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VEHICLE DATA

VEHICLE IDENTIFICATION NUMBER

DESCRIPTION

The Vehicle Identification Number (VIN) plate is located on the lower windshield fence near the left A-pillar. The VIN contains 17 characters that provide data concerning the vehicle. Refer to the VIN decoding chart to determine the identification of a vehicle.

The Vehicle Identification Number is also imprinted on the:

- Vehicle Safety Certification Label.
- Frame rail.

To protect the consumer from theft and possible fraud the manufacturer is required to include a Check Digit at the ninth position of the Vehicle Identification Number. The check digit is used by the manufacturer and government agencies to verify the authenticity of the vehicle and official documentation. The formula to use the check digit is not released to the general public.

VEHICLE IDENTIFICATION NUMBER DECODING CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = Manufactured By DaimlerChrysler Corporation
2	Make	J = Jeep
3	Vehicle Type	4 = Multipurpose Passenger Vehicle Less Side Air Bags 8 = Multipurpose Passenger Vehicle With Side Air Bags
4	Gross Vehicle Weight Rating	F = 4001 - 5000 lbs. (1815 - 2267 kg) G = 5001 - 6000 lbs. (2268 - 2721 kg)
5	Vehicle Line	A = Wrangler Left Hand Drive (4x4) B = Wrangler Left Hand Drive (4x2) E = Wrangler Right Hand Drive (4x4)
6	Series/Transmission	2 = L (Low Line) 3 = M (Medium) 5 = P (Premium) 6 = S (Sport) B = 4 Speed Automatic VLP - Sales Code (DGV) C = 6 Speed Manual - Sales Code (DEH) E = 5 Speed Automatic - Sales Code (DGQ)
7	Body Style	4 = Open Body (JK 72) 9 = Extended Open Body (JK 74)

8	Engine	1 = 3.8L V-6 CYL Gasoline (EGT) 9 = 2.8L I4 CYL Turbo Diesel Next Gen (ENS)
9	Check Digit	0 through 9 or X
10	Model Year	8 = 2008
11	Assembly Plant	L = Toledo South Assembly
12 – 17	Vehicle Build Sequence	

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

DESCRIPTION

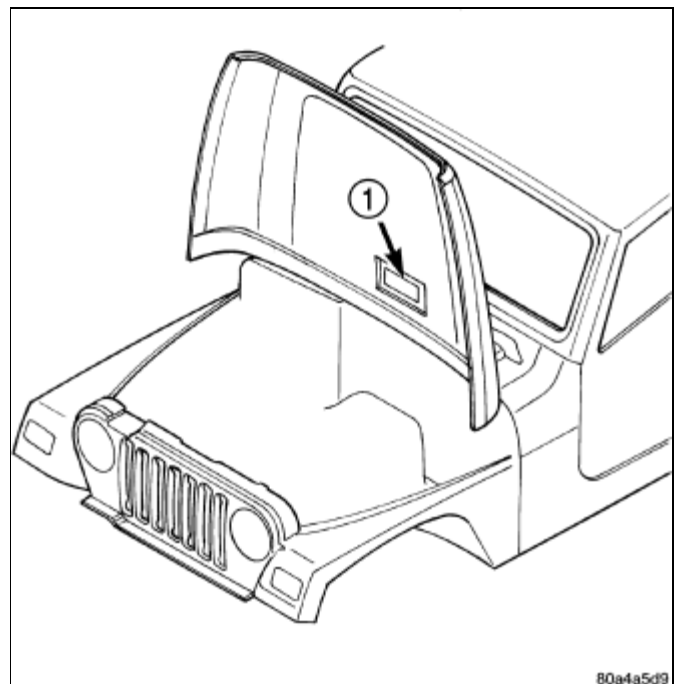
All models have a Vehicle Emission Control Information (VECI) Label. DaimlerChrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

The VECI label contains the following:

- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Engine timing specifications (if adjustable)
- Idle speeds (if adjustable)
- Spark plug and gap

The label also contains an engine vacuum schematic. These labels are permanently attached and cannot be removed without defacing information and destroying label.



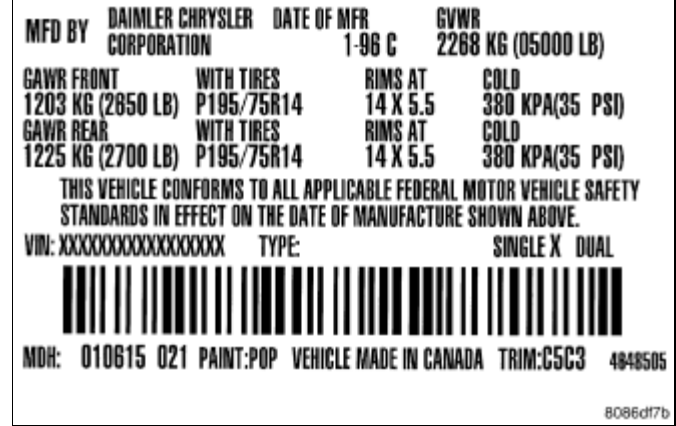
VEHICLE CERTIFICATION LABEL

DESCRIPTION

A vehicle certification label is attached to every DaimlerChrysler Corporation vehicle. The label certifies that

the vehicle conforms to all applicable Federal Motor Vehicle Standards. The label also lists:

- Month and year of vehicle manufacture.
- Gross Vehicle Weight Rating (GVWR). The gross front and rear axle weight ratings (GAWRs) are based on a minimum rim size and maximum cold tire inflation pressure.
- Vehicle Identification Number (VIN).
- Type of vehicle.
- Type of rear wheels.
- Bar code.
- Month, Day and Hour (MDH) of final assembly.
- Paint and Trim codes.
- Country of origin.

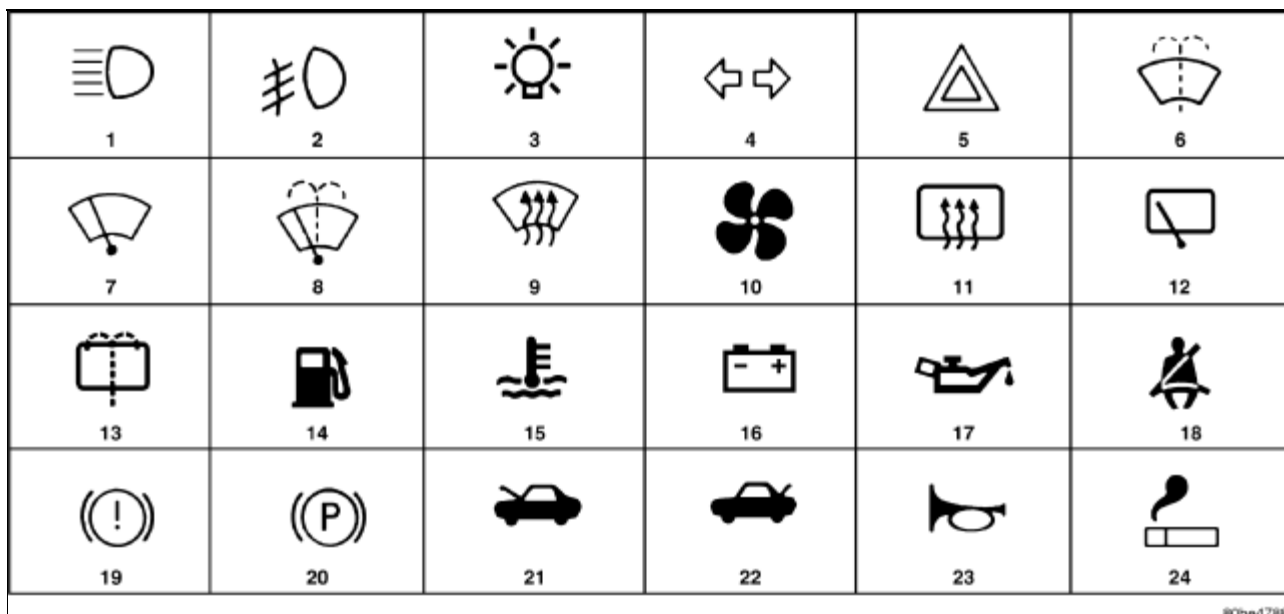


The label is located on the driver-side door shut-face.

INTERNATIONAL SYMBOLS

DESCRIPTION

The graphic symbols illustrated in the following International Control and Display Symbols Chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.



FASTENER IDENTIFICATION

DESCRIPTION

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 8.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

Bolt Markings and Torques - Metric

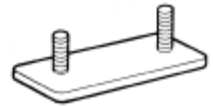
Bolt Markings	8.8/8.9		10.9		12.9	
Bolt Dia.	N·m	Ft. Lbs.	N·m	Ft. Lbs.	N·m	Ft. Lbs.
6	12	105*	14	125*	16	12
8	25	250*	32	23	38	28
10	54	40	60	45	74	55
12	95	70	108	80	135	100
14	155	115	175	130	216	160
16	243	180	324	240	324	240
* Inch Lbs.						

Bolt Markings and Torques - U. S. Customary

Bolt Markings	Grade 5		Grade 8	
Bolt Dia.	N·m	Ft. Lbs.	N·m	Ft. Lbs.
1/4 - 20	10	95*	14	125*
1/4 - 28	10	95*	17	150*
5/16 - 18	22	200*	30	270*
5/16 - 24	26	240*	33	300*
3/8 - 16	40	30	55	40
3/8 - 24	47	35	60	45

7/16 - 14	68	50	88	65
7/16 - 20	74	55	95	70
1/2 - 13	101	75	135	100
1/2 - 20	115	85	150	110
9/16 - 12	135	100	182	135
9/16 - 18	155	115	202	150
5/8 - 11	202	150	263	195
5/8 - 18	215	160	284	210
3/4 - 10	230	170	297	220
3/4 - 16	236	175	304	225
7/8 - 14	405	300	540	400
* Inch Lbs.				

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt	 Bolt head No. 4 — 4T 5 — 5T 6 — 6T 7 — 7T 8 — 8T 9 — 9T 10 — 10T 11 — 11T		Stud bolt	 No mark 4T	
	 No mark 4T			 Grooved 6T	
Hexagon flange bolt	 No mark 4T				
w/washer hexagon bolt					
Hexagon head bolt	 Two protruding lines 5T				
Hexagon flange bolt	 Two protruding lines 6T		Welded bolt		
w/washer hexagon bolt					
Hexagon head bolt	 Three protruding lines 7T			 4T	
Hexagon head bolt	 Four protruding lines 8T				

95IN-4

FASTENER USAGE

DESCRIPTION

FASTENER USAGE

WARNING: Use of an incorrect fastener may result in component damage. Failure to follow these instructions may result in personal injury or death.

Fasteners and torque specifications references in this Service Manual are identified in metric and SAE format.

During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be used.

DESCRIPTION - THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the vehicle or Helicoil® recommendations for application and repair procedures.

METRIC SYSTEM

DESCRIPTION

in-lbs to N•m										N•m to in-lbs									
in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032	.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292	.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552	.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811	.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071	1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331	1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590	1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850	1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110	1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369	2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629	2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889	2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148	2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408	2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668	3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927	3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187	3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447	3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706	3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966	4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m										N•m to ft-lbs									
ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212	1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770	2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328	3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888	4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446	5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004	6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562	7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120	8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678	9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236	10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794	11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352	12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910	13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468	14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026	15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586	16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144	17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702	18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260	19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820	20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm										mm to in.									
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574	.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828	.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082	.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336	.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590	.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844	.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098	.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352	.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606	.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860	.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114	.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368	.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622	.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876	.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130	.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384	.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638	.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892	.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146	.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.038

MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
in-lbs	x 0.11298	= Newton Meters (N·m)	N·m	x 8.851	= in-lbs
ft-lbs	x 1.3558	= Newton Meters (N·m)	N·m	x 0.7376	= ft-lbs
Inches Hg (60° F)	x 3.377	= Kilopascals (kPa)	kPa	x 0.2961	= Inches Hg
psi	x 6.895	= Kilopascals (kPa)	kPa	x 0.145	= psi
Inches	x 25.4	= Millimeters (mm)	mm	x 0.03937	= Inches
Feet	x 0.3048	= Meters (M)	M	x 3.281	= Feet
Yards	x 0.9144	= Meters (M)	M	x 1.0936	= Yards
mph	x 1.6093	= Kilometers/Hr. (Km/h)	Km/h	x 0.6214	= mph
Feet/Sec	x 0.3048	= Meters/Sec (M/S)	M/S	x 3.281	= Feet/Sec
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

COMMON METRIC EQUIVALENTS

1 inch = 25 Millimeters	1 Cubic Inch = 16 Cubic Centimeters
1 Foot = 0.3 Meter	1 Cubic Foot = 0.03 Cubic Meter
1 Yard = 0.9 Meter	1 Cubic Yard = 0.8 Cubic Meter
1 Mile = 1.6 Kilometers	

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton Meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.).

TORQUE REFERENCES

DESCRIPTION

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N•m	kgf-cm	ft-lbf	N•m	kgf-cm	ft-lbf
4T	6	1	5	55	48 in.-lbf	6	60	52 in.-lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.-lbf	7.5	75	65 in.-lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.-lbf	9	90	78 in.-lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

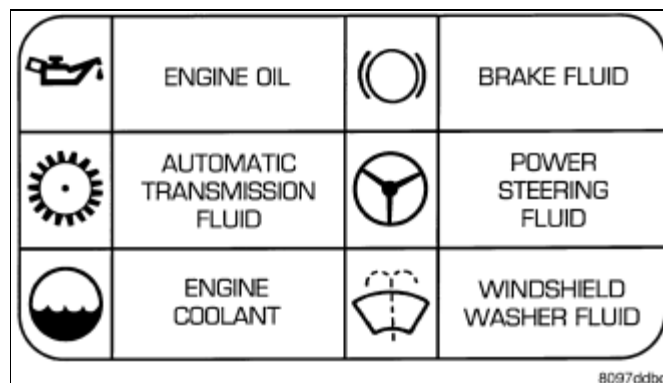
Individual Torque Charts appear within many of the Groups. Refer to the Standard Torque Specifications chart for torque references not listed in the individual torque charts.

0 - LUBRICATION AND MAINTENANCE

INTERNATIONAL SYMBOLS

DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations.



PARTS & LUBRICANT RECOMMENDATION

DESCRIPTION

LUBRICANT RECOMMENDATIONS

Chassis

Component	Fluid, Lubricant, or Genuine Part
Steering Gear & Linkage, Ball Joints, Prop Shafts & Yokes, Wheel Bearings	Mopar® Multi-Purpose Grease NLGI Grade 2 EP, GC-LB

Body

Component	Fluid, Lubricant, or Genuine Part
Hinges:	
Door And Hood	Mopar® Engine Oil
Liftgate	Mopar® Multi-Purpose Grease NLGI Grade 2 EP, GC-LB
Latches:	
Door, Hood/Safety Catch, Liftgate	Mopar® Multi-Purpose Grease NLGI Grade 2 EP, GC-LB

Seat Regulator & Track	Mopar® Multi-Purpose Grease NLGI Grade 2 EP, GC-LB
Window System Components	Mopar® Spray White Lubricant
Lock Cylinders	Mopar® Lock Cylinder Lubricant
Parking Brake Mechanism	Mopar® Wheel Bearing Grease NLGI Grade 1, GC-LBB
Soft Top	Mopar® Soft Top Zipper Cleaner & Lubricant

FLUID TYPES

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar® provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

Only lubricants bearing designations defined by the following organization should be used to service a DaimlerChrysler Corporation vehicle:

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)
- European Automobile Manufacturers Association (ACEA)

API QUALITY CLASSIFICATION

This symbol on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by DaimlerChrysler Corporation.



GEAR LUBRICANTS

SAE ratings also apply to multigrade gear lubricants. In addition, API classification defines the lubricant's usage, such as API GL-5 and SAE 75W-90.

FLUID TYPES

DESCRIPTION

ENGINE OIL

WARNING: New or used engine oil can be irritating to the skin. Avoid prolonged or repeated skin contact with engine oil. Contaminants in used engine oil, caused by internal combustion, can be hazardous to your health. Thoroughly wash exposed skin with soap and water. Do not wash skin with gasoline, diesel fuel, thinner, or solvents, health problems can result. Do not pollute, dispose of used engine oil properly. Contact your dealer or government agency for location of collection center in your area.

Only lubricants bearing designations defined by the following organization should be used.

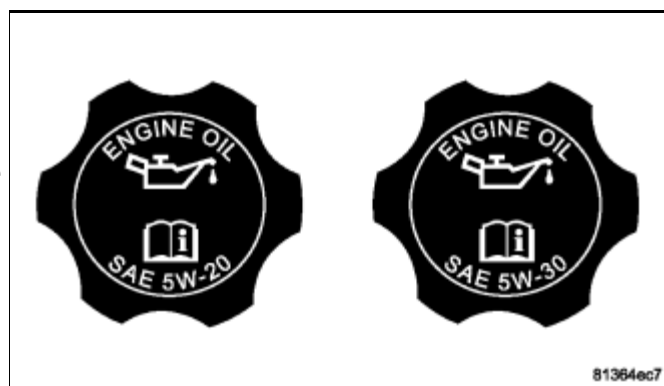
- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)
- Association des Constructeurs Européens d' Automobiles (European Automobile Manufacturers Association) (ACEA)

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Certified. MOPAR® provides engine oils, that meet or exceed this requirement.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range. **Refer to your engine oil filler cap for the recommended engine oil viscosity for your vehicle.**



Engine Oil Viscosity (2.8L Diesel Engines)

For vehicles equipped with a Diesel Particulate Filter (DPF), use a fully synthetic, low ash oil that meets DaimlerChrysler Material Standard MS-11106.

For vehicles not equipped with a DPF, use a fully synthetic oil that meets DaimlerChrysler Material Standard MS-10725.

ACEA Categories

For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils that meet the requirements of ACEA A1/B1, A2/B2, or A3/B3.

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the front label of engine oil plastic bottles and the top of engine oil cans.

This symbol means that the oil has been certified by the American Petroleum Institute (API). DaimlerChrysler only recommends API Certified engine oils. Use Mopar® engine oil or equivalent.



SYNTHETIC ENGINE OILS

There are a number of engine oils being promoted as either synthetic or semi-synthetic. If you chose to use such a product, use **only** those oils that meet the American Petroleum Institute (API) and SAE viscosity standard. Follow the service schedule that describes your driving type.

ENGINE OIL ADDITIVES/SUPPLEMENTS

The manufacturer **does not recommend** the addition of any engine oil additives/supplements to the specified engine oil. Engine oil additives/supplements should not be used to enhance engine oil performance. Engine oil additives/supplements should not be used to extend engine oil change intervals. No additive is known to be safe for engine durability and can degrade emission components. Additives can contain undesirable materials that harm the long term durability of engines by:

- Doubling the level of Phosphorus in the engine oil. The ILSAC (International Lubricant Standard Approval Committee) GF-2 and GF-3 standards require that engine oil contain no more than 0.10% Phosphorus to protect the vehicles emissions performance. Addition of engine oil additives/supplements can poison, from the added sulfur and phosphorus, catalysts and hinder efforts to guarantee emissions performance to 80,000 miles.

- Altering the viscosity characteristics of the engine oil so that it no longer meets the requirements of the specified viscosity grade.
- Creating potential for an undesirable additive compatibility interaction in the engine crankcase. Generally it is not desirable to mix additive packages from different suppliers in the crankcase; there have been reports of low temperature engine failures caused by additive package incompatibility with such mixtures.

FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded “regular” gasoline having an octane rating of 87. The routine use of premium gasoline is not recommended. Under normal conditions the use of premium fuel will not provide a benefit over high quality regular gasolines and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

Over 40 auto manufacturers world-wide have issued and endorsed consistent gasoline specifications (the Worldwide Fuel Charter, WWFC) to define fuel properties necessary to deliver enhanced emissions, performance and durability for your vehicle. We recommend the use of gasolines that meet the WWFC specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as “reformulated” gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

We strongly support the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT IN GASOLINE

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number

without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. We recommend that gasolines free of MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with Cleaner-Burning California reformulated gasoline with low sulfur. If such fuels are not available in states adopting California emission standards, your vehicles will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be adversely affected. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light to illuminate. We recommend that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

CAUTION: If the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of DaimlerChrysler Corporation and may not be covered under the new vehicle warranty.

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

ENGINE COOLANT

GAS ENGINES

WARNING: Antifreeze is an ethylene glycol based coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene glycol. Keep out of reach of children. Dispose of glycol based coolant properly, contact your government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less boiling protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol based coolant with hybrid organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

The green coolant **MUST NOT BE MIXED** with the orange or magenta coolants. When replacing coolant the complete system flush must be performed before using the replacement coolant.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Doing so will reduce the corrosion protection and may result in premature water pump seal failure. If non-HOAT coolant is introduced into the cooling system in an emergency, it should be replaced with the specified coolant as soon as possible.

DIESEL ENGINE

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less boiling protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Glysantin G 30–91 Antifreeze/Coolant, 5 Year/150,000 Mile Formula (ASTM D3306), or the equivalent ethylene glycol based coolant. This coolant offers the best engine cooling without corrosion when mixed with 50% coolant and 50% distilled water to obtain a freeze point of -36°C (-34°F). It is dyed purple to distinguish its unique chemistry from traditional green and yellow silicate coolants. If it loses color or becomes

contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

The purple coolant **MUST NOT BE MIXED** with the orange, green or magenta coolants. When replacing coolant the complete system flush must be performed before using the replacement coolant.

CAUTION: Glystantin G 30–91 Antifreeze/Coolant, 5 Year/150,00 Mile Formula (ASTM D3306) may not be mixed with any other type of antifreeze. Doing so will reduce the corrosion protection and may result in premature water pump seal failure.

TRANSFER CASE - NV241

Recommended lubricant for the NV241 transfer case is Mopar® ATF +4, Automatic Transmission Fluid.

MANUAL TRANSMISSION

NOTE: DaimlerChrysler recommends using Mopar® lubricants or lubricants of equal quality.

- NSG370 - Mopar® Manual Transmission Lubricant MS-9224

AUTOMATIC TRANSMISSION FLUID

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

Mopar® ATF +4, Automatic Transmission Fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF +4, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used**. The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

POWER STEERING FLUID

The recommended fluid for the power steering system is Mopar ® ATF +4 and Mopar ® Power Steering Fluid + 4.

Mopar ® ATF+4, when new is red in color. The ATF+4 is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF+4 will begin to look darker in color and may eventually become brown. **THIS IS NORMAL.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from a container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

A/C REFRIGERANT

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear and colorless liquefied gas.

CAUTION: R-134a refrigerant is not compatible with R-12 refrigerant in an A/C system. Even a small amount of R-12 refrigerant added to an R-134a refrigerant system will cause A/C compressor failure.

The A/C refrigerant system is filled-for-life at the factory and requires no regular maintenance. Although not required at specific intervals, the charge level should be checked if system performance deteriorates or if a noise or leak is suspected (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS).

OPERATION

AUTOMATIC TRANSMISSION FLUID

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

FLUID - CAPACITIES & RECOMMENDED SPECIFICATIONS

RECOMMENDED FLUIDS, LUBRICANTS AND GENUINE PARTS

ENGINE

Component	Fluid, Lubricant, or Genuine Part
Engine Coolant	Mopar ® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology)
Engine Oil	API Certified SAE 5W-20 Engine Oil is recommended. Meets the requirements of DaimlerChrysler Material Standard MS-6395. Refer to your engine oil filler cap for correct SAE grade.
Spark Plugs (3.8L Engine)	RE14PLP5 (Gap 0.050 in [1.27 mm])
Oil Filter (3.8L Engine)	Mopar ® Oil Filter (P/N 04105409AC)
Fuel Selection	87 Octane

ENGINE - EXPORT

Component	Fluid, Lubricant, or Genuine Part
Engine Coolant	Mopar ® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology)
Engine Oil - Gasoline (Non ACEA Categories)	Use API Certified SAE 5W-20 engine oil, meeting the requirements of DaimlerChrysler Material Standard MS-6395. Refer to your engine oil filler cap for correct SAE grade. SAE 5W-30 engine oil approved to MB 229.31 or MB 229.51 may be used when SAE 5W-20 engine oil is not available.
Engine Oil - Gasoline (ACEA Categories)	For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3, and approved to MB 229.31 or MB 229.51. SAE 5W-30 engine oil approved to MB 229.31 or MB 229.51 may be used when SAE 5W-20 engine oil is not available.
Engine Oil - Diesel (without Particulate Filter)	Use SAE 0W-40 diesel engine oils confirming to API Quality CI-4 or CJ-4. For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3 and approved to MB 229.31 or MB 229.51.
Engine Oil - Diesel (with Particulate Filter)	Use SAE 5W-30 diesel engine oils conforming to API Quality CI-4 or CJ-4. For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3 (LOW ASH) and approved to MB 229.31 or MB 229.51.
Spark Plugs (3.8L Engine)	RE14PLP5 (Gap 0.050" [1.27 mm])
Oil Filter (2.8L)	Mopar ® Oil Filter (P/N 5003558AA)

Diesel Engine)	
Oil Filter (3.8L Engine)	Mopar ® Oil Filter (P/N 04105409AC)
Fuel Selection (Gasoline Engines)	91 Octane
Fuel Selection (Diesel Engines)	50 Cetane or higher (Less than 15 ppm Sulfur)

CHASSIS

Component	Fluid, Lubricant, or Genuine Part
Automatic Transmission	Mopar ® ATF+4 Automatic Transmission Fluid
Manual Transmission	Mopar ® Manual Transmission Lubricant or equivalent (meeting the requirements of DaimlerChrysler Material Standard MS-9224)
Transfer Case	Mopar ® ATF+4 Automatic Transmission Fluid or equivalent.
Brake Master Cylinder	Mopar ® DOT 3 Brake Fluid, SAE J1703 should be used. If DOT 3, SAE J1703 brake fluid is not available, then DOT 4 is acceptable. Use only recommended brake fluids.
Power Steering Reservoir	Mopar ® ATF+4 Automatic Transmission Fluid Mopar ® Power Steering Fluid + 4, Mopar ® ATF+4 Automatic Transmission Fluid

CHASSIS - EXPORT

Component	Fluid, Lubricant, or Genuine Part
Automatic Transmission	Mopar ® ATF+4 Automatic Transmission Fluid
Manual Transmission	Mopar ® Manual Transmission Lubricant or equivalent (meeting the requirements of DaimlerChrysler Material Standard MS-9224)
Transfer Case	Mopar ® ATF+4 Automatic Transmission Fluid or equivalent.
Brake Master Cylinder	Mopar ® DOT 3 Brake Fluid, SAE J1703 should be used. If DOT 3, SAE J1703 brake fluid is not available, then DOT 4 is acceptable. Use only recommended brake fluids.
Power Steering Reservoir	Mopar ® ATF+4 Automatic Transmission Fluid Mopar ® Power Steering Fluid + 4, Mopar ® ATF+4 Automatic Transmission Fluid

AXLES

FRONT AXLE		U.S.	Metric
186 FBI (Model 30)	Mopar ® Gear Lubricant 80W-90	2.1 Pints	1.0 Liters
216 FBI (Model 44)	Mopar ® Gear Lubricant 80W-90	2.7 Pints	1.3 Liters
REAR AXLE			
226 FBI (Model 44)	Mopar ® Gear Lubricant 80W-90 (Trailer Towing Mopar ® Synthetic Gear Lubricant 75W-140)	4.75 Pints*	2.25 Liters
Trac-lok ® equipped axles require 0.1 L (3.4 ounces) of Limited Slip Additive in the lubricant.			

CAPACITIES

	U.S.	Metric
Fuel (Approximate) — 2 Door Models	18.5 Gallons	70 Liters
Fuel (Approximate) — 4-Door Models	22.5 Gallons	85 Liters
Engine Oil with Filter		
3.8 Liter Engine (SAE 5W-20, API Certified Engine Oil)	6 Quarts	5.7 Liters
Cooling System *		
3.8 Liter Engine (Mopar ® Antifreeze/Engine Coolant 5 Year/100,000 Mile (160 000 km) Formula)	13 Quarts	12 Liters
POWER STEERING SYSTEM		
Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures.		
A/C REFRIGERANT SYSTEM		
Single Unit	1.125 lbs	0.51 kg
AUTOMATIC TRANSMISSION		

Service Fill - 45RFE/545RFE	4X2 - 5.5 Quarts)	4X2 - 5.2 Liters
	4X4 - 6.5 Quarts	4X4 - 6.2 Liters
Overhaul - 45RFE/545RFE	14.8–16.9 Quarts ¹	14-16 Liters
Service Fill - 42RLE	8.0 Pints	3.8 Liters
Overhaul Fill - 42RLE	17.6 Pints ¹	8.3 Liters
¹ Dry fill capacity. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE).		
TRANSFER CASE		
NV241	4.2 Pints	2.0 Liters
MANUAL TRANSMISSION		
NSG 370 Approximate dry fill or fill to bottom edge of the fill plug hole.	3.17 Pints	1.5 Liters
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		
* Includes heater and coolant recovery bottle filled to MAX level.		

CAPACITIES - EXPORT

	U.S.	Metric
Fuel (Approximate) — 2 Door Models	18.5 Gallons	70 Liters
Fuel (Approximate) — 4 Door Models	22.5 Gallons	85 Liters
Engine Oil with Filter		
Engine Oil - with Filter - 2.8L	7 Quarts	6.6 Liters
Engine Oil - with Filter - 3.8L	6 Quarts	5.7 Liters
Cooling System *		
2.8 Liter Diesel Engine (Glysantin G 30–91 Antifreeze/Engine Coolant 5 Year/150,000 Mile Formula)	13 Quarts	12 Liters
3.8 Liter Engine (Mopar ® Antifreeze/Engine Coolant 5 Year/100,000 Mile Formula)	13 Quarts	12 Liters

* Includes heater and coolant recovery bottle filled to MAX level.		
POWER STEERING SYSTEM		
Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures.		
A/C REFRIGERANT SYSTEM		
Single Unit	1.125 lbs	0.51 kg
AUTOMATIC TRANSMISSION		
Service Fill - 45RFE/545RFE	4X2 - 5.5 Quarts	4X2 - 5.2 Liters
	4X4 - 6.5 Quarts	4X4 - 6.2 Liters
Overhaul - 45RFE/545RFE	14.8–16.9 Quarts ¹	14-16 Liters
Service Fill - 42RLE	8.0 Pints	3.8 Liters
Overhaul Fill - 42RLE	17.6 Pints ¹	8.3 Liters
¹ Dry fill capacity. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE).		
TRANSFER CASE		
NV241	4.2 Pints	2.0 Liters
MANUAL TRANSMISSION		
NSG 370 Approximate dry fill or fill to bottom edge of the fill plug hole.	3.17 Pints	1.5 Liters
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

MAINTENANCE SCHEDULES

DESCRIPTION

MAINTENANCE SCHEDULES - NAFTA

The oil change indicator system will remind you that it is time to take your vehicle in for scheduled maintenance.

On Non-EVIC equipped vehicles “CHANGE OIL” will flash in the instrument cluster odometer and a single chime will sound, indicating that an oil change is necessary.

Based on engine operation conditions the oil change indicator message will illuminate, this means that service is required for your vehicle. Have your vehicle serviced as soon as possible, within the next 500 miles (805 km).

NOTE:

- **The oil change indicator message will not monitor the time since the last oil change. Change your vehicles oil if it has been 6 months since your last oil change even if the oil change indicator message is NOT illuminated.**
- **Change your engine oil more often if you drive your vehicle off-road for an extended period of time.**
- **Under no circumstances should oil change intervals exceed 6,000 miles (10,000 km) or 6 months, whichever comes first.**

Your dealer will reset the oil change indicator message after completing the scheduled oil change. If this scheduled oil change is performed by someone other than your dealer the message can be reset by referring to the steps described under “Odometer/Trip Odometer” in the “Instrument Cluster Description” section of this manual.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

Once a Month

- Check tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the brake hoses and lines.
- Check the manual transmission fluid level.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

Required Maintenance Intervals

	Perform Maintenance Every
--	---

	(Where time and mileage are listed, follow the interval that occurs first.)
--	--

Maintenance Items	Miles	Kilometers	or Months
Change the engine oil and engine oil filter.	6,000	10 000	6
Rotate tires.	6,000	10 000	6
If using your vehicle for any of the following: Dusty or off-road conditions. Inspect the engine air cleaner filter, replace if necessary.	12,000	20 000	12
Inspect the brake linings, replace if necessary.	12,000	20 000	12
Replace the air conditioning filter.	12,000	20 000	12
Inspect the front & rear axle fluid, change if using your vehicle for police, taxi, fleet, off-road or frequent trailer towing.	18,000	30 000	18
Inspect the CV Joints. Perform the first inspection at 12,000 miles (20 000 km) or 12 months.	24,000	40 000	24
Inspect exhaust system. Perform the first inspection at 12,000 miles (20 000 km) or 12 months.	24,000	40 000	24
Inspect the front suspension, tie rod ends and boot seals, replace if necessary.	24,000	40 000	24
Replace the engine air cleaner filter.	30,000	50 000	30
Change the manual transmission fluid if using your vehicle for any of the following: trailer towing, snow plowing, heavy loading, taxi, police, delivery service (commercial service), off-road, desert operation or more then 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).	30,000	50 000	30
Inspect the transfer case fluid.	30,000	50 000	30
Change the automatic transmission fluid and main sump filter if using your vehicle for any of the following: police, taxi, fleet or frequent trailer towing.	60,000	100 000	60
Change the transfer case fluid if using your vehicle for any of the following: police, taxi, fleet, off-road or frequent trailer towing.	60,000	100 000	60
Inspect and replace PCV valve if necessary.	90,000	150 000	90
Flush and replace the engine coolant.	102,000	170 000	60
Replace the ignition cables.	102,000	170 000	102
Replace the spark plugs.	102,000	170 000	102
Change the automatic transmission fluid, main sump filter, and spin-on cooler return filter (if equipped).	120,000	200 000	120
Replace accessory drive belt(s).	120,000	200 000	120

WARNING:

You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.

MAINTENANCE SCHEDULES - EXPORT - GAS

To help you have the best driving experience possible, the manufacturer has identified the specific vehicle maintenance service intervals that are required to keep your vehicle operating properly and safely.

DaimlerChrysler Corporation recommends that these maintenance intervals be performed at your selling dealer. The technicians at your dealership know your vehicle best, and have access to factory trained information, genuine Mopar parts, and specially designed electronic and mechanical tools that can help prevent future costly repairs.

The maintenance intervals shown should be performed as indicated in this section.

NOTE: Under no circumstances should oil change intervals exceed 7,500 miles (12 000 km) or 6 months, whichever comes first.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

Once a Month

- Check tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the brake hoses and lines.
- Check the manual transmission fluid level.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

Severe Duty

If your vehicle is operated under the Severe Duty conditions listed below change your engine oil and filter every 3,000 miles (5 000 km) or 3 months as indicated in the Maintenance Schedule.

- Stop and go driving.

- Driving in dusty conditions.
- Short trips of less than 10 miles (16 km).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert operation.

Required Maintenance Intervals

	Perform Maintenance Every		
	(Where time and mileage are listed, follow the interval that occurs first.)		
Maintenance Items	Miles	Kilometers	or Months
Change the engine oil and engine oil filter if using your vehicle under any of the severe duty conditions: Short trips, stop and go driving, dusty or off-road conditions, police, taxi, fleet, or frequent trailer towing.	3,000	5 000	3
	or	or	or
Change the engine oil and engine oil filter if your vehicle is NOT operated under any of the conditions listed under Severe Duty .	7,500	12 000	6
Rotate tires.	7,500	12 000	6
If using your vehicle for any of the following: Dusty or off-road conditions. Inspect the engine air cleaner filter, replace if necessary.	15,000	24 000	12
Inspect the brake linings, replace if necessary.	15,000	24 000	12
Inspect the front & rear axle fluid, change if using your vehicle for police, taxi, fleet, off-road or frequent trailer towing.	15,000	24 000	12
Inspect the CV Joints. Perform the first inspection at 15,000 miles (24 000 km) or 12 months.	22,500	36 000	18
Inspect Exhaust System. Perform the first inspection at 15,000 miles (24 000 km) or 12 months.	22,500	36 000	18
Inspect the front suspension, tie rod ends and boot seals, replace if necessary.	22,500	36 000	18
Replace the engine air cleaner filter.	30,000	50 000	30
Change the manual transmission fluid if using your vehicle for any of the following: trailer towing, snow plowing, heavy loading, taxi, police, delivery service (commercial service), off-road, desert operation or more then 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).	30,000	50 000	30

Inspect the transfer case fluid.	30,000	50 000	30
Change the automatic transmission fluid & filter if using your vehicle for any of the following: police, taxi, fleet or frequent trailer towing.	60,000	100 000	60
Change the transfer case fluid if using your vehicle for any of the following: police, taxi, fleet, off-road or frequent trailer towing.	60,000	100 000	60
Inspect and replace PCV valve if necessary.	90,000	150 000	90
Flush and replace the engine coolant.	102,000	170 000	60
Replace the ignition cables.	102,000	170 000	102
Replace the spark plugs.	102,000	170 000	102
Change the automatic transmission fluid, main sump filter, and spin-on cooler return filter (if equipped).	120,000	200 000	120
Replace Accessory Drive Belt(s).	120,000	200 000	120

WARNING:

You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.

MAINTENANCE SCHEDULES - EXPORT - DIESEL

Change Oil Message (Diesel Models with DPF (Diesel Particulate Filter) Only)

The oil change indicator system will remind you that it is time to take your vehicle in for scheduled maintenance.

On Non-EVIC equipped vehicles “CHANGe OIL” will flash in the instrument cluster odometer and a single chime will sound, indicating that an oil change is necessary.

Based on engine operation conditions, the oil change indicator message will illuminate, this means that service is required for your vehicle. Have your vehicle serviced as soon as possible, within the next 500 miles (805 km).

Your dealer will reset the oil change indicator message after completing the scheduled oil change. If this scheduled oil change is performed by someone other than your dealer the message can be reset by referring to the steps described under “Odometer/Trip Odometer” in the “Instrument Cluster Description” section of this manual.

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule “**A**”. It is for vehicles that are not operated under any of the conditions listed under Schedule “**B**.”

Second is Schedule “**B**”. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

Once a Month

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, clean and tighten the terminals as required.
- Check the fluid levels of engine coolant/antifreeze deaeration bottle, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/antifreeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.
- Inspect for the presence of water in the fuel filter/water separator unit.

Schedule “A”

Kilometers	20 000	40 000	60 000	80 000	100 000
(Miles)	(12,500)	(25,000)	(37,500)	(50,000)	(62,500)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	
Drain the fuel filter/water separator unit.	X	X	X	X	X

Replace the fuel filter/water separator unit.		X		X	
Replace the engine accessory drive belt.					X
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.		X		X	
Inspect the transfer case fluid, add if necessary.				X	

Kilometers	120 000	140 000	160 000	180 000	200 000
(Miles)	(75,000)	(87,500)	(100,000)	(112,500)	(125,000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	X
Replace the engine air filter element.	X		X		X
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.	X		X		X
Flush and replace the engine coolant.			X		X
Replace the engine accessory drive belt.					X
Replace the engine timing belt, and timing belt tensioner.					X
Inspect the brake linings.	X		X		X
Inspect the manual transmission fluid, add if necessary.	X		X		X
Inspect the transfer case fluid, add if necessary.			X		

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).

- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Kilometers	10 000	20 000	30 000	40 000	50 000
(Miles)	(6,250)	(12,500)	(18,750)	(25,000)	(31,250)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.				X	
Drain and refill the front and rear axle fluid.		X		X	
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.					X
Inspect the transfer case fluid, add if necessary.		X		X	
Drain and refill the front and rear axle fluid.		X		X	

Kilometers	60 000	70 000	80 000	90 000	100 000
(Miles)	(37,500)	(43,750)	(50,000)	(56,250)	(62,500)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	
Replace the engine air filter element.	X		X		X
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.			X		
Replace the engine accessory drive belt.	X				
Inspect the brake linings.	X		X		X

Drain and refill the front and rear axle fluid.	X		X		X
Inspect the transfer case fluid, add if necessary.	X		X		X
Inspect the manual transmission fluid, add if necessary.					X
Drain and refill the automatic transmission fluid. Replace main sump filter and spin-on cooler return filter (if equipped).					X

Kilometers	110 000	120 000	130 000	140 000	150 000
(Miles)	(68,750)	(75,000)	(81,250)	(87,500)	(93,750)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X	X	X	X	X
Replace the engine air filter element.		X		X	
Replace the engine accessory drive belt.		X			
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.		X			
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.					X
Inspect the transfer case fluid, add if necessary.		X		X	
Drain and refill the front and rear axle fluid.		X		X	

Kilometers	160 000	170 000	180 000	190 000	200 000
(Miles)	(100,000)	(106,250)	(112,500)	(118,750)	(125,000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	
Replace the engine air filter element.	X		X		X
Replace the engine accessory drive belt.			X		
Replace the engine timing belt, and timing belt tensioner.					X

Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.	X				X
Flush and replace the engine coolant/anti-freeze.	X				
Inspect the brake linings.	X		X		X
Inspect the manual transmission fluid, add if necessary.					X
Drain and refill the automatic transmission fluid. Replace main sump filter and spin-on cooler return filter (if equipped).					X
Inspect the transfer case fluid, add if necessary.	X		X		X
Drain and refill the front and rear axle fluid.	X		X		X

! Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

HOISTING

STANDARD PROCEDURE - HOISTING RECOMMENDATIONS

Refer to the Owner's Manual for emergency vehicle lifting procedures.

When properly positioned, a floor jack can be used to lift a Jeep vehicle. Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

CAUTION: Do not attempt to lift a Jeep vehicle with a floor jack positioned under:

- A body side sill.
- A steering linkage component.
- A drive shaft.
- The engine or transmission oil pan.
- The fuel tank.
- A front suspension arm.
- Transfer case.

NOTE: Use the correct sub-frame rail or frame rail lifting locations only.

HOIST

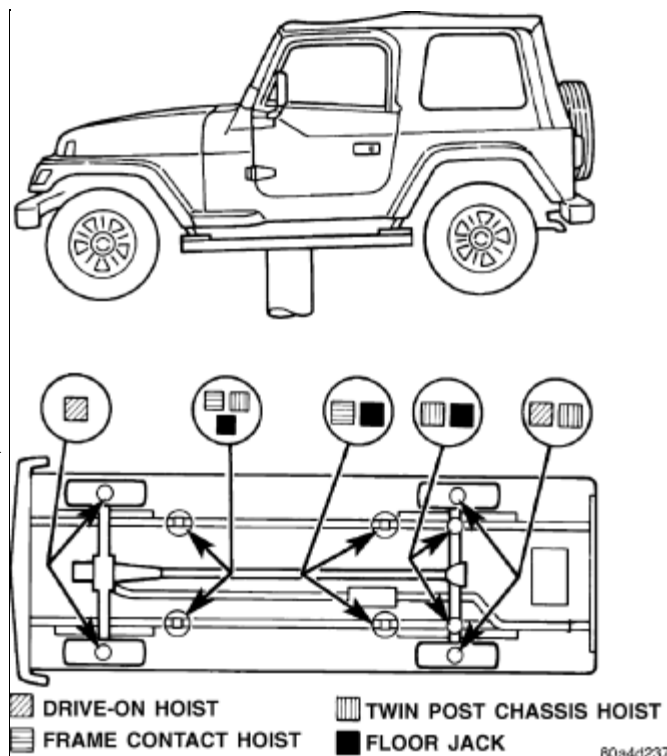
Refer to the Owner's Manual for emergency vehicle lifting procedures.

A vehicle can be lifted with:

- A single-post, frame-contact hoist.
- A twin-post, chassis hoist.
- A ramp-type, drive-on hoist.

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly.

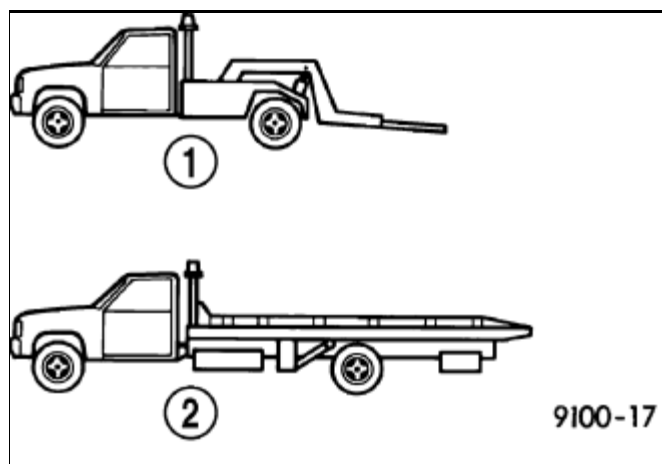
WARNING: The hoisting and jack lifting points provided are for a complete vehicle. When a chassis or drivetrain component is removed from a vehicle, the center of gravity is altered making some hoisting conditions unstable. Properly support or secure vehicle to hoisting device when these conditions exist.



TOWING

STANDARD PROCEDURE - TOWING RECOMMENDATIONS

DaimlerChrysler Corporation recommends that a 4WD vehicle be transported on a flat-bed device. A Wheel-lift device can be used provided all the wheels are lifted off the ground using tow dollies.



SAFETY PRECAUTIONS

- Secure loose and protruding parts.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow towing equipment to contact the disabled vehicle's fuel tank.
- Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe state and local laws regarding towing regulations.
- Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
- Do not attach tow chains, T-hooks, J-hooks, or a tow sling to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.

GROUND CLEARANCE

CAUTION: If vehicle is towed with wheels removed, install lug nuts to retain brake drums.

A towed vehicle should be raised until lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the opposite end of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums.

FLAT-BED TOWING RAMP ANGLE

If a vehicle with flat-bed towing equipment is used, the approach ramp angle should not exceed 15 degrees.

VEHICLE TOWING

WARNING: When towing a disabled vehicle and the drive wheels are secured in a wheel lift or tow dollies, ensure the transmission is in the park position (automatic transmission) or a forward drive gear (manual transmission). Do not use sling-type towing equipment for this vehicle.

TOWING-FRONT END LIFTED (WHEEL LIFT)

1. Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
2. Attach the wheel lift to the front wheels.

TOWING-REAR END LIFTED (WHEEL LIFT ONLY)

1. Raise the front of the vehicle off the ground and install tow dollies under front wheels.
2. Attach the wheel lift to the rear wheels.

RECREATIONAL TOWING

Refer to the Owners Manual for towing procedures.

EMERGENCY TOW HOOKS

WARNING: Remain at a safe distance from a vehicle that is being towed via its tow hooks. The tow straps/chains could break and cause serious injury.

Some Jeep vehicles are equipped with front emergency tow hooks. The tow hooks should be used for **EMERGENCY** purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

JUMP STARTING

STANDARD PROCEDURE - JUMP STARTING PROCEDURE

WARNING: Review all safety precautions and warnings in the battery system section of the service manual. (refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE)

- Do not jump start a frozen battery, personal injury can result.
- If equipped, do not jump start when maintenance free battery indicator dot is yellow or bright color.
- Do not jump start a vehicle when the battery fluid is below the top of lead plates.
- Do not allow jumper cable clamps to touch each other when connected to a booster source.
- Do not use open flame near battery.
- Remove metallic jewelry worn on hands or wrists to avoid injury by accidental arcing of battery current.
- When using a high output boosting device, do not allow battery voltage to exceed 16 volts. Refer to instructions provided with device being used.

Failure to follow these instructions may result in personal injury.

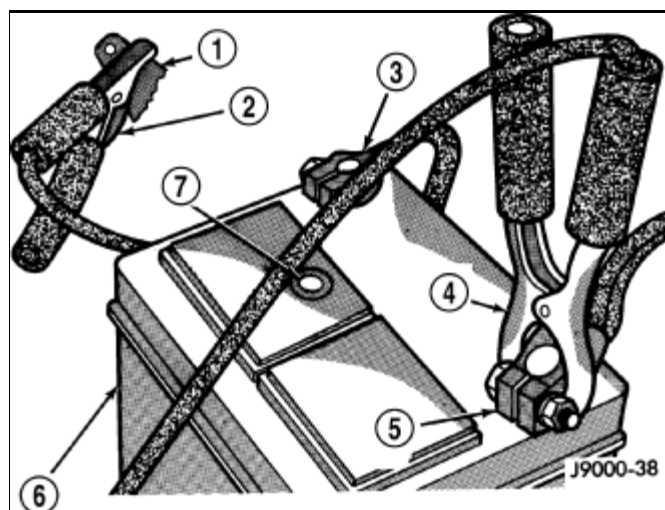
CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

TO JUMP START A DISABLED VEHICLE:

1. Raise hood on disabled vehicle and visually inspect engine compartment for:

- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.

CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.



2. When using another vehicle as a booster source, turn off all accessories, place gear selector in park or neutral, set park brake or equivalent and operate engine at 1200 rpm.

3. On disabled vehicle, place gear selector in park or neutral and set park brake or equivalent. Turn OFF all accessories.

4. Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.

5. On disabled vehicle, connect RED jumper cable clamp to battery positive (+) terminal. Connect BLACK jumper cable clamp to the engine as close to the ground cable connection as possible.

CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.

6. Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal.
Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

EMERGENCY TOW HOOKS

DESCRIPTION — EMERGENCY TOW HOOKS

WARNING: Remain at a safe distance from a vehicle that is being towed via its tow hooks. The tow straps/chains could break and cause serious injury.

Some Jeep vehicles are equipped with front emergency tow hooks. The tow hooks should be used for **EMERGENCY** purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

2 - SUSPENSION

SUSPENSION - ELECTRICAL DIAGNOSTICS

ACTIVE CHASSIS - ELECTRICAL DIAGNOSTICS

ACTIVE CHASSIS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

ASBS INTERMITTENT CONDITION

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. PERFORM ASBS INTERMITTENT CONDITION TEST

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Environmental Data (EV Data). If possible, try to duplicate the conditions under which the DTC set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Wiggle the wires while checking for shorts and open circuits.

Perform a voltage drop test on the related circuits between the suspected faulty component and the Automatic Sway-Bar System.

Inspect and clean all PCM, ASBS, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

Use the scan tool to perform a System Test if one applies to failing component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

Were any problems found during the above inspections?

Yes

- Perform the necessary repairs.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Test Complete.

C2100–BATTERY VOLTAGE LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously.

◦ **Set Condition:**

The Automatic Sway-Bar System detects that system voltage is below 9.0 volts for 60 seconds.

Possible Causes
INTERMITTENT BATTERY VOLTAGE LOW
CHARGING SYSTEM DTCS PRESENT
(A959) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
AUTOMATIC SWAY-BAR SYSTEM (ASBS)

Diagnostic Test

1. CHARGING SYSTEM DTCS PRESENT

Ignition on.

With the scan tool, select View DTCs in the Powertrain Control Module.

Are there any Charging System or related voltage DTCs present?

Yes

- Refer to the symptom list and perform any Charging System DTC diagnostic procedures before continuing with this test.

No

- Go to [2](#)
-

2. DTC IS ACTIVE

With the scan tool, select View DTCs in the ASBS.

Is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Go to [5](#)
-

3. (A959) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the ASBS harness connector.

Turn the ignition on.

With a 12-volt test light connected to ground, check the (A959) Fused B+ circuit in the ASBS harness connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

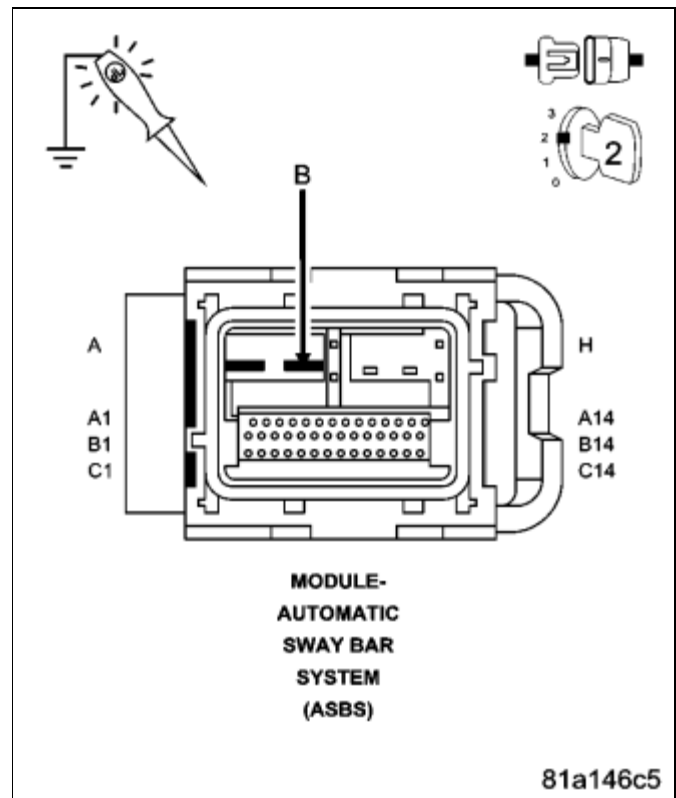
Does the test light illuminate brightly?

Yes

- Go to [4](#)

No

- Repair the (A959) Fused B+ circuit for an open circuit or high resistance.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)



4. AUTOMATIC SWAY-BAR SYSTEM (ASBS)

View repair.

Repair

- Replace the Automatic Sway-Bar System Module in accordance with the Service information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

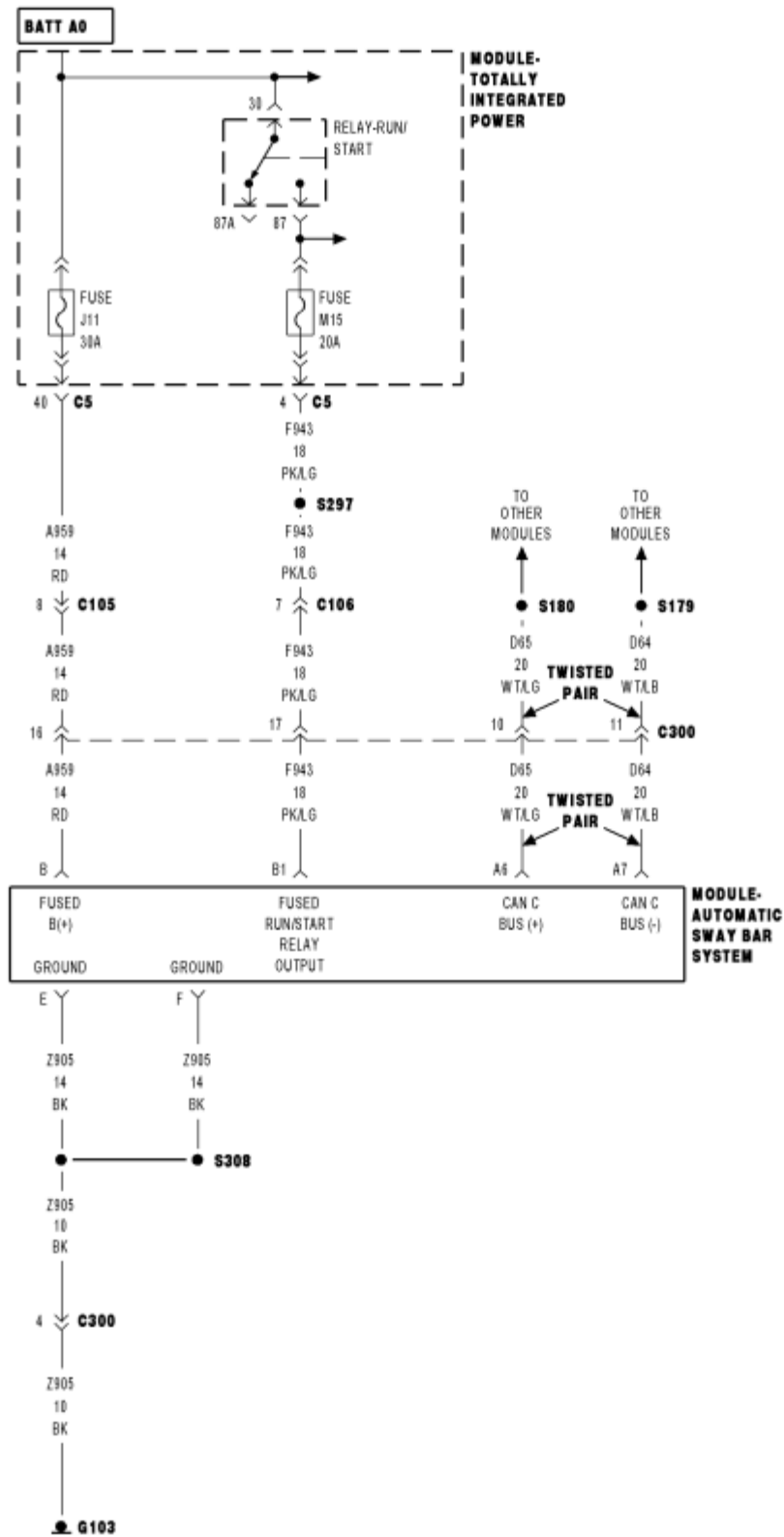
Yes

- Repair as necessary.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Test complete.

C2101–BATTERY VOLTAGE HIGH



819ca795

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

The Automatic Sway-Bar System detects that system voltage is above 16.0 volts for 10 seconds with engine RPM greater than 350.

Possible Causes
INTERMITTENT BATTERY VOLTAGE HIGH
CHARGING SYSTEM DTCS PRESENT
AUTOMATIC SWAY-BAR SYSTEM POWER CIRCUITS OPEN OR HIGH RESISTANCE
AUTOMATIC SWAY-BAR SYSTEM (ASBS)

Diagnostic Test

1. CHARGING SYSTEM DTCS PRESENT

Ignition on.

With the scan tool, select View DTCs in the Powertrain Control Module.

Are there any Charging System or related voltage DTCs present?

Yes

- Refer to the symptom list and perform any Charging System DTC diagnostic procedures before continuing with this test.

No

- Go to [2](#)
-

2. DTC IS ACTIVE

With the scan tool, select View DTCs in the ASBS Module.

Is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Go to [5](#)
-

3. AUTOMATIC SWAY-BAR SYSTEM (ASBS) MODULE GROUND CIRCUITS OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the ASBS harness connector.

With a 12-volt test light connected to B+, check the Ground circuits in the ASBS harness connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

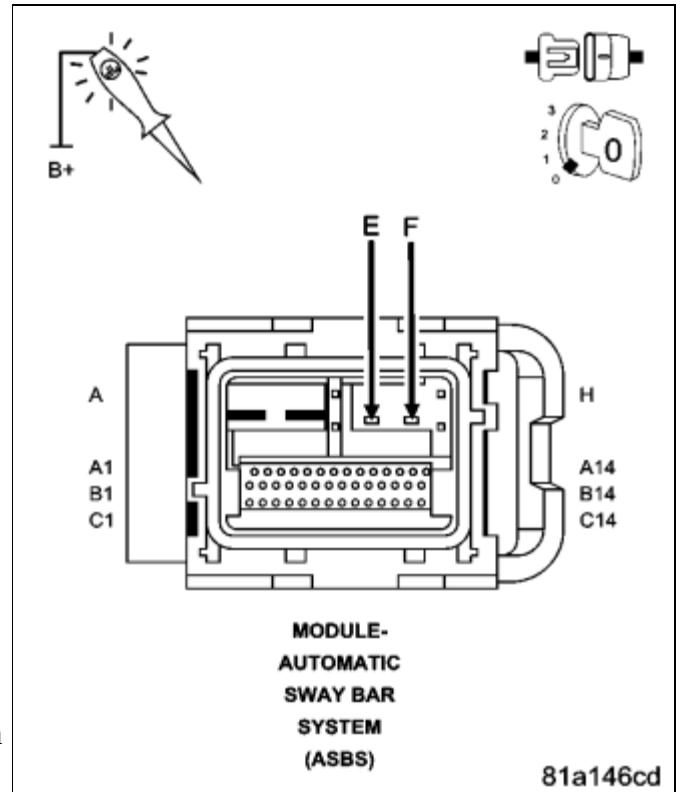
Does the test light illuminate brightly for each of the Ground circuits?

Yes

- Go to [4](#)

No

- Repair the Ground circuit(s) for an open circuit or high resistance.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)



4. AUTOMATIC SWAY-BAR SYSTEM (ASBS) MODULE

View repair.

Repair

- Replace the ASBS Module in accordance with the Service information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes

- Repair as necessary.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Test complete.

C2207–OFF–ROAD ECU INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. The Automatic Sway-Bar System Module monitors its internal microprocessors for correct operation.

- **Set Condition:**

If the Automatic Sway-Bar System Module detects an internal fault, the DTC is set.

Possible Causes
ASBS - INTERNAL FAULT

Diagnostic Test

1. ASBS INTERNAL FAILURE DTC PRESENT

Turn the ignition on.
With the scan tool, read DTCs.
With the scan tool, erase DTCs.
Cycle the ignition switch.
With the scan tool, read DTCs.

Does the scan tool display ASBS INTERNAL FAILURE?

Yes

- Replace the Automatic Sway-Bar System Module in accordance with the Service information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Perform the ASBS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ASBS INTERMITTENT CONDITION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - DIAGNOSIS AND TESTING).

U0146–LOST COMMUNICATION WITH CENTRAL GATEWAY

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
 - With the ignition on
 - Battery voltage between 10 and 16 volts
 - IOD fuse installed
- **Set Condition:**

If the Automatic Sway-Bar System Module either fails to receive bus messages from the Engine Control Module (ECM) for approximately 500 ms, or it receives invalid messages from the ECM, or it detects messages from the ECM are of improper data length.

Possible Causes
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
ECM POWER AND GROUND
ECM
AUTOMATIC SWAY-BAR SYSTEM (ASBS) MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

Turn the ignition on.

With the scan tool, read and record ASBS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ASBS DTCs.

Cycle the ignition switch.

With the scan tool, read ASBS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. VERIFY THAT THE ECM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ECM is active on the bus.

Is the ECM active on the bus?

Yes

- Go To [4](#)

No

- Perform the Stored Lost Communication test procedure.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the ECM?

Yes

- Replace/update the ECM in accordance with the service information.

No

- Replace and program the Final Drive Control Module in accordance with Service Information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 10 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM doesn't receive an ABS message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
ABS MODULE
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View PCM DTCs.

Is the DTC Active at this time?

Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0415–IMPLAUSIBLE DATA RECEIVED FROM ABS

For a complete wiring diagram **Refer to Section 8W**

◦ When Monitored:

With the ignition on for 4 seconds, no CAN BUS circuit error condition present, no lost communication with ABS condition present, and no system undervoltage or overvoltage condition present.

◦ Set Condition:

The Automatic Sway-Bar System Module is receiving implausible data for vehicle speed, wheel speed.

Possible Causes
ANTILOCK BRAKE SYSTEM DTCS PRESENT
AUTOMATIC SWAY-BAR SYSTEM (ASBS)

Diagnostic Test

1. ABS DTCS PRESENT

Ignition on, engine not running.

With the scan tool, read DTCs in the Antilock Brake Controller.

Are there any DTCs present?

Yes

- Refer to the symptom list and perform the applicable diagnostic procedure.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Replace the ASBS Module in accordance with the Service Information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

U0447–IMPLAUSIBLE DATA RECEIVED FROM CENTRAL GATEWAY

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously with the ignition on, one valid CAN message received at least once, and no U0002-CAN C Bus Off Performance DTC present.

◦ **Set Condition:**

When the Automatic Sway-Bar System Module detects an incorrect CAN message from the Totally Integrated Power Module (TIPM).

Possible Causes
ASBS CAN BUS DTCS
ENGINE DTCS
AUTOMATIC SWAY-BAR SYSTEM (ASBS) MODULE

Diagnostic Test

1. CHECK FOR DTC U0401-IMPLAUSIBLE DATA RECEIVED FROM TIPM

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: U0401-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM?

Yes

- Go To [2](#)

No

- Perform the ASBS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ASBS-INTERMITTENT CONDITION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - DIAGNOSIS AND TESTING).

Diagnostic Test

2. CHECK IF TIPM CAN BUS DTCs ARE PRESENT

With the scan tool, read TIPM DTCs.

Are there any TIPM CAN BUS DTCs present?

Yes

- Refer to the appropriate diagnostic. (Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK IF ENGINE DTCs ARE PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine DTCs present?

Yes

- Refer to the 9 - ENGINE ELECTRICAL DIAGNOSTICS and diagnose the appropriate symptom.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Automatic Sway-Bar System Module pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Final Drive Control Module in accordance with Service Information.
- Perform ASBS VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

STANDARD PROCEDURE

ASBS VERIFICATION TEST

Diagnostic Test

1. PERFORM ASBS VERIFICATION TEST

CAUTION: Before removing the ASBS harness connector, clean the connector and locking cam area of dirt and debris. Failure to do so can result in the connector being jammed or damage to the locking cams on the harness connector or module. Do not force the assist arm when releasing or installing the harness connector.

NOTE: If the SKIM, PCM or FCM was replaced, refer to the service information for proper programming procedures.

- Disconnect all jumper wires and reconnect all previously disconnected components and connectors.
- Ensure that all accessories are turned off.
- Ensure that the battery is fully charged.
- With the scan tool, record and erase all DTC(s) from the ASBS
- Start and run the engine for 2 minutes while operating all functions of the system that caused the original concern.
- **NOTE: When a Stabilizer System DTC diagnostic is complete and all repairs have been made, running the Stabilizer Motor System Test and/or LED System Test can also provide verification that the DTC has been repaired and the system is operating normally.**
- Turn the ignition off, wait 5 seconds, then turn the ignition on. Using the scan tool, read DTC(s) from the ASBS.

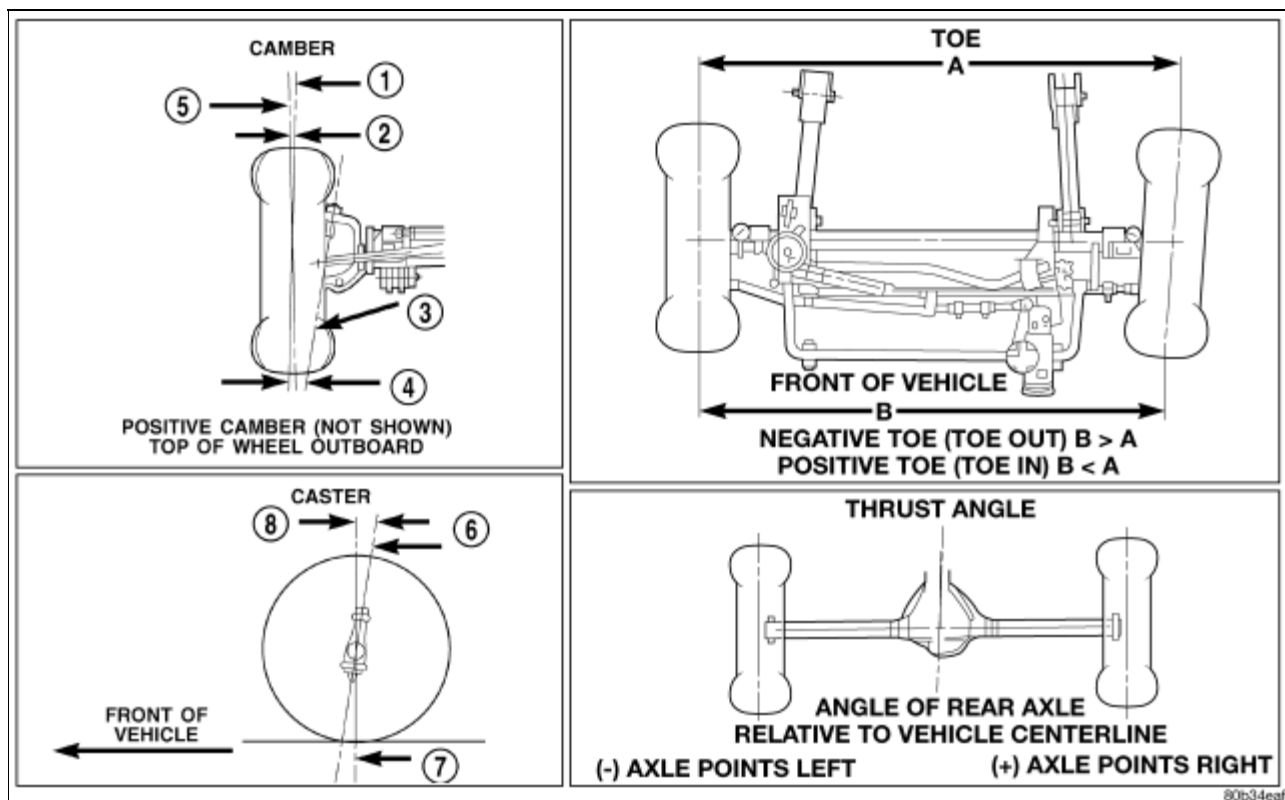
Are any ASBS DTC(s) present or is the original condition still present?

Yes

- The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No

- The repair is complete.

SUSPENSION - SERVICE INFORMATION**WHEEL ALIGNMENT****WHEEL ALIGNMENT****DESCRIPTION**

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe position.

CAUTION: Never attempt to modify suspension or steering components by heating or bending.

NOTE: Periodic lubrication of the front suspension/steering system components may be required. Rubber

bushings must never be lubricated. Refer to Lubrication And Maintenance for the recommended maintenance schedule.

OPERATION

- **CASTER** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle rearward provides positive caster. Tilting the top of the knuckle forward provides negative caster. Caster is a directional stability angle. This angle enables the front wheels to return to a straight ahead position after turns
- **CAMBER** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire. The angle is not adjustable, damaged component(s) must be replaced to correct the camber angle
- **WHEEL TOE POSITION** is the difference between the leading inside edges and trailing inside edges of the front tires. Incorrect wheel toe position is the most common cause of unstable steering and uneven tire wear. The wheel toe position is the **final** front wheel alignment adjustment
- **STEERING AXIS INCLINATION ANGLE** is measured in degrees and is the angle that the steering knuckles are tilted. The inclination angle has a fixed relationship with the camber angle. It will not change except when a spindle or ball stud is damaged or bent. The angle is not adjustable, damaged component(s) must be replaced to correct the steering axis inclination angle
- **THRUST ANGLE** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. This angle is not adjustable, damaged component(s) must be replaced to correct the thrust angle

DIAGNOSIS AND TESTING

SUSPENSION AND STEERING SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Adjust or replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.

	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
	5. Leaking steering damper.	5. Replace steering damper.
	6. Tire pressure.	6. Adjust tire pressure.
VEHICLE INSTABILITY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Adjust or replace steering gear.
	2. Power steering fluid low.	2. Add fluid and repair leak.
	3. Column coupler binding.	3. Replace coupler.
	4. Tire pressure.	4. Adjust tire pressure.
	5. Alignment.	5. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE DURING BRAKING	1. Uneven tire pressure.	1. Adjust tire pressure.
	2. Worn brake components.	2. Repair brakes as necessary.
	3. Air in brake line.	3. Repair as necessary.
VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD	1. Radial tire lead.	1. Cross front tires.
	2. Brakes dragging.	2. Repair brake as necessary.
	3. Weak or broken spring.	3. Replace spring.
	4. Uneven tire pressure.	4. Adjust tire pressure.
	5. Wheel Alignment.	5. Align vehicle.
	6. Loose or worn steering or suspension components.	6. Repair as necessary.
	7. Cross caster out of spec.	7. Align vehicle.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings.	1. Replace shock.

IMPROPER TRACKING	2. Loose, worn or bent steering/suspension components.	2. Inspect, tighten or replace components as necessary.
	3. Shock valve.	3. Replace shock.
	1. Loose, worn or bent track bar.	1. Inspect, tighten or replace component as necessary.
	2. Loose, worn or bent steering/suspension components.	2. Inspect, tighten or replace components as necessary.

STANDARD PROCEDURE

HEIGHT MEASUREMENT

CURB HEIGHT

NOTE: The suspension is non-adjustable.

The vehicle suspension height should be measured before performing wheel alignment procedure. Also when front suspension components have been replaced. This measure must be performed with the vehicle supporting it's own weight and taken on both sides of the vehicle.

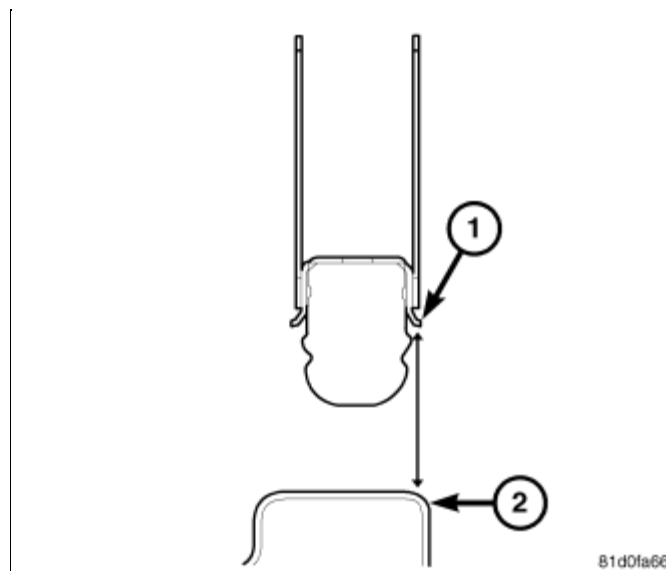
Front and rear curb heights are not adjustable. The spring selections at assembly determine curb height for acceptable appearance of the vehicle. Curb height dimensions assume full fluids (including fuel) and zero passengers. Refer to the table below for front curb height dimensions.

Vehicle curb height audits should be performed utilizing the following procedure:

NOTE: Make sure the vehicle is in 2WD when checking curb height.

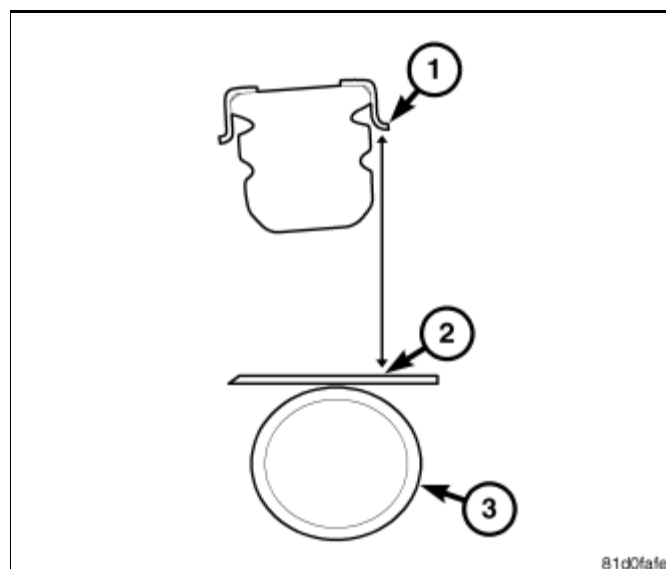
1. Bounce the front of the vehicle five times.
2. Measure and record the dimensions

Front – On each side of the vehicle, measure the distance from the bottom of the jounce bumper cup (1) to the top lip of the inner spring seat on axle (2).



REAR CURB HEIGHT

Rear – On each side of the vehicle, measure the distance from the bottom of the jounce bumper cup (1) to the top (2) of the rear axle (3).



CURB HEIGHT SPECIFICATIONS

MODEL	FRONT	REAR
4X2	63 mm / +25 mm to -12 mm	102 mm / +25 mm to -12 mm
	2.48 in. / + 0.98 to -0.47 in	4.01 in. / + 0.98 to -0.47 in
4X4 Short Wheel Base (SWB) X / SPORT / SAHARA	93 mm / +25 mm to -12 mm	126 mm / +25 mm to -12 mm
	3.66 in. / + 0.98 to -0.47 in	4.96 in. / + 0.98 to -0.47 in
4X4 Short Wheel Base (SWB) RUBICON	97 mm / +25 mm to -12 mm	130 mm / +25 mm to -12 mm
	3.81 in. / + 0.98 to -0.47 in	5.11 in. / + 0.98 to -0.47 in
4X4 Short Wheel Base (SWB)	76 mm / +25 mm to -12 mm	126 mm / +25 mm to -12 mm

DIESEL - ALL	2.99 in. / + 0.98 to -0.47 in	4.96 in. / + 0.98 to -0.47 in
4X4 Long Wheel Base (LWB) X / SPORT / SAHARA	93 mm / +25 mm to -12 mm	132 mm / +25 mm to -12 mm
	3.66 in. / + 0.98 to -0.47 in	5.19 in. / + 0.98 to -0.47 in
4X4 Long Wheel Base (LWB) RUBICON	97 mm / +25 mm to -12 mm	136 mm / +25 mm to -12 mm
	3.81 in. / + 0.98 to -0.47 in	5.35 in. / + 0.98 to -0.47 in
4X4 Long Wheel Base (LWB) DIESEL - ALL	76 mm / +25 mm to -12 mm	132 mm / +25 mm to -12 mm
	2.99 in. / + 0.98 to -0.47 in	5.19 in. / + 0.98 to -0.47 in

TOLERANCES

INDIVIDUAL	CROSS CAR
+25 mm -12 mm	± 12 mm
(0.984 in. - 0.47 in)	(± 0.47 in)

CAMBER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

The wheel camber angle is preset. This angle is not adjustable and cannot be altered.

CASTER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

Check the caster of the front axle for correct angle. Be sure the axle is not bent or twisted. Road test the vehicle and observe the steering wheel return-to-center position. Low caster will cause poor steering wheel return ability.

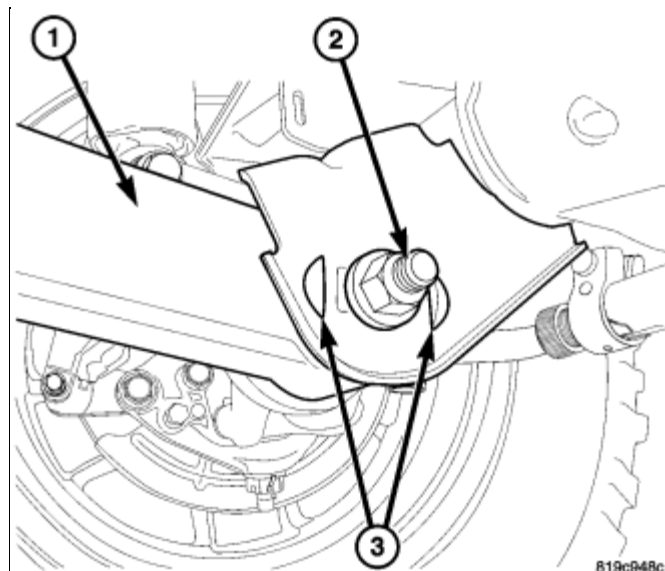
During the road test, turn the vehicle to both the left and right. If the steering wheel returns to the center position unassisted, the caster angle is correct. However, if steering wheel does not return toward the center position unassisted, a low caster angle is probable.

Caster can be adjusted by installing a Mopar® cam adjustment kit located between the notches in the axle

bracket (3) and moving the lower suspension arm (1) at the axle forward or rearward.

The lower suspension arm will have to be removed at the axle bracket and then the knock-outs will have to be removed in order for the kit to be installed. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).

NOTE: Changing caster angle will also change the front propeller shaft angle. The propeller shaft angle has priority over caster. Refer to Group 3, Differential and Driveline for additional information.

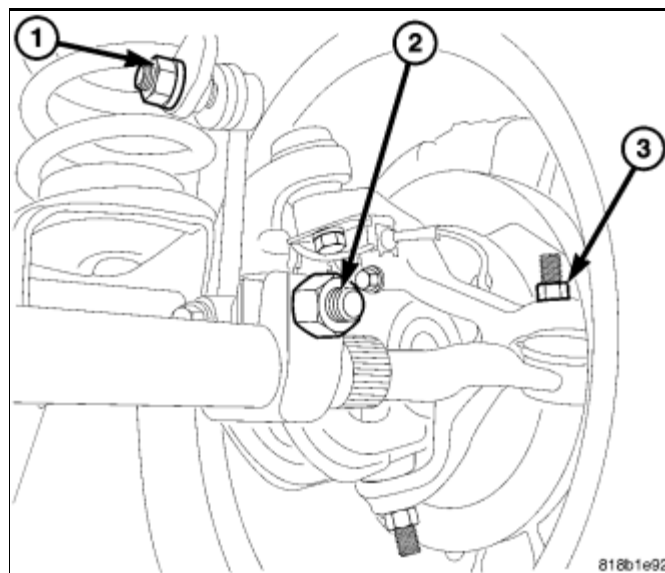


TOE POSITION

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

NOTE: The wheel toe position adjustment is the final adjustment. This adjustment must be performed with the engine running, if the vehicle is equipped with power steering.

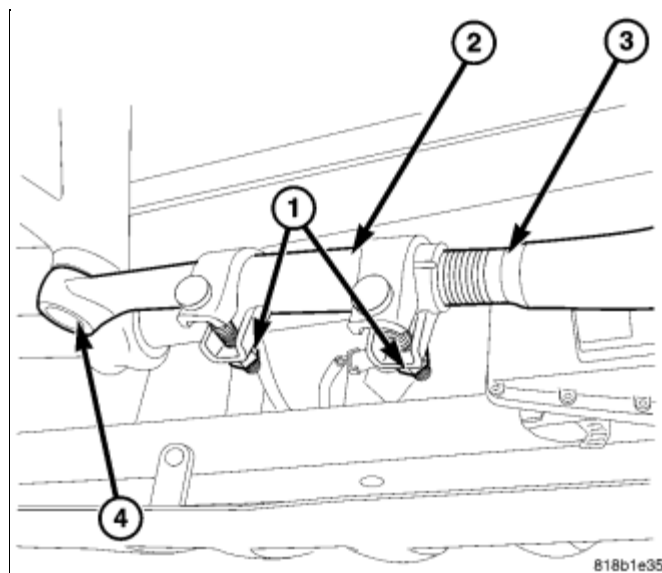
1. Start the engine and turn wheels both ways before straightening the steering wheel. Center and secure the steering wheel.
2. Loosen the adjustment sleeve clamp bolts (2).
3. Adjust the total toe with the tie rod. Turn the knurled adjuster until the correct total toe is reached. Center both sockets at the knuckles and tighten the clamp bolts to 61 N·m (45 ft.lbs). **Make sure the toe setting does not change during clamp tightening.**



4. Adjust the drag link adjuster sleeve so that the left and right toe values are equal. Verify the steering wheel is still straight. Position the clamps as shown and tighten to 35 N·m (26 ft. lbs.).
5. Verify the toe specifications and turn off the engine.

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS



NOTE: Alignment specifications are in degrees.

DESCRIPTION	SPECIFICATION		
PREFERRED	CASTER + 4.2°	CAMBER ? 0.25° (fixed angle)	TOTAL TOE-IN + 0.20° (0.10° each front wheel)
RANGE	± 0.5°	± 0.37°	±0.03°
MAX LT/RT DIFFERENCE	0.65°	± 0.5°	0.04°
REAR SPECIFICATION			
PREFERRED	N/A	REAR CAMBER –0.25°	TOTAL TOE-IN +0.25°
RANGE	N/A	0° to –.50°	0° to .5°
THRUST ANGLE 0° ± 0.25°			

FRONT

FRONT

DESCRIPTION

FRONT SUSPENSION

The front suspension is a link/coil design comprised of:

- Shock absorbers
- Jounce Bumper
- Coil springs
- Upper and lower suspension arms
- Stabilizer bar
- Track bar

CAUTION: Suspension components with rubber/urethane bushings (except stabilizer bar to frame and stabilizer bar to link attachments) should be tightened with the full weight of the vehicle at normal ride height. It is important to have the springs supporting the full weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

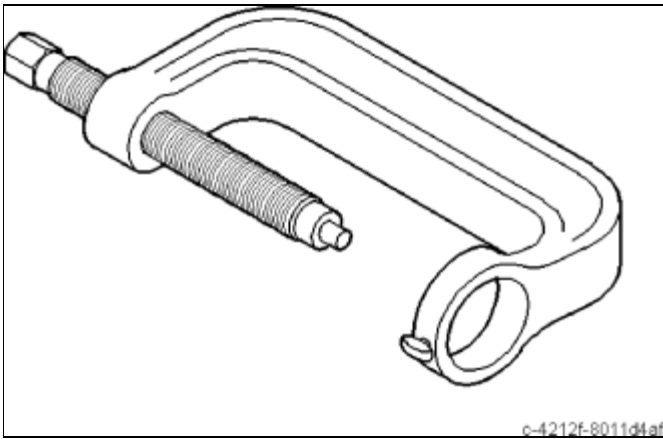
SPECIFICATIONS

TORQUE

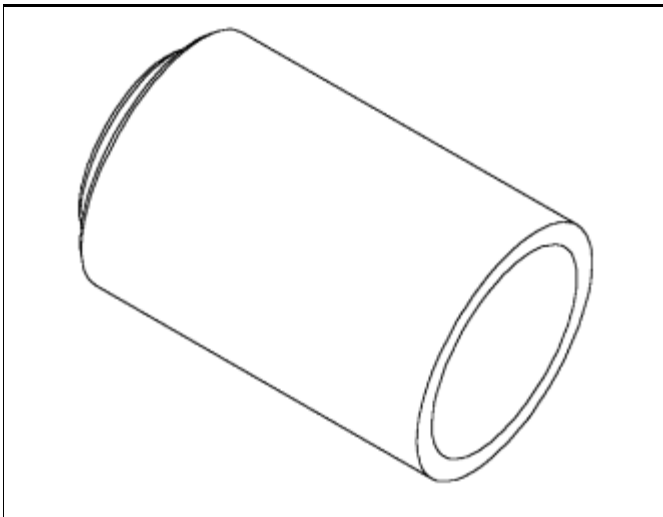
DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Nut	27	20	—
Shock Absorber Lower Nut	76	56	—
Suspension Arm Lower Axle Bracket Nut	169	125	—
Suspension Arm Lower Frame Bracket Nut	169	125	—
Suspension Arm Upper Axle Bracket Nut/Bolt	102	75	—
Suspension Arm Upper Frame Bracket Bolt	102	75	—
Stabilizer Bar Retainer Bolts	61	45	—
Stabilizer Bar Link Upper Nut	102	75	—
Stabilizer Bar Link Lower Bolt	102	75	—
Track Bar Frame Bracket Nut	169	125	—
Track Bar Axle Bracket Bolt	169	125	—
Hub/Bearing Bolts	102	75	—
Hub/Bearing Axle Nut	136	100	—
Jounce Cup Bolt	42	31	—

SPECIAL TOOLS

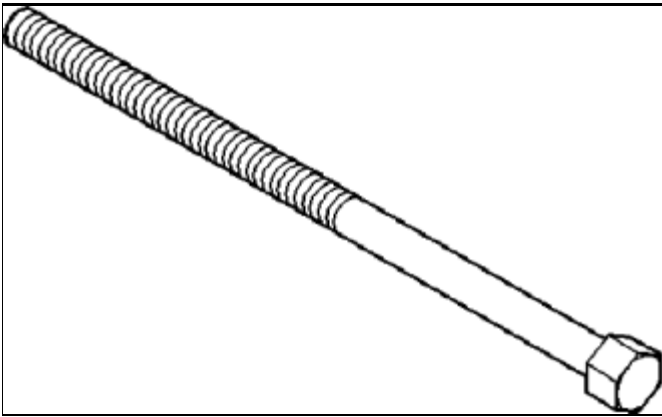
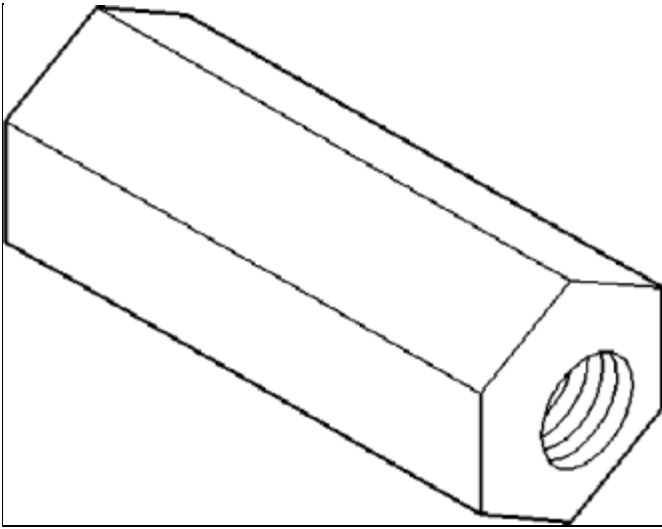
FRONT SUSPENSION

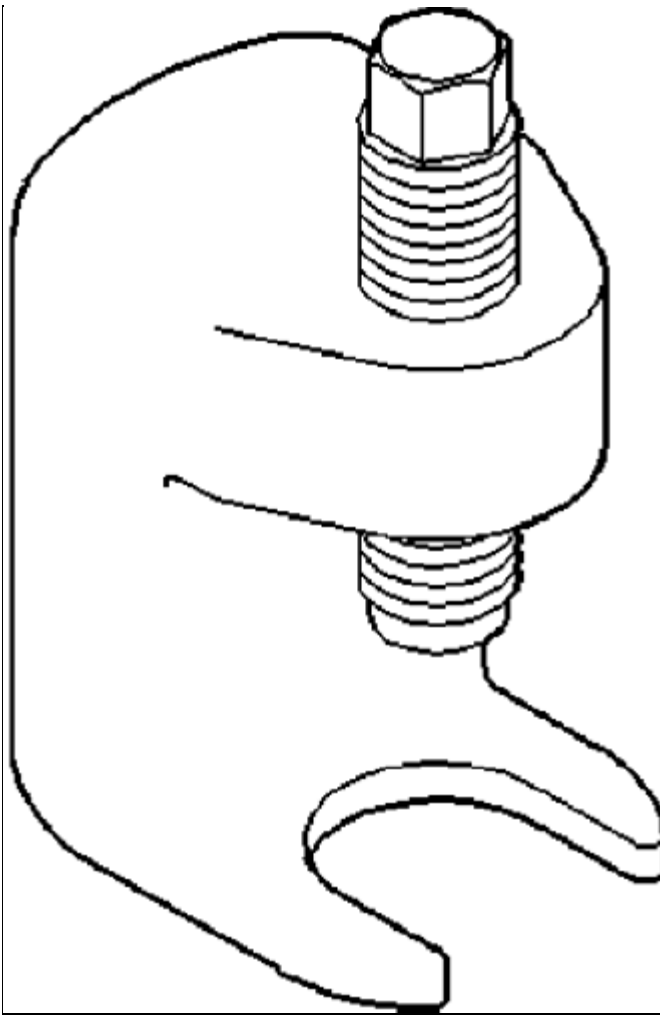


BALL JOINT PRESS - C-4212F



RECEIVER CUP - 6761



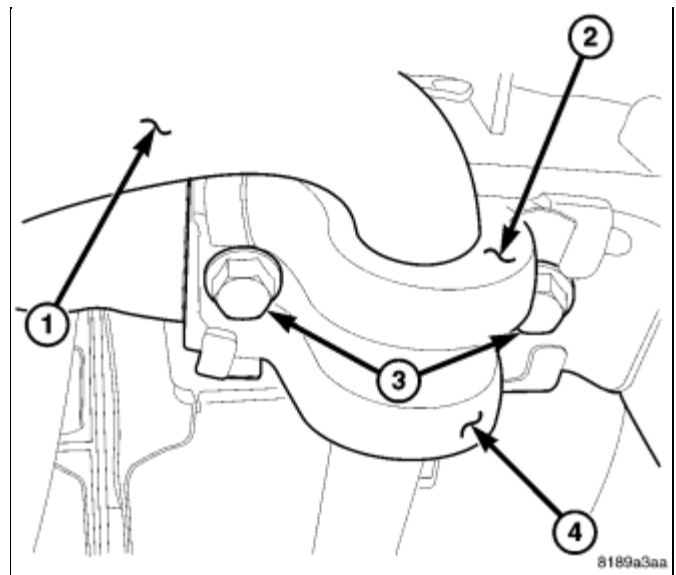


BUSHINGS

REMOVAL

STABILIZER BAR BUSHING

1. Raise and support the vehicle.
2. Remove the left upper stabilizer bar link nut from the stabilizer bar.
3. Remove the left lower stabilizer bar link bolt to the axle. **This will allow clearance to remove the stabilizer bar from the right side link without removing the whole link.**
4. Remove the right upper stabilizer bar link nut from the stabilizer bar.
5. Remove the splash shield.
6. Remove the right side stabilizer bar bracket bolts (3) to the frame.
7. Remove the left side stabilizer bar bracket bolts (3) to the frame.
8. Remove the stabilizer bar (1) to the bench.

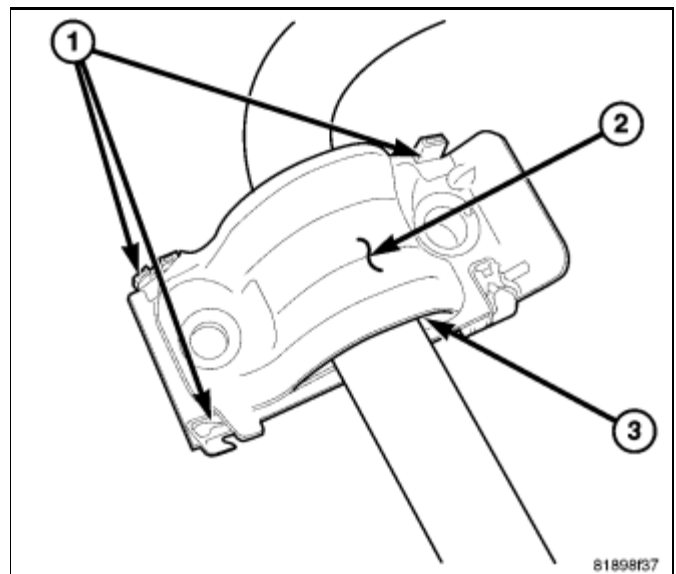


9. Bend open the retaining tabs (1) on the bracket. **If these tabs (1) break that is okay, they are used for the factory installation only.**

10. Remove the retainer bracket (2).

11. Slide the bushings (3) off the stabilizer bar with a mixture of soapy water.

AXLE BUSHING

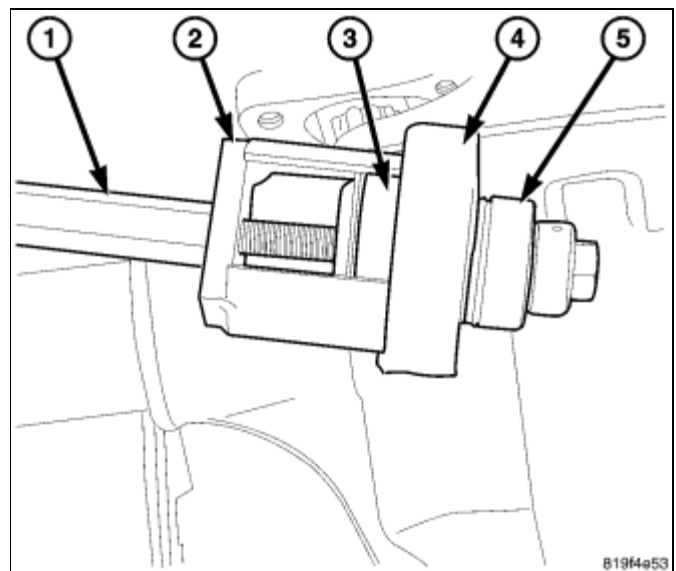


1. Remove the upper suspension arm from axle (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).

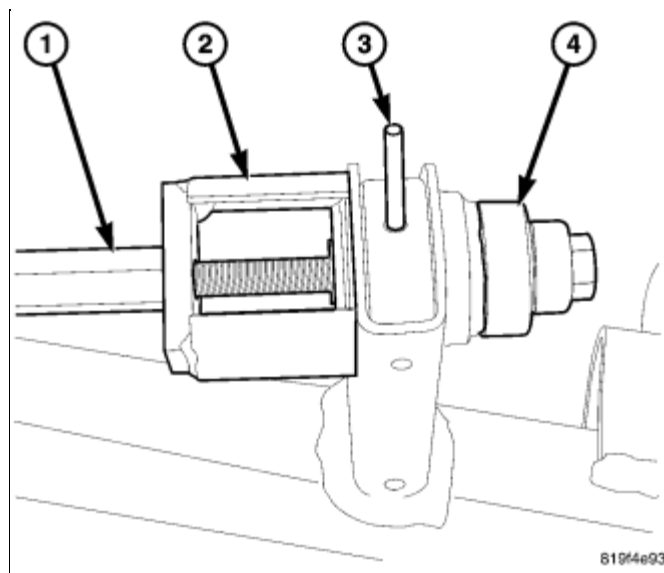
2. Install the special tool 9948-3 Nut (1), 9948-1 Receiver (2) and 9948-2 Driver (4).

3. Press the bushing out of the axle housing.

AXLE BRACKET BUSHING



1. Remove the upper suspension arm from axle (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).
2. Install the special tool 9948-3 Nut (1), 9948-1 Receiver (2), 9948-5 Spacer and 9948-2 Driver (4).
3. Press the bushing (5) out of the axle bracket (6).



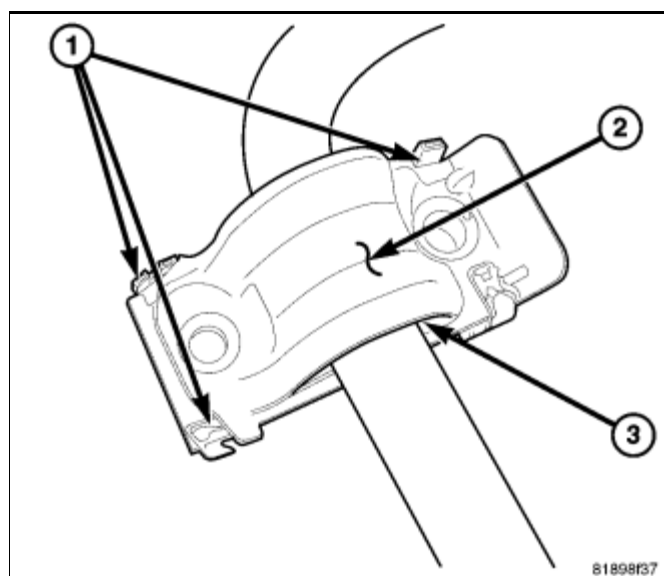
INSTALLATION

STABILIZER BAR BUSHING

1. Slide the bushings (3) on the stabilizer bar with a mixture of soapy water.
2. Install the retainer bracket (2).

NOTE: Be sure to install the shear plate bracket (1) with the down turned part facing forward in vehicle.

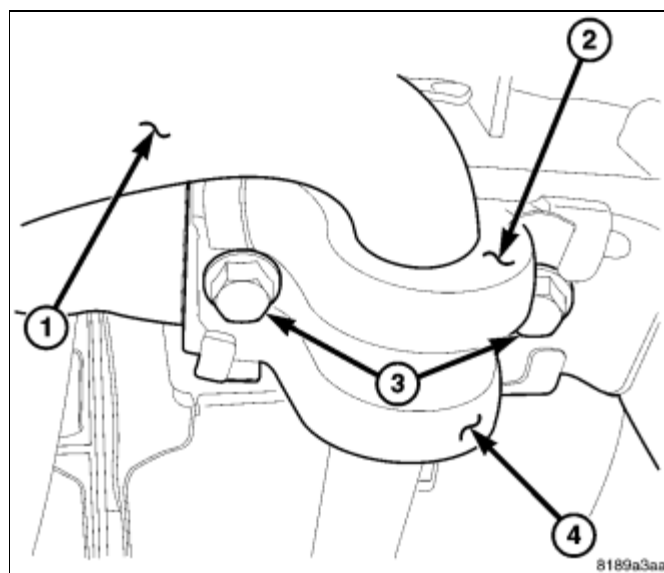
3. Bend the retaining tabs (1) back into place on the bracket if they didn't break off. **If these tabs (1) break that is okay, they are used for the factory installation only and are not needed for proper operation.**



4. Install the stabilizer bar (1) to the vehicle.

NOTE: Stabilizer bar link to axle bolt should be tightened with vehicle sitting on its tires

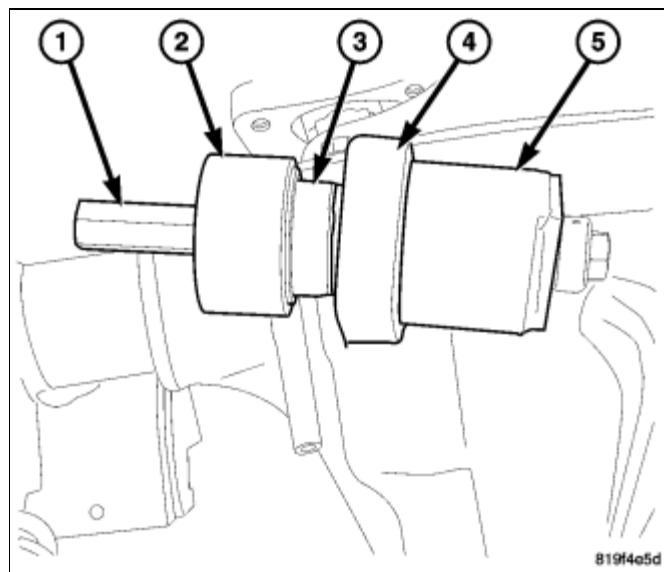
5. Install the right side stabilizer bar bracket bolts (3) to the frame. Tighten to 61 N·m (45 ft.lbs).
6. Install the left side stabilizer bar bracket bolts (3) to the frame. Tighten to 61 N·m (45 ft.lbs).
7. Install the splash shield.
8. Install the right upper stabilizer bar link nut to the stabilizer bar. Tighten to 61 N·m (45 ft.lbs).
9. Install the left lower stabilizer bar link bolt to the axle. Tighten to 61 N·m (45 ft.lbs).
10. Install the left upper stabilizer bar link nut to the stabilizer bar. Tighten to 61 N·m (45 ft.lbs).



11. Remove the support and lower the vehicle.

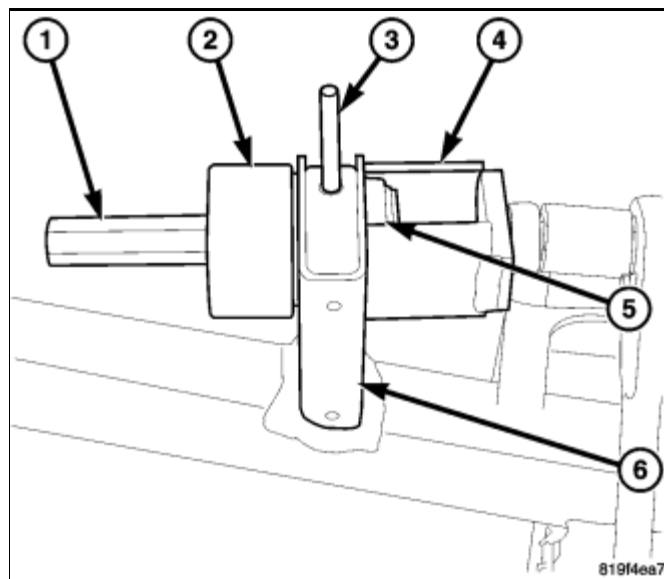
AXLE BUSHING

1. Place special tool 9948-3 Nut (1), 9948-4 Driver (2), 9948-1 Receiver (5) and the press the bushing (3) in the axle housing (4).
2. Remove tools and install the upper suspension arm (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).



AXLE BRACKET BUSHING

1. Place special tool 9948-3 Nut (1), 9948-1 Receiver (5), 9948-5 Spacer (3), 9948-4 Driver (2) and the press the bushing in the axle bracket (5).
2. Remove tools and install the upper suspension arm (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).



HUB / BEARING

DESCRIPTION

The bearing used on the front hub of this vehicle is the combined hub and bearing unit type assembly. This unit assembly combines the front wheel mounting hub (flange) and the front wheel bearing into a one piece unit. The wheel mounting studs are the only replaceable component of the hub/bearing assembly.

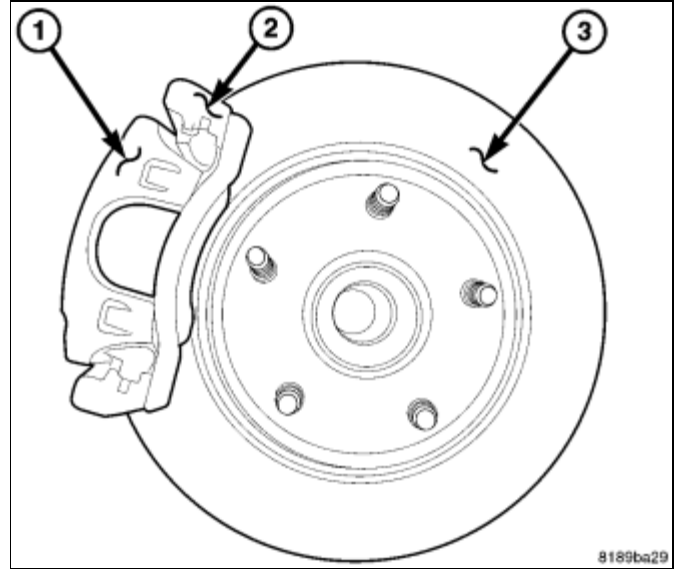
OPERATION

The hub/bearing assembly is mounted to the steering knuckle and is retained by three mounting bolts accessible from the back of the steering knuckle. The hub/bearing unit is not serviceable and must be replaced as an assembly if the bearing or the hub is determined to be defective.

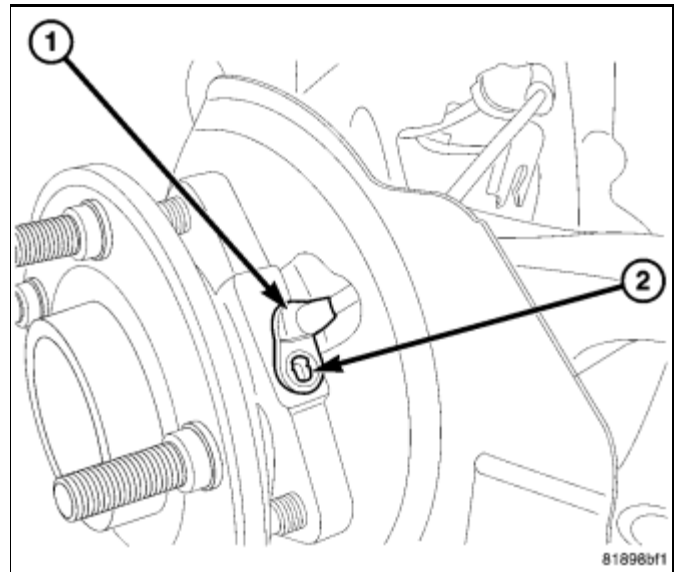
REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel and tire assembly. **Support the caliper, Do not let the caliper hang by the hose.**
3. Remove the disc brake caliper (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the brake caliper adaptor (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

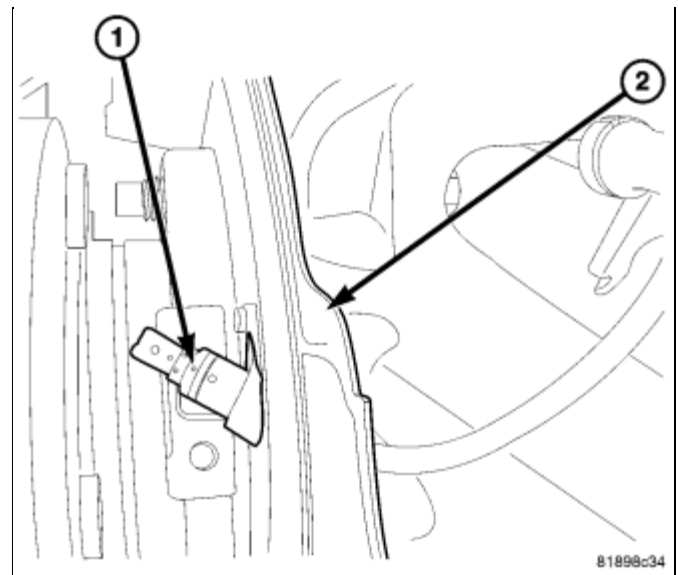
5. Remove the disc brake rotor (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).



6. Remove the wheel speed sensor bolt (2).

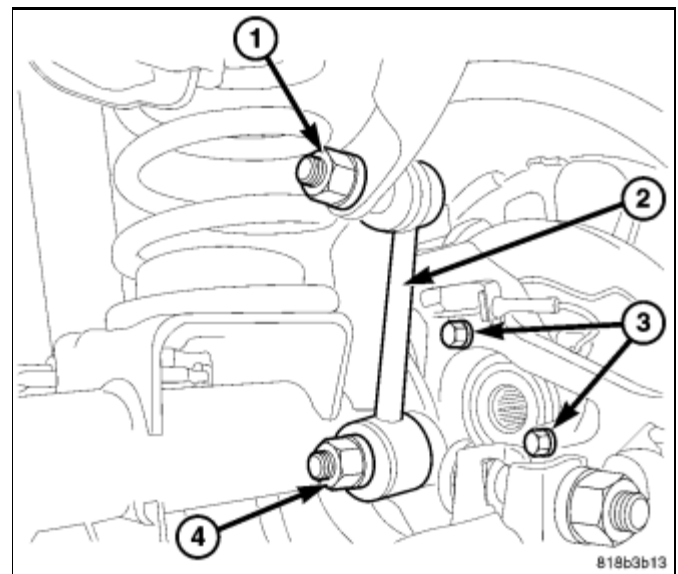


7. Remove the wheel speed sensor (1) through the hole in the brake shield (2) (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).

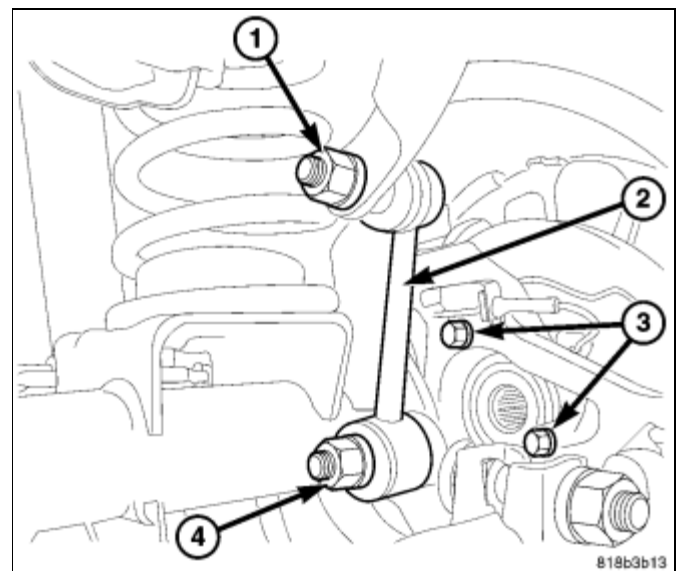


8. Remove the axle shaft nut if equipped.
9. Remove the 3 hub bearing mounting bolts (3) from the back of the steering knuckle. Remove hub bearing from the steering knuckle.

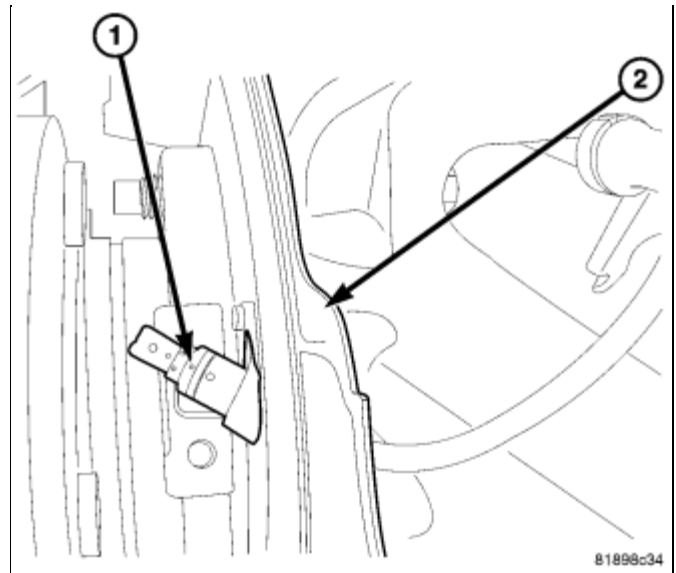
INSTALLATION



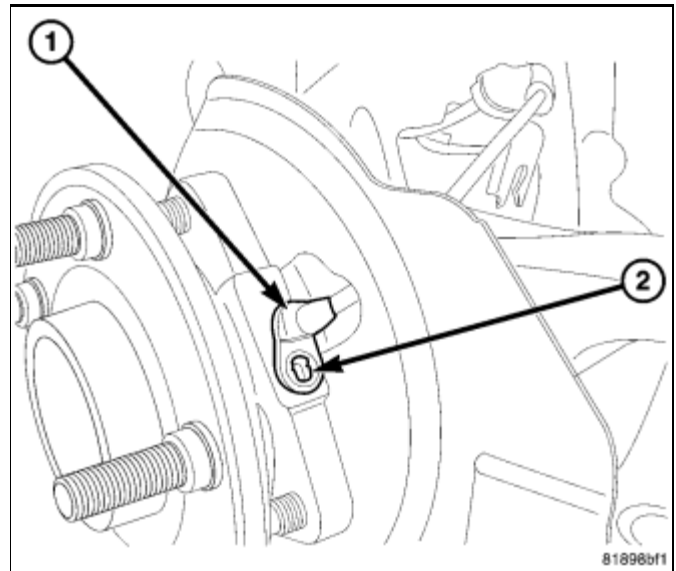
1. Install the hub bearing to the knuckle.
2. Install the hub bearing to knuckle and the 3 bolts (3) then tighten to 102 N·m (75 ft. lbs.).
3. Install the axle nut if equipped. Tighten to 136 N·m (100 ft. lbs.).



4. Install the wheel speed sensor (1) through the hole in the brake shield (2) (Refer to 5 - BRAKES/ELECTRICAL/Front WHEEL SPEED SENSOR - INSTALLATION).



5. Install the wheel speed sensor (1) into the hub & bearing and install the mounting bolt (2). Tighten to 4-6 N·m (34-50 in. lbs.).



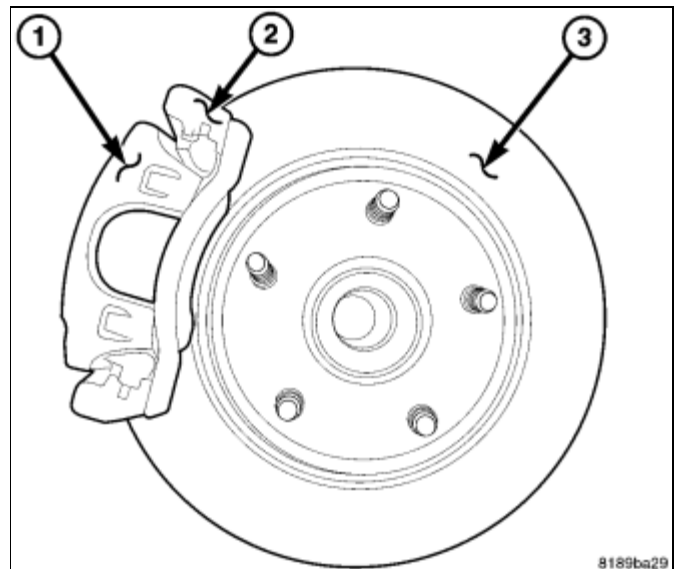
6. Install the brake rotor (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

7. Install the brake caliper adaptor (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

8. Install the caliper (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

9. Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).

10. Remove the support and lower the vehicle.



JOUNCE BUMPER

DESCRIPTION

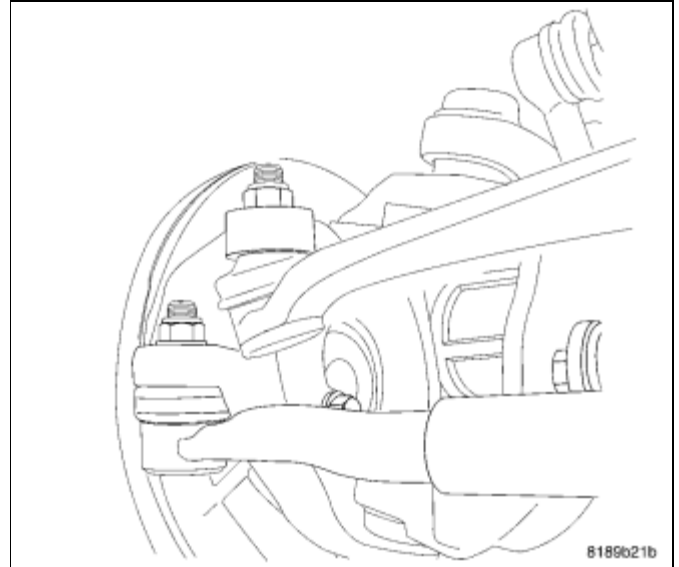
The jounce bumpers are mounted under the frame rails inside of the coil springs.

KNUCKLE

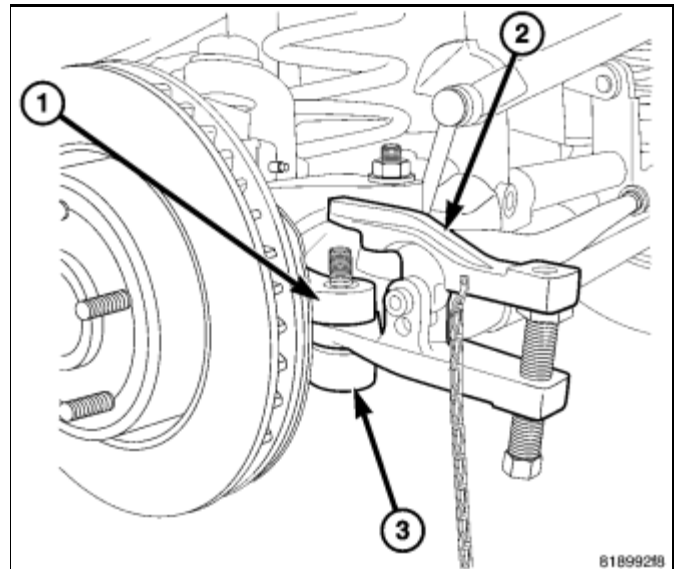
REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.

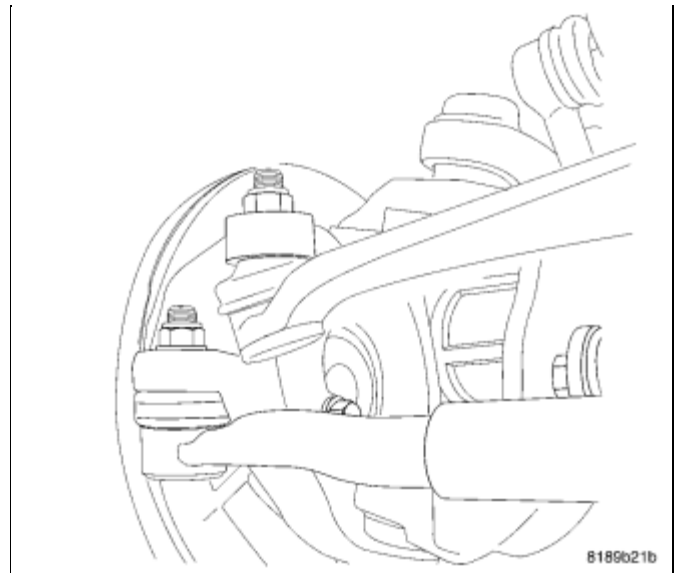
3. Remove the outer tie rod end nut.



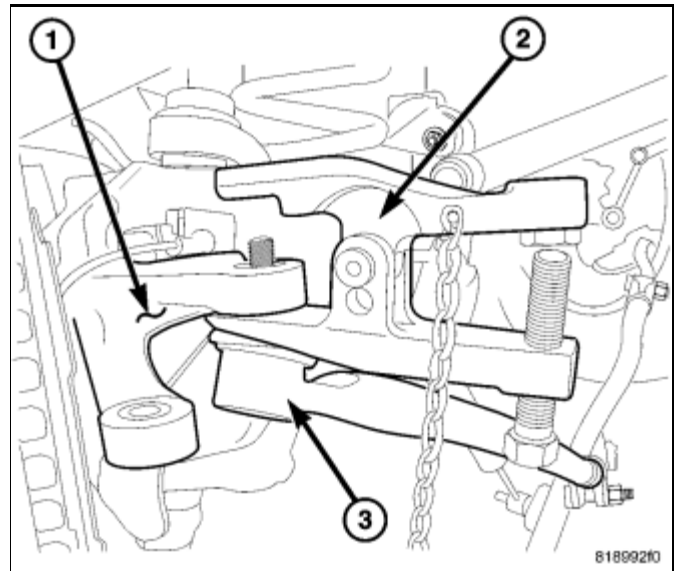
4. Separate the tie rod (3) from the knuckle (1) using special tool 9360 separator (2).



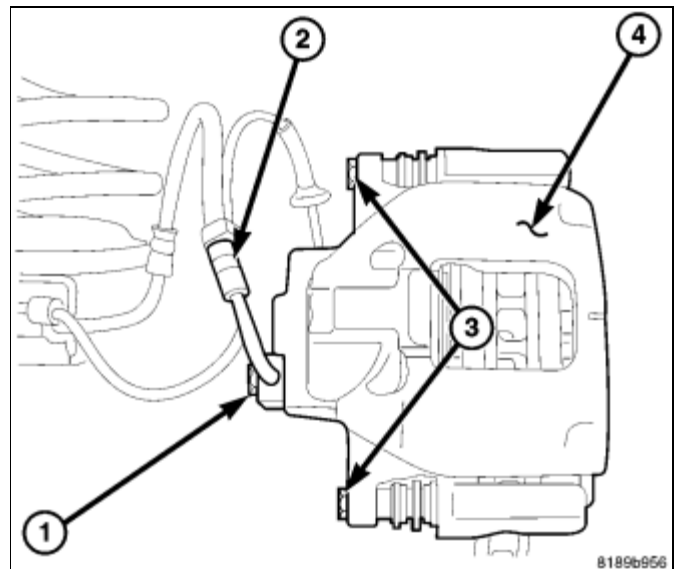
5. Remove the drag link nut. **Right side only.**



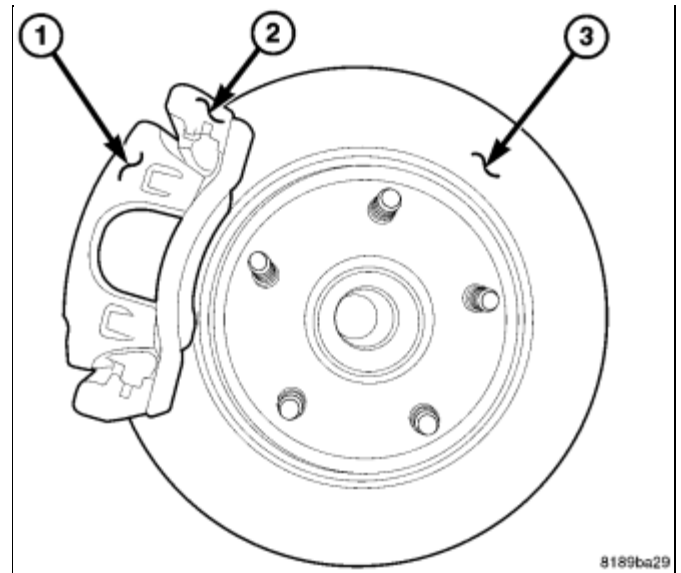
6. Separate the drag link (3) from the knuckle (1) using special tool 9360 separator (2) **Right side only.**



7. Remove the disc brake caliper adapter bolts (3). **support the disc brake caliper (4) do not let it hang by the brake hose.**

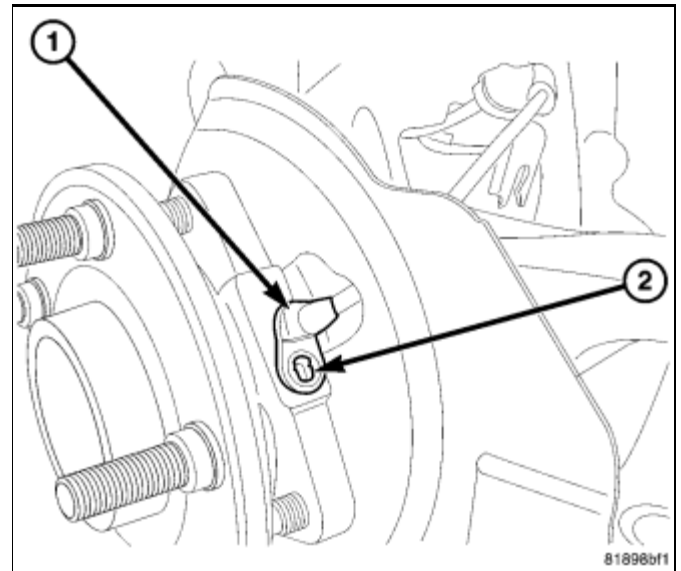


8. Remove the disc brake rotor (3).

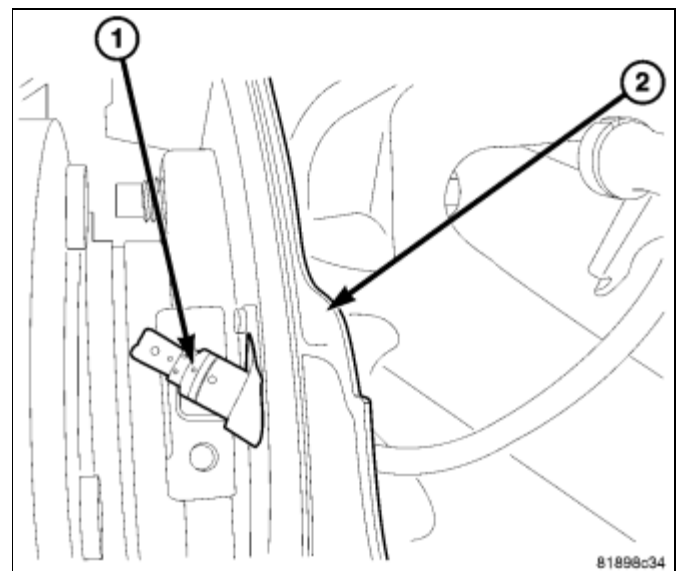


9. Remove axle shaft nut (if equipped).

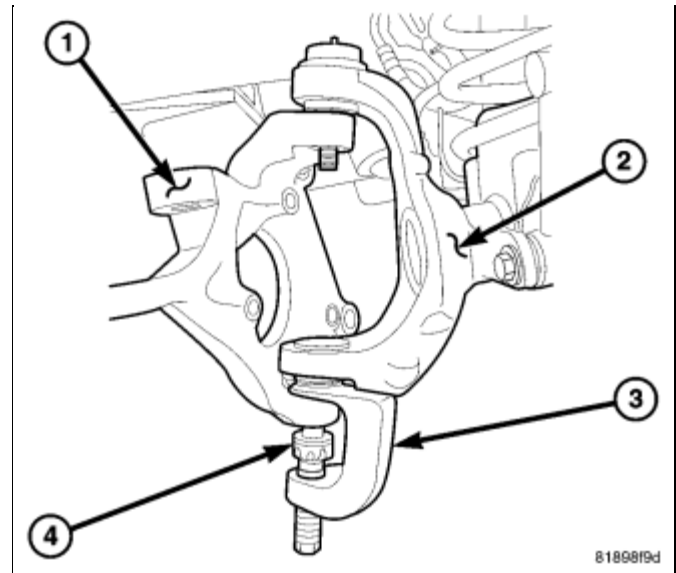
10. Remove the wheel speed sensor mounting bolt (2).



11. Remove the wheel speed sensor (1) through the hole in the brake shield (2).



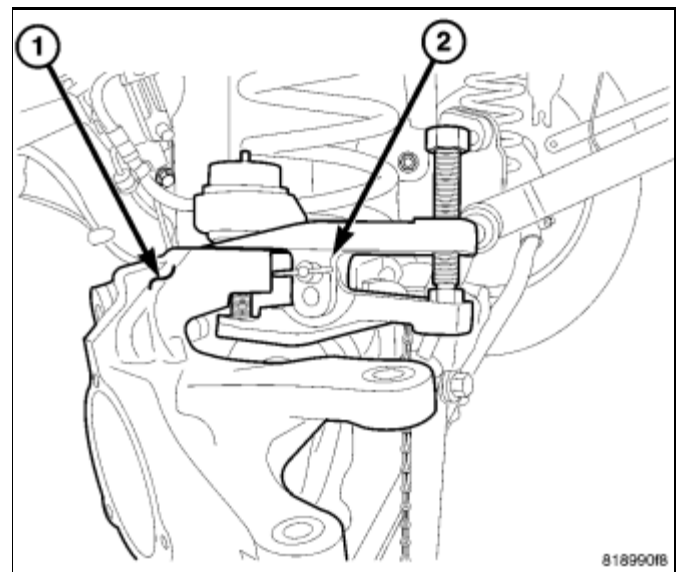
12. Remove the lower ball joint cotter pin and nut (4).
13. Remove the upper ball joint cotter pin and nut.
14. Separate the lower ball joint from the knuckle (1) using special tool C-4150A puller (3).



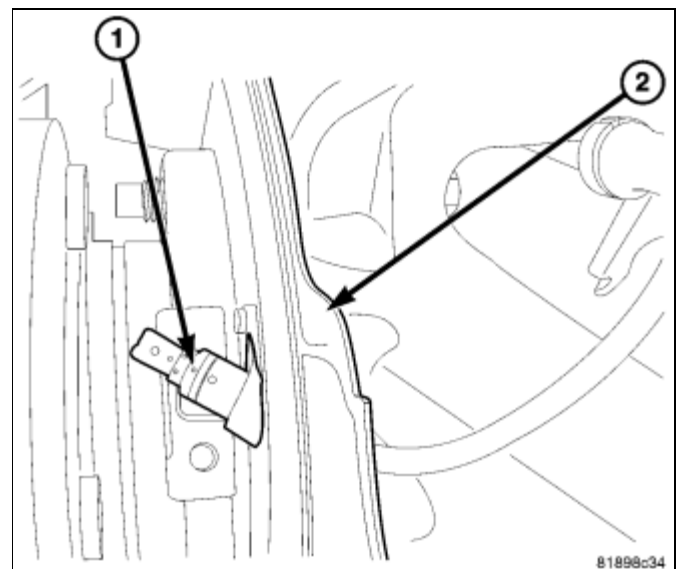
15. Separate the upper ball joint from the knuckle (1) using special tool 9360 separator (2).
16. Remove the knuckle from the vehicle and transfer the hub/bearing with brake shield if needed.

INSTALLATION

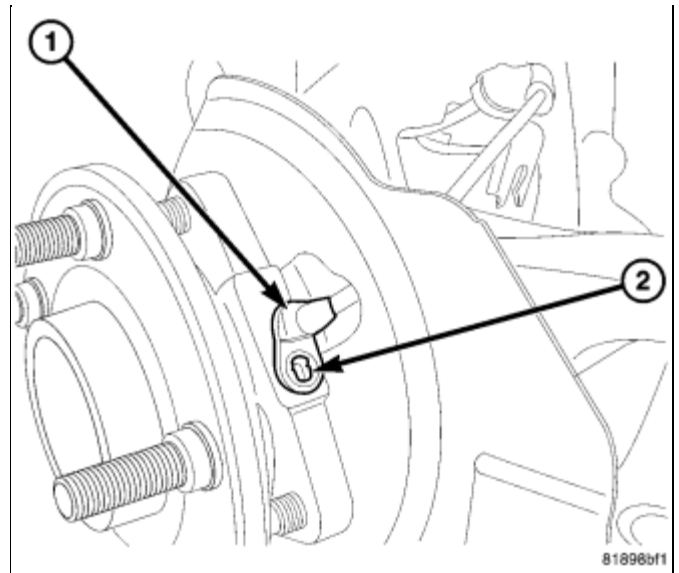
1. Install the knuckle to the ball joint studs.
2. Install the upper ball joint nut and cotter pin. Tighten to
3. Install the lower ball joint nut and cotter pin. Tighten to



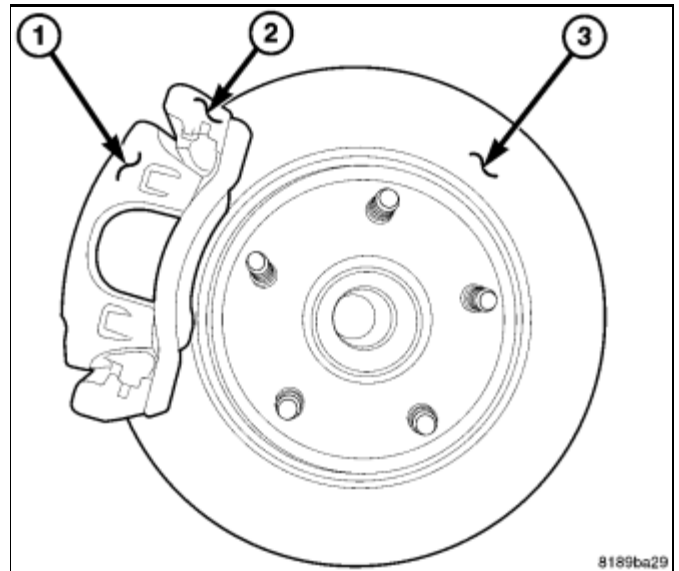
4. Install the wheel speed sensor (1) through the hole in the brake shield (2).



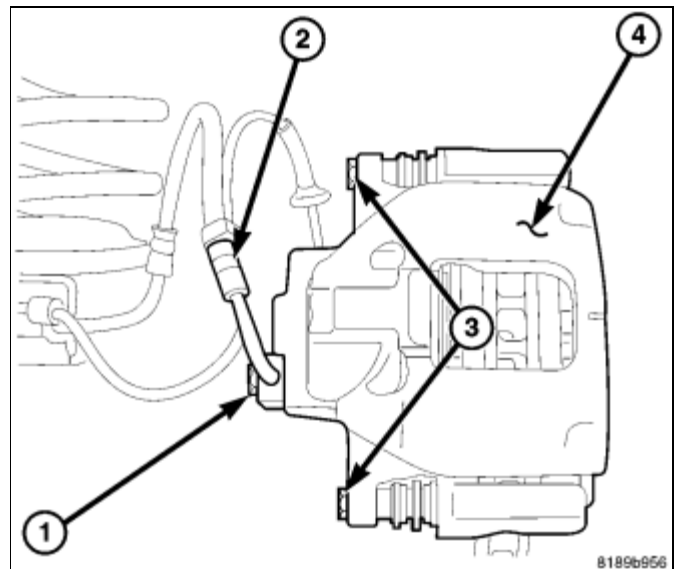
5. Install the axle shaft nut (if equipped). Tighten to 136 N·m (100 ft.lbs).
6. Install the wheel speed sensor (1) in the hub/bearing and tighten the bolt (2) to 4-6 N·m (34-50 in. lbs.).



7. Install the disc brake rotor (3).



8. Install the disc brake caliper (4) and tighten the caliper adaptor mounting bolts (3) to



9. Install the drag link to the knuckle and install the mounting nut. Tighten to 74 Nm (55 ft-lbs). **Right side only.**

10. Install the drag link to the knuckle and install the mounting nut. Tighten to 74Nm (55 ft-lbs).

11. Install the tire and wheel assembly.

12. Remove the support and lower the vehicle.

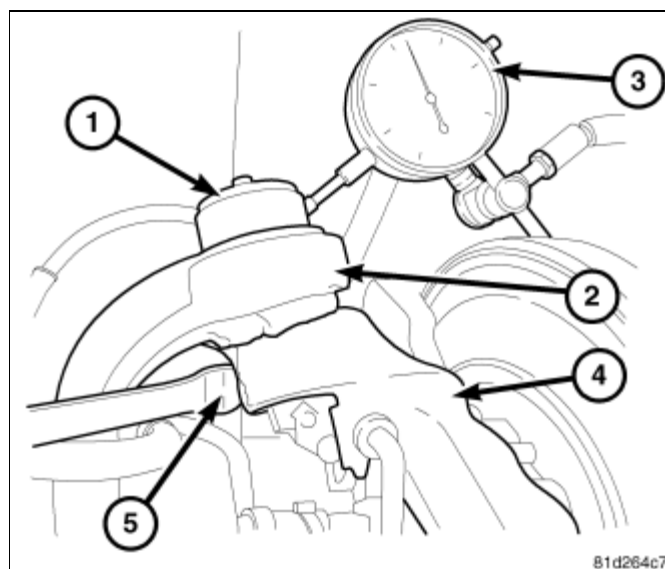
UPPER BALL JOINT

DIAGNOSIS AND TESTING

UPPER BALL JOINT

To properly diagnose the upper ball joint readings from the dial indicator are necessary.

1. Raise and support the vehicle.
2. Attach a dial indicator (3) with the indicator resting on either the front or back sides of the steering knuckle (4) as close to the upper ball joint (1) as possible.
3. Set the dial indicator(3) to zero.
4. Insert a prybar (5) between the knuckle (4) and axle tube (2).
5. Record the radial upper ball joint movement. If this reading is above 1.5 mm (0.060 in) then replacement of the upper ball joint is necessary (Refer to 2 - SUSPENSION/Front/UPPER BALL JOINT - REMOVAL).

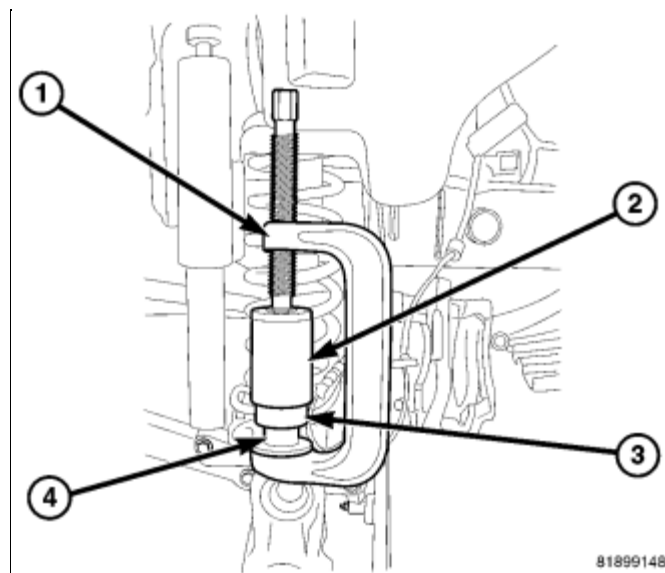


REMOVAL

1. Remove the steering knuckle (Refer to 2 - SUSPENSION/Front/KNUCKLE - REMOVAL).
2. Remove the axle shaft from the axle (Refer to 3 - DIFFERENTIAL & DRIVELINE/Front AXLE - 216FBI/AXLE SHAFTS - REMOVAL). **4X4 only.**

3. Position special tool 6761 (RECEIVER) (2) and 6289-3 (DRIVER) (4) with C-4212-F (PRESS)(1) as shown to remove upper ball joint.

INSTALLATION

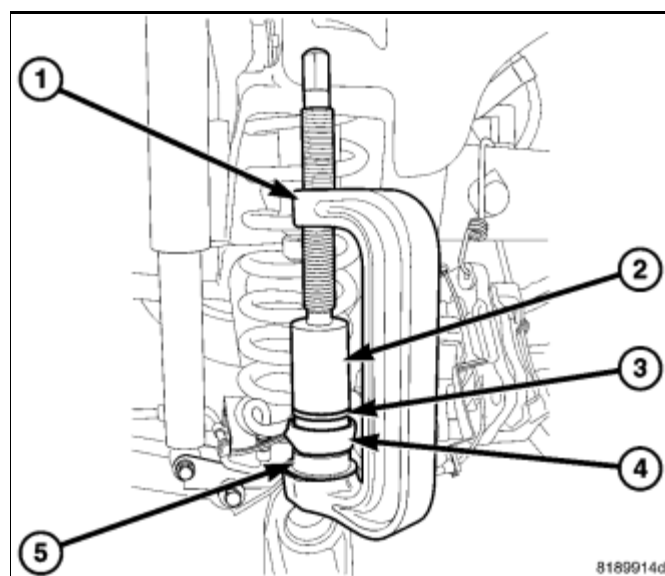


1. Position special tool 6752 (DRIVER) (2) and 6289-6 (RECEIVER) (5) with C-42121-F (PRESS) (1) as shown to install upper ball stud (3) .
2. Install the axle shaft into the axle (Refer to 3 - DIFFERENTIAL & DRIVELINE/Front AXLE - 216FBI/AXLE SHAFTS - INSTALLATION) **4X4 only**.
3. Install the steering knuckle (Refer to 2 - SUSPENSION/Front/KNUCKLE - INSTALLATION).

UPPER CONTROL ARM

DESCRIPTION

The upper suspension arms are steel and use rubber bushings at each end of the arm. The arms mount to the frame rail bracket and the axle brackets.



OPERATION

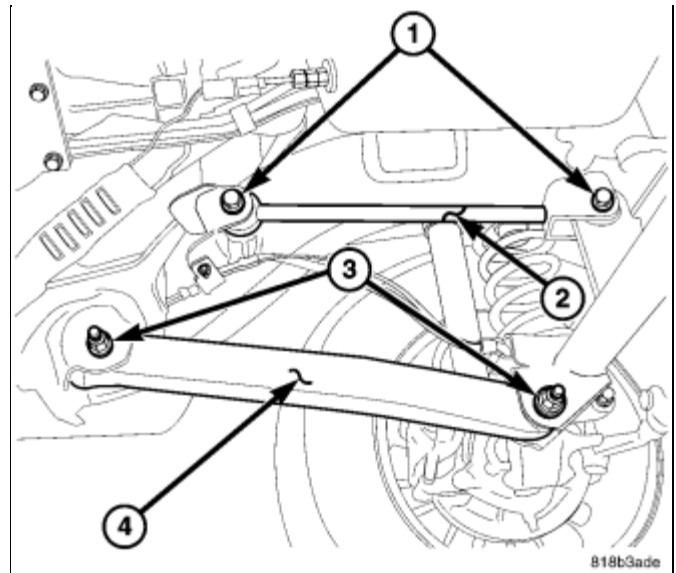
The arm and bushings provide location and react to loads from the axle. The bushings provide isolation from the axle.

REMOVAL

1. Raise and support the vehicle.
2. Remove electrical clip from the control arm clevis bracket
If equipped.
3. Remove the upper suspension arm nut and bolt (1) at the axle bracket.

4. Remove the nut and bolt (1) at the frame rail and remove the upper suspension arm (2).

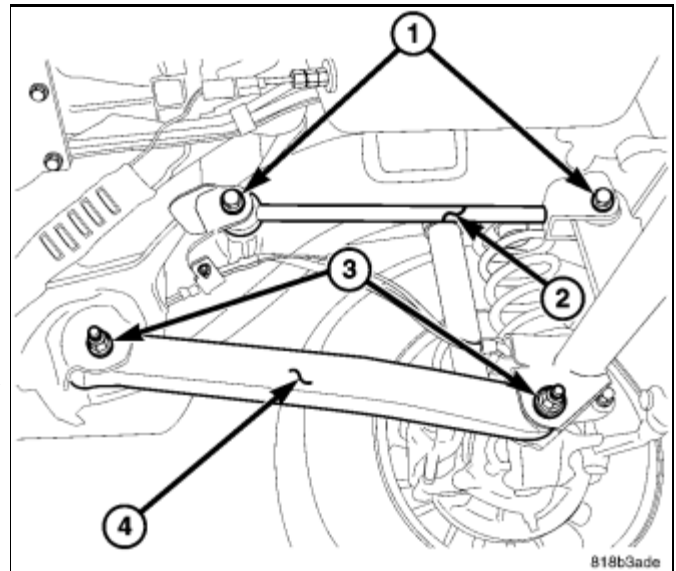
INSTALLATION



1. Position the upper suspension arm (2) at the axle and frame rail.

NOTE: Axle bolt must be installed from the inboard to outboard.

2. Install the bolts and finger tighten the nuts (1).
3. Remove the supports and lower the vehicle.
4. Tighten the bolt at the axle and frame brackets to 102 N·m (75 ft. lbs.).



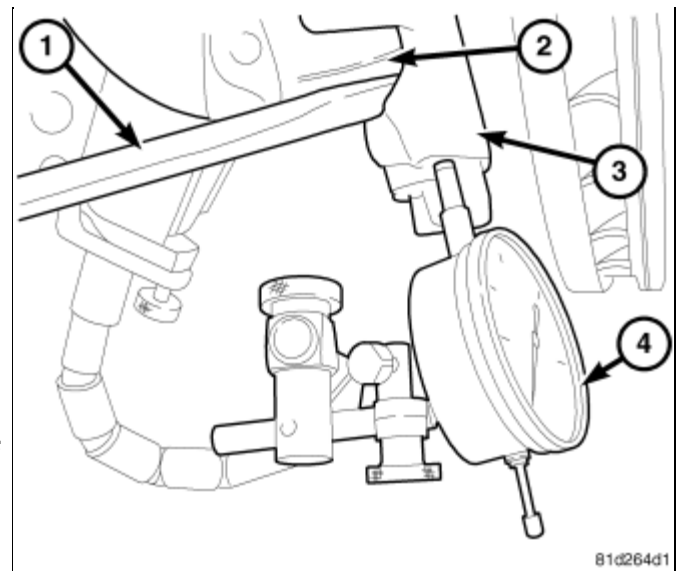
LOWER BALL JOINT

DIAGNOSIS AND TESTING

LOWER BALL JOINT

To properly diagnose the lower ball joint readings from the dial indicator are necessary.

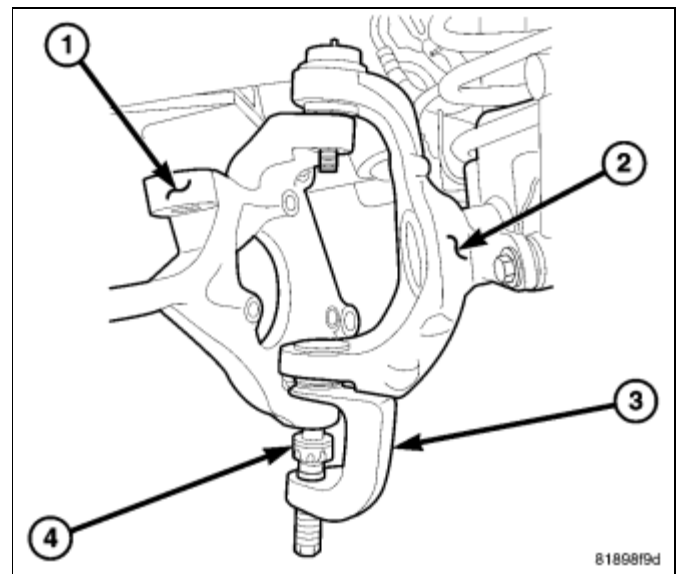
1. Raise and support the vehicle.
2. Attach a dial indicator (4) with the indicator resting on the flat part of the steering knuckle (3) by the lower ball stud .
3. Set the dial indicator (4) to zero.
4. Pry between the knuckle (3) and the axle tube yoke (2) next to the upper ball joint using a pry bar (1), Record the reading on the dial indicator.
5. Axial measurement for a total lower ball joint movement, If



this reading is above 1.25 mm (0.050 in) then replacement of the lower ball joint is necessary (Refer to 2 - SUSPENSION/FRONT/LOWER BALL JOINT - REMOVAL).

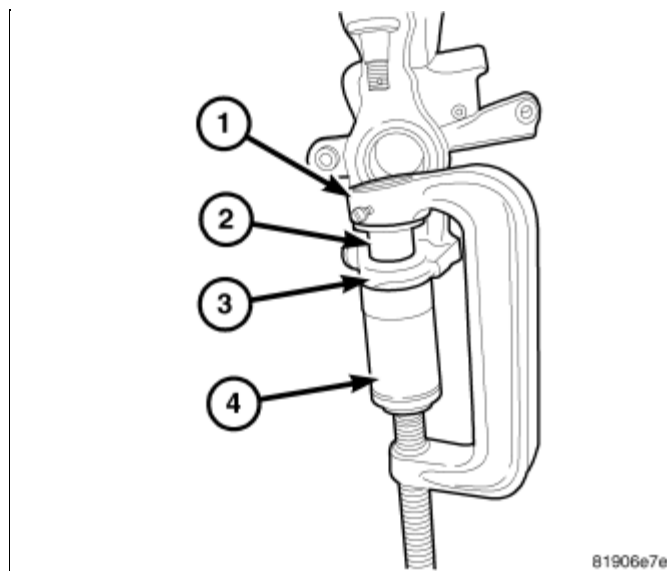
REMOVAL

1. Remove the hub/bearing (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL).
2. Remove the axle shaft from the axle (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 216FBI/AXLE SHAFTS - REMOVAL) **4X4 only**.
3. Remove the steering knuckle (1) (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - REMOVAL).

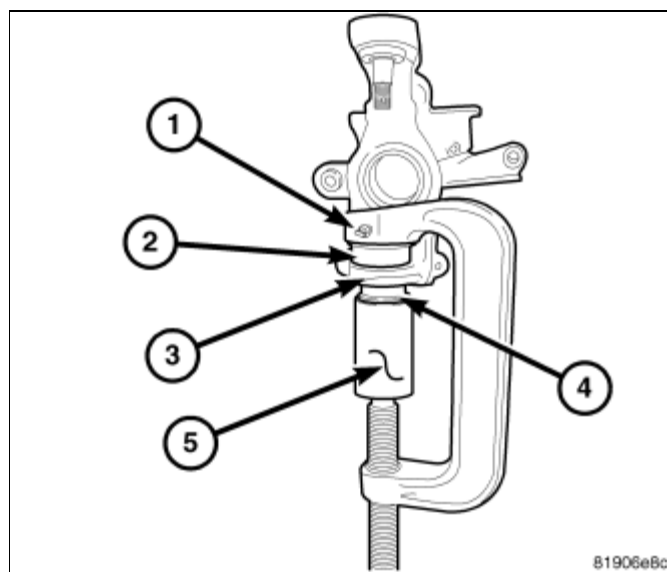


4. Position special tool 9949 (RECEIVER) (4) and 8975-4 (DRIVER) (2) with tool C4212-F (PRESS)(1) as shown to remove lower ball stud .

INSTALLATION



1. Position special tool 9950 (DRIVER) (5) and 6289-12 (RECEIVER) (2) with C4212-F (PRESS) (1) as shown to install lower ball stud (4).
2. Install the axle shaft into the axle (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 216FBI/AXLE SHAFTS - INSTALLATION).
3. Install the hub/bearing (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - INSTALLATION).
4. Install the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - INSTALLATION).



LOWER CONTROL ARM

DESCRIPTION

The lower suspension arms are steel and use bushings at both ends of the arm. The arms mount to the frame rail bracket and the axle brackets.

OPERATION

The lower suspension arm bushings provide isolation from the axle. The arm and bushings provide location and react to loads from the axle. The lower suspension arms can be used to adjust caster and pinion angle by installing a cam bolt service package.

REMOVAL

1. Raise and support the vehicle.

NOTE: If the vehicle is equipped with a cam bolt service kit, paint or scribe marks on the cam adjuster and the suspension arm for installation reference.

2. Remove the lower suspension arm nut and cam/bolt (3) from the axle.
3. Remove the nut and bolt (3) from the frame rail bracket and remove the lower suspension arm (4).

INSTALLATION

1. Position the lower suspension arm (4) in the axle bracket and frame rail bracket.

NOTE: Position the paint dot located on the control arm toward the axle and facing outboard. If paint dot is not visible, the bend should point inboard, and the short end should attach to the axle side.

NOTE: Frame and axle bolts should be installed outboard to inboard.

2. Install the frame bolt and nut (3) finger tighten.
3. Install bolt and new nut (3) finger tighten in the axle.
4. Lower the vehicle.
5. Tighten axle bracket nut to 169 N·m (125 ft. lbs.).
6. Tighten frame bracket nut to 169 N·m (125 ft. lbs.).
7. Align vehicle to specifications. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

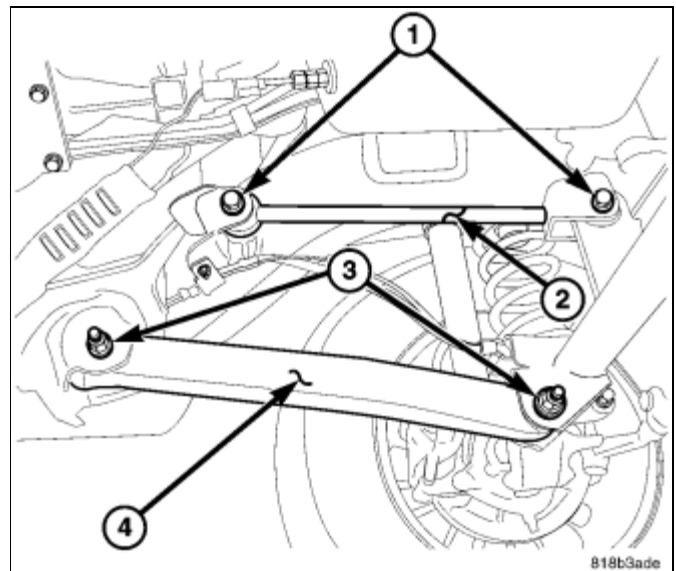
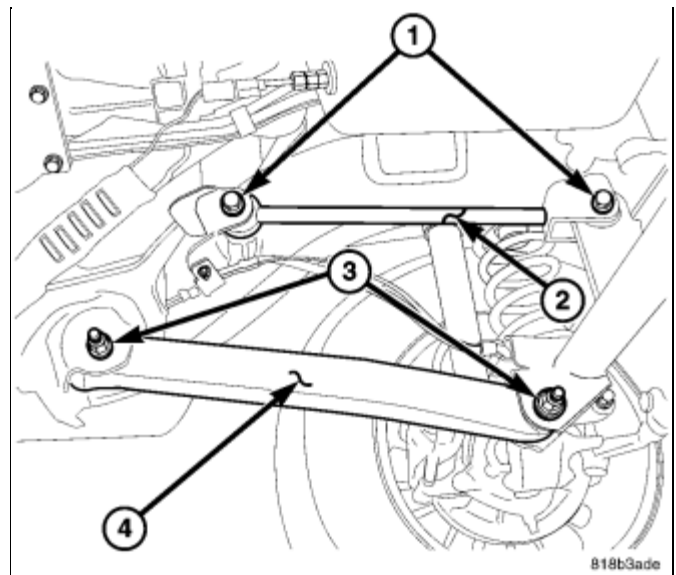
SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to a frame bracket. The bottom of the shocks are bolted to the axle brackets.

OPERATION

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.



DIAGNOSIS AND TESTING

SHOCK ABSORBER

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

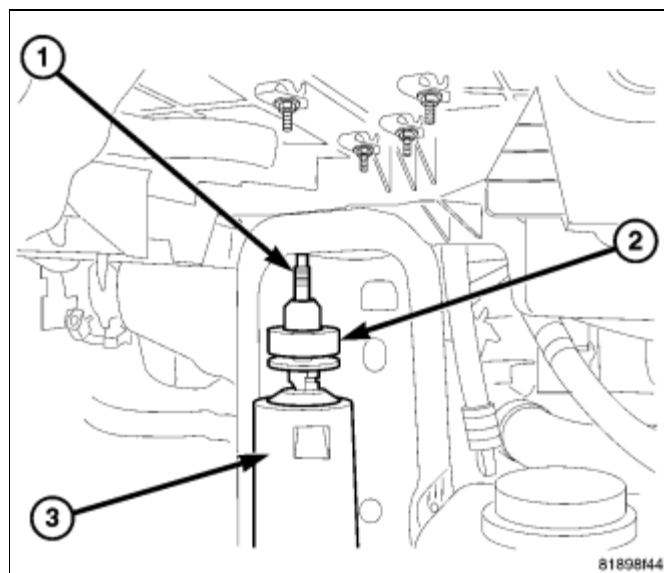
A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

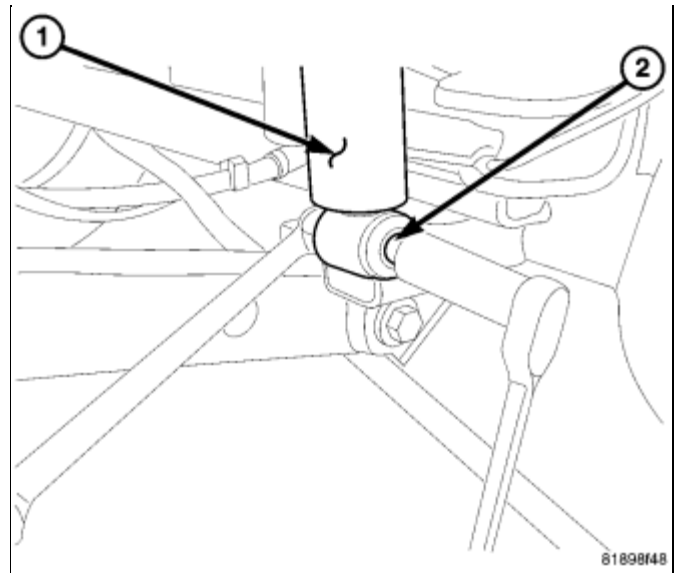
REMOVAL

1. Raise and support the vehicle.
2. Remove the inner fender well.
3. Remove the nut, retainer and grommet (2) from the upper stud (1).

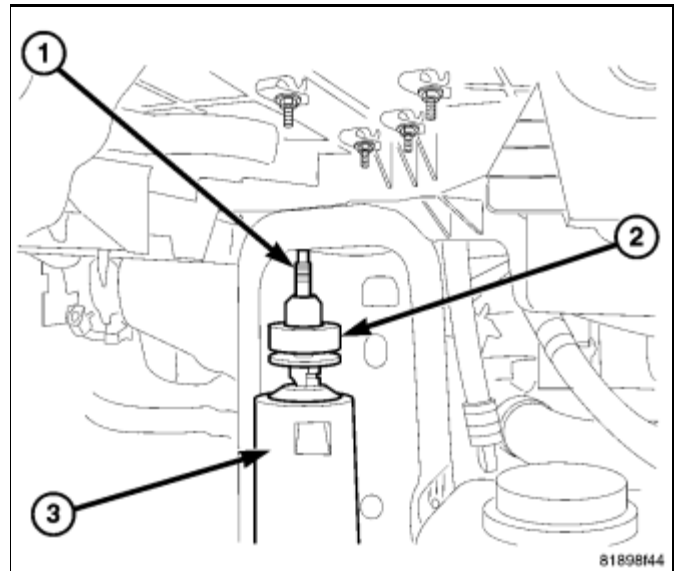


4. Remove the lower nut and bolt (2) from the axle bracket and remove the shock absorber (1).

INSTALLATION



1. Position the retainer and grommet (2) on the upper stud (1). Insert the shock absorber (3) through the shock bracket hole and tighten to 27 N·m (20 ft. lbs.).



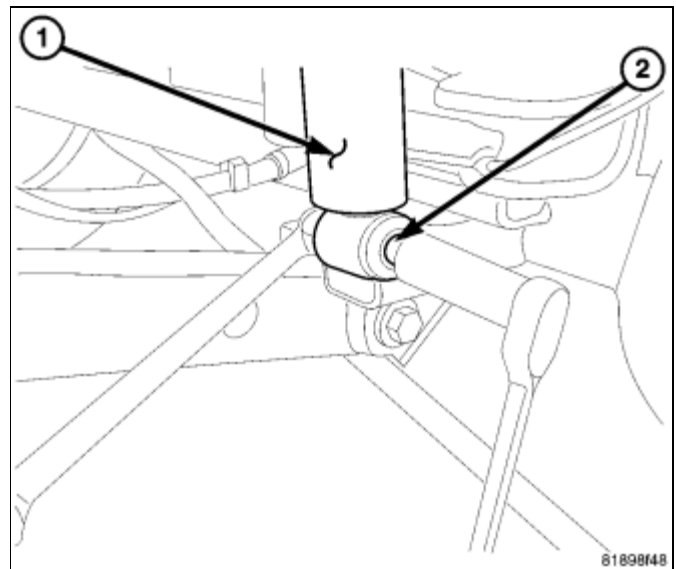
2. Install the lower part of the shock (1) into the bracket.
 3. Install the lower bolt and nut (2). Tighten nuts to 76 N·m (56 ft. lbs.).
 4. remove the support and lower the vehicle.

SPRING

DESCRIPTION

The coil springs mount up in the wheelhouse which is part of the frame. A rubber doughnut isolator is located between the top of the spring and the bracket. The bottom of the spring seats on the axle pad.

OPERATION



The coil springs control ride quality and maintain proper ride height. The isolators provide road noise isolation.

REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel and tire assemblies.
3. Position a hydraulic jack under the axle to support it.
4. Remove the front shocks at the lower mountings, (Refer to 2 - SUSPENSION/FRONT/SHOCK - REMOVAL).
5. Remove lower suspension arms mounting nuts and bolts from the frame, (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
6. Remove the track bar from the axle bracket, (Refer to 2 - SUSPENSION/FRONT/TRACK BAR - REMOVAL).
7. Remove the right side of the drag link from the right side knuckle, (Refer to 19 - STEERING/LINKAGE/DAG LINK - REMOVAL).
8. Lower the axle until the spring is free from the upper mount.

NOTE: Rotation of the spring and prying down slightly on the axle will aid in removal.

9. Remove the upper spring isolator. (if needed)
10. Pull jounce bumper out of mount. (if needed)

INSTALLATION

1. Install jounce bumper into mount.
2. Install the spring isolator.

NOTE: Rotation of the spring and prying down slightly on the axle will aid in installation.

3. Position the coil spring on the axle pad. It may be necessary to rotate the spring while installing.
4. Raise the axle into position until the spring seats in the upper mount.
5. Install the shock at the axle, (Refer to 2 - SUSPENSION/FRONT/SHOCK - INSTALLATION).
6. Install the track bar to the axle bracket, (Refer to 2 - SUSPENSION/FRONT/TRACK BAR - INSTALLATION).
7. Install the lower suspension arms to the frame. Install mounting bolts and nuts finger tight, (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
8. Install the drag link to the right side knuckle, (Refer to 19 - STEERING/LINKAGE/DAG LINK - INSTALLATION).
9. Remove the hydraulic jack from under the axle.
10. Install the wheel and tire assemblies, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
11. Remove the supports and lower the vehicle.
12. Tighten the lower suspension arms nuts to 169 N·m (125 ft. lbs.) at normal ride height with the vehicle weight.

STABILIZER BAR

DESCRIPTION

STABILIZER BAR

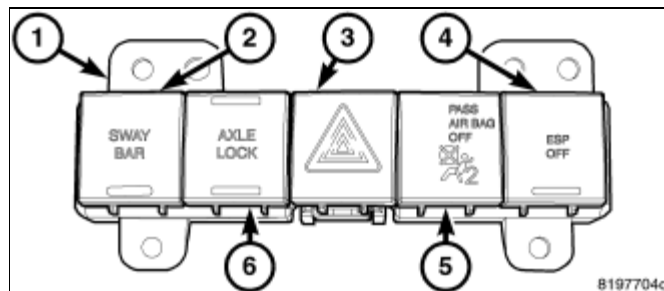
The stabilizer bar is on the bottom of the frame rails. Links are connected from the bar to the axle brackets. The stabilizer bar and links are isolated by rubber bushings.

DISCONNECTING STABILIZER BAR

This feature will provide feedback to the driver and be controlled by an electronic module which communicates via CAN C at 500 kbps. The disconnecting stabilizer bar module will read the ignition switch, vehicle speed, transfer case, and stabilizer bar switch messages on the CAN C bus and control the disconnecting stabilizer bar. The module will send a stabilizer bar status message and a lighting message on CAN C.

DISCONNECTING STABILIZER SWITCH

The instrument panel switch pod (1) is located just below the heater and air conditioner controls in the center stack area of the instrument panel. This switch is available in multiple configurations, which varies from two single push button switches to as many as five push button switches, or four switches and an indicator lamp, depending upon the optional equipment in the vehicle. The pod may include the following switches or indicators:



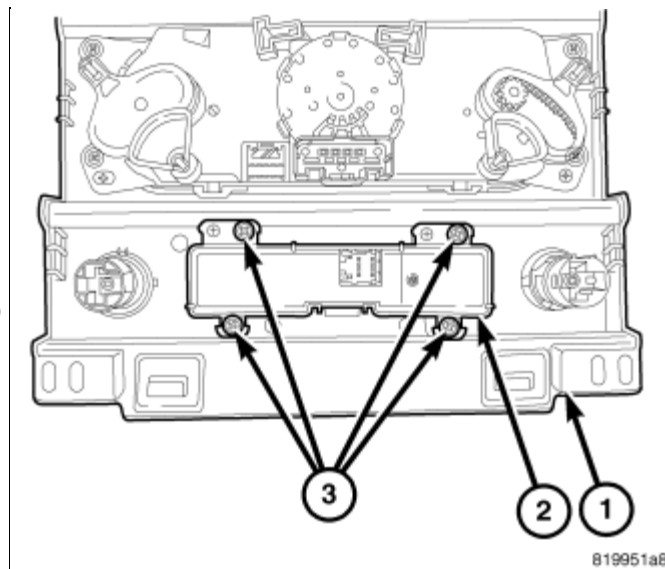
- **Front Sway Bar Disconnect Switch (2)**
- **Axle Locker Switch (6)**
- **Hazard Warning Switch (3)**
- **Headlamp Leveling Switch (Not Shown)**
- **Passenger Airbag On/Off Indicator (5)**
- **Electronic Stability Program (ESP) Switch (4)**

The switch housing and the push buttons are constructed of molded plastic. Each push button has a smooth finish and is clearly identified with the appropriate text and International Control and Display Symbol icons. Several of the push buttons feature Light Emitting Diode (LED) units to give the vehicle operator an indication when the function of that switch is currently active. Only the hazard warning switch push button latches, while the remaining switches feature momentary operation.

Four screws (3) secure the switch to the back of the instrument panel center bezel through integral mounting tabs that are molded into each corner of the switch housing. The back of the switch housing has an integral connector receptacle containing terminal pins that connect the switch to the vehicle electrical system through a dedicated take out

and connector of the instrument panel wire harness.

Panel lamps dimmer controlled illumination lamps integral to the circuit board within the switch provide back lighting for visibility at night, but these lamps are not serviceable. The individual switches in the lower instrument panel switch pod cannot be repaired and are not serviced separately. If any component within the switch pod is ineffective or damaged, the entire switch pod unit must be replaced. For switch replacement (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/INSTRUMENT PANEL SWITCH POD - REMOVAL).

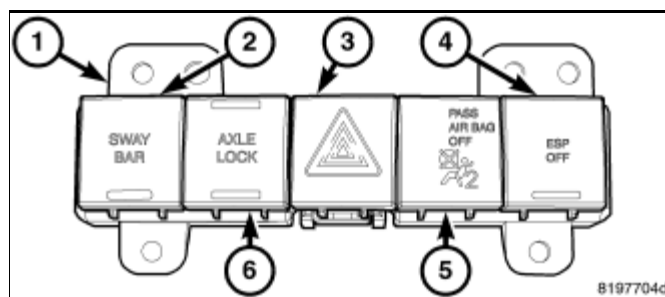


OPERATION

STABILIZER BAR

The stabilizer bar is used to control vehicle body roll during turns. The bar helps to control the vehicle body in relationship to the suspension.

DISCONNECTING STABILIZER BAR



STABILIZER BAR FAILSAFE

Stabilizer bar will ENGAGE with the loss of ignition switch, vehicle speed, or stabilizer bar switch signals

DISENGAGE

The bar will DISENGAGE when ALL the following conditions are met:

- vehicle speed under 18 MPH
- automatically at speeds over 14 MPH if the switch is in the ON position

transfer case in 4 HI or 4 LO

- stabilizer bar switch message received for DISENGAGE
- ignition switch in the RUN or START position
- no stabilizer bar faults detected

ENGAGE

The bar will ENGAGE when ANY of the following conditions are met:

- vehicle speed is greater or equal to 18 MPH
- stabilizer bar switch message received for ENGAGE
- transfer case in 2WD or neutral

DISCONNECTING STABILIZER BAR SWITCH

The disconnecting stabilizer bar system will latch the momentary switch (2) through software for an ignition switch OFF condition if the stabilizer bar was DISENGAGED and the transfer case was in 4LO at ignition switch OFF. Upon ignition switch RUN/START and the transfer case in 4LO, the system checks to verify all conditions to DISENGAGE the stabilizer bar are correct and then DISENGAGE the stabilizer bar without switch input.

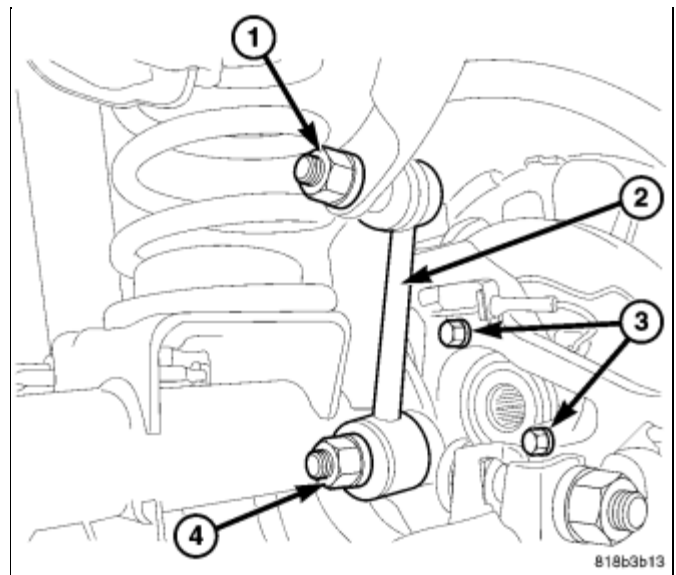
The stabilizer switch LED will:

- Be ON SOLID when the stabilizer bar is DISENGAGED
- turn ON BLINKING when the stabilizer bar is transitioning from one state to another
- turn ON BLINKING when a request is received but conditions to DISENGAGE are not correct
- be turned OFF when the stabilizer bar is ENGAGED
- turn ON FAST BLINKING when there is a fault detected for the stabilizer bar
- turn OFF when the system is in diagnostic mode

REMOVAL

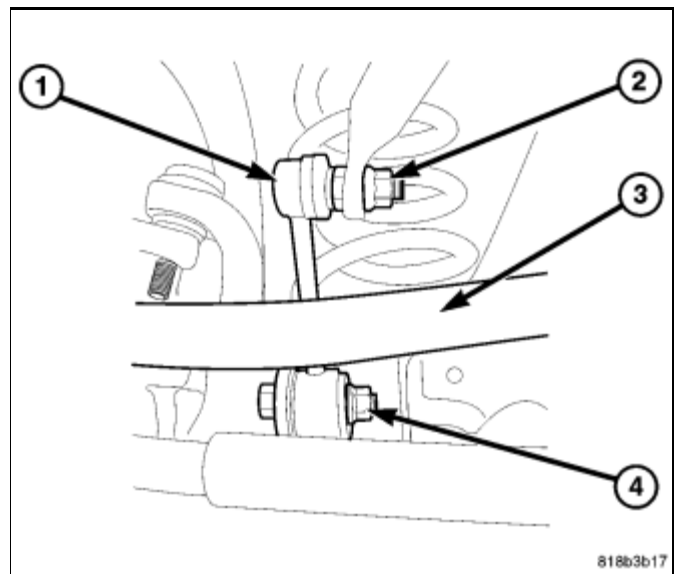
STABILIZER BAR

1. Raise and support the vehicle.
2. Remove the left upper stabilizer bar link nut (1) from the stabilizer bar.



3. Remove the right upper stabilizer bar link nut (2) from the stabilizer bar.

4. Remove the splash shield.

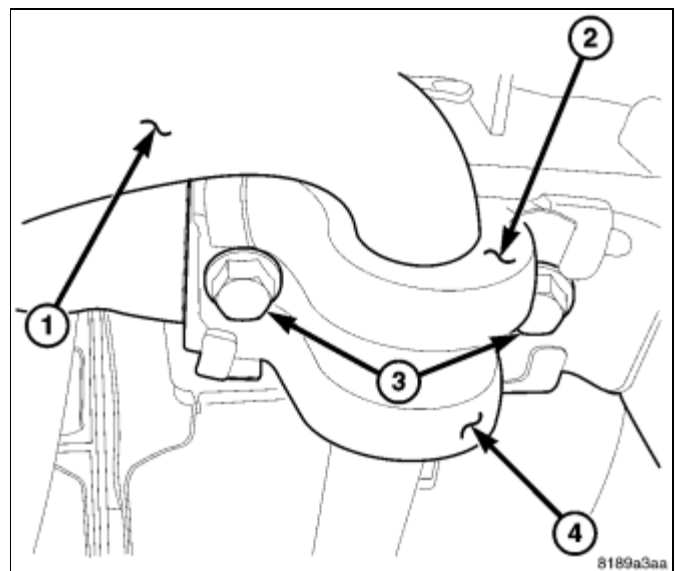


5. Remove the right side stabilizer bar bracket bolts (3) to the frame.

6. Remove the left side stabilizer bar bracket bolts (3) to the frame.

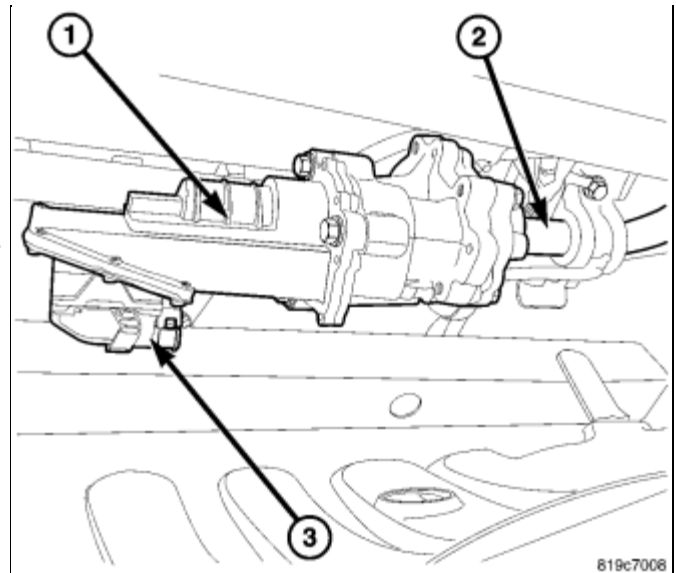
7. Remove the stabilizer bar (1) to the bench.

DISCONNECTING STABILIZER BAR

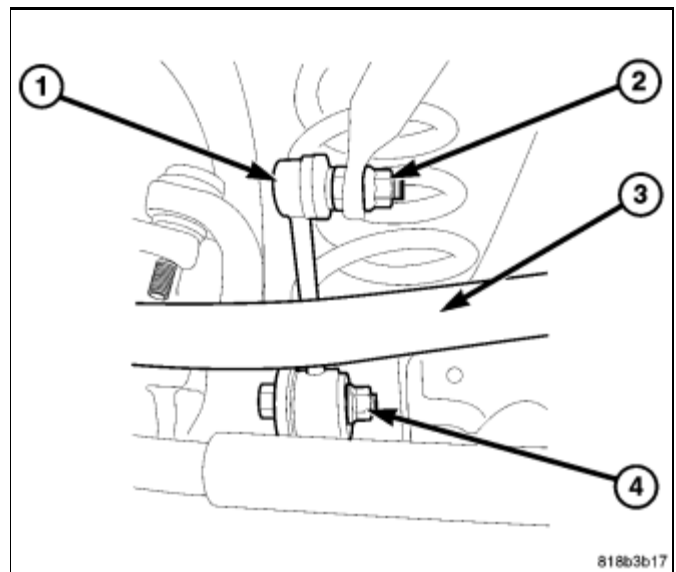


WARNING: The disconnecting stabilizer bar unit is not serviced separately from the bar. Do not disassemble this unit from the stabilizer bar.

NOTE: The stabilizer links, stabilizer bar retainers/bushings and the stabilizer bar as a complete unit only are serviceable. The new bar consists of the disconnecting unit and electronic actuator (1) attached as an assembly to the bar (2).

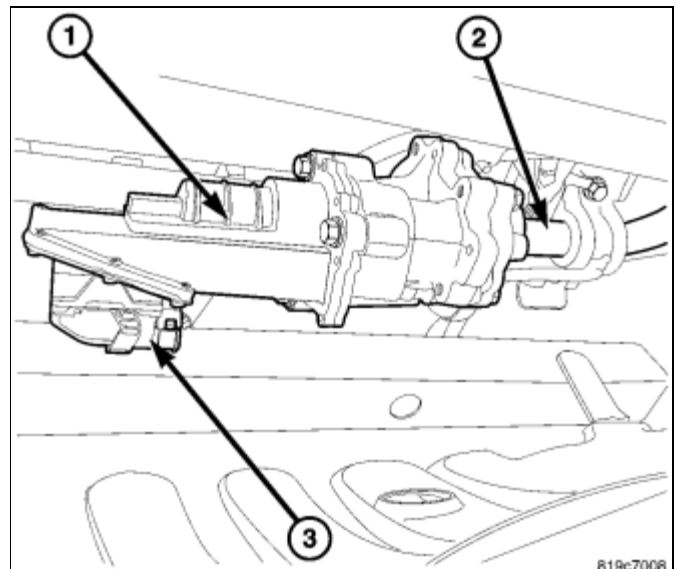


1. Raise and support the vehicle.
2. Hold the stabilizer link (1) shafts with a wrench and remove the link nuts (2) at the stabilizer bar.



NOTE: Before removing the connector (3) from the actuator clean the outside of the connector with a cleaner and compressed air, to remove any dirt or debris.

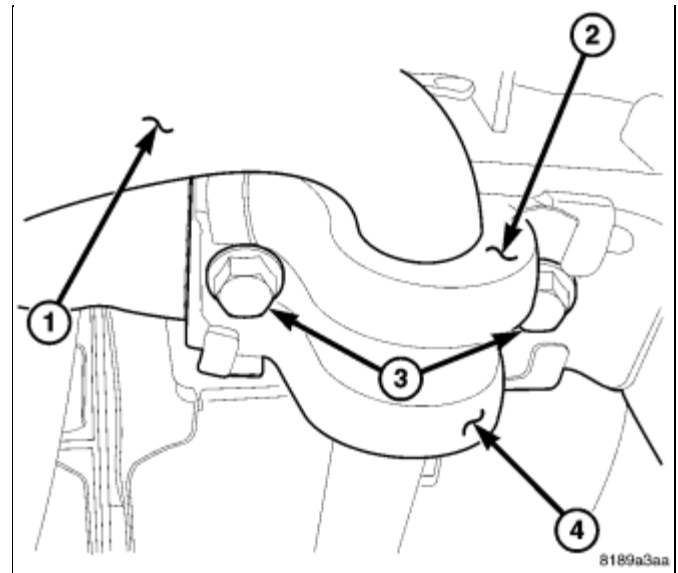
3. Disconnect the electronic actuator electrical connector (3) for the disconnecting stabilizer bar.



4. Remove the stabilizer bar retainers (4) from the frame rails and remove the stabilizer bar (1).

INSTALLATION

STABILIZER BAR



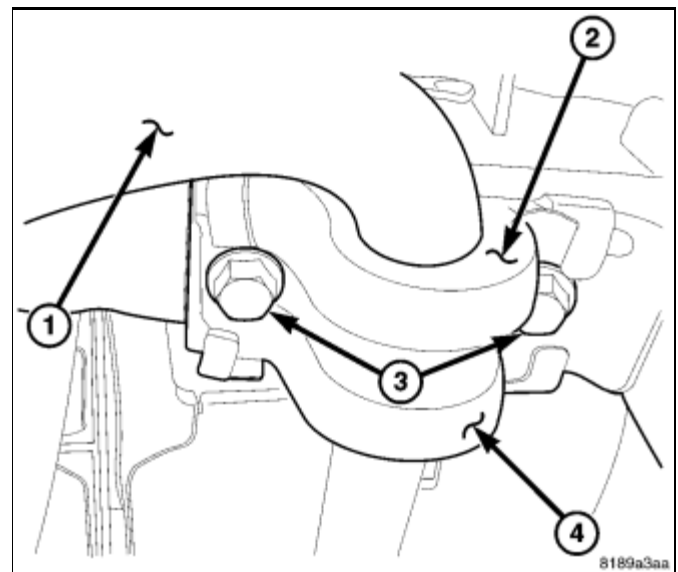
1. Install the stabilizer bar (1) to the vehicle.

NOTE: Stabilizer bar link to axle bolt should be tightened with vehicle sitting on its tires

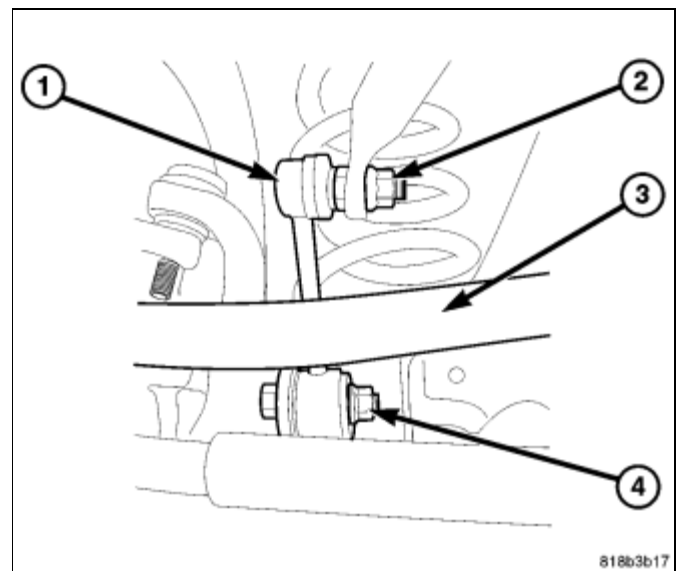
2. Install the right side stabilizer bar bracket bolts (3) to the frame. Tighten to 102 N·m (75 ft. lbs.).

3. Install the left side stabilizer bar bracket bolts (3) to the frame. Tighten to 102 N·m (75 ft. lbs.).

4. Install the splash shield.

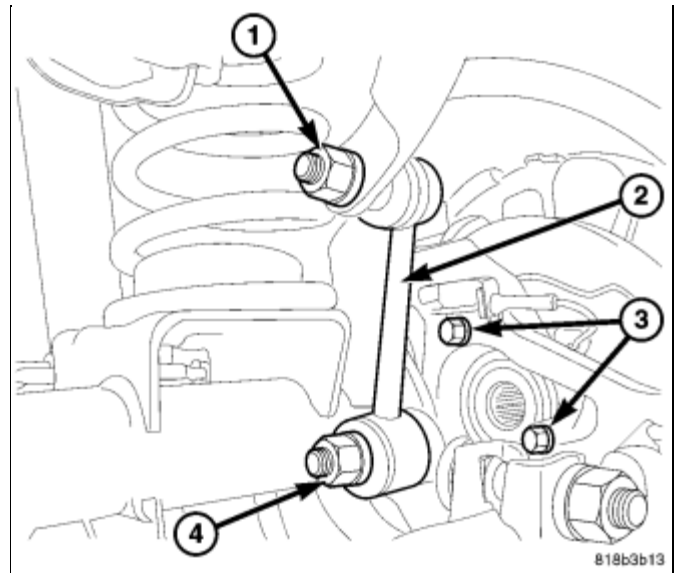


5. Install the right upper stabilizer bar link nut (2) to the stabilizer bar. Tighten to 102 N·m (75 ft. lbs.).



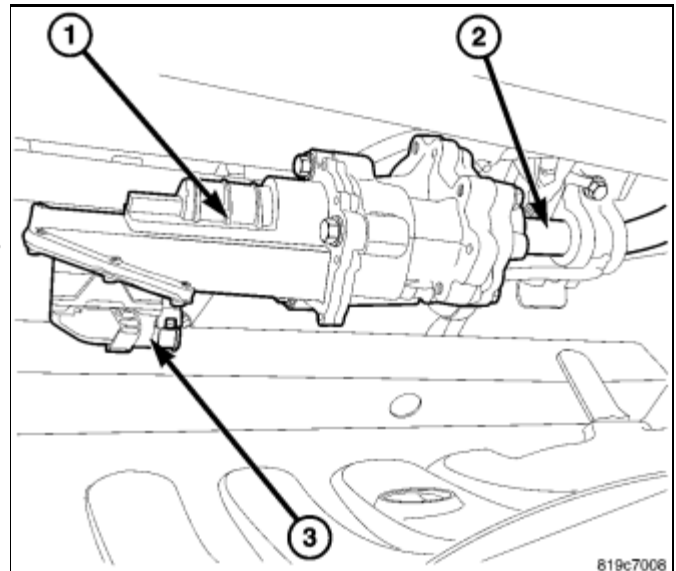
6. Install the left upper stabilizer bar link nut (1) to the stabilizer bar. Tighten to 102 N·m (75 ft. lbs.).
7. Remove the support and lower the vehicle.

DISCONNECTING STABILIZER BAR

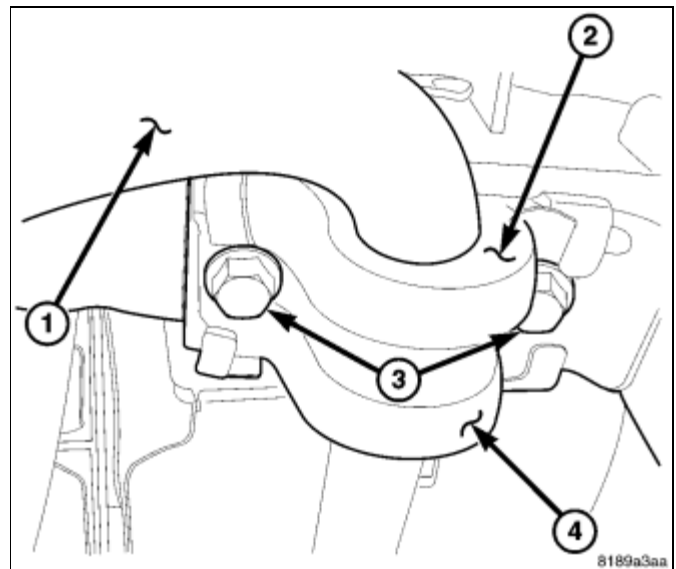


WARNING: The disconnecting stabilizer bar unit (1) is not serviced separately from the bar (2). Do not disassemble this unit from the stabilizer bar.

NOTE: The stabilizer links, stabilizer bar retainers/bushings and the stabilizer bar as a complete unit only are serviceable. The new bar consists of the disconnecting unit and electronic actuator (1) attached as an assembly to the bar.

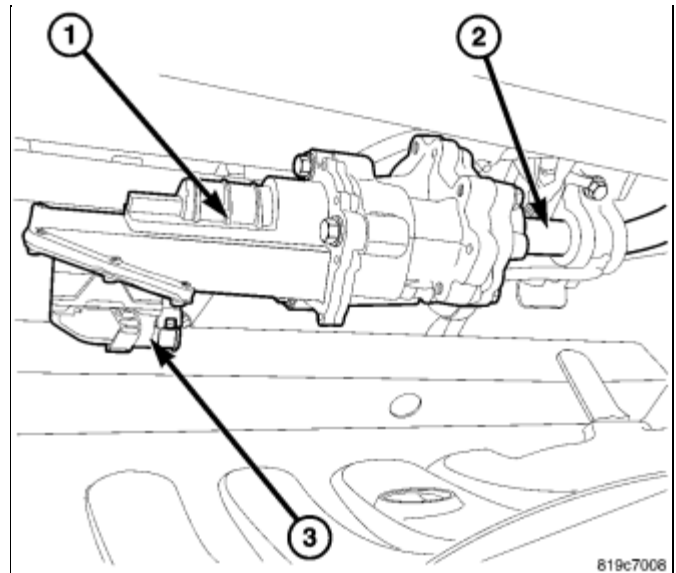


1. Position the stabilizer bar (1) on the frame rail and install the retainers (4) with bushings (2) and bolts (3). Ensure the bar is centered with equal spacing on both sides.
2. Tighten the retainer bolts (3) to 61 N·m (45 ft. lbs.).



NOTE: The seal must be clean and intact in the electrical connector (3) when reconnecting to the actuator (1).

3. Reconnect the electronic actuator electrical connector (3) for the disconnecting stabilizer bar.

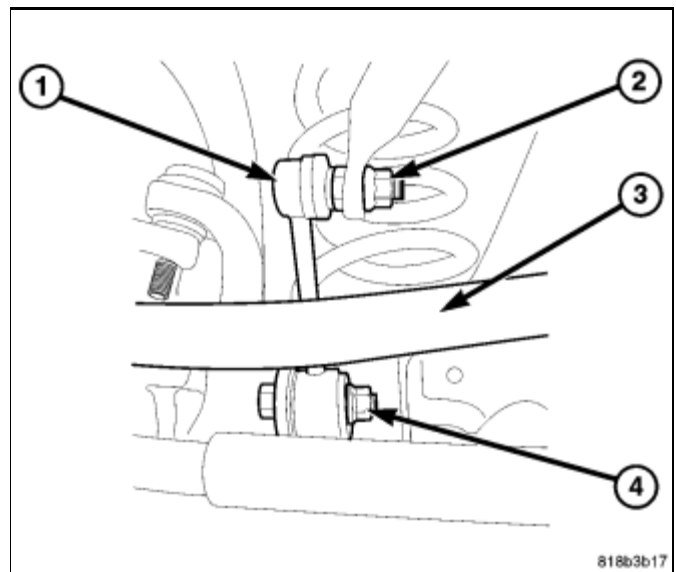


NOTE: Stabilizer bar link to axle bolt should be tightened with vehicle sitting on its tires

4. Install links (1) and nuts (2) to the stabilizer bar. Hold the link shaft with a wrench and tighten the nuts (2) to 102 N·m (75 ft. lbs.).

5. Remove the supports and lower the vehicle.

6. Using a scan tool program the new stabilizer bar to the vehicle.



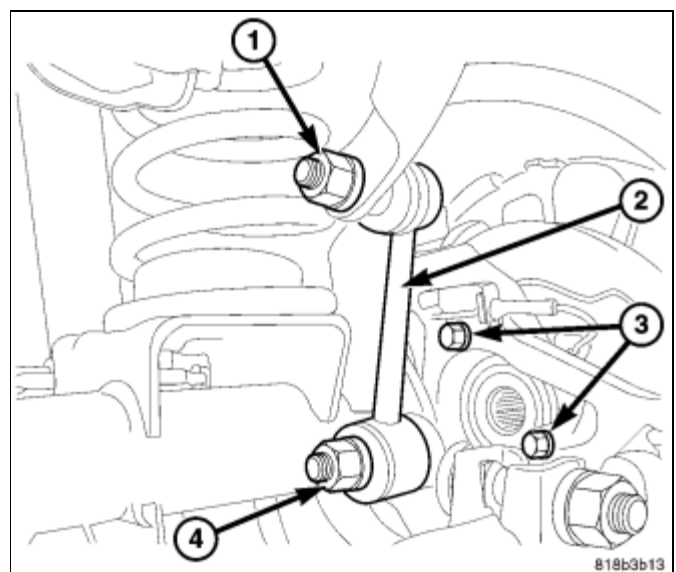
STABILIZER LINK

REMOVAL

1. Raise and support the vehicle.

2. Remove the left upper stabilizer bar link nut (1) from the stabilizer bar.

3. Remove the left lower stabilizer bar link bolt (4) to the axle.

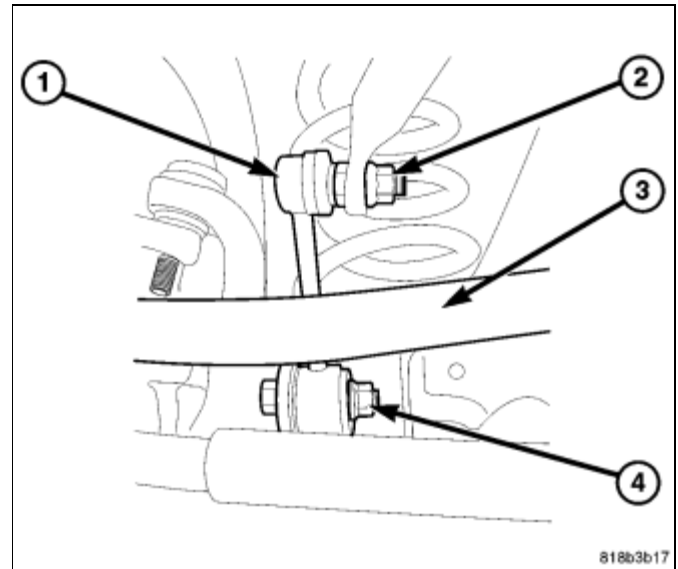
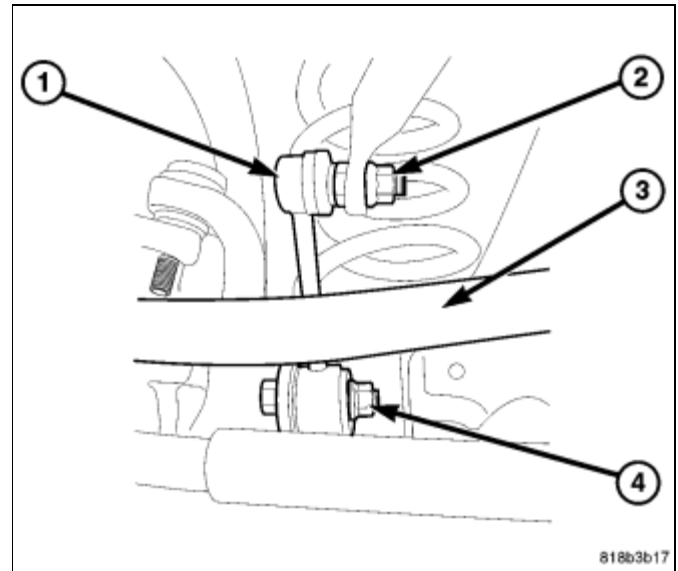


4. Remove the right upper stabilizer bar link nut (2) from the stabilizer bar.
5. Remove the right lower stabilizer bar link bolt (4) to the axle.
6. Remove the stabilizer link (1).

INSTALLATION

NOTE: Stabilizer bar link to axle bolt should be tightened with vehicle sitting on its tires

1. Install the stabilizer link (1) to the vehicle.
2. Install the right lower stabilizer bar link bolt (4) to the axle. Tighten to 102 N·m (75 ft. lbs.).
3. Install the right upper stabilizer bar link nut (2) to the stabilizer bar. Tighten to 102 N·m (75 ft. lbs.).



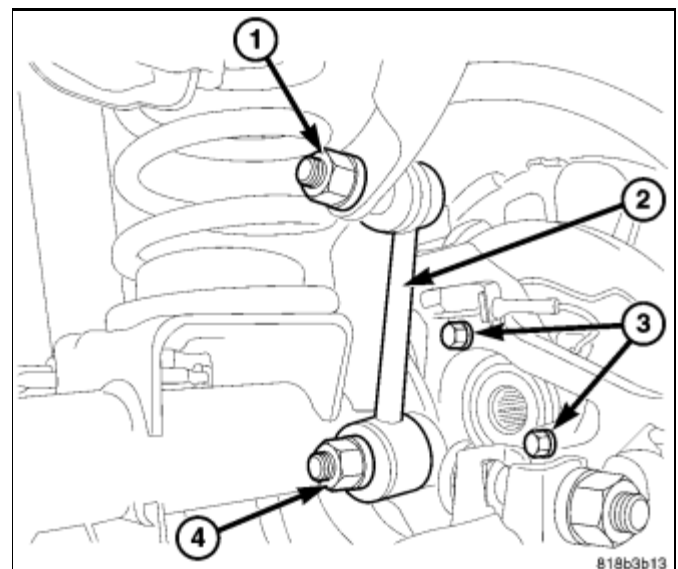
4. Install the left lower stabilizer bar link bolt (4) to the axle. Tighten to 102 N·m (75 ft. lbs.).
5. Install the left upper stabilizer bar link nut (1) to the stabilizer bar. Tighten to 102 N·m (75 ft. lbs.).
6. Remove the support and lower the vehicle.

TRACK BAR

DESCRIPTION

The front track bar is a forged component with non-replaceable bushings on the frame and axle sides.

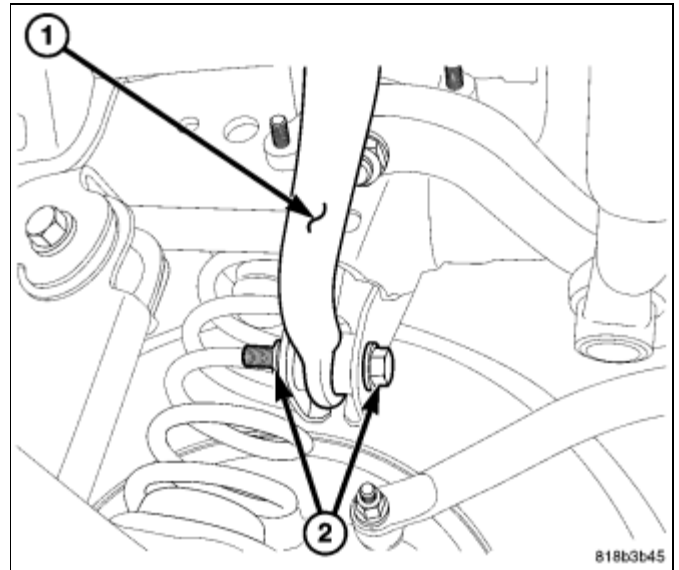
OPERATION



The track bar is used to control front axle lateral movement and provides cross car location of the axle assembly.

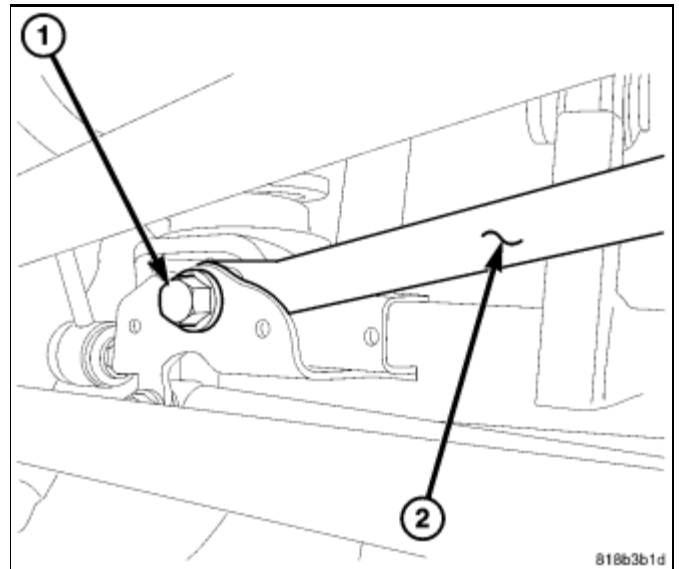
REMOVAL

1. Raise and support the vehicle.
2. Remove the nut and bolt (2) from the frame rail bracket.

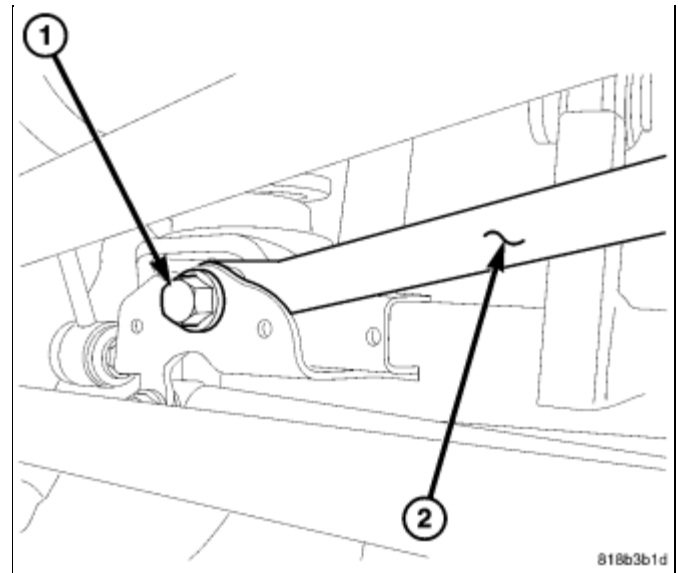


3. Remove the bolt and flag nut (1) from the axle bracket.
4. Remove the track bar (2).

INSTALLATION

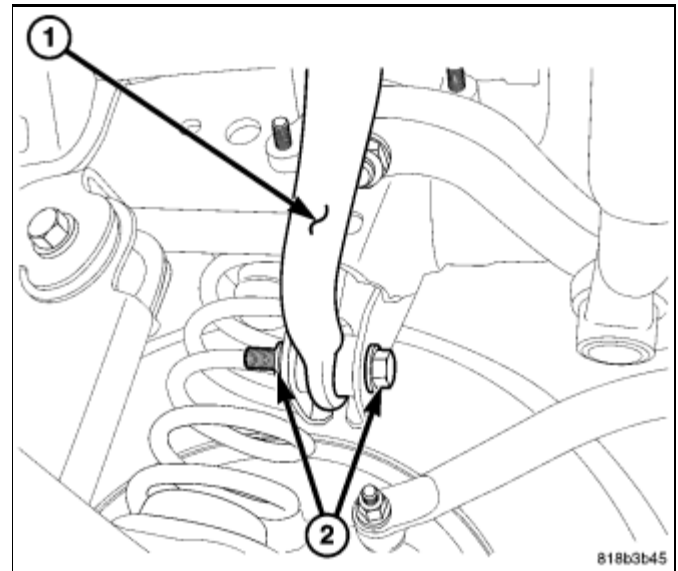


1. Install the track bar (2) at axle tube bracket. Loosely install the retaining bolt and flag nut (1).



NOTE: Frame bolt must be installed from front to rear.

2. It may be necessary to pry the axle assembly over to install the track bar (1) at the frame rail. Install track bar at the frame rail bracket. Install the nut and bolt (2) at the frame rail bracket.
3. Remove the supports and lower the vehicle.
4. Tighten the bolt at the frame and axle bracket to 169 N·m (125 ft. lbs.).
5. Check toe if a new track bar was installed. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



REAR

REAR

DESCRIPTION

REAR SUSPENSION

The rear suspension is link/coil design comprised of:

- Shock absorbers
- Coil springs
- Upper and lower suspension arms
- Stabilizer bar
- Track bar

CAUTION: Suspension components with rubber/urethane bushings (except stabilizer bar) should be tightened with the full weight of the vehicle at normal ride height. It is important to have the springs supporting the full weight of the vehicle when the fasteners are torqued. This will maintain vehicle ride comfort and prevent premature bushing wear.

SPECIFICATIONS

TORQUE

DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Bolts	50	37	—
Shock Absorber Lower Nut	76	56	—
Suspension Arm Lower Axle Bracket Nut	169	125	—
Suspension Arm Lower Frame Bracket Bolt	169	125	—
Suspension Arm Upper Axle Bracket Bolt	169	125	—
Suspension Arm Upper Frame Bracket Bolt	169	125	—
Stabilizer Bar Retainer Bolts	61	45	—
Stabilizer Bar Link Nut/Bolt	102	75	—
Stabilizer Bar to Link Nut	90	66	—
Track Bar Frame Bracket Nut	169	125	—
Track Bar Axle Bracket Bolt	169	125	—

JOUNCE BUMPER

DESCRIPTION

The jounce bumpers are mounted outside the coil spring to the frame rail.

OPERATION

The jounce bumpers are used to limit suspension travel in compression.

REMOVAL

1. Raise and support the vehicle.
2. Pry the jounce bumper out of the cup.
3. Remove the jounce bumper.

INSTALLATION

1. Install the jounce bumper into the cup by pushing upwards until fully seated.
2. Remove the supports and lower the vehicle.

UPPER CONTROL ARM

DESCRIPTION

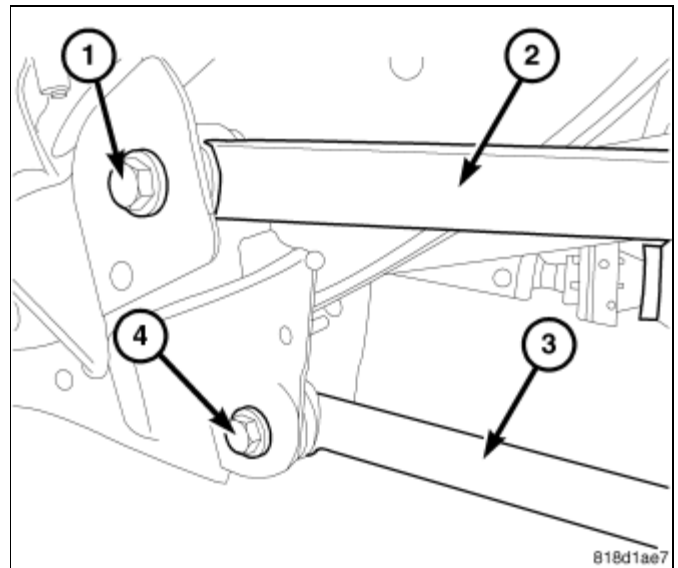
The Upper suspension arms are steel and use bushings at each end of the arm. The arms are mounted from the frame to the axle brackets.

OPERATION

The bushings isolate axle and road noise. The arm and bushings provide location and react to loads from the axle.

REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the upper suspension arm flagnut and bolt at the axle bracket.
4. Remove the flagnut and bolt (1) at the frame rail mount and remove the upper suspension arm (2).



INSTALLATION

NOTE: Position the paint dot located on the control arm toward the axle and facing outboard. If paint dot is not visible, the bend should point inboard, and the short end should attach to the axle side.

1. Position the upper suspension arm (2) in the axle bracket and frame rail mount.
2. Install the mounting bolt (1) and finger tighten.
3. Remove the supports and lower the vehicle.

4. Tighten the upper suspension arm bolts to 169 N·m (125 ft. lbs.) with vehicle weight.

LOWER CONTROL ARM

DESCRIPTION

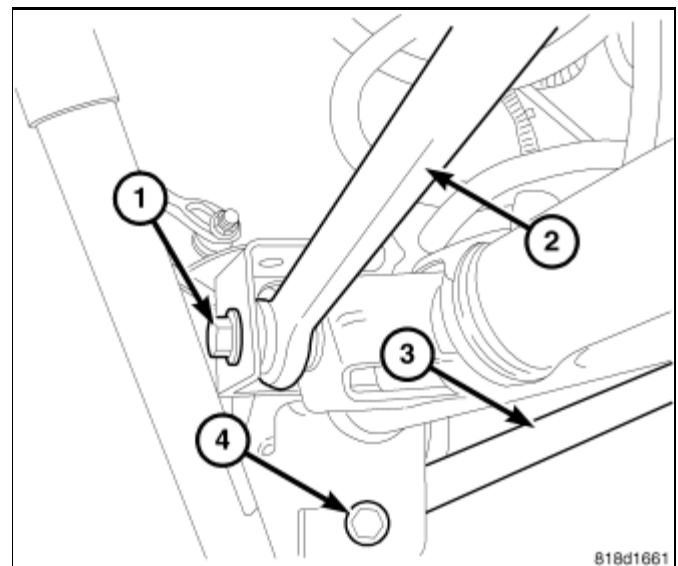
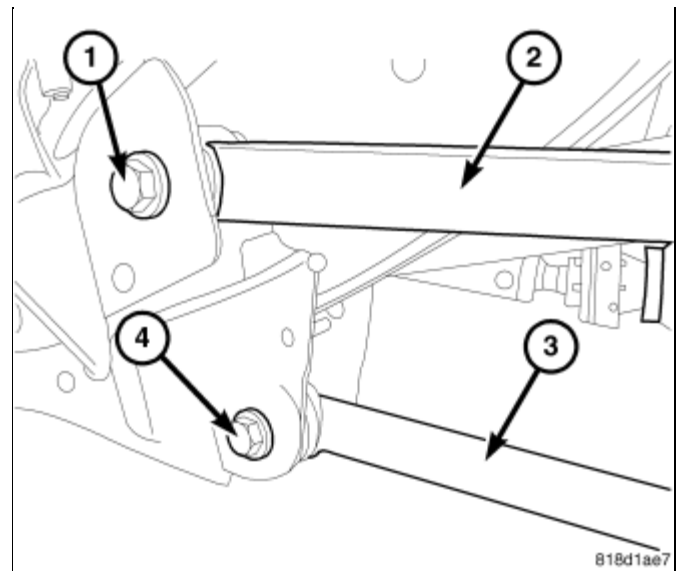
The lower suspension arms are steel and use bushings at each end of the arm. The arms are mounted from the frame to the axle brackets.

OPERATION

The bushings isolate axle and road noise. The arm and bushings provide location and react to loads from the axle.

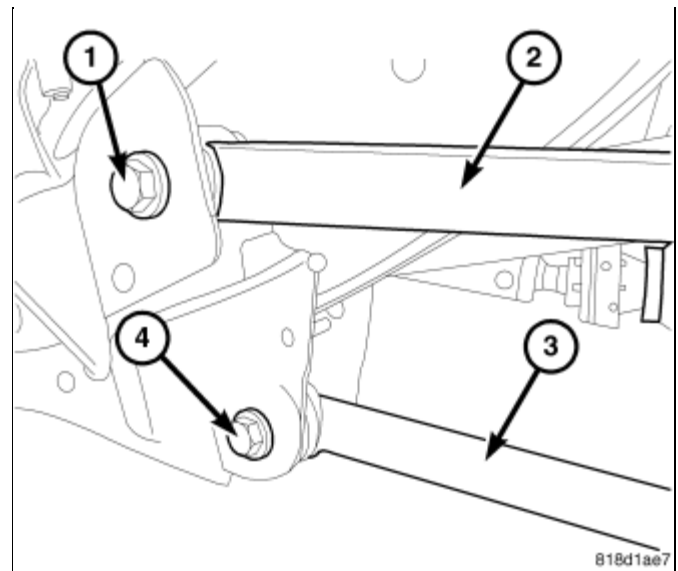
REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the lower suspension arm nut and bolt at the axle bracket (4).

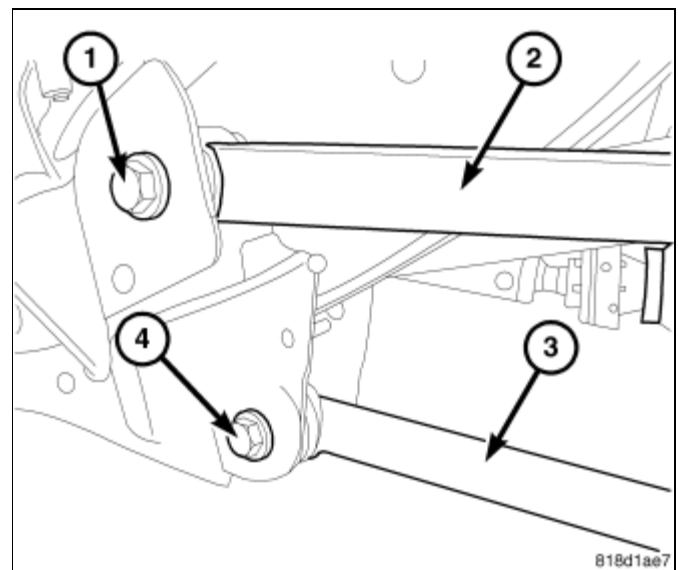


4. Remove the flagnut and bolt (4) at the frame rail mount and remove the lower suspension arm (3).

INSTALLATION



1. Position the lower suspension arm (3) in the axle bracket and frame rail mount.
2. Install the frame mounting bolt (4) finger tight.



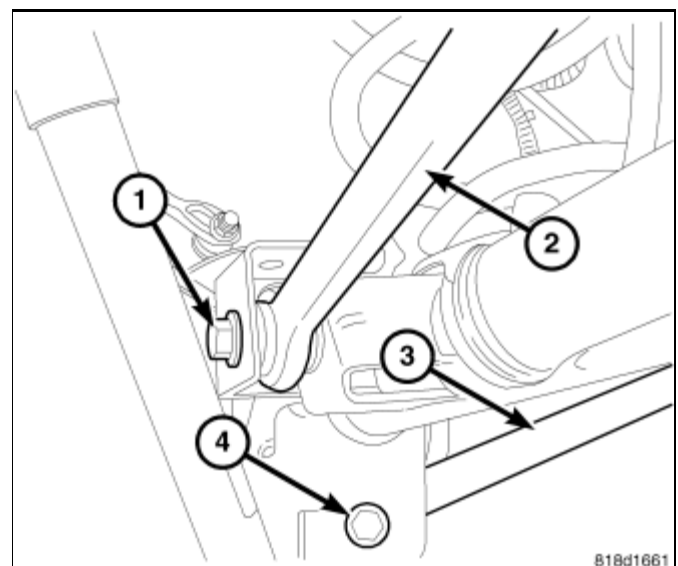
3. Install the axle mounting bolt (4) and nut at the axle bracket finger tight.
4. Remove the supports and lower the vehicle.
5. Tighten the lower suspension arm bolts to 169 N·m (125 ft. lbs.) with vehicle weight.

SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to the frame. The bottom of the shocks are bolted to the axle brackets.

OPERATION



The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.

DIAGNOSIS AND TESTING

SHOCK ABSORBER

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

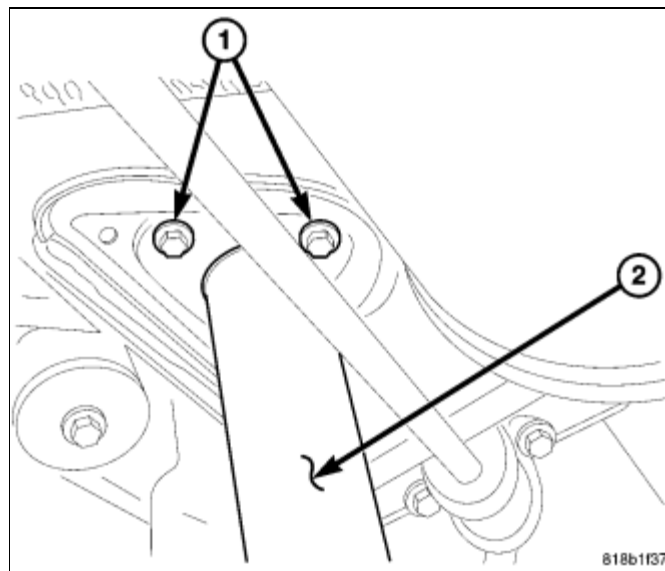
A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

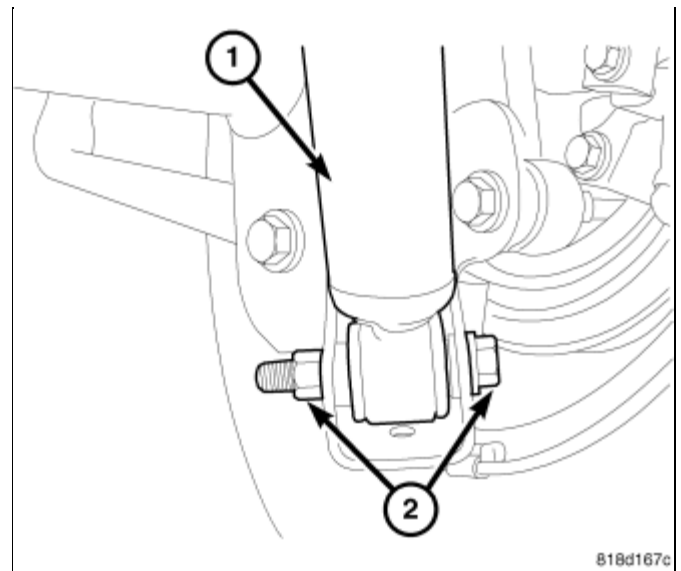
REMOVAL

1. Raise and support the vehicle and the axle.
2. Remove the upper mounting bolts (1).



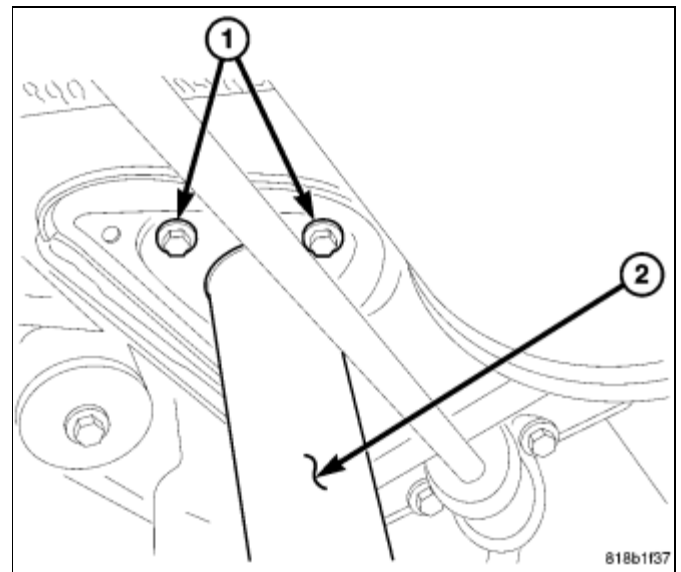
3. Remove the lower nut and bolt (2) from the axle bracket.
- Remove the shock absorber (1).

INSTALLATION



818d167c

1. Install the shock absorber (2) on the upper frame rail and install mounting bolts (1).
2. Tighten the upper bolts (1) to 50 N·m (37 ft. lbs.).



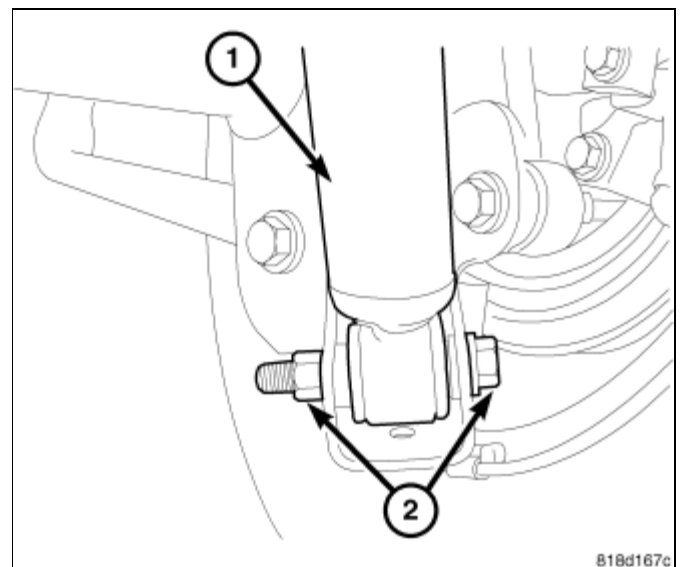
818b1f37

3. Install lower bolt and nut (2) finger tight.
4. Remove the supports and lower the vehicle.
5. Tighten the lower nut to 76 N·m (56 ft. lbs.).

SPRING

DESCRIPTION

The coil springs mount between the bottom of the frame rail and the top of the axle. A rubber doughnut isolator is located between the top of the spring and the frame rail. A plastic isolator is located between the bottom of the spring and the axle.



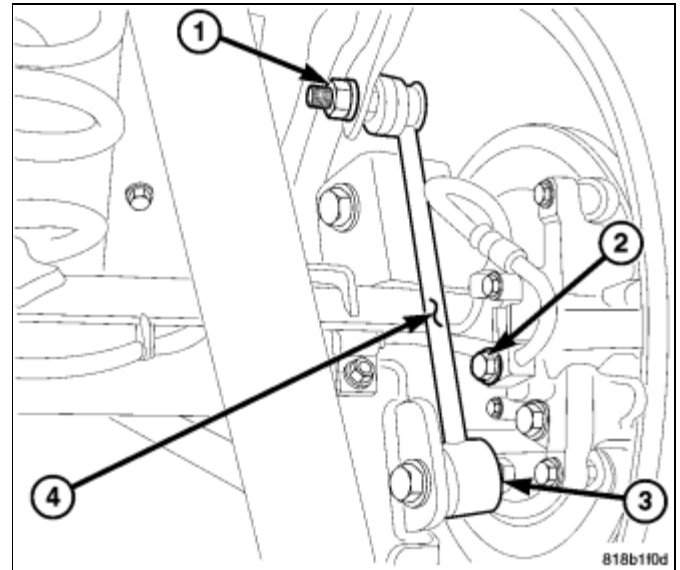
818d167c

OPERATION

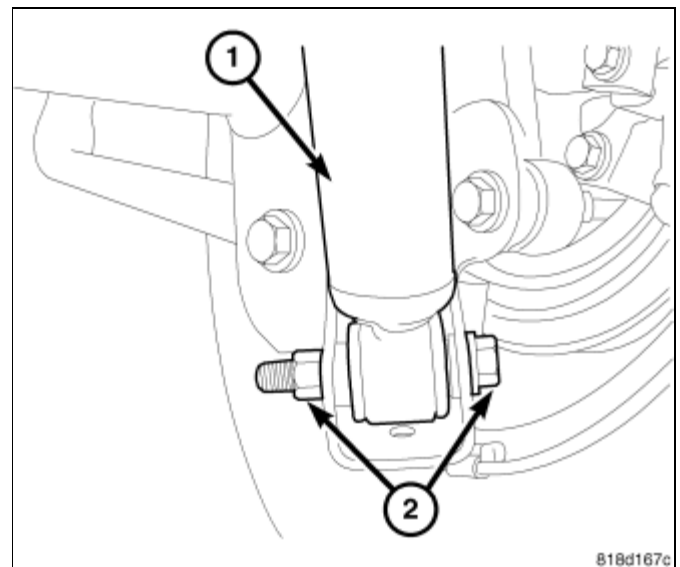
The coil springs control ride quality and maintain proper ride height. The isolators are used to isolate road noise.

REMOVAL

1. Raise and support the vehicle. Position a hydraulic jack under the axle to support it.
2. Disconnect the stabilizer bar links (3) from the axle brackets. (Refer to 2 - SUSPENSION/REAR/STABILIZER BAR - REMOVAL)

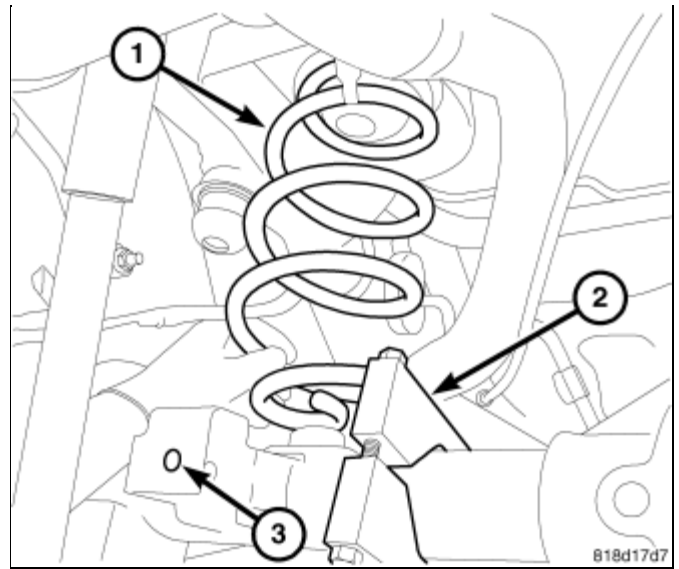


3. Disconnect the shock absorbers from the axle brackets (2). (Refer to 2 - SUSPENSION/REAR/SHOCK - REMOVAL)

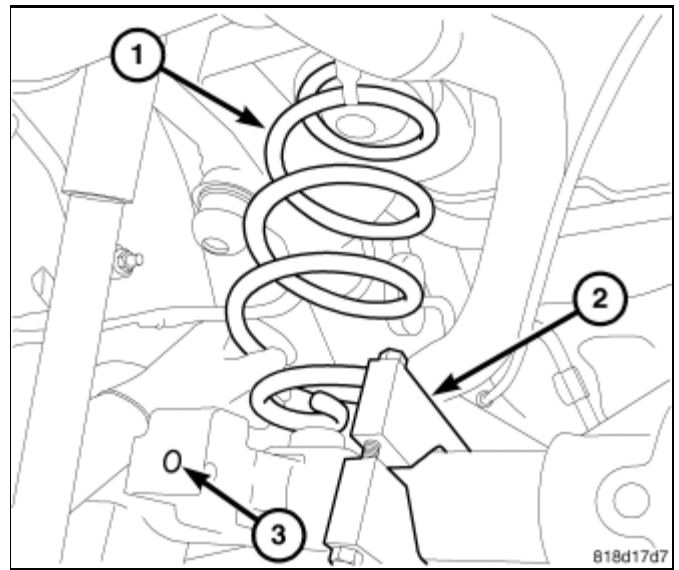


4. Disconnect the track bar from the axle bracket (3). (Refer to 2 - SUSPENSION/REAR/TRACK BAR - REMOVAL).
5. Lower the axle until the spring (1) is free from the upper mount seat and remove the spring (1).

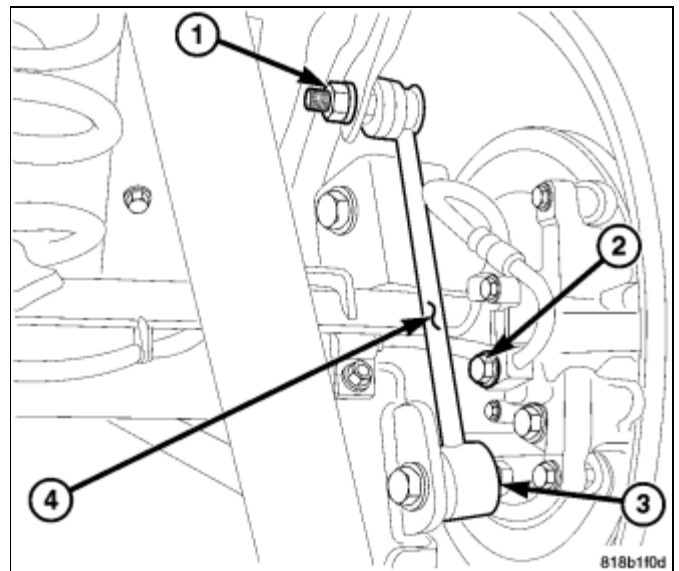
INSTALLATION



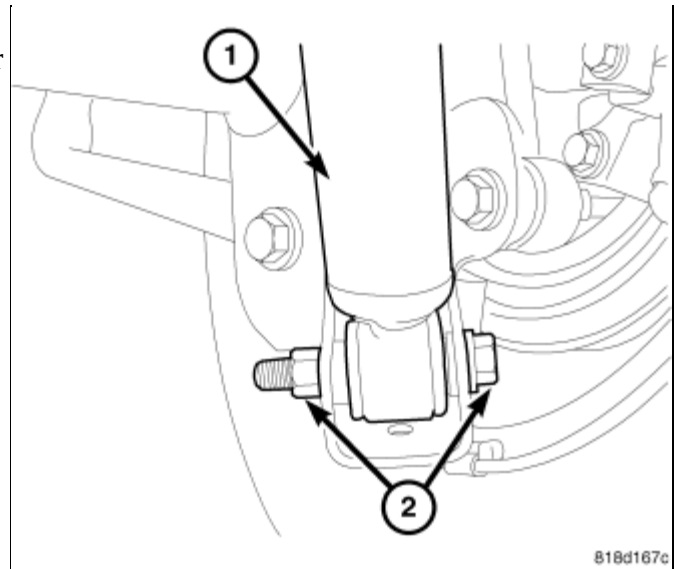
1. Position the coil spring (1) on the axle pad isolator.
2. Raise the axle into position until the spring seats on the upper isolator.



3. Connect the stabilizer bar links to the axle bracket (3). (Refer to 2 - SUSPENSION/REAR/STABILIZER LINK - INSTALLATION).



4. Connect the shock absorbers to the axle bracket (2). (Refer to 2 - SUSPENSION/REAR/SHOCK - INSTALLATION).



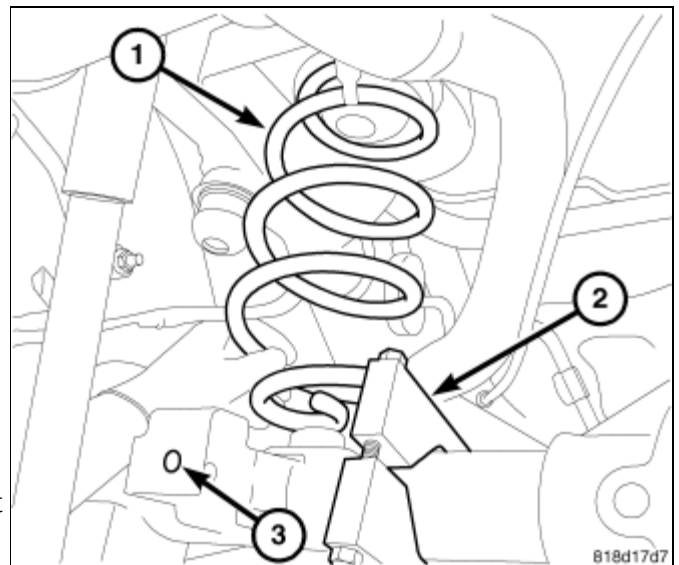
5. Connect the track bar to the frame axle bracket (3). (Refer to 2 - SUSPENSION/REAR/TRACK BAR - INSTALLATION).

6. Remove the supports (2) and lower the vehicle.

STABILIZER BAR

DESCRIPTION

The spring steel bar extends across the frame and mounts to the frame rails. Links are connected from the bar to the axle. The stabilizer bar and links are isolated by rubber bushings at the axle bracket, and attach to the stabilizer bar with a ball joint..

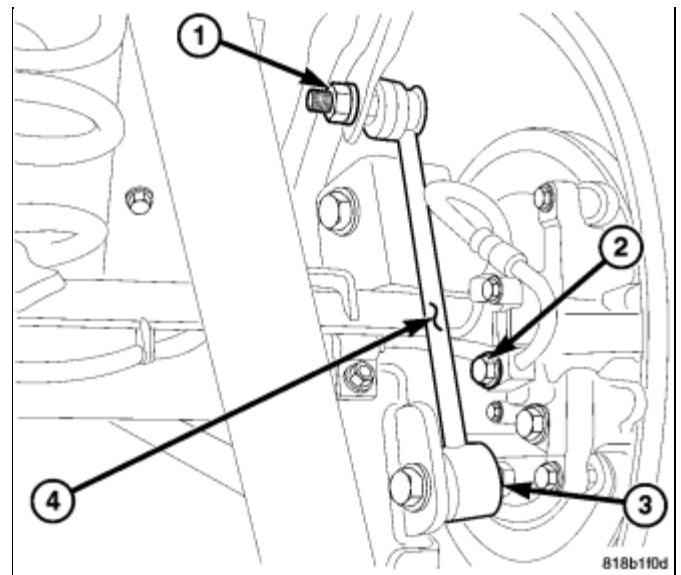


OPERATION

The stabilizer bar is used to control vehicle body roll during turns. The bar helps to control the vehicle body in relationship to the suspension.

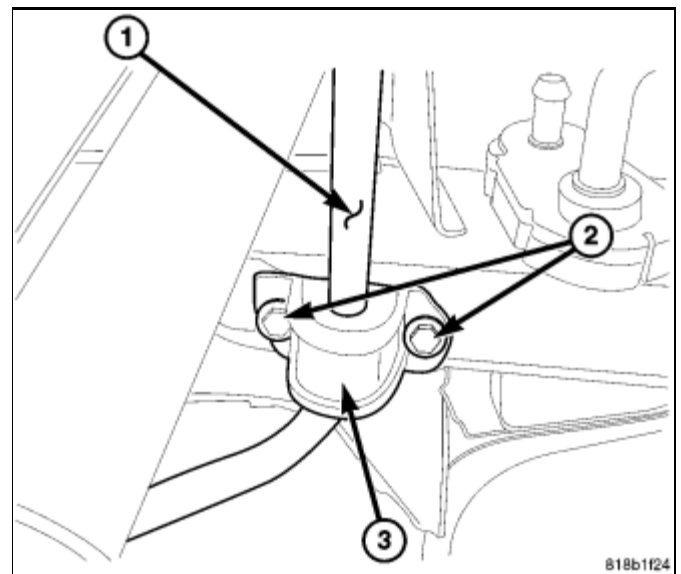
REMOVAL

1. Raise and support the vehicle.
2. Remove the stabilizer bar link nuts (1) from the stabilizer bar.
3. Remove the link (4) from the stabilizer bar.



4. Remove the stabilizer bar retainer bolts (2) and retainers (3) from the frame and remove the bar (1).

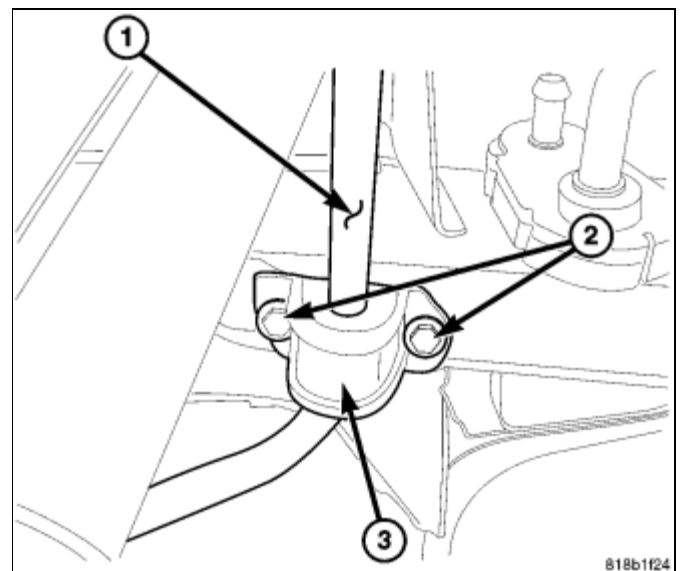
INSTALLATION



1. Install the stabilizer bar (1) to the frame and install the retainers (3) and bolts (2).

NOTE: Ensure the bar is centered with equal spacing on both sides.

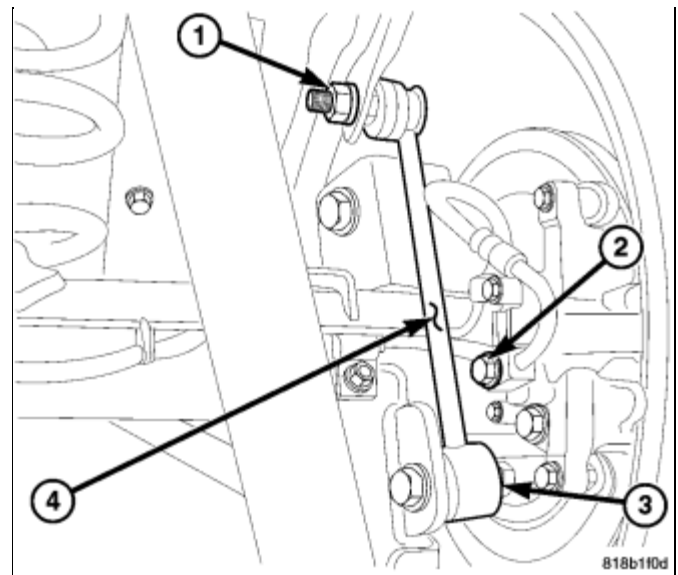
2. Tighten the retainer bolts (2) to 61 N·m (45 ft. lbs.).



3. Install the links (4) onto the stabilizer bar. Install the nut (1) finger tight.
4. Support the axle and Tighten the link nut (1) to 90 N·m (66 ft. lbs.).

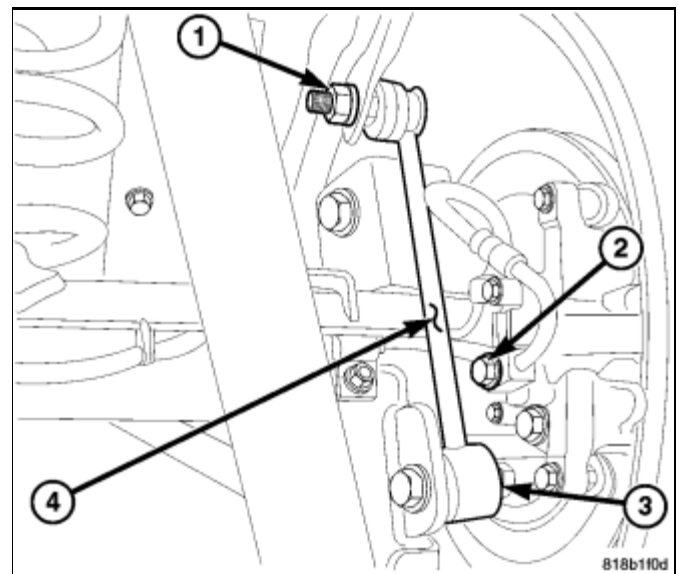
STABILIZER LINK

REMOVAL



1. Raise and support the vehicle.
2. Remove the rear tire.
3. Support the rear axle with a jack.
4. Remove the upper link nut at the stabilizer bar.
5. Remove the lower link nut & bolt (3) at the axle.
6. Remove stabilizer link (4).

INSTALLATION

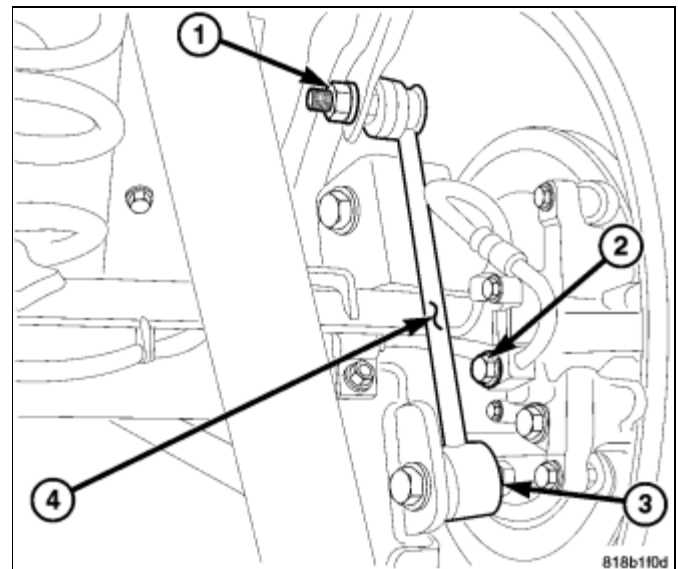


NOTE: The stabilizer bar link to axle bracket fastener must be tightened with full vehicle weight.

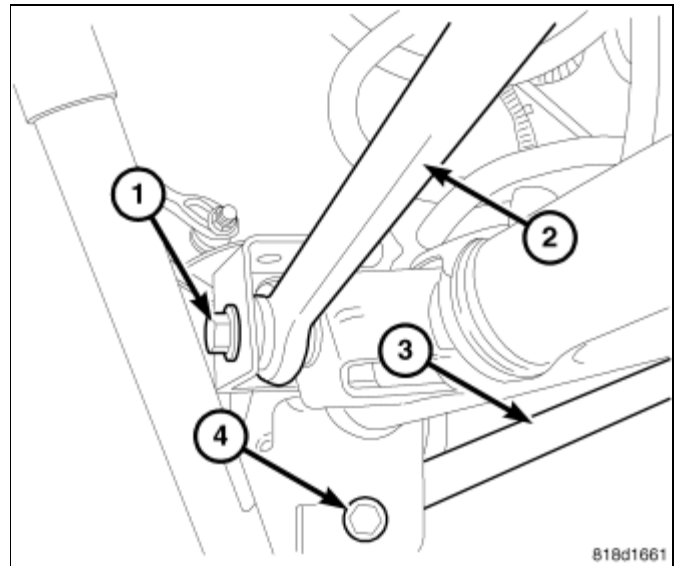
1. Install the stabilizer link (4) to the vehicle.
2. Install the upper nut (1) for the stabilizer link to the stabilizer bar and tighten to 90 N·m (66 ft. lbs.).
3. Install the nut & bolt (3) to the axle and tighten to 102 N·m (75 ft. lbs.).
4. Remove the jack and lower the vehicle.

TRACK BAR

REMOVAL

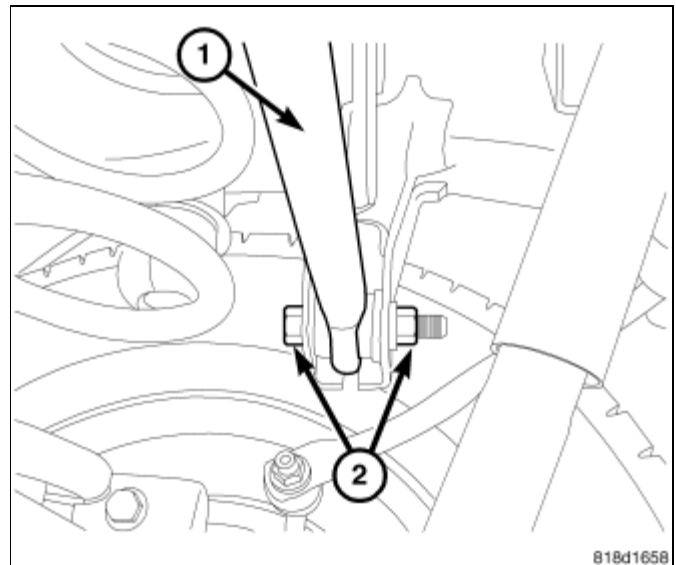


1. Raise and support the vehicle. Position a hydraulic jack under the axle to support the axle.
2. Remove the track bar bolt at the axle bracket (1).



3. Remove the track bar bolt and nut (2) from the frame bracket.
4. Remove the track bar (1) from the vehicle.

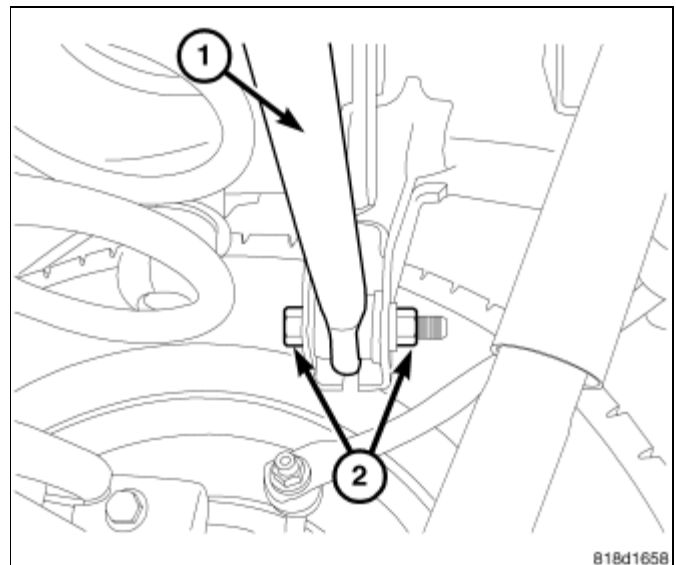
INSTALLATION



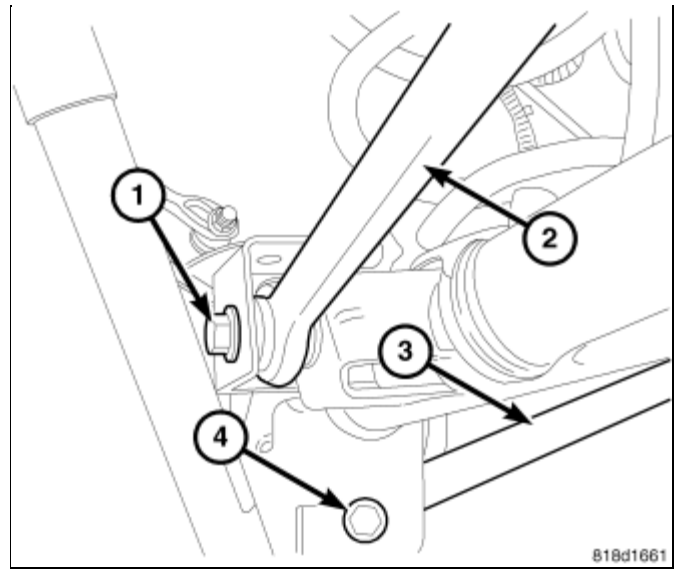
1. Install the track bar (1) to the vehicle.

NOTE: Frame bolt must be installed from the front to the rear of the vehicle.

2. Install the track bar bolt and flagnut (2) in the frame bracket.



3. Install the track bar (2) into the axle bracket.
4. Install the track bar bolt and flagnut (1) in the axle bracket.
5. Remove the supports and lower the vehicle.
6. Tighten the frame and axle mounting bolt/nut to 169 N·m (125 ft. lbs.) **with full vehicle weight.**



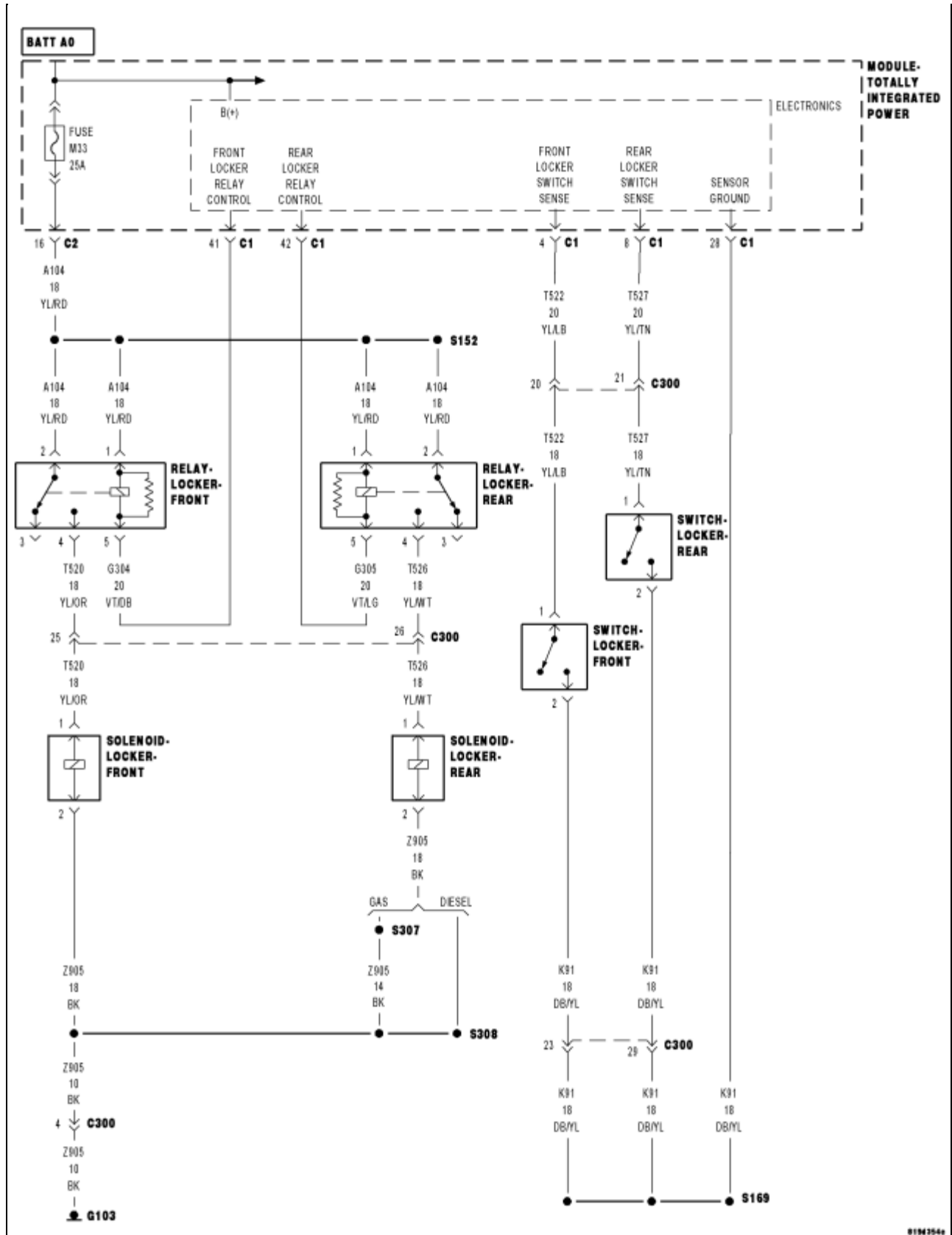
3 - DIFFERENTIAL & DRIVELINE

DIFFERENTIAL & DRIVELINE - ELECTRICAL DIAGNOSTICS

DIFFERENTIAL & DRIVELINE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

C1417–FRONT DIFFERENTIAL CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

▪ **When Monitored:**

Ignition on. Front Axle Lock engaged.

▪ **Set Condition:**

The TIPM detects the Front Locker Control circuit is shorted low.

Possible Causes
(A104) FUSED B+ CIRCUIT OPEN OR SHORTED TO GROUND
(G304) FRONT LOCKER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(G304) FRONT LOCKER RELAY CONTROL CIRCUIT OPEN
FRONT LOCKER (OFF-ROAD) RELAY
FRONT LOCKER SOLENOID
TOTALLY INTEGRATED CONTROL MODULE (TIPM)

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. FRONT LOCKER SOLENOID OPERATION

NOTE: Before continuing with the below diagnostic test, ensure the TIPM harness connector seal is installed correctly. Inspect the terminals on both

harness connector and the module for damage. Failure to do so can result in misdiagnoses of the system.

Turn the ignition off.

Disconnect the Front Locker Solenoid harness connector.

Ignition on, engine not running.

Using a 12-volt test light, jump across from the (T520)

Front Locker Relay Output circuit and the (Z905)

Ground circuit in the Front Locker harness connector.

With the scan tool, actuate the Front Locker Solenoid.

Does the test light illuminate and flash on and off?

Yes

- Inspect the Front Locker Solenoid terminals and connectors for corrosion and/or dirt that may compromise the connection. If OK, replace the Front Locker Solenoid in accordance with the Service Manual.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. FRONT LOCKER (OFF ROAD) RELAY

Turn the ignition off.

Verify the Front Locker (OFF-ROAD) Relay is installed properly and that the terminals are making a tight fit.

Remove the Front Locker (OFF-ROAD) Relay and substitute it with a known good Relay.

Ignition on, engine not running.

Using a 12-volt test light, jump across from the (T520)

Front Locker Relay Output circuit and the (Z905)

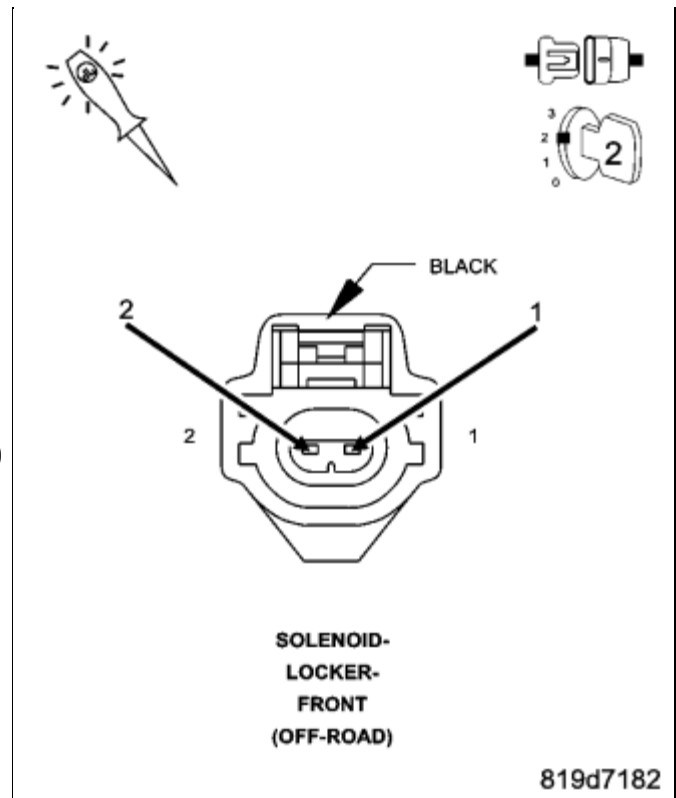
Ground circuit in the Front Locker harness connector.

With the scan tool, actuate the Front Locker Solenoid.

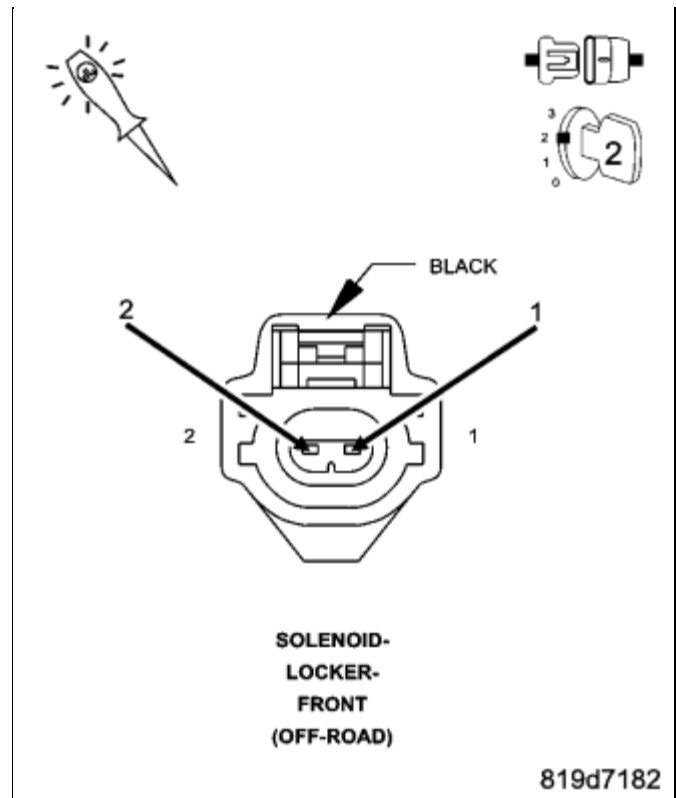
Does the test light illuminate and flash on and off?

Yes

- Replace the Front Locker (OFF-ROAD) Relay.



- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [4](#)

4. (A104) FUSED B+ FOR VOLTAGE

Turn the ignition off.

Remove the Front Locker (OFF-ROAD) Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Front Locker (OFF-ROAD) relay connection.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

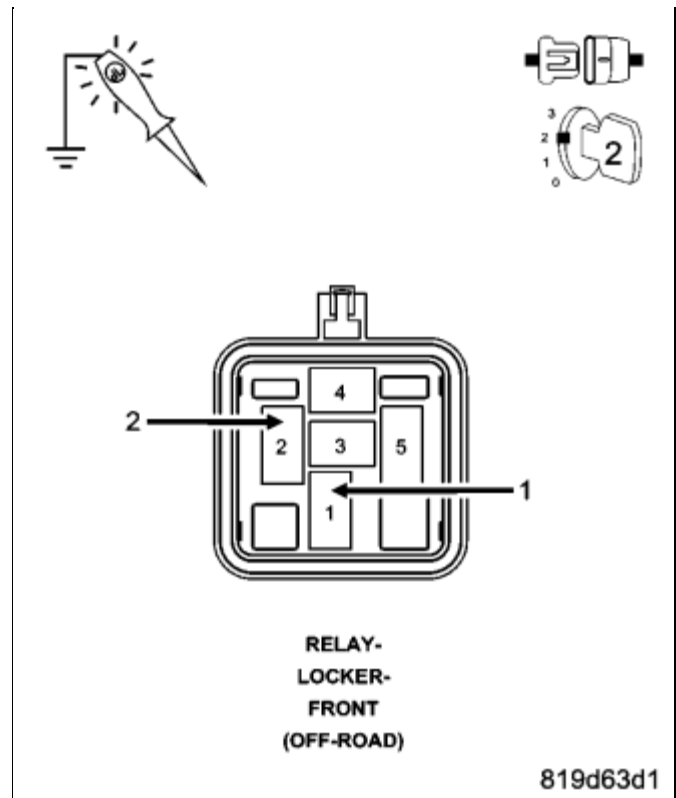
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair (A104) Fused B+ circuit for an open or a



short to ground.

- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

5. (G304) FRONT LOCKER RELAY CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the C2 TIPM harness connector.
Measure the resistance between ground and the (G304) Front Locker Relay Control circuit at the relay connection.

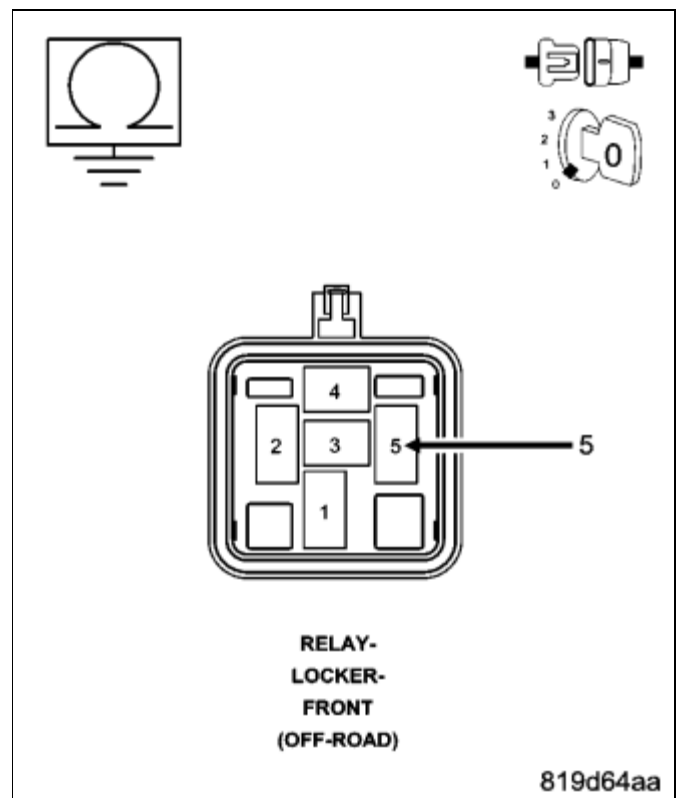
Is the resistance below 100 ohms?

Yes

- Repair the (G304) Front Locker Relay Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (G304) FRONT LOCKER RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (G304) Front Locker Relay Control circuit between the TIPM C1 harness connector and the Front Locker (OFF-ROAD) relay connection.

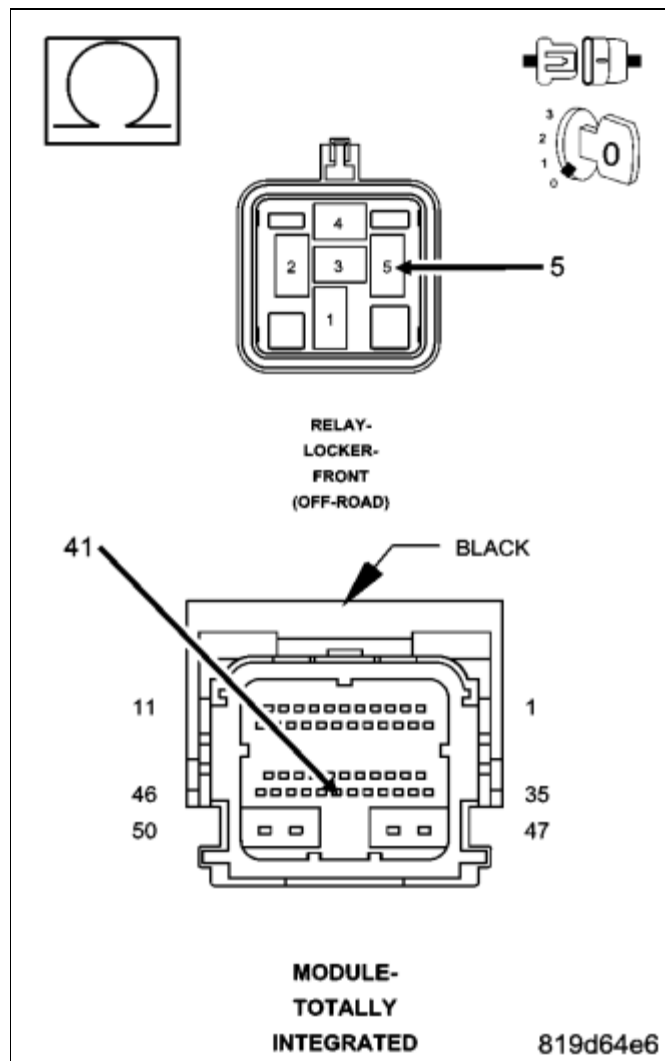
Is the resistance below 5.0 ohms?

Yes

- Repair (G304) Front Locker Relay Control circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. TOTALLY INTEGRATED POWER MODULE (TIPM)

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace and program the TIPM in accordance with Service Information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle test the wiring harness and connectors while checking for shorted and open circuits.

Using the scan tool, monitor the data related to this circuit while performing the wiggle test. Look for the data to change or for the DTC to reset.

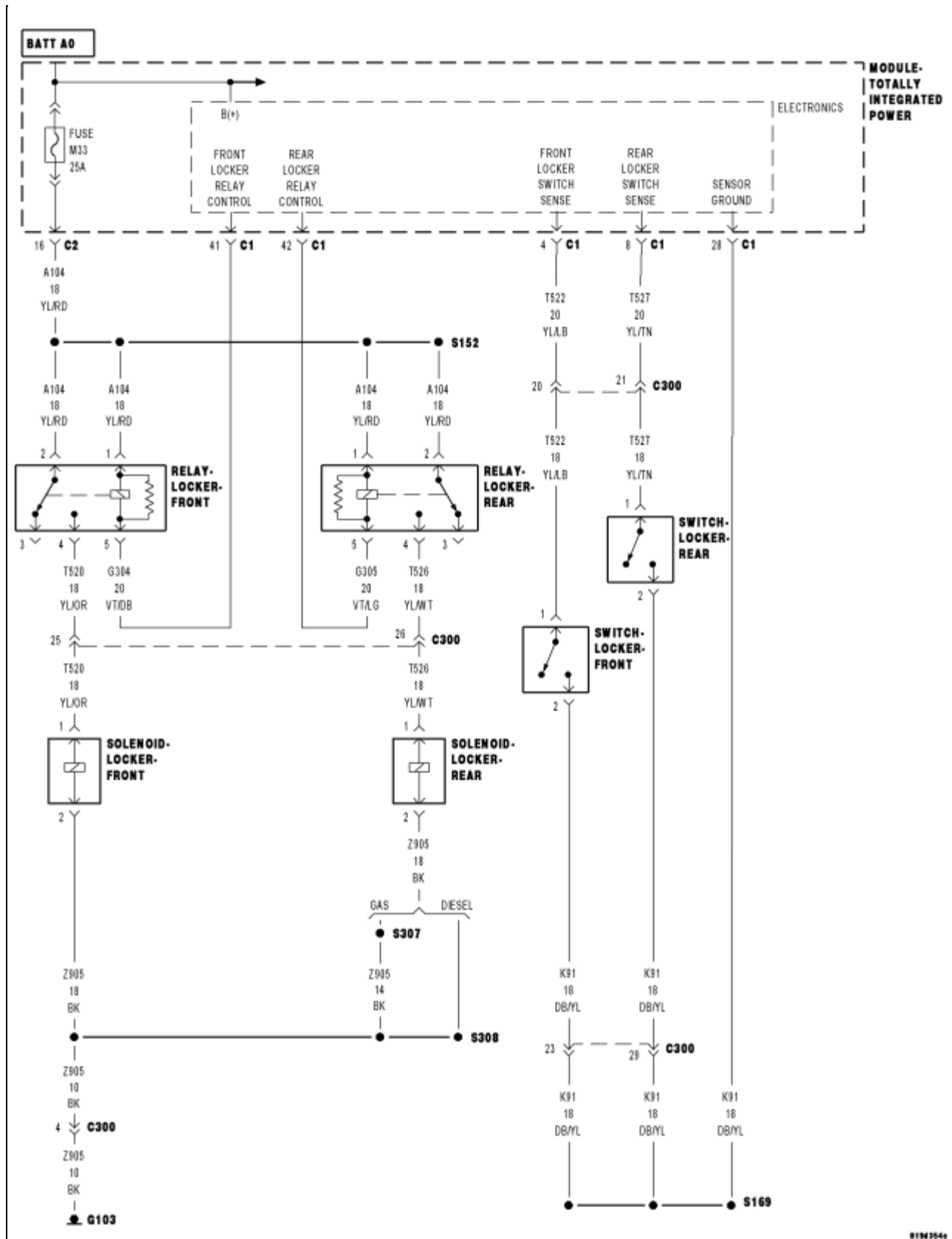
Were there any problems found?**Yes**

- Repair as necessary.
- Perform TIPM VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Test Complete.

C1418–FRONT DIFFERENTIAL CONTROL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

▪ **When Monitored:**

Ignition on. Front Axle Lock engaged.

▪ **Set Condition:**

The TIPM detects the Front Locker Control circuit is shorted high.

Possible Causes
(G304) FRONT LOCKER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
FRONT LOCKER (OFF-ROAD) RELAY
FRONT LOCKER SOLENOID
TOTALLY INTEGRATED CONTROL MODULE (TIPM)

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. FRONT LOCKER SOLENOID OPERATION

NOTE: Before continuing with the below diagnostic test, ensure the TIPM harness connector seal is installed correctly. Inspect the terminals on both harness connector and the module for damage. Failure to do so can result in misdiagnoses of the system.

Turn the ignition off.
 Disconnect the Front Locker Solenoid harness connector.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T520) Front Locker Relay Output circuit and the (Z905) Ground circuit in the Front Locker harness connector.
 With a scan tool, actuate the Front Locker Solenoid.

Does the test light flash on and off?

Yes

- Inspect the Front Locker Solenoid terminals and connectors for corrosion and/or dirt that may compromise the connection. If OK, replace the Front Locker Solenoid in accordance with the Service Manual.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

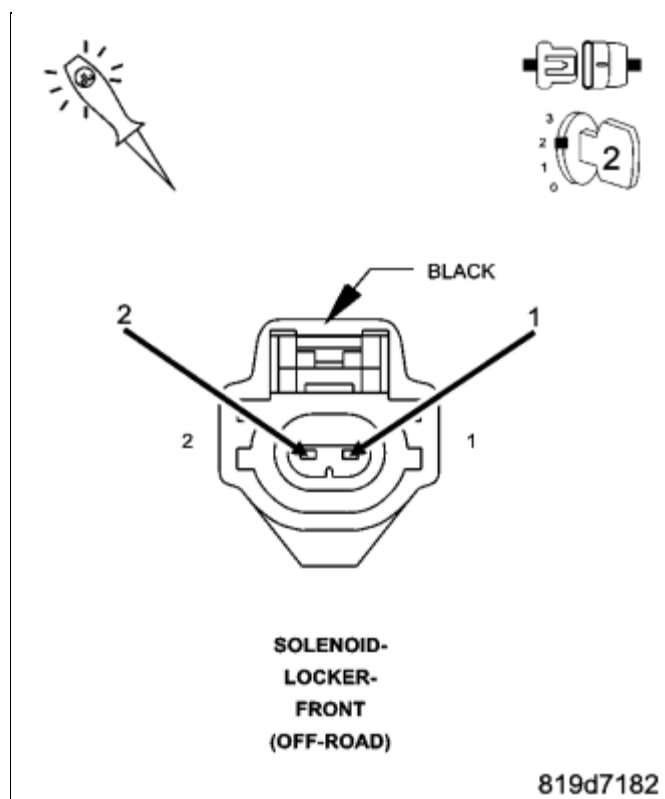
3. FRONT LOCKER (OFF ROAD) RELAY

Turn the ignition off.
 Verify the Front Locker (OFF-ROAD) Relay is installed properly and that the terminals are making a tight fit.
 Remove the Front Locker (OFF-ROAD) Relay and substitute it with a known good Relay.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T520) Front Locker Relay Output circuit and the (Z905) Ground circuit in the Front Locker harness connector.
 With the scan tool, actuate the Front Locker Solenoid.

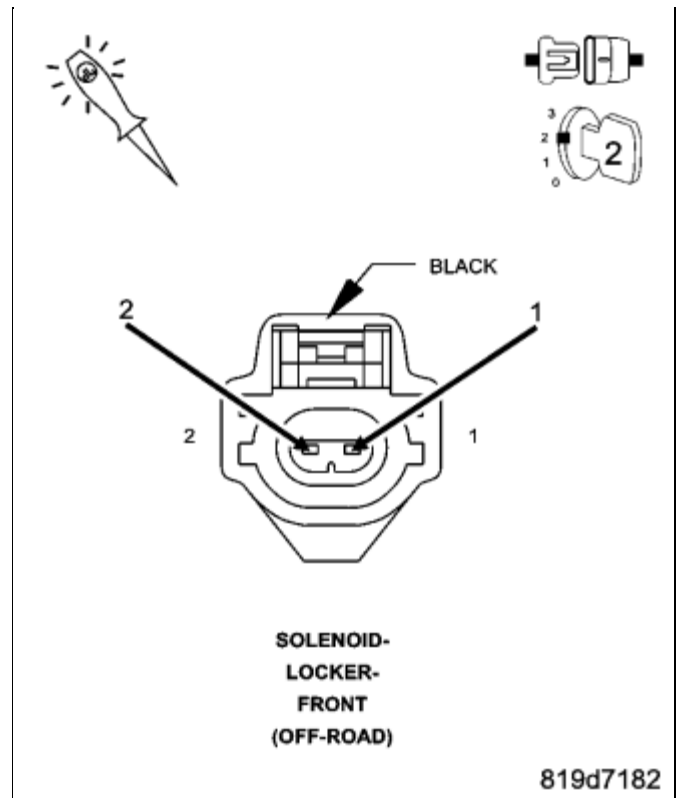
Does the test light illuminate and flash on and off?

Yes

- Replace the Front Locker (OFF-ROAD) Relay.



- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [4](#)

4. (G304) FRONT LOCKER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 TIPM harness connector.
 Remove the Front Locker (OFF-ROAD) Relay.
 Ignition on, engine not running.
 Measure the voltage on the (G304) Front Locker Relay Control circuit at the relay connection.

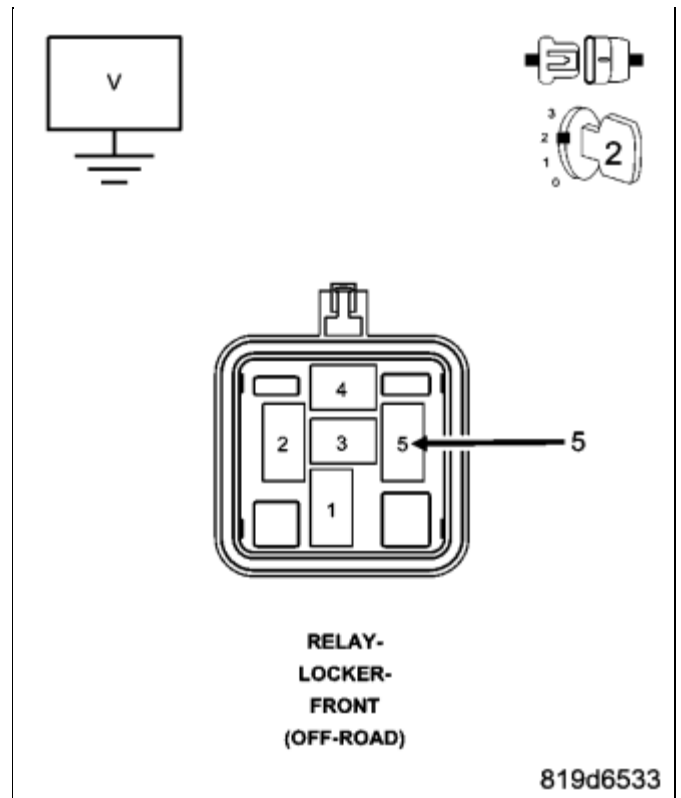
Is there any voltage present?

Yes

- Repair the (G304) Front Locker Relay Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. TOTALLY INTEGRATED POWER MODULE (TIPM)

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace and program the TIPM in accordance with Service Information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle test the wiring harness and connectors while checking for shorted and open circuits.

Using the scan tool, monitor the data related to this circuit while performing the wiggle test. Look for the data to change or for the DTC to reset.

Were there any problems found?

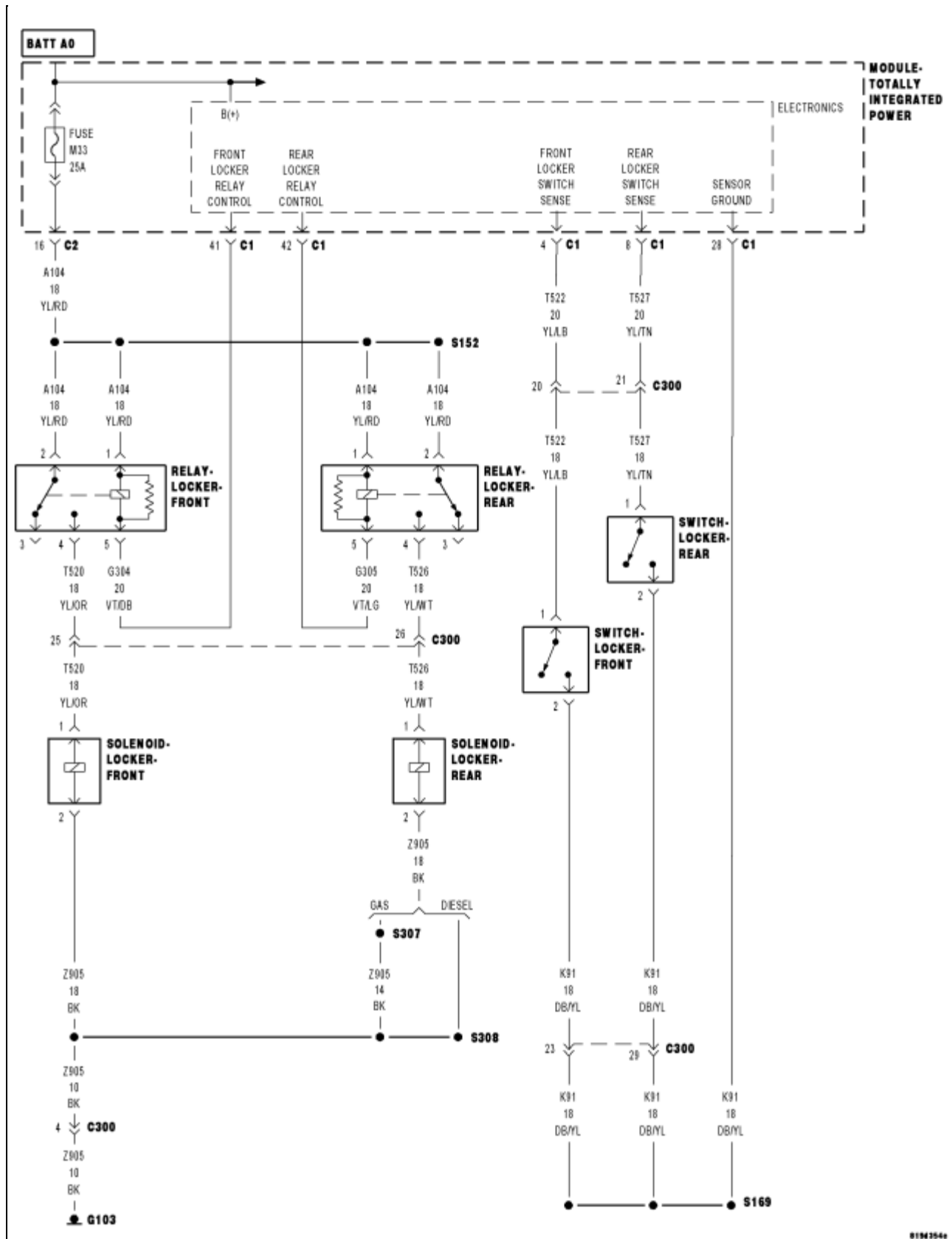
Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Test Complete.

C141D-REAR DIFFERENTIAL CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. Rear Axle Lock engaged.

▪ **Set Condition:**

The TIPM detects the Rear Locker Control circuit is shorted low.

Possible Causes
(A104) FUSED B+ CIRCUIT OPEN OR SHORTED TO GROUND
(G305) REAR LOCKER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(G305) REAR LOCKER RELAY CONTROL CIRCUIT OPEN
REAR LOCKER (OFF-ROAD) RELAY
REAR LOCKER SOLENOID
TOTALLY INTEGRATED CONTROL MODULE (TIPM)

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. REAR LOCKER SOLENOID OPERATION

NOTE: Before continuing with the below diagnostic test, ensure the TIPM harness connector seal is installed correctly. Inspect the terminals on both

harness connector and the module for damage. Failure to do so can result in misdiagnoses of the system.

Turn the ignition off.
 Disconnect the Rear Locker Solenoid harness connector.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T526) Rear Locker Relay Output circuit and the (Z905) Ground circuit in the Rear Locker harness connector.
 With a scan tool, actuate the Rear Locker Solenoid.

Does the test light flash on and off?

Yes

- Inspect the Rear Locker Solenoid terminals and connectors for corrosion and/or dirt that may compromise the connection. If OK, replace the Rear Locker Solenoid.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

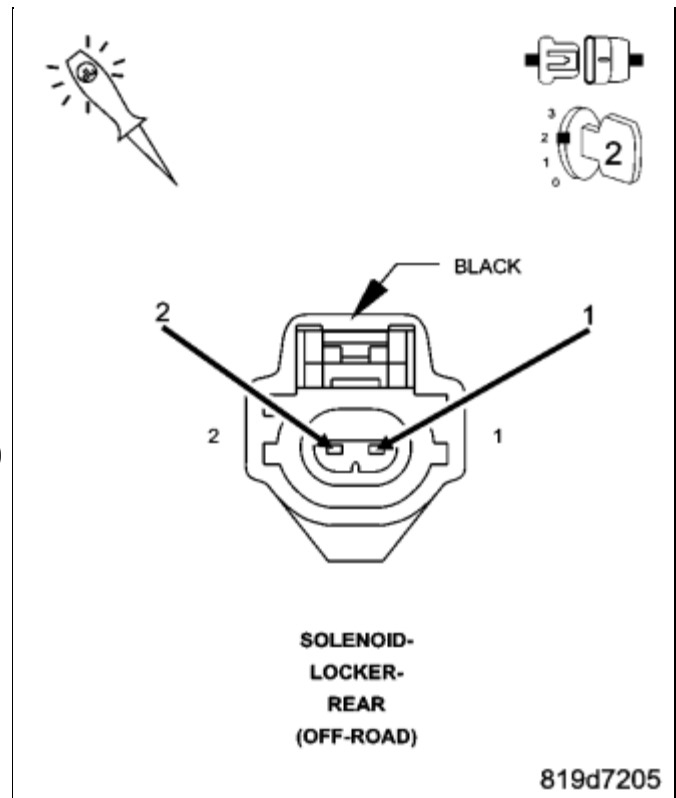
3. REAR LOCKER (OFF ROAD) RELAY

Turn the ignition off.
 Verify the Rear Locker (OFF-ROAD) Relay is installed properly and that the terminals are making a tight fit.
 Remove the Rear Locker (OFF-ROAD) Relay and substitute it with a known good Relay.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T526) Rear Locker Relay Output circuit and the (Z905) Ground circuit in the Rear Locker harness connector.
 With the scan tool, actuate the Rear Locker Solenoid.

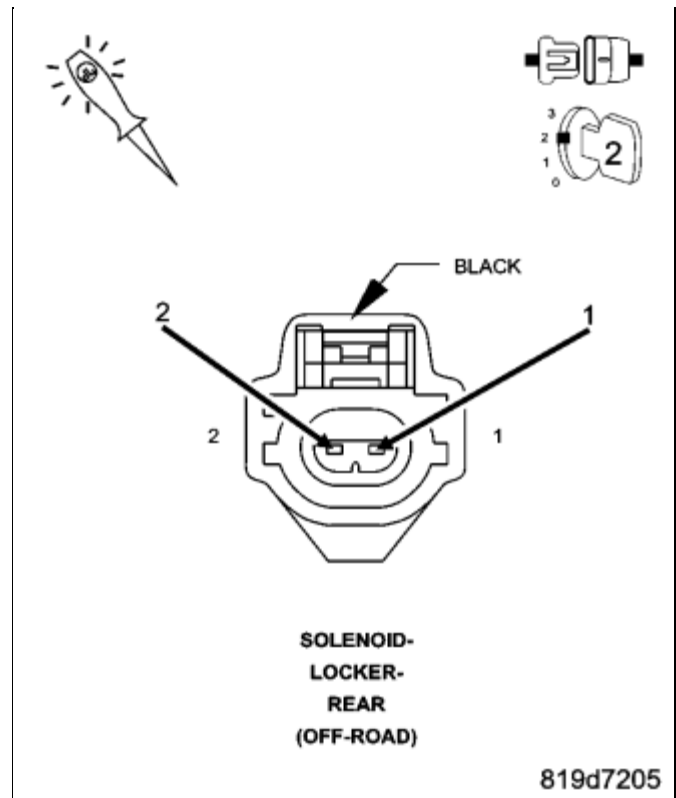
Does the test light illuminate and flash on and off?

Yes

- Replace the Rear Locker (OFF-ROAD) Relay.



- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [4](#)

4. (A104) FUSED B+ FOR VOLTAGE

Turn the ignition off.

Remove the Rear Locker (OFF-ROAD) Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Rear Locker (OFF-ROAD) relay connection.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

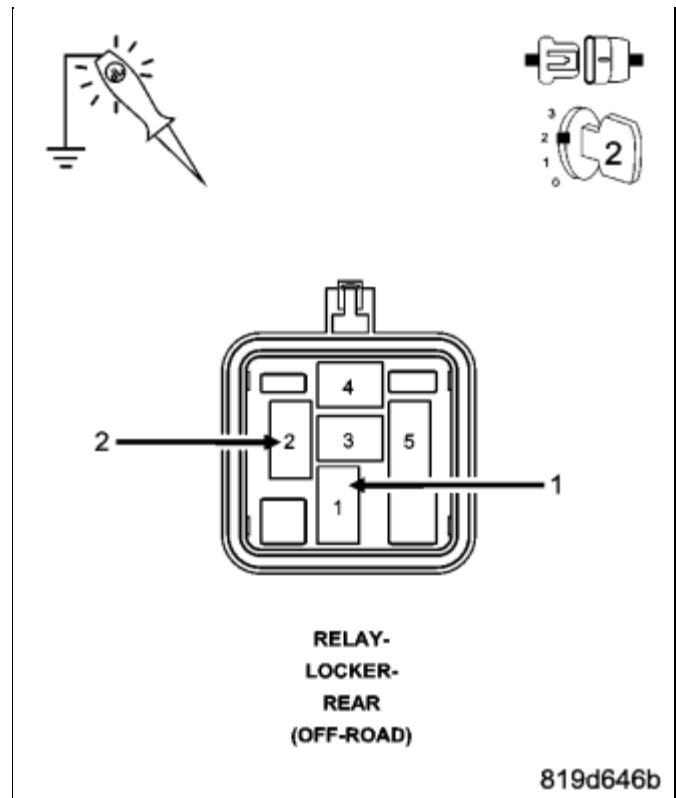
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair (A104) Fused B+ circuit for an open or a



short to ground.

- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

5. (G305) REAR LOCKER RELAY CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the C2 TIPM harness connector.
Measure the resistance between ground and the (G305) Rear Locker Relay Control circuit at the relay connection.

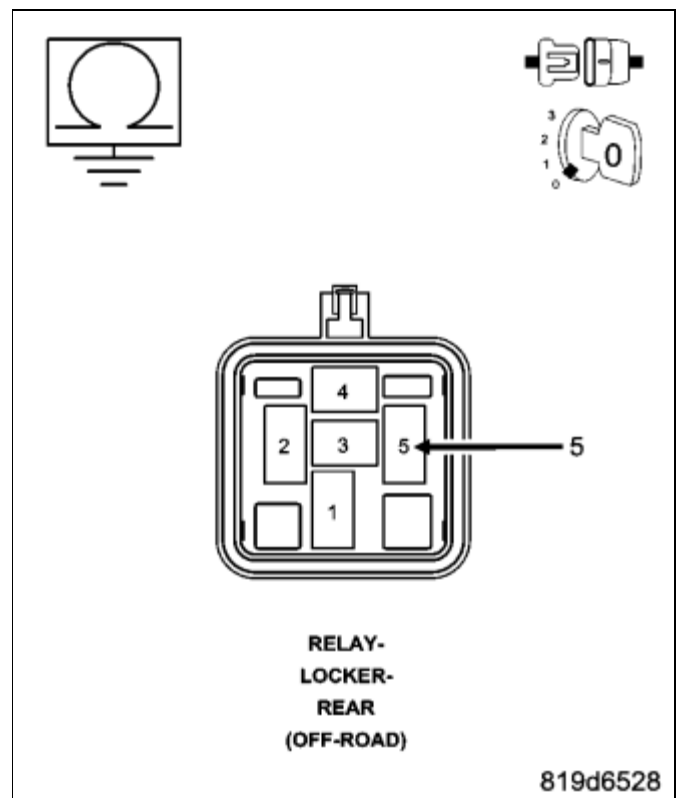
Is the resistance below 100 ohms?

Yes

- Repair the (G305) Rear Locker Relay Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (G305) REAR LOCKER RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (G305) Rear Locker Relay Control circuit between the TIPM C1 harness connector and the Rear Locker (OFF-ROAD) relay connection.

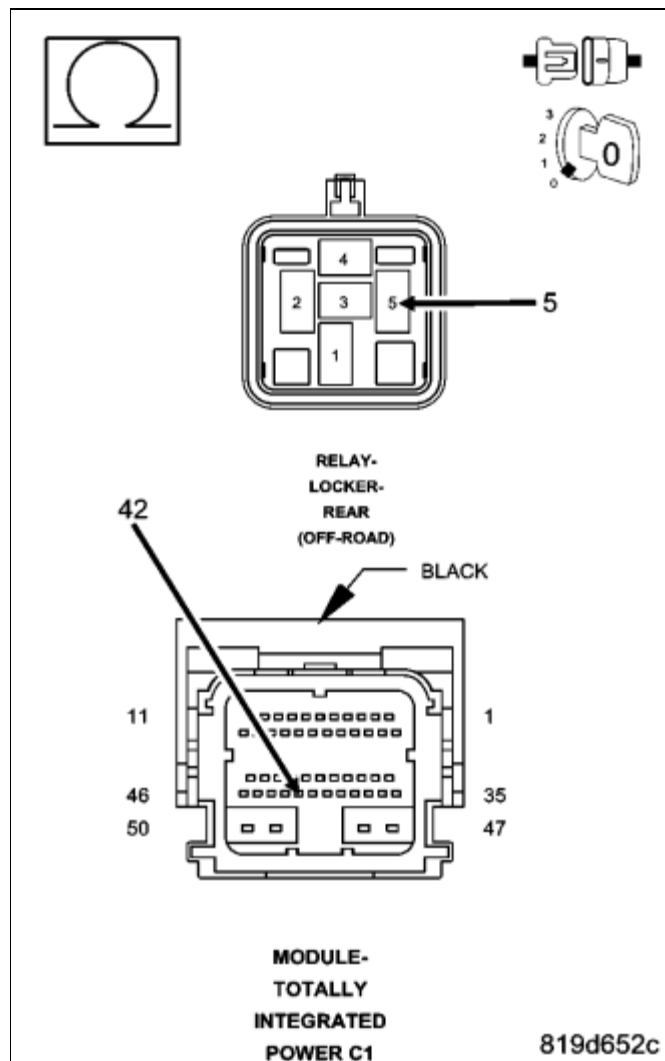
Is the resistance below 5.0 ohms?

Yes

- Repair (G305) Rear Locker Relay Control circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. TOTALLY INTEGRATED POWER MODULE (TIPM)

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace and program the TIPM in accordance with Service Information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle test the wiring harness and connectors while checking for shorted and open circuits.

Using the scan tool, monitor the data related to this circuit while performing the wiggle test. Look for the data to change or for the DTC to reset.

Were there any problems found?

Yes

- Repair as necessary.
- Perform TIPM VERIFICATION TEST. (Refer to 2 - SUSPENSION/ACTIVE CHASSIS - STANDARD PROCEDURE)

No

- Test Complete.

C141E–REAR DIFFERENTIAL CONTROL CIRCUIT HIGH

- **When Monitored:**

Ignition on. Rear Axle Lock engaged.

▪ **Set Condition:**

The TIPM detects the Rear Locker Control circuit is shorted high.

Possible Causes
(G305) REAR LOCKER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
REAR LOCKER (OFF-ROAD) RELAY
REAR LOCKER SOLENOID
TOTALLY INTEGRATED CONTROL MODULE (TIPM)

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. REAR LOCKER SOLENOID OPERATION

NOTE: Before continuing with the below diagnostic test, ensure the TIPM harness connector seal is installed correctly. Inspect the terminals on both harness connector and the module for damage. Failure to do so can result in misdiagnoses of the system.

Turn the ignition off.
 Disconnect the Rear Locker Solenoid harness connector.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T526) Rear Locker Relay Output circuit and the (Z905) Ground circuit in the Rear Locker harness connector.
 With a scan tool, actuate the Rear Locker Solenoid.

Does the test light flash on and off?

Yes

- Inspect the Rear Locker Solenoid terminals and connectors for corrosion and/or dirt that may compromise the connection. If OK, replace the Rear Locker Solenoid in accordance with the Service Manual.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

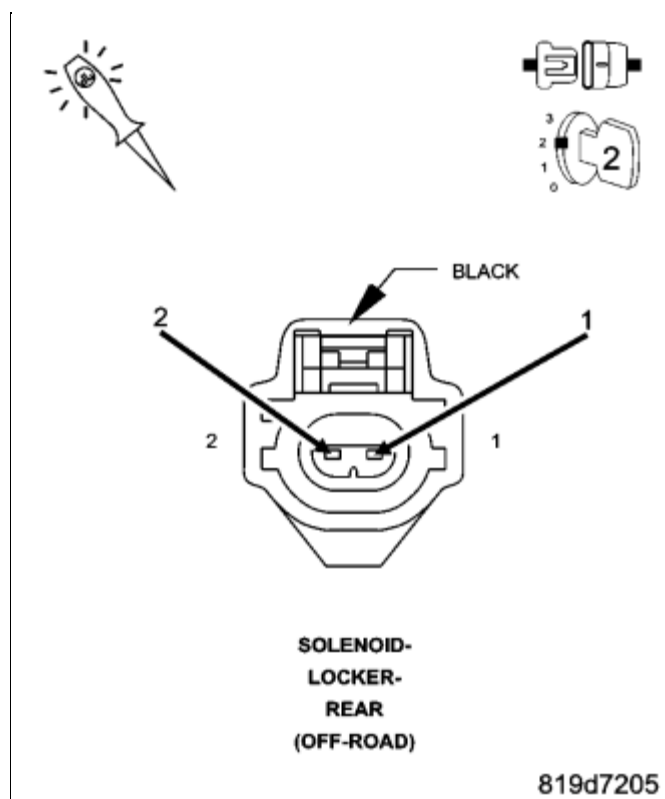
3. REAR LOCKER (OFF ROAD) RELAY

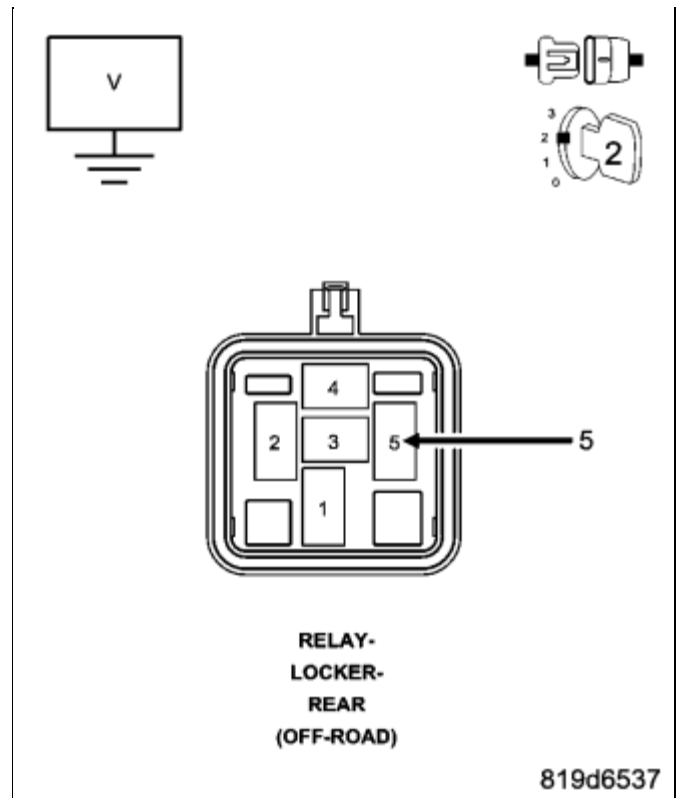
Turn the ignition off.
 Verify the Rear Locker (OFF-ROAD) Relay is installed properly and that the terminals are making a tight fit.
 Remove the Rear Locker (OFF-ROAD) Relay and substitute it with a known good Relay.
 Ignition on, engine not running.
 Using a 12-volt test light, jump across from the (T526) Rear Locker Relay Output circuit and the (Z905) Ground circuit in the Rear Locker harness connector.
 With the scan tool, actuate the Rear Locker Solenoid.

Does the test light illuminate and flash on and off?

Yes

- Replace the Rear Locker (OFF-ROAD) Relay.





5. TOTALLY INTEGRATED POWER MODULE (TIPM)

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace and program the TIPM in accordance with Service Information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle test the wiring harness and connectors while checking for shorted and open circuits.

Using the scan tool, monitor the data related to this circuit while performing the wiggle test. Look for the data to change or for the DTC to reset.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Test Complete.

DIFFERENTIAL & DRIVELINE - SERVICE INFORMATION

PROPELLER SHAFT

PROPELLER SHAFT

DIAGNOSIS AND TESTING

PROPELLER SHAFT

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration.

Brake drums/rotors that are unbalanced will cause a harsh, low frequency vibration.

Driveline vibration can also result from loose or damaged engine mounts.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal/CV joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose flange bolts.	2) Install new bolts and tighten to proper torque.
	3) Loose or bent flange or excessive runout.	3) Install new flange.

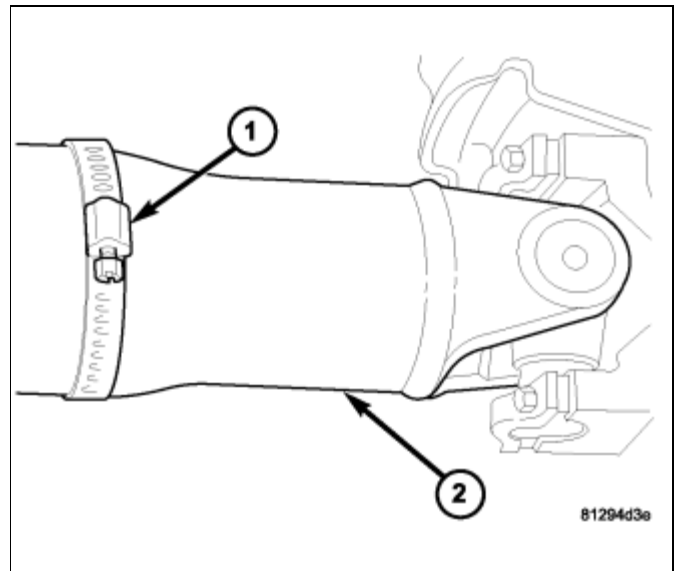
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Worn U-joint/CV bearings.	5) Install new propeller shaft.
	6) Propeller shaft damaged or out of balance.	6) Install new propeller shaft.
	7) Broken rear spring.	7) Install new rear spring.
	8) Excessive runout or unbalanced condition.	8) Re-index propeller shaft, test, and evaluate.
	9) Excessive drive pinion gear shaft runout.	9) Re-index propeller shaft and evaluate.
	10) Excessive axle flange deflection.	10) Inspect and replace flange if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint /CV Noise	1) Loose clamping bolts.	1) Install new bolts and tighten to proper torque.

BALANCE

If propeller shaft is suspected of being out of balance, use the following procedure.

NOTE: Indexing propeller shaft 180 degrees relative to the yoke may eliminate some vibrations.

1. Raise and support vehicle.
2. Clean all foreign material from the propeller shaft.
3. Inspect propeller shaft for missing balance weights, broken welds and bent areas. **If propeller shaft is bent, it must be replaced.**
4. Inspect universal joints/CV joints for wear.
5. Check propeller shaft bolt torques.
6. Remove wheels and install lug nuts to retain brake rotors.
7. Mark and number the shaft six inches from the pinion flange end at four positions 90 degrees apart.
8. Run and accelerate vehicle until vibration occurs. Note at what speed the vibration occurred. Stop the engine.
9. Install a screw clamp at position (1).

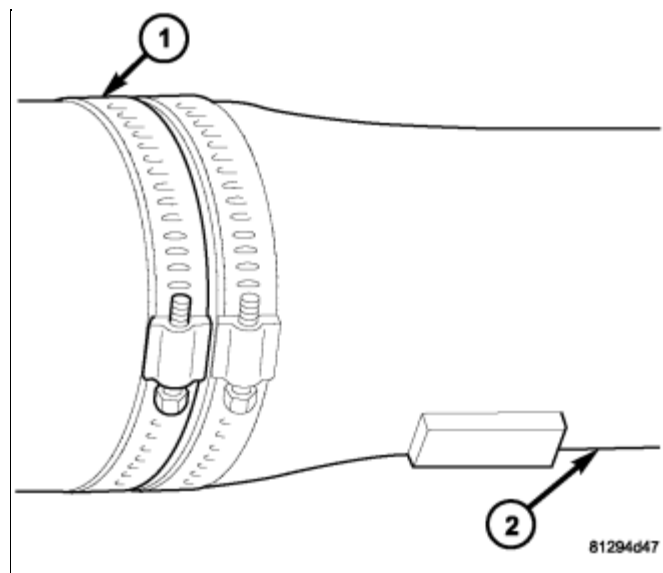


10. Start engine and check vibration. If there is little or no change move the clamp to the next positions and

repeat vibration test.

NOTE: If there is no difference in vibration at this positions, the vibration may not be the propeller shaft.

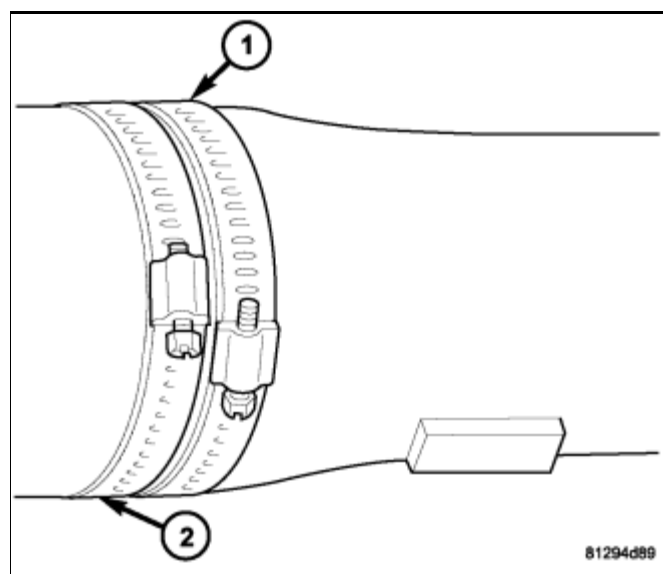
11. If vibration decreased, install a second clamp (1) and repeat the test.



12. If additional clamp causes an additional vibration, separate the clamps 1/2 inch (1) above and below the mark. Repeat the vibration test .

13. Increase distance between the clamp screws (1) (2) and repeat test, until the least amount of vibration is noticed. Bend the slack end of the clamps so screws will not loosen.

14. If vibration remains unacceptable, repeat the procedure to the front end of the propeller shaft.



RUNOUT

1. Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.
2. The dial indicator must be installed perpendicular to the shaft surface.
3. Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure that the effects of the weld process will not enter into the measurements.
4. Refer to Runout Specifications chart.
5. If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 180°, and re-install the propeller shaft. Measure shaft runout again.
6. If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.
7. If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.
8. Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
NOTE: Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

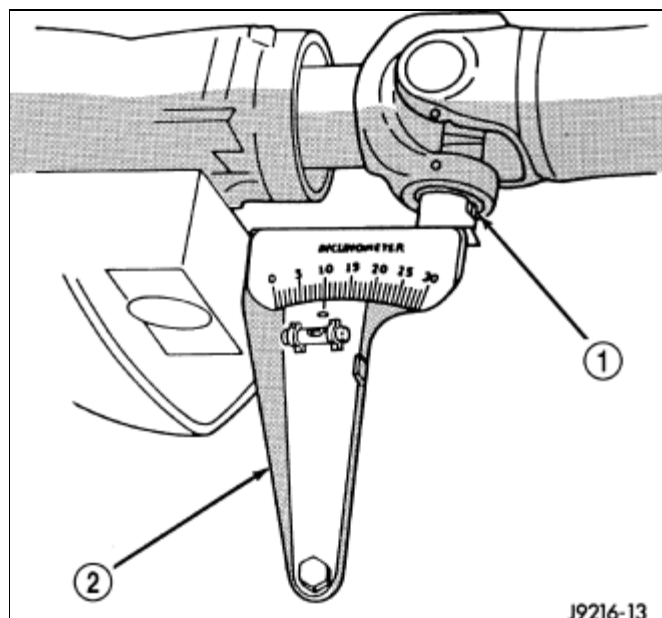
STANDARD PROCEDURE

PROPELLER SHAFT ANGLE

To obtain front (output) angle on a C/V propeller shaft, place Inclinometer 7663 on the machined ring of the pinion flange. To obtain propeller shaft angle measurement on the C/V front propeller shaft, place inclinometer on the propeller shaft tube. To obtain rear (output) angle on rear propeller shaft use transfer case/transmission flange.

1. Raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn.
2. Remove universal joint snap rings if equipped, so inclinometer base sits flat.
3. Rotate shaft until transmission/transfer case output yoke bearing cap is facing downward.

NOTE: Always make measurements from front to rear and from the same side of the vehicle.

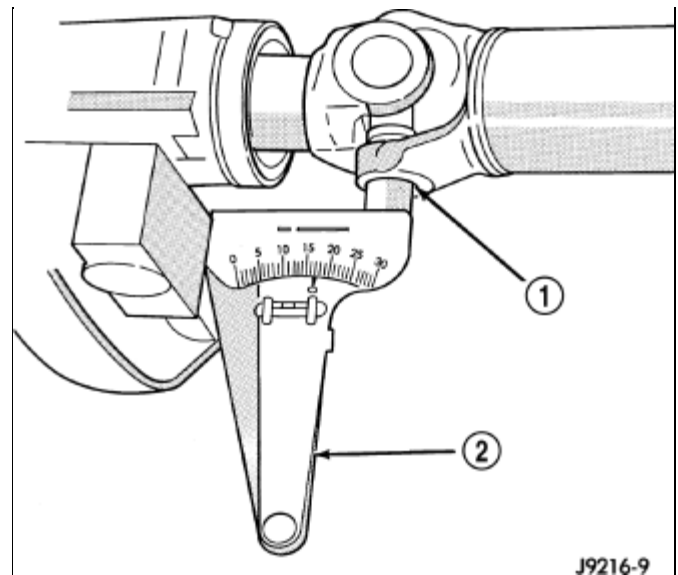


4. Place inclinometer (2) on yoke bearing cap (1) or pinion flange ring parallel to the shaft. Center bubble in sight glass and record measurement. This measurement will give you the transmission or Output Yoke Angle (A).

5. Rotate propeller shaft 90 degrees and place inclinometer (2) on yoke bearing cap (1) or propeller shaft tube on C/V propeller shaft, parallel to the shaft. Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft. This measurement will give you the propeller

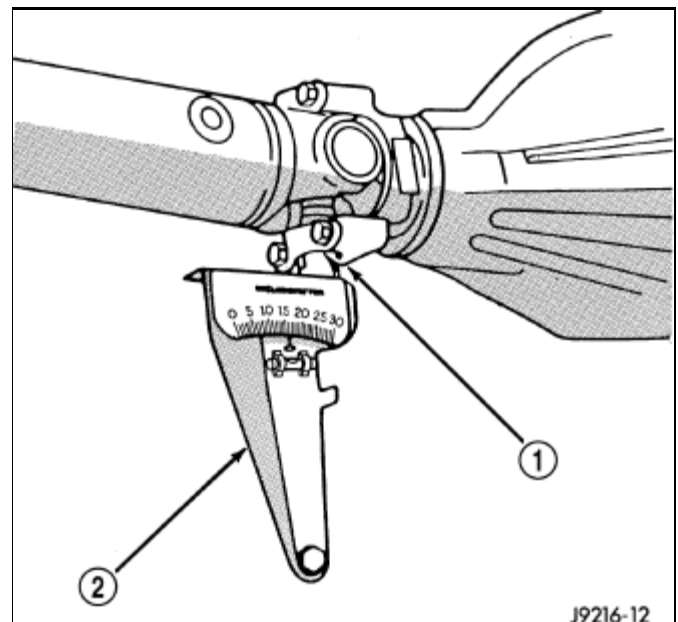
shaft angle (C)

6. Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.



7. Rotate propeller shaft 90 degrees and place inclinometer (2) on pinion yoke bearing cap (1) parallel to the shaft. Center bubble in sight glass and record measurement. This measurement will give you the pinion shaft or input yoke angle (B).

8. Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.



RULES

Good cancellation of U-joint operating angles is within 1 degree.

Operating angles less than 3 degrees (U-joint system).

Operating angles less than 10 degrees for constant velocity joint.

At least 1/2 of one degree continuous operating (propeller shaft) angle. On one U-joint system less than 1 1/2 degree operating angle.

SPECIFICATIONS

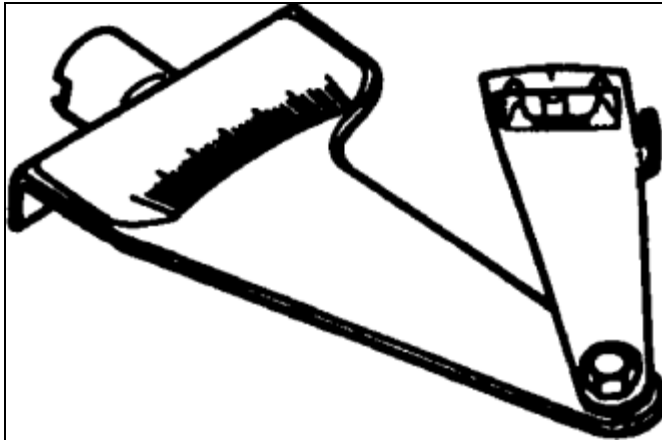
PROPELLER SHAFT

TORQUE SPECIFICATIONS

DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Front Shaft - Axle Flange Bolts	110	81	-
Front Shaft - Transfer Case Flange Bolts	20	15	-
Rear Shaft - Axle Flange Bolts	20	15	-
Rear Shaft - Transfer Case Flange Bolts	20	15	-

SPECIAL TOOLS

PROPELLER SHAFT



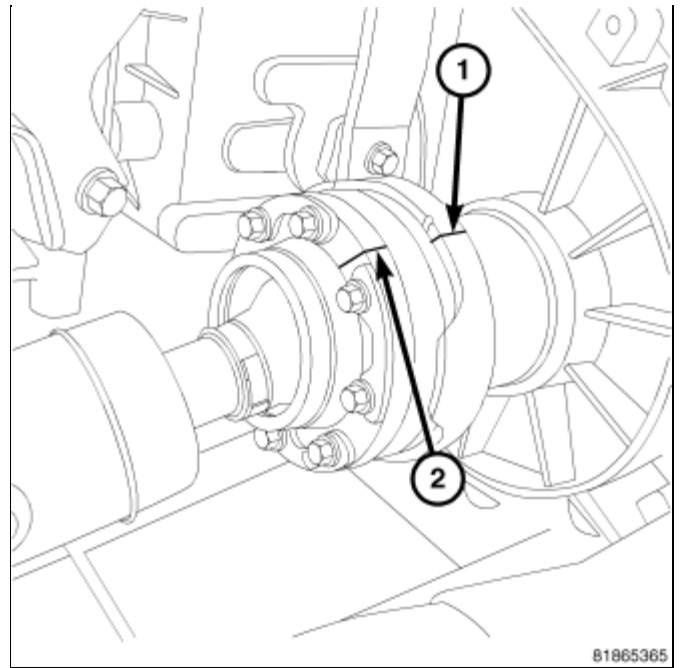
INCLINOMETER 7663

SHAFT-PROPELLER FRONT

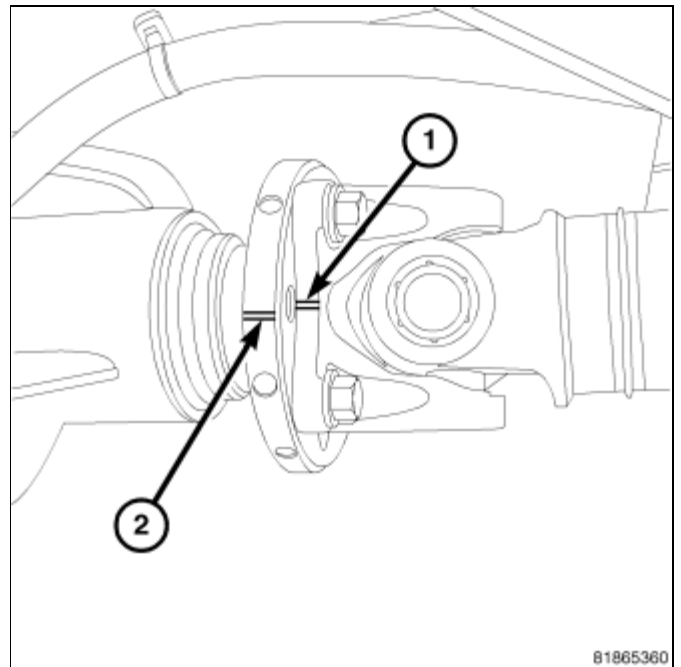
REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Mark an installation reference line across the front propeller shaft CV joint (1) and transfer case flange

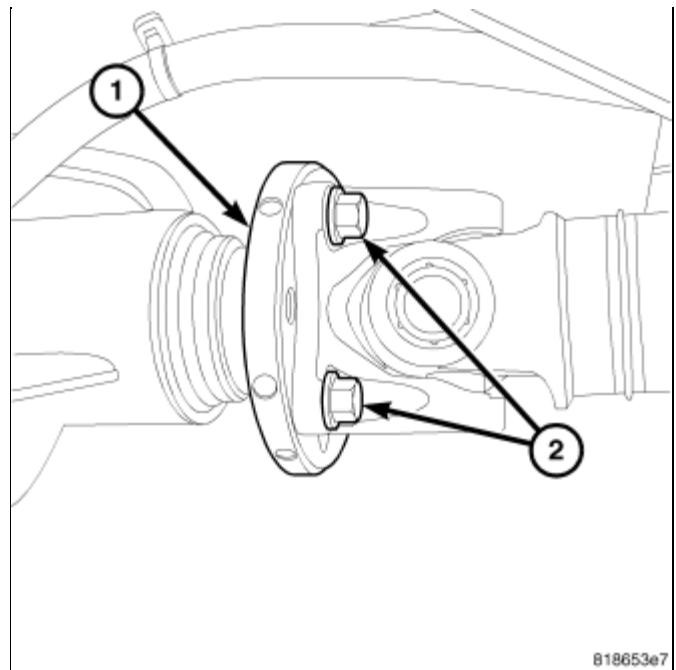
(2).



3. Mark an installation reference line across the front propeller shaft flange (1) and the axle flange (2).

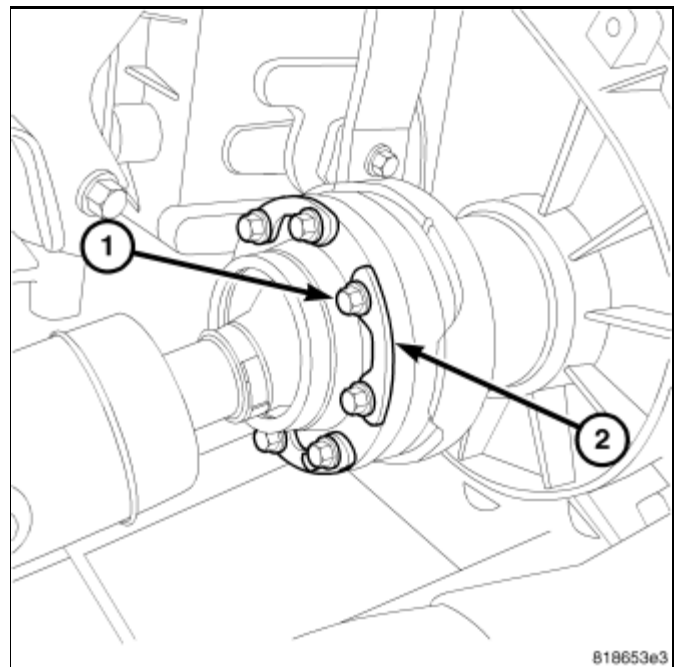


4. Remove the axle flange (1) bolts (2).



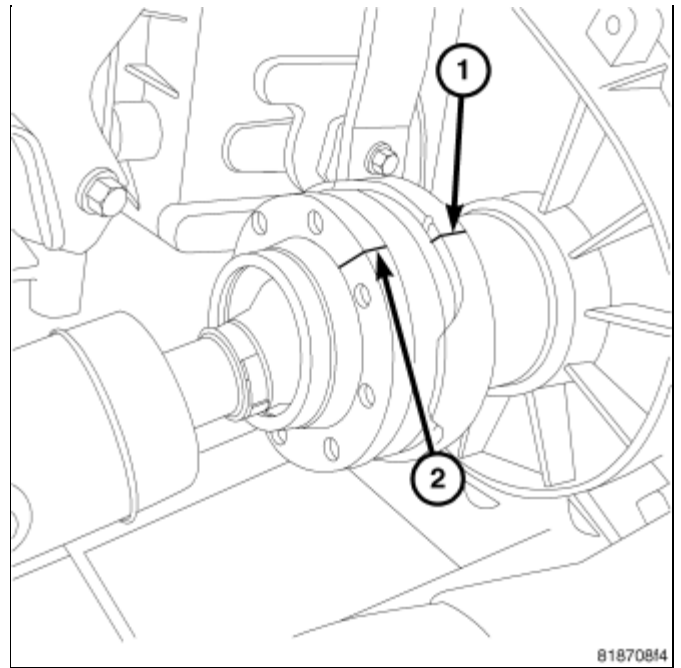
5. Remove the CV joint bolts (1) and retainers (2).
6. Compress the propeller shaft enough to remove the shaft from the flanges.

INSTALLATION

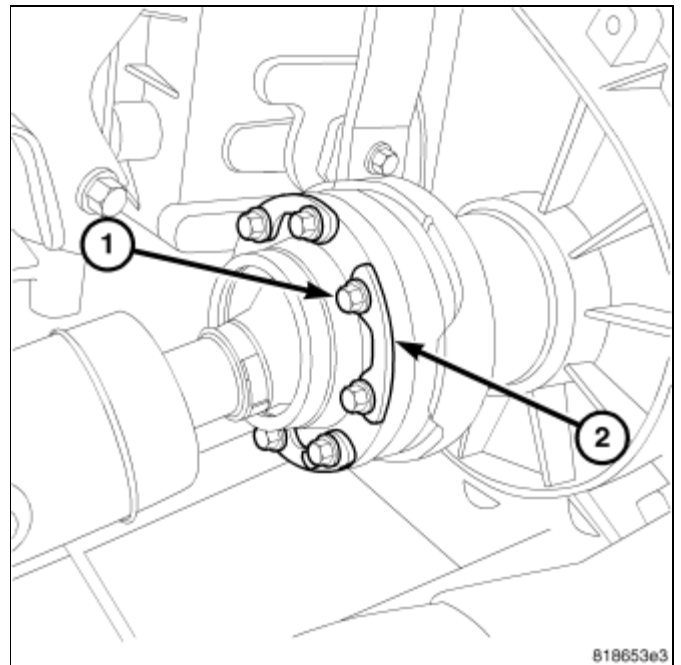


NOTE: Clean all propeller shaft bolts and apply Mopar® Lock & Seal Adhesive or equivalent to the threads before installation.

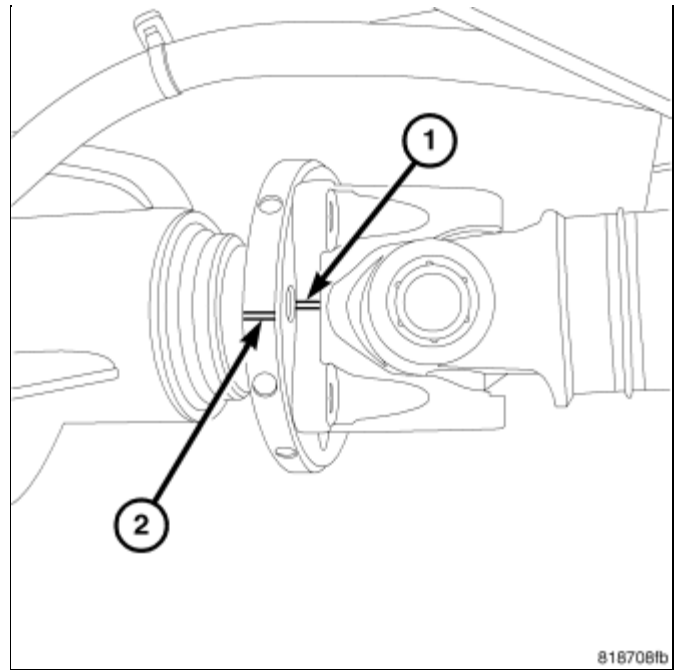
1. Compress the propeller shaft enough to install the shaft into the axle and transfer case flanges.
2. Align installation reference marks on the transfer case flange (1) front shaft CV joint (2).



3. Install CV joint retainers (2) and bolts (1). Tighten bolts to 20 N·m (15 ft. lbs.).

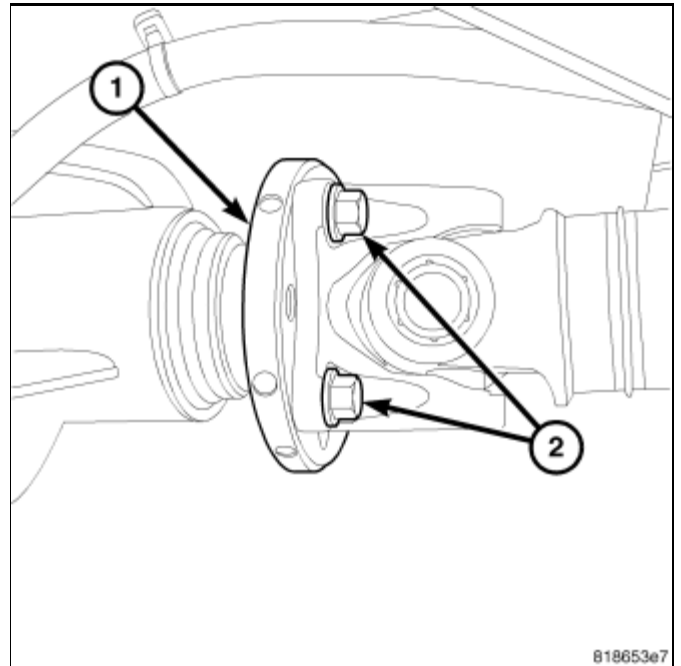


4. Align installation reference marks on the front propeller shaft flange (1) and axle flange (2).



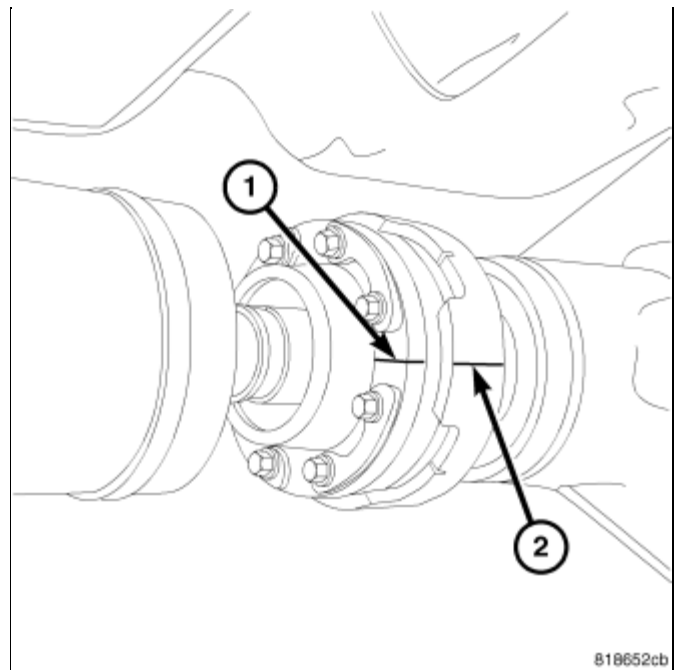
5. Install the axle flange (1) bolts (2) and tighten to 110 N·m (81 ft. lbs.).

SHAFT-PROPELLER REAR REMOVAL

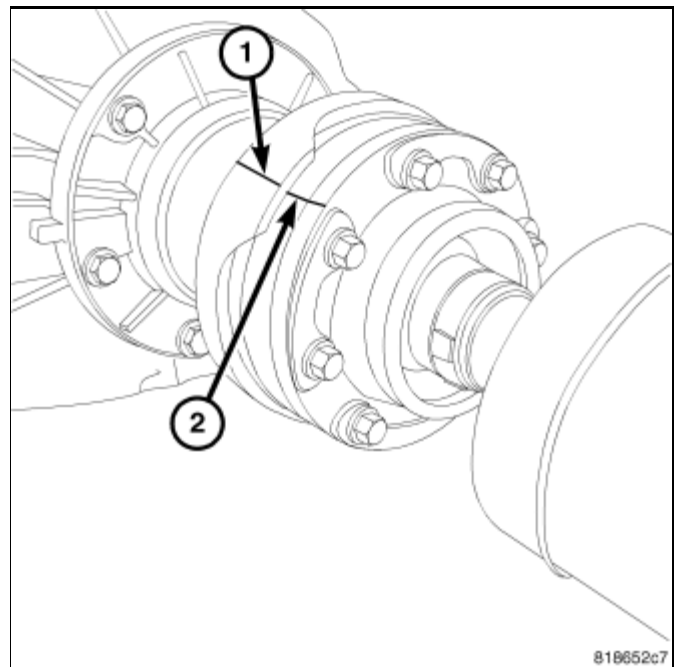


1. With vehicle in neutral, position vehicle on hoist.
2. Mark installation reference line across the rear propeller shaft CV joint (1) and the axle flange (2). Also mark to indicate propeller shaft axle end.

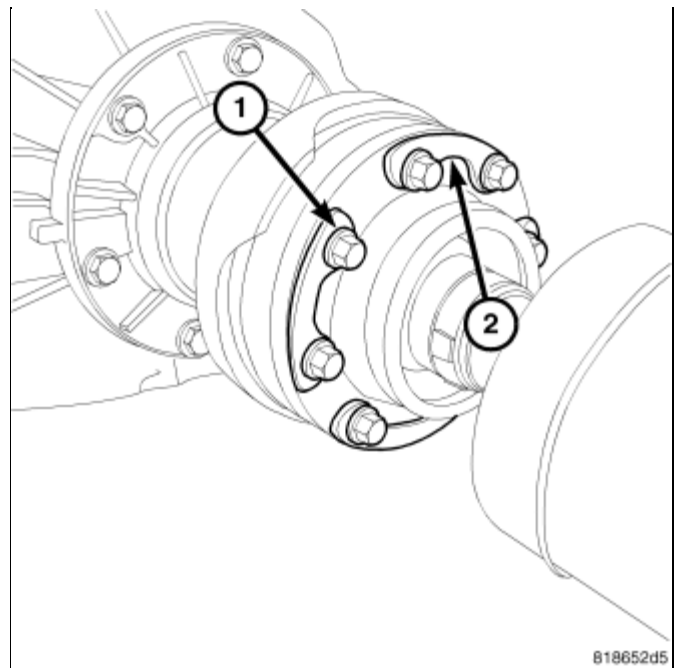
NOTE: Propeller shaft can be install either way.



3. Mark installation reference line across the front propeller shaft CV joint (1) and the transmission/transfer case flange (2). Also mark to indicate propeller shaft transmission/transfer case flange end.

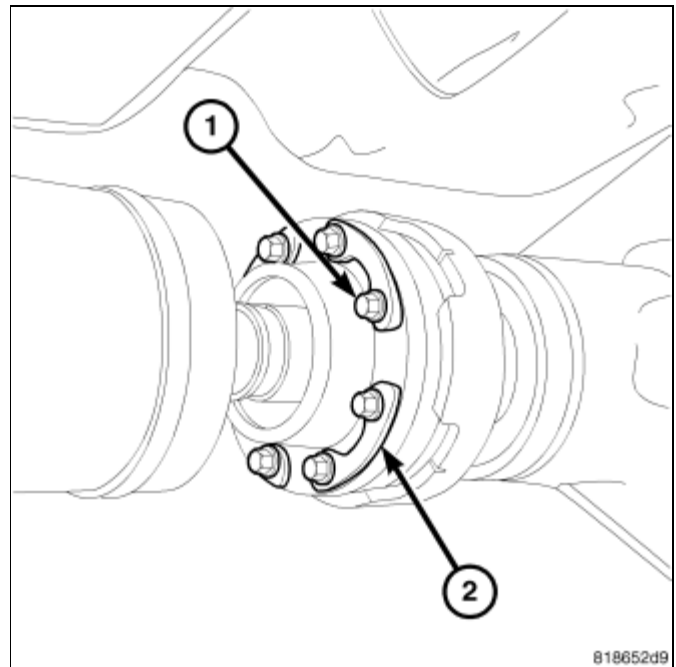


4. Remove front propeller shaft CV joint bolts (1) and retainers (2).



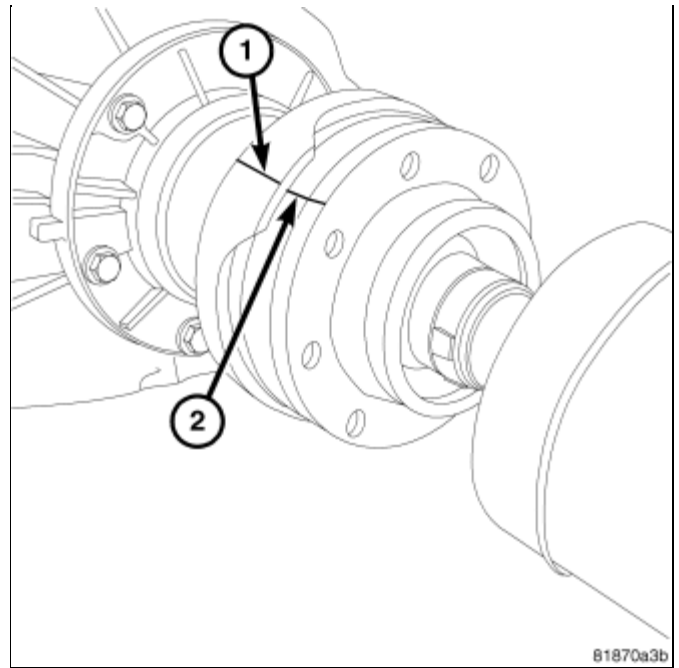
5. Remove rear propeller shaft CV joint bolts (1) and retainers (2).
6. Compress the propeller shaft enough to remove it from the axle flange and transmission/transfer case flange.

INSTALLATION

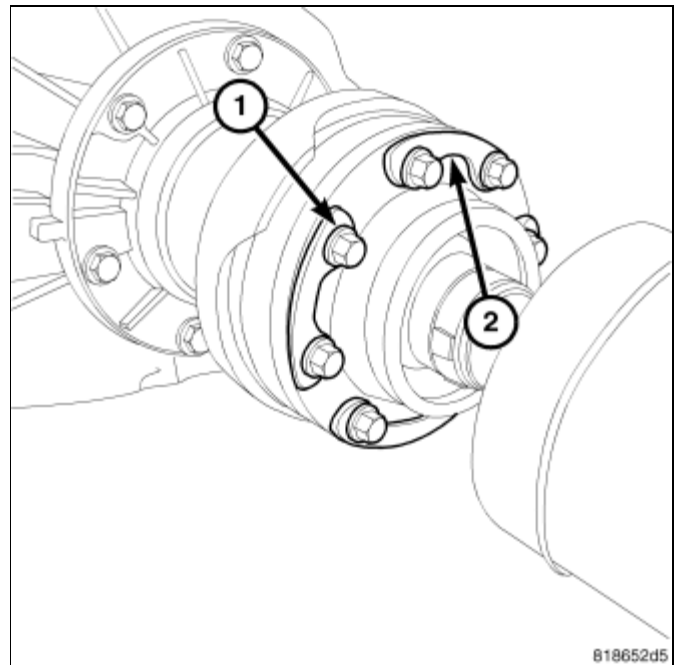


NOTE: Clean all propeller shaft bolts and apply Mopar® Lock & Seal Adhesive or equivalent to the threads before installation.

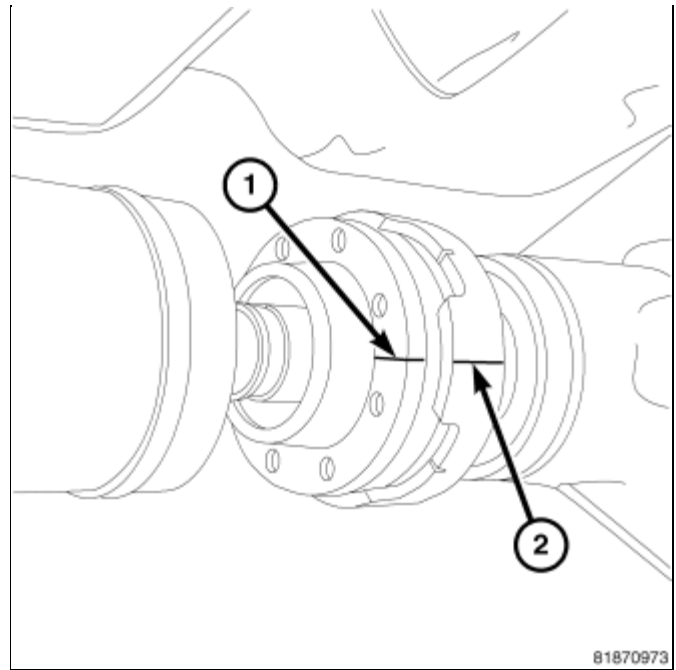
1. Compress the propeller shaft enough to install it into the axle flange and transmission/transfer case flange.
2. Align installation reference marks on the transmission/transfer case flange (1) and propeller shaft transmission/transfer end CV joint (2).



3. Install propeller shaft CV joint retainers (2) and bolts (1). Tighten bolts to 20 N·m (15 ft. lbs.).



4. Align installation reference marks on the propeller shaft CV joint (1) and axle flange (2).



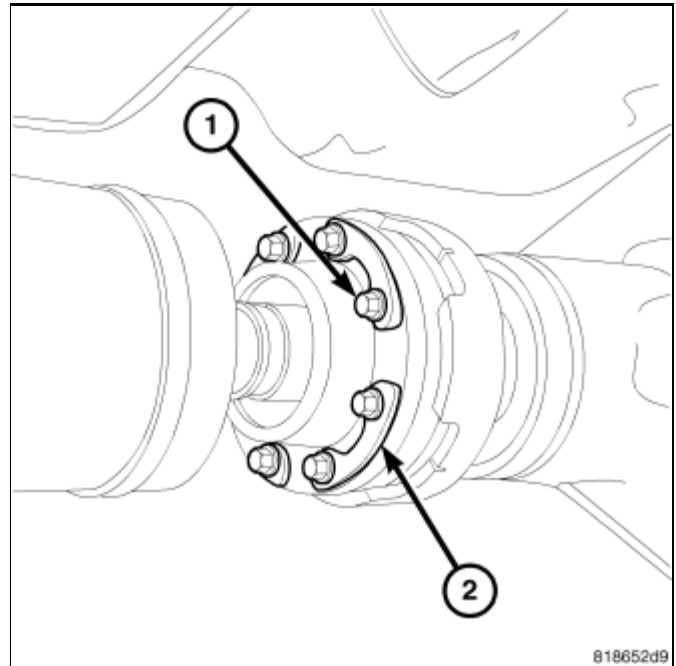
5. Install propeller shaft CV joint retainers (2) and bolts (1). Tighten bolts to 20 N·m (15 ft. lbs.).

FRONT AXLE - 186FBI

FRONT AXLE - 186FBI

DIAGNOSIS AND TESTING

FRONT AXLE - 186FBI



GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.

- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint/CV or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joint or CV.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front end components or engine/transmission mounts. These components can contribute to what appears to be a rear end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged) can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or CV.
- Loose spring mounts.
- Loose pinion gear nut and flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive ring and pinion gear backlash.	4. Check and adjustment ring and pinion gear backlash.
	5. Improper pinion bearing adjustments.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion flange nut.	6. Tighten pinion flange nut to specifications.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace broken shaft after correcting tube mis-alignment.
	2. Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.

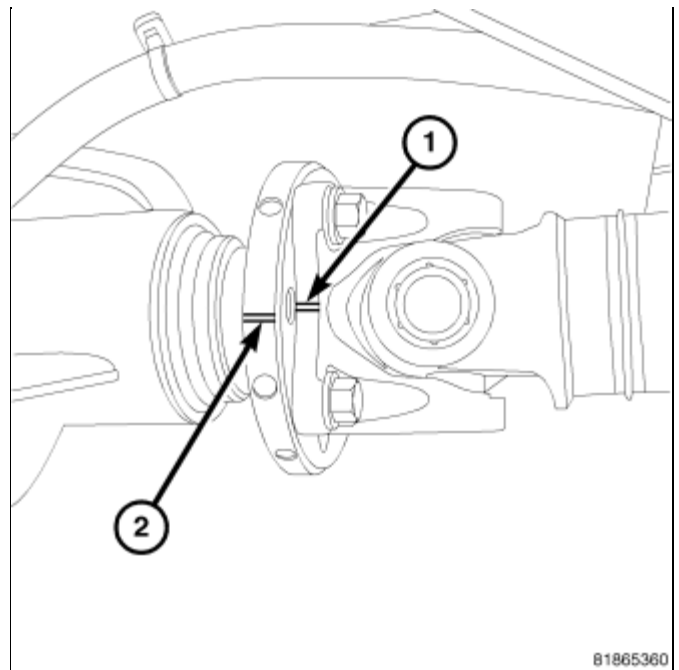
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper differential bearing adjustment.	1. Replace case, inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored flange.	5. Replace flange and seal.
	6. Differential cover not sealed.	6. Remove, clean, and seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.

	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring and pinion gear adjustment.	2. Check ring and pinion gear contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring and pinion gears.	4. Replace ring and pinion gears.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Loose or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure bearing caps are torqued to the proper specification.
	9. Housing not machined properly.	9. Replace housing.

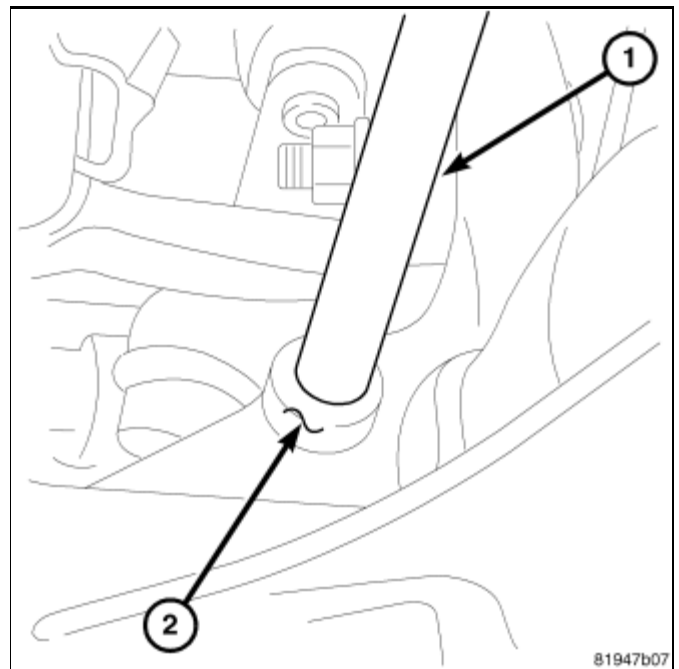
REMOVAL

NOTE: Procedure is the same for a 4x2 tube axle except for propeller shaft and axle vent removal.

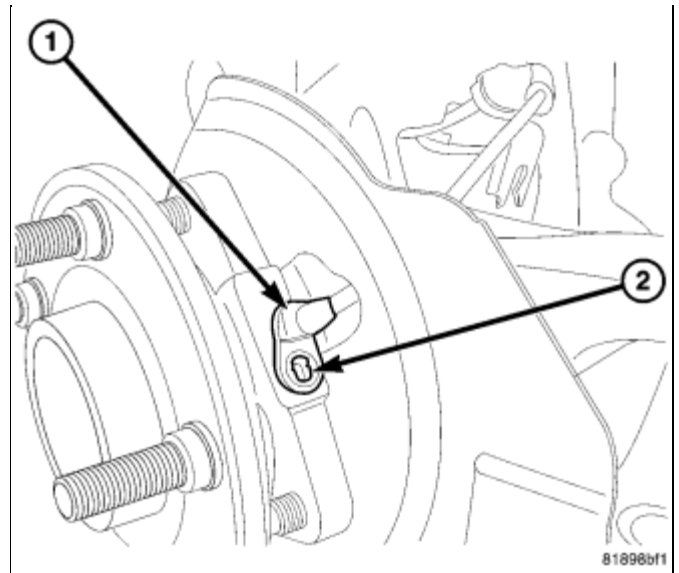
1. With transmission in neutral, position vehicle on hoist.
2. Position and secure lift to axle.
3. Mark an installation reference line across the front propeller shaft flange (1) and the axle flange (2).



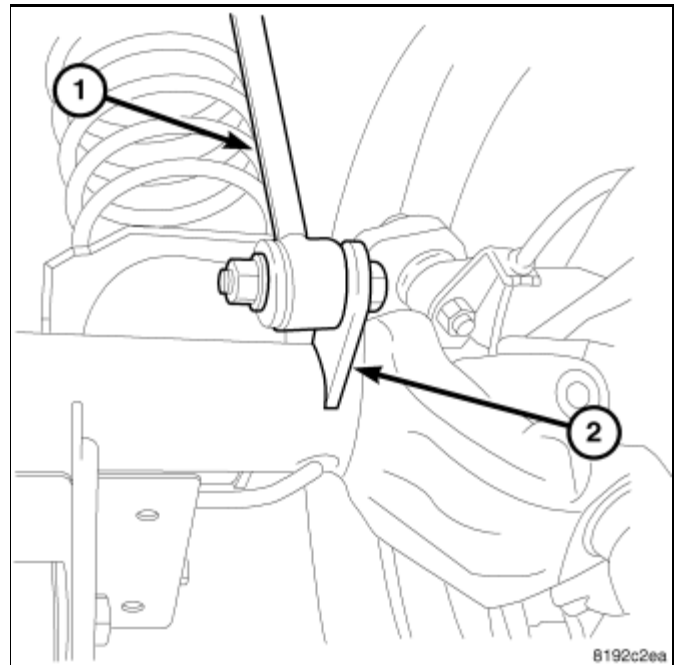
4. Remove vent hose (1) from axle housing (2).



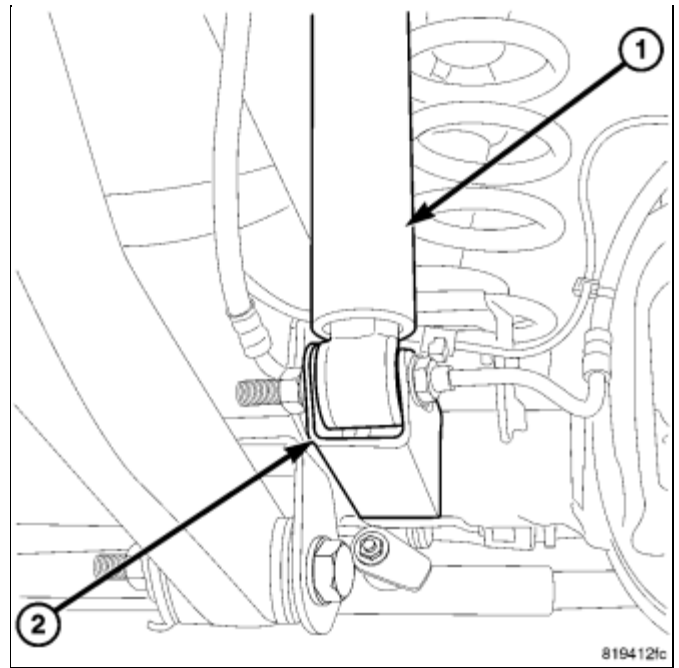
- 5. Remove brake calipers and rotors.
- 6. Remove wheel speed sensors (1) from hub bearings.
- 7. Remove brake lines and sensor wiring from axle.



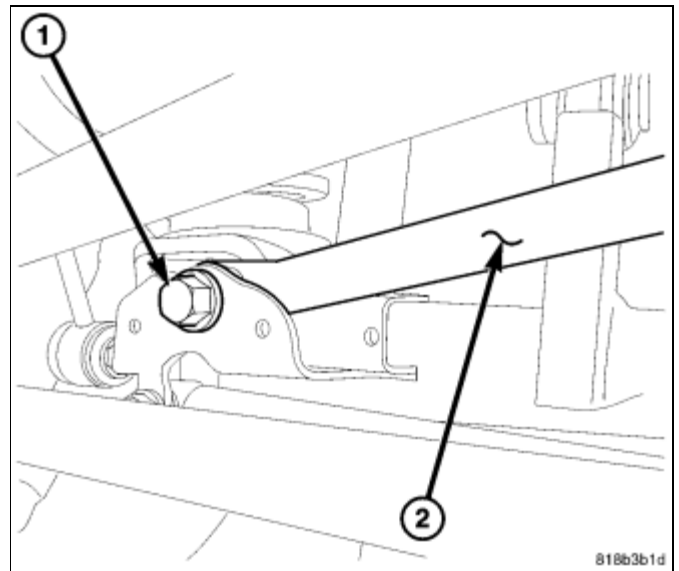
8. Remove stabilizer bar links (1) from axle brackets (2).



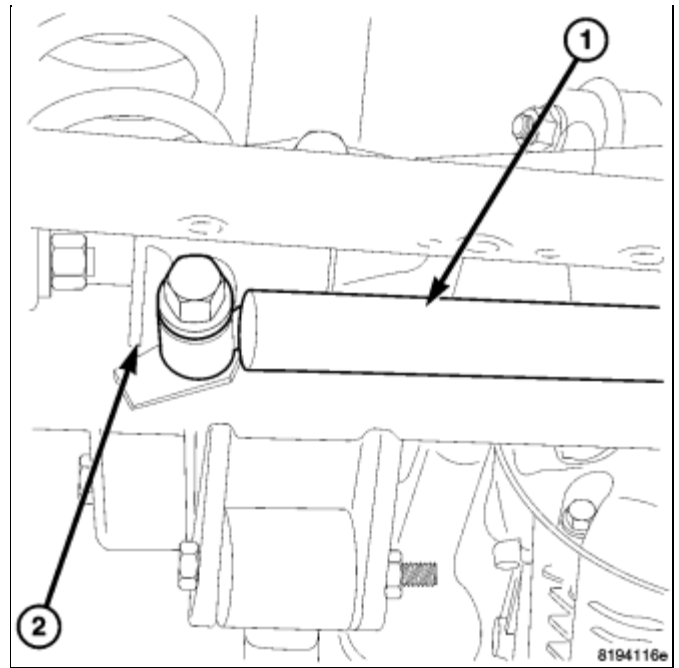
9. Remove shock absorbers (1) from axle brackets (2).



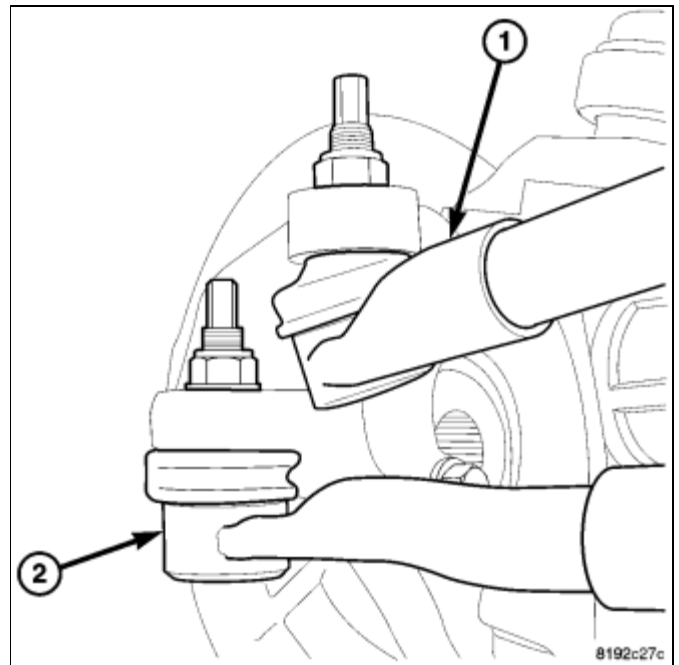
10. Remove track bar bolt (1) and track bar (2) from axle bracket.



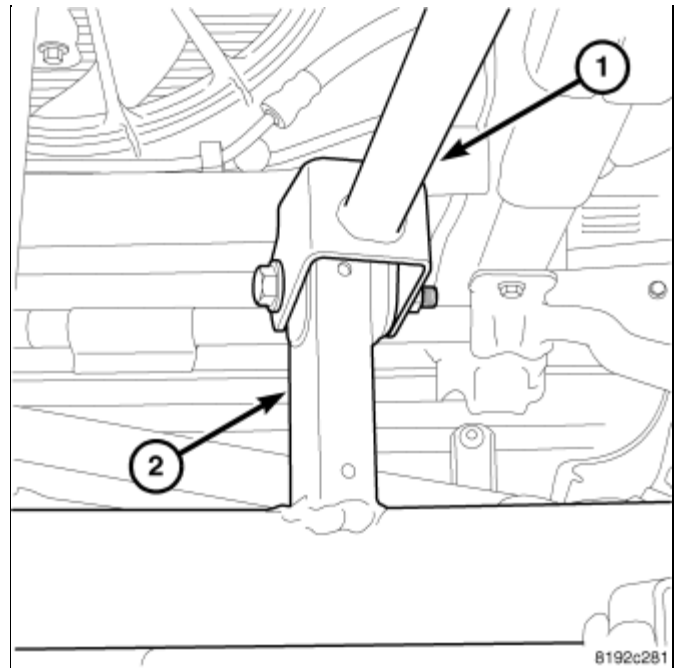
11. Remove steering damper (1) from axle bracket (2).



12. Remove drag link (1) and tie rod ends (2) from steering knuckles.

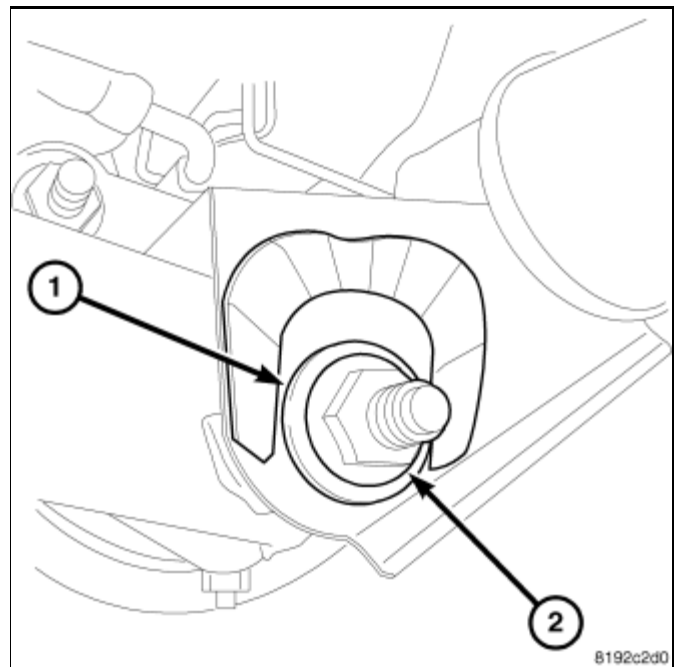


13. Remove upper control arms (1) from axle brackets (2).



14. Mark lower control arm cams (1) for installation reference and loosen nuts (2).
15. Lower axle enough to remove coil springs from axle.
16. Remove lower control arm bolts remove axle from vehicle.

INSTALLATION

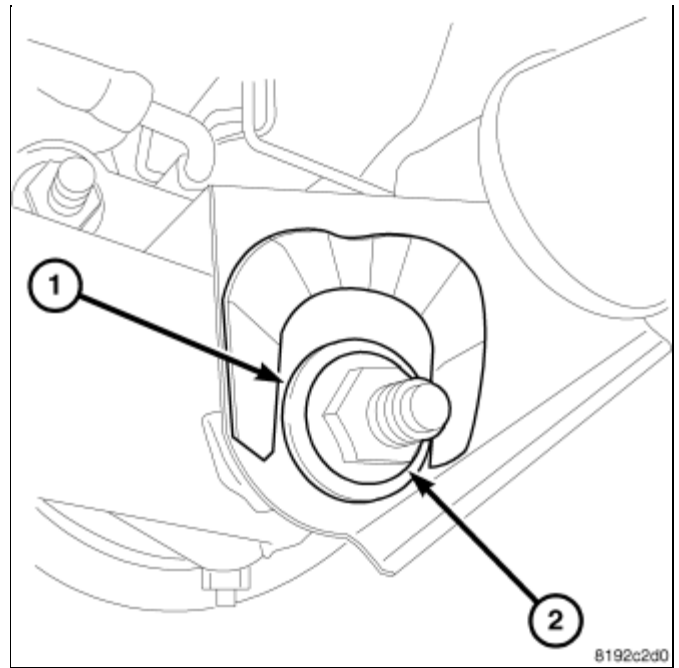


CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners are tightened. Failure to follow these instruction will result in damaging the bushings.

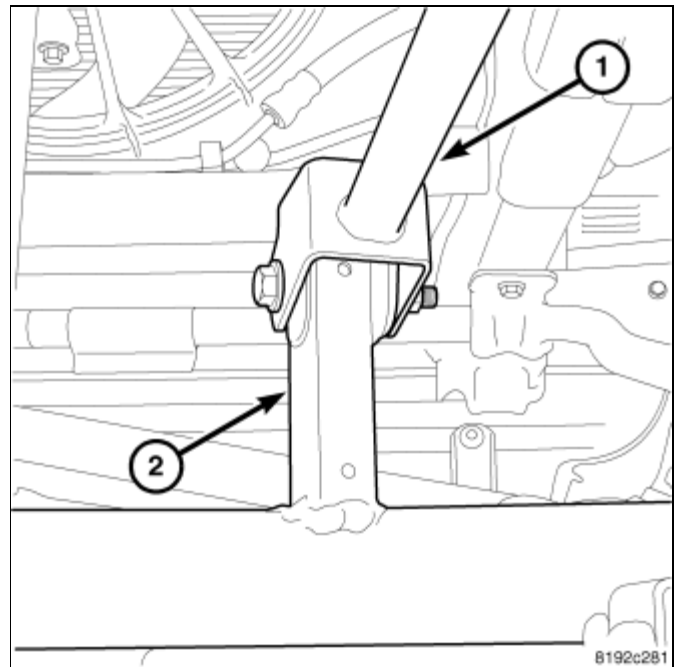
NOTE: Procedure is the same for a 4x2 tube axle except for propeller shaft and axle vent installation.

1. Position axle under vehicle.
2. Install lower control arms in axle brackets.
3. Install lower control arm bolts, cams (1) and loosely

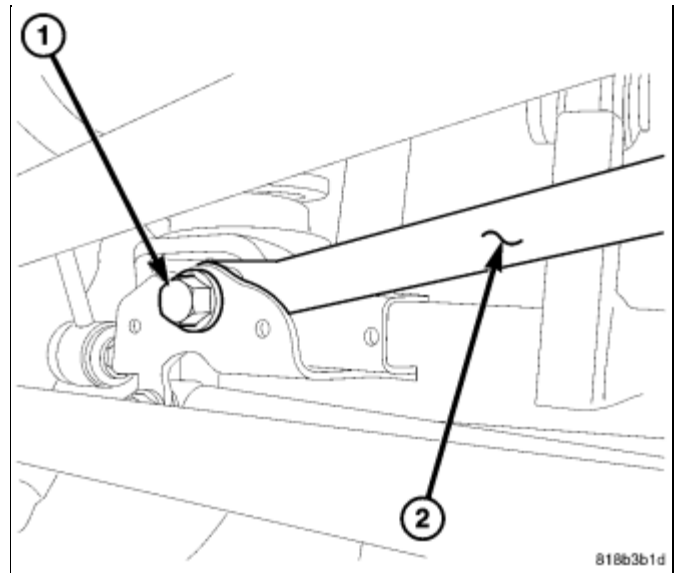
install nuts (2).
4. Install coil springs on axle and raise axle into position.



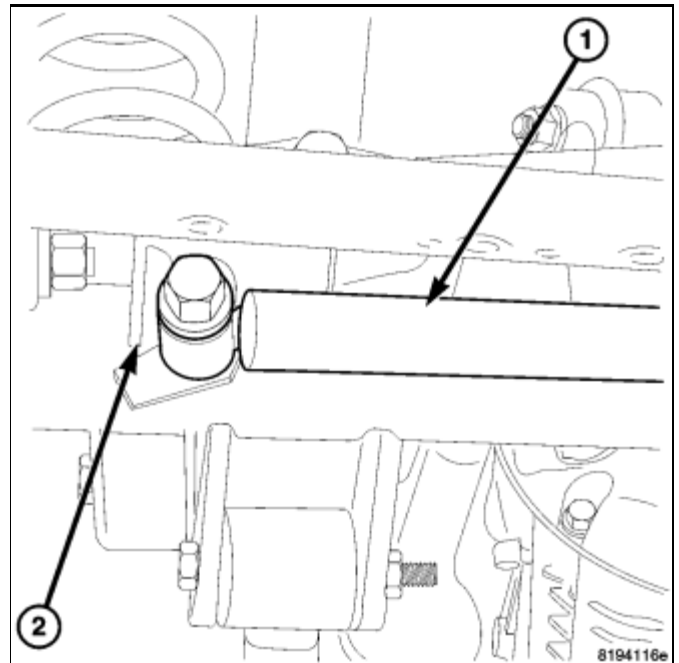
5. Install upper control arms (1) on axle brackets (2) and loosely install bolts and nuts.



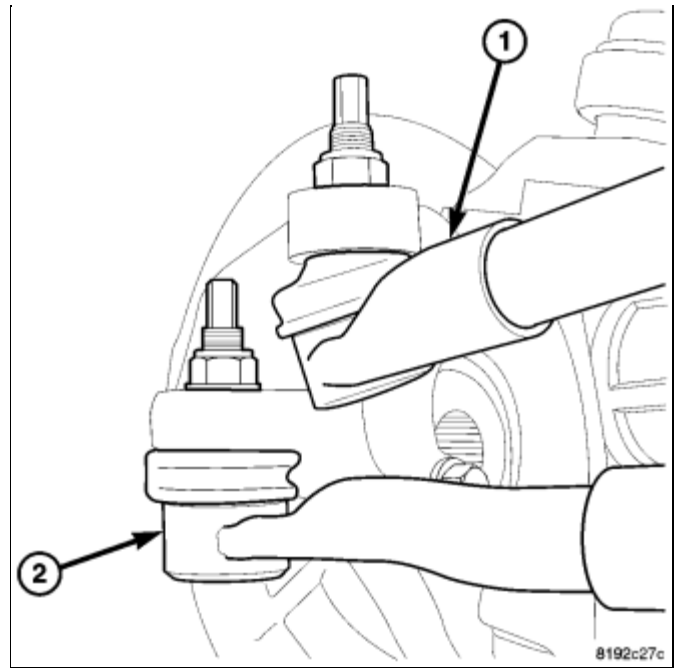
6. Install track bar (2) in axle bracket and loosely install bolt (1).



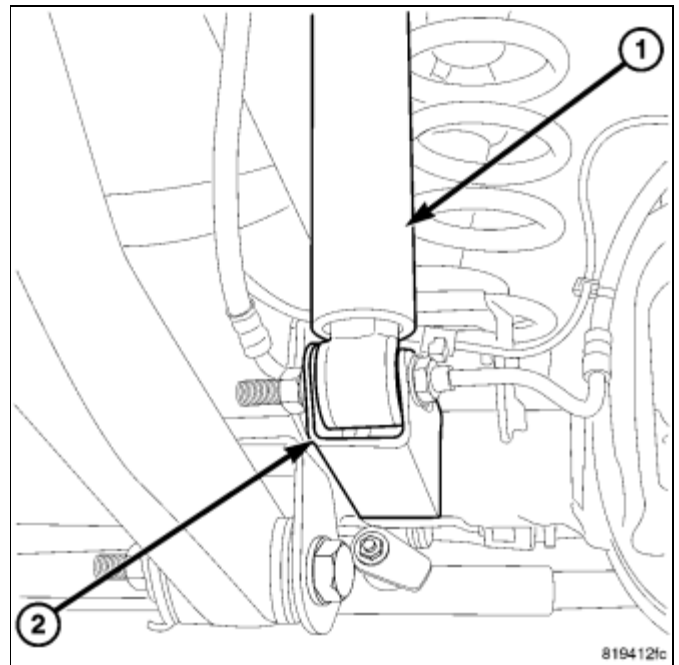
7. Install steering damper (1) on axle bracket (2) and tighten to specification.



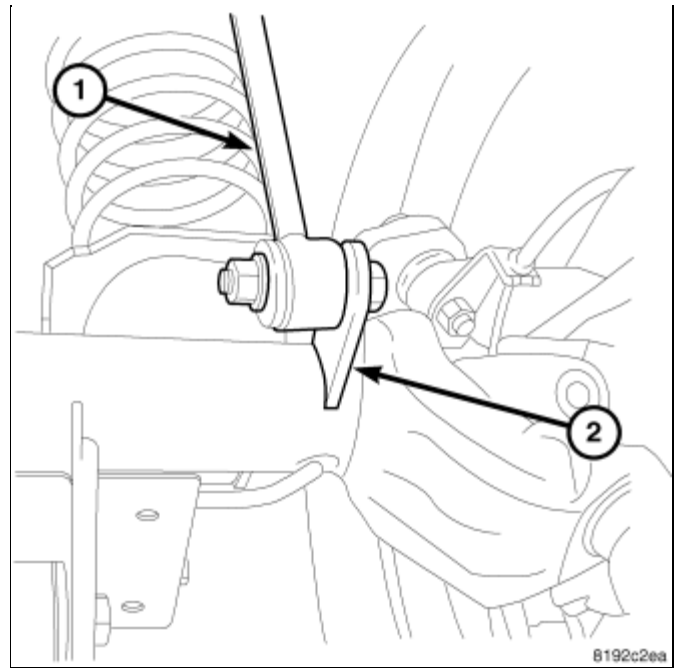
8. Install drag link (1) and (2) tie rod ends on steering knuckles and tighten to specification.



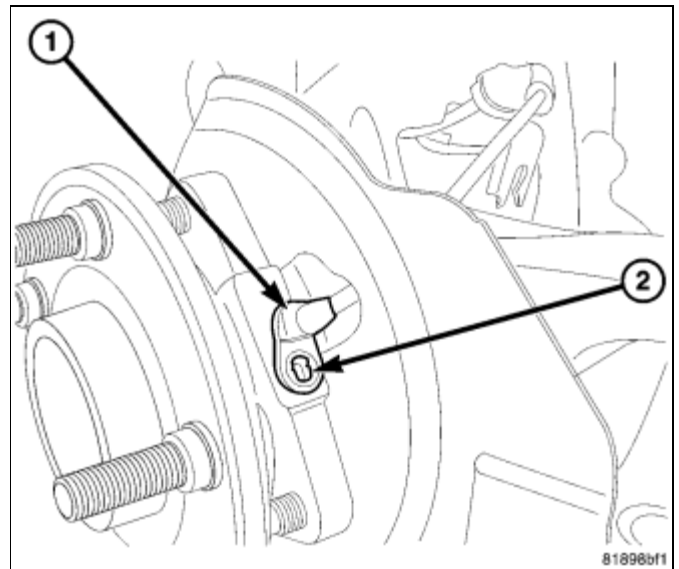
9. Install shock absorbers (1) on axle brackets (2) and tighten to specification.



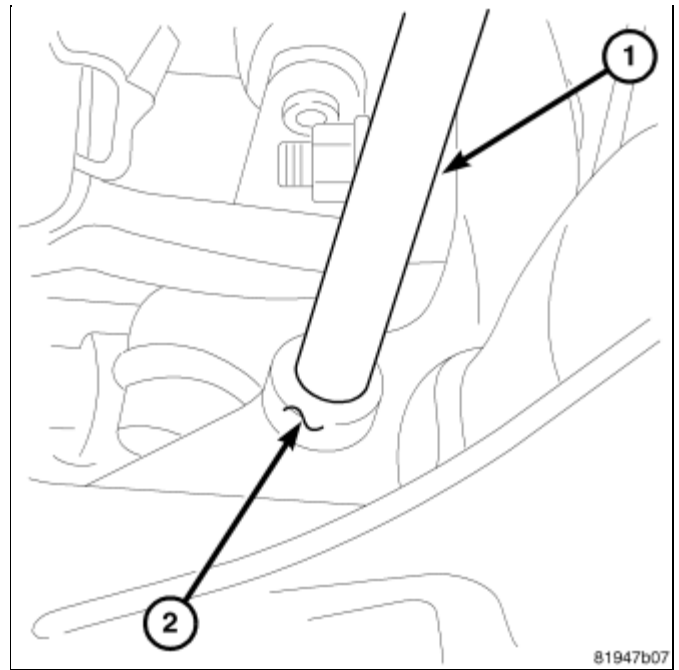
10. Install stabilizer bar links (1) on axle brackets (2) and tighten to specification.



11. Install wheel speed sensors harness on axle and install sensors (1) in hub bearings.
12. Install brake rotors, calipers and brakes lines.

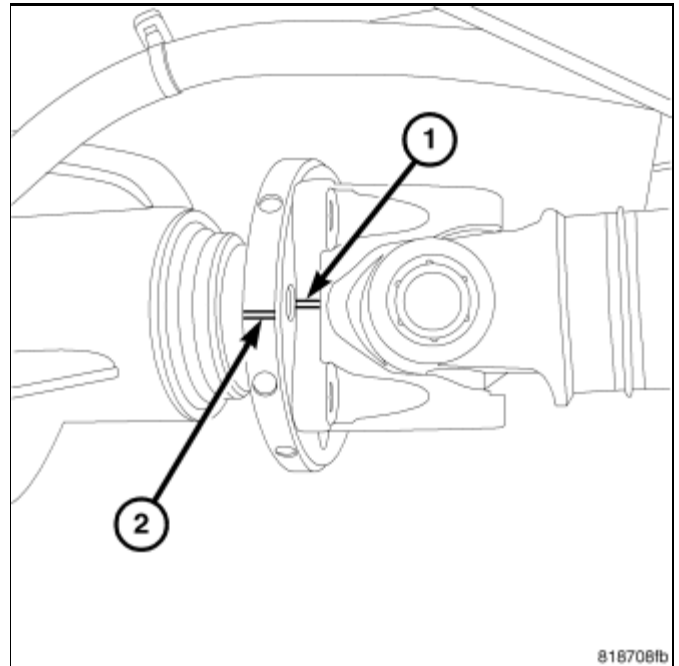


13. Install vent hose (1) on axle housing (2).



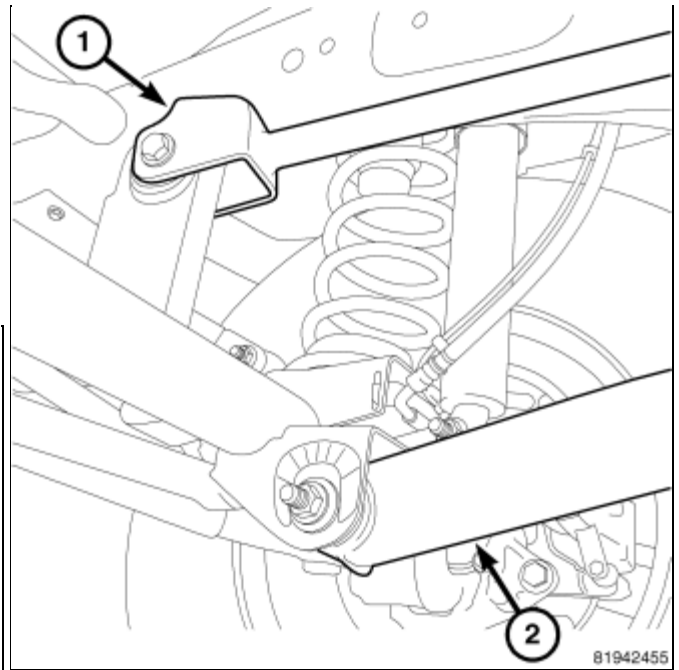
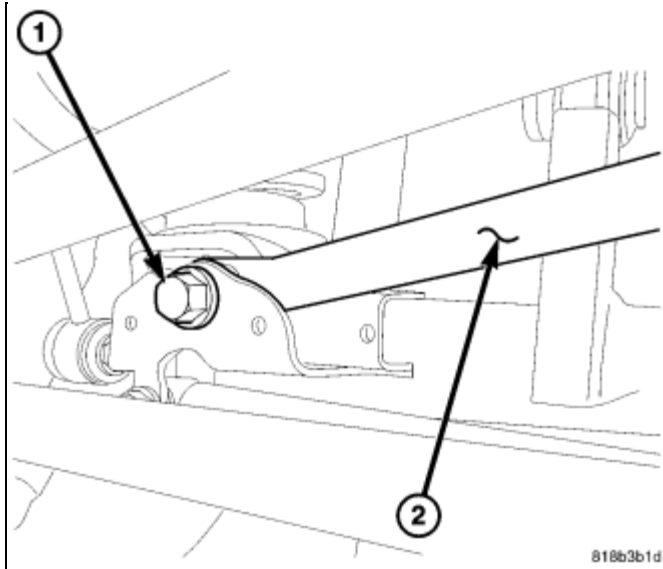
NOTE: Clean all propeller shaft bolts and apply Mopar® Lock & Seal Adhesive or equivalent to the threads before installation.

14. Install propeller shaft with axle flange (2) and propeller shaft (1) marks aligned. Tighten bolts to specification.



- 15. Remove lift from the axle.
- 16. Install wheel and lower vehicle.
- 17. Align lower control arm (2) cams to reference marks and tighten control arm nuts to specification.
- 18. Tighten upper (1) control arm nuts to specification.

19.

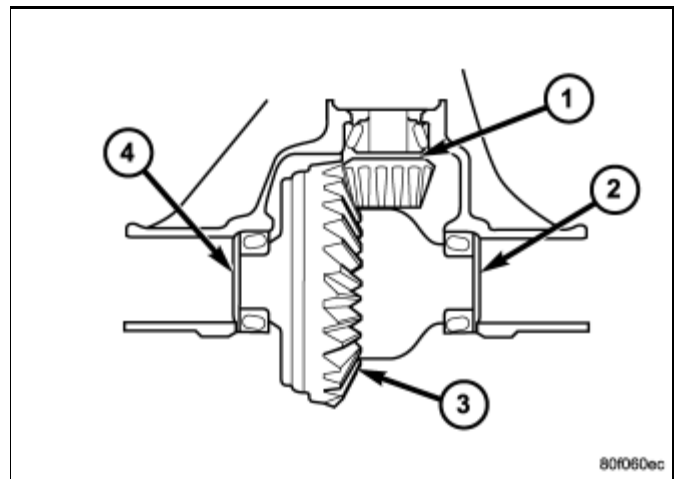


Tighten track bar (2) bolt (1) at axle bracket to torque specification.

ADJUSTMENTS

PINION DEPTH-BEARING PRELOAD-GEAR BACKLASH

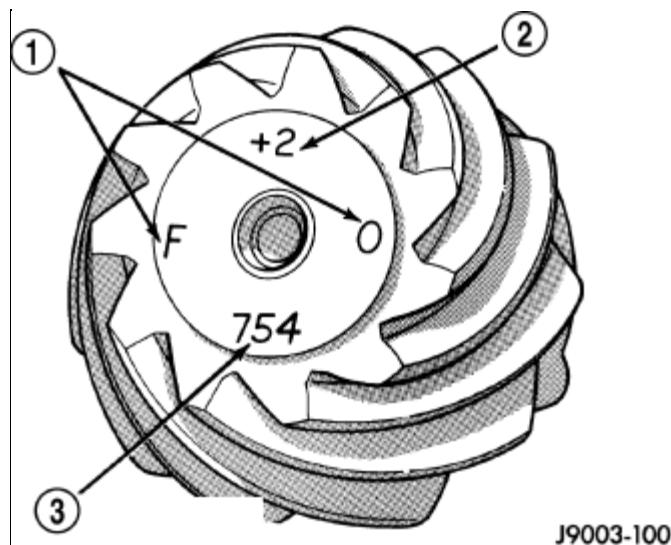
Compensation for pinion depth variance is achieved with a select shim (1). The shims are placed between the rear pinion bearing and the pinion gear head. A collapsible spacer on the pinion shaft is used to maintain pinion bearing preload. Differential bearing preload and ring gear (3) backlash is achieved, with select shims (2,4) located behind the bearing cups.



Ring and pinion gears are supplied as matched sets. The identifying numbers (3) for the ring and pinion gear are etched/marked onto each gear. A plus (+) number, minus (-) number or zero (0) is

etched/marked on the pinion gear (2). This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched/marked with a (0).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim to compensate for the difference in the depth variances. Refer to the Pinion Gear Depth Variance chart.



Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

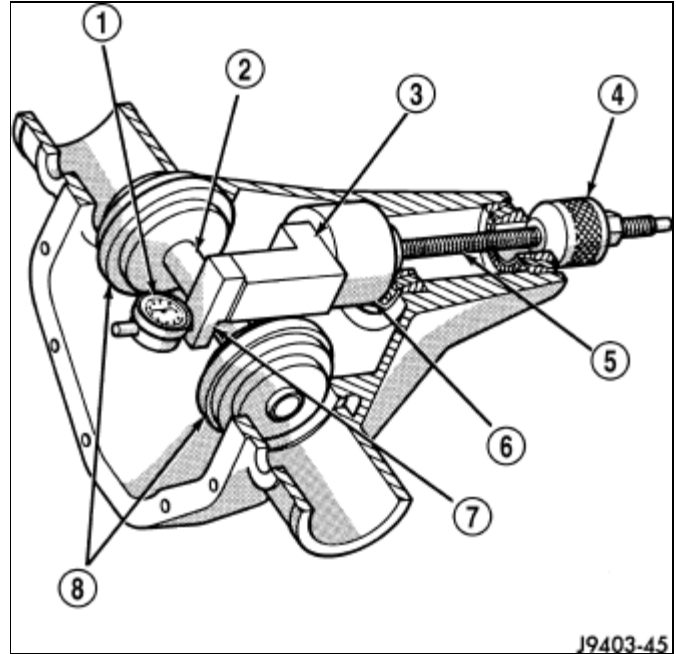
Note the etched number on the face of the pinion gear head (-1, -2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION GEAR DEPTH VARIANCE

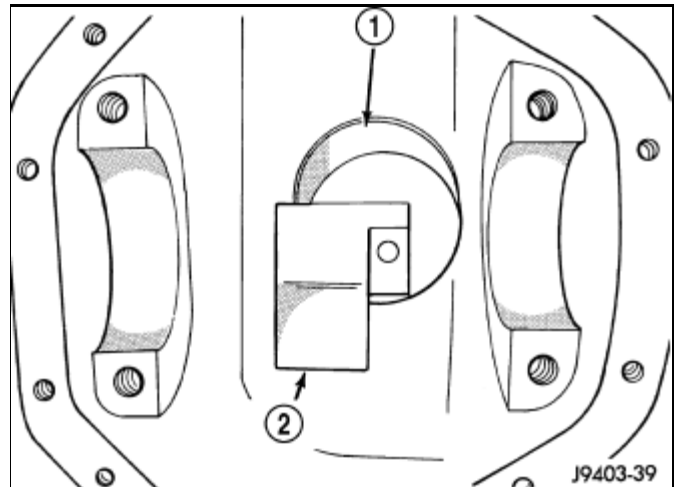
Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	?4	?3	?2	?1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003
0	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004
?1	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005
?2	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006
?3	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006	?0.007
?4	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006	?0.007	?0.008

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set 6730 (2,3,4,5,6,7,8) and Dial Indicator C-3339A (1).

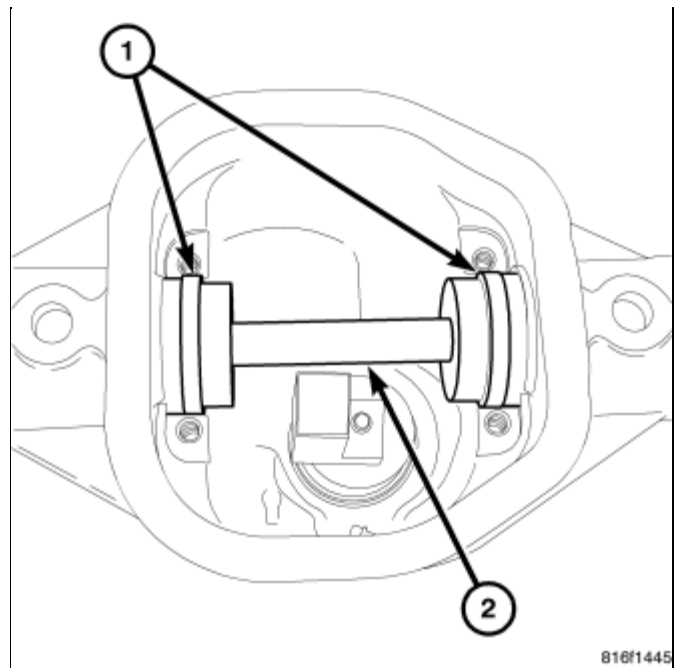


1. Assemble Pinion Height Block 6739 (2), Pinion Block 9946 (1) and rear pinion bearing onto Screw 6741.
2. Insert assembled height gauge components into the housing through pinion bearing cups.
3. Install front pinion bearing and Cone-nut 6740. Tighten nut until torque to rotate the screw is 2.25 N·m (20 in. lbs.).

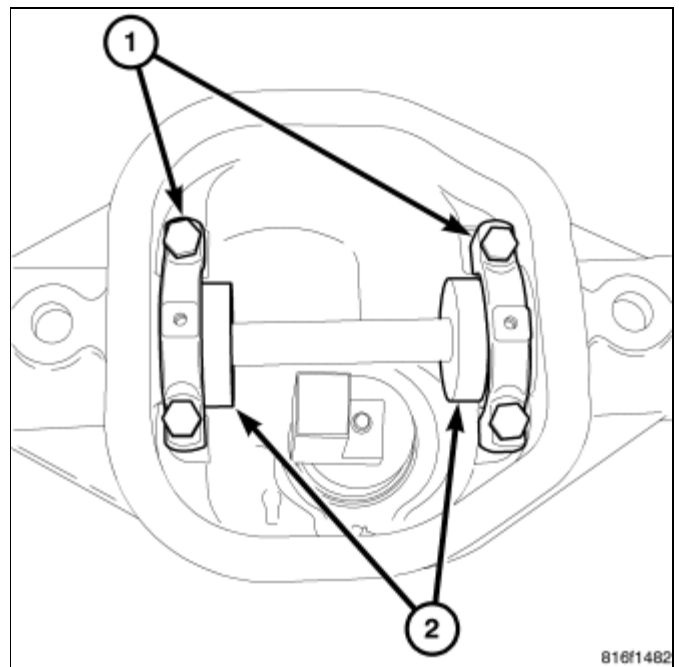


4. Place Arbor Disc 6732 (1) on Arbor D-115-3 (2) and position in axle housing differential bearing cradles.

NOTE: Arbor Discs 6732 has different step diameters to fit other axles. Choose proper step for axle being serviced.

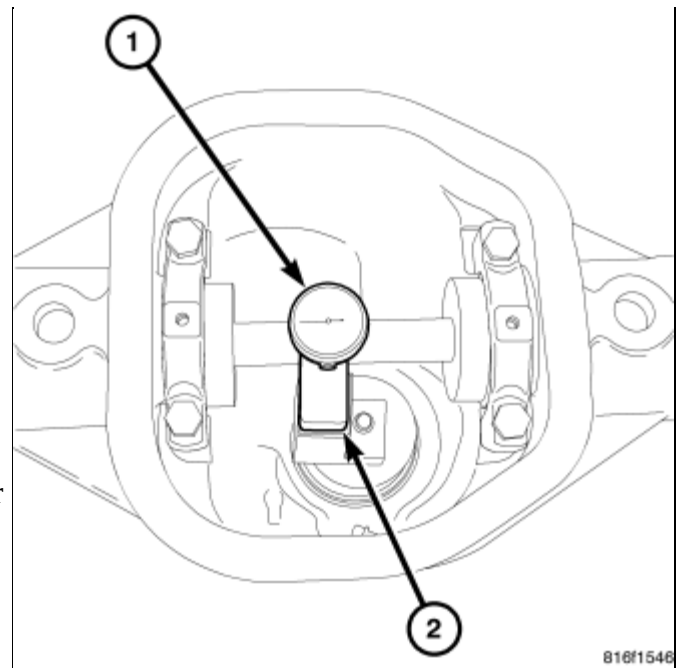


5. Install differential bearing caps (1) on arbor discs (2) and tighten cap bolts to 61 N·m (45 ft. lbs.).



6. Install Dial Indicator C-3339A (1) into Scooter Block D-115-2A (2) and secure set screw.
7. Position Scooter Block/Dial Indicator flush on the pinion height block and zero the dial indicator.
8. Slowly slide the scooter block across the pinion height block over to the arbor. Move the scooter block till the dial indicator probe crests the arbor and record the highest reading.
9. Select a shim equal to the dial indicator reading plus or minus the pinion depth variance number etched in the face of the pinion. **Example:** If depth variance is – 2 add 0.002 in. to the dial indicator reading. If depth

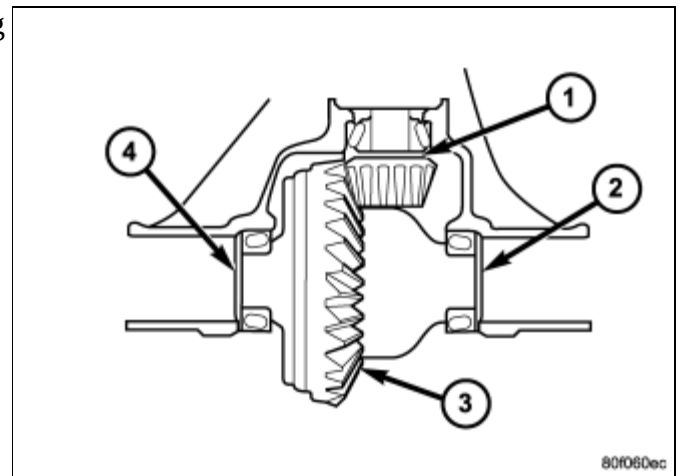
variance is +2 subtract 0.002 in. from the dial indicator reading. The total is the shim thickness needed for the pinion depth variance.



DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Before performing differential bearing preload and ring gear backlash measurements, pinion gear depth must be established and the pinion gear ready for installation. Establishing pinion gear depth is essential to ring gear backlash and tooth contact patterns.

Differential side bearing preload and gear backlash is accomplished with selective shims (2,4) positioned behind the differential side bearing cups. Shims are determined using Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339A.



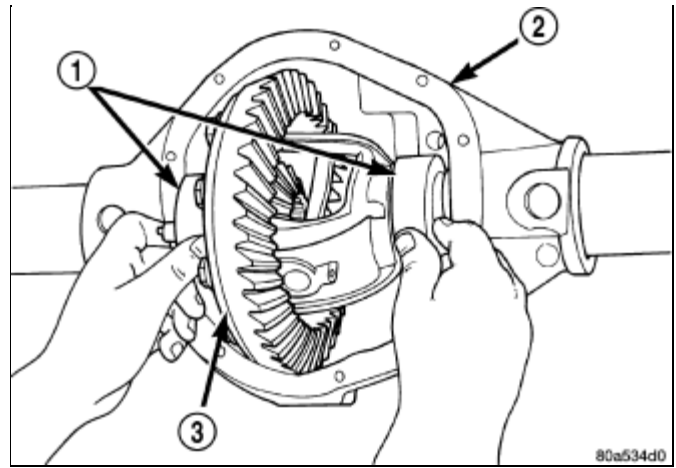
SHIM FORMULA: Differential End Play + Preload Specification = Total Differential Shim. Total Differential Shim – Ring Gear Side Shim – Backlash Specification = Pinon Gear Side Shim.

PRELOAD SHIM SELECTION

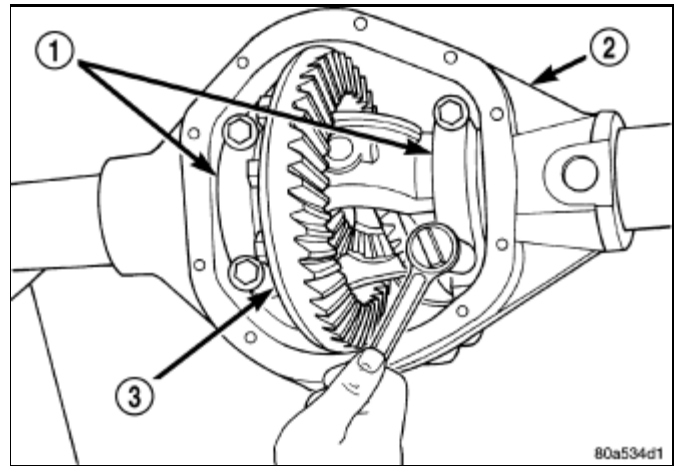
1. Remove differential side bearings from differential case.
2. Remove factory installed shims from differential case.

3. Install ring gear on differential case and tighten bolts to specification.

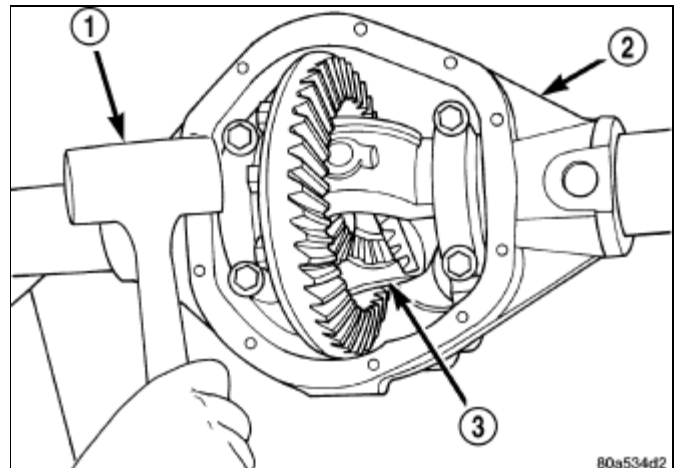
4. Install dummy side bearings D-348 (1) on differential case (3) and install differential case (3) in the housing (2).



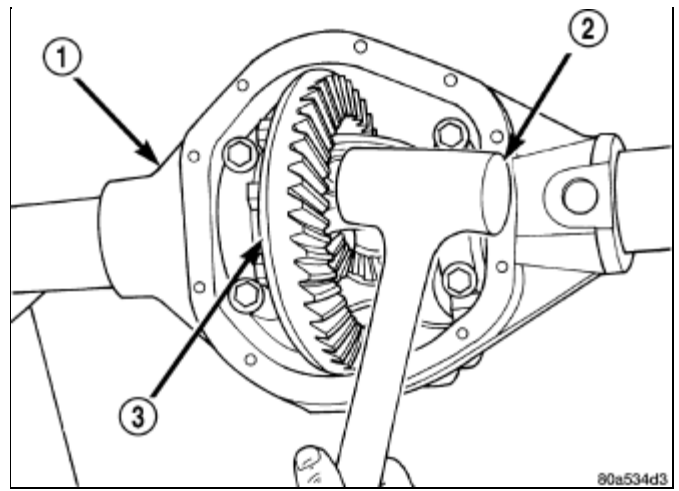
5. Install differential (3) bearing caps (1) in original location and snug bearing cap bolts.



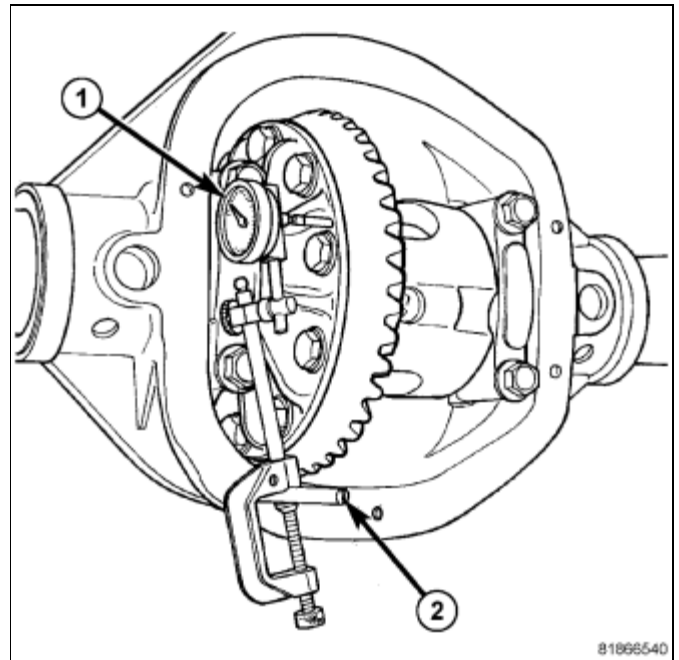
6. Seat differential dummy bearings to pinion gear side of the housing (2), with a dead-blow hammer (1).



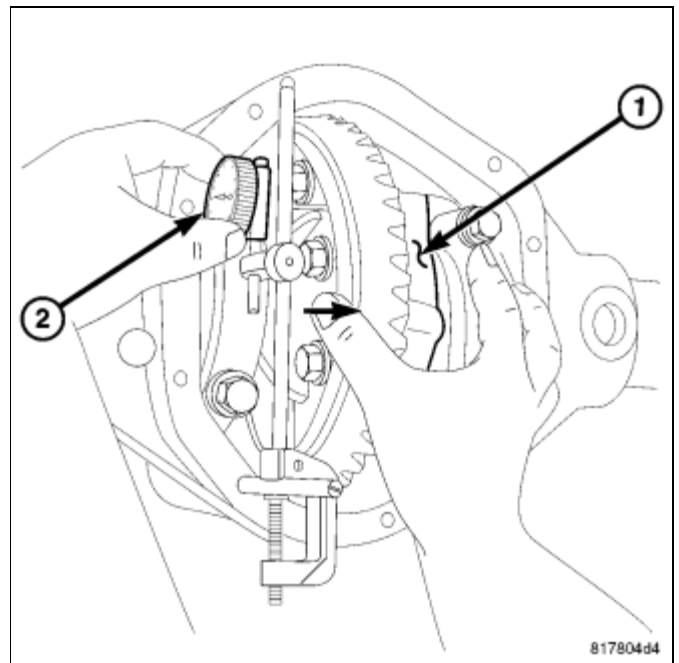
7. Seat differential dummy bearings to ring gear side of the housing (1), with a dead-blow hammer (2).



8. Thread Pin C-3288-B (2) into cover bolt hole.
9. Attach Dial Indicator C-3339A (1) to the pin and position indicator plunger on a flat surface between the ring gear bolts.



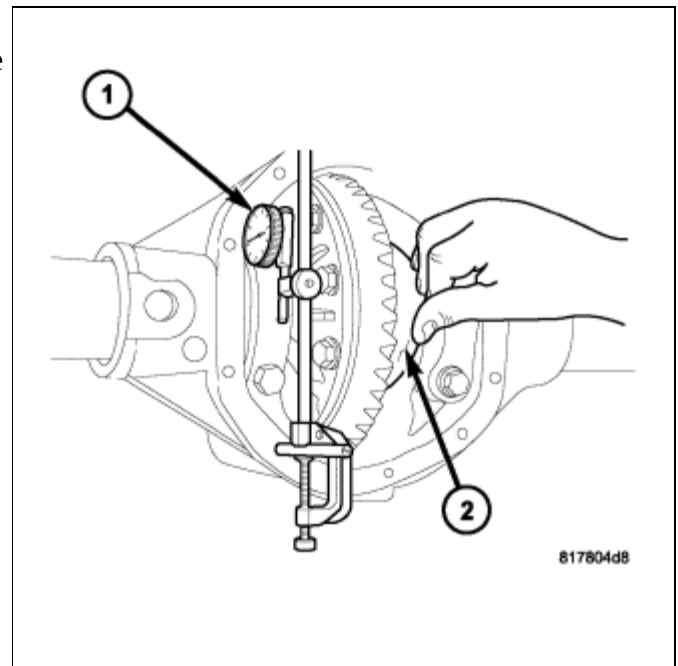
10. Push and hold differential case (1) to pinion gear side of the housing and zero dial indicator (2).



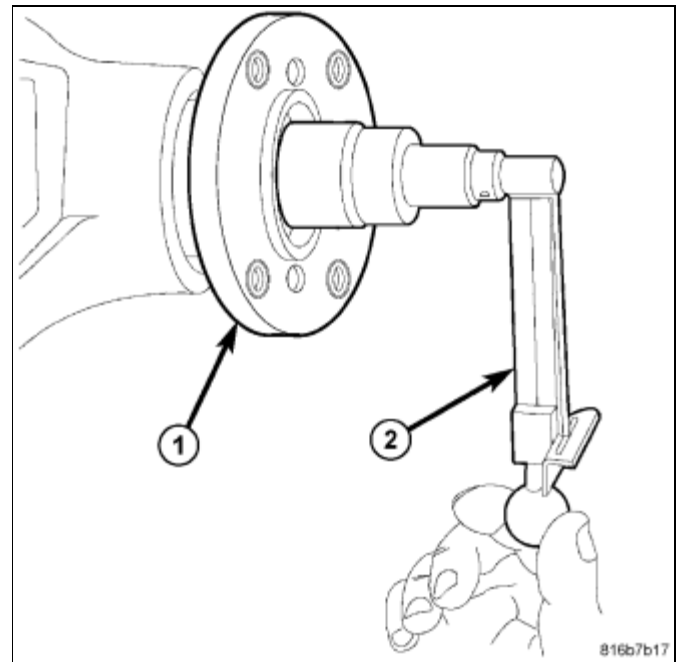
11. Push and hold differential case (2) to ring gear side of the housing. Record the dial indicator (1) reading. Add preload specification 0.2 mm (0.008 in.) to differential dial indicator reading. This is the total differential shim thickness needed to preload the differential bearings.

EXAMPLE: Differential Dial Indication Reading + Preload Specification 0.2 mm (0.008 in.) = Total Differential Shim

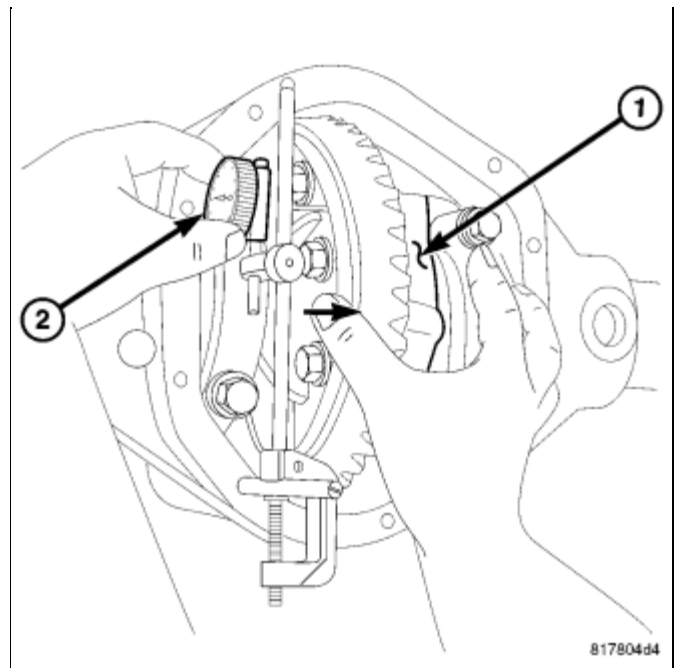
12. Rotate dial indicator out of the way on the pilot stud.
13. Remove differential case and dummy bearings from the housing.



14. Install pinion gear in the housing and establish pinion (1) torque to rotating (PTTR).



15. Install differential case (1) with dummy bearings D-348 in the housing, install bearing caps and snug bolts.
16. Seat ring gear side dummy bearing.
17. Position dial indicator (2) plunger on a flat surface between the ring gear bolts.
18. Push and hold differential case (1) against pinion gear and zero dial indicator (2).



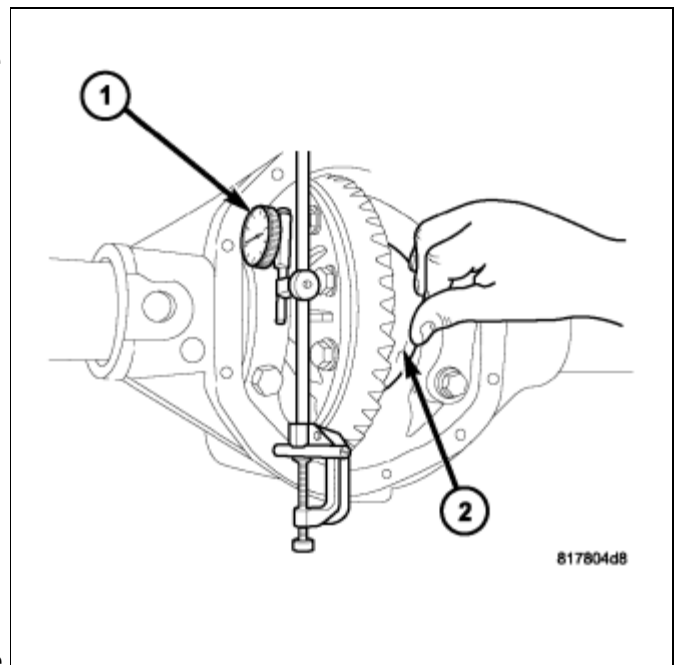
19. Push and hold differential case (2) to ring gear side of the housing and record dial indicator (1) ring gear side reading.

20. Subtract backlash specification 0.05 mm (0.002 in.) from ring gear side reading for ring gear backlash. The remainder is the shim needed on the ring gear side of the differential.

EXAMPLE: Ring Gear Side Reading – Backlash Specification 0.05 mm (0.002 in.) = Ring Gear Side Shim

21. Subtract ring gear side shim from differential total preload shim. The remainder is the shim needed on the pinion gear side of the differential.

EXAMPLE: Total Differential Shim – Ring Gear Side Shim = Pinion Gear Side Shim



22. Rotate dial indicator out of the way on pilot stud.

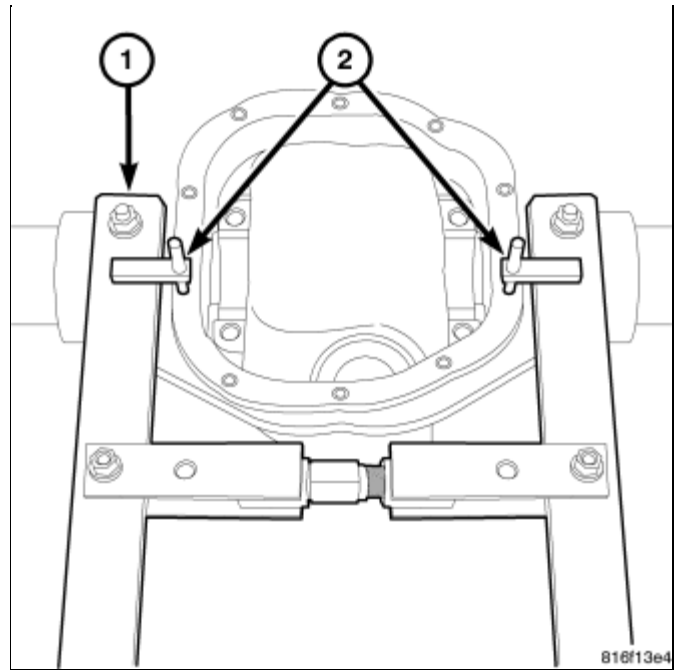
23. Remove differential case with dummy bearings from the housing.

24. Install side bearings on differential case.

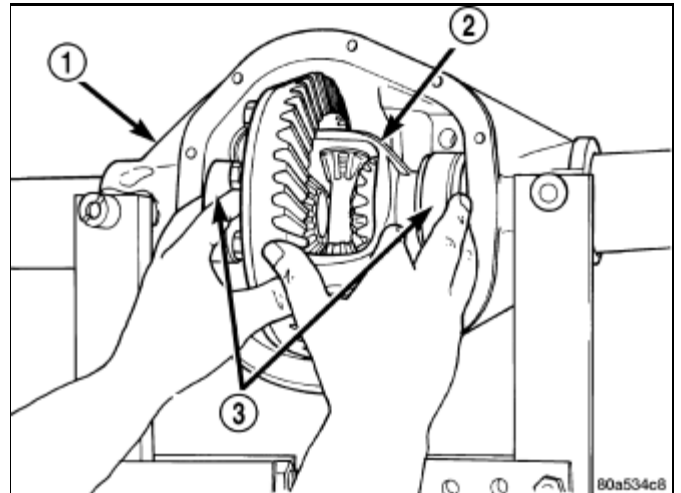
25. Install spreader W-129-B (1) and hold down adapters (2) from Adapter Set 6987B onto housing. Spread the housing 0.50 mm (0.020 in.).

CAUTION: Never spread housing over 0.50 mm (0.020 in.). Failure to follow these instruction could

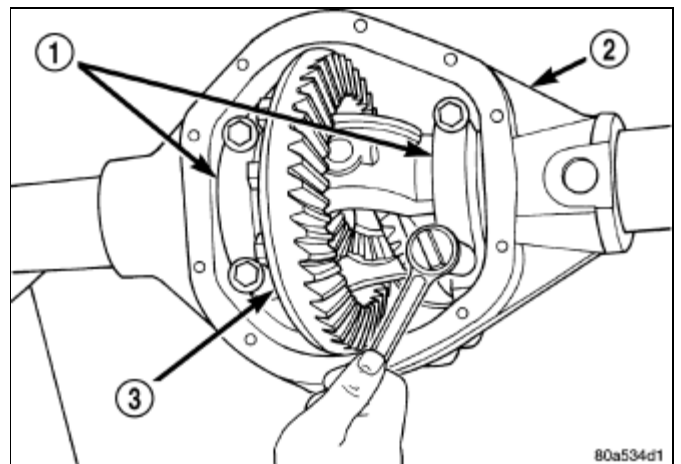
result in distorting the housing.



- 26. Install differential case (2) with bearings cups (3) and shims into the housing (1).
- 27. Remove spreader from the housing.

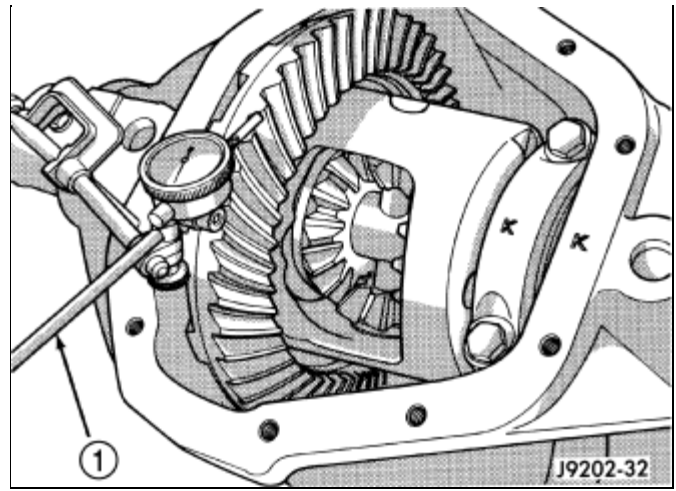


- 28. Install bearing caps (1) and tighten bolts to 61 N·m (45 ft. lbs.).
- 29. Rotate differential case several times to seat the side bearings.



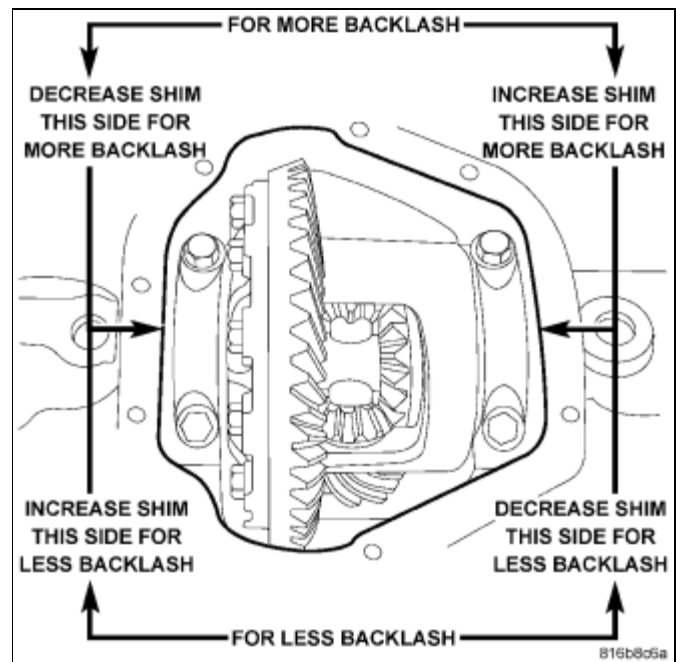
- 30. Position dial indicator plunger (1) against a ring gear tooth.

31. Push and hold ring gear upward while holding the pinion gear.
32. Zero dial indicator face to pointer.



33. Push and hold ring gear downward while holding the pinion gear. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in - 0.008 in). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other.
34. Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in). If readings vary more than specified, the ring gear or the differential case is defective.

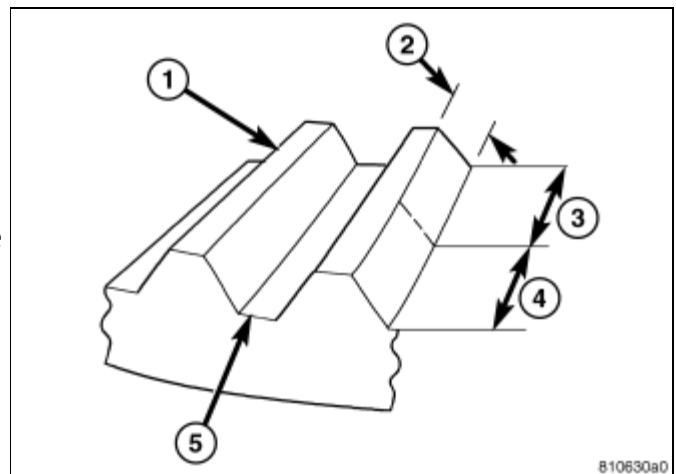
After the proper backlash is achieved, perform Gear Contact Pattern procedure.



GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion gear depth and ring gear backlash has been adjusted correctly. Backlash can be adjusted within specifications to achieve desired tooth contact patterns.

The TOP LAND (1) of the gear tooth is the top surface of the tooth. The PROFILE (2) of the gear tooth is the depth of the tooth. The TOE (3) of the gear is the portion of the tooth surface at the end towards the center. The HEEL (4) of the gear is the portion of the tooth at the outer-end. The ROOT (5) of the gear tooth is the lowest portion of the tooth.



1. Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.
2. Wrap, twist and hold a shop towel around the pinion flange to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.
3. With a boxed end wrench on the ring gear bolt, rotate the differential case one complete revolution in both directions while loading the pinion gear with shop towel.

The ring gear teeth with the greatest degree of contact with the pinion gear teeth will squeeze the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart and adjust pinion depth and gear backlash as necessary.

NOTE: If the PROFILE across the tooth is the same it is a 3 Axis cut gear. If the PROFILE across the tooth is tapered it is a 2 Axis cut gear.

3 AXIS CUT GEAR

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top heel contact		Top toe contact	Backlash correct. Thicker pinion position shim required.
	Root toe contact		Root heel contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top heel contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root toe contact	Pinion position shim correct. Increase backlash.

8106312d

2 AXIS CUT GEAR

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top toe contact		Top heel contact	Backlash correct. Thicker pinion position shim required.
	Root heel contact		Root toe contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top toe contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root heel contact	Pinion position shim correct. Increase backlash.

8106361d

DIFFERENTIAL BEARING PRELOAD CHECK

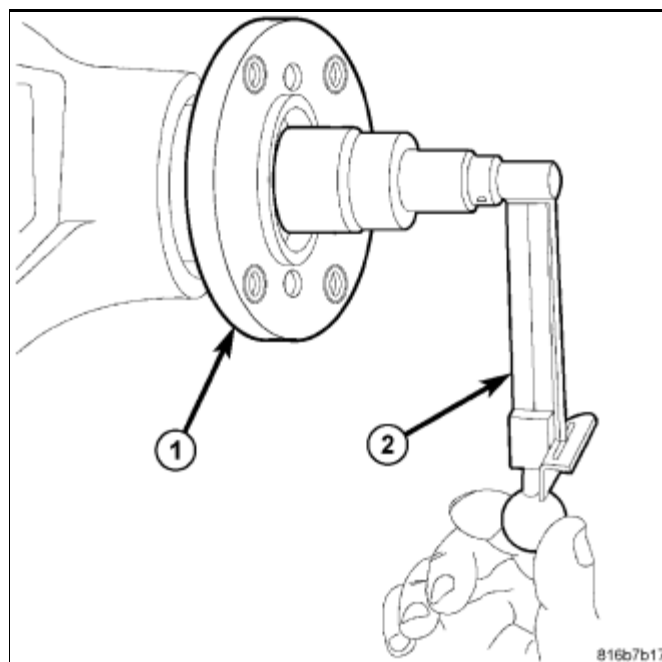
With an inch pound torque wrench (2) measure Total Torque To Rotate (TTTR). This is the final check on the differential assembly before installing the axle shafts. This will verify the correct differential bearing preload.

Total Torque To Rotate is: Pinion Torque To Rotate (PTTR) plus 0.79 - 1.24 N·m (7 - 11 in. lbs.).

NOTE: If TTTR is high, decrease the shim thickness equally on both sides of the differential and check TTTR again. If TTTR is low, increase the shims thickness equally on both sides of the differential and check TTTR again.

SPECIFICATIONS

FRONT AXLE - 186FBI



816b7b17

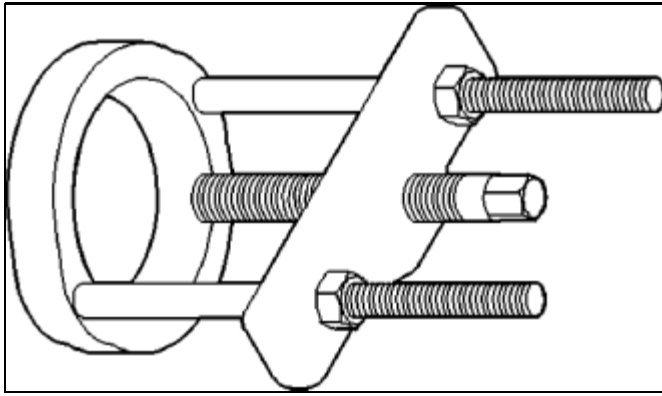
AXLE

DESCRIPTION	SPECIFICATION
Axle Ratio	3.21, 4.10
Ring Gear Diameter	186 mm (7.33 in.)
Ring Gear Runout	0.12 mm (0.005 in.)
Ring Gear Backlash	0.12 - 0.20 mm (0.005 - 0.008 in.)
Pinion Torque To Rotate - Original Bearings	1.2 - 2.2 N·m (10 - 20 in. lbs.)
Pinion Torque To Rotate - New Bearings	2 - 3.4 N·m (15 - 30 in. lbs.)
Differential Total Torque To Rotate: Pinion Torque To Rotate Plus	0.79 - 1.24 N·m (7 - 11 in. lbs.)

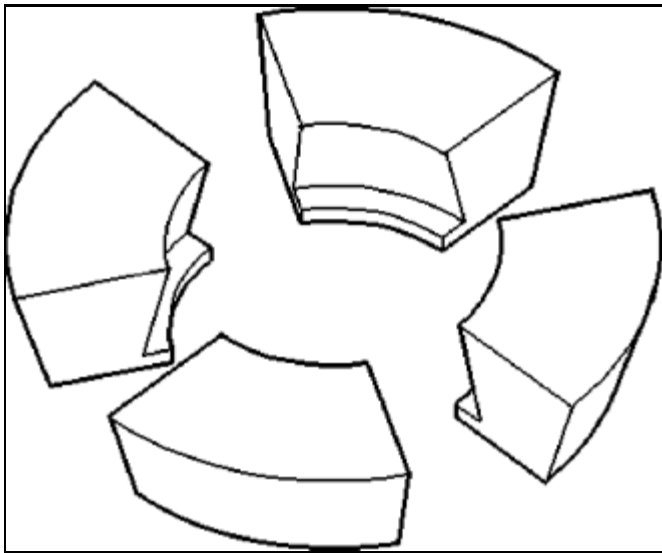
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	61	45	-
Ring Gear Bolts	108	80	-
Pinion Nut	217 - 542	160 - 400	-
Axle Nut	136	100	-
Hub Bearing Bolts	102	75	-

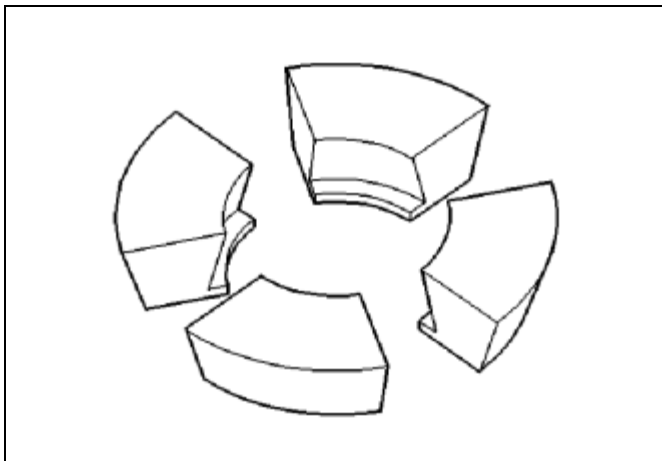
SPECIAL TOOLS**FRONT AXLE - 186FBI**

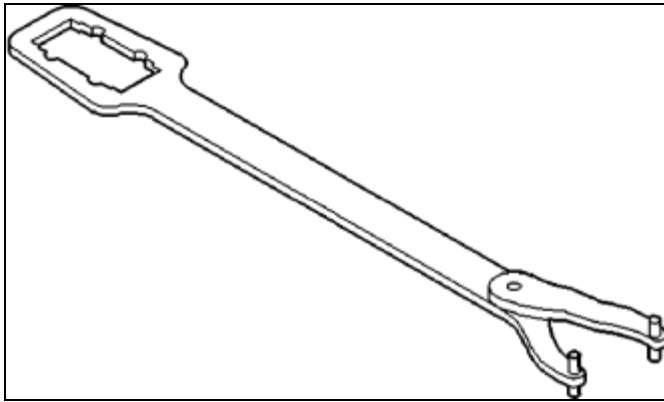
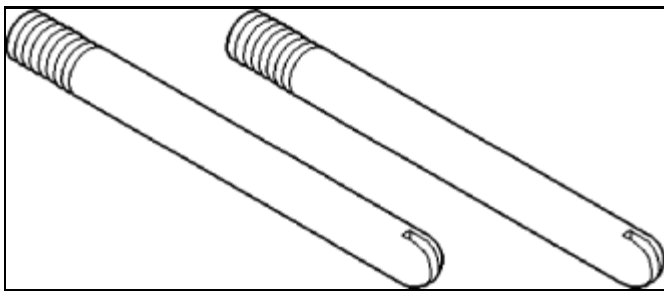
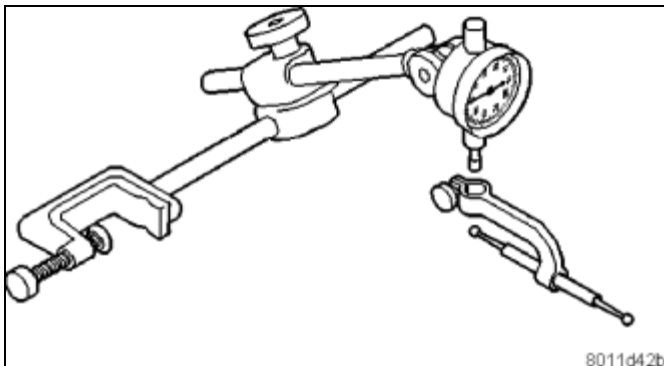


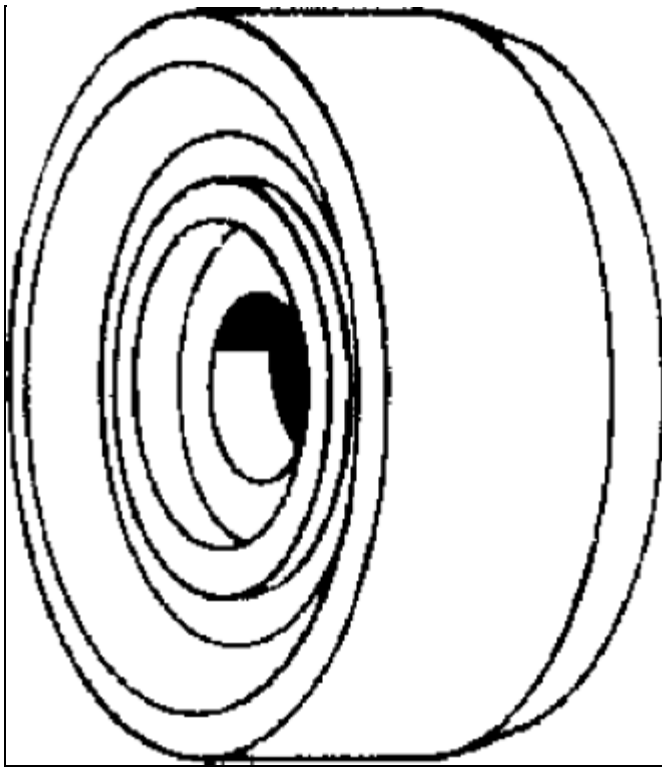
PULLER - C-293-PA



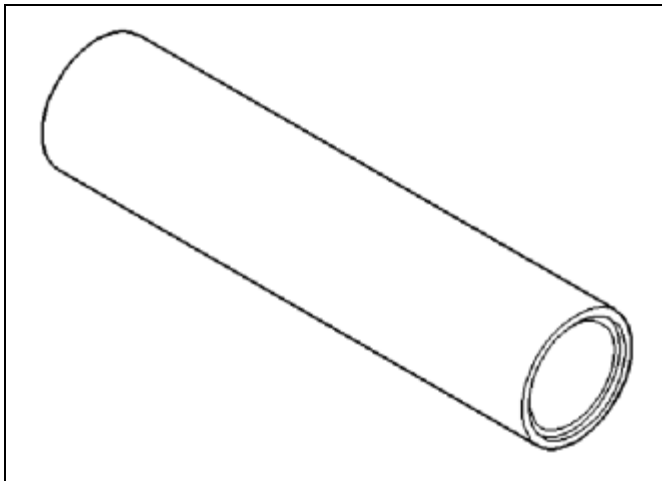
ADAPTER C-293-39



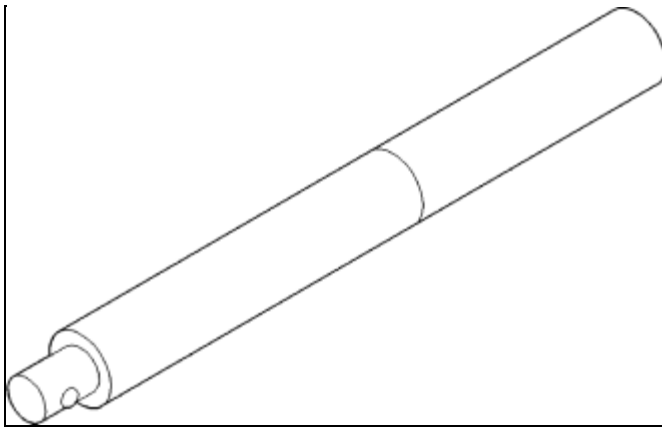
ADAPTER C-293-48**FLANGE WRENCH C-3281****PINS C-3288-B****DIAL INDICATOR C-3339A**



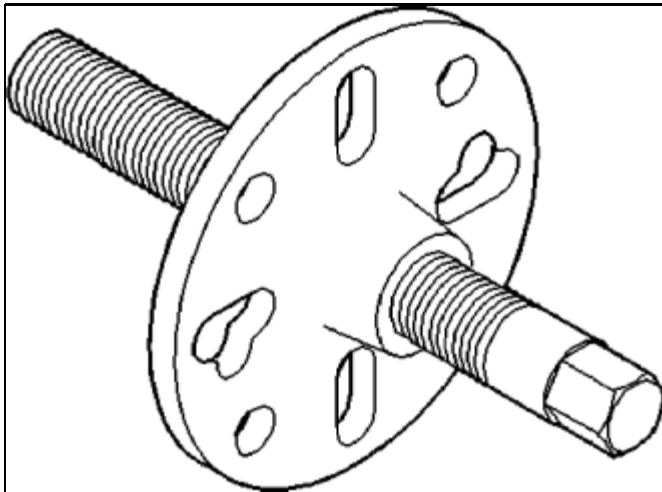
INSTALLER C-3716-A



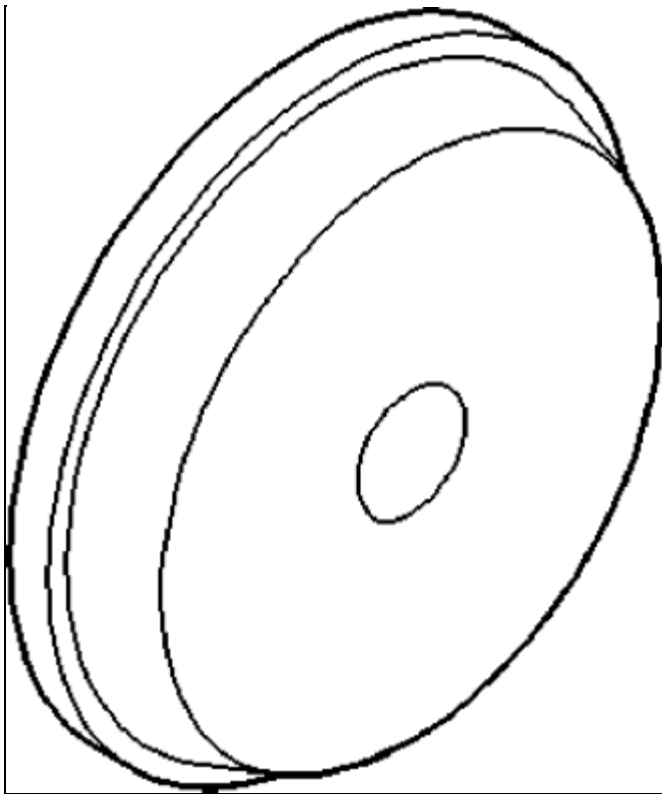
INSTALLER C-4040



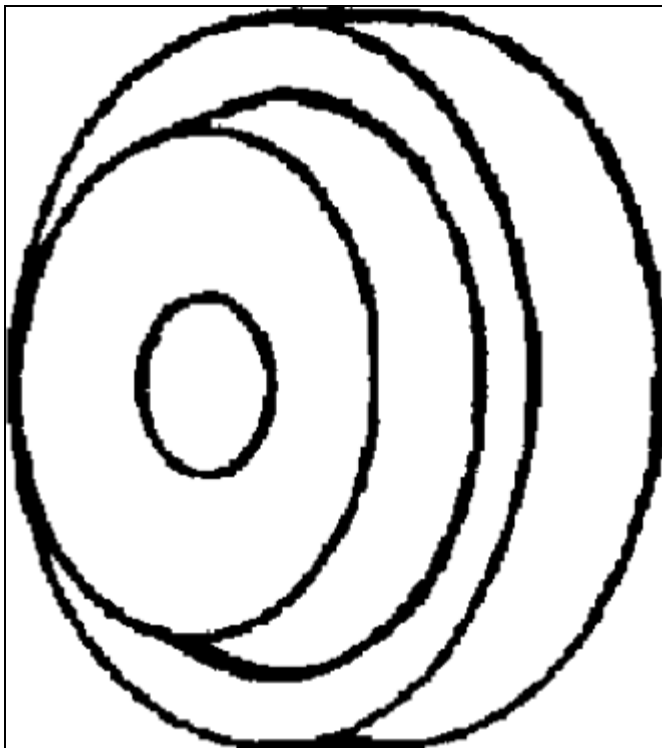
HANDLE C-4171



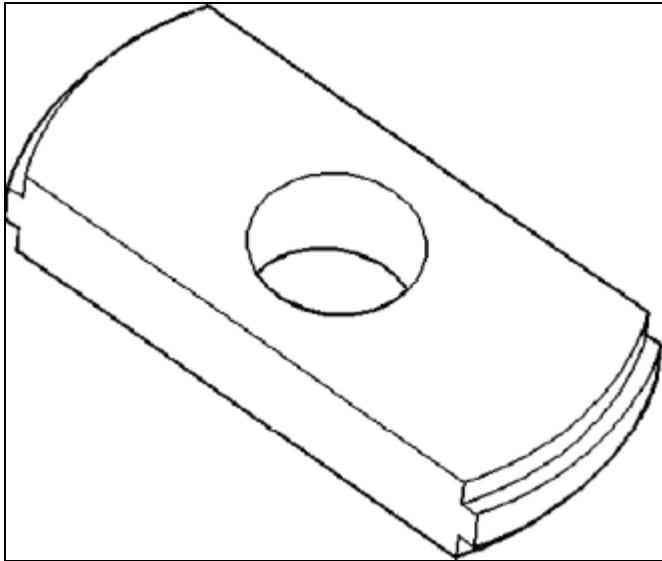
PULLER C-452



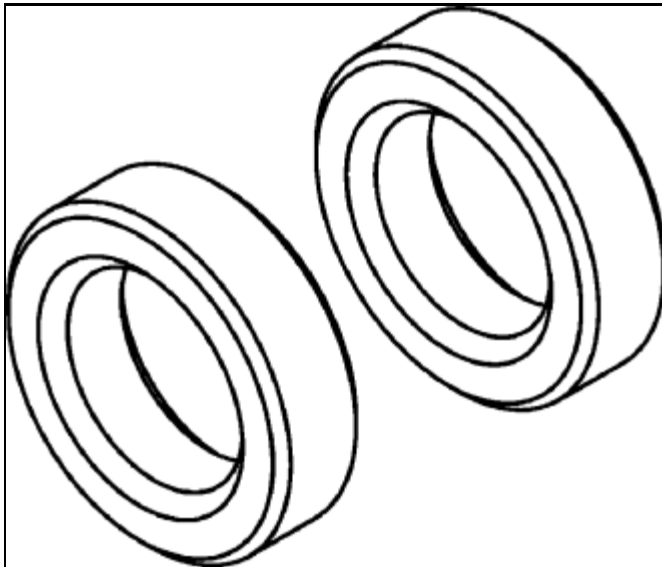
INSTALLER C-4308



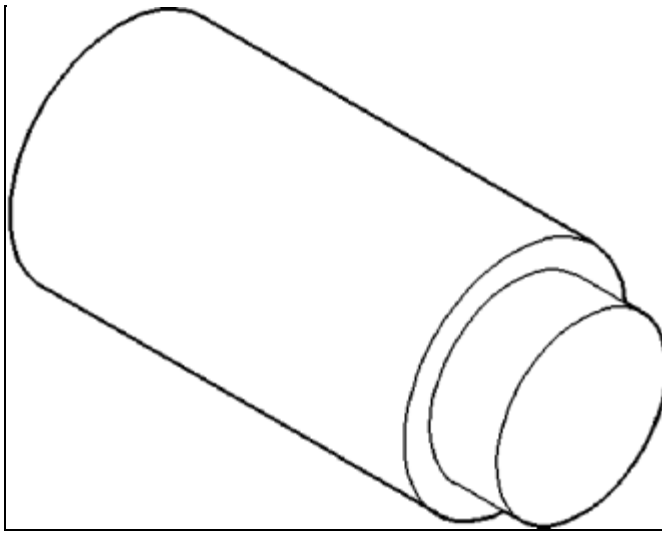
INSTALLER D-146



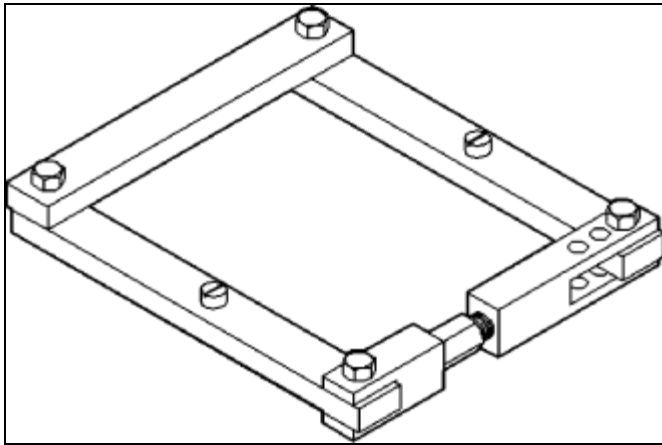
REMOVER D-149



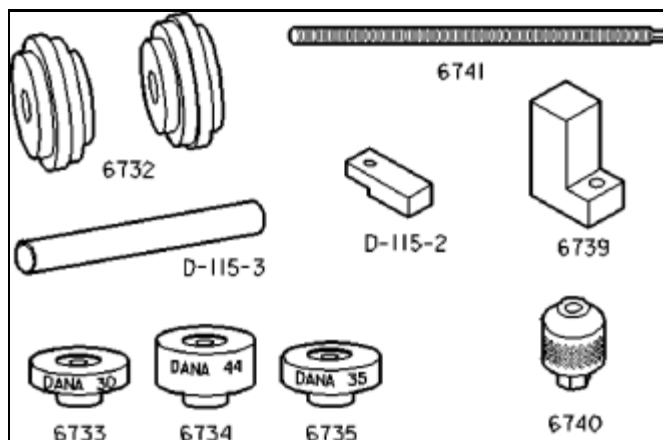
DUMMY BEARINGS D-348

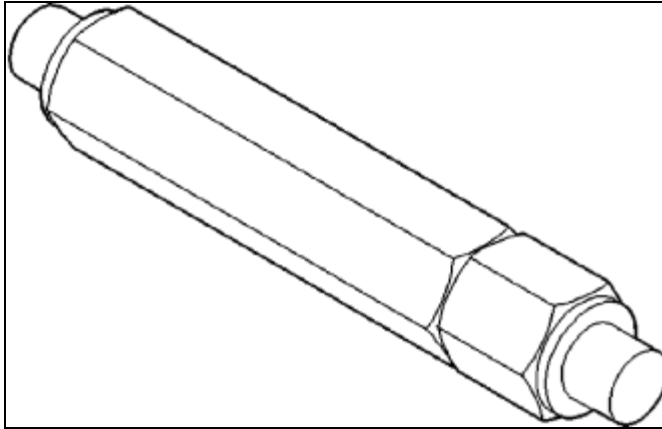
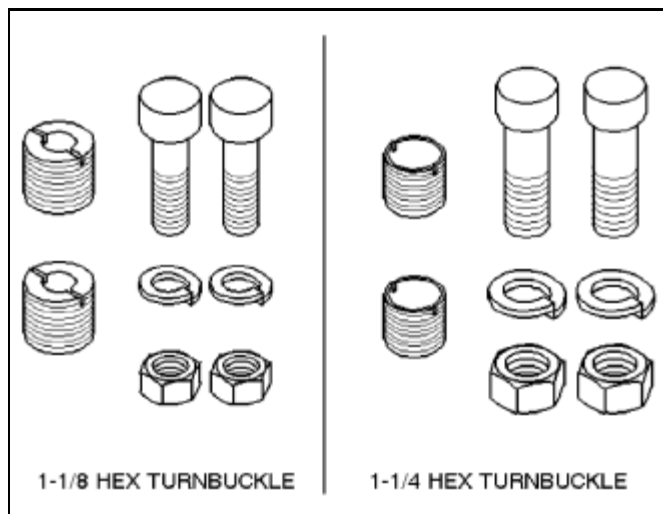


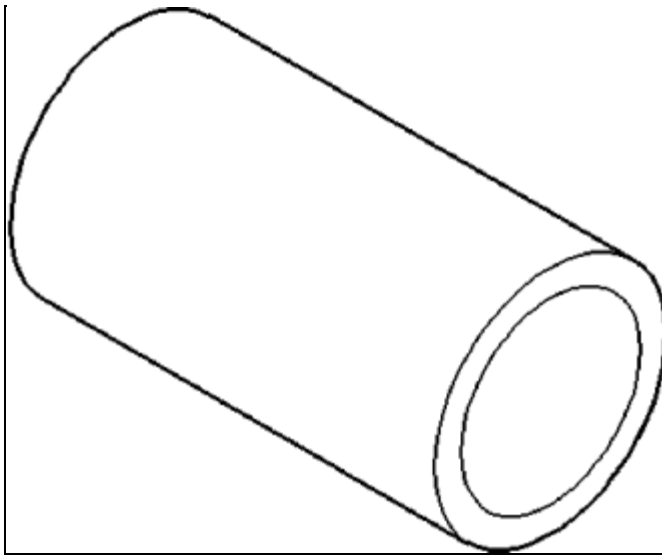
PLUG SP-3289



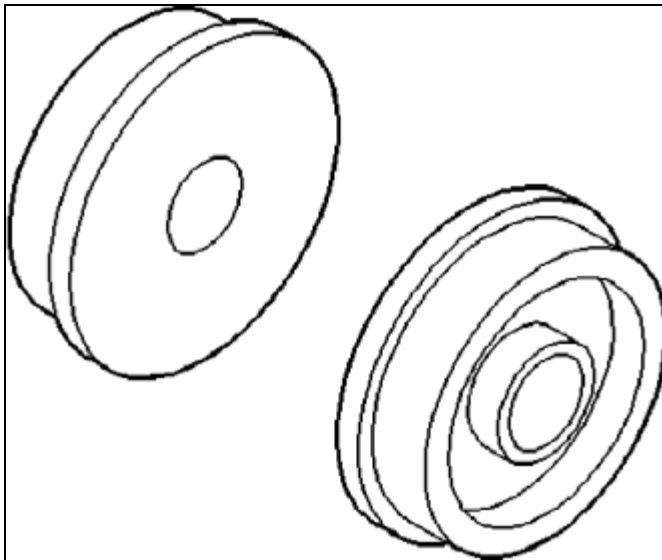
SPREADER W-129-B



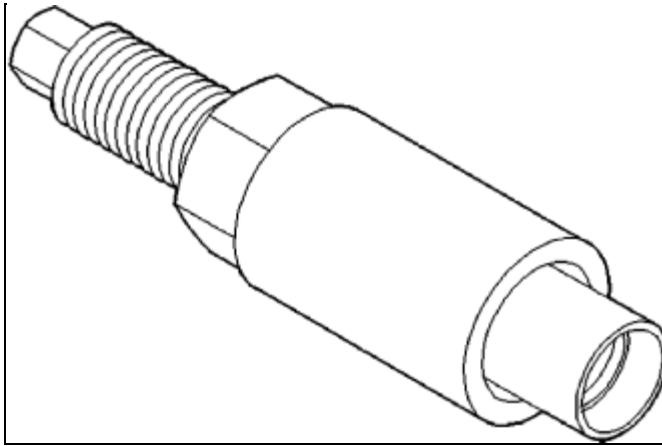
PINION DEPTH SET 6730**TURNBUCKLE 6797****ADAPTER KIT 6987B**



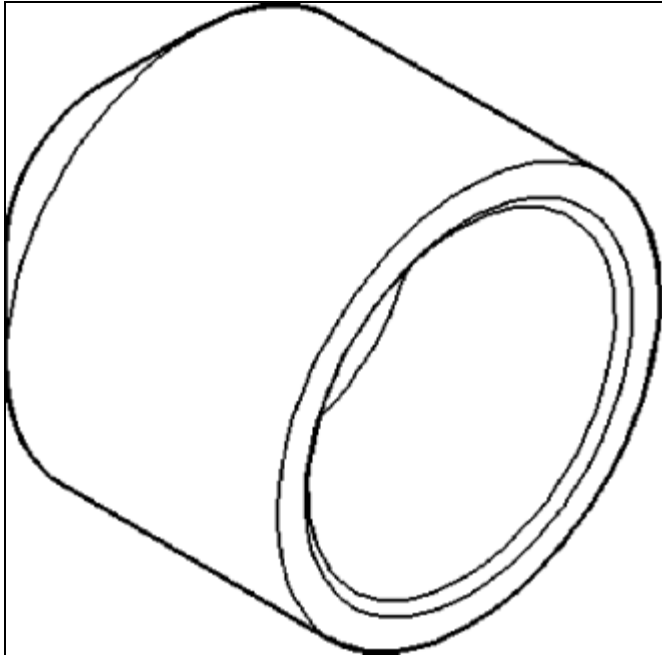
CUP 8109



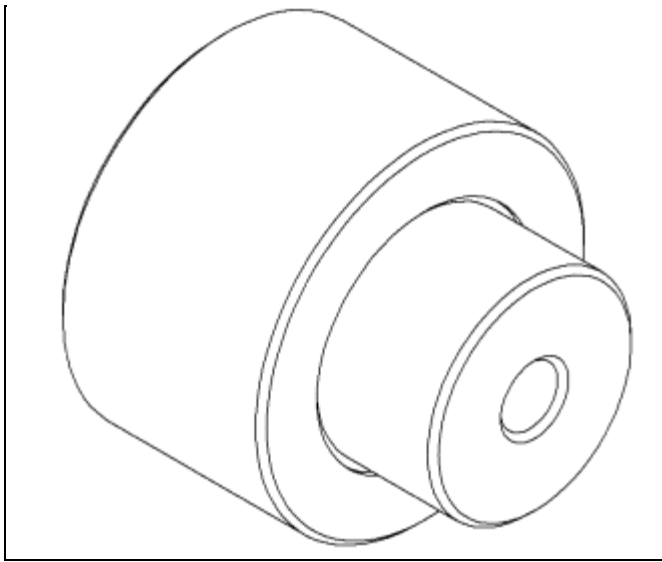
SEAL INSTALLER 8110



INSTALLER 8112



INSTALLER 8681

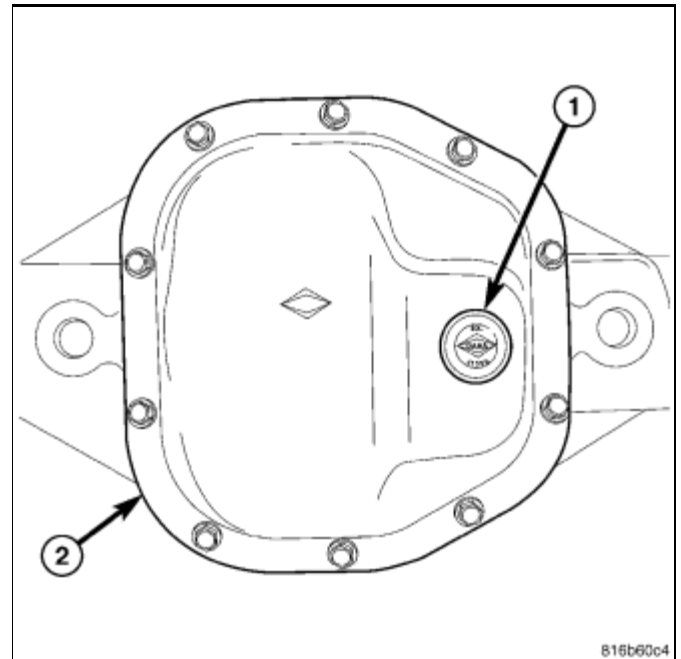


PINION BLOCK 9946

COVER-DIFFERENTIAL REMOVAL

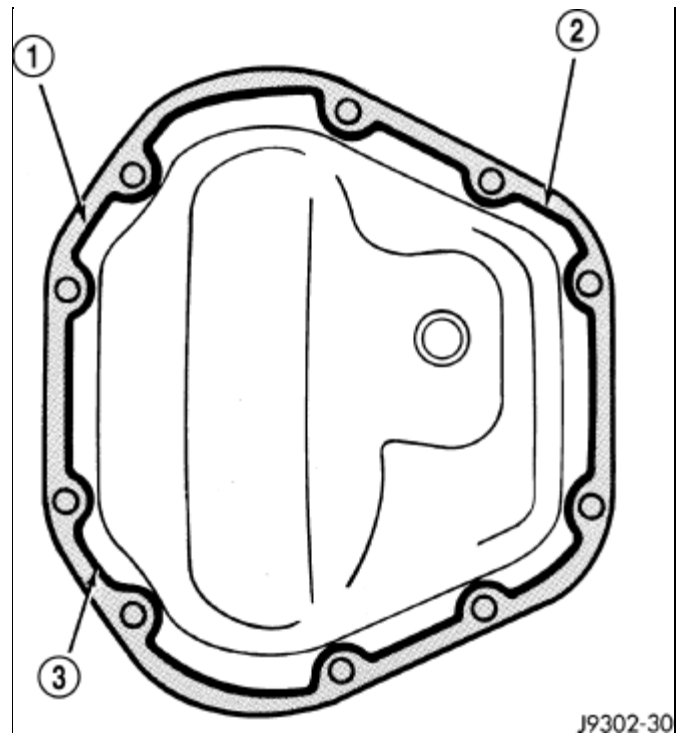
1. With transmission in neutral, position vehicle on hoist.
2. Remove fill plug (1) and cover (2) bolts.
3. Remove cover and drain lubricant.

INSTALLATION



1. Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant (2) or equivalent to the housing cover (1).

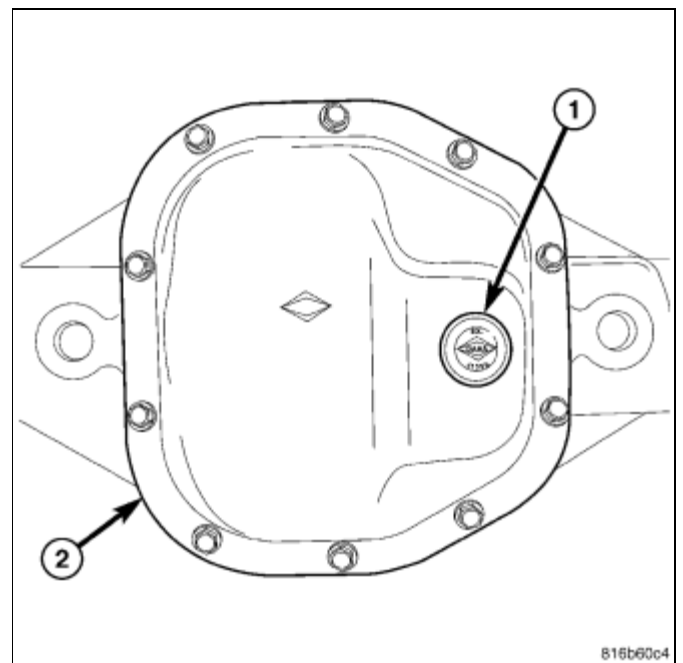
CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to follow these instructions will result in a leak.



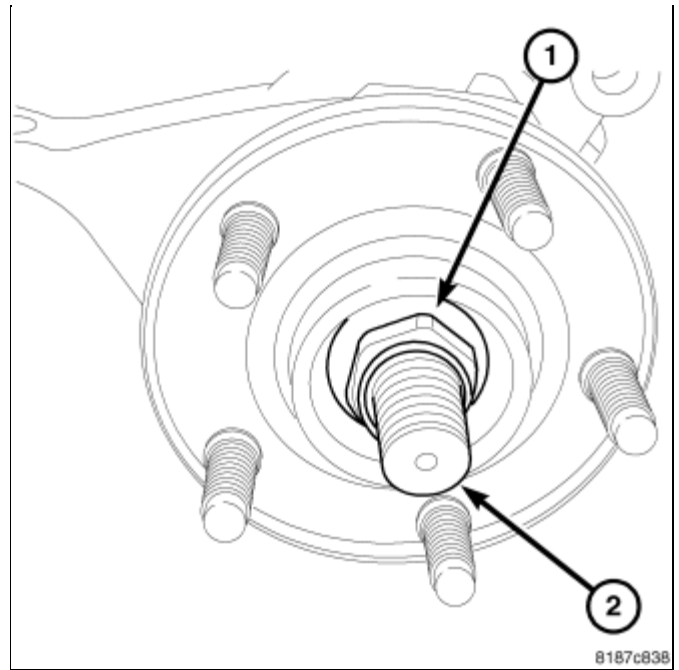
2. Install differential cover (2) and identification tag. Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
3. Fill differential to specifications.
4. Install fill plug (1) and tighten to 34 N·m (25 ft. lbs.).

SHAFTS-AXLE

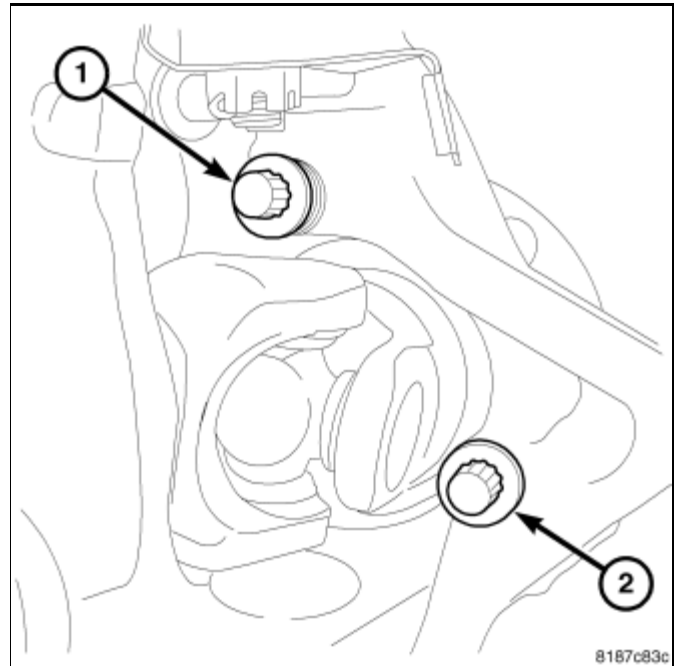
REMOVAL



1. With transmission in neutral, position vehicle on hoist.
2. Remove brake components.
3. Remove wheel speed sensor from hub bearing.
4. Remove hub nut (1) from axle shaft (2).



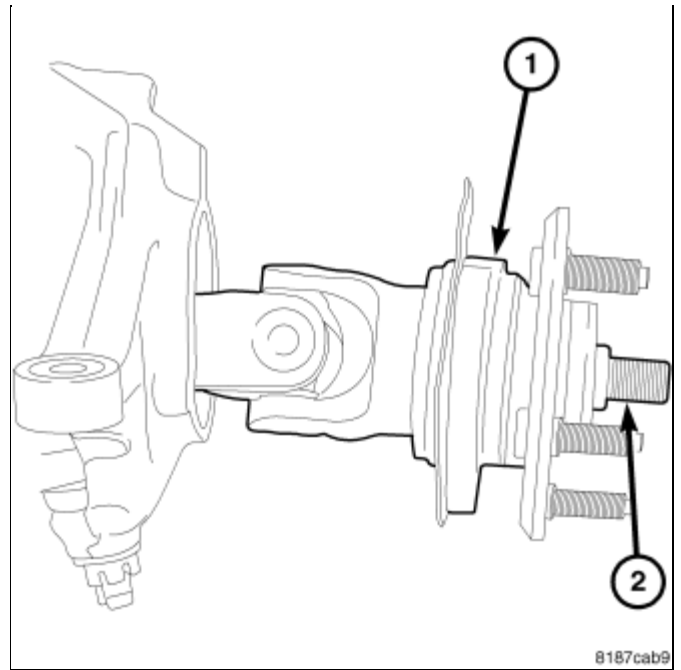
5. Remove three hub bearing bolts (1) from steering knuckle (2).



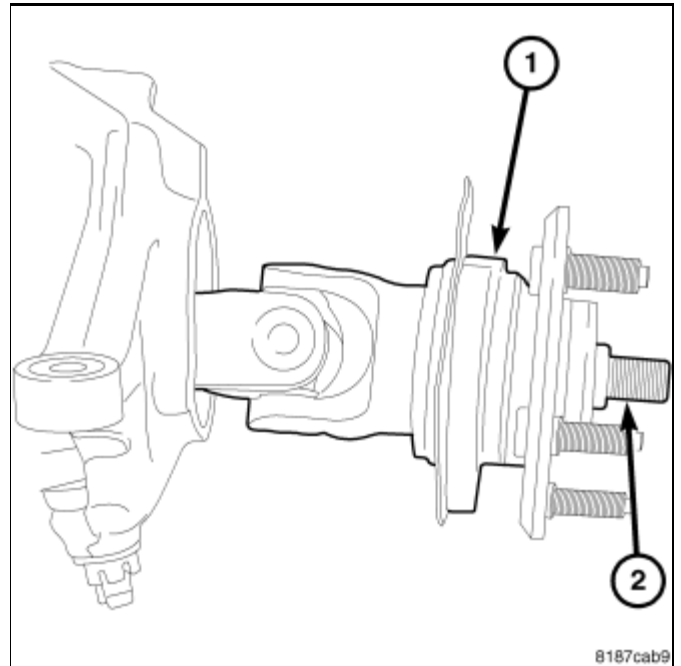
6. Remove hub bearing (1) with axle shaft (2) through steering knuckle (3).

7. Remove brake shield and hub bearing from axle.

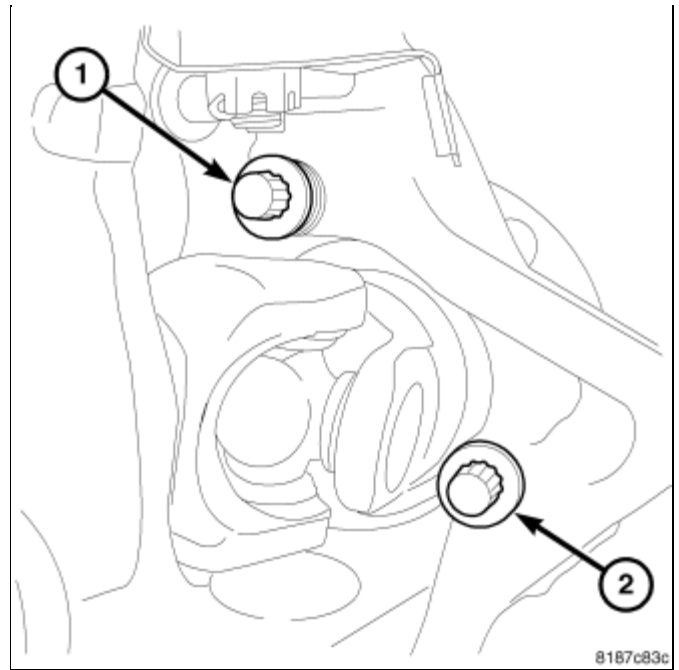
INSTALLATION



1. Clean axle shaft and apply a thin film of Mopar Wheel Bearing Grease or equivalent to the shaft splines and seal contact surface.
2. Install hub bearing and brake shield on axle shaft.
3. Install axle shaft (2) with hub bearing (1) through steering knuckle and into differential side gears.



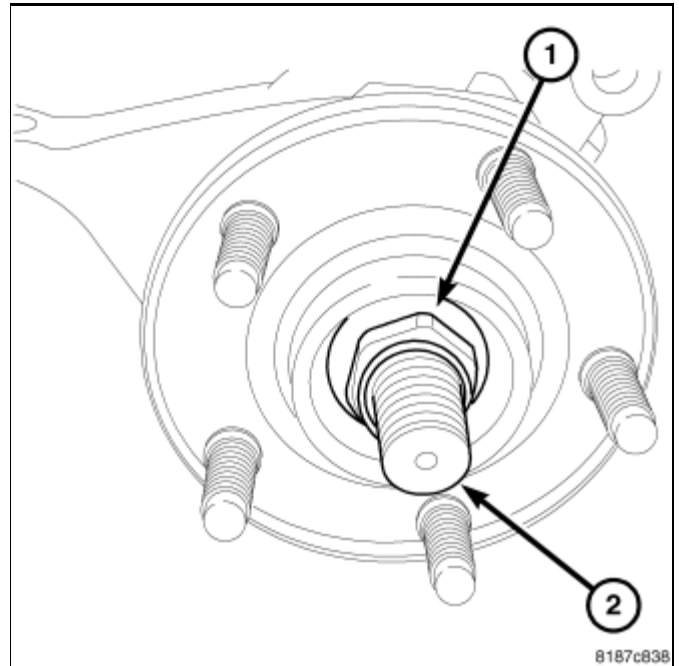
4. Install three hub bearing bolts (1) through steering knuckle (2) and tighten to 102 N·m (75 ft. lbs.).



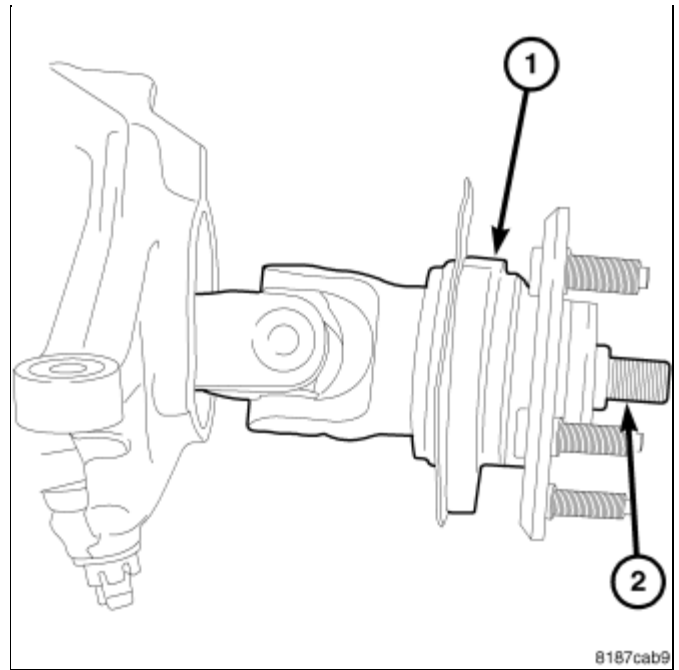
5. Install hub nut (1) on axle shaft (2) and tighten to 136 N·m (100 ft. lbs.).
6. Install wheel speed sensor.
7. Install brake components.

SEALS-AXLE SHAFT

REMOVAL

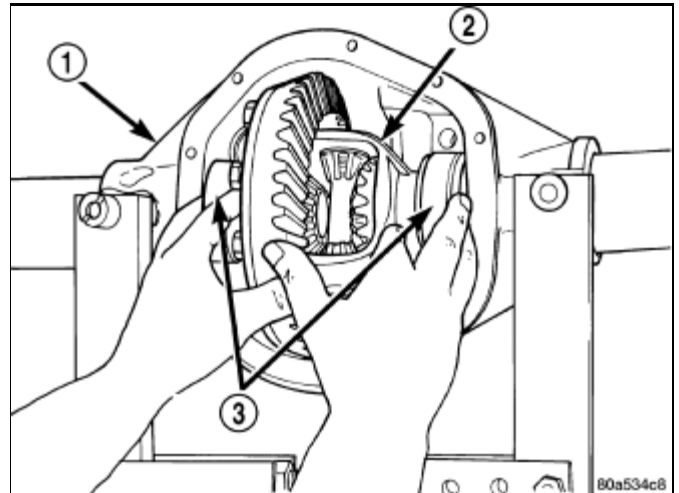


1. With transmission in neutral, position vehicle on hoist.
2. Remove hub bearings (1) and axle shafts (2) from axle.

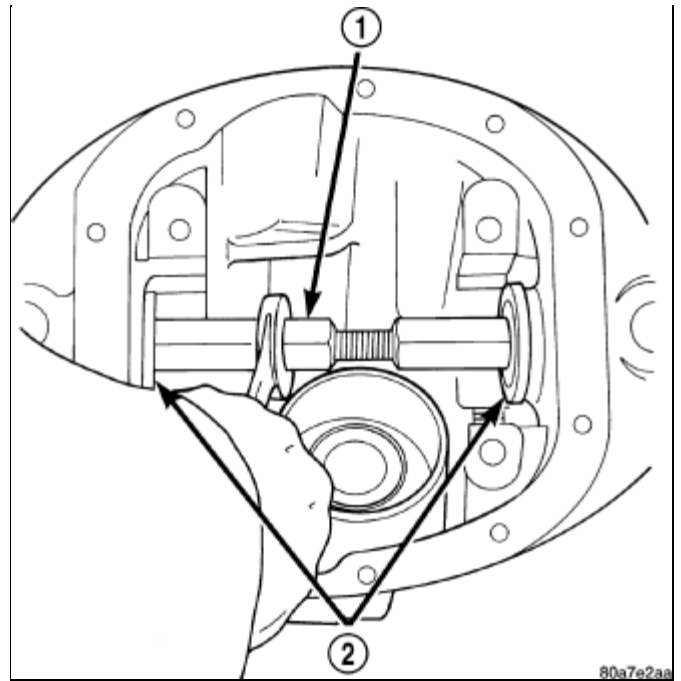


3. Remove differential case (2) with bearing cups (3) and shims from differential housing (1).
4. Remove inner axle shaft seals with a seal puller.

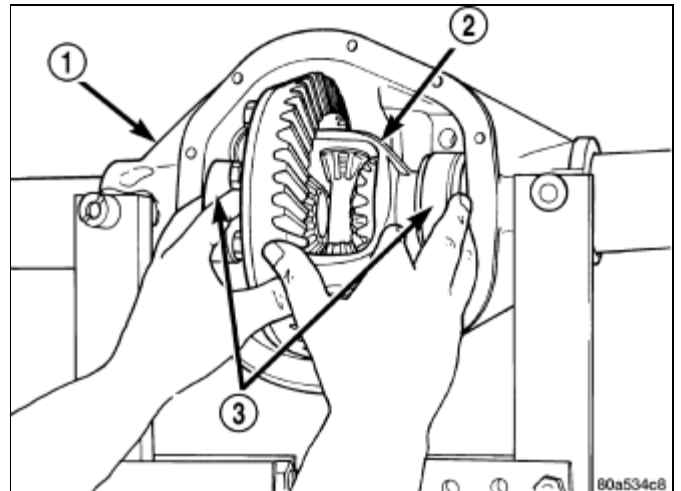
INSTALLATION



1. Clean axle oil seal bores.
2. Install oil seals in axle tube, then with Turnbuckle 6797 (1) and Discs 8110 (2) tighten tool until disc bottoms (2) in housing.



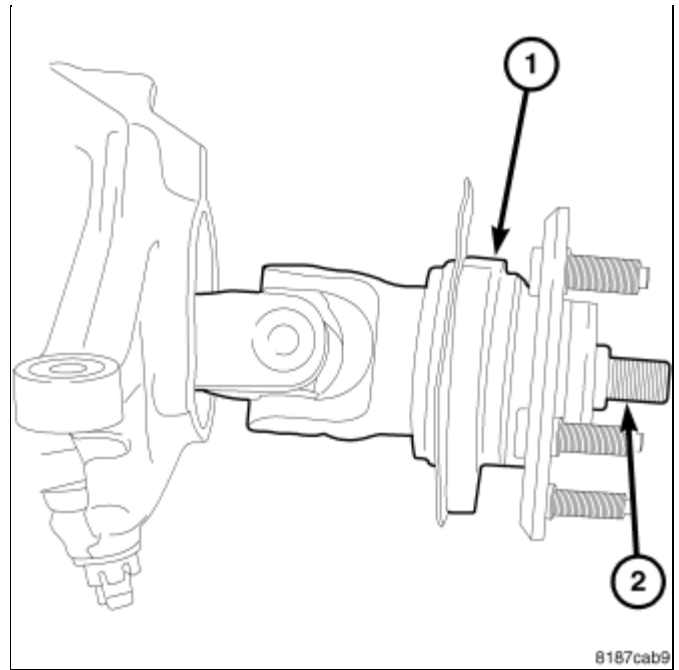
3. Install differential (1) into housing (1) with bearing cups (3) and shims. Install bearing caps.



- 4. Install hub bearings (1) with axle shafts (2).
- 5. Install wheel speed sensor.
- 6. Install brake components.

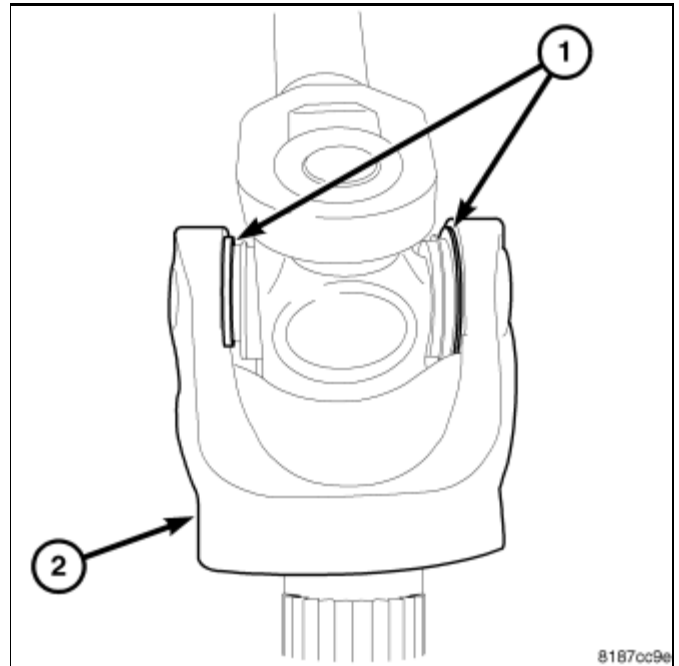
UNIVERSAL JOINT-SINGLE CARDAN

REMOVAL

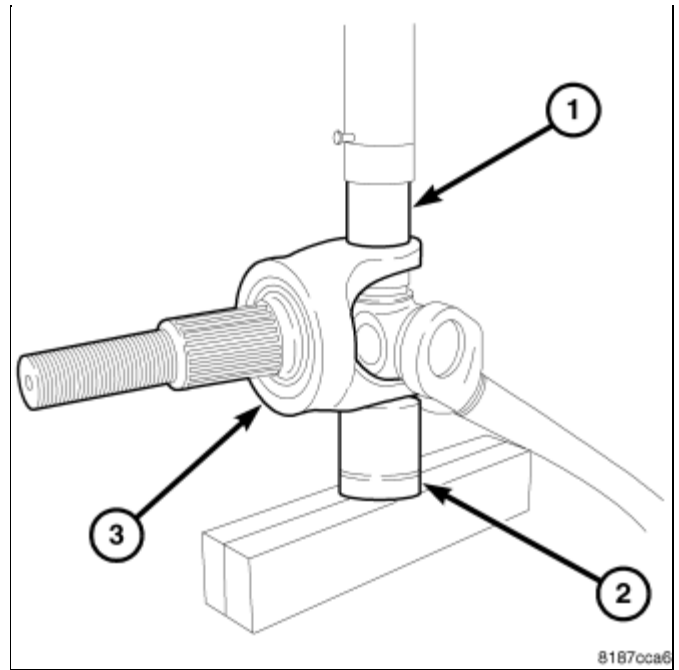


NOTE: Saturate bearing caps with penetrating oil prior to removal.

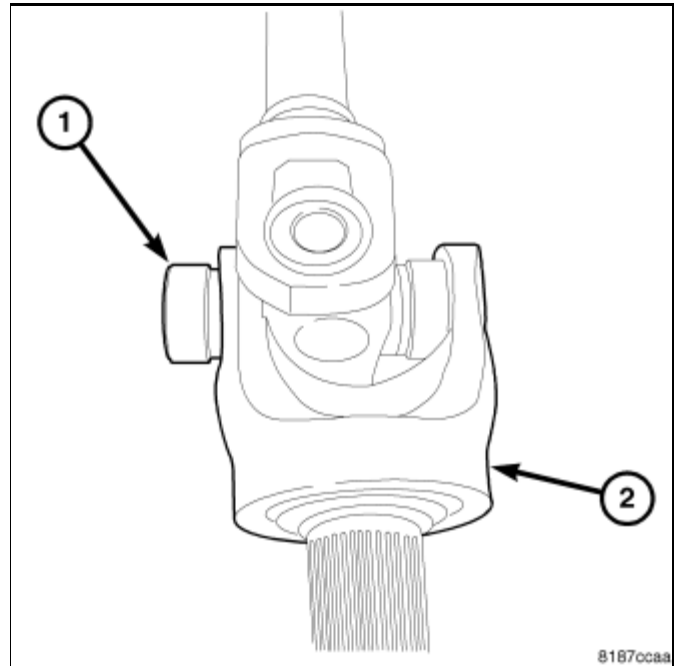
1. Remove axle shaft.
2. Remove bearing cap snap rings (1) from stub shaft yoke (2) bearing caps.



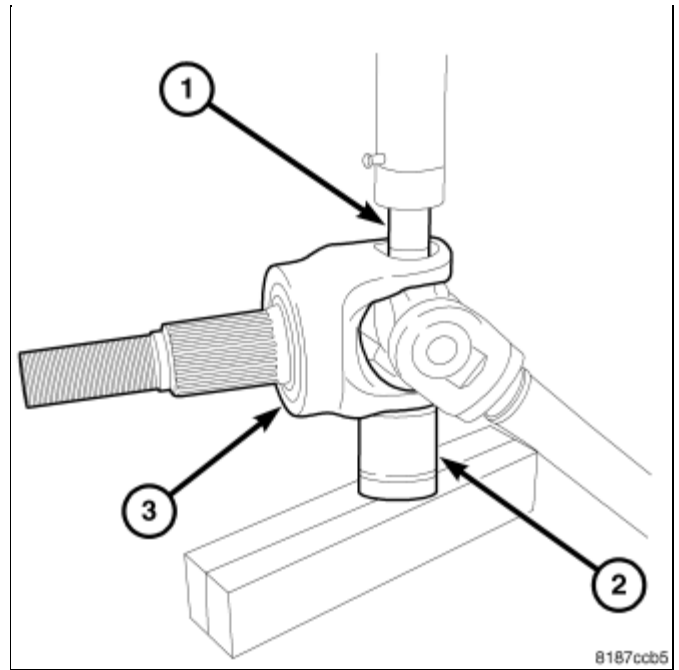
3. Position receiver/socket (2) and driver/socket (1) on stub shaft yoke (3) in press. Press bearing cup into receiver/socket (2).



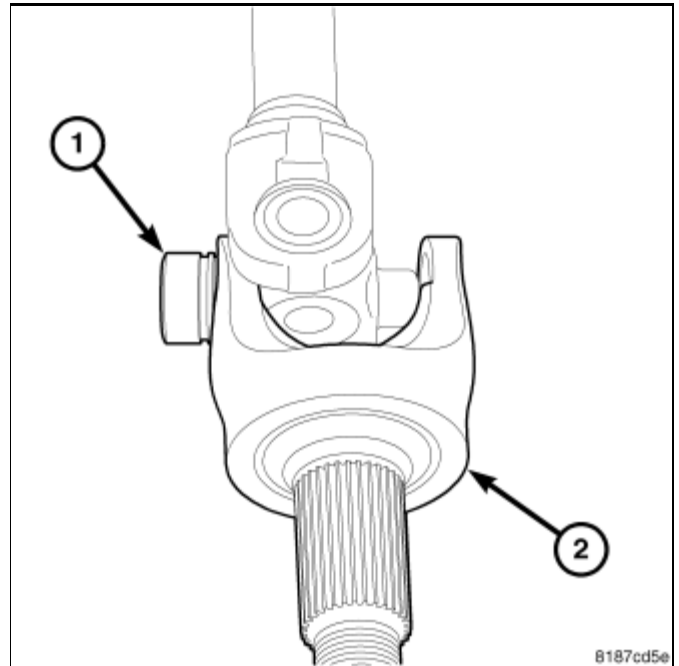
4. Remove bearing cap (1) from stub shaft yoke (2).



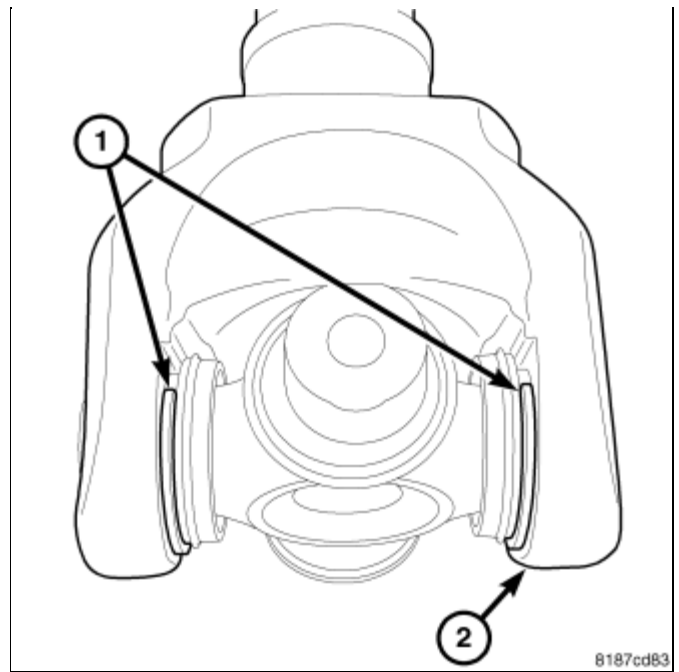
5. Position receiver/socket (2) under stub shaft yoke (3) remaining bearing cup and driver/socket (1) on U-joint cross in press. Press bearing cup into receiver/socket (2)



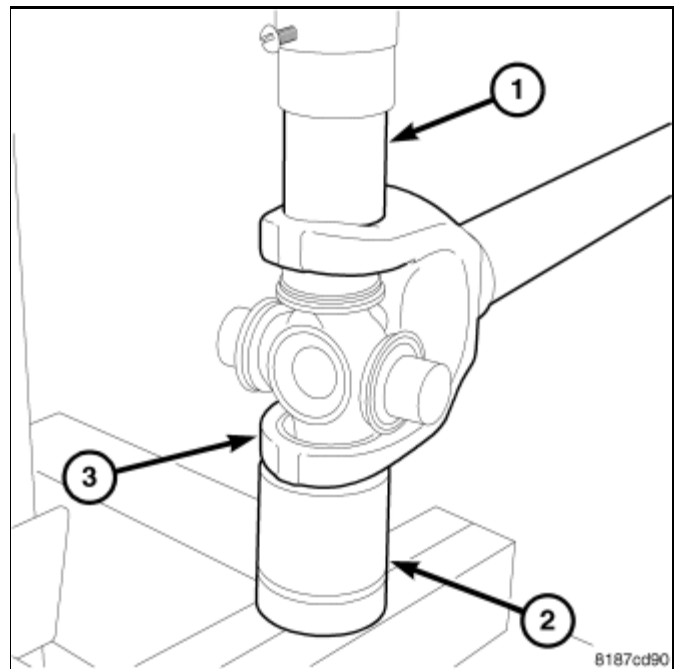
6. Remove bearing cap (1) from stub shaft yoke (2). Then remove stub shaft from U-joint cross.



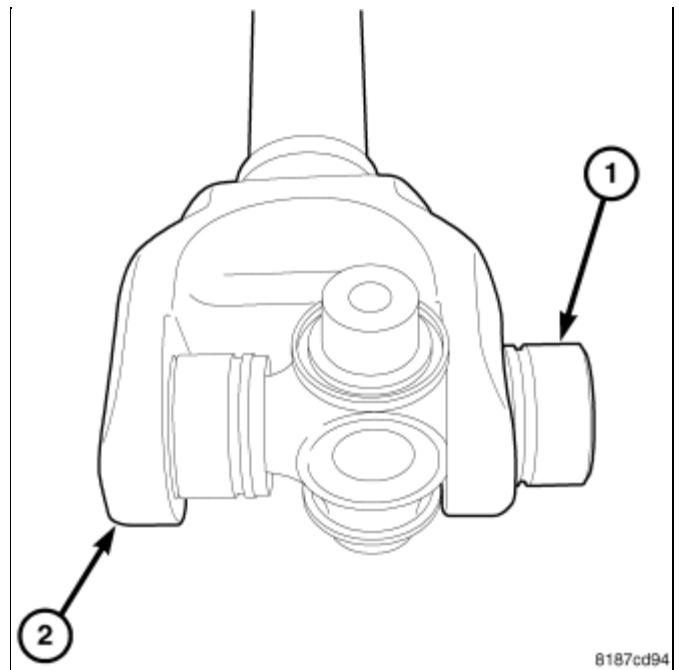
7. Remove snap rings (1) from shaft yoke (2) bearing caps.



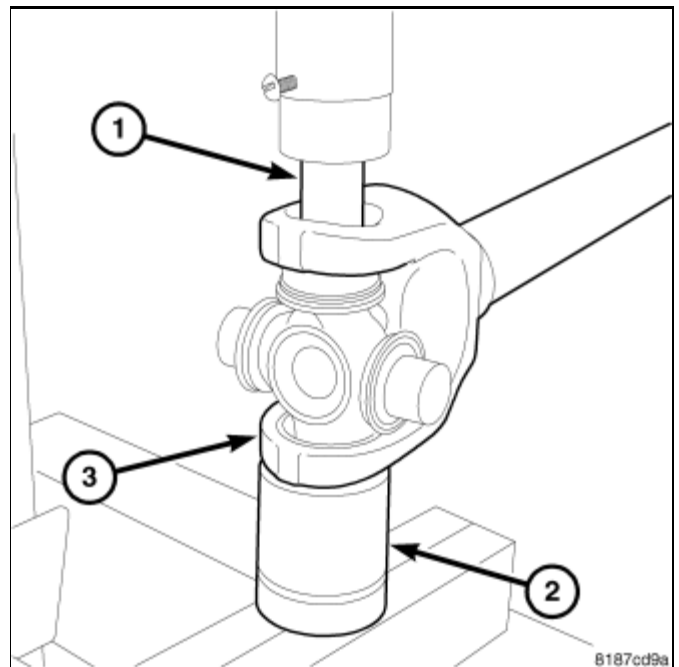
8. Position receiver/socket (2) and driver/socket (1) on shaft yoke (3) in press. Press bearing cup into receiver/socket (2).



9. Remove bearing cap (1) from shaft yoke (2).

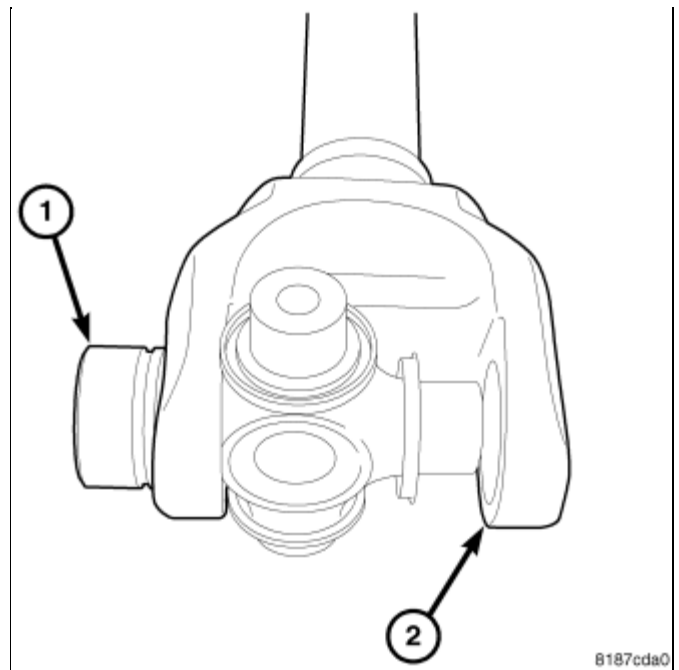


10. Position receiver/socket (2) under shaft yoke (3) remaining bearing cup and driver/socket (1) on U-joint cross in press. Press bearing cup into receiver/socket (2)



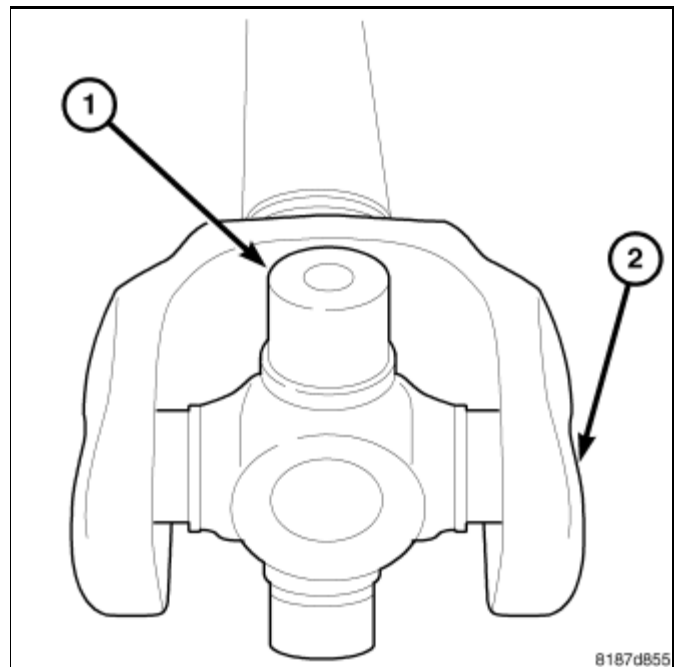
11. Remove bearing cap (1) from shaft yoke (2). Then remove U-joint cross from shaft yoke.

INSTALLATION

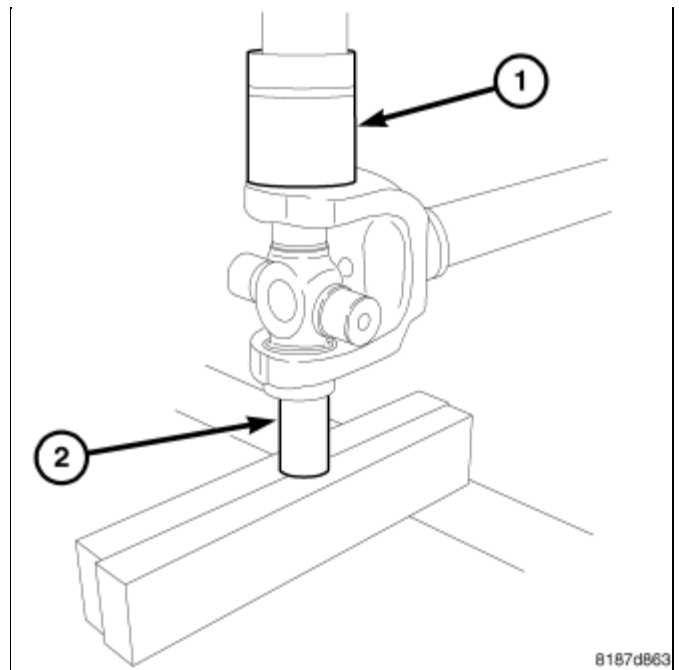


CAUTION: Keep cross and bearing cap straight during installation. Failure to follow these instruction will result in damage.

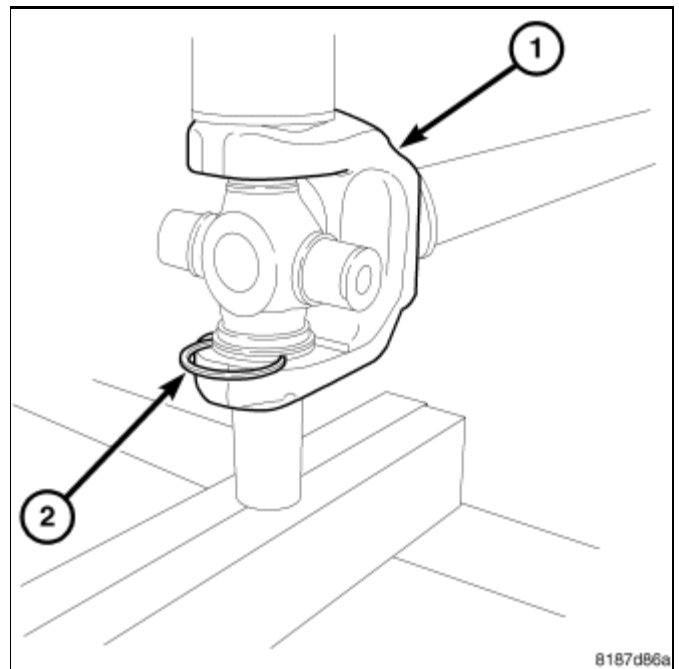
1. Pack bearing caps 1/3 full of wheel bearing lubricant. Apply extreme pressure (EP), lithium-base lubricant to aid in installation.
2. Position cross (1) in the shaft yoke (2).



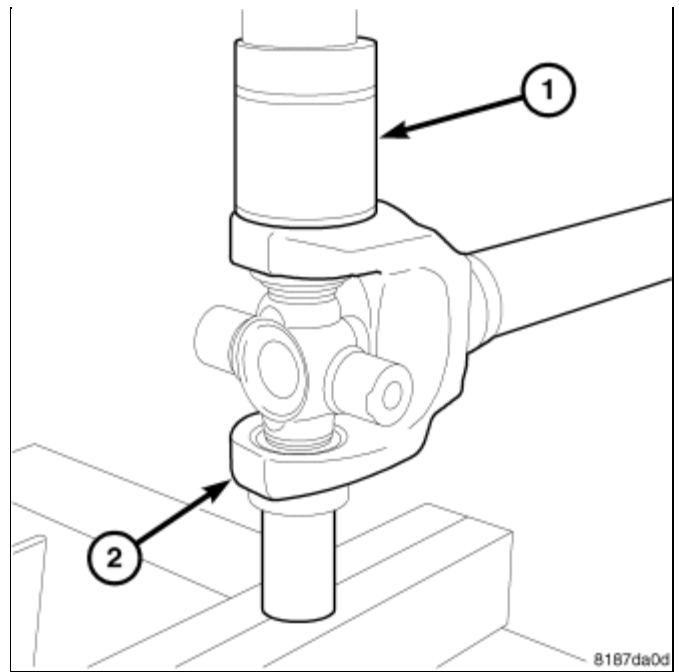
3. Tap bearing cap into the yoke bores far enough to position cross.
4. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



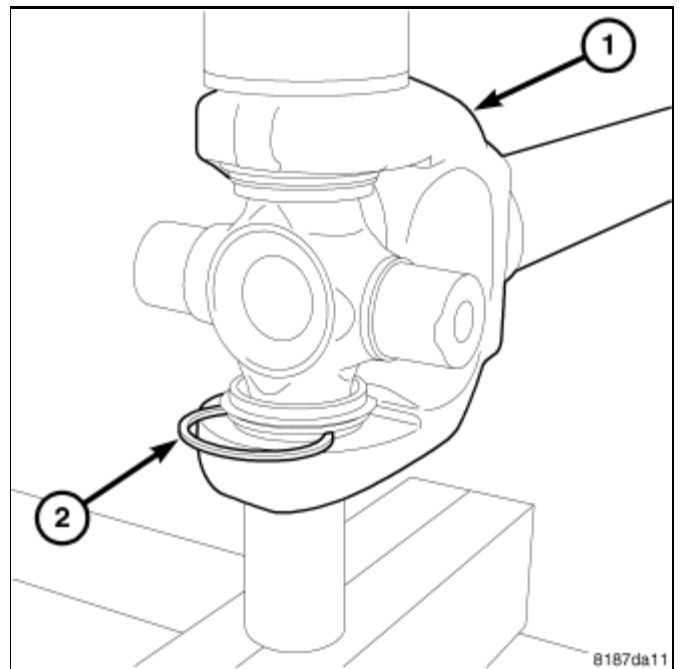
5. Press bearing cap into shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).



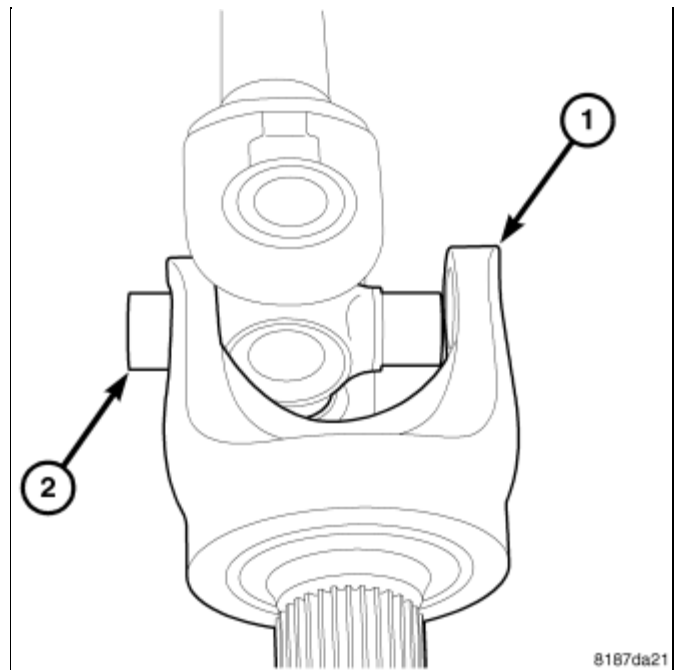
6. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



7. Press bearing cap into shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).

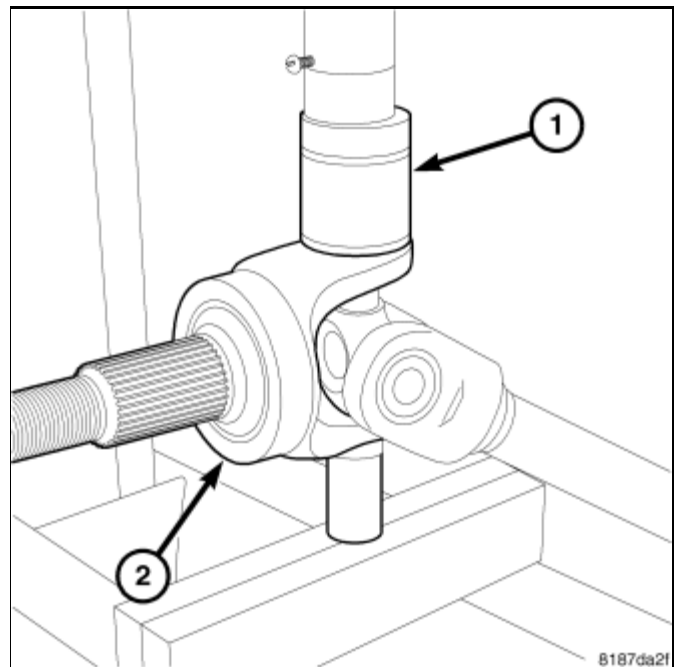


8. Install stub shaft yoke (1) on U-joint cross (2).

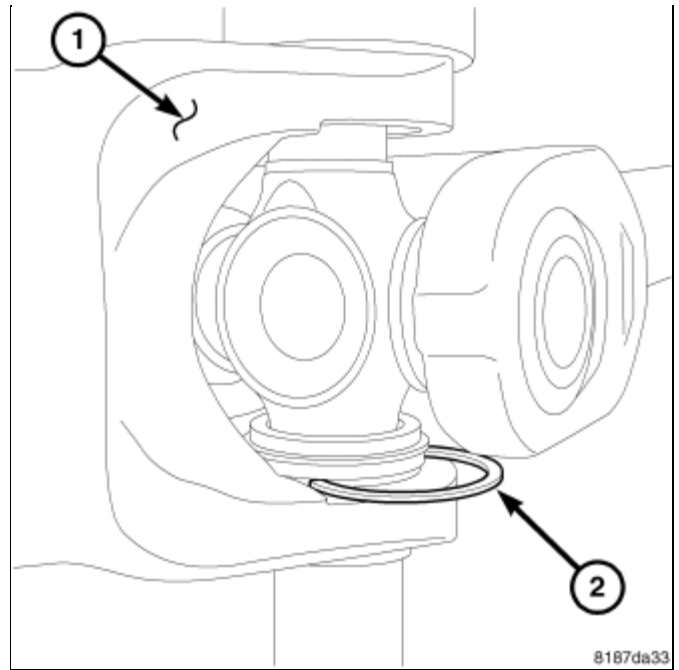


9. Tap fist bearing cap into the stub shaft yoke bore far enough to position cross.

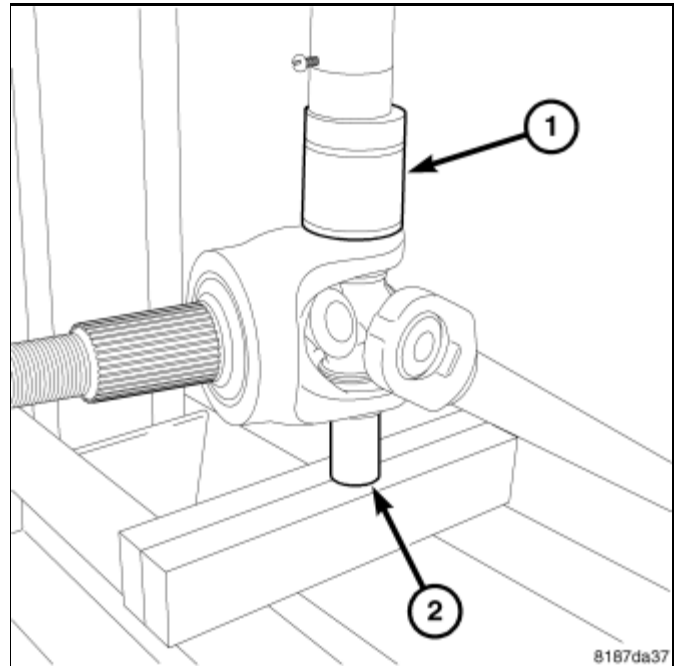
10. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



11. Press bearing cap into stub shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).



12. Position receiver/socket (1) on stub shaft yoke and driver/socket (2) on bearing cap in press.

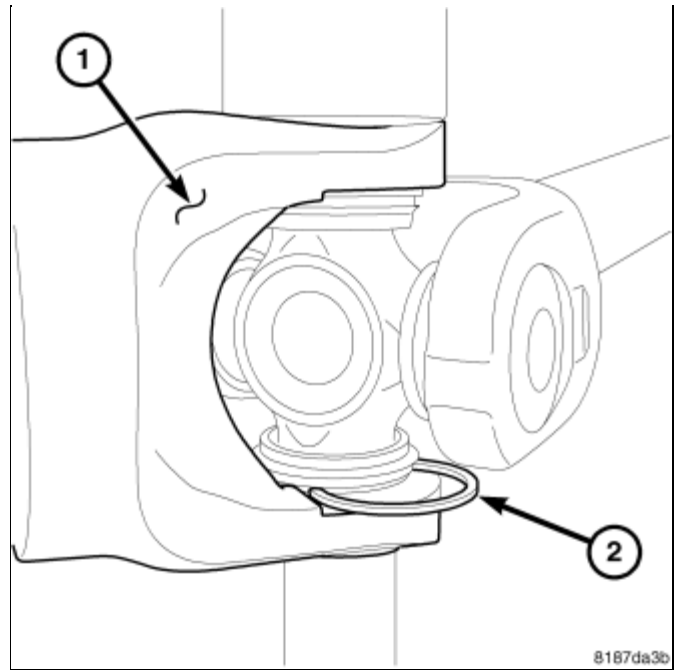


13. Press bearing cap into stub shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).

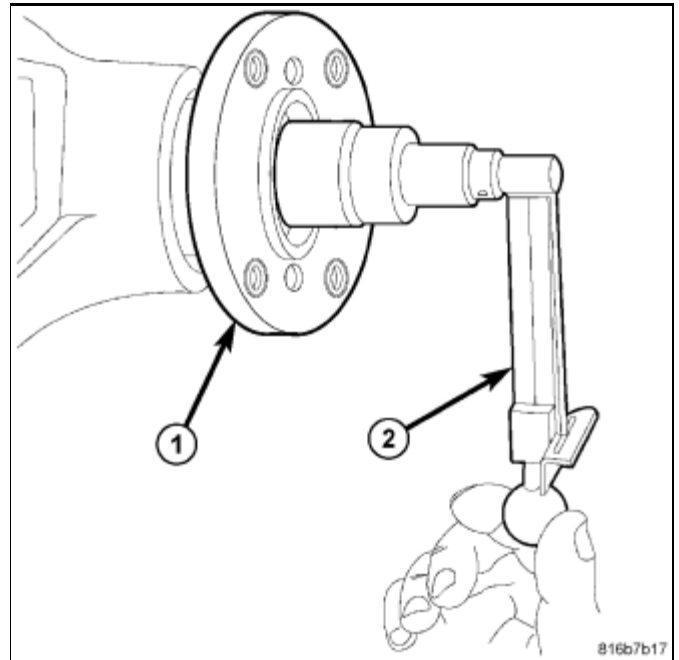
14. Install axle shaft.

SEAL-PINION

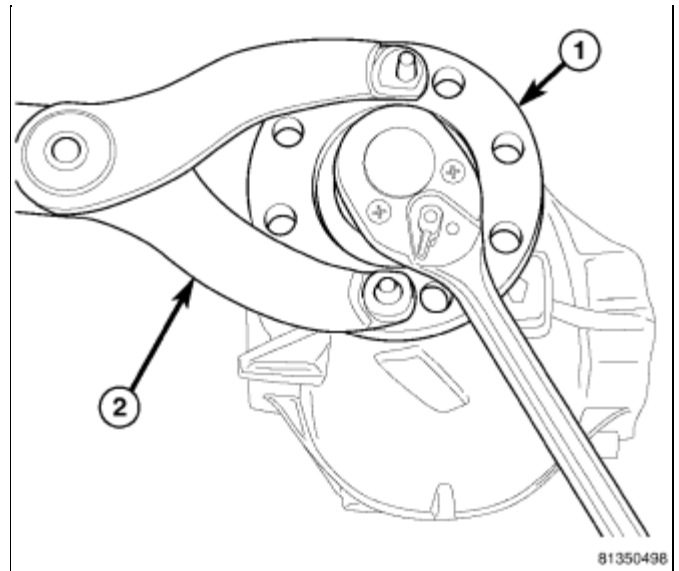
REMOVAL



1. With transmission in neutral, position vehicle on hoist.
2. Remove brake rotors and calipers.
3. Remove propeller shaft.
4. Rotate pinion gear three or four times.
5. Record pinion torque to rotate (1) with an inch pound torque wrench (2), for installation reference.

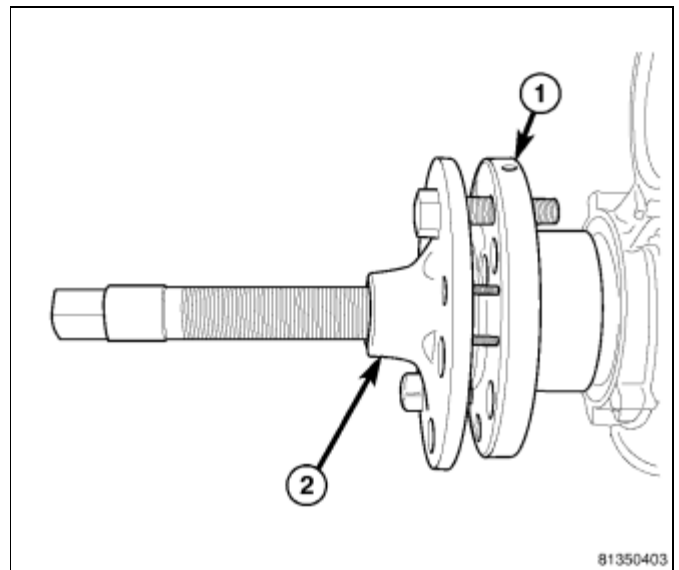


6. Hold pinion flange (1) with Flange Wrench C-3281 (2) and remove pinion nut.
7. Mark a reference line across the pinion shaft and flange for installation reference.

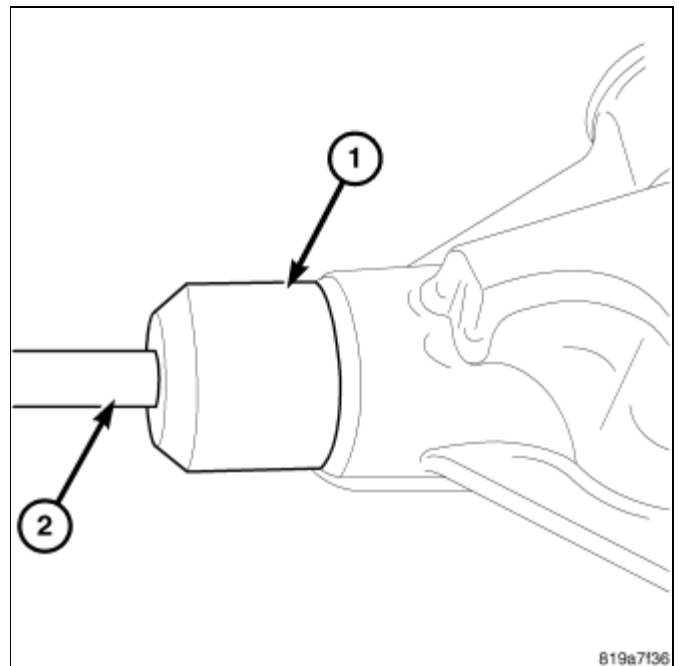


8. Remove pinion flange (1) with Puller C-452 (2).
9. Remove seal with a seal puller.

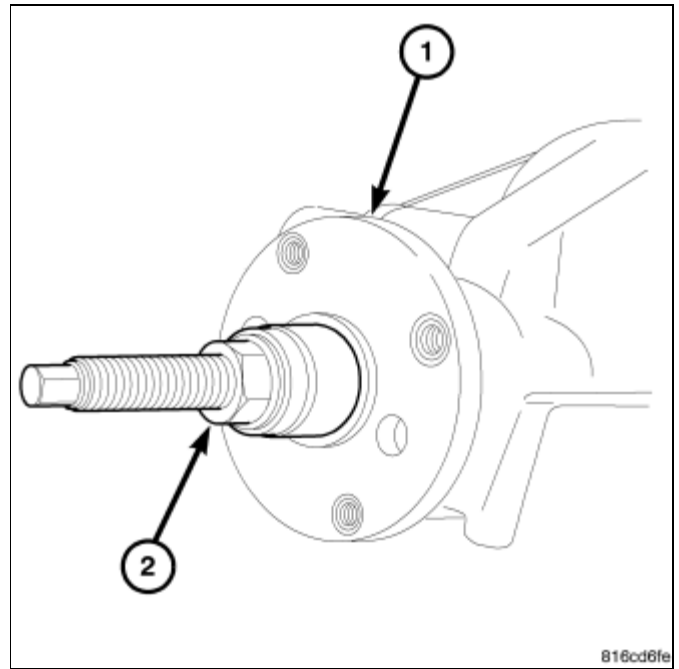
INSTALLATION



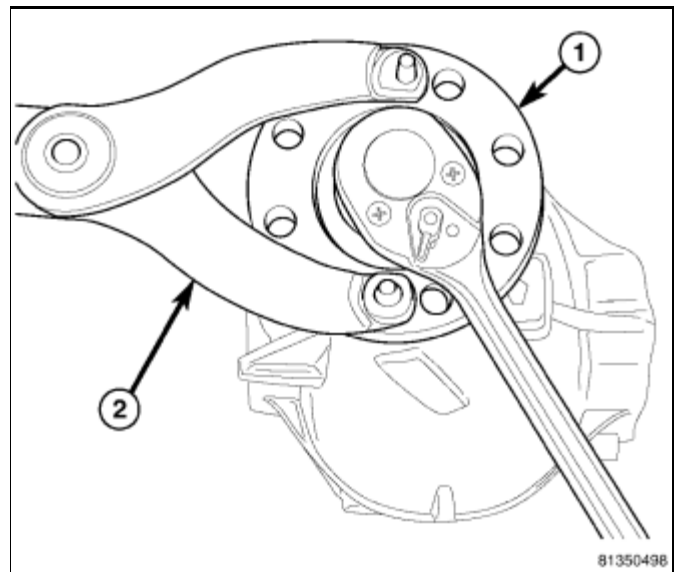
1. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer 8681 (1) and Handle C-4171 (2).



2. Install flange on the pinion shaft with the reference marks aligned.
3. Install flange (1) with Installer 8112 (2) and Cup 8109.



4. Install **new** pinion nut.
5. Hold pinion flange (1) with Flange Wrench C-3281 (2) and tighten pinion nut to 217 N·m (160 ft. lbs.).

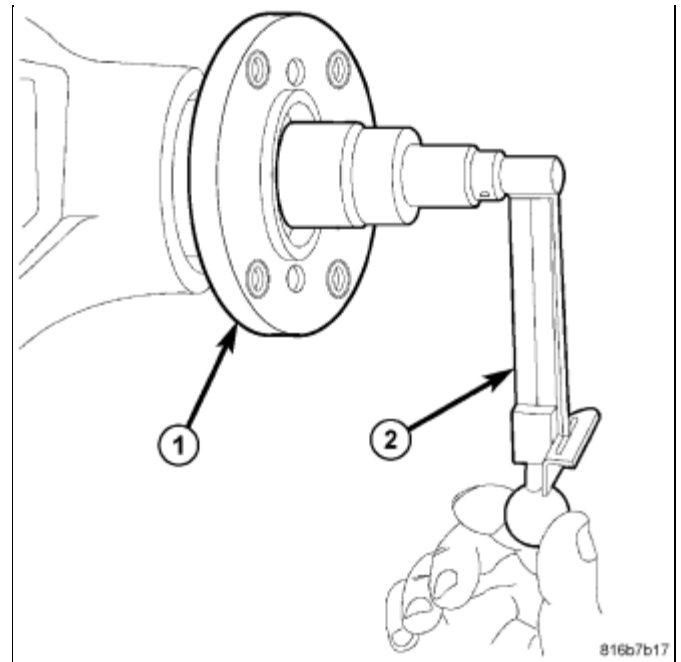


6. Measure pinion torque to rotating (1) with an inch pound torque wrench (2). With a torque wrench set at 542 N·m (400 ft. lbs.) tighten nut in 6.8 N·m (5 ft. lbs.) increments until pinion torque to rotating is achieved. Pinion torque to rotating is, the recorded reading plus an additional 0.56 N·m (5 in. lbs.).

CAUTION: If maximum tightening torque of 542 N·m (400 ft. lbs.) is reached before torque to rotate is achieved, the collapsible spacer may have been damaged. Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. Failure to follow

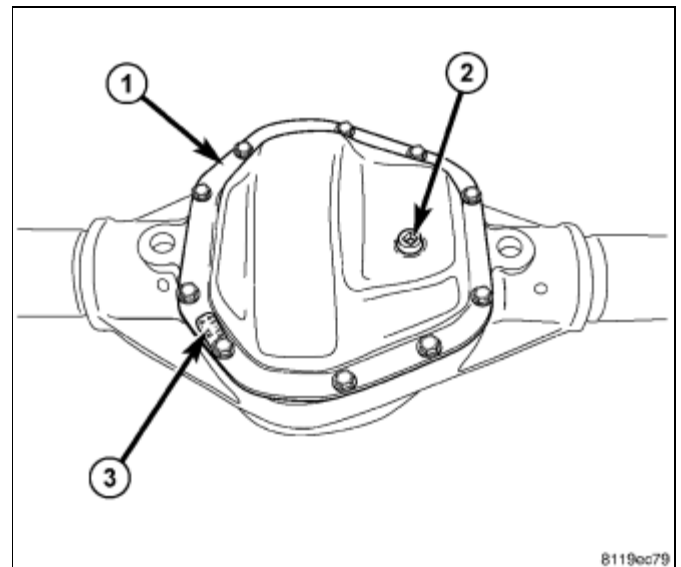
these instruction may result in damage.

7. Install propeller shaft.
8. Install brake components.

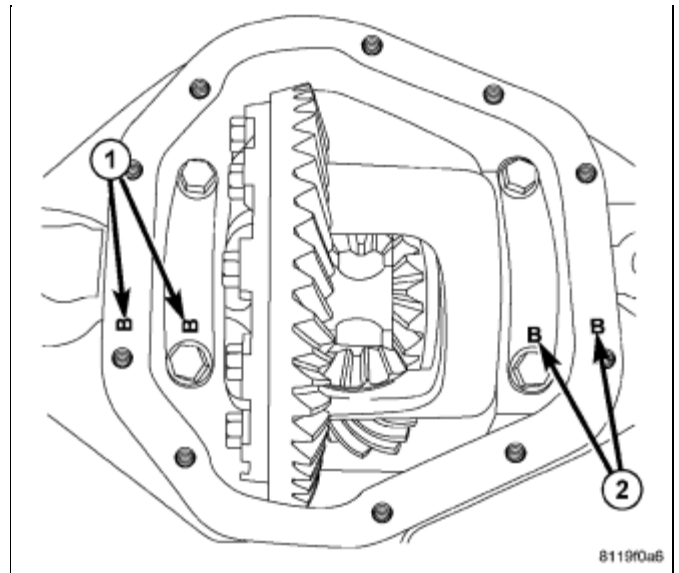


DIFFERENTIAL REMOVAL

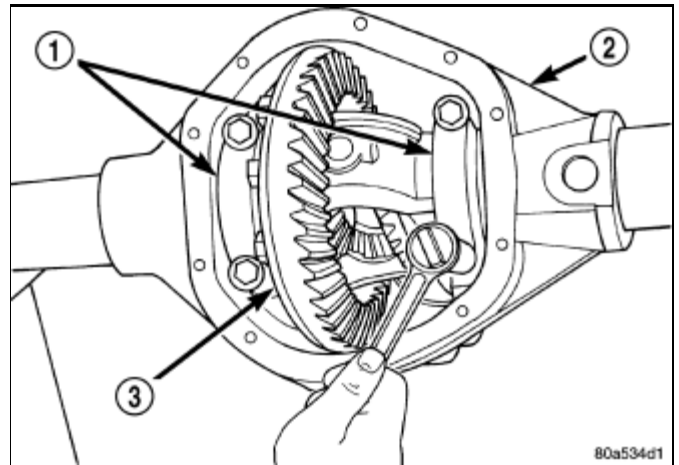
1. Remove differential fill plug (2).
2. Remove differential cover (1) and drain fluid.
3. Remove axle shafts.



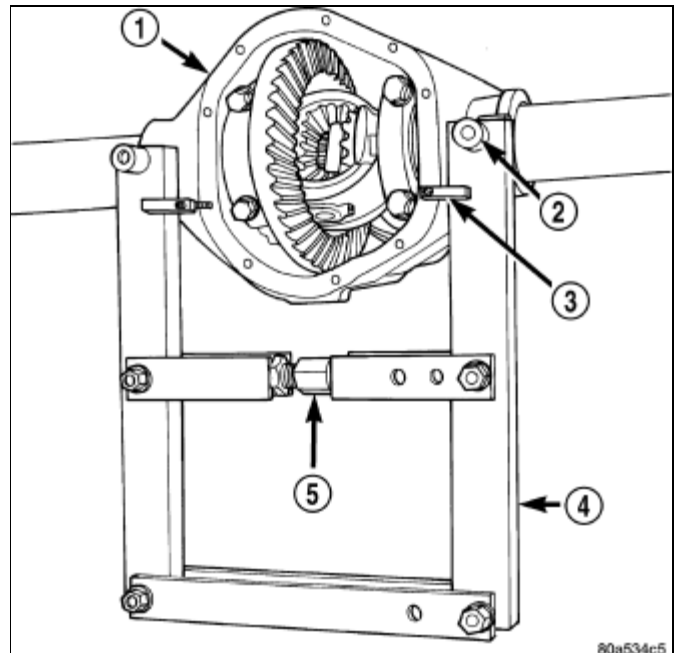
4. Note reference letters stamped (1,2) on the bearing caps and housing machined sealing surface.



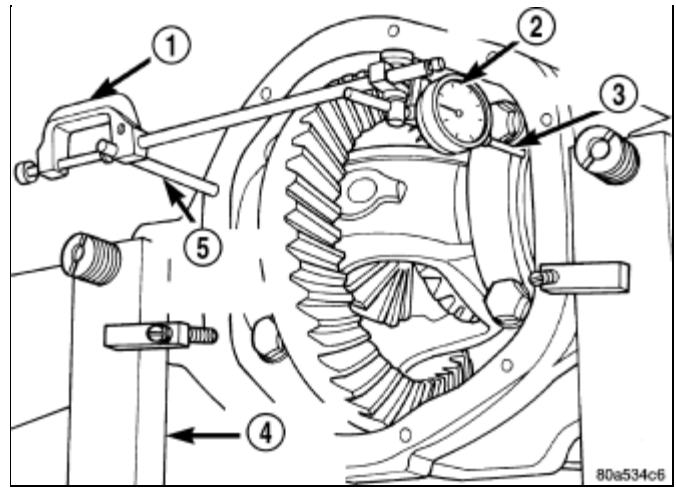
5. Loosen differential bearing cap (1) bolts.



6. Position Spreader W-129-B (4) with Adapter Kit 6987B (2) on differential locating holes. Install hold-down clamps (3) and tighten the turnbuckle (5) finger-tight.

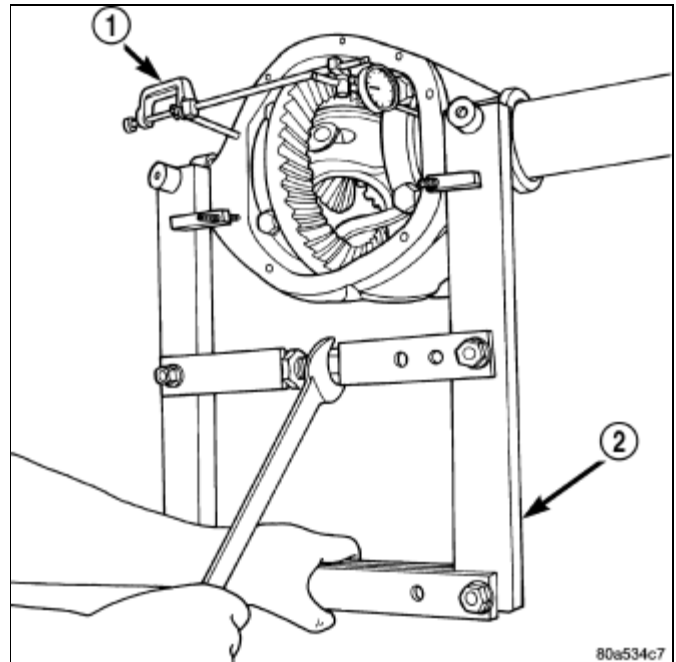


7. Install a Pin C-3288-B (5) at the left side of the differential housing. Attach Dial Indicator C-3339A (2) to pin. Load indicator plunger against the opposite side of the housing and zero the indicator.



8. Spread housing while measuring the distance with the dial indicator (1).

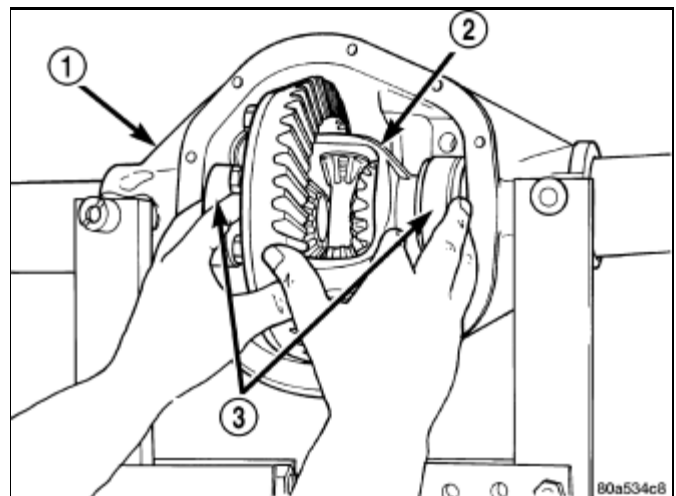
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.



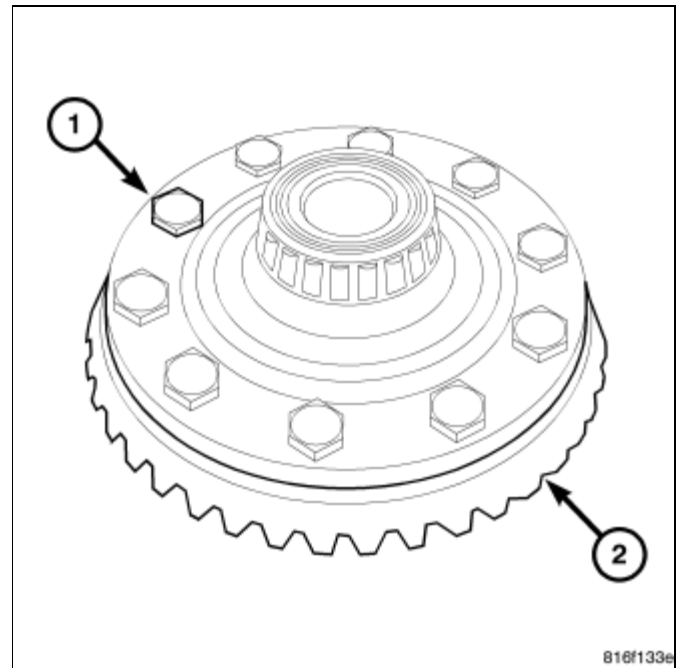
9. Remove dial indicator.
10. Holding differential case (2) in position, remove differential bearing caps.
11. Remove differential case (2) from housing (1) and tag differential bearing cups (3) and shims location.
12. Remove spreader from housing.
13. Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

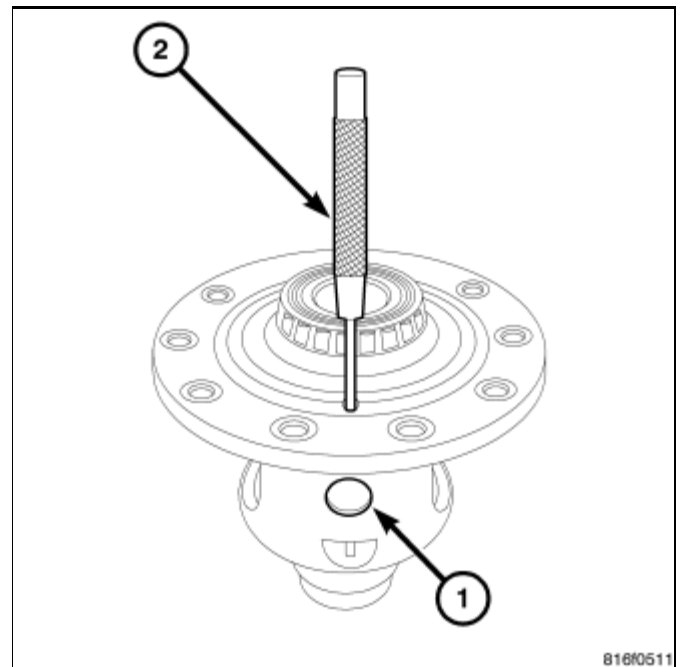
DISASSEMBLY



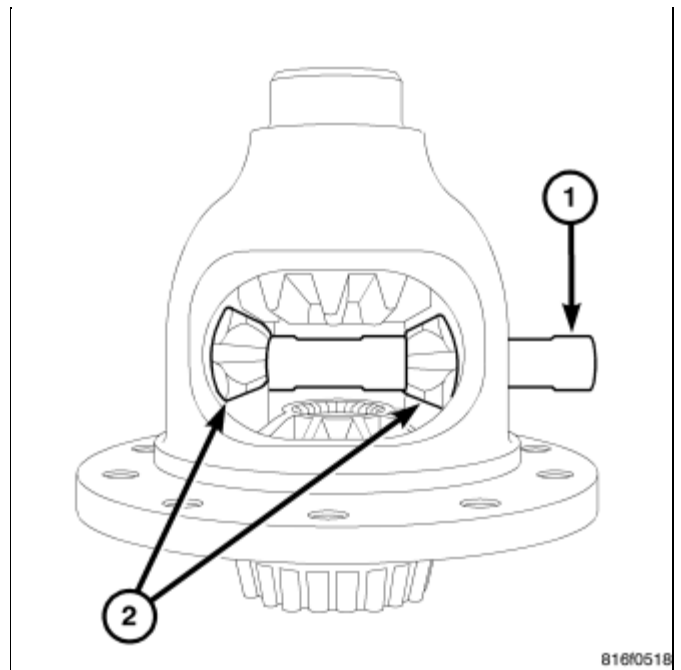
1. Remove ring gear bolts (1) and ring gear (2) from differential.



2. Remove pinion mate shaft (1) roll pin with a punch (2) and hammer.

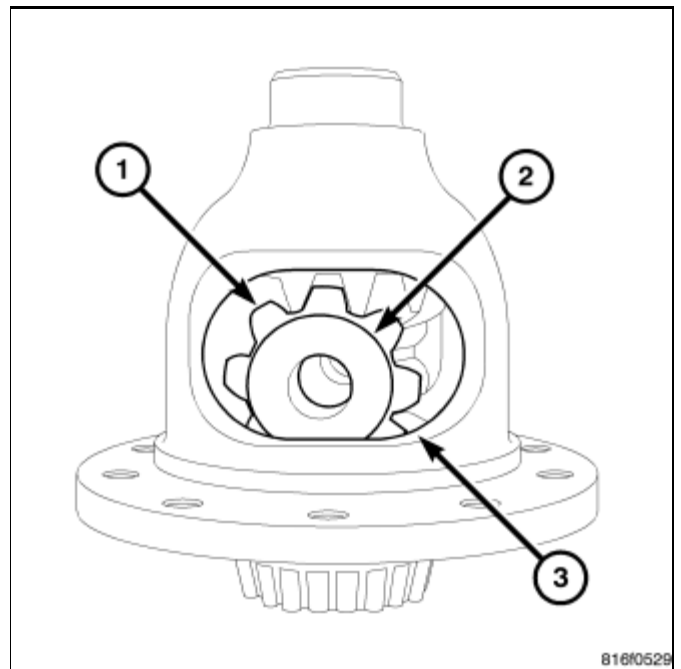


3. Remove pinion mate shaft (1) from differential and pinion gears (2).

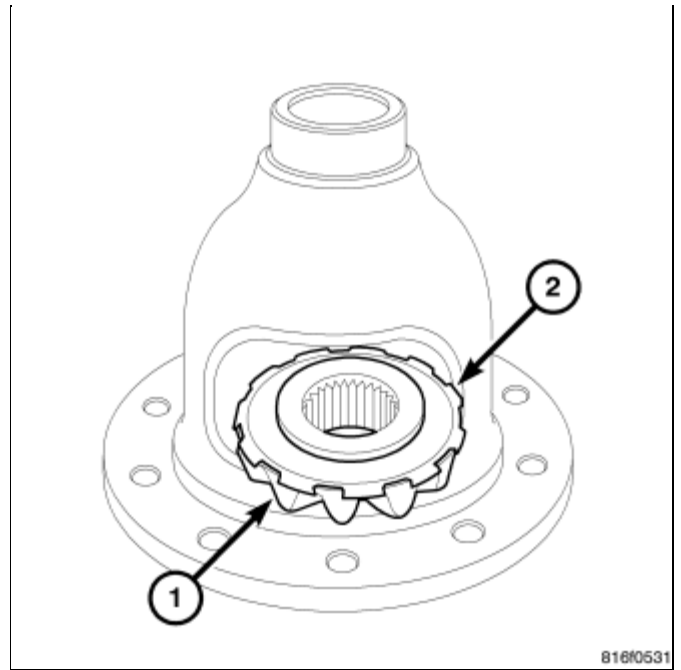


4. Rotate pinion gears (1) with thrust washers (2) to differential windows (3).

5. Remove pinion gears (1) with thrust washers (2) through differential windows (3).

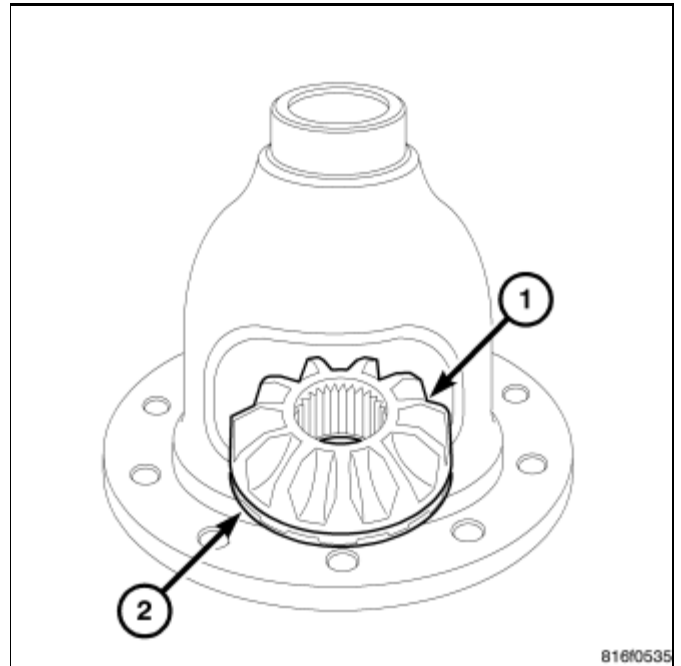


6. Remove first side gear (1) with thrust washer (2) through differential window.



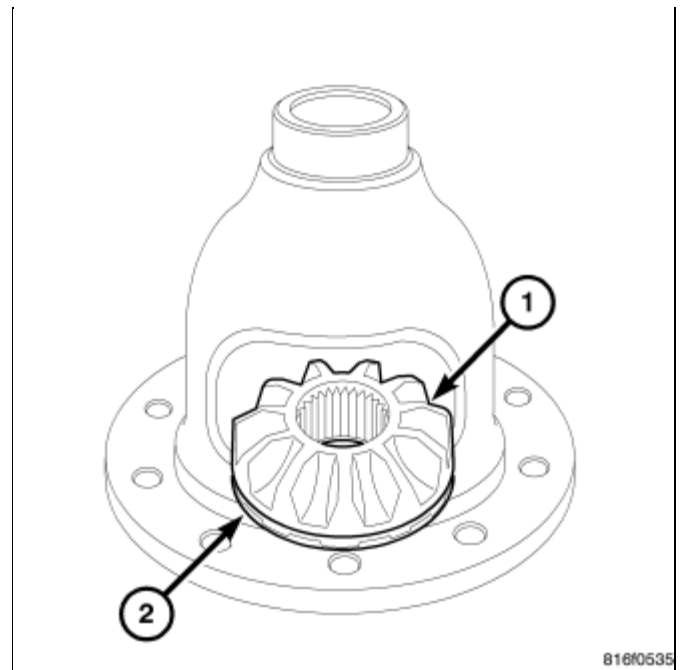
7. Remove second side gear (1) with thrust washer (2) through differential window.

ASSEMBLY

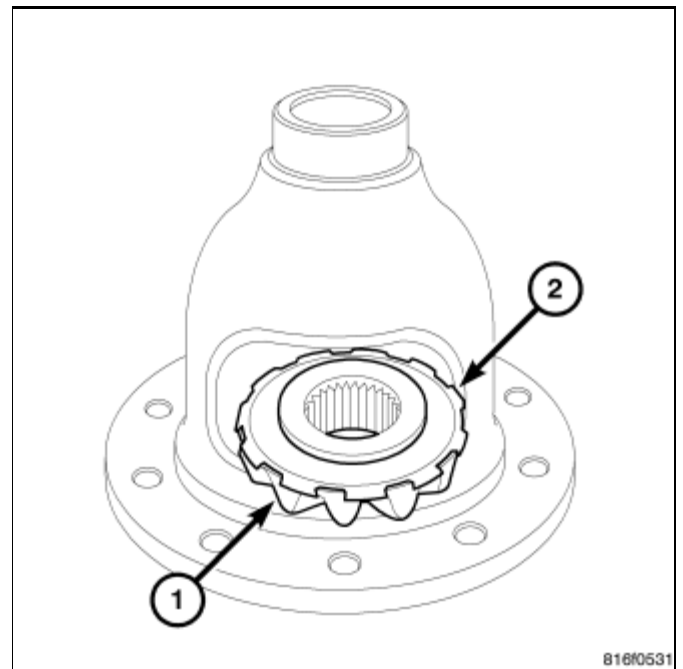


NOTE: If same gears and thrust washers are being used, install them into their original locations.

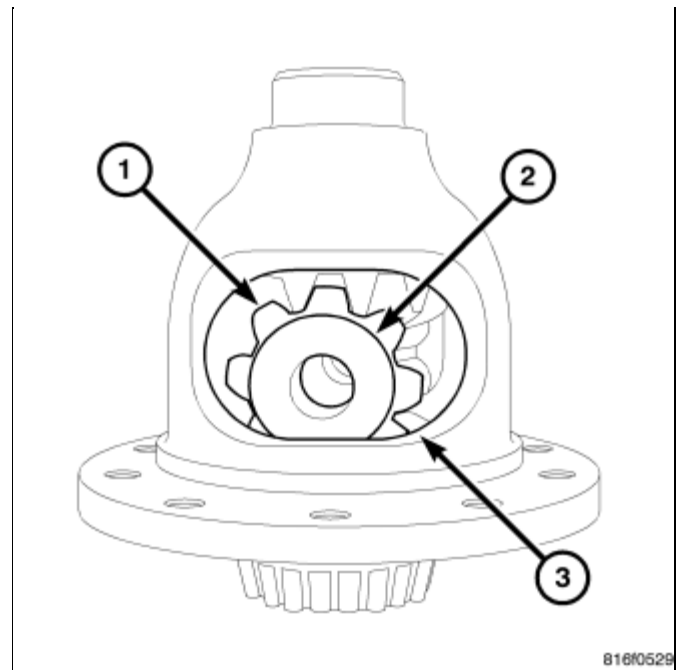
1. Lubricate all differential components with axle lubricant.
2. Install first side gear (1) with thrust washer (2) through differential window.



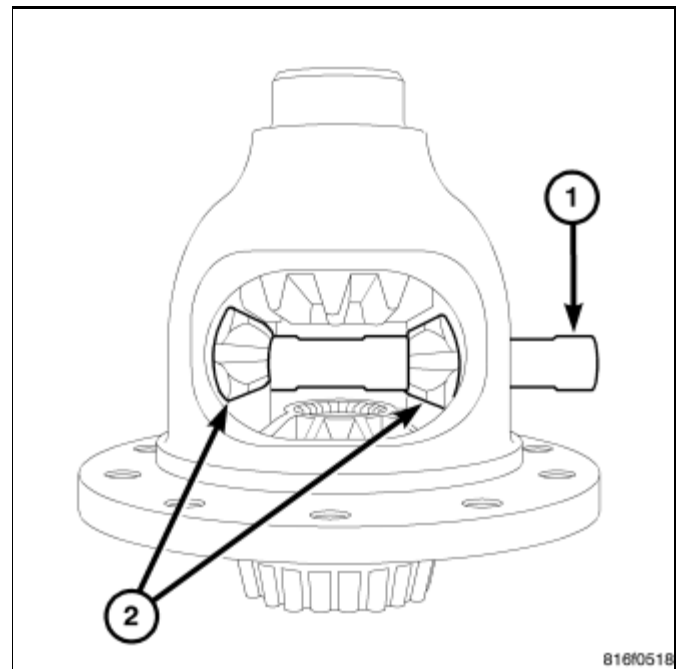
3. Install second side gear (1) with thrust washer (2) through differential window.



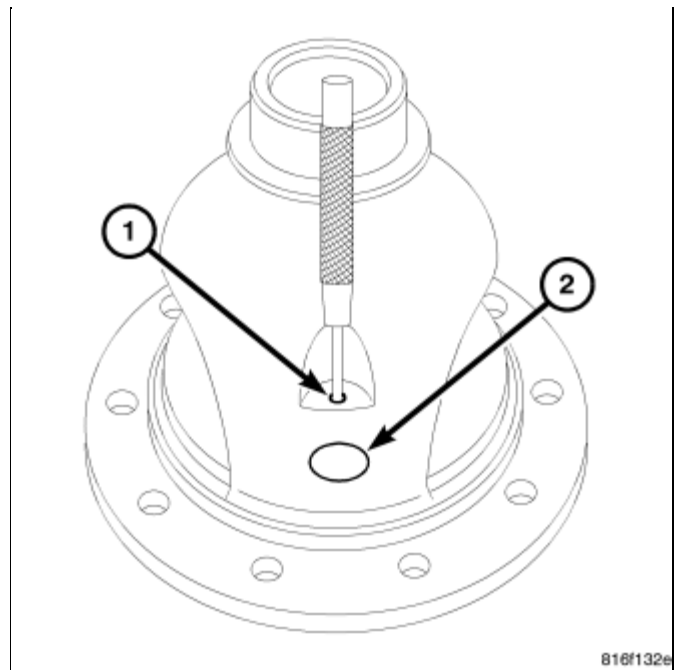
4. Install pinion gears (1) with thrust washers (2) through differential windows (3).
5. Rotate pinion gears (1) with thrust washers (2) and align gears to pinion mate shaft hole.



6. Install pinion mate shaft (1) in differential and pinion gears (2).

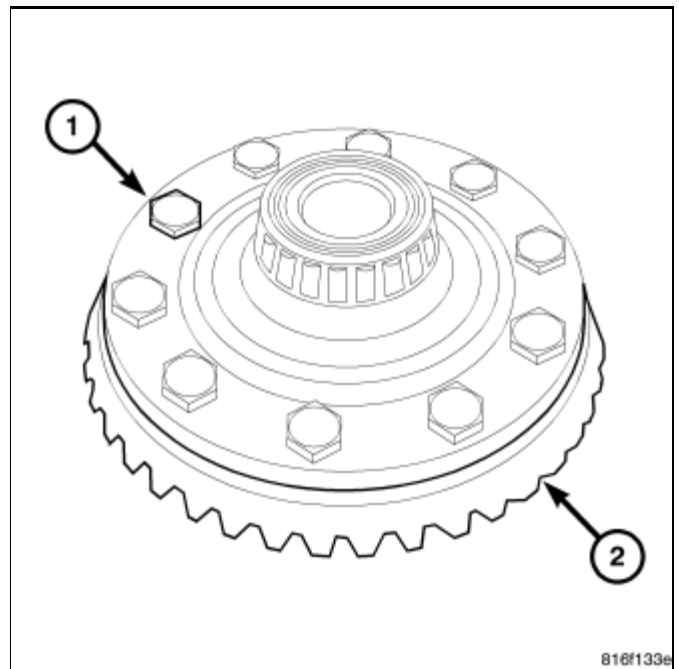


7. Install pinion mate shaft (2) roll pin (1).



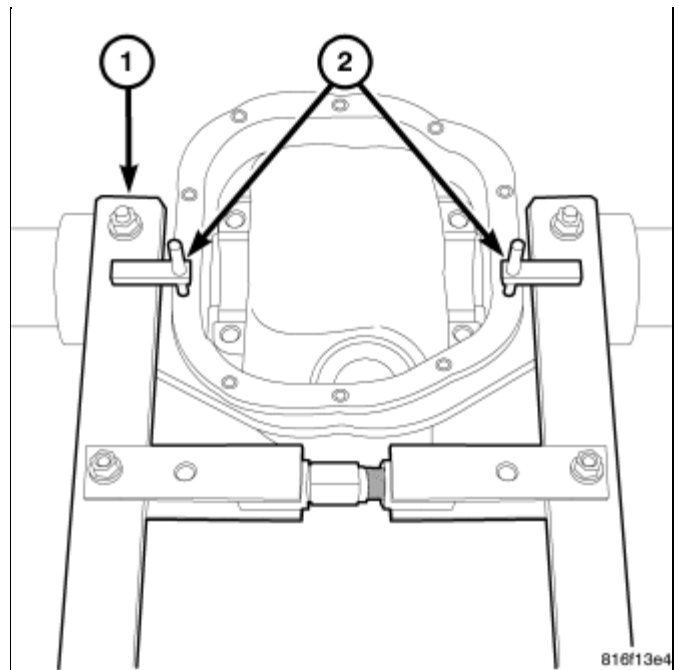
8. Install ring gear (2) and bolts (1) on differential.

INSTALLATION



NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer **Adjustments (Differential Bearing Preload and Gear Backlash)** to determine the proper shim selection.

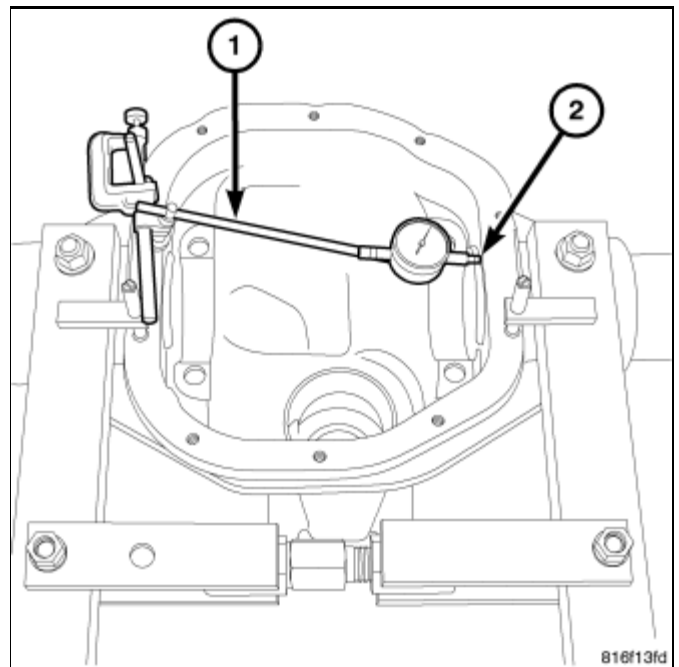
1. Position Spreader W-129-B (1) and with dowel pins from Adapter Kit 6987B seated in housing locating holes. Install hold-down clamps (2) and tighten turnbuckle finger-tight.



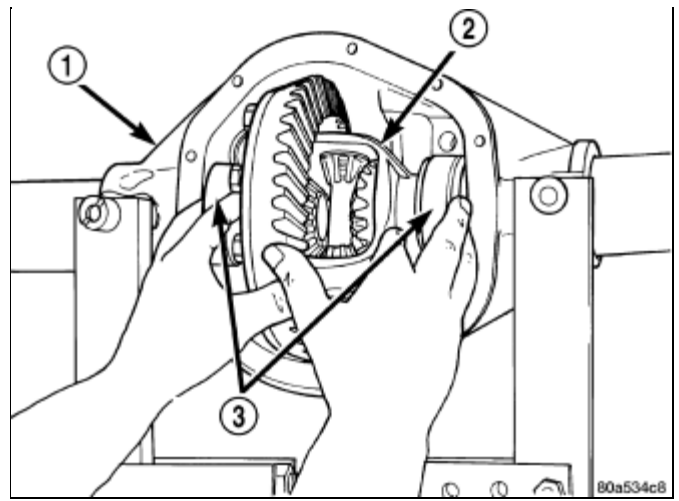
2. Install Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339A (1) to pin. Load the indicator plunger (2) against the opposite side of the housing and zero the indicator.
3. Spread the housing while measuring the distance with the dial indicator.

CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

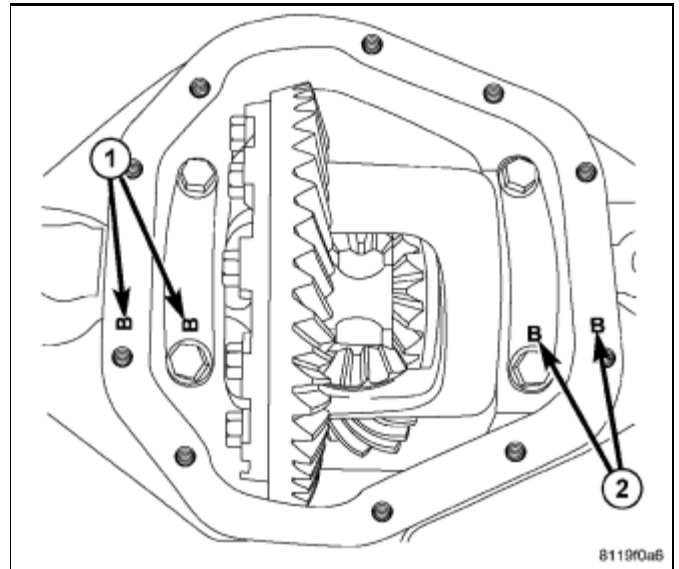
4. Remove the dial indicator.



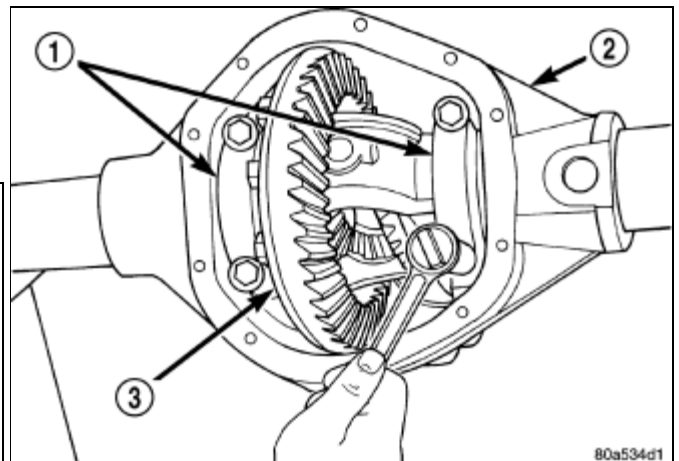
5. Install differential case (2) into the housing (1) with bearing cups (3) and preload shims. Tap the differential case to ensure the bearings cups (3) are seated in the housing.



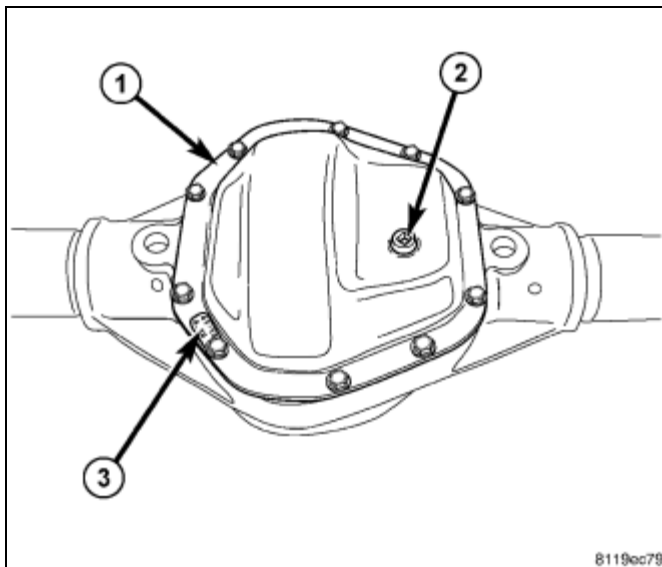
6. Install bearing caps with reference marks (1,2) in their original locations.
7. Loosely install differential bearing cap bolts.
8. Remove axle housing spreader.



9. Tighten bearing cap (1) bolts to 61 N·m (45 ft. lbs.).



- 10.



Install axle shafts.

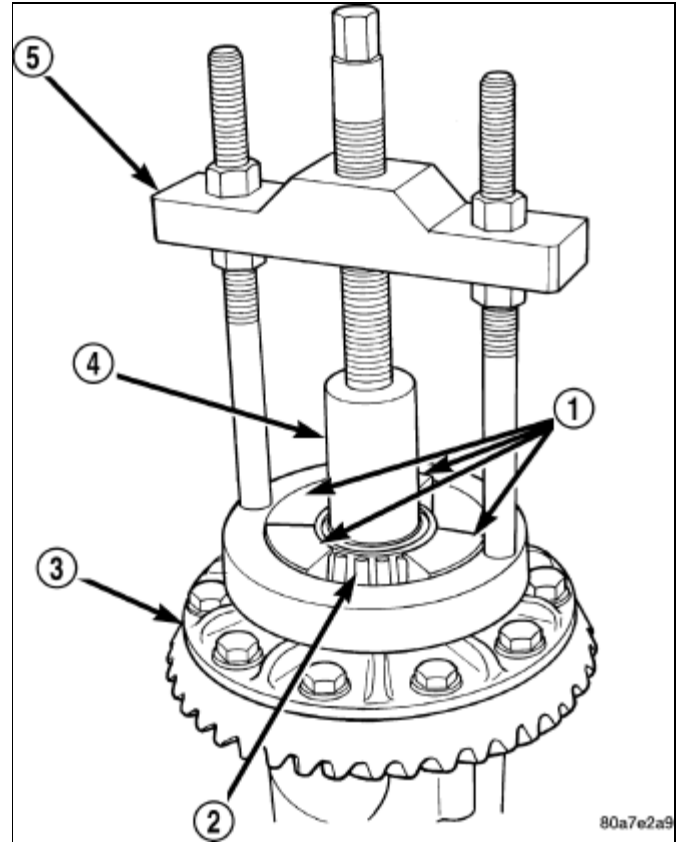
11. Install differential cover (1).

BEARINGS-DIFFERENTIAL CASE

REMOVAL

1. Remove bearings (2) from the differential case (3) with Puller C-293-PA (5) Adapter C-293-39 (1) and Plug SP-3289 (4).

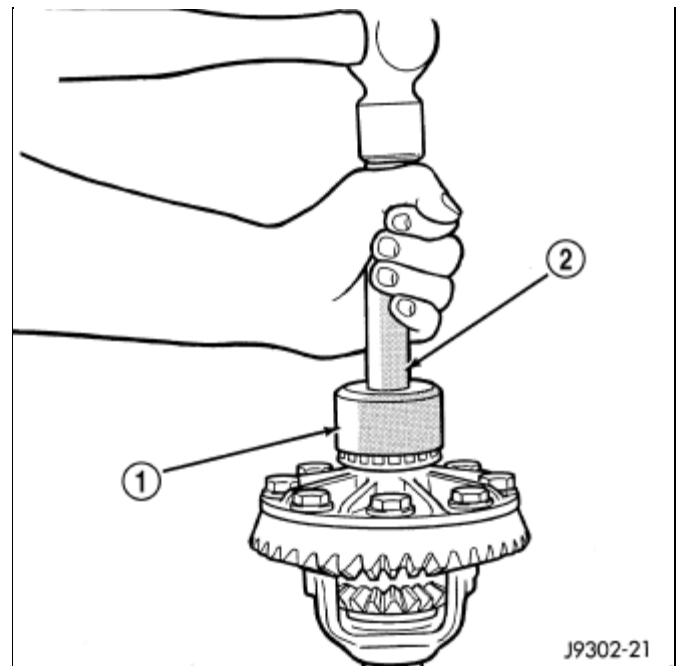
INSTALLATION



1. Install differential side bearings with Installer C-3716-A (1) and Handle C-4171 (2).

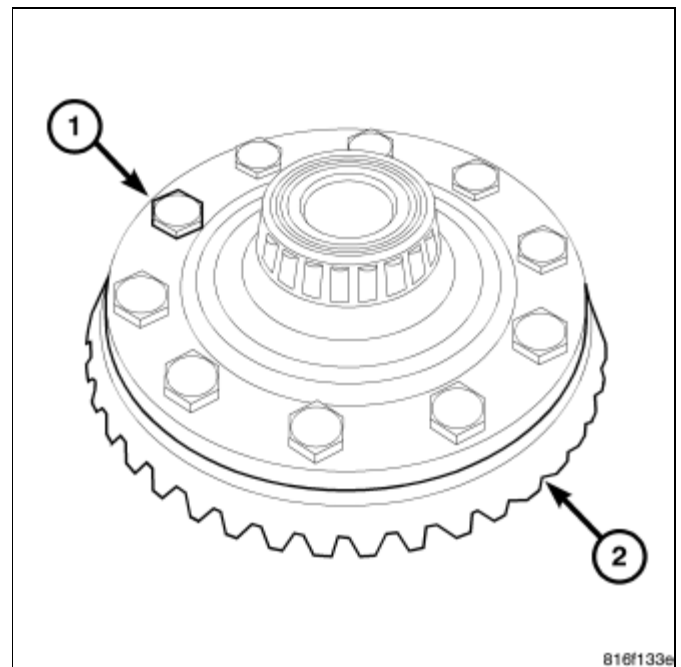
GEAR-PINION/RING

REMOVAL

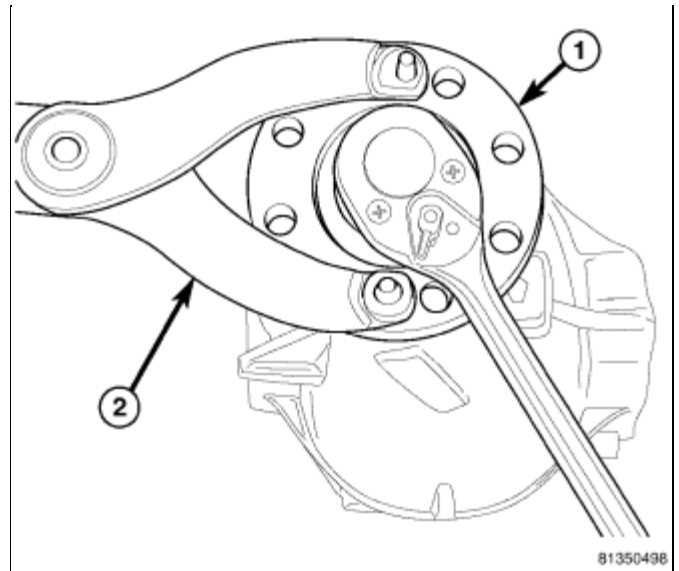


NOTE: The ring and pinion gears are serviced as a matched set. Never replace one gear without replacing the other matched gear.

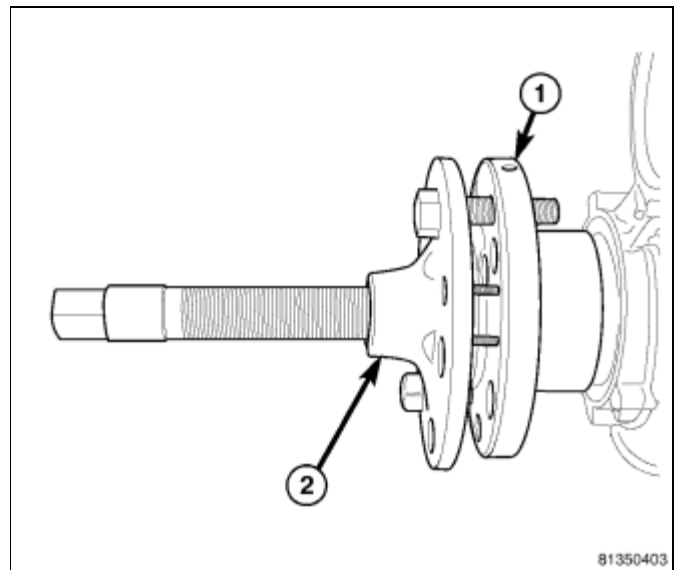
1. Remove differential from axle housing.
2. Remove ring gear bolts (1) and remove ring gear (2) from differential case.



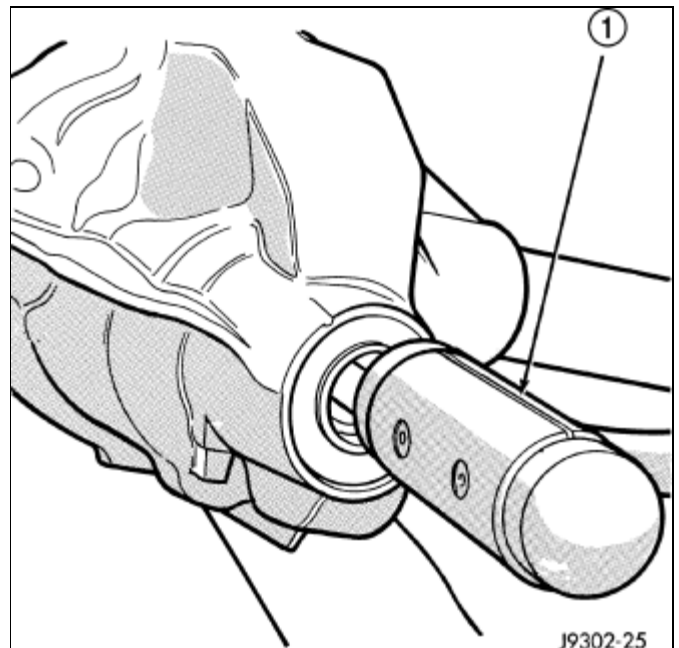
3. Hold pinion flange (1) with Flange Wrench C-3281 (2) and remove the pinion nut.



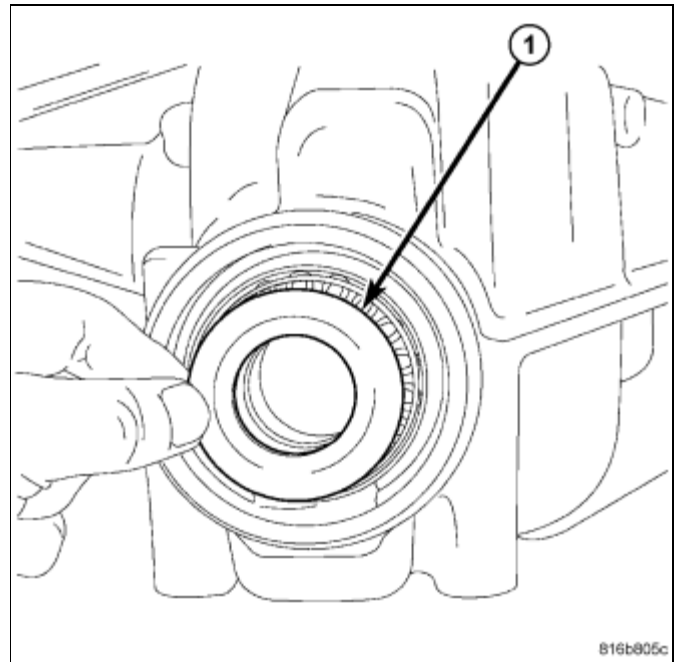
4. Remove pinion flange (1) with Puller C-452 (2).



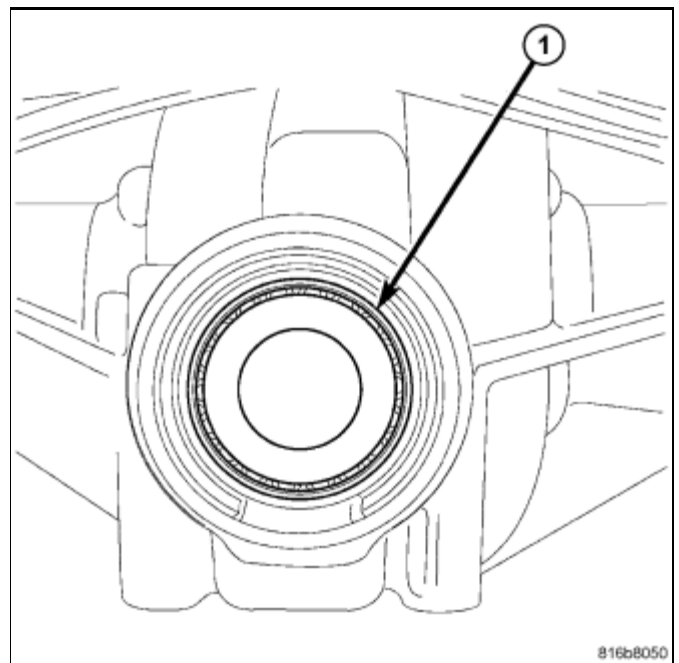
5. Drive pinion out of the housing with a dead blow hammer (1).



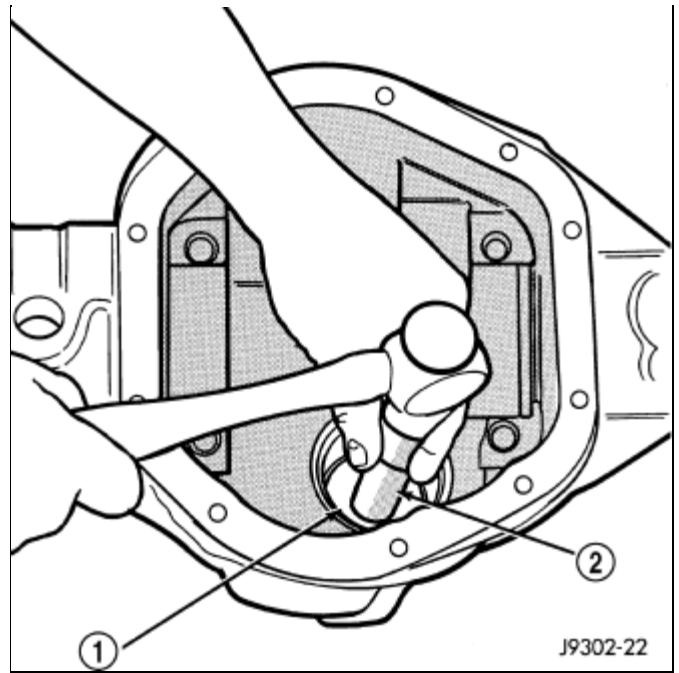
6. Remove pinion seal with seal puller.
7. Remove oil slinger (1).



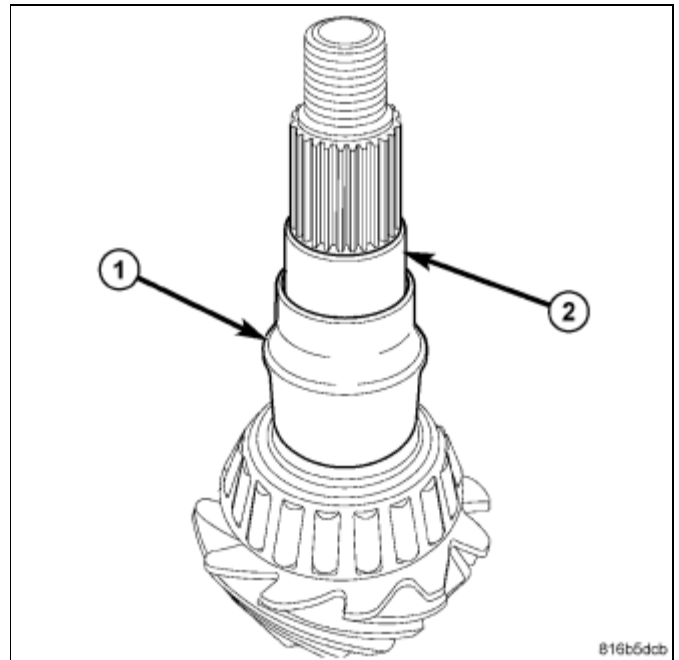
8. Remove front bearing (1).



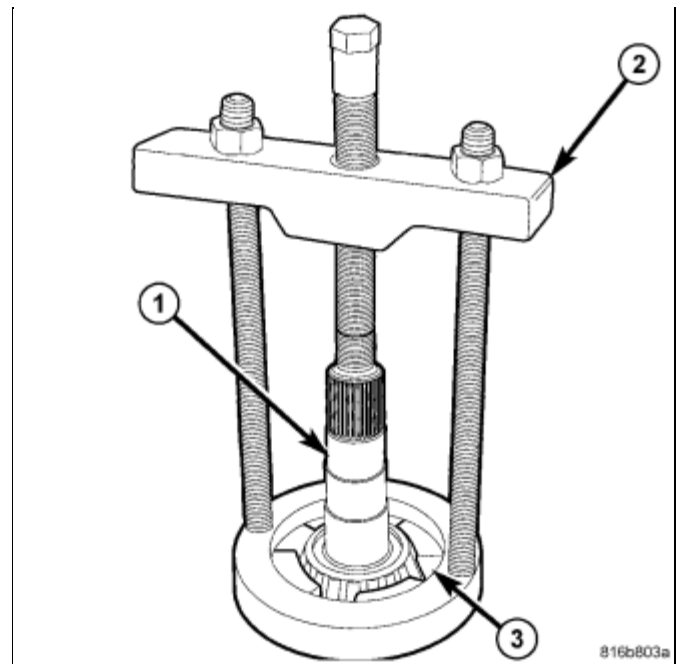
9. Remove front pinion bearing cup with Remover D-149 (1) and Handle C-4171 (2).
10. Remove rear pinion bearing cup and oil baffle with a hammer and brass drift.



11. Remove collapsible spacer (1) from pinion shaft (2).

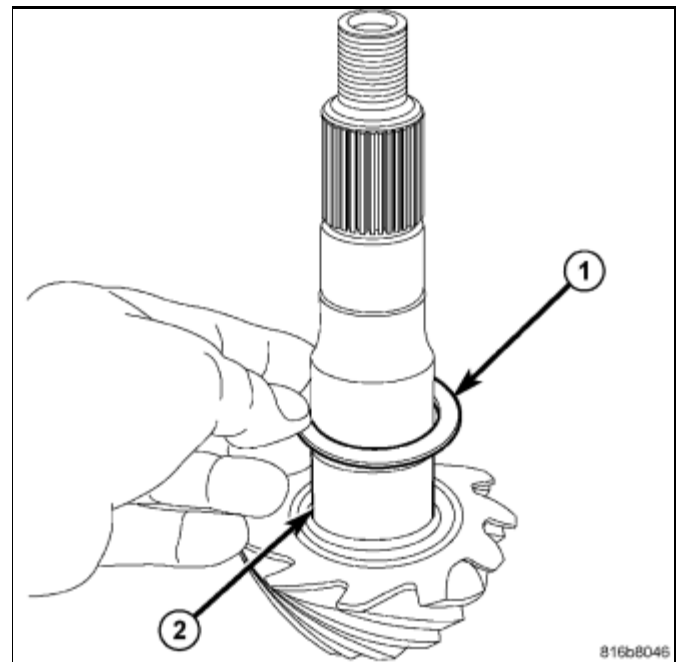


12. Remove rear pinion bearing from pinion shaft (1) with Puller C-293-PA (2) and Adapters C-293-48 (3).

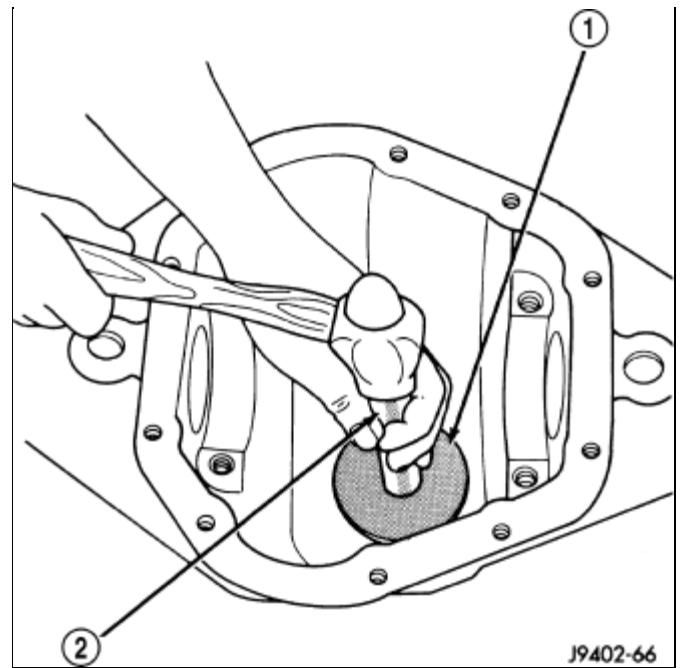


13. Remove pinion depth shim (1) from the pinion shaft (2) and record thickness.

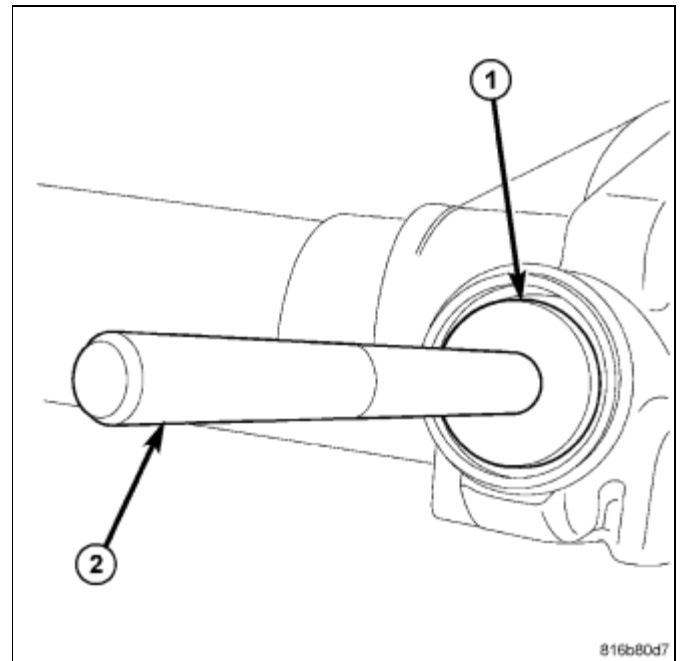
INSTALLATION



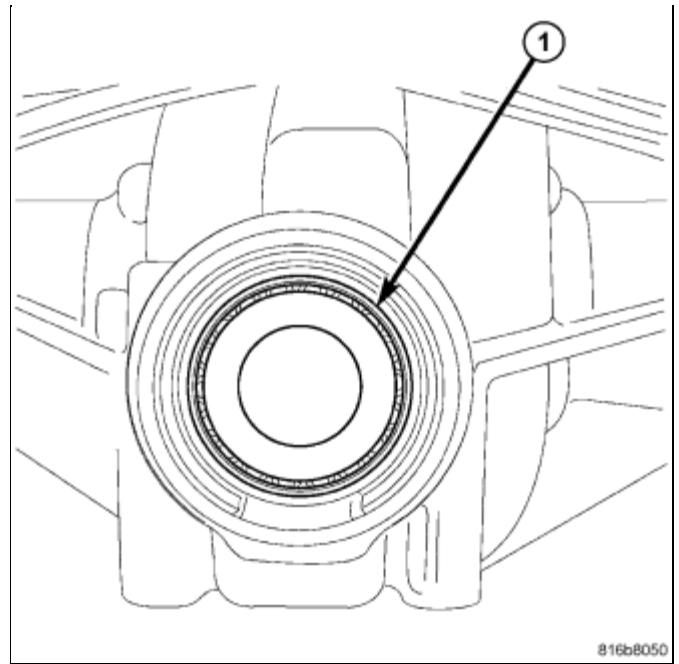
1. Install oil baffle in rear bearing cup bore then install rear bearing cup with Installer C-4308 (1) and Handle C-4171 (2).



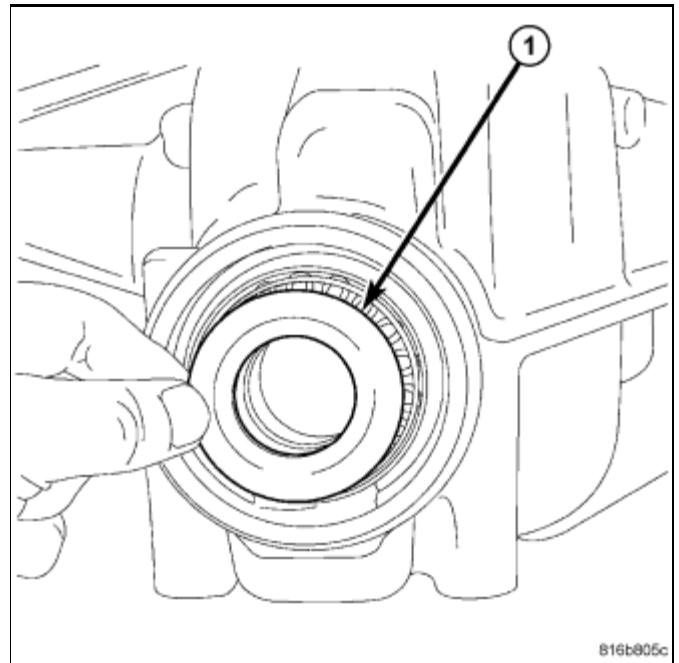
2. Install front bearing cup with Installer D-146 (1) and Handle C-4171 (2).



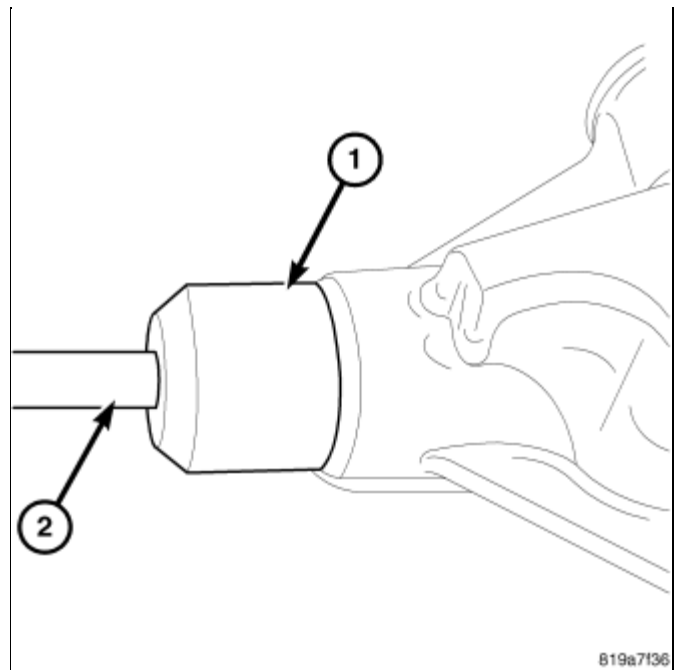
3. Install front pinion bearing (1) into the housing.



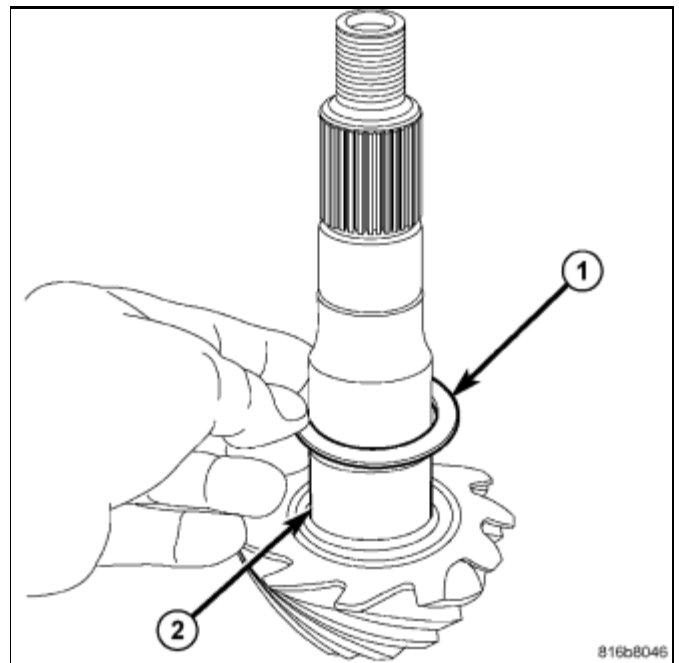
4. Install front pinion bearing oil slinger (1) into the housing.



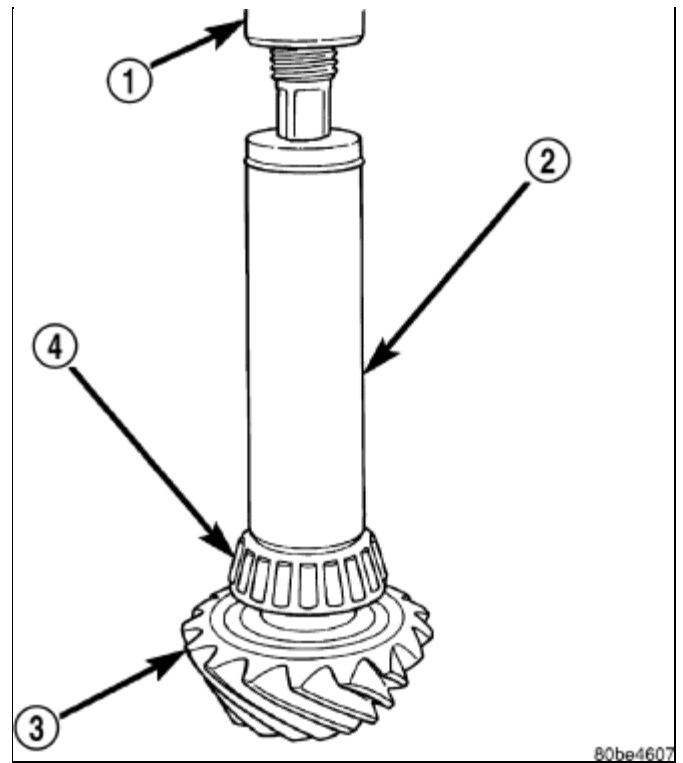
5. Apply a light coating of gear lubricant on pinion seal lip and install seal with Installer 8681 (1) and Handle C-4171 (2).



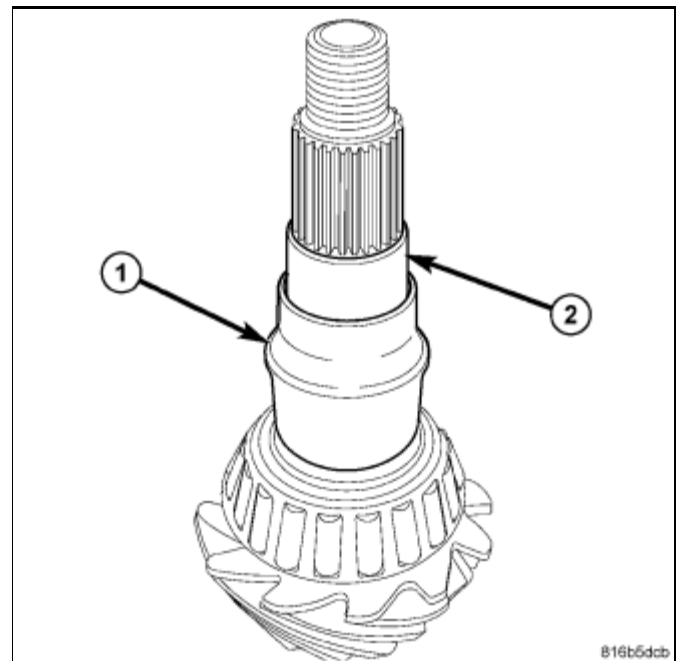
6. Install pinion depth shim (1) on pinion shaft (2).



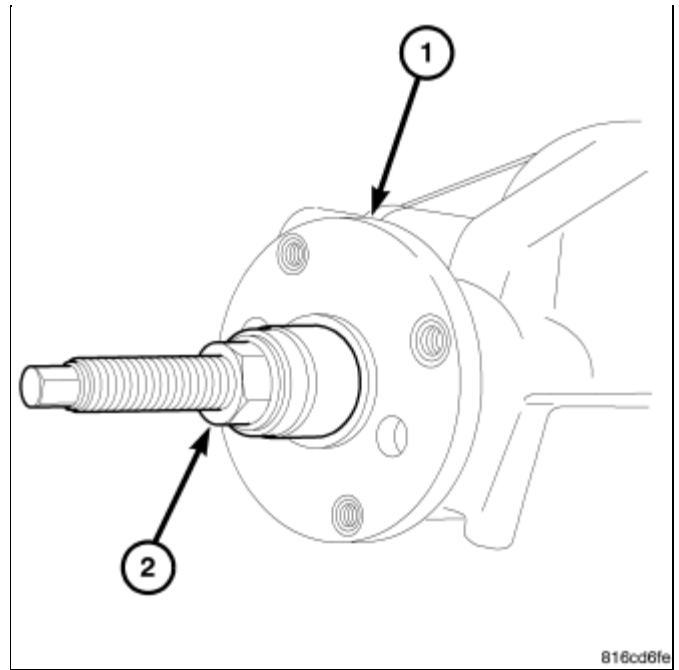
7. Install rear pinion bearing (4) on pinion gear (3) with Installer C-4040 (2) and a press (1).



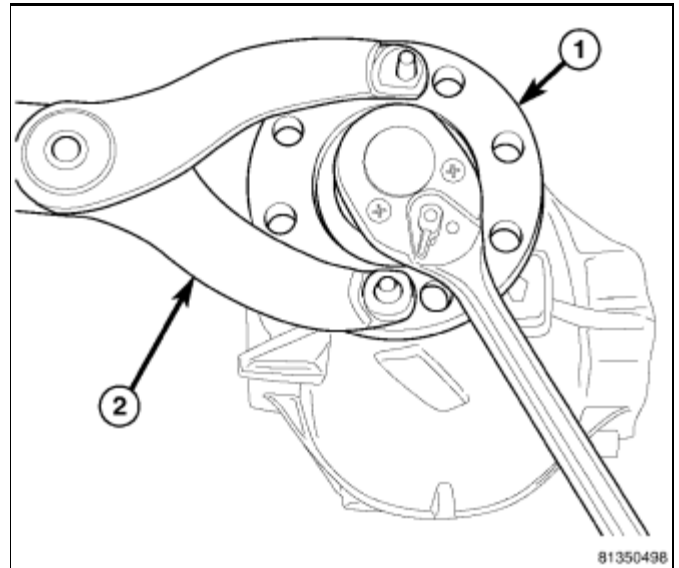
8. Install **new** collapsible spacer (1) on pinion shaft (2) and install pinion into the housing.



9. Install pinion flange (1) with Installer 8112 (2) and Cup 8109.



10. Install **new** pinion nut.
11. With Flange Wrench C-3281 (2) and torque wrench tighten pinion nut to 217 N·m (160 ft. lbs.).

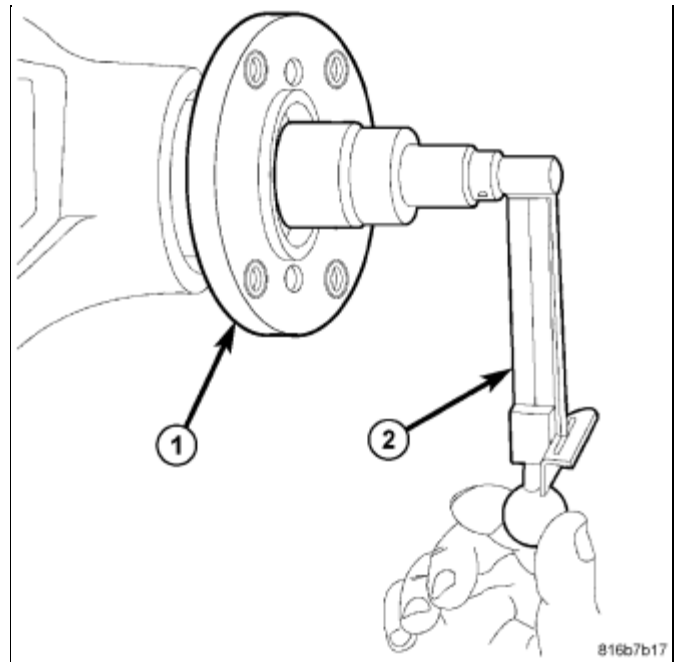


12. Using Flange Wrench C-3281 and torque wrench set at 542 N·m (400 ft. lbs.). Slowly tighten the nut in 6.8 N·m (5 ft. lb.) increments until the pinion torque to rotate is achieved. Measure pinion (1) torque to rotate with an inch pound torque wrench (2) frequently to avoid over crushing the collapsible spacer.

Pinion Torque To Rotate (PTTR) is:

- **Original Bearings:** 1.13 - 2.26 N·m (10 - 20 in. lbs.).
- **New Bearings:** 1.7 - 3.4 N·m (15 - 30 in. lbs.).

CAUTION: If more than 542 N·m (400 ft. lbs.) torque is required to crush the collapsible spacer,

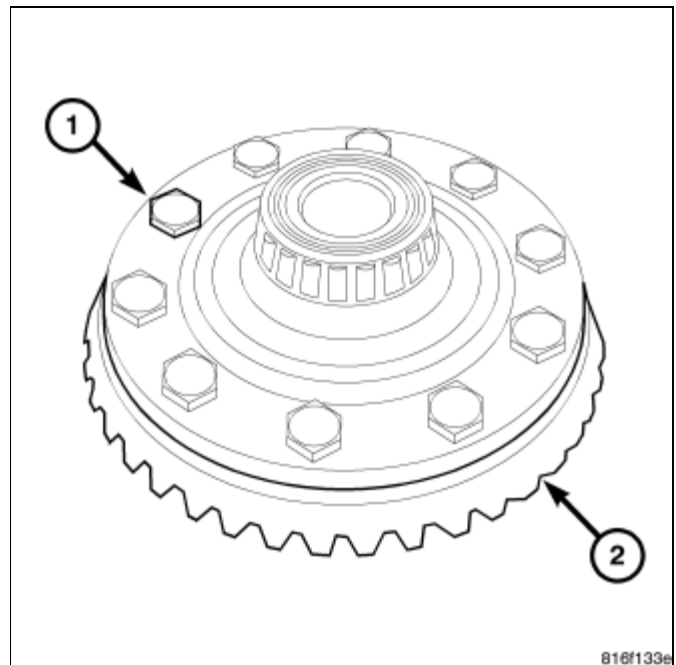


the spacer is defective and must be replaced. Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. Failure to follow these instructions may result in damage.

13. Install ring gear with **new** ring gear bolts (1) and alternately tighten to 108 N·m (80 ft. lbs.).

CAUTION: Never reuse ring gear bolts. Failure to follow these instructions may result in damage.

14. Install differential case in to axle housing.



15. Measure differential Total Torque To Rotate (TTTR) with an inch pound torque wrench (2) before installing the axle shafts. This will verify differential bearing preload.

Total Torque To Rotate is: Pinion Torque To Rotate (PTTR) plus 0.79 - 1.24 N·m (7 - 11 in lbs.).

NOTE: If TTTR is too high, decrease shim

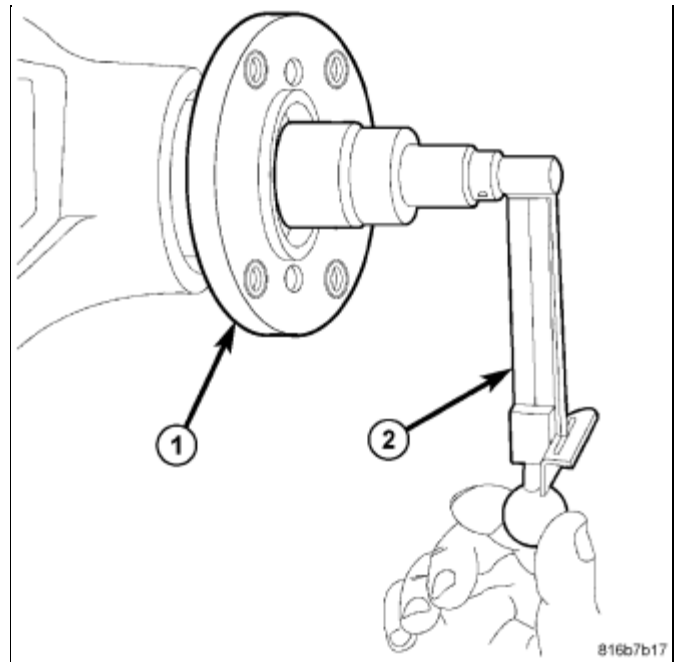
thickness equally from both sides of the differential and check TTTR again. If TTTR is too low, increase shim thickness equally to both sides of the differential and check TTTR again.

FRONT AXLE - 216FBI

FRONT AXLE - 216FBI

DIAGNOSIS AND TESTING

FRONT AXLE - 216FBI



GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint/CV or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joint or CV.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front end components or engine/transmission mounts. These components can contribute to what appears to be a rear end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged) can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or CV.
- Loose spring mounts.

- Loose pinion gear nut and flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive ring and pinion gear backlash.	4. Check and adjustment ring and pinion gear backlash.
	5. Improper pinion bearing adjustments.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion flange nut.	6. Tighten pinion flange nut to specifications.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace broken shaft after correcting tube mis-alignment.
	2. Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper differential bearing adjustment.	1. Replace case, inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.

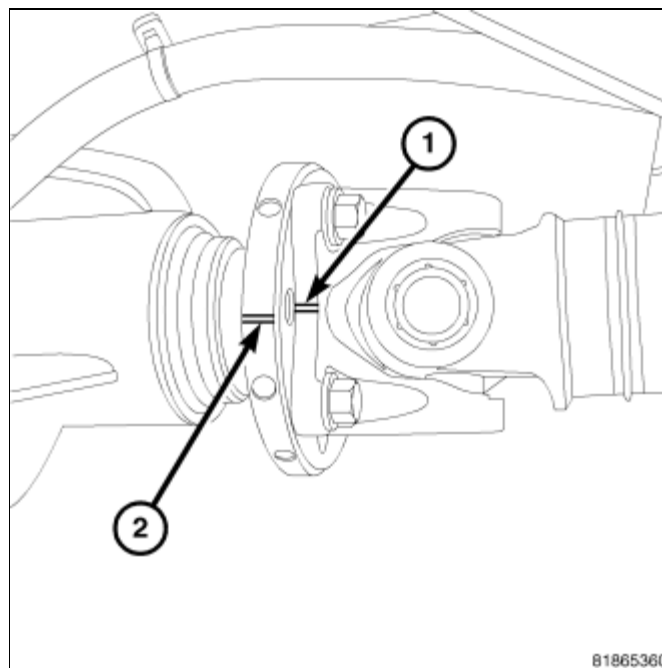
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored flange.	5. Replace flange and seal.
	6. Differential cover not sealed.	6. Remove, clean, and seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring and pinion gear adjustment.	2. Check ring and pinion gear contact pattern.
	3. Unmatched ring gear and	3. Replace gears with a matched ring gear and pinion.

pinion.	
4. Worn teeth on ring and pinion gears.	4. Replace ring and pinion gears.
5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
6. Loose differential bearings.	6. Adjust differential bearing pre-load.
7. Loose or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure bearing caps are torqued to the proper specification.
9. Housing not machined properly.	9. Replace housing.

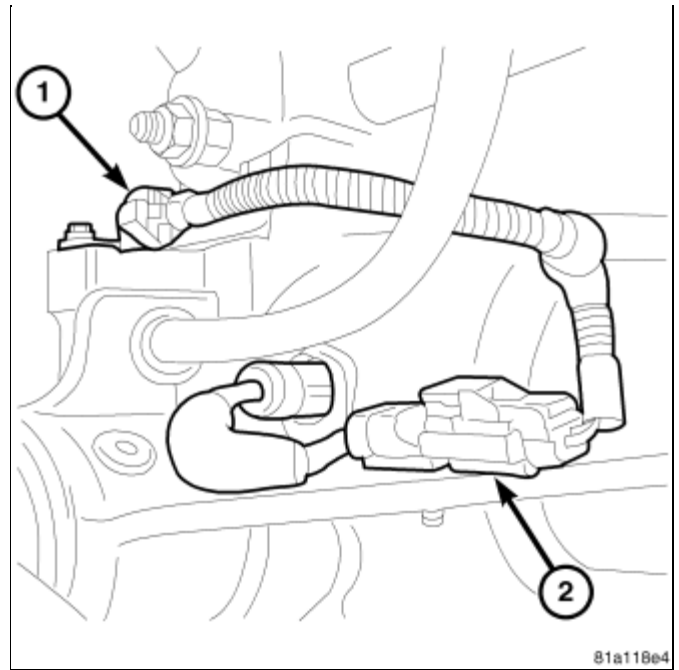
REMOVAL

NOTE: Procedure is the same for a 4x2 tube axle except for propeller shaft and axle vent removal.

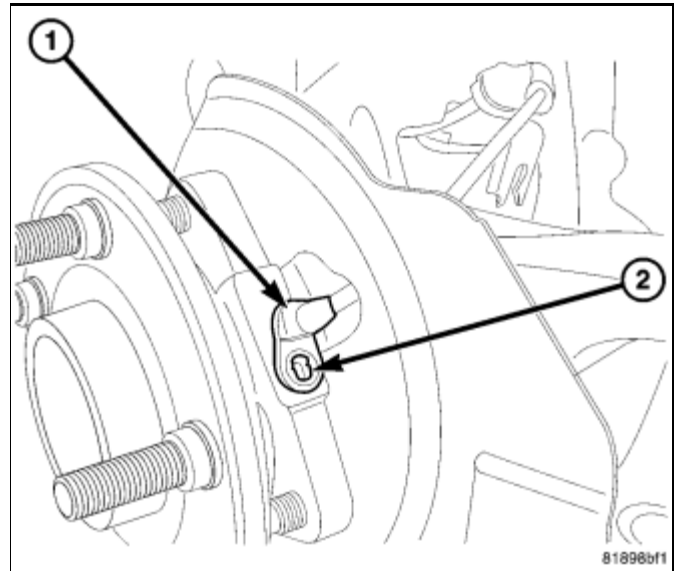
1. With transmission in neutral, position vehicle on hoist.
2. Position and secure a lift under the axle.
3. Mark an installation reference line across the front propeller shaft flange (1) and the axle flange (2).



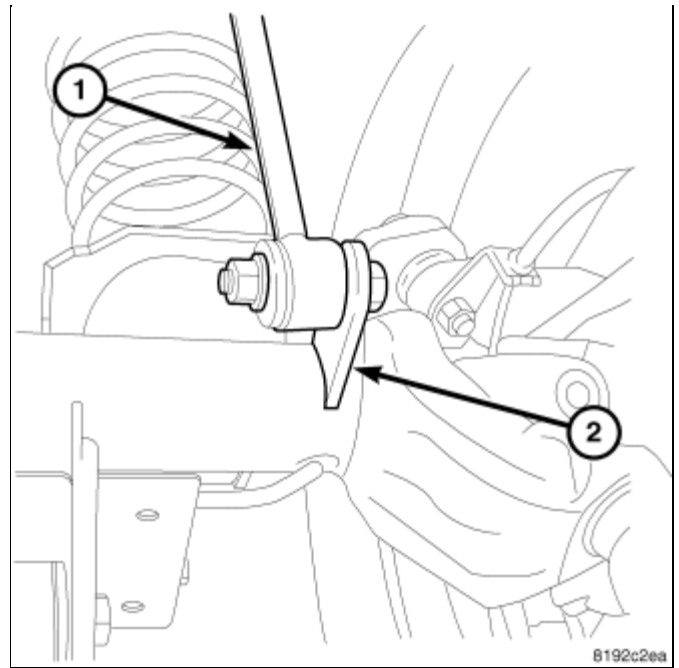
4. Disconnect Tru-Lok wiring connectors (1,2) and axle vent hose.



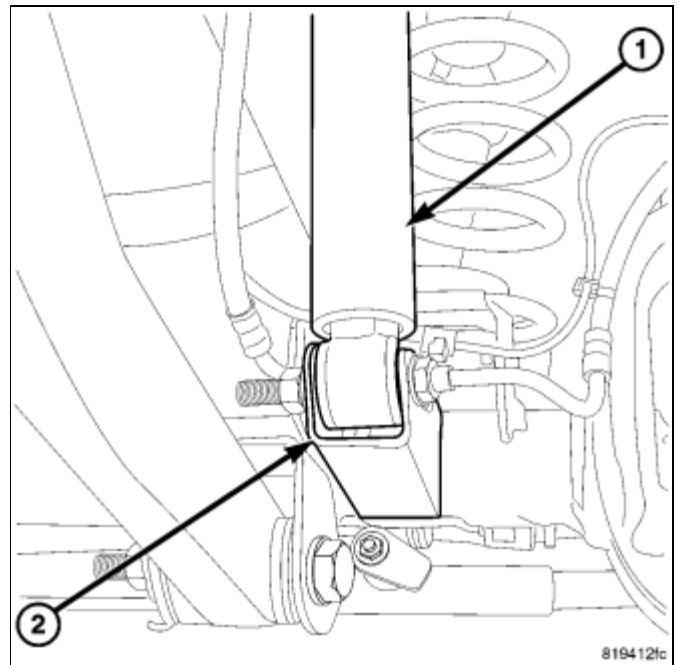
5. Remove brake calipers and rotors.
6. Remove wheel speed sensors (1) from hub bearings.
7. Remove brake lines and sensor wiring from axle.



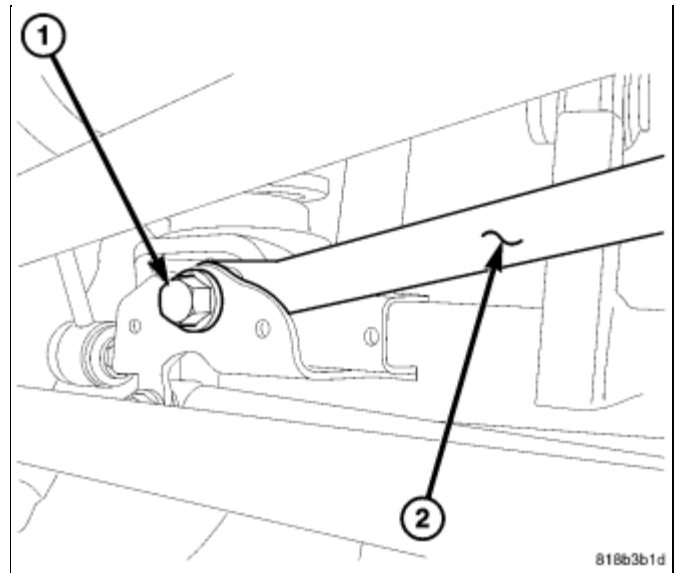
8. Remove stabilizer bar links (1) from axle brackets (2).



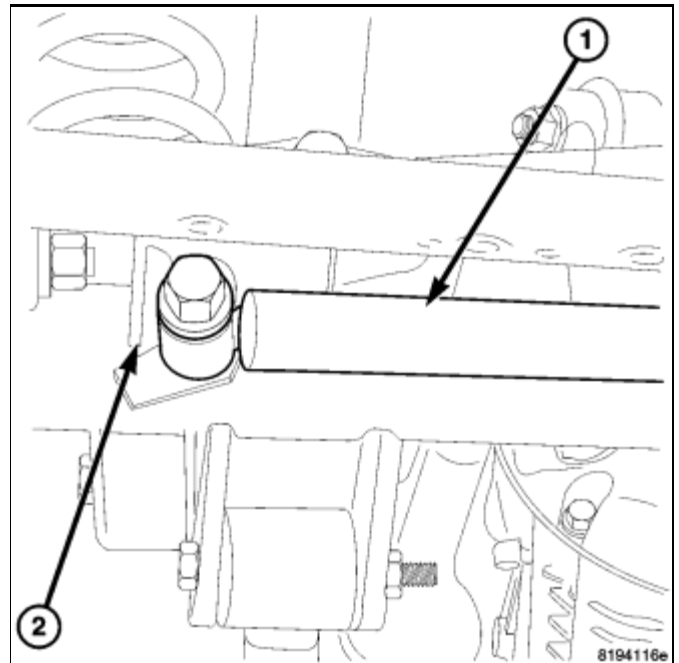
9. Remove shock absorbers (1) from axle brackets (2).



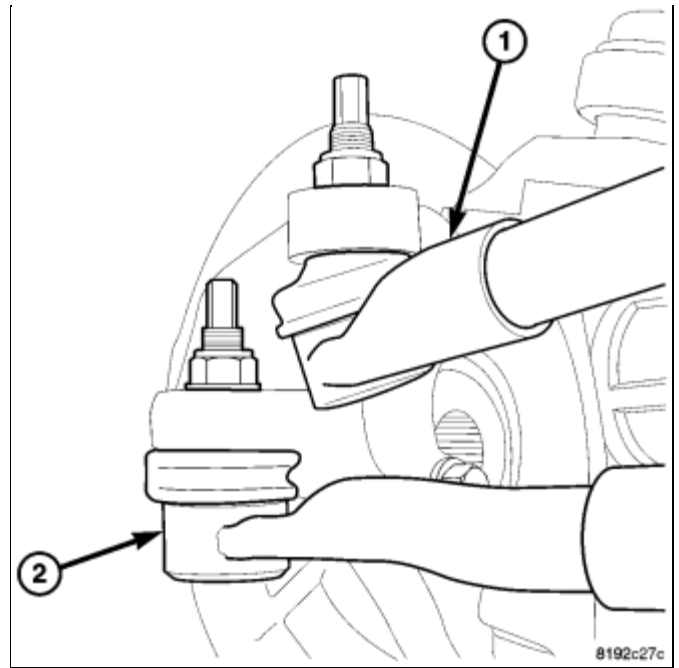
10. Remove track bar bolt (1) and track bar (2) from axle bracket.



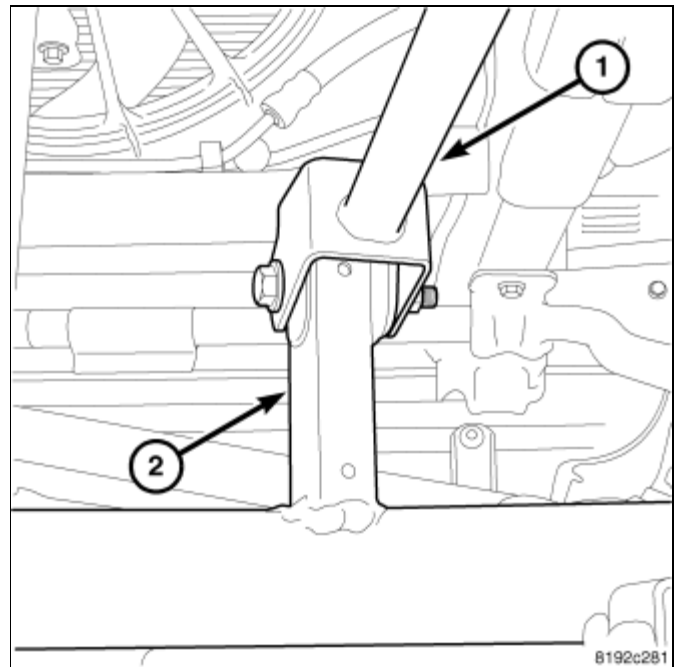
11. Remove steering damper (1) from axle bracket (2).



12. Remove drag link (1) and tie rod ends (2) from steering knuckles.



13. Remove upper control arms (1) from axle brackets (2).

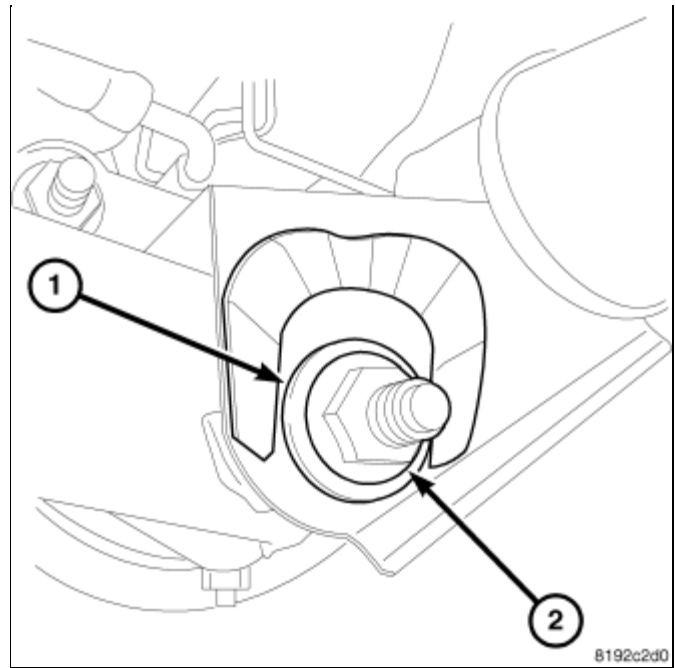


14. Mark lower control arm cams (1) for installation reference and loosen nuts (2).

15. Lower axle enough to remove coil springs from axle.

16. Remove lower control arm bolts remove axle from vehicle.

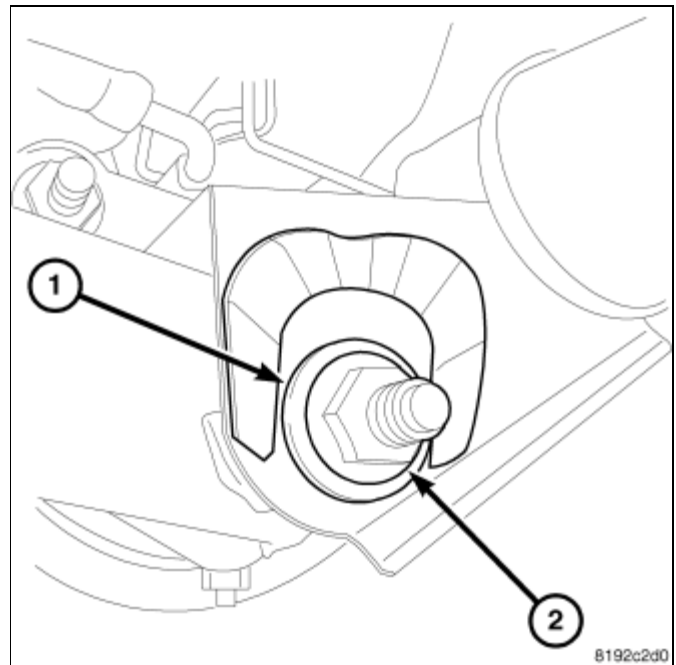
INSTALLATION



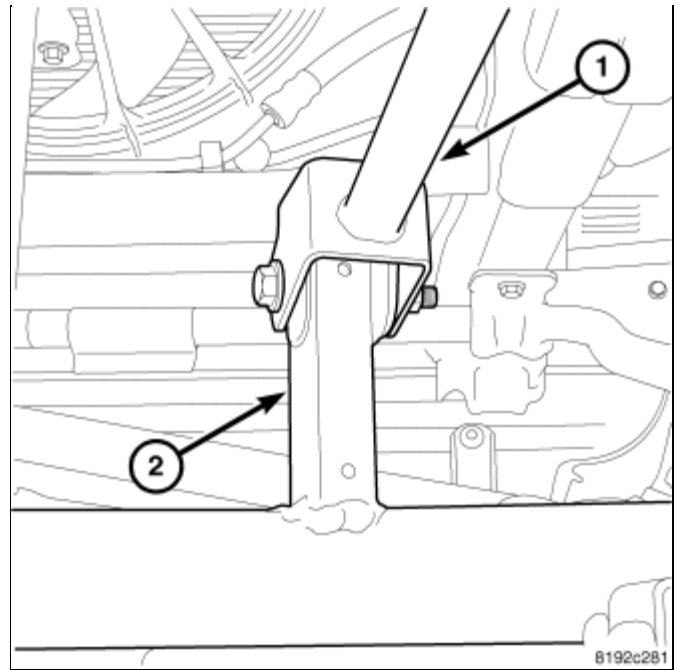
CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. Failure to follow these instruction will result in damaging the bushings.

NOTE: Procedure is the same for a 4x2 tube axle except for propeller shaft and axle vent installation.

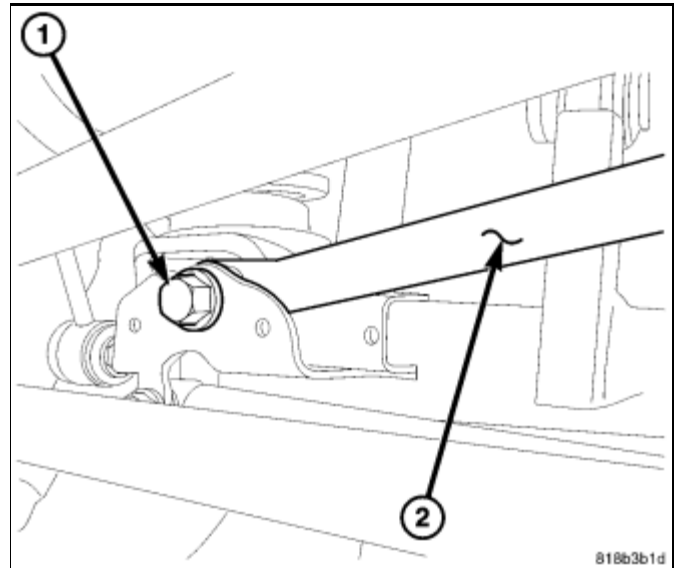
1. Position axle under vehicle.
2. Install lower control arms in axle brackets.
3. Install lower control arm bolts, cams (1) and loosely install nuts (2).
4. Install coil springs on axle and raise axle into position.



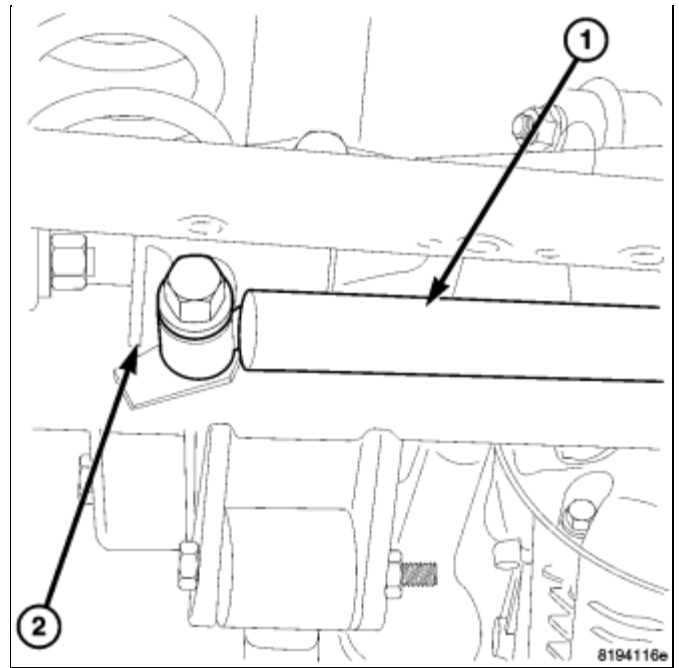
5. Install upper control arms (1) on axle brackets (2) and loosely install bolts and nuts.



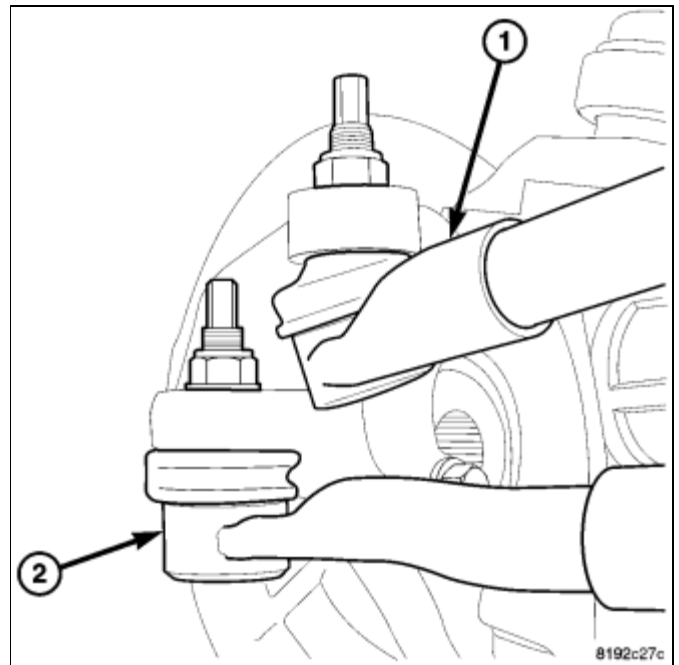
6. Install track bar (2) in axle bracket and loosely install bolt (1).



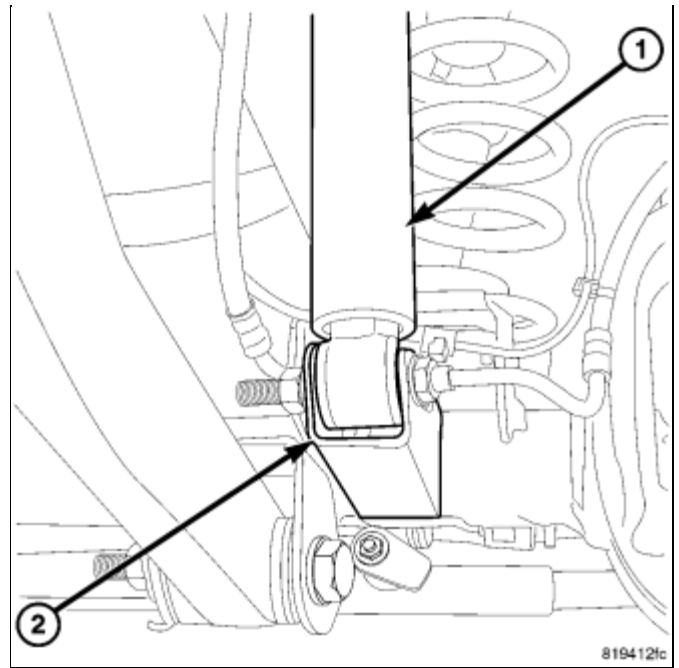
7. Install steering damper (1) on axle bracket (2) and tighten to specification.



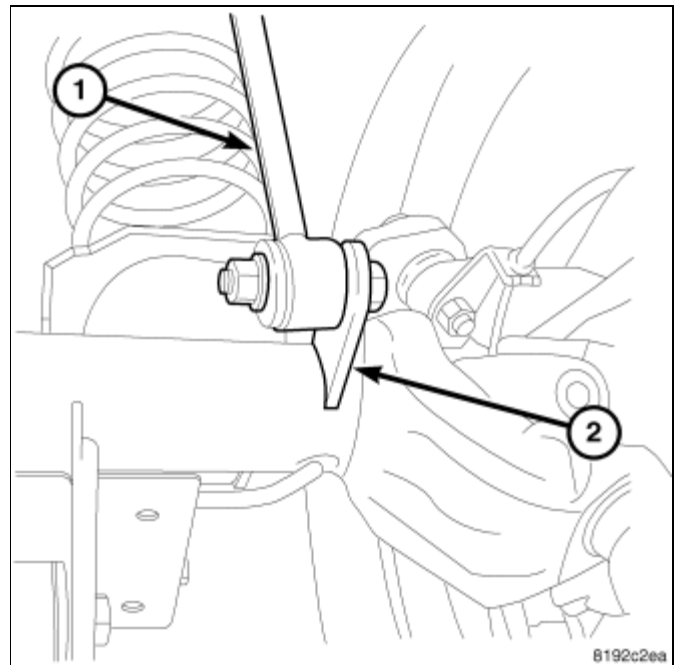
8. Install drag link (1) and (2) tie rod ends on steering knuckles and tighten to specification.



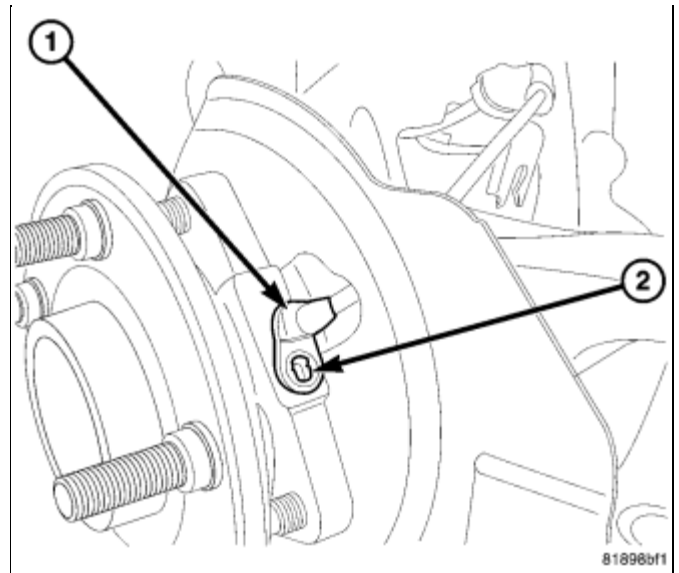
9. Install shock absorbers (1) on axle brackets (2) and tighten to specification.



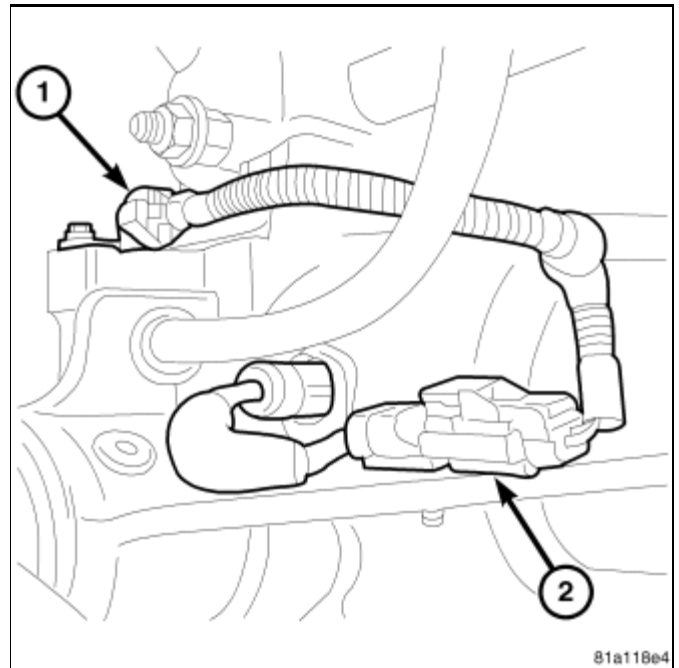
10. Install stabilizer bar links (1) on axle brackets (2) and tighten to specification.



11. Install wheel speed sensors harness on axle and install sensors (1) in hub bearings.
12. Install brake rotors, calipers and brakes lines.

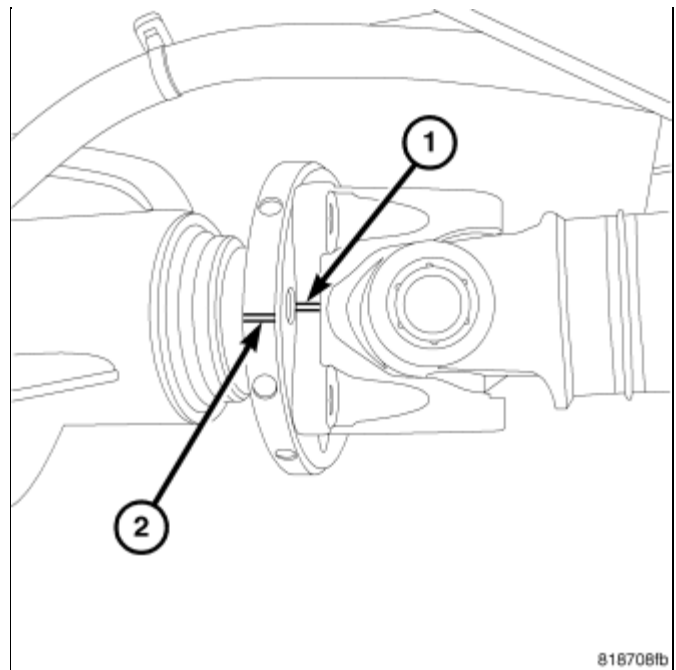


13. Connect Tru-Lok wiring connectors (1,2) and axle vent hose.

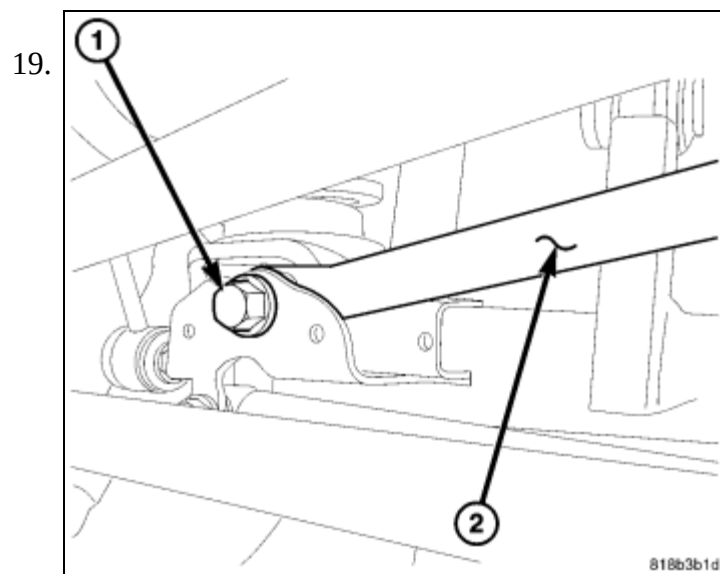
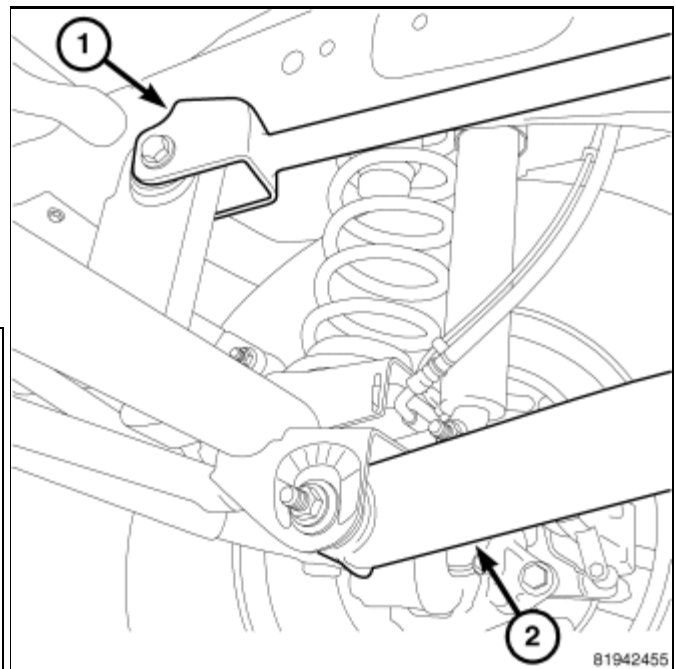


NOTE: Clean all propeller shaft bolts and apply Mopar® Lock & Seal Adhesive or equivalent to the threads before installation.

14. Install propeller shaft with axle flange (2) and propeller shaft (1) marks aligned.



15. Remove lift from the axle.
16. Install wheel and lower vehicle.
17. Align lower control arm (2) cams to reference marks and tighten control arm nuts to specification.
18. Tighten upper (1) control arm nuts to specification.



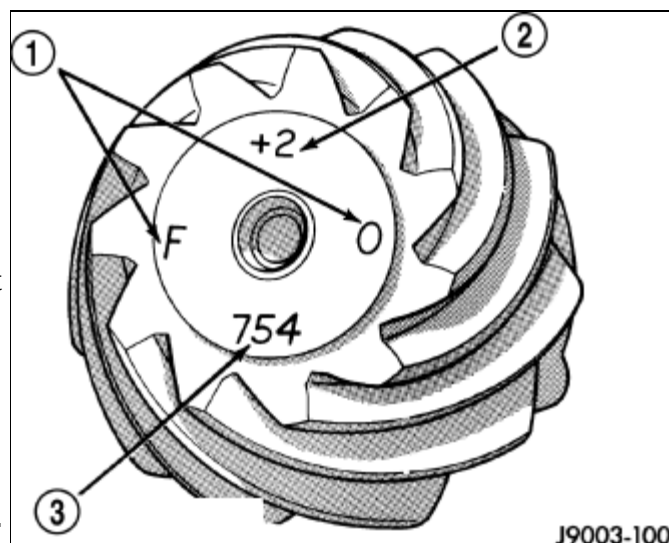
19. Tighten track bar (2) bolt (1) at axle bracket to torque specification.

ADJUSTMENTS

PINION DEPTH-BEARING PRELOAD-GEAR BACKLASH

Ring and pinion gears are supplied as matched sets. The identifying numbers (3) for the ring and pinion gear are etched into the each gear. A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear (2). This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern in this section for additional information.

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Depth Variance chart.



Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

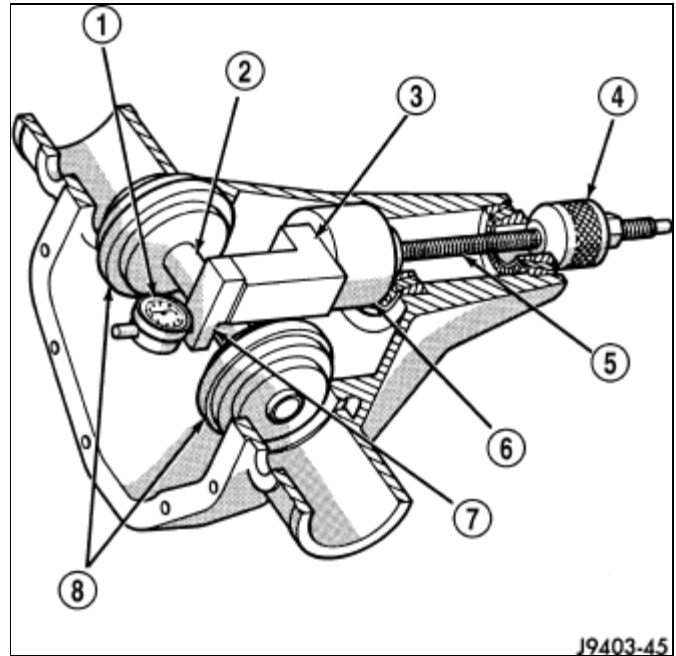
Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION GEAR DEPTH VARIANCE

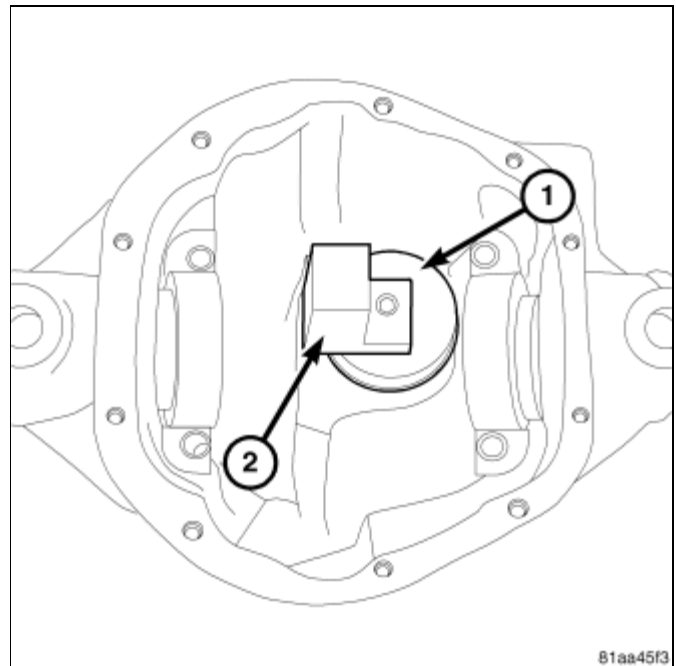
Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	?4	?3	?2	?1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003
0	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004
?1	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005
?2	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006
?3	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006	?0.007
?4	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006	?0.007	?0.008

PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set 6730 (2,3,4,5,6,7,8) and Dial Indicator C-3339A (1).

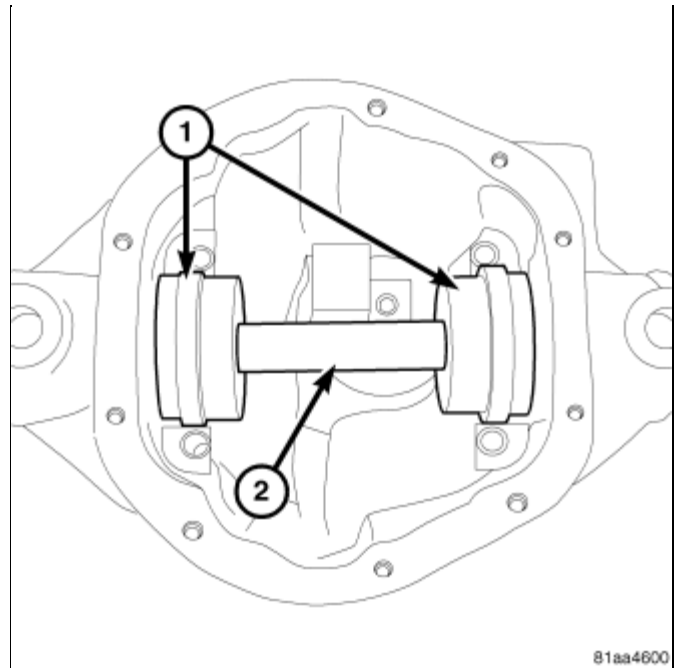


1. Assemble Pinion Height Block 6739 (2), Pinion Block 9990 (1) and rear pinion bearing onto Screw 6741 .
2. Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups.
3. Install front pinion bearing and Cone-nut 6740. Tighten nut until a Torque To Rotate the screw is 2.25 N·m (20 in. lbs.).

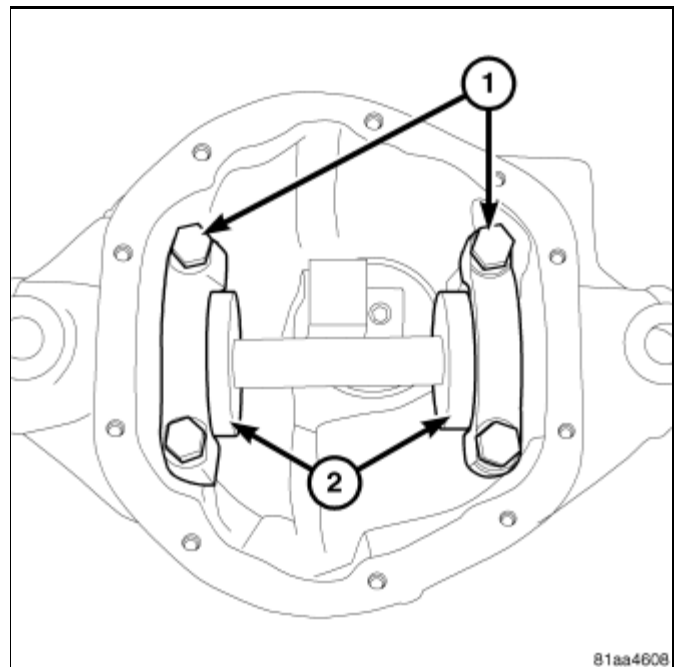


4. Place Arbor Disc 8541 (1) on Arbor D-115-3 (2) in position in the housing side bearing cradles .

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.



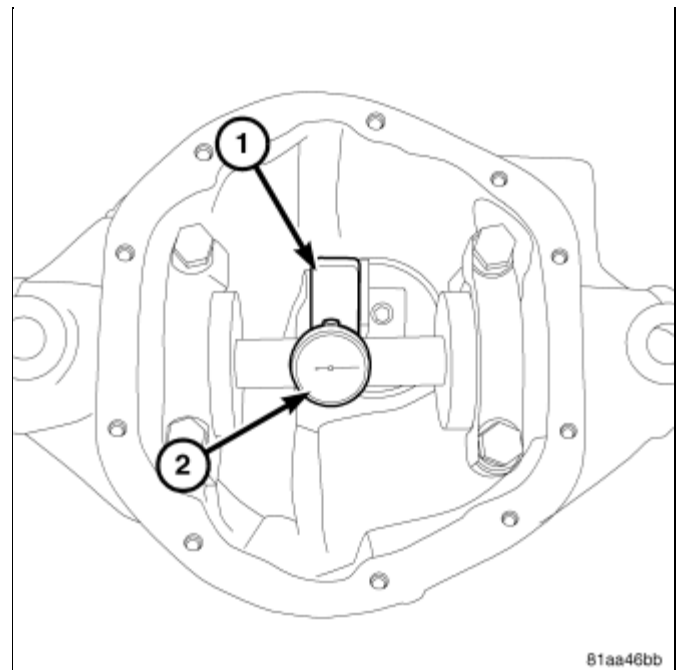
5. Install differential bearing caps (1) on arbor discs (2) and install bearing cap bolts. Tighten bearing cap bolts to 108 N·m (80 ft. lbs.).



6. Assemble Scooter Block D-115-2A (1) and Dial Indicator C-3339A (2) secure set screw.
7. Position Scooter Block/Dial Indicator flush on the pinion height block. Hold scooter block and zero the dial indicator.
8. Slowly slide the scooter block (1) across the pinion height block over to the arbor. Move the scooter block till dial indicator (2) crests the arbor, then record the highest reading.
9. Select a shim equal to the dial indicator reading plus or minus the pinion depth variance number etched in the face of the pinion. **Example:** If the depth variance

is -2, add 0.002 in. to the dial indicator reading. If the depth variance is +2, subtract 0.002 in. from the dial indicator reading.

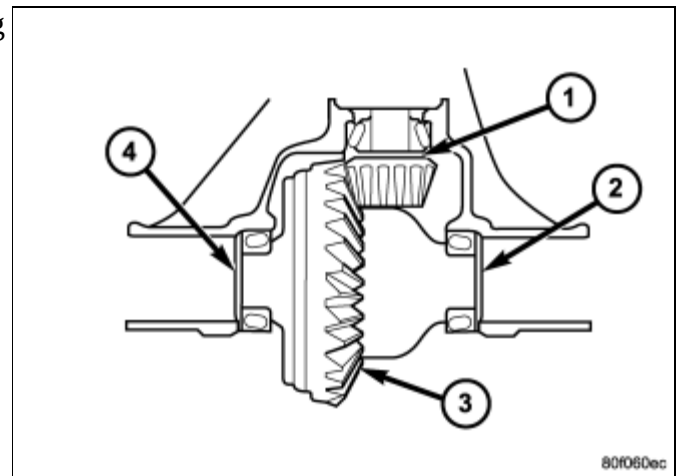
The total is the shim thickness needed for the pinion depth variance.



DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Before performing differential bearing preload and ring gear backlash measurements, pinion gear depth must be established and the pinion gear ready for installation. Establishing pinion gear depth is essential to gear backlash and tooth contact patterns.

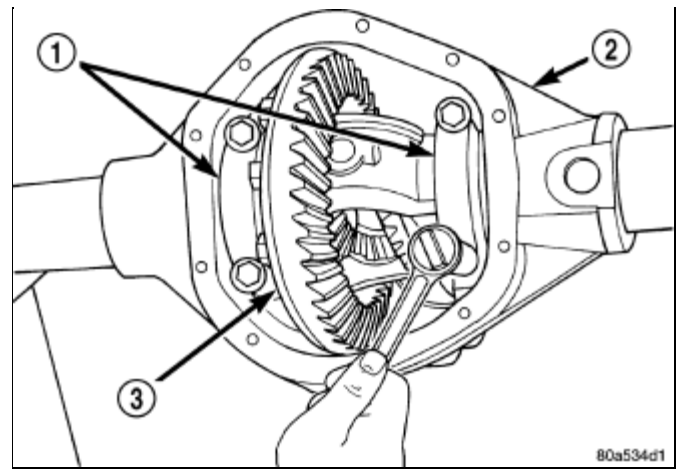
Differential bearing preload and gear backlash is accomplished with selective shims (2,4) positioned behind the differential side bearing cups. Shim thickness is determined using Dummy Bearings 9992 in place of the differential side bearings and a Dial Indicator C-3339A.



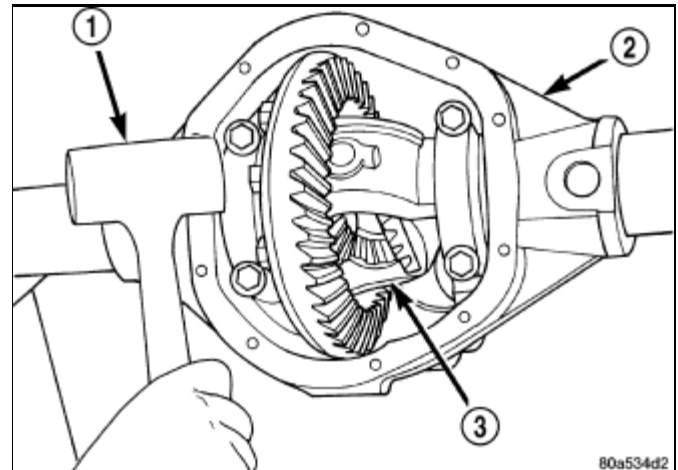
SHIM FORMULA: Differential End Play + Preload Specification = Total Differential Shim. Total Differential Shim – Ring Gear Side Shim – Backlash Specification = Pinon Gear Side Shim.

1. Remove differential side bearings from differential case.
2. Remove factory installed shims from differential case.
3. Install ring gear on differential case and tighten bolts to specification.

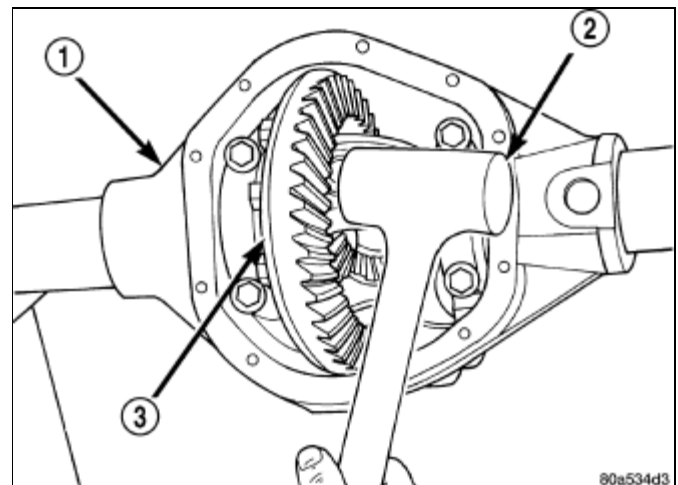
4. Install dummy side bearings 9992 on differential case.
5. Install differential case (3) in the housing (2).
6. Install bearing caps (1) in original location and snug the bolts.



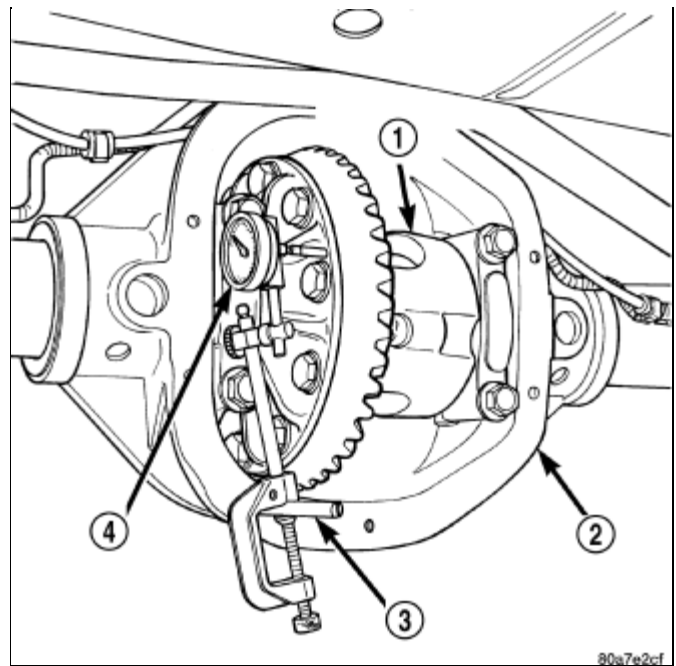
7. Seat differential (3) dummy bearings to pinion side (2) of the housing with a dead-blow hammer (1).



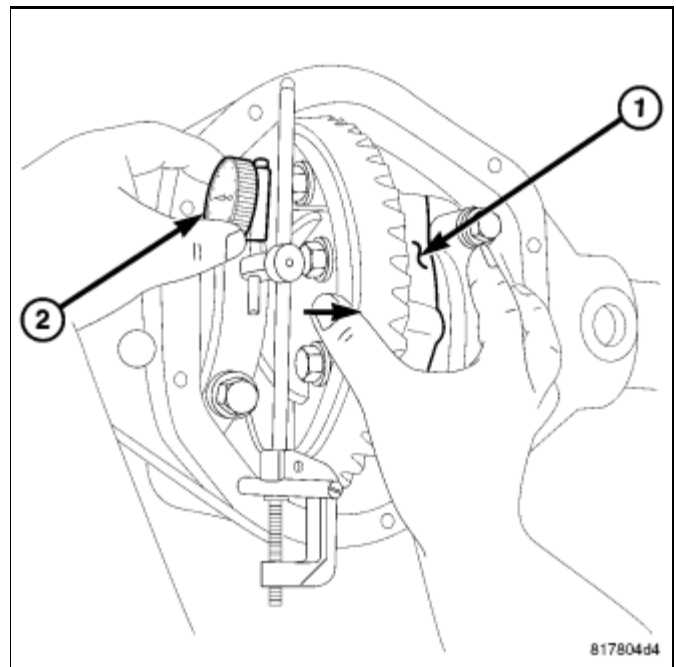
8. Seat differential (3) dummy bearings to ring gear side (1) of the housing with a dead-blow hammer (2).



9. Thread Pin C-3288-B (3) into cover bolt hole below ring gear.
10. Attach the Dial Indicator C-3339A (4) to the pin. Position the dial indicator plunger on a flat surface between the ring gear bolt heads.



11. Push and hold differential case (1) to pinion gear side of the housing and zero dial indicator (2).



12. Push and hold differential case (2) to ring gear side of the housing. Record dial indicator (1) differential reading. Add preload specification 0.25 mm (0.010 in) to differential dial indicator reading. This is the total shims needed to preload the differential bearings.

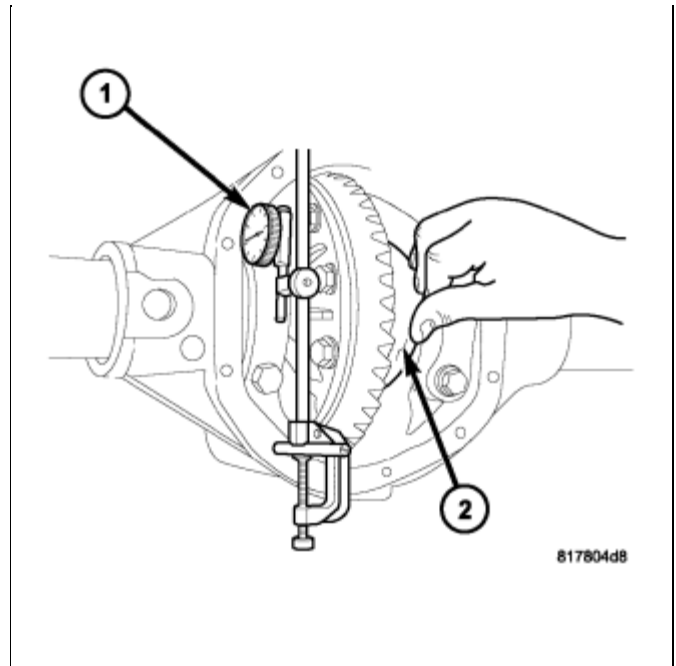
EXAMPLE: Differential Dial Indicator Reading + Preload Specification 0.25 mm (0.010 in) = Total Differential Shim

13. Rotate dial indicator out of the way on the pilot

stud.

14. Remove differential case and dummy bearings from the housing.

15. Install pinion gear in the housing and establish pinion torque to rotating (PTTR).

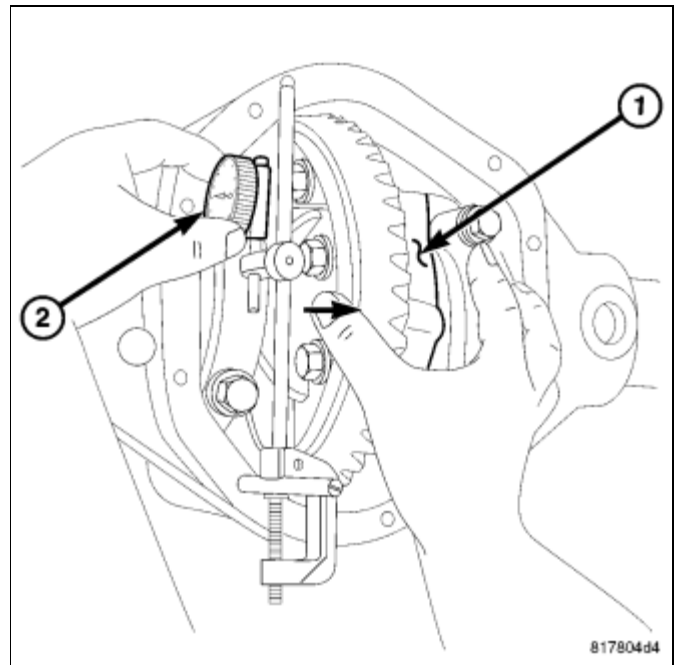


16. Install differential case and dummy bearings 9992 in the housing, install bearing caps and snug bolts.

17. Seat ring gear side dummy bearing.

18. Position dial indicator (2) plunger on a flat surface between the ring gear bolts.

19. Push and hold differential case (1) against pinion gear and zero dial indicator (2).



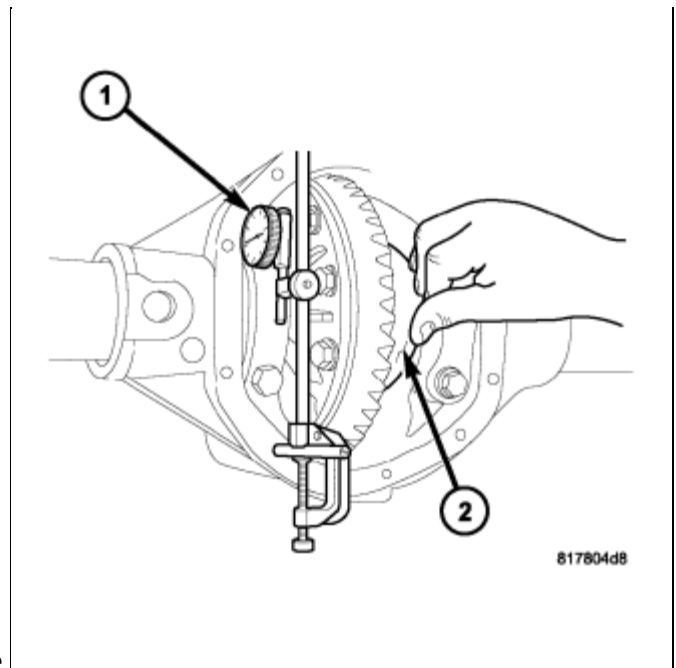
20. Push and hold differential case (2) to ring gear side of the housing and record dial indicator (1) ring gear side reading.

21. Subtract backlash specification 0.05 mm (0.002 in.) from ring gear side reading for ring gear backlash. The remainder is the shim needed for the ring gear side of the differential.

EXAMPLE: Ring Gear Side Dial Indicator Reading – Backlash Specification 0.05 mm (0.002 in.) = Ring Gear Side Shim

22. Subtract ring gear side shim from the total preload shim. This is the shim needed on the pinion side of the differential.

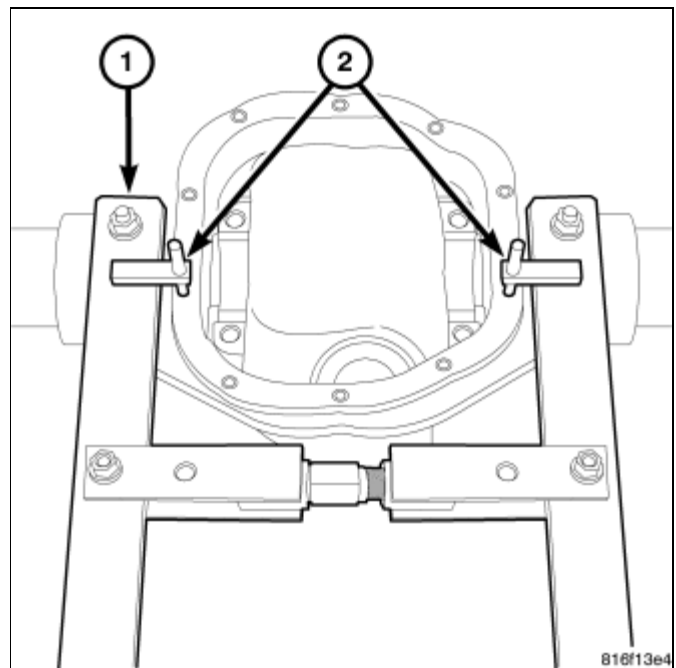
EXAMPLE: Total Differential Shim – Ring Gear Side Shim = Pinion Gear Side Shim



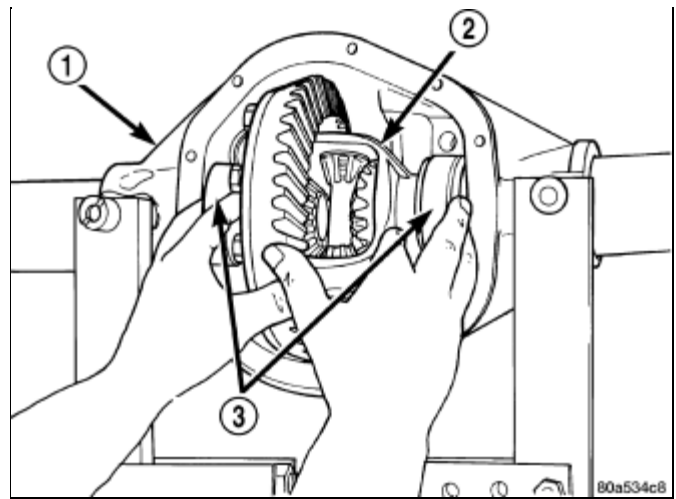
- 23. Rotate dial indicator out of the way on pilot stud.
- 24. Remove differential case and dummy bearings from the housing.
- 25. Install side bearings on differential case.

26. Install Spreader W-129-B (1) with hold downs (2) from Adapter Set 6987B on the housing and spread open enough to receive differential case.

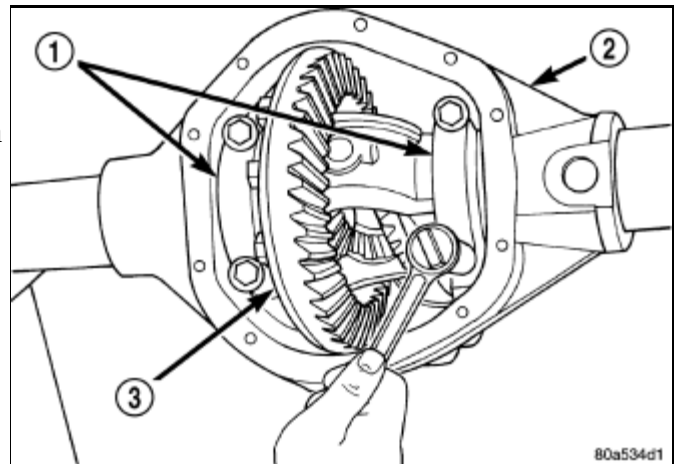
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.



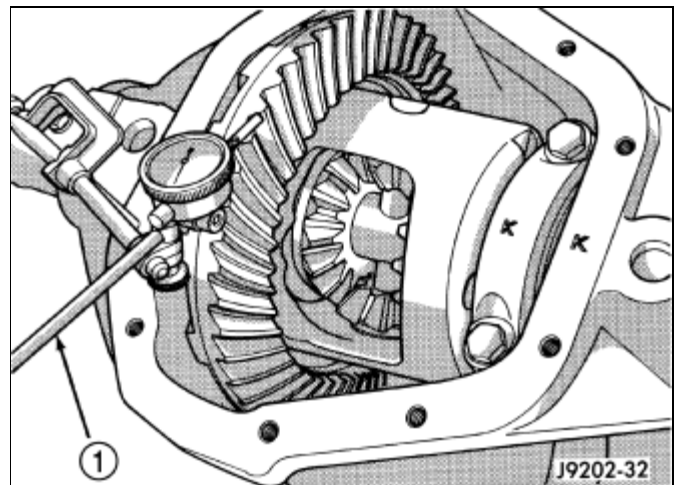
27. Install differential case (2) into the housing with bearing cups (3) and shims.



28. Install bearing caps and tighten bolts finger tight. Remove spreader from the housing.
29. Install bearing cap (1) and tighten bolts to 108 N·m (80 ft. lbs.).
30. Rotate the differential case several times to seat the side bearings.

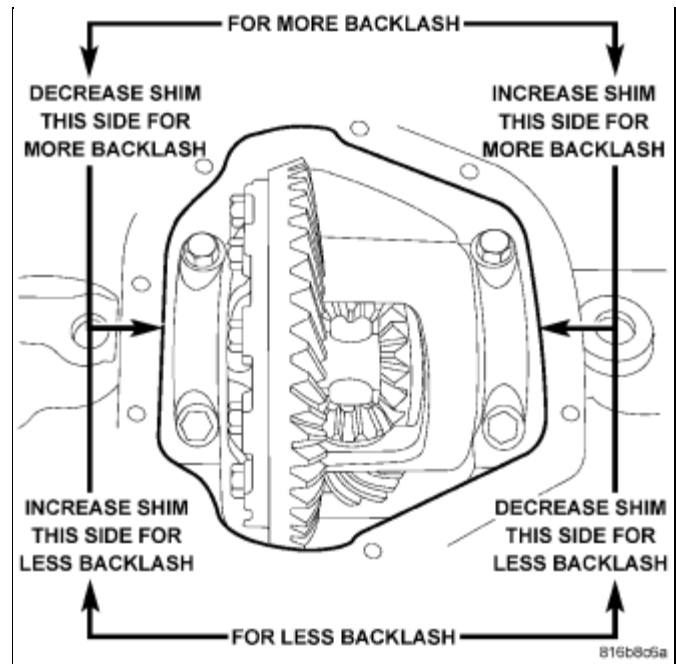


31. Position dial indicator plunger against a ring gear tooth.
32. Push and hold ring gear upward while not allowing the pinion gear to rotate.
33. Zero dial indicator (1) face to pointer.
34. Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in - 0.008 in). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other.



35. Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in). If readings vary more than specified, the ring gear or the differential case is defective.

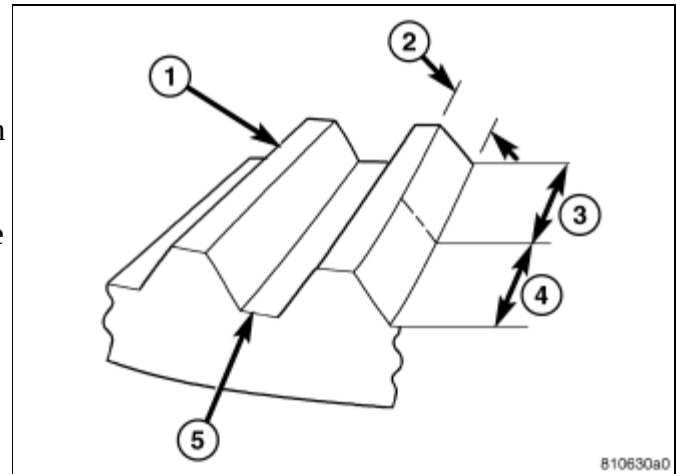
After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.



GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

The TOP LAND (1) of the gear tooth is the top surface of the tooth. The PROFILE (2) of the gear tooth is the depth of the tooth. The TOE (3) of the gear is the portion of the tooth surface at the end towards the center. The HEEL (4) of the gear is the portion of the tooth at the outer-end. The ROOT (5) of the gear tooth is the lowest portion of the tooth.



NOTE: If the PROFILE across the tooth is the same it is a 3 Axis cut gear. If the PROFILE across the tooth is tapered it is a 2Axis cut gear.

1. Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.
2. Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.
3. With a boxed end wrench on the ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart adjust pinion depth and gear backlash as necessary.

THREE AXIS CUT GEAR

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top heel contact		Top toe contact	Backlash correct. Thicker pinion position shim required.
	Root toe contact		Root heel contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top heel contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root toe contact	Pinion position shim correct. Increase backlash.

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TWO AXIS CUT GEAR

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top toe contact		Top heel contact	Backlash correct. Thicker pinion position shim required.
	Root heel contact		Root toe contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top toe contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root heel contact	Pinion position shim correct. Increase backlash.

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DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axle shafts is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Total Torque To Rotate (TTTR) is: Pinion Torque To Rotate plus 0.79 - 1.24 N·m (7 - 11 in lbs).

NOTE: If TTTR is high, decrease the shim thickness equally on both sides of the differential and check TTTR again. If TTTR is low, increase the shims thickness equally on both sides of the differential and check TTTR again.

SPECIFICATIONS

FRONT AXLE - 216FBI

AXLE

DESCRIPTION	SPECIFICATION
Axle Ratio	4.10
Ring Gear Diameter	2166 mm (8.5 in.)
Ring Gear Runout	0.12 (0.005 in.)
Ring Gear Backlash	0.12 - 0.20 mm (0.005 - 0.008 in.)
Pinion Torque To Rotate - Original Bearing	1 - 2.2 N·m (10 - 20 in. lbs.)
Pinion Torque To Rotate - New Bearing	2.2 - 4.5 N·m (20 - 40 in. lbs.)
Total Torque To Rotate: Pinion Torque To Rotate plus	0.79 - 1.24 N·m (7 - 11 in lbs)

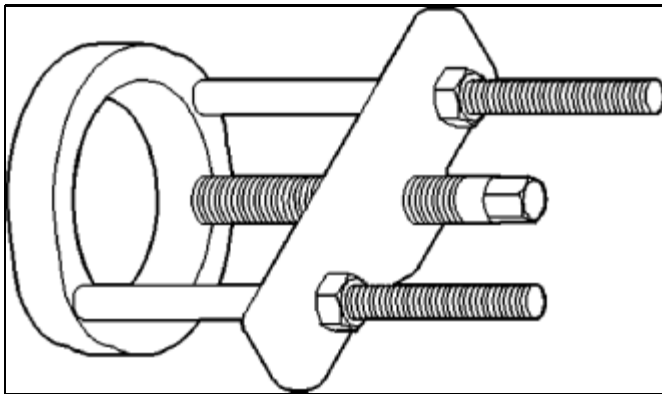
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Plug	34	25	-
Differential Cover Bolts	41	30	-

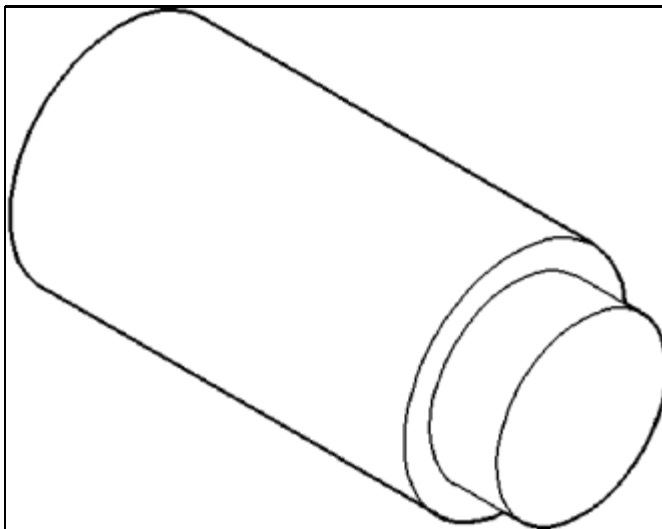
Bearing Cap Bolts	108	80	-
Pinion Nut	217-271	160-200	-
Ring Gear Bolts	136	100	-
Axle Nut	136	100	-
Hub Bearing Bolts	102	75	-

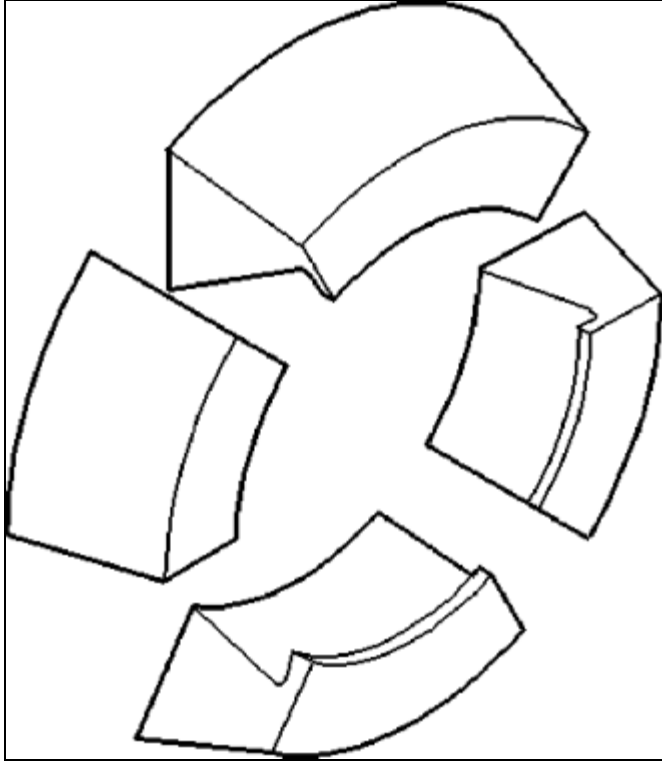
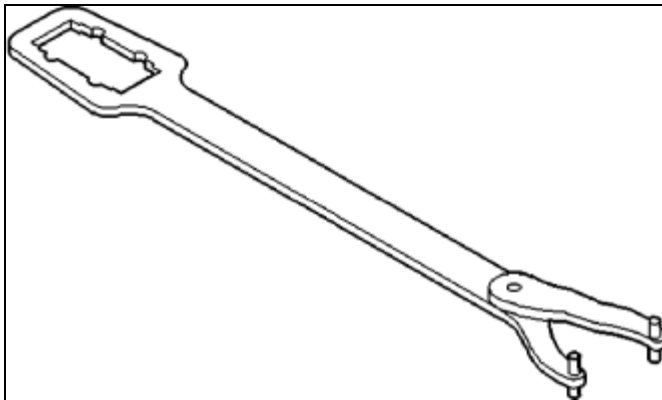
SPECIAL TOOLS

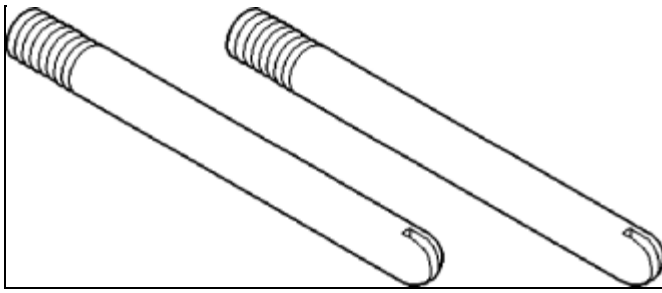
FRONT AXLE - 216FBI



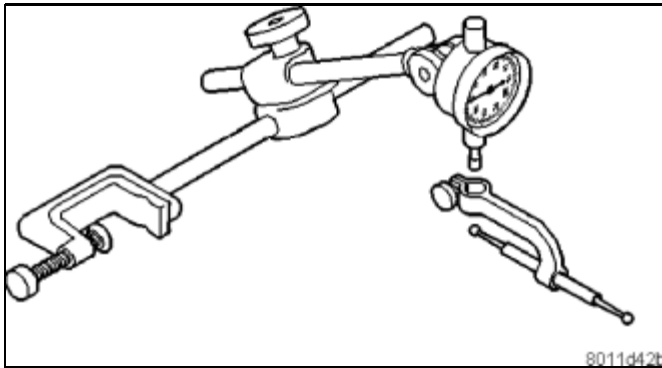
PULLER- C-293-PA



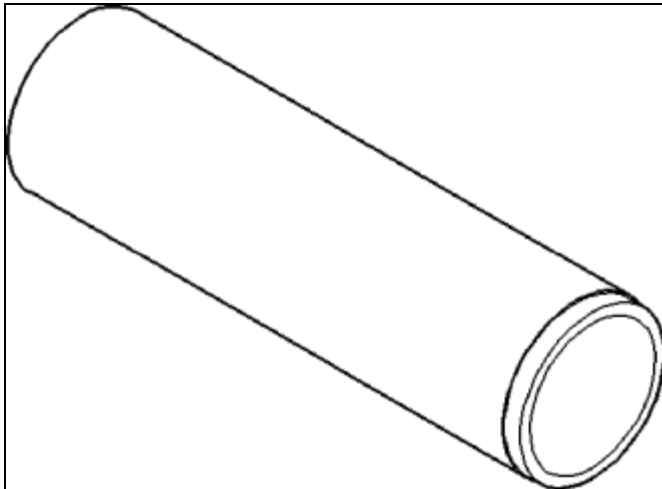
PLUG C-293-3**ADAPTER C-293-47****FLANGE WRENCH C-3281**



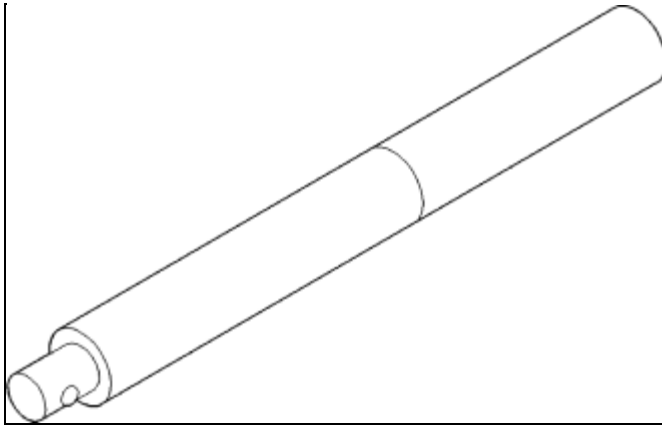
PINS C-3288-B



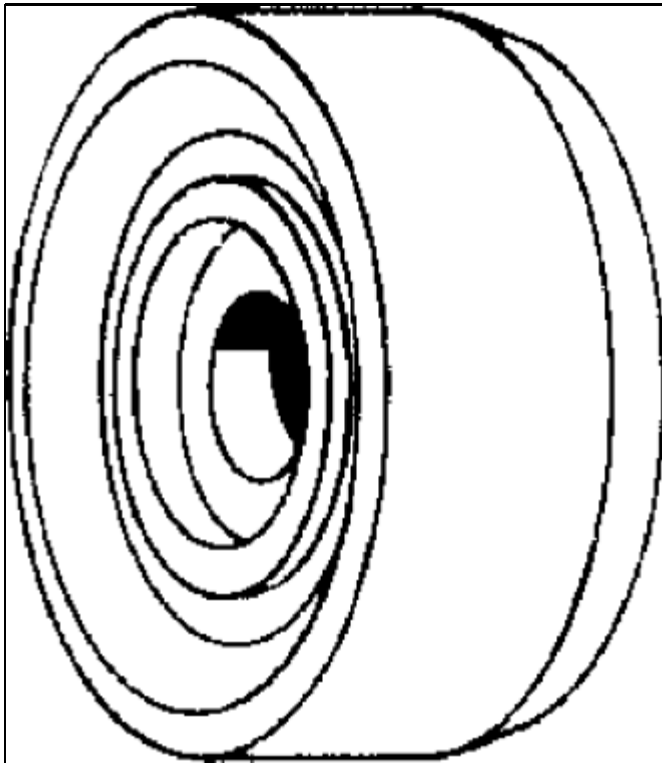
DIAL INDICATOR C-3339A



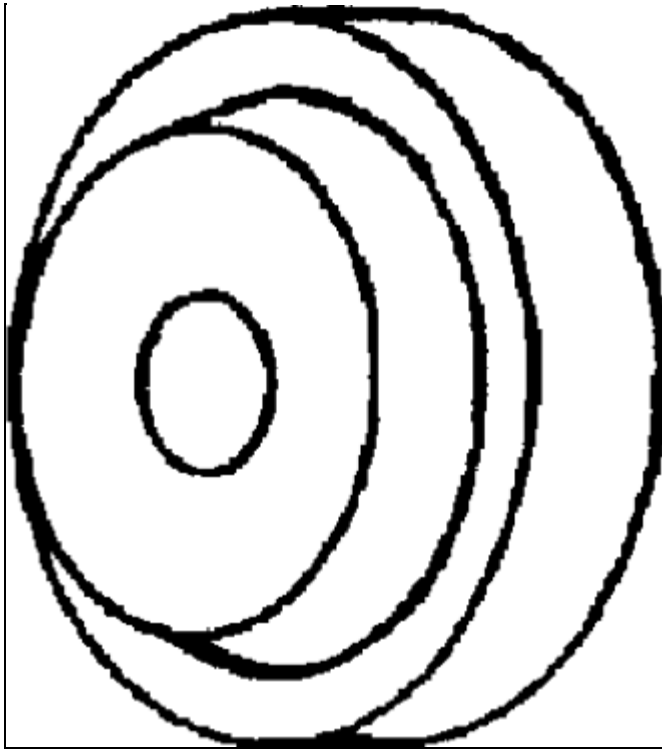
INSTALLER C-4040



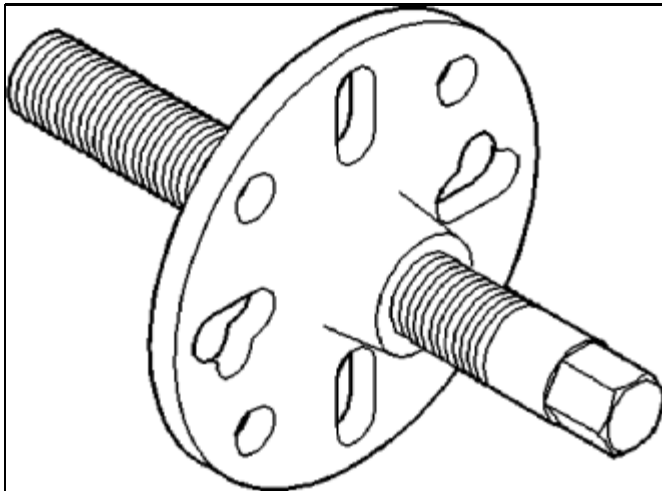
HANDLE C-4171



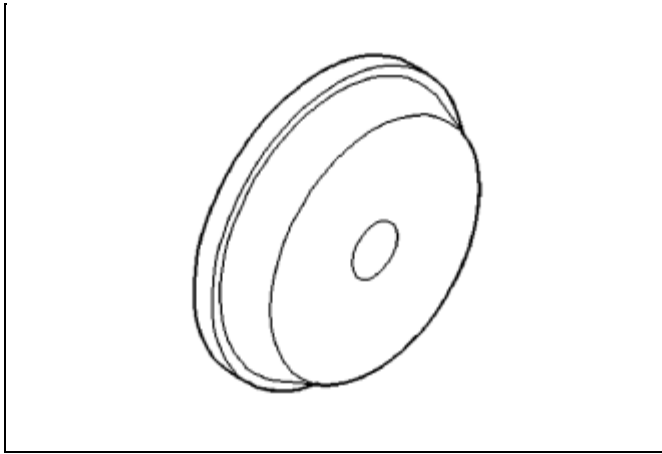
INSTALLER C-4213



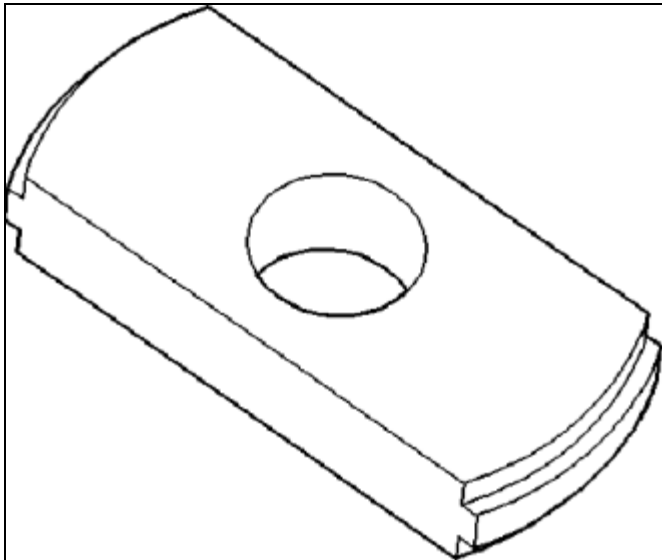
INSTALLER C-4308



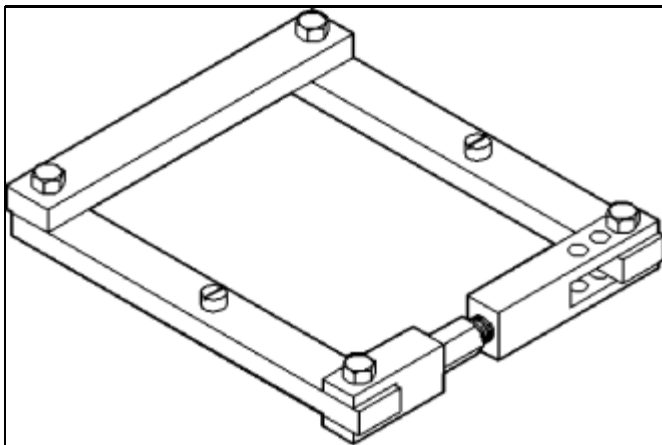
REMOVER C-452

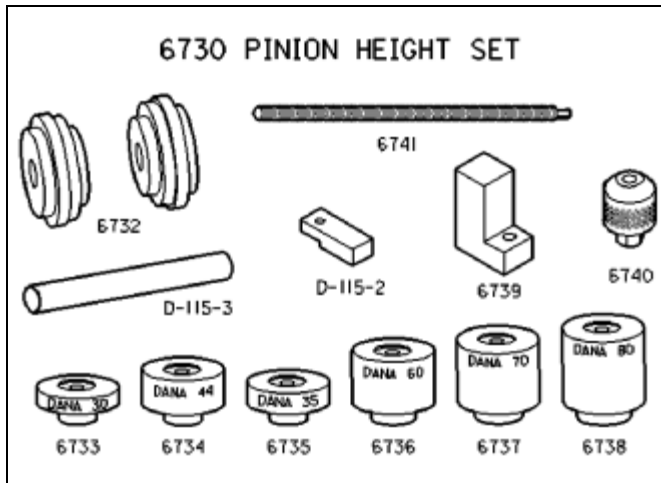
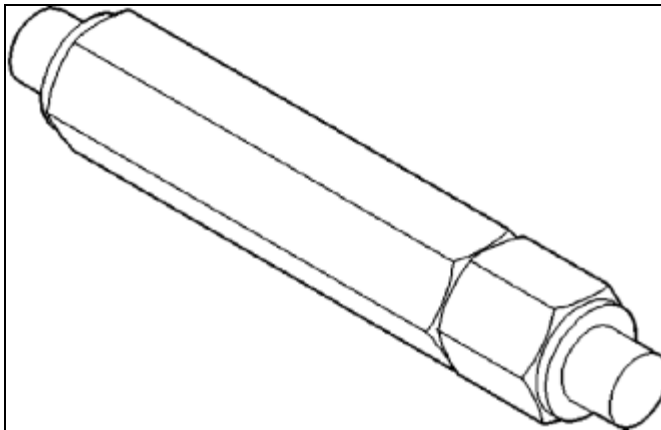


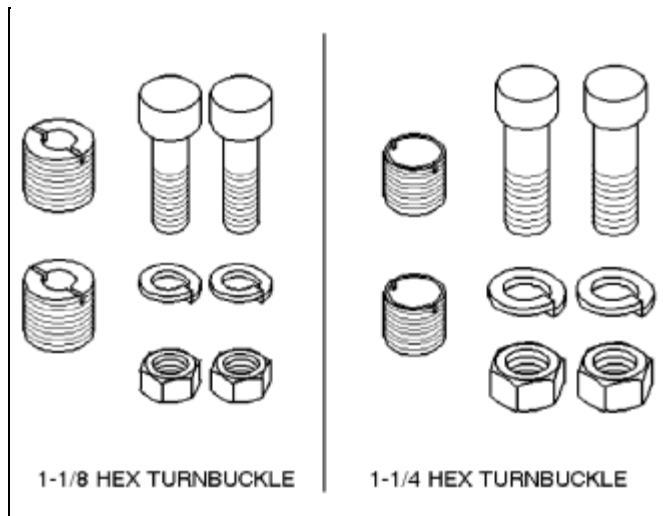
INSTALLER D-146



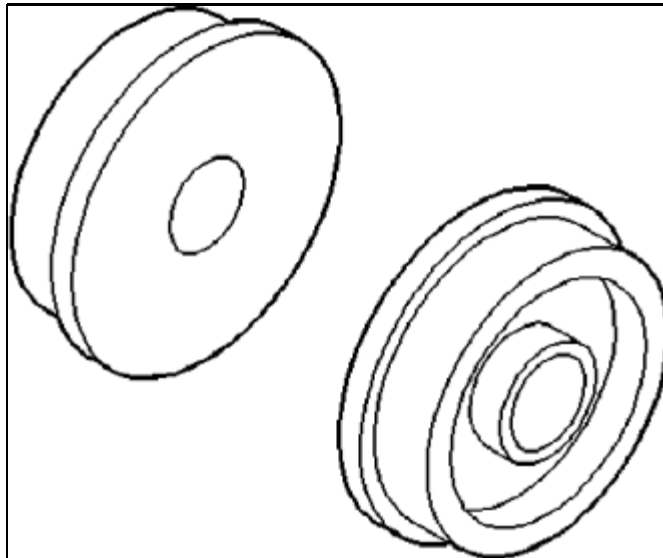
REMOVER D-158



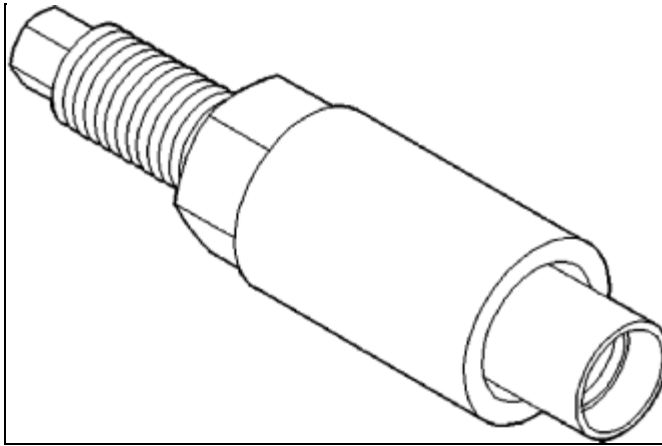
SPREADER W-129-B**PINION DEPTH SET 6730****TURNBUCKLE 6797**



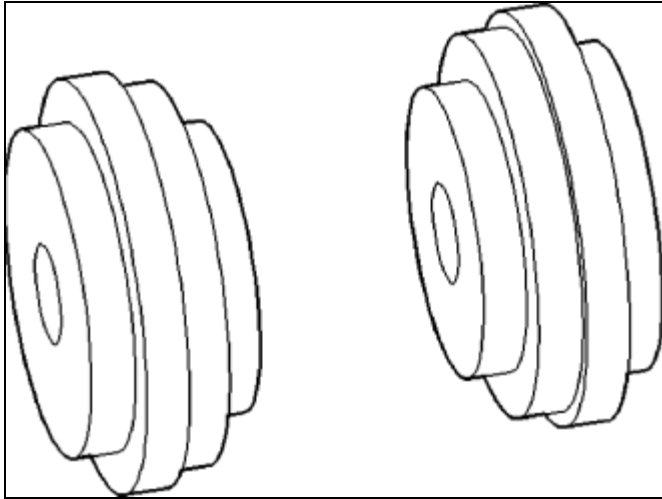
ADAPTER KIT 6987B



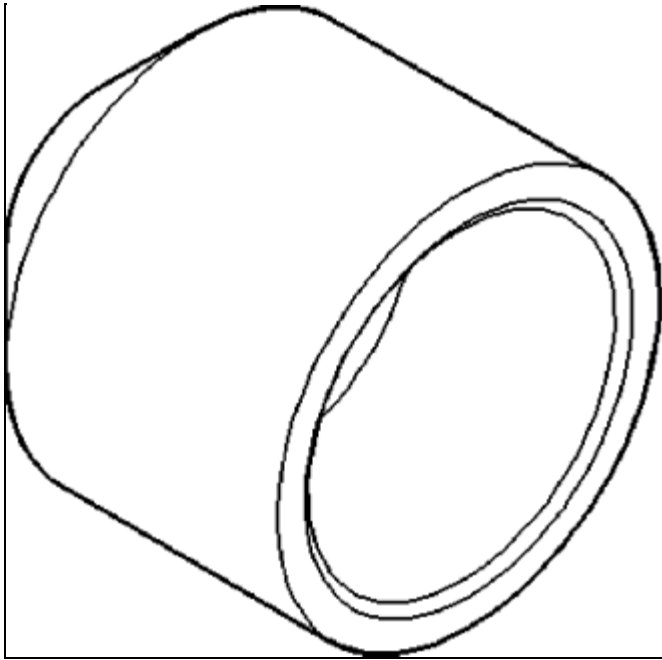
INSTALLER DISCS 8110



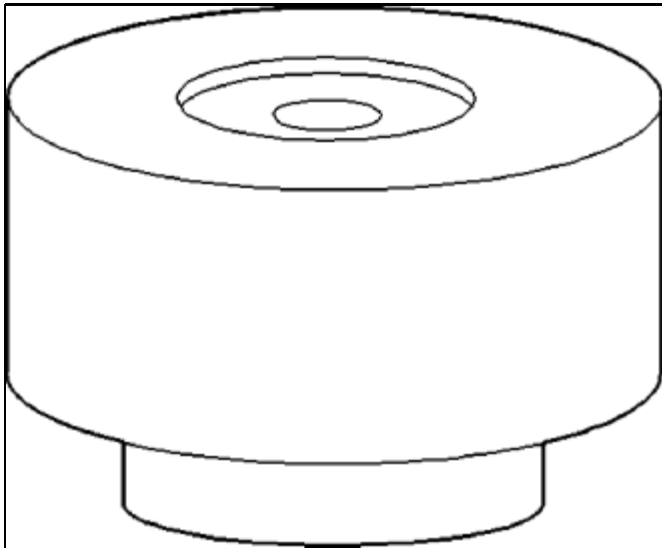
INSTALLER 8112



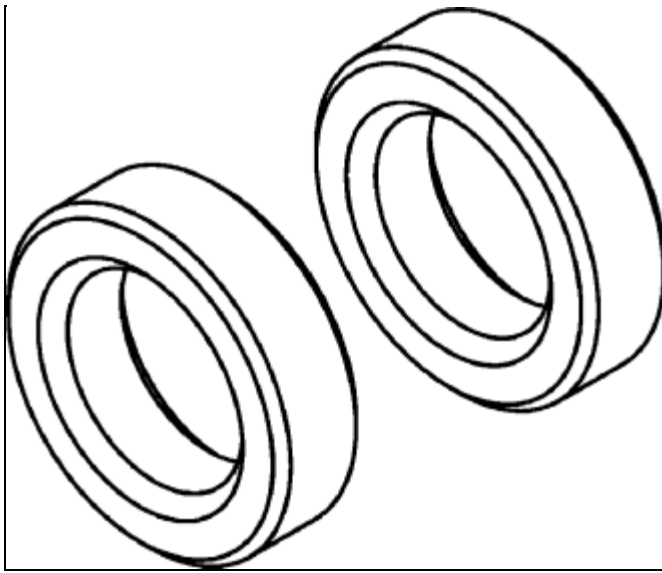
ARBOR DISCS 8541



INSTALLER 8681



PINION BLOCK 9990

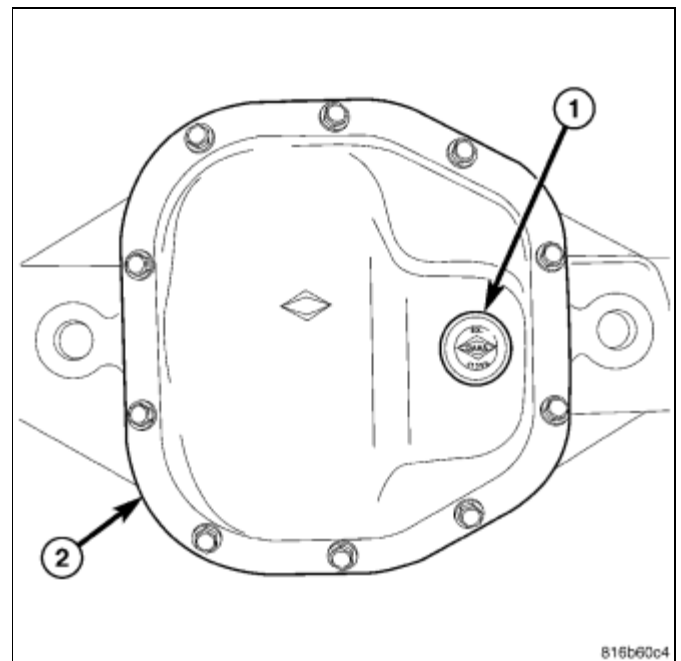


DUMMY BEARING 9992

COVER-DIFFERENTIAL REMOVAL

1. With transmission in neutral, position vehicle on hoist.
2. Remove fill plug (1).
3. Remove cover (2) bolts.
4. Remove cover and drain lubricant.

INSTALLATION



1. Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant (3) or equivalent to the housing cover .

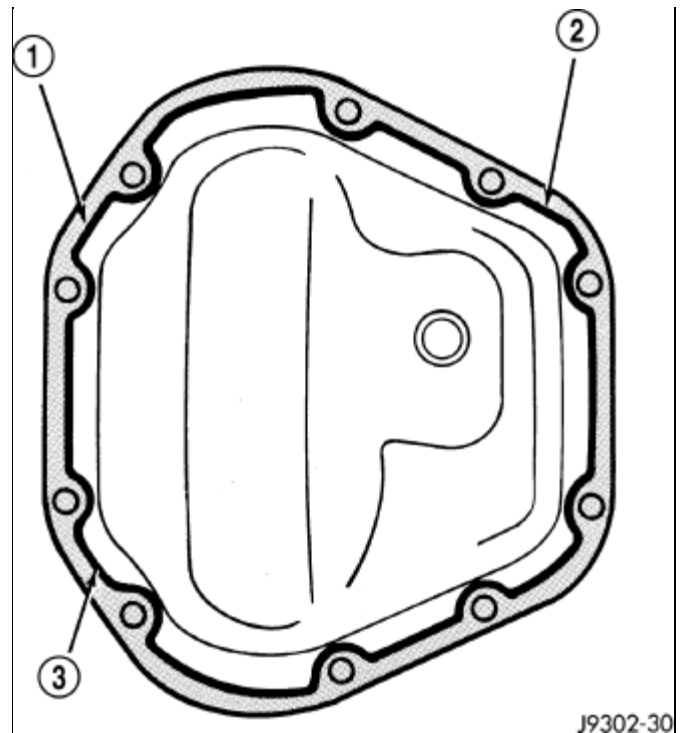
CAUTION: If housing cover is not installed within

3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.

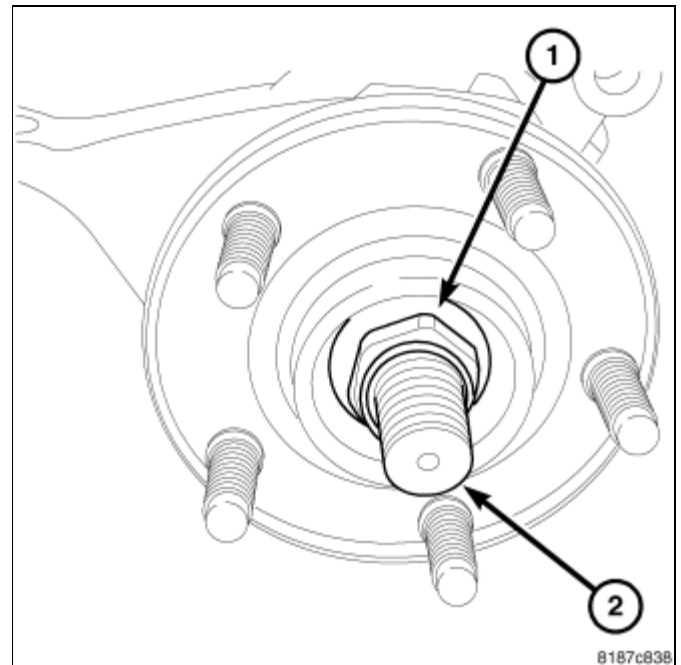
2. Install differential cover (2), and tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
3. Fill differential to specifications.
4. Install fill plug and tighten to 34 N·m (25 ft. lbs.).

SHAFT-AXLE

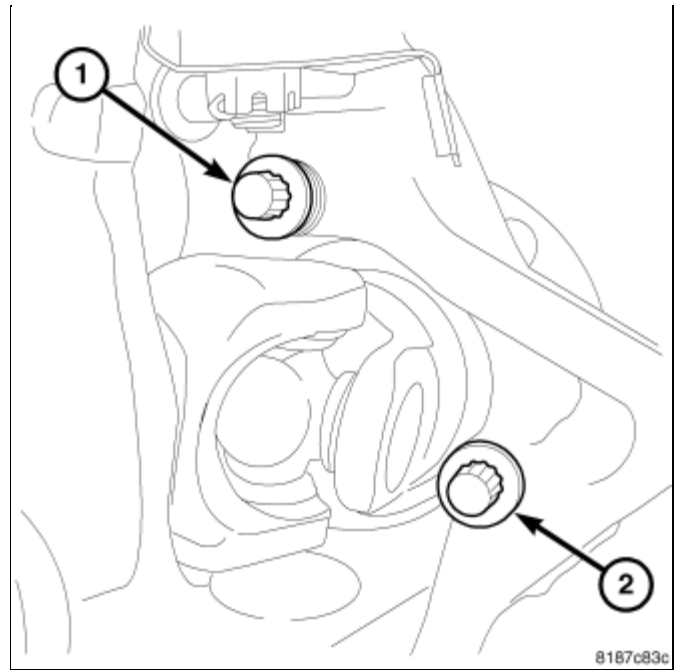
REMOVAL



1. With transmission in neutral, position vehicle on hoist.
2. Remove brake components.
3. Remove wheel speed sensor from hub bearing.
4. Remove hub nut (1) from axle shaft (2).

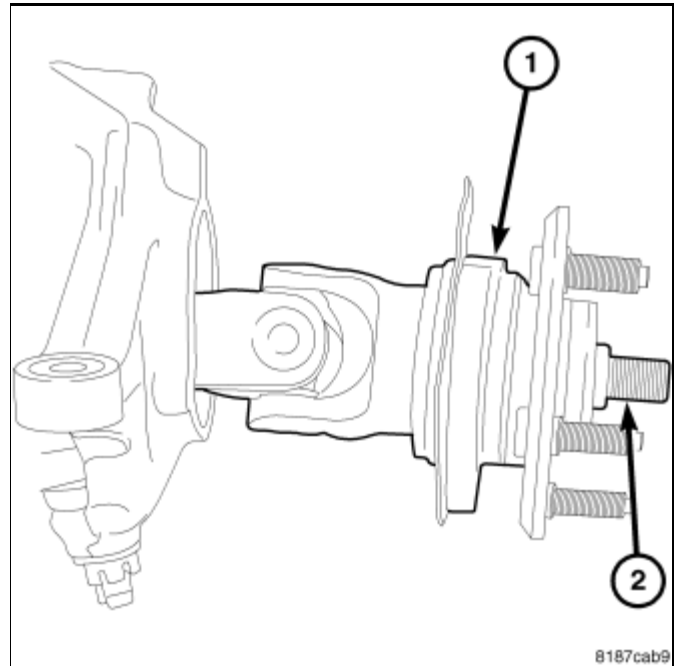


5. Remove three hub bearing bolts (1) from steering knuckle (2).

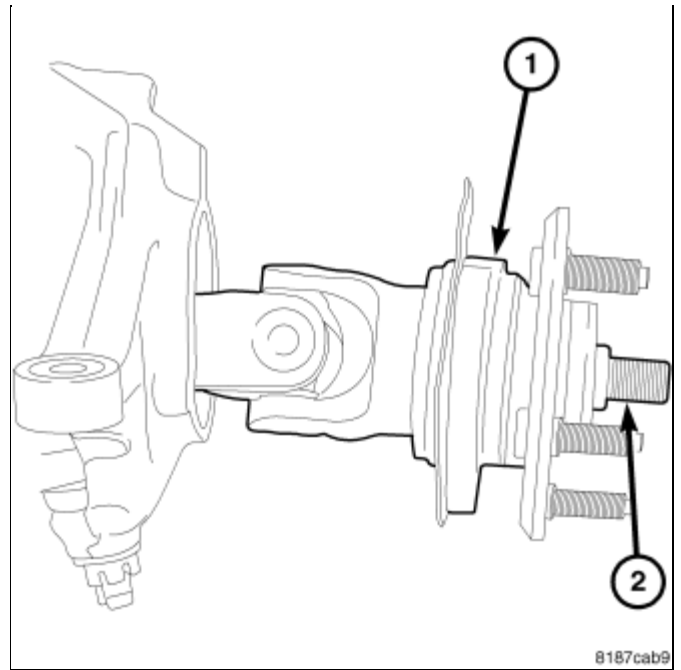


6. Remove hub bearing (1) with axle shaft (2) through steering knuckle (3).
7. Remove brake shield and hub bearing from axle.

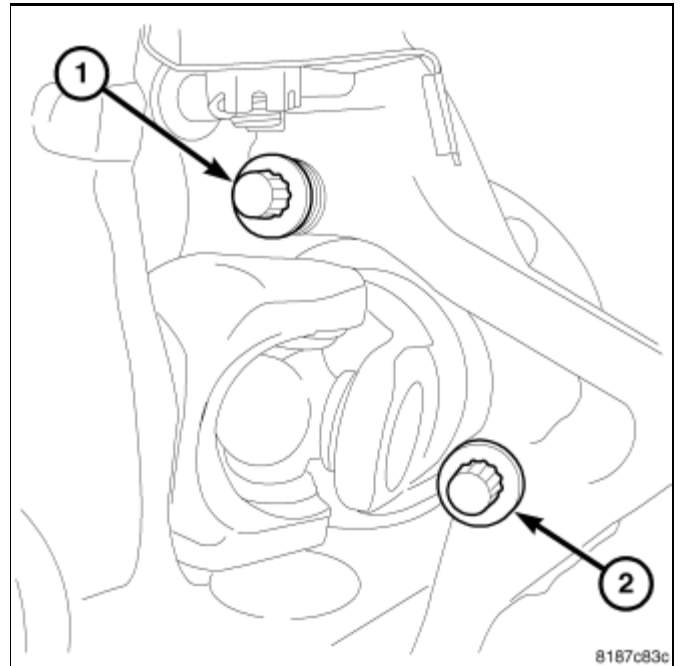
INSTALLATION



1. Clean axle shaft and apply a thin film of Mopar Wheel Bearing Grease or equivalent to the shaft splines and seal contact surface.
2. Install hub bearing and brake shield on axle shaft.
3. Install axle shaft (2) with hub bearing (1) through steering knuckle and into differential side gears.



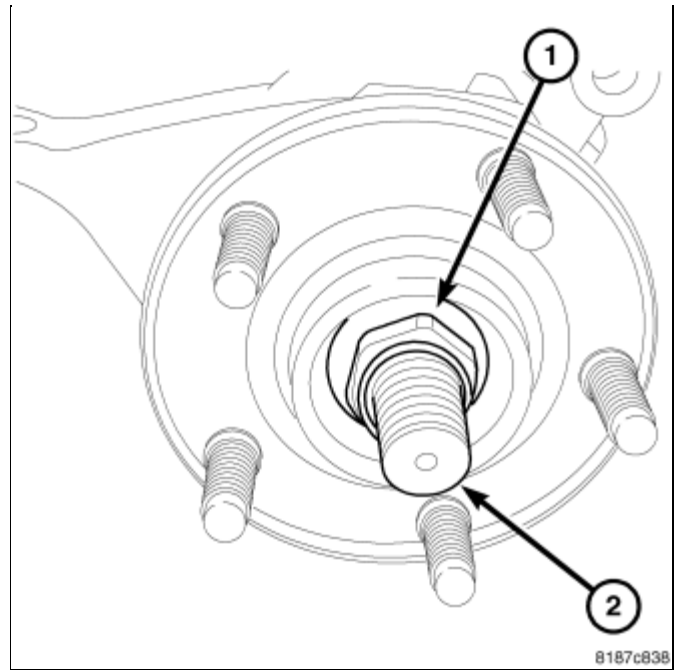
4. Install three hub bearing bolts (1) through steering knuckle (2) and tighten to 102 N·m (75 ft. lbs.).



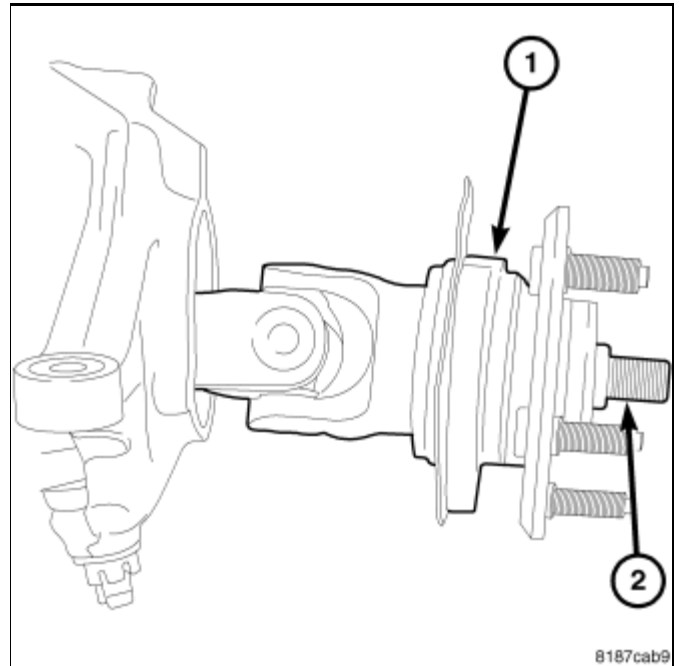
5. Install hub nut (1) on axle shaft (2) and tighten to 136 N·m (100 ft. lbs.).
6. Install wheel speed sensor.
7. Install brake components.

SEAL-AXLE SHAFT

REMOVAL

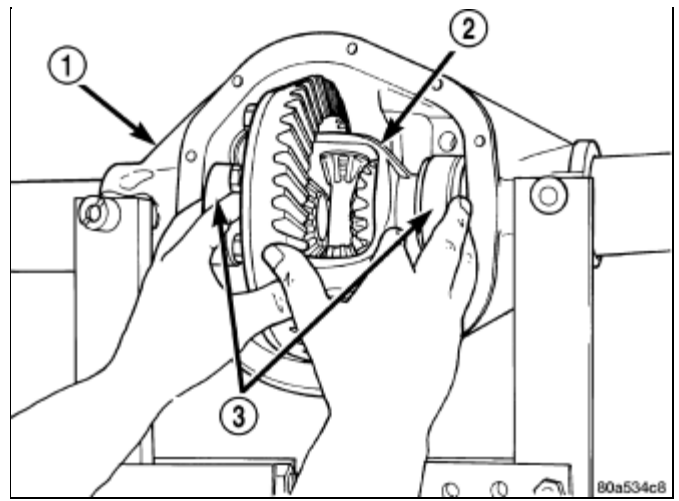


1. With trasmission in neutral, position vehicle on hoist.
2. Remove brake components.
3. Remove wheel speed sensor from hub bearing.
4. Remove hub bearings (1) with axle shafts (2) from axle.

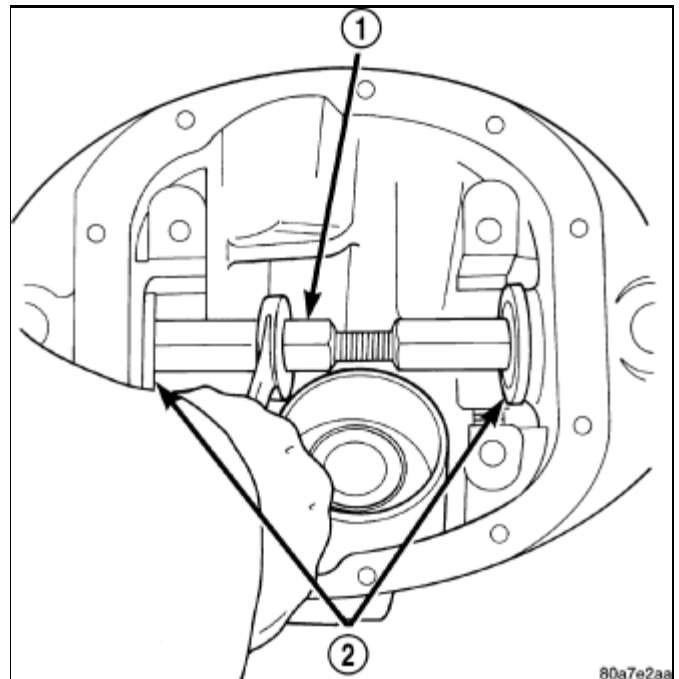


5. Remove differential cover.
6. Remove differential assembly (2) from axle housing (1).
7. Remove inner axle shaft seals with a seal puller.

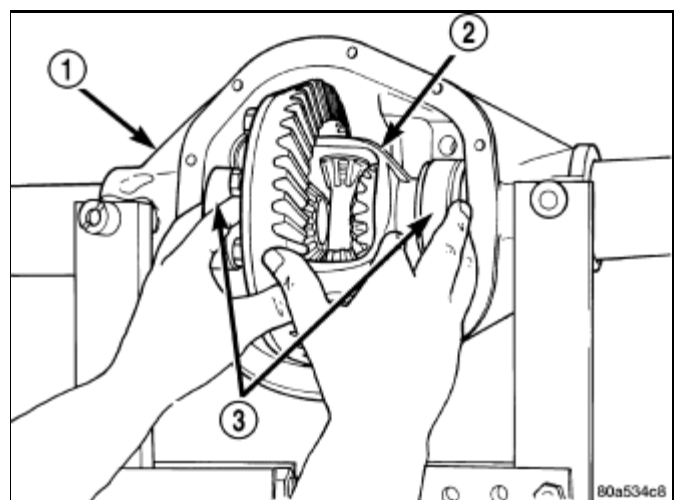
INSTALLATION



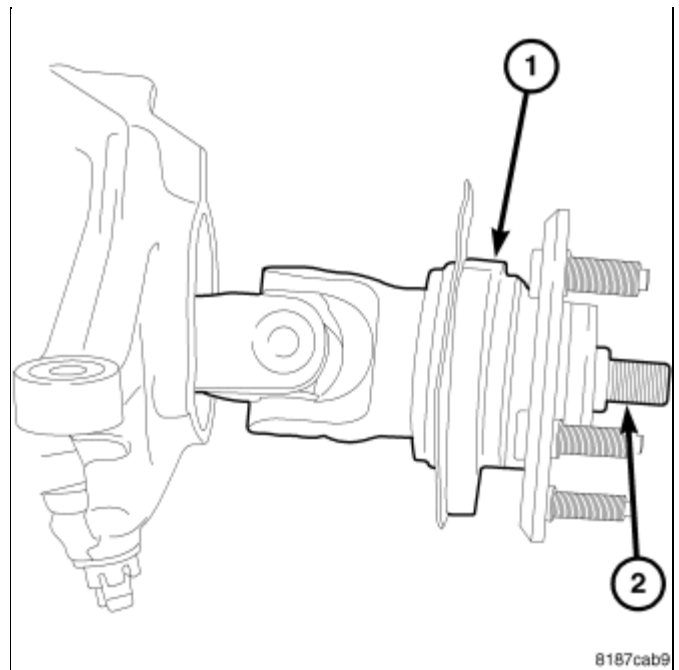
1. Remove any sealer remaining from original seals.
2. Install oil seals with Discs 8110 (2) and Turnbuckle 6797 (1). Tighten tool until disc bottoms in housing.



3. Install differential (2) into housing (1).



4. Install hub bearings (1) and axles (2).

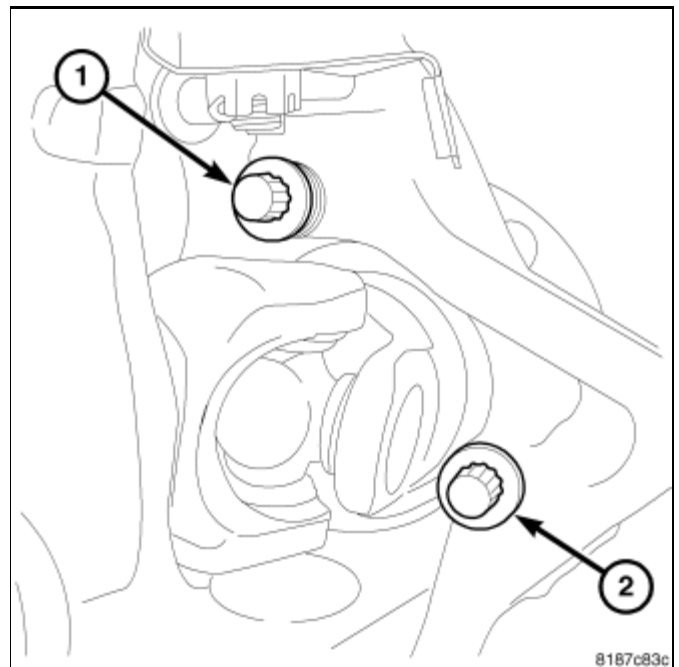


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5. Install hub bearing bolts (1) through steering knuckle (2) and tighten to 102 N·m (75 ft. lbs.).
6. Install wheel speed sensor.
7. Install brake components.

UNIVERSAL JOINT-SINGLE CARDAN

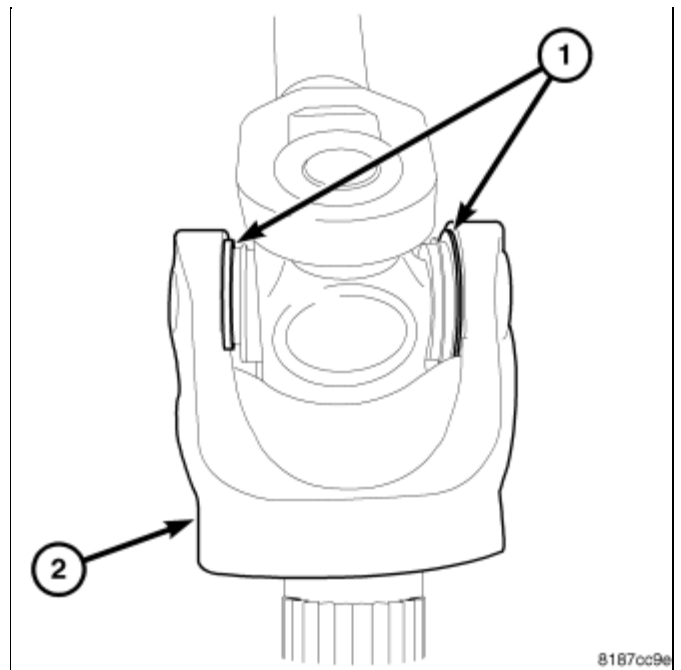
REMOVAL



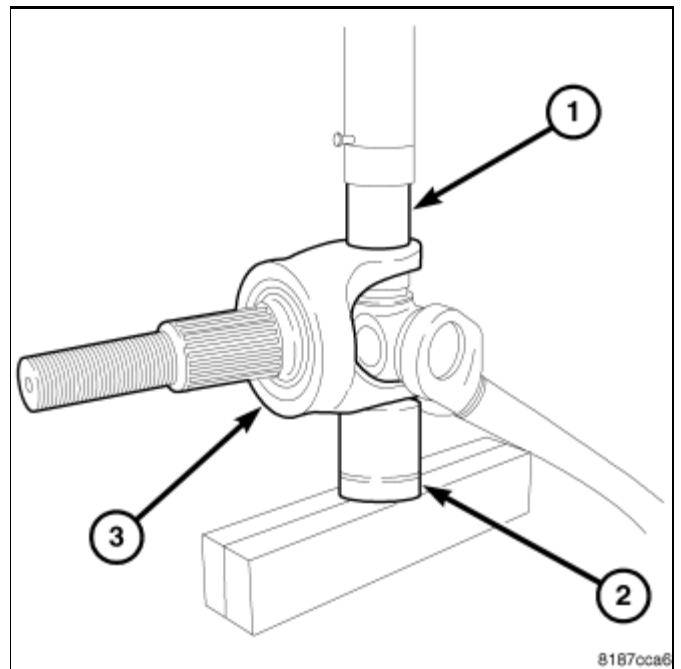
8187c83c

NOTE: Saturate bearing caps with penetrating oil prior to removal.

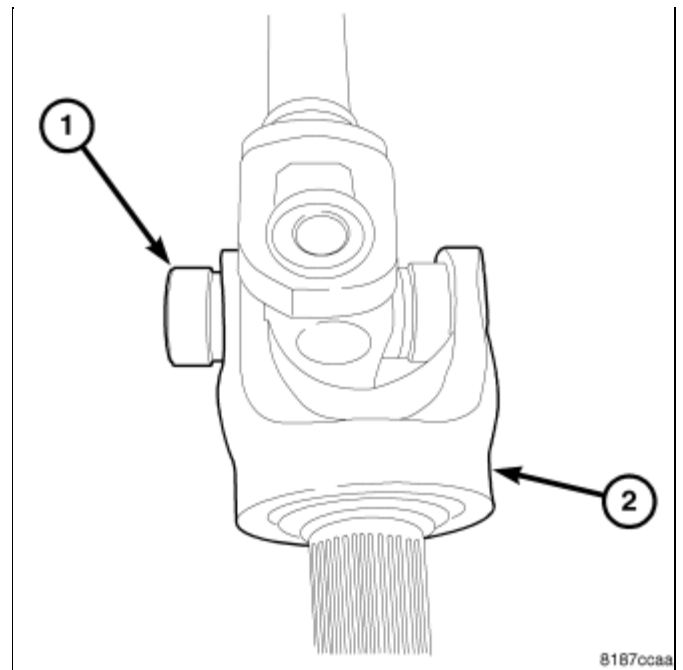
1. Remove axle shaft.
2. Remove bearing cap snap rings (1) from stub shaft yoke (2) bearing caps.



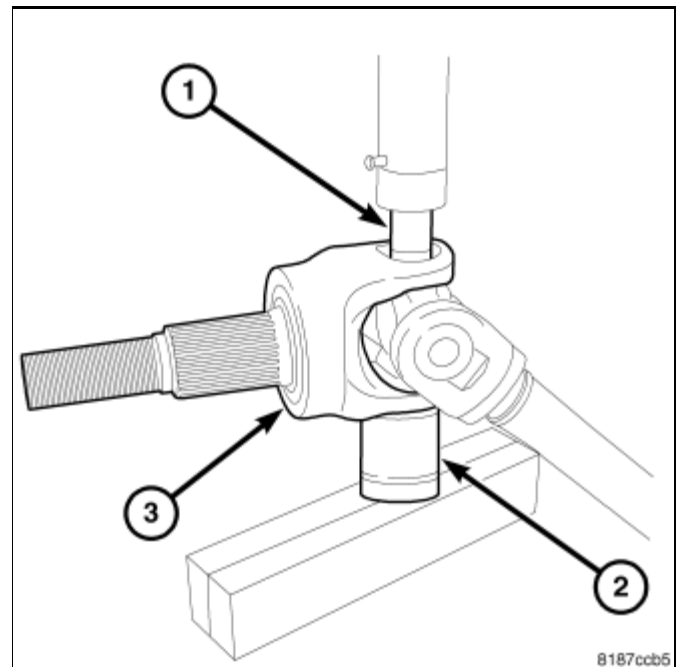
3. Position receiver/socket (2) and driver/socket (1) on stub shaft yoke (3) in press. Press bearing cup into receiver/socket (2).



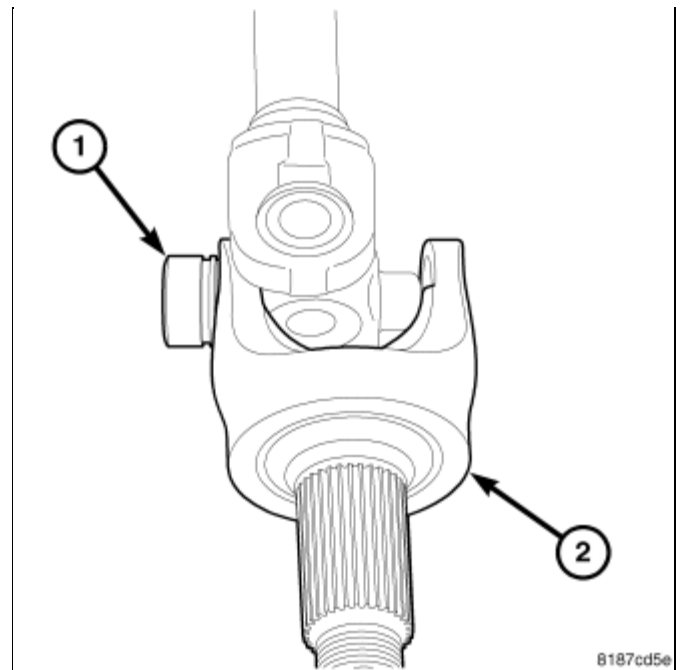
4. Remove bearing cap (1) from stub shaft yoke (2).



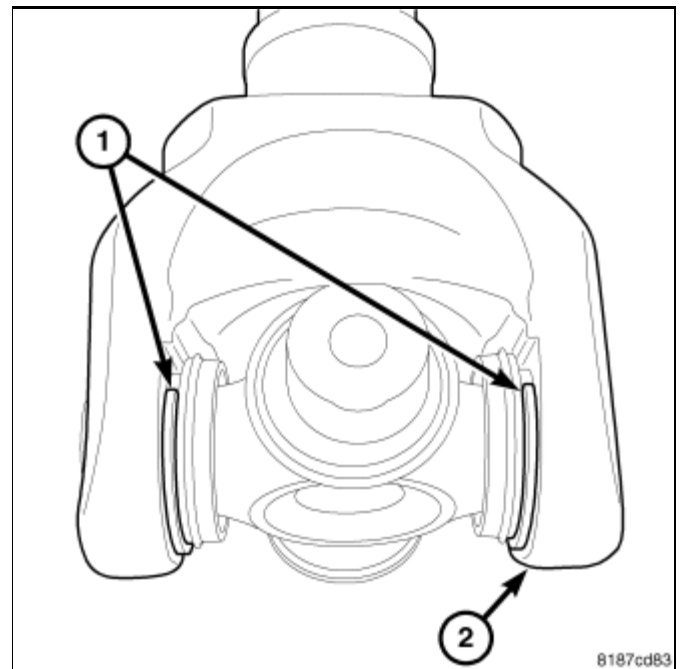
5. Position receiver/socket (2) under stub shaft yoke (3) remaining bearing cup and driver/socket (1) on U-joint cross in press. Press bearing cup into receiver/socket (2)



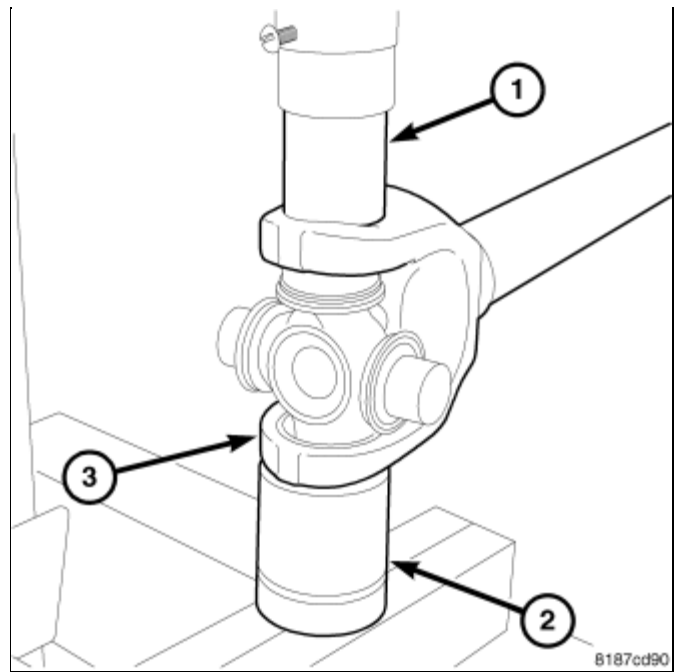
6. Remove bearing cap (1) from stub shaft yoke (2). Then remove stub shaft from U-joint cross.



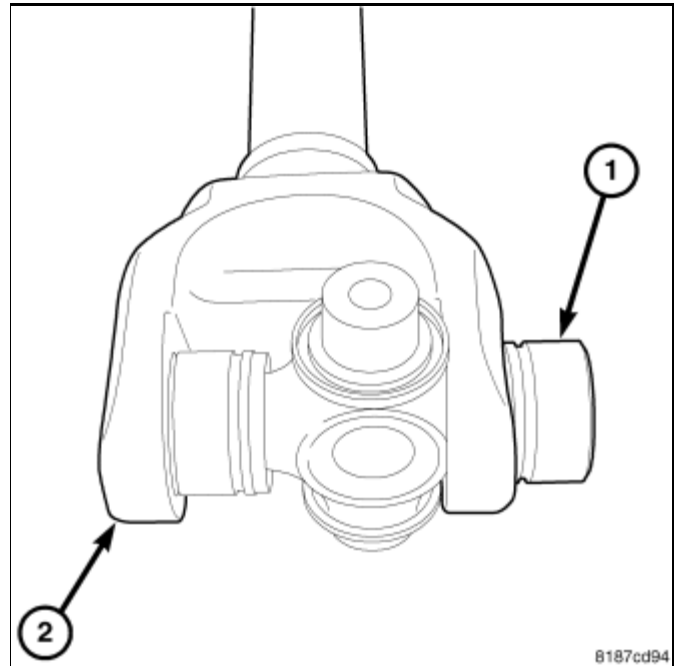
7. Remove snap rings (1) from shaft yoke (2) bearing caps.



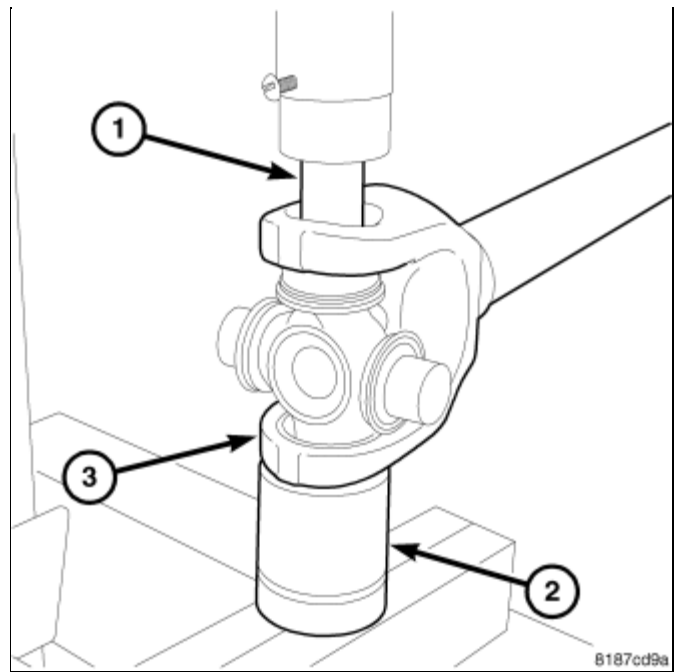
8. Position receiver/socket (2) and driver/socket (1) on shaft yoke (3) in press. Press bearing cup into receiver/socket (2).



9. Remove bearing cap (1) from shaft yoke (2).

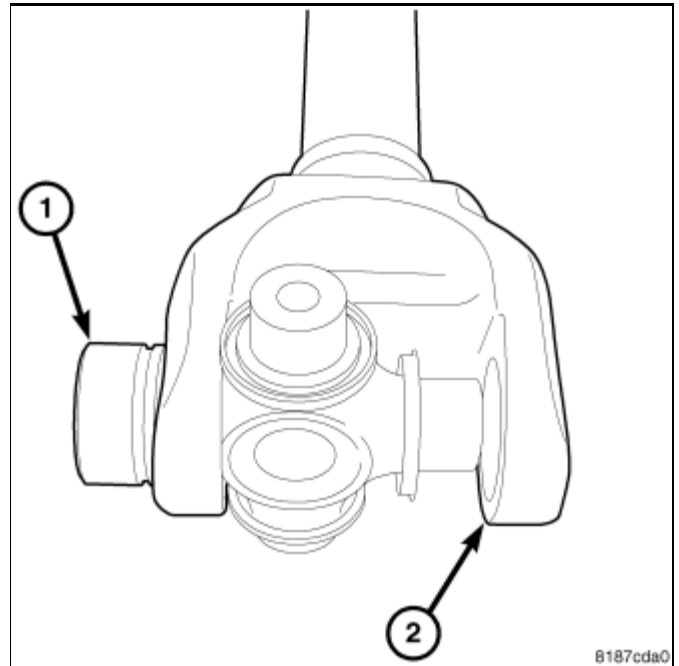


10. Position receiver/socket (2) under shaft yoke (3) remaining bearing cup and driver/socket (1) on U-joint cross in press. Press bearing cup into receiver/socket (2)



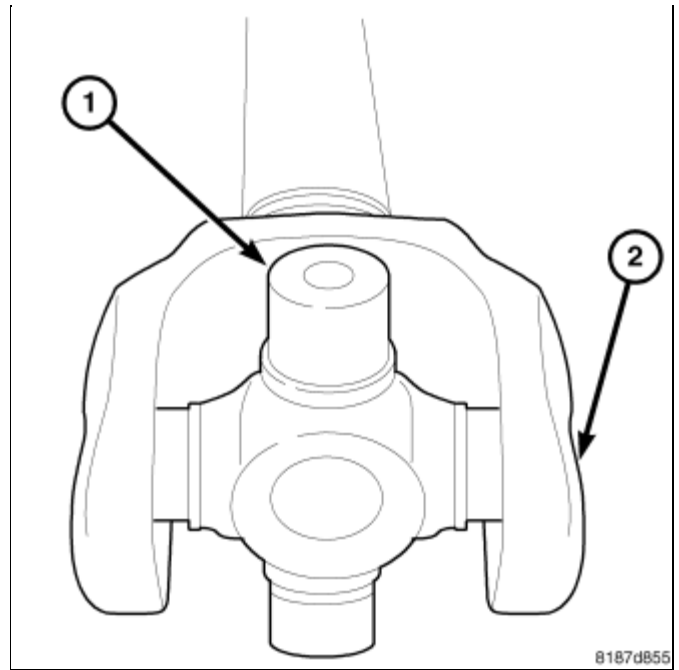
11. Remove bearing cap (1) from shaft yoke (2). Then remove U-joint cross from shaft yoke.

INSTALLATION



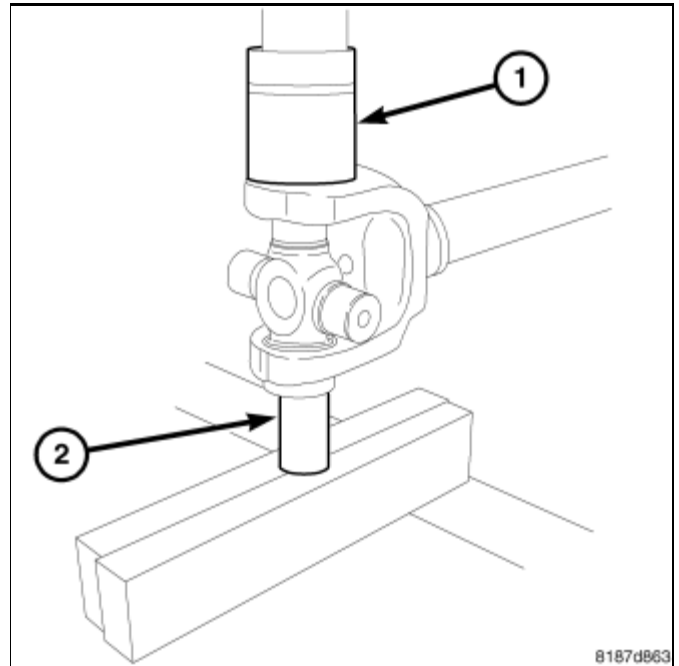
CAUTION: Keep cross and bearing cap straight during installation. Failure to follow these instruction will result in damage.

1. Pack bearing caps 1/3 full of wheel bearing lubricant. Apply extreme pressure (EP), lithium-base lubricant to aid in installation.
2. Position cross (1) in the shaft yoke (2).

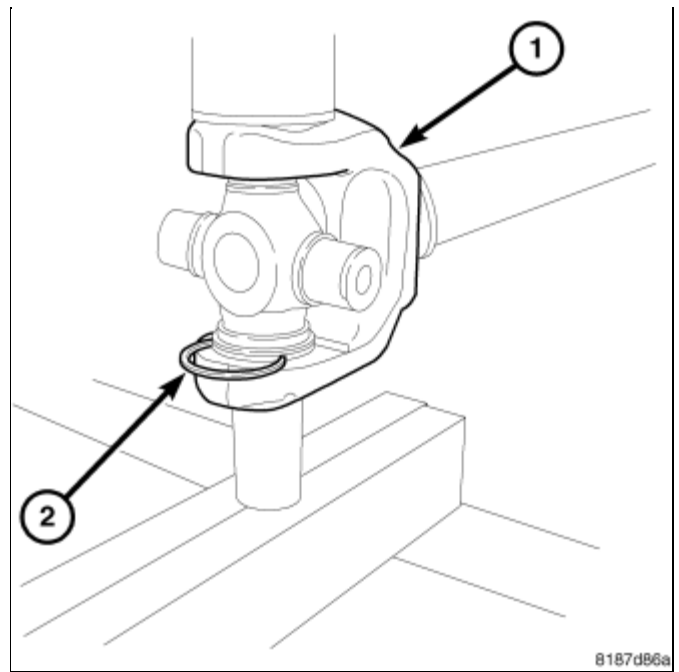


3. Tap bearing cap into the yoke bores far enough to position cross.

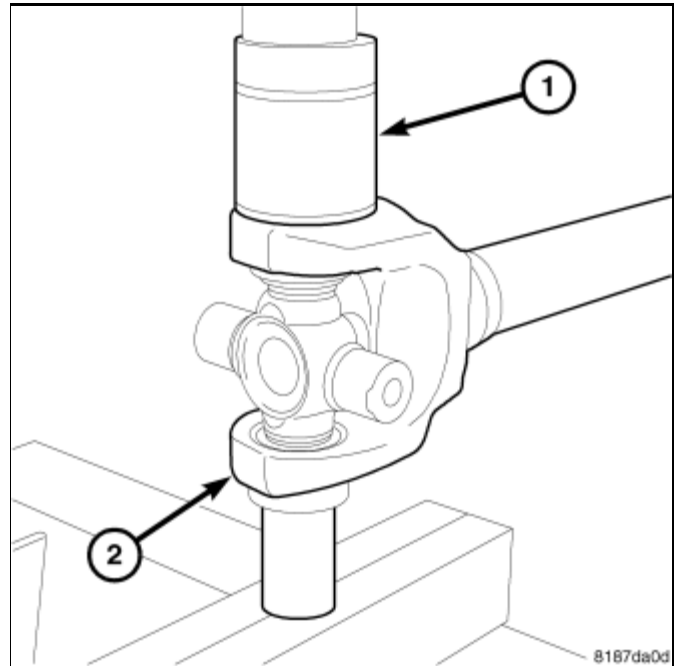
4. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



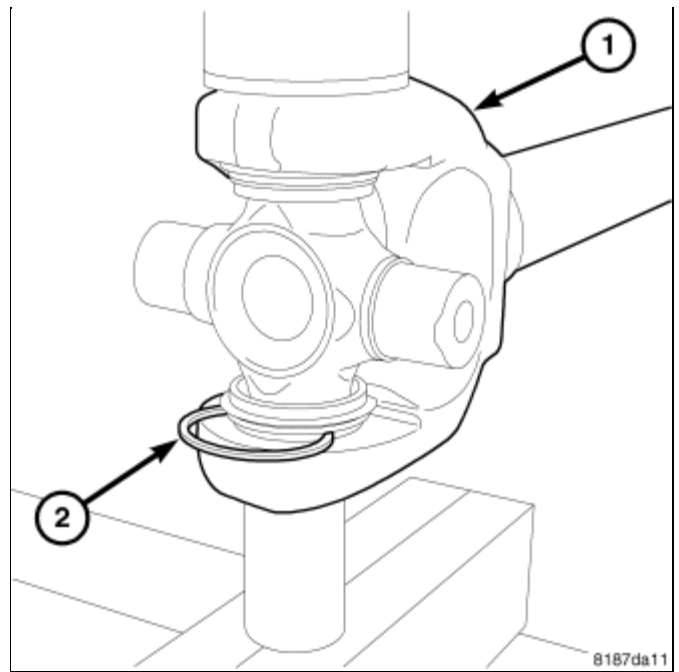
5. Press bearing cap into shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).



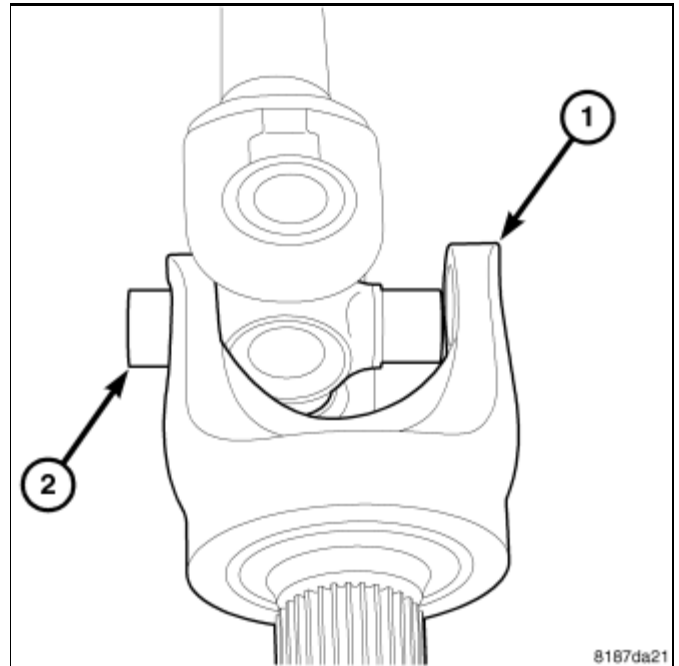
6. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



7. Press bearing cap into shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).

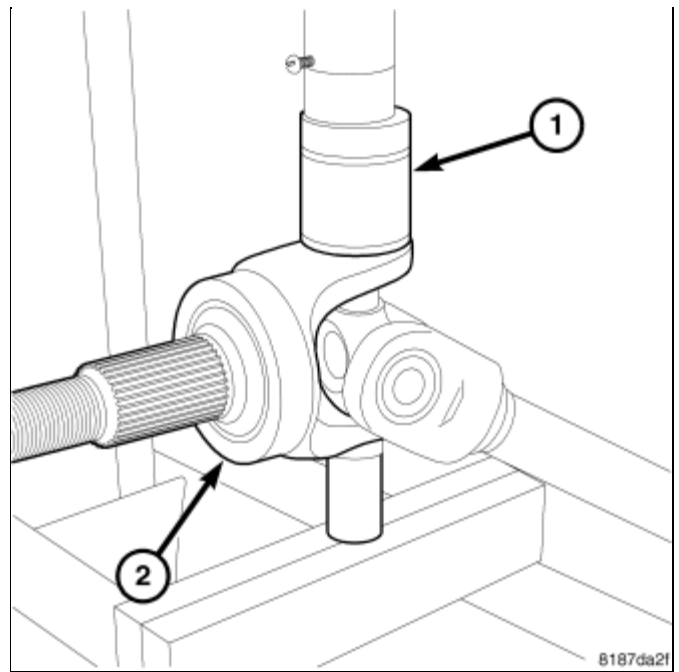


8. Install stub shaft yoke (1) on U-joint cross (2).

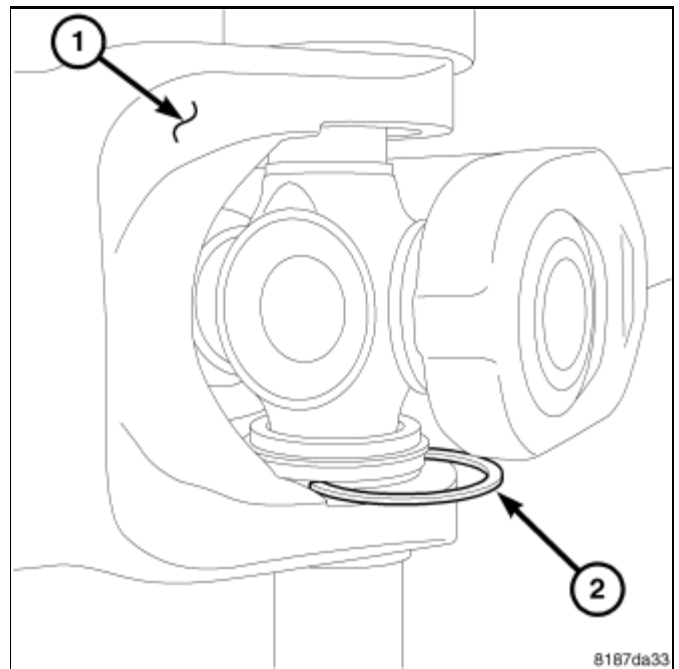


9. Tap fist bearing cap into the stub shaft yoke bore far enough to position cross.

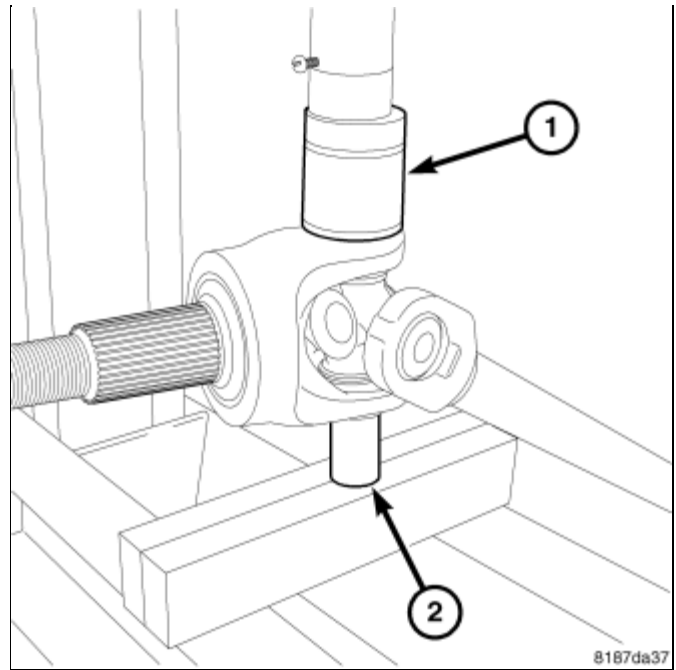
10. Position receiver/socket (1) on shaft yoke and driver/socket (2) on bearing cap in press.



11. Press bearing cap into stub shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).



12. Position receiver/socket (1) on stub shaft yoke and driver/socket (2) on bearing cap in press.

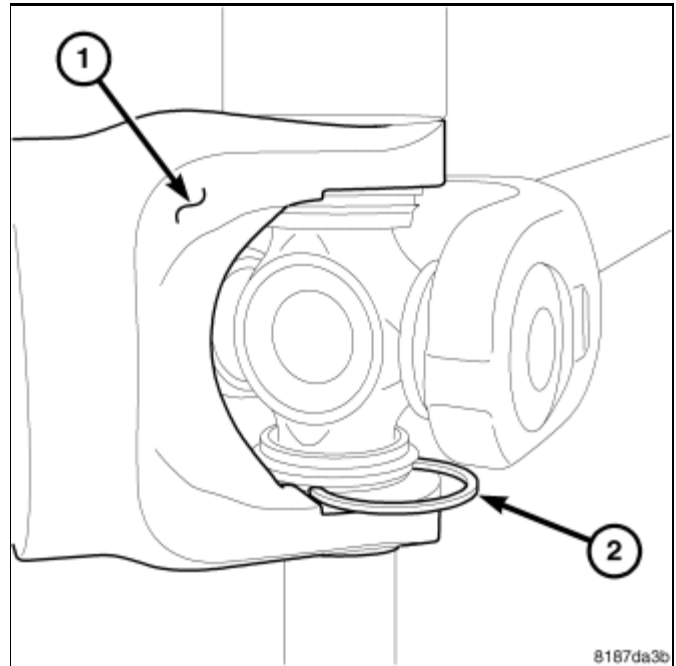


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13. Press bearing cap into stub shaft yoke (1) until bearing cap snap ring groove is visible and install snap ring (2).
14. Install axle shaft.

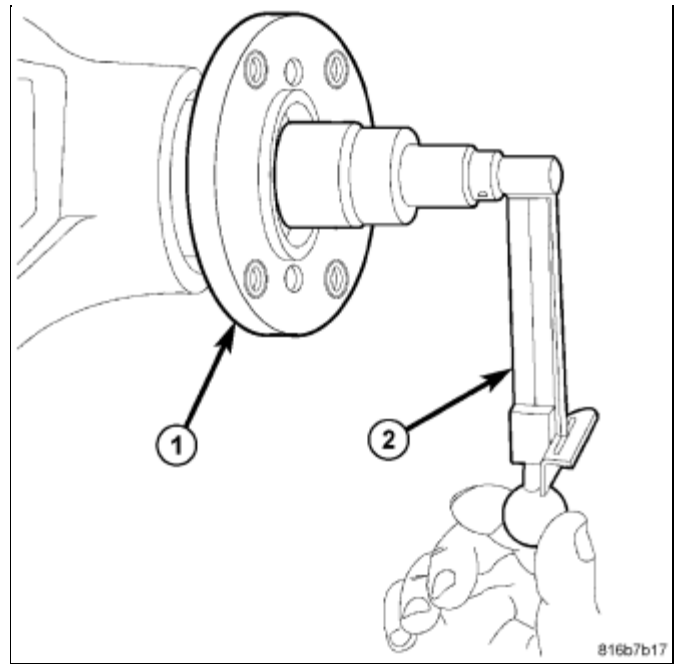
SEAL-PINION

REMOVAL

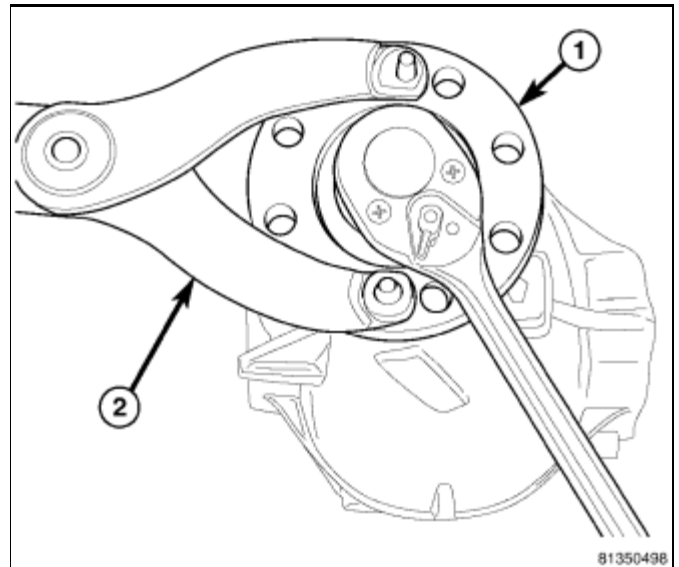


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1. With transmission in neutral, position vehicle on hoist.
2. Mark propeller shaft, pinion flange and pinion shaft for installation reference.
3. Remove propeller shaft.
4. Remove brake calipers to prevent drag.
5. Rotate pinion gear three or four times and verify it rotates smoothly.
6. Record pinion torque to rotate (1) with an inch pound torque wrench (2) for installation reference.

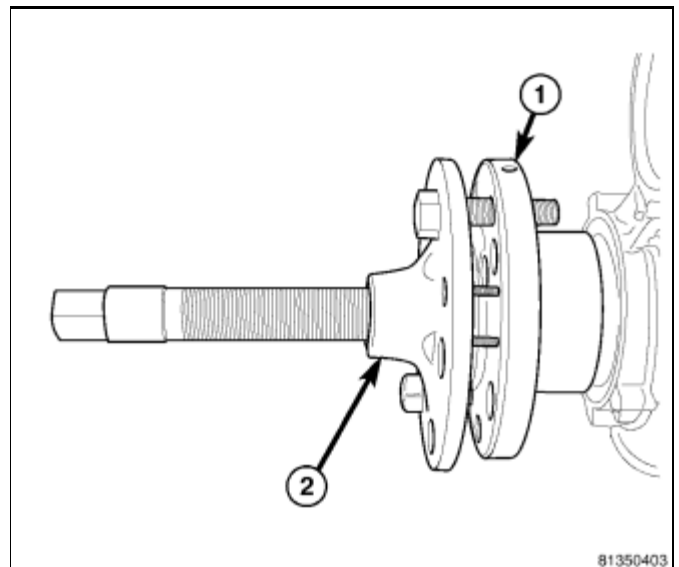


7. Hold pinion flange (1) with Flange Wrench C-3281 (2) and remove pinion nut.
8. Mark a reference line across the pinion shaft and flange for installation reference.

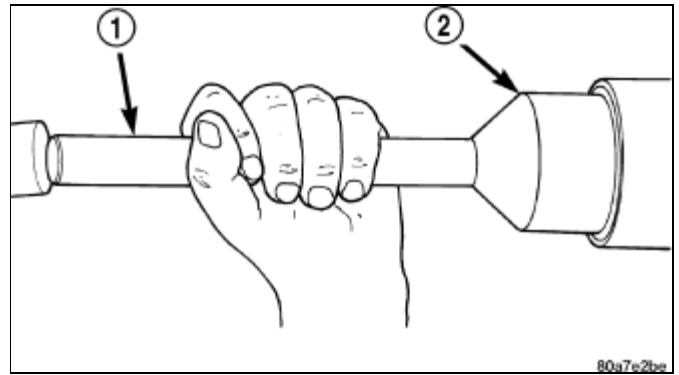


9. Remove pinion flange (1) with Puller C-452 (2).
10. Remove seal with a seal puller.

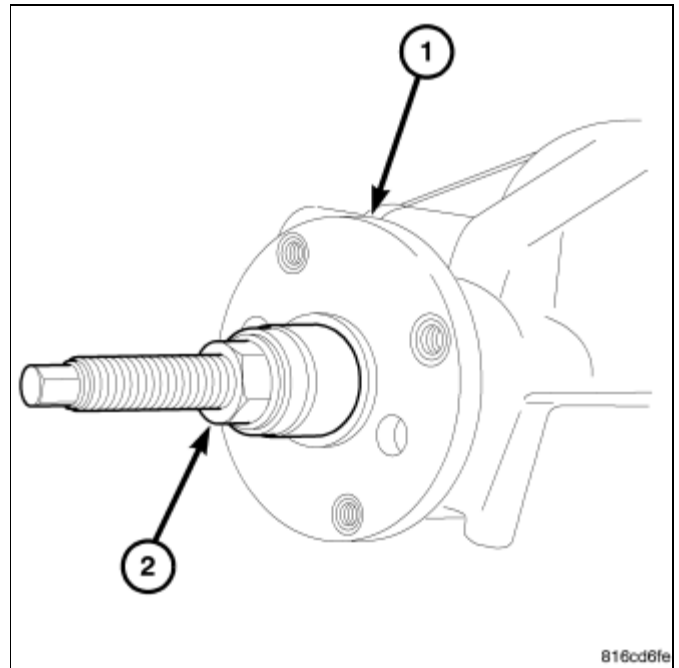
INSTALLATION



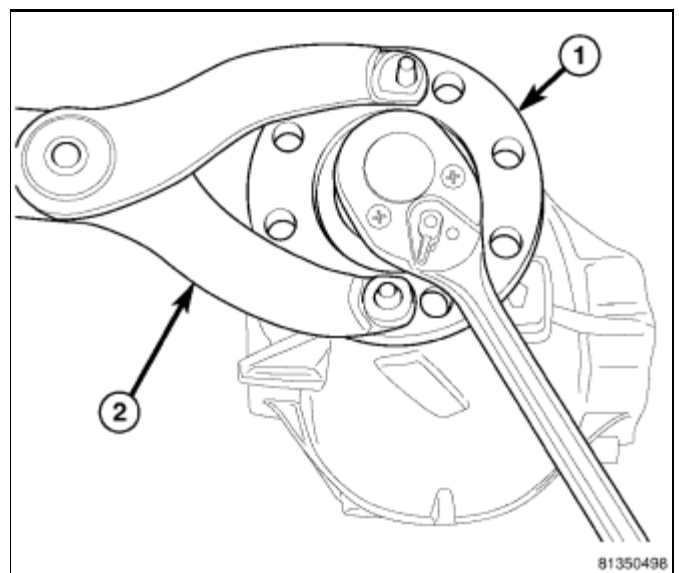
1. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Handle C-4171 (1) and Installer 8681 (2).



2. Place pinion flange on the pinion shaft with reference marks aligned.
3. Install flange (1) with Installer 8112 (2) and Cup 8109.



4. Install **new** pinion nut.
5. Hold pinion flange (1) with Flange Wrench C-3281 (2) and tighten pinion nut to 217 N·m (160 ft. lbs.).

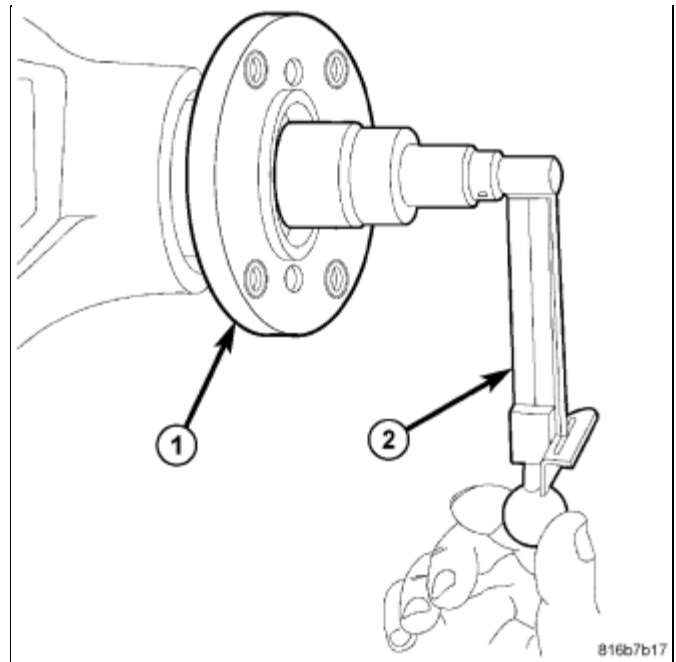


6. Measure pinion torque to rotate (1) with an inch

pound torque wrench (2). Pinion torque to rotate is recorded reading plus 0.56 N·m (5 in. lbs.). If torque to rotate is low, tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until torque to rotate is achieved.

CAUTION: If maximum tightening torque of 271 N·m (200 ft. lbs.) is reached before torque to rotate is achieved, the collapsible spacer may have been damaged. Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. Failure to follow these instruction may result in damage.

7. Install propeller shaft with reference marks aligned.
8. Install brake calipers.
9. Check and add gear lubricant to axle if necessary.



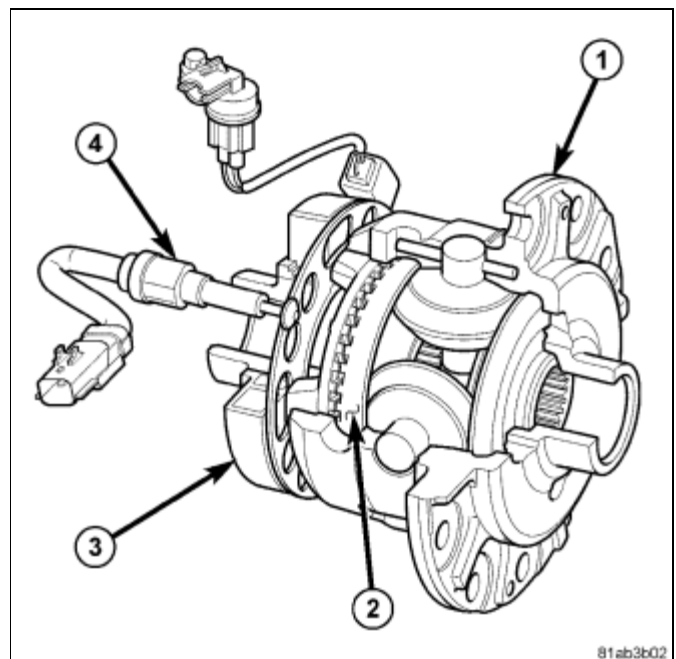
DIFFERENTIAL-TRU-LOK

DESCRIPTION

Tru-Lok is an electronically locking differential (1). The differential has four pinion gears, three pinion shafts and two side gears. On the back side of one side gear (2) is half of the dog clutch.

NOTE: The electric locking differential is serviced as an assembly.

A 12 volt electromagnetic coil (3) on the differential is controlled by the Totally Integrated Power Module (TIPM). When the coil (3) is energized the dog clutch is engaged which locks the one side gear to the differential case. This action locks the axles and triggers a switch (4) in the differential housing which activates the Tru-Lok indicator light on the dash.



OPERATION

Pressing a two-way momentary rocker switch on the switch bank request axle lock. The first press DOWN requests rear axle to be locked, every other press DOWN toggles between "front and rear axle lock" and "rear axle lock" request states. Press rocker switch UP requests both axles to be unlocked. The switch is on the IP in the switch bank. The switch bank sends a message to the Cabin Cluster Node (CCN). The CCN handles the switch debounce and switch diagnostics. Any one message sent by the CCN on the network is a valid switch change. The CCN passes the information to the Totally Integrated Power Module (TIPM) via a CAN B message. The TIPM will process the switch info received from CAN B, control the outputs

as required by the Axle Lock Electrical Requirements, and send a lighting request to the CCN via CAN B. There are three telltales on the cluster, "Rear", "Front", and "Lock". The telltales will be off if the axles are unlocked, flashing if there is a pending request to lock but the axles are not yet locked (transition to lock, torque-locked, or conditions not correct), and flashing rapidly if there is a fault. The "Front" and "Rear" telltales will match the front and rear differential states. The "Lock" telltale will be on solid if either the "Front" or "Rear" telltale is on or blinking. The TIPM will send the axle lock status message to the ESP module via CAN C.

AXLE LOCK ELECTRICAL REQUIREMENTS

DIFFERENTIAL LOCK

- Vehicle speed of 16 KPH (10 MPH) or below
- Transfer case in 4 LO position
- Switch request message for the corresponding axle/s has been received
- Ignition switch in the RUN or START position
- No system, module, or switch faults have been detected

DIFFERENTIAL UNLOCK

- Transfer case in 4 HI, 2 WD, or Neutral
- Loss of ignition switch signal, vehicle speed signal, transfer case signal
- Vehicle speed of 50 KPH (30 MPH) or higher
- Valid switch message received

AXLE FAIL-SAFE

- Axles will UNLOCK with ignition switch in either the OFF or ACC position.
- Axles will not LOCK if there is no ignition switch, vehicle speed, or transfer case position signal. Axles will UNLOCK with the loss of any of these signals.
- Axles will not LOCK if the ignition switch is OFF.
- Axles will UNLOCK if a switch failure is detected.

Software Latch Feature: The Totally Integrated Power Module (TIPM) will have a software latch of the axle switch during an ignition switch OFF when the vehicle is in 4 LO transfer case position. Upon ignition key RUN or START the TIPM shall check to verify conditions are correct for an axle lock and automatically lock the axles that were locked before the ignition was turned OFF.

NOTE: The electric locking differential is serviced as an assembly.

DIAGNOSIS AND TESTING

DIFFERENTIAL - TRU-LOK

The control module for the electronically locking differentials detects faults from input signal/messages, sensors, solenoids, and drivers/relays and report the corresponding Diagnostic Trouble Code (DTC).

The lighting strategy for the axle lock switch.

1. The FRONT LED will

- a. turn ON SOLID when the front axle is locked
- b. turn ON BLINKING when the front axle is attempting to lock
- c. turn ON BLINKING when a lock front axle request is received but conditions to lock are not correct
- d. turn OFF when the axle is UNLOCKED
- e. turn ON FAST BLINKING when there is a fault detected for the front axle

2. The REAR LED will

- a. turn ON SOLID when the rear axle is locked
- b. turn ON BLINKING when the rear axle is attempting to lock
- c. turn ON BLINKING when a lock rear axle request is received but conditions to lock are not correct
- d. turn OFF when the axle is UNLOCKED
- e. turn ON FAST BLINKING when there is a fault detected for the rear axle

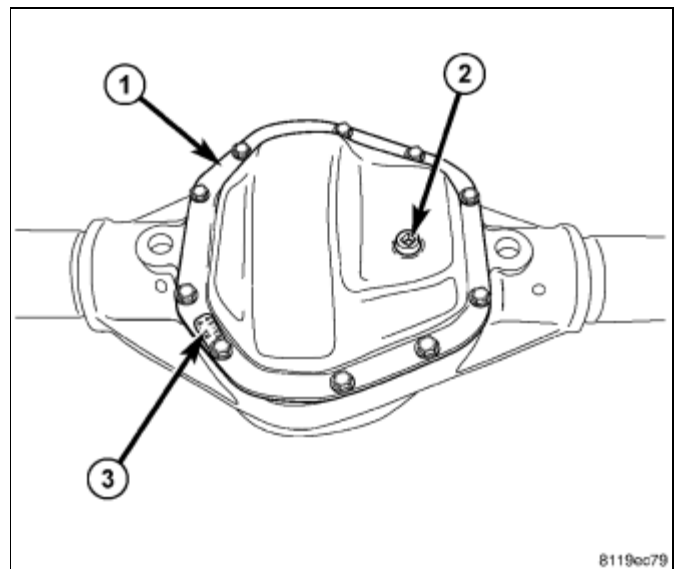
INDICATOR SWITCH

Ohm meter set on continuity: One lead on each connector terminal

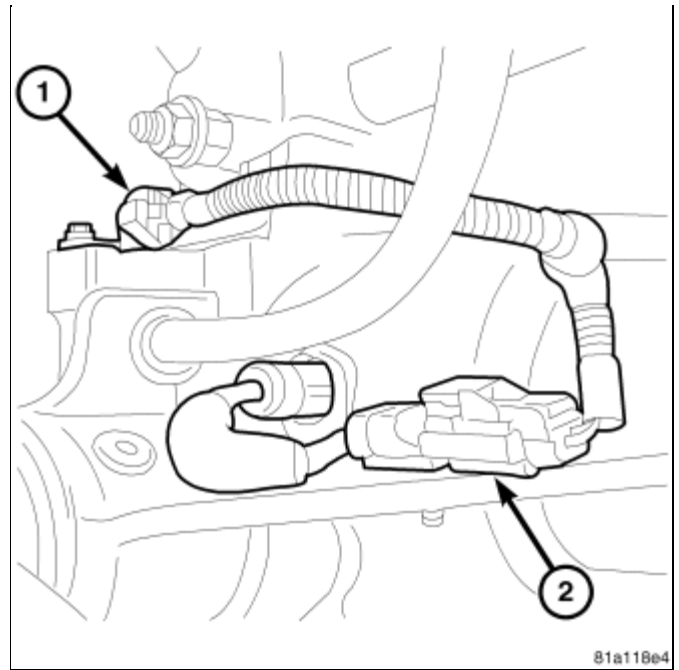
- Switch Plunger IN Locker Not Engaged - No Continuity
- Switch Plunger OUT Locker Engaged - Continuity

REMOVAL

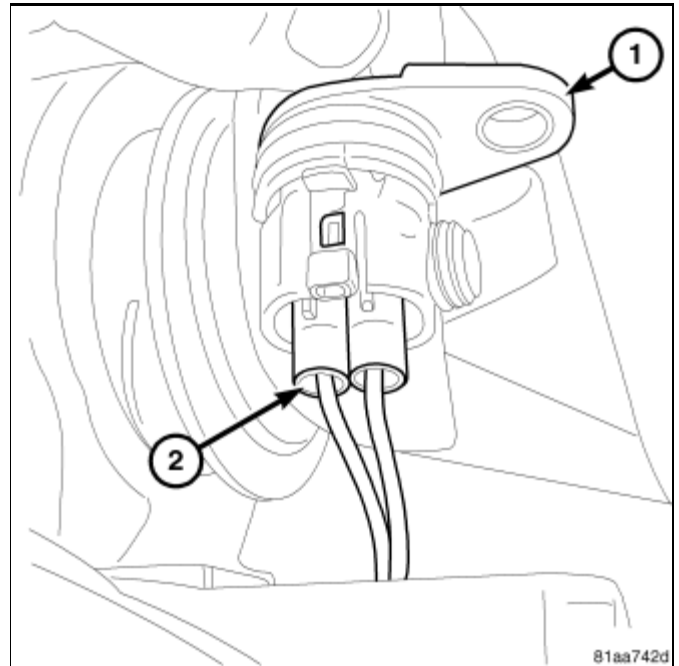
1. Remove differential fill plug (2).
2. Remove differential cover (1) and drain fluid.
3. Remove axle shafts.



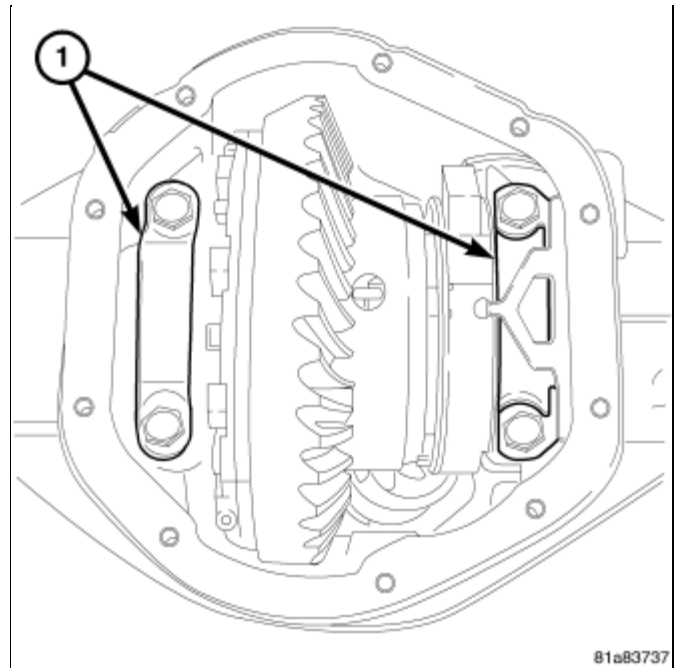
4. Remove Tru-Lok harness from the coil connector (1) and indicator switch (2).
5. Remove Tru-Lok coil connector (1) bolt.



6. Remove Tru-Lok coil connector (1) from the axle housing and remove coil harness (2) from the connector (1).

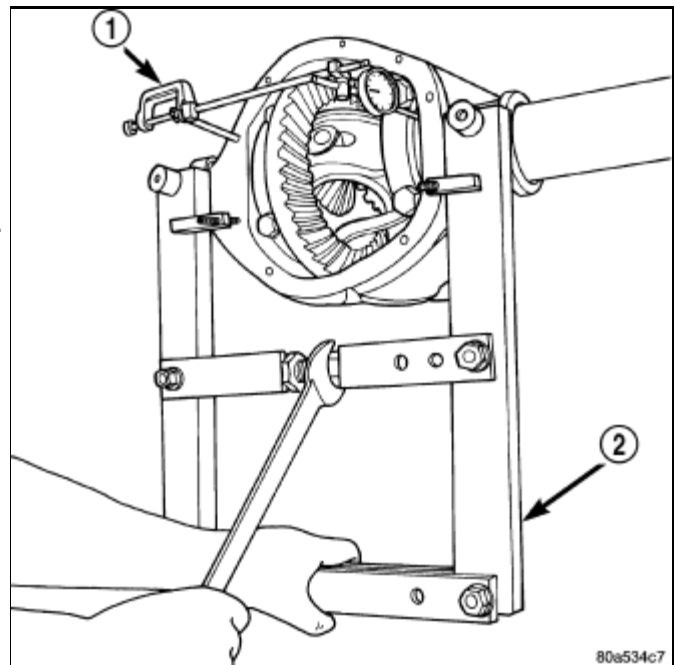


7. Loosen differential bearing cap (1) bolts.

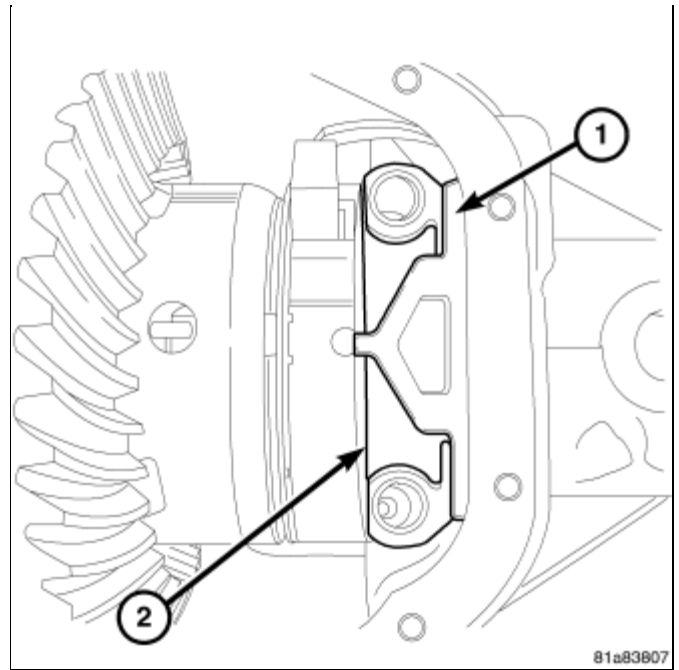


8. Position Spreader W-129-B (2) with Adapter Kit 6987B on differential locating holes. Install hold-down clamps and tighten the turnbuckle finger-tight.
9. Install a Pin C-3288-B (1) at the left side of the differential housing. Attach Dial Indicator C-3339A to pin. Load indicator plunger against the opposite side of the housing and zero the indicator.
10. Spread housing while measuring the distance with the dial indicator (1).

CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.



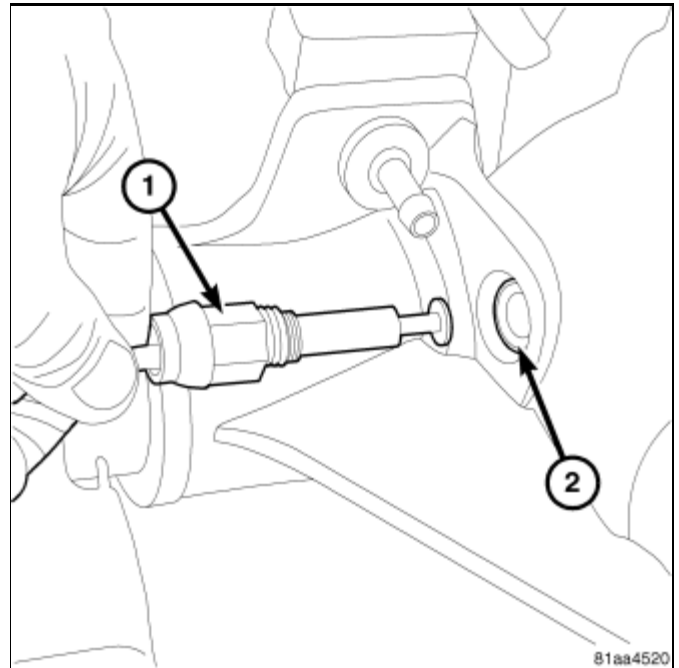
11. Remove dial indicator.
12. Holding differential case in position, remove differential bearing cap bolts.
13. Remove coil anti-rotation bracket (1) from the bearing cap (2), then remove both bearing caps.
14. Remove differential case from housing and tag differential bearing cups and shims location.
15. Remove spreader from housing.



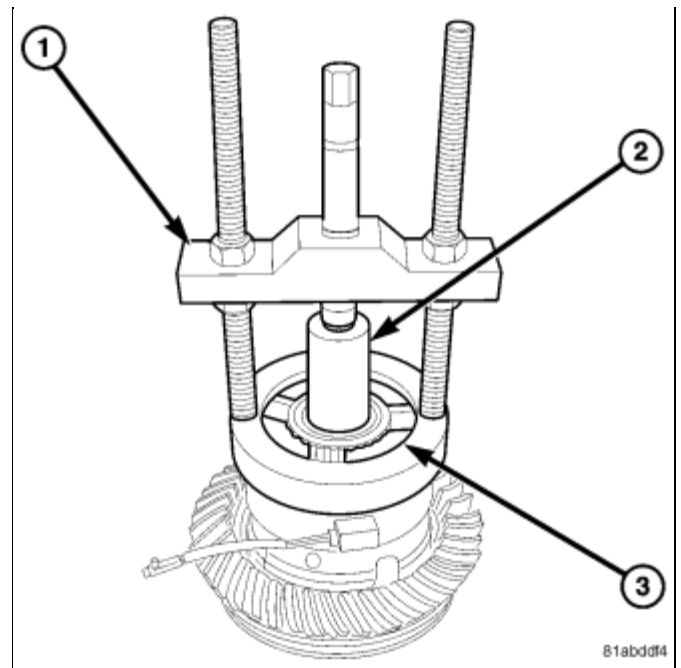
16. Remove Tru-Lok indicator switch (1) from differential housing (2).
17. Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

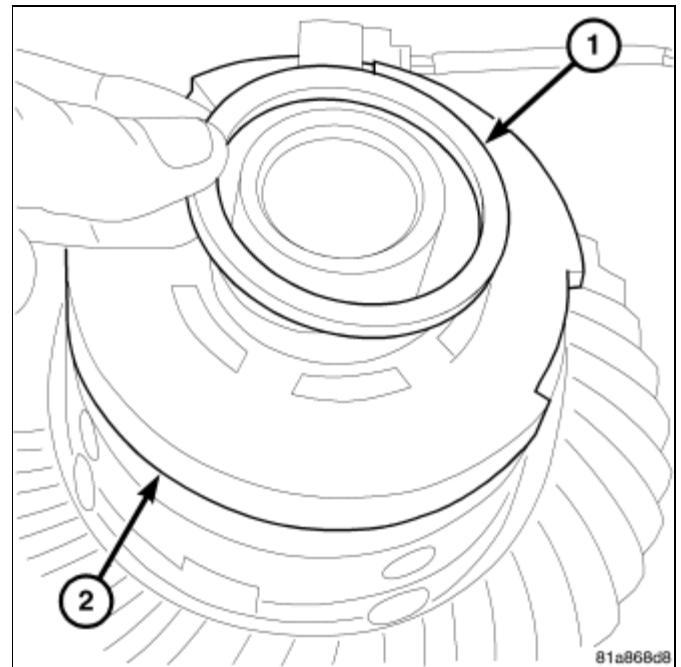
DISASSEMBLY



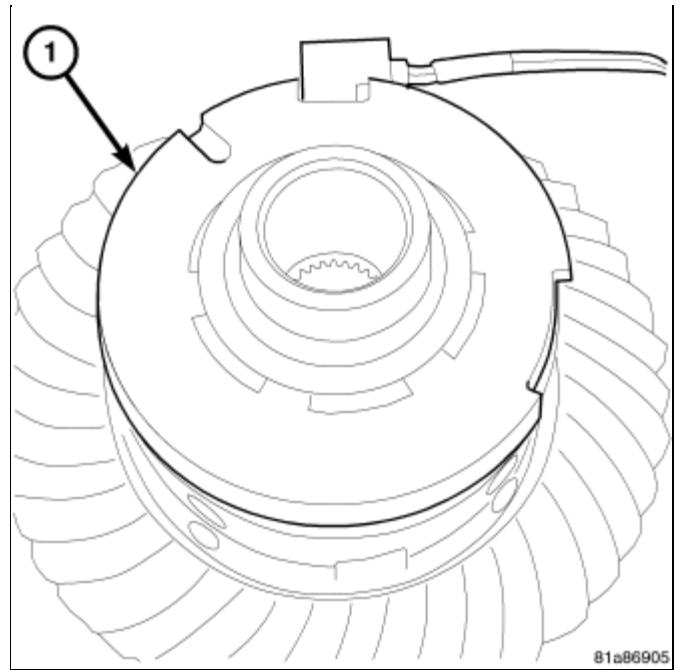
1. Remove bearing from coil side of the differential case with Puller C-293-PA (1), Plug C-293-3 (2), and Adapters C-293-47 (3).



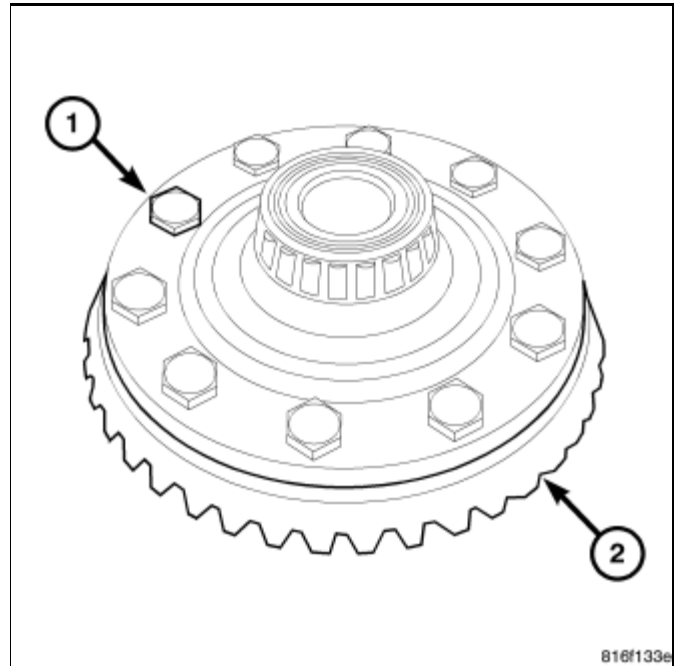
2. Remove washer (1) from coil (2).



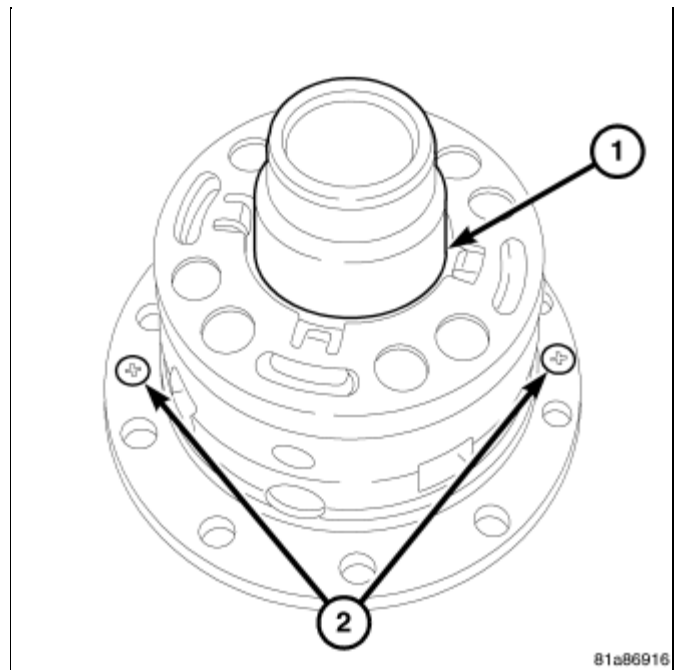
3. Remove coil (1) from differential case.



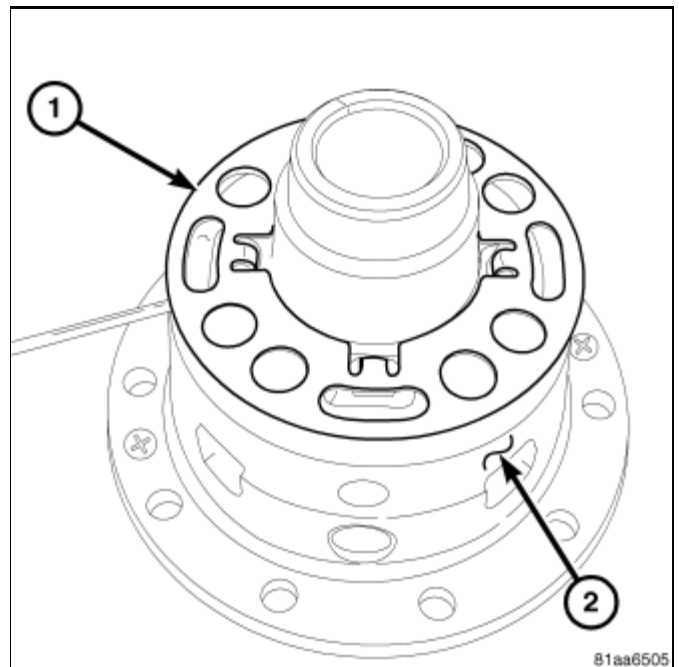
4. Remove ring gear bolts (1) and remove ring gear (2).



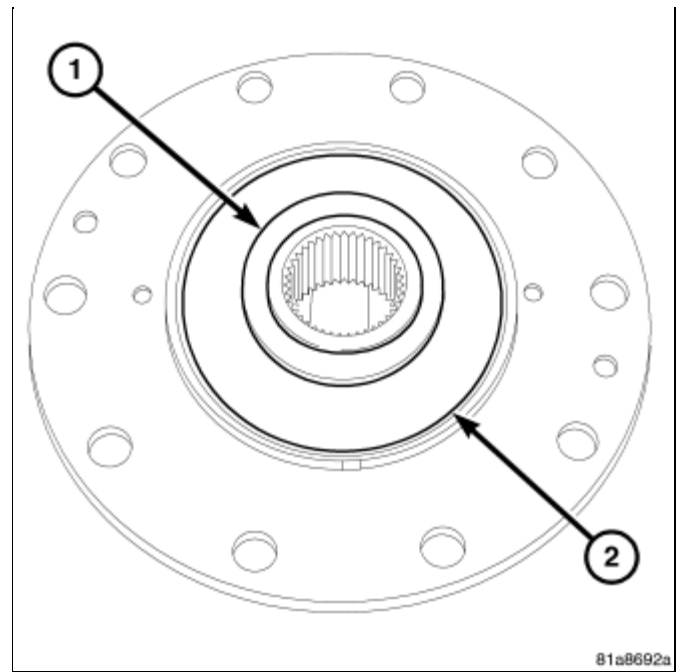
5. Remove differential case (1) screws (2).



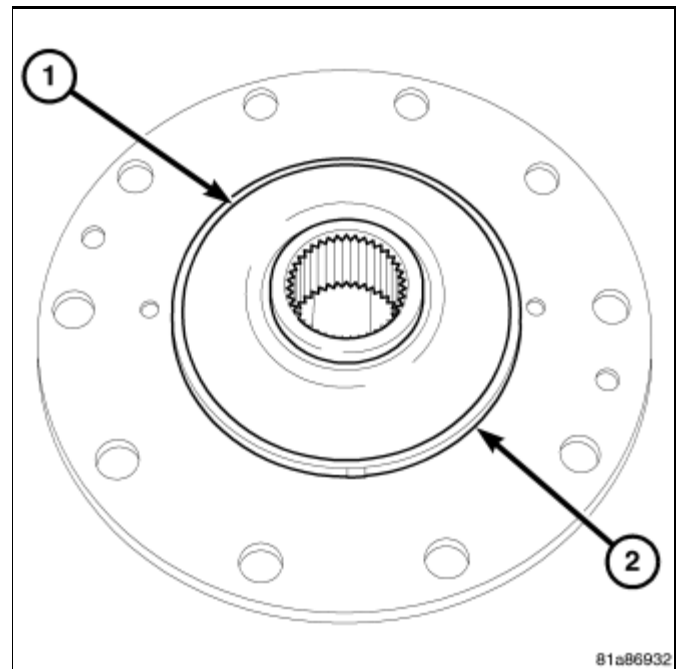
6. Pry up dog clutch actuator plate (1) and remove from differential case (2).



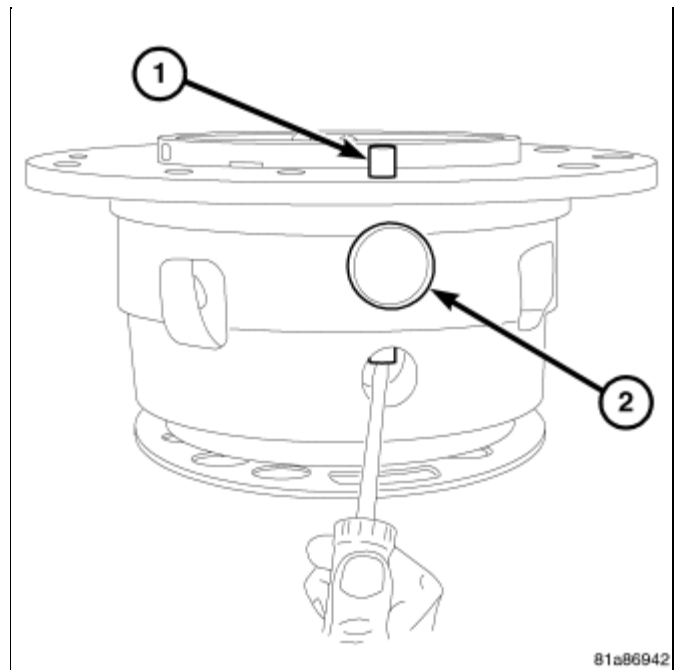
7. Turn differential case over and remove case half.
8. Remove thrust washer (1) from side gear (2).



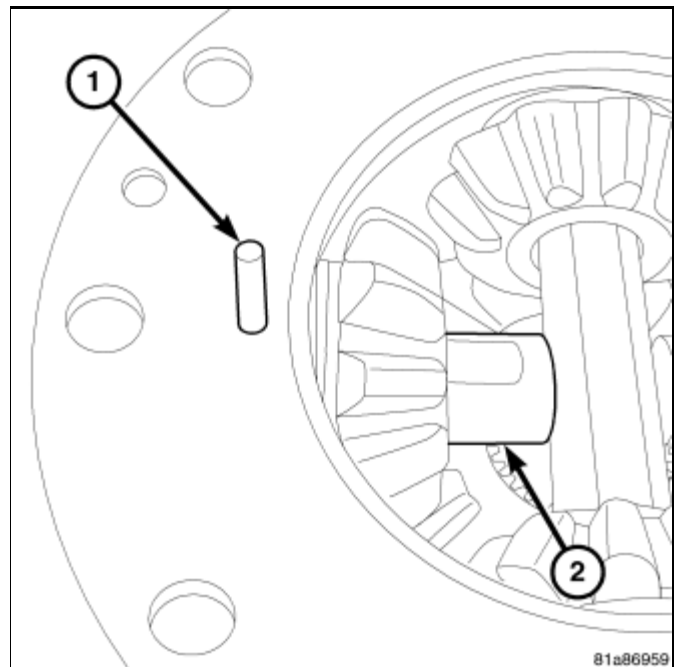
9. Remove side gear (1) from differential case (2).



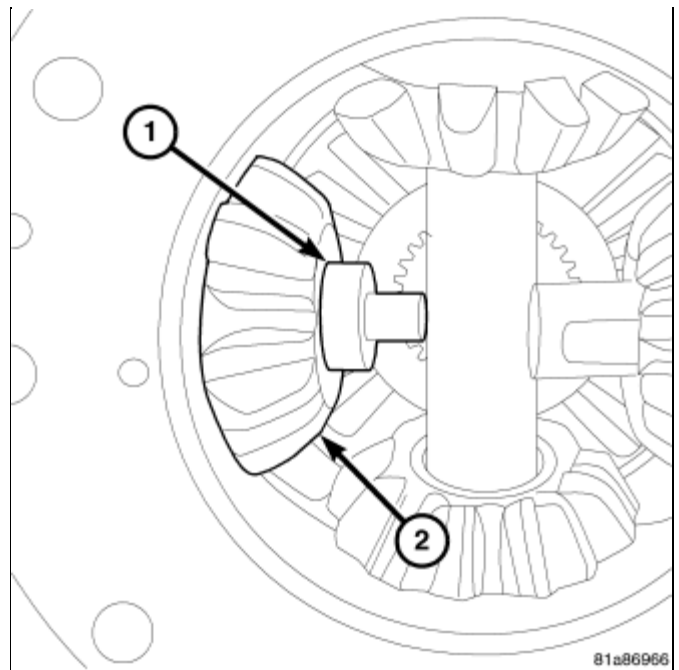
10. Push pinion shaft (2) pin (1) up.



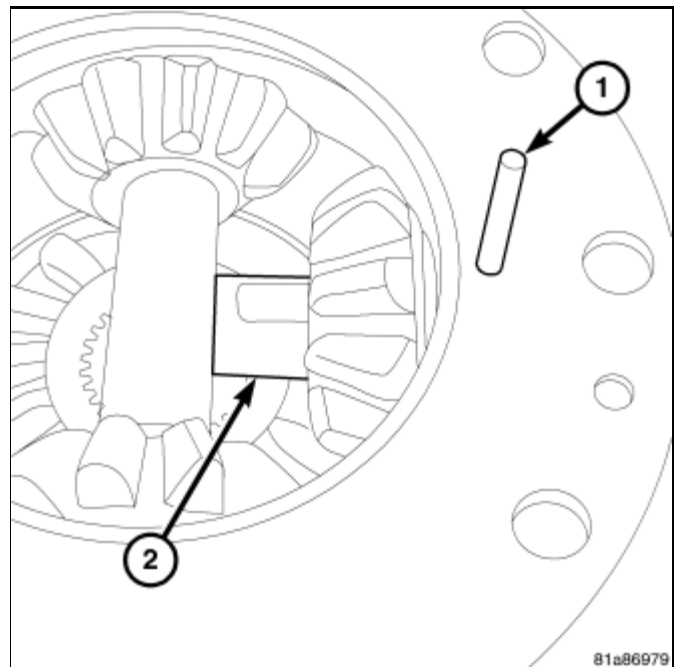
11. Pull pinion shaft pin (1) out of the pinion shaft (2) and case.



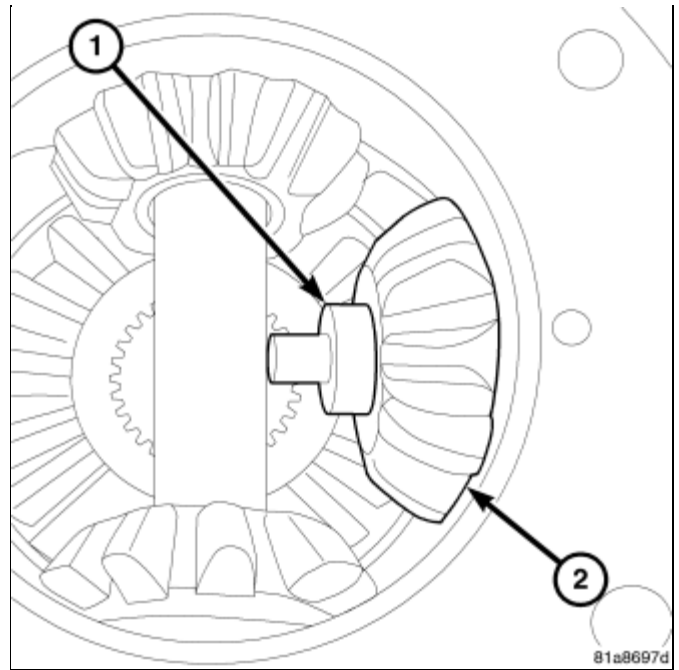
12. Remove pinion shaft (1) from the case and remove pinion gear (2) with thrust washer.



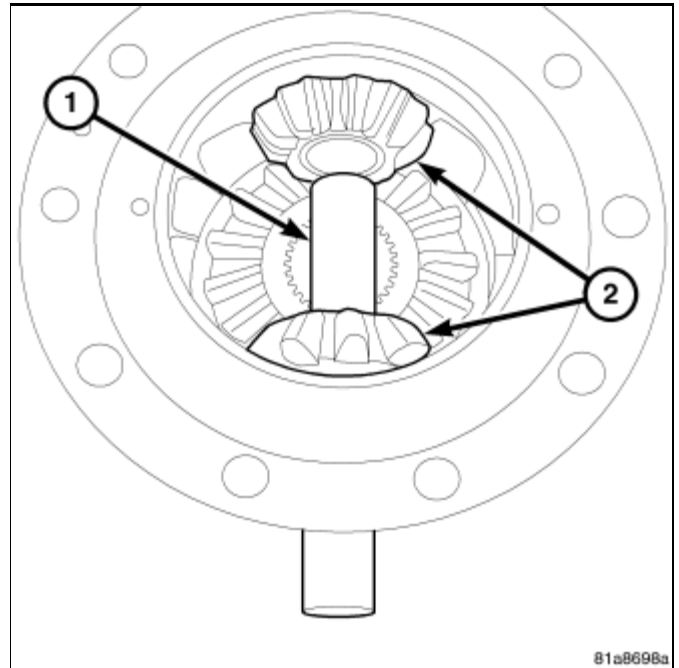
13. Pull opposite pinion shaft pin (1) out of the pinion shaft (2) and case.



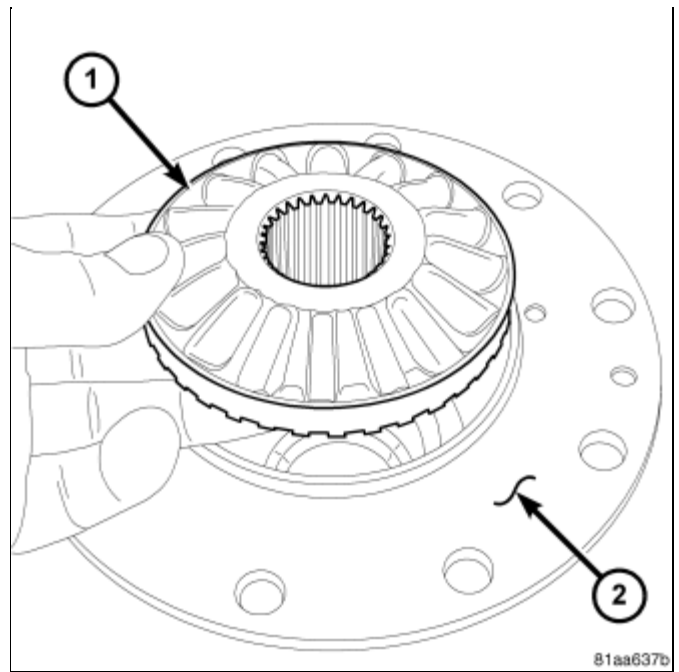
14. Remove the pinion shaft (1) from the case and remove pinion gear (2) with thrust washer.



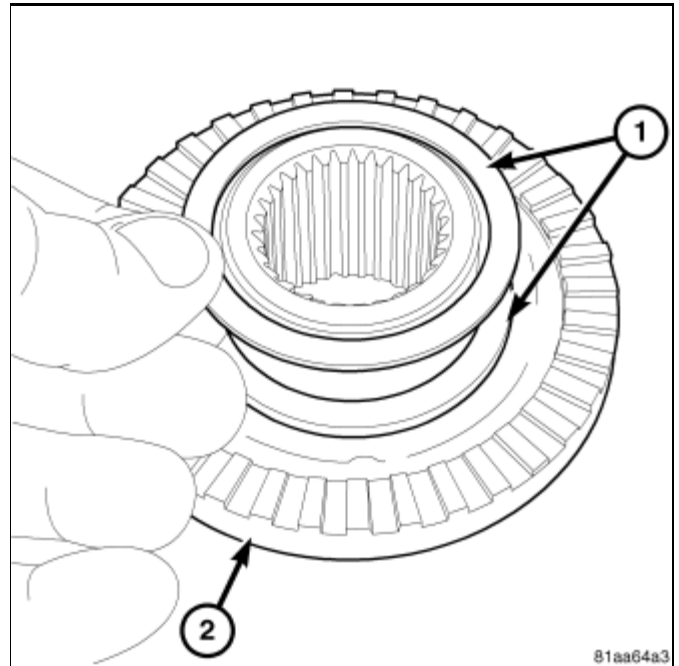
15. Slid remaining pinion shaft (1) out of the case and remove the remaining two pinion gears (2) with thrust washers.



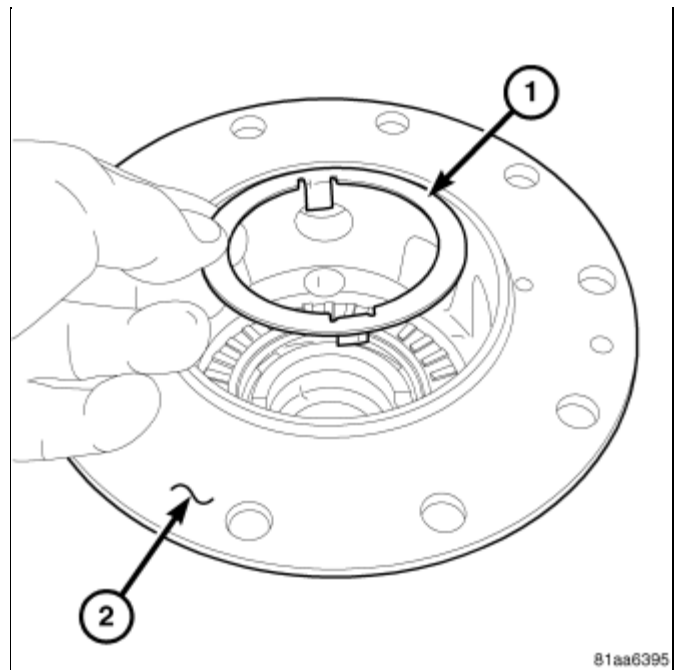
16. Remove dog clutch side gear (1) from differential case (2).



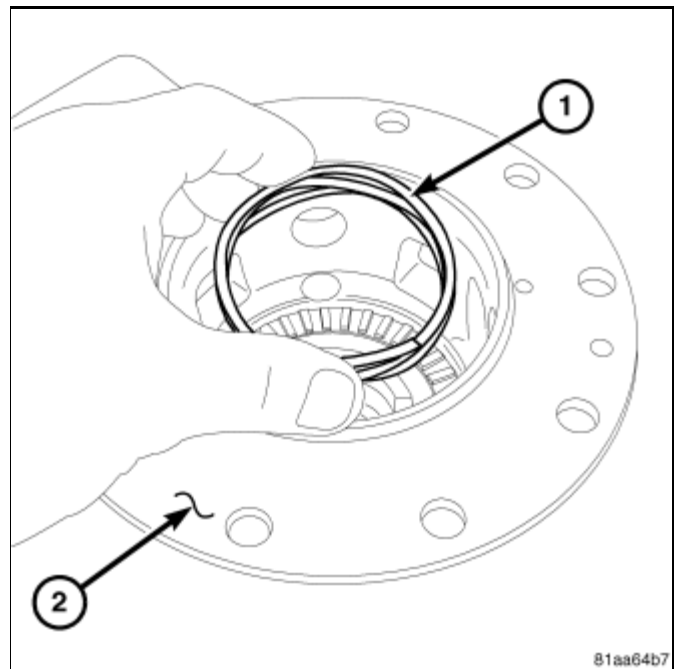
17. Turn dog clutch side gear (2) over and remove thrust washers (1).



18. Remove wave spring stop ring (1) from differential case (2).

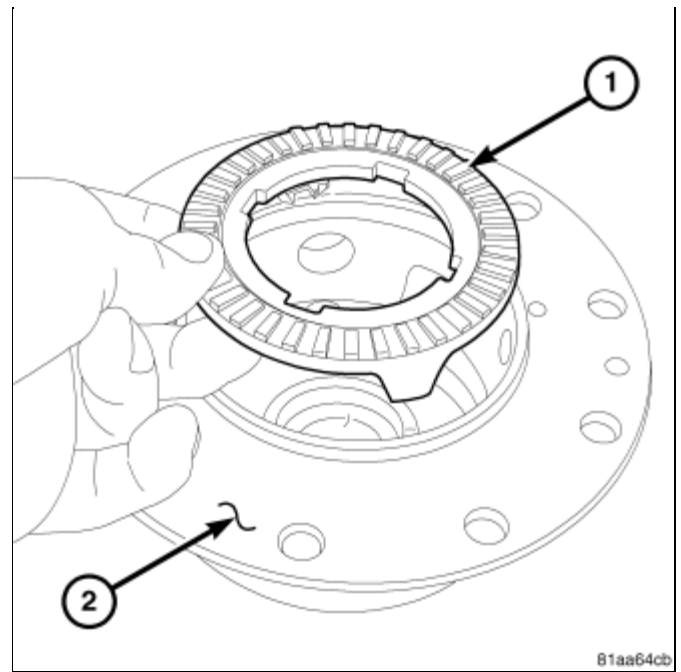


19. Remove wave spring (1) from differential case (2).

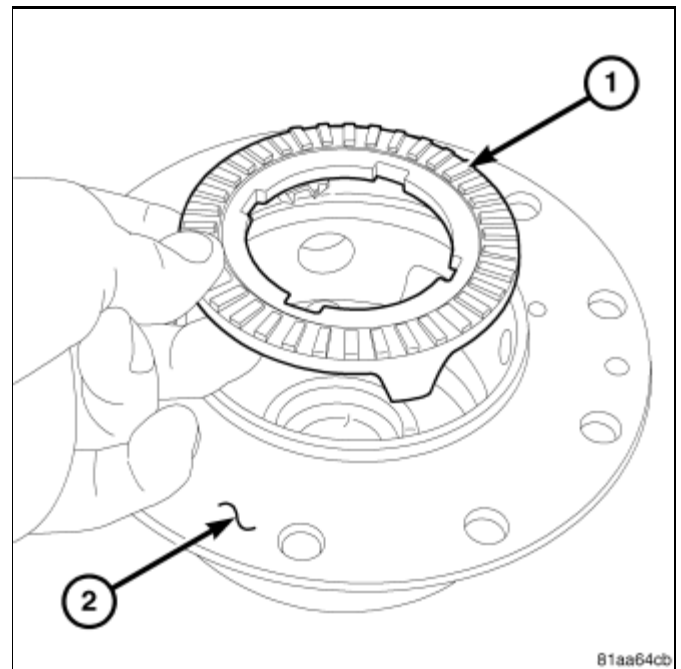


20. Remove dog clutch (1) from differential case (2).

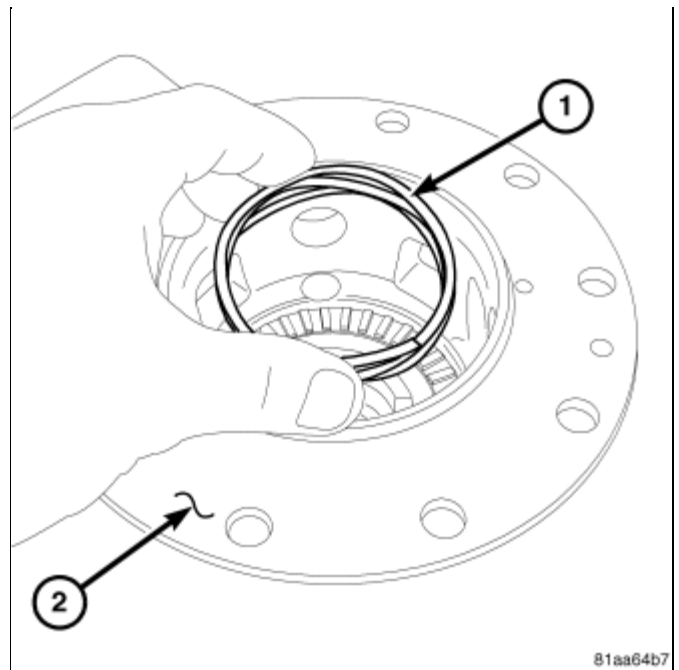
ASSEMBLY



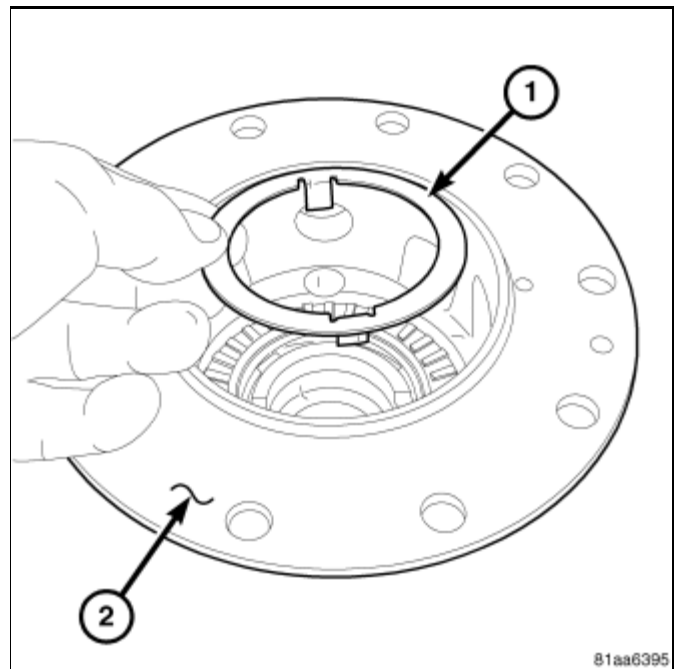
1. Install dog clutch (1) in differential case (2).



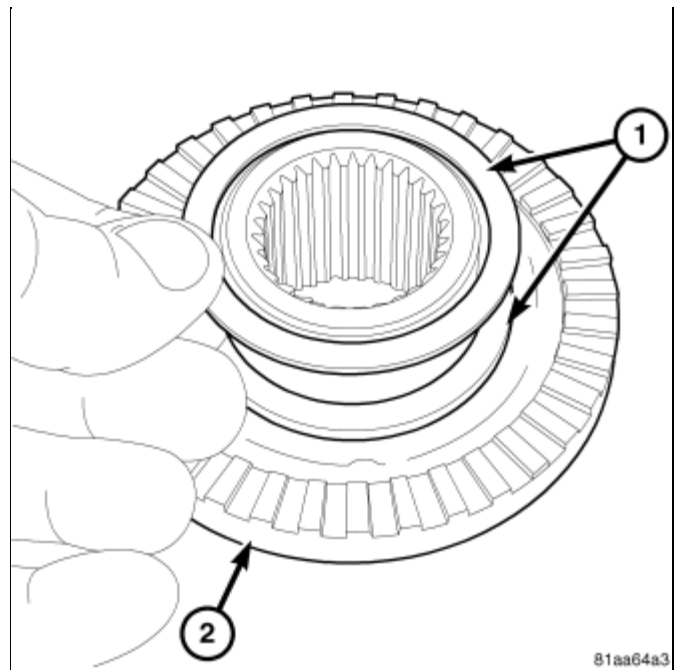
2. Install wave spring (1) in differential case (2).



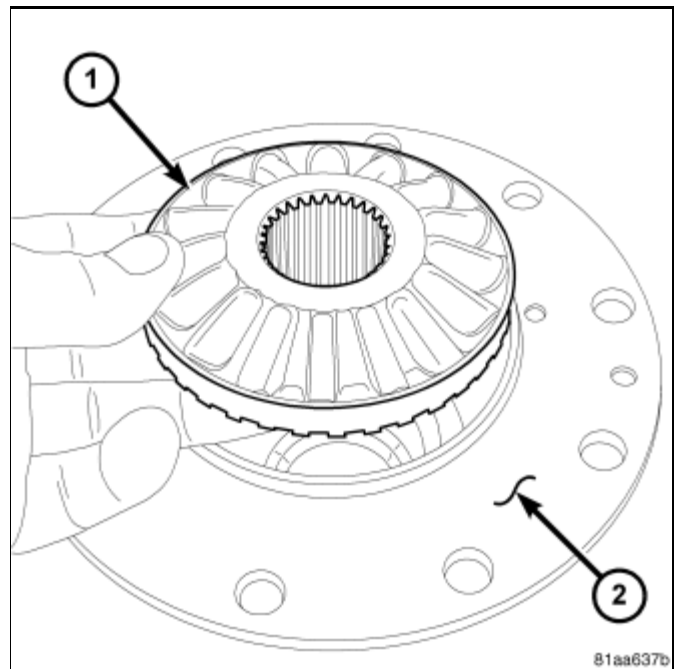
3. Install wave spring stop ring (1) in differential case (2) and align tabs with dog clutch notches.



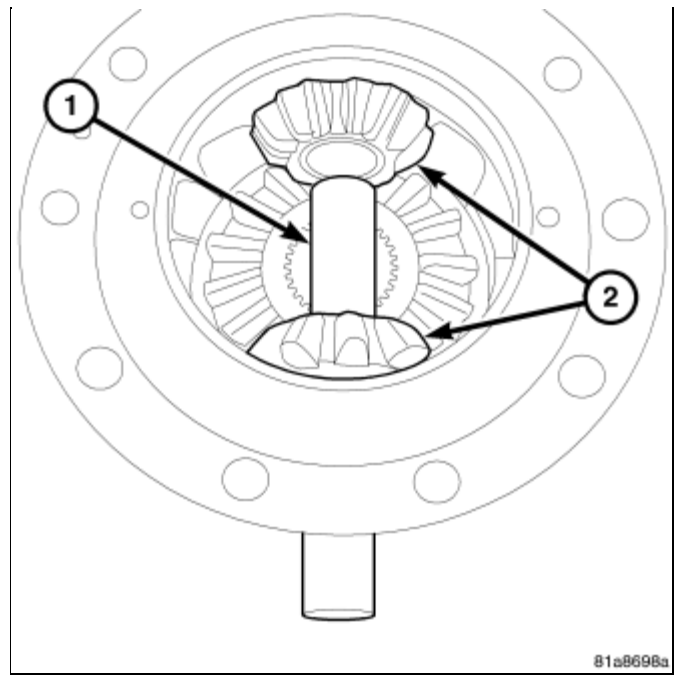
4. Install both thrust washers (1) on dog clutch side of the side gear (2).



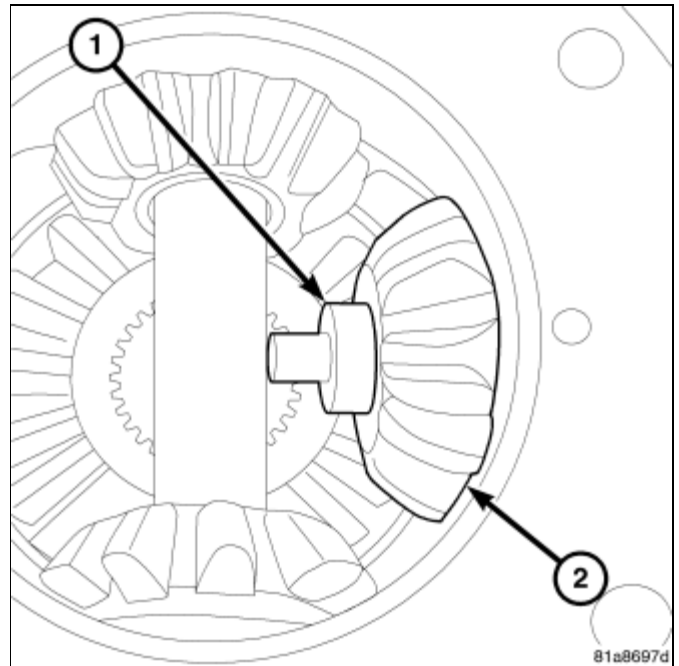
5. Install side gear dog clutch (1) with thrust washers in differential case (2).



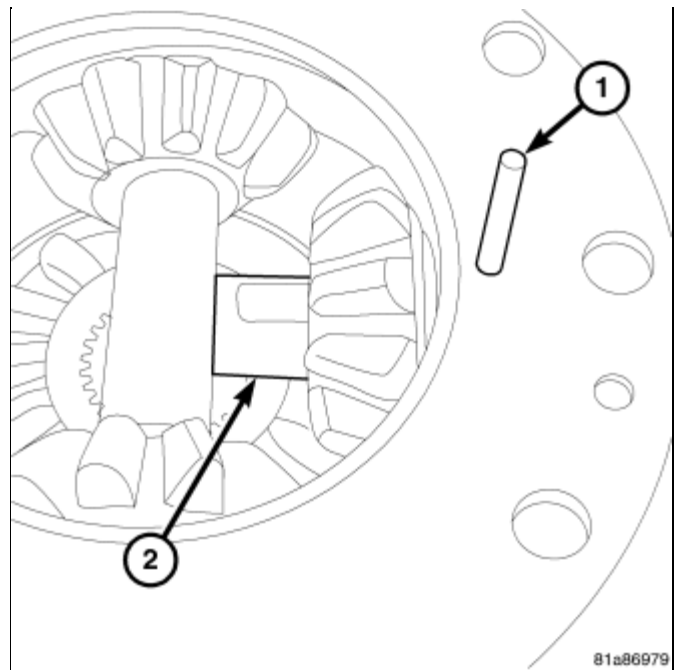
6. Install two pinion gears (2) with thrust washers then slid pinion shaft (1) into the case.



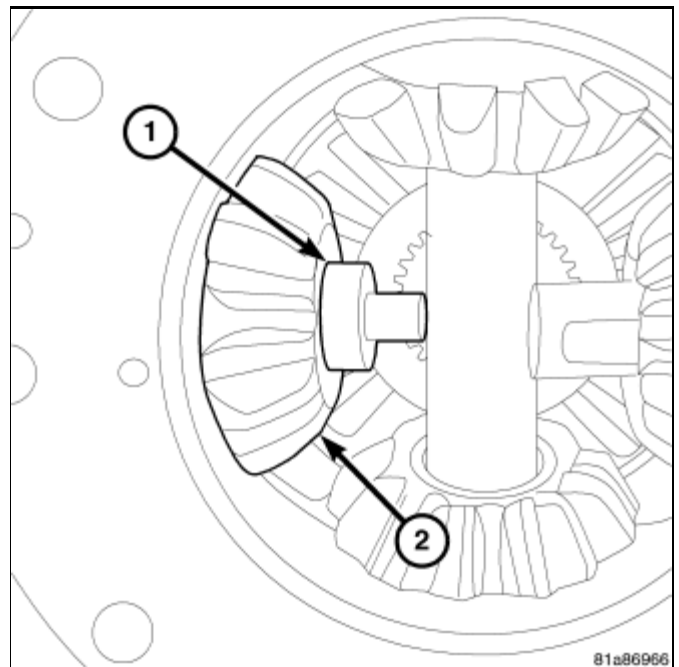
7. Install third pinion gear (2) with thrust washer then slid pinion shaft (1) into the case.



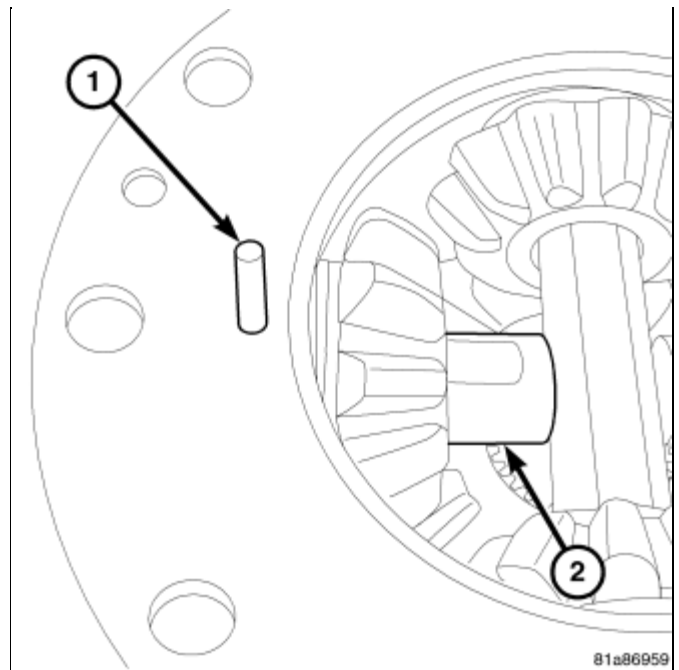
8. Install pinion shaft pin (1) into the pinion shaft (2) and case.



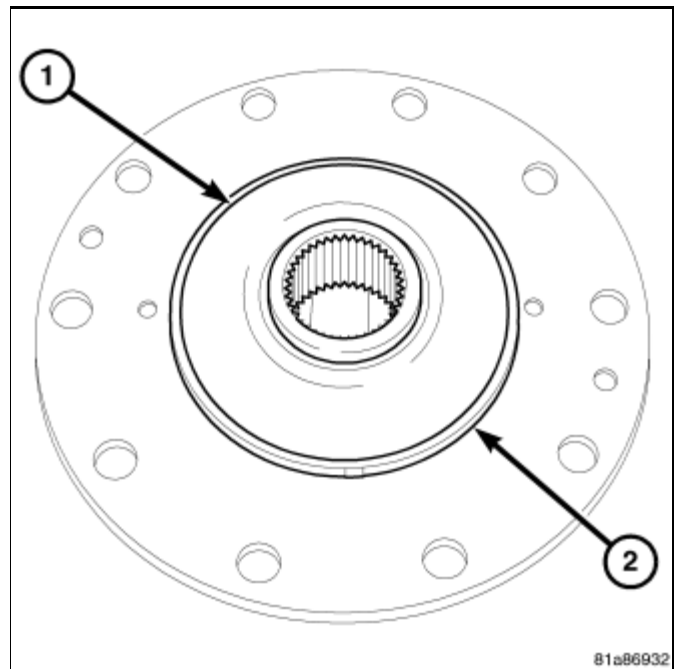
9. Install fourth pinion gear (2) with thrust washer then slid pinion shaft (1) into the case.



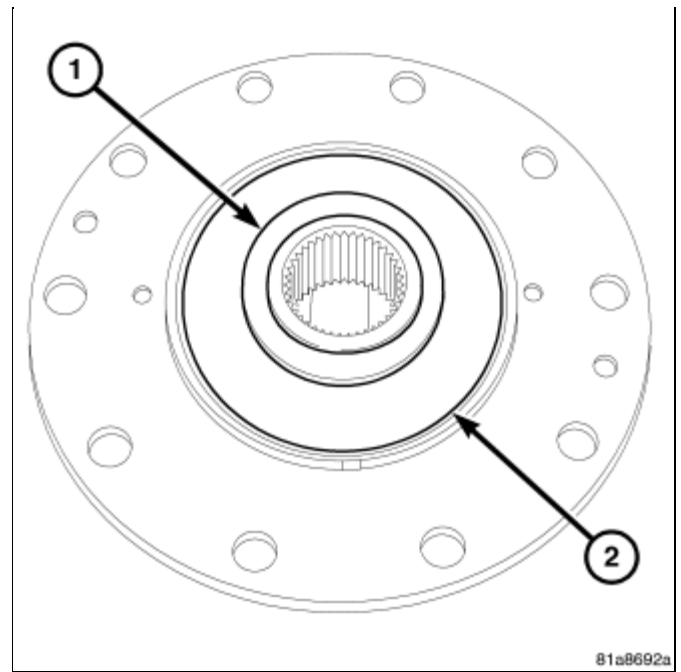
10. Install pinion shaft pin (1) into the pinion shaft (2) and case.



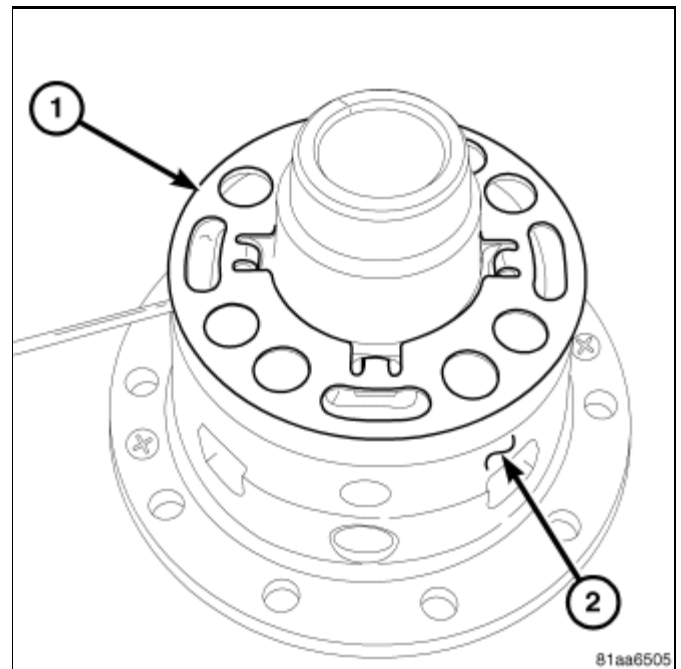
11. Install side gear (1) into differential case (2).



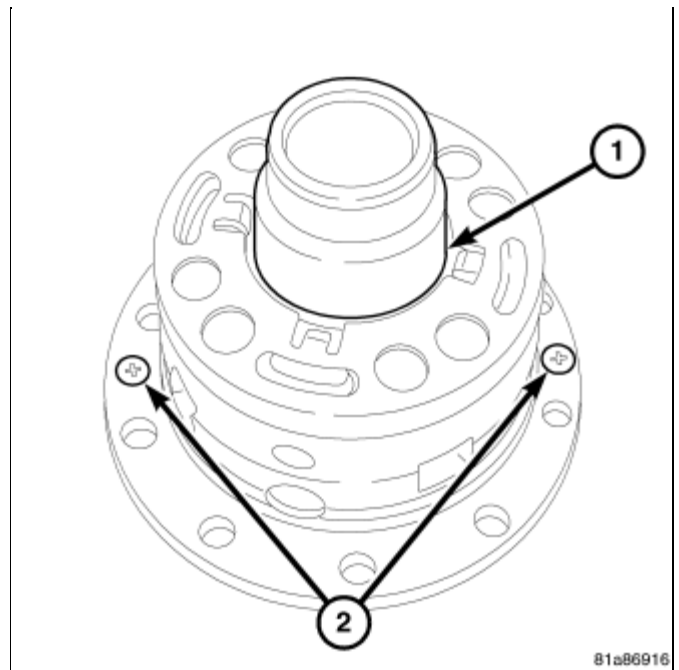
12. Install thrust washer (1) on side gear (2).
13. Install case half and align screw holes.



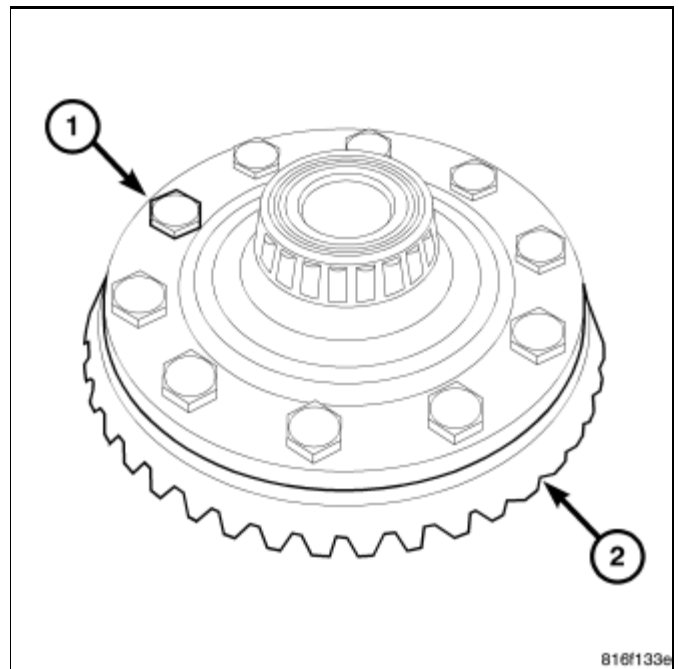
14. Install dog clutch actuator plate (1) on dog clutch and case (2).



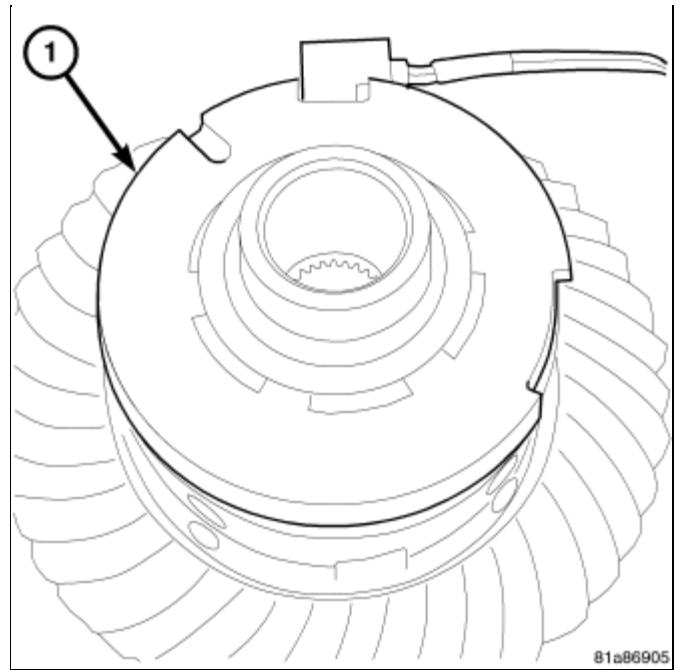
15. Install differential case (1) screws (2).



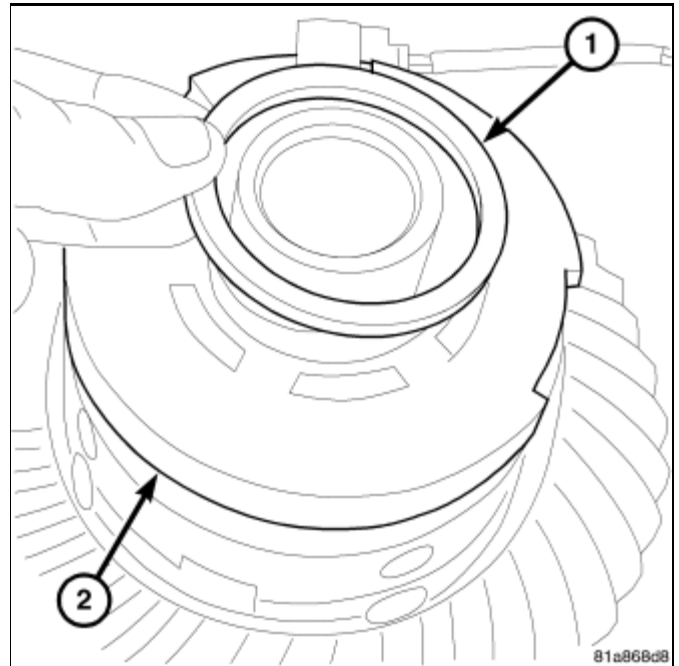
16. Install ring gear with **new** ring gear (2) bolts (1) and alternately tighten to 136 N·m (100 ft. lbs.).



17. Install coil (1) on differential case.

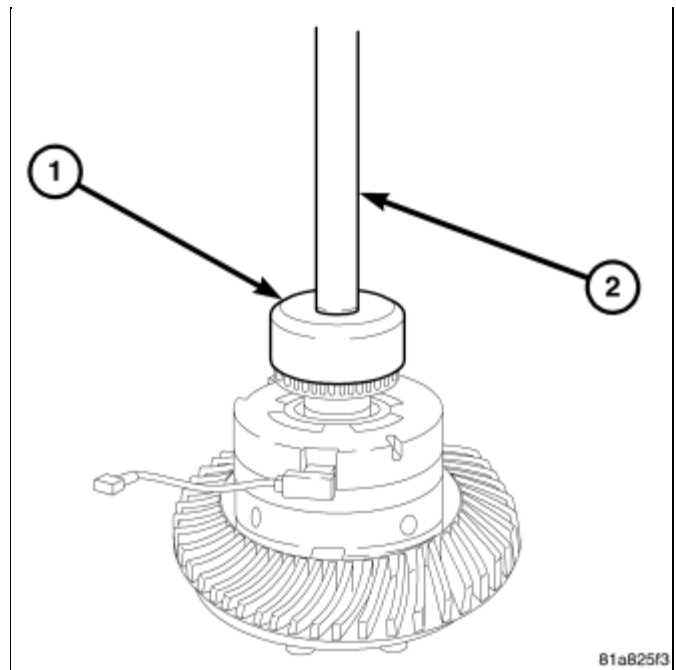


18. Install washer (1) on coil (2).



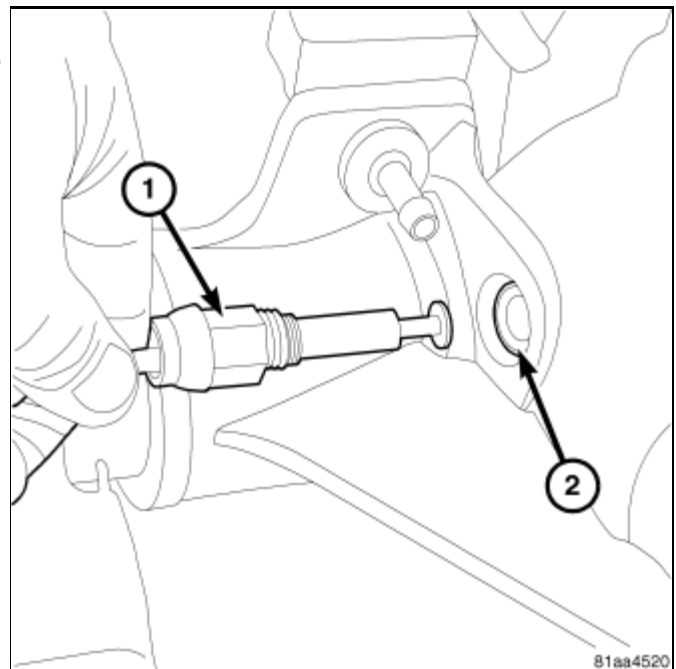
19. Install differential bearing with Installer C-4213 (1) and Handle C-4171 (2).

INSTALLATION

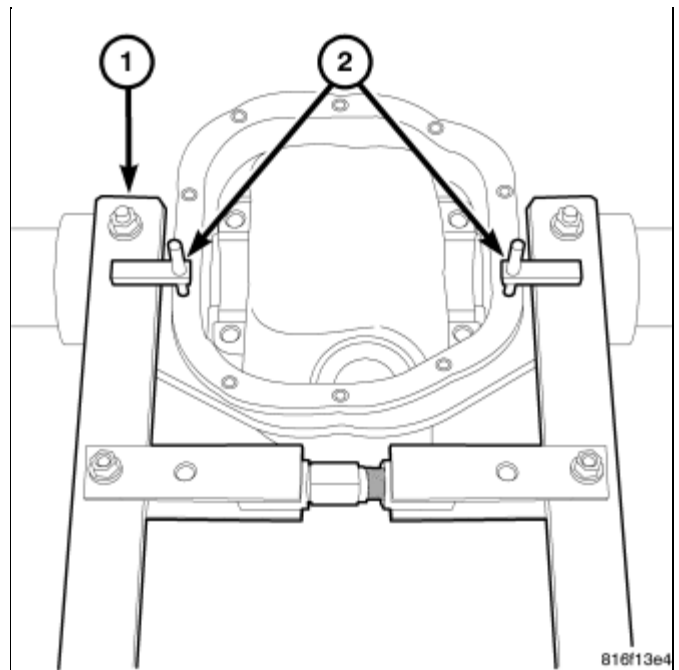


NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

1. Install Tru-Lok indicator switch (1) into differential housing (2).



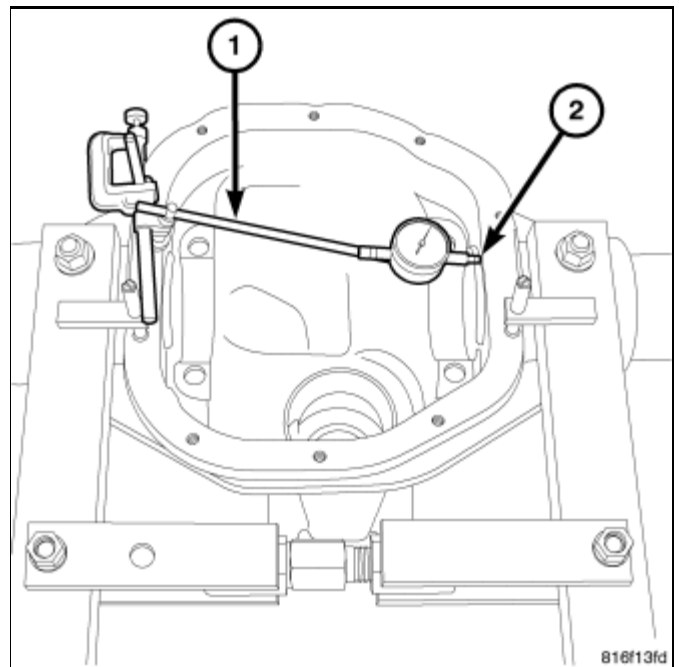
2. Position Spreader W-129-B (1) and with dowel pins from Adapter Kit 6987B seated in housing locating holes. Install hold-down clamps (2) and tighten turnbuckle finger-tight.



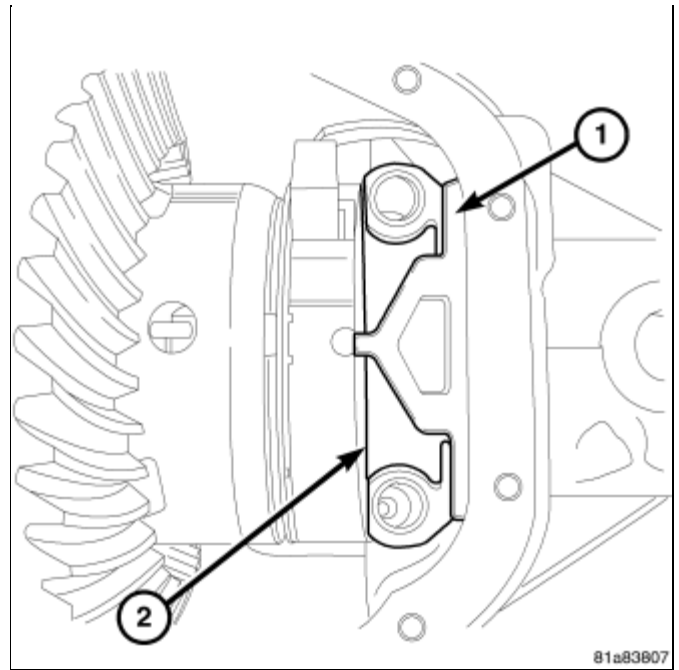
3. Install Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339A (1) to pin. Load the indicator plunger (2) against the opposite side of the housing and zero the indicator.
4. Spread the housing while measuring the distance with the dial indicator.

CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

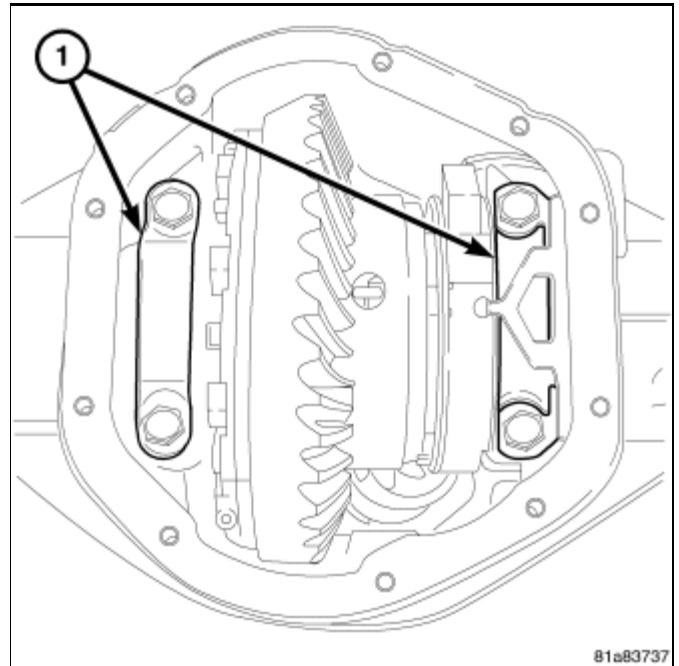
5. Remove the dial indicator.



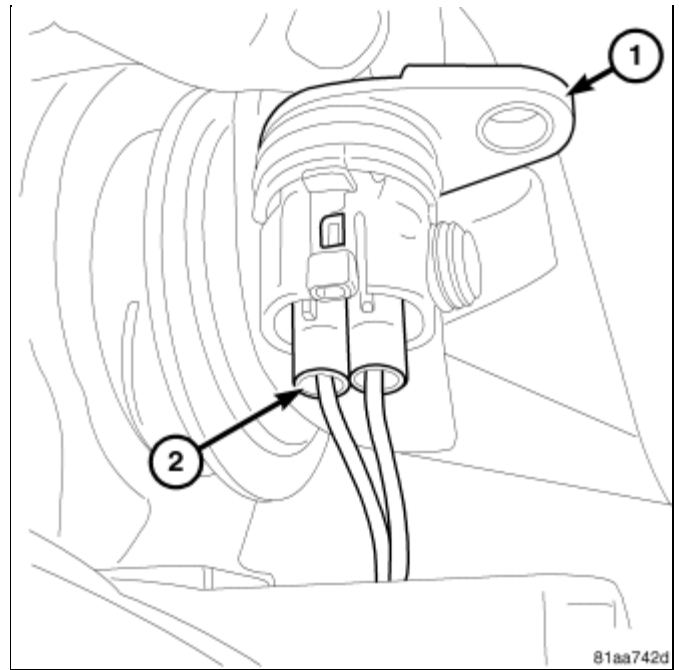
6. Install differential case into the housing with differential bearing cups and shims in their original locations.
7. Install bearing caps (2) in their original locations and coil anti-rotation bracket (1).



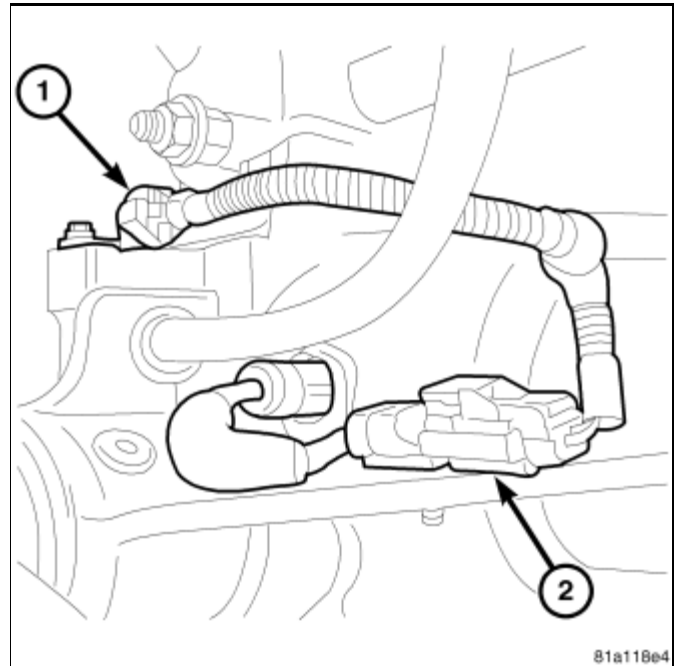
8. Loosely install differential bearing cap bolts.
9. Remove spreader.
10. Tighten bearing cap (1) bolts in a criss-cross pattern to 108 N·m (80 ft. lbs.).



11. Install Tru-Lok coil connector (2) to the coil harness (1).



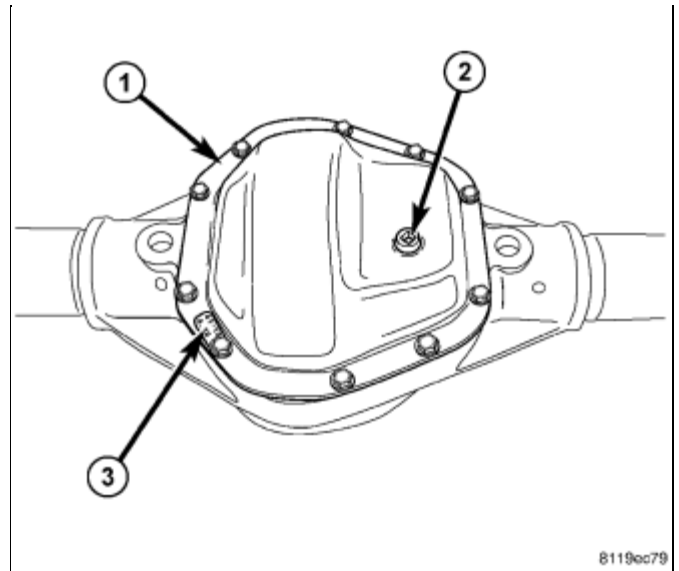
12. Install Tru-Lok coil connector (1) and install bolt.
13. Install Tru-Lok harness to the coil connector (1) and indicator switch (2).



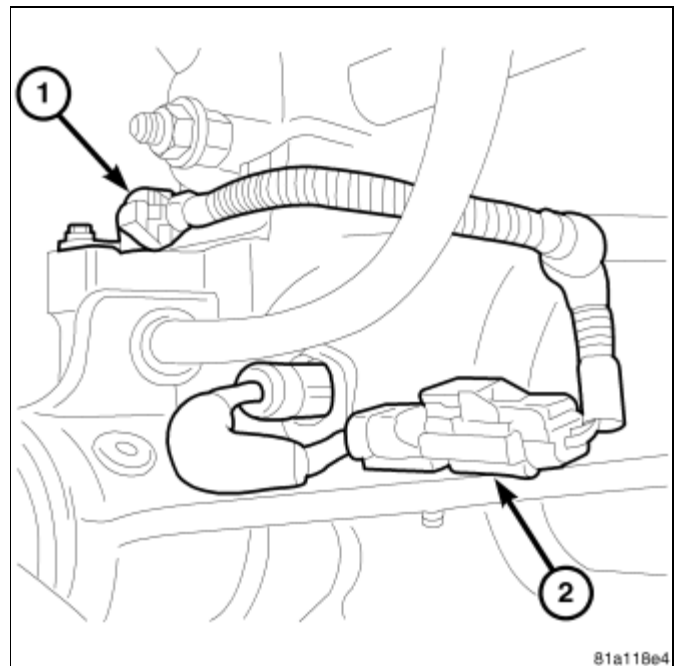
14. Install axle shafts.
15. Install differential cover (1).

SWITCH-LOCKER

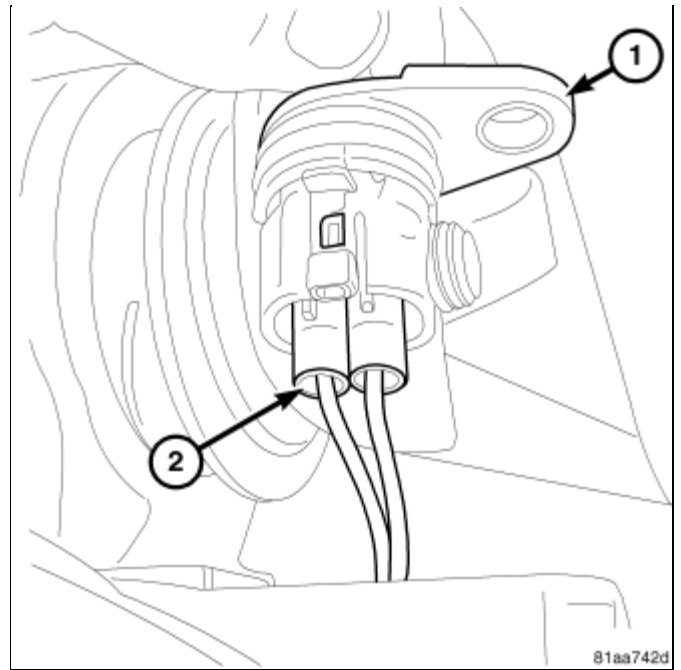
REMOVAL



1. Remove Tru-Lok harness from the coil connector (1) and indicator switch (2).
2. Remove Tru-Lok coil connector (1) bolt.

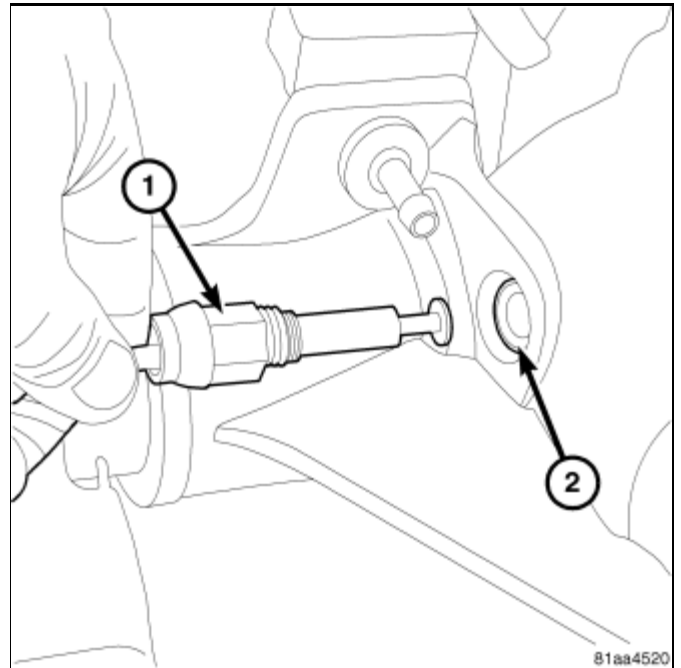


3. Remove Tru-Lok coil connector (1) from the axle housing and remove coil harness (2) from the connector (1).
4. Remove differential.

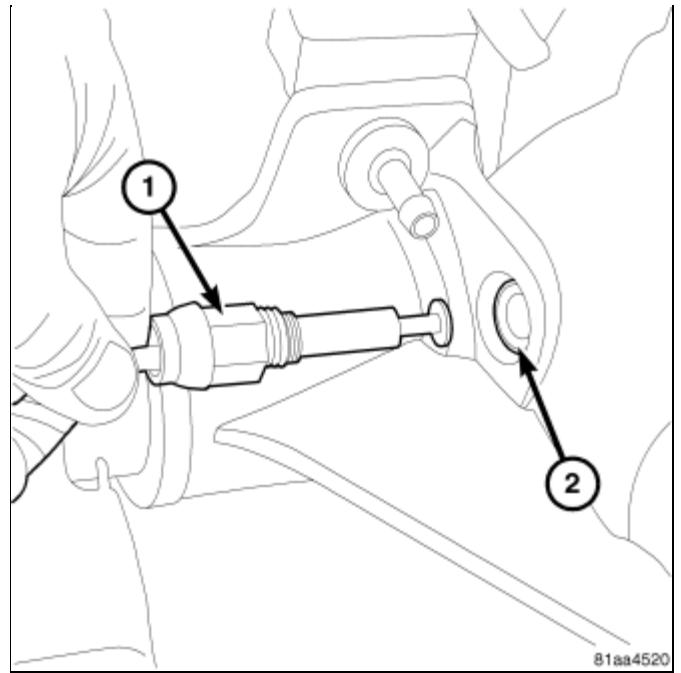


5. Remove Tru-Lok indicator switch (1) from differential housing (2).

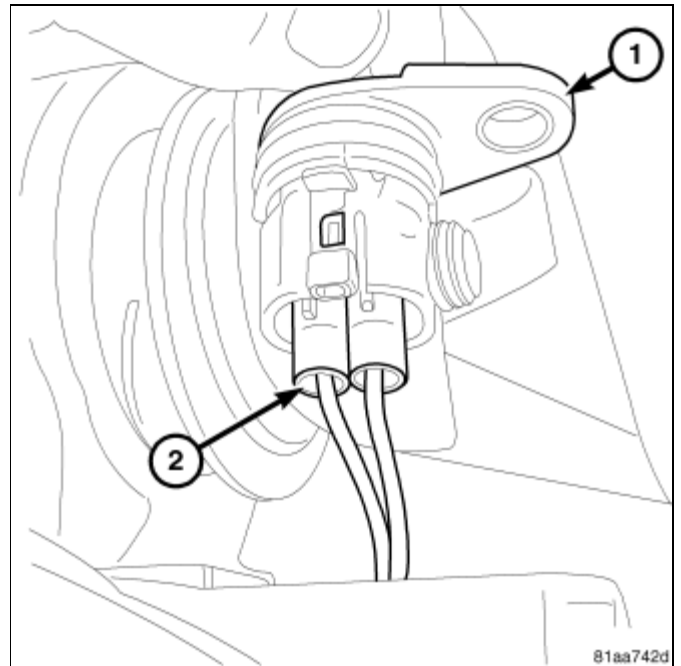
INSTALLATION



1. Install Tru-Lok indicator switch (1) into differential housing (2).
2. Install differential.



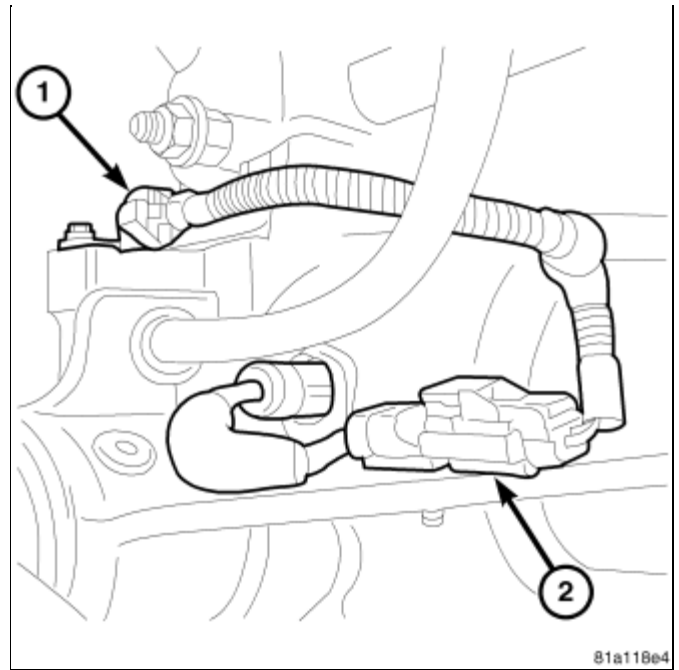
3. Install Tru-Lok coil connector (2) to the coil harness (1).



4. Install Tru-Lok coil connector (1) and install bolt.
 5. Install Tru-Lok harness to the coil connector (1) and indicator switch (2).

BEARINGS-DIFFERENTIAL CASE

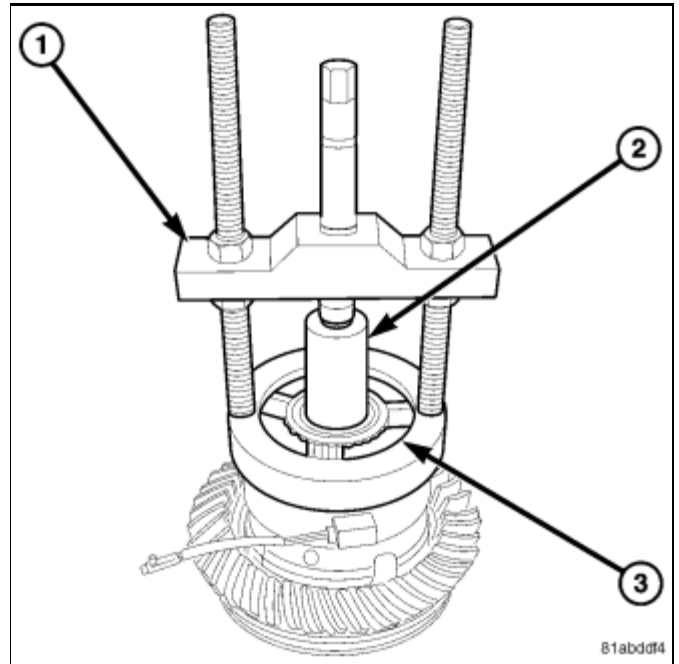
REMOVAL



81a118e4

1. Remove differential case from axle housing.
2. Remove bearings from the differential case with Puller C-293-PA (1), Plug C-293-3 (2), and Adapters C-293-47 (3).

INSTALLATION

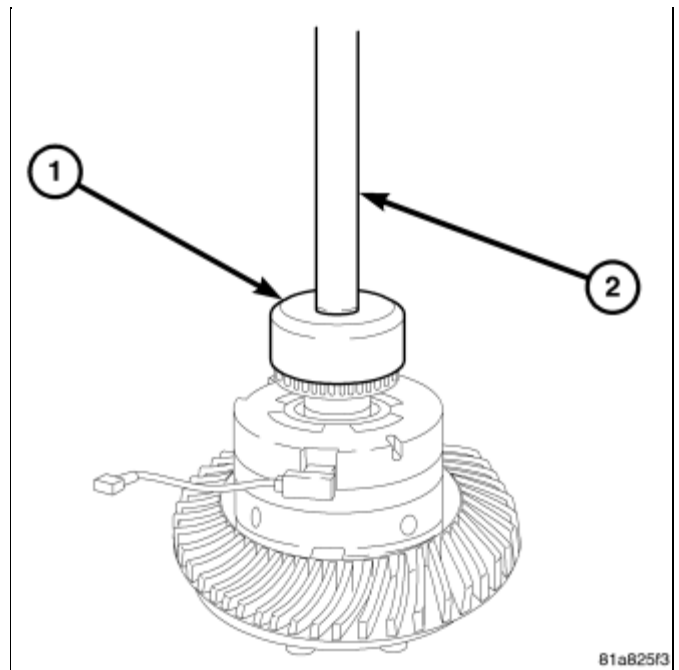


81abdd14

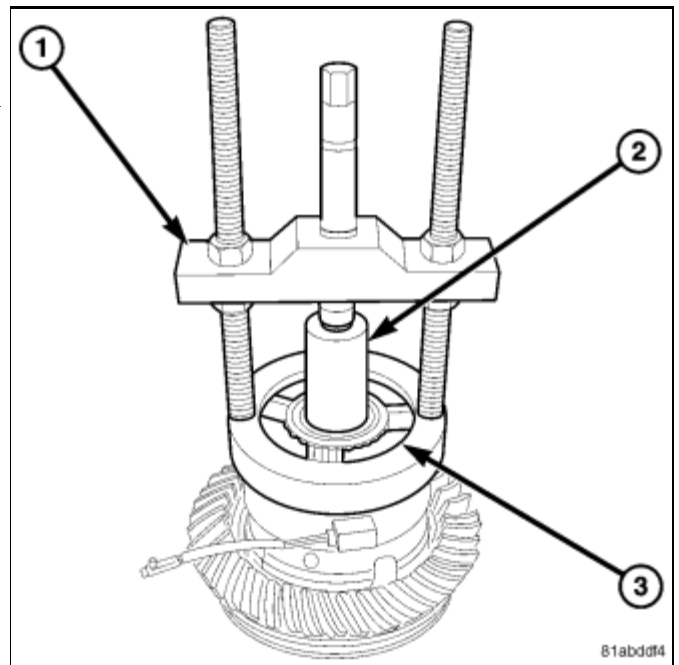
1. Install differential side bearings with Installer C-4213 (1) and Handle C-4171 (2).
2. Install differential into the housing.

COIL-DIFFERENTIAL

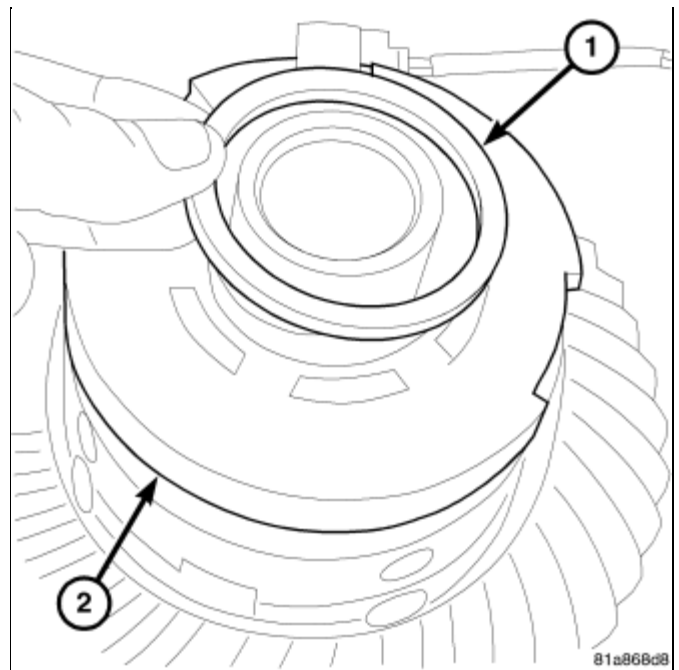
REMOVAL



1. Remove differential case from axle housing.
2. Remove bearing from the coil side of the differential case with Puller C-293-PA (1), Plug C-293-3 (2), and Adapters C-293-47 (3).

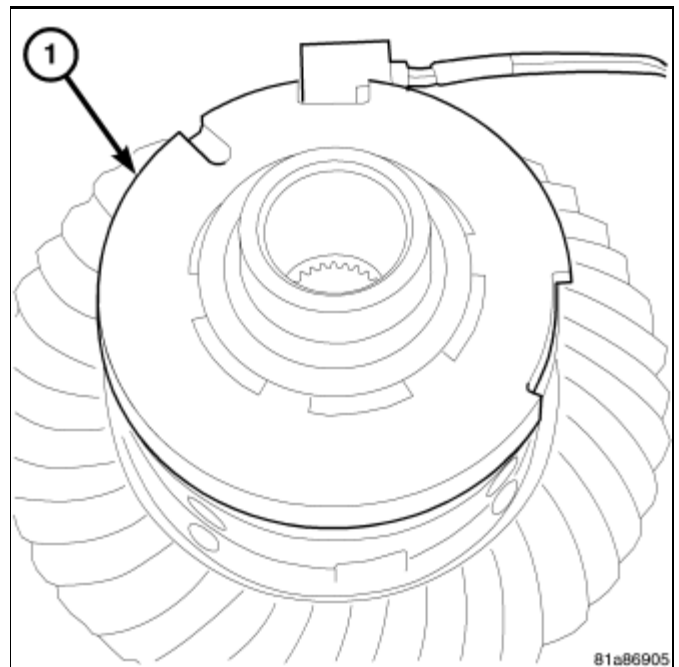


3. Remove thrust washer (1) from differential case and coil (2).

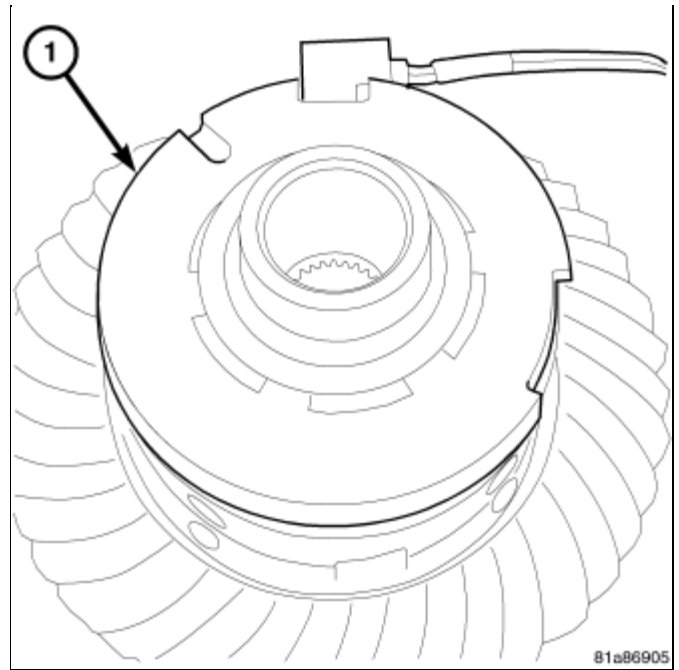


4. Remove coil (1) from differential case.

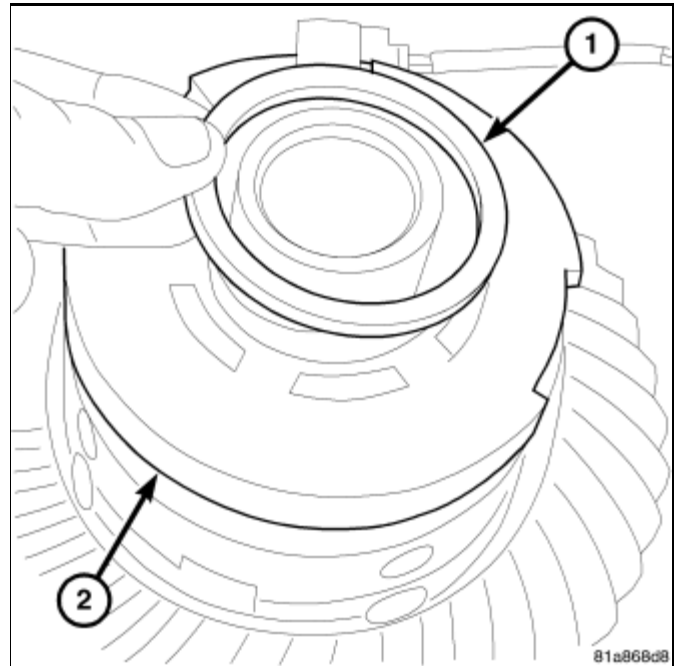
INSTALLATION



1. Install coil (1) on differential case.



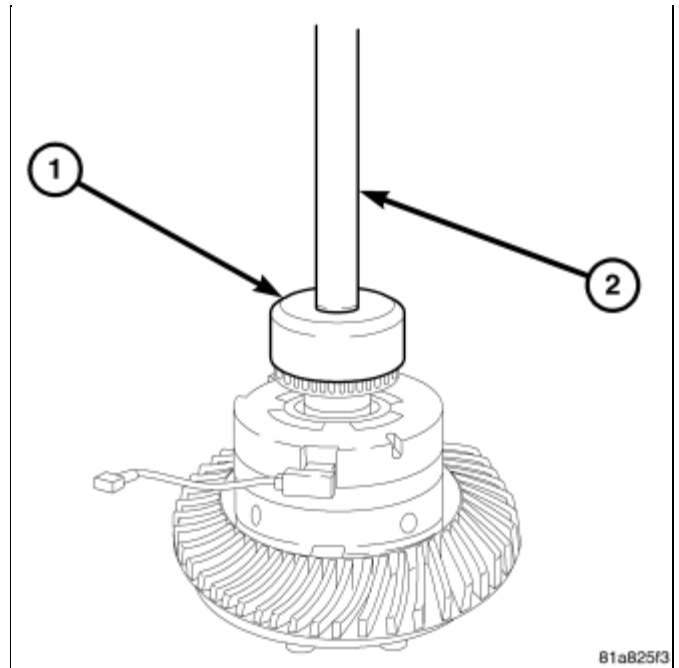
2. Install thrust washer (1) on top of the coil (2).



3. Install differential side bearing with Installer C-4213 (1) and Handle C-4171 (2).
4. Install differential into the housing.

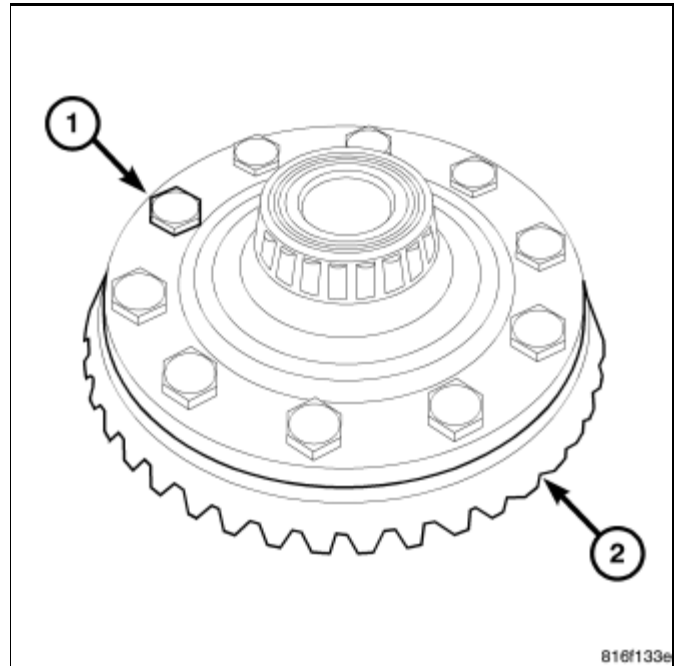
GEAR-PINION/RING

REMOVAL

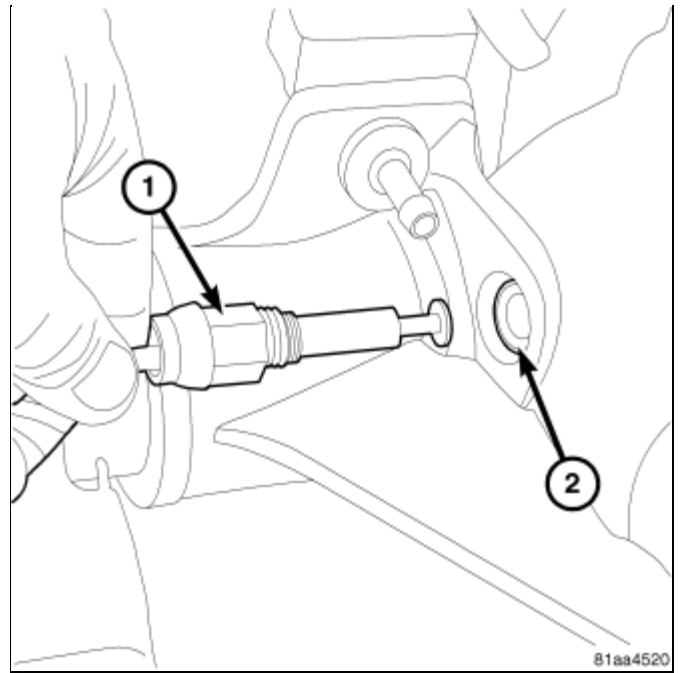


NOTE: The ring and pinion gears are serviced as a matched set. Never replace one gear without replacing the other gear.

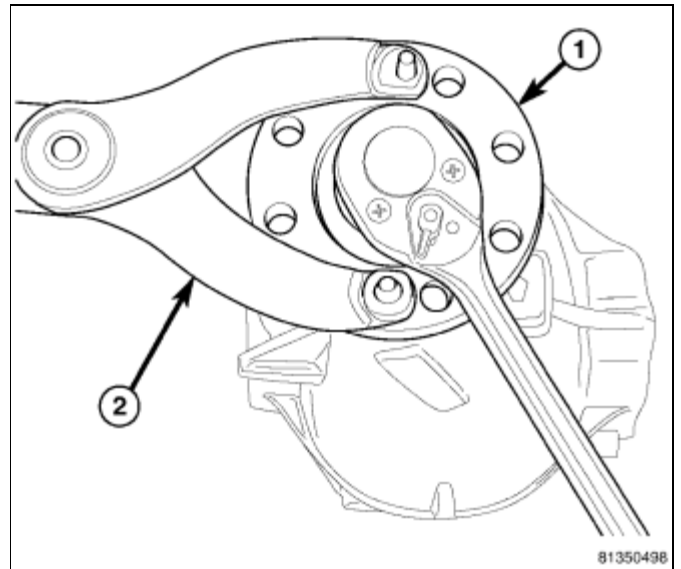
1. Remove differential assembly from axle housing.
2. Remove ring gear bolts (1) and remove ring gear (2) from differential case.



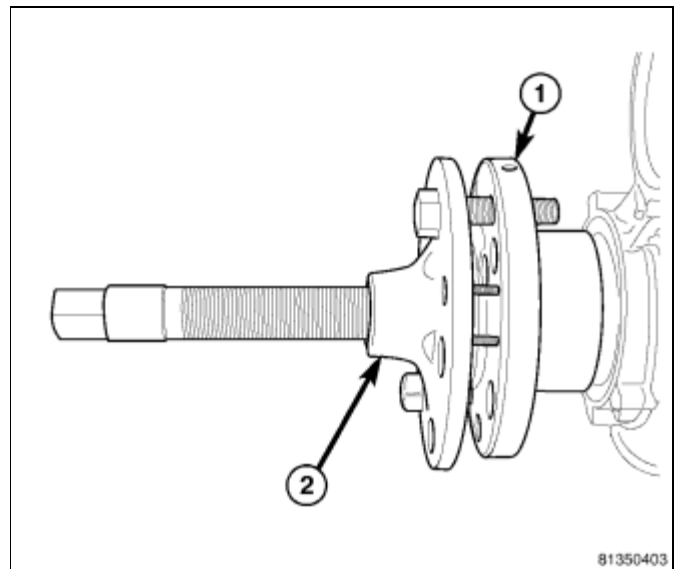
3. Remove Tru-Lok indicator switch (1) from differential housing (2).



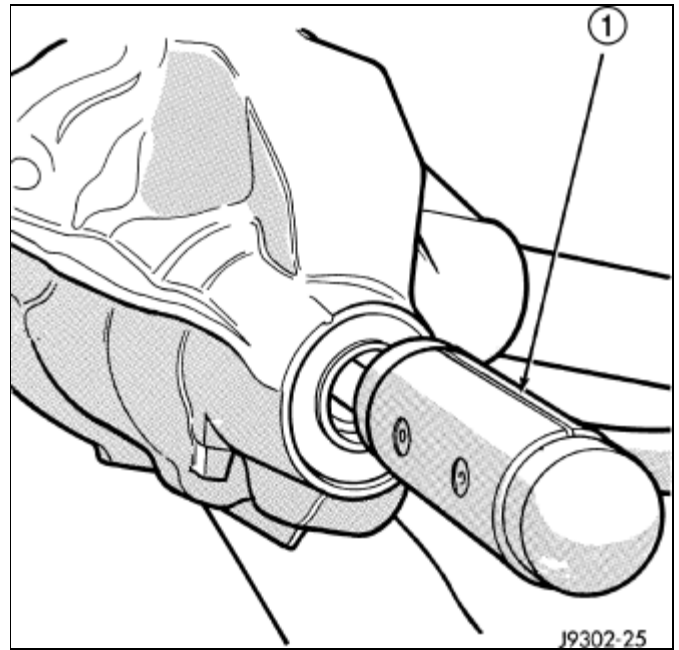
4. Hold pinion flange (1) with Flange Wrench C-3281 (2) and remove pinion nut.



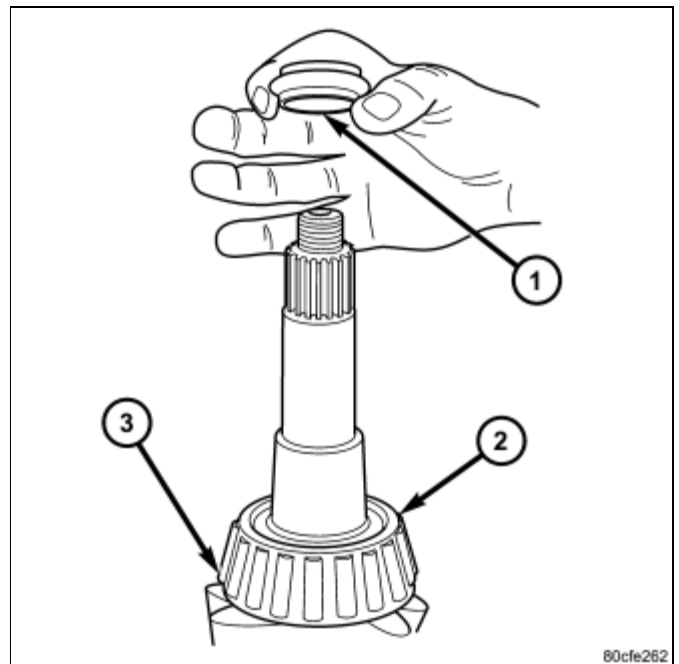
5. Remove pinion flange (1) with Puller C-452 (2).



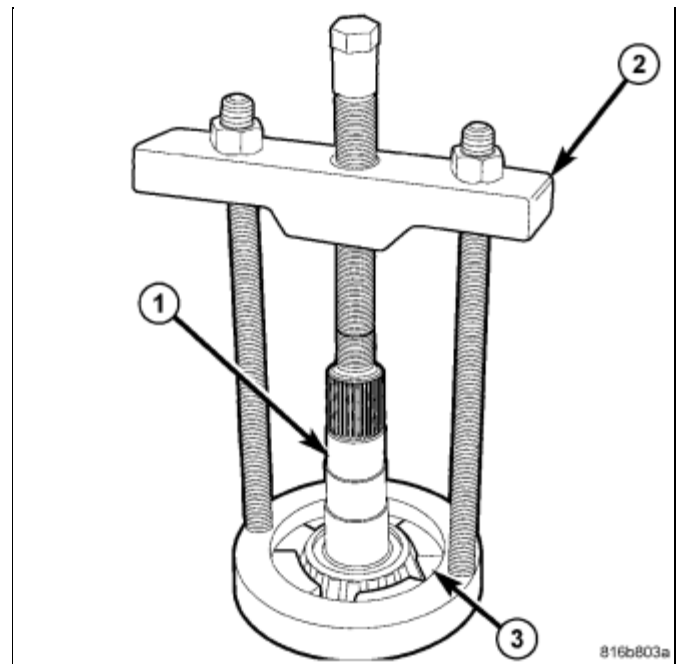
6. Remove pinion gear from housing with dead blow hammer (1).



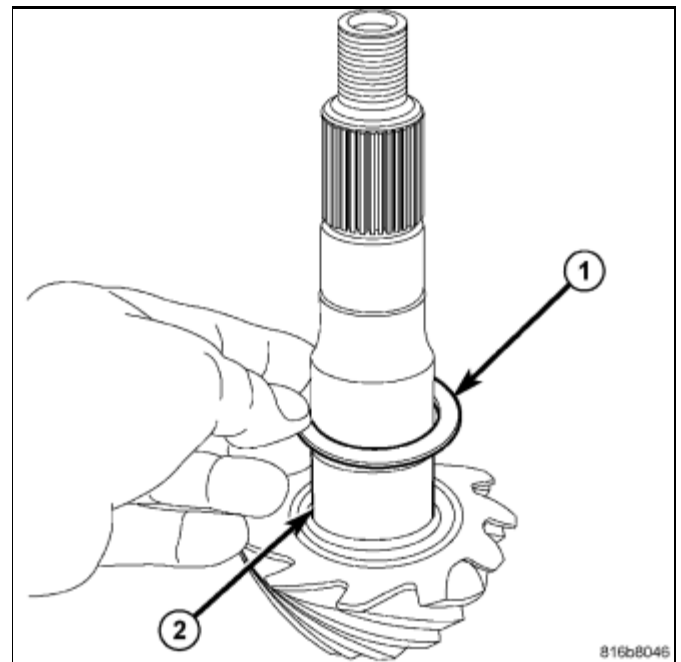
7. Remove collapsible spacer (1) from pinion gear (3).



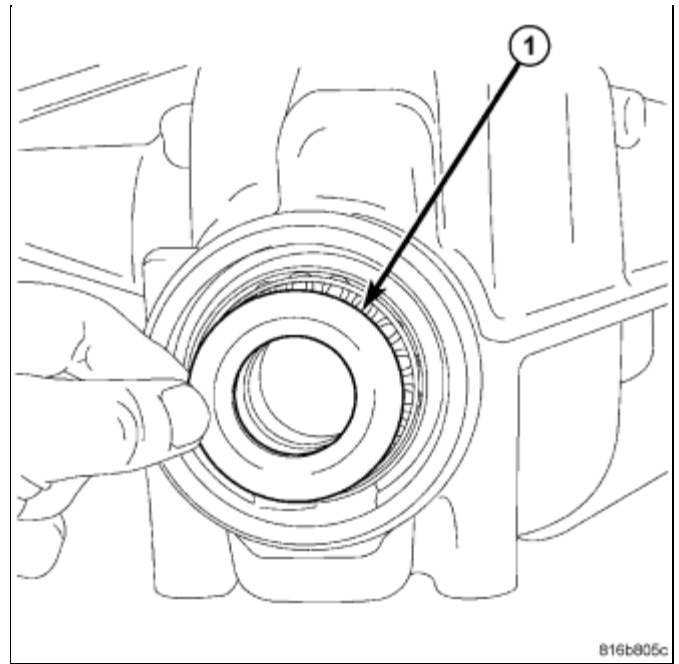
8. Remove rear pinion bearing from pinion shaft (1) with Puller C-293-PA (2) and Adapters C-293-47 (3).



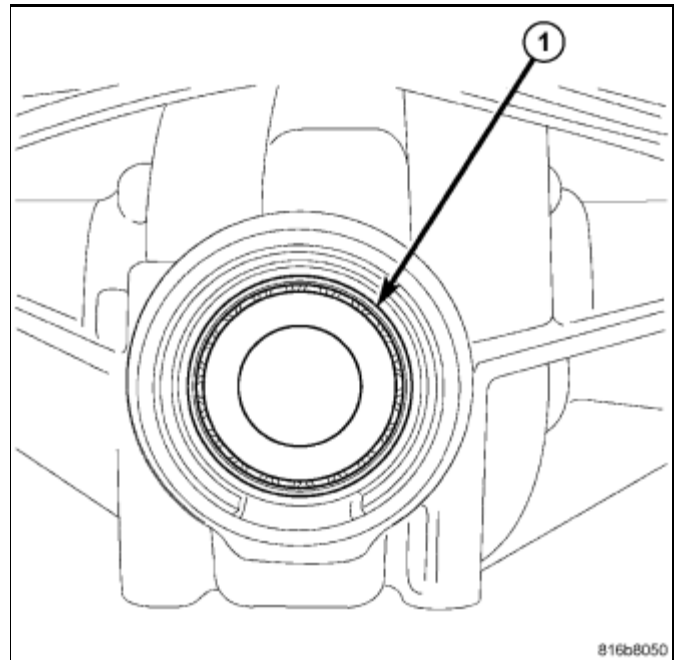
9. Remove pinion depth shim (1) from pinion shaft (2) and record thickness.



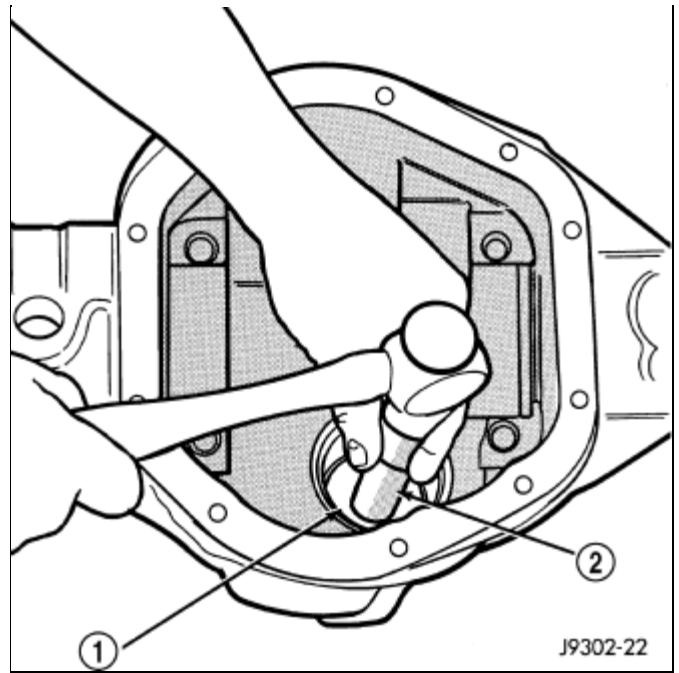
- 10. Remove pinion seal with seal puller.
- 11. Remove front bearing oil slinger (1).



12. Remove front pinion bearing (1).

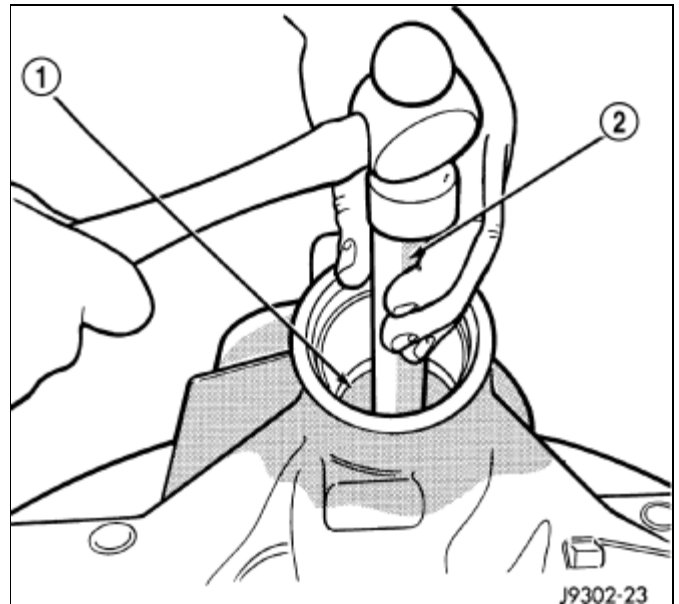


13. Remove front pinion bearing cup with Remover D-158 (1) and Handle C-4171 (2).

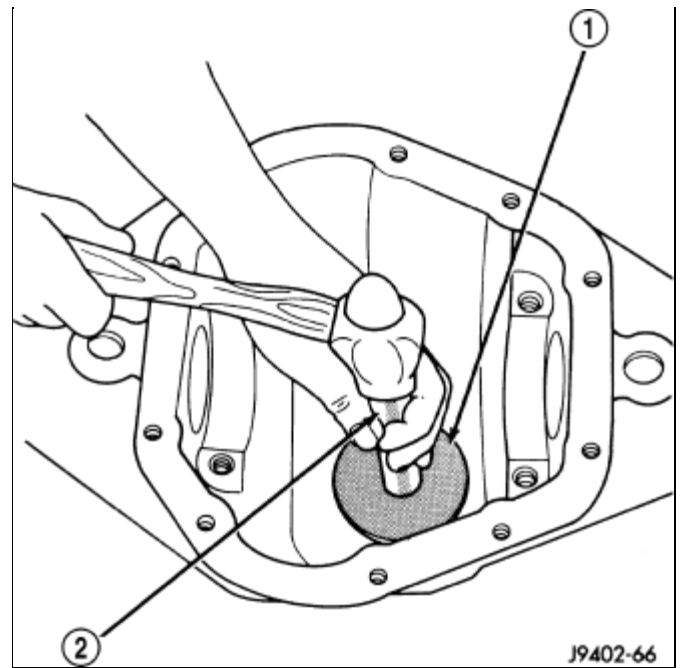


14. Remove rear bearing cup (1) and oil baffle with a hammer and punch (2).

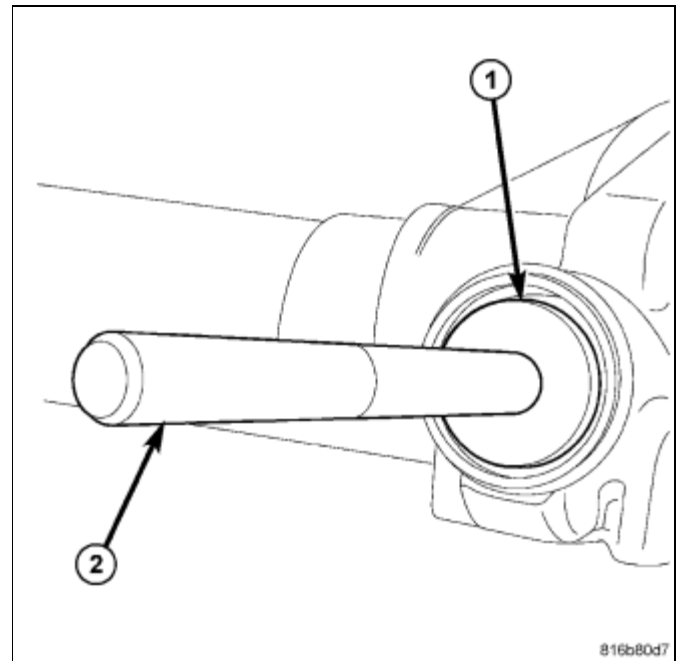
INSTALLATION



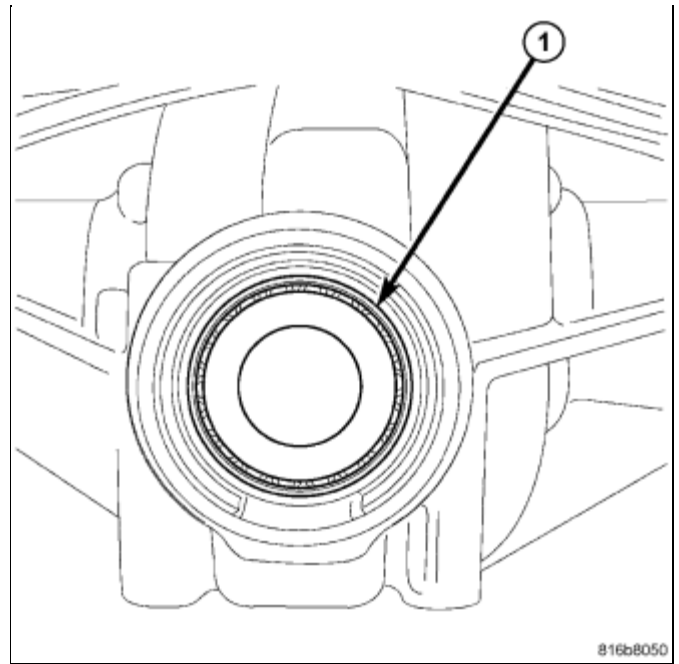
1. Install oil baffle in rear pinion cup bore.
2. Install rear pinion bearing cup with Installer C-4308 (1) and Handle C-4171 (2).



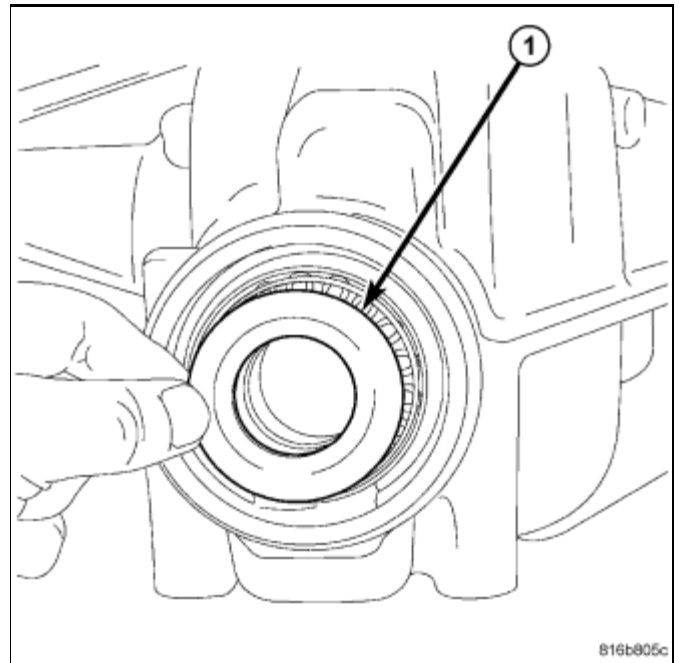
3. Install front pinion bearing cup with Installer D-146 (1) and Handle C-4171 (2).



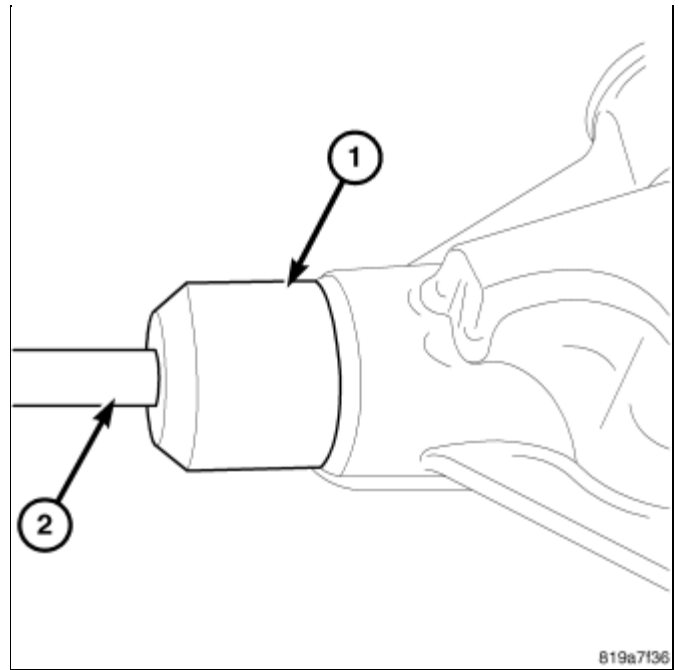
4. Install pinion front bearing (1).



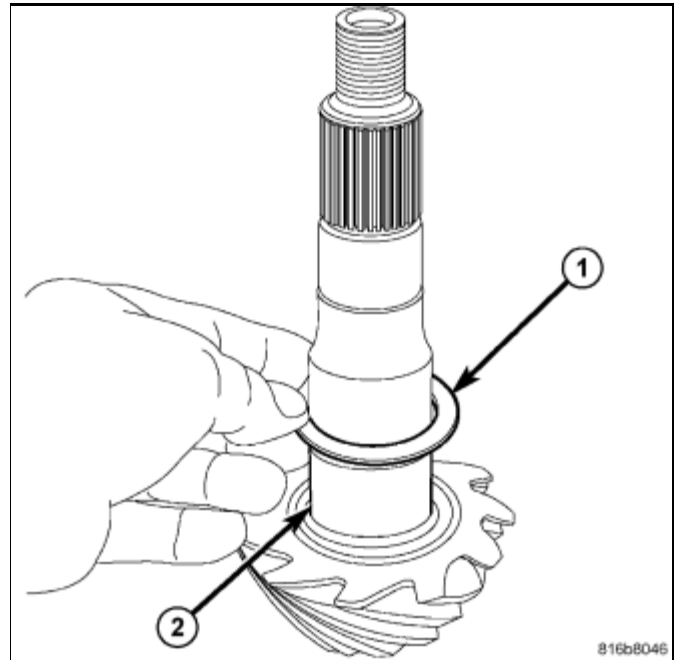
5. Install pinion front bearing oil slinger (1).



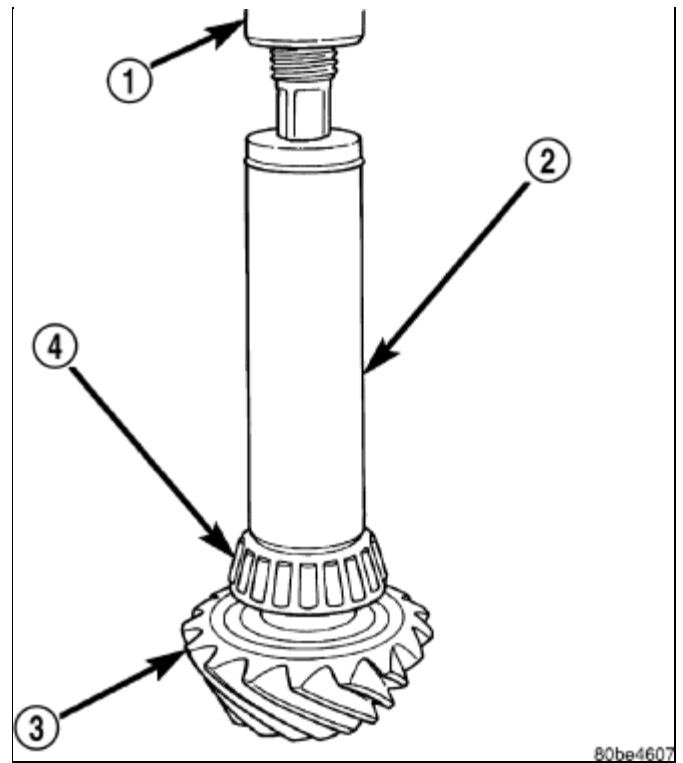
6. Apply a light coating of gear lubricant on pinion seal lip. Install seal with Installer 8681 (1) and Handle C-4171 (2).



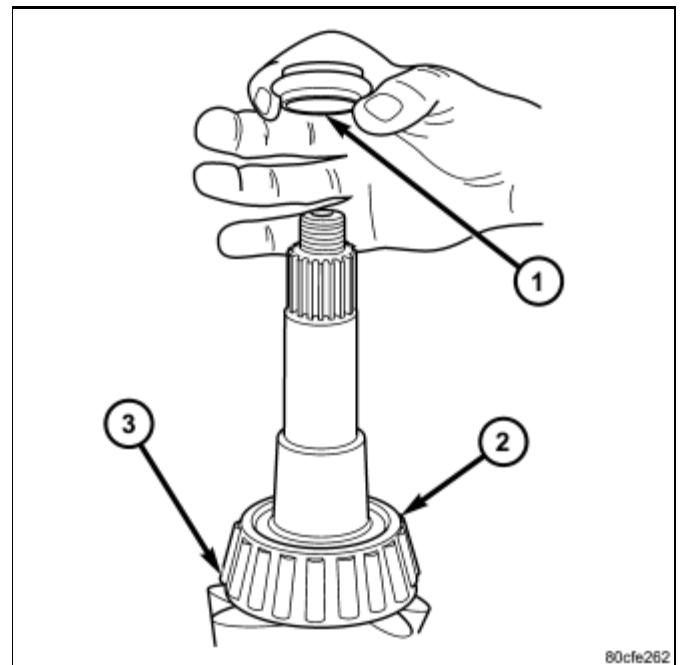
7. Install pinion depth shim (1) on pinion gear shaft (2).



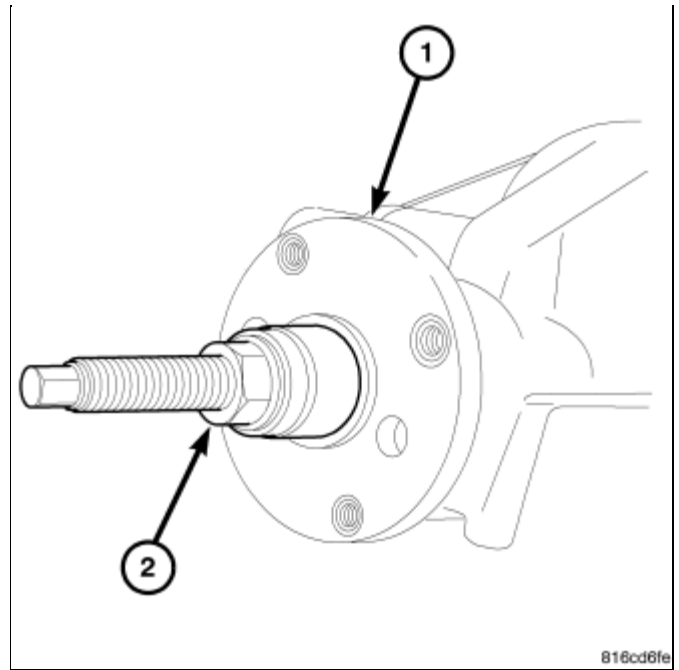
8. Install rear pinion bearing (4) on the pinion gear (3) with Installer C-4040 (2) and a press (1).



9. Install collapsible spacer (1) on pinion gear (3).

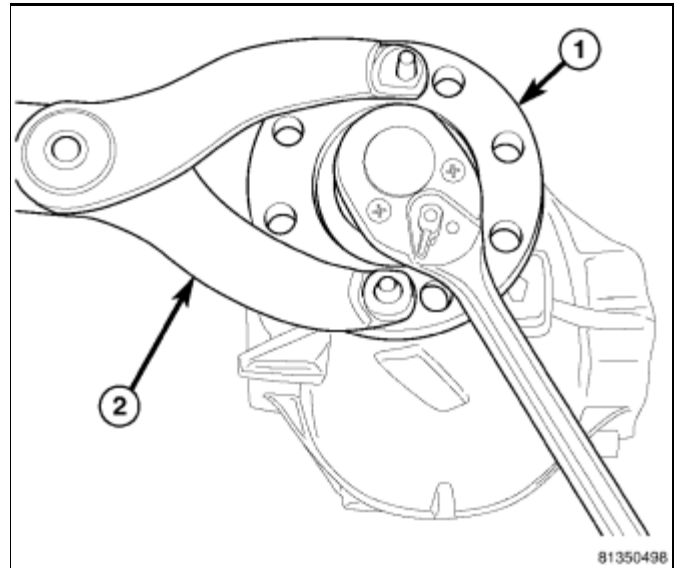


- 10. Install pinion gear in housing.
- 11. Install pinion flange (1) with Installer 8112 (2) and Cup 8109.



12. Install **new** nut on the pinion gear. Hold pinion flange (1) with Flange Wrench C-3281 (2) and tighten nut to 217 N·m (160 ft. lbs.).

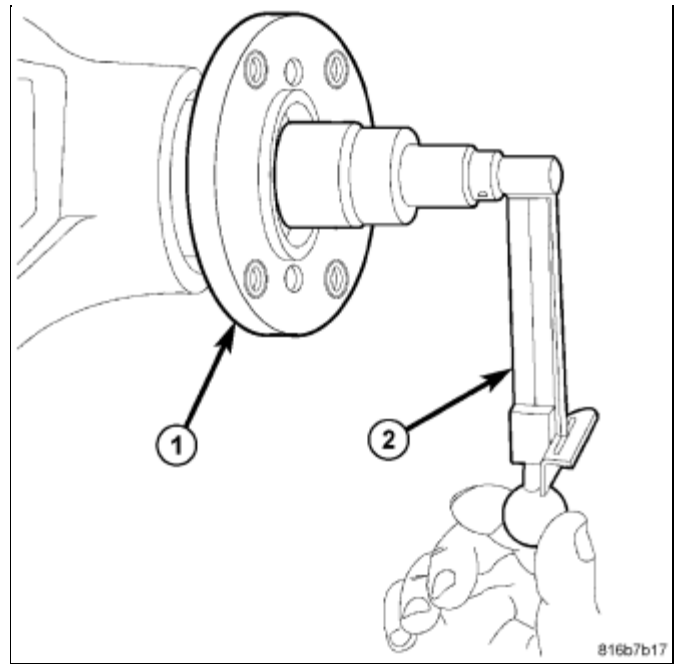
13. Set torque wrench to 271 N·m (200 ft. lbs.) and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until Pinion Torque To Rotate (PTTR) specification is achieved.



14. Measure Pinion Torque To Rotate (1) after each 6.8 N·m (5 ft. lbs.) increment with an inch pound torque wrench (2).

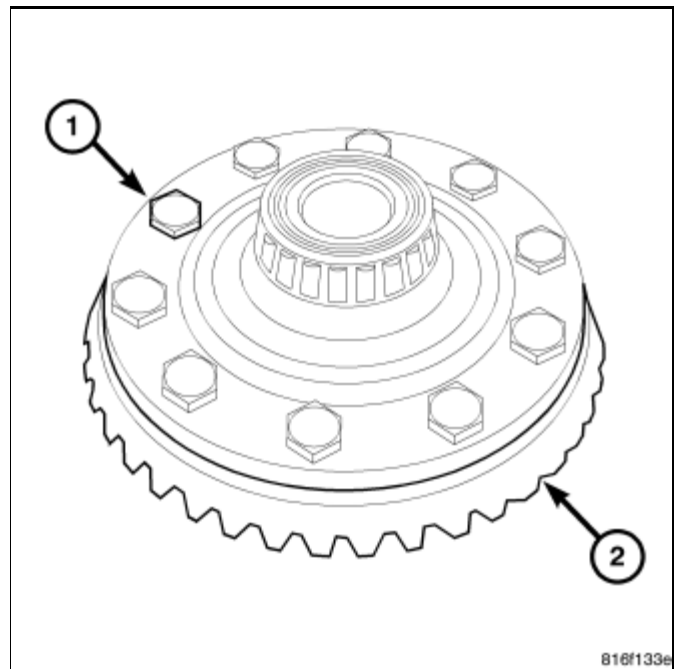
Pinion Torque To Rotate is:

- **Original Bearings:** 1 - 2 N·m (10 - 20 in. lbs.)
- **New Bearings:** 2 - 4.5 N·m (20 - 40 in. lbs.)

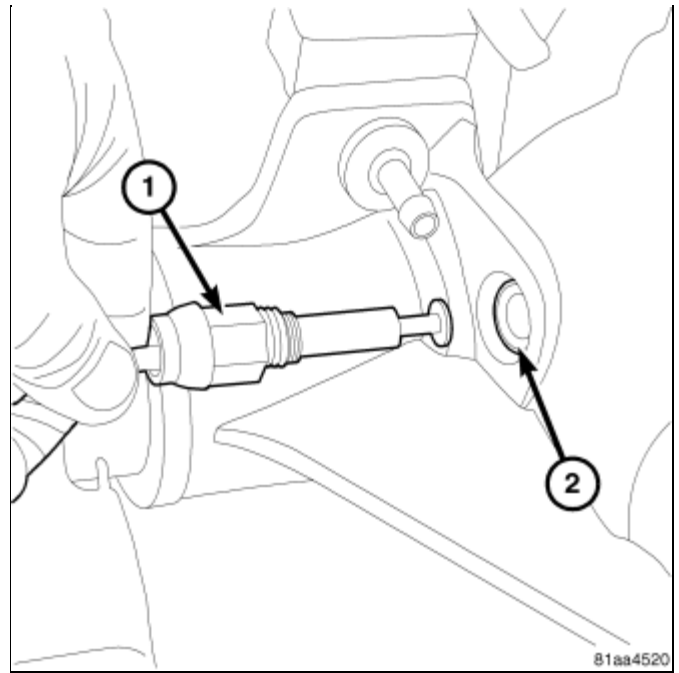


15. Install ring gear with **new** ring gear (2) bolts (1) and alternately tighten to 136 N·m (100 ft. lbs.).

CAUTION: Never reuse the ring gear bolts. Failure to follow these instruction may result in damage.



16. Install Tru-Lok indicator switch (1) into differential housing (2).
17. Install differential case into axle housing.



18. Measure differential Total Torque To Rotate (TTTR) with an inch pound torque wrench (2) before installing the axle shaft. This will verify differential bearing preload.

Total Torque To Rotate is: Pinion Torque To Rotate plus 0.79 - 1.24 N·m (7 - 11 in lbs.).

NOTE: If TTTR is too high, decrease shim thickness equally from both sides of the differential and check TTTR again. If TTTR is too low, increase shim thickness equally to both sides of the differential and check TTTR again.

REAR AXLE - 226RBI

REAR AXLE - 226RBI

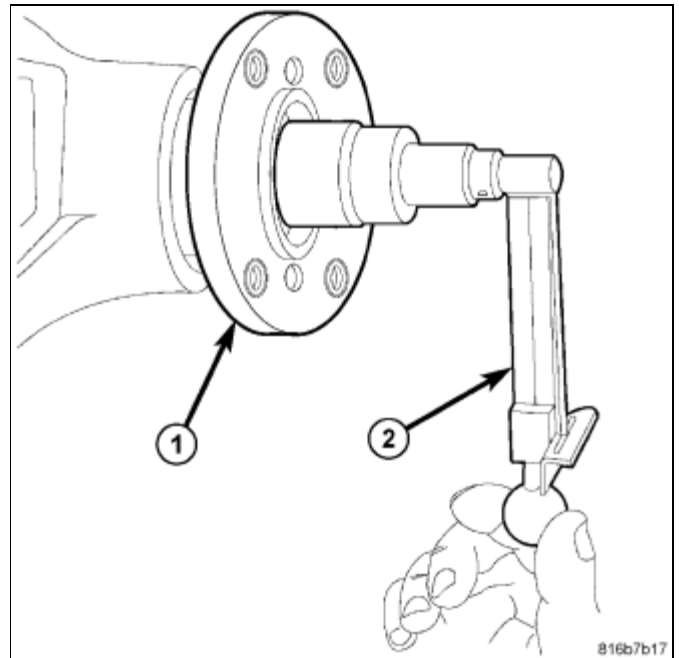
DIAGNOSIS AND TESTING

REAR AXLE - 226RBI

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of



driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint/CV or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out of balance wheels.
- Loose wheel lug nuts.
- Worn U-joint or CV.
- Loose/broken springs.
- Damaged axle shaft bearing(s).

- Loose pinion gear nut.
- Excessive pinion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front end components or engine/transmission mounts. These components can contribute to what appears to be a rear end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged) can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints or CV.
- Loose spring mounts.
- Loose pinion gear nut and flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

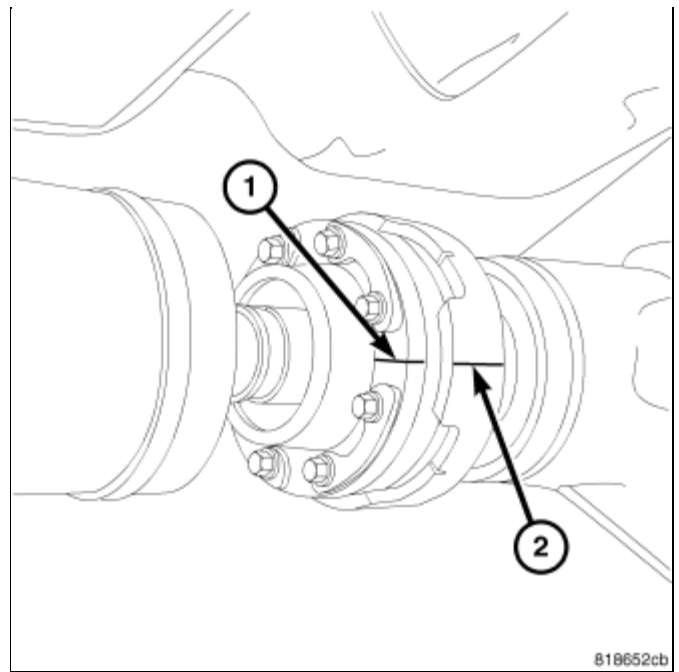
Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brindled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive ring and pinion gear backlash.	4. Check and adjustment ring and pinion gear backlash.
	5. Improper pinion bearing adjustments.	5. Adjust the pinion bearings pre-load.

	6. Loose pinion flange nut.	6. Tighten pinion flange nut to specifications.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace broken shaft after correcting tube mis-alignment.
	2. Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper differential bearing adjustment.	1. Replace case, inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored flange.	5. Replace flange and seal.
	6. Differential cover not sealed.	6. Remove, clean, and seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Adjust bearing pre-loads.

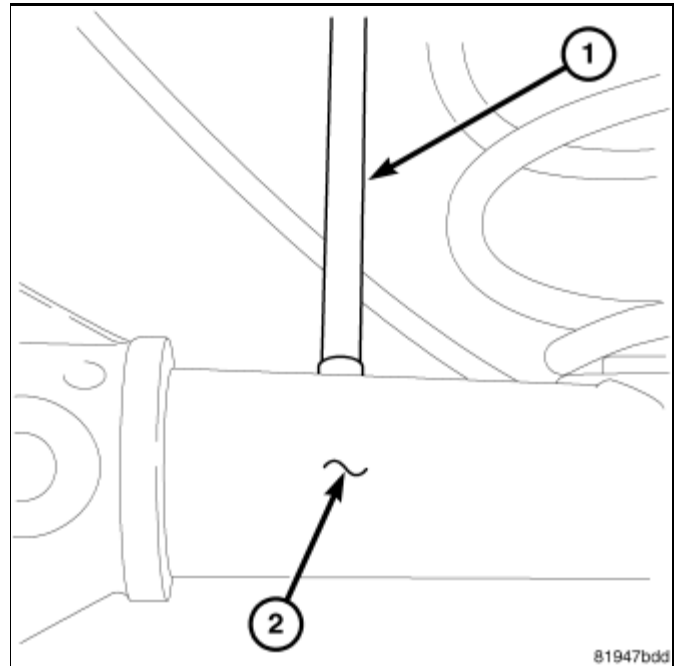
	4. Insufficient ring gear backlash.	4. Adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring and pinion gear adjustment.	2. Check ring and pinion gear contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring and pinion gears.	4. Replace ring and pinion gears.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Loose or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure bearing caps are torqued to the proper specification.
	9. Housing not machined properly.	9. Replace housing.

REMOVAL

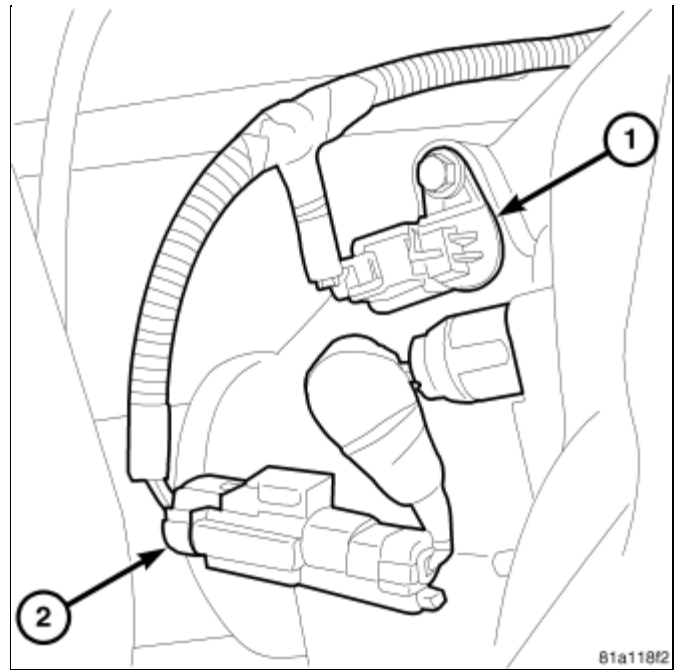
1. With vehicle in neutral, position vehicle on hoist.
2. Position and secure a lift under the axle.
3. Mark propeller shaft flange (1) and axle pinion flange (2) for installation reference.
4. Remove propeller shaft and suspend under the vehicle.



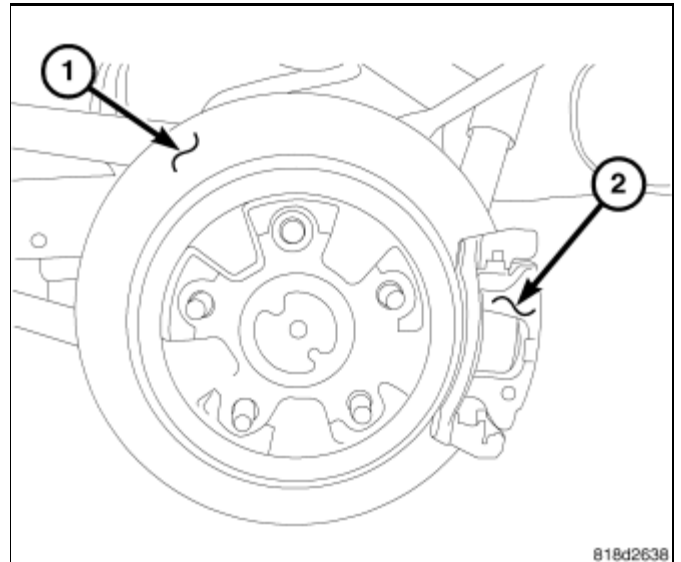
5. Remove vent hose (1) from the axle tube (2).



6. Disconnect Tru-Lok wiring connectors (1,2).

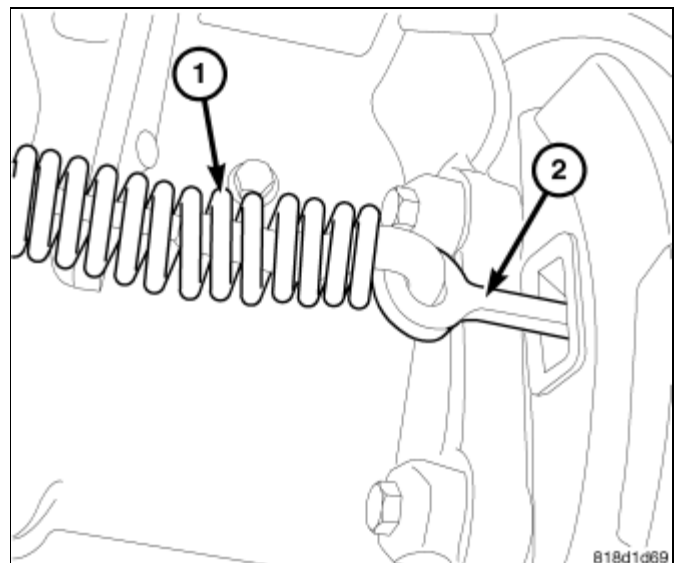


7. Remove brake calipers (2) and rotors (1) from axle.

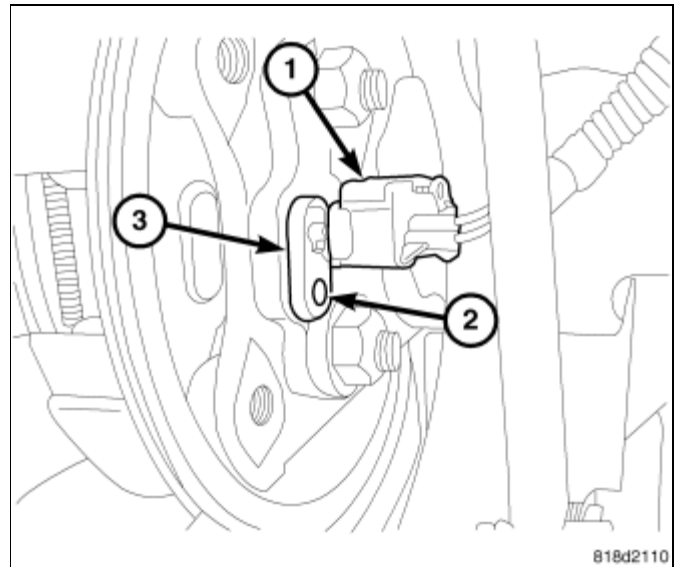


8. Remove park brake cables (1) from axle (2).

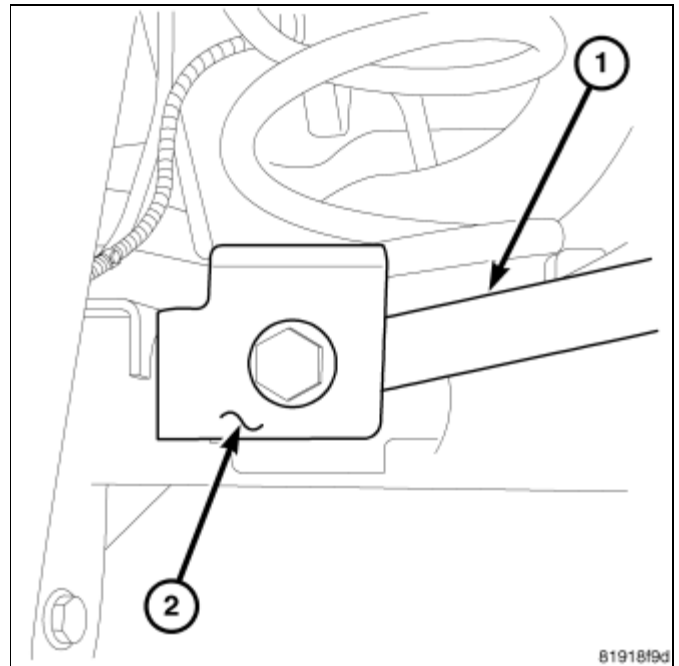
NOTE: Park brake cables are self adjusting and must be locked out before removal.



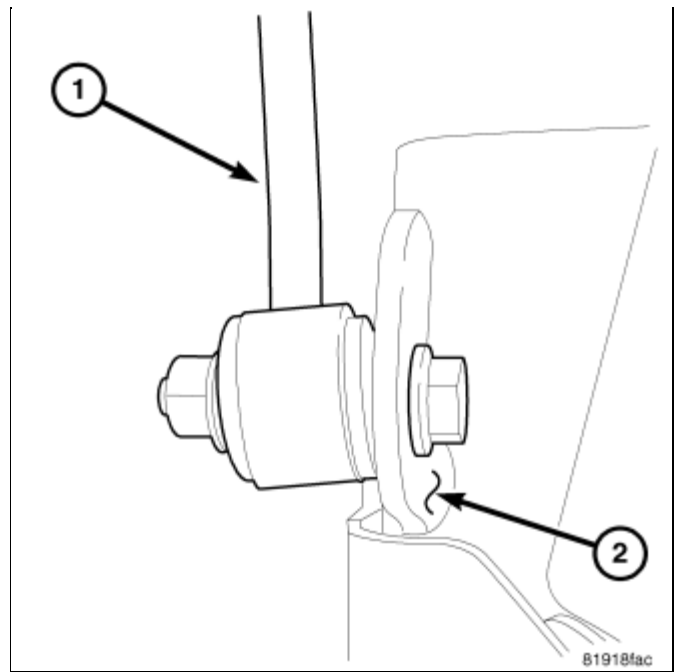
9. Remove brake sensors connector (1) from sensors (2).



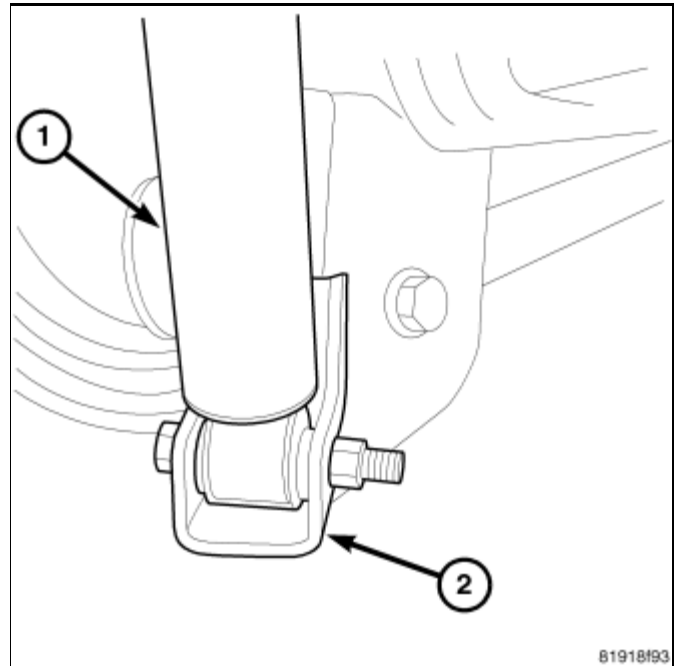
10. Remove track bar (1) from axle bracket (2)



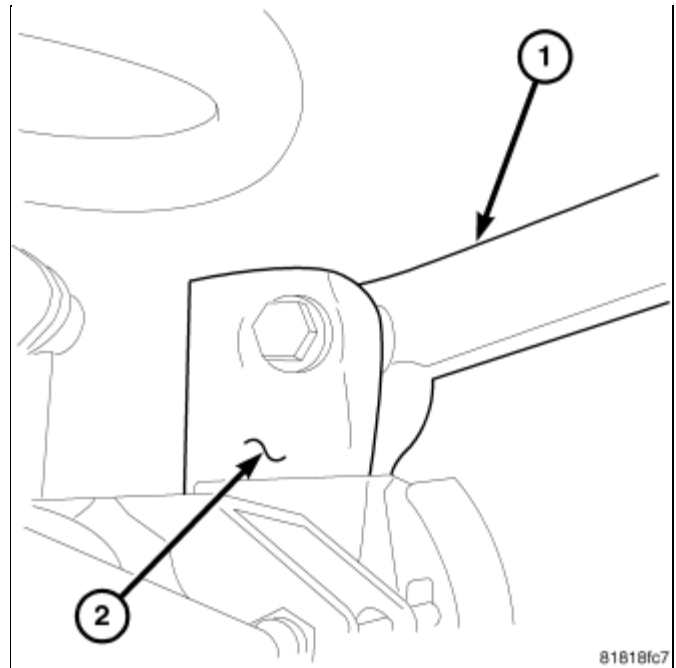
11. Remove stabilizer bar links (1) from axle brackets (2).



12. Remove shock absorbers (1) from axle brackets (2).

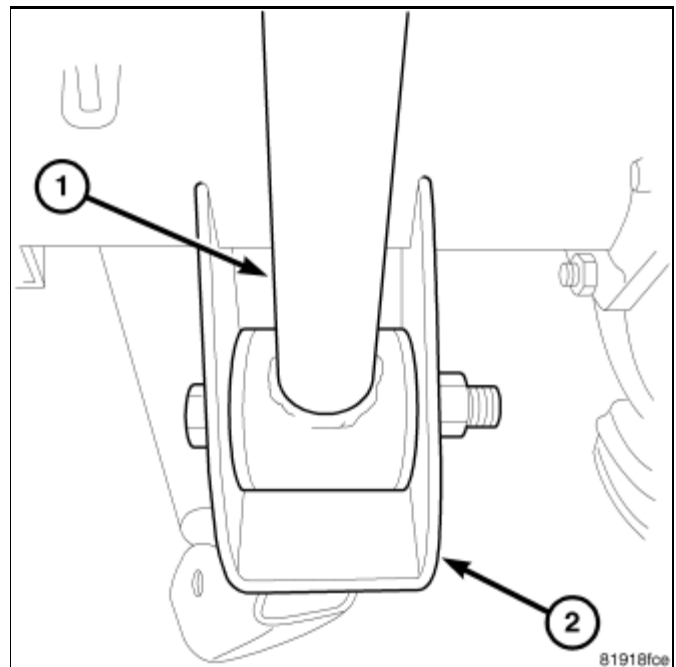


13. Remove upper control arms (1) from axle brackets (2).



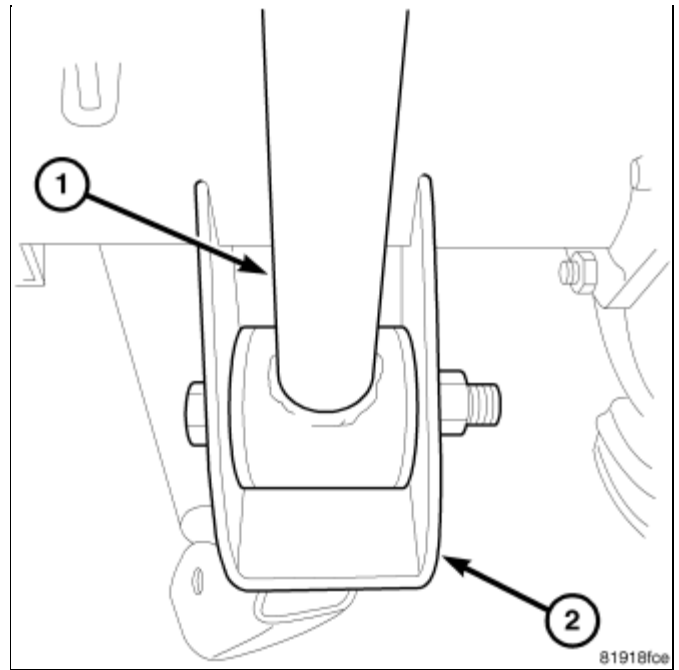
14. Loosen lower control arm (1) bolts and lower axle enough to remove coil springs and spring insulators.
15. Remove lower control arm (1) from axle brackets (2).
16. Lower and remove the axle.

INSTALLATION

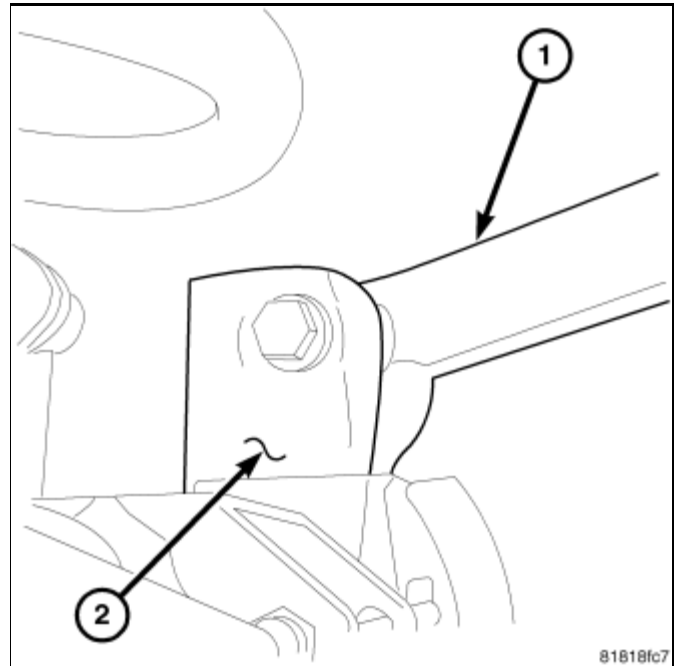


CAUTION: The weight of the vehicle must be supported by the springs before the control arms and track bar are tightened. Failure to follow these instructions will cause premature bushing failure.

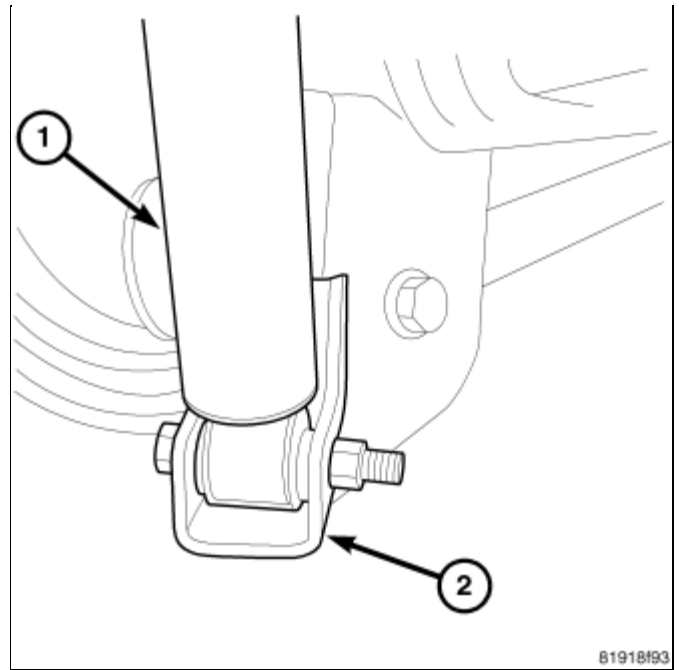
1. Raise the axle under the vehicle.
2. Install lower control arms (1) onto axle brackets (2) and loosely install mounting bolts and nuts.
3. Install coil spring isolators and springs.
4. Raise axle up until springs are seated.



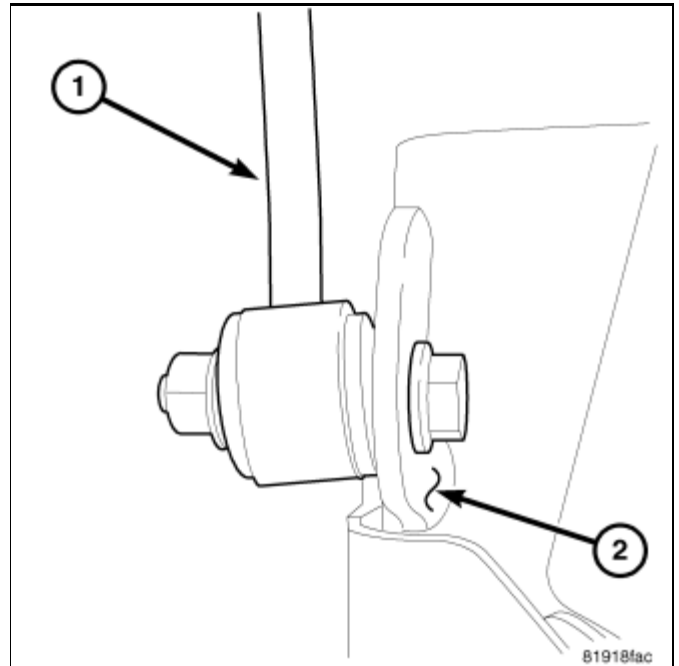
5. Install upper control arms (1) onto axle brackets (2) and loosely install mounting bolts and nuts.



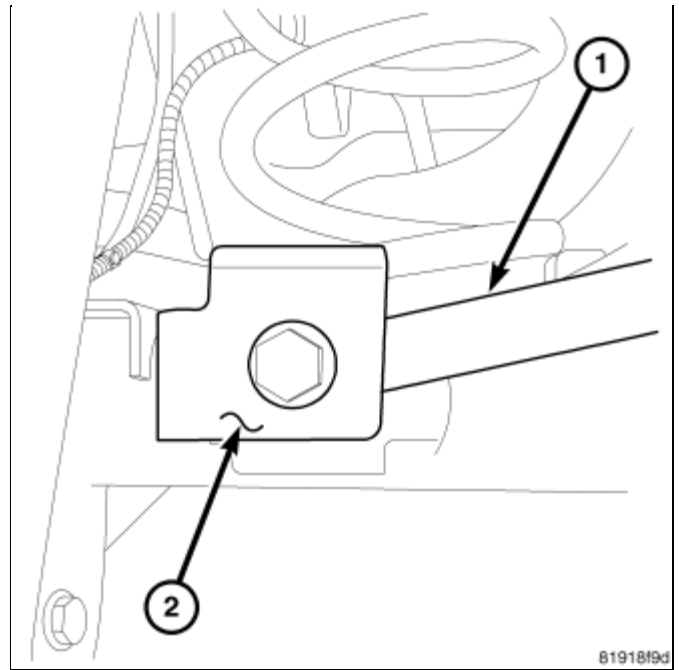
6. Install shock absorbers (1) onto axle brackets (2) and tighten nuts to specification.



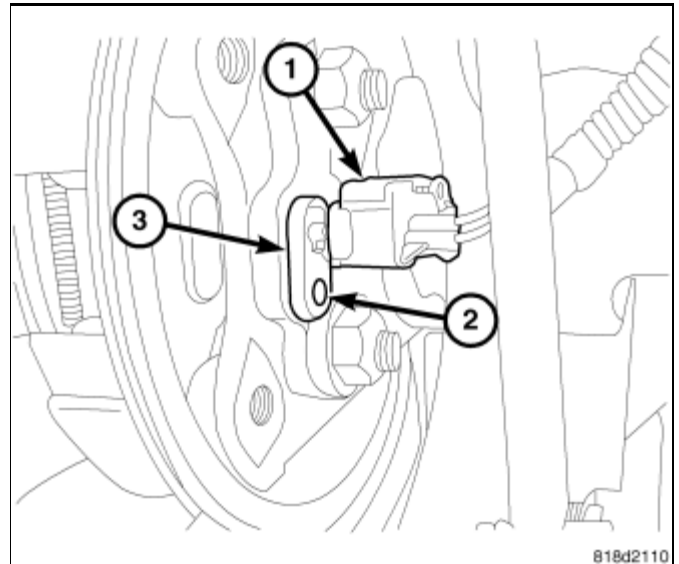
7. Install stabilizer links (1) onto axle brackets (2) and tighten nuts to specification.



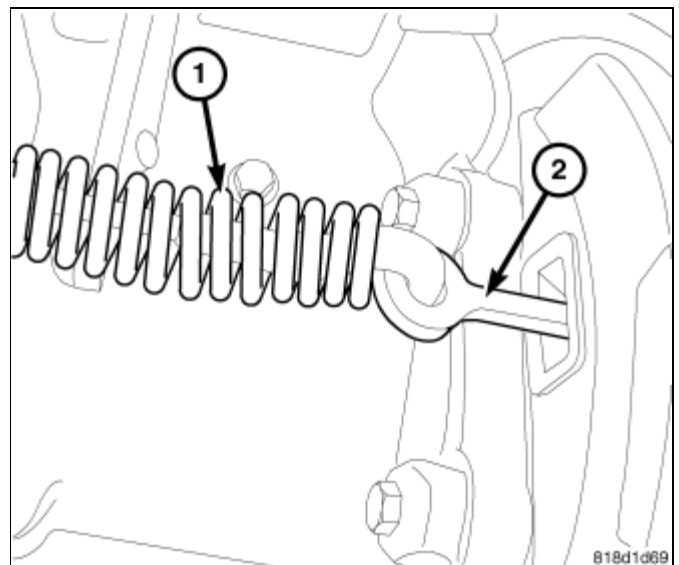
8. Install track bar (1) onto axle bracket (2). and loosely install track bar bolt.



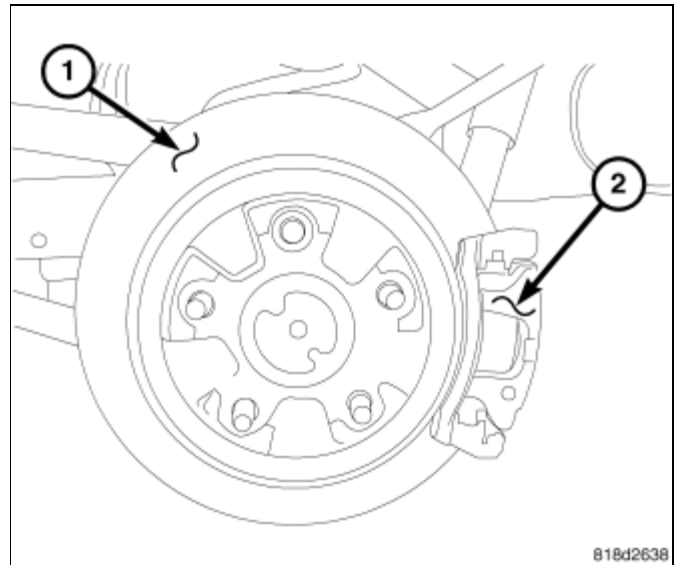
9. Install brake sensors connector (1) on sensors (2).



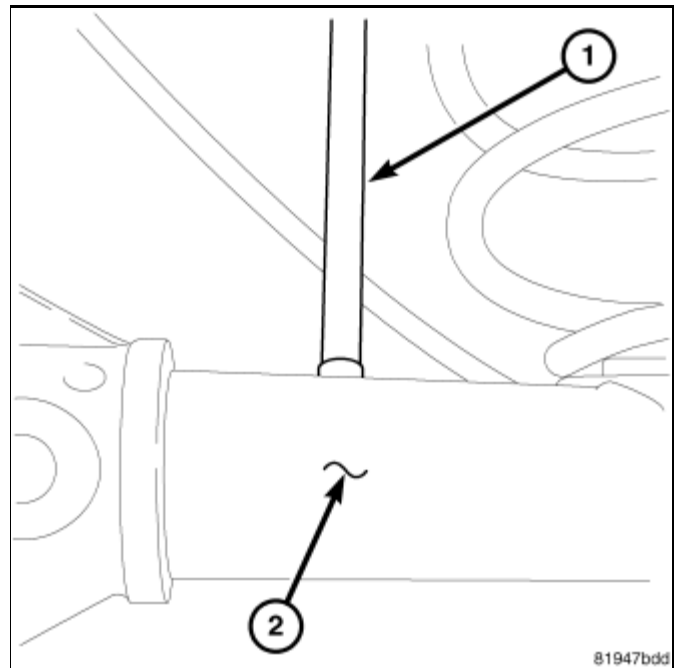
10. Install park brake cables (1) on axle (2).



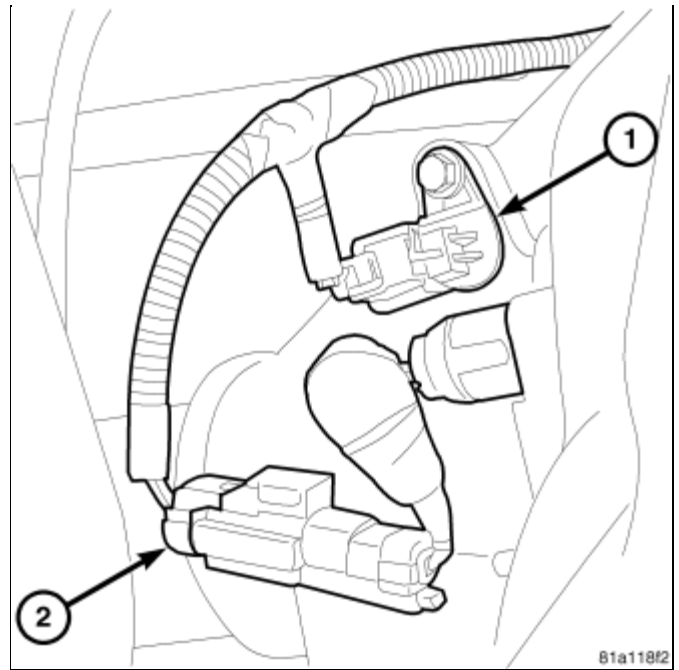
11. Install brake rotors (1) and calipers (2) on axle.



12. Install vent hose (1) on axle tube (2).



13. Connect Tru-Lok wiring connectors (1,2).



14. Install propeller shaft with propeller shaft flange (1) and pinion flange (2) reference marks aligned.

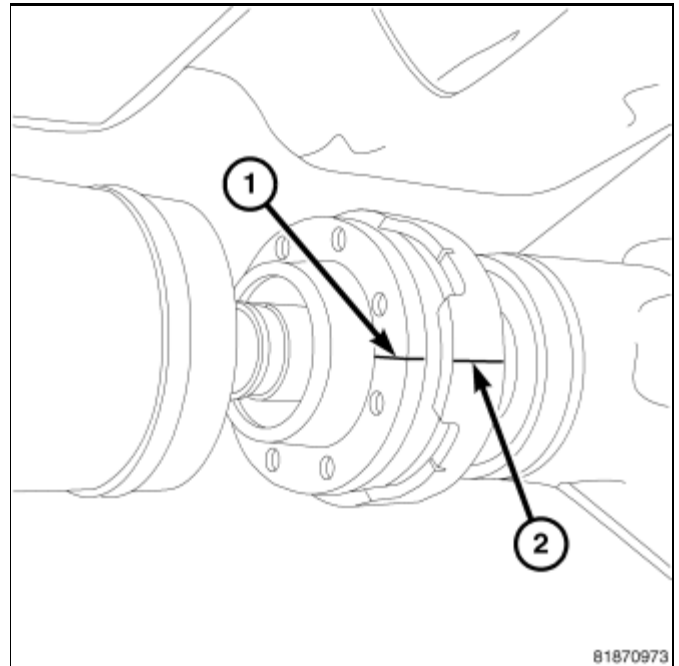
NOTE: Clean all propeller shaft bolts and apply Mopar Lock & Seal Adhesive or equivalent to the threads before installation.

15. Install propeller shaft bolts and tighten to specifications.

16. Install wheels and tires.

17. Remove lift from axle and lower vehicle.

18. Tighten lower control arms, upper control arms and track bar nuts to specification.



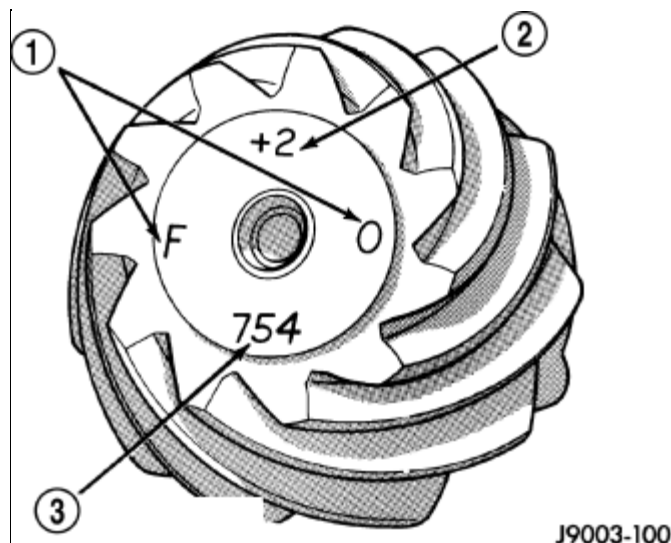
ADJUSTMENTS

PINION DEPTH-BEARING PRELOAD-GEAR BACKLASH

Ring and pinion gears are supplied as matched set. The identifying match numbers (3) for the ring and pinion gear are etched into the face of each gear. A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear (2). This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard depth provides the best teeth

contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing on the pinion shaft.



If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. The intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the drive pinion gear (-1, -2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

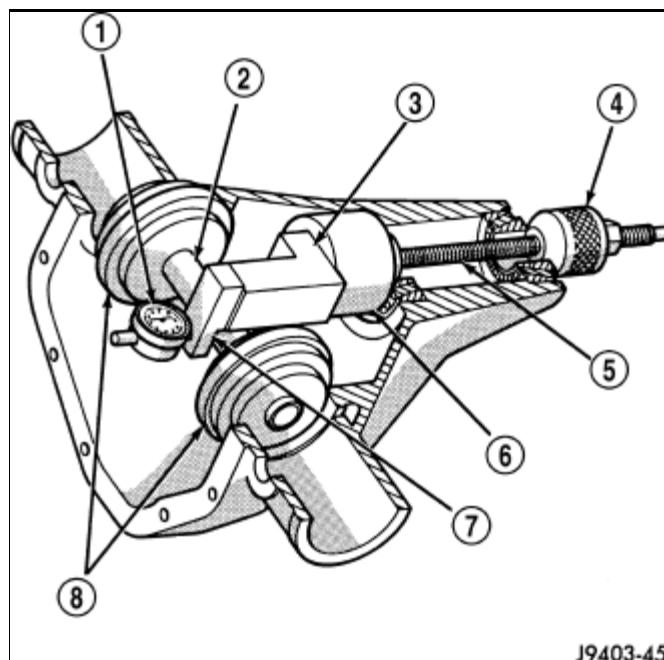
PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	?4	?3	?2	?1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003
0	+0.004	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004
?1	+0.003	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005
?2	+0.002	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006
?3	+0.001	0	?0.001	?0.002	?0.003	?0.004	?0.005	?0.006	?0.007

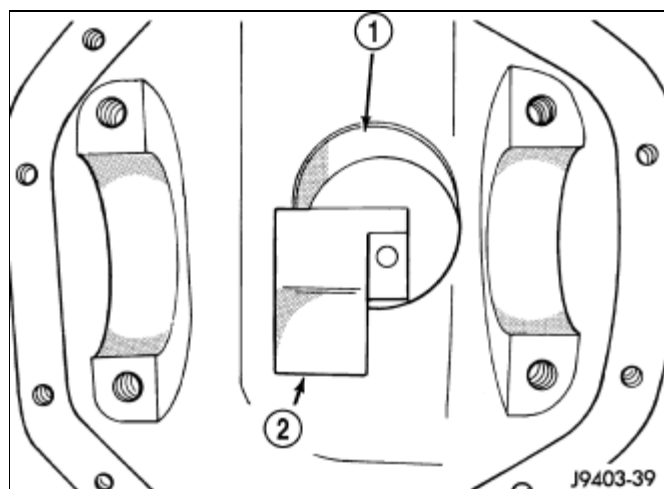
4	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008		
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PINION DEPTH MEASUREMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6730 (2,3,4,5,6,7,8) and Dial Indicator C-3339A (1).

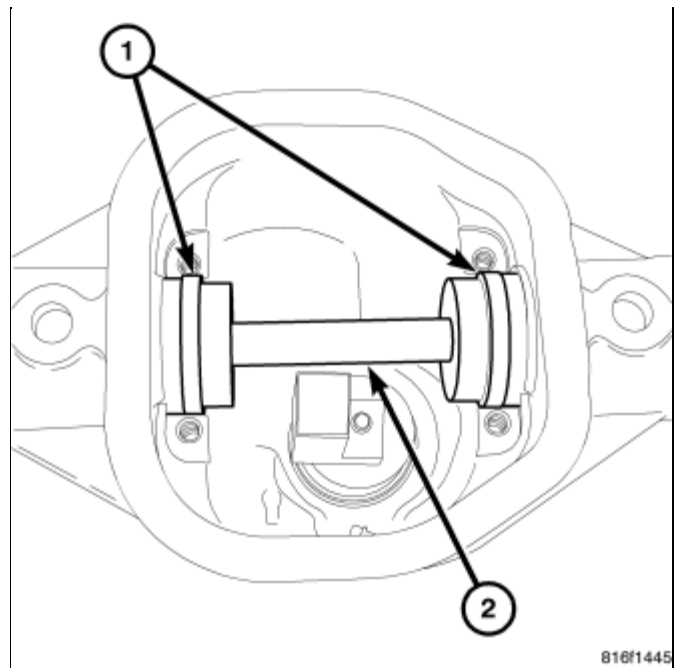


1. Assemble Pinion Height Block 6739 (2), Pinion Block 9990 (1) and rear pinion bearing onto Screw 6741.
2. Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups.
3. Install front pinion bearing and Cone Nut 6740. Tighten nut until torque to rotate the screw is 2.25 N·m (20 in. lbs.). Measure torque to rotate with an inch pound torque wrench.

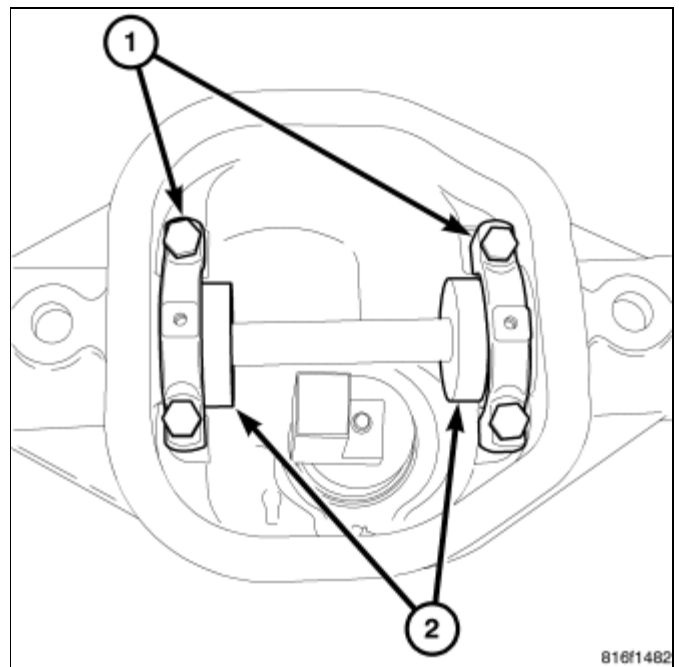


4. Place Arbor Disc 8541 (1) on Arbor D-115-3 (2) and position in the housing side bearing cradles.

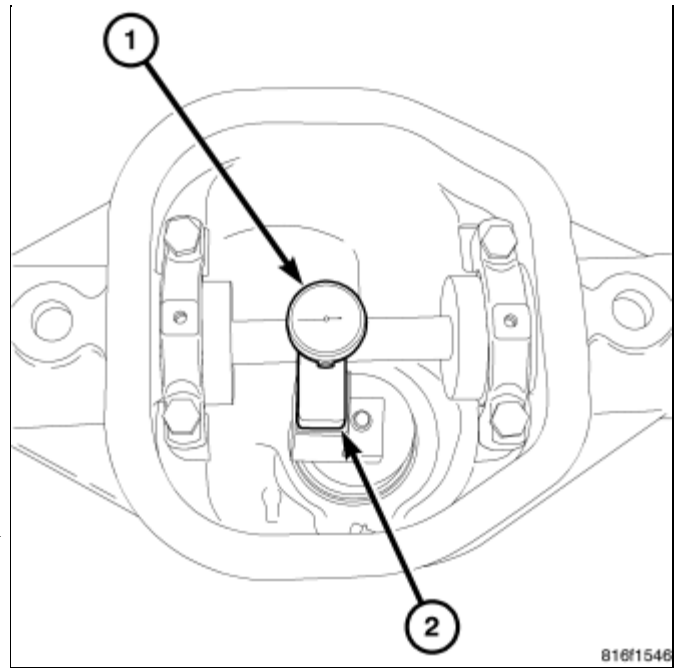
NOTE: Arbor Discs 8541 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.



5. Install differential bearing caps (1) on arbor discs (2) and tighten cap bolts to 108 N·m (80 ft. lbs.).



6. Assemble Dial Indicator C-3339A (1) into Scooter Block D-115-2 (2) and secure set screw.
7. Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.
8. Slowly slide the Scooter Block/Dial Indicator across the pinion height block over to the arbor bar (1). Move the Scooter Block/Dial Indicator to the crest of the arbor bar and record the highest reading.



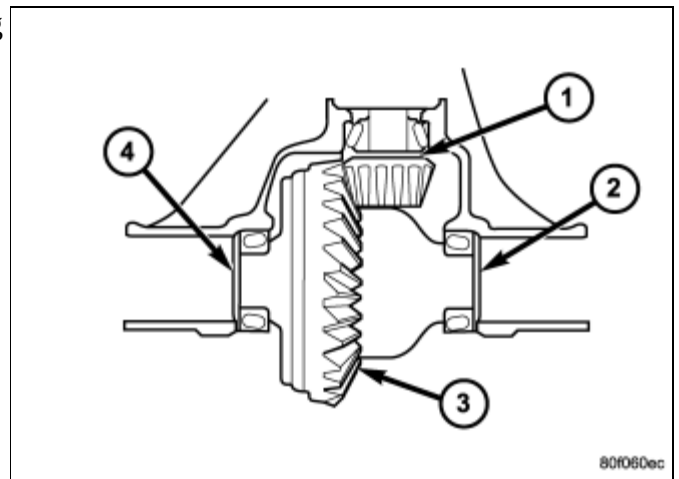
9. Select a shim equal to the dial indicator reading plus or minus the pinion gear depth variance number etched in the face of the pinion gear. **Example:** If the depth variance is – 2 add 0.002 in. to the dial indicator reading. If the depth variance is + 2 subtract 0.002 in. to the dial indicator reading.

The total is the shim thickness needed for the pinion depth variance.

PRELOAD SHIM SELECTION

Before performing differential bearing preload and ring gear backlash measurements, pinion gear depth must be established and the pinion gear ready for installation. Establishing pinion gear depth is essential to gear backlash and tooth contact patterns.

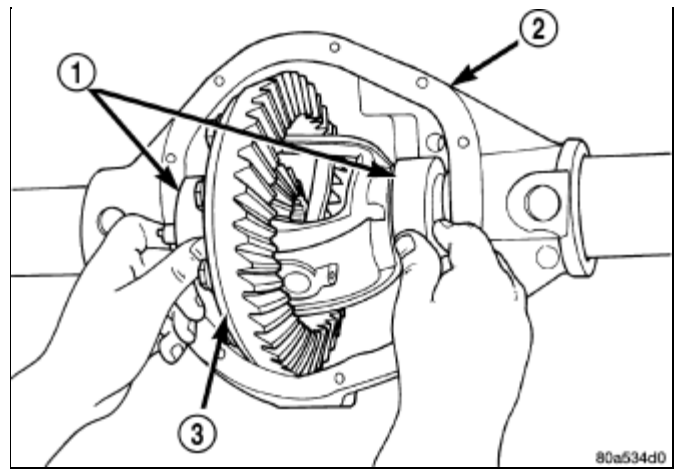
Differential side bearing preload and gear backlash is accomplished with selective shims (2,4) positioned behind the differential side bearing cups. Shim thickness is determined using Dummy Bearings 9992 in place of the differential side bearings and a Dial Indicator C-3339A.



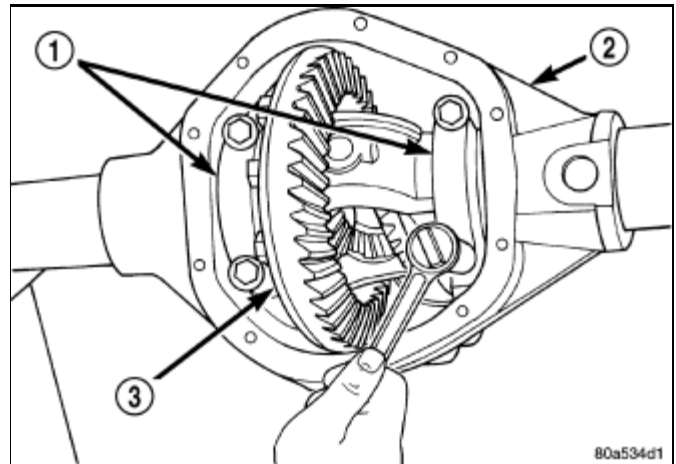
SHIM FORMULA : Differential End Play + Preload Specification = Total Differential Shim. Total Differential Shim – Ring Gear Side Shim – Backlash Specification = Pinon Gear Side Shim.

1. Remove differential side bearings from differential case.
2. Remove factory installed shims from differential case.

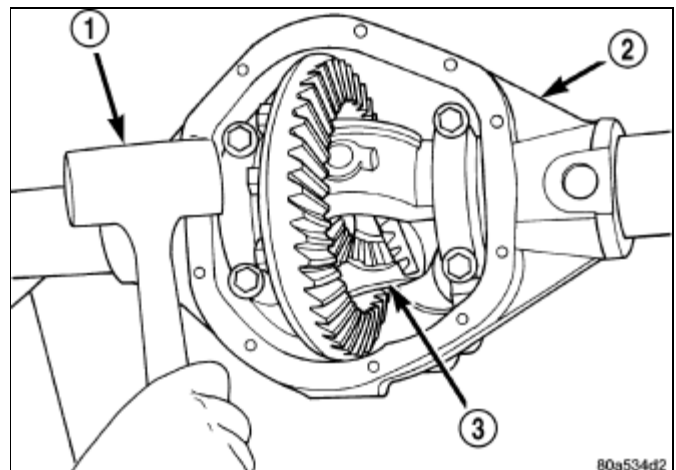
3. Install ring gear on differential case and tighten bolts to specification.
4. Install dummy side bearings 9992 (1) on differential case.
5. Install differential case (3) with dummy bearings (1) into the differential housing (2).



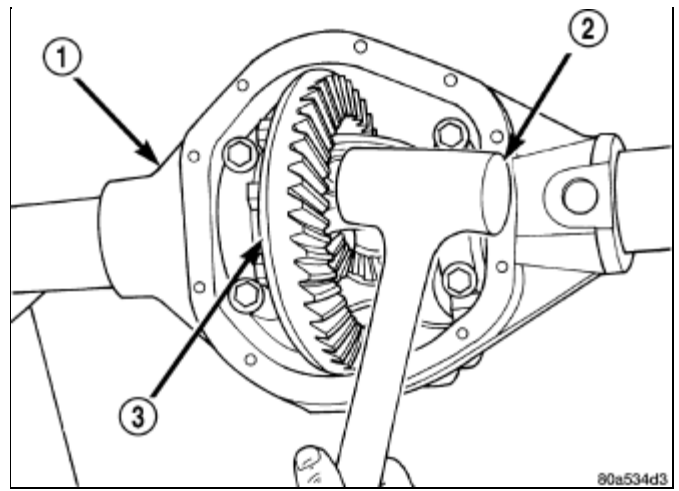
6. Install the differential (3) bearing caps (1) in their correct positions. Install and snug the bolts.



7. Seat pinion gear side (2) differential dummy bearing in the housing with a dead blow hammer (1).

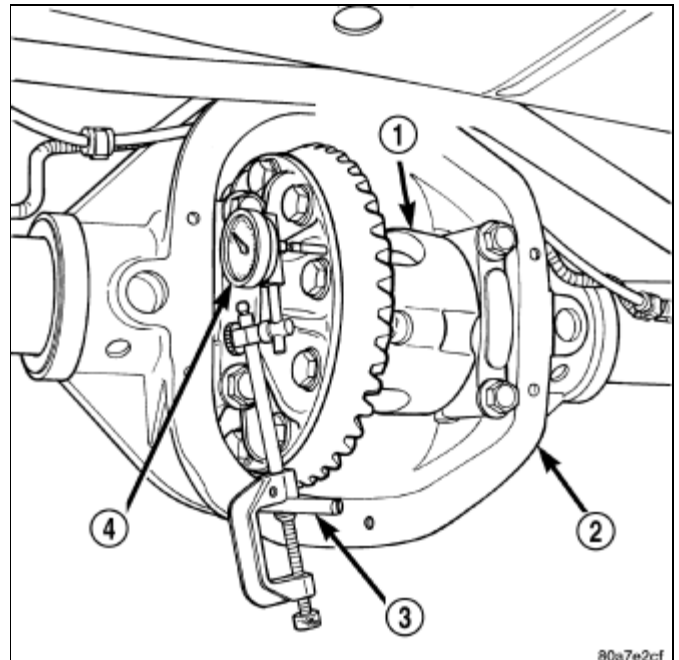


8. Seat ring gear side (1) differential dummy bearing in the housing with a dead blow hammer (2).

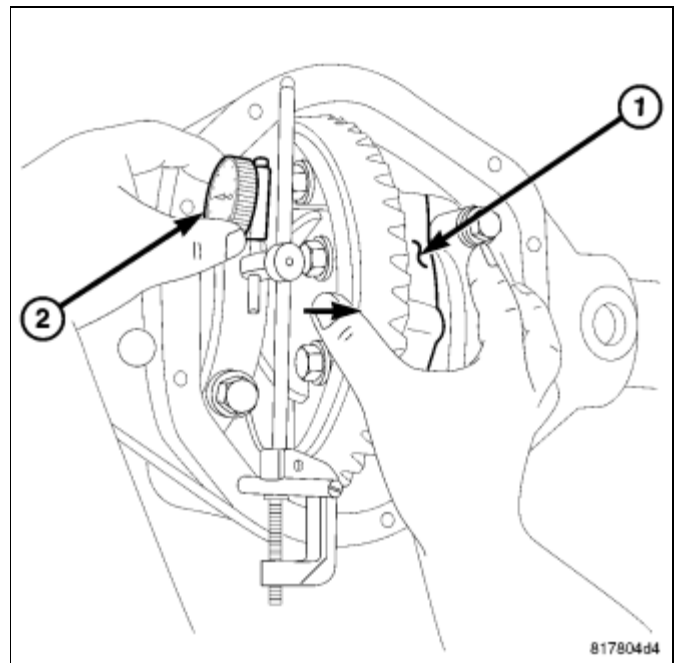


9. Install Pin C-3288-B (3) into rear cover bolt hole below ring gear.

10. Attach a dial indicator C-3339A (4) to Pilot Stud C-3288-B (3). Position the dial indicator plunger on a flat surface between the ring gear bolt heads.



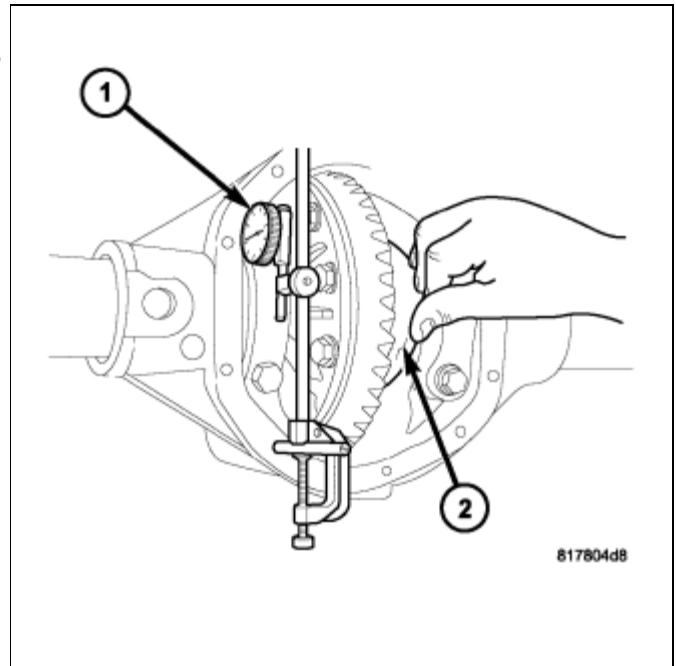
11. Push and hold differential case (1) to pinion gear side of the housing and zero dial indicator (2).



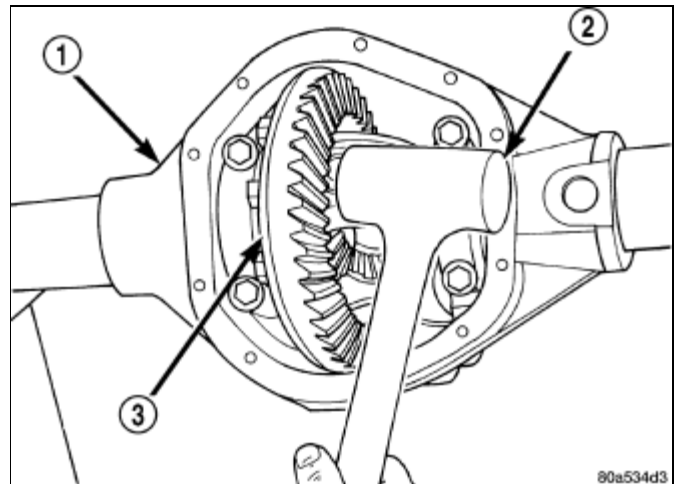
12. Push and hold differential case (2) to ring gear side of the housing. Record dial indicator (1) differential reading. Add preload specification 0.25 mm (0.010 in.) to differential dial indicator reading. This is the total shim needed to preload the differential bearings.

EXAMPLE: Differential Dial Indicator Reading + Preload Specification 0.25 mm (0.010 in.) = Total Differential Shim

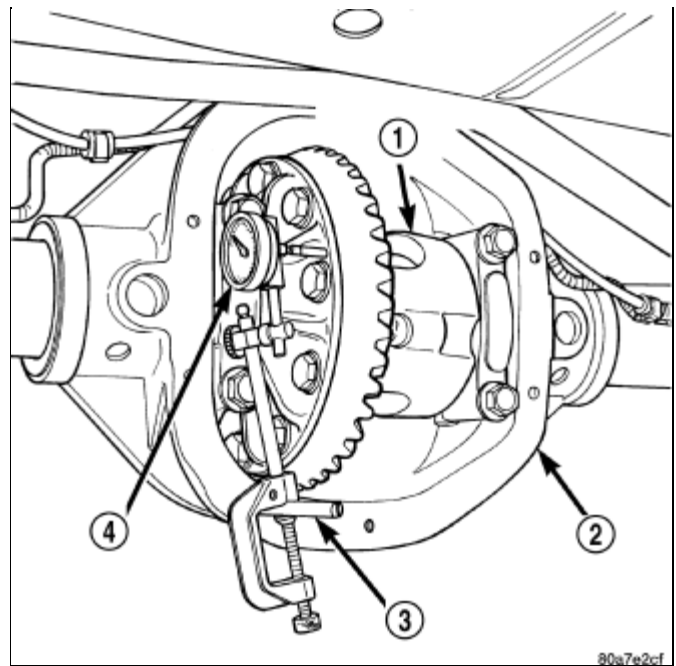
13. Rotate dial indicator out of the way on pilot stud.
 14. Remove differential case and dummy bearings from the housing.
 15. Install pinion gear in the housing and establish pinion torque to rotating (PTTR) .



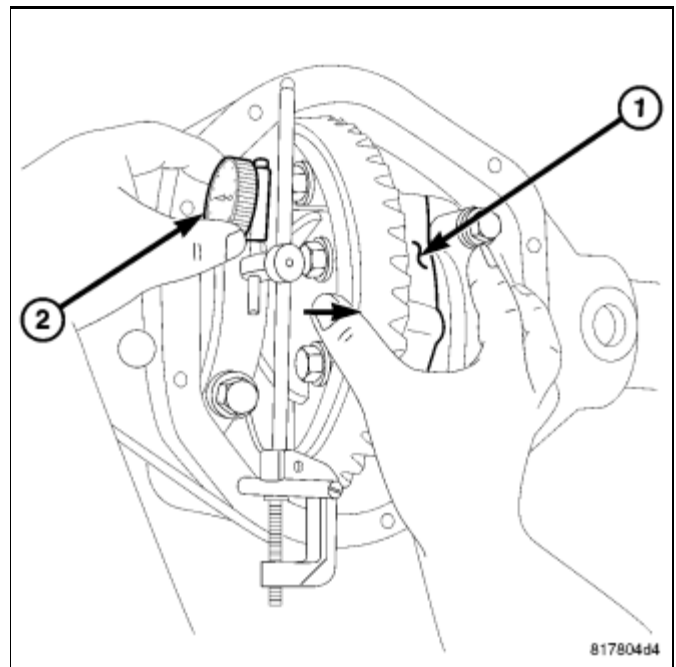
16. Install differential case and dummy bearings 9992 in the housing, install bearing caps and tighten bolts snug.
 17. Seat ring gear side (3) dummy bearing in the housing (1) with dead blow hammer (2)



18. Position the dial indicator plunger (4) on a flat surface between the ring gear bolt heads.



19. Push and hold differential case (1) toward the pinion gear and zero dial indicator (2).



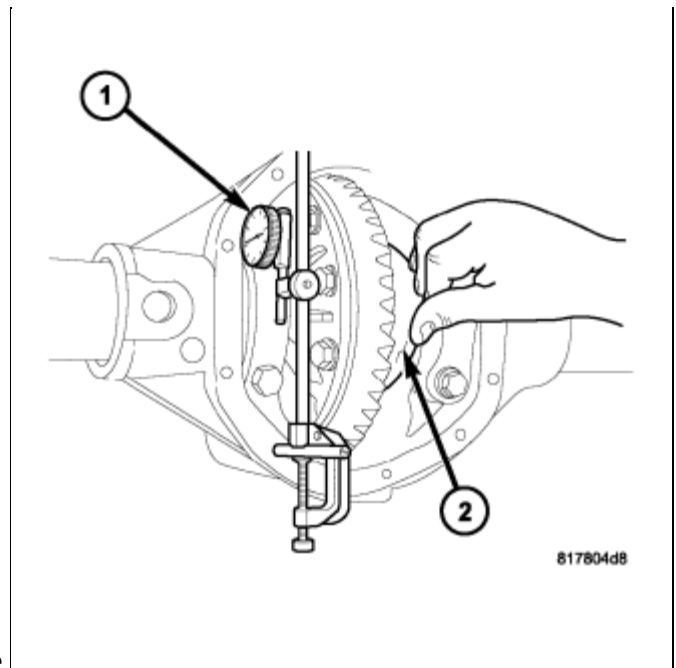
20. Push and hold differential case (2) to ring gear side of the housing and record dial indicator (1) ring gear side reading.

21. Subtract backlash specification 0.05 mm (0.002 in.) from ring gear side reading for ring gear backlash. The remainder is the shim needed on the ring gear side of the differential.

EXAMPLE: Ring Gear Side Dial Indicator Reading – Backlash Specification 0.05 mm (0.002 in.) = Ring Gear Side Shim

22. Subtract ring gear side shim from differential total preload shim. This remainder is the shim needed on the pinion side of the differential.

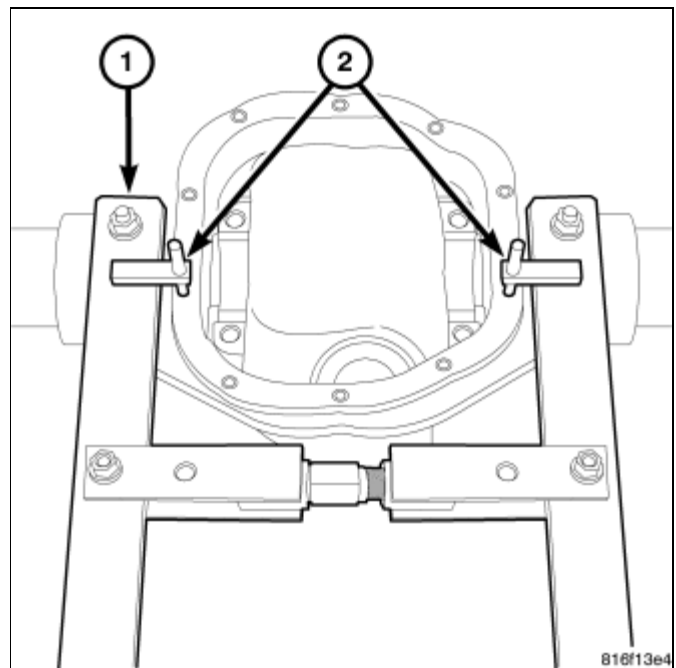
EXAMPLE: Total Differential Shim – Ring Gear Side Shim = Pinion Gear Side Shim



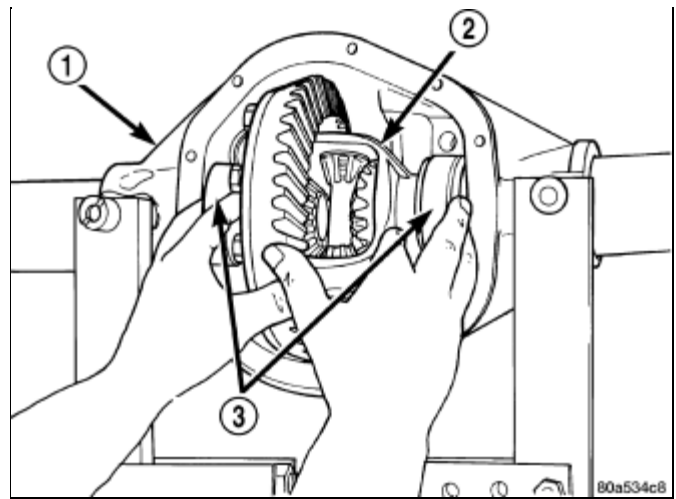
- 23. Rotate dial indicator out of the way on pilot stud.
- 24. Remove differential case and dummy bearings from the housing.
- 25. Install new side bearings on differential case.

26. Install Spreader W-129-B (1) with hold downs (2) from Adapter Set 6987B on the housing and spread open enough to receive differential case.

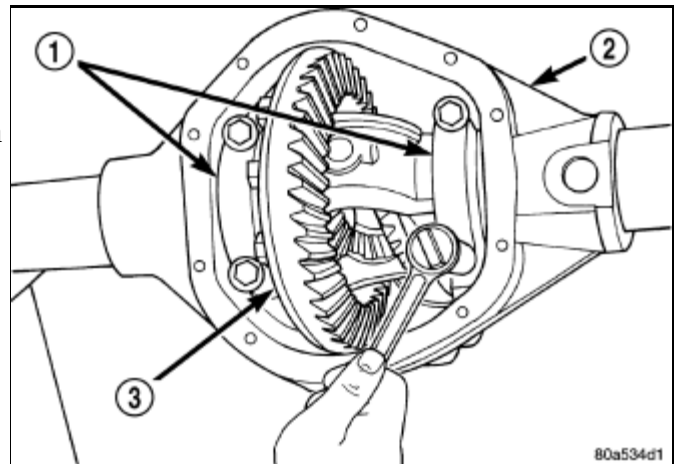
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.



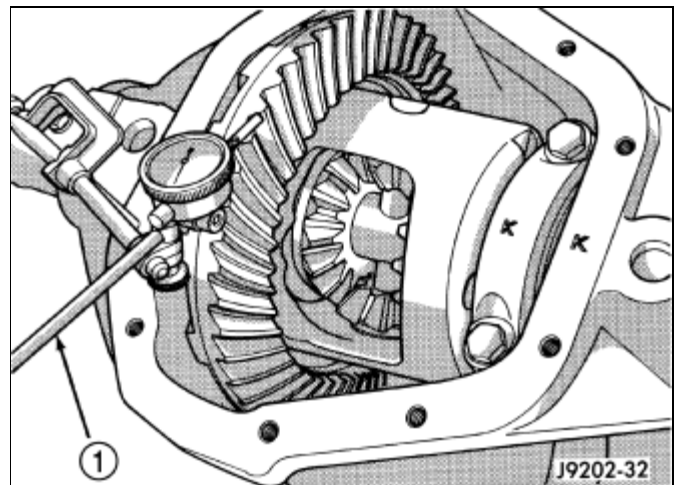
27. Install differential case (2) into the housing with bearing cups (3) and shims.



28. Install bearing caps and tighten bolts finger tight. Remove spreader from the housing.
29. Install bearing cap (1) and tighten bolts to 108 N·m (80 ft. lbs.).
30. Rotate the differential case several times to seat the side bearings.



31. Position dial indicator (1) plunger against a ring gear tooth.
32. Push and hold ring gear upward while not allowing the pinion gear to rotate and zero dial indicator.
33. Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in. - 0.008 in.).

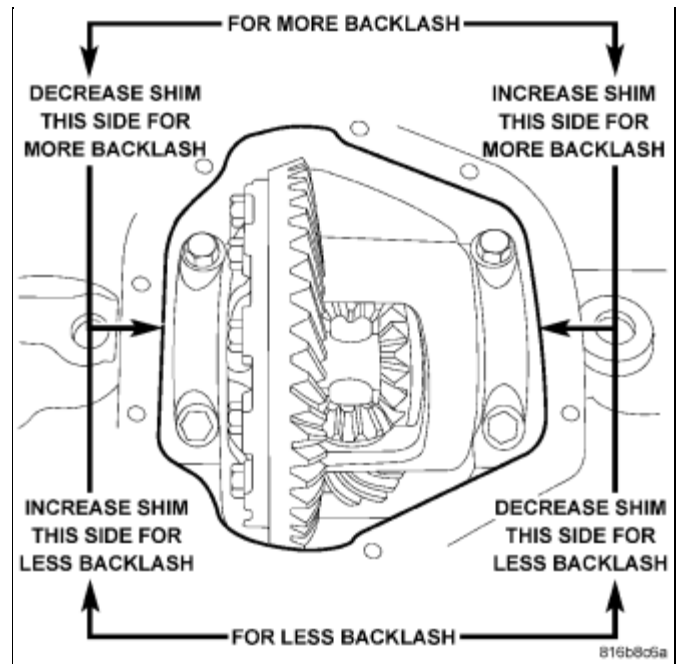


If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other

Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary

more than specified, the ring gear or the differential case is defective.

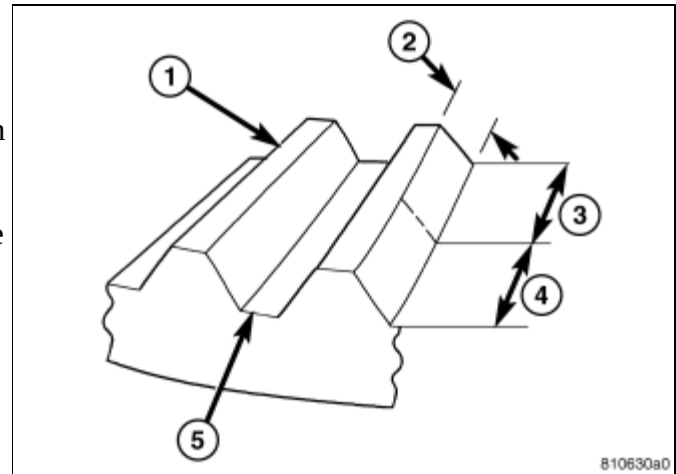
After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.



GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

The TOP LAND (1) of the gear tooth is the top surface of the tooth. The PROFILE (2) of the gear tooth is the depth of the tooth. The TOE (3) of the gear is the portion of the tooth surface at the end towards the center. The HEEL (4) of the gear is the portion of the tooth at the outer-end. The ROOT (5) of the gear tooth is the lowest portion of the tooth.



NOTE: If the PROFILE across the tooth is the same it is a 3 Axis cut gear. If the PROFILE across the tooth is tapered it is a 2 Axis cut gear.

1. Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.
2. Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.
3. Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart and adjust pinion depth and gear backlash as necessary.

THREE AXIS CUT GEARS

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top heel contact		Top toe contact	Backlash correct. Thicker pinion position shim required.
	Root toe contact		Root heel contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top heel contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root toe contact	Pinion position shim correct. Increase backlash.

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TWO AXIS CUT GEARS

DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	Desirable pattern. The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		Desirable pattern. The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth.	None
	Top toe contact		Top heel contact	Backlash correct. Thicker pinion position shim required.
	Root heel contact		Root toe contact	Backlash correct. Thinner pinion position shim required.
	Top heel contact		Top toe contact	Pinion position shim correct. Decrease backlash.
	Root toe contact		Root heel contact	Pinion position shim correct. Increase backlash.

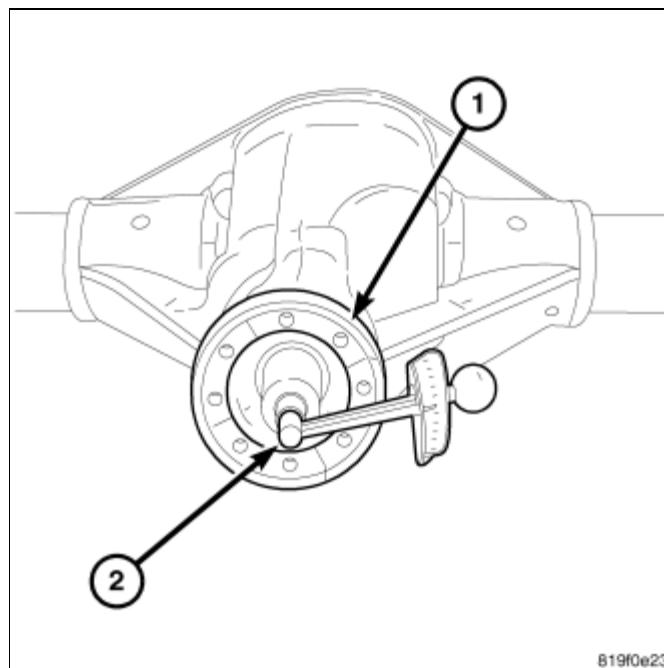
8106361d

DIFFERENTIAL BEARING PRELOAD CHECK

With an inch pound torque wrench (2) measure Total Torque To Rotate (TTTR). This is the final check on the differential assembly before installing the axle shafts. This will verify the correct differential bearing preload.

Total Torque To Rotate the differential is: Pinion Torque To Rotate plus 0.79 - 1.24 N·m (7 - 11 in. lbs.).

NOTE: If TTTR is high, decrease the shim thickness equally on both sides of the differential and check TTTR again. If TTTR is low, increase the shims thickness equally on both sides of the differential and check TTTR again.



SPECIFICATIONS

REAR AXLE - 226RBI

AXLE

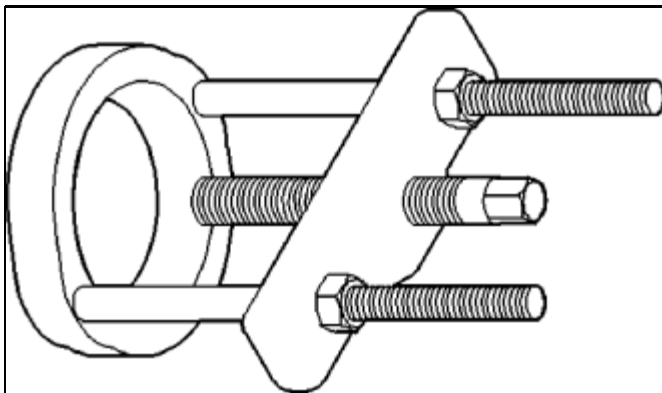
DESCRIPTION	SPECIFICATION
Axle Ratio	3.21, 4.10
Ring Gear Diameter	226 mm (8.89 in.)
Ring Gear Runout	0.12 mm (0.005 in.)
Ring Gear Backlash	0.12 - 0.20 mm (0.005 - 0.008 in.)
Pinion Torque To Rotate - Original Bearings	1 - 2.2 N·m (10 - 20 in. lbs.)
Pinion Torque To Rotate - New Bearings	2.2 - 4.5 N·m (20 - 40 in. lbs.)
Total Torque To Rotate: Pinion Torque To Rotate plus	0.79 - 1.24 N·m (7 - 11 in. lbs.)

TORQUE

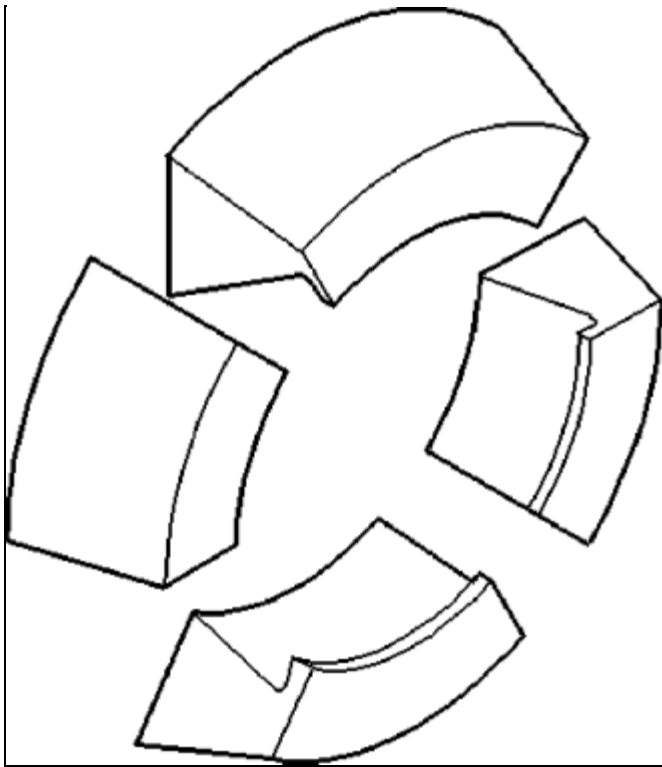
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	108	80	-
Ring Gear Bolts	183	135	-
Pinion Nut	217 - 271	160 - 200	-
Axle Retainer Nuts	61	45	-

SPECIAL TOOLS

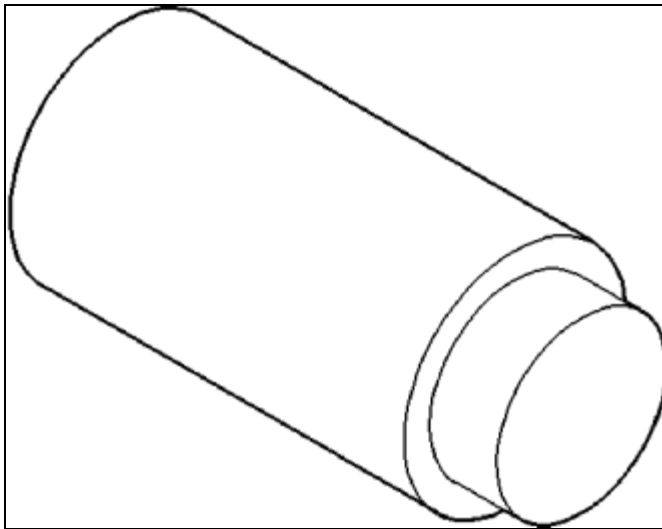
REAR AXLE - 226RBI



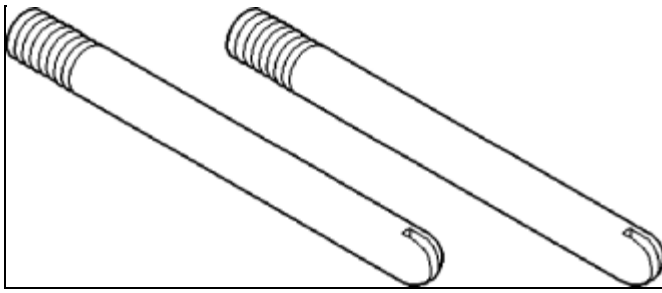
PULLER C-293-PA



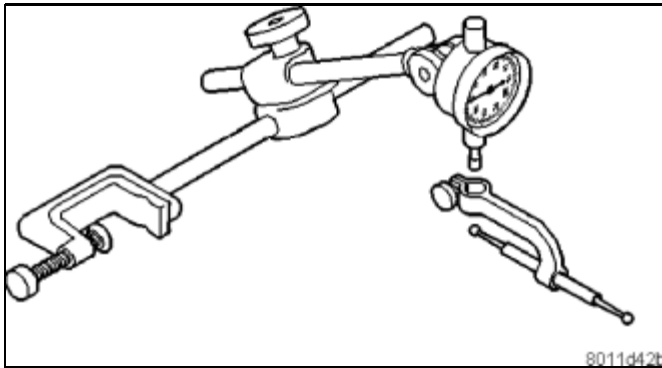
ADAPTERS C-293-47



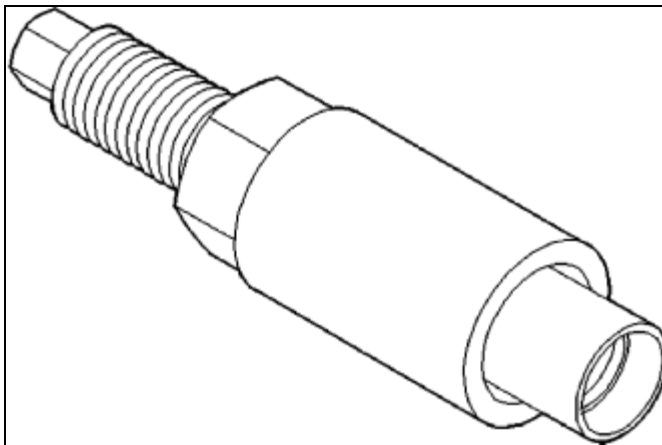
PLUG C-293-3



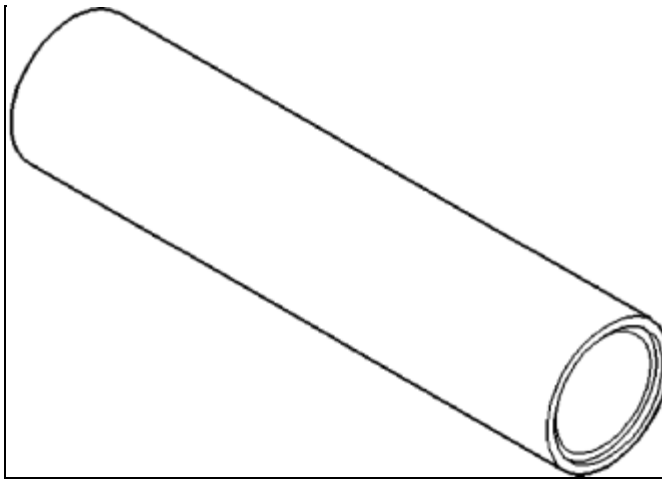
PILOT STUDS C-3288-B



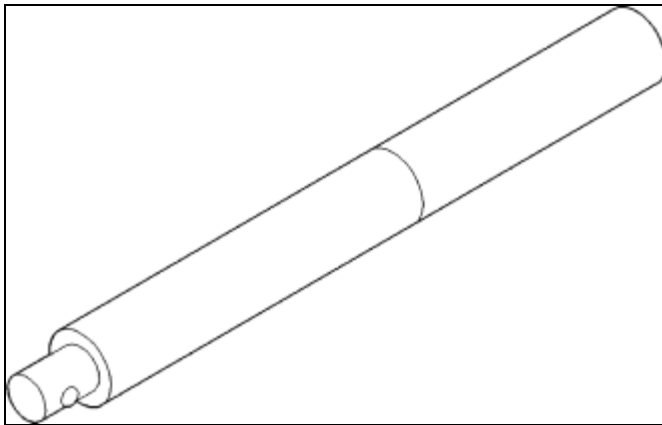
DIAL INDICATOR C-3339A



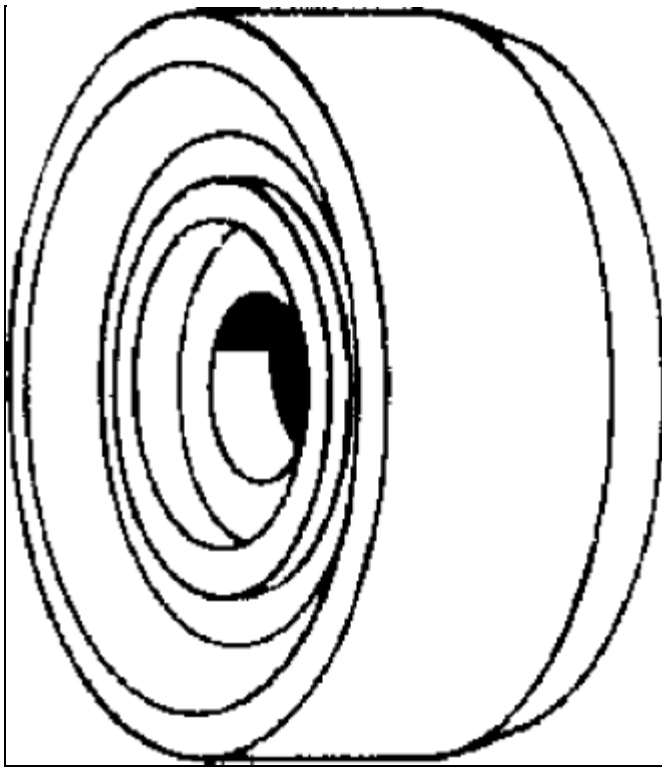
INSTALLER C-3718



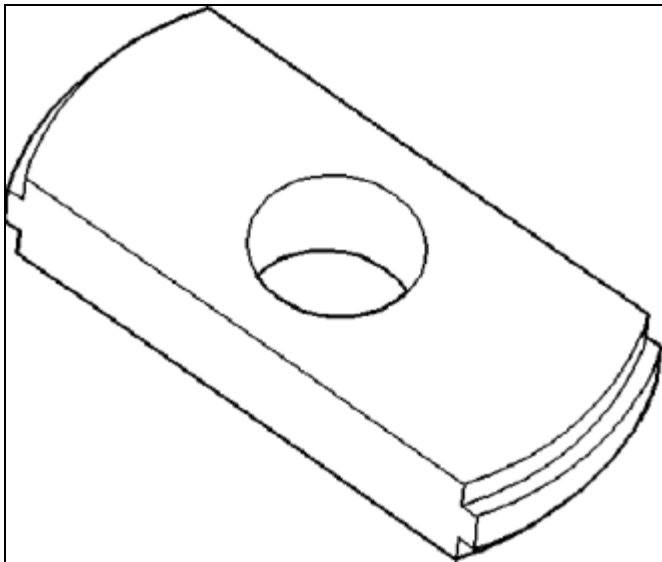
INSTALLER C-4040



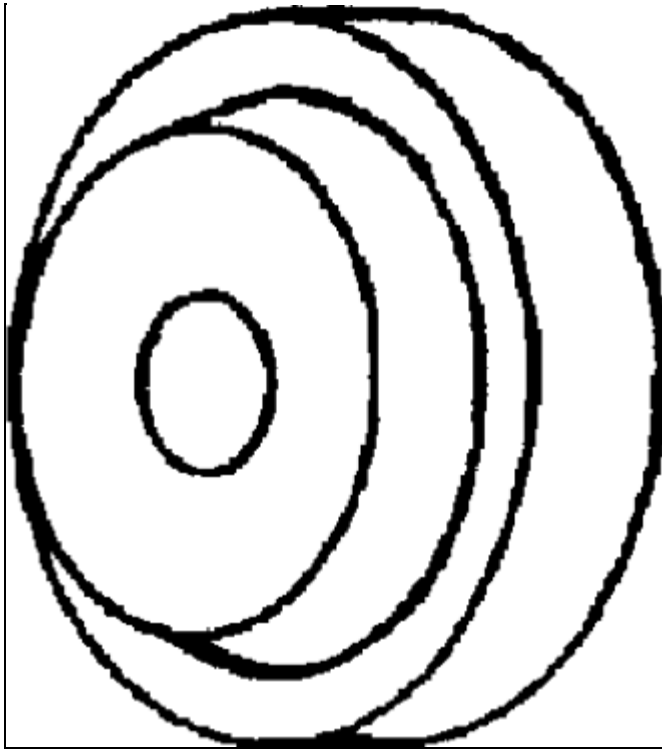
HANDLE C-4171



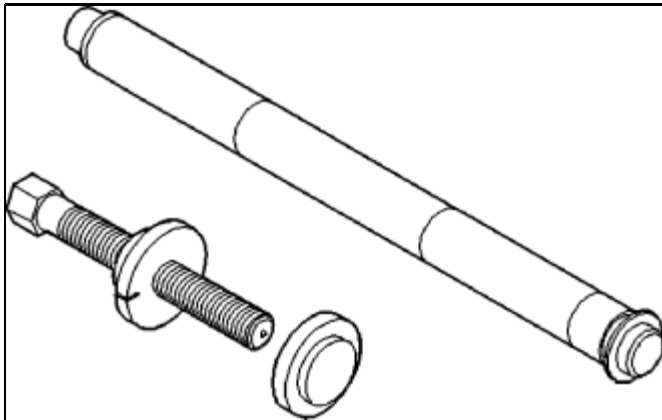
INSTALLER C-4213



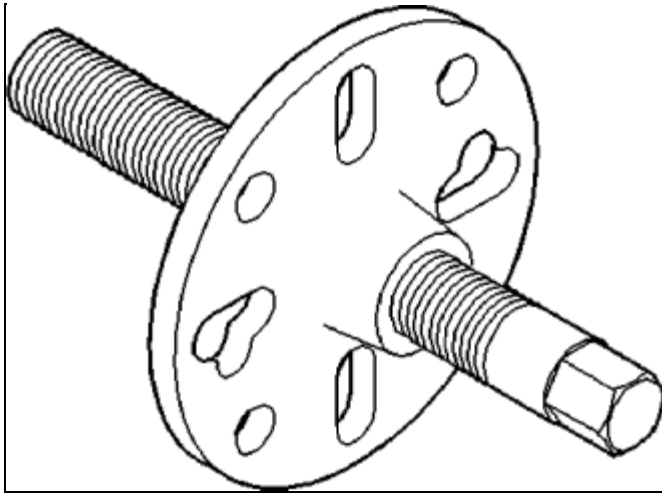
REMOVER C-4307



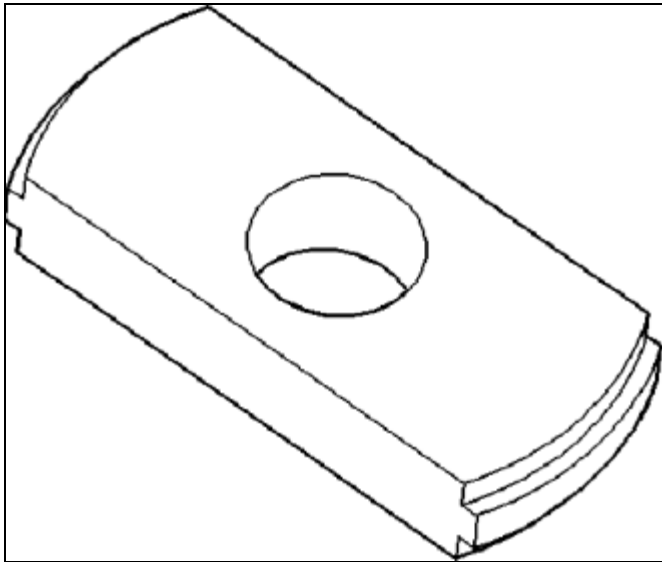
INSTALLER C-4308



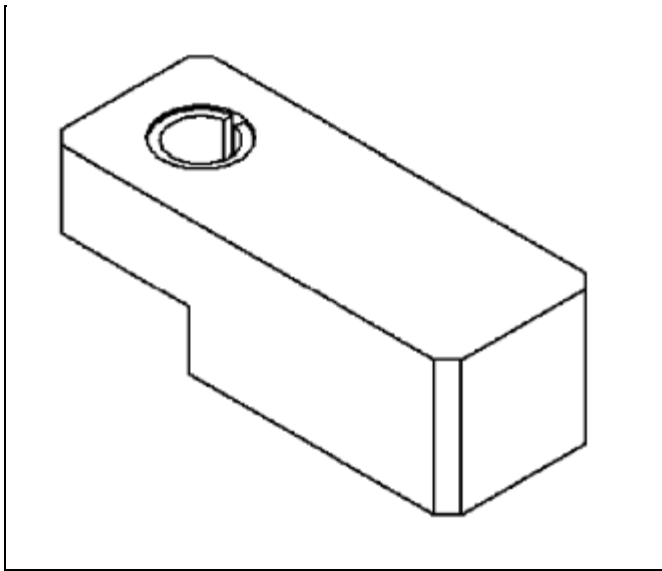
TRAC-LOK TOOLS C-4487



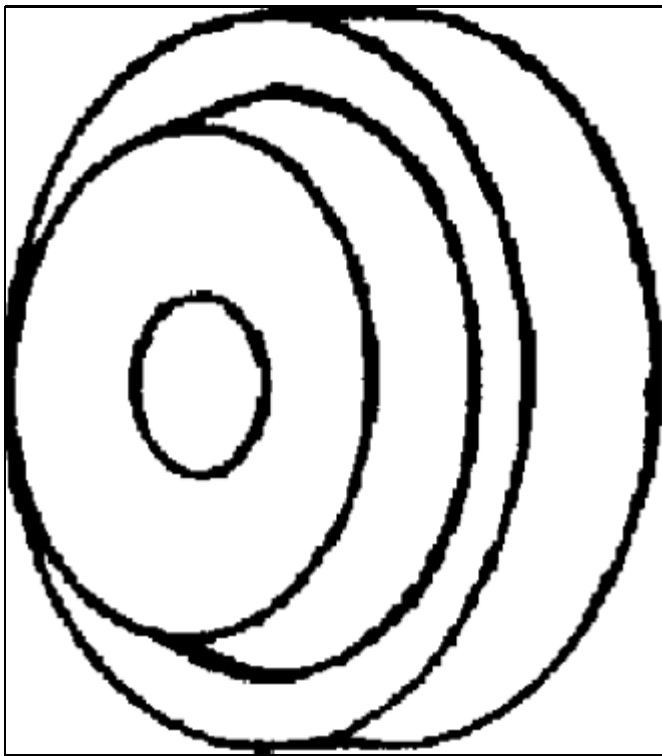
PULLER C-452



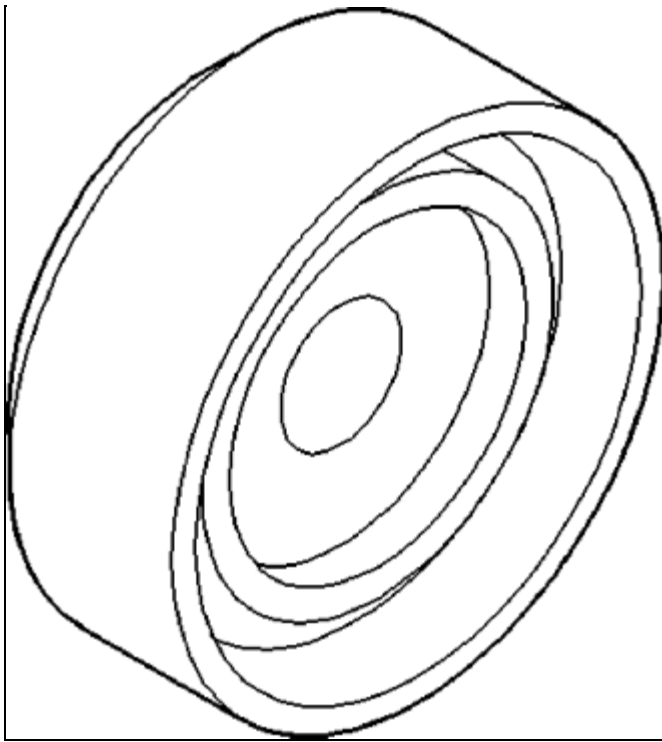
REMOVER D-103



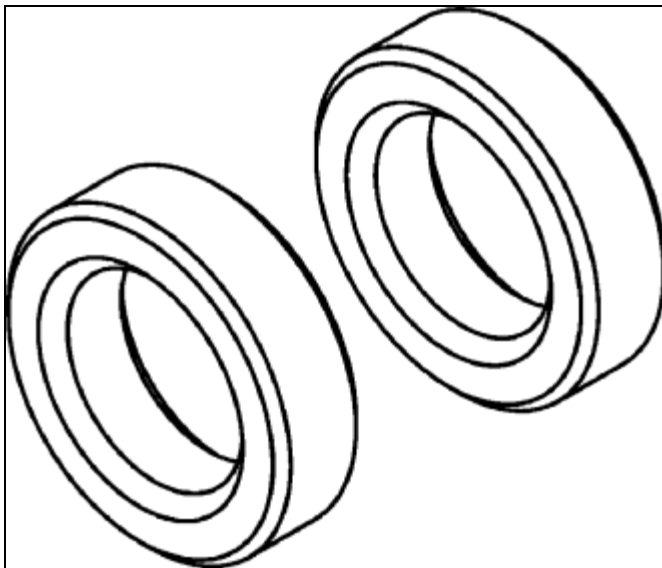
SCOOTER BLOCK D-115-2A



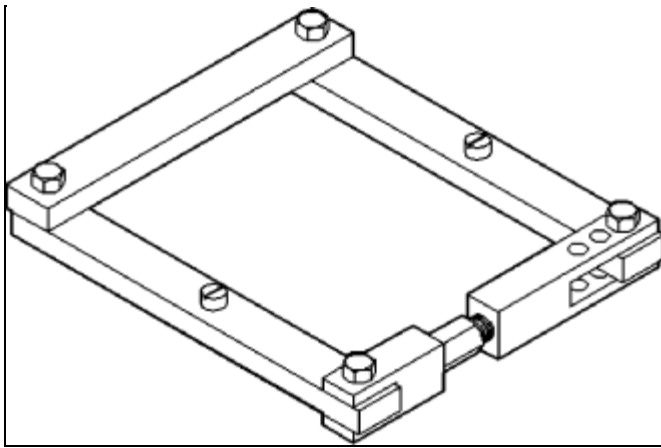
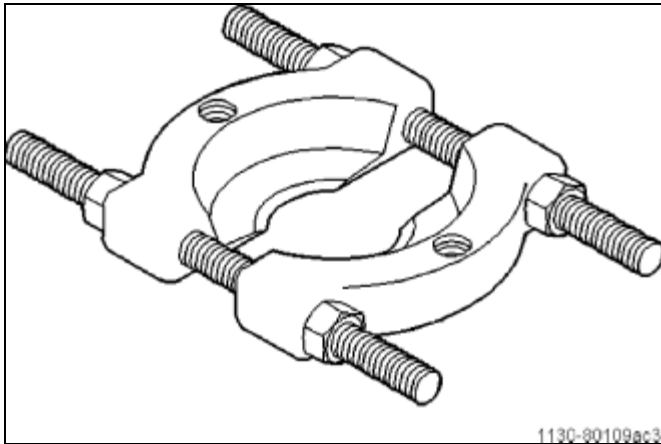
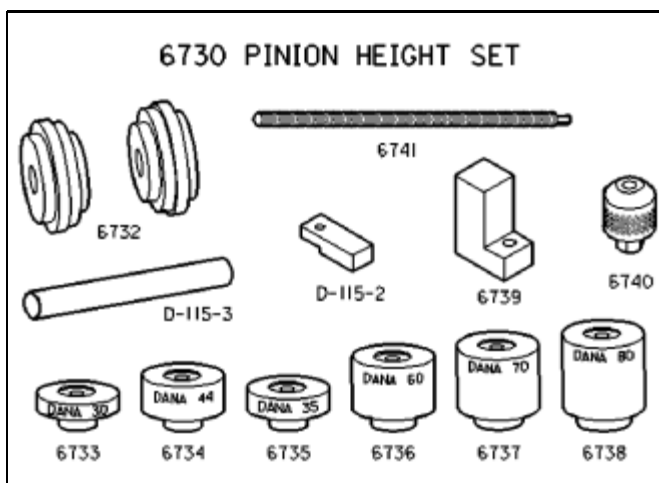
INSTALLER D-129

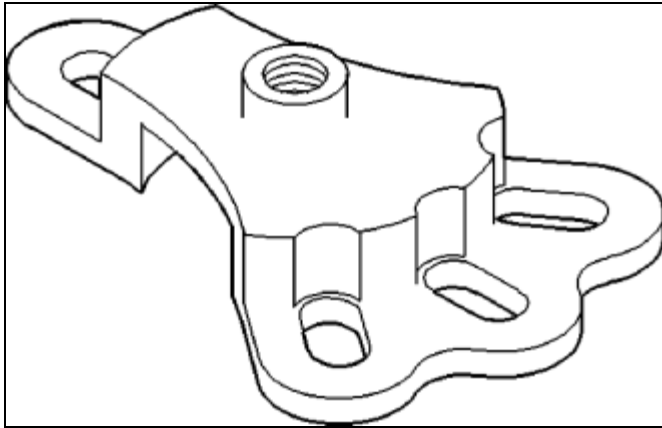


INSTALLER D-156

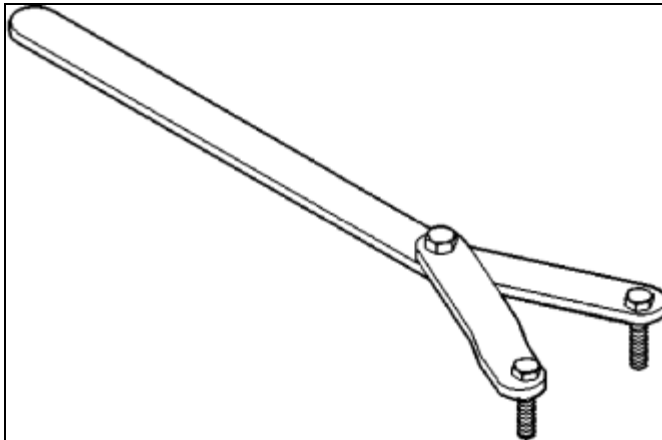


DUMMY BEARINGS D-345

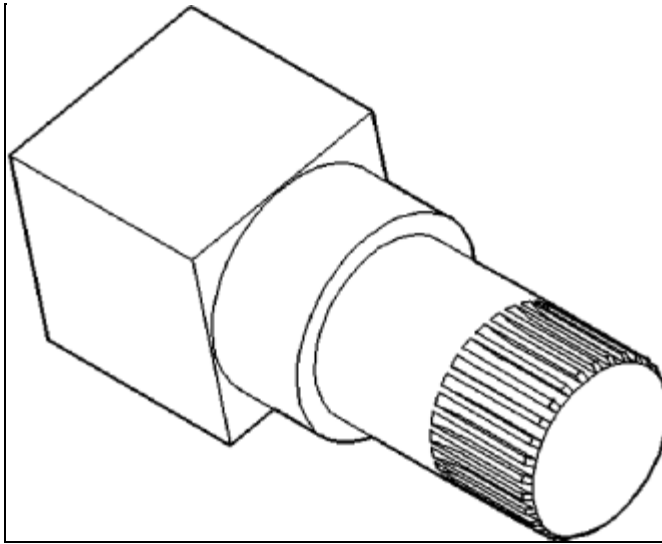
**SPREADER W-129-B****SPLITTER 1130****PINION DEPTH SET 6730**



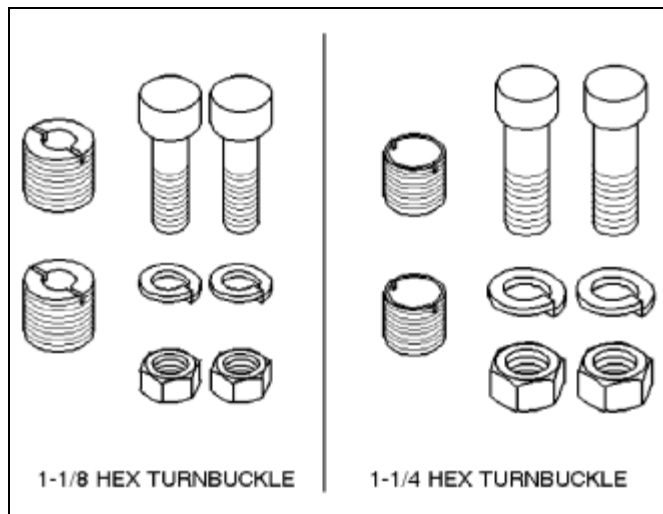
TRAC-LOK TORQUE 6790



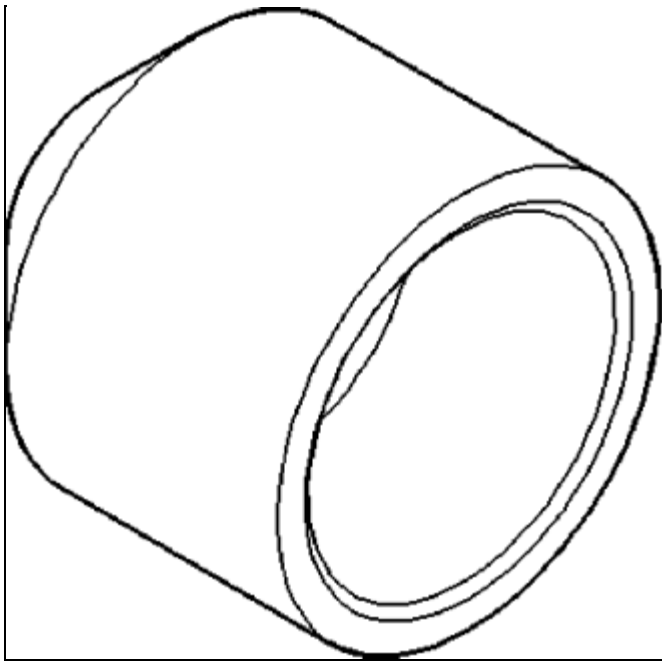
SPANNER WRENCH 6958



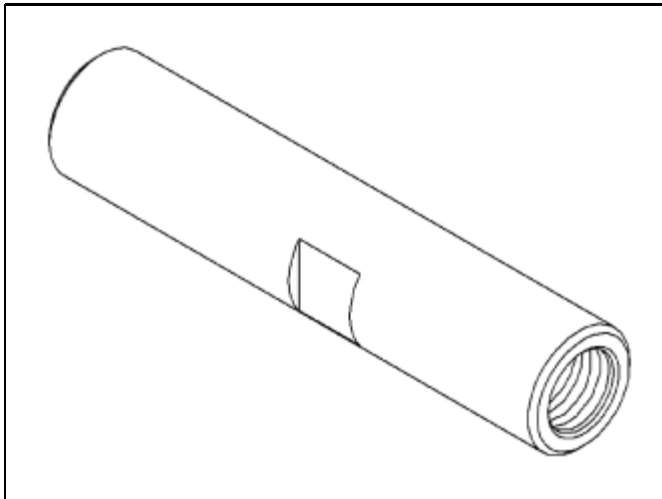
FIXTURE 6963A



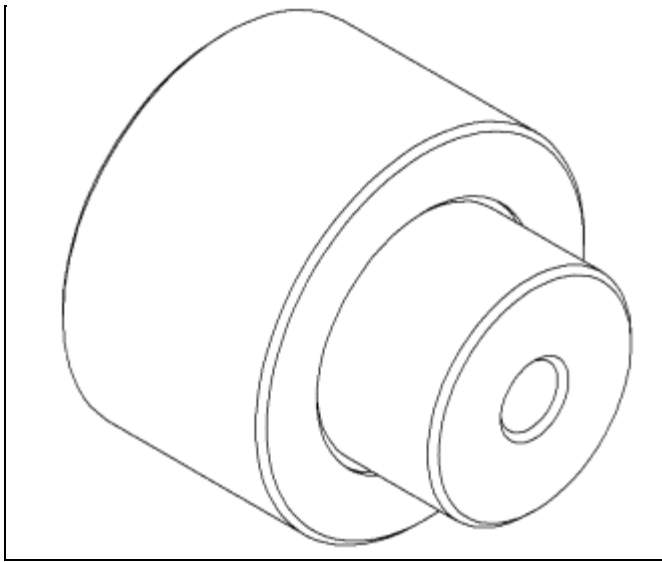
ADAPTER KIT 6987B



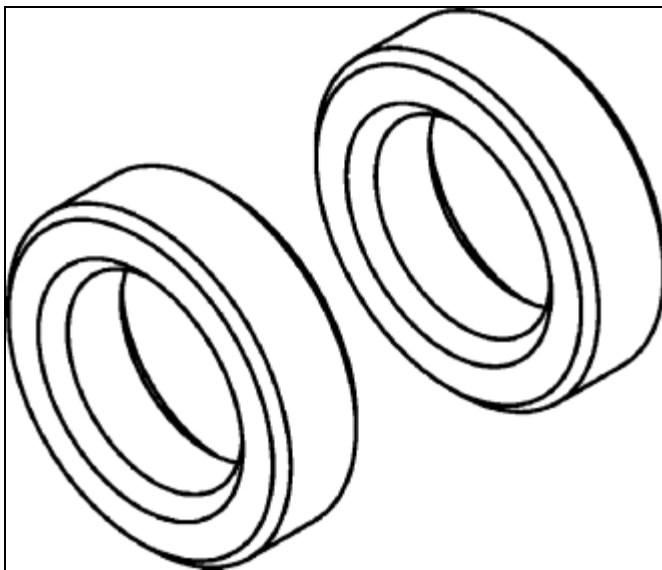
INSTALLER 8681



PINION DRIVER 8976



PINION BLOCK 9990



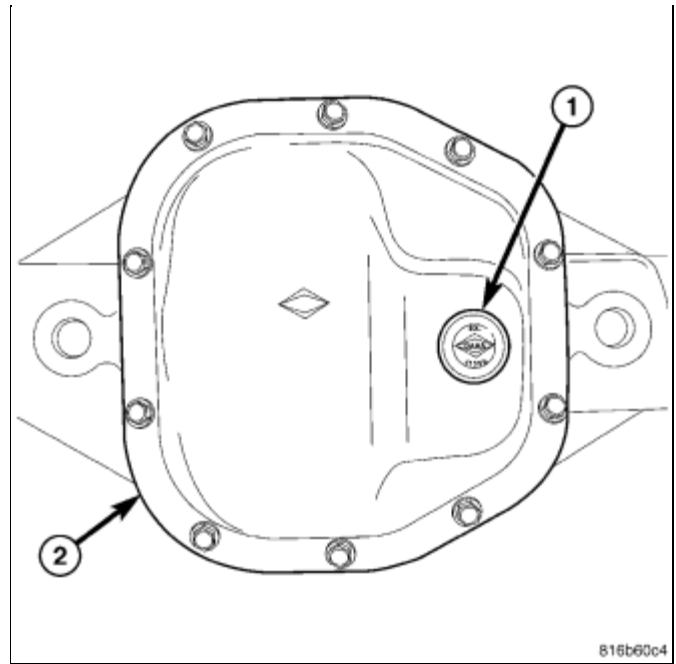
DUMMY BEARING 9992

COVER-DIFFERENTIAL REMOVAL

1. With transmission in neutral, position vehicle on hoist.

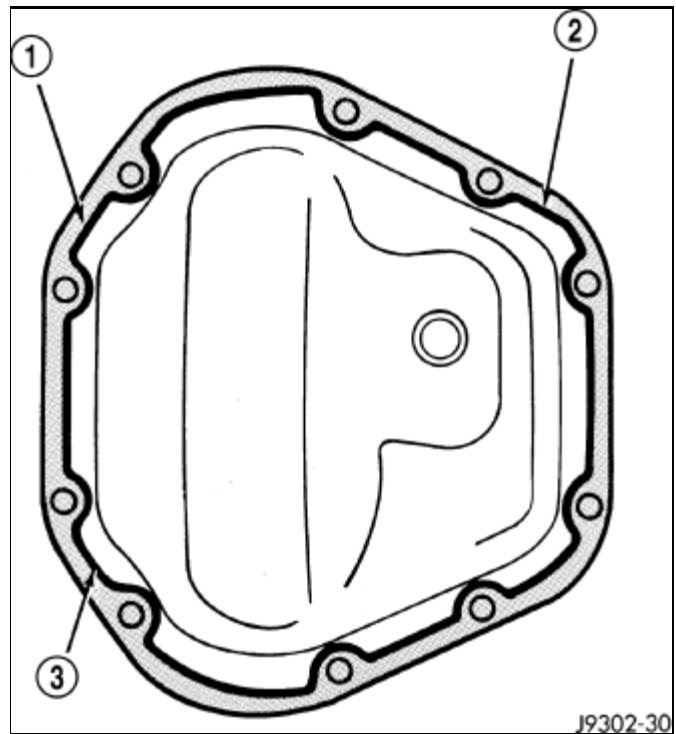
2. Remove fill plug (1).
3. Remove cover (2) bolts.
4. Remove cover and drain lubricant.

INSTALLATION



1. Apply a 6.35 mm (1/4 in.) bead of Mopar Silicone Rubber Sealant (2) or equivalent to the housing cover (1).

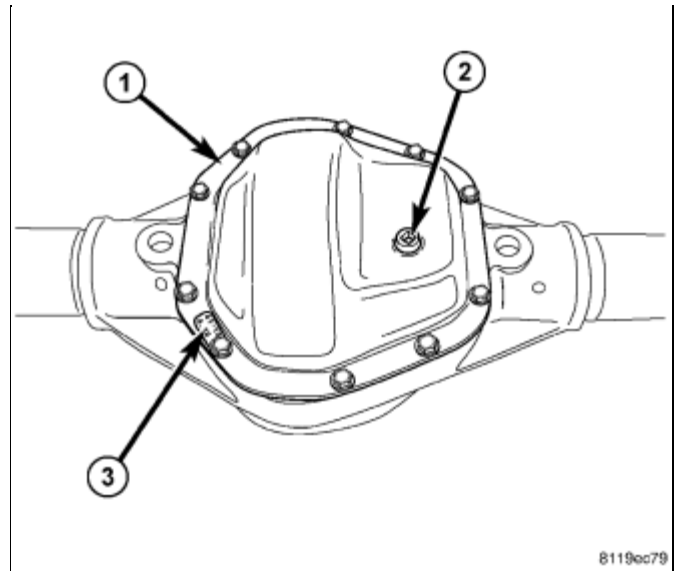
CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.



2. Install cover (1), identification tag (3) and tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
3. Fill differential to specifications.
4. Install fill plug (2) and tighten to 34 N·m (25 ft. lbs.).

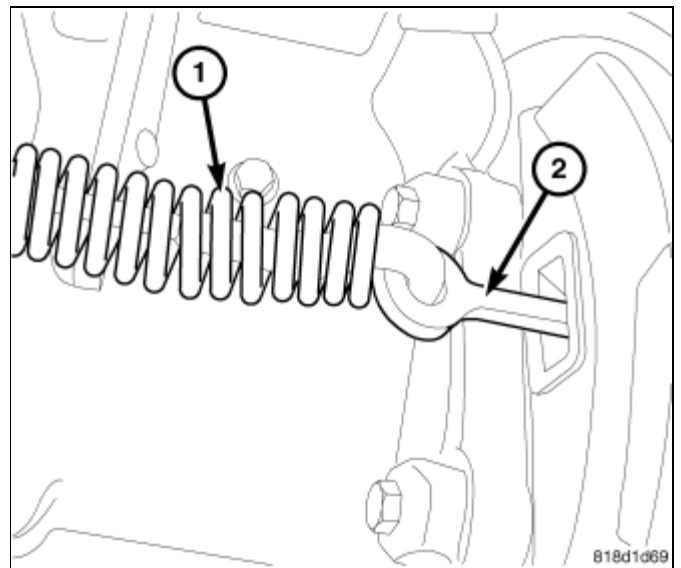
SHAFT-AXLE

REMOVAL

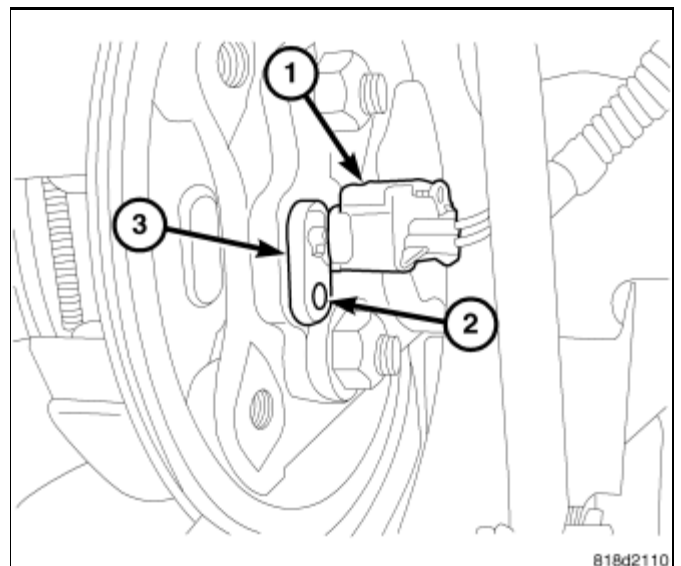


1. With transmission in neutral, position vehicle on hoist.
2. Remove brake caliper with adapter and rotor.
3. Remove park brake cable (1) from support plate (2).

NOTE: Park brake cables are self adjusting and must be locked out before removal.

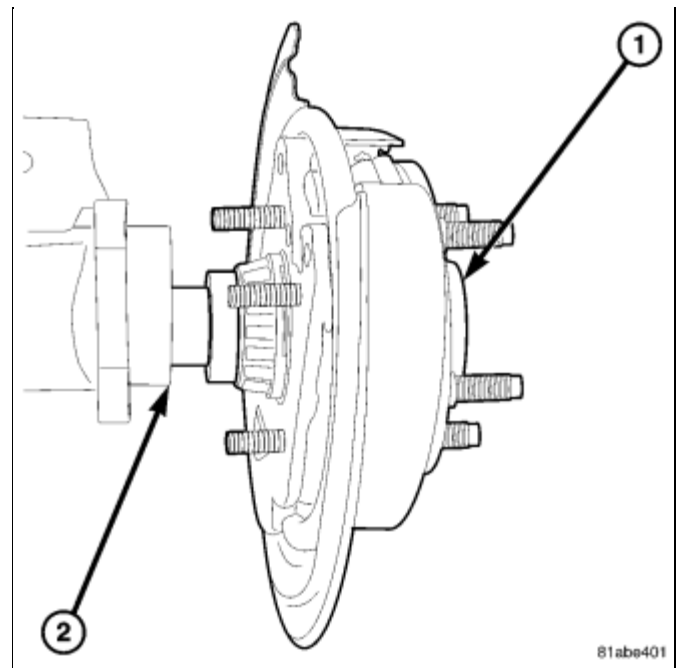


4. Remove brake sensor harness (1) and remove sensor (2) from support plate.

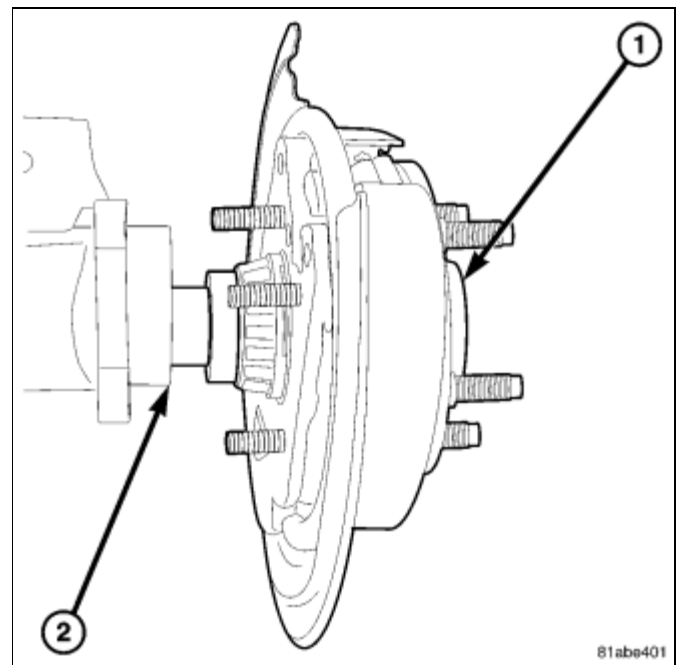


5. Remove axle retainer plate nuts.
6. Pull axle shaft (1) with support plate, bearing and seal from axle tube (2).

INSTALLATION

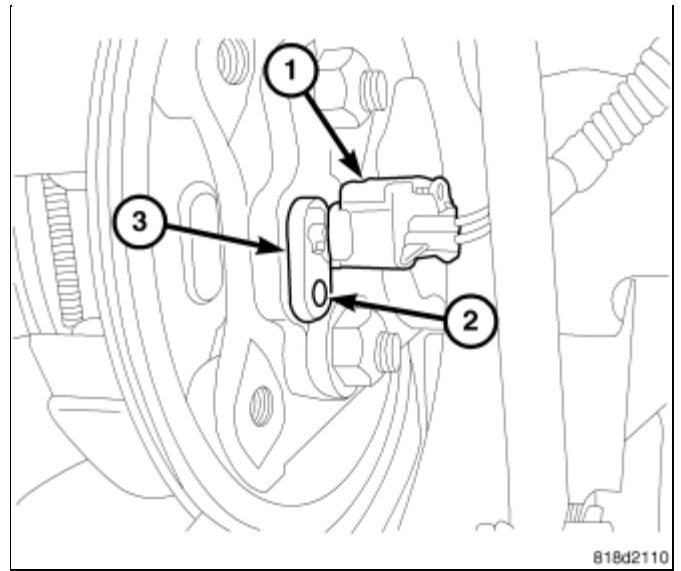


1. Install axle assembly (1) into the axle tube (2).



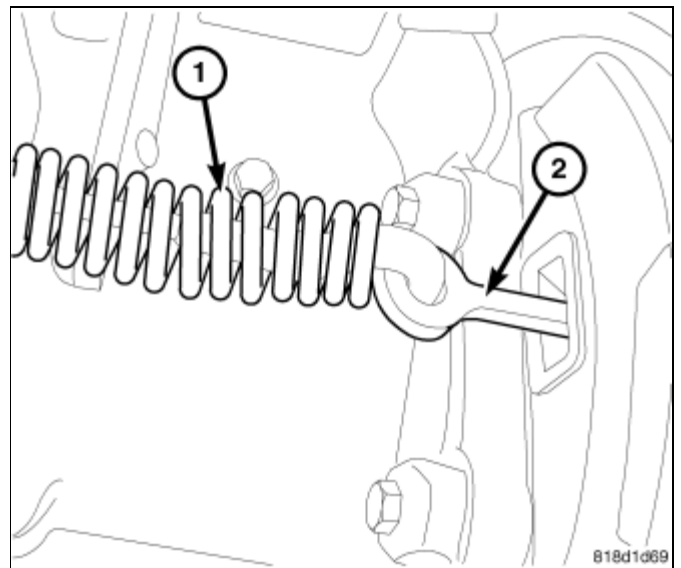
WARNING: Never reuse axle retainer nuts. Used torque nuts can loosen up. Failure to follow these instruction may result in personal injury.

2. Install **new** axle retainer nuts and tighten to 61 N·m (45 ft. lbs.).
3. Install brake (2) and harness (1).



4. Install park brake cables (1).

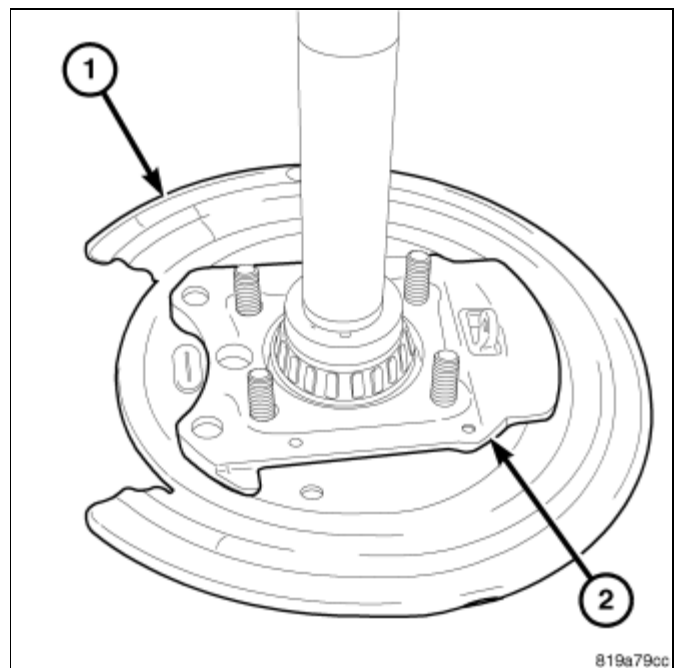
BEARINGS-AXLE REMOVAL



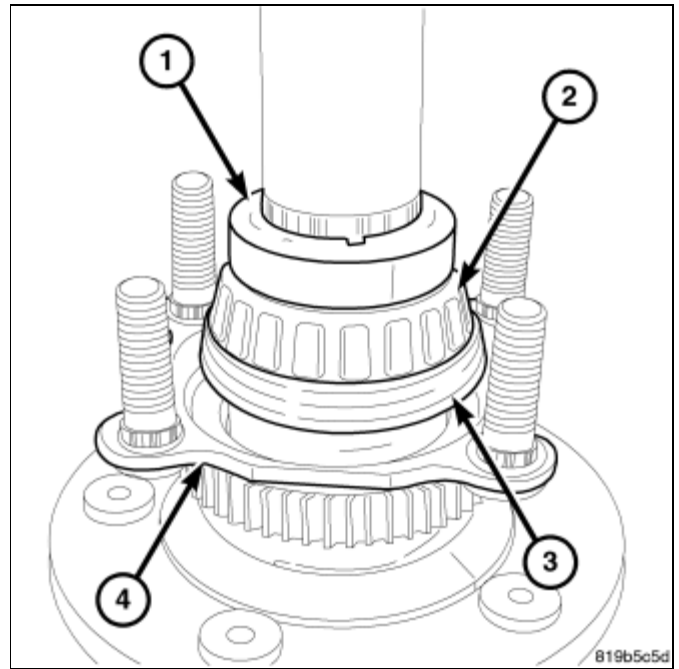
1. Remove axle shaft from vehicle.

NOTE: Axle bearing race is a slip fit in the axle tube. No tool are required.

2. Remove brake dust shield (1) and support plate (2) from the axle.

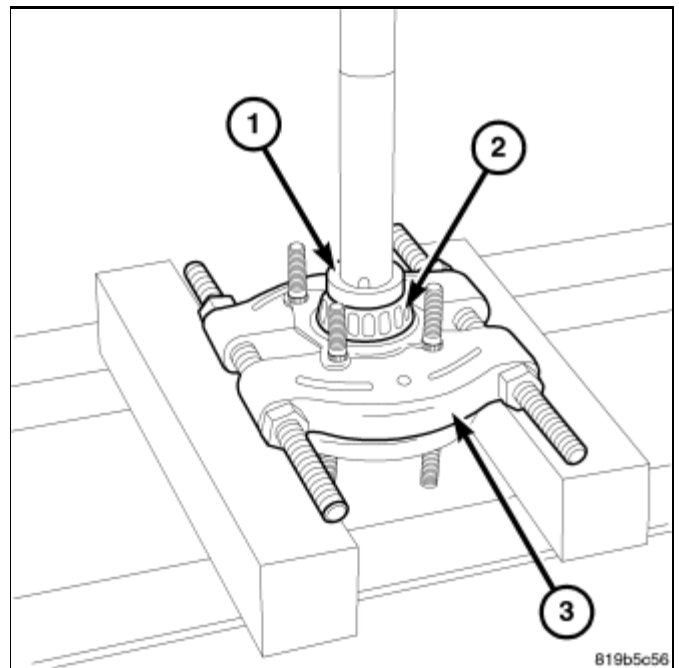


3. Bearing retainer (1), axle bearing (2), axle shaft seal (3) and axle shaft retainer (4) are removed as an assembly.



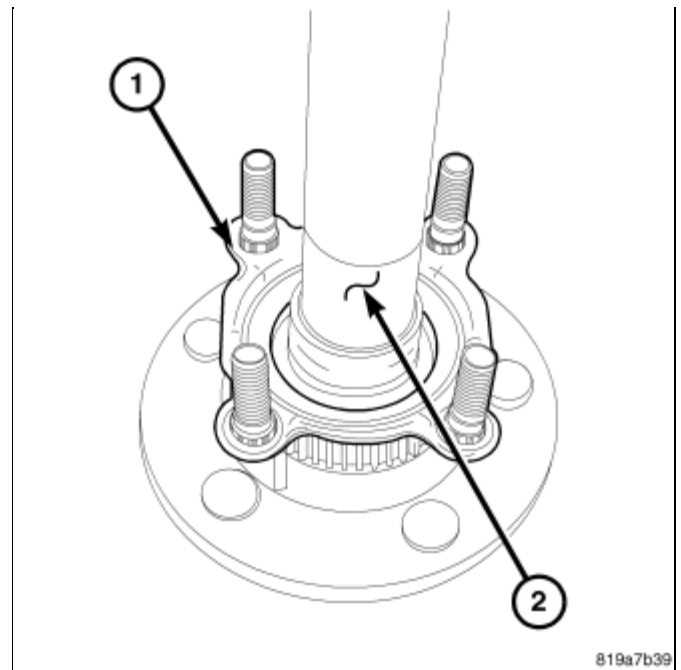
4. Remove bearing retainer (1) and bearing (2) with seal from axle with Splitter 1130 (3) and press. Position splitter between axle shaft retainer and tone ring and press assembly off shaft.

INSTALLATION

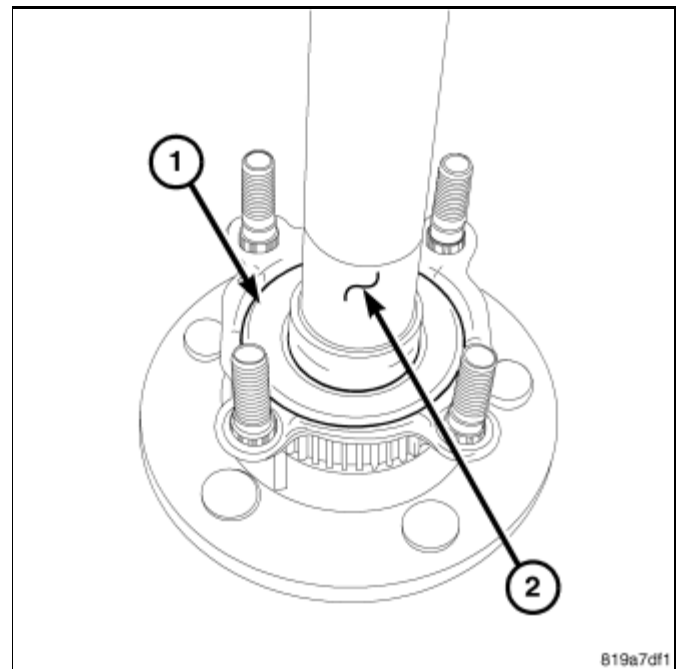


NOTE: Inspect axle shaft retaining plate (1), if plate is bent or warped replace plate.

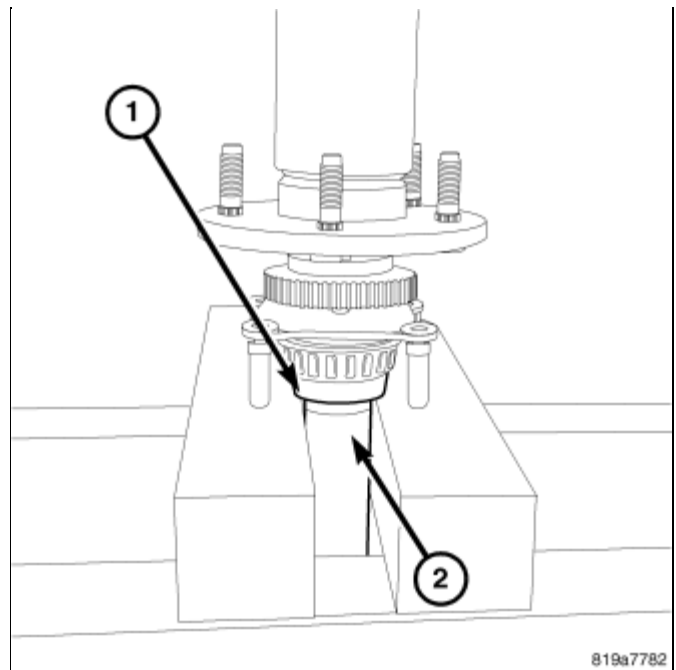
1. Install retaining plate (1) on axle shaft (2).



2. Apply a coat of multi-purpose grease on sealing surface of axle seal.
3. Install seal (1) on axle shaft (2) with cavity away from axle shaft retaining.



4. Press bearing and bearing retaining ring (1) onto axle shaft (2) with press and press blocks.



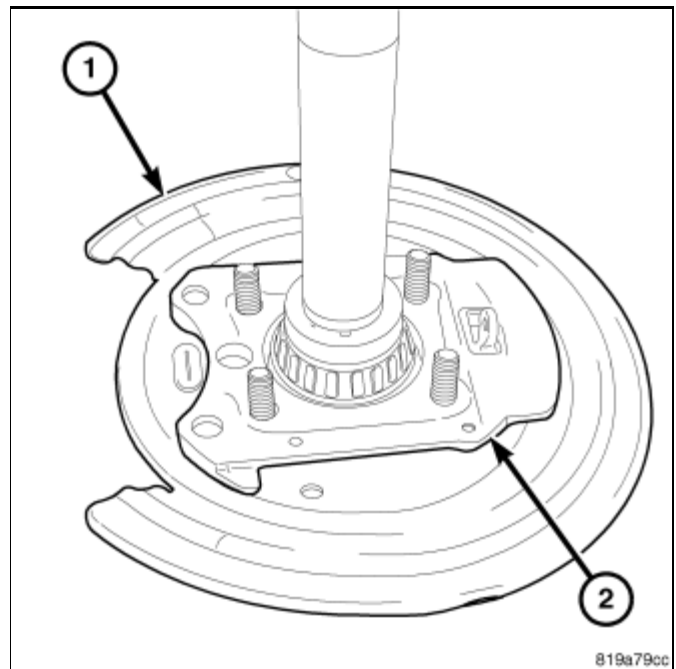
5. Install dust shield (1) and support plate (2) on axle shaft retainer.

6. Lubricate bearing with Mopar Wheel Bearing Grease, or equivalent. Wipe excess grease from outside of bearing.

7. Install axle in vehicle.

SEAL-PINION

REMOVAL



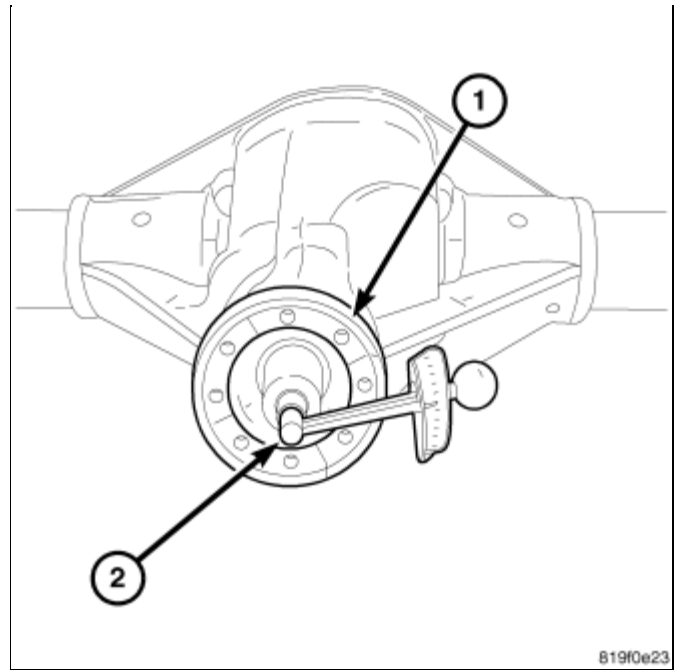
1. With transmission in neutral, position vehicle on hoist.

2. Remove brake component to eliminate drag.

3. Remove propeller shaft at pinion flange.

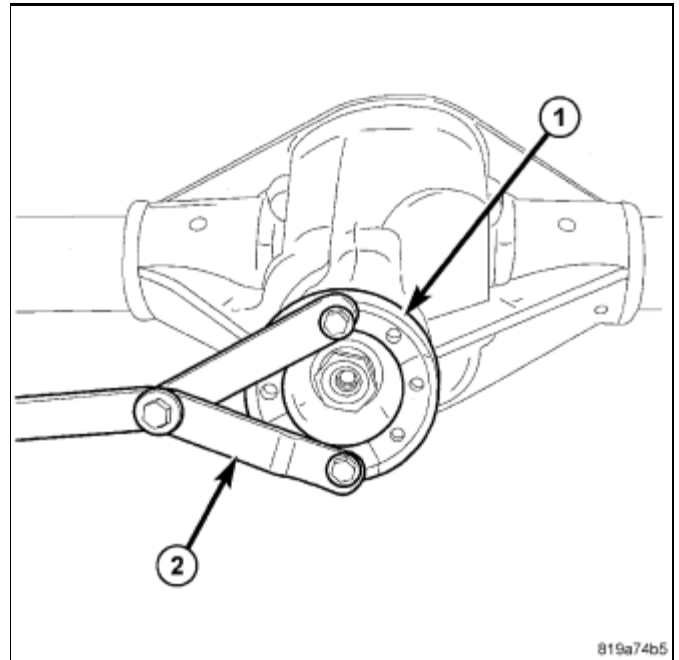
4. Rotate pinion gear three or four times.

5. Record pinion torque to rotate (1) with an inch pound torque wrench (2).



819f0e23

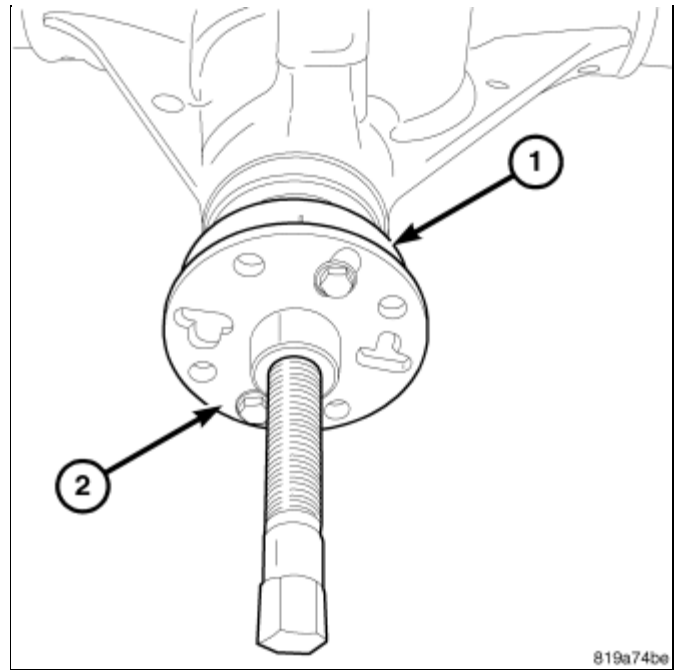
6. Hold pinion flange (1) with Spanner Wrench 6958 (2) and remove pinion nut and washer.
7. Mark a line across the pinion shaft and flange for installation reference.



819a74b5

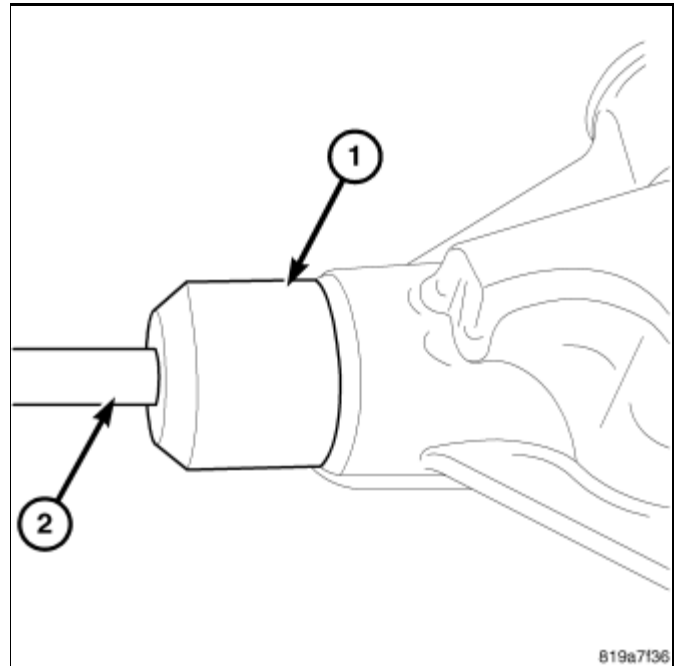
8. Remove pinion flange (1) with Puller C-452 (2).
9. Remove pinion seal with a seal puller.

INSTALLATION



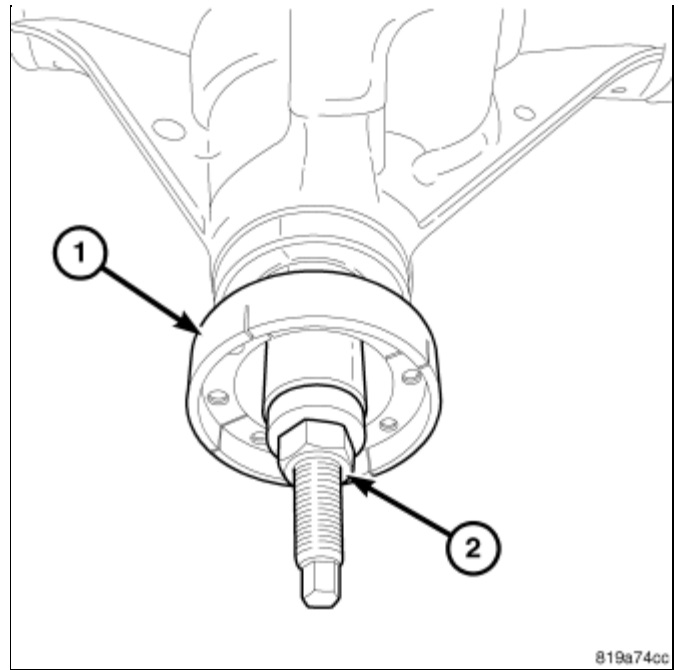
819a74be

1. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer 8681 (1) and Handle C-4171 (2).

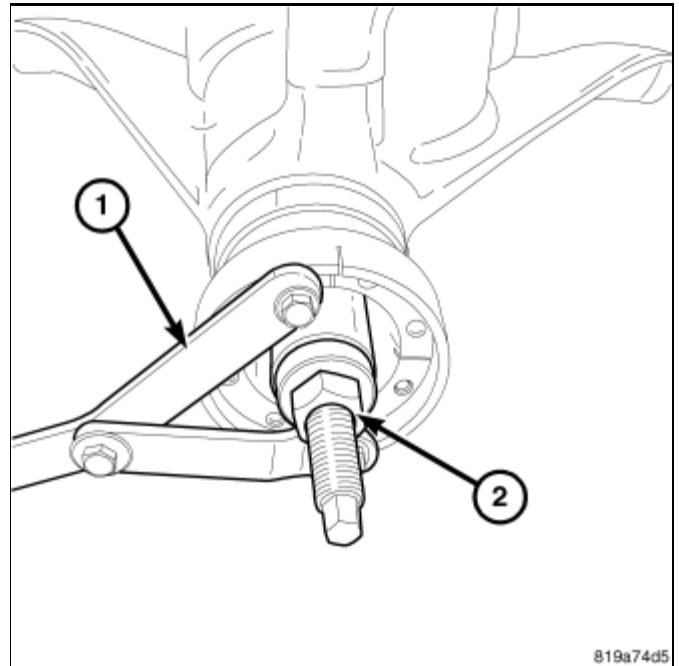


819a7136

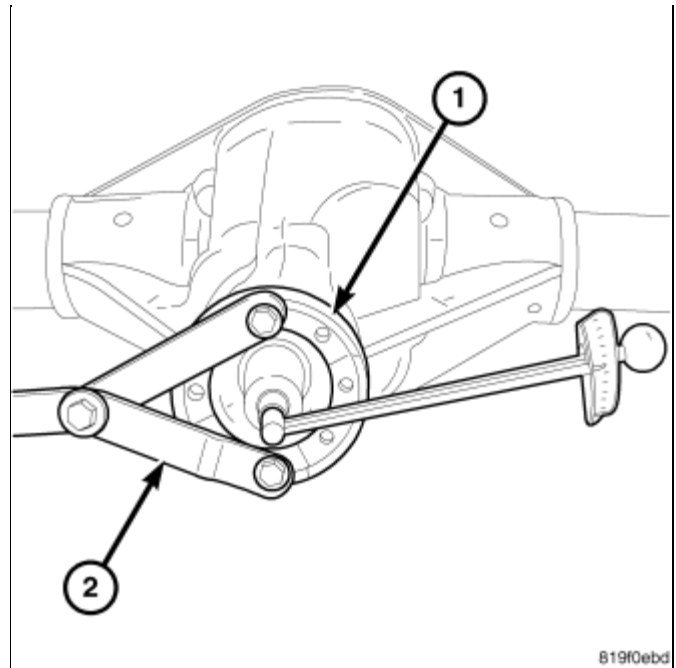
2. Install flange on the pinion shaft with the reference marks aligned.
3. Install flange (1) Installer C-3718 (2) on pinion shaft.



4. Hold pinion flange with Spanner Wrench 6958 (1) and tighten Installer C-3718 nut (2). Tighten nut to remove all end play.



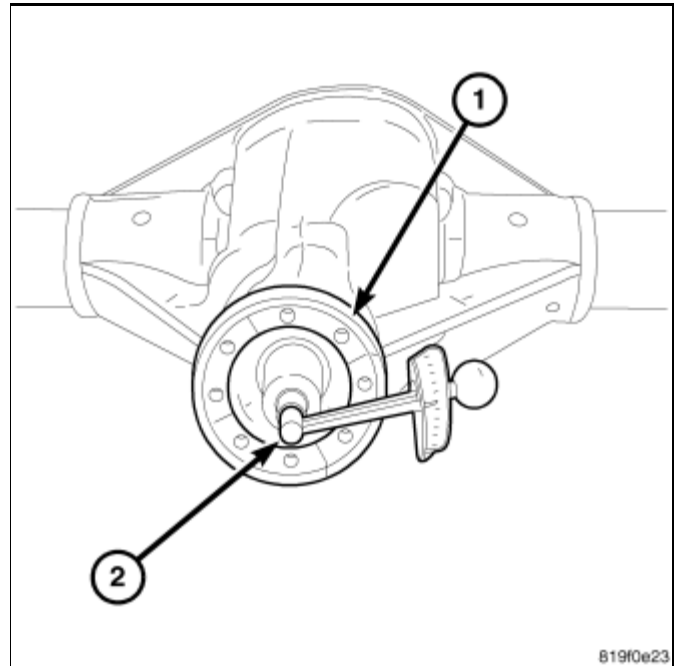
5. Install pinion washer and a **new** nut on the pinion gear.
6. Hold pinion flange (1) with Spanner Wrench 6958 (2) and tighten pinion nut to 217 N·m (160 ft. lbs.).



7. Measure pinion torque to rotate (1) inch pound torque wrench (2). Pinion torque to rotate is recorded reading plus 0.56 N·m (5 in. lbs.).

8. If pinion rotating torque is low. Hold pinion flange with Spanner Wrench 6958 and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until pinion torque to rotating is achieved.

CAUTION: If maximum tightening torque of 271 N·m (200 ft. lbs.) is reached before torque to rotate is achieved, the collapsible spacer may have been damaged. Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. Failure to follow these instruction may result in damage.



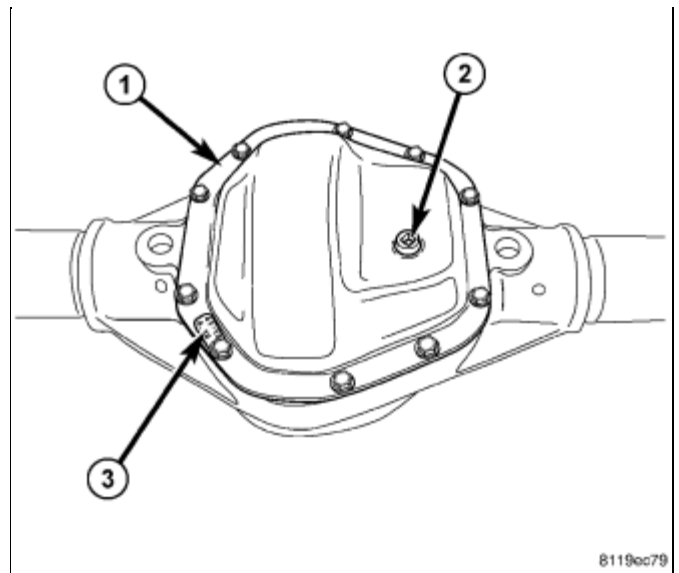
9. Install propeller shaft.

10. Install brake components.

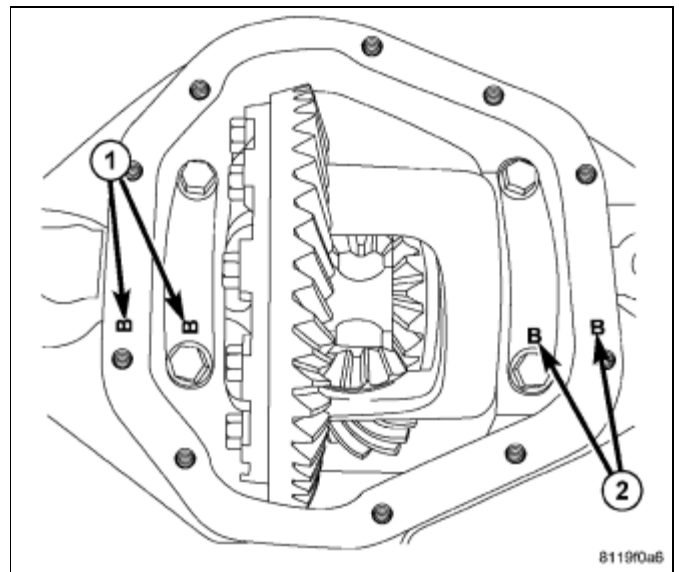
DIFFERENTIAL

REMOVAL

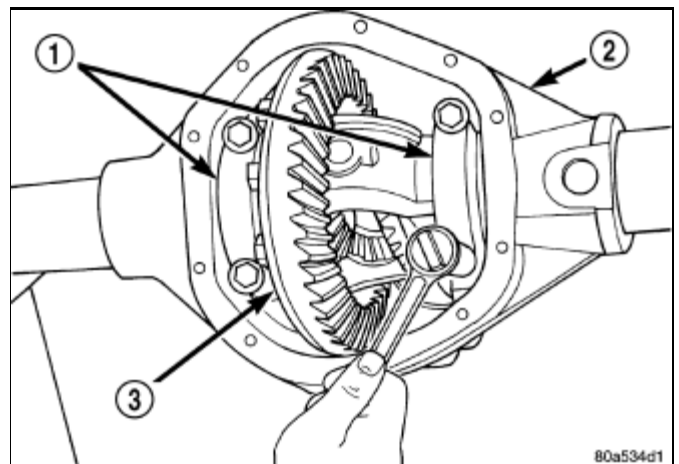
1. Remove differential fill plug (2).
2. Remove differential cover (1) and drain fluid.
3. Remove axle shafts.



4. Note reference letters stamped (1,2) on the bearing caps and housing machined sealing surface.

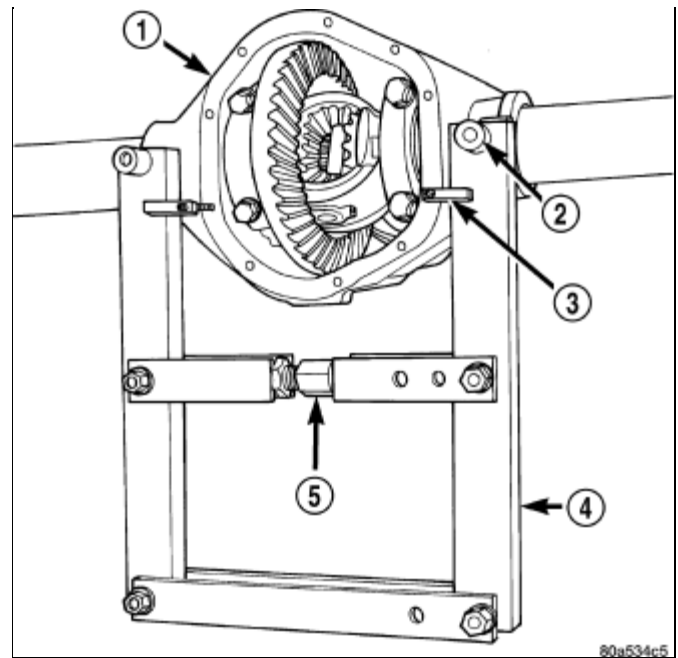


5. Loosen differential bearing cap (1) bolts.

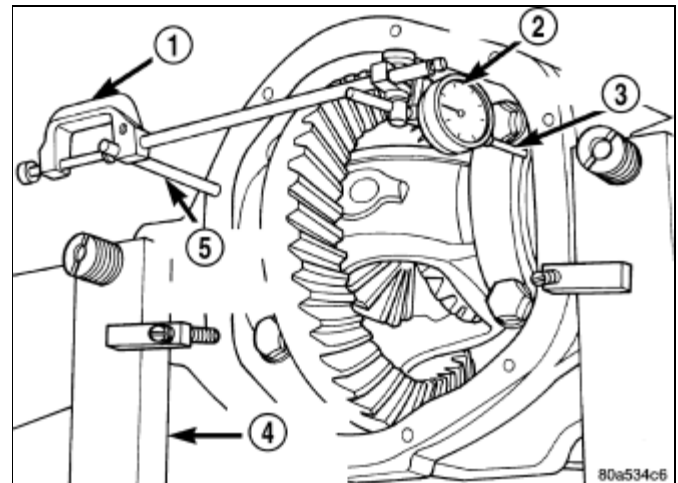


6. Position Spreader W-129-B (4) with Adapter Kit 6987B (2) on differential locating holes. Install hold-

down clamps (3) and tighten the turnbuckle (5) finger-tight.

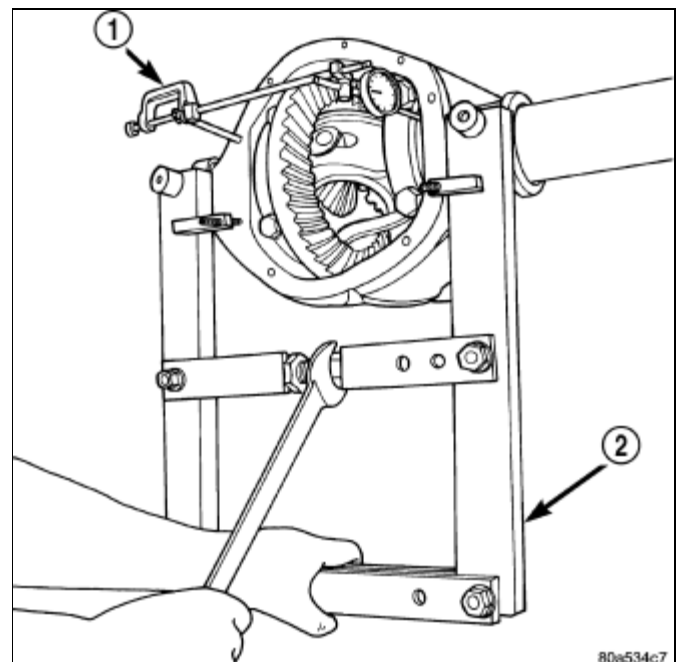


7. Install a Pin C-3288-B (5) at the left side of the differential housing. Attach Dial Indicator C-3339A (2) to pin. Load indicator plunger against the opposite side of the housing and zero the indicator.



8. Spread housing while measuring the distance with the dial indicator (1).

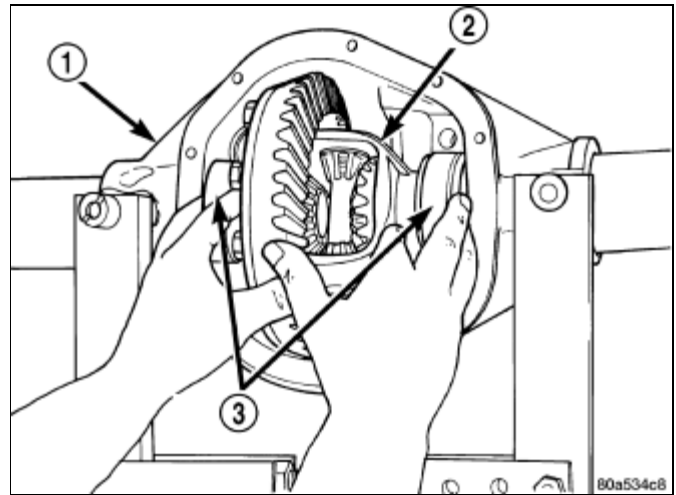
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.



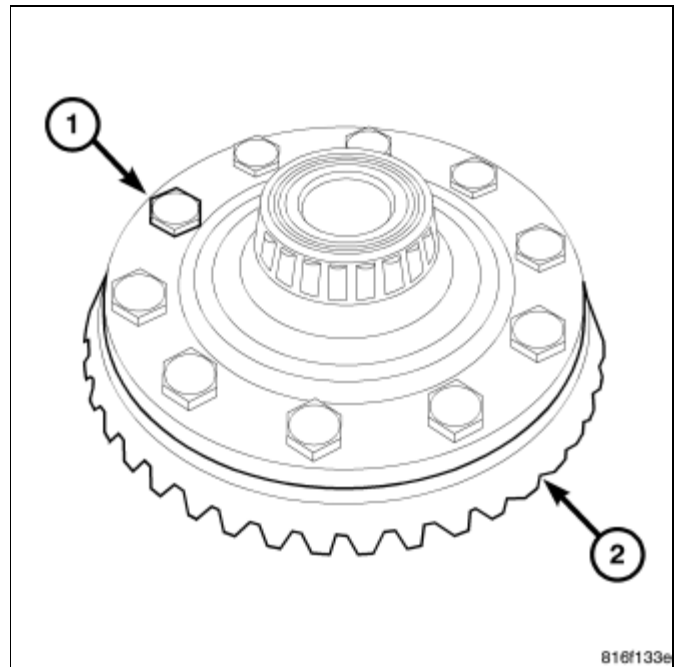
9. Remove dial indicator.
10. Holding differential case (2) in position, remove differential bearing caps.
11. Remove differential case (2) from housing (1) and tag differential bearing cups (3) and shims location.
12. Remove spreader from housing.
13. Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

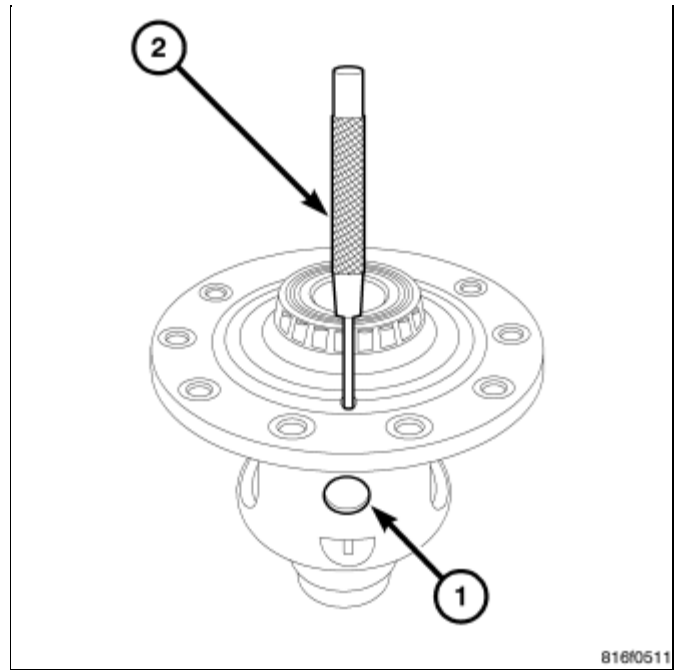
DISASSEMBLY



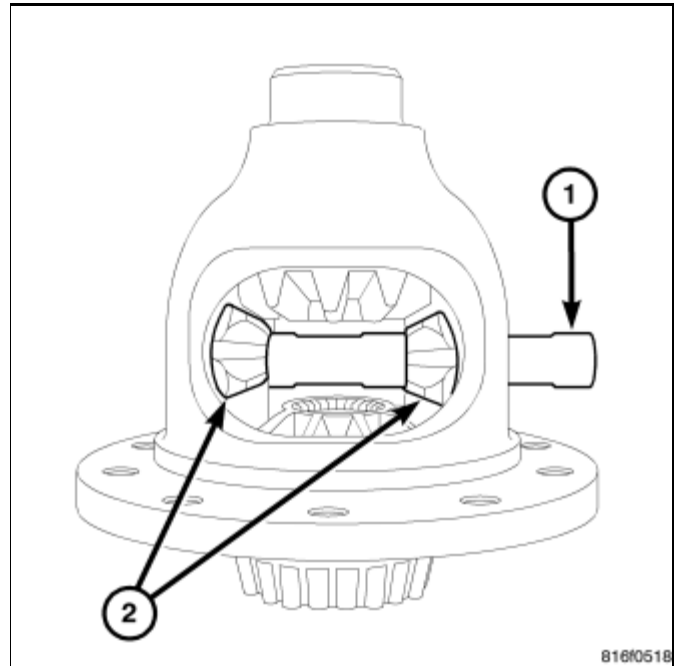
1. Remove ring gear bolts (1) and ring gear (2) from differential.



2. Remove pinion mate shaft (1) roll pin with a punch (2) and hammer.

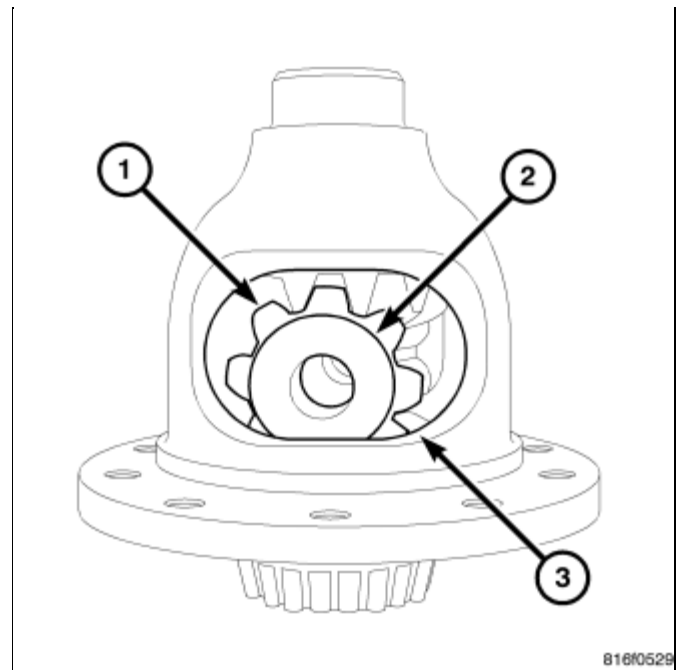


3. Remove pinion mate shaft (1) from differential and pinion gears (2).

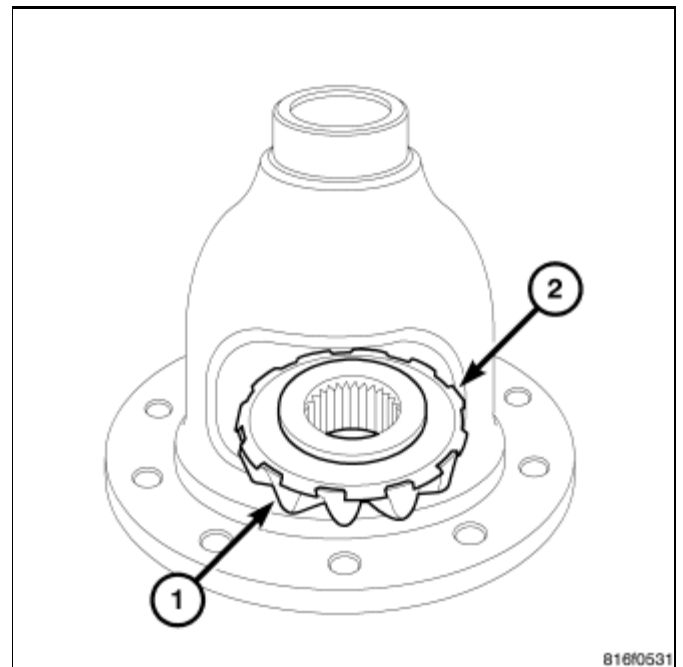


4. Rotate pinion gears (1) with thrust washers (2) to differential windows (3).

5. Remove pinion gears (1) with thrust washers (2) through differential windows (3).

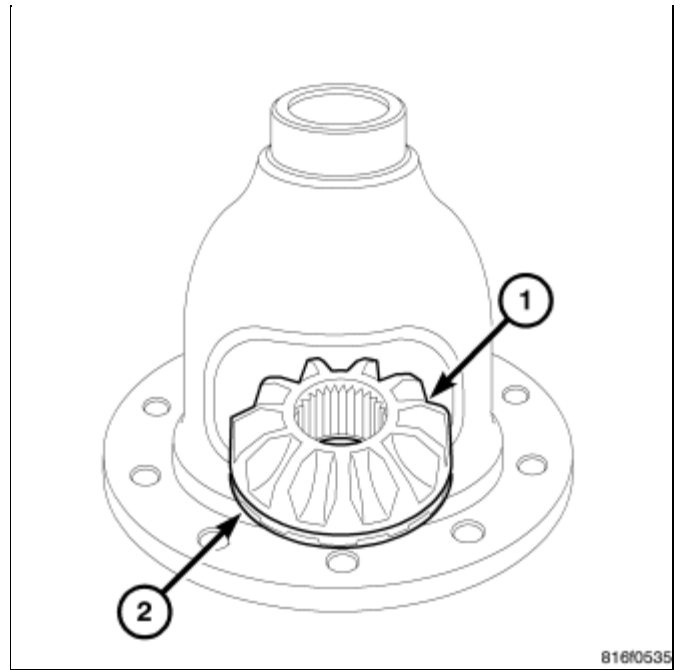


6. Remove first side gear (1) with thrust washer (2) through differential window (3).



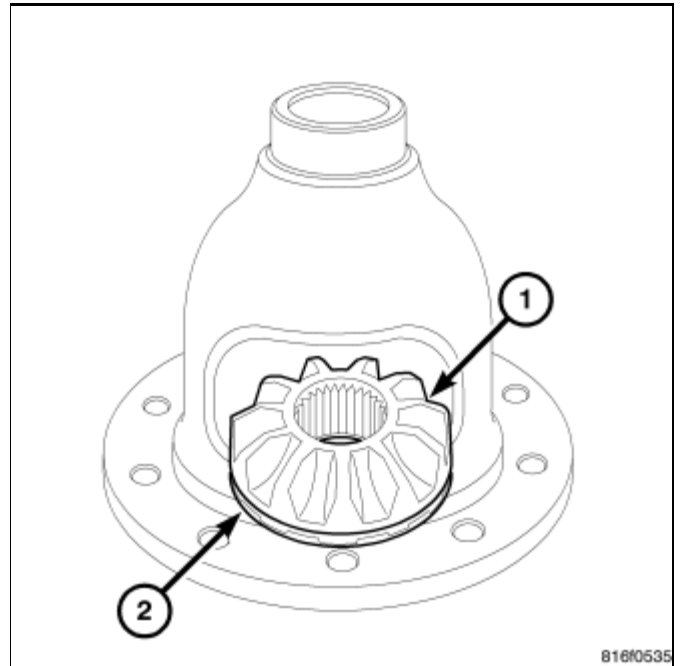
7. Remove second side gear (1) with thrust washer (2) through differential window.

ASSEMBLY

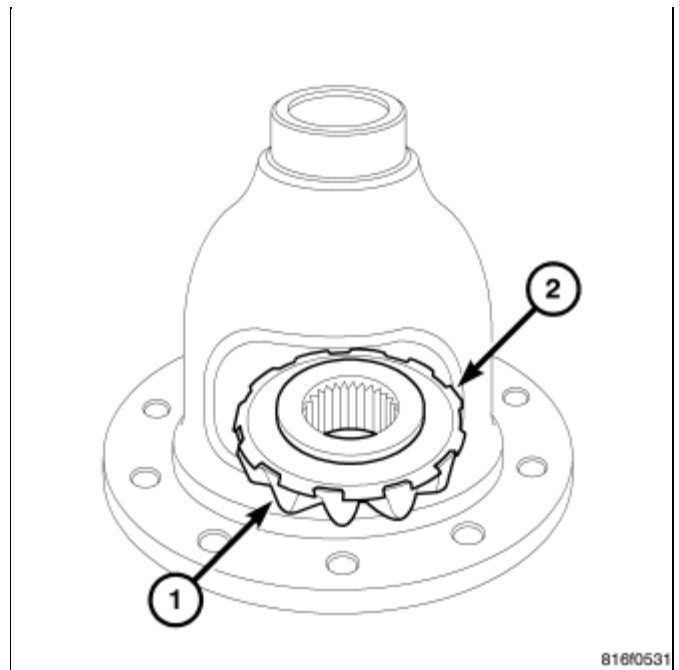


NOTE: If same gears and thrust washers are being used, install them into their original locations.

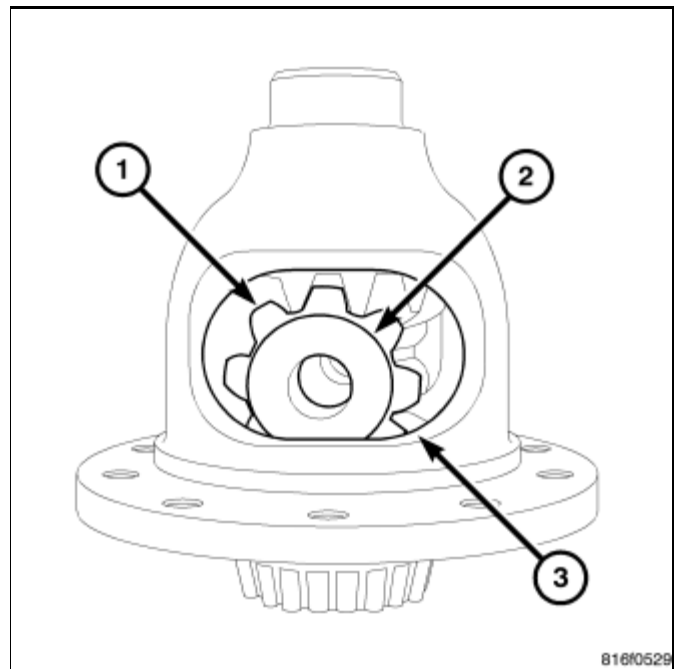
1. Lubricate all differential components with axle lubricant.
2. Install first side gear (1) with thrust washer (2) through differential window.



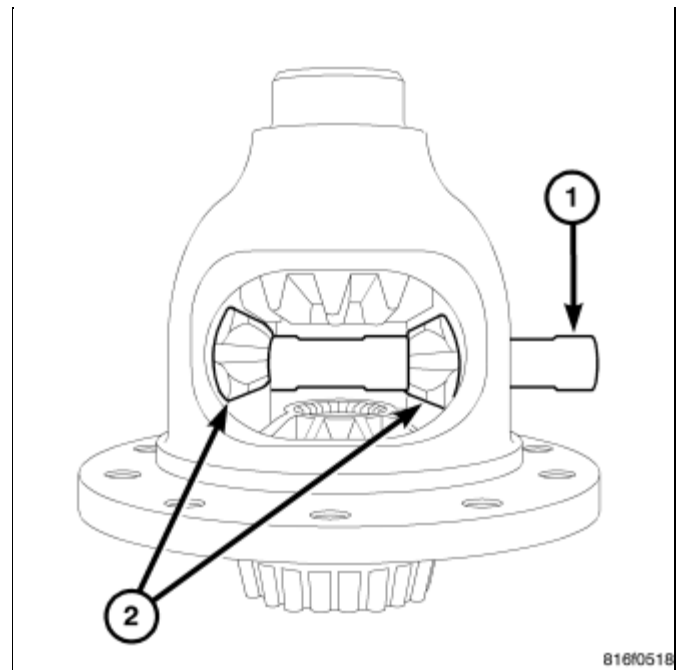
3. Install second side gear (1) with thrust washer (2) through differential window.



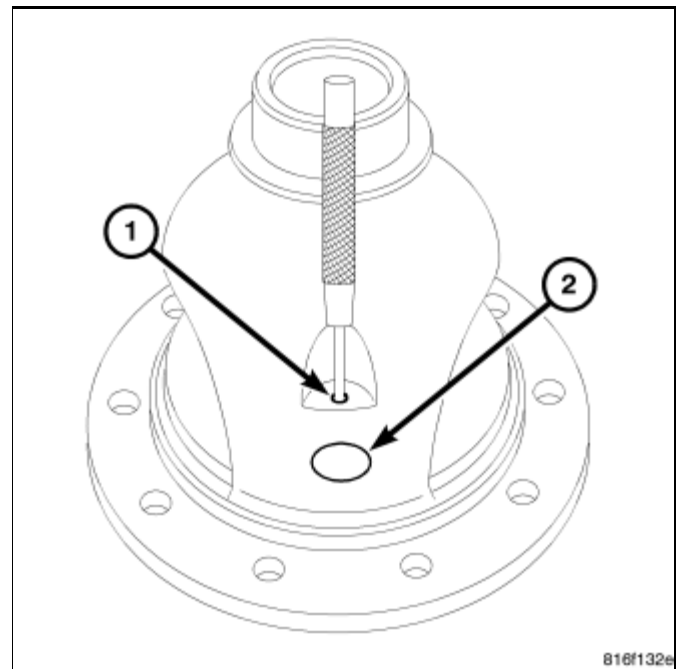
4. Install pinion gears (1) with thrust washers (2) through differential windows (3).
5. Rotate pinion gears (1) with thrust washers (2) and align gears to pinion mate shaft hole.



6. Install pinion mate shaft (1) in differential and pinion gears (2).

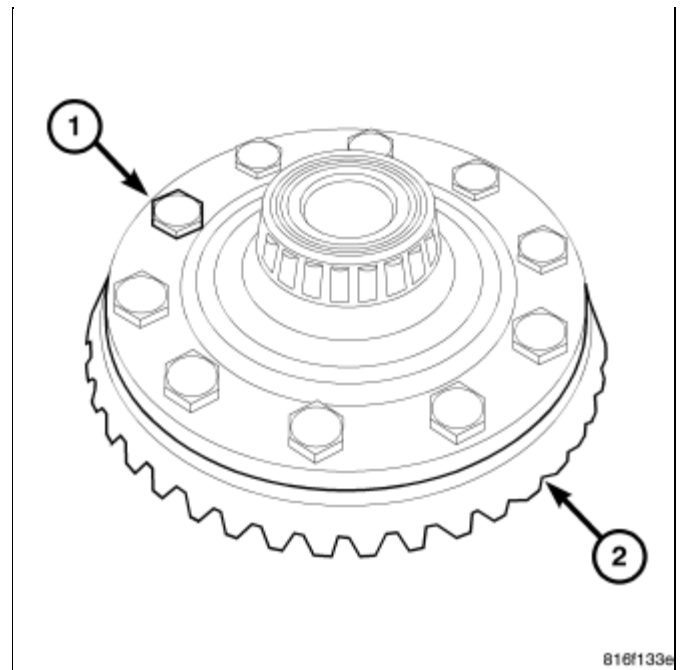


7. Install pinion mate shaft (2) roll pin (1).



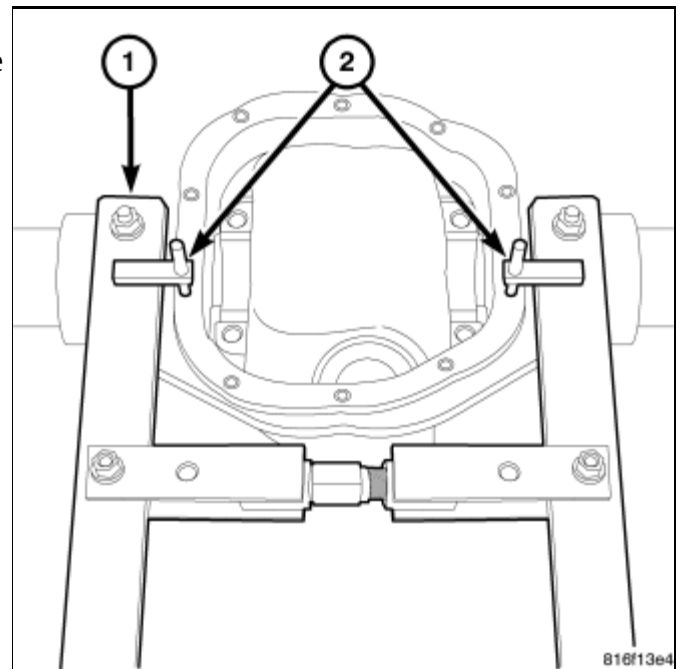
8. Install ring gear (2) and bolts (1) on differential.

INSTALLATION



NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer **Adjustments (Differential Bearing Preload and Gear Backlash)** to determine the proper shim selection.

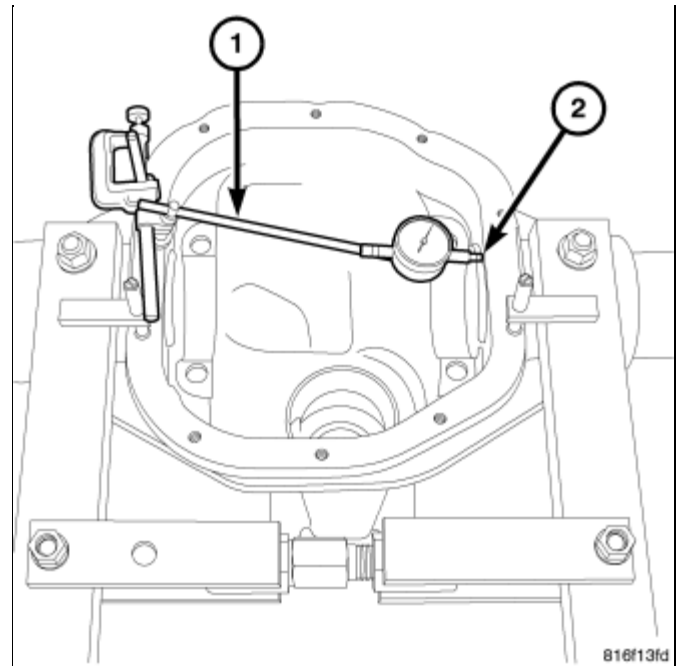
1. Position Spreader W-129-B (1) and with dowel pins from Adapter Kit 6987B seated in housing locating holes. Install hold-down clamps (2) and tighten turnbuckle finger-tight.



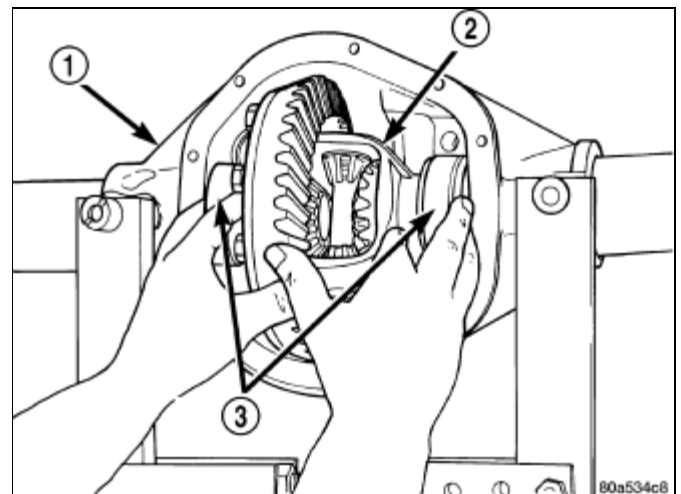
2. Install Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339A (1) to pin. Load the indicator plunger (2) against the opposite side of the housing and zero the indicator.
3. Spread the housing while measuring the distance with the dial indicator.

CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

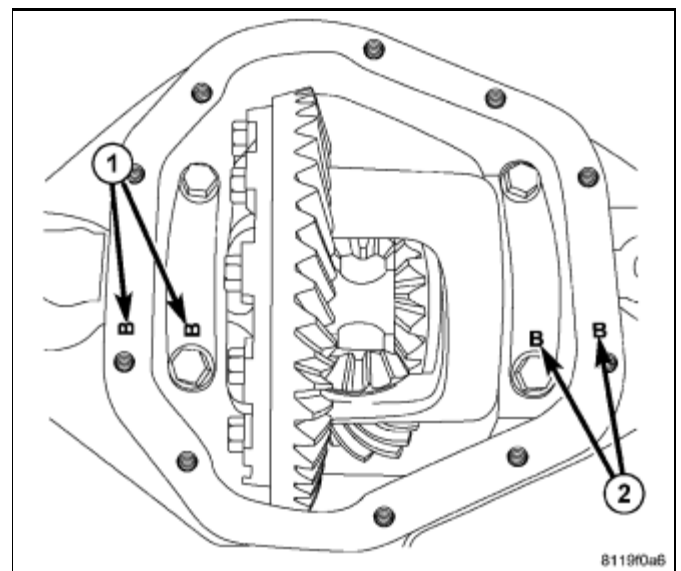
4. Remove the dial indicator.



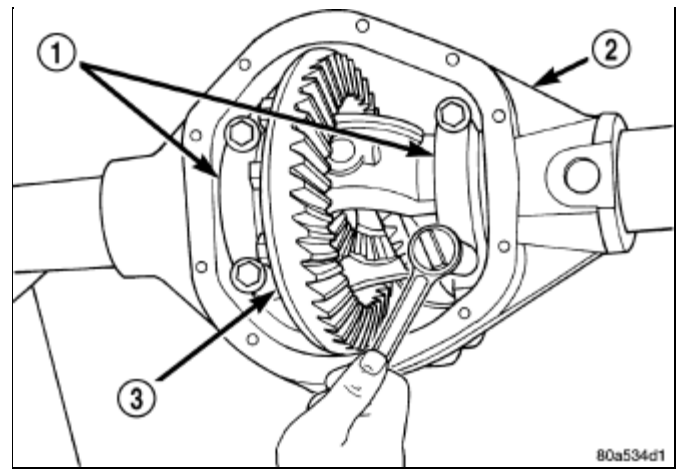
5. Install differential case (2) in the housing (1). Ensure that the differential bearing cups remain in position on the bearing cones. Tap the differential case to ensure the bearings cups (3) are seated in the housing.



6. Install bearing caps with reference marks (1,2) in their original locations.
 7. Loosely install differential bearing cap bolts.
 8. Remove axle housing spreader.



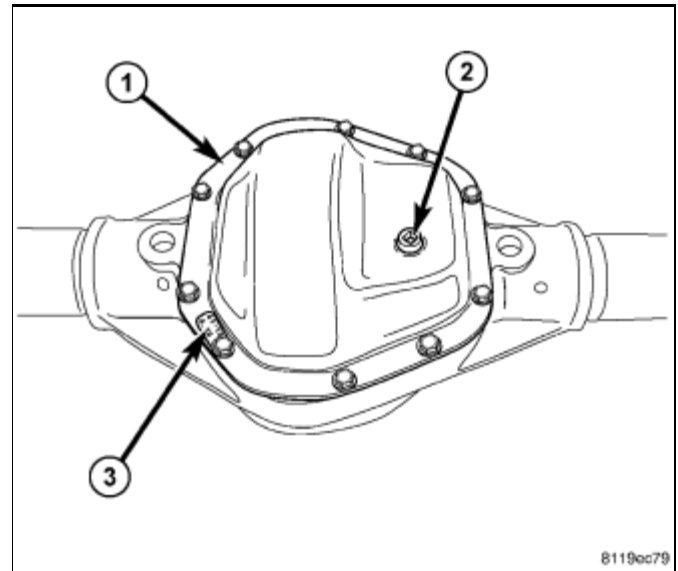
9. Tighten bearing cap (1) bolts in a criss-cross pattern to 108 N·m (80 ft. lbs.).



- 10. Install axle shafts.
- 11. Install differential cover (1).

DIFFERENTIAL-TRAC-LOK

OPERATION-TRAC-LOK®

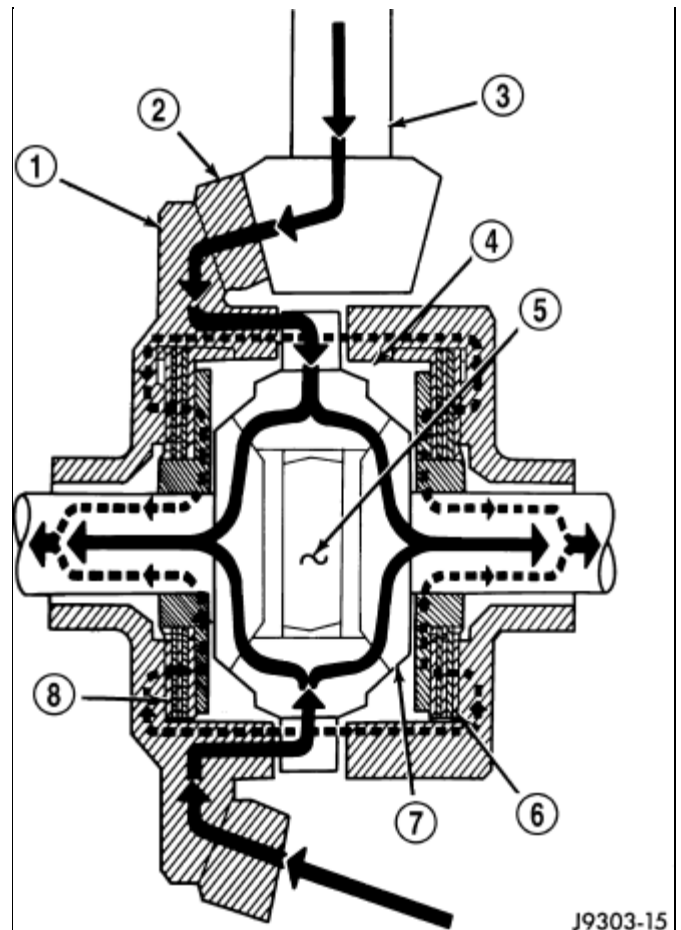


This differential clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs (6) (8). The second is the separating forces generated by the side gears (7) as torque is applied through the ring gear (2).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel loses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel loses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok® operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

DIAGNOSIS AND TESTING

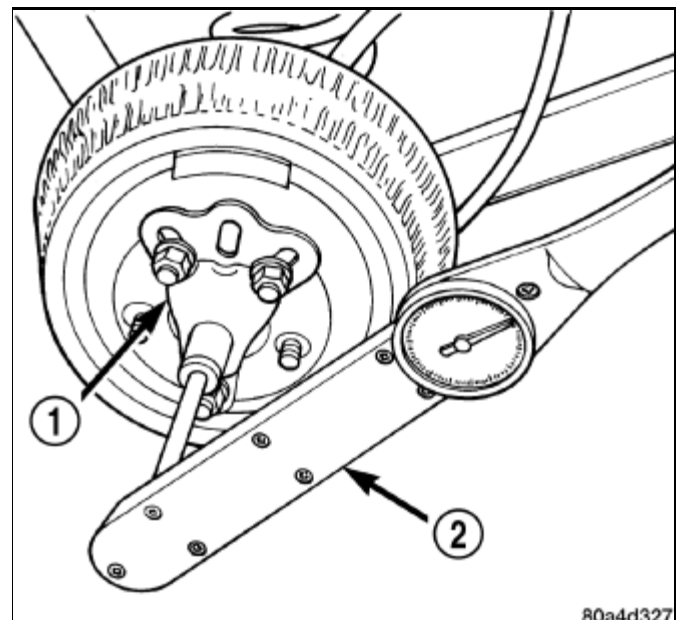
DIFFERENTIAL-TRAC-LOK®



A common problem of the Trac-Lok® differential is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. Add a container of Mopar Limited Slip Additive after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

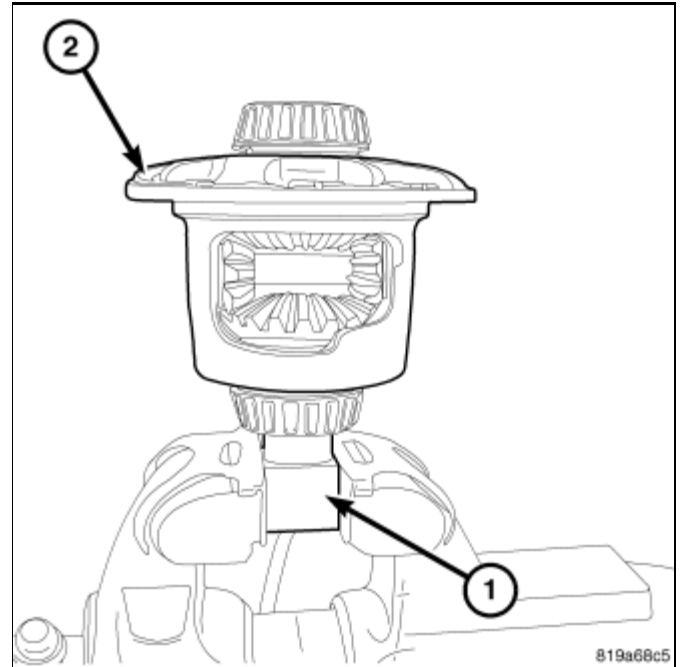
The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.



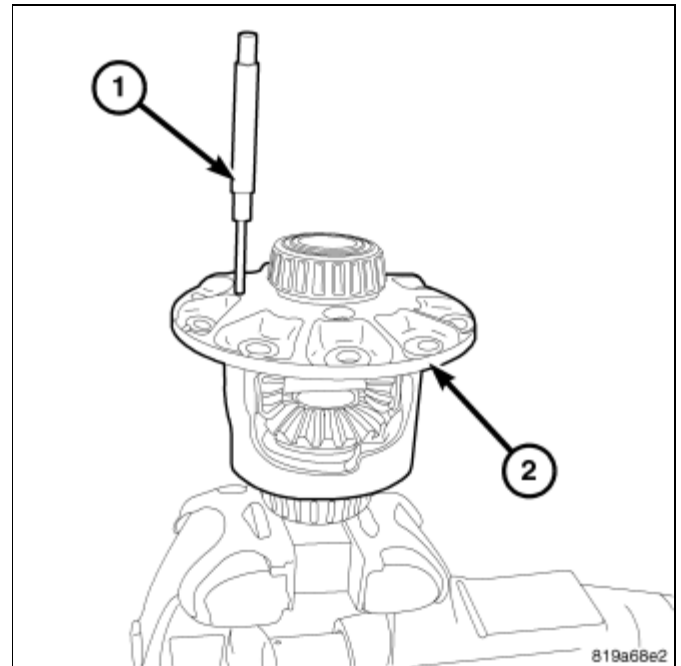
1. Place blocks in front and rear of both front wheels.
2. Raise one rear wheel until it is completely off the ground.
3. Engine off, transmission in neutral, and parking brake off.
4. Remove wheel and bolt Torque Check Tool 6790 (1) or equivalent tool to studs.
5. Use torque wrench (2) on Torque Check Tool (1) to rotate wheel and read rotating torque.
6. If rotating torque is less than 41 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit must be replaced.

DISASSEMBLY

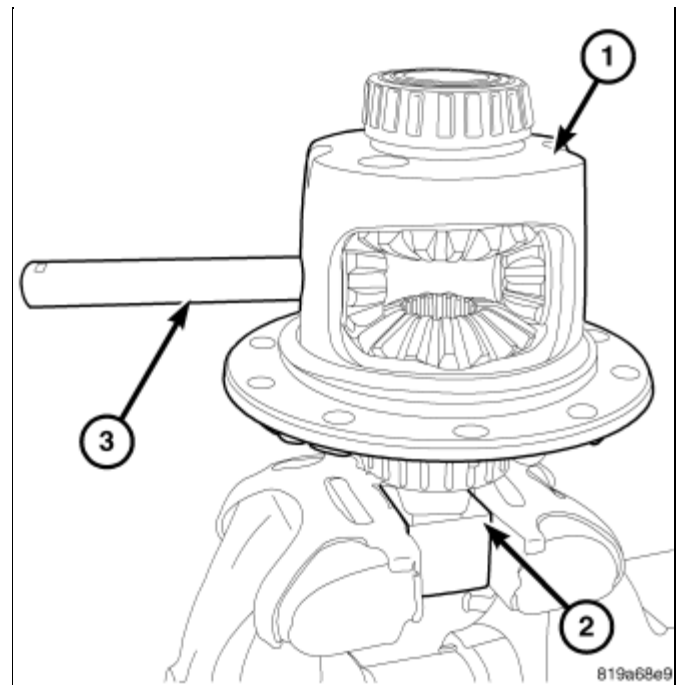
1. Remove ring gear.
2. Clamp side gear Fixture 6963A (1) in a vise and set differential case (2) on the fixture.



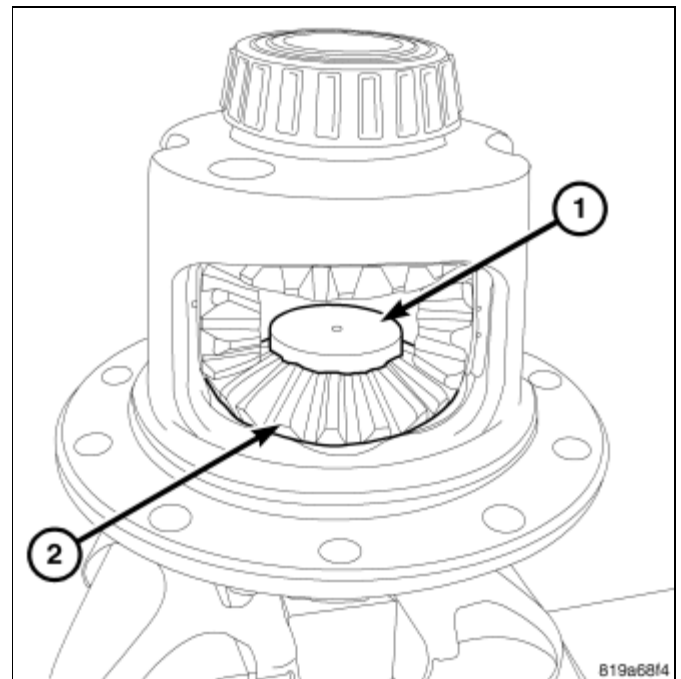
3. Remove pinion gear mate shaft roll pin from differential case (1) with a hammer and punch (2).



4. Rotate differential case (1) on the fixture (2) and remove pinion mate shaft (3).

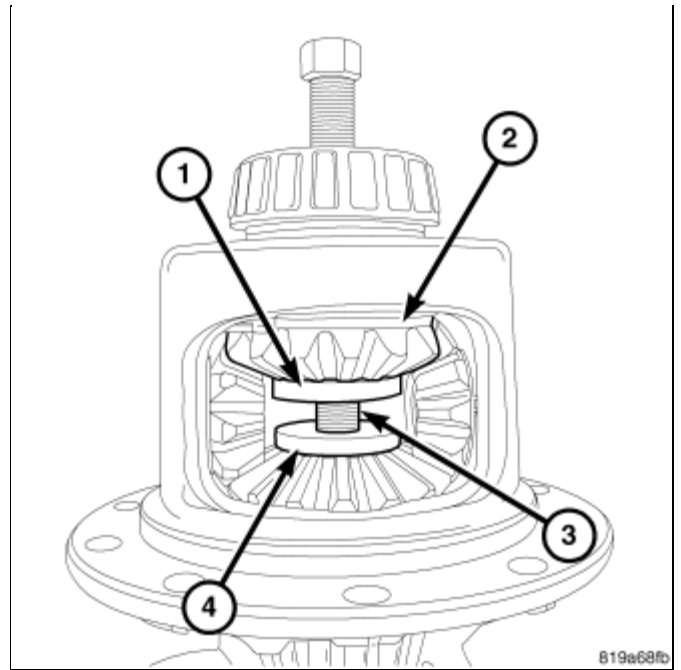


5. Lubricate and install disc (1) without threaded hole from Trac-lok® Tool C-4487 into lower side gear (2).

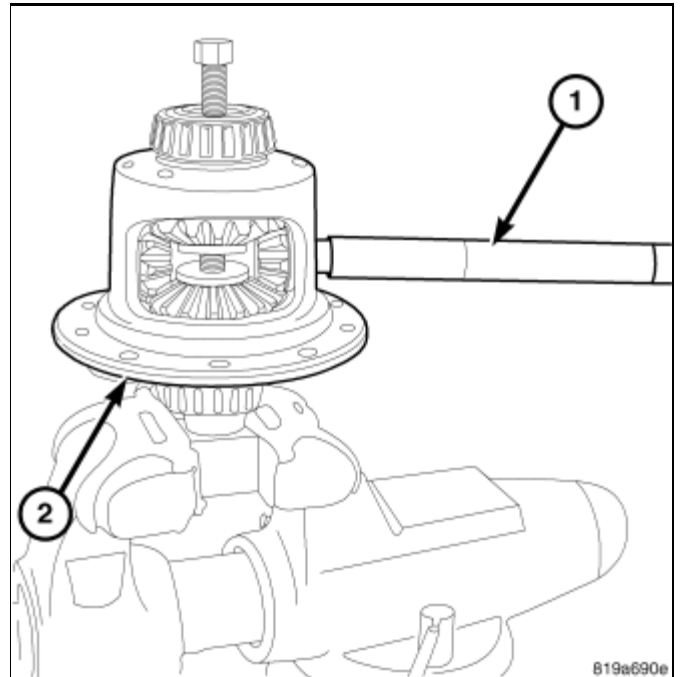


6. Lubricate and install disc (1) with threaded hole from Trac-lok® Tool C-4487 into upper side gear (2). Thread forcing screw (3) from Trac-lok® Tool C-4487 into upper disc until it contacts the lower disc (4).

NOTE: Slot in threaded upper disc (1) can be used to prevent it from turning using a screw driver.

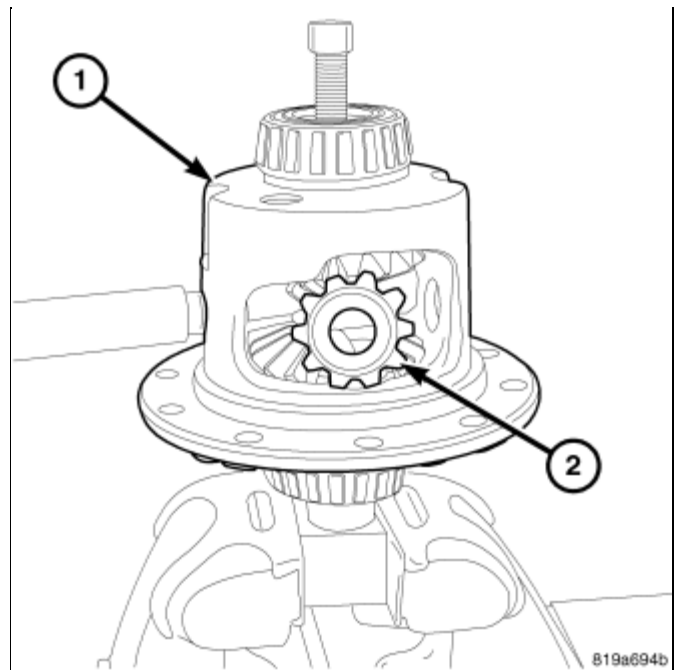


7. Tighten forcing screw to compress belleville springs in clutch packs. Then Insert turning bar (1) from Trac-lok® Tool C-4487 into the pinion mate shaft hole in the case (2).



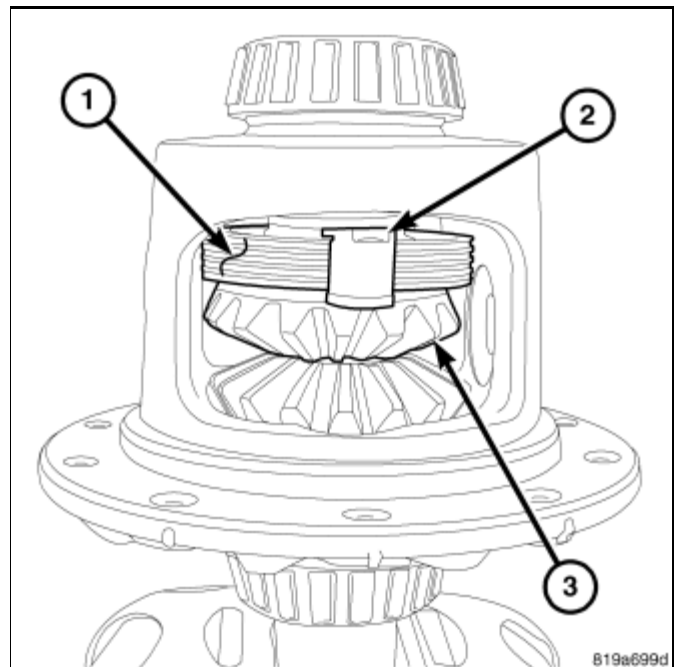
8. Rotate differential case (1) with turning bar until the pinion gears (1) and washers can be removed.

NOTE: Loosen forcing screw in small increments to relieve clutch pack tension if differential case can not be rotated.

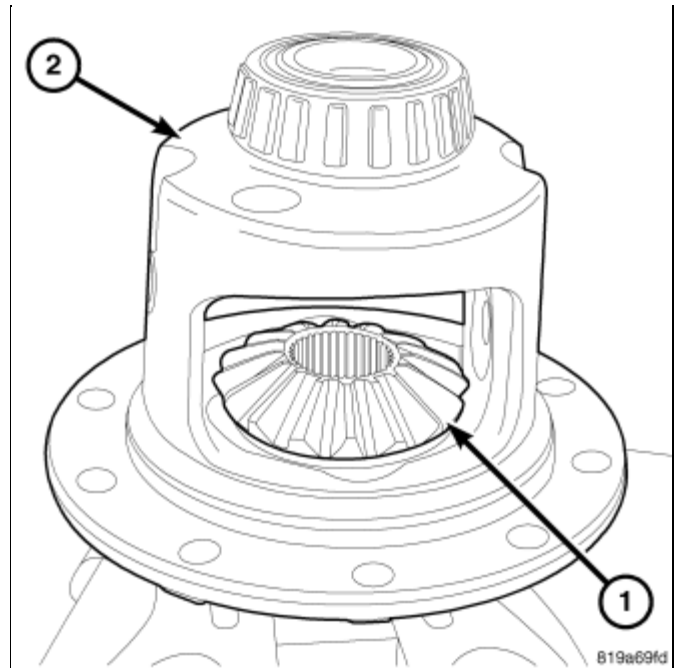


9. Remove Forcing Screw, Step Plate and Threaded Adapter.

10. Remove upper clutch pack (1), clutch pack retainers (2) and upper side gear (3) from case.

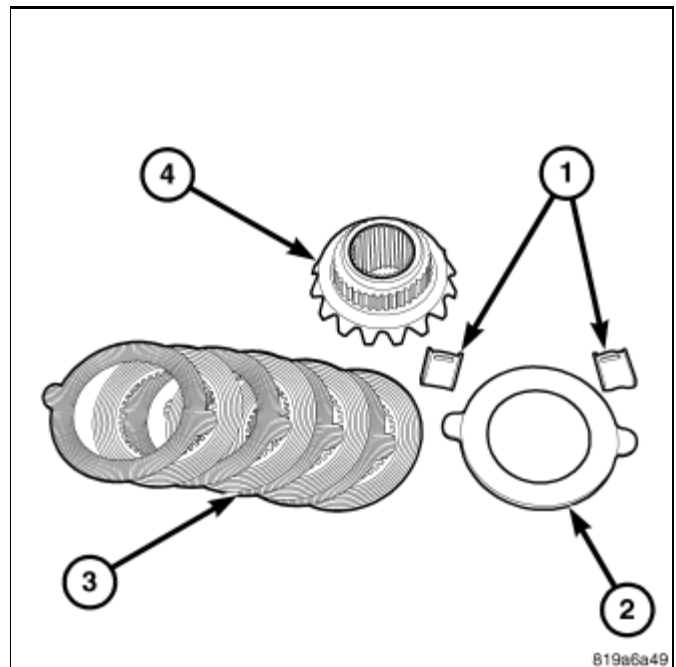


11. Remove lower clutch pack, clutch pack retainers and lower side gear (1) from case (2).



12. Remove clutch pack retainers (1), clutch pack (3) belleville spring (2) from side gear (4). Keep plates in order during removal.

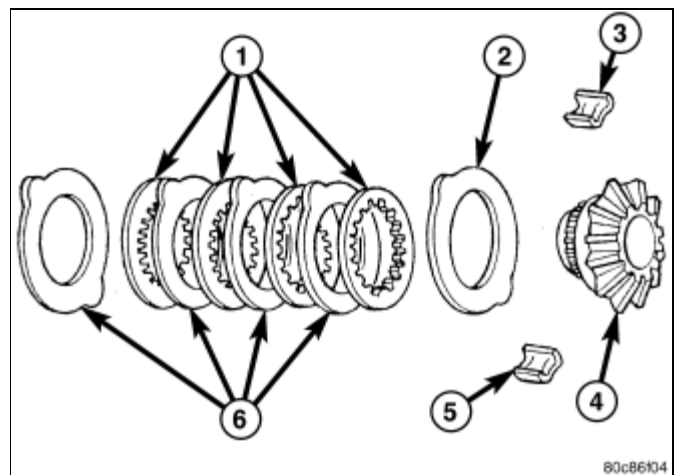
ASSEMBLY



NOTE: New Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

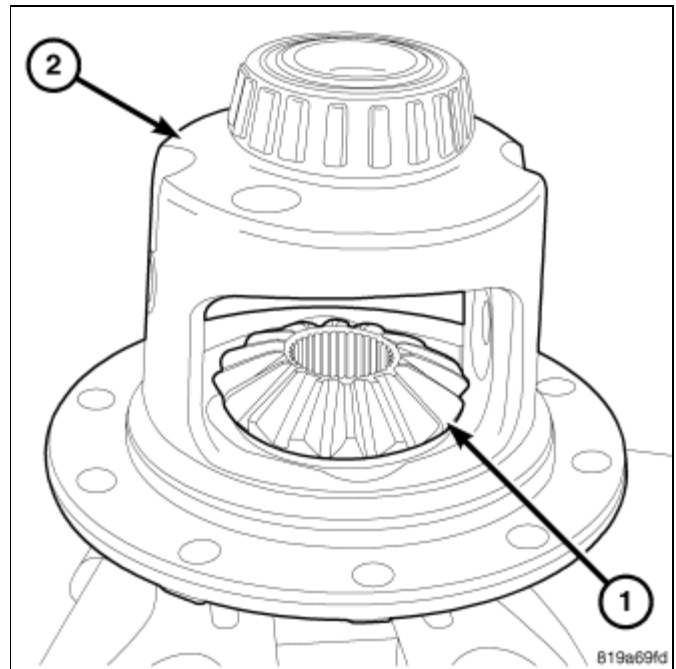
1. Lubricate components with gear lubricant.
2. Assemble clutch discs (1), plates (6) and belleville spring (2) into packs and secure disc packs with retainers (5).

NOTE: Belleville spring (2) is position with the convex side against the side gear.

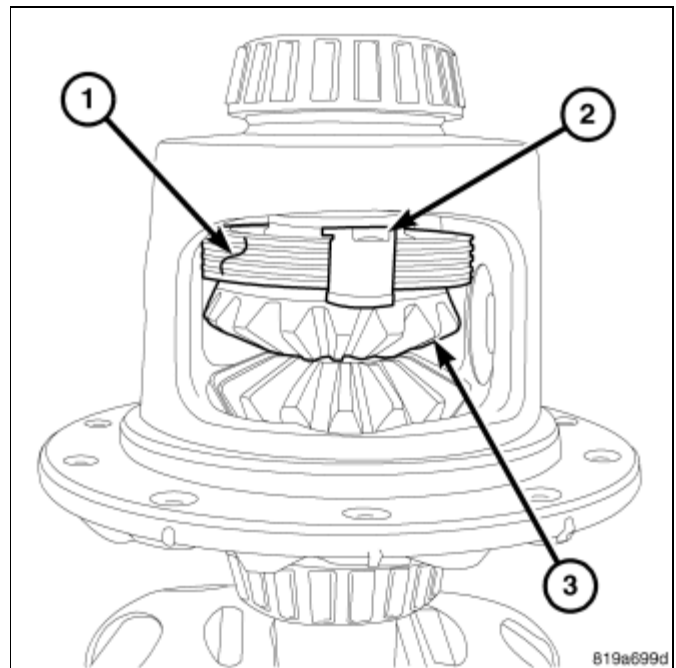


3. Position assembled clutch disc packs on the side gear (4) hubs.

4. Install lower clutch pack and side gear (1) in the differential case (2), with retaining clips seated in the case pocket.

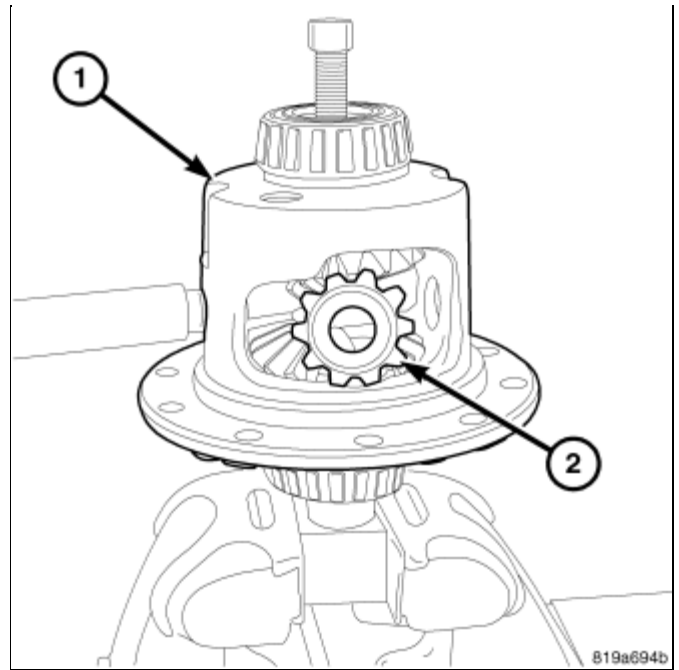


5. Install upper clutch disc pack (1) retaining clips (2) and side gear (3) with seated in the case pocket.



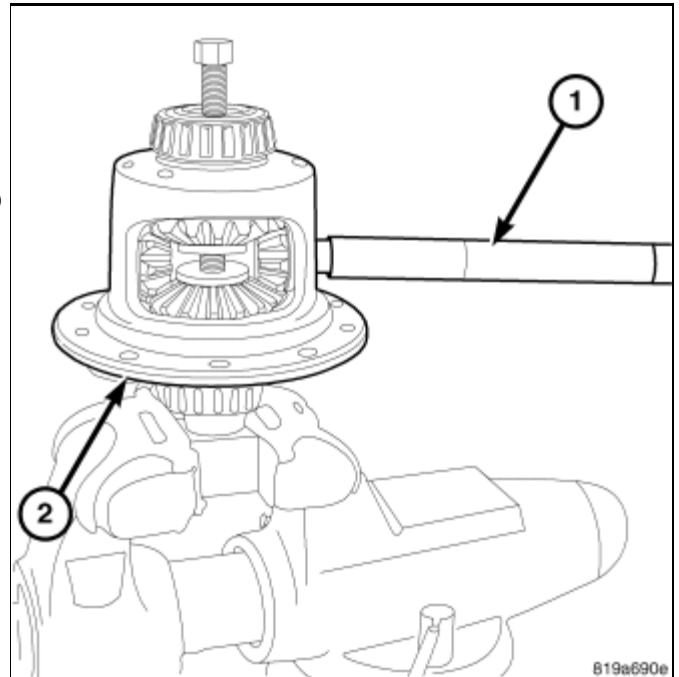
6. Lubricated and install discs into side gears from Trac-lok® Tool C-4487. Install forcing screw from Trac-lok® Tool C-4487 and thread screw to compress belleville springs in clutch packs.

7. Install pinion gears (2) in side gears opposite each other.

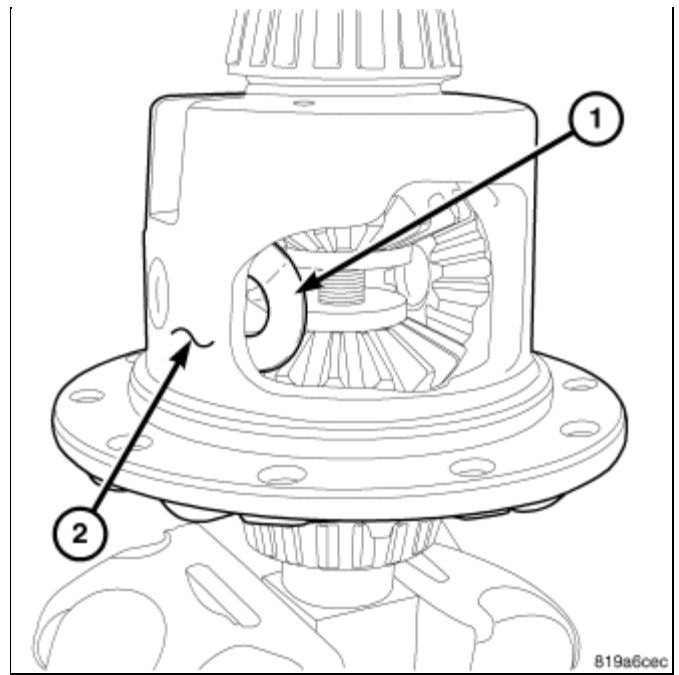


8. Rotate differential case (2) with turning bar (1) from Trac-lok® Tool C-4487 until pinion gears align with mate shaft holes in the case.

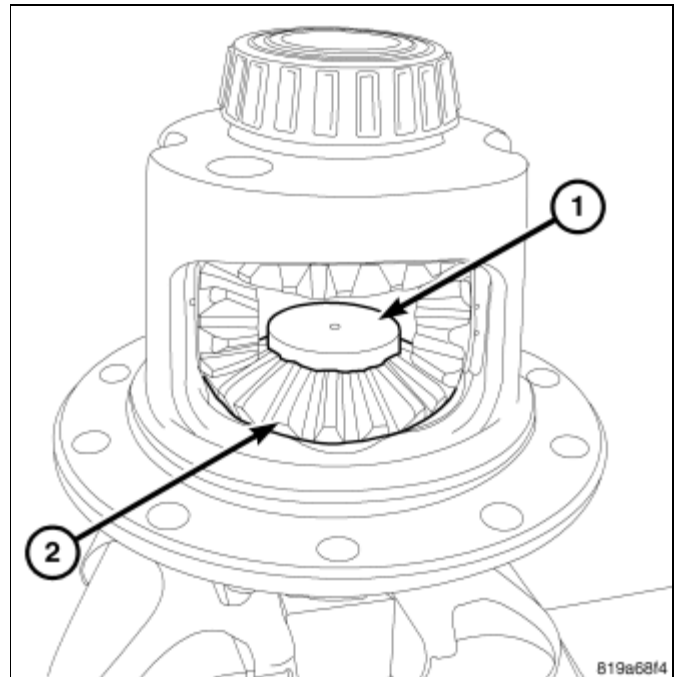
NOTE: Loosen forcing screw in small increments to relieve clutch pack tension if differential case can not be rotated.



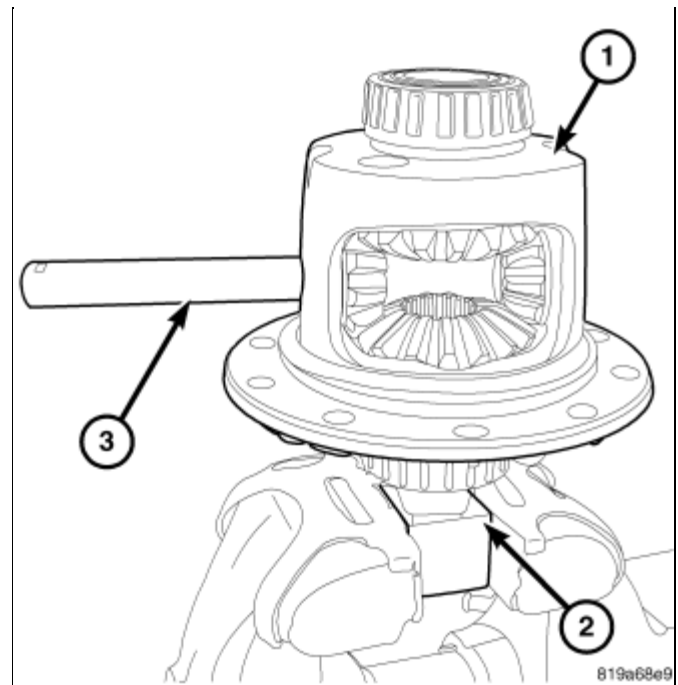
9. Install pinion gear thrust washers (1) between the gear and case (2). Align washers with mate shaft hole in the case.



10. Remove forcing screw upper disc from side gear.
11. Remove lower disc (1) from side gear (2).



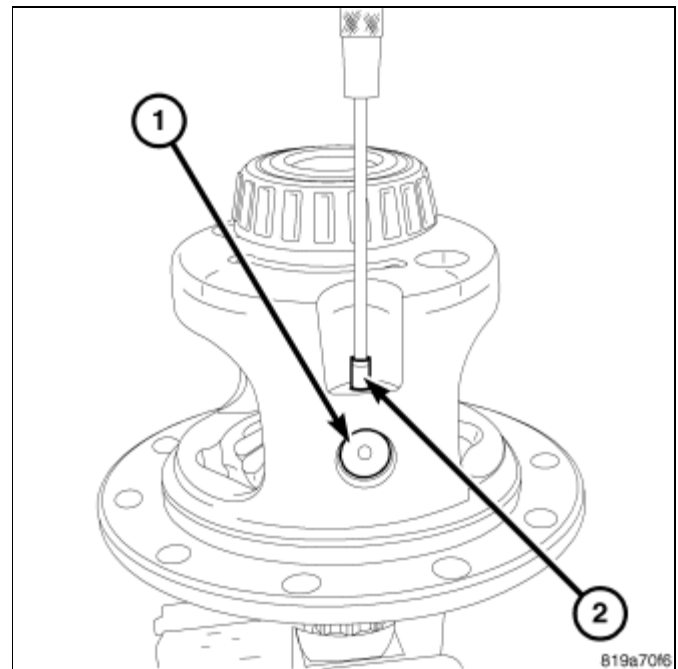
12. Install pinion mate shaft (3) in case (1).



13. Install pinion mate shaft (1) roll pin (2).
14. Install ring gear.
15. Lubricate all differential components with gear lubricant.

DIFFERENTIAL-TRU-LOK

DESCRIPTION



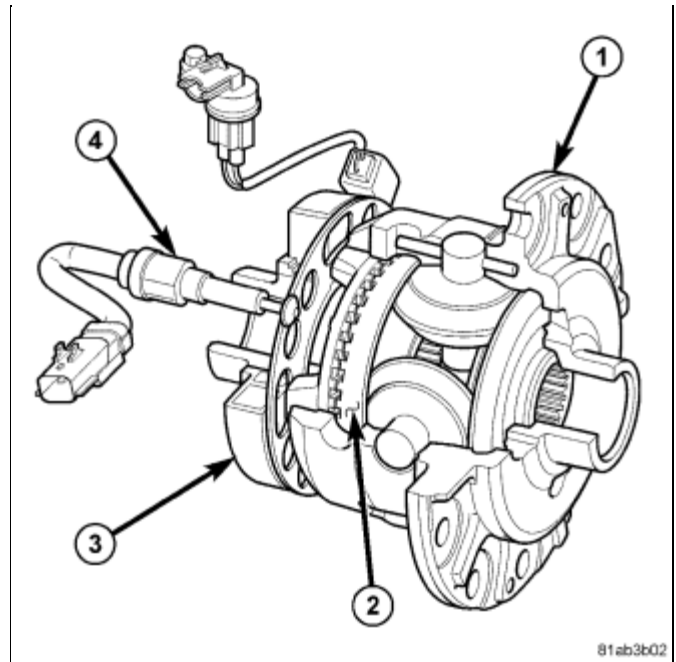
Tru-Lok is an electronically locking differential (1). The differential has four pinion gears, three pinion shafts and two side gears. On the back side of one side gear (2) is half of the dog clutch.

NOTE: The electric locking differential is serviced as an assembly.

A 12 volt electromagnetic coil (3) on the differential is controlled by the Totally Integrated Power Module (TIPM). When the coil (3) is energized the dog clutch is engaged which locks the one side gear to the differential case. This action locks the axles and

triggers a switch (4) in the differential housing which activates the Tru-Lok indicator light on the dash.

OPERATION



Pressing a two-way momentary rocker switch on the switch bank request axle lock. The first press DOWN requests rear axle to be locked, every other press DOWN toggles between "front and rear axle lock" and "rear axle lock" request states. Press rocker switch UP requests both axles to be unlocked. The switch is on the IP in the switch bank. The switch bank sends a message to the Cabin Cluster Node (CCN). The CCN handles the switch debounce and switch diagnostics. Any one message sent by the CCN on the network is a valid switch change. The CCN passes the information to the Totally Integrated Power Module (TIPM) via a CAN B message. The TIPM will process the switch info received from CAN B, control the outputs as required by the Axle Lock Electrical Requirements, and send a lighting request to the CCN via CAN B. There are three telltales on the cluster, "Rear", "Front", and "Lock". The telltales will be off if the axles are unlocked, flashing if there is a pending request to lock but the axles are not yet locked (transition to lock, torque-locked, or conditions not correct), and flashing rapidly if there is a fault. The "Front" and "Rear" telltales will match the front and rear differential states. The "Lock" telltale will be on solid if either the "Front" or "Rear" telltale is on or blinking. The TIPM will send the axle lock status message to the ESP module via CAN C.

AXLE LOCK ELECTRICAL REQUIREMENTS

DIFFERENTIAL LOCK

- Vehicle speed of 16 KPH (10 MPH) or below
- Transfer case in 4 LO position
- Switch request message for the corresponding axle/s has been received
- Ignition switch in the RUN or START position
- No system, module, or switch faults have been detected

DIFFERENTIAL UNLOCK

- Transfer case in 4 HI, 2 WD, or Neutral
- Loss of ignition switch signal, vehicle speed signal, transfer case signal

- Vehicle speed of 50 KPH (30 MPH) or higher
- Valid switch message received

AXLE FAIL-SAFE

- Axles will UNLOCK with ignition switch in either the OFF or ACC position.
- Axles will not LOCK if there is no ignition switch, vehicle speed, or transfer case position signal. Axles will UNLOCK with the loss of any of these signals.
- Axles will not LOCK if the ignition switch is OFF.
- Axles will UNLOCK if a switch failure is detected.

Software Latch Feature: The Totally Integrated Power Module (TIPM) will have a software latch of the axle switch during an ignition switch OFF when the vehicle is in 4 LO transfer case position. Upon ignition key RUN or START the TIPM shall check to verify conditions are correct for an axle lock and automatically lock the axles that were locked before the ignition was turned OFF.

NOTE: The electric locking differential is serviced as an assembly.

DIAGNOSIS AND TESTING

DIFFERENTIAL - TRU-LOK

The control module for the electronically locking differentials detects faults from input signal/messages, sensors, solenoids, and drivers/relays and report the corresponding Diagnostic Trouble Code (DTC).

The lighting strategy for the axle lock switch.

1. The FRONT LED will

- a. turn ON SOLID when the front axle is locked
- b. turn ON BLINKING when the front axle is attempting to lock
- c. turn ON BLINKING when a lock front axle request is received but conditions to lock are not correct
- d. turn OFF when the axle is UNLOCKED
- e. turn ON FAST BLINKING when there is a fault detected for the front axle

2. The REAR LED will

- a. turn ON SOLID when the rear axle is locked
- b. turn ON BLINKING when the rear axle is attempting to lock
- c. turn ON BLINKING when a lock rear axle request is received but conditions to lock are not correct
- d. turn OFF when the axle is UNLOCKED
- e. turn ON FAST BLINKING when there is a fault detected for the rear axle

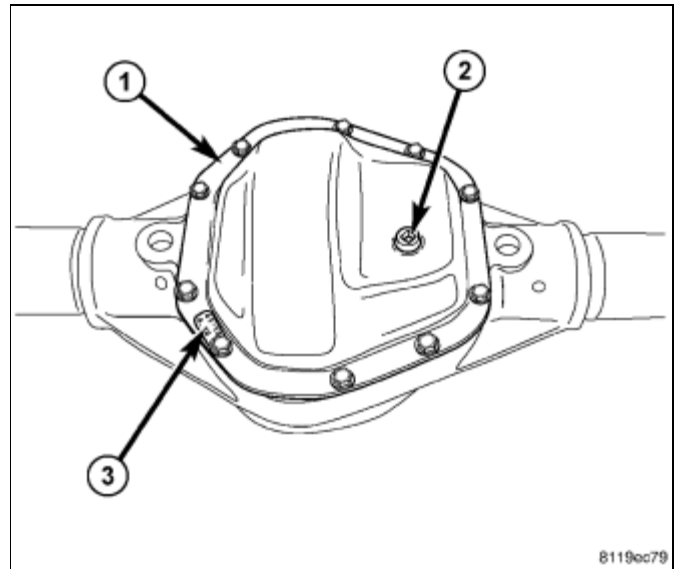
INDICATOR SWITCH

Ohm meter set on continuity: One lead on each connector terminal

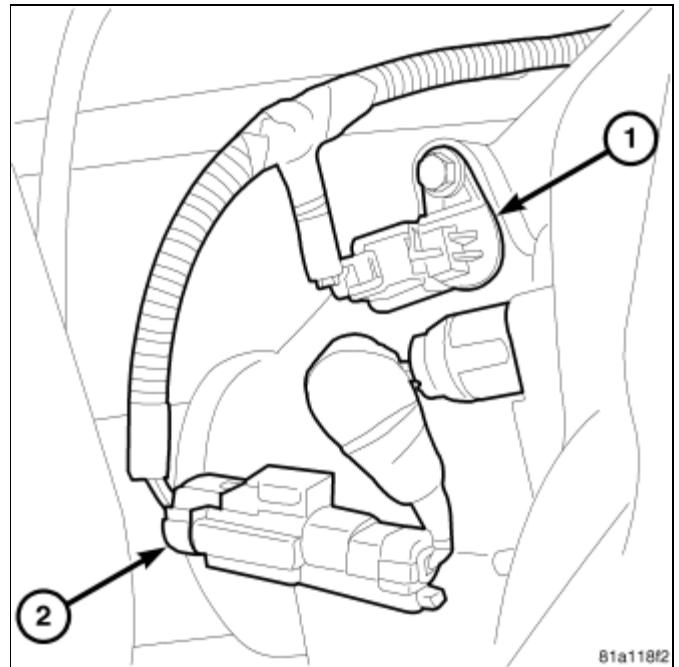
- Switch Plunger IN Locker Not Engaged - No Continuity
- Switch Plunger OUT Locker Engaged - Continuity

REMOVAL

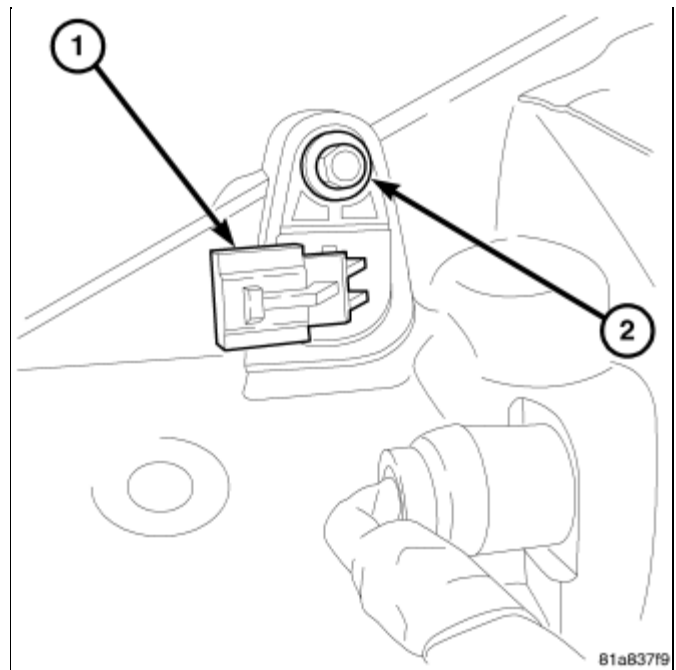
1. Remove differential fill plug (2).
2. Remove differential cover (1) and drain fluid.
3. Remove axle shafts.



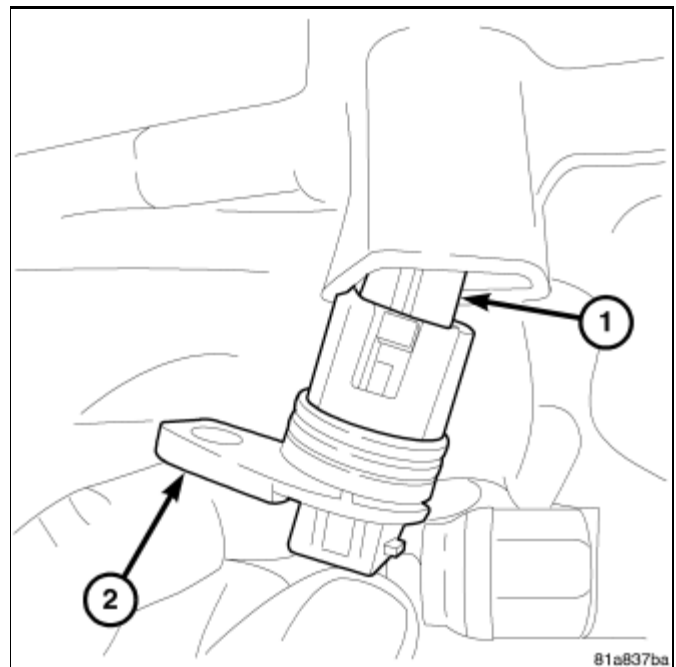
4. Remove Tru-Lok harness from the coil (1) and indicator switch (2).



5. Remove Tru-Lok coil connector (1) bolt (2).



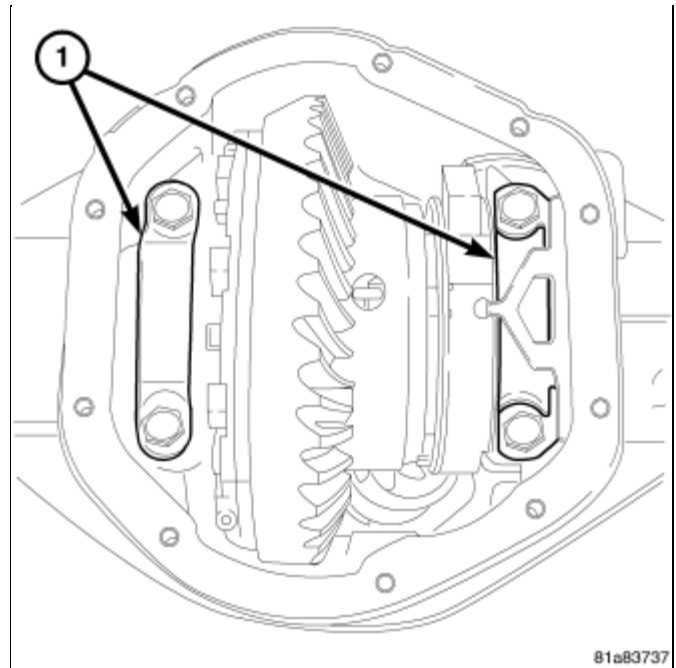
6. Remove Tru-Lok coil connector from the axle housing and remove coil harness (1) from the connector (2).



7. Loosen differential bearing cap (1) bolts.
8. Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes. Install hold-down clamps and tighten the turnbuckle finger-tight.
9. Install a Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339A to pin. Load indicator plunger against the opposite side of the housing and zero the indicator.
10. Spread housing while measuring the distance with the dial indicator.

CAUTION: Never spread housing over 0.50 mm

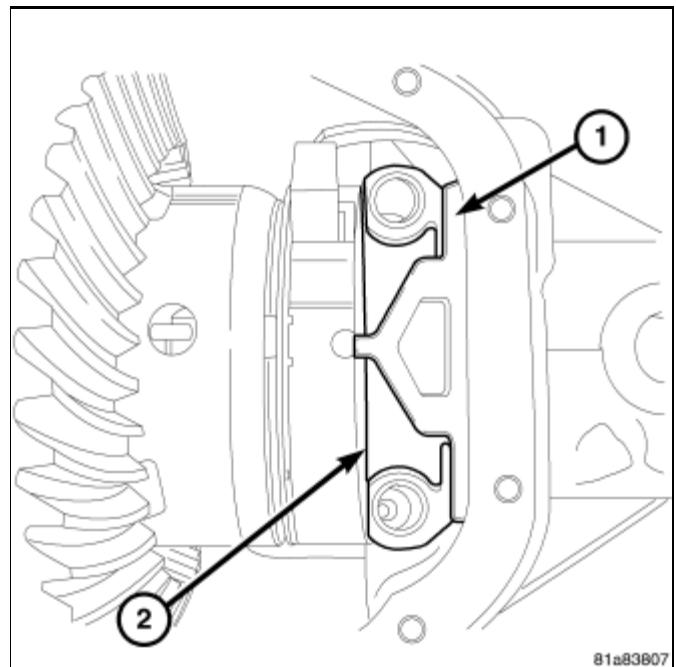
(0.020 in). Failure to follow these instructions will damage the housing.



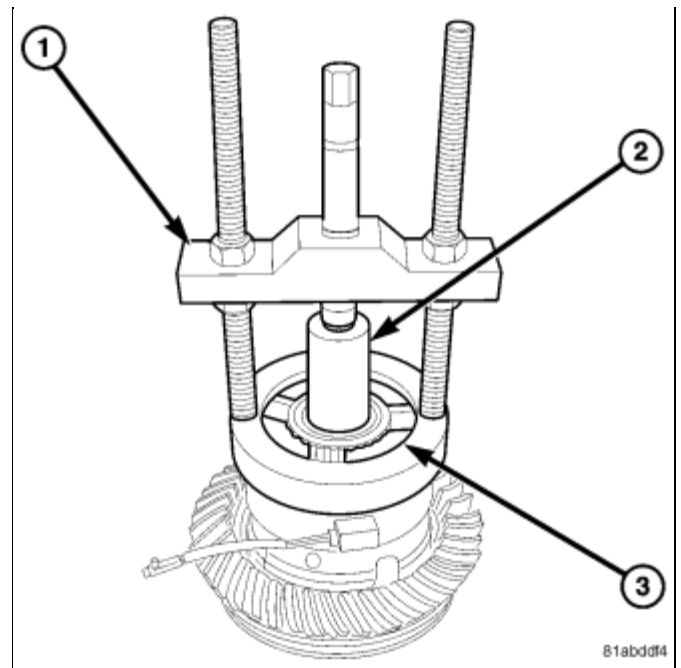
11. Remove dial indicator.
12. Holding differential case in position, remove differential bearing cap bolts.
13. Remove coil anti-rotation bracket (1) from the bearing cap (2), then remove both bearing caps.
14. Remove differential case from housing and tag differential bearing cups and shims location.
15. Remove spreader from housing.
16. Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

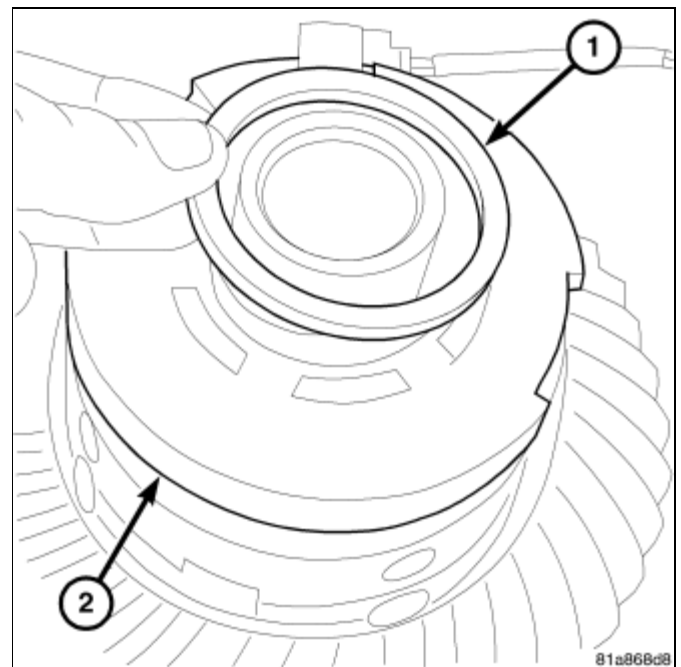
DISASSEMBLY



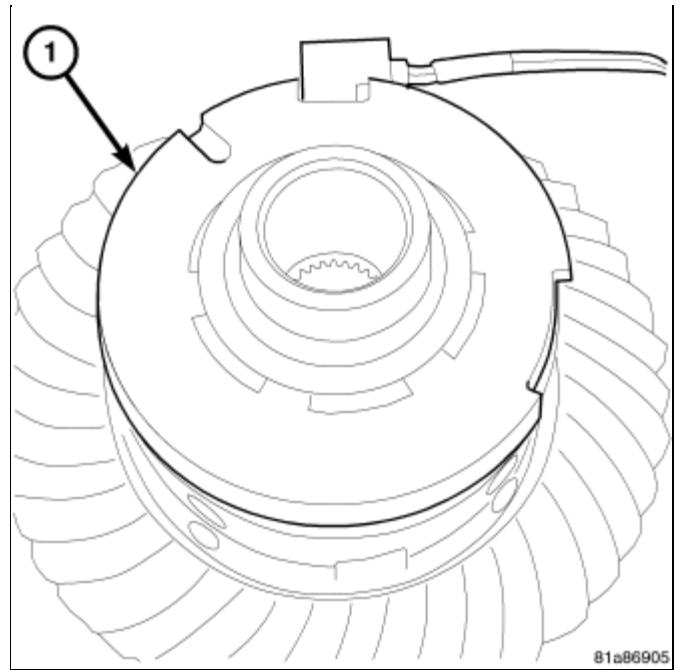
1. Remove bearing from coil side of the differential case with Puller C-293-PA (1), Plug C-293-3 (2), and Adapters C-293-47 (3).



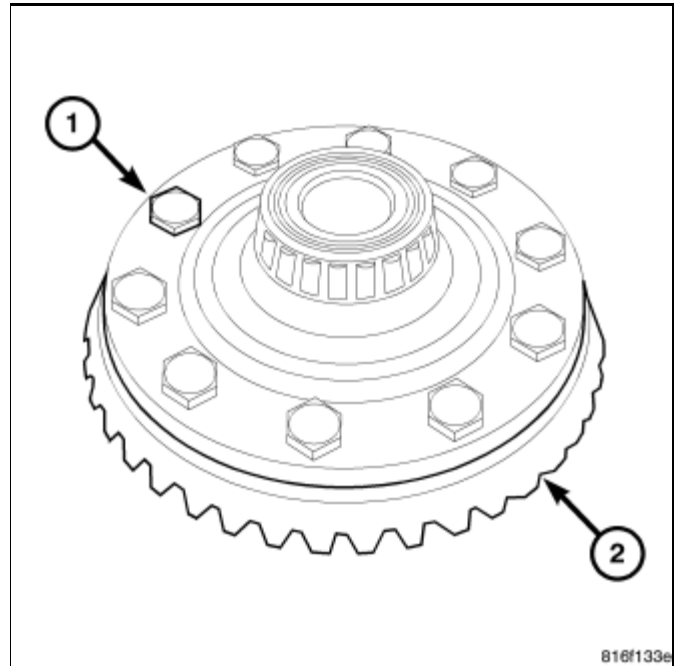
2. Remove washer (1) from coil (2).



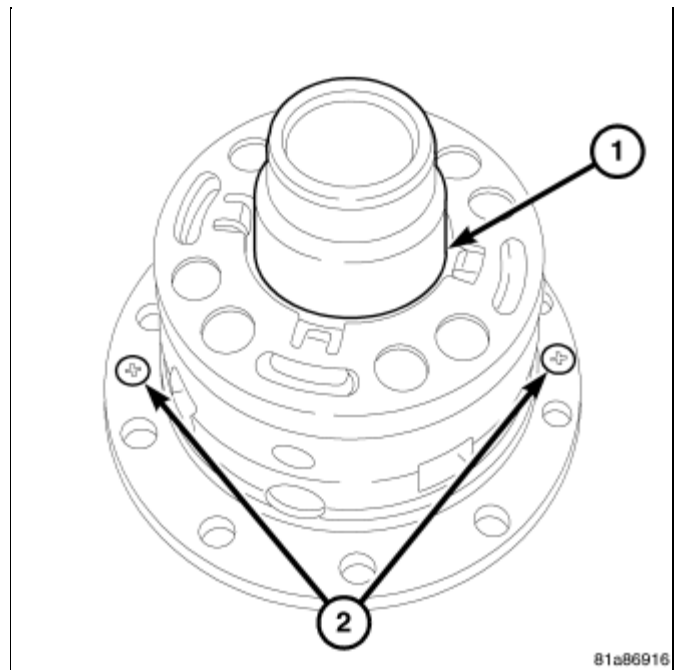
3. Remove coil (1) from differential case.



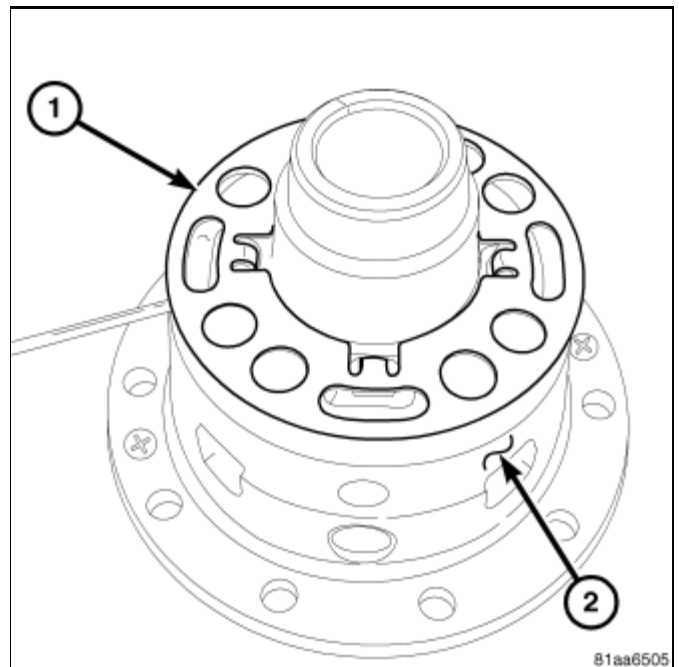
4. Remove ring gear bolts (1) and remove ring gear (2).



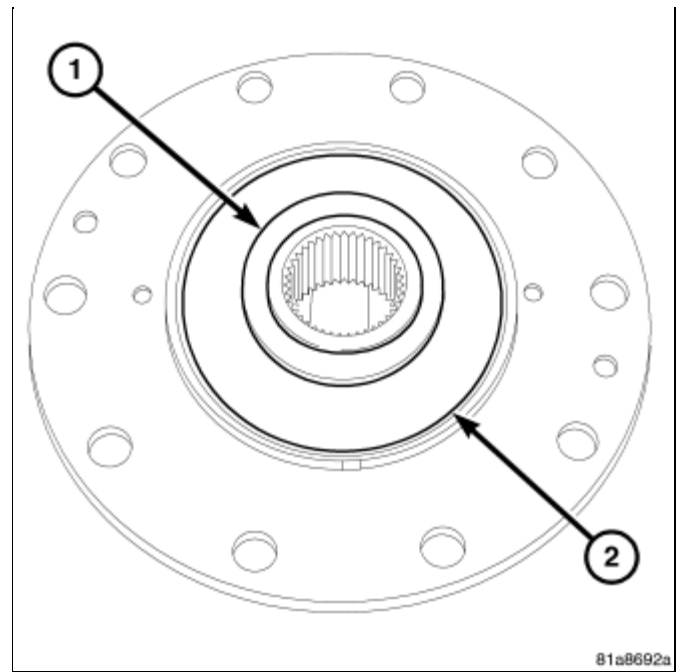
5. Remove differential case (1) screws (2).



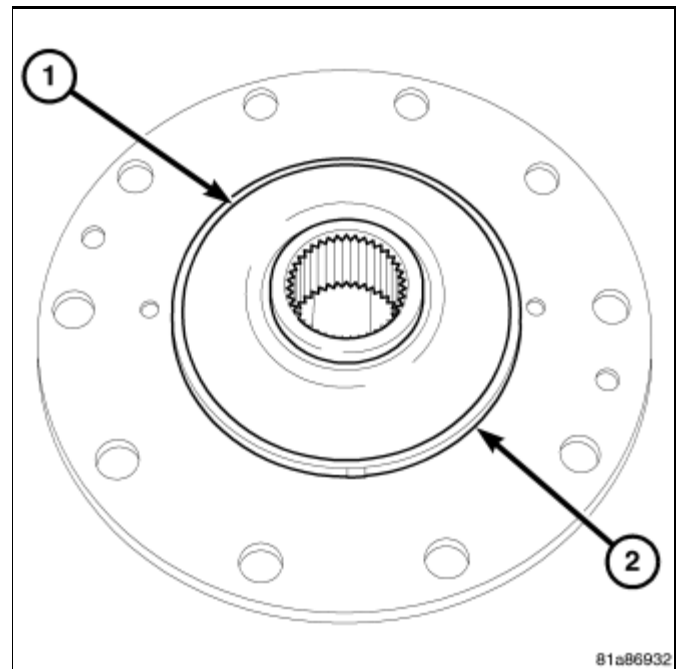
6. Pry up dog clutch actuator plate (1) and remove from differential case (2).



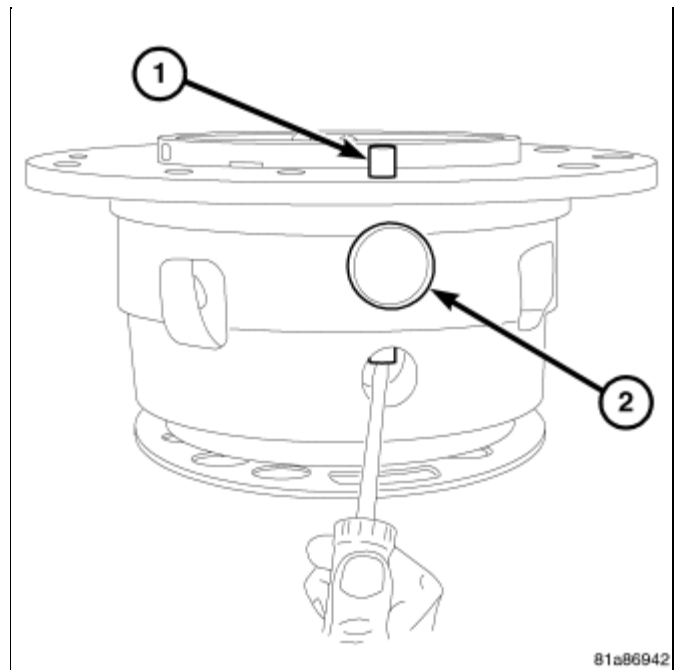
7. Turn differential case over and remove case half.
8. Remove thrust washer (1) from side gear (2).



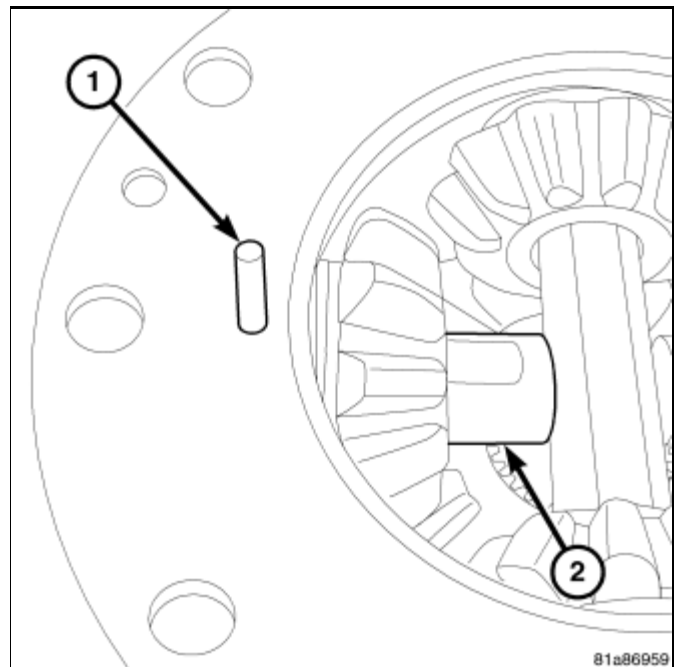
9. Remove side gear (1) from differential case (2).



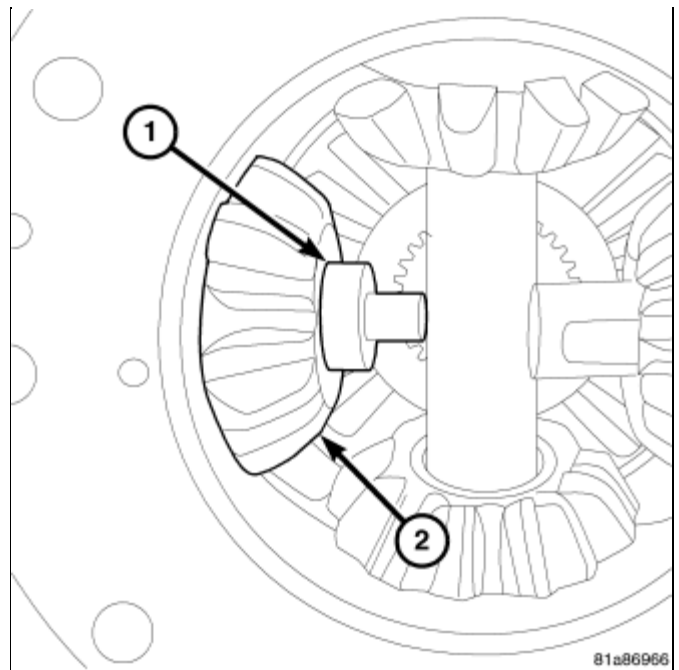
10. Push pinion shaft (2) pin (1) up.



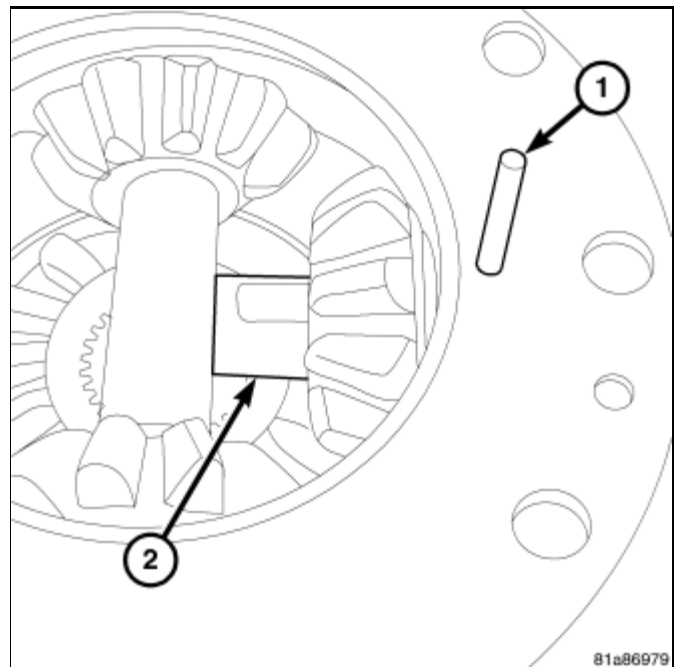
11. Pull pinion shaft pin (1) out of the pinion shaft (2) and case.



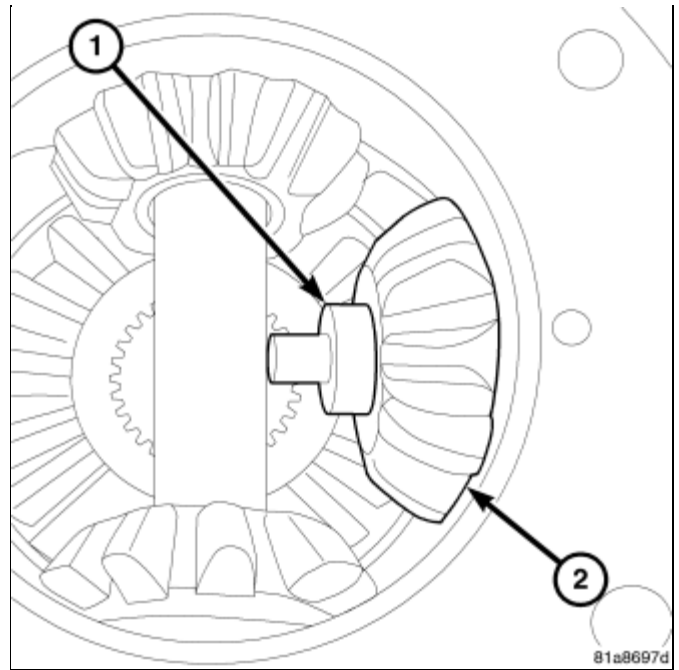
12. Remove pinion shaft (1) from the case and remove pinion gear (2) with thrust washer.



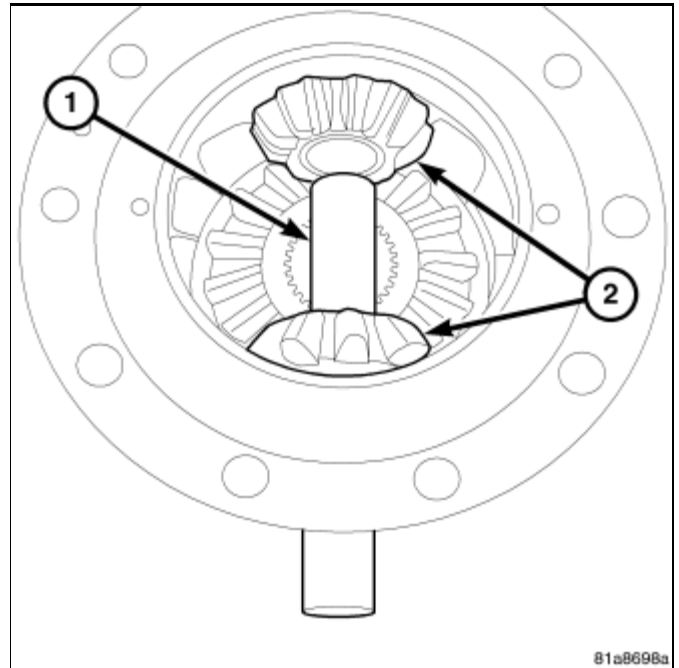
13. Pull opposite pinion shaft pin (1) out of the pinion shaft (2) and case.



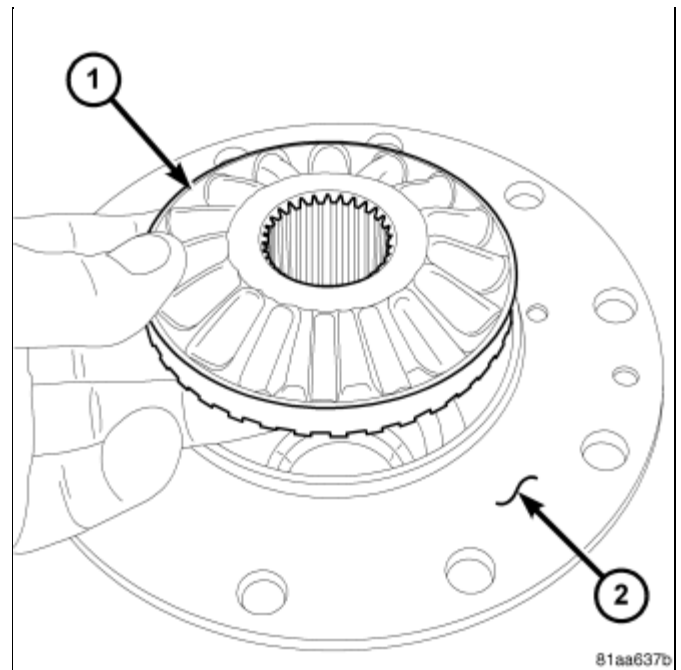
14. Remove the pinion shaft (1) from the case and remove pinion gear (2) with thrust washer.



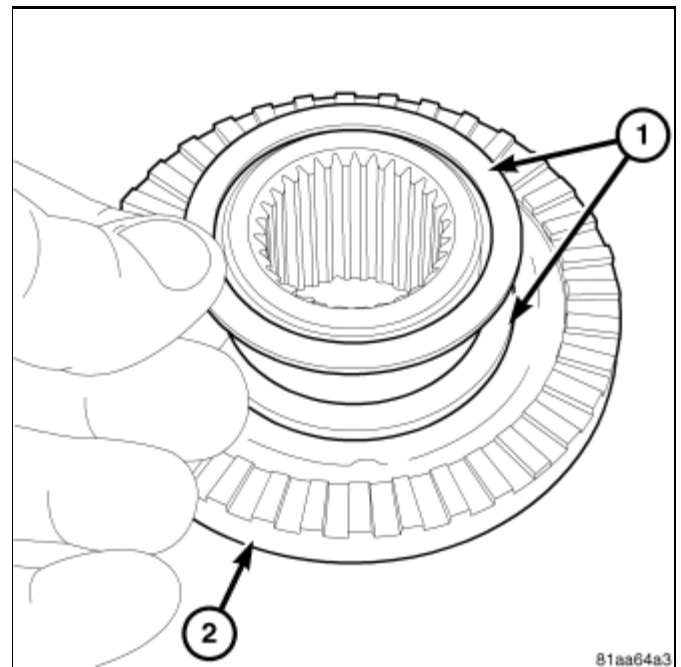
15. Slid remaining pinion shaft (1) out of the case and remove the remaining two pinion gears (2) with thrust washers.



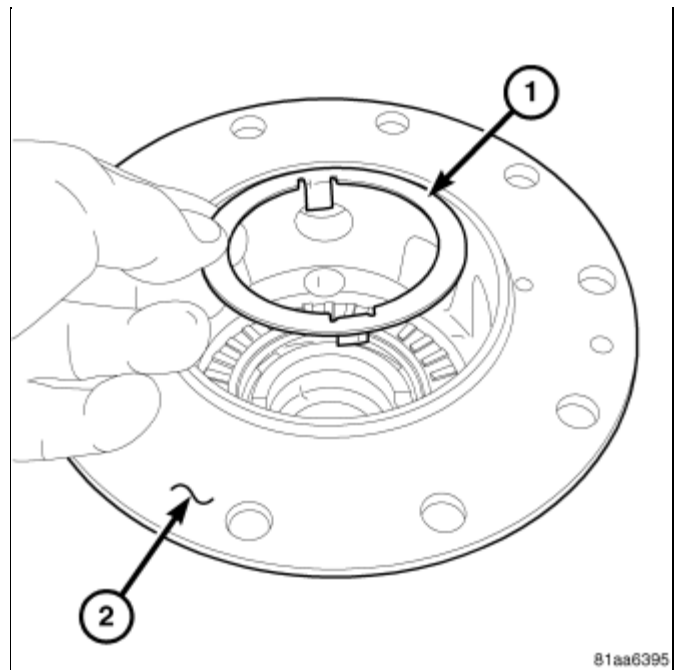
16. Remove dog clutch side gear (1) from differential case (2).



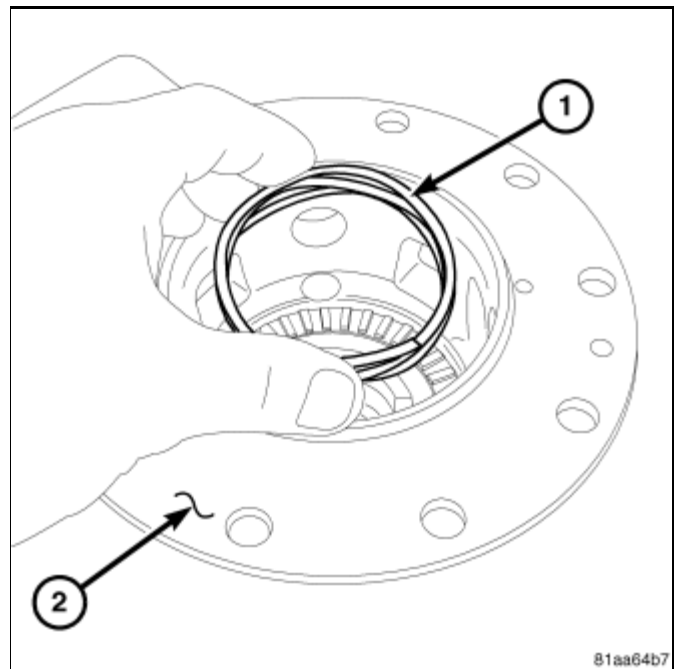
17. Turn dog clutch side gear (2) over and remove thrust washers (1).



18. Remove wave spring stop ring (1) from differential case (2).

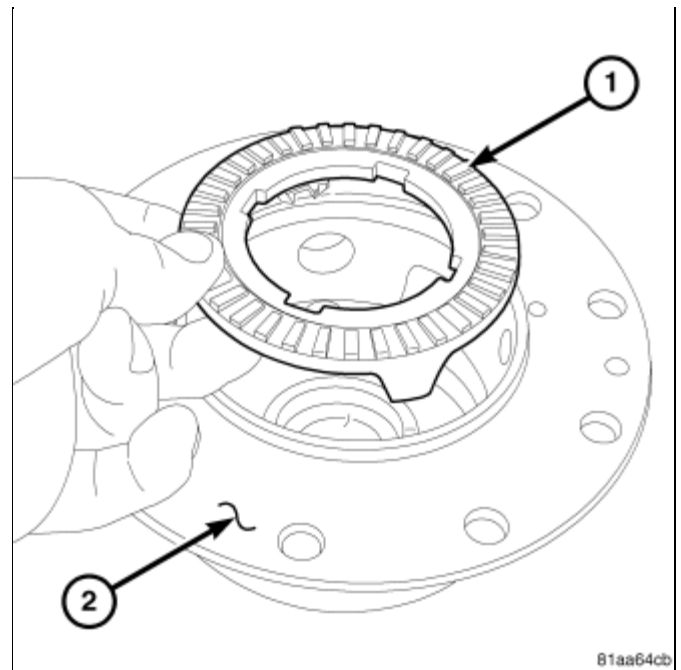


19. Remove wave spring (1) from differential case (2).

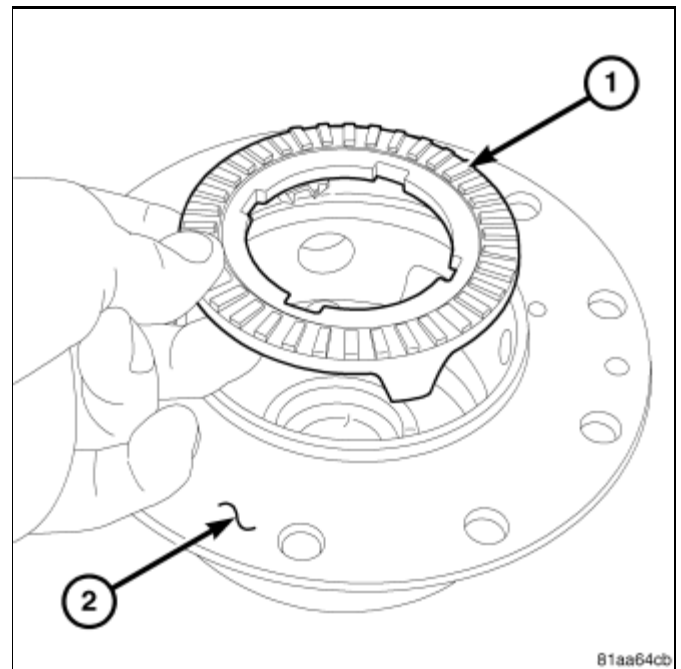


20. Remove dog clutch (1) from differential case (2).

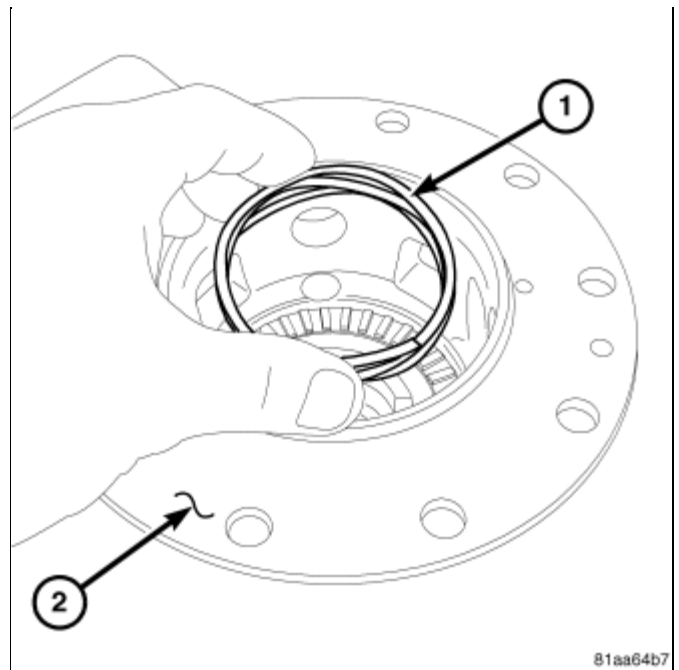
ASSEMBLY



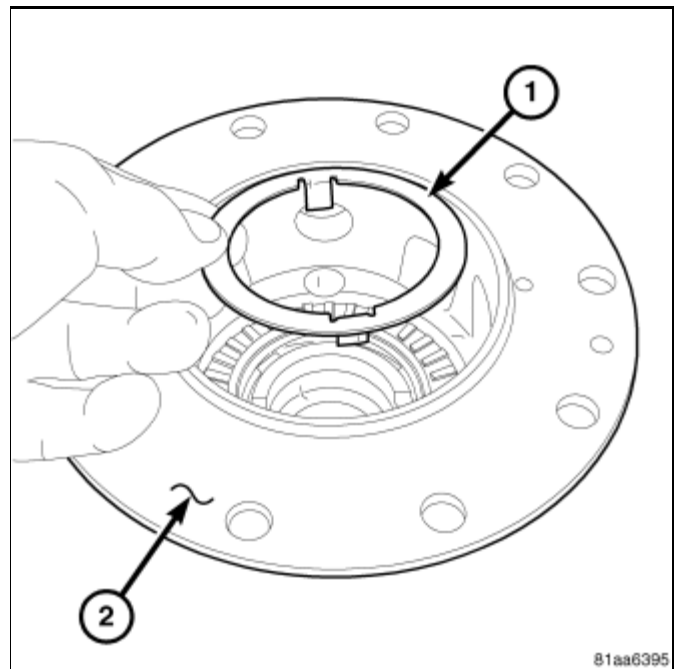
1. Install dog clutch (1) in differential case (2).



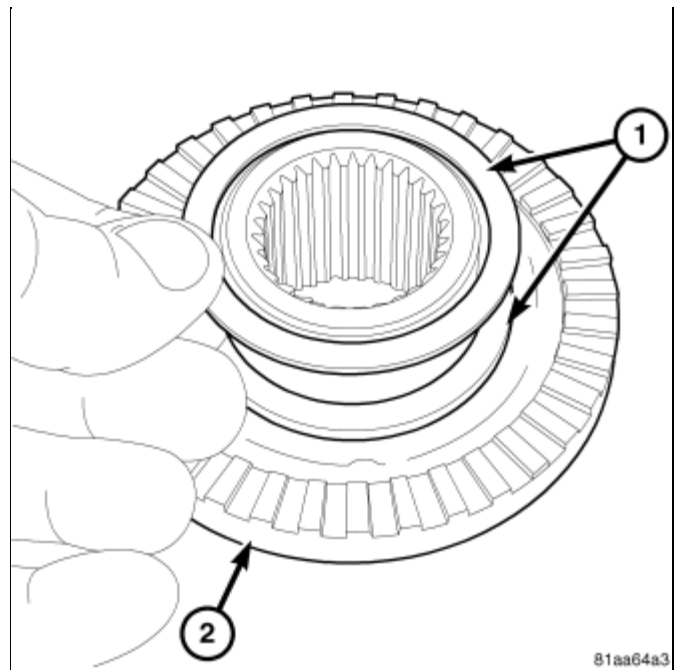
2. Install wave spring (1) in differential case (2).



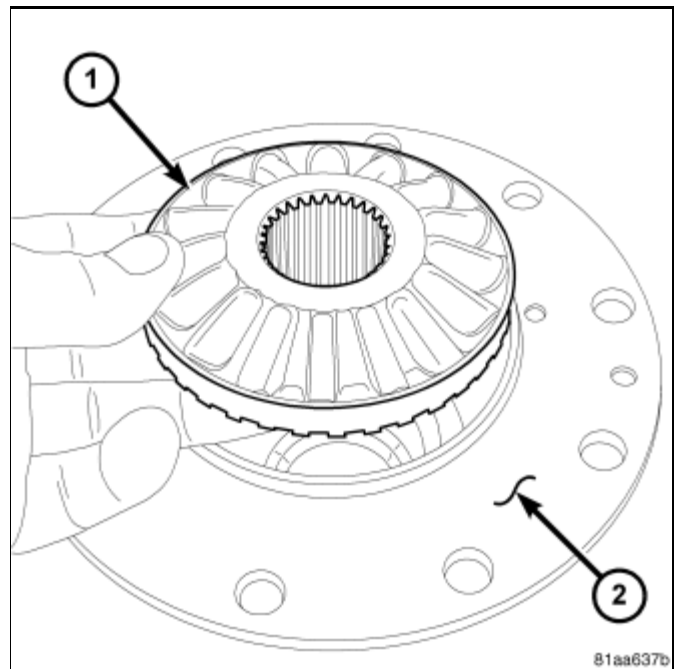
3. Install wave spring stop ring (1) in differential case (2) and align tabs with dog clutch notches.



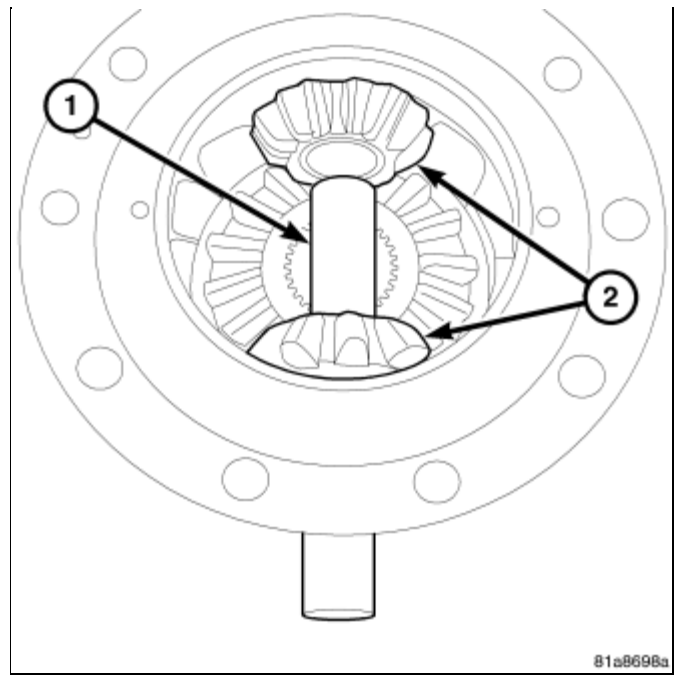
4. Install both thrust washers (1) on dog clutch side of the side gear (2).



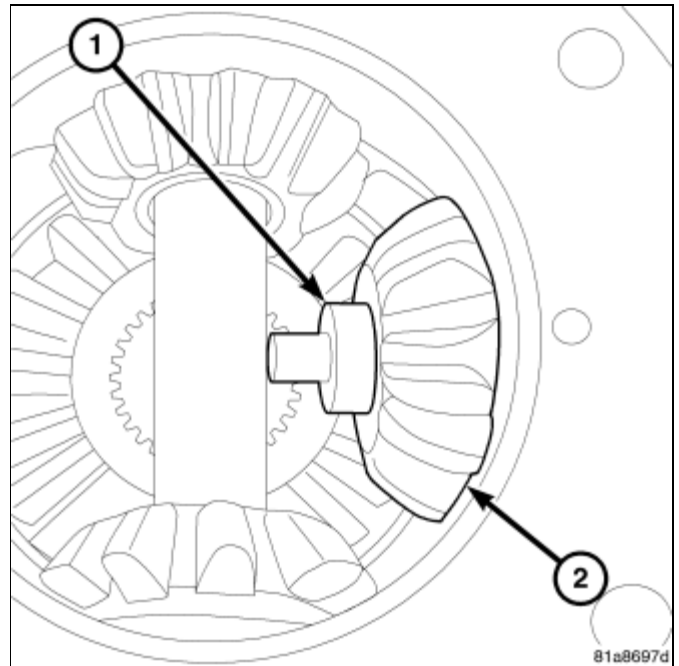
5. Install side gear dog clutch (1) with thrust washers in differential case (2).



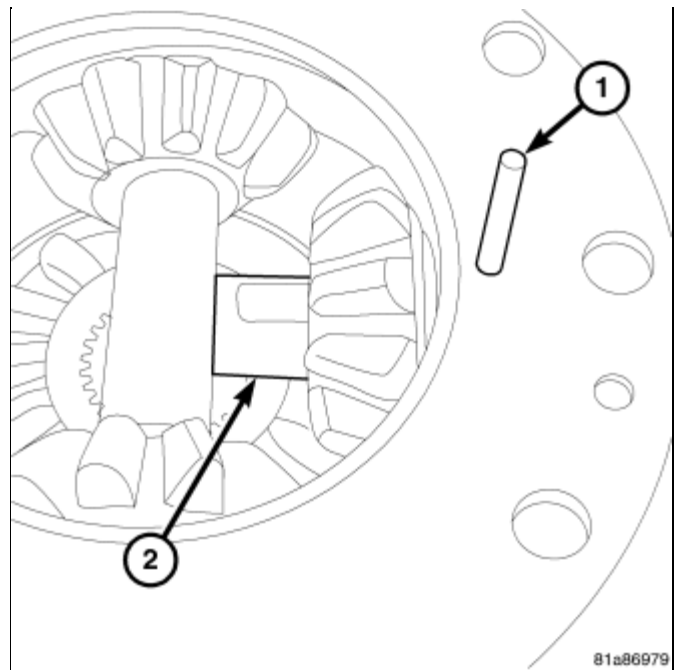
6. Install two pinion gears (2) with thrust washers then slid pinion shaft (1) into the case.



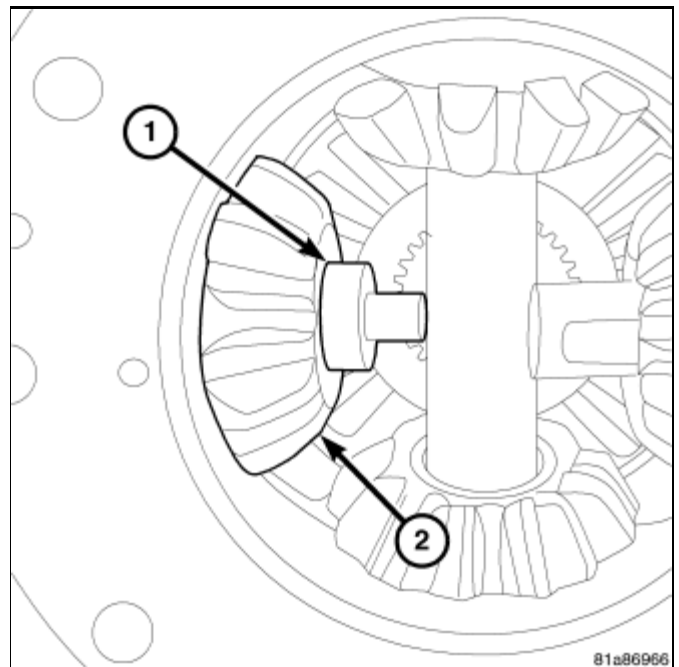
7. Install third pinion gear (2) with thrust washer then slid pinion shaft (1) into the case.



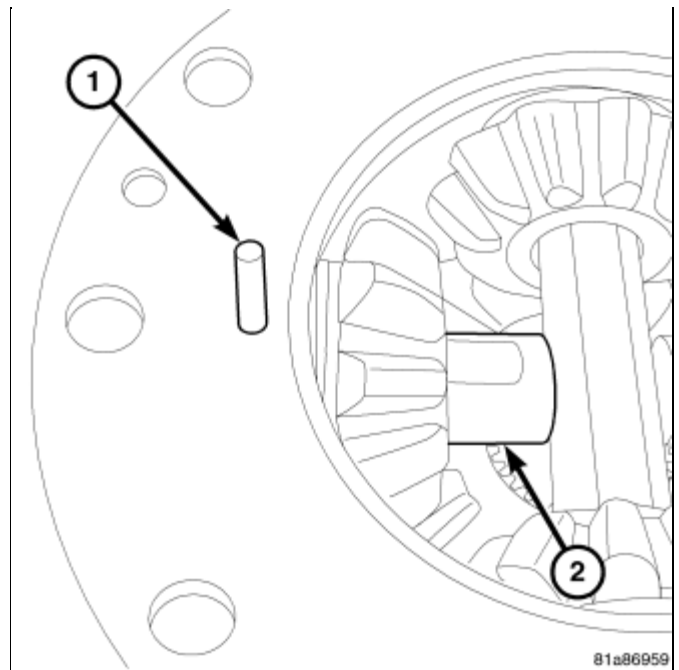
8. Install pinion shaft pin (1) into the pinion shaft (2) and case.



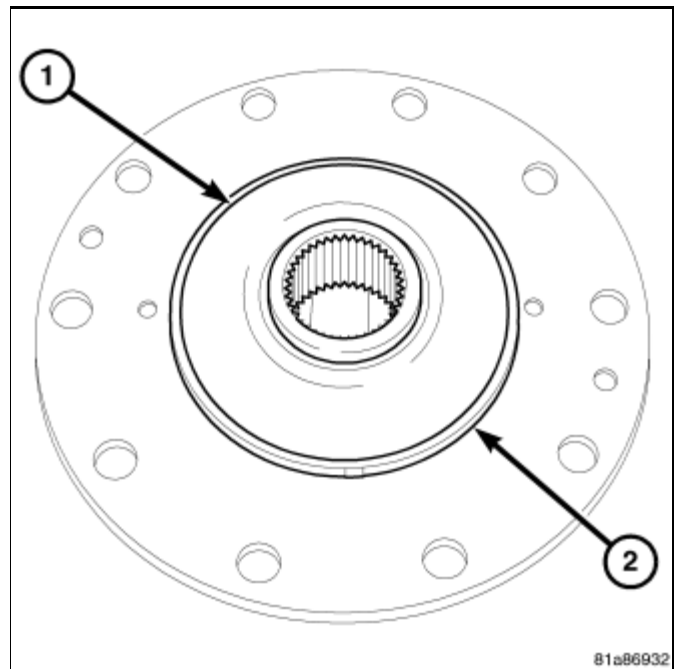
9. Install fourth pinion gear (2) with thrust washer then slid pinion shaft (1) into the case.



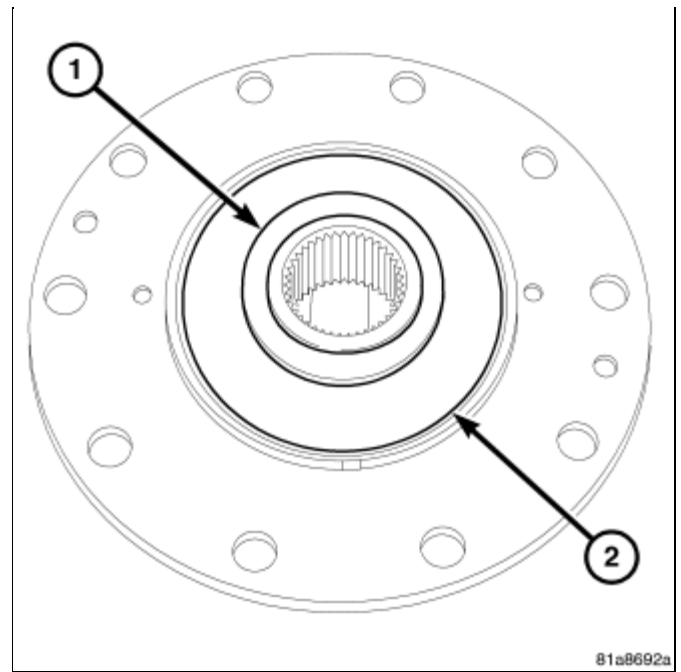
10. Install pinion shaft pin (1) into the pinion shaft (2) and case.



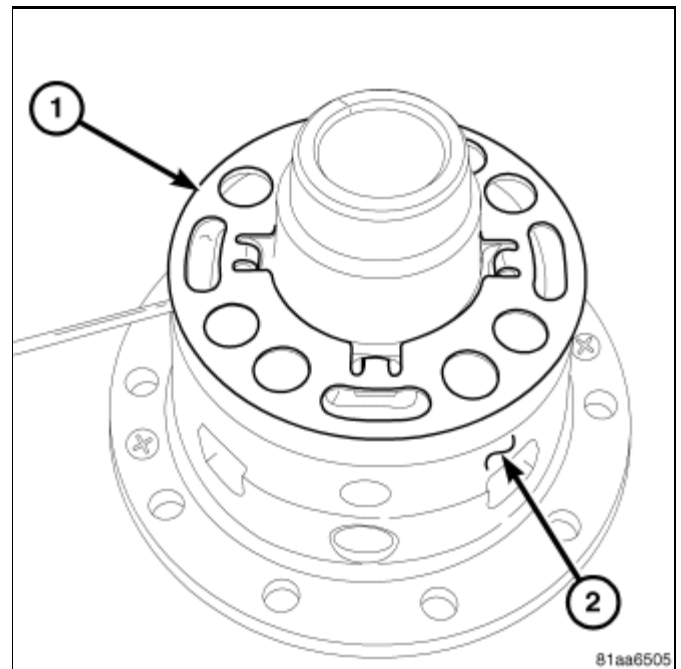
11. Install side gear (1) into differential case (2).



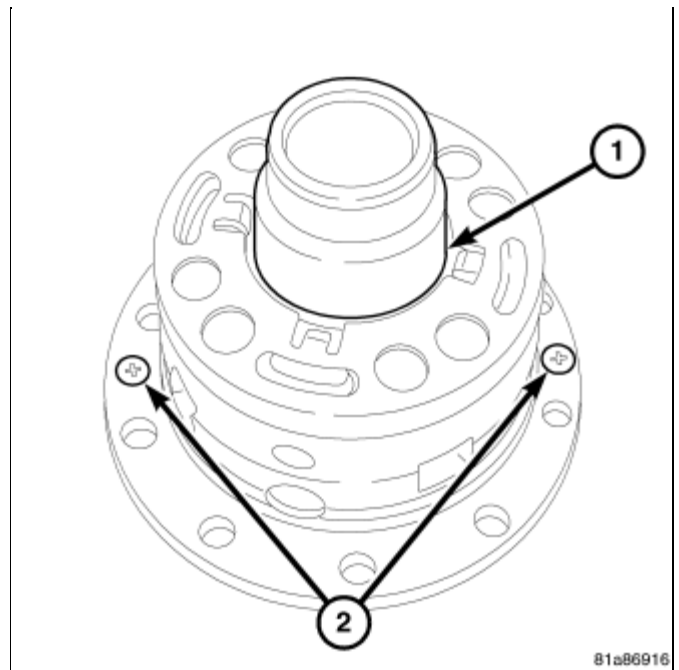
12. Install thrust washer (1) on side gear (2).
13. Install case half and align screw holes.



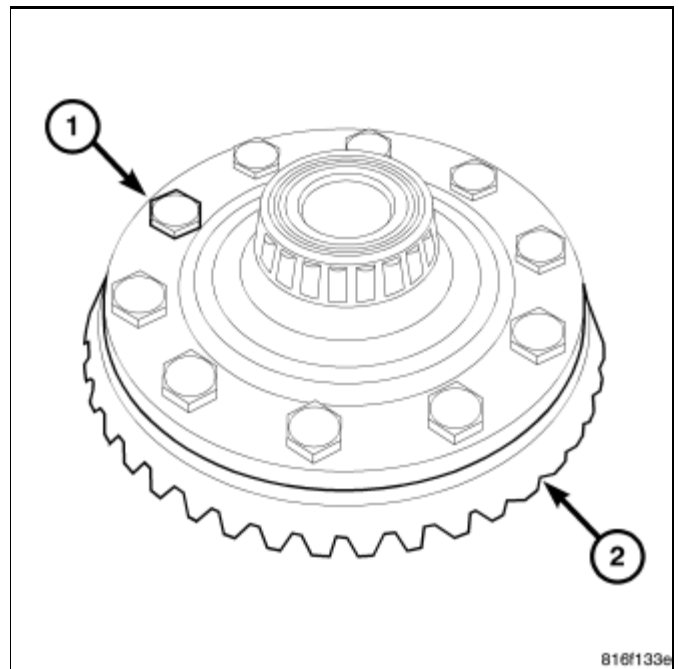
14. Install dog clutch actuator plate (1) on dog clutch and case (2).



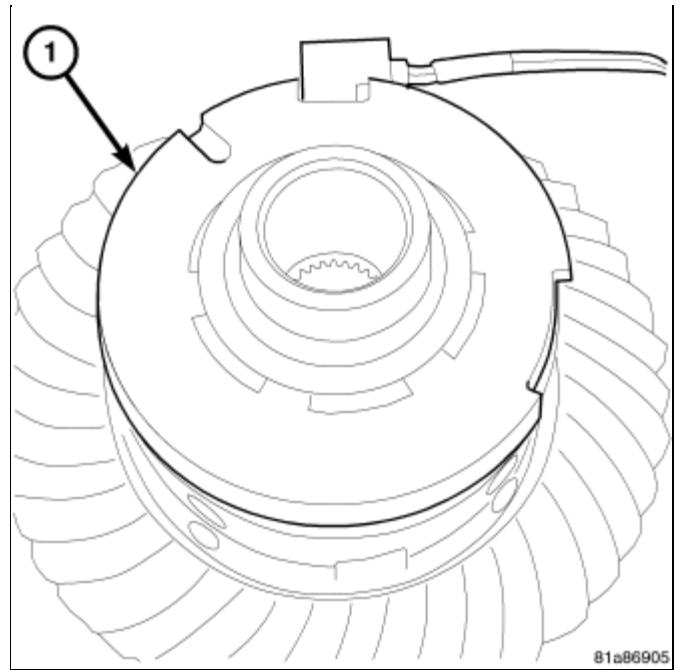
15. Install differential case (1) screws (2).



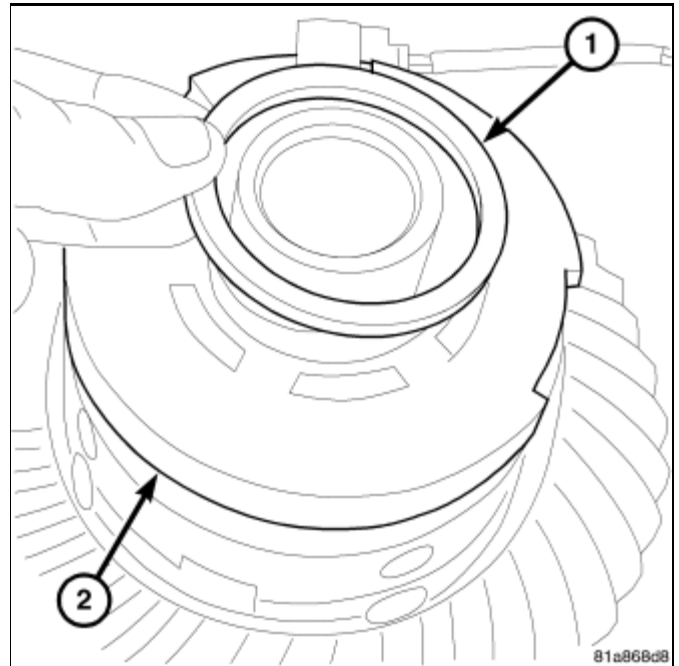
16. Install ring gear with **new** ring gear (2) bolts (1) and alternately tighten to 136 N·m (100 ft. lbs.).



17. Install coil (1) on differential case.

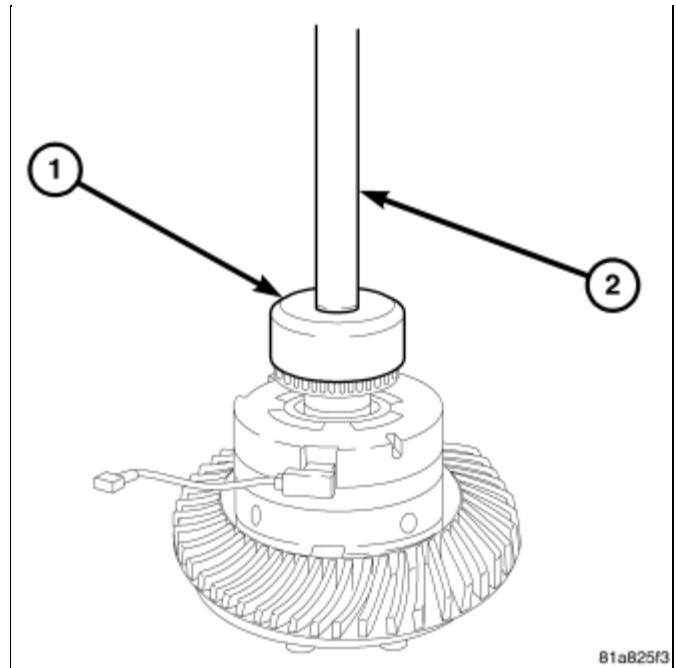


18. Install washer (1) on coil (2).



19. Install differential bearing with Installer C-4213 (1) and Handle C-4171 (2).

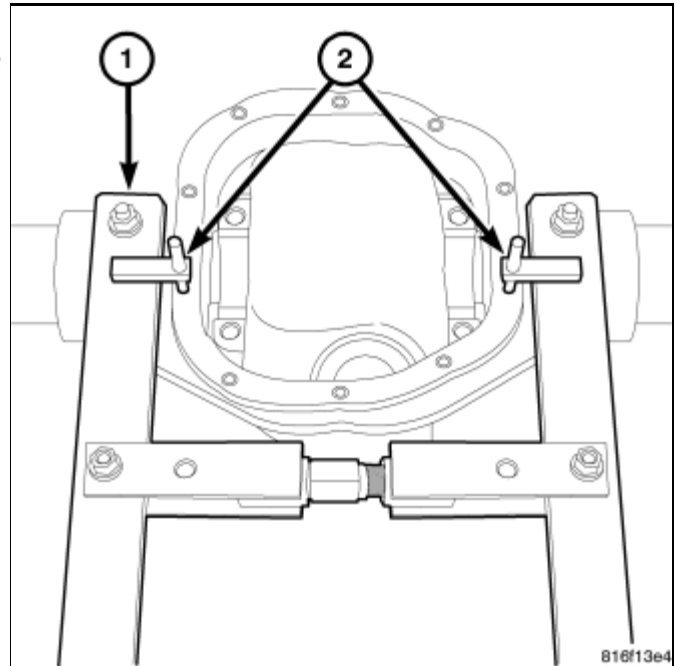
INSTALLATION



81aB25f3

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer **Adjustments (Differential Bearing Preload and Gear Backlash)** to determine the proper shim selection.

1. Position Spreader W-129-B (1) and with dowel pins from Adapter Kit 6987B seated in housing locating holes. Install hold-down clamps (2) and tighten turnbuckle finger-tight.

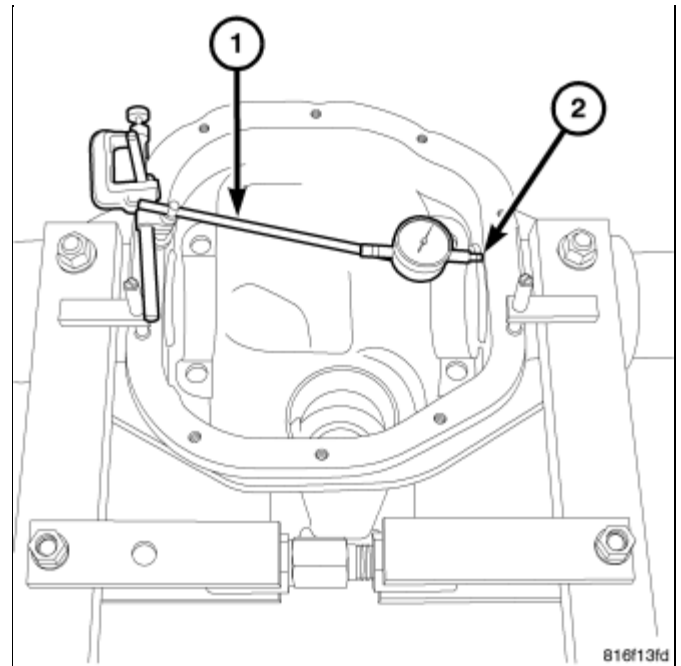


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2. Install Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339A (1) to pin. Load the indicator plunger (2) against the opposite side of the housing and zero the indicator.
3. Spread the housing while measuring the distance with the dial indicator.

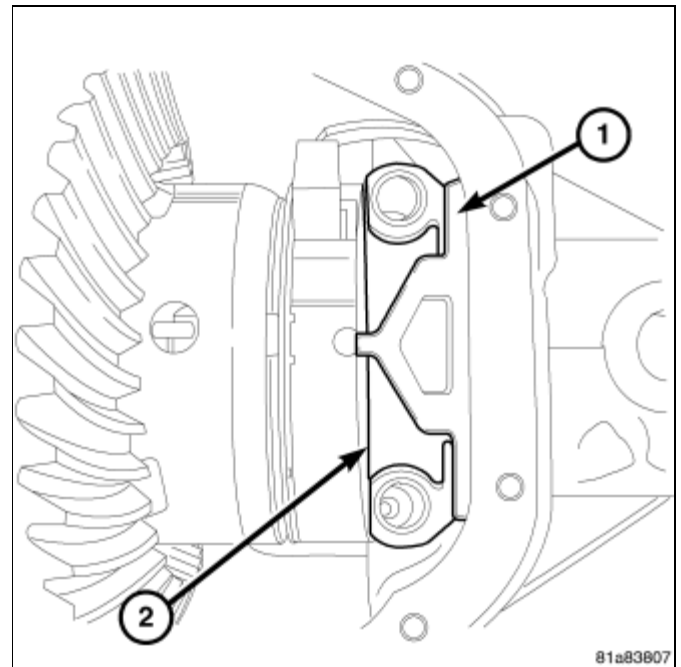
CAUTION: Never spread housing over 0.50 mm (0.020 in). Failure to follow these instructions will damage the housing.

4. Remove the dial indicator.



5. Install differential case into the housing with differential bearing cups and shims in their original locations.

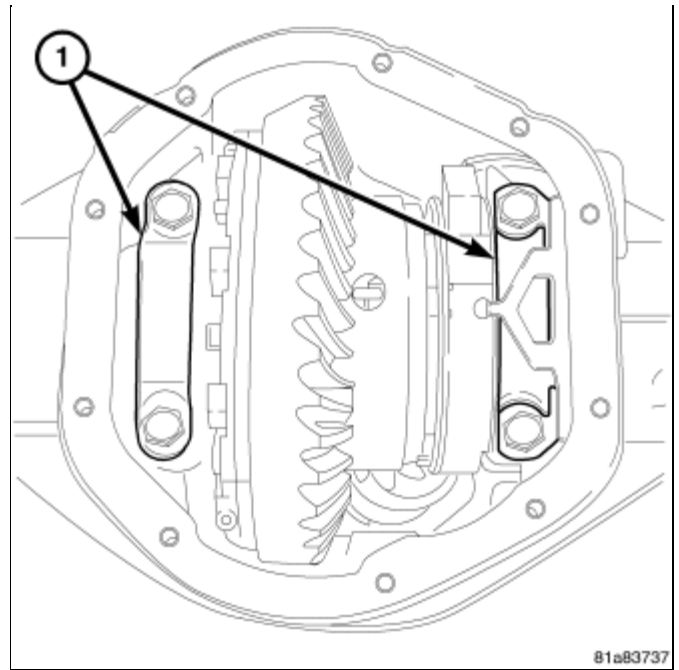
6. Install bearing caps (2) in their original locations and coil anti-rotation bracket (1).



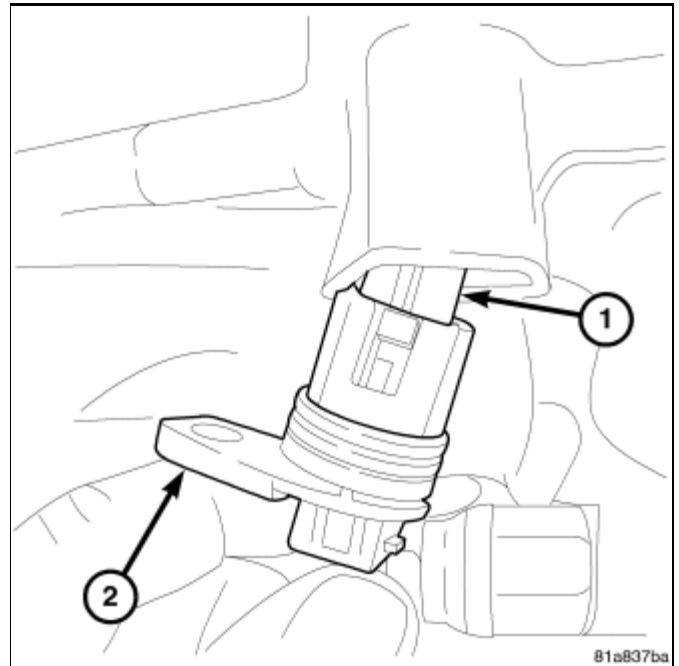
7. Loosely install differential bearing cap bolts.

8. Remove spreader.

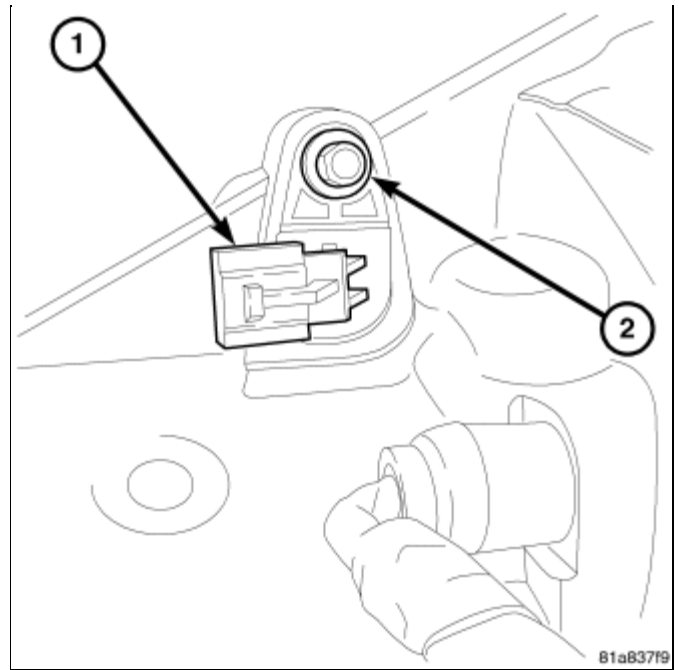
9. Tighten bearing cap (1) bolts in a criss-cross pattern to 108 N·m (80 ft. lbs.).



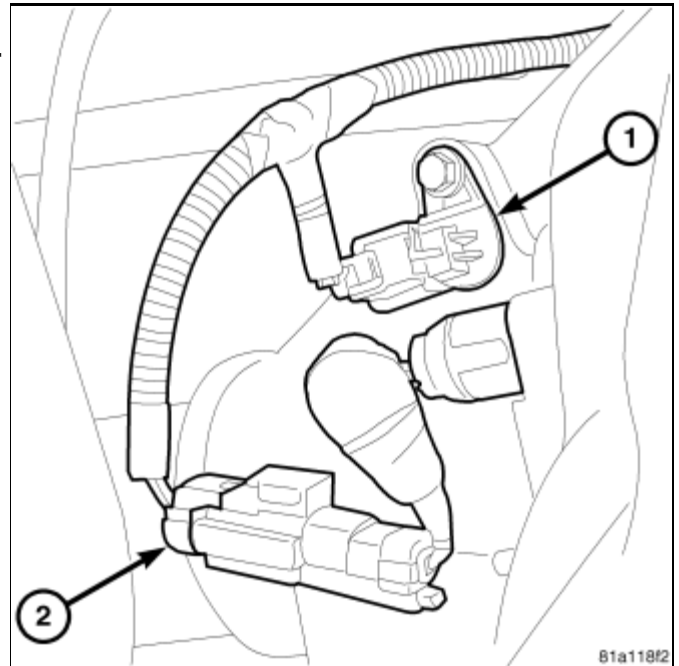
10. Install Tru-Lok coil connector (2) to the coil harness (1).



11. Install Tru-Lok coil connector (1) bolt (2).



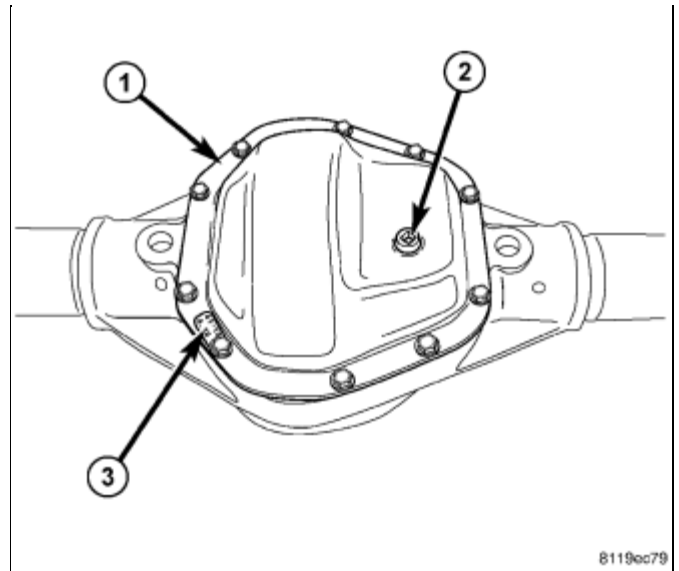
12. Install Tru-Lok harness to the coil (1) and indicator switch (2).



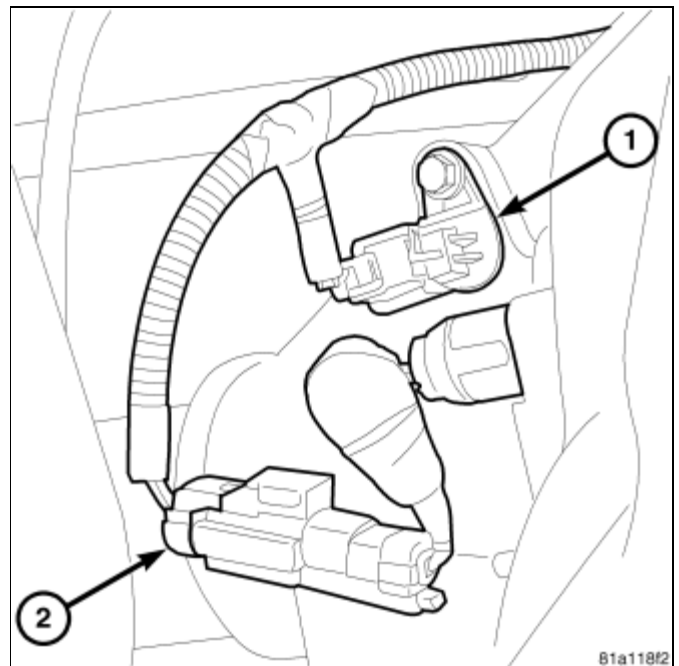
- 13. Install axle shafts.
- 14. Install differential cover (1).

SWITCH-LOCKER

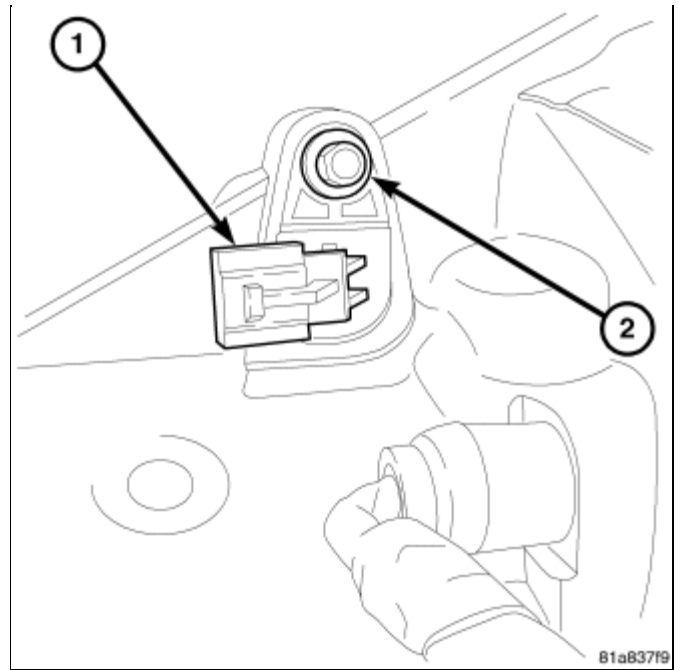
REMOVAL



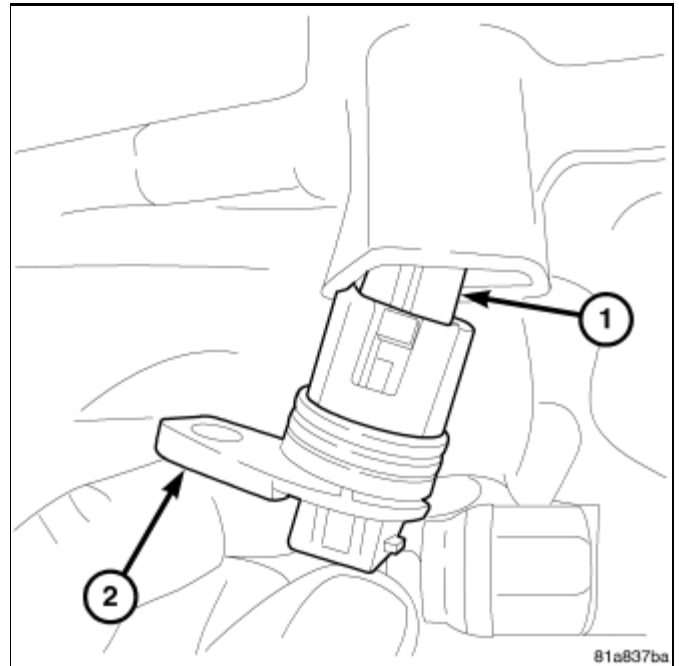
1. Remove Tru-Lok harness from the coil (1) and indicator switch (2).



2. Remove Tru-Lok coil connector (1) bolt (2).

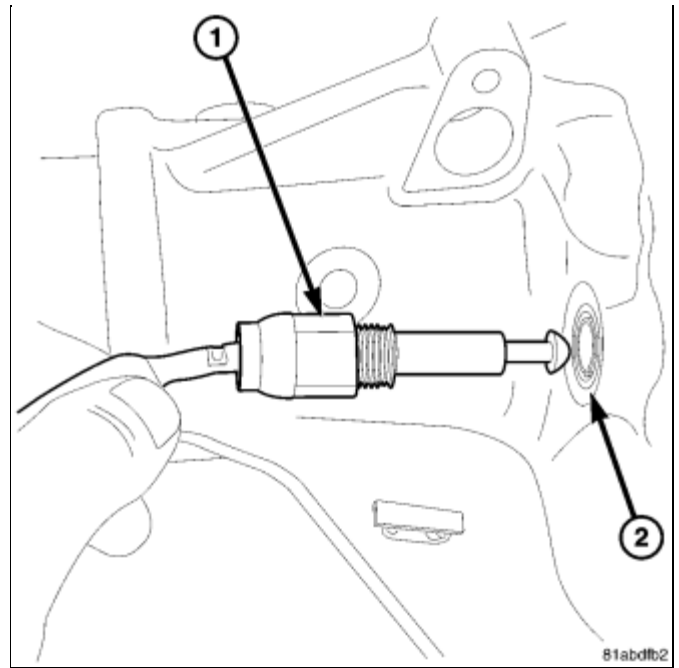


3. Remove Tru-Lok coil connector from the axle housing and remove coil harness (1) from the connector (2).

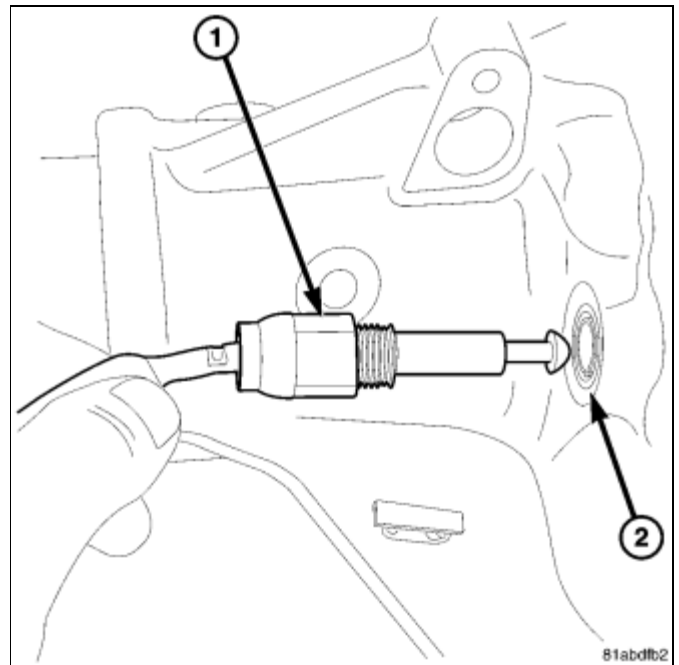


4. Remove differential.
5. Remove Tru-Lok inductor switch (1) from differential housing (2).

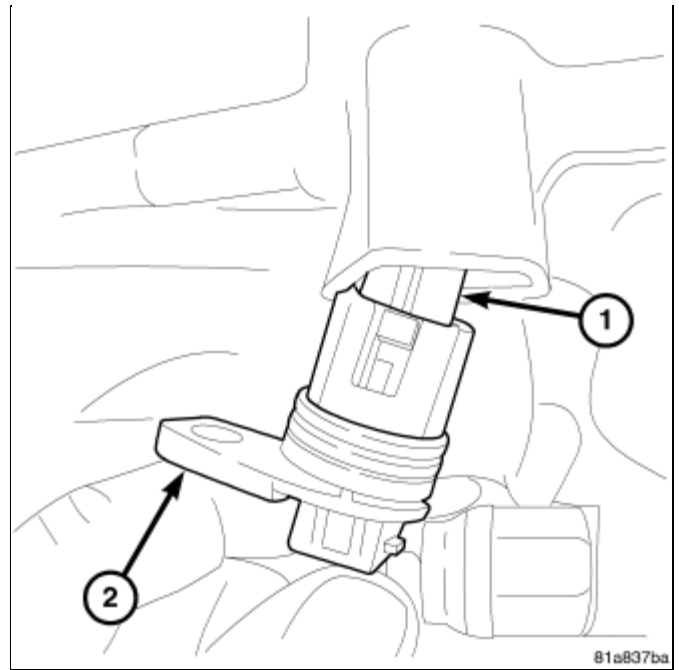
INSTALLATION



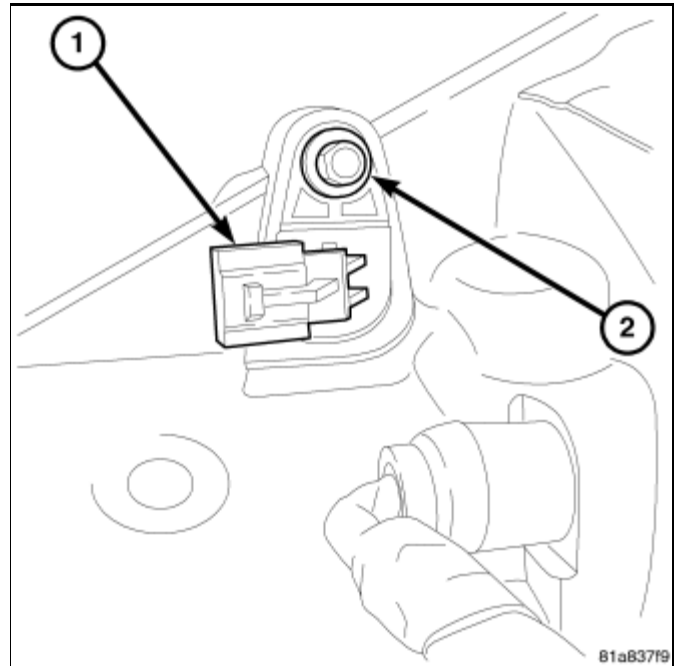
1. Install indicator switch (1) into differential housing (2).



2. Install differential.
3. Install Tru-Lok coil connector (2) to the coil harness (1).



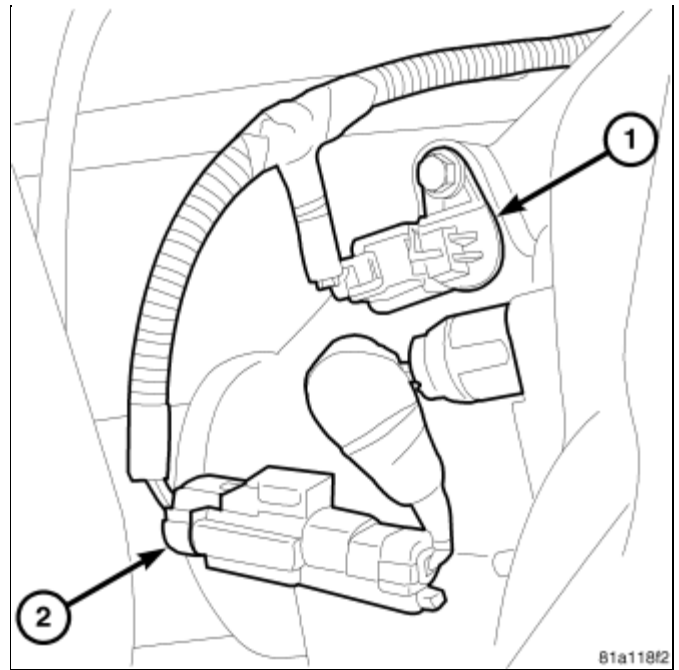
4. Install Tru-Lok coil connector (1) bolt (2).



5. Install Tru-Lok harness to the coil (1) and indicator switch (2).

BEARINGS-DIFFERENTIAL CASE

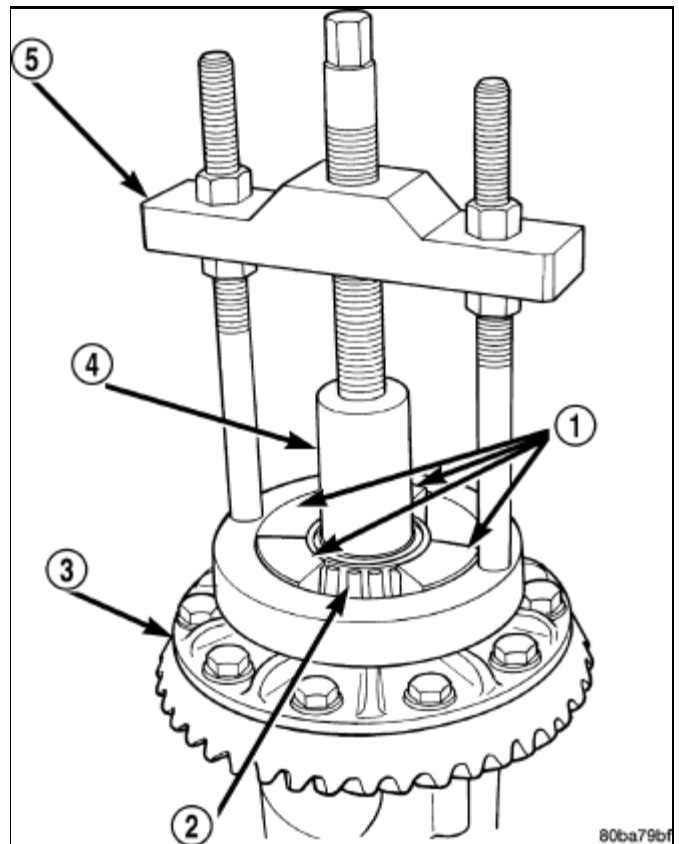
REMOVAL



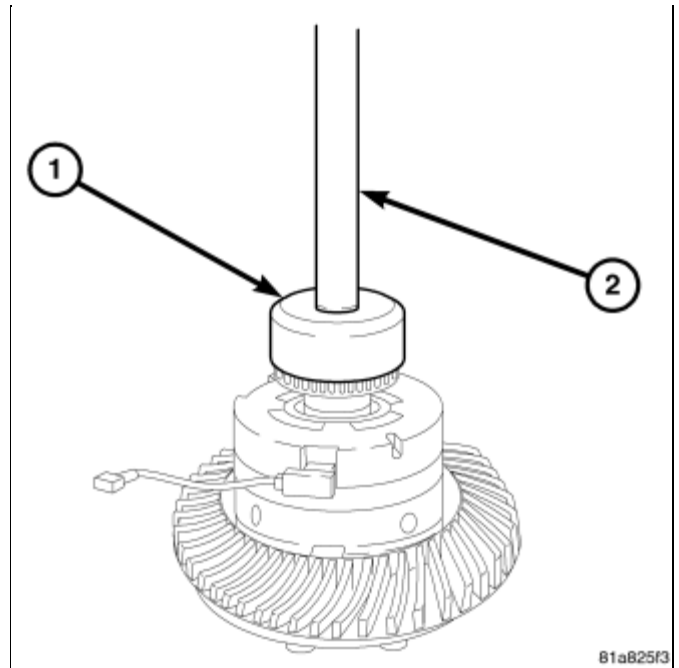
1. Remove differential case from axle housing.
2. Remove bearings (2) from the differential case with Puller C-293-PA (5), Adapters C-293-47 (1) and Plug C-293-3 (4).

NOTE: Use the same tools for the Tru-Lok differential.

INSTALLATION

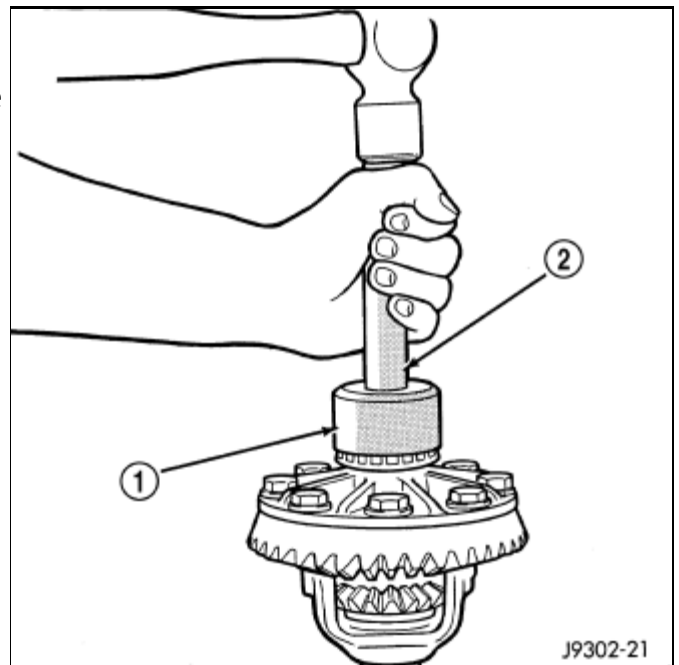


1. Install differential side bearings on Tru-Lok differentials with Installer C-4213 (1) and Handle C-4171 (2).

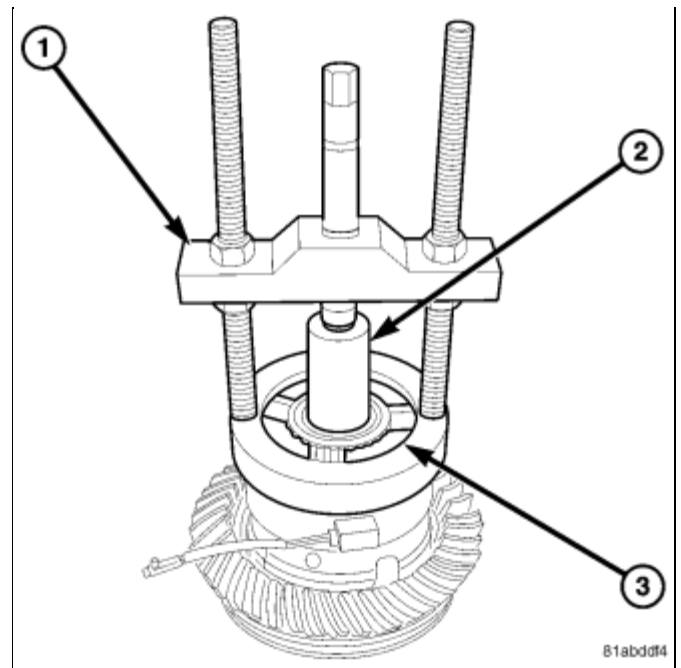


2. Install differential side bearings on open or Trac-Lok® differentials with Installer D-156 (1) and Handle C-4171 (2).
3. Install differential into the housing.

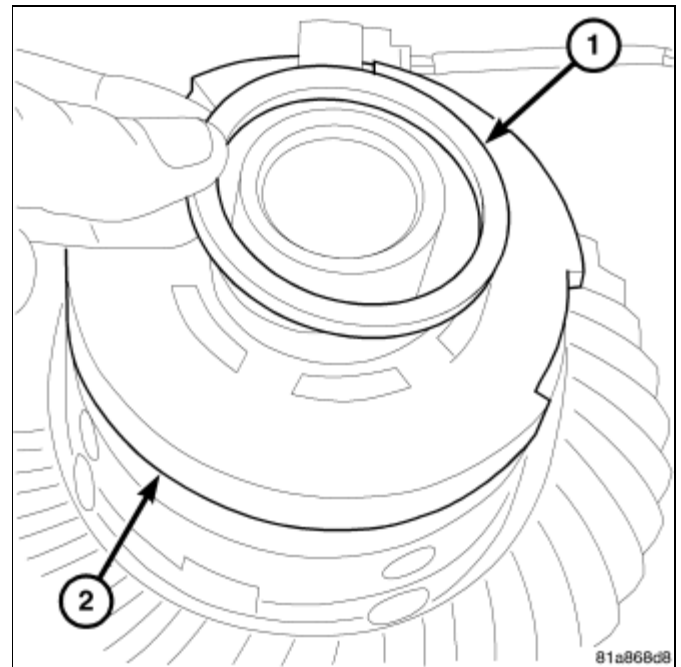
COIL-DIFFERENTIAL REMOVAL



1. Remove differential case from axle housing.
2. Remove bearing from the coil side of the differential case with Puller C-293-PA (1), Plug C-293-3 (2), and Adapters C-293-47 (3).

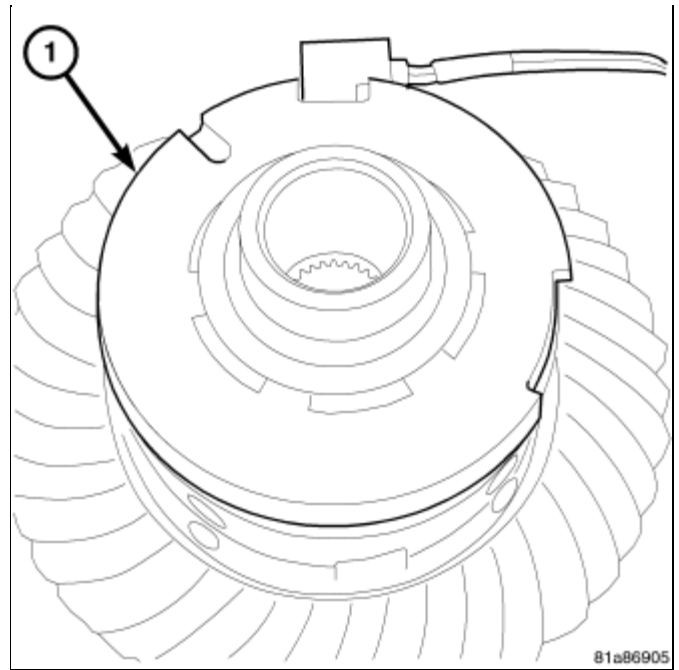


3. Remove thrust washer (1) from differential case and coil (2).

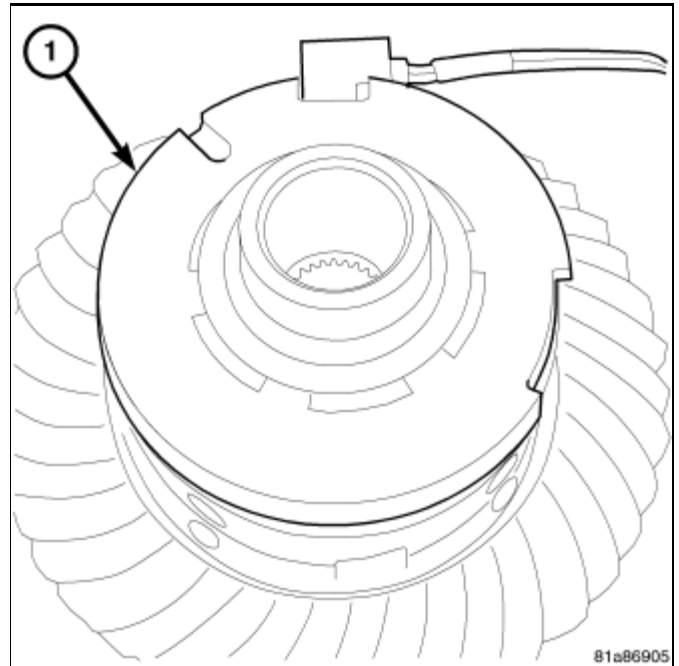


4. Remove coil (1) from differential case.

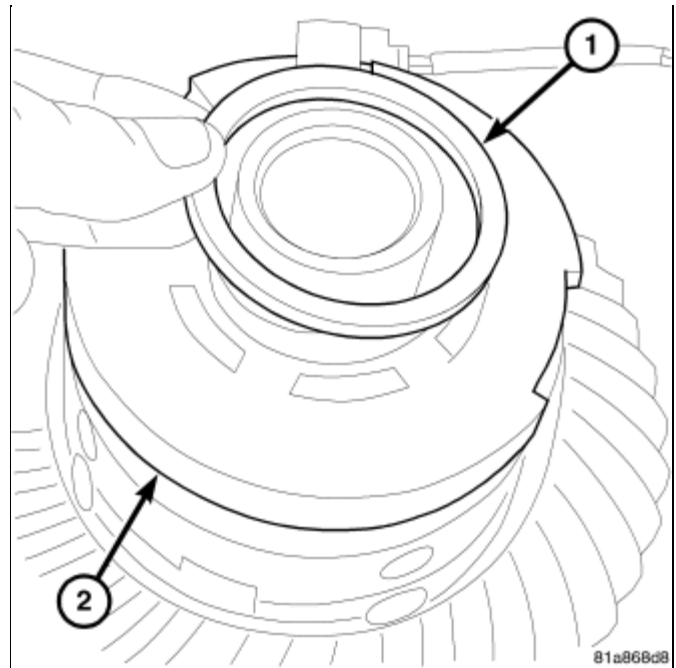
INSTALLATION



1. Install coil (1) on differential case.

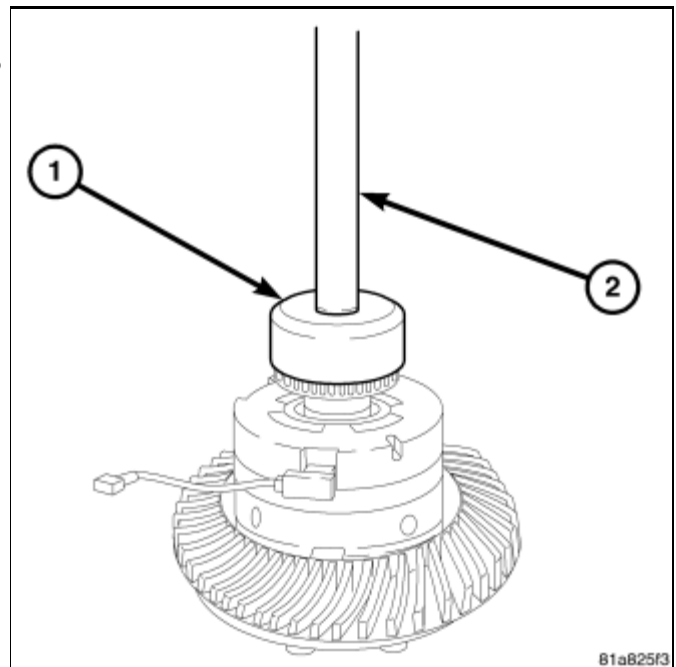


2. Install thrust washer (1) on top of the coil (2).



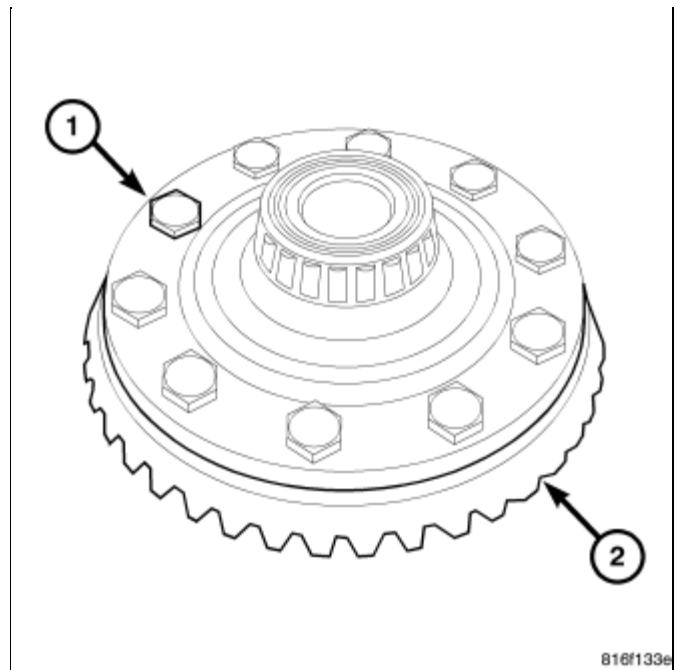
3. Install differential side bearing with Installer C-4213 (1) and Handle C-4171 (2).
4. Install differential into the housing.

GEAR-PINION/RING REMOVAL

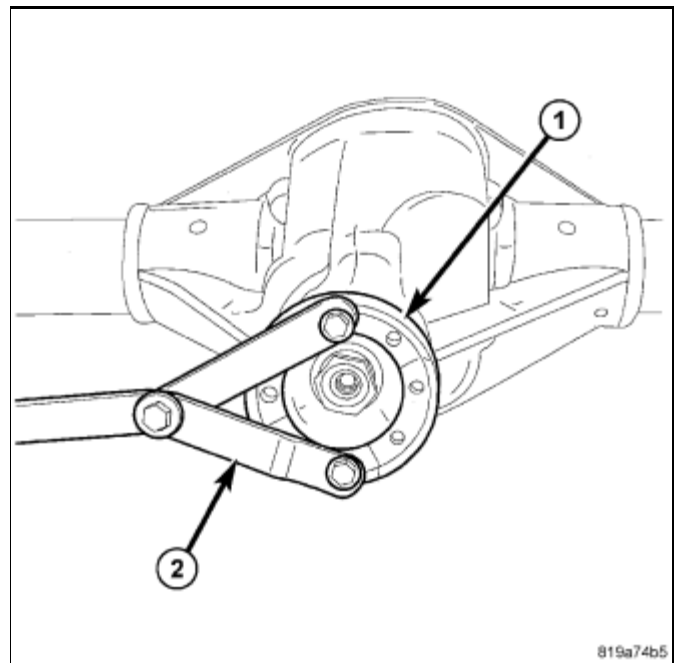


NOTE: The ring gear and pinion are serviced as a matched set. Never replace one gear without replacing the other matched gear.

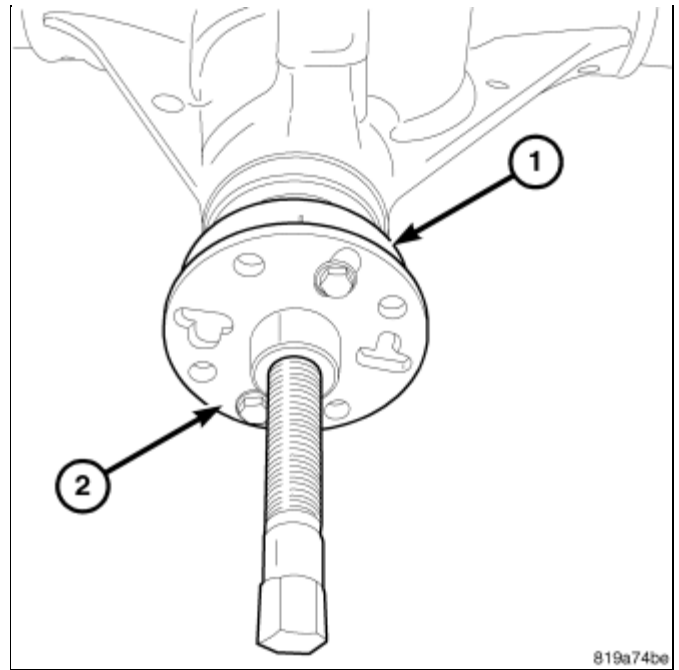
1. Remove differential assembly from axle housing.
2. Remove ring gear bolt (1) and ring gear (2) from differential case.



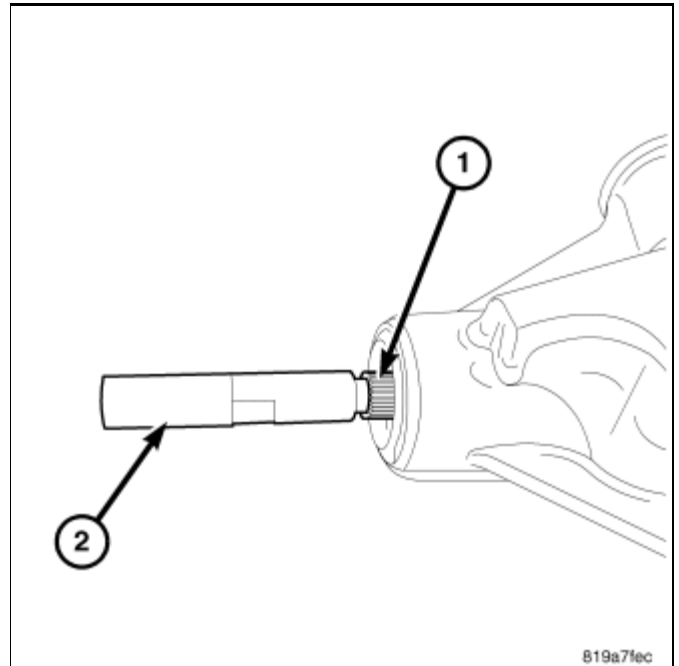
3. Hold pinion flange (1) with Spanner Wrench 6958 (2) and remove the pinion nut and washer.



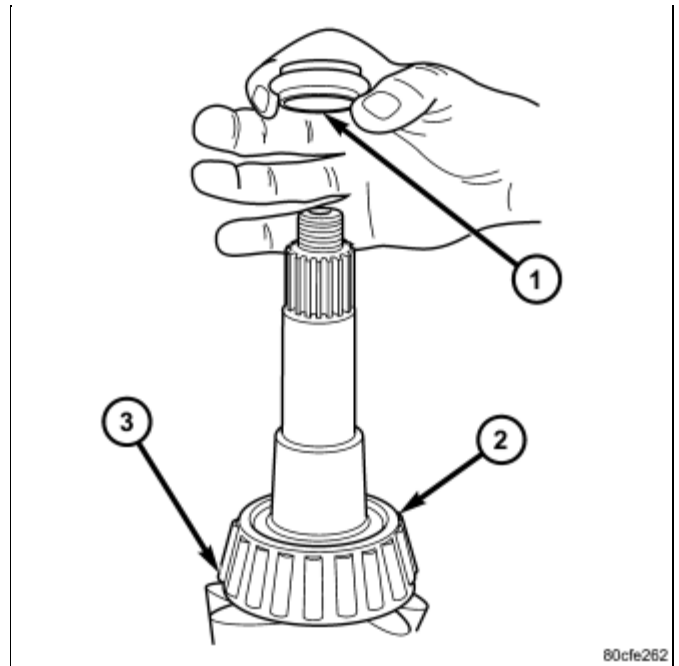
4. Remove pinion flange (1) with Puller C-452 (2).



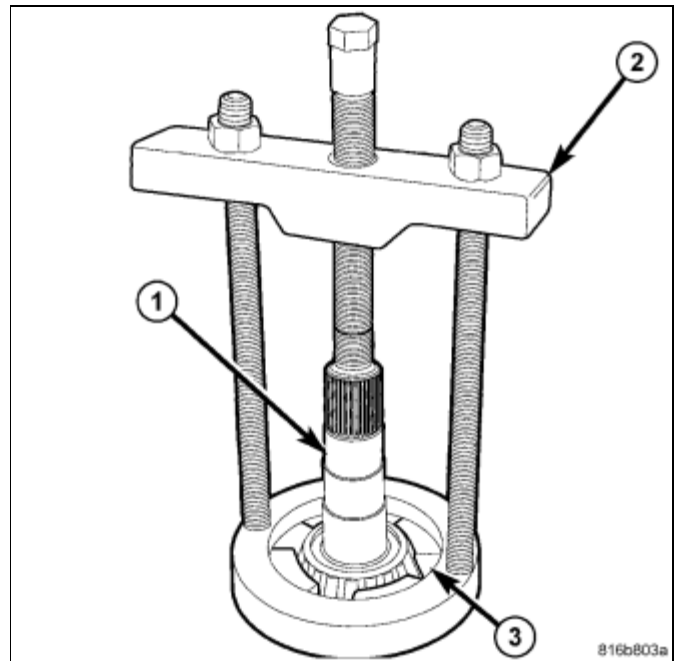
5. Remove pinion gear (1) from the housing with Driver 8976 (2).



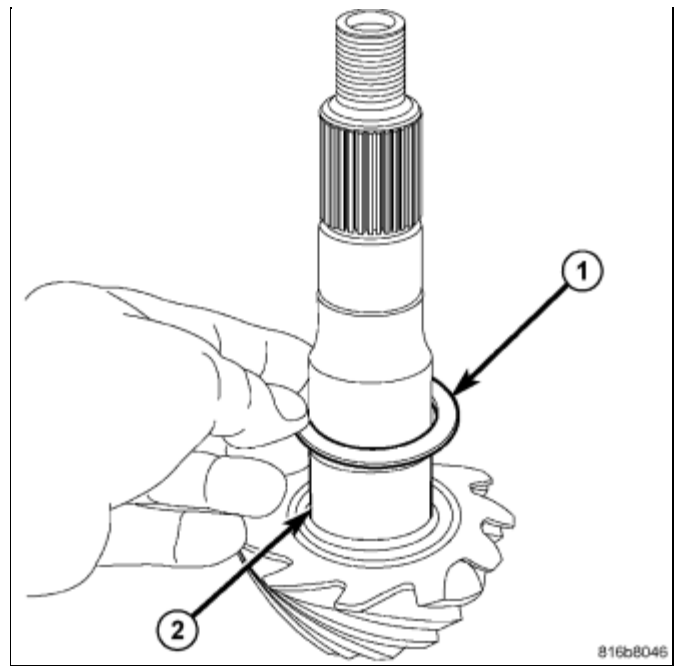
6. Remove collapsible spacer (1) from pinion (3).



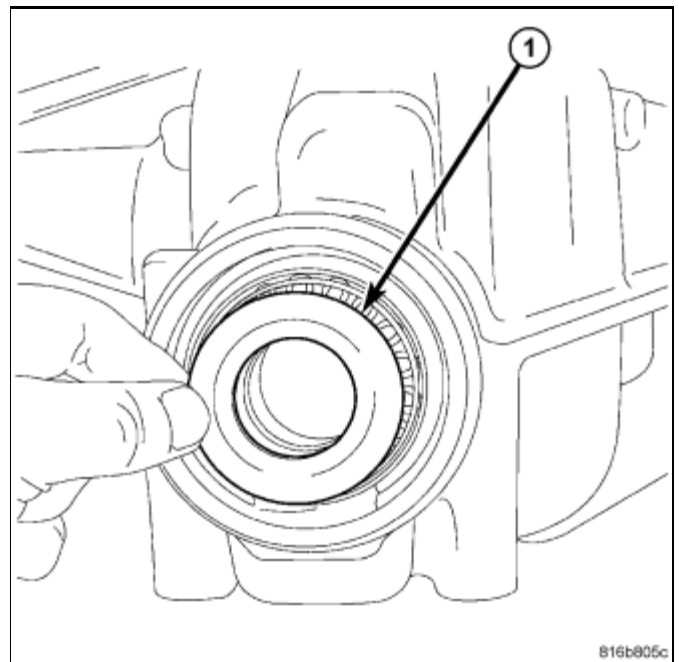
7. Remove rear pinion bearing from pinion shaft (1) with Puller C-293-PA (2) and Adapters C-293-47 (3).



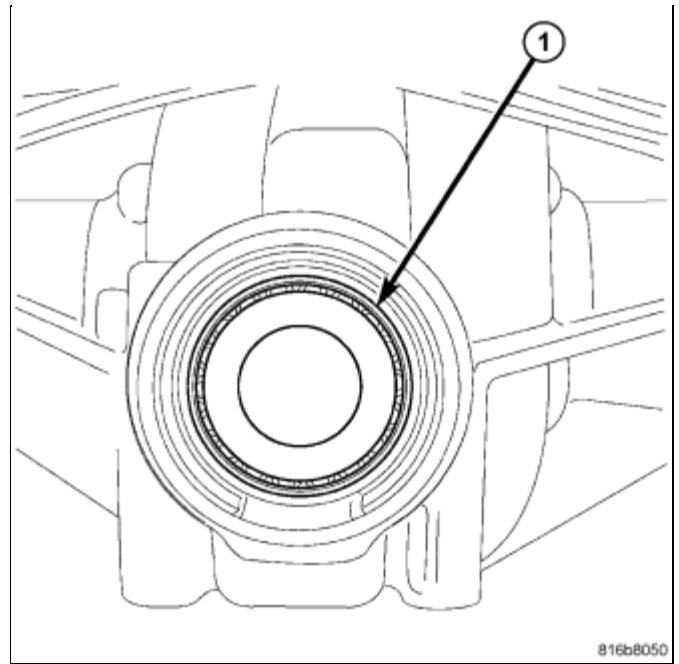
8. Remove and record pinion depth shims (1) from the pinion gear shaft (2).



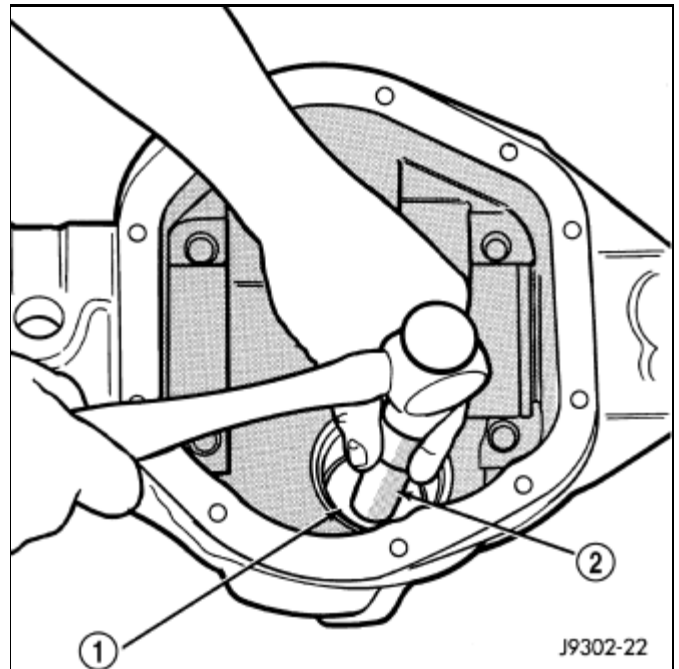
9. Remove pinion seal with seal puller and remove oil slinger (1).



10. Remove front pinion bearing (1).

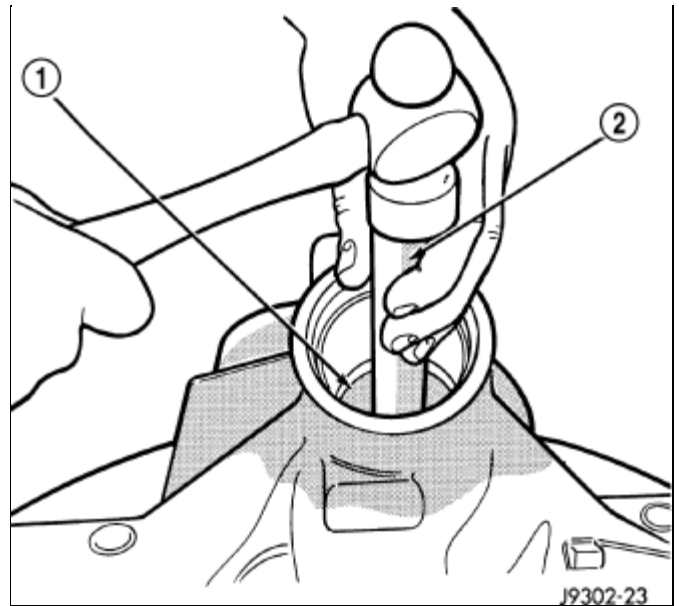


11. Remove front pinion bearing cup from differential housing with Remover D-103 (1) and Handle C-4171 (2).

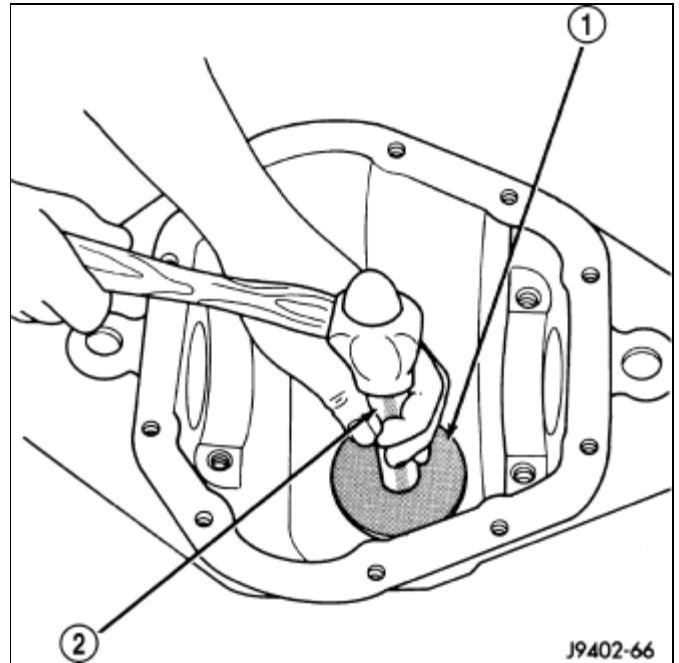


12. Remove rear pinion bearing cup from differential housing with Remover C-4307 (1) and Handle C-4171 (2).

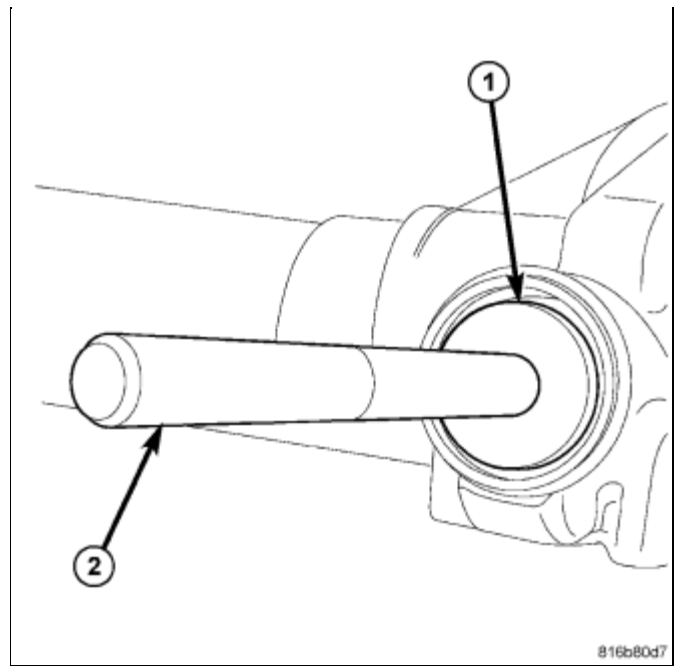
INSTALLATION



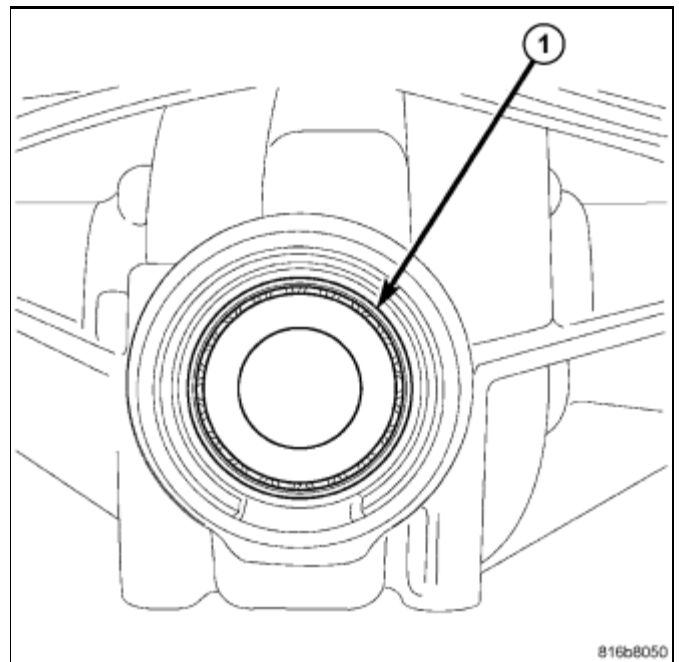
1. Install rear bearing cup with Installer C-4308 (1) and Handle C-4171 (2).



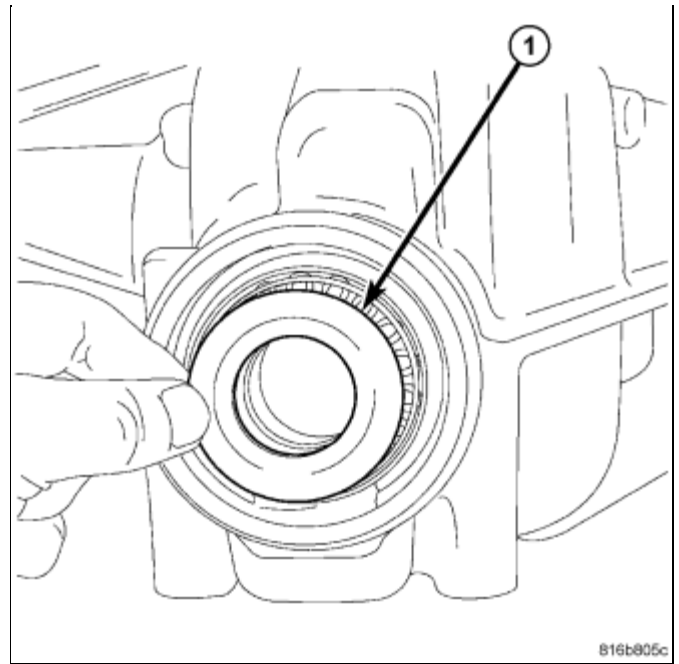
2. Install front bearing cup with Installer D-129 (1) and Handle C-4171 (2).



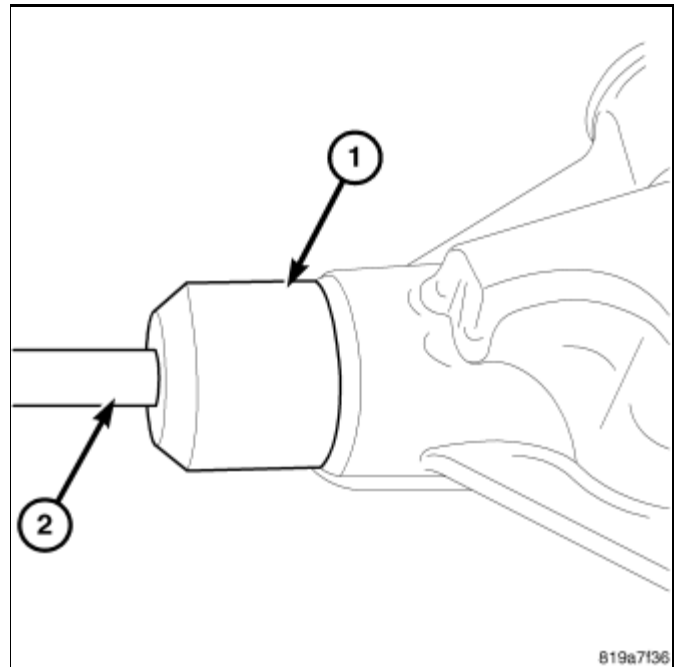
3. Install front pinion bearing (1).



4. Install front pinion bearing oil slinger (1).

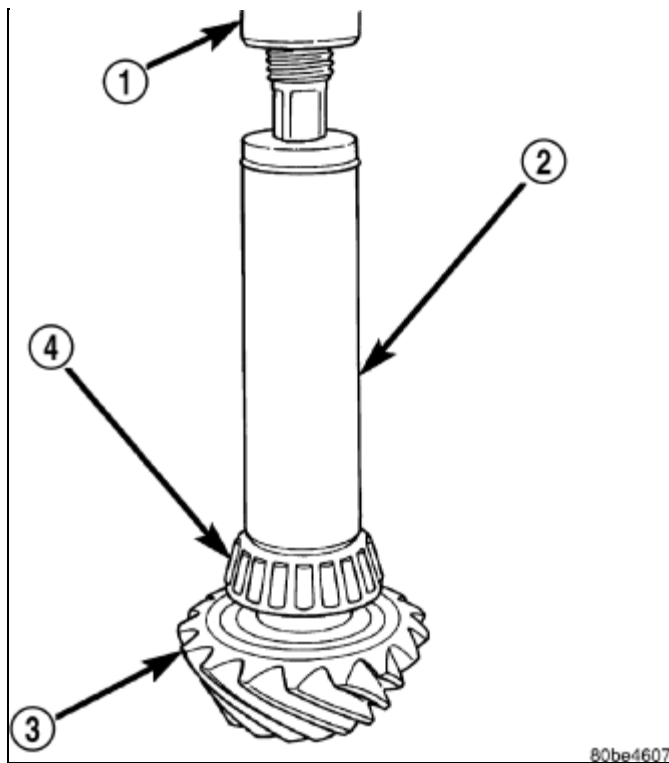


5. Apply a light coating of gear lubricant on the lip of pinion seal. Install pinion seal with Installer 8681 (1) and Handle C-4171 (2).



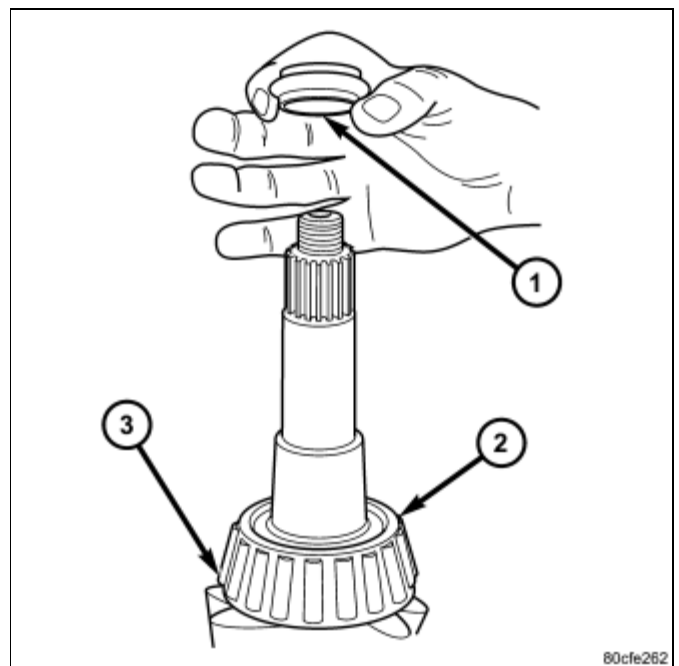
6. Install pinion depth shims (1) on the pinion shaft (2).

7.



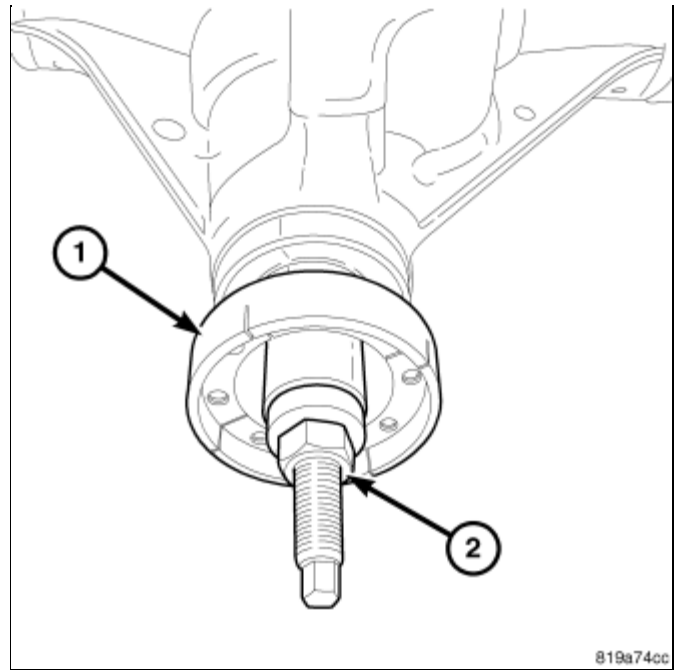
Install rear pinion bearing (4) on the pinion gear (3) with Installer C-4040 (2) and a press (1).

8. Install collapsible spacer (1) on pinion shaft (3).



9. Install pinion gear into the housing.

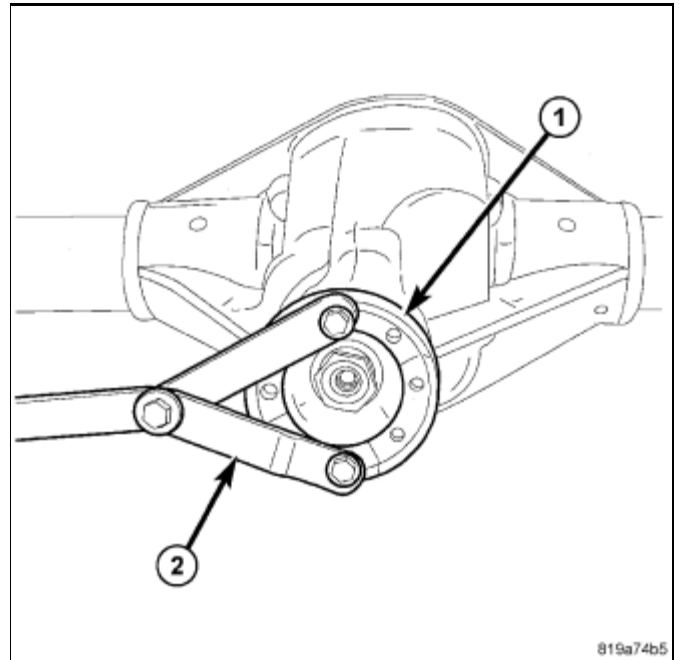
10. Install pinion flange (1) with Installer C-3718 (2).



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11. Install pinion washer and a new nut. Hold pinion flange with Spanner Wrench 6958 and tighten pinion nut to 217 N·m (160 ft. lbs.).

12. Set torque wrench to 271 N·m (200 ft. lbs.) and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until Pinion Torque To Rotate specification is achieved.

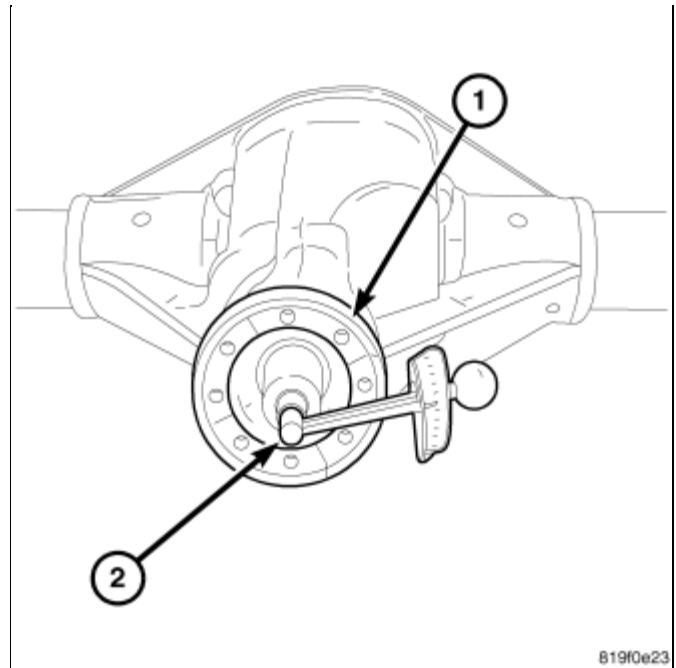


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13. Measure Pinion Torque To Rotate (1) (PTTR) after each 6.8 N·m (5 ft. lbs.) increment with an inch pound torque wrench (2).

Pinion Torque To Rotate is:

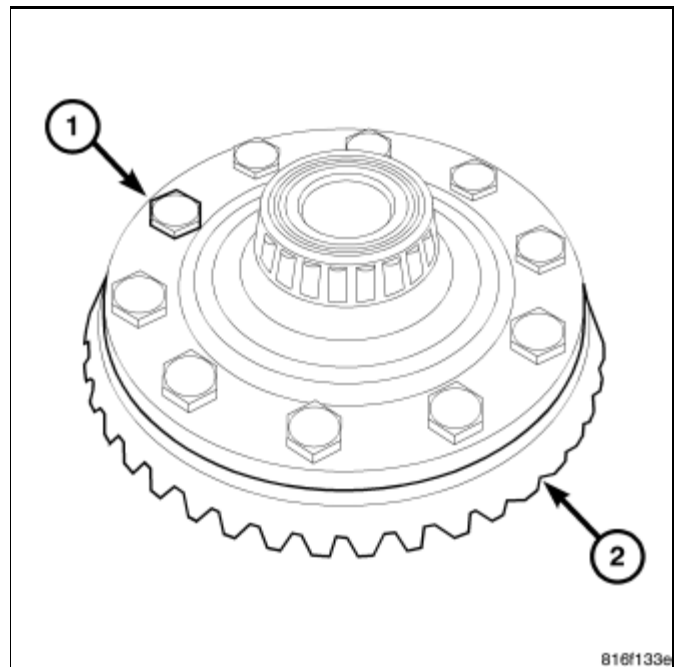
- **Original Bearings** - 1 to 2 N·m (10 to 20 in. lbs.)
- **New Bearings** - 2 to 4.5 N·m (20 to 40 in. lbs.)



14. Install **new** ring gear bolts (1) and alternately tighten to 183 N·m (135 ft. lbs.).

CAUTION: Never reuse ring gear bolts, the bolts can fracture causing extensive damage. Failure to these instruction may result in damage.

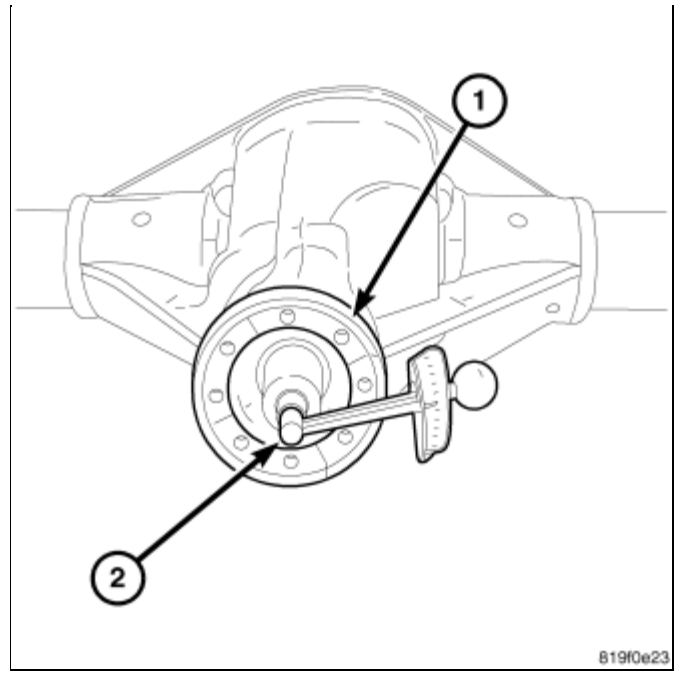
15. Install differential in axle housing and verify gear backlash, mesh and contact pattern.



16. Measure Total Torque To Rotate (TTTR) with an inch pound torque wrench (2) before installing the axle shafts.

Total Torque To Rotate is: Pinion Torque To Rotate plus 0.79 - 1.24 N·m (7 - 11 in lbs.).

NOTE: If TTTR is too high, decrease shim thickness equally from both sides of the differential and check TTTR again. If TTTR is too low, increase shim thickness equally to both sides of the differential and check TTTR again.



4 - VEHICLE QUICK REFERENCE

FLUID - CAPACITIES & RECOMMENDED

SPECIFICATIONS

RECOMMENDED FLUIDS, LUBRICANTS AND GENUINE PARTS

ENGINE

Component	Fluid, Lubricant, or Genuine Part
Engine Coolant	Mopar ® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology)
Engine Oil	API Certified SAE 5W-20 Engine Oil is recommended. Meets the requirements of DaimlerChrysler Material Standard MS-6395. Refer to your engine oil filler cap for correct SAE grade.
Spark Plugs (3.8L Engine)	RE14PLP5 (Gap 0.050 in [1.27 mm])
Oil Filter (3.8L Engine)	Mopar ® Oil Filter (P/N 04105409AC)
Fuel Selection	87 Octane

ENGINE - EXPORT

Component	Fluid, Lubricant, or Genuine Part
Engine Coolant	Mopar ® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology)
Engine Oil - Gasoline (Non ACEA Categories)	Use API Certified SAE 5W-20 engine oil, meeting the requirements of DaimlerChrysler Material Standard MS-6395. Refer to your engine oil filler cap for correct SAE grade. SAE 5W-30 engine oil approved to MB 229.31 or MB 229.51 may be used when SAE 5W-20 engine oil is not available.
Engine Oil - Gasoline (ACEA Categories)	For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3, and approved to MB 229.31 or MB 229.51. SAE 5W-30 engine oil approved to MB 229.31 or MB 229.51 may be used when SAE 5W-20 engine oil is not available.
Engine Oil - Diesel (without Particulate Filter)	Use SAE 0W-40 diesel engine oils confirming to API Quality CI-4 or CJ-4. For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3 and approved to MB 229.31 or MB 229.51.

Engine Oil - Diesel (with Particulate Filter)	Use SAE 5W-30 diesel engine oils conforming to API Quality CI-4 or CJ-4. For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils meeting the requirements of ACEA C3 (LOW ASH) and approved to MB 229.31 or MB 229.51.
Spark Plugs (3.8L Engine)	RE14PLP5 (Gap 0.050" [1.27 mm])
Oil Filter (2.8L Diesel Engine)	Mopar ® Oil Filter (P/N 5003558AA)
Oil Filter (3.8L Engine)	Mopar ® Oil Filter (P/N 04105409AC)
Fuel Selection (Gasoline Engines)	91 Octane
Fuel Selection (Diesel Engines)	50 Cetane or higher (Less than 15 ppm Sulfur)

CHASSIS

Component	Fluid, Lubricant, or Genuine Part
Automatic Transmission	Mopar ® ATF+4 Automatic Transmission Fluid
Manual Transmission	Mopar ® Manual Transmission Lubricant or equivalent (meeting the requirements of DaimlerChrysler Material Standard MS-9224)
Transfer Case	Mopar ® ATF+4 Automatic Transmission Fluid or equivalent.
Brake Master Cylinder	Mopar ® DOT 3 Brake Fluid, SAE J1703 should be used. If DOT 3, SAE J1703 brake fluid is not available, then DOT 4 is acceptable. Use only recommended brake fluids.
Power Steering Reservoir	Mopar ® ATF+4 Automatic Transmission Fluid Mopar ® Power Steering Fluid + 4, Mopar ® ATF+4 Automatic Transmission Fluid

CHASSIS - EXPORT

Component	Fluid, Lubricant, or Genuine Part
Automatic Transmission	Mopar ® ATF+4 Automatic Transmission Fluid
Manual	Mopar ® Manual Transmission Lubricant or equivalent (meeting the requirements of DaimlerChrysler Material

Transmission	Standard MS-9224)
Transfer Case	Mopar ® ATF+4 Automatic Transmission Fluid or equivalent.
Brake Master Cylinder	Mopar ® DOT 3 Brake Fluid, SAE J1703 should be used. If DOT 3, SAE J1703 brake fluid is not available, then DOT 4 is acceptable. Use only recommended brake fluids.
Power Steering Reservoir	Mopar ® ATF+4 Automatic Transmission Fluid Mopar ® Power Steering Fluid + 4, Mopar ® ATF+4 Automatic Transmission Fluid

AXLES

FRONT AXLE		U.S.	Metric
186 FBI (Model 30)	Mopar ® Gear Lubricant 80W-90	2.1 Pints	1.0 Liters
216 FBI (Model 44)	Mopar ® Gear Lubricant 80W-90	2.7 Pints	1.3 Liters
REAR AXLE			
226 RBI (Model 44)	Mopar ® Gear Lubricant 80W-90 (Trailer Towing Mopar ® Synthetic Gear Lubricant 75W-140)	4.75 Pints*	2.25 Liters
Trac-lok ® equipped axles require 0.1 L (3.4 ounces) of Limited Slip Additive in the lubricant.			

CAPACITIES

	U.S.	Metric
Fuel (Approximate) — 2 Door Models	18.5 Gallons	70 Liters
Fuel (Approximate) — 4-Door Models	22.5 Gallons	85 Liters
Engine Oil with Filter		
3.8 Liter Engine (SAE 5W-20, API Certified Engine Oil)	6 Quarts	5.7 Liters
Cooling System *		
3.8 Liter Engine (Mopar ® Antifreeze/Engine Coolant 5 Year/100,000 Mile (160 000 km) Formula)	13 Quarts	12 Liters
POWER STEERING SYSTEM		

Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures.

A/C REFRIGERANT SYSTEM

Single Unit	1.125 lbs	0.51 kg
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AUTOMATIC TRANSMISSION

Service Fill - 45RFE/545RFE	4X2 - 5.5 Quarts)	4X2 - 5.2 Liters
	4X4 - 6.5 Quarts	4X4 - 6.2 Liters
Overhaul - 45RFE/545RFE	14.8–16.9 Quarts ¹	14-16 Liters
Service Fill - 42RLE	8.0 Pints	3.8 Liters
Overhaul Fill - 42RLE	17.6 Pints ¹	8.3 Liters

¹Dry fill capacity. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE).

TRANSFER CASE

NV241	4.2 Pints	2.0 Liters
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MANUAL TRANSMISSION

NSG 370 Approximate dry fill or fill to bottom edge of the fill plug hole.	3.17 Pints	1.5 Liters
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****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.

* Includes heater and coolant recovery bottle filled to MAX level.

CAPACITIES - EXPORT

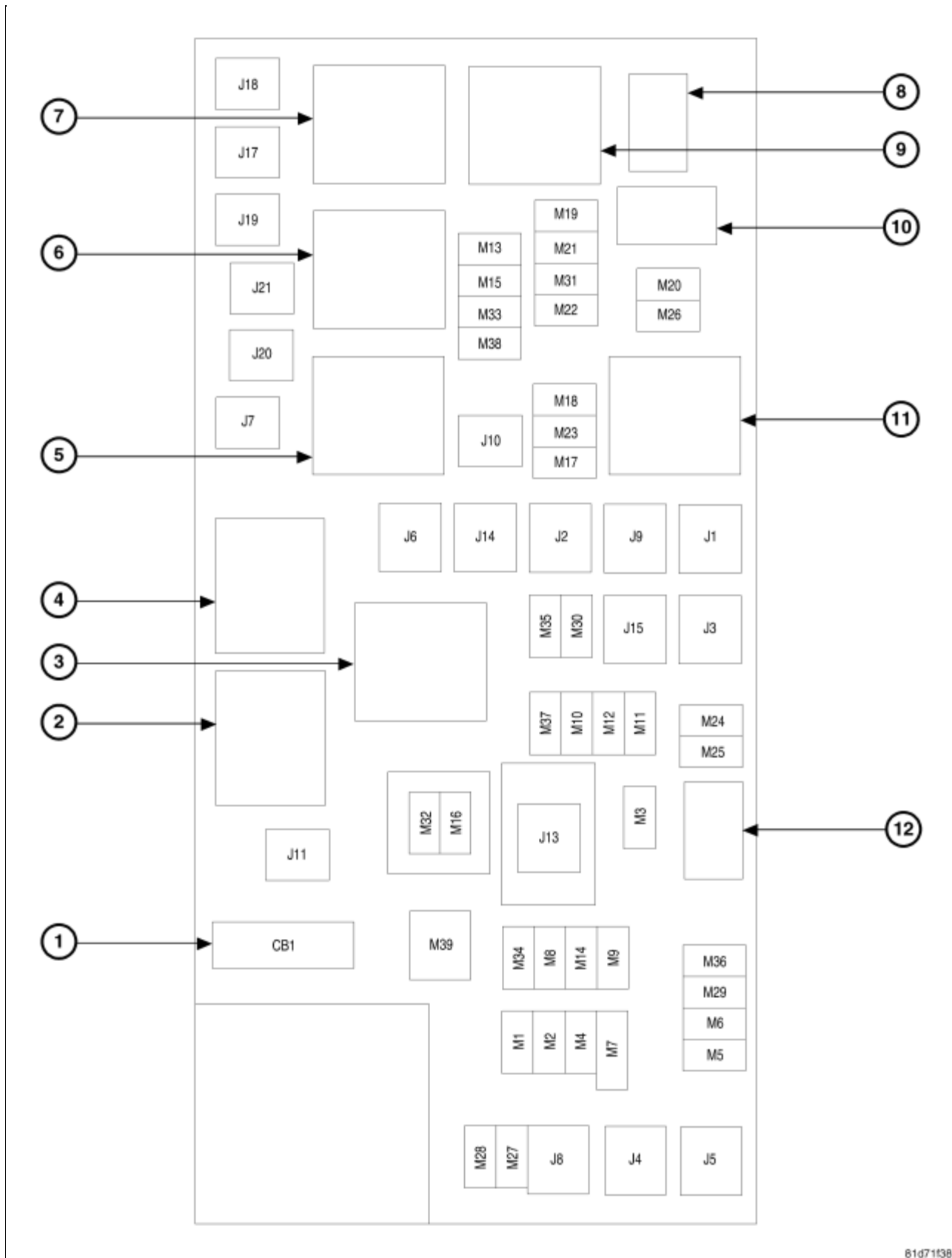
	U.S.	Metric
Fuel (Approximate) — 2 Door Models	18.5 Gallons	70 Liters
Fuel (Approximate) — 4 Door Models	22.5 Gallons	85 Liters
Engine Oil with Filter		
Engine Oil - with Filter - 2.8L	7 Quarts	6.6 Liters

Engine Oil - with Filter - 3.8L	6 Quarts	5.7 Liters
Cooling System *		
2.8 Liter Diesel Engine (Glysantin G 30–91 Antifreeze/Engine Coolant 5 Year/150,000 Mile Formula)	13 Quarts	12 Liters
3.8 Liter Engine (Mopar ® Antifreeze/Engine Coolant 5 Year/100,000 Mile Formula)	13 Quarts	12 Liters
* Includes heater and coolant recovery bottle filled to MAX level.		
POWER STEERING SYSTEM		
Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures.		
A/C REFRIGERANT SYSTEM		
Single Unit	1.125 lbs	0.51 kg
AUTOMATIC TRANSMISSION		
Service Fill - 45RFE/545RFE	4X2 - 5.5 Quarts	4X2 - 5.2 Liters
	4X4 - 6.5 Quarts	4X4 - 6.2 Liters
Overhaul - 45RFE/545RFE	14.8–16.9 Quarts ¹	14-16 Liters
Service Fill - 42RLE	8.0 Pints	3.8 Liters
Overhaul Fill - 42RLE	17.6 Pints ¹	8.3 Liters
¹ Dry fill capacity. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE).		
TRANSFER CASE		
NV241	4.2 Pints	2.0 Liters
MANUAL TRANSMISSION		
NSG 370 Approximate dry fill or fill to bottom edge of the fill plug hole.	3.17 Pints	1.5 Liters
*****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

FUSE LOCATIONS & TYPES

SPECIFICATIONS

FUSES (TOTALLY INTEGRATED POWER MODULE)



The Totally Integrated Power Module (TIPM) is located in the engine compartment near the battery. This center contains cartridge fuses, mini fuses and relays. A label that identifies each component is printed on the inside of the cover.

Cavity	Cartridge Fuse	Mini Fuse	Description
J1	—		—
J2	30 Amp Pink		Transfer Case Module
J3	—		—
J4	25 Amp Natural		Driver Door Node
J5	25 Amp Natural		Passenger Door Node
J6	40 Amp Green		Anti-Lock Brake System (ABS) Pump Feed/ESP
J7	30 Amp Pink		Anti-Lock Brake System (ABS) Valve Feed/ESP
J8	—		—
J9	40 Amp Green		PZEV Sec Motor Feed/Flex Fuel
J10	30 Amp Pink		Headlamp Wash Relay/Manifold Tuning Valve
J11	30 Amp Pink		Sway Bar
J13	60 Amp Yellow		Ignition Off Draw (IOD) — Main
J14	40 Amp Green		EBL (Rear Window Defogger)
J15	30 Amp Pink		Rear Blower
J17	40 Amp Green		Starter Solenoid
J18	20 Amp Yellow		Powertrain Control Module (PCM) Trans Range
J19	60 Amp Yellow		Radiator Fan
J20	30 Amp		Front Wiper LO/HI

	Pink		
J21	20 Amp Yellow		Front/Rear Washer
J22	—		Spare
M1		15 Amp Blue	Center High-Mounted Stop Light (CHMSL)/Switch Stop Lamp Feed
M2		20 Amp Yellow	Relay Trailer Lighting (Stop)
M3		20 Amp Yellow	Frt/Rear Axle Locker Relay
M4		—	—
M5		—	—
M6		20 Amp Yellow	Power Outlet #1/Rain Sensor
M7		20 Amp Yellow	Power Outlet #2 (BATT/ACC SELECT)
M8		20 Amp Yellow	Front Heated Seat
M9		20 Amp Yellow	Rear Heated Seat (If Equipped)
M10		20 Amp Yellow	Ignition Off Draw — Vehicle Entertainment System (IOD-VES), Satellite Digital Audio Receiver (SDARS), DVD, Hands-Free Module (HFM), RADIO, Antenna (ANT), Universal Garage Door Opener (UGDO), Vanity Lamp (VANITY LP)
M11		10 Amp Red	(Ignition Off Draw) IOD-HVAC/ATC, MW SENSR, Underhood Lamp (UH LMP)
M12		30 Amp Green	Amplifier (AMP)
M13		20 Amp Yellow	Ignition Off Draw— Cabin Compartment Node (IOD-CCN), Wireless Control Module (WCM), SIREN, Multifunction Control Switch (MULTIFCTN SW)

M14		20 Amp Yellow	Trailer Tow (Export Only)
M15		20 Amp Yellow	COL MOD, IR SNS, Heater Ventilation, Air Conditioning/Automatic Temperature Control (HVAC/ATC), Rear View Mirror (RR VW MIR), Cabin Compartment Node (CCN), Transfer Case Switch (T-CASE SW), RUN/ST, Multi-Function Control Switch (MULTIFTCN SW), Tire Pressure Monitor (TPM), Glow Plug Module (GLW PLG MOD) — Export Diesel Only
M16		10 Amp Red	Occupant Restraint Controller (ORC)
M17		15 Amp Blue	Left Tail/License/Park Lamp (LT-TAIL/LIC/PRK LMP)
M18		15 Amp Blue	Right Tail/Park/Run Lamp (RT-TAIL/PRK/RUN LMP)
M19		25 Amp Natural	Auto Shut Down (ASD #1 and #2)
M20		15 Amp Blue	Cabin Compartment Node Interior Light (CCN INT LIGHT), Switch Bank (SW BANK)
M21		20 Amp Yellow	Auto Shut Down (ASD #3)
M22		10 Amp Red	Right Horn (RT HORN (HI/LOW)
M23		10 Amp Red	Left Horn (LT HORN (HI/LOW)
M24		25 Amp Natural	Rear Wiper (REAR WIPER)
M25		20 Amp Yellow	Fuel Pump (FUEL PUMP), Diesel Lift Pump (DSL LIFT PUMP) — Export Only
M26		—	—
M27		10 Amp Red	Ignition Switch Feed, Wireless Module

M28		10 Amp Red	PCM Feed/TCM
M29		—	—
M30		15 Amp Blue	Wiper Motor Frt, J1962 Diagnostic Feed
M31		20 Amp Yellow	Backup Lamps (B/U LAMPS)
M32		10 Amp Red	Occupant Restraint Controller (ORC), TT EUROPE
M33		10 Amp Red	Next Generation Controller (NGC), Global Powertrain Engine Controller (GPEC)
M34		10 Amp Red	Park Assist (PRK ASST), Heater Ventilation, Air Conditioning Module (HVAC MOD), Headlamp Wash (HDLP WASH), Compass (COMPAS)
M35		10 Amp Red	Heated Mirrors
M36		20 Amp Yellow	Power Outlet
M37		10 Amp Red	Anti-Lock Brake System (ABS) , Electronic Stability Program (ESP), Stop Lamp Switch (STP LP SW), Fuel Pump Rly Hi Control
M38		25 Amp Natural	Lock/Unlock Motors (LOCK/UNLOCK MTRS)

Relay's

1	Circuit Breaker 1
2	Run Accessory
3	Run Start
4	Run

5	Rear Window Defogger (EBL)
6	Starter Motor
7	Transmission Control (EATX)
8	Spare
9	Auto Shut Down
10	Spare
11	Radiator Fan Control
12	Spare

CAUTION:

- **When installing the Integrated Power Module cover, it is important to ensure the cover is properly positioned and fully latched. Failure to do so may allow water to get into the Integrated Power Module, and possibly result in an electrical system failure.**
- **When replacing a blown fuse, it is important to use only a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical system overload. If a properly rated fuse continues to blow, it indicates a problem in the circuit that must be corrected.**

MAINTENANCE SCHEDULES**DESCRIPTION****MAINTENANCE SCHEDULES - NAFTA**

The oil change indicator system will remind you that it is time to take your vehicle in for scheduled maintenance.

On Non-EVIC equipped vehicles “CHANGE OIL” will flash in the instrument cluster odometer and a single chime will sound, indicating that an oil change is necessary.

Based on engine operation conditions the oil change indicator message will illuminate, this means that service is required for your vehicle. Have your vehicle serviced as soon as possible, within the next 500 miles (805 km).

NOTE:

- **The oil change indicator message will not monitor the time since the last oil change. Change your vehicles oil if it has been 6 months since your last oil change even if the oil change indicator message is NOT illuminated.**
- **Change your engine oil more often if you drive your vehicle off-road for an extended period of time.**
- **Under no circumstances should oil change intervals exceed 6,000 miles (10,000 km) or 6 months, whichever comes first.**

Your dealer will reset the oil change indicator message after completing the scheduled oil change. If this

scheduled oil change is performed by someone other than your dealer the message can be reset by referring to the steps described under “Odometer/Trip Odometer” in the “Instrument Cluster Description” section of this manual.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

Once a Month

- Check tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the brake hoses and lines.
- Check the manual transmission fluid level.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

Required Maintenance Intervals

Maintenance Items	Perform Maintenance Every		
	Miles	Kilometers	or Months
Change the engine oil and engine oil filter.	6,000	10 000	6
Rotate tires.	6,000	10 000	6
If using your vehicle for any of the following: Dusty or off-road conditions. Inspect the engine air cleaner filter, replace if necessary.	12,000	20 000	12
Inspect the brake linings, replace if necessary.	12,000	20 000	12

Replace the air conditioning filter.	12,000	20 000	12
Inspect the front & rear axle fluid, change if using your vehicle for police, taxi, fleet, off-road or frequent trailer towing.	18,000	30 000	18
Inspect the CV Joints. Perform the first inspection at 12,000 miles (20 000 km) or 12 months.	24,000	40 000	24
Inspect exhaust system. Perform the first inspection at 12,000 miles (20 000 km) or 12 months.	24,000	40 000	24
Inspect the front suspension, tie rod ends and boot seals, replace if necessary.	24,000	40 000	24
Replace the engine air cleaner filter.	30,000	50 000	30
Change the manual transmission fluid if using your vehicle for any of the following: trailer towing, snow plowing, heavy loading, taxi, police, delivery service (commercial service), off-road, desert operation or more then 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).	30,000	50 000	30
Inspect the transfer case fluid.	30,000	50 000	30
Change the automatic transmission fluid and main sump filter if using your vehicle for any of the following: police, taxi, fleet or frequent trailer towing.	60,000	100 000	60
Change the transfer case fluid if using your vehicle for any of the following: police, taxi, fleet, off-road or frequent trailer towing.	60,000	100 000	60
Inspect and replace PCV valve if necessary.	90,000	150 000	90
Flush and replace the engine coolant.	102,000	170 000	60
Replace the ignition cables.	102,000	170 000	102
Replace the spark plugs.	102,000	170 000	102
Change the automatic transmission fluid, main sump filter, and spin-on cooler return filter (if equipped).	120,000	200 000	120
Replace accessory drive belt(s).	120,000	200 000	120

WARNING:

You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.

MAINTENANCE SCHEDULES - EXPORT - GAS

To help you have the best driving experience possible, the manufacturer has identified the specific vehicle maintenance service intervals that are required to keep your vehicle operating properly and safely.

DaimlerChrysler Corporation recommends that these maintenance intervals be performed at your selling dealer. The technicians at your dealership know your vehicle best, and have access to factory trained information,

genuine Mopar parts, and specially designed electronic and mechanical tools that can help prevent future costly repairs.

The maintenance intervals shown should be performed as indicated in this section.

NOTE: Under no circumstances should oil change intervals exceed 7,500 miles (12 000 km) or 6 months, whichever comes first.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

Once a Month

- Check tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the brake hoses and lines.
- Check the manual transmission fluid level.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

Severe Duty

If your vehicle is operated under the Severe Duty conditions listed below change your engine oil and filter every 3,000 miles (5 000 km) or 3 months as indicated in the Maintenance Schedule.

- Stop and go driving.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16 km).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert operation.

Required Maintenance Intervals

	Perform Maintenance Every
--	--------------------------------------

	(Where time and mileage are
--	-----------------------------

	listed, follow the interval that occurs first.)		
Maintenance Items	Miles	Kilometers	or Months
Change the engine oil and engine oil filter if using your vehicle under any of the severe duty conditions: Short trips, stop and go driving, dusty or off-road conditions, police, taxi, fleet, or frequent trailer towing.	3,000	5 000	3
	or	or	or
Change the engine oil and engine oil filter if your vehicle is NOT operated under any of the conditions listed under Severe Duty .	7,500	12 000	6
Rotate tires.	7,500	12 000	6
If using your vehicle for any of the following: Dusty or off-road conditions. Inspect the engine air cleaner filter, replace if necessary.	15,000	24 000	12
Inspect the brake linings, replace if necessary.	15,000	24 000	12
Inspect the front & rear axle fluid, change if using your vehicle for police, taxi, fleet, off-road or frequent trailer towing.	15,000	24 000	12
Inspect the CV Joints. Perform the first inspection at 15,000 miles (24 000 km) or 12 months.	22,500	36 000	18
Inspect Exhaust System. Perform the first inspection at 15,000 miles (24 000 km) or 12 months.	22,500	36 000	18
Inspect the front suspension, tie rod ends and boot seals, replace if necessary.	22,500	36 000	18
Replace the engine air cleaner filter.	30,000	50 000	30
Change the manual transmission fluid if using your vehicle for any of the following: trailer towing, snow plowing, heavy loading, taxi, police, delivery service (commercial service), off-road, desert operation or more then 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).	30,000	50 000	30
Inspect the transfer case fluid.	30,000	50 000	30
Change the automatic transmission fluid & filter if using your vehicle for any of the following: police, taxi, fleet or frequent trailer towing.	60,000	100 000	60
Change the transfer case fluid if using your vehicle for any of the following: police, taxi, fleet, off-road or frequent trailer towing.	60,000	100 000	60
Inspect and replace PCV valve if necessary.	90,000	150 000	90
Flush and replace the engine coolant.	102,000	170 000	60
Replace the ignition cables.	102,000	170 000	102

Replace the spark plugs.	102,000	170 000	102
Change the automatic transmission fluid, main sump filter, and spin-on cooler return filter (if equipped).	120,000	200 000	120
Replace Accessory Drive Belt(s).	120,000	200 000	120

WARNING:

You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.

MAINTENANCE SCHEDULES - EXPORT - DIESEL**Change Oil Message (Diesel Models with DPF (Diesel Particulate Filter) Only)**

The oil change indicator system will remind you that it is time to take your vehicle in for scheduled maintenance.

On Non-EVIC equipped vehicles “CHANG E OIL” will flash in the instrument cluster odometer and a single chime will sound, indicating that an oil change is necessary.

Based on engine operation conditions, the oil change indicator message will illuminate, this means that service is required for your vehicle. Have your vehicle serviced as soon as possible, within the next 500 miles (805 km).

Your dealer will reset the oil change indicator message after completing the scheduled oil change. If this scheduled oil change is performed by someone other than your dealer the message can be reset by referring to the steps described under “Odometer/Trip Odometer” in the “Instrument Cluster Description” section of this manual.

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule “**A**”. It is for vehicles that are not operated under any of the conditions listed under Schedule “**B**.”

Second is Schedule “**B**”. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.

At Each Stop for Fuel

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

Once a Month

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, clean and tighten the terminals as required.
- Check the fluid levels of engine coolant/antifreeze deaeration bottle, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

At Each Oil Change

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/antifreeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.
- Inspect for the presence of water in the fuel filter/water separator unit.

Schedule “A”

Kilometers	20 000	40 000	60 000	80 000	100 000
(Miles)	(12,500)	(25,000)	(37,500)	(50,000)	(62,500)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.		X		X	
Replace the engine accessory drive belt.					X
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.		X		X	
Inspect the transfer case fluid, add if necessary.				X	

Kilometers	120 000	140 000	160 000	180 000	200 000
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(Miles)	(75,000)	(87,500)	(100,000)	(112,500)	(125,000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	X
Replace the engine air filter element.	X		X		X
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.	X		X		X
Flush and replace the engine coolant.			X		X
Replace the engine accessory drive belt.					X
Replace the engine timing belt, and timing belt tensioner.					X
Inspect the brake linings.	X		X		X
Inspect the manual transmission fluid, add if necessary.	X		X		X
Inspect the transfer case fluid, add if necessary.			X		

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Kilometers	10 000	20 000	30 000	40 000	50 000
(Miles)	(6,250)	(12,500)	(18,750)	(25,000)	(31,250)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	

Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.				X	
Drain and refill the front and rear axle fluid.		X		X	
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.					X
Inspect the transfer case fluid, add if necessary.		X		X	
Drain and refill the front and rear axle fluid.		X		X	

Kilometers	60 000	70 000	80 000	90 000	100 000
(Miles)	(37,500)	(43,750)	(50,000)	(56,250)	(62,500)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	
Replace the engine air filter element.	X		X		X
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.			X		
Replace the engine accessory drive belt.	X				
Inspect the brake linings.	X		X		X
Drain and refill the front and rear axle fluid.	X		X		X
Inspect the transfer case fluid, add if necessary.	X		X		X
Inspect the manual transmission fluid, add if necessary.					X
Drain and refill the automatic transmission fluid. Replace main sump filter and spin-on cooler return filter (if equipped).					X

Kilometers	110 000	120 000	130 000	140 000	150 000
(Miles)	(68,750)	(75,000)	(81,250)	(87,500)	(93,750)

Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X	X	X	X	X
Replace the engine air filter element.		X		X	
Replace the engine accessory drive belt.		X			
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.		X			
Inspect the brake linings.		X		X	
Inspect the manual transmission fluid, add if necessary.					X
Inspect the transfer case fluid, add if necessary.		X		X	
Drain and refill the front and rear axle fluid.		X		X	

Kilometers	160 000	170 000	180 000	190 000	200 000
(Miles)	(100,000)	(106,250)	(112,500)	(118,750)	(125,000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	
Replace the engine air filter element.	X		X		X
Replace the engine accessory drive belt.			X		
Replace the engine timing belt, and timing belt tensioner.					X
Drain the fuel filter/water separator unit.	X	X	X	X	X
Replace the fuel filter/water separator unit.	X				X
Flush and replace the engine coolant/anti-freeze.	X				
Inspect the brake linings.	X		X		X
Inspect the manual transmission fluid, add if necessary.					X
Drain and refill the automatic transmission fluid. Replace main sump filter and spin-on cooler return filter (if equipped).					X

Inspect the transfer case fluid, add if necessary.	X		X		X
Drain and refill the front and rear axle fluid.	X		X		X

‡ Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

REPLACEMENT BULBS

SPECIFICATIONS

REPLACEMENT BULBS - INTERIOR

LIGHT BULBS - INTERIOR	BULB NUMBER
Auto. Trans. Indicator Light	658
Courtesy Lights, Under Dash (1)	906
Heater Control Lights (2)	194
Rocker Switch Indicator Light (Rear Window Defogger, and Rear Wash/Wipe)	**
Soundbar Dome Light	912
** Bulbs only available from authorized dealer.	

REPLACEMENT BULBS - EXTERIOR

LIGHT BULBS - EXTERIOR	BULB NUMBER
Backup Lights (2)	3157
Center High Mounted Stop Light (1)	L.E.D.
Fog Lights	9145
Front Park/Turn Lights (2)	3157
Front Side Marker Lights (2)	168

Headlights (2)	H13
Stop/Tail/Turn Lights (2)	3157
Underhood Light	561
License Light	194
Numbers refer to commercial bulb types that can be purchased from your local authorized dealer. If a bulb needs to be replaced, visit your authorized dealer or refer to the applicable Service Manual.	

TRAILER TOWING

SPECIFICATIONS

TRAILER TOWING - NAFTA

In this section you will find safety tips and information on limits to the type of towing you can reasonably do with your vehicle. Before towing a trailer carefully review this information to tow your load as efficiently and safely as possible.

To maintain warranty coverage, follow the requirements and recommendations in this manual concerning vehicles used for trailer towing.

Common Towing Definitions

The following trailer towing related definitions will assist you in understanding the following information:

Gross Vehicle Weight Rating (GVWR)

The GVWR is the total allowable weight of your vehicle. This includes driver, passengers, cargo and tongue weight. The total load must be limited so that you do not exceed the GVWR.

Gross Trailer Weight (GTW)

The Gross Trailer Weight (GTW) is the weight of the trailer plus the weight of all cargo, consumables and equipment (permanent or temporary) loaded in or on the trailer in its "loaded and ready for operation" condition. The recommended way to measure GTW is to put your fully-loaded trailer on a vehicle scale. The entire weight of the trailer must be supported by the scale.

Gross Combination Weight Rating (GCWR)

The Gross Combination Weight Rating (GCWR) is the total permissible weight of your vehicle and trailer when weighed in combination. (Note that GCWR ratings include a 150 lbs (68 kg) allowance for the presence of a driver).

Gross Axle Weight Rating (GAWR)

The GAWR is the maximum capacity of the front and rear axles. Distribute the load over the front and rear axles evenly. Make sure that you do not exceed either front or rear GAWR.

WARNING:

It is important that you do not exceed the maximum front or rear GAWR. A dangerous driving condition can result if either rating is exceeded. You could lose control of the vehicle and have an accident.

Tongue Weight (TW)

Trailer tongue weight is the downward force exerted on the hitch ball by the trailer. In most cases it should not be less than 10% or more than 15% of the trailer load. You must consider this as part of the load on your vehicle.

Frontal Area

Frontal area is the maximum height and maximum width of the front of a trailer.

Trailer Sway Control

The trailer sway control is a telescoping link that can be installed between the hitch receiver and the trailer tongue. It typically provides adjustable friction associated with the telescoping motion to dampen any unwanted trailer swaying motions while traveling.

Weight-Carrying Hitch

A weight-carrying hitch supports the trailer tongue weight, just as if it were luggage located at a hitch ball or some other connecting point of the vehicle. This kind of hitch is the most popular on the market today and is commonly used to tow small and medium-sized trailers.

Weight-Distributing Hitch

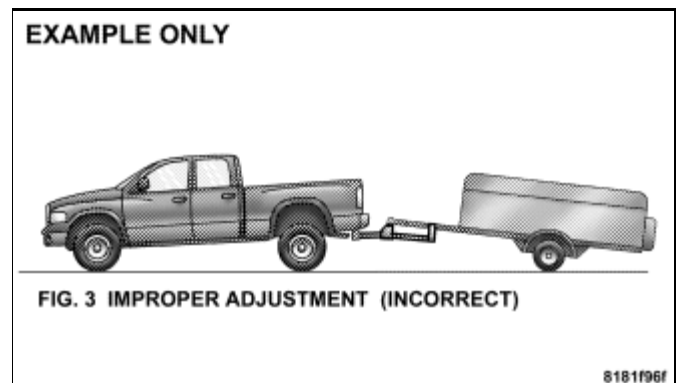
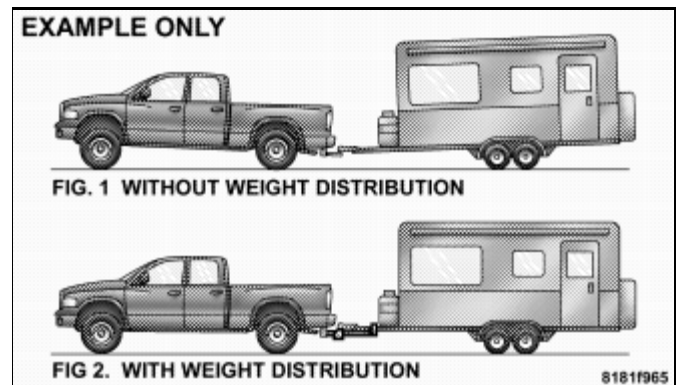
A weight-distributing hitch system works by applying leverage through spring (load) bars. It is typically used for

heavier loads, to distribute trailer tongue weight to the tow vehicle's front axle and the trailer axle(s). When used in accordance with the manufacturers' directions, it provides for a more level ride, offering more consistent steering and brake control thereby enhancing towing safety. The addition of a friction/hydraulic sway control also dampens sway caused by traffic and crosswinds, and contributes positively to tow vehicle and trailer stability. Trailer sway control and a weight-distributing (load-equalizing) hitch are recommended for heavier tongue weights (TW) and may be required depending on vehicle and trailer configuration/loading to comply with Gross Axle Weight Rating (GAWR) requirements.

WARNING:

An improperly adjusted weight-distributing hitch system may reduce handling, stability, braking performance, and could result in an accident.

Weight-Distributing Hitch Systems may not be compatible with Surge Brake Couplers. Consult with your hitch and trailer manufacturer or a reputable Recreational Vehicle dealer for additional information.



Trailer Hitch Classification

The following chart provides the industry standard for the maximum trailer weight a given trailer hitch class can tow and should be used to assist you in selecting the correct trailer hitch for your intended towing condition. Refer to the Trailer Towing Weights (Maximum Trailer Weight Ratings) chart for the Max. GTW towable for your given drivetrain.

Trailer Hitch Classification	
Class	Max. GTW (Gross Trailer Wt.)

Class I - Light Duty	2,000 lbs (907 kg)
Class II - Medium Duty	3,500 lbs (1 587 kg)

All trailer hitches should be professionally installed on your vehicle.

Trailer Towing Weights (Maximum Trailer Weight Ratings)

The following chart provides the maximum trailer weight ratings towable for your given drivetrain.

Engine/Transmission	Axle	Model	GCWR (Gross Combined Wt. Rating)	Frontal Area	Max. GTW (Gross Trailer Wt.)	Max. Tongue Wt. (See Note 1)
3.8L/Manual	3.21	2-Door X Model (4WD)	4,987 lbs (2 262 kg)	25 sq ft (2.32 sq m)	1,000 lbs (453 kg)	100 lbs (45 kg)
3.8L/Manual	3.73	2-Door X Model (4WD)	5,987 lbs (2 716 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Automatic	3.73	2-Door X Model (4WD)	6,032 lbs (2 736 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Manual	3.21	2-Door Sahara Model (4WD)	5,163 lbs (2 342 kg)	25 sq ft (2.32 sq m)	1,000 lbs (453 kg)	100 lbs (45 kg)
3.8L/Manual	3.73	2-Door Sahara Model (4WD)	6,163 lbs (2 795 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Automatic	3.73	2-Door Sahara Model (4WD)	6,163 lbs (2 795 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Manual	4.10	2-Door Rubicon Model (4WD)	6,236 lbs (2 829 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Automatic	4.10	2-Door Rubicon Model (4WD)	6,281 lbs (2 849 kg)	25 sq ft (2.32 sq m)	2,000 lbs (907 kg)	200 lbs (91 kg)
3.8L/Manual	3.21	4-Door X Model (2WD)	5,121 lbs (2 323 kg)	32 sq ft (2.97 sq m)	1,000 lbs (453 kg)	100 lbs (45 kg)
3.8L/Manual	3.73	4-Door X Model (2WD)	7,621 lbs (3 457 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Automatic	3.73	4-Door X Model (2WD)	7,647 lbs (3 469 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Manual	3.21	4-Door Sahara	5,277 lbs (2 394 kg)	32 sq ft	1,000 lbs (453 kg)	100 lbs (45 kg)

		Model (2WD)		(2.97 sq m)		
3.8L/Manual	3.73	4-Door Sahara Model (2WD)	7,777 lbs (3 527 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Automatic	3.73	4-Door Sahara Model (2WD)	7,803 lbs (3 539 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Manual	3.21	4-Door X Model (4WD)	5,325 lbs (2 415 kg)	32 sq ft (2.97 sq m)	1,000 lbs (453 kg)	100 lbs (45 kg)
3.8L/Manual	3.73	4-Door X Model (4WD)	7,825 lbs (3 549 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Automatic	3.73	4-Door X Model (4WD)	7,825 lbs (3 549 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Manual	3.21	4-Door Sahara Model (4WD)	5,481 lbs (2 486 kg)	32 sq ft (2.97 sq m)	1,000 lbs (453 kg)	100 lbs (45 kg)
3.8L/Manual	3.73	4-Door Sahara Model (4WD)	7,981 lbs (3 620 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Automatic	3.73	4-Door Sahara Model (4WD)	8,027 lbs (3 641 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Manual	4.10	4-Door Rubicon Model (4WD)	8,059 lbs (3 655 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
3.8L/Automatic	4.10	4-Door Rubicon Model (4WD)	8,104 lbs (3 676 kg)	32 sq ft (2.97 sq m)	3,500 lbs (1 587 kg)	350 lbs (159 kg)
Refer to local laws for maximum trailer towing speeds.						

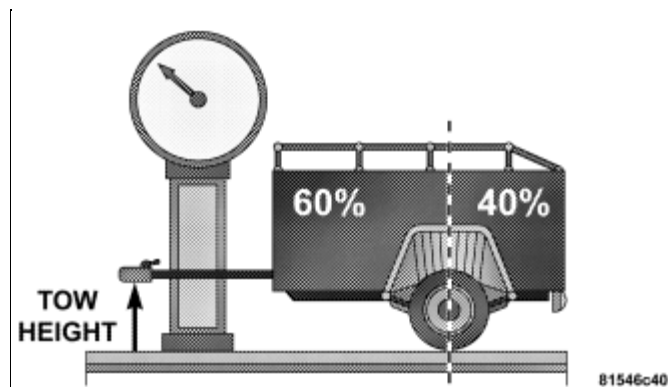
NOTE: The trailer tongue weight must be considered as part of the combined weight of occupants and cargo, and should never exceed the weight referenced on the Tire and Loading Information placard. Refer to the “Tire-Safety Information” section in this manual.

Trailer and Tongue Weight

Always load a trailer with 60% to 65% of the weight in the front of the trailer. This places 10% to 15% of the Gross Trailer Weight (GTW) on the tow hitch of your vehicle. Loads balanced over the wheels or heavier in the rear can cause the trailer to sway **severely** side-to-side which will cause loss of control of vehicle and trailer. Failure to load trailers heavier in front is the cause of many trailer accidents.

Consider the following items when computing the weight on the rear axle of the vehicle:

- The trailer tongue weight.
- The weight of any other type of cargo or equipment put in or on your vehicle.
- The weight of the driver and all passengers.



NOTE: Remember that everything put into or on the trailer adds to the load on your vehicle. Also, additional factory-installed options, or authorized dealer-installed options, must be considered as part of the total load on your vehicle. Refer to the Tire and Loading Information placard in the “Tire— Safety Information” section of this manual for the maximum combined weight of occupants and cargo for your vehicle.

Towing Requirements

To promote proper break-in of your new vehicle drivetrain components, the following guidelines are recommended:

NOTE: Trailer towing requires special rear axle lubricant. Refer to “Fluids, Lubricants, and Genuine Parts” in Section 7 for more information.

CAUTION: Avoid towing a trailer for the first 500 miles (805 km) of vehicle operation. Doing so may damage your vehicle.

Perform the maintenance listed in the “Maintenance Schedule.” Refer to Section 8 of this manual. When towing a trailer, never exceed the GAWR, or GCWR, ratings.

WARNING:

Improper towing can lead to an injury accident. Follow these guidelines to make your trailer towing as safe as possible:

Make certain that the load is secured in the trailer and will not shift during travel. When trailering cargo that is not fully secured, dynamic load shifts can occur that may be difficult for the driver to control. You could lose control of your vehicle and have an accident.

- When hauling cargo or towing a trailer, do not overload your vehicle or trailer. Overloading can cause a loss of control, poor performance or damage to brakes, axle, engine, transmission, steering, suspension, chassis structure or tires.
- Safety chains must always be used between your vehicle and trailer. Always connect the chains to the frame or hook retainers of the vehicle hitch. Cross the chains under the trailer tongue and allow enough slack for turning corners.
- Vehicles with trailers should not be parked on a grade. When parking, apply the parking brake on the tow vehicle. Put the tow vehicle automatic transmission in PARK (P). With a manual transmission, shift the transmission into 1st gear. And with four-wheel-drive vehicles, make sure the transfer case is not in N (Neutral). Always, block or "chock" the trailer wheels.
- GCWR must not be exceeded.
- **Total weight must be distributed between the tow vehicle and the trailer such that the following four ratings are not exceeded:**
 - GVWR

- GTW
- GAWR
- Tongue weight rating for the trailer hitch utilized (This requirement may limit the ability to always achieve the 10% to 15% range of tongue weight as a percentage of total trailer weight).

Towing Requirements - Tires

- Do not attempt to tow a trailer while using a compact spare tire.
- Proper tire inflation pressures are essential to the safe and satisfactory operation of your vehicle. Refer to the “Tires–General Information” section of this manual for proper tire inflation procedures.
- Also, check the trailer tires for proper tire inflation pressures before trailer usage.
- Check for signs of tire wear or visible tire damage before towing a trailer. Refer to the (Refer to 22 - TIRES/WHEELS/TIRES - DESCRIPTION) section of this manual on Tread Wear Indicators for the proper inspection procedure.
- When replacing tires refer to (Refer to 22 - TIRES/WHEELS/TIRES - DESCRIPTION) section of this manual on Replacement Tires for proper tire replacement procedures. Replacing tires with a higher load carrying capacity will not increase the vehicle's GVWR and GAWR limits.

Towing Requirements — Trailer Brakes

- Do **not** interconnect the hydraulic brake system or vacuum system of your vehicle with that of the trailer. This could cause inadequate braking and possible personal injury.
- An electronically-actuated trailer brake controller is required when towing a trailer with electronically actuated brakes. When towing a trailer equipped with a hydraulic surge-actuated brake system, an electronic brake controller is not required.
- Trailer brakes are recommended for trailers over 1,000 lbs (454 kg) and required for trailers in excess of 2,000 lbs (907 kg).

CAUTION:

If the trailer weighs more than 1,000 lbs (454 kg) loaded, it should have its own brakes and they should be of adequate capacity. Failure to do this could lead to accelerated brake lining wear, higher brake pedal effort, and longer stopping distances.

WARNING:

Do not connect trailer brakes to your vehicle's hydraulic brake lines. It can overload your brake system and cause it to fail. You might not have brakes when you need them and could have an accident.

Towing any trailer will increase your stopping distance. When towing you should allow for additional space between your vehicle and the vehicle in front of you. Failure to do so could result in an accident.

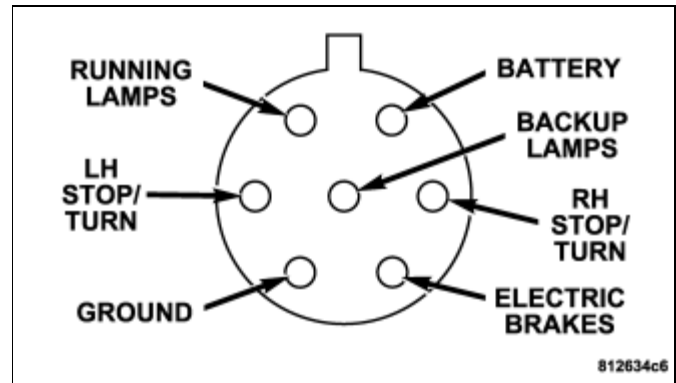
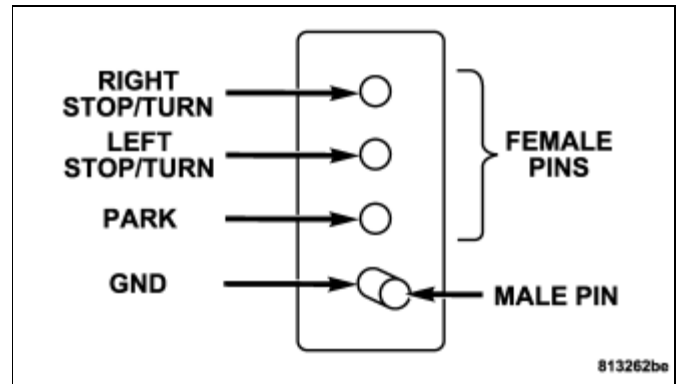
Towing Requirements — Trailer Lights & Wiring

Whenever you pull a trailer, regardless of the trailer size, stop lights and turn signals on the trailer are required for motoring safety.

The Trailer Tow Package will include a 4-pin wiring harness. Use a factory-approved trailer harness and connector.

NOTE: Do not cut or splice wiring into the vehicles wiring harness.

The electrical connections are all complete to the vehicle but you must mate the harness to a trailer connector. Refer to the following illustration.



Towing Tips

Before setting out on a trip, practice turning, stopping and backing the trailer in an area away from heavy traffic.

If using a manual transmission vehicle for trailer towing, all starts must be in 1st gear to avoid excessive clutch slippage.

Towing Tips - Automatic Transmission

The DRIVE (D) range can be selected when towing. However, if frequent shifting occurs while in this range, the OVERDRIVE (O/D) range should be selected.

NOTE: Using “O/D OFF” while operating the vehicle under heavy operating conditions will improve performance and extend transmission life by reducing excessive shifting and heat build up. This action will also provide better engine braking.

The automatic transmission fluid and filter should be changed if you REGULARLY tow a trailer for more than 45 minutes of continuous operation. Refer to the “Maintenance Schedule” in Section 8 of this manual for transmission fluid change intervals.

NOTE: Check the automatic transmission fluid level before towing.

Towing Tips - O/D Off (If Equipped)

To reduce potential for automatic transmission overheating, select the “O/D OFF” feature when driving in hilly areas or shift the transmission to DRIVE (D) position 2 on more severe grades. Refer to “Transmission Shifting” in this section.

Towing Tips - Electronic Speed Control (If Equipped)

- Don't use in hilly terrain or with heavy loads.
- When using the speed control, if you experience speed drops greater than 10 mph (16 km/h), disengage until you can get back to cruising speed.
- Use speed control in flat terrain and with light loads to maximize fuel efficiency.

Towing Tips - Cooling System

To reduce potential for engine and transmission overheating, take the following actions:

- Highway Driving - Reduce speed.
- Air Conditioning - Turn off temporarily.
- Refer to Cooling System Operating information in the Maintenance section of this manual for more information.

5 - BRAKES

BRAKES - BASE - SERVICE INFORMATION

BRAKES - BASE - SERVICE INFORMATION

DESCRIPTION

BRAKE SYSTEM

Power assist front disc and rear drum brakes are standard equipment. Disc brake components consist of single piston calipers and ventilated rotors. Rear drum brakes are dual shoe units with cast brake drums.

The parking brake mechanism is lever and cable operated. The cables are attached to levers on the rear drum brake secondary shoes. The parking brakes are operated by a hand lever.

A dual diaphragm vacuum power brake booster is used for all applications. All models have an aluminum master cylinder with plastic reservoir.

Factory brake lining on all models consists of an organic base material combined with metallic particles. The original equipment linings do not contain asbestos.

NOTE: LHD shown in graphics. The removal and installation procedures and torques specs are the same for the RHD.

SERVICE WARNINGS & CAUTIONS

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF ASBESTOS FIBERS FROM BRAKE COMPONENTS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WITH A WATER DAMPENED CLOTH. DO NOT SAND, OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DISPOSE OF ALL RESIDUE CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE EXPOSURE TO YOURSELF AND OTHERS. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper brake component operation.

CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.

WARNING

WARNING: DaimlerChrysler does not manufacture any vehicles or replacement parts that contain asbestos. Aftermarket products may or may not contain asbestos. Refer to aftermarket product packaging for product information. Whether the product contains asbestos or not, dust and dirt can accumulate on brake parts during normal use. Follow practices prescribed by appropriate regulations for the handling, processing and disposing of dust and debris.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.

CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, wheel cylinders, brake drums, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

1. Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.
2. If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

3. Inspect brake fluid level and condition. Note that the front disc brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

a. If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brake lines, and master cylinder.

b. If fluid appears contaminated, drain out a sample. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.

4. Check parking brake operation. Verify free movement and full release of cables and pedal. Also note if vehicle was being operated with parking brake partially applied.

5. Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

6. If components checked appear OK, road test the vehicle.

ROAD TESTING

1. If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

2. Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.

3. During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper/wheel cylinder. Internal leakage in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

If leakage is severe, fluid will be evident at or around the leaking component. However, internal leakage in the master cylinder may not be physically evident.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, worn lining, rotors, or drums are the most likely causes.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, or replace thin drums and suspect quality brake lines and hoses.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn.

The power booster or check valve could also be faulty.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums. Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Possible causes for brake drag condition are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper or wheel cylinder piston.
- Caliper binding on corroded bushings or rusted slide surfaces.
- Loose caliper mounting bracket.
- Drum brake shoes binding on worn/damaged support plates.
- Mis-assembled components.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Possible causes for front brake pull condition are:

- Contaminated lining in one caliper.
- Seized caliper piston.
- Binding caliper.
- Loose caliper.
- Rusty adapter/caliper slide surfaces.
- Improper brake shoes.
- Damaged rotor.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brake shoes can also produce a thump noise.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or wheel cylinders, worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

STANDARD PROCEDURE

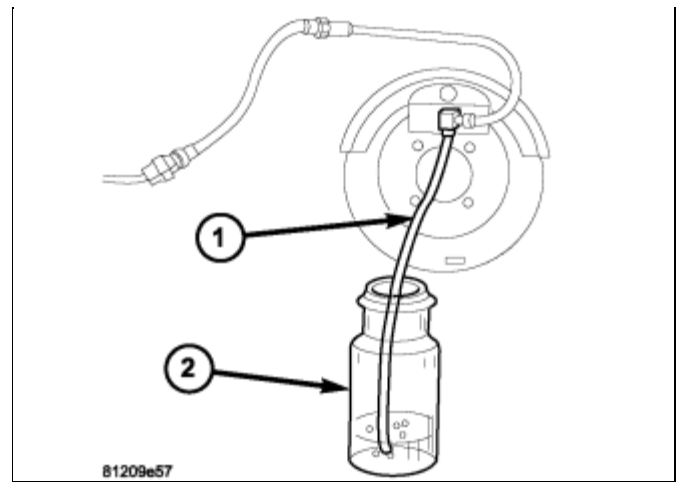
MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

1. Remove reservoir filler caps and fill reservoir.
2. If calipers were overhauled, open all caliper bleed screws.

Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

3. Attach one end of bleed hose (1) to bleed screw and insert opposite end in glass container (2) partially filled with brake fluid. Be sure end of bleed hose is immersed in fluid.



NOTE: Bleed procedure should be in this order (1) Right rear (2) Left rear (3) Right front (4) Left front.

4. Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

5. Before moving the vehicle verify the pedal is firm and not mushy.

6. Top off the brake fluid and install the reservoir cap.

PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system.

SPECIFICATIONS

BRAKE COMPONENTS

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Disc Brake Caliper Type	Sliding
Front Disc Brake Rotor Type	Ventilated
Rear Disc Brake Rotor Type	Solid

Front Disc Brake Rotor Diameter	302 x 28 mm (11.89 x 1.10 in.)
Rear Disc Brake Rotor Diameter	312 x 12 mm (12.28 x 0.472 in.)
Front Ventilated Disc Brake Rotor	Max. Runout 0.10 mm (0.0039 in.)
Rear Solid Disc Brake Rotor	Max. Runout 0.102 mm (0.004 in)
Front Ventilated Disc Brake Rotor	Max. Thickness Variation 0.009 mm (0.00035 in.)
Rear Solid Disc Brake Rotor	Max Thickness Variation 0.018 mm (0.0007 in)
Front Ventilated Disc Brake Rotor	Min. Thickness 22.7 mm (0.8937 in.)
Rear Solid Disc Brake Rotor	Min. Thickness 11.00 mm (0.433 in.)
Brake Booster Type	Tandem Diaphragm

TORQUE CHART

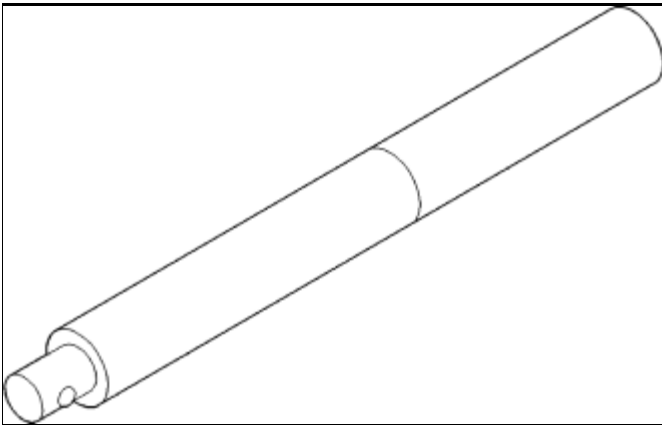
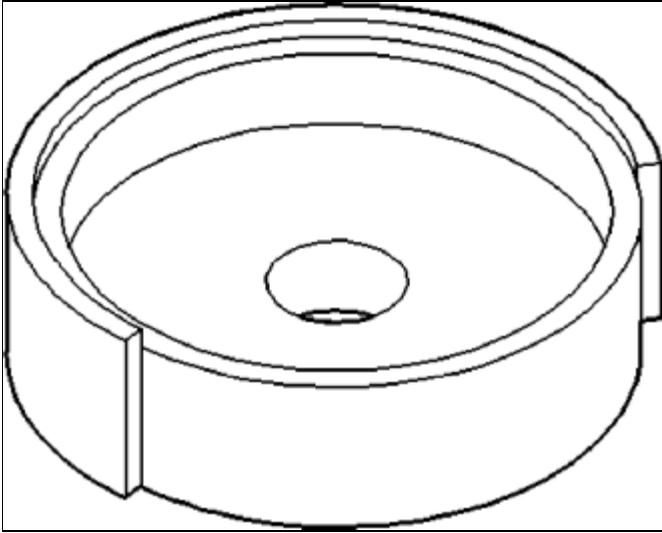
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Booster Mounting Nuts	25	18	—
Master Cylinder Mounting Nuts	17	13	151
Booster Mounting Plate	18	—	159
Master Cylinder Brake Lines	19	14	168
Front Caliper Adapter Mounting Bolts	35	26	—
Rear Caliper Adapter Mounting Bolts	35	26	220
Front Caliper Brake Hose Banjo Bolt	31	23	—
Rear Caliper Brake Hose Banjo Bolt	31	23	—
Front Caliper adapter	163	120	—
Rear Caliper adapter	75	55	—
Parking Brake Lever Bracket Bolts	12	9	—

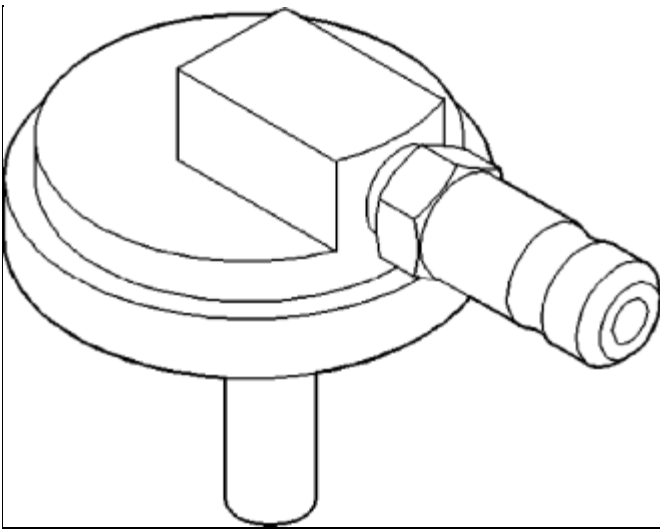


SPECIAL TOOLS

BASE BRAKES



Handle C-4171



BRAKE LINES

DESCRIPTION

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Double walled steel tubing is used to connect the master cylinder to the major hydraulic braking components and then to the flexible rubber hoses. Double inverted style and ISO style flares are used on the brake lines.

OPERATION

The hoses and lines transmit the brake fluid hydraulic pressure to the calipers and or wheel cylinders.

DIAGNOSIS AND TESTING

BRAKE LINE AND HOSES

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper seal washers at all caliper connections. Be sure brake line connections are properly made (not

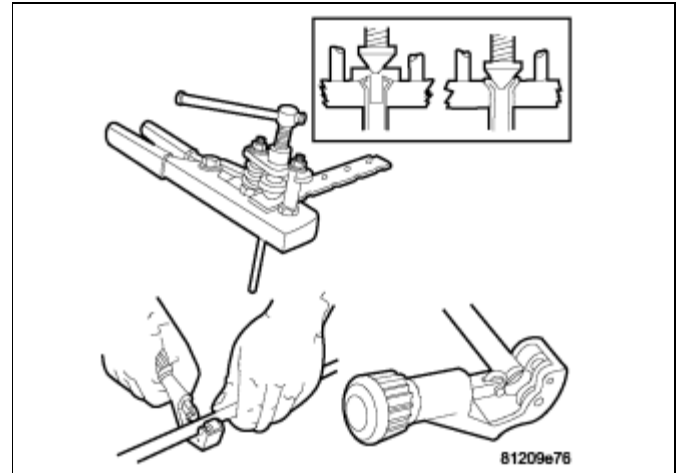
cross threaded) and tightened to recommended torque.

STANDARD PROCEDURE

DOUBLE INVERTED FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

1. Cut off damaged tube with Tubing Cutter.
2. Ream cut edges of tubing to ensure proper flare.
3. Install replacement tube nut on the tube.
4. Insert tube in flaring tool.
5. Place gauge form over the end of the tube.
6. Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.
7. Tighten the tool bar on the tube
8. Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc.
9. Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.
10. Remove the plug gauge and complete the inverted flare.

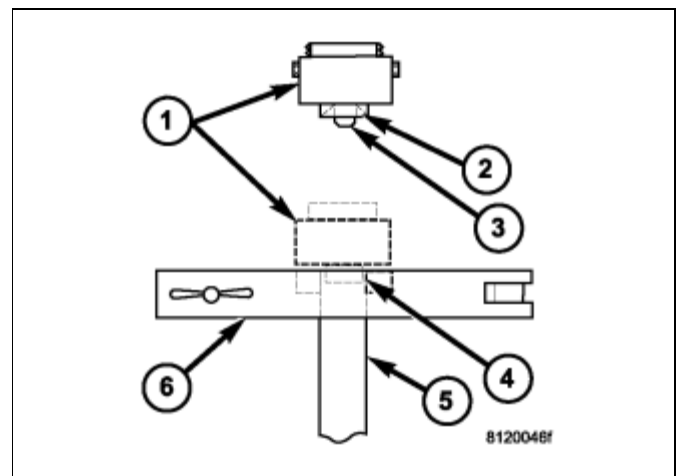


ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

To make a ISO flare use an ISO flaring tool kit.

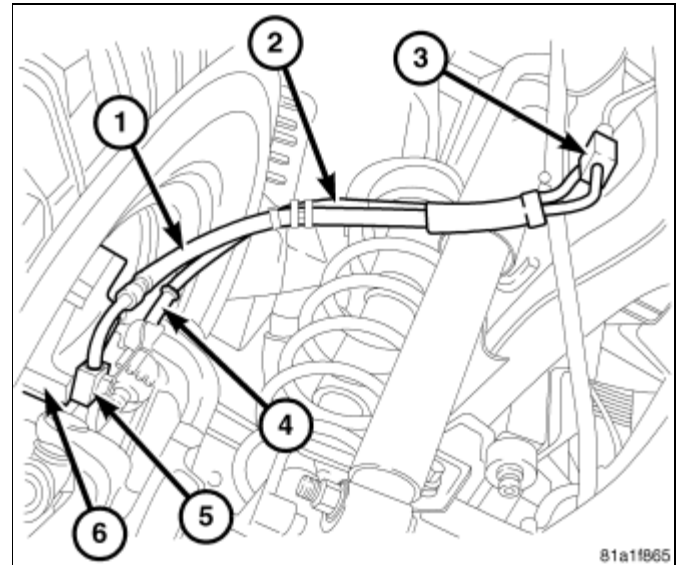
1. Cut off damaged tube with Tubing Cutter.
2. Remove any burrs from the inside of the tube.
3. Install tube nut on the tube.
4. Position the tube in the flaring tool flush with the top of the tool bar (6). Then tighten the tool bar on the tube.
5. Install the correct size adaptor (1) on the flaring tool yoke screw.
6. Lubricate the adaptor (2).
7. Align the adaptor and yoke screw over the tube.
8. Turn the yoke screw in until the adaptor is squarely seated on the tool bar.



REMOVAL

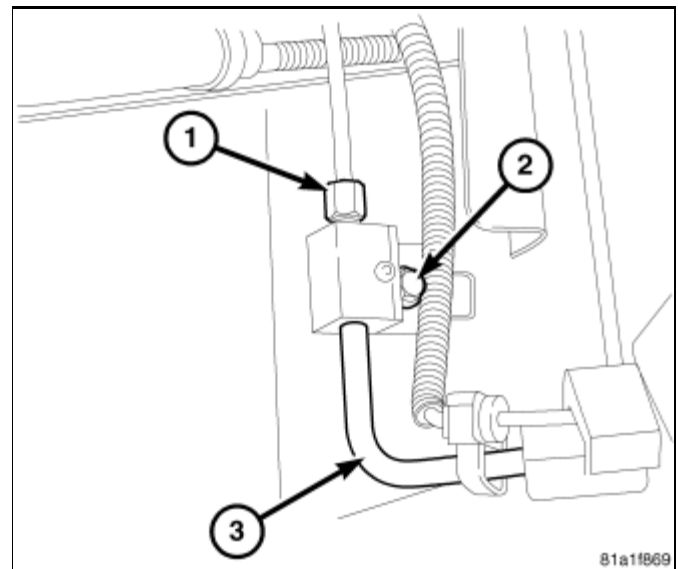
FRONT BRAKE HOSE

1. Raise and support vehicle.
2. Remove the tire and wheel assembly.
3. Remove the wheel speed sensor wire (2) from the brake hose (1).
4. Remove the brake hose banjo bolt (5) at the caliper (6).

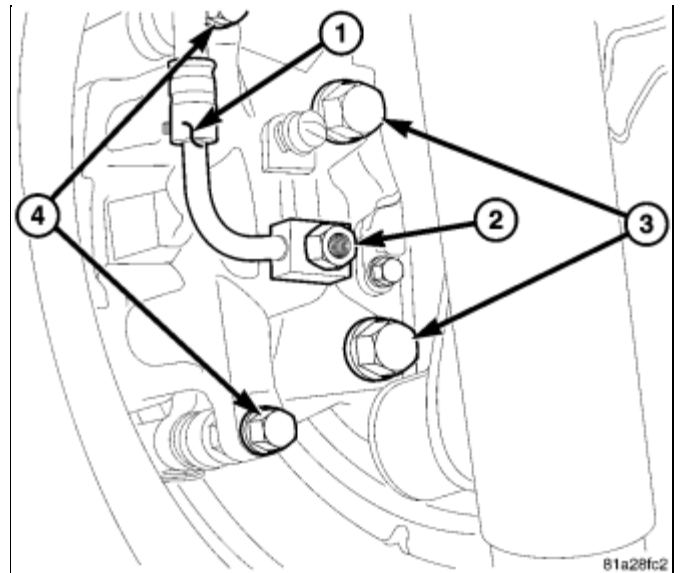


- Remove the brake line (1) at the frame.
5. Remove the brake hose mounting bolt (2) at the frame.
6. Remove the hose (3).

REAR BRAKE HOSE



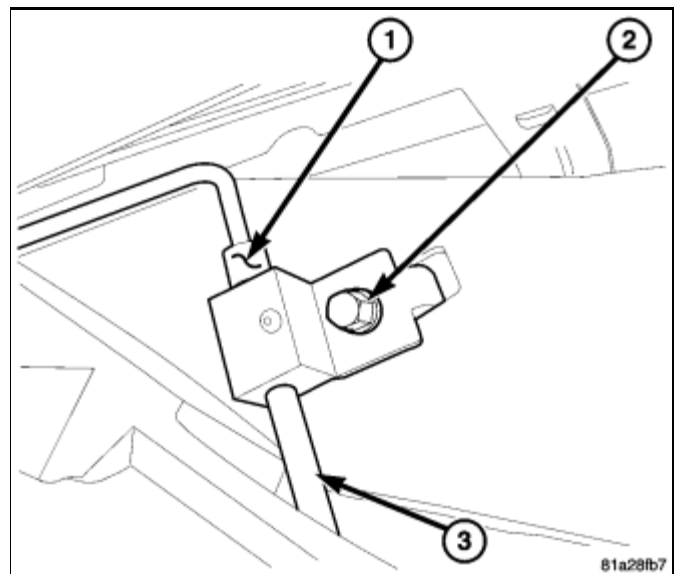
1. Using a brake pedal holding tool, depress brake pedal past its first inch of travel and hold it in this position. Holding pedal in this position will isolate master cylinder from hydraulic brake system and will not allow brake fluid to drain out of brake fluid reservoir while brake lines are open.
2. Raise and support vehicle.
3. Remove the banjo bolt (2) from the rear caliper for the brake hose (1).



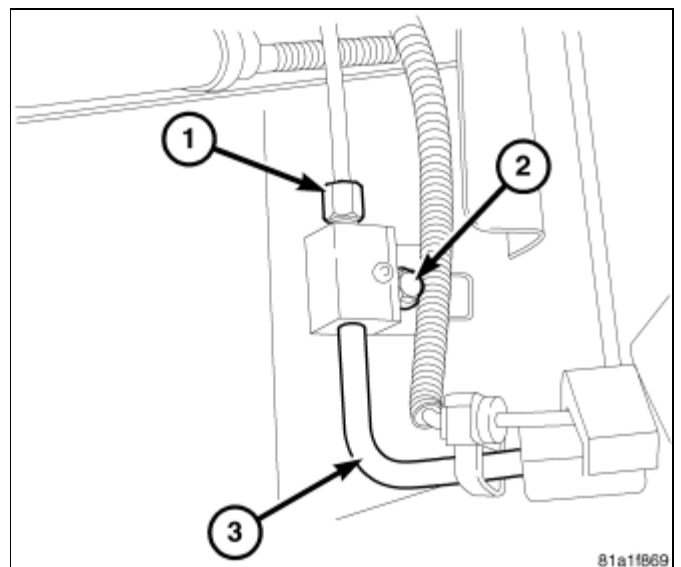
4. Remove the rear brake line (1) from the brake hose (3) at the frame.
5. Remove the mounting bolt (2) for the brake hose (3) at the frame.
6. Remove the brake hose (3).

INSTALLATION

INSTALLATION

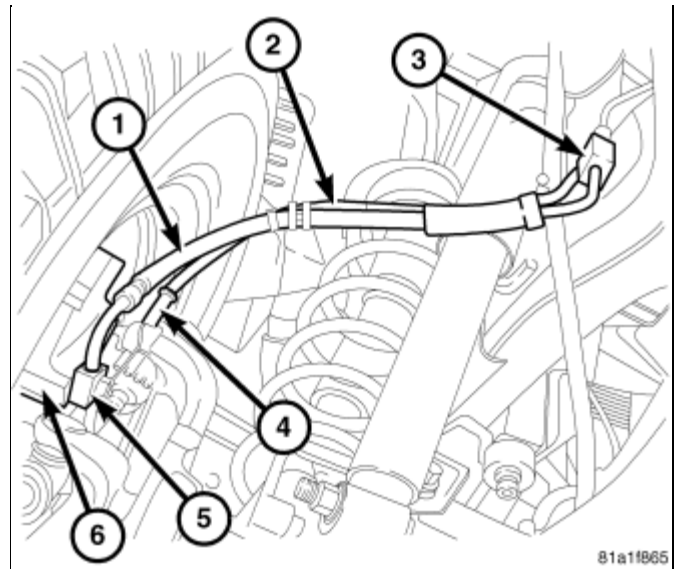


1. Install the hose (3).
2. Install the mounting bolt (2) for the brake hose at the frame.
3. Install the brake line (1) to the brake hose (3).

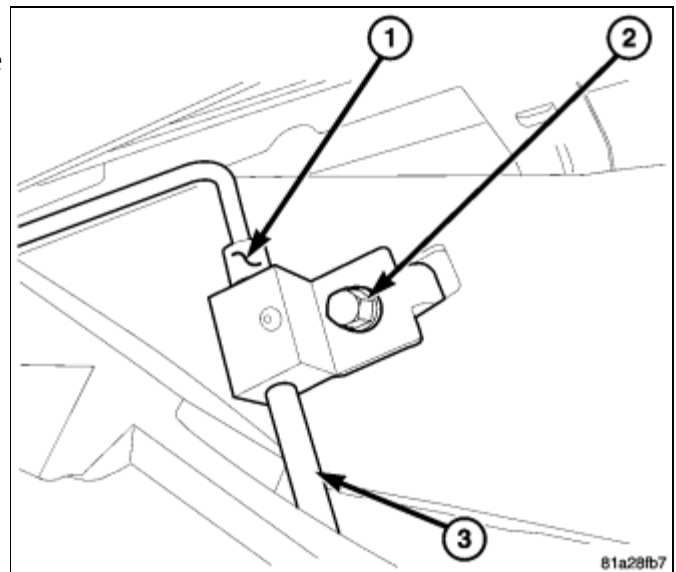


4. Reinstall the wheel speed sensor wire (2) to the brake hose (1).
5. Install the brake hose banjo bolt (5) at the caliper (6). Tighten to 28 N·m (250 in. lbs.)
6. Remove the support and lower the vehicle.
7. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

INSTALLATION



1. Install the brake hose (3) to the mounting hole at the frame and install the mounting bolt (2).
2. Install the brake line tube nut (1) to the brake hose (3) and tighten to 23 N·m (200 in. lbs.) torque.

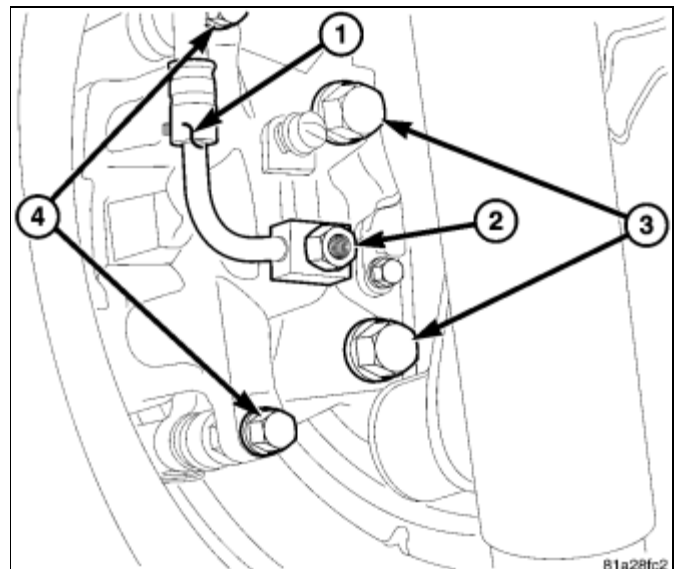


3. Install banjo bolt (2) attaching brake hose (1) to caliper. Install NEW washers on each side of hose fitting as banjo bolt is placed through banjo fitting. Thread banjo bolt into caliper and tighten to 31 N·m (23 ft. lbs.) torque.
4. Lower vehicle.
5. Remove brake pedal holding tool.
6. Bleed base brake hydraulic system as necessary. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

DISC BRAKE CALIPERS

DESCRIPTION

The calipers are a single piston type. The calipers are free to slide laterally, this allows continuous compensation for lining wear.



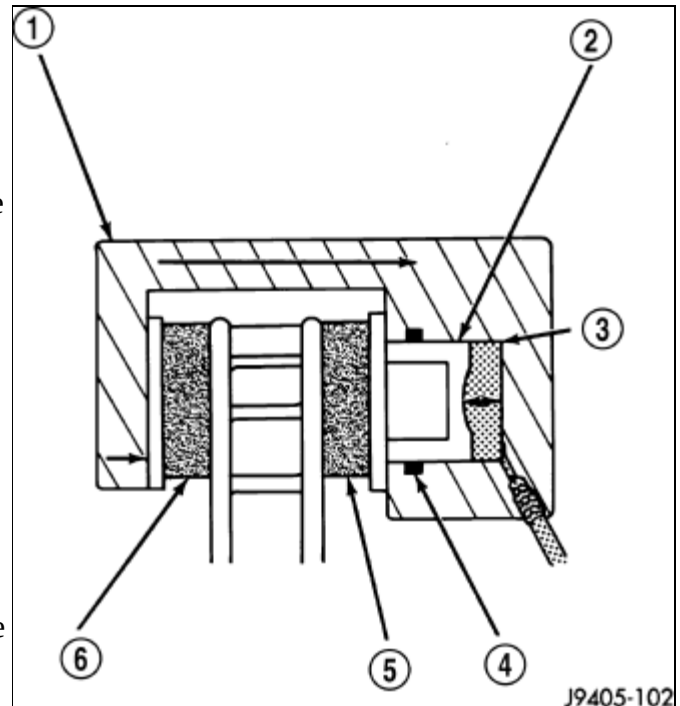
OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal .

Fluid pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.



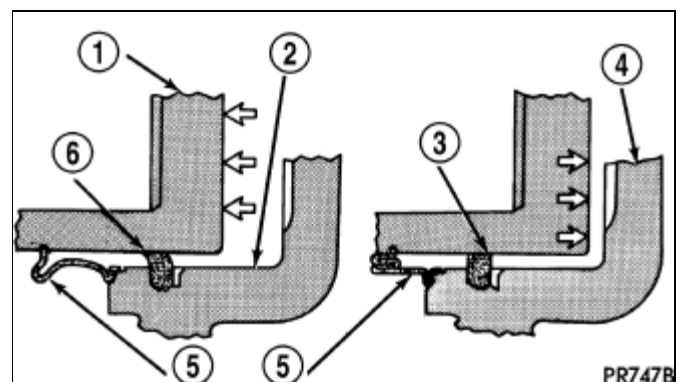
The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement . When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake shoe.

REMOVAL

FRONT



1. Raise and support vehicle.
2. Remove front wheel and tire assembly.
3. Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.
4. Bottom caliper pistons into the caliper (4) by prying the caliper over.
5. Remove brake hose banjo bolt and gasket washers (1). Discard gasket washers.
6. Remove the caliper slide bolts (3).
7. Remove the caliper (4) from the adapter.

REAR

1. Raise and support vehicle.
2. Remove rear wheel and tire assembly.
3. Drain small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.
4. Bottom caliper pistons into the caliper by prying the caliper over.
5. Remove brake hose banjo bolt (3) and discard gasket washers.
6. Remove the caliper slide pins (2).
7. Remove caliper from the adapter.
8. Remove the brake pads.

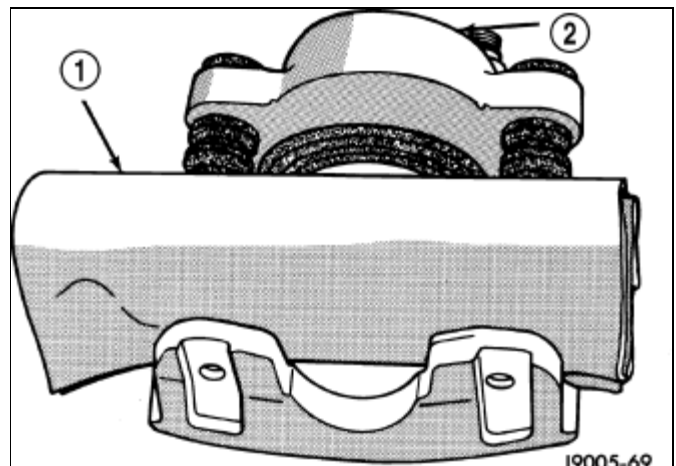
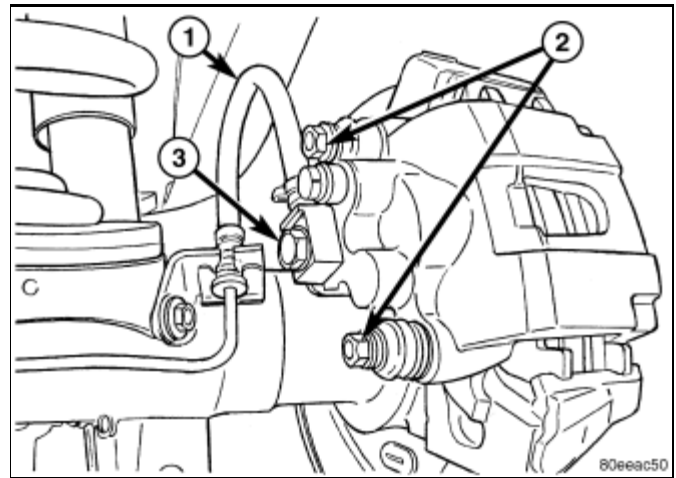
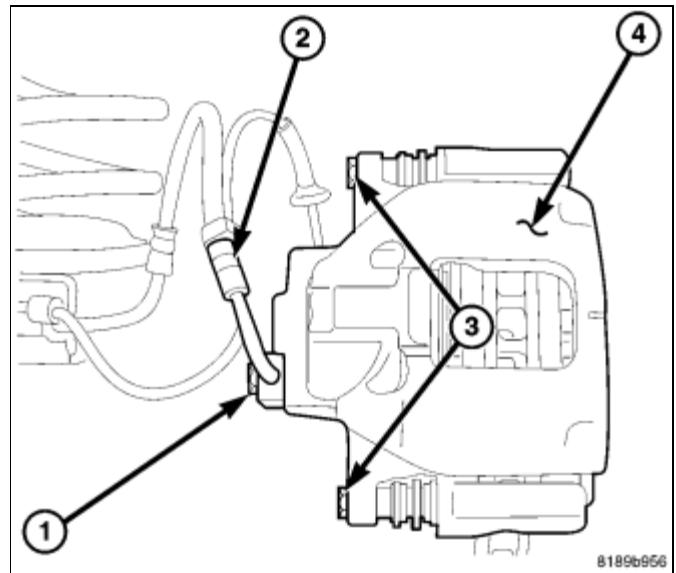
DISASSEMBLY

1. Remove brake shoes from caliper.
2. Drain brake fluid out of caliper.
3. Take a piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the piston. This will cushion and protect caliper piston during removal .

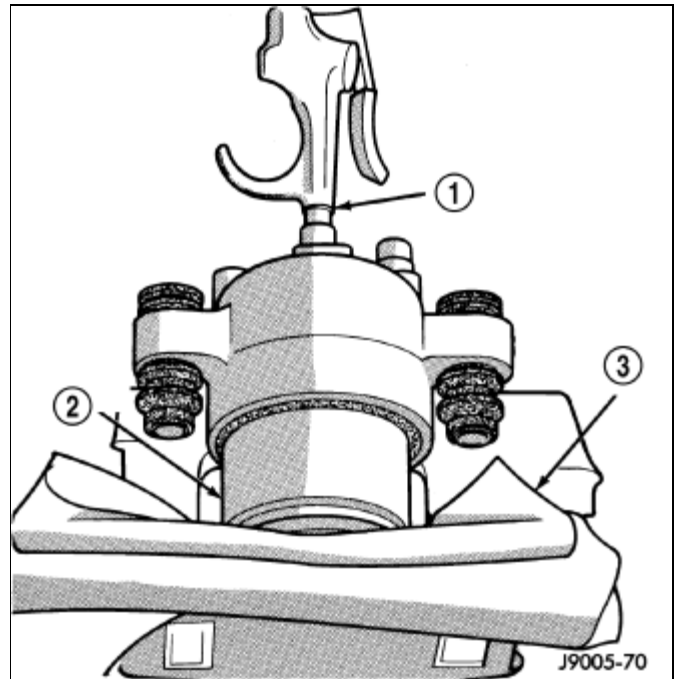
4. Remove caliper piston with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore .

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out.

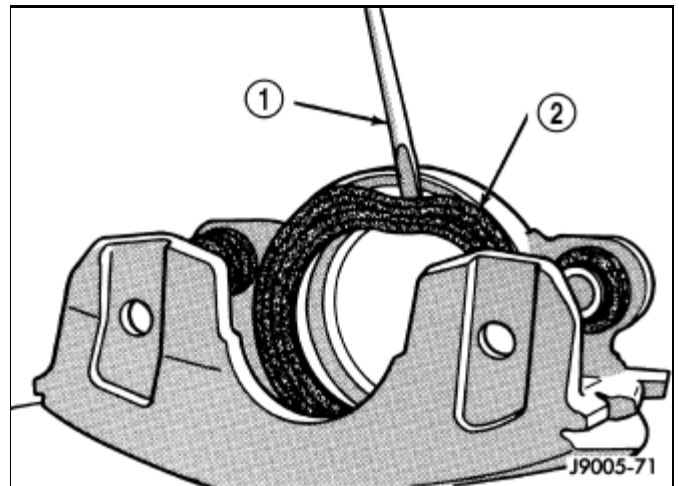
WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS MAY RESULT IN PERSONAL INJURY.



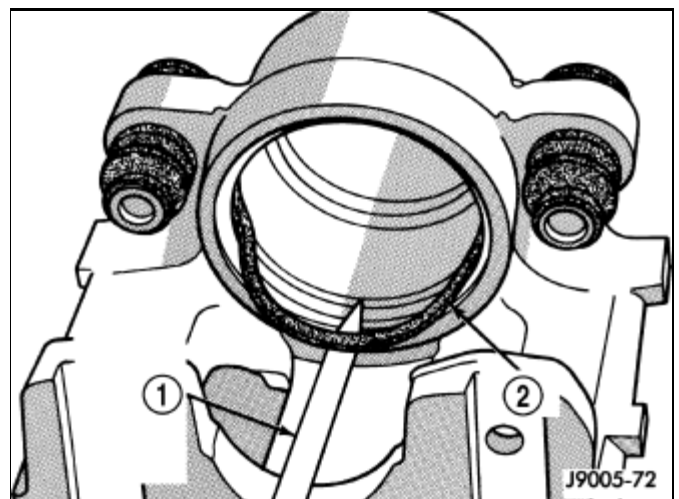
5. Remove caliper piston dust boot with suitable pry tool .



6. Remove caliper piston seal with wood or plastic tool . Do not use metal tools as they will scratch piston bore.



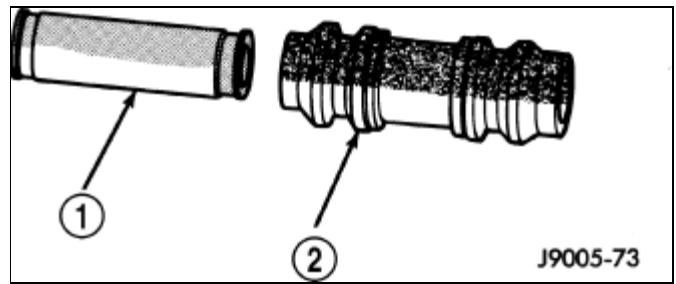
7. Remove caliper mounting bolt bushings and boots .



CLEANING

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

CAUTION: Do not use gasoline, kerosene, paint thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.



INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

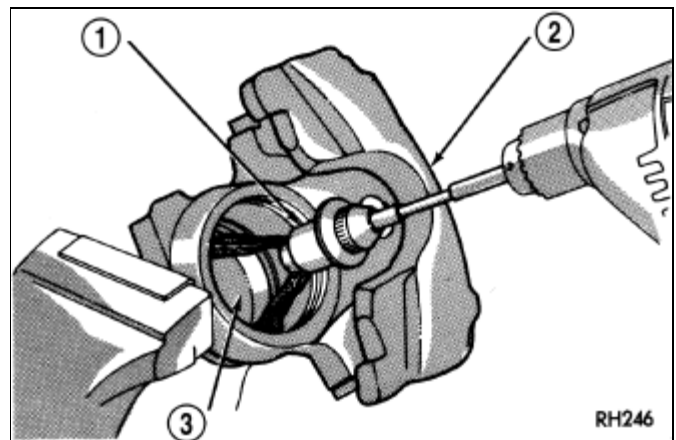
CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections. The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

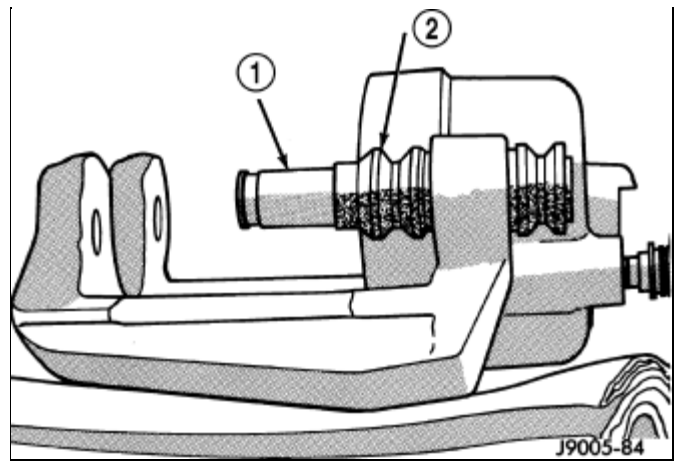
ASSEMBLY

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

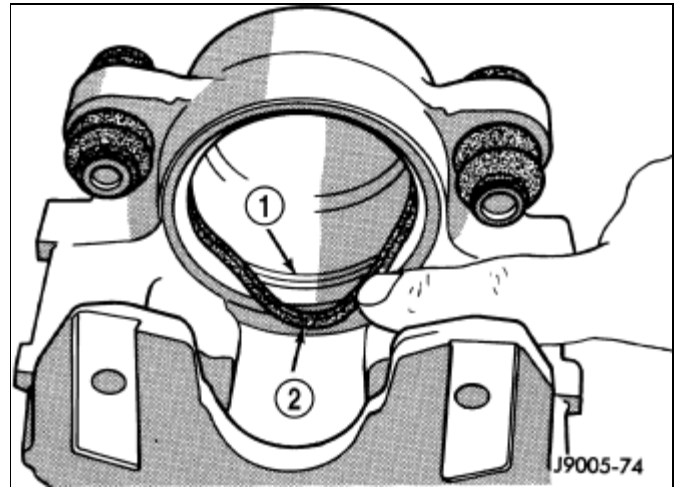
1. Lubricate caliper piston bore, new piston seal and piston with clean brake fluid.
2. Lubricate caliper bushings and interior of bushing boots with silicone grease.
3. Install bushing boots in caliper, then insert bushing into boot and push bushing into place.



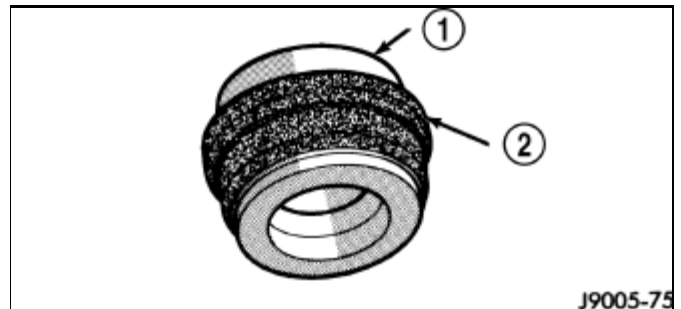
4. Install new piston seal into seal groove with finger.



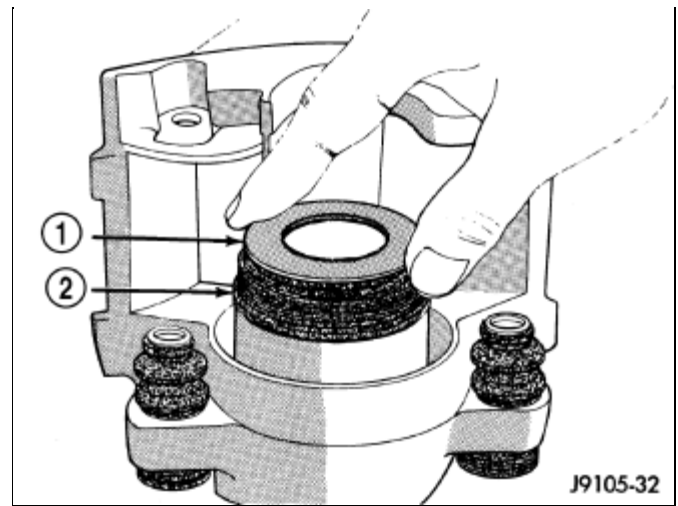
5. Install new dust boot on caliper piston and seat boot in piston groove .



6. Press piston into caliper bore by hand, use a turn and push motion to work piston into seal .



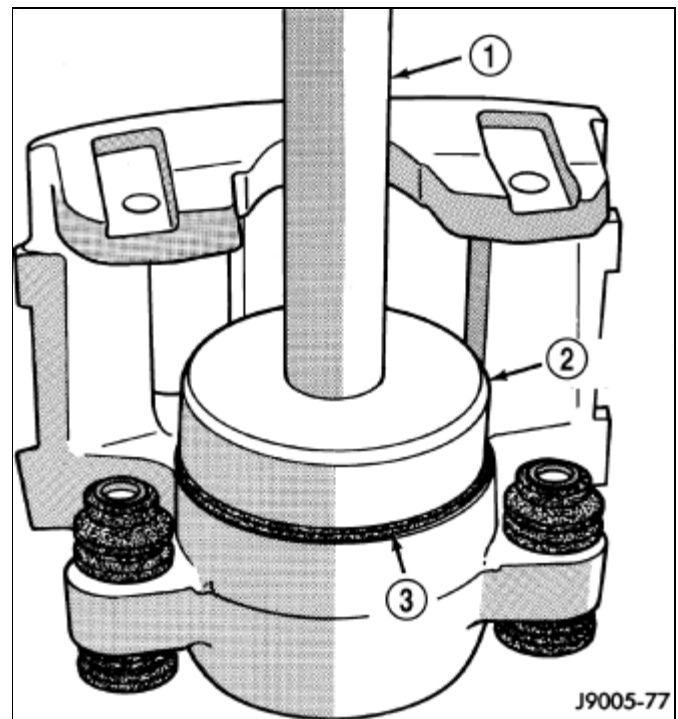
7. Press caliper piston to bottom of bore.
 8. Seat dust boot in caliper with Installer Tool C-4842 and Tool Handle C-4171 .



9. Replace caliper bleed screw if removed.

INSTALLATION

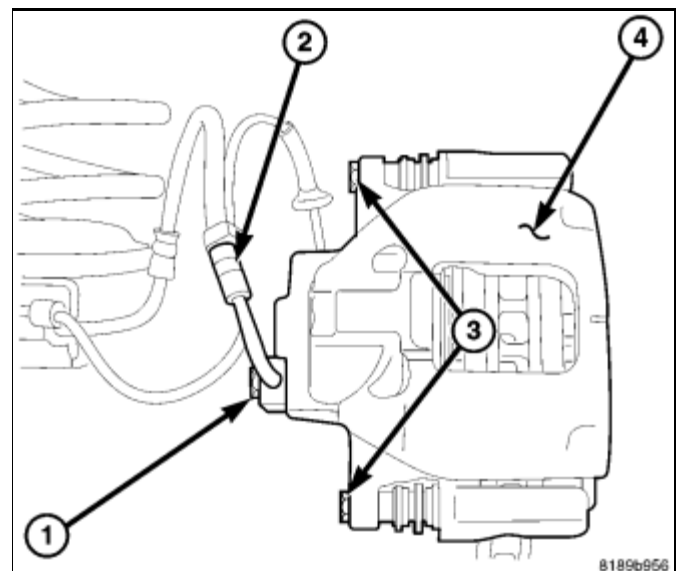
FRONT



1. Install the caliper (4) on the adapter.
2. Caliper slide pins should be free from debris and lightly lubricated..
3. Install the caliper slide pin bolts (3) and tighten to 35 N·m (26 ft. lbs.).
4. Gently lift one end of the slide pin boot to equalize air pressure, then release the boot and verify that the boot is fully covering the slide pin.

CAUTION: Verify brake hose is not twisted or kinked before tightening banjo bolt.

5. Install brake hose (1) to caliper (4) with **new copper washers (6)** and tighten banjo bolt (6) to 31 N·m (23 ft.

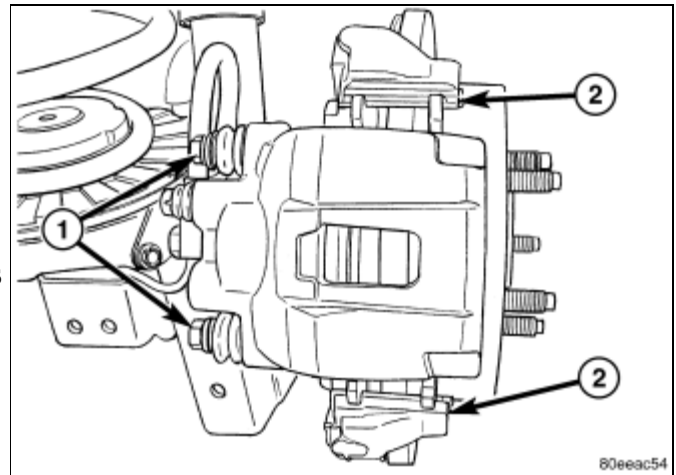


- lbs.).
- 6. Fill and bleed brake system.
- 7. Install wheel and tire assemblies.
- 8. Remove supports and lower vehicle.
- 9. Verify brake fluid level.

REAR

- 1. Install the brake pads if removed.
- 2. Install caliper to the caliper adapter.
- 3. Coat the caliper mounting slide pin bolts (1) with silicone grease. Then install and tighten the bolts to 35 N·m (26 in. lbs.).
- 4. Install the brake hose banjo bolt if removed.
- 5. Install the brake hose to the caliper with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.



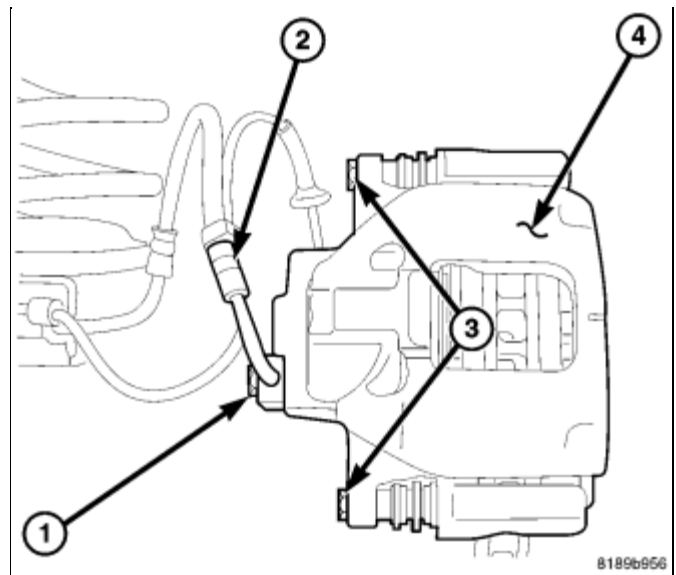
- 6. Remove the prop rod from the vehicle.
- 7. Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
- 8. Install the wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
- 9. Remove the supports and lower the vehicle.
- 10. Verify a firm pedal before moving the vehicle.

BRAKE PADS/SHOES

REMOVAL

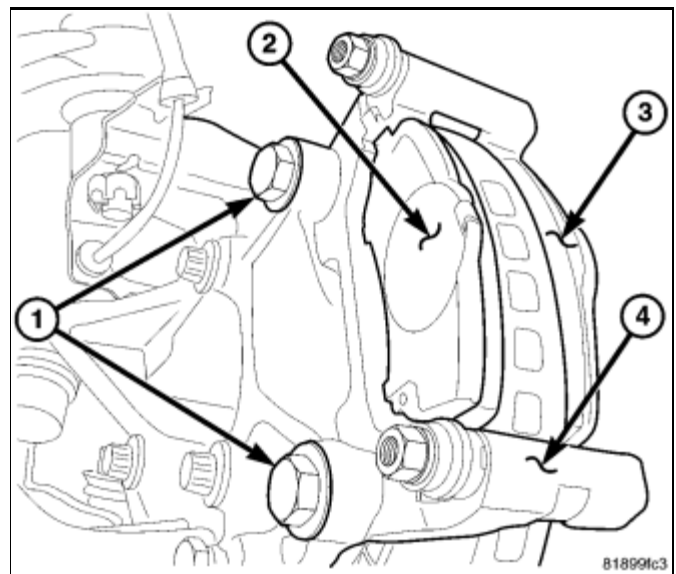
FRONT PADS

- 1. Raise and support vehicle.
- 2. Remove wheel and tire assembly.
- 3. Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.
- 4. Remove the 2 caliper mounting bolts (3).
- 5. Compress the caliper (4) and remove from the adaptor.
- 6. Secure caliper (4) to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**



7. Remove the inboard (2) and outboard brake pads (3) from the caliper adapter (4).
8. Remove the anti-rattle clips from the brake caliper adapter (4).

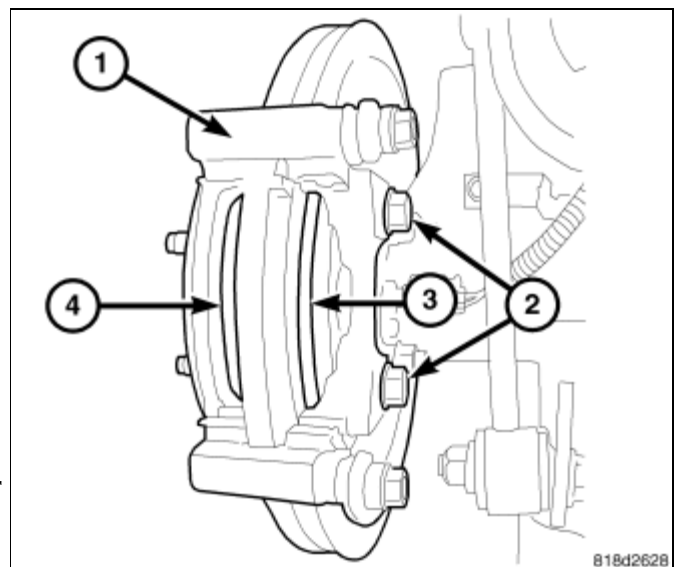
REAR DISC BRAKE PADS



1. Raise and support vehicle.
2. Remove the wheel and tire assemblies.
3. Compress the caliper.
4. Remove the caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

NOTE: Do not allow brake hose to support caliper assembly.

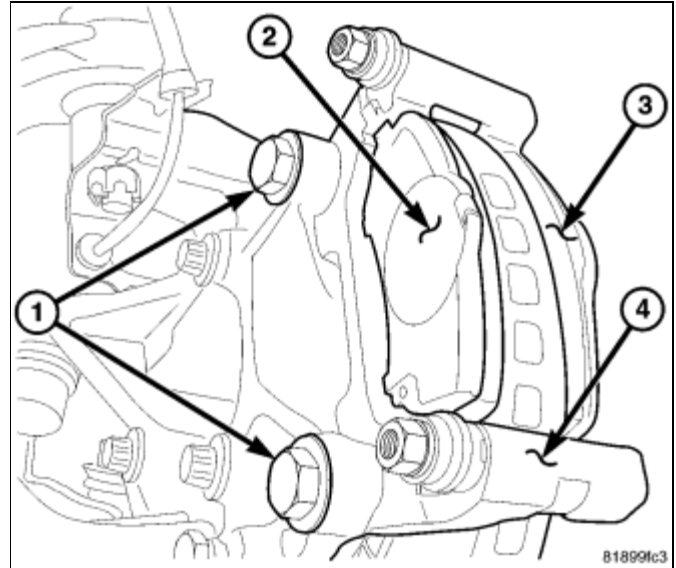
5. Support and hang the caliper.
6. Remove the inboard brake pad (3) from the caliper adapter (1).
7. Remove the outboard brake pad (4) from the caliper adapter (1).



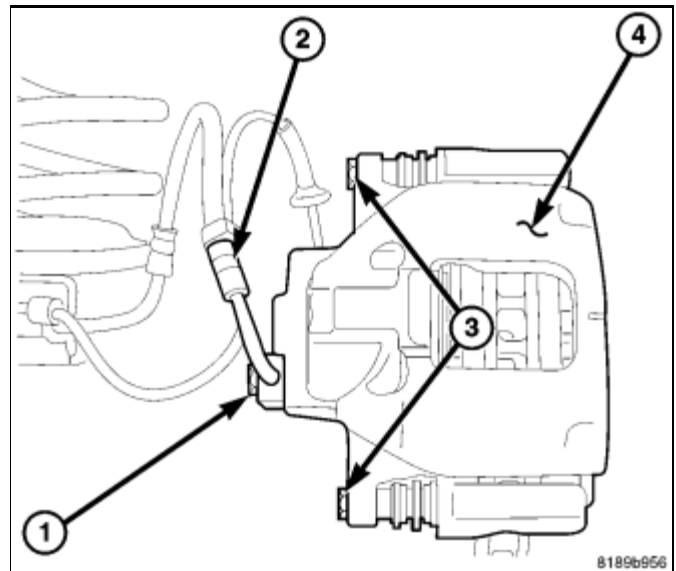
INSTALLATION

FRONT PADS

1. Remove and clean all rust and debris from the anti-rattle clip mounting surfaces (3) on the brake caliper adapter (2).
2. Install new anti-rattle clips into the caliper adapter (4).
3. Install the inboard (2) and outboard brake pads (3) onto the caliper adapter (4).



4. Install caliper (4) on the caliper adapter.
5. Install the caliper slide pin bolts (3) and tighten to 44 N·m (32 ft. lbs.).
6. Install wheel and tire assembly.
7. Remove support and lower vehicle.
8. Pump brake pedal until caliper pistons and brake pads are seated and a firm brake pedal is obtained.
9. Fill brake fluid.

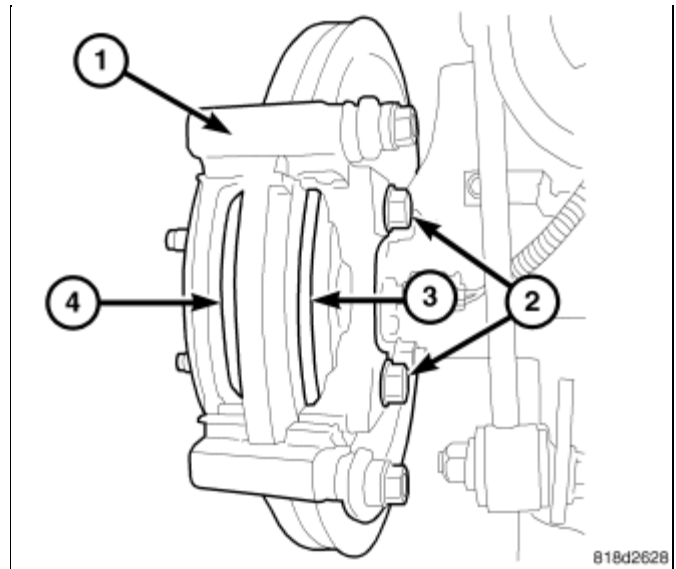


REAR DISC BRAKE PADS

1. Bottom pistons in caliper bore with C-clamp. Place an old brake shoe between a C-clamp and caliper piston.
2. Clean caliper mounting adapter and anti-rattle springs.
3. Install anti-rattle springs.

NOTE: Anti-rattle springs are not interchangeable.

4. Install inboard brake pad (3) in adapter (1).



5. Install outboard brake pad (4) in adapter (1).
6. Install caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
7. Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Apply brakes several times to seat caliper pistons and brake pads to obtain firm pedal.
9. Top off master cylinder fluid level.

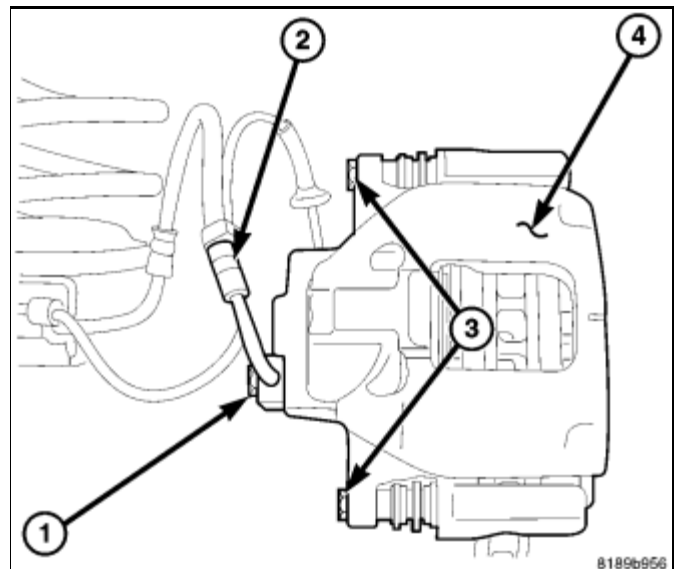
DISC BRAKE CALIPER ADAPTER

REMOVAL

FRONT

1. Raise and support the vehicle.
2. Remove the front wheel and tire assembly.
3. Remove the caliper (4) from the adaptor (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the disc brake caliper (1) from the adapter (4).

CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.

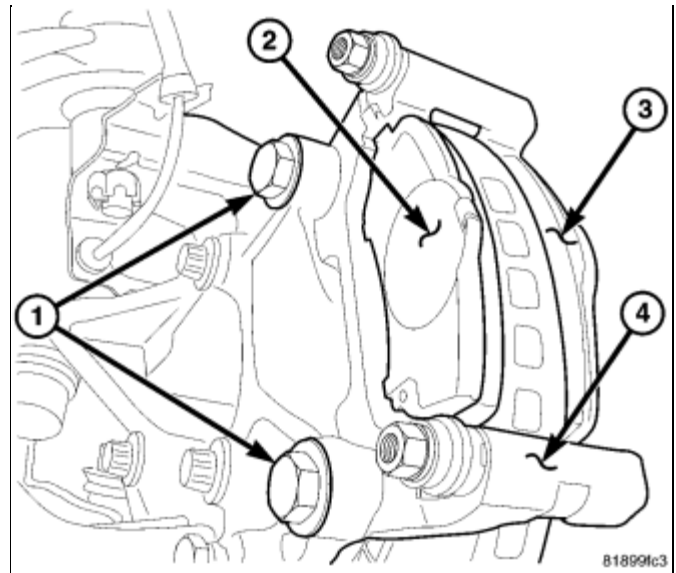


5. Remove the inboard (2) and outboard brake pads (3). (Refer to 5 -

BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL).

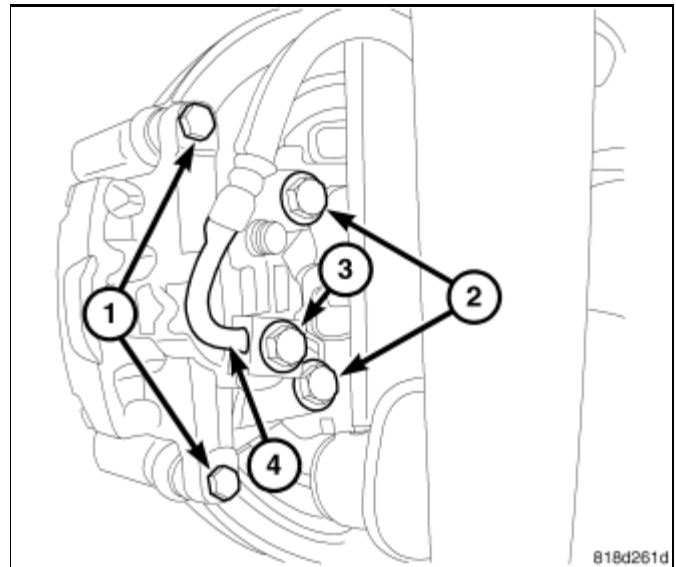
6. Remove the caliper adapter mounting bolts (1).
7. Remove the caliper adapter (4).

REAR



1. Raise and support the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the caliper (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the disc brake caliper from the adapter.

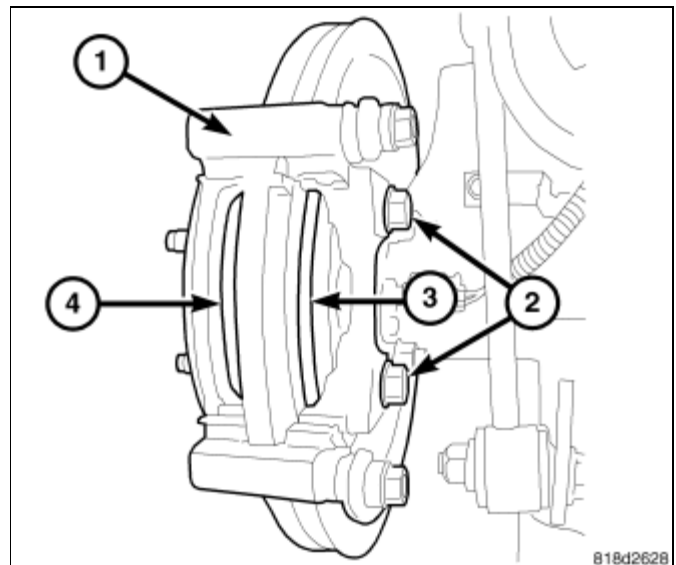
CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.



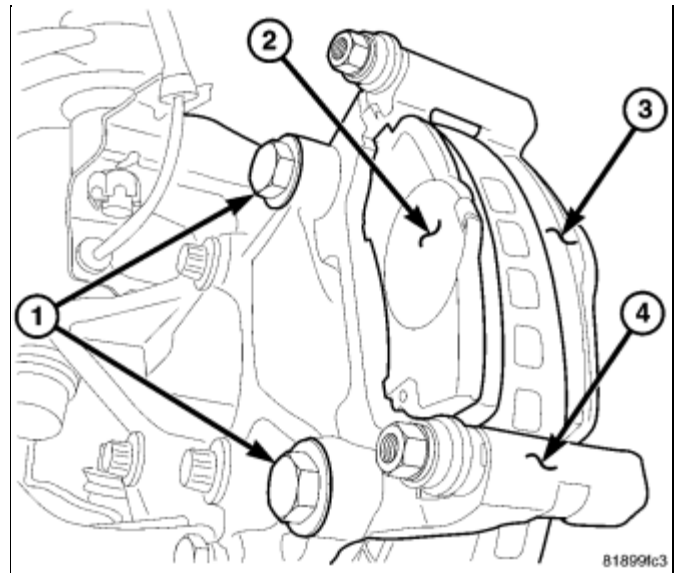
5. Remove the inboard (3) and outboard brake pads (4). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL).
6. Remove the caliper adapter mounting bolts (2).

INSTALLATION

FRONT

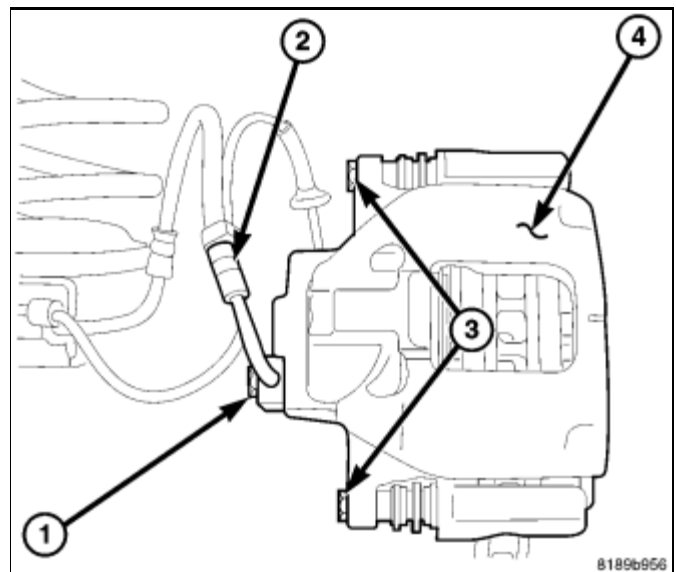


1. Install the caliper adapter mounting bolts (1). Tighten the mounting bolts to 163 N·m (120 ft.lbs).
2. Install the inboard (2) and outboard pads (3). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION).

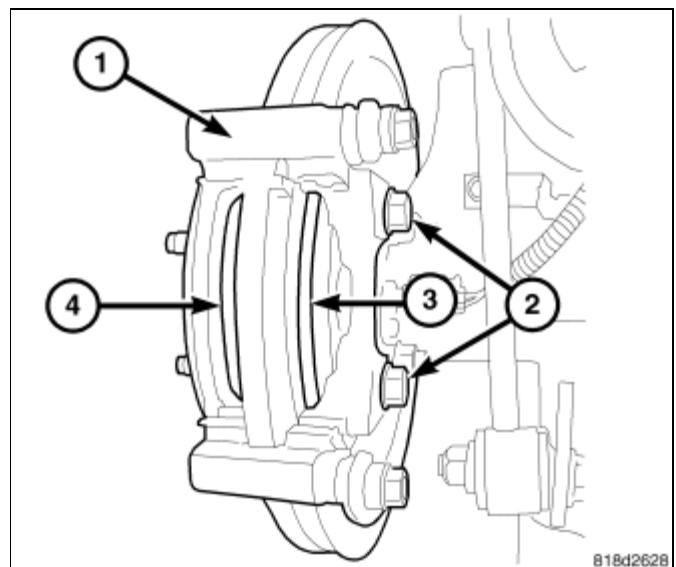


3. Install the caliper (4) to the adapter (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

REAR



1. Install the caliper adapter mounting bolts (2). Tighten the mounting bolts to 75 N·m (55 ft.lbs).
2. Install the inboard (3) and outboard pads (3). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION).



3. Install the caliper (1) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

FLUID

DIAGNOSIS AND TESTING

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, caliper seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

STANDARD PROCEDURE

BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and caps before checking fluid level. If not cleaned, dirt could enter the fluid.

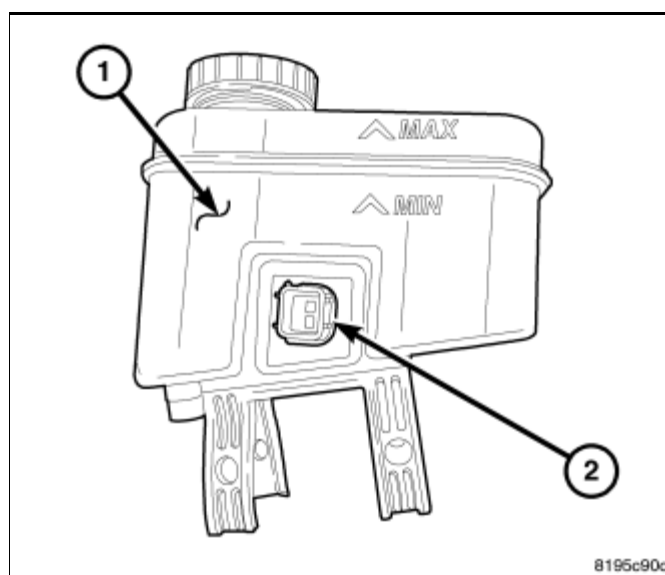
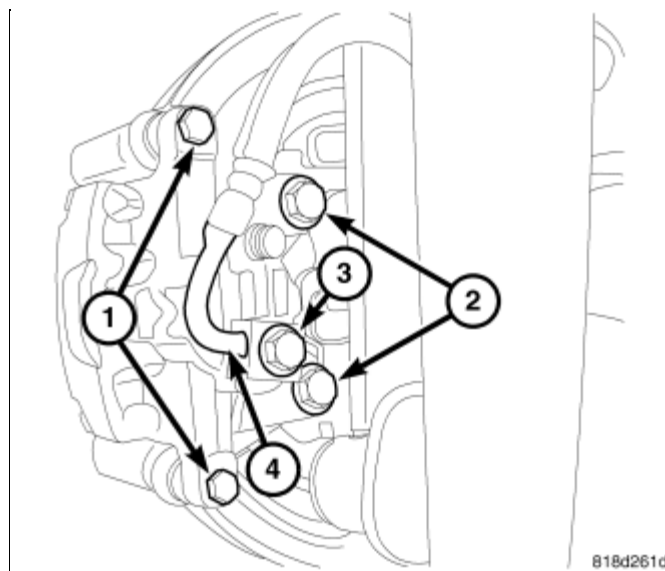
The fluid fill level is indicated on the side of the master cylinder reservoir (1).

The correct fluid level is to the MAX indicator on the side of the reservoir. If necessary, add fluid to the proper level.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.



CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open

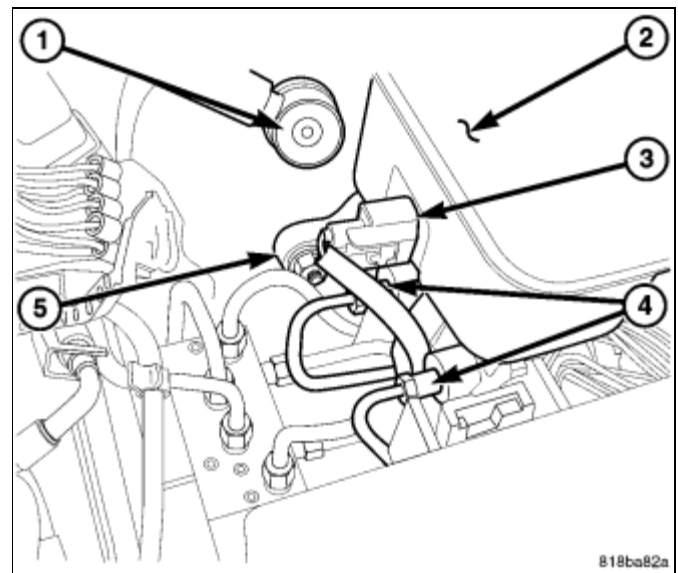
container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

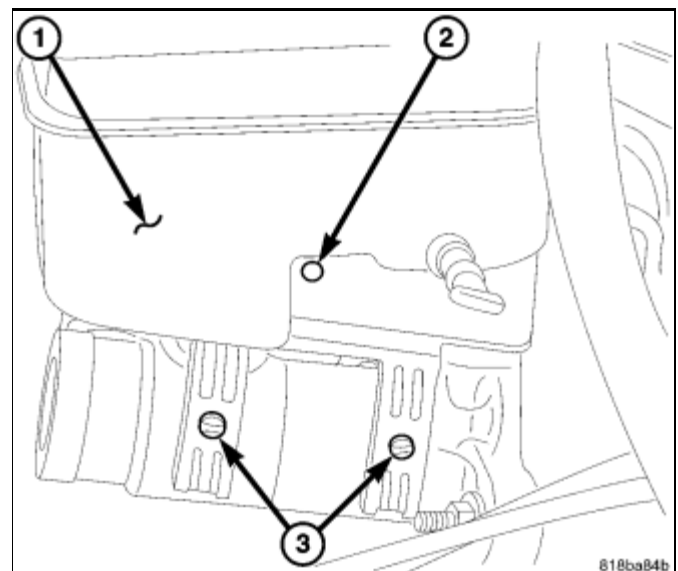
FLUID RESERVOIR

REMOVAL

1. Install prop rod on brake pedal to keep pressure on the brake system.
2. Remove reservoir cap and siphon fluid into drain container.
3. Remove the electrical connector (3) from the fluid level switch in the reservoir (2).

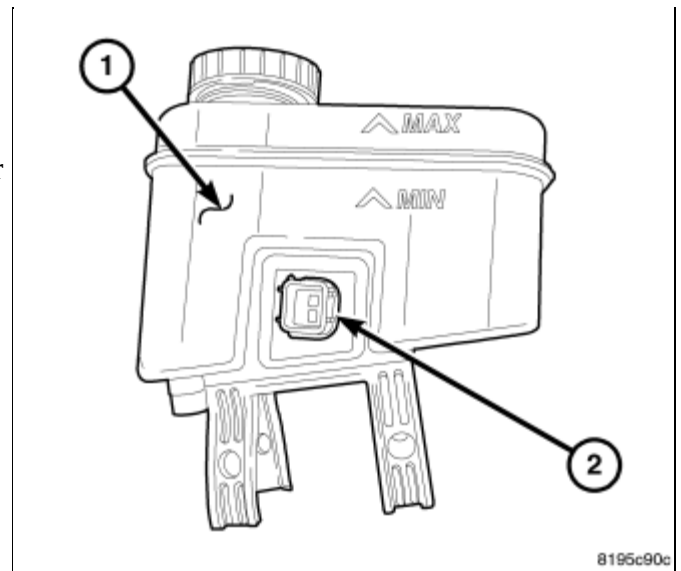


4. Remove the reservoir (1) from the master cylinder by pulling the four tabs (3) outward to release.



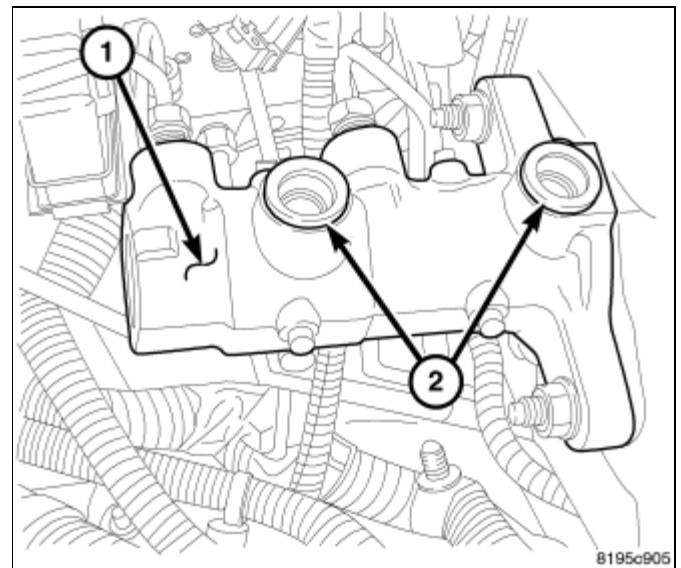
5. Remove the reservoir (1) from the master cylinder by pulling upwards.

6. If replacing the reservoir (1) remove the fluid level sensor (2) by squeezing the tabs together while pulling on the sensor (2).



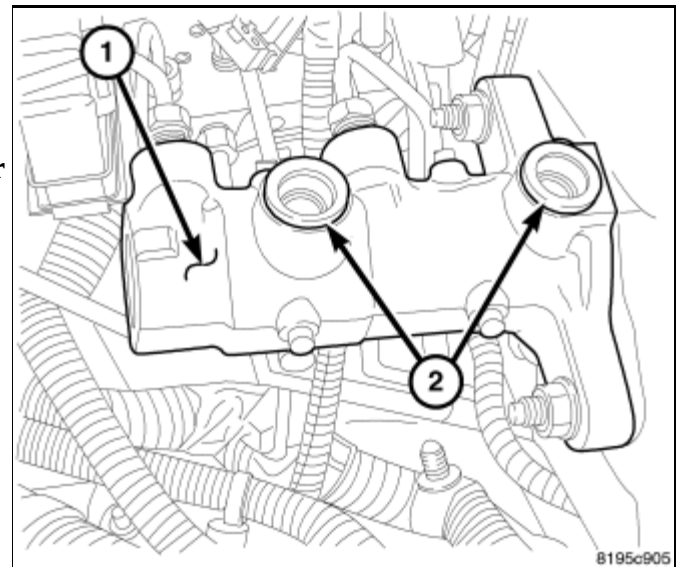
7. Remove old grommets (2) from cylinder body (1).

INSTALLATION

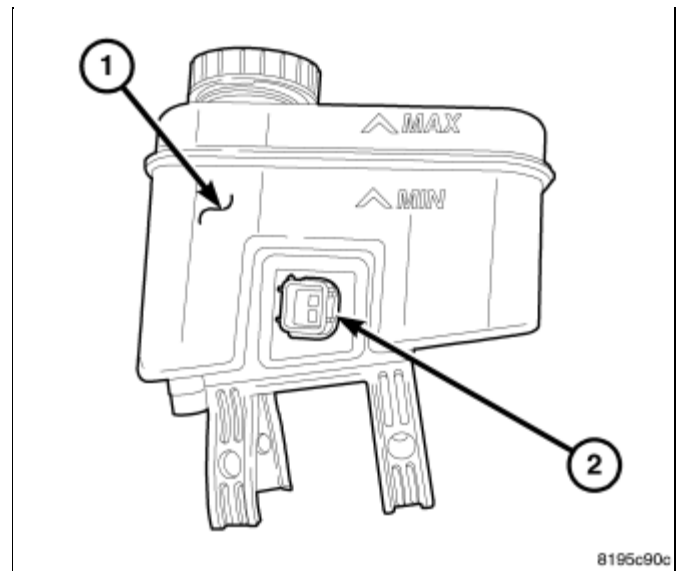


CAUTION: Do not use any type of tool to install the grommets (2). Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only and insure that the grommets are properly seated and checked for leaks after installation.

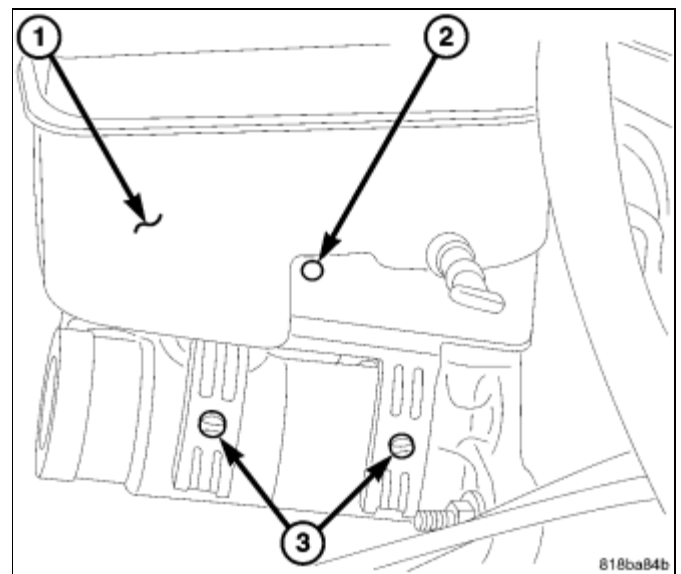
1. Lubricate new grommets (2) with clean brake fluid and Install new grommets (2) onto reservoir outlets (1). Use finger pressure to install and seat grommets.



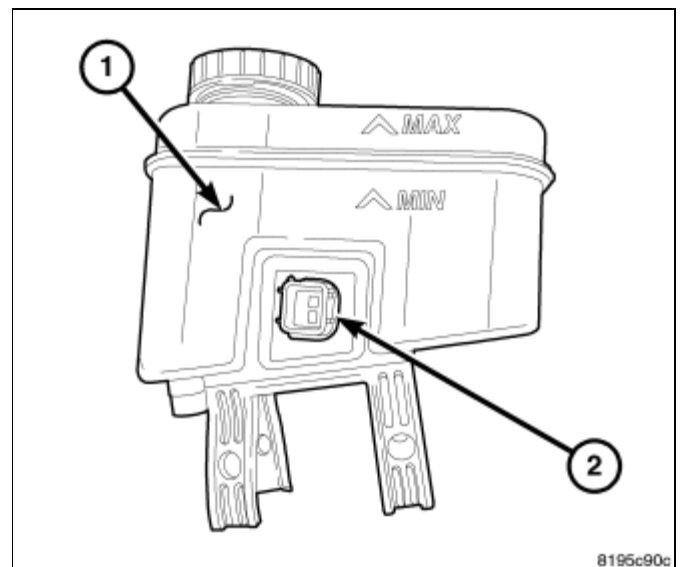
2. Start reservoir (1) and grommets into holes on master cylinder.



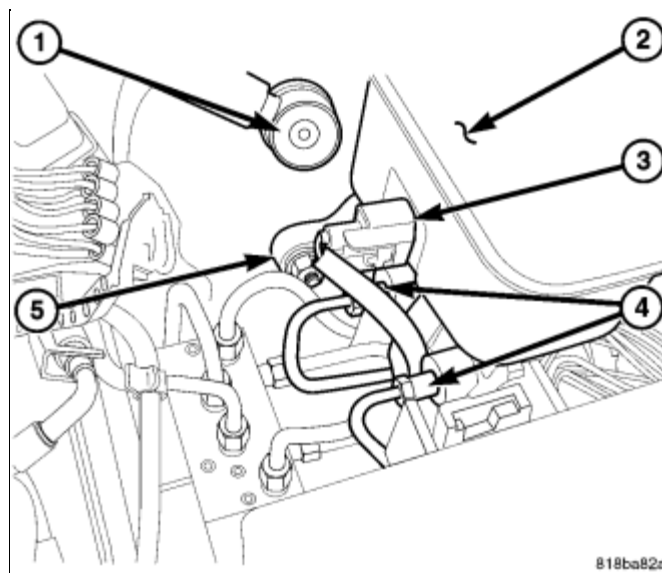
3. Then rock reservoir (1) back and forth while pressing downward to seat it in the holes on the master cylinder. **Make sure the four tabs are securely seated over the nubs (3).**



4. Install the fluid level sensor (2) if removed by just inserting the sensor in the reservoir until the tabs click.



5. Reconnect the electrical connector (3) to the fluid reservoir level switch.
6. Remove the prop rod from the vehicle.
7. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).



MASTER CYLINDER

DESCRIPTION

The master cylinder has a removable plastic reservoir. The cylinder body is made of aluminum and contains a primary and secondary piston assembly. The cylinder body including the piston assemblies are not serviceable. If diagnosis indicates an internal problem with the cylinder body, it must be replaced as an assembly. The reservoir and grommets are the only replaceable parts on the master cylinder.

OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes. The master cylinder reservoir stores reserve brake fluid for the hydraulic brake circuits.

DIAGNOSIS AND TESTING

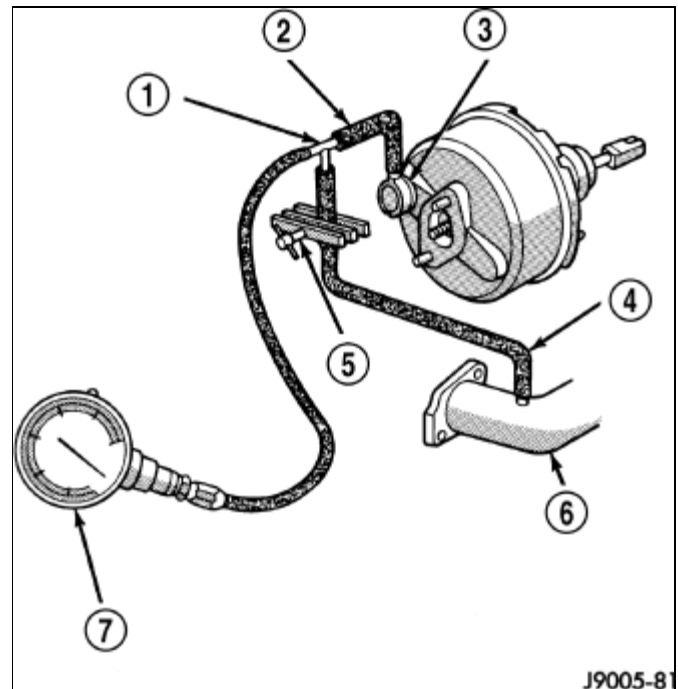
MASTER CYLINDER/POWER BOOSTER

1. Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding, also ensure booster mounting nuts are torqued correctly.
2. Stop engine and shift transmission into Neutral.
3. Pump brake pedal until all vacuum reserve in booster is depleted.
4. Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage). This could also indicate an external leak, such as at fittings, hoses, HCU, etc, or a symptom of an internal leak in the HCU
5. Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.
6. If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.
7. Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

POWER BOOSTER VACUUM TEST

1. Connect vacuum gauge to booster check valve with short length of hose and T-fitting .
2. Start and run engine at curb idle speed for one minute.
3. Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

4. Clamp hose shut between vacuum source and check valve.
5. Stop engine and observe vacuum gauge.
6. If vacuum drops more than one inch Hg (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.



POWER BOOSTER CHECK VALVE TEST

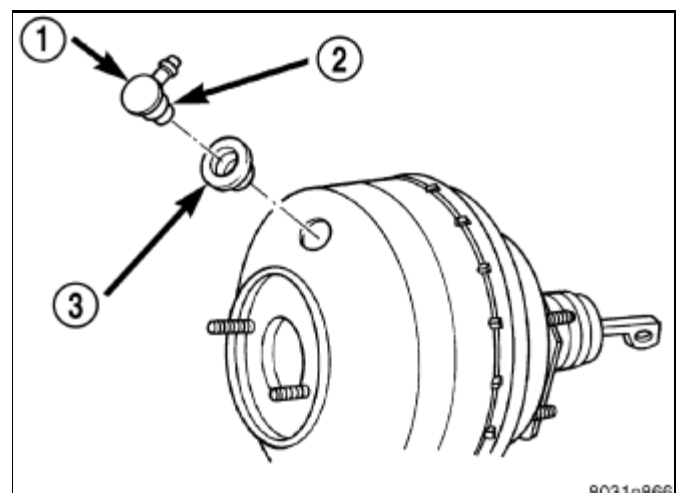
1. Disconnect vacuum hose from check valve.
2. Remove check valve and valve seal from booster.
3. Use a hand operated vacuum pump for test.
4. Apply 15-20 inches vacuum at large end of check valve .
5. Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

STANDARD PROCEDURE

MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

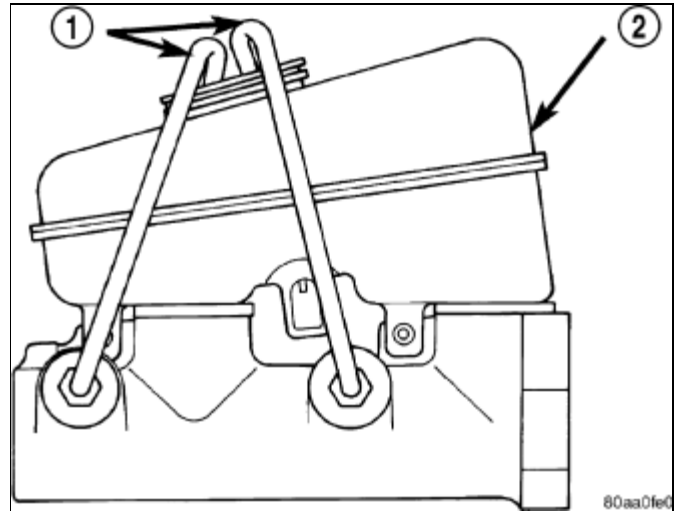
1. Mount master cylinder in vise.
2. Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir .
3. Fill reservoir with fresh brake fluid.
4. Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring



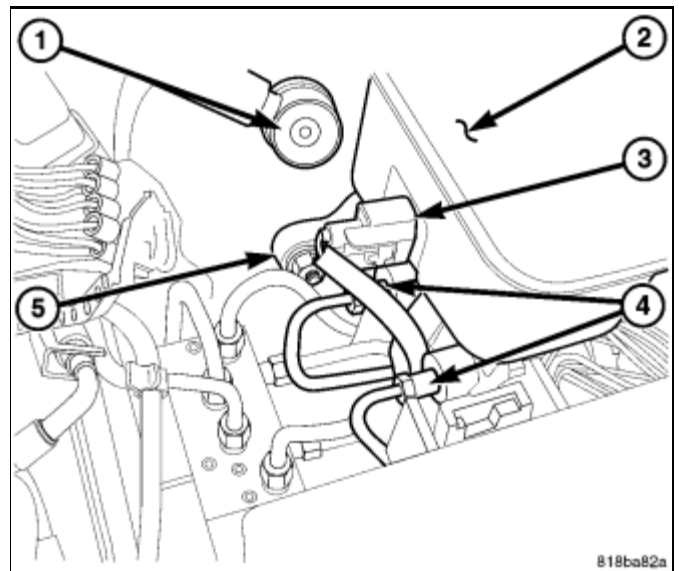
pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.

REMOVAL

NOTE: LHD shown in graphics. The removal and installation procedures and torques specs are the same for the RHD.



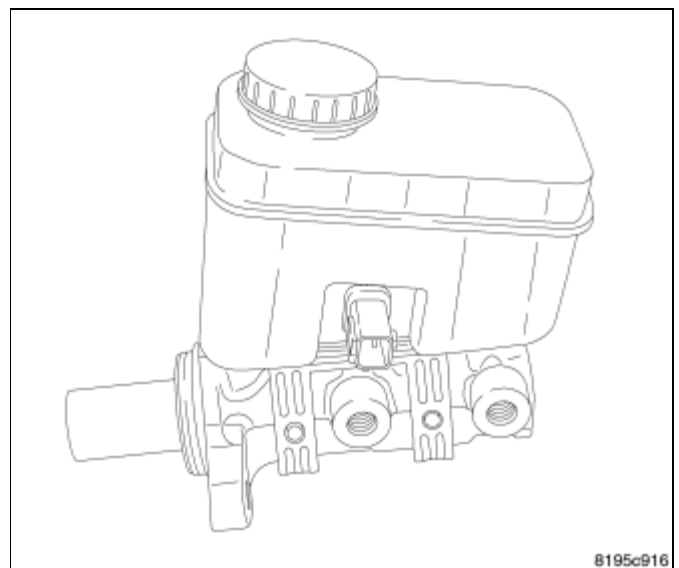
1. Siphon and drain the fluid from the reservoir (2).
2. Disconnect the fluid level electrical connector (3) from the reservoir (2).
3. Remove the brake lines (4) at the master cylinder.
4. Remove mounting nuts (5) from the master cylinder.



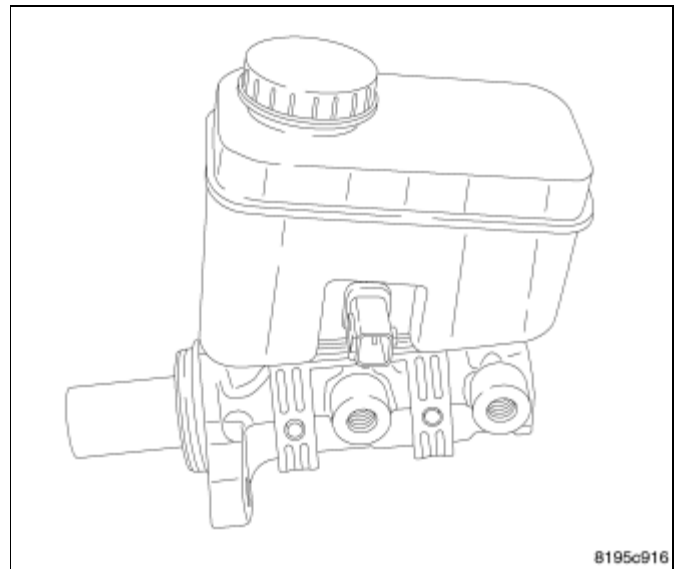
5. Remove master cylinder.
6. Remove cylinder cover and drain the rest of the fluid.
7. If master cylinder reservoir requires service, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/FLUID RESERVOIR - REMOVAL).

INSTALLATION

NOTE: LHD shown in graphics. The removal and installation procedures and torques specs are the same for the RHD.



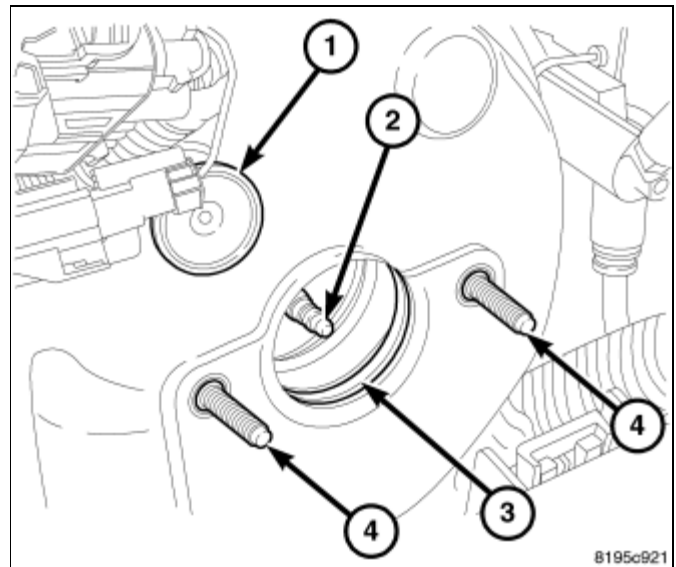
NOTE: If master cylinder is replaced, bleed cylinder before installation.



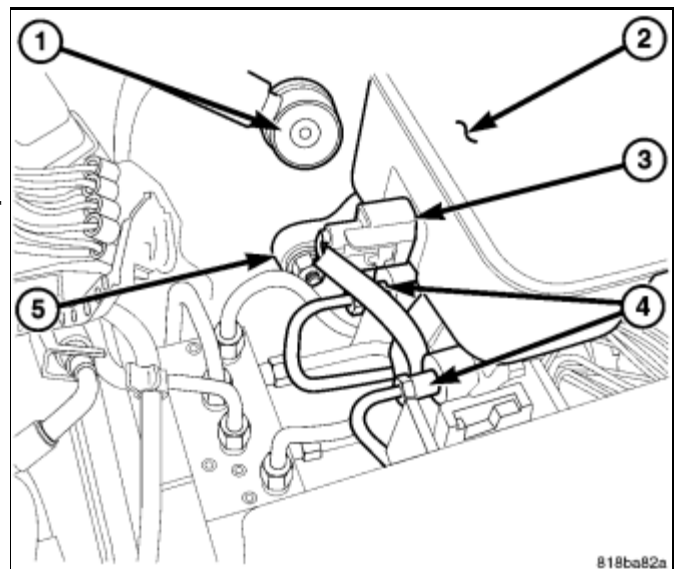
1. Clean cylinder mounting surface of brake booster (3).

NOTE: Insure the O-ring is on the master cylinder at the booster interface.

2. Install master cylinder onto brake booster studs (4).



3. Install mounting nuts (5) and tighten to 17 N·m (151 in. lbs.).
4. Connect the brake lines (4) to the master cylinder and tighten to 19 N·m (168 in. lbs.).
5. Connect fluid level electrical connector (3) to the reservoir (2).
6. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).



PEDAL

DESCRIPTION

A suspended-type brake pedal is used, the pedal pivots on a shaft mounted in the pedal support bracket. The bracket is attached to the dash panel.

The brake pedal assembly and pedal pad are the only serviceable component.

OPERATION

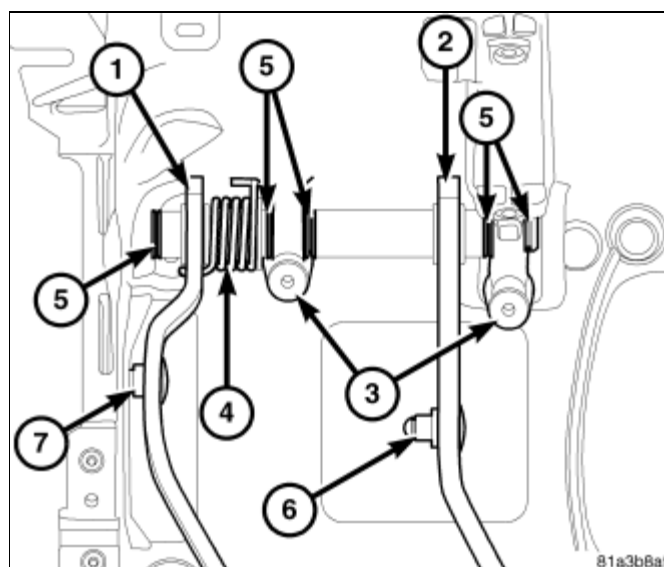
The brake pedal is attached to the booster push rod. When the pedal is depressed, the primary booster push rod is depressed which moves the booster secondary rod. The booster secondary rod depresses the master cylinder piston.

REMOVAL

1. Remove negative battery cable.
2. Remove the steering column opening cover.
3. Remove brake lamp switch **and discard**.
4. Remove retainer clip securing booster push rod (6) to brake pedal (2).
5. Disconnect the master cylinder/clutch push rod (7) from the pedal (1).
6. Remove the mounting bolts (3) securing the shaft.

NOTE: Clutch pedal is spring loaded (4), Care should be taken when shaft is being removed.

7. Slide the pedal shaft inboard until pedals fall free.
8. Remove pedal bushings (5) if they are to be replaced.

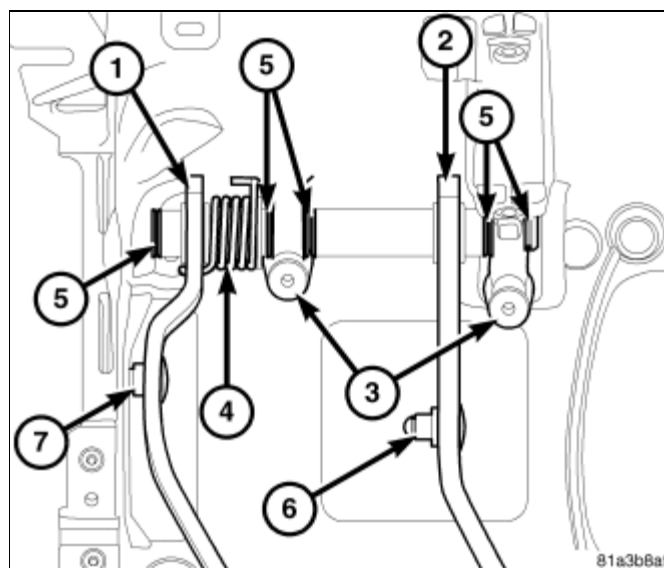


INSTALLATION

1. Install new bushings (5) in pedal and IP structure lubricate all bushings and shaft with multi-purpose grease.
2. Position the shaft in IP structure and install the shaft mounting bolts (3).
3. Install new retaining clip.
4. Install the booster push rod over the brake pedal (2) push pin (6).

NOTE: Clutch pedal is spring loaded (4), Care should be taken when shaft is being installed.

5. Reconnect the clutch M/C push rod (7) to clutch pedal (1) **if equipped**.
6. Install and connect a **new** brake lamp switch.
7. Install the steering column opening cover.



8. Install negative battery cable.

POWER BRAKE BOOSTER

DESCRIPTION

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms. The outer edge of each diaphragm is attached to the booster housing.

Two push rods are used in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

OPERATION

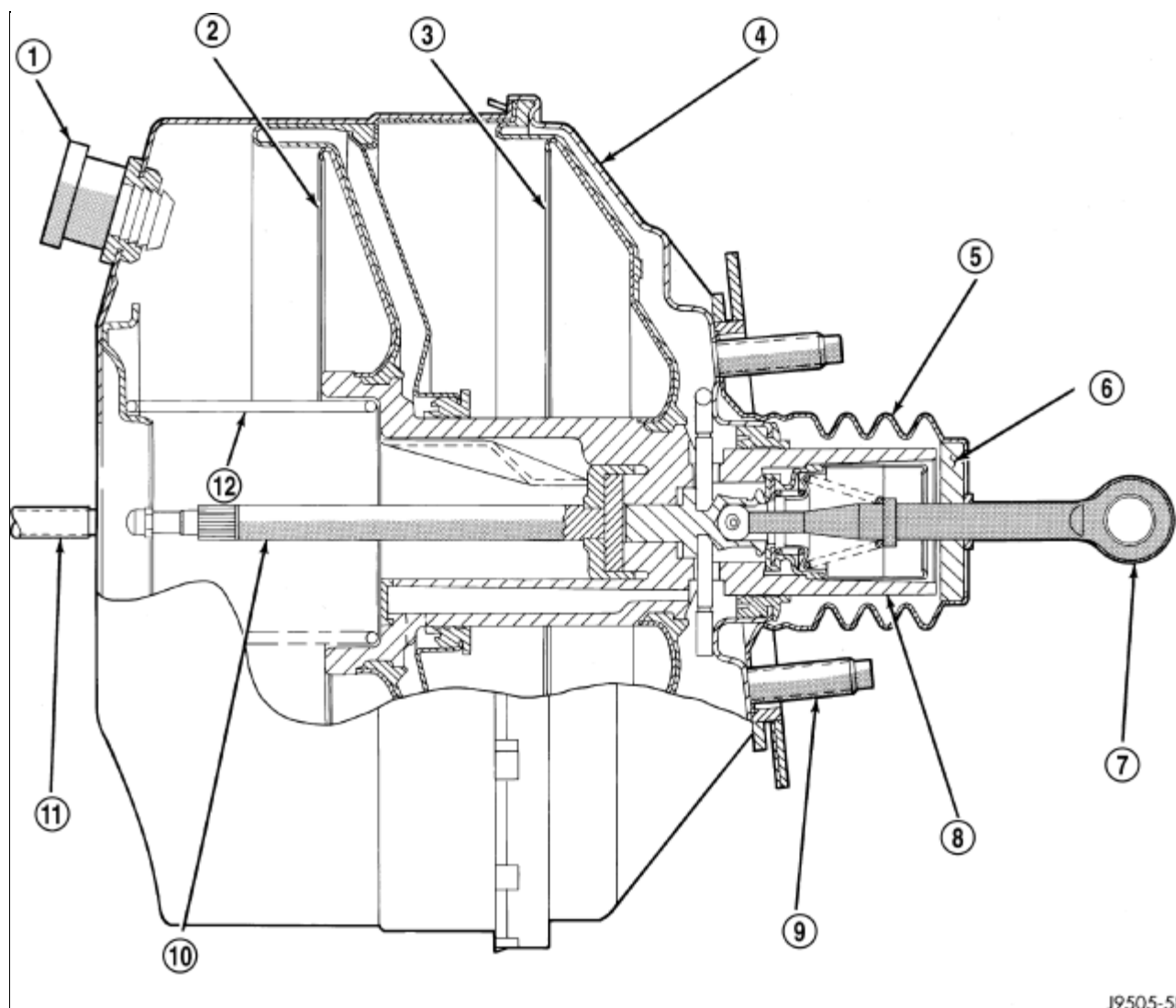
The atmospheric inlet valve is opened and closed by the primary push rod. Booster vacuum supply is through a hose attached to an intake manifold fitting at one end and to the booster check valve at the other. The vacuum check valve in the booster housing is a one-way device that prevents vacuum leak back.

Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing .

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply force for power assist.

The booster check valve, check valve grommet and booster seals are serviceable.

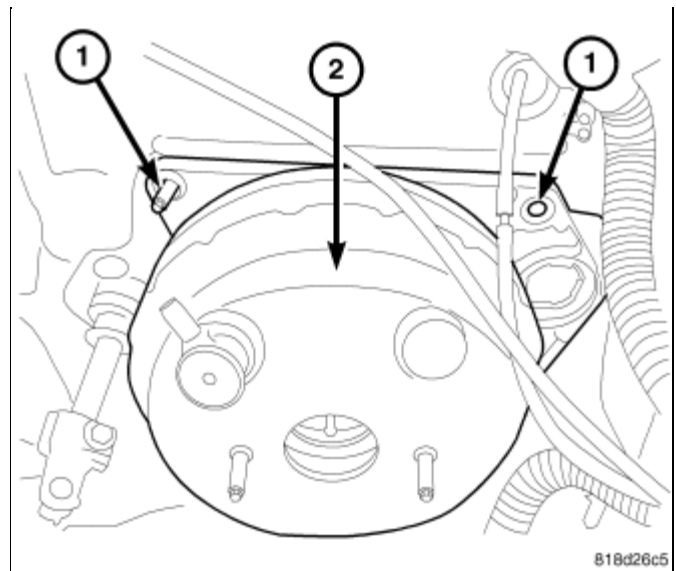


J9505-58

REMOVAL

NOTE: LHD shown in graphics. The removal and installation procedures and torques specs are the same for the RHD.

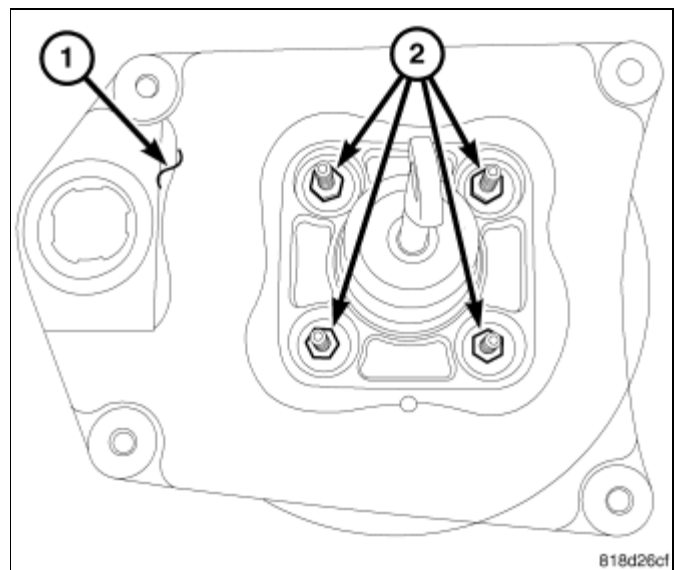
1. Remove the master cylinder.
2. Disconnect vacuum hose from booster check valve.
3. Remove retaining clip that secures booster push rod to brake pedal and slide the rod off the pin.
4. Remove the nuts (1) attaching booster mounting plate to the front cowl panel.
5. In engine compartment, slide booster and mounting plate out of the cowl panel, and remove the booster assembly from engine compartment.



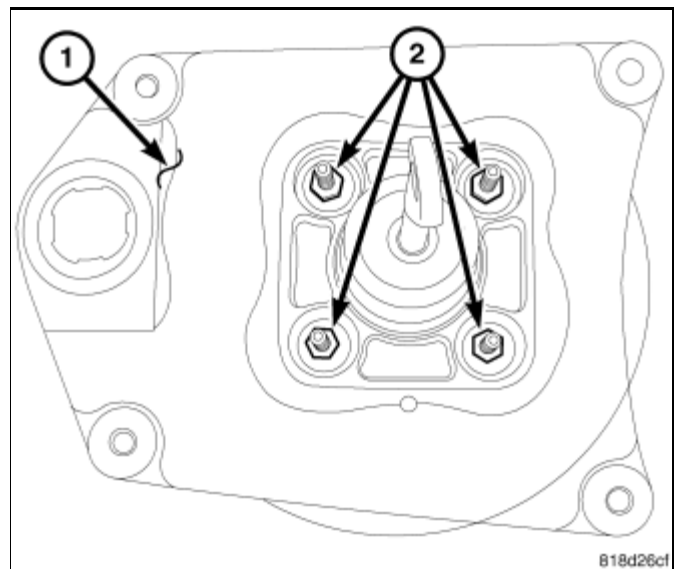
6. Remove booster mounting nuts (2) from the mounting plate (1).
7. Disconnect the clutch pedal from the clutch M/C **if equipped.**
8. Remove the booster from the mounting plate (1).

INSTALLATION

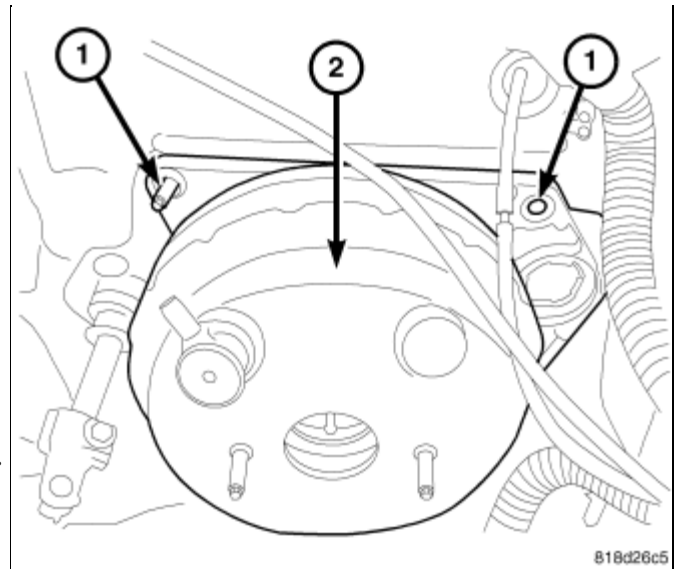
NOTE: LHD shown in graphics. The removal and installation procedures and torques specs are the same for the RHD.



1. Clean the booster mounting surface.
2. Install the booster on the mounting plate (1).
3. Install the booster mounting nuts (2) that attach booster to mounting plate. Tighten booster mounting nuts to 25 N·m (18 ft. lbs.).



4. Install the booster assembly (2) with the mounting plate to the front cowl.
5. Install the booster mounting plate nuts (1) that attach the mounting plate to the front cowl. Tighten booster mounting plate nuts **in an X pattern** to 18 N·m (159 in. lbs.).
6. Connect vacuum hose to booster check valve.
7. Install master cylinder.
8. Lubricate the pedal pin and bushing with Mopar multi-mileage grease. Then slide the booster push rod onto brake pedal pin and secure with retaining clip.
9. Reconnect the clutch M/C to pedal **if equipped**.
10. Top off master cylinder fluid level and bleed base brakes.



ROTORS

DIAGNOSIS AND TESTING

DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor surfaces can be restored by machining in a disc brake lathe if surface scoring and wear are light.

Replace the rotor under the following conditions:

- Severely Scored
- Tapered
- Hard Spots
- Cracked
- Below Minimum Thickness

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

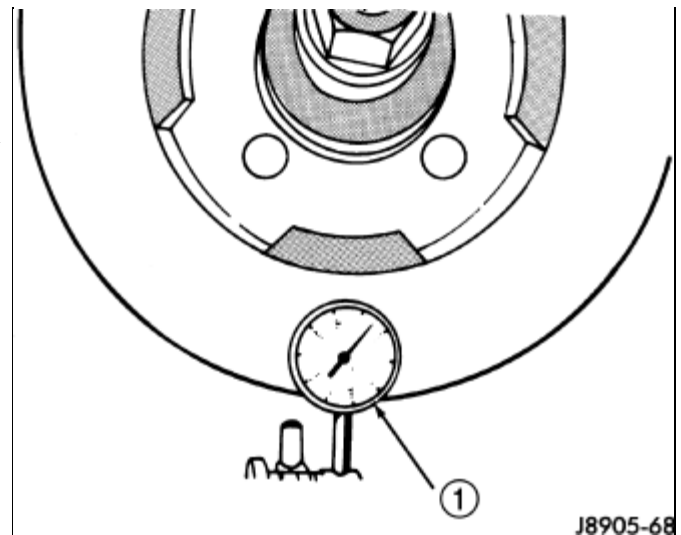
ROTOR RUNOUT

Check rotor lateral runout with dial indicator C-3339. Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brake shoes. Position the dial

indicator (1) plunger approximately 6.35 mm (1/4 in.) inward from the rotor edge.

NOTE: Be sure wheel bearing has zero end play before checking rotor runout.

Maximum allowable rotor runout is 0.102 mm (0.004 in.).



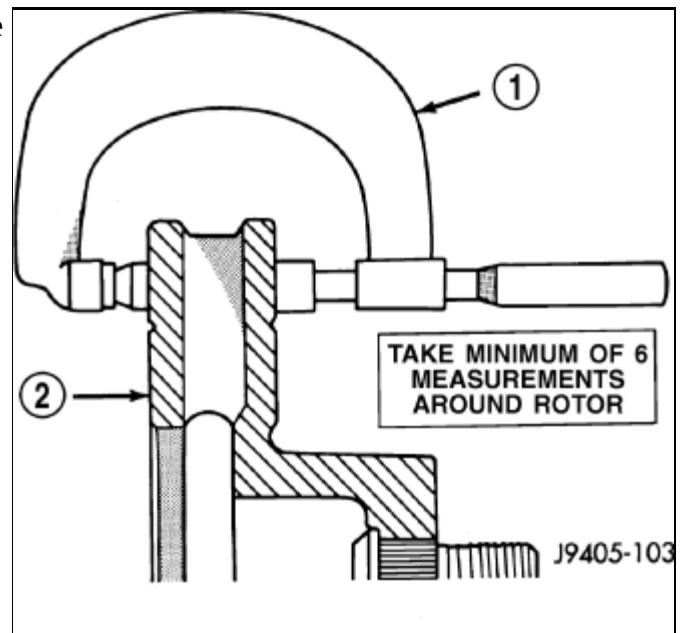
ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at 6-to-12 points around the rotor face .

Position the micrometer (1) approximately 25.4 mm (1 in.) from the rotor outer circumference for each measurement.

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point-to-point on the rotor. Machine or replace the rotor if necessary.



BRAKE DRUM IN HAT ROTOR

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum in hat.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Machine the drum if runout or variation exceed values. Replace the drum in hat rotor if machining causes the drum in hat rotor to exceed the maximum allowable diameter.

STANDARD PROCEDURE

DISC BRAKE ROTORS

NOTE: A hub mounted on-vehicle lathe is highly recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

The disc brake rotor can be machined if scored or worn. The on-vehicle lathe must machine both sides of the rotor simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the on-vehicle lathe. Equipment capable of machining only one side at a time may produce a tapered rotor **This type of rotor machining is not recommended.**

NOTE: Proper wheel torque is also critical to help prevent any warping of the disc brake rotor.

CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.

BRAKE DRUM IN HAT ROTOR MACHINING

The brake drum in hat rotor can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum in hat rotor is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum in hat rotor.

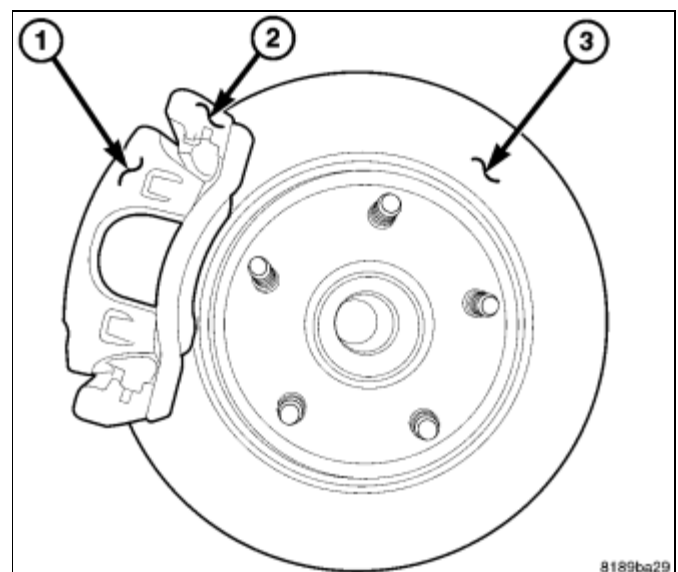
CAUTION: Replace the drum in hat rotor if machining will cause the drum to exceed the maximum allowable diameter.

REMOVAL

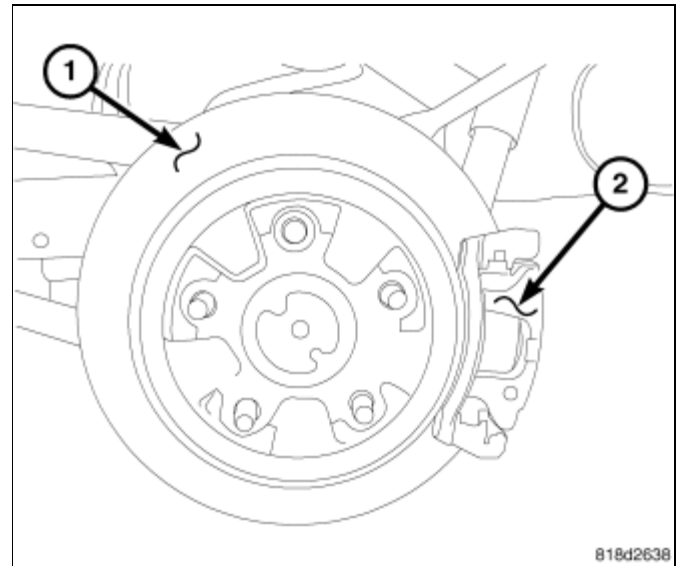
FRONT

1. Remove wheel and tire assemble.
2. Remove caliper (1). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
3. Remove retainers securing rotor to hub studs .
4. Remove rotor (3) from hub.
5. If rotor shield requires service, remove front hub and bearing assembly.

REAR

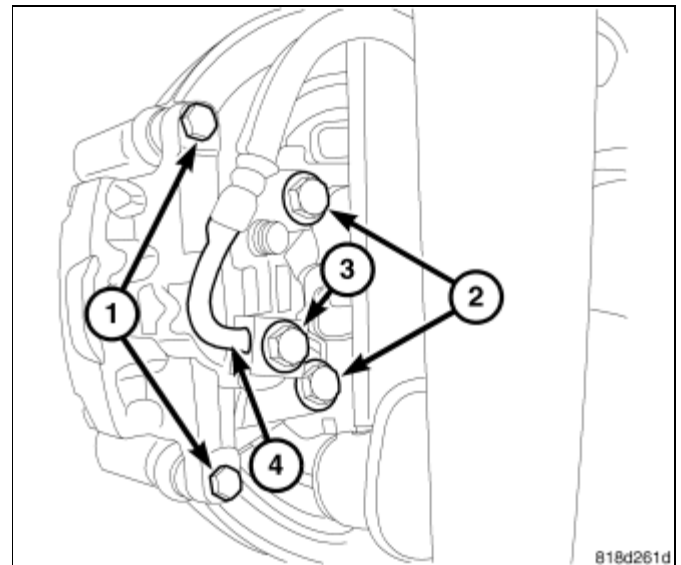


1. Raise and support the vehicle
2. Remove the tire and wheel assembly.



CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.

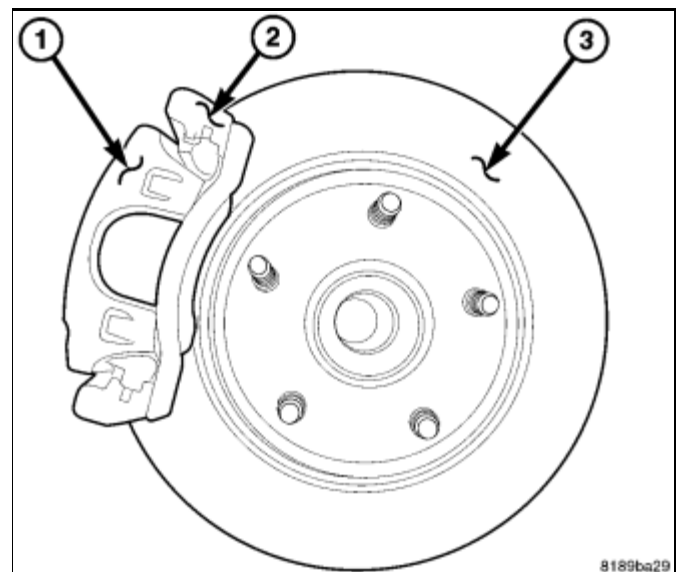
3. Remove the disc brake caliper adapter (2) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).
4. Remove the retaining clips and rotor assembly.



INSTALLATION

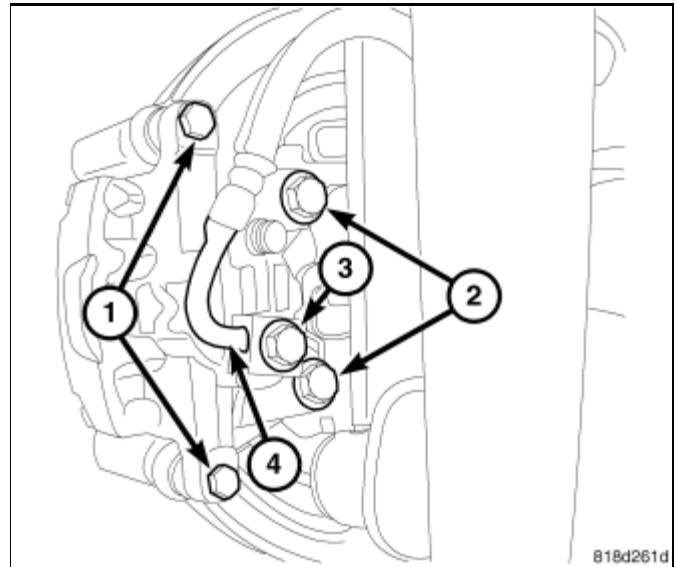
FRONT

1. Clean the hub from any rust before installing the rotor.
2. Install rotor on hub.
3. Install caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
4. Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).



REAR

1. Install the rotor to the axle shaft.
2. Install the disc brake caliper adapter (2) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

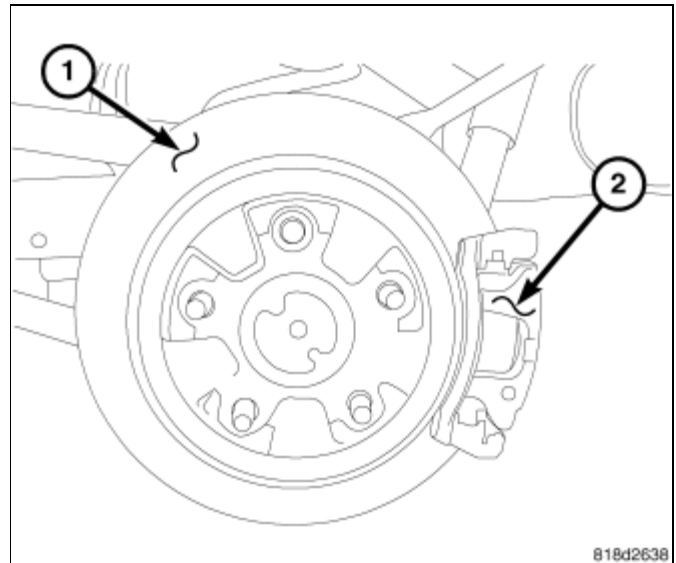


3. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
4. Lower the vehicle.

SUPPORT PLATE

REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).
4. Remove the disc brake rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
5. Remove the wheel speed sensor (Refer to 5 - BRAKES/ELECTRICAL/REAR WHEEL SPEED SENSOR - REMOVAL).
6. Lock out the front brake cable at the equalizer.
7. Remove the rear parking brake cable from the equalizer.
8. Remove the parking brake cable from the brake shoe lever at the axle.
9. Remove the axle shaft.
10. Tap the support plate from the axle shaft.
11. Disassemble the rear park brake shoes.
12. Remove the support plate from the axle seal plate.



INSTALLATION

NOTE: After parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake lever.

1. Install the support plate on the axle seal plate. Tighten the bolts to
2. Reassemble the rear park brake shoes.
3. Install the support plate on the axle shaft.
4. Install the axle shaft to the axle.
5. Reconnect the brake cable to the park brake shoe lever behind the support plate.
6. Install the rear park brake cable at the equalizer.
7. Remove the lockout on the front park brake cable.
8. Install the rear wheel speed sensor. (Refer to 5 - BRAKES/ELECTRICAL/REAR WHEEL SPEED SENSOR - INSTALLATION).
9. Adjust the rear brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).
10. Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
11. Install the disc brake caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
12. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
13. Check and fill the rear axle fluid.
14. Lower the vehicle.
15. Check the operation of the park brake system.

PARKING BRAKE

DESCRIPTION

The parking brake is a hand lever (1) and cable (2) operated system used to apply the rear brakes.

OPERATION

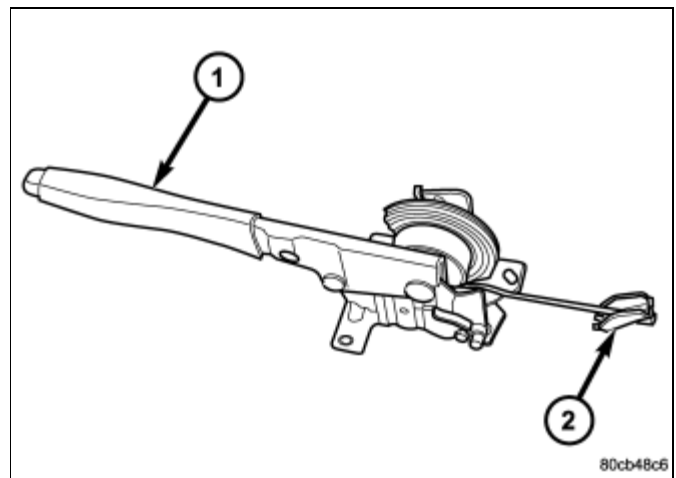
A hand operated lever in the passenger compartment is the main application device. The front cable is connected between the hand lever and the tensioner.

The rear cables are connected to the actuating lever on each secondary brake shoe.

To apply the parking brakes, the hand lever is pulled upward. This pulls the rear brake shoe actuating levers forward, by means tensioner and cables.

A parking brake switch is mounted on the parking brake lever and is actuated by movement of the lever. The switch, which is in circuit with the red warning light in the dash, will illuminate the warning light whenever the parking brakes are applied.

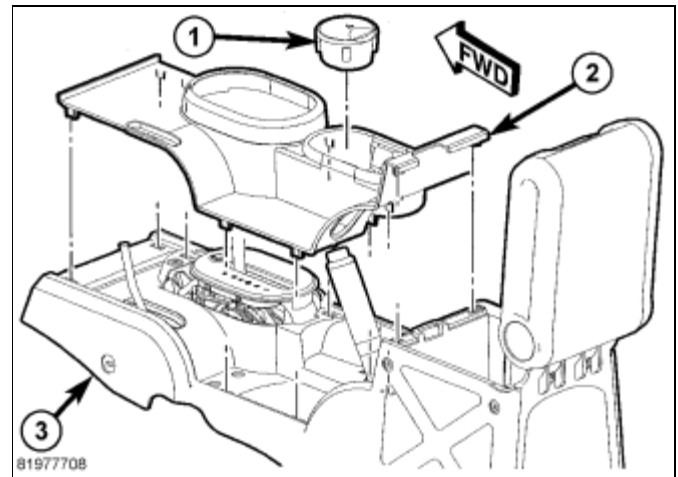
Parking brake adjustment is controlled by a cable tensioner mechanism. The cable tensioner, once adjusted at the factory, should not need further adjustment under normal circumstances. Adjustment may be required if a new tensioner, or cables are installed, or disconnected.



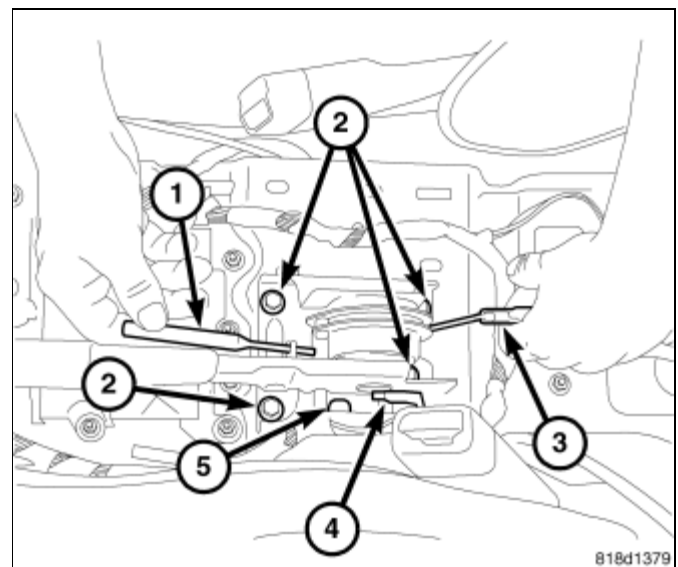
STANDARD PROCEDURE

PARK BRAKE SYSTEM LOCKOUT

1. Remove the center floor console (3) (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).

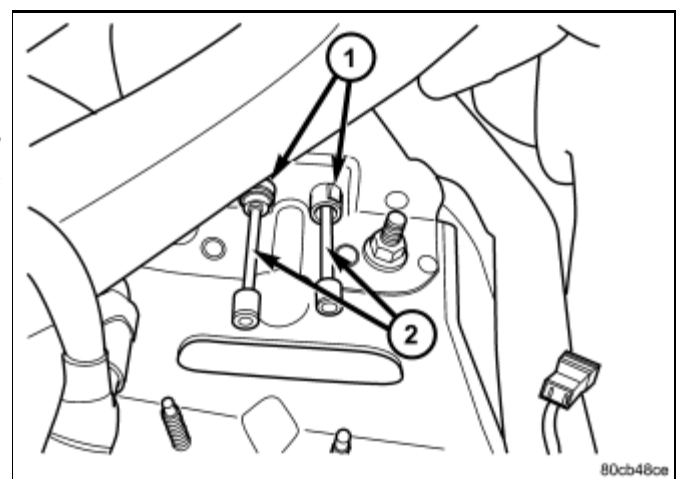


2. Pull up on the equalizer cable (3) and then install a suitable tool (1) to lockout the park brake lever.



3. Remove the rear park brake cables (2) from the equalizer.

When repairs are completed install the rear park brake cables to the equalizer, remove the lockout tool, check the operation of the system and then install the center floor console (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).



SHOES

DESCRIPTION

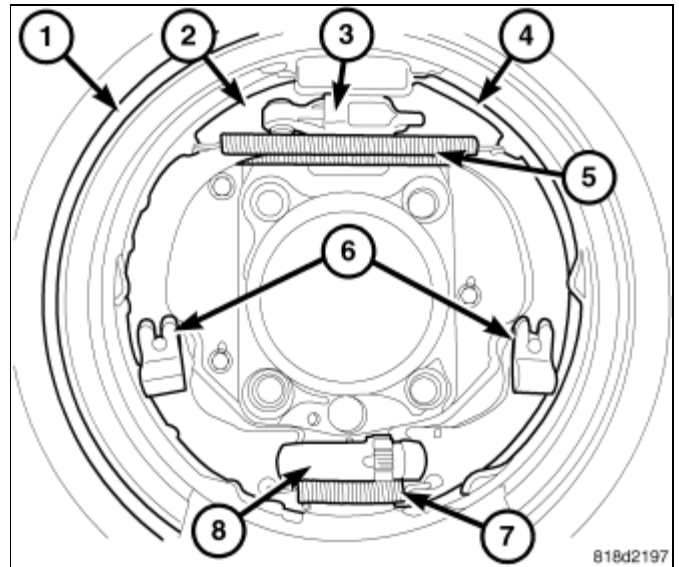
Drum in hat park brakes are dual shoe (2&4), internal expanding units with an automatic self adjusting mechanism.

OPERATION

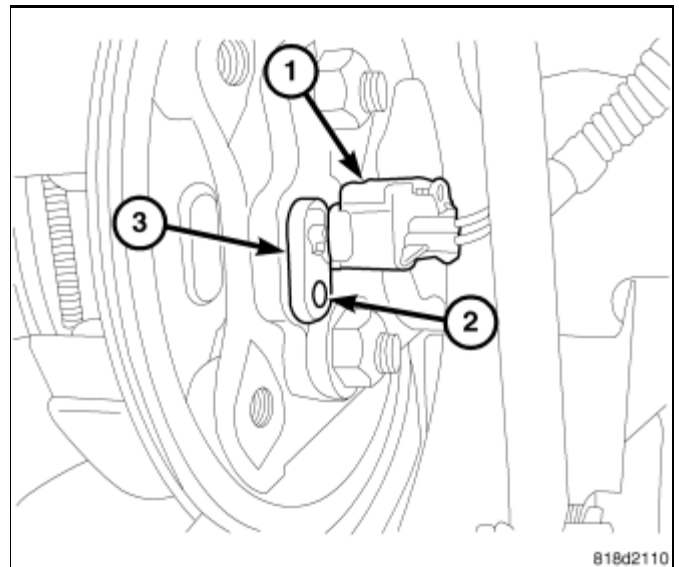
When the parking brake lever is pulled the brake cable pulls the brake shoes outward against the brake drum. When the brake lever is released the return springs attached to the brake shoes pull the shoes back to their original position.

REMOVAL

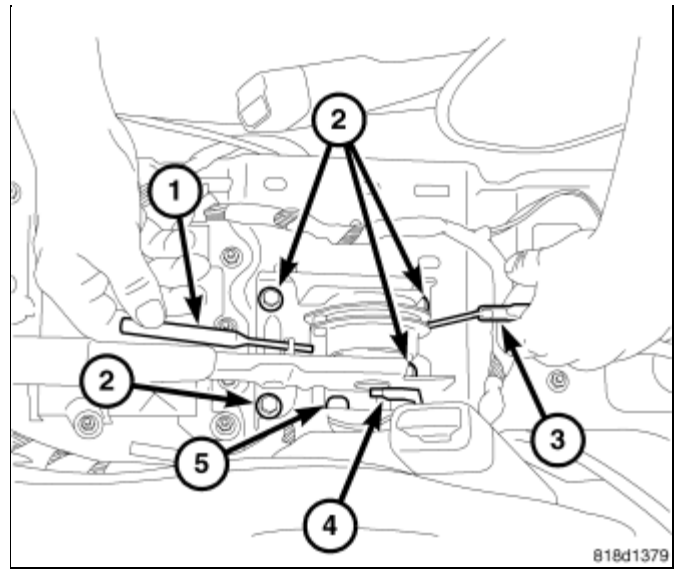
1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).
4. Remove the disc brake rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).



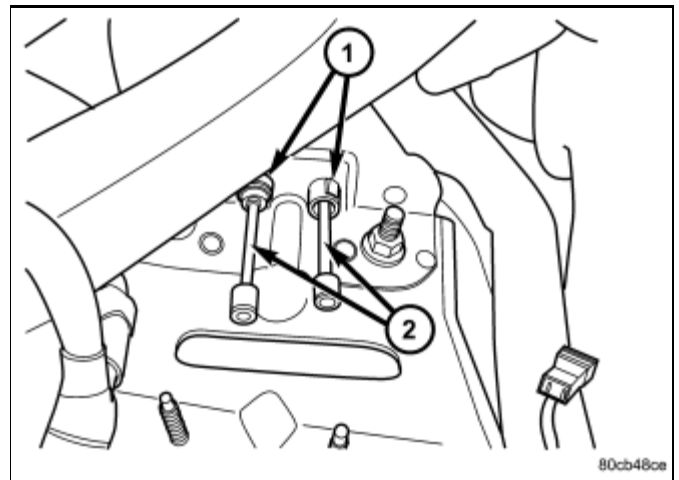
5. Remove the wheel speed sensor (3) (Refer to 5 - BRAKES/ELECTRICAL/REAR WHEEL SPEED SENSOR - REMOVAL).



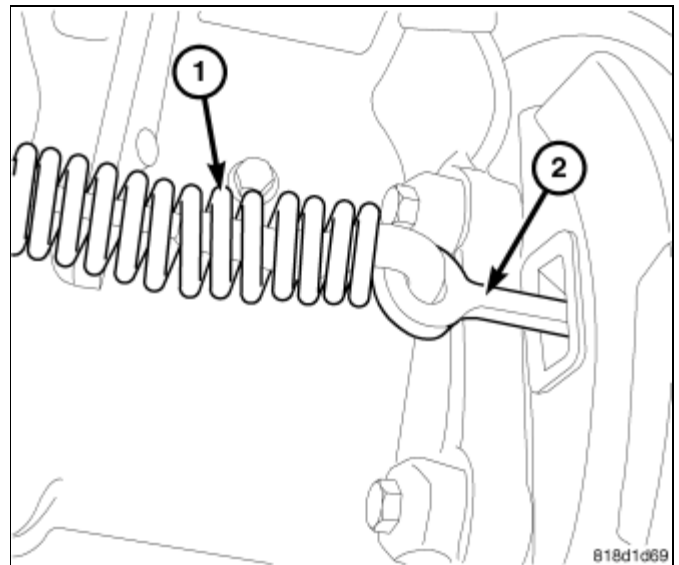
6. Remove the center floor console (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).
7. Lock out the park brake system at the lever using a suitable tool (1) and pulling upward on the brake cable (3) (Refer to 5 - BRAKES/PARKING BRAKE - STANDARD PROCEDURE).



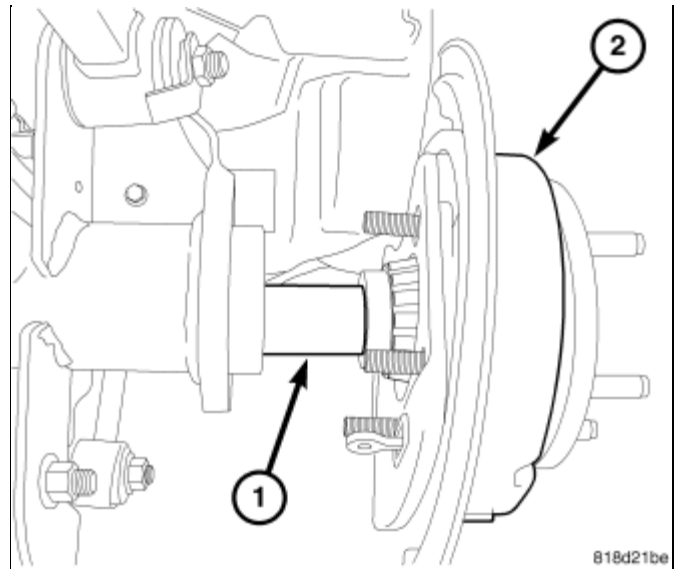
8. Remove the rear parking brake cables (2) from the equalizer.



9. Remove the parking brake cable (1) from the brake shoe lever (2) at the axle.

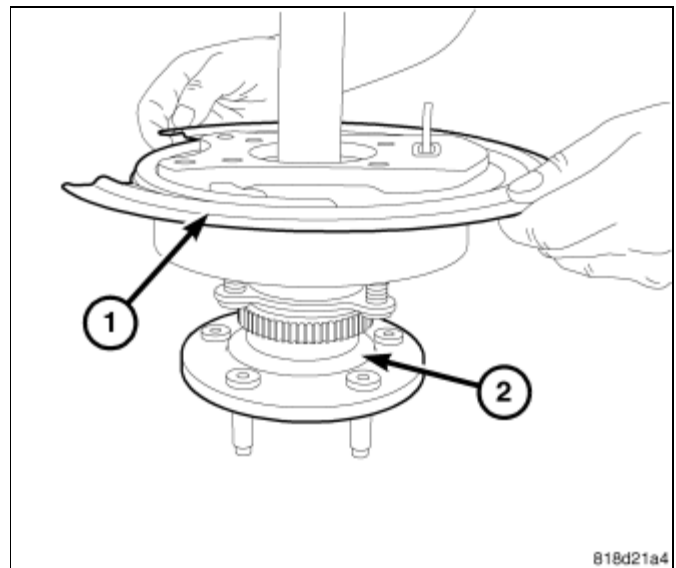


10. Remove the axle shaft (1).



11. Tap the seal plate from the brake support (1) on the axle shaft (2).

12. Remove the support plate with the brake shoes (1) from the axle shaft (1).

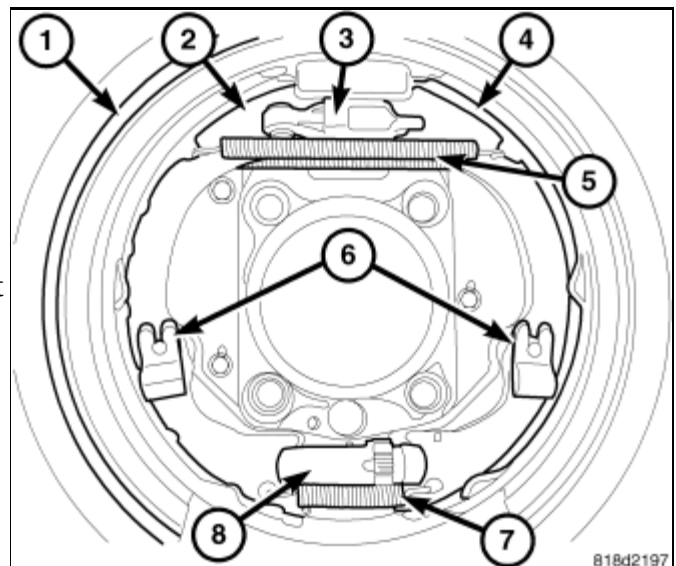


13. Disassemble the rear park brake shoes.

CLEANING - REAR DRUM IN HAT BRAKE

Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION - REAR DRUM IN HAT BRAKE



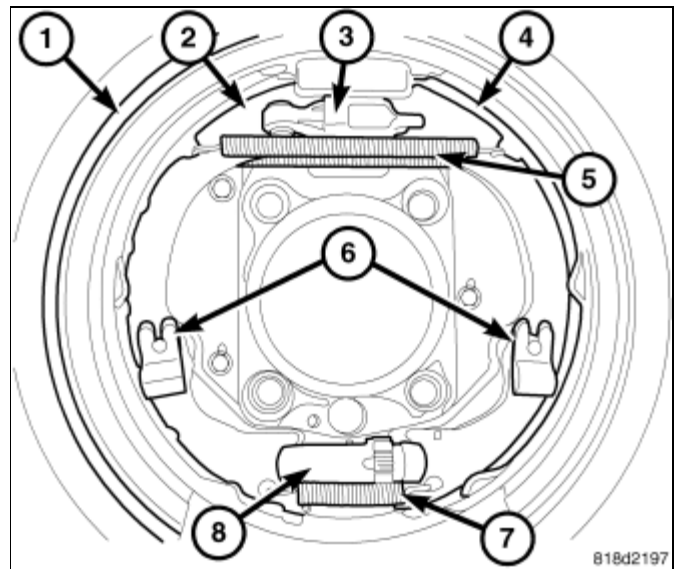
As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

Inspect the adjuster screw assembly (8). Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

Discard the brake springs (5&7) and retainer components (6) if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

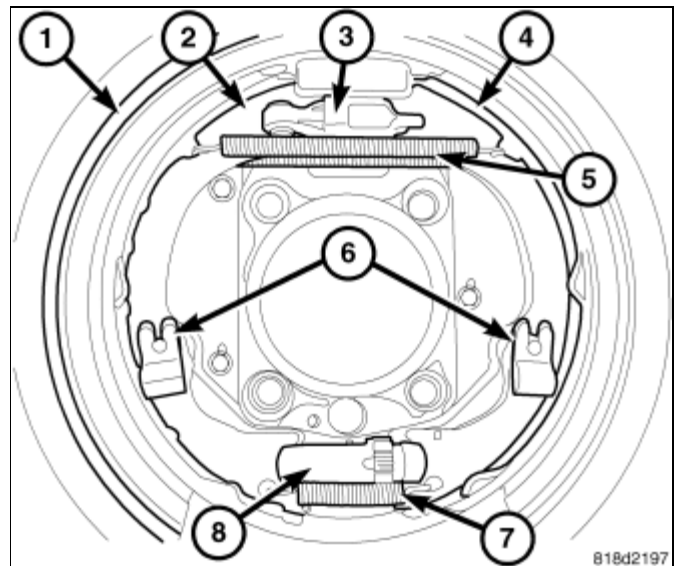
Inspect the brake shoe contact pads on the support plate (1), replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted.



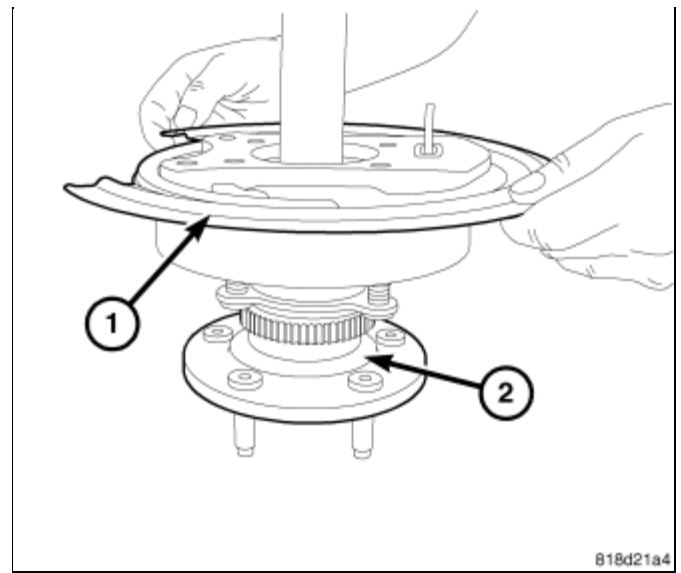
INSTALLATION

NOTE: After parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake lever.

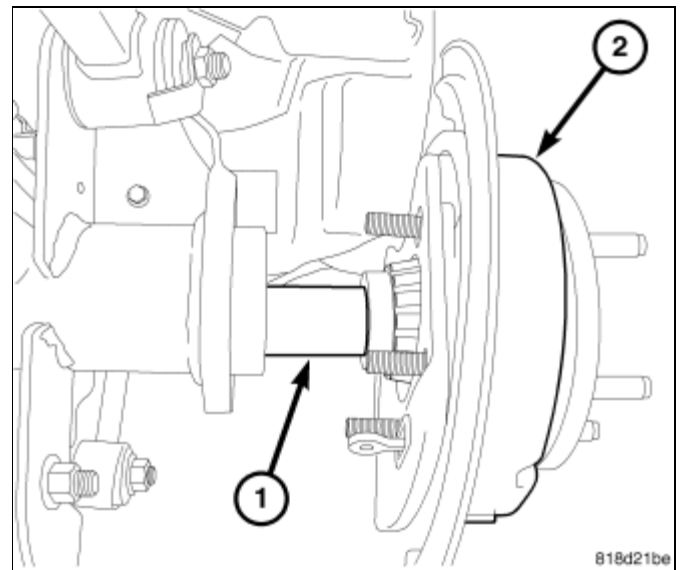
1. Reassemble the rear park brake shoes.



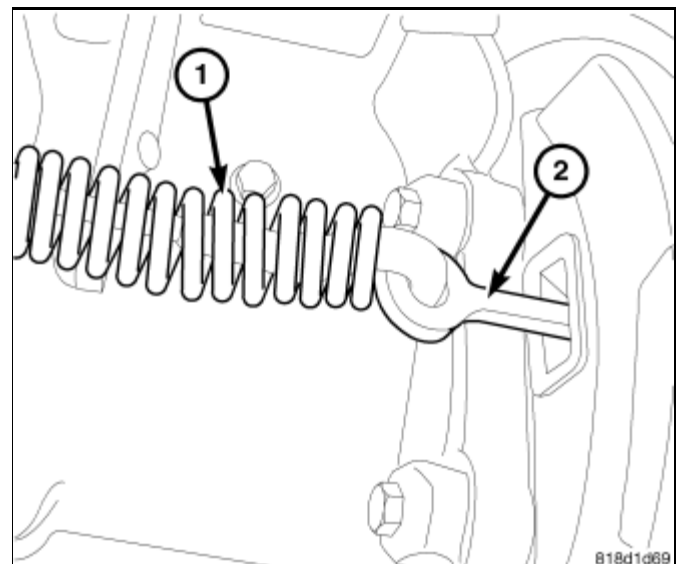
2. Install the support plate (1) on the axle shaft (2).



3. Install the axle shaft (1) to the axle housing.



4. Reconnect the brake cable (1) to the park brake shoe lever (2) behind the support plate.



5. Install the rear wheel speed sensor (3). (Refer to 5 - BRAKES/ELECTRICAL/REAR WHEEL SPEED SENSOR - INSTALLATION).

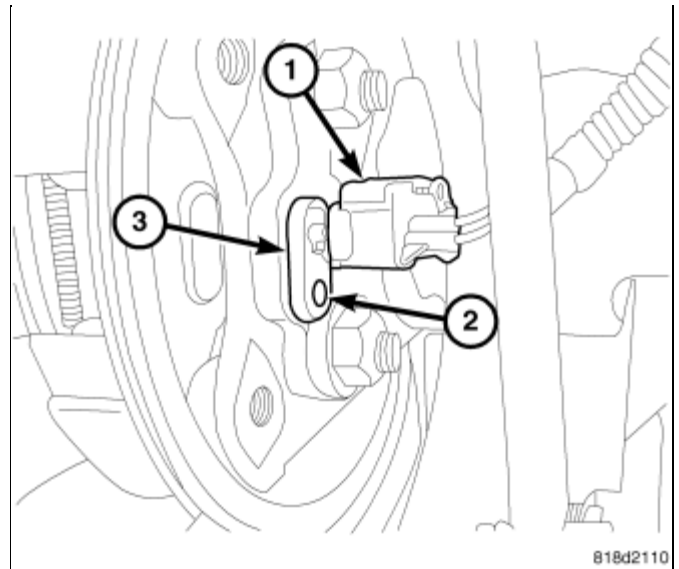
6. Adjust the rear brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

7. Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

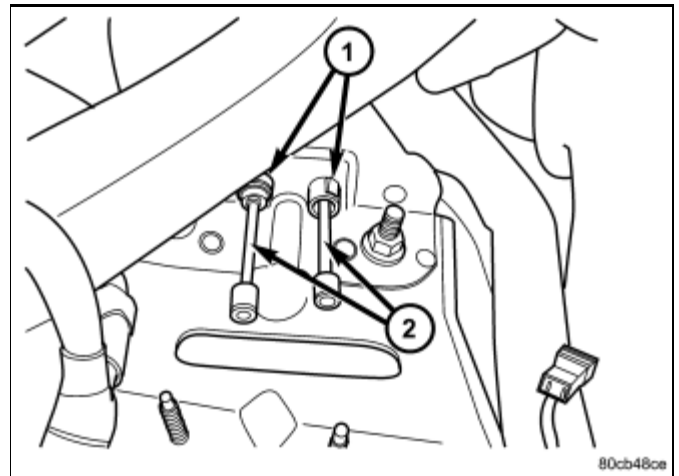
8. Install the disc brake caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

9. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

10. Lower the vehicle.



11. Install the rear park brake cables (2) at the equalizer.



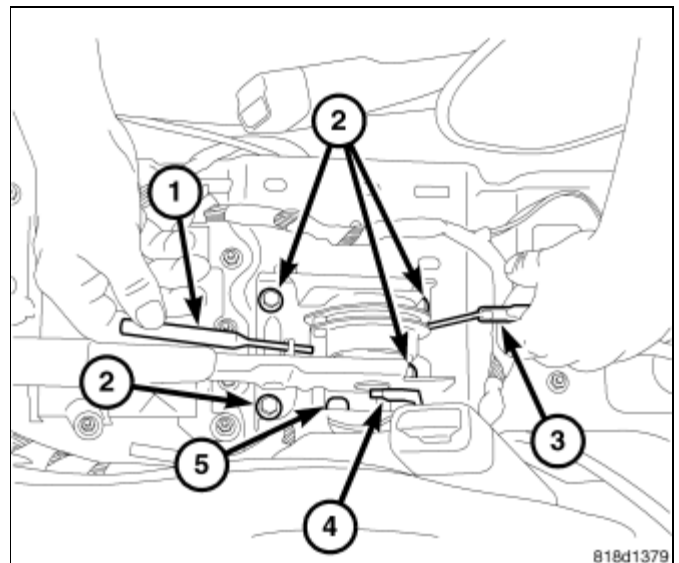
12. Remove the lockout (1) on the front park brake lever.

13. Check the operation of the park brake system.

14. Install the center floor console (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

ADJUSTMENTS

ADJUSTMENT - REAR DRUM IN HAT PARK BRAKE (ROTOR REMOVED)



Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both rotors are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool . Adjustment is performed with the

complete brake assembly installed on the backing plate.

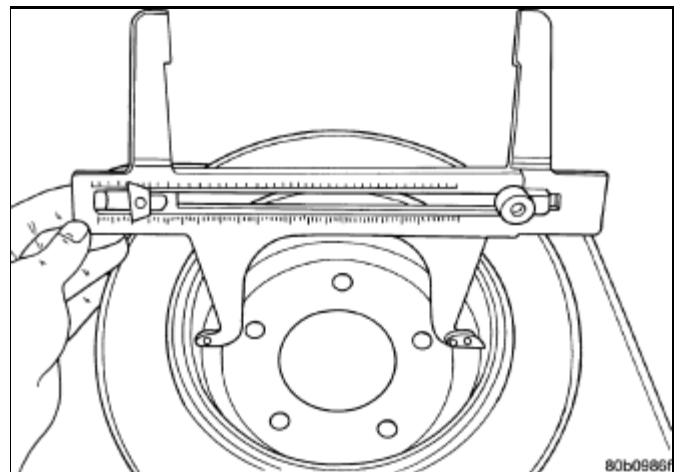
CAUTION: Before adjusting the park brake shoes be sure that the park brake pedal is in the fully released position. If park brake pedal is not in the fully released position, the park brake shoes can not be accurately adjusted.

1. Raise vehicle.
2. Remove tire and wheel.
3. Remove disc brake caliper from caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove rotor from the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

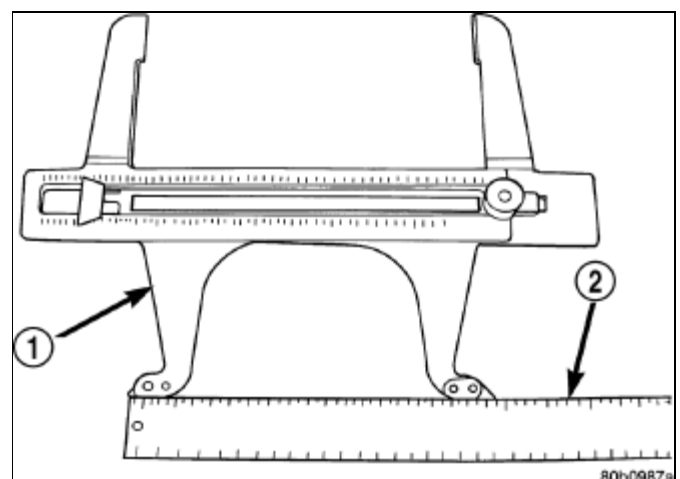
NOTE: When measuring the brake drum diameter, the diameter should be measured in the center of the area in which the park brake shoes contact the surface of the brake drum.

5. Using Brake Shoe Gauge, Special Tool C-3919, or equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor .

6. Using a ruler that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool .



7. Reduce the inside diameter measurement of the brake drum that was taken using Special Tool C-3919 by 1/64 of an inch. Reset Gauge, Brake Shoe, Special Tool C-3919 or the equivalent used, so that the outside measurement jaws are set to the reduced measurement .



8. Place Gauge, Brake Shoe, Special Tool C-3919, or

equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.

9. Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.

10. Repeat step 8 above and measure shoes in both directions.

11. Install brake rotor on the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION) .

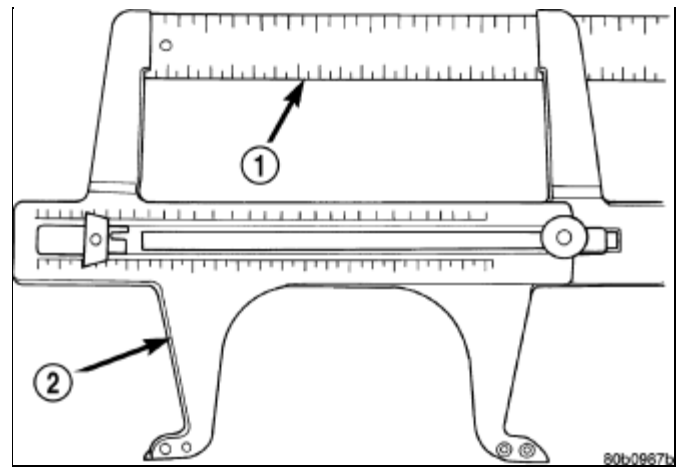
12. Rotate rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.

13. Install disc brake caliper on caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

14. Install wheel and tire.

15. Tighten the wheel mounting nuts in the proper sequence until all nuts are torqued to half the specified torque. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

16. Lower vehicle.



CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.

NOTE: After parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake hand lever.

17. Road test the vehicle to ensure proper function of the vehicle's brake system.

WITH ADJUSTING TOOL (ROTOR INSTALLED)

Adjustment can be made with a standard brake gauge or with adjusting tool . Adjustment is performed with the complete brake assembly installed on the backing plate.

1. Be sure parking brake lever is fully released.
2. Raise vehicle so rear wheels can be rotated freely.
3. Remove plug from each access hole in brake support plates.
4. Loosen parking brake cable adjustment nut until there is slack in front cable.
5. Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel .
6. Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.
7. Push and hold adjuster lever away from star wheel with thin screwdriver.
8. Back off adjuster screw star wheel until brake drag is

eliminated.

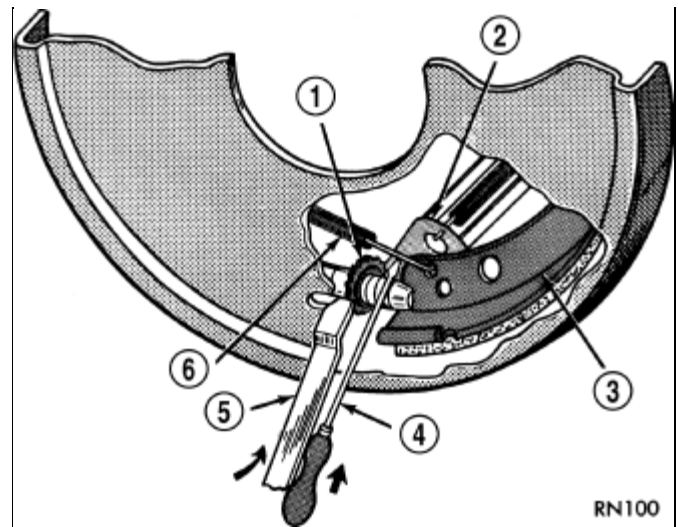
9. Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.

10. Install support plate access hole plugs.

11. Adjust parking brake cable and lower vehicle.

12. Depress park brake lever and make sure park brakes hold the vehicle stationary.

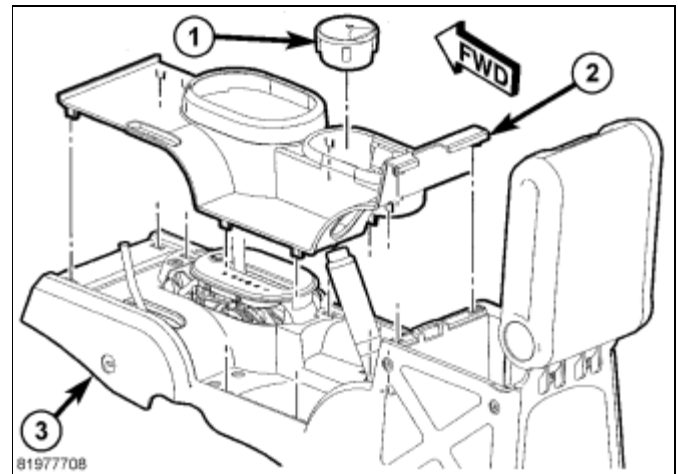
13. Release park brake lever.



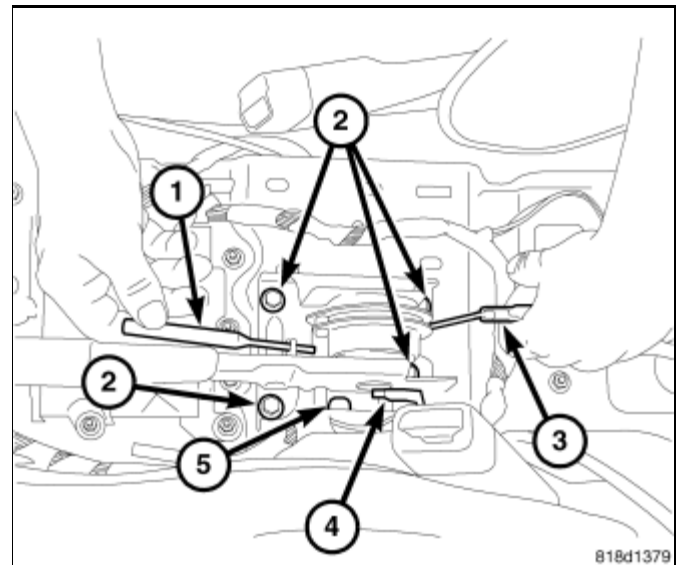
LEVER

REMOVAL

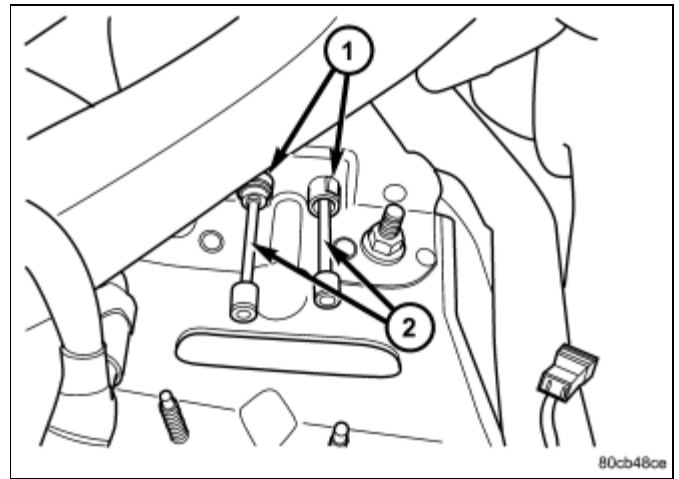
1. Remove the center console (3) (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).



2. Lockout the parking brake lever by inserting a punch (1) in the hole on the lever and by pulling up on the cable (3) to loosen and provide some slack (Refer to 5 - BRAKES/PARKING BRAKE - STANDARD PROCEDURE).

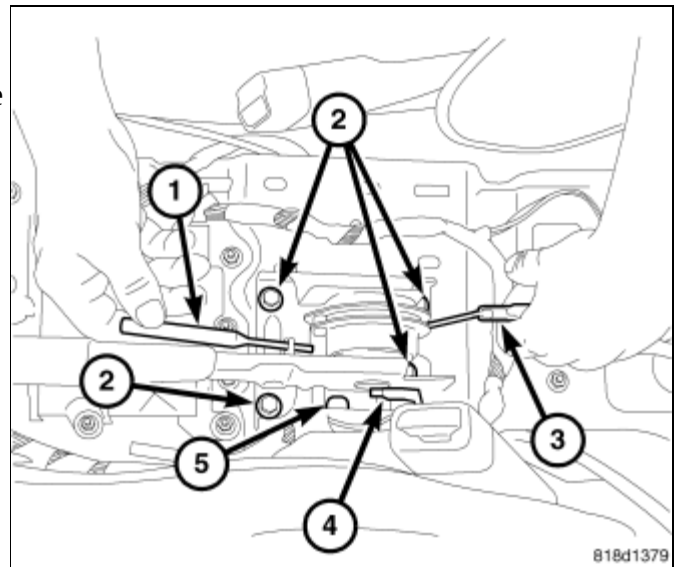


3. Disconnect the rear park cables (2) from the equalizer.

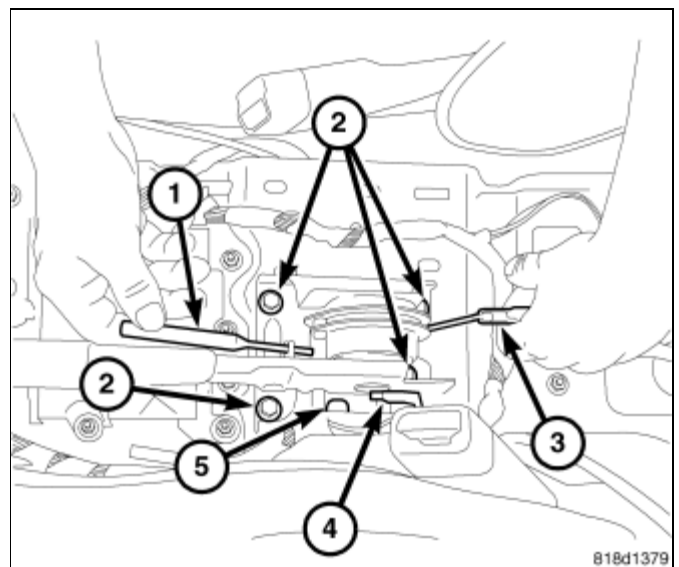


- 4. Disconnect the electrical connector (4).
- 5. Disconnect the electrical wiring harness clip (5) on the side of the lever.
- 6. Remove the four mounting nuts (2) for the park brake lever.
- 7. Remove the lever from the vehicle.

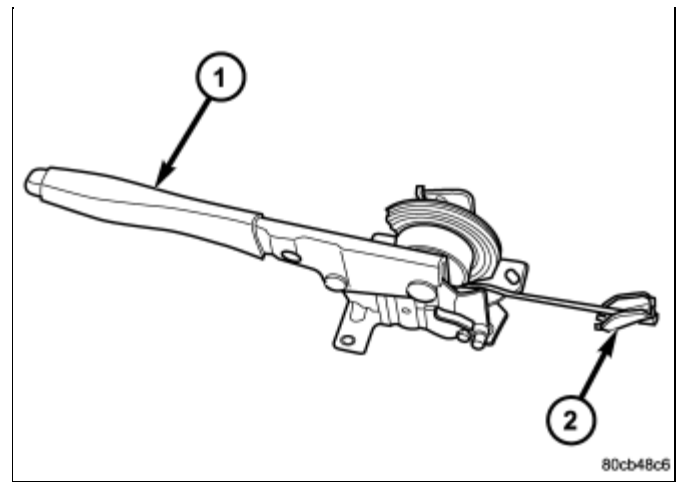
INSTALLATION



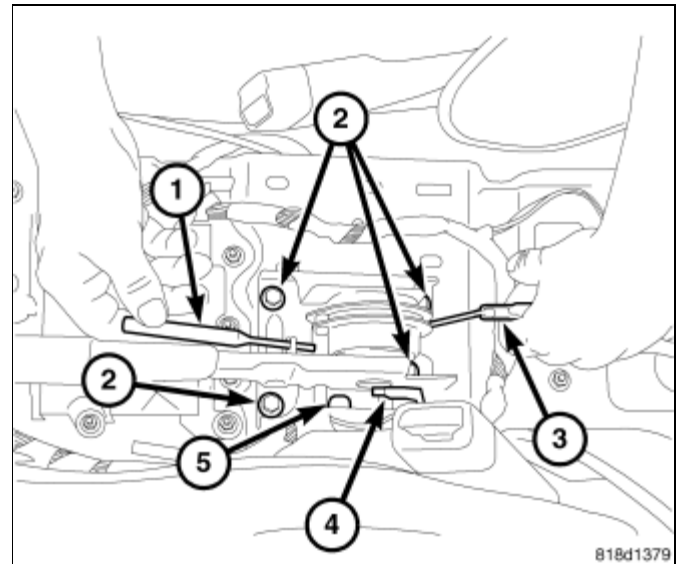
- 1. Install the lever to the vehicle.
- 2. Install the four mounting nuts (2) and tighten the nuts to
- 3. Reconnect the electrical wiring clip (5) to the side of the lever.
- 4. Reconnect the electrical connector (4) to the lever.



5. Reconnect the equalizer (2) to the rear park brake cables.



6. Remove the lockout (1) for the park brake lever.
7. Check park brake system operation.

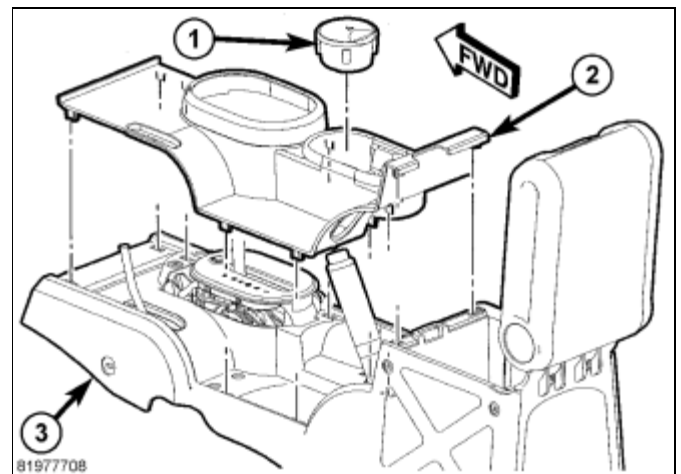


8. Install the center console (3) (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

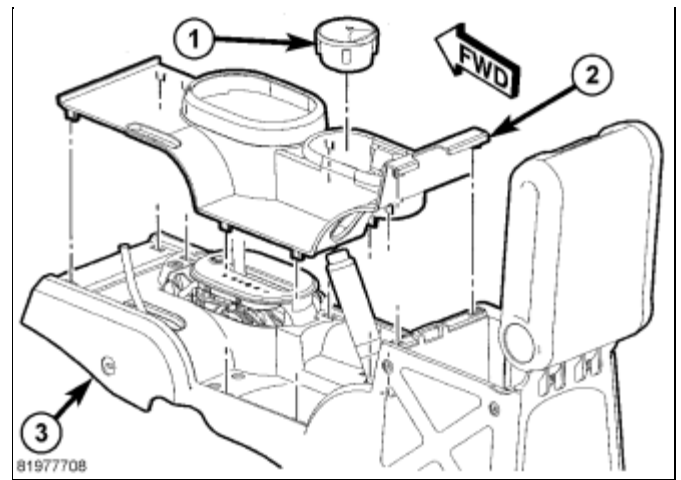
CABLES

REMOVAL

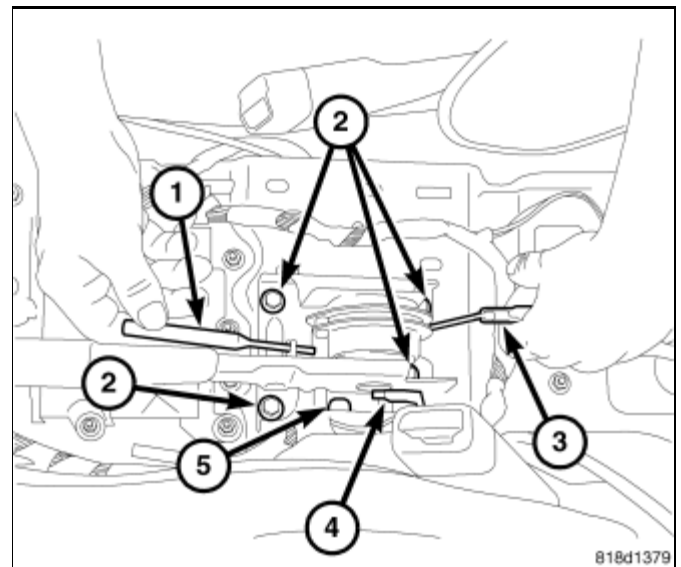
NOTE: Park brake system must be locked out for servicing (Refer to 5 - BRAKES/PARKING BRAKE - STANDARD PROCEDURE).



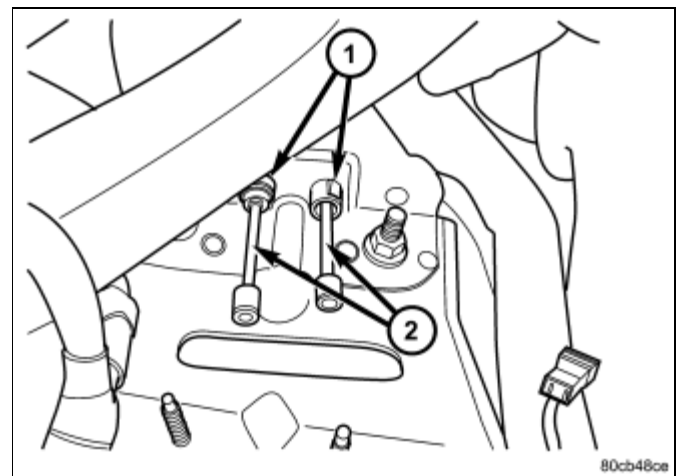
1. Remove the center console (3). (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).



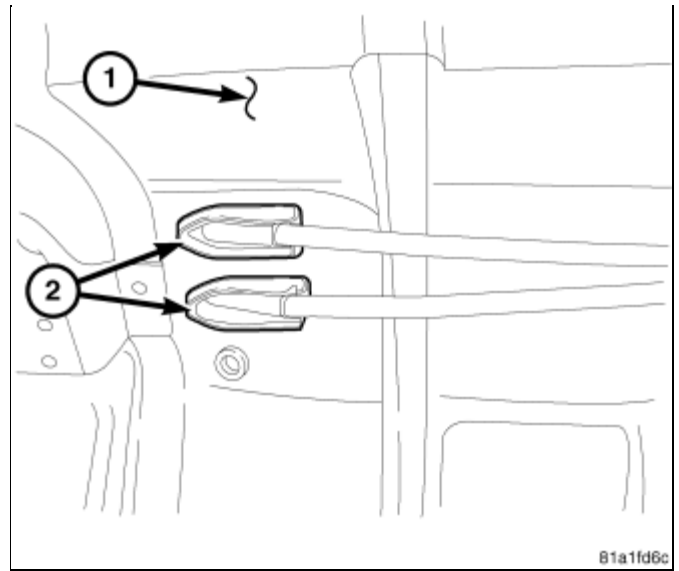
2. Lockout the parking brake cable by pulling up on the brake cables at the equalizer (3) then installing or a suitable tool (1).



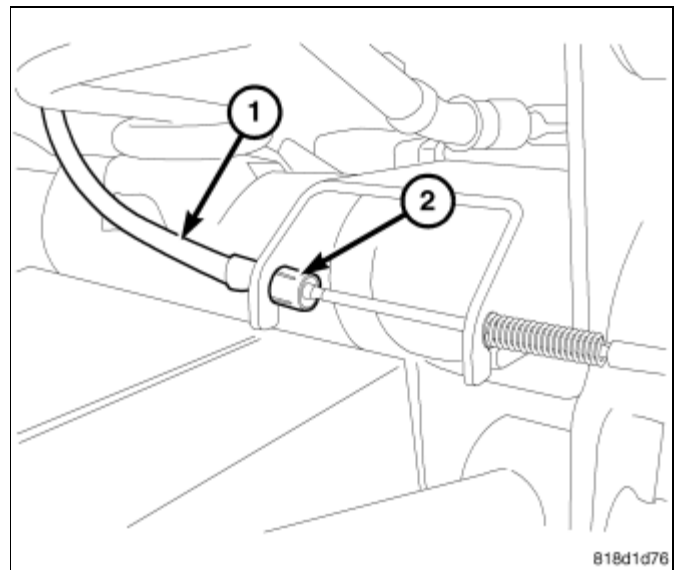
3. Remove the cables from the equalizer (2).
4. Remove the cables from the body bracket (1) using a wrench to fit the end of the cable snug to depress the tangs.



5. Raise and support the vehicle.
6. Remove the cables and grommets (2) from the floor (1) of the vehicle.



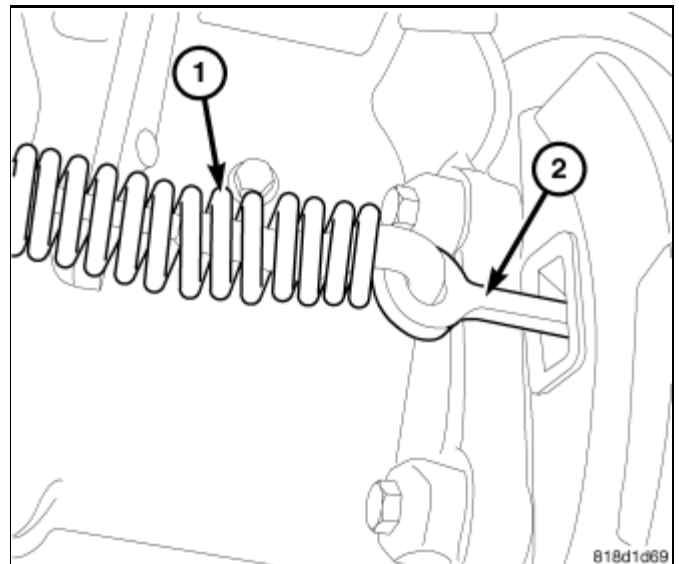
7. Remove the cable (1) from the axle bracket (2).



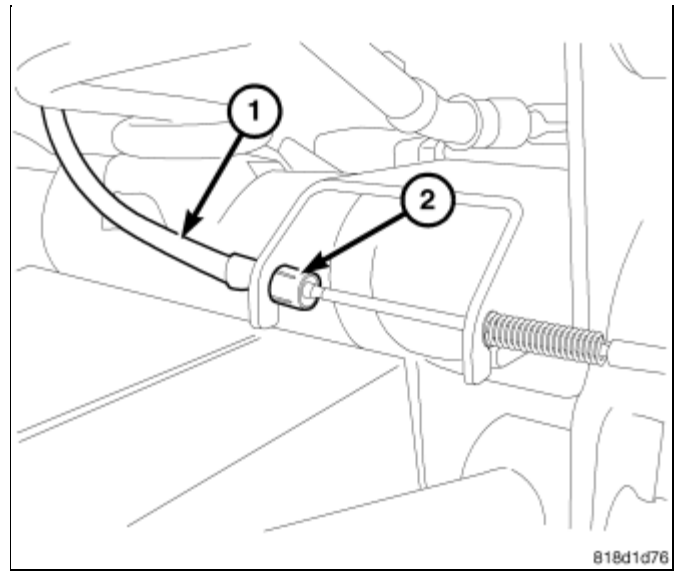
8. Remove the brake cable (1) from the brake lever (2) at the support plate.

INSTALLATION

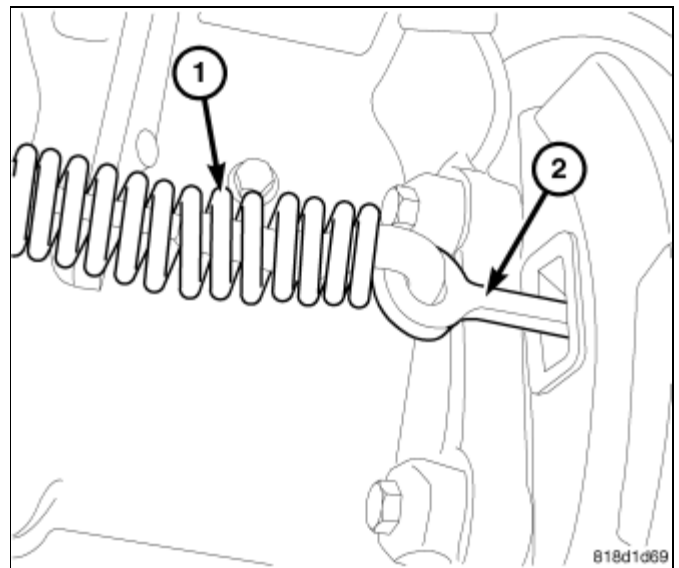
REAR CABLE



1. Install the cable (1) to the axle bracket (2).

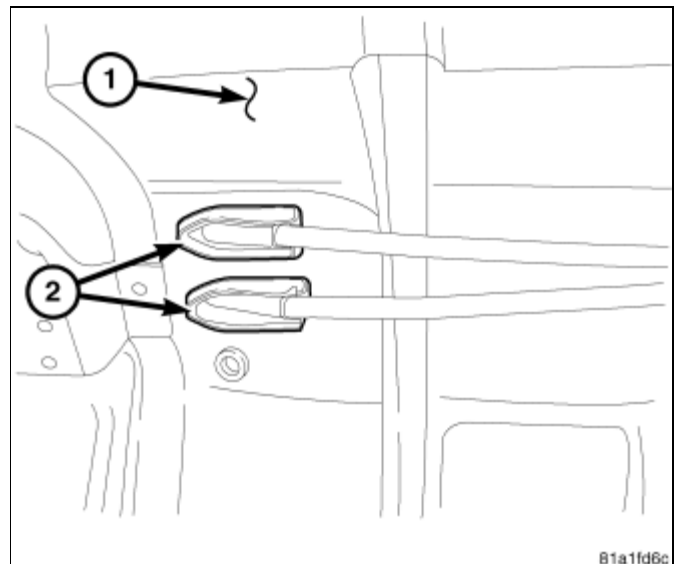


2. Install the cable (1) into the brake lever (2) at the support plate.

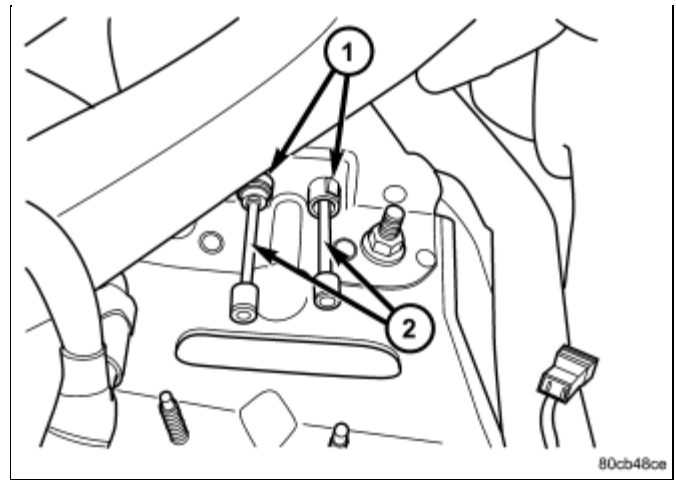


3. Install the cables and grommets (2) into the floor (1) of the vehicle.

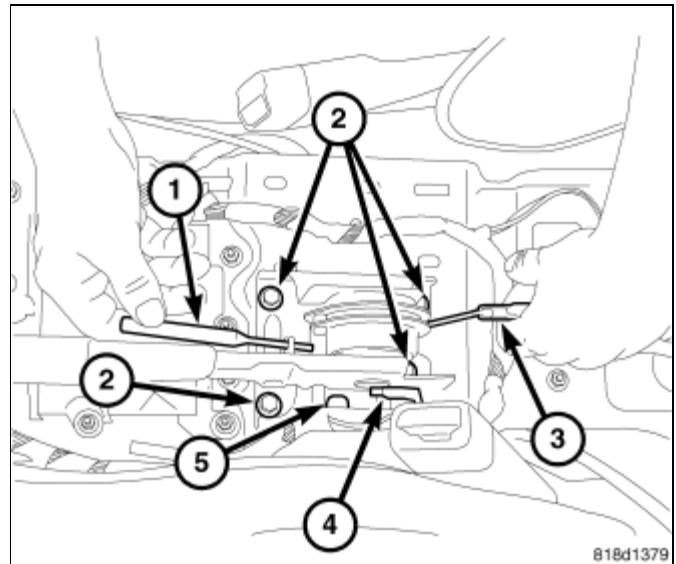
4. Lower the vehicle.



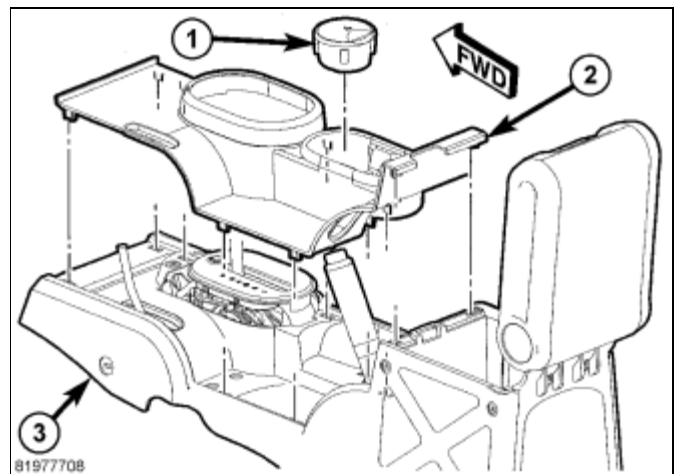
5. Install the brake cables (2) to the body bracket (1).
6. Install the cables (2) to the equalizer.



7. Remove the lockout (1) for the park brake cable.
8. Check the park brake system operation.



9. Install the center floor console (3) (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

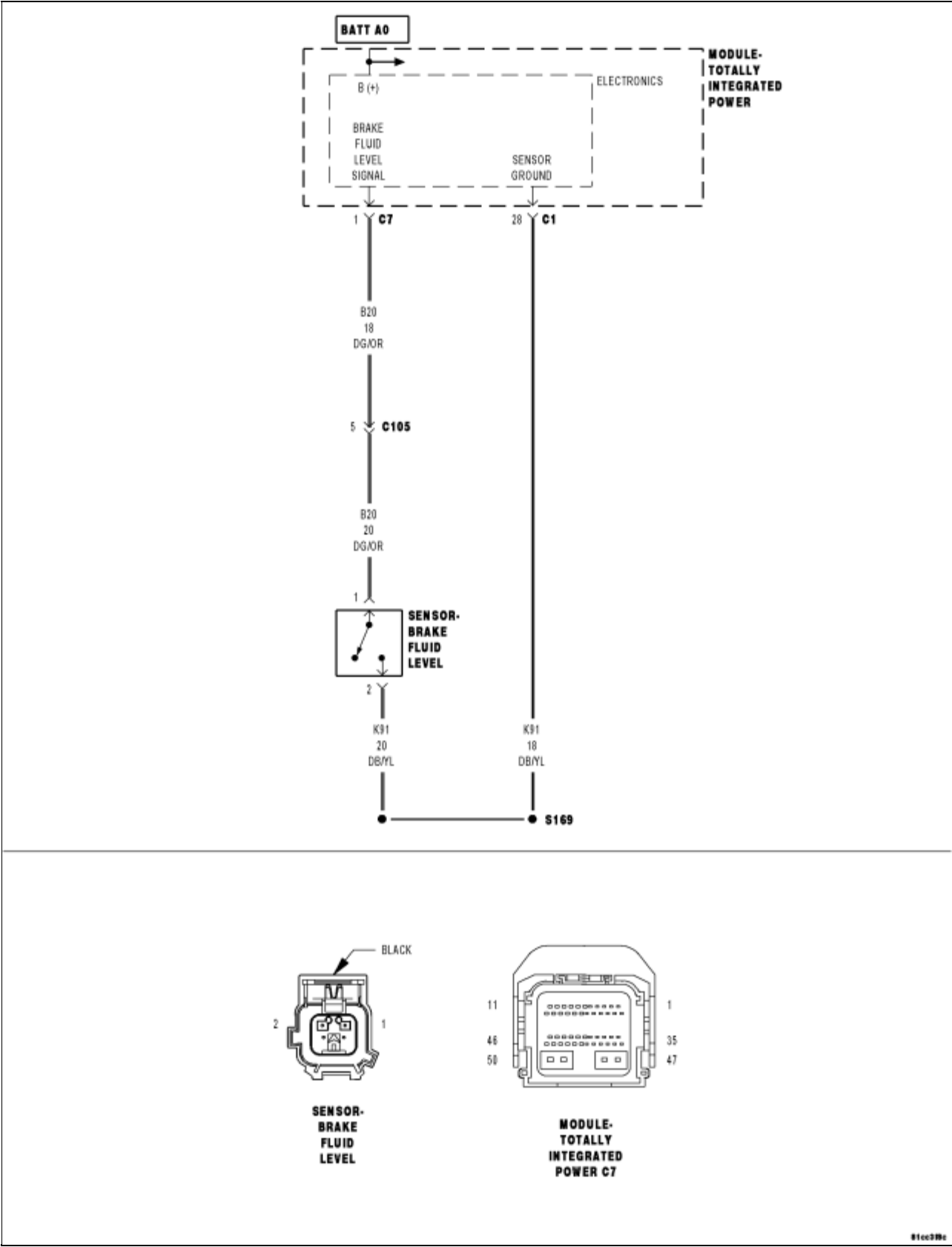


BRAKES - ABS ELECTRICAL DIAGNOSTICS

BRAKES - ABS ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

C1008-BRAKE FLUID LEVEL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Totally Integrated Power Module indicates that the Brake Fluid Level Circuit is greater than 4.9 volts for more than 5 seconds.

Possible Causes
(B20) BRAKE FLUID LEVEL SWITCH SIGNAL CIRCUIT OPEN
(B20) BRAKE FLUID LEVEL SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
BRAKE FLUID LEVEL SWITCH INTERNAL FAILURE
(K91) SENSOR GROUND CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. BRAKE FLUID LEVEL SWITCH SIGNAL VOLTAGE ABOVE 4.9 VOLTS

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read Brake Fluid Level Switch Signal voltage.

Is the voltage above 4.9 volts?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. (B20) BRAKE FLUID LEVEL SWITCH SIGNAL CIRCUIT FOR SHORT TO BATTERY VOLTAGE

Turn the ignition off.
 Disconnect the Brake Fluid Level Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (B20) Brake Fluid Level signal circuit in the Brake Fluid Level Switch harness connector to ground.

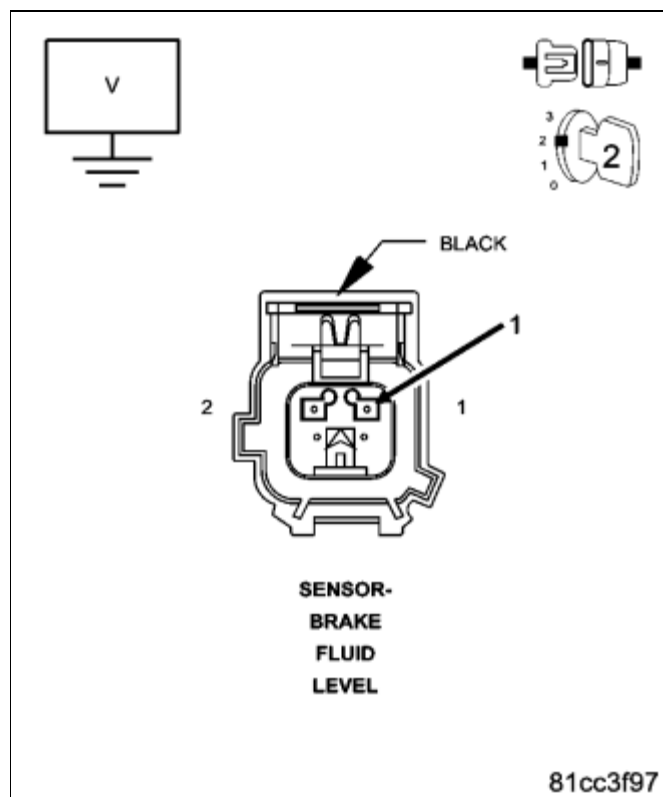
Is the voltage above 5.2 volts?

Yes

- Repair the (B20) Brake Fluid Level signal circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)



3. BRAKE FLUID LEVEL SWITCH INTERNAL FAILURE

Turn the ignition off.
 Connect a jumper wire between the (B20) Brake Fluid Level signal circuit and the (K91) Brake Fluid Level ground circuit in the Brake Fluid Level Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the Brake Fluid Level Switch voltage

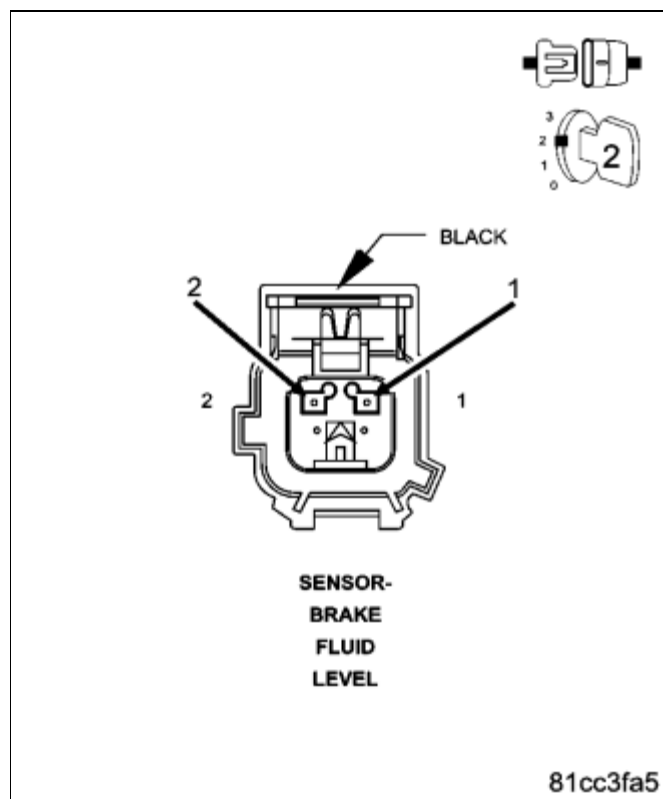
Is the voltage below 1.0 volt?

Yes

- Replace the Brake Fluid Level Switch in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)



(B20) BRAKE FLUID LEVEL SWITCH CIRCUIT OPEN

4.

Turn the ignition off.
 Disconnect the Brake Fluid Level Switch.
 Disconnect the TIPM harness connector.
 Measure the resistance of the (B20) Brake Fluid Level signal circuit between the Brake Fluid Level Switch harness connector and the TIPM harness connector.

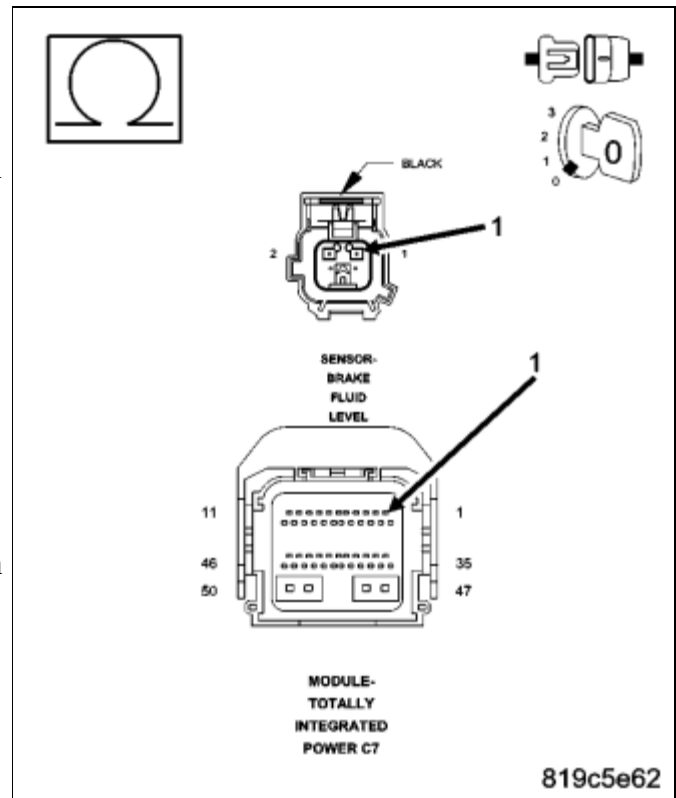
Is the resistance below 5 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (B20) Brake Fluid Level Switch signal circuit.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



5. (K91) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Brake Fluid Level Switch harness connector.
 Reconnect the TIPM harness connector.
 Measure the resistance of the (K91) Brake Fluid Level Switch ground circuit between the Brake Fluid Level Switch harness connector and ground.

Is the resistance below 5.0 ohms?

Yes

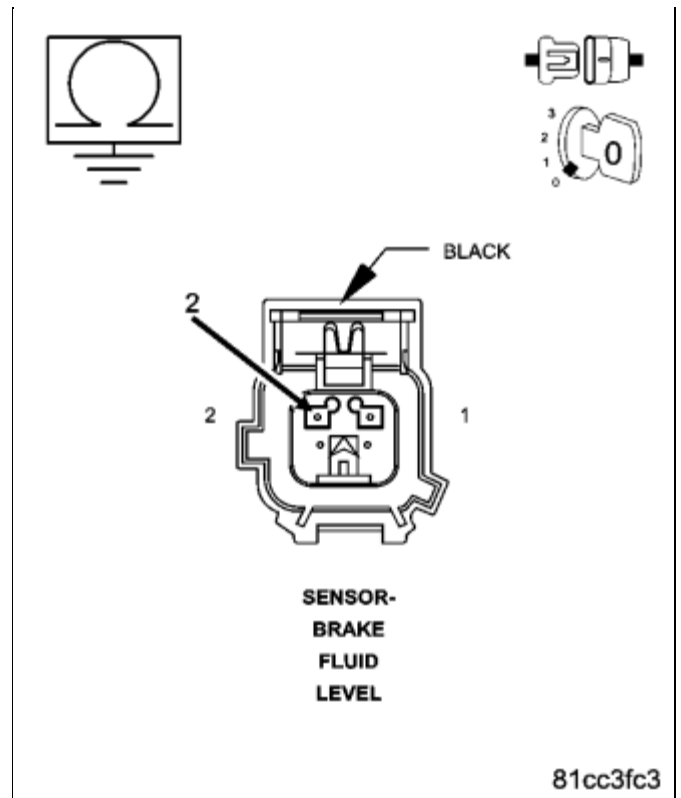
- Replace and program the Totally Integrated Power Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

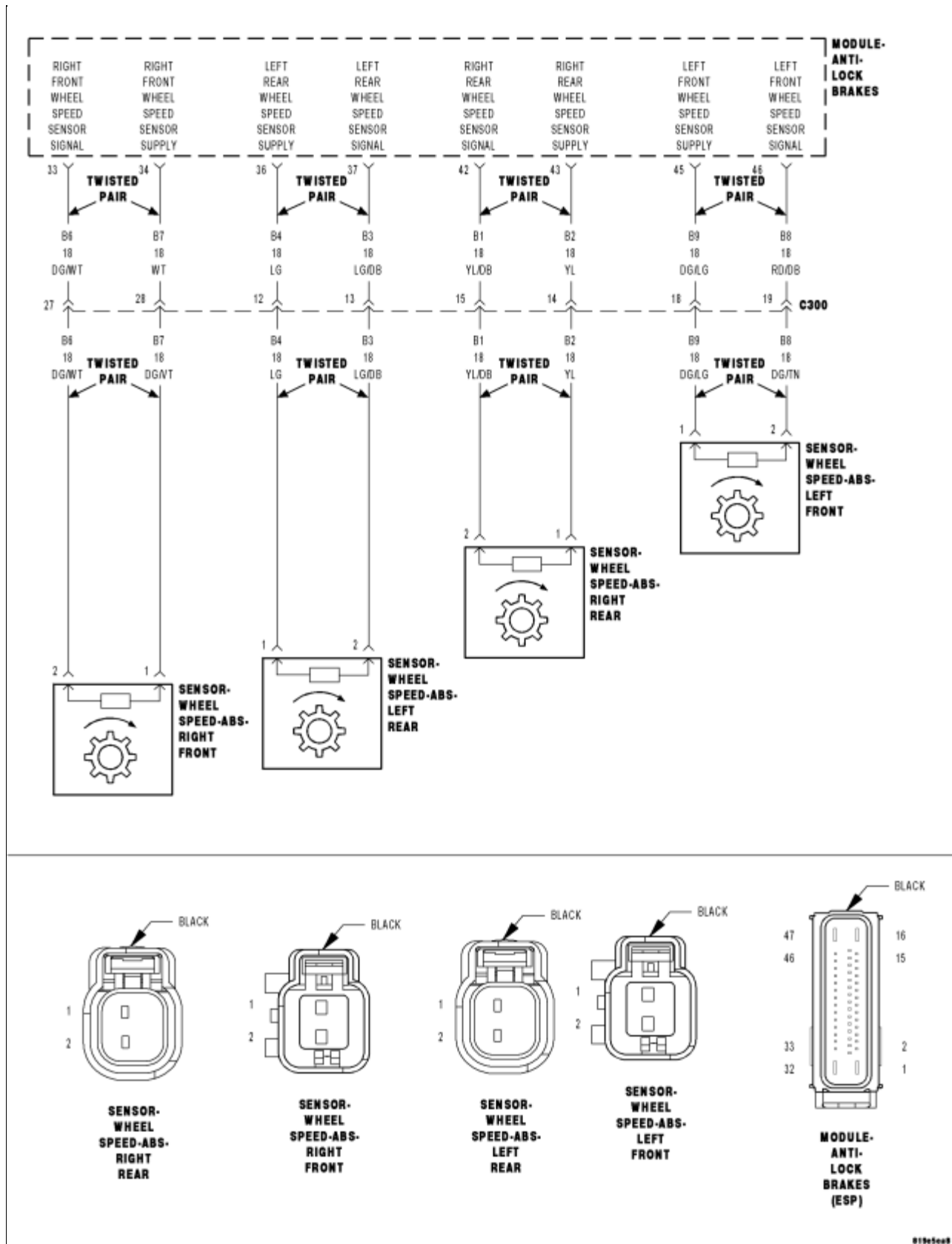
No

- Repair the open in the (K91) Sensor ground circuit .

Perform POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE)

C100A-LEFT FRONT WHEEL SPEED SENSOR CIRCUIT





For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Left Front Wheel Speed Sensor (WSS) circuit fails the diagnostic test.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORTED TO (B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT
LEFT FRONT WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR DTC C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector.

Is the Left Front WSS or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Left Front WSS harness connector.

Turn the ignition on.

Measure the voltage of the (B9) Left Front WSS 12 Volt Supply circuit.

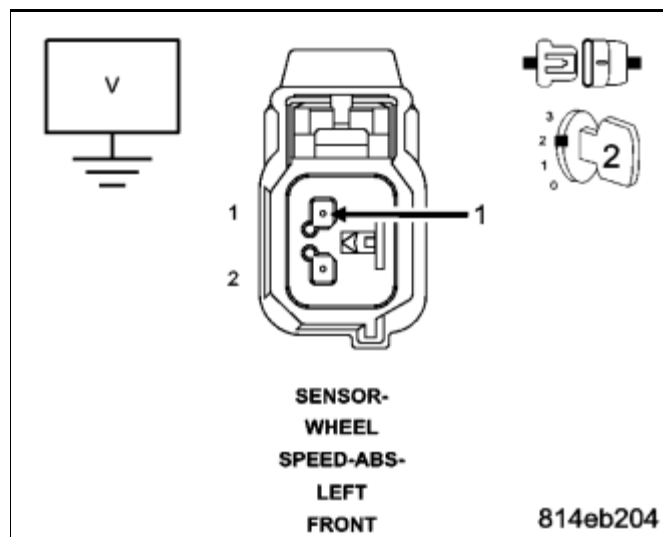
Is the voltage above 10.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)



4. CHECK (B9) LEFT FRONT WSS SUPPLY CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

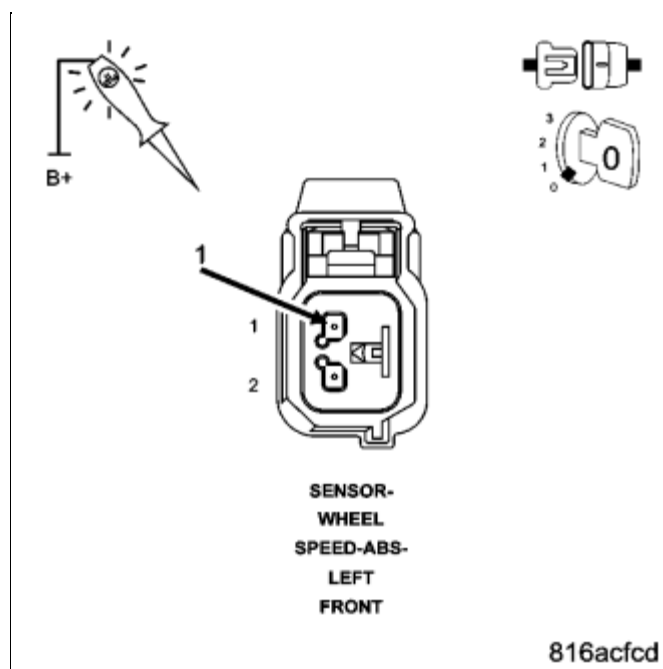
Using a 12-volt test light connected to 12-volts, probe the (B9) Left Front WSS Supply circuit.

Does the test light illuminate brightly?**Yes**

- Repair the (B9) Left Front WSS Supply circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)

**5. CHECK (B9) LEFT FRONT WSS SUPPLY CIRCUIT OPEN**

Connect a jumper wire between ground and the (B9) Left Front WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

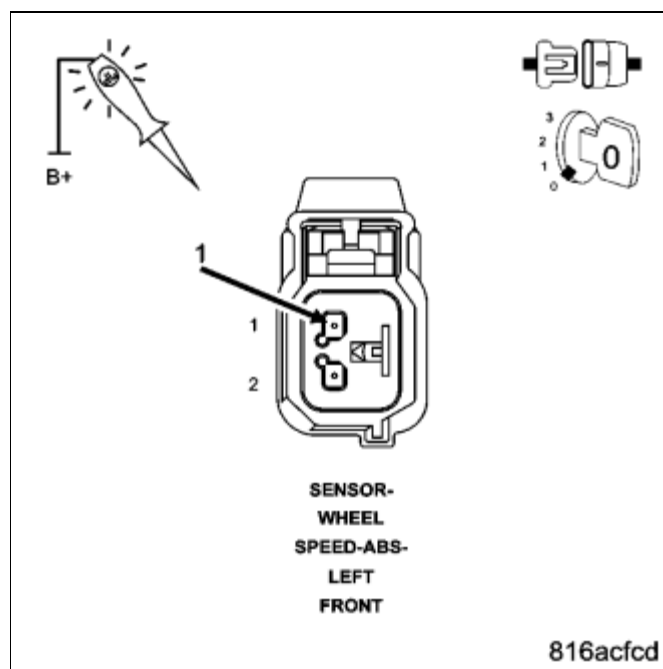
Using a 12-volt test light connected to 12-volts, probe the (B9) Left Front WSS Supply circuit.

Does the test light illuminate brightly?**Yes**

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (B9) Left Front WSS Supply circuit for an open.
- Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**6. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORT TO GROUND**

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector. Using a 12-volt test light connected to 12-volts, probe the (B8) Left Front WSS Signal circuit.

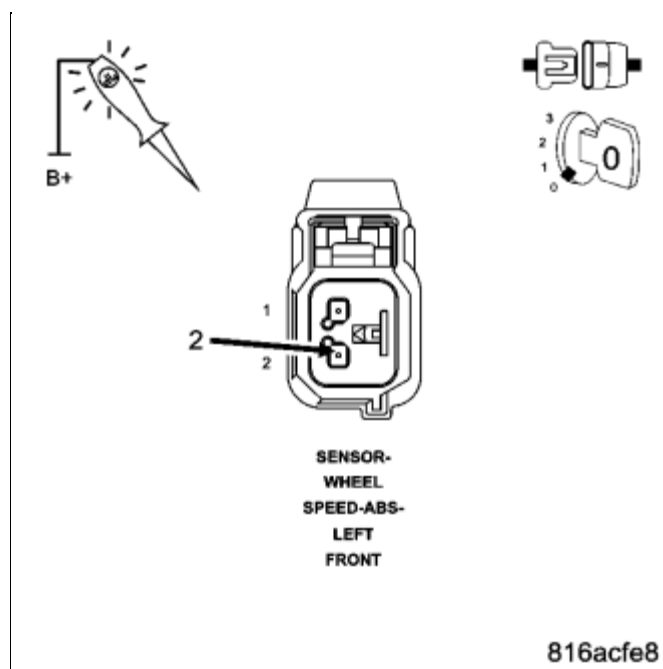
Does the test light illuminate brightly?

Yes

- Repair the (B8) Left Front WSS Signal circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT OPEN

Connect a jumper wire between ground and the (B8) Left Front WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B8) Left Front WSS Signal circuit.

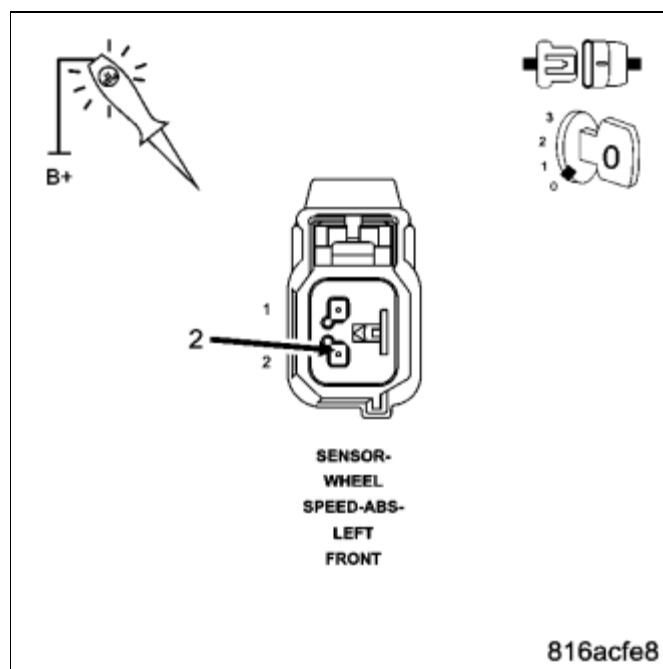
Does the test light illuminate brightly?

Yes

- Go To [8](#)

No

- Repair the (B8) Left Front WSS Signal circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



8. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Remove all jumper wires.

Measure the voltage between the (B8) Left Front WSS

Signal circuit and ground.

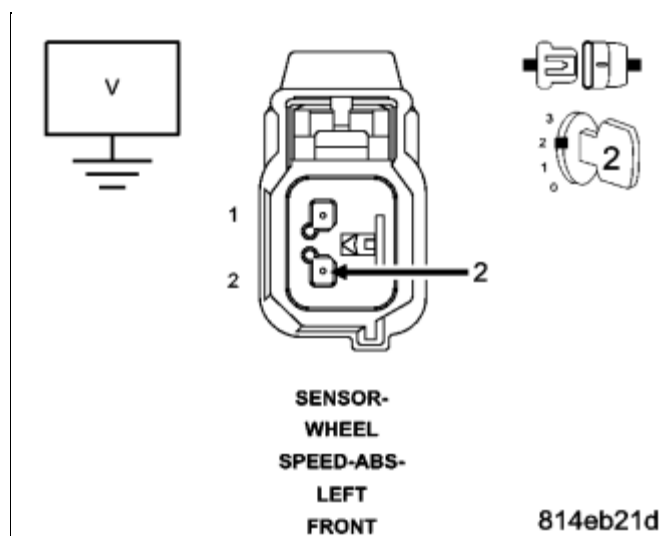
Is the voltage above one volt?

Yes

- Repair the (B8) Left Front WSS Signal circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [9](#)



9. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT AND (B9) LEFT FRONT WSS SUPPLY CIRCUIT SHORT TOGETHER

Turn the ignition off.

Measure the resistance between the (B8) Left Front WSS Signal circuit and the (B9) Left Front WSS Supply circuit.

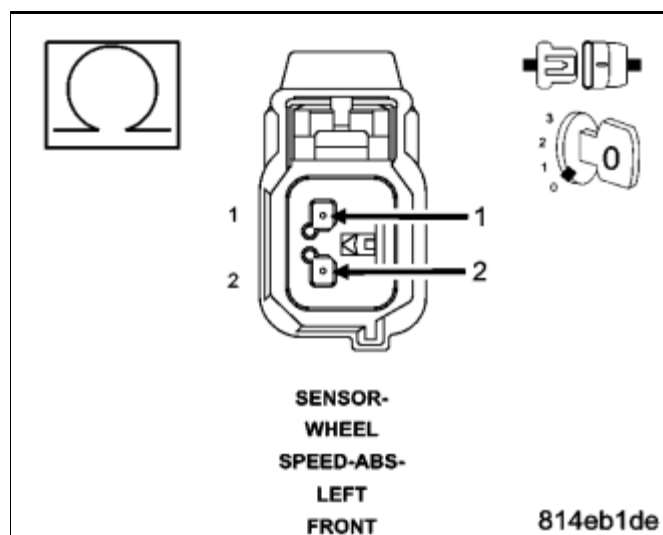
Is the resistance above 120 ohms?

Yes

Go To [10](#)

No

- Repair the (B8) Left Front WSS Signal circuit and the (B9) Left Front WSS Supply circuit for a short together.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



10. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Left Front Wheel Speed Sensor (WSS) Signal is intermittently missing while vehicle speed is above 40 km/h (25 mph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

Possible Causes
LEFT FRONT WSS LOOSE — B8, B9 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
LEFT FRONT TONE WHEEL DAMAGE
LEFT FRONT WHEEL/ BEARING DAMAGE
IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES
LEFT FRONT WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

NOTE: If DTC C100A Left Front Wheel Speed Sensor Circuit is present it must be repaired before continuing.

Turn the ignition on.

With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE active?

Yes

- Go To [3](#)
-

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK LEFT FRONT WSS LOOSENESS, INSPECT B8, B9 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector

Inspect the Left Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B8) Left Front WSS Signal and (B9) Left Front WSS Supply circuits between the Left Front WSS and Anti-Lock Brake Module for damage.

Is the Left Front WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECK LEFT FRONT WHEEL SPEED SENSOR FOR DAMAGE

Remove the Left Front Wheel Speed Sensor
Inspect the Left Front Wheel Speed Sensor face for damage.

Is the Left Front Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK LEFT FRONT TONE WHEEL/BEARING FOR DAMAGE

Inspect the Left Front Tone Wheel/Bearing for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Left Front Tone Wheel/Bearing damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK LEFT FRONT WHEEL BEARING FOR DAMAGE

Inspect the Left Front wheel bearing for excessive runout or clearance.

NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

Is the Left Front Wheel Bearing Damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
 Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
 Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Left Front Wheel Speed Sensor (WSS) Signal reading is different from the readings received from the other WSS's at a vehicle speed above 40 km/h (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

Possible Causes
LEFT FRONT WSS LOOSE — B8, B9 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES
LEFT FRONT TONE WHEEL/BEARING DAMAGE
LEFT FRONT WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK LEFT FRONT WSS LOOSENESS, INSPECT B8, B9 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector.

Inspect the Left Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B8) Left Front WSS Signal and (B9) Left Front WSS Supply circuits between the Left Front WSS and Anti-Lock Brake Module for damage.

Is the Left Front WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECK LEFT FRONT WHEEL SPEED SENSOR FOR DAMAGE

Remove the Left Front Wheel Speed Sensor
Inspect the Left Front Wheel Speed Sensor face for damage.

Is the Left Front Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK LEFT FRONT TONE WHEEL/BEARING FOR DAMAGE

Inspect the Left Front Tone Wheel/Bearing for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Left Front Tone Wheel/Bearing damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE reset?

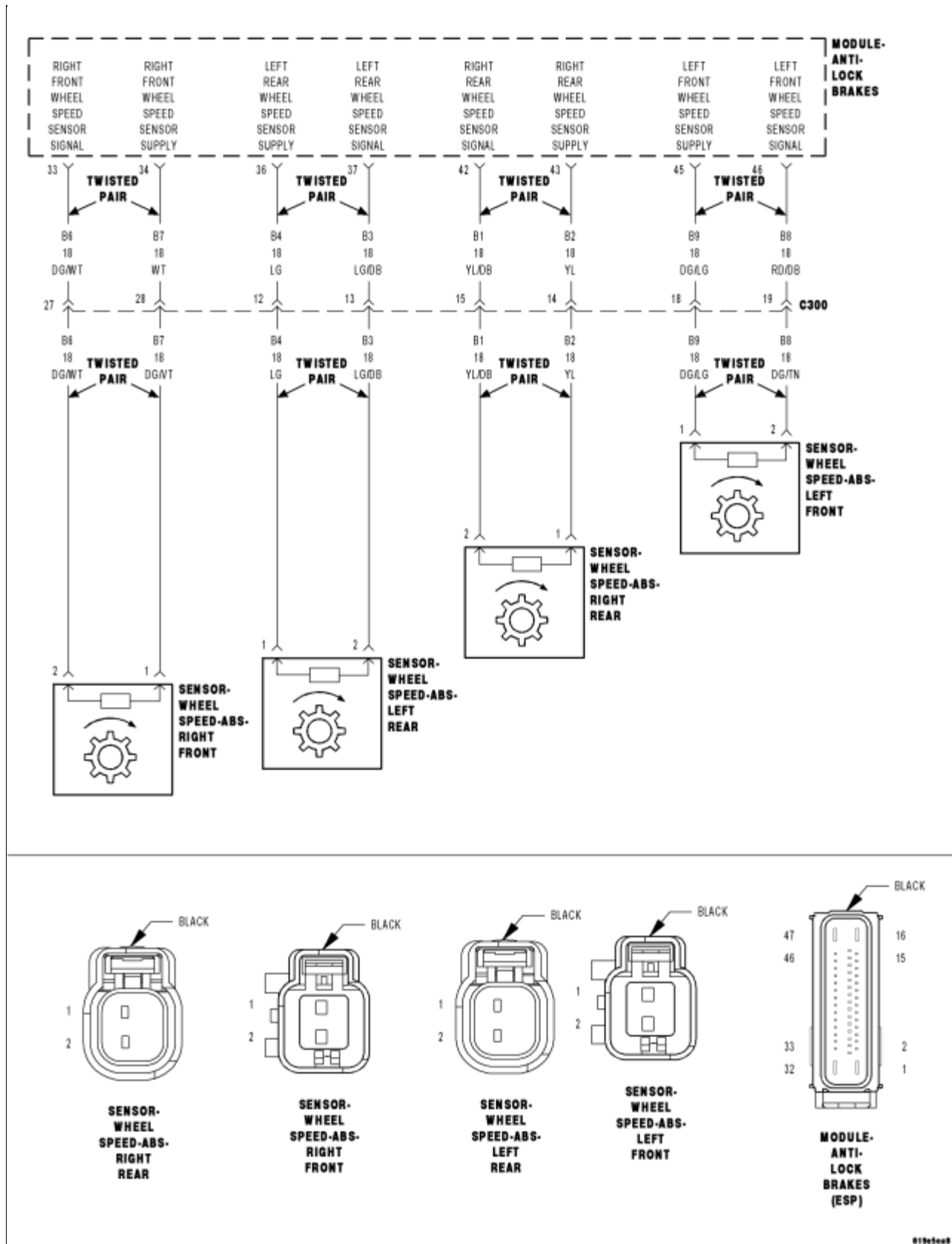
Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Right Front Wheel Speed Sensor (WSS) circuit fails the diagnostic test.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORTED TO (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT
RIGHT FRONT WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR DTC C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector.

Is the Right Front WSS or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Right Front WSS harness connector.

Turn the ignition on.

Measure the voltage of the (B7) Right Front WSS 12 Volt Supply circuit.

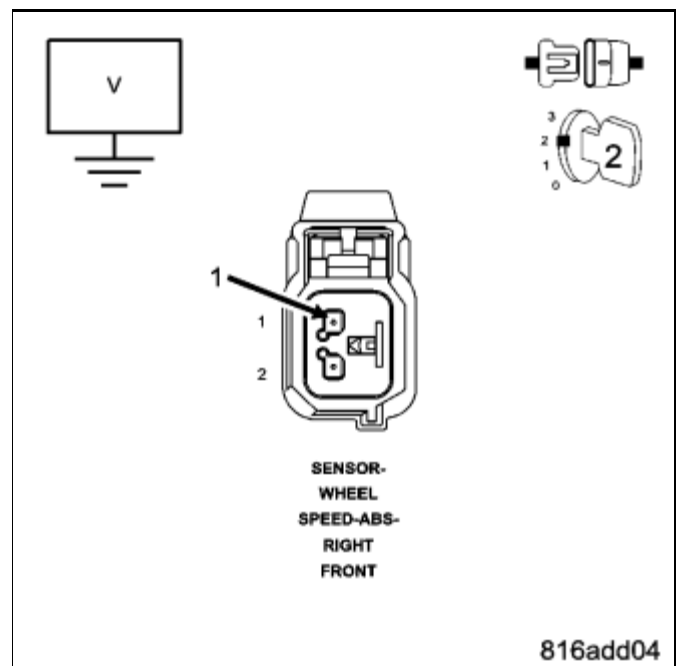
Is the voltage above 10.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)



4. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Right Front WSS harness connector.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B7) Right Front WSS Supply circuit.

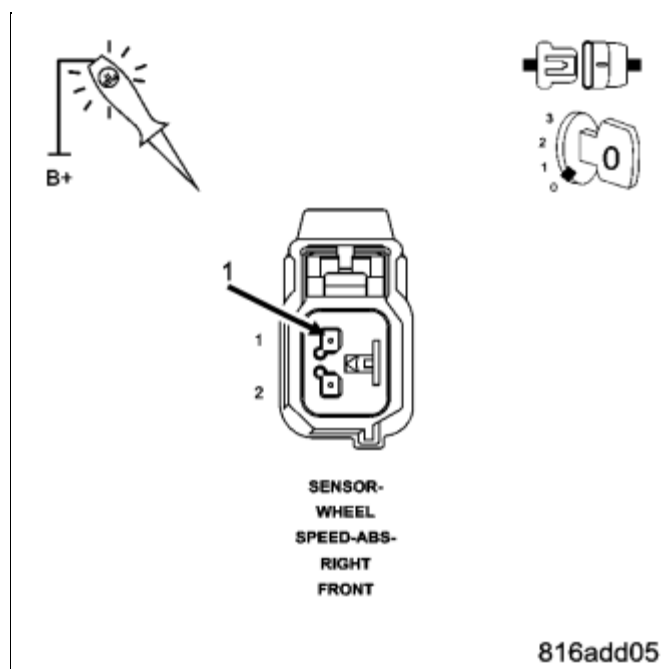
Does the test light illuminate brightly?

Yes

- Repair the (B7) Right Front WSS Supply circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B7) Right Front WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B7) Right Front WSS Supply circuit.

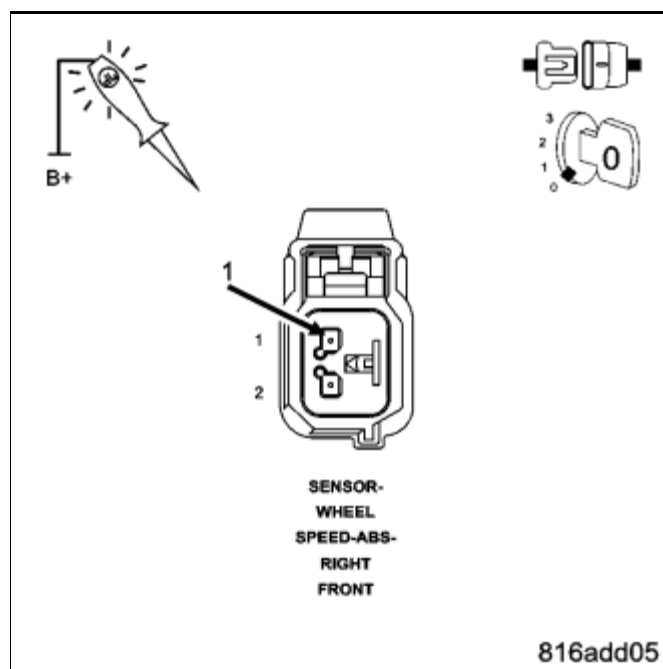
Does the test light illuminate brightly?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (B7) Right Front WSS Supply circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B6) Right Front WSS Signal circuit.

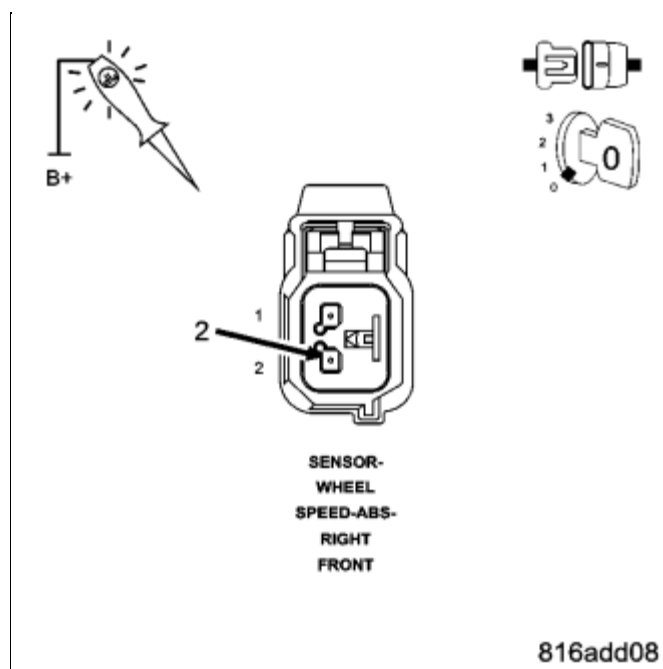
Does the test light illuminate brightly?

Yes

- Repair the (B6) Right Front WSS Signal circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT OPEN

Connect a jumper wire between ground and the (B6) Right Front WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B6) Right Front WSS Signal circuit.

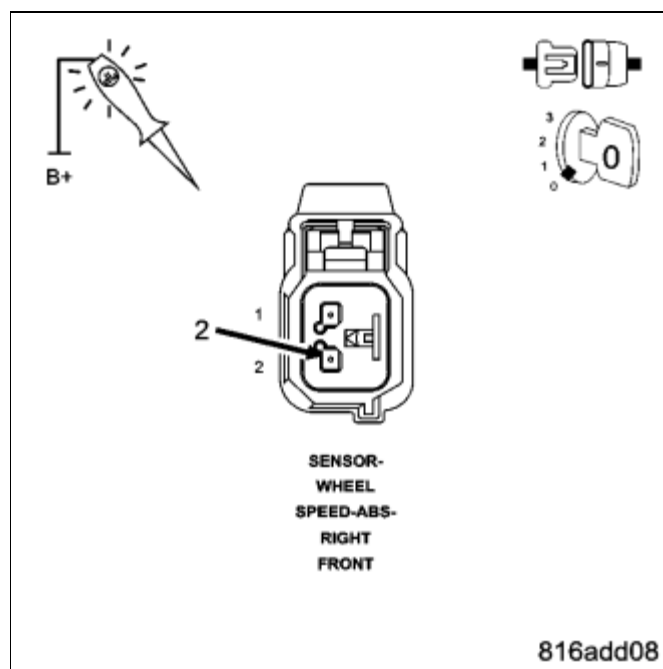
Does the test light illuminate brightly?

Yes

- Go To [8](#)

No

- Repair the (B6) Right Front WSS Signal circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



8. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.
 Remove all jumper wires.
 Measure the voltage between the (B6) Right Front WSS

Signal circuit and ground.

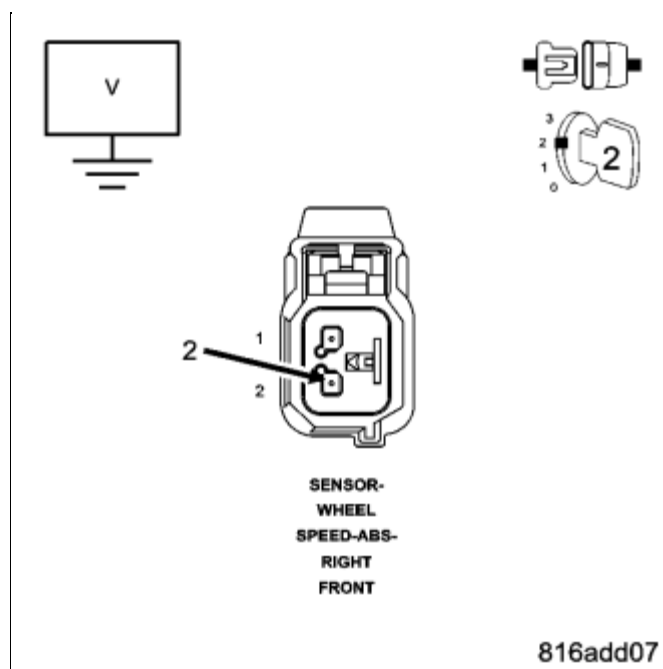
Is the voltage above one volt?

Yes

- Repair the (B6) Right Front WSS Signal circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [9](#)



9. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT AND (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the (B6) Right Front WSS Signal circuit and the (B7) Right Front WSS Supply circuit.

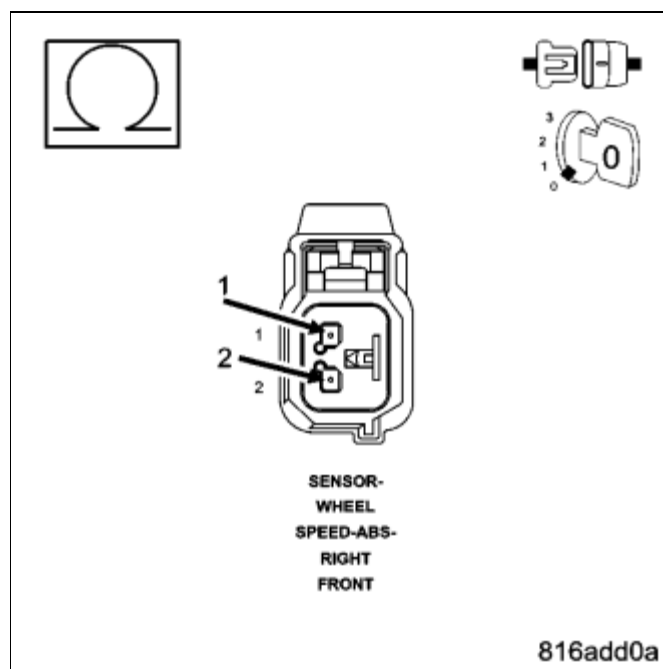
Is the resistance above 120 ohms?

Yes

Go To [10](#)

No

- Repair the (B6) Right Front WSS Signal circuit and the (B7) Right Front WSS Supply circuit for a short together.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



10. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Right Front Wheel Speed Sensor (WSS) Signal is intermittently missing while vehicle speed is above 40 km/h (25 mph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

Possible Causes
RIGHT FRONT WSS LOOSE — B6, B7 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
RIGHT FRONT TONE WHEEL DAMAGE
RIGHT FRONT WHEEL/BEARING DAMAGE
IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES
RIGHT FRONT WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

NOTE: If DTC C1015–Right Front Wheel Speed Sensor Circuit is present it must be repaired before continuing.

Turn the ignition on.

With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Right Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK RIGHT FRONT WSS LOOSENESS, INSPECT B6, B7 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector

Inspect the Right Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B6) Right Front WSS Signal and (B7) Right Front WSS Supply circuits between the Right Front WSS and Anti-Lock Brake Module for damage.

Is the Right Front WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECK RIGHT FRONT WHEEL SPEED SENSOR FOR DAMAGE

Remove the Right Front Wheel Speed Sensor
Inspect the Right Front Wheel Speed Sensor face for damage.

Is the Right Front Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK RIGHT FRONT TONE WHEEL/BEARING FOR DAMAGE

Inspect the Right Front Tone Wheel/Bearing for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Right Front Tone Wheel/Bearing damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK RIGHT FRONT WHEEL BEARING FOR DAMAGE

Inspect the Right Front wheel bearing for excessive runout or clearance.

NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

Is the Right Front Wheel Bearing Damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Right Front Wheel Speed Sensor (WSS) reading is different from the readings received from the other sensors at a vehicle speed above 40 km/h (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

Possible Causes
RIGHT FRONT WSS LOOSE — B6, B7 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES
RIGHT FRONT TONE WHEEL/BEARING DAMAGE
RIGHT FRONT WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Right Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK RIGHT FRONT WSS LOOSENESS, INSPECT B6, B7 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector

Inspect the Right Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B6) Right Front WSS Signal and (B7) Right Front WSS Supply circuits between the Right Front WSS and Anti-Lock Brake Module for damage.

Is the Right Front WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECK RIGHT FRONT WHEEL SPEED SENSOR FOR DAMAGE

Remove the Right Front Wheel Speed Sensor
Inspect the Right Front Wheel Speed Sensor face for damage.

Is the Right Front Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK RIGHT FRONT TONE WHEEL/BEARING FOR DAMAGE

Inspect the Right Front Tone Wheel/Bearing for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Right Front Tone Wheel/Bearing damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE reset?

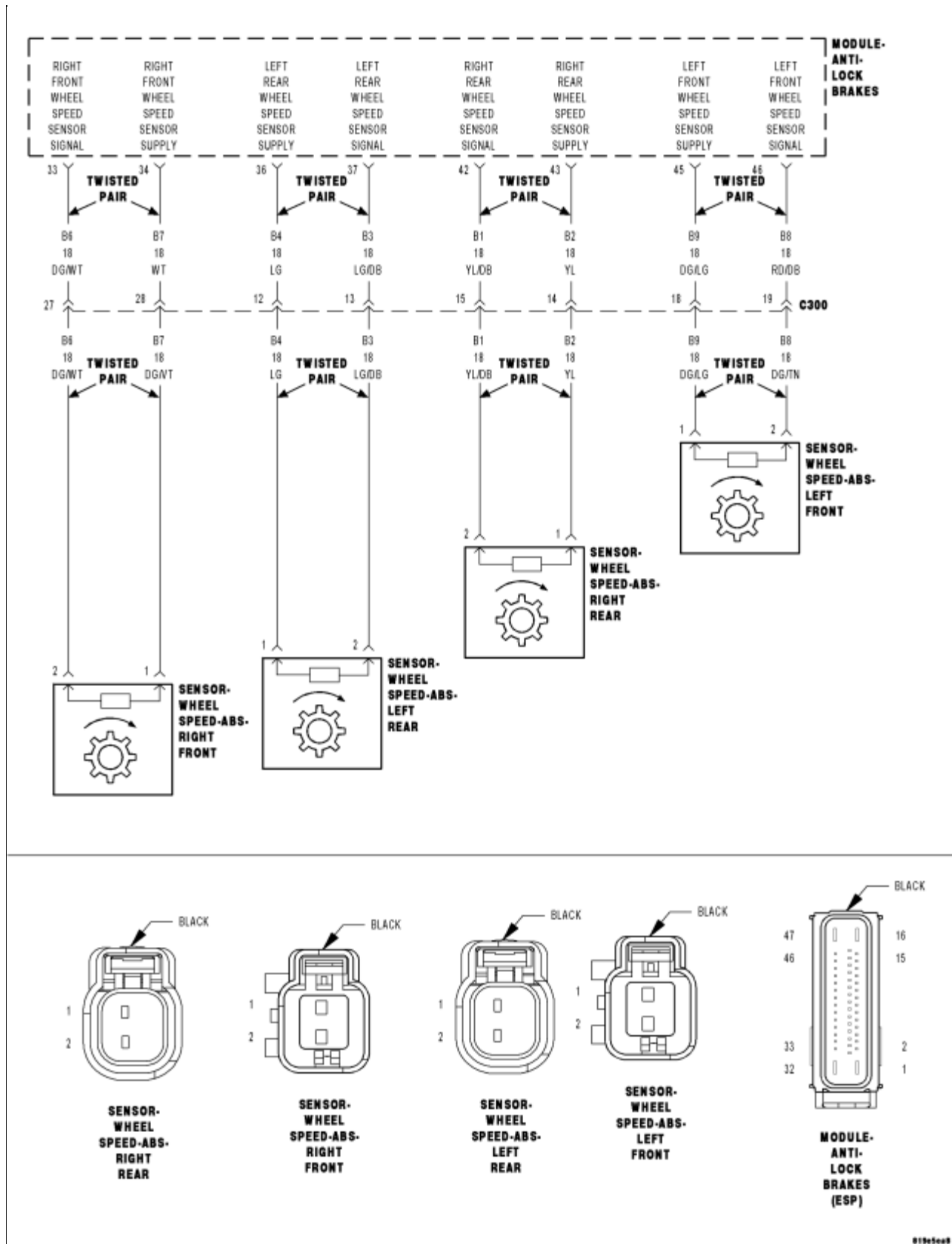
Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Left Rear Wheel Speed Sensor (WSS) circuit fails the diagnostic test.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B3) LEFT REAR WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B3) LEFT REAR WSS SIGNAL CIRCUIT SHORTED TO (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT
LEFT REAR WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR DTC C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector.

Is the Left Rear WSS or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Left Rear WSS harness connector.

Turn the ignition on.

Measure the voltage of the (B4) Left Rear WSS 12 Volt Supply circuit.

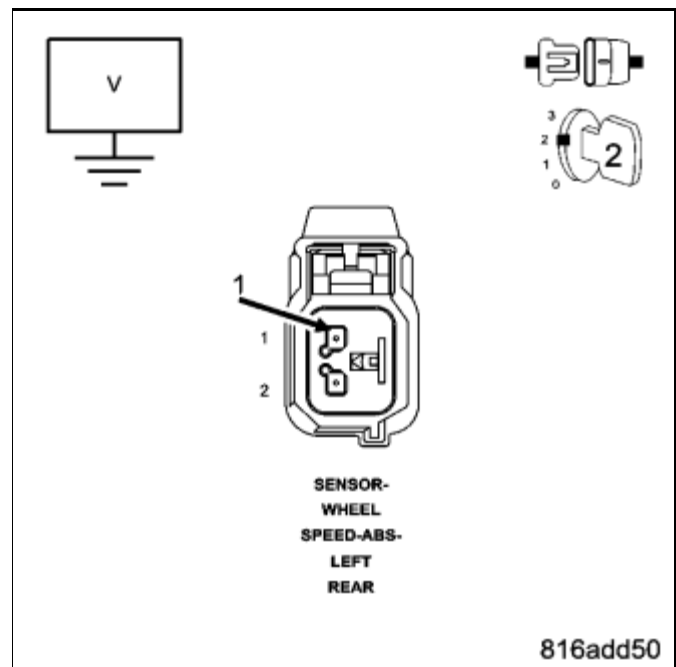
Is the voltage above 10.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)



4. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Left Rear WSS harness connector.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B4) Left Rear WSS Supply circuit.

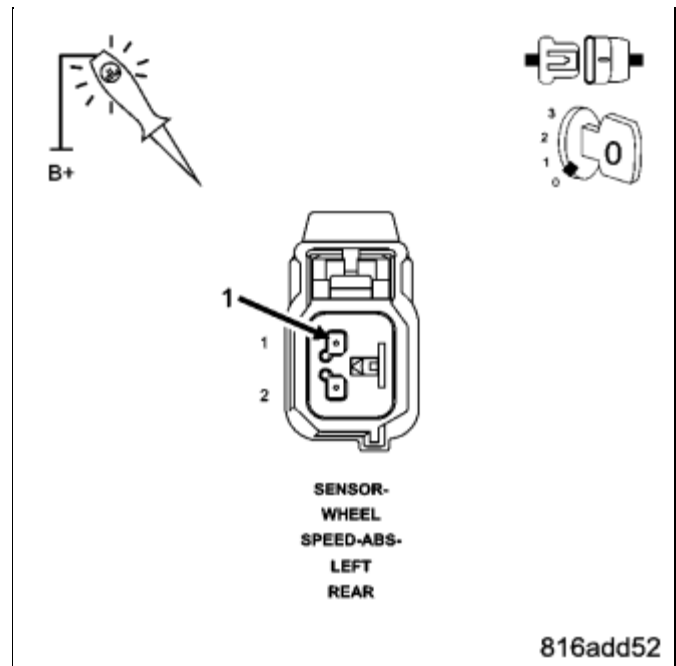
Does the test light illuminate brightly?

Yes

- Repair the (B4) Left Rear WSS Supply circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B4) Left Rear WSS Supply circuit in the Anti-Lock Brakes Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B4) Left Rear WSS Supply circuit.

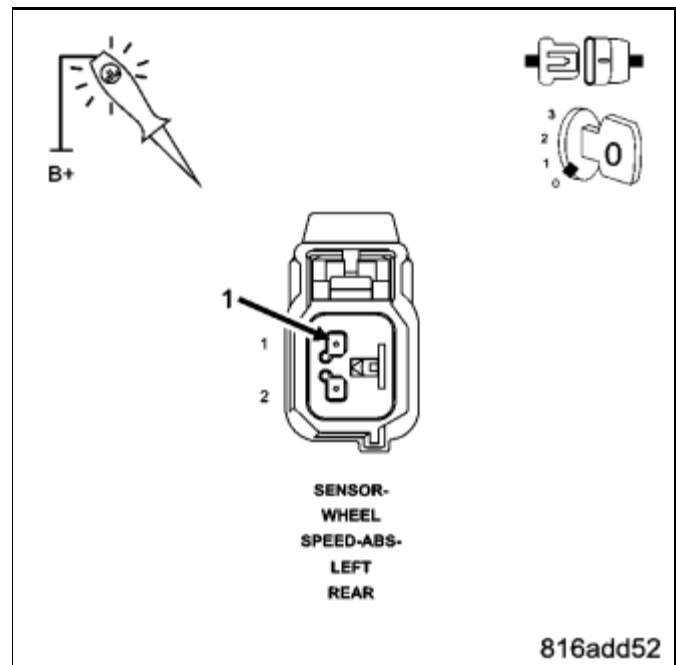
Does the test light illuminate brightly?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (B4) Left Rear WSS Supply circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B3) Left Rear WSS Signal circuit.

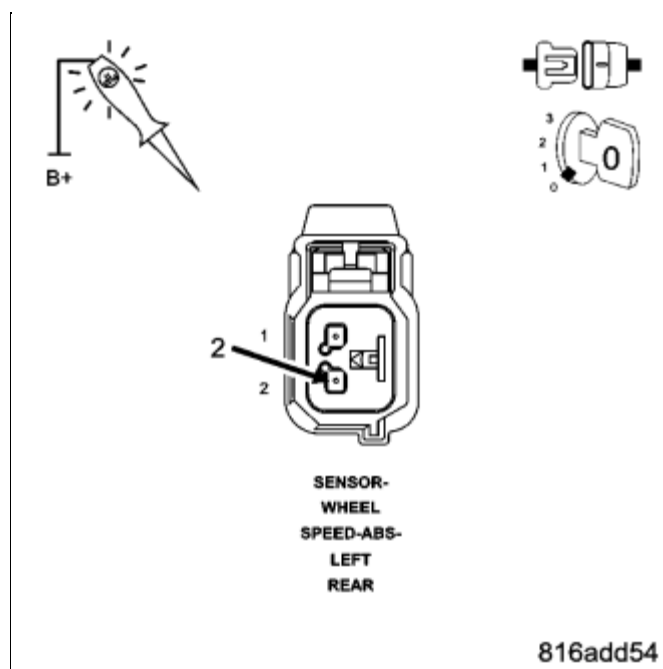
Does the test light illuminate brightly?

Yes

- Repair the (B3) Left Rear WSS Signal circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B3) Left Rear WSS Signal circuit in the Anti-Lock Brakes Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B3) Left Rear WSS Signal circuit.

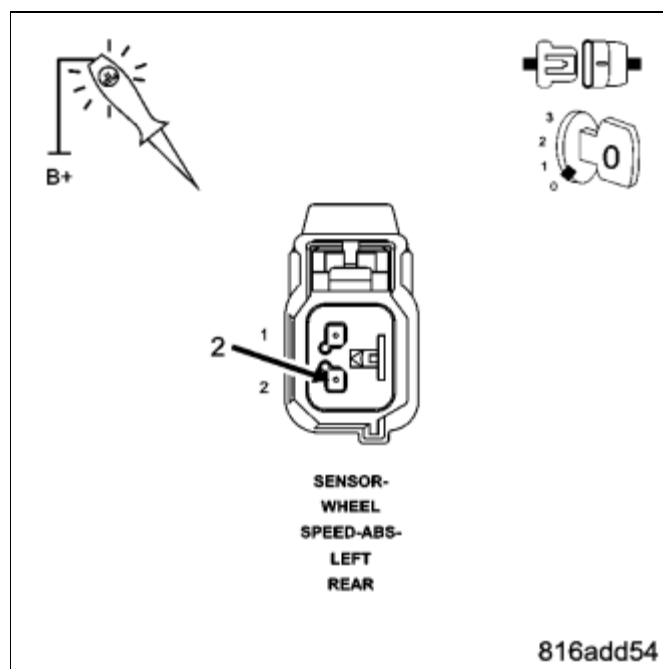
Does the test light illuminate brightly?

Yes

- Go To [8](#)

No

- Repair the (B3) Left Rear WSS Signal circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



8. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.
 Remove all jumper wires.
 Measure the voltage between the (B3) Left Rear WSS Signal

circuit and ground.

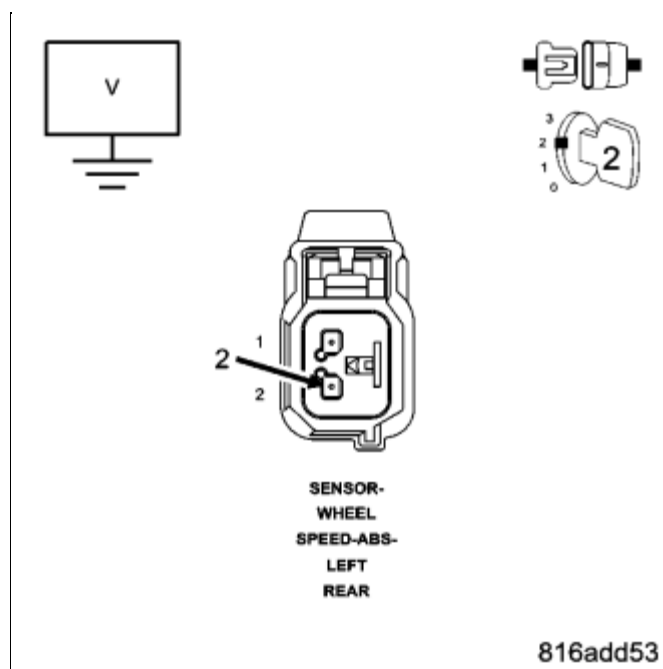
Is the voltage above one volt?

Yes

- Repair the (B3) Left Rear WSS Signal circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [9](#)



9. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT AND (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the (B3) Left Rear WSS Signal circuit and the (B4) Left Rear WSS Supply circuit.

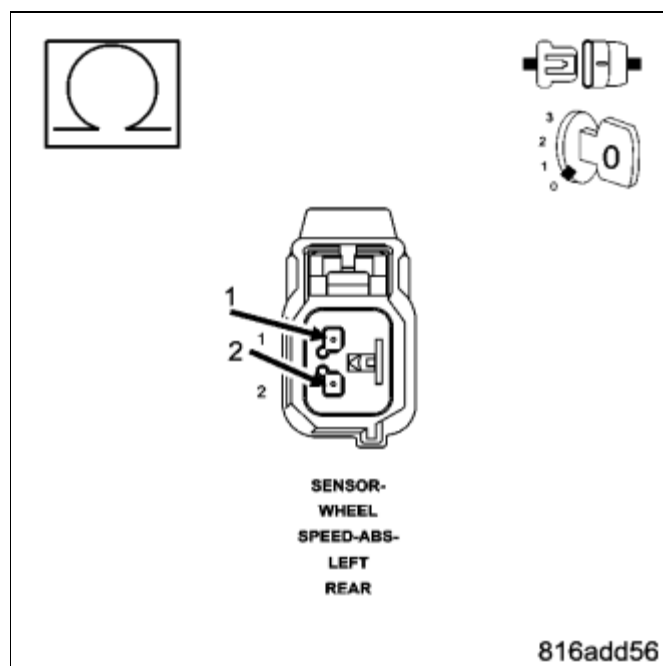
Is the resistance above 120 ohms?

Yes

Go To [10](#)

No

- Repair the (B3) Left Rear WSS Signal circuit and the (B4) Left Rear WSS Supply circuit for a short together.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



10. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Left Rear Wheel Speed Sensor (WSS) Signal is intermittently missing while vehicle speed is above 40 km/h (25 mph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

Possible Causes
LEFT REAR WSS LOOSE — B3, B4 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
LEFT REAR TONE WHEEL DAMAGE
LEFT REAR WHEEL BEARING DAMAGE
AXLE SHAFT FASTENER HARDWARE
IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES
LEFT REAR WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.
With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

Was the Axle Shaft fastener loose?

Yes

- Repair as necessary.

No

- Go To [5](#)

5. CHECK LEFT REAR WSS LOOSENESS, INSPECT B4, B5 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector

Inspect the Left Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B3) Left Rear WSS Signal and (B4) Left Rear WSS Supply circuits between the Left Rear WSS and

Anti-Lock Brake Module for damage.

Is the Left Rear WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK LEFT REAR WHEEL SPEED SENSOR FOR DAMAGE

Remove the Left Rear Wheel Speed Sensor
Inspect the Left Rear Wheel Speed Sensor face for damage.

Is the Left Rear Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK LEFT REAR TONE WHEEL FOR DAMAGE

Inspect the Left Rear Tone Wheel for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Left Rear Tone Wheel damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK LEFT REAR WHEEL BEARING FOR DAMAGE

Inspect the Left Rear wheel bearing for excessive runout or clearance.

NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

Is the Left Rear Wheel Bearing Damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [9](#)

9. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Left Rear Wheel Speed Sensor (WSS) reading is different from the readings received from the other sensors at a vehicle speed above 40 km/h (25 mph). The Anti-Lock Brake Module compares WSS

readings from side-to-side on an axle and front-to-rear.

Possible Causes
LEFT REAR WSS LOOSE — B3, B4 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES
LEFT REAR TONE WHEEL DAMAGE
AXLE SHAFT FASTENER HARDWARE
LEFT REAR WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

Was the Axle Shaft fastener loose?**Yes**

- Repair as necessary.

No

- Go To [5](#)

5. CHECK LEFT REAR WSS LOOSENESS, INSPECT B3, B4 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector. Inspect the Left Rear WSS for looseness, excessive corrosion and not properly fastened. Inspect the (B3) Left Rear WSS Signal and (B4) Left Rear WSS Supply circuits between the Left Rear WSS and Anti-Lock Brake Module for damage.

Is the Left Rear WSS loose or any of the wiring/connectors/terminals damaged?**Yes**

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK LEFT REAR WHEEL SPEED SENSOR FOR DAMAGE

Remove the Left Rear Wheel Speed Sensor
Inspect the Left Rear Wheel Speed Sensor face for damage.

Is the Left Rear Wheel Speed Sensor damaged?**Yes**

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK LEFT REAR TONE WHEEL FOR DAMAGE

Inspect the Left Rear Tone Wheel for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Left Rear Tone Wheel damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE reset?

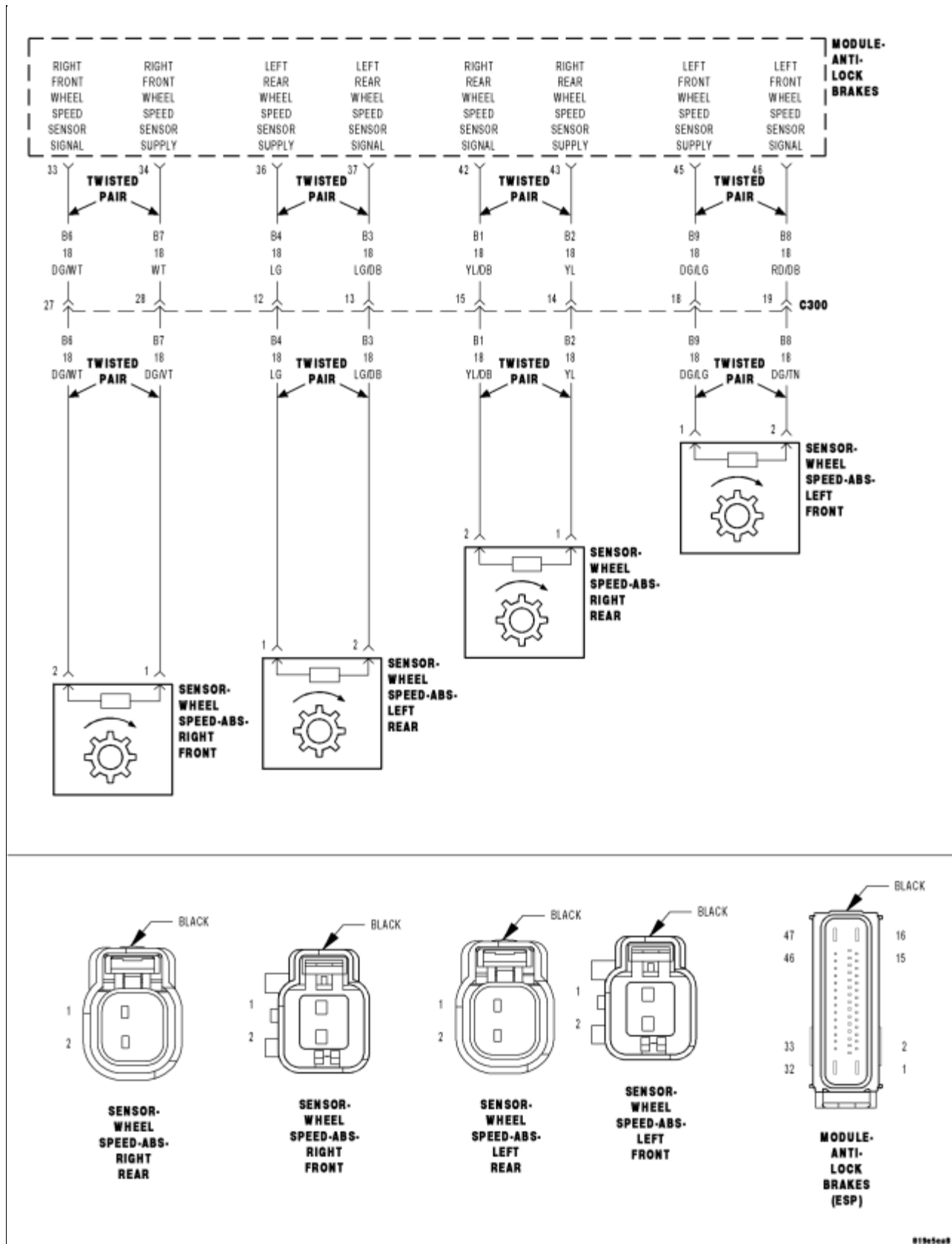
Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Right Rear Wheel Speed Sensor (WSS) circuit fails the diagnostic test.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN
(B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORTED TO (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT
RIGHT REAR WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR DTC C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector.

Is the Right Rear WSS or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Right Rear WSS harness connector.

Turn the ignition on.

Measure the voltage of the (B2) Right Rear WSS 12 Volt Supply circuit.

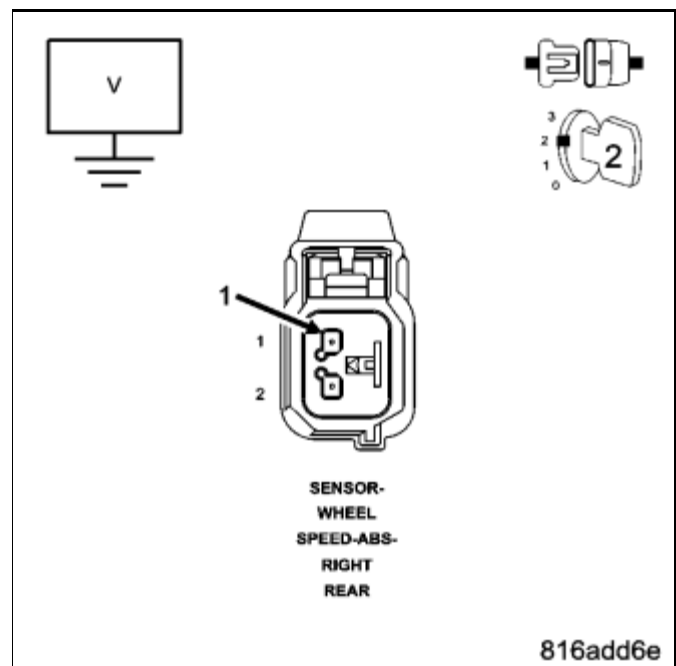
Is the voltage above 10.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)



4. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Right Rear WSS harness connector.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B2) Right Rear WSS Supply circuit.

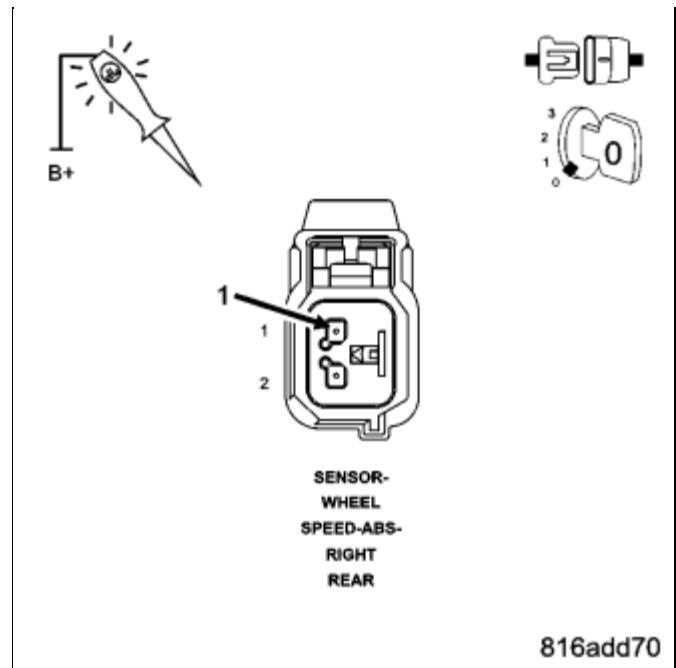
Does the test light illuminate brightly?

Yes

- Repair the (B2) Right Rear WSS Supply circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B2) Right Rear WSS Supply circuit in the Anti-Lock Brakes Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B2) Right Rear WSS Supply circuit.

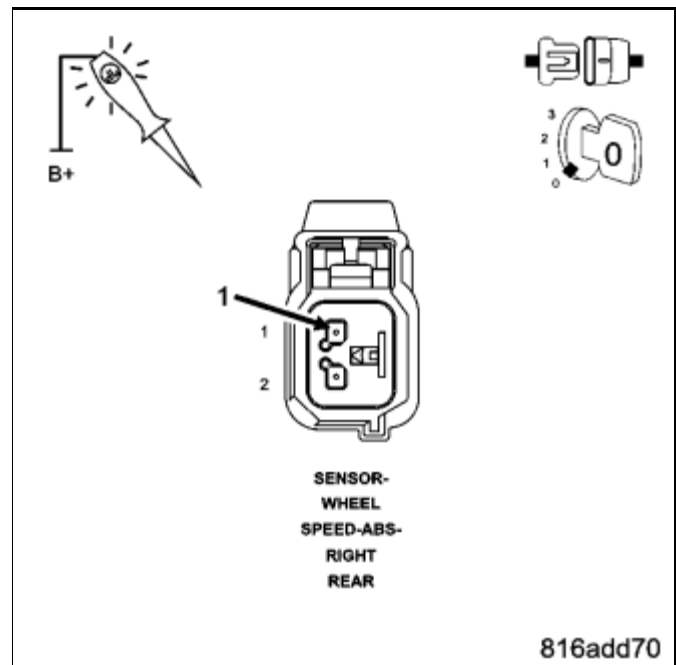
Does the test light illuminate brightly?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (B2) Right Rear WSS Supply circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Anti-Lock Brake Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B1) Right Rear WSS Signal circuit.

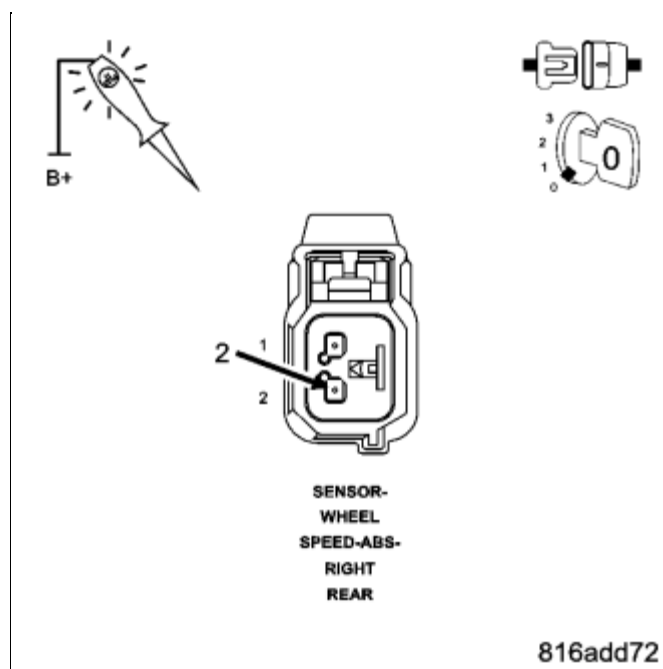
Does the test light illuminate brightly?

Yes

- Repair the (B1) Right Rear WSS Signal circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B1) Right Rear WSS Signal circuit in the Anti-Lock Brakes Module harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (B1) Right Rear WSS Signal circuit.

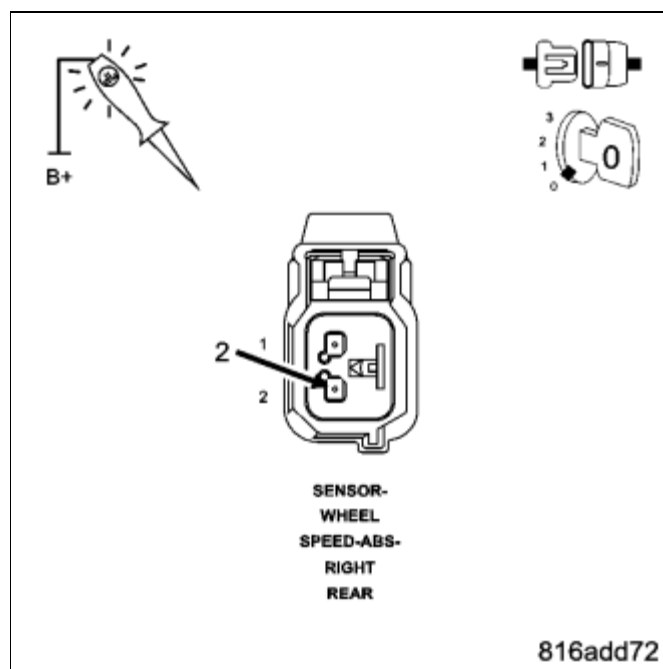
Does the test light illuminate brightly?

Yes

- Go To [8](#)

No

- Repair the (B1) Right Rear WSS Signal circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



8. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.
 Remove all jumper wires.
 Measure the voltage between the (B1) Right Rear WSS

Signal circuit and ground.

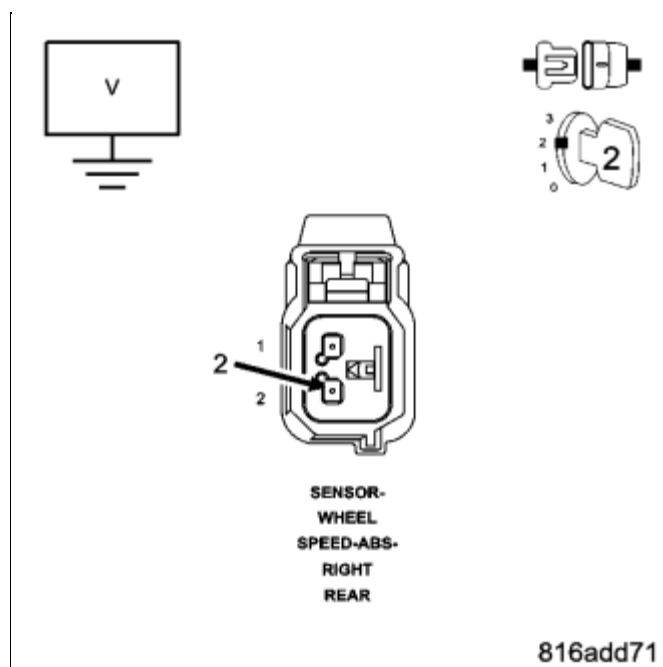
Is the voltage above one volt?

Yes

- Repair the (B1) Right Rear WSS Signal circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [9](#)



9. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT

Turn the ignition off.

Measure the resistance between the (B1) Right Rear WSS Signal circuit and the (B2) Right Rear WSS Supply circuit.

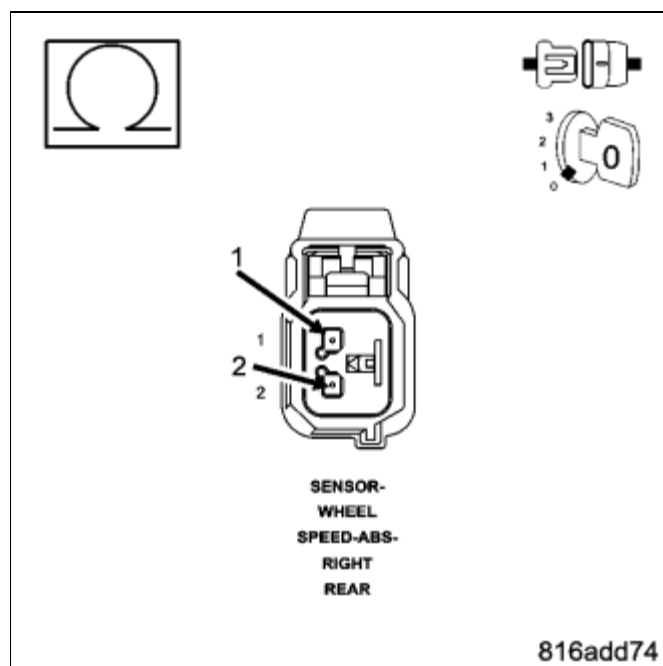
Is the resistance above 120 ohms?

Yes

Go To [10](#)

No

- Repair the (B1) Right Rear WSS Signal circuit and the (B2) Right Rear WSS Supply circuit for a short together.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



10. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Right Rear Wheel Speed Sensor (WSS) Signal is intermittently missing while vehicle speed is above 40 km/h (25 mph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

Possible Causes
RIGHT REAR WSS LOOSE — B1, B2 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
RIGHT REAR TONE WHEEL DAMAGE
RIGHT REAR WHEEL BEARING DAMAGE
AXLE SHAFT FASTENER HARDWARE
IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES
RIGHT REAR WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.
With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

Was the Axle Shaft fastener loose?

Yes

- Repair as necessary.

No

- Go To [5](#)

5. CHECK RIGHT REAR WSS LOOSENESS, INSPECT B1, B2 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector.

Inspect the Right Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B1) Right Rear WSS Signal and (B2) Right Rear WSS Supply circuits between the Right Rear WSS and Anti-Lock Brake Module for damage.

Is the Right Rear WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK RIGHT REAR WHEEL SPEED SENSOR FOR DAMAGE

Remove the Right Rear Wheel Speed Sensor.
Inspect the Right Rear Wheel Speed Sensor face for damage.

Is the Right Rear Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK RIGHT REAR TONE WHEEL FOR DAMAGE

Inspect the Right Rear Tone Wheel for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Right Rear Tone Wheel damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK RIGHT REAR WHEEL BEARING FOR DAMAGE

Inspect the Right Rear wheel bearing for excessive runout or clearance.

NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.

Is the Right Rear Wheel Bearing Damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [9](#)

9. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Right Rear Wheel Speed Sensor (WSS) reading is different from the readings received from the other sensors at a vehicle speed above 40 km/h (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

Possible Causes
RIGHT REAR WSS LOOSE — B1, B2 CIRCUITS/CONNECTOR/TERMINAL DAMAGE
IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES
RIGHT REAR TONE WHEEL/BEARING DAMAGE
AXLE SHAFT FASTENER HARDWARE
RIGHT REAR WSS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, record and erase DTCs.

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification

as required.

Was the Axle Shaft fastener loose?

Yes

- Repair as necessary.

No

- Go To [5](#)

5. CHECK RIGHT REAR WSS LOOSENESS, INSPECT B1, B2 CIRCUITS/TERMINALS FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector

Inspect the Right Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B1) Right Rear WSS Signal and (B2) Right Rear WSS Supply circuits between the Right Rear WSS and Anti-Lock Brake Module for damage.

Is the Right Rear WSS loose or any of the wiring/connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK RIGHT REAR WHEEL SPEED SENSOR FOR DAMAGE

Remove the Right Rear Wheel Speed Sensor.

Inspect the Right Rear Wheel Speed Sensor face for damage.

Is the Right Rear Wheel Speed Sensor damaged?

Yes

- Replace sensor and hub assembly.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK RIGHT REAR TONE WHEEL/BEARING FOR DAMAGE

Inspect the Right Rear Tone Wheel/Bearing for damage, missing teeth, cracks, corrosion or looseness.

NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.

Is the Right Rear Tone Wheel/Bearing damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [8](#)

8. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

Did DTC C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test Complete.

C1041-LEFT FRONT TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects periodic drops of a WSS signal.

Possible Causes
LEFT FRONT TONE WHEEL/BEARING DAMAGE
IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES
DIRT, METAL, DAMAGED TONE WHEEL/SENSOR

Diagnostic Test

1. CHECK FOR A DTC C1041-LEFT FRONT TONE WHEEL PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
 With the scan tool, read DTCs.
 Record DTC and Freeze Frame information.
 With the scan tool, erase DTCs.
 Cycle the ignition switch off then on.

CAUTION: Ensure brake capability is available before road testing.

Test drive the vehicle in a straight line to 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1041-LEFT FRONT TONE WHEEL PERFORMANCE active?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE LEFT FRONT TONE WHEEL/BEARING FOR DAMAGE

NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.

Check the Left Front Tone Wheel/Bearing for damage.

Check the Left Front Tone Wheel for dirt.

Was the tone wheel dirty?

Yes

- Clean tone wheel and sensor. Clear codes and retest.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Replace the Left Front Tone Wheel/Bearing in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

C1042-RIGHT FRONT TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

Possible Causes
DIRTY TONE WHEEL/SENSOR
IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES
RIGHT FRONT TONE WHEEL/BEARING DAMAGE

Diagnostic Test

1. CHECK FOR A DTC C1042-RIGHT FRONT TONE WHEEL PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, read DTCs.
Record DTC and Freeze Frame information.
With the scan tool, erase DTCs.
Cycle the ignition switch off then on.

CAUTION: Ensure brake capability is available before road testing.

Test drive the vehicle in a straight line to 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1042-RIGHT FRONT TONE WHEEL PERFORMANCE?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Front WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Right Front Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK THE RIGHT FRONT TONE WHEEL/BEARING FOR DAMAGE

NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.

Check the Right Front Tone Wheel/Bearing for damage.
Check the Right Front Tone Wheel for dirt.

Was the tone wheel dirty?

Yes

- Clean tone wheel and sensor. Clear codes and retest.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Right Front Tone Wheel/Bearing in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1043-LEFT REAR TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

Possible Causes
DIRTY TONE WHEEL/SENSOR
IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES
AXLE SHAFT FASTENER HARDWARE
LEFT REAR TONE WHEEL/BEARING DAMAGE

Diagnostic Test

1. CHECK FOR A DTC C1043-LEFT REAR TONE WHEEL PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

CAUTION: Ensure brake capability is available before road testing.

Test drive the vehicle in a straight line to 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1043-LEFT REAR TONE WHEEL PERFORMANCE?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Left Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic

behavior?

Yes

- Go To [3](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

Was the Axle Shaft fastener loose?

Yes

- Repair as necessary.

No

- Go To [5](#)

5. CHECK THE LEFT REAR TONE WHEEL/BEARING FOR DAMAGE

NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.

Check the Left Rear Tone Wheel/Bearing for damage.
Check the Left Rear Tone Wheel for dirt.

Was the tone wheel dirty?

Yes

- Clean tone wheel and sensor. Clear codes and retest.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Replace the Left Rear Tone Wheel/Bearing in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

C1044-RIGHT REAR TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects periodic drops of a Wheel Speed Sensor (WSS) signal.

Possible Causes
DIRTY TONE WHEEL/SENSOR
IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES
AXLE SHAFT FASTENER HARDWARE
RIGHT REAR TONE WHEEL/BEARING DAMAGE

Diagnostic Test

1. CHECK FOR A DTC C1044-RIGHT REAR TONE WHEEL PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, read DTCs.
Record DTC and Freeze Frame information.
With the scan tool, erase DTCs.
Cycle the ignition switch off then on.

CAUTION: Ensure brake capability is available before road testing.

Test drive the vehicle in a straight line to 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C1044-RIGHT REAR TONE WHEEL PERFORMANCE?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.
With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Is the Right Rear WSS speed showing 0 km/h (0 mph) or not matching other wheels or showing erratic behavior?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

3. CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.
Check and adjust the Right Rear Tire pressure.
Check and adjust all other tire pressures.
Inspect for mismatched tires on vehicle.

Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK AXLE SHAFT FASTENER HARDWARE FOR LOOSENESS

Inspect the axle shaft fastener for looseness, and not properly fastened. Tighten fastener to proper specification as required.

Was the Axle Shaft fastener loose?

Yes

- Repair as necessary.

No

- Go To [5](#)

5. CHECK THE RIGHT REAR TONE WHEEL FOR DAMAGE

NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.

Check the Right Rear Tone Wheel for damage.
Check the Right Rear Tone Wheel for dirt.

Was the tone wheel dirty?

Yes

- Clean tone wheel and sensor. Clear codes and retest.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Replace the Right Rear Tone Wheel in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

C1046–LEFT FRONT WHEEL PRESSURE PHASE MONITORING

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During active ABS control.

- **Set Condition:**

If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

Possible Causes
LEFT FRONT TONE WHEEL/BEARING DAMAGED
WHEEL SPEED SIGNALS SWAPPED
LEFT FRONT WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. COMPARE WHEEL SPEED SENSOR SIGNALS

WARNING: Ensure brake capability is available before road testing.

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Does the Left Front WSS speed differ from the other WSS speeds by 8 km/h (5 mph) or show NO speed?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECKING INSIDE WHEEL SPEED

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph) and perform a 90 degree turn while monitoring if inside wheel is slower than outside.

Was the inside wheel slower than outside?

Yes

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

No

- Go To [3](#)

3. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)

5. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.

Did DTC C1046–LEFT FRONT WHEEL PRESSURE PHASE MONITORING reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1047–RIGHT FRONT WHEEL PRESSURE PHASE MONITORING

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During active ABS control.

- **Set Condition:**

If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

Possible Causes
RIGHT FRONT TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED

RIGHT FRONT WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. COMPARE WHEEL SPEED SENSOR SIGNALS

WARNING: Ensure brake capability is available before road testing.

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Does the Right Front WSS speed differ from the other WSS speeds by 8 km/h (5 mph) or show NO speed?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECKING INSIDE WHEEL SPEED

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph) and perform a 90 degree turn while monitoring if inside wheel is slower than outside.

Was the inside wheel slower than outside?

Yes

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

No

- Go To [3](#)

3. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)

5. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.

Did DTC C1047–RIGHT FRONT WHEEL PRESSURE PHASE MONITORING reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1048–LEFT REAR WHEEL PRESSURE PHASE MONITORING

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During active ABS control.

- **Set Condition:**

If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

Possible Causes
LEFT REAR TONE WHEEL/WHEEL BEARING
WHEEL SPEED SIGNALS SWAPPED
LEFT REAR WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. COMPARE WHEEL SPEED SENSOR SIGNALS

WARNING: Ensure brake capability is available before road testing.

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Does the Left Rear WSS speed differ from the other WSS speeds by 8 km/h (5 mph) or show NO speed?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECKING INSIDE WHEEL SPEED

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph) and perform a 90 degree turn while monitoring if inside wheel is slower than outside.

Was the inside wheel slower than outside?

Yes

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

No

- Go To [3](#)

3. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired

connectors.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)

5. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.

Did DTC C1048–LEFT REAR WHEEL PRESSURE PHASE MONITORING reset?

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1049–RIGHT REAR WHEEL PRESSURE PHASE MONITORING

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During active ABS control.

- **Set Condition:**

When the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

Possible Causes
RIGHT REAR TONE WHEEL DAMAGED
WHEEL SPEED SIGNALS SWAPPED
RIGHT REAR WSS
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. COMPARE WHEEL SPEED SENSOR SIGNALS

WARNING: Ensure brake capability is available before road testing.

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph).

Does the Right Rear WSS speed differ from the other WSS speeds by 8 km/h (5 mph) or show NO speed?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECKING INSIDE WHEEL SPEED

Slowly accelerate as straight as possible from a stop to 40 km/h (25 mph) and perform a 90 degree turn while monitoring if inside wheel is slower than outside.

Was the inside wheel slower than outside?

Yes

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND

TESTING)

No

- Go To [3](#)

3. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)

5. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CAUTION: Ensure brake capability is available before road testing.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read ABS DTCs.

NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.

Did DTC C1049–RIGHT REAR WHEEL PRESSURE PHASE MONITORING reset?

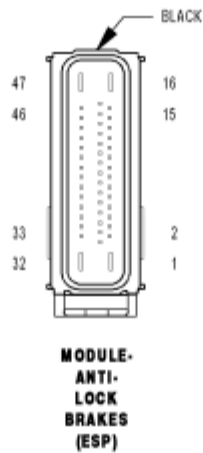
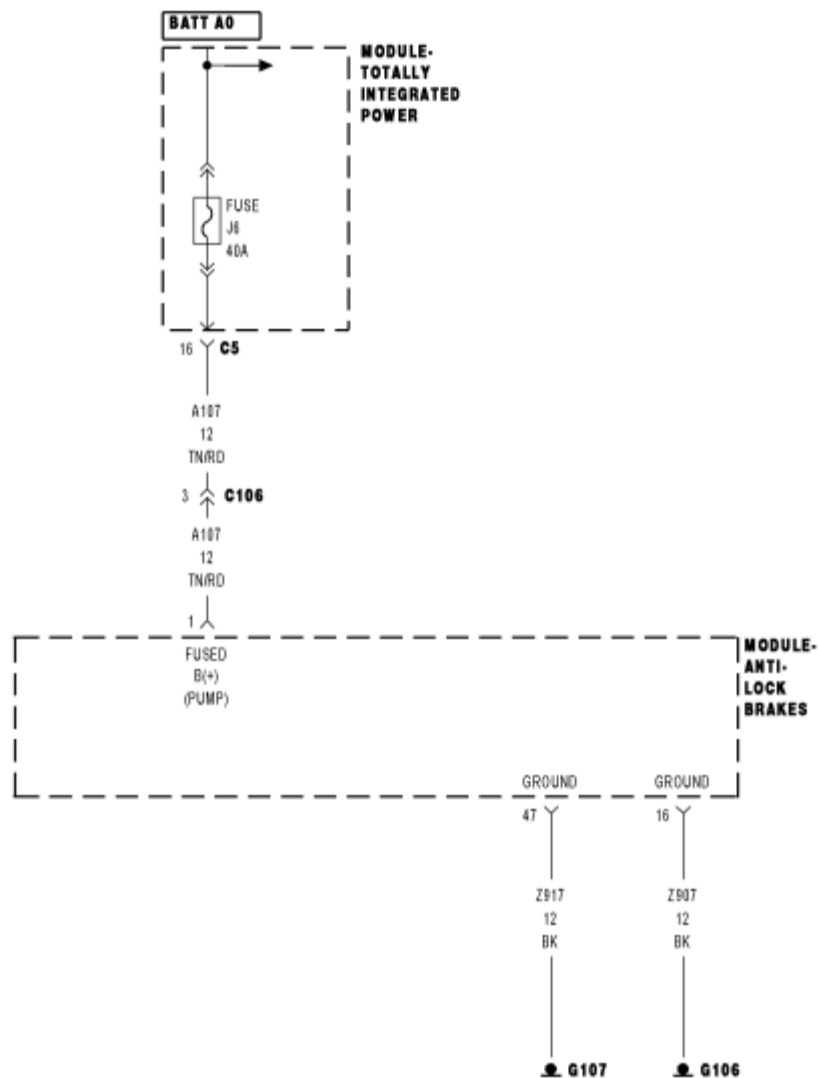
Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

C1073–ABS PUMP MOTOR CONTROL CIRCUIT



01550012

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the ABS Pump Motor is activated.

- **Set Condition:**

The ABM detects low pump motor feedback voltage with actuation of the pump motor relay.

Possible Causes
BLOWN PUMP FUSE
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
HIGH RESISTANCE IN B+ CIRCUITS
HIGH RESISTANCE IN GROUND CIRCUITS
INTEGRATED CONTROL UNIT

Diagnostic Test

1. CHECK FOR A DTC C1073-ABS PUMP MOTOR CONTROL CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid. If present, diagnose and repair DTC C2116-ABS PUMP MOTOR SUPPLY LOW VOLTAGE before diagnosing this DTC.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs

NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.

Does the scan tool display: C1073-ABS PUMP MOTOR CONTROL CIRCUIT?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK THE ABS PUMP MOTOR FUSED B+ FOR AN OPEN

Turn the ignition off.

Remove and visually inspect the ABS Pump Motor B+ fuse.

Is the ABS Pump Motor B+ fuse open?

Yes

- Go To [4](#)

No

- Go To [6](#)

4. CHECK THE (A107) FUSED B(+) FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (A107) Fused B+ circuit.

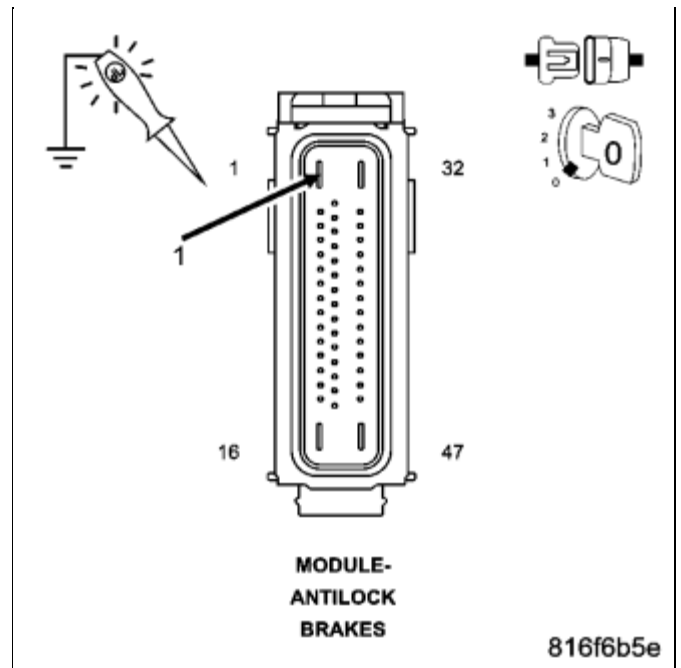
Does the test light illuminate brightly?

Yes

- Repair the (A107) Fused B(+) circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK THE (A107) FUSED B(+) CIRCUIT

Turn the ignition off.

Visually inspect the (A107) Fused B(+) circuit in the wiring harness.

Look for any signs of intermittent short to ground.

Is the wiring harness OK?

Yes

- Go To [6](#)

No

- Repair the (A107) Fused B(+) circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

6. CHECK THE VOLTAGE ON THE (A107) FUSED B(+) CIRCUIT

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

Measure the voltage of the (A107) Fused B(+) circuit in the Anti-Lock Brake Module harness connector.

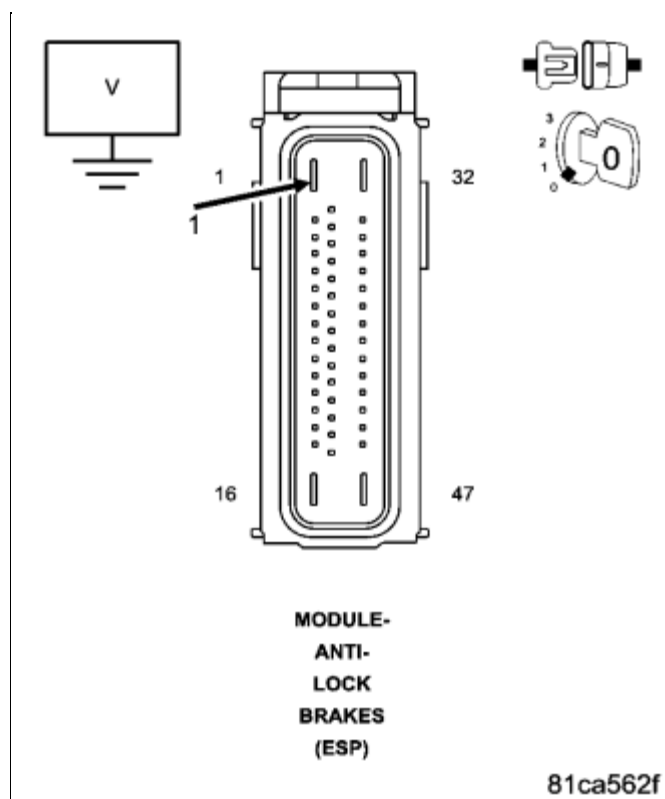
Is the voltage above 10 volts?

Yes

- Go To [7](#)

No

- Repair the (A107) Fused B(+) circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



7. CHECK THE (Z907) AND (Z917) GROUND CIRCUITS FOR AN OPEN

Measure the resistance of the (Z907) and (Z917) Ground circuits between the Anti-Lock Brake Module harness connector and ground

Is the resistance below 5.0 ohms?

Yes

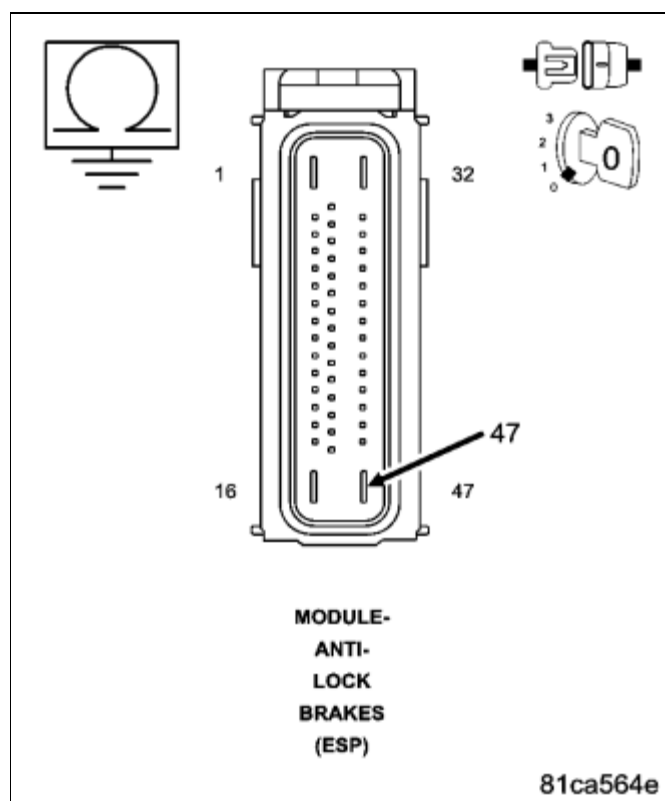
- Replace the ICU per service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the high resistance in the affected circuit.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1078–TIRE REVOLUTIONS RANGE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**



When Monitored:

Continuously.

- **Set Condition:**

A comparison between the tire circumference value contained in the EEPROM and the tire circumference value received on the CAN bus. Programmed value for tire size is not within acceptable range.

Possible Causes
INCORRECT VALUE PROGRAMMED INTO TIPM

Diagnostic Test

1. INCORRECT VALUE PROGRAMMED INTO TIPM

TIRE SIZE	BODY STYLE	ENGINE SIZE	SALES CODE	TIRE DIAMETER (MM)
P225/75R 17 BSW ALL TERRAIN	JK	ALL	TNA	2480
P225/70R 18 BSW ON/OFF ROAD	JK	ALL	TNB, TT6	2480
P225/75R 16 BSW ON/OFF ROAD	JK	ALL	TRM	2253
LT225/75R 17 BSW OFF ROAD	JK	ALL	TT7	2495
P225/75R 17 OWL ON/OFF ROAD	JK	ALL	TUF	2480
P245/75R 16 BSW ON/OFF ROAD	JK	ALL	TYX, TYZ	2357

Verify the correct Tire/wheel information is programmed in the TIPM.

Is the correct value programmed in the TIPM according to the chart?

Yes

- Test complete.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Program the correct Tire/Wheel information in the TIPM.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C107C–BRAKE PEDAL SWITCH 1/2 STUCK

For a complete wiring diagram **Refer to Section 8W.**

1. ENGINE DTCS PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine DTCs present?

Yes

- Refer to Section 9 – Engine Electrical Diagnostics and perform the appropriate diagnostic procedure.

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.
- Perform POWERTRAIN VERIFICATION TEST - VER 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

C107D–BRAKE PEDAL SWITCH 1/2 CORRELATION

For a complete wiring diagram **Refer to Section 8W.**

1. ENGINE DTCS PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine DTCs present?

Yes

- Refer to Section 9 – Engine Electrical Diagnostics and perform the appropriate diagnostic procedure.

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.
- Perform POWERTRAIN VERIFICATION TEST - VER 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

C1090–ABS BRAKE LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When monitoring the Brake Lamp Activation Relay Control circuit the module detects a short to ground.

Possible Causes
(B45) BRAKE LAMP ACTIVATION RELAY CONTROL OPEN OR SHORTED TO GROUND
BLOWN FUSE
BRAKE LAMP ACTIVATION RELAY
ANTI-LOCK BRAKE MODULE (ABM)

Diagnostic Test

1. CHECK FOR DTC C1090–ABS BRAKE LAMP CONTROL CIRCUIT LOW

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Start Engine.

Apply brake pedal firmly with at least 80 bar (1160 psi.) .

With the scan tool, read DTCs.

Does the scan tool display: C1090–ABS BRAKE LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST.

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector and the Brake Lamp Activation Relay harness connector.

Is the Anti-Lock Brake Module or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST.

No

- Go To [3](#)

3. CHECK (B45) BRAKE LAMP ACTIVATION RELAY CONTROL SHORTED TO GROUND

Turn the ignition off.

Disconnect the Anti-Lock Brake Module

Start the engine.

Using a 12-volt test light connected to ground, probe the (B45) Brake Lamp Activation Relay Control Circuit at the Anti-Lock Brake Module harness connector.

Does the test light illuminate brightly?

Yes

- Replace the Anti-Lock Brake Module in accordance with the service information.
- Perform ABS VERIFICATION TEST.

No

- Go To [4](#)

4. CHECK (F500) FUSED IGNITION SWITCH OUTPUT

Turn the ignition off.

Disconnect the Brake Lamp Activation Relay.

Start the engine.

Using a 12-volt test light connected to ground, probe the (F500) Fused Ignition Switch Output Circuit at the Brake Lamp Activation Relay harness connector.

Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Check for open Fuse, if ok repair open or short to ground in the (F500) Fused Ignition Switch Output Circuit.
- Perform ABS VERIFICATION TEST.

5. BRAKE LAMP ACTIVATION RELAY

Turn the ignition off.

Measure the resistance of the (B45) Brake Lamp Activation Relay Control Circuit between the Brake Lamp Activation relay and the Anti-Lock Brake Module.

Is the resistance 5 ohms ?

Yes

- Replace the Brake Lamp Activation Relay in accordance with the Service Information.
- Perform ABS VERIFICATION TEST.

No

- Repair open in the (B45) Brake Lamp Inhibit Relay Control circuit.
- Perform ABS VERIFICATION TEST.

C1091–ABS BRAKE LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

When Set:

When monitoring the Brake Lamp Activation Relay Control circuit the module detects a short to B+.

Possible Causes
(B45) BRAKE LAMP ACTIVATION RELAY CONTROL SHORTED TO VOLTAGE
BRAKE LAMP ACTIVATION RELAY
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC C1091–ABS BRAKE LAMP CONTROL CIRCUIT HIGH

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Start Engine.

Apply brake pedal firmly with at least 80 bar (1160 psi.) .

With the scan tool, read DTCs.

Does the scan tool display: C1091–ABS BRAKE LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST.

2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector and the Brake Lamp Activation Relay harness connector.

Is the Anti-Lock Brake Module or any of the connectors/terminals damaged?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST.

No

- Go To [3](#)

3. CHECK (B45) BRAKE LAMP ACTIVATION RELAY CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Anti-Lock Brake Module

Disconnect the Brake Lamp Activation Relay.

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (B45) Brake Lamp Activation Relay Control Circuit at the Brake Lamp Activation Relay harness connector.

Does the test light illuminate brightly?

Yes

- Repair the short to voltage in the (B45) Brake Lamp Inhibit Relay Control circuit.
- Perform ABS VERIFICATION TEST.

No

- Go To [4](#)

4. BRAKE LAMP ACTIVATION RELAY

Turn the ignition off.

Measure the resistance across the relay between the (B45) Brake Lamp Activation Relay Control Circuit and the (F500) Fused Ignition switch Output.

Is the resistance 75 ohms $\pm$ 5 ohms?

Yes

- Replace the Anti-Lock Brake Module in accordance with the service information.
- Perform ABS VERIFICATION TEST.

No

- Replace the Brake Lamp Activation Relay in accordance with the Service Information.
- Perform ABS VERIFICATION TEST.

C1210–G SENSOR INPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

Continuously, with ignition on, until vehicle speed exceeds 20 km/h (12.4 m.p.h.) for the first time, but not if the sensor voltage is out of range.

Or, during diagnostic mode.

Or, if the monitoring was inhibited by a corresponding diagnostics command.

◦ Set Condition:

If the measured acceleration signal is higher than 0.8 g for longer than the specified detection time.

DYNAMICS SENSOR INSTALLATION
DYNAMICS SENSOR

Diagnostic Test

1. CHECK FOR A DTC C1210–G SENSOR INPUT CIRCUIT PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read and record DTCs.

Does the scan tool display: C1210–G SENSOR INPUT CIRCUIT PERFORMANCE?

Yes

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1219–STEERING ANGLE SENSOR ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuous monitoring.

◦ **Set Condition:**

If the Anti-Lock Brake Module detects that the calculated steering wheel angle and the actual steering angle disagree.

Possible Causes

VEHICLE DAMAGE
STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE
STEERING ANGLE SENSOR LOOSE
STEERING ANGLE SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

NOTE: If present, diagnose and repair DTC C123F-STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE before diagnosing this DTC.

Turn the ignition on.
 With the scan tool, erase ABS DTCs.
 Cycle the ignition switch.

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

Test drive the vehicle by driving straight at a velocity between 10 and 25 km/hr (6 and 15 mph.) for 1 minute.
 Park the vehicle.
 Turn the steering wheel from stop to stop.
 With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK STEERING ANGLE SENSOR OUTPUT

Start the engine.
 Center the steering wheel.
 With the scan tool, read the Steering Angle Sensor Position.

Is the Steering Angle Sensor Position within $\pm 15^\circ$?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

NOTE: If possible, check vehicle repair history for collision damage. ABS module must be reinitialized after repair.

Turn the ignition off.
 Inspect the vehicle for damage causing tracking problems.
 Inspect the steering column and intermediate shaft for damage.

Were any problems found?

Yes

- Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK STEERING ANGLE SENSOR INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Verify that the Steering Angle Sensor is properly installed.

Is the Steering Angle Sensor properly installed?

Yes

- Go To [5](#)

No

- Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

5. CHECK STEERING ANGLE SENSOR OUTPUT WHILE ROTATING THE STEERING WHEEL

With the scan tool, read the Steering Angle Sensor Position while rotating the steering wheel to the right and then to the left. The Steering Angle Sensor Position should decrease when rotating the steering wheel to the right and increase when rotating the steering wheel to the left.

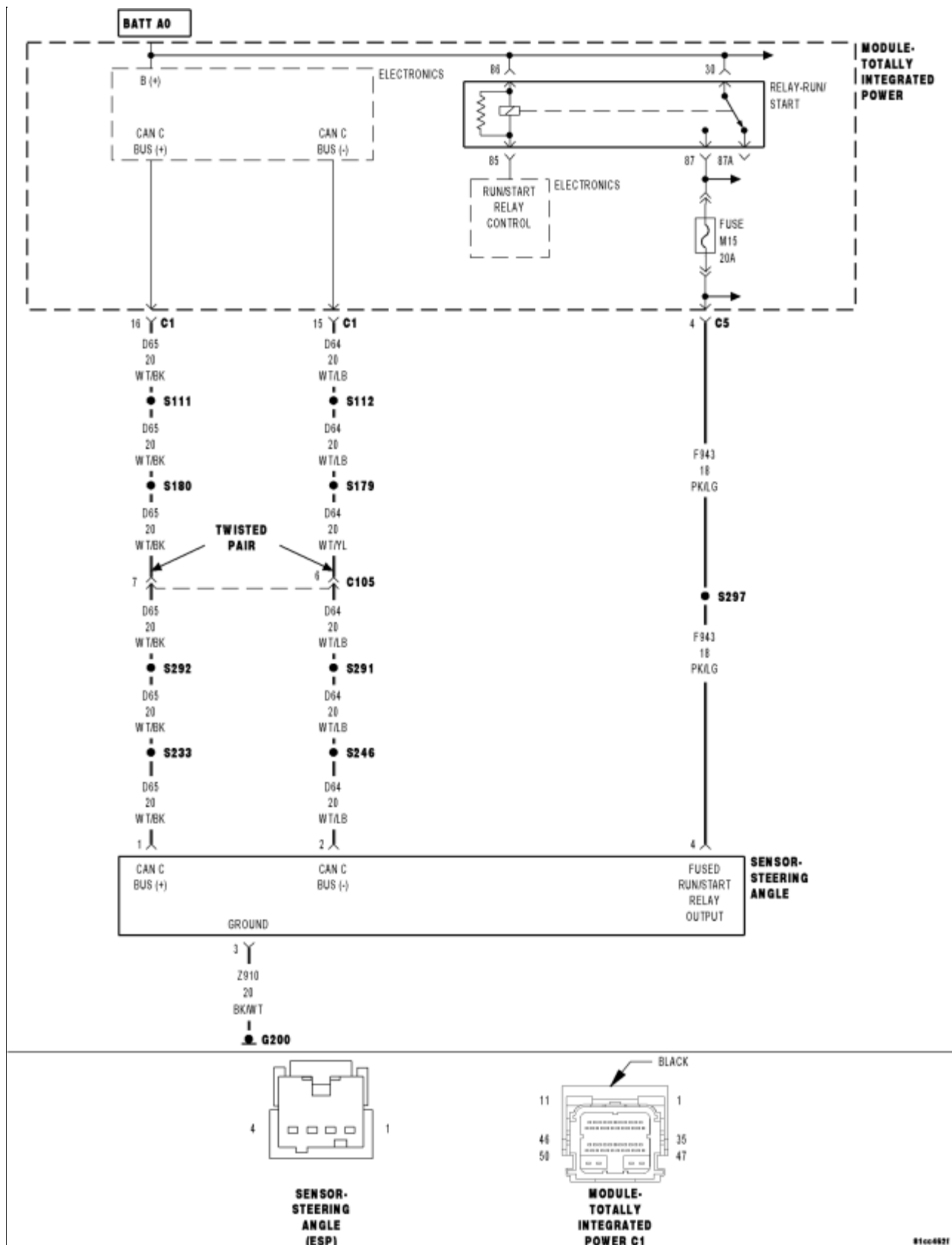
Did the steering angle change accordingly?**Yes**

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C121A-STEERING ANGLE SENSOR NOT INITIALIZED



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuous monitoring.

◦ **Set Condition:**

When the Anti-Lock Brake Module detects a low voltage at the Steering Angle Sensor or Steering Angle Sensor failure.

Possible Causes
TERMINAL/CONNECTOR/WIRING HARNESS DAMAGE
(F943) FUSED B(+) CIRCUIT OPEN
(Z910) GROUND CIRCUIT OPEN
STEERING CONTROL MODULE

Diagnostic Test

1. CHECK FOR A DTC C121A-STEERING ANGLE SENSOR NOT INITIALIZED

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Road test the vehicle over 30 km/h (19 mph) for at least 30 seconds.

With the scan tool, read and record DTCs.

Does the scan tool display: C121A-STEERING ANGLE SENSOR NOT INITIALIZED?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK THE TERMINALS/CONNECTORS/WIRING HARNESS FOR DAMAGE

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Check the Steering Angle Sensor installation.

Check all related wiring for bruised, chafed, pierced, or partially broken wires.

Check all related connectors for broken, bent, pushed out, or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK THE VOLTAGE ON THE (F943) FUSED B(+) CIRCUIT

Turn the ignition off.

Disconnect the Steering Control Module harness connector.

Turn the ignition on.

Measure the voltage of the (F943) Fused B(+) circuit.

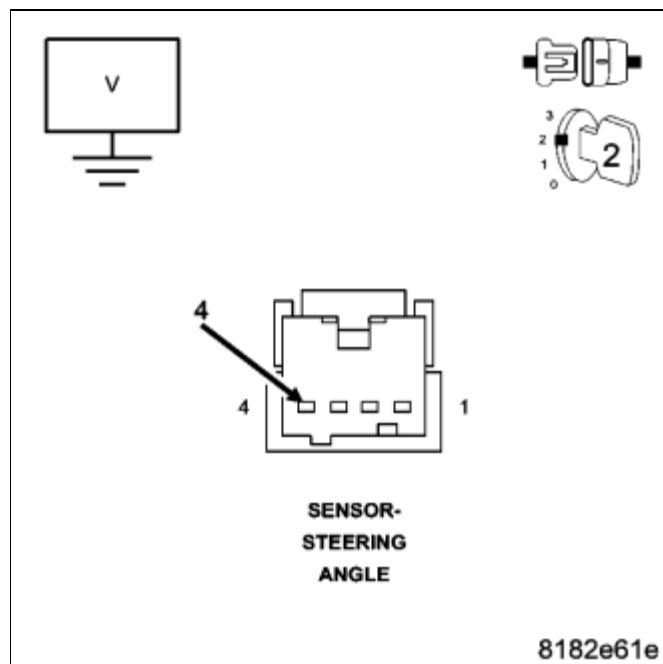
Is the voltage above 10 volts?

Yes

- Go To [4](#)

No

- Repair the (F943) Fused B(+) circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



4. CHECK THE RESISTANCE OF THE (Z910) GROUND CIRCUIT

Turn the ignition off.
Disconnect the Steering Control Module harness connector.
Measure the resistance between the (Z910) Ground circuit and ground.

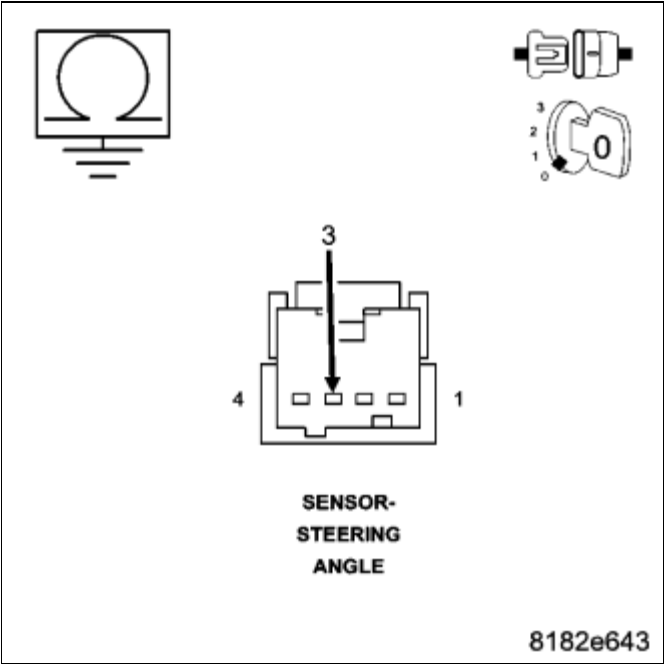
Is the resistance below 5.0 ohms?

Yes

- Replace the Steering Control Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (Z910) Ground circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



C121C–TORQUE REQUEST SIGNAL DENIED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module indicates if engine management relevant for Automatic Yaw Control/Traction Control System control can be accomplished.

Possible Causes
ANTI-LOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE

Diagnostic Test

1. CHECK FOR A DTC C121C-TORQUE REQUEST SIGNAL DENIED

NOTE: This DTC must be active for the results of this test to be valid and this DTC may set while driving under severe load conditions.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch from off to on.

Start Engine.

With the scan tool, read and record DTCs and monitor ESP Torque Request status.

Does the scan tool display: C121C-TORQUE REQUEST SIGNAL DENIED?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

2. ESP TORQUE REQUEST SIGNAL

Engine started.

With the scan tool, read the Allow ESP Torque Request status bit.

Was the Allow ESP Torque Request showing NOT set?

Yes

- Replace the Powertrain Module in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C121D-BRAKE PRESSURE SENSOR CIRCUIT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module indicates that the Brake Pressure Sensor Signal is out of range.

Possible Causes
AIR IN BRAKE SYSTEM/WORN MECHANICAL COMPONENTS
ECU INTERNAL FAILURE
HCU INTERNAL FAILURE

Diagnostic Test

1. CHECK FOR A DTC C121D-BRAKE PRESSURE SENSOR CIRCUIT

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Slowly depress and release the brake pedal.

With the scan tool, read and record DTCs.

Does the scan tool display: C121D-BRAKE PRESSURE SENSOR CIRCUIT?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. HCU/ECU ISOLATION

Turn the ignition off.

Separate the ECU from the HCU.

With the scan tool, monitor brake pressure.

Does the scan tool display brake pressure above 218 bar (3162 psi)?

Yes

- Replace the HCU in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the ECU in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C121E–BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module indicates that the Brake Pressure Sensor Signal is out of range.

Possible Causes
AIR IN BRAKE SYSTEM/WORN MECHANICAL COMPONENTS
ECU INTERNAL FAILURE
ICU INTERNAL FAILURE

Diagnostic Test

1. CHECK FOR A DTC C121E–BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, read and record DTCs.
With the scan tool, read and record Freeze Frame information.
With the scan tool, erase DTCs.
Start the engine.
Depress and release the brake pedal.

With the scan tool, read and record DTCs.

Does the scan tool display: C121E–BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. RECHECK FOR A DTC C121E–BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Depress and release the brake pedal.

With the scan tool, read and record DTCs.

Does the scan tool display: C121E–BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE?

Yes

- Go To [3](#)
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test complete

3. HCU/ECU ISOLATION

Turn the ignition off.

Separate the ECU from the HCU.

With the scan tool, monitor brake pressure.

Does the scan tool display brake pressure above 218 psi?

Yes

- Replace the HCU in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the ECU in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1231-DRIVE TEST: STEERING ANGLE SENSOR

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the Drive Test.

- **Set Condition:**

If the Anti-Lock Brakes Module detects implausible Steering Angle Sensor data.

Possible Causes
STEERING ANGLE SENSOR INSTALLATION
STEERING ANGLE SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR A DTC C1231-DRIVE TEST: STEERING ANGLE SENSOR

NOTE: This DTC must be active for the results of this test to be valid.

NOTE: If any of the following DTCs are present they must be repaired before continuing.

DTC C1219-STEERING ANGLE SENSOR ERRATIC PERFORMANCE
DTC C123F-STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE
DTC C1240-STEERING ANGLE SENSOR ANGLE OVERTRAVEL PERFORMANCE

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine.

With the scan tool, read and record DTCs.

Does the scan tool display: C1231-DRIVE TEST: STEERING ANGLE SENSOR?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. VERIFY THAT THE STEERING ANGLE SENSOR IS ACTIVE ON THE BUS

With the scan tool, select Steering Control Module.
Verify that the Steering Angle Sensor is active on the bus.

Is the Steering Angle Sensor active on the bus?**Yes**

- Go To [3](#)

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

3. CHECK STEERING ANGLE

Turn steering wheel so wheels point in a straight ahead position.
With scan tool check steering angle.

Is the Steering Angle reading within ± 15 degrees?**Yes**

- Go To [4](#)

No

- Go To [5](#)

4. CHECK STEERING ANGLE CHANGE

Turn steering wheel so wheels point in a straight ahead position.
With scan tool check steering angle.
Slowly rotate steering wheel while looking for a smooth change. The degrees will decrease to the right and increase when rotating steering wheel to the left.

Did the steering angle change accordingly?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

5. CHECK STEERING ANGLE SENSOR INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Turn the ignition off.

Verify that the Steering Angle Sensor is properly installed. Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION.

Is the Steering Angle Sensor properly installed?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1232–DRIVE TEST: PRESSURE SENSOR

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the Drive Test.

- **Set Condition:**

If the Pressure Sensor fails to activate.

Possible Causes
HYDRAULIC / BRAKE SYSTEM COMPONENT INSTALLATION
INTEGRATED CONTROL UNIT
PRESSURE SENSOR (HYDRAULIC CONTROL UNIT)

Diagnostic Test

1. CHECK FOR A DTC C1232–DRIVE TEST: PRESSURE SENSOR

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine and apply the brake firmly.

With the scan tool, read and record DTCs.

Does the scan tool display: C1232–DRIVE TEST: PRESSURE SENSOR?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK HYDRAULIC SYSTEM & BRAKE SYSTEM COMPONENT INSTALLATION & FUNCTION

Verify that the Anti-Lock Brakes Module and Hydraulic Control Unit are properly installed.

Verify that the hydraulic system is properly filled and bled.

Verify that the brake system components are installed and functioning properly.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Clean contacts in HCU first if problem reoccurs replace the Integrated Control Unit in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the Drive Test.

- **Set Condition:**

If the Anti-Lock Brakes Module detects implausible Dynamics Sensor data.

Possible Causes
DYNAMICS SENSOR INSTALLATION
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK FOR A DTC C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, read and record DTCs.
With the scan tool, read and record Freeze Frame information.
Perform ECU initialization with drive test. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).
Start the engine.
With the scan tool, read and record DTCs.

Does the scan tool display: C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK THE DYNAMICS SENSOR INSTALLATION

NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.

Turn the ignition off.
Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.
Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1238-DRIVE TEST: UNSUCCESSFUL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the Drive Test.

- **Set Condition:**

If the Anti-Lock Brakes Module detects a fault with the Steering Angle Sensor, the Pressure Sensor, or the Dynamics Sensor.

Possible Causes
STEERING ANGLE SENSOR

PRESSURE SENSOR
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. DIAGNOSE & REPAIR ALL DTCs

Repair

- Diagnose and repair all DTCs.

C1239–EMISSIONS ROLLS TEST ACTIVE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The functional effects are that the output signal for all wheel speeds mimic the wheel with the highest wheel speed.

This DTC sets when the Emissions Rolls Test is active.

Close out the Emissions Rolls Test through the Gateway Module.

C123A–ESP SYSTEM SENSORS CALIBRATION

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Once per ignition cycle.

- **Set Condition:**

If the calculated checksum does not match the stored checksum.

Possible Causes
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. INITIALIZE ANTI-LOCK BRAKES MODULE

Initialize ECU refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Does this DTC reset?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test complete.

C123B-ESP SYSTEM CONTROL TOO LONG

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

When the Anti-Lock Brake Module indicates ESP control lasting longer the 10 seconds.

Possible Causes
HYDRAULIC/BRAKE ISSUE
DYNAMICS SENSOR
INTEGRATED CONTROL MODULE
STEERING ANGLE SENSOR

Diagnostic Test

1. CHECK FOR A DTC C123B-ESP SYSTEM CONTROL TOO LONG

NOTE: If other DTCs are set they must be repaired before continuing. To help in the service of the ESP System, it is recommend speaking to the customer to find out what type of environment they were driving in when the ESP concern took place, heavy rain, snow or ice. This should be considered normal operation and no repair is necessary. This DTC may set while driving under excessive driving conditions.

Turn the ignition on.

Perform ECU initialization with drive test. Refer to Perform ABS VERIFICATION TEST.

NOTE: Drive test must be performed correctly for ECU to initialize.

Cycle the ignition switch from off to on.

Did the ECU initialization/drive test pass?

Yes

- Go To [2](#)

No

- Refer to associated drive test diagnostic procedure.
- Refer to the DTC list. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK STEERING ANGLE SIGNAL

Turn steering wheel so wheels point in a straight ahead position.

With scan tool read Steering Angle Sensor Signal.

Is the Steering Angle reading within ± 6 degrees?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. CHECK STEERING ANGLE INSTALLATION AND WHEEL ALIGNMENT

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Turn the ignition off.

Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.

Inspect the steering column and intermediate shaft for damage.

Verify that the Steering Angle Sensor is properly installed.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Replace the Steering Angle Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

4. CHECK HYDRAULIC SYSTEM & BRAKE SYSTEM COMPONENT INSTALLATION & FUNCTION

Verify that the Anti-Lock Brakes Module and Hydraulic Control Unit are properly installed.

Verify that the hydraulic system is properly filled and bled.

Verify that the brake system components are installed and functioning properly.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. REPLACE THE INTEGRATED CONTROL MODULE & VERIFY IF THE DTC IS STILL ACTIVE

Replace the Integrated Control Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

Connect all previously disconnected components and connectors.

Turn the ignition on.
With the scan tool, erase ABS DTCs.
Cycle the ignition switch.

WARNING: Ensure brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/h (6 and 12 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

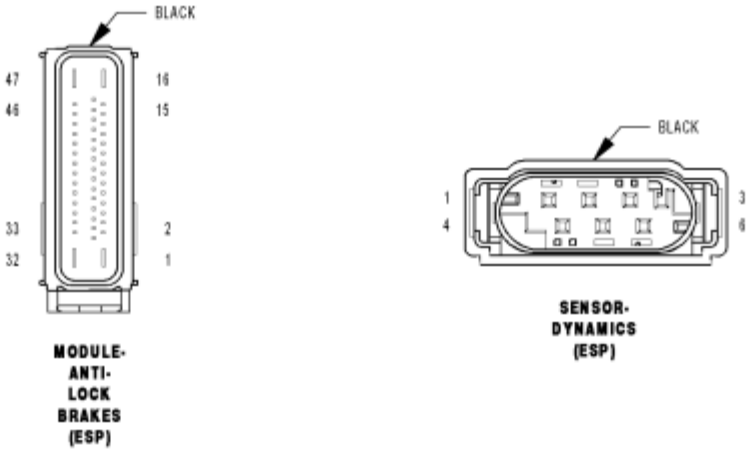
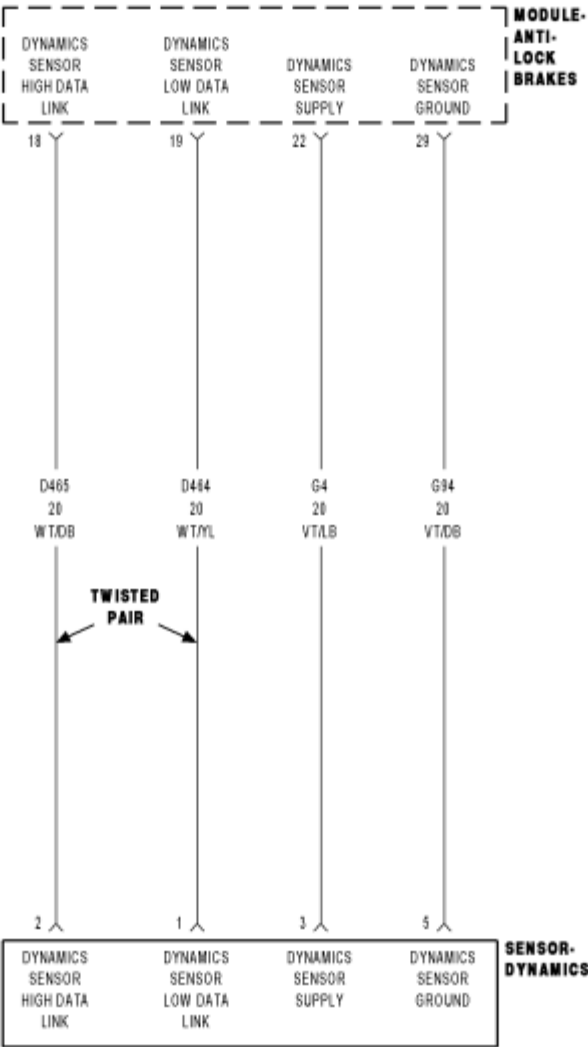
Yes

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

No

- Test complete.

C123C–DYNAMICS SENSOR MOUNTING/INSTALLATION PERFORMANCE



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For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With vehicle speed above 11 km/h (7 mph), but not if the sensor signal is invalid.

Or, during skidding.

Or, when driving in reverse.

- **Set Condition:**

If the Anti-Lock Brakes Module detects implausible Dynamics Sensor values.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
DYNAMICS SENSOR INSTALLATION
DYNAMICS SENSOR

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: If present, diagnose and repair DTC C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW or DTC C2115–DYNAMICS SENSOR SUPPLY VOLTAGE HIGH before diagnosing this DTC.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

WARNING: Ensure brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/h (6 and 12 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK THE DYNAMICS SENSOR INSTALLATION

NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C123F–STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With ignition on, but not if a checksum failure of the stored offset values is detected.

Or, a CAN time-out failure is detected.

Or, a failure is detected by the Steering Angle Sensor.

- **Set Condition:**

If the Anti-Lock Brakes Module detects that either the calculated steering wheel angle offset or the steering wheel angle signal measured output is out of range.

Possible Causes
VEHICLE DAMAGE
STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE
STEERING WHEEL ALIGNMENT
STEERING ANGLE SENSOR LOOSE
STEERING ANGLE SENSOR IMPROPERLY INSTALLED (WRONG MOUNTING POSITION)
STEERING ANGLE SENSOR
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

NOTE: If present, diagnose and repair DTC C1219-STEERING ANGLE SENSOR ERRATIC PERFORMANCE, C121A-STEERING ANGLE SENSOR NOT INITIALIZED, or C1240-STEERING ANGLE SENSOR OVERTRAVEL PERFORMANCE before diagnosing this DTC.

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

NOTE: If possible, check vehicle repair history for collision damage.

Turn the ignition off.

Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.

Inspect the steering column and intermediate shaft for damage.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK STEERING ANGLE SENSOR OUTPUT

Start the engine.

Turn the steering wheel so wheels point in a straight ahead position.

With the scan tool, read the Steering Angle Sensor position.

Is the Steering Angle Sensor Position within $\pm 15^\circ$ degrees?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. CHECK STEERING ANGLE SENSOR INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Verify that the Steering Angle Sensor is properly installed.

Is the Steering Angle Sensor properly installed?

Yes

- Go To [5](#)

No

- Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

5. RE-INITIALIZE THE ESP MODULE

Perform ECU initialization with drive test to clear offsets. Refer to Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Is DTC C123F–STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE still active?

Yes

- Go To [6](#)

No

- Sensor was probably loose or calibrated with wheels not centered to vehicle. Test complete.
- Perform the ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

6. CHECK STEERING ANGLE SENSOR OUTPUT WHILE ROTATING THE STEERING WHEEL

With the scan tool, read the Steering Angle Sensor position while rotating the steering wheel to the right and then to the left. The Steering Angle Sensor position should decrease when rotating the steering wheel to the right and increase when rotating the steering wheel to the left.

Did the steering angle change accordingly?**Yes**

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform the ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1240–STEERING ANGLE SENSOR OVERTRAVEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With ignition on, but not if a CAN time out failure is detected.

Or, if a fault is detected by the Steering Angle Sensor.

- **Set Condition:**

If the Anti-Lock Brakes Module detects that the absolute value of the measured steering wheel angle is greater than 720 degrees.

Possible Causes
VEHICLE DAMAGE
STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE
STEERING WHEEL ALIGNMENT
STEERING ANGLE SENSOR LOOSE
STEERING ANGLE SENSOR IMPROPERLY INSTALLED (WRONG MOUNTING POSITION)
STEERING ANGLE SENSOR

Diagnostic Test

1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

Turn steering wheel from lock to lock.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK STEERING ANGLE SENSOR OUTPUT

Start the engine.

Center the steering wheel.

With the scan tool, read the Steering Angle Sensor Position.

Is the Steering Angle Sensor Position within $\pm 15^\circ$?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

NOTE: If possible, check vehicle repair history for collision damage.

Turn the ignition off.

Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.

Inspect the steering column and intermediate shaft for damage.

Center the steering wheel.

With the scan tool, read the Steering Angle Sensor Position.

Is the Steering Angle Sensor Position within $\pm 15^\circ$?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK STEERING ANGLE CHANGE

Turn steering wheel so wheels point in a straight ahead position.

With scan tool check steering angle if reading travels to 720 degrees while rotating wheel from lock to lock.

NOTE: Sensor damage can occur if wheel is turned over 720 degrees.

Rotate steering wheel to the right and the degrees will decrease and rotate steering wheel to the left and the degrees will increase.

Did the steering angle change accordingly and display less than 720 degrees from lock to lock?

Yes

- Go To [5](#)

No

- Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

5. CHECK STEERING ANGLE SENSOR INSTALLATION

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.

Verify that the Steering Angle Sensor is properly installed. Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION.

Is the Steering Angle Sensor properly installed?

Yes

Replace the Steering Angle Sensor and clear offsets by initializing ECU with wheels pointing straight ahead, in accordance with the Service Information.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1242–G SENSOR INPUT SIGNAL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

Continuously, with ignition on, until vehicle speed exceeds 20 km/h (12.4 m.p.h.) for the first time, but not if the sensor voltage is out of range,

Or, during diagnostic mode.

Or, if the monitoring was inhibited by a corresponding diagnostics command.

Or, if the vehicle speed has exceeded 20 km/h (12.4 m.p.h.) during the actual ignition cycle.

Or, if at least one over spinning wheel is detected.

Or, if one of the control functions is active.

◦ Set Condition:

If the measured acceleration signal is higher than 0.8 g and longer than the specified detection time.

Possible Causes
DYNAMICS SENSOR INSTALLATION
DYNAMICS SENSOR OR ANTI-LOCK BRAKE MODULE
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/h (6 and 12 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK THE DYNAMICS SENSOR INSTALLATION

NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- **NOTE: Vehicles without a Dynamics Sensor replace Anti-Lock Brake Module.**

Replace the Dynamics Sensor or Anti-Lock Brake Module in accordance with the Service Information.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C1243–G SENSOR NOT INITIALIZED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Once after ignition on.

- **Set Condition:**

If the stored zero point calibration value of the longitudinal acceleration sensor is invalid.

Possible Causes
DYNAMICS SENSOR NOT CALIBRATED
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. PERFORM ECU INITIALIZATION

Turn the ignition on.
With the scan tool, erase ABS DTCs.
Cycle the ignition switch.

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

Perform ECU initialization with drive test refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

NOTE: The ECU Initialization process must include driving the vehicle into a 90° turn.

Park the vehicle.

- Go To [2](#)

2. VERIFY IF DTC IS STILL ACTIVE

Cycle the ignition switch.

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- **NOTE: Vehicles without a Dynamics Sensor replace Anti-Lock Brake Module.**

Replace the Dynamics Sensor or Anti-Lock Brake Module in accordance with the Service Information.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

C2100–BATTERY VOLTAGE LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Anti-Lock Brakes Module detects system voltage is below 9.5 volts.

Possible Causes
ECM OR PCM DTCs PRESENT
VEHICLE BATTERY / CHARGING SYSTEM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. DTCS IN THE PCM

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs from the PCM.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read and record DTCs.

With the scan tool read DTCs from the PCM.

Are any charging system codes present?

Yes

- Repair the charging system DTC in the PCM.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [2](#)

2. CHARGING SYSTEM FAILURE

Start the engine.

Connect voltmeter to vehicle battery.

Is the vehicle battery voltage under 8.2 volts?

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

Yes

- Repair the charging system per service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2101–BATTERY VOLTAGE HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Anti-Lock Brakes Module detects system voltage is above 17 volts.

Possible Causes
ECM/PCM DTCs PRESENT
VEHICLE BATTERY / CHARGING SYSTEM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs from the ECM/PCM.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read and record DTCs.

With the scan tool read DTCs from the PCM.

Are any charging system codes present?

Yes

- Repair the charging system DTC in the ECM/PCM.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [2](#)

2. CHARGING SYSTEM FAILURE

Start the engine.

Connect voltmeter to vehicle battery.

Is the vehicle battery voltage over 16.8 volts?

No

- Go To [3](#)

Yes

- Repair the charging system per service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

3. CHARGING POWER SUPPLY VOLTAGE

With a scan tool read Power Supply Voltage.

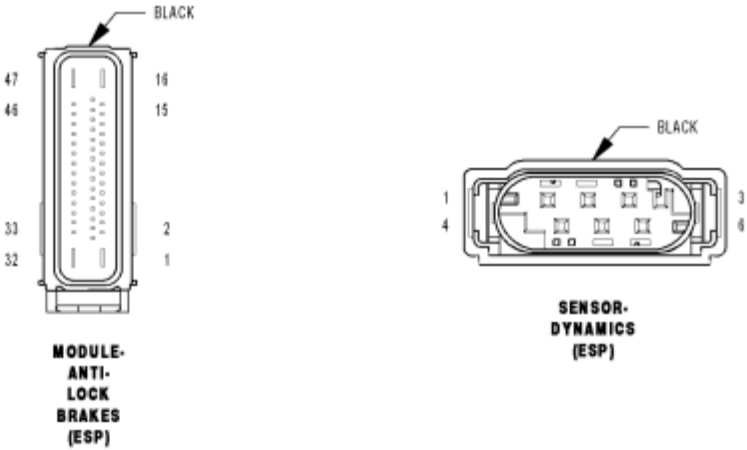
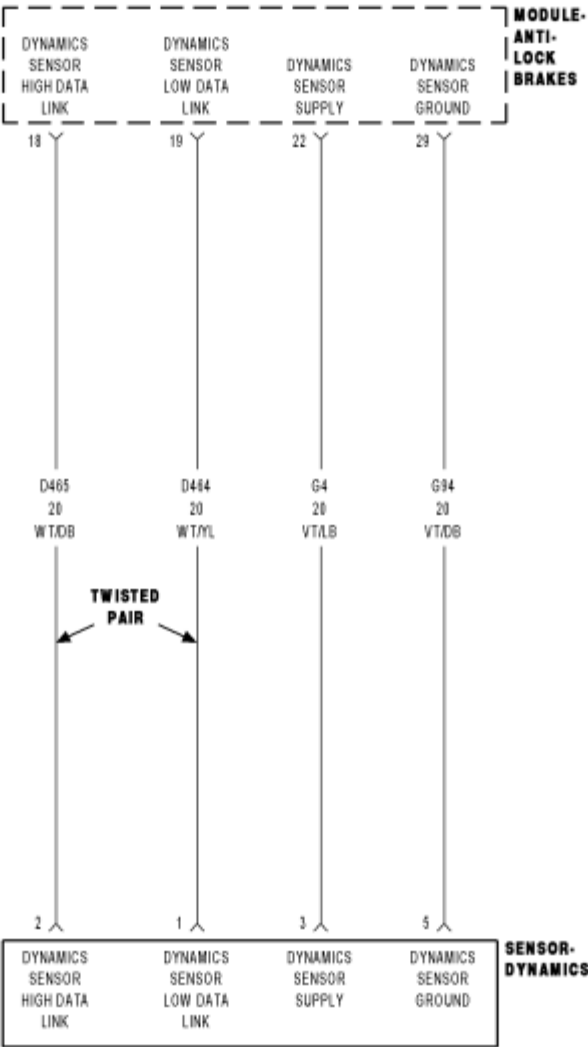
Is Power Supply Voltage over 16.8 volts?**No**

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW



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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Dynamics Sensor status changes from initialized to not initialized due to low voltage on the (G4) Dynamics Sensor Supply circuit.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(G4) DYNAMICS SENSOR SUPPLY CIRCUIT HIGH RESISTANCE
(G94) DYNAMICS SENSOR GROUND CIRCUIT HIGH RESISTANCE
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

Were any problems found?**Yes**

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT & (G94) DYNAMICS SENSOR GROUND CIRCUIT FUNCTION

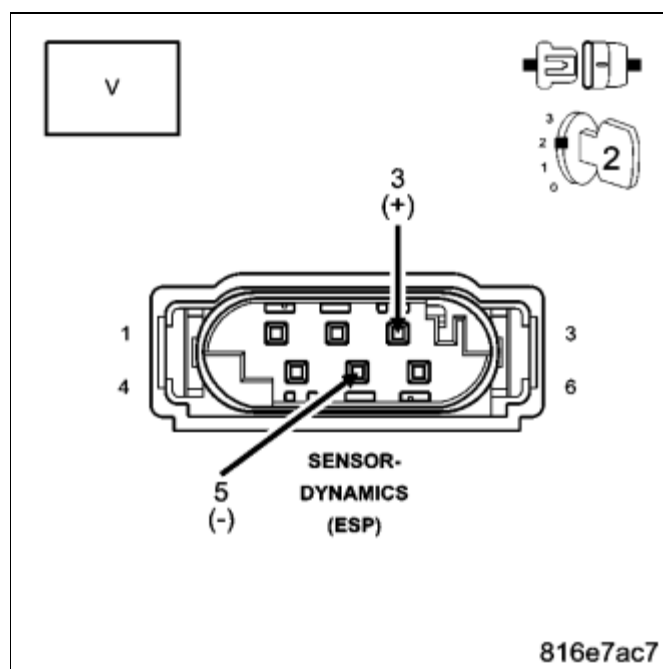
Disconnect the Dynamics Sensor harness connector.
 Turn the ignition on.
 Measure the voltage between the (G4) Dynamics Sensor Supply Circuit and the (G94) Dynamics Sensor Ground Circuit.

Is the voltage above 10.5 volts?**Yes**

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)



4. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT FOR HIGH RESISTANCE

Turn the ignition off.
 Disconnect the Anti-Lock Brakes Module harness connector.

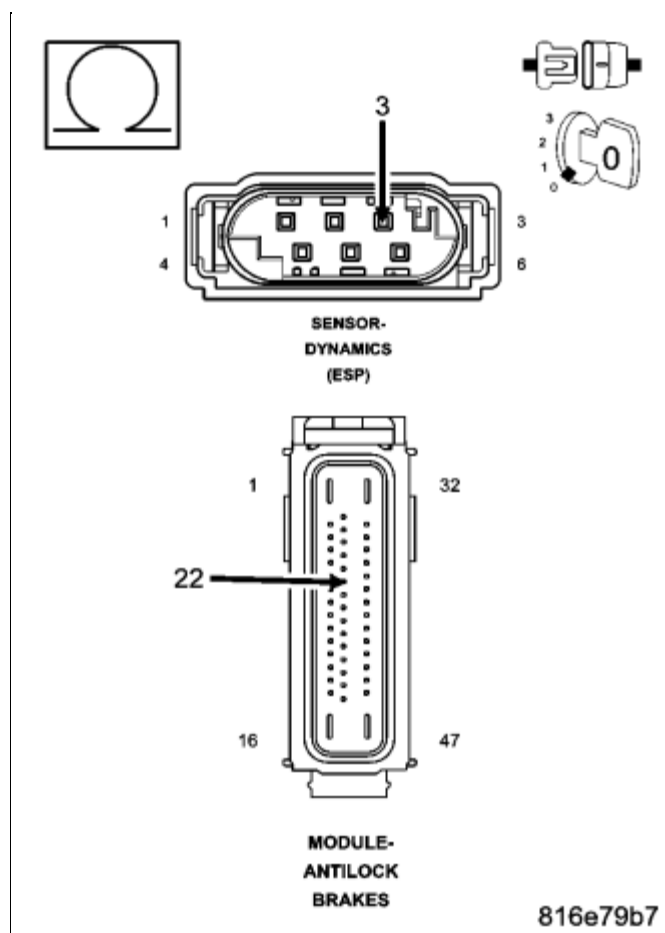
Measure the resistance of the (G4) Dynamics Sensor Supply circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

Is the resistance below 5.0 ohms?**Yes**

- Go To [5](#)

No

- Repair the (G4) Dynamics Sensor Supply circuit for high resistance.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



5. CHECK (G94) DYNAMICS SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE

Measure the resistance of the (G94) Dynamics Sensor Ground circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

Is the resistance below 5.0 ohms?

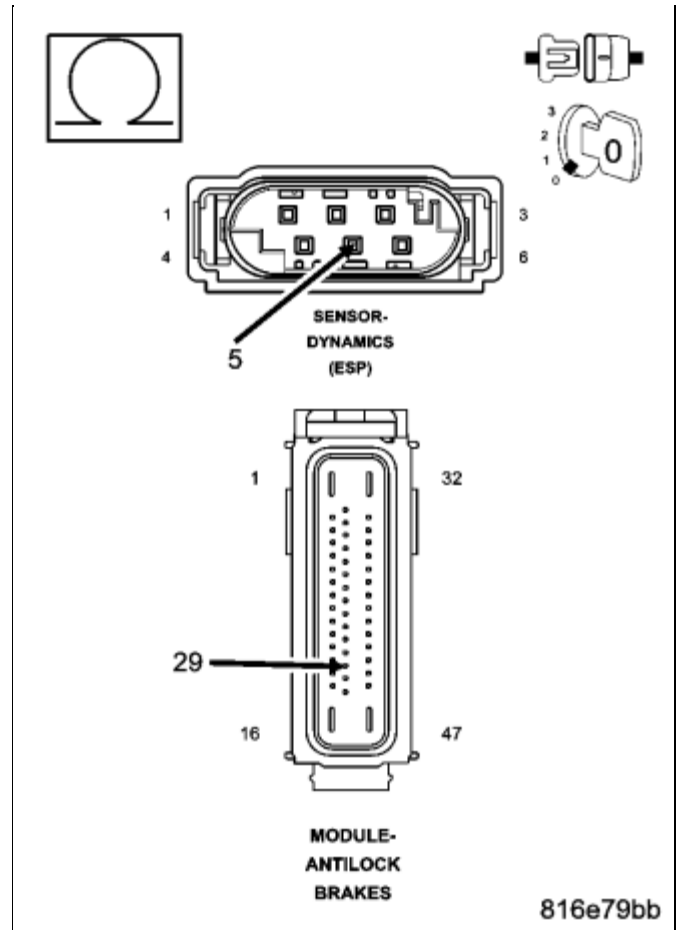
Yes

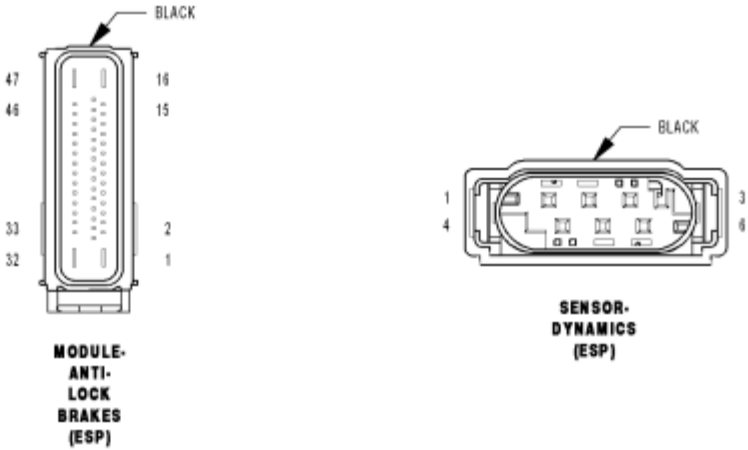
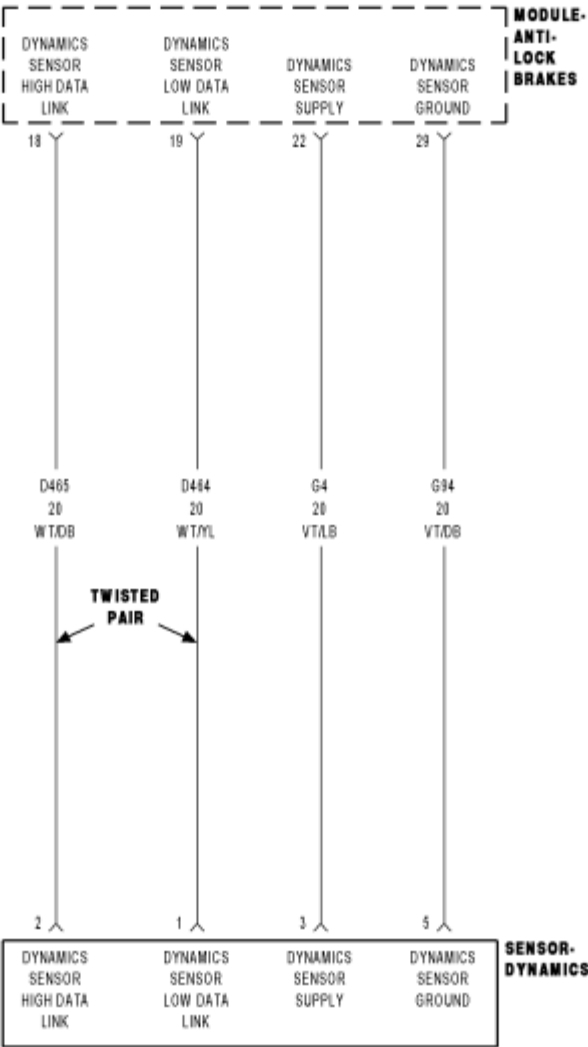
- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (G94) Dynamics Sensor Ground circuit for high resistance.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2115-DYNAMICS SENSOR SUPPLY VOLTAGE HIGH





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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Upon ignition on, prior to switching the (G4) Dynamics Sensor Supply circuit power on.

◦ **Set Condition:**

If the Anti-Lock Brakes Module detects voltage on the (G4) Dynamics Sensor Supply circuit when the circuit's power is turned off.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(G4) DYNAMICS SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
ANTI-LOCK BRAKES MODULE

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

Were any problems found?

Yes

- Repair as necessary.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT SHORT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.

Turn the ignition on.

Measure the voltage of the (G4) Dynamics Sensor Supply Circuit.

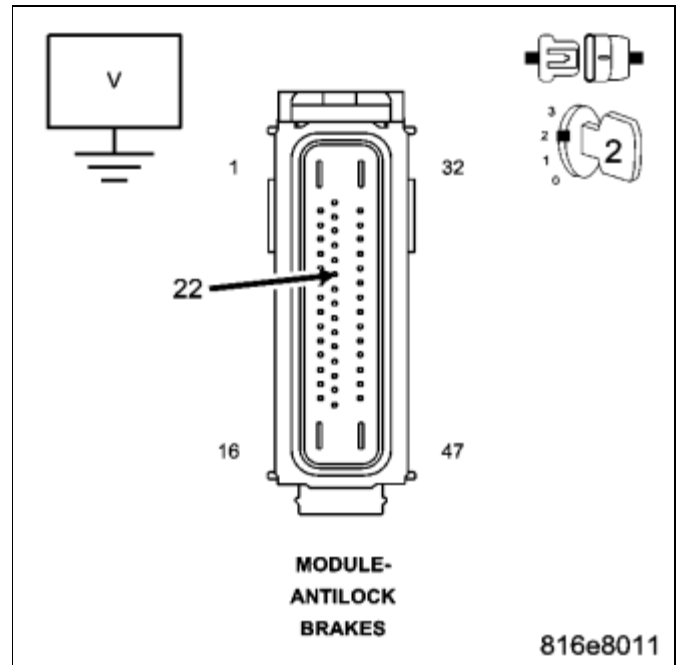
Is the voltage above 0.2 volts?

Yes

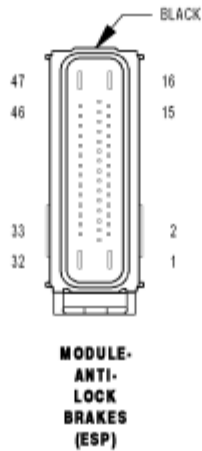
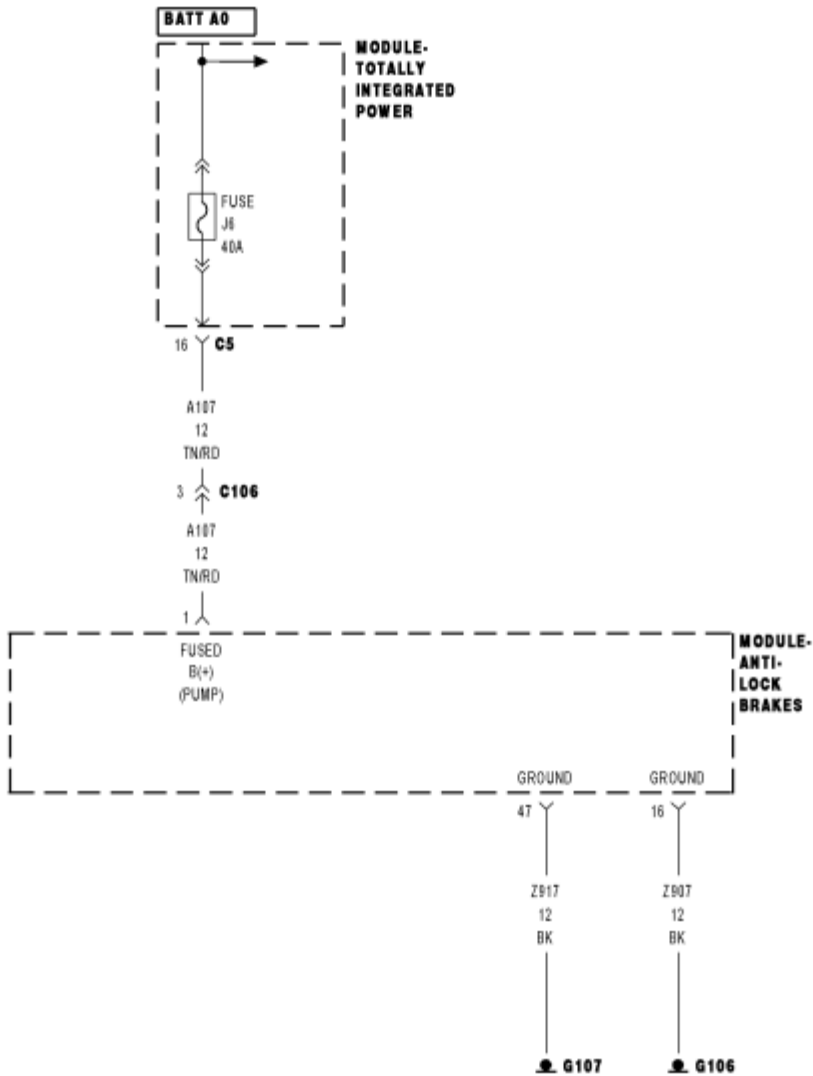
- Repair the (G4) Dynamics Sensor Supply Circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE



01550012

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on and the ABS Pump Motor deactivated, but not if supply voltage faults are detected.

Or, if the control is switched off.

◦ **Set Condition:**

If the Anti-Lock Brakes Module detects either a low voltage condition when the ABS Pump Motor is activated or deactivated or a high voltage condition when the ABS Pump Motor is deactivated.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
ABS PUMP MOTOR FUSE OPEN
(A917) FUSED B(+) CIRCUIT SHORTED TO GROUND, OPEN, OR HIGH RESISTANCE
(Z907) OR (Z917) GROUND CIRCUIT OPEN, OR HIGH RESISTANCE
ANTI-LOCK BRAKES MODULE
PUMP MOTOR (HYDRAULIC CONTROL UNIT)

Diagnostic Test

1. CHECK FOR A DTC C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

Road test the vehicle over 40 km/h (25 mph).

NOTE: Vehicle must be driven above 40 km/h (25 mph) for set conditions to be met.

With the scan tool, read DTCs.

Does the scan tool display: C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

Diagnostic Test**2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS**

Turn the ignition off.

Visually inspect the Anti-Lock Brakes Module harness connector and wiring harness for damage.

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

Were any problems found?**Yes**

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK ABS PUMP MOTOR FUSE

Remove and visually inspect the ABS Pump Motor fuse.

Is the fuse open?**Yes**

- Go To [4](#)

No

- Go To [5](#)

4. CHECK (A917) FUSED B(+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Anti-Lock Brakes Module harness connector.

Measure the resistance of the (A917) Fused B(+) circuit

between ground and the Anti-Lock Brakes Module harness connector.

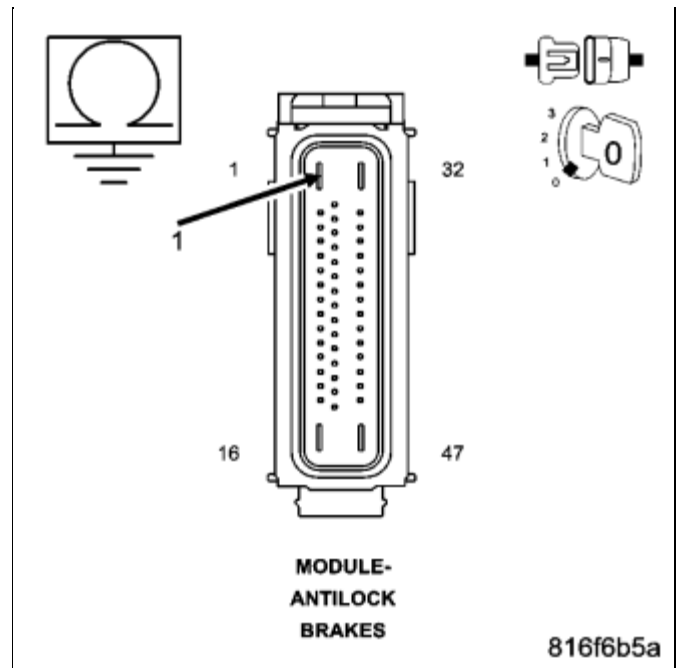
Is the resistance below 10k ohms?

Yes

- Repair the (A917) Fused B(+) circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK (A917) FUSED B(+) CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Replace the ABS Pump Motor fuse.

Using a 12-volt test light connected to ground, probe the (A917) Fused B(+) circuit.

NOTE: The test light should illuminate brightly. Compare the brightness to that of a direct connection to the battery.

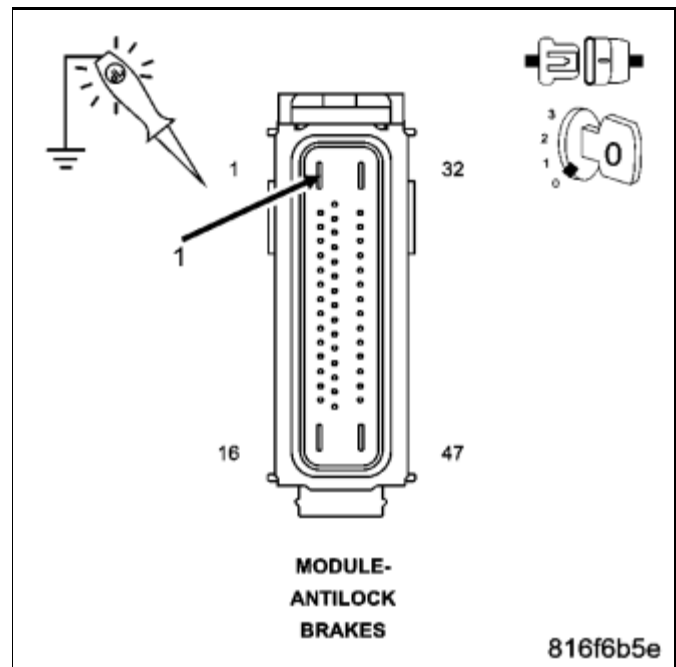
Does the test light illuminate brightly?

Yes

- Go To [6](#)

No

- Repair the (A917) Fused B(+) circuit for an open or high resistance.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK (Z907) OR (Z917) GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Using a 12-volt test light connected to 12 volts, probe the (Z907) and (Z917) Ground circuit.

NOTE: The test light should illuminate brightly. Compare the brightness to that of a direct connection to the battery.

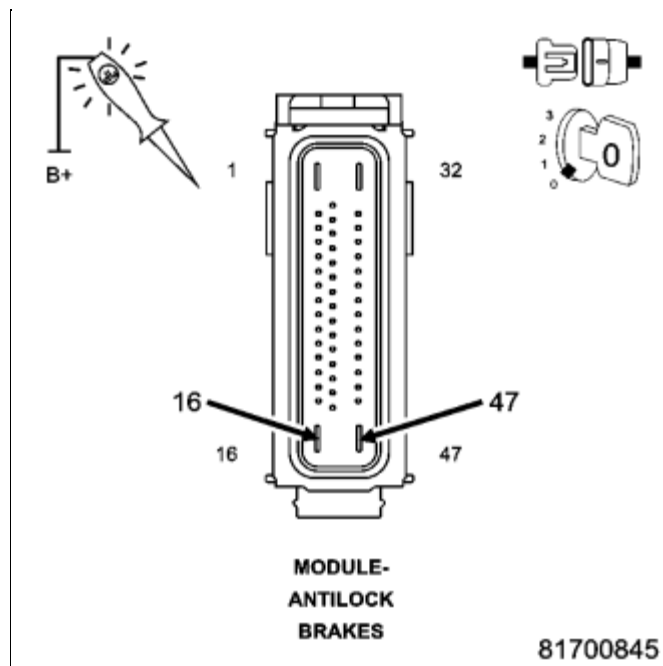
Does the test light illuminate brightly on both circuits?

Yes

- Go To [7](#)

No

- Repair (Z907) or (Z917) circuit for an open or high resistance.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



7. REPLACE ANTI-LOCK BRAKES MODULE & VERIFY IF DTC IS STILL ACTIVE

Replace the Anti-Lock Brakes Module in accordance with the Service Information.
 Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).
 Turn the ignition on.
 With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Replace the Hydraulic Control Unit in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

C2200–ANTI-LOCK BRAKE MODULE INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. The Anti-Lock Brake Module monitors its internal microprocessors for correct operation.

- **Set Condition:**

If the Anti-lock brake module detects an internal fault, the DTC is set.

Possible Causes
ABM - INTERNAL FAULT

Diagnostic Test

1. ABM INTERNAL FAILURE DTC PRESENT

Turn the ignition on.
 With the scan tool, read DTCs.
 With the scan tool, erase DTCs.
 Turn the ignition off.
 Turn the ignition on.
 With the scan tool, read DTCs.

Does the scan tool display ANTI-LOCK BRAKE MODULE INTERNAL FAILURE?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

C2202-ORIGINAL VIN MISMATCH/MISSING

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

At power up, VIN is read off the CAN bus.

◦ **Set Condition:**

The VIN stored in the ABM does not match the VIN read off of the CAN bus.

Possible Causes

ABM MOVED FROM DIFFERENT VEHICLE
ANTI-LOCK BRAKE MODULE (ABM)
WRONG VIN PROGRAMMED INTO VEHICLE

Diagnostic Test

1. CHECK FOR A DTC C2202-ORIGINAL VIN MISMATCH/MISSING

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine.

With the scan tool, read and record DTCs.

Does the scan tool display: C2202-ORIGINAL VIN MISMATCH/MISSING?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

2. WRONG VIN PROGRAMMED INTO VEHICLE

Is the correct VIN programmed into the vehicle?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Reprogram the VIN per service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2204–DYNAMICS SENSOR INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously, with ignition on, until vehicle speed exceeds 20 km/h (12.4 mph) for the first time, but not if the sensor voltage is out of range.

Or, during diagnostic mode.

Or, if the monitoring was inhibited by a corresponding diagnostics command.

Or, if the vehicle speed has exceeded 20 km/h (12.4 mph) during the actual ignition cycle.

Or, if at least one over spinning wheel is detected.

Or, if one of the control functions is active.

- **Set Condition:**

If the Anti-Lock Brakes Module detects that the Lateral Sensor signal is out of range.

Possible Causes
DYNAMICS SENSOR INSTALLATION
DYNAMICS SENSOR

Diagnostic Test

1. VERIFY DTC IS ACTIVE

- Turn the ignition on.
- With the scan tool, read and record ABS DTCs.
- With the scan tool, read and record Environmental Data (EV Data).
- With the scan tool, erase ABS DTCs.
- Cycle the ignition switch.

WARNING: Ensure brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/h (6 and 12 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK THE DYNAMICS SENSOR INSTALLATION

NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

Were any problems found?

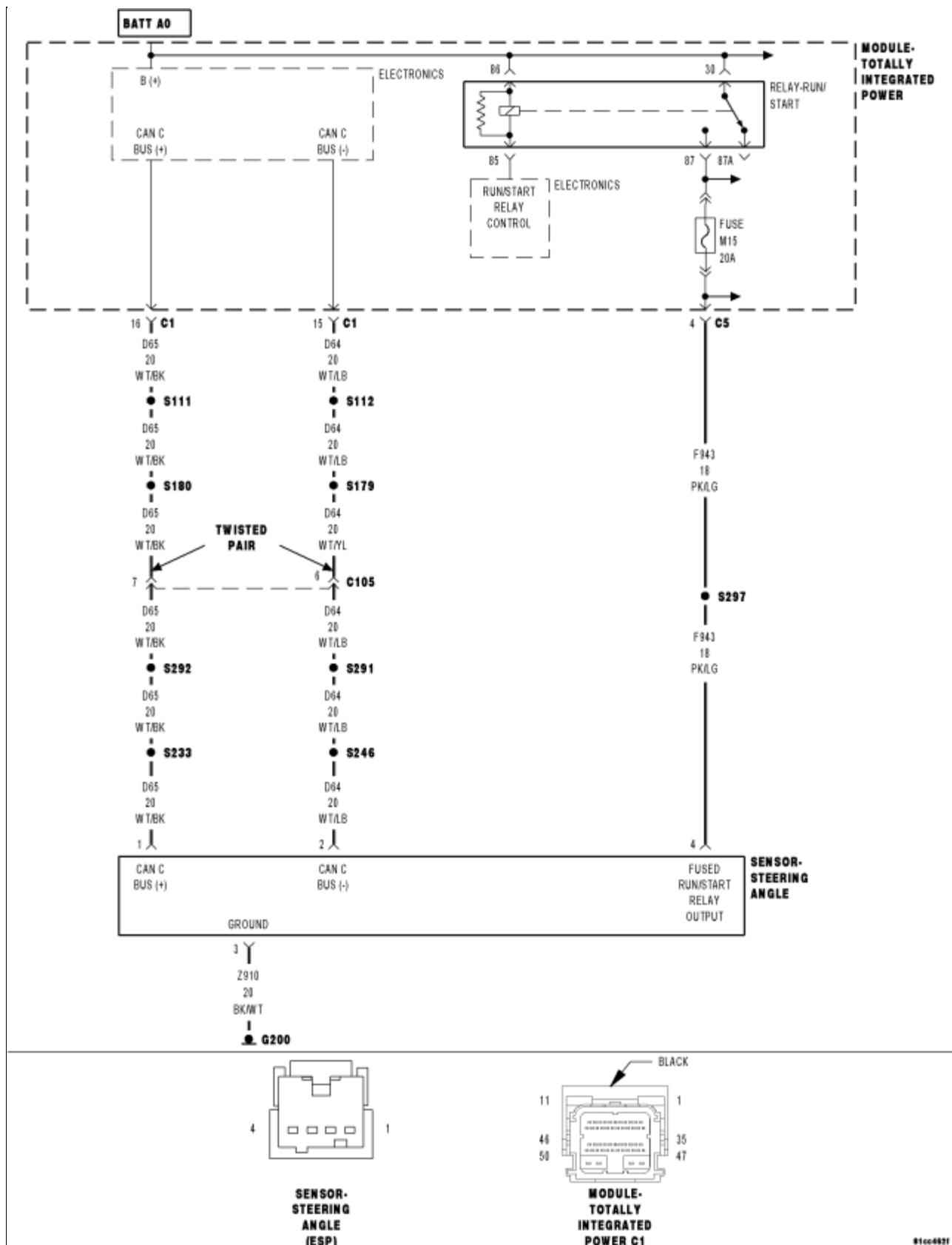
Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2205–STEERING ANGLE SENSOR INTERNAL



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With ignition on, but not if supply voltage faults are detected.

◦ **Set Condition:**

If the Anti-Lock Brakes Module detects that the Steering Angle Sensor sends an internal failure message.

Possible Causes
STEERING ANGLE SENSOR

Diagnostic Test

1. CHECK FOR A DTC C2205-STEERING ANGLE SENSOR INTERNAL

NOTE: This DTC must be active for the results of this test to be valid.

- Turn the ignition on.
- With the scan tool, read and record DTCs.
- With the scan tool, read and record Freeze Frame information.
- With the scan tool, erase DTCs.

WARNING: Ensure brake capability is available before road testing.

- Start the vehicle and turn the wheel from lock to lock.
- Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).
- Park the vehicle.
- With the scan tool, read and record DTCs.

Does the scan tool display: C2205-STEERING ANGLE SENSOR INTERNAL?

Yes

- Replace the Steering Angle Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Refer to the INTERMITTENT CONDITION diagnostic procedure.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

C2206–VEHICLE CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects the signal from the gateway module relevant for vehicle characteristic is missing or does not match for a period greater than the specified fault duration.

Possible Causes
TIPM / PCM NOT CONFIGURED CORRECTLY
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR A DTC C2206-VEHICLE CONFIGURATION MISMATCH

NOTE: This DTC must be active for the results of this test to be valid.

NOTE: This DTC will be active when a new module is installed until initialization is performed.

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Perform ECU initialization with drive test on ABM. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Cycle the ignition switch from off to on.

With the scan tool, read and record DTCs.

Does the scan tool display: C2206-VEHICLE CONFIGURATION MISMATCH?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. VERIFY THAT THE TIPM/PCM IS CONFIGURED CORRECTLY

Turn the ignition on.

Check the following data to verify the TIPM/PCM is configured correctly. Engine Displacement (PCM), XWD 4x2, 4x4, all Wheel Drive, (TIPM), Axle ratio (TIPM), Vehicle Line (TIPM), Brake type 0= ABS 1=ESP (TIPM).

NOTE: The DTC will be active when a new controller is installed until initialization is performed.

Was the TIPM/PCM configured correctly?

Yes

- Replace the Anti-Lock Brake Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Reprogram the appropriate module.
- Perform ABS or PCM VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U0002–CAN C BUS OFF PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Anti-Lock Brake Module detects a corrupt CAN C Bus message.

Possible Causes
(D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND
(D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND
(D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE
(D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT
ANTILOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE

ENGINE CONTROL MODULE (DIESEL ONLY)
TRANSMISSION CONTROL MODULE
STEERING ANGLE SENSOR
AUTOMATIC SWAY BAR SYSTEM MODULE
WIRELESS CONTROL MODULE
OCCUPANT RESTRAINT CONTROLLER MODULE
OCCUPANT CLASSIFICATION MODULE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. ANTILOCK BRAKE MODULE — INTERNAL SHORT

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [3](#)

No

- Inspect the wiring and connectors for damage or shorted circuits in accordance with the service information. If ok, replace and program the Anti—Lock Brake Module in accordance with the service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

3. POWERTRAIN CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.
 Disconnect the Powertrain Control Module C1 harness connector.
 Turn the ignition on.
 With the scan tool, record and erase TIPM DTCs.
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [4](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Powertrain Control Module in accordance with the service information.
- Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

4. ENGINE CONTROL MODULE (DIESEL ONLY) — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Engine Control Module harness connectors.
 Turn the ignition on.
 With the scan tool, record and erase TIPM DTCs.
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [5](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Engine Control Module in accordance with the service information.
- Perform the ECM VERIFICATION TEST.

5. TRANSMISSION CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Transmission Control Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [6](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Transmission Control Module in accordance with the service information.
- Perform the TCM VERIFICATION TEST.

6. STEERING ANGLE SENSOR — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Steering Angle Sensor harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [7](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Steering Angle Sensor in accordance with the service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

7. AUTOMATIC SWAY BAR SYSTEM MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Automatic Sway Bar System Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [8](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Automatic Sway Bar System Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. WIRELESS CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Wireless Control Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [9](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Wireless Control Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

9. OCCUPANT RESTRAINT CONTROLLER MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Occupant Restraint Controller Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [10](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Occupant Restraint Controller Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

10. OCCUPANT CLASSIFICATION MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Occupant Classification Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTCs.

Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read active TIPM DTCs.

Does the scan tool display U0002–CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [11](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Occupant Classification Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

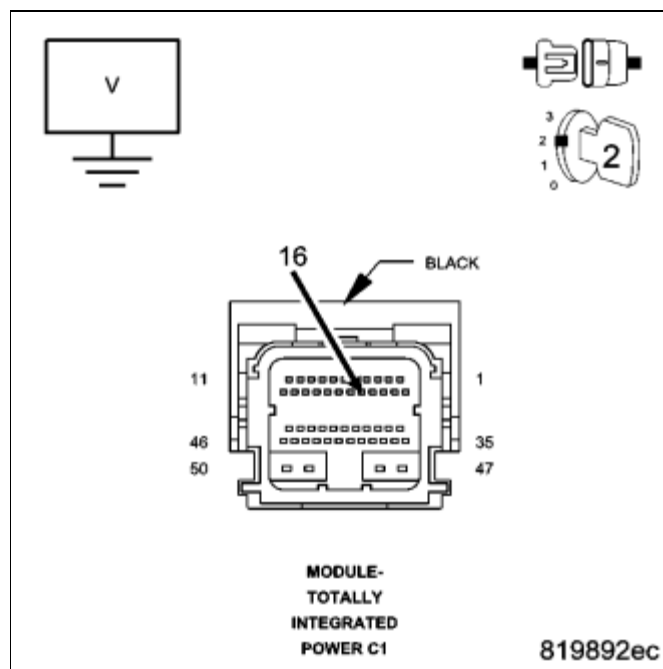
11. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Totally Integrated Power Module C1 harness connector.
 Turn the ignition on.
 Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is there any voltage present?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [12](#)

12. (D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE

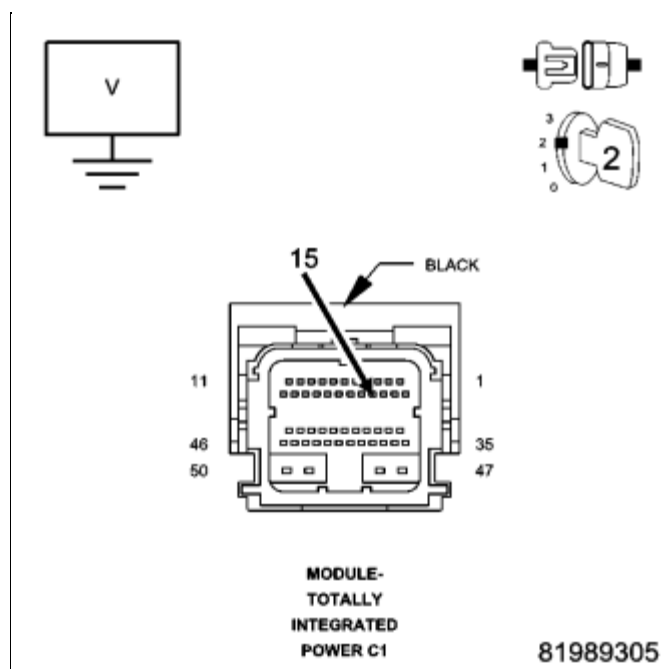
Measure the voltage between the (D64) CAN C Bus (-) circuit and ground.

Is there any voltage present?**Yes**

- Repair the (D64) CAN C Bus (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [13](#)

**13. (D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND**

Turn the ignition off.

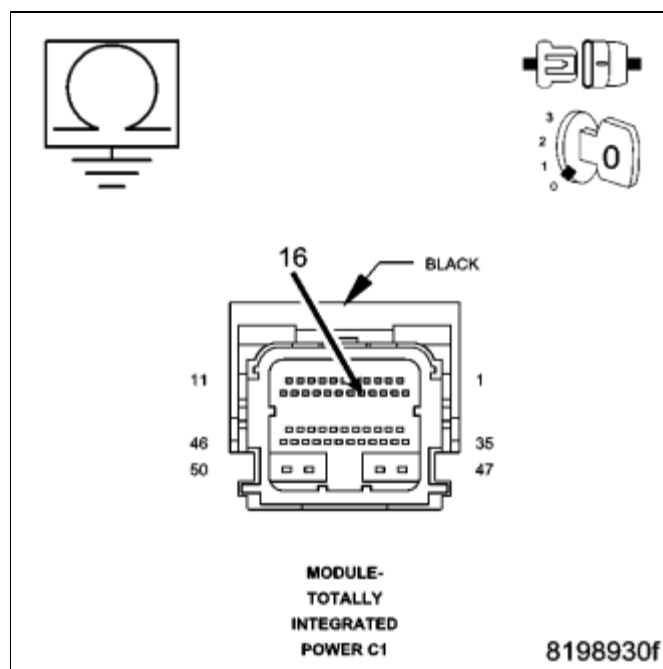
Measure the resistance between ground and the (D65) CAN C Bus (+) circuit.

Is any resistance present?**Yes**

- Repair the (D65) CAN C Bus (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [14](#)

**14. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND**

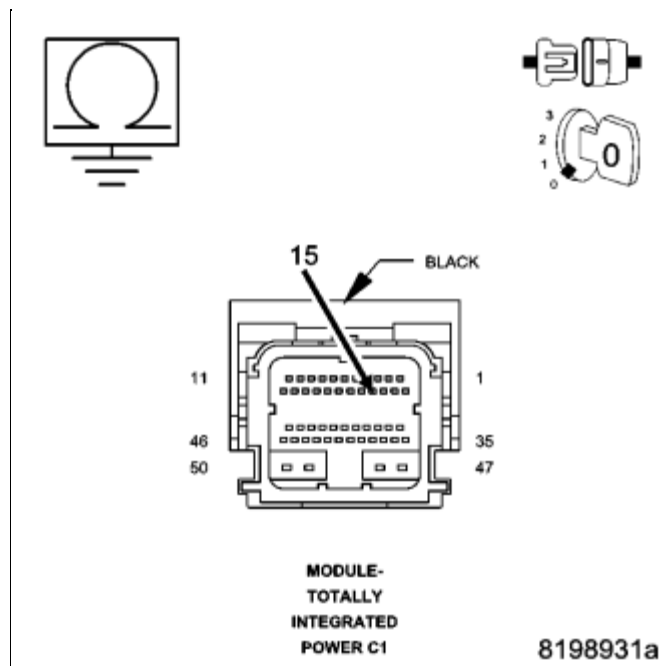
Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is any resistance present?**Yes**

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [15](#)

**15. (D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT**

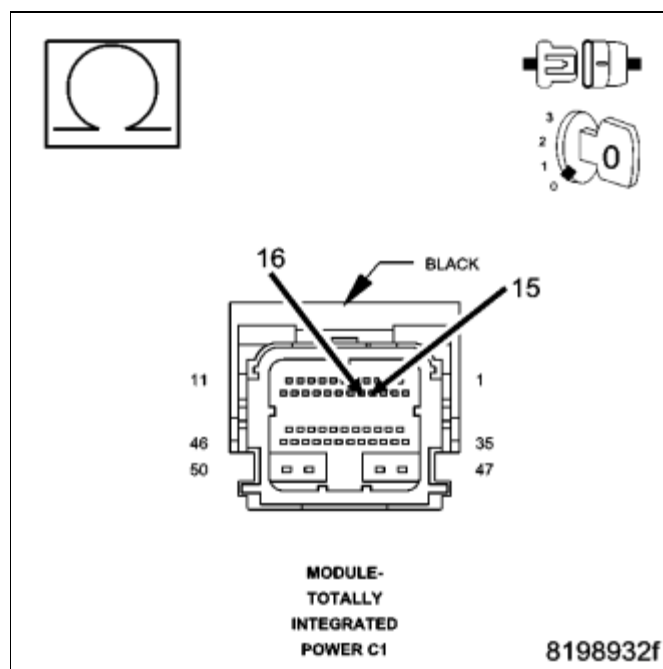
Measure the resistance between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit.

Is any resistance present?**Yes**

- Repair the (D65) CAN C Bus (+) circuit for a short to the (D64) CAN C Bus (-) circuit.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**U0100–LOST COMMUNICATION WITH ECM/PCM**

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

- With the ignition on
- Battery voltage between 10 and 16 volts
- IOD fuse installed
- **Set Condition:**

If the Anti-Lock Brakes Module fails to receive bus messages from the ECM or PCM for approximately 500 ms.

Possible Causes
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
ECM OR PCM POWER AND GROUND
ECM OR PCM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Verify the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

No

- Go To [3](#)

3. VERIFY THAT THE ECM OR PCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ECM or PCM is active on the bus.

Is the ECM or PCM active on the bus?

Yes

- Go To [4](#)

No

- Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the ECM or PCM?

Yes

- Replace/update the ECM or PCM in accordance with the service information.
- Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)..

No

- Replace the Anti-Lock Brakes Module in accordance with the service information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U0101–LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
 - With the ignition on
 - Battery voltage between 10 and 16 volts
 - IOD fuse installed
- **Set Condition:**

If the Anti-Lock Brakes Module fails to receive bus messages from the TCM for approximately 500 ms.

Possible Causes
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
TCM POWER AND GROUND
PCM DTCs PRESENT
TCM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Verify the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

NOTE: If present, diagnose and repair DTC U0002–CAN C BUS OFF PERFORMANCE, DTC or DTC U1502–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM TIPM before diagnosing this DTC.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- Perform the Stored Lost Communication test procedure. Refer to the table of contents in this section. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

No

- Go To [3](#)

3. VERIFY THAT THE TCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the TCM is active on the bus.

Is the TCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the Table of Contents located in this section for a no response test procedure.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the TCM?

Yes

- Replace/update the TCM in accordance with the service information.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace the Anti-Lock Brakes Module in accordance with the service information.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

U0114-LOST COMMUNICATION WITH FINAL DRIVE MODULE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
 - With the ignition on
 - Battery voltage between 10 and 16 volts
 - IOD fuse installed
 - TIPM is configured correctly
- **Set Condition:**

Bus messages not received from the Totally Integrated Power Module (TIPM) for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
TOTALLY INTEGRATED CONTROL MODULE
MODULE THAT SET THIS DTC

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.
- Perform BODY VERIFICATION TEST – VER 1.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.
- Perform BODY VERIFICATION TEST – VER 1.

No

- Go To [3](#)

3. VERIFY THAT THE TIPM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the TIPM is active on the bus.

Is the TIPM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the Table of Contents located in this section for a no response test procedure.
- Perform BODY VERIFICATION TEST – VER 1.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the TIPM?

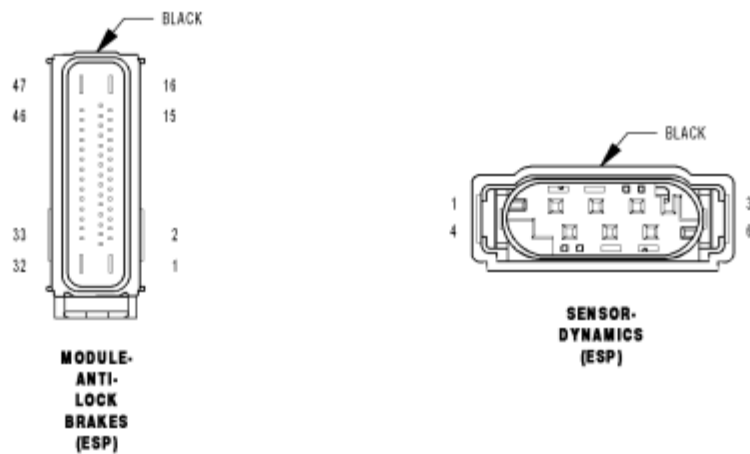
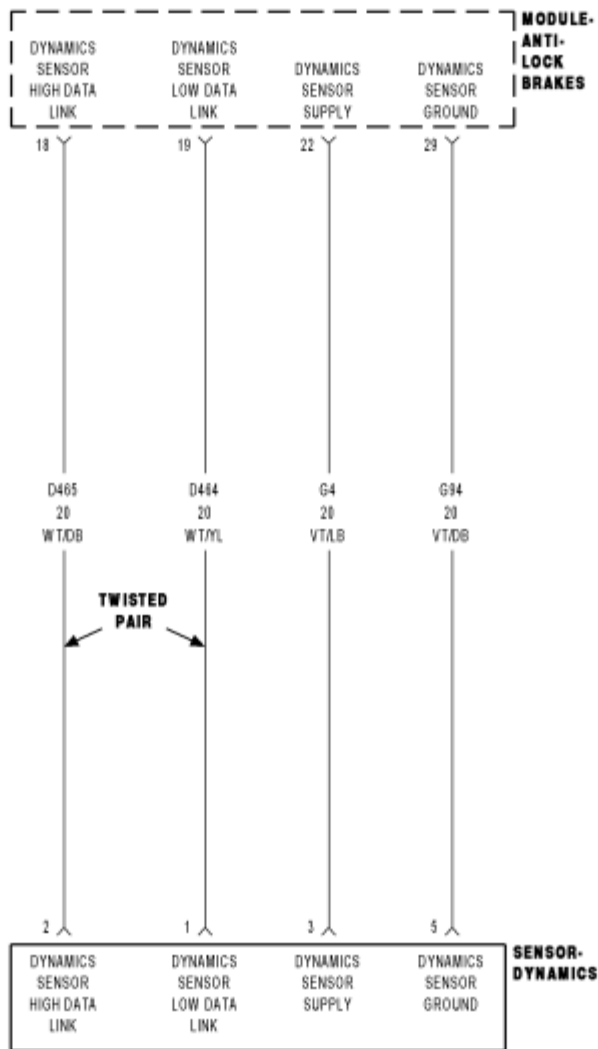
Yes

- Replace/update the Totally Integrated Power Module in accordance with the service information.
- Perform BODY VERIFICATION TEST – VER 1.

No

- Replace/update the module that set this DTC in accordance with the service information
- Perform BODY VERIFICATION TEST – VER 1.

U0125–LOST COMMUNICATION WITH DYNAMICS SENSOR



01a00036

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Anti-Lock Brakes Module fails to receive bus messages from the Dynamics Sensor.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(D465) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT SHORTED TO GROUND, SHORTED TO VOLTAGE, OR OPEN
(D464) DYNAMICS SENSOR LOW DATA LINK CIRCUIT SHORTED TO GROUND, SHORTED TO VOLTAGE, OR OPEN
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: If present, diagnose and repair DTC C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW or DTC C2115–DYNAMICS SENSOR SUPPLY VOLTAGE HIGH before proceeding.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK THE (D465) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.

Disconnect the Dynamics Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (D465) Dynamics Sensor High Data Link circuit.

Is there any voltage present?

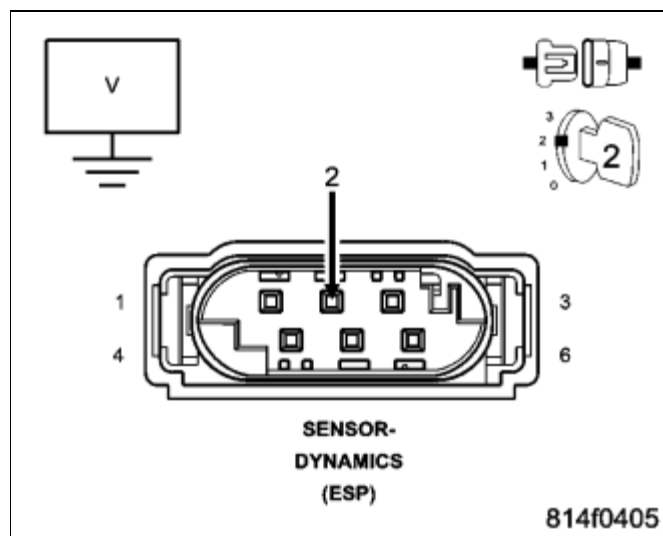
Yes

- Repair the (D465) Dynamics Sensor High Data Link circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK THE (D465) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO GROUND



Turn the ignition off.

Measure the resistance of the (D465) Dynamics Sensor High Data Link circuit between ground and the Dynamics Sensor harness connector.

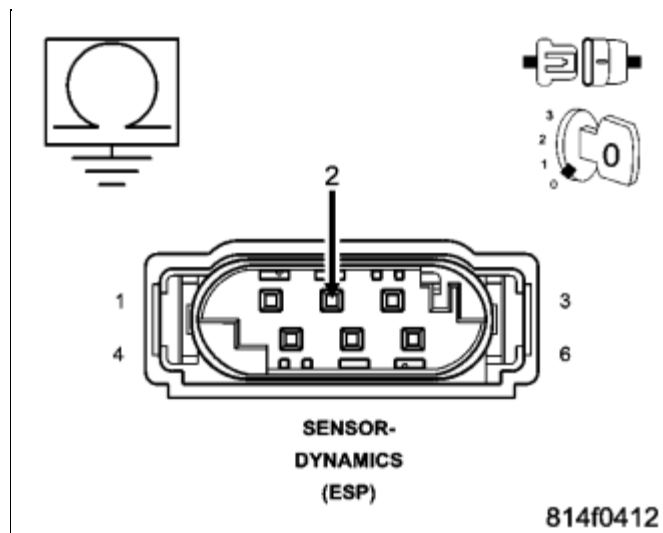
Is the resistance below 5.0 ohms?

Yes

- Repair the (D465) Dynamics Sensor High Data Link circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK THE (D465) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D465) Dynamics Sensor High Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

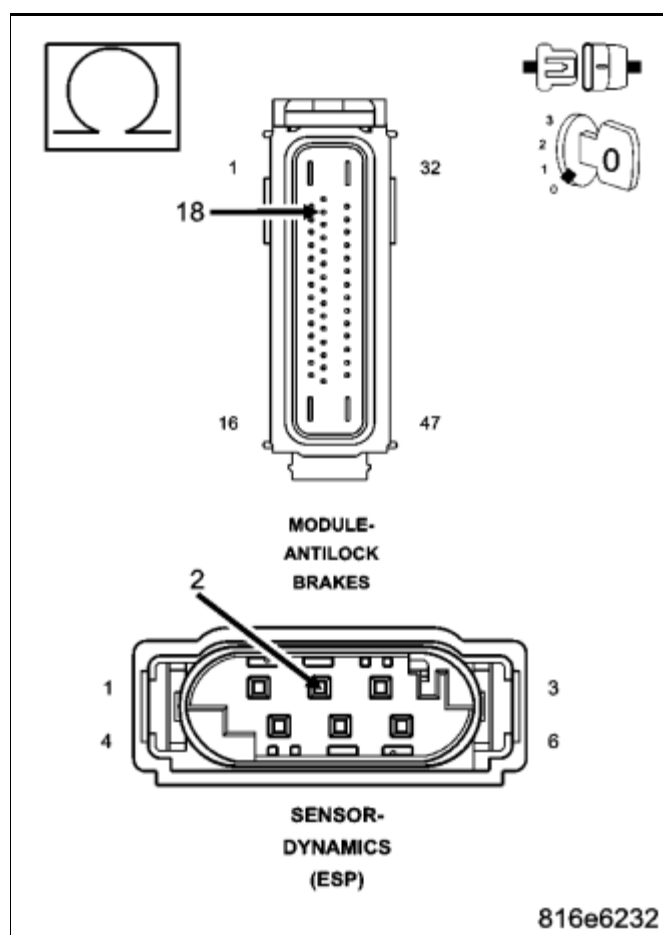
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D465) Dynamics Sensor High Data Link circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK THE (D464) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (D464) Dynamics Sensor Low Data Link circuit.

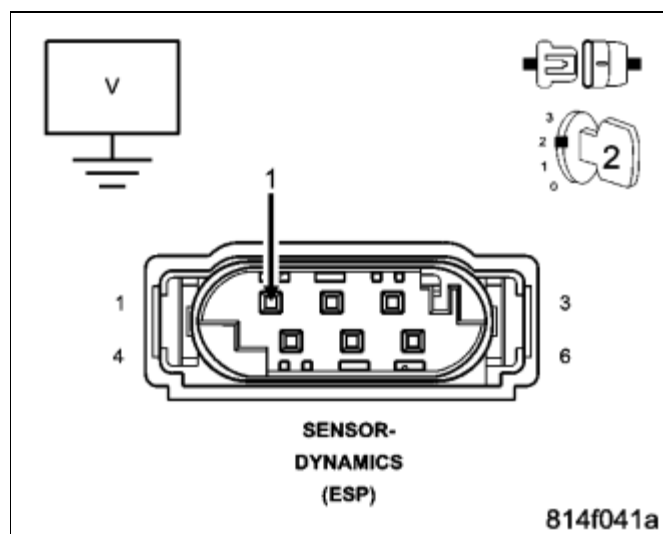
Is there any voltage present?

Yes

- Repair the (D464) Dynamics Sensor Low Data Link circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK THE (D464) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Measure the resistance of the (D464) Dynamics Sensor Low Data Link circuit between ground and the Dynamics Sensor harness connector.

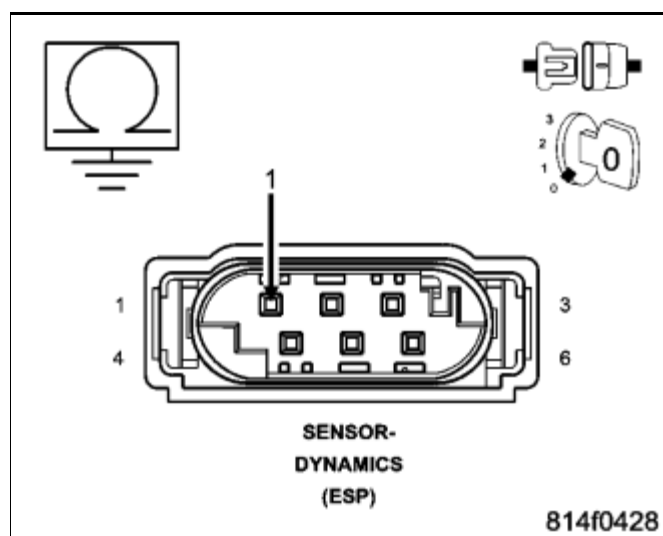
Is the resistance below 5.0 ohms?

Yes

- Repair the (D464) Dynamics Sensor Low Data Link circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [8](#)



8. CHECK THE (D464) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D464) Dynamics Sensor Low Data Link circuit between the Dynamics Sensor harness

connector and the Anti-Lock Brakes Module harness connector.

Is the resistance below 5.0 ohms?

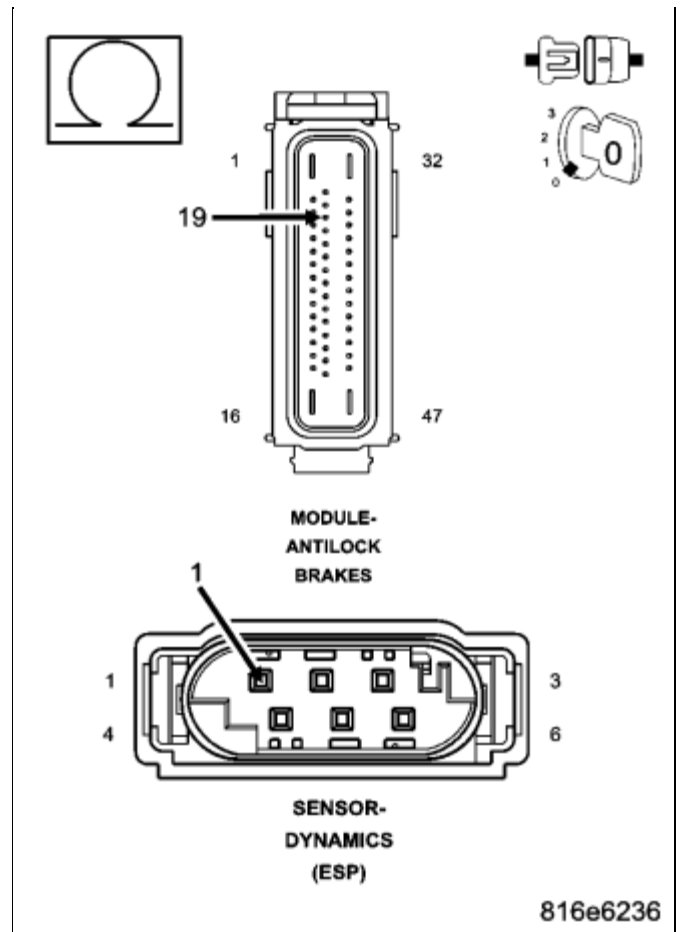
Yes

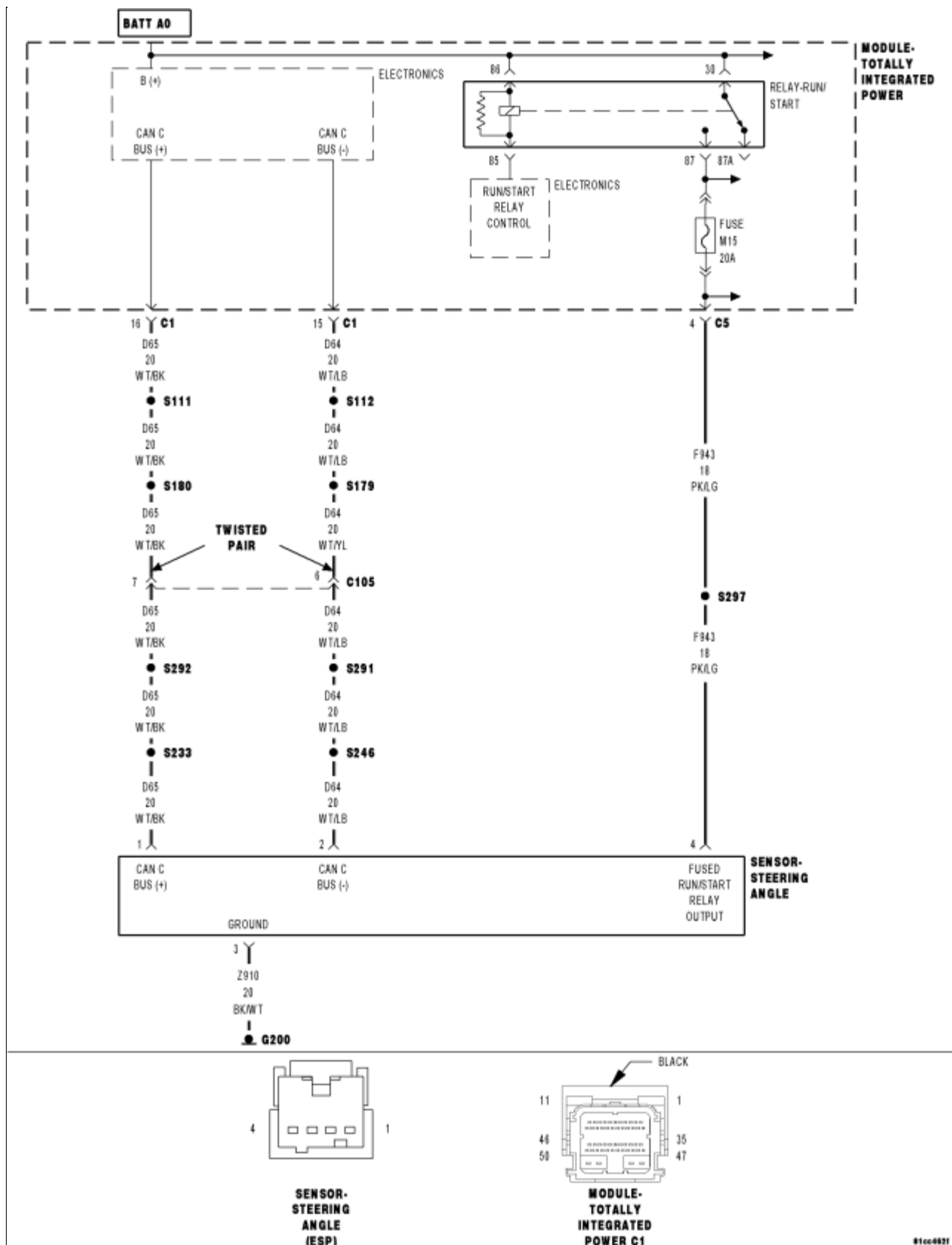
- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Repair the (D464) Dynamics Sensor Low Data Link circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U0126—LOST COMMUNICATION WITH STEERING ANGLE SENSOR





- Battery voltage between 10 and 16 volts
- IOD fuse installed
- **Set Condition:**

If the Anti-Lock Brakes Module fails to receive bus messages from the Steering Angle Sensor for approximately 500 ms.

Possible Causes
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
STEERING ANGLE SENSOR POWER AND GROUND
STEERING ANGLE SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. VERIFY THAT THE STEERING ANGLE SENSOR IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the Steering Angle Sensor is active on the bus.

Is the Steering Angle Sensor active on the bus?

Yes

- Go To [4](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the STEERING ANGLE SENSOR?

Yes

- Replace/update the Steering Angle Sensor in accordance with the service information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

Replace the Anti-Lock Brakes Module in accordance with the service information.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
 - With the ignition on
 - Battery voltage between 10 and 16 volts
 - IOD fuse installed
 - TIPM is configured correctly
- **Set Condition:**

Bus messages not received from the Totally Integrated Power Module (TIPM) for approximately 2 to 5 seconds.

Possible Causes
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
TOTALLY INTEGRATED CONTROL MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN B or C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. VERIFY THAT THE TIPM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the TIPM is active on the bus.

Is the TIPM active on the bus?

Yes

- Go To [4](#)

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the TIPM?

Yes

- Replace/update the Front Control Module in accordance with the service information.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

U0401–IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously with the ignition on, one valid CAN message received at least once, and no U0002-CAN C Bus Off Performance DTC present.

◦ **Set Condition:**

When the Anti-Lock Brake Module detects an incorrect CAN message from the Engine Module.

Possible Causes
ABM CAN BUS DTCS
ENGINE DTCS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK FOR DTC U0401-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

NOTE: This DTC must be active for the results of this test to be valid.

Turn the ignition on.
With the scan tool, record and erase DTCs.
Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

Does the scan tool display: U0401-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM?

Yes

- Go To [2](#)

No

- Perform the ABS Intermittent Condition diagnostic procedure in this Section.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) .

Diagnostic Test

2. CHECK IF TIPM CAN BUS DTCs ARE PRESENT

With the scan tool, read TIPM DTCs.

Are there any TIPM CAN BUS DTCs present?

Yes

- Refer to the appropriate diagnostic. (Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK IF ENGINE DTCs ARE PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine DTCs present?

Yes

- Refer to the 9 - ENGINE ELECTRICAL DIAGNOSTICS and diagnose the appropriate symptom.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Using the schematics as a guide, check the Anti-Lock Brake Module pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Anti-Lock Brake Module per the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U0429–IMPLAUSIBLE DATA RECEIVED FROM SCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With ignition on, but not if low voltage is detected.

Or, if a CAN Bus off event is detected.

- **Set Condition:**

If the Anti-Lock Brakes Module detects either the sequence or integrity of the Steering Angle Sensor messages is invalid.

Possible Causes
CAN C BUS CIRCUIT(S) SHORTED
LOAD TOO HIGH ON CAN C BUS
STEERING ANGLE SENSOR DTCs PRESENT
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. CHECK IF COMMUNICATION RELATED DTCs ARE PRESENT

Turn the ignition on.
With the scan tool, read ABS DTCs.

Are any Communication related DTCs present?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of symptoms.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [2](#)

2. CHECK IF OTHER STEERING ANGLE SENSOR RELATED DTCs ARE PRESENT

With the scan tool, read ABS DTCs.

Are any other STEERING ANGLE SENSOR DTCs present?

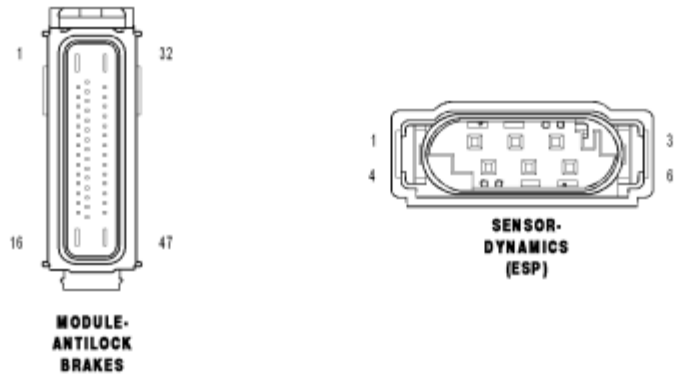
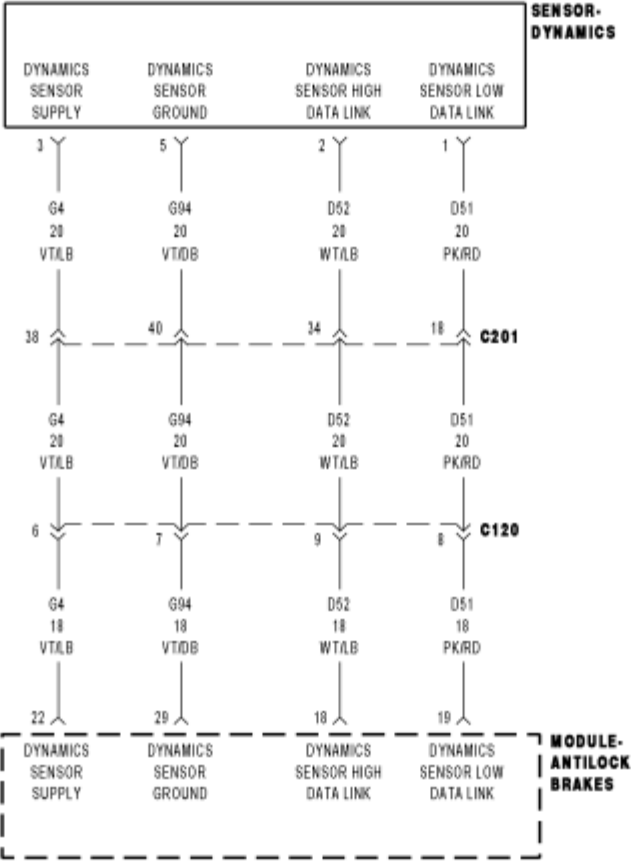
Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of symptoms.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Steering Angle Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U1003–ESP CAN C BUS PERFORMANCE



#10e61cf

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

If the Anti-Lock Brakes Module detects too many CAN Bus off events on the Dynamics Sensor Data Link circuits.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
(D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN
(D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN
DYNAMICS SENSOR
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.

Disconnect the Dynamics Sensor harness connector.

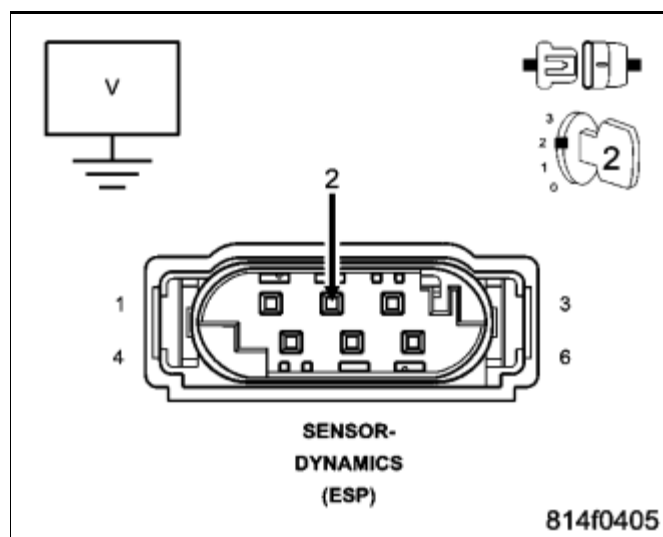
Turn the ignition on.

Measure the voltage of the (D52) Dynamics Sensor High Data Link circuit.

Is there any voltage present?

Yes

- Repair the (D52) Dynamics Sensor High Data Link circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



No

- Go To [4](#)

4. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between ground and the Dynamics Sensor

harness connector.

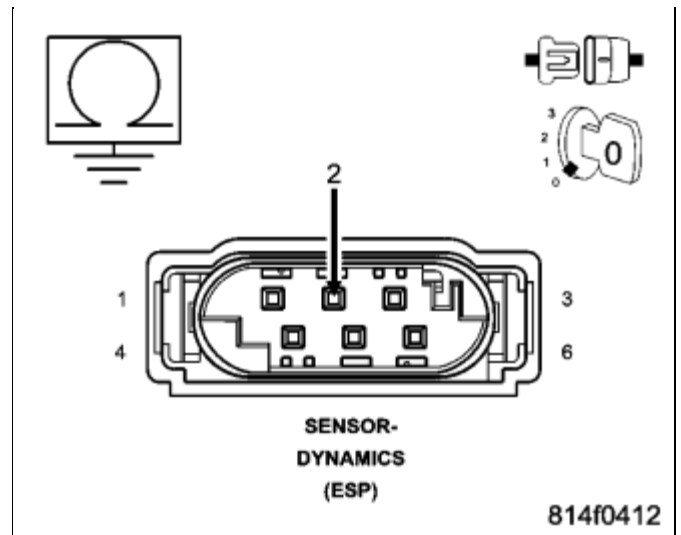
Is the resistance below 5.0 ohms?

Yes

- Repair the (D52) Dynamics Sensor High Data Link circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

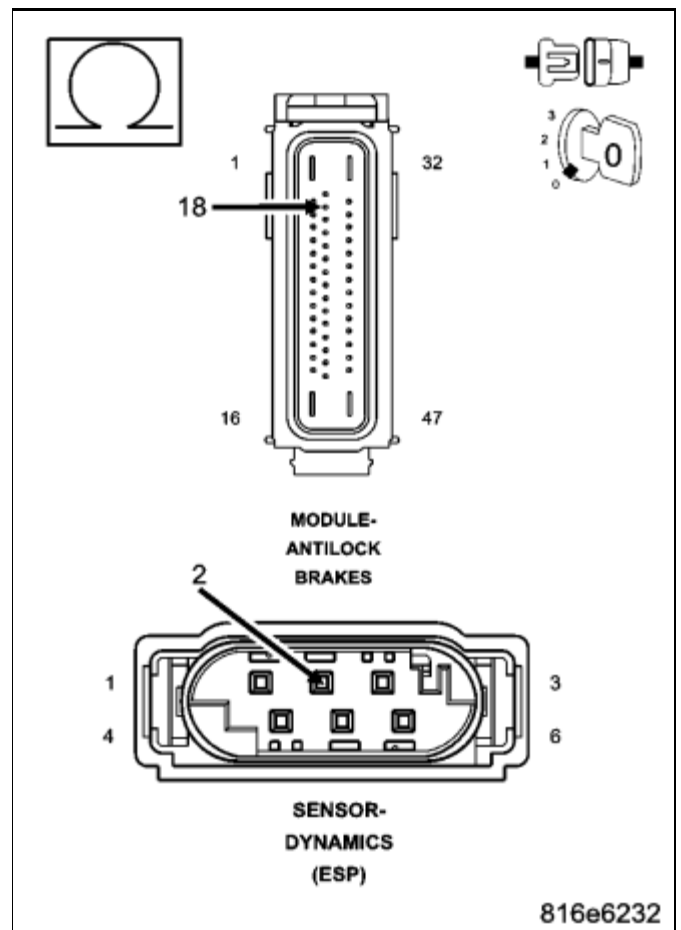
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D52) Dynamics Sensor High Data Link circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (D51) Dynamics Sensor Low Data Link circuit.

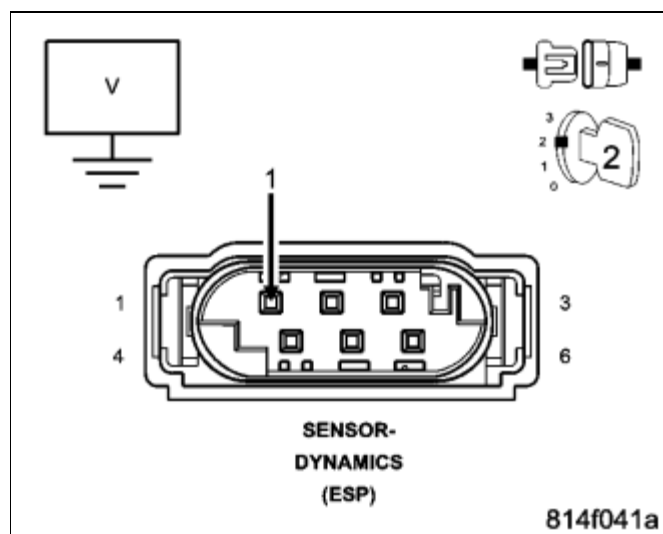
Is there any voltage present?

Yes

- Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to voltage.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [7](#)



7. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between ground and the Dynamics Sensor harness connector.

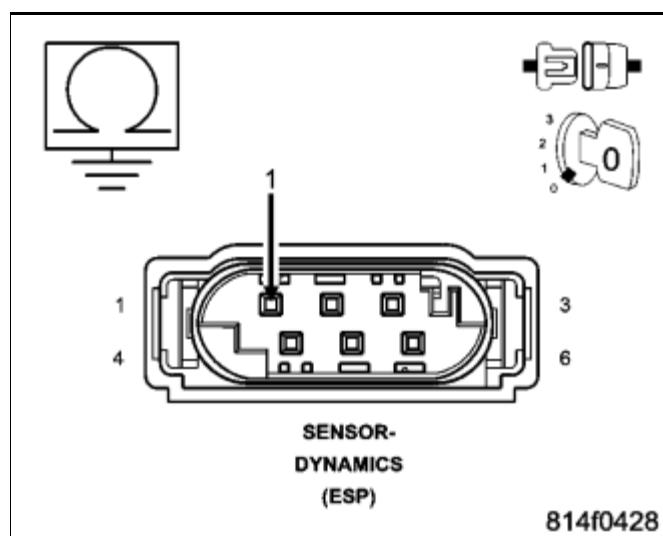
Is the resistance below 5.0 ohms?

Yes

- Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to ground.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [8](#)



8. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between the Dynamics Sensor harness

connector and the Anti-Lock Brakes Module harness connector.

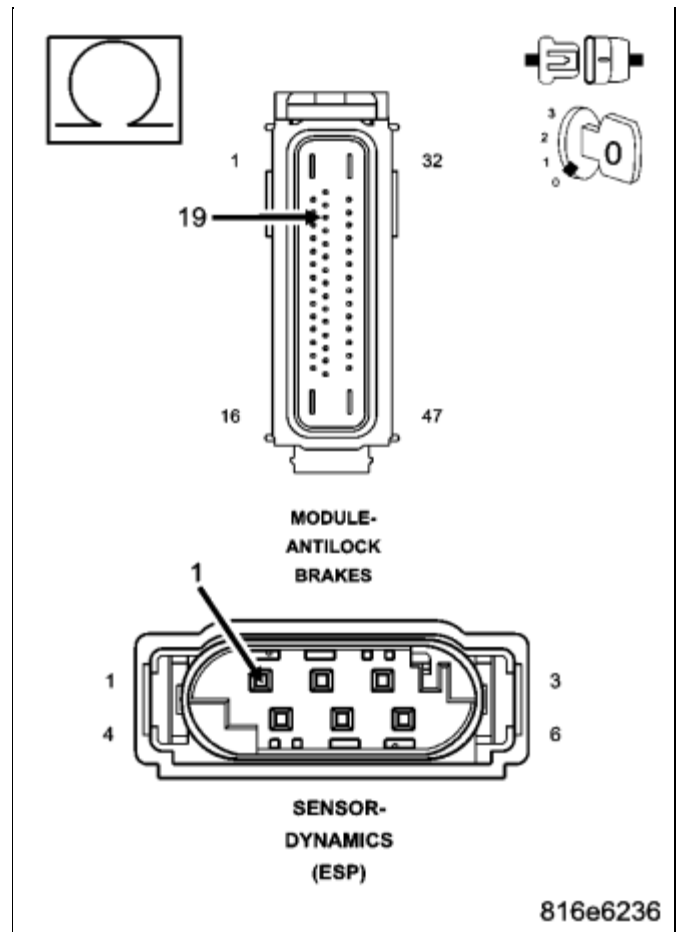
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the (D51) Dynamics Sensor Low Data Link circuit for an open.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



9. REPLACE DYNAMICS SENSOR & VERIFY IF DTC IS STILL ACTIVE

Replace the Dynamics Sensor in accordance with the Service Information. Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

WARNING: Ensure brake capability is available before road testing.

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).

Park the vehicle.

With the scan tool, read ABS DTCs.

Does this DTC reset?

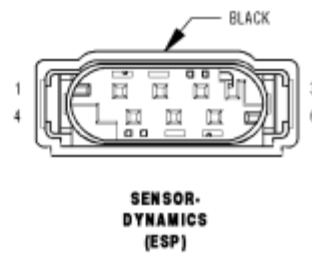
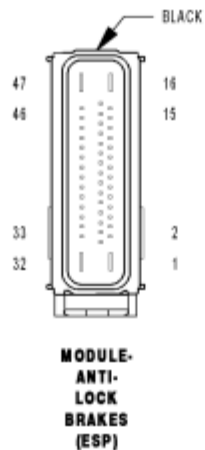
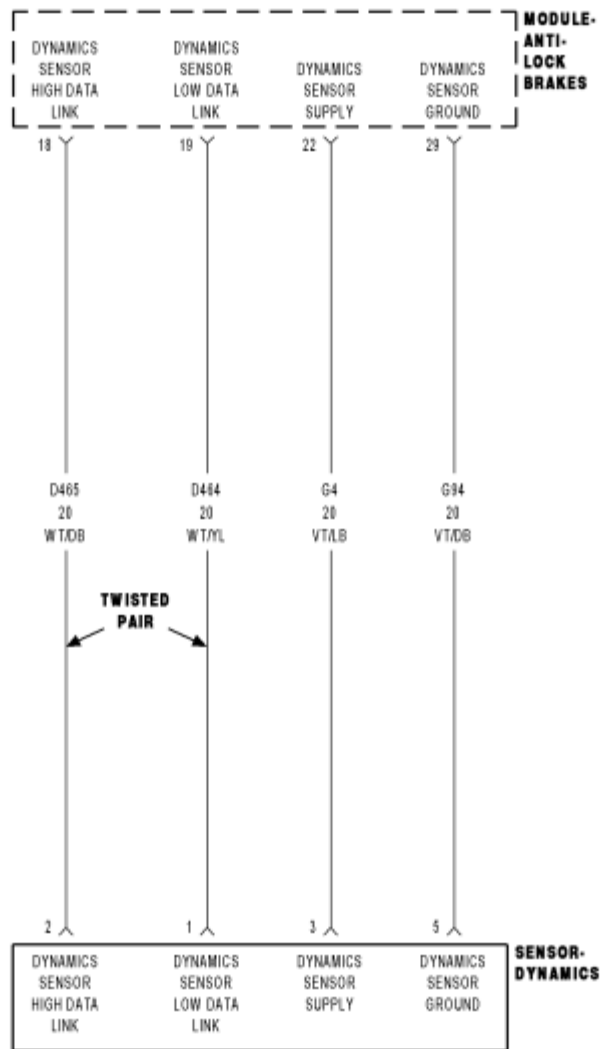
Yes

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U1104-CAN C BUS CRC PERFORMANCE



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Anti-Lock Brakes Module detects an invalid CAN message from the Dynamics Sensor.

Possible Causes
DYNAMICS SENSOR

Diagnostic Test

1. VERIFY DTC IS ACTIVE

- Turn the ignition on.
With the scan tool, read and record ABS DTCs.
With the scan tool, read and record Environmental Data (EV Data).
With the scan tool, erase ABS DTCs.
Cycle the ignition switch.
With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Replace the Dynamics Sensor in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

U140E–IMPLAUSIBLE VEHICLE CONFIGURATION DATA RECEIVED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Once per ignition cycle, but not during cranking.

Or, if low supply voltage faults are detected.

- **Set Condition:**

If the Anti-Lock Brakes Module either fails to receive vehicle configuration data from the Engine Control Module (ECM) or Powertrain Control Module (PCM) or Totally Integrated Power Module (TIPM) or the configuration data it receives from the ECM or PCM or TIPM is invalid

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
ECM OR PCM DTCs PRESENT
ECM OR PCM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT VIN
TIPM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT INFORMATION
ECM, PCM OR TIPM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: This DTC must be active for the results of this test to be valid. If DTC C2206-VEHICLE CONFIGURATION MISMATCH is present it must be repaired before continuing.

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?**Yes**

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?**Yes**

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

No

- Go To [3](#)

3. CHECK IF TIPM DTCs ARE PRESENT

With the scan tool, read TIPM DTCs.

Are any DTCs present?**Yes**

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. VERIFY TIPM IS CONFIGURED CORRECTLY

With the scan tool, verify that the TIPM part number and configuration is correct for the vehicle.

Is the correct TIPM installed in the vehicle?**No**

- Replace and program the TIPM in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Yes

- Go To [5](#)

5. CHECK IF ECM OR PCM DTCs ARE PRESENT

With the scan tool, read ECM or PCM DTCs.

Are any DTCs present?**Yes**

- Diagnose and repair the DTC(s). Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [6](#)

6. VERIFY CORRECT ECM OR PCM IS INSTALLED IN THE VEHICLE

With the scan tool, verify that the ECM or PCM part number is correct for the vehicle.

Is the correct ECM or PCM installed in the vehicle?**No**

- Replace and program the ECM or PCM in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Yes

- Go To [7](#)

7. VERIFY ECM OR PCM IS PROGRAMMED WITH CORRECT VIN

With the scan tool, verify that the ECM or PCM is programmed with the correct VIN.

Is the ECM or PCM programmed with the correct VIN?**No**

- Using the scan tool, perform PCM Replaced to update the VIN in the PCM.

- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Yes

- Go To [8](#)

8. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the ECM or PCM?

Yes

- Replace/update the ECM or PCM in accordance with the service information.
- Perform POWERTRAIN VERIFICATION TEST. Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U1501–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM ECM/PCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously, with ignition on.

- **Set Condition:**

If the Anti-Lock Brakes Module detects bus messages from the Engine Control Module (ECM) or Powertrain Control Module (PCM) are of improper data length.

Possible Causes
WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
ECM OR PCM DTCs PRESENT

ECM OR PCM

ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

No

- Go To [3](#)

3. CHECK IF ECM OR PCM DTCs ARE PRESENT

With the scan tool, read ECM or PCM DTCs.

Are any DTCs present?

Yes

- Diagnose and repair the DTC(s). Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the ECM or PCM?

Yes

- Replace/update the ECM or PCM in accordance with the service information.
- Perform POWERTRAIN VERIFICATION TEST. Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U1502–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM TCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously, with ignition on.

- **Set Condition:**

If the Anti-Lock Brakes Module detects bus messages from the Transmission Control Module (TCM) are of improper data length.

WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE
DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
CAN C BUS CIRCUITS OPEN OR SHORTED
TCM DTCs PRESENT
TCM
ANTI-LOCK BRAKES MODULE

Diagnostic Test

1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

Does this DTC reset?

Yes

- Go To [2](#)

No

- The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
- Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs related to the conditions listed above?

Yes

- Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

No

- Go To [3](#)

3. CHECK IF TCM DTCs ARE PRESENT

With the scan tool, read TCM DTCs.

Are any TCM DTCs present?

Yes

- Diagnose and repair the DTC(s).
- Perform TRANSMISSION VERIFICATION TEST - VER 1.

No

- Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

U1503–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM TIPM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously with the ignition on.

- **Set Condition:**

When the Anti-Lock Brake Module detects an incorrect CAN message from the Totally Integrated Power Module (TIPM).

Possible Causes
TIPM CAN BUS DTCS
ANTI-LOCK BRAKE MODULE

Diagnostic Test

1. CHECK IF TIPM CAN BUS DTCs ARE PRESENT

With the scan tool, read TIPM DTCs.

Are there any TIPM CAN BUS DTCs present?

Yes

- Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING and diagnose the appropriate symptom.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Replace the Anti-Lock Brakes Module in accordance with the Service Information.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

ABS INTERMITTENT CONDITION

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. PERFORM ABS INTERMITTENT CONDITION TEST

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Environmental Data (EV Data). If possible, try to duplicate the conditions under which the DTC set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Wiggle the wires while checking for shorts and open circuits.

Perform a voltage drop test on the related circuits between the suspected inoperative component and the Anti-Lock Brake Module.

Inspect and clean all PCM, ABS, engine, and chassis grounds that are related to the most current DTC. If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits. For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation. Use the scan tool to perform a System Test if one applies to failing component. A co-pilot, data recorder, or lab scope should be used to help diagnose intermittent conditions.

Were any problems found during the above inspections?

Yes

- Perform the necessary repairs.
- Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

No

- Test Complete.

STANDARD PROCEDURE

ABS VERIFICATION TEST

1. ABS VERIFICATION TEST

WARNING: To avoid personal injury or death, check brake capability is available before road testing.

NOTE: If the ABM (Anti-Lock Brake Module), SAS (Steering Angle Sensor), Dynamics Sensor was replaced, it must be initialized using the scan tool. If not initialized, the ABS indicator will flash continuously with no DTCs. To initialize the ABM and clear offsets have wheels pointing straight ahead and follow the directions on the scan tool. The drive test requires a 90° turn. If the Dynamics Sensor was replaced, test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/h (6 and 15 mph).

1. Turn the ignition off.
2. Connect all previously disconnected components and connectors.
3. Verify all accessories are turned off and the battery is fully charged.
4. Verify that the ignition is on, with the scan tool, erase all Diagnostic Trouble Codes from All modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was indicating the failure.
5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the scan tool, read DTCs from all modules.
6. If any Diagnostic Trouble Codes are present, return to symptom list and trouble shoot new or recurring symptom.

NOTE: For Sensor Signal and Pump Motor faults, the ABM must sense all 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicator.

7. If there are no DTCs present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several anti-lock braking stops.
8. Again, with the scan tool read DTCs . If any DTCs are present, refer to the Table of Contents in the applicable Section for the diagnostic test procedure and troubleshoot the new or recurring symptom.
9. If there are no Diagnostic Trouble Codes (DTCs) present, and the customer's concern can no longer be duplicated, the repair is complete.

Are any DTCs present or is the original concern still present?

Yes

- Repair is not complete, refer to appropriate symptom.

No

- Repair is complete.

BRAKES - ABS - SERVICE INFORMATION

BRAKES - ABS - SERVICE INFORMATION

DESCRIPTION

The ESP system enhances directional control and stability of the vehicle under various driving conditions. ESP corrects for over/under steering of the vehicle by applying the brake of the appropriate wheel to assist in counteracting the over/under steer condition. Engine power may also be reduced to help the vehicle maintain the desired path. ESP uses sensors in the vehicle to determine the vehicle path intended by the driver and compares it to the actual path of the vehicle. When the actual path does not match the intended path, ESP applies the brake of the appropriate wheel to assist in counteracting the oversteer or understeer condition.

OPERATION

To determine whether the car is responding properly to cornering commands, ESP uses steering wheel angle, yaw (turning) rate and lateral acceleration sensors (combined into Dynamics Sensor). Using signals from these sensors, in addition to individual wheel speed sensor signals, the system determines appropriate brake and throttle actions. Once initiated, ESP operates much like All-Speed Traction Control, except that the goal is directional stability. If the vehicle yaw response, or rate of turning, is inconsistent with the steering angle and vehicle speed indications, the ESP system applies the brakes and, if necessary closes the throttle, to restore control. This occurs whether the vehicle is turning too rapidly (oversteering) or not rapidly enough (understeering).

DIAGNOSIS AND TESTING

ANTILOCK BRAKES

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.

NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Antilock Brake section in Group 8W. For test procedures refer to the Chassis Diagnostic Manual.

STANDARD PROCEDURE

BLEEDING ABS BRAKE SYSTEM

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

1. Perform base brake bleeding. Refer to base brake section for procedure.
2. Connect scan tool to the Data Link Connector.
3. Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.
4. Perform base brake bleeding a second time. Refer to base brake section for procedure.
5. Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Hydraulic Control Unit Bracket to HCU Bolts	6.5	—	57
Hydraulic Control Unit Body Bracket Bolts	16-24	—	142-212
HCU to Body Bracket Bolts	9-13	—	80-115
Hydraulic Control Unit Brake Lines	15-18	—	130-160
Antilock Brake Module (ABM) Mounting Bolt	7-9	—	60-80
Front Wheel Speed Sensors Mounting Bolt	4-6	—	34-50
Rear Wheel Speed Sensors Mounting Bolt	12-14	—	106-124

ELECTRICAL

DESCRIPTION

A wheel speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear

sensors are mounted at the outboard end of the axle. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor.

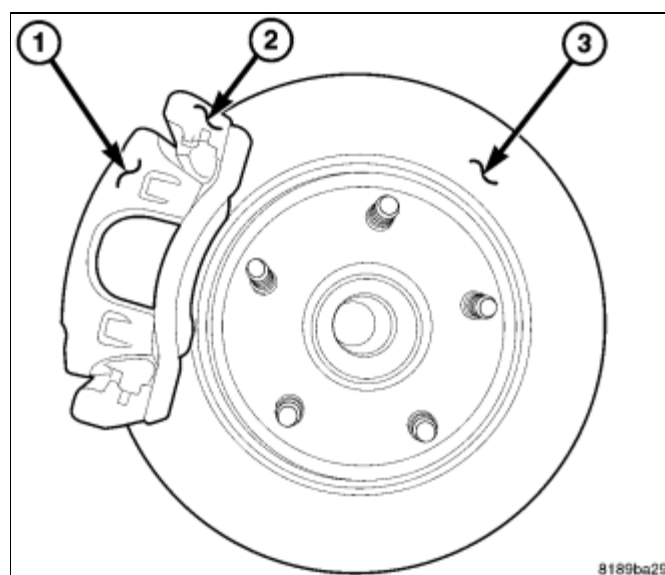
OPERATION

The sensors convert wheel speed into a small digital signal. The ABM sends 12 volts to the sensors. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when the toothed tone wheel passes the wheel speed sensor. This digital signal is sent to the ABM. The ABM measures the voltage and amperage of the digital signal for each wheel.

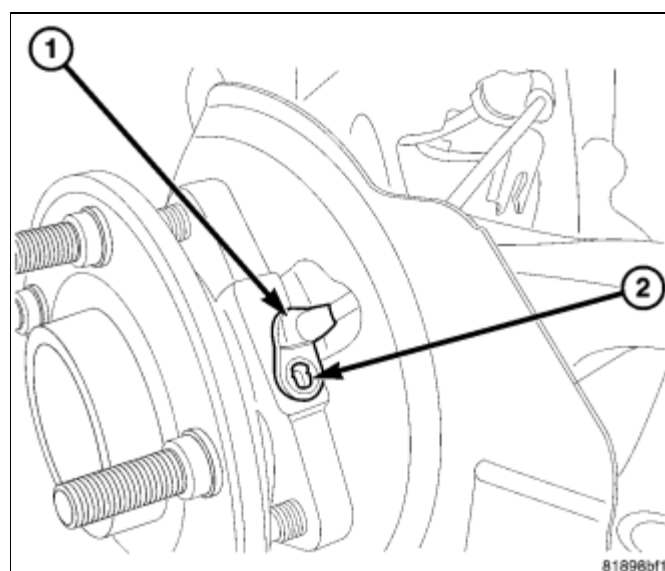
SENSOR - FRONT WHEEL SPEED

REMOVAL

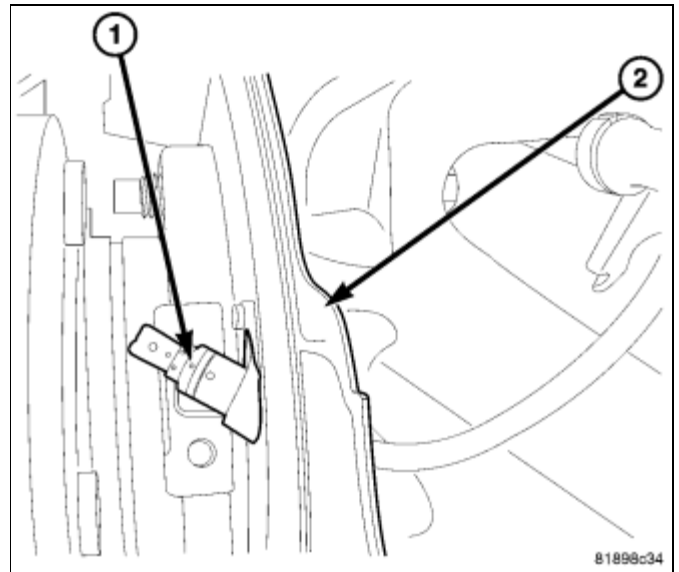
1. Raise vehicle and support the vehicle.
2. Remove the disc brake caliper (1) and adapter (2).
3. Remove the disc brake rotor (3).



4. Clean sensor (1) and surrounding area with shop towel before removal.
5. Remove bolt (2) attaching sensor (1) to hub/bearing.

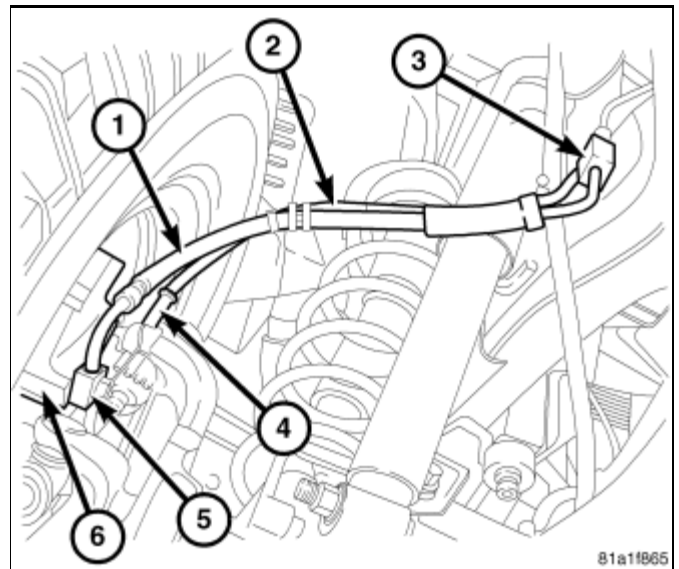


6. Remove the sensor (1) through the hole in the brake shield (2).

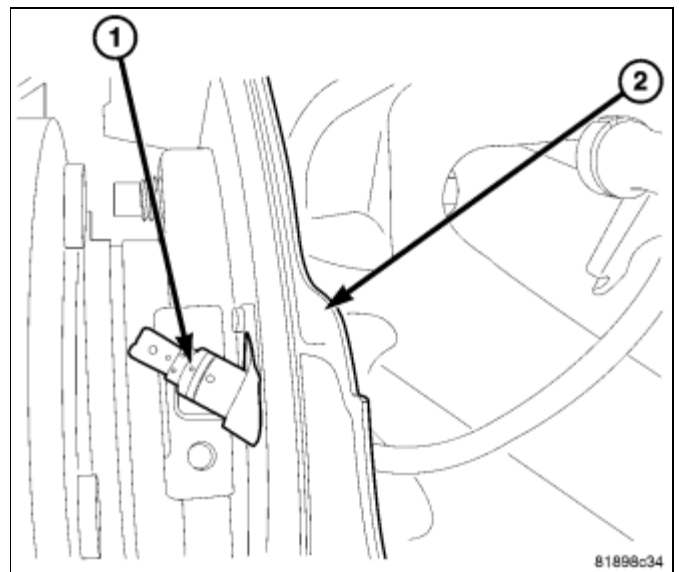


7. Remove sensor wire (2) from brake hose (1).
8. Disconnect sensor wire connector at harness plug.

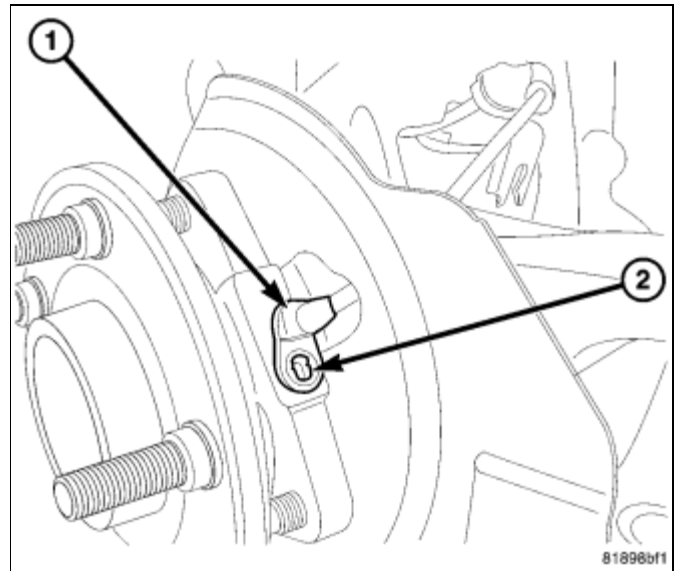
INSTALLATION



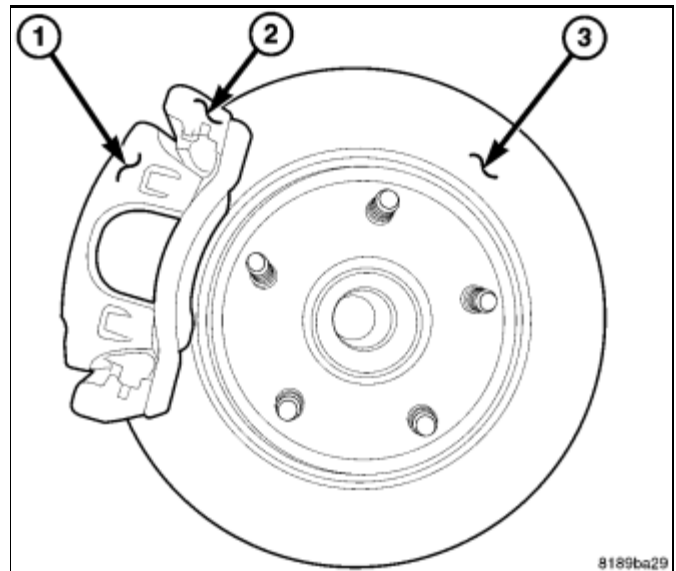
1. Install the sensor (1) through the hole in the brake shield (2).



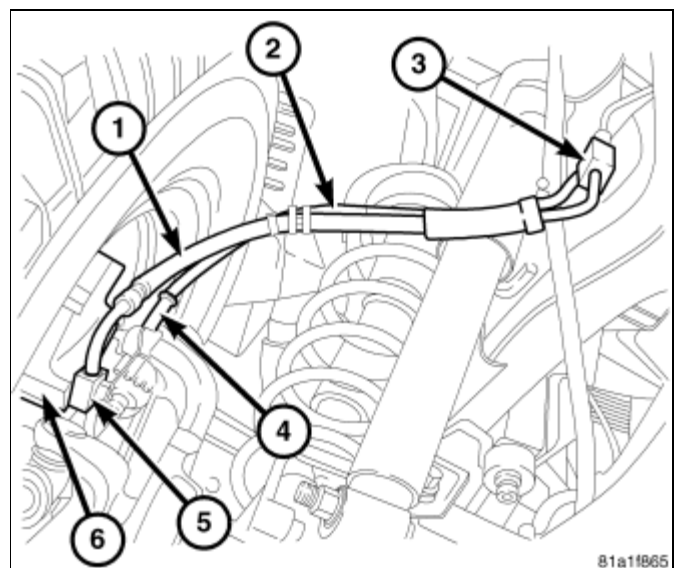
2. Install the sensor (1) in the hub & bearing and tighten sensor attaching bolt (2) to 4-6 N·m (34-50 in. lbs.).



3. Install the disc brake rotor (3).
4. Install the disc brake caliper (1) and adaptor (2).



5. Route the sensor wire (2) and secure to the brake hose (1).
6. Connect sensor wire to harness.
7. Install the tire & wheel assembly.
8. Remove the support and lower the vehicle.



SENSOR - REAR WHEEL SPEED

REMOVAL

1. Raise and support the vehicle.
2. Disconnect the wheel speed sensor electrical connector (1).
3. Remove the wheel speed sensor mounting bolt (2) from the rear support plate.
4. Remove the wheel speed sensor (3).

INSTALLATION

1. Insert the wheel speed sensor (3).
2. Tighten the wheel speed sensor bolt (2) to 12-14 N·m (106-124 in. lbs.).
3. Reconnect the wheel speed sensor electrical connector (1).
4. Lower the vehicle.

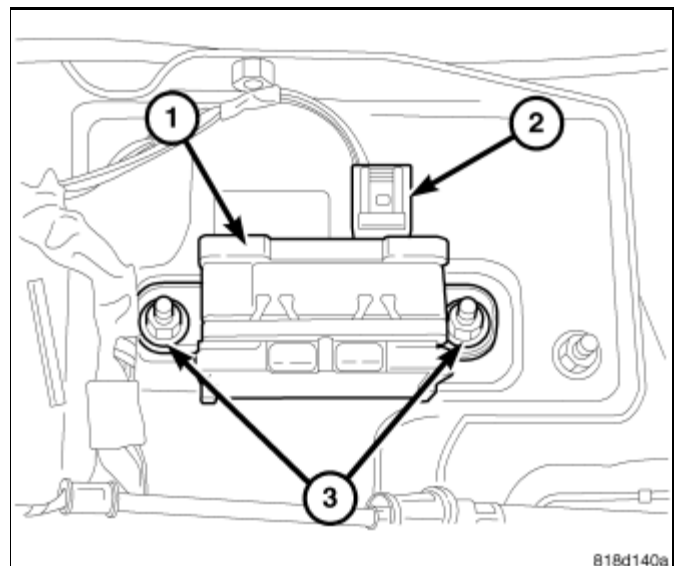
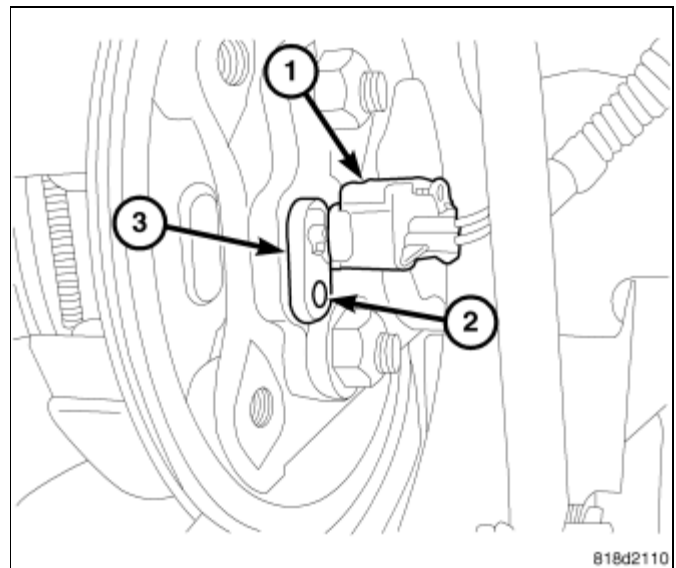
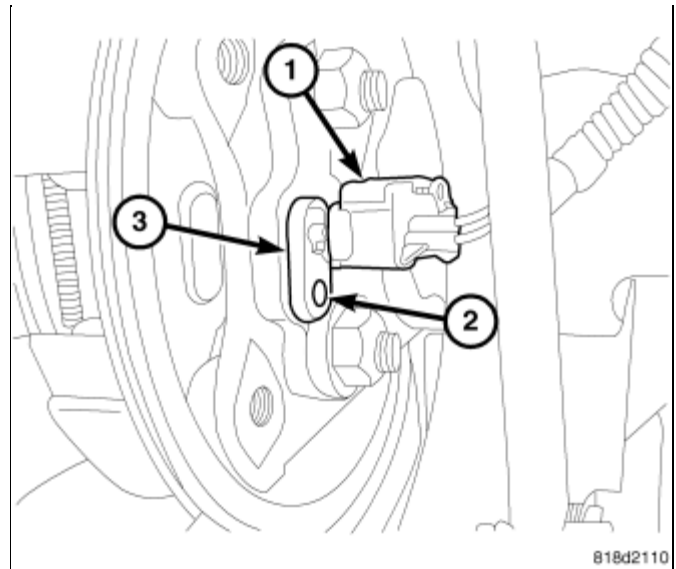
SENSOR - DYNAMICS

DESCRIPTION

The Yaw Rate and Lateral Acceleration Sensors are housed into one unit known as the Dynamics Sensor (1). The sensor is used to measure side-to-side (Lateral) motion and vehicle rotational sensing (how fast the vehicle is turning - Yaw).

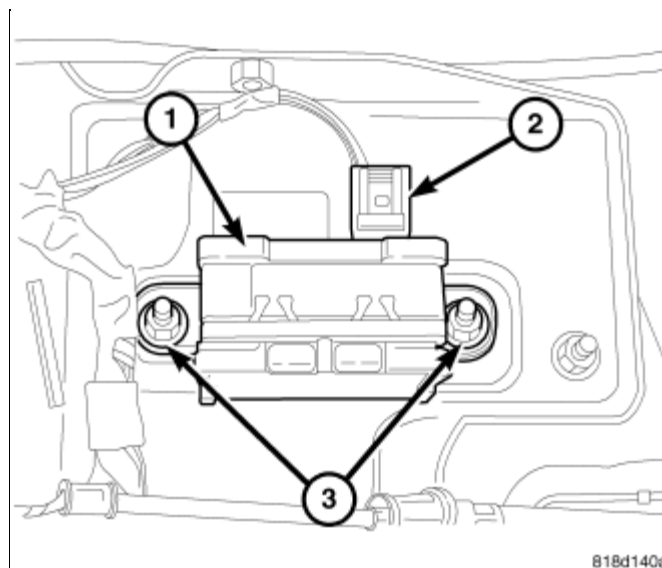
Yaw and Lateral Acceleration Sensors cannot be serviced separately. The entire Dynamics Sensor (1) must be replaced when necessary.

REMOVAL



1. Remove the center console.
2. Disconnect the electrical connector (2) for the sensor (1).
3. Remove the two nuts (3) securing the sensor (1).
4. Remove the sensor (1).

INSTALLATION



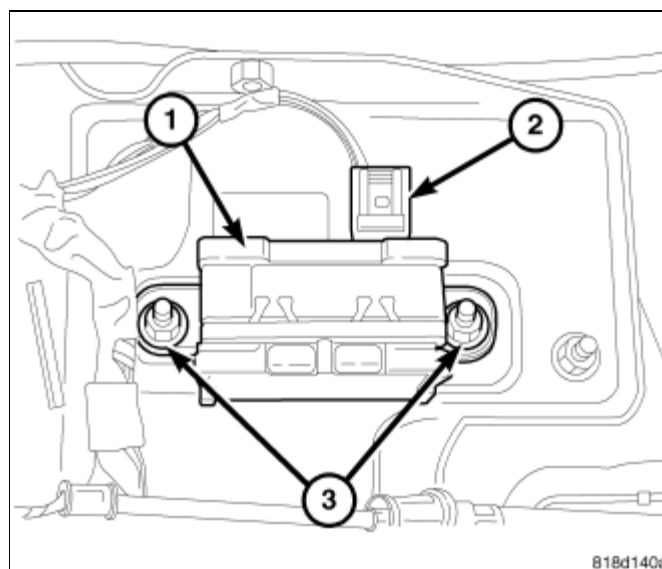
1. Install the sensor (1) to the vehicle.
2. Install the two mounting nuts (3).
3. Reconnect the electrical connector (2) to the sensor (1).
4. Install the center console.

SENSOR-STEERING ANGLE

DESCRIPTION

NOTE: Steering angle sensor is part of the airbag clockspring and is not serviced separately from the clockspring.

Under transient cornering conditions the lateral acceleration sensor does not measure the true side to side force on the car. In order to compensate for this the system uses the driver's steering command (Steering angle sensor) and vehicle speed to estimate the true sway force. This signal is matched with the lateral acceleration sensor signal to ensure a significantly-reduced transient side to side force of the vehicle body.



REMOVAL

NOTE: Steering angle sensor is part of the airbag clockspring and is not serviced separately from the clockspring.

1. For removal of the steering angle sensor (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

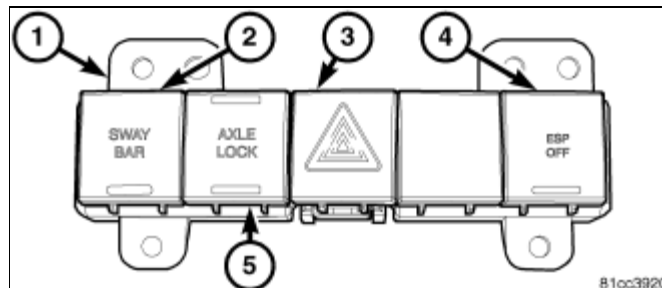
INSTALLATION

1. For installation of the steering angle sensor (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

SWITCH - ESP

DESCRIPTION

The instrument panel switch pod (1) is located just below the heater and air conditioner controls in the center stack area of the instrument panel. This switch is available in multiple configurations, which varies from two single push button switches to as many as five push button switches, depending upon the optional equipment in the vehicle. The pod may include the following switches:



- **Axle Locker Switch (5)**
- **Electronic Stability Program (ESP) Switch (4)**
- **Front Sway Bar Disconnect Switch (2)**
- **Hazard Warning Switch (3)**
- **Headlamp Leveling Switch (Not Shown)**

The switch housing and the push buttons are constructed of molded plastic. Each push button has a smooth finish and is clearly identified with the appropriate text and International Control and Display Symbol icons. Several of the push buttons feature Light Emitting Diode (LED) units to give the vehicle operator an indication when the function of that switch is currently active. Only the hazard warning switch push button latches, while the remaining switches feature momentary operation.

Four screws secure the switch to the back of the instrument panel center bezel through integral mounting tabs that are molded into each corner of the switch housing. The back of the switch housing has an integral connector receptacle containing terminal pins that connect the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

Panel lamps dimmer controlled illumination lamps integral to the circuit board within the switch provide back lighting for visibility at night, but these lamps are not serviceable. The individual switches in the lower instrument panel switch pod cannot be repaired and are not serviced separately. If any component within the switch pod is ineffective or damaged, the entire switch pod unit must be replaced.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

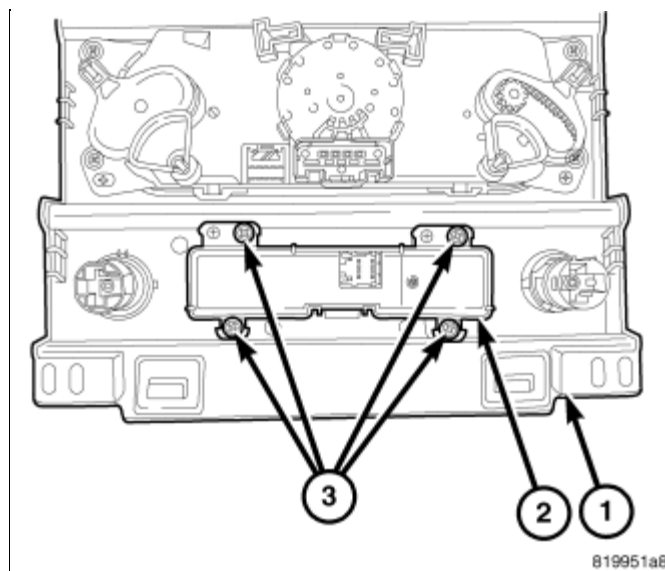
1. Disconnect and isolate the battery negative cable.

2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Disconnect the wire harness connector from the back of the instrument panel switch pod (2).
4. Remove the four screws (3) that secure the switch pod to the back of the center bezel.
5. Remove the switch pod from the center bezel.

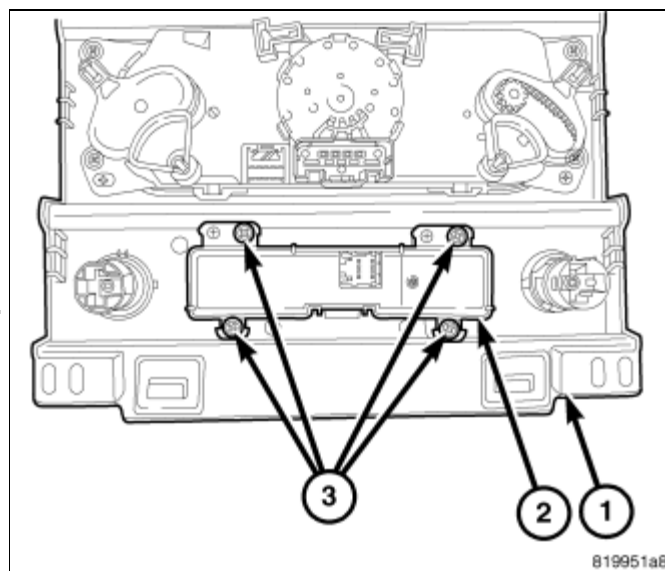
INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: There are several different instrument panel switch pods available, depending upon the optional equipment content of the vehicle. Be certain that a replacement switch pod matches the optional equipment of the vehicle into which it is being installed.



1. Position the instrument panel switch pod (2) to the back of the center bezel (1).
2. Install and tighten the four screws (3) that secure the switch pod to the center bezel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Reconnect the wire harness connector to the back of the switch pod.
4. Reinstall the center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.



HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The HCU consists of a valve body, pump motor, low pressure accumulators, inlet valves, outlet valves and noise attenuators.

OPERATION

Accumulators in the valve body store extra fluid released from the calipers during ABS mode operation. The pump is used to clear the accumulator of brake fluid and is operated by a DC type motor. The motor is controlled by the ABM. The valves modulate brake pressure during antilock braking and are controlled by the ABM. The HCU provides individual pressure control to each front and rear brake.

During antilock braking, the solenoid valves are opened and closed as needed. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration. Brake Traction Control and Electronic Stability Program modulate pressure on each wheel individually without any driver brake input.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system. During antilock braking, solenoid valve pressure modulation occurs in three stages; pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ABM closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the ABM closes the outlet valve and begins a pressure increase or hold cycle as needed.

PRESSURE HOLD

Both solenoid valves are closed in the pressure hold cycle but only the inlet valve is energized. Fluid apply pressure in the control channel is maintained at a constant rate. The ABM maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE INCREASE

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to reapply the brakes. This cycle controls re-application of fluid apply pressure.

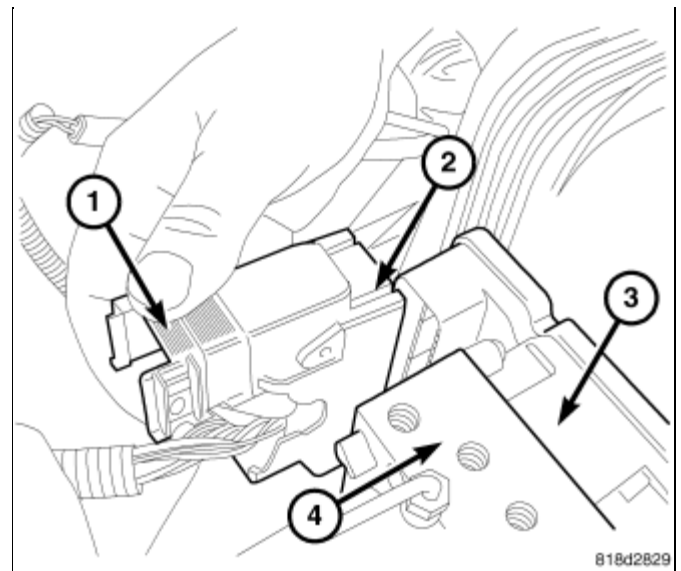
REMOVAL

1. Remove the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
2. Install prop rod on the brake pedal to keep pressure on the

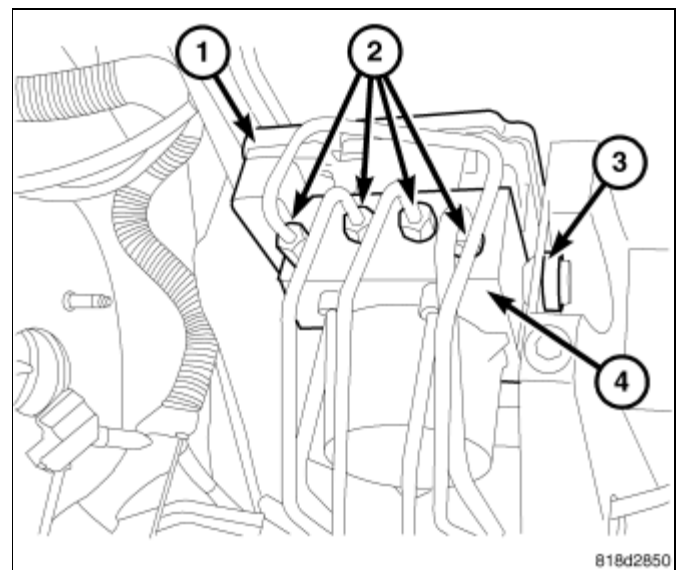
brake system.

3. Remove negative battery cable from the battery.

4. Pull up on the ABM harness connector release (1) and remove connector (2).

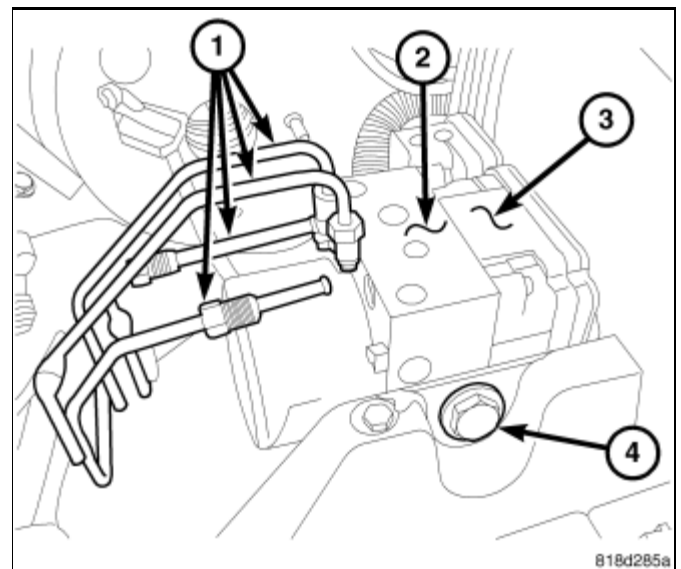


5. Remove brake lines (2) from the HCU (4).



6. Remove HCU/ABM mounting nuts and bolt (4) and remove HCU (2) / ABM (3) as an assembly.

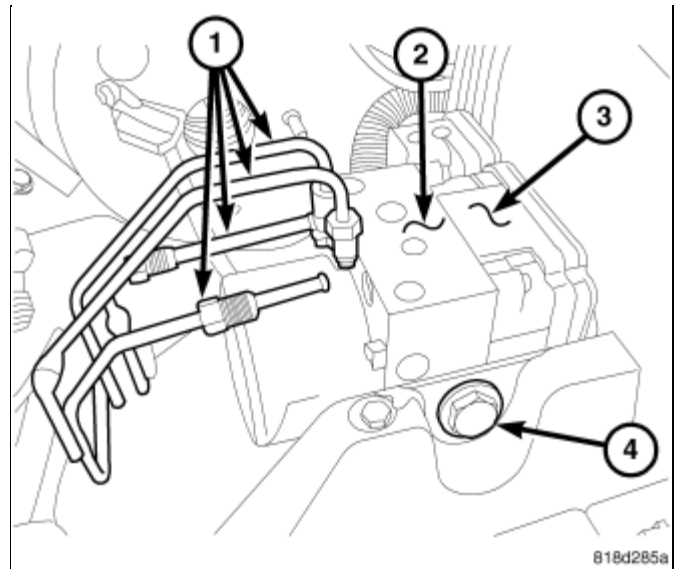
INSTALLATION



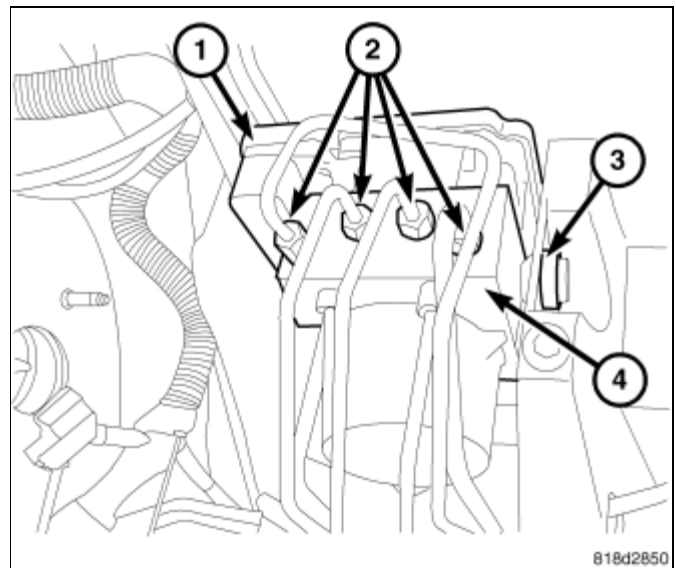
NOTE: If the ABM is being replaced with a new ABM is

must be reprogrammed with the use of a scan tool.

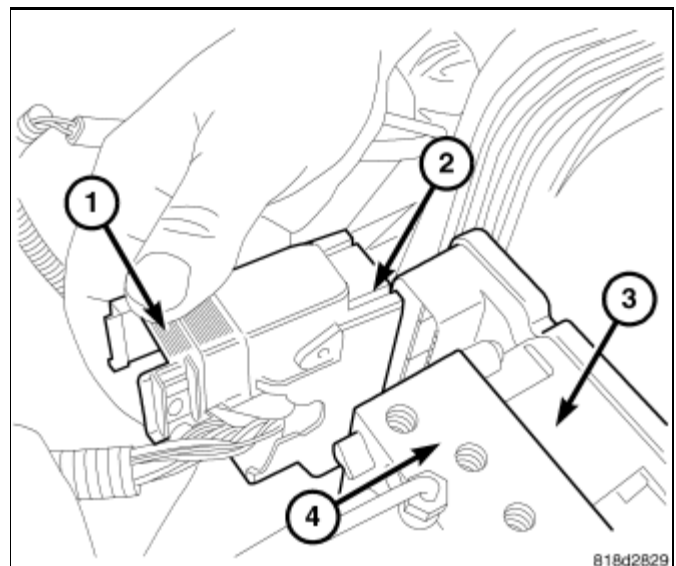
1. Install HCU/ABM (2&3) on the mounting studs (4).
2. Install mounting nuts and bolt (4). Tighten to 11.5 N·m (102 in. lbs.).



3. Install brake lines (2) to the HCU (4) and tighten to 19 N·m (170 in. lbs.).



4. Install wiring harness connector (2) to the ABM and push down on the release (1) to secure the connector.
5. Install the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION).
6. Install negative battery cable to the battery.
7. Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



6 - CLUTCH

CLUTCH

WARNING

WARNING: DaimlerChrysler does not manufacture any vehicles or replacement parts that contain asbestos. Aftermarket products may or may not contain asbestos. Refer to aftermarket product packaging for product information. Whether the product contains asbestos or not, dust and dirt can accumulate on manual clutch parts during normal use. Follow practices prescribed by appropriate regulations for the handling, processing and disposing of dust and debris.

DIAGNOSIS AND TESTING

CLUTCH

Drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If the clutch chatters, grabs, slips or does not release properly, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed as the transmission or another driveline component may be at fault.

NOTE: Vehicles equipped with a Dual Mass Flywheel may produce a rattle when the engine is shut off. This noise is considered normal.

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, water or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab. Inspect components for oil, hydraulic fluid or water/road splash contamination.

Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Clutch fluid leaks are usually from damaged slave cylinder push rod seals. Heat buildup caused by slippage between the pressure plate, disc and flywheel can bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination is dirt/water entering the clutch housing due to loose bolts, housing cracks. Driving through deep water puddles can force water/road splash into the housing through such openings.

IMPROPER RELEASE OR CLUTCH ENGAGEMENT

Clutch release or engagement problems are caused by wear or damage clutch components. A visual inspection of the release components will usually reveal the problem part.

Release problems can result in hard shifting and noise. Look for leaks at the clutch cylinders and interconnecting line and loose slave cylinder bolts. Also worn/loose release fork, pivot stud, clutch disc, pressure plate or release bearing.

Engagement problems can result in slip, chatter/shudder and noisy operation. The causes may be clutch disc contamination, wear, distortion or flywheel damage. Visually inspect to determine the actual cause of the problem.

CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

PRESSURE PLATE AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if runout is excessive.

Check condition of the clutch before installation. A warped cover or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc.

Use an alignment tool when positioning the disc on the flywheel. The tool prevents accidental misalignment which could result in cover distortion and disc damage.

A frequent cause of clutch cover distortion (and consequent misalignment) is improper bolt tightening.

FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended**. Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the

flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

DIAGNOSIS CHART

The diagnosis charts [Diagnosis Chart](#) describe common clutch problems, causes and correction. Conditions, causes and corrective action are outlined in the indicated columns.

Diagnosis Chart

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc facing worn out	1. Normal wear.	1. Replace cover and disc.
	2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear.	2. Replace cover and disc.
	3. Insufficient clutch cover diaphragm spring tension.	3. Replace cover and disc.
Clutch disc facing contaminated with oil, grease, or clutch fluid.	1. Leak at rear main engine seal or transmission input shaft seal.	1. Replace appropriate seal.
	2. Excessive amount of grease applied to the input shaft splines.	2. Remove grease and apply the correct amount of grease.
	3. Road splash, water entering housing.	3. Replace clutch disc. Clean clutch cover and reuse if in good condition.
	4. Slave cylinder leaking.	4. Replace hydraulic clutch linkage.
Clutch is running partially disengaged.	1. Release bearing sticking or binding and does not return to the normal running position.	1. Verify failure. Replace the release bearing and transmission front bearing retainer as necessary.
Flywheel below minimum thickness specification.	1. Improper flywheel machining. Flywheel has excessive taper or excessive material removal.	1. Replace flywheel.
Clutch disc, cover and/or diaphragm spring warped or distorted.	1. Rough handling. Impact bent cover, spring, or disc.	1. Replace disc or cover as necessary.
	2. Improper bolt tightening procedure.	2. Tighten clutch cover using proper procedure.
Facing on flywheel side of disc torn, gouged, or worn.	1. Flywheel surface scored or nicked.	1. Correct surface condition if possible. Replace flywheel and disc as necessary.

	2. Clutch disc sticking or binding on transmission input shaft.	2. Lubricate splines with high temperature grease.
Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed.	1. Frequent operation under high loads or hard acceleration conditions.	1. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
	2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	2. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
	3. Contamination of clutch.	3. Correct fluid leak. Replace clutch cover and disc.
Clutch disc binds on input shaft splines.	1. Clutch disc hub splines damaged during installation.	1. Clean, smooth, and lubricate hub splines if possible. Replace disc if necessary.
	2. Input shaft splines rough, damaged, or corroded.	2. Clean, smooth, and lubricate shaft splines if possible. Replace input shaft if necessary.
Clutch disc rusted to flywheel and/or pressure plate.	1. Clutch not used for and extended period of time (e.g. long term vehicle storage).	1. Sand rusted surfaces with 180 grit sanding paper. Replace clutch cover and flywheel if necessary.
Pilot bearing seized, loose, or rollers are worn.	1. Bearing cocked during installation.	1. Install and lubricate a new bearing.
	2. Bearing defective.	2. Install and lubricate a new bearing.
	3. Bearing not lubricated.	3. Install and lubricate a new bearing.
	4. Clutch misalignment.	4. Inspect clutch and correct as necessary. Install and lubricate a new bearing.
Clutch will not disengage properly.	1. Low clutch fluid level.	1. Replace hydraulic linkage assembly.
	2. Clutch cover loose.	2. Follow proper bolt tightening procedure.
	3. Clutch disc bent or distorted.	3. Replace clutch disc.
	4. Clutch cover diaphragm spring bent or warped.	4. Replace clutch cover.
	5. Clutch disc installed backwards.	5. Remove and install clutch disc correctly.
	6. Release fork bent or fork pivot loose or damaged.	6. Replace fork or pivot as necessary.
	7. Clutch master or slave cylinder failure.	7. Replace hydraulic linkage assembly.
Clutch pedal squeak.	1. Pivot pin loose.	1. Tighten pivot pin if possible. Replace clutch pedal if necessary.
	2. Master cylinder bushing not	2. Lubricate master cylinder bushing.

	lubricated.	
	3. Pedal bushings worn out or cracked.	3. Replace and lubricate bushings.
Clutch master or slave cylinder plunger dragging and/or binding	1. Master or slave cylinder components worn or corroded.	1. Replace clutch hydraulic linkage assembly.
Release bearing is noisy.	1. Release bearing defective or damaged.	1. Replace release bearing.
Contact surface of release bearing damaged.	1. Clutch cover incorrect or release fingers bent or distorted.	1. Replace clutch cover and release bearing.
	2. Release bearing defective or damaged.	2. Replace the release bearing.
	3. Release bearing misaligned.	3. Check and correct runout of clutch components. Check front bearing sleeve for damage/alignment. Repair as necessary.
Partial engagement of clutch disc. One side of disc is worn and the other side is glazed and lightly worn.	1. Clutch pressure plate position incorrect.	1. Replace clutch disc and cover.
	2. Clutch cover, spring, or release fingers bent or distorted.	2. Replace clutch disc and cover.
	3. Clutch disc damaged or distorted.	2. Replace clutch disc.
	4. Clutch misalignment.	4. Check alignment and runout of flywheel, disc, pressure plate, and/or clutch housing. Correct as necessary.

STANDARD PROCEDURE

BLEED CLUTCH HYDRAULIC CIRCUIT

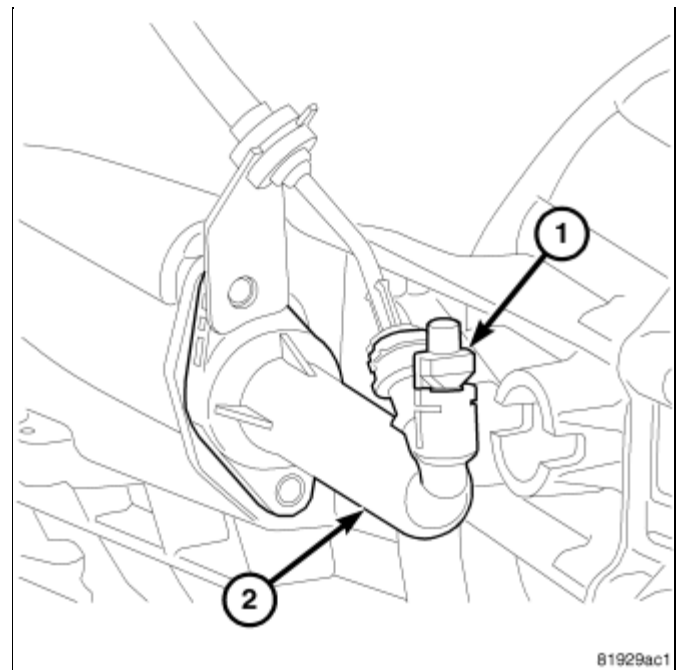
Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

BLEED CLUTCH HYDRAULIC CIRCUIT

1. Verify fluid level in brake master cylinder, top off brake fluid as necessary.
2. Open bleeder (1) on slave cylinder (2) and install a length of clear hose to divert fluid into suitable container. Push and hold clutch pedal down then close bleeder. Repeat this step several times.
3. Remove slave cylinder from transmission.
4. Hold slave cylinder with actuator rod pointing down and open bleeder. Push cylinder actuator rod in completely then close bleeder. Repeat this step several times.
5. Remove drain hose and replace dust cap on bleeder and install slave cylinder on transmission.
6. Actuate clutch pedal 25 times, then start engine and verify clutch operation and pedal feel.

If pedal feels spongy or clutch does not fully disengage, air is still trapped in the hydraulic circuit and must be bleed again.



PRESSURE BLEED CLUTCH HYDRAULIC CIRCUIT

Follow manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill bleeder tank with recommended DOT 3 fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

NOTE: When pressure bleeding system slave cylinder must be removed and actuator rod pointing downward to remove trapped air.

SPECIFICATIONS

CLUTCH

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pressure Plate Bolts - 2.8L	31	23	-
Pressure Plate Bolts - 3.8L	50	37	-
Flywheel Bolts - 2.8L	95	70	-

Flywheel Bolts - 3.8L	81	60	-
Slave Cylinder Nuts	23	17	-
Dust Shield Bolts	50	37	-
Crossmember Frame Bolts	41	30	-

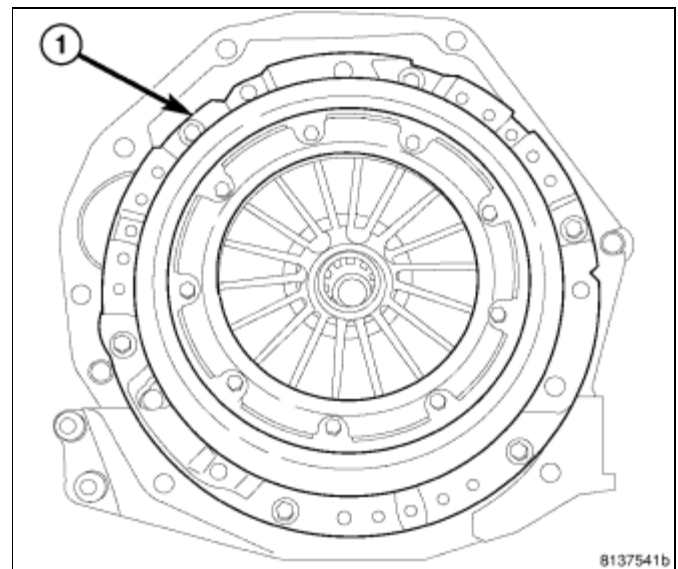
DISC-CLUTCH

REMOVAL

1. Remove transmission.
2. Mark position of pressure plate (1) on flywheel with paint or a scribe for assembly reference, if clutch is not being replaced.
3. Loosen pressure plate bolts evenly and in rotation to relieve spring tension and avoid warping the plate.
4. Remove pressure plate bolts and pressure plate and disc.

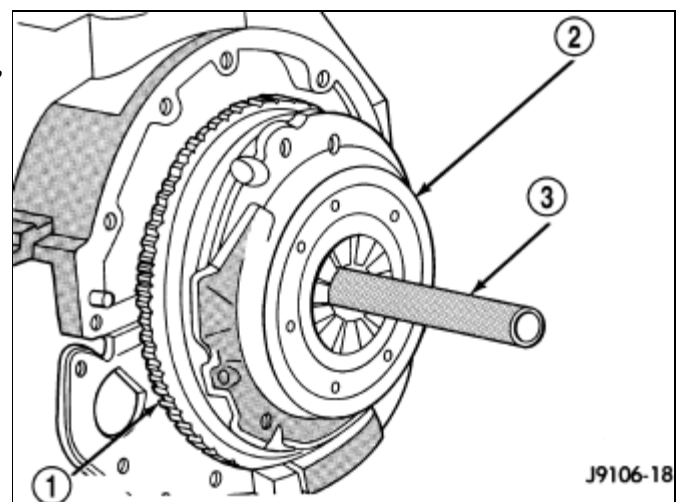
INSTALLATION

GAS ENGINES



1. Lightly scuff sand flywheel face with 180 grit emery cloth, then clean with a wax and grease remover.
2. Lubricate pilot bearing with Mopar high temperature bearing grease or equivalent.
3. Check runout and operation of **new** clutch disc.

NOTE: Disc must slide freely on transmission input shaft splines.



4. With the disc on the input shaft, check face runout with dial indicator. Check runout at disc hub 6 mm (1/4 in.) from outer edge of facing. Obtain another clutch disc if runout exceed 0.5 mm (0.020 in.).
5. Position clutch disc on flywheel with side marked flywheel against the flywheel.

NOTE: If not marked, the flat side of disc hub goes towards the flywheel.

6. Insert clutch alignment tool (3) through the clutch disc and into the pilot bearing.
7. Position clutch pressure plate (2) over disc and on the flywheel (1).
8. Install pressure plate bolts finger tight.

CAUTION: Use only the factory bolts to mount the pressure plate. The bolts must be the correct size. If bolts are too short, there isn't enough thread engagement, if too long bolts interfere with the Dual Mass Flywheel.

9. Tighten pressure plate bolts evenly and in rotation a few threads at a time.

CAUTION: The bolts must be tightened evenly and to specified torque. Failure to follow these instructions will distort the pressure plate.

10. Tighten pressure plate bolts 50 N·m (37 ft. lbs.).
11. Apply light coat of Mopar high temperature bearing grease or equivalent to clutch disc hub and splines of transmission input shaft.

CAUTION: Do not over lubricate shaft splines. This will result in grease contamination of disc.

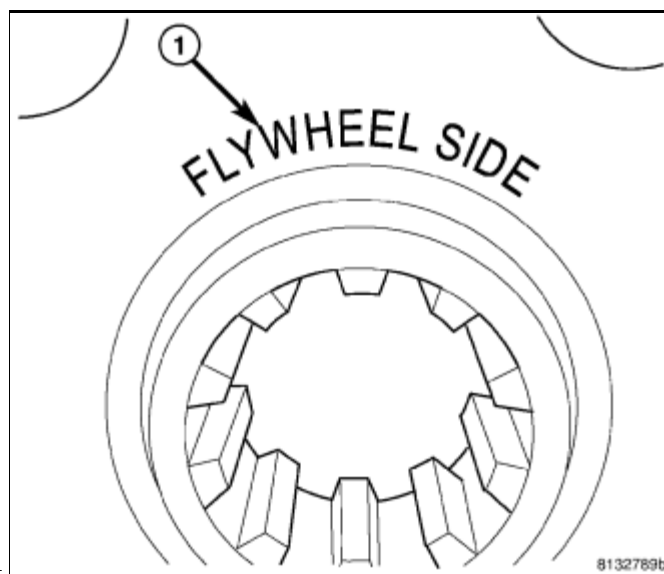
12. Install transmission.

DIESEL ENGINE

1. Lightly scuff sand flywheel face with 180 grit emery cloth, then clean with a wax and grease remover.
2. Lubricate pilot bearing with Mopar high temperature bearing grease or equivalent.
3. Check runout and operation of **new** clutch disc.

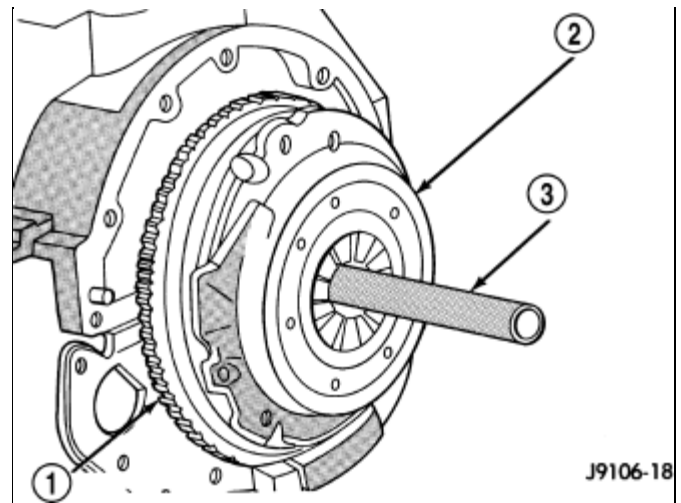
NOTE: Disc must slide freely on transmission input shaft splines.

4. With the disc on the input shaft, check face runout with dial indicator. Check runout at disc hub 6 mm (1/4 in.) from outer edge of facing. Obtain another clutch disc if runout exceed 0.5 mm (0.020 in.).
5. Position clutch disc on flywheel with side marked flywheel side (1) against the flywheel. If not marked, the flat side of disc hub goes towards the flywheel.



6. Insert clutch alignment tool (3) through the clutch disc and into the pilot bearing.

7. Position clutch pressure plate (2) over disc and on the flywheel (1).



8. Install pressure plate bolts (1) finger tight.

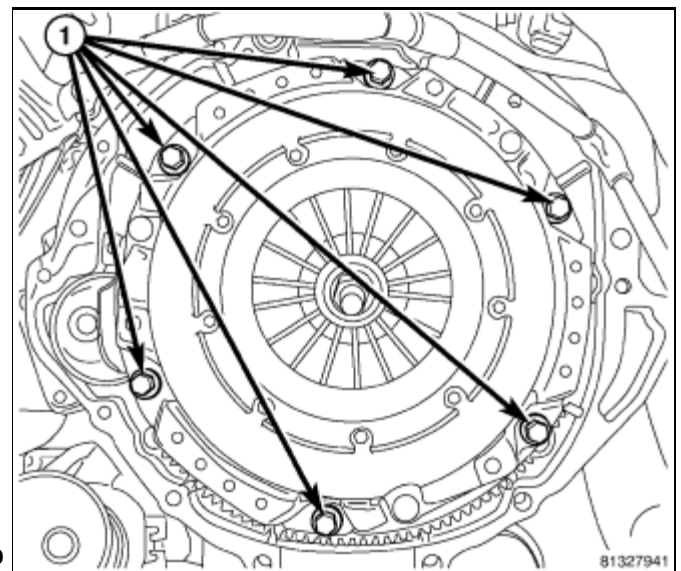
9. Tighten pressure plate bolts evenly and in rotation a few threads at a time.

CAUTION: The bolts must be tightened evenly and to specified torque. Failure to follow these instruction will distort the pressure plate.

10. Tighten pressure plate bolts to 54 N·m (40 ft. lbs.).

11. Apply light coat of Mopar® high temperature bearing grease or equivalent to clutch disc hub and splines of transmission input shaft.

CAUTION: Do not over lubricate shaft splines. Failure to follow these instruction will contamination of disc.



12. Install transmission.

BEARING-CLUTCH RELEASE

REMOVAL

1. Remove transmission.

2. Disconnect release bearing (1) from release fork (2) and remove the bearing.

3. Inspect bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn, or cracked.

4. Inspect release fork and fork pivot. Be sure pivot is secure and in good condition. Be sure fork is not distorted or worn.

Replace release fork retainer spring if bent or damaged.

INSTALLATION

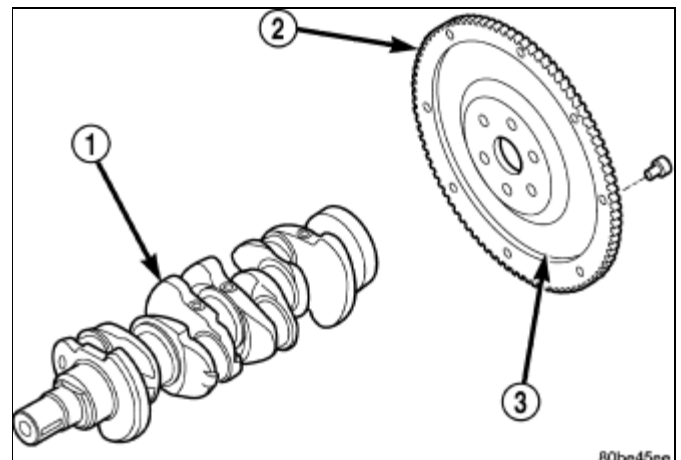
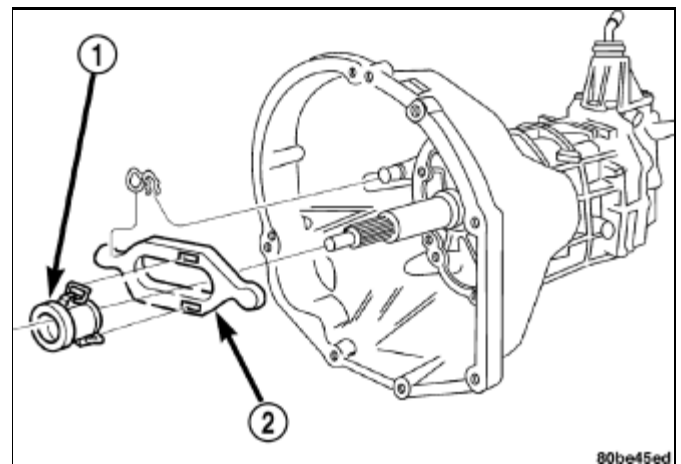
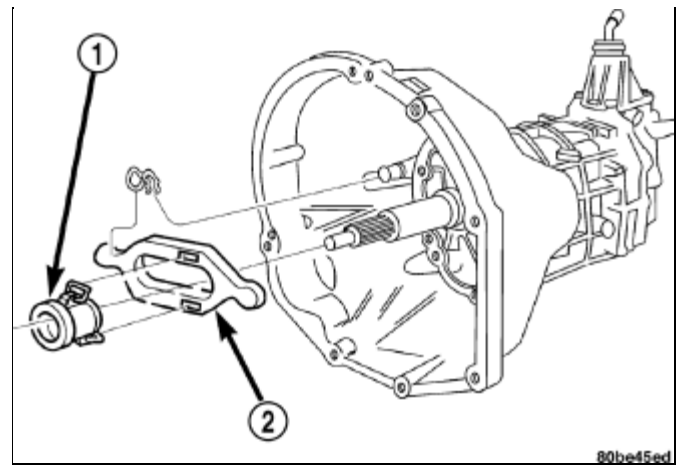
1. Lubricate crankshaft pilot bearing with Mopar™ high temperature bearing grease or equivalent. Apply grease to end of long shank, small diameter flat blade screwdriver. Then insert tool through clutch disc hub to reach bearing.
2. Lubricate input shaft splines, bearing retainer slide surface, fork pivot and release fork pivot surface.
3. Install new release bearing (1) and secured to release fork (2).
4. Install transmission.

FLYWHEEL

DESCRIPTION

STANDARD FLYWHEEL

The standard flywheel (3) is a heavy plate bolted to the rear of the crankshaft (1). The flywheel incorporates the ring gear (2) to mesh with the starter. The rear face of the flywheel serves as the driving member to the clutch disc.

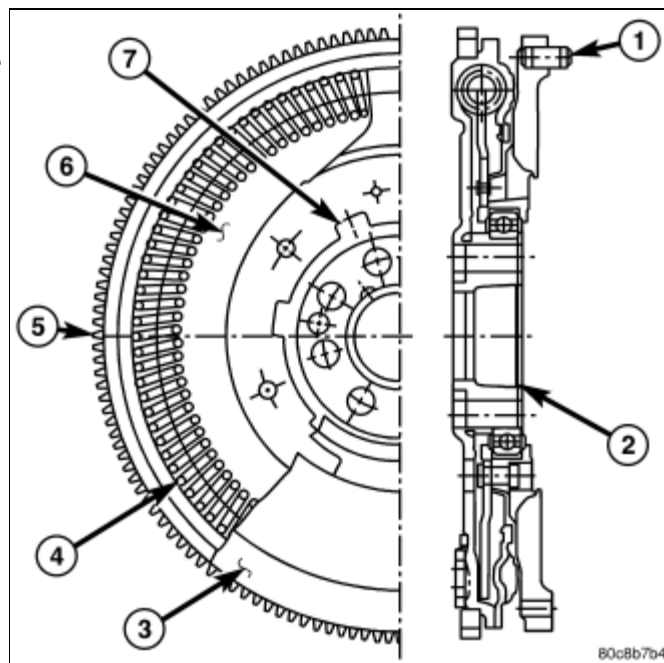


DUAL MASS FLYWHEEL

The Dual Mass Flywheel incorporates the ring gear to mesh with the starter. The primary flywheel (6) side is bolted to the crankshaft. The secondary flywheel (3) face serves as the driving member to the clutch disc. Internal springs (4) between the flywheels are used to dampen energy.

OPERATION

The flywheel serves to dampen the engine firing pulses. The heavy weight of the flywheel relative to the rotating mass of the engine components serves to stabilize the flow of power to the remainder of the drivetrain. The crankshaft has the tendency to attempt to speed up and slow down in response to the cylinder firing pulses. The flywheel dampens these impulses by absorbing energy when the crankshaft speeds and releasing the energy back into the system when the crankshaft slows down.



On a Dual Mass Flywheel the additional secondary mass coupled to the transmission lowers the natural frequency of the transmission rotating elements. This decreases the transmission gear rattle. The damper springs between the two flywheel masses replace the clutch disc damper springs and assist in a smooth transfer of torque to the transmission.

CAUTION: The Dual Mass Flywheel is serviced as an assembly only and should never be taken apart. Failure to heed caution may result in damage.

DIAGNOSIS AND TESTING

FLYWHEEL

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended**. Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also

weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

REMOVAL

1. Remove transmission.
2. Remove clutch pressure plate and disc.
3. Remove flywheel-to-crankshaft bolts and remove flywheel assembly.

INSTALLATION

1. Clean the surfaces of the flywheel and pressure plate.
2. Install flywheel with **new** bolts and tighten in a criss-cross pattern. On 3.8L engine tighten bolts to 81 N·m (60 ft. lbs.). On 2.8L engine tighten bolts to 95 N·m (70 ft. lbs.).
3. Install clutch disc and pressure plate.
4. Install transmission.

BEARING-PILOT

REMOVAL

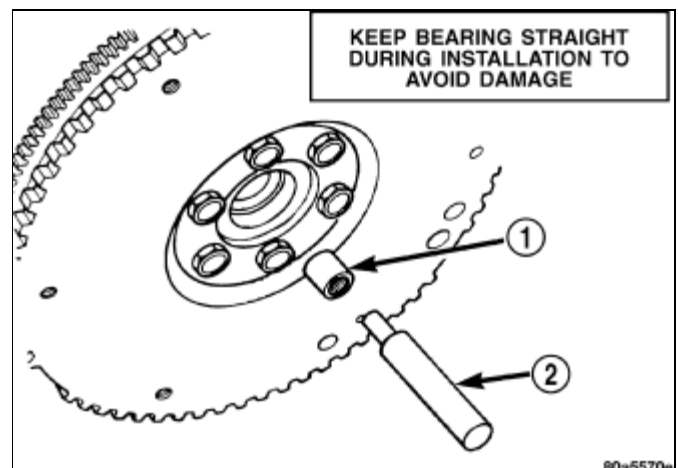
1. Remove transmission.
2. Remove pressure plate and clutch disc.
3. Remove pilot bearing with an internal (blind hole) puller.

INSTALLATION

1. Lubricate new bearing with Mopar high temperature bearing grease or equivalent.
2. Start new pilot bearing (1) into crankshaft by hand. Then seat bearing with clutch alignment tool (2).
3. Install clutch disc and pressure plate.
4. Install transmission.

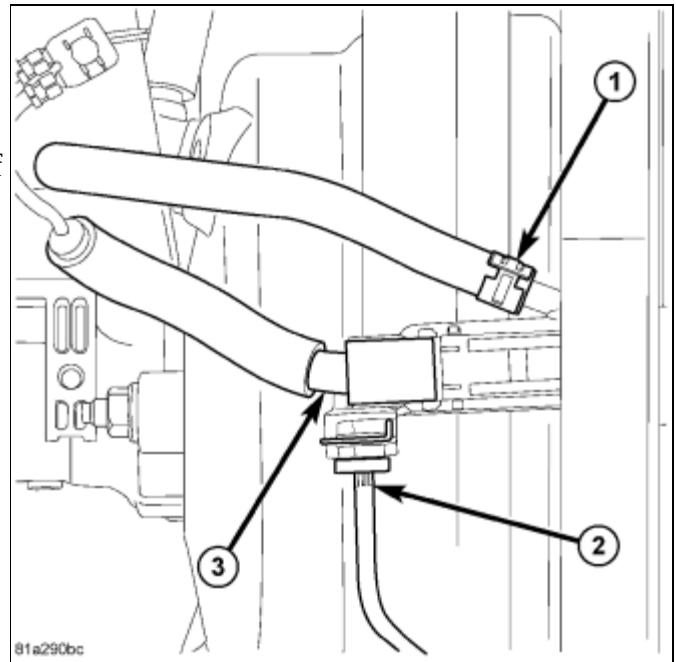
CYLINDER-MASTER

REMOVAL



1. Pry actuator rod off clutch pedal pin.
2. Remove hose (1) from clutch master cylinder and plug hose to prevent fluid loss.
3. Pull hydraulic line (2) clip and remove line from bottom of clutch master cylinder.
4. Disconnect wiring harness (3) from pedal position switch.
5. Turn clutch master cylinder assembly clockwise a quarter turn and remove from brake booster mounting plate.

INSTALLATION



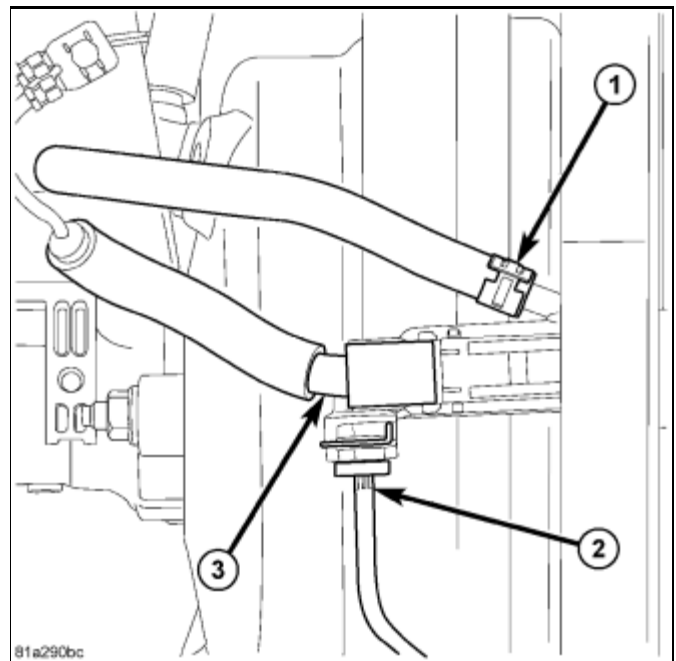
1. Install clutch master cylinder through brake booster mounting plate and turn counter clockwise a quarter turn.
2. Install hose (1) to clutch master cylinder from brake master cylinder reservoir.
3. Install hydraulic line to the bottom of clutch master cylinder.

NOTE: Verify O-ring is on hydraulic line.

4. Connect wiring harness (3) to pedal position switch.
5. Install actuator rod on clutch pedal pin.
6. Bleed clutch hydraulic circuit.

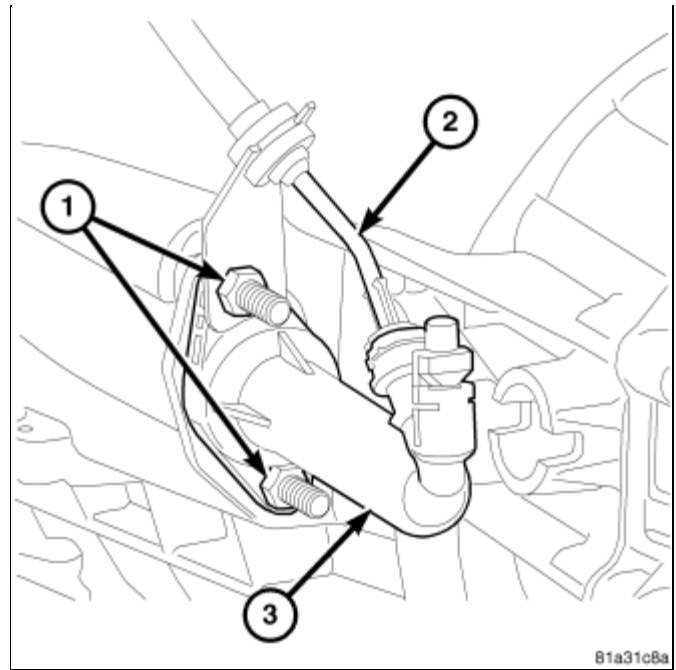
CYLINDER-SLAVE

REMOVAL



1. With transmission in neutral, position vehicle on hoist.
2. Remove mounting nuts (1) from slave cylinder (3).
3. Pull hydraulic line (2) clip and the line with bracket from slave cylinder (3).
4. Remove slave cylinder.

INSTALLATION



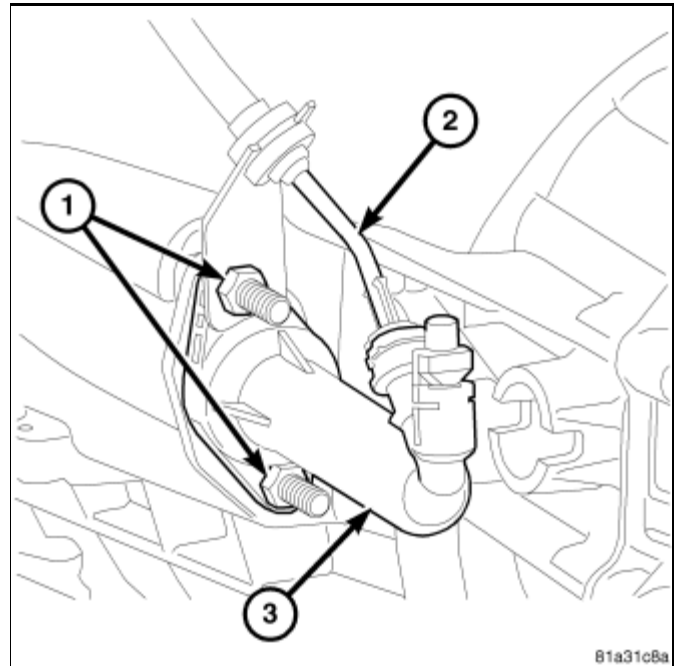
1. Install slave cylinder (3) in transmission.
2. Install hydraulic line (2) and with bracket to slave cylinder.

NOTE: Verify O-ring is on hydraulic line.

3. Install slave cylinder nuts (1) and tighten to 23 N·m (17 ft. lbs.).
4. Bleed hydraulic system.

PEDAL-CLUTCH

REMOVAL



1. Remove steering column lower cover and knee blocker for access.
2. Disengage clutch master cylinder actuator to pedal pivot.
3. Remove nuts attaching pedal and bracket to dash panel and upper cowl support.
4. Separate pedal assemble from vehicle.

INSTALLATION

1. Place clutch pedal and bracket over studs on dash panel and cowl support. Install nuts and tighten to 39 N·m (29 ft. lbs.).
2. Engage clutch master cylinder actuator on brake pedal pivot.

SWITCH-CLUTCH PEDAL POSITION

DESCRIPTION

The clutch pedal position switch is attached to the side of the clutch master cylinder.

The clutch pedal position switch override relay is located in the Power Distribution Center (PDC). Refer to PDC cover label for location within PDC.

OPERATION

The clutch pedal position switch is used to prevent starter motor engagement unless the clutch pedal is depressed. An input from this switch is also used to either shut down/prevent operation of the speed control system when the clutch pedal is depressed.

Four Wheel Drive Feature: The clutch pedal position switch override relay, inhibits operation of the position switch when the vehicle transfer case is in the four wheel drive low-range position. This enables the starter motor to operate without depressing the clutch pedal, for off-road applications. If Diagnostic Trouble Codes (DTC's) for the override relay or transfer case switch are stored, override relay will be inhibited.

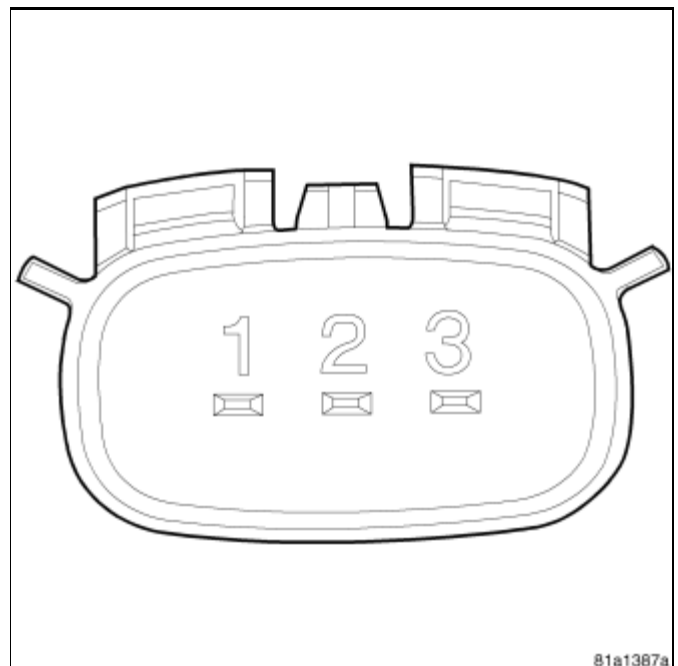
DIAGNOSIS AND TESTING

CLUTCH PEDAL POSITION SWITCH

START INTERLOCK TEST - DIESEL AND GAS

Ohm meter set on continuity: One lead on switch START INTERLOCK post 2 and second lead on COMMON post 3.

- Pedal Released - No Continuity
- Pedal Depressed End Of Stroke - Continuity



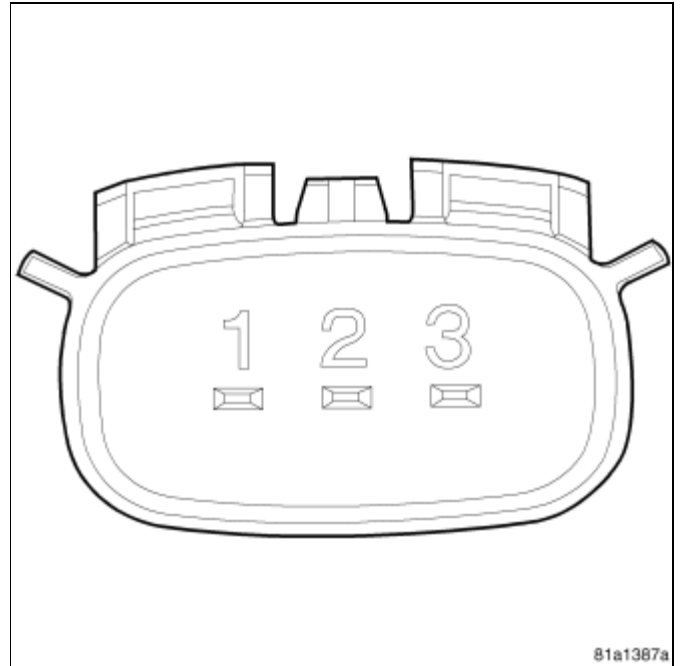
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CRUISE TEST - DIESEL ONLY

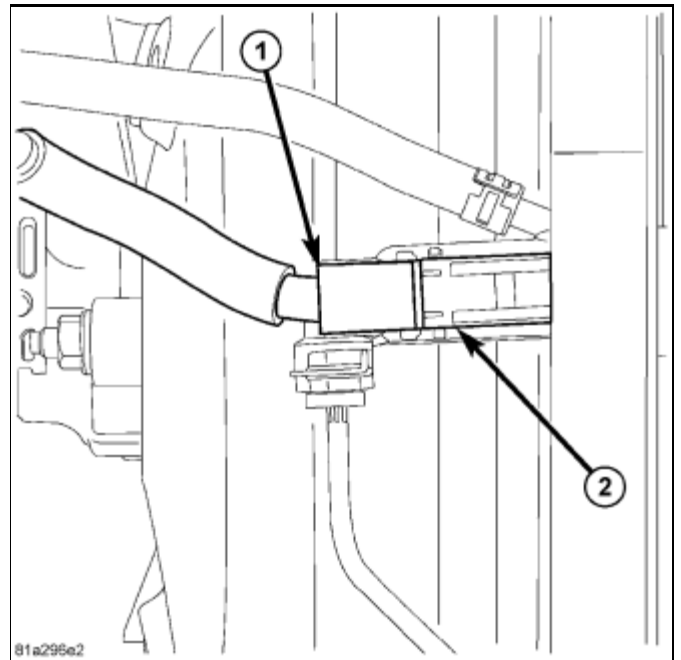
Ohm meter set on continuity: One lead on switch CRUISE post 1 and second lead on COMMON post 3.

- Pedal Released - Continuity
- Pedal Depressed Beginning Of Stroke - No Continuity

REMOVAL

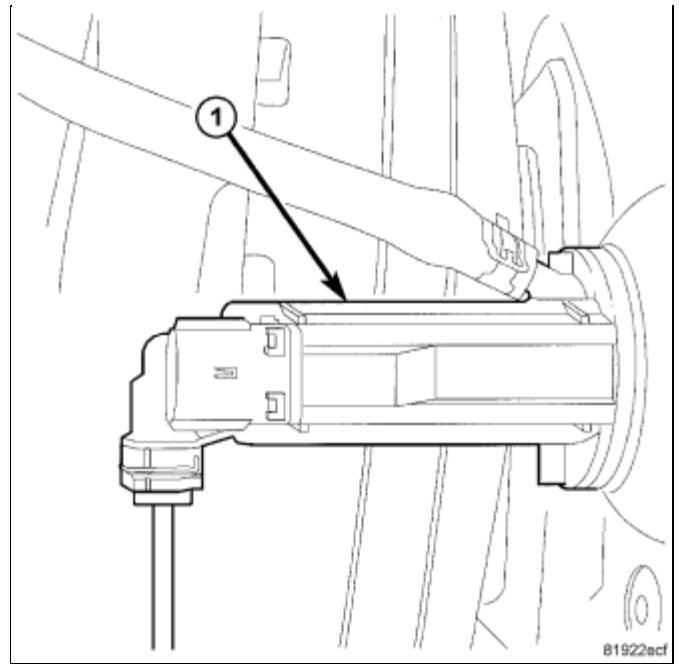


1. Disconnect wiring harness (1) from pedal position switch (2).

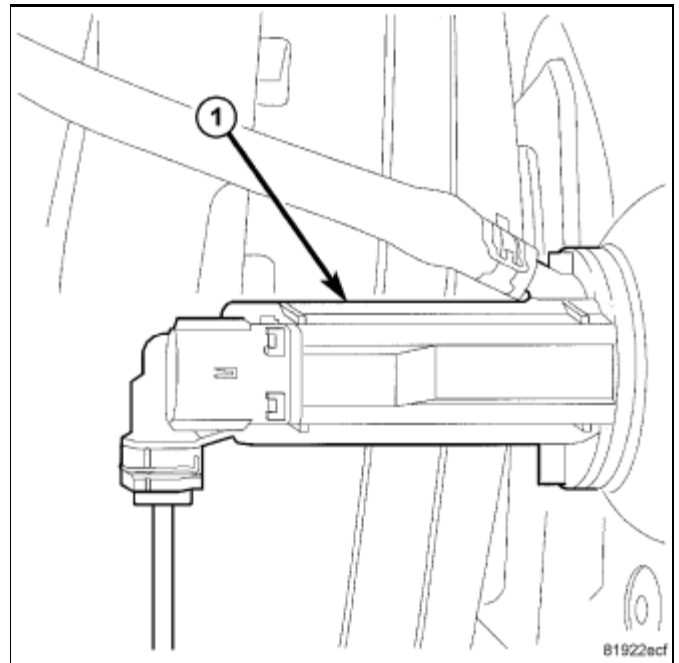


2. Pry pedal position switch (1) off clutch master cylinder.

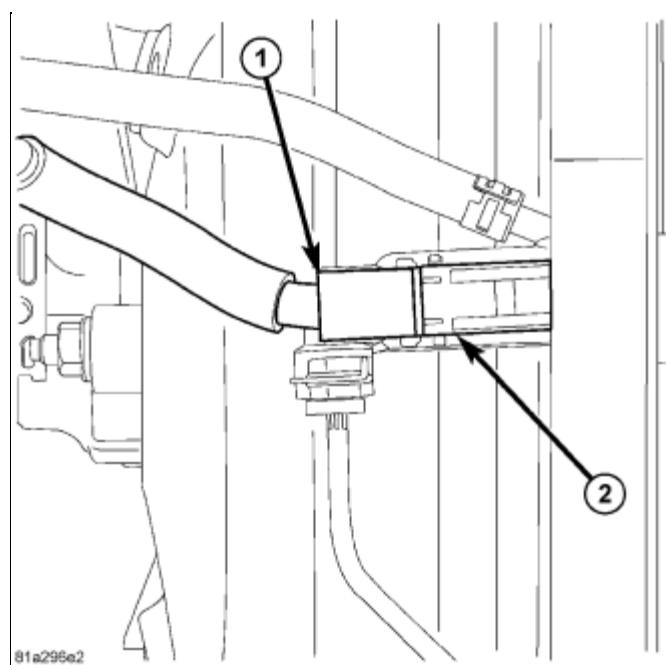
INSTALLATION



1. Snap pedal position switch (1) on clutch master cylinder.



2. Connect harness (1) to clutch pedal position switch (2).



7 - COOLING

COOLING

DESCRIPTION

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible, maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

COOLING SYSTEM COMPONENTS

The cooling system consists of:

- Charge Air Cooler (Diesel engine)
- 2 Speed Electric Cooling Fan
- Mechanical fan drive (Diesel engine)
- Aluminum-core radiator with plastic side tanks
- Pressurized coolant recovery container (Diesel engine)
- Ambient coolant recovery container (Gas engine)
- Water pump
- Combination A/C condenser/transmission oil cooler (automatic transmission)
- Thermostat
- Hoses and hose clamps

OPERATION

- When engine is cold the thermostat is closed. The cooling system has no flow through the radiator. The coolant flows through the engine, water pump, and heater.
- When engine is warm, the thermostat is full open. The coolant flows through the engine, radiator, heater, and water pump.
- On the diesel engine coolant flows through the engine, radiator, heater, and water pump.
- As coolant expands, some coolant will move to the coolant recovery container. Once the coolant cools, the coolant from the coolant recovery container will move back to the radiator. (Gas engine only)

DIAGNOSIS AND TESTING

ON-BOARD DIAGNOSTICS - OBD

COOLING SYSTEM RELATED DIAGNOSTICS

The Powertrain Control Module (PCM) has been programmed to monitor the following cooling system

components:

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician.

ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data, (Refer to 25 - EMISSIONS CONTROL/ON-BOARD DIAGNOSTICS - OPERATION).

PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- Prolonged idle
- Very high ambient temperature
- Slight tail wind at idle
- Slow traffic
- Traffic jams
- High speed or steep grades

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- Increasing engine speed for more air flow is recommended. (Diesel engine only)

TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Incorrect water pump or pump rotating in wrong direction due to belt not correctly routed

- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to [COOLING SYSTEM DIAGNOSIS CHART](#).

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat?	1. (Refer to 25 - EMISSIONS CONTROL/ON-BOARD DIAGNOSTICS - OPERATION). Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Repair as necessary.
	4. Coolant level low in cold ambient temperatures, accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank or degas bottle and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and CAUTIONS associated with removing the radiator cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) for procedures.
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. Refer to Possible Causes (2-18).
	2. Is the temperature gauge reading correctly?	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	4. Coolant low in coolant reserve/overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6.	5. Tighten cap
6. Poor seals at the radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary.
	(b) Check condition of radiator filler neck or degas bottle. If neck is bent or damaged, replace radiator or degas bottle.
7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools	7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary.
	(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.
	(c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.
	(d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.
8. Incorrect coolant concentration	8. Check coolant. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
9. Coolant not flowing through system	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.
10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
12. Dragging brakes	12. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)
13. Fuel or ignition system problems.	13. Refer to 14 - Fuel System or 8 - Electrical for diagnosis and testing procedures.
14. Bug screen or cardboard is being, reducing airflow.	14. Remove bug screen or cardboard.
15. Thermostat partially or completely shut.	15. Check thermostat operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL) .

	16. Viscous fan drive not operating properly.	16. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL) .
	17. Cylinder head gasket leaking.	17. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	18. Heater core leaking.	18. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING). Repair as necessary.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES, OR IS ERRATIC	1. During cold weather operation, with the heater in the high position, the gauge reading may drop slightly.	1. During cold weather operation, with the heater in the high position, the gauge reading may drop slightly.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)	3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting a warmed up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
		(b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL).
	8. Loose accessory drive belt. (water pump slipping)	8. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary.
	9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR

TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK		PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.	
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).	
DETONATION OR PRE- IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating.	1. Check reason for overheating and repair as necessary.	
	2. Freeze point of coolant not correct. Mixture is too rich or too lean.	2. Check coolant concentration. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).	
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system.	1. (a) Radiator cap relief valve stuck. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary	
		(b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary.	
		(c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary.	
		(d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.	
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose.	1. Replace fan blade assembly. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).	
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.	
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.	
	4. Thermal viscous fan drive has defective bearing.	4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).	
	5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	5. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DESCRIPTION) for an explanation of normal fan noise.	
INADEQUATE HEATER PERFORMANCE. THERMOSTAT	1. Has a Diagnostic trouble Code (DTC) been set?	1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).	

FAILED IN OPEN POSITION		
	2. Coolant level low	2. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	3. Obstructions in heater hose/fittings	3. Remove heater hoses at both ends and check for obstructions
	4. Heater hose kinked	4. Locate kinked area and repair as necessary
	5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	5. (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL). If a slipping belt is detected, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). If heater core obstruction is detected, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/HEATER CORE - REMOVAL)
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) Adjust coolant mixture as necessary.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

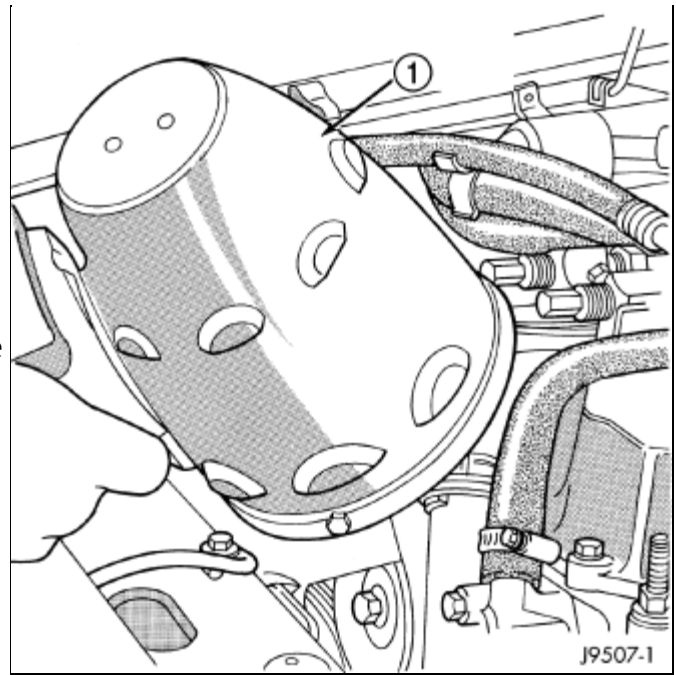
LEAK TESTING

ULTRAVIOLET LIGHT METHOD

All Jeep models have a leak detection additive added to the cooling system before they leave the factory. The additive is highly visible under ultraviolet light (black light). If the

factory original coolant has been drained, pour one ounce of additive into the cooling system. The additive is available through the parts department. Place the heater control unit in HEAT position. Start and operate the engine until the radiator upper hose is warm to the touch. Aim the commercially available black light tool at the components to be checked. If leaks are present, the black light will cause the additive to glow a bright green color.

The black light can be used along with a pressure tester to determine if any external leaks exist.

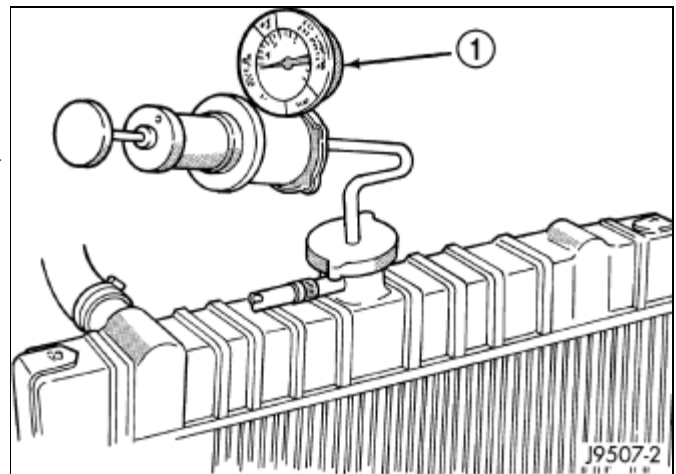


PRESSURE TESTER METHOD

The engine should be at the normal operating temperature. Recheck the system cold if the cause of coolant loss is not located during warm engine examination.

WARNING: Hot, pressurized coolant can cause injury by scalding.

Carefully remove the radiator pressure cap from the filler neck and check the coolant level. Push down on the cap to disengage it from the stop tabs. Wipe the inner part of the filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect the reserve/overflow tank tube for internal obstructions. Insert a wire through the tube to be sure it is not obstructed.



Inspect the cams on the outside part of the filler neck. If the cams are bent, seating of pressure cap valve and tester seal will be affected. Replace cap if cams are bent.

Attach pressure tester 7700 (or an equivalent) to the radiator filler neck.

Operate the tester pump to apply 124 kPa (18 psi) pressure to the system. If the hoses enlarge excessively or bulge while testing, replace as necessary. Observe the gauge pointer and determine the condition of the cooling system according to the following criteria:

- **Holds Steady:** If the pointer remains steady for two minutes, there are no serious coolant leaks in the system. However, there could be an internal leak that does not appear with normal system test pressure. Inspect for interior leakage or do the Internal Leakage Test. Do this if it is certain that coolant is being lost and no leaks can be detected.
- **Drops Slowly:** Shows a small leak or seepage is occurring. Examine all connections for seepage or slight

leakage with a flashlight. Inspect the radiator, hoses, gasket edges and heater. Seal any small leak holes with a Sealer Lubricant or equivalent. Repair leak holes and reinspect the system with pressure applied.

- Drops Quickly: Shows that a serious leakage is occurring. Examine the system for serious external leakage. If no leaks are visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove the engine oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier than engine oil, will drain first. Another way of testing is to operate the engine and check for water globules on the engine oil dipstick. Also inspect the automatic transmission oil dipstick for water globules. Inspect the automatic transmission fluid cooler for leakage. Operate the engine without the pressure cap on the radiator until thermostat opens.

Attach a pressure tester to the filler neck. If pressure builds up quickly, a leak exists as a result of a faulty cylinder head gasket or crack in the engine. Repair as necessary.

WARNING: Do not allow pressure to exceed 124 kPa (18 psi). Turn the engine off. To release the pressure, rock the tester from side to side. When removing the tester, do not turn the tester more than 1/2 turn if the system is under pressure.

If there is no immediate pressure increase, pump the pressure tester until the indicated pressure is within the system range. Vibration of the gauge pointer indicates compression or combustion leakage into the cooling system.

WARNING: Do not disconnect the spark plug wires while the engine is operating.

CAUTION: Do not operate the engine with a spark plug shorted for more than a minute. The catalytic converter may be damaged.

Isolate the compression leak by shorting each spark plug to the cylinder block. The gauge pointer should stop or decrease vibration when spark plug for leaking cylinder is shorted. This happens because of the absence of combustion pressure.

COMBUSTION LEAKAGE TEST (WITHOUT PRESSURE TESTER)

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and under pressure. Serious burns from coolant can occur.

Remove thermostat (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).

Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Add coolant to the radiator to bring the level to within 6.3 mm (1/4 in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate boil over of coolant.

Start the engine and accelerate rapidly three times (to approximately 3000 rpm) while observing the coolant. If internal engine combustion gases are leaking into the cooling system, bubbles will appear in the coolant. If

bubbles do not appear, there is no internal combustion gas leakage.

STANDARD PROCEDURE

CLEANING/REVERSE FLUSHING

CAUTION: The cooling system normally operates at 97 - 110 kPa (14 -16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

CHEMICAL CLEANING

If visual inspection indicates the formation of sludge or scaly deposits, use a radiator cleaner, Mopar® Radiator Kleen or equivalent, before flushing. This will soften scale and other deposits and aid the flushing operation.

CAUTION: Be sure instructions on the container are followed.

REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: The cooling system normally operates at 97 - 110 kPa (14 - 16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

CAUTION: Be sure that the heater control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied

with flushing equipment.

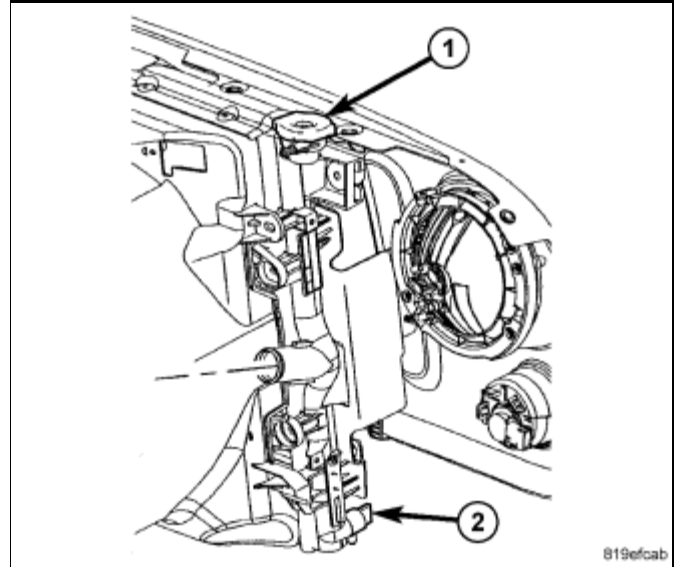
Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Install the thermostat and housing with a replacement gasket (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION). Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

DRAINING COOLING SYSTEM

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with system hot and under pressure. Serious burns from coolant can occur.

NOTE: Radiator draincock is located on the right/lower side of radiator facing to front of vehicle.

1. Remove radiator pressure cap from radiator or coolant recovery container as necessary.
2. Raise and support vehicle.
3. Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator.
4. If necessary, siphon coolant from coolant recovery container. (Diesel engine)



COOLING - REFILLING

1. Tighten the radiator draincock and the cylinder block drain plug(s).
2. Fill system with an antifreeze mixture (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION). Fill the radiator to the top and install the radiator cap. Add sufficient coolant to the reserve/overflow tank to raise the level to the FULL mark.
3. Operate the engine with both the radiator cap and reserve/overflow tank cap in place. After the engine has reached the normal operating temperature, shut the engine off and allow it to cool.
4. Add coolant to the reserve/overflow tank as necessary. **Only add coolant when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

COOLANT LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant reserve/overflow tank.

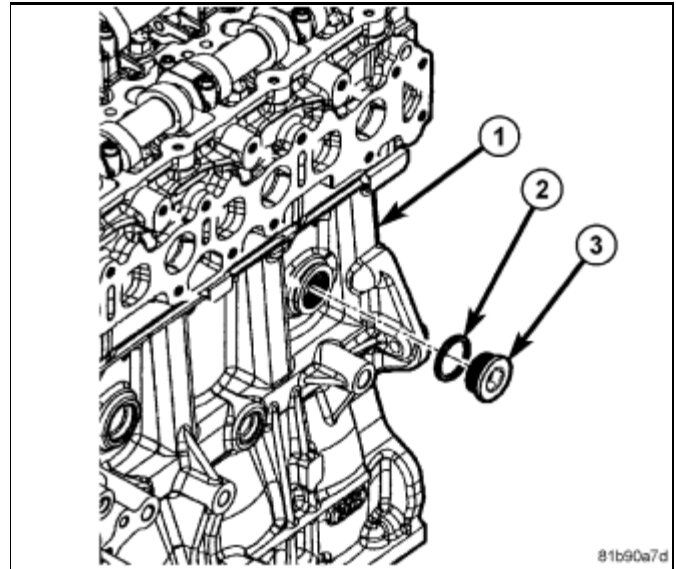
The coolant reserve/overflow system provides a quick visual method for determining coolant level without removing radiator pressure cap. With engine idling and at normal operating temperature, observe coolant level in reserve/overflow tank. The coolant level should be between ADD and FULL marks.

DRAINING - 2.8L DIESEL

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with system hot and under pressure. Serious burns from coolant can occur.

DO NOT remove the radiator cap when draining the coolant from the reserve/overflow tank. Open the radiator draincock and when the tank is empty, remove the radiator cap. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture.

1. Drain the coolant from the radiator by loosening the draincock.
2. Drain coolant from engine block by removing the block heater plug.



SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, Block Heater	2	-	17
Bolts, Condenser to Radiator			
Electric Fan to Fan Shroud bolts	6		53
Bolts, Fan Blade Assembly to Viscous Drive - Diesel	23	-	210
Viscous Fan Drive - Diesel	50	37	-
Bolts, Fan Shroud to Radiator Mounting	8	-	70
Bolts, Radiator Upper Isolator to Crossmember	9	-	80
Bolts, Thermostat Housing-	28	-	250
Accessory Drive Belt Tensioner Bolt	45	33	-
Idler Pulley Bolt	45	33	-
Bolts, Water Pump			

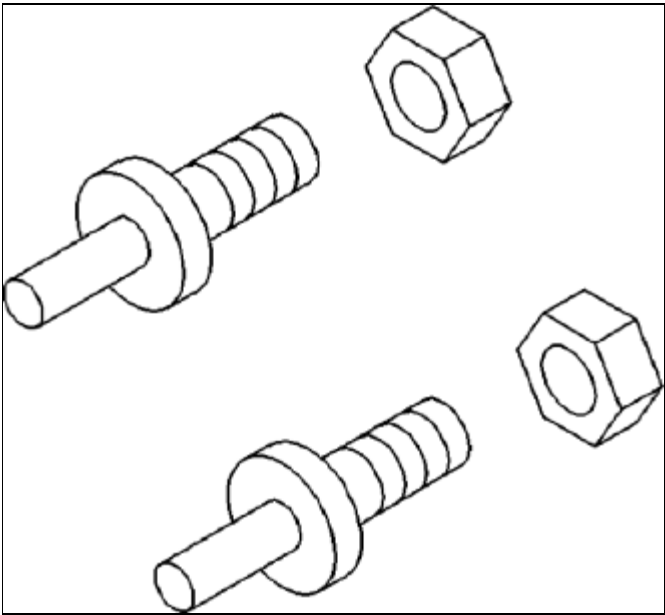
	3.8L	12	-	105
	2.8L	32	23	-

FILL VOLUMES

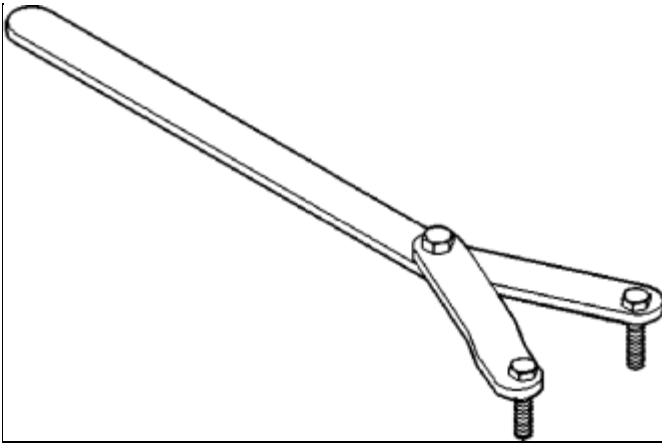
DESCRIPTION	SPECIFICATION	
	Metric	US
3.7L	12L	13 qts.
2.8L DIESEL	12 L	13 qts

SPECIAL TOOLS

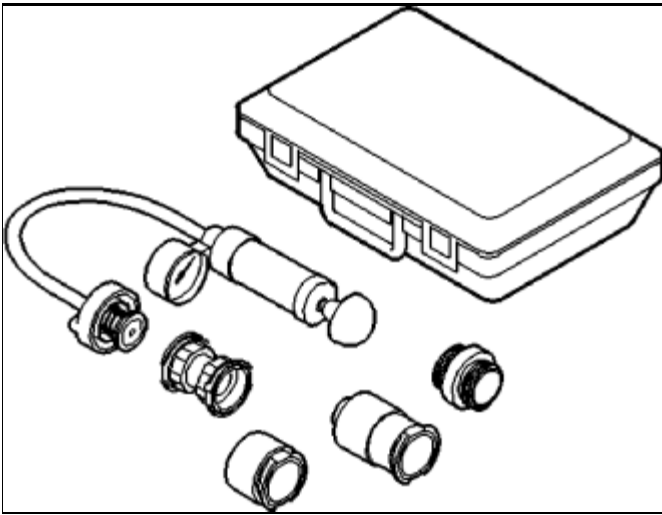
COOLING



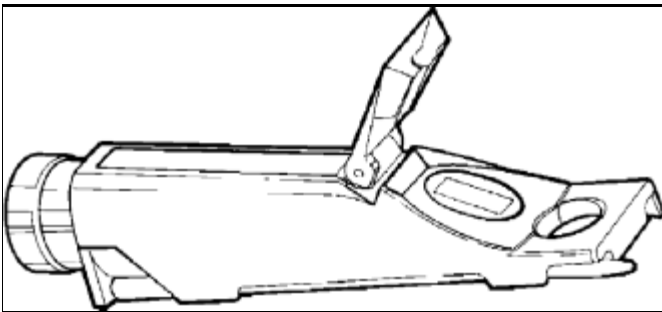
Adapter Pins 8346



Spanner Wrench 6958 with 8346 adapter pins



Pressure Tester 7700



Coolant Refractometer 8286

ACCESSORY DRIVE

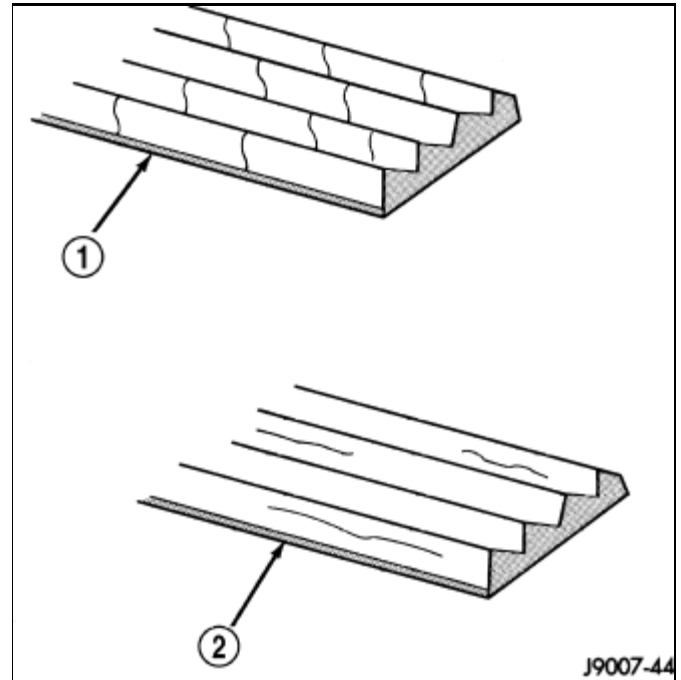
BELTS-ACCESSORY DRIVE

DIAGNOSIS AND TESTING

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (1), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) (2) are **not** normal. Any belt with cracks running along a rib must be replaced. Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the [ACCESSORY DRIVE BELT DIAGNOSIS CHART](#) for further belt diagnosis.



NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary

	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Adjust tension (2.5L)
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
"GROOVE JUMPING" (Belt does not maintain correct position on pulley)	1. Belt tension either too low or too high	1. Replace accessory drive belt tensioner (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Excessive tension	1. Replace belt and adjust tension to specification
	2. Tensile member damaged during belt installation	2. Replace belt
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Belt slippage	1. Replace accessory drive belt tensioner (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)

	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
	6. System resonant frequency induced vibration	6. Vary belt tension within specifications.
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Excessive tension	1. Replace accessory drive belt tensioner (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt and adjust tension to specifications

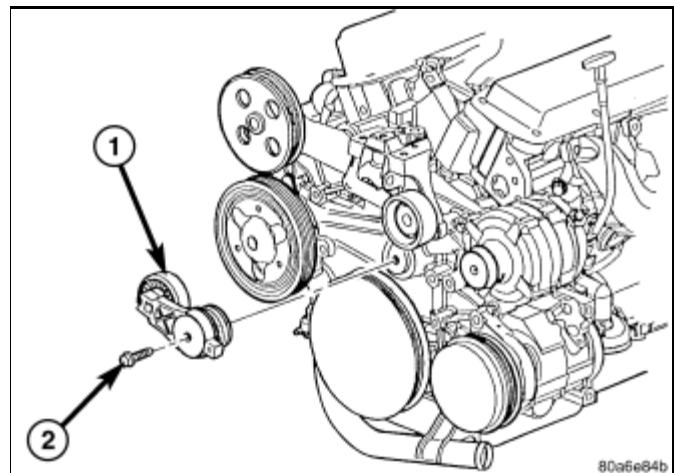
REMOVAL

3.8L

CAUTION: Do not let tensioner arm snap back to the freearm position, severe damage may occur to the tensioner.

1. Disconnect negative battery cable from battery.
2. Rotate belt tensioner **clockwise** until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position .

2.8L DIESEL

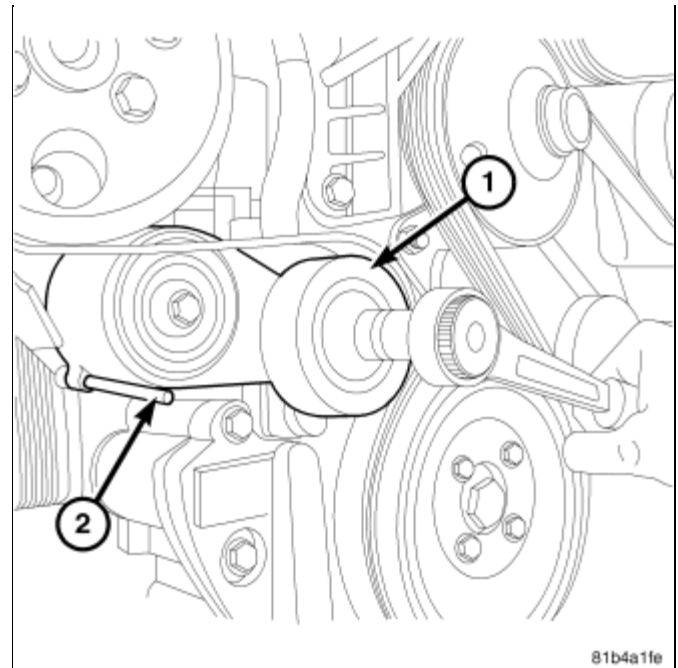


CAUTION: Do not let tensioner arm snap back to the freearm position, severe damage may occur to the tensioner.

1. Disconnect negative battery cable.
2. Using a suitable tool, rotate accessory drive belt tensioner until holes on arm and base are aligned.
3. Insert pin into hole to lock tensioner in place.
4. Remove accessory drive belt.

INSTALLATION

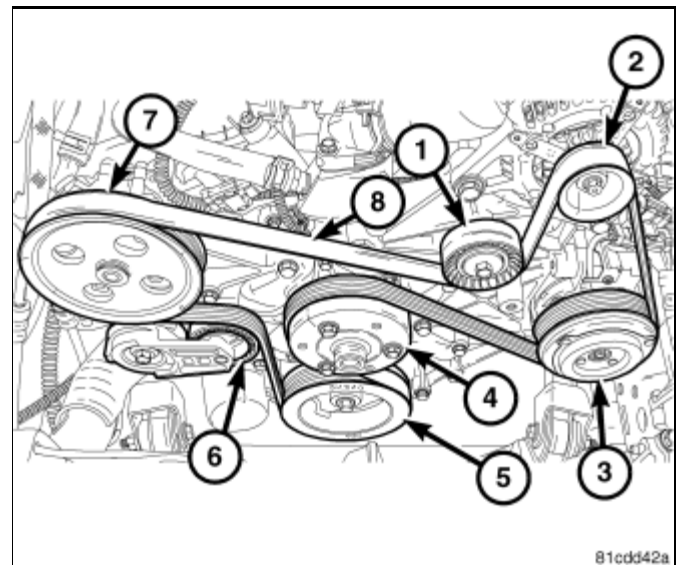
3.8L



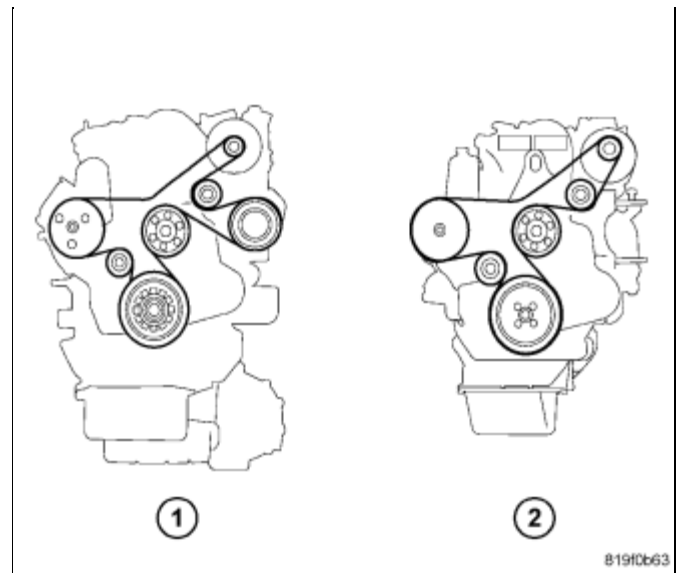
1. Check condition of all pulleys.

CAUTION: When installing the accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.

2. Route belt around all pulleys except the idler pulley (1). Rotate the tensioner arm **clockwise** until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.



2.8L DIESEL



BELT ROUTING

1 - WITH A/C
2 - WITHOUT A/C

1. Check condition of all pulleys.

CAUTION: When installing the accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.

2. Install accessory drive belt. Route the belt around all pulleys (1 or 2).

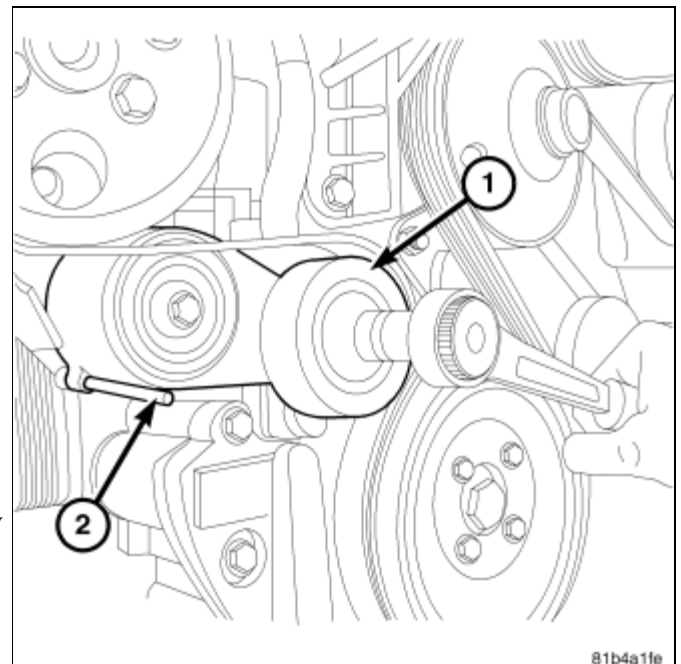
3. Using a suitable tool, hold accessory drive belt tensioner and remove pin.
4. Make sure the belt is seated onto all pulleys.
5. Slowly release tensioner into accessory drive belt.

TENSIONER-ACCESSORY DRIVE BELT

DESCRIPTION

The automatic belt tensioner is a spring loaded arm and pulley assembly. The tensioner assembly is designed to apply constant pressure on the accessory drive belt to maintain proper belt tension.

OPERATION



WARNING: The automatic belt tensioner assembly is spring loaded. Do not attempt to disassemble the tensioner assembly.

The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

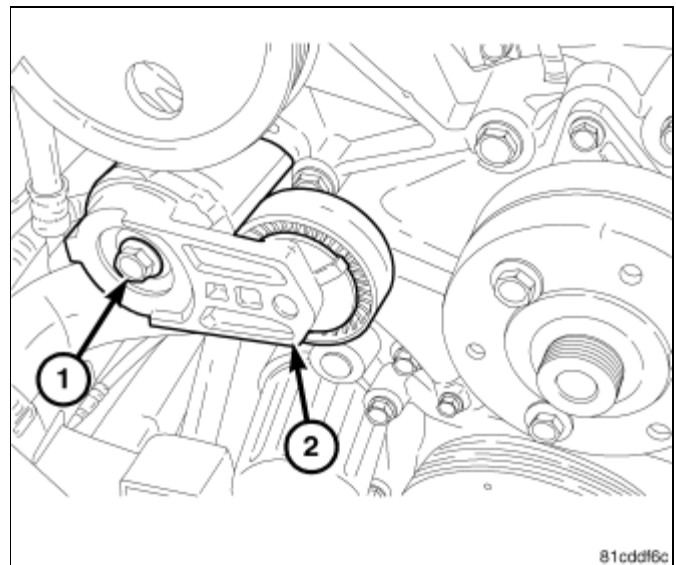
- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

REMOVAL

3.8L

1. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
2. Remove accessory drive belt tensioner mounting bolt (1).
3. Remove accessory drive belt tensioner (2) from engine front cover .

WARNING: Because of high spring tension, do not attempt to disassemble automatic tensioner. Unit is serviced as an assembly.

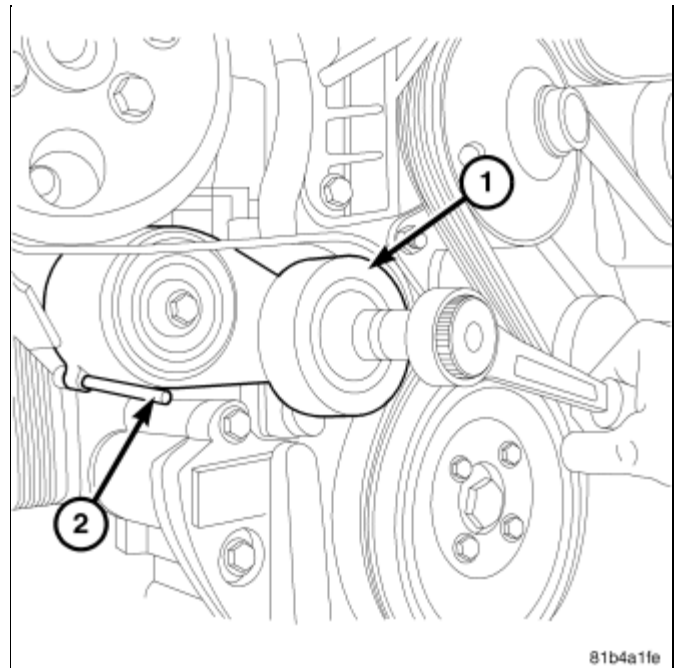


2.8L DIESEL

1. Disconnect negative battery cable.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Using a suitable tool, hold accessory drive belt tension and remove pin.
4. Slowly release accessory drive belt tensioner to the freearm position.
5. Remove belt tensioner retaining bolt and remove accessory drive belt tensioner.

INSTALLATION

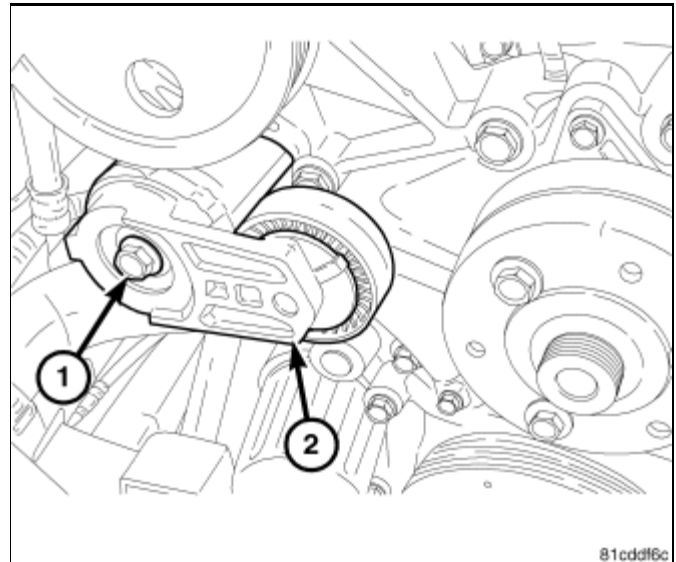
3.8L



81b4a1fe

1. An indexing slot is located on back of tensioner (2). Align this slot to the head of the bolt on the front cover. Install the mounting bolt (1) . Tighten bolt to 41 N·m (30 ft. lbs.).
2. Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

2.8L DIESEL ENGINE



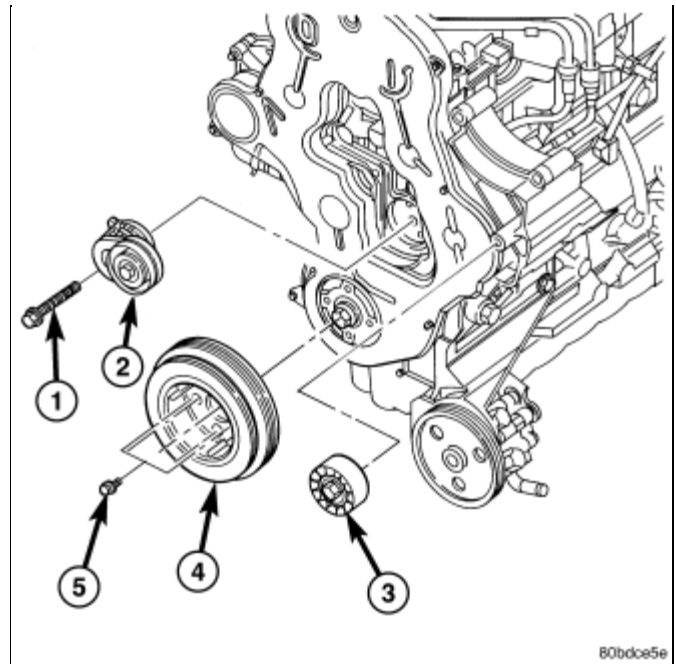
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1. Install belt tensioner and retaining bolt. Torque bolt to 55 N·m (40 ft. lbs.).
2. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

PULLEY-IDLER

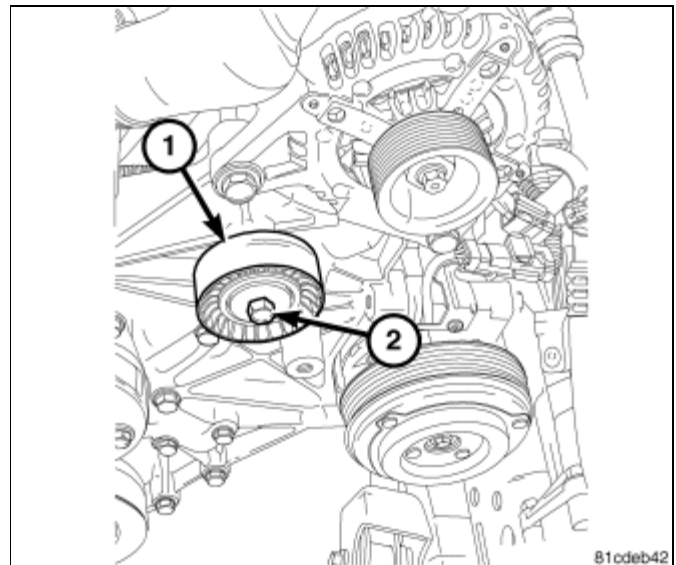
REMOVAL

3.8L ENGINE



1. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)
2. Remove bolt (1) and idler pulley (2).

2.8L DIESEL

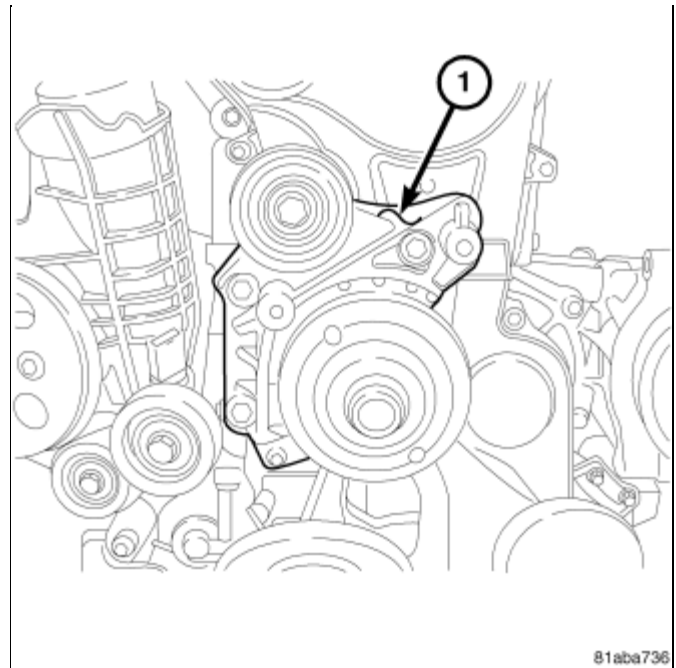


CAUTION: The retaining bolts on the idler pulleys are left hand thread.

1. Disconnect negative battery cable.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove idler pulley retaining bolts and pulley.

INSTALLATION

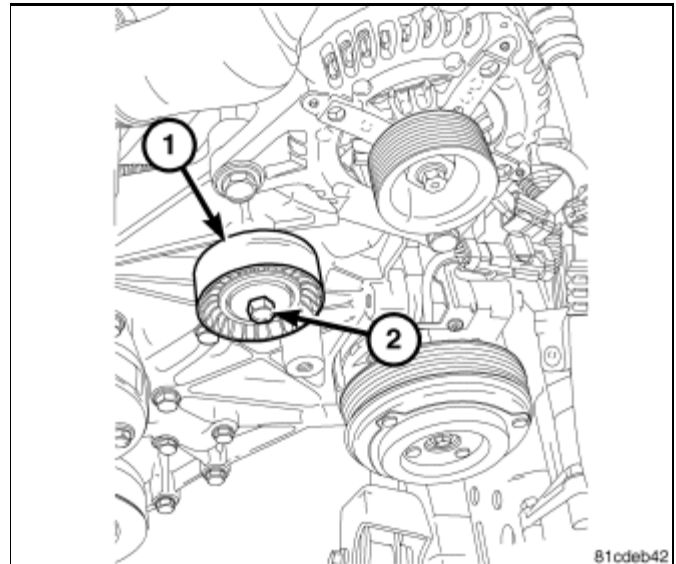
3.8L ENGINE



81aba736

1. Install idler pulley (1) and pulley bolt (2). Tighten bolt to 61 N·m (45 ft. lbs.) torque.
2. install accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

2.8L DIESEL



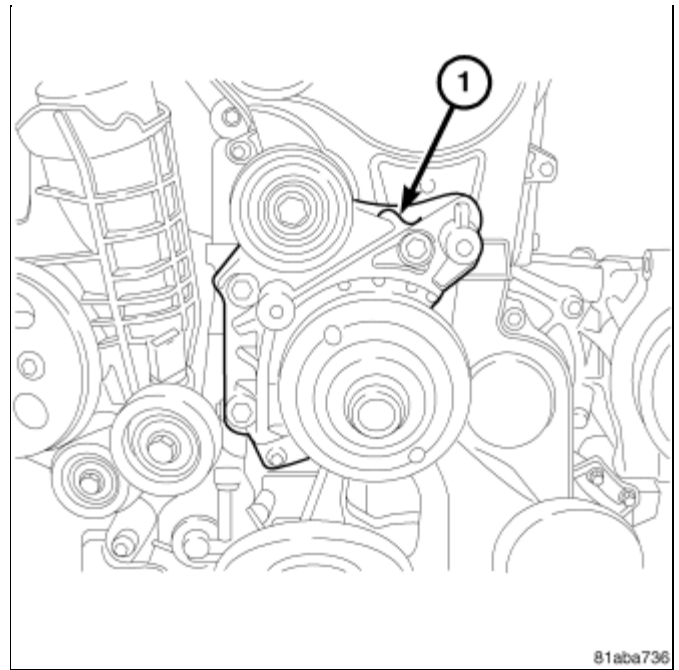
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1. Install idler pulley and retaining bolt. Tighten bolts to 53 N·m (39 ft. lbs.)
2. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
3. Connect negative battery cable.

ENGINE

COOLANT

DESCRIPTION



DESCRIPTION - ENGINE COOLANT

WARNING: Antifreeze is an ethylene glycol base coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene glycol. Keep out of reach of children. Dispose of glycol base coolant properly, contact your dealer or government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (ethylene-glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain a freeze point of -37°C (-35°F).

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68% antifreeze concentration, which prevents freezing down to -67.7° C (-90° F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22°C (-8°F).

PROPYLENE-GLYCOL MIXTURES

Its overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32°C (-26°F). 5°C (41°F) higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125°C (257°F) at 96.5 kPa (14 psi), compared to 128°C (263°F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene-glycol also has poorer heat transfer characteristics than ethylene-glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene-glycol.

HOAT COOLANT

WARNING: Antifreeze is an ethylene-glycol base coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene-glycol. Keep out of reach of children. Dispose of glycol base coolant properly, contact your dealer or government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.

CAUTION: Use of Propylene-Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene-glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% ethylene-glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Mopar® Antifreeze/Coolant, 5Year 160,000 km (100,000 Mile) Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.

COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

Pure Water-Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

100 % Ethylene-Glycol-The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 % ethylene-glycol freezes at -22°C (-8°F).

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 %, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 % antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

DIESEL ENGINE

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less boiling protection.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Glysantin G 30-91 Antifreeze/Coolant, 5 Year/150,000 Mile Formula (ASTM D3306), or the equivalent ethylene glycol based coolant. This coolant offers the best engine cooling without corrosion when mixed with 50% coolant and 50% distilled water to obtain a freeze point of -36°C (-34°F). It is dyed purple to distinguish it's unique chemistry from traditional green and yellow silicate coolants. If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

The purple coolant **MUST NOT BE MIXED** with the orange, green or magenta coolants. When replacing coolant the complete system flush must be performed before using the replacement coolant.

CAUTION: Glysantin G 30-91 Antifreeze/Coolant, 5 Year/150,000 Mile Formula (ASTM D3306) may not be mixed with any other type of antifreeze. Doing so will reduce the corrosion protection and may result in premature water pump seal failure.

OPERATION

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the

cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

DIAGNOSIS AND TESTING

COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -46°C (-50°F). The a hydrometer or a refractometer can be used to test coolant concentration.

A hydrometer will test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene-glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 60% by volume glycol).

A refractometer, Tool 8286 (Refer to 7 - COOLING - SPECIAL TOOLS) will test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene-glycol is the most common new coolant. However, propylene-glycol based coolants do not provide the same freezing protection and corrosion protection and is not recommended.

CAUTION: Do not mix types of coolant - corrosion protection will be severely reduced.

CONTAINER-COOLANT RECOVERY

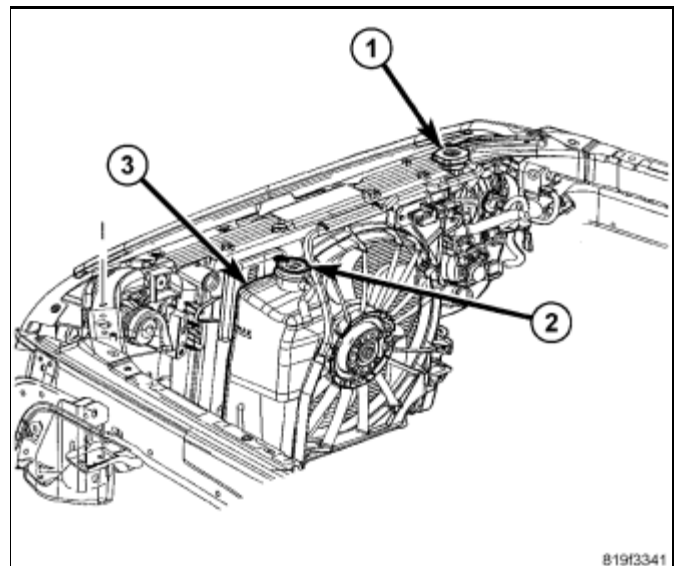
DESCRIPTION

GAS ENGINE

The coolant reserve/overflow system consists of a radiator mounted pressurized cap, a plastic coolant recovery bottle, a hose connecting the radiator and recovery bottle, and an overflow tube on the side of the bottle.

The reservoir bottle also has an anti-slosh insert located within the bottle, this insert will aid in reducing coolant loss from splash and spillage.

DIESEL ENGINE



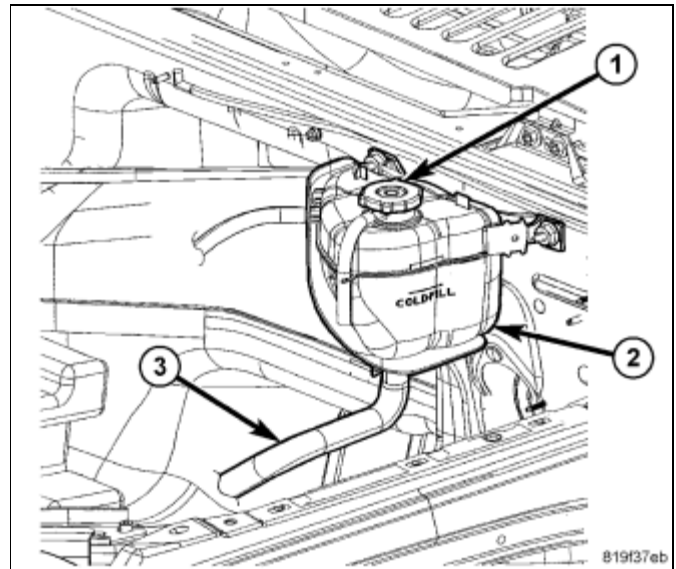
The coolant recovery system consists of a radiator, a plastic coolant recovery container with a pressurized cap, a hose connecting the radiator and the pressurized coolant recovery container, and an overflow tube on the side of the bottle.

OPERATION

GAS ENGINE

The system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.



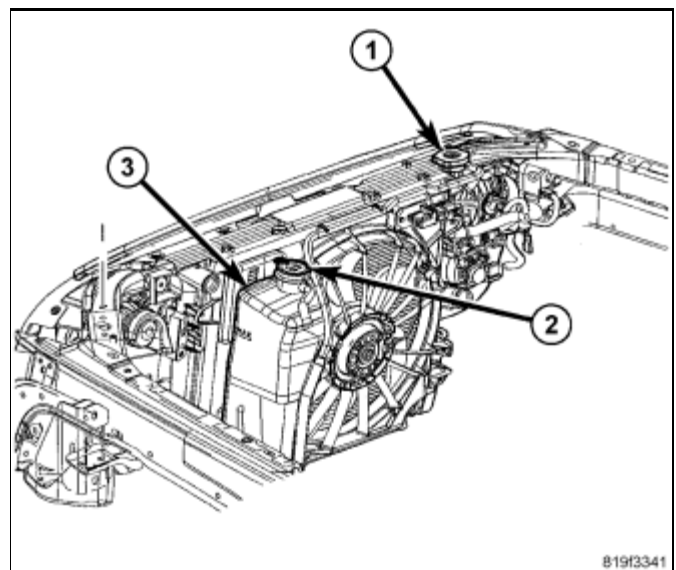
As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

REMOVAL

GAS ENGINE

1. Disconnect the hose from radiator filler neck.
2. Remove coolant recovery bottle.

DIESEL ENGINE

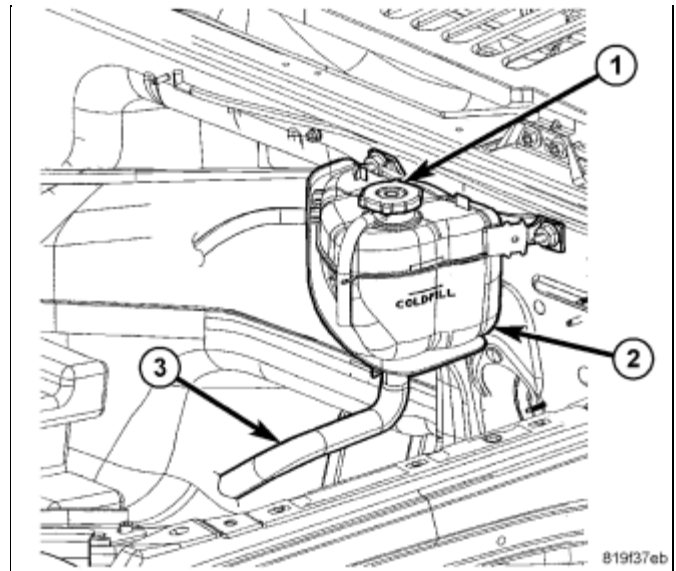


1. Remove coolant recovery container pressure cap.
2. Remove and plug coolant recovery tube.
3. Remove mounting nuts.

4. Remove coolant recovery container from vehicle.

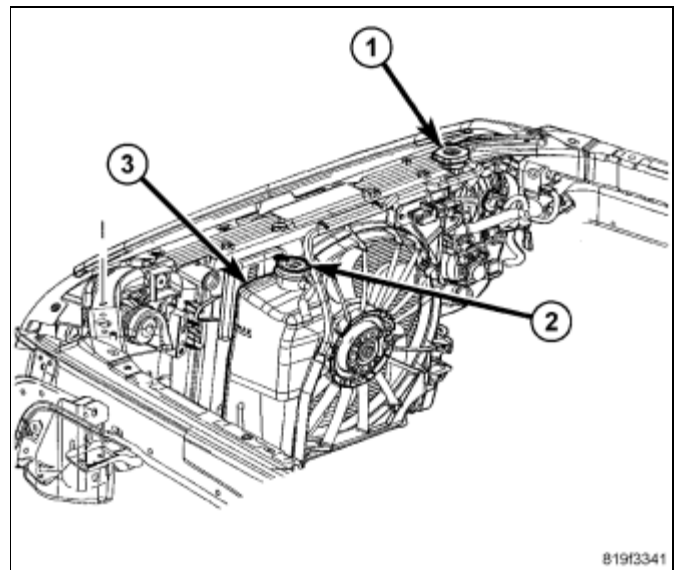
INSTALLATION

GAS ENGINE



1. Position the tabs on the overflow bottle into the slots on the fan shroud.
2. Reconnect the overflow hose onto the radiator filler neck.
3. Fill coolant recovery container (Refer to 7 - COOLING - STANDARD PROCEDURE).

DIESEL ENGINE

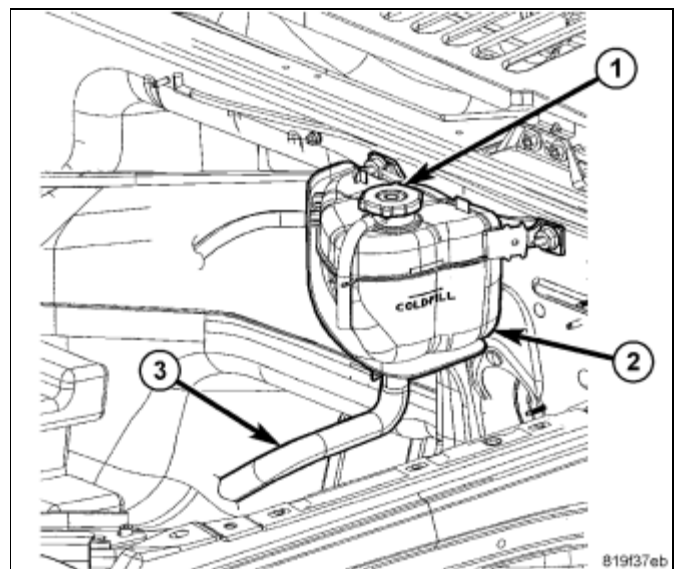


1. Position coolant recovery container.
2. Install mounting nuts. Tighten to 10 N·m (89 in. lbs.).
3. Install coolant recovery tube.
4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Install coolant recovery container pressure cap.

HEATER-ENGINE BLOCK

DESCRIPTION

WARNING: Do not operate engine unless block heater cord has been disconnected from power source and secured in place.



An optional engine block heater is available for all models. The heater is equipped with a power cord. The cord

is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block (in place of a freeze plug) with the heating element immersed in engine coolant.

OPERATION

Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded, three-wire extension cord, supplies the electricity required to heat the element thus heating the engine coolant.

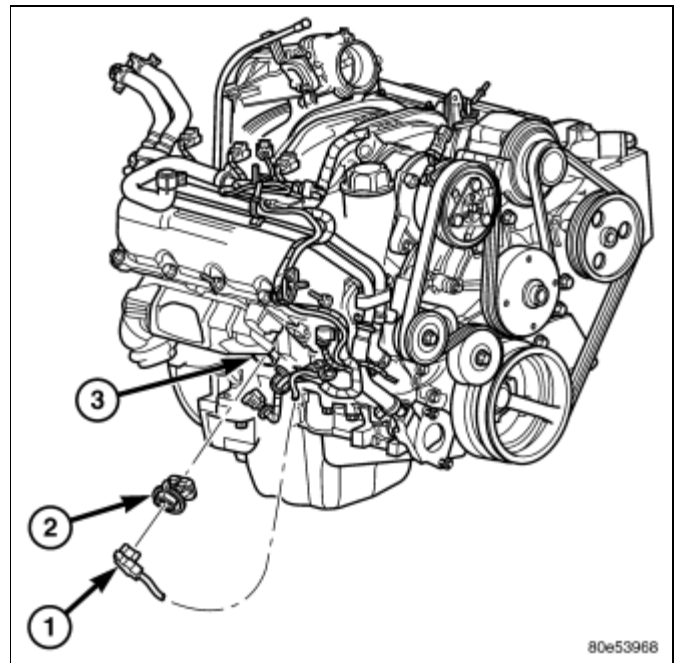
REMOVAL

3.8L ENGINE

1. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Raise vehicle on hoist.
3. Detach power cord plug from heater.
4. Loosen screw in center of heater. Remove heater assembly.

INSTALLATION

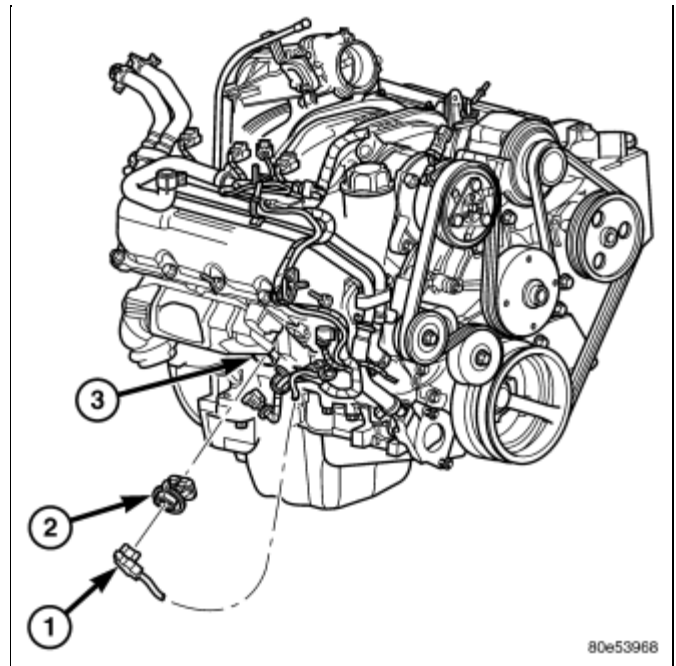
3.8L ENGINE



1. Thoroughly clean core hole and heater seat.
2. Insert heater assembly with element loop positioned **upward**.
3. With heater seated, tighten center screw securely to assure a positive seal.

CAUTION: To prevent damage, the power cord must be secured in it's retaining clips, and not positioned so it could contact linkages or exhaust manifold.

4. Connect power cord to heater.
5. Lower vehicle.
6. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



SENSOR-ENGINE COOLANT TEMPERATURE

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

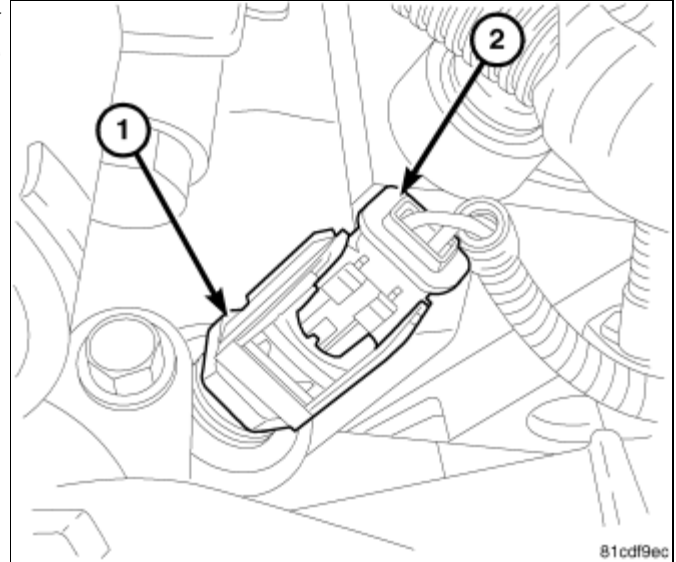
- For engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

REMOVAL

3.8L ENGINE

WARNING: Hot, pressurized coolant can cause injury by scalding. Cooling system must be partially drained before removing the coolant temperature sensor.

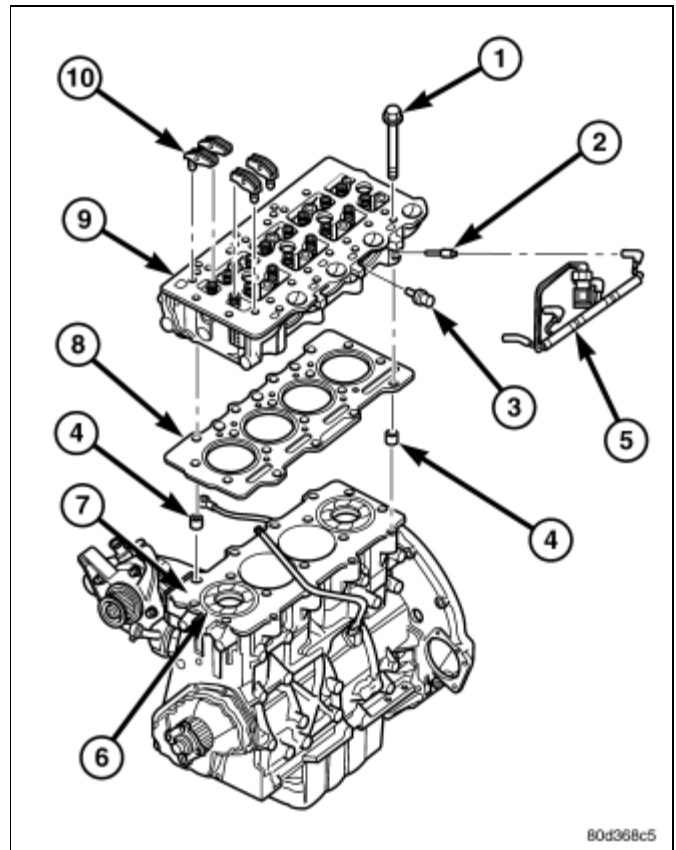
1. Remove air cleaner assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
2. Partially drain the cooling system.
3. Disconnect the electrical connector (2) from the engine coolant sensor (1).
4. Remove the sensor from the intake manifold.



2.8L DIESEL

WARNING: Do not remove or loosen the coolant pressure/vent cap, cylinder block drain plugs, or the draincock when the system is hot and under pressure because serious burns from the coolant can occur.

1. Disconnect negative battery cable.
2. Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Disconnect coolant temperature sensor electrical connector.
4. Remove coolant temperature sensor (3) from cylinder head.



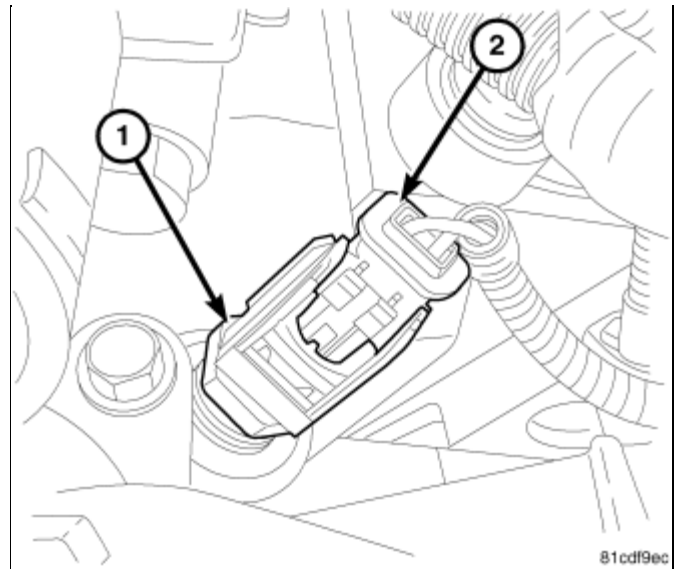
INSTALLATION

3.8L ENGINE

1. Apply sealant to ECT sensor threads (new replacement

- ECT sensors will have sealant already applied).
2. Install ECT sensor (1) into intake manifold. Tighten to 11 N·m (8 ft. lbs.) torque.
 3. Connect electrical connector (2).
 4. Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE).
 5. Install air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

2.8L DIESEL ENGINE



1. Install coolant temperature sensor in thermostat housing.
2. Connect coolant temperature sensor electrical connector .
3. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Connect negative battery cable.

FAN-RADIATOR

DESCRIPTION

The electric cooling fan replaces the engine driven mechanical fan. The electric cooling fan is integral to the fan shroud and is located between the radiator and the engine.

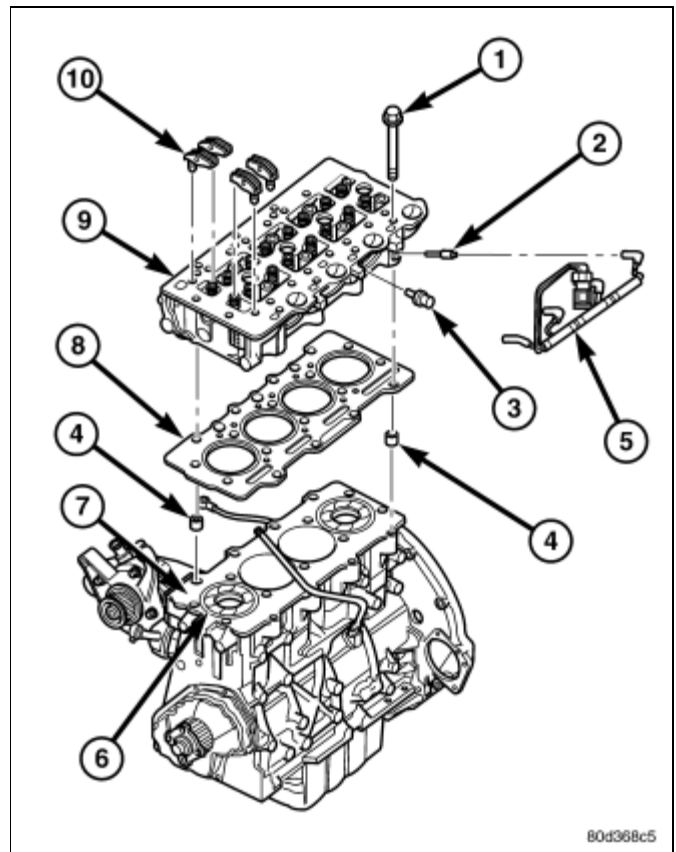
The electric fan is controlled by the electronic control module (ECM).

The electric cooling fan is not serviceable. Any failure of the fan blade, electric motor or fan shroud requires replacement of the fan module.

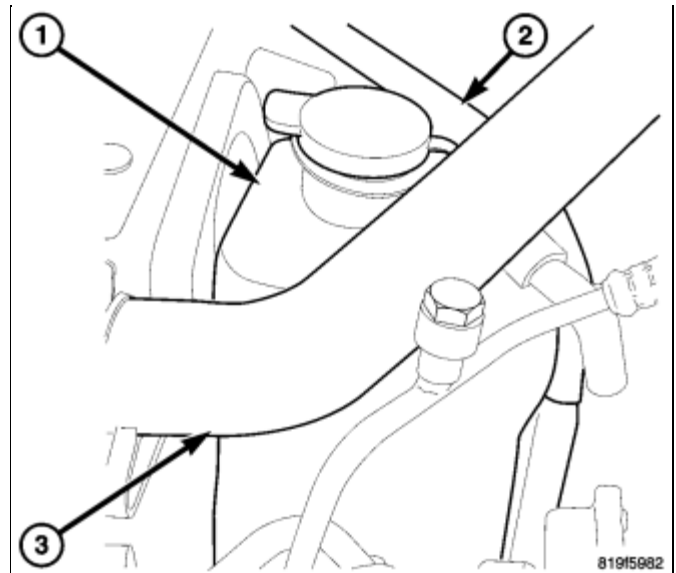
CAUTION: Do not attempt to service the electric cooling fan or fan blades separately, replace the cooling module as an assembly. Failure to do so may cause severe damage to the electric cooling fan assembly.

REMOVAL

1. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



2. Remove upper radiator hose (3).
3. Remove hose (2).
4. Remove the coolant recovery container (1) and position out of the way.



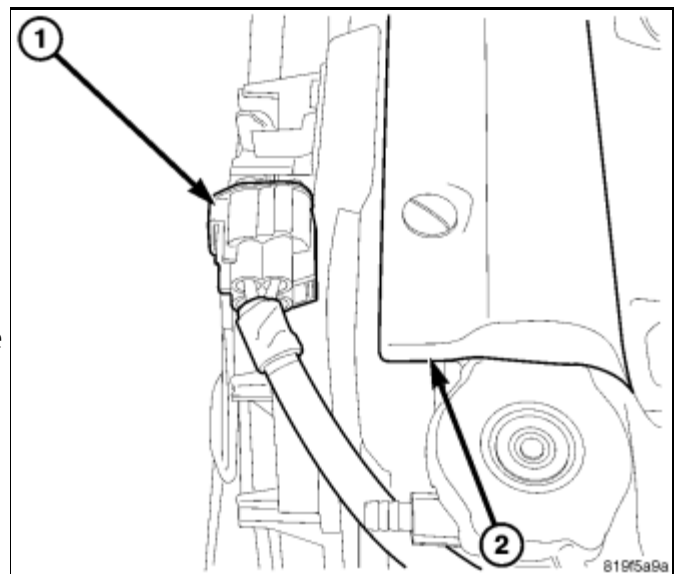
5. Disconnect the electrical connector (1).
6. Remove radiator upper seal (2).
7. Remove the mounting screws.
8. Remove the cooling fan assembly .

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: Do not attempt to bend or straighten fan blades if fan is not within specifications.



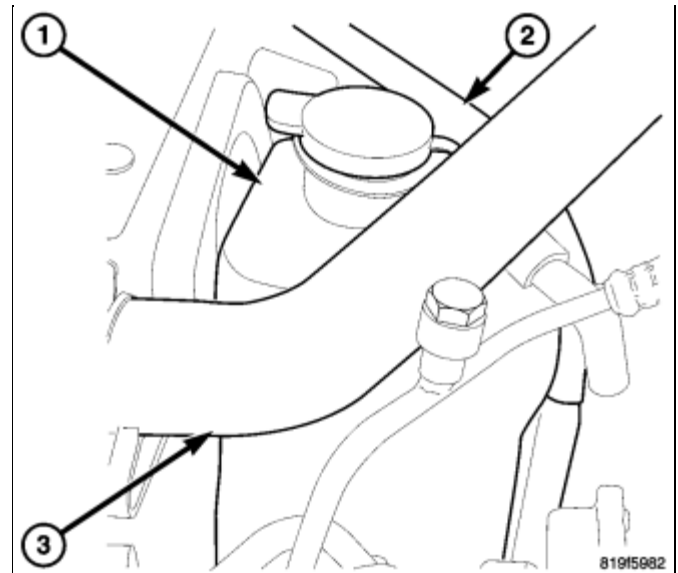
CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

1. Remove fan blade assembly from viscous fan drive unit (four bolts).
2. Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.
3. Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

INSTALLATION

1. Position the cooling fan assembly.
2. Install mounting screws. Tighten to 5.5 N·m (50 in. lbs.)

3. Install upper radiator hose (3)



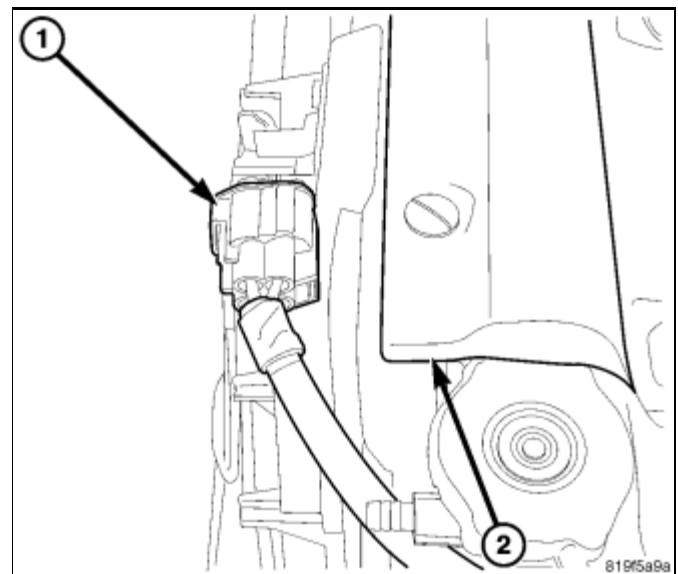
4. Install upper radiator seal (2).

5. Connect the electrical connector (1).

6. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

THERMOSTAT-ENGINE COOLANT

DESCRIPTION



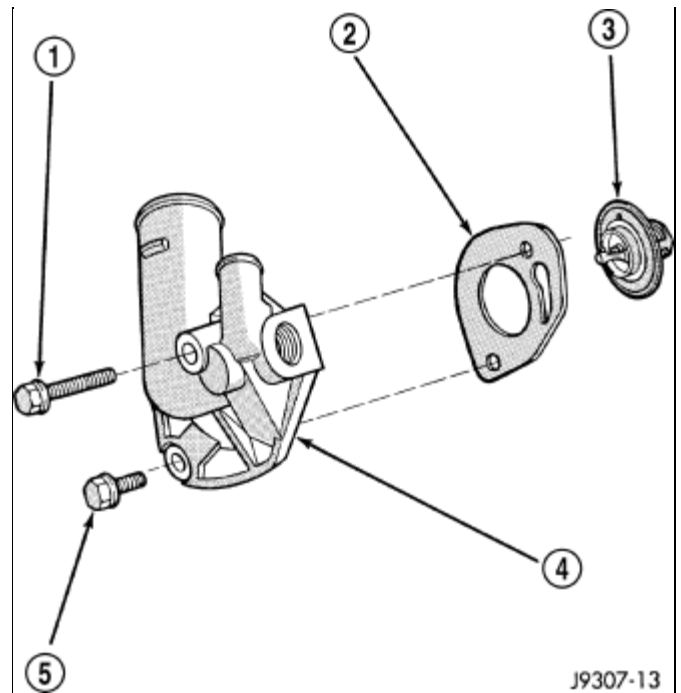
CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat on all gas powered engines is located beneath the thermostat housing at the front of the intake manifold.

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warm-up time, unreliable warm-up performance, increased exhaust emissions and



crankcase condensation that can result in sludge formation.

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

DIAGNOSIS AND TESTING

ENGINE COOLANT THERMOSTAT

ON-BOARD DIAGNOSTICS

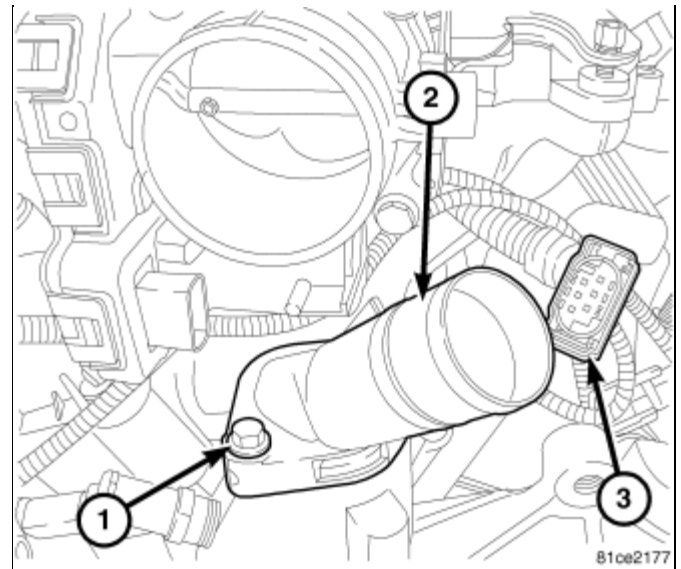
All models are equipped with On-Board Diagnostics for certain cooling system components. If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC). For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL/ON-BOARD DIAGNOSTICS - OPERATION).

REMOVAL

3.8L ENGINE

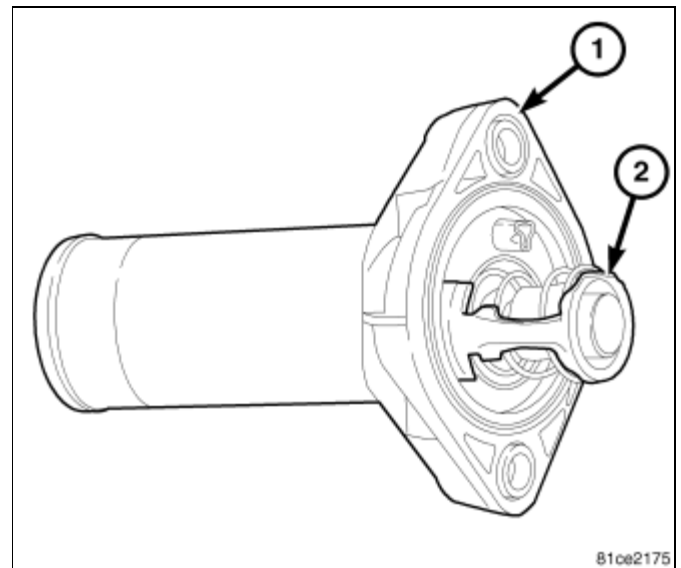
1. Disconnect negative battery cable.
2. Remove air filter housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

3. Drain cooling system down below the thermostat level. (Refer to 7 - COOLING - STANDARD PROCEDURE)
4. Disconnect throttle body electrical connector (3).
5. Remove radiator upper hose at thermostat housing (2).
6. Remove thermostat housing bolts (1) and thermostat housing (2).



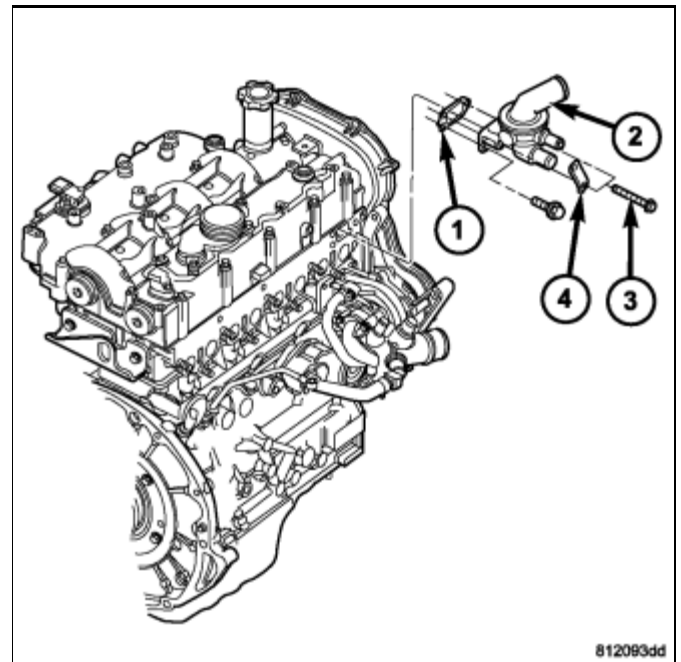
7. Remove thermostat (2) from thermostat housing (1)..
8. Clean both sealing surfaces.

2.8L DIESEL ENGINE



NOTE: The thermostat is not serviced separately. The thermostat and housing must be replaced as an assembly.

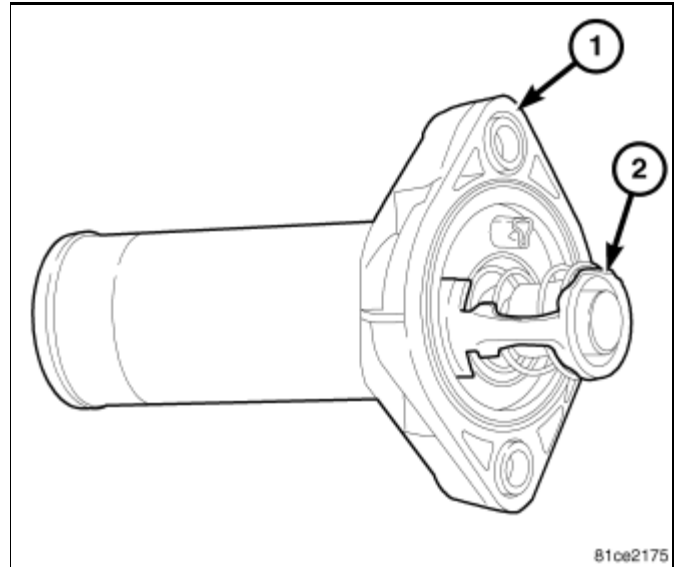
1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL) .
3. Partially drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Disconnect upper radiator hose and bypass hoses at thermostat housing (2) .
5. Remove thermostat housing retaining bolts, support bracket and housing from cylinder head, discard gasket.



INSTALLATION

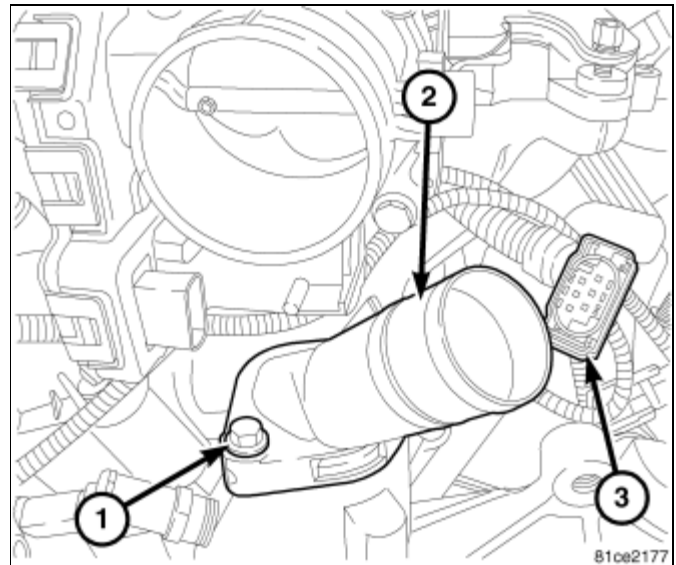
3.8L ENGINE

1. Position thermostat (2) in thermostat housing (1).



2. Install thermostat housing and thermostat assembly on intake manifold. Tighten bolts (1) to 28 N·m (250 in. lbs.).
3. Install the radiator upper hose to thermostat housing (2).
4. Connect throttle body electrical connector (3).
5. Refill the cooling system to the proper level. (Refer to 7 - COOLING - STANDARD PROCEDURE)
6. Connect negative battery cable.
7. Install air filter housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

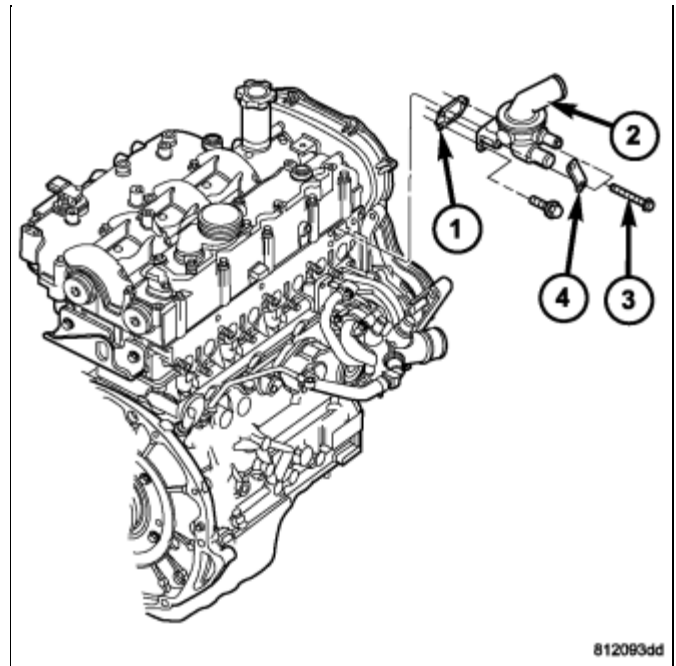
2.8L DIESEL ENGINE



1. Clean old gasket material from cylinder head and thermostat housing.
2. Install thermostat housing with gasket and support bracket to cylinder head. Torque bolts to 28 N·m. (250 in. lbs.).
3. Connect coolant bypass hose and upper radiator hose to thermostat housing.
4. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
6. Connect negative battery cable.

FAN-VISCOUS RADIATOR

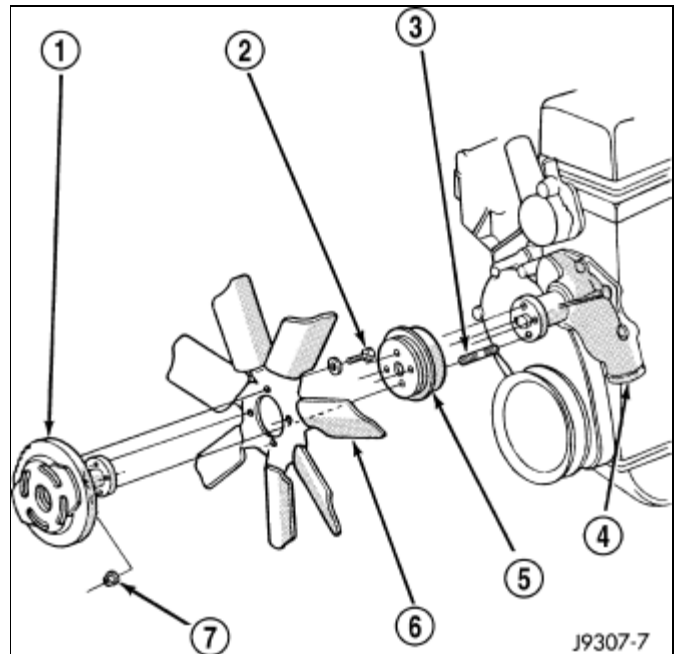
DESCRIPTION



CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word **REVERSE** to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

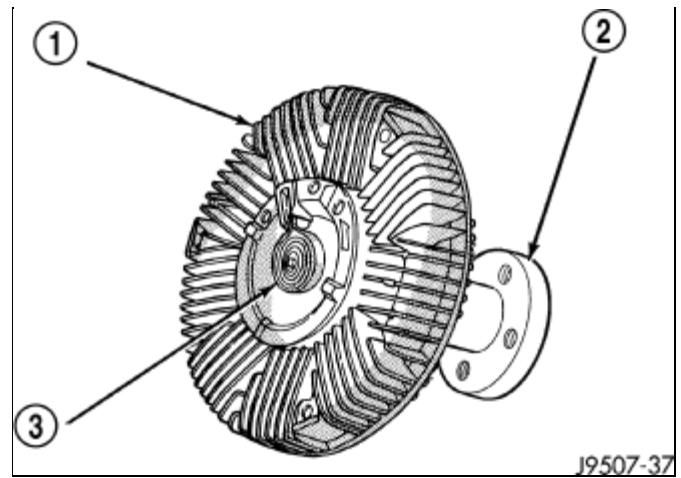
The thermal viscous fan drive is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

OPERATION



A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit. This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional



engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

DIAGNOSIS AND TESTING

VISCOUS FAN DRIVE

NOISE

NOTE: It is normal for fan noise to be louder (roaring) when:

- The under hood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

TESTING

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: Be sure that there is adequate fan blade clearance before drilling.

1. Drill a 3.18 mm (1/8 in.) diameter hole in the top center of the fan shroud.
2. Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° - 105°C (-4° - 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.
3. Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).
4. Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.
5. Be sure that the air conditioner (if equipped) is turned off.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

6. Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 88° C (190° F). Fan drive **engagement** should have started to occur at between 91° - 100° C (197° - 213° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.
7. When the air temperature reaches 88° C (190° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 80.5° - 89.4° C (177° - 193° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

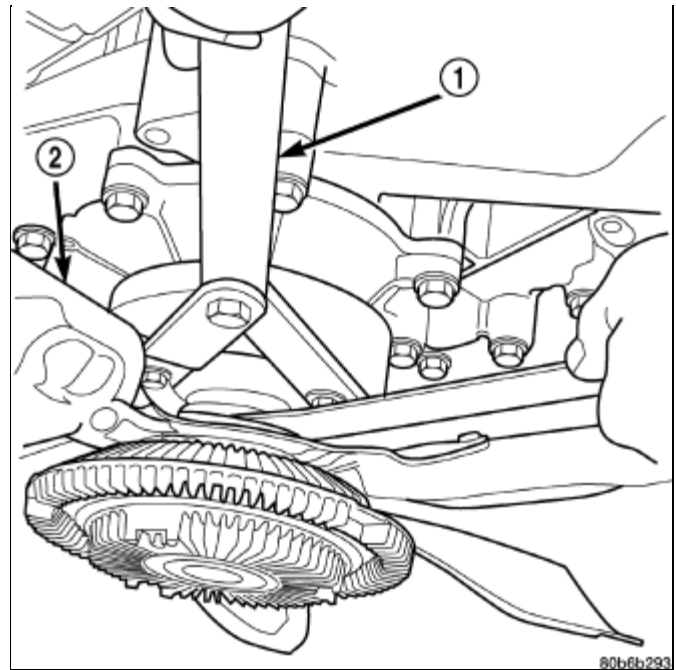
REMOVAL

DIESEL ENGINE

1. Disconnect negative battery cable from battery.

NOTE: The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft.

2. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove fan shroud to radiator bolts.
4. Do not unbolt fan blade assembly from viscous fan drive at this time.
5. Remove fan blade/viscous fan drive assembly from water pump using spanner wrench, tool 6958 and adapters (1) 8346, by turning mounting nut counterclockwise as viewed



from front. Threads on viscous fan drive (2) are **RIGHT HAND**.

6. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

7. Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

8. After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

CAUTION: Do not remove water pump pulley-to-water pump bolts . This pulley is under belt tension.

9. Remove four bolts securing fan blade assembly to viscous fan drive .

INSTALLATION

DIESEL ENGINE

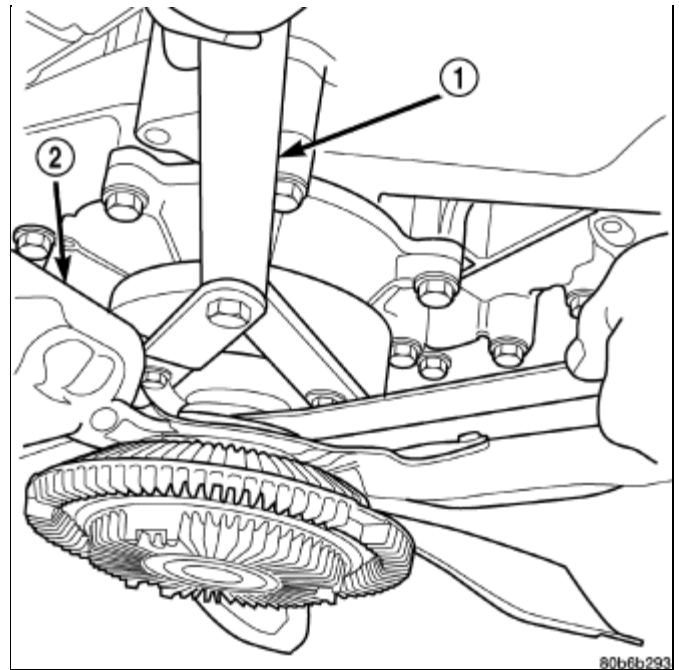
1. Assemble fan blade to viscous fan drive. Tighten mounting bolts to 23.7 N·m (210 in. lbs.) torque.

NOTE: The viscous fan and fan shroud must be installed as an assembly.

2. Position fan drive assembly and fan shroud, thread the fan drive assembly onto the water pump pulley. Tighten nut using spanner wrench, tool 6958 and adapters, tool 8346, to 50 N·m (37 ft. lbs.).

3. Install the fan shroud to radiator mounting bolts. Tighten bolts to 9 N·m (80 in·lbs).

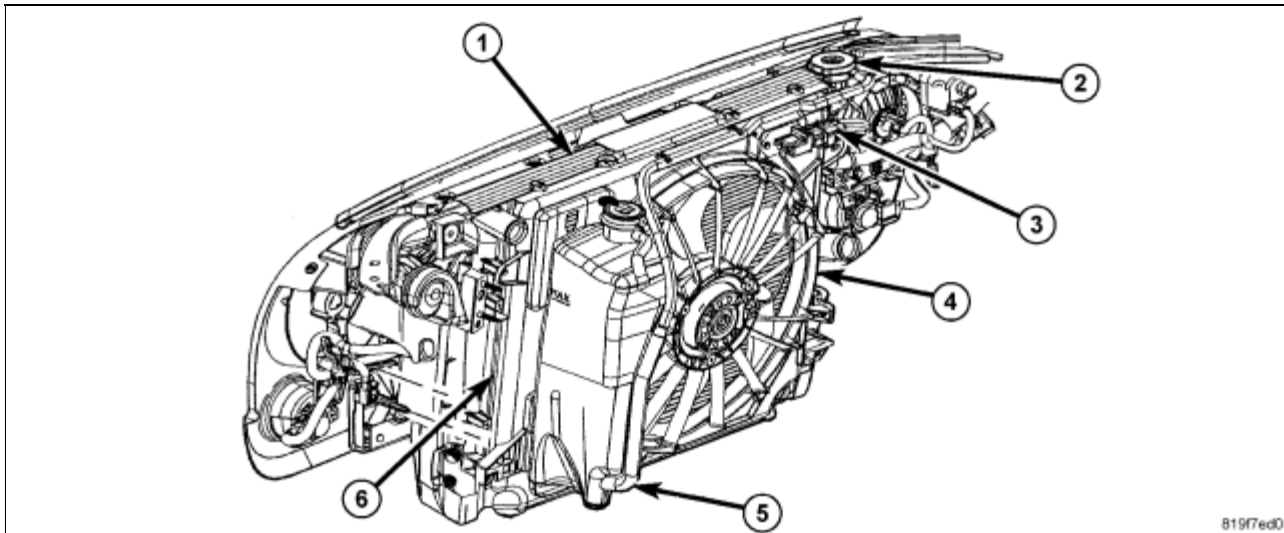
4. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS -



INSTALLATION).

RADIATOR

DESCRIPTION



A heavy duty cross-flow aluminum/plastic radiator is used. The radiator consists of an aluminum core and plastic end tanks, which are fastened to the core with clinch tabs and sealed with a high temperature rubber gasket.

Vehicles equipped with automatic transmissions use a combination A/C condenser/transmission oil cooler located on the front of the radiator.

If the plastic tank has been damaged, individual parts are not available, and the radiator must be replaced.

OPERATION

As air passes through the radiator core, the heat within the coolant is dissipated into the ambient air.

DIAGNOSIS AND TESTING - RADIATOR COOLANT FLOW

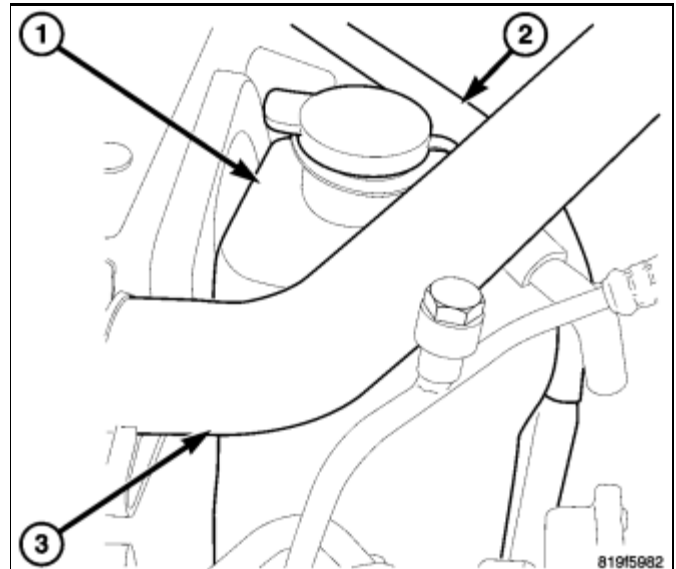
The following procedure will determine if coolant is flowing through the cooling system.

If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If hose is hot, the thermostat is open and water is circulating through cooling system.

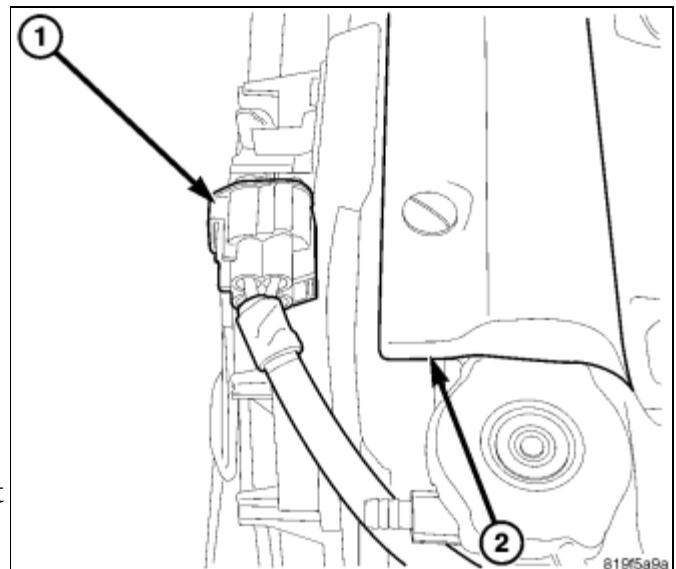
REMOVAL

CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

1. Disconnect negative battery cable at battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) drain coolant into a clean container for reuse.
3. Remove coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).



4. Remove radiator upper seal (2).
5. Remove the electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove lower radiator seal.
7. Remove lower radiator hose.
8. Remove front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
9. Remove two A/C condenser mounting bolts. Lift A/C condenser out of J-clips.
10. Loosen horn mounting bolt. Rotate horn out of the way.
11. Remove A/C tubing mounting bracket bolt.
12. Remove radiator mounting bolts.
13. The lower part of radiator is equipped with two alignment dowel pins. They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.
14. Lift radiator straight up and out of vehicle taking care not to damage radiator fins.
15. When removing radiator, note position of the rubber seals located on the top and bottom of radiator (on certain models only). To prevent possible overheating, these seals must be installed to their original positions.



CLEANING

Clean radiator fins. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

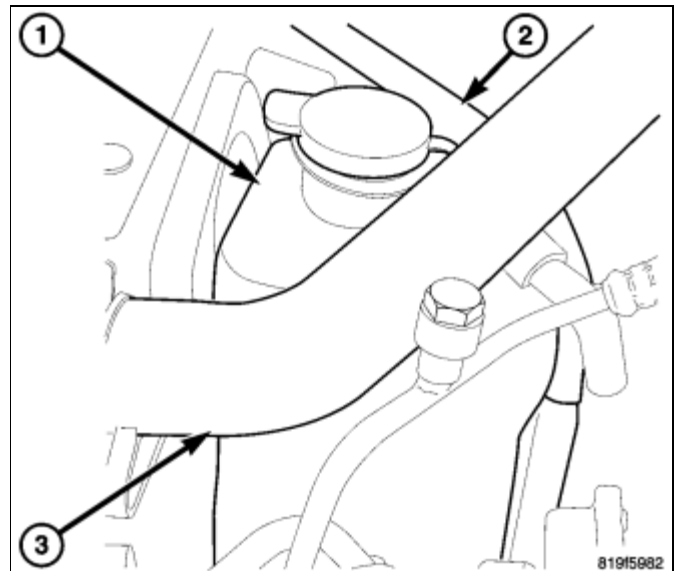
INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks. Inspect the radiator neck for damage or distortion.

INSTALLATION

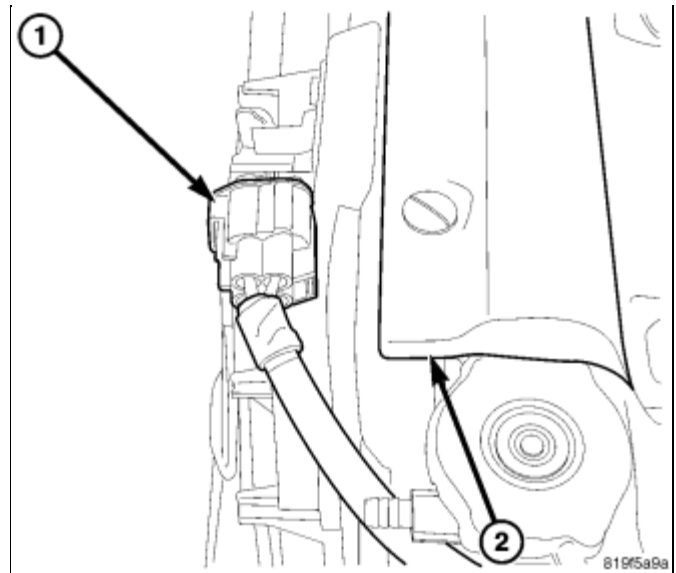
CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

1. Guide the two radiator alignment dowels into the rubber grommets located in lower radiator crossmember. Install and tighten mounting bolts to 8 N·m (70 in. lbs.) torque.
 2. Position combination A/C condenser/transmission oil cooler in J-clips and install mounting bolts.
 3. Tighten bolts to 8 N·m (70 in. lbs.).
 4. Position evaporator line tapping block and install mounting bolt. Tighten to 8 N·m (70 in. lbs.).
 5. Position horn and tighten mounting bolt to 8 N·m (70 in. lbs.).
 6. Install the electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
 7. Position and install the lower radiator seal.
 8. Install upper radiator seal.
-
9. Install front grill (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
 10. Connect radiator hoses and install hose clamps.
 11. Install coolant recovery container.
 12. Fill cooling system with correct coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
 13. Connect battery negative cable.
 14. Start engine and check for leaks.



CAP-RADIATOR PRESSURE

DESCRIPTION



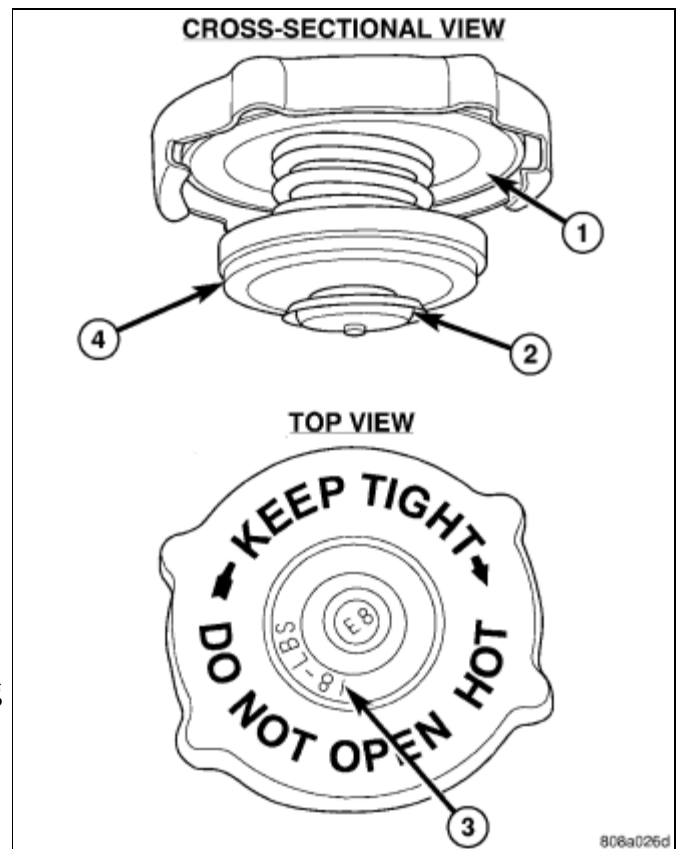
All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-145 kPa (18-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-145 kPa (18-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.



DIAGNOSIS AND TESTING

RADIATOR CAP-TO-FILLER NECK SEAL

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at a minimum of 55 kPa (8 psi).

WARNING: The warning words - **DO NOT OPEN HOT** - on radiator pressure cap, are a safety precaution, when hot, pressure builds up in cooling system. To prevent scalding or injury, radiator cap should not be removed while system is hot and/or under pressure.

Do not remove radiator cap at any time **except** for the following purposes:

1. Check and adjust antifreeze freeze point.
2. Refill system with new antifreeze.
3. Conducting service procedures.
4. Checking for vacuum leaks.

WARNING: If vehicle has been run recently, wait at least 15 minutes before removing radiator cap. With a rag, squeeze radiator upper hose to check if system is under pressure. Place a rag over cap and without pushing cap down, rotate it counter-clockwise to first stop. Allow fluid to escape through the coolant reserve/overflow hose into reserve/overflow tank. Squeeze radiator upper hose to determine when pressure has been released. When coolant and steam stop being pushed into tank and system pressure drops, remove radiator cap completely.

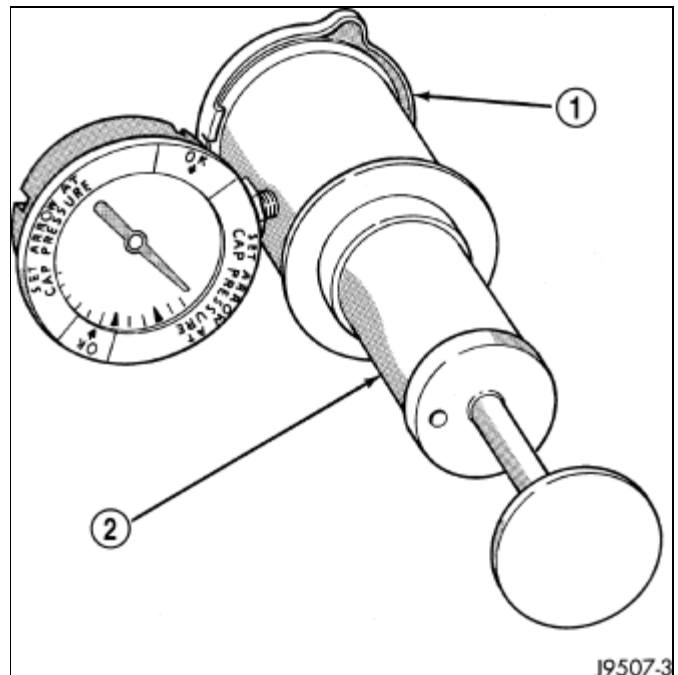
DIAGNOSIS AND TESTING - RADIATOR CAP

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap on pressure tester 7700 or an equivalent.

Operate tester pump to bring pressure to 117 kPa (17 psi) on gauge. If pressure cap fails to hold pressure of at least 110 kPa (16 psi) replace cap. Refer to the following **CAUTION**.

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.



CLEANING

Use only a mild soap and water to clean the radiator cap. Using any type solvent may cause damage to the seal in the radiator cap.

INSPECTION

Hold cap at eye level, right side up. The vent valve at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

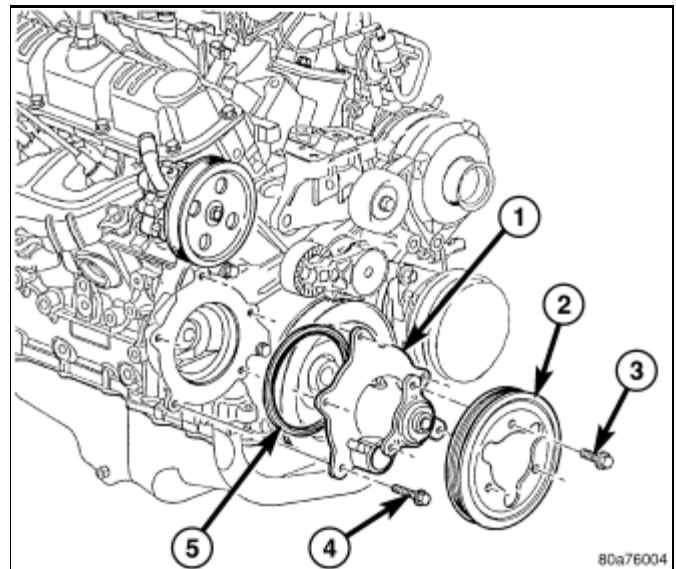
PUMP-WATER

DESCRIPTION

3.8L ENGINE

The water pump has a die-cast aluminum body and a plastic impeller. It bolts directly to the timing chain case cover, using a rubber seal for sealing. It is driven by the accessory drive belt.

2.8L DIESEL ENGINE



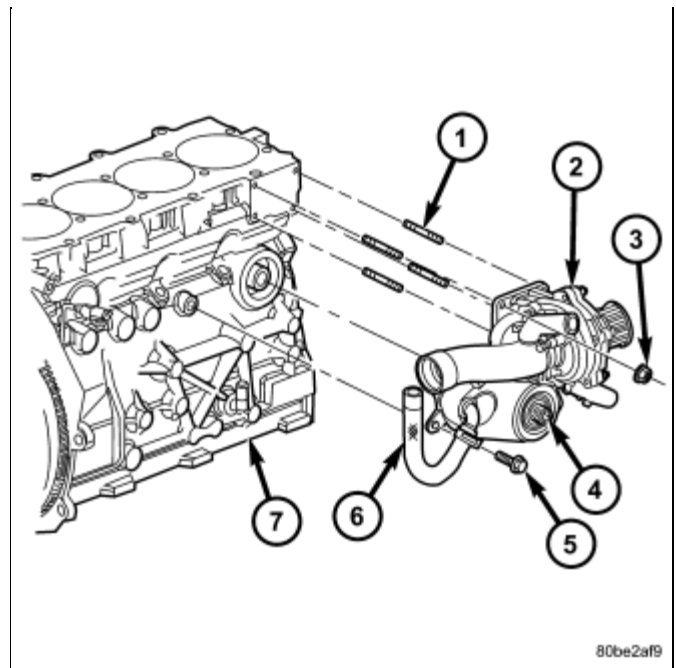
The water pump on the 2.8L diesel has a die cast aluminum housing. It bolts to an aluminum housing which attaches to the engine block.

OPERATION

2.8L DIESEL ENGINE

The water pump is used to circulate coolant through the cooling system. The coolant is pumped through the engine block, cylinder head, heater core, EGR cooler, viscous heater, and radiator.

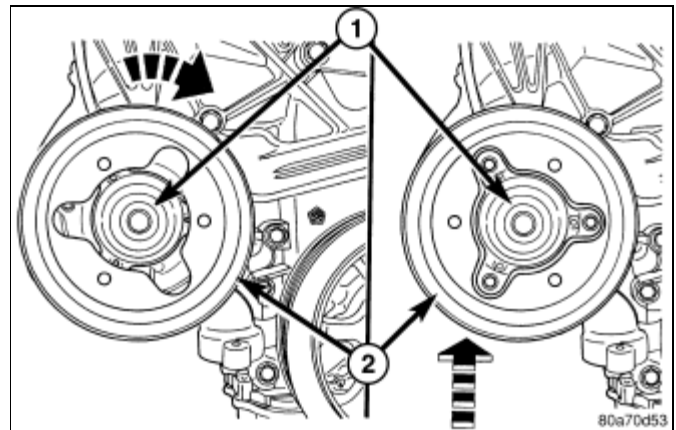
REMOVAL



3.8L ENGINE

1. Drain the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
2. Remove the accessory drive belt shield.
3. Remove the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)
4. Remove water pump pulley bolts.

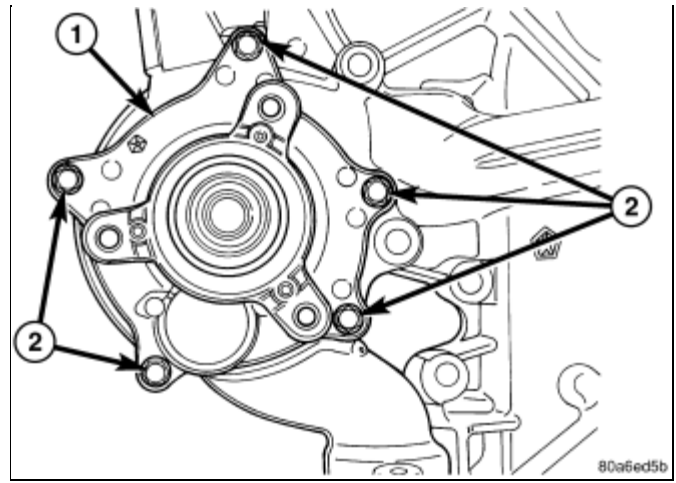
NOTE: To remove the water pump pulley, it MUST first be positioned between water pump housing and drive hub. The pulley can then be removed with the water pump assembly.



5. Rotate pulley until openings in pulley align with water pump drive hub spokes. Move pulley inward between pump housing and hub.

6. Position pulley to allow access to water pump mounting bolts. Remove water pump mounting bolts.
7. Remove water pump with the pulley loosely positioned between hub and the pump body.
8. Remove and discard the seal.
9. Clean seal groove and sealing surfaces on pump and timing chain case cover. Take care not to scratch or gouge sealing surfaces.

2.8L DIESEL ENGINE



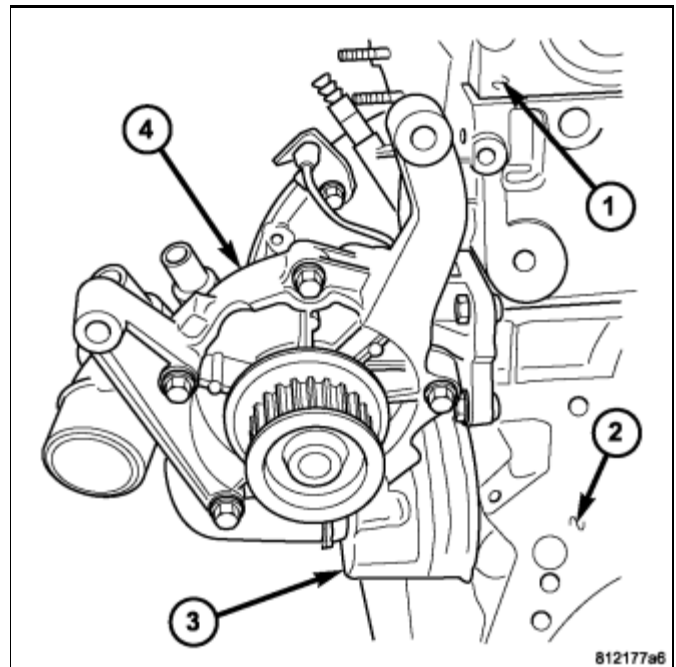
1. Disconnect negative battery cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove timing belt inner and outer covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
4. Remove water pump retaining bolts and pump (4).

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, loose or rough turning bearing or impeller rubbing either the pump body or timing chain case/cover.



INSTALLATION

3.8L ENGINE

1. Install new seal into water pump housing groove.

NOTE: The water pump pulley MUST be positioned loosely between the pump housing and drive hub BEFORE water pump installation.

2. Position the water pump pulley loosely between pump

housing and drive hub.

3. Install water pump and pulley to the timing chain case cover. Tighten water pump bolts to 12 N·m (105 in. lbs.).

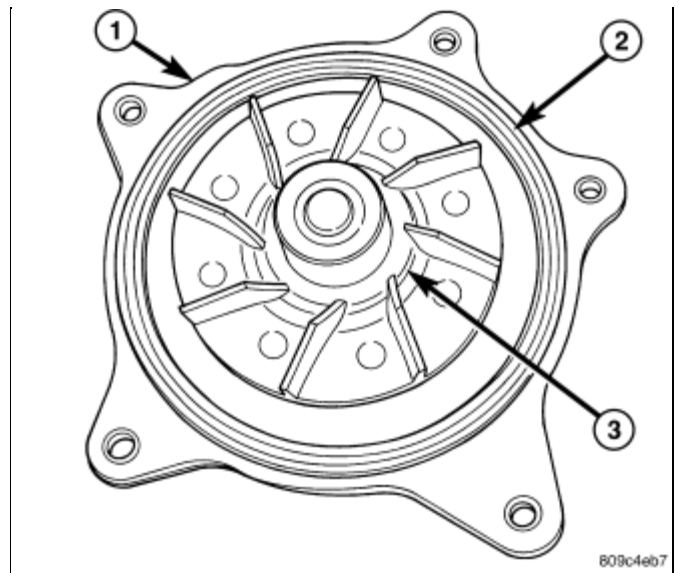
4. Position pulley on water pump hub. Install bolts and tighten to 28 N·m (250 in. lbs.).

5. Rotate pump by hand to check for freedom of movement.

6. Install the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

7. Install drive belt shield.

8. Fill the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)



2.8L DIESEL ENGINE

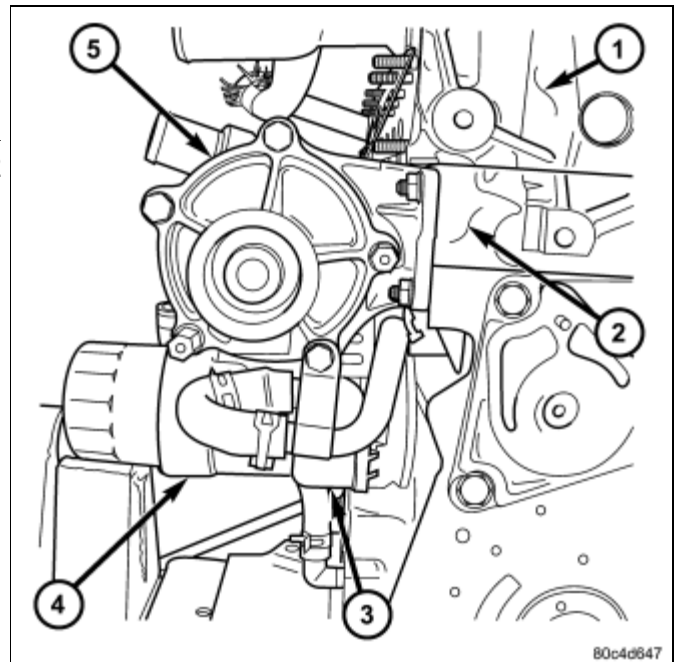
1. Clean mating surfaces of water pump housing and engine block as necessary.

2. Place new O-ring in groove in water pump housing. Install water pump and retaining bolts. Torque bolts to 24 N·m (212 in. lbs.).

3. Install both inner and outer timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

4. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

5. Connect negative battery cable.



COOLER-EGR

REMOVAL

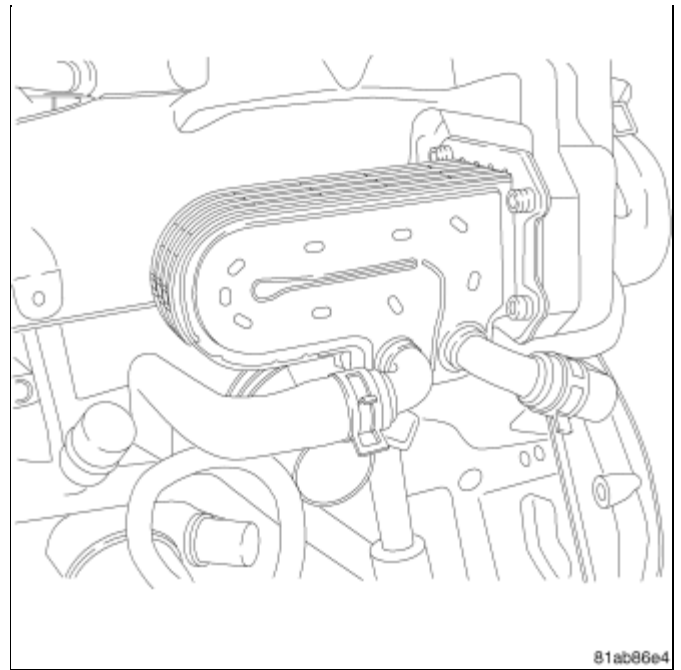
1. Drain coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

2. Remove coolant hoses.

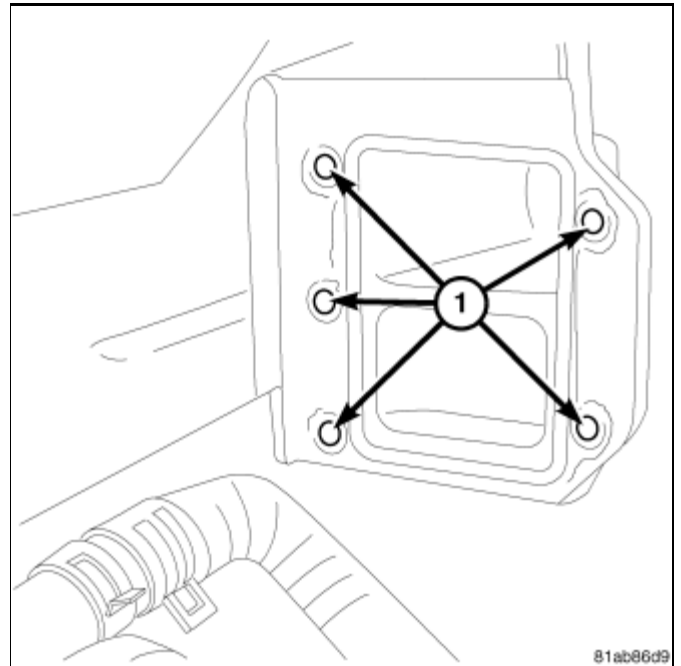
3. Remove five mounting bolts.

4. Remove EGR cooler.

INSTALLATION



1. Position new gasket and EGR Cooler.
2. Install five mounting bolts. Tighten bolts to 10 N·m (89 in lbs.).



3. Install cooler hoses.
4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

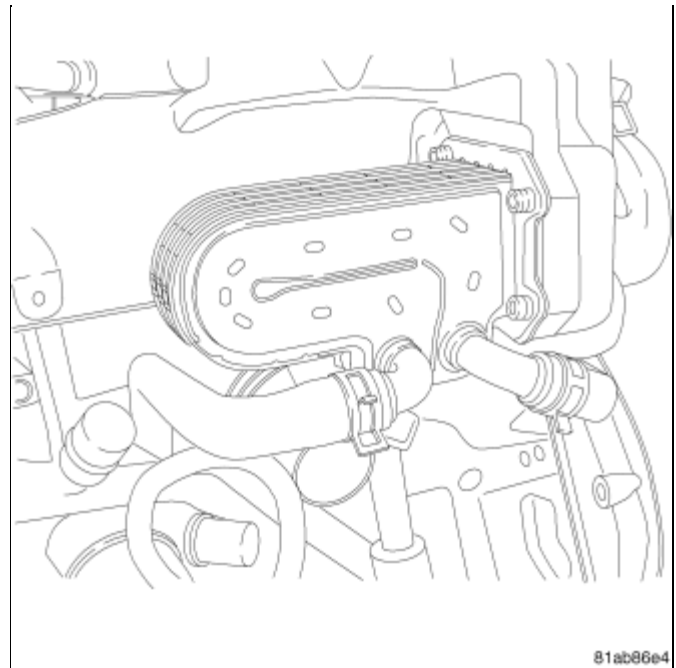
RELAY-RADIATOR FAN

DESCRIPTION

The electric cooling fan HI and LOW relays are located in the Power Distribution Center (PDC) in the engine compartment. See the fuse and relay layout label affixed to

the inside surface of the PDC cover for cooling fan relay identification and location.

The HI and LOW cooling fan relays cannot be adjusted or repaired. If the HI or LOW relay is damaged or faulty, it must be replaced.



HOSES-COOLING SYSTEM-2.8L DIESEL

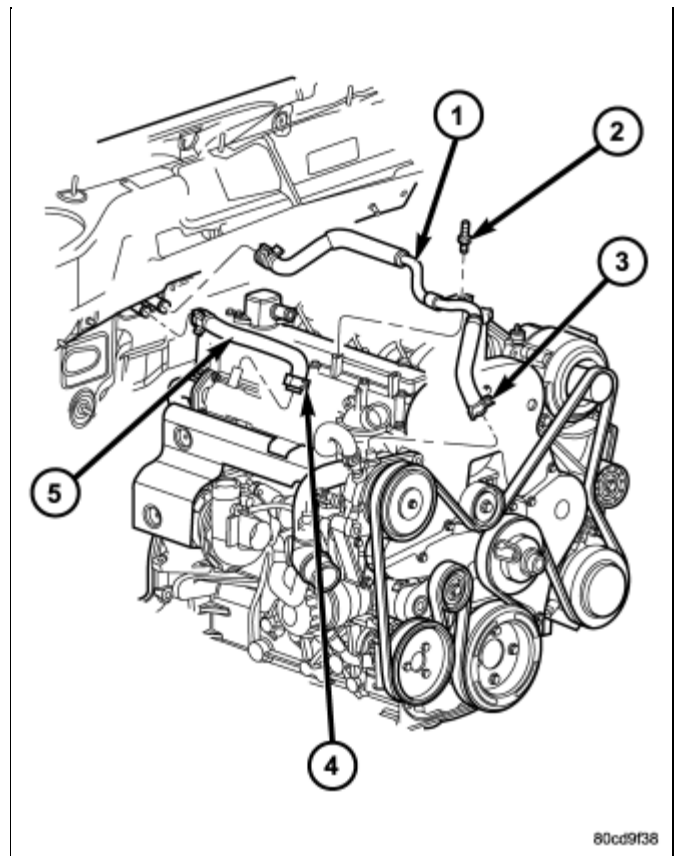
REMOVAL

HEATER HOSES - 2.8L DIESEL

1. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE)
2. Remove engine cover from engine (Refer to 9 - ENGINE COVER - REMOVAL) .
3. Disconnect heater core supply line at heater core and viscous heater. Remove hose from vehicle.
4. Disconnect heater core return line (5) from heater core and EGR cooler. Remove hose from vehicle.

INSTALLATION

HEATER HOSES - 2.8L DIESEL



80cd9f38

1. Connect heater core supply hose to heater core and viscous heater. Position hose clamps into proper position.
2. Connect heater core return hose to heater core and EGR cooler. Position hose clamps into proper position.
3. Install engine cover to engine (Refer to 9 - ENGINE COVER - INSTALLATION) .
4. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

TRANSMISSION

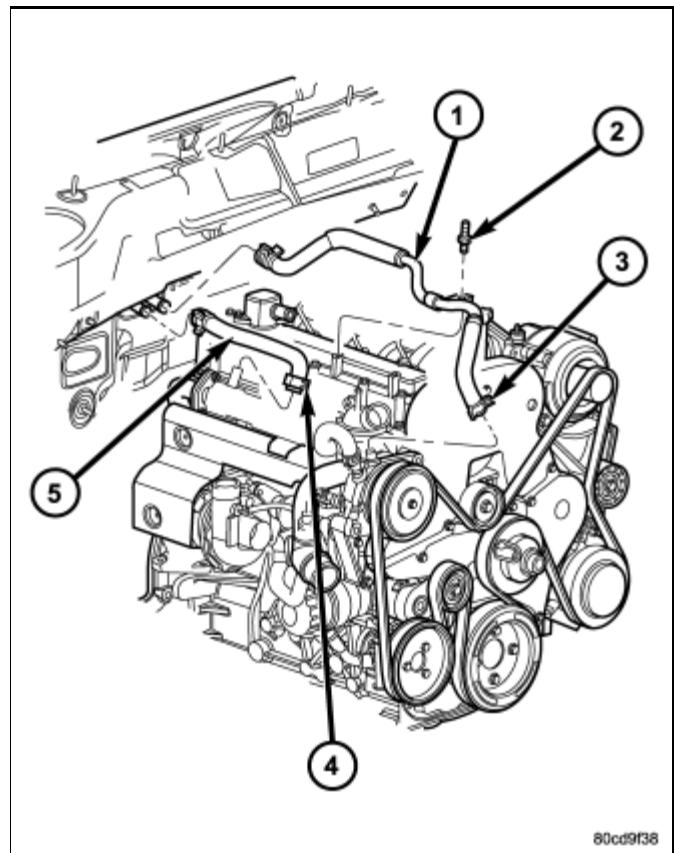
COOLER-TRANSMISSION

DESCRIPTION

The automatic transmission oil cooler is located in the front of the radiator and behind the front grill and is combined with the A/C condenser. The transmission oil cooler is a heat exchanger that allows heat in the transmission fluid to be transferred to the air passing over the cooler fins.

The Transmission oil cooler/A/C condenser assembly is equipped with quick connect fitting for the transmission oil cooler lines and a tapping block for the evaporator condenser.

The Transmission oil cooler/A/C condenser assembly.



80cd9f38

OPERATION

Transmission oil is routed through the cooler where heat is removed from the transmission oil before returning to the transmission.

REMOVAL

1. Remove electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
2. Position cooling fan out of the way.
3. Remove the transmission cooler line retaining block nut.
4. Remove transmission cooler lines from transmission lines.
5. Using Release Tool 8875A, disconnect transmission cooler tube from the transmission.
6. Remove the transmission cooler mounting bolts.
7. Remove transmission cooler from vehicle.

INSTALLATION

1. Position transmission cooler in vehicle.
2. Install transmission mounting bolts. Tighten to 14 N·m (123 in. lbs.)
3. Install transmission cooler lines into transmission.
4. Install locking plate and nut. Tighten nut to 22.5 N·m (200 in. lbs.)
5. Install electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

LINES-TRANSMISSION COOLER

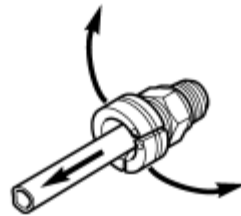
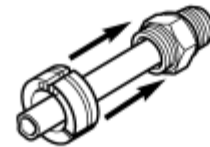
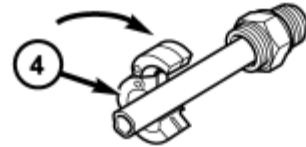
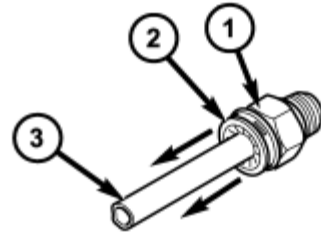
STANDARD PROCEDURE

QUICK CONNECT FITTING DISASSEMBLY/ASSEMBLY

DISCONNECT

1. Remove dust cap by pulling it straight back off of quick connect fitting (1).
2. Place Release Tool 8875A (4) onto transmission cooler line with the fingers of the tool facing the quick connect fitting.
3. Slide Release Tool 8875A down the transmission line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the release tool 60° to expand the retaining clip.

5. While holding the release tool against the quick connect fitting, pull back on the transmission cooler line to remove.
6. If quick connect fitting is damaged or leaking at transmission oil cooler or transmission, remove fitting.

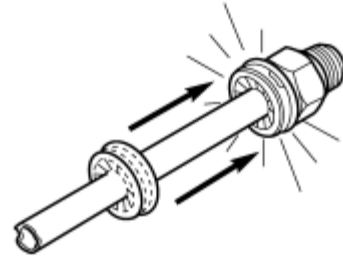
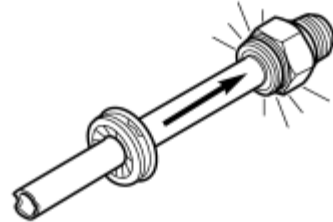
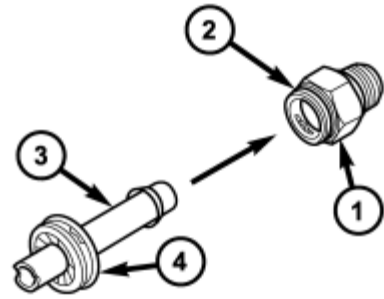


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CONNECT

1. If removed, install quick connect fitting into transmission oil cooler or transmission. Tighten fitting to 15 N·m (132 in. lbs.).
2. Align transmission cooler line (3) with quick connect fitting while pushing straight into the fitting.
3. Push in on transmission cooler line until a “click” is heard or felt .
4. Slide dust cap (4) down the transmission cooler line and snap it over the quick connect fitting until it is fully seated and rotates freely. Dust cap will only snap over quick connect fitting when the transmission cooler line is properly installed.

NOTE: If dust cap will not snap into place, repeat assembly step #2.



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8 - ELECTRICAL

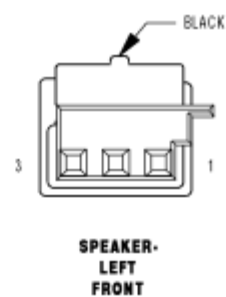
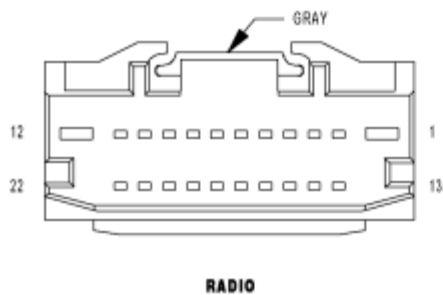
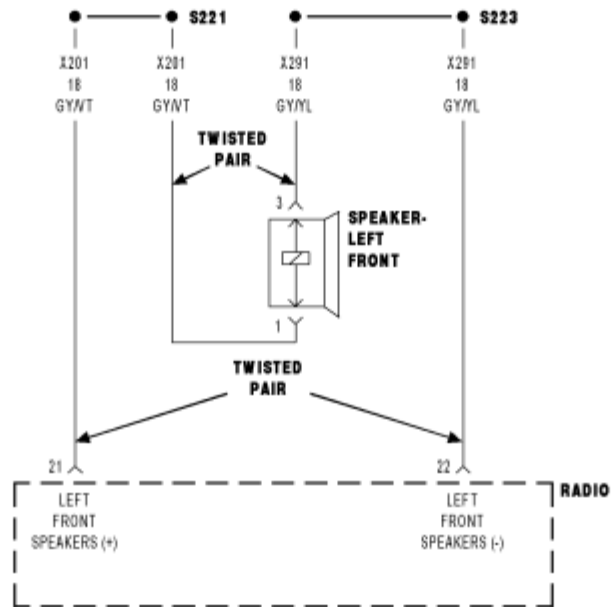
8A - AUDIO/VIDEO

AUDIO/VIDEO SYSTEMS - ELECTRICAL DIAGNOSTICS

AUDIO/VIDEO SYSTEMS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW



8180215

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.

- **Set Condition:**
- When the output circuit is LOW for more than three seconds.

Possible Causes
(X201) LEFT FRONT SPEAKERS (+) CIRCUIT SHORTED TO GROUND
(X291) LEFT FRONT SPEAKERS (-) CIRCUIT SHORTED TO GROUND
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X201) LEFT FRONT SPEAKERS (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Front Left Audio Speaker harness connector.

Measure the resistance between ground and the (X201) Left Front Speakers (+) circuit.

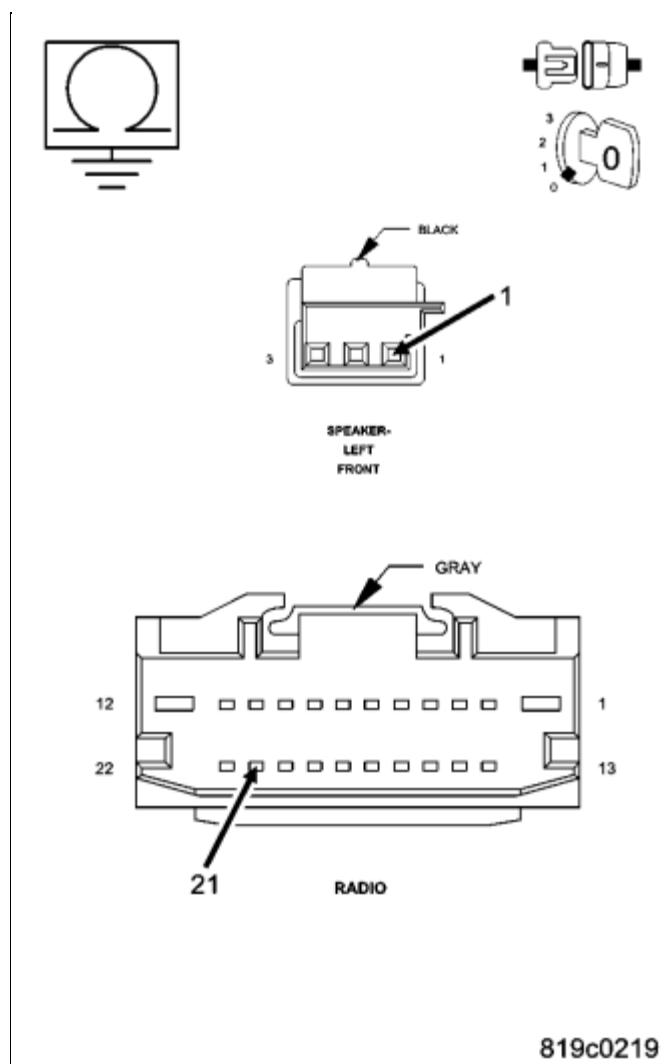
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X201) Left Front Speakers (+) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X291) LEFT FRONT SPEAKERS (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X291) Left Front Speakers (-) circuit.

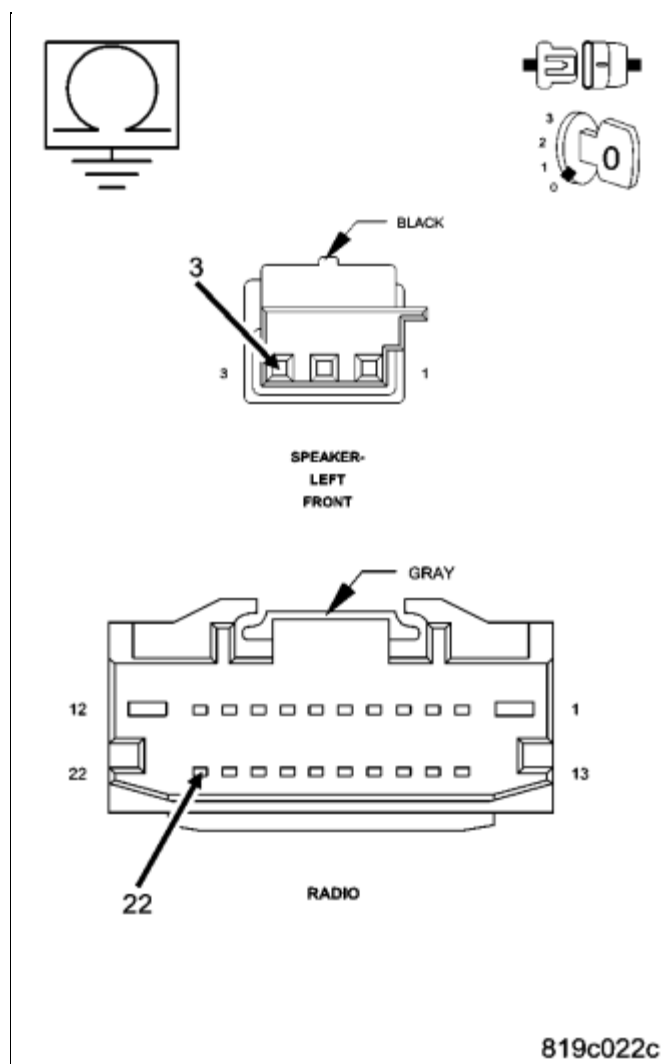
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X291) Left Front Speakers (-) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. SPEAKER

Connect the Radio harness connector.

With the Front Left Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B1401-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

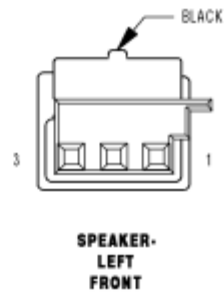
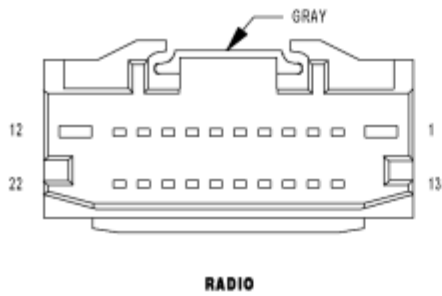
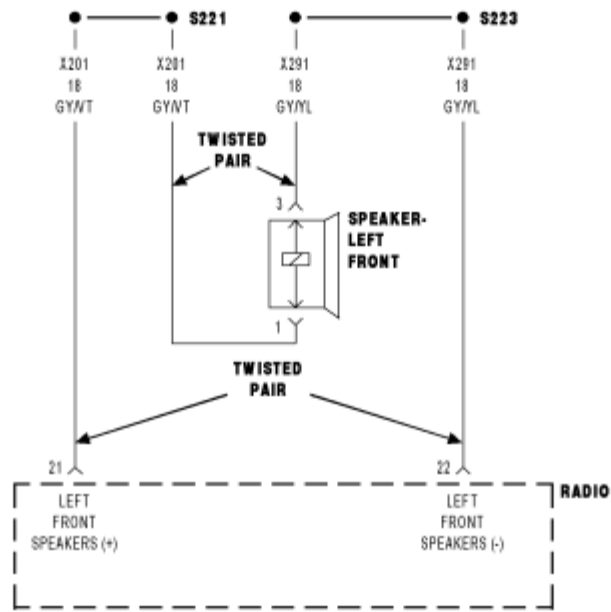
Yes

- Replace the Front Left Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH



819c0219

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(X201) LEFT FRONT SPEAKERS (+) CIRCUIT SHORTED TO VOLTAGE
(X291) LEFT FRONT SPEAKERS (-) CIRCUIT SHORTED TO VOLTAGE
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B1402-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X201) LEFT FRONT SPEAKERS (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Radio harness connector.
Disconnect the Left Front Audio Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X201) Left Front Speakers (+) circuit.

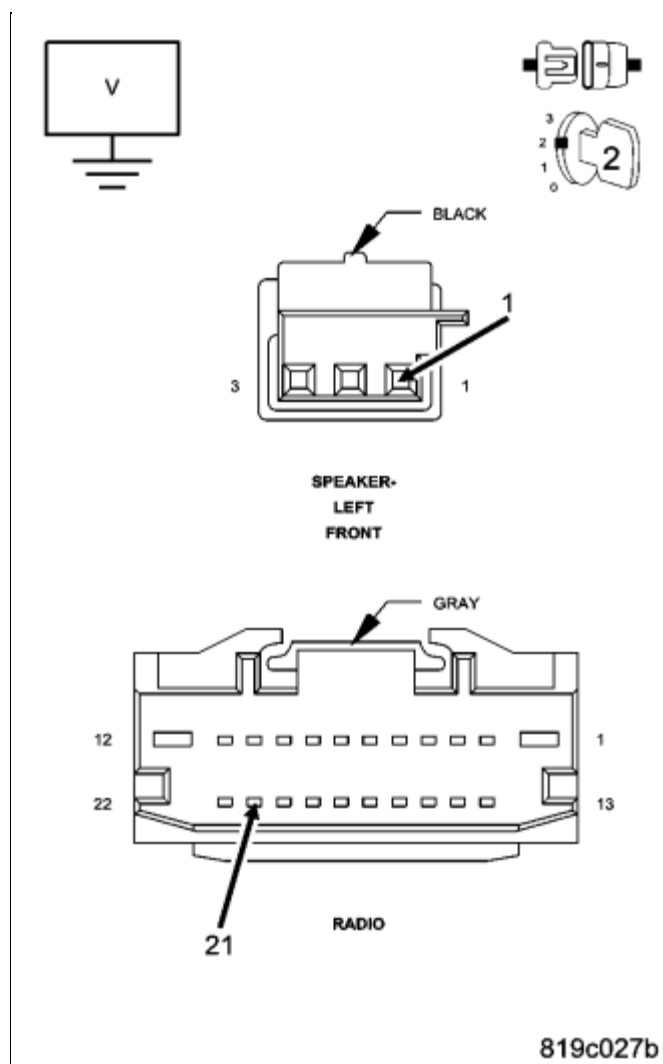
Is the voltage above 10.0 volts?

Yes

- Repair the (X201) Left Front Speakers (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X291) LEFT FRONT SPEAKERS (-) CIRCUIT SHORTED TO VOLTAGE

Measure for voltage on the (X291) Left Front Speakers (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X291) Left Front Speakers (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

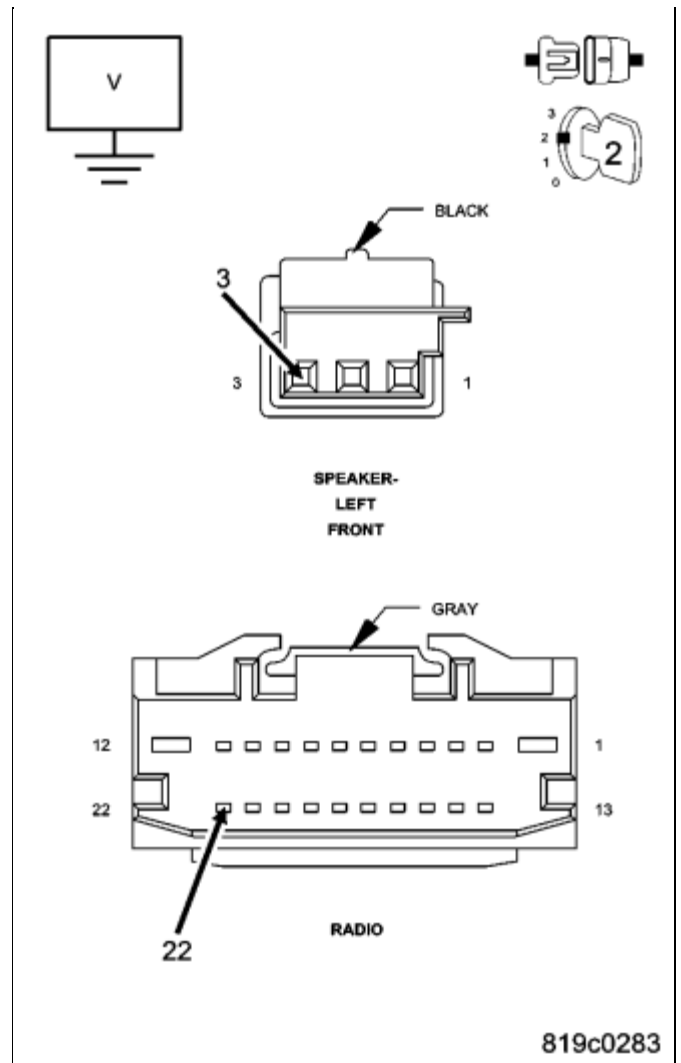
No

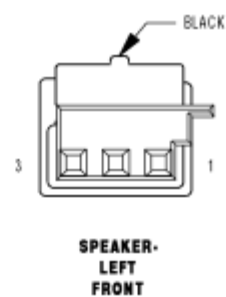
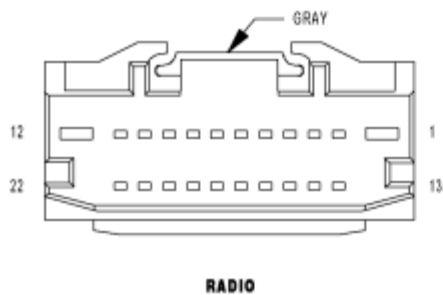
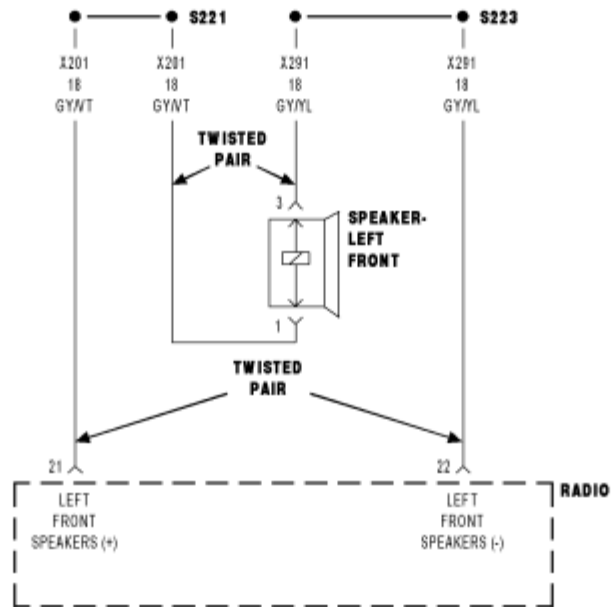
- Replace the Radio in accordance with the service

information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





8180215

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.

- **Set Condition:**
- When the output circuit is open for more than three seconds. The radio will not set the fault if the radio confirms an amplifier is on the BUS.

Possible Causes
(X201) LEFT FRONT SPEAKERS (+) CIRCUIT OPEN
(X291) LEFT FRONT SPEAKERS (-) CIRCUIT OPEN
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X201) LEFT FRONT SPEAKERS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Front Left Audio Speaker harness connector.

Measure the resistance of the (X201) Left Front Speakers (+)

circuit between the Radio and the Speaker.

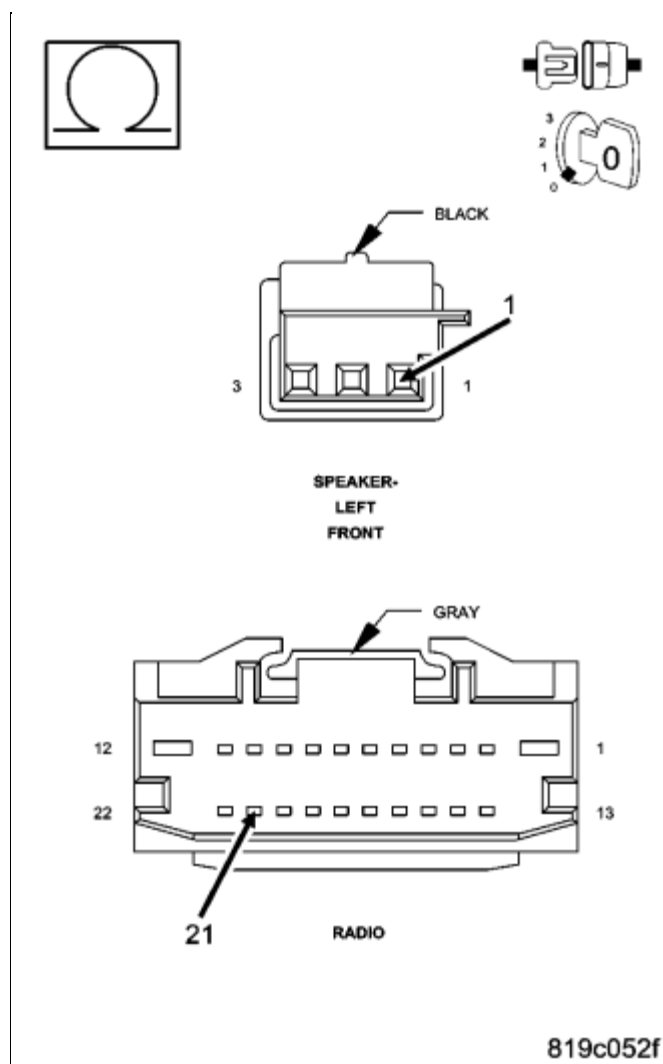
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [3](#)

No

- Repair the (X201) Left Front Speakers (+) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (X291) LEFT FRONT SPEAKERS (-) CIRCUIT OPEN

Measure the resistance of the (X291) Left Front Speakers (-) circuit between the Radio and the Speaker.

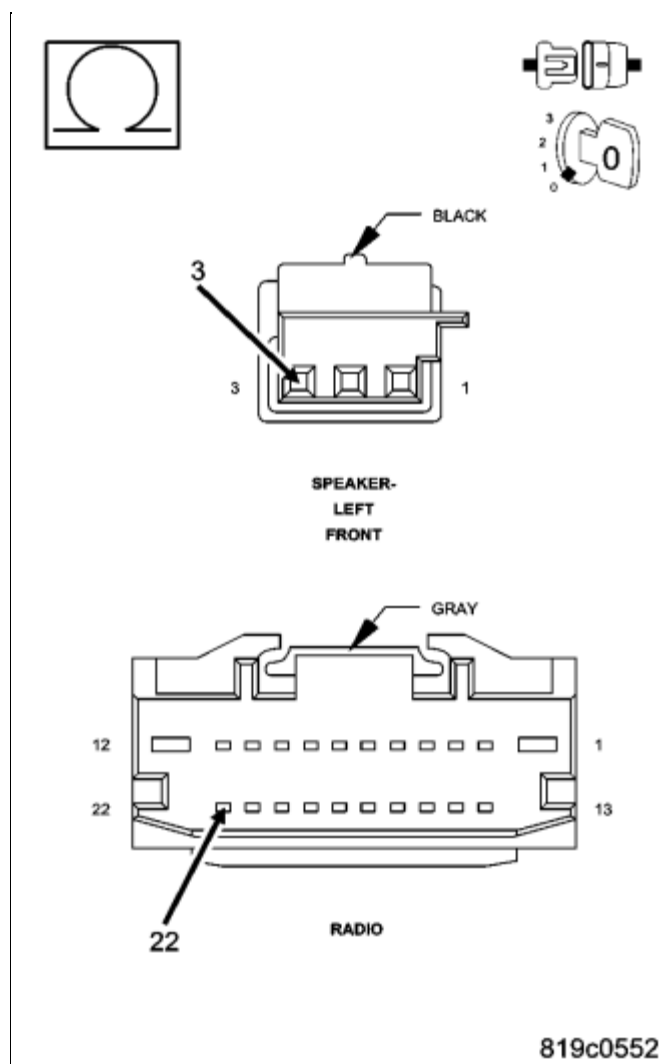
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (X291) Left Front Speakers (-) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. SPEAKER

Connect the Radio harness connector.

With the Front Left Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B1403-FRONT LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

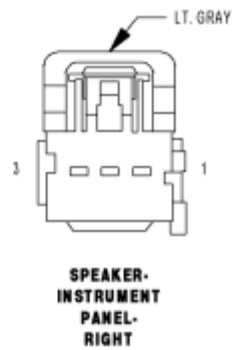
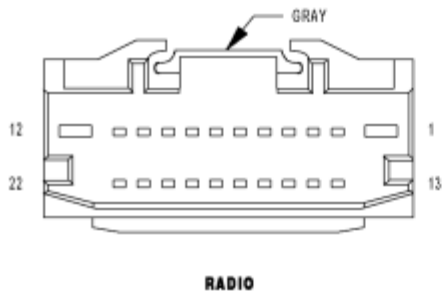
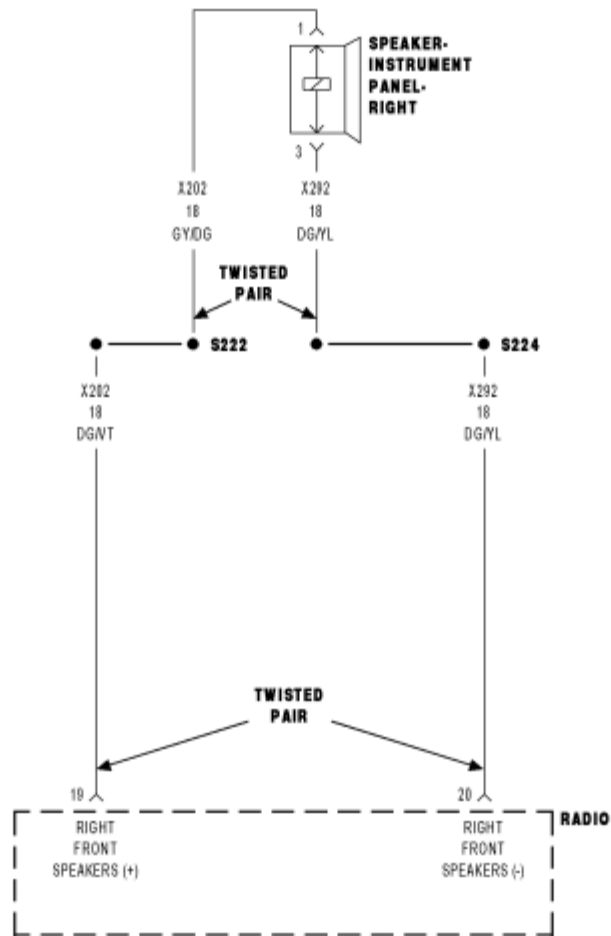
Yes

- Replace the Front Left Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW



919c057c

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.
- **Set Condition:**
- When the output circuit is LOW for more than three seconds.

Possible Causes
(X202) RIGHT FRONT SPEAKERS (+) CIRCUIT SHORTED TO GROUND
(X292) RIGHT FRONT SPEAKERS (-) CIRCUIT SHORTED TO GROUND
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X202) RIGHT FRONT SPEAKERS (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Radio harness connector.
 Disconnect the Front Right Audio Speaker harness connector.
 Measure the resistance between ground and the (X202) Right Front Speakers (+) circuit.

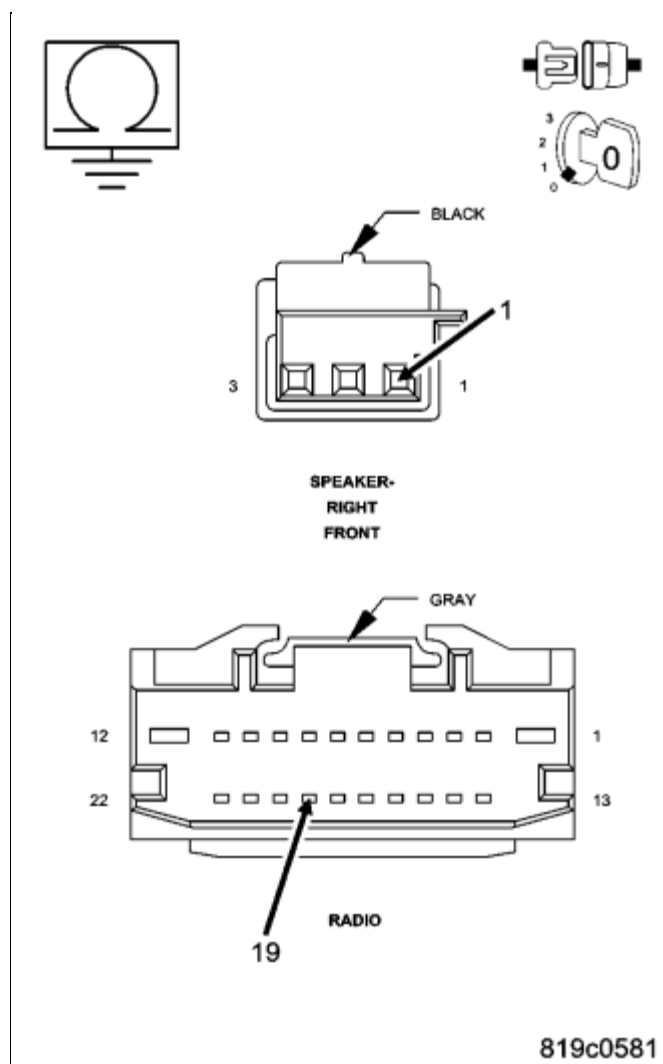
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X202) Right Front Speakers (+) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X292) RIGHT FRONT SPEAKERS (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X292) Right Front Speakers (-) circuit.

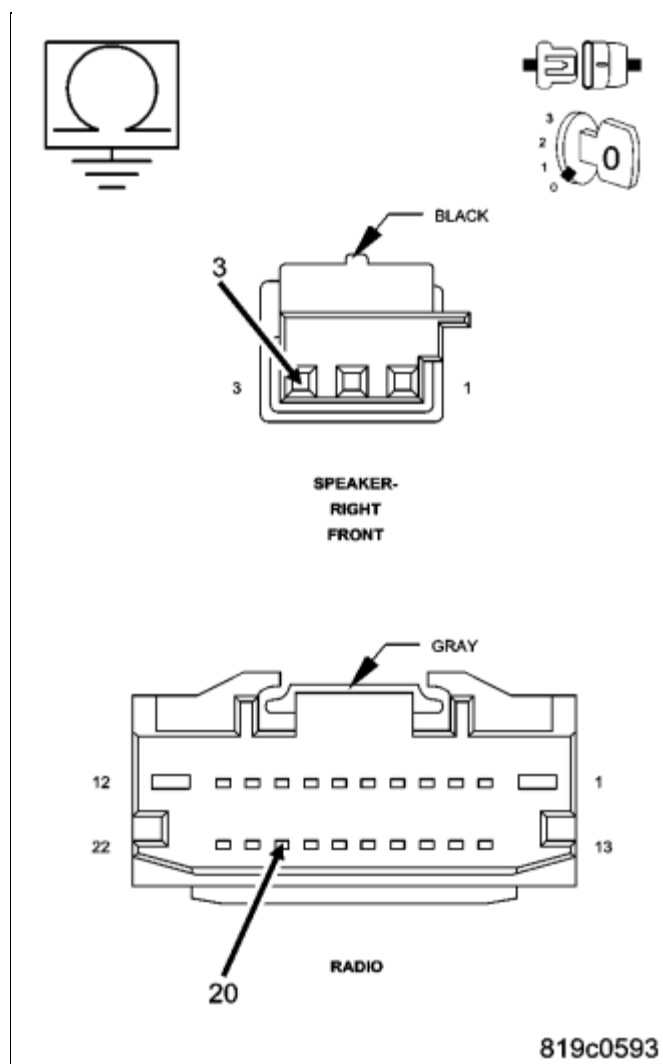
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X292) Right Front Speakers (-) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. SPEAKER

Connect the Radio harness connector.

With the Front Right Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B1405-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

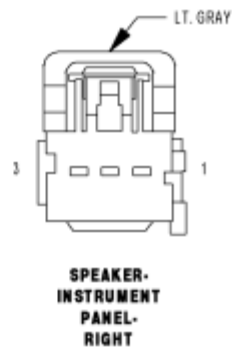
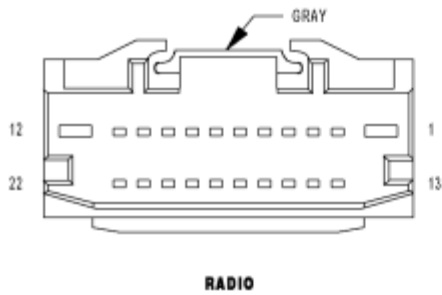
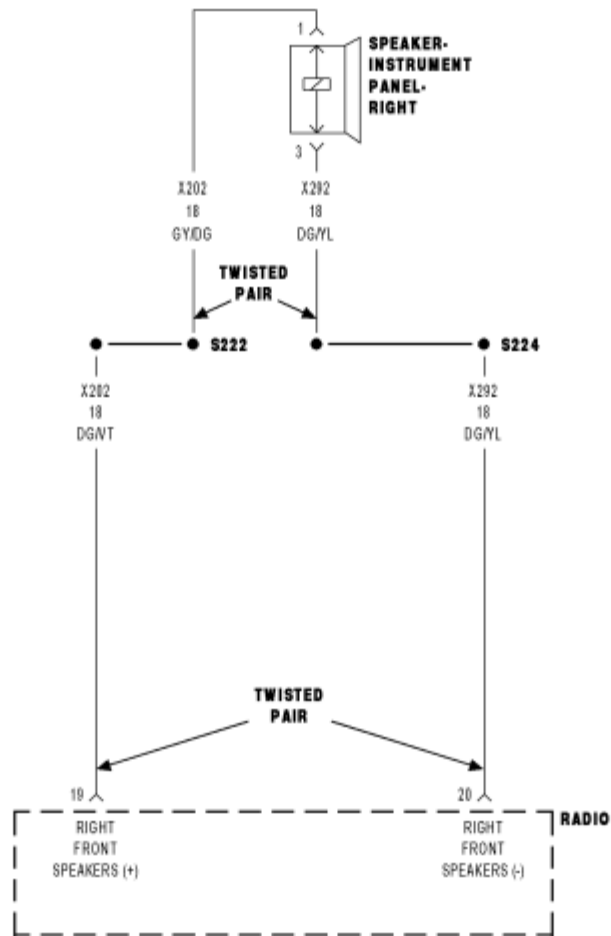
Yes

- Replace the Front Right Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH



919c057c

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(X202) RIGHT FRONT SPEAKERS (+) CIRCUIT SHORTED TO VOLTAGE
(X292) RIGHT FRONT SPEAKERS (-) CIRCUIT SHORTED TO VOLTAGE
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B1406-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X202) RIGHT FRONT SPEAKERS (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Radio harness connector.
Disconnect the Right Front Audio Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X202) Right Front Speakers (+)

circuit.

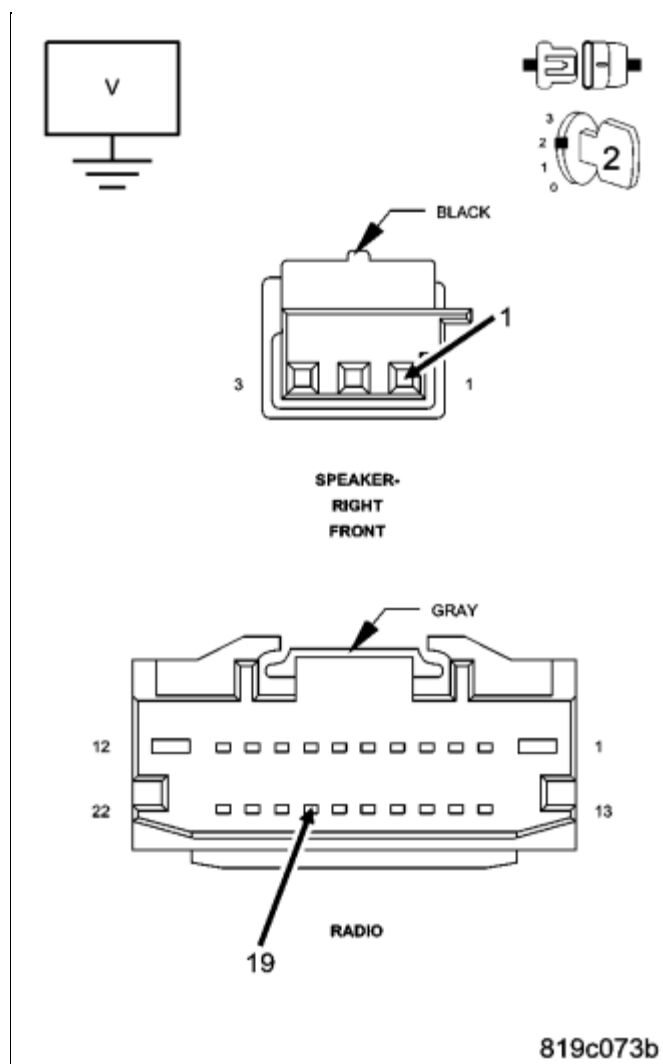
Is the voltage above 10.0 volts?

Yes

- Repair the (X202) Right Front Speakers (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



819c073b

3. (X292) RIGHT FRONT SPEAKERS (-) CIRCUIT SHORTED TO VOLTAGE

Measure for voltage on the (X292) Right Front Speakers (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X292) Right Front Speakers (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

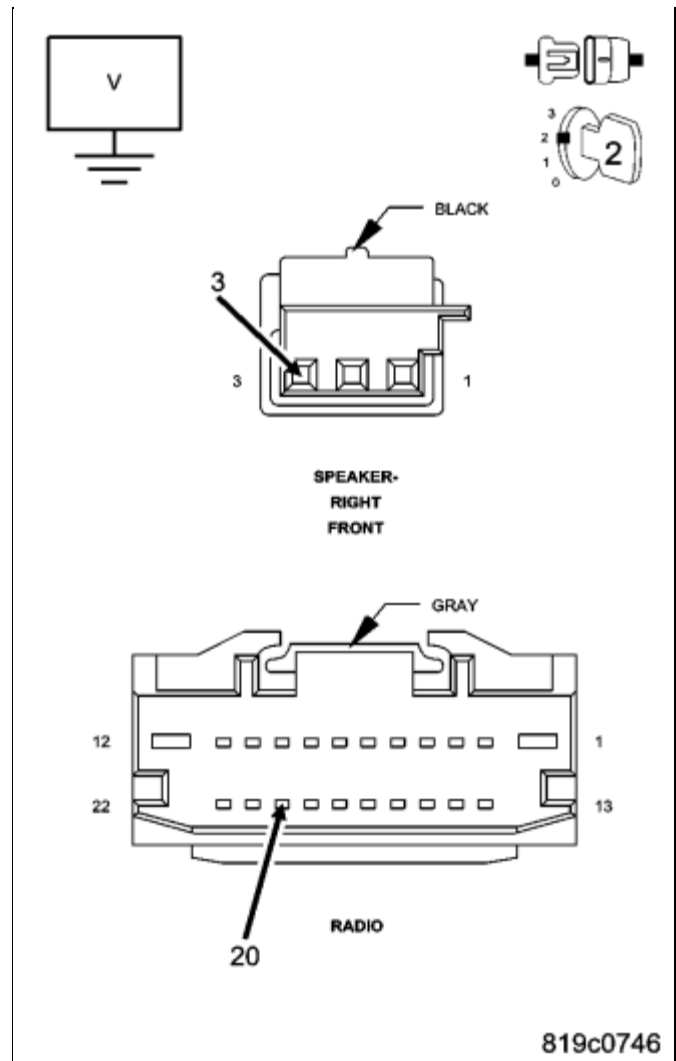
No

- Replace the Radio in accordance with the service

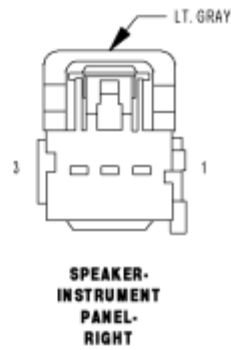
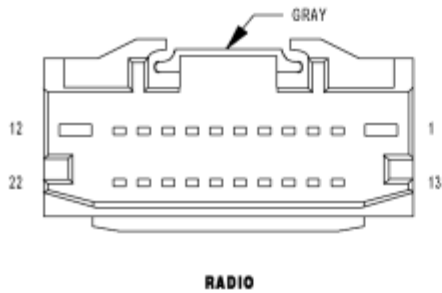
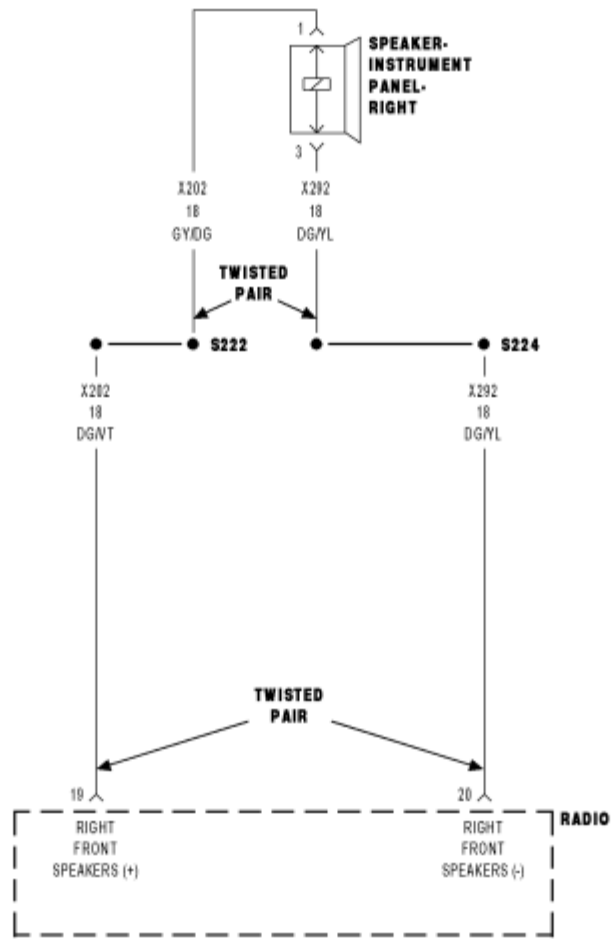
information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN



819c0746



819c057c

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.

- **Set Condition:**
- When the output circuit is open for more than three seconds. The radio will not set the fault if the radio confirms an amplifier is on the BUS.

Possible Causes
(X202) RIGHT FRONT SPEAKERS (+) CIRCUIT OPEN
(X292) RIGHT FRONT SPEAKERS (-) CIRCUIT OPEN
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X202) RIGHT FRONT SPEAKERS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Front Right Audio Speaker harness connector.

Measure the resistance of the (X202) Right Front Speakers (+) circuit between the Radio and the Speaker.

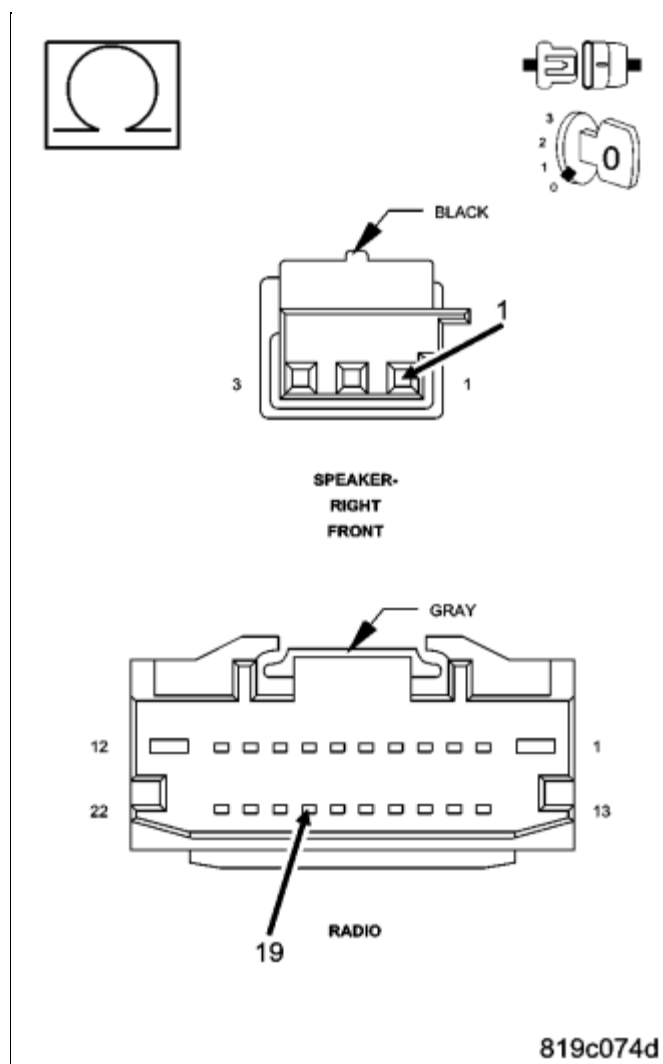
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [3](#)

No

- Repair the (X202) Right Front Speakers (+) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (X292) RIGHT FRONT SPEAKERS (-) CIRCUIT OPEN

Measure the resistance of the (X292) Right Front Speakers (-) circuit between the Radio and the Speaker.

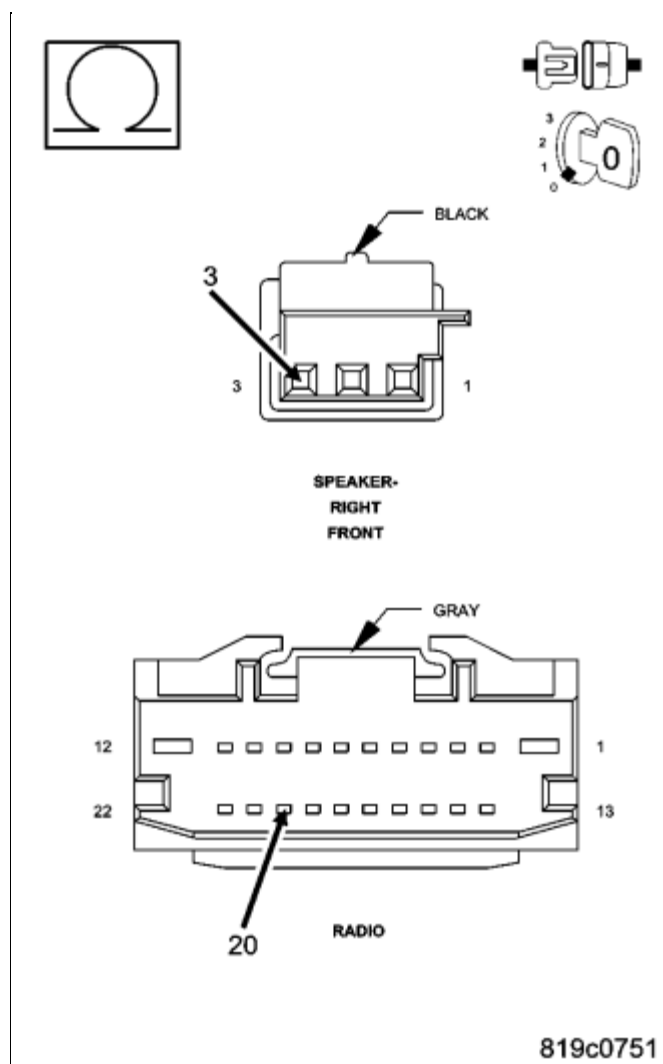
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (X292) Right Front Speakers (-) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. SPEAKER

Connect the Radio harness connector.

With the Front Right Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B1407-FRONT RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

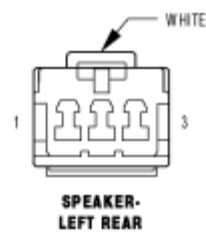
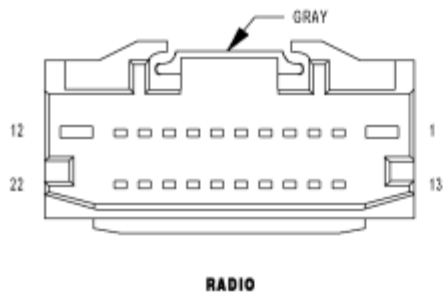
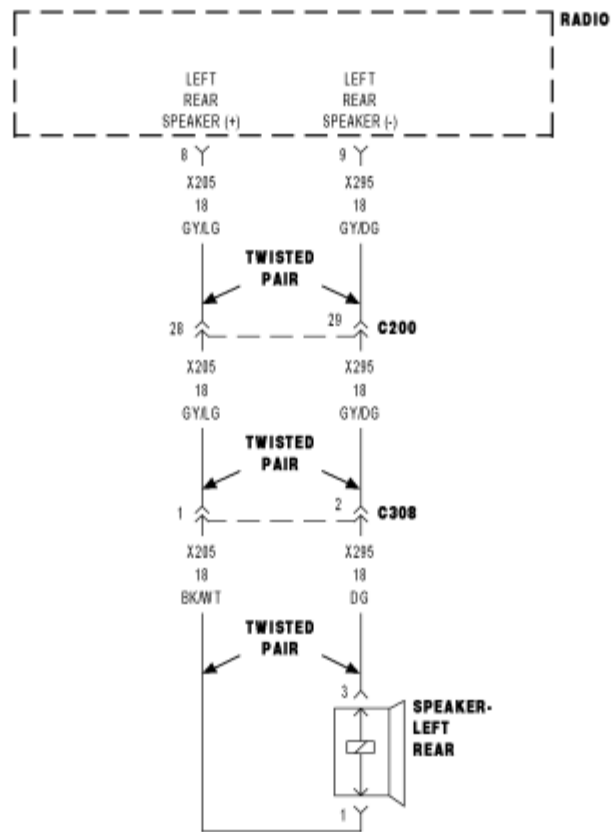
Yes

- Replace the Front Right Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW



019c00a

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.
- **Set Condition:**
- When the output circuit is LOW for more than three seconds.

Possible Causes
(X205) LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X295) LEFT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X205) LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Rear Left Audio Speaker harness connector. Measure the resistance between ground and the (X205) Left Rear Speaker (+) circuit.

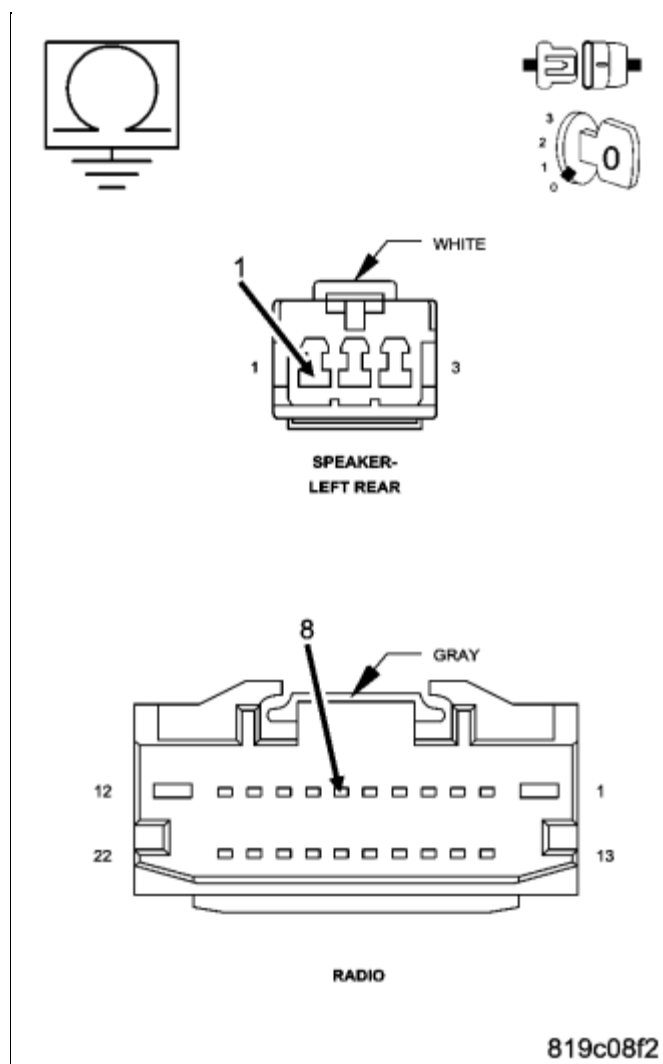
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X205) Left Rear Speaker (+) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X295) LEFT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X295) Left Rear Speaker (-) circuit.

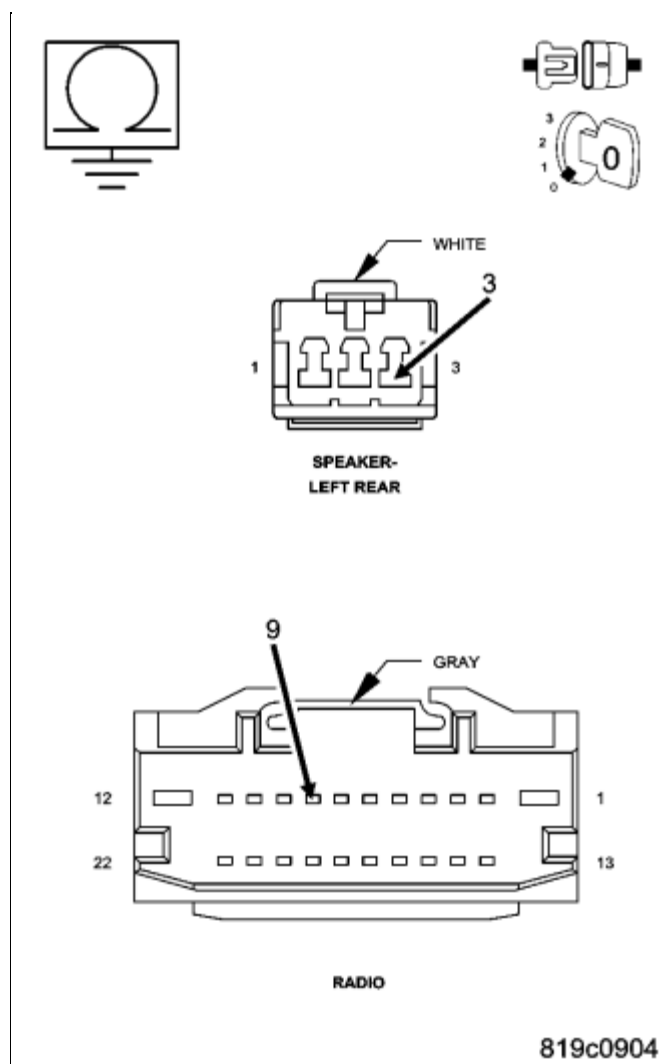
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X295) Left Rear Speaker (-) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. SPEAKER

Connect the Radio harness connector.

With the Rear Left Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B1409-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

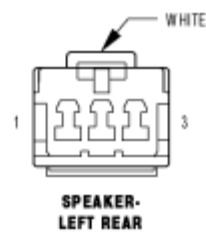
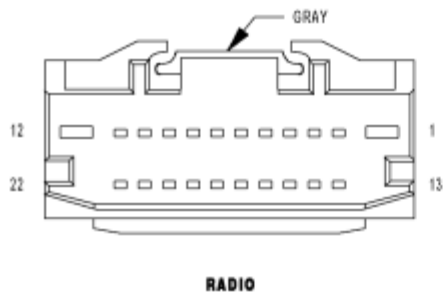
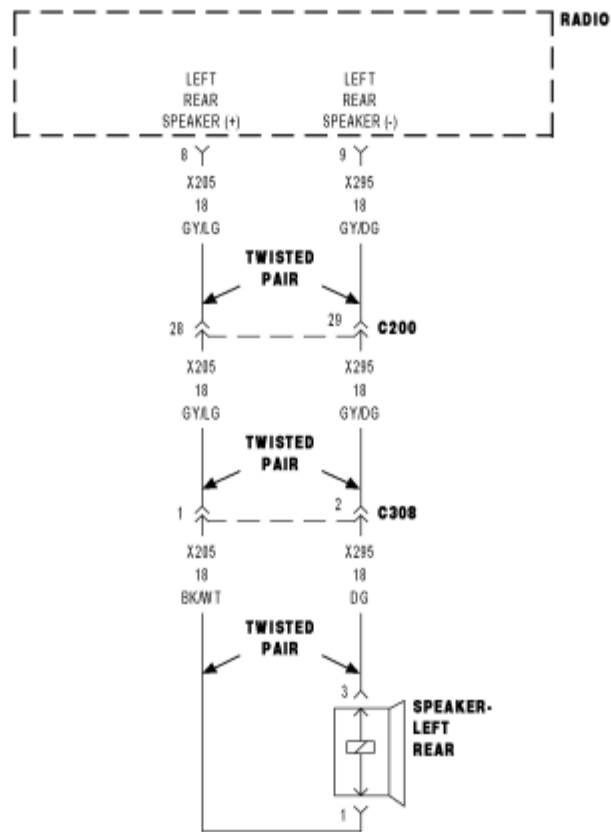
Yes

- Replace the Rear Left Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH



019c00a

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(X205) LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO VOLTAGE
(X295) LEFT REAR SPEAKER (-) CIRCUIT SHORTED TO VOLTAGE
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B140A-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X205) LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Radio harness connector.
Disconnect the Left Rear Audio Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X205) Left Rear Speaker (+) circuit.

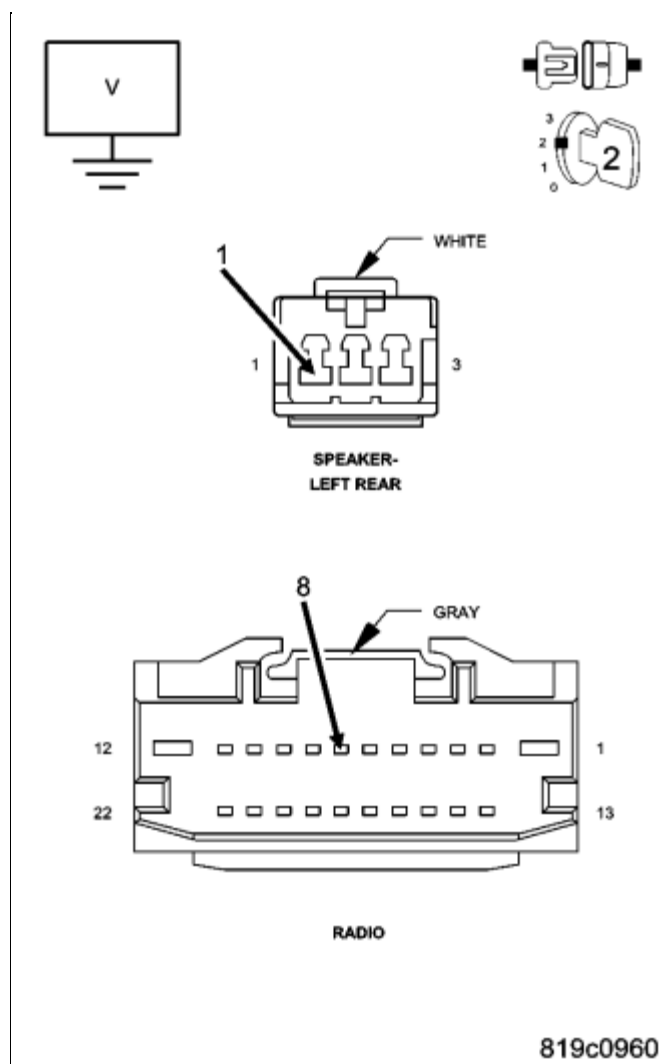
Is the voltage above 10.0 volts?

Yes

- Repair the (X205) Left Rear Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X295) LEFT REAR SPEAKER (-) CIRCUIT SHORTED TO VOLTAGE

Measure for voltage on the (X295) Left Rear Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X295) Left Rear Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

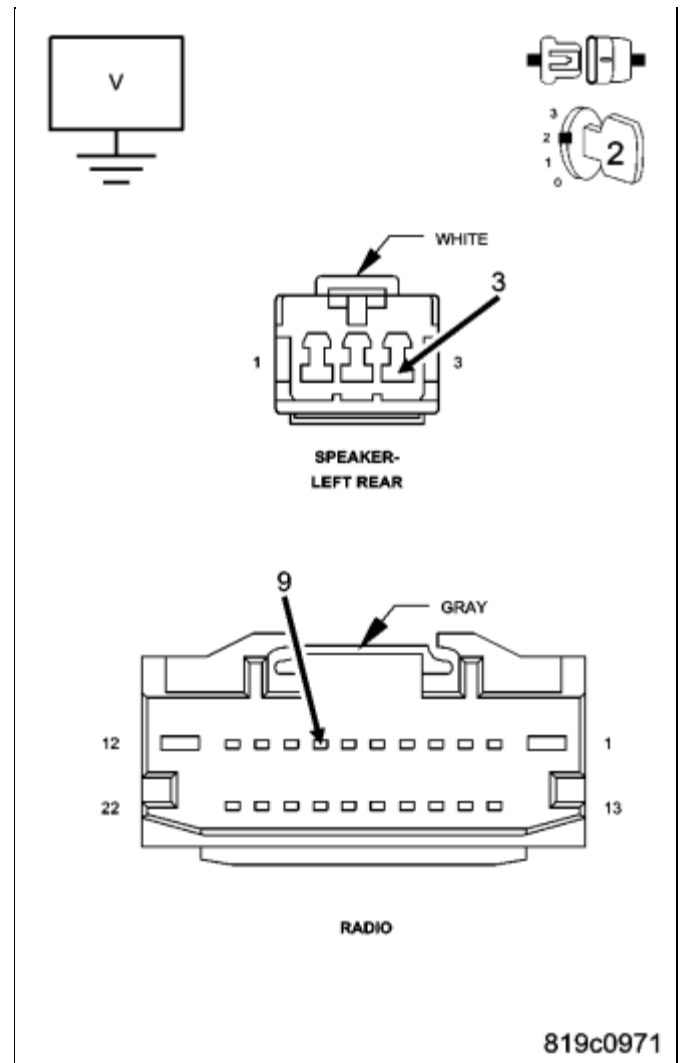
No

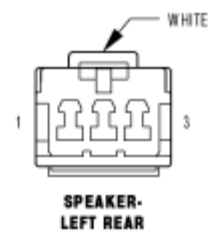
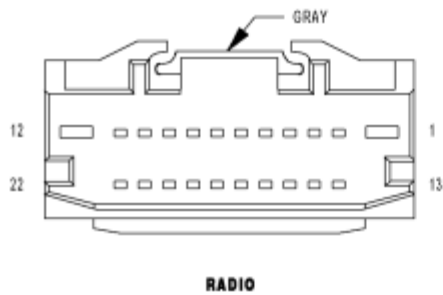
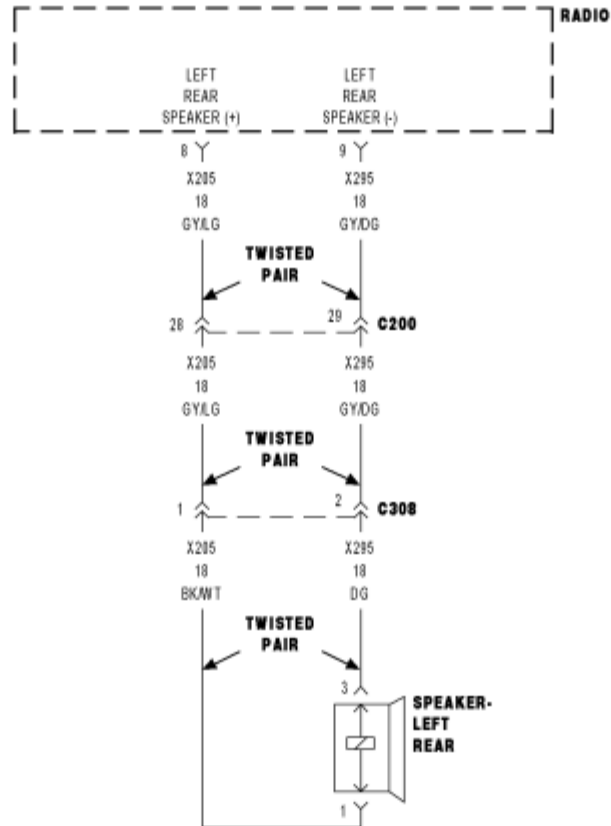
- Replace the Radio in accordance with the service

information.

- Perform the BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





01Sc000b

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.

- **Set Condition:**
- When the output circuit is open for more than three seconds. The radio will not set the fault if the radio confirms an amplifier is on the BUS.

Possible Causes
(X205) LEFT REAR SPEAKER (+) CIRCUIT OPEN
(X295) LEFT REAR SPEAKER (-) CIRCUIT OPEN
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X205) LEFT REAR SPEAKER (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Rear Left Audio Speaker harness connector.

Measure the resistance of the (X205) Left Rear Speaker (+)

circuit between the Radio and the Speaker.

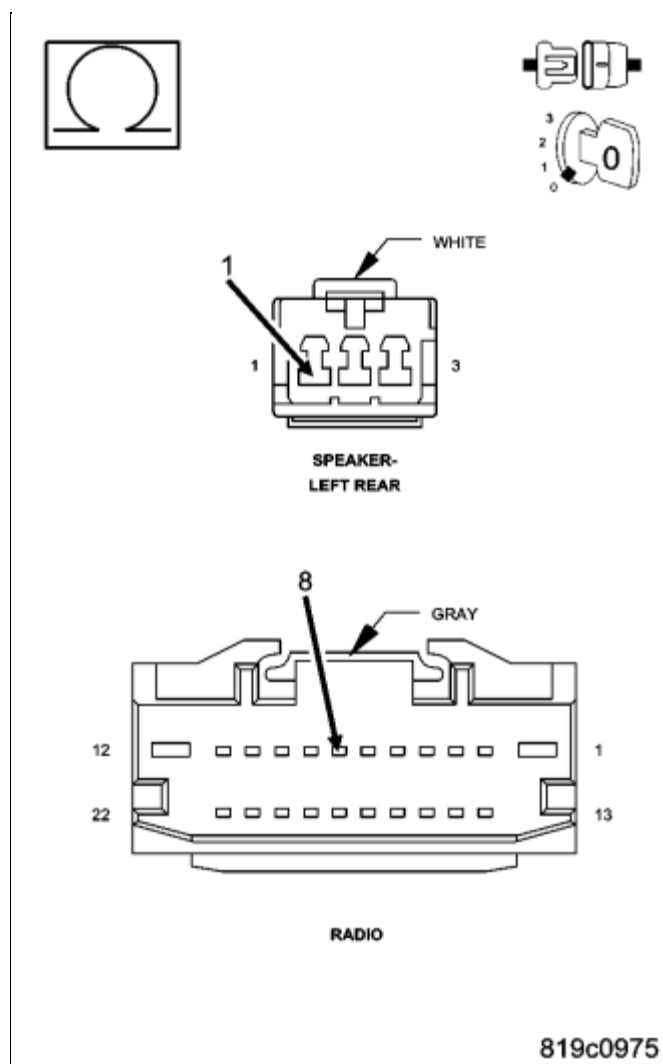
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [3](#)

No

- Repair the (X205) Left Rear Speaker (+) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (X295) LEFT REAR SPEAKER (-) CIRCUIT OPEN

Measure the resistance of the (X295) Left Rear Speaker (-) circuit between the Radio and the Speaker.

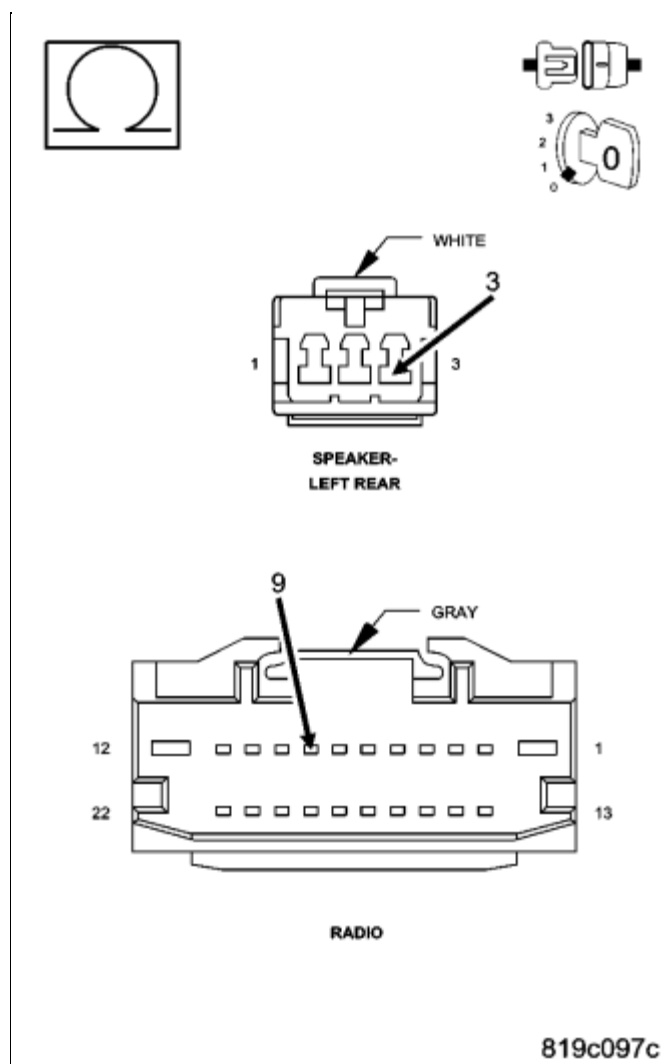
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (X295) Left Rear Speaker (-) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. SPEAKER

Connect the Radio harness connector.

With the Rear Left Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B140B-REAR LEFT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

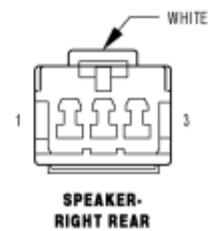
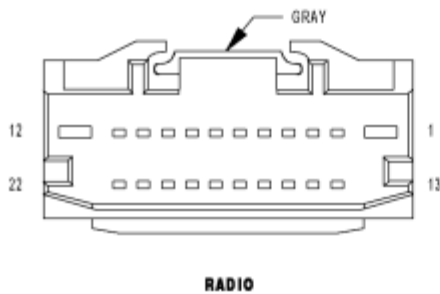
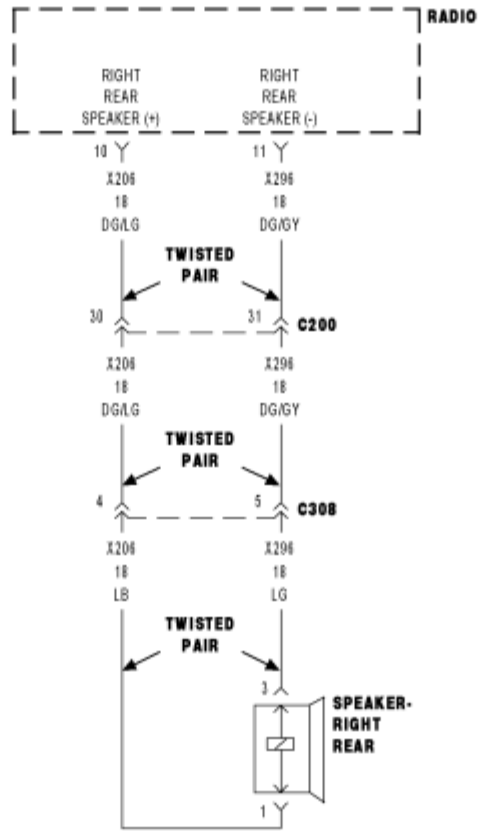
Yes

- Replace the Rear Left Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW



019c0004

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.
- **Set Condition:**
- When the output circuit is LOW for more than three seconds.

Possible Causes
(X206) RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X296) RIGHT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X206) RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Rear Right Audio Speaker harness connector.

Measure the resistance between ground and the (X206) Right Rear Speaker (+) circuit.

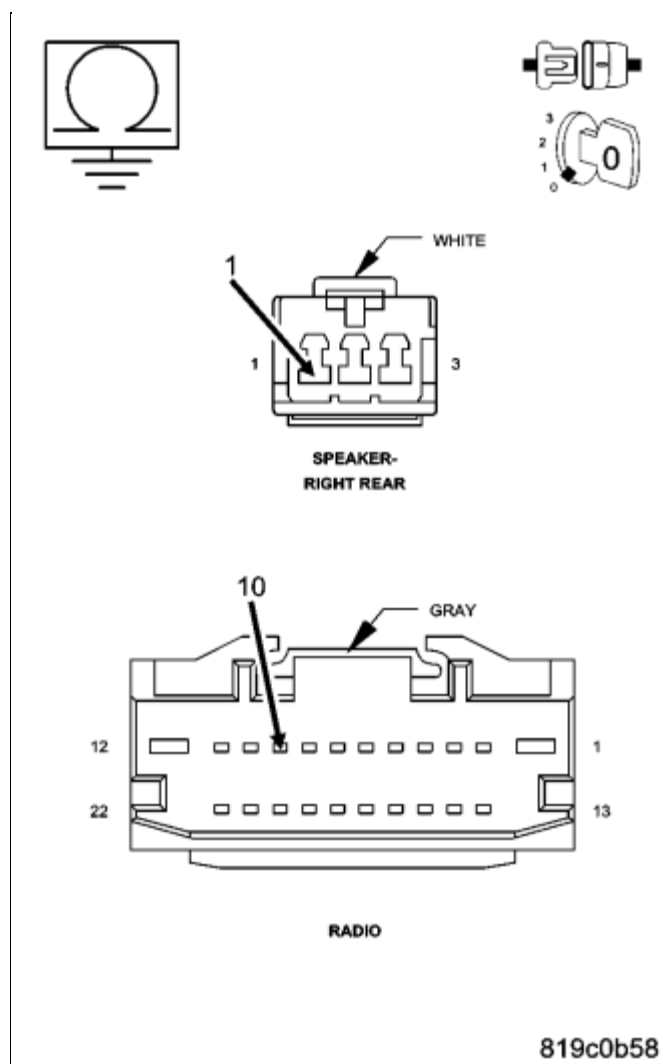
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X206) Right Rear Speaker (+) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X296) RIGHT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X296) Right Rear Speaker (-) circuit.

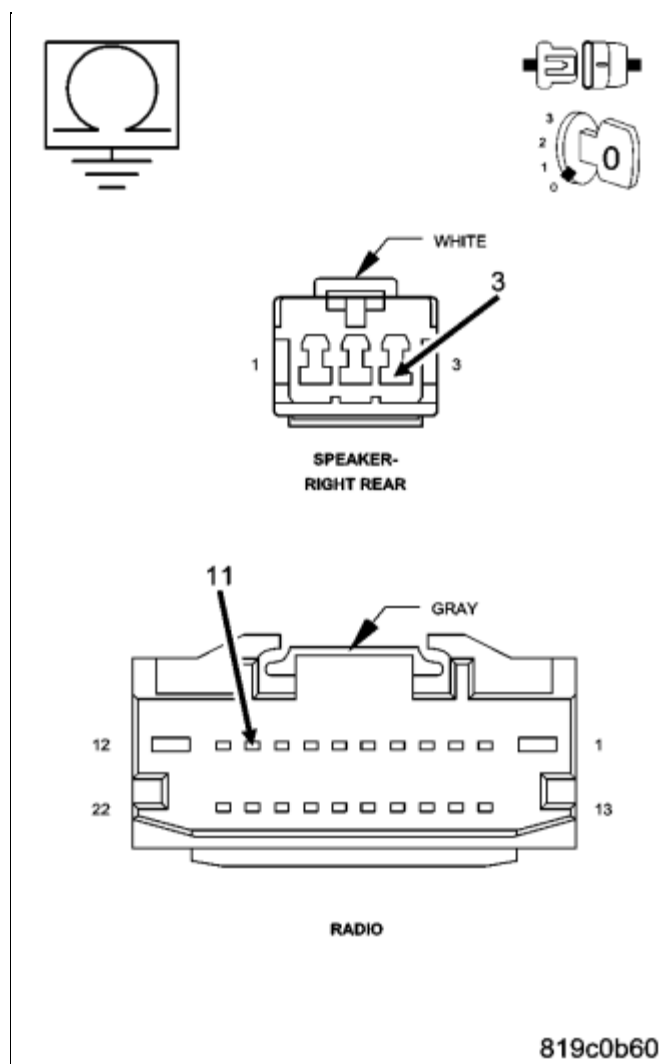
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X296) Right Rear Speaker (-) circuit for a short to ground condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. SPEAKER

Connect the Radio harness connector.

With the Rear Right Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B140D-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT LOW?

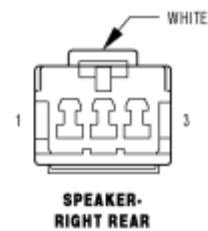
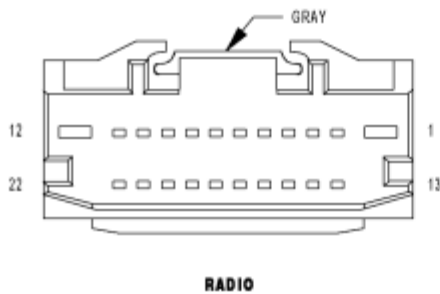
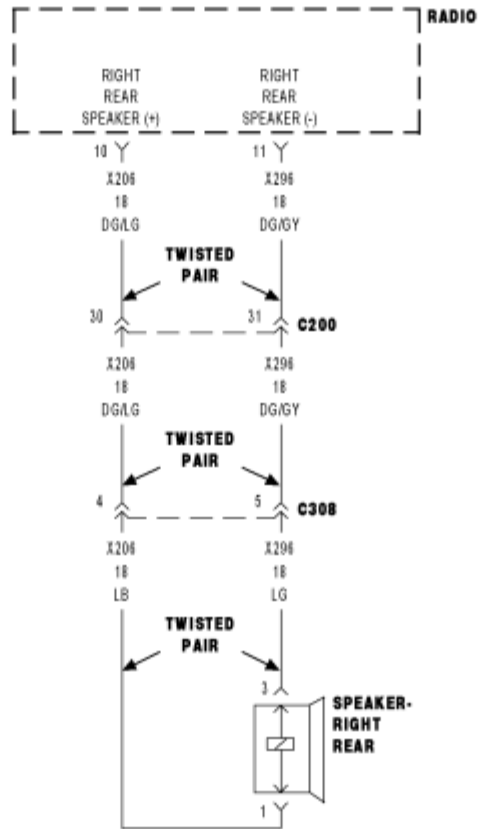
Yes

- Replace the Rear Right Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH



019c0004

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(X206) RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO VOLTAGE
(X296) RIGHT REAR SPEAKER (-) CIRCUIT SHORTED TO VOLTAGE
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Radio DTCs.

Does the scan tool display active: B140E-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X206) RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Radio harness connector.
Disconnect the Right Rear Audio Speaker harness connector.

Turn the ignition on.
Measure for voltage on the (X206) Right Rear Speaker (+) circuit.

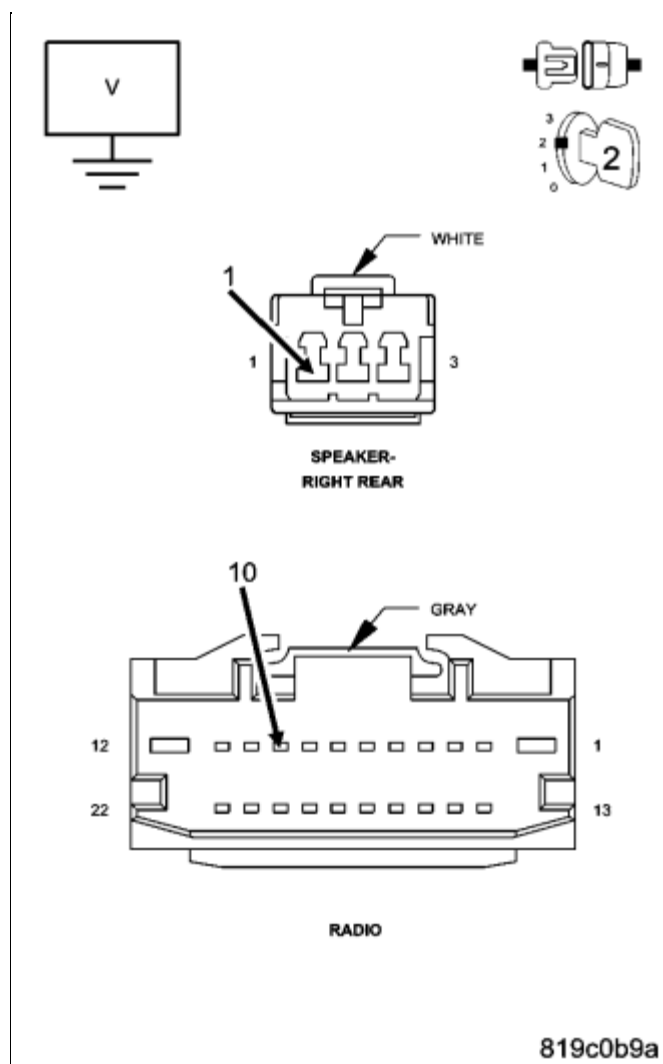
Is the voltage above 10.0 volts?

Yes

- Repair the (X206) Right Rear Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (X296) RIGHT REAR SPEAKER (-) CIRCUIT SHORTED TO VOLTAGE

Measure for voltage on the (X296) Right Rear Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X296) Right Rear Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

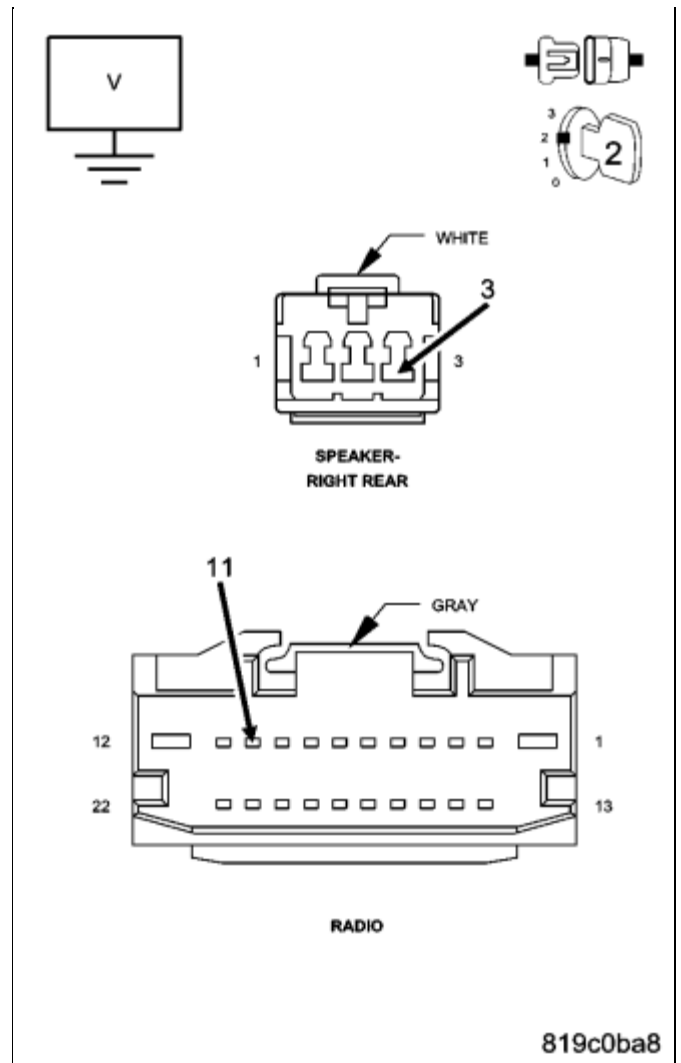
No

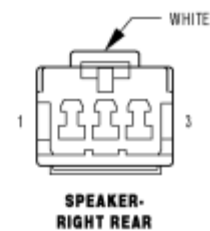
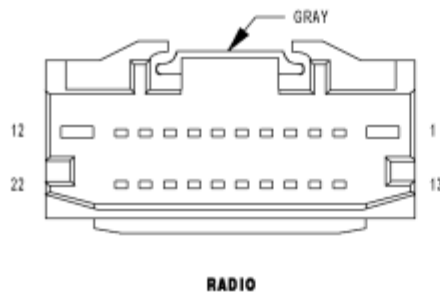
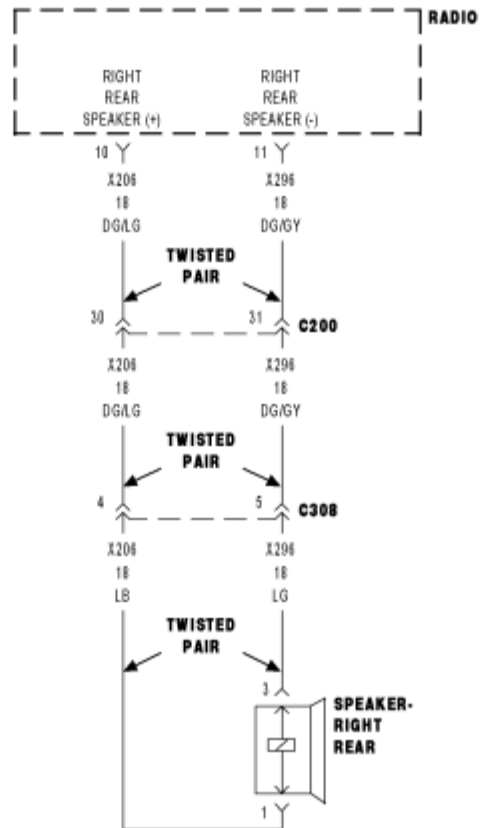
- Replace the Radio in accordance with the service

information.

- Perform the BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN





019c000d

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the radio on.

- **Set Condition:**
- When the output circuit is open for more than three seconds. The radio will not set the fault if the radio confirms an amplifier is on the BUS.

Possible Causes
(X206) RIGHT REAR SPEAKER (+) CIRCUIT OPEN
(X296) RIGHT REAR SPEAKER (-) CIRCUIT OPEN
SPEAKER

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all Radio DTC's.

Turn the Radio on.

With the scan tool, read the DTC information.

Does the scan tool read: B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (X206) RIGHT REAR SPEAKER (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio harness connector.

Disconnect the Rear Right Audio Speaker harness connector.

Measure the resistance of the (X206) Right Rear Speaker (+) circuit between the Radio and the Speaker.

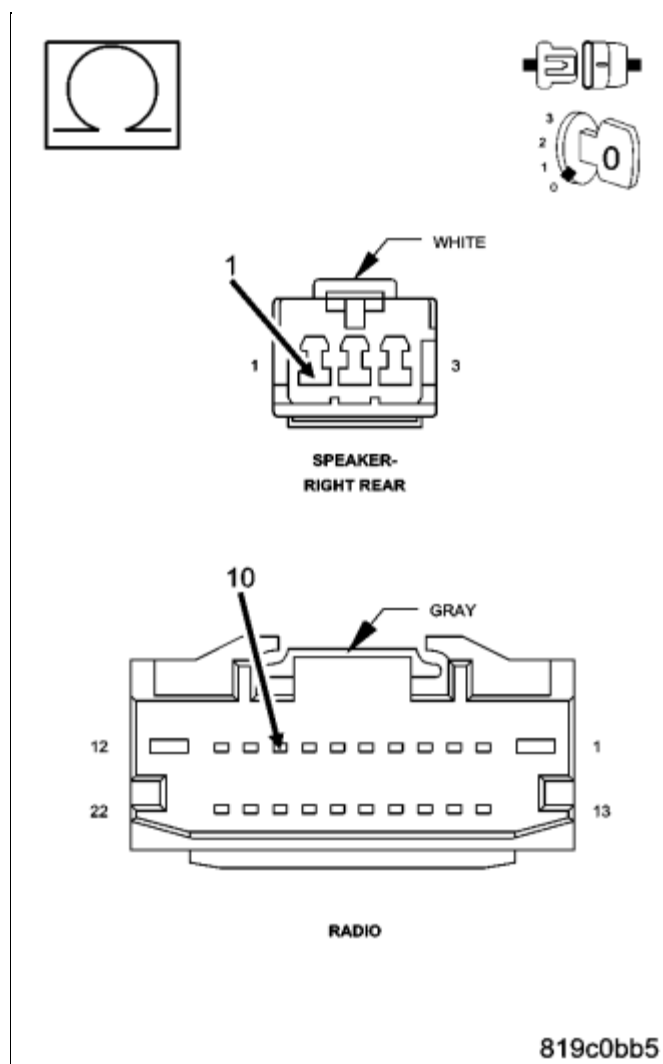
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [3](#)

No

- Repair the (X206) Right Rear Speaker (+) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (X296) RIGHT REAR SPEAKER (-) CIRCUIT OPEN

Measure the resistance of the (X296) Right Rear Speaker (-) circuit between the Radio and the Speaker.

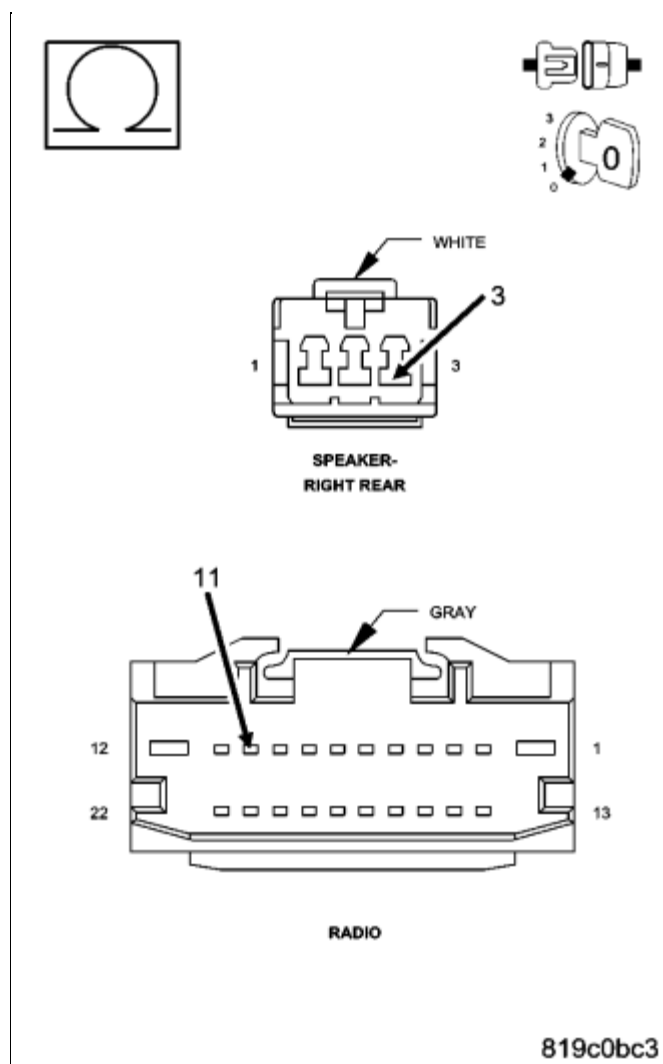
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (X296) Right Rear Speaker (-) circuit for an open condition.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. SPEAKER

Connect the Radio harness connector.

With the Rear Right Audio Speaker still disconnected, turn the ignition on.

Turn the Radio on.

With the scan tool, clear all Radio DTC's.

With the scan tool, read the DTC information.

Does the scan tool read: B140F-REAR RIGHT AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Replace the Rear Right Audio Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1421-AUDIO CD READ ERROR/INOPERABLE DISC

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Continuously with the ignition on and the radio CD player turned on.
- **Set Condition:**
- The code will set if a CD that is not formatted as a music CD is installed in the radio CD player.

Possible Causes
CD READ FAILURE

Diagnostic Test

1. RADIO

Replace the problem CD with a good, clean, unscratched, music CD.

Turn the radio CD player on.

With the scan tool, read DTC's.

Does the scan tool display: B1421 AUDIO CD READ ERROR/INOPERABLE DISC?

Yes

- Eject the inoperative CD and replace the CD in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B142F-SATELLITE RADIO ANTENNA NOT CONNECTED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on and the Satellite Radio in seek mode.
- **Set Condition:**
- With the radio in seek mode for two loops around the band. The radio does not detect an antenna connection or does not receive a radio satellite signal.

Possible Causes
BAD ANTENNA CONNECTION

SATELLITE RADIO RECEIVER

Diagnostic Test

1. TEST ANTENNA

Turn the ignition off.
Disconnect the Satellite Radio Antenna connector.
Inspect the Satellite Radio Antenna connection.

Was the Antenna connection clean and secure?

Yes

- Go To [2](#)

No

- Repair the Antenna connection as needed.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. SATELLITE RADIO ANTENNA

Refer to the Audio System in the service information and test the antenna in accordance with the service procedure.

Is the Antenna ok?

Yes

- Go To [3](#)

No

- Repair or replace the Antenna assembly as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. SATELLITE RADIO RECEIVER

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft (9.144m) from any structure.

Turn the ignition and radio on.
With the scan tool, erase the audio DTC's, put the satellite radio in seek up and down mode for 2 loops around the band cycle before proceeding.
With the scan tool, read the audio DTC's.

Did this DTC reset?

Yes

- Replace the Satellite Radio Receiver in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1460-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ±1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1460-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

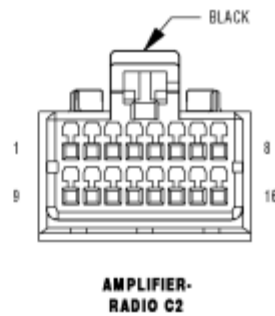
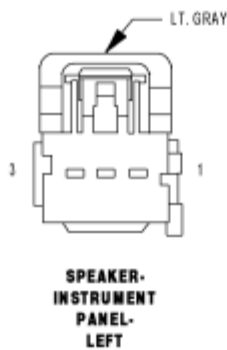
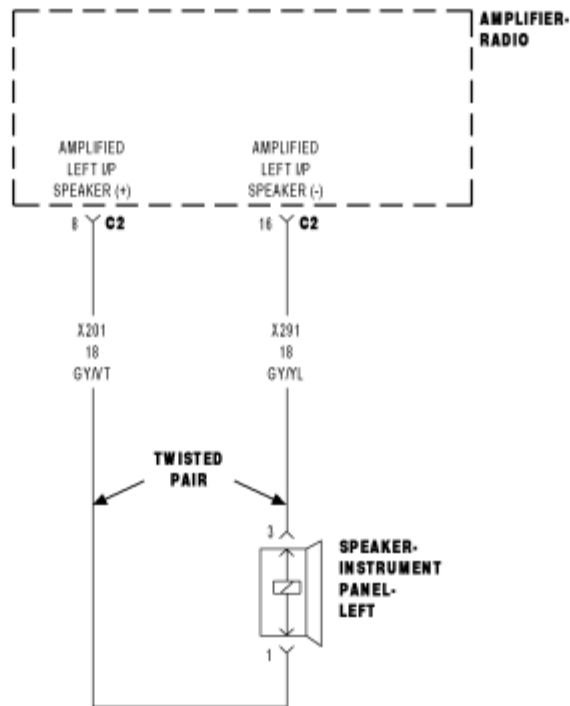
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW



810c0e17

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X201) AMPLIFIED LEFT FRONT I/P SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X291) AMPLIFIED LEFT FRONT I/P SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1461-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X201) AMPLIFIED LEFT FRONT I/P SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Left I/P Speaker harness connector.

Measure the resistance between ground and the (X201) Amplified Left Front I/P Speaker (+) circuit.

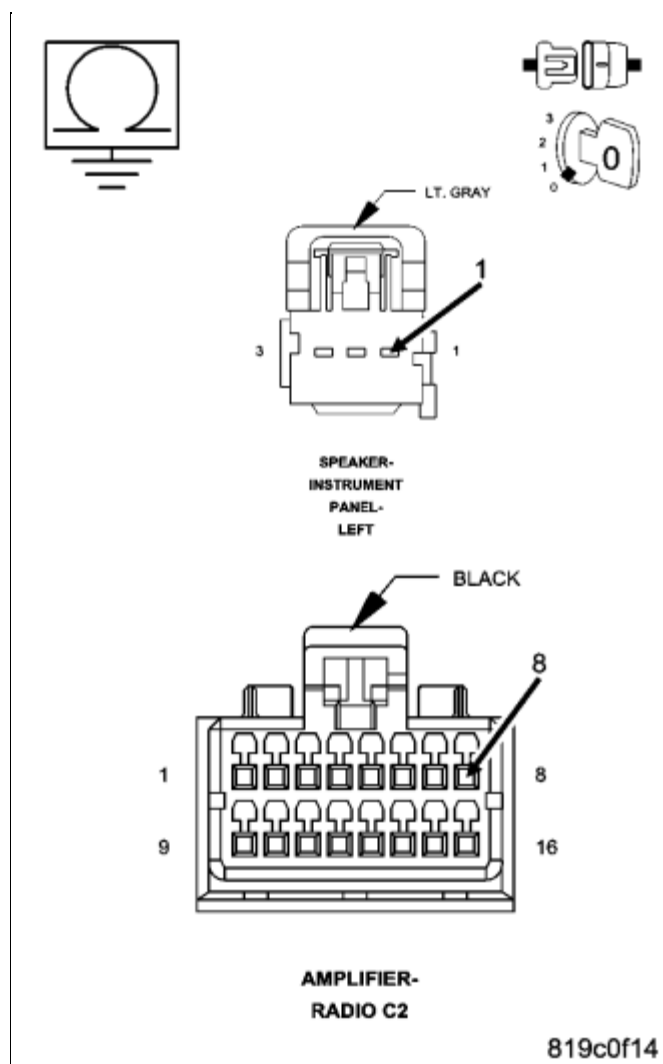
Is the resistance below 10K ohms?

Yes

- Repair the (X201) Amplified Left Front I/P Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X291) AMPLIFIED LEFT FRONT I/P SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X291) Amplified Left Front I/P Speaker (-) circuit.

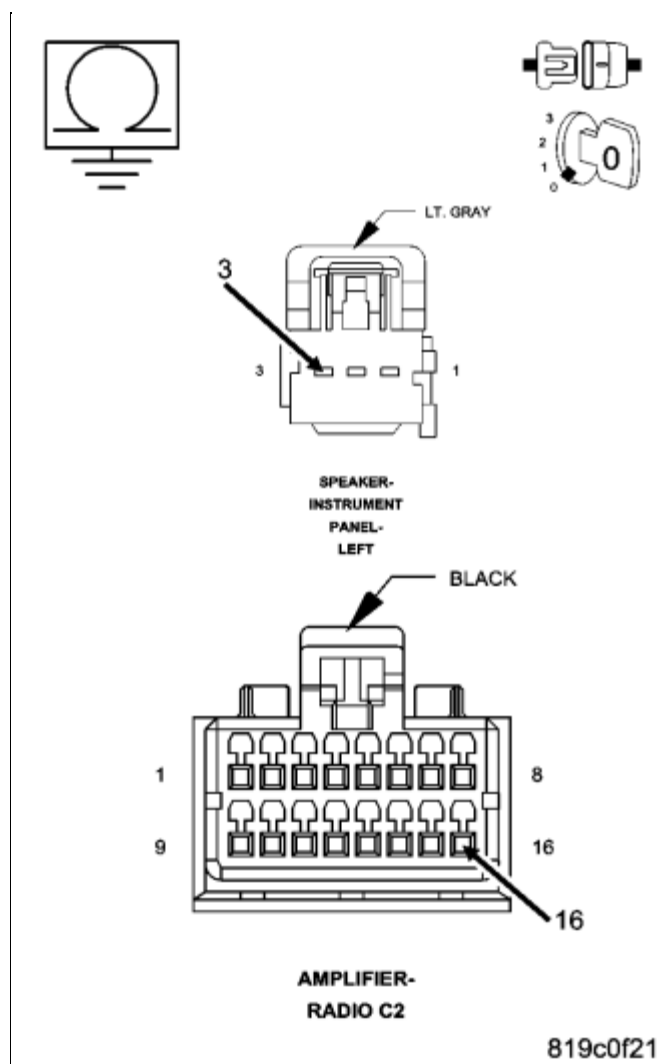
Is the resistance below 10K ohms?

Yes

- Repair the (X291) Amplified Left Front I/P Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED LEFT FRONT I/P SPEAKER

Reconnect and reinstall the Left Front I/P Speaker. Measure the resistance of the speaker circuit between the Amplifier C2 harness connector and ground.

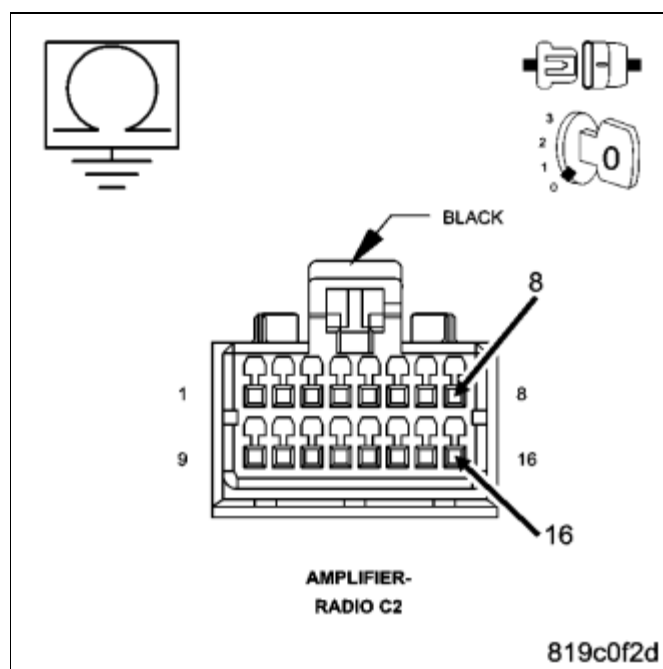
Is the resistance below 10K ohms?

Yes

- Replace the Left Front I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

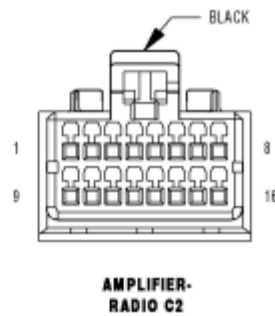
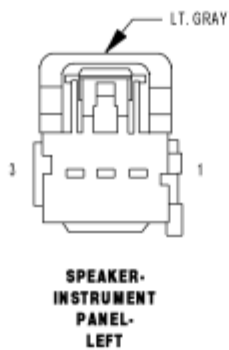
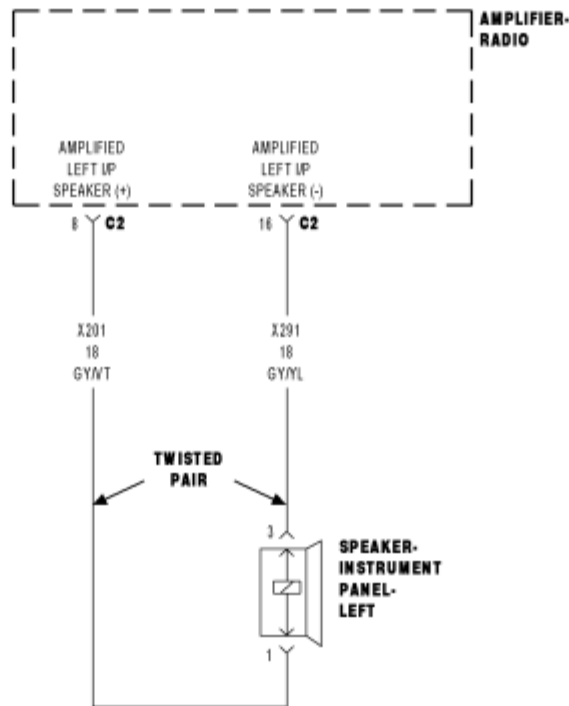
- Replace the Amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



810c0e17

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1462-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Left I/P Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X201) Amplified Left I/P Speaker (+) circuit.

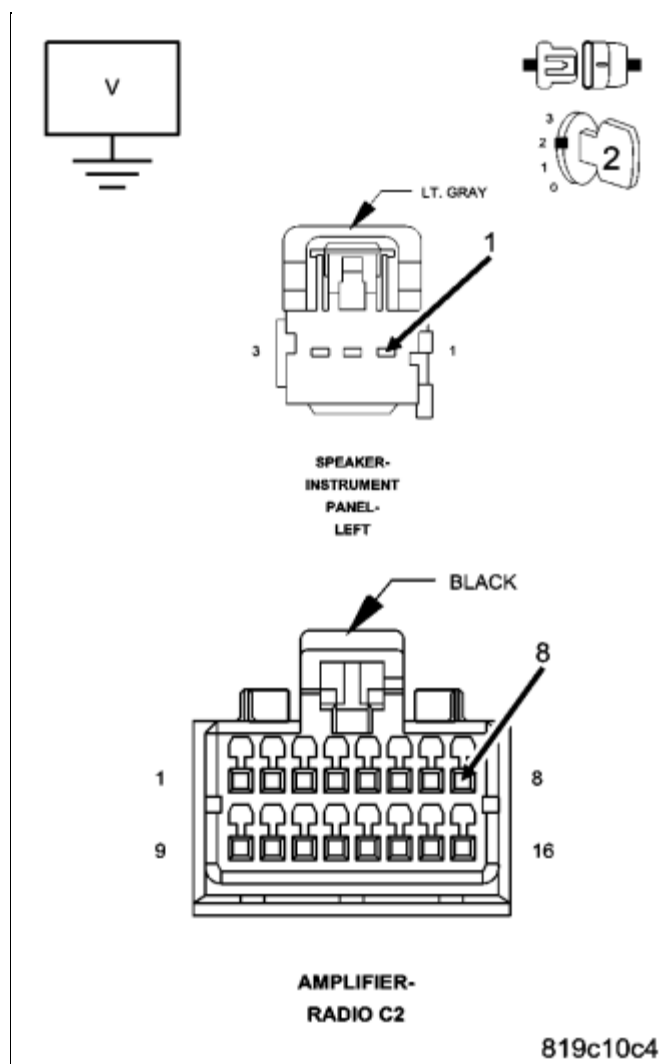
Is the voltage above 10.0 volts?

Yes

- Repair the (X201) Amplified Left I/P Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT

Measure for voltage on the (X291) Amplified Left I/P Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X291) Amplified Left I/P Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

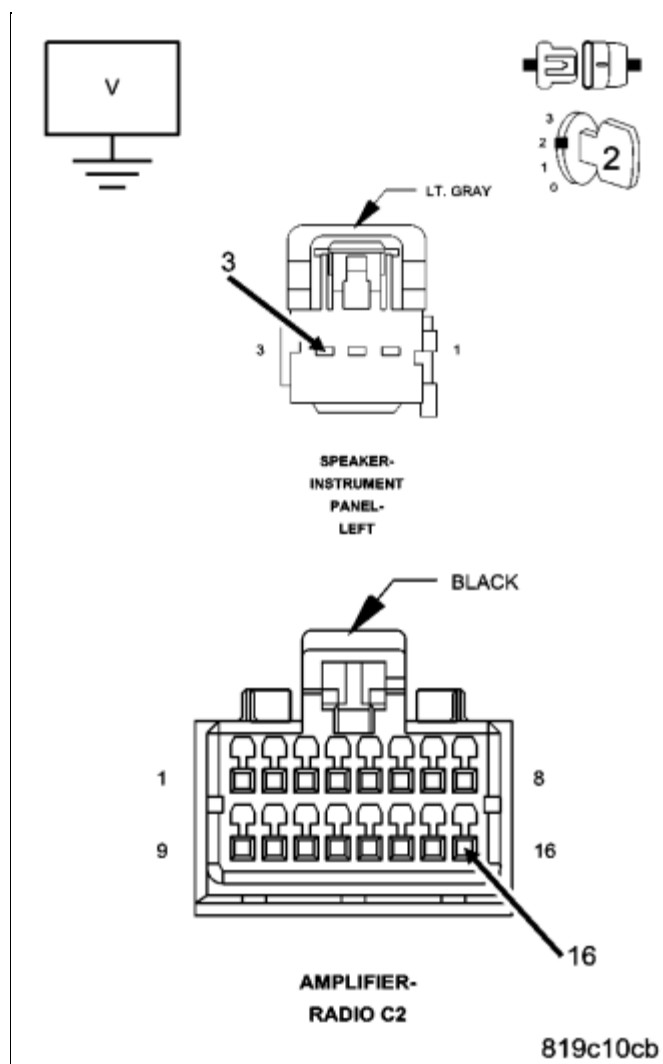
No

- Replace the amplifier in accordance with the service information.

- o Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN

For a complete wiring diagram **Refer to Section 8W.**



- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.
- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT OPEN
(X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT OPEN
LEFT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1463-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE LEFT FRONT I/P SPEAKER

Turn the ignition off.

Disconnect the Left I/P Speaker harness connector.

Turn the ignition on.

Turn the radio on and turn the volume to mid level.

With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left I/P Speaker circuits in the Amplified Left I/P Speaker harness connector.

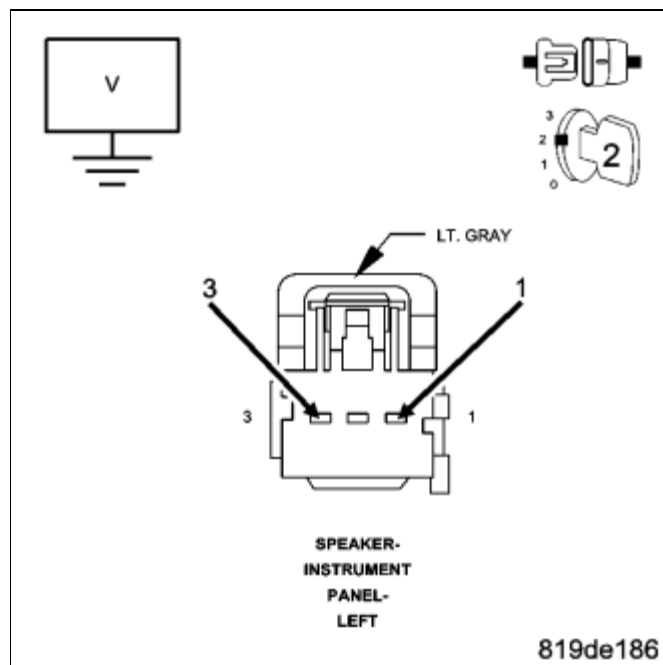
Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Left I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C2 harness connector.
 Measure the resistance of the (X201) Amplified Left I/P Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Left I/P Speaker harness connector.

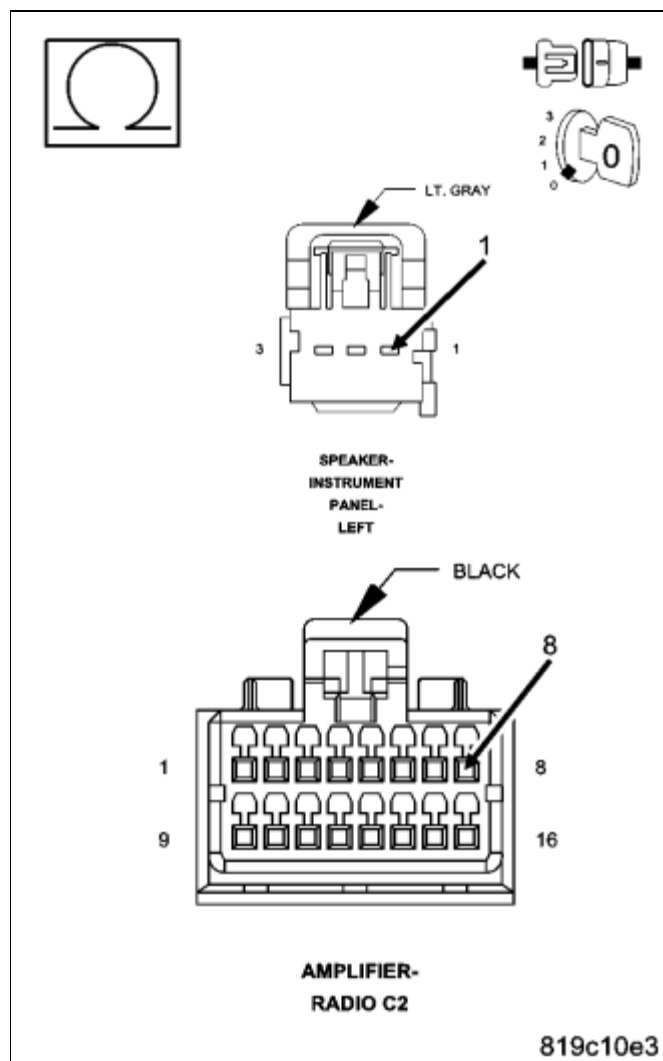
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the (X201) Amplified Left I/P Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



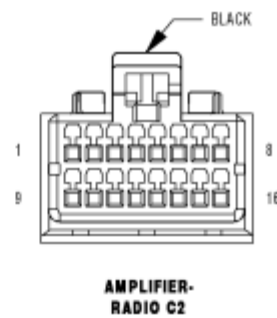
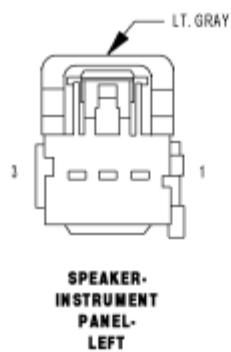
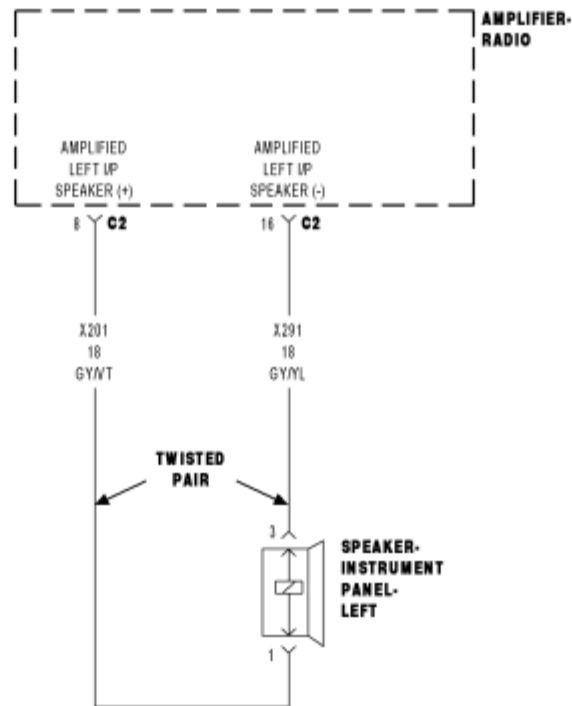
4. CHECK THE (X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X291) amplified Left I/P Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Left I/P Speaker harness connector.

Is the resistance below 5.0 ohms?

Yes

- Replace the Amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1.



810c0e17

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT SHORTED TO THE (X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUIT
AMPLIFIED LEFT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, erase Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1464-CHANNEL 1 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT I/P SPEAKER

Turn the ignition off.

Disconnect the Amplified Left I/P Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Left I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X201) AMPLIFIED LEFT I/P SPEAKER (+) CIRCUIT, AND THE (X291) AMPLIFIED LEFT I/P SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C2 harness connector.
Measure the resistance between the (X201) Amplified Left I/P Speaker (+) circuit, and the (X291) Amplified Left I/P Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X201) Amplified Left I/P Speaker (+) circuit, and the (X291) Amplified Left I/P Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

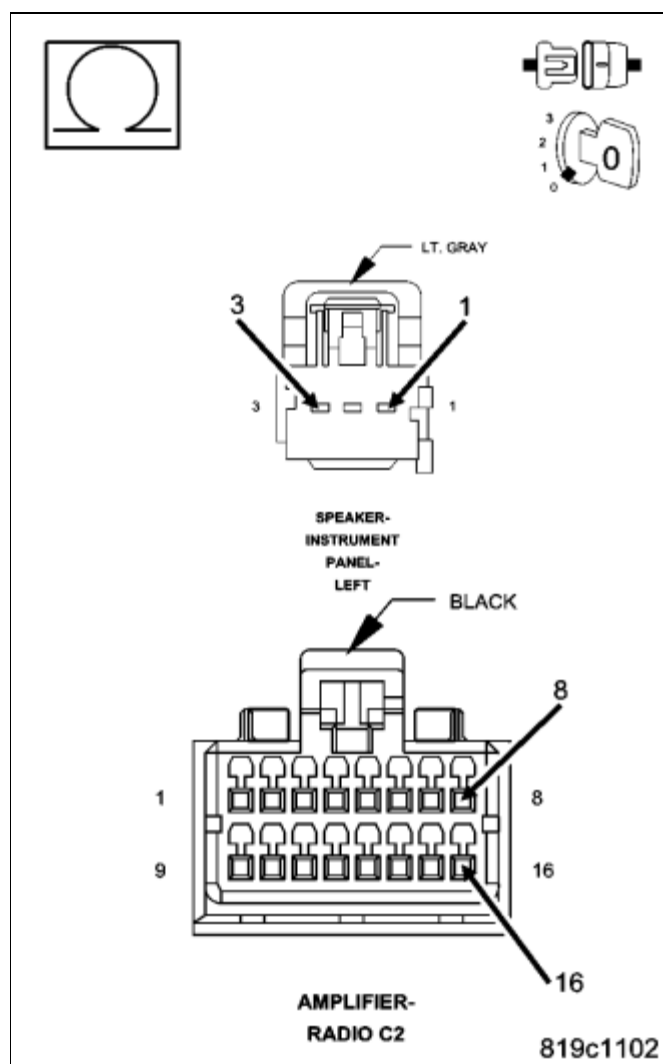
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1465-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.



- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ± 1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read amplifier DTCs.

Does the scan tool display active: B1465-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

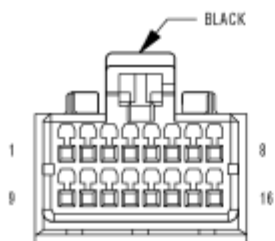
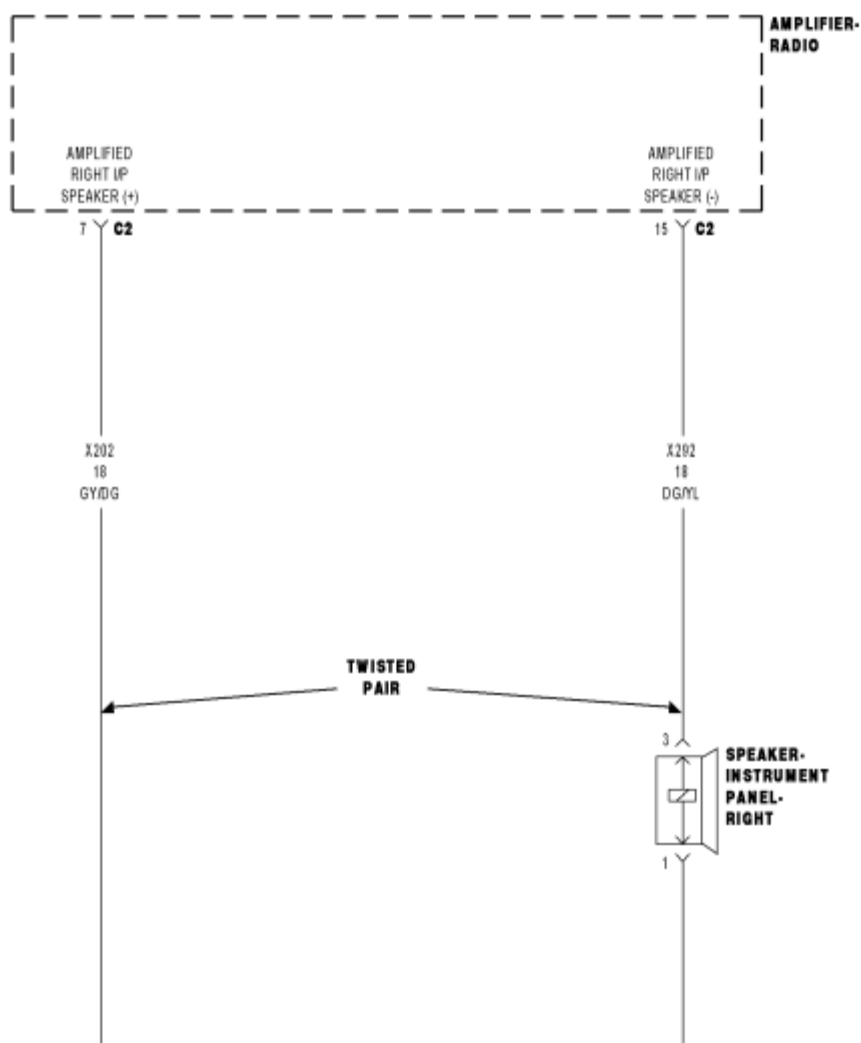
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

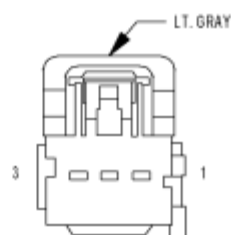
No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW



**AMPLIFIER-
RADIO C2**



**SPEAKER-
INSTRUMENT
PANEL-
RIGHT**

010c13a5

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT FRONT I/P SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X292) AMPLIFIED RIGHT FRONT I/P SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT FRONT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1466-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X202) AMPLIFIED RIGHT FRONT I/P SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Right Front I/P Speaker harness connector.

Measure the resistance between ground and the (X202) Amplified Right Front I/P Speaker (+) circuit.

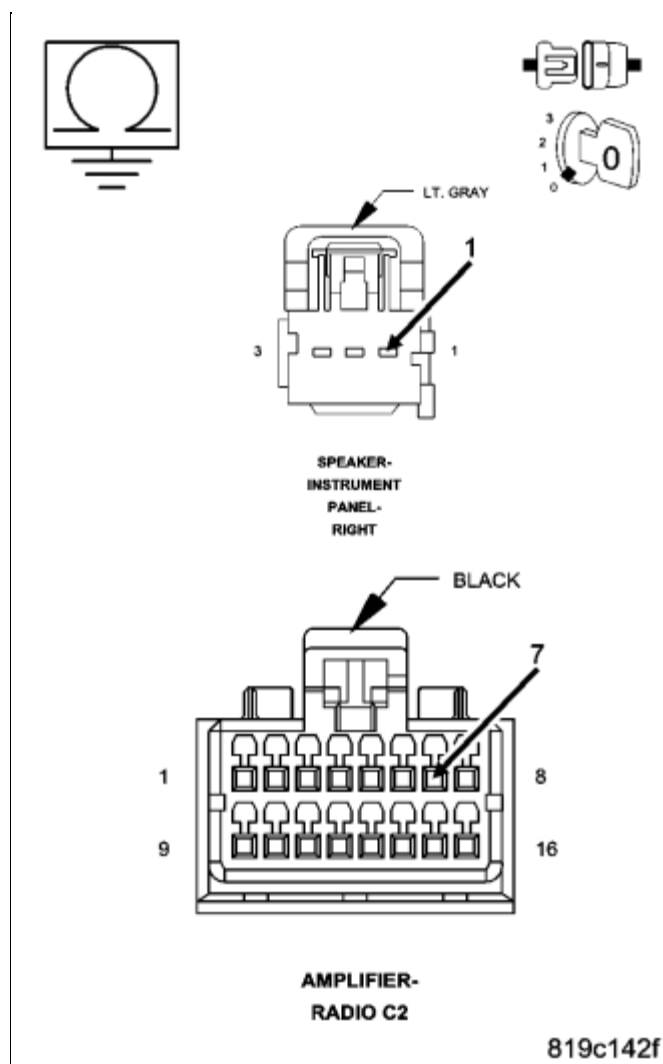
Is the resistance below 10K ohms?

Yes

- Repair the (X202) Amplified Right Front I/P Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X292) AMPLIFIED RIGHT FRONT I/P SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X292) Amplified Right Front I/P Speaker (-) circuit.

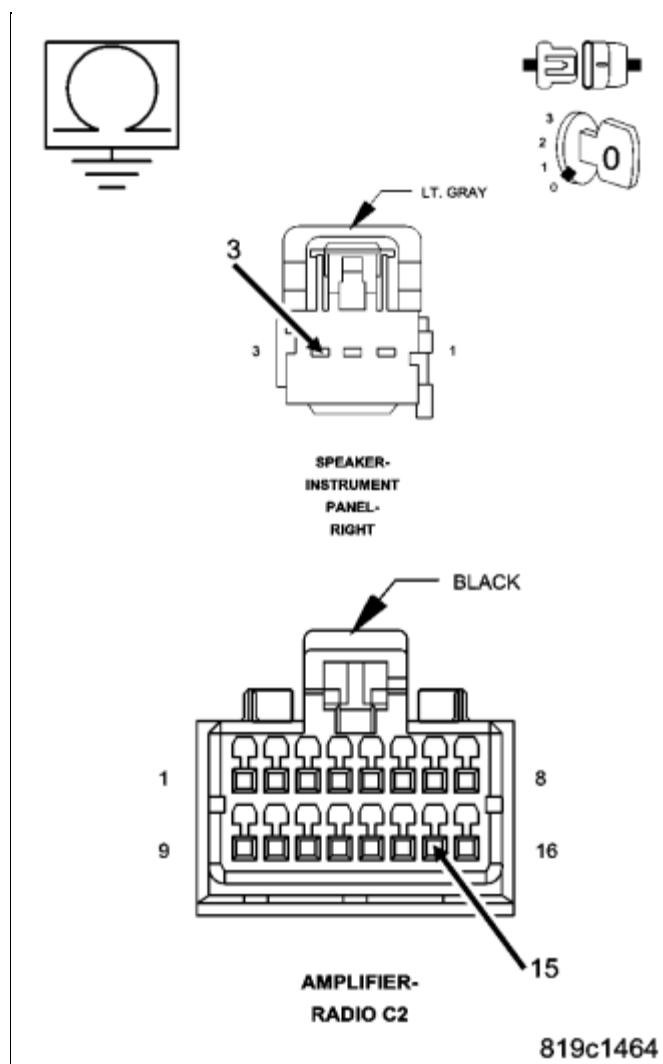
Is the resistance below 10K ohms?

Yes

- Repair the (X292) Amplified Right Front I/P Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED RIGHT FRONT I/P SPEAKER

Reconnect and reinstall the Right Front I/P Speaker. Measure the resistance of the speaker circuit between the Amplifier C2 harness connector and ground.

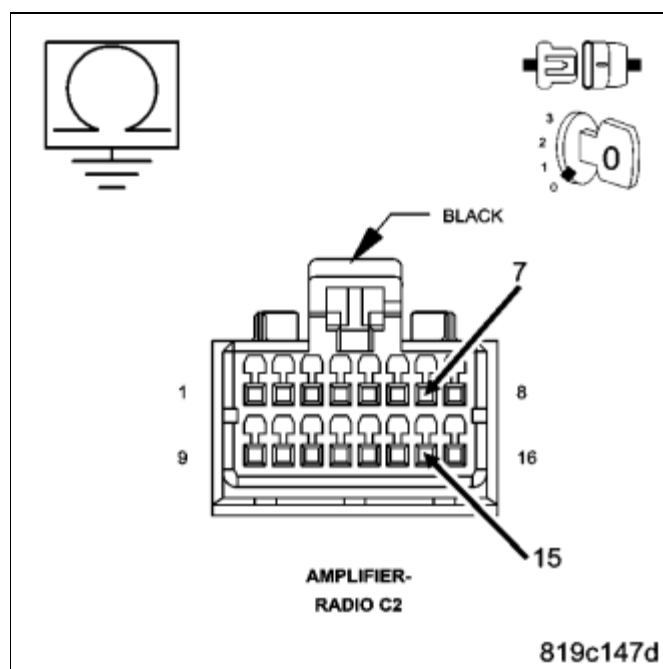
Is the resistance below 10K ohms?

Yes

- Replace the Right Front I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

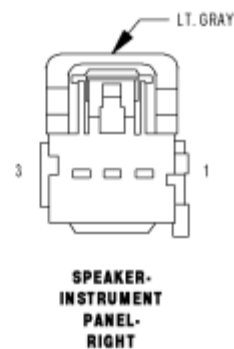
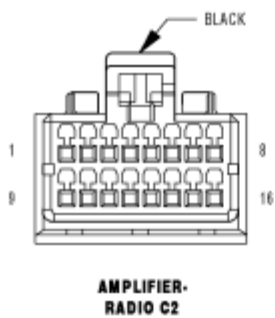
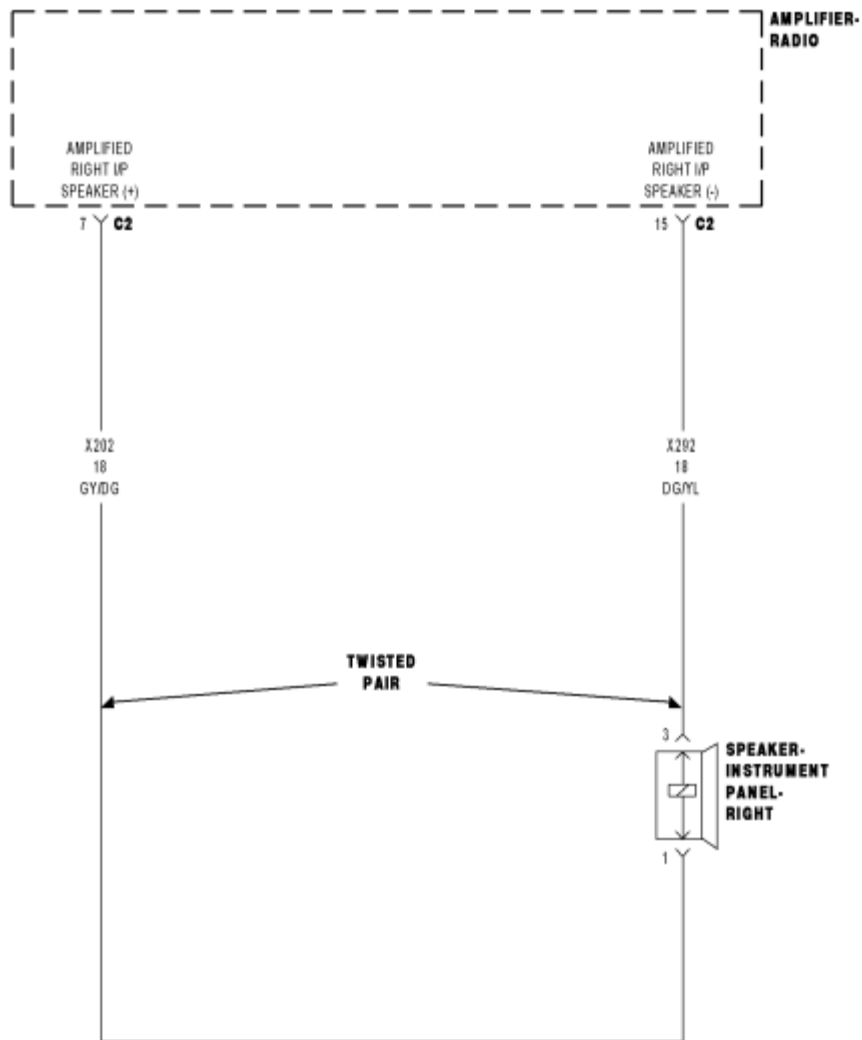
- Replace the amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



019c13a5

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1467-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Right I/P Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X202) Amplified Right I/P Speaker (+) circuit.

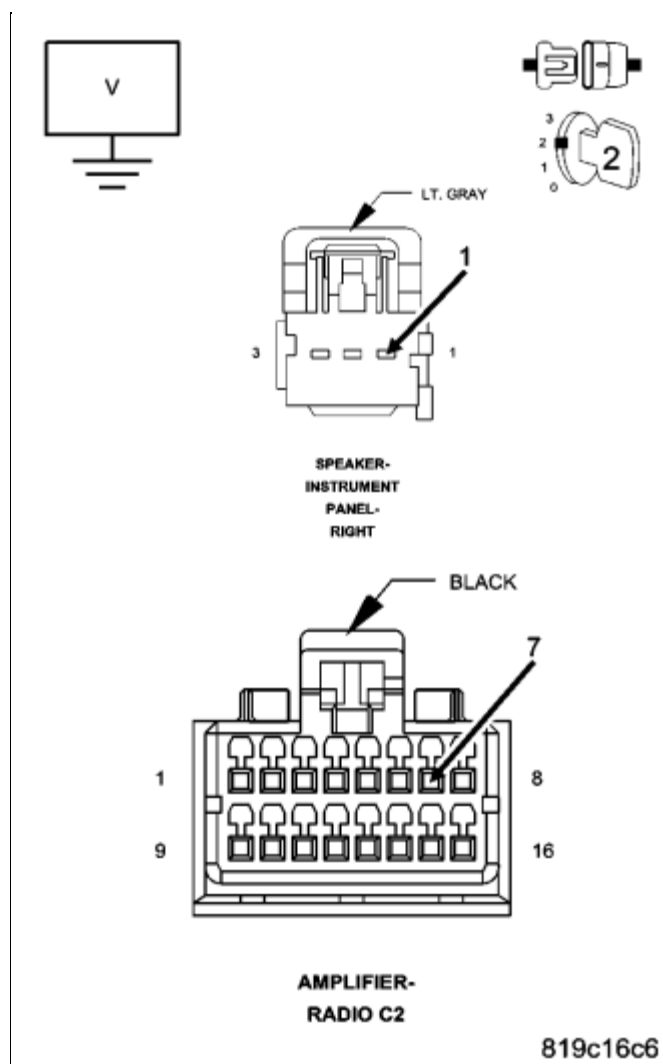
Is the voltage above 10.0 volts?

Yes

- Repair the (X202) Amplified Right I/P Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT

Measure for voltage on the (X292) Amplified Right I/P Speaker (-) circuit.

Is the voltage above 10.0 volts?

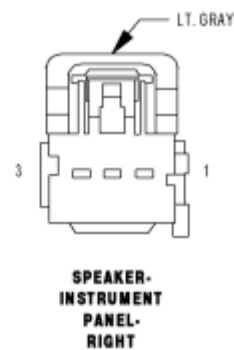
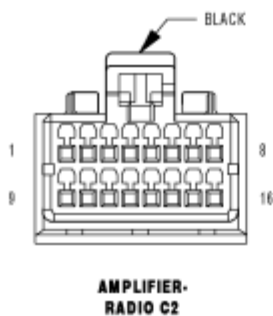
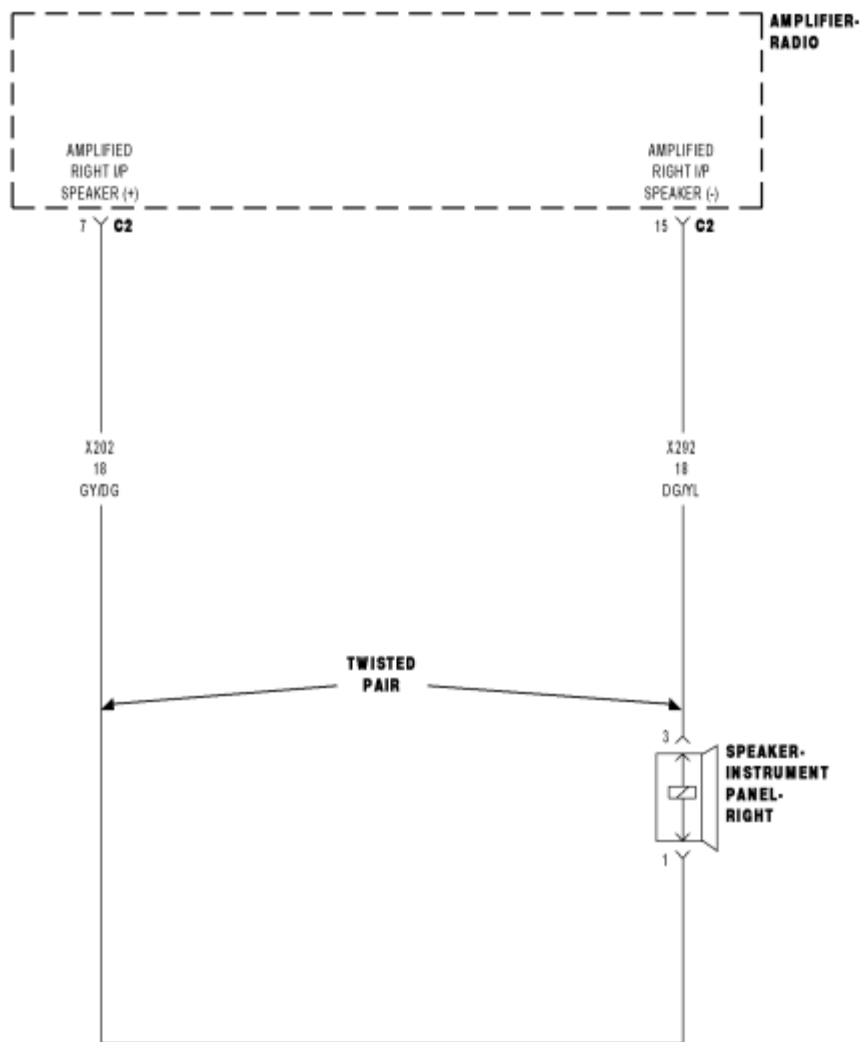
Yes

- Repair the (X292) Amplified Right I/P Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN



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For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.

- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT OPEN
(X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT OPEN
RIGHT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1468-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE RIGHT FRONT I/P SPEAKER

Turn the ignition off.

Disconnect the Right I/P Speaker harness connector.
 Turn the ignition on.
 Turn the radio on and turn the volume to mid level.
 With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right I/P Speaker circuits in the Amplified Right I/P Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Right I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C2 harness connector.
 Measure the resistance of the (X202) Amplified Right I/P Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Right I/P Speaker harness connector.

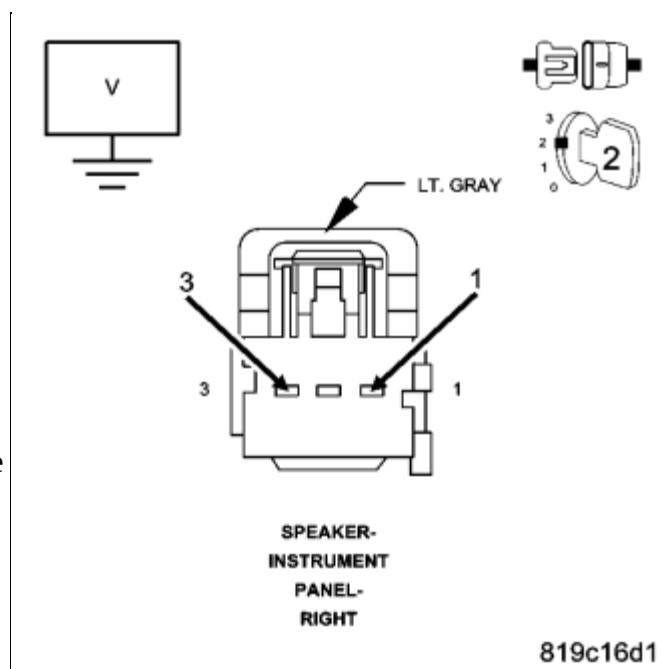
Is the resistance below 5.0 ohms?

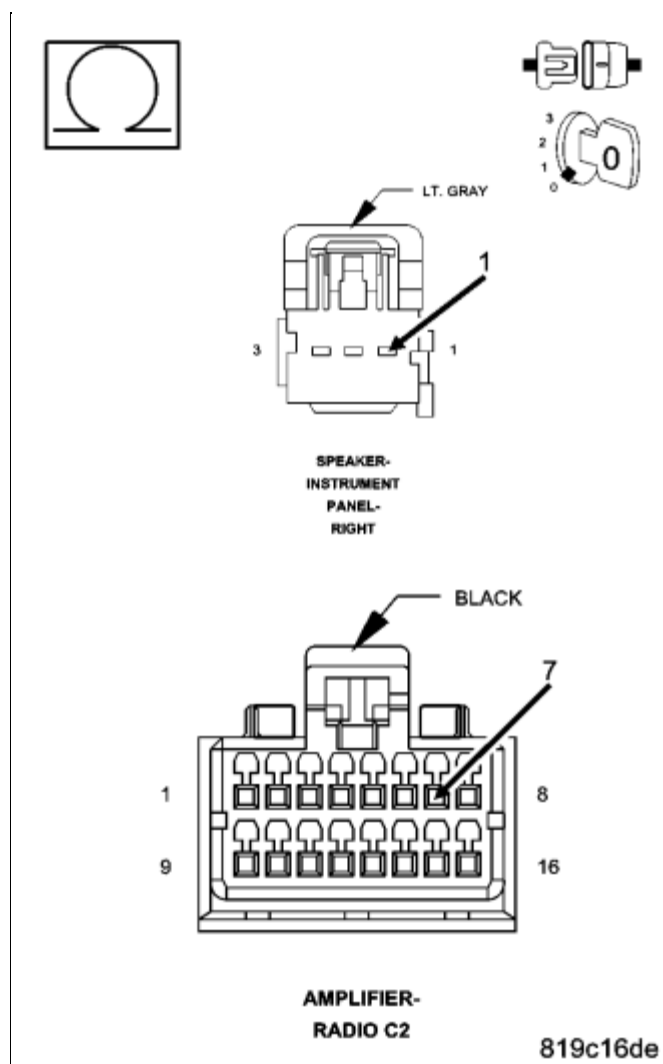
Yes

- Go To [4](#)

No

- Repair the (X202) Amplified Right I/P Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)





4. CHECK THE (X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X292) Amplified Right I/P Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Right I/P Speaker harness connector.

Is the resistance below 5.0 ohms?

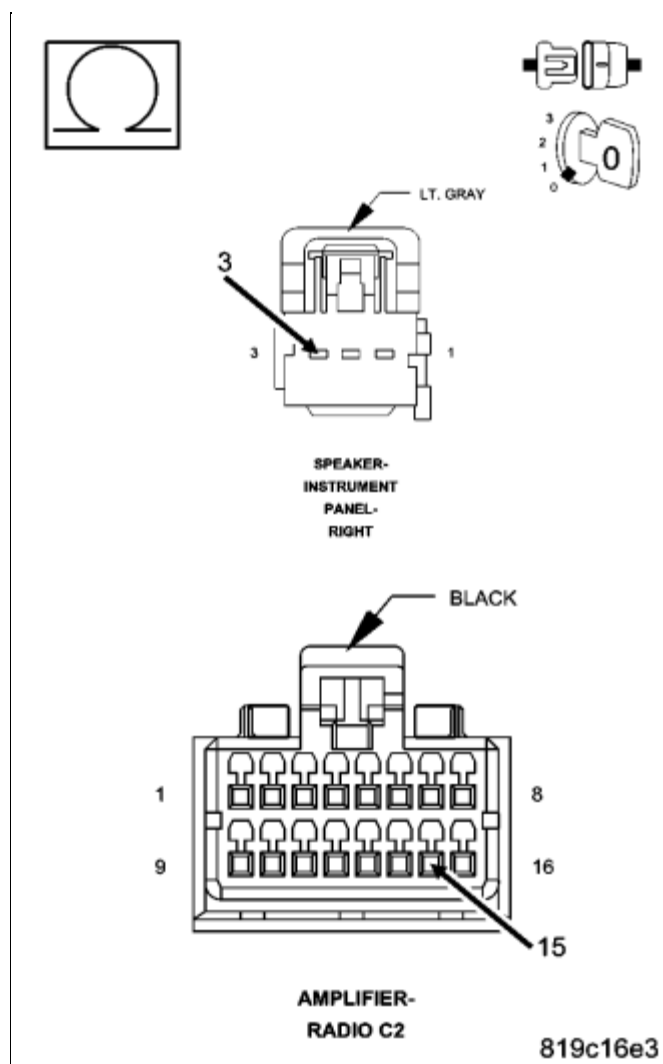
Yes

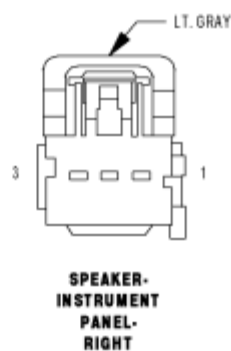
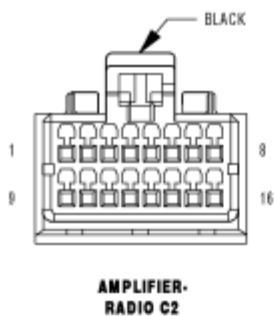
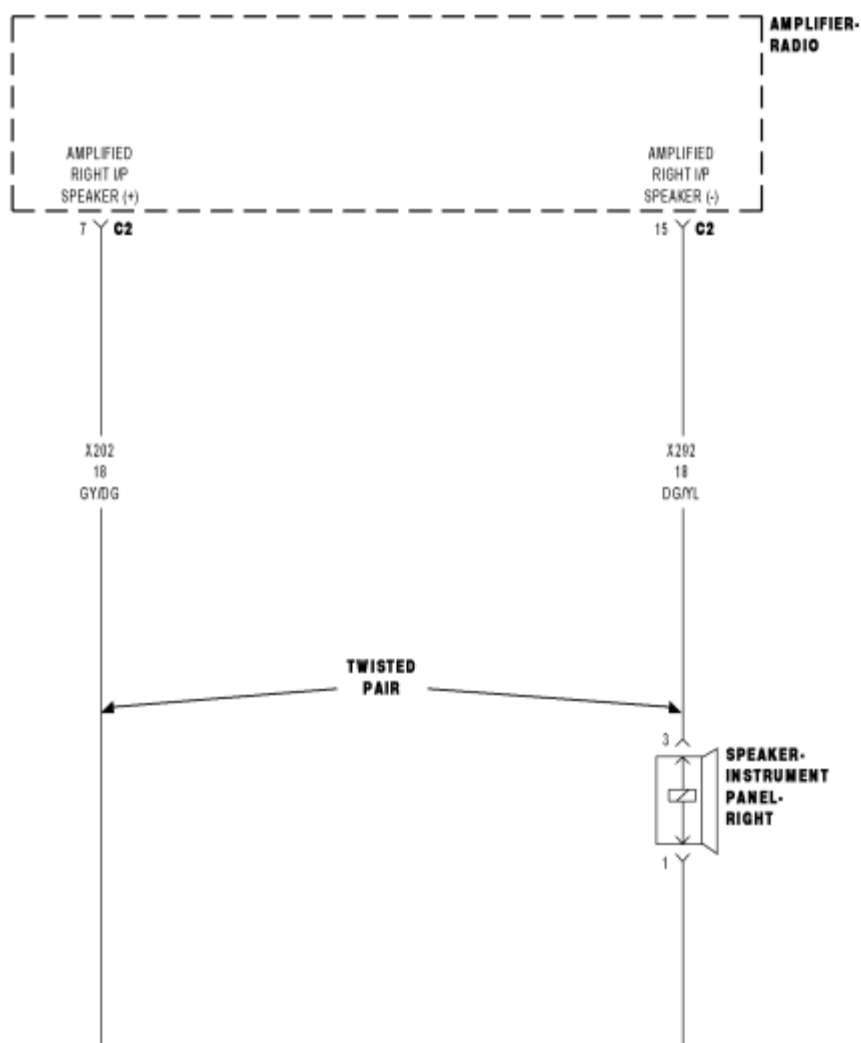
- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (X292) Amplified Right I/P Speaker (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





019c13a5

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT SHORTED TO THE (X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT I/P SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, erase Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1469-CHANNEL 2 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT I/P SPEAKER

Turn the ignition off.

Disconnect the Amplified Right I/P Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Right I/P Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X202) AMPLIFIED RIGHT I/P SPEAKER (+) CIRCUIT, AND THE (X292) AMPLIFIED RIGHT I/P SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C2 harness connector.
Measure the resistance between the (X202) Amplified Right I/P Speaker (+) circuit, and the (X292) Amplified Right I/P Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X202) Amplified Right I/P Speaker (+) circuit, and the (X292) Amplified Right I/P Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

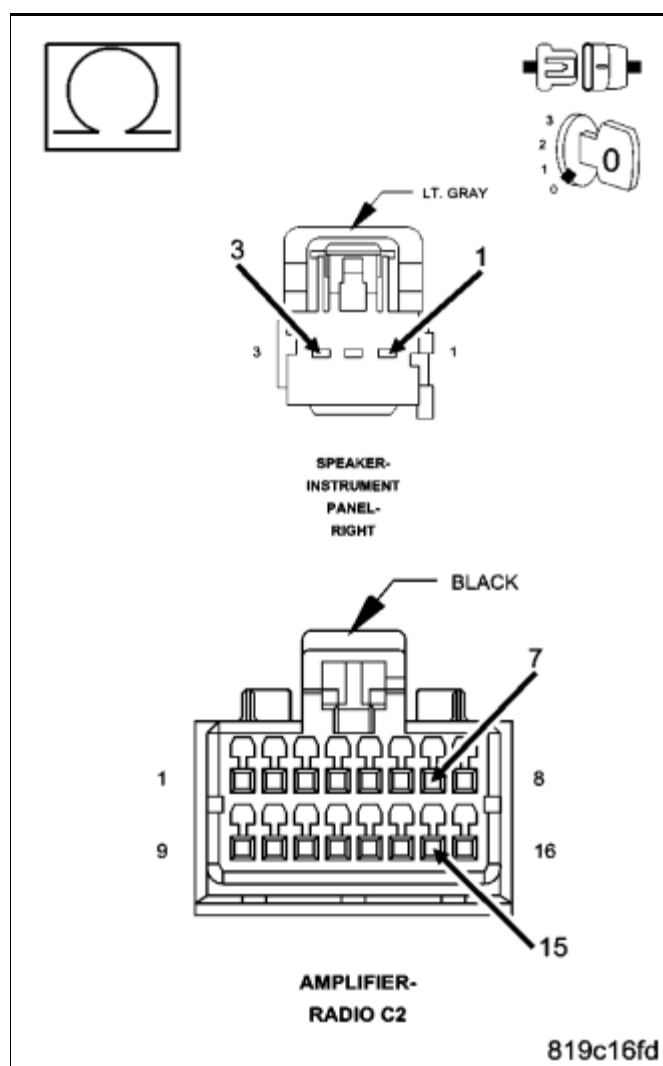
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146A-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.



819c16fd

- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ± 1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146A-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

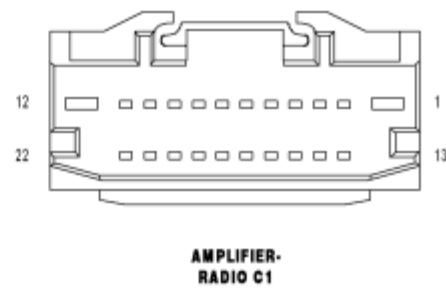
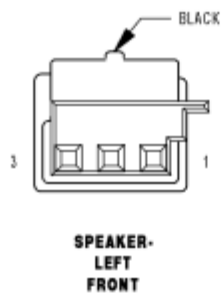
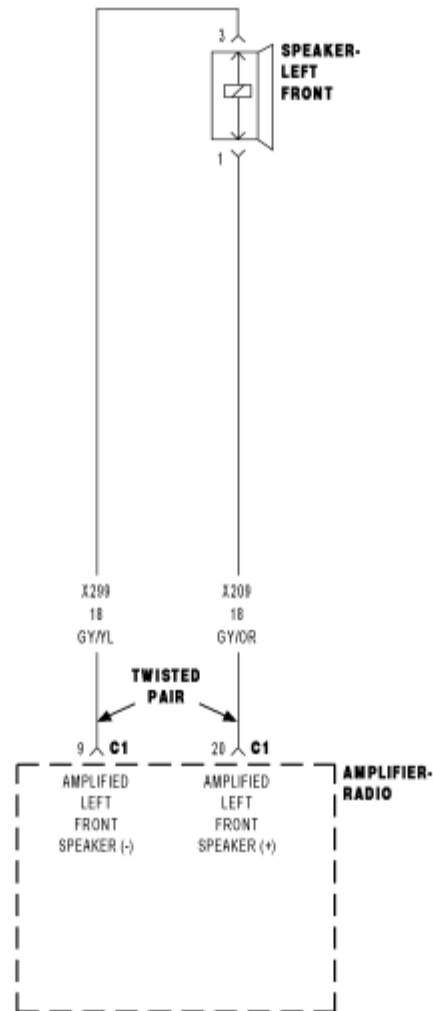
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW



819c18af

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146B-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Left Front Speaker harness connector.

Measure the resistance between ground and the (X209) Amplified Left Front Speaker (+) circuit.

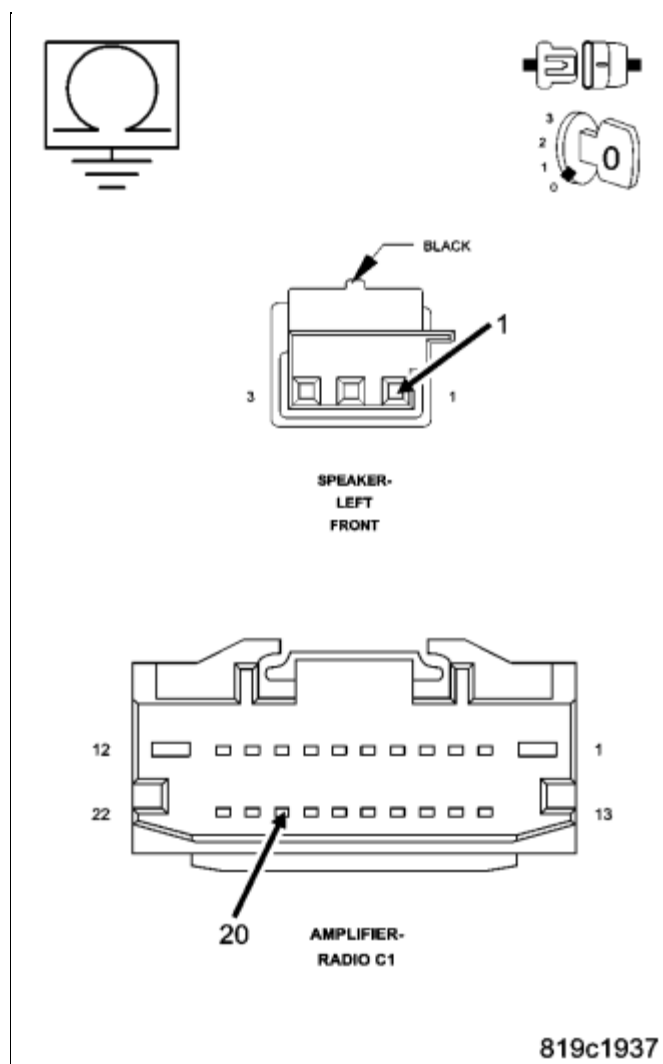
Is the resistance below 10K ohms?

Yes

- Repair the (X209) Amplified Left Front Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X299) Amplified Left Front Speaker (-) circuit.

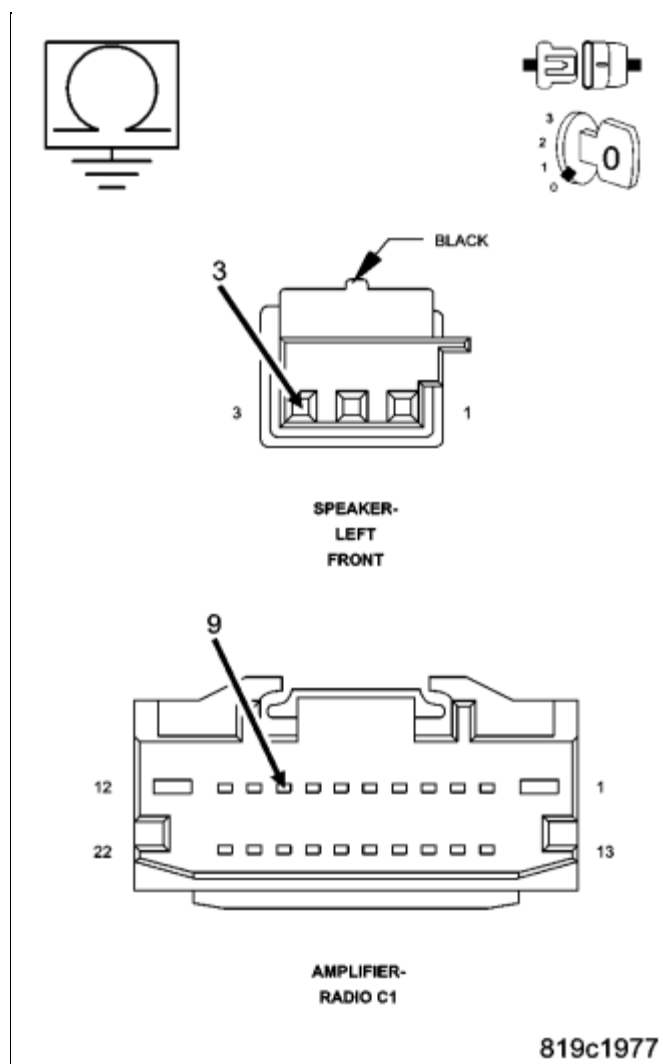
Is the resistance below 10K ohms?

Yes

- Repair the (X299) Amplified Left Front Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED LEFT FRONT SPEAKER

Reconnect and reinstall the Left Front Speaker.
Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground.

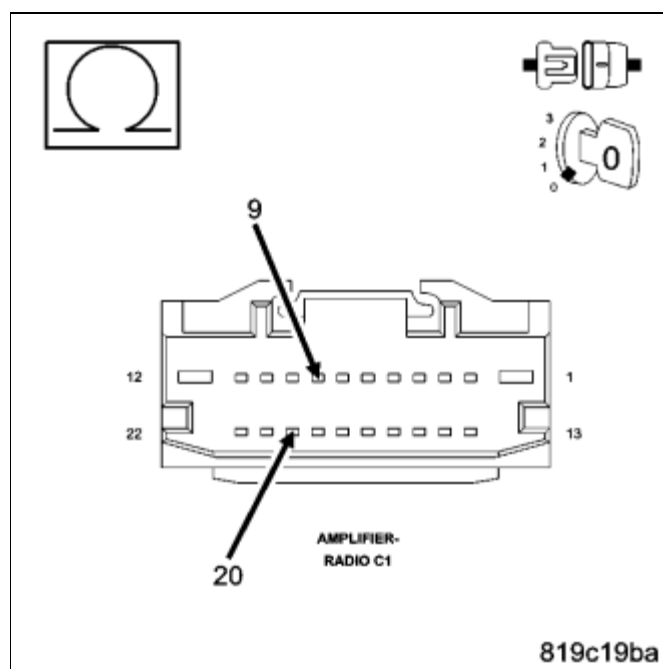
Is the resistance below 10K ohms?

Yes

- Replace the Left Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

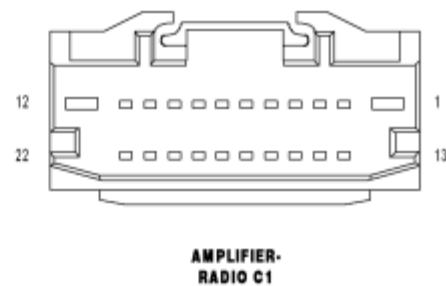
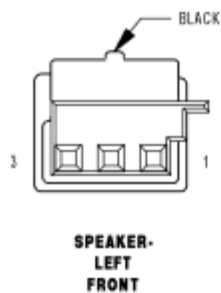
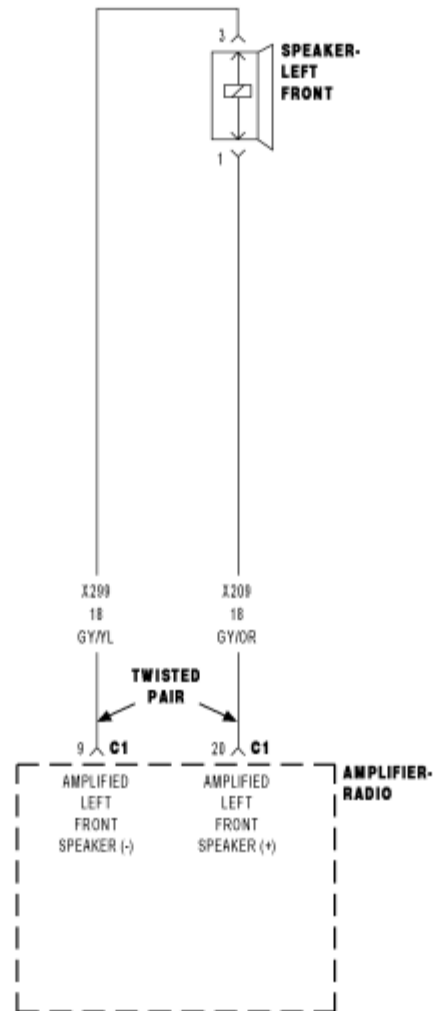
- Replace the amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



819c18af

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146C-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Left Front Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X209) Amplified Left Front Speaker (+) circuit.

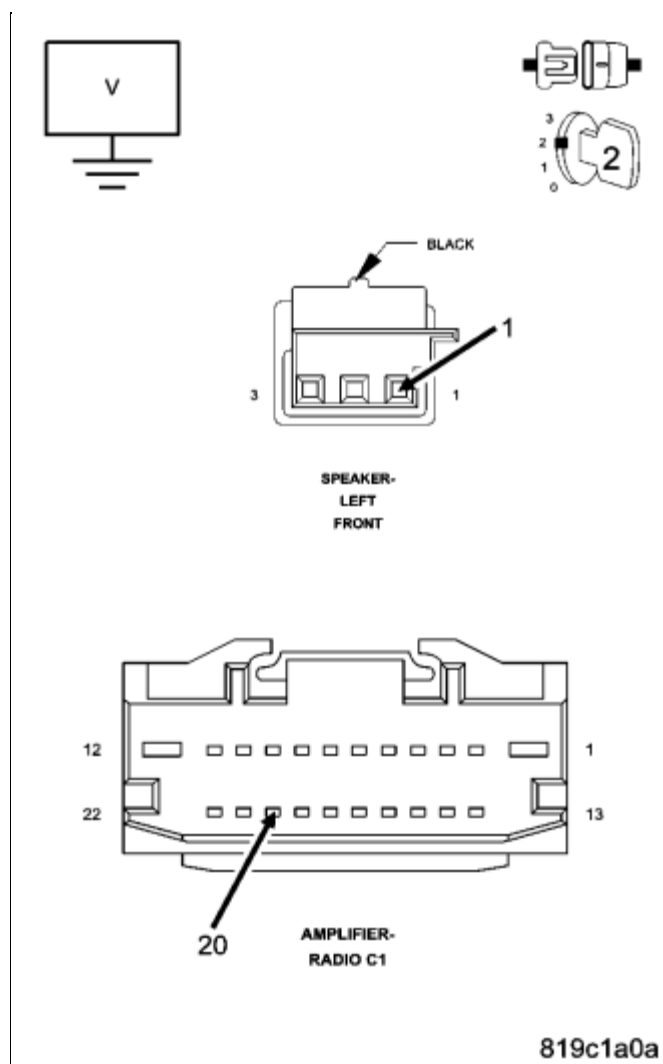
Is the voltage above 10.0 volts?

Yes

- Repair the (X209) Amplified Left Front Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT

Measure for voltage on the (X299) Amplified Left Front Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

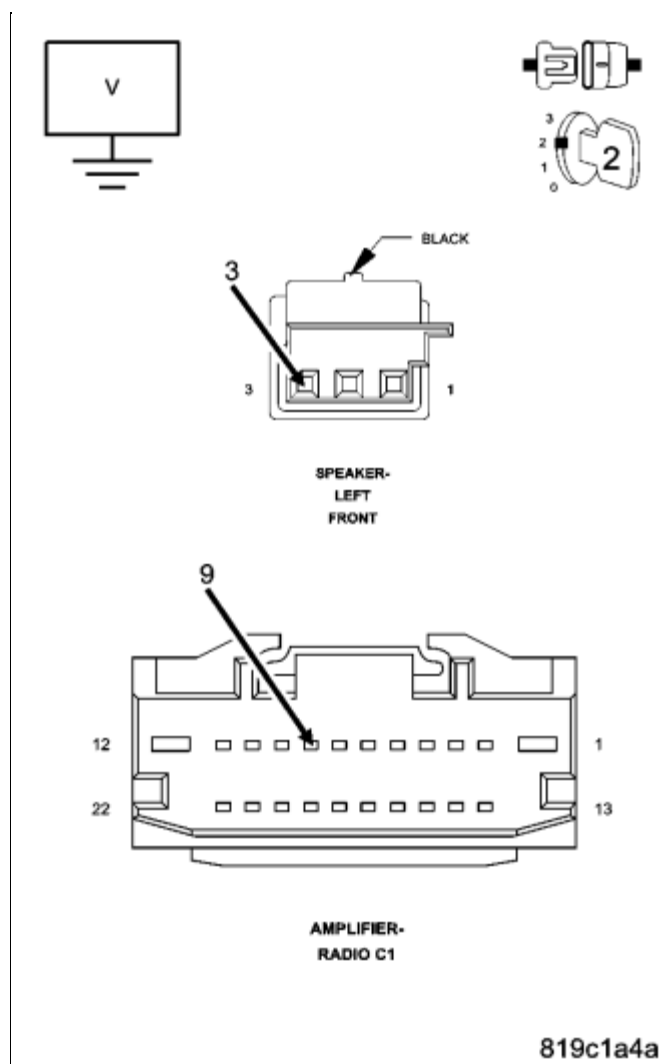
- Repair the (X299) Amplified Left Front Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

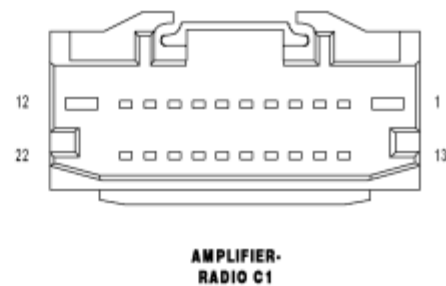
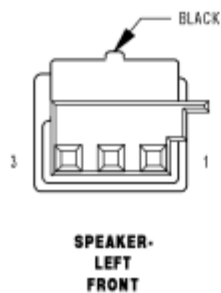
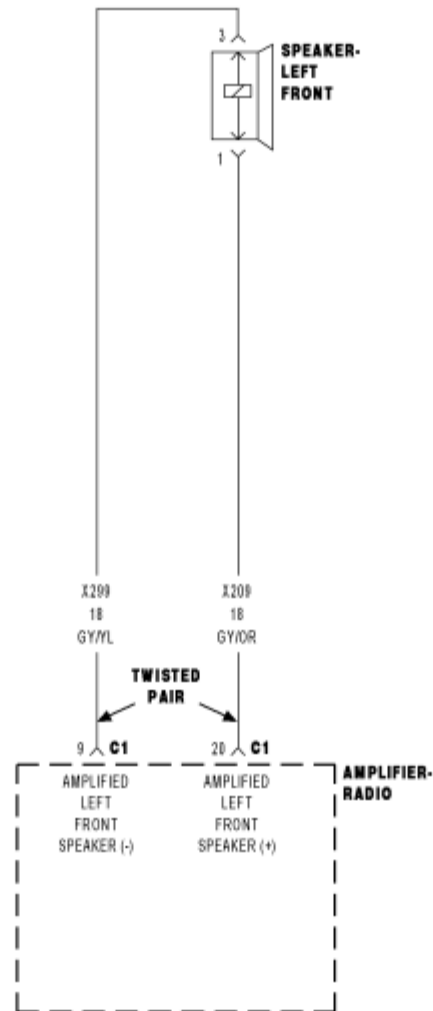
No

- Replace the amplifier in accordance with the service information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





819c18a1

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.

- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT OPEN
(X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT OPEN
AMPLIFIED LEFT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146D-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT FRONT SPEAKER

Turn the ignition off.

Disconnect the Amplified Left Front Speaker harness connector.
 Turn the ignition on.
 Turn the radio on and turn the volume to mid level.
 With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left Front Speaker circuits in the Amplified Left Front Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Left Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C1 harness connector.
 Measure the resistance of the (X209) Amplified Left Front Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Left Front Speaker harness connector.

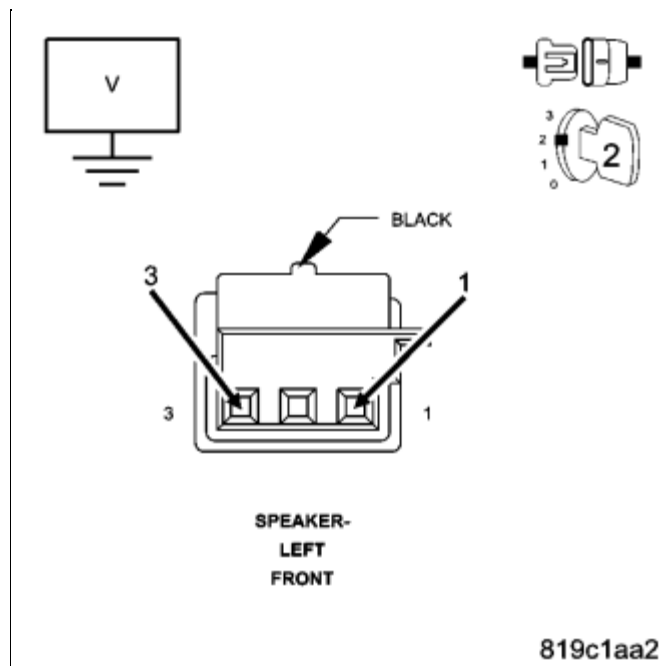
Is the resistance below 5.0 ohms?

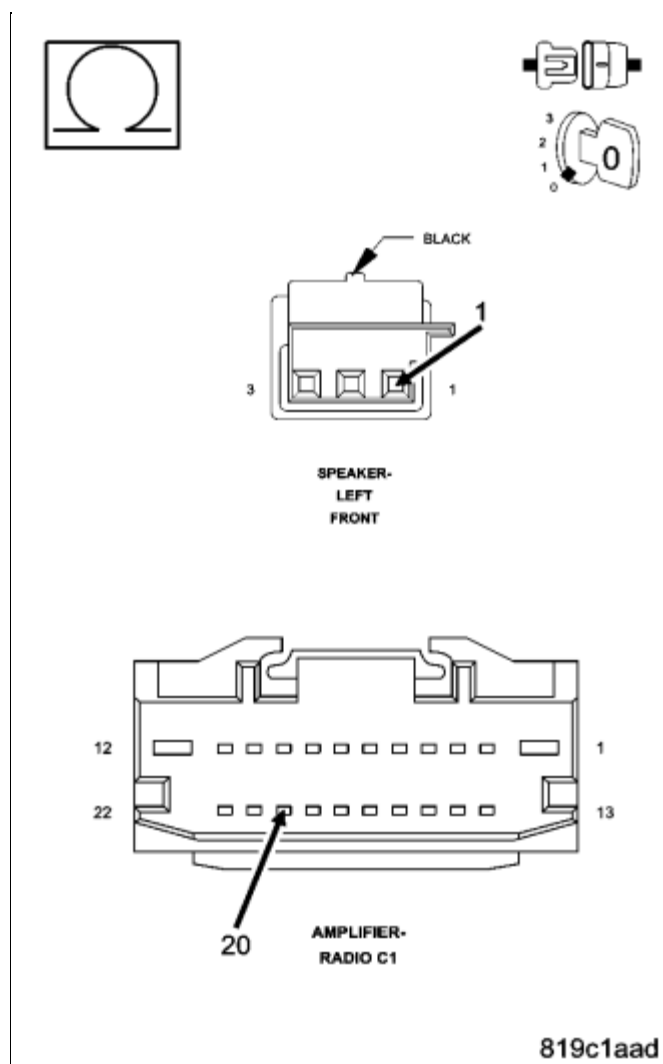
Yes

- Go To [4](#)

No

- Repair the (X209) Amplified Left Front Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)





4. CHECK THE (X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X299) Amplified Left Front Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Left Front Speaker harness connector.

Is the resistance below 5.0 ohms?

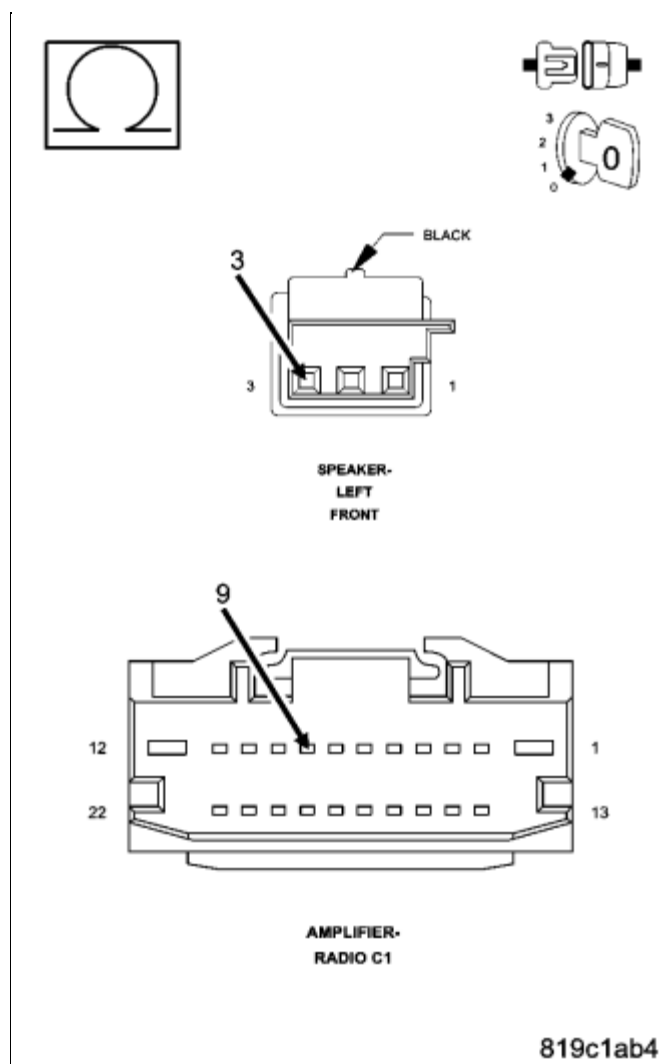
Yes

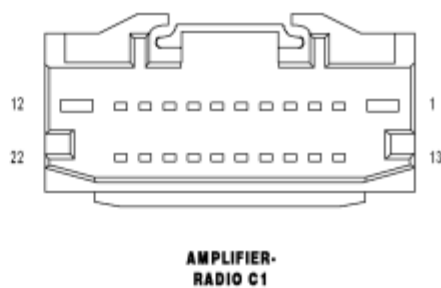
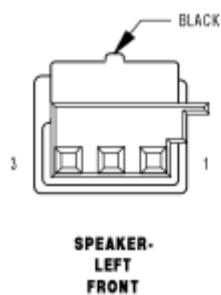
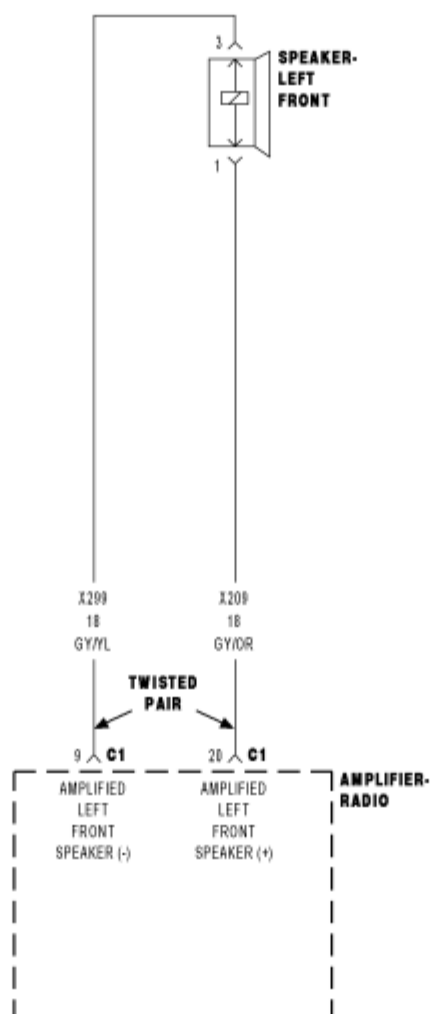
- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (X299) Amplified Left Front Speaker (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





819c18af

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT SHORTED TO THE (X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUIT
AMPLIFIED LEFT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, erase Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B146E-CHANNEL 3 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT FRONT SPEAKER

Turn the ignition off.

Disconnect the Amplified Left Front Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Left Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X209) AMPLIFIED LEFT FRONT SPEAKER (+) CIRCUIT, AND THE (X299) AMPLIFIED LEFT FRONT SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C1 harness connector.
Measure the resistance between the (X209) Amplified Left Front Speaker (+) circuit, and the (X299) Amplified Left Front Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X209) Amplified Left Front Speaker (+) circuit, and the (X299) Amplified Left Front Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

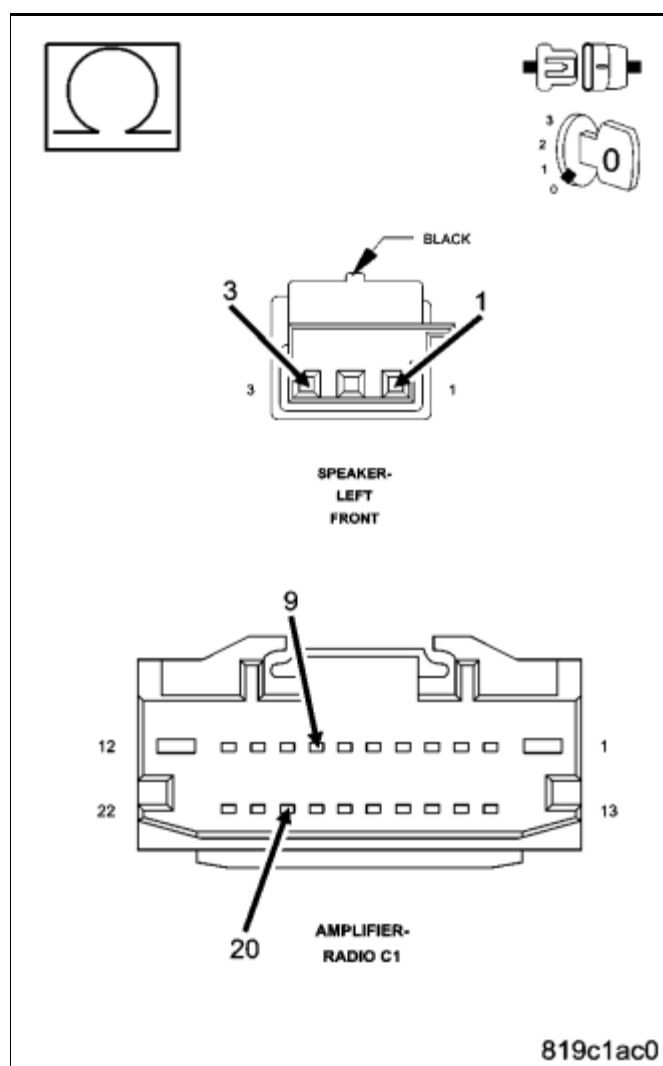
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B146F-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.



- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ± 1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read amplifier DTCs.

Does the scan tool display active: B146F-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

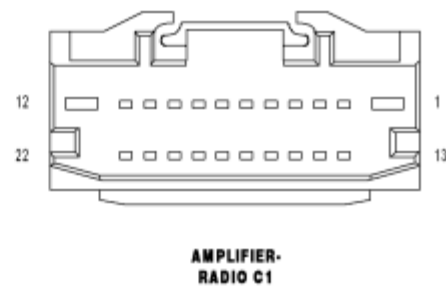
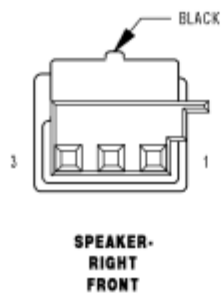
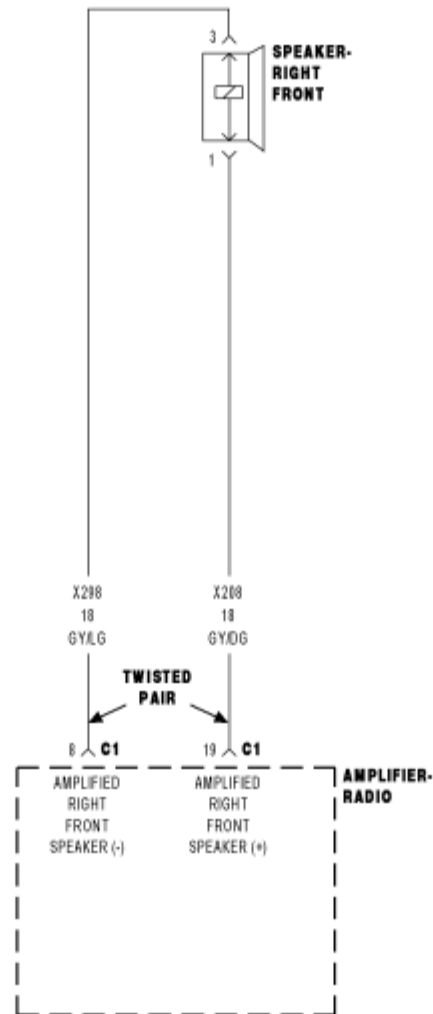
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW



819c2659

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1470-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Right Front Speaker harness connector.

Measure the resistance between ground and the (X208) Amplified Right Front Speaker (+) circuit.

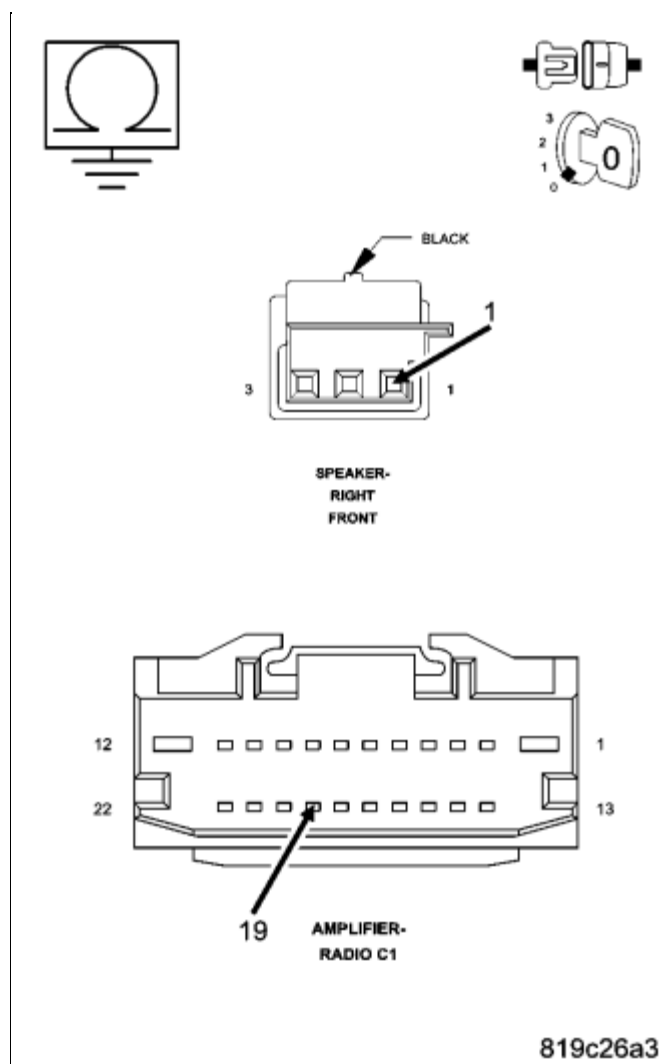
Is the resistance below 10K ohms?

Yes

- Repair the (X208) Amplified Right Front Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X298) Amplified Right Front Speaker (-) circuit.

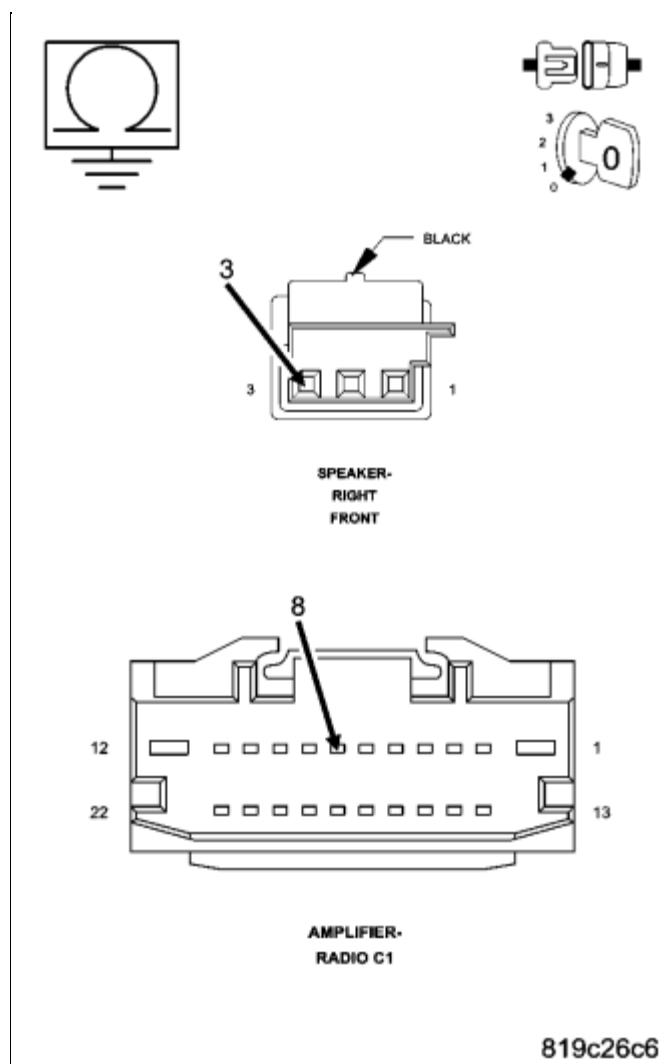
Is the resistance below 10K ohms?

Yes

- Repair the (X298) Amplified Right Front Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED RIGHT FRONT SPEAKER

Reconnect and reinstall the Right Front Speaker.
Measure the resistance of the speaker circuit between the Amplifier C1 harness connector and ground.

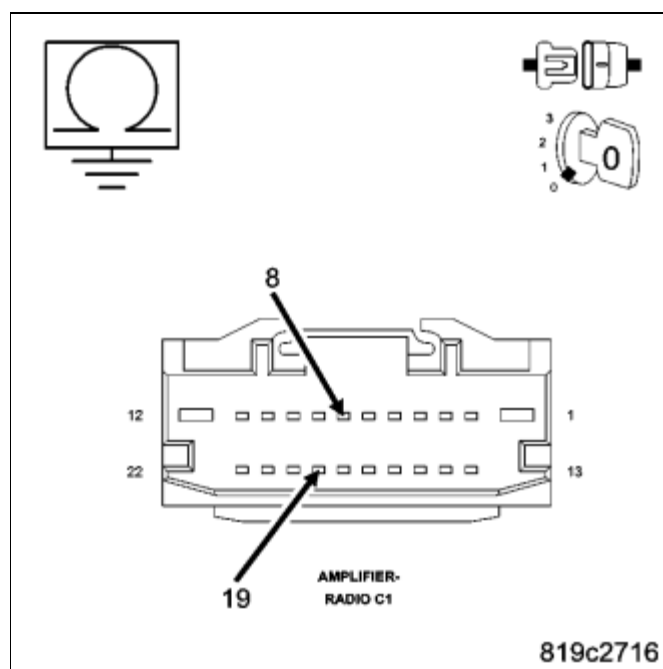
Is the resistance below 10K ohms?

Yes

- Replace the Right Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

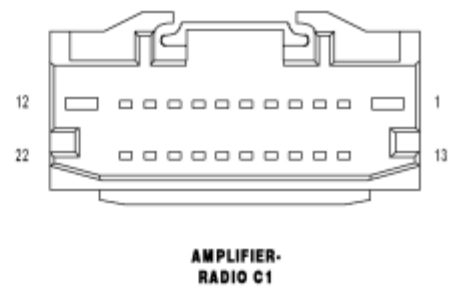
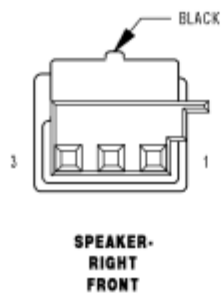
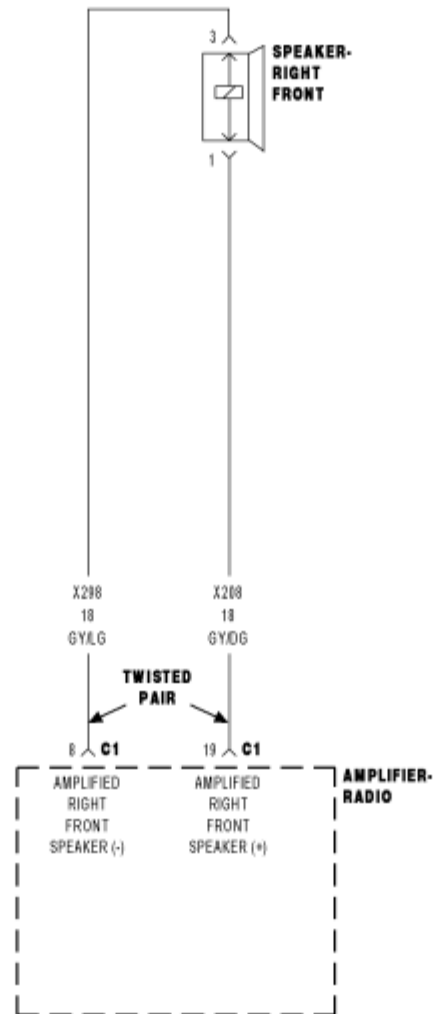
- Replace the amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



819c2659

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1471-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C1 harness connector.
Disconnect the Amplified Right Front Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X208) Amplified Right Front Speaker (+) circuit.

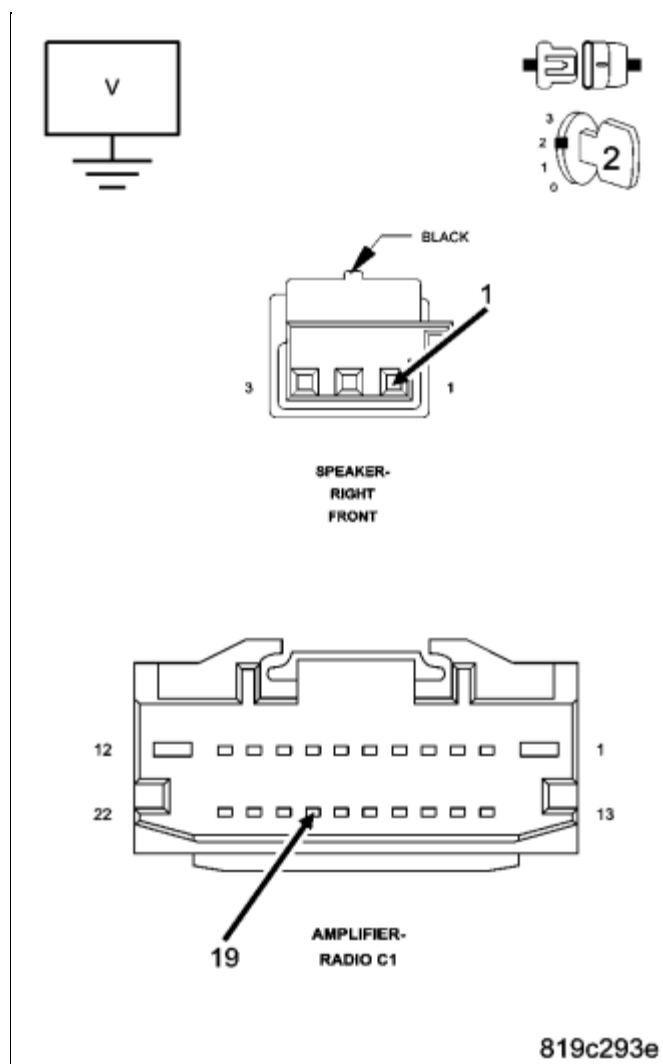
Is the voltage above 10.0 volts?

Yes

- Repair the (X208) Amplified Right Front Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT

Measure for voltage on the (X298) Amplified Right Front Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

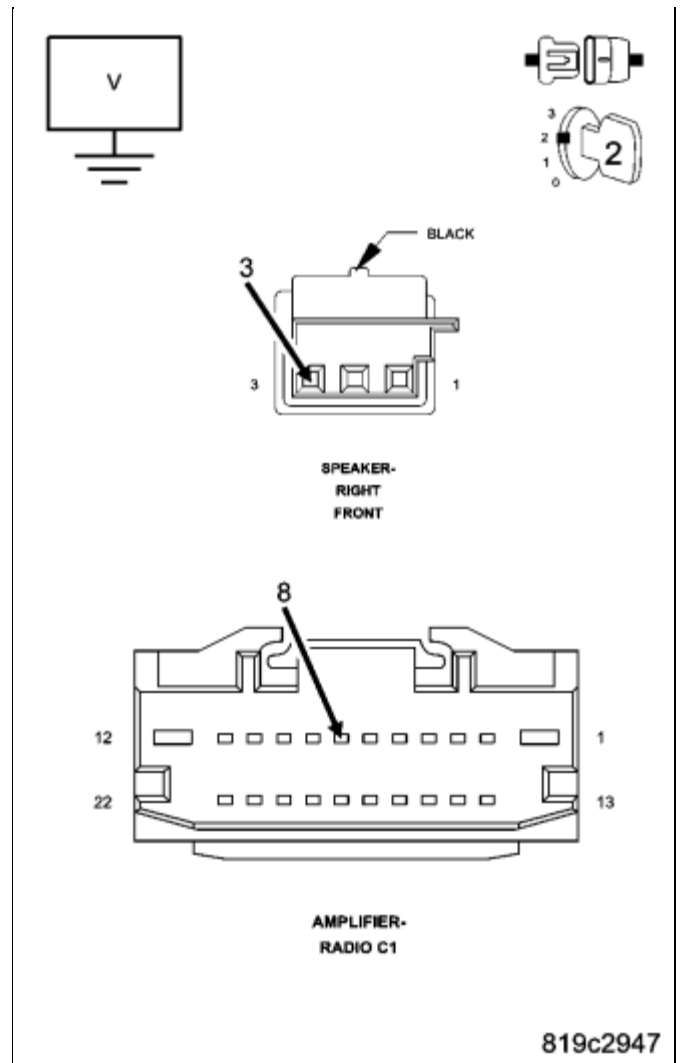
- Repair the (X298) Amplified Right Front Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

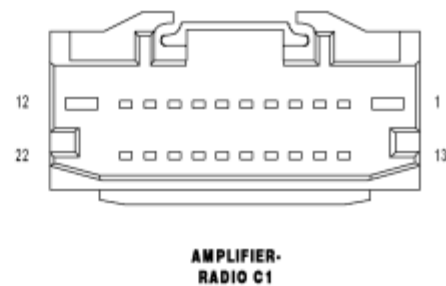
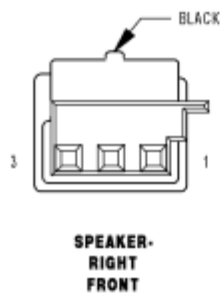
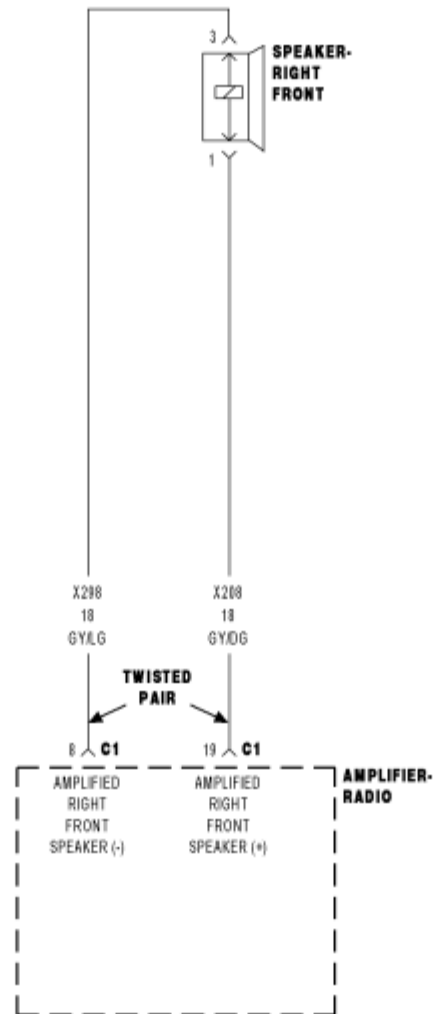
No

- Replace the amplifier in accordance with the service information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





019c2659

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.

- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT OPEN
(X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT OPEN
AMPLIFIED RIGHT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1472-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT FRONT SPEAKER

Turn the ignition off.

Disconnect the Amplified Right Front Speaker harness connector.
 Turn the ignition on.
 Turn the radio on and turn the volume to mid level.
 With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right Front Speaker circuits in the Amplified Right Front Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Right Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C1 harness connector.
 Measure the resistance of the (X208) Amplified Right Front Speaker (+) circuit between the Amplifier C1 harness connector and the Amplified Right Front Speaker harness connector.

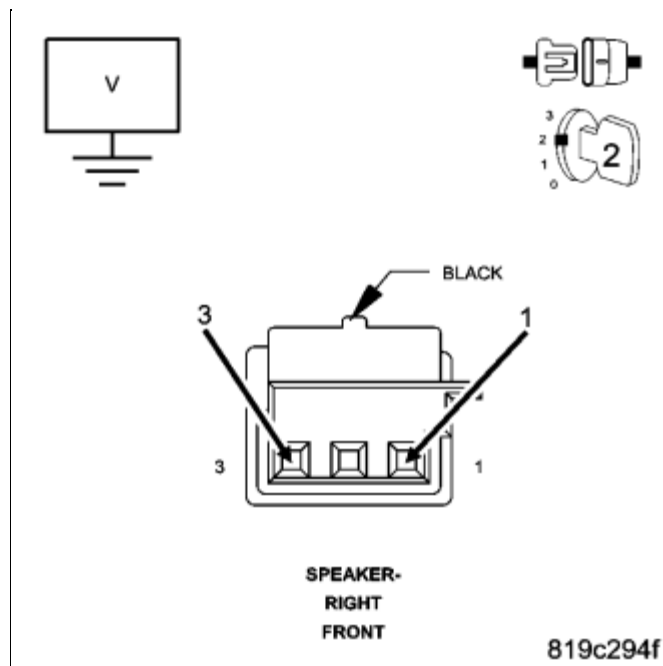
Is the resistance below 5.0 ohms?

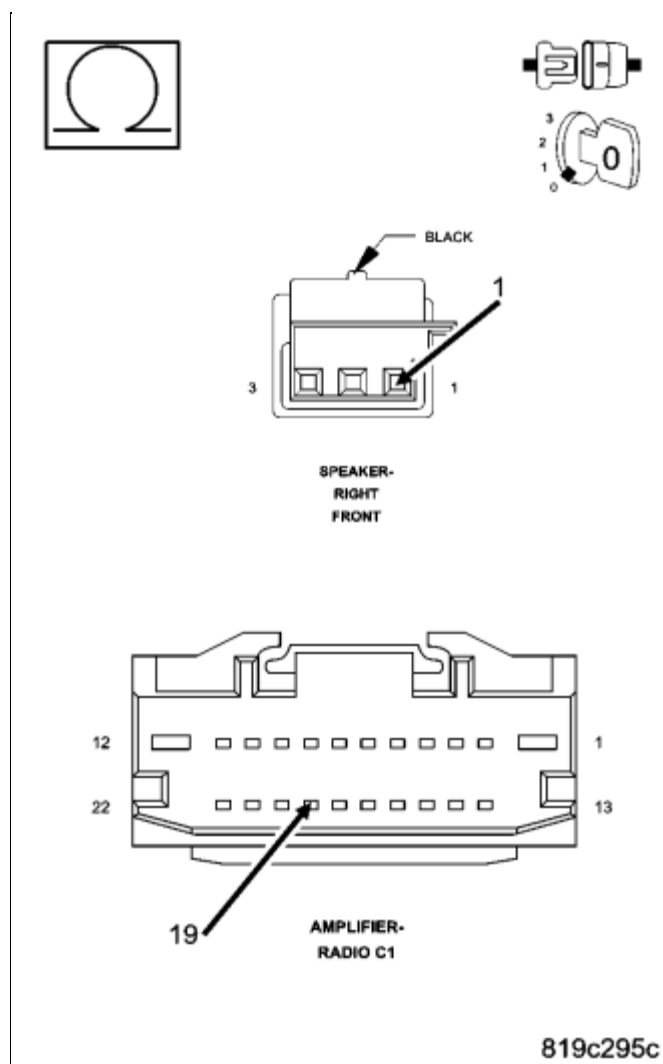
Yes

- Go To [4](#)

No

- Repair the (X208) Amplified Right Front Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)





4. CHECK THE (X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X298) Amplified Right Front Speaker (-) circuit between the Amplifier C1 harness connector and the Amplified Right Front Speaker harness connector.

Is the resistance below 5.0 ohms?

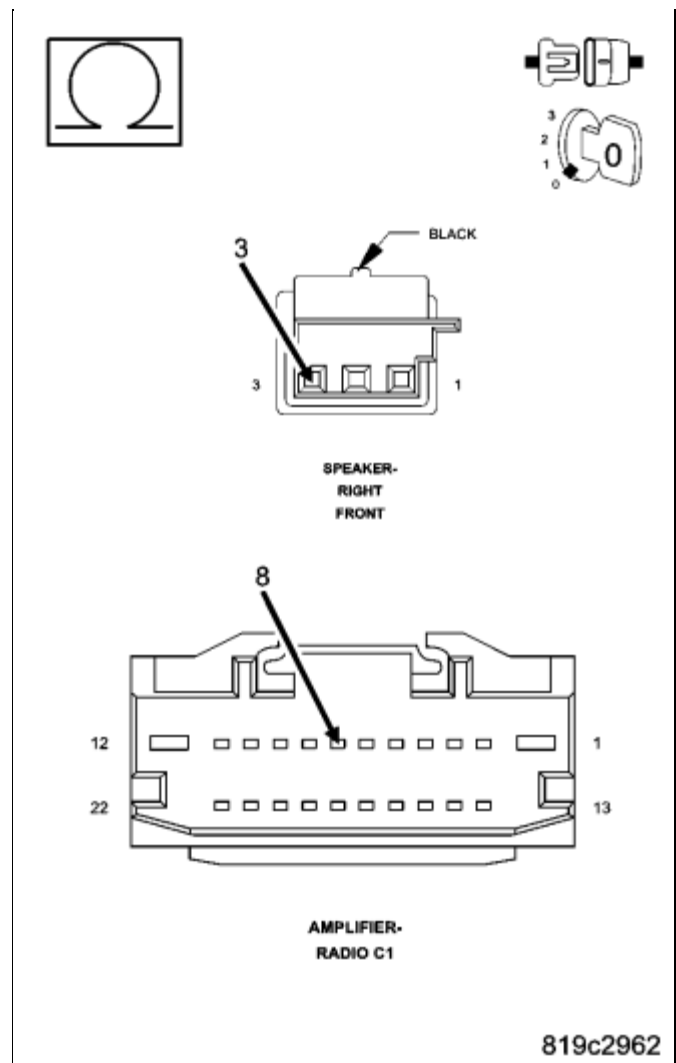
Yes

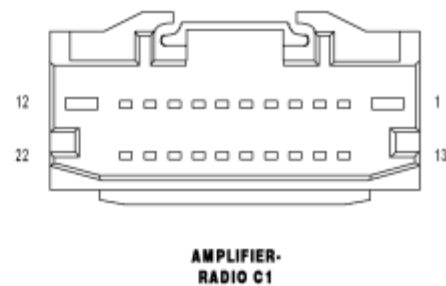
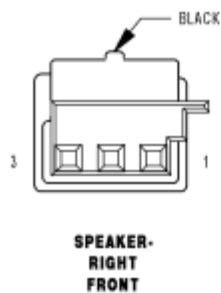
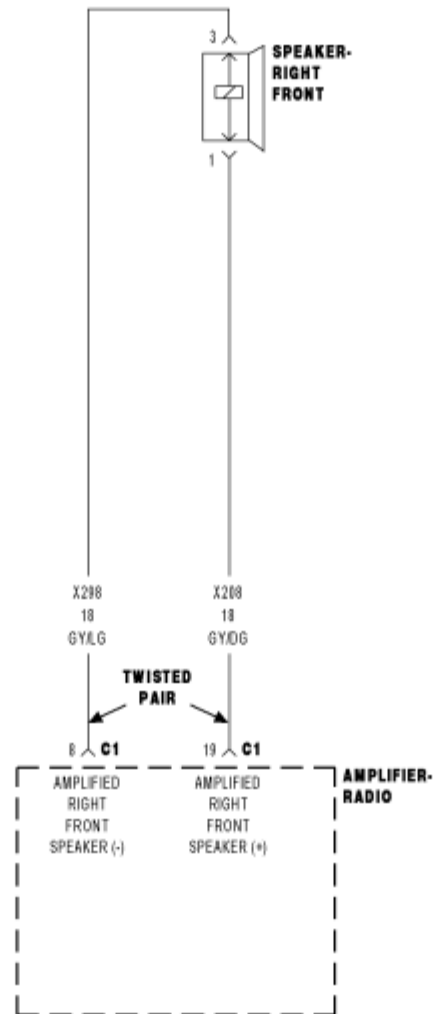
- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (X298) Amplified Right Front Speaker (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





819c2659

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT SHORTED TO THE (X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT FRONT SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, erase Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1473-CHANNEL 4 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT FRONT SPEAKER

Turn the ignition off.

Disconnect the Amplified Right Front Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Right Front Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X208) AMPLIFIED RIGHT FRONT SPEAKER (+) CIRCUIT, AND THE (X298) AMPLIFIED RIGHT FRONT SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C1 harness connector.
Measure the resistance between the (X208) Amplified Right Front Speaker (+) circuit, and the (X298) Amplified Right Front Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X208) Amplified Right Front Speaker (+) circuit, and the (X298) Amplified Right Front Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

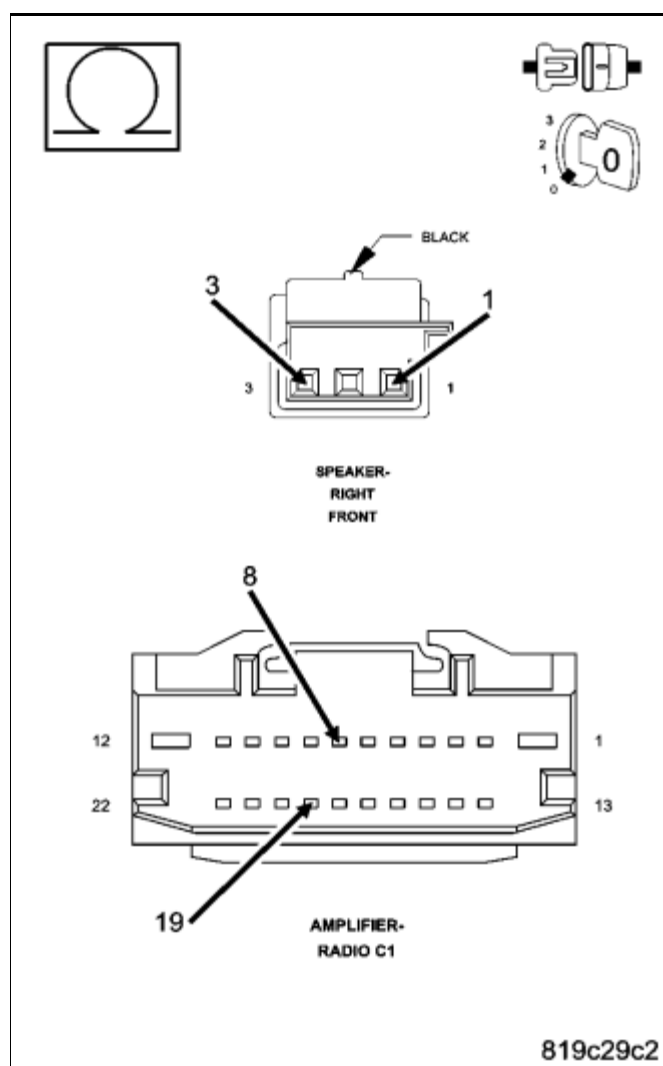
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1474-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.



- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ± 1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1474-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

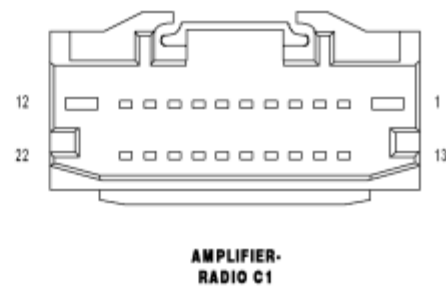
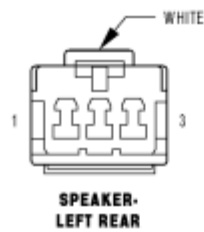
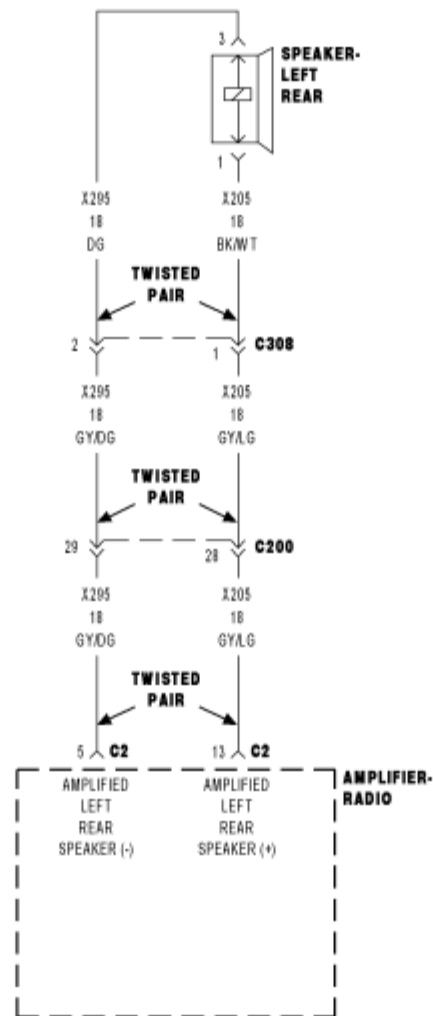
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW



019c2b73

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND
LEFT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1475-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Left Rear Speaker harness connector.

Measure the resistance between ground and the (X205) Amplified Left Rear Speaker (+) circuit.

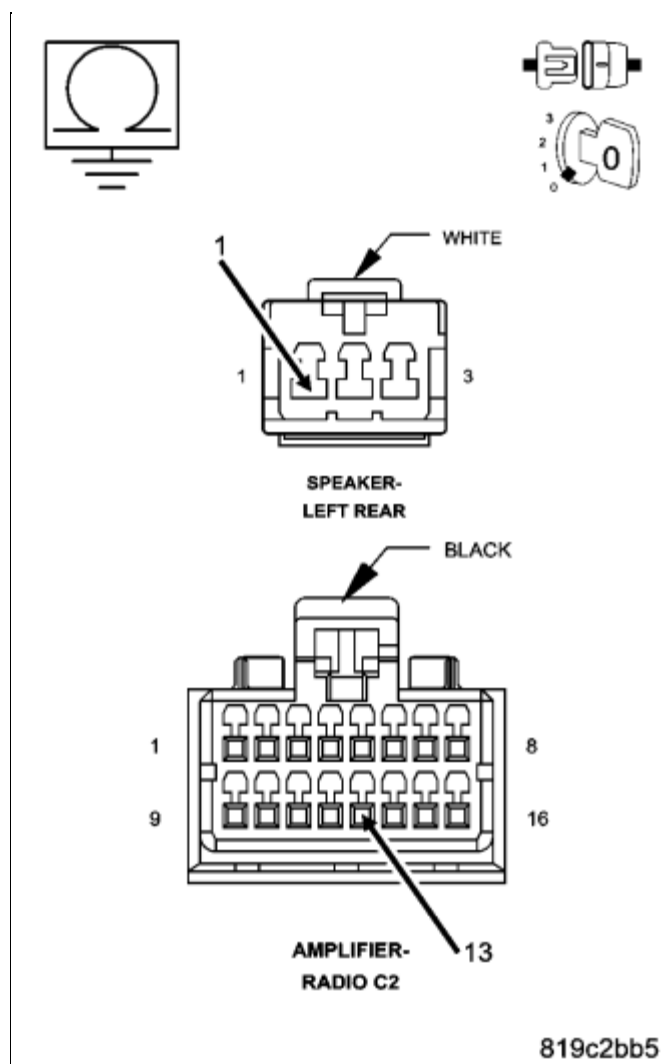
Is the resistance below 10K ohms?

Yes

- Repair the (X205) Amplified Left Rear Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X295) Amplified Left Rear Speaker (-) circuit.

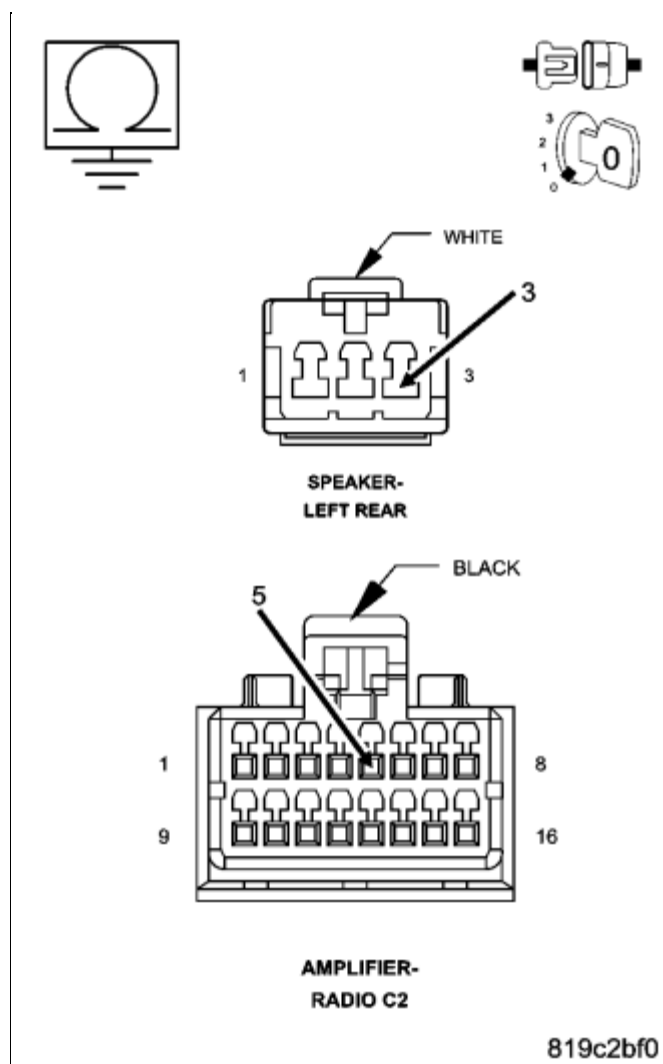
Is the resistance below 10K ohms?

Yes

- Repair the (X295) Amplified Left Rear Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED LEFT REAR SPEAKER

Reconnect and reinstall the Left Rear Speaker. Measure the resistance of the speaker circuit between the Amplifier C2 harness connector and ground.

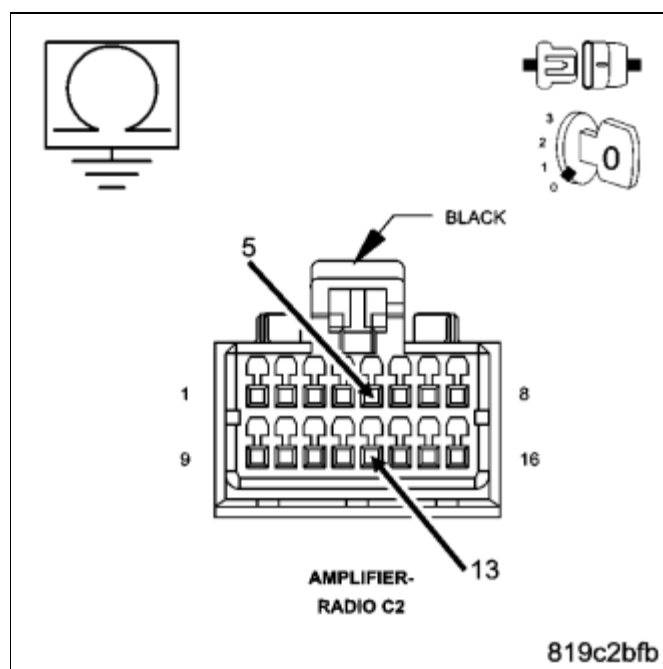
Is the resistance below 10K ohms?

Yes

- Replace the Left Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

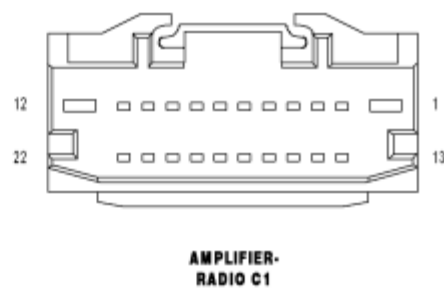
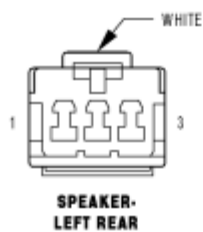
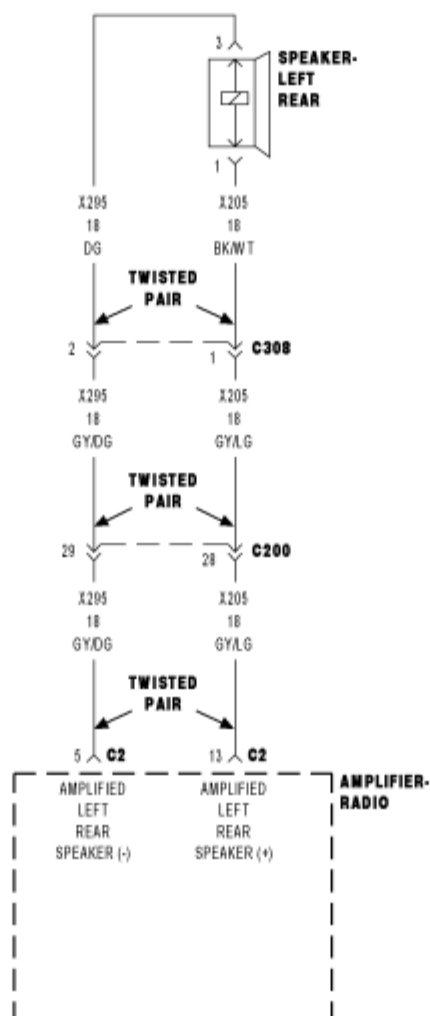
- Replace the amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



019c2b73

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1476-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Left Rear Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X205) Amplified Left Rear Speaker (+) circuit.

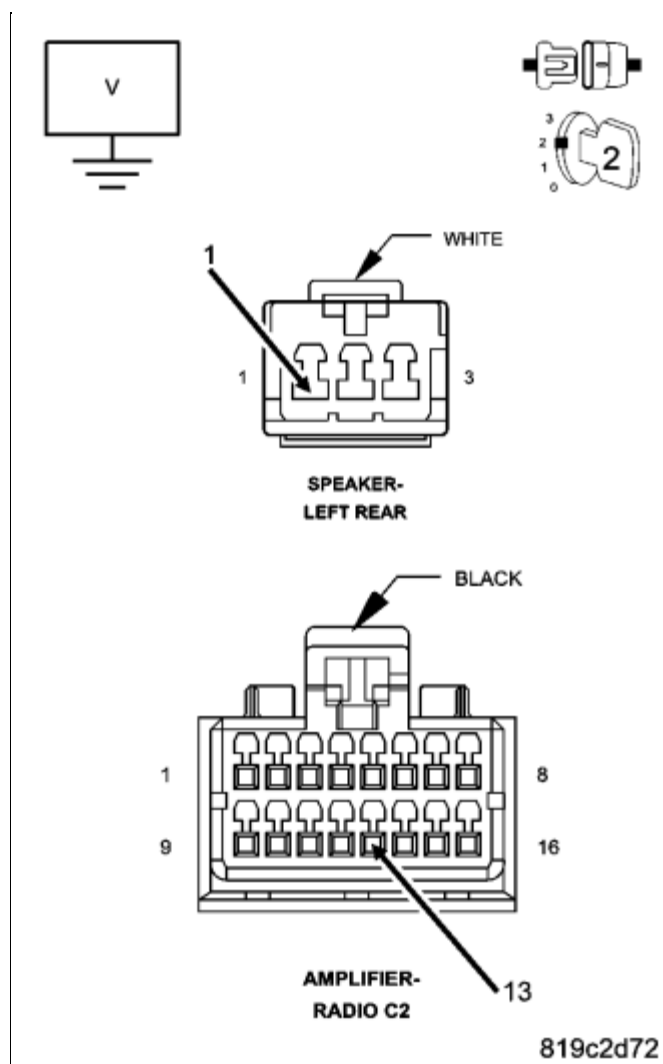
Is the voltage above 10.0 volts?

Yes

- Repair the (X205) Amplified Left Rear Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT

Measure for voltage on the (X295) Amplified Left Rear Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

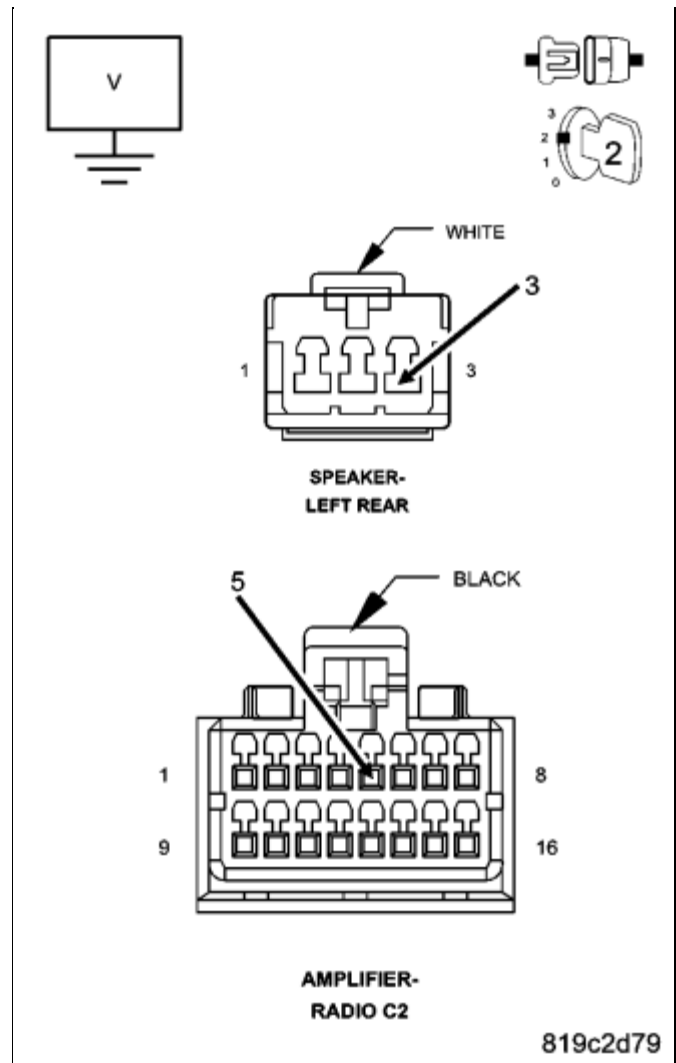
- Repair the (X295) Amplified Left Rear Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

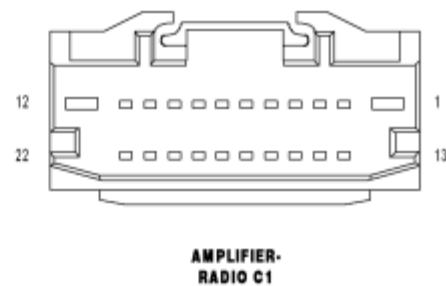
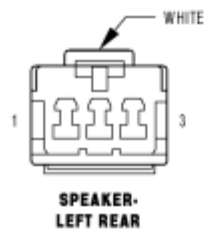
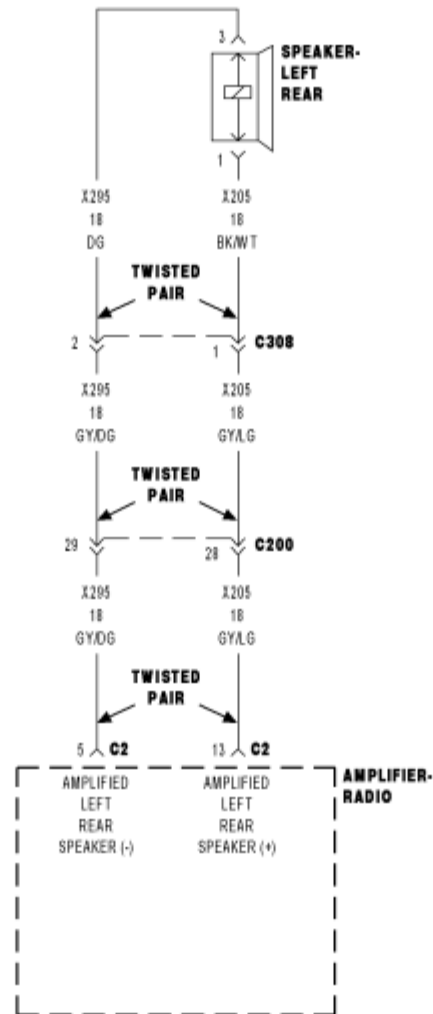
No

- Replace the amplifier in accordance with the service information.

- Perform the BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





019c2b73

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.

- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT OPEN
(X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT OPEN
LEFT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1477-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT REAR SPEAKER

Turn the ignition off.

Disconnect the Left Rear Speaker harness connector.
 Turn the ignition on.
 Turn the radio on and turn the volume to mid level.
 With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Left Rear Speaker circuits in the Amplified Left Rear Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Left Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C2 harness connector.
 Measure the resistance of the (X205) Amplified Left Rear Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Left Rear Speaker harness connector.

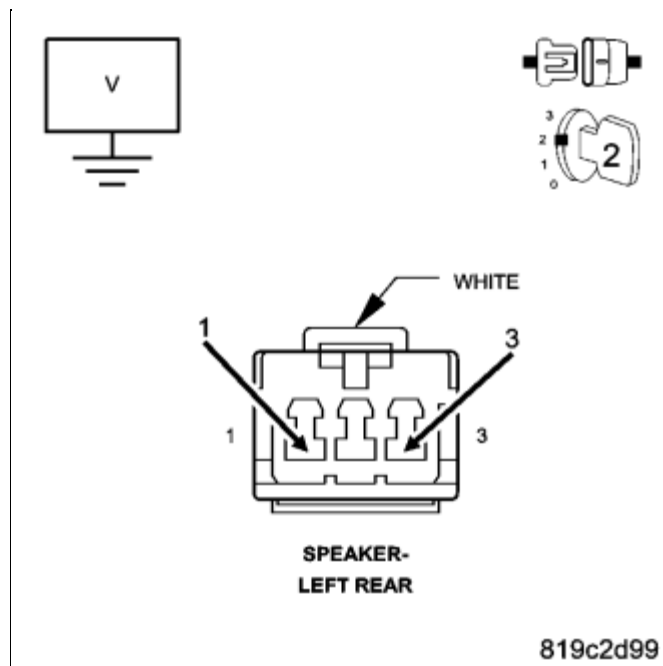
Is the resistance below 5.0 ohms?

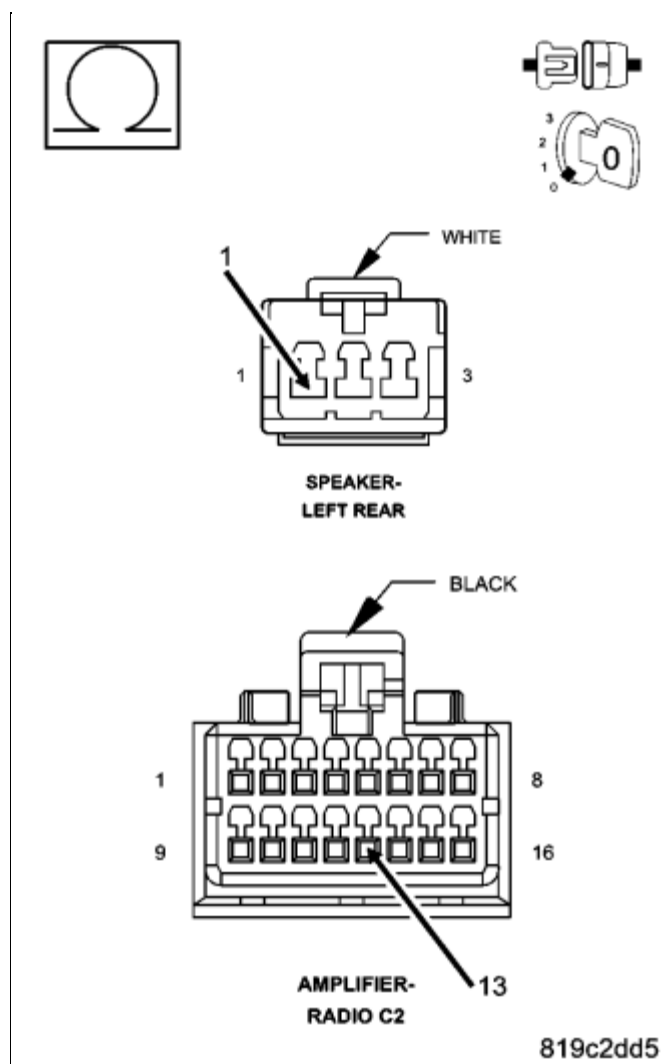
Yes

- Go To [4](#)

No

- Repair the (X205) Amplified Left Rear Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)





4. CHECK THE (X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X295) Amplified Left Rear Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Left Rear Speaker harness connector.

Is the resistance below 5.0 ohms?

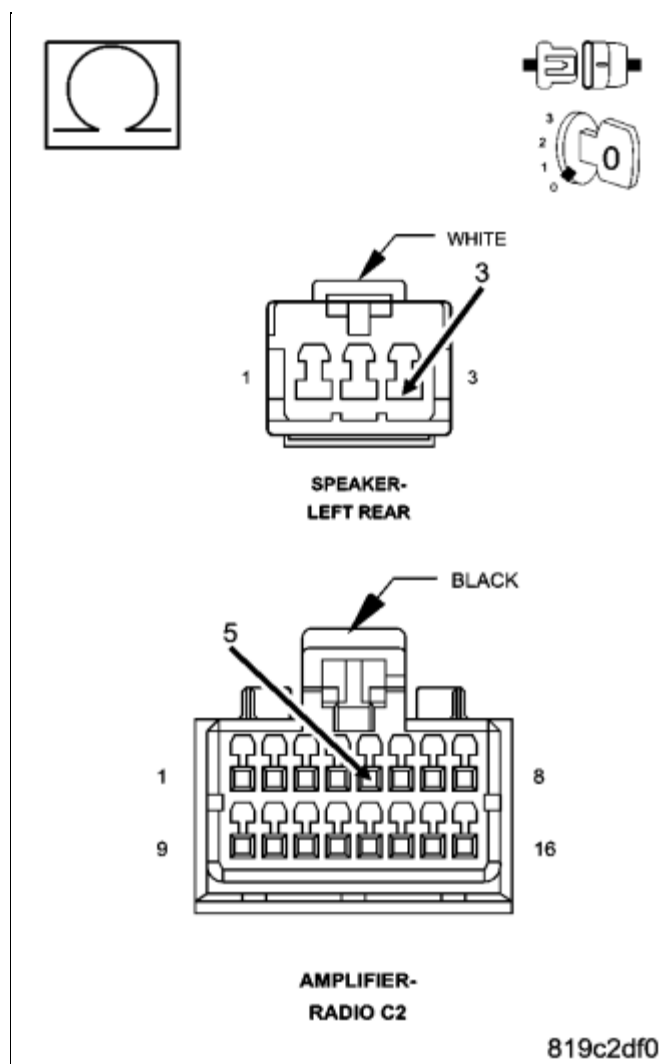
Yes

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

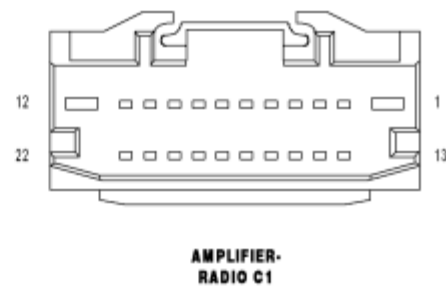
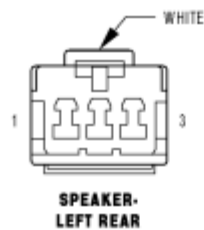
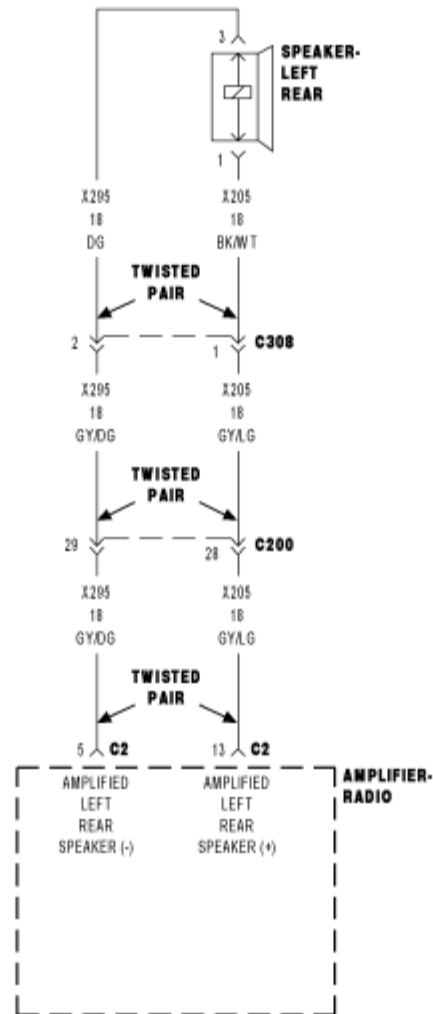
No

- Repair the (X295) Amplified Left Rear Speaker (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER



819c2df0



019c2b73

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT SHORTED TO THE (X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUIT
AMPLIFIED LEFT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, erase Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1478-CHANNEL 5 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED LEFT REAR SPEAKER

Turn the ignition off.

Disconnect the Amplified Left Rear Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Left Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X205) AMPLIFIED LEFT REAR SPEAKER (+) CIRCUIT, AND THE (X295) AMPLIFIED LEFT REAR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C2 harness connector.
Measure the resistance between the (X205) Amplified Left Rear Speaker (+) circuit, and the (X295) Amplified Left Rear Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X205) Amplified Left Rear Speaker (+) circuit, and the (X295) Amplified Left Rear Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

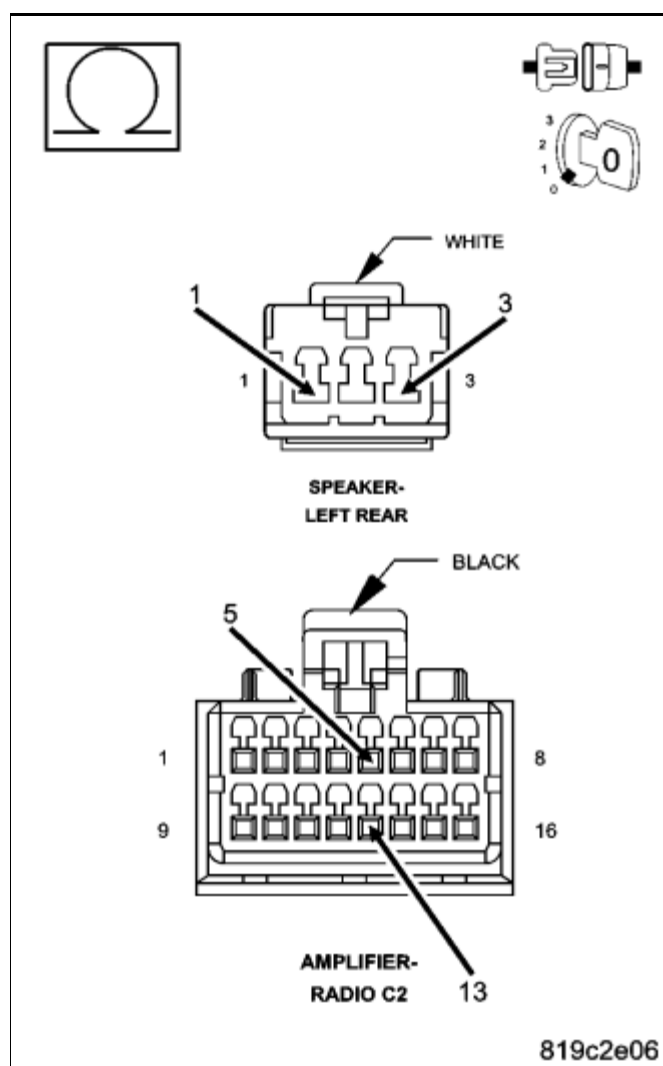
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1479-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.



819c2e06

- **Set Condition:**
- This DTC will set if a DC offset occurs on the output channel, the amplifier shall set a DTC after a maturity rate of 5 ± 1 sec.

Possible Causes
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B1479-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT PERFORMANCE?

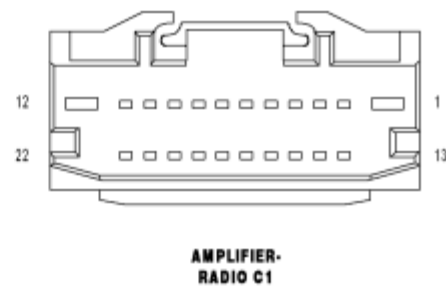
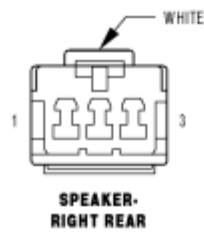
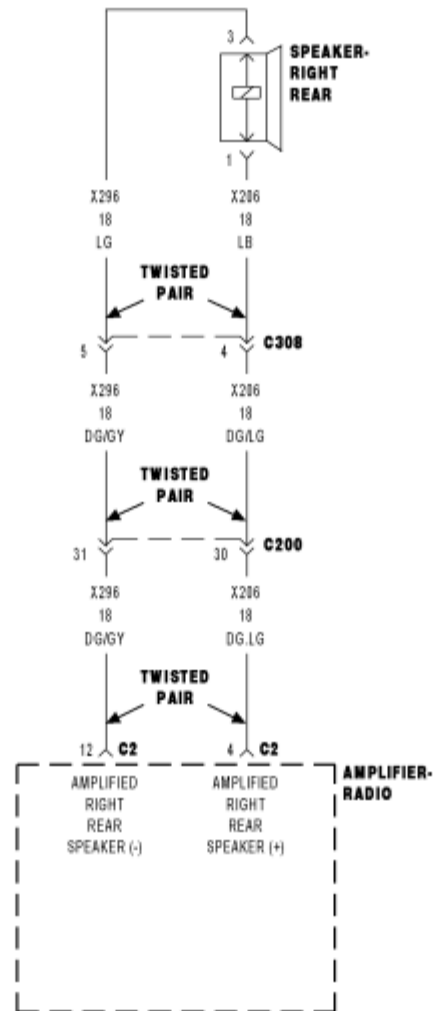
Yes

- Replace the amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST VER-1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW



819c306d

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a shorted to ground condition on the speaker output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO GROUND
(X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT SHORTED TO GROUND
RIGHT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147A-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Right Rear Speaker harness connector.

Measure the resistance between ground and the (X206) Amplified Right Rear Speaker (+) circuit.

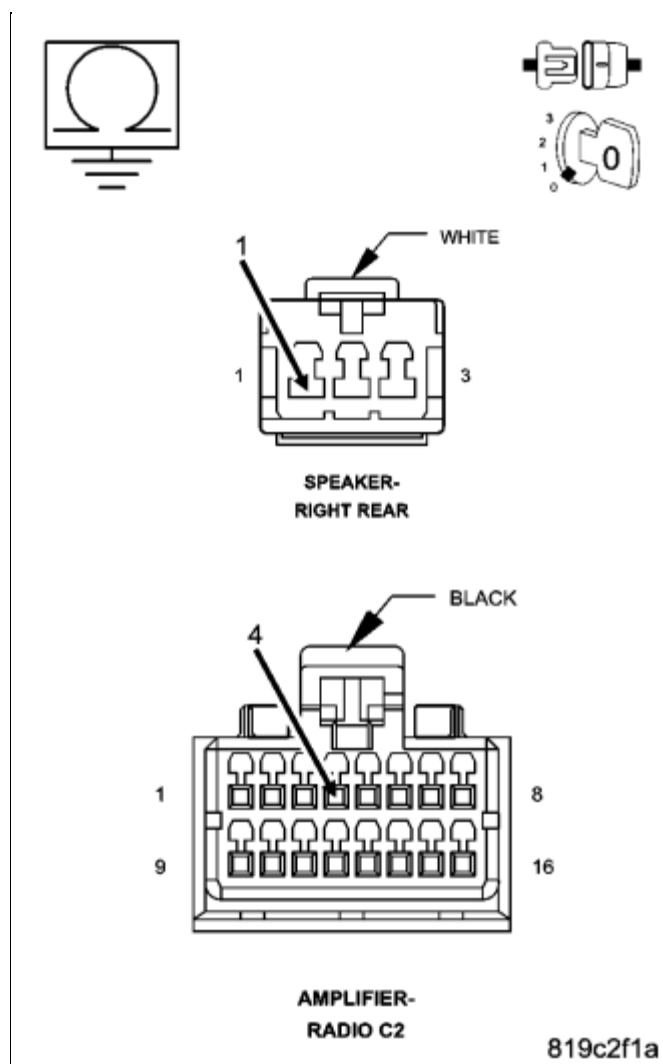
Is the resistance below 10K ohms?

Yes

- Repair the (X206) Amplified Right Rear Speaker (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (X296) Amplified Right Rear Speaker (-) circuit.

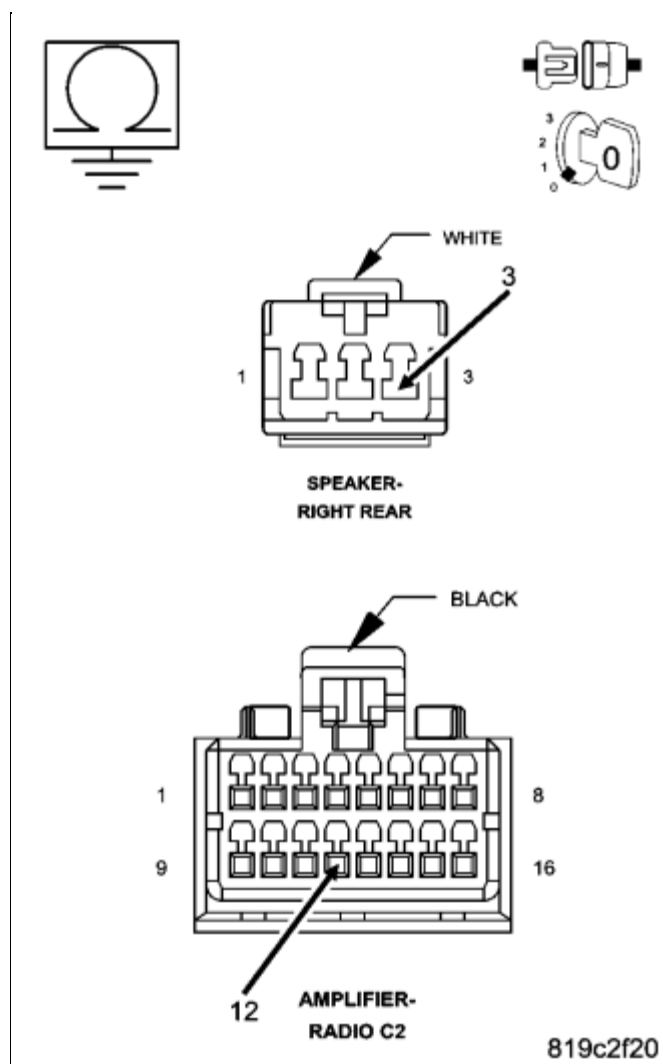
Is the resistance below 10K ohms?

Yes

- Repair the (X296) Amplified Right Rear Speaker (-) for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK OPERATION OF THE AMPLIFIED RIGHT REAR SPEAKER

Reconnect and reinstall the Right Rear Speaker.
Measure the resistance of the speaker circuit between the
Amplifier C2 harness connector and ground.

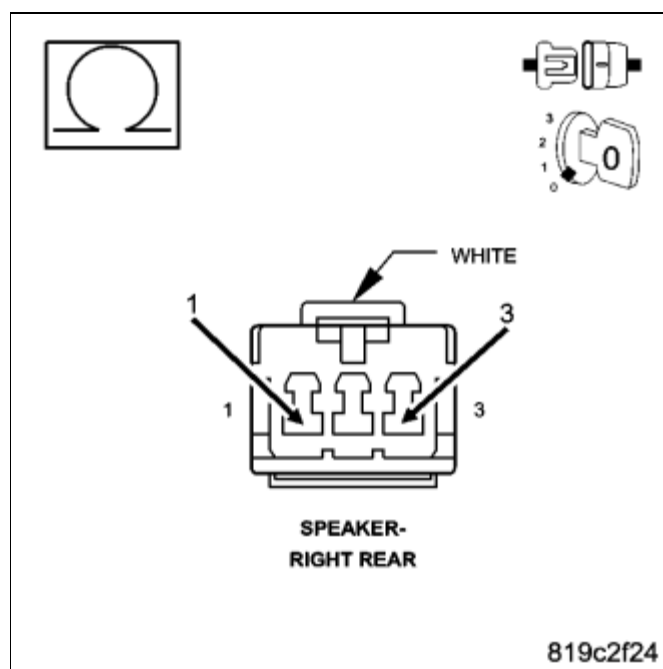
Is the resistance below 10K ohms?

Yes

- Replace the Right Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

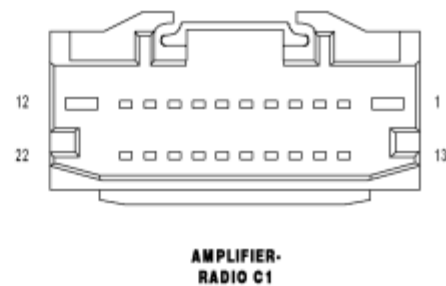
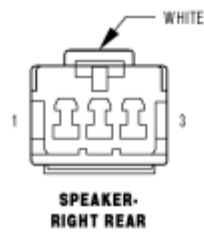
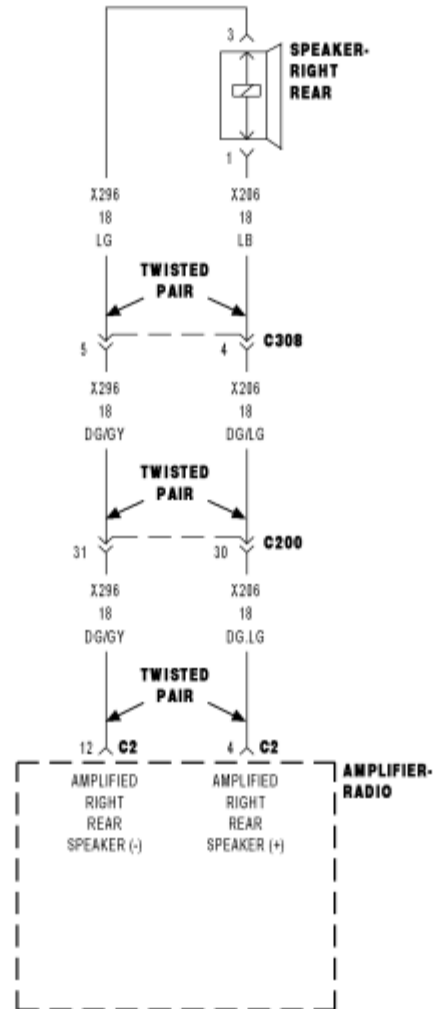
- Replace the amplifier in accordance with the service



information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH



819c306d

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.

- **Set Condition:**
- The amplifier detects a short to battery condition on the output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT SHORT TO VOLTAGE
(X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT SHORT TO VOLTAGE
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.
With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147B-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FOR VOLTAGE ON THE (X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT

Turn the ignition off.
Disconnect the Amplifier C2 harness connector.
Disconnect the Amplified Right Rear Speaker harness connector.
Turn the ignition on.
Measure for voltage on the (X206) Amplified Right Rear Speaker (+) circuit.

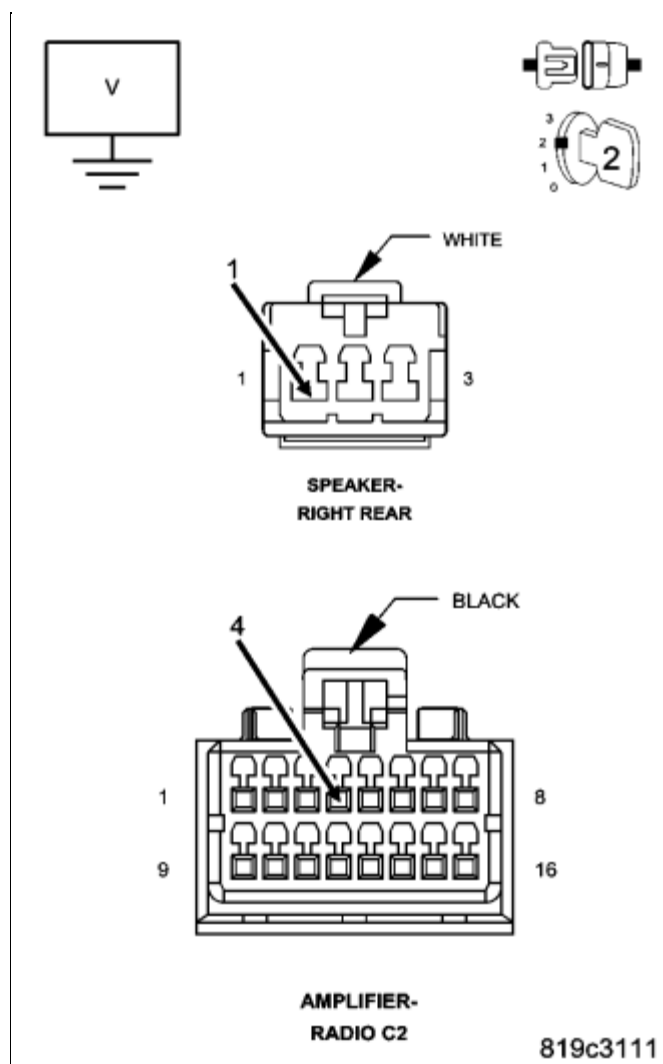
Is the voltage above 10.0 volts?

Yes

- Repair the (X206) Amplified Right Rear Speaker (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK FOR VOLTAGE ON THE (X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT

Measure for voltage on the (X296) Amplified Right Rear Speaker (-) circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (X296) Amplified Right Rear Speaker (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

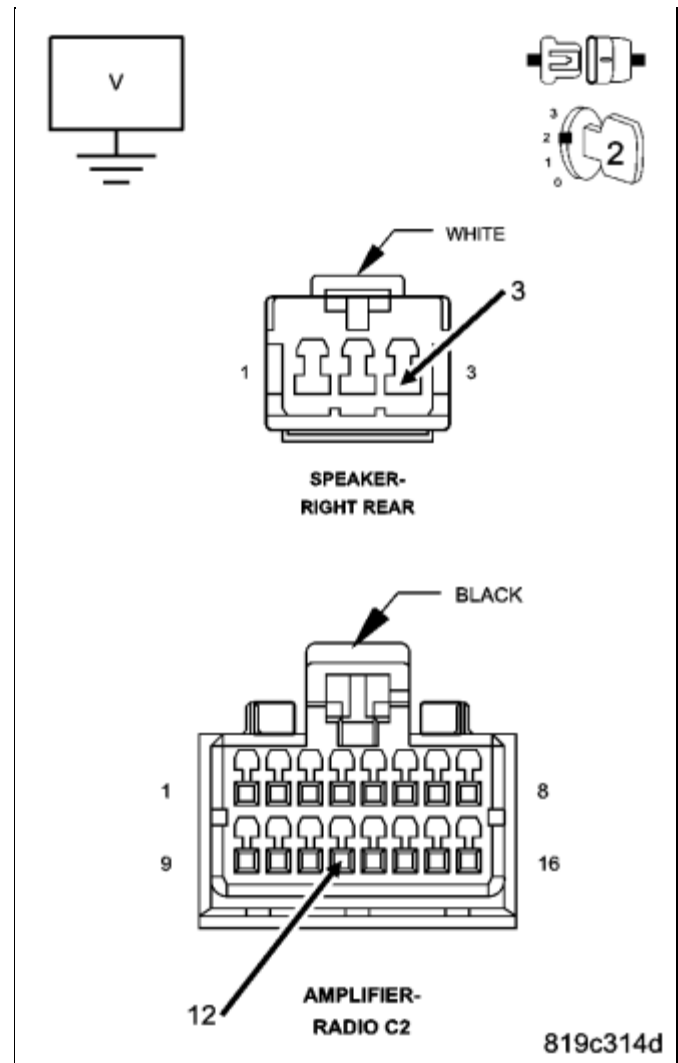
No

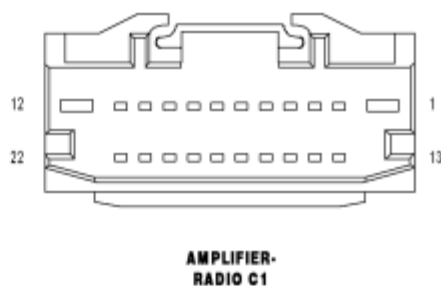
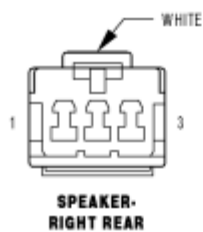
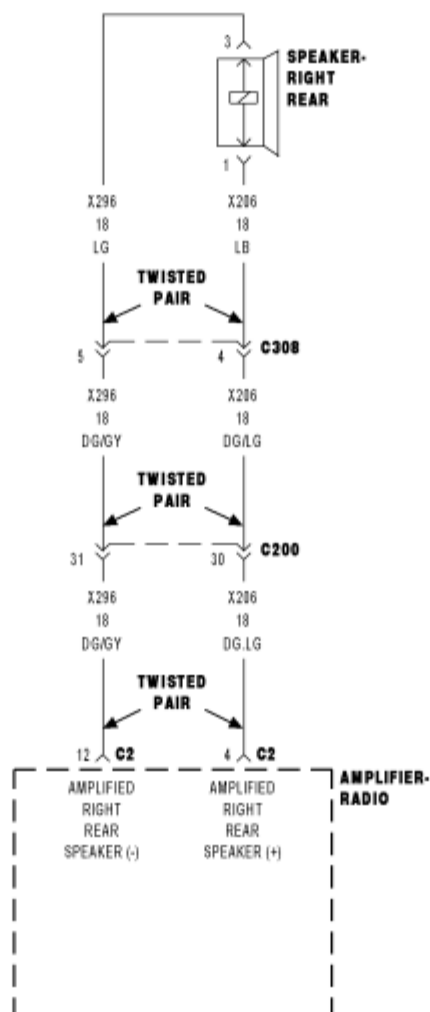
- Replace the amplifier in accordance with the service

information.

- Perform the BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN





819c306

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Amplifier BUS wake-up. Amplifier reset with scan tool.

- **Set Condition:**
- The amplifier detects an open condition on the speaker output circuit.

Possible Causes
(X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT OPEN
(X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT OPEN
RIGHT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on.

Turn the radio on.

With the scan tool, erase Amplifier DTCs.

With the scan tool, reset the amplifier.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147C-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE RIGHT REAR SPEAKER

Turn the ignition off.

Disconnect the Right Rear Speaker harness connector.
 Turn the ignition on.
 Turn the radio on and turn the volume to mid level.
 With a voltmeter set to read in A/C voltage, measure the voltage of the Amplified Right Rear Speaker circuits in the Amplified Right Rear Speaker harness connector.

Is the voltage present greater than 1 volt?

Yes

- Replace the Amplified Right Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT FOR AN OPEN

Turn the ignition off.
 Disconnect the Amplifier C2 harness connector.
 Measure the resistance of the (X206) Amplified Right Rear Speaker (+) circuit between the Amplifier C2 harness connector and the Amplified Right Rear Speaker harness connector.

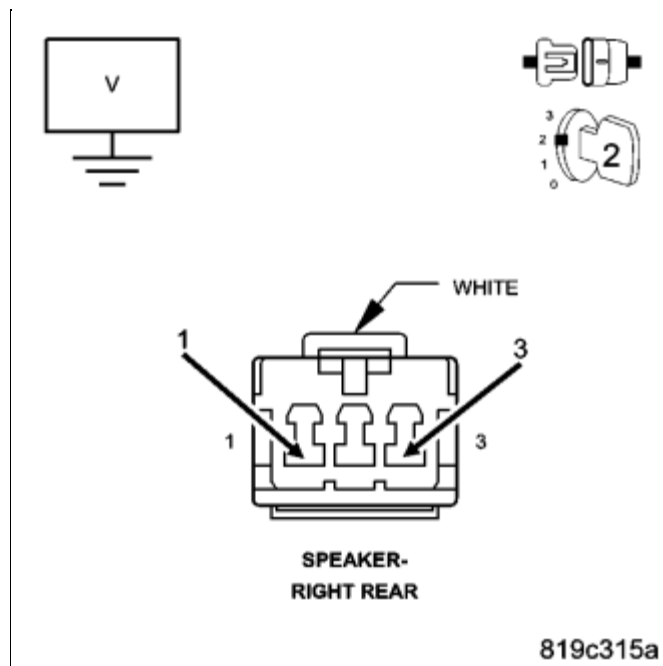
Is the resistance below 5.0 ohms?

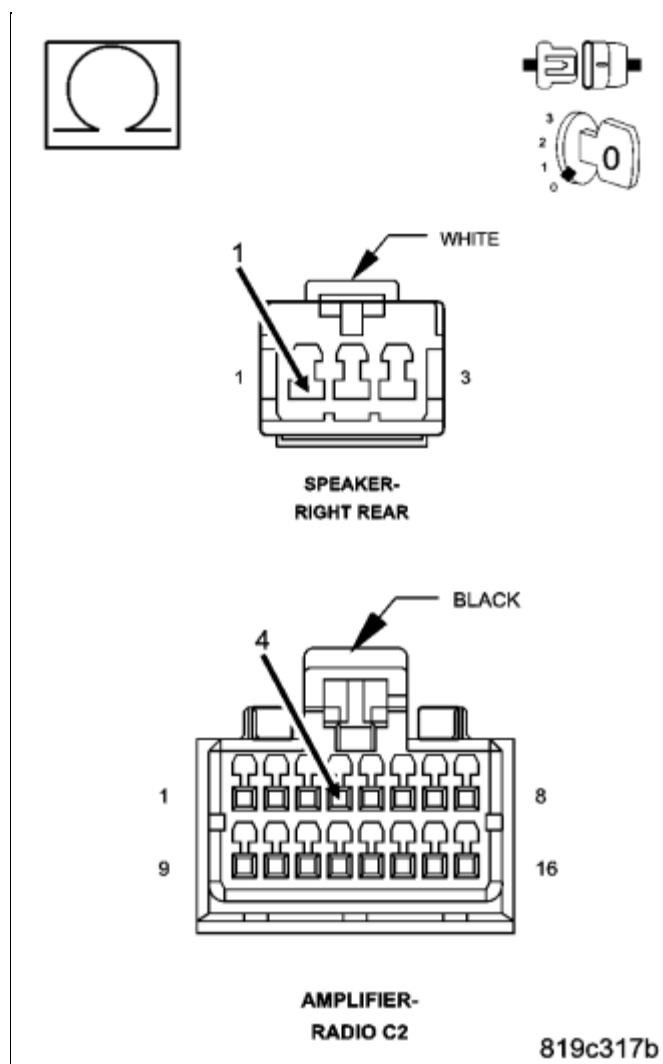
Yes

- Go To [4](#)

No

- Repair the (X206) Amplified Right Rear Speaker (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)





4. CHECK THE (X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT FOR AN OPEN

Measure the resistance of the (X296) Amplified Right Rear Speaker (-) circuit between the Amplifier C2 harness connector and the Amplified Right Rear Speaker harness connector.

Is the resistance below 5.0 ohms?

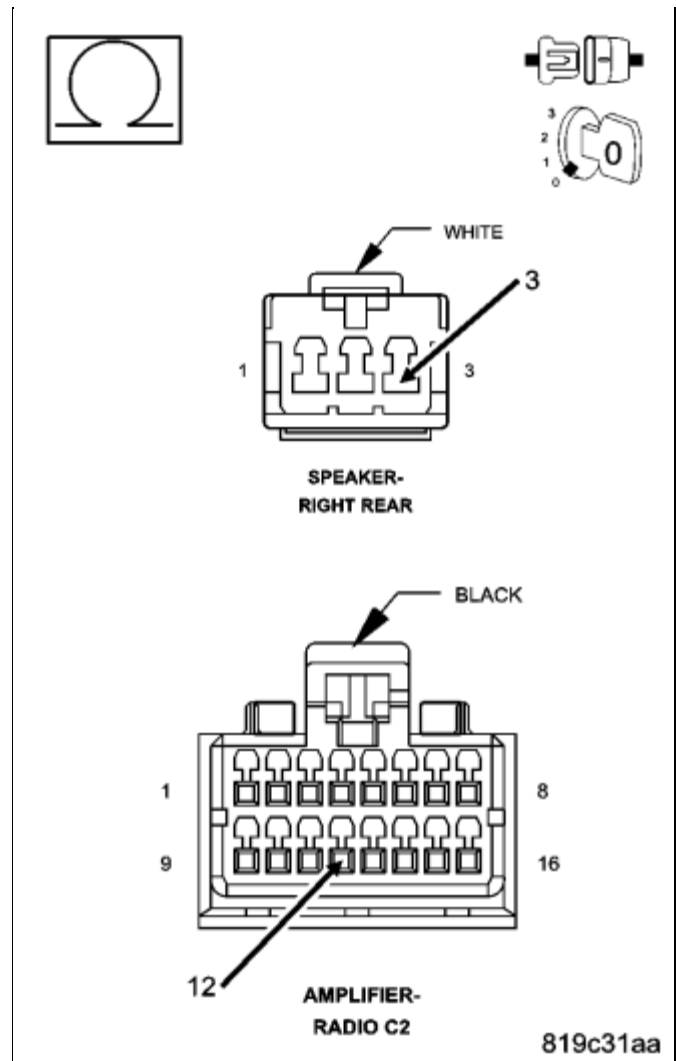
Yes

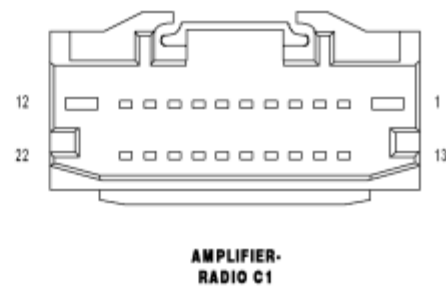
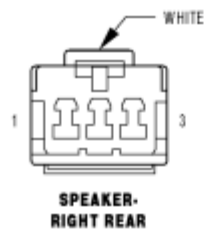
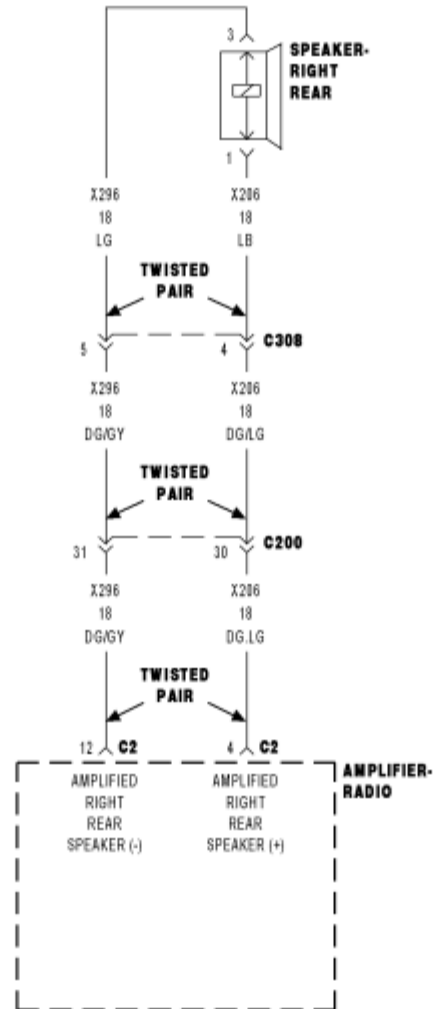
- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (X296) Amplified Right Rear Speaker (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER





819c306

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on. Radio volume at 25 or higher.

- **Set Condition:**
- The amplifier detects that the output circuits are shorted together.

Possible Causes
(X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT SHORTED TO THE (X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUIT
AMPLIFIED RIGHT REAR SPEAKER
AMPLIFIER

Diagnostic Test

1. CHECK FOR AN INTERMITTENT CONDITION

Turn the ignition on, then off, and then on again.

With the scan tool, clear Amplifier DTCs.

Turn the radio on.

Turn the volume level to 25.

With the scan tool, read Amplifier DTCs.

Does the scan tool display active: B147D-CHANNEL 6 AUDIO SPEAKER OUTPUT CIRCUIT SHORTED TOGETHER?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE OPERATION OF THE AMPLIFIED RIGHT REAR SPEAKER

Turn the ignition off.

Disconnect the Amplified Right Rear Speaker.

Measure the resistance of the speaker between the two terminals.

Is the resistance of the speaker less than 1 ohm?

Yes

- Replace the Amplified Right Rear Speaker in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (X206) AMPLIFIED RIGHT REAR SPEAKER (+) CIRCUIT, AND THE (X296) AMPLIFIED RIGHT REAR SPEAKER (-) CIRCUITS FOR A SHORT TOGETHER

Disconnect the Amplifier C2 harness connector.
Measure the resistance between the (X206) Amplified Right Rear Speaker (+) circuit, and the (X296) Amplified Right Rear Speaker (-) circuit.

Is the resistance below 10K ohms?

Yes

- Repair the (X206) Amplified Right Rear Speaker (+) circuit, and the (X296) Amplified Right Rear Speaker (-) circuit for a short together.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

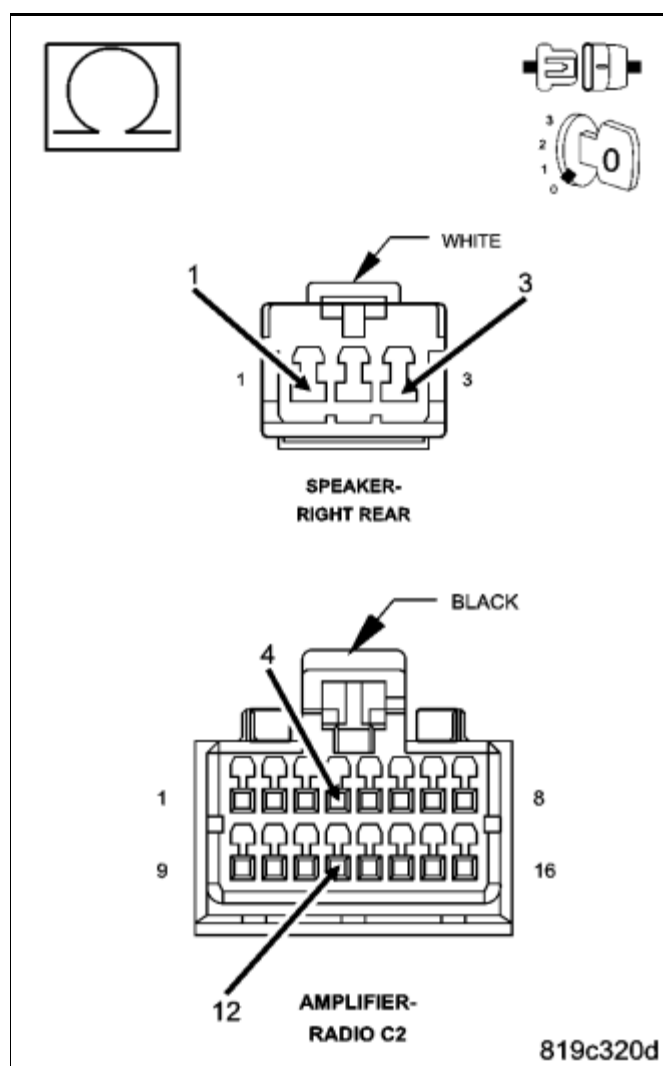
No

- Replace the amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B2222-SATELLITE RADIO RECEIVER INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- With the ignition on.
- **Set Condition:**



819c320d

The Satellite Radio Receiver detects a software checksum test failure.

Possible Causes
SATELLITE RADIO RECEIVER

Diagnostic Test

1. REPLACE THE SATELLITE RADIO RECEIVER

When this code is set, the Satellite Radio must be replaced.

Repair

- Replace the Satellite Radio Receiver in accordance with the Service Information. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

U0019–CAN INTERIOR BUS

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Continuously.
- **Set Condition:**
- Whenever the CAN INTERIOR BUS (+) or INTERIOR BUS (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN INTERIOR BUS DTCs IN THE TOTALLY INTEGRATED POWER MODULE
(D264) CAN INTERIOR BUS (–) CIRCUIT OPEN
(D265) CAN INTERIOR BUS (+) CIRCUIT OPEN
AMPLIFIER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display: U0019–CAN INTERIOR BUS CIRCUIT?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1.

2. CHECK TOTALLY INTEGRATED POWER MODULE DTCs

With the scan tool, read Totally Integrated Power Module DTCs

Does the scan tool display any CAN INTERIOR BUS DTCs – ACTIVE?

Yes

- Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.
-

No

- Go to [3](#)
-

3. CAN INTERIOR BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Disconnect the Totally Integrated Power Module C7 harness connector.

Measure the resistance of the (D265) CAN INTERIOR BUS (+) circuit between the Totally Integrated Power Module C7 harness connector and the Amplifier C1 harness connector.

Is the resistance below 2.0 ohms?

Yes

- Go To [4](#)
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the CAN INTERIOR BUS (+) circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CAN INTERIOR BUS (–) CIRCUIT OPEN

Measure the resistance of the (D264) CAN INTERIOR BUS (–) circuit between the Totally Integrated Power Module C7 harness connector and the Amplifier C1 harness connector.

Is the resistance below 2.0 ohms?

Yes

- Replace the Amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the CAN INTERIOR BUS (–) circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U0020-CAN INTERIOR BUS OFF PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Continuously.
- **Set Condition:**
- Whenever the CAN INTERIOR BUS (+) or INTERIOR BUS (–) circuit is open, shorted to voltage or shorted to ground, this code will set.

Possible Causes
CAN INTERIOR BUS DTCs IN THE TOTALLY INTEGRATED POWER MODULE
(D264) CAN INTERIOR BUS (–) CIRCUIT OPEN
(D265) CAN INTERIOR BUS (+) CIRCUIT OPEN
AMPLIFIER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display: U0020-CAN INTERIOR BUS OFF PERFORMANCE?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK FRONT CONTROL MODULE DTCs

With the scan tool, read Totally Integrated Power Module DTCs.

Does the scan tool display any CAN INTERIOR BUS DTCs – ACTIVE?

Yes

- Refer to the symptom list for problems related to Communication in the ELECTRICAL.– ELECTRONIC CONTROL MODULES – ELECTRICAL DIAGNOSES section.

No

- Go to [3](#)
-

3. CAN INTERIOR BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Amplifier C1 harness connector.

Disconnect the Totally Integrated Power Module C7 harness connector.

Measure the resistance of the (D265) CAN INTERIOR BUS (+) circuit between the Totally Integrated Power module C7 harness connector and the Amplifier C1 harness connector.

Is the resistance below 2.0 ohms?

Yes

- Go To [4](#)
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the CAN INTERIOR BUS (+) circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CAN INTERIOR BUS (–) CIRCUIT OPEN

Measure the resistance of the (D264) CAN INTERIOR BUS (–) circuit between the Totally Integrated Power Module C7 harness connector and the Amplifier C1 harness connector.

Is the resistance below 2.0 ohms?

Yes

- Replace the Amplifier in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the CAN INTERIOR BUS (–) circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0154-LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0195-LOST COMMUNICATION WITH SDAR

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0197-LOST COMMUNICATION WITH HANDS FREE MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0199-LOST COMMUNICATION WITH DRIVERS DOOR MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0200-LOST COMMUNICATION WITH PASSENGER DOOR MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

B1420-AUDIO CASSETTE ERROR/INOPERABLE CASSETTE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on and the Radio Cassette player turned on.

- **Set Condition:**

The code will set when a damaged Cassette is placed in the Cassette Player.

Possible Causes
CASSETTE READ FAILURE

Diagnostic Test

1. RADIO

Replace the problem Cassette with a good, clean, undamaged, cassette.

Turn the Radio cassette player on.

With the scan tool, read DTC's.

Does the scan tool display active: B1420–AUDIO CASSETTE ERROR/INOPERABLE CASSETTE?

Yes

- Eject the inoperative cassette and replace the Radio/Cassette Player in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1422-AUDIO DVD READ ERROR/INOPERABLE DISC

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on and the DVD player turned on.

- **Set Condition:**

The code will set if a DVD that is not formatted as a DVD is installed in the DVD player.

Possible Causes
DVD READ FAILURE

Diagnostic Test

1. DVD PLAYER

Replace the problem DVD with a good, clean, unscratched DVD.

Turn the DVD player on.

With the scan tool, read DTC's.

Does the scan tool display active: B1422-AUDIO DVD READ ERROR/INOPERABLE DISC?

Yes

- Eject the inoperative DVD and replace the DVD in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1423-VES DVD READ ERROR/INOPERABLE DISC

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on and the DVD player turned on.

- **Set Condition:**

The code will set if a DVD that is not formatted as a DVD is installed in the DVD player.

Possible Causes
DVD READ FAILURE

Diagnostic Test

1. DVD PLAYER

Replace the problem DVD with a good, clean, unscratched DVD.

Turn the DVD player on.

With the scan tool, read DTC's.

Does the scan tool display active: B1423-VES DVD READ ERROR/INOPERABLE DISC?

Yes

- Eject the inoperative DVD and replace the DVD in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1424-IMPROPER DVD-WRONG REGION

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on and the DVD player turned on.

- **Set Condition:**

The code will set if a DVD that is not formatted as a DVD is installed in the DVD player.

Possible Causes
DVD READ FAILURE

Diagnostic Test

1. DVD PLAYER

Replace the problem DVD with a good, clean, unscratched DVD.

Turn the DVD player on.

With the scan tool, read DTC's.

Does the scan tool display active: B1424-IMPROPER DVD-WRONG REGION?

Yes

- Eject the inoperative DVD and replace the DVD in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1429-RADIO DISPLAY HIGH TEMPERATURE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously with the ignition and Radio on.

◦ **Set Condition:**

The code will set if the temperature inside the Radio is above +65°C (+145°F)

Possible Causes
HIGH TEMPERATURE FAILURE

Diagnostic Test

1. VERIFY THAT DTC B1429-RADIO DISPLAY HIGH TEMPERATURE IS ACTIVE.

With the scan tool, clear all DTC's.
Start the engine and allow the engine to reach normal operating temperature.
If the vehicle has been in the hot sunlight or extreme cold, move the vehicle indoors and open the doors to allow the inside temperature to stabilize.
The Radio should operate between —23°C and +65°C (—10°F and +145°F).
With the scan tool, read DTC's.

Does the scan tool display active: B1429-RADIO DISPLAY HIGH TEMPERATURE?

Yes

- Replace the Radio in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B1430 SATELLITE RADIO ANTENNA INTERNAL PERFORMANCE

For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**
- With the ignition on.
- **Set Condition:**
- The Satellite Radio Antenna detects a software checksum test failure.

Possible Causes
SATELLITE RADIO ANTENNA

Diagnostic Test

1. REPLACE THE SATELLITE RADIO ANTENNA

When this code is set, the Satellite Radio Antenna must be replaced.

Repair

- Replace the Satellite Radio Antenna in accordance with the Service Information. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

B142A-RADIO UNIT HIGH TEMPERATURE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition and Radio on.

- **Set Condition:**

The code will set if the temperature inside the Radio is above +65°C (+145°F)

Possible Causes
HIGH TEMPERATURE FAILURE

Diagnostic Test

1. VERIFY THAT DTC B142A-RADIO UNIT HIGH TEMPERATURE IS ACTIVE.

With the scan tool, erase the DTC's.
Start the engine and allow the engine to reach normal operating temperature.
If the vehicle has been in the hot sunlight or extreme cold, move the vehicle indoors and open the doors to allow the inside temperature to stabilize.
The Radio should operate between —23°C and +65°C (—10°F and +145°F).
With the scan tool, read DTC's.

Does the scan tool display active: B142A-RADIO UNIT HIGH TEMPERATURE?

Yes

- Replace the Radio in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B142C-VES VIDEO SCREEN DISCONNECTED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on and the Radio in Video mode.

- **Set Condition:**

With the Radio in Video mode, the Radio does not detect a VES Video Screen.

Possible Causes
BAD VES VIDEO SCREEN CONNECTION
RADIO

Diagnostic Test

1. TEST VES VIDEO SCREEN CONNECTION

Turn the ignition off.
Disconnect the VES Video Screen connector.
Inspect the VES Video Screen connection.

Was the VES Video Screen connection clean and secure?

Yes

- Go To [2](#)

No

- Repair the VES Video Screen connection as needed.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. VES VIDEO SCREEN

Refer to the Audio System in the Service Information and test the VES Video Screen in accordance with the Service Procedure.

Is the Antenna ok?

Yes

- Go To [3](#)

No

- Repair or replace the VES Video Screen in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. RADIO

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft (9.14m) from any structure.

Turn the ignition on.

Turn the Radio on.

With the scan tool, clear all DTC's, put the Radio in mode.

With the scan tool, read DTC's.

Does the scan tool display active: B142C-VES VIDEO SCREEN DISCONNECTED?

Yes

- Replace the Radio in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B142D-AUDIO ANTENNA NOT CONNECTED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on and the Radio in seek mode.

- **Set Condition:**

With the Radio in seek mode for two loops around the band. The Radio does not detect an Antenna connection or does not receive a Radio station signal.

Possible Causes
BAD ANTENNA CONNECTION
RADIO

Diagnostic Test

1. TEST ANTENNA

Turn the ignition off.
 Disconnect the Radio Antenna connector.
 Inspect the Radio Antenna connection.

Was the Antenna connection clean and secure?

Yes

- Go To [2](#)

No

- Repair the Antenna connection as needed.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. ANTENNA

Refer to the Audio System in the Service Information and test the antenna in accordance with the Service Procedure.

Is the Antenna ok?

Yes

- Go To [3](#)

No

- Repair or replace the Antenna assembly in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. RADIO

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft (9.14m) from any structure.

Turn the ignition on.

Turn the Radio on.

With the scan tool, clear all DTC's, put the Radio in seek up and down mode for 2 loops around the band cycle before proceeding.

With the scan tool, read DTC's.

Does the scan tool display active: B142D-AUDIO ANTENNA NOT CONNECTED?

Yes

- Replace the Radio in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

B142E-GPS ANTENNA NOT CONNECTED

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and the Radio in Navigation mode.

◦ **Set Condition:**

With the Radio in Navigation mode. The Radio does not detect an Antenna connection or does not receive a Navigation (GPS) signal.

Possible Causes
BAD ANTENNA CONNECTION
RADIO
ANTENNA

Diagnostic Test

1. TEST ANTENNA

Turn the ignition off.
Disconnect the GPS Antenna connector.
Inspect the GPS Antenna connection.

Was the Antenna connection clean and secure?

Yes

- Go To [2](#)

No

- Repair the Antenna connection as needed.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. ANTENNA

Refer to the Audio System in the Service Information and test the antenna in accordance with the Service Procedure.

Is the Antenna ok?

Yes

- Go To [3](#)

No

- Repair or replace the Antenna assembly in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. RADIO

NOTE: Reconnect all previously disconnected components.

NOTE: Move vehicle outside approximately 30ft (9.14m) from any structure.

Turn the ignition and Radio on.
With the scan tool, clear all DTC's and operate the Navigation system.
With the scan tool, read DTC's.

Does the scan tool display active: B142E-GPS ANTENNA NOT CONNECTED?

Yes

- Replace the Radio in accordance with the Service Information.

- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test Complete.

AUDIO - SERVICE INFO

AUDIO - SERVICE INFO

DESCRIPTION

Several combinations of radio receivers and speaker systems are offered.

The audio system includes the following components:

- Antenna (Radio, Satellite, GPS)
- Amplifier (if equipped)
- Radio noise suppression components
- Radio
- Satellite receiver (Integrated within the radio unit)
- Speakers
- Subwoofer (if equipped)

Certain functions and features of the audio system rely upon resources shared with other electronic modules in the vehicle over the Controlled Area Network (CAN). The data bus network allows the sharing of sensor information. For diagnosis of these electronic modules or of the data bus network, the use of a scan tool and the proper Diagnostic Procedures manual are recommended.

OPERATION

The audio system components are designed to provide audio entertainment and information through the reception, tuning and amplification of locally broadcast radio signals in both the Amplitude Modulating (AM) and Frequency Modulating (FM) commercial frequency ranges.

The audio system components operate on battery current received through a fuse in the Junction Block (JB) on a fused ignition switch output (run-acc) circuit so that the system will only operate when the ignition switch is in the Run or Accessory positions.

DIAGNOSIS AND TESTING

AUDIO

Any diagnosis of the Audio system should begin with the use of the scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic Service Manual.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: On vehicles equipped with air bags, (refer to electrical/restraints) before attempting any

steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

Audio System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
NO AUDIO.	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw fuse in Power Distribution Center. Replace fuses, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Speakers inoperative.	5. Refer to speaker diagnosis.
	6. Radio inoperative.	6. Exchange or replace radio, if required.
NO DISPLAY.	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw fuse in Power Distribution Center. Replace fuses, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Exchange or replace radio, if required.
POOR RADIO RECEPTION.	1. Antenna inoperative.	1. See antenna diagnosis, in this group. Repair or replace antenna, if required.
	2. Ground damaged.	2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	3. Radio inoperative.	3. Exchange or replace radio, if required.

NO COMPACT DISC/DVD OPERATION	1. CD/DVD damaged.	1. Insert known good CD/DVD and test operation.
	2. Foreign material on CD/DVD.	2. Clean CD/DVD and test operation.
	3. Condensation on CD/DVD or optics.	3. Allow temperature of vehicle interior to stabilize and test operation.
	4. Radio inoperative	4. Exchange or replace radio, if required.

AMPLIFIER

DESCRIPTION

The amplifier is located under the steering column behind the steering column opening cover. The amplifier can not be adjusted or repaired. If faulty the unit as a whole must be replaced.

OPERATION

The amplifier receives fused battery current from a fuse in the rear Totally Integrated Power Module (TIPM) at all times. The internal circuitry of the amplifier switches the amplifier ON based upon a CAN bus message that is received from the radio receiver whenever the radio is turned on. The amplifier receives the sound signal inputs from the radio, then sends the amplified outputs to the speakers.

DIAGNOSIS AND TESTING

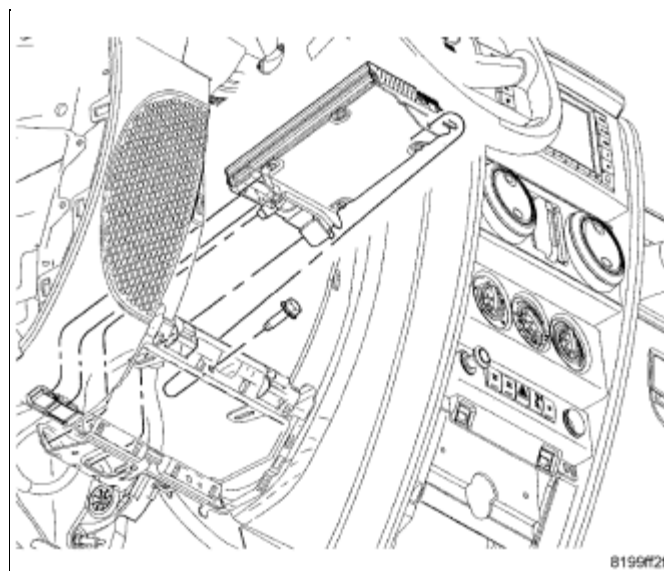
AMPLIFIER

Any diagnosis of the Audio system should begin with the use of a scan tool and the appropriate Diagnostic Service information.

REMOVAL

1. Disconnect the battery negative cable.
2. Remove the steering column opening cover.
3. Remove the steering column opening cover bracket.
4. Remove the mounting fastener.
5. Disconnect the electrical connector and remove the amplifier.

INSTALLATION

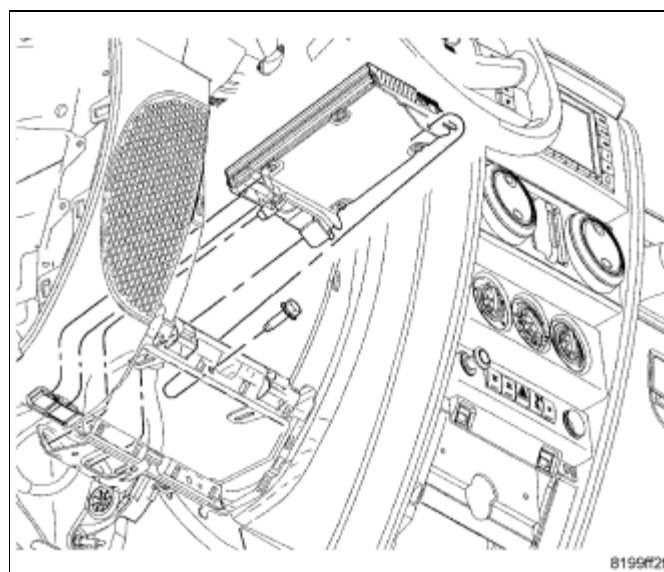


1. Connect the electrical connector and install the amplifier.
2. Install the mounting fastener.
3. Install the steering wheel opening cover support bracket.
4. Install the steering wheel opening cover.
5. Connect the battery negative cable.

ANTENNA BODY & CABLE

DESCRIPTION

All models use a fixed-length stainless steel rod-type antenna mast, installed on the right front cowl side panel of the vehicle. The antenna mast is connected to the center wire of the coaxial antenna cable, and is not grounded to any part of the vehicle.



To eliminate static, the antenna base must have a good ground. The antenna coaxial cable shield (the outer wire mesh of the cable) is grounded to the antenna base and the radio chassis.

The antenna coaxial cable has an additional disconnect, located behind the right end of the instrument panel between the radio and the right cowl side panel. This additional disconnect allows the instrument panel assembly to be removed and installed without removing the radio.

DIAGNOSIS AND TESTING

ANTENNA BODY AND CABLE

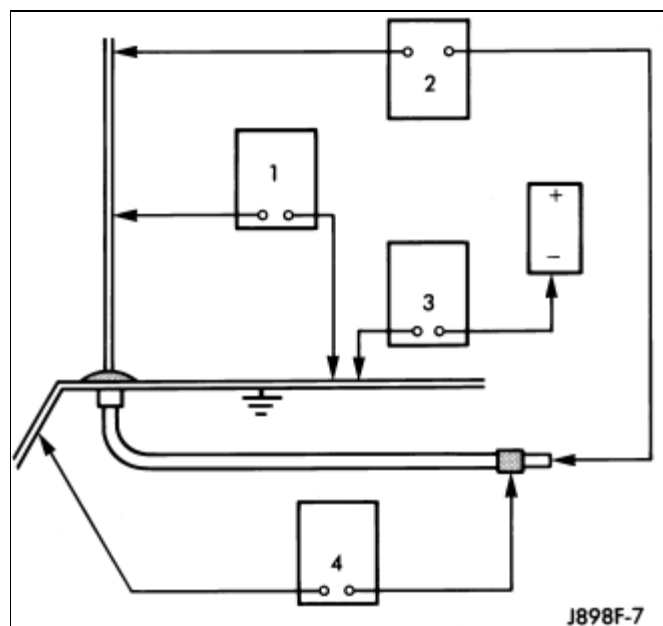
WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1** - Mast to ground test
- **Test 2** - Tip-of-mast to tip-of-conductor test
- **Test 3** - Body ground to battery ground test
- **Test 4** - Body ground to coaxial shield test.

The ohmmeter test lead connections for each test are shown in Antenna Tests .

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate an antenna cable problem. First, test the primary antenna cable (integral to the antenna body and cable) from the coaxial cable connector behind the right side of the instrument panel between the radio and the right side cowl panel, to the antenna body. Then, test the secondary antenna cable (instrument panel antenna cable) from the coaxial connector behind the right side of the instrument panel between the radio and the right side cowl panel, to the coaxial cable connector at the radio.



TEST 1

Test 1 determines if the antenna mast is insulated from the base. Proceed as follows:

1. Unplug the antenna coaxial cable connector from the radio chassis and isolate.
2. Connect one ohmmeter test lead to the tip of the antenna mast. Connect the other test lead to the antenna base. Check for continuity.
3. There should be no continuity. If continuity is found, replace the faulty or damaged antenna base and cable assembly.

TEST 2

Test 2 checks the antenna for an open circuit as follows:

1. Unplug the antenna coaxial cable connector from the radio chassis.
2. Connect one ohmmeter test lead to the tip of the antenna mast. Connect the other test lead to the center pin of

the antenna coaxial cable connector.

3. Continuity should exist (the ohmmeter should only register a fraction of an ohm). High or infinite resistance indicates damage to the base and cable assembly. Replace the faulty base and cable, if required.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. This test should be performed with the battery positive cable removed from the battery. Disconnect both battery cables, the negative cable first. Reconnect the battery negative cable and perform the test as follows:

1. Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the battery negative post.
2. The resistance should be less than one ohm.
3. If the resistance is more than one ohm, check the braided ground strap connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair or replace the ground strap connection, if required.

TEST 4

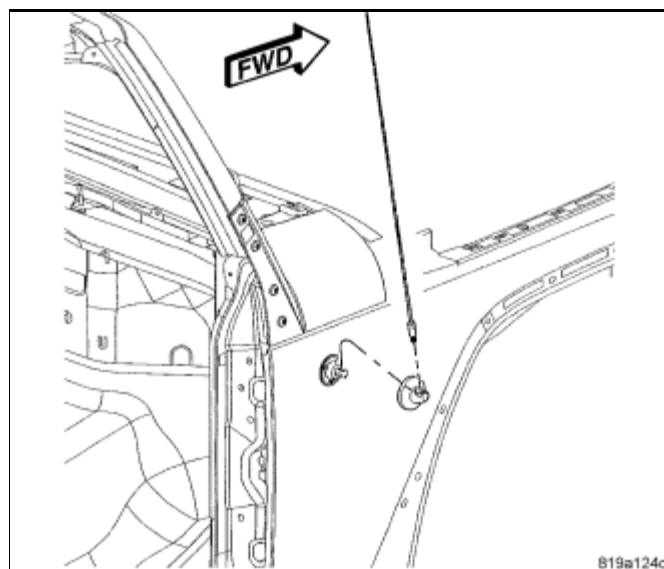
Test 4 checks the condition of the ground between the antenna base and the vehicle body as follows:

1. Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the outer crimp on the antenna coaxial cable connector.
2. The resistance should be less than one ohm.
3. If the resistance is more than one ohm, clean and/or tighten the antenna base to fender mounting hardware.

REMOVAL

WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

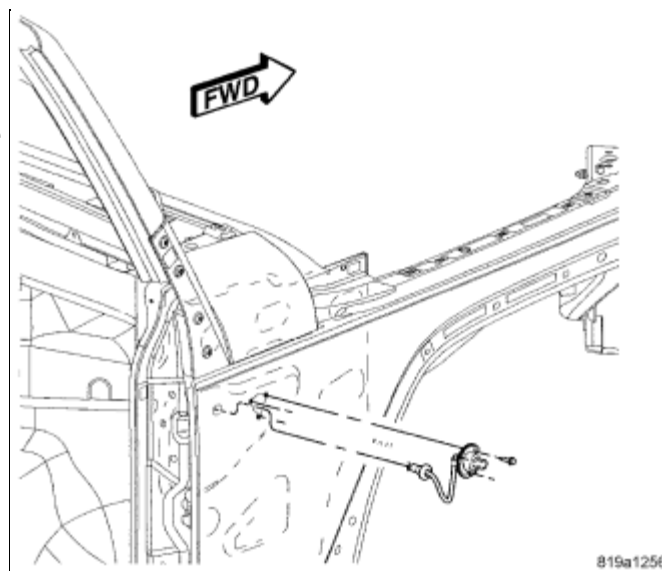
1. Disconnect and isolate the battery negative cable.
2. Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
3. Reach through the instrument panel glove box opening to unplug the two antenna coaxial cables in line connector.
4. Unscrew the antenna mast from the antenna body base on the right outer cowl side panel.



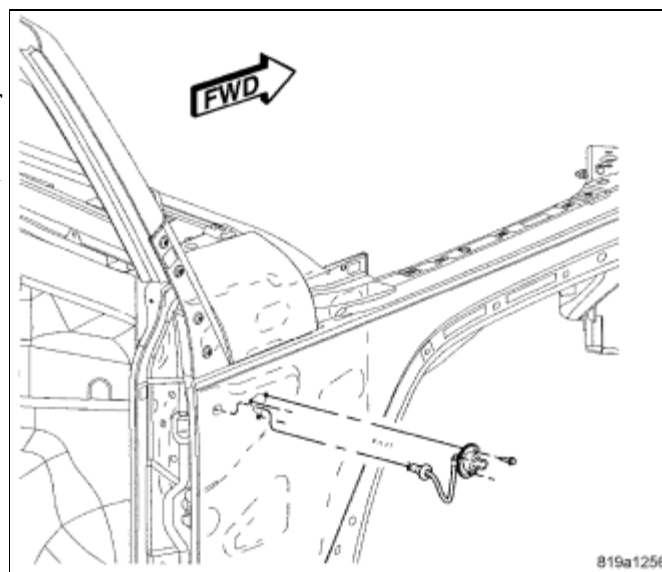
5. Using a trim stick, gently pry the edge of the antenna base trim cover to unsnap it from the antenna body base.
6. Remove the three screws that secure the antenna body base to the right outer cowl side panel.
7. From inside the passenger compartment, push the coaxial cable grommet on the antenna body half of the coaxial cable out through the hole in the right inner cowl side panel.
8. From the outside of the vehicle, pull the antenna body base and cable assembly out through the hole in the right outer cowl side panel.

INSTALLATION

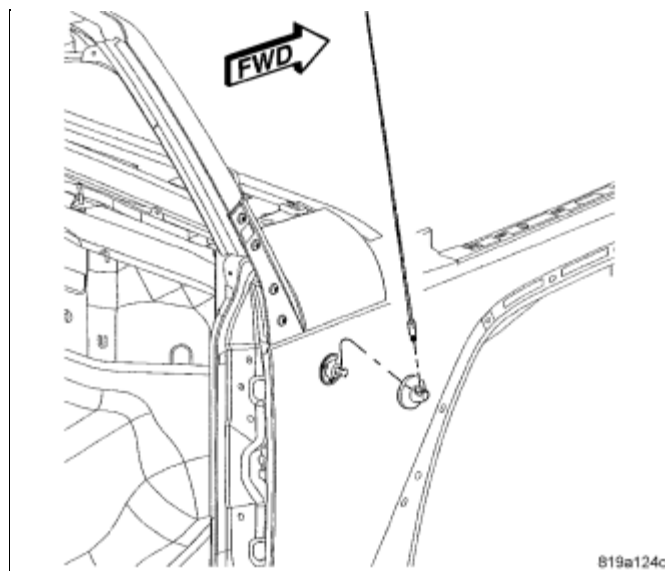
WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.



1. From outside the vehicle, feed the antenna cable and base assembly through the outer cowl side panel and into the inner cowl side panel hole.
2. From inside the passenger compartment, pull the cable and grommet into the hole in the inside cowl side panel until the grommet is fully seated.
3. Install the three screws retaining the antenna body base to right outer cowl side panel. Tighten the screws to 3.3 N·m (30 in. lbs.).



4. Snap on the antenna base trim cover to the antenna body base.
5. Install antenna mast. Tighten to 5 N·m (46 in. lbs.).
Ensure that the antenna mast is fully seated on antenna base and that there is no gap between the mast and base.
6. Reach through the glove box opening and connect the two antenna coaxial cables in line connector.
7. Install the glove box to the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
8. Connect the battery negative cable.



ANTENNA-SATELLITE

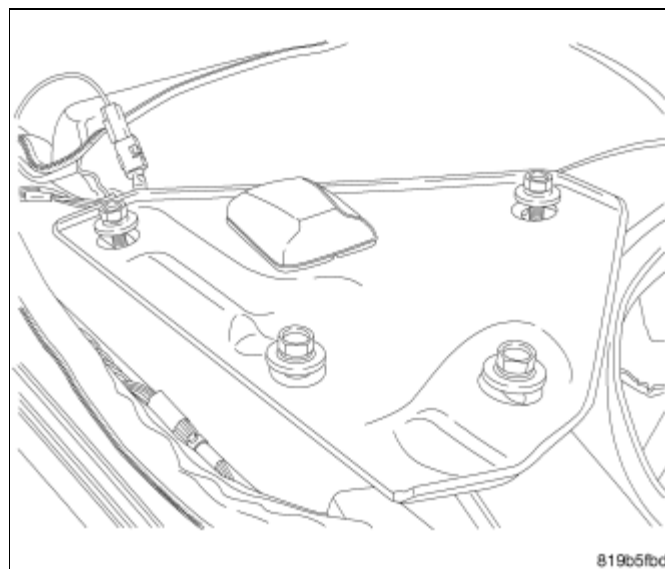
OPERATION

The satellite radio antenna receives signals from orbiting satellites and sends these signals to the radio. The satellite radio antenna must have open space in which to operate. Items carried on the roof, parking inside etc. can have an effect on the antenna's ability to receive signals.

REMOVAL

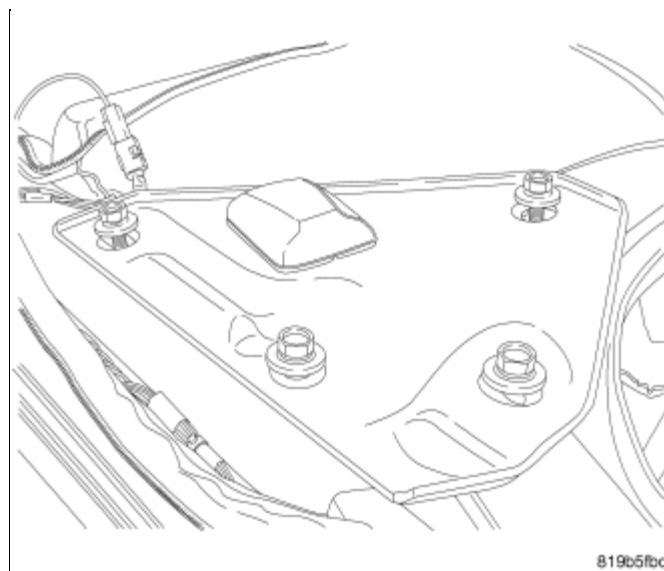
1. Disconnect and isolate the battery negative cable.
2. Remove the hard top.
3. Remove the fasteners from mounting plate.
4. Disconnect the antenna connector.
5. Remove the antenna fastener and remove antenna.

INSTALLATION



1. Install the antenna mounting fastener.
2. Connect the antenna connector.
3. Install mounting plate and fasteners
4. Install the hard top.
5. Connect the battery negative cable.

RADIO



DESCRIPTION

Available factory-installed radio receivers for this model include:

- AM/FM (1-CD/MP3), with & without integral satellite & input jacks (RES)
- AM/FM (6-DVD/MP3), with & without integral satellite & input jacks (REQ)
- AM/FM (1-CD/DVD/MP3), full map navigation (6.5" integrated touch screen display), 1-disc data drive, integral satellite & input jacks (RER)

All factory-installed radio receivers can communicate on the Controller Area Network (CAN). All factory-installed receivers are stereo Electronically Tuned Radios (ETR).

These radio receivers can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

STANDARD PROCEDURE – RADIO BACKUP

The radio hard drive (HDD) can be backed up to save customer data in the event that a radio replacement is required. This procedure can only be done with all radios with a hard disk drive. All other radios do not have a HDD.

1. Turn the ignition to RUN, engine OFF.
2. Power on the external HDD.
3. Connect the external HDD to the radio using the USB (Universal Serial Bus) cable. The radio display will change to the "Manage My Files" screen.
4. Connect the scan tool and preform the following steps to place the radio into "Dealership Mode":
 - ECU View
 - Radio
 - Misc. Functions
 - Service Mode
 - Start
 - Next
5. Follow the on screen instructions on the radio to back up the radio HDD.

REMOVAL

WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the

proper precautions could result in accidental airbag deployment and possible personal injury.

NOTE: For REQ and RET radios, turn ignition to RUN and press the SET + SCAN buttons simultaneously to place the radio into transportation mode. The radio will display "Transportation" on the display within 5 seconds. If the radio is inoperative or not REQ/RET, skip this step.

1. Disconnect the battery negative cable.
2. Remove the center bezel.
3. Remove the radio mounting fasteners.
4. Pull out the radio and disconnect the electrical connectors.
5. Remove the radio.

INSTALLATION

WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

1. Connect the electrical connectors and install the radio.
2. Install the radio mounting fasteners.
3. Install the center bezel.
4. Connect the battery negative cable.

RADIO NOISE SUPPRESSION COMPONENTS

DESCRIPTION

Radio Frequency Interference (RFI) and ElectroMagnetic Interference (EMI) noise suppression is accomplished primarily through circuitry internal to the radio receivers. These internal suppression devices are only serviced as part of the radio receiver.

External suppression devices that are used on this vehicle to control RFI or EMI noise include the following:

- Radio antenna base ground
- Radio receiver chassis ground wire
- Engine-to-body ground strap
- Resistor-type spark plugs
- Radio suppression-type secondary ignition wiring.

DIAGNOSIS AND TESTING

RADIO NOISE SUPPRESSION COMPONENTS

WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and

retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds. Inspect the ground paths and connections at the following locations:

- Blower motor
- Electric fuel pump
- Engine-to-body ground strap
- Generator
- Ignition module
- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Wiper motor.

If the source of RFI or EMI noise is identified as a component on the vehicle (i.e., generator, blower motor, etc.), the ground path for that component should be checked. If excessive resistance is found in any ground circuit, clean, tighten, or repair the ground circuits or connections to ground as required before considering any component replacement.

- Ignition coil
- Spark plugs
- Spark plug wire routing and condition.

Reroute the spark plug wires or replace the faulty components as required.

If the source of the RFI or EMI noise is identified as two-way mobile radio or telephone equipment, check the equipment installation for the following:

- Power connections should be made directly to the battery, and fused as closely to the battery as possible.
- The antenna should be mounted on the roof or toward the rear of the vehicle. Remember that magnetic antenna mounts on the roof panel can adversely affect the operation of an overhead console compass, if the vehicle is so equipped.
- The antenna cable should be fully shielded coaxial cable, should be as short as is practical, and should be routed away from the factory-installed vehicle wire harnesses whenever possible.
- The antenna and cable must be carefully matched to ensure a low Standing Wave Ratio (SWR).

REMOVAL

ENGINE-TO-BODY GROUND STRAP

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

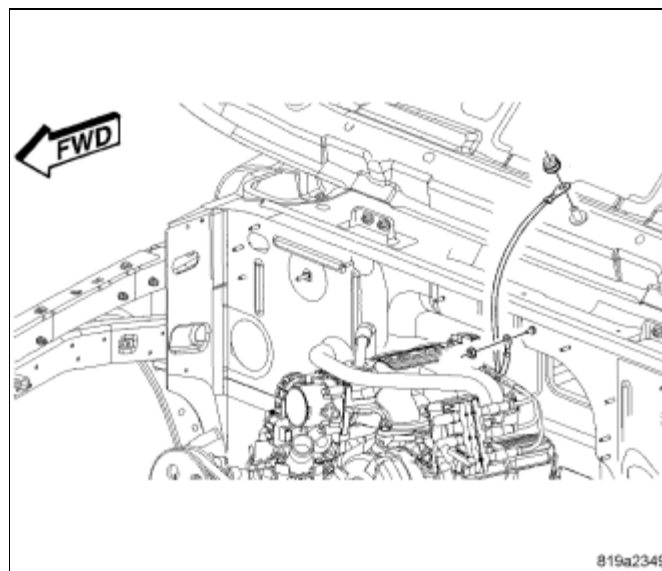
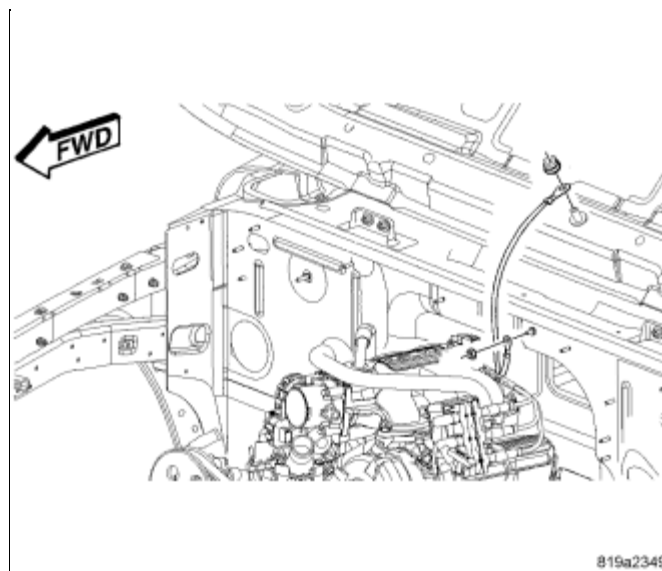
1. Remove the screw that secures the engine-to-body ground strap eyelet to the hood panel center reinforcement.
2. Remove the screw that secures the engine-to-body ground strap eyelet to the dash panel.

3. Remove the nut that secures the engine-to-body ground strap eyelet to the stud on the left upper rear corner of the engine cylinder head.
4. Remove the engine-to-body ground strap eyelet from the stud on the left upper rear corner of the engine cylinder head.
5. Remove the engine-to-body ground strap from the engine compartment.

INSTALLATION

ENGINE-TO-BODY GROUND STRAP

1. Position the engine-to-body ground strap in the engine compartment.
2. Position the engine-to-body ground strap eyelet over the stud on the left upper rear corner of the engine cylinder head.
3. Install and tighten the nut that secures the engine-to-body ground strap eyelet to the stud on the left upper rear corner of the engine cylinder head. Tighten the nut to 5.6 N·m (50 in. lbs.).
4. Install and tighten the screw that secures the engine-to-body ground strap eyelet to the dash panel. Tighten the screw to 48.5 N·m (430 in. lbs.).
5. Install and tighten the screw that secures the engine-to-body ground strap eyelet to the hood panel center reinforcement. Tighten the screw to 1.9 N·m (17 in. lbs.).



CABLE-SATELLITE ANTENNA

REMOVAL

1. Disconnect the battery negative cable.
2. Remove the top.
3. Remove the B-pillars. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

4. Remove the cowl trim. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL).
5. Remove the glove box.
6. Remove the instrument panel speaker. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).
7. Remove the satellite antenna cable.

INSTALLATION

1. Install the satellite antenna cable.
2. Install the instrument panel speaker. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).
3. Install the glove box.
4. Install the cowl trim.
5. Install the lower B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).
6. Install the top.
7. Connect the battery negative cable.

SPEAKER

DESCRIPTION

The standard equipment speaker system includes four full-range speakers. The two front speakers are mounted behind a removable bezel located on each outboard end of the lower instrument panel. With the premium speaker system, the standard front speakers are replaced with an enclosure assembly that includes a 4 inch speaker and a 1 inch tweeter. The two rear speakers are mounted behind a grille located on each outboard end of the sport bar, above the rear seating area of the vehicle.

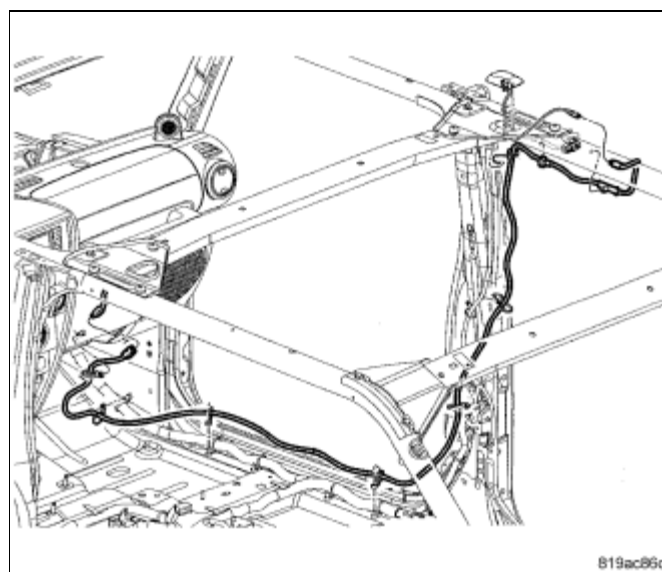
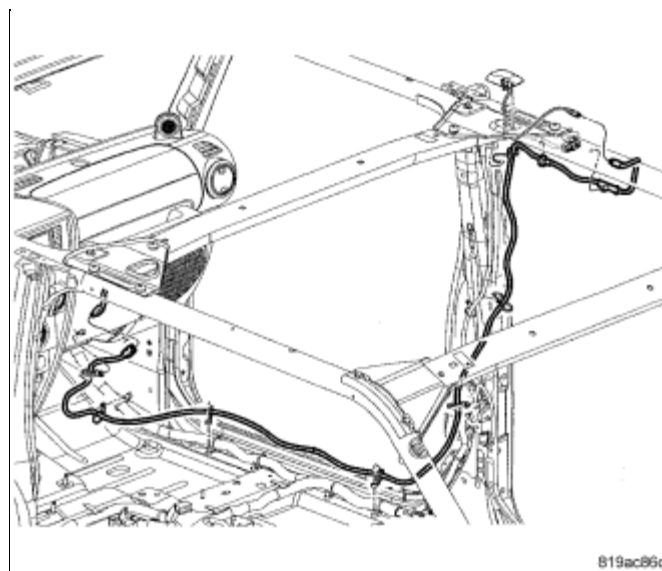
OPERATION

Two wires connected to each speaker, one feed circuit (+) and one return circuit (-), allow the audio output signal electrical current to flow through the speaker voice coil.

DIAGNOSIS AND TESTING

SPEAKER

Any diagnosis of the Audio system should begin with the use of the scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic Service Manual.



For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

NOTE: If poor sound quality is noted in the audio system, check the Cabin Equalization curve programmed in the instrument cluster. Make sure a base speaker system has the Base Cabin Equalization Curve programmed to the vehicle. If the vehicle has a premium speaker system, make sure the Premium Cabin Equalization Curve is programmed to the vehicle

1. If all speakers are inoperative, check the fuses in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the ON position. Turn the radio receiver ON. Adjust the balance and fader control controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 3.
3. Turn the radio receiver OFF. Turn the ignition OFF. Disconnect and isolate the battery negative cable. Remove the radio receiver. Go to Step 4.
4. Check both the speaker feed (+) circuit and return (-) circuit cavities for the inoperative speaker at the radio receiver wire harness connector for continuity to ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted speaker feed (+) and/or return (-) circuit(s) to the speaker as required.
5. Disconnect wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (-) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (-) circuit(s) as required.

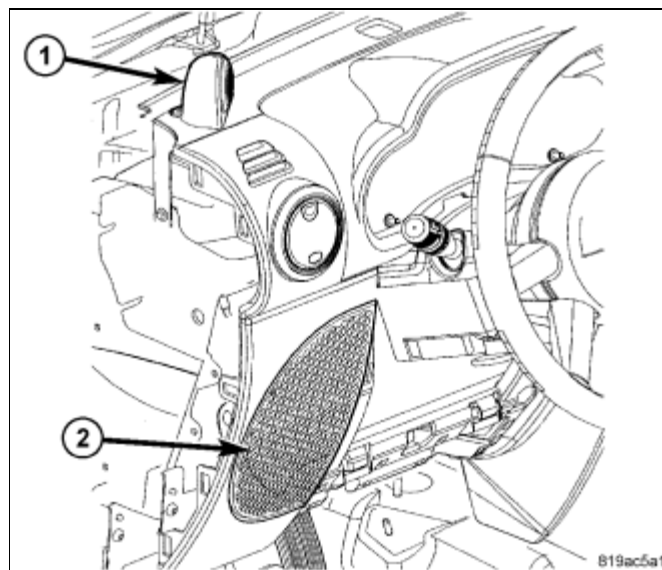
REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

Tweeter	Refer to TWEETER removal procedure.
Instrument panel speaker – driver	Refer to INSTRUMENT PANEL SPEAKER – DRIVER removal procedure.
Instrument panel speaker – passenger	Refer to INSTRUMENT PANEL SPEAKER – PASSENGER removal procedure.
Sound bar speaker	Refer to SOUND BAR removal procedure.
Subwoofer	Refer to SUBWOOFER removal procedure.

TWEETER

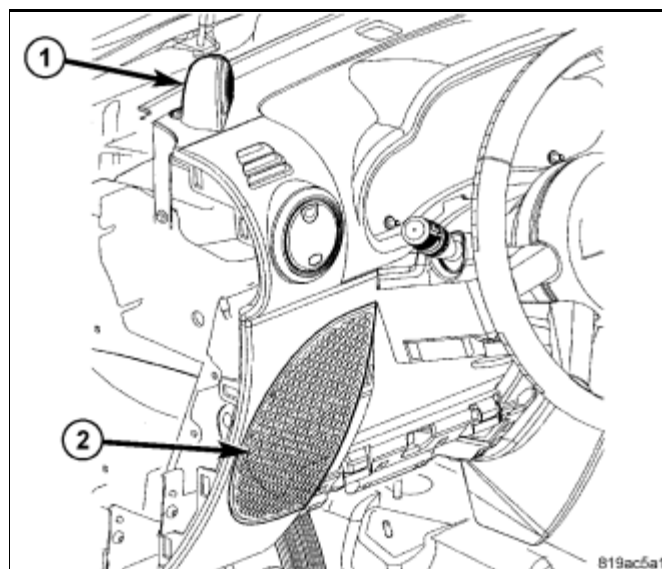
1. Disconnect the battery negative cable.
2. Remove the mounting fastener.
3. Remove the tweeter (1).
4. Disconnect the electrical connector.



INSTRUMENT PANEL SPEAKER – DRIVER

1. Disconnect the battery negative cable.
2. Remove the instrument panel end cap.
3. Remove the steering column opening cover.
4. Remove the amplifier. Refer to (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - REMOVAL).

5. Disconnect the electrical connector.
6. Remove the mounting fasteners in the left side of the instrument panel.
7. Remove the speaker mounting fasteners.
8. Remove the speaker (2) by carefully pulling the left side of the instrument panel outward until there is sufficient room to remove the speaker through the end cap area.

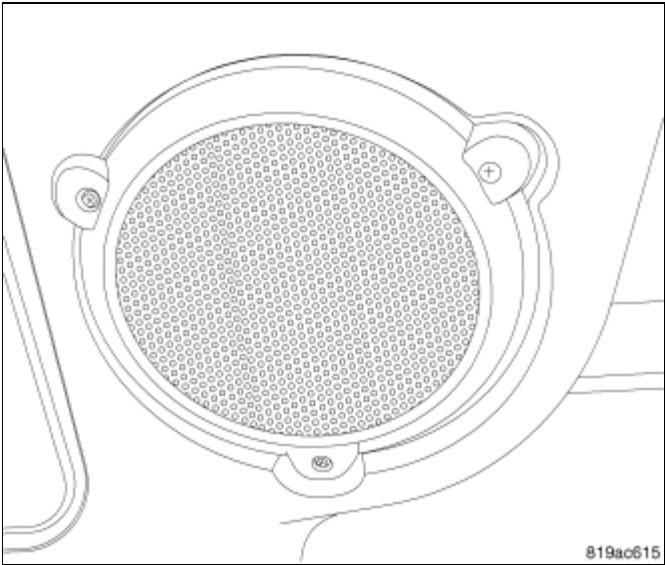


INSTRUMENT PANEL SPEAKER – PASSENGER

1. Disconnect the battery negative cable.
2. Remove the glove box.
3. Remove the instrument panel end cap.
4. Disconnect the electrical connectors.
5. Remove the speaker mounting fasteners.
6. Remove the speaker.

SOUND BAR

1. Disconnect the battery negative cable.
2. Remove the mounting fasteners and remove the speaker cover grille.
3. Remove the speaker.
4. Disconnect the electrical connector.

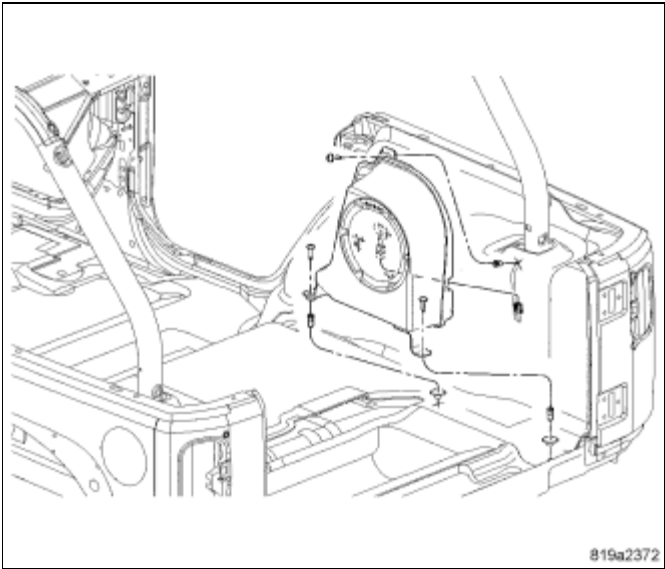


SUBWOOFER

1. Disconnect the battery negative cable.
2. Remove the mounting fasteners and remove the speaker cover grille.
3. Remove the speaker.
4. Disconnect the electrical connector.

INSTALLATION

WARNING: On vehicles equipped with airbags, (refer to electrical/restraints) before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

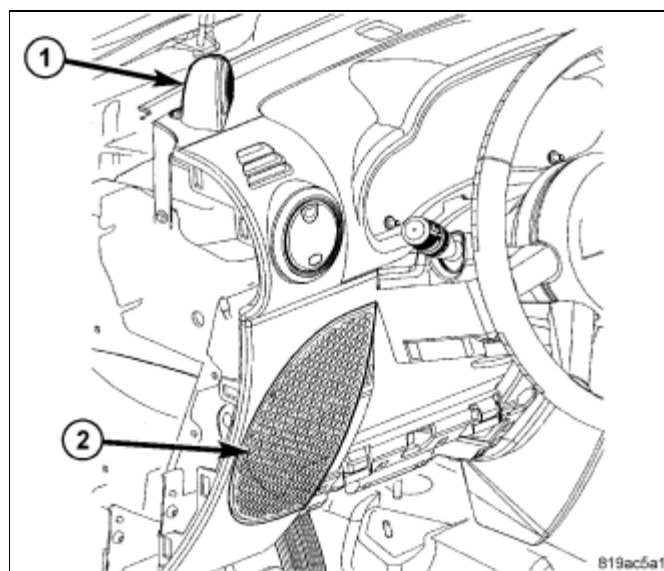


Tweeter	Refer to TWEETER installation procedure.
---------	--

Instrument panel speaker – driver	Refer to INSTRUMENT PANEL SPEAKER – DRIVER installation procedure.
Instrument panel speaker – passenger	Refer to INSTRUMENT PANEL SPEAKER – PASSENGER installation procedure.
Sound bar	Refer to SOUND BAR installation procedure.
Subwoofer	Refer to SUBWOOFER installation procedure.

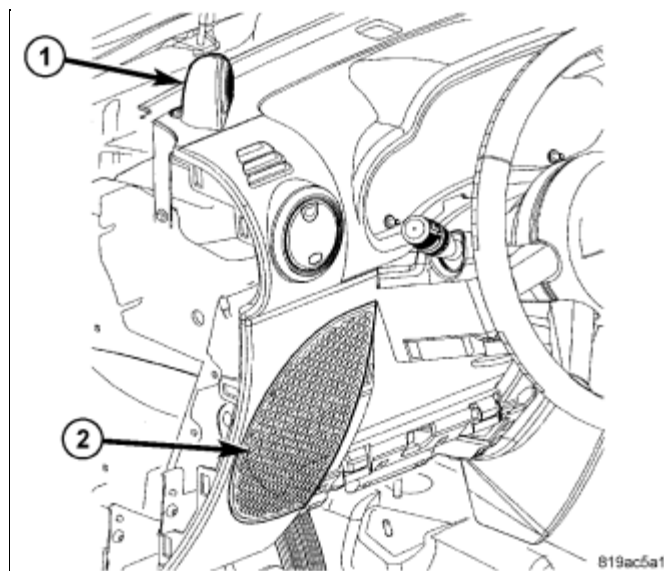
TWEETER

1. Connect the electrical connector.
2. Install the tweeter (1).
3. Install the mounting fastener.
4. Connect the battery negative cable.



INSTRUMENT PANEL SPEAKER – DRIVER

1. Install the speaker (2).
2. Install the speaker mounting fasteners.
3. Connect the electrical connector.
4. Install the instrument panel mounting fasteners.
5. Install the amplifier. Refer to (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - INSTALLATION).
6. Install the steering column opening cover.
7. Install the instrument panel end cap.
8. Connect the battery negative cable.

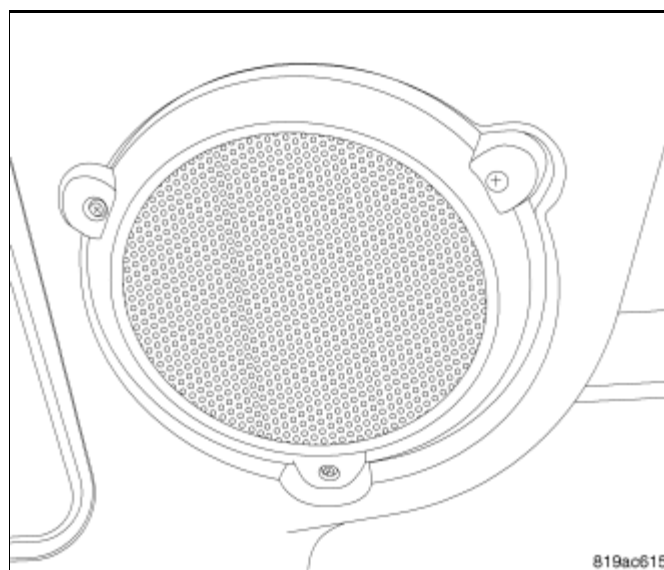


INSTRUMENT PANEL SPEAKER – PASSENGER

1. Install the speaker.
2. Install the mounting fasteners.
3. Connect the electrical connectors.
4. Install the glove box.
5. Install the instrument panel end cap.
6. Connect the battery negative cable.

SOUND BAR

1. Connect the electrical connector.
2. Install the speaker.
3. Install the mounting fasteners.
4. Connect the battery negative cable.



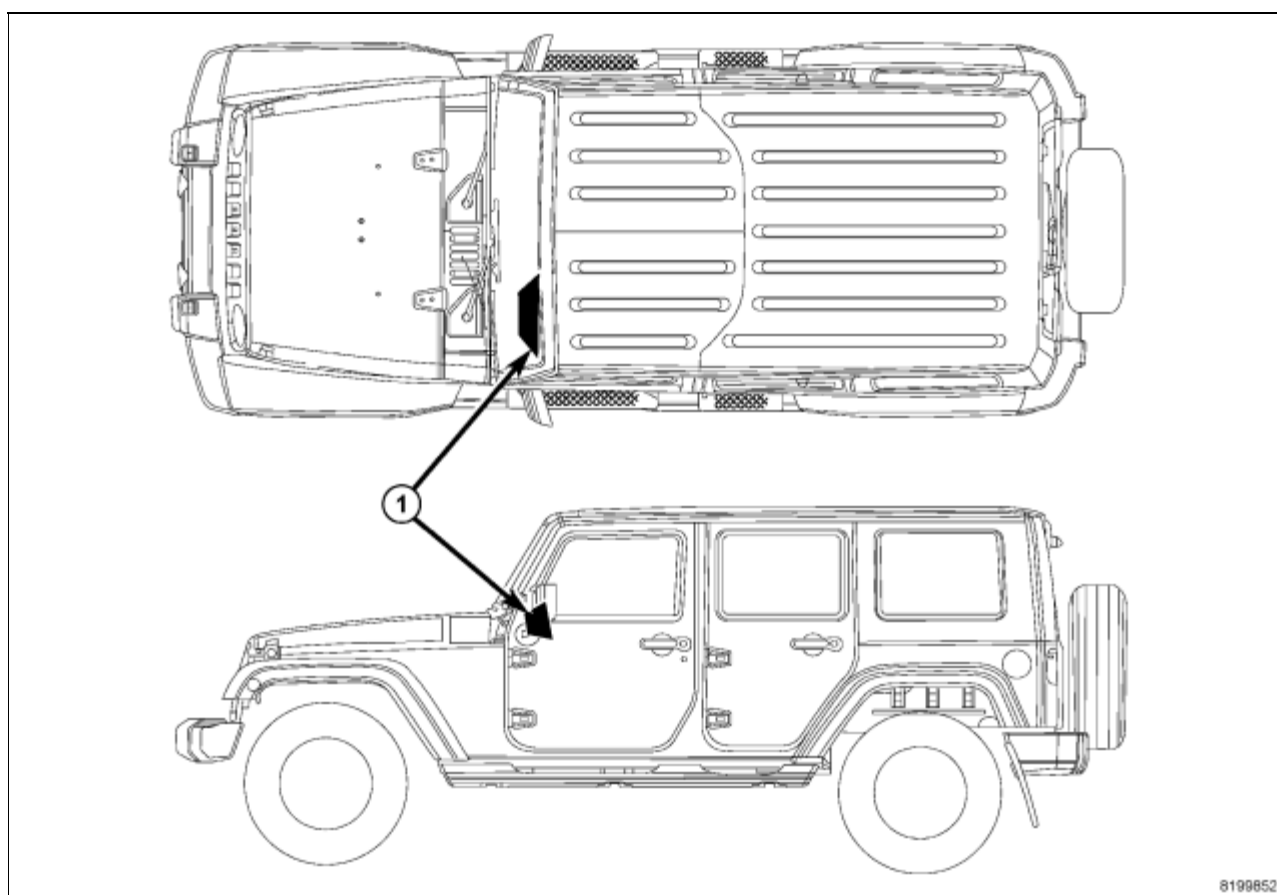
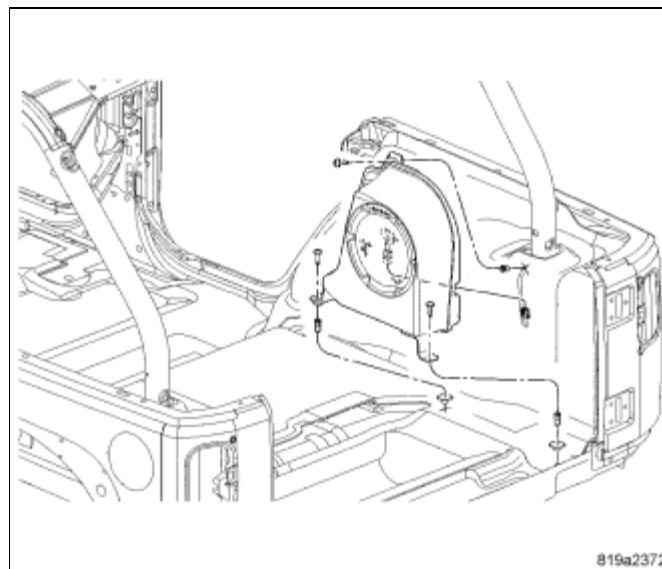
SUBWOOFER

1. Install the subwoofer.
2. Connect the electrical connector.
3. Install the mounting fasteners.
4. Connect the battery negative cable.

8B - CHIME/BUZZER

CHIME/BUZZER

DESCRIPTION



A chime warning system is standard factory-installed equipment. The chime warning system uses an electromechanical transducer and an electromechanical relay that are soldered onto the electronic circuit board inside of the ElectroMechanical Instrument Cluster (EMIC) (1) to provide audible indications of various vehicle conditions that may require the attention of the vehicle operator or occupants. The EMIC also includes the hardware and software necessary to serve as the electronic body control module and is sometimes referred to as the Cab Compartment Node or CCN.

The electromechanical transducer generates beep tones and chime tones, while the electromechanical relay generates click tones to emulate the sounds associated with conventional turn signal and hazard warning flasher

operation. The microprocessor-based EMIC utilizes electronic **chime request** messages received from other modules in the vehicle over the Controller Area Network (CAN) data bus and the Local Interface Network (LIN) data bus along with hard wired inputs to monitor many sensors and switches throughout the vehicle. In response to those inputs, the circuitry and programming of the EMIC allow it to control the audible outputs that are produced through its on-board transducer and relay.

The EMIC is capable of producing the following audible outputs:

- **Slow Rate Repetitive Click** - Repeated **click** tones that are issued at a slow rate of about 90 clicks per minute.
- **Fast Rate Repetitive Click** - Repeated **click** tones that are issued at a fast rate of more than about 180 clicks per minute.
- **Single Chime Tone** - A single **chime** tone.
- **Slow Rate Repetitive Chime** - Repeated **chime** tones that are issued at a slow rate of about 50 chimes per minute.
- **Fast Rate Repetitive Chime** - Repeated **chime** tones that are issued at a fast rate of about 180 chimes per minute.

Hard wired circuitry connects the EMIC and the various chime warning system switch and sensor inputs to their modules and to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC chime warning system circuits and components cannot be adjusted or repaired. If the EMIC circuitry, the on-board transducer or the relay are damaged or ineffective, the EMIC unit must be replaced.

OPERATION

The chime warning system operates on battery voltage received through a fuse in the Totally Integrated Power Module (TIPM) on a non-switched fused B(+) circuit so that the system may operate regardless of the ignition switch position. The chime warning system also monitors the ignition switch position so that some chime features are functional only with the ignition switch in the ON position, while others are functional regardless of the ignition switch position.

The chime warning system provides an audible indication to the vehicle operator or occupants under the following conditions:

- **Airbag Indicator Warning** - The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) transducer will generate one short chime when the ignition switch is in the ON position, and the airbag indicator is illuminated. This warning indicates that a failure condition has been monitored affecting the operation of the Supplemental Restraint System (SRS) related components or circuits. This warning will only occur following completion of the airbag indicator bulb test, and will only occur once during any ignition cycle.
- **Door Ajar Warning** - The EMIC/CCN will generate one short chime when the ignition switch is in the ON position, when the door ajar indicator is illuminated, or when a **DOOR(S) OPEN** textual message is displayed in the odometer Vacuum Fluorescent Display (VFD) unit of the instrument cluster. This warning indicates that a door is, or multiple doors are not closed or completely latched while the vehicle is moving.
- **Fasten Seat Belt Indicator Warning** - The EMIC/CCN transducer will generate repetitive chimes at a slow rate to announce that the seat belt switches and the ignition switch indicate that a front seat belt is not fastened with the ignition switch in the ON position. Vehicles with the optional Occupant Classification

System (OCS) monitor both outboard front seat belts, while vehicles without OCS monitor only the driver side front seat belt. The chime warning system also supports the enhanced seat belt reminder (beltminder) when this feature is enabled. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SEAT BELT INDICATOR - OPERATION).

- **Gate Ajar Indicator Warning** - The EMIC/CCN transducer will generate one short chime when the swing gate/trunk ajar indicator is illuminated, or when a **SWING GATE OPEN** textual message is displayed in the odometer VFD unit of the instrument cluster. This warning indicates that the swing gate is not closed or completely latched while the vehicle is moving.
- **Head/Park Lamps-On Warning** - The EMIC/CCN transducer will generate repetitive chimes at a fast rate to indicate that inputs from the headlamp switch and the ignition switch indicate that the exterior lamps are turned ON with the ignition switch in the OFF position, and a hard wired input is received indicating that the driver side front door is open. The chimes will continue to sound until the exterior lamps are turned OFF, the driver side front door is closed, or the ignition switch is turned to the ON position, whichever occurs first.
- **Key-In-Ignition Warning** - The EMIC/CCN transducer will generate repetitive chimes at a fast rate to indicate that inputs from the key-in ignition switch, the ignition switch, and the driver side front door ajar switch indicate that the key is in the ignition lock cylinder with the ignition switch in the OFF position with the driver side front door open. The chimes will continue to sound until the key is removed from the ignition lock cylinder, the driver side front door is closed, or the ignition switch is turned to the ON position, whichever occurs first.
- **Low Fuel Indicator Warning** - The EMIC/CCN transducer will generate one short chime when the low fuel indicator is illuminated in the instrument cluster. This warning indicates that the monitored fuel level in the fuel tank is low. This chime will only occur once during any ignition cycle.
- **Park Brake Reminder** - The EMIC/CCN transducer will generate one short chime when the brake/park brake indicator is illuminated to announce that the park brake is applied or not fully released and the vehicle is moving. This chime will repeat each time the input conditions are met.
- **Overspeed Warning** - The EMIC transducer will generate one short chime when the vehicle speed is over a pre-programmed speed value. This feature is only enabled on vehicles that have been configured for sale in a Middle East Gulf Coast Country (GCC).
- **Park Brake Reminder** - The instrument cluster chime tone generator will generate ten repetitive chimes at a slow rate to announce that the hard wired input from the park brake switch and a vehicle speed message input received from the PCM over the PCI data bus indicates that the park brake is applied and the vehicle is moving. This chime feature will repeat each time the input conditions are met.
- **Sentry Key Customer Learn Mode Announcement** - The EMIC/CCN transducer will generate one short chime to confirm that the Sentry Key electronic **Customer Learn** mode is active, which indicates that the Sentry Key Remote Entry Module/Wireless Control Module (SKREEM/WCM) is prepared for programming additional Sentry Key transponders. This chime feature is only active on vehicles equipped with the optional Sentry Key system, and sold in a market where Customer Learn programming is an allowed feature.
- **Turn Signal On Warning** - The EMIC/CCN transducer will generate repetitive chimes at a slow rate to indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per hour). Vehicles built for markets other than the United States and Canada have a revised distance threshold of 4 kilometers (2.49 miles) for this feature. The chime will continue until the turn signal input becomes inactive or until the vehicle speed message indicates that the speed is less than 22 kilometers-per-hour (15 miles-per-hour), whichever occurs first. The hazard warning flashers will not activate this chime feature.
- **Warning Indicator Announcement** - The EMIC/CCN transducer will generate one short chime each time the Malfunction Indicator Lamp (MIL) lamp or certain other indicators are illuminated by the instrument cluster circuitry. The MIL and certain other indicators may be illuminated when any critical engine or transmission systems are operating outside of their normal parameters. The instrument cluster monitors electronic messages received over the CAN data bus to determine when to illuminate these indicators.

The EMIC/CCN provides chime service for all available features in the chime warning system. The EMIC/CCN

relies upon its internal programming, numerous hard wired inputs, and electronic message inputs received from other modules over the Controller Area Network (CAN) and the Local Interface Network (LIN) data buses to provide the chime warning system features. The internal programming of the EMIC/CCN determines the priority of each chime request input that is received, as well as the rate and duration of each chime that is to be generated.

The hard wired circuits between components related to the chime warning system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the chime warning system or the electronic controls or communication between modules and other devices that provide some features of the chime warning system. The most reliable, efficient, and accurate means to diagnose the chime warning system or the electronic controls and communication related to chime warning system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

CHIME WARNING SYSTEM

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired circuits between components related to the chime warning system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the chime warning system or the electronic controls or communication between modules and other devices that provide some features of the chime warning system. The most reliable, efficient, and accurate means to diagnose the chime warning system or the electronic controls and communication related to chime warning system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

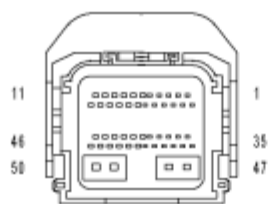
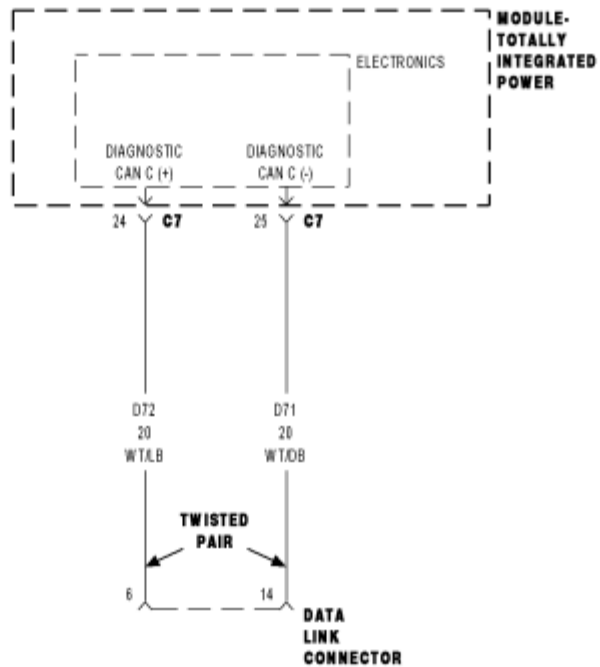
8E - ELECTRONIC CONTROL MODULES

ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS

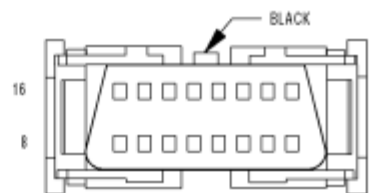
ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

***DIAGNOSTIC CAN C (+) AND/OR DIAGNOSTIC CAN C (-)
CIRCUITS HIGH**



MODULE-TOTALLY INTEGRATED POWER C7



DATA LINK CONNECTOR

81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected a shorted high condition on either or both Diagnostic CAN C circuits.

Possible Causes
(D72) DIAGNOSTIC CAN C (+) CIRCUIT SHORTED TO VOLTAGE
(D71) DIAGNOSTIC CAN C (-) CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.
 Disconnect the scan tool from the Data Link Connector (DLC).
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. DIAGNOSTIC CAN C CIRCUITS SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Disconnect the scan tool from the DLC.
 Turn the ignition on.
 Measure the voltage of the Diagnostic CAN C circuits.

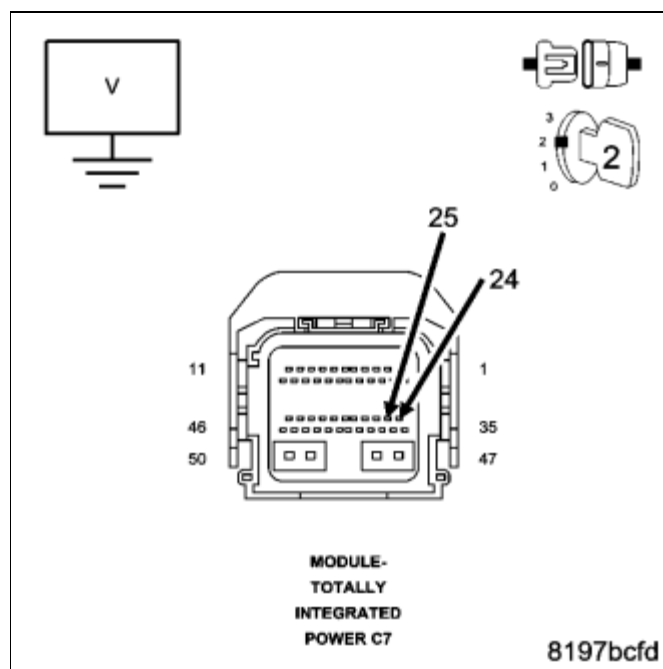
Is the voltage above 6.0 volts for either circuit?

Yes

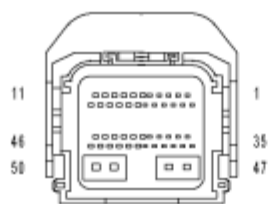
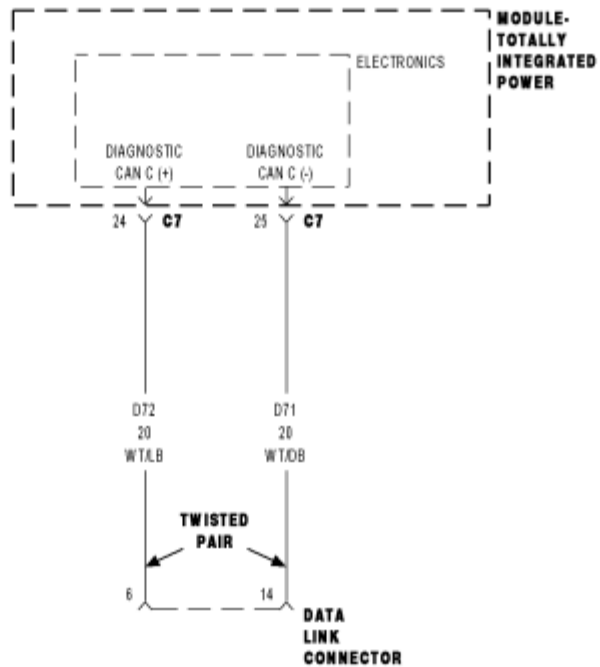
- Repair the Diagnostic CAN C circuits for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

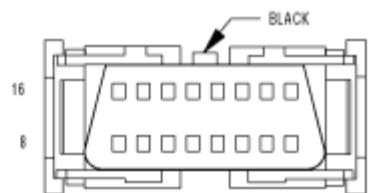
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



***DIAGNOSTIC CAN C (+) CIRCUIT LOW**



MODULE-TOTALLY INTEGRATED POWER C7



DATA LINK CONNECTOR

81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected a shorted low condition on the (D72) Diagnostic CAN C (+) circuit.

Possible Causes
(D72) DIAGNOSTIC CAN C (+) CIRCUIT SHORTED TO GROUND
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D72) DIAGNOSTIC CAN C (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Disconnect the scan tool from the DLC.
 Measure the resistance between ground and the (D72) Diagnostic CAN C (+) circuit.

Is the resistance below 100.0 ohms?

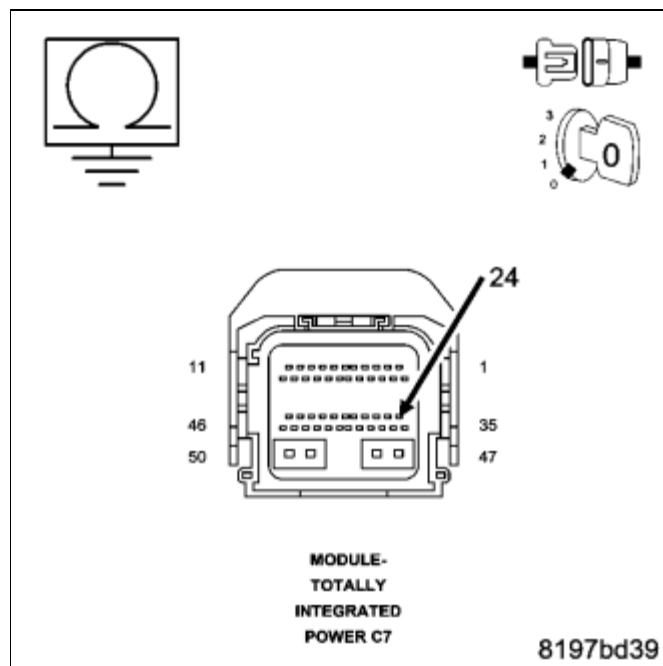
Yes

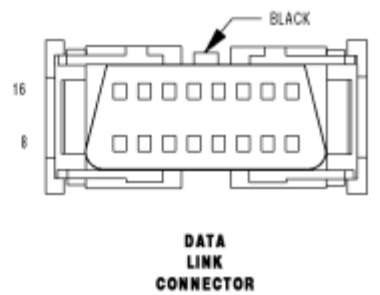
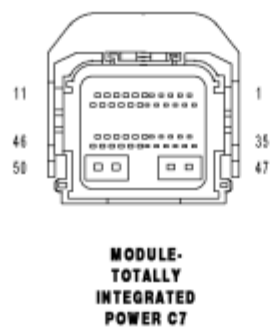
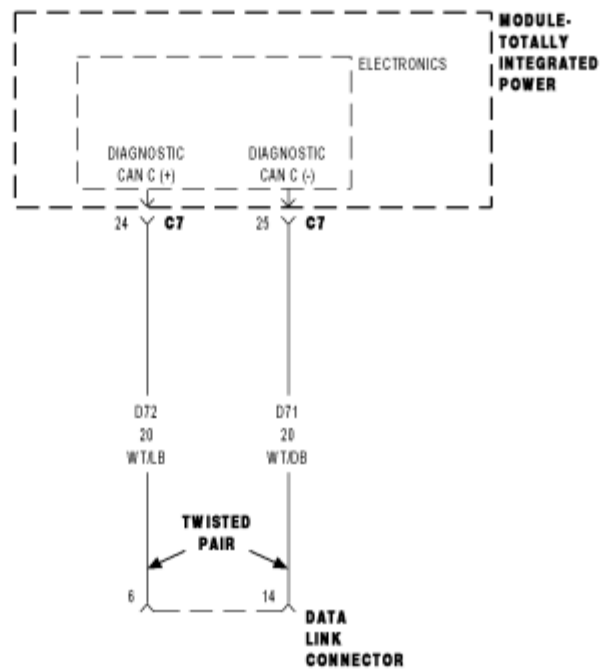
- Repair the (D72) Diagnostic CAN C (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***DIAGNOSTIC CAN C (-) CIRCUIT LOW**





81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected a shorted low condition on the (D71) Diagnostic CAN C (-) circuit.

Possible Causes
(D71) DIAGNOSTIC CAN C (-) CIRCUIT SHORTED TO GROUND
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D71) DIAGNOSTIC CAN C (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Disconnect the scan tool from the DLC.
 Measure the resistance between ground and the (D71) Diagnostic CAN C (-) circuit.

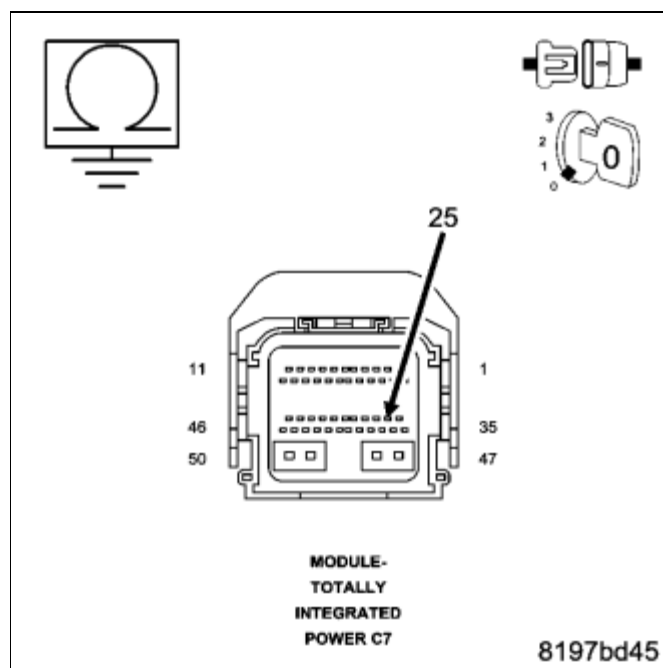
Is the resistance below 100.0 ohms?

Yes

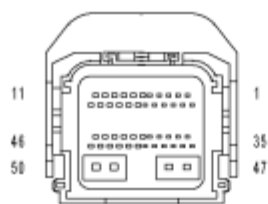
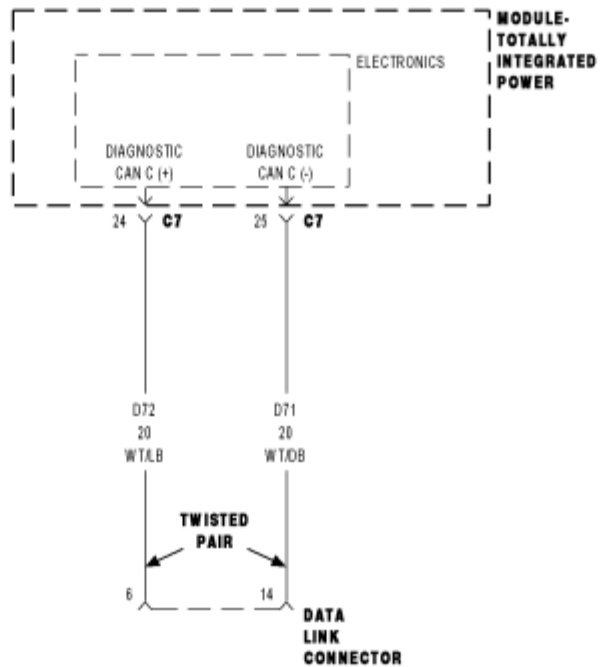
- Repair the (D71) Diagnostic CAN C (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

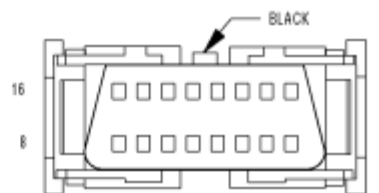
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



***DIAGNOSTIC CAN C (+) SHORTED TO DIAGNOSTIC CAN C (-)**



MODULE-TOTALLY INTEGRATED POWER C7



DATA LINK CONNECTOR

81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected a shorted together condition on the Diagnostic CAN C circuits.

Possible Causes
(D72) DIAGNOSTIC CAN C (+) CIRCUIT SHORTED TO (D71) DIAGNOSTIC CAN C (-) CIRCUIT
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D72) DIAGNOSTIC CAN C (+) CIRCUIT SHORTED TO (D71) DIAGNOSTIC CAN C (-) CIRCUIT

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance between the (D72) Diagnostic CAN C (+) circuit and the (D71) Diagnostic CAN C (-) circuit.

Is the resistance below 100.0 ohms?

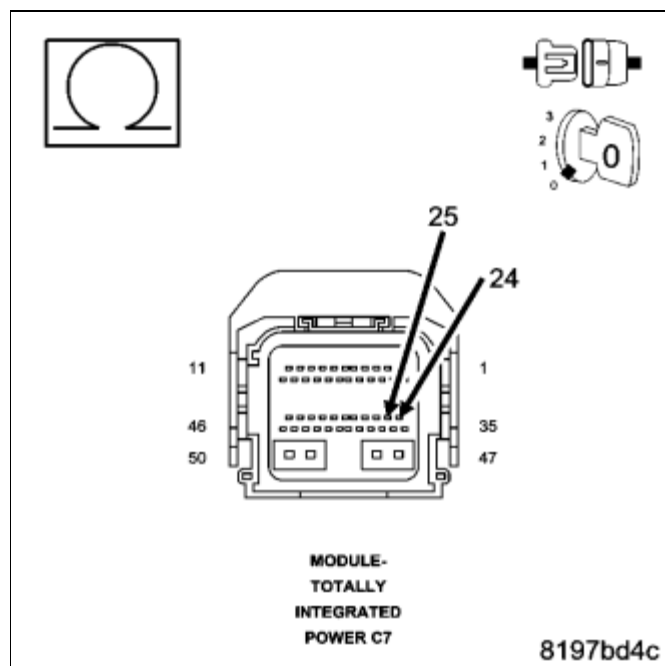
Yes

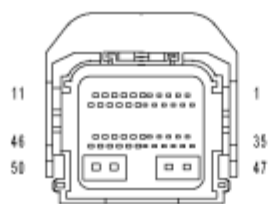
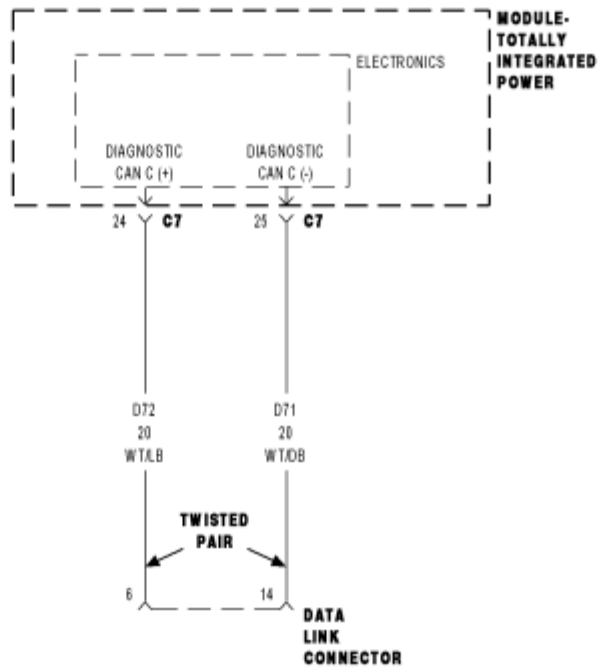
- Repair the (D72) Diagnostic CAN C (+) circuit for a short to the (D71) Diagnostic CAN C (-) circuit.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

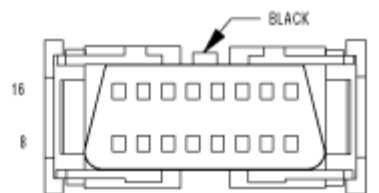
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***DIAGNOSTIC CAN C (-) CIRCUIT OPEN**





MODULE-TOTALLY INTEGRATED POWER C7



DATA LINK CONNECTOR

81875cc8

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected an open condition on the (D71) Diagnostic CAN C (-) circuit.

Possible Causes
(D71) DIAGNOSTIC CAN C (-) CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D71) DIAGNOSTIC CAN C (-) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance of the (D71) Diagnostic CAN C (-) circuit between the TIPM C7 harness connector and the DLC.

Is the resistance below 5.0 ohms?

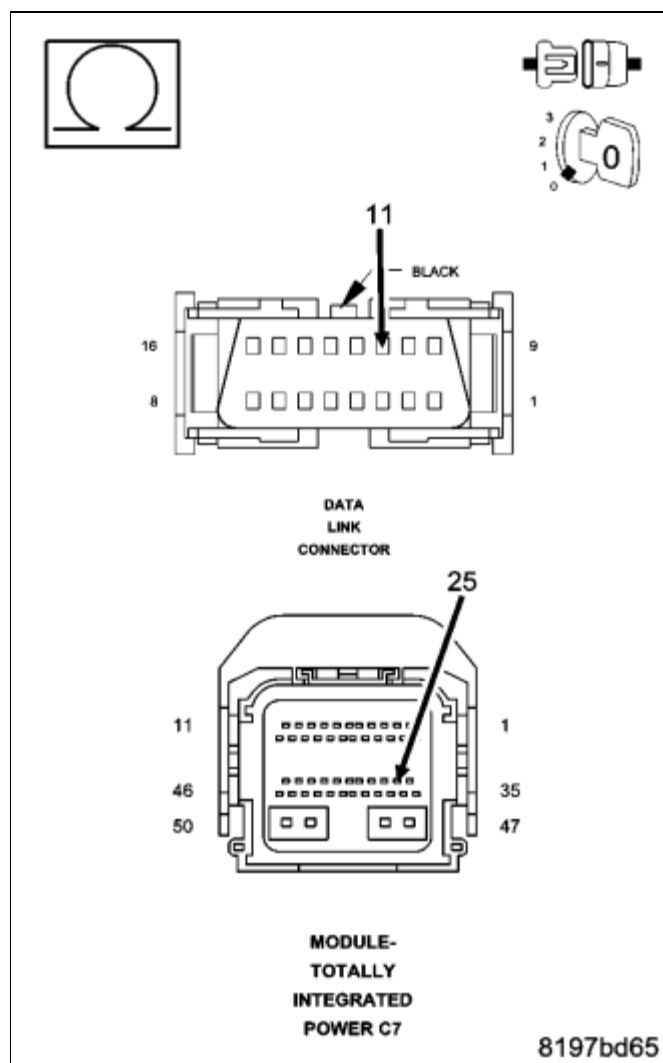
Yes

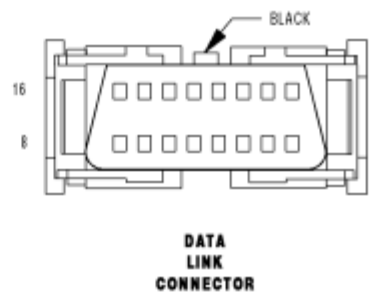
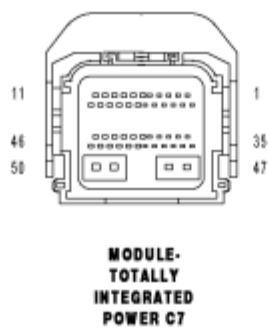
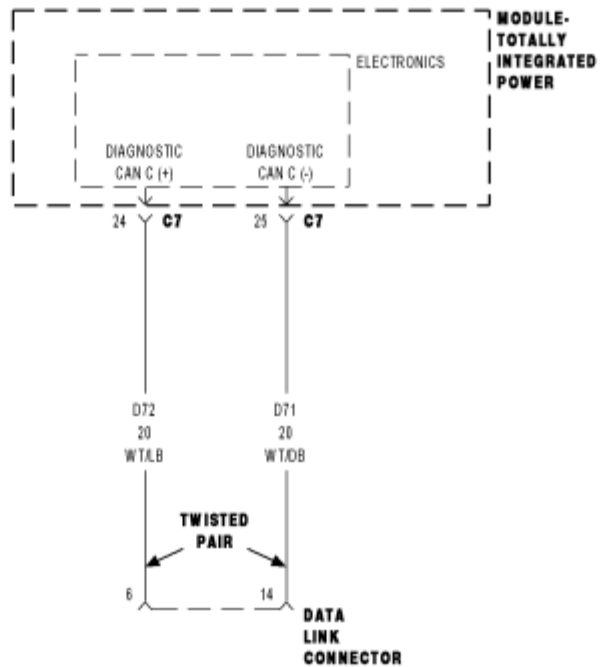
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D71) Diagnostic CAN C (-) circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***DIAGNOSTIC CAN C (+) CIRCUIT OPEN**





81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

- **Set Condition:**

The scan tool has detected an open condition on the (D72) Diagnostic CAN C (+) circuit.

Possible Causes
(D72) DIAGNOSTIC CAN C (+) CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.

Disconnect the scan tool from the DLC.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D72) DIAGNOSTIC CAN C (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Disconnect the scan tool from the DLC.

Measure the resistance of the (D72) Diagnostic CAN C (+) circuit between the TIPM C7 harness connector and the DLC.

Is the resistance below 5.0 ohms?

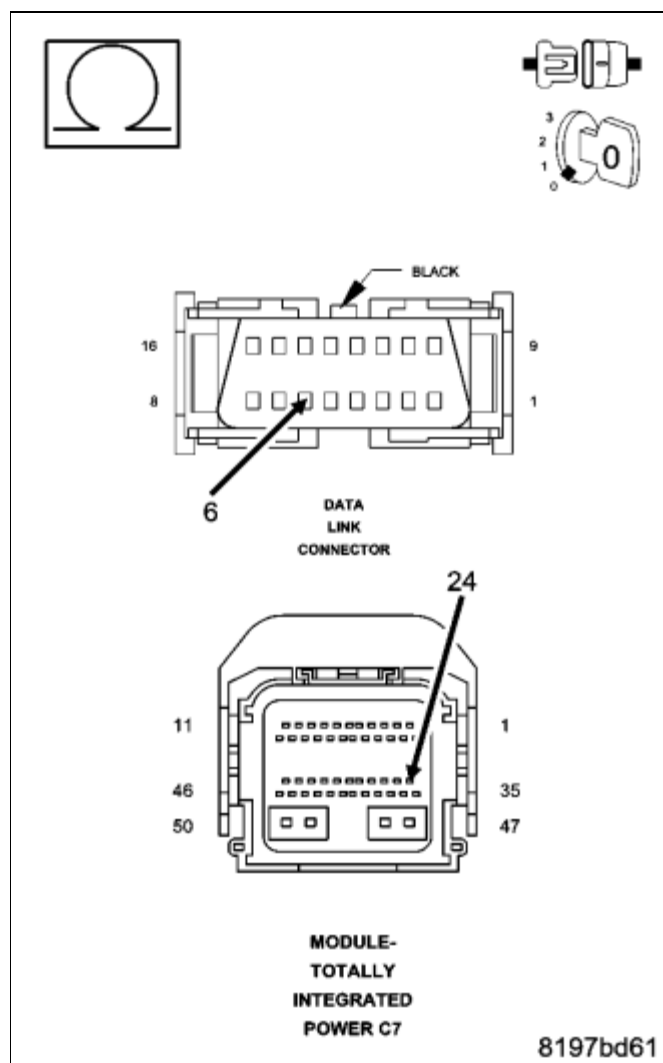
Yes

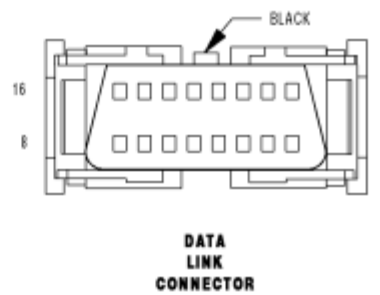
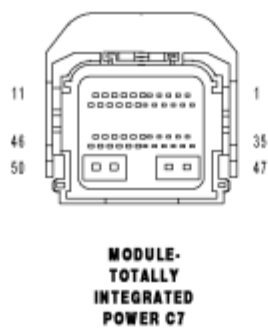
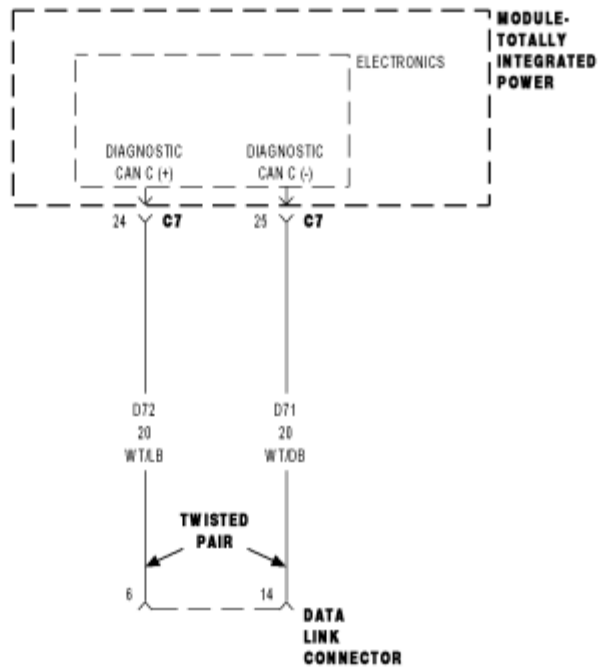
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D72) Diagnostic CAN C (+) circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***BOTH DIAGNOSTIC CAN C (+)
AND DIAGNOSTIC CAN C (-) CIRCUITS OPEN**





81875cc9

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When the scan tool queries the TIPM.

◦ **Set Condition:**

The scan tool has detected an open condition on both Diagnostic CAN C circuits.

Possible Causes
(D72) DIAGNOSTIC CAN C (+) CIRCUIT OPEN
(D71) DIAGNOSTIC CAN C (-) CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE ERROR MESSAGE

NOTE: Ensure the vehicle being tested is a CAN BUS VEHICLE. If not, false error messages may be displayed.

NOTE: Ensure the scan tool is updated to the latest software.

With the scan tool, record the error message.
Disconnect the scan tool from the DLC.
Cycle the ignition from on to off 3 times.
Turn the ignition on.

Does the scan tool display this same error message?

Yes

- Go To [2](#)

No

- The conditions that caused this error message to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. (D72) DIAGNOSTIC CAN C (+) CIRCUIT OPEN

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Disconnect the scan tool from the DLC.

NOTE: Check the connectors at both the DLC and the TIPM.

Measure the resistance of the (D72) Diagnostic CAN C (+) circuit between the TIPM C7 harness connector and the DLC.

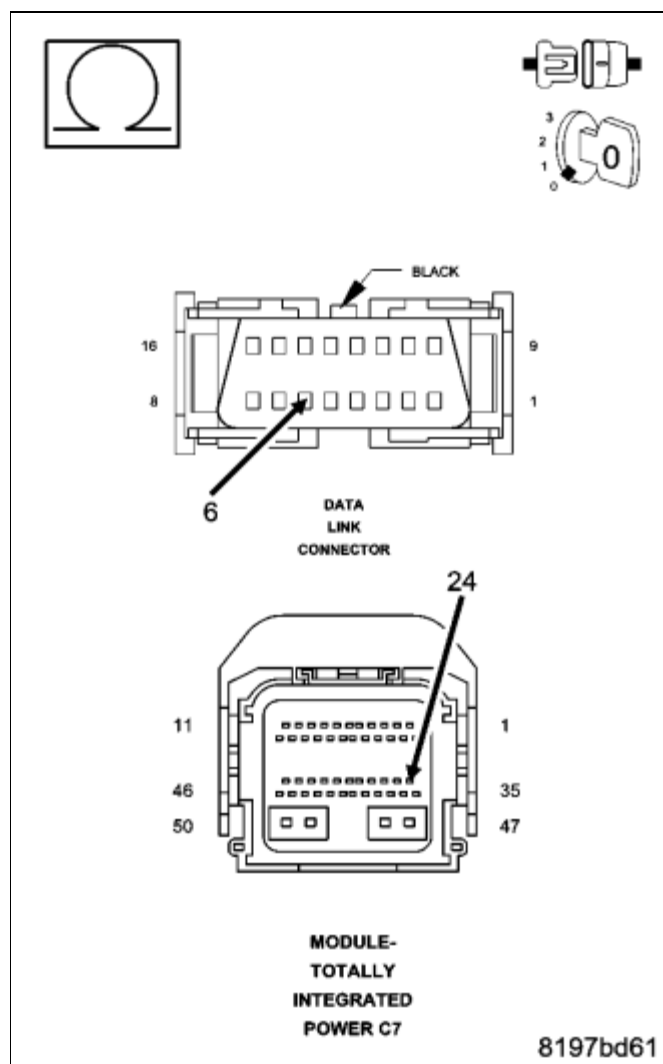
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (D72) Diagnostic CAN C (+) circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (D71) DIAGNOSTIC CAN C (-) CIRCUIT OPEN

Measure the resistance of the (D71) Diagnostic CAN C (-) circuit between the TIPM C7 harness connector and the DLC.

Is the resistance below 5.0 ohms?

Yes

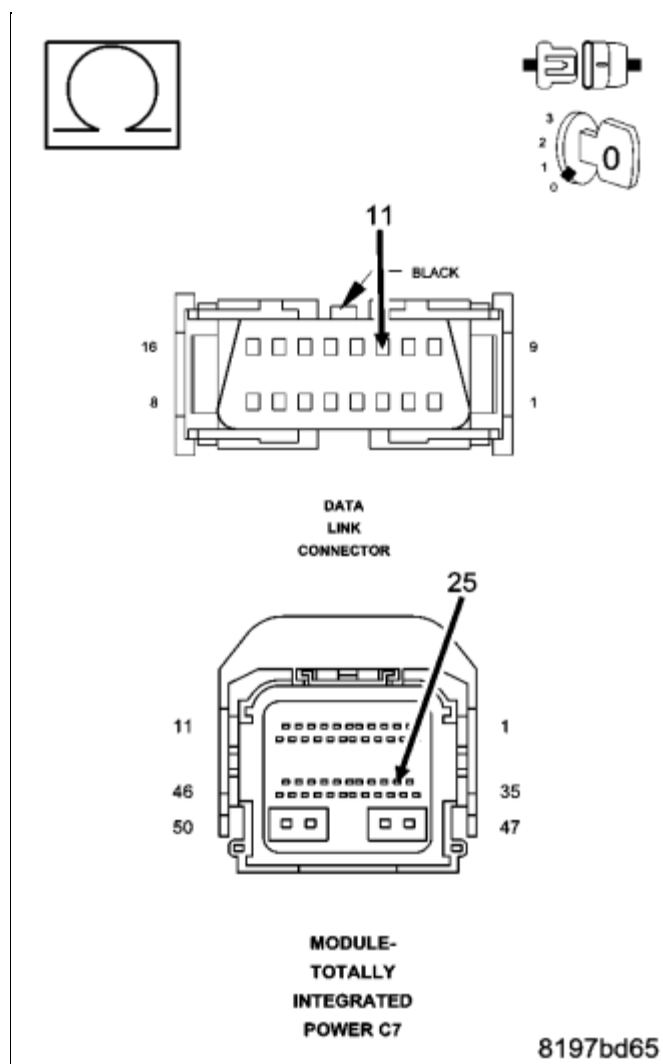
- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

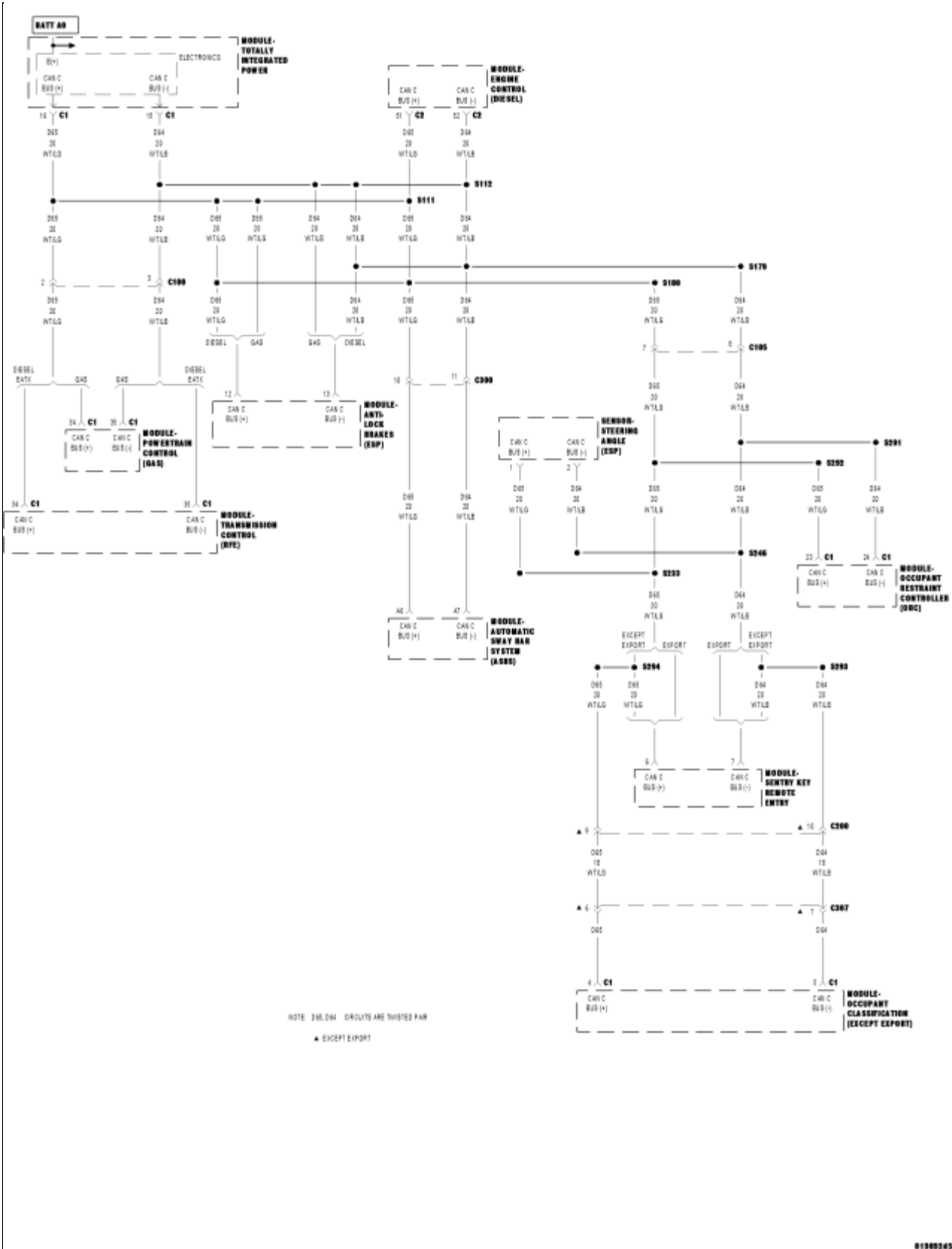
PROCEDURE).

No

- Repair the (D71) Diagnostic CAN C (-) circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

U0001-CAN C BUS CIRCUIT





For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) detects a corrupt CAN C Bus message.

Possible Causes
(D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND
(D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE
(D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT
ANTILOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE
ENGINE CONTROL MODULE (DIESEL ONLY)
TRANSMISSION CONTROL MODULE
STEERING ANGLE SENSOR
AUTOMATIC SWAY BAR SYSTEM MODULE
WIRELESS CONTROL MODULE
OCCUPANT RESTRAINT CONTROLLER MODULE
OCCUPANT CLASSIFICATION MODULE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001-CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. ANTILOCK BRAKE MODULE — INTERNAL SHORT

Turn the ignition off.

Disconnect the Antilock Brake Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001-CAN C BUS OFF PERFORMANCE as active?

Yes

- Go To [3](#)

No

- Inspect the wiring and connectors for damage or shorted circuits in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. POWERTRAIN CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.

Disconnect the Powertrain Control Module C1 harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001-CAN C BUS CIRCUIT as active?

Yes

- Go To [4](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the

Powertrain Control Module in accordance with the service information.

- Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

4. ENGINE CONTROL MODULE (DIESEL ONLY) — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Engine Control Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [5](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Engine Control Module in accordance with the service information.
- Perform the ECM VERIFICATION TEST.

5. TRANSMISSION CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Transmission Control Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [6](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the

Transmission Control Module in accordance with the service information.

- Perform the TCM VERIFICATION TEST.

6. STEERING ANGLE SENSOR — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Steering Angle Sensor harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [7](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Steering Angle Sensor in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

7. AUTOMATIC SWAY BAR SYSTEM MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Automatic Sway Bar System Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [8](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Automatic Sway Bar System Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. WIRELESS CONTROL MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Wireless Control Module harness connector.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [9](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Wireless Control Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

9. OCCUPANT RESTRAINT CONTROLLER MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Occupant Restraint Controller Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [10](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Occupant Restraint Controller Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

10. OCCUPANT CLASSIFICATION MODULE — INTERNAL SHORT

Turn the ignition off.

NOTE: If vehicle is not equipped with this module, answer yes to the question.

Disconnect the Occupant Classification Module harness connectors.

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display U0001–CAN C BUS CIRCUIT as active?

Yes

- Go To [11](#)

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace the Occupant Classification Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

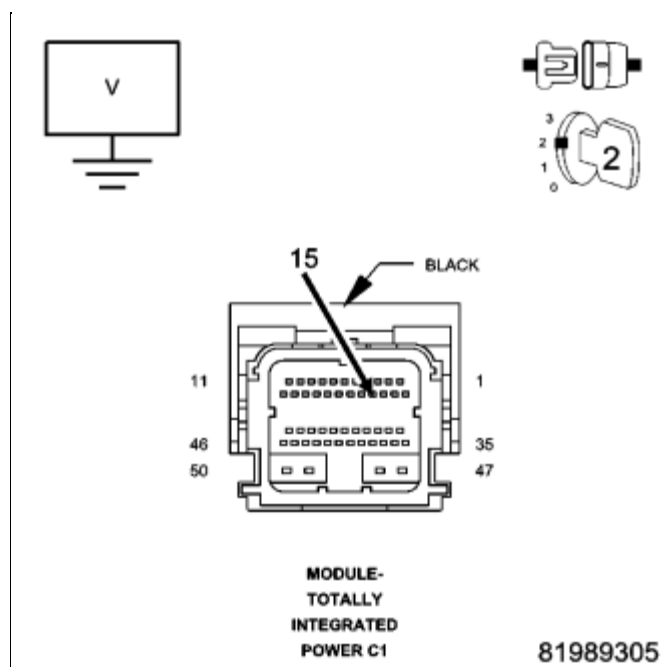
11. (D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D64) CAN C Bus (-) circuit and ground.

Is there any voltage present?

Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [12](#)

12. (D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D65) CAN C Bus (+) circuit.

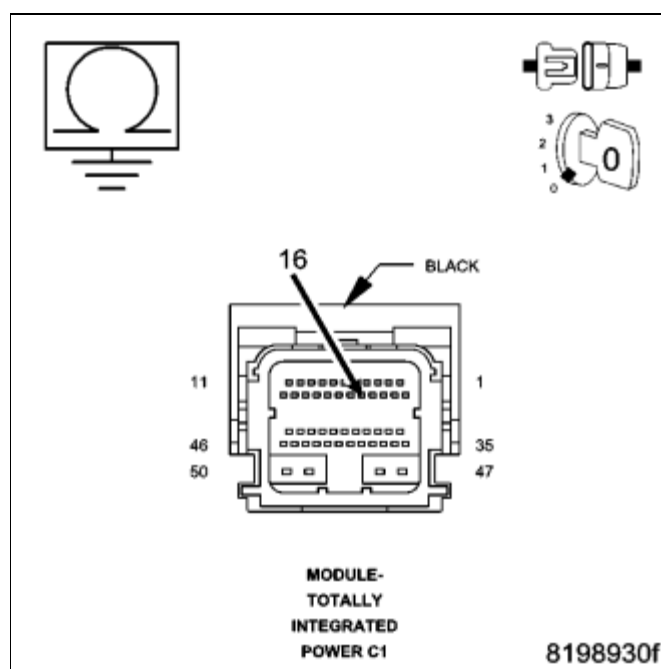
Is any resistance present?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [13](#)



13. (D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT

Measure the resistance between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit.

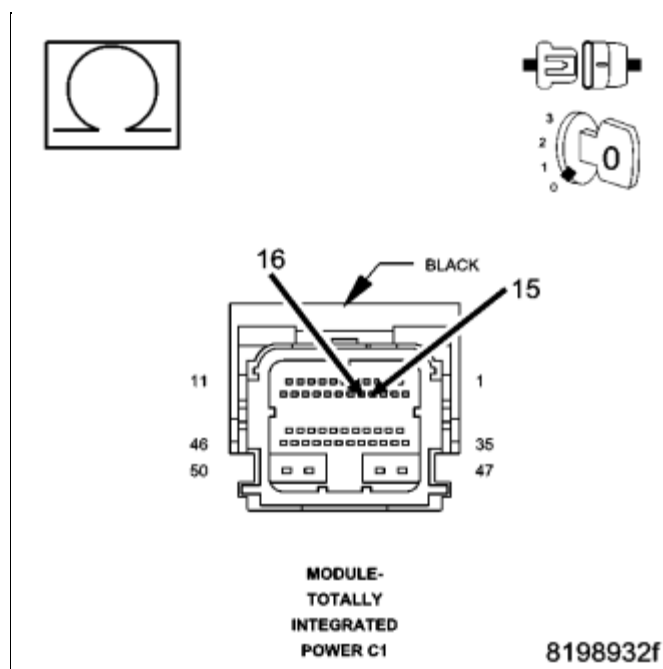
Is any resistance present?

Yes

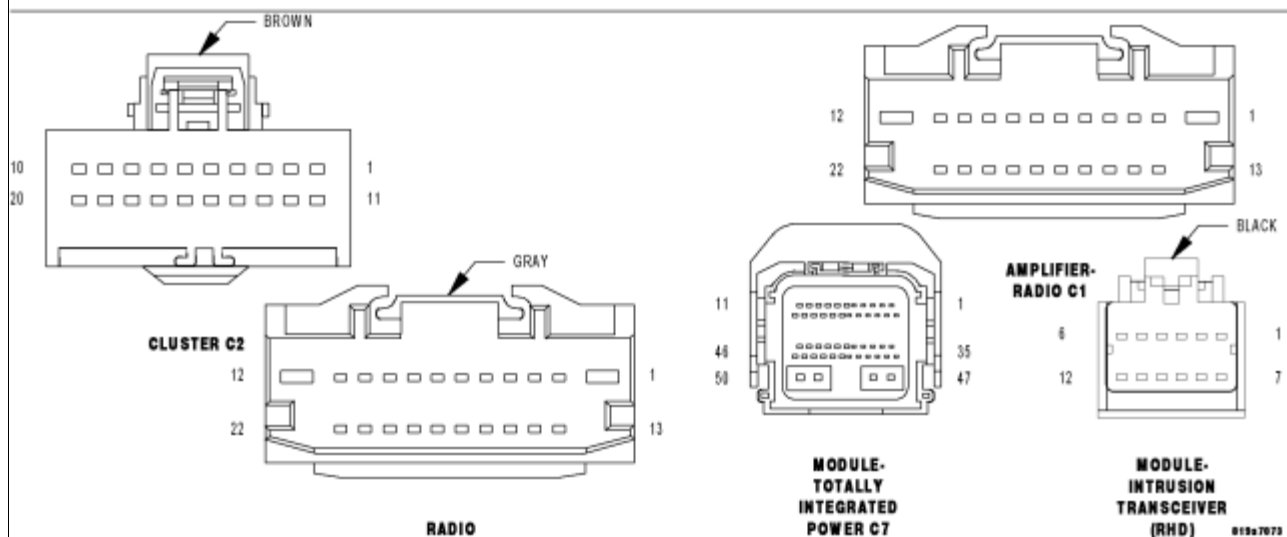
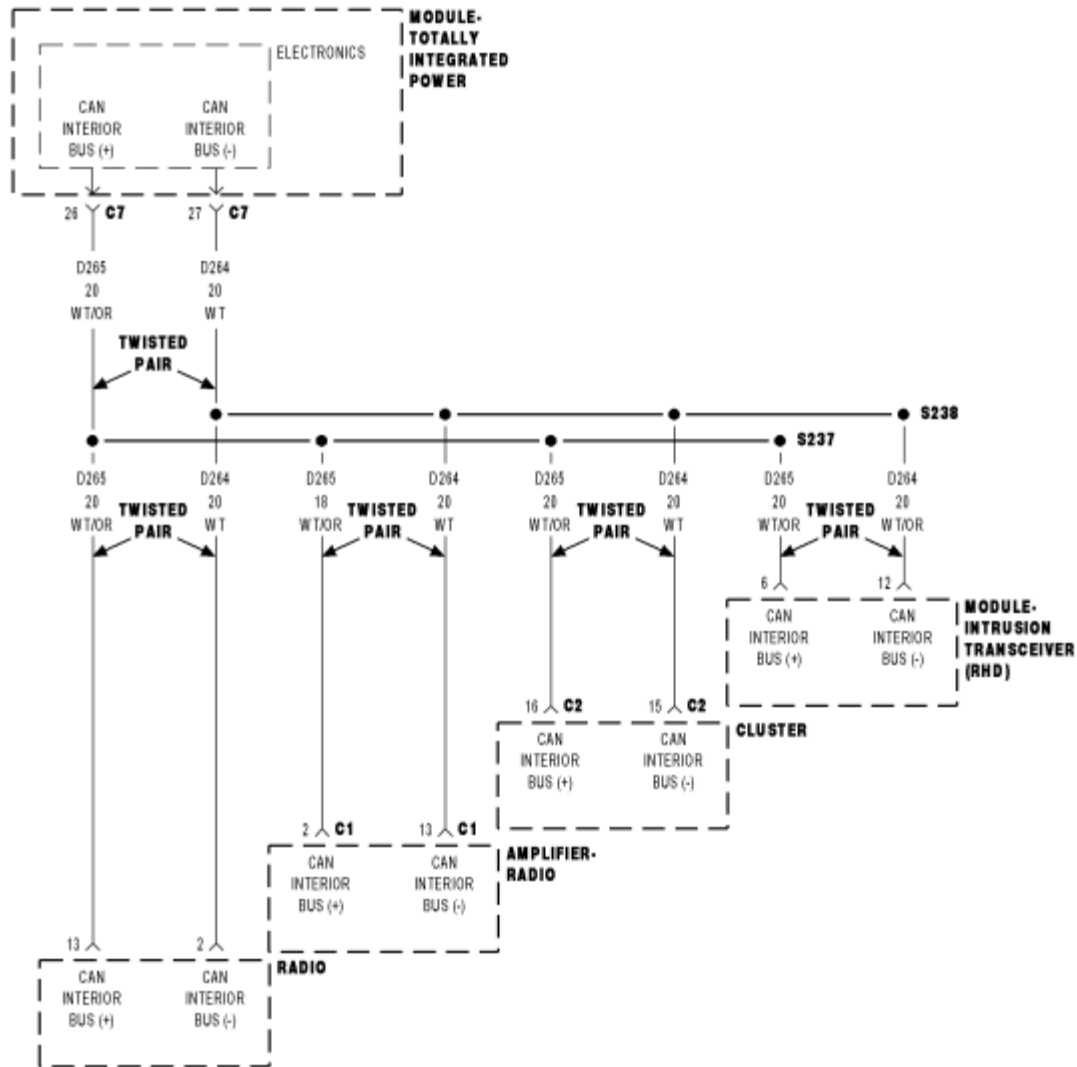
- Repair the (D65) CAN C Bus (+) circuit for a short to the (D64) CAN C Bus (-) circuit.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



U0010-CAN INTERIOR BUS



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The TIPM detects a short to ground on either CAN Interior Bus (125K) circuit.

Possible Causes
(D265) CAN INTERIOR BUS (125K)(+) CIRCUIT SHORTED TO GROUND
ANY CAN INTERIOR BUS MODULE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. ANY CAN INTERIOR BUS (125K) MODULE— INTERNAL SHORT

NOTE: When performing this step, turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on.

NOTE: This step is to determine if the fault is internal within a module.

While monitoring the scan tool, disconnect each CAN Interior Bus (125K) module one at a time.

Check for this DTC to become active after disconnecting each CAN Interior Bus (125K) module the vehicle is

equipped with.

NOTE: If the DTC becomes stored when a particular module is disconnected, that module is causing the DTC to set.

With all the CAN Interior Bus modules disconnected does the scan tool display this DTC as active?

Yes

- Go To [3](#)

No

- Replace the module that when disconnected caused this DTC to become stored in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

3. (D265) CAN INTERIOR BUS (125K)(+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D265) CAN Interior Bus (125K)(+) circuit at the TIPM C7 harness connector.

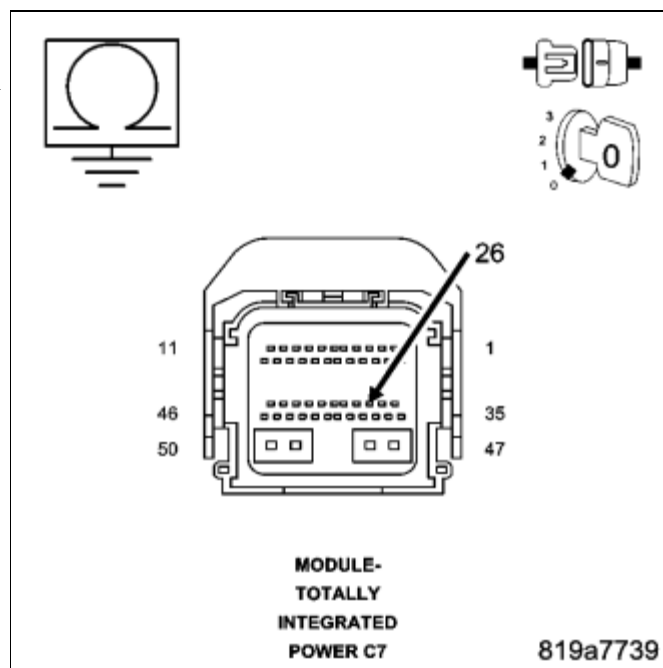
Is any resistance present?

Yes

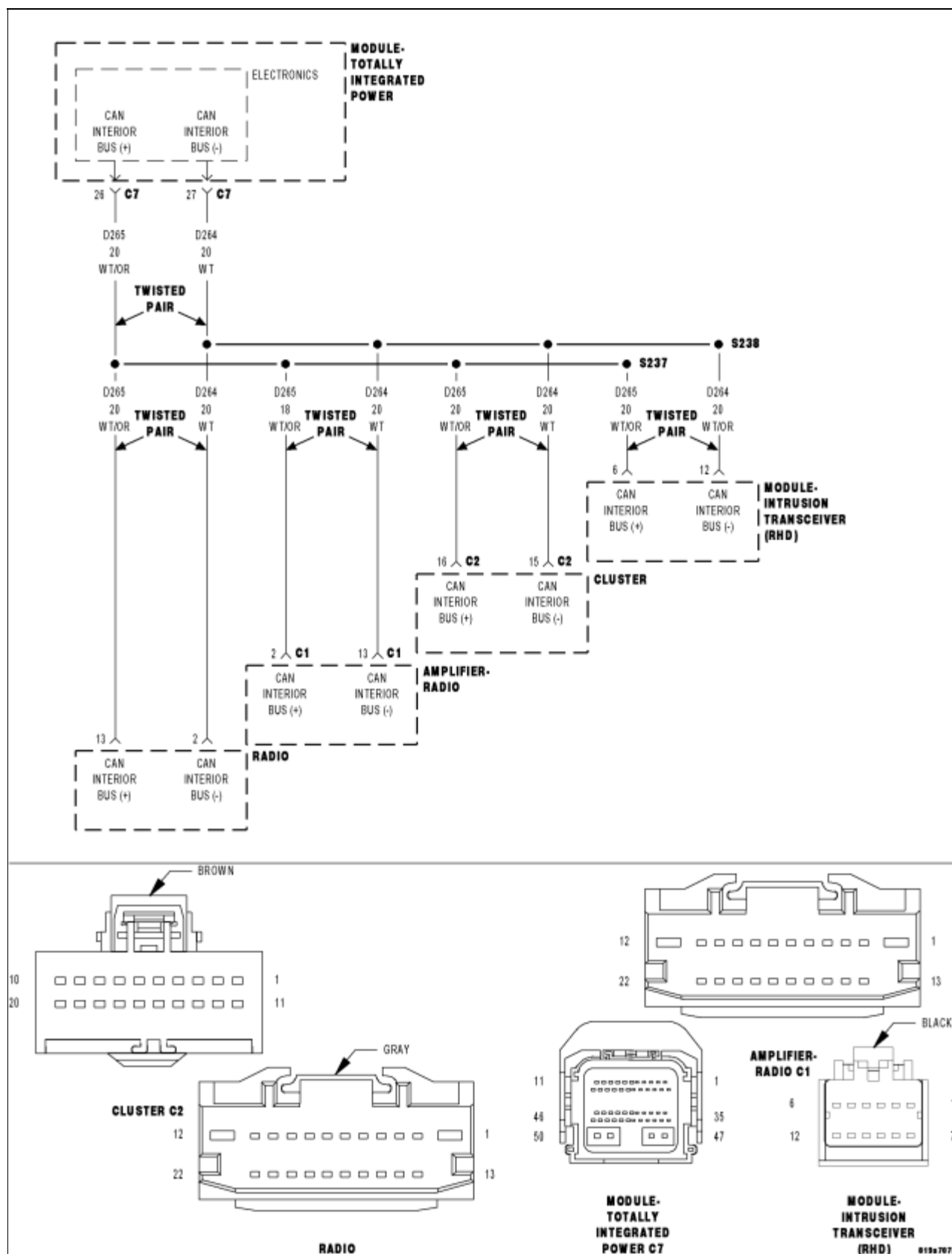
- Repair the (D265) CAN Interior Bus (125K)(+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



U0011–CAN INTERIOR BUS OFF PERFORMANCE



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

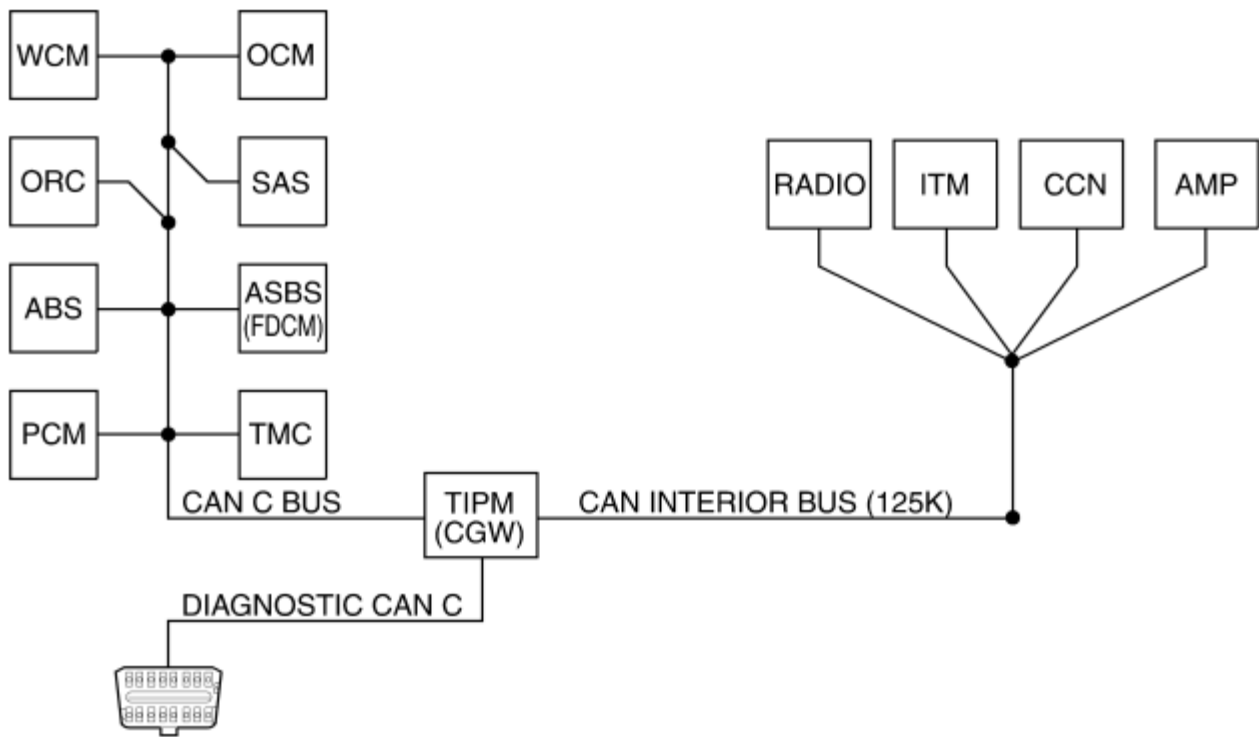
With the ignition on.

- **Set Condition:**

A module detects a short in either CAN Interior Bus circuit.

Perform the CAN Interior Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) .**

U0100-LOST COMMUNICATION WITH ECM/PCM



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the ECM/PCM for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
ECM/PCM POWER AND GROUND
ECM/PCM
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE ECM/PCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the ECM/PCM is active on the bus.

Is the ECM/PCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the ECM/PCM?

Yes

- Replace/update the ECM/PCM in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the ECM/PCM.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

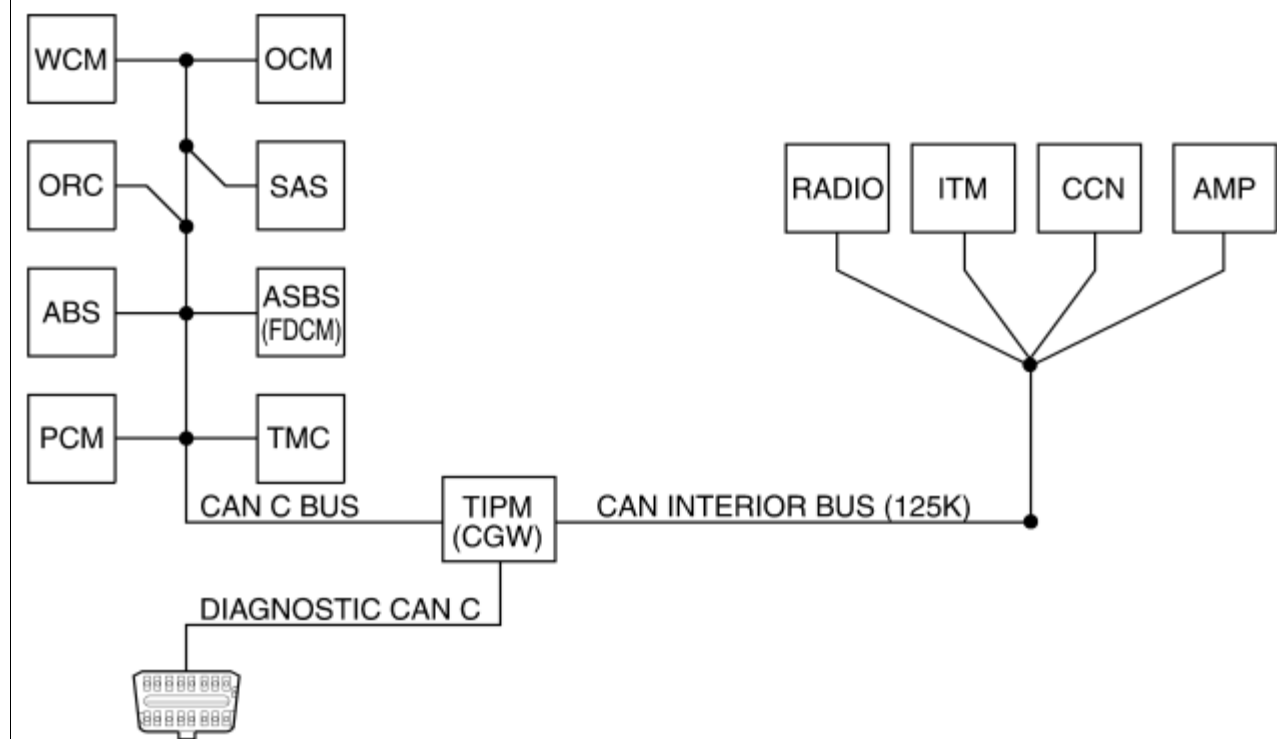
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0101-LOST COMMUNICATION WITH TCM



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the TCM for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
TCM POWER AND GROUND
TCM (PCM)
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE TCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the TCM is active on the bus.

Is the TCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the TCM?

Yes

- Replace/update the Transmission Control Module in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the TCM.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

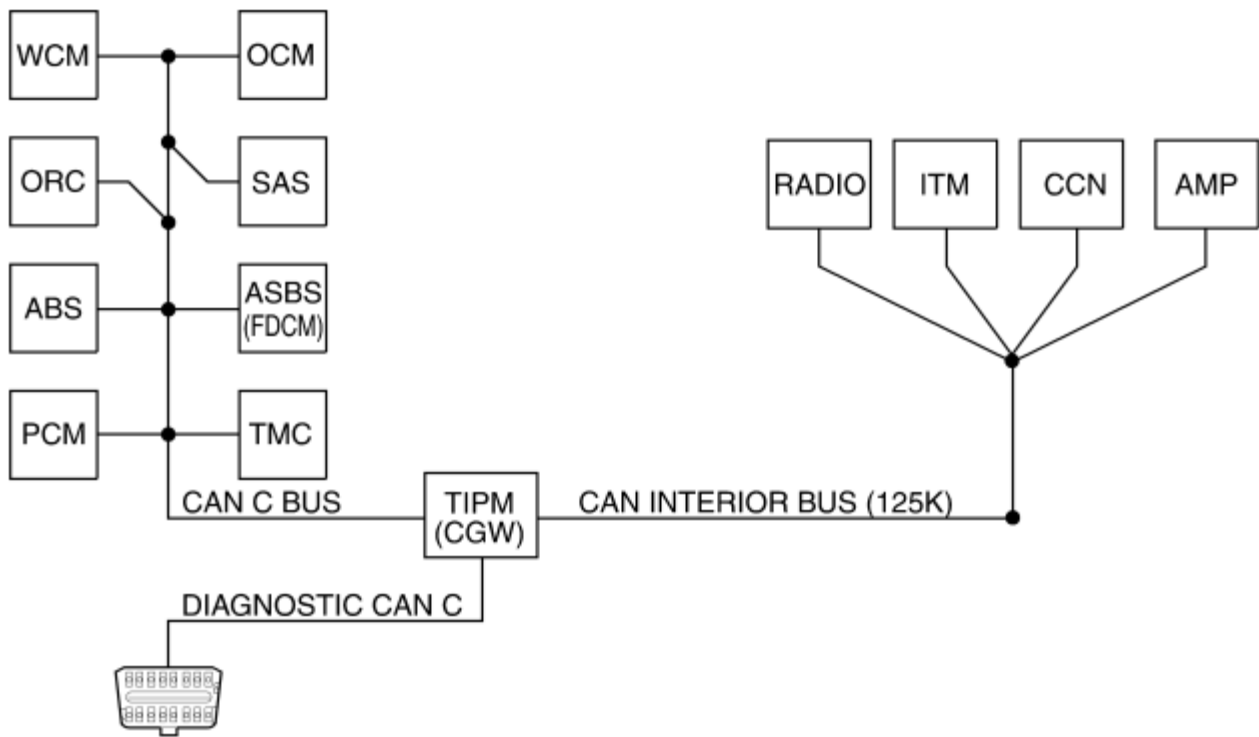
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0114-LOST COMMUNICATION WITH FINAL DRIVE CONTROL MODULE (FDCM)



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Final Drive Control Module for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
FINAL DRIVE CONTROL MODULE POWER AND GROUND
FINAL DRIVE CONTROL MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE FDCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the FDCM is active on the bus.

Is the FDCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the FDCM?

Yes

- Replace/update the Final Drive Control Module (FDCM/ASBS) in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the FDCM.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

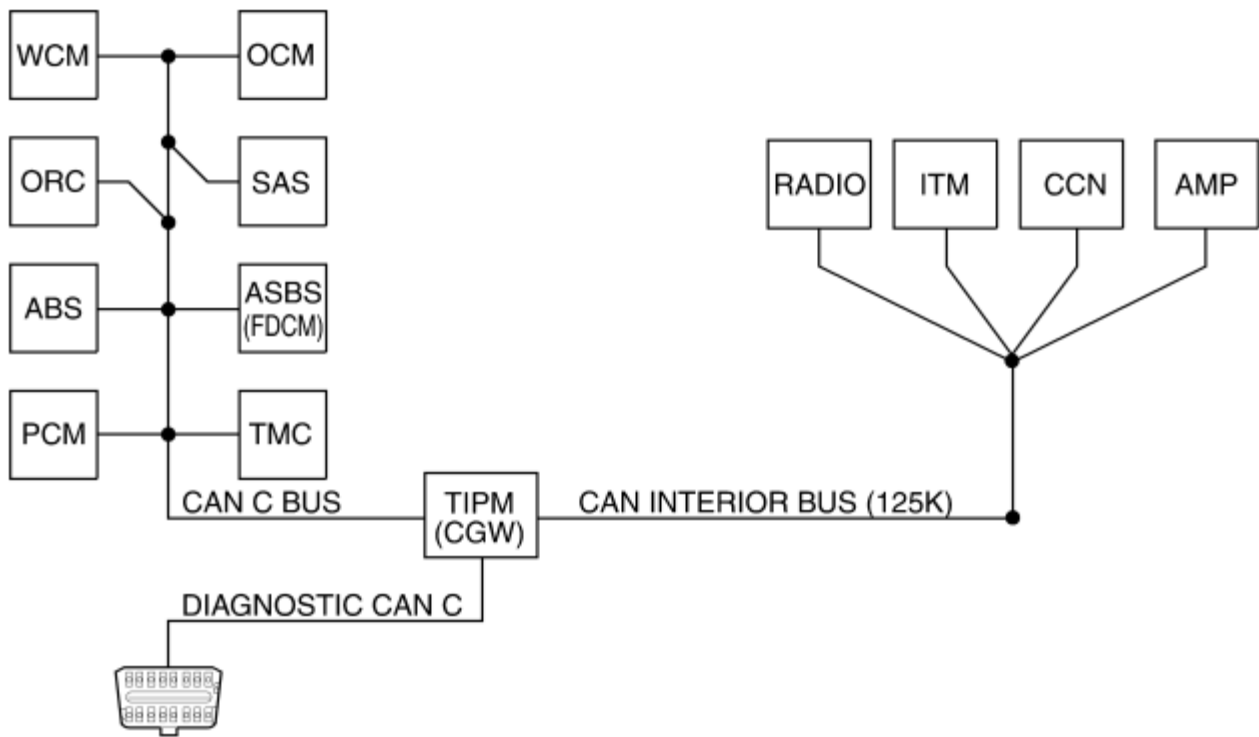
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Antilock Brake Module for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
ANTILOCK BRAKE MODULE POWER AND GROUND
ANTILOCK BRAKE MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCS from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCS.

Does the scan tool display any active DTCS to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE ABS IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the ABS is active on the bus.

Is the ABS active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCS “Logged Against” the ABS?

Yes

- Replace/update the Antilock Brake Module in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the ABS.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

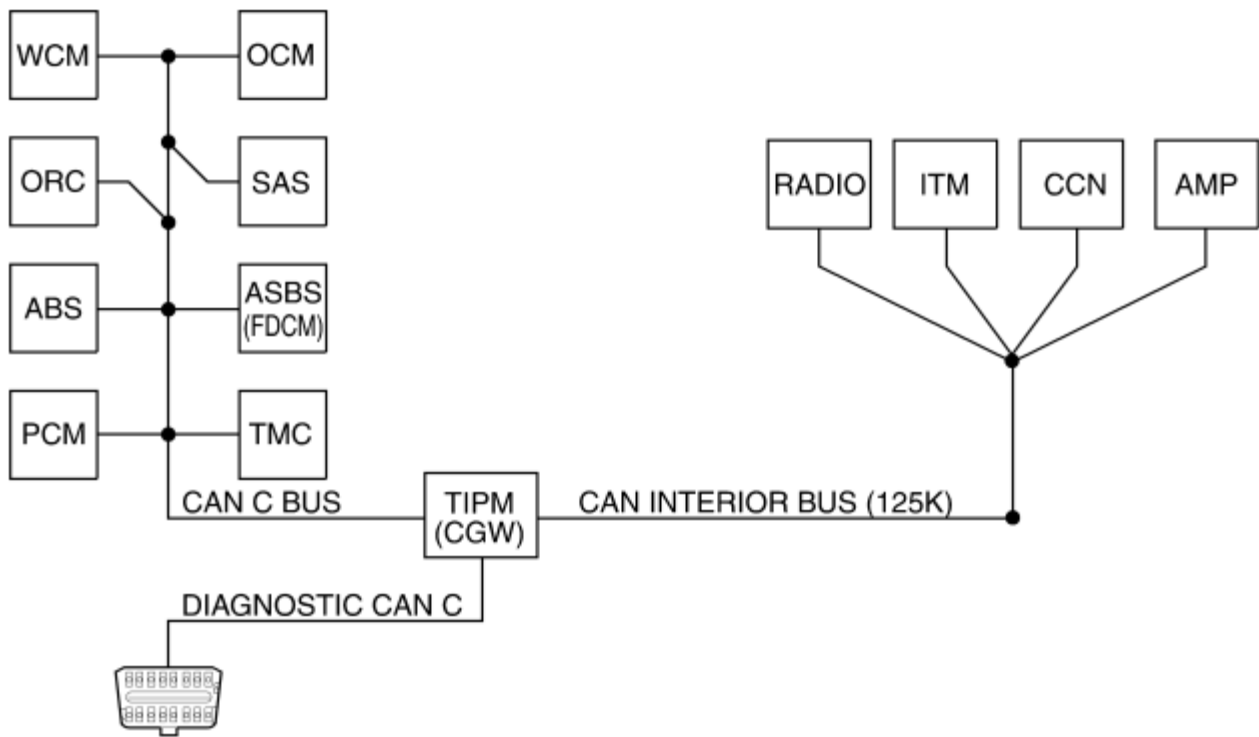
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0126-LOST COMMUNICATION WITH STEERING ANGLE SENSOR (SAS)



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the SCM (Steering Angle Sensor or SAS) for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
STEERING ANGLE SENSOR
STEERING ANGLE SENSOR POWER AND GROUND
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.
- Perform BODY VERIFICATION TEST – VER 1.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. VERIFY THAT THE SCM (SAS) IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the SCM (SAS) is active on the bus.

Is the SCM (SAS) active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the SCM (SAS)?

Yes

- Replace/update the SCM (Steering Angle Sensor or SAS) in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the SCM (SAS).
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.

- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

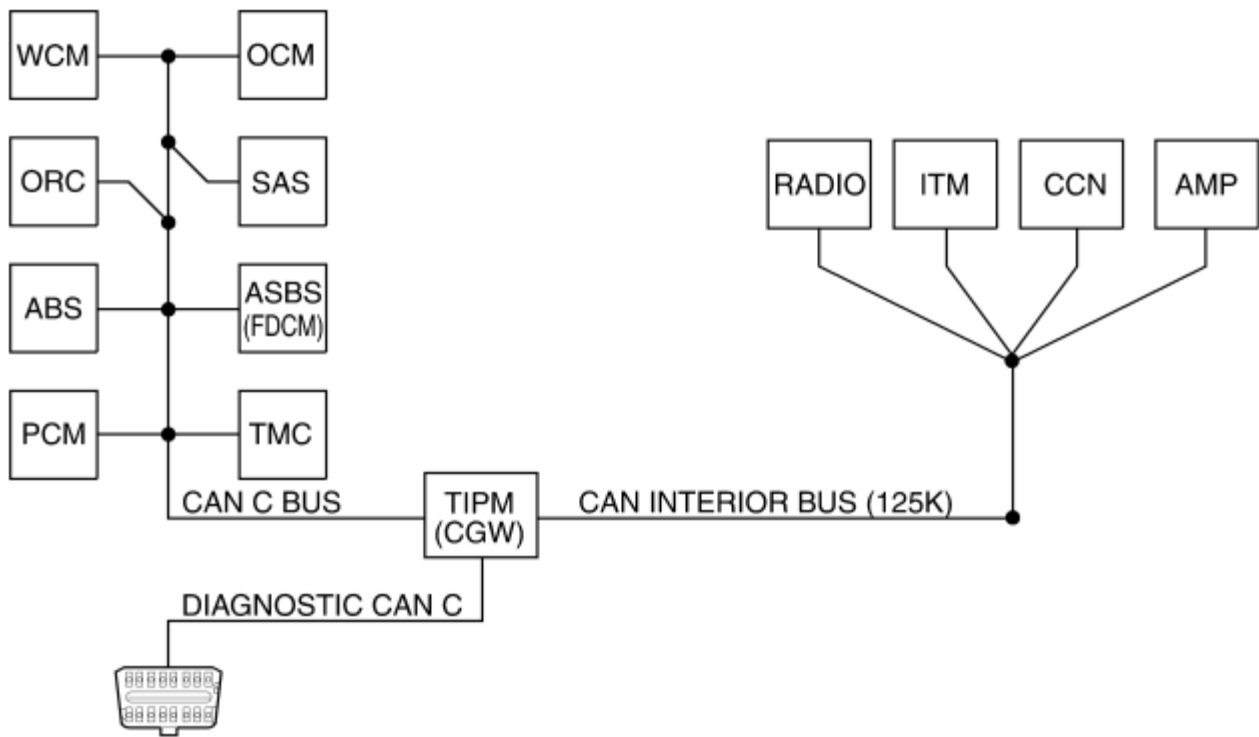
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (TOTALLY INTEGRATED POWER MODULE)



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Totally Integrated Power Module (TIPM) for approximately 2 to 5 seconds.

Possible Causes
DIAGNOSTIC CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
TOTALLY INTEGRATED POWER MODULE POWER AND GROUND
TOTALLY INTEGRATED POWER MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE TIPM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the TIPM is active on the bus.

Is the TIPM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the TIPM?

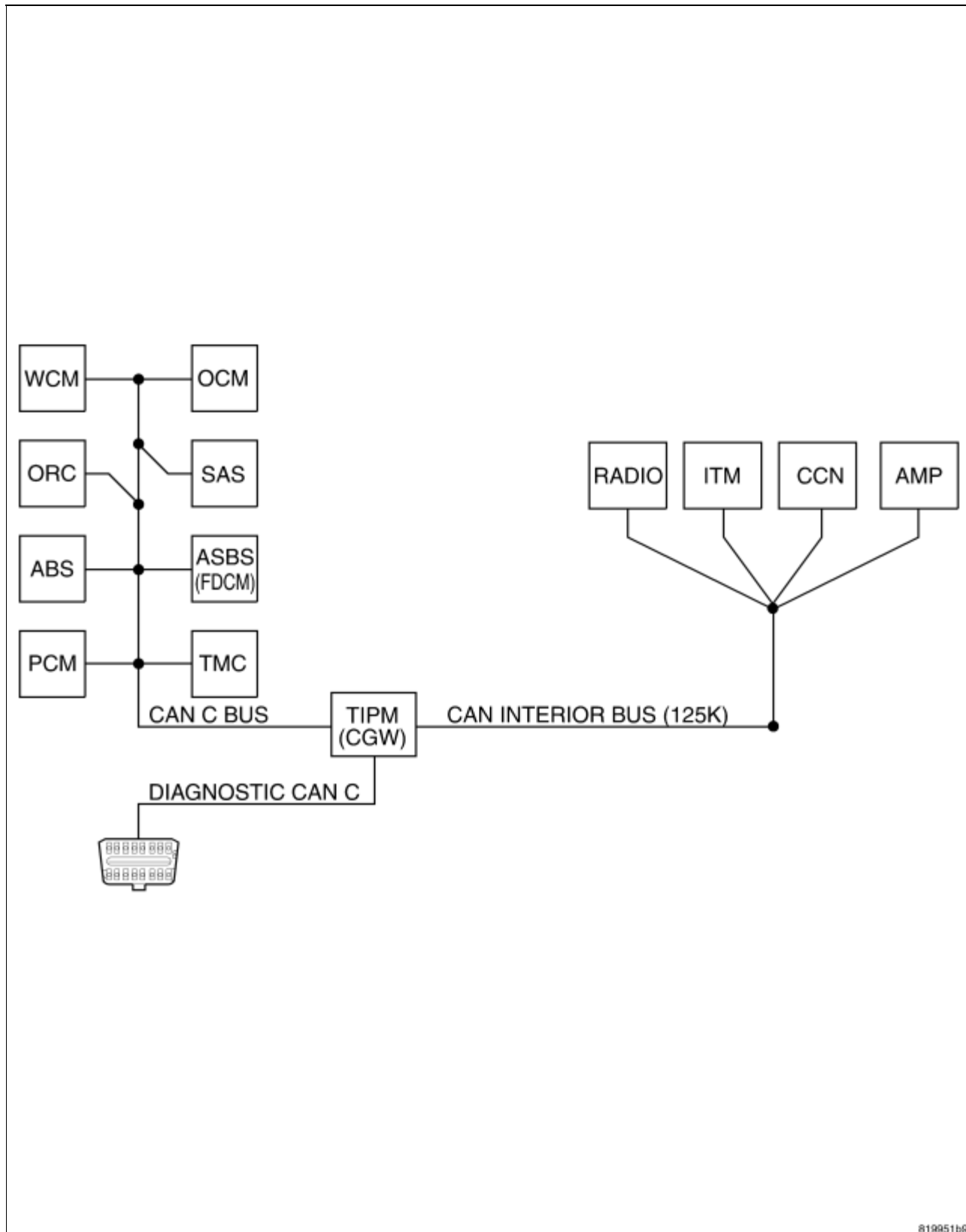
Yes

- Replace/update the Totally Integrated Power Module (TIPM) in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information
- Perform the appropriate VERIFICATION TEST.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Occupant Restraint Controller for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
OCCUPANT RESTRAINT CONTROLLER POWER AND GROUND
OCCUPANT RESTRAINT CONTROLLER
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCS from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCS.

Does the scan tool display any active DTCS to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE ORC IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the ORC is active on the bus.

Is the ORC active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCS “Logged Against” the ORC?

Yes

- Replace/update the Occupant Restraint Controller in accordance with the service information.

Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the ORC.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

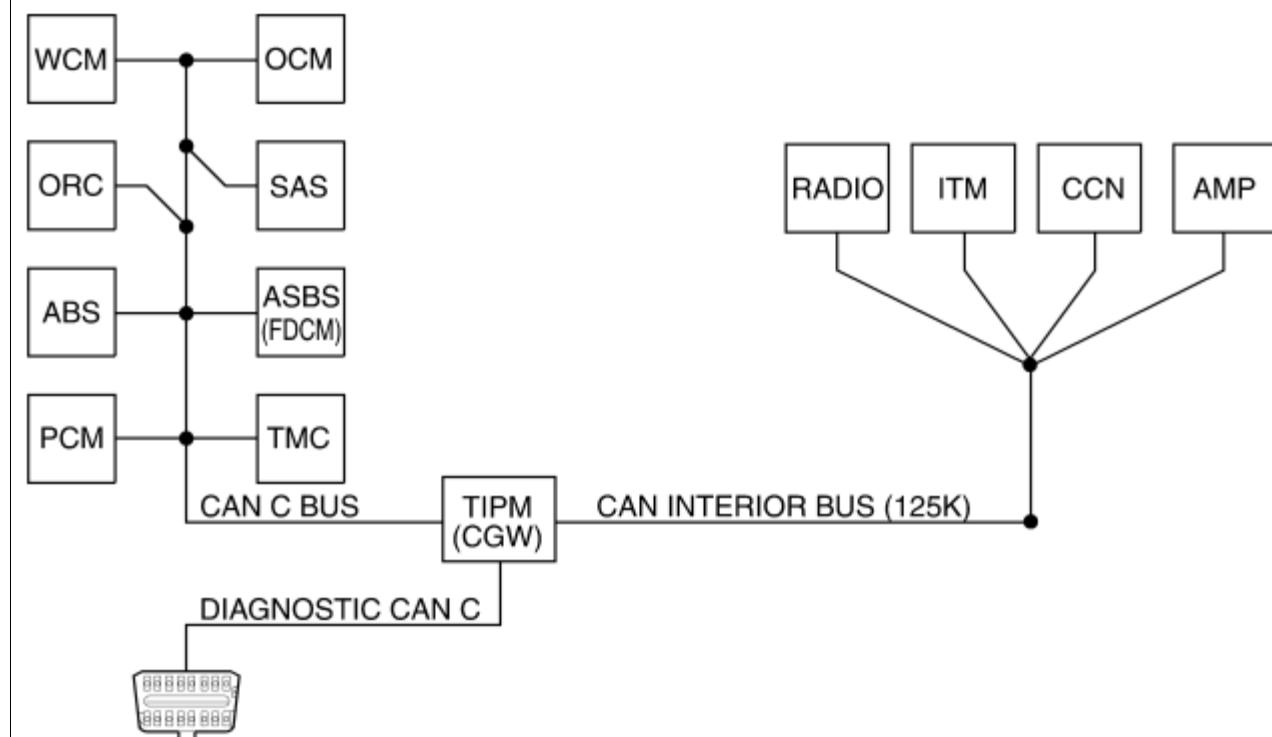
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0154–LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Occupant Classification Module for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
OCCUPANT CLASSIFICATION MODULE POWER AND GROUND
OCCUPANT CLASSIFICATION MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE OCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the OCM is active on the bus.

Is the OCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the OCM?

Yes

- Replace/update the Occupant Classification Module in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the OCM.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

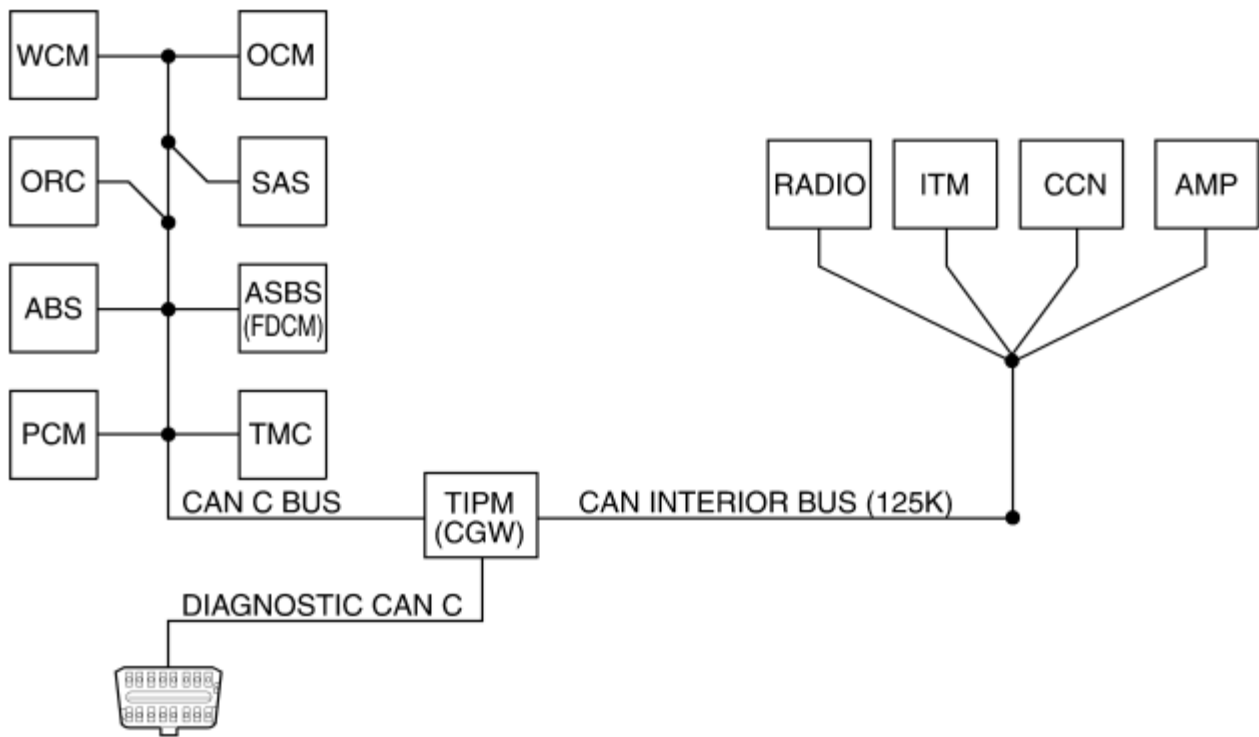
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Cluster/CCN for approximately 2 to 5 seconds.

Possible Causes
CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
CLUSTER/CCN POWER AND GROUND
CLUSTER/CCN
MODULE THAT SET THE DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE CCN IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the CCN is active on the bus.

Is the CCN active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the CCN?

Yes

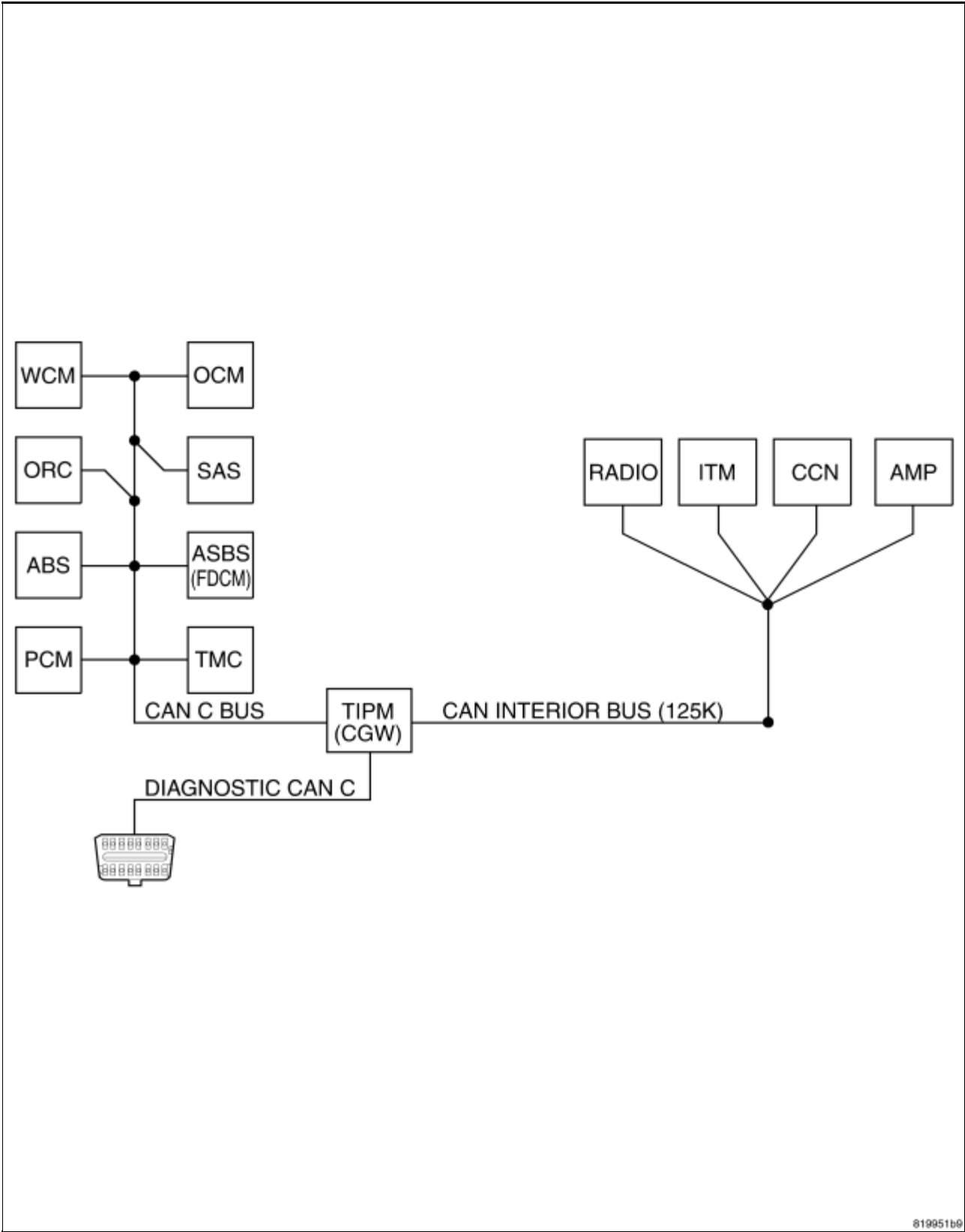
- Replace/update the Cluster (CCN) in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0164-LOST COMMUNICATION WITH HVAC CONTROL

MODULE



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the A/C Heater Control (HVAC) for approximately 2 to 5 seconds.

Possible Causes
CAN C INTERIOR BUS (125K) CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
A/C HEATER CONTROL POWER AND GROUND
A/C HEATER CONTROL
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE HVAC IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network View and select Advanced.

Verify that the HVAC is active on the bus.

Is the HVAC active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

Is there more than one module with active DTCs “Logged Against” the HVAC?

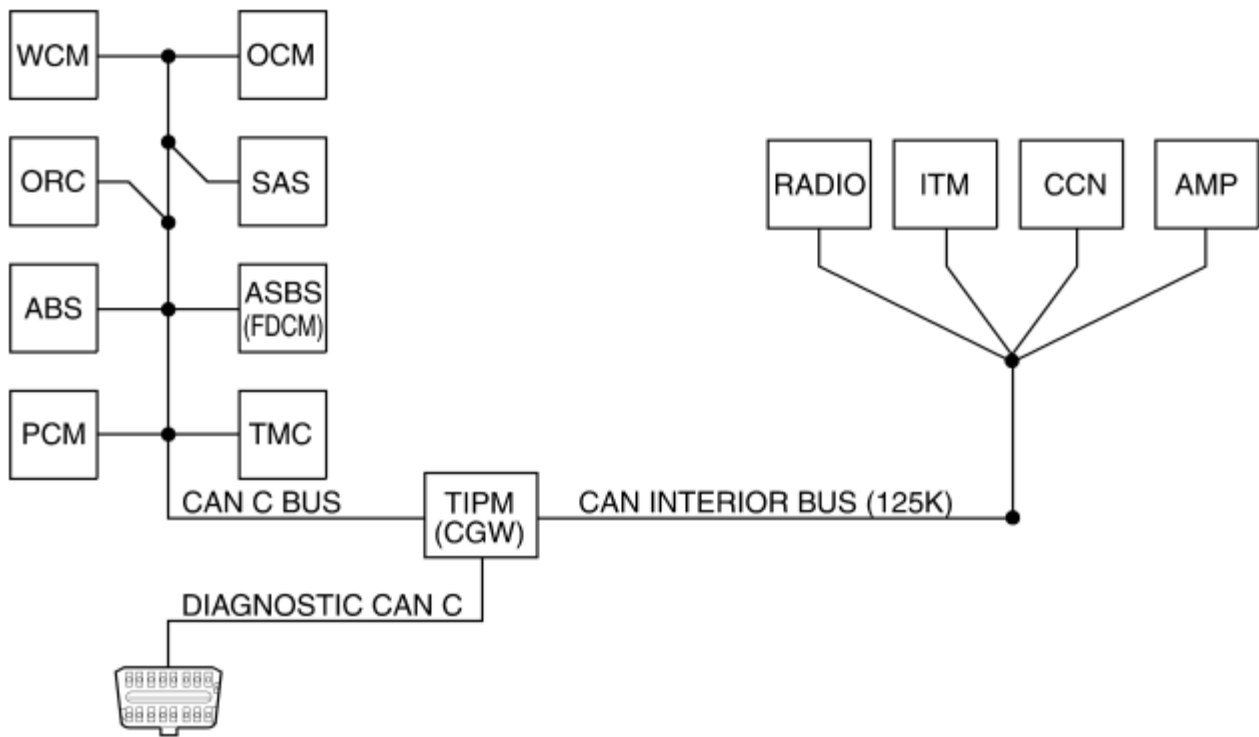
Yes

- Replace/update the A/C Heater Control in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set the DTC in accordance with the service information
- Perform the appropriate VERIFICATION TEST.

U0167-LOST COMMUNICATION WITH INTRUSION TRANSCIEVER CONTROL MODULE



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Intrusion Transceiver Control Module (ITM) for approximately 2 to 5 seconds.

Possible Causes
CAN C INTERIOR BUS (125K) CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
INTRUSION TRANSCIEVER CONTROL MODULE POWER AND GROUND
INTRUSION TRANSCIEVER CONTROL MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE ITM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the ITM is active on the bus.

Is the ITM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the ITM?

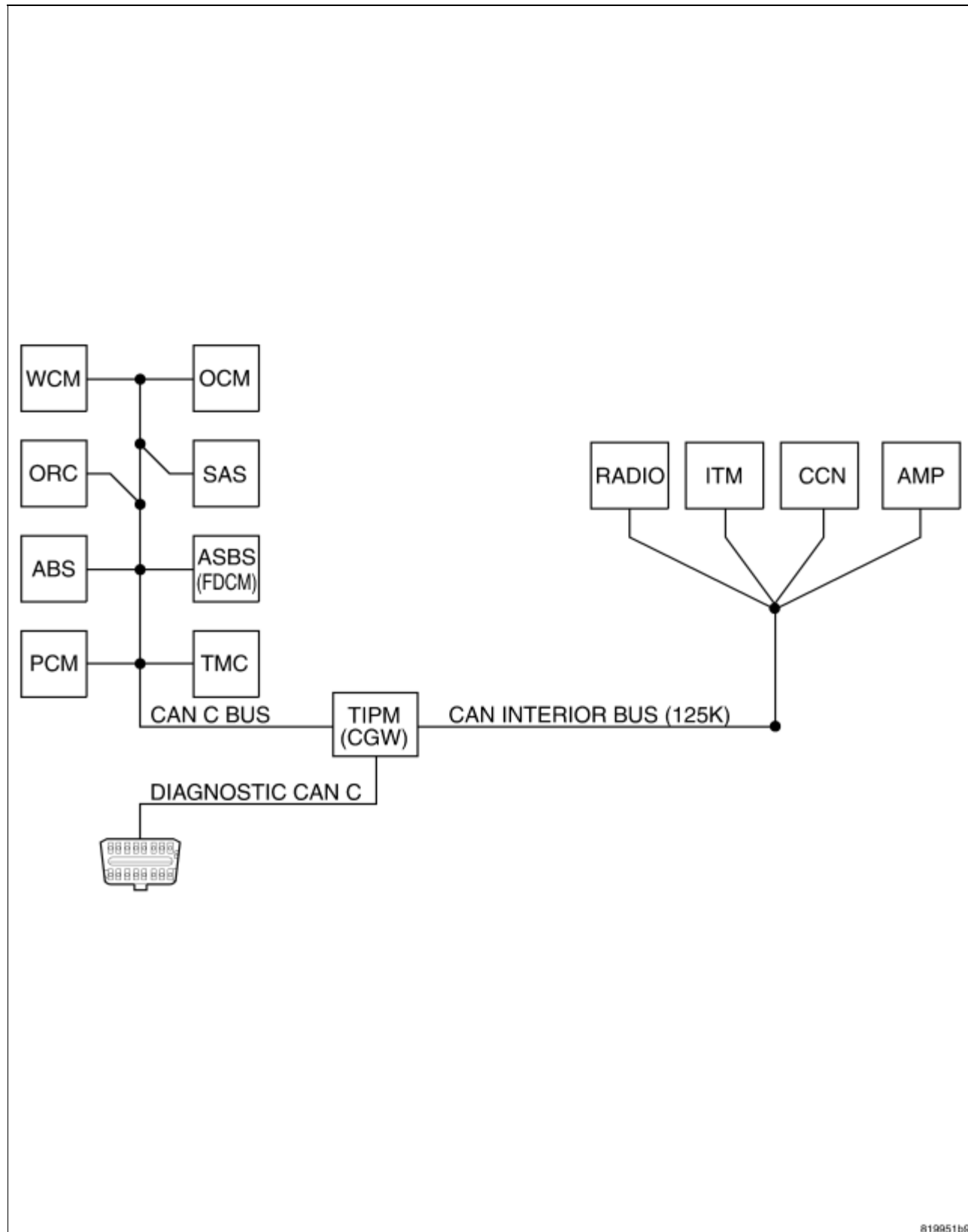
Yes

- Replace/update the Intrusion Transceiver Control Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set the DTC in accordance with the service information
- Perform the appropriate VERIFICATION TEST.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Sentry Key Remote Entry Module (SKREEM/WCM) for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
SENTRY KEY REMOTE ENTRY MODULE POWER AND GROUND
SENTRY KEY REMOTE ENTRY MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE WCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the WCM is active on the bus.

Is the WCM active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the WCM?

Yes

Replace/update the Sentry Key Remote Entry Module (SKREEM/WCM) in accordance with the service information.

- Perform the appropriate VERIFICATION TEST.

No

- Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the WCM.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the appropriate VERIFICATION TEST.

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

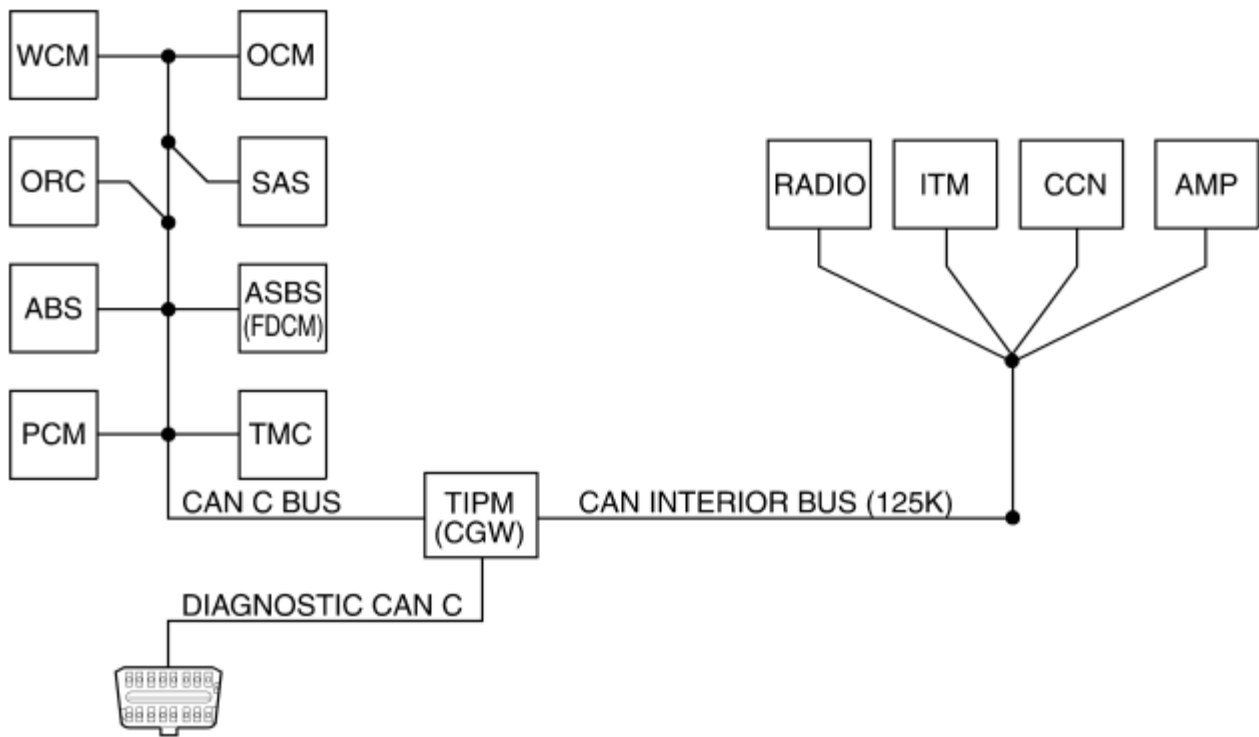
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0184-LOST COMMUNICATION WITH RADIO



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Radio for approximately 2 to 5 seconds.

Possible Causes
CAN C INTERIOR BUS (125K) CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
RADIO POWER AND GROUND
RADIO
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE RADIO IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the Radio is active on the bus.

Is the Radio active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the Radio?

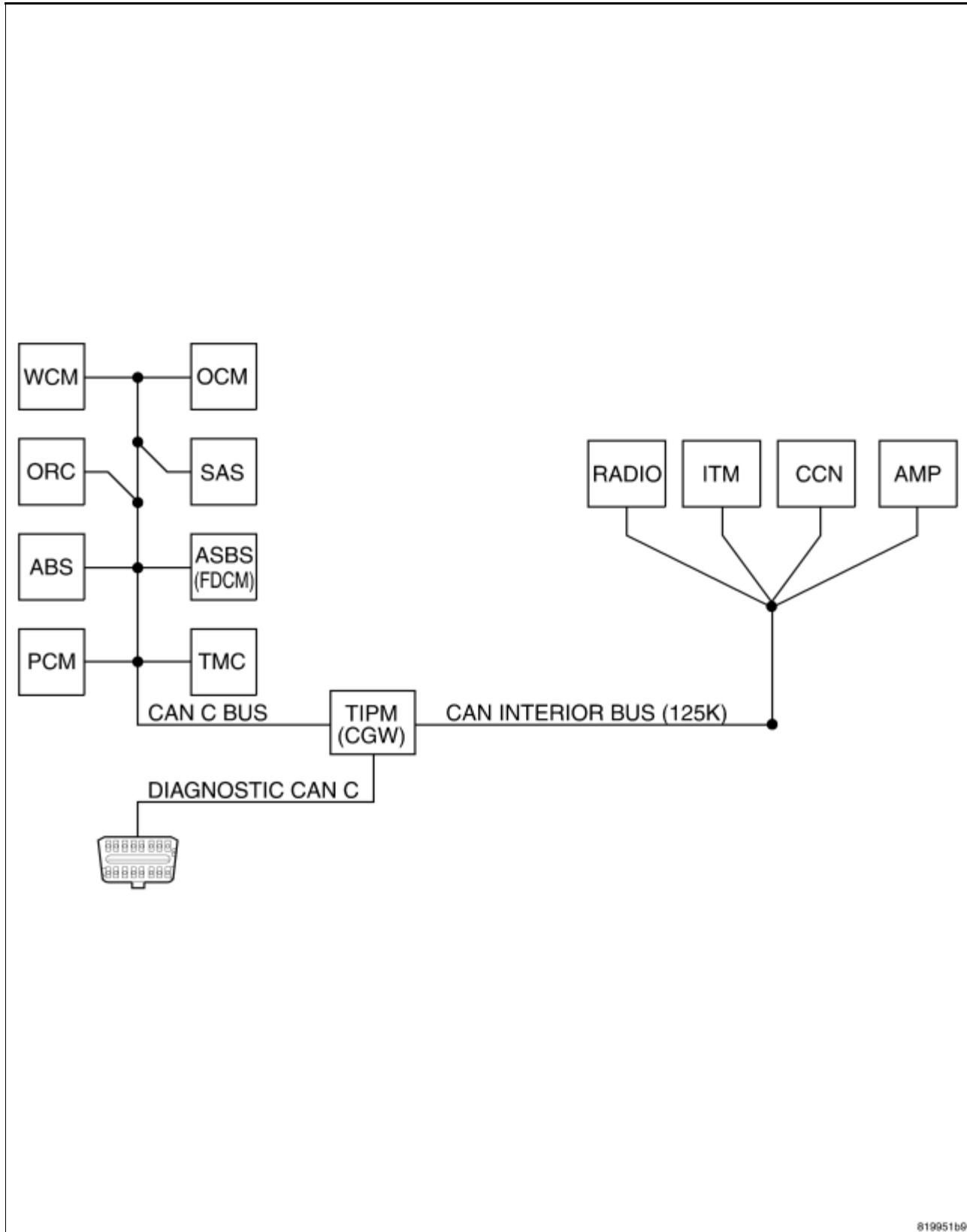
Yes

- Replace/update the Radio in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the appropriate VERIFICATION TEST.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the Amplifier for approximately 2 to 5 seconds.

Possible Causes
CAN C INTERIOR BUS (125K) CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
AMPLIFIER POWER AND GROUND
AMPLIFIER
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE AMPLIFIER IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the Amplifier is active on the bus.

Is the Amplifier active on the bus?

Yes

- Go To [4](#)

No

- Refer to the No Response test procedure. Refer to the table of contents in this section.

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the Amplifier?

Yes

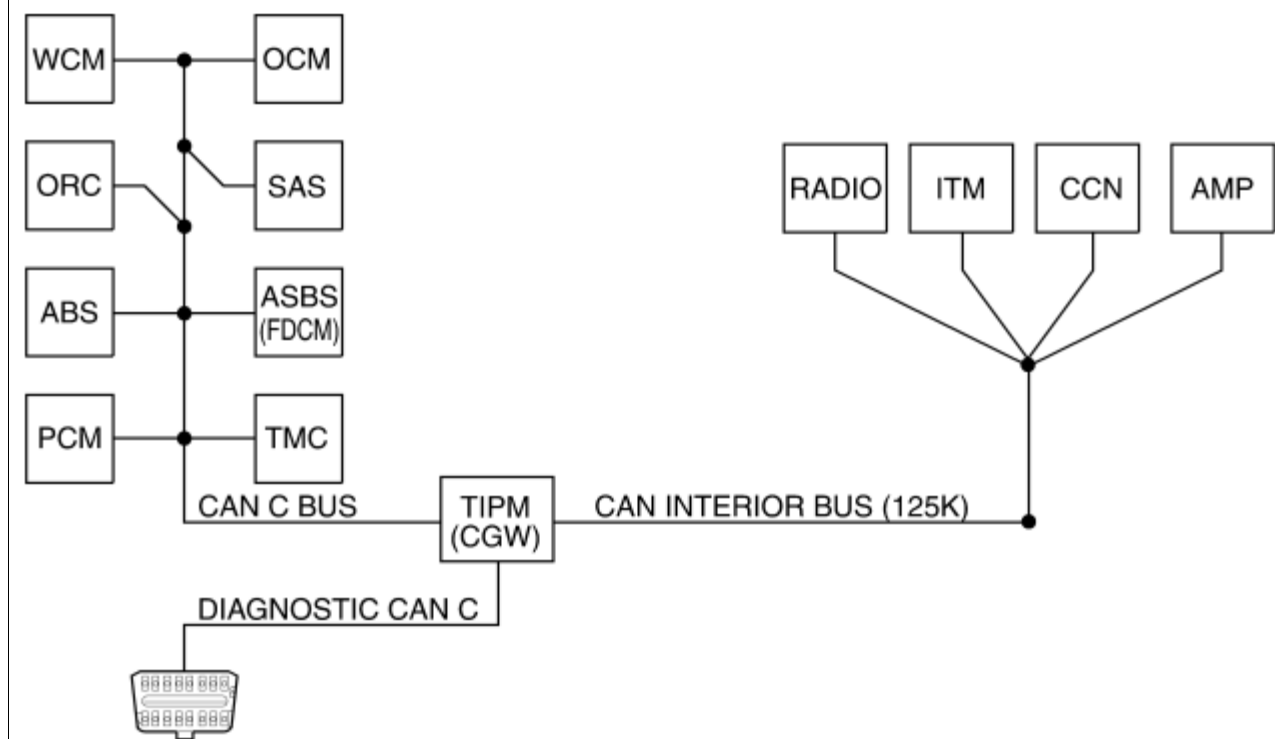
- Replace/update the Amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

Replace/update the module that set this DTC in accordance with the service information.

- Perform the appropriate VERIFICATION TEST.

U1159-LOST COMMUNICATION WITH AUTOMATIC SWAY BAR SYSTEM (ASBS) MODULE



819951b9

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received from the ASBS for approximately 2 to 5 seconds.

Possible Causes
(D65) CAN C BUS(+) CIRCUIT SHORTED TO VOLTAGE
(D64) CAN C BUS(-) CIRCUIT SHORTED TO GROUND
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
AUTOMATIC SWAY BAR SYSTEM MODULE POWER AND GROUND
AUTOMATIC SWAY BAR SYSTEM MODULE
MODULE THAT SET THIS DTC

Diagnostic Test

1. VERIFY DTC IS ACTIVE

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

With the scan tool, read active DTCs.

Is this DTC active?

Yes

- Go To [2](#)

No

- Refer to the Stored Lost Communication diagnostic procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all modules.

NOTE: Check for TIPM configuration, CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.

Does the scan tool display any active DTCs to the conditions listed above?

Yes

- Diagnose and repair the DTC. Refer to the Index for a complete list of the symptoms.

No

- Go To [3](#)

3. VERIFY THAT THE ASBS IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, select Network Diagnostics.

Verify that the ASBS is active on the bus.

Is the ASBS active on the bus?

Yes

- Go To [4](#)

No

- Perform the No Response diagnostic procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network Diagnostics.

Is there more than one module with active DTCs “Logged Against” the ASBS?

Yes

- Replace/update the ASBS in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

Go To [5](#)

5. CLEAR DTC IN MODULE SETTING FAULT

With the scan tool, select the module setting the DTC against the ASBS.
Clear active DTCs.

Is this DTC still active?

Yes

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [6](#)

6. CYCLE IGNITION

Cycle the ignition from RUN to OFF three times ending with the key in the RUN position.

Does this DTC become active?

Yes

- Go To [7](#)

No

- The condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

7. CHECK FOR ADDITIONAL LOST COMMUNICATION FAULTS

With the scan tool, select Network Diagnostics.

Does the TIPM and other CAN C BUS modules show Lost Communication with the remaining CAN C BUS modules?

Yes

- Go To [8](#)

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (D65) CAN C Bus (+) circuit and ground.

Is the voltage above 5 volts?

Yes

- Repair the (D65) CAN C Bus (+) circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D64) CAN C Bus (-) circuit.

Is the resistance below 10K Ohms?

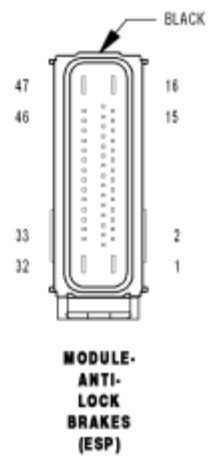
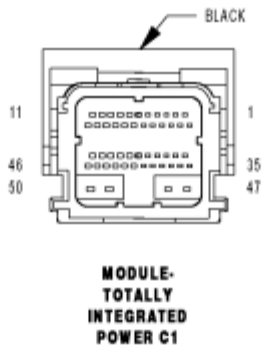
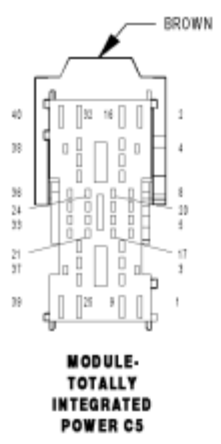
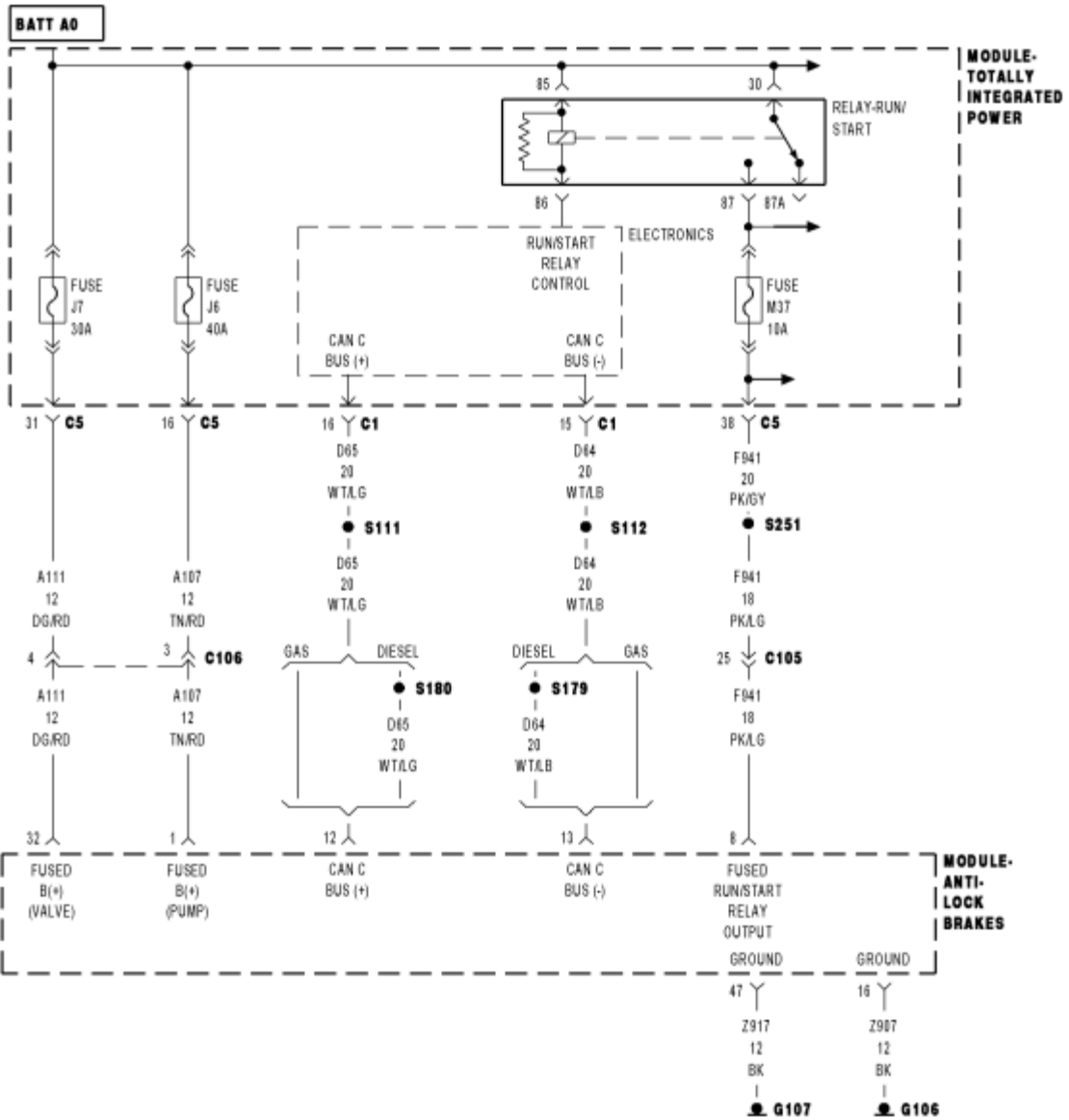
Yes

- Repair the (D64) CAN C Bus (-) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace/update the module that set this DTC in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE)**



010956ad

For a complete wiring diagram Refer to Section 8W.

Possible Causes

(A107) (A111) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z907) (Z917) GROUND CIRCUIT OPEN
(F941) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTILOCK BRAKE MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the TIPM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A107) (A111) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Antilock Brake Module harness connector. Using a 12-volt test light connected to ground, check each (A107) and (A111) Fused B(+) circuit.

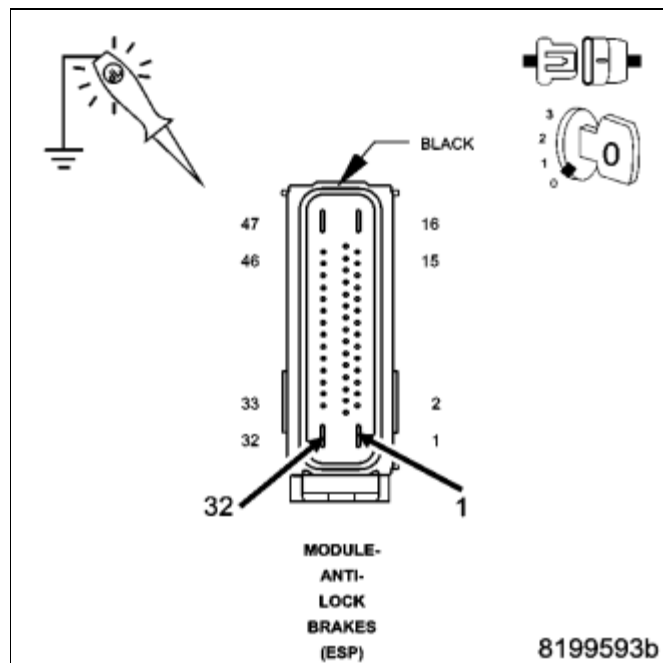
Does the test light illuminate brightly for each circuit?

Yes

- Go To [3](#)

No

- Repair the Fused B(+) circuit for an open or short.
- Perform the ABS VERIFICATION TEST - VER 1.



3. (Z907) (Z917) GROUND CIRCUITS OPEN

Using a 12-volt test light connected to 12-volts, check each (Z907) and (Z917) ground circuit.

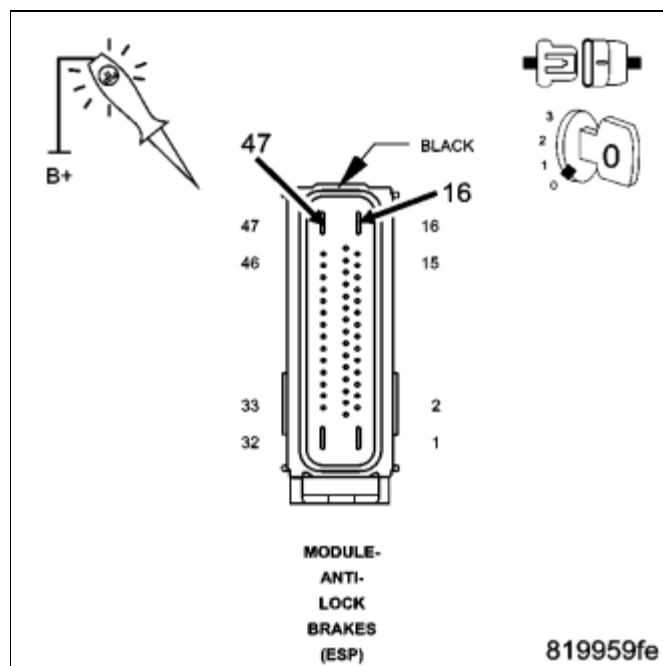
Does the test light illuminate brightly for each circuit?

Yes

- Go To [4](#)

No

- Repair the (Z907) or (Z917) ground circuit for an open.
- Perform the ABS VERIFICATION TEST - VER 1.



4. (F941) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.
Using a 12-volt test light connected to ground, check the (F941) Fused Run/Relay Output circuit.

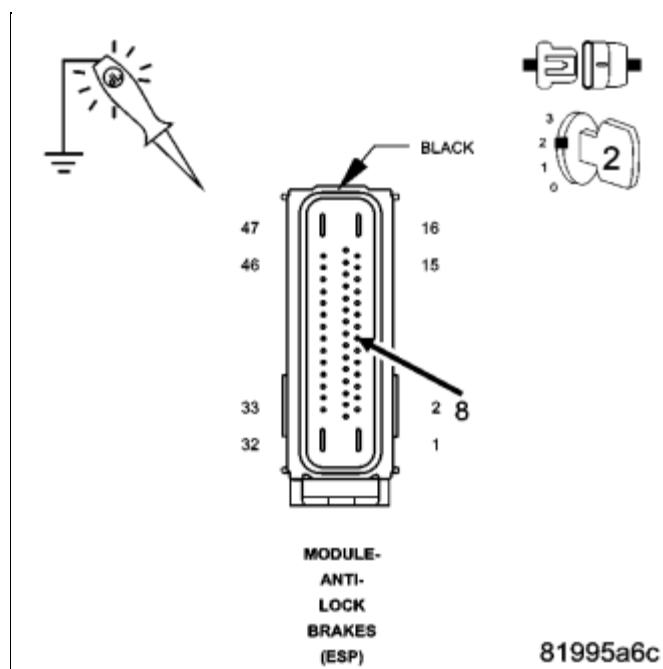
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F941) Fused Run/Relay Output circuit for an open or short.
- Perform the ABS VERIFICATION TEST - VER 1.



5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.
Disconnect the TIPM C1 harness connector.
Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Antilock Brake Module connector.

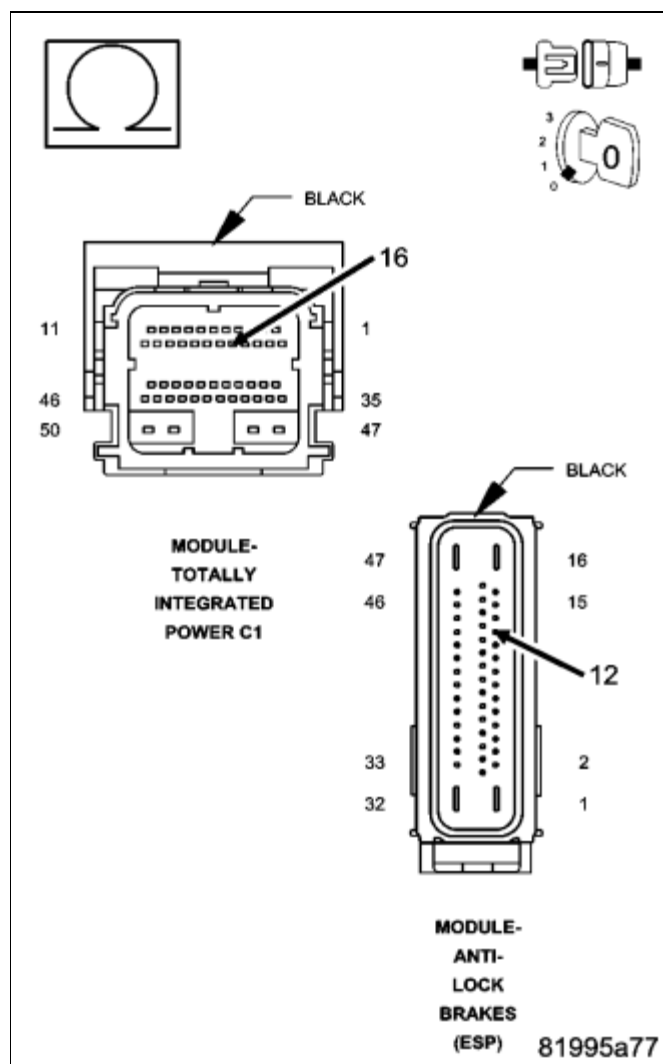
Is resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the ABS VERIFICATION TEST - VER 1.



6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Antilock Brake Module connector.

Is resistance below 5.0 ohms?

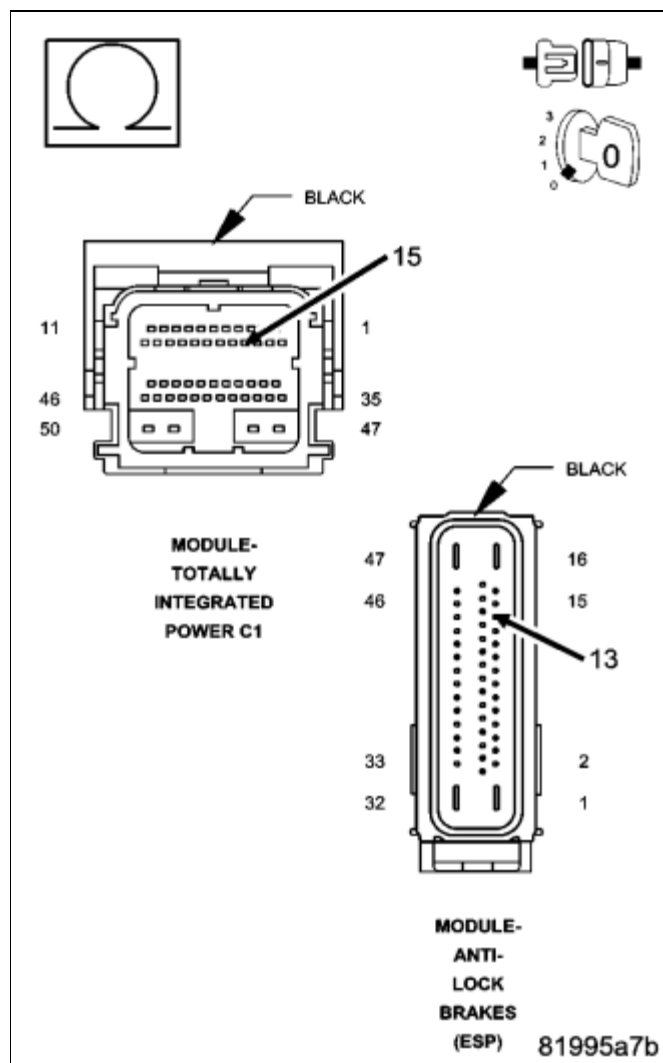
Yes

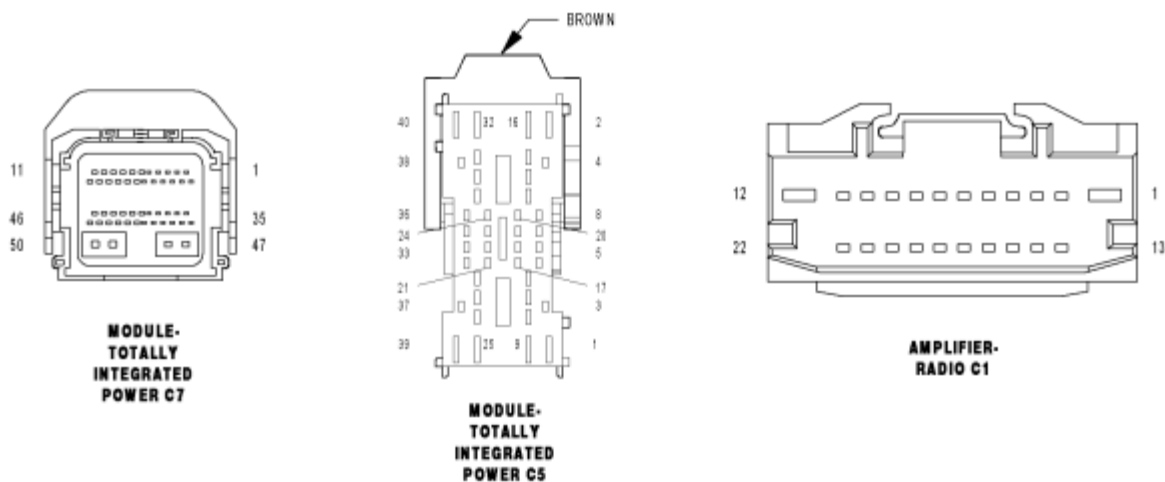
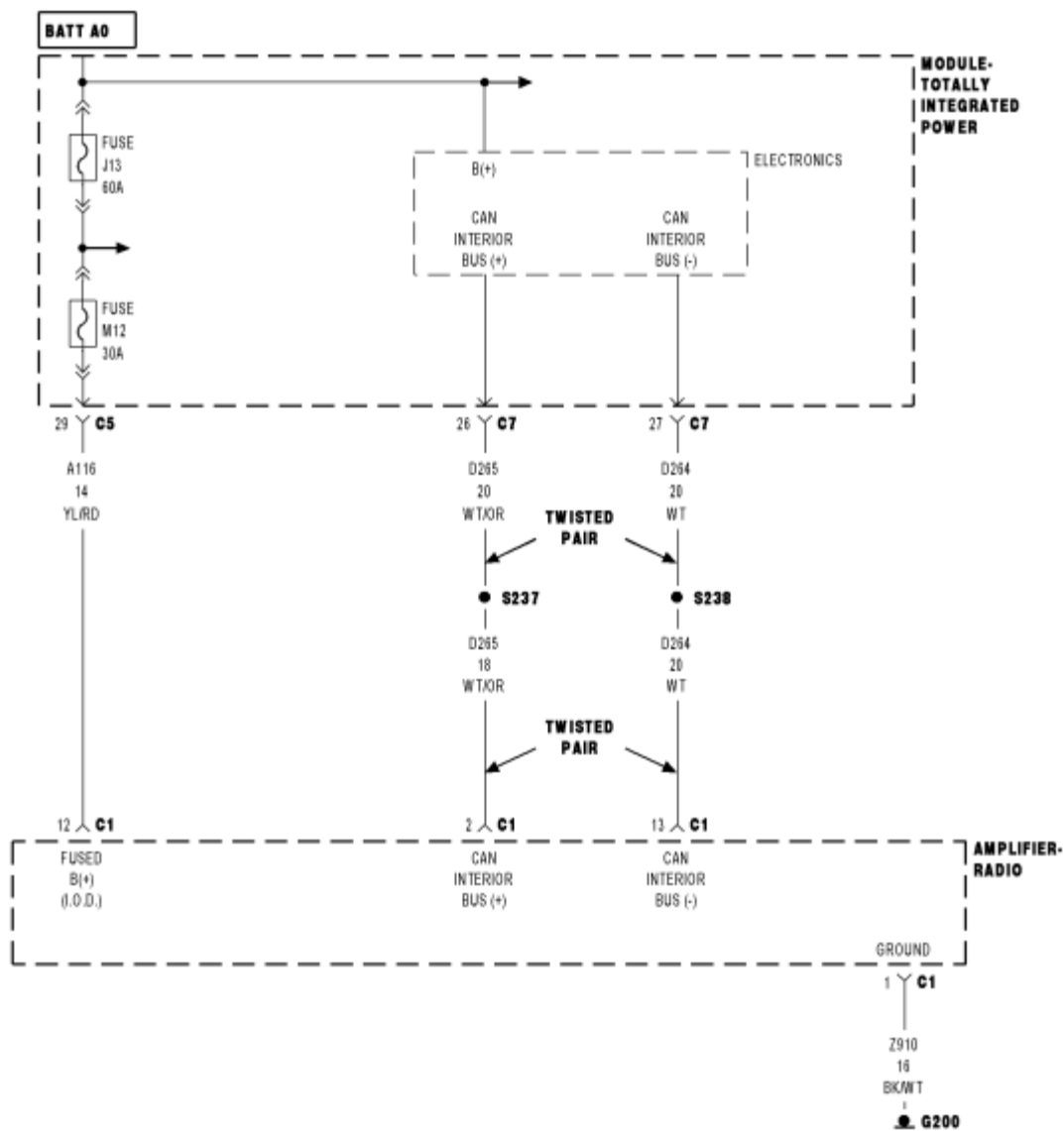
- Replace the Antilock Brake Module in accordance with the service information.
- Perform the ABS VERIFICATION TEST - VER 1.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the ABS VERIFICATION TEST - VER 1.

***NO RESPONSE FROM AMP (AMPLIFIER)**





0199480*

For a complete wiring diagram **Refer to Section 8W.**

(A116) FUSED B (+) (I.O.D.) CIRCUIT OPEN OR SHORTED
(Z910) GROUND CIRCUIT OPEN
(D264) AND (D265) CAN C INTERIOR BUS (125K) CIRCUITS OPEN
AMPLIFIER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A116) FUSED B(+) (I.O.D.) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Radio Amplifier C1 harness connector.

Using a 12-volt test light connected to ground, check the

(A116) Fused B(+) (I.O.D.) circuit.

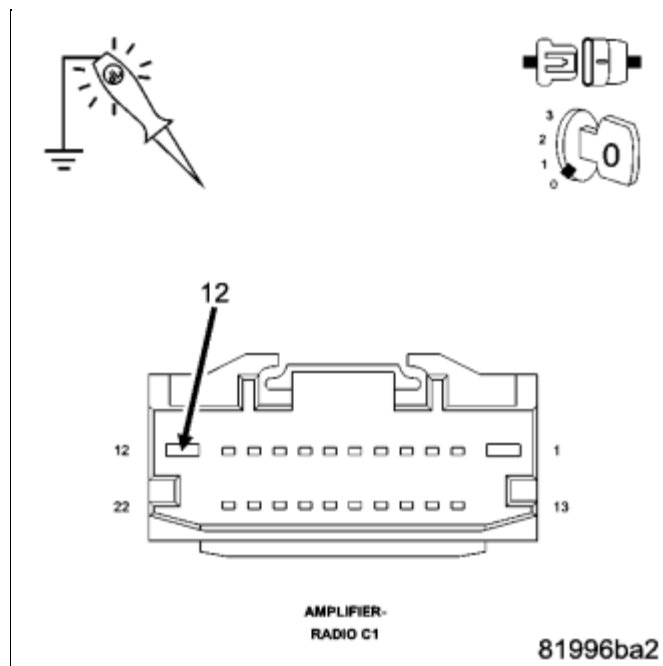
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A116) Fused B(+) (I.O.D.) circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (Z910) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z910) ground circuit.

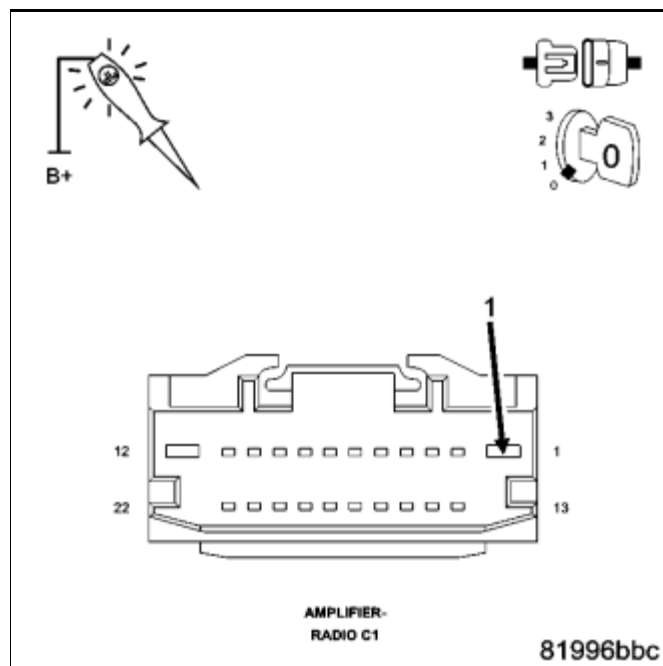
Does the test light illuminate brightly for each circuit?

Yes

- Go To [4](#)

No

- Repair the (Z910) ground circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



4. (D265) OR (D264) CAN C INTERIOR BUS (125K) CIRCUIT OPEN

Measure the resistance of the (D264) CAN C Interior Bus (-) (125K) circuit between the TIPM C7 harness connector and

the Radio Amplifier C1 harness connector.
Measure the resistance of the (D265) CAN C Interior Bus (+) (125K) circuit between the TIPM C7 harness connector and the Radio Amplifier C1 harness connector.

Is resistance below 5.0 ohms on both circuits?

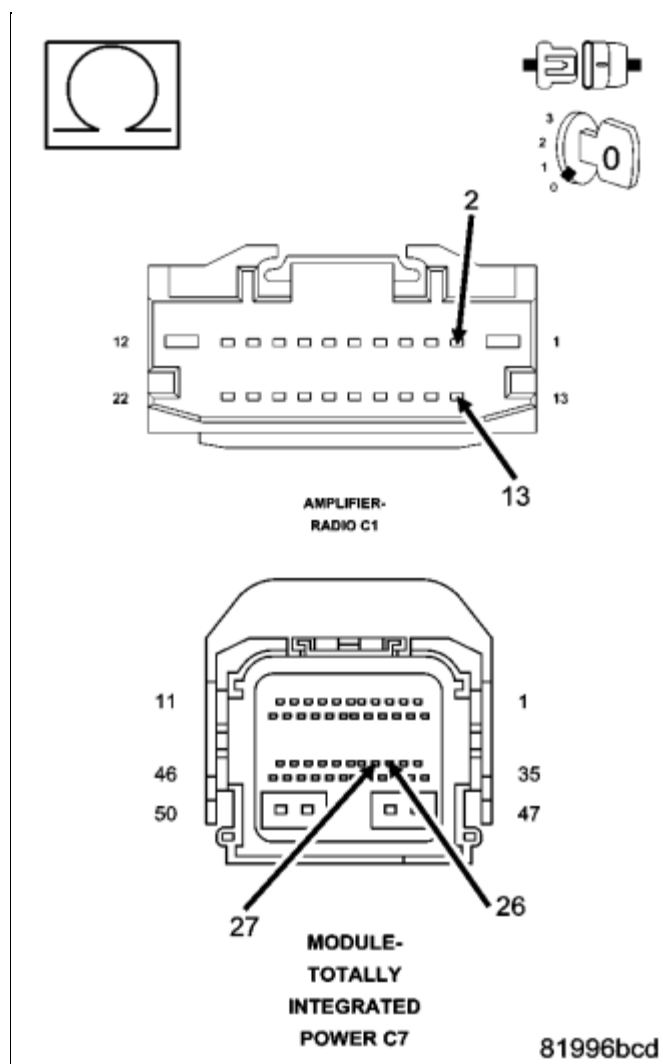
Yes

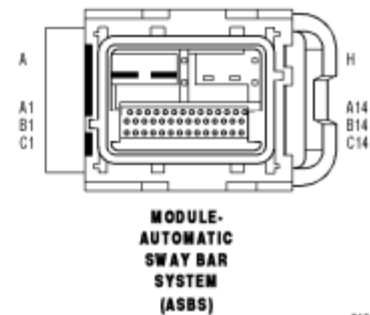
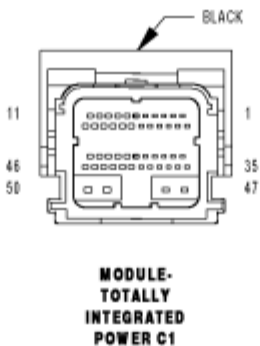
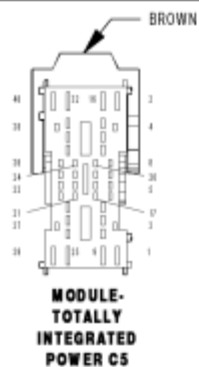
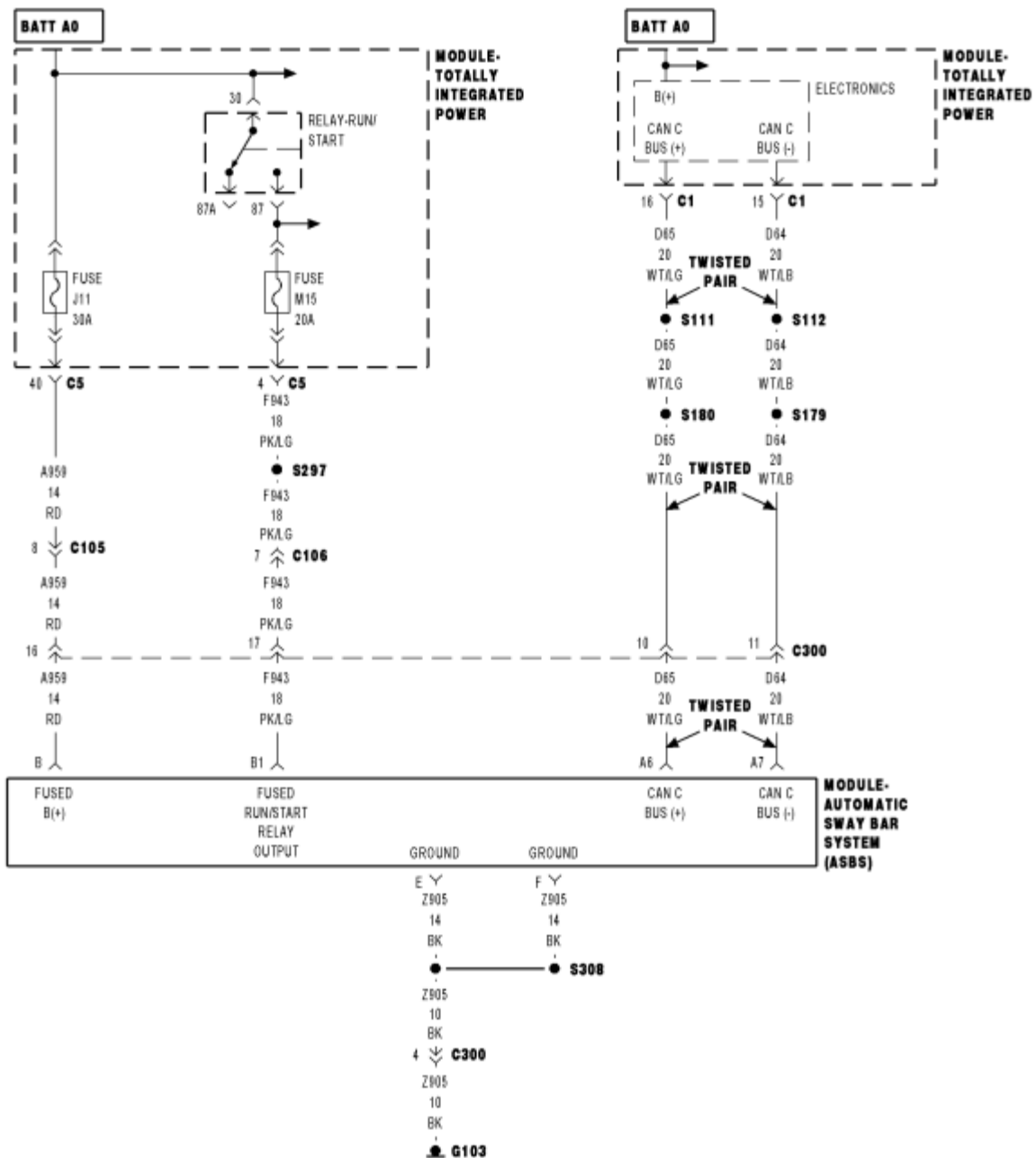
- Replace the Radio Amplifier in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D265) or (D264) CAN C Interior Bus (125K) circuit for an open. Inspect the connector for damage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM FDCM
(FINAL DRIVE CONTROL MODULE)**





01000629

For a complete wiring diagram **Refer to Section 8W.**

(A959) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z905) GROUND CIRCUIT OPEN
(F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ANTILOCK BRAKE MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the TIPM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A959) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.
 Disconnect the Stabilizer Bar Control Module harness connector.
 Using a 12-volt test light connected to ground, check each (A959) Fused B(+) circuit.

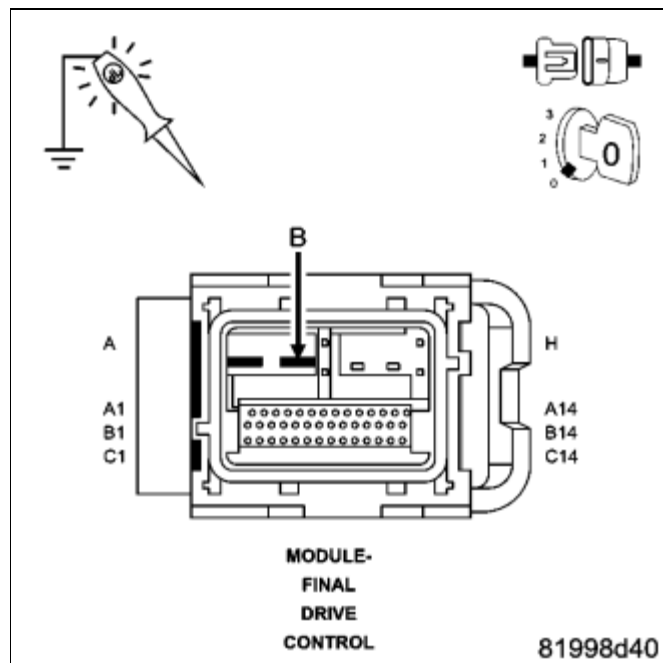
Does the test light illuminate brightly for each circuit?

Yes

- Go To [3](#)

No

- Repair the (A959) Fused B(+) circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (Z905) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z905) ground circuit.

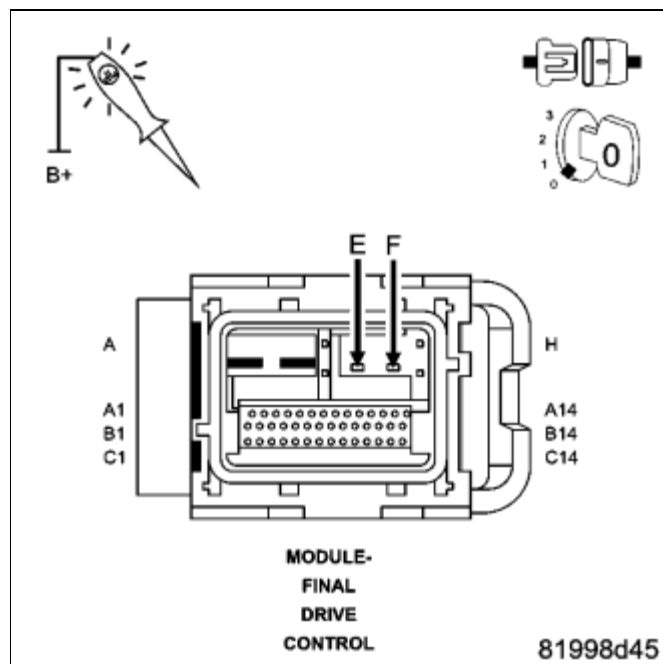
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z905) ground circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



4. (F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.
Using a 12-volt test light connected to ground, check the (F943) Fused Run/Relay Output circuit.

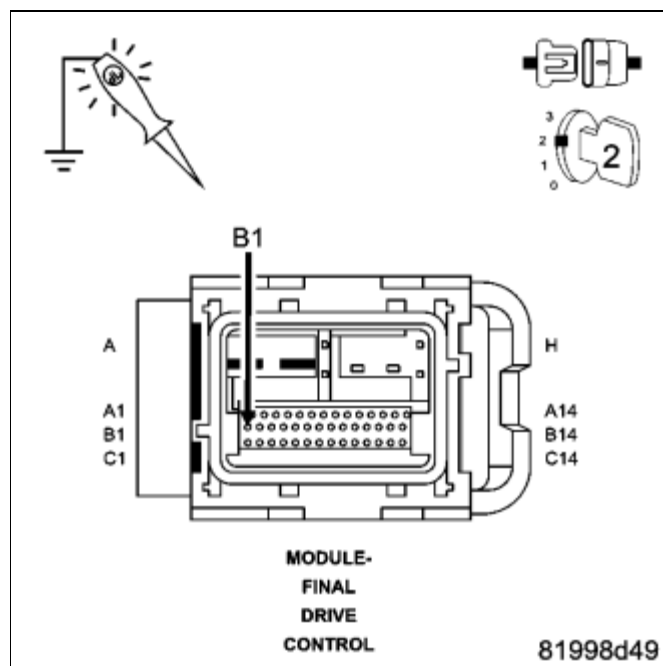
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F943) Fused Run/Relay Output circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.
Disconnect the TIPM C1 harness connector.
Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Stabilizer Bar Control Module connector.

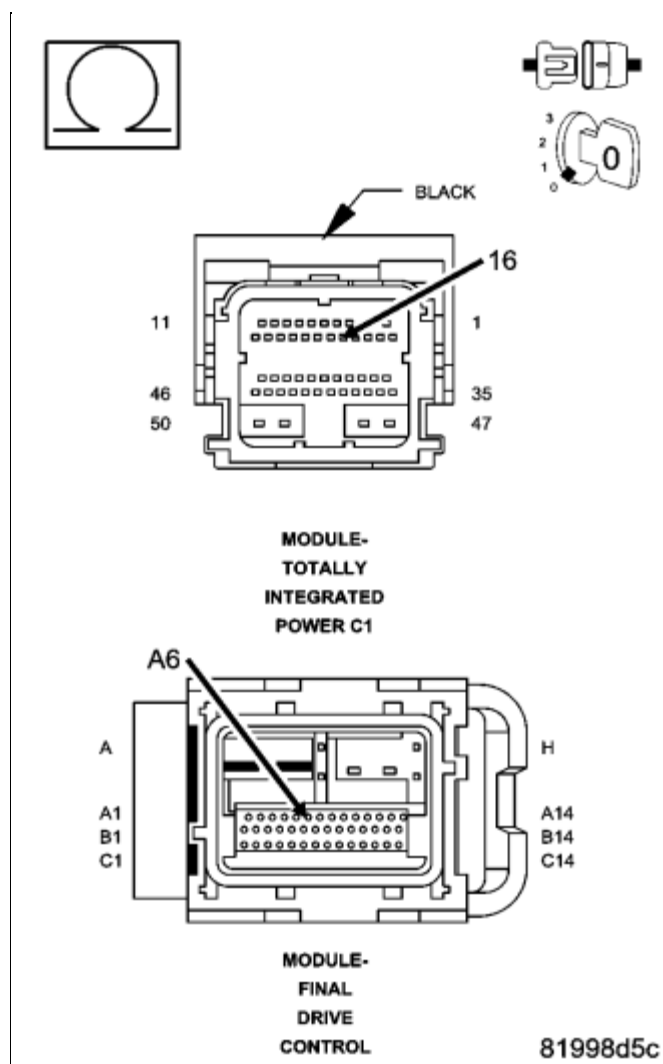
Is resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Stabilizer Bar Control Module connector.

Is resistance below 5.0 ohms?

Yes

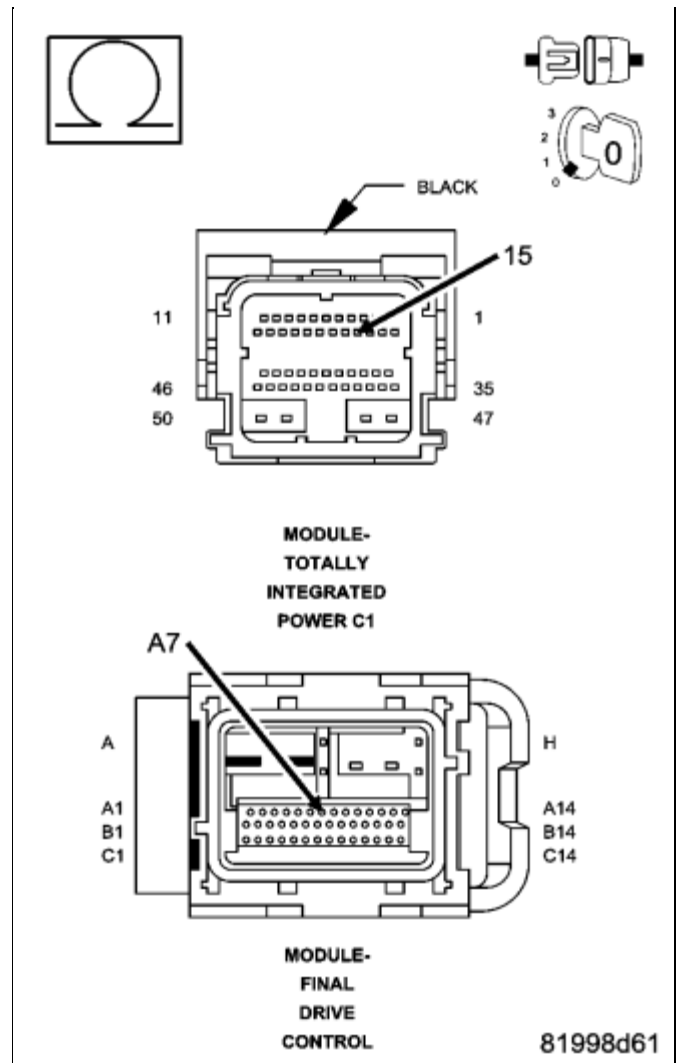
- Replace the Final Drive Control Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

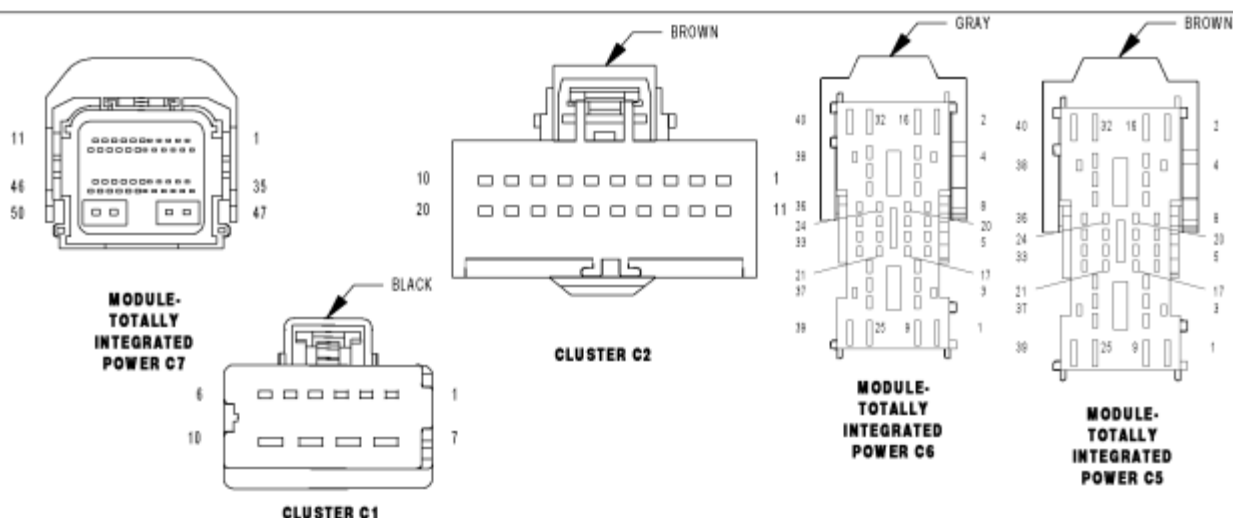
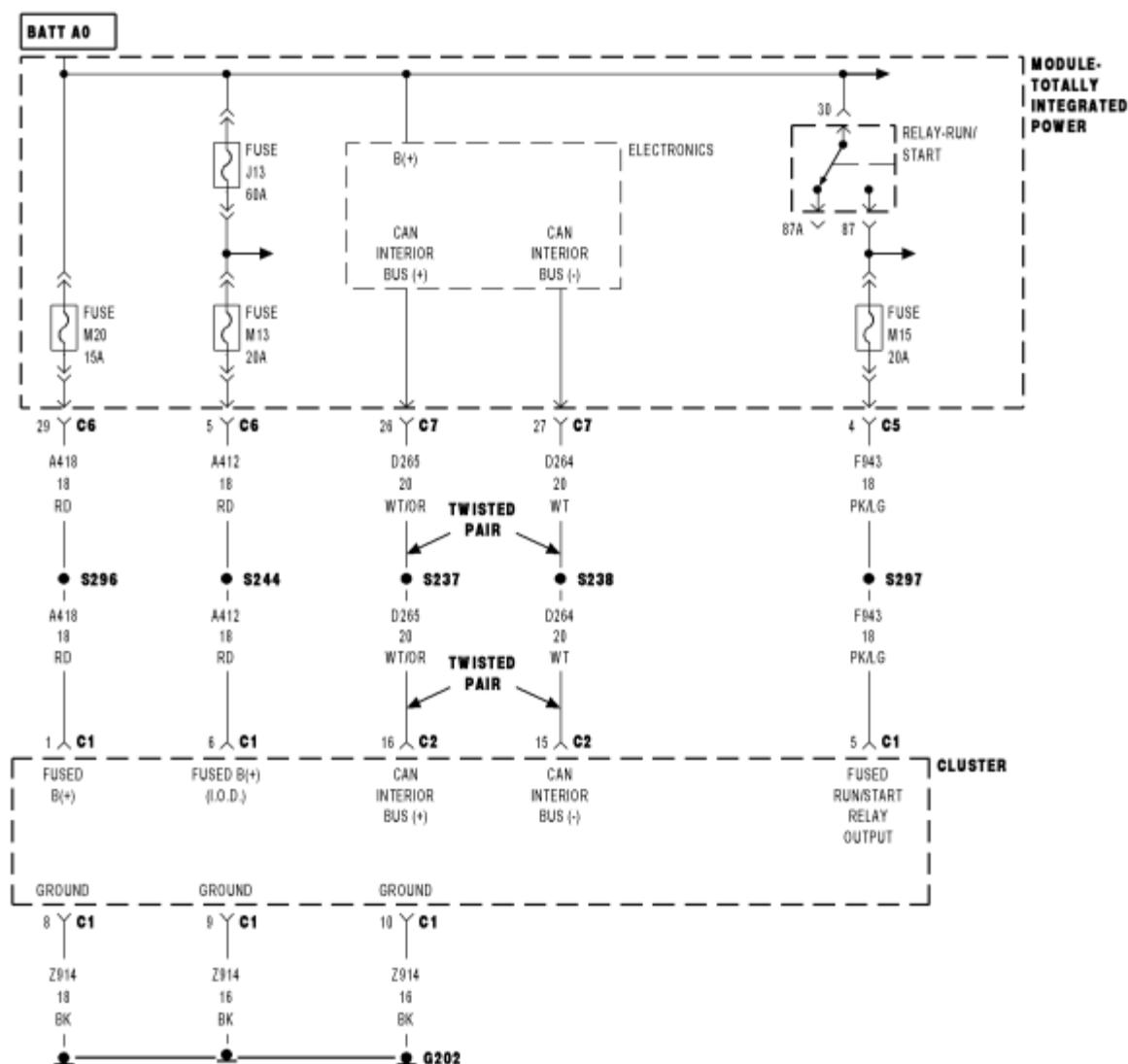
No

- Repair the (D64) CAN C Bus (-) circuit for an open.

- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM CCN
(CLUSTER)**





01007103

For a complete wiring diagram **Refer to Section 8W.**

(A418) (A412) FUSED B(+) CIRCUITS OPEN OR SHORTED
(Z914) GROUND CIRCUITS OPEN
(F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D264) AND (D265) CAN C INTERIOR BUS (125K) CIRCUITS OPEN
CLUSTER (CCN)

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A418) (A412) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Cluster C1, C2 and C3 harness connectors. Using a 12-volt test light connected to ground, check each (A418) and (A412) Fused B(+) circuit.

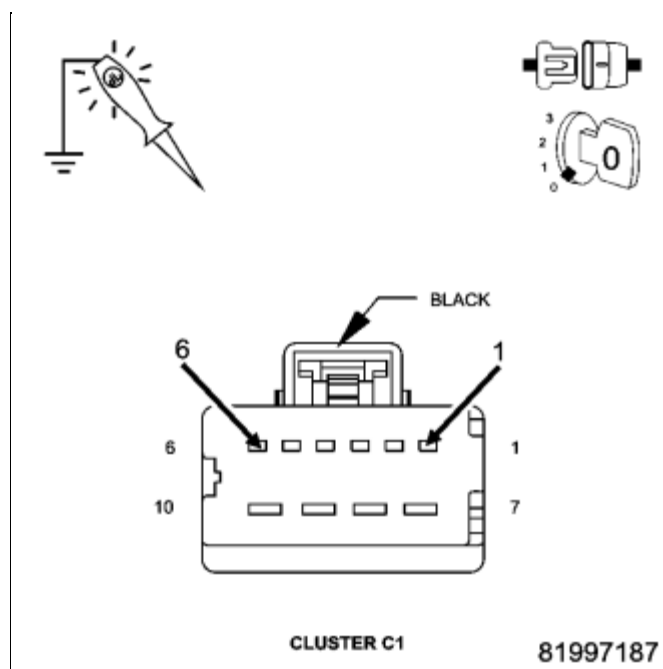
Does the test light illuminate brightly for each circuit?

Yes

- Go To [3](#)

No

- Repair the Fused B(+) circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (Z914) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z914) ground circuit.

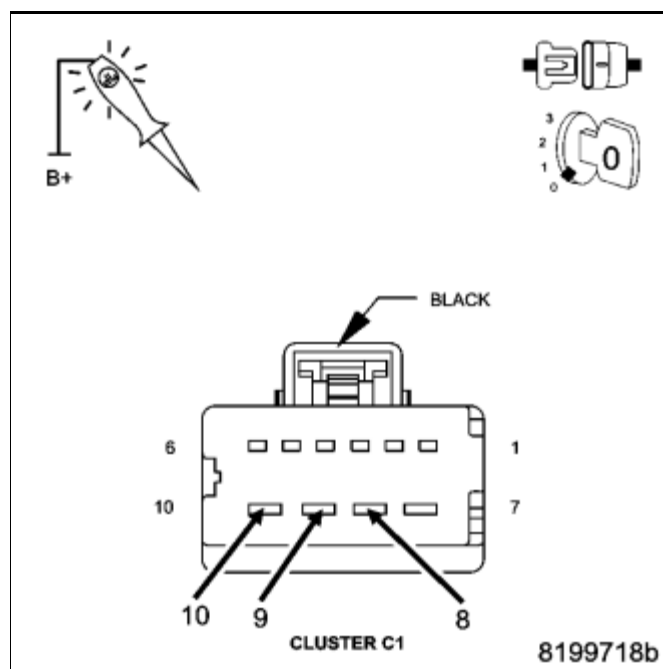
Does the test light illuminate brightly for each circuit?

Yes

- Go To [4](#)

No

- Repair the (Z914) ground circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



4. (F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F943) Fused Run/Start Relay Output circuit.

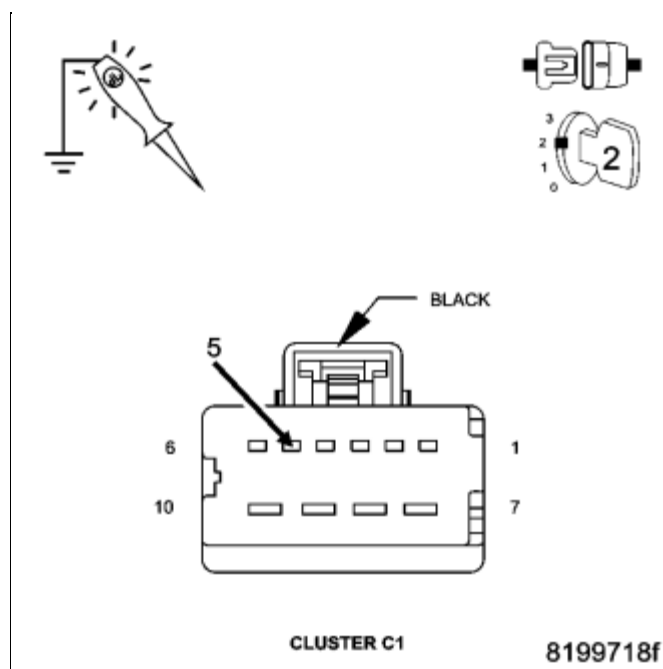
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F943) Fused Run/Start Relay Output circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



5. (D265) OR (D264) CAN C INTERIOR BUS (125K) CIRCUIT OPEN

Measure the resistance of the (D264) CAN C Interior Bus (-) (125K) circuit between the TIPM C7 harness connector and the Cluster C2 harness connector.

Measure the resistance of the (D265) CAN C Interior Bus (+) (125K) circuit between the TIPM C7 harness connector and the Cluster C2 harness connector.

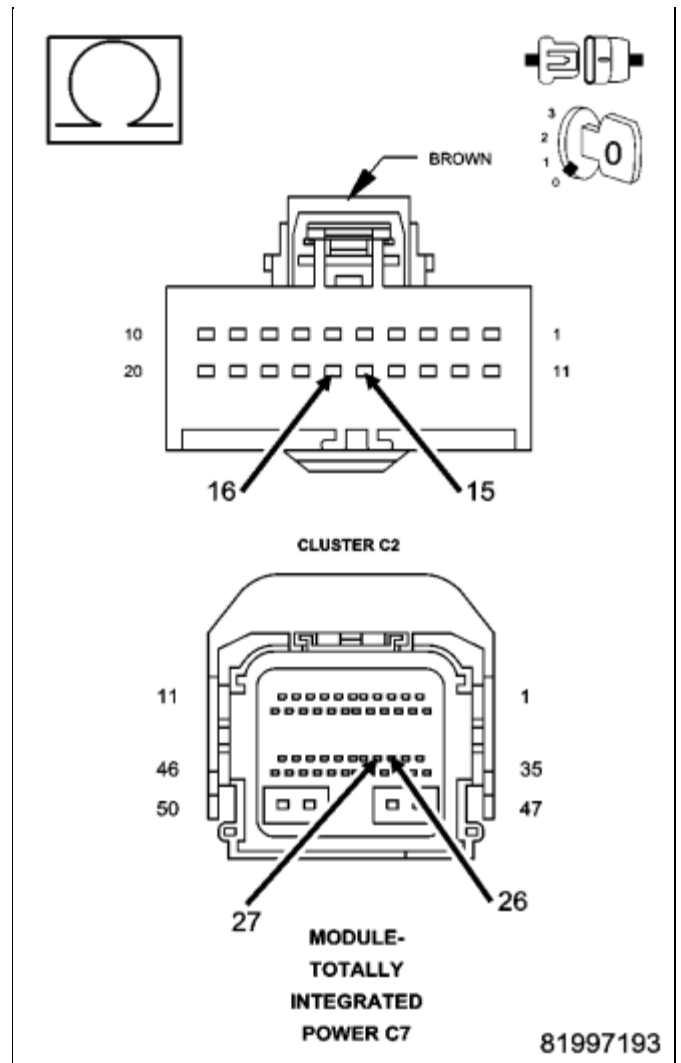
Is resistance below 5.0 ohms on both circuits?

Yes

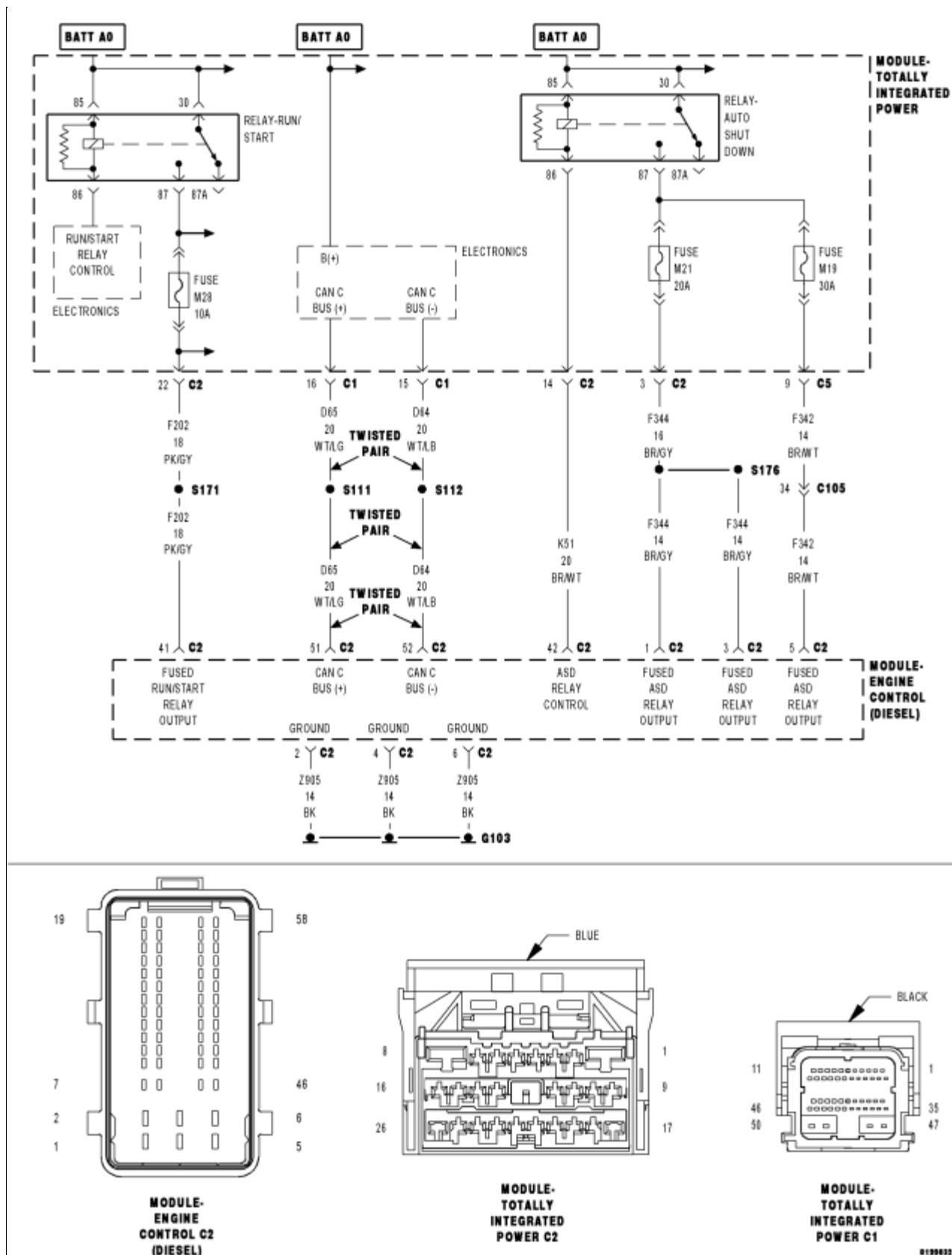
- Replace the Cluster in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D265) or (D264) CAN C Interior Bus (125K) circuit for an open. Inspect the connector for damage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



***NO RESPONSE FROM ECM
(ENGINE CONTROL MODULE) - DIESEL**



For a complete wiring diagram **Refer to Section 8W.**

Possible Causes

ENGINE CONTROL MODULE POWER AND GROUND
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
ENGINE CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the TIPM for any active CAN C hardware and any ignition related DTCs, perform DTCs before proceeding.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. CHECK ECM POWER AND GROUND

Check the ECM power and ground circuits. Refer to 9 - ENGINE ELECTRICAL DIAGNOSTICS - DIESEL for

the diagnostic test procedure.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM VERIFICATION TEST.

No

- Go To [3](#)

3. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Disconnect the ECM C2 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM connector and the ECM connector.

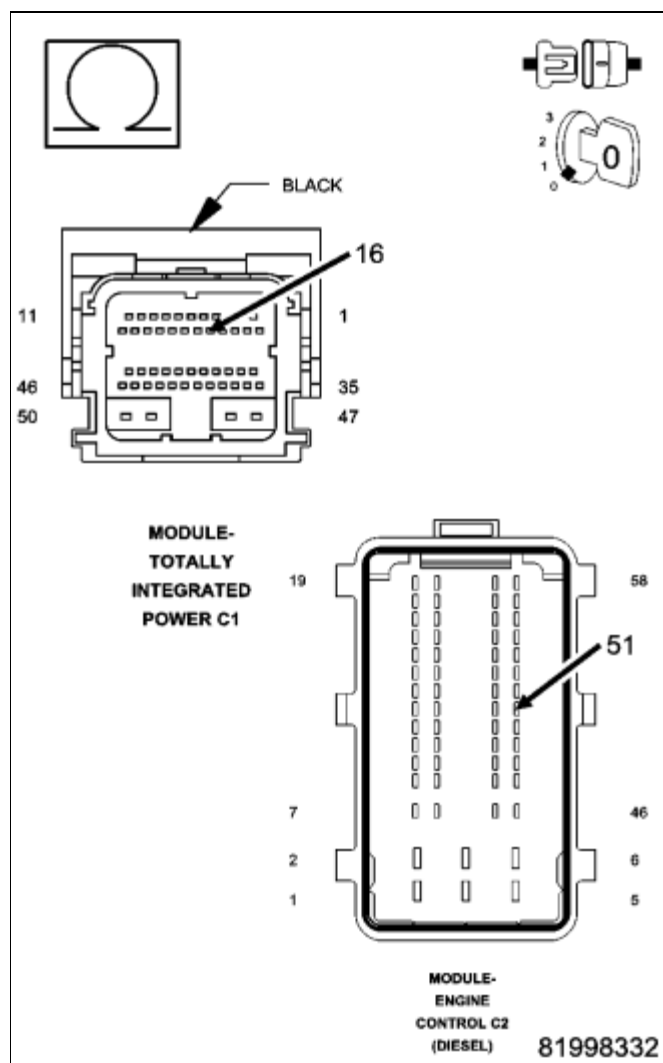
Is resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the ECM VERIFICATION TEST.



4. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM connector and the ECM connector.

Is resistance below 5.0 ohms?

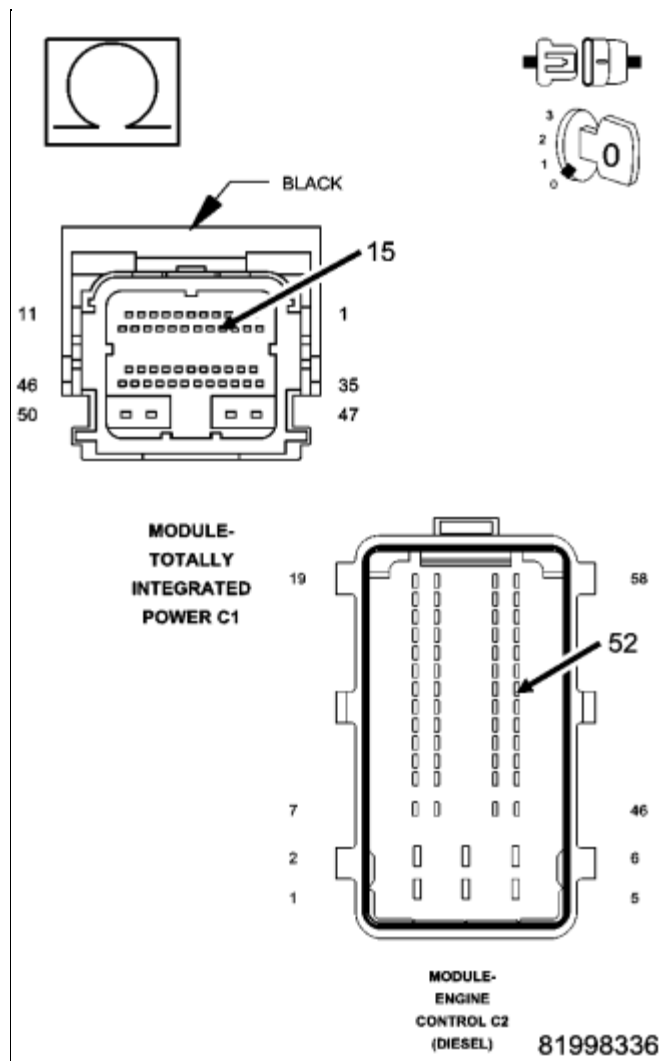
Yes

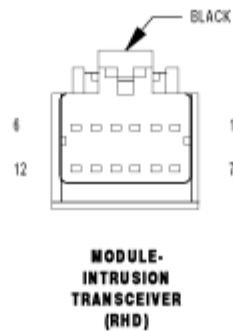
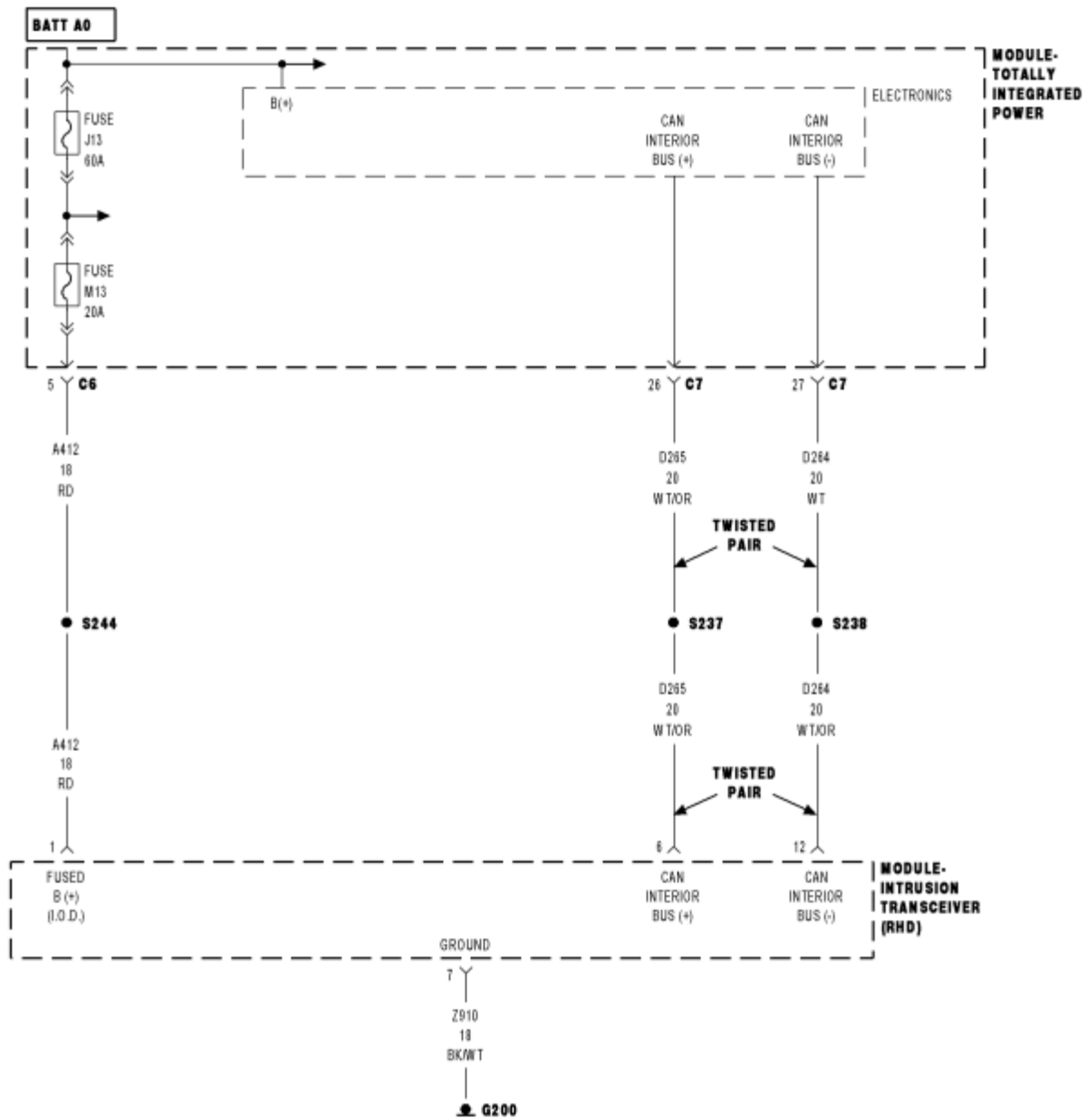
- Replace and program the Engine Control Module in accordance with the service information.
- Perform the ECM VERIFICATION TEST.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the ECM VERIFICATION TEST.

***NO RESPONSE FROM ITM
(INTRUSION TRANSCIEVER
MODULE)**





01990304

For a complete wiring diagram **Refer to Section 8W.**

(A412) FUSED B (+) (I.O.D.) CIRCUIT OPEN OR SHORTED
(Z910) GROUND CIRCUIT OPEN
(D264) AND (D265) CAN C INTERIOR BUS (125K) CIRCUITS OPEN
INTRUSION TRANSCIEVER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A412) FUSED B(+) (I.O.D.) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Intrusion Transceiver Module harness connector.

Using a 12-volt test light connected to ground, check the (A412) Fused B(+) (I.O.D.) circuit.

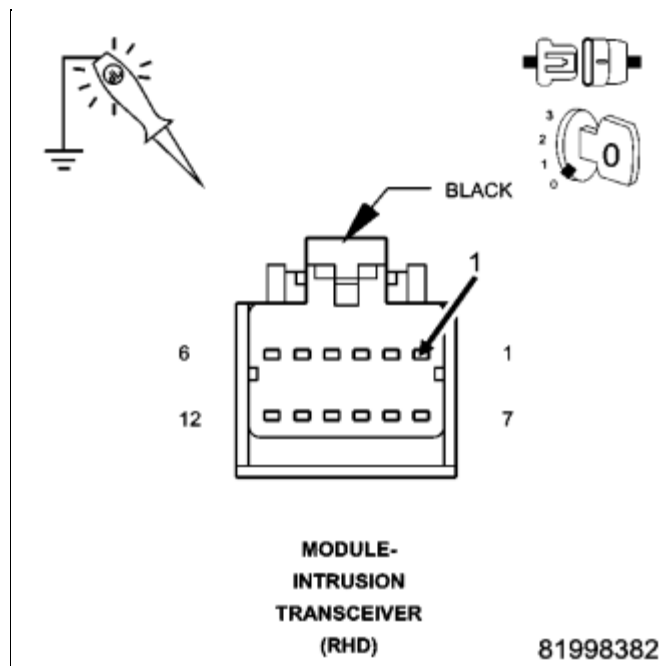
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A412) Fused B(+) (I.O.D.) circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (Z910) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z910) ground circuit.

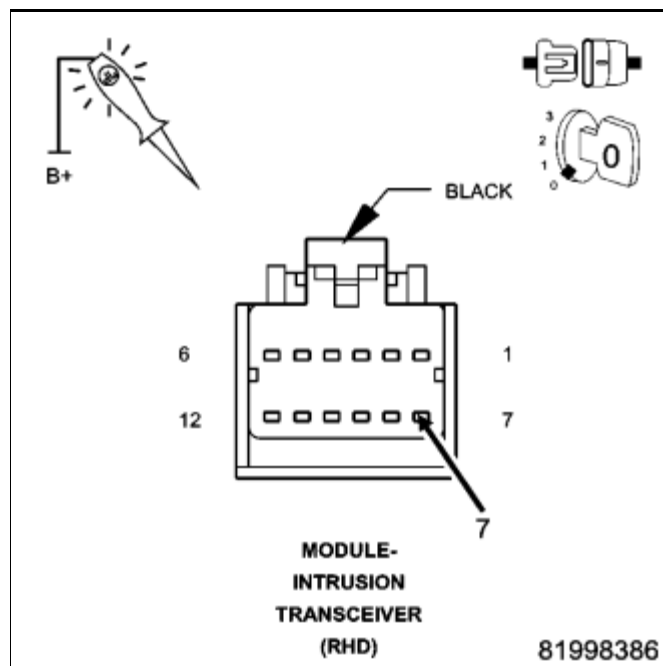
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z910) ground circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



4. (D265) OR (D264) CAN C INTERIOR BUS (125K) CIRCUIT OPEN

Measure the resistance of the (D264) CAN C Interior Bus (-)

(125K) circuit between the TIPM C7 harness connector and the Intrusion Transceiver Module harness connector.
 Measure the resistance of the (D265) CAN C Interior Bus (+) (125K) circuit between the TIPM C7 harness connector and the Intrusion Transceiver Module harness connector.

Is resistance below 5.0 ohms on both circuits?

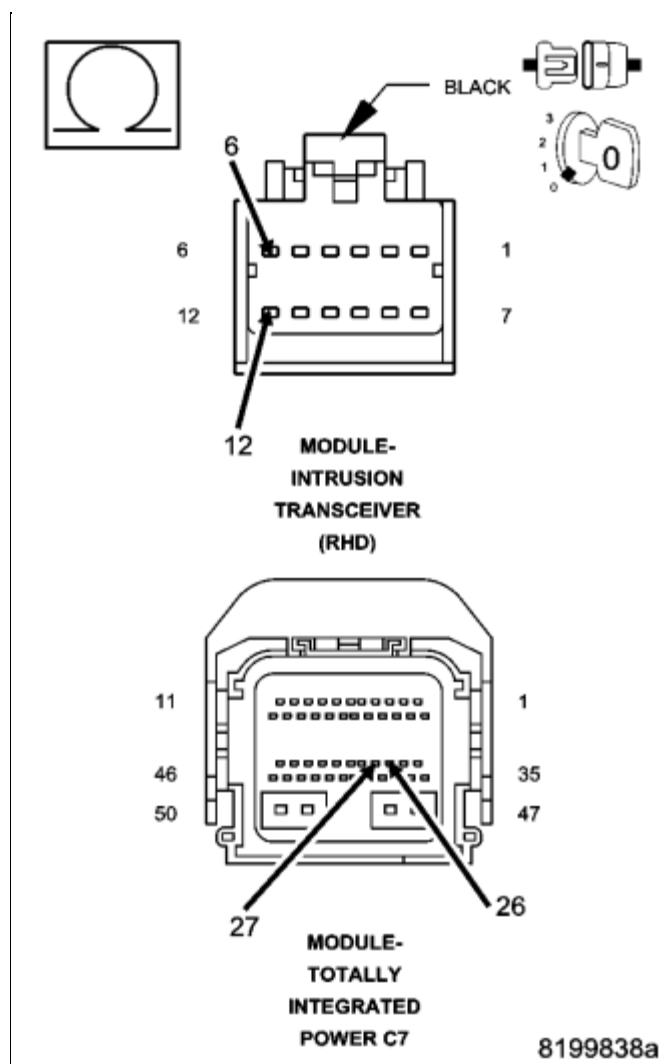
Yes

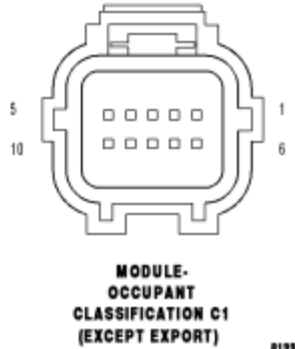
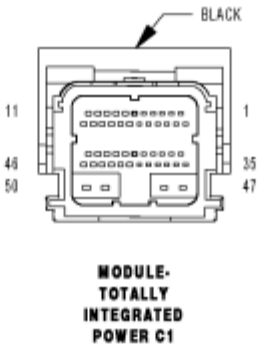
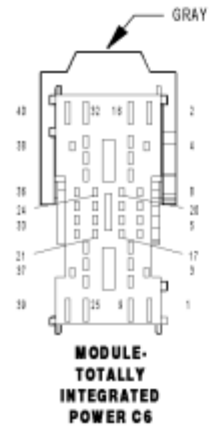
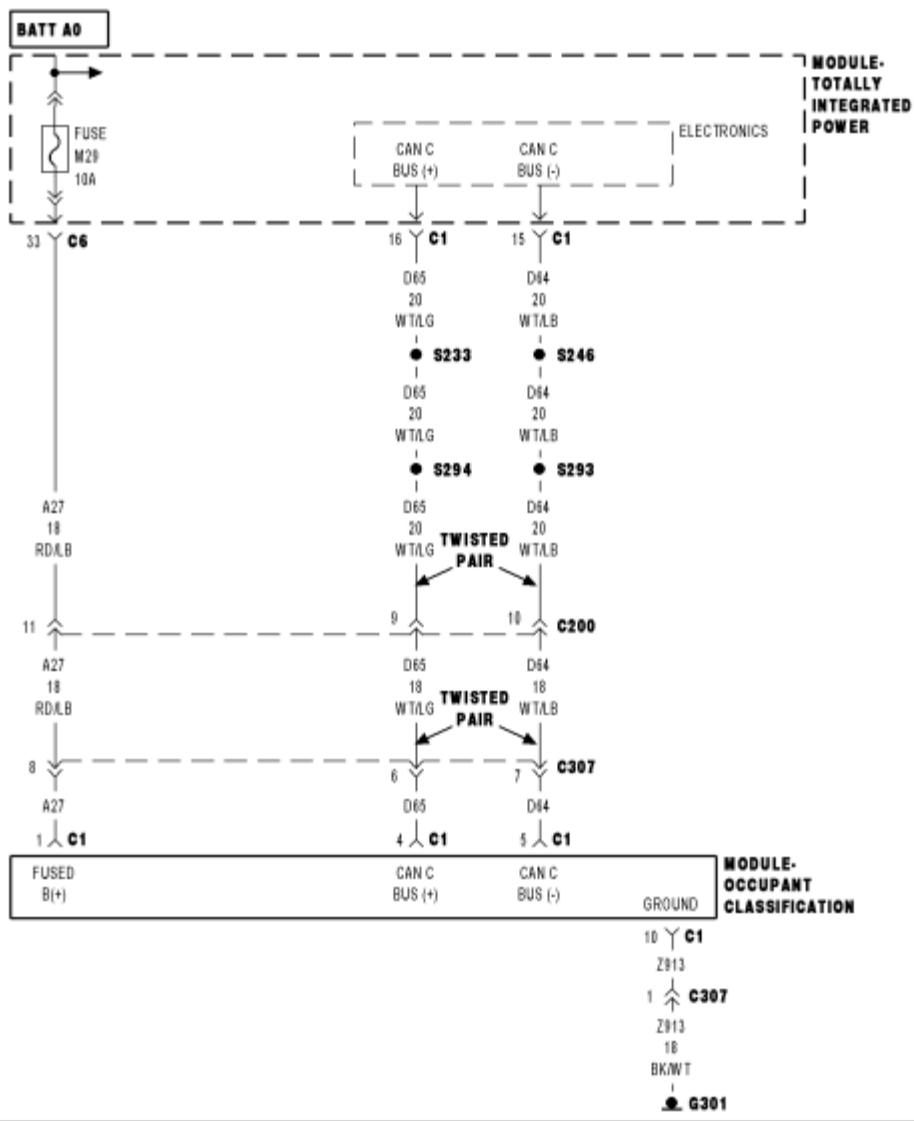
- Replace the Intrusion Transceiver Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D265) or (D264) CAN C Interior Bus (125K) circuit for an open. Inspect the connector for damage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM OCM
 (OCCUPANT CLASSIFICATION MODULE)**





01934649

For a complete wiring diagram Refer to Section 8W.

Possible Causes

(Z913) GROUND CIRCUIT OPEN
(A27) FUSED B+ CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
OCCUPANT CLASSIFICATION MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (Z913) GROUND CIRCUIT OPEN

Disconnect the Occupant Restraint Controller Module

harness connectors.

Using a 12-volt test light connected to 12-volts, check the (Z913) ground circuit.

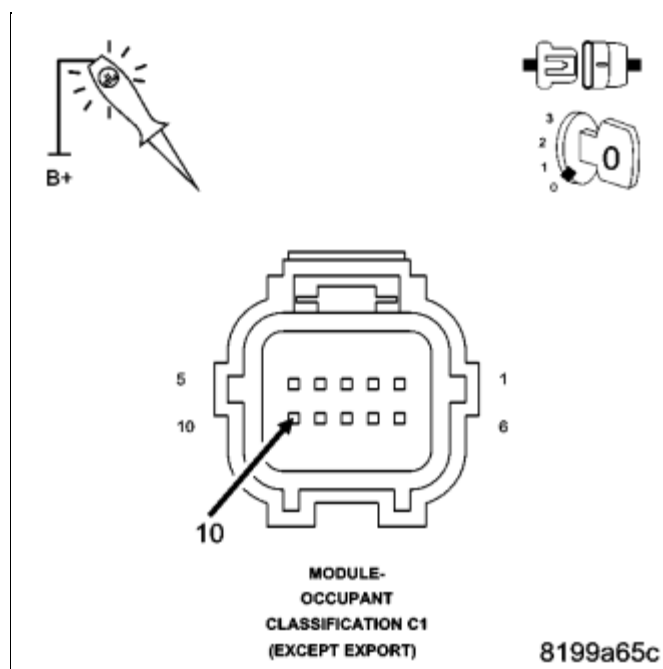
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (Z913) ground circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.



3. (A27) FUSED B+ CIRCUIT OPEN OR SHORTED

Using a 12-volt test light connected to ground, check the (A27) Fused B+ circuit.

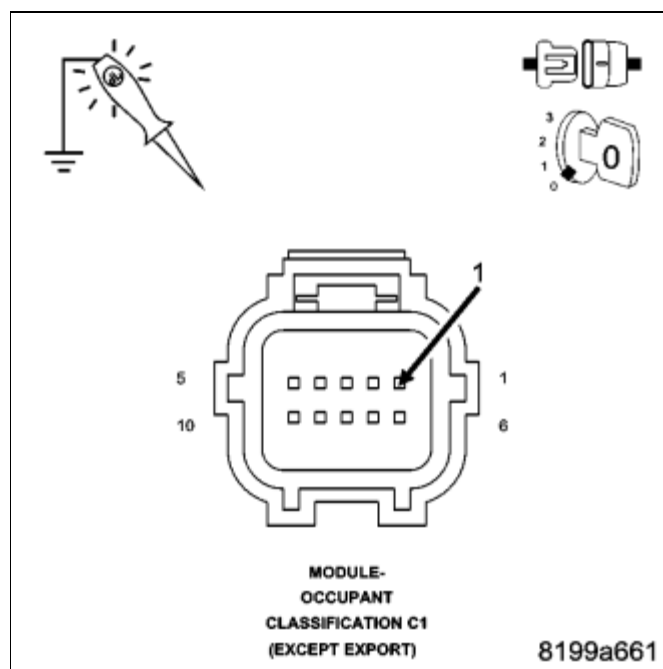
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (A27) Fused B+ circuit for an open or short.
- Perform the AIRBAG VERIFICATION TEST - VER 1.



4. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Occupant

Classification Module connector.

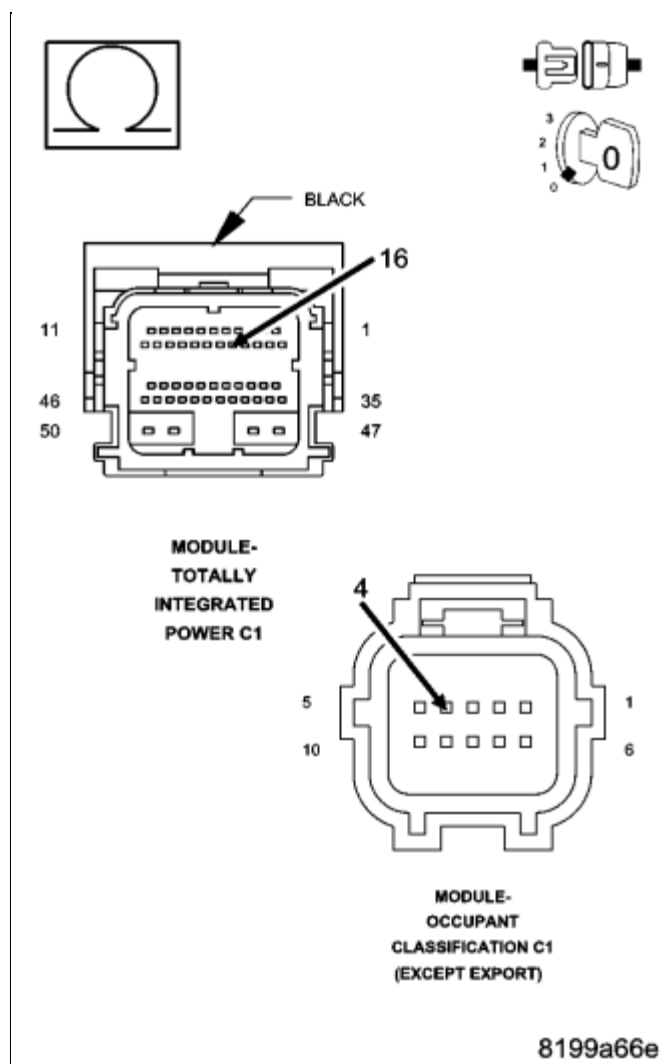
Is resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.



5. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Occupant Classification Module connector.

Is resistance below 5.0 ohms?

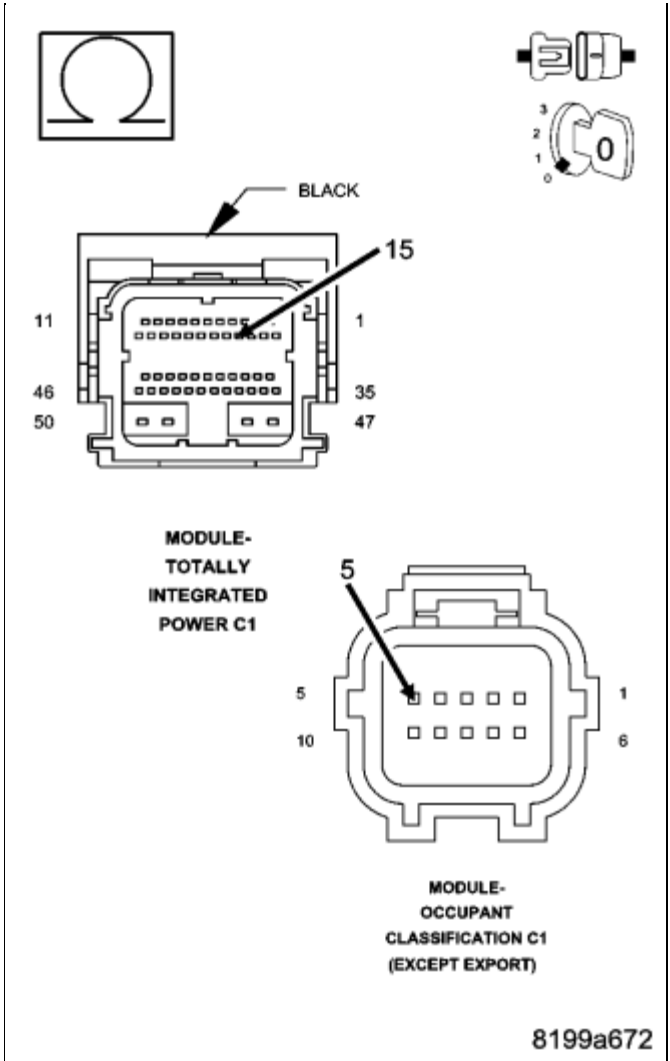
Yes

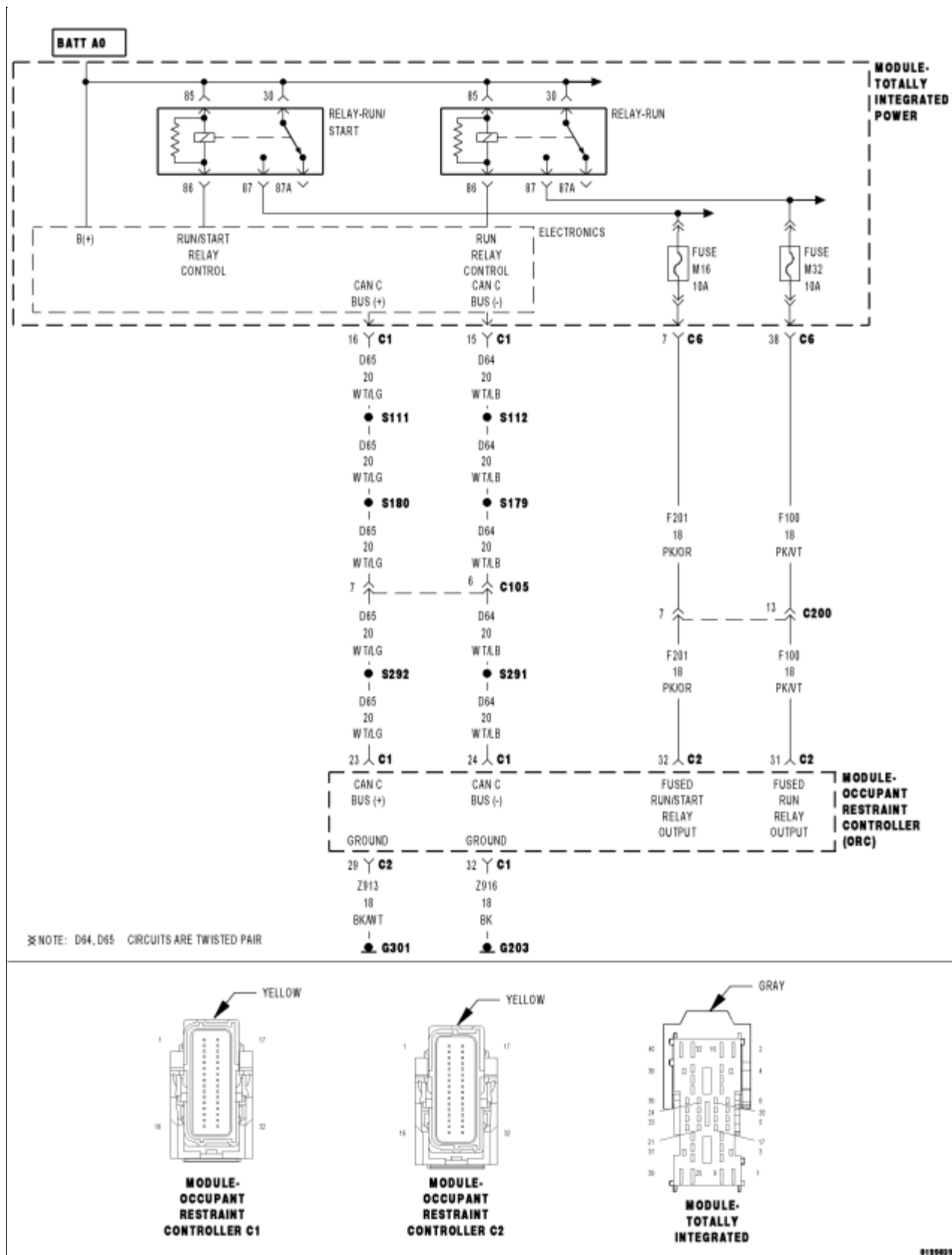
- Replace the Occupant Classification Module in accordance with the service information.
- Perform the AIRBAG VERIFICATION TEST - VER 1.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.

***NO RESPONSE FROM ORC
(OCCUPANT RESTRAINT
CONTROLLER)**





For a complete wiring diagram **Refer to Section 8W.**

(Z913) (Z916) GROUND CIRCUITS OPEN
(F100) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(F201) FUSED RUN/START RELAY OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROLLER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (Z913) (Z916) GROUND CIRCUITS OPEN

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Occupant Restraint Controller Module harness connectors.

Connect the appropriate Load Tool ACM Adaptor to the ORC connectors.

Measure the resistance between ground and the (Z913) and (Z916) ground circuits.

Is the resistance below 10k ohms?

Yes

- Go To [3](#)

No

- Repair the (Z913) or (Z916) ground circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.

3. (F100) FUSED RUN RELAY OUTPUT CIRCUIT OPEN OR SHORTED

NOTE: Check the TIPM for any ignition related DTCs before proceeding. If set (Refer to 8 - ELECTRICAL/IGNITION CONTROL - DIAGNOSIS AND TESTING).

WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.

Using a 12-volt test light connected to ground, check the (F100) Fused Run Relay Output circuit.

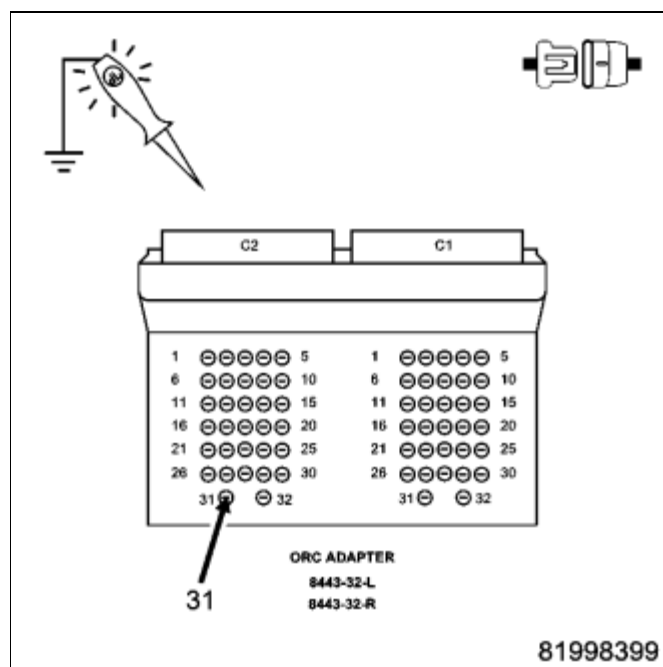
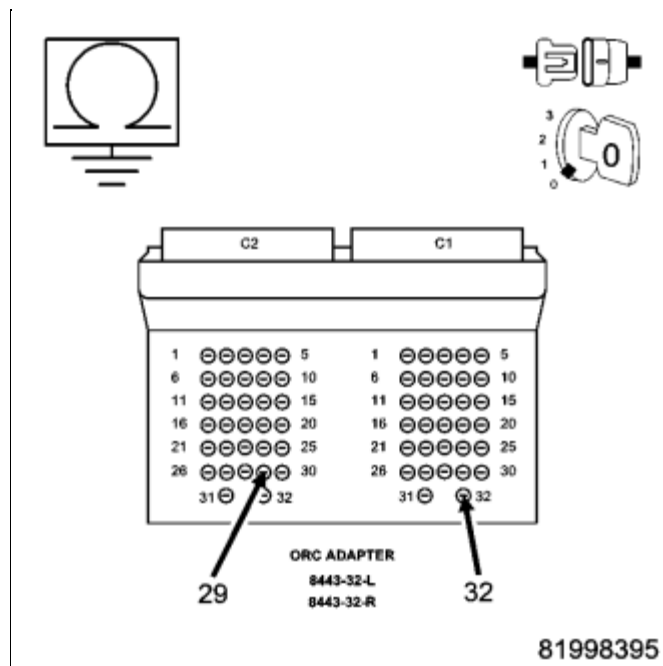
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (F100) Fused Run Relay Output circuit for an open or short.



- Perform the AIRBAG VERIFICATION TEST - VER 1.

4. (F201) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Using a 12-volt test light connected to ground, check the (F201) Fused Run/Start Relay Output circuit.

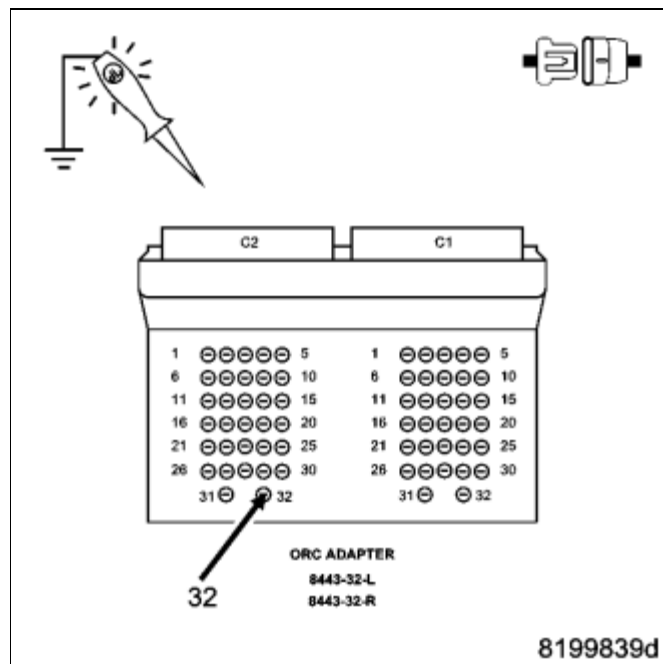
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F201) Fused Run/Start Relay Output circuit for an open or short.
- Perform the AIRBAG VERIFICATION TEST - VER 1.



5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Occupant Restraint Controller Module connector.

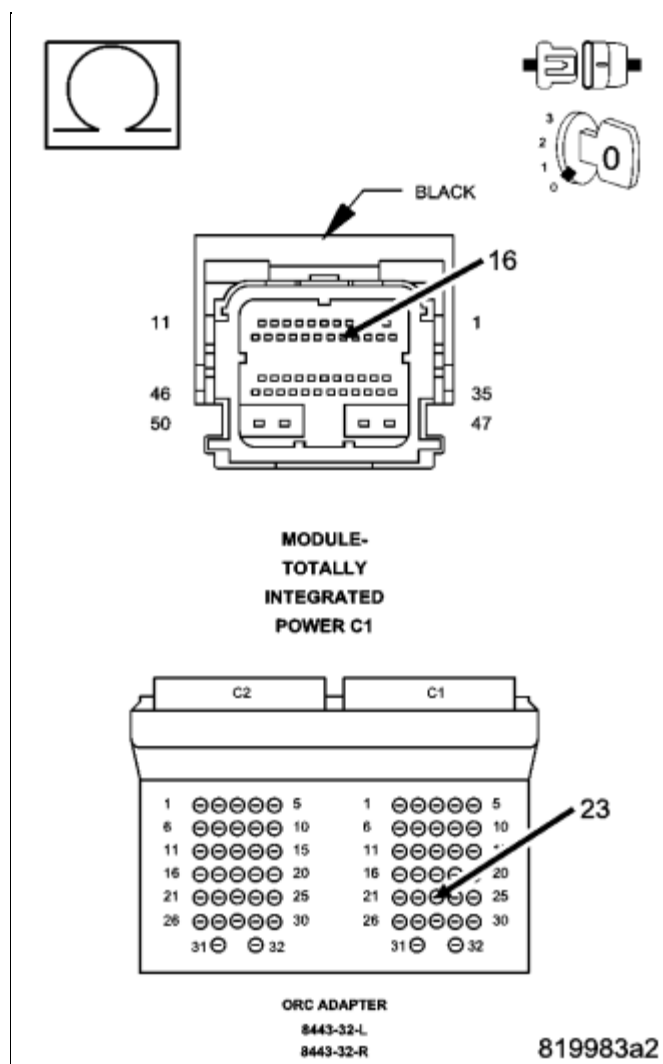
Is resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.



6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Occupant Restraint Controller Module connector.

Is resistance below 5.0 ohms?

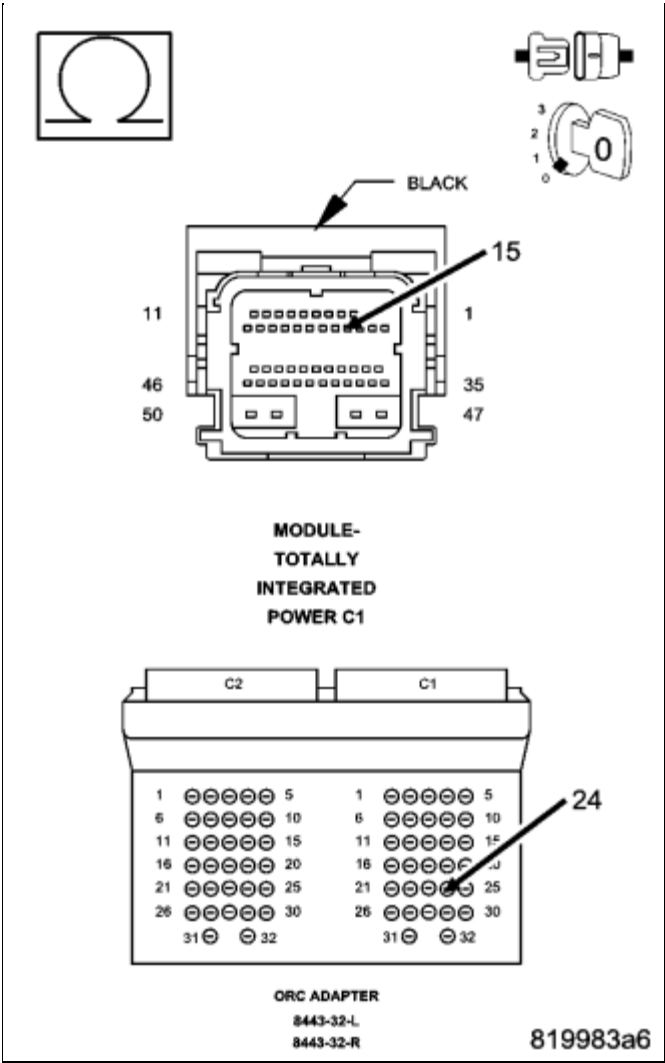
Yes

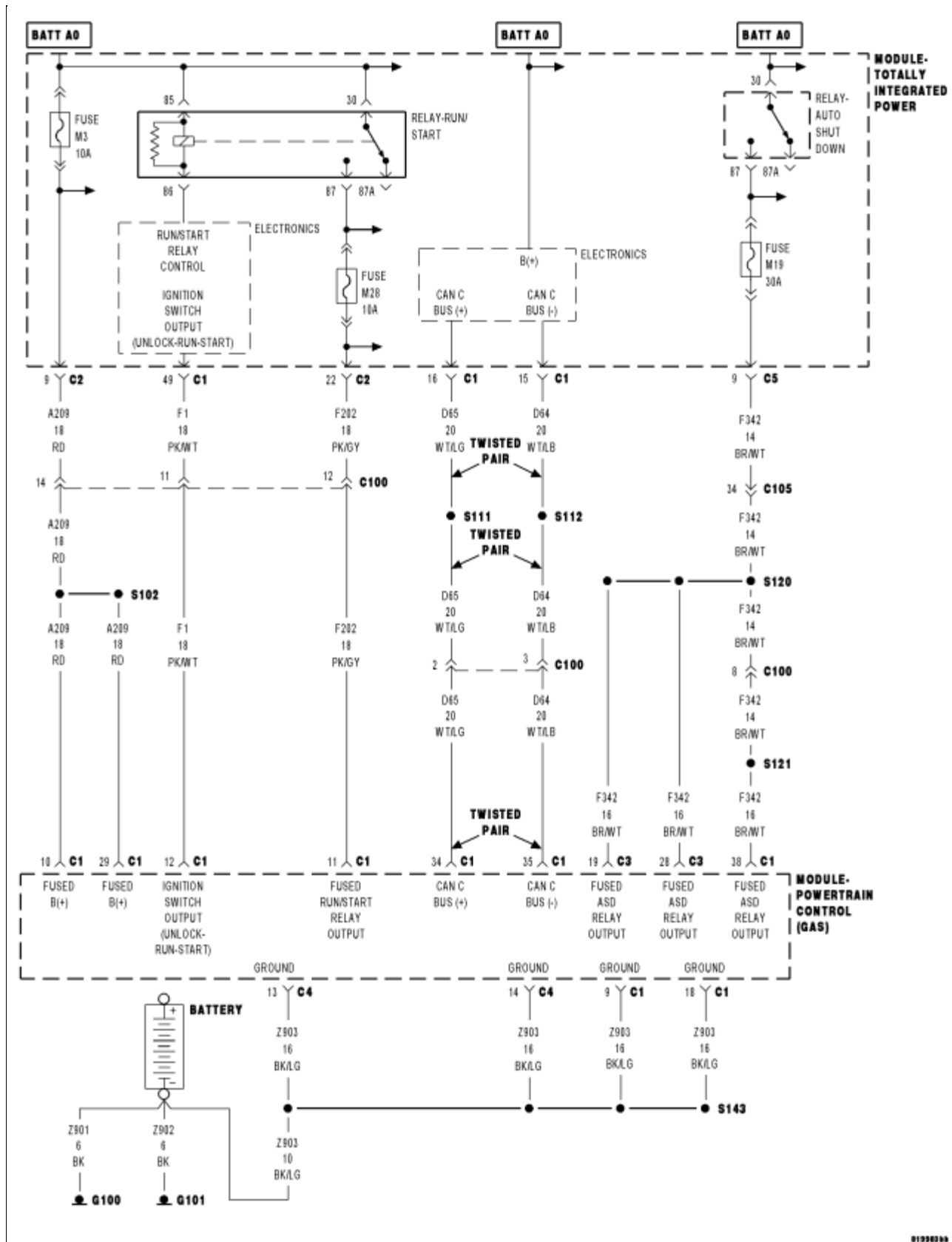
- Replace the Occupant Restraint Controller Module in accordance with the service information.
- Perform the AIRBAG VERIFICATION TEST - VER 1.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the AIRBAG VERIFICATION TEST - VER 1.

***NO RESPONSE FROM PCM
(POWERTRAIN CONTROL
MODULE) (NGC)**





For a complete wiring diagram **Refer to Section 8W.**

(A209) FUSED B(+) CIRCUITS OPEN OR SHORTED
(Z903) GROUND CIRCUITS OPEN
(F202) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(F1) FUSED IGNITION SWITCH OUTPUT (UNLOCK/RUN/START) CIRCUIT OPEN OR SHORTED
(F342) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the TIPM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness

connectors for broken, bent, pushed out, and corroded terminals.

2. (A209) FUSED B(+) CIRCUITS OPEN OR SHORTED

Turn the ignition off.

Disconnect the PCM C1 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check the (A209) Fused B(+) circuit.

Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A209) Fused B(+) circuit for an open or short.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

3. (Z903) GROUND CIRCUITS OPEN

Using a 12-volt test light connected to 12-volts, check each (Z903) ground circuits.

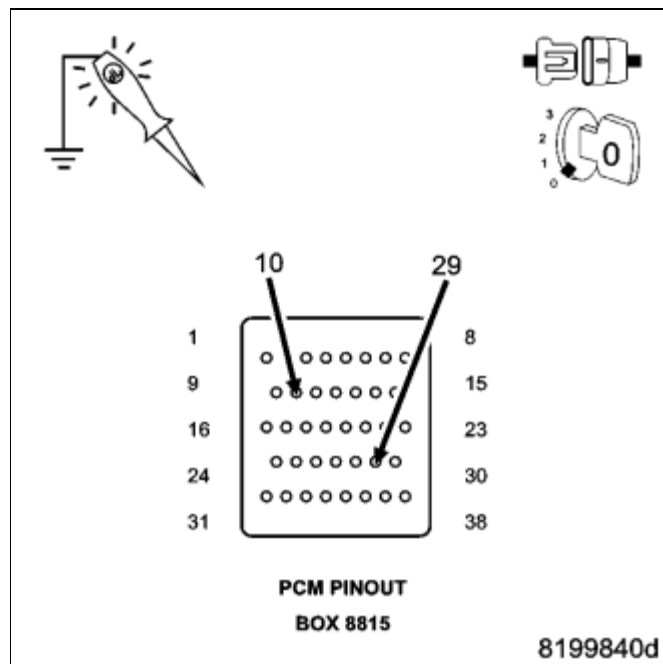
Does the test light illuminate brightly for each circuit?

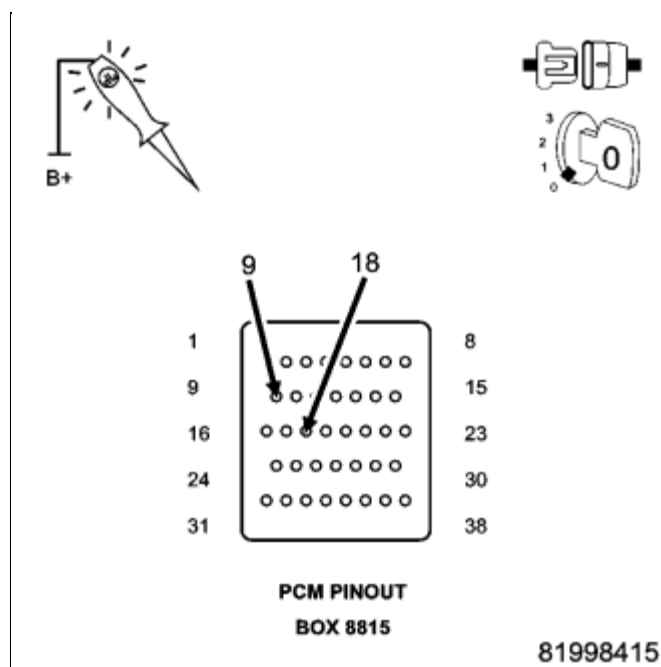
Yes

- Go To [4](#)

No

- Repair the ground circuit for an open.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.





4. (F202) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F202) Fused Run/Start Relay Output circuit.

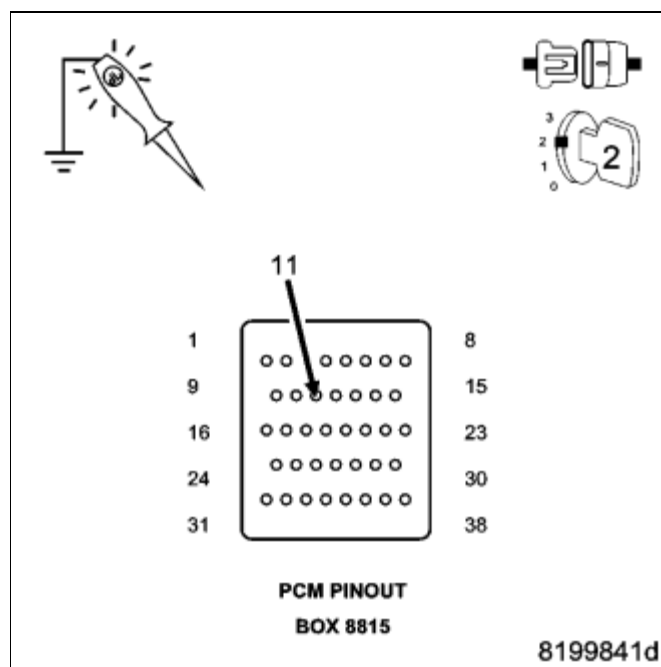
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F202) Fused Run/Start Relay Output circuit for an open or short.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



5. (F1) FUSED IGNITION SWITCH OUTPUT (UNLOCK/RUN/START) CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F1) Fused Ignition Switch Output (Unlock/Run/Start)

circuit.

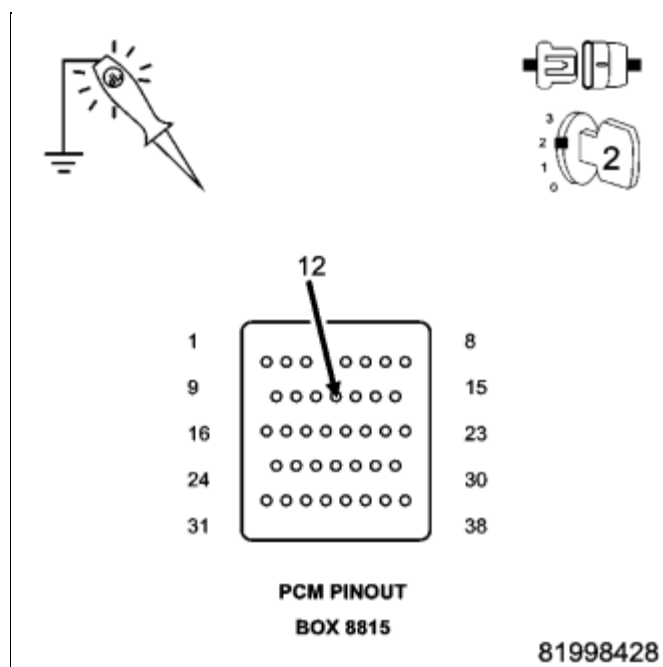
Does the test light illuminate brightly?

Yes

- Go To [6](#)

No

- Repair the (F1) Fused Ignition Switch Output (Unlock/Run/Start) circuit for an open or short.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



6. (F342) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F342) Fused ASD Relay Output circuit.

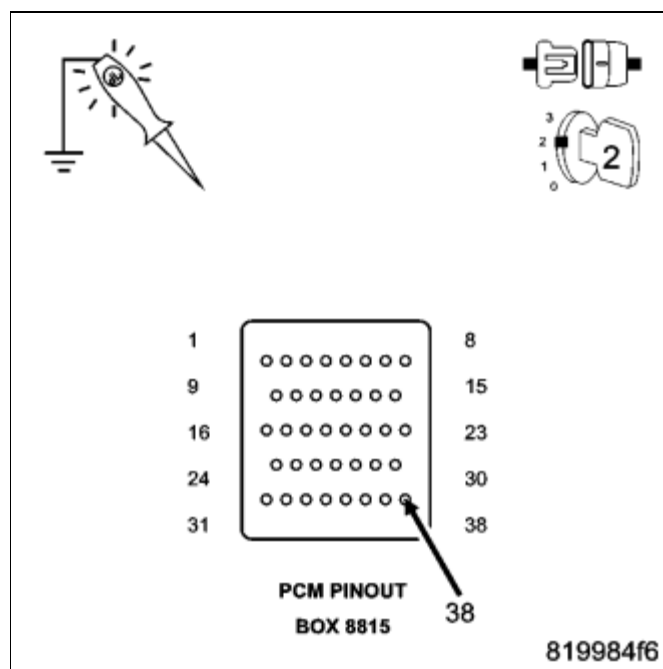
Does the test light illuminate brightly?

Yes

- Go To [7](#)

No

- Repair the (F342) Fused ASD Relay Output circuit for an open or short.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



7. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM connector and the appropriate terminal of

the special tool #8815.

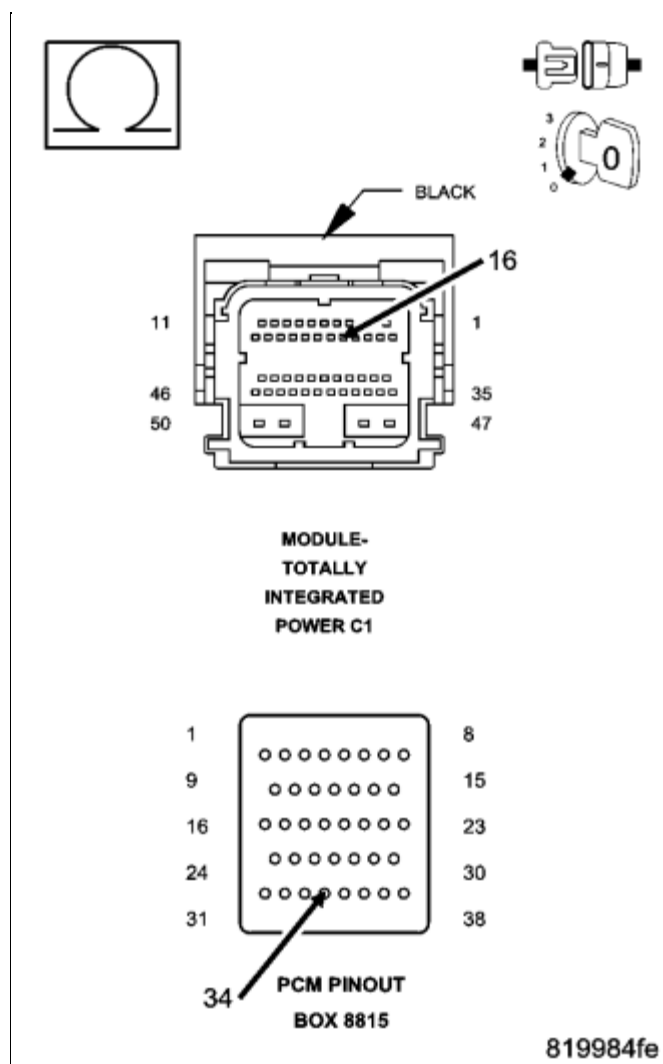
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



8. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM connector and the appropriate terminal of the special tool #8815.

Is the resistance below 5.0 ohms?

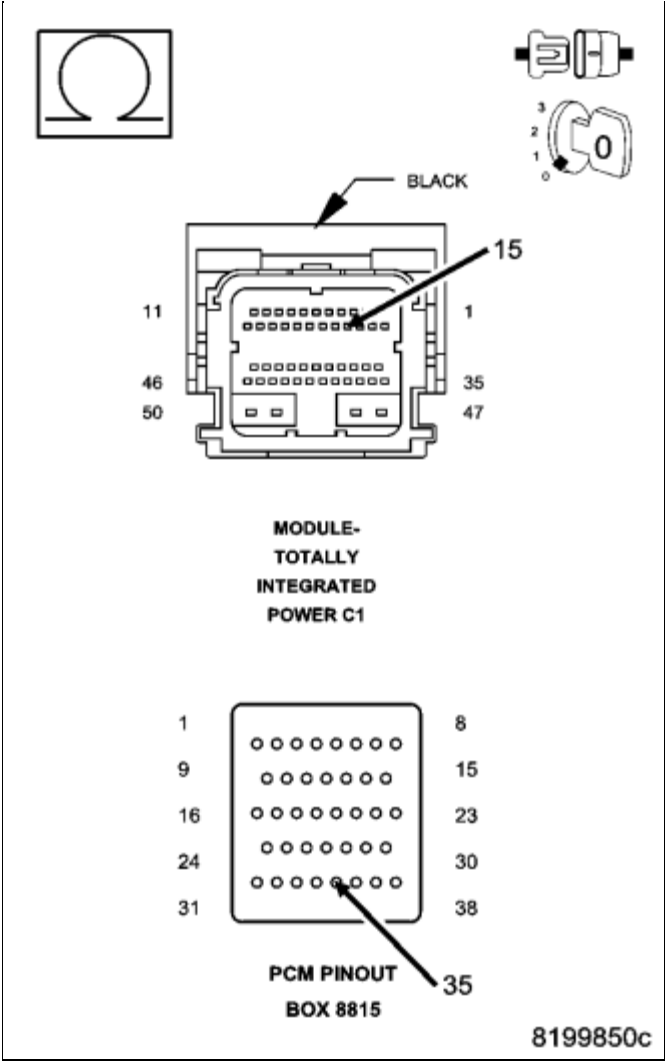
Yes

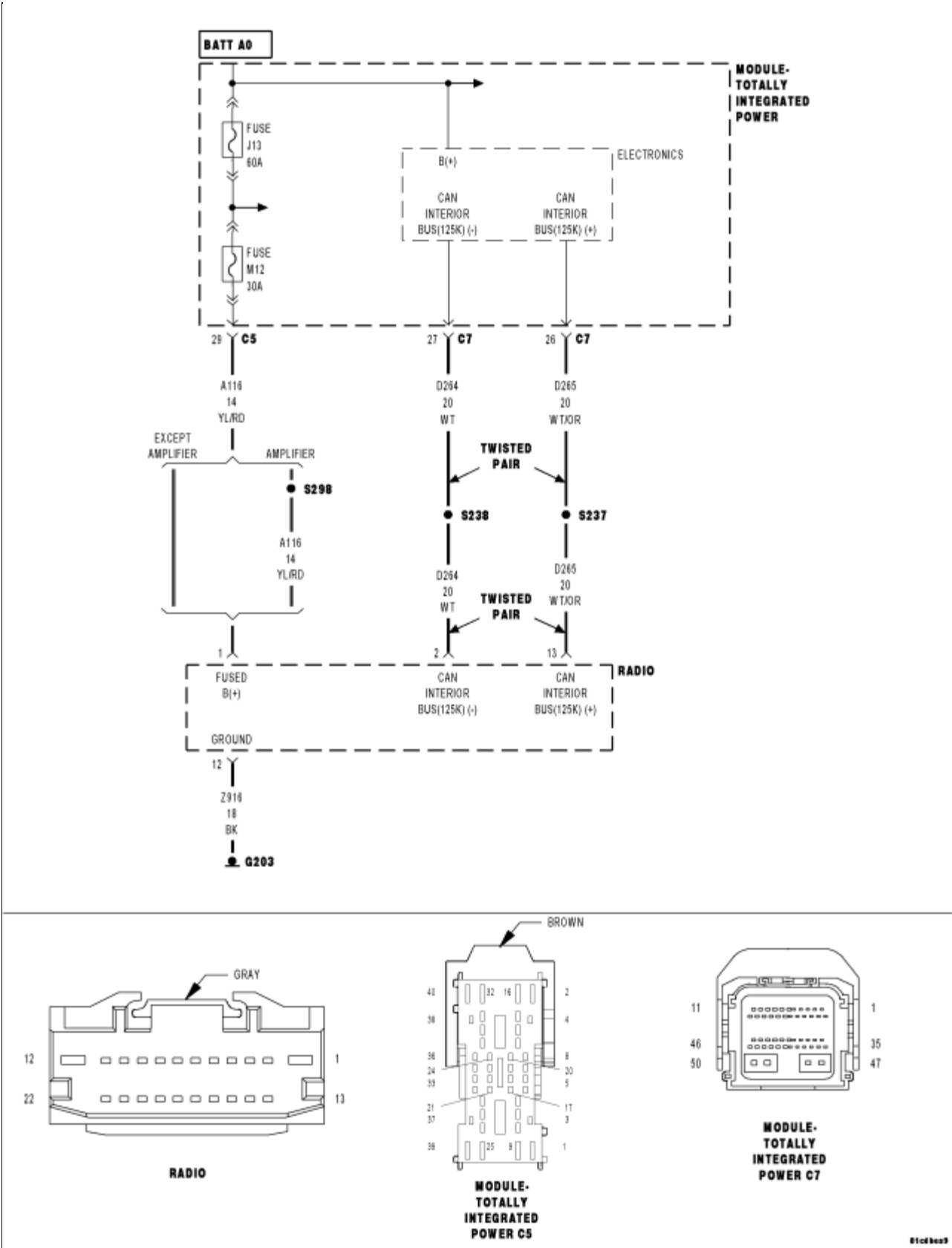
- Replace and program the Powertrain Control Module in accordance with the service information.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

***NO RESPONSE FROM RADIO**





For a complete wiring diagram **Refer to Section 8W.**

Possible Causes

(A116) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z916) GROUND CIRCUIT OPEN
(D265) AND (D264) CAN C INTERIOR BUS (125K) CIRCUITS OPEN
RADIO

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A116) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Radio harness connector.

Using a 12-volt test light connected to ground, check the

(A116) Fused B(+) circuit.

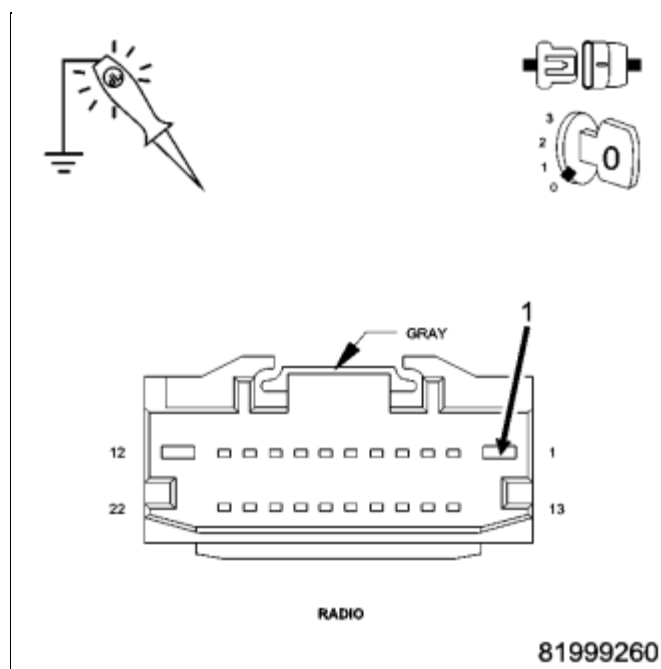
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A116) Fused B(+) circuit for an open or short.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. (Z916) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z916) ground circuit.

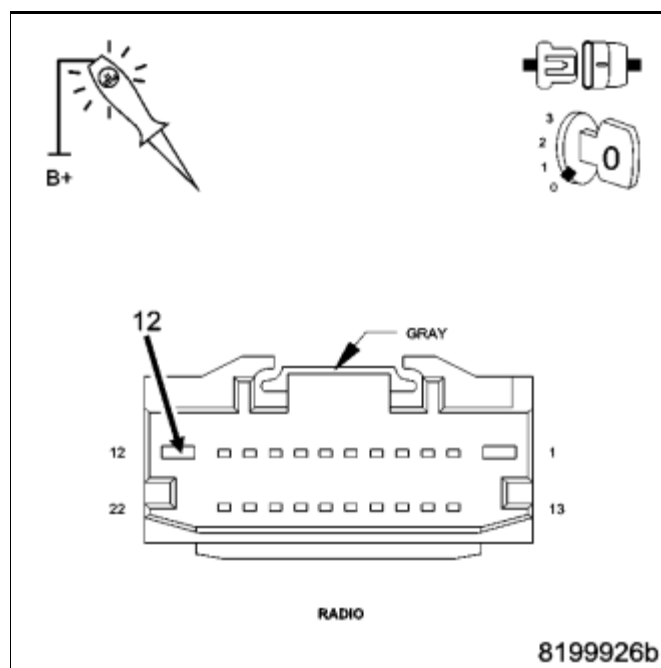
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z916) ground circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



4. (D265) OR (D264) CAN C INTERIOR BUS (125K) CIRCUIT OPEN

Measure the resistance of the (D264) CAN C Interior Bus (-) (125K) circuit between the TIPM C7 harness connector and

the Radio harness connector.

Measure the resistance of the (D265) CAN C Interior Bus (+) (125K) circuit between the TIPM C7 harness connector and the Radio harness connector.

Is resistance below 5.0 ohms on both circuits?

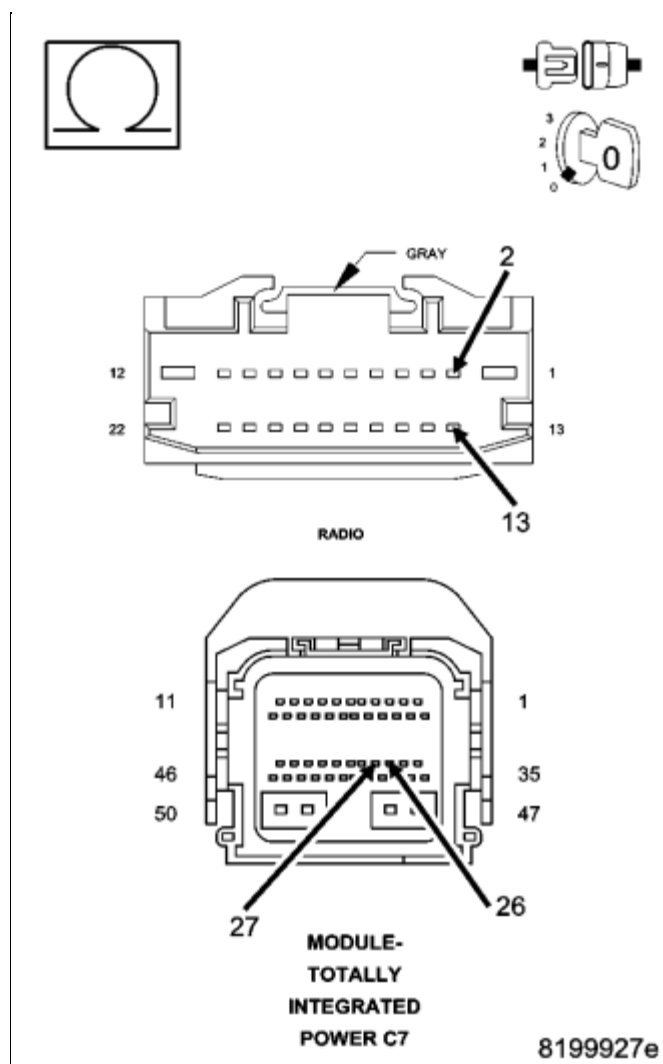
Yes

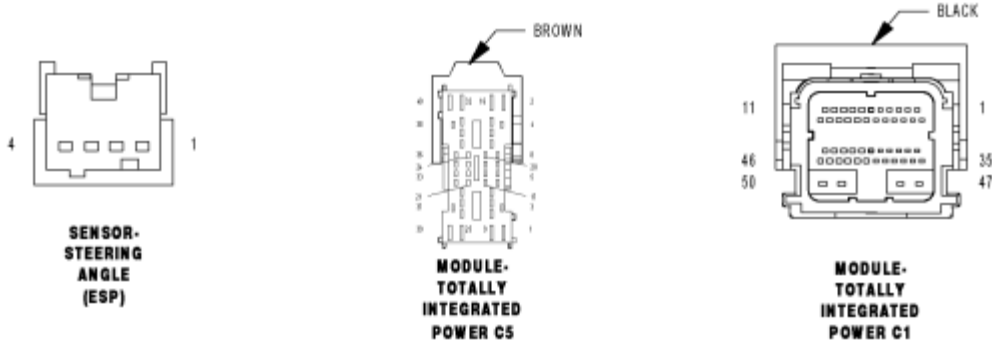
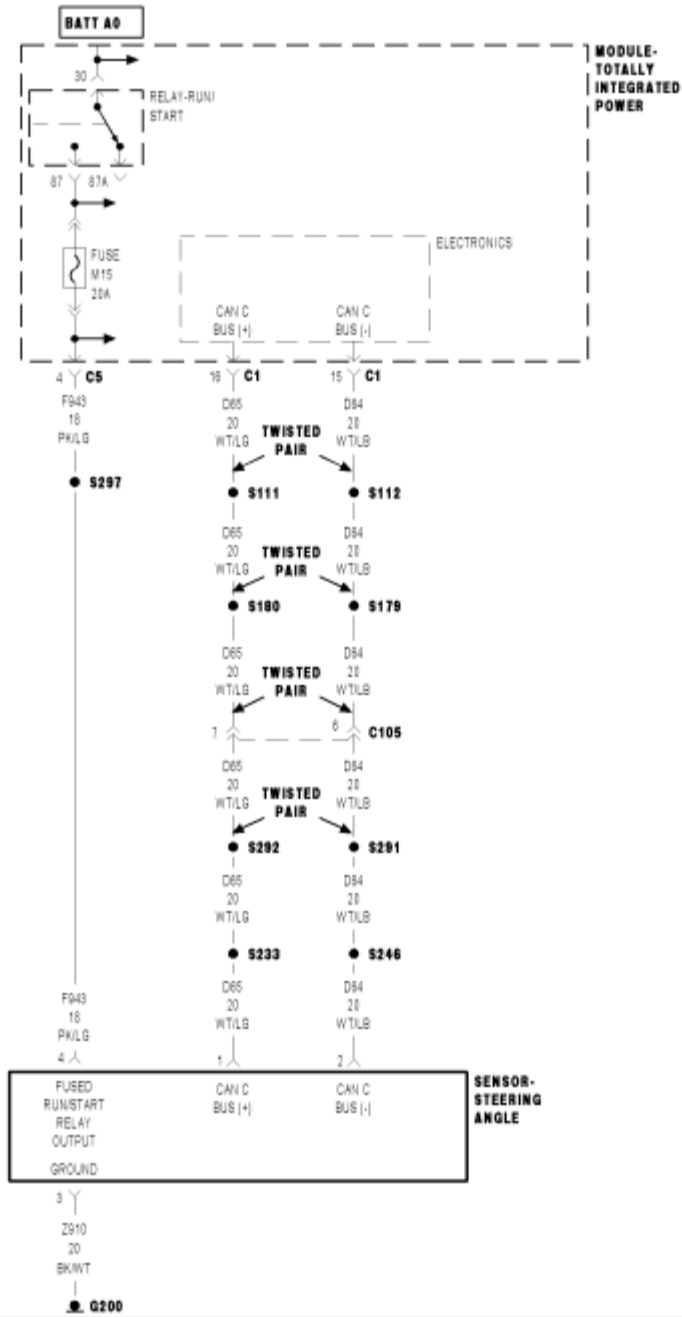
- Replace the Radio in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (D265) or (D264) CAN C Interior Bus (125K) circuit for an open. Inspect the connector for damage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM THE STEERING ANGLE SENSOR (SAS)**





(F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(Z910) GROUND CIRCUIT OPEN
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
STEERING ANGLE SENSOR

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

NOTE: Check for any TSB(s) related to the condition. If a TSB applies, perform the procedure outlined in the TSB before continuing.

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the sensor?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition off.
 Disconnect the Steering Angle Sensor harness connector.
 Turn the ignition on.
 Using a 12-volt test light connected to ground, check the (F943) Fused Run/Start Relay Output circuit.

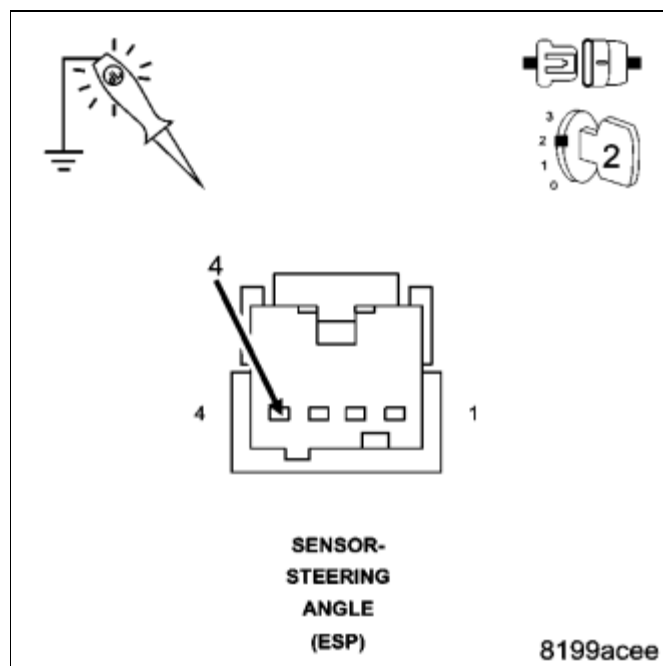
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (F943) Fused Run/Start Relay Output circuit for an open or short.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (Z910) GROUND CIRCUIT OPEN

Turn the ignition off.
 Using a 12-volt test light connected to 12-volts, check the (Z910) ground circuit.

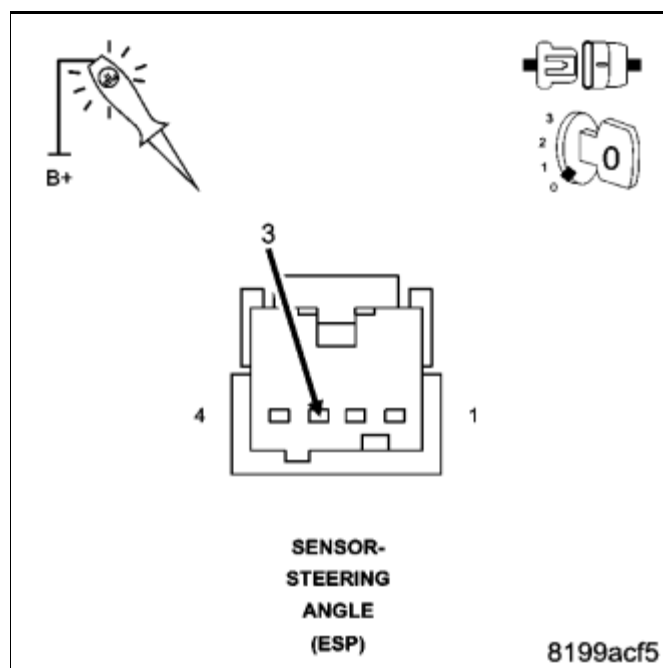
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z910) ground circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. (D65) CAN C BUS (+) CIRCUIT OPEN

Disconnect the TIPM C1 harness connector.
Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Steering Angle Sensor connector.

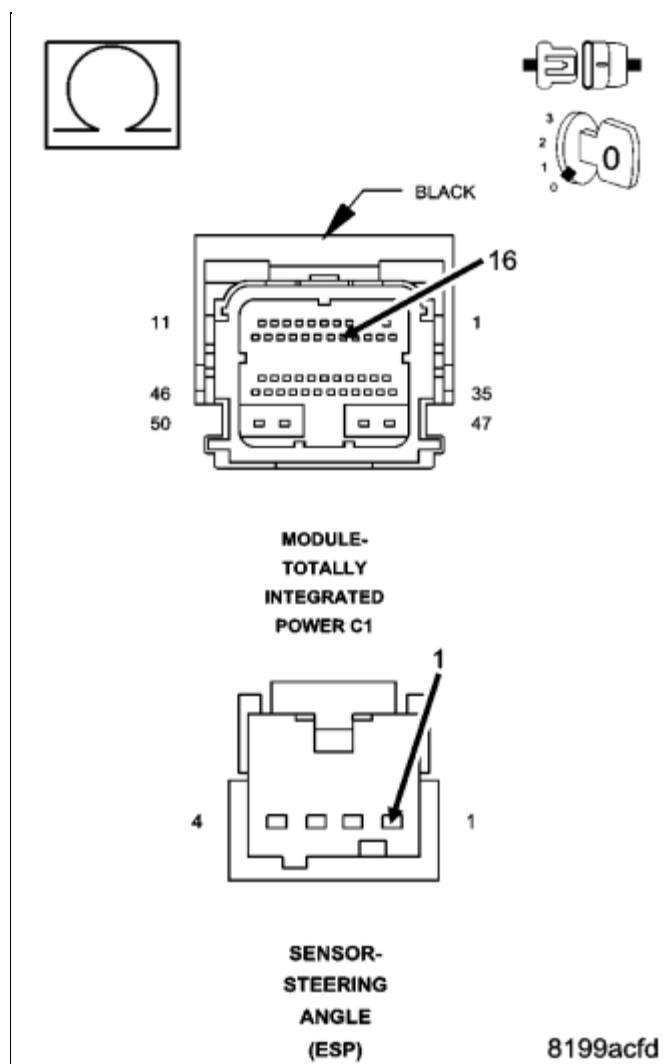
Is resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Steering Angle Sensor connector.

Is resistance below 5.0 ohms?

Yes

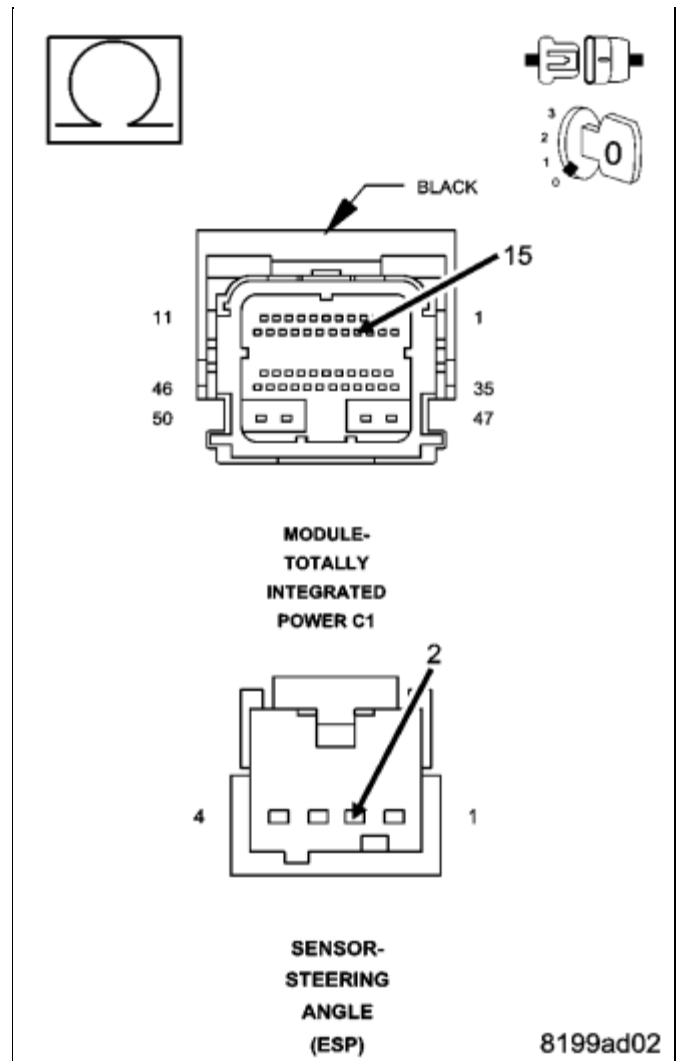
- Replace the Steering Angle Sensor in accordance with the service information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

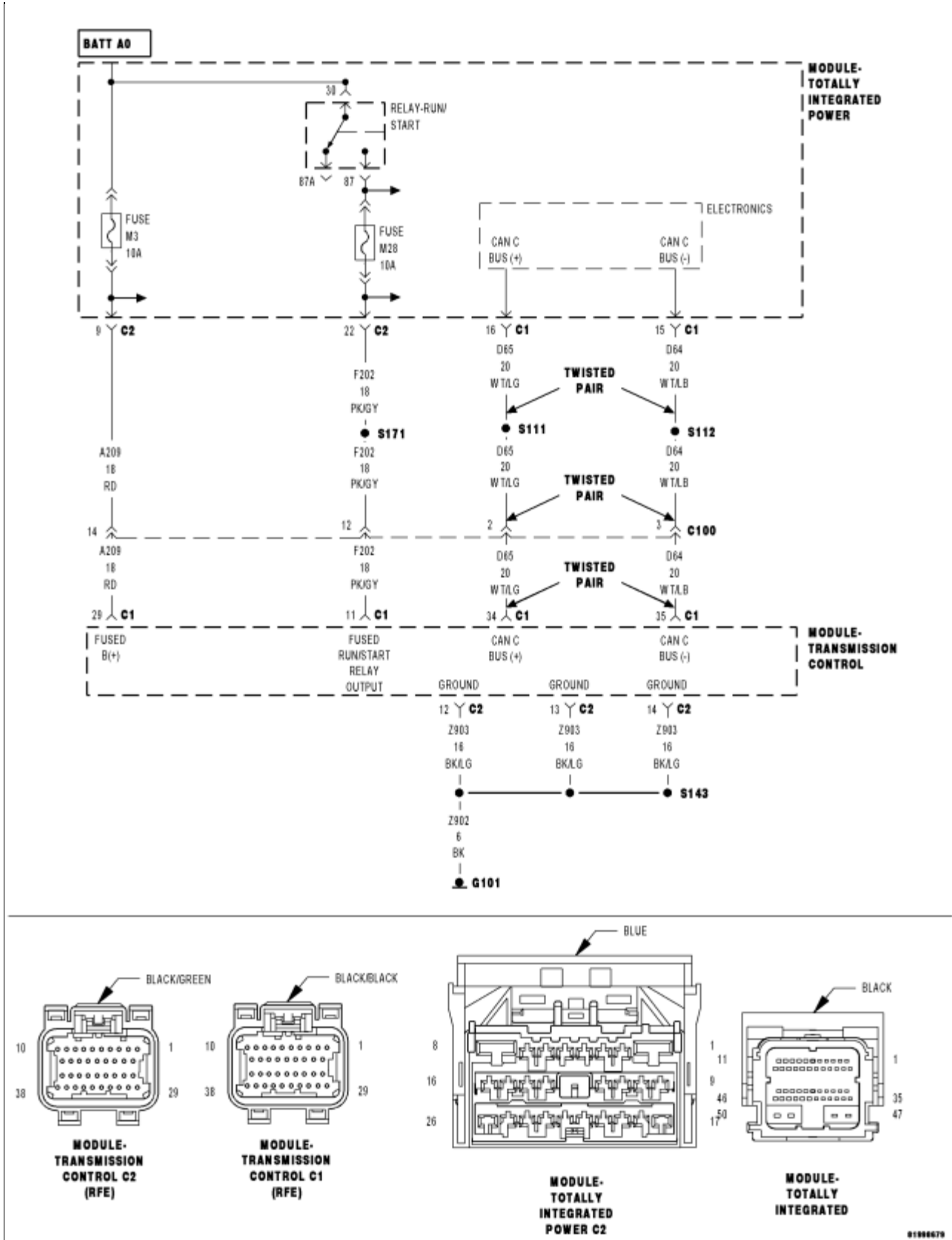
No

- Repair the (D264) CAN C Bus (-) circuit for an open.

- Perform the BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

***NO RESPONSE FROM TCM
(POWERTRAIN CONTROL
MODULE) - RFE**





For a complete wiring diagram **Refer to Section 8W.**

(A209) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z903) GROUND CIRCUITS OPEN
(F202) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

NOTE: Check the TIPM for any active CAN C hardware DTCs, perform DTC before proceeding.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. ATTEMPT TO COMMUNICATE WITH THE PCM

With the scan tool in ECU View, observe the status of the PCM.

Does the scan tool display a red X next to the PCM?

Yes

- Refer to the No Response From PCM test procedure. Refer to the table of contents in this section.

No

- Go To [3](#)

3. (A209) FUSED B(+) CIRCUITS OPEN OR SHORTED

Turn the ignition off.

Disconnect the TCM C1 harness connector.

CAUTION: Do not probe the TCM harness connectors. Probing the TCM harness connectors will damage the TCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check the (A209) Fused B(+) circuit.

Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

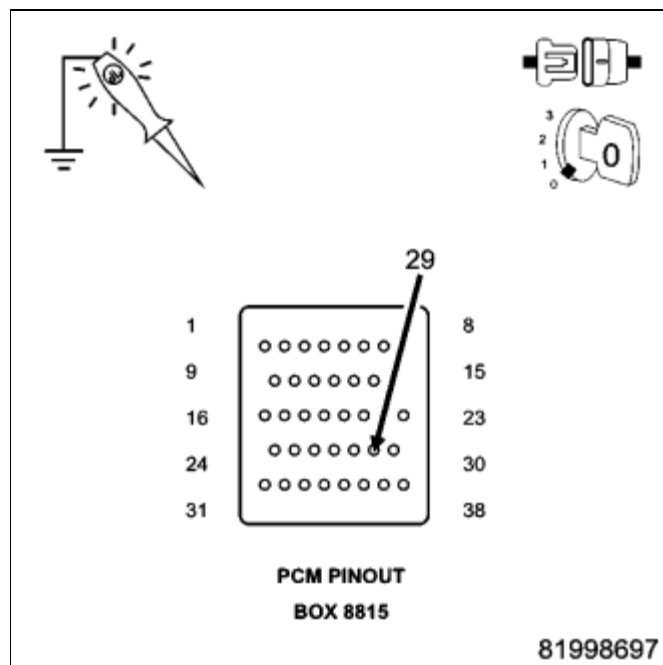
- Repair the (A209) Fused B(+) circuit for an open or short.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.

4. (Z903) GROUND CIRCUITS OPEN

Turn the ignition off.

Disconnect the TCM C2 harness connector.

CAUTION: Do not probe the TCM harness connectors.



Probing the TCM harness connectors will damage the TCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, check each (Z903) ground circuits.

Does the test light illuminate brightly for each circuit?

Yes

- Go To [5](#)

No

- Repair the ground circuit for an open.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.

5. (F202) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

CAUTION: Do not probe the TCM harness connectors. Probing the TCM harness connectors will damage the TCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check the (F202) Fused Run/Start Relay Output circuit.

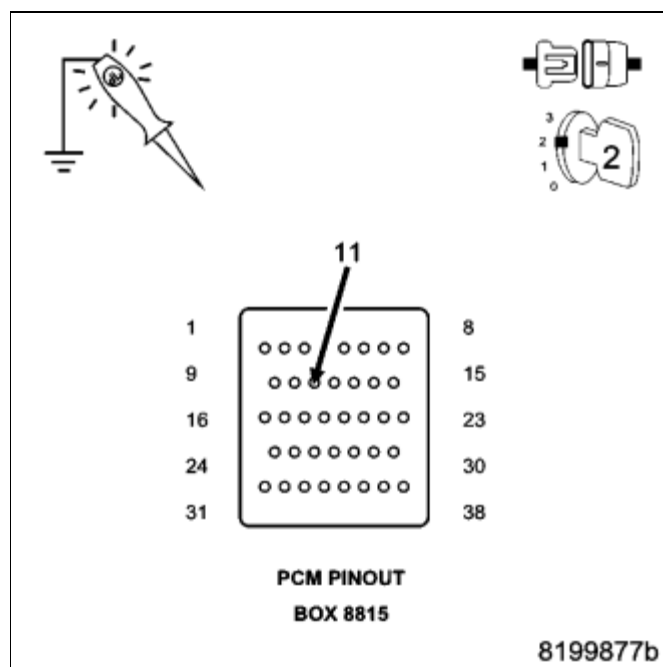
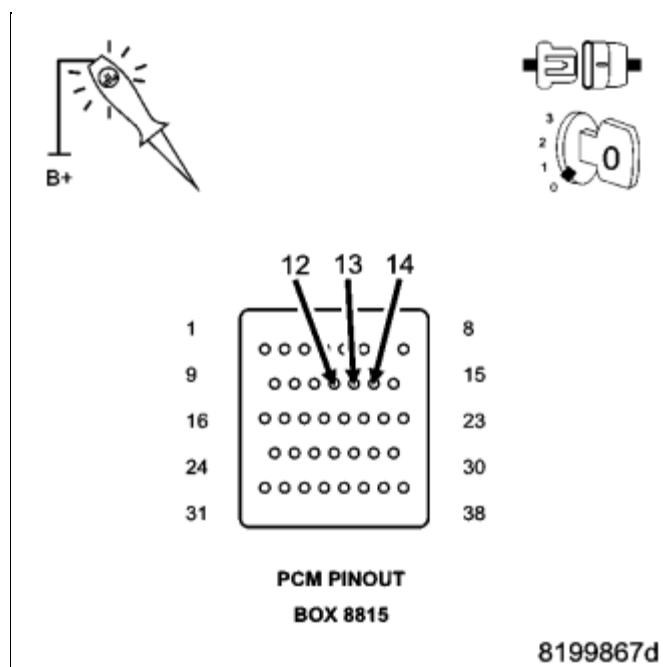
Does the test light illuminate brightly?

Yes

- Go To [6](#)

No

- Repair the (F202) Fused Run/Start Relay Output circuit for an open or short.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.



6. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM connector and the appropriate terminal of the special tool #8815.

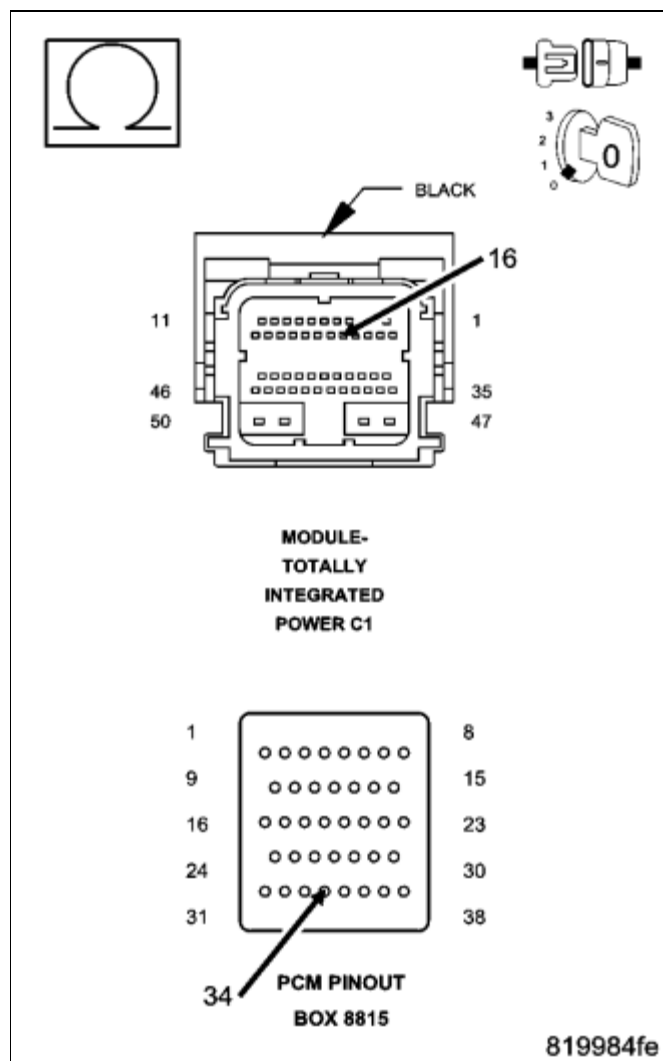
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.



7. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM connector and the appropriate terminal of the special tool #8815.

Is the resistance below 5.0 ohms?

Yes

- Replace and program the Transmission Control Module in accordance with the service information.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.

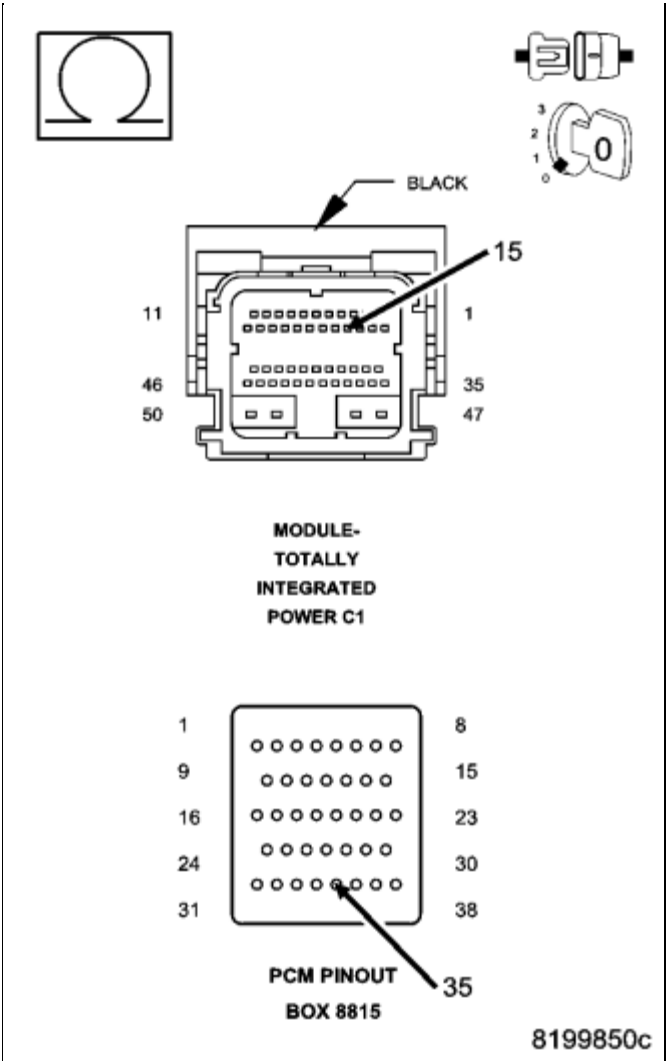
No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the appropriate POWERTRAIN VERIFICATION TEST VER - 5.

***NO RESPONSE FROM TIPM
(TOTALLY INTEGRATED POWER
MODULE)**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
FUSED B (+) CIRCUITS OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUITS OPEN
GROUND CIRCUITS OPEN
DIAGNOSTIC CAN C CIRCUITS OPEN
DIAGNOSTIC CAN C CIRCUITS SHORTED TO GROUND
DIAGNOSTIC CAN C CIRCUITS SHORTED TOGETHER
TOTALLY INTEGRATED POWER MODULE



Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

NOTE: Ensure the scan tool is updated to the latest software.

NOTE: If the scan tool displays any error messages involving the Diagnostic CAN C circuits, diagnose and repair the error message before proceeding. Refer to the Table of Contents.

NOTE: A loss of communication with the TIPM can cause the ECU View button on the scan tool to be inoperative (not highlighted).

With the scan tool, attempt to select ECU View.

Can the scan tool communicate with the TIPM?

Yes

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

No

- Go To [2](#)

2. FUSED B (+) CIRCUITS OPEN AT TIPM

Disconnect the scan tool from the DLC.

Using a 12-volt test light connected to ground, and using the wiring diagram as a guide, check all Fused B (+) circuits at the TIPM.

Does the test light illuminate brightly for each circuit?

Yes

- Go To [3](#)

No

- Repair the Fused B(+) circuit for an open or short.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. FUSED IGNITION SWITCH OUTPUT CIRCUITS OPEN AT TIPM

Turn the ignition on.

Using a 12-volt test light connected to ground, and using the wiring diagram as a guide, check each Fused Ignition Switch Output circuit at the TIPM.

Does the test light illuminate brightly for each circuit?

Yes

- Go To [4](#)

No

- Repair the Fused Ignition Switch Output circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. GROUND CIRCUITS OPEN AT TIPM

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, and using the wiring diagram as a guide, check all ground circuits at the TIPM.

Does the test light illuminate brightly on each circuit?

Yes

- Go To [5](#)

No

- Repair the ground circuit that did not light the test light for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

5. CHECK FOR (D52) DIAGNOSTIC CAN C (+) CIRCUIT OPEN AT DLC

Disconnect the TIPM C7 harness connector.

Measure the resistance on the (D52) Diagnostic CAN C (+) circuit between the TIPM C7 harness connector and the DLC.

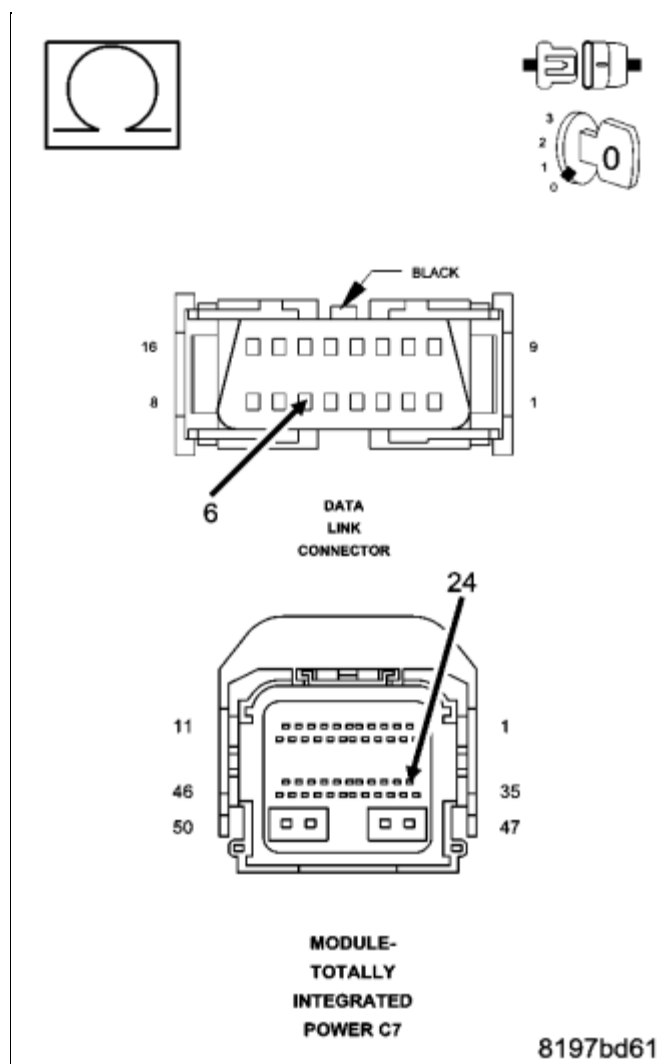
Is the resistance above 10.0 ohms?

Yes

- Repair the (D52) Diagnostic CAN C (+) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [6](#)



6. CHECK FOR (D51) DIAGNOSTIC CAN C (-) CIRCUIT OPEN AT DLC

Measure the resistance on the (D51) Diagnostic CAN C (-) circuit between the TIPM C7 harness connector and the DLC.

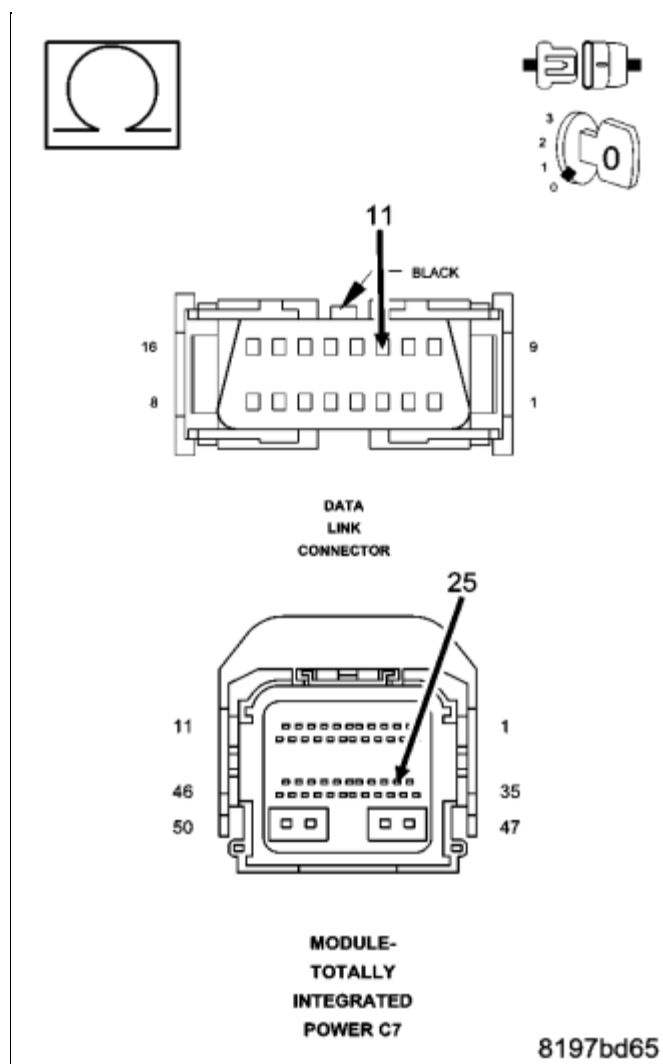
Is the resistance above 10.0 ohms?

Yes

- Repair the (D51) Diagnostic CAN C (-) circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [7](#)



7. CHECK FOR DIAGNOSTIC CAN C CIRCUITS SHORTED TOGETHER

Measure the resistance between the (D52) Diagnostic CAN C (+) circuit and the (D51) Diagnostic CAN C (-) circuit at the TIPM C7 harness connector.

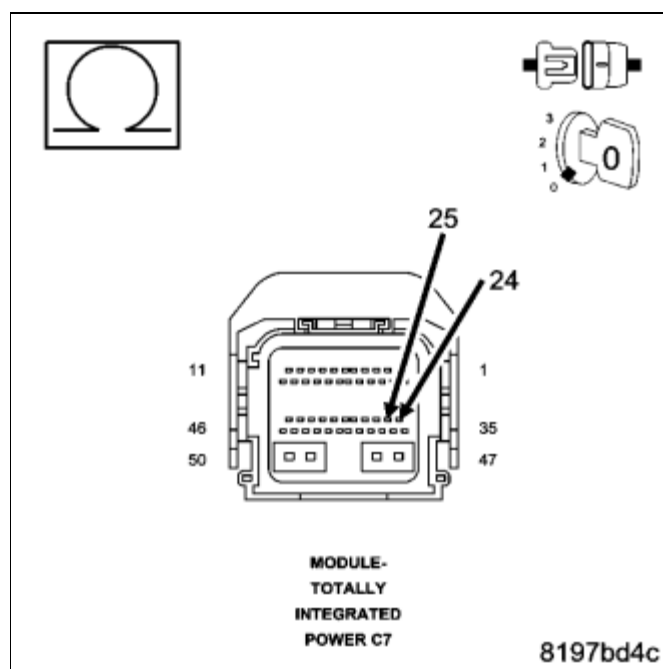
Is the resistance below 100.0 ohms?

Yes

- Repair the (D52) Diagnostic CAN C (+) circuit for a short to the (D51) Diagnostic CAN C (-) circuit.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

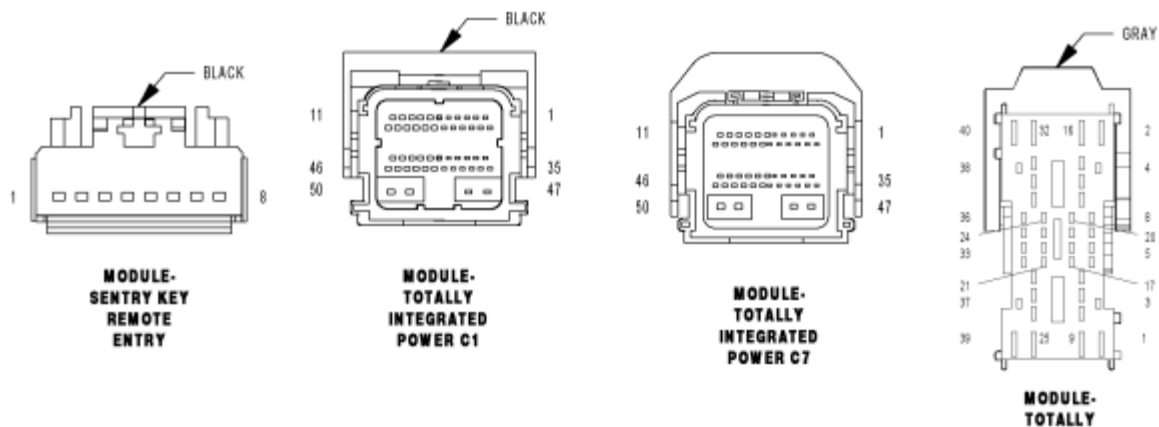
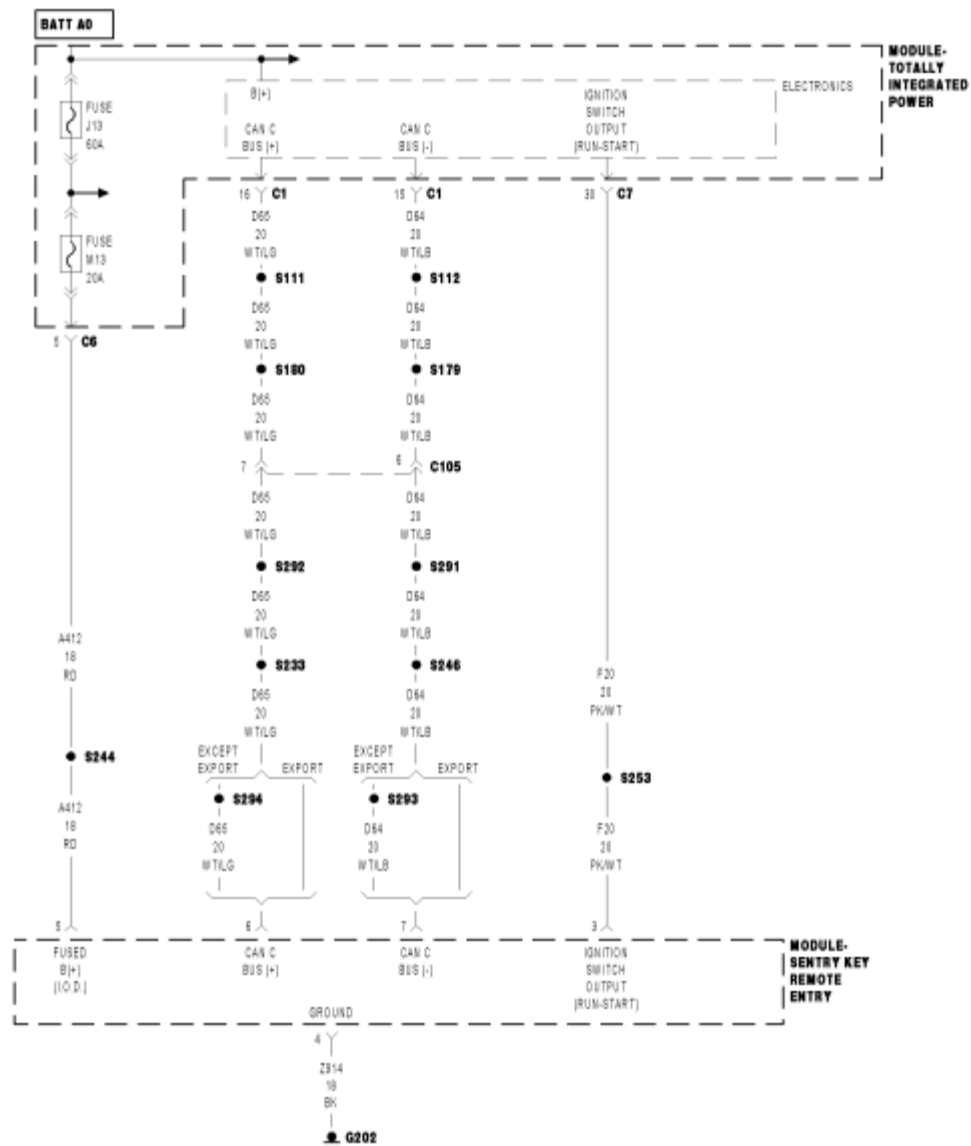
- Replace the Totally Integrated Power Module in



accordance with the service information.

- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

***NO RESPONSE FROM WCM (SENTRY KEY REMOTE ENTRY MODULE)**



8100001-1

For a complete wiring diagram **Refer to Section 8W.**

(A412) FUSED B(+) CIRCUIT OPEN OR SHORTED
(Z914) GROUND CIRCUIT OPEN
(F20) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED
(D65) CAN C BUS (+) CIRCUIT OPEN
(D64) CAN C BUS (-) CIRCUIT OPEN
SENTRY KEY REMOTE ENTRY MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.

With the scan tool, select ECU View.

NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.

Does the scan tool display a red X next to the module?

Yes

- Go To [2](#)

No

- The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. (A412) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.
 Disconnect the Sentry Key Remote Entry Module harness connector.
 Using a 12-volt test light connected to ground, check the (A412) Fused B(+) circuit.

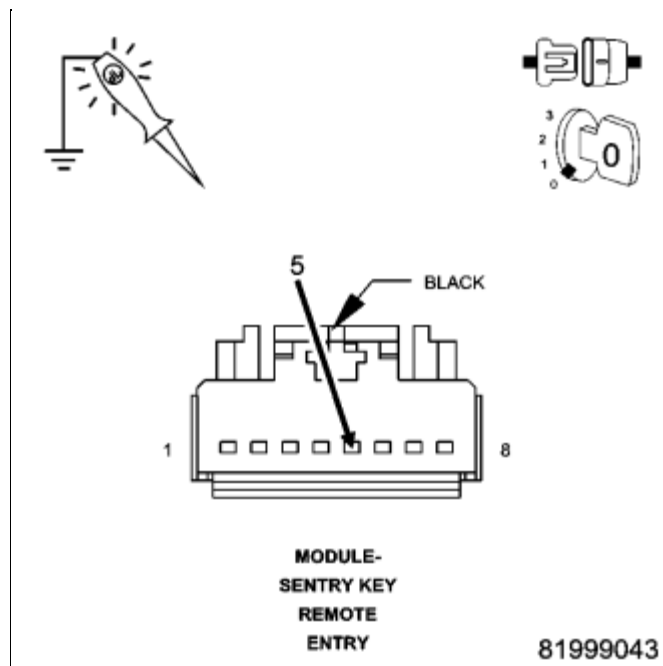
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A412) Fused B(+) circuit for an open or short.
- Perform SKREEM VERIFICATION TEST.



3. (Z914) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z914) ground circuit.

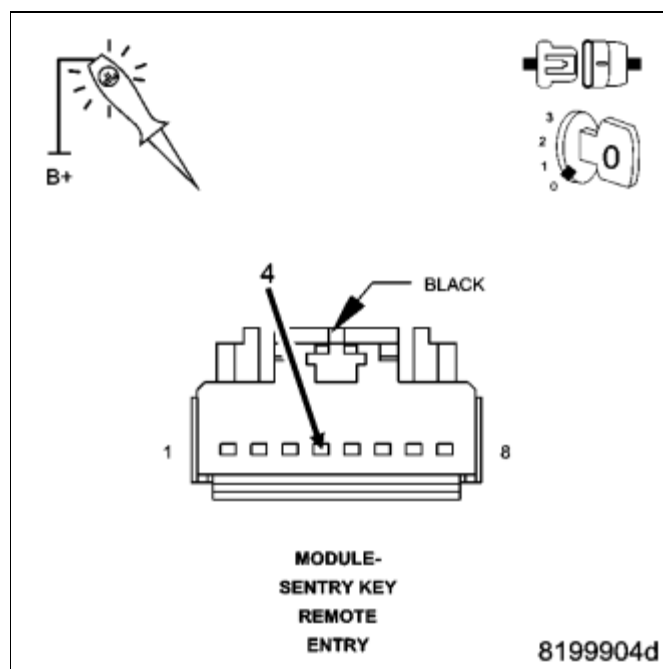
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z914) ground circuit for an open.
- Perform SKREEM VERIFICATION TEST.



4. (F20) FUSED IGNITION SWITCH OUTPUT (RUN/START) CIRCUIT OPEN OR SHORTED

Turn the ignition on.
 Using a 12-volt test light connected to ground, check the (F20) Fused Ignition Switch Output (Run/Start) circuit.

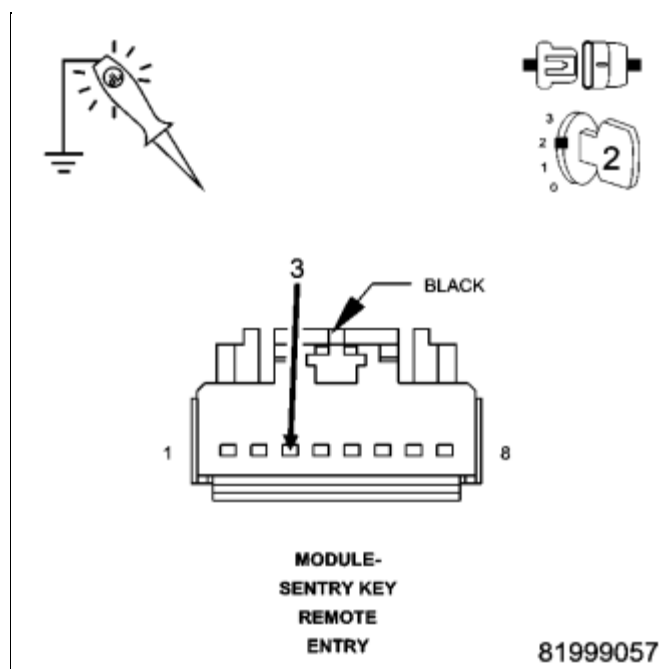
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (F20) Fused Ignition Switch Output (Run/Start) circuit for an open or short.
- Perform SKREEM VERIFICATION TEST.



5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the TIPM C1 harness connector and the Sentry Key Remote Entry Module connector.

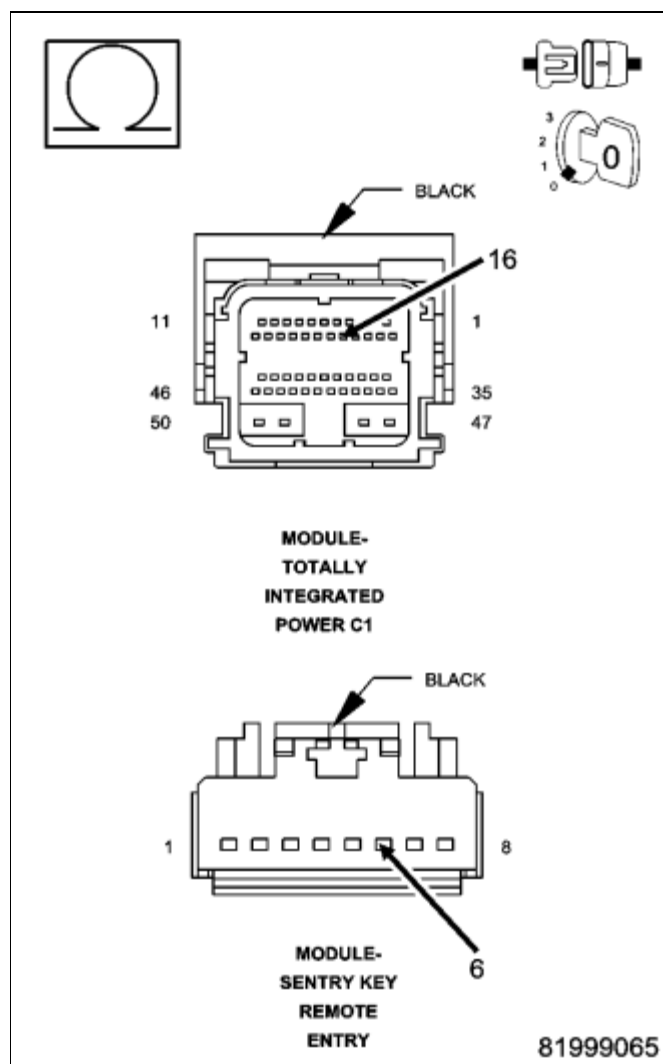
Is resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (D65) CAN C Bus (+) circuit for an open.
- Perform the SKREEM VERIFICATION TEST.



6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the TIPM C1 harness connector and the Sentry Key Remote Entry Module connector.

Is resistance below 5.0 ohms?

Yes

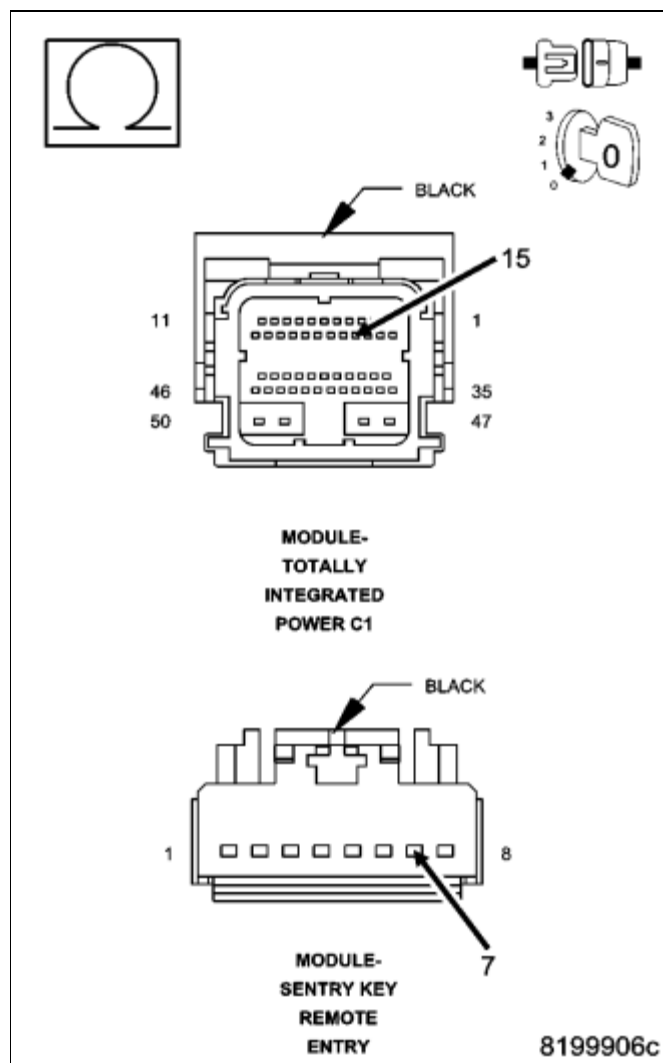
- Replace the Sentry Key Remote Entry Module in accordance with the service information.
- Perform the SKREEM VERIFICATION TEST.

No

- Repair the (D64) CAN C Bus (-) circuit for an open.
- Perform the SKREEM VERIFICATION TEST.

STANDARD PROCEDURE

BODY VERIFICATION TEST – VER 1



Diagnostic Test

1. Perform Body Verification Test

NOTE: If the SKREEM or PCM/ECM was replaced, refer to the service information for proper programming procedures.

- Disconnect all jumper wires and reconnect all previously disconnected components and connectors.
- Ensure that all accessories are turned off.
- Ensure that the battery is fully charged.
- Turn the ignition on.
- With the scan tool, record and erase DTC's from all modules.
- If an electronic control module was replaced, select the applicable module from the scan tool menu and press "Misc. Functions". If the module has programmable features, program as necessary.

(Export only) If the Intrusion Transceiver Module (ITM) and/or Siren was replaced, select ITM from the scan tool ECU View menu then “Misc. Functions” and perform the applicable replacement procedure.

- Turn the ignition off, wait 10 seconds, and then turn the ignition on.
- Operate all functions of the system that caused the original concern.
- With the scan tool, select ECU View and check for DTC's in the modules.

Are DTCs present in any of the modules or is the original condition still present?

Yes

- The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No

- The repair is complete.

ELECTRONIC CONTROL MODULES

ELECTRONIC CONTROL MODULES

STANDARD PROCEDURE

SKREEM PROGRAMMING

When a Powertrain Control Module (PCM) for a gasoline engine, or an Engine Control Module (ECM) for a diesel engine and the Sentry Key Remote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) on vehicles equipped with the Sentry Key Immobilizer System (SKIS) are replaced at the same time, perform the following steps in order:

NOTE: If the PCM and the SKREEM are replaced at the same time, program the PCM VIN into the PCM first.

1. If applicable first replace the PCM/ECM with the original WCM still connected to the vehicle.
2. Using the appropriate service information program the new PCM/ECM. (This will ensure the Secret Key Transfer from the original WCM into the new PCM/ECM).
3. Now replace and program the WCM. This will retain the Secret Key from the PCM/ECM back into the new WCM.
4. With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
5. If the vehicle is equipped with Tire Pressure Monitoring System program the Placard Pressure Values into the WCM/SKREEM.
6. Ensure all the customer's keys have been programmed into the new module if necessary.

NOTE: If the original keys do not successfully program to the new SKREEM after the proper procedures are followed correctly, programming new keys will be necessary.

PROGRAMMING THE SKREEM

The SKIS Secret Key is an ID code that is unique to each SKREEM/WCM. This code is programmed and stored in the SKREEM/WCM, the PCM/ECM, and each ignition key transponder chip. When the PCM/ECM or SKREEM/WCM is replaced, it is necessary to program the Secret Key into the new module using a diagnostic scan tool. Follow the programming steps outlined in the diagnostic scan tool for **PCM REPLACED**, **ECM REPLACED**, **WCM REPLACED**, or **GATEWAY REPLACED** under **MISCELLANEOUS FUNCTIONS** for the **WIRELESS CONTROL MODULE/WCM** menu item as appropriate.

NOTE: Programming the PCM/ECM or SKREEM is done using a diagnostic scan tool and a PIN to enter secure access mode. If three attempts are made to enter secure access mode using an incorrect PIN, secure access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. Be certain that all accessories are turned OFF. Also monitor the battery state and connect a battery charger if necessary.

NOTE: Before replacing the ECU for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal component failures (i.e. relay and solenoids) and shorted circuits (i.e. pull-ups, drivers and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has set.

ECM/SKIM/WCM PROGRAMMING

When a ECM and the SKIM are replaced at the same time perform the following steps in order:

1. Program the new SKIM
2. Program the new ECM
3. Replace all ignition keys and program them to the new SKIM.

ECM/SKIM/WCM PROGRAMMING

When an ECM (Bosch) and the SKIM are replaced at the same time perform the following steps in order:

1. Program the new SKIM
2. Program the new ECM (Bosch)
3. Replace all ignition keys and program them to the new SKIM.

PROGRAMMING THE SKIM

CAUTION: Read all notes and cautions for programming procedures.

1. Connect a battery charger to the vehicle.
2. Connect the StarSCAN®.

CAUTION: If the ECM/PCM and SKREEM/WCM are replaced at the same time, the ECM/PCM MUST be programmed before the SKREEM/WCM.

3. Select "ECU View".
4. Select "WCM Wireless Control Module".
5. Select "Miscellaneous Functions".

6. Select WCM replaced.
7. Enter the PIN when prompted.
8. Verify the correct information.

NOTE: If the ECM and the SKIM are replaced at the same time, all vehicle keys will need to be replaced and programmed to the new SKIM.

PROGRAMMING IGNITION KEYS TO THE SKREEM

Each ignition key transponder also has a unique ID code that is assigned at the time the key is manufactured. When a key is programmed into the SKREEM/WCM, the transponder ID code is learned by the module and the transponder acquires the unique Secret Key ID code from the SKREEM/WCM. To program ignition keys into the SKREEM/WCM, follow the programming steps outlined in the diagnostic scan tool for **PROGRAM IGNITION KEYS OR KEY FOBS** under **MISCELLANEOUS FUNCTIONS** for the **WIRELESS CONTROL MODULE/WCM** menu item.

NOTE: If the original keys do not successfully program to the new SKREEM after the proper procedures are followed correctly, programming new keys will be necessary.

NOTE: A maximum of eight keys can be learned to each SKREEM. Once a key is learned to a SKREEM, that key has acquired the Secret Key for that SKREEM and cannot be transferred to any other SKREEM or vehicle.

If ignition key programming is unsuccessful, the scan tool will display one of the following error messages:

- **PROGRAMMING NOT ATTEMPTED** - The scan tool attempts to read the programmed key status and there are no keys programmed into SKREEM memory.
- **PROGRAMMING KEY FAILED (POSSIBLE USED KEY FROM WRONG VEHICLE)** - SKREEM is unable to program an ignition key transponder due to one of the following:
 - The ignition key transponder is ineffective.
 - The ignition key transponder is or has been already programmed to another vehicle.
- **8 KEYS ALREADY LEARNED, PROGRAMMING NOT DONE** - The SKREEM transponder ID memory is full.
- **LEARNED KEY IN IGNITION** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed into SKREEM memory.

COMMUNICATION

DESCRIPTION

The primary on-board communication network between microprocessor-based electronic control modules in this vehicle is the Controller Area Network (CAN) data bus system. A data bus network minimizes redundant wiring connections; and, at the same time, reduces wire harness complexity, sensor current loads and controller hardware by allowing each sensing device to be connected to only one module (also referred to as a node). Each node reads, then broadcasts its sensor data over the bus for use by all other nodes requiring that data. Each node ignores the messages on the bus that it cannot use.

The CAN bus is a two-wire multiplex system. Multiplexing is any system that enables the transmission of multiple messages over a single channel or circuit. The CAN bus is used for communication between most vehicle nodes. However, in addition to the CAN bus network, certain nodes may also be equipped with a Local Interface Network (LIN) data bus. The LIN data bus is a single wire low-speed (9.6 Kbps) serial link bus used to

provide direct communication between a LIN master module and certain switch or sensor inputs.

There are actually three separate CAN bus systems used in the vehicle. They are designated: the CAN-Interior (also known as CAN Interior High Speed/IHS), the CAN-C and the Diagnostic CAN-C. The CAN-Interior and CAN-C systems provide on-board communication between all nodes in the vehicle. The CAN-C is the faster of the two systems providing near real-time communication (500 Kbps). The CAN-C is used typically for communications between more critical nodes, while the slower (125 Kbps) CAN-Interior system is used for communications between less critical nodes.

The added speed of the CAN data bus is many times faster than previous data bus systems. This added speed facilitates the addition of more electronic control modules or nodes and the incorporation of many new electrical and electronic features in the vehicle.

The Diagnostic CAN-C bus is also capable of 500 Kbps communication, and is sometimes informally referred to as the CAN-D system to differentiate it from the other high speed CAN-C bus. The Diagnostic CAN-C is used exclusively for the transmission of diagnostic information between the Totally Integrated Power Module/Central GateWay (TIPM or TIPMCGW) and a diagnostic scan tool connected to the industry-standard 16-way Data Link Connector (DLC) located beneath the instrument panel on the driver side of the vehicle.

The TIPM is located in the engine compartment near the battery. The central CAN gateway or hub module integral to the TIPM is connected to all three CAN buses. This gateway physically and electrically isolates the CAN buses from each other and coordinates the bi-directional transfer of messages between them.

OPERATION

The Controller Area Network (CAN) data bus allows all electronic modules or nodes connected to the bus to share information with each other. Regardless of whether a message originates from a module on the lower speed CAN-Interior (also known as CAN Interior High Speed/IHS) bus or on the higher speed CAN-C or CAN-D bus, the message structure and layout is similar, which allows the Totally Integrated Power Module/Central GateWay (TIPM or TIPMCGW) to process and transfer messages between the CAN buses. The TIPM also stores a Diagnostic Trouble Code (DTC) for certain bus network faults.

All modules (also referred to as nodes) transmit and receive messages over one of these buses. Data exchange between nodes is achieved by serial transmission of encoded data messages. Each node can both send and receive serial data simultaneously. Each digital bit of a CAN bus message is carried over the bus as a voltage differential between the two bus circuits which, when strung together, form a message. Each node uses arbitration to sort the message priority if two competing messages are attempting to be broadcast at the same time.

The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) is the Local Interface Network (LIN) master module in this vehicle and it gathers information from the compass module, the instrument panel switch bank, the Steering Control Module (SCM), and the Heated Seat Module (HSM) through the LIN data bus. There is also LIN bus communication between the individual Tire Pressure Monitor (TPM) transponders and the Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM). Both the EMIC and the SKREEM either act directly upon the information received through the LIN data bus, relay the information to other nodes in the vehicle using electronic messages placed on the CAN bus, or both.

The voltage network used to transmit messages requires biasing and termination. Each module on the CAN bus network provides its own biasing and termination. There are two types of nodes used in the CAN bus network. On the CAN-C or the IHS bus, a dominant node has a 120 ohm termination resistance while a non-dominant (or recessive) node has about a 2500 to 3000 ohm (2.5 to 3.0 kilohm) termination resistance. The dominant nodes on the CAN-C bus are the TIPM and the Powertrain Control Module (PCM). The dominant nodes on the IHS bus are the EMIC and the TIPM.

The termination resistance of two dominant nodes is combined in parallel to provide a total of about 60 ohms. This resistance value may vary somewhat by application, depending upon the number of non-dominant nodes on the bus. On the CAN-D bus (or Diagnostic CAN-C) all of the 60 ohm termination resistance is present in the Central GateWay (TIPMCGW).

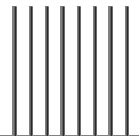
NOTE: All measurement of termination resistance is done with the vehicle battery disconnected.

The communication protocol being used for the CAN data bus is a non-proprietary, open standard adopted from the Bosch CAN Specification 2.0b. The CAN-C is the faster of the two primary buses in the CAN bus system, providing near real-time communication (500 Kbps).

The CAN bus nodes are connected in parallel to the two-wire bus using a twisted pair, where the wires are wrapped around each other to provide shielding from unwanted electromagnetic induction, thus preventing interference with the relatively low voltage signals being carried through them. The twisted pairs have between 33 and 50 twists per meter (yard). While the CAN bus is operating (active), one of the bus wires will carry a higher voltage and is referred to as the CAN High or CAN bus (+) wire, while the other bus wire will carry a lower voltage and is referred to as the CAN Low or CAN bus (–) wire. Refer to the CAN Bus Voltages table.

CAN Bus Voltages (Normal Operation)																		
CAN-C Bus Circuits	Sleep	Recessive (Bus Idle)	Dominant (Bus Active)	CAN-L Short to Ground	CAN-H Short to Ground	CAN-L Short to Battery	CAN-H Short to Battery	CAN-H Short to CAN-L										
CAN-L (–)	0 V	2.4 - 2.5 V	1.3 - 2.3 V	0 V	0.3 - 0.5V	Battery Voltage	Battery Voltage Less 0.75 V	2.45 V										
CAN-H (+)	0 V	2.4 - 2.5 V	2.6 - 3.5 V	0.02 V	0 V	Battery Voltage Less 0.75 V	Battery Voltage	2.45 V										
CAN-Interior Bus Circuits	Key-Off (Bus Asleep)		Key-On (Bus Active)	CAN-L Short to Ground	CAN-H Short to Ground	CAN-L Short to Battery	CAN-H Short to Battery	CAN-H Short to CAN-L										
CAN-L (–)	0.0 V		1.3 - 2.3 V	0 V	0.3 - 0.5 V	Battery Voltage	Battery Voltage Less 0.75 V	2.45 V										
CAN-H (+)	0.0 V		2.6 - 3.5 V	0.02 V	0 V	Battery Voltage Less 0.75 V	Battery Voltage	2.45 V										
Notes																		
All measurements taken between node ground and CAN terminal with a standard DVOM.																		
DVOM will display average network voltage.																		
Total resistance of CAN-C network can also be measured (60 ohms). Total resistance of CAN-Interior network varies,																		

depending upon the number of optional non-dominant nodes on the bus. CAN-Interior total resistance should range between about 60 ohms with the minimal number of nodes, to about 42 ohms with the maximum number of nodes.



In order to minimize the potential effects of Ignition-OFF Draw (IOD), the CAN-Interior network employs a sleep strategy. However, a network sleep strategy should not be confused with the sleep strategy of the individual nodes on that network, as they may differ. For example: The CAN-C bus network is awake only when the ignition switch is in the ON or START positions; however, the TIPM, which is on the CAN-C bus, may still be awake with the ignition switch in the ACCESSORY or UNLOCK positions. The integrated circuitry of an individual node may be capable of processing certain sensor inputs and outputs without the need to utilize network resources.

The CAN-Interior bus network remains active until all nodes on that network are ready for sleep. This is determined by the network using tokens in a manner similar to polling. When the last node that is active on the network is ready for sleep, and it has already received a token indicating that all other nodes on the bus are ready for sleep, it broadcasts a **bus sleep acknowledgment** message that causes the network to sleep. Once the CAN-Interior bus network is asleep, any node on the bus can awaken it by transmitting a message on the network. The TIPM will keep either the CAN-Interior or the CAN-C bus awake for a timed interval after it receives a diagnostic message for that bus over the Diagnostic CAN-C bus.

In the CAN system, available options are configured into the TIPM at the assembly plant, but additional options can be added in the field using the diagnostic scan tool. The configuration settings are stored in non-volatile memory. The TIPM also has two 64-bit registers, which track each of the **as-built** and **currently responding** nodes on the CAN-Interior and CAN-C buses. The TIPM stores a Diagnostic Trouble Code (DTC) in one of two caches for any detected active or stored faults in the order in which they occur. One cache stores powertrain (P-Code), chassis (C-Code) and body (B-Code) DTCs, while the second cache is dedicated to storing network (U-Code) DTCs.

If there are intermittent or active faults in the CAN network, a diagnostic scan tool connected to the Diagnostic CAN-C bus through the 16-way Data Link Connector (DLC) may only be able to communicate with the TIPM. To aid in CAN network diagnosis, the TIPM will provide CAN-Interior and CAN-C network status information to the scan tool using certain diagnostic signals. In addition, the transceiver in each node on the CAN-C bus will identify a **bus off hardware failure**, while the transceiver in each node on the CAN-Interior bus will identify a **general bus hardware failure**. The transceivers for some CAN-Interior nodes will also identify certain failures for both CAN-Interior bus signal wires.

DATA LINK CONNECTOR

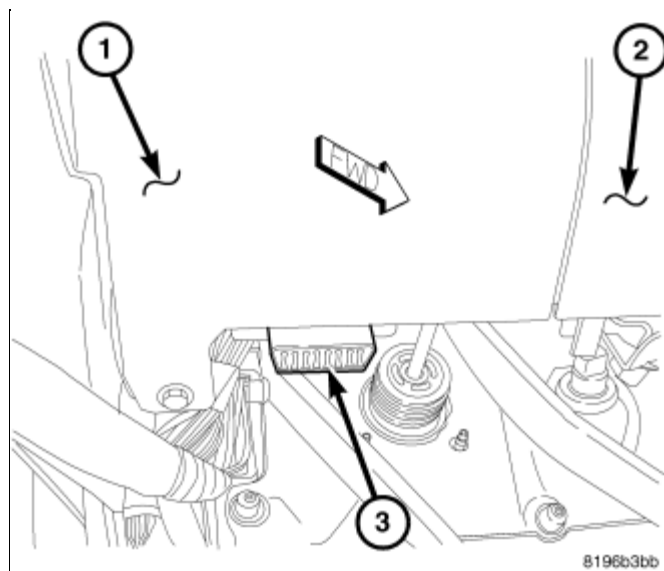
DESCRIPTION

The Data Link Connector (DLC) (3) is a 16-way molded plastic connector insulator on a dedicated take out of the instrument panel wire harness. This connector is located at the lower edge of the instrument panel (1), just outboard of the steering column opening cover (2). The connector insulator is retained by integral latch features within a rectangular cutout in the instrument panel lower structural support just below the lower instrument panel base trim and

just inboard of the cowl side inner panel.

OPERATION

The Data Link Connector (DLC) is an industry-standard 16-way connector that permits the connection of a diagnostic scan tool to the Controller Area Network (CAN) data bus for interfacing with, configuring, and retrieving Diagnostic Trouble Code (DTC) data from the electronic modules that reside on the data bus network of the vehicle.



MODULE-ANTILOCK BRAKE

DESCRIPTION

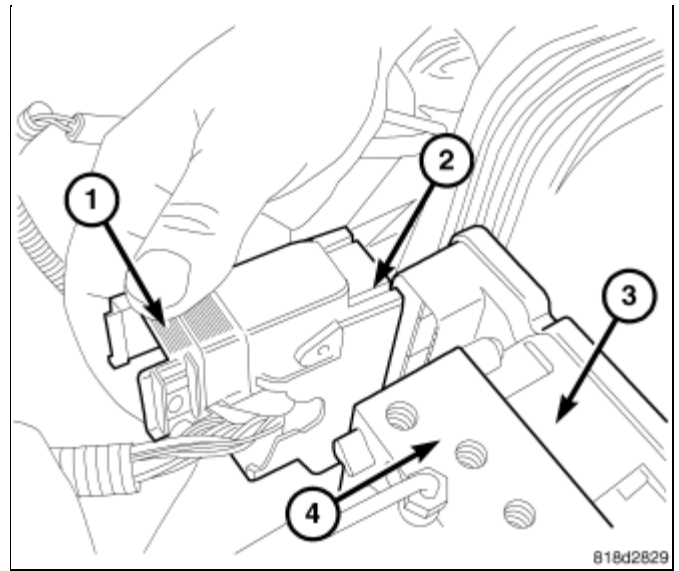
The Antilock Brake Module (ABM) is mounted to the Hydraulic Control Unit (HCU) and operates the ABS system.

OPERATION

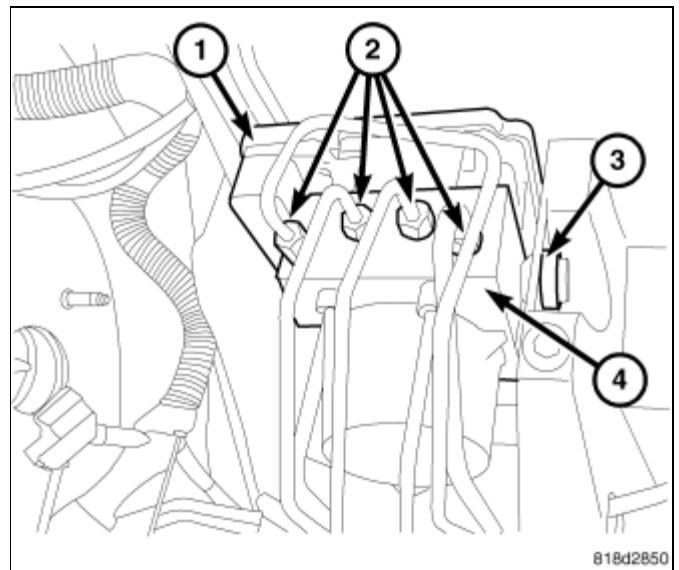
The ABM voltage source is through the ignition switch in the RUN position. The ABM contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously. The ABM contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the scan tool. ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

REMOVAL

1. Remove the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
2. Install prop rod on the brake pedal to keep pressure on the brake system.
3. Remove negative battery cable from the battery.
4. Pull up on the ABM harness connector release (1) and remove connector (2).

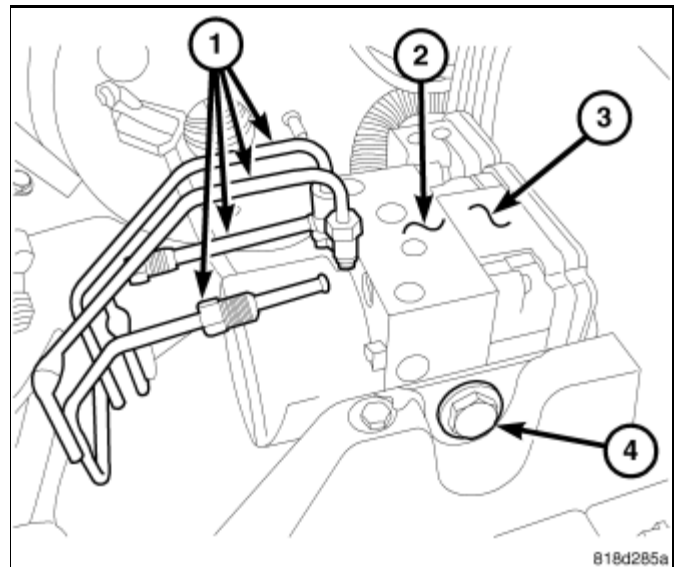


5. Remove brake lines (2) from the HCU (4).



6. Remove HCU/ABM mounting nuts and bolt (4) and remove HCU (2) / ABM (3) as an assembly.
7. Remove the ABM from the HCU.

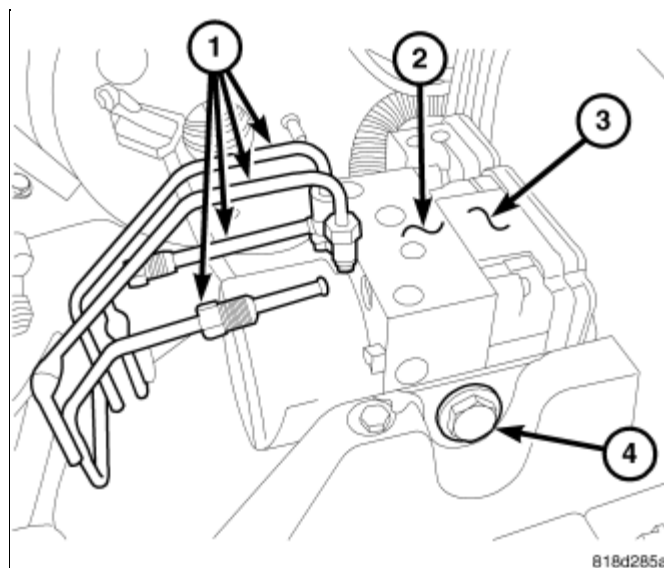
INSTALLATION



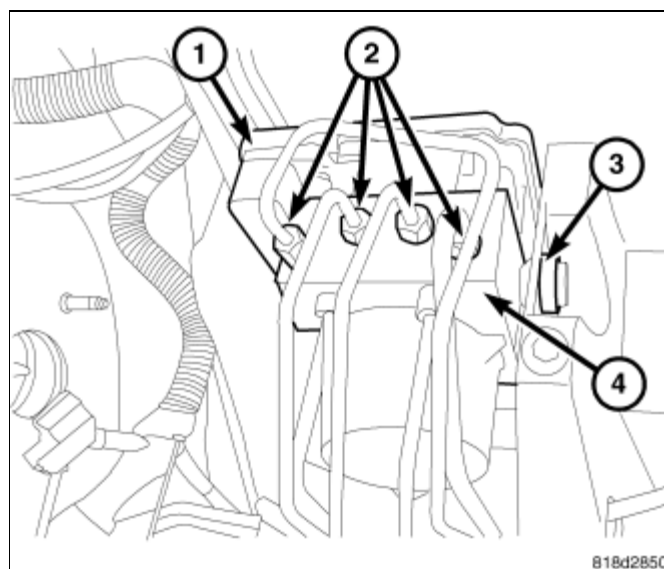
NOTE: If the ABM is being replaced with a new ABM is

must be reprogrammed with the use of a scan tool.

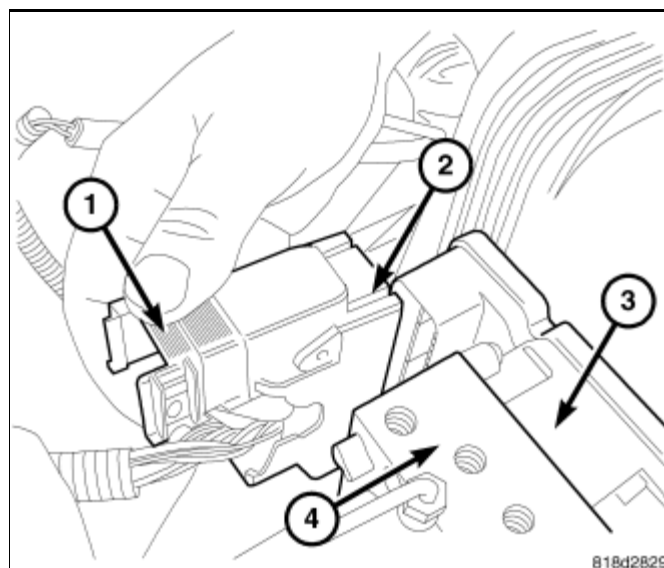
1. Install the ABM on the HCU and tighten then screws to 2 N·m (16 in. lbs.).
2. Install HCU/ABM (2&3) on the mounting studs (4).
3. Install mounting nuts and bolt (4). Tighten to 11.5 N·m (102 in. lbs.).



4. Install brake lines (2) to the HCU (4) and tighten to 19 N·m (170 in. lbs.).



5. Install wiring harness connector (2) to the ABM and push down on the release (1) to secure the connector.
6. Install the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION).
7. Install negative battery cable to the battery.
8. Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



MODULE -ENGINE CONTROL

STANDARD PROCEDURE

ECM/PCM PROGRAMMING

MODULE REPROGRAMING

Replacement ECM's will require programming utilizing the StarSCAN® or equivalent. The ECM will not operate the engine until it is programmed. A Diagnostic Trouble Code (DTC) will be set - "not programmed".

CAUTION: Extreme care must be taken when programming a calibration into a generic ECM. Do not randomly select a calibration. Once a calibration is selected and programmed, the controller cannot be reprogrammed to a different calibration. The module can only be reprogrammed to a more recent version of that calibration.

SPECIAL TOOLS/EQUIPMENT OR EQUIVALENT REQUIRED:

NPN	Battery Charger
CH9401	StarSCAN® Tool
CH9404	StarSCAN® Vehicle Cable
CH9409	StarSCAN® Documentation Kit
CH9410	StarSCAN® Ethernet Cable, 12 ft.
CH9412	StarSCAN® Software Update Device Kit
	TechCONNECT PC or equivalent
	StarSCAN® Software Update CD

**REPAIR PROCEDURE - USING THE INTERNET TO RETRIEVE THE FLASH FILE:

NOTE: The StarSCAN® or equivalent diagnostic scan tool fully supports Internet connectivity. However, in order to take advantage of this feature you must first configure the StarSCAN® or equivalent for your dealership's network. For instruction on setting up your StarSCAN® or equivalent for the dealer's network; refer to the StarSCAN® or equivalent Quick Start Networking Guide available on DealerCONNECT > Service > StarSCAN and StarMOBILE or equivalent Tools > Online Documentation or at www.dcctools.com website under the "download center".

NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9410 StarSCAN® or equivalent ethernet cable to the StarSCAN® or equivalent and the

dealer's network drop.

3. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent and the vehicle.

4. Power ON the StarSCAN® or equivalent .

5. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the “Home” screen:

- Select “ECU View”
- Touch the screen to highlight the ECM in the list of modules.
- Select “More Options”
- Select “ECU Flash”
- Record the part number at the top of the “Flash ECM” screen for later reference.

NOTE: For the Cummins Diesel, if the ECM is not operational, the “ECM part number” can be obtained from the label on the controller. If the label on the controller is not legible, record the “Reference No.” for use later. The “Reference No.” is located in the Reference No. box at the top, center of the Engine Data Plate . Do not use the reference number shown in the figure. The Engine Data Plate is located on the intake side of the breather cover or affixed to the APPS bracket.



 MANUFACTURED BY CUMMINS INC. FOR DAWLECHRYSLER Assembled in the USA © 3931342 WARNING: Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application. AVERTISSEMENT: Danger de blessures et d'annulation de la garantie, si de bit de combustible, tr/min ou altitude, de passent les valeurs maximum annonce'es pour ce modele et son utilisation.	Engine No. Moteur No. 56100101	Ref. No. 53040317AE	MODEL MODULE ISB 305	Fuel Rate at adx. HP Debit combust a puissance indiquee 114 mm³/stroke	CPL 8228	
	Idle Speed (rpm) Vitesse Rotation 750	Advertised HP Puiss. Indiquee (ch) 305 at 2900 rpm	Family Famille 403E	FEL	EPA	CARB
	Firing Order Ordre d'Allumage 1 5 3 6 2 4	Timing - T.D.C. Calage - P.M.H. ELECTRONIC	Catalyst No. Catalyseur No.	NOx		0.0
	Valve lash cold Jeux Soup. 'a Froid 0.020	Int. Adj. 0.010	Exh. Ech.	Date of Mfg. Date of Fab. 07-29-02	C.I.D. Pouce L. Cube/L 369 5.9	PM 0.00 0.00
This engine conforms to California Regulations applicable to XXXX model year medium duty vehicles. This engine is certified to operate on diesel fuel. 08011 Certified.						

813377b9

6. Replace the ECM with the appropriate Generic ECM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Engine Control Module, Removal.

7. Program the ECM as follows:

- Using the StarSCAN® or equivalent at the “Home” screen, Select “ECU View”
- Touch the screen to highlight the ECM in the list of modules.
- Select “More Options”
- Select “ECU Flash”
- Select “Browse for New File”. Follow the on screen instructions.
- Highlight the appropriate calibration based on the part number recorded in Step 5.
- Select “Download to Scantool”.
- Select “Close” after the download is complete, then select “Back”.

- i. Highlight the listed calibration.
- j. Select “Update Controller”. Follow on screen instructions.
- k. When the update is complete, select “OK”.
- l. Verify the part number at the top of the “Flash ECM” screen has updated to the new part number.
8. Is “WCM - Wireless Control Module” displayed in the “ECU Overview” screen list of modules?
 - a. Yes >> go to [STEP 9](#).
 - b. No >> go to [STEP 10](#).
9. Program the ECM to the Wireless Control Module (WCM).
 - a. Highlight the WCM.
 - b. Select “Misc. Function”.
 - c. Highlight “ECM Replaced”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.
- f. When complete proceed to .
10. Program the VIN into the ECM.
 - a. Scroll through the list of controllers and highlight the ECM.
 - b. Select “Misc. Function”.
 - c. Highlight “Check ECM VIN”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.
 - f. Unplug the scan tool from the Data Link Connector.
 - g. At the “Vehicle Disconnected” screen, press “OK”.
 - h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.

NOTE: Due to the ECM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKREEM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. From the “Home” screen select “System View”. Then select “All DTCs”. Press “Clear All Stored DTCs” if there are any DTCs shown on the list.

NOTE: The following step is required by law when reprogramming a ECM and/or TCM.

11. Type the necessary information on the “Authorized Modification Label” p/n 04275086AB and attach near the VECI label .

DaimlerChrysler AUTHORIZED MODIFICATIONS THESE MODIFICATIONS HAVE BEEN APPROVED AS APPROPRIATE, BY EPA AND CALIF.

THE FOLLOWING MODIFICATIONS HAVE BEEN MADE:

1

CHANGE AUTHORITY DEALER CODE DATE

2 3 4

VECI 80F34528

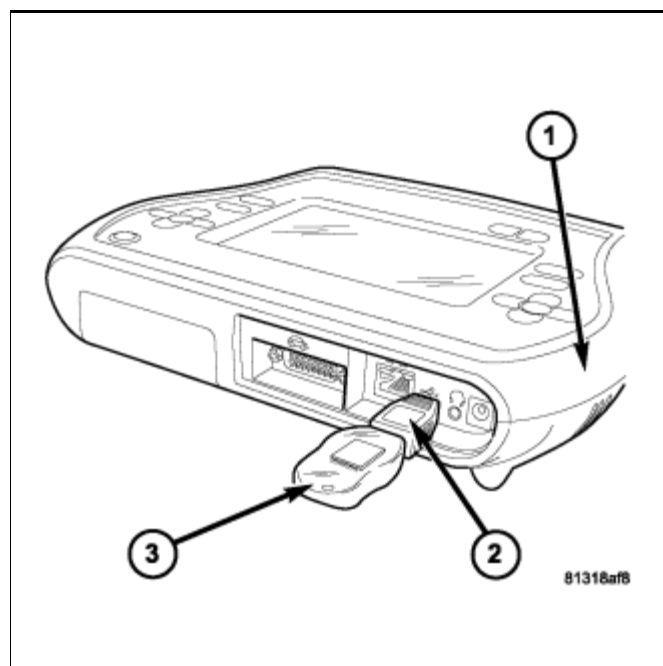
REPAIR PROCEDURE USING SOFTWARE UPDATE CD TO RETRIEVE THE FLASH FILE:

NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

NOTE: For detailed information on the operation of the StarSCAN®, refer to the Quick Reference documentation provided in the StarSCAN® or equivalent documentation kit. In addition, more recent information may also be available at the www.dcctools.com website. Look under "Training Aids" and also under "Download Center > Frequently Asked Questions" for more help.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent or equivalent and the vehicle.
3. Power ON the StarSCAN® or equivalent .
4. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the "Home" screen:
 - a. Select "ECU View"
 - b. Touch the screen to highlight the ECM in the list of modules.
 - c. Select "More Options"
 - d. Select "ECU Flash"
 - e. Record the part number at the top of the "Flash ECM" screen for later reference.
5. Replace the ECM with the appropriate Generic ECM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Engine Control Module, Removal.
6. Insert the StarSCAN® or equivalent Software Update CD into the TechCONNECT or equivalent PC. The StarSCAN® Software Update CD will start automatically. Select "Download Flash Updates".
7. At the "**Select a method for looking up controller flash updates.**" screen:
 - a. Select "Enter part number". Enter the "Part Number" recorded in [STEP 4](#) when prompted to do so.
 - b. Using the mouse highlight the appropriate "Calibration". Select "Next".
 - c. Follow the on screen instructions.
 - d. When completed, proceed to [STEP 8](#).
8. With the StarSCAN® or equivalent powered OFF, connect the USB Key and Gender Changer to the StarSCAN® or equivalent USB port .

9. Connect the StarSCAN® or equivalent to the vehicle (if not already connected).
10. Power ON the StarSCAN® or equivalent .
11. Download the flash file from the USB key to the StarSCAN® or equivalent. Using the StarSCAN® or equivalent at the "Home" screen:
 - a. Select "Flash Download", then select "Retrieve files from the USB storage device"
 - b. Highlight the appropriate calibration. Select "Download to Scan Tool"
 - c. When the download is complete, select "Close" and "Back".
12. Reprogram the ECU. Using the StarSCAN® or equivalent at the "Home" screen:
 - a. Select "ECU View".
 - b. Select "More Options".
 - c. Select "ECU Flash".
 - d. Highlight the appropriate calibration.
 - e. Select "Update Controller". Follow the on screen instructions.
 - f. When the update is complete, select "OK".
 - g. Verify the part number at the top of the "Flash ECM" screen has updated to the new part number.
13. Is "WCM - Wireless Control Module" displayed in the "ECU Overview" screen list of modules?



- a. Yes >> go to [STEP 14](#).
 - b. No >> go to [STEP 15](#).
14. Program the ECM to the Wireless Control Module (WCM). Using the StarSCAN at the “Home” screen:
- a. Select “ECU View”
 - b. Scroll through the list of controllers and highlight the WCM.
 - c. Select “Misc. Function”.
 - d. Highlight “ECM Replaced”.
 - e. Select “Start”
 - f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.
- g. When complete proceed to [STEP 16](#).
15. Program the VIN into the ECM.
- a. Scroll through the list of controllers and highlight the ECM.
 - b. Select “Misc. Function”.
 - c. Highlight “Check ECM VIN”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.
 - f. Unplug the scan tool from the Data Link Connector.
 - g. At the “Vehicle Disconnected” screen, press “OK”.
 - h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.
16. Is the vehicle is equipped with a 3.7L or 4.7L engine?
- a. Yes >> go to [STEP 18](#).
 - b. No >> go to [STEP 17](#).
17. Using the StarSCAN® or equivalent at the “Home” screen:
- a. Select “ECU View”
 - b. Scroll through the list of controllers and highlight the ECM.
 - c. Select “Misc. Function”.
 - d. Highlight “Learn ETC”.
 - e. Select “Start”
 - f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.

NOTE: Due to the ECM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKIM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. Check all modules using “ECU View” from the Home screen, record the DTC's, and erase these DTC's prior to returning the vehicle to the customer. Erase any DTC's in the ECM only after all other modules have had their DTC's erased.

NOTE: The following step is required by law.

18. Type the necessary information on the “Authorized Modification Label” p/n 04275086AB and attach near the VECI label . **

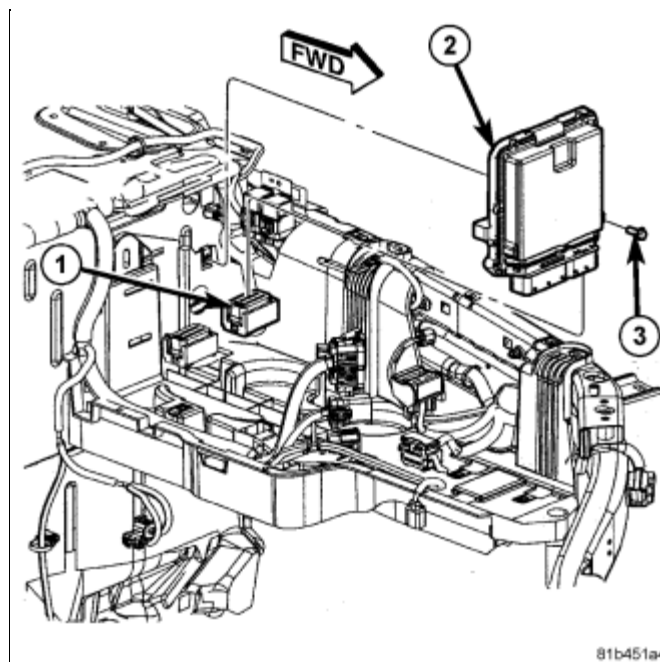
REMOVAL

The ECM (Engine Control Module) (2) is located in the engine compartment.

Use a diagnostic scan tool to reprogram the new ECM with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

To avoid possible voltage spike damage to the ECM, ignition key must be off, and negative battery cable must be disconnected before unplugging ECM connectors.

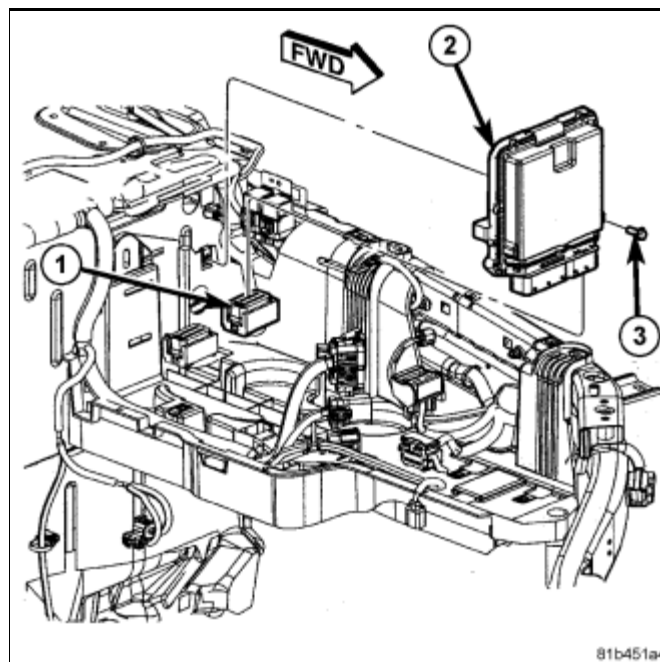
1. Disconnect negative battery cable at battery.
2. Remove plastic shields from over electrical connectors. Shields snap to connectors.
3. Carefully unplug two electrical connectors (1) from ECM.
4. Remove ECM mounting bolts (3) and remove ECM (2) from vehicle.



INSTALLATION

Use a diagnostic scan tool to reprogram the new Engine Control Module (ECM) with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

1. Check pin connectors in ECM and electrical connectors for corrosion or damage. Also check pin heights in connectors. Pin heights should all be the same. Repair as necessary before installing electrical connectors.
2. Install two electrical connectors to ECM.
3. Install ECM (2) and mounting screws (3) to vehicle.
4. Tighten screws to 4 N·m (35 in. lbs.).
5. Install plastic shield to electrical connectors. Shields snap to connectors.
6. Install negative battery cable.
7. Use a diagnostic scan tool to reprogram new ECM with vehicles original Vehicle Identification Number (VIN) and original vehicle mileage.



MODULE-POWERTRAIN CONTROL

STANDARD PROCEDURE

PCM/ECM REPROGRAMMING - GAS

MODULE REPROGRAMING

Replacement PCM's will require programming utilizing the StarSCAN® or equivalent. The PCM will not operate the engine until it is programmed. A Diagnostic Trouble Code (DTC) will be set - "not programmed".

CAUTION: Extreme care must be taken when programming a calibration into a generic PCM. Do not randomly select a calibration. Once a calibration is selected and programmed, the controller cannot be reprogrammed to a different calibration. The module can only be reprogrammed to a more recent version of that calibration.

SPECIAL TOOLS/EQUIPMENT OR EQUIVALENT REQUIRED:

NPN	Battery Charger
CH9401	StarSCAN® Tool
CH9404	StarSCAN® Vehicle Cable
CH9409	StarSCAN® Documentation Kit
CH9410	StarSCAN® Ethernet Cable, 12 ft.
CH9412	StarSCAN® Software Update Device Kit
	TechCONNECT PC or equivalent
	StarSCAN® Software Update CD

**REPAIR PROCEDURE - USING THE INTERNET TO RETRIEVE THE FLASH FILE:

NOTE: The StarSCAN® or equivalent diagnostic scan tool fully supports Internet connectivity. However, in order to take advantage of this feature you must first configure the StarSCAN® or equivalent for your dealership's network. For instruction on setting up your StarSCAN® or equivalent for the dealer's network; refer to the StarSCAN® or equivalent Quick Start Networking Guide available on DealerCONNECT > Service > StarSCAN® or equivalent and StarMOBILE Tools > Online Documentation or at www.dcctools.com website under the download center.

NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9410 StarSCAN® or equivalent ethernet cable to the StarSCAN® or equivalent and the

dealer's network drop.

3. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent and the vehicle.
4. Power ON the StarSCAN® or equivalent.
5. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “ECU View”
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Record the part number at the top of the “Flash PCM” screen for later reference.
6. Replace the PCM with the appropriate Generic PCM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Powertrain Control Module, Removal.
7. Program the PCM as follows:
 - a. Using the StarSCAN® or equivalent at the “Home” screen, Select “ECU View”
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Select “Browse for New File”. Follow the on screen instructions.
 - f. Highlight the appropriate calibration based on the part number recorded in Step 5.
 - g. Select “Download to Scantool”.
 - h. Select “Close” after the download is complete, then select “Back”.
 - i. Highlight the listed calibration.
 - j. Select “Update Controller”. Follow on screen instructions.
 - k. When the update is complete, select “OK”.
 - l. Verify the part number at the top of the “Flash PCM” screen has updated to the new part number.
8. Is this a GPEC Module?
 - a. Yes >> go to [STEP 9](#).
 - b. No >> go to [STEP 12](#).
9. Do not start the engine prior to completing the following steps (a. and b.)
 - a. Turn the ignition switch to the OFF position for no less than 15 seconds.
 - b. Turn the ignition to the RUN position (DO NOT CRANK THE ENGINE) for no less than 20 seconds.
10. Is this vehicle equipped with a CVT?
 - a. Yes >> go to [STEP 11](#).
 - b. No >> go to [STEP 17](#).
11. The TCM must be reprogrammed as follows:
 - a. Using the StarSCAN® or equivalent at the “Home” screen, Select “ECU View”
 - b. Touch the screen to highlight the TCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Record the part number at the top of the “Flash TCM” screen for later reference.
 - f. Select “Browse for New File”. Follow the on screen instructions.

NOTE: If the part number recorded in step “11e” is the same as the new p/n shown on the “Flash File List” screen no further action is required. Cancel the TCM reprogram procedure. Continue to step [STEP 17](#).

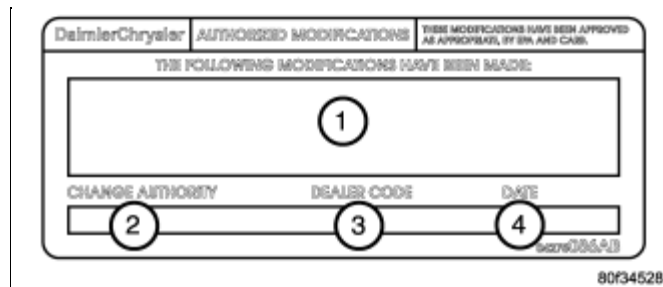
- g. Highlight the appropriate calibration.
- h. Select “Download to Scantool”.
- i. Select “Close” after the download is complete, then select “Back”.
- j. Highlight the listed calibration.
- k. Select “Update Controller”. Follow on screen instructions.
- l. When the update is complete, select “OK”.

- m. Verify the part number at the top of the “Flash TCM” screen has updated to the new part number.
- n. Continue to step [STEP 15](#)
- 12. Is “WCM - Wireless Control Module” displayed in the “ECU Overview” screen list of modules?
 - a. Yes >> go to [STEP 13](#).
 - b. No >> go to [STEP 14](#).
- 13. Program the PCM to the Wireless Control Module (WCM).
 - a. Highlight the WCM.
 - b. Select “Misc. Function”.
 - c. Highlight “PCM Replaced”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.
- f. When complete proceed to [STEP 15](#).
- 14. Program the VIN into the PCM.
 - a. Scroll through the list of controllers and highlight the PCM.
 - b. Select “Misc. Function”.
 - c. Highlight “Check PCM VIN”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.
 - f. Unplug the scan tool from the Data Link Connector.
 - g. At the “Vehicle Disconnected” screen, press “OK”.
 - h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.
- 15. Is the vehicle equipped ETC?
 - a. Yes >> go to [STEP 17](#).
 - b. No >> go to [STEP 16](#).
- 16. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select ECU View
 - b. Scroll through the list of controllers and highlight the PCM.
 - c. Select Misc. Function.
 - d. Highlight “Learn ETC”.
 - e. Select “Start”
 - f. Follow the on screen instructions. Select Next after each step . Select Finish after completing the last step.

NOTE: Due to the PCM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKREEM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. From the Home screen select System View. Then select All DTCs. Press Clear All Stored DTCs if there are any DTCs shown on the list.

NOTE: The following step is required by law when reprogramming a PCM and/or TCM.

- 17. Type the necessary information on the Authorized Modification Label p/n 04275086AB and attach near the VECI label .



REPAIR PROCEDURE USING SOFTWARE UPDATE CD TO RETRIEVE THE FLASH FILE:

NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

NOTE: For detailed information on the operation of the StarSCAN® or equivalent, refer to the Quick Reference documentation provided in the StarSCAN® or equivalent documentation kit. In addition, more recent information may also be available at the www.dcctools.com website. Look under Training Aids and also under Download Center > Frequently Asked Questions for more help.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent and the vehicle.
3. Power ON the StarSCAN® or equivalent.
4. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “ECU View”
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Record the part number at the top of the “Flash PCM” screen for later reference.
5. Replace the PCM with the appropriate Generic PCM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Powertrain Control Module, Removal.
6. Insert the StarSCAN® or equivalent Software Update CD into the TechCONNECT or equivalent PC. The StarSCAN® or equivalent Software Update CD will start automatically. Select “Download Flash Updates”.
7. At the “**Select a method for looking up controller flash updates.**” screen:
 - a. Select “Enter part number”. Enter the “Part Number” recorded in [STEP 4](#) when prompted to do so.
 - b. Using the mouse highlight the appropriate “Calibration”. Select “Next”.
 - c. Follow the on screen instructions.
 - d. When completed, proceed to [STEP 8](#).
8. With the StarSCAN® or equivalent powered OFF, connect the USB Key and Gender Changer to the StarSCAN® or equivalent USB port .
9. Connect the StarSCAN® or equivalent to the vehicle (if not already connected).
10. Power ON the StarSCAN® or equivalent.
11. Download the flash file from the USB key to the StarSCAN® or equivalent. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “Flash Download”, then select “Retrieve files from

the USB storage device”

b. Highlight the appropriate calibration. Select “Download to Scan Tool”

c. When the download is complete, select “Close” and “Back”.

12. Reprogram the ECU. Using the StarSCAN® or equivalent at the “Home” screen:

a. Select “ECU View”.

b. Select More Options”.

c. Select “ECU Flash”.

d. Highlight the appropriate calibration.

e. Select “Update Controller”. Follow the on screen instructions.

f. When the update is complete, select “OK”.

g. Verify the part number at the top of the “Flash PCM” screen has updated to the new part number.

13. Is “WCM - Wireless Control Module” displayed in the “ECU Overview” screen list of modules?

a. Yes >> go to [STEP 14](#).

b. No >> go to [STEP 15](#).

14. Program the PCM to the Wireless Control Module (WCM). Using the StarSCAN® or equivalent at the “Home” screen:

a. Select “ECU View”

b. Scroll through the list of controllers and highlight the WCM.

c. Select “Misc. Function”.

d. Highlight “PCM Replaced”.

e. Select “Start”

f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.

g. When complete proceed to [STEP 16](#).

15. Program the VIN into the PCM.

a. Scroll through the list of controllers and highlight the PCM.

b. Select “Misc. Function”.

c. Highlight “Check PCM VIN”.

d. Select “Start”

e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.

f. Unplug the scan tool from the Data Link Connector.

g. At the “Vehicle Disconnected” screen, press “OK”.

h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.

16. Is the vehicle equipped with a 3.7L or 4.7L engine?

a. Yes >> go to [STEP 18](#).

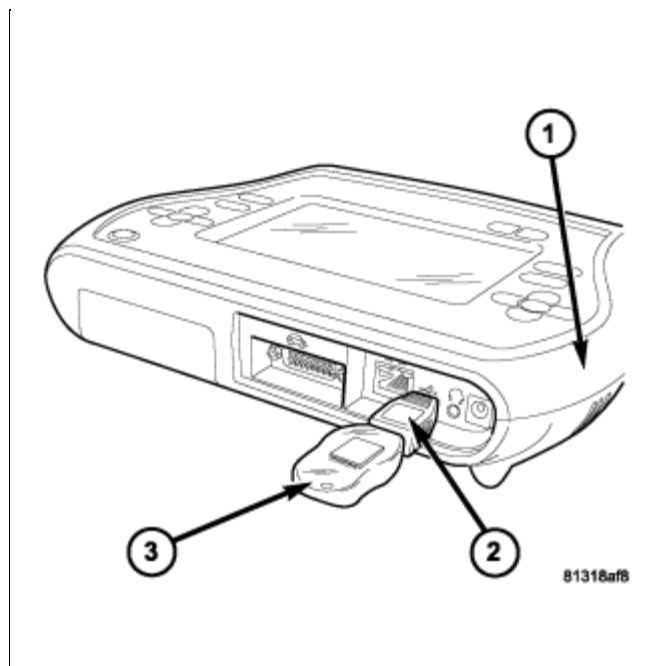
b. No >> go to [STEP 17](#).

17. Using the StarSCAN® or equivalent at the “Home” screen:

a. Select “ECU View”

b. Scroll through the list of controllers and highlight the PCM.

c. Select “Misc. Function”.



- d. Highlight “Learn ETC”.
- e. Select “Start”
- f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.

NOTE: Due to the PCM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKIM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. Check all modules using “ECU View” from the Home screen, record the DTC's, and erase these DTC's prior to returning the vehicle to the customer. Erase any DTC's in the PCM only after all other modules have had their DTC's erased.

NOTE: The following step is required by law.

18. Type the necessary information on the “Authorized Modification Label” p/n 04275086AB and attach near the VECI label . **

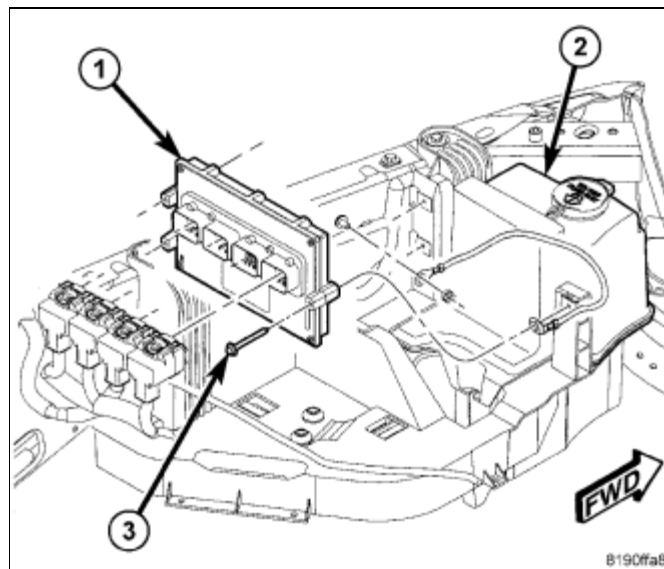
REMOVAL

The PCM (Powertrain Control Module) (1) is located in the engine compartment near the windshield washer reservoir tank (2).

Use a diagnostic scan tool to reprogram the new Powertrain Control Module (PCM) with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

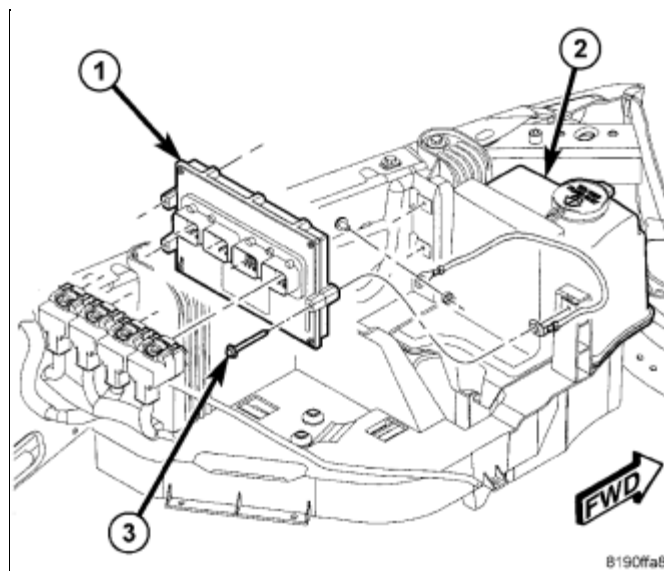
1. Disconnect negative battery cable at battery.
2. Remove plastic shields from over four electrical connectors. Shields snap to connectors.
3. Carefully unplug four electrical connectors from PCM.
4. Remove three PCM mounting bolts (3) and remove PCM from vehicle.



INSTALLATION

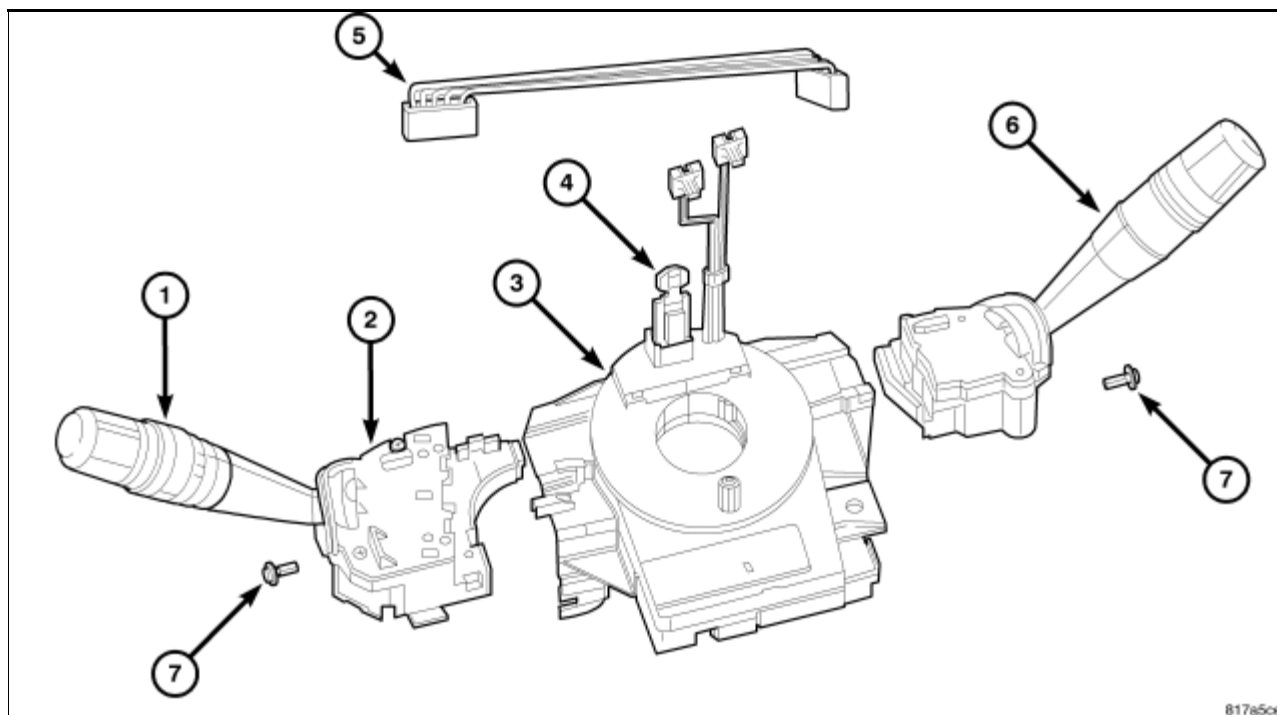
Use a diagnostic scan tool to reprogram the new Powertrain Control Module (PCM) with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

1. Install PCM (1) and three mounting screws (3) to vehicle.
2. Tighten screws to 4 N·m (35 in. lbs.).
3. Check pin connectors in PCM and four electrical connectors for corrosion or damage. Also check pin heights in connectors. Pin heights should all be the same. Repair as necessary before installing electrical connectors.
4. Install four electrical connectors to PCM.
5. Install plastic shield to electrical connectors. Shields snap to connectors.
6. Install battery cable.
7. Use a diagnostic scan tool to reprogram new PCM with vehicles original Vehicle Identification Number (VIN) and original vehicle mileage.



MODULE-STEERING CONTROL

DESCRIPTION



This vehicle is equipped with a Steering Control Module (SCM) that is internal to the left multi-function switch housing (2). The left (lighting) multi-function switch is located on the left side of the steering column, just below the steering wheel. This switch is the primary control for the interior and exterior lighting systems. The only visible components of the switch are the control stalk (1), control knob and control sleeve that extend through

the steering column shrouds on the left side of the column. The remainder of the switch including its mounting provisions and electrical connections are concealed beneath the shrouds.

The switch housing and controls are constructed of molded black plastic. A single screw (7) through a mounting tab integral to the back of the switch housing, and a slide tab integral to the bottom of the switch housing secure the switch to the mounting bracket integral to the clockspring (3). A connector receptacle containing seven terminal pins is integral to the inboard end of the switch housing and connects the SCM through a jumper wire harness (5) directly to the right (wiper) multi-function switch (6). A second connector receptacle containing four terminal pins is integral to the back of the switch housing and connects the SCM to the vehicle electrical system through a dedicated takeout and connector of the instrument panel wire harness.

The SCM cannot be adjusted or repaired. If ineffective or damaged the entire left multi-function switch must be replaced. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - REMOVAL). The clockspring (with the multi-function switch mounting bracket), the left multi-function switch (with the SCM), the right multi-function switch and the jumper wire harness are each available for separate service replacement.

OPERATION

The microprocessor-based Steering Control Module (SCM) utilizes integrated circuitry to monitor hard wired analog and multiplexed inputs from both the right and left multi-function switches. In response to those inputs, the internal circuitry of the SCM allow it to transmit electronic message outputs to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the Local Interface Network (LIN) data bus.

In response to those inputs the internal circuitry and programming of the EMIC, which is also the LIN master module in the vehicle, allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - CAN-LIN BUS).

The SCM is connected to both a fused B(+) circuit and a fused ignition switch output (run-start) circuit. It receives a path to ground at all times. These connections allow it to remain functional regardless of the ignition switch position. Any input to the SCM that controls a vehicle system function that does not require that the ignition switch be in the ON position such as turning on the lights, prompts the SCM to wake up and transmit on the LIN data bus.

The hard wired circuits between components related to the SCM may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SCM or the electronic controls or communication between modules and other devices that provide some features of the SCM. The most reliable, efficient, and accurate means to diagnose the SCM or the electronic controls and communication related to SCM operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

STEERING CONTROL MODULE

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired circuits between components related to the Steering Control Module (SCM) may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

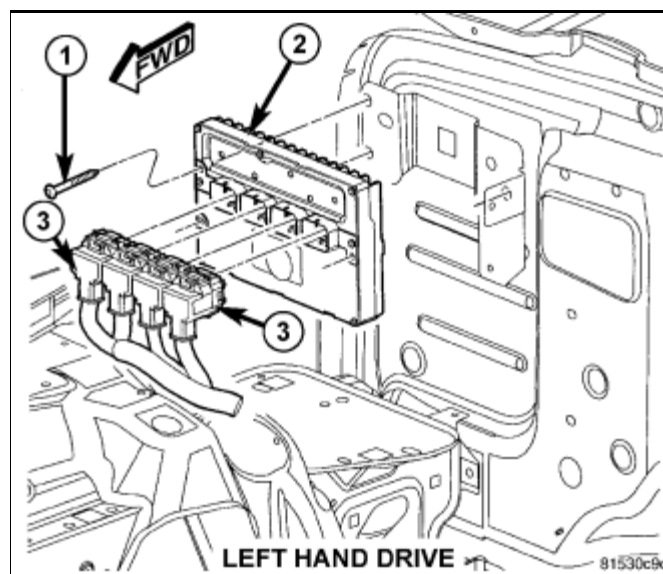
However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SCM or the electronic controls or communication between modules and other devices that provide some features of the SCM. The most reliable, efficient, and accurate means to diagnose the SCM or the electronic controls and communication related to SCM operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

TRANSMISSION CONTROL MODULE

DESCRIPTION

The Transmission Control Module (TCM) is a sub-module within the Powertrain Control Module (PCM) (2).

The PCM (2) is located on the right side of the dash panel in the engine compartment on left hand drive vehicles. The PCM is referred to as the NGC.



The PCM (1) is located on the left side of the dash panel in the engine compartment on right hand drive vehicles.

OPERATION

The TCM is the controlling unit for all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and

selects the operational mode of the transmission. Direct inputs are hard-wired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the CAN bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor (CKP)
- Transmission Range Sensor (TRS)
- Pressure Switches (L/R, 2/4, OD)
- Transmission Temperature Sensor (Integral to TRS)
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Speed Control ON/OFF Switch
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Brake Switch Status
- Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

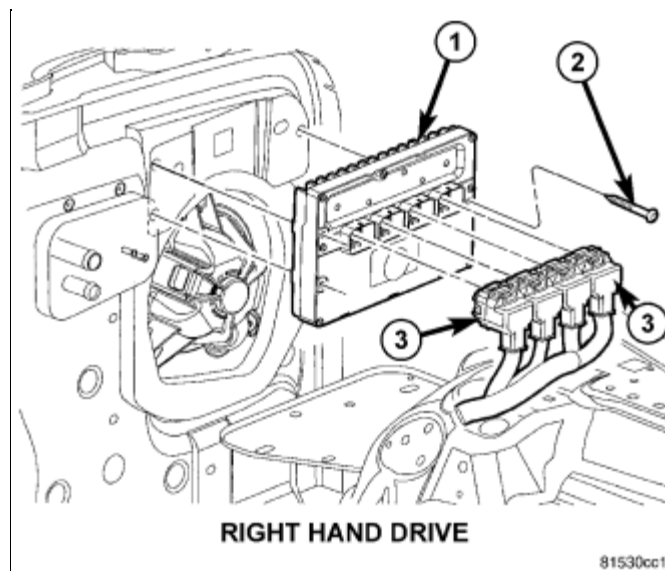
- Transmission Control Relay
- Solenoids (L/R, 2/4, OD and UD)
- Vehicle Speed (to PCM)
- Torque Reduction Request (to PCM)

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indices (CVI)
- Storing and selecting appropriate Shift Schedules



- System self-diagnostics
 - Diagnostic capabilities (with scan tool)

NOTE: If the TCM has been replaced, the “Quick Learn Procedure” must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

CLUTCH VOLUME INDEX (CVI)

An important function of the TCM is to monitor Clutch Volume Index (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

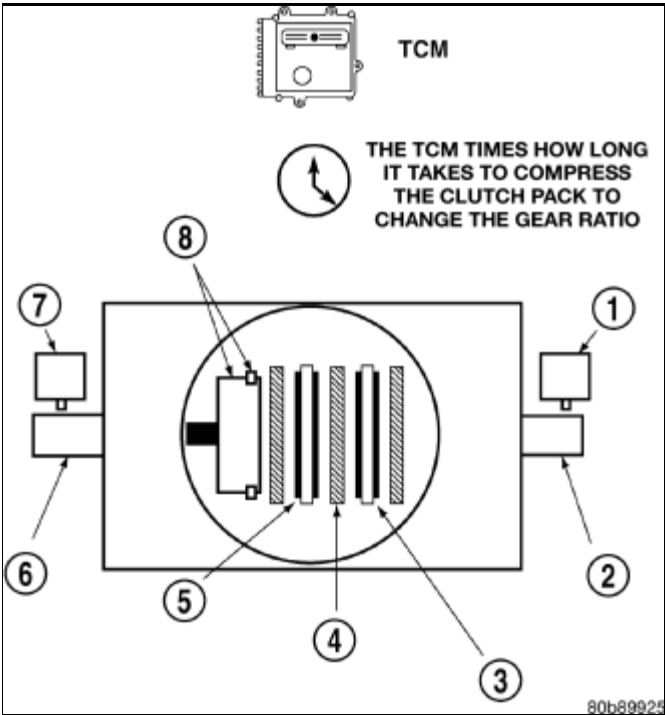
By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur .

Gear ratios can be determined by using the Scan Tool and reading the Input/Output Speed Sensor values in the “Monitors” display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:



CLUTCH VOLUMES		
	When Updated	

Clutch				Proper Clutch Volume
	Shift Sequence	Oil Temperature	Throttle Angle	
L/R	2-1 or 3-1 coast downshift	> 21° C (70° F)	< 5°	35 to 83
2/4	1-2 shift	> 43° C (110° F)	5 - 54°	20 to 77
OD	2-3 shift			48 to 150
UD	4-3 or 4-2 shift		> 5°	24 to 70

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following table [42RLE Shift Schedule](#) to determine the appropriate operation expected, depending on driving conditions.

42RLE Shift Schedule

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature at start-up below -27° C (-16° F)	Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts)
Cold	Oil temperature at start-up above -25° C (-12° F) and below 2° C (36° F)	- Delayed 2-3 upshift (approximately 22-31 mph)
		- Delayed 3-4 upshift (45-53 mph)
		- Early 4-3 coastdown shift (approximately 30 mph)
		- Early 3-2 coastdown shift (approximately 17 mph)
		- High speed 4-2, 3-2, 2-1 kickdown shifts are prevented
		- No EMCC
Warm	Oil temperature at start-up above 2° C (36° F) and below 27° C (80° F)	- Normal operation (upshift, kickdowns, and coastdowns)

		- No EMCC		
Hot	Oil temperature at start-up above 27° C (80° F)	- Normal operation (upshift, kickdowns, and coastdowns)		
		- Full EMCC, no PEMCC except to engage FEMCC (except at closed throttle at speeds above 70-83 mph)		
Overheat	Oil temperature above 115° C (240° F) or engine coolant temperature above 118° C (244° F)	- Delayed 2-3 upshift (25-32 mph)		
		- Delayed 3-4 upshift (41-48 mph)		
		- 3rd gear FEMCC from 30-48 mph		
		- 3rd gear PEMCC from 27-31 mph		
Super Overheat	Oil temperature above 127° C (260° F)	- All "Overheat" shift schedule features apply		
		- 2nd gear PEMCC above 22 mph		
		- Above 22 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made		

STANDARD PROCEDURE - TCM QUICK LEARN

The quick learn procedure requires the use of the scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the scan tool indicates the procedure is complete.
- The calculated oil temperature must be above 60°F (16°C) and below 200°F (93°C)

8F - ENGINE SYSTEMS

BATTERY SYSTEM - SERVICE INFORMATION

BATTERY SYSTEM - SERVICE INFORMATION

DESCRIPTION

This vehicle is equipped with a single 12-volt battery. All of the components of the battery system are located within the engine compartment of the vehicle. The battery system for this vehicle contains the following components:

- **Battery** - The storage battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cables** - The battery cables connect the positive and negative charged battery terminal posts to the vehicle electrical system.
- **Battery Holddown** - The battery holddown hardware secures the battery in the battery tray.
- **Battery Thermal Guard** - The battery thermal guard insulates the battery to protect it from engine compartment temperature extremes.
- **Battery Tray** - The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware.

For battery system maintenance schedules, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION). For the proper jump starting procedures, (Refer to LUBRICATION & MAINTENANCE/JUMP STARTING - STANDARD PROCEDURE).

OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING

BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the

Powertrain Control Module (PCM). Use of an induction-type milliammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING) for the proper charging system on-board diagnostic test procedures.

MICRO 420 BATTERY TESTER (GASOLINE ENGINES)

The Micro 420 automotive battery tester is designed to help diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER) which includes the directions for using the Micro 420 battery tester.

OTC ONE STEP BATTERY ANALYZER AND CHARGER (DIESEL ENGINES)

The OTC One Step Battery Analyzer and Charger is designed to help diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle.

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - IGNITION-OFF DRAW TEST) for the appropriate test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is inoperative.	2. Determine if the charging system is performing to specifications. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING) for the appropriate charging system diagnosis and testing procedures. Repair the inoperative charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the appropriate battery tester. Charge the inoperative battery, as required.
	4. The battery terminal connections are loose or corroded.	4. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DIAGNOSIS AND TESTING) for the appropriate battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper battery size and rating. Replace an incorrect battery, as required.
	6. The battery is inoperative.	6. Test the battery using the appropriate battery tester. Replace the inoperative battery, as required.

	7. The starting system is inoperative.	7. Determine if the starting system is performing to specifications. (Refer to 8 - ELECTRICAL/STARTING - SPECIFICATIONS). Repair the inoperative starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper battery size and rating. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DIAGNOSIS AND TESTING) for the appropriate battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - IGNITION-OFF DRAW TEST) for the appropriate test procedures. Repair the excessive ignition-off draw, as required.
	4. The battery is inoperative.	4. Test the battery using the appropriate battery tester. Replace the inoperative battery, as required.
	5. The starting system is inoperative.	5. Determine if the starting system is performing to specifications. (Refer to 8 - ELECTRICAL/STARTING - SPECIFICATIONS). Repair the inoperative starting system, as required.
	6. The charging system is inoperative.	6. Determine if the charging system is performing to specifications. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING) for the appropriate charging system diagnosis and testing procedures. Repair the inoperative charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw loads in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is inoperative.	1. Test the battery using the appropriate battery tester. Replace the inoperative battery, as required.

STANDARD PROCEDURE

BATTERY RECONNECTION

NOTE: This reconnection procedure is to be performed anytime the battery has been disconnected.

1. Connect the battery negative cable to the battery post and tighten the clamp nut.
2. Install the rear compartment floor trim panel.

CAUTION: Once the battery has been connected, review and perform the following information as applicable.

ELECTRONIC STABILITY PROGRAM (ESP)

If the vehicle is equipped with ESP, once the battery is reconnected, the Steering Angle Sensor (SAS) in the clockspring needs to be calibrated. The SAS requires calibration anytime the battery or an ABS (ESP) component has been disconnected for any length of time. **If the SAS is not calibrated following battery reconnection, the ESP/BAS indicator lamp is illuminated following five ignition cycles indicating the need for calibration.**

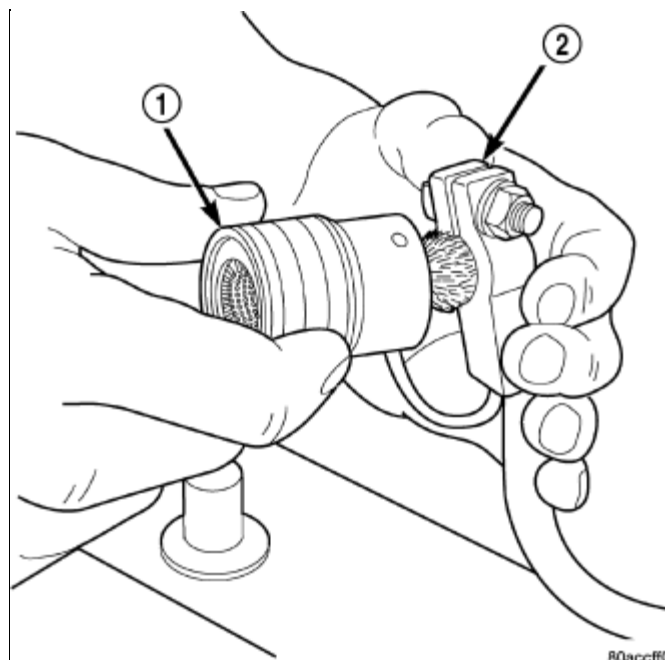
To calibrate, perform the following:

1. Start the engine.
2. Center the steering wheel.
3. Turn the steering wheel all the way to the left until the internal stop in the steering gear is met, then turn the wheel all the way to the right until the opposite internal stop in the steering gear is met.
4. Center the steering wheel.
5. Stop the engine.

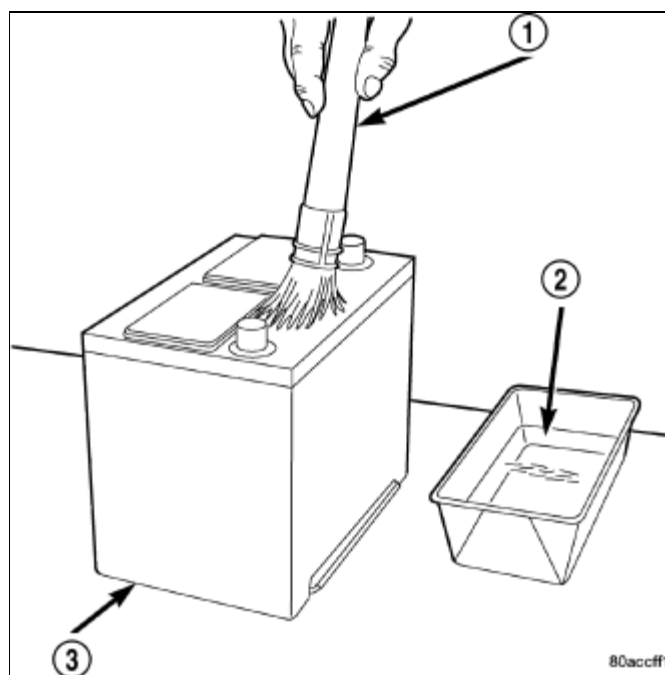
CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the Owner's Manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

1. Clean the battery cable terminal clamps (2) of all corrosion. Remove any corrosion using a wire brush (1) or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution.
2. Clean the battery tray and battery holddown hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.



3. If the removed battery is to be reinstalled, clean the outside of the battery case (3) and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush (1) to remove any acid film. Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.
4. Clean the battery thermal guard with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film.



5. Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution.

INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time

the battery or related components must be removed for vehicle service.



1. Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.
2. Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.
3. Slide the thermal guard off of the battery case (if equipped). Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.
4. Inspect the battery thermal guard for tears, cracks, deformation or other damage (if equipped). Replace any battery thermal guard that has been damaged.
5. Inspect the battery built-in test indicator sight glass (if equipped) for an indication of the battery condition. If the battery is discharged, charge as required. Refer to Standard Procedures for detailed instructions.

SPECIFICATIONS

BATTERY

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

NOTE: Vehicles equipped with a diesel engine utilize a unique battery. The specifications for this battery may differ from the standards shown here. Refer to the battery manufacturer for detailed specifications.

- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.

- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.
- **Load Test Amperage** - The Load Test Amperage rating specifies the current (in amperes) that a battery should be tested at with the battery load test equipment. This value should always be 50 percent of the CCA. For example: if the CCA for this battery is 700 amps, the Load Test Amperage is 50 percent of that or 350 amps.

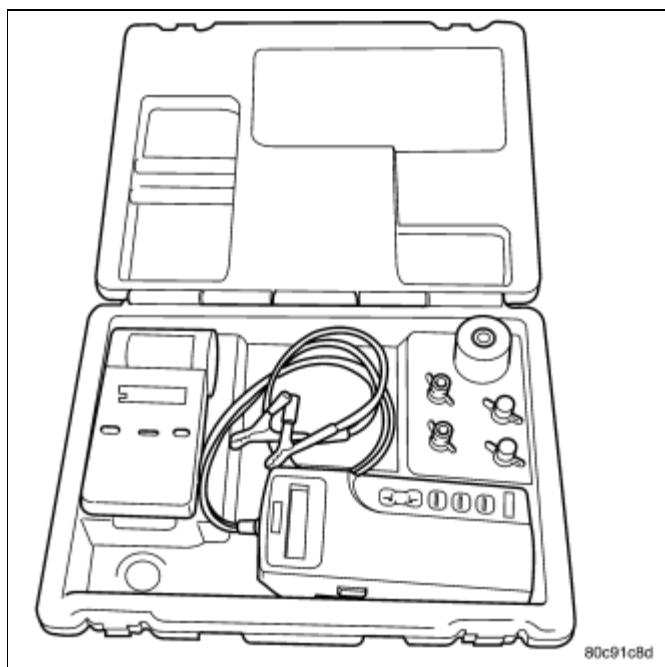
BATTERY CLASSIFICATIONS & RATINGS											
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere - Hours	Load Test Amperage						
04609365AE	34	600	120 Minutes	66	300						
04727475AC	31	825	140 Minutes	50	400						

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Battery Terminal Clamp Pinch-Bolt Hex Nut	5	-	45
Battery Hold Down Bolt	7	-	62
Starter Solenoid B(+) Terminal Stud Nut	13	-	115
Battery Negative Cable Ground Eyelet Terminal To Engine Block Bolt	16.5	-	145
Generator Output Terminal Stud Nut	14	-	125
Totally Integrated Power Module B(+) Terminal Stud Nut	10	-	90
Battery Negative Cable Eyelet Terminal To The Inner Fender Bolt	12	9	-
Lower Battery Tray Bolts	10.5	-	93
Upper Battery Tray Bolts	10.5	-	93
Battery Tray Nut	10.5	-	93

SPECIAL TOOLS

BATTERY SYSTEM SPECIAL TOOLS



Micro 420 Battery Tester

BATTERY

DESCRIPTION

There are two different batteries available for this vehicle. Vehicles equipped with a diesel engine utilize a spiral cell battery with recombination technology. This is a maintenance-free battery that is capable of delivering more power than a conventional battery. This additional power is required by a diesel engine during cold cranking. Vehicles equipped with a gasoline engine utilize a conventional battery. Refer to the following information for detailed differences and descriptions of these two batteries.

SPIRAL CELL BATTERY - DIESEL ENGINE

WARNING: Never exceed 14.4 volts when charging a spiral cell battery. Personal injury and/or battery damage may result.

By tightly winding layers of spiral grids and acid-permeated vitreous separators into cells, the battery has more power and service life than conventional batteries of the same size. The spiral cell battery is completely, permanently sealed. Through gas recombination, hydrogen and oxygen within the battery are captured during normal charging and reunited to

form the water within the electrolyte, eliminating the need to add distilled water. Therefore, these batteries have non-removable battery vent caps.

The acid inside a spiral cell battery is bound within the vitreous separators, ending the threat of acid leaks. This feature allows the battery to be installed in any position anywhere in the vehicle.



Spiral cell technology is the process by which the cells holding the active material in the battery are wound tightly in coils instead of hanging flat, like conventional batteries. This design has a lower internal resistance and also increases the active material surface area.

Due to the maintenance-free design, distilled water cannot be added to this battery. Therefore, if more than 14.4 volts are used during the spiral cell battery charging process, water vapor can be exhausted through the pressure-sensitive battery vents and lost for good. This can permanently damage the spiral cell battery.

CONVENTIONAL BATTERY - GASOLINE ENGINE

Low-maintenance conventional batteries are used on vehicles equipped with a gasoline engine, these batteries have non-removable battery cell caps. Under normal service, the composition of this battery reduces gassing and water loss at normal charge rates.

Conventional batteries are made up of six individual cells that are connected in series. Each cell contains positive charged cell groups made of lead oxide, and negatively charged cell groups made of sponge lead. The cells are submerged in a sulfuric acid and water solution called electrolyte.

The battery is used to store electrical energy potential in a chemical form. When an electrical load is applied to the battery terminals, an electrochemical reaction occurs within the battery. This reaction causes the battery to discharge electrical current.

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery.

terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

DIAGNOSIS AND TESTING

BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) for the proper battery cleaning procedures. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

MICRO 420 BATTERY TESTER (GASOLINE ENGINES)

The Micro 420 automotive battery tester is designed to help diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

OTC ONE STEP BATTERY ANALYZER AND CHARGER (DIESEL ENGINES)

The OTC One Step Battery Analyzer and Charger is designed to help diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle.

WARNING: If the battery shows signs of freezing, leaking or loose posts, do not test, assist-boost, or charge. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.

WARNING: Explosive hydrogen gas forms in and around the battery. Do not smoke, use flame, or create sparks near the battery. Personal injury and/or vehicle damage may result.

WARNING: The battery contains sulfuric acid, which is poisonous and caustic. Avoid contact with the skin, eyes, or clothing. In the event of contact, flush with water and call a physician immediately. Keep out of the reach of children.

WARNING: Never exceed 14.4 volts when charging a spiral cell battery. Personal injury and/or battery

damage may result.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be tested to determine its cranking capacity. A battery that is fully-charged, but fails the OTC One Step Battery Analyzer and Charger or other load test, is faulty and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.

STANDARD PROCEDURE

SPIRAL CELL BATTERY CHARGING

WARNING: Never exceed 14.4 volts when charging a spiral cell battery. Personal injury and/or battery damage may result.

Vehicles equipped with a diesel engine utilize a unique spiral cell battery. This battery has a maximum charging voltage that must not be exceeded in order to restore the battery to its full potential, failure to use the following spiral cell battery charging procedure could result in damage to the battery or personal injury.

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- OTC One Step Battery Analyzer and Charger special tool number OT-3641 or equivalent tester indicates battery is OK.
- Open-circuit voltage of the battery is 12.65 volts or above.
- Battery passes Load Test multiple times.

WARNING: If the battery shows signs of freezing, leaking, loose posts or low electrolyte level, do not test, assist-boost, or charge. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.

WARNING: Explosive hydrogen gas forms in and around the battery. Do not smoke, use flame, or create sparks near the battery. Personal injury and/or vehicle damage may result.

WARNING: The battery contains sulfuric acid, which is poisonous and caustic. Avoid contact with the skin, eyes, or clothing. In the event of contact, flush with water and call a physician immediately. Keep out of the reach of children.

CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Charge the battery directly at the battery terminals. Do not exceed 14.4 volts while charging a battery.

CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

After the battery has been charged to 12.6 volts or greater, perform a load test to determine the battery cranking capacity. If the battery passes a load test, return the battery to service. If the battery fails a load test, it is faulty and must be replaced.

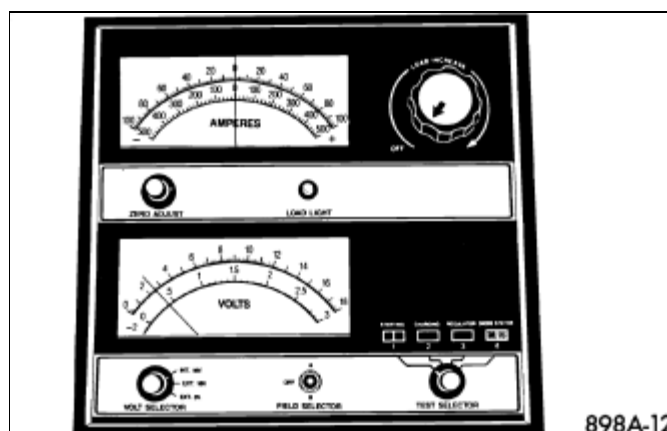
Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) for the proper battery system cleaning procedures. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper battery system inspection procedures.

CHARGING A COMPLETELY DISCHARGED BATTERY – SPIRAL CELL BATTERY

WARNING: Never exceed 14.4 volts when charging a spiral cell battery. Personal injury and/or battery damage may result.

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt. Refer to Battery Removal and Installation for access instructions. If the reading is below ten volts, the battery charging current will be low. It could take several hours before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.
2. Disconnect and isolate the battery negative cable. Connect the OTC One Step Battery Analyzer and Charger special tool number OT-3641 or equivalent.



NOTE: Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

3. Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

SPIRAL-PLATE BATTERY CHARGE RATE TABLE

Voltage	Minutes
14.4 volts maximum	up to 10 minutes
13.0 to 14 volts	up to 20 minutes
12.9 volts or less	up to 30 minutes

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies eight amperes will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

SPIRAL-PLATE BATTERY CHARGING TIME TABLE

Charging Amperage	5 Amps	8 Amps
Open Circuit Voltage	Hours Charging @ 21° C (70° F)	
12.25 to 12.49	6 hours	3 hours
12.00 to 12.24	10 hours	5 hours
10.00 to 11.99	14 hours	7 hours
Below 10.00	18 hours	9 hours

STANDARD PROCEDURE - CONVENTIONAL BATTERY CHARGING

CAUTION: Vehicles equipped with a diesel engine utilize a unique spiral cell battery. This battery has a maximum charging voltage that must be used in order to restore the battery to its full potential, failure to use the spiral cell battery charging procedure could result in damage to the battery or personal injury. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - SPIRAL CELL BATTERY CHARGING) for the appropriate procedure.

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 battery tester indicates battery is OK.
- Open-circuit voltage of the battery is 12.65 volts or above.
- Battery passes Load Test multiple times.

WARNING: If the battery shows signs of freezing, leaking, loose posts, do not test, assist-boost, or charge. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.

WARNING: Explosive hydrogen gas forms in and around the battery. Do not smoke, use flame, or create sparks near the battery. Personal injury and/or vehicle damage may result.

WARNING: The battery contains sulfuric acid, which is poisonous and caustic. Avoid contact with the skin, eyes, or clothing. In the event of contact, flush with water and call a physician immediately. Keep out of the reach of children.

WARNING: If the battery is equipped with removable cell caps, be certain that each of the cell caps is in place and tight before the battery is returned to service. Personal injury and/or vehicle damage may result from loose or missing cell caps.

CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

CAUTION: Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.

CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

After the battery has been charged to an open-circuit voltage reading of 12.4 volts or greater, retest the battery with the Micro 420 tester or perform a load test to determine the battery cranking capacity. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER) for the proper battery test procedures. If the battery passes a load test, return the battery to service. If the battery fails a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) for the proper battery system cleaning procedures. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper battery system inspection procedures.

CHARGING A COMPLETELY DISCHARGED CONVENTIONAL BATTERY

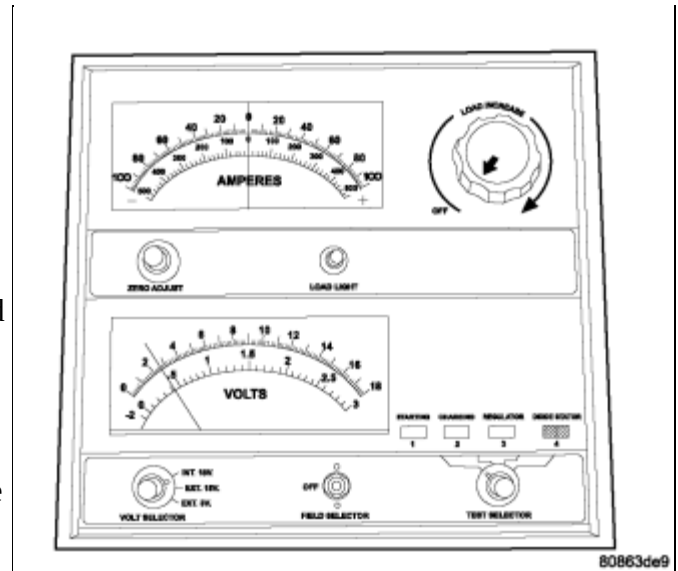
The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt. If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the

ammeters built into many battery chargers.

2. Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

3. Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.



CONVENTIONAL BATTERY CHARGE RATE TABLE

Voltage	Minutes
16.0 volts maximum	up to 10 min.
14.0 to 15.9 volts	up to 20 min.
13.9 volts or less	up to 30 min.

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18°C (0°F) than at 27°C (80°F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Conventional Battery Charging Time Table gives an indication of the time required to charge a typical

battery at room temperature based upon the battery state-of-charge and the charger capacity.

CONVENTIONAL BATTERY CHARGING TIME TABLE

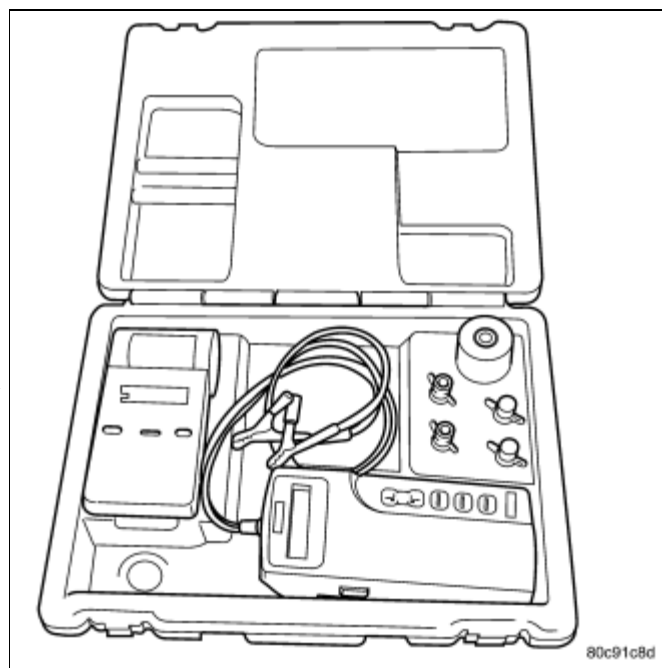
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
Below 10.00	18 hours	9 hours	4.5 hours

USING MICRO 420 BATTERY TESTER (GASOLINE ENGINES)

NOTE: The Micro 420 Battery Tester should only be used to test vehicles equipped with gasoline engines. If the vehicle being tested has a diesel engine the OTC One Step Battery Analyzer and Charger special tool number OT-3641 or equivalent should be used to test the battery.

Always use the Micro 420 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:

WARNING: Always wear appropriate eye protection and use extreme caution when working with batteries.



BATTERY TESTING

1. If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing. If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.

2. If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition.
3. Connect the tester to the battery, the red clamp to the positive (+) terminal and the black clamp to the negative (-) terminal.

NOTE: Multiple batteries connected in parallel must have the ground cable disconnected to perform a battery test. Failure to disconnect may result in false battery test readings.

4. Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.
5. If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the BATTERY TEST RESULTS TABLE.

CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.

6. While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

BATTERY TEST RESULTS	
GOOD BATTERY	Return to service
GOOD - RECHARGE	Fully charge battery and return to service
CHARGE & RETEST	Fully charge battery and retest battery
REPLACE BATTERY	Replace the battery and retest complete system
BAD-CELL REPLACE	Replace the battery and retest complete system

NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.

STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate state-of-charge of a battery.

Before proceeding with this test, completely charge the battery, refer to the appropriate battery charging procedure.

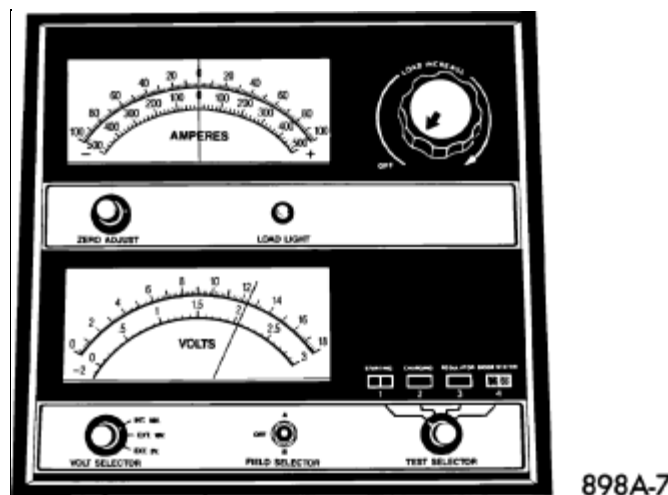
1. Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes

for the battery voltage to stabilize.

2. Disconnect and isolate both battery cables, negative cable first.

3. Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage.

See the Open-Circuit Voltage Table. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity.



OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Totally Integrated Power Module (TIPM). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Faulty or improperly adjusted switches.
- Faulty or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

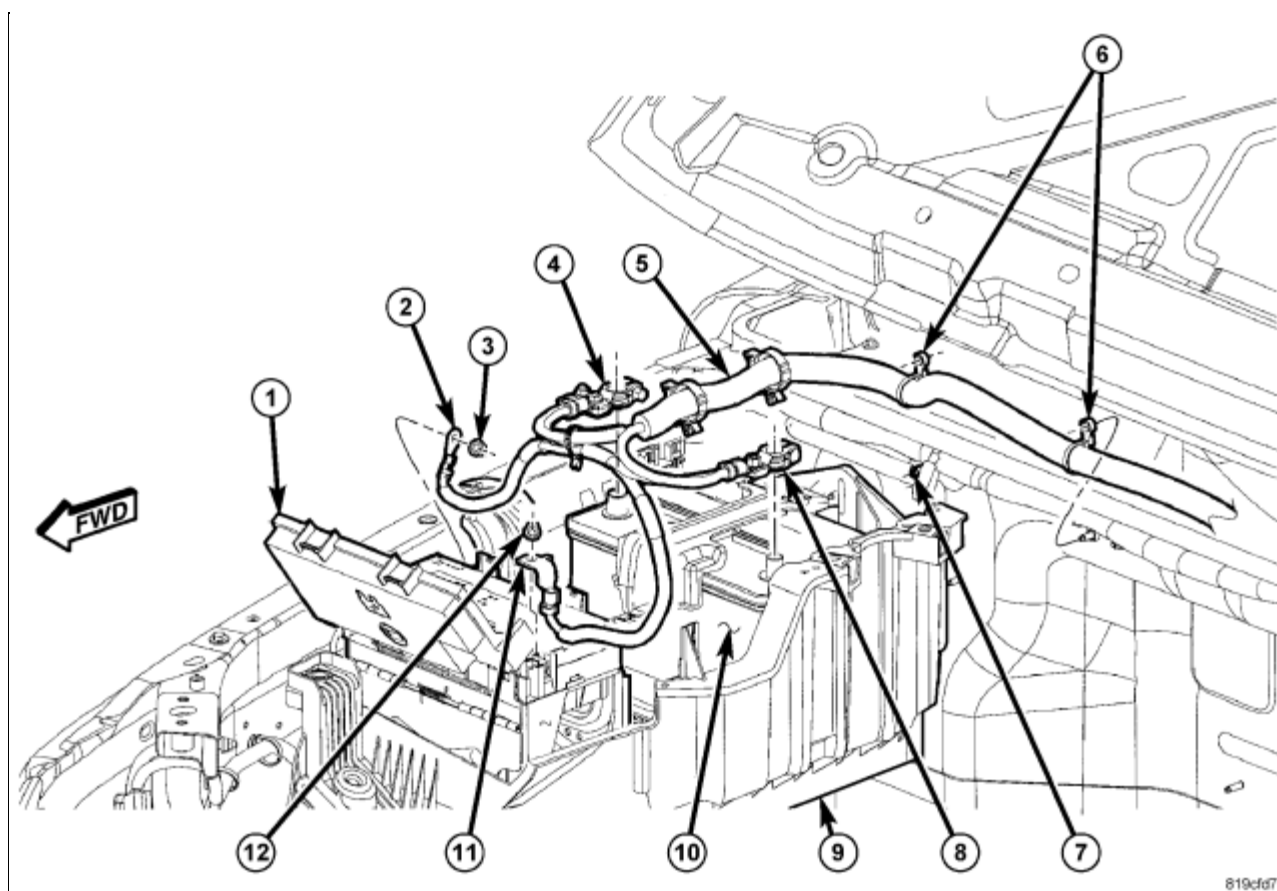
If the IOD is over thirty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

1. Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes.
2. Determine that the underhood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.
3. Disconnect the battery negative cable.
4. Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.
5. After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Totally Integrated Power Module (TIPM), one at a time until the amperage reading becomes very low, or nonexistent. **Refer to the appropriate wiring information for complete TIPM fuse, circuit breaker, and circuit identification.** This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING) for the proper charging system diagnosis and testing procedures. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliamperage scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliamperage scale selected, or the multi-meter may be damaged.

6. Observe the multi-meter reading. The low-amperage IOD should not exceed thirty-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in [STEP 5](#). The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

REMOVAL



WARNING:

To protect the hands from battery acid, a suitable pair of heavy duty rubber gloves should be worn when removing or servicing a battery. Safety glasses also should be worn.

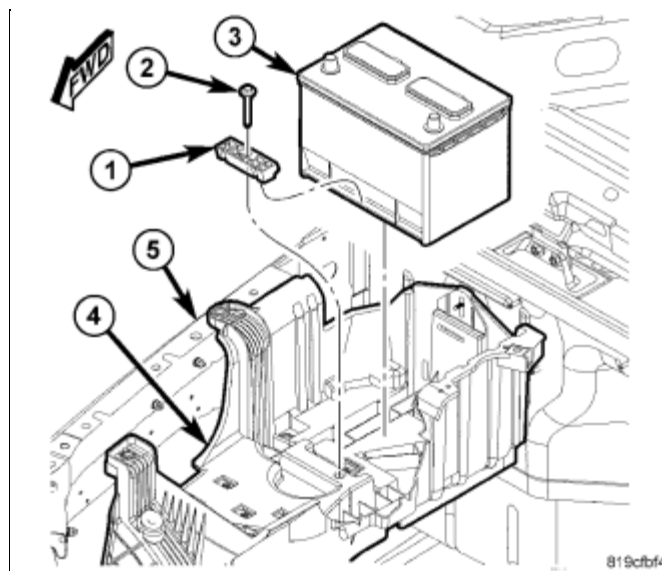
WARNING: Remove metallic jewelry to avoid injury by accidental arcing of battery current.

WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

1. Loosen the pinch clamp bolt and disconnect and isolate the battery negative cable (8).
2. Loosen the pinch clamp bolt and disconnect the battery positive cable (4).

3. On gasoline engine equipped vehicles, loosen bolt (2) and remove the retainer (1) that holds the battery (3) down to the tray (4).



4. On diesel engine equipped vehicles, loosen the bolts (2 and 3) and remove the retaining bracket that holds the battery (4) down to the tray (5).
5. Remove the battery from the vehicle.
6. Remove thermal guard (if equipped) from battery.

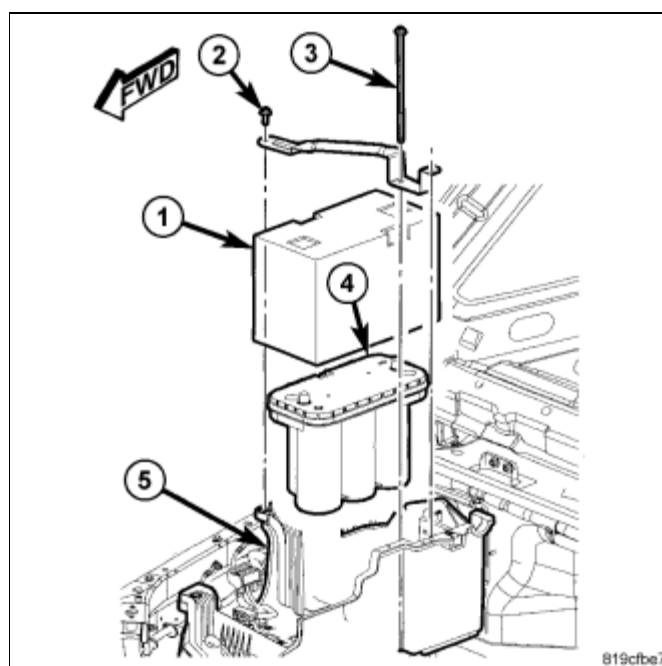
INSTALLATION

WARNING:

To protect the hands from battery acid, a suitable pair of heavy duty rubber gloves should be worn when removing or servicing a battery. Safety glasses also should be worn.

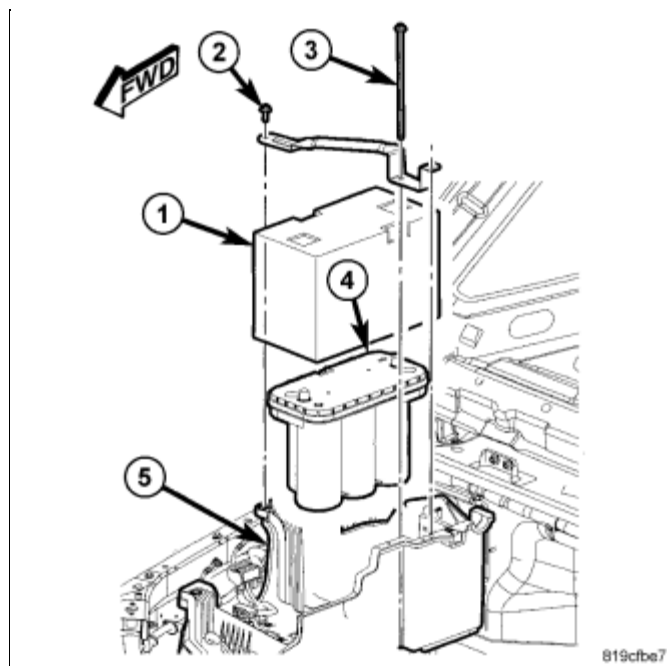
WARNING: Remove metallic jewelry to avoid injury by accidental arcing of battery current.

NOTE: When replacing battery, the thermal guard MUST be transferred to the new battery (if equipped).

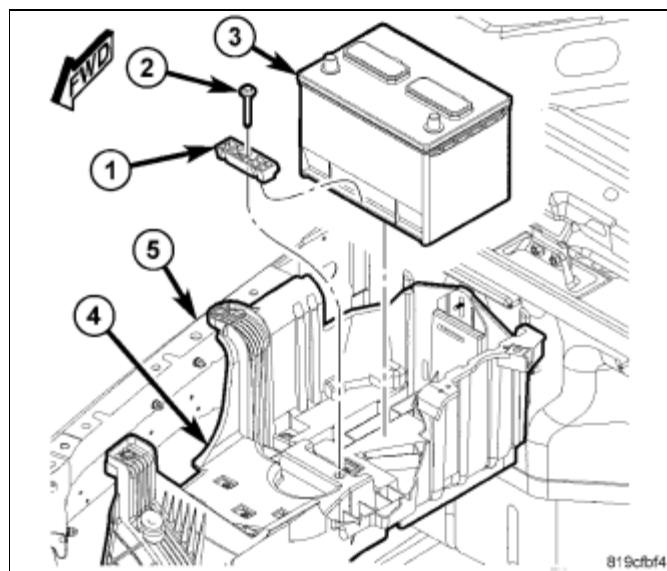


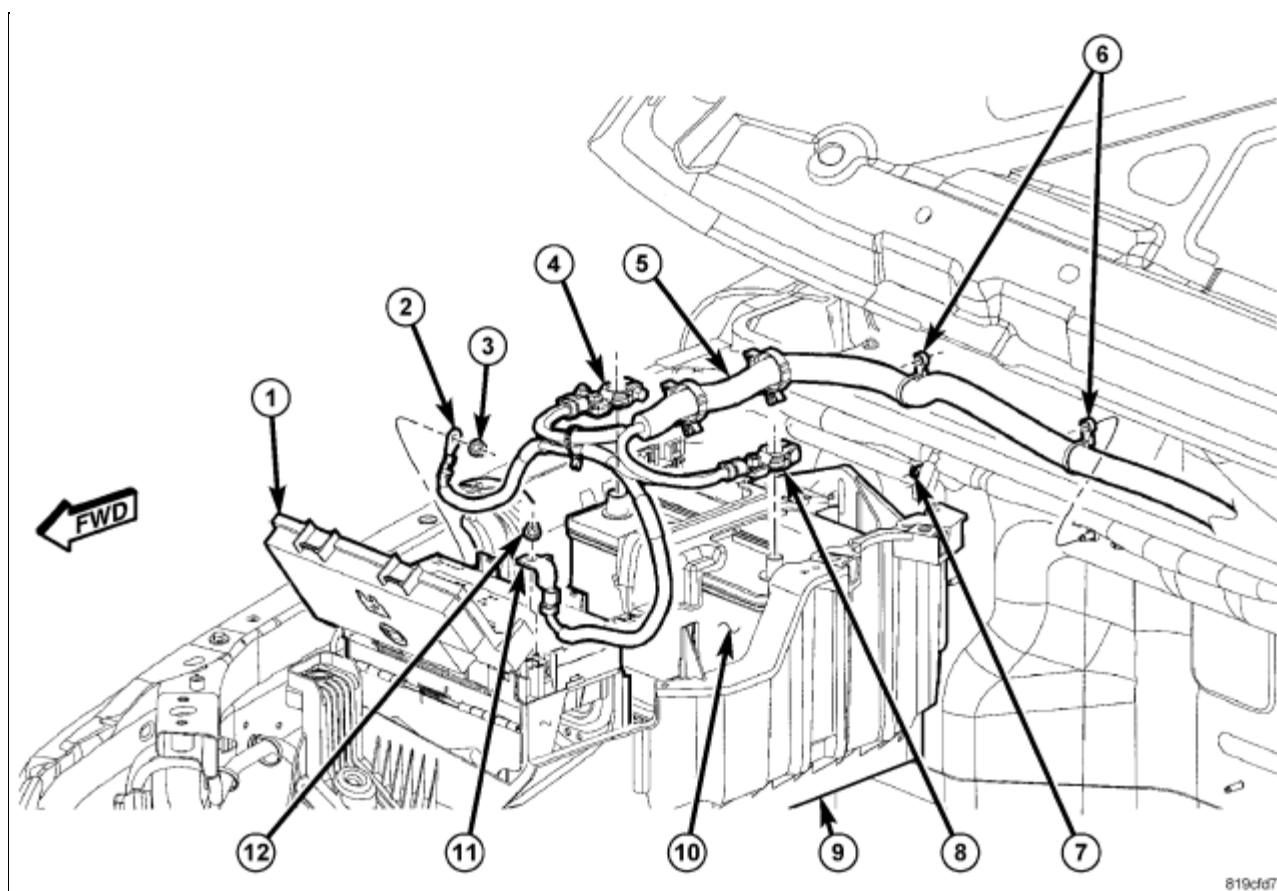
1. Install battery into the vehicle making sure that the thermal guard (if equipped) is present and battery is properly positioned on battery tray.

On diesel engine equipped vehicles, position the retaining bracket onto the battery (4) and install the bracket bolts (2 and 3). Tighten the bolts to 7 N·m (62 in. lbs.)



2. On gasoline engine equipped vehicles, install the battery hold down retainer (1) and bolt (2) making sure that it is properly positioned on battery (3). Tighten the hold down bolt to 7 N·m (62 in. lbs.)





WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

3. Connect the battery positive cable (4) and tighten the pinch clamp nut to 5 N·m (45 in. lbs.)
4. Connect the battery negative cable (8) and tighten the pinch clamp nut to 5 N·m (45 in. lbs.)
5. Verify proper vehicle operation.

BATTERY CABLES

DESCRIPTION

The battery cables are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. The battery cables feature a clamping type female battery terminal made of stamped sheet metal that is die cast onto one end of the battery cable wire. A pinch-bolt and nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then soldered. The battery positive cable wires feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a smaller female battery terminal clamp.

Both the battery positive and negative cables are available for service replacement only as a unit with the battery wire harness, which may include portions of the wiring circuits for the generator and other components on some vehicles.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a path back to the battery for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the opposite ends of the battery cable wires from the female battery terminal clamps provide secure and reliable connection of the battery cables to the vehicle electrical system.

One wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the Totally Integrated Power Module (TIPM), and the other wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp has one wire as an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a ground connection, typically on the engine cylinder block.

DIAGNOSIS AND TESTING

BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cable. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

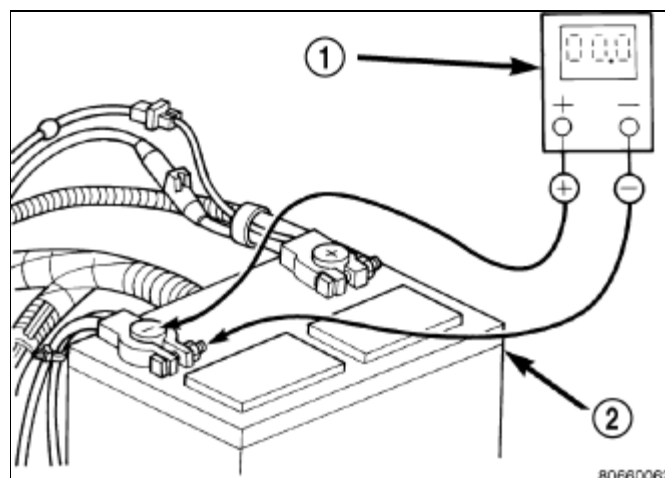
VOLTAGE DROP TEST

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

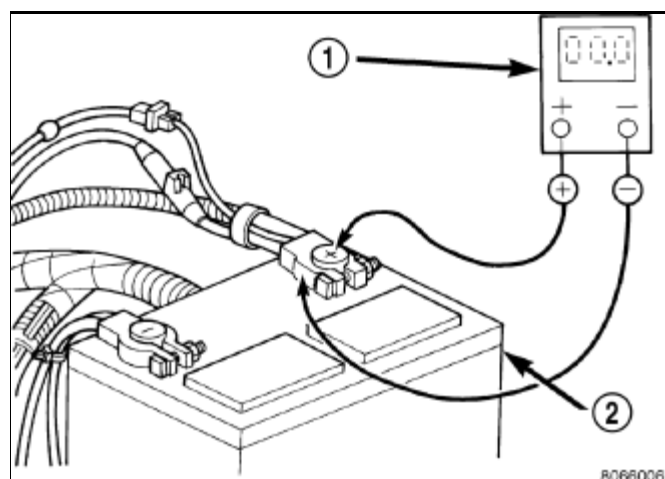
- The battery is fully-charged and load tested. Refer to Standard Procedures for the proper battery charging and load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic Shut Down (ASD) relay. The ASD relay can

be found in the Fuse Block located in the left front bumper fascia. See the fuse and relay layout label affixed to the underside of the Fuse Block cover for ASD relay identification and location.

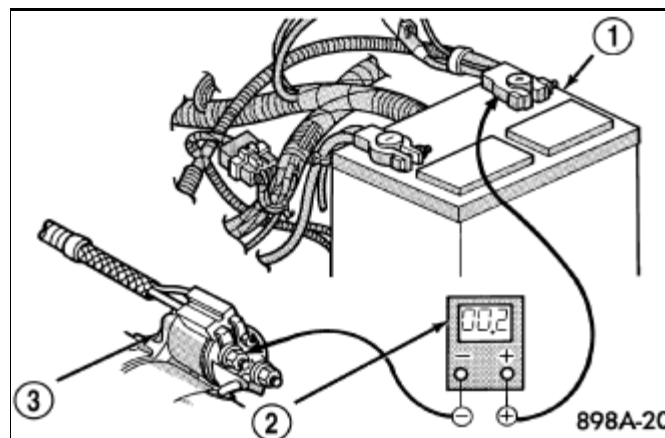
1. Connect the positive lead of the voltmeter (1) to the battery (2) negative terminal post. Connect the negative lead of the voltmeter (1) to the battery (2) negative cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.



2. Connect the positive lead of the voltmeter (1) to the battery (2) positive terminal post. Connect the negative lead of the voltmeter (1) to the battery (2) positive cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.



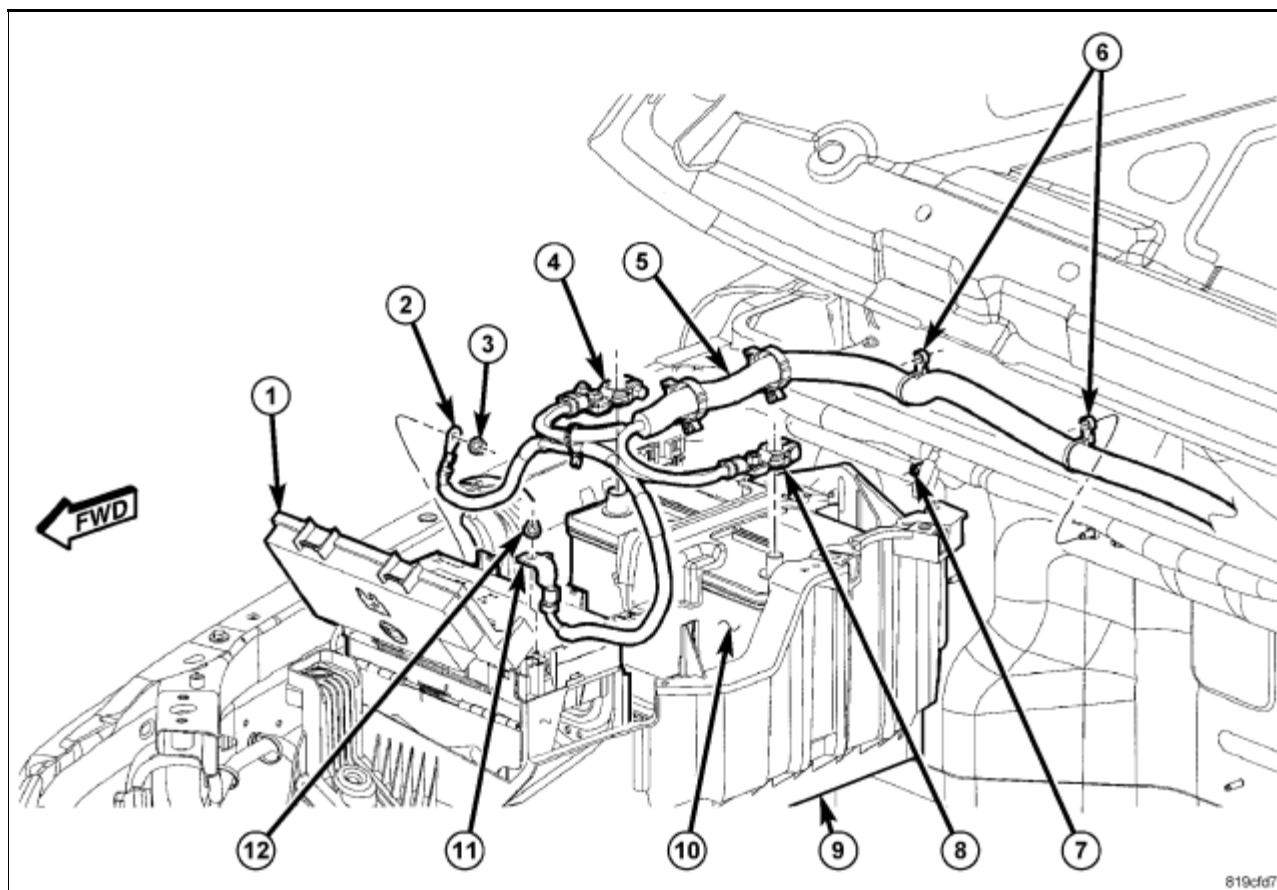
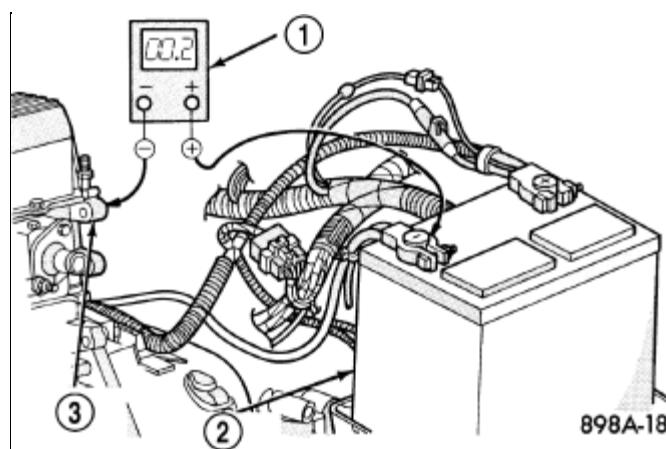
3. Connect the voltmeter (2) to measure between the battery positive cable terminal clamp (1) and the starter solenoid B(+) terminal stud (3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.



4. Connect the voltmeter (1) to measure between the battery (2) negative cable terminal clamp and a good clean ground on the engine block (3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is

above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

REMOVAL



WARNING: Remove metallic jewelry to avoid injury by accidental arcing of battery current.

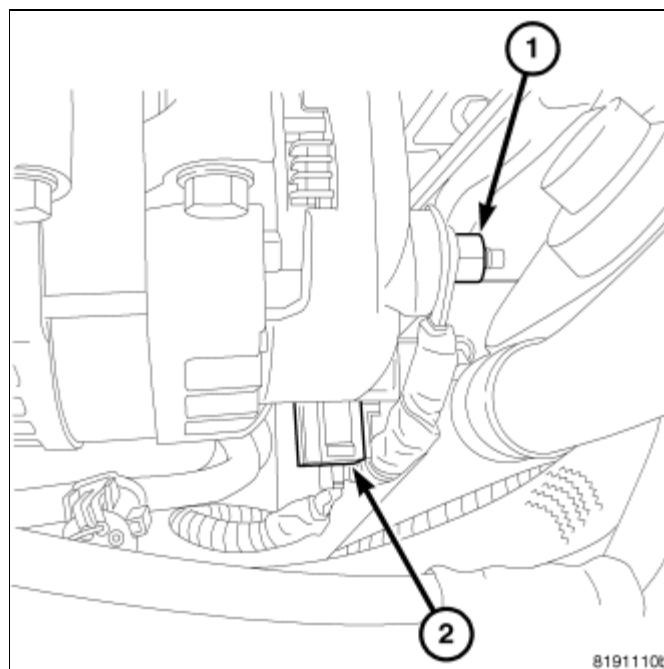
WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

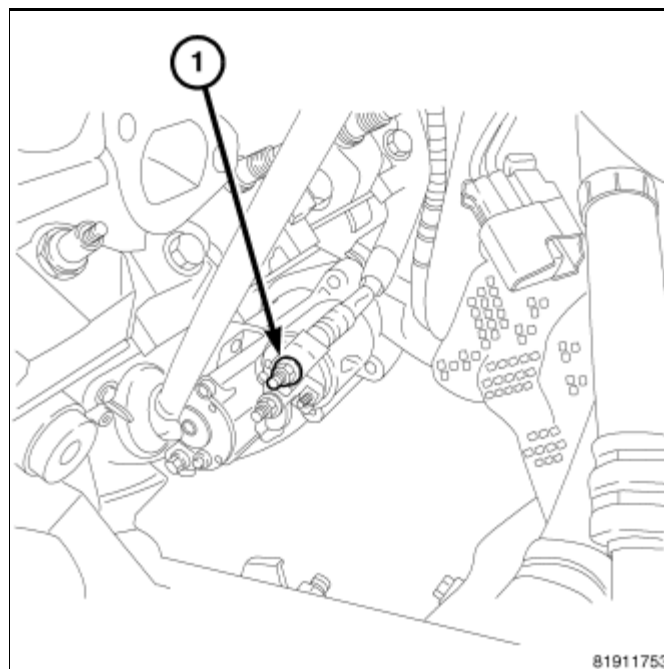
1. Loosen the pinch clamp bolt and disconnect and isolate the battery negative cable (8).

2. Loosen the pinch clamp bolt and disconnect the battery positive cable (4).
3. Remove the positive cable retaining nut (12) from the mounting stud on the Totally Integrated Power Module (1). Remove the cable (11) from the stud.
4. Remove the negative cable retaining nut (3) from the mounting stud on the inner fender. Remove the cable (2) from the stud.
5. Disconnect the cable assembly (5) routing clips (6) from the mounting studs (7).

6. Remove the battery cable nut (1) from the B+ terminal of the generator. Remove the cable from the generator.



7. Remove the battery cable from the B+ terminal of the starter motor (1).
8. Remove the negative battery cable from the engine block ground.
9. One at a time, trace any remaining battery cable retaining pushpins, fasteners and routing clips until the cables are free from the vehicle.
10. Remove the battery cables from the engine compartment.

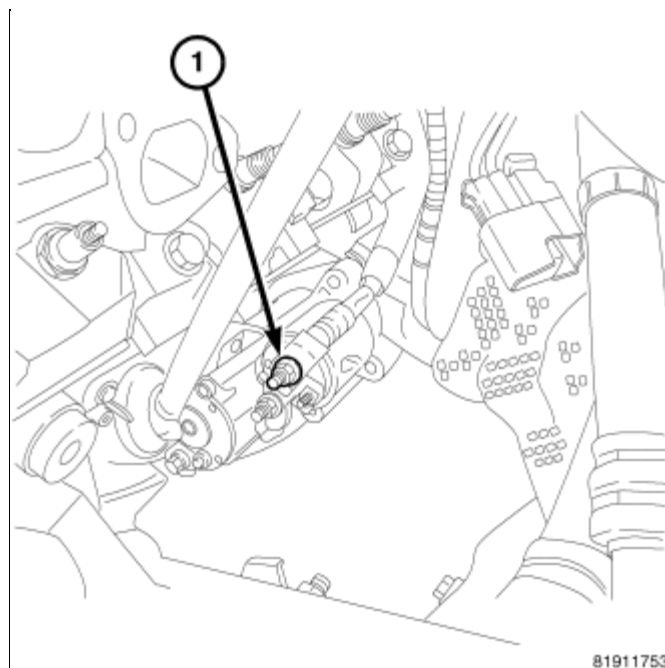


INSTALLATION

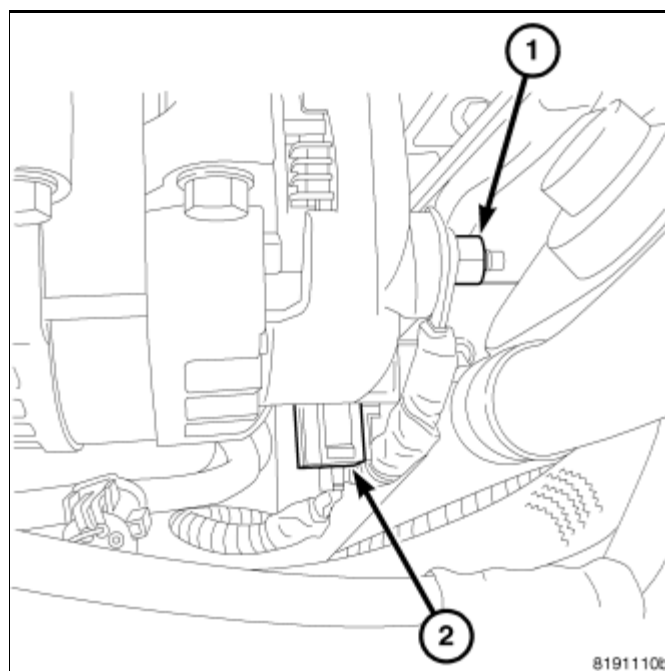
WARNING: Remove metallic jewelry to avoid injury by accidental arcing of battery current.

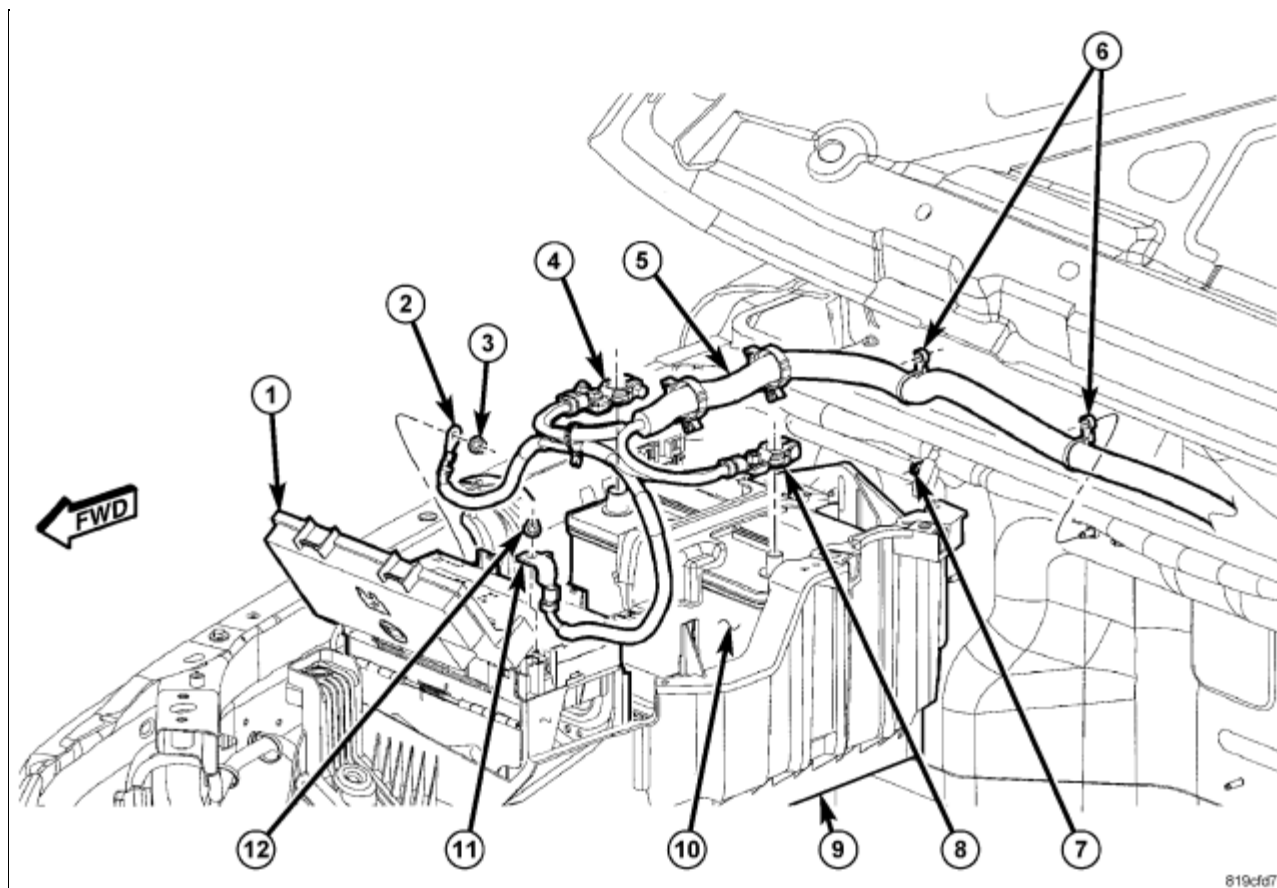
1. Position the battery cables in the engine compartment.

2. One at a time, install the battery cable retaining pushpins, fasteners and routing clips until the cables are installed exactly where they were in the vehicle.
3. Install the negative battery cable to the engine block ground.
4. Connect the battery cable to the B+ terminal of the starter motor (1). Tighten the cable nut to 13 N·m (115 in. lbs.).



5. Connect the battery cable to the B+ terminal of the generator (1). Tighten the cable nut to 14 N·m (125 in. lbs.).





WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

6. Connect the cable assembly (5) routing clips (6) to the mounting studs (7).
7. Install the nut (3) securing the negative cable (2) to the body ground stud. Tighten the cable nut to 12 N·m (9 ft. lbs.)
8. Install the nut (12) securing the Totally Integrated Power Module (TIPM) cable (11) to the battery cable stud (5).
9. Connect the battery positive cable (4). Tighten the cable clamp nut to 5 N·m (45 in. lbs.)
10. Connect the battery negative cable (8). Tighten the cable clamp nut to 5 N·m (45 in. lbs.)

BATTERY TRAY

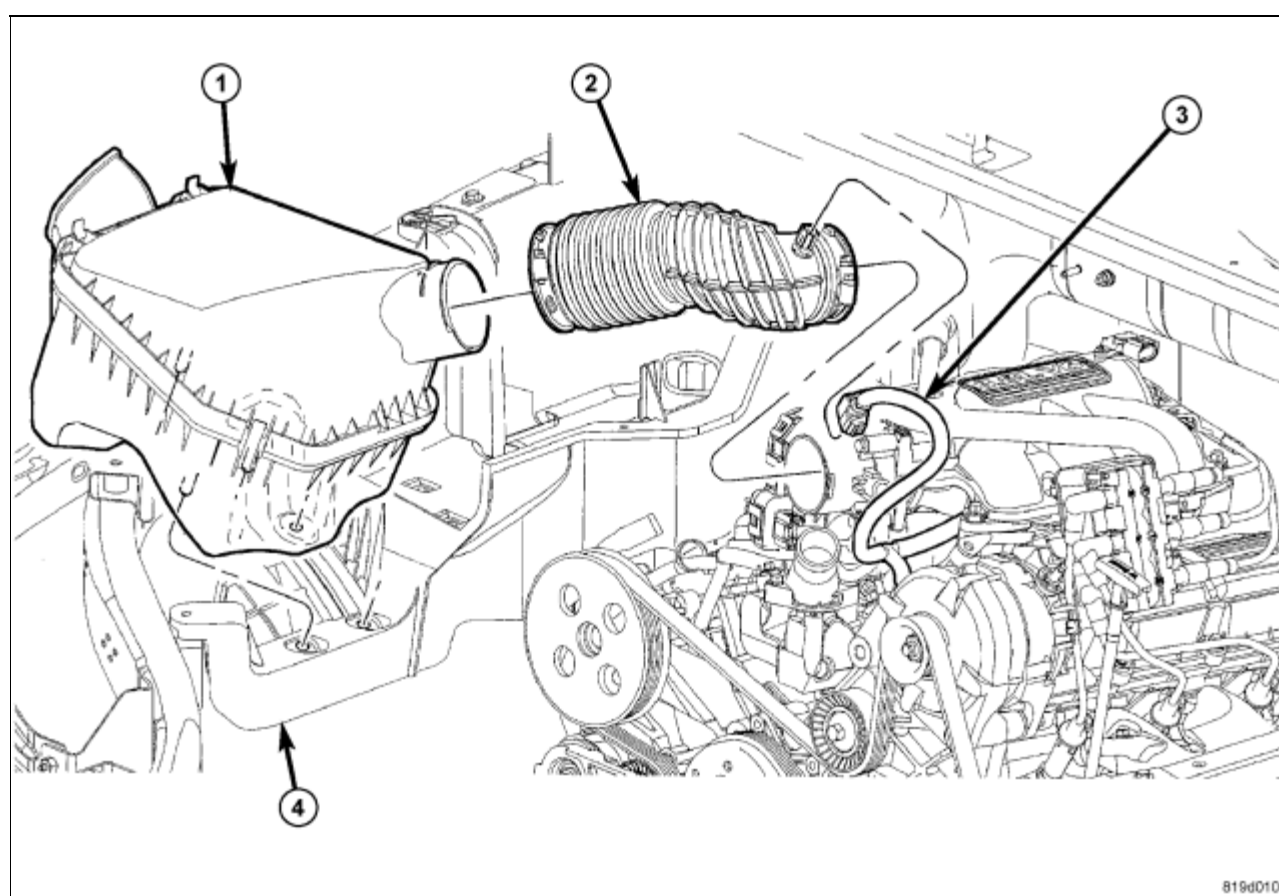
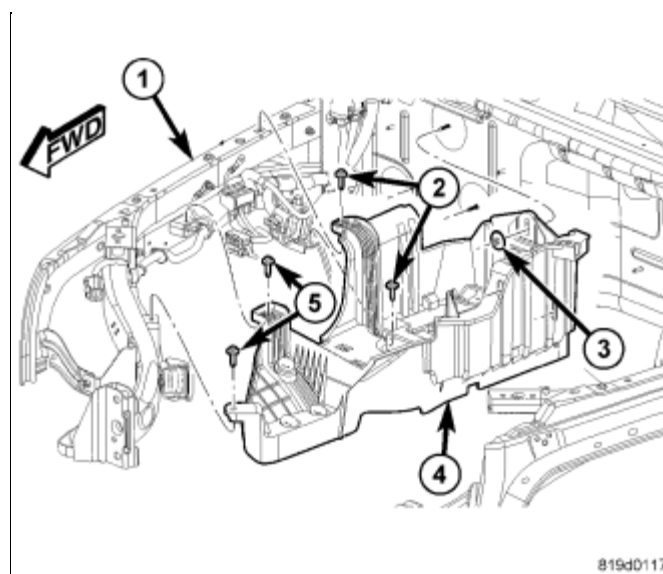
DESCRIPTION

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel

similar with the battery and related components packaged on the left side of the engine compartment.

The battery is placed and secured in a plastic battery tray (4). The battery tray is located next to the inner front fender and is secured in place by one nut (3) and four bolts (2 and 5).

REMOVAL



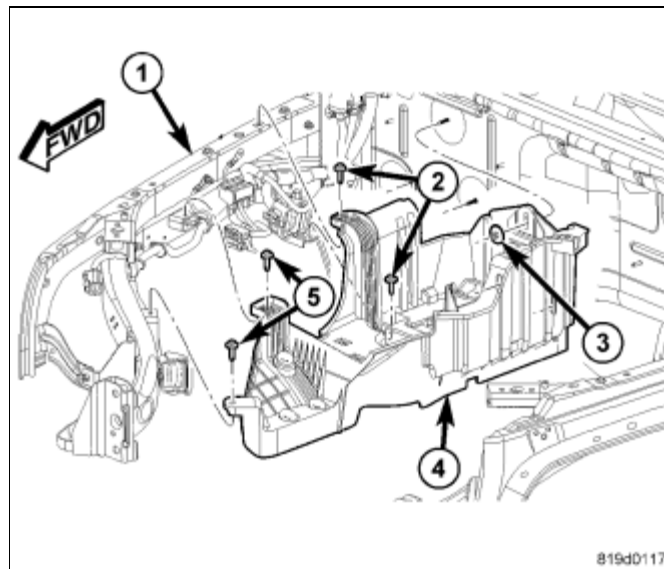
WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

1. Disconnect and isolate the battery negative cable.
2. Disconnect the fresh air tube (2) from the air cleaner assembly (1).
3. Remove the air cleaner assembly (1) from the battery tray (4) by pulling up on the air cleaner to disengage the mounting pins.
4. Remove the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).
5. Remove the Totally Integrated Power Module, (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).

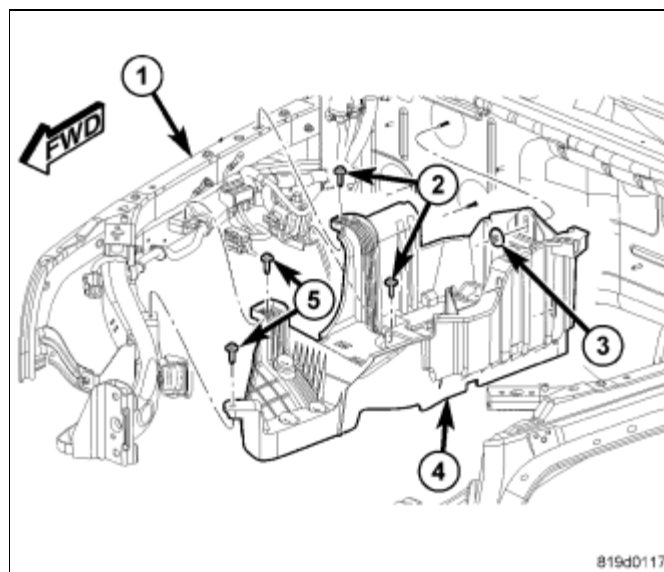
6. Remove the four bolts (2 and 5) and one nut (3) securing the battery tray (4) to the vehicle.
7. Lift the battery tray out of the engine compartment and remove from the vehicle.

INSTALLATION

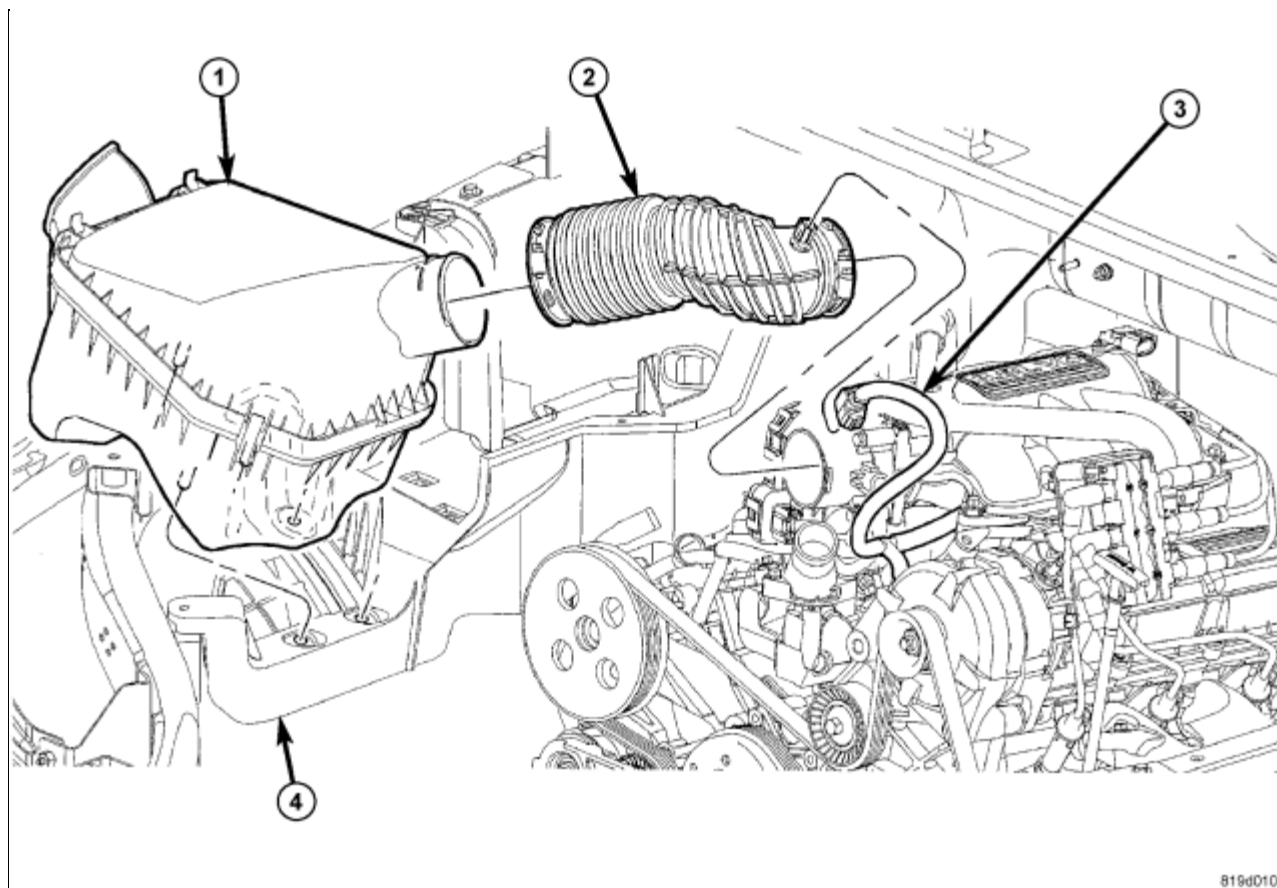


WARNING: The battery negative and positive cable polarity are different from the gasoline engine equipped vehicles to the diesel engine equipped vehicles. Please note the location of the positive and negative cables prior to service of the battery or related components.

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.



1. Position the battery tray (4) into the engine compartment.
2. Loosely install the one nut (3) and four bolts (2 and 5) securing the battery tray (4) to the vehicle.
3. Tighten the nut to 10.5 N·m (93 in. lbs.)
4. Tighten the bolts to 10.5 N·m (93 in. lbs.)
5. Install the Totally Integrated Power Module (TIPM), (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - INSTALLATION)
6. Install the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).



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7. Install the air cleaner assembly (1) to the battery tray (4) by pushing down on the air cleaner to fully engage the mounting pins.
8. Connect the fresh air tube (2) to the air cleaner assembly (1).
9. Connect the battery negative cable.

THERMAL GUARD (DIESEL ENGINES ONLY)

DESCRIPTION

On diesel engine equipped vehicles, a flexible thermal guard wraps around the battery case (2) to enclose the sides of the battery. The thermal guard (1) consists of a plastic cloth outer skin with a polyester based insulator fiber.

REMOVAL

WARNING:

To protect the hands from battery acid, a suitable pair of heavy duty rubber gloves, not the household type, should be worn when removing or servicing a battery. Safety

glasses also should be worn.

1. Disconnect and isolate the battery negative cable.
2. Remove the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).
3. Carefully lift the thermal guard off over the battery taking care not to tear it.
4. Remove the thermal guard from battery.

INSTALLATION

NOTE: When replacing battery, the thermal guard MUST be transferred to the new battery.

1. Slip the battery thermal guard over the battery being careful not to tear it.
2. Install the battery into the vehicle, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).
3. Connect the battery negative cable.

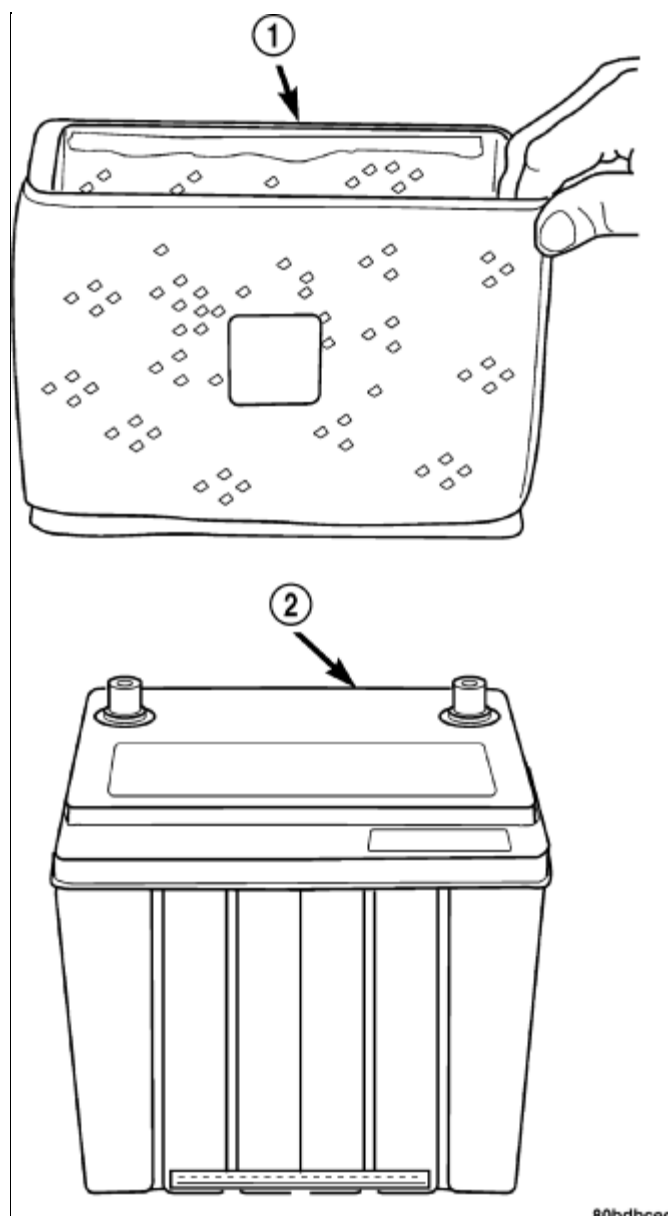
CHARGING

CHARGING

DESCRIPTION

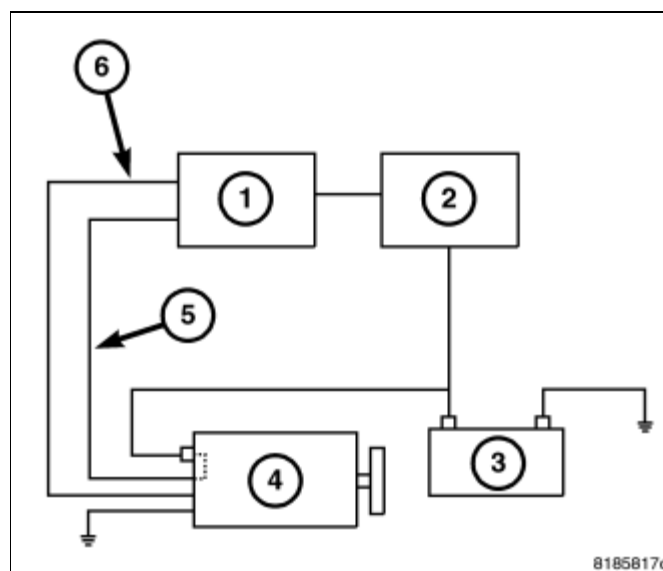
The charging system consists of:

- Generator
- Generator Decoupler Pulley (if equipped)
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch
- Battery (refer to 8, Battery for information)
- Battery temperature sensor
- Generator Lamp (if equipped)



- Check Gauges Lamp (if equipped)
- Voltmeter (refer to 8, Instrument Cluster for information)
- Wiring harness and connections (refer to 8, Wiring for information)

OPERATION - CHARGING SYSTEM



1 - PCM
2 - TIPM
3 - Battery
4 - Generator
5 - Feed Back Circuit B+
6 - Control Circuit
7 - Battery Sense

On gasoline powered engines, the charging system is turned on and off with the PCM (Powertrain Control Module) and ignition switch with engine running. On diesel powered engines, the charging system is turned on and off with the ECM (Engine Control Module) and ignition switch with engine running. The field circuit will not be energized until engine is running and ignition switch on. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source B+) at the back of the generator. The generator is internally grounded. The generator regulates the field using pin-1 of the field connector (high side driver).

The generator is driven by the engine through a serpentine belt and pulley, or a decoupler pulley arrangement.

The PCM, or ECM receives a voltage input from the generator (5) and also a battery voltage input (7) from the TIPM (Totally Integrated Power Module), it then compares the voltages to the desired voltage programed in the EVR (Electronic Voltage Regulator) software, and, if there is a difference it sends a signal to the generator EVR

circuit to increase or decrease output. It uses a Pulse Width Modulation (PWM) to send signals to the generator circuitry to control the amount of output from the generator. The amount of DC current produced by the generator is controlled by the EVR circuitry contained within the generator.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage**, engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as reminder to check the three gauges. The lamp is located on the instrument panel. Refer to the Instrument Cluster section for additional information.

Voltage is monitored at the B+ terminal stud to insure it is connected. If the B+ cable is loose, the PCM will shut down generator field. Because of this new feature, pin-2 of the field connector is internally connected to the B+ terminal.

The generator used with diesel engines is internally regulated. The generator and ECM communicate for diagnostics, etc. If the generator regulator becomes disconnected from the ECM, it will still operate, but in a default mode.

DIAGNOSIS AND TESTING - CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. Refer to Ignition-Off Draw Test in 8, Battery for more information.

INSPECTION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

To perform a complete test of the charging system, refer to a diagnostic scan tool. Perform the following inspections before attaching the scan tool.

1. Inspect the battery condition. Refer to 8, Battery for procedures.
2. Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.
3. Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.
4. Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

5. Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in 7, Cooling System.
6. Inspect automatic belt tensioner (if equipped). Refer to 7, Cooling System for information.
7. Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

SPECIFICATIONS

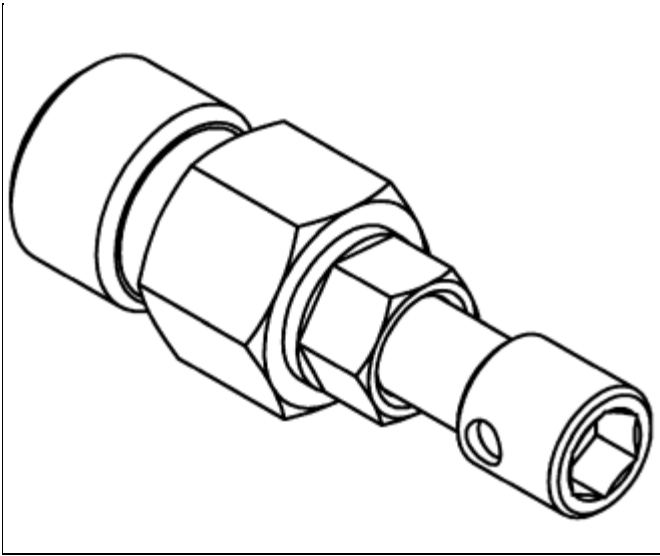
GENERATOR RATINGS

TYPE	RATED SAE AMPS	ENGINES
DENSO	160	3.8L V-6
DENSO	180	2.8L Diesel

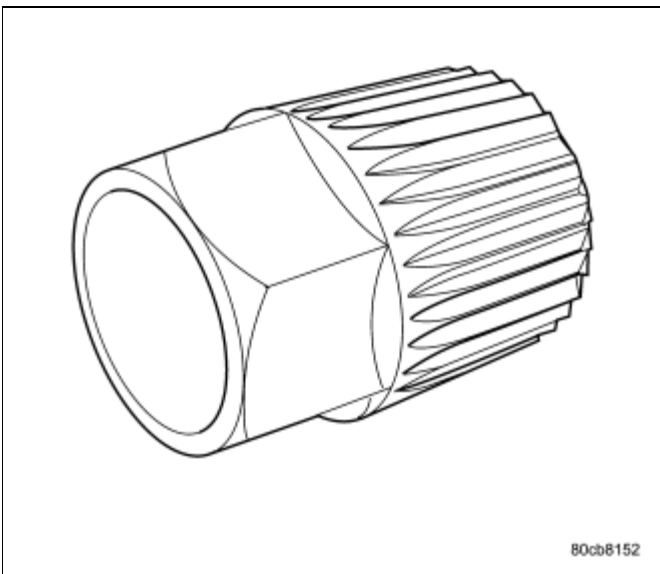
TORQUE

DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Generator B+ Nut	12.4	9.2	110
Generator Mounting Bolts 3.8L	54.2	40	-
Generator Mounting Bolts/Nut 2.8L Diesel	54	40	-
Rear Generator Support Bracket Bolts (to engine) 2.8L Diesel	28	-	250
Starter Solenoid Battery Nut 3.8L	11.3	8.3	100
Generator Decoupler	109.8	81	

SPECIAL TOOLS



GENERATOR DECOUPLER TOOL #8433



GENERATOR DECOUPLER TOOL #8823

GENERATOR 3.8L

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into

the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator battery terminal.

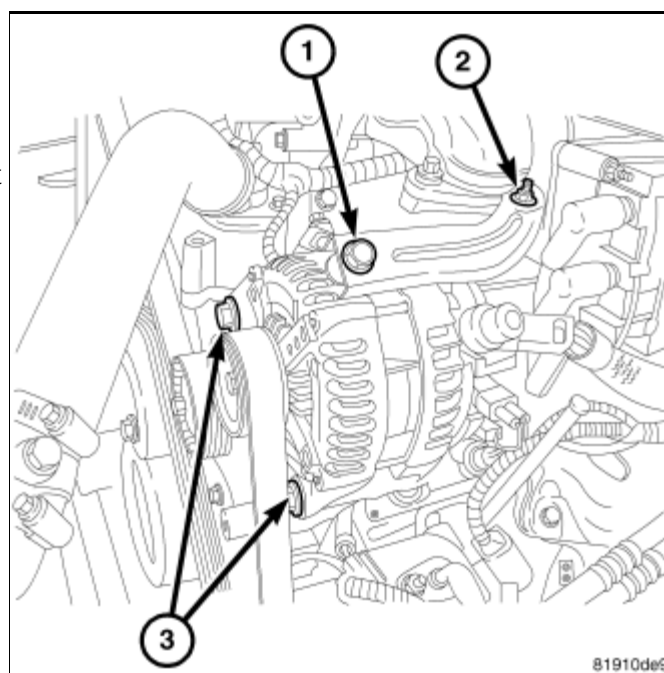
Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

REMOVAL - 3.8L

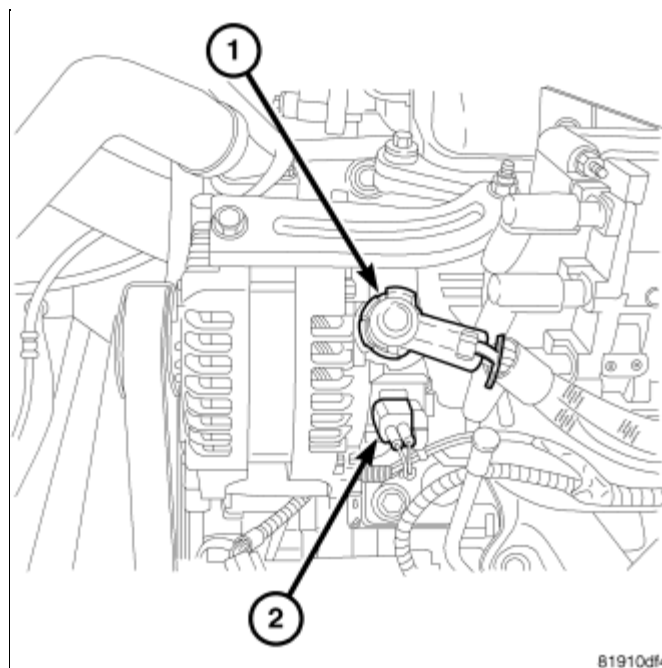
WARNING: Disconnect negative cable from battery before removing battery output wire (b+ wire) from generator. Failure to do so can result in injury or damage to electrical system.

1. Disconnect negative battery cable at battery.
2. Remove generator drive belt. Refer to 7, Cooling System for procedure.
3. Remove generator mounting bolts (1) and (3). Remove nut (2),



4. Unsnap plastic cover (1) from B+ terminal.
5. Remove B+ cable output terminal mounting nut. Disconnect terminal from generator.
6. Disconnect field wire connector (2) at rear of generator by pushing on connector tab.
7. Remove generator from vehicle.

INSTALLATION - 3.8L

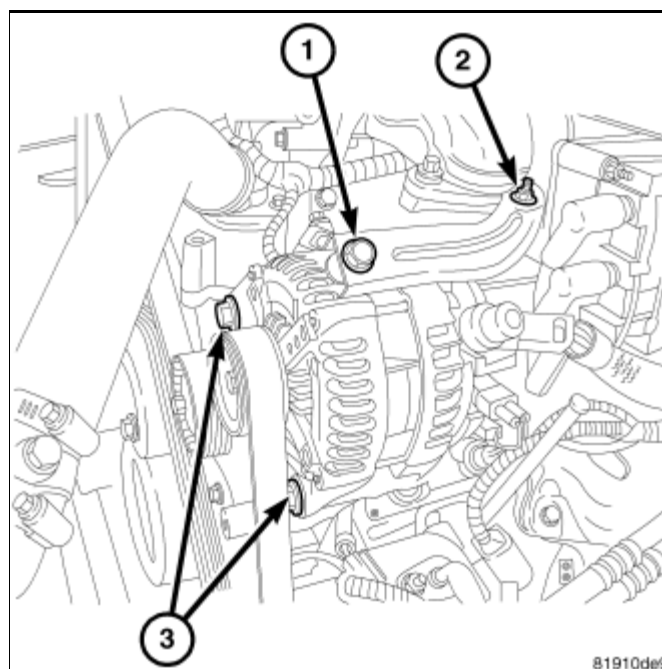


1. Install generator mounting fasteners (1), (2), and (3) and tighten. Refer to Torque Specifications.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt **MUST** be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.

2. Install generator drive belt. Refer to 7, Cooling System for procedure.



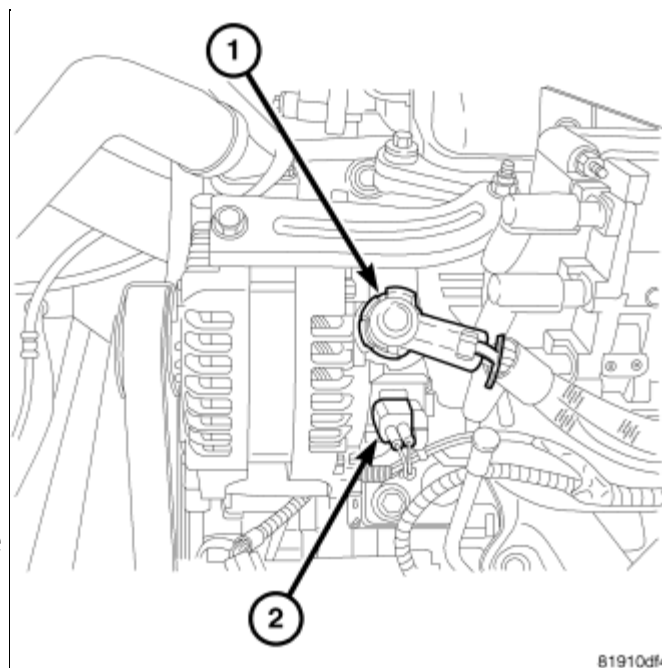
3. Snap field wire connector (2) into generator.
4. Install B+ terminal to generator mounting stud. Tighten mounting nut. Refer to Torque Specifications.
5. Snap plastic cover (1) to B+ terminal.
6. Install negative battery cable to battery.

GENERATOR 2.8L VM

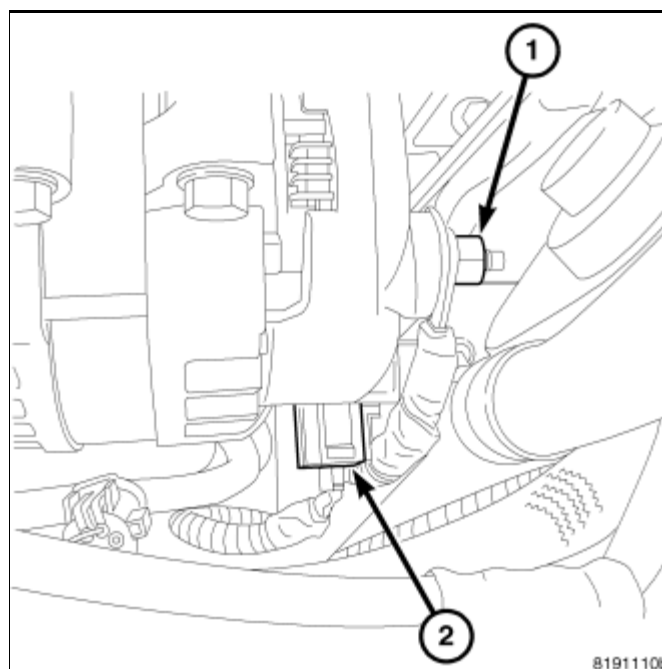
REMOVAL - 2.8L DIESEL

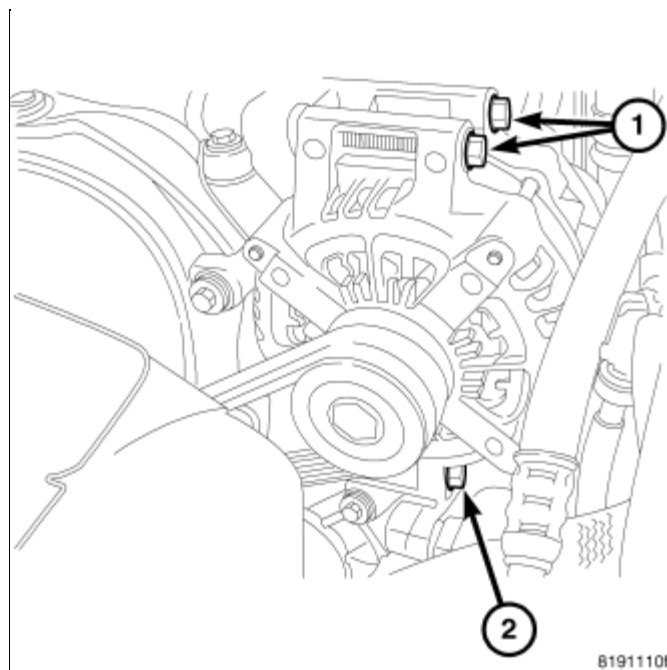
WARNING: Disconnect negative cable from battery

before removing battery output wire (b+ wire) from generator. Failure to do so can result in injury or damage to electrical system.



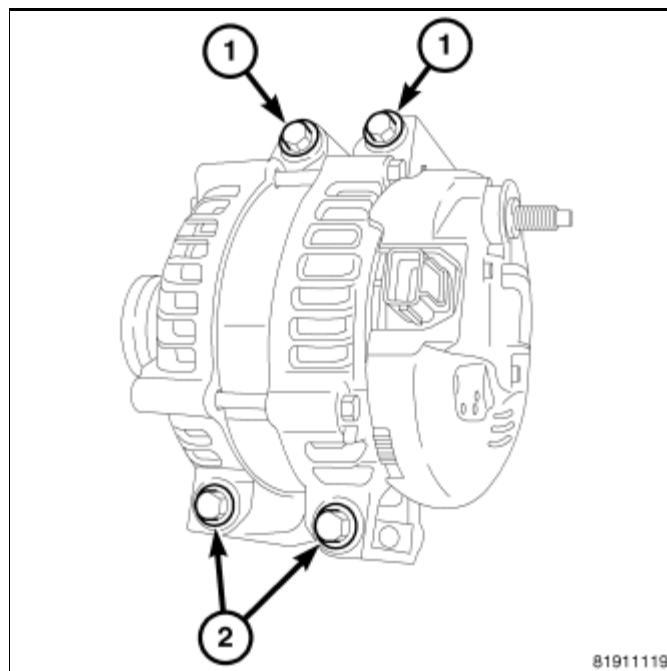
1. Disconnect negative battery cable at battery.
2. Disconnect field wire connector (2) at side of generator by pushing on connector tab.
3. Remove B+ cable output terminal mounting nut (1). Disconnect terminal from generator.
4. Remove generator drive belt. Refer to 7, Cooling System for procedure.

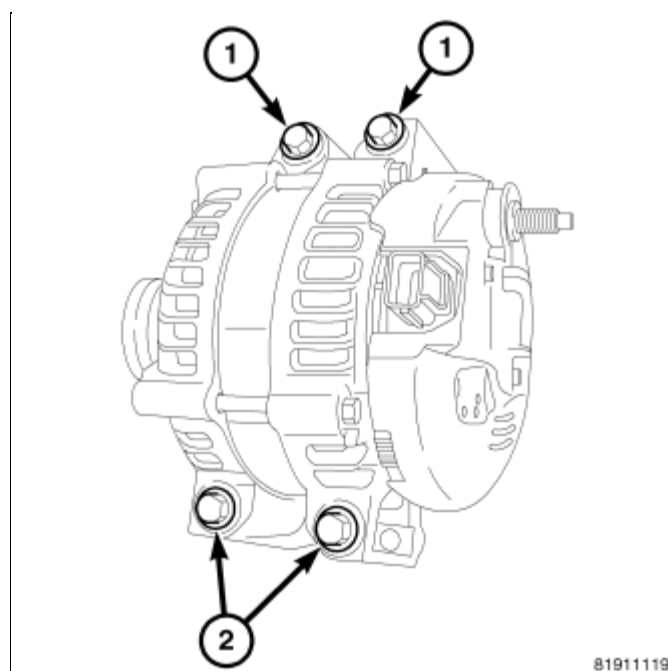




5. Remove two upper generator mounting bolts (1).
6. Remove two lower generator mounting bolts (2).
7. Remove generator from vehicle.

INSTALLATION - 2.8L DIESEL



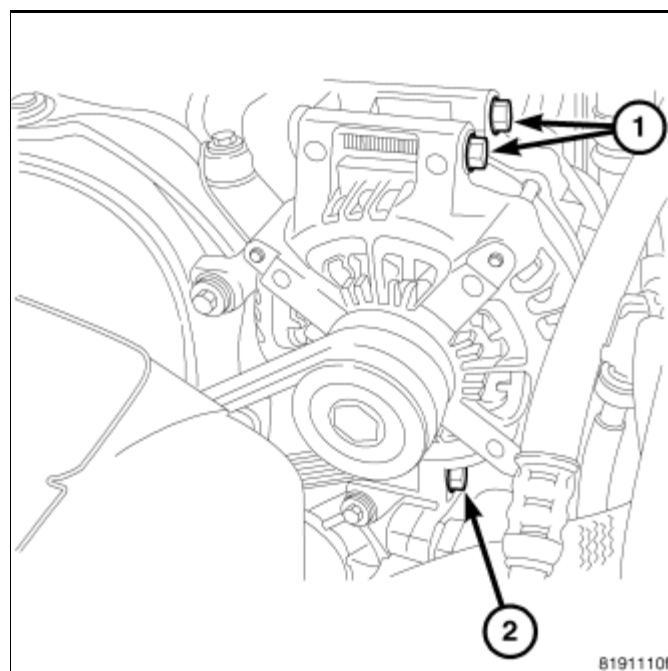


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1. Position generator to engine. Install two upper mounting bolts (1).
2. Install two lower mounting bolts (2). Tighten upper and lower bolts. Refer to Torque Specifications.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt **MUST** be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.



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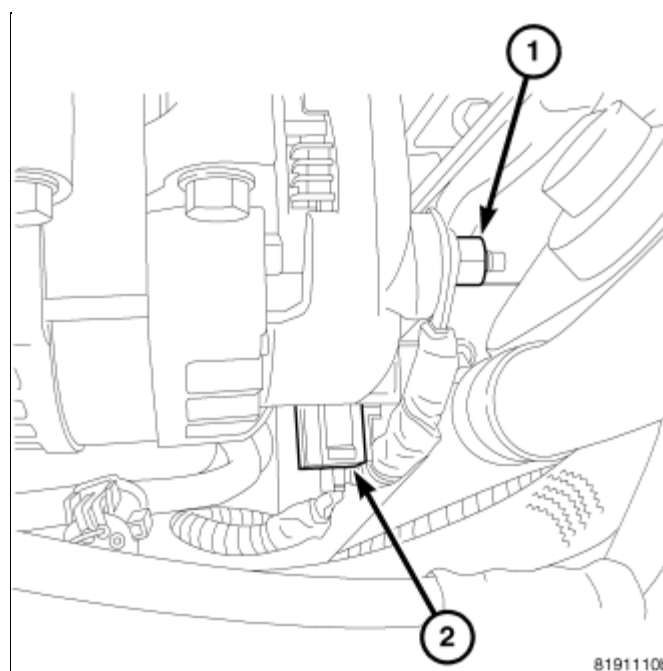
3. Install generator drive belt. Refer to 7, Cooling System for procedure.

4. Snap field wire connector (2) into generator.
5. Install B+ terminal to generator mounting stud. Tighten mounting nut (1). Refer to Torque Specifications.
6. Install negative battery cable to battery.

PULLEY - GENERATOR DECOUPLER

DESCRIPTION

The generator decoupler is used only with certain engines. The decoupler is used in place of the standard generator drive pulley .

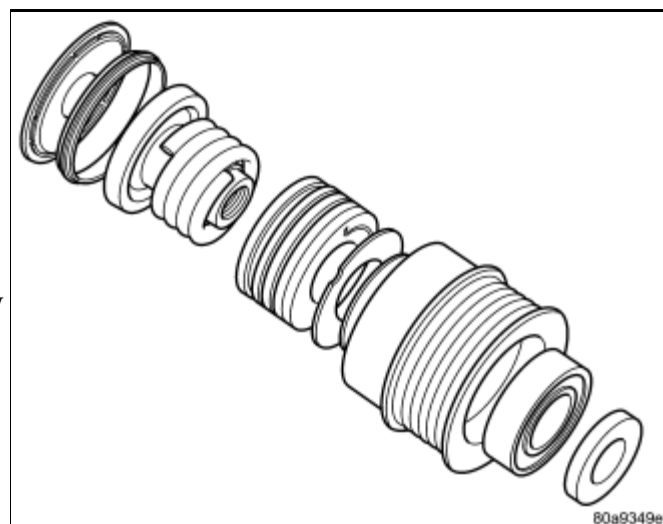


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OPERATION

The generator decoupler is used only with certain engines. The decoupler is a one-way clutch designed to help reduce belt tension fluctuation, vibration, reduce fatigue loads, improve belt life, reduce hubloads on components, and reduce noise. Dry operation is used (no grease or lubricants). The decoupler is not temperature sensitive and also has a low sensitivity to electrical load. The decoupler is a non-serviceable item and is to be replaced as an assembly.

DIAGNOSIS AND TESTING - GENERATOR DECOUPLER



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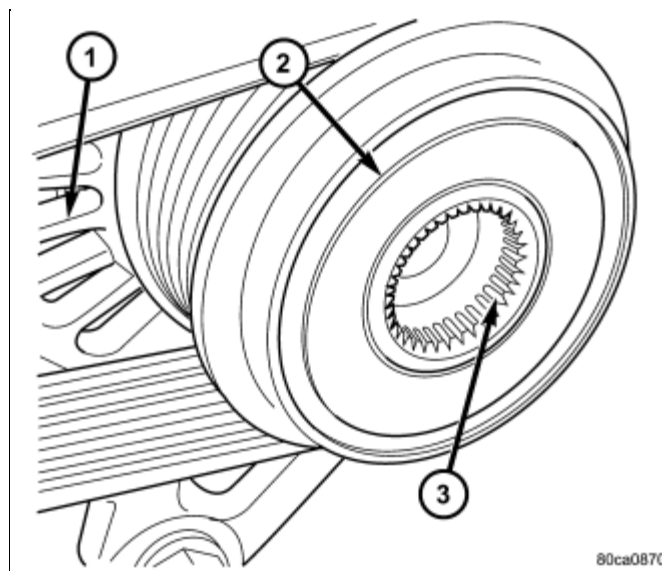
CONDITION	POSSIBLE CAUSES	CORRECTION
Does not drive generator (generator not charging)	Internal failure	Replace decoupler
Noise coming from decoupler	Internal failure	Replace decoupler

REMOVAL

The generator decoupler (2) is used only with certain

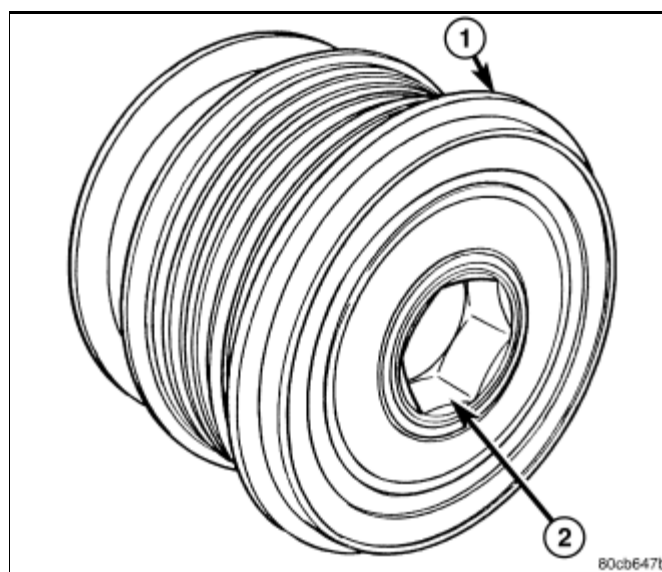
engines.

Two different type generator decoupler pulleys are used. One can be identified by the use of machined splines (3).



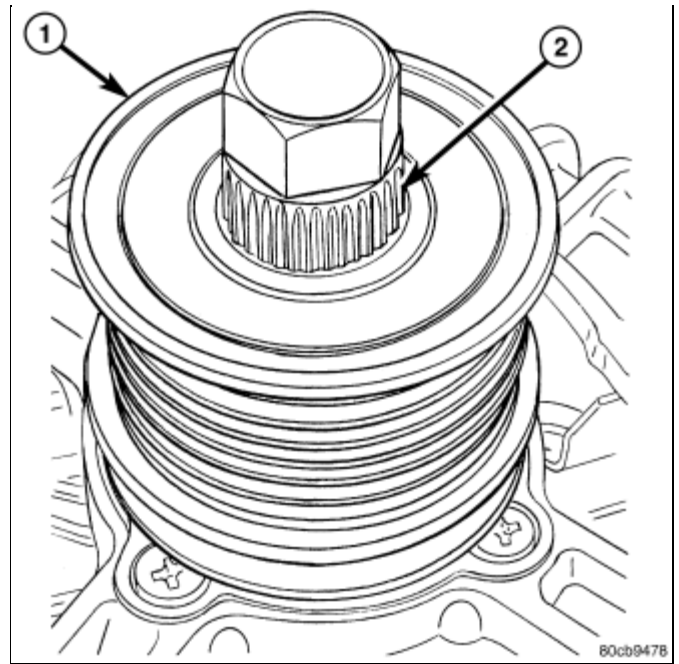
The other can be identified by a hex opening (2) and will not use splines.

Different special tools are required to service each different decoupler. Refer to following procedure.



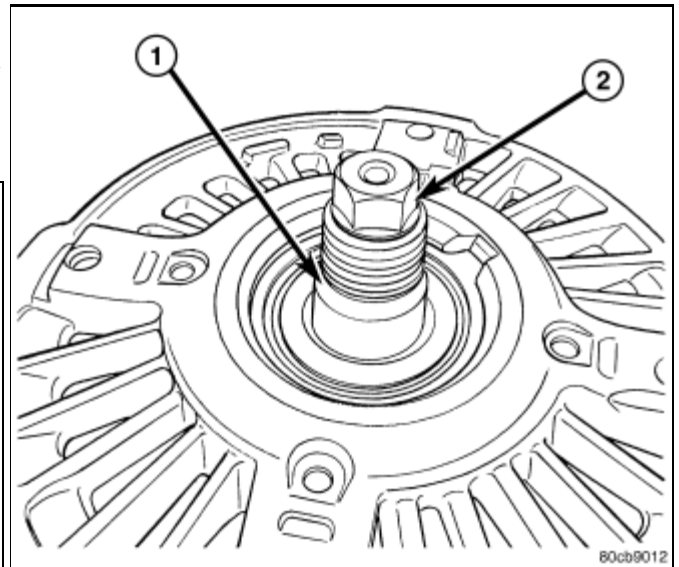
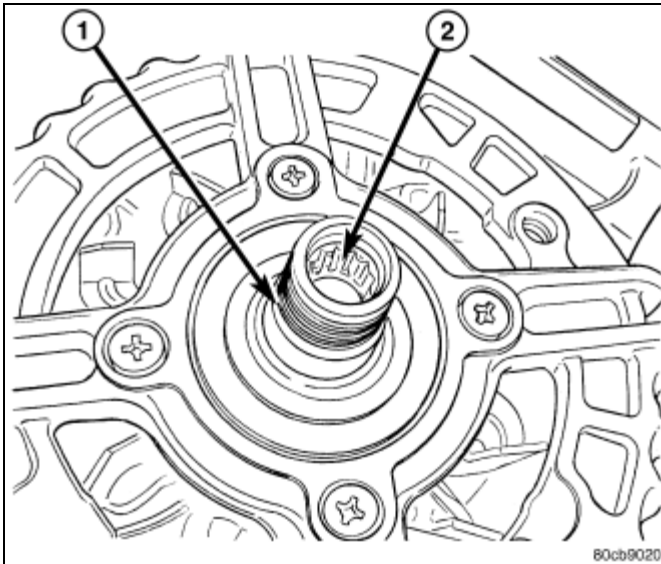
INA Decoupler

1. Disconnect negative battery cable.
2. Remove generator and accessory drive belt. Refer to Generator Removal.
3. Position Special Tool #8823 (VM.1048) (2) into decoupler (1).

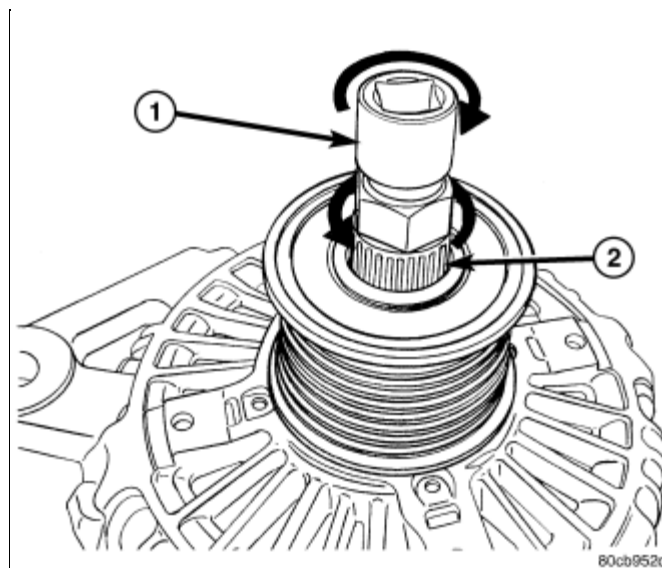


4. Determine if end of generator shaft is hex shaped (2) or.....

5.or
is splined
(2).



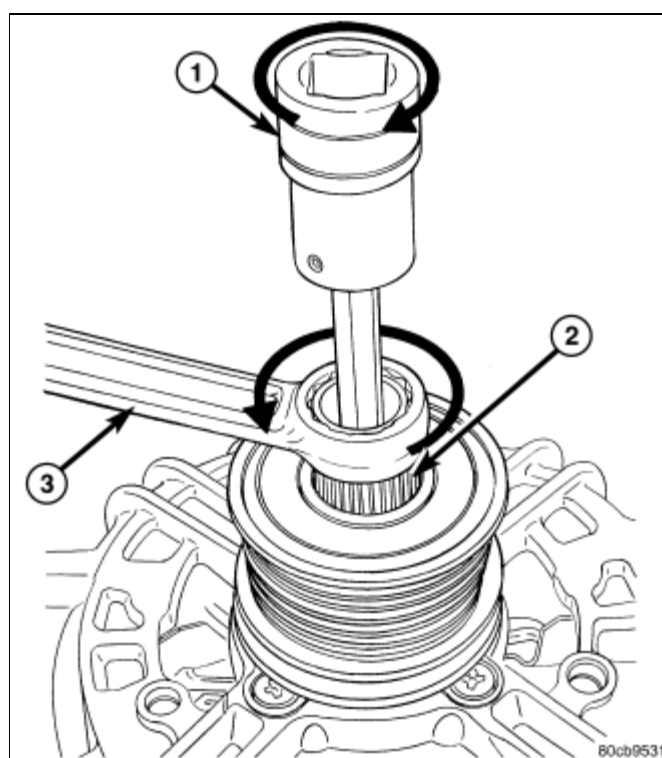
6. If hex is used, insert a 10mm deep socket (1) into tool
#8823 (VM.1048) (2).



7. If splined, insert a 5/16" 6-point hex driver, or a 10mm 12-point triple square driver (1) into tool #8823 (VM.1048) (2).

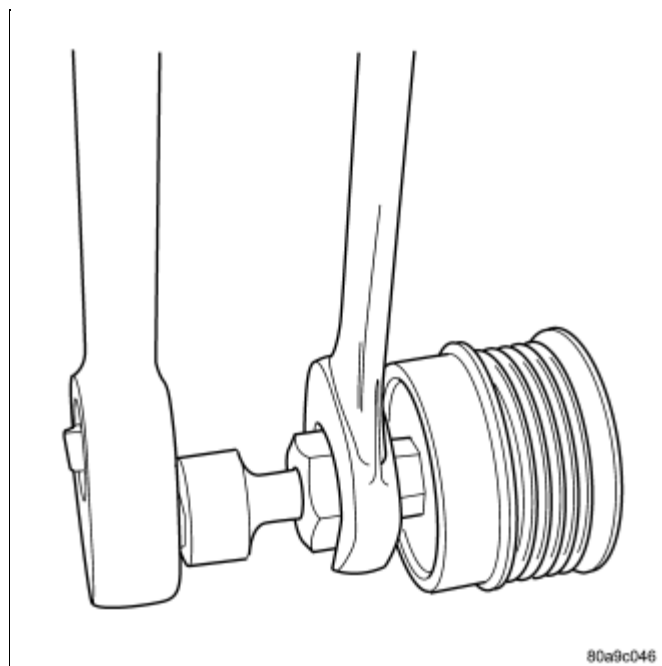
8. The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate tools as shown

9. After breaking loose with tools, unthread decoupler by hand from generator.



Litens Decoupler

1. Disconnect negative battery cable.
2. Remove generator and accessory drive belt. Refer to Generator Removal.
3. Position Special Tool #8433 into decoupler. Align to hex end of generator shaft.

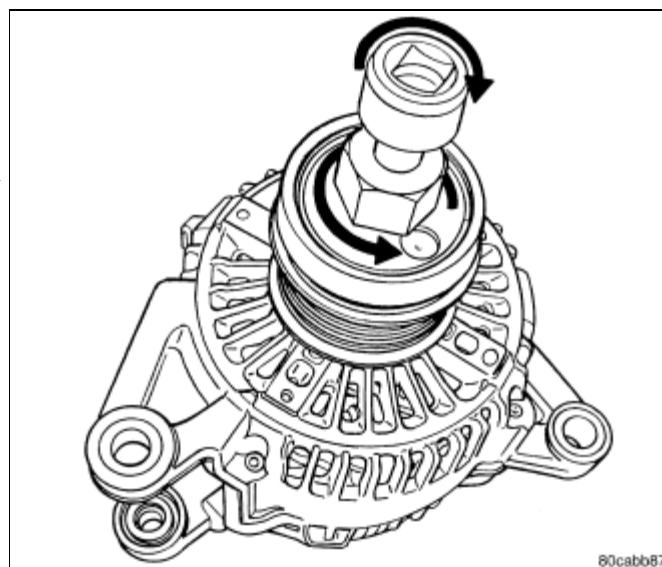


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4. The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise.

5. After breaking loose with tool, unthread decoupler by hand from generator.

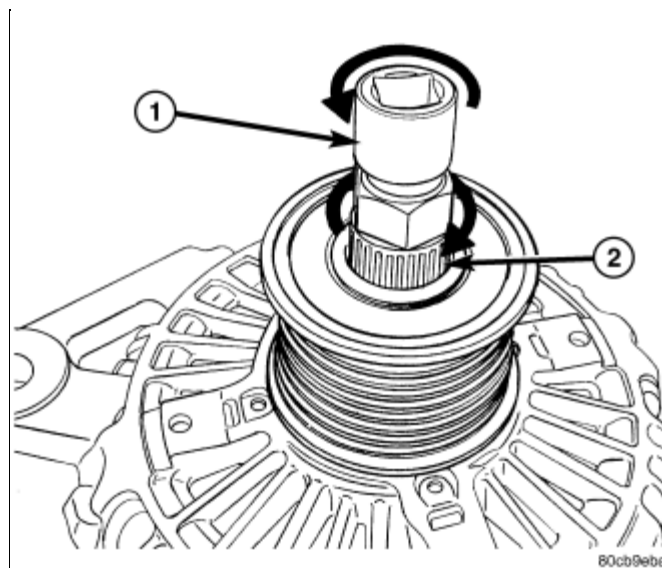
INSTALLATION



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INA Decoupler

1. Thread decoupler pulley onto generator shaft by hand (right-hand threads).
2. Position Special Tool #8823 (VM.1048) (2) into decoupler.
3. Determine if end of generator shaft is hex shaped or is splined. If hex is used, insert a 10mmM deep socket (1) into tool #8823 (VM.1048) (2).

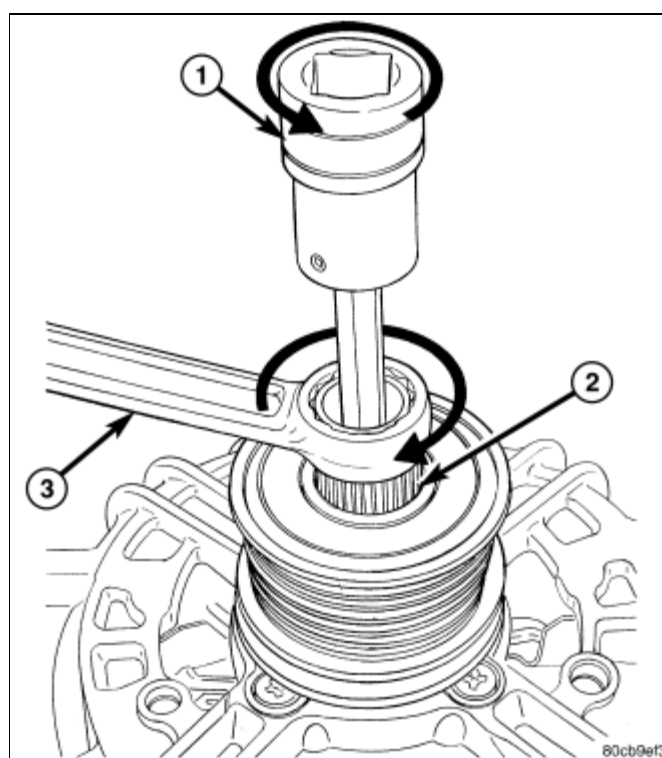


4. If splined, insert a 5/16" 6-point hex driver, or a 10mm 12-point triple square driver (1) into tool #8823 (VM.1048) (2).

5. **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in directions as shown. Refer to torque specifications.

6. Install accessory drive belt, and generator. Refer to Generator Installation.

7. Connect negative battery cable.



Litens Decoupler

1. Thread decoupler pulley onto generator shaft by hand (right-hand threads).

2. Position Special Tool 8433 into decoupler. Align tool to hex end of generator shaft.

3. **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in direction as

shown. Refer to torque specifications.

4. Install accessory drive belt, and generator. Refer to Generator Installation.

5. Connect negative battery cable.

VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

STARTING

STARTING

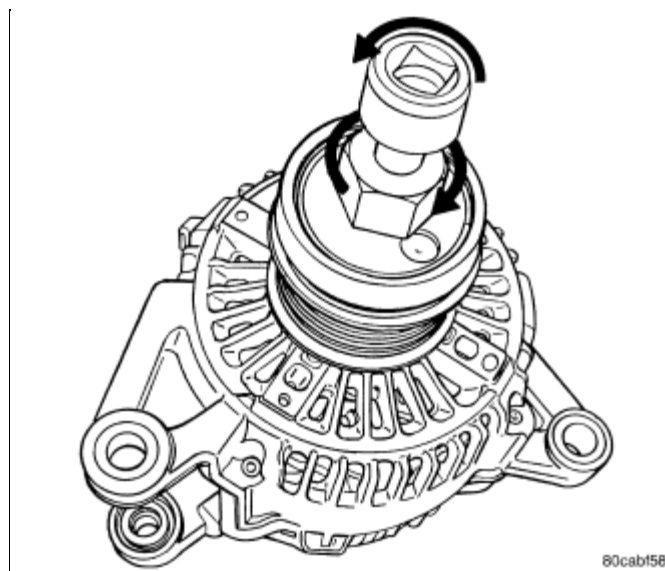
DESCRIPTION

The starting system consists of:

- Starter relay
- Starter motor (including an integral starter solenoid)

Other components to be considered as part of starting system are:

- Battery



- Battery cables
- Ignition switch and key lock cylinder
- Clutch pedal position switch (manual transmission)
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections.

The Battery, Starting, and Charging systems operate in conjunction with one another, and must be tested as a complete system. For correct operation of starting/charging systems, all components used in these 3 systems must perform within specifications. When attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

Certain starting system components are monitored by the PCM and may produce a Diagnostic Trouble Code (DTC).

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes (700 amperes - diesel engine), and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the clutch pedal position switch (manual transmission), the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with a manual transmission, it has a clutch pedal position switch installed in series between the ignition switch and the coil battery terminal of the starter relay. This normally open switch prevents the starter relay from being energized when the ignition switch is turned to the momentary Start position, unless the clutch pedal is depressed. This feature prevents starter motor operation while the clutch disc and the flywheel are engaged. The starter relay coil ground terminal is always grounded on vehicles with a manual transmission.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the momentary Start position. The park/neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the manual transmission flywheel or on the automatic transmission torque converter or torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter

pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

DIAGNOSIS AND TESTING

STARTING SYSTEM

The battery, starting, and charging systems operate in conjunction with one another, and must be tested as a complete system. For correct starting/charging system operation, all of the components involved in these three systems must perform within specifications.

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery, if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits, if required.
	3. Starter relay faulty.	3. The starter relay is located within the TIPM (Totally Integrated Power Module). Refer to “no crank condition” in 9 - Engine - Electrical Diagnosis.
	4. Ignition switch faulty.	4. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	5. Clutch pedal position switch faulty.	5. Refer to Clutch Pedal Position Switch.
	6. Park/Neutral position switch faulty or misadjusted.	6. Refer to Park/Neutral Position Switch. Replace park/neutral position switch if required.
	7. Starter solenoid faulty.	7. Refer to Starter Motor. Replace starter motor assembly if required.
	8. Starter motor faulty.	8. If all other starting system components and circuits test OK, replace starter motor.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits if required.

	3. Starter motor faulty.	3. If all other starting system components and circuits test OK, replace starter motor assembly.
	4. Engine seized.	4. Refer to Engine Diagnosis in the Diagnosis and Testing section of 9, Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty.	1. Refer to Starter Motor Removal and Installation. Remove starter motor to inspect starter ring gear. Replace starter ring gear if required.
	2. Starter motor faulty.	2. If all other starting system components and circuits test OK, replace starter motor assembly.
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed.	1. Refer to Starter Motor Removal and Installation. Tighten starter mounting hardware to correct torque specifications.
	2. Starter relay faulty.	2. The starter relay is located within the TIPM (Totally Integrated Power Module). Refer to “no crank condition” in 9 - Engine - Electrical Diagnosis.
	3. Ignition switch faulty.	3. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	4. Starter motor faulty.	4. If all other starting system components and circuits test OK, replace starter motor.

INSPECTION

For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. Before removing any unit from starting system for repair or diagnosis, perform the following inspections:

WARNING: On vehicles equipped with airbags, refer to 8, passive restraint systems, before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

- **Battery** - Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery if required. Refer to **Battery** in 8, Battery. **Note: If equipped with diesel engine, a dual battery system may be used, and both batteries must be inspected.**
- **Ignition Switch** - Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder**.
- **Clutch Pedal Position Switch** - If equipped with manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Starter Relay** - The starter relay is located within the TIPM (Totally Integrated Power Module). Refer to “no crank condition” in 9 - Engine - Electrical Diagnosis.
- **Starter Motor** - Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect starter solenoid for indications of physical damage and loose or

corroded wire harness connections.

- **Wiring** - Visually inspect wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to 8, Wiring Diagrams.

TESTING

COLD CRANKING TEST

NOTE: For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to Battery in 8, Battery.

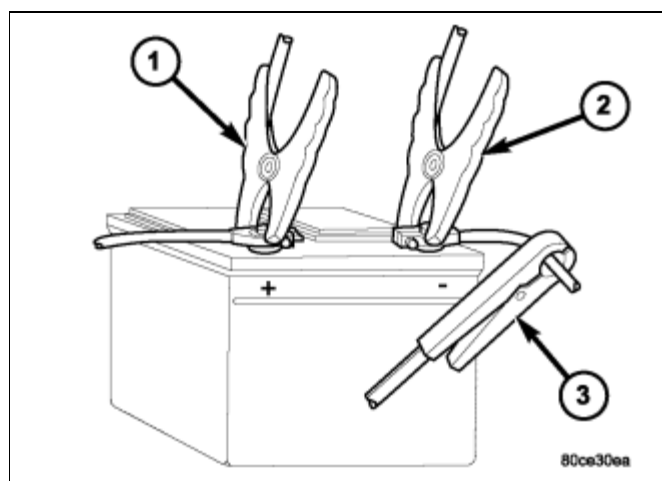
1. Connect volt-ampere tester (1) and (2) to battery terminals. See instructions provided by manufacturer of volt-ampere tester being used. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, tester should be connected to battery on left side of vehicle only. Also, tester current reading must be taken from positive battery cable lead that connects to starter motor.**

2. Fully engage parking brake.

3. If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.

4. Verify that all lamps and accessories are turned off.

5. To prevent a gasoline engine from starting, remove either the ignition run fuse, or the fuel pump control fuse. To prevent a diesel engine from starting, disconnect the electrical connectors at both the camshaft and crankshaft position sensors.



WARNING: Attempt to start engine a few times before proceeding with following step.

NOTE: A cold engine will increase starter current (amperage) draw reading, and reduce battery voltage reading.

6. Rotate and hold ignition switch in Start position. Note cranking voltage and current (amperage) draw readings shown on volt-ampere tester.

a. If voltage reads below 9.6 volts, refer to **Starter Motor** in Diagnosis and Testing. If starter motor is OK, refer to **Engine Diagnosis** in 9, Engine for further testing of engine. If starter motor is not OK, replace faulty starter motor.

b. If voltage reads above 9.6 volts and current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.

c. If voltage reads 12.5 volts or greater and starter motor does not turn, refer to **Control Circuit Testing** in this section.

d. If voltage reads 12.5 volts or greater and starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in high-amperage feed circuit. For complete starter wiring circuit diagrams, refer to Wiring Diagrams.

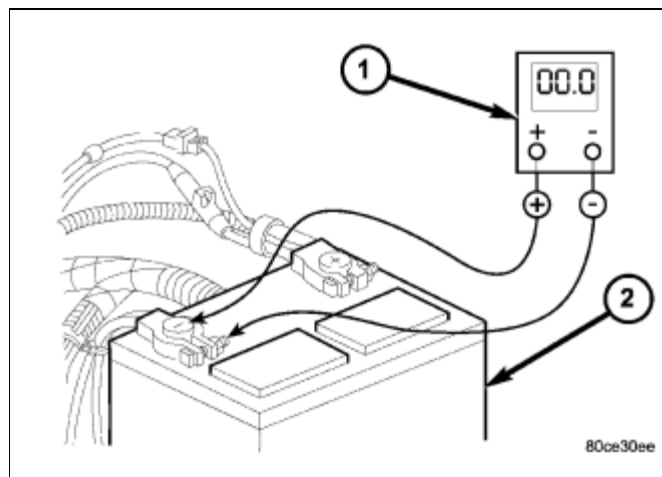
When performing these tests, it is important to remember that voltage drop is giving an indication of resistance between two points at which voltmeter probes are attached.

Example: When testing resistance of positive battery cable, touch voltmeter leads to positive battery cable clamp and cable connector at starter solenoid. If you probe positive battery terminal post and cable connector at starter solenoid, you are reading combined voltage drop in positive battery cable clamp-to-terminal post connection and positive battery cable.

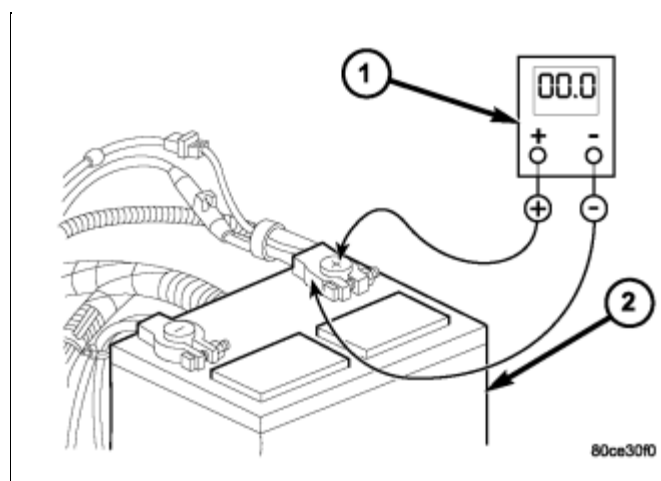
The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing tests, be certain that following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in 8, Battery.
- Fully engage parking brake.
- If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.
- Verify that all lamps and accessories are turned off.
- To prevent a gasoline engine from starting, remove Automatic ShutDown (ASD) relay. To prevent a diesel engine from starting, remove Fuel Pump Relay. These relays are located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

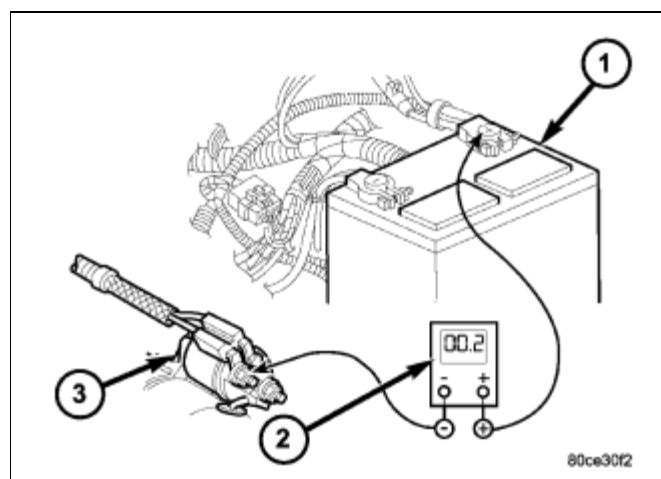
1. Connect positive lead of voltmeter (1) to negative battery cable terminal post. Connect negative lead of voltmeter to negative battery cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, procedure must be performed twice, once for each battery.**



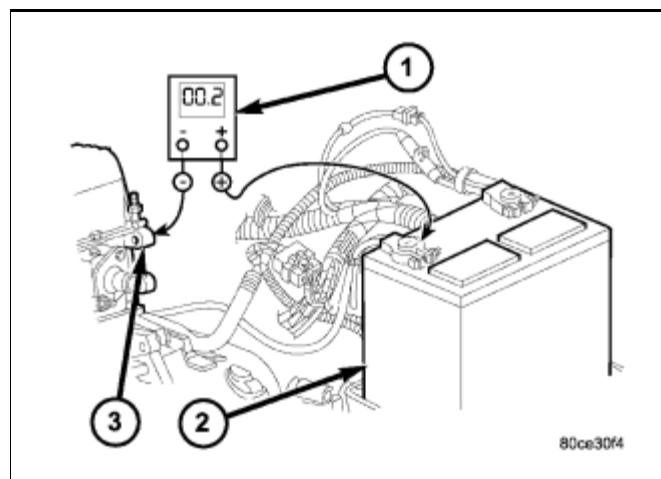
2. Connect positive lead of voltmeter to positive battery terminal post. Connect negative lead of voltmeter to battery positive cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



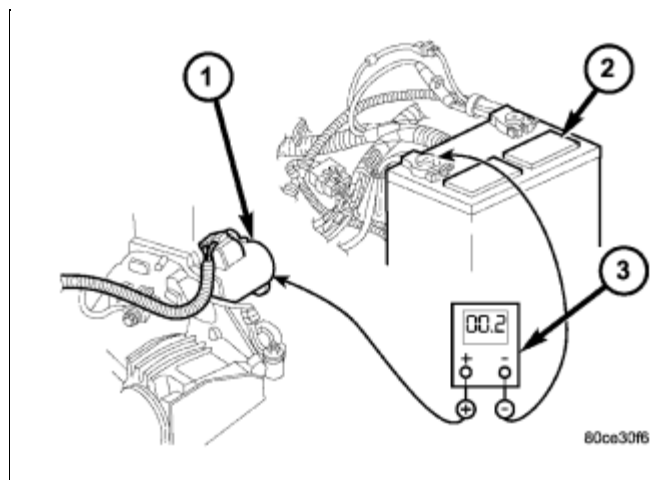
3. Connect voltmeter to measure between battery positive terminal post and starter solenoid battery terminal stud . Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cable connection at solenoid. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed on driver side battery only.**



4. Connect voltmeter to measure between negative battery terminal post and a good clean ground on engine block . Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten negative battery cable attachment on engine block. Repeat test. If reading is still above 0.2 volt, replace faulty negative battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



5. Connect positive lead of voltmeter to starter housing. Connect negative lead of voltmeter to negative battery terminal post . Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, correct poor starter to engine block ground contact. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must**



be performed on driver side battery only.

6. If equipped with dual battery system (certain diesel equipped models), connect positive lead of voltmeter to positive battery cable clamp on battery located on left side of vehicle. Connect negative lead of voltmeter to positive battery terminal post on battery located on right side of vehicle. Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cables at both batteries. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable.

If resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing.

CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** The starter relay is located within the TIPM (Totally Integrated Power Module). Refer to “no crank condition” in 9 - Engine - Electrical Diagnosis.
- **Starter Solenoid** - Refer to **Starter Motor** Diagnosis and Testing.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder**
- **Clutch Pedal Position Switch** - If equipped with manual transmission, refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Wire harnesses and connections** - Refer to 8, Wiring Diagrams.

INSPECTION - STARTING SYSTEM

The following starting system components should be carefully inspected whenever any starting system problem is encountered.

WARNING: On vehicles equipped with airbags, disable airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate battery negative (ground) cable, then wait two minutes for airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable airbag system. Failure to take proper precautions could result in accidental airbag deployment and possible personal injury.

Battery

- Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery, if required. Refer to **Battery** for battery cleaning and inspection procedures.

Ignition Switch

- Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Wiring Diagrams**. Refer to **Ignition Switch and Key Lock Cylinder** for ignition switch service procedures.

Clutch Pedal Position Switch

- If vehicle is equipped with a manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Clutch Hydraulic Linkage** for clutch pedal position switch service procedures.

Park/Neutral Position Switch

- If vehicle is equipped with an automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Park/Neutral Position Switch** for park/neutral position switch service procedures.

Starter Relay

- Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Relay** for starter relay service procedures.

Starter Motor

- Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. If problem being diagnosed involves improper starter engagement, disengagement or noise complaints, starter motor should be removed. With starter motor removed, inspect starter pinion and ring gears for damaged or missing teeth. Replace faulty components as required. Refer to **Starter Motor** for removal/installation procedures.

Starter Solenoid

- Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Motor** for starter solenoid service procedures.

Wiring

- Visually inspect starting system wire harnesses for indications of physical damage. Repair or replace any faulty wiring, as required. Refer to **Wiring Diagrams** for repair or connector and terminal service procedures.

SPECIFICATIONS

STARTER

Starter Motor		
Engine Application	3.8L V-6	2.8L Diesel
Power Rating	1.2 Kilowatt	2.2 Kilowatt
* Cranking Amperage Draw Test	150 - 200 Amperes	500 Amperes
* Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.		

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Starter Solenoid B+ Terminal Nut	11.3	8.3	100
Starter Mounting Bolts (3.8L)	54	40	-
Starter Mounting Bolts (2.8L Diesel)	68	50	-

MOTOR - STARTER

DIAGNOSIS AND TESTING - STARTER MOTOR

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with starter motor removed from vehicle. Refer to Specifications for starter motor specifications.

1. Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Mount starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of starter motor. Never clamp on starter motor by field frame.
3. Connect a suitable volt-ampere tester and a 12-volt battery to starter motor in series, and set ammeter to 100 ampere scale. See instructions provided by manufacturer of volt-ampere tester being used.
4. Install jumper wire from solenoid terminal to solenoid battery terminal. The starter motor should operate. If starter motor fails to operate, replace faulty starter motor assembly.
5. Adjust carbon pile load of tester to obtain free running test voltage. Refer to Specifications for starter motor free running test voltage specifications.
6. Note reading on ammeter and compare reading to free running test maximum amperage draw. Refer to Specifications for starter motor free running test maximum amperage draw specifications.
7. If ammeter reading exceeds maximum amperage draw specification, replace faulty starter motor assembly.

STARTER SOLENOID

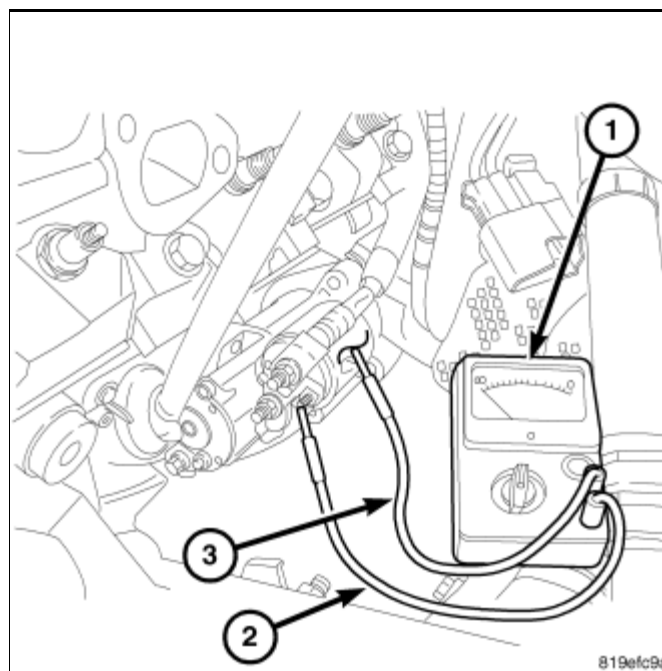
Certain vehicles with certain engines may require starter motor removal for the following test.

1. If necessary, remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Disconnect solenoid connector wiring from starter motor.

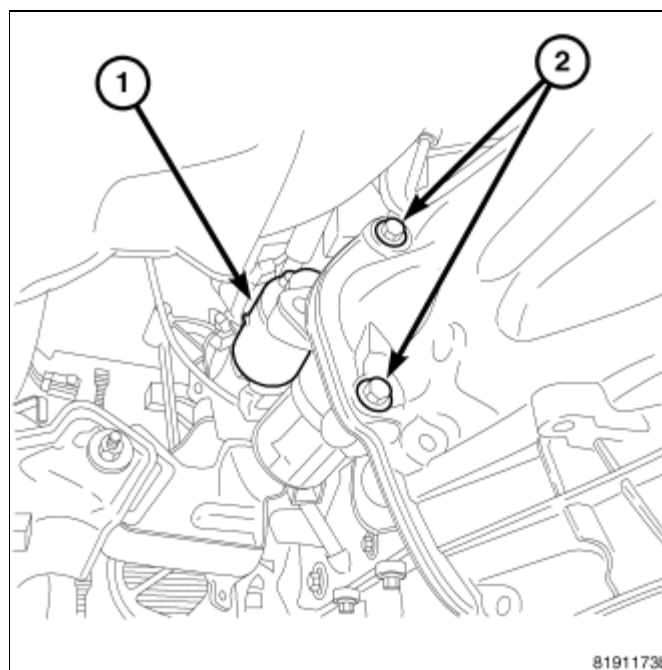
3. Check for continuity between solenoid terminal (2) and solenoid case (3). There should be continuity. If not OK, replace faulty starter motor assembly.

REMOVAL

REMOVAL - 3.8L



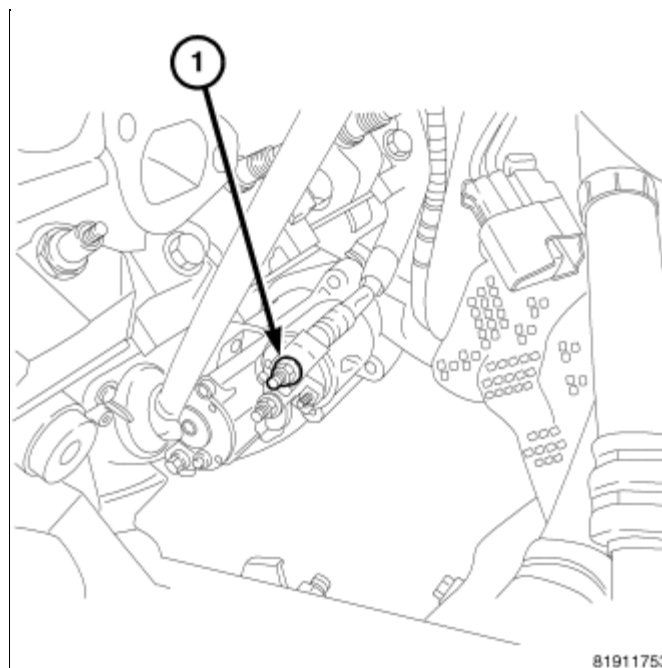
1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. While supporting starter motor (1), remove two bolts (2) securing starter motor to transmission.



4. Lower starter motor far enough to access and remove nut (1) securing battery cable to starter solenoid B(+) terminal stud. Always support starter motor during this process. Do not let starter motor hang from wire harness.

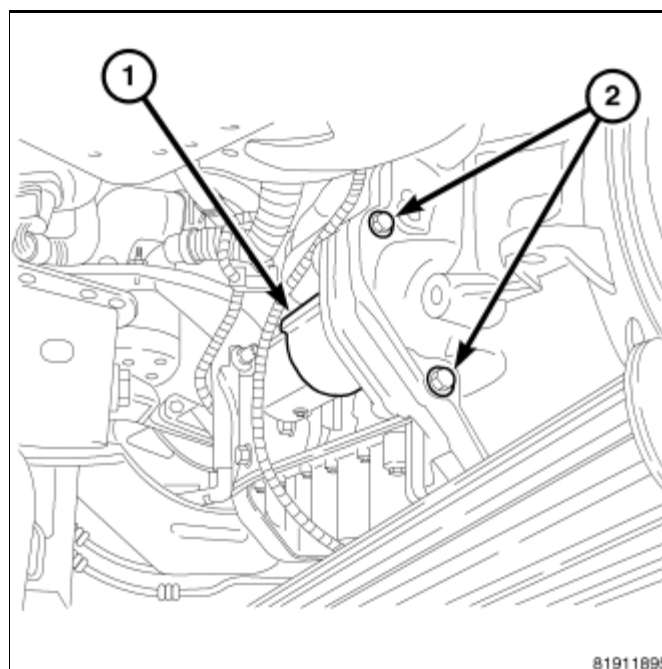
5. Remove battery cable at starter.
6. Disconnect solenoid terminal wire harness connector from starter solenoid.
7. Remove starter motor.

REMOVAL - 2.8L DIESEL



81911753

1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. While supporting starter motor (1), remove two bolts (2) securing starter motor to transmission.

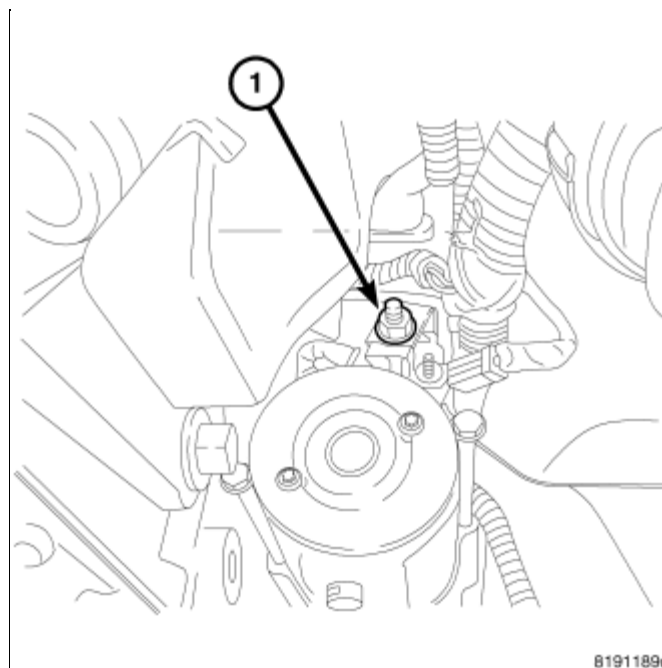


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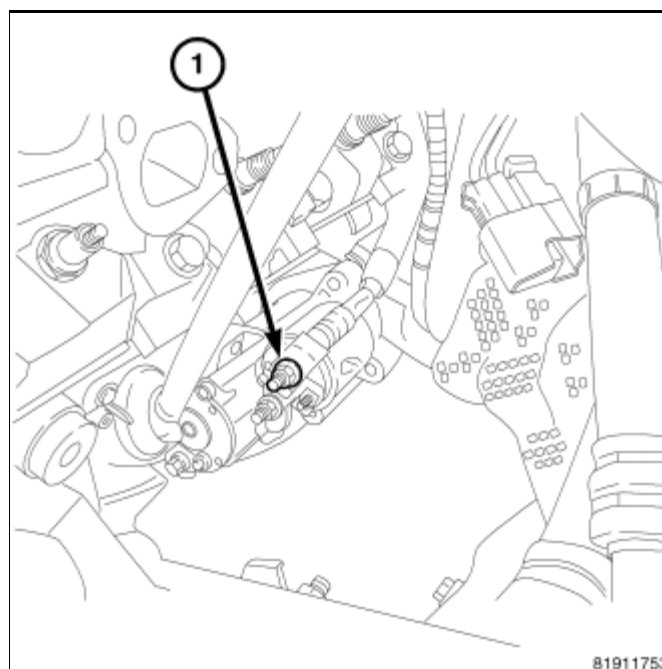
4. Lower starter motor far enough to access and remove nut (1) securing battery cable to starter solenoid B(+) terminal stud. Always support starter motor during this process. Do not let starter motor hang from wire harness.
5. Remove battery cable at starter.
6. Disconnect solenoid terminal wire harness connector from starter solenoid.
7. Remove starter motor.

INSTALLATION

INSTALLATION - 3.8L

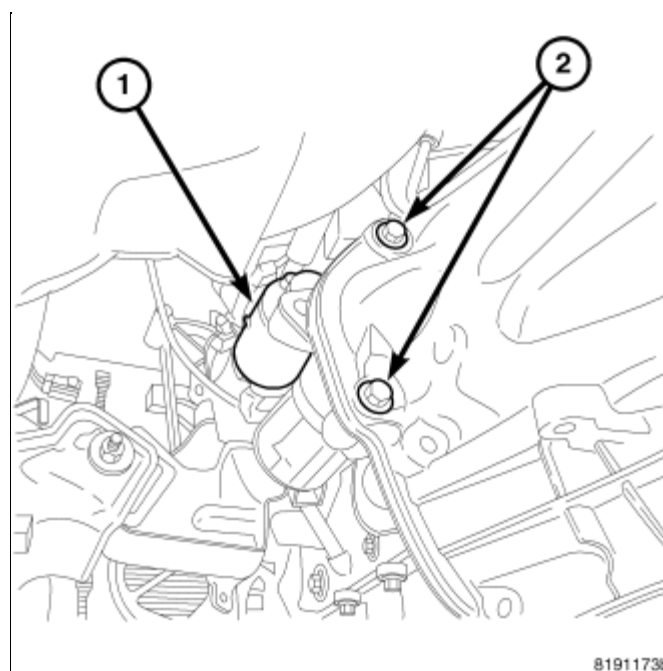


1. Connect solenoid terminal wire harness connector to starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.
2. Install battery cable eyelet onto starter solenoid stud. Install and tighten nut (1). Refer to Torque Specifications.

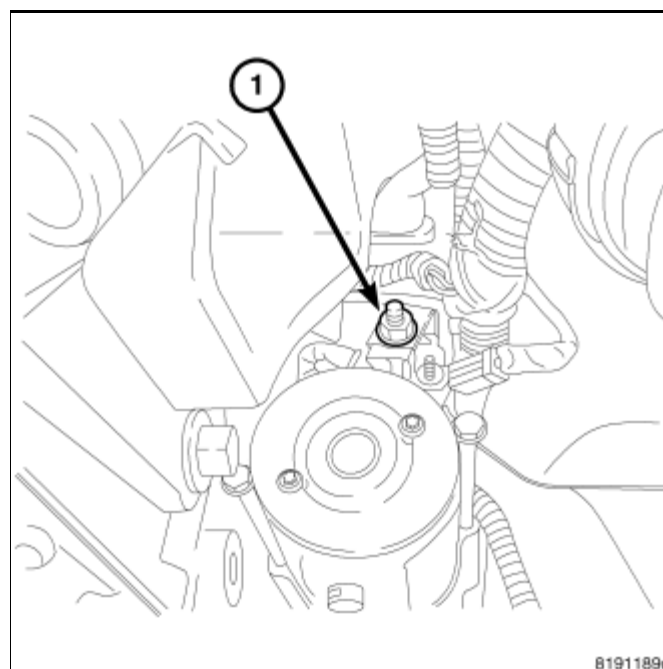


3. Position starter motor to transmission. Install and tighten two mounting bolts (2). Refer to Torque Specifications.
4. Lower vehicle.
5. Connect negative battery cable.

INSTALLATION - 2.8L DIESEL



1. Connect solenoid terminal wire harness connector to starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.
2. Install battery cable eyelet onto starter solenoid stud. Install and tighten nut (1). Refer to Torque Specifications.

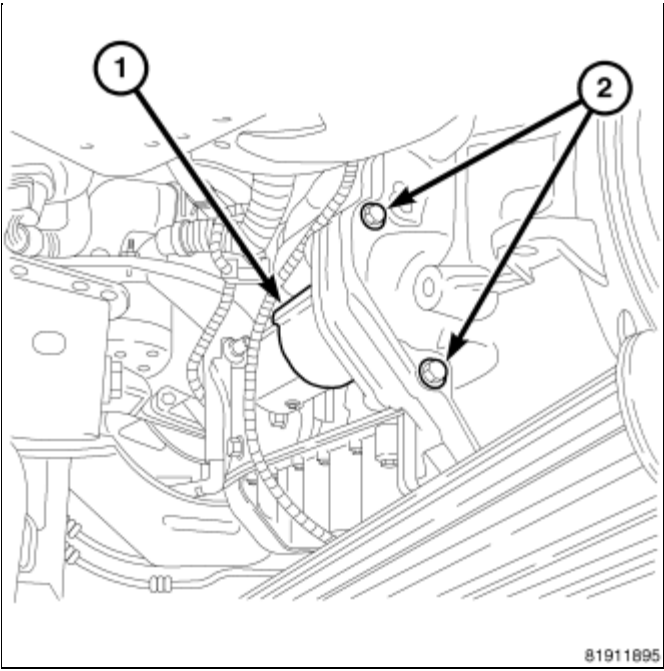


3. Position starter motor to transmission. Install and tighten two mounting bolts (2). Refer to Torque Specifications.
4. Lower vehicle.
5. Connect negative battery cable.

RELAY - STARTER MOTOR

DESCRIPTION

The starter motor relay is located in the TPIM (Totally Integrated Power Module).



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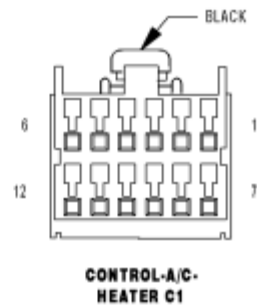
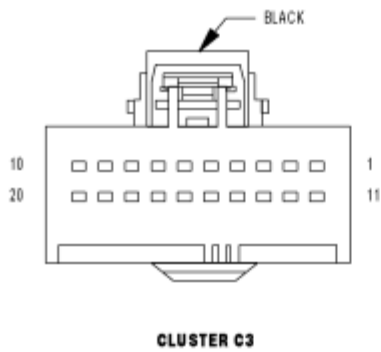
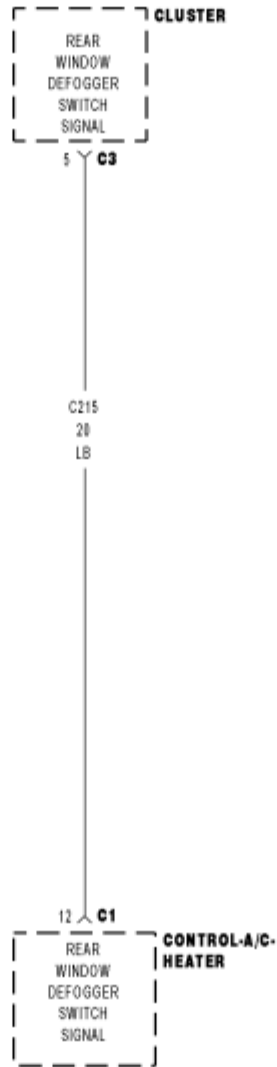
8G - HEATED SYSTEMS

HEATED GLASS-ELECTRICAL DIAGNOSTICS

HEATED GLASS-ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1016-REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW (CCN)



01559c78

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With ignition on, and the rear Defroster Grid activated.

◦ **Set Condition:**

When the Instrument Cluster (CCN) detects a low condition on the Rear Window Defogger Switch Signal circuit..

Possible Causes
(C215) REAR WINDOW DEFOGGER SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
INSTRUMENT CLUSTER (CCN)
HVAC CONTROL MODULE

1. VERIFY REAR DEFROST SWITCH REQUEST INPUT CIRCUIT LOW IS ACTIVE

Turn the ignition on.

With the scan tool, check for DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR DTC WITH THE A/C HEATER CONTROL DISCONNECTED

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

Turn the ignition on.

Using the scan tool, check for DTC's

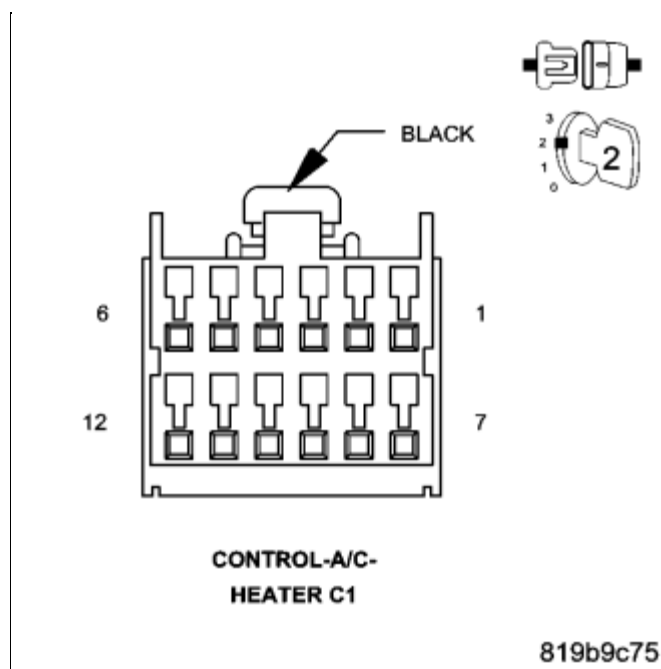
Does the scan tool display this DTC as active?

Yes

- Go To [3](#)

No

- Replace A/C Heater Control in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. CHECK THE (C215) REAR WINDOW DEFOGGER SWITCH SIGNAL CIRCUIT FOR SHORT TO GROUND

Disconnect the Instrument Cluster (CCN) C3 harness connector.

Using an ohm meter measure the resistance from the (C215) Rear Window Defogger Switch Signal circuit to ground.

Does the ohm meter read open circuit?

Yes

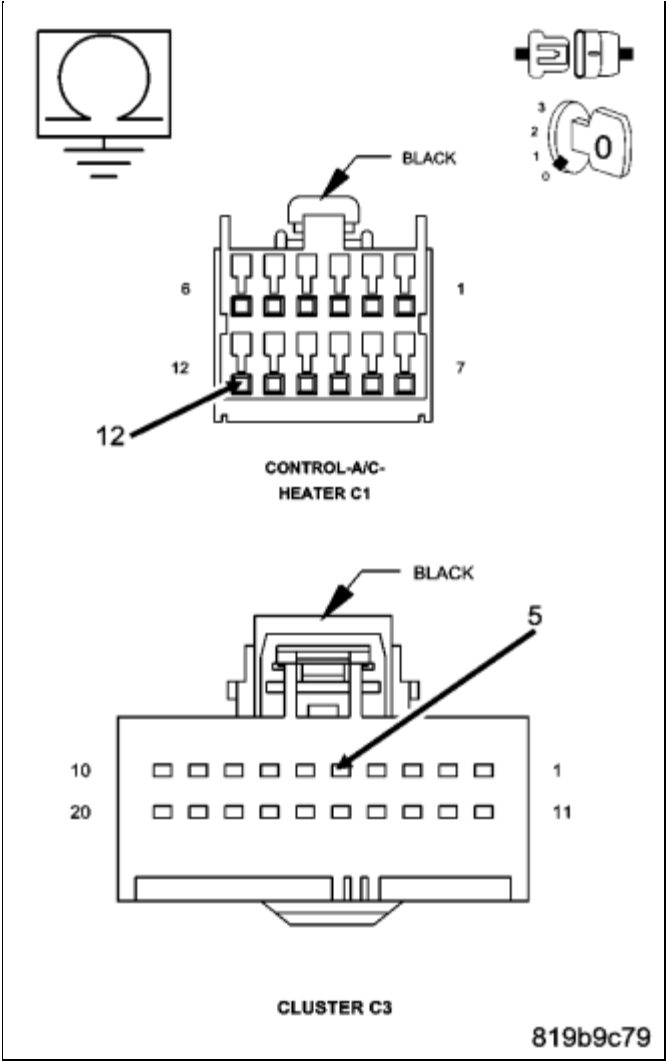
- Replace the Instrument Cluster (CCN) in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

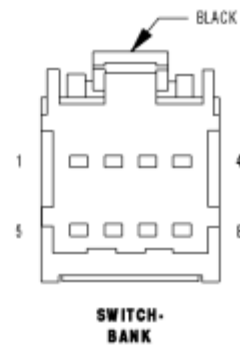
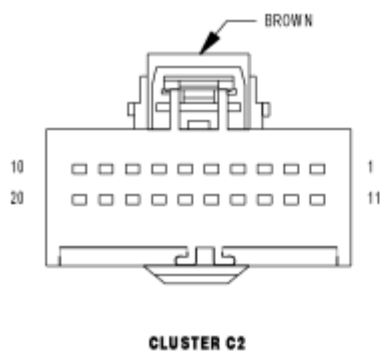
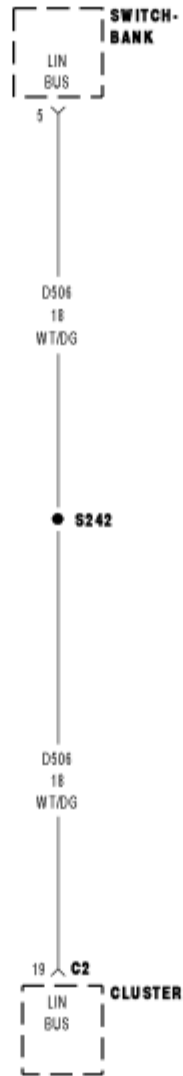
No

- Repair short to ground on the (C215) Rear Window Defogger Switch Signal circuit.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

B10C2 – REAR DEFROST SWITCH

STUCK (CCN)





0100070

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously

◦ **Set Condition:**

When the Rear Defrost Switch in the Switch Bank is held in the On position for over 10 seconds, this code will set.

Possible Causes
(D506) LIN BUS CIRCUIT SHORTED TO GROUND
SWITCH BANK STUCK
INSTRUMENT CLUSTER

1. VERIFY DTC B10C2 – REAR DEFROST SWITCH STUCK IS ACTIVE

Turn the ignition on.

With the scan tool, check for DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR DTC B10C2 – REAR DEFROST SWITCH STUCK WITH SWITCH BANK (REAR DEFOGGER SWITCH) DISCONNECTED

Turn the ignition off.

With the scan tool, erase DTC's.

Disconnect the Switch Bank connector.

Turn the ignition on.

With the scan tool, read DTC's.

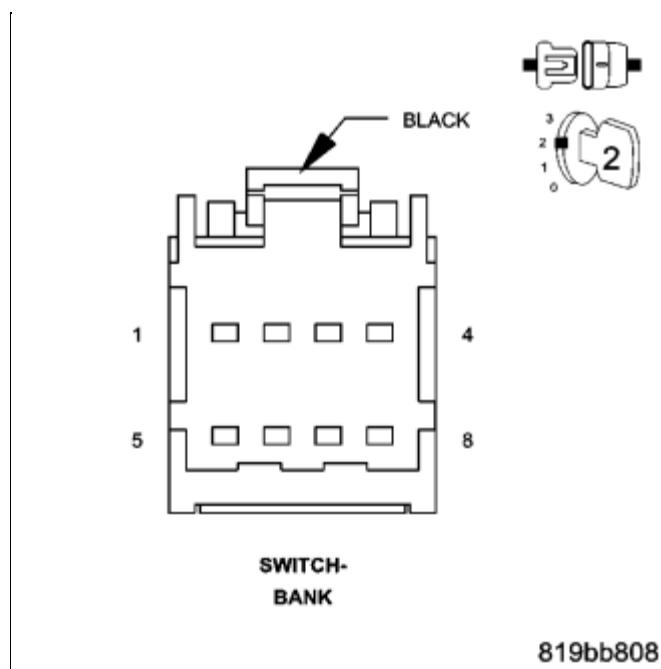
Does the scan tool display this code as active?

No

- Replace the Switch Bank in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

Yes

- Go To [3](#)



3. (D506) LIN BUS CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Instrument Cluster (CCN) C2 harness connector.

Measure the resistance between ground and the (D506) LIN Bus circuit.

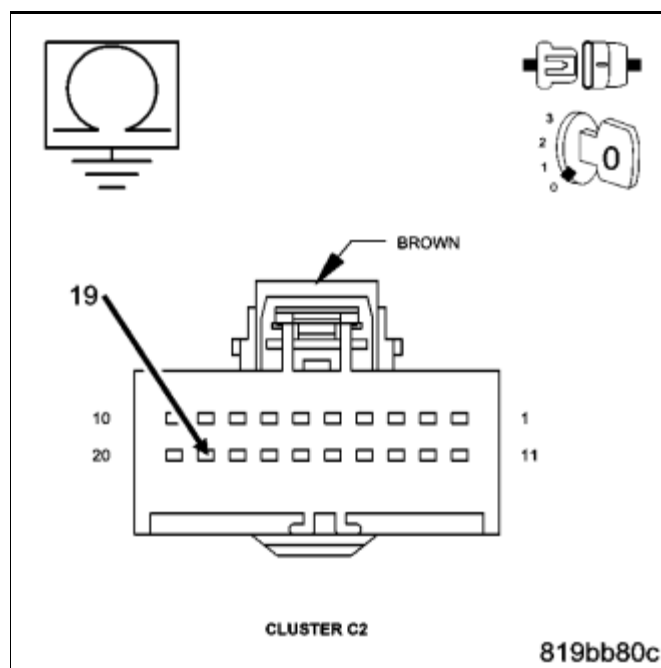
Does the ohm meter read open circuit?

Yes

- Replace the Instrument Cluster (CCN) in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D506) LIN Bus circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



HEATED GLASS - SERVICE INFORMATION

HEATED GLASS - SERVICE INFORMATION

DESCRIPTION

CAUTION: Grid lines can be damaged or scraped off with sharp instruments. Care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

The rear window defogger system, also known as electric backlight (EBL), consists of two vertical bus bars (1) linked by a series of grid lines (2) fired onto the inside surface of the rear window (3).

The EBL system is turned on or off by a switch located in the A/C-heater control at the center of the instrument panel (refer to 8 - ELECTRICAL/HEATED GLASS/SWITCH-REAR WINDOW DEFOGGER - DESCRIPTION).

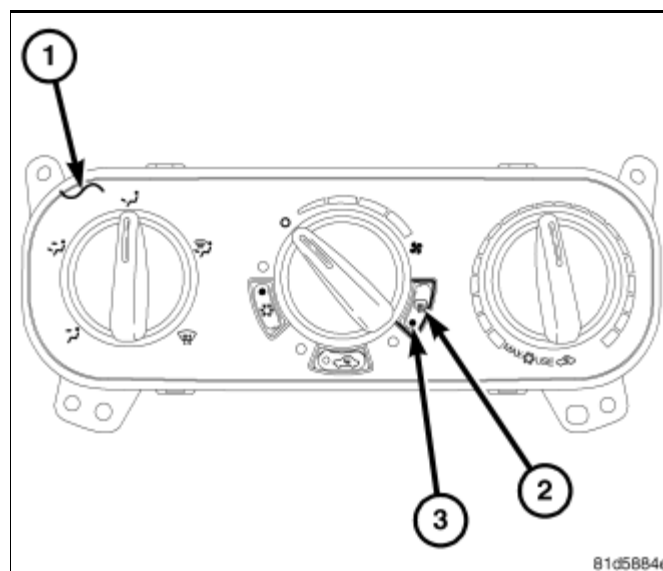
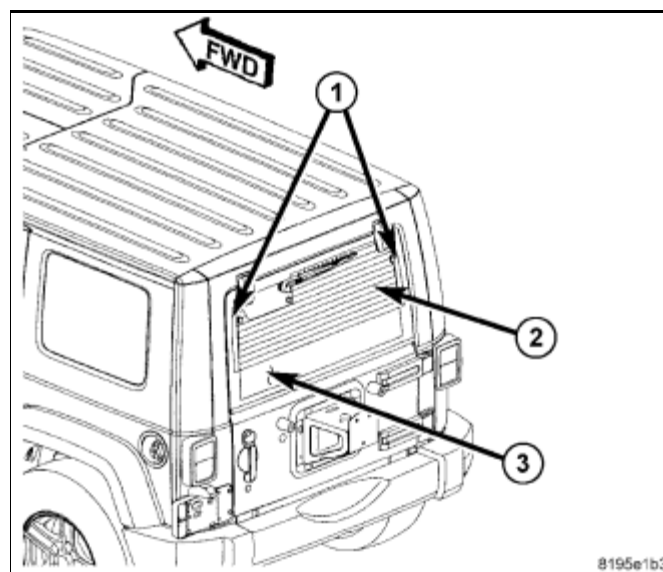
OPERATION

When equipped, the electric backlight (EBL) system is controlled by a momentary switch (2) located in the A/C-heater control (1) in the instrument panel. When the rear window defogger switch is pressed to ON with the ignition switch in RUN, the cabin compartment node (CCN) sends a request signal over the CAN I-HS Bus to the totally integrated power module (TIPM) to energize the internal EBL high side driver. When energized, the EBL high side driver provides battery current to the rear window defogger grid lines. The grid lines heat the glass to help clear the rear window surface of fog or frost.

An amber indicator (3) in the rear window defogger switch will illuminate to indicate when the EBL system is ON.

NOTE: The EBL system turns off automatically after 10 minutes of initial operation. Each following activation cycle of the EBL system will last 5 minutes.

The EBL system will be automatically turned off after an initial programmed time interval of about 10 minutes as long as the ignition switch is in RUN. After the initial time interval has expired, if the rear window defogger switch is pressed to ON again during the same ignition cycle, the EBL system will automatically turn off after about 5 minutes. The EBL system will also turn off if the ignition switch is turned to any position other than RUN or by manually pressing the rear window defogger switch a second time.



Repair of the rear window defogger grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar® Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent (refer to 8 - ELECTRICAL/HEATED GLASS/GRID-REAR WINDOW DEFOGGER - STANDARD PROCEDURE - GRID LINE AND TERMINAL REPAIR).

The EBL control system is diagnosed using a scan tool (refer to 8G - Heated Glass Electrical Diagnostics for more information).

DIAGNOSIS AND TESTING

ELECTRIC BACKLIGHT (EBL) SYSTEM

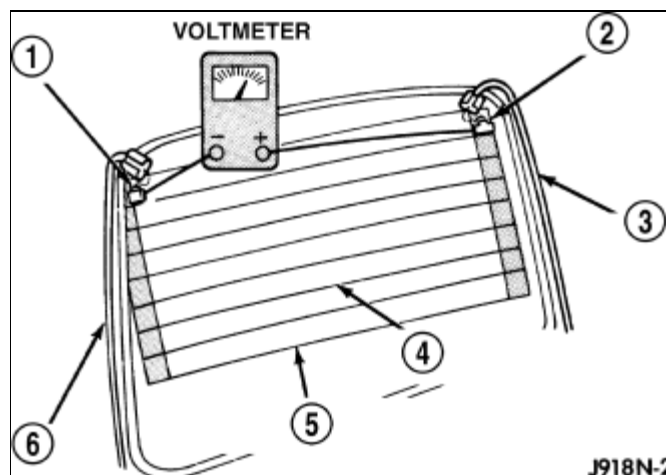
NOTE: Illumination of the defogger switch indicator lamp does not necessarily mean that electrical current is reaching the rear window glass heating grid.

NOTE: For circuit descriptions and diagrams of the rear window defogger (EBL), refer to 8W - WIRING DIAGRAM INFORMATION.

Operation of the electric backlight (EBL) system can be confirmed by the following:

NOTE: Typical heated rear window glass shown.

1. Use a scan tool and check for diagnostic trouble codes (DTCs) related to the rear window defogger switch, cabin compartment node (CCN) and the totally integrated power module (TIPM). If no DTCs are found, go to [STEP 2](#). If any DTCs are found, repair as required, then proceed to [STEP 2](#).
2. Turn the ignition switch to RUN. Set the rear window defogger switch to ON. Rear window defogger operation can be checked by feeling the surfaces of the rear window glass. A distinct difference in temperature between the grid lines (5) and the adjacent clear glass should be detected within three to four minutes of operation.



3. If a temperature difference is not detected, use a 12-volt DC voltmeter and contact the rear glass heating grid terminal A (1) with the negative lead, and terminal B (2) with the positive lead. The voltmeter should read battery voltage. If the voltmeter does not read battery voltage, check the following:

- Confirm the ignition switch is in RUN.
- Confirm the rear window defogger switch is ON.
- Confirm the EBL feed wire (3) is connected to the heating grid positive terminal and that there is continuity between the TIPM and the heating grid.
- Confirm the EBL ground wire (6) is connected to the heating grid negative terminal and that there is continuity to ground.

4. If broken defogger grid lines or bus bars are suspected, use a 12-volt DC voltmeter and contact terminal A with the negative lead and each rear glass heating grid line at its mid-point C (4) with the positive lead. The voltmeter should read approximately 6 volts at each grid line mid-point. If the voltmeter does not read approximately 6 volts, repair the open grid line(s) or bus bar(s) (refer to 8 - ELECTRICAL/HEATED GLASS/GRID-REAR WINDOW DEFOGGER - STANDARD PROCEDURE - GRID LINE AND TERMINAL REPAIR).

5. If the EBL system operation has been verified but the rear window defogger indicator does not illuminate, replace the A/C-heater control (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL - A/C HEATER - REMOVAL).

GRID-REAR WINDOW DEFOGGER

STANDARD PROCEDURE

GRID LINE AND TERMINAL REPAIR

WARNING: Materials contained in the Repair Kit (Part Number 04549275) may cause skin or eye irritation. The kit contains epoxy resin and amine type hardener, which are harmful if swallowed. Avoid contact with the skin and eyes. For skin contact, wash the affected areas with soap and water. For contact with the eyes, flush with plenty of water. Do not take internally. If taken internally, induce vomiting and call a physician immediately. Use with adequate ventilation. Do not use near fire or flame. Contains flammable solvents. Keep out of the reach of children. Failure to follow the warnings may result in serious or fatal injury.

Repair of the rear glass heating grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar® Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent.

1. Mask the repair area with masking tape (3) so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the grid line (2) or the bus bar on each side of the break (1).

2. Follow the instructions in the repair kit for preparing the damaged area.

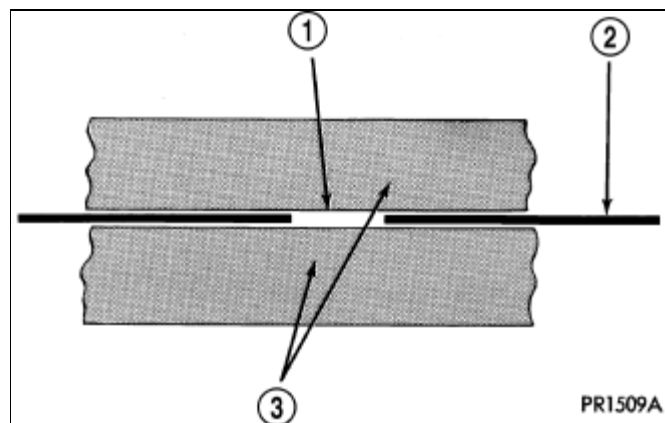
3. Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.

4. Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).

5. For a terminal or pigtail wire replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as the bus bar. Apply a thin layer of epoxy to the area where the terminal or pigtail wire was fastened and onto the adjacent grid line.

6. Apply a thin layer of conductive epoxy to the terminal or bare wire end of the pigtail and place it in the proper location on the bus bar. To prevent the terminal or pigtail wire from moving while the epoxy is curing, it must be wedged or clamped.

7. Carefully remove the masking tape or template.



CAUTION: Do not allow the glass surface to exceed 204° C (400° F) when using a heat gun, or the glass may fracture.

8. Allow the epoxy to cure 24 hours at room temperature, or carefully use a heat gun for 15 minutes. When using a heat gun, hold it approximately 25.4 centimeters (10 inches) from the repair and do not allow the glass surface to exceed 204° C (400° F).

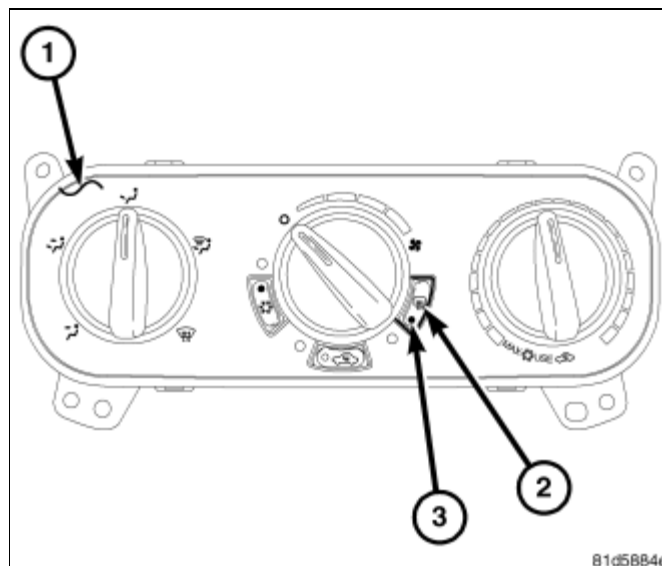
9. After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal or pigtail wire.
10. Connect the wire harness leads to the grid terminals or pigtail wires and verify EBL operation.

SWITCH-REAR WINDOW DEFOGGER

DESCRIPTION

The switch (2) for the rear window defogger (EBL) system is located in the A/C-heater control (1) in the instrument panel. When the rear window defogger switch is pressed to ON, the amber indicator (3) in the switch illuminates and a request signal is sent to the totally integrated power module (TIPM) to operate the EBL system.

When the EBL high side driver in the TIPM is energized, current is directed to the rear defogger grid lines to heat the glass to help clear the surface of fog or frost.



OPERATION

An amber indicator will illuminate when the rear window defogger switch is activated. When activated, the cabin compartment node (CCN) sends a request signal to the totally integrated power module (TIPM) to energize the internal EBL high side driver to provide battery current to the rear window defogger grid lines.

NOTE: The EBL system turns off automatically after 10 minutes of initial operation. Each following activation cycle of the EBL system will last 5 minutes.

The EBL system will be automatically turned off after an initial programmed time interval of about 10 minutes as long as the ignition switch is in RUN. After the initial time interval has expired, if the rear window defogger switch is pressed to ON again during the same ignition cycle, the EBL system will automatically turn off after about 5 minutes. The EBL system will also turn off if the ignition switch is turned to any position other than RUN or by manually pressing the rear window defogger switch a second time.

The rear window defogger switch is diagnosed using a scan tool (refer to 8G - Heated Glass Electrical Diagnostics for more information).

The rear window defogger switch and indicator lamp cannot be adjusted or repaired and the A/C-heater control must be replaced if found inoperative or damaged (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).

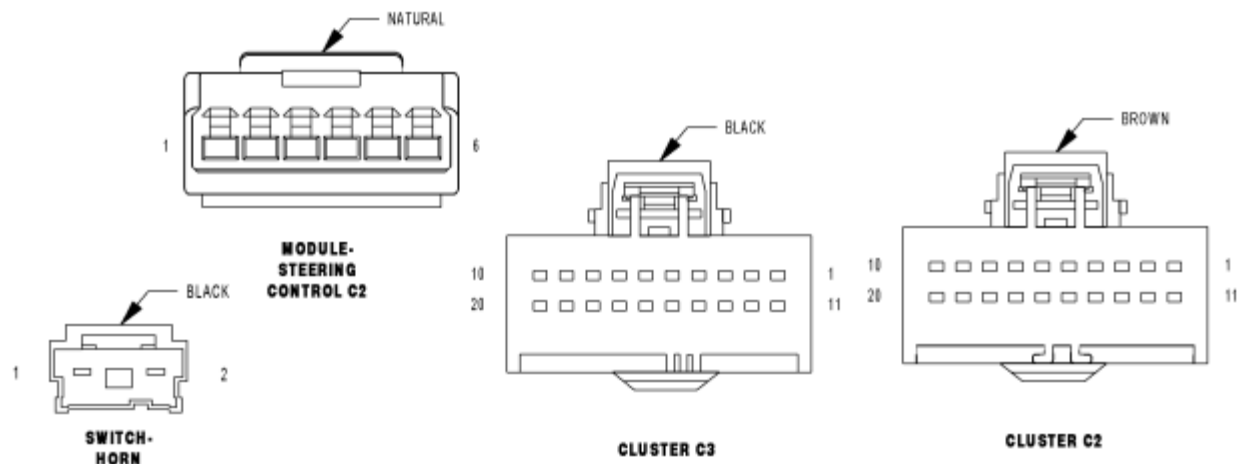
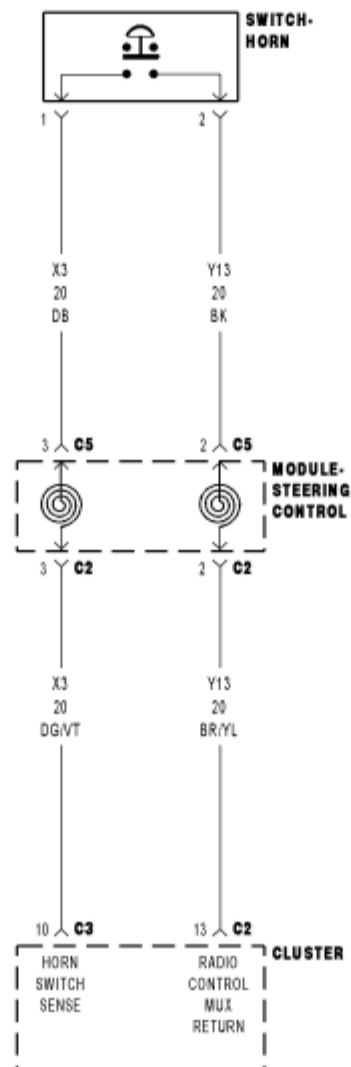
8H - HORN

HORN SYSTEM-ELECTRICAL DIAGNOSTICS

HORN SYSTEM-ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B2339–HORN SWITCH STUCK – CLUSTER



01945006

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously

- **Set Condition:**

When the Cluster senses the Horn Switch input for over 30 seconds, this code will set.

Possible Causes
HORN SWITCH
CLOCKSPRING
(X3) HORN SWITCH SENSE CIRCUIT SHORTED TO GROUND
(X3) HORN SWITCH SENSE CIRCUIT SHORTED TO (Y13) RADIO CONTROL RETURN
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Horn Switch several times.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display HORN SWITCH STUCK?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. HORN SWITCH SHORTED

WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Horn switch connector.
 With the scan tool, erase DTC's
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read DTC's.

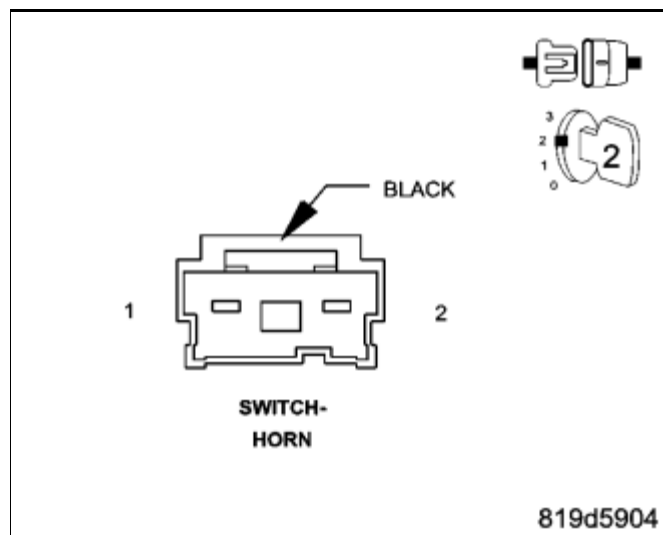
Does the scan tool display HORN SWITCH STUCK?

Yes

- Go To [3](#)

No

- Replace the Horn Switch.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. STEERING WHEEL HARNESS SHORTED

Disconnect the Steering Control Module C5 connector.
 With the scan tool, erase DTC's
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read DTC's.

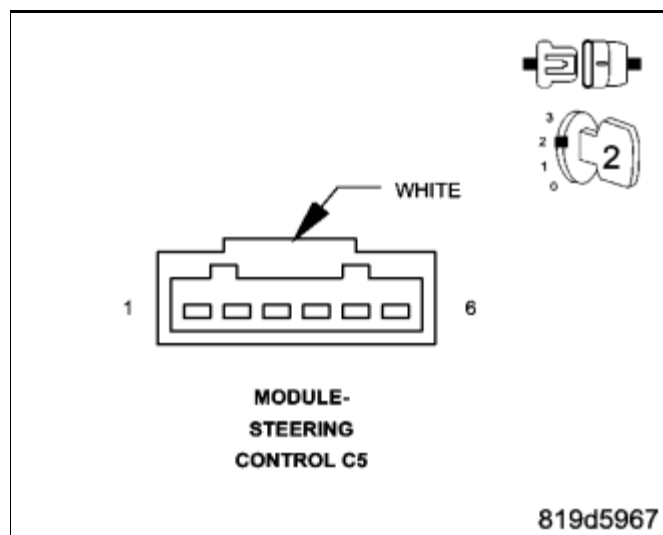
Does the scan tool display HORN SWITCH STUCK?

Yes

- Go To [4](#)

No

- Repair/replace the steering wheel jumper harness.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. CLOCKSPRING SHORTED

Disconnect the Steering Control Module C2 connector.
 With the scan tool, erase DTC's
 Cycle the ignition from on to off 3 times.
 Turn the ignition on.
 With the scan tool, read DTC's.

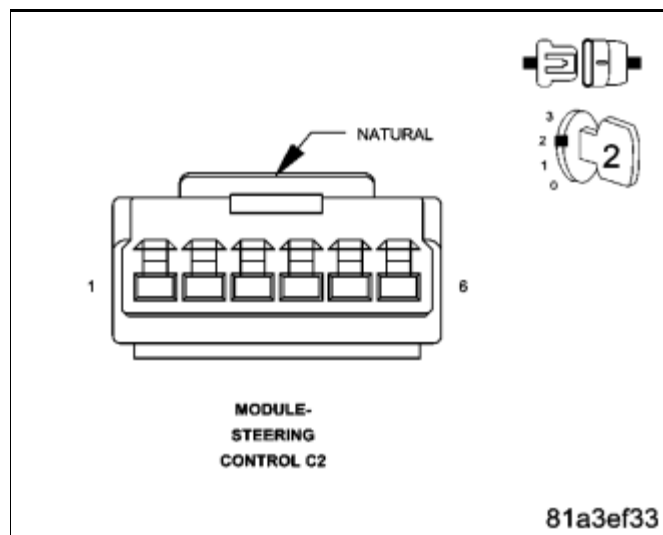
Does the scan tool display HORN SWITCH STUCK?

Yes

- Go To [5](#)

No

- Replace the clockspring.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (X3) HORN SWITCH SENSE SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Cluster C2 and C3 connector.
 Measure the resistance between (X3) Horn Switch Sense and the (X13) Radio Control Return circuit.

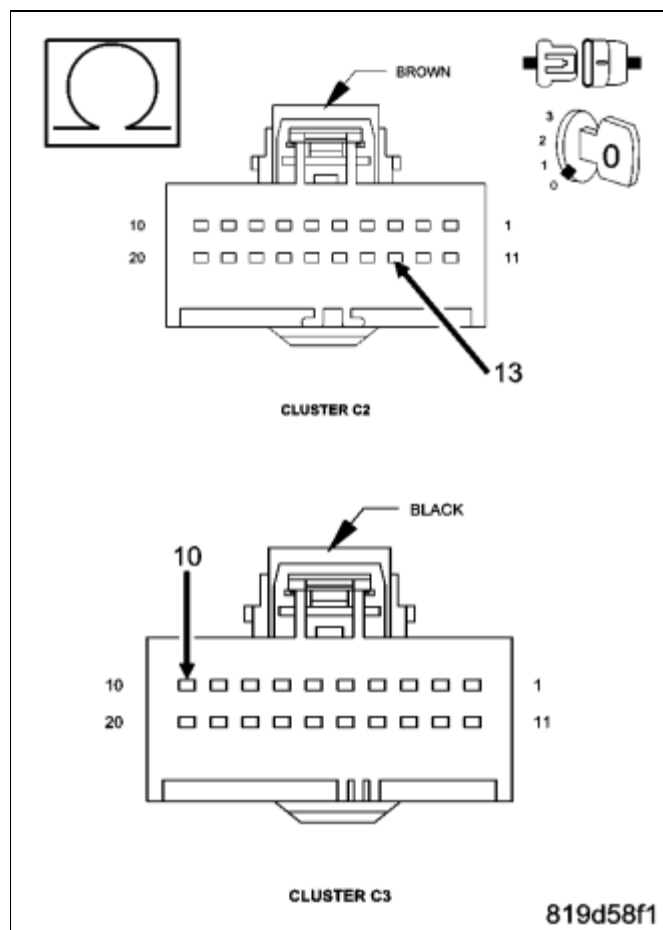
Is the resistance below 1000.0 ohms?

Yes

- Repair the (X3) Horn Switch Sense circuit for a short to (X13) Radio Control Return circuit.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (X3) HORN SWITCH SENSE SHORTED TO GROUND

Measure the (X3) Horn Switch Sense circuit to ground.

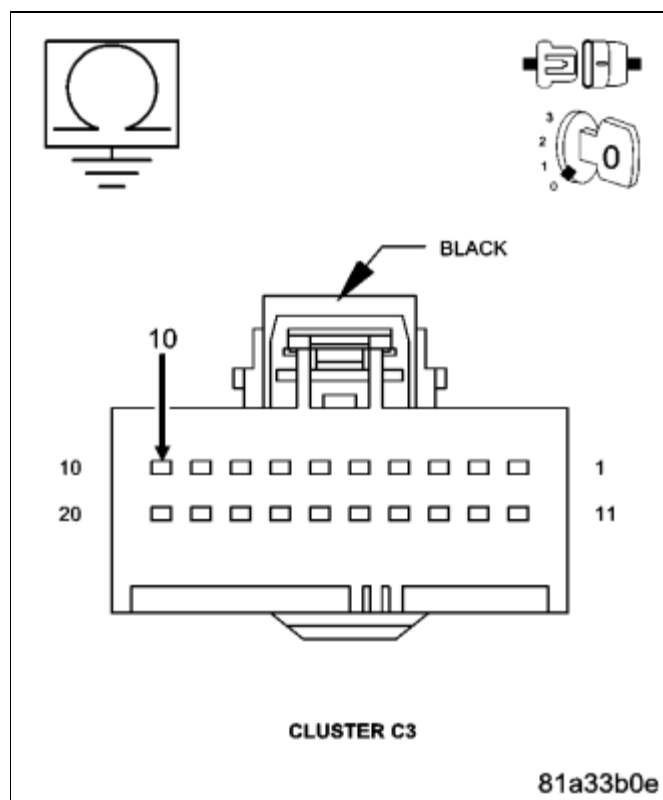
Is the resistance below 1000.0 ohms?

Yes

- Repair the Horn Switch Sense circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Cluster.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



HORN SYSTEM - SERVICE INFO

HORN SYSTEM - SERVICE INFO

DESCRIPTION

The horn system features one low-note horn unit. The horn system uses a non-switched source of battery current so that the system will remain functional, regardless of the ignition switch position. The horn system includes the following components:

- Clockspring
- Horn
- Horn relay
- Horn switch

OPERATION

The horn system operates on battery current received through a fuse in the Totally Integrated Power Module (TIPM). The horn system circuit is designed so that the system will remain operational, regardless of the ignition switch position.

HORN

DIAGNOSIS AND TESTING

HORN

For complete circuit diagrams, refer to the appropriate wiring information.

1. Disconnect the wire harness connectors from the horn connector receptacles. Measure the resistance between the ground circuit cavity of the horns wire harness connectors and a good ground. There should be continuity. If OK, go to [STEP 2](#). If not OK, repair the open ground circuit to ground as required.
2. Check for battery voltage at the horn relay output circuit cavity of the horns wire harness connectors. There should be zero volts. If OK, go to [STEP 3](#). If not OK, repair the shorted horn relay output circuit or replace the faulty horn relay as required.
3. Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the horns wire harness connectors. If OK, replace the faulty horns. If not OK, repair the open horn relay output circuit to the horn relay as required.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Disconnect the wire harness connector from the horn.
3. Remove the screw that secures the horn and mounting bracket.
4. Remove the horn and mounting bracket.

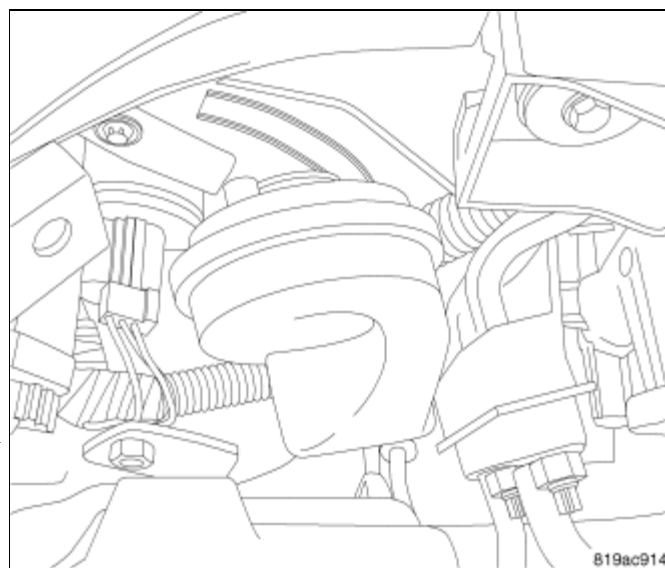
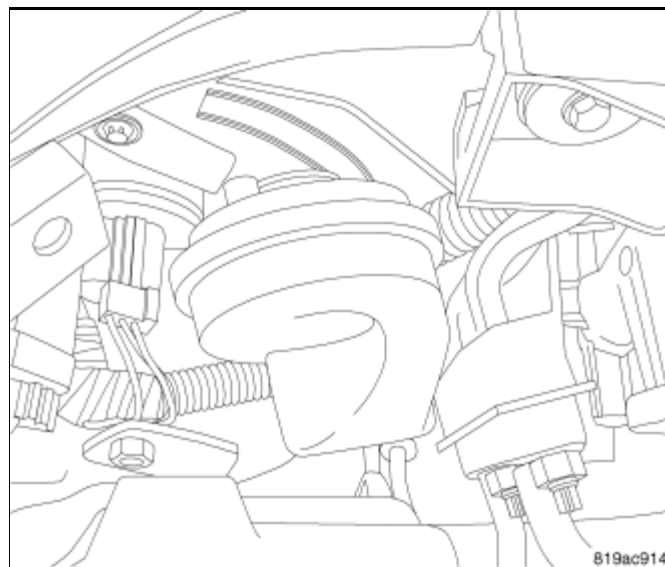
INSTALLATION

1. Install the horn to the mounting bracket.
2. Install the horn and bracket mounting fastener.
3. Connect the electrical connector.
4. Connect the battery negative cable.

HORN SWITCH

DESCRIPTION

A center-blow, normally open, resistive membrane-type horn switch is secured in a plastic tray that is inserted in a pocket sewn on the front of the driver side airbag retainer strap. The horn switch is concealed behind the driver side airbag module trim cover.



The steering wheel and steering column must be properly grounded in order for the horn switch to function properly. The horn switch and plastic tray are serviced as a unit. If the horn switch is damaged or faulty, or if the driver side airbag is deployed, the horn switch and tray must be replaced as a unit.

OPERATION

When the center area of the driver side airbag trim cover is depressed, the electrically conductive grids on the facing surfaces of the horn switch membranes contact each other, closing the switch circuit. The completed horn switch circuit provides a ground for the control coil side of the horn relay, which activates the relay. When the horn switch is released, the resistive tension of the convex membrane separates the two electrically conductive grids and opens the switch circuit.

DIAGNOSIS AND TESTING

HORN SWITCH

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: On vehicles equipped with airbags, refer to electrical, restraints before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.

1. Disconnect and isolate the battery negative cable. Remove the steering column opening cover from the instrument panel.
2. Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to [STEP 3](#). If not OK, refer to Steering, Column for proper installation of the steering column.
3. Remove the driver side airbag module from the steering wheel. Disconnect the horn switch wire harness connectors from the driver side airbag module.
4. Remove the horn fuse from the Totally Integrated Power Module (TIPM). Check for continuity between the steering column half of the horn switch feed wire harness connector and a good ground. There should be no continuity. If OK, go to [STEP 5](#). If not OK, repair the shorted horn relay control circuit to the horn relay in the TIPM as required.
5. Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the TIPM. There should be continuity. If OK, go to [STEP 6](#). If not OK, repair the open horn relay control circuit to the horn relay in the TIPM as required.
6. Check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should be no continuity. If OK, go to [STEP 7](#). If not OK, replace the faulty horn switch.
7. Depress the center of the driver side airbag module trim cover and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch.

REMOVAL

WARNING:

- On vehicles equipped with airbags, refer to electrical, restraints before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.
- The horn switch is integral to the driver side airbag module. Service of this component should be performed only by Chrysler trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or

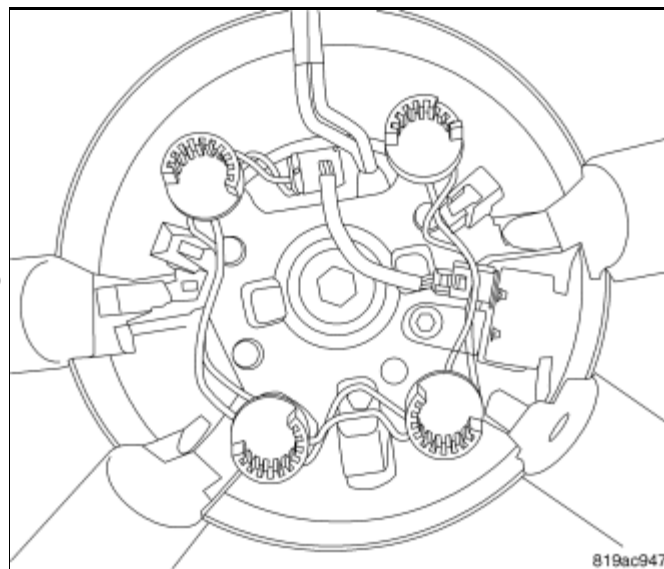
improper airbag deployment and possible occupant injuries.

1. Disconnect and isolate the battery negative cable.
2. Remove the trim cover from the driver side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Remove the mounting fasteners.
4. Disconnect the electrical connector.
5. Remove horn switches by gently rocking the switch side to side while pulling outwards.

INSTALLATION

WARNING:

- On vehicles equipped with airbags, refer to electrical, restraints before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.
- The horn switch is integral to the driver side airbag module. Service of this component should be performed only by Chrysler trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.



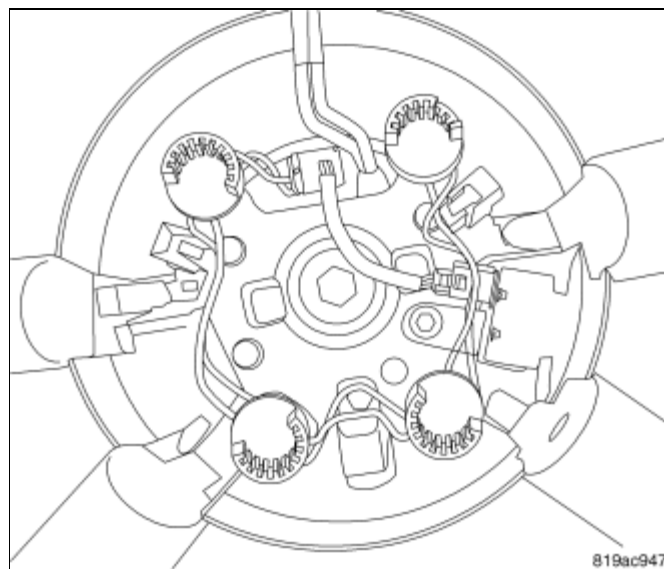
1. Install the horn switches.
2. Connect the electrical connector.
3. Install the trim cover onto the driver side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION) for the procedure.
4. Reconnect the battery negative cable.

8I - IGNITION CONTROL

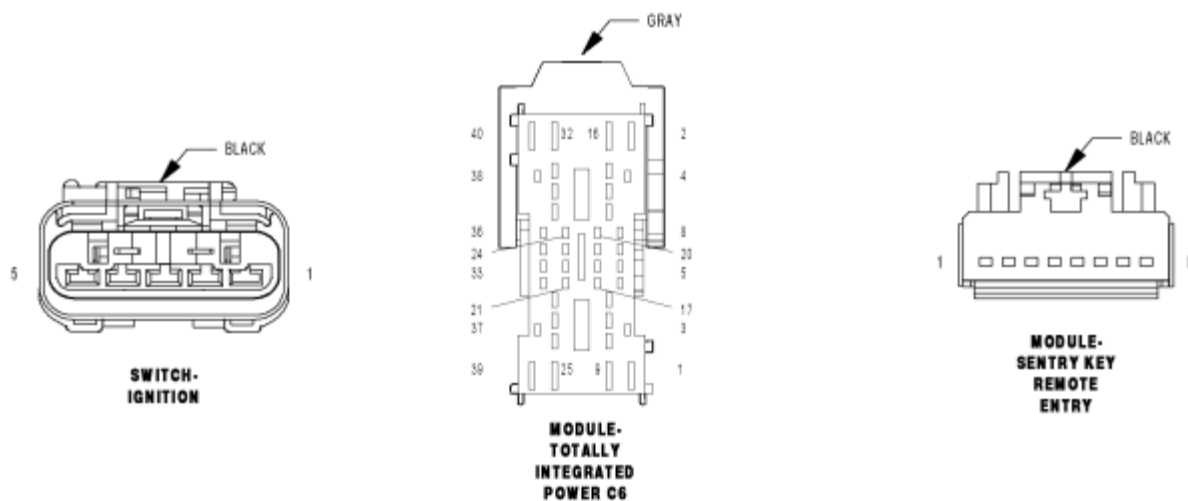
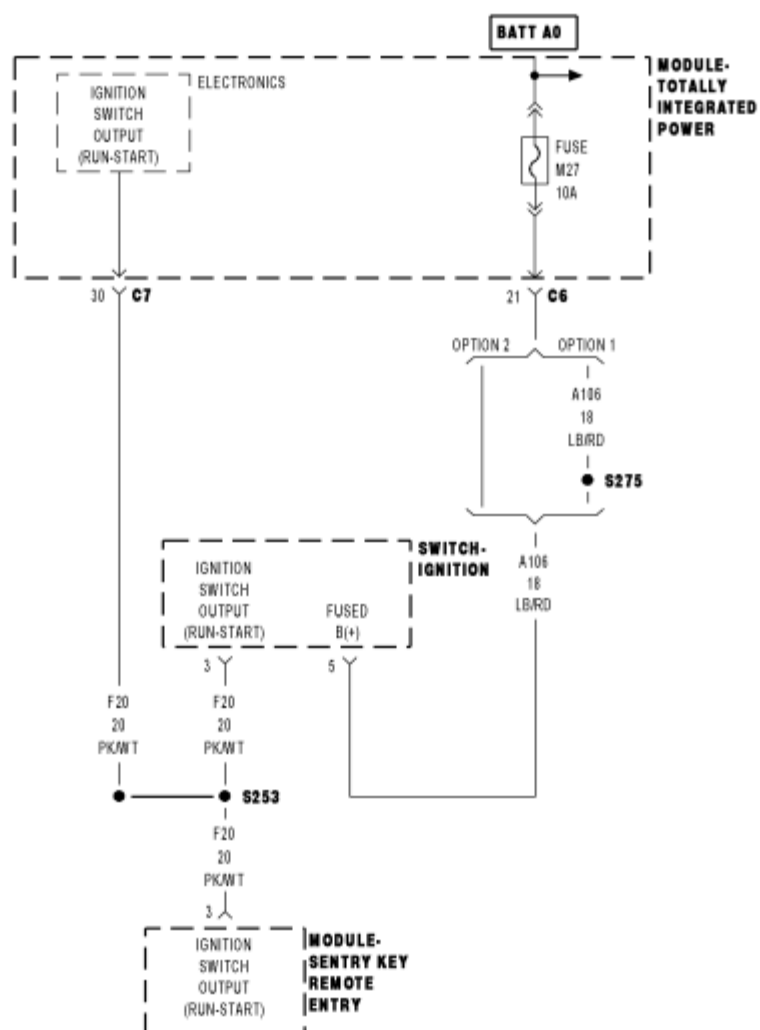
IGNITION CONTROL- ELECTRICAL DIAGNOSTICS

IGNITION CONTROL- ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING



B2101-IGNITION RUN/START INPUT LOW



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition switch on.

- **Set Condition:**

The WCM/WIN (SKREEM) Module has detected the ignition switch input voltage below a calibrated value.

Possible Causes
(F20) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
(A106) FUSED B+ SHORTED TO GROUND
IGNITION SWITCH
TIPM

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With a scan tool, read, record and erase TIPM DTCs.

Turn the ignition off for 30 seconds, then back on.

Using the scan tool, read TIPM DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (F20) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN

NOTE: Check the related fuse (TIPM 46) to the (F20) Ignition Switch Output (Run-Start) circuit. If blown, use the wiring diagrams as a guide to make necessary repairs.

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F20) Ignition Switch output (Run-Start) circuit in the TIPM C7 harness connector.

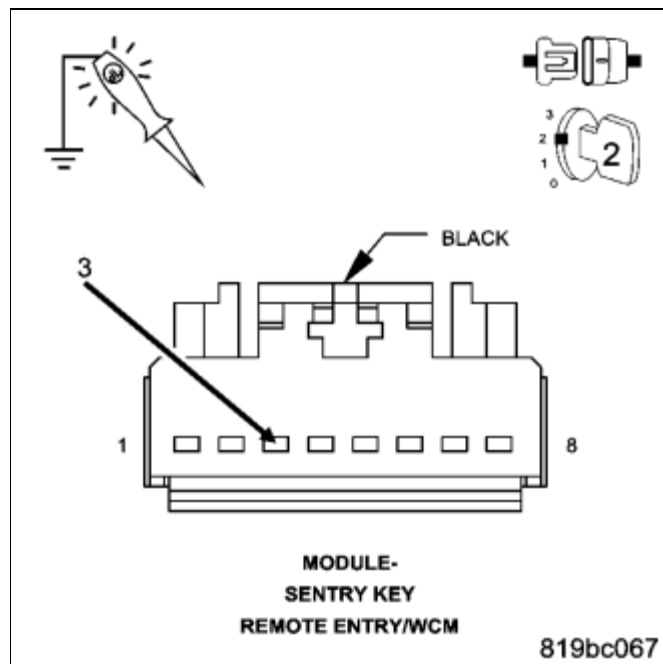
Does the test light illuminate brightly?

Yes

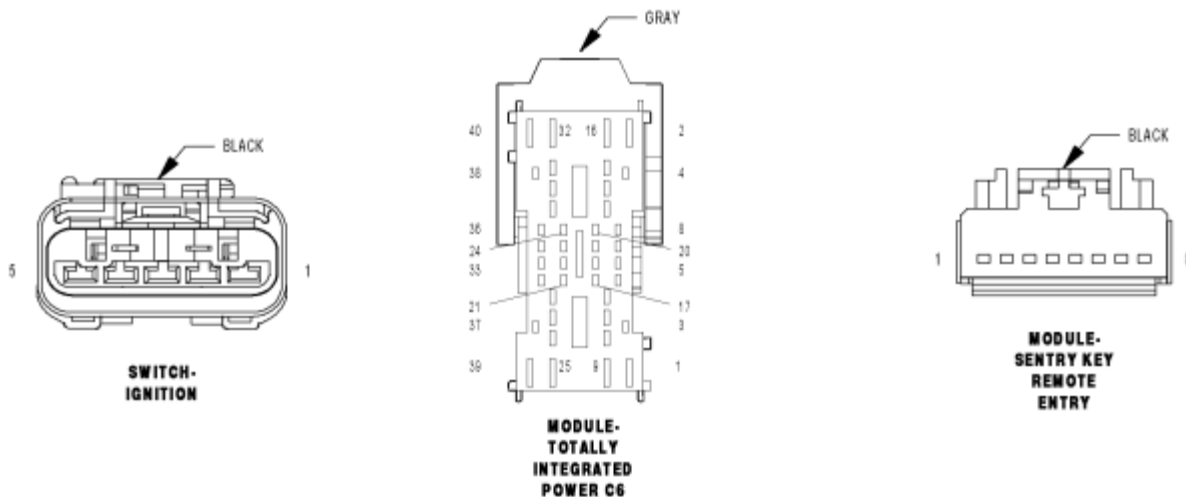
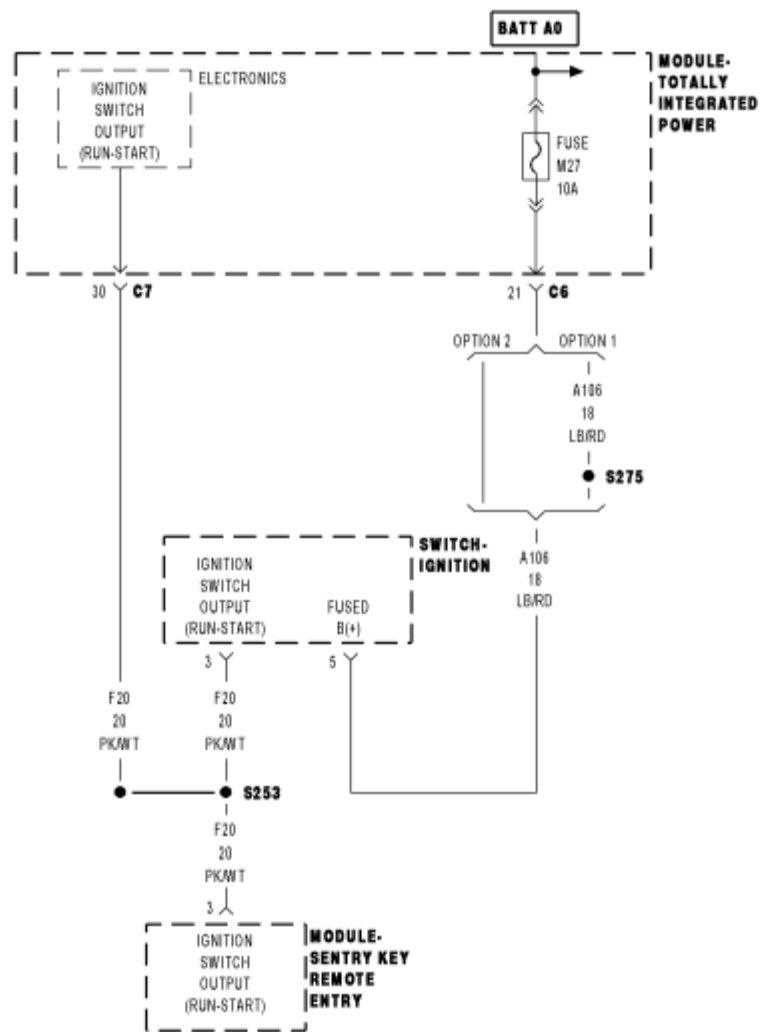
- Replace the TIPM in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (F20) Ignition switch output circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B2102-IGNITION RUN/START INPUT CIRCUIT HIGH



01591128

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition switch on.

◦ **Set Condition:**

The WCM/WIN (SKREEM) Module has detected the ignition switch input voltage above a calibrated value.

Possible Causes
(F20) IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO BATTERY VOLTAGE
WCM/WIN (SKREEM) MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: Check to make sure the battery and charging system are operating properly. Battery and charging system problems may cause these DTC's to set.

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

Turn the ignition on.

With a scan tool, read, record and erase WCM/WIN (SKREEM) DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read WCM/WIN (SKREEM) DTC(s).

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (F20) IGNITION SWITCH OUTPUT (RUN-START) SHORTED TO BATTERY VOLTAGE

Turn the ignition off.
 Disconnect the WCM/WIN (SKREEM) harness connector.
 Using a 12-volt test light connected to ground, probe the (F20) Ignition Switch Output (Run-Start) circuit in the WCM/WIN (SKREEM) harness connector.

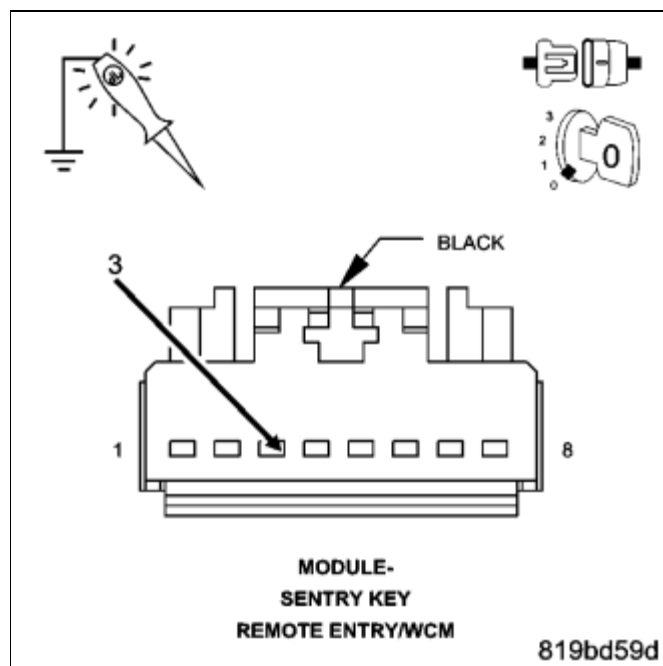
Does the test light illuminate brightly?

Yes

- Repair the (F20) Ignition Switch Output (Run-Start) circuit for a short to battery voltage.
- Perform SKREEM VERIFICATION TEST.

No

- Replace and program the WCM/WIN (SKREEM) in accordance with the service information.
- Perform SKREEM VERIFICATION TEST.



B210E-BATTERY VOLTAGE HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

Battery voltage greater than 16 volts for approximately 15 seconds.

Possible Causes
GENERATOR
PCM

Diagnostic Test

1. CHECK FOR ANY POWERTRAIN CONTROL MODULES DTCS

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the TIPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Turn the ignition on.
With the scan tool, read active PCM DTC's.

Does the scan tool display any active PCM DTC's?

Yes

- (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

No

- Check the above conditions that can cause a high voltage condition. Repair as necessary.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B2142 IGNITION OFF DRAW (IOD) FUSE NOT PRESENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Ignition on. This DTC will set only if vehicle has less that 50 miles on it. After 50 miles, DTC B219F will set.

- **Set Condition:**

IOD Fuse not installed in the TIPM.

Possible Causes
IOD FUSE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, record and erase DTC's.

Cycle the ignition switch from off to on, leaving the ignition off for a minimum of 30 seconds.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- If the DTC is stored, check for an intermittent condition. Using the wiring diagram/schematic as a guide, visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

2. IOD FUSE INSTALLED

Verify IOD Fuse installed in TIPM

Is IOD Fuse present?

Yes

- Go To [3](#)

No

- Install the IOD Fuse.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. IOD FUSE BLOWN CHECK

Is IOD Fuse blown?

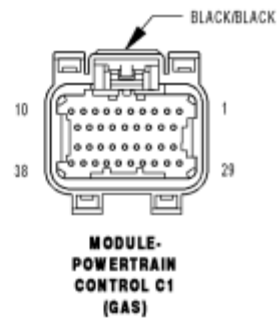
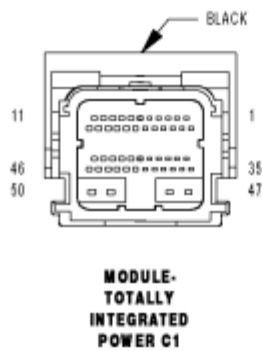
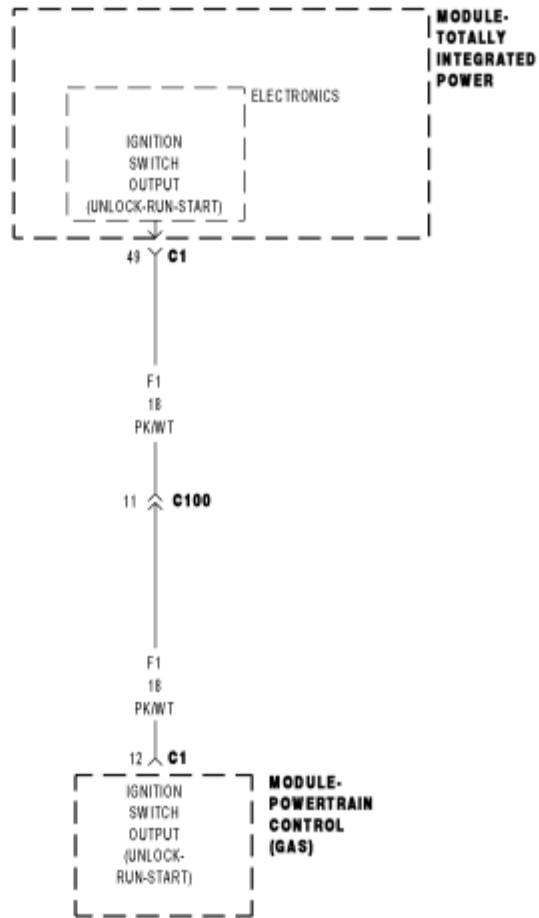
Yes

- Replace the IOD Fuse.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test complete.

B219A-IGNITION UNLOCK RUN/START CONTROL CIRCUIT OVERCURRENT



01991151

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

Over current condition detected on the (F200) Fused Ignition Switch Output (Run-Start) circuit.

Possible Causes
(F1) IGNITION SWITCH OUTPUT (UNLOCK-RUN-START) CIRCUIT SHORT TO GROUND
TERMINAL DAMAGE OR CORROSION
HIGH RESISTANCE ON THE (F1) FUSED IGNITION SWITCH OUTPUT (UNLOCK-RUN-START) CIRCUIT
POWERTRAIN CONTROL MODULE (PCM)
TIPM

Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, record and erase DTC's.

Cycle the ignition switch from off to on, leaving the ignition off for a minimum of 30 seconds.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- If the DTC is stored, check for an intermittent condition. Using the wiring diagram/schematic as a guide, visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

2. CHECK THE (F1) IGNITION SWITCH OUTPUT (UNLOCK-RUN-START) CIRCUIT FOR A SHORT TO GROUND

Disconnect the TIPM C1 harness connector.
 Disconnect the PCM harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (F1) Ignition Switch Output (Unlock-Run-Start) circuit in the TIPM harness connector.

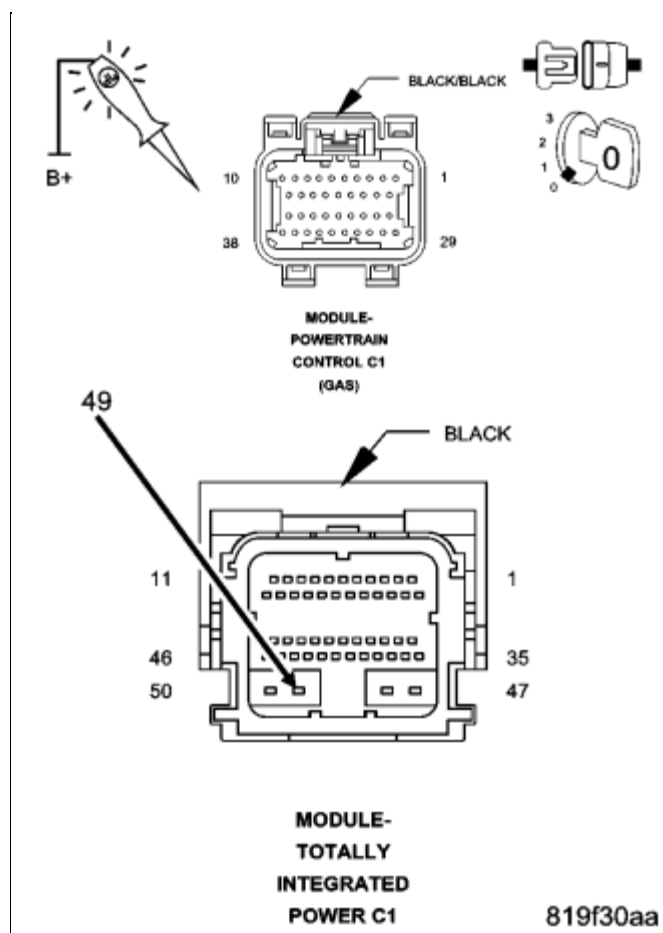
Does the test light illuminate brightly?

Yes

- Repair the (F1) Ignition Switch Output (Unlock-Run-Start) circuit for a short to ground.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. INSPECT THE TIPM & PCM TERMINALS & WIRE HARNESS FOR A CONDITION CAUSING HIGH CIRCUIT RESISTANCE

Disconnect the TIPM C1 harness connector.
 Disconnect the PCM harness connector.
 Inspect the connector terminals for signs of corrosion build up and damage.
 Visually inspect the wiring harness for any chafed, pierced, pinched or partially broken wires hidden in the wire insulation.

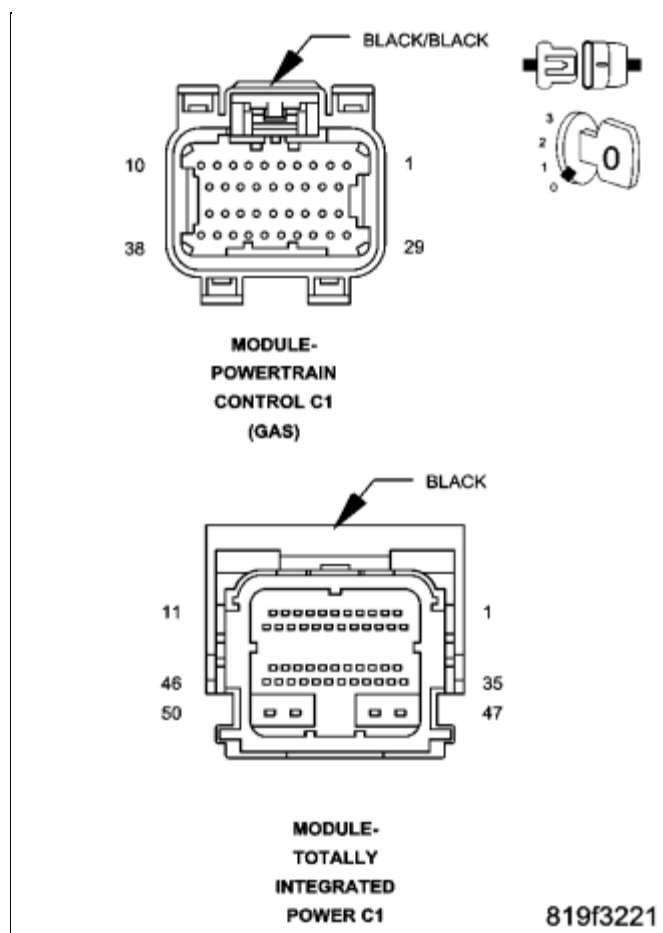
Were any of the above conditions found?

Yes

- Repair as necessary.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK THE (F1) IGNITION SWITCH OUTPUT (UNLOCK-RUN-START) CIRCUIT FUNCTION

Connect one end of a jumper wire to the (F1) Ignition Switch Output (Unlock-Run-Start) circuit, and connect the other end to a clean chassis ground.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to battery.

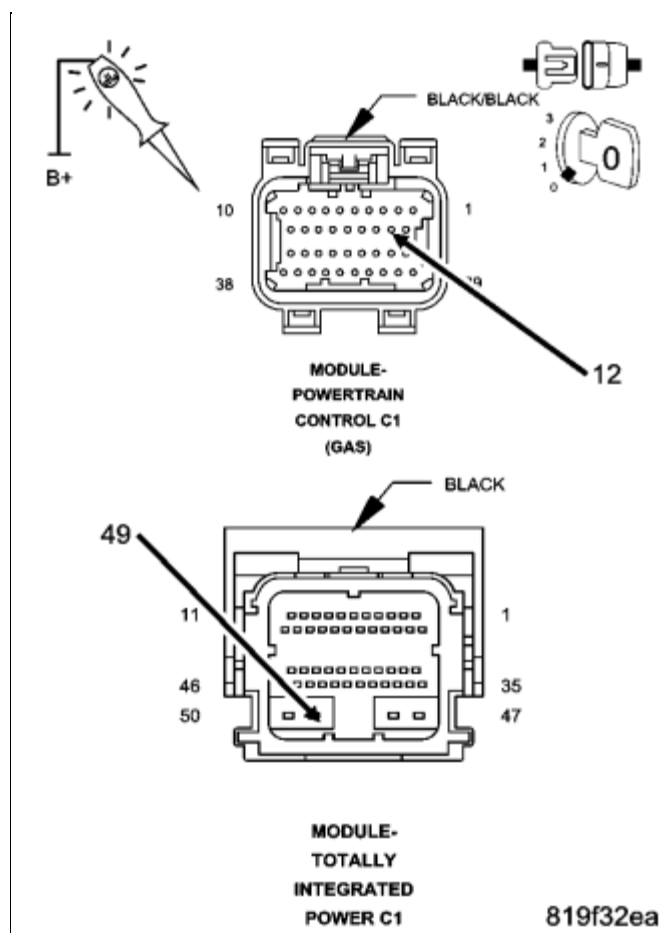
Using a 12 volt test light connected to 12 volts, probe the (F1) Ignition Switch Output (Unlock-Run-Start) circuit in the TIPM C7 harness connector.

Does the test light illuminate brightly?

Yes

- Go To [5](#)
-

No



- Repair the Fused Ignition Switch Output (Run-Start) Circuit for high resistance.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

5. CHECK THE OUTPUT FROM THE TIPM ON THE (F1) IGNITION SWITCH OUTPUT (UNLOCK-RUN-START) CIRCUIT

Reconnect the TIPM C1 harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, probe the (F1) Ignition Switch Output (Unlock-Run-Start) circuit.

Does the test light illuminate brightly?

Yes

- Replace the PCM in accordance with the service information.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the TIPM in accordance with the service

- information.
- Perform BODY VERIFICATION TEST VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B219F IGNITION OFF DRAW (IOD) FUSE BLOWN

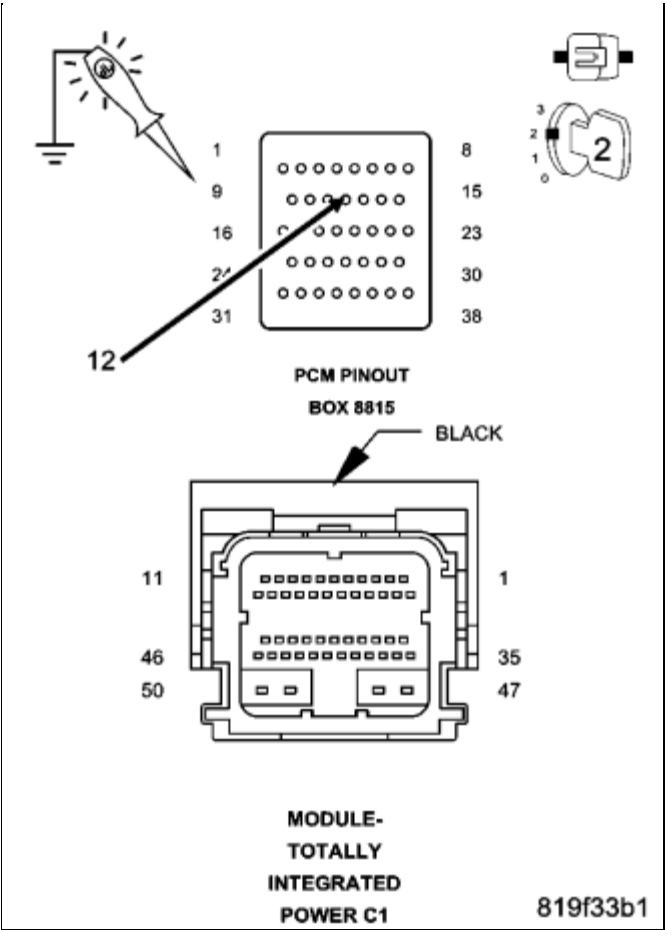
For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. This DTC will only set if vehicle has over 50 miles on it.
- **Set Condition:**

IOD Fuse not installed or blown.

Possible Causes
IOD FUSE NOT INSTALLED
IOD FUSE BLOWN



Diagnostic Test

1. CHECK FOR ACTIVE DTC

With the scan tool, record and erase DTC's.

Cycle the ignition switch from off to on, leaving the ignition off for a minimum of 30 seconds.

With the scan tool, read the active DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- If the DTC is stored, check for an intermittent condition. Using the wiring diagram/schematic as a guide, visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

2. IOD FUSE

Verify IOD Fuse installed in TIPM.

Is IOD Fuse present?

Yes

- Go To [3](#)

No

- Replace the IOD Fuse.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. IOD FUSE BLOWN

Verify IOD Fuse is blown.

Is IOD Fuse blown?

Yes

- Using the wiring diagrams, diagnose for a short to ground condition.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test complete.

B2206-CURRENT VIN MISSING / MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

A PCM from another vehicle has been installed in the vehicle.

Possible Causes
PCM FROM ANOTHER VEHICLE INSTALLED

Diagnostic Test

1. PCM FROM ANOTHER VEHICLE INSTALLED

NOTE: This DTC is set when a PCM from another vehicle is installed into the current vehicle.

Has another PCM been installed?

Yes

- Replace the PCM in accordance with the service information.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)

2. OTHER CAN-C MODULES SET VIN MISMATCH

Is VIN Mismatch DTC set in other CAN-C modules?

Yes

- Replace the PCM in accordance with the service information.

- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the TIPM in accordance with the service information.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B222C-VEHICLE CONFIGURATION NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously

- **Set Condition:**

The TIPM is not configured for the vehicle.

Possible Causes
TIPM

Diagnostic Test**1. CHECK FOR ACTIVE DTC**

Turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- Test complete.

2. ACTIVE TIPM DTC

Cycle the ignition from off to run remaining in run.
With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [3](#)

No

- Test complete.

3. VIN MISMATCH DTC PRESENT

Turn the ignition on.
With the scan tool, read DTCs.

Is DTC: B2206-CURRENT VIN MISSING / MISMATCH also active?

Yes

- Refer to repair procedure for DTC-B2206-CURRENT VIN MISSING / MISMATCH. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - DIAGNOSIS AND TESTING)

No

- Replace the TIPM in accordance with the service information.
- Perform BODY VERIFICATION TEST VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U0100-LOST COMMUNICATION WITH ECM/PCM

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0101-LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0114-LOST COMMUNICATION WITH FINAL DRIVE

CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0151-LOST COMMUNICATION WITH OCCUPANT RESTRAINT CONTROLLER (ORC)

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0154-LOST COMMUNICATION WITH OCCUPANT CLASSIFICATION MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0164-LOST COMMUNICATION WITH HVAC CONTROL

MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) for the diagnostic test procedure.

IGNITION CONTROL - SERVICE INFORMATION

IGNITION CONTROL - SERVICE INFORMATION

DESCRIPTION - IGNITION SYSTEM

NOTE: The 3.8L V-6 engine uses a fixed ignition timing system. Basic ignition timing is not adjustable. All spark advance is determined by the Powertrain Control Module (PCM).

The ignition system used on this engine is referred to as the Direct Ignition System (DIS). The system's four main components are the coils, crankshaft position sensor, spark plugs, and camshaft position sensor.

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sensor Mounting Bolt — 3.8L V-6 Gas	14.1	-	125
Camshaft Sensor Mounting Bolt — 2.8L Diesel	11	8	97
Ignition coil bolts — 3.8L V-6 Gas	11.8	-	105
Spark Plugs — 3.8L V-6 Gas	17.5	13	-
Glow Plugs — 2.8L Diesel	14	10	124
Knock Sensor — 3.8L V-6 Gas	10	7	-

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	10,000 Ohms Per Foot

SPARK PLUG

Engine	Spark Plug Type	Plug Gap	Plug Thread Size
3.8L V-6	RE14PLP5	1.2mm to 1.3mm (0.048 to 0.053 inches)	14mm (1 in.) reach

FIRING ORDER — 3.8L

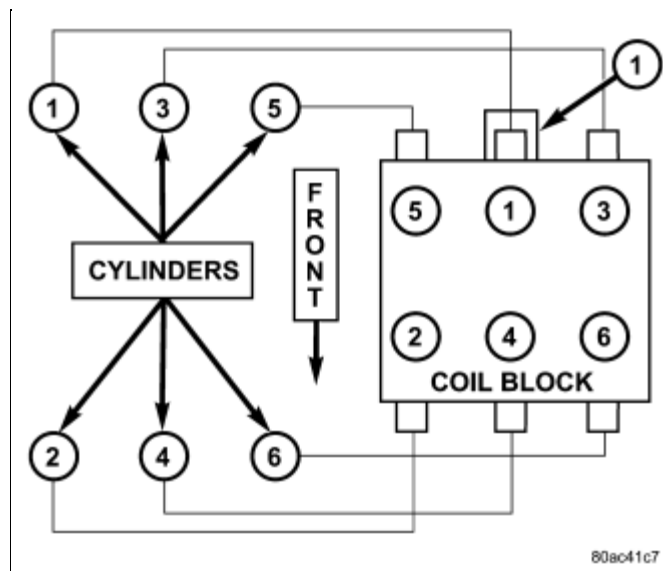
RELAY - AUTO SHUT DOWN

DESCRIPTION

The ASD (Automatic Shutdown Relay) is located in the TPIM (Totally Integrated Power Module).

SENSOR - CAMSHAFT POSITION 3.8L

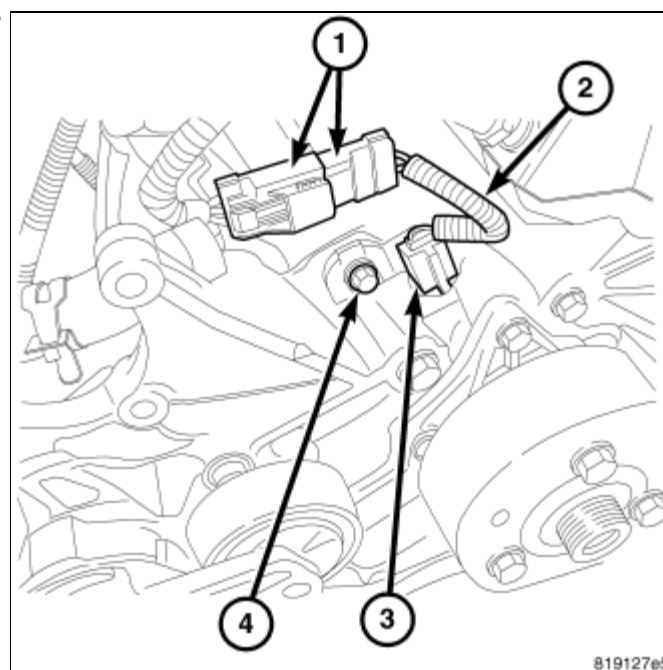
REMOVAL - 3.8L



The CMP (Camshaft Position Sensor) (3) is bolted to front of engine. The CMP uses a pigtail wiring harness (2). This connects the sensor to the engine harness.

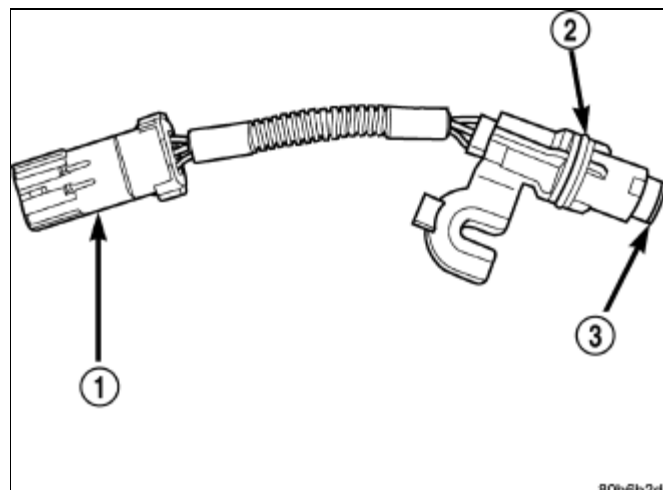
1. Disconnect negative battery cable.
2. Disconnect electrical connectors (1).
3. Remove sensor mounting bolt (4).
4. An O-ring is used to seal the sensor to engine. Remove sensor (3) from engine by pulling while rotating.

INSTALLATION - 3.8L



If the removed sensor is reinstalled, clean off old spacer (3) on sensor face. A NEW SPACER (3) must be attached to face before installation. Inspect O-ring (2) for damage, replace if necessary. If sensor is being replaced, confirm that paper spacer (3) is attached to face, and O-ring (2) is positioned in groove of new sensor.

1. Apply a couple drops of clean engine oil to the O-ring (2) prior to installation.



2. Install sensor (3) into engine and rotate into position.
3. Push sensor down until contact is made with camshaft gear. While holding sensor in this position, install and tighten mounting bolt (4) to 14 N·m (125 in. lbs.) torque.
4. Connect sensor pigtail connector (1) to engine harness connector.
5. Connect negative battery cable.

SENSOR - CAMSHAFT POSITION 2.8L DIESEL

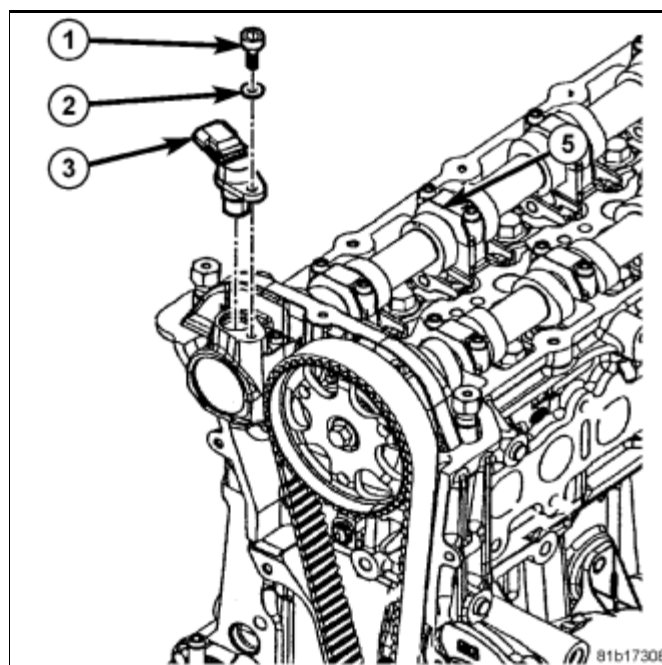
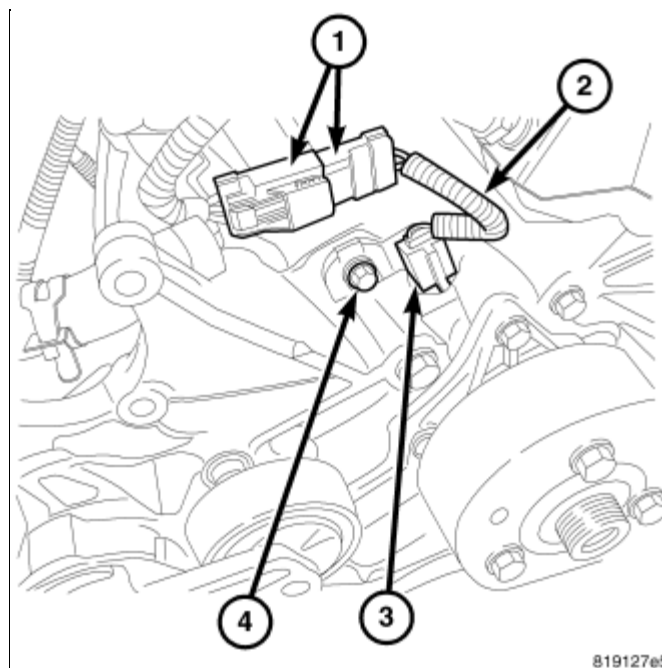
DESCRIPTION

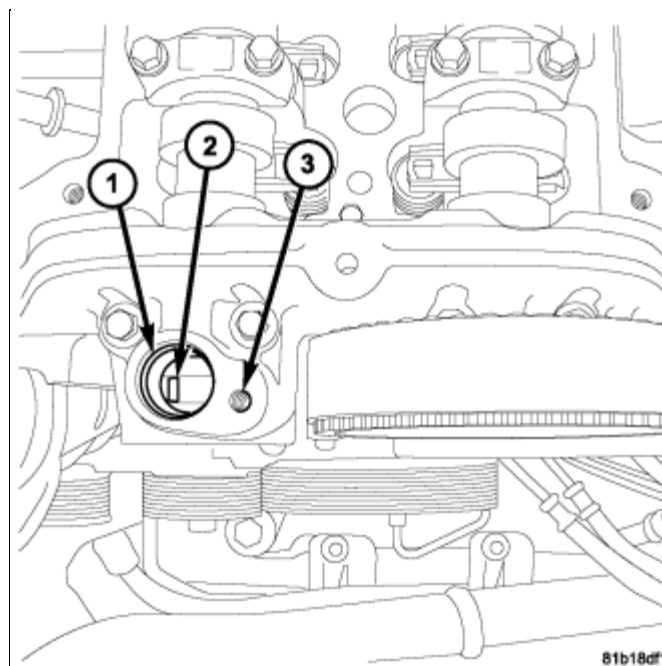
The Camshaft Position Sensor (CMP) (3) is located at the front/top of the cylinder head.

OPERATION

The Camshaft Position (CMP) sensor is a hall effect switch. A tooth made of a ferromagnetic material is attached to the camshaft. When this tooth (2) passes the CMP sensor, an electronic signal is created. This signal is then sent to the Engine Control Module (ECM) to determine Top Dead Center (TDC), and which cylinder has just entered its compression phase.

REMOVAL

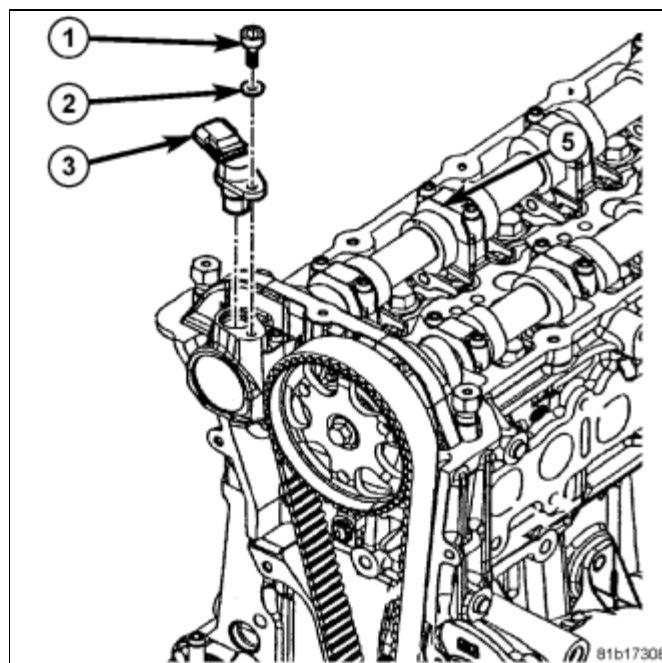




The Camshaft Position Sensor (CMP) (3) is located at the front/top of the cylinder head.

1. Remove electrical connector from CMP sensor (3).
2. Clean area at base of sensor.
3. Remove sensor mounting bolt (1) and washer (2).
4. Pull sensor (3) straight up for removal.

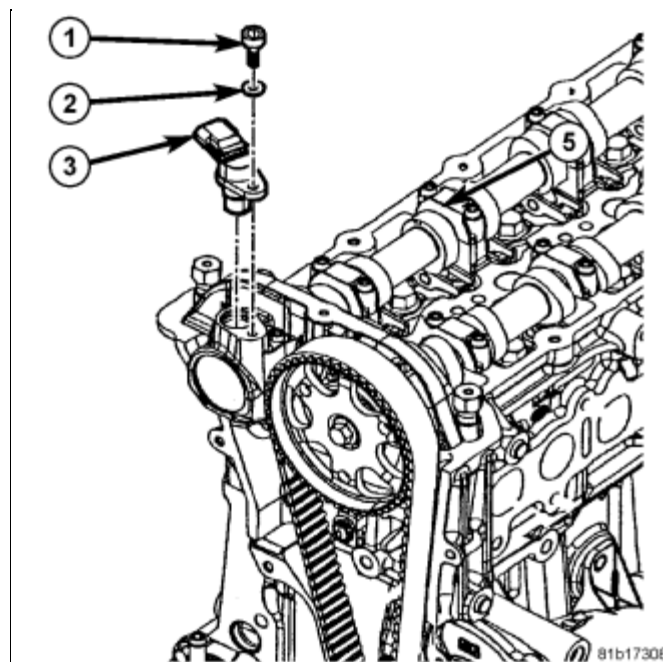
INSTALLATION



1. Position CMP sensor (3) into mounting hole.
2. Install sensor mounting bolt (1) and washer (2). Tighten bolt to 11 N·m (8 ft. lbs.) (97 in. lbs.) torque.
3. Connect electrical connector to CMP sensor (3).

COIL - IGNITION 3.8L

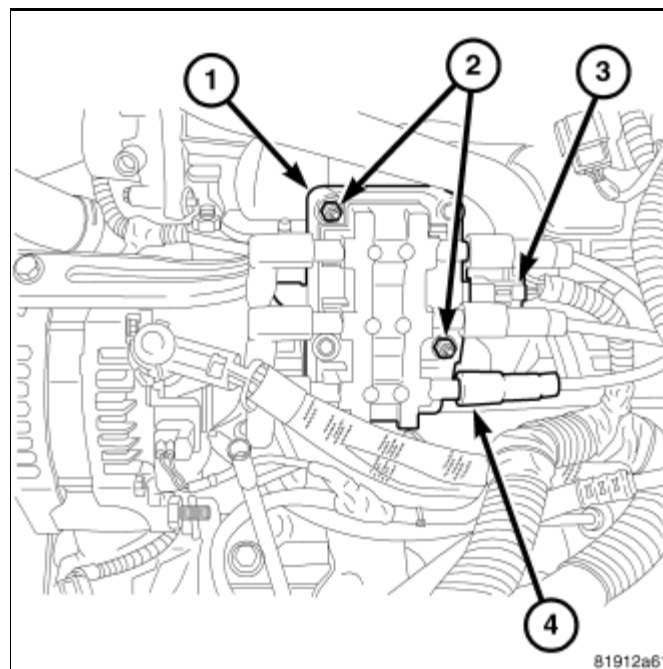
REMOVAL - 3.8L



The ignition coil pack (1) is located above the left valve cover

1. Disconnect negative battery cable.
2. Remove six spark plug cables (4).
3. Disconnect electrical connector (3) from ignition coil.
4. Remove two coil mounting nuts (2).
5. Pull coil pack from mounting studs.

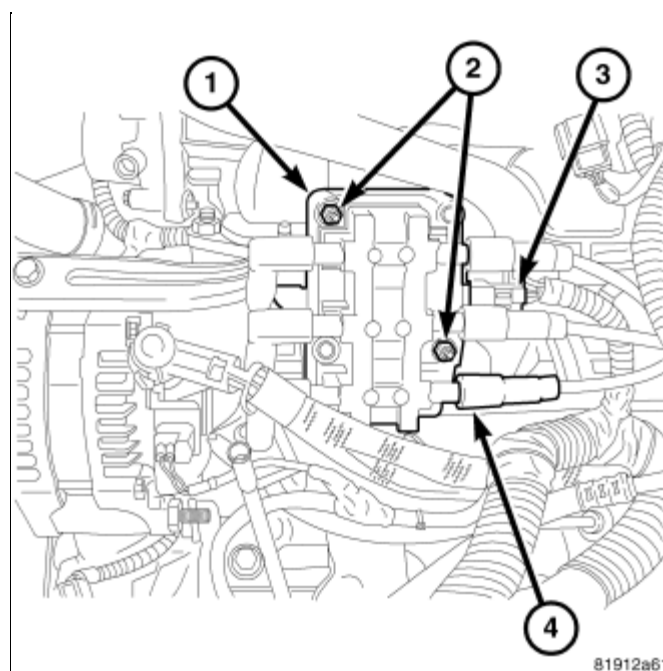
INSTALLATION - 3.8L



1. Install coil pack over mounting studs.
2. Install two mounting nuts (2).
3. Connect electrical connector (3) to ignition coil.
4. Install six ignition cables (4) to ignition coil.
5. Connect negative battery cable.

SENSOR - KNOCK 3.8L

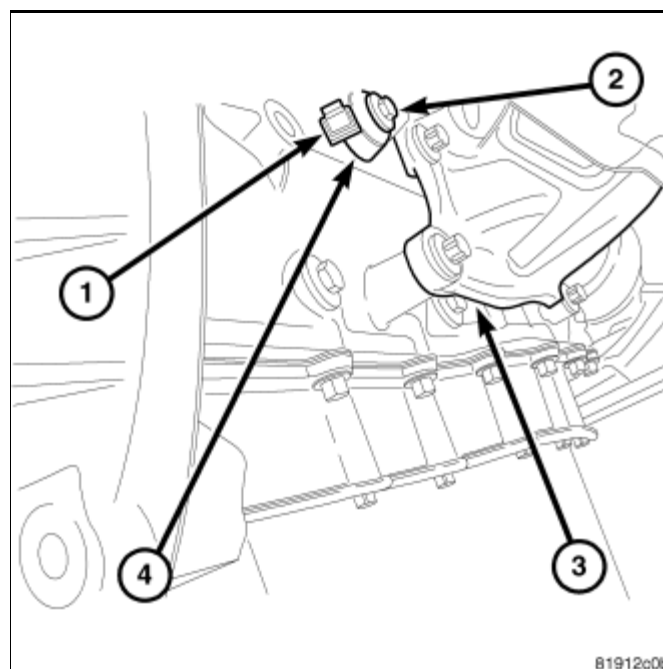
REMOVAL - 3.8L



Only one knock sensor (4) is used. It is located on the right side of engine block, to the rear of right engine mount (3).

1. Disconnect negative battery cable.
2. Raise vehicle and support.
3. Disconnect electrical connector (1) from knock sensor.
4. Remove mounting bolt (2).
5. Remove sensor (4) from engine.

INSTALLATION - 3.8L



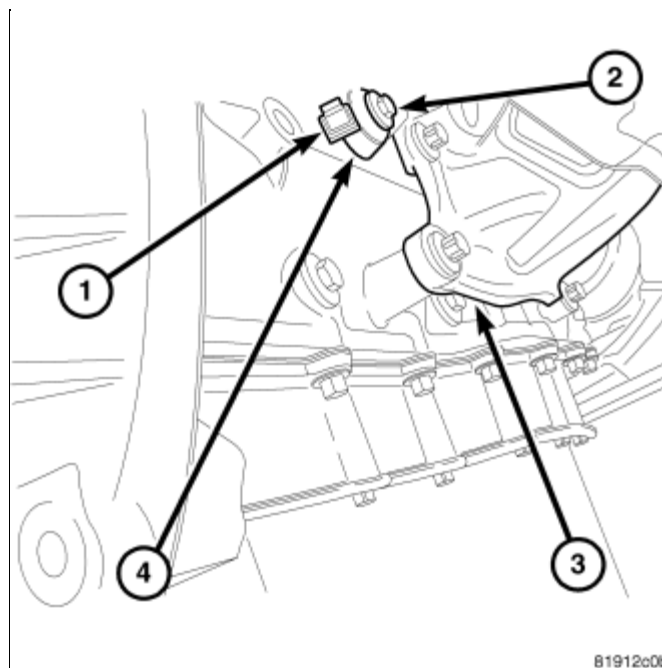
1. Thoroughly clean knock sensor mounting hole.
2. Position sensor (4) to engine.

NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock sensor bolt is relatively light for an 8 mm bolt (2).

NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant

assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.

3. Install and tighten mounting bolt (2). Tighten to 15 +/- 2 ft. lbs. (20 N·m) (176 in.lbs.).
4. Attach electrical connector (1) to knock sensor.
5. Lower vehicle.
6. Connect negative cable.



SPARK PLUG

DESCRIPTION - PLATINUM PLUGS

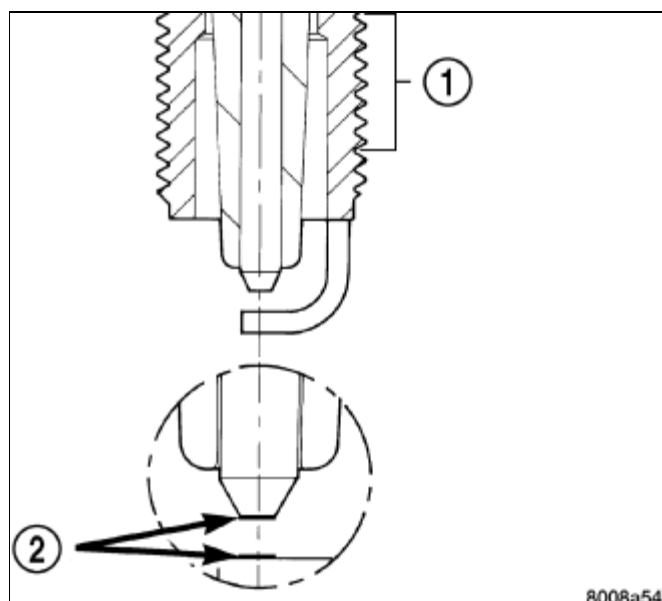
The V6 engine uses platinum resistor spark plugs. They have resistance values of 6,000 to 20,000 ohms when checked with at least a 1000 volt tester.

Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.

CAUTION: Cleaning of the platinum plug may damage the platinum tip.

Apply anti-seize compound to spark plug threads only at point (1).

When the spark plug has a single or double platinum tip (2), a thin platinum pad may be welded to both, or just the center electrode end(s).



1. Extreme care (1) must be used to prevent spark plug

cross-threading, mis-gapping and ceramic insulator damage during plug removal and installation.

REMOVAL

When replacing the spark plugs and spark plug cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise, cross ignition of the spark plugs or **short circuit the cables to ground**.

Always remove cables by grasping at the boot, rotating the boot 1/2 turn, and pulling straight back in a steady motion.

1. Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug.
2. Remove the spark plug using a quality socket with a foam insert.
3. Inspect the spark plug condition.

INSTALLATION

When replacing the spark plugs and spark plug cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise, cross ignition of the spark plugs or **short circuit the cables to ground**.

1. Coat threads of spark plug with anti-seize. Be sure not to get anti-seize **ANYWHERE BUT ON THE THREADS OF THE SPARK PLUG..**
2. To avoid cross threading, start the spark plug into the cylinder head by hand.
3. Tighten spark plugs by referring to the Torque Specifications chart.
4. Install spark plug cables over spark plugs. A click will be heard and felt when the cable properly attaches to the spark plug.

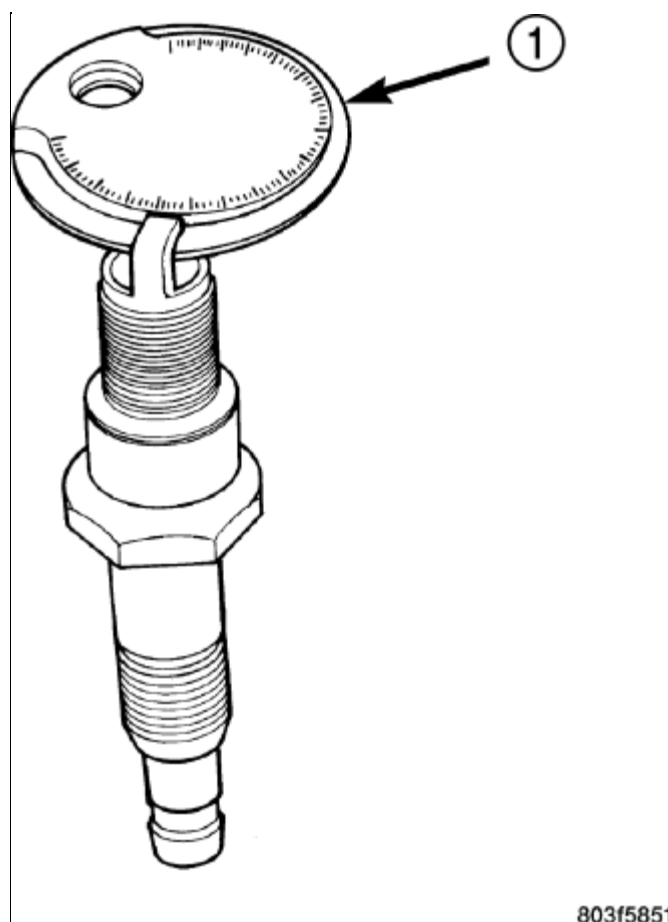
CABLE - SPARK PLUG

DIAGNOSIS AND TESTING

Check the spark plug cable connections for good contact at the coil(s) and spark plugs. Terminals should be fully seated. The insulators should be in good condition and should fit tightly on the coil and spark plugs. Spark plug cables with insulators that are cracked or torn must be replaced.

Clean high voltage ignition cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

When testing secondary cables for damage with an oscilloscope, follow the instructions of the equipment manufacturer.



If an oscilloscope is not available, spark plug cables may be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected for longer than necessary during testing. This may cause possible heat damage to the catalytic converter. Total test time must not exceed ten minutes.

With the engine running, remove spark plug cable from spark plug (one at a time) and hold next to a good engine ground. If the cable and spark plug are in good condition, the engine rpm should drop and the engine will run poorly. If engine rpm does not drop, the cable and/or spark plug may not be operating properly and should be replaced. Also check engine cylinder compression.

With the engine not running, connect one end of a test probe to a good ground. Start the engine and run the other end of the test probe along the entire length of all spark plug cables. If cables are cracked or punctured, there will be a noticeable spark jump from the damaged area to the test probe. Cracked, damaged or faulty cables should be replaced with resistance type cable. This can be identified by the words ELECTRONIC SUPPRESSION printed on the cable jacket.

Use an ohmmeter to test for open circuits, excessive resistance or loose terminals. Remove the cable at ignition coil, and from spark plug. Connect ohmmeter to each end of cable. Resistance should be 250 to 1000 Ohms per inch of cable. If resistance is not within specifications as found in the SPARK PLUG CABLE RESISTANCE chart, replace the cable. Test all spark plug cables in this manner.

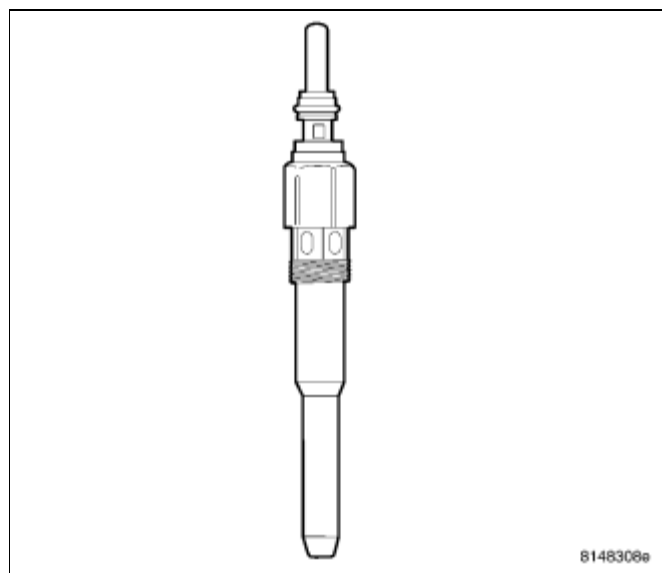
PLUG - GLOW 2.8L DIESEL

DESCRIPTION

CAUTION: The glow plugs operate on a 4.4-volt system. The glow plugs DO NOT tolerate any over voltage. Full battery voltage will destroy the glow plug immediately. DO NOT test the glow plugs with a 12V source as damage will occur to the glow plug.

CAUTION:

- Never bend, bump or knock the fast metallic glow plugs.
- Fast metallic glow plugs must not be handled loose in a container. Store, handle, and transport them only in original boxes.
- If there is any doubt about the proper condition of a glow plug, do not reuse it.
- Do not clean the glow plugs with abrasive or aggressive media.
- Avoid dipping the glow plug into fluids.
- Read Diagnostic Trouble Codes (DTCs). If a glow plug problem is indicated, do not start the engine.



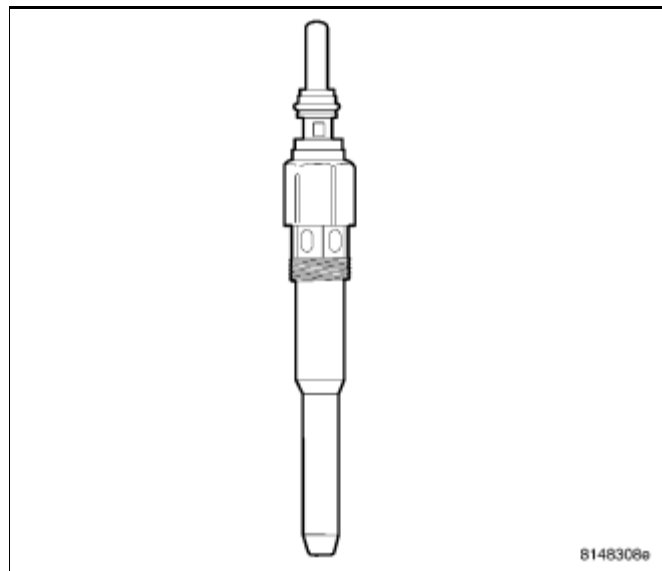
CAUTION: Disregarding these instructions may cause severe engine damage.

Glow plugs are used to help start a cold or cool engine. The glow plugs will heat up and glow to heat the combustion chamber of each cylinder. An individual glow plug is used for each cylinder.

OPERATION

CAUTION: The glow plugs operate on a 4.4-volt system. DO NOT test the glow plugs with a 12 V source as damage will occur to the glow plug(s).

The Engine Control Module (ECM) monitors various engine sensors. When the ignition key is turned to the ON position, the ECM sends a signal to the glow plug module (relay) to turn on, and cycle, the glow plugs for a pre-determined amount of time, plus illuminate the glow plug light in the instrument panel. Once activated, the element inside of the core of the glow plug begins to glow. Each glow plug draws approximately 8 amps, for a total system amperage of 32 amps at 22° C (72° F) ambient temperature. If there is a fault with the glow plug system, the ECM will store a fault code.



DIAGNOSIS AND TESTING - GLOW PLUGS

CAUTION: DO NOT attempt to start the engine until the glow plug system tests correctly.

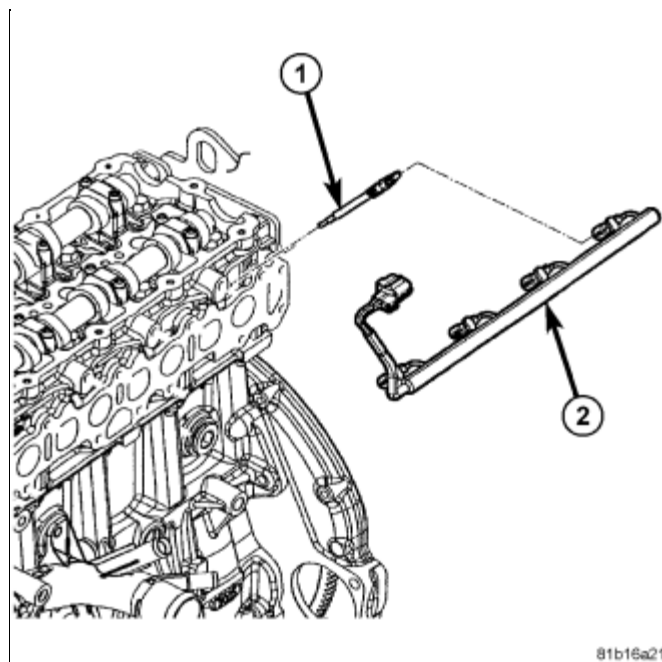
1. Measure the electrical resistance of each glow plug while it is still installed in the cylinder head. Resistance should be less than 0.8 Ω between the electrical connector point on the glow plug and the cylinder head. The ground contact on the DVOM must be as close as possible to the point where the glow plug contacts the cylinder head to avoid erratic resistance measurements.
2. If the resistance is out of tolerance, remove the glow plug from the cylinder head and check the resistance again.
3. Use the actuator test function of the scan tool to test the glow plug module and glow plug lamp. The glow plug module's on-board diagnostic tests will automatically check the electrical condition of the entire glow plug system.
4. After the scan tool glow plug actuator test function is complete, if MIL is OFF and no glow plug DTCs are present, testing is complete and the engine can be started.
5. If MIL is still ON, check the harness connectors of glow plugs, repair any loose or damaged connections, and run the glow plug actuator test again.
6. If MIL is still ON and glow plug DTCs are present, refer to 9 - Engine Electrical Diagnostics - Diesel, and follow the diagnostic test(s) related to the active or stored DTCs.

REMOVAL

The four glow plugs (1) are attached to cylinder head below fuel rail.

1. Disconnect negative battery cable.

2. Remove fuel rail and high-pressure fuel lines.
3. Disconnect glow plug wiring harness (2) at all four glow plugs (1).

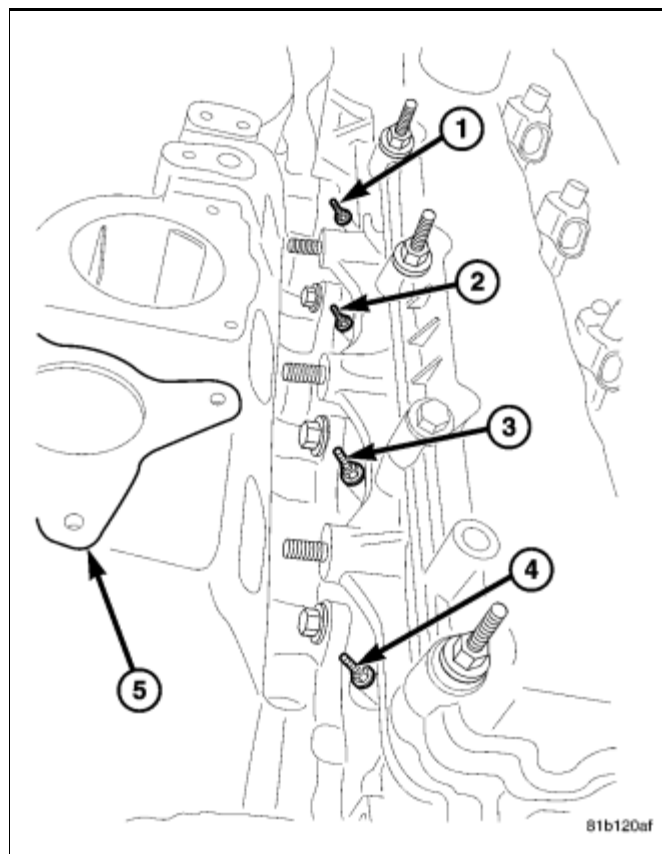


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4. Use a socket to loosen glow plug(s) (1), (2), (3) or (4). After loosening, attach a flexible tool such as a rubber hose to remove glow plug from cylinder head.

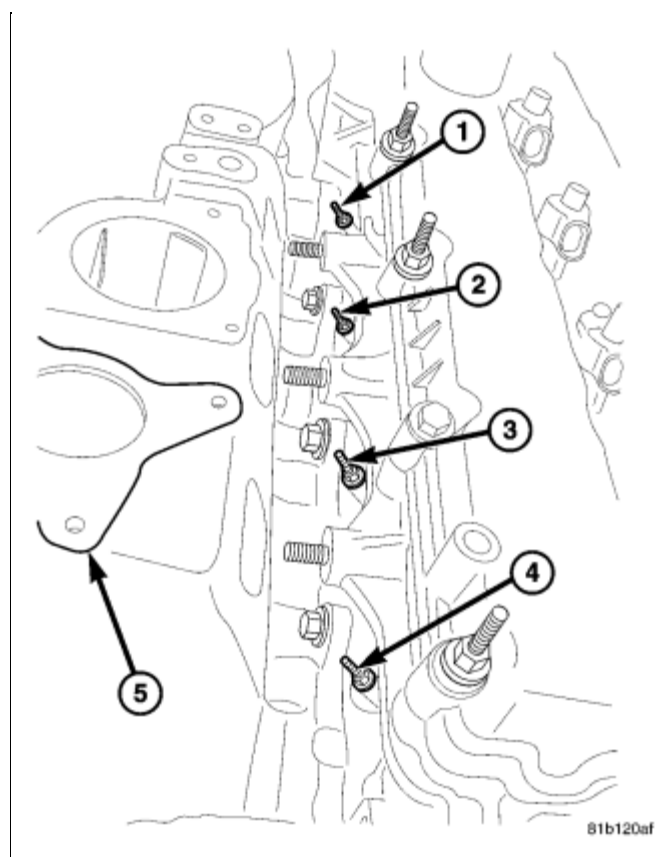
CAUTION: After plug removal, do not bend, knock, or drop the glow plugs while handling (any mechanical impact may damage the glow plug).

INSTALLATION



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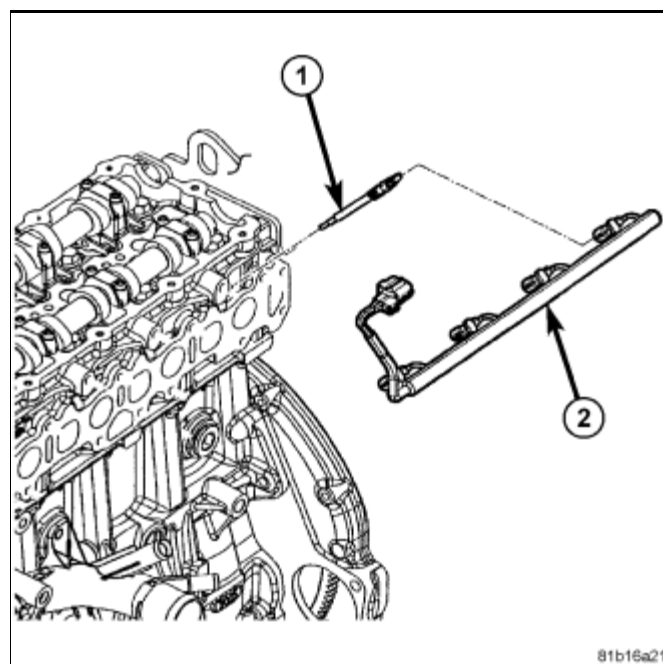
1. Apply a small amount of clean diesel oil or motor oil to glow plug threads.
2. Attach a flexible tool such as a rubber hose to install glow plug into cylinder head. Tighten each plug to 14 N·m (10 ft. lbs.) (124 in. lbs.) torque.



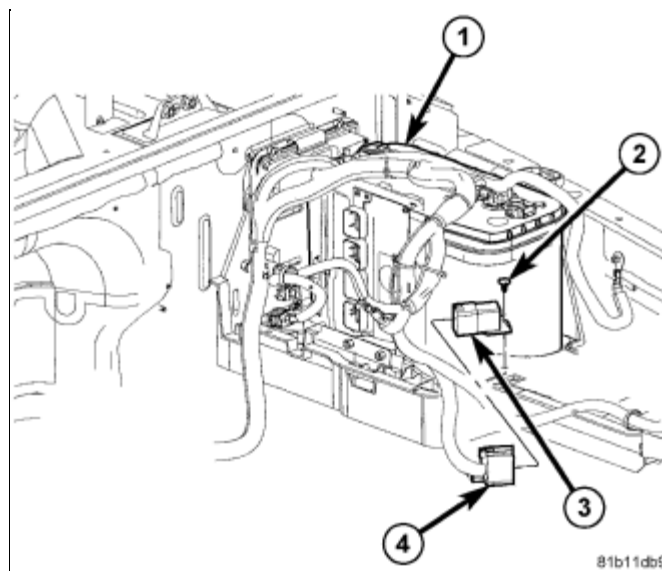
3. Connect glow plug wiring harness (2) to all four glow plugs (1).
4. Install fuel rail and high-pressure fuel lines.
5. Connect negative battery cable.

GLOW PLUG RELAY

REMOVAL



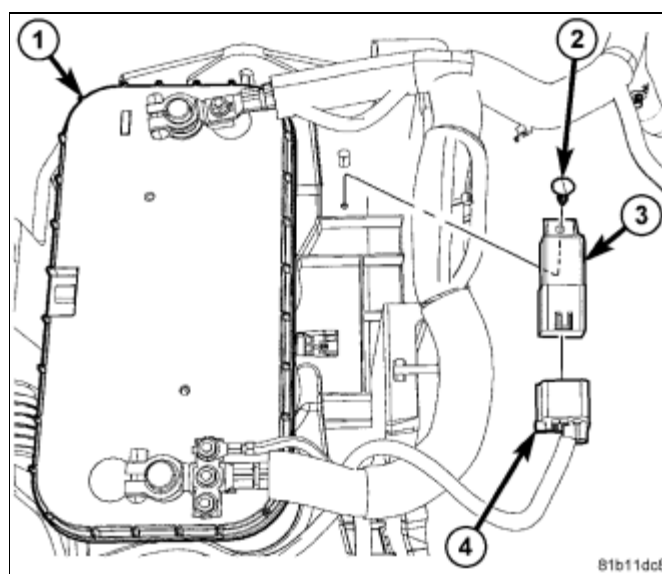
1. **RIGHT HAND DRIVE:**
2. The glow plug relay (3) is located near the front of the battery (1).
3. Disconnect negative battery cable.
4. Carefully pull out mounting pin (2).
5. Disconnect electrical connector (4) from relay.



6. **LEFT HAND DRIVE:**

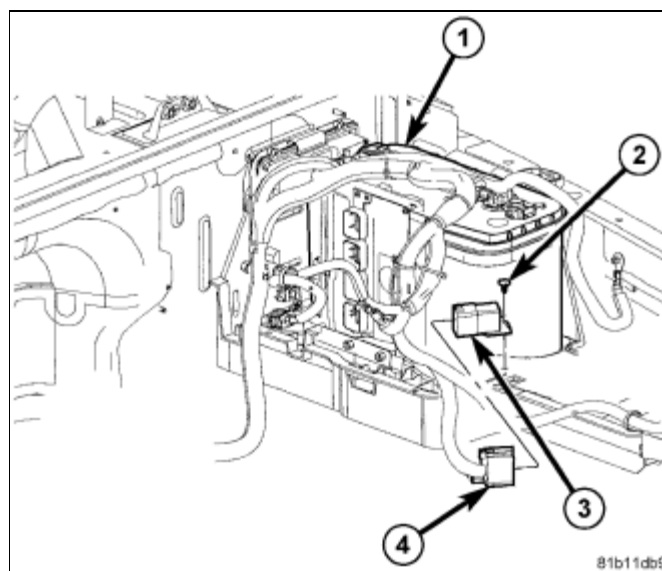
7. The glow plug relay (3) is located near the side of the battery (1).
8. Disconnect negative battery cable.
9. Carefully pull out mounting pin (2).
10. Disconnect electrical connector (4) from relay.

INSTALLATION



1. **RIGHT HAND DRIVE:**

2. The glow plug relay (3) is located near the front of the battery (1).
3. Connect electrical connector (4) to relay.
4. Push mounting pin (2) through relay (3).
5. Connect negative battery cable.



6. LEFT HAND DRIVE:

7. The glow plug relay (3) is located near the side of the battery (1).
8. Connect electrical connector (4) to relay.
9. Push mounting pin (2) through relay (3).
10. Connect negative battery cable.

8J - INSTRUMENT CLUSTER**INSTRUMENT CLUSTER -
ELECTRICAL DIAGNOSTICS****INSTRUMENT CLUSTER -
ELECTRICAL DIAGNOSTICS****DIAGNOSIS AND TESTING****B123F-MENU SWITCH STUCK**

For a complete wiring diagram **Refer to Section 8W.**

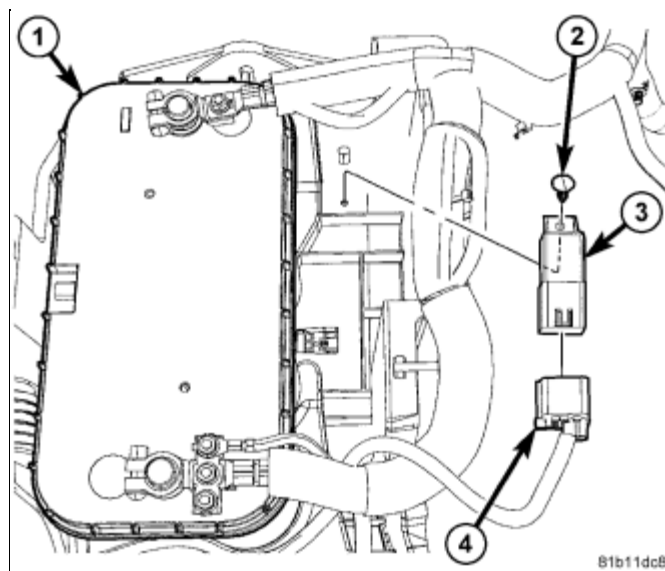
- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Instrument Cluster detects the Menu Switch active for greater than 20 seconds.

Possible Causes
INSTRUMENT CLUSTER

**Diagnostic Test****1. CHECK FOR AN ACTIVE DTC**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Press the MENU switch three times.
With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

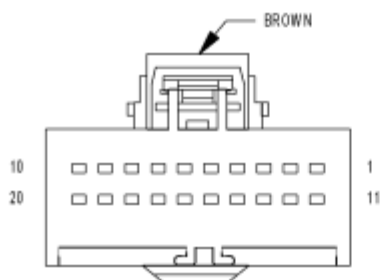
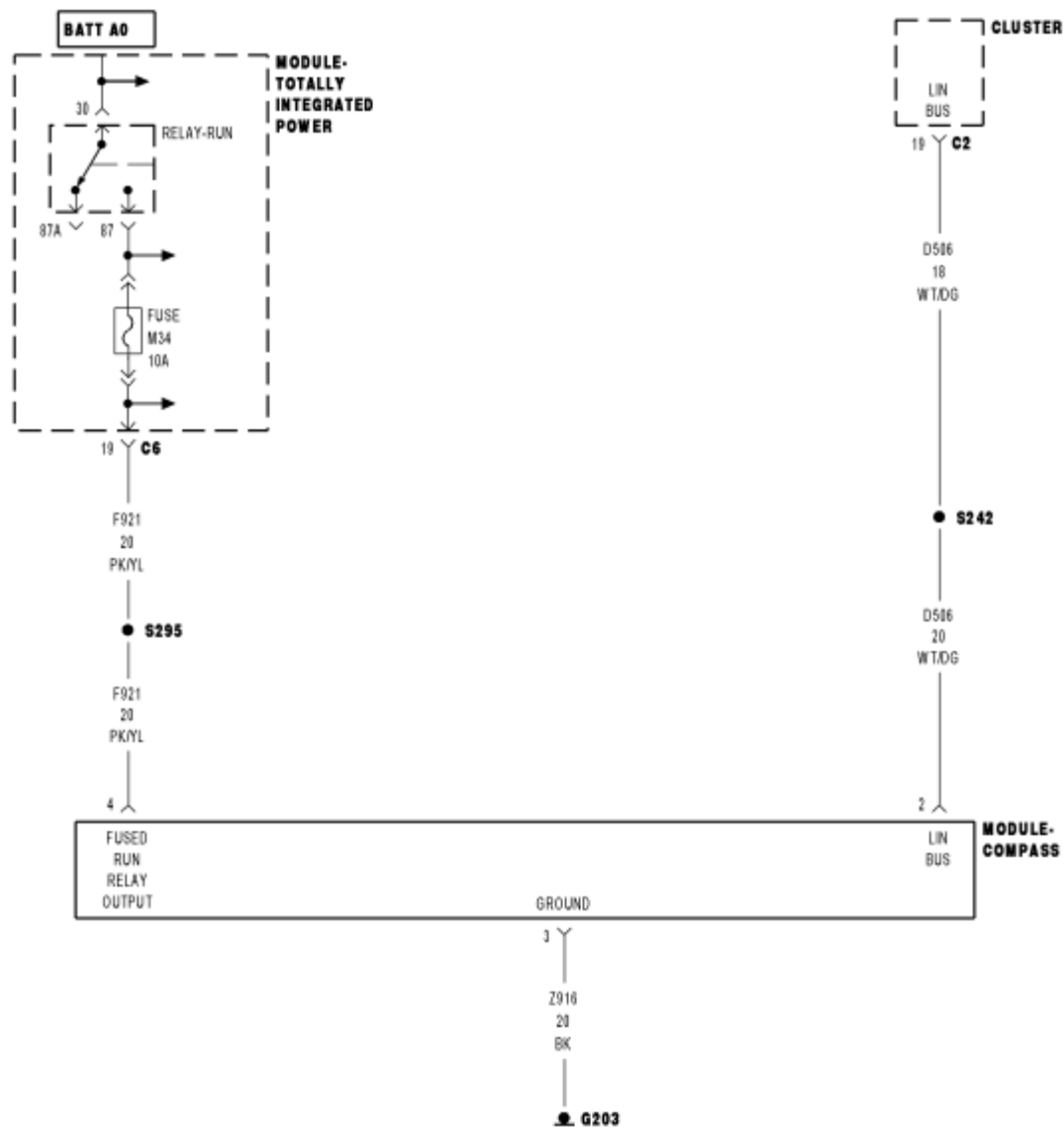
Yes

- Replace the Instrument Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

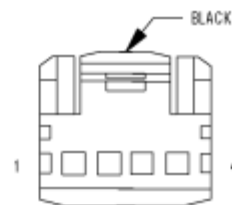
No

- Test complete

B127A-COMPASS PERFORMANCE



CLUSTER C2



MODULE-COMPASS

01041958

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

Compass performance.

Possible Causes
(F921) FUSED RUN RELAY OUTPUT CIRCUIT OPEN
(Z916) GROUND CIRCUIT OPEN
COMPASS MODULE
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

NOTE: Remove any electronic devices (laptop computers, cell phones) from the instrument panel.

NOTE: Before proceeding, check the compass variance and calibration in accordance with the service information.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (F921) FUSED RUN RELAY OUTPUT CIRCUIT OPEN

Measure the voltage of the (F921) Fused Run Relay Output circuit for an open.

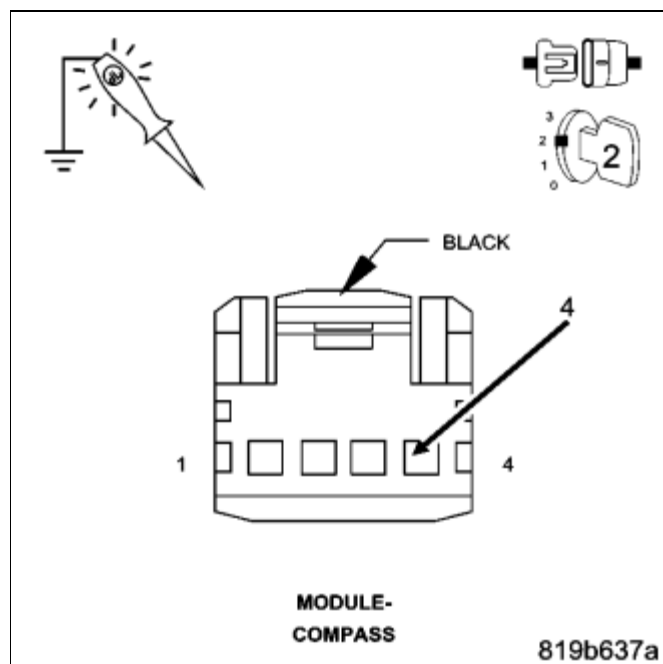
Is the voltage above 10 volts?

Yes

- Go To [3](#)

No

- Repair the (F921) Fused Run Relay Output circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (Z916) GROUND CIRCUIT OPEN

Measure the resistance of the (Z916) Ground circuit for an open.

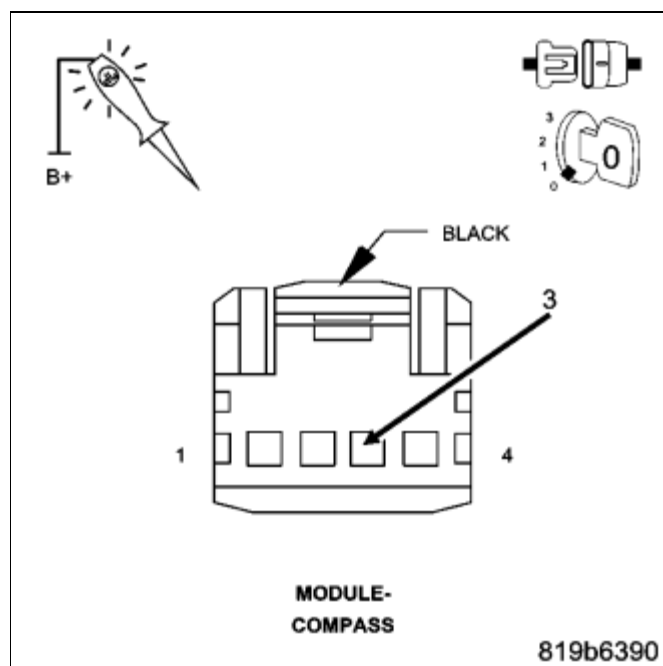
Is the resistance above 10K ohms?

Yes

- Repair the (Z916) Ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Compass Module in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1288-TRIP/TOGGLE SWITCH PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Instrument Cluster detects the Trip/Toggle Switch active for greater than 20 seconds.

Possible Causes
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Press the Trip/Toggle switch three times.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

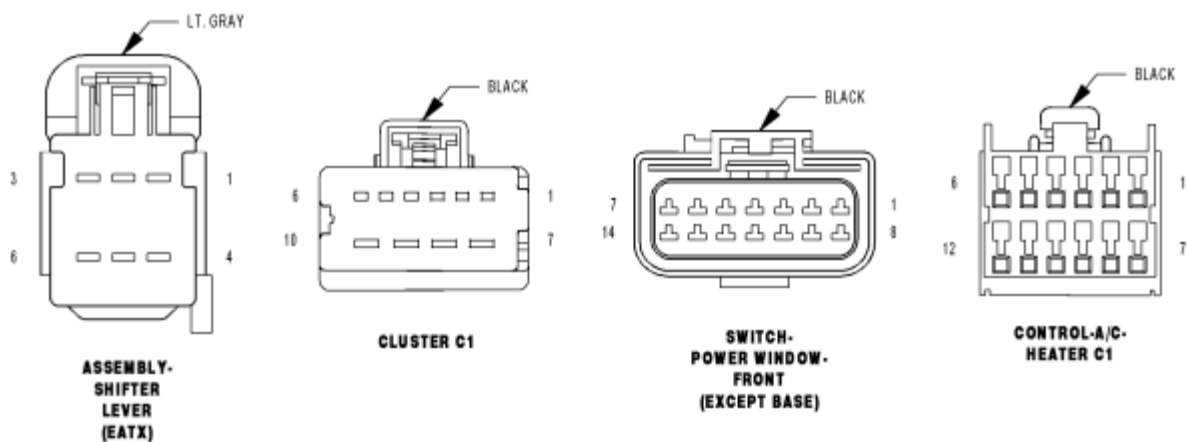
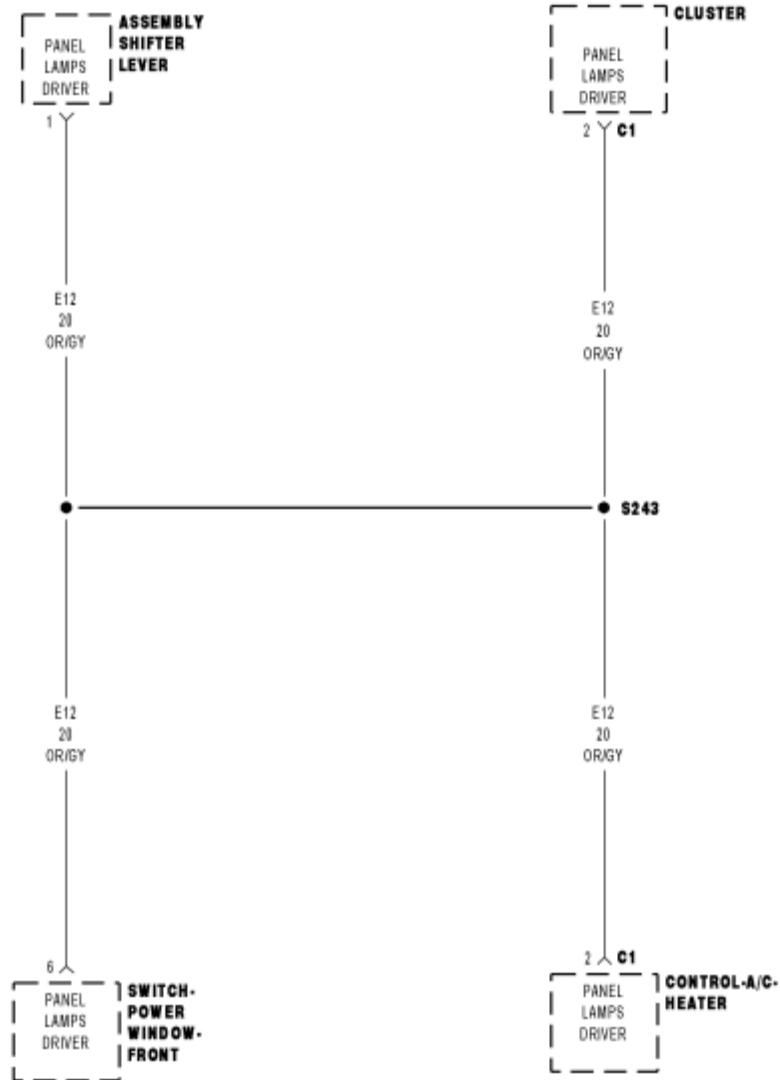
Yes

- Replace the Instrument Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Test complete

B1613-PANEL ILLUMINATION CONTROL CIRCUIT LOW



0194000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and the Panel Illumination active.

- **Set Condition:**

Panel Illumination Status LOW.

Possible Causes
(E12) PANEL LAMPS DRIVER CIRCUIT SHORTED TO GROUND
A/C HEATER CONTROL LAMP (FRONT AND/OR REAR) SHORTED TO GROUND
FRONT WINDOW SWITCH LAMP SHORTED TO GROUND
SHIFT ASSEMBLY LAMP SHORTED TO GROUND
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Activate the Panel Illumination.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK EACH NON-FUNCTIONING COMPONENT FOR AN INTERNAL SHORT TO GROUND

NOTE: Using the wiring diagram as a guide disconnect each non-functioning component one at a time while checking for the DTC to become stored. Repeat these steps for each component.

Turn the ignition off.

Disconnect the non-functioning component harness connector.

Turn the ignition on.

Activate the Panel Illumination.

With the scan tool, read DTCs.

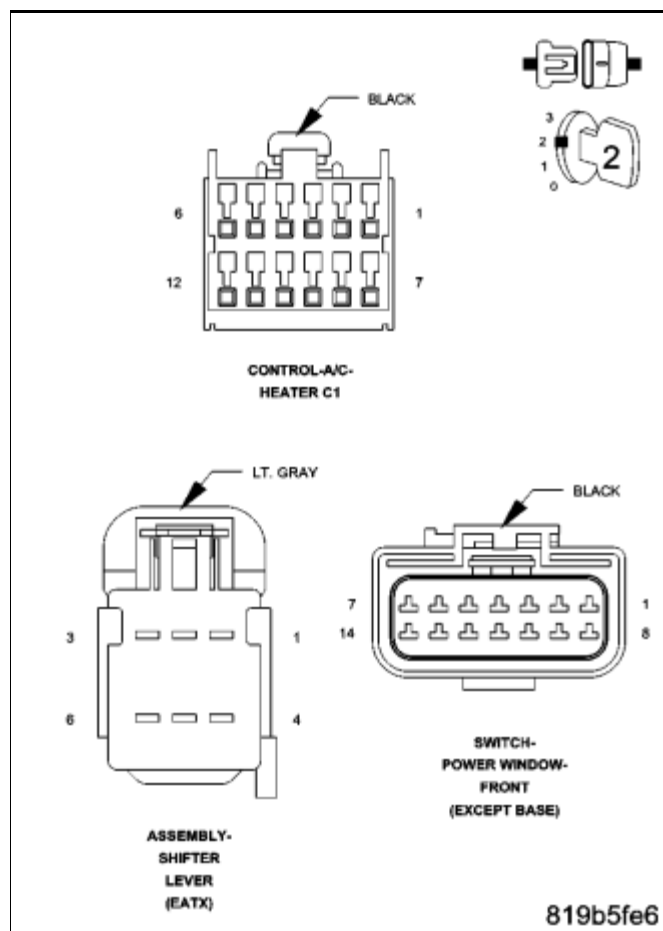
Is the DTC still active?

Yes

- Go To [3](#)

No

- Replace the non-functioning component that when disconnected caused the DTC to become stored in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. CHECK THE (E12) PANEL LAMPS DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Instrument Cluster C1 harness connector.

With all (E12) Panel Lamps Driver circuit components disconnected, measure the resistance to ground on the (E12) Panel Lamps Driver Circuit from the Instrument Cluster C1 harness connector.

Is the resistance less than 10K ohms?

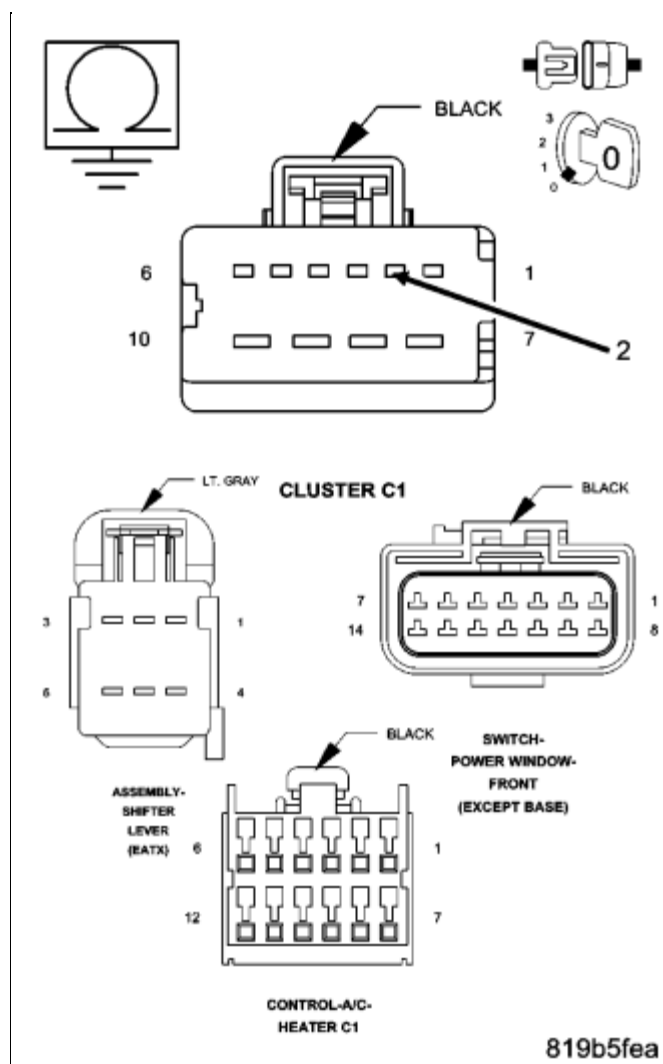
Yes

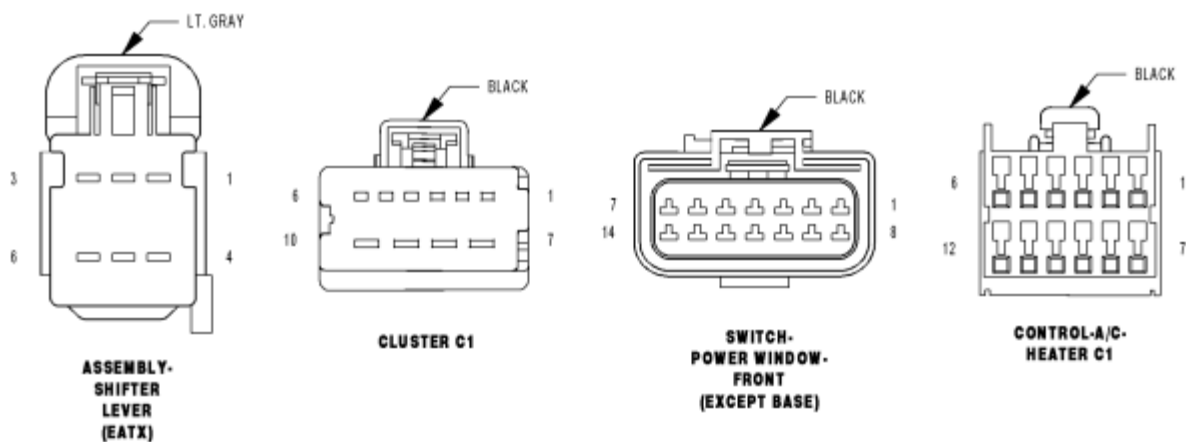
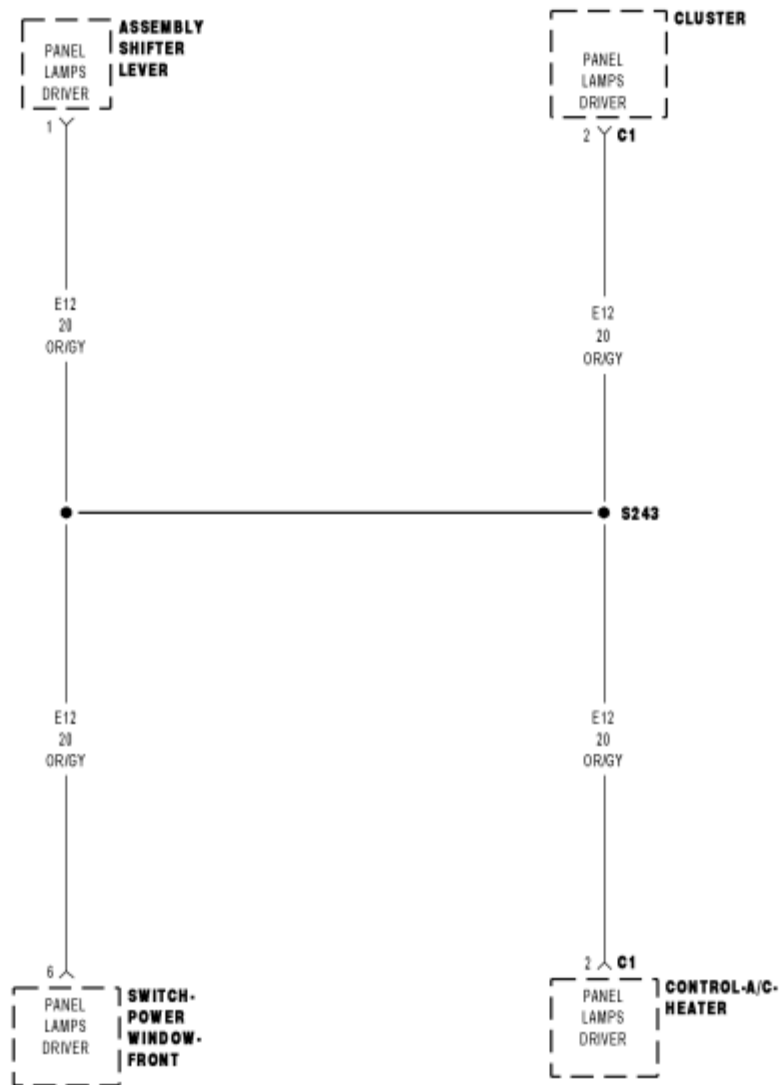
- Repair the (E12) Panel Lamps Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)

B1615-PANEL ILLUMINATION CONTROL CIRCUIT OPEN





0194000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and the Panel Illumination circuit active.

◦ **Set Condition:**

The Instrument Cluster detects an open condition on the Panel Illumination Control circuit.

Possible Causes
(E12) PANEL LAMPS DRIVER CIRCUIT OPEN
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Activate the Panel Illumination.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (E12) PANEL LAMPS DRIVER CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Cluster C1 harness connector.

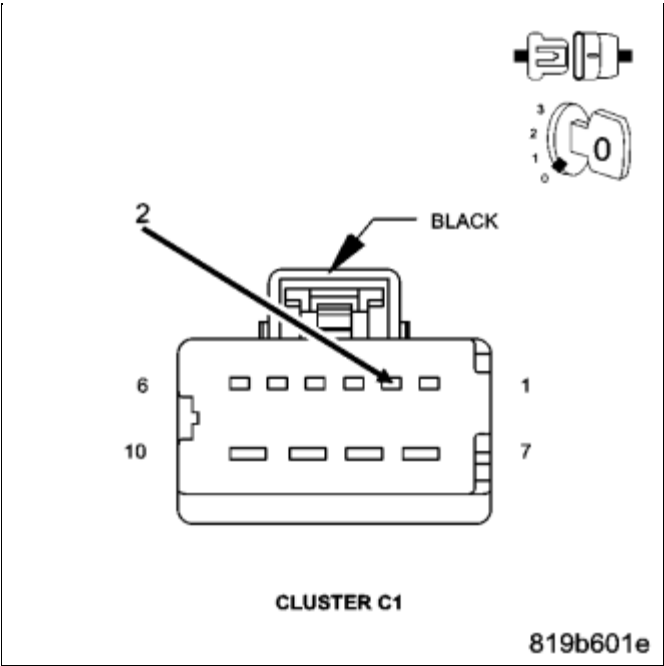
Inspect the connector and associated wiring for the Panel

illumination circuit.
Using a fused jumper wire connected to 12 volts, probe cavity 2 of the Cluster C1 harness connector.

Did the components illuminate?

- Yes**
- Replace the Instrument Cluster in accordance with the service information.
 - Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

- No**
- Using the wiring diagrams as a guide, locate and repair the (E12) Panel Lamps Driver circuit for an open.
 - Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B210E-BATTERY VOLTAGE HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.
- **Set Condition:**

Battery voltage greater than 16 volts for approximately 15 seconds.

Possible Causes
GENERATOR
PCM

Diagnostic Test

1. CHECK FOR ANY POWERTRAIN CONTROL MODULES DTCS

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the TIPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Turn the ignition on.

With the scan tool, read active PCM DTC's.

Does the scan tool display any active PCM DTC's?

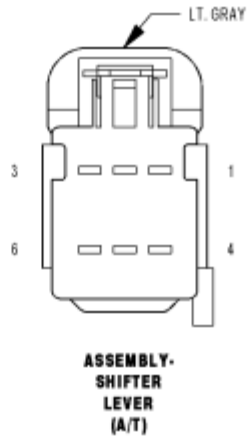
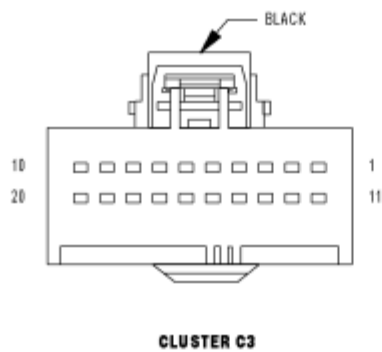
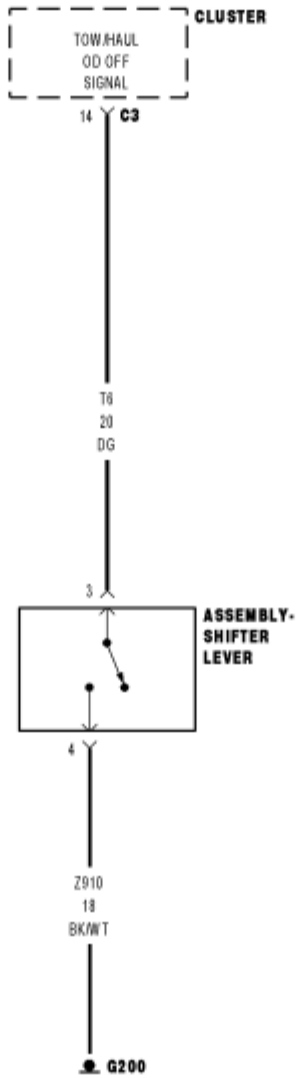
Yes

- (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

No

- Check the above conditions that can cause a high voltage condition. Repair as necessary.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

P0853-OVERDRIVE/TOW SWITCH INPUT CIRCUIT STUCK



010220018

For a complete wiring diagram **Refer to Section 8W.**

(T6) TOW/HAUL OD OFF SIGNAL SHORTED TO GROUND
SHIFT LEVER ASSEMBLY
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

Press the TOW/HAUL switch 3 times.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. SHIFT LEVER ASSEMBLY

Disconnect the Shift Lever Assembly harness connector.

With the scan tool, read DTCs.

Does the scan tool display the DTC as active?

Yes

- Go To [3](#)

No

- Replace the Shift Lever Assembly in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (T6) TOW/HAUL OD OFF SIGNAL SHORTED TO GROUND

Turn the ignition off.

Disconnect the Cluster C3 harness connector.

Measure the resistance between ground and the (T6) TOW/HAUL OD OFF signal circuit at the Cluster C3 harness connector.

Is the resistance below 10K ohms?

Yes

- Repair the (T6) TOW/HAUL OD OFF Signal Circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

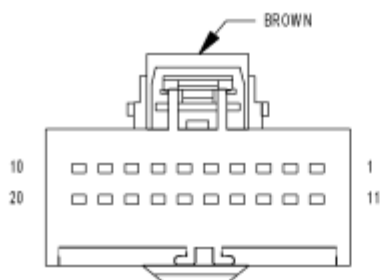
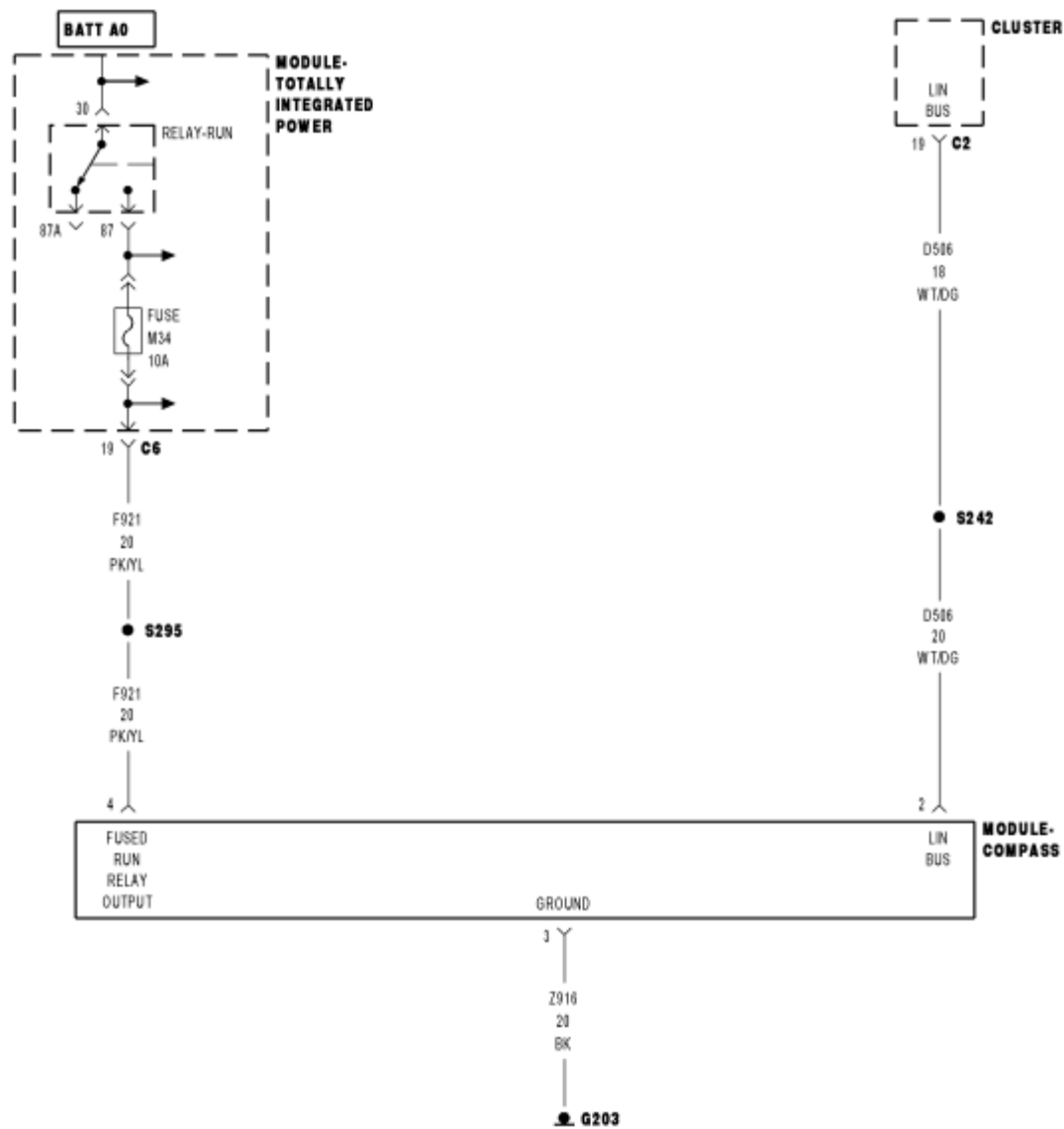
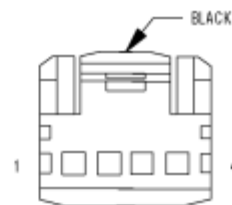
- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U0141–LOST COMMUNICATION WITH FRONT CONTROL MODULE (TOTALLY INTEGRATED POWER MODULE)

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0161-LOST COMMUNICATION WITH COMPASS MODULE

**CLUSTER C2****MODULE-COMPASS**

01041958

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Cluster does not receive information from the Compass Module.

Possible Causes
(D506) LIN BUS CIRCUIT OPEN
(F921) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN
(Z916) GROUND CIRCUIT OPEN
COMPASS MODULE
INSTRUMENT CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

NOTE: Remove any electronic devices (laptop computers, cell phones) from the instrument panel.

NOTE: Before proceeding, check the compass variance and calibration in accordance with the service information.

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (D506) LIN BUS CIRCUIT

Turn the ignition off.
Disconnect the Compass Module harness connector.
Turn the ignition on.
Measure the voltage of the (D506) LIN BUS circuit.

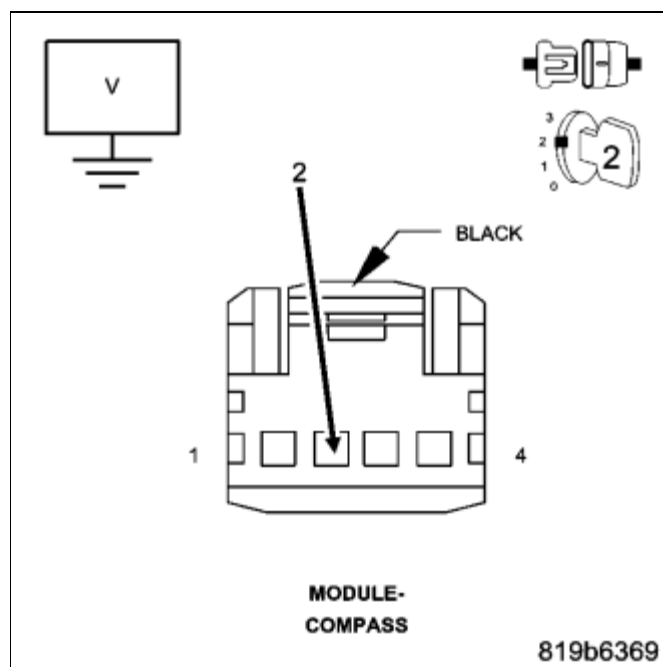
Is the voltage above 5 volts?

Yes

- Go To [4](#)

No

- Go To [3](#)



3. (D506) LIN BUS CIRCUIT OPEN

Turn the ignition off.
Disconnect the Instrument Cluster C2 harness connector.
Measure the resistance of the (D506) LIN BUS circuit.

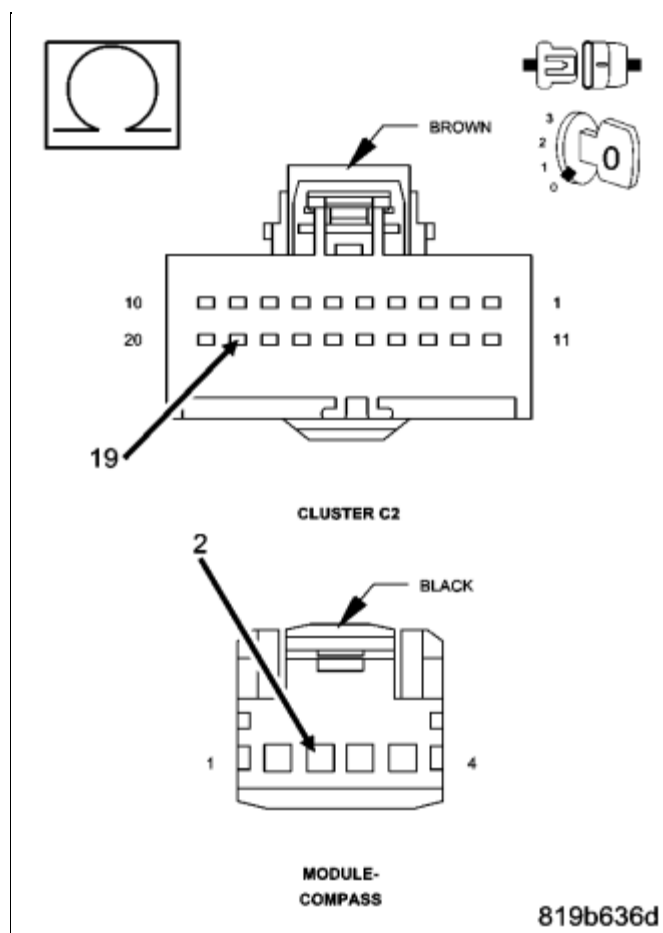
Is the resistance below 10K ohms?

Yes

- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D506) LIN BUS circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. (F921) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F921) Fused Ignition Switch Output (RUN) circuit at the Compass Module harness connector.

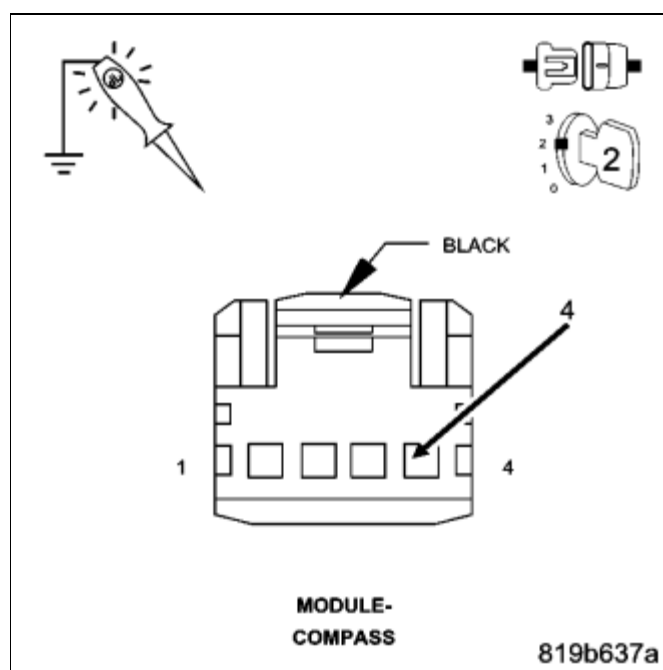
Does the test light illuminate brightly?

Yes

- Go To [5](#)
-

No

- Repair the (F921) Fused Ignition Switch Output (RUN) circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (Z916) GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, check the (Z916) Ground circuit at the Compass Module harness connector.

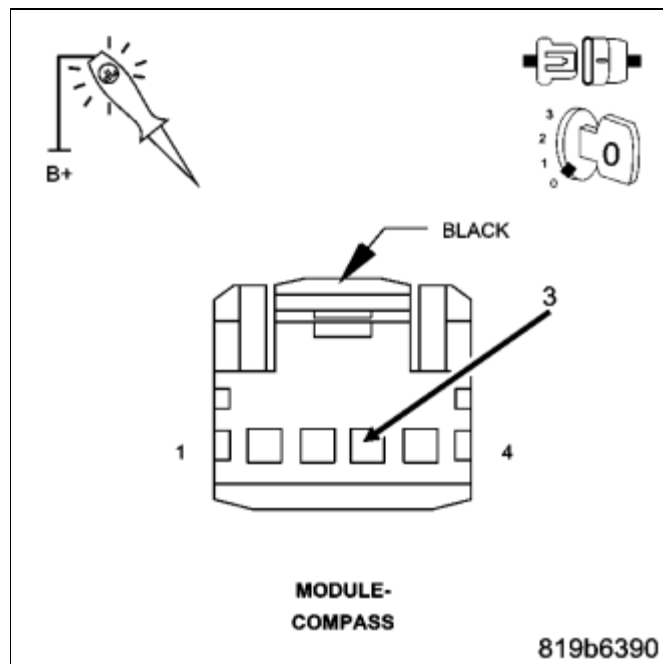
Does the test light illuminate brightly?

Yes

- Replace the Compass Module in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (Z916) ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

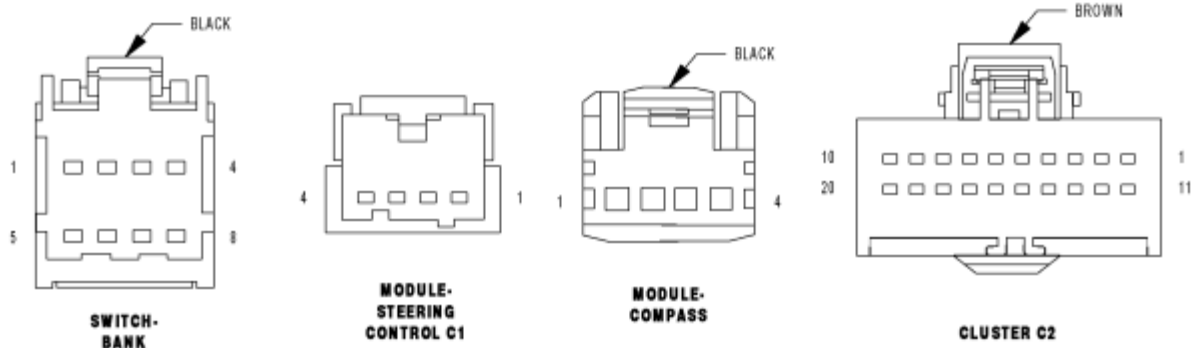
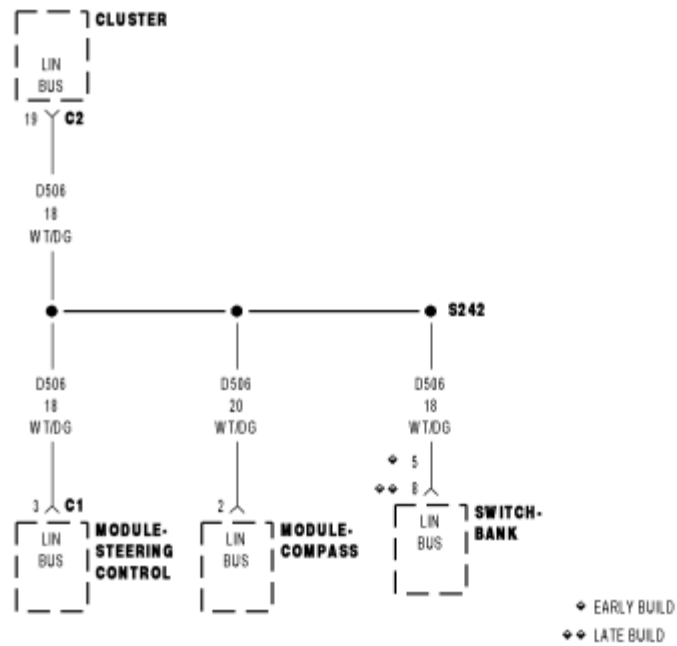


U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U1008-LIN 1 BUS



01-06-1902

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

LIN 1 Bus Performance.

Possible Causes
(D506) LIN BUS CIRCUIT OPEN
(D506) LIN BUS CIRCUIT SHORT TO GROUND
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display: U1008–LIN 1 BUS?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. SHORTED COMPONENT

NOTE: After disconnecting each component, check DTCs with the scan tool.

Turn the ignition on.

Disconnect the Compass Module harness connector.

Disconnect the Switch Bank harness connector.

Disconnect the Steering Control Module C1 harness connector.

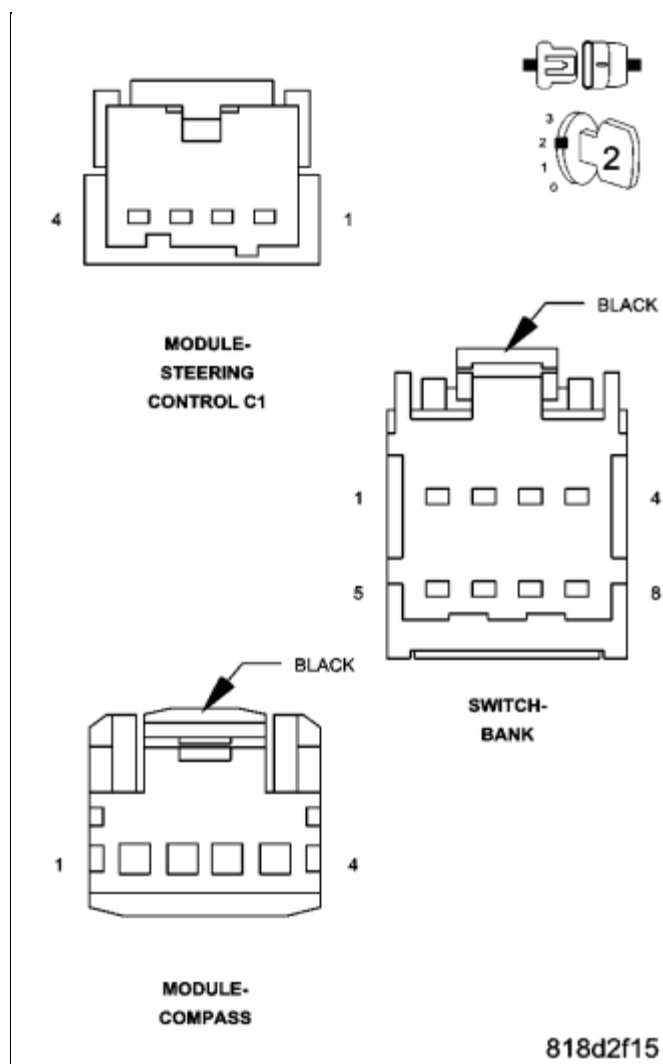
With each component disconnected, did the DTC U1008–LIN 1 BUS change from active to stored?

Yes

- Replace the component that caused the DTC U1008–LIN 1 BUS to change from active to stored.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)
-



3. (D506) LIN BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cluster C2 harness connector.

Disconnect the Multifunction Switch harness connector.

Measure the resistance of the (D506) LIN Bus circuit.

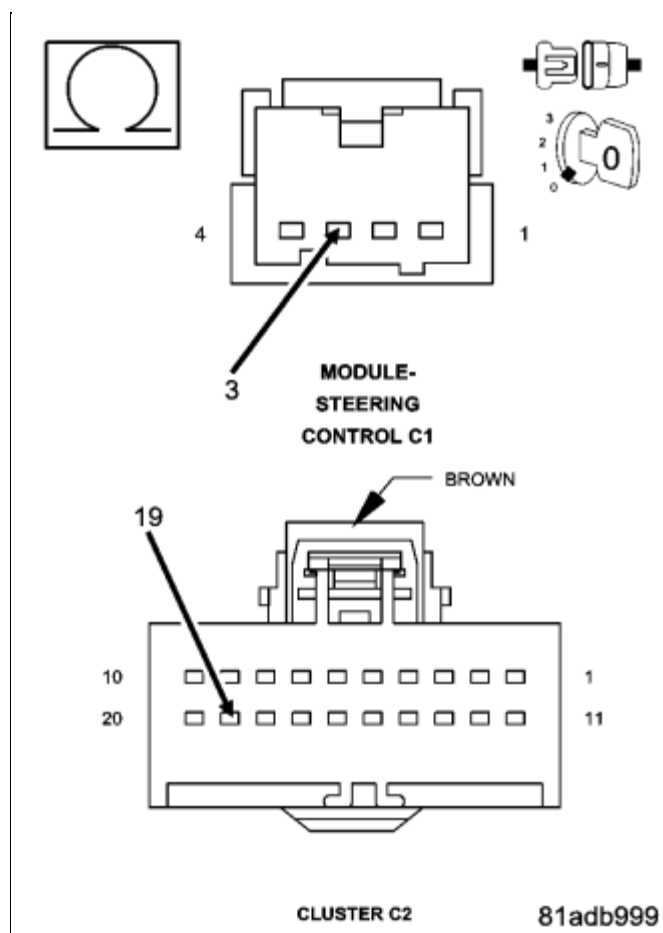
Is the resistance above 10K ohms?

Yes

- Repair the (D506) LIN Bus circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (D506) LIN BUS CIRCUIT SHORT TO GROUND

Turn the ignition off.
Measure the resistance to ground on the (D506) LIN Bus circuit.

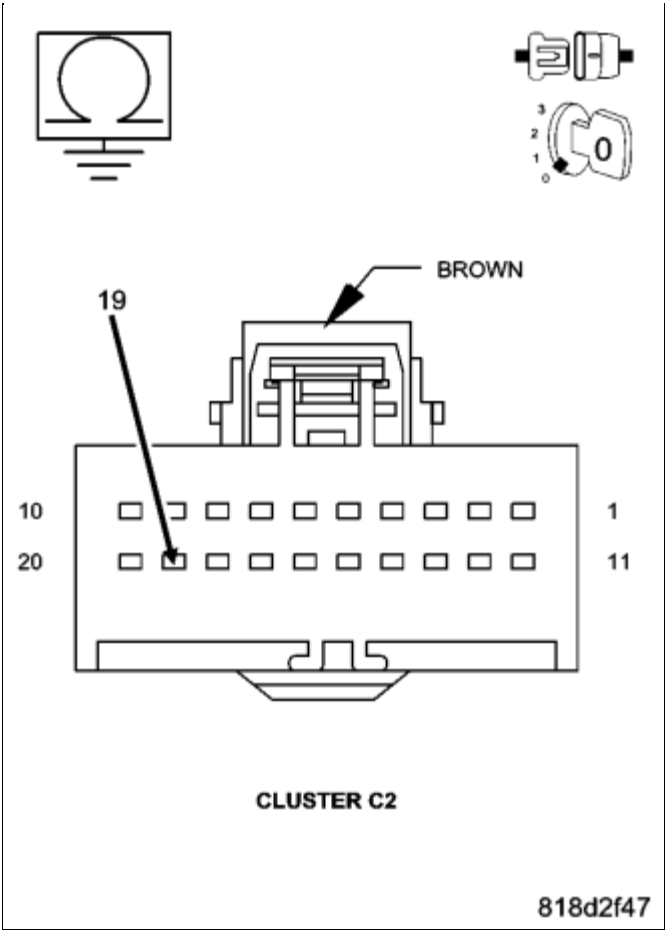
Is the resistance below 10K ohms?

Yes

- Repair the (D506) LIN Bus circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

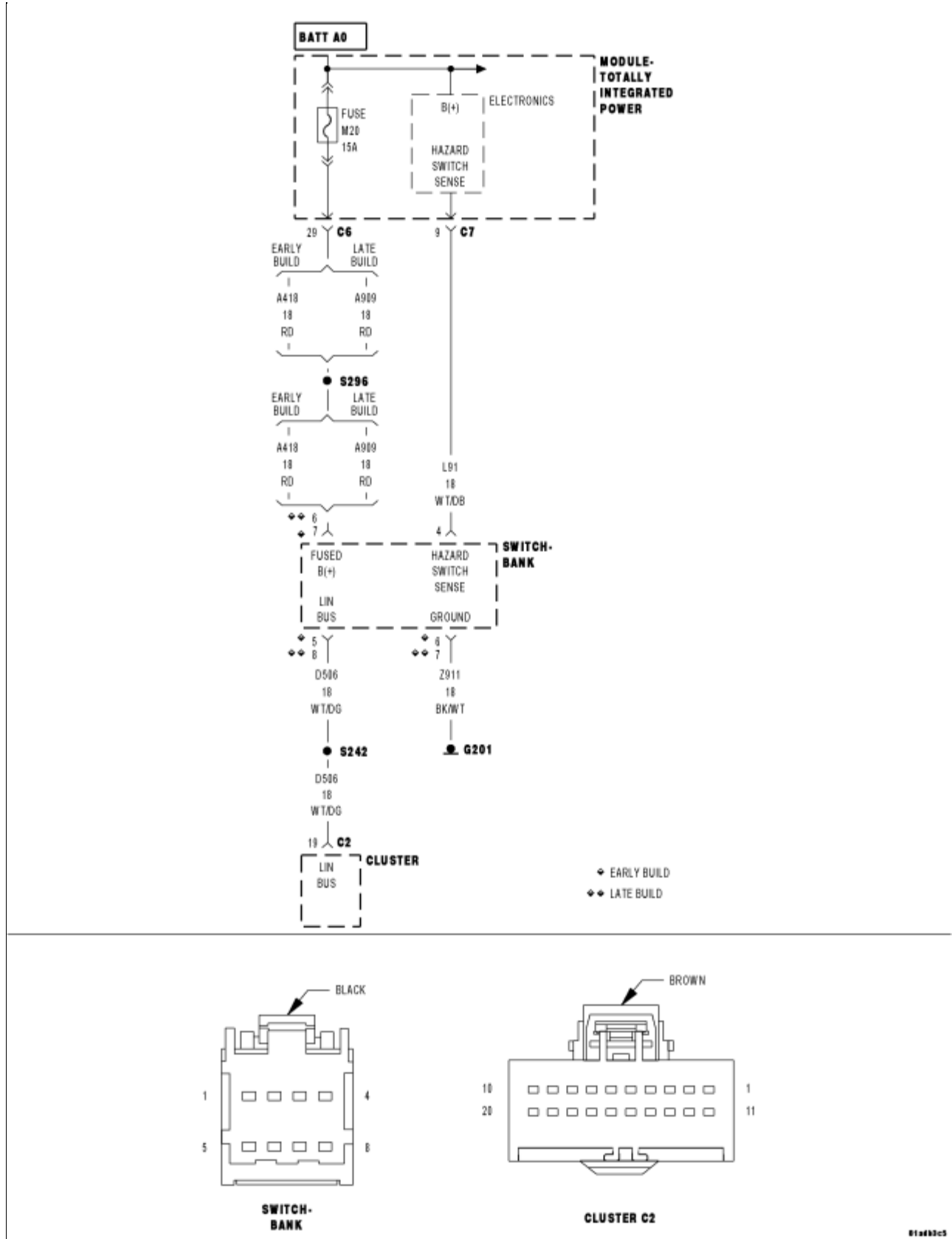
No

- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



PROCEDURE)

**U113B-LOST COMMUNICATION
WITH SWITCH BANK MODULE**



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The Cluster does not receive information from the Switch Bank Module.

Possible Causes
(D506) LIN BUS CIRCUIT OPEN
(A418) FUSED B+ CIRCUIT (EARLY PRODUCTION) OPEN
(A909) FUSED B+ CIRCUIT (LATE PRODUCTION) OPEN
(Z911) GROUND CIRCUIT OPEN
SWITCH BANK MODULE
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (D506) LIN BUS CIRCUIT

Turn the ignition off.
 Disconnect the Switch Bank Module harness connector.
 Turn the ignition on.
 Measure the voltage of the (D506) LIN BUS circuit.

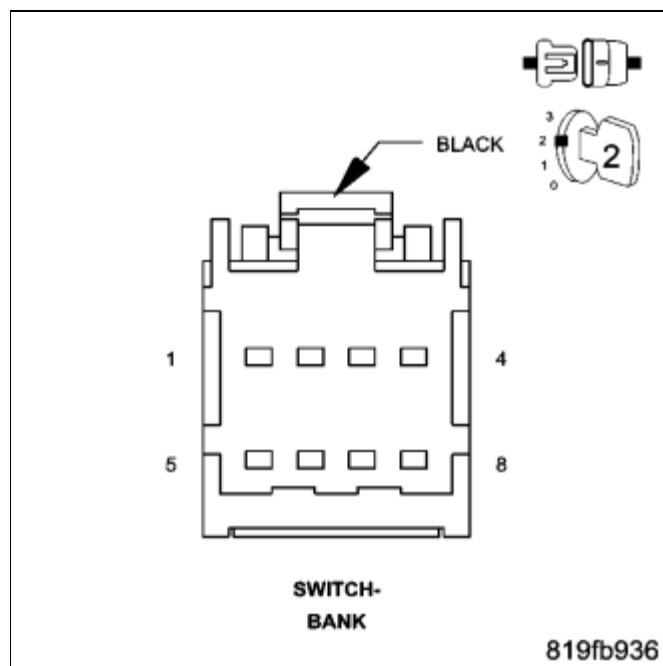
Is the voltage above 5 volts?

Yes

- Go To [4](#)

No

- Go To [3](#)



3. (D506) LIN BUS CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Cluster C2 harness connector.
 Measure the resistance of the (D506) LIN BUS circuit.

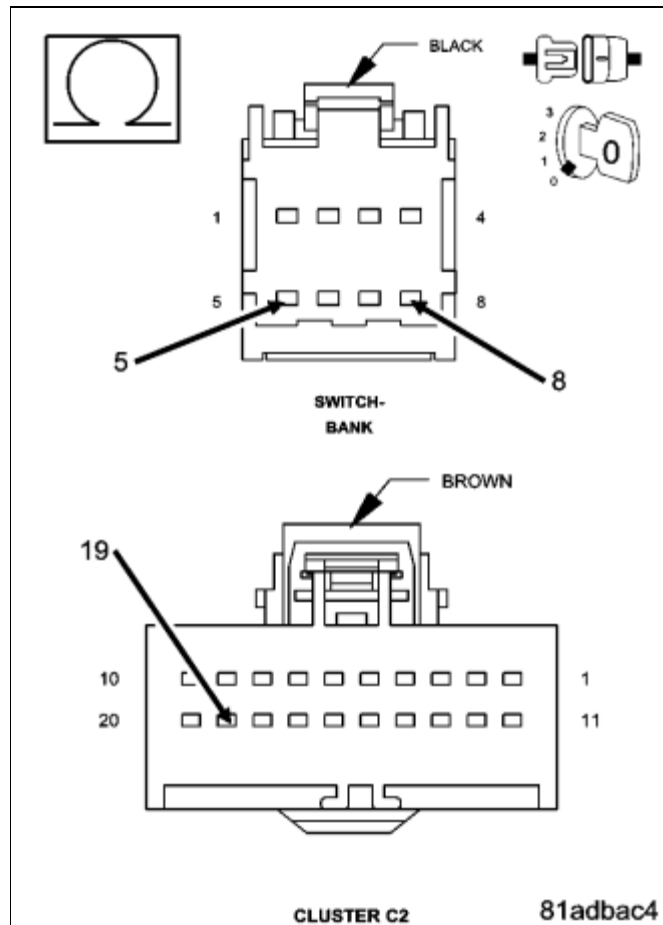
Is the resistance below 10K ohms?

Yes

- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D506) LIN BUS circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. (A418)/(A909) FUSED B+ CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (A418)/(A909) Fused B+ circuit at the Switch Bank Module harness connector.

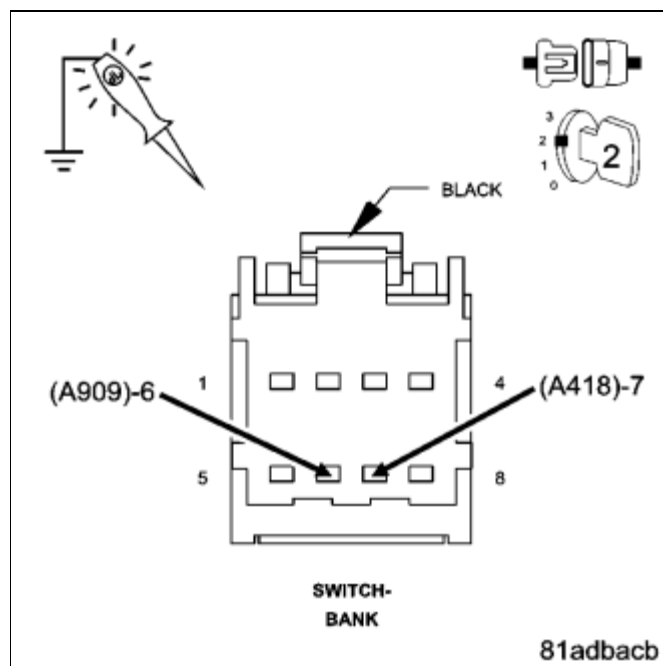
Does the test light illuminate brightly?

Yes

- Go To [5](#)
-

No

- Repair the (A418)/(A909) Fused B+ circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (Z911) GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, check the (Z911) Ground circuit at the Switch Bank Module harness connector.

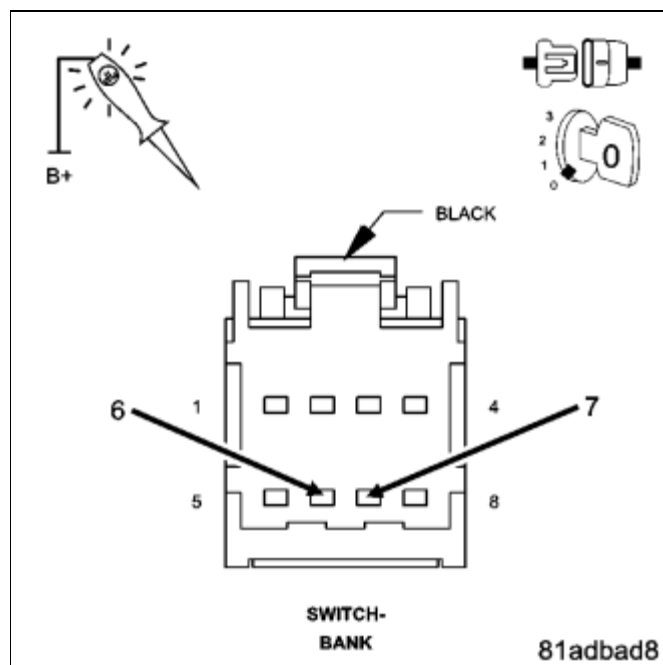
Does the test light illuminate brightly?

Yes

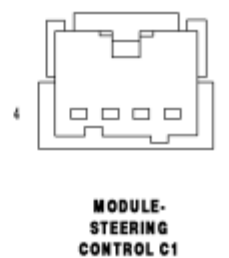
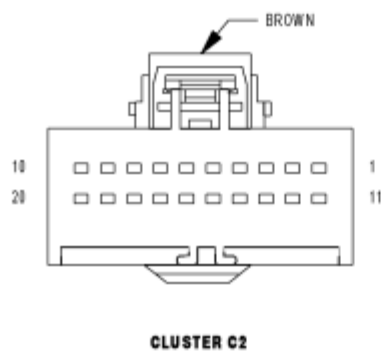
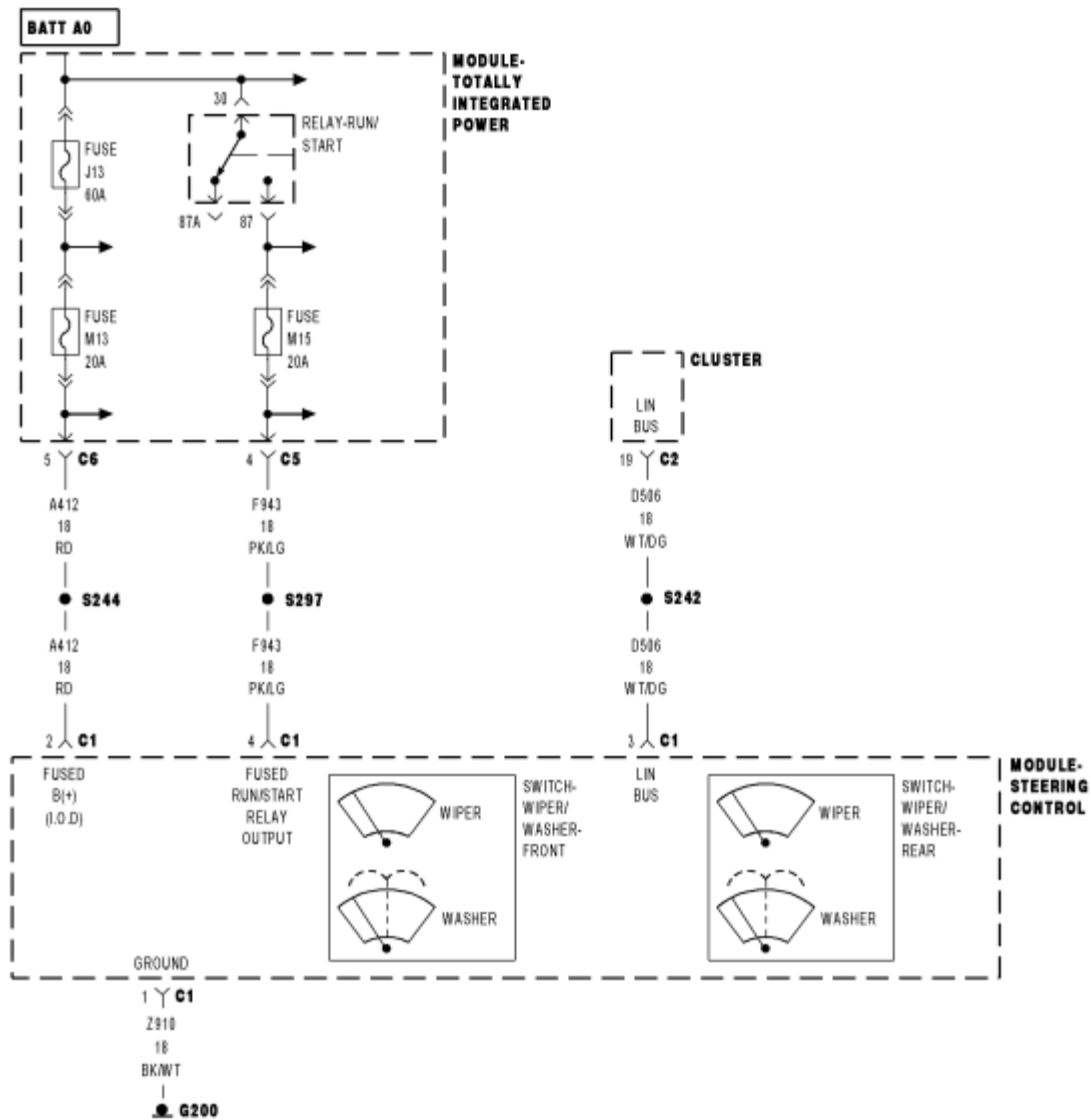
- Replace the Switch Bank Module in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (Z911) ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



U1149-LOST COMMUNICATION WITH MULTIFUNCTION SWITCH (STEERING CONTROL MODULE)



81310064

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Cluster does not receive information from the Steering Control Module.

Possible Causes
(D506) LIN BUS CIRCUIT OPEN
(F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN
(A412) FUSED B(+) (I.O.D.) CIRCUIT OPEN
(Z910) GROUND CIRCUIT OPEN
STEERING CONTROL MODULE
CLUSTER

Diagnostic Test

1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, record and erase DTCs.

Wait 30 seconds.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this code to set is not present at this time. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (D506) LIN BUS CIRCUIT

Turn the ignition off.
 Disconnect the Steering Control Module harness connector.
 Turn the ignition on.
 Measure the voltage of the (D506) LIN BUS circuit.

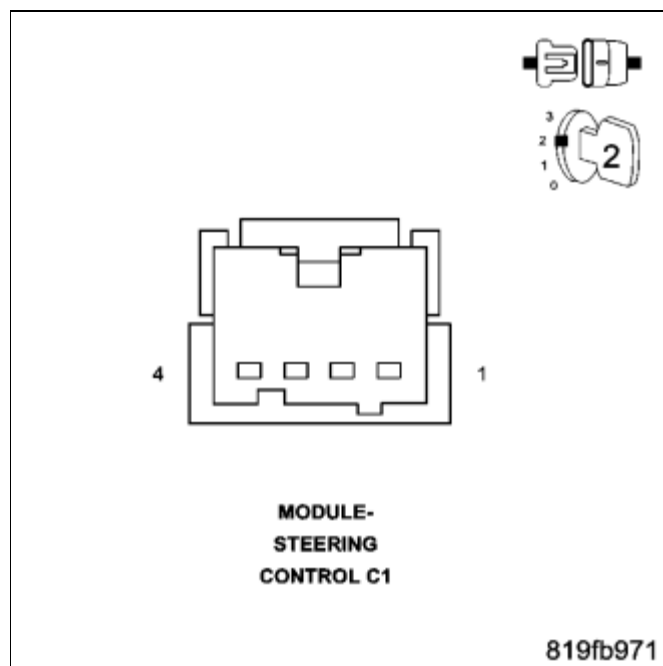
Is the voltage above 5 volts?

Yes

- Go To [4](#)

No

- Go To [3](#)



3. (D506) LIN BUS CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Cluster C2 harness connector.
 Measure the resistance of the (D506) LIN BUS circuit.

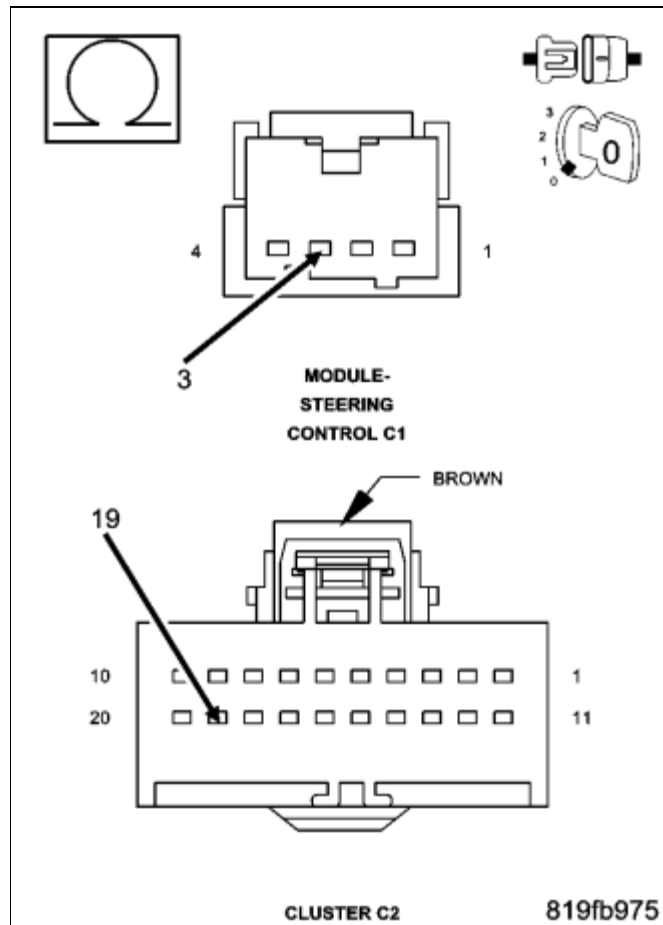
Is the resistance below 10K ohms?

Yes

- Replace the Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D506) LIN BUS circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. (F943) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F943) Fused RUN/START Relay Output circuit at the Steering Control Module harness connector.

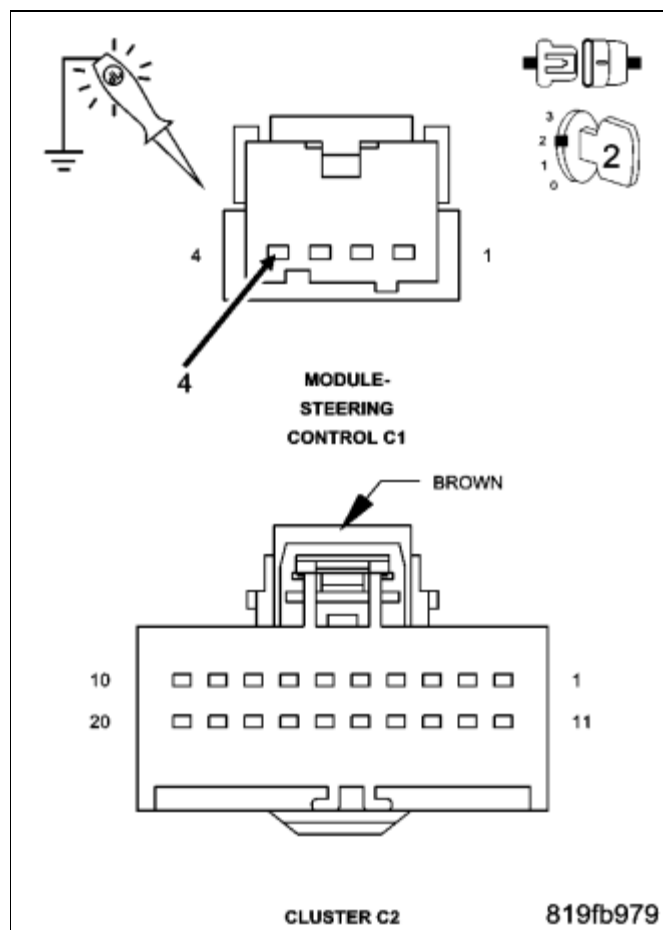
Does the test light illuminate brightly?

Yes

- Go To [5](#)
-

No

- Repair the (F943) Fused RUN/START Relay Output circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (A412) FUSED B+ (I.O.D.) CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (A412) Fused B+ (I.O.D.) circuit at the Steering Control Module harness connector.

Does the test light illuminate brightly?

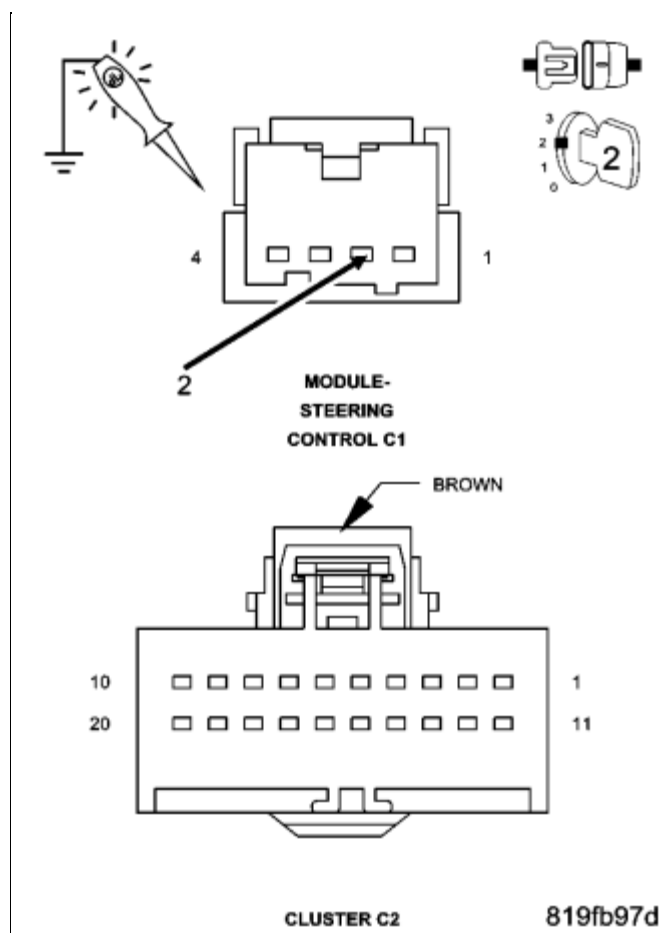
Yes

- Go To [6](#)
-

No

- Repair the (A412) Fused B+ (I.O.D.) circuit for an open.

- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



6. (Z910) GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, check the (Z910) Ground circuit at the Steering Control Module harness connector.

Does the test light illuminate brightly?

Yes

- Replace the Steering Control Module in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (Z916) ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

INSTRUMENT CLUSTER

INSTRUMENT CLUSTER

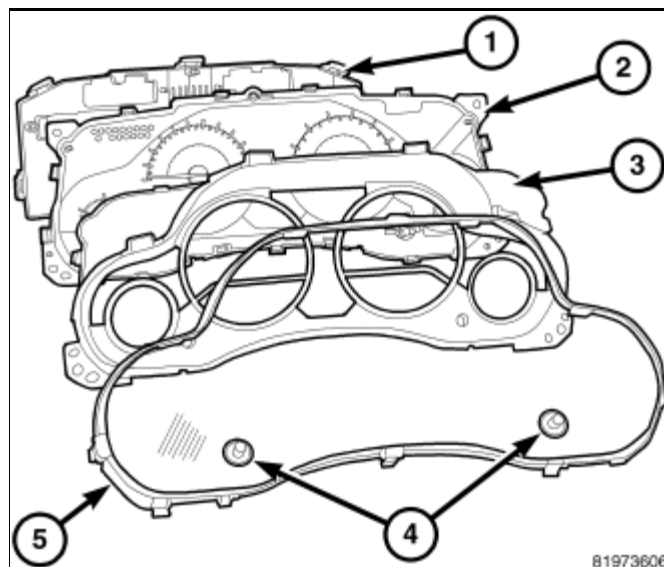
DESCRIPTION

Diagram illustrating the location of the horn button (1) and the horn relay (2) in the steering column area.

1394

features, numerous textual warning or reminder indicators and certain diagnostic information depending upon vehicle equipment.

The EMIC gauges and indicators are visible through a dedicated opening in the instrument panel below the cluster bezel and are protected by a clear plastic cluster lens (5). Nine integral latch formations on the lens secure it to the cluster hood and mask unit (3) as well as the cluster housing (2). Just behind the cluster lens is the cluster hood and integral mask, which is constructed of molded black plastic. The mask is painted silver on vehicles with certain optional trim packages. The hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare, while the cluster mask serves to separate and define the individual gauges from the indicator areas and trims the outside perimeter of the cluster overlay. The hood and mask has eight integral latch features that secure it to the outer perimeter of the cluster housing. The hood and mask unit also has two integral mounting tabs on the lower corners that combine with the tabs integral to the cluster housing to secure the bottom of the EMIC to the molded plastic instrument panel cluster carrier with two screws.



The rear of the cluster housing and the EMIC electronic circuitry are protected by a molded white plastic rear cover (1), which is also secured to the cluster housing by integral latch features. The rear cover includes clearance holes for the four cluster connector receptacles. The connector receptacles on the back of the cluster electronic circuit board connect the EMIC to the vehicle electrical system through four take outs with connectors from the instrument panel wire harness.

Sandwiched between the rear cover and the lens and hood unit is the cluster housing. The molded white plastic cluster housing serves as the carrier for the cluster circuit board and circuitry, the cluster connector receptacles, the two major and two minor gauges, a Light Emitting Diode (LED) for each cluster indicator, the VFD display units, an audible tone transducer, several LED units for general cluster illumination, the cluster overlay, and the gauge pointers. The standard equipment molded black plastic odometer/trip odometer switch button as well as the optional CMTC display switch button extend from the face of the cluster housing through dedicated holes in the cluster mask and the cluster lens adjacent to their respective VFD units. A black rubber boot (4) seals each switch button to the clearance hole in the lens. The cluster housing also has four integral mounting tabs, one on each upper and lower corner of the housing.

The cluster overlay is a laminated plastic unit. The dark, visible, outer surface of the overlay is marked with all of the gauge dial faces and graduations, but this layer is also translucent. The darkness of this outer layer prevents the cluster from appearing cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the overlay is opaque and allows light from the LED for each of the various indicators and illumination lamps behind it to be visible through the outer layer of the overlay through predetermined stencil-like cutouts. Openings in the overlay at the base of the speedometer and tachometer dial faces have smoked clear lenses through which the illuminated VFD units can be viewed.

Several versions of the EMIC module are offered on this vehicle. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle is offered. The microprocessor-based EMIC utilizes integrated circuitry and information carried on the Controller Area Network (CAN) data bus and the Local Interface Network (LIN) data bus along with several hard wired

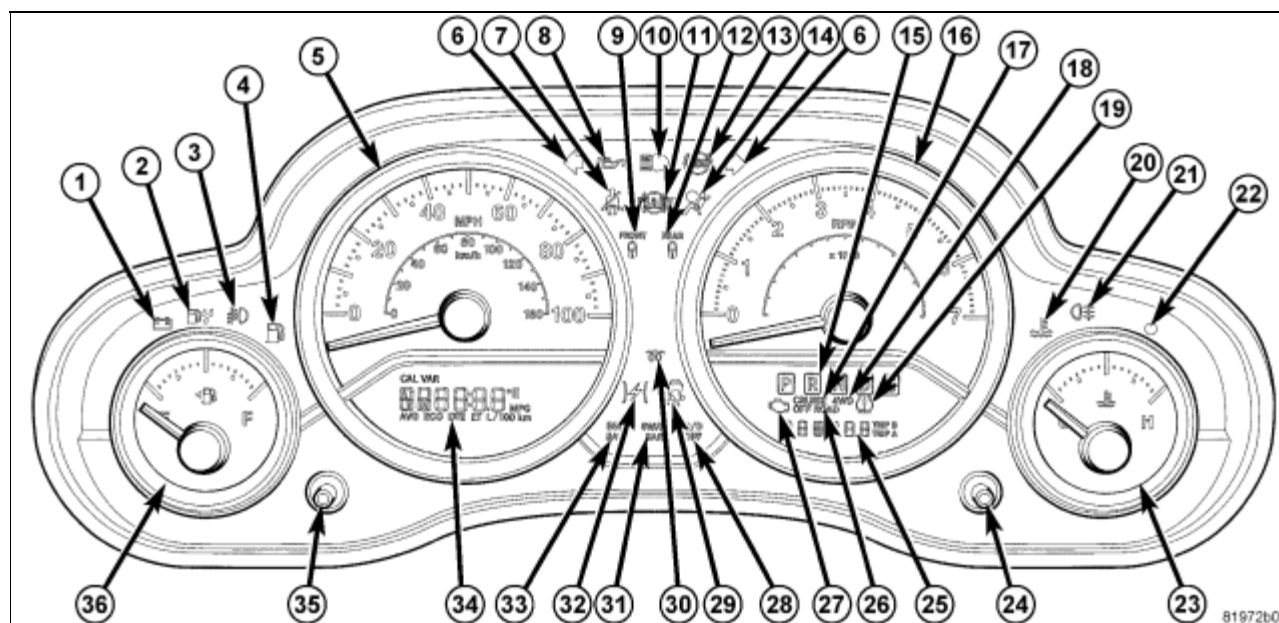
analog and multiplexed inputs to monitor sensors and switches throughout the vehicle. In response to those inputs, the internal circuitry and programming of the EMIC allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN and LIN data busses. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - CAN BUS).

Besides typical instrument cluster gauge and indicator support, the electronic functions and features that the EMIC supports or controls include the following:

- **A/C Select and Evaporator Probe Support** - The EMIC monitors hard wired inputs from the A/C select switch in the air conditioner-heater control and evaporator temperature sensor inputs, then transmits electronic **A/C clutch request** messages over the CAN data bus when appropriate to support the A/C clutch control feature.
- **Audible Warnings** - The EMIC electronic circuit board is equipped with an audible tone transducer and programming that allows it to provide various audible alerts to the vehicle operator. These alerts include single chime tones and continuous slow or fast tones. An electromechanical relay is also soldered onto the circuit board to produce audible clicks that are used to emulate the sound of a conventional turn signal or hazard warning flasher.
- **Compass Mini-Trip Computer Display Support** - The EMIC provides support for each of the functions and features of the Compass-Mini-Trip Computer (CMTC) display. This includes support for the compass, thermometer, trip computer and the switch inputs that are used to control and configure many of the displays. This also includes display arbitrator programming, which controls the priorities, sequences, and transition of information that is displayed in the CMTC display, particularly when multiple display requests are received simultaneously.
- **Electric Backlight Support** - The EMIC monitors Electric BackLight (EBL) switch hard wired inputs from the air conditioner-heater control, then transmits the appropriate electronic **EBL request** messages over the CAN data bus to support the EBL function.
- **Enhanced Accident Response Support** - The EMIC monitors inputs from the Occupant Restraint Controller (ORC) and the Powertrain Control Module (PCM) to automatically turn ON the interior lighting after an airbag deployment event, 10 seconds after the vehicle speed is zero. The interior lighting remains illuminated until the key is removed from the ignition switch lock cylinder, at which time the interior lighting returns to normal operation and control. These Enhanced Accident Response System (EARS) features are each dependent upon a functional vehicle electrical system following the vehicle impact event.
- **Exterior Lighting Switch Support** - The EMIC monitors electronic **exterior lighting switch**, and **turn signal switch status** messages from the Steering Control Module (SCM) on the steering column over the LIN data bus and transmits the appropriate electronic **exterior lighting** and **turn signal request** messages to the Totally Integrated Power Module (TIPM) over the CAN data bus to support the exterior lighting functions.
- **Four Wheel Drive (4WD) Lock Switch Support** - The EMIC monitors a hard wired input from the 4WD Lock switch on the center floor console then transmits the appropriate electronic **4WD Lock request** and **Unlock request** messages to the Totally Integrated Power Module (TIPM) over the CAN data bus to support the 4WD Lock mode functions.
- **Horn Switch Support** - The EMIC receives a hard wired input from the horn switch on the steering wheel then provides electronic **horn request** messages over the CAN data bus to support the horn function.
- **Interior Lamp Load Shedding** - The EMIC provides a battery saver feature which will automatically turn OFF all interior lamps if they remain ON after a timed interval of about ten minutes.
- **Interior Lighting Control** - The EMIC monitors electronic messages and hard wired inputs from the interior lighting switch, the door ajar switches, the liftgate ajar switch, the reading lamp switches, and the Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) to provide courtesy lamp control. This includes support for timed illuminated entry with theater-style fade-to-OFF and courtesy illumination DEFEAT features.
- **Local Interface Network Master Module** - The EMIC is the master module for the LIN data bus. In this

role it gathers information from the compass sensor, the Heated Seat Module (HSM), the instrument panel switch pod and the SCM, then either acts on that information directly or places electronic messages on the CAN data bus for use by other modules

- **Panel Lamps Dimming Control** - The EMIC monitors electronic **dimming level** messages received from the panel lamps dimmer switch input to the SCM over the LIN data bus, then provides both a hard wired 12-volt Pulse-Width Modulated (PWM) output and electronic message outputs over the LIN data bus that synchronizes the dimming level of all panel lamps dimmer controlled lamps with that of the cluster general illumination lighting.
- **Wiper and Washer Switch Support** - The EMIC monitors electronic **wiper switch** and **washer switch status** messages from the SCM on the steering column over the LIN data bus and transmits the appropriate electronic **wiper** and **washer request** messages to the TIPM over the CAN data bus to support the wiper and washer system functions, including the headlamps-on with wipers programmable feature.



The EMIC houses 4 analog gauges and has provisions for up to 25 indicators. Some of the EMIC indicators are automatically configured when the EMIC is connected to the vehicle electrical system for compatibility with certain optional equipment or equipment required for regulatory purposes in certain markets. While each EMIC may have provisions for indicators to support every available option, the configurable indicators will not be functional in a vehicle that does not have the equipment that an indicator supports.

The EMIC includes the following analog gauges:

- **Engine Temperature Gauge (23)**
- **Fuel Gauge (36)**
- **Speedometer (5)**
- **Tachometer (16)**

The EMIC includes the following VFD units:

- **Odometer Display (25)** - includes Cruise indicator (17), Gear Selector indicator (15), Malfunction Indicator Lamp (MIL) (27) (domestic market vehicles only), Off Road indicator (26) (Not Used), Push Buttons (24), Tire Pressure Monitor (TPM) indicator (19) and 4WD indicator (18) (domestic market vehicles only).
- **Compass Mini-Trip Computer Display (34)** - includes Push Button (35).

The EMIC includes provisions for the following indicators:

- **Airbag Indicator (14)**
- **Ajar Indicators** - text in odometer display (25) for doors and swing gate
- **Antilock Brake System (ABS) Indicator (13)**
- **Brake Indicator (11)** - text only for U.S. market, icon only for markets outside U.S.
- **Change Oil Indicator** - textual message in odometer display (25) on all domestic market vehicles and only BUX market vehicles equipped with a 2.8L diesel engine and an optional diesel particulate filter
- **Charging Indicator (1)**
- **Cruise Indicator (17)**
- **Electronic Stability Program (ESP)/Brake Assist System (BAS) Indicator (33)**
- **Electronic Throttle Control (ETC) Indicator (32)**
- **Engine Coolant Temperature Indicator (20)**
- **Four-Wheel Drive (4WD) Indicator (18)** - with optional four-wheel drive system only on domestic market vehicles. On export market vehicles, this indicator is located on the right side of the cluster overlay near the top, above the engine coolant temperature gauge.
- **Four-Wheel Drive Lock (Off Road) Indicator (26)** - Not Used
- **Front Axle Lock Indicator (9)** - with optional axle lockers only
- **Front Fog Lamp Indicator (3)** - with optional front fog lamps only
- **Front Sway Bar Disconnect Indicator (31)** - with optional electronic sway bar disconnect only
- **Gas Cap Indicator** - textual message in odometer display (25)
- **Gear Selector Indicator (15)** - with automatic transmission only
- **High Beam Indicator (10)**
- **Low Fuel Indicator (4)**
- **Low Oil Pressure Indicator (8)**
- **Malfunction Indicator Lamp (MIL) (27)** - only on domestic market vehicles. On export market vehicles, this indicator is located on the right side of the cluster overlay near the top, above the engine coolant temperature gauge.
- **No Fuse Indicator** - textual message in odometer display (25)
- **Overdrive Off Indicator (28)** - with automatic transmission only
- **Rear Axle Lock Indicator (12)** - with optional axle lockers only
- **Rear Fog Lamp Indicator (21)** - in markets where rear fog lamps are available only
- **Seat Belt Indicator (7)**
- **Security Indicator (22)**
- **Tire Pressure Monitor (TPM) Indicator (19)**
- **Traction Control/Electronic Stability Program (ESP) Indicator (29)**
- **Turn Signal (Right and Left) Indicators (6)**
- **Wait-To-Start Indicator (30)** - with diesel engine only
- **Water-In-Fuel Indicator (2)** - with diesel engine only

Each indicator in the EMIC, except those located within a VFD unit, is illuminated by a dedicated LED that is soldered onto the EMIC electronic circuit board. Cluster illumination is accomplished by several dimmable LED units, which illuminate each of the gauge dial faces for visibility when the exterior lighting is turned ON. These LED units are not available for service replacement and, if damaged or ineffective, the entire EMIC must be replaced.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC module for this vehicle is serviced only as a complete unit. The EMIC module cannot be adjusted or repaired. If a gauge, an LED unit, a VFD unit, the electronic circuit board, the circuit board hardware, the cluster overlay or the cluster housing are damaged or ineffective, the entire EMIC module must be replaced. The cluster lens and the cluster hood and mask unit are available for separate service replacement.

OPERATION

The ElectroMechanical Instrument Cluster (EMIC) in this vehicle also includes the hardware and software necessary to serve as the electronic body control module and is sometimes referred to as the Cab Compartment Node or CCN. The following information deals primarily with the instrument cluster functions of this unit. Additional details of the electronic body control functions of this unit may be found within the service information for the system or component that the EMIC controls. For example: Additional details of the audible warning functions of the EMIC are found within the Chime/Buzzer service information.

The EMIC is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges and indicators in the EMIC provide valuable information about the various standard and optional powertrains, fuel and emissions systems, cooling systems, lighting systems, safety systems and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service.

The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but most are in the form of electronic messages that are transmitted by other electronic modules over the Controller Area Network (CAN) data bus or the Local Interface Network (LIN) data bus. The EMIC is the master node for the LIN data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that are consistent with customer expectations. However, when abnormal conditions exist such as high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor can sound a chime through the on-board audible tone transducer to provide distinct visual and audible indications of a problem to the vehicle operator. The EMIC may also produce audible warnings for other electronic modules in the vehicle based upon electronic **tone request** messages received over the CAN or LIN data bus. Each audible warning is intended to provide the vehicle operator with an audible alert to supplement a visual indication.

The EMIC circuitry operates on battery current received through a fused B(+) fuse on a non-switched fused B(+) circuit, and on battery current received through a fused ignition switch output (run-start) fuse on a fused ignition switch output (run-start) circuit. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the ON or START positions. The EMIC circuitry is grounded through a ground circuit and take out of the instrument panel wire harness with an eyelet terminal connector that is secured by a ground screw to a ground location on the instrument panel structural support.

The EMIC also has a self-diagnostic actuator test capability, which will test each of the CAN or LIN bus message-controlled functions of the cluster by lighting the appropriate indicators, positioning the gauge needles at several predetermined calibration points across the gauge faces, and illuminating all segments of the Vacuum-Fluorescent Display (VFD) units. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

GAUGES

All gauges receive battery current through the EMIC circuitry only when the ignition switch is in the ON or START positions. With the ignition switch in the OFF position battery current is not supplied to any gauges, and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the ON or START positions.

Each of the EMIC gauges contains an electronically controlled stepper motor unit. The EMIC circuitry completely controls the activation and deactivation of these stepper motors to position each gauge needle in the appropriate position based upon cluster programming and electronic messages received over the CAN or LIN data bus.

The gauges are diagnosed using the self-diagnostic Cab Compartment Node (CCN) actuator test. Proper testing of the CAN or LIN data bus and the electronic data bus message inputs to the EMIC that control each gauge requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

VACUUM-FLUORESCENT DISPLAYS

The Vacuum-Fluorescent Display (VFD) units are soldered to the EMIC electronic circuit board. Both the standard one located below the tachometer and the optional Compass Mini-Trip Computer (CMTC) display located below the speedometer are fixed segment displays. With the ignition switch in the OFF or ACCESSORY positions, both VFD displays are activated and the total odometer information is displayed when the driver door is opened (Rental Car Mode) and are deactivated when the driver door is closed or after five minutes, whichever occurs first. Otherwise, both display units are active when the ignition switch is in the ON or START positions, and inactive when the ignition switch is in the OFF or ACCESSORY positions.

The illumination intensity of the VFD units is controlled by the EMIC circuitry based upon electronic **dimming level** messages received over the CAN data bus indicating the exterior lighting is turned ON and the dimming level selected using the panel dimmer function of the control sleeve on the control stalk of the left (lighting) multi-function switch. The illumination intensity of the EMIC VFD units is synchronized with that of other display units in the vehicle by sending the same electronic **dimming level** message inputs to all electronic modules in the vehicle over the CAN or LIN data bus. However, on domestic market vehicles only, if the Tire Pressure Monitor (TPM) indicator or Malfunction Indicator Lamp (MIL) is active, the odometer VFD will illuminate at full daytime brightness until both the TPM indicator and the MIL are extinguished.

The odometer VFD unit has several display capabilities including odometer, trip odometer A and B, gear selector indication (PRNDL) for vehicles with an automatic transmission, several warning or reminder indications, and various diagnostic information when certain fault conditions exist. On vehicles not equipped with the optional CMTC, the odometer display toggles to an outside temperature display following Trip B. The CMTC VFD unit displays numerous warning or reminder textual messages, all CMTC data including compass, temperature, trip computer, the customer programmable features interface and various diagnostic information when certain fault conditions exist. An odometer/trip odometer switch and a CMTC display switch on the EMIC circuit board are used to control many of the display modes of the VFD units. These switches are actuated manually by depressing the odometer/trip odometer or CMTC push button that extends through the lower edge of the cluster lens, adjacent to the VFD that it controls.

Actuating the odometer/trip odometer push button momentarily with the ignition switch in the ON position will toggle the odometer VFD between the odometer and trip odometer modes. Depressing the odometer/trip odometer push button for about two seconds while the VFD is in the trip odometer mode will reset the trip odometer value to zero. Holding the odometer/trip odometer push button depressed while turning the ignition

switch from the OFF position to the ON position will initiate the CCN self-diagnostic actuator test. Refer to the instrument cluster diagnosis and testing service information for additional details on this cluster function. The EMIC microprocessor remembers which odometer display mode is active when the ignition switch is turned to the OFF position, and returns the display to that mode when the ignition switch is turned ON again.

Actuating the CMTC VFD push button momentarily with the ignition switch in the ON position will toggle the CMTC VFD between the various trip computer functions and the various customer programmable feature selectors. The EMIC microprocessor remembers which display modes are active when the ignition switch is turned to the OFF position, and returns the display to that mode when the ignition switch is turned ON again.

Both VFD units are diagnosed using the self-diagnostic Cab Compartment Node (CCN) actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the CAN or LIN data bus message inputs to the EMIC that control some of the VFD functions requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for the odometer, the trip odometer, the gear selector indicator, the CMTC and the various warning and reminder indicator functions of the VFD units may be found elsewhere in this service information.

INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC electronic circuit board. Some indicators operate based upon hard wired inputs to the EMIC, but most are controlled by CAN or LIN data bus messages from other electronic modules in the vehicle. Some are controlled by a combination of hard wired inputs, electronic messaging and EMIC programming. If the EMIC loses CAN data bus communication, the EMIC circuitry will automatically turn ON the Malfunction Indicator Lamp (MIL) until CAN data bus communication is restored.

The various EMIC indicators are controlled by different strategies; some receive fused ignition switch output from the EMIC circuitry and have a switched ground, while others are grounded through the EMIC circuitry and have a switched battery feed. However, all indicators are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. The cruise and 4WD indicators located within the odometer VFD unit are dimmable. All other indicators are illuminated at a fixed intensity, which is not affected by the selected illumination intensity of the EMIC general illumination LED units. The illumination intensity of the dimmable indicators is synchronized with that of the general illumination lighting.

In addition, certain indicators in this instrument cluster are automatically or self-configured. This feature allows the configurable indicators to be enabled by the EMIC circuitry for compatibility with certain optional equipment. These indicators are enabled or disabled by an electronic **configuration** message sent to the EMIC by the Totally Integrated Power Module (TIPM). The TIPM defaults for the ABS indicator and airbag indicator are enabled, and these configuration settings must be programmatically disabled in the TIPM using a diagnostic scan tool for vehicles that do not have this equipment. The automatically or self-configured indicators remain latent in each EMIC at all times and will be active only when the EMIC receives the appropriate CAN or LIN bus message inputs for that optional system or equipment.

The hard wired indicator inputs may be diagnosed using conventional diagnostic tools and procedures. However, the EMIC circuitry and electronic CAN or LIN data bus message controlled indicators are diagnosed using the self-diagnostic Cab Compartment Node (CCN) actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the CAN or LIN data bus and the electronic data bus message inputs to the EMIC that control each indicator requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

CLUSTER ILLUMINATION

The EMIC has several Light Emitting Diode (LED) units that provide cluster back lighting whenever the exterior lighting is turned ON. The illumination intensity of these LED units is adjusted when the panel lamps dimmer function of the control sleeve on the control stalk of the left (lighting) multi-function switch is rotated to one of six available minor detent positions. The EMIC monitors an electronic **dimming level** message input received over the LIN data bus from the Steering Control Module (SCM) to determine the selected lighting level. In response to that input, the EMIC electronic circuitry converts a fused 12-volt input it receives on a hard wired panel lamps dimmer switch signal circuit into a 12-volt Pulse Width Modulated (PWM) output.

The EMIC uses this PWM output to control the illumination intensity of the cluster general illumination lighting and the VFD units on the EMIC circuit board, then provides a synchronized PWM output on various hard wired fused panel lamps dimmer switch signal circuits to control and synchronize the illumination intensity of other incandescent illumination lamps in the vehicle. The EMIC also transmits electronic **dimming level** messages over the CAN and LIN data bus to other electronic modules in the vehicle to control and synchronize the illumination intensity of their display units to that of the EMIC displays.

The hard wired panel lamps dimmer outputs from the EMIC may be diagnosed using conventional diagnostic tools and procedures. However, proper testing of the PWM processing of the EMIC and the electronic **dimming level** messages received by the EMIC over the LIN data bus requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

INSTRUMENT CLUSTER

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

If all of the instrument cluster gauges and indicators are ineffective, be certain to check the instrument cluster fused B(+) fuse and the instrument cluster fused B(+) and ground circuits for shorts or opens. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

If an individual hard wired gauge or indicator is ineffective, refer to the diagnosis and testing service information for that specific gauge or indicator. If an individual Controller Area Network (CAN) or Local Interface Network (LIN) data bus message-controlled gauge or indicator is ineffective, perform the Actuator Test as follows:

CAUTION: Instrument clusters used in this vehicle automatically configure themselves for compatibility with the features and optional equipment in the vehicle in which they are initially installed. The instrument cluster is programmed to do this by embedding the Vehicle Identification Number (VIN) and other information critical to proper cluster operation into electronic memory. This embedded information is learned through electronic messages received from other electronic modules in the vehicle over the Controller Area Network (CAN) data bus, and through certain hard wired inputs received when the cluster is connected to the vehicle electrically. Once configured, the instrument cluster memory may be irreparably damaged and certain irreversible configuration errors may occur if the cluster is connected

electrically to another vehicle; or, if an electronic module from another vehicle is connected that provides data to the instrument cluster (including odometer values) that conflicts with that which was previously learned and stored. Therefore, the practice of exchanging (swapping) instrument clusters and other electronic modules in this vehicle with those removed from another vehicle must always be avoided. Failure to observe this caution may result in instrument cluster damage, which is not reimbursable under the terms of the product warranty. Service replacement instrument clusters are provided with the correct VIN, and the certified odometer and engine hours values embedded into cluster memory, but will otherwise be automatically configured for compatibility with the features and optional equipment in the vehicle in which they are initially installed.

NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated or deactivated for compatibility with certain optional equipment. If the problem being diagnosed involves improper illumination of the cruise indicator, the electronic throttle control indicator, the fog lamp indicator, any of the four-wheel drive indicators, the transmission overtemp indicator, the security indicator or the gear selector indicator, disconnect and isolate the battery negative cable. After about five minutes, reconnect the battery negative cable and turn the ignition switch to the ON position. The instrument cluster should automatically relearn the equipment in the vehicle and properly configure the configurable indicators accordingly.

ACTUATOR TEST

The instrument cluster actuator test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges and the indicators are capable of operating as designed. During the actuator test the instrument cluster circuitry will position each of the gauge needles at various calibration points, illuminate each of the segments in the Vacuum-Fluorescent Display (VFD) units, and turn all of the indicators ON and OFF again.

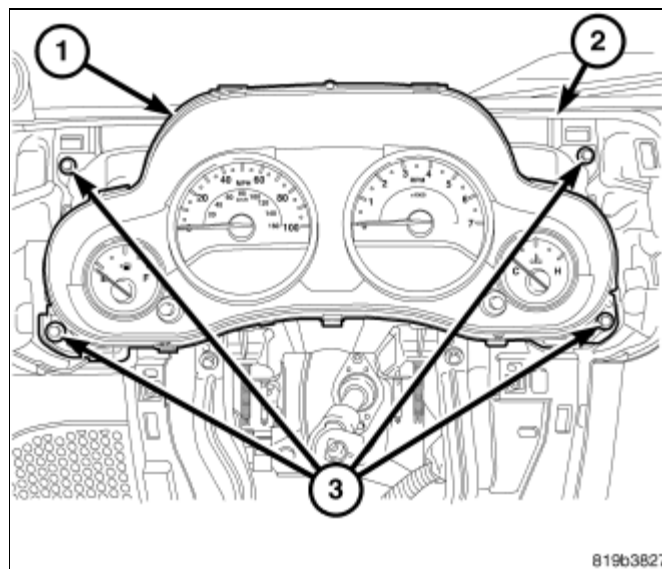
Successful completion of the actuator test will confirm that the instrument cluster is operational. However, there may still be a problem with the CAN or LIN data bus, the Powertrain Control Module (PCM), the Totally Integrated Power Module (TIPM), the Controller Antilock Brake (CAB), the All-Wheel Drive Control Module (AWDCM), the Occupant Restraint Controller (ORC), the compass module, the Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM), or the inputs to one of these electronic control modules. Use a diagnostic scan tool to diagnose these components. Refer to the appropriate diagnostic information.

1. Begin the test with the ignition switch in the OFF position.
2. Depress the odometer/trip odometer switch button.
3. While still holding the odometer/trip odometer switch button depressed, turn the ignition switch to the ON position, but do not start the engine.
4. Release the odometer/trip odometer switch button.
5. The instrument cluster will simultaneously begin to illuminate all of the operational segments in the VFD units, and perform a bulb check of each operational LED indicator. The VFD segments and LED indicators remain illuminated as each gauge needle is swept to several calibration points and back. If a VFD segment or an LED indicator fails to illuminate, or if a gauge needle fails to sweep through the calibration points and back during this test, the instrument cluster must be replaced.
6. The actuator test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test. The actuator test will be aborted if the ignition switch is turned to the OFF position, or if an electronic **vehicle speed** message indicating that the vehicle is moving is received over the CAN data bus during the test.
7. Go back to [STEP 1](#) to repeat the test, if necessary.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the cluster bezel from the instrument panel.
(Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).
3. Remove the four screws (3) that secure the instrument cluster (1) to the instrument panel armature (2).
4. Pull the top of the instrument cluster rearward far enough to access and disconnect the instrument panel wire harness connectors from the connector receptacles on the back of the cluster housing.
5. Remove the instrument cluster from the instrument panel.



DISASSEMBLY

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

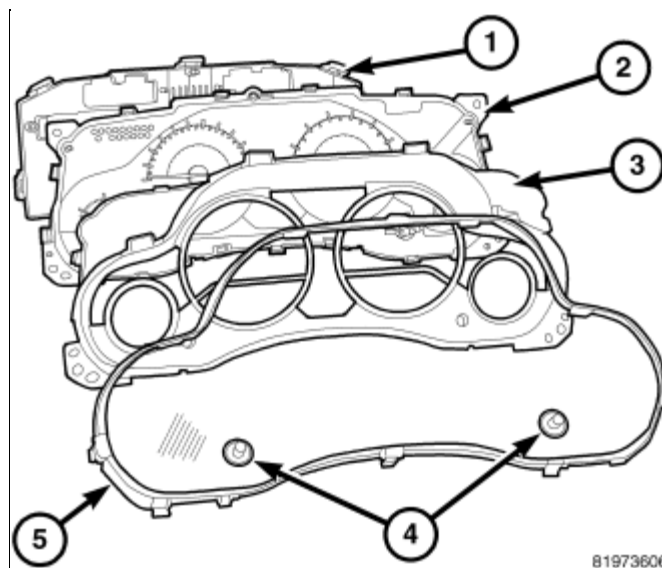
NOTE: Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include the cluster lens and the cluster hood and mask unit. Following are the procedures for disassembling these components from the instrument cluster.

CLUSTER LENS

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument cluster from the instrument panel.
(Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. Working around the perimeter of the cluster, disengage each of the nine integral latch features that secure the cluster

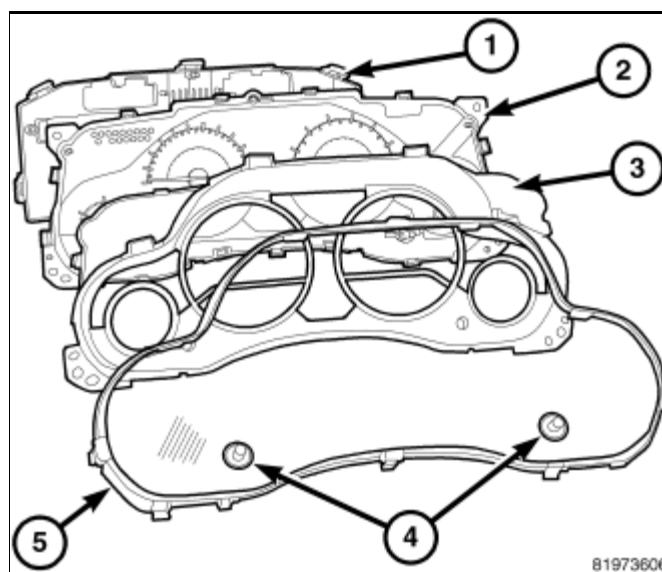
lens (5) to the cluster hood and mask unit (3) and to the cluster housing (2).

4. Remove the lens from the face of the cluster hood and mask unit.



CLUSTER HOOD AND MASK

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. Remove the cluster lens (5) from the face of the cluster hood and mask unit (3). Refer to [CLUSTER LENS](#).
4. Working around the perimeter of the cluster, disengage each of the eight integral latch features that secure the cluster hood and mask unit to the cluster housing (2).
5. Remove the hood and mask unit from the face of the instrument cluster.



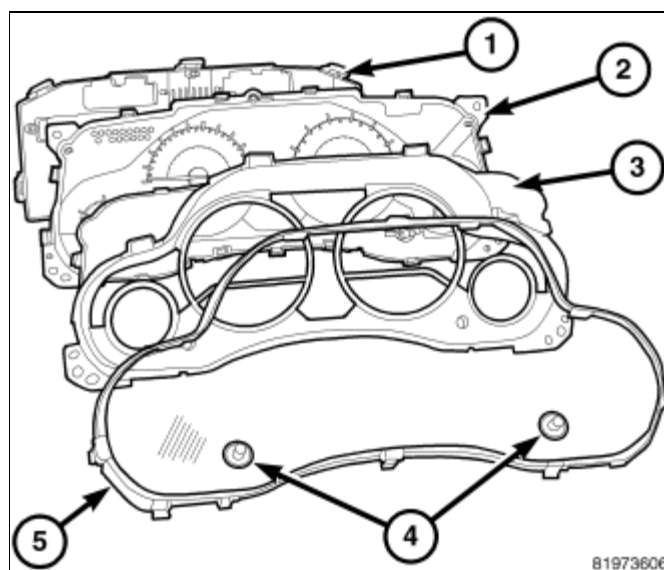
ASSEMBLY

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include the cluster lens and the cluster hood and mask unit. Following are the procedures for assembling these components onto the instrument cluster.

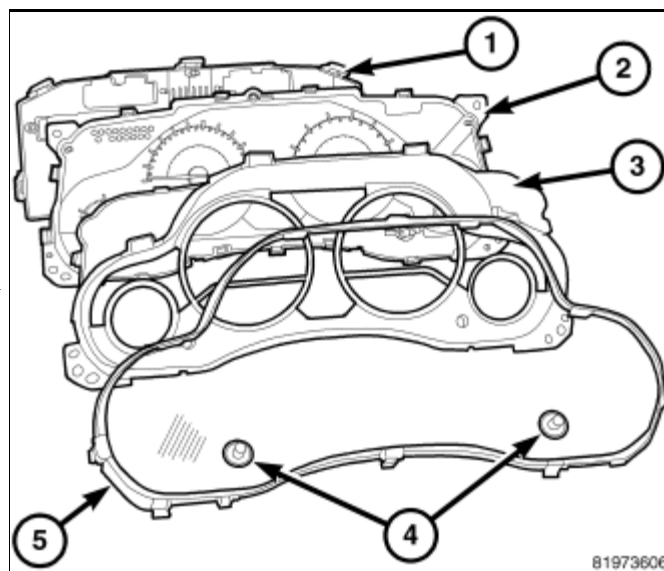
CLUSTER LENS

1. Position the cluster lens (5) over the face of the cluster hood and mask unit (3). Be certain that the rubber boots (4) for the odometer/trip odometer switch and reconfigurable display switch push buttons are installed in the clearance holes in the lens, and that the push buttons are engaged into the boots.
2. Working around the perimeter of the cluster, press the lens over the face of the hood and mask until each of the nine integral latch features is fully engaged in the receptacles of the hood and mask or the cluster housing (2).
3. Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
4. Reconnect the battery negative cable.



CLUSTER HOOD AND MASK

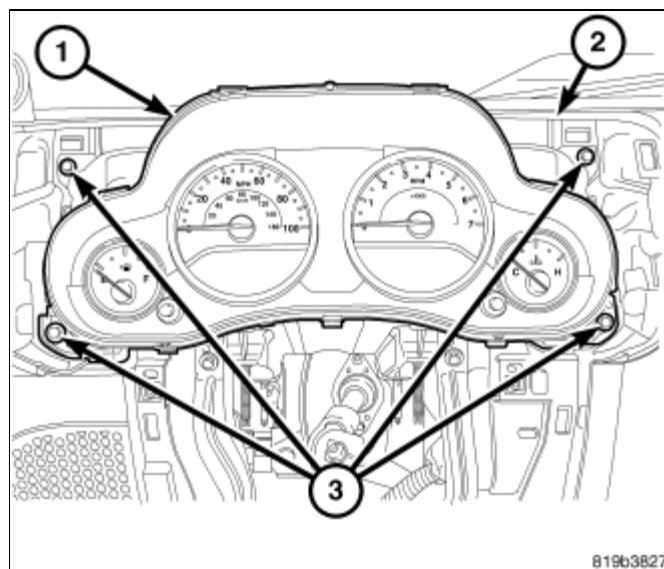
1. Position the cluster hood and mask unit (3) over the face of the cluster housing (2). Be certain that the odometer/trip odometer switch and reconfigurable display switch push buttons are inserted through the proper clearance holes in the mask.
2. Working around the perimeter of the cluster, press the hood and mask over the face of the cluster housing until each of the eight integral latch features is fully engaged in the receptacles of the housing.
3. Reinstall the cluster lens (5) onto the face of the cluster hood and mask unit. Refer to [CLUSTER LENS](#).
4. Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
5. Reconnect the battery negative cable.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the instrument cluster (1) close enough to the instrument panel to reconnect the instrument panel wire harness connectors to the connector receptacles on the back of the cluster housing.
2. Position the instrument cluster mounting tabs to the mounting holes in the instrument panel armature (2).
3. Install and tighten the four screws (3) that secure the mounting tabs of the instrument cluster. Tighten the screws to 2 N·m (17 in. lbs.).
4. Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.



NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated or deactivated for compatibility with certain optional equipment. If a problem is noted that involves improper illumination of an indicator, disconnect and isolate the battery negative cable. After about five minutes, reconnect the battery negative cable and turn the ignition switch to the ON position. The instrument cluster should automatically relearn the equipment in the vehicle and properly configure the configurable indicators accordingly.

SPECIFICATIONS

INSTRUMENT CLUSTER

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Instrument Cluster Mounting Screws	2		17
Instrument Panel Switch Pod Mounting Screws	2		17

ABS INDICATOR

DESCRIPTION

An Antilock Brake System (ABS) indicator is standard equipment on all instrument clusters. This indicator is located near the top of the cluster overlay, between the speedometer

and the tachometer. Illumination of this indicator may also be accompanied by the display of certain textual messages in the cluster odometer display.

The ABS indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Failure of Anti-lock Braking System** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The ABS indicator is serviced as a unit with the instrument cluster.

OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS system, or a circuit or component of the system is ineffective. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus.

The ABS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the ABS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the ABS indicator is illuminated for about three seconds as a bulb test. The entire bulb test is a function of the CAB.
- **ABS Indicator Lamp-On Message** - Each time the cluster receives an electronic **ABS indicator lamp-ON** message from the CAB, the ABS indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Communication Error** - If the cluster receives no lamp-ON or lamp-OFF messages from the CAB for five consecutive message cycles, the ABS indicator is illuminated. The indicator remains illuminated until the cluster receives a valid message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test and the Totally Integrated Power Module (TIPM) is configured for the ABS option, the ABS indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.
- **ABS Diagnostic Test** - The ABS indicator is blinked ON and OFF by lamp-ON and lamp-OFF messages from the CAB during the performance of the ABS diagnostic tests.

The CAB continually monitors the ABS circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the CAB sends a lamp-ON message after

the bulb test, it indicates that the CAB has detected a system malfunction or that the ABS system has become ineffective. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ABS indicator fails to light due to an open or short in the cluster ABS indicator circuit, the cluster sends a message notifying the CAB of the condition, then the instrument cluster and the CAB will each store a DTC and the cluster will flash the brake indicator ON and OFF as a backup to notify the vehicle operator.

For proper diagnosis of the antilock brake system, the CAB, the EMIC, the CAN data bus or the electronic communication related to ABS indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

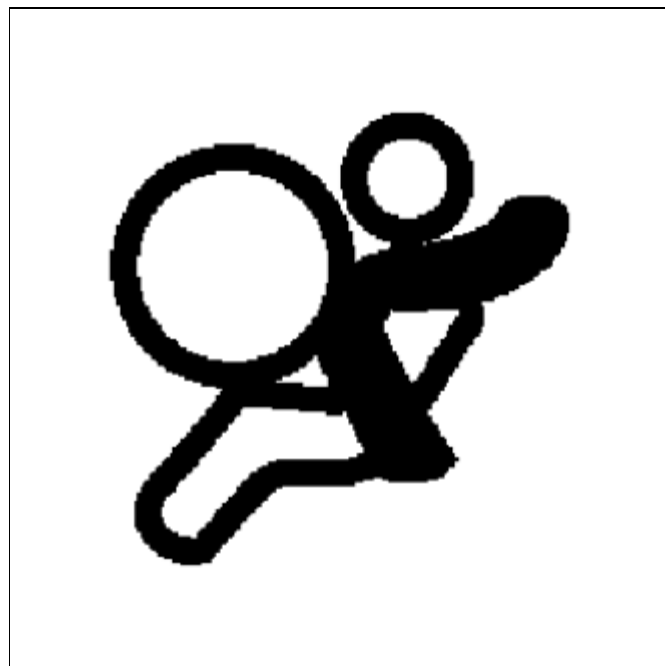
AIRBAG INDICATOR

DESCRIPTION

An airbag indicator is standard equipment on all instrument clusters. However, the instrument cluster can be programmed to disable this indicator on vehicles that are not equipped with the airbag system, which is not available in some markets. This indicator is located near the top of the cluster overlay, between the speedometer and tachometer.

The airbag indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Airbag** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The airbag indicator is serviced as a unit with the instrument cluster.



OPERATION

The airbag indicator gives an indication to the vehicle operator when the airbag system, or a circuit or component of the system is ineffective. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Occupant Restraint Controller (ORC) over the Controller Area Network (CAN) data bus.

The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the airbag indicator for the following reasons:

Bulb Test - Each time the ignition switch is turned to the ON position the airbag indicator is illuminated for about six to eight seconds. The entire bulb test is a function of the ORC.

- **Airbag Indicator Lamp-On Message** - Each time the cluster receives an electronic **airbag indicator lamp-ON** message from the ORC, the airbag indicator will be illuminated. The indicator remains illuminated for about 12 seconds or until the cluster receives a lamp-OFF message from the ORC, whichever is longer. This indicator will also be extinguished when the ignition switch is turned to the OFF position.
- **Communication Error** - If the cluster receives no lamp-ON or lamp-OFF messages from the ORC for 10 consecutive message cycles, the airbag indicator is illuminated. The indicator remains illuminated until the cluster receives a single lamp-OFF message from the ORC.
- **Actuator Test** - Each time the cluster is put through the actuator test, the airbag indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the airbag indicator is a function of the instrument cluster.

The ORC continually monitors the airbag system circuits and sensors to decide whether the system is in good operating condition. The ORC then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the ORC sends a lamp-ON message after the bulb test, it indicates that the ORC has detected a system malfunction or that the airbags and seat belt tensioners may not deploy when required, or may deploy when not required. The ORC will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the airbag indicator fails to illuminate due to an open or short in the cluster airbag indicator circuit, the cluster sends a message notifying the ORC of the condition, then the instrument cluster and the ORC will each store a DTC.

For proper diagnosis of the airbag system, the ORC, the EMIC, the CAN data bus or the electronic communication related to airbag indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

AJAR INDICATORS

DESCRIPTION

Door and swing gate ajar indicators are standard equipment on all instrument clusters. The ajar indications appear within the fixed segment odometer Vacuum-Fluorescent Display (VFD) unit. The odometer VFD ajar indicators are textual messages that appears in place of the odometer/trip odometer information.

The odometer VFD unit is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located at the base of the cluster overlay tachometer dial face. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The ajar indicator textual messages appear in the same blue-green color and at the same lighting level as the other information displayed in the odometer VFD when they are illuminated by the instrument cluster electronic circuit board.

The ajar indicators are serviced as a unit with the odometer VFD unit in the instrument cluster.

OPERATION

The ajar indicators give an indication to the vehicle operator that one or more of the passenger compartment doors or the swing gate may be open or not completely latched. These indicators are controlled by the instrument cluster logic circuit based upon cluster programming and electronic **ajar switch status** messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The ajar indicator function of the odometer Vacuum-Fluorescent Display (VFD) unit is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the VFD ajar indications can occur regardless of the ignition switch position. The instrument cluster will turn ON the ajar indicator for the following reasons:

- **Ajar Switch Message Input** - Each time the cluster receives a door or swing gate ajar switch status message indicating that a door, the swing gate or any combination of these is open or not completely latched with the ignition switch in any position, the appropriate ajar textual message will be illuminated. If the cluster detects a vehicle speed input greater than zero (kilometers or miles-per-hour) while the ignition switch is in the ON or START positions, the ajar indication will be accompanied by a single chime tone. When the ignition switch is in any position except ON or START, any and all ajar indications will time out after about five minutes.

The TIPM continually monitors the door and swing gate ajar switches to determine the status of the doors and swing gate. The TIPM then sends the proper ajar switch status messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). The door and swing gate ajar switches and their circuits may be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

BRAKE/PARK BRAKE INDICATOR

DESCRIPTION

A brake indicator is standard equipment on all instrument clusters. This indicator is located near the top of the cluster overlay, between the speedometer and tachometer.

The brake indicator consists of a stencil-like cutout in the opaque layer of the instrument cluster overlay. The word **BRAKE** is cutout for vehicles manufactured for sale in the U.S. market, or the International Control and Display Symbol icon for **Brake Failure** is cutout for vehicles manufactured for all other markets. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The brake indicator is serviced as a unit with the instrument cluster.



OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, when there are certain brake hydraulic system malfunctions as indicated by a low brake hydraulic fluid level condition, or when

the brake fluid level switch is disconnected. The brake indicator can also give an indication when certain faults are detected in the Antilock Brake System (ABS). This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus, and a hard wired input from the park brake switch.

The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the brake indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **Brake Indicator Lamp-On Message** - Each time the cluster receives an electronic **brake indicator lamp-ON** message from the CAB, the brake indicator will be illuminated. The CAB may also send lamp-ON messages as feedback during ABS diagnostic procedures. The indicator remains illuminated until the cluster receives a lamp-OFF message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Park Brake Switch Input** - Each time the cluster detects ground on the park brake switch sense circuit (park brake switch closed = park brake applied or not fully released) while the ignition switch is in the ON position, the brake indicator flashes ON and OFF. The indicator continues to flash until the park brake switch sense input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Antilock Brake System (ABS) Indicator Backup** - If the instrument cluster detects a fault in the ABS indicator circuit it will send a message indicating the fault to the Controller Antilock Brake (CAB), then flash the brake indicator ON and OFF. The cluster will continue to flash the brake indicator until the ABS indicator circuit fault is resolved, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the brake indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The park brake switch on the park brake lever mechanism provides a hard wired ground input to the instrument cluster circuitry through the park brake switch sense circuit whenever the park brake is applied or not fully released. The Totally Integrated Power Module (TIPM) monitors the brake fluid level switch on the brake master cylinder reservoir, then sends the appropriate electronic messages to the CAB. The CAB continually monitors the ABS system circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the CAB sends a lamp-ON message after the bulb test, it indicates that the CAB has detected a brake hydraulic system malfunction or that the ABS system has become ineffective. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects.

The hard wired park brake switch input to the EMIC may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. For proper diagnosis of the brake fluid level switch, the ABS, the CAB, the EMIC, the TIPM, the CAN data bus or the electronic communication related to brake indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

BRAKE INDICATOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired park brake switch input to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the Controller Antilock Brake (CAB), the Totally Integrated Power Module (TIPM), the Controller Area Network (CAN) data bus, or the electronic message inputs also used by the EMIC to provide brake indicator operation. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAB, the TIPM, the CAN data bus or the electronic communication related to brake indicator operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

CHANGE OIL INDICATOR

DESCRIPTION

A change oil indicator is standard equipment on all instrument clusters. However, on vehicles manufactured for export markets except those equipped with a 2.8 liter diesel engine and an optional diesel particulate filter, this indicator is electronically disabled. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. The change oil indicator consists of cycling textual **CHAngE** and **OIL** messages which appear in place of the odometer/trip odometer information in the odometer VFD unit.

The odometer VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The change oil textual messages appear in the same blue-green color and at the same lighting level as the odometer information when they are illuminated by the instrument cluster electronic circuit board.

The change oil indicator is serviced as a unit with the VFD in the instrument cluster.

OPERATION

The change oil indicator gives an indication to the vehicle operator when a duty-cycle algorithm contained within the software of the Powertrain Control Module (PCM) determines that a recommended oil change interval has been attained. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received over the Controller Area Network (CAN) data bus from the PCM.

The change oil indicator function of the Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD change oil indication will always be OFF when the ignition switch is in any position except ON or START. The instrument cluster will turn ON the change oil indicator for the following reasons:

Change Oil Indicator Lamp-On Message - Each time the ignition switch is turned to the ON position and the cluster receives an electronic **change oil indicator lamp-ON** message from the PCM indicating that a duty-cycle based recommended oil change interval has been attained, the change oil indicator will be illuminated for about three seconds, until the trip odometer reset switch button is depressed, or until the ignition switch is turned to the OFF position, whichever occurs first.

- **Change Oil Indicator Reset Procedure** - Once an engine oil change has been completed, the PCM duty cycle counters can be reset using the following procedure. Turn the ignition switch to the ON position, but DO NOT start the engine. Slowly depress and release the accelerator pedal fully three times within ten seconds. Turn the ignition switch to the OFF position. If the change oil indicator illuminates the next time the engine is started, repeat this procedure.

The PCM continually monitors numerous sensor inputs to determine the duty-cycles to which the engine is being subjected. A pre-programmed algorithm within the PCM then determines when to send the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

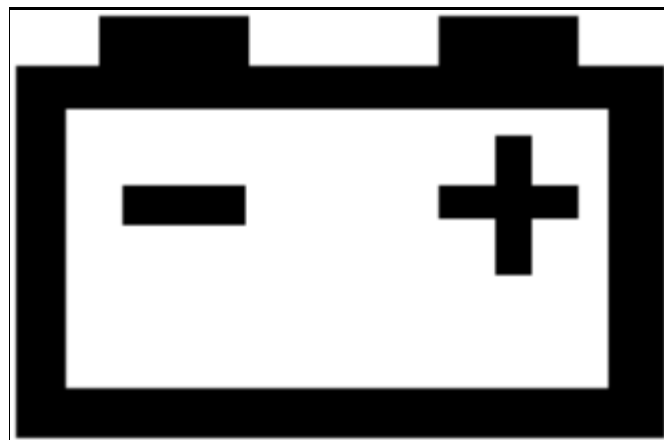
For proper diagnosis of the change oil indicator, the PCM, the EMIC, the CAN data bus or the electronic communication related to change oil indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

CHARGING INDICATOR

DESCRIPTION

A charging indicator is standard equipment on all instrument clusters. This indicator is located above the fuel gauge on the cluster overlay, to the left of speedometer.

The charging indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Battery Charging Condition** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The charging indicator is serviced as a unit with the instrument cluster.

OPERATION

The charging indicator gives an indication to the vehicle operator when the electrical system voltage is too low or too high. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The charging indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic

circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the charging indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the charging indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **Voltage Low Message** - Each time the cluster receives an electronic **system voltage** message from the PCM indicating the voltage is low (less than about 11.5 volts is a charge fail condition), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the voltage is normal (greater than about 12.0 volts, but less than 16.0 volts), or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Voltage High Message** - Each time the cluster receives an electronic **system voltage** message from the PCM indicating the voltage is high (greater than about 16.0 volts), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the voltage is normal (less than about 15.5 volts, but greater than 11.5 volts), or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the charging indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the electrical system voltage to control the generator output. The PCM then sends the proper messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the instrument cluster turns ON the charging indicator due to a charge fail or voltage high condition, it may indicate that the charging system requires service.

For proper diagnosis of the charging system, the PCM, the EMIC, the CAN data bus or the electronic communication related to charging indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

CRUISE INDICATOR

DESCRIPTION

A cruise indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional speed control system, this indicator is electronically disabled. This indicator is located within the odometer Vacuum Fluorescent Display (VFD) unit.

The cruise indicator consists of the text **CRUISE** in the VFD display. The odometer VFD unit is soldered onto the instrument cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The cruise indicator text appears in a blue-green color and at the same lighting level as the odometer information when it is illuminated by the instrument cluster electronic circuit board.



CRUISE

During daylight hours (exterior lamps are OFF) the odometer VFD unit is illuminated at full brightness for clear visibility. At night (exterior lamps are ON), the VFD lighting level is adjusted with the other cluster illumination lamps using the panel lamps dimmer function of the interior lighting control sleeve on the left multi-function switch control stalk. However, a PARADE mode position of the control sleeve allows the VFD unit to be illuminated at full brightness if the exterior lamps are turned ON during daylight hours.

The cruise indicator is serviced as a unit with the odometer VFD unit in the instrument cluster.

OPERATION

The cruise indicator gives an indication to the vehicle operator when the speed control system is ON, regardless of whether the speed control is engaged. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The cruise indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be OFF when the ignition switch is in any position except ON or START. The indicator only illuminates when it is energized by the instrument cluster logic circuit. The instrument cluster will turn ON the cruise indicator for the following reasons:

- **Cruise Indicator Lamp-On Message** - Each time the cluster receives an electronic **cruise indicator lamp-ON** message from the PCM indicating the speed control system is ON, the cruise indicator is illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the PCM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the cruise indicator will be turned ON, then OFF again during the Vacuum Fluorescent Display (VFD) portion of the test in order to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the speed control switches to determine the appropriate outputs to the speed control servo. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the speed control system, the PCM, the EMIC, the CAN data bus or the electronic communication related to cruise indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE GAUGE

DESCRIPTION

An engine coolant temperature gauge is standard equipment on all instrument clusters. This gauge is located on the right side of the instrument cluster, just right and below the tachometer. The gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree gauge scale on the cluster overlay that reads left-to-right from **C** (or Cold) to **H** (or Hot). An International Control and Display Symbol icon for **Engine**

Coolant Temperature is located on the cluster overlay, directly above the hub of the gauge needle.

The engine coolant temperature gauge graphics are white and gray against a black field except for a single red graduation at the high end of the gauge scale, making them clearly visible within the instrument cluster in daylight.

When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned ON, the white and gray text and graphics still appear white or gray and the red graphics still appear red. The red gauge needle has internal optical illumination. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board.



The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The engine coolant temperature gauge is driven by an electronic stepper motor unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the ON or START positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the OFF position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Message** - Each time the cluster receives an electronic **engine temperature** message from the PCM indicating the temperature is between the low end of normal [about 41 °C (105 °F) for gasoline engines, or about 28 °C (82 °F) for diesel engines] and the high end of normal [about 124 °C (255 °F) for gasoline engines, or about 118 °C (244 °F) for diesel engines], the gauge needle is moved to the actual relative temperature position on the gauge scale.
- **Engine Temperature Low Message** - Each time the cluster receives an electronic **engine temperature** message from the PCM indicating the temperature is low [at or below about 40 °C (104 °F) for gasoline engines, or about 27 °C (81 °F) for diesel engines], the gauge needle is held below the graduation on the far left end of the gauge scale. The gauge needle remains below the low end of the gauge scale until the cluster receives a message from the PCM indicating that the temperature is above the low end of normal, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Engine Temperature High or Critical Message** - Each time the cluster receives an electronic **engine temperature** message from the PCM indicating the temperature is high [at or above about 127 °C (261 °F) for gasoline engines, or about 118 °C (244 °F) for diesel engines], the gauge needle is moved to the red graduation at the high end of the gauge scale, the engine temperature indicator is illuminated and a single chime tone is sounded. The gauge needle remains at the red graduation and the engine temperature indicator remains illuminated until the cluster receives a message from the PCM indicating that the

temperature is below about 124 °C (255 °F) for gasoline engines, or about 115 °C (239 °F) for diesel engines, or until the ignition switch is turned to the OFF position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the engine temperature indicator is cycled OFF and then ON again by the appropriate messages from the PCM.

- **Communication Error** - If the cluster fails to receive an **engine temperature** message, it will hold the gauge needle at the last indication for about five seconds or until the ignition switch is turned to the OFF position, whichever occurs first. After five seconds, the cluster will move the gauge needle to the low end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the engine coolant temperature gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the instrument cluster turns ON the engine temperature indicator due to a high or critical engine coolant temperature gauge reading, it may indicate that the engine or the engine cooling system requires service.

For proper diagnosis of the engine coolant temperature sensor, the PCM, the EMIC, the CAN data bus or the electronic communication related to engine coolant temperature gauge operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE INDICATOR

DESCRIPTION

An engine temperature indicator is standard equipment on all instrument clusters. The engine temperature indicator is located above the engine coolant temperature gauge in the cluster overlay, to the right of the tachometer.

The engine temperature indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Engine Coolant Temperature** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The engine temperature indicator is serviced as a unit with the instrument cluster.

OPERATION

The engine temperature indicator gives an indication to the vehicle operator when the engine temperature gauge reading reflects a condition requiring immediate attention. This indicator is controlled by a transistor on the

instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The engine temperature indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the engine temperature indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the engine temperature indicator is illuminated for about two seconds as a bulb test. The entire bulb test is a function of the PCM.
- **Engine Temperature High or Critical Message** - Each time the cluster receives an electronic **engine temperature** message from the PCM indicating the temperature is high [at or above about 127 °C (261 °F) for gasoline engines, or about 118 °C (244 °F) for diesel engines], the engine temperature indicator will be illuminated and a single chime tone is sounded. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the temperature is below about 124 °C (255 °F) for gasoline engines, or about 115 °C (239 °F) for diesel engines, or until the ignition switch is turned to the OFF position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the engine temperature indicator is cycled OFF, then ON again by the appropriate messages from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the engine temperature indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). For further diagnosis of the engine temperature indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns ON the engine temperature indicator due to a high engine temperature gauge reading, it may indicate that the engine or the engine cooling system requires service.

For proper diagnosis of the engine coolant temperature sensor, the PCM, the EMIC, the CAN data bus or the electronic communication related to engine temperature indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ELECTRONIC STABILITY PROGRAM/BRAKE ASSIST SYSTEM INDICATOR

DESCRIPTION

An Electronic Stability Program (ESP)/Brake Assist System (BAS) indicator is standard equipment on all instrument clusters. This indicator is located near the bottom of the cluster overlay, between the speedometer and the tachometer.

The ESP/BAS indicator consists of a stencil-like cutout of the text **ESP BAS** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents

the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The ESP/BAS indicator is serviced as a unit with the instrument cluster.



OPERATION

The ESP/BAS indicator gives an indication to the vehicle operator when the Electronic Stability Program (ESP)/Brake Assist System (BAS) has been activated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) and the All-Wheel Drive Control Module (AWDCM) over the Controller Area Network (CAN) data bus.

The ESP/BAS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the ESP/BAS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the ESP/BAS indicator is illuminated for about four seconds as a bulb test.
- **ESP/BAS Indicator Lamp-On Message** - Each time the cluster receives an electronic **ESP/BAS indicator lamp-ON** message from the CAB indicating that the ESP/BAS system has been activated, the ESP/BAS indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **ESP Full Off Textual Message** - Each time the cluster receives an electronic **ESP Full OFF indicator lamp-ON** message from the CAB indicating that the ESP/BAS system has been manually disabled, an **ESP Full OFF** textual message will appear within the cluster odometer display. The **ESP Full OFF** textual message remains displayed until the cluster receives a lamp-OFF message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **ESP Permanent Disable Textual Message** - Each time the cluster receives an electronic **ESP Permanent Disable** message from the CAB indicating that the ESP/BAS system has been permanently disabled, an **ESP OFF** textual message will appear within the cluster odometer display for about 10 seconds each time the ignition switch is turned to the ON position.
- **Actuator Test** - Each time the cluster is put through the actuator test, the ESP/BAS indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The CAB continually monitors the ESP/BAS circuits and sensors to decide whether the system is in good operating condition and the proper outputs to the components of the system. The CAB then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

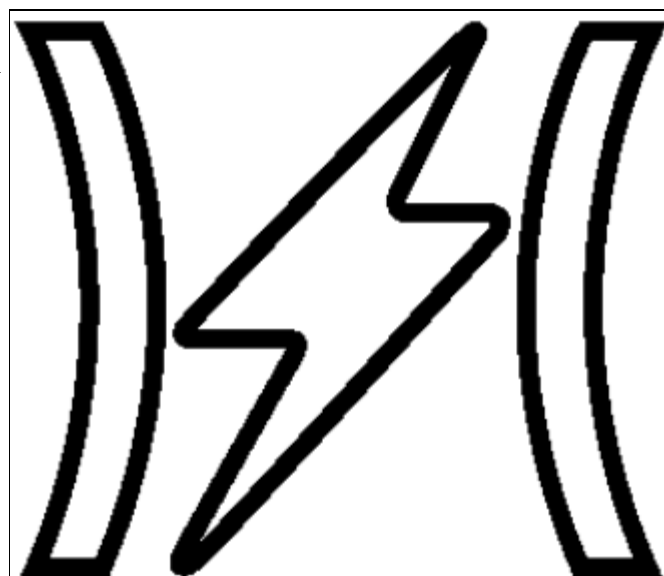
For proper diagnosis of the ESP/BAS system, the CAB, the AWDCM, the EMIC, the CAN data bus or the electronic communication related to the ESP/BAS indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ETC INDICATOR

DESCRIPTION

An Electronic Throttle Control (ETC) indicator is standard equipment on all instrument clusters. This indicator is located near the bottom of the cluster overlay, between the speedometer and the tachometer.

The ETC indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Electronic Throttle Control** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The ETC indicator is serviced as a unit with the instrument cluster.

OPERATION

The Electronic Throttle Control (ETC) indicator gives an indication to the vehicle operator when the ETC system, or a circuit or component of the system is ineffective. The ETC indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The ETC indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the ETC indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the ETC indicator is illuminated for about three seconds. The entire bulb test is a function of the instrument cluster.
- **ETC Indicator Lamp-On Message** - Each time the cluster receives an electronic **ETC indicator lamp-**

ON message from the PCM, the ETC indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the PCM message. The indicator remains illuminated solid or continues to flash for about 12 seconds or until the cluster receives a lamp-OFF message from the PCM, whichever is longer. If the indicator is illuminated solid with the engine running the vehicle will usually remain drivable. If the indicator is flashing with the engine running the vehicle may require towing. A flashing indicator means the ETC system requires immediate service. The indicator will be extinguished when the ignition switch is turned to the OFF position.

- **Actuator Test** - Each time the cluster is put through the actuator test, the ETC indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the ETC indicator is a function of the PCM.

The PCM continually monitors the ETC system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the PCM sends a lamp-ON message after the bulb test, it indicates that the PCM has detected an ETC system malfunction or that the ETC system is ineffective. The PCM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ETC indicator fails to illuminate due to an open or short in the cluster ETC indicator circuit, the cluster sends a message notifying the PCM of the condition, then the EMIC and the PCM will each store a DTC.

For proper diagnosis of the ETC system, the PCM, the EMIC, the CAN data bus or the electronic communication related to ETC indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FOUR-WHEEL DRIVE INDICATOR

DESCRIPTION

A four-wheel drive indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional four-wheel drive system, this indicator is electronically disabled. For domestic market vehicles, this indicator is located within the odometer Vacuum Fluorescent Display (VFD) unit. For export market vehicles, this indicator is located on the right side of the cluster overlay near the top, above the engine coolant temperature gauge.

The domestic four-wheel drive indicator consists of the text **4WD** in the VFD display. The odometer VFD unit is soldered onto the instrument cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The four-wheel drive indicator text appears in an amber color and at the same lighting level as the other odometer VFD information when it is illuminated by the cluster electronic circuit board.



During daylight hours (exterior lamps are OFF) the VFD unit is illuminated at full brightness for clear visibility. At night (exterior lamps are ON), the VFD unit lighting level is adjusted with the other cluster general

illumination lamps using the panel lamps dimmer function of the interior lighting control sleeve on the left multi-function switch control stalk. However, a PARADE mode position of the control sleeve allows the VFD unit to be illuminated at full brightness if the exterior lamps are turned ON during daylight hours.

The export four-wheel drive indicator consists of a stencil-like cutout of the text **4WD** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The four-wheel drive indicator is serviced as a unit with the instrument cluster.

OPERATION

The four-wheel drive indicator gives an indication to the vehicle operator when a four-wheel drive (4WD) mode of the transfer case is selected. This indicator is controlled either by the instrument cluster circuit board (domestic market vehicles) or by a transistor on the circuit board (export market vehicles) based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The four-wheel drive indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be OFF when the ignition switch is in any position except ON or START. The indicator only illuminates when it is energized by the instrument cluster logic circuit. The instrument cluster will turn ON the four-wheel drive indicator for the following reasons:

- **Four-Wheel Drive Indicator Lamp-On Message** - Each time the cluster receives an electronic **four-wheel drive indicator lamp-ON** message from the TIPM indicating that a four-wheel drive mode is selected, the four-wheel drive indicator is illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the four-wheel drive indicator will be turned ON, then OFF again during the Vacuum Fluorescent Display (VFD) portion (domestic market vehicles) or the Light Emitting Diode (LED) portion (export market vehicles) of the test in order to confirm the functionality of the VFD or LED and the cluster control circuitry.

The TIPM continually monitors inputs from the four-wheel drive switch to determine the status of the transfer case. The TIPM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the four-wheel drive switch, the EMIC, the TIPM, the CAN data bus or the electronic communication related to four-wheel drive indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FRONT AXLE LOCK INDICATOR

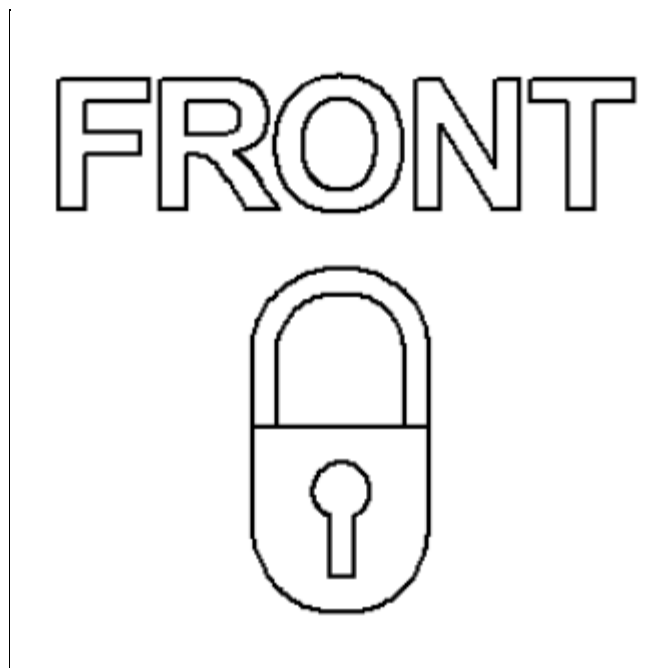
DESCRIPTION

A front axle lock indicator is standard equipment on all

instrument clusters. However, on vehicles not equipped with the optional off-road package, this indicator is electronically disabled. This indicator is located near the top of the cluster overlay, between the speedometer and tachometer.

The front axle lock indicator consists of a stencil-like cutout of the word **FRONT** above the International Control and Display Symbol icon for **Lock** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The front axle lock indicator is serviced as a unit with the instrument cluster.



OPERATION

The front axle lock indicator gives an indication to the vehicle operator when the locking mechanism in the front axle of vehicles equipped with the optional off-road package is engaged. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus

The front axle lock indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the front axle lock indicator for the following reasons:

- **Front Axle Lock Indicator Lamp-On Message** - Each time the cluster receives an electronic **front axle lock lamp-ON** message from the TIPM, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the front axle lock indicator will be turned ON, then OFF again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The TIPM continually monitors an input from the front axle lock solenoid to determine the status of the front axle lock mechanism. The TIPM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the front axle lock system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to front axle lock indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FRONT FOG LAMP INDICATOR

DESCRIPTION

A front fog lamp indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional front fog lamps, this indicator is electronically disabled. This indicator is located on the left side of the cluster overlay, above the fuel gauge and just left of the speedometer.

The front fog lamp indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Front Fog Light** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in green through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The front fog lamp indicator is serviced as a unit with the instrument cluster.

OPERATION

The front fog lamp indicator gives an indication to the vehicle operator whenever the front fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The front fog lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the front fog lamp indicator for the following reasons:

- **Front Fog Indicator Lamp-On Message** - Each time the cluster receives an electronic **front fog indicator lamp-ON** message from the TIPM indicating the front fog lamps are turned ON, the front fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the exterior lamp load shedding (battery saver) timed interval expires, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the front fog lamp indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The TIPM continually monitors electronic **exterior lighting request** messages from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) to determine the appropriate outputs to the front fog lamps. The TIPM activates or deactivates the front fog lamps then sends the proper lamp-ON or lamp-OFF message back to the EMIC.

For proper diagnosis of the front fog lamp system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to front fog lamp indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FRONT SWAY BAR INDICATOR

DESCRIPTION

A front sway bar disconnect indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional off-road package, this indicator is electronically disabled. This indicator is located near the bottom of the cluster overlay, between the speedometer and tachometer.

The front sway bar disconnect indicator consists of a stencil-like cutout of the words **SWAY BAR** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The front sway bar disconnect indicator is serviced as a unit with the instrument cluster.



OPERATION

The front sway bar disconnect indicator gives an indication to the vehicle operator when the locking mechanism of the front sway bar of vehicles equipped with the optional off-road package is disengaged. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The front sway bar disconnect indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the front sway bar disconnect indicator for the following reasons:

- **Front Sway Bar Disconnect Indicator Lamp-On Message** - Each time the cluster receives an electronic **front sway bar disconnect lamp-ON** message from the TIPM, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the front sway bar disconnect

indicator will be turned ON, then OFF again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

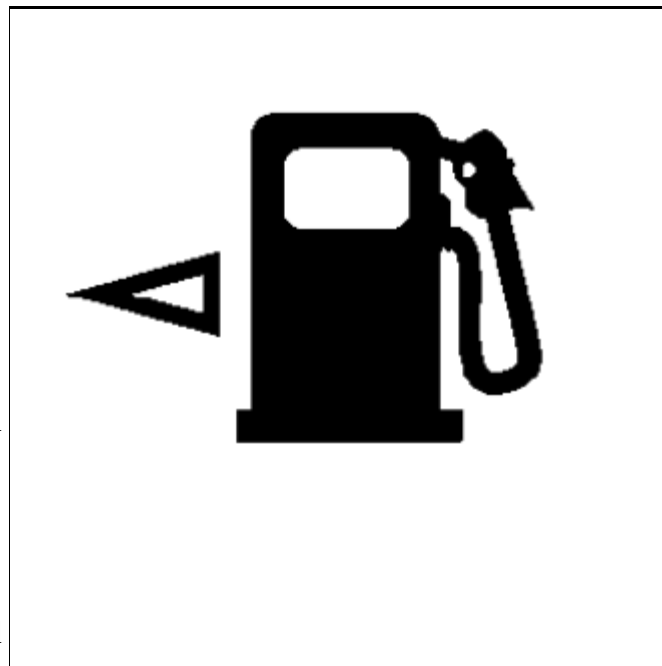
The TIPM continually monitors an input from the front sway bar disconnect solenoid to determine the status of the front sway bar disconnect mechanism. The TIPM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the front sway bar disconnect system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to front sway bar disconnect indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

FUEL GAUGE

DESCRIPTION

A fuel gauge is standard equipment on all instrument clusters. This gauge is located on the left side of the instrument cluster, just left and below the speedometer. The gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree gauge scale on the cluster overlay that reads left-to-right from **E** (or Empty) to **F** (or Full). An International Control and Display Symbol icon for **Fuel** is located on the cluster overlay, directly above the hub of the gauge needle. An arrowhead pointed to the left side of the vehicle is imprinted on the cluster overlay next to the **Fuel** icon on the gauge to provide the driver with a reminder as to the location of the fuel filler access.



The fuel gauge graphics are white and gray against a black field except for a single red graduation at the low end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned ON, the white and gray text and graphics still appear white or gray and the red graphics still appear red. The red gauge needle has internal optical illumination. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board.

The fuel gauge is serviced as a unit with the instrument cluster.

OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic **fuel level** messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The fuel gauge is driven by an electronic stepper motor unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition

switch is in the ON or START positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the OFF position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Fuel Level Message** - The TIPM provides a constant current source to the fuel level sending unit and monitors a return input on a fuel level sense circuit. The resistance through the fuel level sending unit increases as the fuel level rises and decreases as the fuel level falls causing changes in the fuel level sense input voltage. The TIPM then sends the appropriate electronic **fuel level** messages to the cluster. The cluster programming applies an algorithm to calculate the proper fuel gauge needle position based upon the fuel level message input, then moves the gauge needle to the proper relative position on the gauge scale. This algorithm is used to dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs from the fuel tank sending unit to the TIPM.
- **Less Than 11 Percent Tank Full Message** - Each time the fuel level message to the cluster indicates the fuel tank is about 11 percent full or less for 10 consecutive seconds and the vehicle speed is zero, or for 60 consecutive seconds and the vehicle speed is greater than zero, the gauge needle is moved to about the one-sixteenth graduation on the gauge scale, the low fuel indicator is illuminated, and a single chime tone is sounded. The low fuel indicator remains illuminated until the fuel level message indicates that the fuel tank is greater than about 14 percent full for 10 consecutive seconds and the vehicle speed is zero, or for 60 consecutive seconds and the vehicle speed is greater than zero, or until the ignition switch is turned to the OFF position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the low fuel indicator is cycled OFF and then ON again by the appropriate messages from the TIPM.
- **Less Than Empty Stop Message** - Each time the cluster receives a fuel level message indicating the fuel level in the fuel tank is less than the **E** (or Empty) gauge needle stop position for five consecutive seconds, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the TIPM is a short circuit.
- **More Than Full Stop Message** - Each time the cluster receives a fuel level message indicating the fuel level in the fuel tank is more than the **F** (or Full) gauge needle stop position for five consecutive seconds, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the TIPM is an open circuit.
- **Actuator Test** - Each time the cluster is put through the actuator test, the fuel gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The TIPM continually monitors the fuel tank sending unit to determine the level of fuel in the fuel tank. The TIPM then sends the proper electronic **fuel level** message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. The TIPM will store a Diagnostic Trouble Code (DTC) for any fault detected in the fuel level sense circuit.

For proper diagnosis of the fuel tank sending unit, the TIPM, the EMIC, the CAN data bus or the electronic communication related to fuel gauge operation or fuel level data processing a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

GAS CAP INDICATOR

DESCRIPTION

A gas cap indicator is standard equipment on all instrument clusters. However, on vehicles equipped with the optional diesel engine, as well as those manufactured for the Chinese market, this indicator is electronically disabled. The gas cap indication appears within the odometer Vacuum Fluorescent Display (VFD) unit. The gas cap indicator consists of a textual **gascap** message which appears in place of the odometer information in the odometer display.

The odometer VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The gas cap textual message appears in the same blue-green color and at the same lighting level as the odometer information when it is illuminated by the instrument cluster electronic circuit board.

The gas cap indicator is serviced as a unit with the VFD in the instrument cluster.

OPERATION

The gas cap indicator gives an indication to the vehicle operator when there is a gross leak detected in the on-board fuel vapor recovery system. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received over the Controller Area Network (CAN) data bus from the Powertrain Control Module (PCM).

The gas cap indicator function of the odometer Vacuum Fluorescent Display (VFD) unit is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the odometer VFD gas cap indication will always be OFF when the ignition switch is in any position except ON or START. The instrument cluster will turn ON the gas cap indicator for the following reasons:

- **Gas Cap Indicator Lamp-On Message** - Each time the cluster receives an electronic **gas cap indicator lamp-ON** message from the PCM indicating there is a gross leak in the vapor recovery system, the gas cap indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the PCM, or until the ignition switch is turned to the OFF position, whichever occurs first.

The PCM continually monitors the on board vapor recovery system to determine whether there are air leaks in the system. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the EMIC turns ON the gas cap indicator due to a monitored gross leak in the vapor recovery system, it may indicate that the gas cap has been removed or is improperly installed.

For proper diagnosis of the on board vapor recovery system, the PCM, the EMIC, the CAN data bus or the electronic communication related to gas cap indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

GEAR SELECTOR INDICATOR

DESCRIPTION

An electronic automatic transmission gear selector indicator is standard factory-installed equipment on this vehicle. However, on vehicles not equipped with an optional automatic transmission, this indicator is electronically disabled. The gear selector indicator information is displayed in the upper portion of the odometer Vacuum Fluorescent Display (VFD) unit. This VFD unit is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge

of the tachometer dial face of the cluster overlay. The dark lens over the VFD unit prevents the indicator from being clearly visible when it is not illuminated.

The gear selector indicator displays the following characters from left to right: **P**, **R**, **N**, **D** and a fifth, reconfigurable character. The reconfigurable character can be any number **1** through **6**. Each character appears in a blue-green color and at the same lighting level as the odometer information.

Respectively, these characters represent the PARK, REVERSE, NEUTRAL, DRIVE and each of the forward drive gear positions of the transmission gear selector lever on the floor panel transmission tunnel. The indicator also illuminates a box around the character that represents the currently selected lever position.



During daylight hours (exterior lamps are OFF) the VFD unit is illuminated at full brightness for clear visibility. At night (exterior lamps are ON), the VFD unit lighting level is adjusted with the other cluster general illumination lamps using the panel lamps dimmer function of the interior lighting control sleeve on the left multi-function switch control stalk. However, a PARADE mode position of the control sleeve allows the VFD unit to be illuminated at full brightness if the exterior lamps are turned ON during daylight hours.

The gear selector indicator is serviced as a unit with the VFD unit in the instrument cluster.

OPERATION

The electronic gear selector indicator gives an indication to the vehicle operator of the transmission gear that has been selected with the automatic transmission gear selector lever. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The gear selector indicator information is displayed by the odometer Vacuum Fluorescent Display (VFD) unit soldered onto the instrument cluster electronic circuit board, and the VFD will not display the gear selector indicator information after the ignition switch is turned to the OFF position. Each time the cluster is disconnected from battery current for more than about five minutes, it must configure itself for the automatic transmission type that is in the vehicle once it is reconnected to battery current. The instrument cluster circuitry operates the gear selector indicator to provide the following features:

- **Selected Gear Message** - Each time the cluster receives an electronic **selected gear** message from the PCM, a box will be illuminated around the appropriate character in the gear selector indicator. The box will remain illuminated until the cluster receives a different **selected gear** message, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a **selected gear** message from the PCM within three seconds, the instrument cluster circuitry will display all gear selector positions boxed (selected) until a valid **selected gear** message is received or until the ignition switch is turned to the OFF position, whichever occurs first.

Actuator Test - Each time the cluster is put through the actuator test, the odometer VFD unit will display all of its characters at once to confirm the functionality of the VFD unit and the cluster control circuitry.

The PCM continually monitors a hard wired multiplex input from the Transmission Range Sensor (TRS), then sends the proper message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the TRS, the PCM, the EMIC, the CAN data bus or the electronic communication related to gear selector indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

HIGH BEAM INDICATOR

DESCRIPTION

A high beam indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the cluster overlay, between the speedometer and the tachometer.

The high beam indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **High Beam** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A blue Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in blue through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The high beam indicator is serviced as a unit with the instrument cluster.

OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The high beam indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the high beam indicator for the following reasons:

- **High Beam Indicator Lamp-On Message** - Each time the cluster receives an electronic **high beam indicator lamp-ON** message from the TIPM indicating the high beam lamps are turned ON, the high beam indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the exterior lamp load shedding (battery saver) timed interval

expires, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the high beam indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

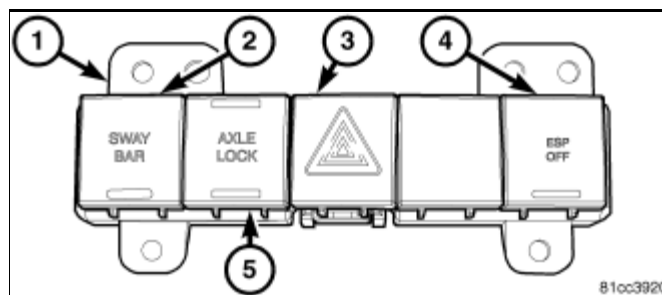
The TIPM continually monitors electronic **exterior lighting request** messages from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) to determine the appropriate outputs to the headlamps. The TIPM activates or deactivates the headlamp high beams then sends the proper lamp-ON or lamp-OFF message back to the EMIC.

For proper diagnosis of the headlamp system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to high beam indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

INSTRUMENT PANEL SWITCH POD

DESCRIPTION

The instrument panel switch pod (1) is located just below the heater and air conditioner controls in the center stack area of the instrument panel. This switch is available in multiple configurations, which varies from two single push button switches to as many as five push button switches, depending upon the optional equipment in the vehicle. The pod may include the following switches:



- **Axle Locker Switch (5)**
- **Electronic Stability Program (ESP) Switch (4)**
- **Front Sway Bar Disconnect Switch (2)**
- **Hazard Warning Switch (3)**
- **Headlamp Leveling Switch (Not Shown)**

The switch housing and the push buttons are constructed of molded plastic. Each push button has a smooth finish and is clearly identified with the appropriate text and International Control and Display Symbol icons. Several of the push buttons feature Light Emitting Diode (LED) units to give the vehicle operator an indication when the function of that switch is currently active. Only the hazard warning switch push button latches, while the remaining switches feature momentary operation.

Four screws secure the switch to the back of the instrument panel center bezel through integral mounting tabs that are molded into each corner of the switch housing. The back of the switch housing has an integral connector receptacle containing terminal pins that connect the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

Panel lamps dimmer controlled illumination lamps integral to the circuit board within the switch provide back lighting for visibility at night, but these lamps are not serviceable. The individual switches in the lower instrument panel switch pod cannot be repaired and are not serviced separately. If any component within the switch pod is ineffective or damaged, the entire switch pod unit must be replaced.

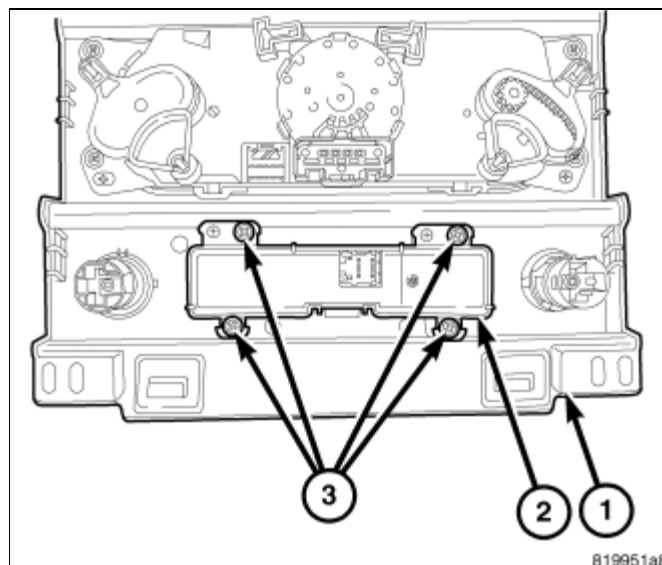
OPERATION

For information covering details of operation for the individual switches contained within the instrument panel switch pod, refer to the specific service information covering the system to which that switch belongs.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Disconnect the wire harness connector from the back of the instrument panel switch pod (2).
4. Remove the four screws (3) that secure the switch pod to the back of the center bezel.
5. Remove the switch pod from the center bezel.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: There are several different instrument panel switch pods available, depending upon the optional equipment content of the vehicle. Be certain that a replacement switch pod matches the optional equipment of the vehicle into which it is being installed.

1. Position the instrument panel switch pod (2) to the back of the center bezel (1).
2. Install and tighten the four screws (3) that secure the switch pod to the center bezel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Reconnect the wire harness connector to the back of the switch pod.
4. Reinstall the center bezel onto the instrument panel. (Refer

to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

5. Reconnect the battery negative cable.

LOW FUEL INDICATOR

DESCRIPTION

A low fuel indicator is standard equipment on all instrument clusters. This indicator is located above the fuel gauge on the cluster overlay, to the left of the speedometer.

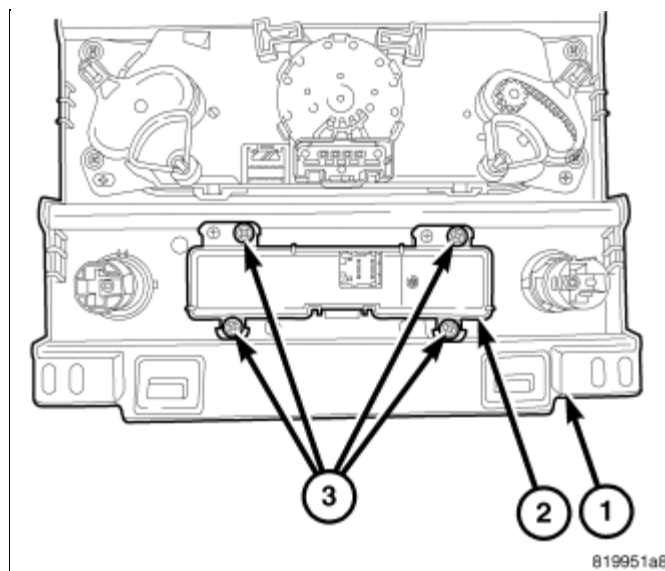
The low fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Fuel** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The low fuel indicator is serviced as a unit with the instrument cluster.

OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic **fuel level** messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The low fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the low fuel indicator for the following reasons:



- **Bulb Test** - Each time the ignition switch is turned to the ON position the low fuel indicator is illuminated for about three seconds as a bulb test.
- **Less Than 11 Percent Tank Full Message** - The TIPM provides a constant current source to the fuel level sending unit and monitors a return input on a fuel level sense circuit. The resistance through the fuel level sending unit increases as the fuel level rises and decreases as the fuel level falls causing changes in the fuel level sense input voltage. The TIPM then sends the appropriate electronic **fuel level** messages to the cluster. Each time the fuel level messages to the cluster indicate the fuel tank is about 11 percent full or less for 10 consecutive seconds and the vehicle speed is zero, or for 60 consecutive seconds and the vehicle speed is greater than zero, the gauge needle is moved to the appropriate position on the gauge scale, the low fuel indicator is illuminated, and a single chime tone is sounded. The low fuel indicator remains illuminated until the fuel level messages indicate that the fuel tank is greater than about 14 percent full for 10 consecutive seconds and the vehicle speed is zero, or for 60 consecutive seconds and the vehicle speed is greater than zero, or until the ignition switch is turned to the OFF position, whichever occurs first. The chime tone feature will only repeat during the same ignition cycle if the low fuel indicator is cycled OFF and then ON again by the appropriate messages from the TIPM.
- **Less Than Empty Stop Message** - Each time the cluster receives a fuel level message indicating the fuel level in the fuel tank is less than the **E** (or Empty) gauge needle stop position for five consecutive seconds, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the TIPM is a short circuit.
- **More Than Full Stop Message** - Each time the cluster receives a fuel level message indicating the fuel level in the fuel tank is more than the **F** (or Full) gauge needle stop position for five consecutive seconds, the gauge needle is moved to the low end of the gauge scale and the low fuel indicator is illuminated immediately. This input would indicate that the fuel level sense input to the TIPM is an open circuit.

The TIPM continually monitors the fuel tank sending unit to determine the level of fuel in the fuel tank. The TIPM then sends the proper electronic **fuel level** message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. The TIPM will store a Diagnostic Trouble Code (DTC) for any fault detected in the fuel level sense circuit.

For proper diagnosis of the fuel tank sending unit, the TIPM, the EMIC, the CAN data bus or the electronic communication related to low fuel indicator operation or fuel level data processing a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

LOW OIL PRESSURE INDICATOR

DESCRIPTION

A low oil pressure indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the cluster overlay, between the speedometer and the tachometer.

The low oil pressure indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Engine Oil** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The low oil pressure indicator is serviced as a unit with the instrument cluster.

OPERATION

The low oil pressure indicator gives an indication to the vehicle operator when the engine oil pressure reading reflects a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The low oil pressure indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the low oil pressure indicator for the following reasons:

- **Engine Oil Pressure Low Message** - Each time the cluster receives an electronic **engine oil pressure** message from the PCM indicating the pressure is about 6.9 kPa (1 psi) or lower, the low oil pressure indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the PCM message. The indicator remains illuminated solid or flashing until the cluster receives a message from the PCM indicating that the pressure is above about 6.9 kPa (1 psi), or until the ignition switch is turned to the OFF position, whichever occurs first. The cluster will only turn the indicator ON in response to low engine oil pressure if the engine speed is greater than zero.
- **Actuator Test** - Each time the cluster is put through the actuator test, the low oil pressure indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine oil pressure sensor to determine the engine oil pressure. The PCM then sends the proper messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the EMIC turns ON the indicator after the bulb test, it may indicate that the engine or the engine oiling system requires service.

For proper diagnosis of the engine oil pressure sensor, the PCM, the EMIC, the CAN data bus or the electronic communication related to low oil pressure indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

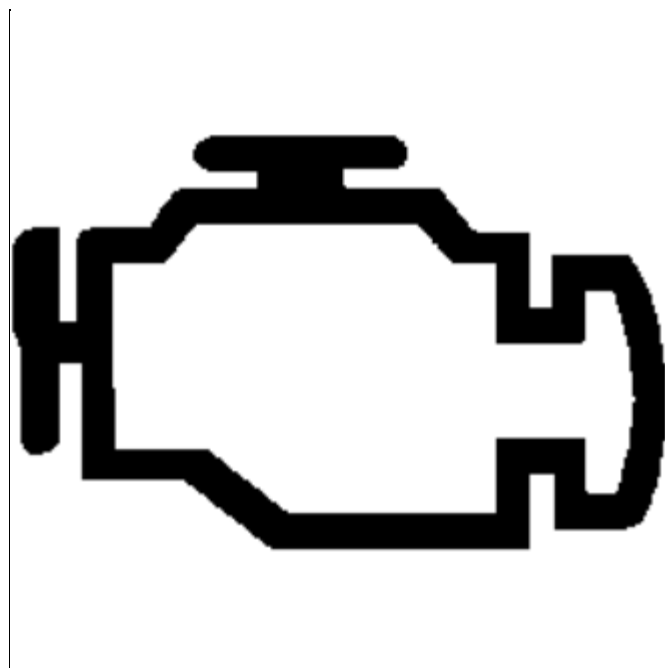
MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters. For domestic market vehicles, this indicator is located within the odometer Vacuum Fluorescent Display (VFD) unit. For export market vehicles, this indicator is located on the right side of the cluster overlay near the top, above the engine coolant temperature gauge.

The domestic MIL indicator consists of the International Control and Display Symbol icon for **Engine** in the VFD

display. The odometer VFD unit is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer dial face of the cluster overlay. The dark lens over the VFD unit prevents the indicator from being clearly visible when it is not illuminated. The MIL icon appears in an amber color when it is illuminated by the cluster electronic circuit board, and the MIL as well as all of the odometer VFD information is illuminated at full (daytime) brightness and cannot be dimmed until the MIL is extinguished.



The export MIL indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Engine** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The MIL is serviced as a unit with the instrument cluster.

OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Powertrain Control Module (PCM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. The MIL is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the PCM over the Controller Area Network (CAN) data bus.

The MIL is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be OFF when the ignition switch is in any position except ON or START. The indicator only illuminates when it is energized by the instrument cluster logic circuit. The instrument cluster will turn ON the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the indicator is illuminated for about 15 seconds as a bulb test. The entire bulb test is a function of the PCM.
- **MIL Lamp-On Message** - Each time the cluster receives an electronic **MIL lamp-ON** message from the PCM, the indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the PCM message. For some DTCs, if a problem does not recur, the PCM will send a lamp-OFF message automatically. Other DTCs may require that a fault be repaired and the PCM be reset before a lamp-OFF message will be sent. For more information on the PCM, and the DTC set and reset parameters, refer to Group 25 - EMISSIONS.
- **Communication Error** - If the cluster receives no lamp-ON or lamp-OFF messages from the PCM for 10

consecutive message cycles, the MIL is illuminated by the instrument cluster to indicate a loss of bus communication. The indicator remains controlled and illuminated by the cluster until a valid message is received from the PCM.

- **Actuator Test** - Each time the cluster is put through the actuator test, the MIL indicator will be turned ON, then OFF again during the odometer VFD portion of the test in order to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the EMIC turns ON the MIL after the bulb test, it may indicate that a malfunction has occurred and that the fuel and emissions systems require service.

For proper diagnosis of the fuel and emissions systems, the PCM, the EMIC, the CAN data bus or the electronic communication related to MIL operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

NO FUSE INDICATOR

DESCRIPTION

A no fuse indicator is standard equipment on all instrument clusters. However, in vehicles built for the Chinese market this indicator is electronically disabled. The no fuse indication appears within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. The no fuse indicator consists of a textual **noFUSE** message which appears in place of the odometer/trip odometer information in the odometer display.

The odometer VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The no fuse textual message appears in the same blue-green color and at the same lighting level as the odometer information when it is illuminated by the instrument cluster electronic circuit board.

The no fuse indicator is serviced as a unit with the odometer VFD in the instrument cluster.

OPERATION

The no fuse indicator gives an indication to the vehicle operator when the Ignition Off Draw (IOD) fuse is ineffective or is not installed. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received over the Controller Area Network (CAN) data bus from the Totally Integrated Power Module (TIPM).

The no fuse indicator function of the odometer Vacuum Fluorescent Display (VFD) unit is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the odometer VFD no fuse indication will always be OFF when the ignition switch is in any position except ON or START. The instrument cluster will turn ON the no fuse indicator for the following reasons:

- **No Fuse Indicator Lamp-On Message** - Each time the ignition switch is turned to the ON position and the cluster receives an electronic **no fuse indicator lamp-ON** message from the TIPM indicating that the IOD fuse is missing or ineffective, the no fuse indicator will be illuminated. The indicator remains illuminated for about three seconds, until the IOD fuse is installed, until the trip odometer reset switch button is depressed or until the ignition switch is turned to the OFF position, whichever occurs first.

The TIPM continually monitors the IOD circuit to determine the status of the IOD fuse, then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the CAN data bus.

For proper diagnosis of the no fuse indicator, the TIPM, the EMIC, the CAN data bus or the electronic communication related to no fuse indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

ODOMETER

DESCRIPTION

An odometer and trip odometer are standard factory-installed equipment in all instrument clusters. The odometer and trip odometer are displayed in a common electronic, blue-green Vacuum-Fluorescent Display (VFD) unit. This VFD unit is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer in the lower right area of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated.

The odometer and trip odometer information are not displayed simultaneously. The trip odometer reset switch on the instrument cluster circuit board toggles the display between odometer and trip odometer modes by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just left of the minor gauge set. When the trip odometer information is displayed, the text **TRIP A** or **TRIP B** is also illuminated in the lower right corner of the odometer/trip odometer VFD in a blue-green color and at the same lighting level as the trip odometer information.



The odometer and trip odometer information are stored in the instrument cluster memory. This information can be increased when the proper inputs are provided to the instrument cluster, but the information cannot be decreased. The odometer can display values up to 999,999 kilometers (999,999 miles). The odometer latches at these values, and will not roll over to zero. The trip odometer can display values up to 999.9 kilometers (999.9 miles) before it rolls over to zero.

The odometer display does not show leading zeroes, does not have a decimal point and will not show values less than a full unit (kilometer or mile). The unit of measure (**km** or **miles**) for the odometer display is not shown in the VFD. The unit of measure for the instrument cluster odometer/trip odometer is selected at the time that it is manufactured, and cannot be changed. The odometer has a RENTAL CAR mode, which will illuminate the odometer information in the VFD whenever the driver side front door is opened with the ignition switch in the OFF or ACCESSORY positions.

During daylight hours (exterior lamps are OFF) the odometer VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are ON), the VFD lighting level is adjusted with the other cluster general illumination lamps using the panel lamps dimmer function of the interior lighting control sleeve on the left

multi-function switch control stalk. However, a PARADE mode position of the control sleeve allows the VFD to be illuminated at full brightness if the exterior lamps are turned ON during daylight hours. On vehicles manufactured for domestic markets, the odometer VFD is also illuminated at full brightness whenever the Malfunction Indicator Lamp (MIL) indicator is illuminated, and cannot be dimmed until the MIL indicator is extinguished.

The odometer/trip odometer VFD, the trip odometer switch and the trip odometer push button are serviced as a unit with the instrument cluster.

OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. This indicator is controlled by the instrument cluster circuitry based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The odometer and trip odometer information is displayed by the instrument cluster odometer/trip odometer Vacuum Fluorescent Display (VFD). The VFD will display the odometer information whenever the driver side front door is opened with the ignition switch in the OFF or ACCESSORY positions. The instrument cluster circuitry controls the VFD and provides the following features:

- **Odometer/Trip Odometer Display Toggling** - Actuating the trip odometer reset switch button momentarily with the VFD illuminated will toggle the display between the odometer and trip odometer A and B information. Each time the VFD is illuminated with the ignition switch in the ON or START positions, the display will automatically return to the last mode previously selected (odometer or trip odometer).
- **Trip Odometer Reset** - When the trip odometer reset switch button is pressed and held for longer than about two seconds with the ignition switch in the ON or START positions, the trip odometer will be reset to **0.0** kilometers (miles). The VFD must be displaying the trip odometer information in order for the trip odometer information to be reset.
- **GasCap Message Display** - On vehicles manufactured with a United States country code, each time the cluster receives an electronic message from the PCM indicating a monitored leak in the evaporative emissions system, the cluster replaces the displayed odometer/trip odometer value with the textual message, **gascap**. This message serves as a reminder to the vehicle operator to check that the gas cap is properly installed and tightened, but could also indicate another source of air leakage in the on-board evaporative and vapor recovery emissions systems. Unless the leak is corrected, this message will latch and remain displayed during the current and each subsequent ignition cycle until the trip odometer reset button is pressed and released momentarily, which will revert the display to the odometer/trip odometer information that was last displayed for the remainder of that ignition cycle. Once the source of a leak has been corrected, either momentarily pressing the trip odometer reset button or cycling the ignition switch will unlatch the message and return the odometer/trip odometer to normal operation.
- **Communication Error** - If the cluster fails to receive an electronic **distance** message during normal operation, it will hold and display the last data received until the ignition switch is turned to the OFF position. If the cluster does not receive a **distance** message within one second after the ignition switch is turned to the ON position, it will display the last distance value stored in the cluster memory. If the cluster is unable to display odometer information due to an error internal to the cluster, the VFD will display **error**.
- **Actuator Test** - Each time the cluster is put through the actuator test, the odometer VFD will display all of its segments simultaneously during the VFD portion of the test to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the vehicle speed pulse information received from the wheel speed sensors, then sends the proper messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab

Compartment Node/CCN).

For proper diagnosis of the wheel speed sensors, the PCM, the EMIC, the CAN data bus or the electronic communication related to odometer/trip odometer operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

OVERDRIVE OFF INDICATOR

DESCRIPTION

An overdrive off indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with an optional overdrive automatic transmission, this indicator is electronically disabled. This indicator is located near the bottom of the cluster overlay, between the speedometer and the tachometer.

The overdrive off indicator consists of a stencil-like cutout of the text **O/D OFF** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The overdrive off indicator is serviced as a unit with the instrument cluster.

OPERATION

The overdrive off indicator gives an indication to the vehicle operator when the overdrive-OFF position of the overdrive switch has been selected, disabling the electronically controlled overdrive feature of the automatic transmission. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The overdrive off indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the overdrive off indicator for the following reasons:

- **Overdrive Off Indicator Lamp-On Message** - Each time the cluster receives an electronic **overdrive off indicator lamp-ON** message from the PCM indicating that the overdrive-OFF position of the tow/haul switch has been selected, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the PCM, or until the ignition switch is turned to the OFF

position, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the overdrive off indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the overdrive switch to determine the proper outputs to the automatic transmission. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). For further diagnosis of the overdrive off indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transmission control system, the PCM, the EMIC, the CAN data bus or the electronic communication related to overdrive off indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

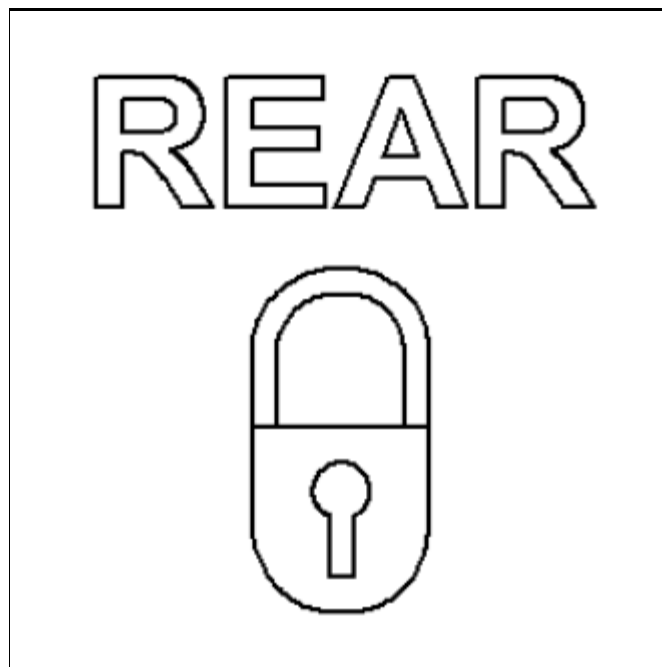
REAR AXLE LOCK INDICATOR

DESCRIPTION

A rear axle lock indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional off-road package, this indicator is electronically disabled. This indicator is located near the top of the cluster overlay, between the speedometer and tachometer.

The rear axle lock indicator consists of a stencil-like cutout of the word **REAR** above the International Control and Display Symbol icon for **Lock** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The rear axle lock indicator is serviced as a unit with the instrument cluster.



OPERATION

The rear axle lock indicator gives an indication to the vehicle operator when the locking mechanism in the rear axle of vehicles equipped with the optional off-road package is engaged. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The rear axle lock indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic.

circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the rear axle lock indicator for the following reasons:

- **Rear Axle Lock Indicator Lamp-On Message** - Each time the cluster receives an electronic **rear axle lock lamp-ON** message from the TIPM, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the rear axle lock indicator will be turned ON, then OFF again during the LED portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The TIPM continually monitors an input from the rear axle lock solenoid to determine the status of the rear axle lock mechanism. The TIPM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

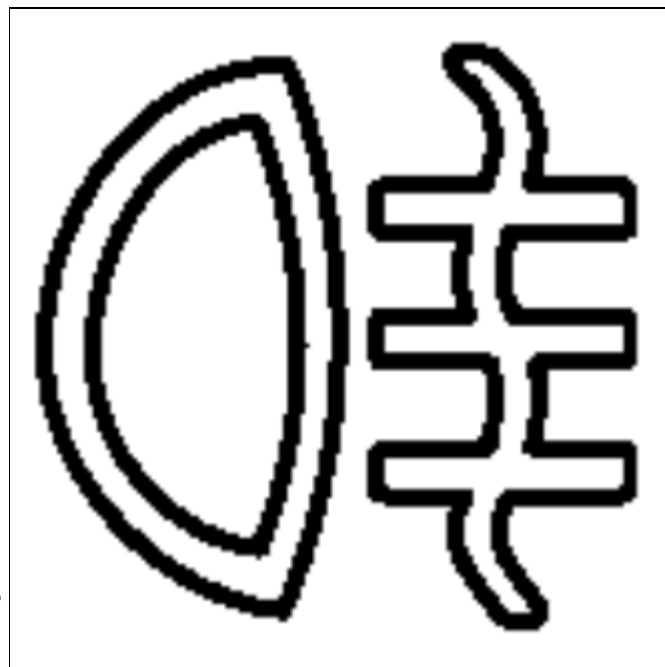
For proper diagnosis of the rear axle lock system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to rear axle lock indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

REAR FOG LAMP INDICATOR

DESCRIPTION

A rear fog lamp indicator is standard equipment on all instrument clusters for certain markets where rear fog lamps are available. However, on vehicles not equipped with the optional rear fog lamps, this indicator is electronically disabled. This indicator is located above the engine coolant temperature gauge on the cluster overlay, to the right of the tachometer.

The rear fog lamp indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Rear Fog Light** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The rear fog lamp indicator is serviced as a unit with the instrument cluster.

OPERATION

The rear fog lamp indicator gives an indication to the vehicle operator whenever the rear fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

The rear fog lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the rear fog lamp indicator for the following reasons:

- **Rear Fog Indicator Lamp-On Message** - Each time the cluster receives an electronic **rear fog indicator lamp-ON** message from the TIPM indicating the rear fog lamps are turned ON, the rear fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the TIPM, or until the exterior lamp load shedding (battery saver) timed interval expires, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the rear fog lamp indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The TIPM continually monitors electronic **exterior lighting request** messages from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) to determine the appropriate outputs to the rear fog lamps. The TIPM activates or deactivates the rear fog lamps then sends the proper lamp-ON or lamp-OFF message back to the EMIC.

For proper diagnosis of the rear fog lamp system, the TIPM, the EMIC, the CAN data bus or the electronic communication related to rear fog lamp indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SEATBELT INDICATOR

DESCRIPTION

A seatbelt indicator is standard equipment on all instrument clusters. This indicator is located near the top of the cluster overlay, between the speedometer and the tachometer.

The seatbelt indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Seat Belt** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The seatbelt indicator is serviced as a unit with the instrument cluster.



OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver side front seat belt. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the seatbelt switch on the driver side front seat belt retractor through the seat belt switch sense circuits.

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or BELTMINDER feature that is enabled when the vehicle is shipped from the factory. This BELTMINDER feature can be disabled and enabled by the customer using a specific programming event sequence, or by the dealer using a diagnostic scan tool.

The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster receives a battery current input on the fused ignition switch output (run-start) circuit, the indicator will be illuminated as a seatbelt reminder for about six seconds, or until the ignition switch is turned to the OFF position, whichever occurs first. This reminder function will occur regardless of the status of the seatbelt switch inputs to the cluster.
- **Front Seatbelt Not Buckled - Beltminder Active** - Following the seatbelt reminder function, each time the cluster detects an open circuit on the front seat belt switch sense circuit (seatbelt switch open = seatbelt unbuckled) with the ignition switch in the START or ON positions, the indicator will be illuminated. In addition, if the front seat belt remains unbuckled about 4 seconds after the conclusion of the seatbelt reminder function, the seatbelt indicator will begin to cycle between flashing ON and OFF for 3 seconds, then lighting solid for 2 seconds. The seatbelt indicator will continue to cycle between flashing and solid illumination for 13 complete cycles, until the seat belt switch sense input to the cluster is a closed circuit to ground (seatbelt switch closed = seatbelt buckled), or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Front Seatbelt Not Buckled - Beltminder Inactive** - Following the seatbelt reminder function, each time the cluster detects an open circuit on the seat belt switch sense circuit (seatbelt switch open = seatbelt

unbuckled) with the ignition switch in the START or ON positions, the indicator will be illuminated. The seatbelt indicator remains illuminated until the seat belt indicator input to the cluster is a closed circuit to ground (seatbelt switch closed = seatbelt buckled), or until the ignition switch is turned to the OFF position, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the seatbelt indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The seatbelt switch is connected in series between ground and the seat belt switch sense circuit input to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). The seatbelt switch input to the instrument cluster circuitry may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

STANDARD PROCEDURE

ENHANCED SEATBELT REMINDER PROGRAMMING

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or BELTMINDER feature that is enabled when the vehicle is shipped from the factory. This BELTMINDER feature provides extended and modified visual seatbelt indicator and audible chime warning responses to an unbuckled driver side front seat belt. The BELTMINDER feature may be disabled or enabled by the customer using the programming sequence that follows, or by the dealer using a diagnostic scan tool.

CUSTOMER PROGRAMMING SEQUENCE

NOTE: The following sequence of events must occur within 60 seconds of the ignition switch being placed in the ON position in order for the programming to be completed successfully.

1. With all doors closed and the ignition switch in any position except ON or START, buckle the driver side front seat belt.
2. Turn the ignition switch to the ON position and wait for the seatbelt indicator reminder function to conclude (about six seconds).
3. Unbuckle and buckle the driver side front seat belt three or more times, ending with the belt buckled.
4. Turn the ignition switch to any position except ON or START to toggle the BELTMINDER feature from its current setting (from active to inactive, or from inactive to active). A single chime tone will provide an audible confirmation that the programming sequence has been successfully completed.

SECURITY INDICATOR

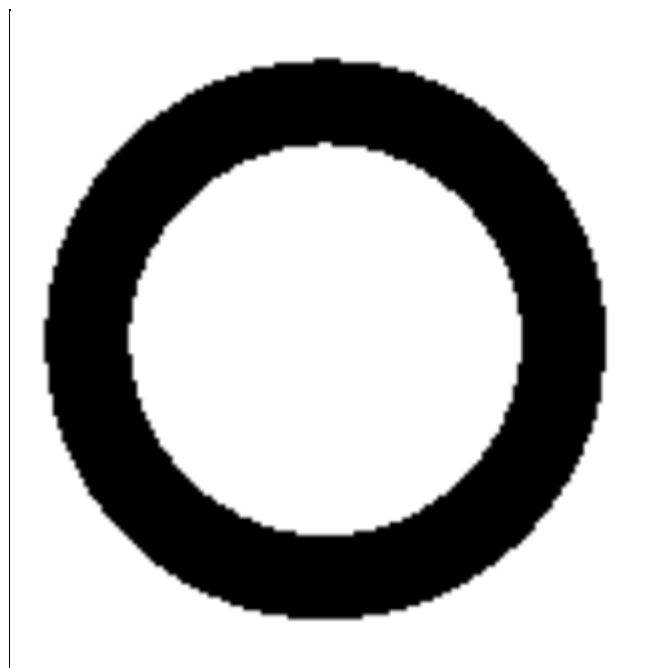
DESCRIPTION

A security indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional Vehicle Theft Security System (VTSS), this indicator is electronically disabled. This indicator is located

above the coolant temperature gauge on the cluster overlay, to the right of the tachometer.

The security indicator consists of a small round cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The security indicator is serviced as a unit with the instrument cluster.



OPERATION

The security indicator gives an indication to the vehicle operator when the Vehicle Theft Security System (VTSS) is arming or is armed. On vehicles equipped with the Sentry Key Immobilizer System (SKIS), the security indicator also gives an indication to the vehicle operator of the status of the SKIS. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, and electronic **security indicator request** messages received by the cluster from the Totally Integrated Power Module (TIPM) or the Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) over the Controller Area Network (CAN) data bus.

The security indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. Depending upon the programmed condition, the indicator can be illuminated solid, flashed at a slow rate (0.5 Hertz, 12.5 percent duty cycle), or flashed at a fast rate (1 Hertz, 50 percent duty cycle). The instrument cluster will turn ON the security indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the security indicator illuminates for about two seconds as a bulb test. The entire bulb test is a function of the SKREEM.
- **Security Indicator Lamp-On Message** - During the 16 second VTSS arming function, the TIPM will request the cluster flash the security indicator ON and OFF repeatedly at a steady, fast rate to indicate that the VTSS is in the process of arming. Following successful VTSS arming, the TIPM will request the cluster flash the security indicator ON and OFF continuously at a slower rate to indicate that the VTSS is armed. The security indicator continues flashing at the slower rate until the VTSS is disarmed or triggered. If the VTSS has alarmed and rearmed, the TIPM will request the cluster flash the security indicator at a steady, slow rate for about 30 seconds after the VTSS is disarmed.
- **SKIS Indicator Lamp-On Message** - Each time the cluster receives an electronic **SKIS indicator lamp-ON** message from the SKREEM, the security indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the SKREEM message. The indicator remains illuminated solid or continues to flash until the cluster receives a lamp-OFF message from the SKREEM, or until the ignition switch is turned to the OFF position, whichever occurs first. For more information on the SKIS and the security indicator control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT

SECURITY/SENTRY KEY IMMOBILIZER SYSTEM - OPERATION).

- **Communication Error** - If the cluster receives no lamp-ON or lamp-OFF messages from the TIPM or the SKREEM for 10 consecutive message cycles, the security indicator is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid lamp-ON or lamp-OFF message is received from the SKREEM.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the security indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The TIPM sends electronic **security indicator request** messages to control the security indicator whenever the ignition switch is in the OFF position and the VTSS is arming, armed, or alarming. Whenever the ignition switch is in the ON or START positions, the SKREEM performs a self-test to decide whether the SKIS is in good operating condition and whether a valid key is present in the ignition lock cylinder. The SKREEM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the cluster flashes the security indicator upon ignition ON, or turns ON the security indicator solid after the bulb test, it indicates that a SKIS malfunction has occurred or that the SKIS is ineffective.

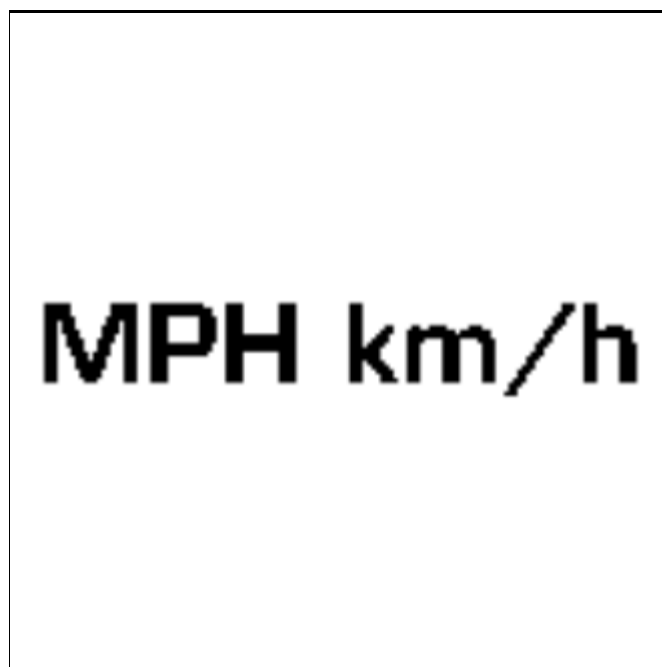
For proper diagnosis of the VTSS, the SKIS, the SKREEM, the TIPM, the EMIC, the CAN data bus or the electronic communication related to security indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

SPEEDOMETER

DESCRIPTION

A speedometer is standard equipment on all instrument clusters. The speedometer is located to the left of center in the instrument cluster, between the tachometer and the fuel gauge. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 185 degree primary scale on the gauge dial face that reads left-to-right either from **0** to **100** or **110** mph, or from **0** to **200** km/h, depending upon the market for which the vehicle is manufactured.

Each version also has a secondary inner scale on the gauge dial face that provides the equivalent opposite units from the primary scale. Text appearing on the cluster overlay above the hub of the speedometer needle and below the primary scale abbreviates the unit of measure for the primary scale (either **MPH** or **km/h**), and text above the hub of the speedometer needle and below the secondary scale indicates the unit of measure for that scale.



The speedometer graphics are white and gray against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned ON, the white and gray graphics still appear white or gray. The red gauge needle has internal optical illumination. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board.

The speedometer is serviced as a unit with the instrument cluster.

OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The speedometer is driven by an electronic stepper motor unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the ON or START positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the OFF position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Vehicle Speed Message** - Each time the cluster receives an electronic **vehicle speed** message from the PCM it will calculate the correct vehicle speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new message and reposition the gauge pointer accordingly about every 88 milliseconds. The gauge needle will continually be positioned at the relative vehicle speed position on the gauge scale until the vehicle stops moving, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a speed message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the OFF position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the speedometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the Vehicle Speed Sensor (VSS) to determine the vehicle road speed. The PCM then sends the proper **vehicle speed** messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the VSS, the PCM, the EMIC, the CAN data bus or the electronic communication related to speedometer operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TACHOMETER

DESCRIPTION

A tachometer is standard equipment on all instrument clusters. The tachometer is located to the right of center in the instrument cluster, between the speedometer and the coolant temperature gauge. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 185 degree scale on the gauge dial face that reads left-to-right either from **0** to **7** for vehicles with a gasoline engine, or from **0** to **5** for vehicles with a diesel engine. The text **RPM X 1000** imprinted on the cluster overlay directly above the hub of the

tachometer needle identifies that each number on the tachometer scale is to be multiplied by 1000 rpm.

The tachometer graphics are white and gray against a black field except for several red graduations that designate the red line area at the high end of the gauge scale, making them clearly visible within the instrument cluster in daylight.

When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned ON, the white and gray text and graphics still appear white or gray and the red graphics still appear red. The red gauge needle has internal optical illumination. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board.



The tachometer is serviced as a unit with the instrument cluster.

OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The tachometer is driven by an electronic stepper motor unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the ON or START positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the OFF position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message** - Each time the cluster receives an electronic **engine speed** message from the PCM it will calculate the correct engine speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new message and reposition the gauge pointer accordingly about every 88 milliseconds. The gauge needle will continually be repositioned at the relative engine speed position on the gauge scale until the engine stops running, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a speed message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the OFF position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the tachometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the crankshaft position sensor to determine the engine speed. The PCM then sends the proper **engine speed** messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

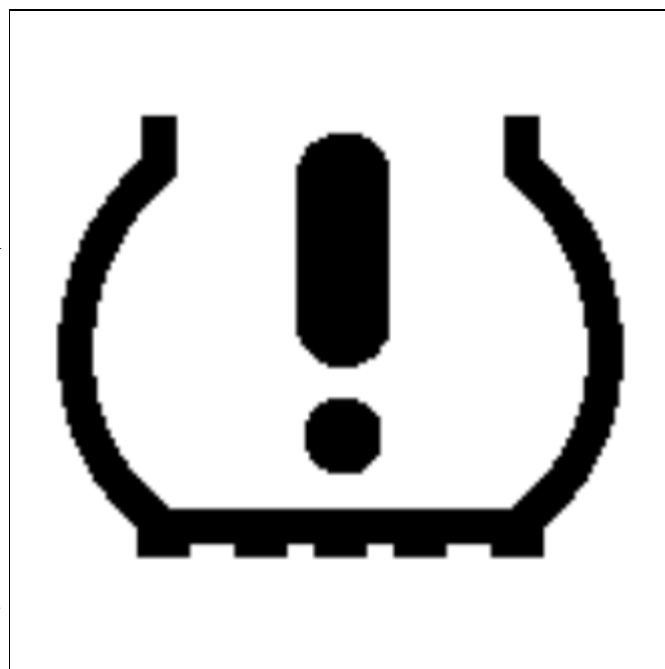
For proper diagnosis of the crankshaft position sensor, the PCM, the EMIC, the CAN data bus or the electronic communication related to tachometer operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TIRE PRESSURE MONITOR INDICATOR

DESCRIPTION

A Tire Pressure Monitor (TPM) indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the TPM system, this indicator is electronically disabled. This indicator is located within the odometer Vacuum Fluorescent Display (VFD) unit.

The TPM indicator consists of a stencil-like cutout of an icon that represents a cross-section of a tire with a centered exclamation point in the VFD unit. The odometer VFD unit is soldered onto the instrument cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. The indicator appears in an amber color (domestic market vehicles) or in the same blue-green color as the odometer information (export market vehicles) when it is illuminated by the cluster electronic circuit board. Once illuminated, the TPM indicator as well as all of the odometer VFD information is illuminated at full (daytime) brightness and cannot be dimmed until the TPM indicator is extinguished.



The TPM indicator is serviced as a unit with the odometer VFD unit in the instrument cluster.

OPERATION

The Tire Pressure Monitor (TPM) indicator gives an indication to the vehicle operator of the status of the TPM system. The TPM indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Sentry Key REMote Entry Module (SKREEM) (also known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) over the Controller Area Network (CAN) data bus.

The TPM indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be OFF when the ignition switch is in any position except ON or START. The indicator only illuminates when it is energized by the instrument cluster logic circuit. The instrument cluster will turn ON the TPM indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position, the SKREEM sends an electronic **TPM indicator lamp-ON** message to the cluster to illuminate the TPM indicator for about three seconds as a bulb test.

TPM Indicator Lamp-On Message - Each time the cluster receives an electronic **TPM indicator lamp-ON** message from the SKREEM, the indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the SKREEM message. The indicator remains illuminated until the cluster receives a lamp-OFF message from the SKREEM, or until the ignition switch is turned to the OFF position, whichever occurs first.

- **Low Tire Textual Message** - On vehicles manufactured for export markets, each time the cluster receives an electronic **TPM indicator lamp-ON** message from the SKREEM requesting the TPM indicator be illuminated solid, a **LOtIRE** textual message will appear within the cluster odometer display. The **LOtIRE** textual message remains displayed until the cluster receives a lamp-OFF message from the SKREEM, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Communication Error** - If the cluster receives no TPM lamp-ON or lamp-OFF messages from the SKREEM for six consecutive seconds, the TPM indicator is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid lamp-ON or lamp-OFF message is received from the SKREEM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the TPM indicator will be turned ON, then OFF again during the odometer VFD portion of the test in order to confirm the functionality of the VFD and the cluster control circuitry.

The SKREEM performs a self-test each time the ignition switch is turned to the ON position to decide whether the TPM system is in good operating condition and whether the tire inflation pressures are too high or too low. The SKREEM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). If the instrument cluster turns ON the TPM indicator after the bulb test, it indicates that the inflation pressure of a tire is too low or that a malfunction has occurred and the TPM system is ineffective.

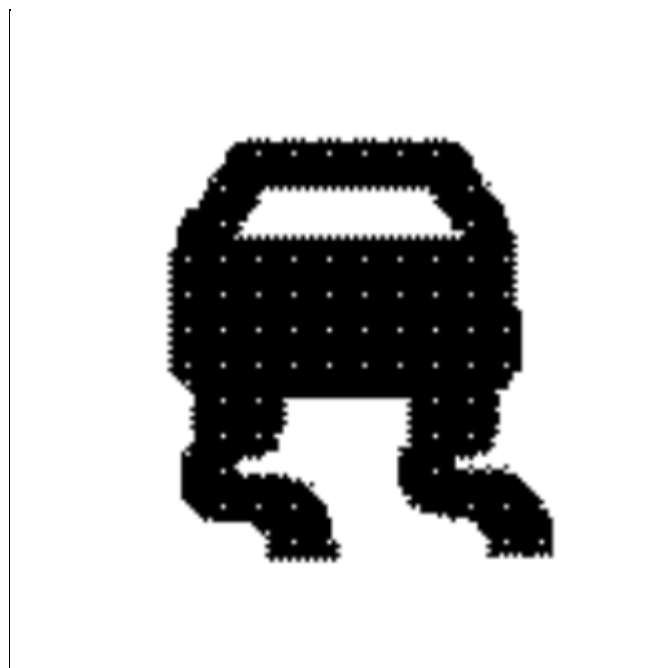
For proper diagnosis of the TPM system, the SKREEM, the EMIC, the CAN data bus or the electronic communication related to TPM indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TRACTION CONTROL INDICATOR

DESCRIPTION

A traction control indicator is standard equipment on all instrument clusters. This indicator is located on the lower edge of the cluster overlay, between the speedometer and the tachometer.

The traction control indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Stability - Anti-Spin** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The traction control indicator is serviced as a unit with the instrument cluster.

OPERATION

The traction control indicator gives an indication to the vehicle operator when the Electronic Stability Program (ESP)/Brake Assist System (BAS)/Traction Control System (TCS) has been activated. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus.

The traction control indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be OFF when the ignition switch is in any position except ON or START. The indicator only illuminates when it is provided a path to ground by the instrument cluster circuitry. The instrument cluster will turn ON the traction control indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the ON position the traction control indicator is illuminated for about four seconds as a bulb test. The entire bulb test is a function of the CAB.
- **Traction Control Indicator Lamp-On Message** - Each time the cluster receives an electronic **traction control indicator lamp-ON** message from the CAB indicating that the ESP/BAS/TCS has been activated, the traction control indicator will be illuminated. The indicator can be flashed ON and OFF, or illuminated solid, as dictated by the CAB message. The indicator remains illuminated solid or continues to flash until the cluster receives a lamp-OFF message from the CAB, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the traction control indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The CAB continually monitors the traction control switch to determine the proper outputs to the components of the Antilock Brake System (ABS). The CAB then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

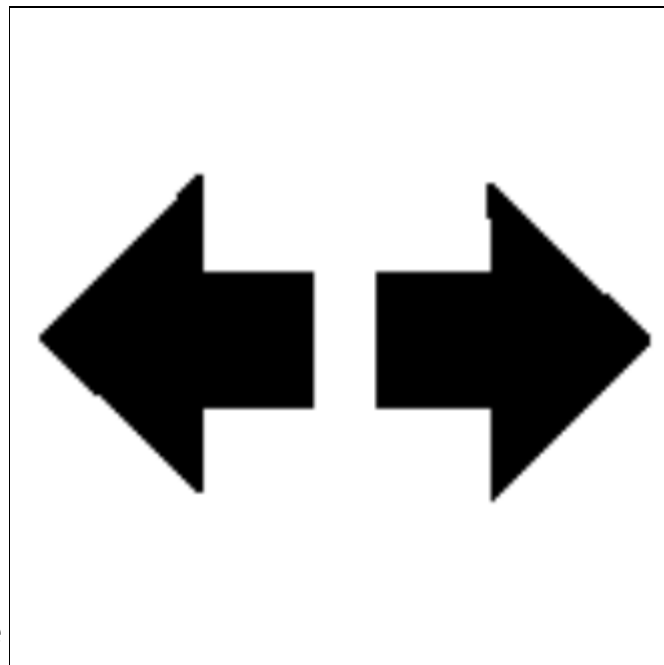
For proper diagnosis of the traction control switch, the ESP/BAS/TCS, the CAB, the EMIC, the CAN data bus or the electronic communication related to traction control indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

TURN SIGNAL INDICATOR

DESCRIPTION

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters. The turn signal indicators are located near the top of the cluster overlay, between the speedometer and the tachometer. Illumination of this indicator may also be accompanied by the display of a turn signal-on warning textual message in the cluster reconfigurable Vacuum Fluorescent Display (VFD) unit.

Each turn signal indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Turn Warning** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. A green Light Emitting Diode (LED) behind each cutout in the opaque layer of the overlay causes the indicator to appear in green through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The turn signal indicators are serviced as a unit with the instrument cluster.

OPERATION

The turn signal indicators give an indication to the vehicle operator that the turn signal (left or right indicator flashing) or hazard warning (both left and right indicators flashing) have been selected and are operating. These indicators are controlled by transistors on the instrument cluster electronic circuit board based upon the cluster programming and electronic messages received from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus.

Each turn signal indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, each LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the turn signal indicators for the following reasons:

- **Turn Signal Indicator Lamp-On Message** - Each time the cluster receives an electronic **right** or **left turn signal-ON** message from the TIPM over the CAN data bus, the appropriate turn signal indicator will be flashed ON and OFF. The TIPM also sends the appropriate electronic message to the cluster to control the flash rate of the turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the cluster electronic circuit board that emulates the sound emitted by a conventional turn signal flasher. The turn signal indicators continue to flash ON and OFF until the cluster receives a lamp-OFF message from the TIPM, or until the ignition switch is turned to the OFF position, whichever occurs

first.

- **Hazard Warning Indicator Lamp-On Message** - Each time the cluster receives an electronic **hazard warning-ON** message from the TIPM over the CAN data bus, both turn signal indicators will be flashed ON and OFF. The TIPM also sends the appropriate electronic messages to the cluster to control the flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the cluster electronic circuit board that emulates the sound emitted by a conventional hazard warning flasher. The turn signal indicators continue to flash ON and OFF until the cluster receives a hazard warning-OFF message from the TIPM.
- **Turn Signal-On Textual Warning Message** - When the cluster detects that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per hour) a chime tone will be sounded and, if the vehicle is so equipped, a **TURN SIGNAL ON** textual message will appear within the instrument cluster reconfigurable Vacuum Fluorescent Display (VFD) unit.
- **Lamp Out Mode** - If the TIPM detects an ineffective turn signal lamp or circuit, it increases the flash rate for the remaining operative turn signals and sends an electronic message to the instrument cluster. To provide an indication of the problem to the vehicle operator the instrument cluster then increases the flash rate of the turn signal indicators, the click rate of the electromechanical relay and, if the vehicle is so equipped, displays a **TURN SIGNAL LAMP OUT** textual message in the reconfigurable VFD unit.
- **Actuator Test** - Each time the cluster is put through the actuator test, the turn signal indicators will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of each LED and the cluster control circuitry.

The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) continually monitors the electronic messages from the TIPM to determine the proper turn signal and hazard warning indicator operation.

For proper diagnosis of the turn signal and hazard warning system, the multi-function switch, the TIPM, the EMIC, the CAN data bus or the electronic communication related to turn signal indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

WAIT-TO-START INDICATOR

DESCRIPTION

A wait-to-start indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional diesel engine, this indicator is electronically disabled. This indicator is located near the lower edge of the cluster overlay, between the speedometer and the tachometer.

The wait-to-start indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Diesel Preheat** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.



The wait-to-start indicator is serviced as a unit with the instrument cluster.

OPERATION

The wait-to-start indicator gives an indication to the vehicle operator when the diesel engine is too cool for efficient and reliable engine starting, and the engine glow plugs are energized in their pre-heat operating mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus.

The wait-to-start indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the wait-to-start indicator for the following reasons:

- **Wait-To-Start Indicator Lamp-On Message** - Each time the cluster receives an electronic **wait-to-start indicator lamp-ON** message from the PCM indicating that the air temperature is too cool for efficient and reliable engine starting and the glow plugs are energized in their pre-heat mode, the wait-to-start indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the PCM, until the PCM detects that the engine is running, or until the ignition switch is turned to the OFF position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the wait-to-start indicator will be turned ON, then OFF again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the glow plug control circuits to determine when they are energized in their pre-heat operating mode. The PCM then sends the proper lamp-ON or lamp-OFF message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the glow plug control circuits, the PCM, the EMIC, the CAN data bus or the electronic communication related to wait-to-start indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

WATER-IN-FUEL INDICATOR

DESCRIPTION

A water-in-fuel indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional diesel engine, this indicator is electronically disabled. This indicator is located above the fuel gauge on the cluster overlay, to the left of the speedometer.

The water-in-fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for **Water In Fuel** in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the

indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The water-in-fuel indicator is serviced as a unit with the instrument cluster.



OPERATION

The water-in-fuel indicator gives an indication to the vehicle operator when there is excessive water detected in the diesel fuel. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received over the Controller Area Network (CAN) data bus from the Powertrain Control Module (PCM).

The water-in-fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be OFF when the ignition switch is in any position except ON or START. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn ON the water-in-fuel indicator for the following reasons:

- **Water-In-Fuel Indicator Lamp-On Message** - Each time the cluster receives an electronic **water-in-fuel indicator lamp-ON** message from the PCM indicating there is excessive water in the diesel fuel system, the water-in-fuel indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-OFF message from the PCM, or until the ignition switch is turned to the OFF position, whichever occurs first.

The PCM continually monitors the water-in-fuel sensor to determine whether there is excessive water in the diesel fuel system. The PCM then sends the proper electronic **water-in-fuel** message to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

For proper diagnosis of the water-in-fuel-sensor, the PCM, the EMIC, the CAN data bus or the electronic communication related to water-in-fuel indicator operation a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

8L - LAMPS

LAMPS/LIGHTING - EXTERIOR-ELECTRICAL/DIAGNOSTICS

LAMPS/LIGHTING - EXTERIOR-ELECTRICAL/DIAGNOSTICS

DIAGNOSIS AND TESTING

B162B-LEFT LOW BEAM CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Headlamps activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L43) LEFT LOW BEAM CONTROL CIRCUIT SHORT TO GROUND
LEFT LOW BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Headlamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B162B-LEFT LOW BEAM CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect

the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT LOW BEAM BULB

Turn the ignition off.

Disconnect the Left Low Beam Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Left Low Beam Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L43) LEFT LOW BEAM CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Disconnect the Left Headlamp harness connector.

Measure the resistance between ground and the (L43) Left Low Beam Control circuit.

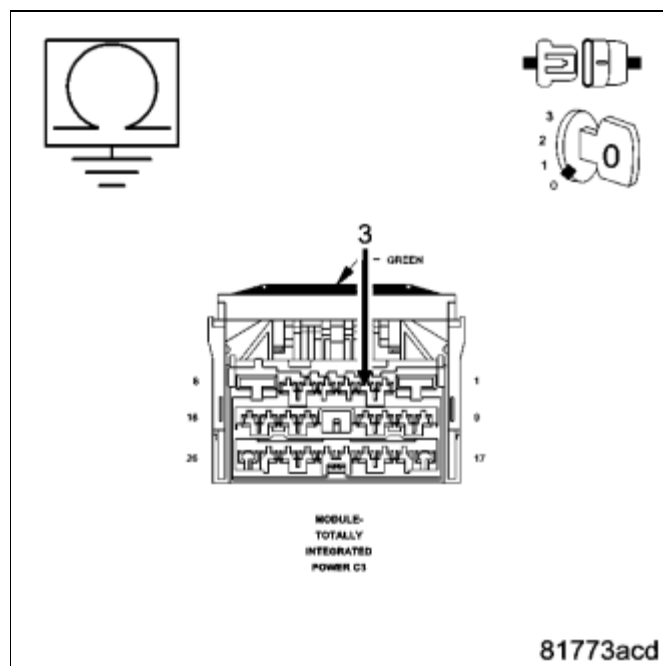
Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L43) Left Low Beam Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B162C-LEFT LOW BEAM CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L43) LEFT LOW BEAM CONTROL CIRCUIT
(L43) LEFT LOW BEAM CONTROL CIRCUIT OPEN
(L43) LEFT LOW BEAM CONTROL CIRCUIT SHORTED TO VOLTAGE
LEFT LOW BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, clear all DTC's.
Turn the Headlamps on.
With the scan tool, read DTC's.

Does the scan tool display active: B162C-LEFT LOW BEAM CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Left Low Beam Lamp harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Left Low Beam harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L43) LEFT LOW BEAM CONTROL CIRCUIT

Turn the ignition on.

With a 12-volt test light connected to ground, check the

(L43) Left Low Beam Control circuit.

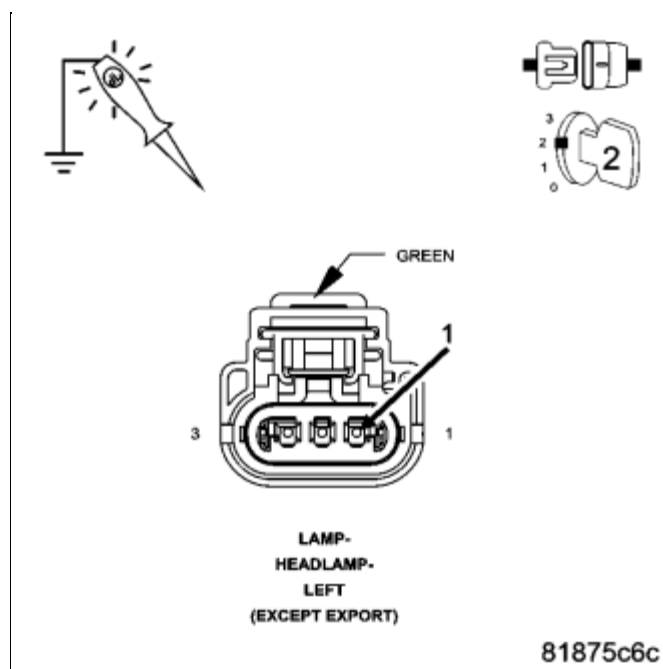
Does the test light illuminate brightly with the headlamps switch turned on, and shut off with the headlamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (L43) LEFT LOW BEAM CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L43) Left Low Beam Control circuit between the Left Low Beam harness connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L43) Left Low Beam Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L43) LEFT LOW BEAM CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L43) Left Low Beam Control circuit.

Is there any voltage present?

Yes

- Repair the (L43) Left Low Beam Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B162F-RIGHT LOW BEAM CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Headlamps activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L44) RIGHT LOW BEAM CONTROL CIRCUIT SHORT TO GROUND
RIGHT LOW BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test**1. INTERMITTENT CONDITION**

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Headlamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B162F-RIGHT LOW BEAM CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. RIGHT LOW BEAM BULB

Turn the ignition off.

Disconnect the Right Low Beam Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?**Yes**

- Go To [3](#)

No

- Replace the Right Low Beam Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L44) RIGHT LOW BEAM CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

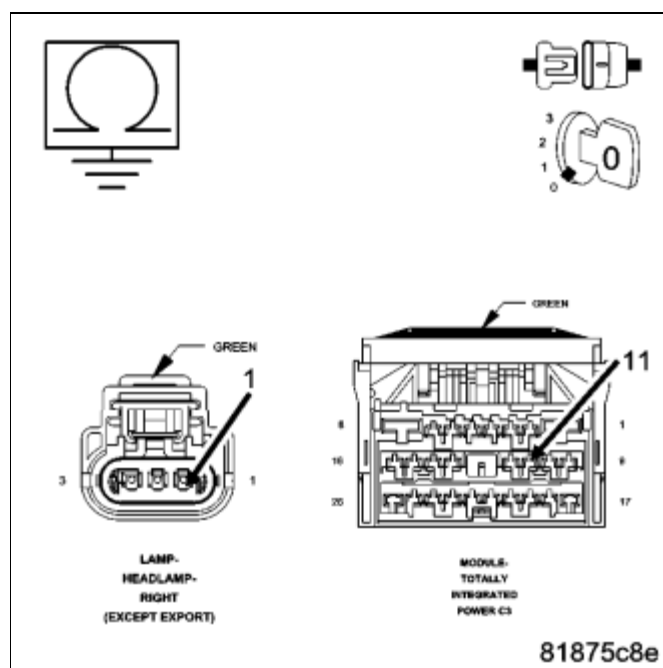
Disconnect the TIPM C3 harness connector.

Disconnect the Right Headlamp harness connector.

Measure the resistance between ground and the (L44) Right Low Beam Control circuit.

Is the resistance above 10k ohms?**Yes**

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

Repair the (L44) Right Low Beam Control circuit for a short to ground.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1630-RIGHT LOW BEAM CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L44) RIGHT LOW BEAM CONTROL CIRCUIT
(L44) RIGHT LOW BEAM CONTROL CIRCUIT OPEN
(L44) RIGHT LOW BEAM CONTROL CIRCUIT SHORTED TO VOLTAGE
RIGHT LOW BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Headlamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B1630-RIGHT LOW BEAM CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Right Low Beam Lamp harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Right Low Beam harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L44) RIGHT LOW BEAM CONTROL CIRCUIT

Turn the ignition on.

With a 12-volt test light connected to ground, check the (L44) Right Low Beam Control circuit.

Does the test light illuminate brightly with the headlamps switch turned on, and shut off with the headlamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L44) RIGHT LOW BEAM CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L44) Right Low Beam Control circuit between the Right Low Beam harness connector and the TIPM C3 harness connector.

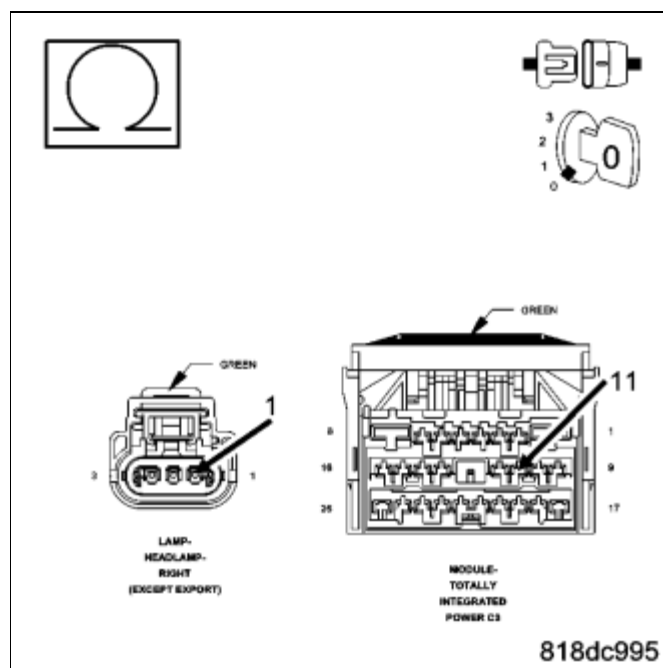
Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L44) Right Low Beam Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



6. (L44) RIGHT LOW BEAM CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L44) Right Low Beam Control circuit.

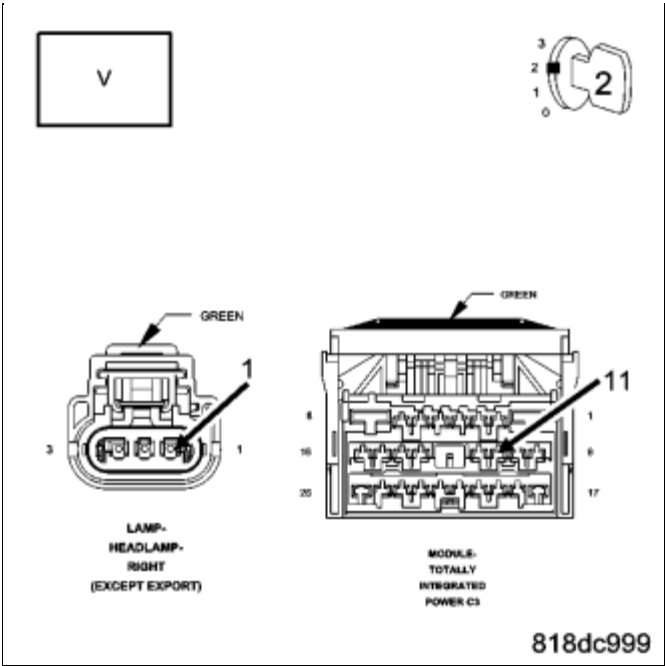
Is there any voltage present?

Yes

- Repair the (L44) Right Low Beam Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1633-LEFT HI BEAM CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the Headlamps activated.

◦ **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L33) LEFT HIGH BEAM CONTROL CIRCUIT SHORT TO GROUND
LEFT HIGH BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, clear all DTC's.
Turn the High Beam Lamps on.
With the scan tool, read DTC's.

Does the scan tool display active: B1633-LEFT HIGH BEAM CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT HIGH BEAM BULB

Turn the ignition off.
Disconnect the Left High Beam Bulb.
Turn the ignition on.
With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Left High Beam Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L33) LEFT HIGH BEAM CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C3 harness connector.
Disconnect the Left Headlamp harness connector.
Measure the resistance between ground and the (L33) Left High Beam Control circuit.

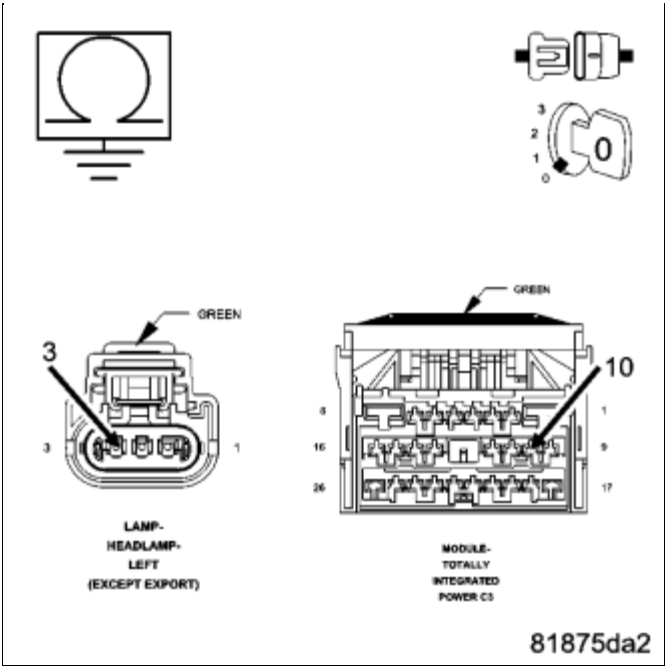
Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L33) Left High Beam Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1634-LEFT HI BEAM CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L33) LEFT HIGH BEAM CONTROL CIRCUIT
(L33) LEFT HIGH BEAM CONTROL CIRCUIT OPEN
(L33) LEFT HIGH BEAM CONTROL CIRCUIT SHORT TO VOLTAGE
LEFT HIGH BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the High Beam Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B1634-LEFT HIGH BEAM CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Left High Beam Lamp harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Left High Beam harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L33) LEFT HIGH BEAM CONTROL CIRCUIT

Turn the ignition on.

With a 12-volt test light connected to ground, check the (L33) Left High Beam Control circuit.

Does the test light illuminate brightly with the headlamps switch turned on, and shut off with the headlamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L33) LEFT HIGH BEAM CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L33) Left High Beam Control Circuit between the Left Headlamp harness connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L33) Left High Beam Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

(L33) LEFT HIGH BEAM CONTROL CIRCUIT SHORT TO VOLTAGE

6.

Turn the ignition on.

Measure for voltage on the (L33) Left High Beam Control circuit.

Is there any voltage present?

Yes

- Repair the (L33) Left High Beam Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1637-RIGHT HIGH BEAM CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the High Beam Headlamps activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L34) RIGHT HIGH BEAM CONTROL CIRCUIT SHORT TO GROUND
RIGHT HIGH BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, clear all DTC's.
 Turn the High Beam Lamps on.
 With the scan tool, read DTC's.

Does the scan tool display active: B1637-RIGHT HIGH BEAM CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. RIGHT HIGH BEAM BULB

Turn the ignition off.
 Disconnect the Right High Beam Bulb.
 Turn the ignition on.
 With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Right High Beam Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L34) RIGHT HIGH BEAM CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
 Disconnect the TIPM C3 harness connector.
 Disconnect the Right Headlamp harness connector.
 Measure the resistance between ground and the Right High Beam Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L34) Right High Beam Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1638-RIGHT HIGH BEAM CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L34) RIGHT HIGH BEAM CONTROL CIRCUIT
(L34) RIGHT HIGH BEAM CONTROL CIRCUIT OPEN
(L34) RIGHT HIGH BEAM CONTROL CIRCUIT SHORT TO VOLTAGE
RIGHT HIGH BEAM BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Headlamps on.
With the scan tool, read DTC's.

Does the scan tool display active: B1638-RIGHT HIGH BEAM CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.
Disconnect the Right High Beam Lamp harness connector.
With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Right High Beam harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L34) RIGHT HIGH BEAM CONTROL CIRCUIT

Turn the ignition on.

With a 12-volt test light connected to ground, check the (L34) Right High Beam Control circuit.

Does the test light illuminate brightly with the headlamps switch turned on, and shut off with the headlamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L34) RIGHT HIGH BEAM CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L34) Right High Beam Control circuit between the Right Headlamp harness connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L34) Right High Beam Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L34) HIGH BEAM CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L34) High Beam Control circuit.

Is there any voltage present?

Yes

- Repair the (L34) High Beam Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B163B-FRONT LEFT TURN LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Turn Signal activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
FRONT LEFT TURN SIGNAL BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test**1. INTERMITTENT CONDITION**

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B163B-FRONT LEFT TURN LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by

inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. FRONT LEFT TURN SIGNAL BULB

Turn the ignition off.

Disconnect the Front Left Turn Signal Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Front Left Turn Signal Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Disconnect the Front Left Turn Signal Lamp harness connector.

Measure the resistance between ground and the (L61) Front Left Turn Signal Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L61) Front Left Turn Signal Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B163C-FRONT LEFT TURN LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT
(L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT OPEN
(L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE
FRONT LEFT TURN LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B163C-FRONT LEFT TURN LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Front Left Turn Signal Lamp assembly harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Front Left Turn Signal Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition on.

With the Left Turn Signal still on and a 12-volt test light connected to ground, check the (L61) Front Left Turn Signal Control circuit.

Does the test light blink brightly from on to off with the turn signal indicator?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L61) Front Left Turn Signal Control circuit between the Front Left Turn Signal Lamp assembly harness connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L61) Front Left Turn Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L61) FRONT LEFT TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L61) Front Left Turn Signal Control circuit.

Is there any voltage present?

No

- Repair the (L61) Front Left Turn Signal Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B163F-FRONT RIGHT TURN LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Turn Signal activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
FRONT RIGHT TURN SIGNAL BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Right Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B163F-FRONT RIGHT TURN LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. FRONT RIGHT TURN SIGNAL BULB

Turn the ignition off.

Disconnect the Front Right Turn Signal Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Front Right Turn Signal Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C3 harness connector.
Disconnect the Right Front Turn Signal Lamp harness connector.
Measure the resistance between ground and the (L60) Right Front Turn Signal Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L60) Right Front Turn Signal Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1640-FRONT RIGHT TURN LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN

CHECK (L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT
(L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT OPEN
(L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE
FRONT RIGHT TURN SIGNAL BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Right Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B1640-FRONT RIGHT TURN LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Front Right Turn Signal Lamp assembly harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Front Right Turn Signal Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT

Turn the ignition on.

With the Right Turn Signal still on and a 12-volt test light connected to ground, check the (L60) Front Right Turn Signal Control circuit.

Does the test light blink brightly from on to off with the turn signal indicator?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L60) FRONT RIGHT TURN SIGNAL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (L60) Front Right Turn Signal Control circuit between the Front Right Turn Signal Lamp assembly harness connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L60) Front Right Turn Signal Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L60) RIGHT TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L60) Front Right Turn Signal Control circuit.

Is there any voltage present?

No

- Repair the (L60) Front Right Turn Signal Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1643-REAR LEFT TURN LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Turn Signal activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L63) REAR LEFT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
REAR LEFT TURN SIGNAL BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B1643-REAR LEFT TURN LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. REAR LEFT TURN SIGNAL BULB

Turn the ignition off.

Disconnect the Rear Left Turn Signal Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Rear Left Turn Signal Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L63) LEFT TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Disconnect the Left Rear Tail Lamp harness connector.

Measure the resistance between ground and the (L63) Rear Left Turn Signal Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L63) Rear Left Turn Signal Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1644-REAR LEFT TURN LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z910) GROUND CIRCUIT
(Z910) GROUND CIRCUIT OPEN
CHECK (L63) LEFT REAR TURN SIGNAL CONTROL CIRCUIT
(L63) LEFT REAR TURN SIGNAL CONTROL CIRCUIT OPEN
(L63) LEFT REAR TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B1644-REAR LEFT TURN LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z910) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Left Rear Turn Signal Lamp assembly harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z910) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z910) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z910) Ground circuit(s) at the Left Rear Turn Signal Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z910) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L63) LEFT REAR TURN SIGNAL CONTROL CIRCUIT

Turn the ignition on.

With the Left Turn Signal still on and a 12-volt test light connected to ground, check the (L63) Left Rear Turn Signal Control circuit.

Does the test light blink brightly from on to off with the turn signal indicator?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L63) LEFT TURN SIGNAL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance of the (L63) Left Rear Turn Signal Control circuit between the Left Rear Tail Lamp assembly harness connector and the TIPM C4 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L63) Left Rear Turn Signal Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L63) LEFT REAR TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L63) Left Rear Turn Signal Control circuit.

Is there any voltage present?

Yes

- Repair short to voltage on the (L63) Left Rear Turn Signal Control circuit.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1647-REAR RIGHT TURN LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

With the Turn Signal activated.

◦ Set Condition:

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
RIGHT REAR TURN SIGNAL BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Right Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B1647-REAR RIGHT TURN LAMP CONTROL CIRCUIT LOW?**Yes**

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. REAR RIGHT TURN SIGNAL BULB

Turn the ignition off.

Disconnect the Right Rear Turn Signal Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?**Yes**

- Go To [3](#)

No

- Replace the Right Rear Turn Signal Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Disconnect the Right Rear Tail Lamp harness connector.

Measure the resistance between ground and the (L62) Right Rear Turn Signal Control circuit.

Is the resistance above 10k ohms?**Yes**

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

Repair the (L62) Right Rear Turn Signal Control circuit for a short to ground.

- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1648-REAR RIGHT TURN LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z910) GROUND CIRCUIT
(Z910) GROUND CIRCUIT OPEN
CHECK (L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT
(L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT OPEN
(L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, clear all DTC's.
Turn the Right Turn Signal on.
With the scan tool, read DTC's.

Does the scan tool display active: B1648-REAR RIGHT TURN LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z910) GROUND CIRCUITS

Turn the ignition off.

Disconnect the Right Rear Turn Signal Lamp assembly harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z910) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z910) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z910) Ground circuit(s) at the Right Rear Turn Signal Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z910) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT

Turn the ignition on.

With the Right Turn Signal still on and a 12-volt test light connected to ground, check the (L62) Right Rear

Turn Signal Control circuit.

Does the test light blink brightly from on to off with the turn signal indicator?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance of the (L62) Right Rear Turn Signal Control circuit between the Right Rear Tail Lamp assembly harness connector and the TIPM C4 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L62) Right Rear Turn Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L62) RIGHT REAR TURN SIGNAL CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L62) Right Rear Turn Signal Control circuit.

Is there any voltage present?

Yes

- Repair the (L62) Right Rear Turn Signal Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1663-REAR FOG LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Rear Fog Lamps activated.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) Detects a LOW condition.

Possible Causes
(L239) REAR FOG LAMP CONTROL CIRCUIT SHORT TO GROUND
LEFT REAR FOG LAMP BULB
RIGHT REAR FOG LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Rear Fog Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B1663-REAR FOG LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT REAR FOG LAMP BULB

Turn the ignition off.
Disconnect the Left Rear Fog Lamp Bulb.
Turn the ignition on.
With the scan tool, read DTC's.

Does the DTC reset?**Yes**

- Go To [3](#)

No

- Replace the Left Rear Fog Lamp Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. RIGHT REAR FOG LAMP BULB

Turn the ignition off.
Disconnect the Right Rear Fog Lamp Bulb.
Turn the ignition on.
With the scan tool, read DTC's.

Does the DTC reset?**Yes**

- Go To [4](#)

No

- Replace the Right Rear Fog Lamp Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (L239) REAR FOG LAMP CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C6 harness connector.
Disconnect the Left and Right Rear Fog Lamp harness connectors.
Measure the resistance between ground and the (L239) Rear Fog Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L239) Rear Fog Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1664-REAR FOG LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) Detects a HIGH condition.

Possible Causes
(L239) REAR FOG LAMP CONTROL CIRCUIT OPEN
(L239) REAR FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
LEFT AND/OR RIGHT REAR FOG LAMP BULBS
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test**1. INTERMITTENT CONDITION**

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Rear Fog Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B1664-REAR FOG LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT AND RIGHT REAR FOG LAMP BULBS

Turn the ignition off.

Remove the Left and Right Fog Lamp Bulbs.

Inspect the Left and Right Fog Lamp Bulbs.

Are the inoperative bulbs OK?

Yes

- Go To [3](#)

No

- Replace the Inoperative bulb(s) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L239) REAR FOG LAMP CONTROL CIRCUIT OPEN

Disconnect the TIPM C6 harness connector.

Disconnect the Left and Right Rear Fog Lamp harness connectors.

Measure the resistance of the (L239) Rear Fog Lamp Control circuit between the Left and Right Rear Fog Lamp harness connectors and the TIPM C6 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [4](#)

No

- Repair the (L239) Rear Fog Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

(L239) REAR FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

4.

Turn the ignition on.

Measure for voltage on the (L239) Rear Fog Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L239) Rear Fog Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B166B-LEFT TRAILER TOW LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) Detects a LOW condition.

Possible Causes
(L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.
 Turn on the Left Turn Signal.
 With the scan tool, read DTC's.

Does the scan tool display active: B166B-LEFT TRAILER TOW LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
 Disconnect the TIPM C6 harness connector.
 Measure the resistance between ground and the (L673) Left Trailer Tow Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L673) Left Trailer Tow Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) detects an HIGH condition.

Possible Causes
(L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT OPEN
(L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn on the Left Turn Signal.

With the scan tool, read DTC's.

Does the scan tool display active: B166C-LEFT TRAILER TOW LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C6 harness connector.

Disconnect the Left Trailer Tow Lamp harness connectors.

Measure the resistance of the (L673) Left Trailer Tow Lamp Control circuit between the Left Trailer Tow Lamp harness connectors and the TIPM C6 harness connector.

Does the ohm meter read open circuit?

Yes

- Repair the (L673) Left Trailer Tow Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (L673) LEFT TRAILER TOW LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage on the (L673) Left Trailer Tow Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L673) Left Trailer Tow Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) Detects a LOW condition.

Possible Causes
(L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn on the Right Turn Signal.

With the scan tool, read DTC's.

Does the scan tool display active: B166F-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C6 harness connector.

Measure the resistance between ground and the (L674) Right Trailer Tow Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (L674) Right Trailer Tow Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1670–RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously

- **Set Condition:**

The Totally Integrated Power Module (TIPM) Detects a HIGH condition.

Possible Causes
(L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT OPEN
(L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn on the Right Turn Signal.

With the scan tool, read DTC's.

Does the scan tool display active: B1670-RIGHT TRAILER TOW LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C6 harness connector.

Disconnect the Right Trailer Tow Lamp harness connectors.

Measure the resistance of the (L674) Right Trailer Tow Lamp Control circuit between the Right Trailer Tow Lamp harness connectors and the TIPM C6 harness connector.

Does the ohm meter read open circuit?**Yes**

- Repair the (L674) Right Trailer Tow Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (L674) RIGHT TRAILER TOW LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage on the (L674) Right Trailer Tow Lamp Control circuit.

Is there any voltage present?**Yes**

- Repair the (L674) Right Trailer Tow Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16B1–LEFT STOP LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z910) GROUND CIRCUIT
(Z910) GROUND CIRCUIT OPEN
CHECK (L53) LEFT STOP LAMP CONTROL CIRCUIT

(L53) LEFT STOP LAMP CONTROL CIRCUIT OPEN
(L53) LEFT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
LEFT STOP LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, clear all DTC's
 Turn the Stop Lamps on.
 With the scan tool, read DTC's.

Does the scan tool display active: B16B1–LEFT STOP LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z910) GROUND CIRCUITS

Turn the ignition off.
 Disconnect the Left Rear Tail Lamp harness connector.
 With a 12–volt test light connected to 12–volts, probe each (Z910) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z910) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z910) Ground circuit(s) at the Left Rear Tail Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z910) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L53) LEFT STOP LAMP CONTROL CIRCUIT

Turn the ignition on.

With the Stop Lamps still on and a 12-volt test light connected to ground, check the (L53) Left Stop Lamp Control circuit.

Does the test light illuminate brightly?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L53) LEFT STOP LAMP CONTROL CIRCUIT OPEN

Disconnect the TIPM C7 harness connector.

Measure the resistance of the (L53) Left Rear Turn Signal Control circuit between the Left Rear Tail Lamp harness connector and the TIPM C7 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L53) Turn Signal Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L53) LEFT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L53) Left Stop Lamp Control circuit.

Is there any voltage present?**Yes**

- Repair the (L53) Left Stop Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16B5–RIGHT STOP LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z910) GROUND CIRCUIT
(Z910) GROUND CIRCUIT OPEN
CHECK (L54) RIGHT STOP LAMP CONTROL CIRCUIT
(L54) RIGHT STOP LAMP CONTROL CIRCUIT OPEN
(L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

RIGHT STOP LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn the Stop Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B16B5–RIGHT STOP LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z910) GROUND CIRCUITS

Disconnect the Right Rear Tail Lamp harness connector.

With a 12-volt test light connected to 12-volts, probe each (Z910) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z910) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z910) Ground circuit(s) at the Right Rear Tail Lamp assembly harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z910) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L54) RIGHT STOP LAMP CONTROL CIRCUIT

Turn the ignition on.

With the Stop Lamps still on and a 12-volt test light connected to ground, check the (L54) Right Stop Lamp Control circuit.

Does the test light illuminate brightly?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L54) RIGHT STOP LAMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C7 connector.

Measure the resistance of the (L54) Right Stop Lamp Control circuit between the Right Rear Tail Lamp harness connector and the TIPM C7 harness connector.

Is the resistance below 10.0 ohms?

No

- Go To [6](#)

Yes

- Repair the (L54) Right Stop Lamp Control circuit for an open.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage between (L54) Right Stop Lamp Control circuit and ground.

Is there any voltage present?

Yes

- Repair the (L54) Right Stop Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16F8–FRONT LEFT FOG LAMP CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Front Fog Lamps activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT SHORT TO GROUND
FRONT LEFT FOG LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Front Fog Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B16F8–FRONT LEFT FOG LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. FRONT LEFT FOG LAMP BULB

Turn the ignition off.

Disconnect the Front Left Fog Lamp Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Front Left Fog Lamp Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance between ground and the (L89) Front Left Fog Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.

No

- Repair the (L89) Front Left Fog Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16F9–FRONT LEFT FOG LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT
(L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT OPEN
(L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
FRONT LEFT FOG LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Front Fog Lamps on.
With the scan tool, read DTC's.

Does the scan tool display active: B16F9–FRONT LEFT FOG LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Disconnect the Front Left Fog Lamp harness connector.
With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Front Left Fog Lamp harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT

Turn the ignition on.

With a 12-volt test light connected to ground, check the (L89) Front Left Fog Lamp Control circuit.

Does the test light illuminate brightly with the fog lamp switch turned on, and shut off with the fog lamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance between the (L89) Front Left Fog Lamp Control circuit and the Front Left Fog Lamp harness connector to the TIPM C4 connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L89) Front Left Fog Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L89) FRONT LEFT FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (L89) Front Left Fog Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L89) Front Left Fog Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16FC-FRONT RIGHT FOG LAMP CONTROL CIRCUIT LOW

For a complete wiring diagramRefer to Section 8W.

- **When Monitored:**

With the Front Fog Lamps activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a LOW condition.

Possible Causes
(L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT SHORT TO GROUND
FRONT RIGHT FOG LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, clear all DTC's.
Turn the Front Fog Lamps on.
With the scan tool, read DTC's.

Does the scan tool display active: B16FC— FRONT RIGHT FOG LAMP CONTROL CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by

inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. FRONT RIGHT FOG LAMP BULB

Turn the ignition off.

Disconnect the Front Right Fog Lamp Bulb.

Turn the ignition on.

With the scan tool, read DTC's.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Replace the Front Right Fog Lamp Bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance between ground and the Front Right Fog Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.

No

- Repair the (L90) Front Right Fog Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B16FD-FRONT RIGHT FOG LAMP CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a HIGH condition.

Possible Causes
CHECK (Z904) GROUND CIRCUIT
(Z904) GROUND CIRCUIT OPEN
CHECK (L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT
(L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT OPEN
(L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
FRONT RIGHT FOG LAMP BULB
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Front Fog Lamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B16FD—FRONT RIGHT FOG LAMP CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK (Z904) GROUND CIRCUITS

Disconnect the Front Right Fog Lamp assembly harness connector.
With a 12-volt test light connected to 12-volts, probe each (Z904) Ground circuit.

Does the test light illuminate brightly on each ground circuit?

Yes

- Go To [4](#)

No

- Go To [3](#)

3. (Z904) GROUND CIRCUIT OPEN

Measure the resistance of the appropriate (Z904) Ground circuit(s) at the Front Right Fog Lamp harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the appropriate (Z904) Ground circuit(s) for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. CHECK (L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT

Turn the ignition on.
With a 12-volt test light connected to ground, check the (L90) Front Right Fog Lamp Control circuit.

Does the test light illuminate brightly with the fog lamp switch turned on, and shut off with the fog lamps turned off?

Yes

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

5. (L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C4 harness connector.

Measure the resistance of the (L90) Front Right Fog Lamp Control circuit between the Front Right Fog Lamp assembly harness connector and the TIPM C4 connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the (L90) Front Right Fog Lamp Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (L90) FRONT RIGHT FOG LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (L90) Front Right Fog Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L90) Front Right Fog Lamp Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B17B8—LEFT STOP LAMP CONTROL CIRCUIT OVERCURRENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a OVERCURRENT condition.

Possible Causes
(L53) LEFT STOP LAMP CONTROL CIRCUIT SHORT TO GROUND
(L53) LEFT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Left Turn Signals on.

With the scan tool, read DTC's.

Does the scan tool read active: B17B8–LEFT STOP LAMP CONTROL CIRCUIT OVERCURRENT?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT STOP LAMP BULB

Turn the ignition off.

Remove Left Stop Lamp Bulb.

Inspect the Left Stop Lamp Bulb.

Is the inoperative bulb OK?

Yes

- Go To [3](#)

No

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L53) LEFT STOP LAMP CONTROL CIRCUIT SHORT TO GROUND

Disconnect the TIPM C7 harness connector.

Disconnect the Left Stop Lamp harness connector.

Measure the resistance between ground and the (L53) Left Stop Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Go To [4](#)

No

- Repair the (L53) Left Stop Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (L53) LEFT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L53) Left Stop Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L543) Left Stop Lamp Control circuit short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B17B9–RIGHT STOP LAMP CONTROL CIRCUIT OVERCURRENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a OVERCURRENT condition.

Possible Causes
(L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORT TO GROUND
(L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B17B9–RIGHT STOP LAMP CONTROL CIRCUIT OVERCURRENT?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. RIGHT STOP LAMP BULB

Turn the ignition off.

Remove Right Stop Lamp Bulb.
Inspect the Right Stop Lamp Bulb.

Is the inoperative bulb OK?

Yes

- Go To [3](#)

No

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORT TO GROUND

Disconnect the TIPM C7 harness connector.
Disconnect the Right Stop Lamp harness connector.
Measure the resistance between ground and the (L54) Right Stop Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Go To [4](#)

No

- Repair the (L54) Right Stop Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (L54) RIGHT STOP LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure for voltage on the (L54) Right Stop Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L54) Right Stop Lamp Control circuit short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B17BA-HEADLAMP LEVELING MOTOR CONTROL CIRCUIT OVERCURRENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a OVERCURRENT condition.

Possible Causes
(L133) HEADLAMP LEVELING MOTOR CONTROL CIRCUIT SHORT TO GROUND
(L133) HEADLAMP LEVELING MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn the Headlamps on.

With the scan tool, read DTC's.

Does the scan tool display active: B17BA-HEADLAMP LEVELING MOTOR CONTROL CIRCUIT OVERCURRENT?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

2. (L133) HEADLAMP LEVELING MOTOR CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Disconnect the Headlamp harness connector.

Measure the resistance between ground and the (L133) Headlamp Leveling Motor Control circuit.

Is the resistance above 10k ohms?

Yes

- Go To [3](#)

No

- Repair the (L133) Headlamp Leveling Motor Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L133) HEADLAMP LEVELING MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L133) Headlamp Leveling Motor Control circuit.

Is there any voltage present?

Yes

- Repair the (L133) Headlamp Leveling Motor Control circuit short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B17BF-LEFT SIDEMARKER LAMP CONTROL CIRCUIT OVERCURRENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

Set Condition:

When the Totally Integrated Power Module (TIPM) detects a OVERCURRENT condition.

Possible Causes
(L163) LEFT SIDEMARKER LAMP CONTROL CIRCUIT SHORT TO GROUND
(L163) LEFT SIDEMARKER LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B17BF-LEFT SIDEMARKER LAMP CONTROL CIRCUIT OVERCURRENT?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. LEFT REAR TURN SIGNAL BULB

Turn the ignition off.

Remove Left Rear Turn Signal Bulb.

Inspect the Left Rear Turn Signal Bulb.

Is the inoperative bulb OK?

Yes

- Go To [3](#)

No

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L163) LEFT SIDEMARKER LAMP CONTROL CIRCUIT SHORT TO GROUND

Disconnect the TIPM C4 harness connector.

Disconnect the Left Sidemarker Lamp harness connector.

Measure the resistance between ground and the (L163) Left Sidemarker Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Go To [4](#)

No

- Repair the (L163) Left Sidemarker Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (L163) LEFT SIDEMARKER LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (L163) Left Sidemarker Lamp Control circuit.

Is there any voltage present?

Yes

- Repair the (L163) Left Sidemarker Lamp Control circuit short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B17C4–RIGHT SIDEMARKER LAMP CONTROL CIRCUIT OVERCURRENT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects a OVERCURRENT condition.

Possible Causes
(L162) RIGHT SIDEMARKER LAMP CONTROL CIRCUIT SHORT TO GROUND
(L162) RIGHT SIDEMARKER LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's

Turn the Left Turn Signal on.

With the scan tool, read DTC's.

Does the scan tool display active: B17C4–RIGHT SIDEMARKER LAMP CONTROL CIRCUIT OVERCURRENT?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. RIGHT REAR TURN SIGNAL BULB

Turn the ignition off.
Remove Right Rear Turn Signal Bulb.
Inspect the Right Rear Turn Signal Bulb.

Is the inoperative bulb OK?

Yes

- Go To [3](#)

No

- Replace the Inoperative bulb in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (L162) RIGHT SIDEMARKER LAMP CONTROL CIRCUIT SHORT TO GROUND

Disconnect the TIPM C4 harness connector.
Disconnect the Right Sidemarker Lamp harness connector.
Measure the resistance between ground and the (L162) Right Sidemarker Lamp Control circuit.

Is the resistance above 10k ohms?

Yes

- Go To [4](#)

No

- Repair the (L162) Right Sidemarker Lamp Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (L162) RIGHT SIDEMARKER LAMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure for voltage on the (L162) Right Sidemarker Lamp Control circuit.

Is there any voltage present?

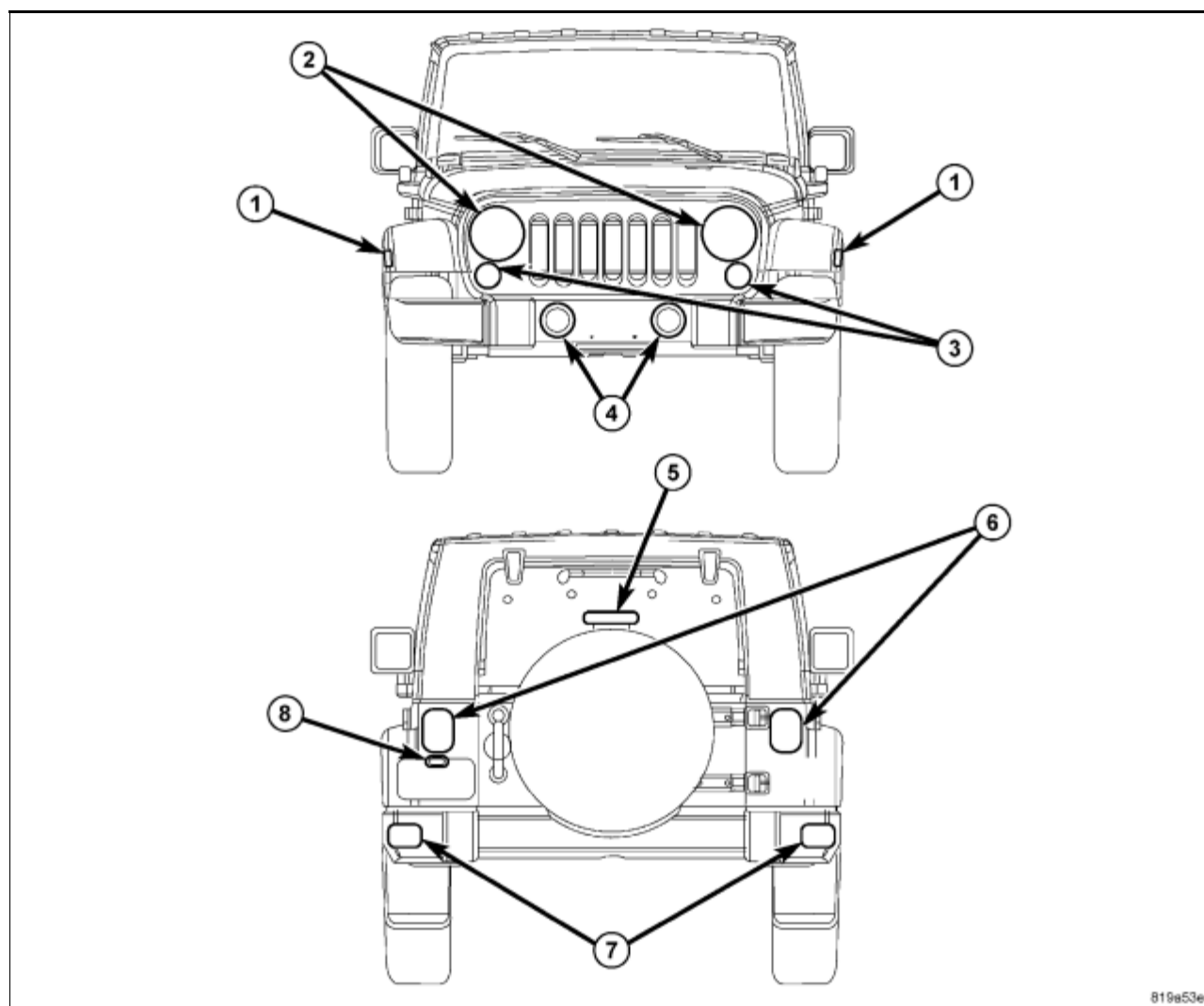
Yes

- Repair the (L162) Right Sidemarker Lamp Control circuit short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

LAMPS/LIGHTING - EXTERIOR**LAMPS/LIGHTING - EXTERIOR****DESCRIPTION**

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The exterior lighting system for this vehicle includes the following exterior lamp units:

- **Center High Mounted Stop Lamp (5)** - A standard equipment Center High Mounted Stop Lamp (CHMSL) is mounted to a stanchion that is integral to the spare tire carrier centered on the swing gate at the rear of the vehicle.
- **Front Fog Lamps (4)** - Optional equipment front fog lamp units are mounted inboard of the bumperettes of the front bumper on vehicles manufactured for domestic markets, or outboard of the bumperettes on vehicles manufactured for export markets.
- **Front Park/Turn Lamps (3)** - A standard equipment front park/turn lamp unit is mounted at each lower

outboard corner of the grille panel.

- **Front Position Lamps** - A front position lamp is integral to each headlamp unit on vehicles manufactured for export markets where they are required.
- **Front Side Marker or Repeater Lamps (1)** - A standard equipment front side marker lamp is located near the front of each front fender flare on vehicles manufactured for domestic markets. The front side marker lamps are replaced with a standard repeater lamp mounted in the same location on vehicles manufactured for export markets where they are required.
- **Headlamps (2)** - A standard equipment front headlamp is mounted to the front end module support at each upper outboard corner of the grille panel.
- **License Plate Lamps (8)** - A single standard equipment rear license plate lamp unit is integral to the license plate mounting bracket just below the left rear lamp unit on vehicles manufactured for domestic markets. A bracket with two rear license plate lamps is located on the rear bumper directly below the spare tire on vehicles manufactured for export markets.
- **Rear Fog Lamps (7)** - Rear fog lamp units are mounted on the outboard ends of the rear bumpers on vehicles manufactured for export markets where they are required.
- **Rear Lamp Units (6)** - A standard equipment rear lamp unit is mounted to the rear of each rear body corner panel on either side of the swing gate opening.
- **Underhood Lamp** - Vehicles equipped with this option have a single underhood lamp unit with an integral automatic mechanical (non-mercury) switch. The lamp and switch unit is mounted to the underside of the inner hood reinforcement above the right side of the engine compartment.

These exterior lighting lamp units and their controls are combined to provide the following exterior lighting features:

- **Backup Lamps** - The backup (or reverse) lamps include a clear bulb, reflector and clear lens that are integral to each rear lamp unit.
- **Brake Lamps** - The brake (or stop) lamps include a clear bulb, reflector and red lens that are integral to each rear lamp unit, and the red lens and multiple Light-Emitting Diode (LED) units of the CHMSL.
- **Daytime Running Lamps** - Daytime Running Lamps (DRL) are standard equipment on vehicles manufactured for sale in Canada and optional on vehicles manufactured for the United States. Vehicles with DRL illuminate the high beam filament of each headlamp bulb at a reduced intensity to serve as the DRLs.
- **Exterior Lamp Fail-Safe Operation** - The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and the Totally Integrated Power Module (TIPM) provide a fail-safe feature which will automatically turn ON the low beam headlamps and all park lamps when the ignition switch is in the ON position and there is no detected input from the Steering Control Module (SCM), or when there is no communication over the Local Interface Network (LIN) or Controller Area Network (CAN) data buses.
- **Exterior Lamp Load Shedding** - The TIPM provides a battery saver feature which will automatically turn OFF all exterior lamps that remain ON with the ignition switch in the LOCK position after a timed interval of about eight minutes.
- **Front Fog Lamps** - The standard equipment front fog lamps include the clear bulb, reflector and clear lens of each adjustable front fog lamp unit.
- **Hazard Warning Lamps** - The hazard warning lamps include the bulbs, reflectors and lenses of each lamp in the right and left, front and rear turn signal circuits.
- **Headlamp Delay** - The standard equipment low or high beam headlamps remain illuminated for a customer-programmable delay period of 0 (disabled), 30, 60 or 90 seconds when the headlamps are turned OFF after the ignition switch has been turned to the OFF position.
- **Headlamps** - The headlamps include a single, dual filament halogen bulb, a reflector and a clear lens integral to each headlamp unit. Headlamps for domestic markets are vertically adjustable, while those for export markets are both vertically and horizontally adjustable.
- **Headlamp Leveling** - Headlamp leveling is available only in certain markets where it is required equipment. A headlamp leveling actuator motor attached to each headlamp mounting collar and a headlamp leveling switch integral to the switch pod in the instrument panel center stack allow the

headlamp beam pattern to be adjusted by the vehicle operator from the interior of the vehicle to compensate for variable passenger or cargo loads.

- **Optical Horn** - Also known as flash-to-pass, the beam selection function of the left (lighting) multi-function switch control stalk has a momentary intermediate position that allows the headlamp high beams to be flashed momentarily, without changing the headlamp beam selection.
- **Park Lamps** - The front park lamps include the bulbs, reflectors and amber lenses integral to each front park/turn lamp unit and, if the vehicle is so equipped, the clear position lamp bulb integral to each headlamp unit. The rear park lamps include the clear bulbs, reflectors and red lenses integral to each rear lamp unit as well as the bulbs and lenses of the rear license plate lamp or lamps.
- **Rear Fog Lamps** - Rear fog lamps are available only in certain markets where they are required equipment. The rear fog lamps include a clear bulb and a red lens and reflector that are integral to each rear lamp unit.
- **Turn Signal Lamps** - The front turn signal lamps include a clear bulb, a reflector and an amber lens that are integral to each front park/turn lamp unit. In certain markets where they are required, the repeater lamps on each front fender flare will also be included in the front turn signal circuits. The domestic market rear turn signal lamps include a clear bulb, a reflector and a red lens integral to each rear lamp unit; while the export market rear turn signal lamps include an amber bulb, a reflector and a clear lens that are integral to each rear lamp unit.

Other components of the exterior lighting system for this vehicle include:

- **Backup Lamp Switch** - A plunger-type backup lamp switch is installed through the transmission housing of vehicles equipped with a manual transmission and is actuated by the shifter mechanism within the transmission when REVERSE gear is selected. On vehicles with an optional automatic transmission a stand-alone Transmission Range Sensor (TRS) performs the backup lamp switch function.
- **Brake Lamp Switch** - A plunger-type brake lamp switch is located on the brake pedal support bracket under the instrument panel and is actuated by the brake pedal arm when the brake pedal is depressed.
- **Clockspring** - The clockspring includes an integral turn signal cancel cam, which provides automatic turn signal cancellation as the steering wheel is rotated back to its centered position following a vehicle turning maneuver. The clockspring is located near the top of the steering column, directly beneath the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - DESCRIPTION).
- **Hazard Switch** - A latching push button-actuated hazard switch is integral to the switch pod located just below the heater and air conditioner controls in the center stack area of the instrument panel.
- **Headlamp Leveling Motor** - A headlamp leveling motor is mounted to the back of the front end module support behind each headlamp of vehicles manufactured for certain markets where the headlamp leveling feature is required.
- **Headlamp Leveling Switch** - A four mode push button-actuated headlamp leveling switch is integral to the switch pod located just below the heater and air conditioner controls in the center stack area of the instrument panel of vehicles manufactured for certain markets where the headlamp leveling feature is required.
- **Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) is also known as the Cab Compartment Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Instrument Panel Switch Pod** - The instrument panel switch pod contains the hazard switch and, on vehicles so equipped, the headlamp leveling switch. The switch pod is located just below the heater and air conditioner controls in the center stack area of the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/INSTRUMENT PANEL SWITCH POD - DESCRIPTION).
- **Left Multi-Function Switch** - The left (lighting) multi-function switch is located on the steering column, just below the steering wheel. A control stalk that extends from the left side of the switch is used to select the turn signal lamps (right or left) and to select the headlamp beam (low, high or optical horn). A control knob on the control stalk is used to select the park lamps, headlamps or fog lamps.
- **Park Brake Switch** - A park brake switch is located on the park brake lever mechanism on the floor panel transmission tunnel between the two front seats.

- **Steering Control Module** - The Steering Control Module (SCM) is located within the left multi-function switch housing on the top of the steering column, just below the steering wheel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/STEERING COLUMN CONTROL MODULE - DESCRIPTION).
- **Totally Integrated Power Module** - The Totally Integrated Power Module (TIPM) is located in the engine compartment, near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION - DESCRIPTION).
- **Trailer Tow Wiring** - Vehicles equipped with an optional Trailer Tow package have a trailer tow wire harness that is connected between the body wire harness and the left rear lamp unit to provide a take out and a molded four-way trailer tow connector secured to a bracket near the trailer hitch receiver below the rear bumper.

Hard wired circuitry connects the exterior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the exterior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

Following are paragraphs that briefly describe the operation of each of the major exterior lighting systems. The lamps and the hard wired circuits between components related to the exterior lighting system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the exterior lighting system or the electronic controls or communication between modules and other devices that provide some features of the exterior lighting system. The most reliable, efficient, and accurate means to diagnose the exterior lighting system or the electronic controls and communication related to exterior lighting system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

BACKUP LAMPS

The backup (or reverse) lamps have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud on the body sheet metal within the passenger compartment. On vehicles with a manual transmission, the backup lamp switch provides a hard wired input to the Totally Integrated Power Module (TIPM) through a reverse switch signal circuit and the TIPM provides battery voltage to the backup lamps on the backup lamp feed circuit whenever the ignition switch is in the ON position and the REVERSE position is selected with the transmission shift linkage.

On vehicles with an automatic transmission the Transmission Control Module (TCM) monitors a multiplex input from the Transmission Range Sensor (TRS), then sends the proper electronic **transmission gear selector status** messages to other electronic modules over the Controller Area Network (CAN) data bus. Whenever the ignition switch is in the ON position and the TIPM receives an electronic message indicating the status of the transmission gear selector is REVERSE, it provides a battery voltage output through a high side driver to the backup lamps on the backup lamp feed circuit.

BRAKE LAMPS

The brake (or stop) lamps and the Center High Mounted Stop Lamp (CHMSL) each have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud on the body sheet metal within the passenger compartment. The CHMSL receives battery voltage directly on the brake lamp switch output circuit when the brake lamp switch is closed by the brake pedal arm. The TIPM also receives battery voltage on the brake lamp switch output circuit, which it uses as a signal to energize the brake lamps. The TIPM provides battery voltage to the brake lamps through a high side driver on the tail/stop lamp rear feed circuit when it receives the proper input from the closed brake lamp switch.

DAYTIME RUNNING LAMPS

Vehicles equipped with the Daytime Running Lamps (DRL) feature illuminate the high beam filament of both headlamp bulbs at a reduced intensity when the engine is running, the parking brake is released, the headlamps are turned OFF, and the optional automatic transmission gear selector lever is in any position except PARK. The park lamps may be ON or OFF for DRL to operate. For vehicles with a manual transmission, the DRL will operate in any transmission gear selector lever position. The TIPM must be programmed appropriately for this feature to be enabled.

Once enabled, anytime the TIPM receives electronic messages over the CAN data bus from the Powertrain Control Module (PCM) indicating the engine is running, from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) indicating the status of the left (lighting) multi-function switch is in any position except headlamps ON and the parking brake lever is released, and from the Transmission Control Module (TCM) indicating the automatic transmission gear selector lever is in any position except PARK, the TIPM provides a pulse width modulated voltage output to the headlamp high beam bulb filaments through high side drivers on the right and left high beam feed circuits to produce illumination at a reduced intensity.

FRONT FOG LAMPS

The front fog lamps have a path to ground at all times through their connection to the engine compartment wire harness. The engine compartment wire harness has takeouts with eyelet terminals that are secured by nuts to ground studs on the front end sheet metal within the engine compartment. The Steering Control Module (SCM) monitors a hard wired multiplex input from the left multi-function switch to determine whether the fog lamps are selected, then sends an electronic **front fog lamp switch status** message to the EMIC over the Local Interface Network (LIN) data bus and the EMIC relays an electronic **front fog lamp request** message to the TIPM over the CAN data bus.

When the TIPM receives a **front fog lamp request** message it then controls front fog lamp operation by controlling a battery voltage output through high side drivers on right and left fog lamp feed circuits. The TIPM also sends the appropriate electronic message back to the EMIC to illuminate or extinguish the front fog lamp indicator. In certain markets where required, the TIPM will automatically de-energize the front fog lamps any time the headlamp high beams are selected.

The TIPM also provides a battery saver (load shedding) feature for the front fog lamps, which will turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the LOCK position, if there is a charging system failure, or if the electrical system voltage falls below about 11.75 volts for more

than about 30 seconds. The TIPM will return the front fog lamps to normal operation when it detects that system voltage is greater than 13.0 volts for more than about 30 seconds.

Each front fog lamp includes an integral adjustment screw to be used for static aiming of the fog lamp beams.

HAZARD WARNING LAMPS

The hazard warning system includes the EMIC, the TIPM and the hazard switch in the switch pod located in the center stack area of the instrument panel, below the air conditioner and heater controls. The hazard switch provides a hard wired output to the TIPM. The TIPM monitors the hazard switch input through an internal pull-up.

When the TIPM receives an input from the hazard switch it controls hazard warning system operation and flash rate by controlling battery voltage outputs through high side drivers on the right and left turn signal feed circuits. The TIPM also sends the appropriate electronic messages back to the EMIC over the CAN data bus to control the illumination and flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional hazard warning flasher. The EMIC then sends messages to the instrument panel switch pod over the LIN data bus to control the illumination of the hazard switch push button.

HEADLAMPS

The headlamp system includes the SCM, the EMIC, the TIPM, and the left (lighting) multi-function switch on the steering column. The headlamp bulbs have a path to ground at all times through their connection to the engine compartment wire harness. The engine compartment harness has takeouts with eyelet terminals that are secured by nuts to ground studs on the front end sheet metal within the engine compartment. The TIPM will store a Diagnostic Trouble Code (DTC) for any shorts or opens in the headlamp circuits.

The SCM monitors a hard wired multiplex input to determine the status of the left multi-function switch and whether the headlamp high or low beams are selected. The SCM then sends the appropriate electronic **headlamp switch** and **headlamp beam select switch status** messages to the EMIC over the LIN data bus. The EMIC then sends the appropriate electronic **headlamp** and **headlamp beam request** messages to the TIPM over the CAN data bus. The TIPM responds to these messages by providing a pulse width modulated voltage output to the headlamps through high side drivers on the right and left low and high beam feed circuits to illuminate the selected headlamp filaments. The TIPM also sends the appropriate electronic messages to the EMIC to control the illumination of the high beam indicator. When the optical horn feature is selected, the low beams will shut OFF about 200 milliseconds after the high beams are activated.

The TIPM also remembers which beams (LOW or HIGH) were selected when the headlamps were last turned OFF, and energizes those beams again the next time the headlamps are turned ON. The TIPM provides a battery saver (load shedding) feature for the headlamps, which will turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the LOCK position. The SCM and the EMIC each provide a fail-safe feature for the headlamps, which will cause the TIPM to turn the low beam headlamps ON automatically if there is no input available from the left multi-function switch. The TIPM also provides a fail-safe feature for the headlamps that will turn the headlamps ON automatically whenever a loss of CAN bus communication is detected with the ignition switch in the ON position.

Each headlamp includes an integral adjustment screw (domestic markets) or screws (export markets) to be used for static aiming of the headlamps.

HEADLAMP DELAY

The headlamp delay feature includes the left (lighting) multi-function switch, the SCM, the EMIC and the TIPM. This feature has customer programmable delay intervals of 0 seconds (disabled), 30 seconds, 60 seconds and 90 seconds. If the left multi-function switch remains in the headlamp ON position until after the ignition switch is turned to the OFF position, then the headlamps will remain illuminated until after the selected delay interval has elapsed. The park lamps will not stay ON during the headlamp delay interval. The default delay interval is zero seconds (disabled), but can be reprogrammed by the customer using the customer programmable features function of the EMIC.

HEADLAMP LEVELING

In certain markets where required, a headlamp leveling system is provided on the vehicle. The headlamp leveling system includes unique front headlamp units each connected to a headlamp leveling actuator motor, and a rocker-actuated headlamp leveling switch integral to the switch pod in the instrument panel center stack. The headlamp leveling system allows the headlamp beams to be adjusted to one of four vertical positions to compensate for changes in inclination caused by the loading of the vehicle suspension. The leveling motors are mechanically connected through an integral pushrod to the adjustable headlamp mounting collar.

Each time the headlamp leveling switch is depressed the circuitry of the switch pod provides an electronic **select status up** or **select status down** message input to the EMIC over the LIN data bus. The EMIC then sends the appropriate electronic **select request up** or **select request down** messages to the TIPM over the CAN data bus. The TIPM responds to these messages by providing a voltage output to the headlamp leveling motors through high side drivers on the headlamp leveling motor right and left signal circuits to move the headlamp reflectors to the selected position based upon the voltage input received from the TIPM. The TIPM also sends the appropriate electronic messages back to the EMIC and the EMIC relays the message back to the switch to control the illumination of the 1, 2, or 3 Light Emitting Diode (LED) selected position indicator in the leveling switch button. The EMIC and TIPM logic will only allow the headlamp leveling system to operate while the ignition switch is in the ON position and the exterior lighting is turned ON.

PARK LAMPS

The park lamps system includes the left (lighting) multi-function switch, the SCM, the EMIC and the TIPM. The front park/turn lamp and the position lamp bulbs each have a path to ground at all times through their connection to the engine compartment wire harness. The engine compartment wire harness has takeouts with eyelet terminals that are secured by nuts to ground studs on the front end sheet metal within the engine compartment. The rear lamp units and license plate lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud on the body sheet metal within the passenger compartment.

The SCM monitors a hard wired multiplex input from the left multi-function switch, then sends the appropriate electronic **headlamp switch status** messages to the EMIC over the LIN data bus. Then the EMIC relays the appropriate electronic message to the TIPM over the CAN data bus. The TIPM responds to these messages by providing a battery voltage output to the appropriate lamp bulbs through high side drivers on the proper park/tail/license/running lamp right and left circuits. The TIPM and the SCM also send the appropriate electronic messages to the EMIC to control the illumination and lighting level of the panel lamps.

The TIPM provides a battery saver (load shedding) feature for the park lamps, which will turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the LOCK position. The SCM and the EMIC each provide a fail-safe feature for the park lamps, which will send an electronic message to the TIPM to turn these lamps ON automatically if there is no input available from the left multi-function switch. The TIPM also provides a fail-safe feature for the park lamps that will turn these lamps ON automatically whenever a loss of CAN bus communication is detected with the ignition switch in the ON position.

REAR FOG LAMPS

Rear fog lamps are installed on vehicles manufactured for all export markets. The rear fog lamp system includes the left (lighting) multi-function switch, the SCM, the EMIC and the TIPM. The rear fog lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud on the body sheet metal within the passenger compartment.

The SCM monitors a hard wired multiplex input from the left multi-function switch to determine whether the rear fog lamps are selected, then sends electronic **rear fog lamp switch status** messages to the EMIC over the LIN data bus. Then the EMIC relays an electronic **rear fog lamp request** message to the TIPM over the CAN data bus. The TIPM responds to this message by providing a battery voltage output to the rear fog lamp bulbs through high side drivers on the fog lamp relay control rear circuit. The TIPM also sends the appropriate electronic message back to the EMIC to control the rear fog lamp indicator.

The TIPM will automatically energize and de-energize the front fog lamps in concert with the rear fog lamps. The TIPM also provides a battery saver (load shedding) feature for the rear fog lamps, which will turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the LOCK position.

TRAILER TOW WIRING

Domestic market vehicles equipped with an optional trailer tow package include a trailer tow wire harness connected between the body wire harness and the left rear lamp unit. The trailer tow harness includes a molded four-way trailer tow connector and an integral cover that are snapped into a bracket on the trailer hitch receiver platform.

TURN SIGNAL LAMPS

The turn signal lamps system includes the left (lighting) multi-function switch, the SCM, the EMIC and the TIPM. The front turn signal lamp bulbs each have a path to ground at all times through their connection to the engine compartment wire harness. The engine compartment wire harness has a takeout with an eyelet terminal that is secured by a nut to a ground stud on the body sheet metal within the engine compartment. The rear turn signal lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a nut to a ground stud on the body sheet metal within the passenger compartment.

The SCM monitors a hard wired multiplex input from the left multi-function switch to determine the status of the turn signal switch, then sends the appropriate electronic **turn signal switch status** messages to the EMIC over the LIN data bus. Then the EMIC relays an electronic **turn signal request** message to the TIPM over the CAN data bus. The TIPM responds to these messages by controlling a battery voltage output and the flash rate for either the right or left turn signal lamps through high side drivers on the appropriate right or left turn signal feed circuits. The TIPM also sends the appropriate electronic messages back to the EMIC to control the

illumination and flash rate of the right or left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional turn signal flasher.

The EMIC also provides a **turn signal ON warning** that will generate repetitive chimes to indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per-hour). Vehicles built for markets other than the United States and Canada have a revised distance threshold of 4 kilometers (2.49 miles) for this feature. The chime will continue until the turn signal input becomes inactive or until the vehicle speed message indicates that the speed is less than 22 kilometers-per-hour (15 miles-per-hour), whichever occurs first.

WARNING

WARNINGS - LAMPS/LIGHTING - EXTERIOR

WARNING: To avoid serious or fatal injury, eye protection should be used when servicing any glass components.

CAUTION: Do not contaminate the glass of halogen bulbs with fingerprints or allow contact with other possibly oily surfaces. Reduced bulb life will result.

CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owner's Manual. Damage to lamps, lenses, wiring and other related electrical components can result.

DIAGNOSIS AND TESTING

LAMPS/LIGHTING - EXTERIOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: When diagnosing the exterior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.

NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.

The lamps and the hard wired circuits between components related to the exterior lighting system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the exterior lighting system or the electronic controls or communication between modules and other devices that provide some features of the exterior lighting system. The most reliable, efficient, and accurate means to diagnose the exterior lighting system or the electronic controls and communication related to exterior lighting system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

BACKUP LAMPS

CONDITION	POSSIBLE CAUSES	CORRECTION
BACKUP LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace backup lamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open backup lamp ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open backup lamp feed circuit if required.
	4. Ineffective switch.	4. Test and replace backup lamp switch (manual transmission) or transmission range sensor (automatic transmission) if required.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
BACKUP LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted backup lamp feed circuit if required.
	2. Ineffective switch.	2. Test and replace backup lamp switch (manual transmission) or transmission range sensor (automatic transmission) if required.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

BRAKE LAMPS

NOTE: The Center High Mounted Stop Lamp (CHMSL) is illuminated by several Light-Emitting Diode (LED) units that are soldered to the electronic circuit board within the lamp housing. The CHMSL is hard wired to the output of the brake lamp switch, while the brake lamps are powered by high side drivers within the TIPM based upon an input from the brake lamp switch. If the brake lamps and all of the LED units within the CHMSL fail to operate, diagnose and repair the brake lamps before attempting to repair the CHMSL. If the brake lamps operate but none of the CHMSL LED units illuminate, test and repair the CHMSL ground or feed circuit if required. If some of the CHMSL LED units operate and others do not, the CHMSL assembly must be replaced with a new unit.

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKE LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace brake lamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open brake lamp ground circuit if required.
	3. Ineffective fuse.	3. Test and replace the fuse in the TIPM if required.
	4. Ineffective feed circuit.	4. Test and repair open brake lamp switch output circuit or stop lamp output circuit if required.
	5. Ineffective switch.	5. Test and replace brake lamp switch if required.
	6. Ineffective TIPM inputs or outputs.	6. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
BRAKE LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted brake lamp switch output circuit or stop lamp output circuit if required.
	2. Improperly adjusted switch.	2. Adjust the brake lamp switch if required.
	3. Ineffective switch.	3. Test and replace brake lamp switch if required.
	4. Ineffective TIPM inputs or outputs.	4. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

DAYTIME RUNNING LAMPS

NOTE: Before performing the following tests, determine whether the headlamp low and high beams operate. If the headlamp low and high beams are also ineffective, diagnose and repair that problem before attempting to repair the Daytime Running Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
DAYTIME RUNNING LAMPS WILL NOT ILLUMINATE	1. Incorrect TIPM programming.	1. Use a diagnostic scan tool to check and configure TIPM if required.
	2. Automatic transmission in PARK position.	2. Place the transmission gear selector lever in any position except PARK.
	3. Parking brake applied.	3. Release the parking brake.
	4. Engine not running.	4. Start the engine.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

FRONT FOG LAMPS

NOTE: The front fog lamp switch is integral to the left multi-function switch/Steering Control Module (SCM), which communicates with the ElectroMechanical Instrument Cluster (EMIC)/Cab Compartment Node (CCN) over the Local Interface Network (LIN) data bus. Before performing any of the following tests, determine whether the other functions of the left multi-function switch/SCM are operational. If the other left multi-function switch/SCM functions are ineffective, diagnose and repair that problem before attempting to repair the Front Fog Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT FOG LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace front fog lamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open front fog lamp ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open front fog lamp feed circuit if required.
	4. Ineffective EMIC (CCN) inputs or outputs.	4. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
FRONT FOG LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted front fog lamp feed circuit if required.
	2. Ineffective EMIC (CCN) inputs or outputs.	2. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

HAZARD WARNING LAMPS

NOTE: The hazard switch is integral to the instrument panel switch bank, which communicates with the EMIC/CCN over the LIN data bus. Before performing any of the following tests, confirm whether the left and right turn signals operate satisfactorily. Then determine whether the other functions of the instrument panel switch bank are operational. If the turn signals are ineffective or operate improperly, or if the other instrument panel switch bank functions are ineffective, diagnose and repair those problems before attempting to repair the Hazard Warning Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
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HAZARD WARNING LAMPS DO NOT FLASH	1. Ineffective EMIC (CCN) inputs or outputs.	1. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	2. Ineffective TIPM inputs or outputs.	2. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
HAZARD WARNING LAMPS DO NOT STOP FLASHING	1. Ineffective EMIC (CCN) inputs or outputs.	1. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	2. Ineffective TIPM inputs or outputs.	2. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

HEADLAMPS

NOTE: As part of the exterior lighting failsafe feature, upon ignition ON, all exterior park lamps and the headlamp low beams will illuminate regardless of the left multi-function switch control knob position if the SCM cannot detect an input from the left multi-function switch, or if there is a loss of communication between the left multi-function switch/SCM and the EMIC or between the EMIC and the TIPM. Diagnose and repair those problems before attempting to repair the Headlamps. In addition, the TIPM will store a Diagnostic Trouble Code (DTC) for an open or shorted headlamp circuit.

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace headlamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open headlamp ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open headlamp low beam or high beam feed circuit if required.
	4. Ineffective EMIC (CCN) inputs or outputs.	4. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
HEADLAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted headlamp low beam or high beam feed circuit if required.
	2. Ineffective EMIC (CCN) inputs or outputs.	2. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

HEADLAMPS ILLUMINATE WITH IGNITION ON AND HEADLAMP SWITCH OFF (FAIL-SAFE OPERATION)	1. Loss of LIN or CAN data bus communication.	1. Test and repair the LIN or CAN data bus if required. Refer to the appropriate diagnostic information.
HEADLAMPS WILL NOT SWITCH FROM HIGH TO LOW BEAMS, OR FROM LOW TO HIGH BEAMS	1. Ineffective EMIC (CCN) inputs or outputs.	1. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	2. Ineffective TIPM inputs or outputs.	2. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

HEADLAMP LEVELING

NOTE: The headlamp leveling switch is integral to the instrument panel switch bank, which communicates with the EMIC/CCN over the LIN data bus. Before performing any of the following tests, confirm whether the park lamps operate satisfactorily. Then determine whether the other functions of the instrument panel switch bank are operational. If the park lamps are ineffective or operate improperly, or if the other instrument panel switch bank functions are ineffective, diagnose and repair those problems before attempting to repair the Headlamp Leveling function.

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE LEVELING MOTOR IS INEFFECTIVE	1. Ineffective ground circuit.	1. Test and repair open leveling motor ground circuit if required.
	2. Ineffective feed circuit.	2. Test and repair open leveling motor feed circuit if required.
	3. Ineffective signal circuit.	3. Test and repair open headlamp leveling motor signal circuit if required.
	4. Ineffective motor.	4. Test and replace headlamp leveling motor if required.
BOTH LEVELING MOTORS ARE INEFFECTIVE	1. Ineffective EMIC (CCN) inputs or outputs.	1. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	2. Ineffective motor ground circuit.	2. Test and repair open leveling motor ground circuit if required.
	3. Ineffective motor feed circuit.	3. Test and repair open leveling motor feed circuit if required.
	4. Ineffective signal circuit.	4. Test and repair open or shorted headlamp leveling motor signal circuit if required.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
	6. Ineffective motors.	6. Test and replace leveling motors if required.

PARK LAMPS

NOTE: As part of the exterior lighting failsafe feature, upon ignition ON, all exterior park lamps and the headlamp low beams will illuminate regardless of the left multi-function switch control knob position if the SCM cannot detect an input from the left multi-function switch, or if there is a loss of communication between the left multi-function switch/SCM and the EMIC or between the EMIC and the TIPM. Diagnose and repair those problems before attempting to repair the Park Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
PARK LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace park lamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open park lamp ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open park lamp feed circuit if required.
	4. Ineffective EMIC (CCN) inputs or outputs.	4. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	5. Ineffective TIPM inputs or outputs.	5. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
PARK LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted park lamp feed circuit if required.
	2. Ineffective EMIC (CCN) inputs or outputs.	2. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

REAR FOG LAMPS

NOTE: The rear fog lamp switch is integral to the left multi-function switch/SCM, which communicates with the EMIC/CCN over the LIN data bus. Before performing any of the following tests, determine whether the other functions of the left multi-function switch/SCM are operational. If the other left multi-function switch/SCM functions are ineffective, diagnose and repair that problem before attempting to repair the Rear Fog Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
REAR FOG LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace rear fog lamp bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open rear fog lamp ground circuit if required.

	3. Ineffective feed circuit.	3. Test and repair open fog lamp relay control rear circuit if required.
	4. Ineffective EMIC (CCN) inputs or outputs.	4. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	5. Incorrect TIPM configuration.	5. Use a diagnostic scan tool to check and correct the TIPM configuration settings if required. Refer to the appropriate diagnostic information.
	6. Ineffective TIPM inputs or outputs.	6. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
REAR FOG LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair shorted fog lamp relay control rear circuit if required.
	2. Ineffective EMIC (CCN) inputs or outputs.	2. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.

TURN SIGNAL LAMPS

NOTE: The turn signal switch is integral to the left multi-function switch/SCM, which communicates with the EMIC/CCN over the LIN data bus. Before performing any of the following tests, determine whether the other functions of the left multi-function switch/SCM are operational. If the other left multi-function switch/SCM functions are ineffective, diagnose and repair that problem before attempting to repair the Turn Signal Lamps.

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE TURN SIGNAL LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace turn signal bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open right or left turn signal feed circuit if required.
	4. Ineffective TIPM inputs or outputs.	4. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
ALL RIGHT SIDE OR ALL LEFT SIDE TURN SIGNAL LAMPS (OR BOTH SIDES) DO NOT FLASH	1. Ineffective feed circuit.	1. Test and repair open right or left turn signal feed circuit if required.
	2. Ineffective EMIC (CCN) inputs or	2. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic

	outputs.	information.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
ALL RIGHT SIDE OR ALL LEFT SIDE TURN SIGNALS FLASH TOO RAPIDLY (MORE THAN 100 FLASHES PER MINUTE)	1. Ineffective or missing bulb.	1. Test and replace turn signal bulb if required.
	2. Ineffective ground circuit.	2. Test and repair open bulb ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair open right or left turn signal feed circuit if required.
TURN SIGNALS DO NOT AUTOMATICALLY CANCEL	1. Ineffective cancel cam.	1. Inspect and replace the turn signal cancel cam (clockspring) if required.
	2. Ineffective cancel actuator.	2. Inspect and replace the turn signal cancel actuator (left multi-function switch) if required.

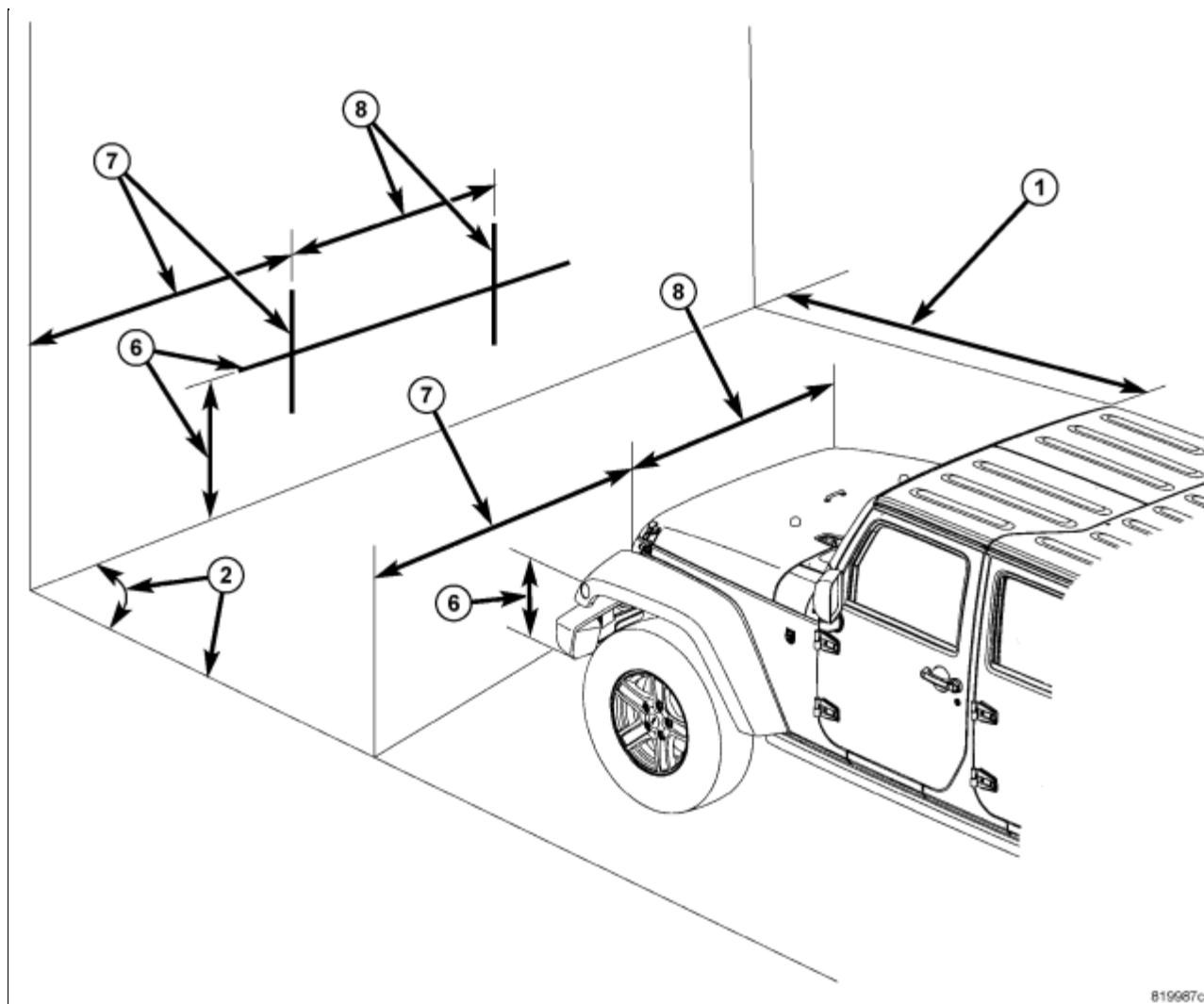
STANDARD PROCEDURE

FRONT LAMP AIMING

VEHICLE PREPARATION FOR LAMP ALIGNMENT

1. Check for and correct any burnt out bulbs.
2. If the vehicle is equipped with headlamp leveling, be certain that the headlamp leveling switch is in the **0** position.
3. Repair or replace any ineffective, worn or damaged body or suspension components that could hinder proper lamp alignment.
4. Verify proper tire inflation pressures.
5. Remove any accumulations of mud, snow or ice from the vehicle underbody and clean the front lamp lenses.
6. Verify that there is no load in the vehicle (cargo or passengers), except for the driver.
7. The fuel tank should be FULL. Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.
8. Verify correct vehicle suspension height.

LAMP ALIGNMENT SCREEN PREPARATION



819687cd

The procedure that follows will prepare a suitable front lamp alignment screen.

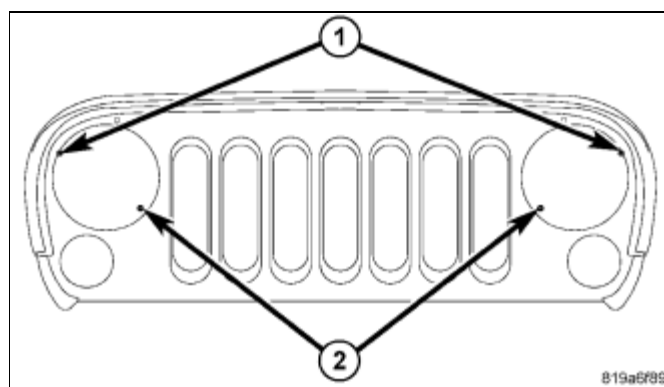
1. Tape a line on a level floor 7.62 meters (25 feet) away from and parallel to the flat wall that will be used as the lamp alignment screen. The level floor will be used as the horizontal zero reference.
2. An adjacent wall or floor member that is perpendicular to the alignment screen can be used as the vertical zero reference. If there is no adjacent wall or floor member that is perpendicular to the screen, tape a second line on the floor perpendicular to both the alignment screen and the first line, and outboard of either side of where the vehicle will be positioned. This will be used as the vertical zero reference.
3. Position the vehicle so that the side of the vehicle is parallel to the vertical zero reference, and so that the front of the lamp lenses are in the vertical plane of the parallel line taped on the floor 7.62 meters (25 feet) away from the screen.
4. Rock the vehicle side-to-side three times to allow the suspension to stabilize.
5. Jounce the front suspension three times by pushing downward on the front bumper and releasing.
6. Measure the distance between the optical center of one of the lamps being aimed (head or fog) and the floor (horizontal zero reference). Transfer this measurement to the alignment screen with a piece of tape placed horizontally to the floor. This line will be used as the lamp horizontal reference.
7. Measure the distance between the vertical zero reference and the optical center of the nearest lamp being aimed (head or fog). Transfer this measurement to the alignment screen with a piece of tape placed vertically across the appropriate (head or fog) lamp horizontal reference. This is the centerline reference for the first lamp.
8. Measure the distance on center between the first and the second lamp being aimed. Transfer this measurement to the alignment screen with a second piece of tape placed vertically across the appropriate (head or fog) lamp

horizontal reference. This is the centerline reference for the second lamp.

HEADLAMP ALIGNMENT

NOTE: Due to the linear nature of the headlamp cutoff, a properly aimed low beam headlamp will project the top edge of the high intensity pattern on the alignment screen from the horizontal line to 50 millimeters (2 inches) below the horizontal line for domestic market vehicles, or to 125 millimeters (5 inches) below the horizontal line for export market vehicles. No horizontal (right/left) adjustment is required for this headlamp beam pattern in domestic market vehicles. Export market vehicles have a second horizontal (right/left) adjustment screw provided. The high beam pattern will be correct when the low beams are properly aimed.

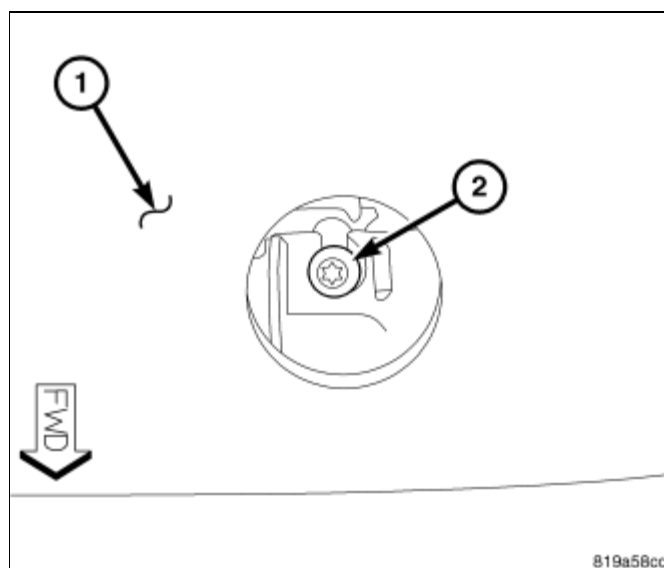
1. Turn the headlamps ON and select the LOW beams for vehicles in all markets.
2. On all vehicles except those with headlamp leveling, use a screwdriver to rotate the headlamp vertical adjustment screw (1) on each headlamp to adjust the beam height as required.
3. For export markets only, use a screwdriver to rotate the headlamp horizontal adjustment screw (2) on each headlamp to adjust the beam right or left as required.



FOG LAMP ALIGNMENT

NOTE: A properly aimed front fog lamp will project a pattern on the alignment screen 100 millimeters (4 inches) below the fog lamp centerline and straight ahead of the lamp.

1. Turn the fog lamps ON.
2. Insert a screwdriver through the clearance hole in the underside of the front bumper (1) to rotate the vertical adjustment screw (2) on each fog lamp to adjust the beam height as required.



SPECIFICATIONS

LAMPS/LIGHTING - EXTERIOR

BULB APPLICATION TABLE

LAMP	BULB
BACKUP	3157 - DOMESTIC 921 (W16W) - EXPORT
BRAKE	3157 (P27W/7W)
CENTER HIGH MOUNTED STOP	LIGHT-EMITTING DIODES SERVICED IN ASSEMBLY
FRONT FOG	9145 (H10)
FRONT PARK	3157 (P27W/7W)
FRONT SIDE MARKER	194 (W5W)
FRONT TURN SIGNAL	3157 (P27W/7W)
HEADLAMP	9008 (H13) - DOMESTIC 9003 (H4 60/55W) - EXPORT
LICENSE PLATE	194 (W5W)
POSITION (EXPORT ONLY)	194 (W5W)
REAR FOG (EXPORT ONLY)	3157 (P27W/7W)
REAR PARK	3157 (P27W/7W)
REAR SIDE MARKER	3157 (P27W/7W)
REAR TURN SIGNAL	3157 (P27W/7W)
REPEATER (EXPORT ONLY)	WY5W
UNDERHOOD	561

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Center High Mounted Stop Lamp (CHMSL) Mounting Screws	2	-	20
Front Fog Lamp Mounting Screws	2	-	18

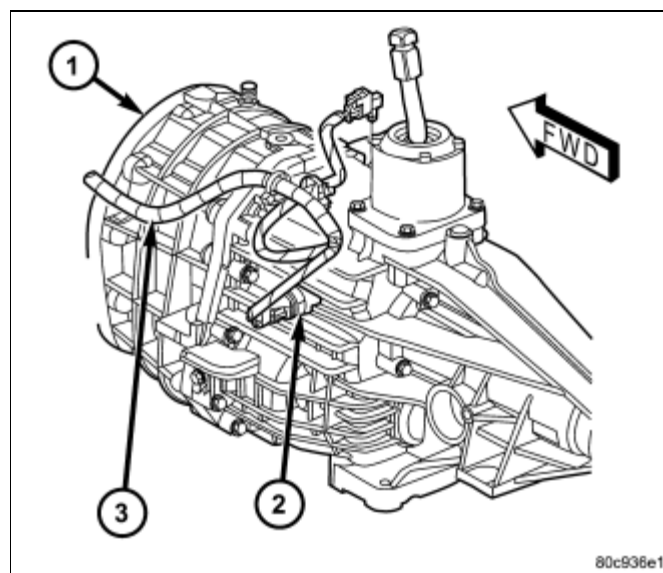
Left Multi-Function Switch Mounting Screw	1	-	10
License Plate Bracket Mounting Screws	1.5	-	15
Park Brake Switch Mounting Screw	2.5	-	24
Rear Fog Lamp Mounting Screws	3	-	27
Rear Lamp Unit Mounting Screws	1.5	-	15

SWITCH-BACK UP LAMP

DESCRIPTION

Vehicles equipped with a manual transmission (1) have a normally open, spring-loaded plunger type backup lamp switch (2). Vehicles with an optional electronic automatic transmission have a Transmission Range Sensor (TRS) that is used to perform several functions, including that of the backup lamp switch. The TRS is described in further detail elsewhere in this service information. Refer to the service and diagnostic information for the automatic transmission type installed in the vehicle.

The backup lamp switch is located in a threaded hole on the side of the manual transmission housing. The switch has a threaded body and a hex formation near the plunger end of the switch. An integral connector receptacle at the end of the switch opposite the plunger connects the switch to the vehicle electrical system through a take out and connector of the engine wire harness. When installed, only the switch connector and the hex formation are visible on the outside of the transmission housing.



The backup lamp switch cannot be adjusted or repaired and, if ineffective or damaged, the entire switch unit must be replaced.

OPERATION

The backup lamp switch controls a path to ground for the Totally Integrated Power Module (TIPM) on the reverse switch signal circuit. The TIPM reads this input through an internal pull-up, then controls an output through a high side driver that regulates the flow of battery voltage to the backup lamp bulbs as appropriate on the backup lamp feed circuit. The switch plunger is mechanically actuated by the gearshift mechanism within the transmission, which will depress the switch plunger and close the switch contacts whenever the REVERSE gear has been selected. The switch receives ground at all times through a take out and eyelet terminal of the engine wire harness that is secured by a nut to a ground stud on the body sheet metal within the engine compartment of the vehicle.

The backup lamp switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

DIAGNOSIS AND TESTING

BACKUP LAMP SWITCH

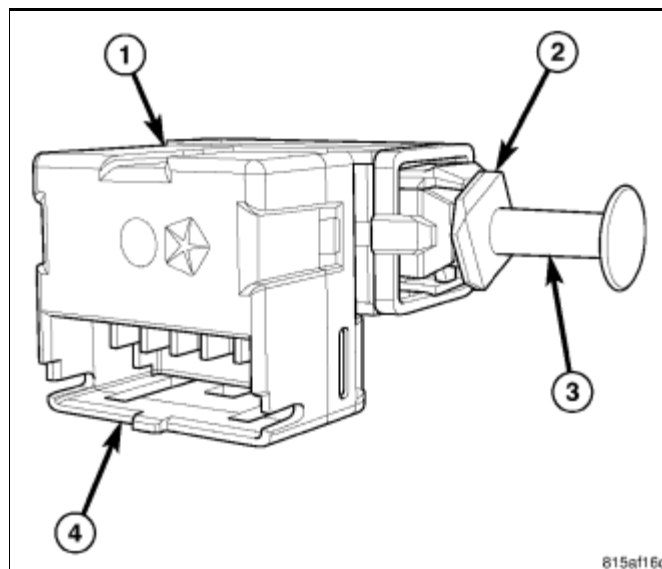
1. Disconnect and isolate the battery negative cable.
2. Raise and support the vehicle.
3. Locate and disconnect the engine wire harness connector from the backup lamp switch connector receptacle.
4. Check for continuity between the two terminal pins in the backup lamp switch connector receptacle.
 - a. With the gear selector lever in the REVERSE position, there should be continuity.
 - b. With the gear selector lever in any position other than REVERSE, there should be no continuity.
5. If the switch fails either of these two continuity tests, replace the ineffective backup lamp switch.

SWITCH-STOP LAMP

DESCRIPTION

The brake lamp switch (1) is a three circuit, spring-loaded plunger actuated switch that is secured to a stamped metal brake lamp switch bracket on the instrument panel structural support armature near the brake pedal under the instrument panel on the driver side of the vehicle. The molded plastic switch housing has an integral connector receptacle (4) containing six terminal pins. The switch is connected to the vehicle electrical system through a dedicated take out of the instrument panel wire harness.

The switch plunger (3) extends through a mounting collar (2) on one end of the switch housing. The plunger has a telescoping self-adjustment feature that is activated after the switch is installed by pulling the brake pedal upward to its normal at-rest position. The telescoping plunger can be pulled outward from the switch housing to repeat the self-adjustment procedure if necessary.



The brake lamp switch cannot be repaired. If the switch is damaged or ineffective it must be replaced with a new unit.

OPERATION

The brake lamp switch controls three independent circuits. These circuits are described as follows:

- **Brake Lamp Switch Circuit** - A normally open brake lamp switch circuit receives a battery voltage input, and supplies this battery voltage to the brake lamps and the Controller Antilock Brake (CAB) on a brake lamp switch output circuit only when the brake pedal is depressed (brake lamp switch plunger released).

- **Brake Lamp Switch Signal Circuit** - A normally closed brake lamp switch signal circuit receives a direct path to ground, and supplies this ground input to the Powertrain Control Module (PCM) on a brake lamp switch sense circuit only when the brake pedal is released (brake lamp switch plunger is depressed).
- **Speed Control Circuit** - A normally closed speed control circuit receives a battery voltage input from the PCM on a speed control supply circuit, and supplies this battery voltage to the speed control servo solenoids (dump, vacuum, and vent) on a speed control brake switch output circuit only when the speed control system is turned ON and the brake pedal is released (brake lamp switch plunger is depressed).

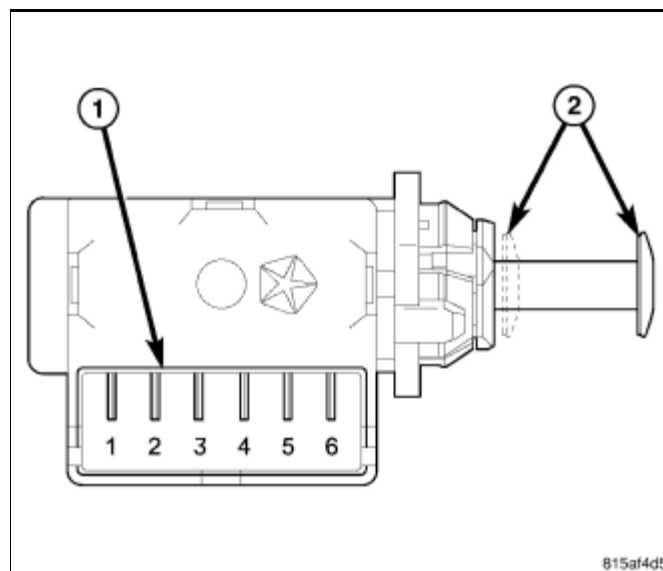
The brake lamp switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

DIAGNOSIS AND TESTING

BRAKE LAMP SWITCH

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Disconnect the wire harness connector from the brake lamp switch.
3. Using an ohmmeter, perform the continuity tests at the terminal pins (1) in the brake lamp switch connector receptacle as shown in the Brake Lamp Switch Tests table.



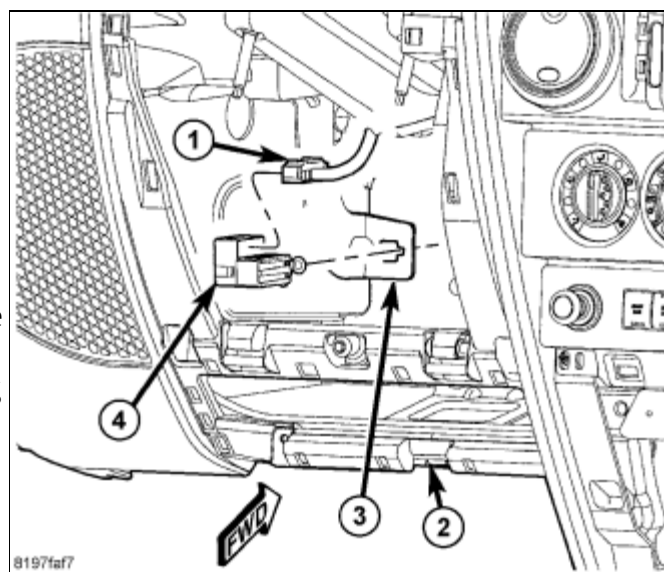
BRAKE LAMP SWITCH TESTS	
PLUNGER POSITION (2)	CONTINUITY BETWEEN
Released (Extended)	Pins 1 and 2
Compressed (Depressed)	Pins 3 and 4, 5 and 6

4. If the switch fails any of the continuity tests, replace the ineffective brake lamp switch as required.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

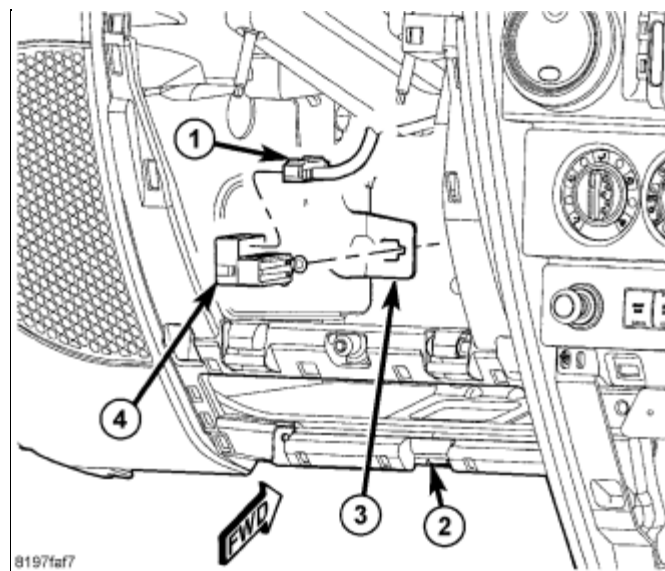
1. Disconnect and isolate the battery negative cable.
2. Remove the steering column opening cover from the instrument panel (2). (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
3. Depress and hold the brake pedal in the depressed position.
4. Rotate the brake lamp switch housing (4) counterclockwise about 30 degrees to align the tabs on the switch locking collar with the keyed hole in the brake lamp switch mounting bracket (3).
5. Pull the switch straight back from the keyed hole to remove it from the bracket.
6. Release the brake pedal.
7. Disconnect the wire harness connector (1) from the brake lamp switch.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Be certain that the brake lamp switch (4) plunger is pulled all the way out of the switch housing to its fully extended position.
2. Reconnect the wire harness connector (1) to the connector receptacle on the switch.
3. Depress and hold the brake pedal in the depressed position.
4. Align the tabs on the brake lamp switch locking collar with the keyed hole in the brake lamp switch mounting bracket (3).



5. Insert the tab on the brake lamp switch locking collar through the keyed hole in the mounting bracket until the switch housing is firmly seated against the bracket.
6. Rotate the switch housing clockwise about 30 degrees to engage the tabs on the locking collar with the mounting bracket.

CAUTION: Brake booster damage may occur if the brake pedal pull exceeds about 9 kilograms (20 pounds).

7. Release the brake pedal. Then pull the pedal lightly upward to its normal at-rest position. The pedal will set the plunger to the correct position as the pedal pushes the plunger into the switch housing. The switch plunger will make a light audible ratcheting noise as it self-adjusts.
8. Reinstall the steering column opening cover onto the instrument panel (2). (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
9. Reconnect the battery negative cable.

ADJUSTMENTS

BRAKE LAMP SWITCH

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
3. Depress and hold the brake pedal in the depressed position.
4. Pull the brake lamp switch plunger all the way out of the switch housing to its fully extended position.

CAUTION: Brake booster damage may occur if the brake pedal pull exceeds about 9 kilograms (20 pounds).

5. Release the brake pedal. Then pull the pedal lightly upward to its normal at-rest position. The pedal will set the plunger to the correct position as the pedal pushes the plunger into the switch housing. The switch plunger

will make a light audible ratcheting noise as it self-adjusts.

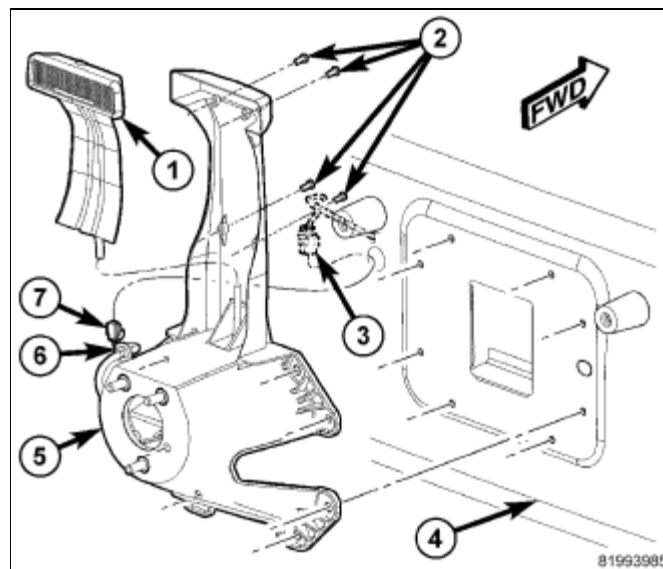
6. Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

7. Reconnect the battery negative cable.

CENTER HIGH MOUNTED STOP LAMP

REMOVAL

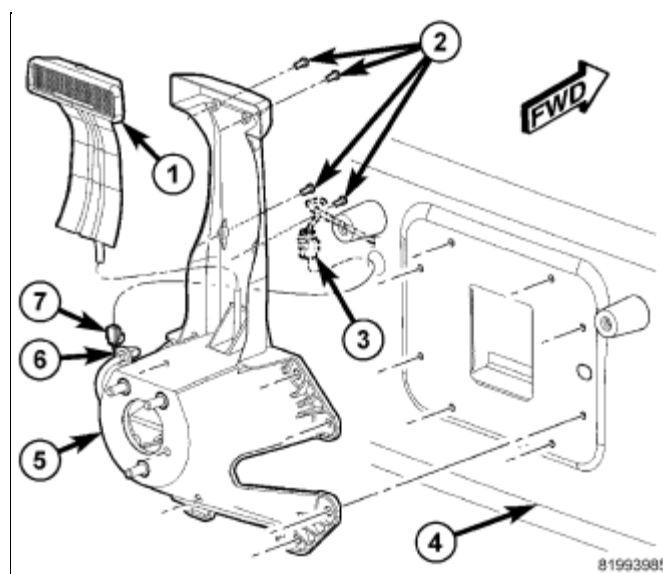
1. Disconnect and isolate the battery negative cable.
2. Unlatch and open the swing gate (4).
3. Unsnap the inboard side of the louvered plastic access panel and unhook it from the outboard edge of the access hole on the inside of the swing gate near the latch.
4. Reach through the access hole to disconnect the Center High Mounted Stop Lamp (CHMSL) pigtail connector (7) from the swing gate wire harness connector (3).
5. Disengage the grommet (6) for the CHMSL pigtail wire harness from the clearance hole in the outer swing gate panel.
6. Carefully pull the CHMSL pigtail wire harness and connector out through the swing gate clearance hole.
7. Remove the four screws (2) from the forward facing surface of the stanchion on the spare tire carrier (5) that secure the CHMSL (1).



8. Pull the CHMSL away from the vehicle while feeding the CHMSL pigtail wire harness through the spare tire carrier.

INSTALLATION

1. Feed the Center High Mounted Stop Lamp (CHMSL) (1) pigtail wire harness through the spare tire carrier (5) on the outer surface of the swing gate (4).
2. Position the CHMSL to the rearward facing surface of the stanchion on the spare tire carrier
3. Install and tighten the four screws (2) that secure the CHMSL to the stanchion. Tighten the screws to 2 N·m (20 in. lbs.).
4. Feed the CHMSL wiring back into the swing gate through the clearance hole far enough to engage the rubber grommet (6) into the clearance hole.
5. Reach through the access hole on the inside of the swing gate near the latch to access and reconnect the CHMSL pigtail connector (7) to the swing gate wire harness



connector (3).

6. Reinstall the louvered plastic access panel over the access hole by hooking it into the outboard edge of the hole, then pressing firmly and evenly over the two snap clip locations on the inboard side of the panel until it snaps into place.

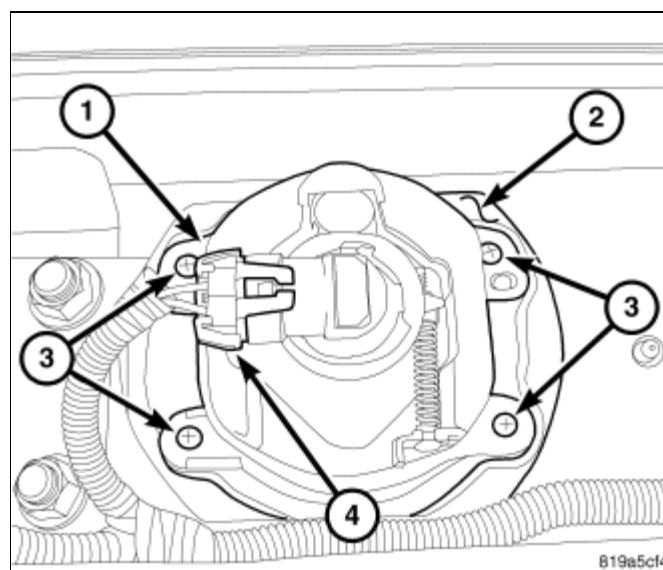
7. Reconnect the battery negative cable.

FRONT FOG LAMP

REMOVAL

LAMP

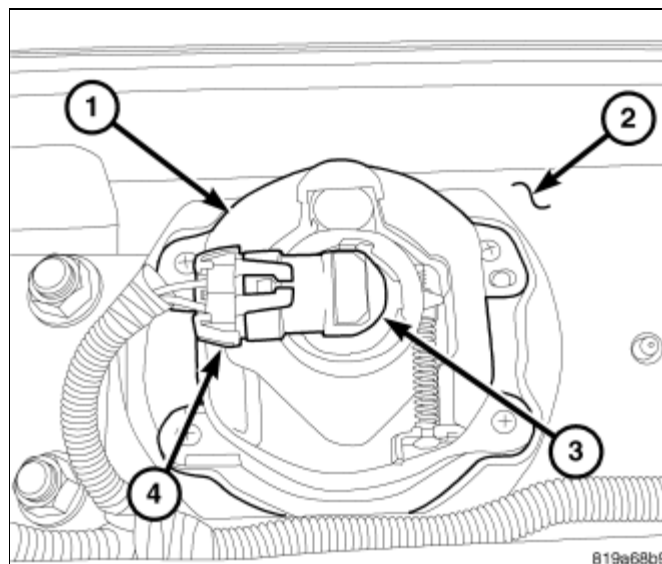
1. Disconnect and isolate the battery negative cable.
2. For export market vehicles, turn the front wheels fully in either direction.
3. Raise and support the vehicle.
4. For domestic market vehicles, remove the front bumper lower air dam from the vehicle.
5. Disconnect the engine compartment wire harness connector (4) from the front fog lamp bulb connector receptacle.
6. Remove the four screws (3) that secure the front fog lamp housing (1) to the back of the front bumper cover (2).
7. Remove the lamp from the back of the front bumper cover.



BULB

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

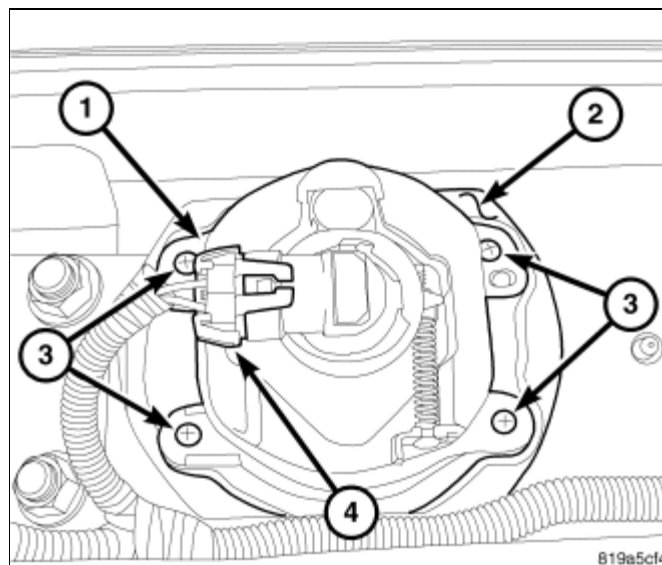
1. Disconnect and isolate the battery negative cable.
2. For export market vehicles, turn the front wheels fully in either direction.
3. Raise and support the vehicle.
4. For domestic market vehicles equipped with the optional electronic sway bar disconnect feature, service of the right fog lamp bulb will also require removal of the front bumper lower air dam from the vehicle.
5. From behind the front bumper (2), disconnect the engine compartment wire harness connector (4) from the front fog lamp bulb (3) connector receptacle.
6. Firmly grasp the bulb on the back of the front fog lamp housing (1) and rotate it counterclockwise about 30 degrees to unlock it.
7. Pull the bulb straight out from the keyed opening in the housing.



INSTALLATION

LAMP

1. Position the front fog lamp housing (1) to the back of the front bumper cover (2). Be certain that the two alignment pins on the back of the front bumper cover are engaged in the alignment holes in the lamp housing.
2. Install and tighten the four screws (3) that secure the lamp to the back of the front bumper cover. Tighten the screws to 2 N·m (18 in. lbs.).
3. Reconnect the engine compartment wire harness connector (4) to the fog lamp bulb connector receptacle.
4. If it was removed during bulb removal, reinstall the front bumper lower air dam onto the vehicle.
5. Lower the vehicle.
6. Reconnect the battery negative cable.
7. Confirm proper front fog lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - STANDARD PROCEDURE - FRONT LAMP AIMING).

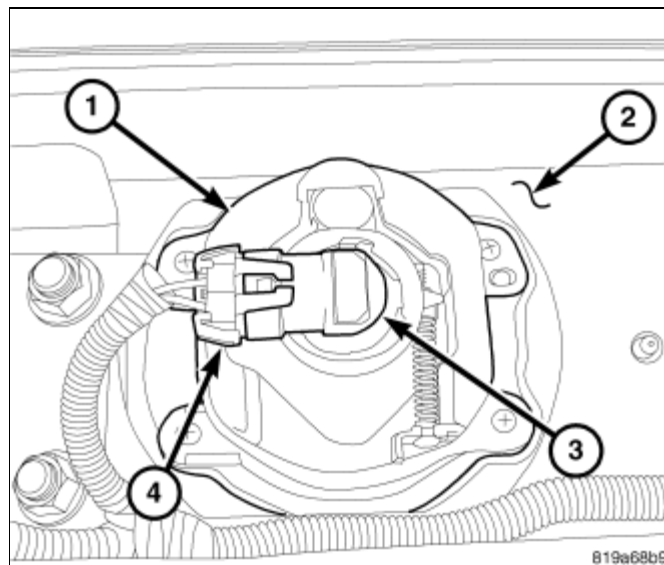


BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Align the front fog lamp bulb (3) with the keyed opening on the back of the front fog lamp housing (1).
2. Insert the bulb into the housing until it is firmly seated.
3. Rotate the bulb clockwise about 30 degrees to lock it into place. The bulb connector receptacle should be horizontal in orientation.
4. Reconnect the engine compartment wire harness connector (4) to the bulb connector receptacle.
5. If it was removed during bulb removal, reinstall the front bumper lower air dam onto the vehicle.
6. Lower the vehicle.
7. Reconnect the battery negative cable.



FRONT SIDE MARKER OR REPEATER LAMP

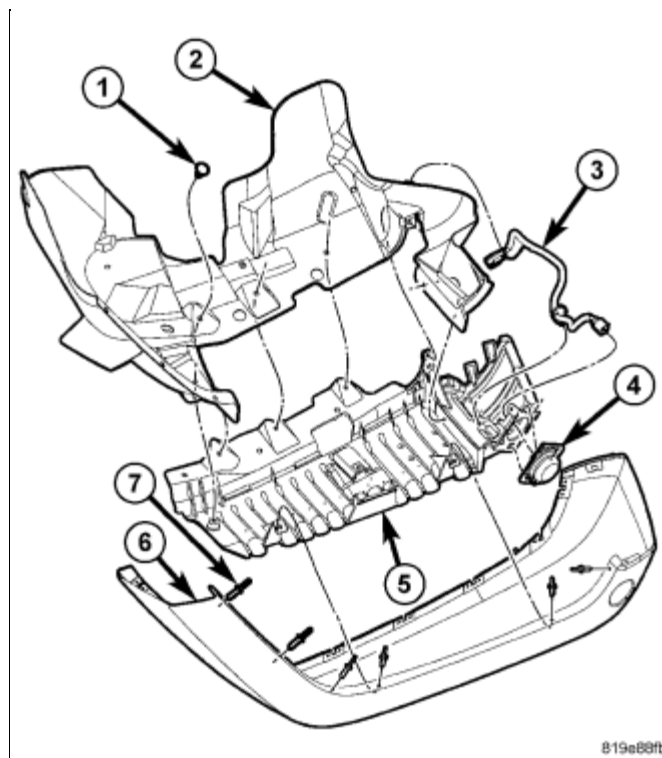
REMOVAL

LAMP

NOTE: The following procedure applies to either the front side marker lamps used on vehicles manufactured for the domestic market or to the repeater lamps used on vehicles manufactured for the export market. Although the lamps and bulbs are unique, the service procedures are the same.

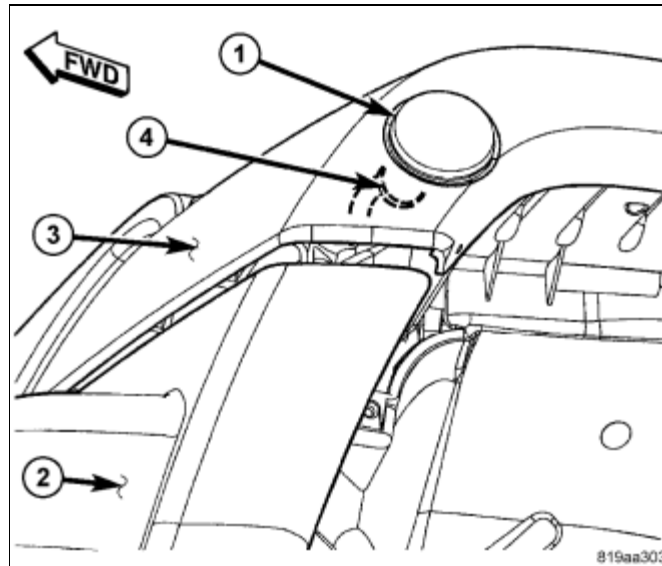
1. Disconnect and isolate the battery negative cable.
2. Raise and support the vehicle.
3. Disconnect the ends of the jumper wire harness (3) from the front side marker/repeater lamp bulb socket and from the engine wire harness.
4. Remove and disassemble the front fender flare (6), reinforcement bracket (5) and wheel liner (2) from the vehicle. Take the proper precautions to protect the fender flare from cosmetic damage during disassembly. (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - FRONT - REMOVAL).
5. Release the two integral latch features on the back of the lamp housing (4) and unhook the integral hook feature on the lamp housing from the slot in the lamp seat of the front fender flare reinforcement bracket.

BULB



NOTE: The front side marker lamps are used only on vehicles manufactured for domestic markets, while repeater lamps are used only on vehicles manufactured for export markets. The service procedures for the bulbs of these two unique lamps are the same.

1. Disconnect and isolate the battery negative cable.
2. Reach between the front wheel flare (3) and the front tire above the front bumper (2) to access the back of the lamp (1).
3. Firmly grasp the bulb socket (4) and connector on the back of the lamp and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



INSTALLATION

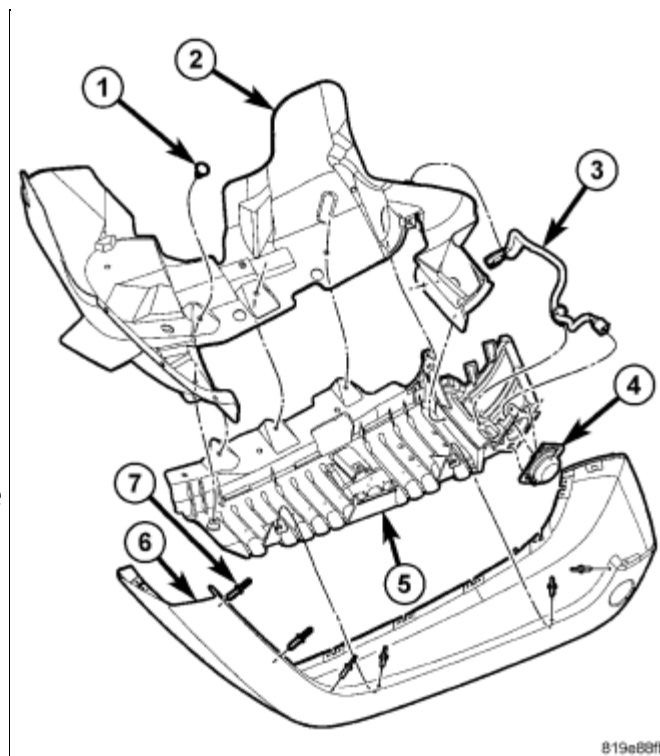
LAMP

NOTE: The following procedure applies to either the front side marker lamps used on vehicles manufactured for the domestic market or to the repeater lamps used on vehicles manufactured for the export market. Although the lamps and bulbs are unique, the service procedures are the same.

1. Position the front side marker/repeater lamp (4) into the

lamp seat in the front fender flare reinforcement bracket (5). Be certain that the integral hook feature on the lamp housing is engaged in the slot on one side of the seat and that the two integral latch features on the lamp housing are fully engaged.

2. Reassemble and reinstall the front fender flare (6), reinforcement bracket, wheel liner (2) and side marker/repeater lamp to the vehicle as a unit. (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - FRONT - INSTALLATION).
3. Reconnect the ends of the jumper wire harness (3) to the front side marker/repeater lamp bulb socket and to the engine wire harness.
4. Lower the vehicle.
5. Reconnect the battery negative cable.

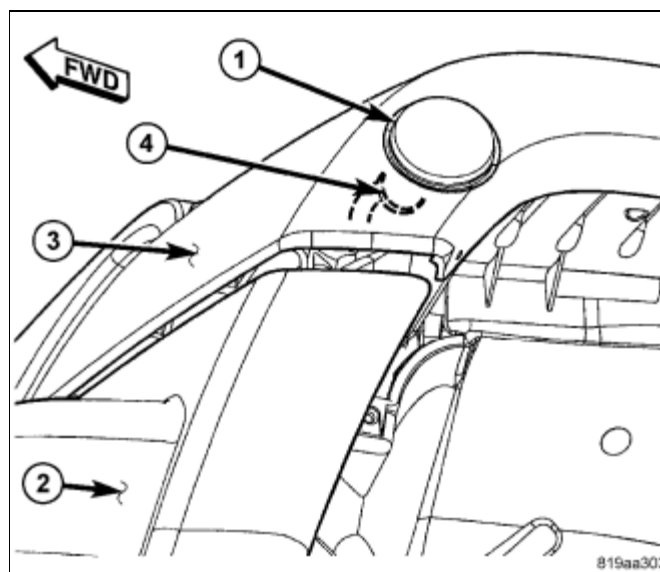


BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

NOTE: The front side marker lamps are used only on vehicles manufactured for domestic markets, while repeater lamps are used only on vehicles manufactured for export markets. The service procedures for the bulbs of these two unique lamps are the same.

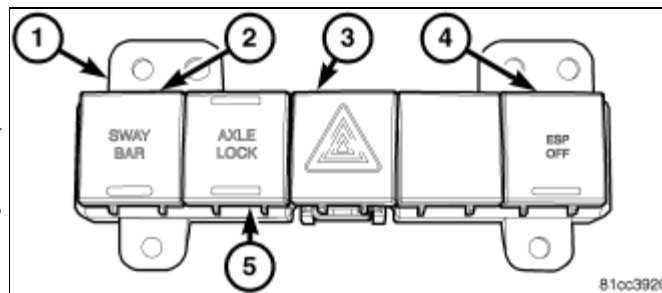
1. Reach between the front wheel flare (3) and the front tire above the front bumper (2) to access the back of the lamp (1).
2. Align the base of the bulb with the lamp socket (4).
3. Push the bulb straight into the socket until the base is firmly seated.
4. Align the socket and bulb with the keyed opening on the back of the lamp.
5. Insert the socket and bulb into the housing until the socket is firmly seated.
6. Rotate the socket clockwise about 30 degrees to lock it into place.
7. Reconnect the battery negative cable.



HAZARD SWITCH

DESCRIPTION

The hazard switch (3) is integral to the instrument panel switch pod (1), which is secured to the instrument panel center bezel just below the heater and air conditioner controls. A red, stencil-like International Control and Display Symbol icon for **Hazard Warning** identifies the hazard switch button. The remainder of the hazard switch circuitry is concealed within the instrument panel switch pod.



The hazard switch button has panel lamps dimmer controlled illumination for night visibility. The switch button unlatches to a slightly raised position when the hazard warning system is activated and the icon on the switch button will illuminate at an increased intensity while the turn signals and turn signal indicators are flashing. The switch button latches to a lowered position flush with the other push buttons in the switch pod when the hazard warning is deactivated.

All of the circuitry and components of the hazard switch are contained within a molded black plastic instrument panel switch pod housing. A single connector receptacle is integral to the back of the switch pod housing. The switch is connected to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The hazard switch cannot be adjusted or repaired and, if ineffective or damaged, the entire instrument panel switch pod unit must be replaced. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/INSTRUMENT PANEL SWITCH POD - REMOVAL).

OPERATION

The status of the hazard switch is continually monitored by the circuitry within the instrument panel switch pod. The switch pod receives battery voltage at all times on a fused battery feed circuit, and a path to ground at all times through the instrument panel wire harness. The only other inputs to the switch pod consists of electronic communication with the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the single wire Local Interface Network (LIN) data bus.

Whenever the hazard switch is in its unlatched and raised position, the hazard warning system is selected and the switch pod circuitry sends a hard wired output to the Totally Integrated Power Module (TIPM) over the CAN data bus. When the TIPM receives a hazard switch input it then controls hazard warning system operation and flash rate by controlling battery voltage outputs through high side drivers on the right and left turn signal feed circuits. The TIPM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional hazard warning flasher. The EMIC then sends messages back to the switch pod to control the illumination of the hazard switch push button.

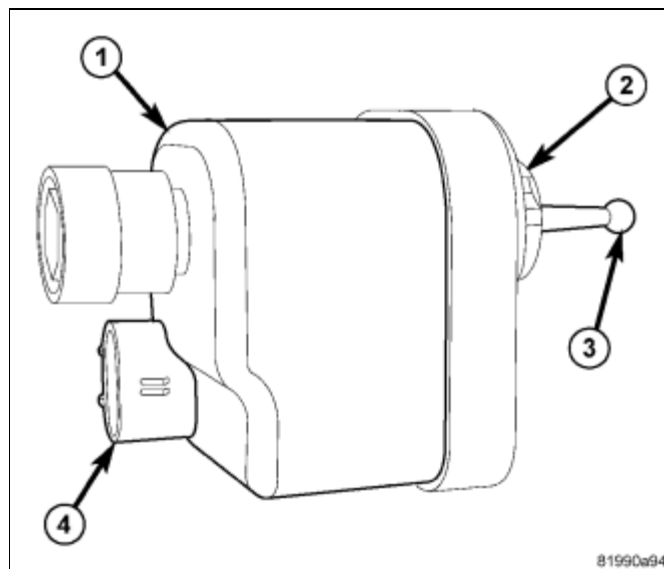
The hard wired circuits for the instrument panel switch pod may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the hazard warning switch or the electronic controls and communication between other modules and devices that provide some features of the hazard warning system. The most reliable, efficient, and accurate means to diagnose the hazard switch or the electronic controls and communication related to hazard warning system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

HEADLAMP LEVELING MOTOR

DESCRIPTION

The headlamp leveling motor (1) is located on the engine compartment side of the front end module carrier behind each headlamp unit on vehicles equipped with the headlamp leveling system, which is available only in certain markets where it is required equipment. The motor is encased within a molded plastic housing and is secured by an integral wedge-type mounting boss (2) to a keyed flange on the front end module carrier.

The outside of the motor housing features an integral molded connector (4) on its lower rearward surface and a plastic pushrod with a ball formation (3) on its free end extends from the motor mounting boss. Within the motor housing is a 12-volt Direct Current (DC) servo motor, an electronic controller board that includes the motor logic circuits, and an integral screw-drive transmission. The headlamp leveling motor is connected to the vehicle electrical system through a dedicated take out and connector of the headlamp wire harness.



The motor cannot be repaired and, if ineffective or damaged, it must be replaced.

OPERATION

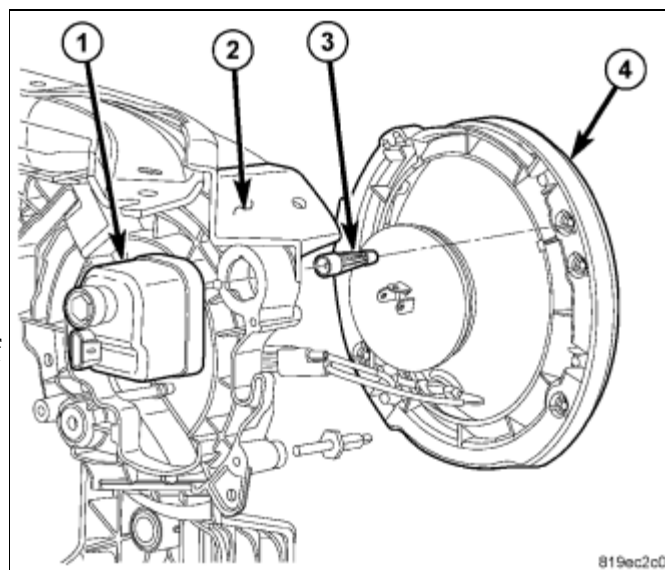
The controller board and logic circuitry of the headlamp leveling motor control motor operation based upon a voltage signal input received from the Totally Integrated Power Module (TIPM). The TIPM uses electronic messages received over the Controller Area Network (CAN) data bus from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) to determine the correct voltage signal to provide the leveling motor, while the EMIC uses electronic messages received over the Local Interface Network (LIN) data bus from the instrument panel switch pod to monitor the headlamp leveling switch selection.

The headlamp leveling motors have a path to ground at all times. The headlamp leveling motors operate on battery voltage received through the headlamp low beam feed circuits so that the system will only operate when the headlamp low beams are turned ON. When the motor is energized it will extend or retract the motor pushrod through an integral screw-drive transmission. The ball on the end of the pushrod is snapped into a socket on one end of a molded plastic spacer. The other end of the spacer snaps into a receptacle in the molded plastic headlamp mounting collar for the headlamp unit on the face of the front end module carrier. The headlamp then moves vertically as the pushrod is extended or retracted, changing the angle at which light is projected from the headlamps.

The hard wired circuits for the headlamp leveling motors may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the active electronic elements within the headlamp leveling motors or the electronic controls and communication between other modules and devices that provide some features of the headlamp leveling system. The most reliable, efficient, and accurate means to diagnose the headlamp leveling motor or the electronic controls and communication related to headlamp leveling system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

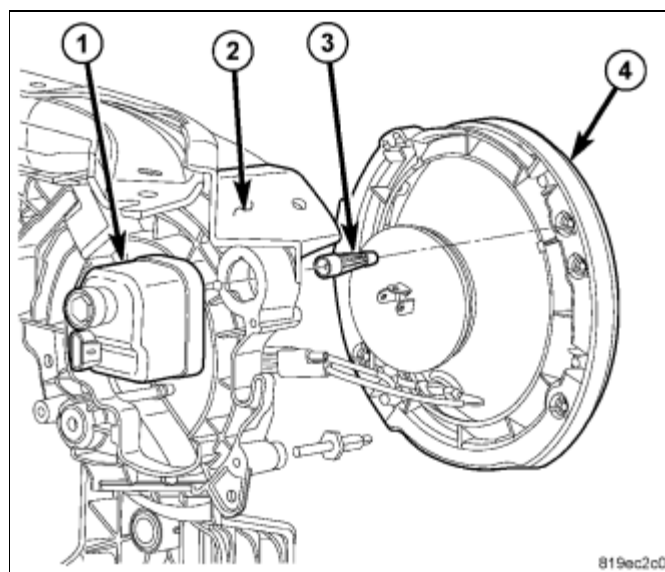
1. Disconnect and isolate the battery negative cable.
2. Disconnect the engine compartment wire harness connector from the headlamp leveling motor (1) connector receptacle.
3. Rotate the headlamp leveling motor on the back of the front end module carrier (2) counterclockwise about 30 degrees.
4. Grasp the motor firmly with one hand and pull sharply and quickly straight rearward to unsnap the ball on the end of the motor pushrod from the socket on the spacer (3).
5. Remove the headlamp leveling motor from the engine compartment.



NOTE: The spacer and the headlamp mounting collar (4) cannot be repaired. If the spacer or collar break or if the spacer becomes disengaged from the collar before the leveling motor pushrod disengages the spacer, both the spacer and the mounting collar will also require replacement.

INSTALLATION

1. Position the headlamp leveling motor (1) and pushrod to the mounting boss on the back of the front end module carrier (2).
2. Align the ball on the end of the leveling motor pushrod with the socket in the spacer (3).
3. While stabilizing the headlamp from the face of the front end module carrier with one hand, firmly and steadily push the headlamp leveling motor pushrod straight into the spacer to snap the ball on the pushrod into the socket end of the spacer.
4. Insert the mounting flange of the headlamp leveling motor into the mounting boss on the front end module carrier until the motor is firmly seated.
5. Rotate the headlamp leveling motor clockwise about 30 degrees to lock it into place.
6. Reconnect the engine compartment wire harness connector to the headlamp leveling motor connector receptacle.
7. Reconnect the battery negative cable.

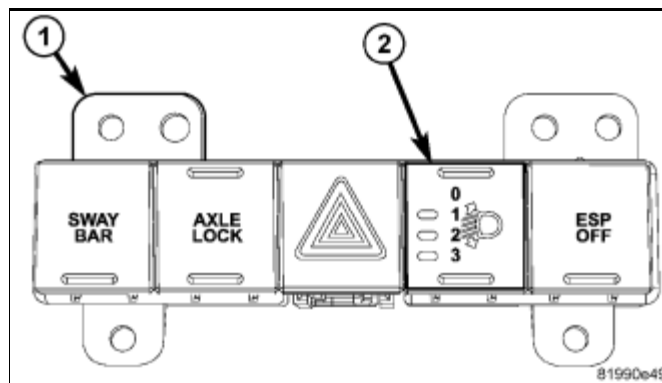


NOTE: The spacer and the headlamp mounting collar (4) cannot be repaired. If the spacer or collar break or if the spacer becomes disengaged from the collar before the leveling motor pushrod engages the spacer, both the spacer and the mounting collar will also require replacement.

HEADLAMP LEVELING SWITCH

DESCRIPTION

The headlamp leveling switch (2) is used only on vehicles manufactured for certain markets where the headlamp leveling system is required. The headlamp leveling switch is integral to the switch pod (1) on the instrument panel. A stencil-like International Control and Display Symbol icon for **Headlamp Levelling Control** identifies the headlamp leveling switch button. The switch push button is also marked with the numbers **0**, **1**, **2**, and **3**, which indicates each of the four headlamp leveling positions. Each higher number represents a lower aiming position of the headlamp beam relative to the road surface.



The headlamp leveling switch button has panel lamps dimmer controlled illumination for night visibility. The switch button also features a jewel like Light Emitting Diode (LED) indicator adjacent to the numbers **1**, **2**, and **3**. The appropriate LED is illuminated when that headlamp position is currently selected. The momentary switch push button is operated by depressing, then releasing the top or bottom of the button in a rocker manner to enable the selection of a sequentially higher or lower position with each button press.

All of the circuitry and components of the headlamp leveling switch are contained within a molded black plastic instrument panel switch pod housing. A single connector receptacle is integral to the back of the switch pod housing. The switch is connected to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The headlamp leveling switch cannot be adjusted or repaired and, if ineffective or damaged, the entire instrument panel switch pod unit must be replaced. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/INSTRUMENT PANEL SWITCH POD - REMOVAL).

OPERATION

The status of the headlamp leveling switch is continually monitored by the circuitry within the instrument panel switch pod. The switch pod receives battery voltage at all times on a fused battery feed circuit, and a path to ground at all times through the instrument panel wire harness. The only other inputs to and outputs from the switch pod consist of electronic communication with the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the single wire Local Interface Network (LIN) data bus.

Whenever the headlamp leveling switch push button is depressed the switch pod circuitry sends an electronic **select status up** or **select status down** message input to the EMIC over the LIN data bus. The EMIC then sends the appropriate electronic **select request up** or **select request down** message to the TIPM over the CAN data bus.

The TIPM responds to these messages by providing a voltage output to the headlamp leveling motors through high side drivers on the headlamp leveling motor right and left signal circuits to move the headlamp reflectors to the selected position based upon the voltage input received from the TIPM. The TIPM also sends the appropriate electronic messages back to the EMIC and the EMIC relays the messages back to the switch pod to control the illumination of the **1**, **2**, or **3** Light Emitting Diode (LED) selected position indicator in the leveling switch button. The EMIC and TIPM logic will only allow the headlamp leveling system to operate while the ignition switch is in the ON position and the exterior lighting is turned ON.

The hard wired circuits for the instrument panel switch pod may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the headlamp leveling switch or the electronic controls and communication between other modules and devices that provide some features of the headlamp leveling system. The most reliable, efficient, and accurate means to diagnose the headlamp leveling switch or the electronic controls and communication related to headlamp leveling system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

HEADLAMP UNIT

STANDARD PROCEDURE

HEADLAMP UNIT MOISTURE CLEARING

Some moisture accumulation inside a vented headlamp unit is normal. This normal moisture will appear as a fogging on the inside of the lamp lens, similar to the fog that sometimes appears on the inside of a windshield. This moisture may be removed by activating the headlamps on HIGH beam for 15 minutes.

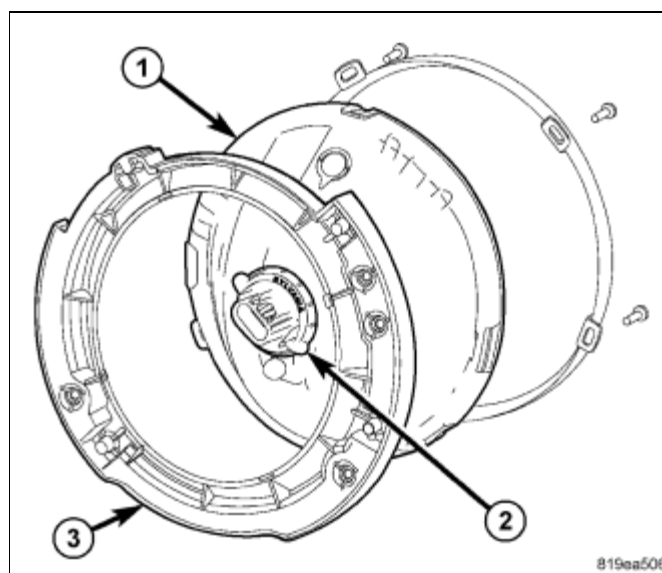
If water droplets larger than 1 millimeter (0.039 inch) in size have accumulated on the inside of the lamp lens, the headlamp unit should be replaced.

REMOVAL

BULB - HEADLAMP - DOMESTIC

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Disconnect and isolate the battery negative cable.
2. Remove the headlamp unit (1) from the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - DOMESTIC - REMOVAL).
3. Using the tabs on each side of the headlamp bulb connector receptacle (2), firmly grasp the bulb base and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the bulb and base straight out from the keyed opening in the headlamp unit.

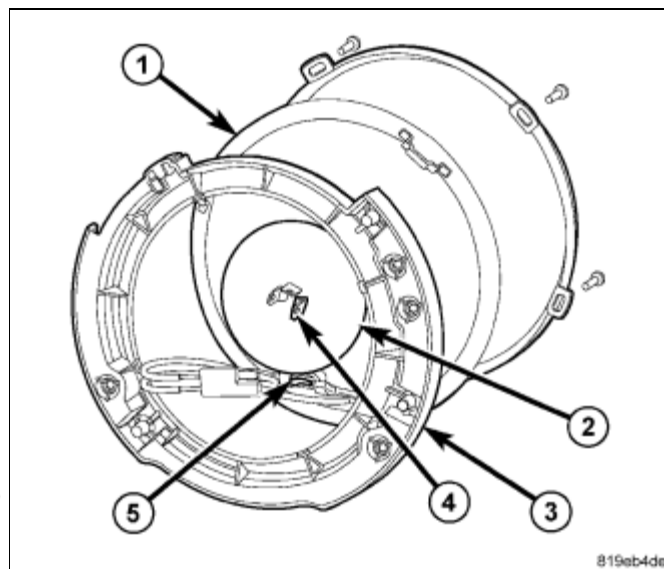


BULB - HEADLAMP - EXPORT

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

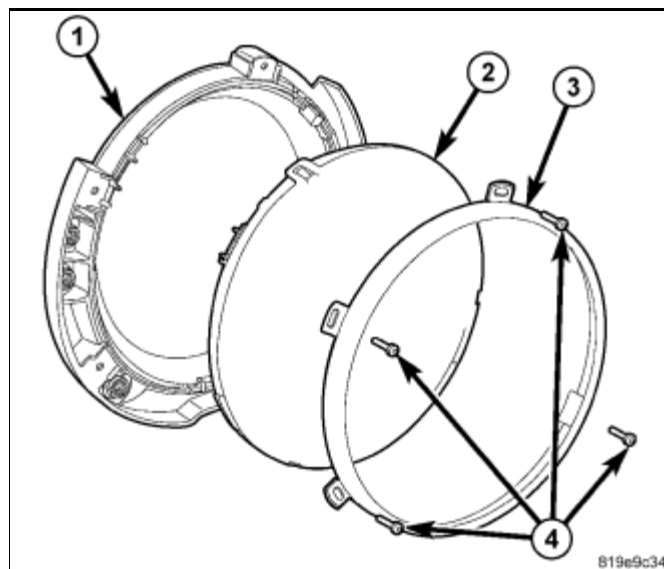
1. Disconnect and isolate the battery negative cable.
2. Remove the headlamp unit (1) from the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - EXPORT - REMOVAL).

3. Remove the rubber headlamp boot seal (2) from the back of the headlamp housing and the headlamp bulb base (4).
4. Removal of the boot seal from the headlamp unit housing will reveal the wire retainer for the headlamp bulb.
5. Pinch the two ends of the wire retainer together and disengage them from the hooks that secure them against the bulb flange on the headlamp housing.
6. Pivot the wire retainer up off of the flange of the headlamp bulb base and out of the way.
7. Pull the bulb straight out of the keyed opening in the headlamp housing.



LAMP - DOMESTIC

1. Disconnect and isolate the battery negative cable.
2. Remove the grille panel from the front of the vehicle. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
3. Remove the four screws (4) that secure the retainer (3) and the headlamp unit (2) to the mounting collar (1) on the face of the front end module carrier.
4. Pull the retainer and the headlamp unit away from the front of the vehicle far enough to access the wiring connection on the back of the lamp housing.
5. Disconnect the engine compartment wire harness connector from the headlamp bulb connector receptacle.
6. Remove the headlamp unit from the vehicle.



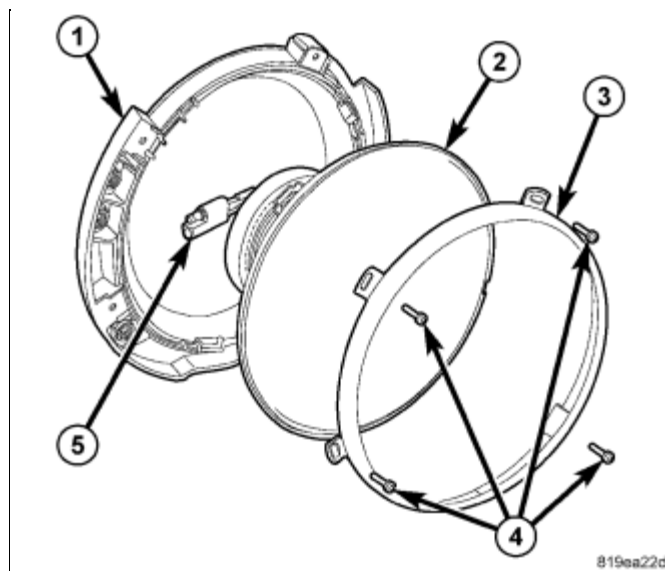
LAMP - EXPORT

1. Disconnect and isolate the battery negative cable.
2. Remove the grille panel from the front of the vehicle. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
3. Remove the four screws (4) that secure the retainer (3) and the headlamp unit (2) to the mounting collar (1) on the face of the front end module carrier.
4. Pull the retainer and the headlamp unit away from the front of the vehicle far enough to access the wiring

- connection on the back of the lamp housing.
5. Disconnect the engine compartment wire harness connectors from the headlamp bulb connector receptacle and from the position lamp bulb pigtail connector (5).
 6. Remove the headlamp unit from the vehicle.

BULB - POSITION LAMP

NOTE: The following procedure applies only to vehicles manufactured for export markets. Vehicles manufactured for domestic markets do not have a position lamp bulb, socket or wiring provided in the headlamp unit.



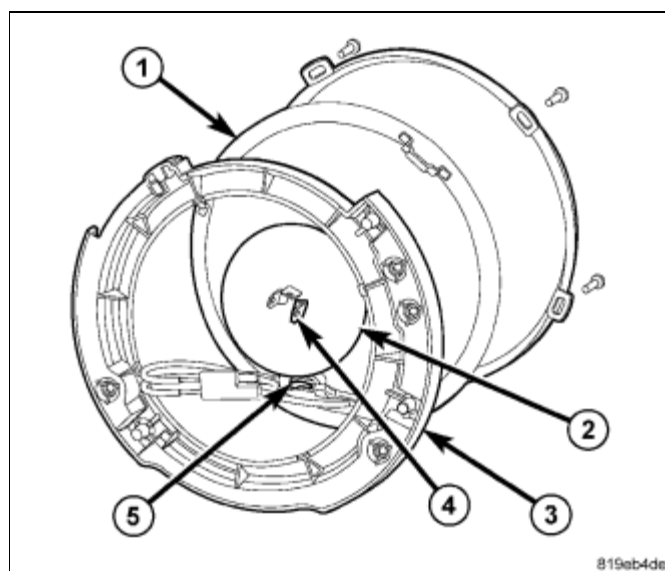
1. Disconnect and isolate the battery negative cable.
2. Remove the headlamp unit (1) from the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - EXPORT - REMOVAL).
3. Firmly grasp the position lamp socket (5) and pull it straight out of the rubber grommet in the headlamp unit housing.
4. Rotate the bulb counterclockwise about 30 degrees to unlock it from the socket.
5. Pull the bulb straight out of the socket.

INSTALLATION

BULB - HEADLAMP - DOMESTIC

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

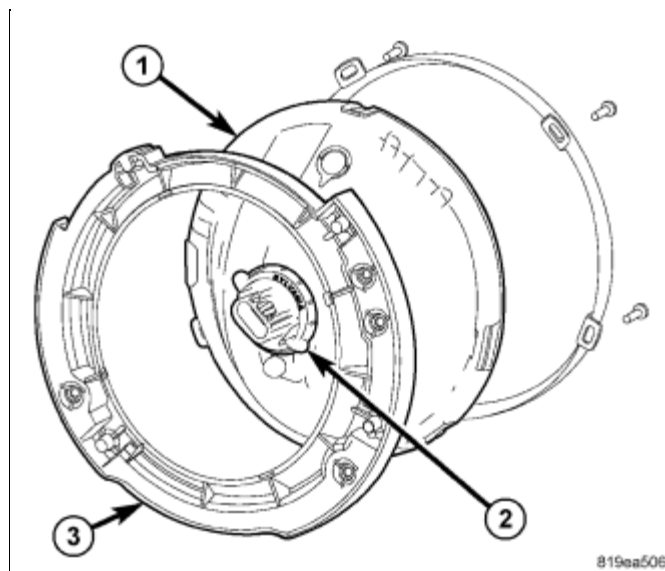
CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.



1. Align the headlamp bulb base (2) with the keyed opening

- on the back of the headlamp unit (1).
2. Insert the bulb and base into the headlamp until the base is firmly seated.
3. Using the tabs on each side of the connector receptacle, rotate the bulb base clockwise about 30 degrees to lock it into place.
4. Reinstall the headlamp unit (1) into the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - DOMESTIC - INSTALLATION).
5. Reconnect the battery negative cable.

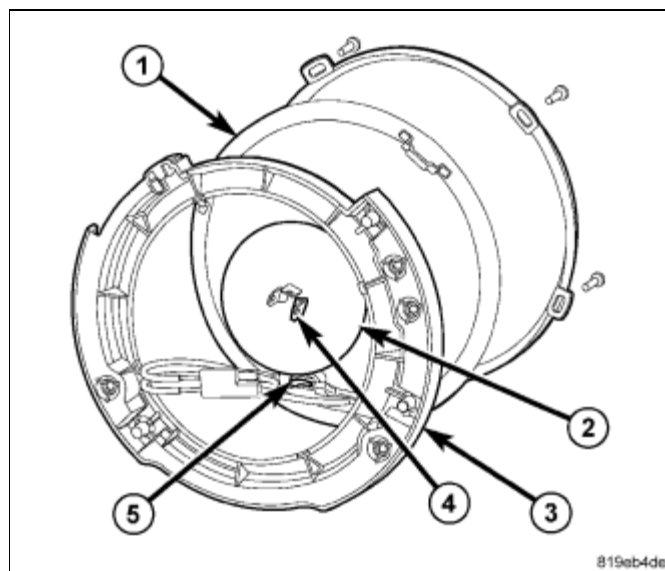
BULB - HEADLAMP - EXPORT



CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.

1. Insert the headlamp bulb (4) into the keyed opening in the headlamp unit housing (1).
2. Be certain the bulb is fully seated in the headlamp, then pivot the wire bulb retainer back over the bulb flange.
3. Pinch the two ends of the wire bulb retainer together and engage them under the hooks to secure them against the flange of the headlamp bulb.
4. Position the center openings of the rubber boot seal (2) over the base of the headlamp bulb and engage it fully over the bulb base.
5. Position the outer circumference of the boot seal over the flange on the back of the headlamp unit housing and pull it down around the circumference housing flange until it is fully engaged.
6. Reinstall the headlamp unit into the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - EXPORT - INSTALLATION).
7. Reconnect the battery negative cable.



LAMP - DOMESTIC

1. Position the headlamp unit (2) close enough to the front of the vehicle to reconnect the engine compartment wire

harness connector to the headlamp bulb connector receptacle.

2. Position the headlamp unit by aligning and engaging the index tabs on the back of the lamp with the depressions in the mounting collar (1) on the face of the front end module carrier.

3. Install the retainer (3) over the headlamp unit and against the mounting collar with the retainer screw tabs in alignment with the screw holes in the collar.

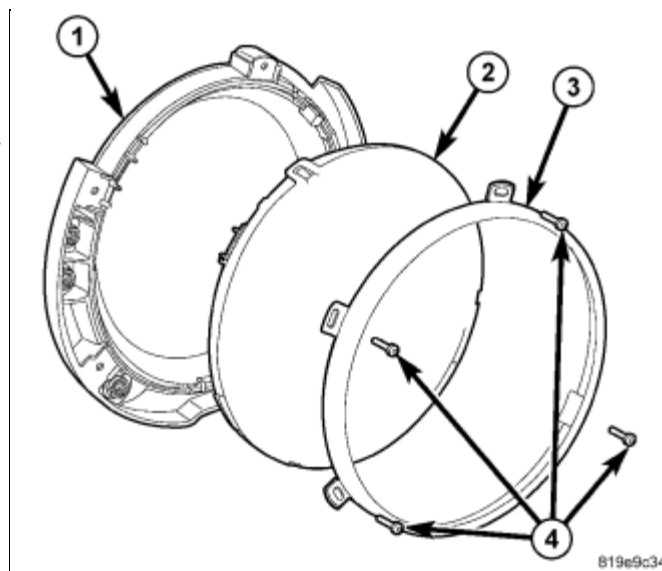
4. Install and tighten the four screws that secure the retainer to the collar. Tighten the screws until they are fully seated.

5. Reinstall the grille panel onto the front of the vehicle.

(Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

6. Reconnect the battery negative cable.

7. Confirm proper headlamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - STANDARD PROCEDURE - FRONT LAMP AIMING).



LAMP - EXPORT

1. Position the headlamp unit (2) close enough to the front of the vehicle to reconnect the engine compartment wire harness connectors to the headlamp bulb connector receptacle and to the position lamp bulb pigtail connector (5).

2. Position the headlamp unit by aligning and engaging the index tabs on the back of the lamp with the depressions in the mounting collar (1) on the face of the front end module carrier.

3. Install the retainer (3) over the headlamp unit and against the mounting collar with the retainer screw tabs in alignment with the screw holes in the collar.

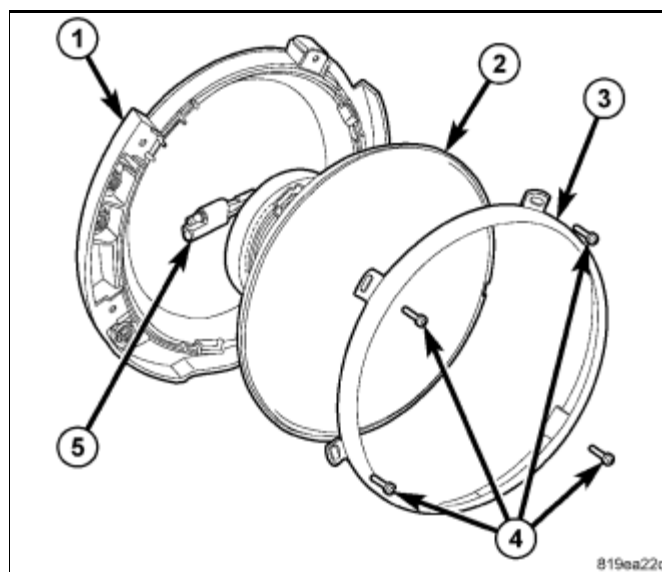
4. Install and tighten the four screws that secure the retainer to the collar. Tighten the screws until they are fully seated.

5. Reinstall the grille panel onto the front of the vehicle.

(Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

6. Reconnect the battery negative cable.

7. Confirm proper headlamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - STANDARD PROCEDURE - FRONT LAMP AIMING).

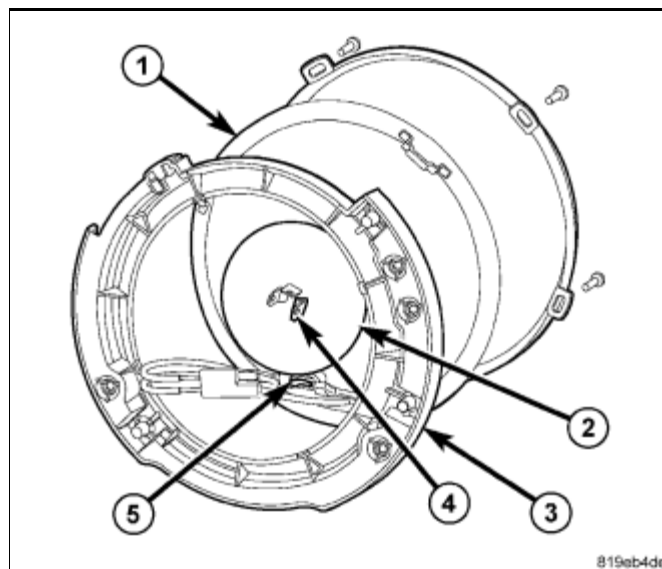


BULB - POSITION LAMP

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

NOTE: The following procedure applies only to vehicles manufactured for export markets. Vehicles manufactured for domestic markets do not have a position lamp bulb, socket or wiring provided in the headlamp unit.

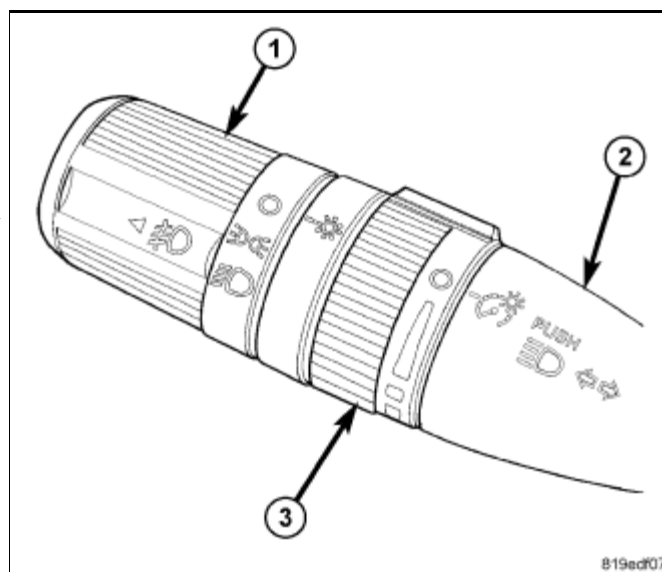
1. Align the base of the bulb with the position lamp bulb socket (5).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Rotate the bulb clockwise about 30 degrees to lock it into place.
4. Align the socket and bulb with the opening near the bottom of the headlamp unit housing (1).
5. Push the socket and bulb straight into the rubber grommet in the housing until the socket is firmly seated.
6. Reinstall the headlamp unit into the mounting collar (3). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - EXPORT - INSTALLATION).
7. Reconnect the battery negative cable.

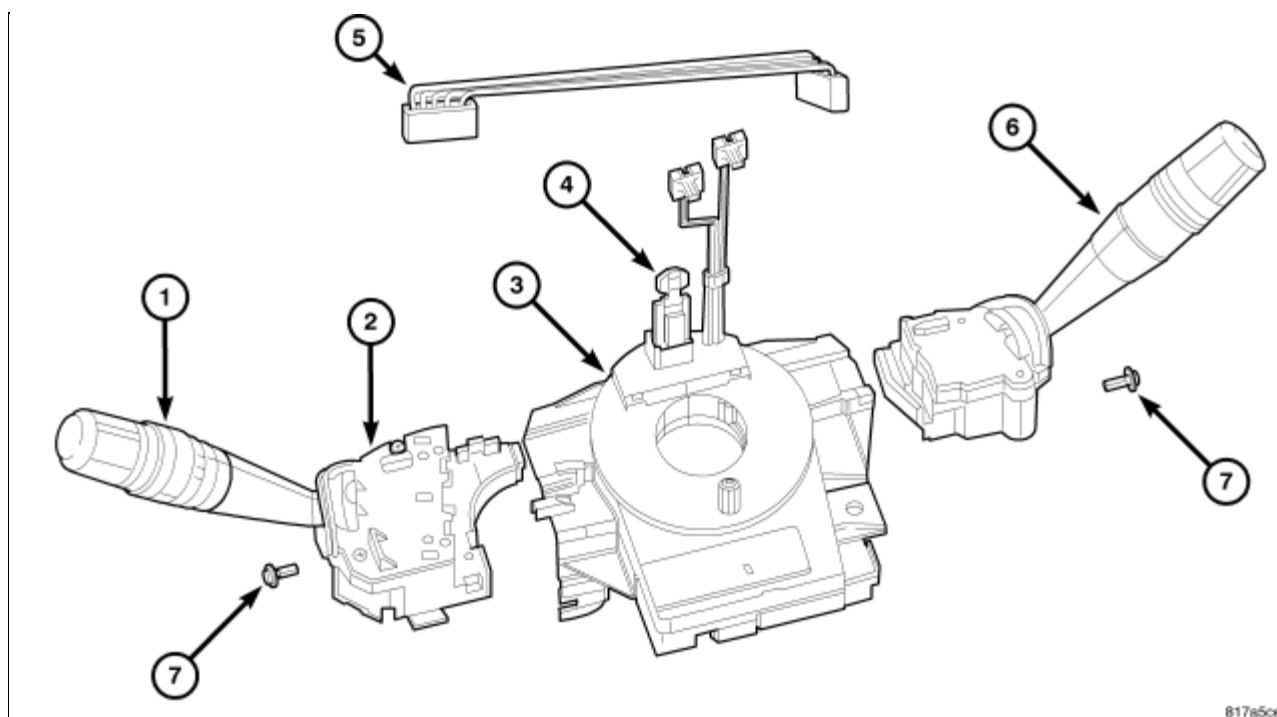


LEFT MULTI-FUNCTION SWITCH

DESCRIPTION

The left (lighting) multi-function switch is located on the left side of the steering column, just below the steering wheel. This switch is the primary control for the interior and exterior lighting systems. The only visible components of the switch are the control stalk (2), control knob (1) and control sleeve (3) that extend through the steering column shrouds on the left side of the column. The remainder of the switch including its mounting provisions, its electrical connection, and the turn signal cancel actuator are concealed beneath the shrouds.





The switch housing (2) and controls (1) are constructed of molded black plastic. Each of the switch controls has white International Control and Display Symbol graphics applied to it, which clearly identify its many functions. A single screw (7) through a mounting tab integral to the back of the switch housing, and a slide tab integral to the bottom of the switch housing secure the switch to the mounting bracket integral to the clockspring (3).

The Steering Control Module (SCM) is internal to the switch housing. The switch outputs are internally connected directly to the SCM. A single connector receptacle containing seven terminal pins is integral to the inboard end of the switch housing and connects the right multi-function switch (6) through a jumper wire harness (5) directly to the SCM. An integral connector receptacle on the back of the switch housing connects the SCM to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The left multi-function switch provides the vehicle operator with a control interface for the following exterior lighting system functions:

- **Front Fog Lamps** - For vehicles so equipped, the left multi-function switch control knob provides detent switching for the optional front fog lamps.
- **Headlamps** - The left multi-function switch control knob provides detent switching for the headlamps.
- **Headlamp Beam Selection** - The left multi-function switch control stalk provides detent switching for selection of the headlamp high or low beams.
- **Headlamp Optical Horn** - The left multi-function switch control stalk includes momentary switching of the headlamp high beam circuits to provide an optical horn feature (sometimes referred to as flash-to-pass), which allows the vehicle operator to momentarily flash the headlamp high beams as an optical signalling device.
- **Park Lamps** - The left multi-function switch control knob provides detent switching for the park lamps.
- **Rear Fog Lamps** - For vehicles so equipped, the left multi-function switch control knob provides detent switching for the optional rear fog lamps. Rear fog lamps are optional only for vehicles manufactured for certain markets, where they are required.
- **Turn Signal Control** - The left multi-function switch control stalk provides both momentary non-detent switching and detent switching with automatic cancellation for both the left and right turn signal lamps.

The left multi-function switch also provides the vehicle operator with a control interface for the following

interior lighting functions:

- **Interior Lamps Defeat** - The left multi-function switch control ring provides detent switching to DEFEAT the illumination of all interior courtesy lamps when a door, the rear flip-up glass, or the liftgate are opened.
- **Interior Lamps On** - The left multi-function switch control ring provides detent switching to simultaneously illuminate all interior courtesy lamps.
- **Panel Lamps Dimming** - The left multi-function switch control ring provides simultaneous adjustable control of the illumination intensity of all instrument panel lighting at one of five available illumination intensity levels.
- **Parade Mode** - The left multi-function switch control ring provides detent switching for a PARADE mode that maximizes the illumination intensity of all instrument panel lighting for visibility when driving in daylight with the exterior lamps turned ON.

The left multi-function switch cannot be adjusted or repaired. If any function of the switch is ineffective, or if the switch is damaged, the entire switch unit must be replaced. The clockspring (with the multi-function switch mounting bracket), the left multi-function switch (with the SCM), the right multi-function switch and the jumper wire harness are each available for separate service replacement.

OPERATION

The left (lighting) multi-function switch uses resistor multiplexing to control the many functions and features it provides using a minimal number of hard wired circuits. The switch receives clean grounds from the Steering Control Module (SCM), then provides resistor multiplexed return outputs to the SCM to indicate the selected switch positions. The SCM then sends electronic **switch status** messages over a Local Interface Network (LIN) data bus to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN), and the EMIC relays electronic **switch request** messages over the Controller Area Network (CAN) data bus to other electronic modules in the vehicle.

If the SCM detects no inputs from the left multi-function switch, it transmits an electronic **Signal Not Available (SNA)** status message over the LIN data bus. The SNA status signals the EMIC to request other electronic modules to implement a failsafe mode of operation for the exterior lighting systems. The failsafe mode automatically turns the exterior lighting ON when the ignition switch is in the ON position, and OFF when the ignition switch is in the OFF position.

The hard wired inputs and outputs of the left multi-function switch and SCM may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, the most reliable, efficient and accurate means to diagnose this component requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

EXTERIOR LIGHTING

Following are descriptions of how the left multi-function switch is operated to control the many exterior lighting functions and features it provides:

- **Front Fog Lamps** - The optional front fog lamps are requested when the left multi-function switch control knob is pulled outward to the front fog lamps detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **exterior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **exterior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle. The switch control knob incorporates an internal cam mechanism that will only allow the front fog lamps to be selected while

the headlamp ON position is also selected, and will automatically move the control knob to the front fog lamps OFF position when the control knob is rotated to deselect the headlamps.

- **Headlamps** - The headlamps are requested when the left multi-function switch control knob is rotated to the headlamps ON detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **exterior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **exterior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Headlamp Beam Selection** - The headlamp high beams are selected when the left multi-function switch control stalk is pushed forward to the high beam selection detent position. The low beams are selected when the control stalk is pulled rearward to the low beam selection detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **beam select switch status** message over the LIN data bus to the EMIC, which relays an electronic **beam select switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Headlamp Optical Horn** - The headlamp optical horn is selected each time the left multi-function switch control stalk is pulled fully rearward to a momentary position. The headlamp high beams will remain illuminated for as long as the control stalk is held in this momentary position and the low beams will be restored when the control stalk is released. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **beam select switch status** message over the LIN data bus to the EMIC, which relays an electronic **beam select switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Park Lamps** - The headlamps are requested when the left multi-function switch control knob is rotated to the park lamps ON detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **exterior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **exterior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Rear Fog Lamps** - The optional rear fog lamps are requested when the left multi-function switch control knob is pulled outward to the front fog lamps detent position and then rotated to the rear fog lamps detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **exterior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **exterior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle. The switch control knob incorporates an internal cam mechanism that will only allow the rear fog lamps to be selected while the front fog lamps ON position is also selected, and will automatically move the control knob to the rear fog lamp OFF position when the control knob is pushed in to deselect the front fog lamps.
- **Turn Signal Control** - The turn signals are requested when the left multi-function switch control stalk is moved downward (left signal) or upward (right signal). The control stalk has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate, momentary position in each direction that automatically provides three turn signal blinks as a LANE CHANGE feature when the control stalk is tapped or will energize the turn signals for as long as the control stalk is held in the momentary position. When the control stalk is moved to a detent turn signal switch position, a cancel actuator extends through an opening in the side of the clockspring case toward the center of the steering column. A turn signal cancel cam that is integral to the clockspring rotor rotates with the steering wheel and the cam lobes contact the cancel actuator when it is extended from the left multi-function switch. When the steering wheel is rotated during a turning maneuver, one of the turn signal cancel cam lobes will contact the turn signal cancel actuator. The cancel actuator latches against the cancel cam rotation in the direction opposite that which is signaled. If the left turn signal detent is selected, the lobes of the cancel cam will ratchet past the cancel actuator when the steering wheel is rotated to the left, but will unlatch the cancel actuator as the steering wheel rotates to the right and returns to center, which will cancel the turn signal event and release the control stalk from the detent so it returns to the neutral OFF position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **exterior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **exterior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.

INTERIOR LIGHTING

Following are descriptions of the how the left multi-function switch is operated to control the many interior lighting functions and features it provides:

- **Interior Lamps Defeat** - The interior lamps defeat feature is requested when the left multi-function switch control sleeve is rotated to the interior lamps DEFEAT detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **interior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **interior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Interior Lamps On** - The interior lamps ON feature is requested when the left multi-function switch control sleeve is rotated to the interior lamps ON detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **interior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **interior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Panel Lamps Dimming** - The panel lamps dimming function is active only when the left multi-function switch control knob is in any exterior lighting ON position. With the exterior lighting ON, the panel lamps dimming level is requested when the left multi-function switch control sleeve is rotated to any one of five minor detent positions. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **interior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **interior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.
- **Parade Mode** - The PARADE (or funeral) mode is active only when the left multi-function switch control knob is in any exterior lighting ON position. With the exterior lighting ON, the PARADE mode is requested when the left multi-function switch control sleeve is rotated to the PARADE mode detent position. The SCM reads the resistor multiplexed input from the left multi-function switch and sends an electronic **interior lighting switch status** message over the LIN data bus to the EMIC, which relays an electronic **interior lighting switch request** message over the CAN data bus to other electronic modules in the vehicle.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

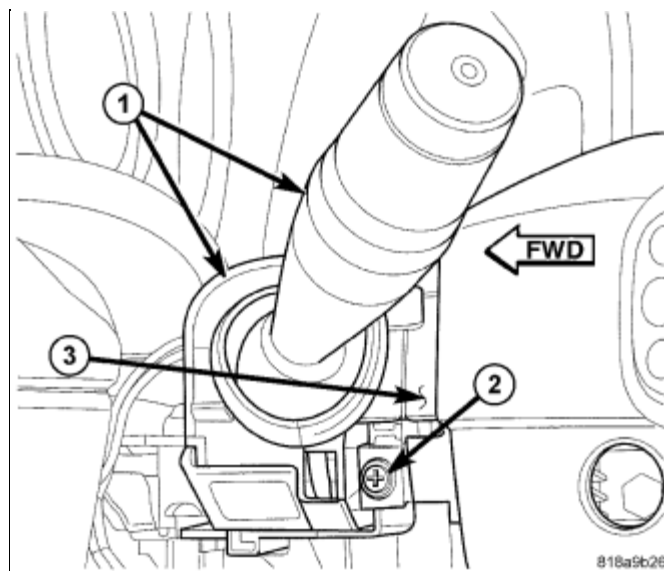
1. Disconnect and isolate the battery negative cable.
2. Remove both the upper and lower shrouds from the steering column. (Refer to 19 - STEERING/COLUMN - REMOVAL).
3. Disconnect the instrument panel wire harness connector from the connector receptacle on the back of the left multi-function switch.
4. Remove the screw (2) that secures the left multi-function switch (1) to the mounting bracket integral to the left side of

the clockspring (3) on the steering column.

5. Slide the switch away from the clockspring far enough to disengage the slide tabs on the switch housing from the channel formations in the mounting bracket.

6. Disconnect the jumper wire harness connector from the connector receptacle on the inboard end of the left multi-function switch.

7. Remove the switch from the clockspring.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the left multi-function switch (1) close enough to the mounting bracket (3) integral to the left side of the clockspring to reconnect the jumper wire harness connector to the connector receptacle on the inboard side of the switch housing.

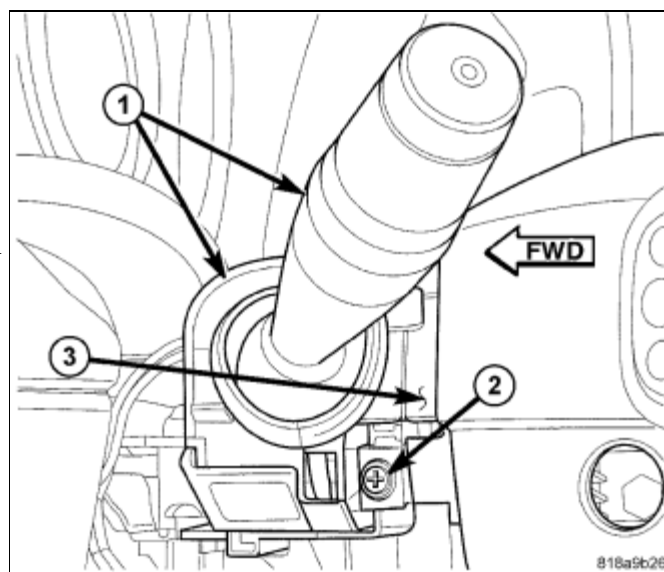
2. Align the slide tabs on the switch housing with the channel formations integral to the clockspring mounting bracket, then slide the switch into the bracket until it is firmly seated.

3. Install and tighten the screw (2) that secures the mounting tab on the front of the left multi-function switch to the mounting bracket on the clockspring. Tighten the screw to 1 N·m (10 in. lbs.).

4. Reconnect the instrument panel wire harness connector to the connector receptacle on the back of the switch housing.

5. Reinstall the upper and lower shrouds onto the steering column. (Refer to 19 - STEERING/COLUMN - INSTALLATION).

6. Reconnect the battery negative cable.

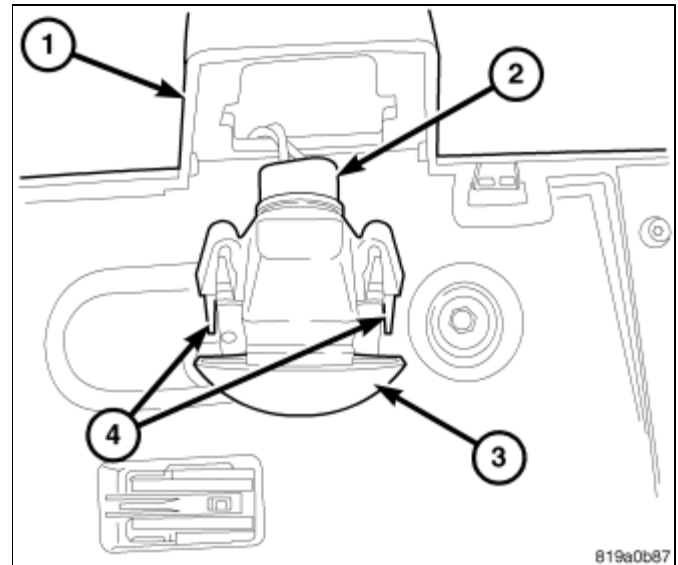


LICENSE PLATE LAMP

REMOVAL

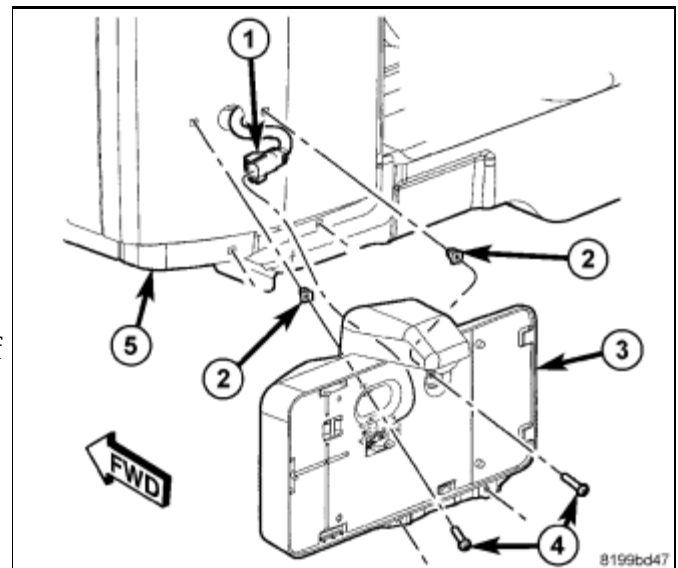
BULB

1. Disconnect and isolate the battery negative cable.
2. Reach under the license plate lamp hood (1) to access and squeeze together the two latch tabs (4) integral to license plate lamp lens (3).
3. Pull the lens downward and back out of the hood far enough to access the bulb socket (2).
4. Firmly grasp the bulb socket on the back of the lens and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the lens.
6. Firmly grasp and pull the bulb straight out of the socket.



LAMP - DOMESTIC

1. Disconnect and isolate the battery negative cable.
2. Remove the license plate from the rear license plate bracket.
3. Remove the four screws (4) that secure the rear license plate bracket and lamp unit (3) to the four spring nuts (2) in the rear body sheet metal (5).
4. Pull the bracket and lamp unit away from the rear body sheet metal far enough to access and disconnect the body wire harness connector (1) from the connector on the back of the bracket and lamp unit housing.
5. Remove the bracket and lamp unit from the vehicle.



LAMP - EXPORT

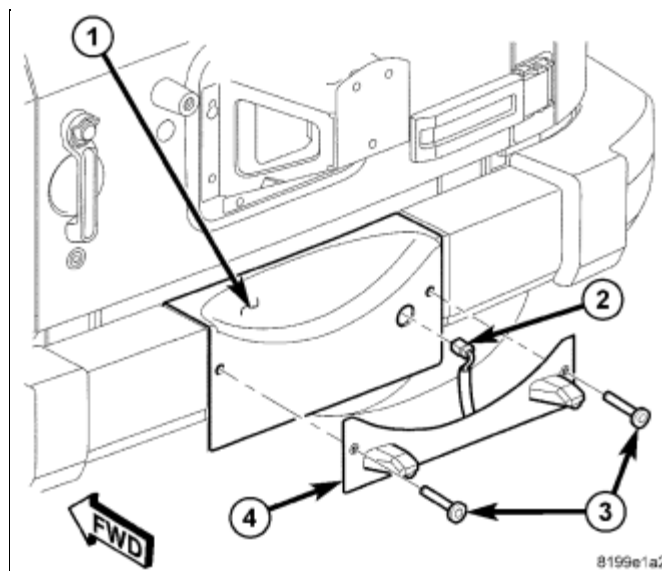
1. Disconnect and isolate the battery negative cable.
2. Remove the license plate from the rear bumper cover (1).
3. Reach under and behind the rear bumper to access and disconnect the license plate lamp pigtail wire harness connector (2) from the body wire harness.
4. Remove the two screws (3) that secure the rear license plate lamp unit (4) to the rear bumper cover.

5. Pull the license plate lamp unit away from the rear bumper cover far enough to disengage the pigtail wire harness from the clearance hole.
6. Remove the bracket and lamp unit from the rear bumper cover.

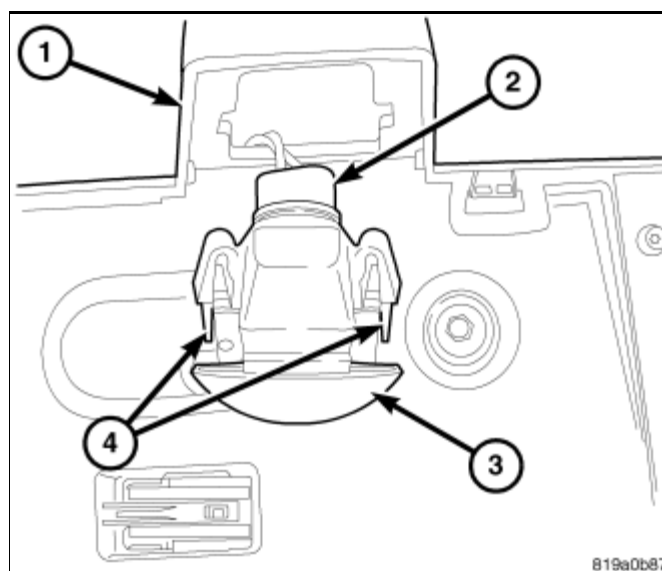
INSTALLATION

BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.



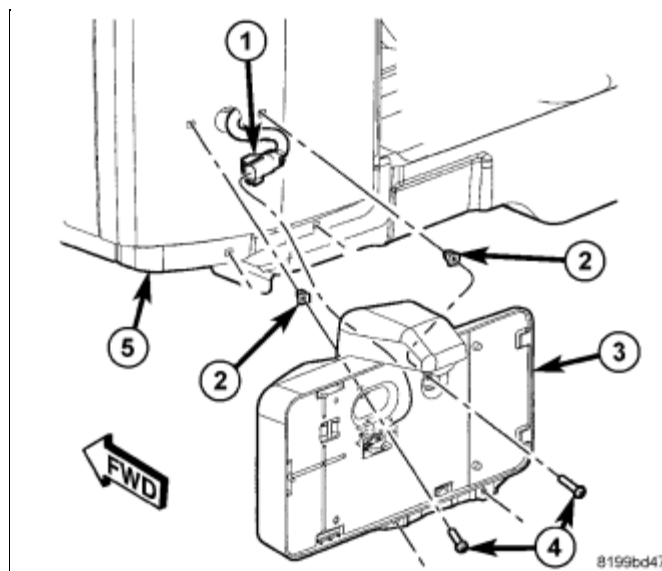
1. Align the base of the bulb with the license plate lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the license plate lamp lens (3).
4. Insert the socket and bulb into the lens until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Push the lens upward into the license plate lamp hood (1) until the two latch tabs (4) integral to the lens snap into place.
7. Reconnect the battery negative cable.



LAMP - DOMESTIC

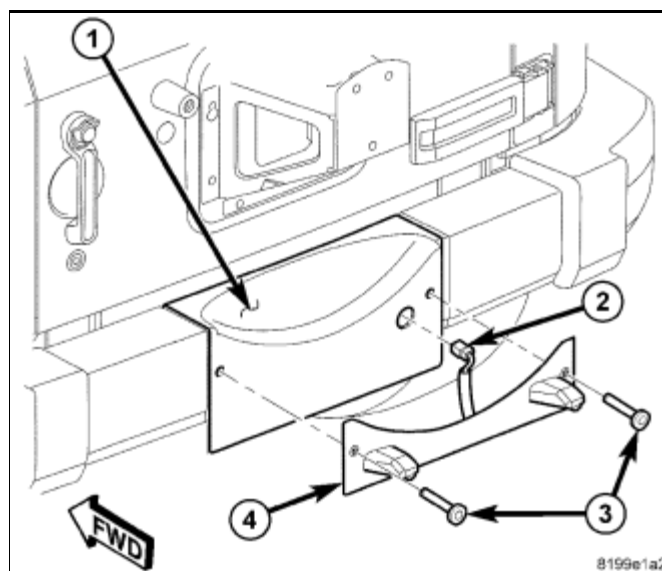
1. Check to be certain that the four spring nuts (2) are in good condition and properly installed in the rear body sheet metal (5).
2. Position the rear license plate bracket and lamp unit (3) to the rear body sheet metal.
3. Reconnect the body wire harness connector (1) to the

- connector on the back of the bracket and lamp unit housing.
4. Align the mounting holes of the bracket and lamp unit to the four spring nuts.
 5. Install and tighten the four screws (4) that secure the bracket and lamp unit to the rear body sheet metal. Tighten the screws to 1.5 N·m (15 in. lbs.).
 6. Reinstall the license plate onto the bracket.
 7. Reconnect the battery negative cable.



LAMP - EXPORT

1. Position the rear license plate lamp unit (4) to the rear bumper cover (1).
2. Insert the license plate lamp pigtail wire harness and connector (2) through the clearance hole in the rear bumper cover.
3. Align the mounting holes of the license plate lamp unit to the two mounting holes in the rear bumper cover.
4. Install and tighten the two screws (3) that secure the lamp unit to the rear bumper cover. Tighten the screws to 1.5 N·m (15 in. lbs.).
5. Reach under and behind the rear bumper to reconnect the license plate lamp pigtail wire harness connector to the body wire harness.
6. Reinstall the license plate onto the rear bumper cover.
7. Reconnect the battery negative cable.

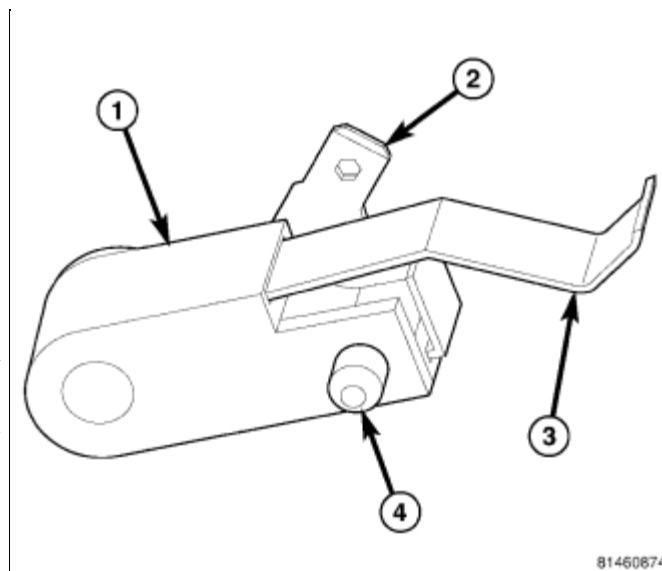


PARK BRAKE SWITCH

DESCRIPTION

The park brake switch (1) is located on the park brake lever mechanism on the floor panel transmission tunnel below the center floor console. This switch includes a spade-type output terminal (2) that connects the switch to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness. The output terminal is integral to the stationary contact within a molded plastic

insulator. A locating tab (4) on the insulator engages a slot in the park brake lever mechanism for positive switch location. External to the insulator is a movable leaf contact (3) with an integral grounding lug on one end and an integral actuating lever and follower on the opposite end. The switch is secured to and grounded by a single screw to the park brake lever mechanism.



The park brake switch cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

OPERATION

The park brake switch is a normally closed, mechanically actuated leaf contact switch that is operated by the park brake lever mechanism. The switch is grounded through its mounting to the park brake lever mechanism and provides a ground input to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) on a park brake switch sense circuit whenever the park brake is applied, and opens this circuit whenever the park brake is released. The park brake switch sense input to the EMIC is used for control of the brake indicator and may also be used as a logic input for other electronic features in the vehicle.

The park brake switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

DIAGNOSIS AND TESTING

PARK BRAKE SWITCH

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: If the brake indicator stays ON with the ignition switch in the ON position and the park brake released, or comes ON while driving, the brake system must be diagnosed and repaired prior to performing the following tests. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no brake system problem is found, the following procedures will help to locate a shorted or open park brake switch sense circuit, or an ineffective park brake switch.

INDICATOR ILLUMINATES DURING BULB TEST, BUT DOES NOT WHEN PARK BRAKE APPLIED

1. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the park brake switch from the switch terminal. Apply the parking brake. Check for continuity between the park brake switch terminal and a good ground. There should be continuity. If OK, go to [STEP 2](#). If not OK, replace the ineffective park brake switch.
2. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavities of the instrument panel wire harness connectors for the park brake switch and the instrument cluster. There should be continuity. If not OK, repair the open park brake switch sense circuit between the park brake switch and the instrument cluster as required.

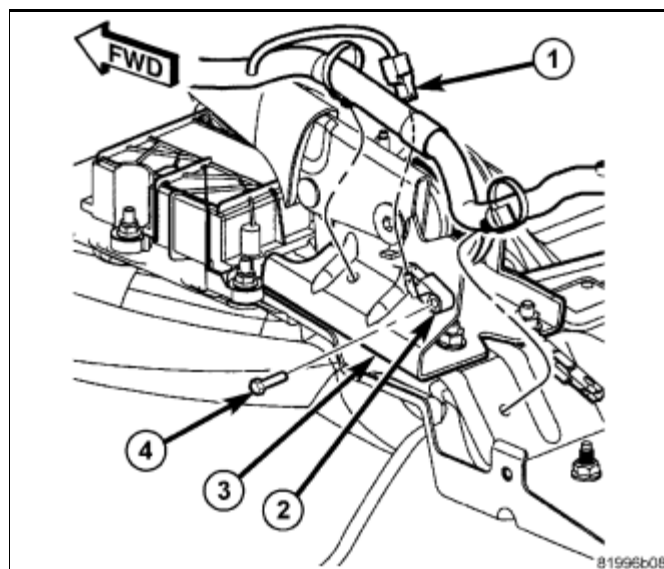
INDICATOR REMAINS ILLUMINATED - BRAKE SYSTEM CHECKS OK

1. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the park brake switch from the switch terminal. Check for continuity between the terminal of the park brake switch and a good ground. There should be no continuity with the park brake released, and continuity with the park brake applied. If OK, go to [STEP 2](#). If not OK, replace the ineffective park brake switch.
2. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavity of the connector for the park brake switch and a good ground. There should be no continuity. If not OK, repair the shorted park brake switch sense circuit between the park brake switch and the instrument cluster as required.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the console from the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).
3. Pull the parking brake lever upward to apply the parking brake.
4. Disconnect the instrument panel wire harness connector (1) from the terminal of the park brake switch (2) located on the outboard side of the park brake lever mechanism.
5. Remove the screw (4) that secures the switch to the park brake lever bracket (3).
6. Remove the switch from the park brake lever bracket.

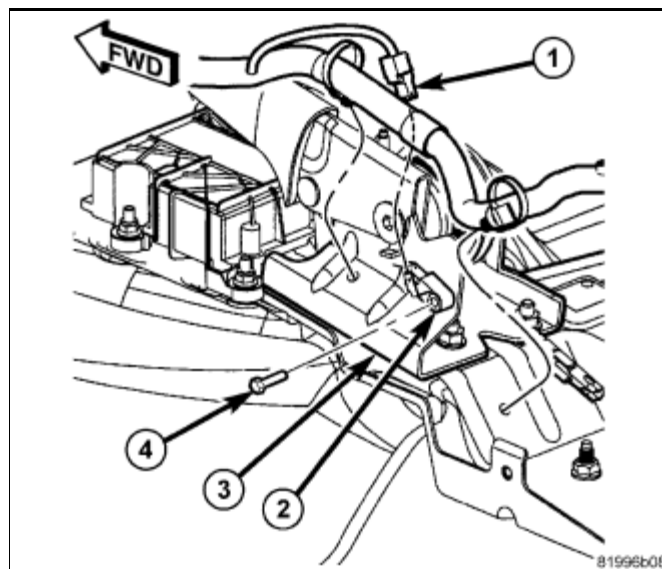


INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental

Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position park brake switch (2) onto the inboard side of the park brake lever bracket (3). Be certain to engage the locating pin on the side of the switch insulator into the locating slot in the lever bracket.
2. Install and tighten the screw (4) that secures the switch to the lever bracket. Tighten the screw to 2.5 N·m (24 in. lbs.).
3. Reconnect the instrument panel wire harness connector (1) to the terminal of the switch.
4. Reinstall the console onto the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).
5. Reconnect the battery negative cable.
6. Turn the ignition switch to the ON position and check for proper brake indicator operation with the parking brake applied, then release the parking brake and check that the brake indicator extinguishes.

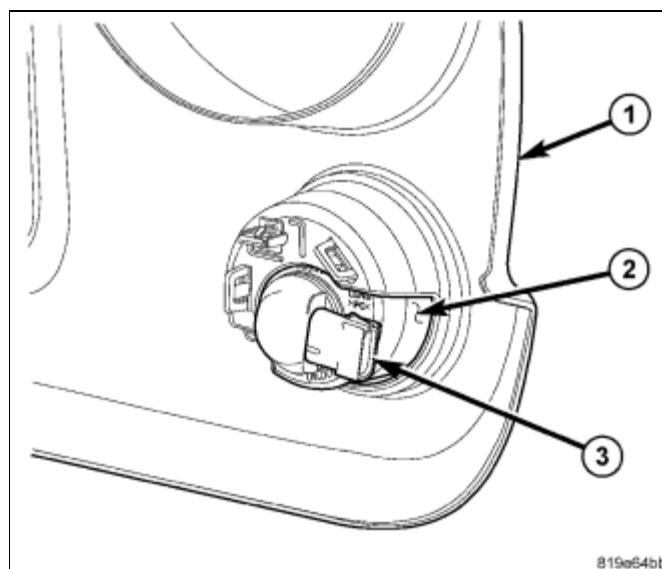


PARK/TURN SIGNAL LAMP

REMOVAL

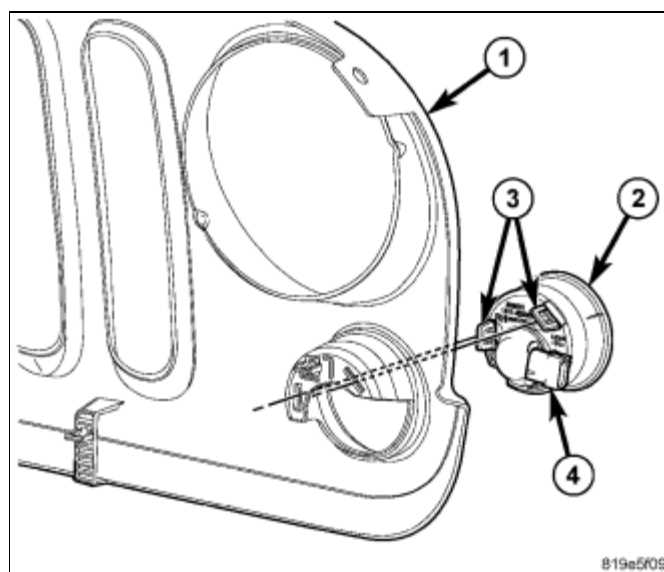
BULB

1. Disconnect and isolate the battery negative cable.
2. Reach behind the lower outboard corner of the grille panel (1) to access and disconnect the wire harness connector from the bulb socket connector receptacle (3) on the back of the park/turn signal lamp (2).
3. Firmly grasp the bulb socket on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



LAMP

1. Disconnect and isolate the battery negative cable.
2. Reach behind the lower outboard corner of the grille panel (1) to access and release the two integral park/turn signal lamp (2) latch features (3) and push the lamp out through the face of the grille panel.
3. From the face of the grille panel, pull the lamp out far enough to access and disconnect the wire harness connector from the bulb socket connector receptacle (4) on the back of the lamp.
4. Remove the lamp from the vehicle.

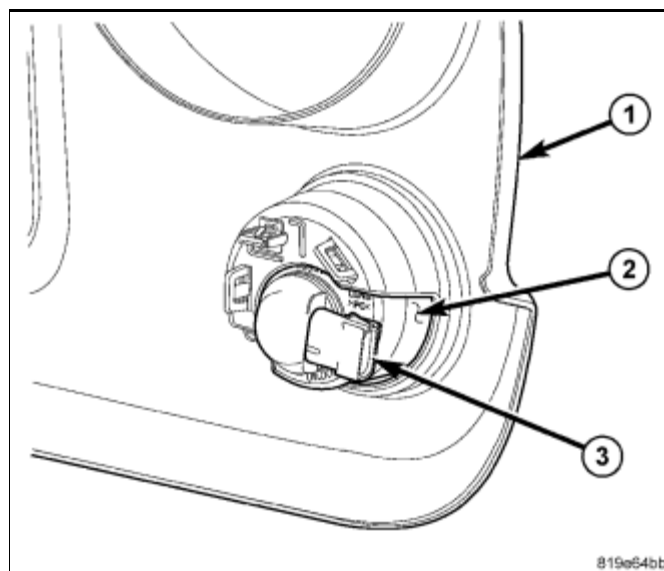


INSTALLATION

BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

1. Align the base of the bulb with the park/turn signal lamp socket (3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Reach behind the lower outboard corner of the grille panel (1) to access and align the socket and bulb with the keyed opening on the back of the lamp housing (2).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reconnect the wire harness connector to the bulb socket connector receptacle.
7. Reconnect the battery negative cable.



LAMP

1. Position the park/turn signal lamp (2) to the seat in the face of the grille panel (1).
2. Reconnect the wire harness connector to the lamp bulb socket connector receptacle (4).
3. Be certain that the two integral latch features (3) on the

back of the lamp housing are aligned with the slots in the seat.

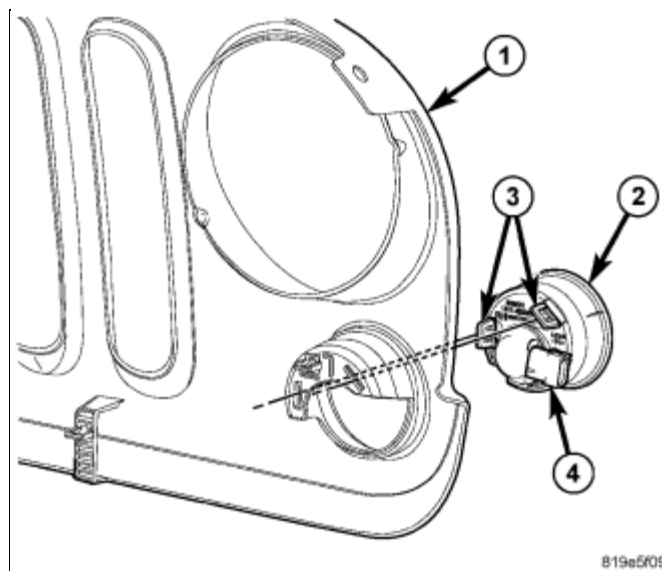
4. Push the lamp into the seat until the two latches are fully engaged in the slots.

5. Reconnect the battery negative cable.

REAR FOG LAMP

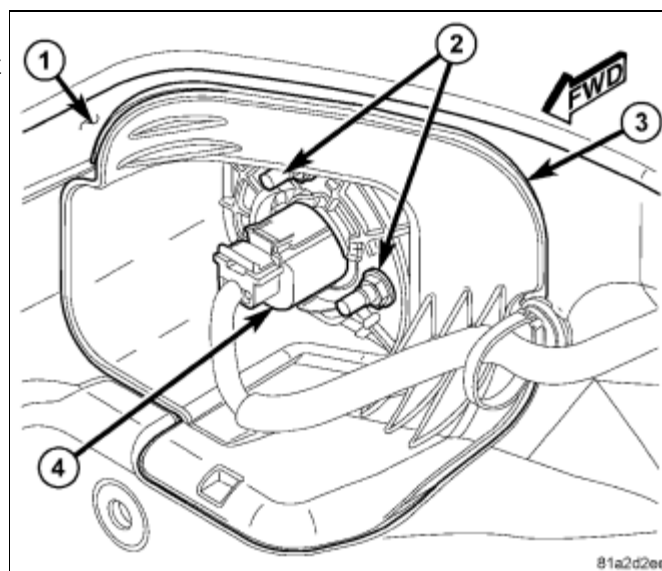
REMOVAL

LAMP



NOTE: The following procedure applies only to vehicles manufactured for export markets. Rear fog lamps are not available in vehicles manufactured for domestic markets.

1. Disconnect and isolate the battery negative cable.
2. Raise and support the vehicle.
3. From behind the outboard end of the rear bumper (1) disconnect the take out and connector (4) of the rear bumper wire harness from the rear fog lamp bulb socket.
4. Remove the two nuts (2) that secure the two mounting studs on the lamp housing to the retainer cap (3) on the back of the rear bumper cover.
5. Remove the lamp from the face of the rear bumper cover.

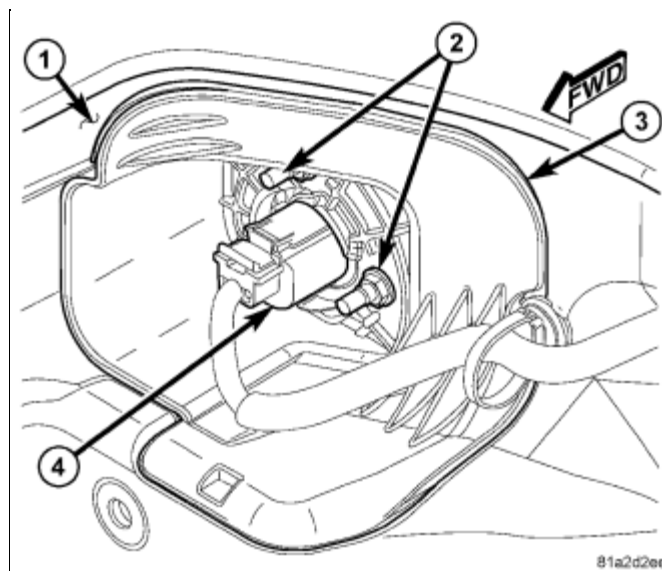


BULB

NOTE: The following procedure applies only to vehicles manufactured for export markets. Rear fog lamps are not available in vehicles manufactured for domestic markets.

1. Disconnect and isolate the battery negative cable.
2. Reach under and behind the outboard end of the rear bumper cover (1) to access the take out and connector (4) of the rear bumper wire harness on the back of the rear fog lamp housing.

3. Firmly grasp the connector and socket on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the lamp housing.
5. Pull the base of the bulb straight out of the socket.

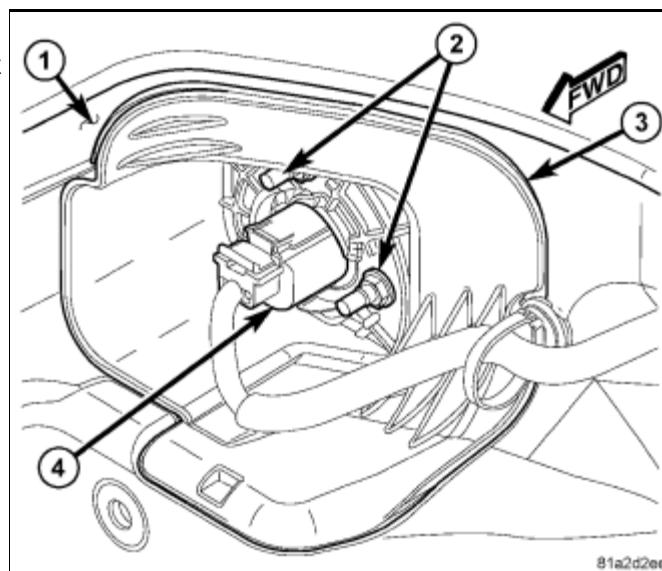


INSTALLATION

LAMP

NOTE: The following procedure applies only to vehicles manufactured for export markets. Rear fog lamps are not available in vehicles manufactured for domestic markets.

1. From the face of the rear bumper, position the rear fog lamp into the receptacle on the outboard end of the rear bumper cover (1).
2. Engage the two mounting studs on the back of the lamp housing through the holes in the retainer cap (3) on the back of the rear bumper cover.
3. Install and tighten the two nuts (2) that secure the lamp to the retainer cap. Tighten the nut to 1.5 N·m (14 in. lbs.).
4. Reconnect the take out and connector (4) of the rear bumper wire harness to the bulb socket on the back of the lamp.
5. Lower the vehicle.
6. Reconnect the battery negative cable.



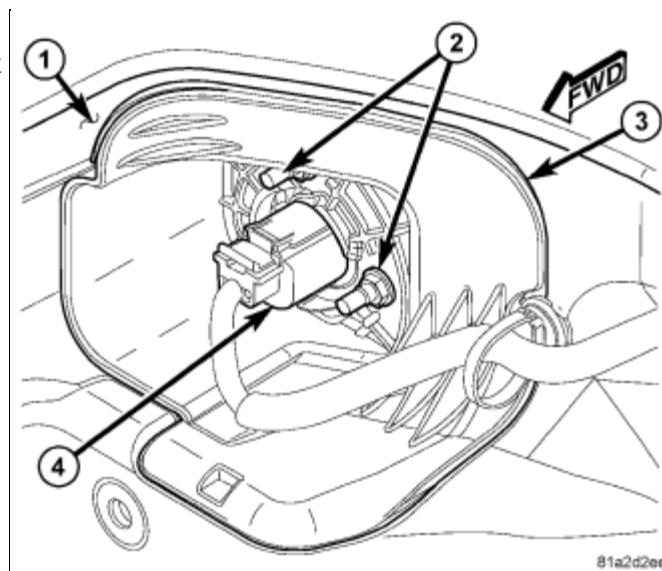
BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

NOTE: The following procedure applies only to vehicles

manufactured for export markets. Rear fog lamps are not available in vehicles manufactured for domestic markets.

1. Reach under and behind the outboard end of the rear bumper cover (1) to access the take out and connector (4) of the rear bumper wire harness connected to the rear fog lamp bulb socket near the back of the lamp housing.
2. Align the base of the bulb with the lamp socket.
3. Push the bulb straight into the socket until the base is firmly seated.
4. Align the socket and bulb with the keyed opening on the back of the rear fog lamp housing.
5. Insert the socket and bulb into the housing until the socket is firmly seated.
6. Rotate the socket clockwise about 30 degrees to lock it into place.
7. Reconnect the battery negative cable.



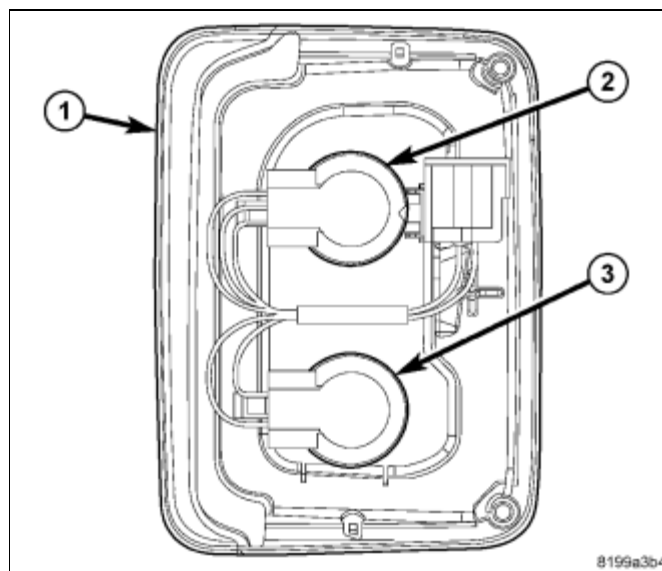
REAR LAMP UNIT

REMOVAL

BULB - DOMESTIC

NOTE: The domestic rear lamp unit (1) contains two bulbs. They are: backup (3) and park/stop/turn signal/rear side marker (2). The service procedures for each bulb are the same, only the bulb sizes and types may differ.

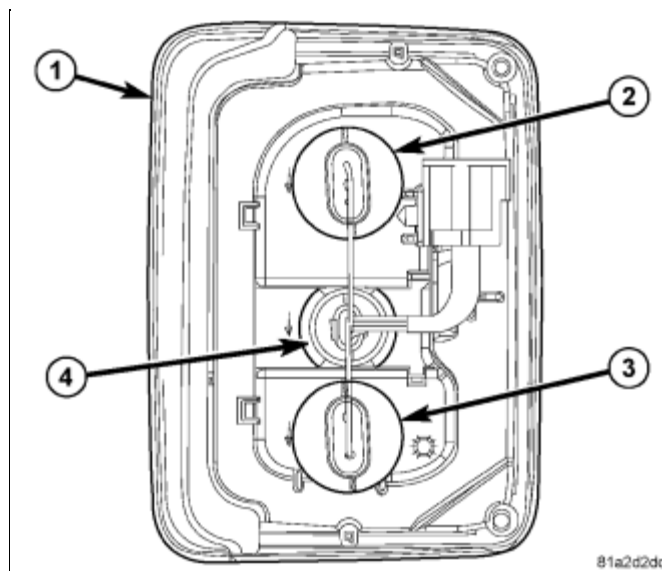
1. Disconnect and isolate the battery negative cable.
2. Remove the rear lamp unit (1) from the rear body sheet metal. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - REMOVAL).
3. Firmly grasp the appropriate bulb socket (2 or 3) on the back of the rear lamp unit housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



BULB - EXPORT

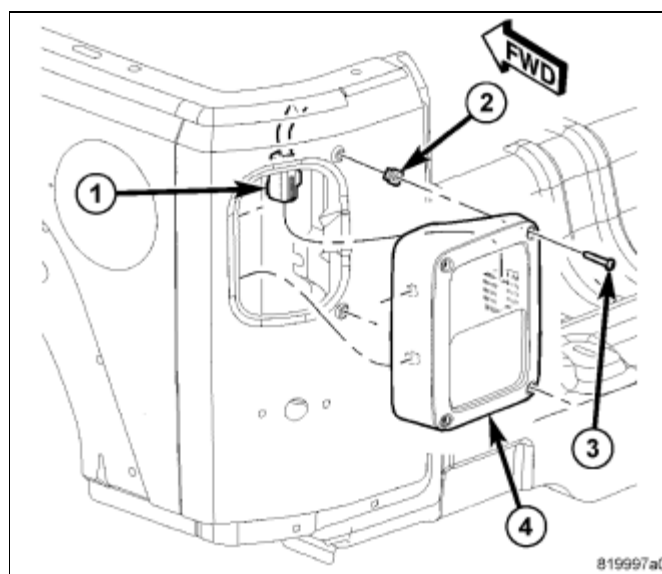
NOTE: The export rear lamp unit (1) contains three bulbs. They are: park/stop (2), backup (4), and turn signal (3). The service procedures for each bulb are the same, only the bulb sizes and types may differ.

1. Disconnect and isolate the battery negative cable.
2. Remove the rear lamp unit (1) from the rear body sheet metal. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - REMOVAL).
3. Firmly grasp the appropriate bulb socket (2, 3 or 4) on the back of the rear lamp unit housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws (3) from the inboard side of the lamp lens that secure the rear lamp unit (4) to the two spring nuts (2) in the rear body sheet metal.
3. Pull the outboard side of the rear lamp unit inboard far enough to disengage the two tabs on the back of the lamp housing from the edge of the lamp opening in the rear body sheet metal.
4. Pull the lamp away from the vehicle far enough to access and disconnect the body wire harness connectors (1) from the bulb socket pigtail wire connector on the back of the lamp housing.
5. Remove the lamp from the vehicle.



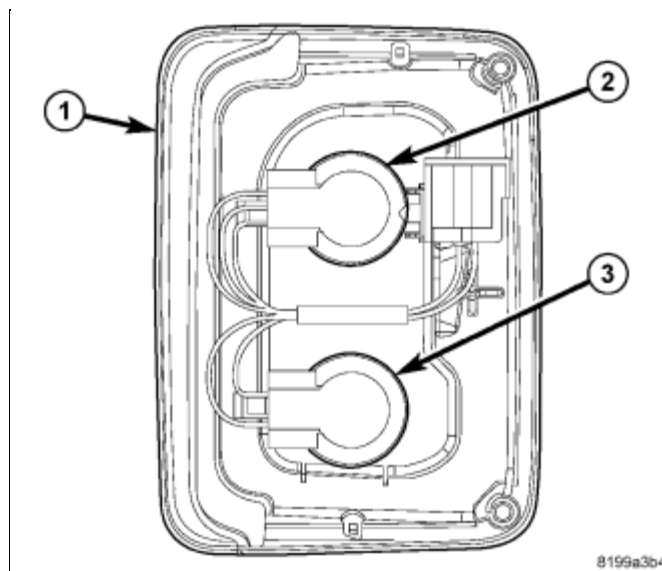
INSTALLATION

BULB - DOMESTIC

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

NOTE: The domestic rear lamp unit (1) contains two bulbs. They are: backup (3) and park/stop/turn signal/rear side marker (2). The service procedures for each bulb are the same, only the bulb sizes and types may differ.

1. Align the base of the bulb with the appropriate lamp socket (2 or 3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the rear lamp unit (1) housing.
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the rear lamp unit onto the rear body sheet metal. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.

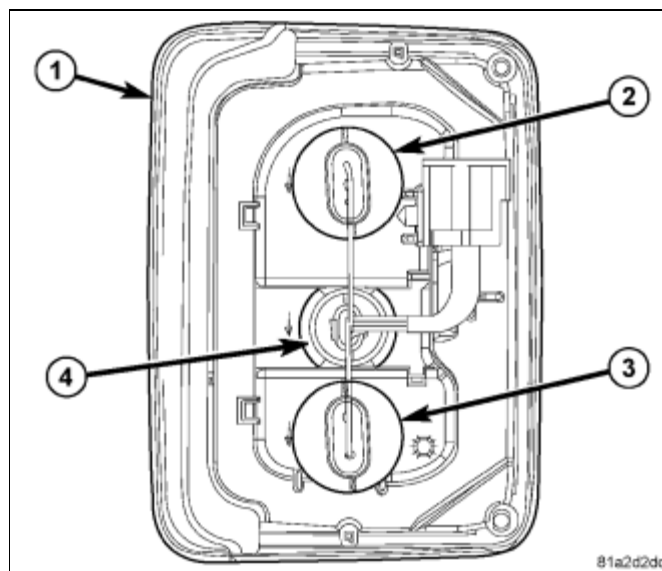


BULB - EXPORT

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

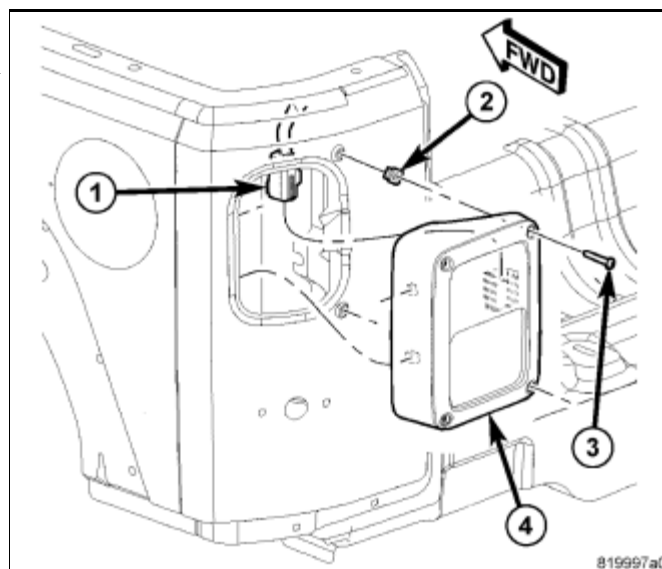
NOTE: The export rear lamp unit (1) contains three bulbs. They are: park/stop (2), backup (4), and turn signal (3). The service procedures for each bulb are the same, only the bulb sizes and types may differ.

1. Align the base of the bulb with the appropriate lamp socket (2, 3 or 4).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the rear lamp unit (1) housing.
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the rear lamp unit onto the rear body sheet metal. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.



LAMP

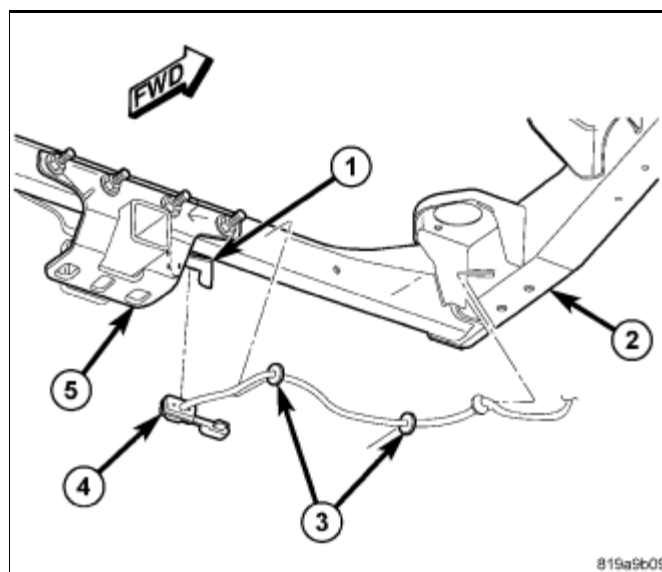
1. Check to be certain that the two spring nuts (2) are in good condition and properly installed in the rear body sheet metal.
2. Position the rear lamp unit (4) to the lamp opening of the rear body sheet metal.
3. Reconnect the body wire harness connector (1) to the bulb socket pigtail wire connector on the back of the lamp housing.
4. Engage the two tabs on the back of the lamp housing with the outboard edge of the lamp opening in the rear body sheet metal.
5. Align the mounting holes on the inboard side of the lamp to the two spring nuts.
6. Install and tighten the two screws (3) that secure the inboard side of the rear lamp unit to the body sheet metal. Tighten the screws to 1.5 N·m (15 in. lbs.).
7. Reconnect the battery negative cable.



WIRING-TRAILER TOW

DESCRIPTION

Vehicles equipped with an optional Trailer Tow package have a trailer tow wiring harness (3) connected between the body wire harness take out for the left rear lamp and the left rear lamp unit. The trailer tow wiring is routed through the left rear lamp cavity of the body to the left rear frame rail (2) then back to the rear crossmember. The wiring is secured to the frame rail and crossmember with molded plastic offset clips. A molded rubber four-way connector and cover (4) are pushed into a stamped metal tab bracket (1) that is welded to the left side of the trailer hitch receiver platform (5).



OPERATION

The trailer tow wiring harness is connected to the body wire harness at the left rear lamp unit connections. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

CAM-TURN SIGNAL CANCEL

DESCRIPTION

The turn signal cancel cam is concealed within the clockspring case on the steering column. The turn signal

cancel cam consists of integral eccentrics on the outer circumference of the molded plastic clockspring rotor. The clockspring mechanism provides turn signal cancellation as well as a constant electrical connection between the horn switch, driver airbag, speed control switches, and remote radio switches on the steering wheel and the instrument panel wire harness on the steering column. The housing of the clockspring is secured to the steering column and remains stationary. The rotor of the clockspring, including the turn signal cancel cam lobes rotate with the steering wheel.

The turn signal cancel cam is serviced as a unit with the clockspring and cannot be repaired. If ineffective or damaged, the entire clockspring unit must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

OPERATION

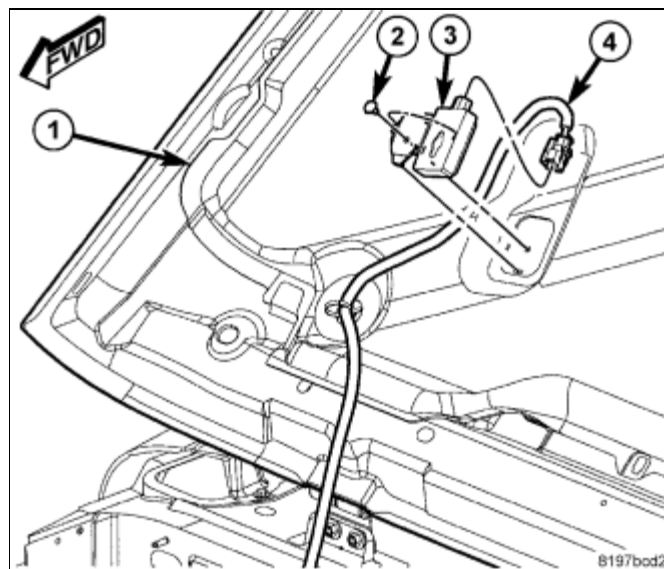
When the left multi-function switch control stalk is moved to a latched turn signal ON position, a turn signal cancel actuator is extended from the inside surface of the switch housing through a small rectangular opening on the left side of the clockspring case toward the turn signal cancel cam. As the steering wheel is rotated to complete the turn, one of the cam eccentrics will contact the actuator, automatically cancelling the turn signal event and releasing the latched left multi-function switch control stalk to the neutral or OFF position.

LAMP-UNDERHOOD

REMOVAL

LAMP

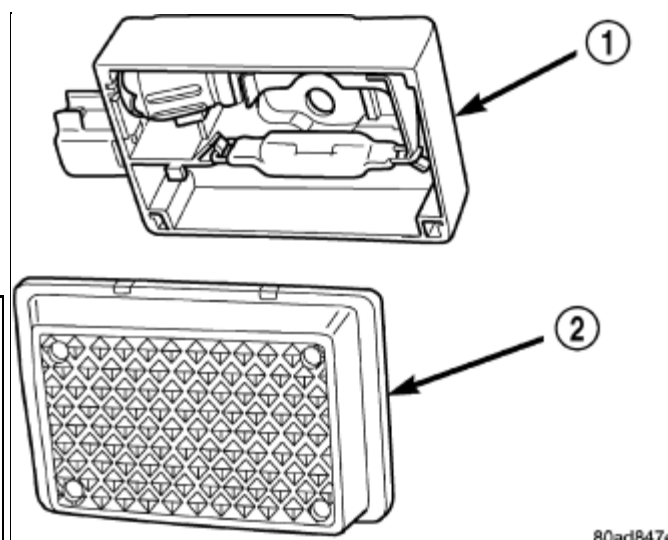
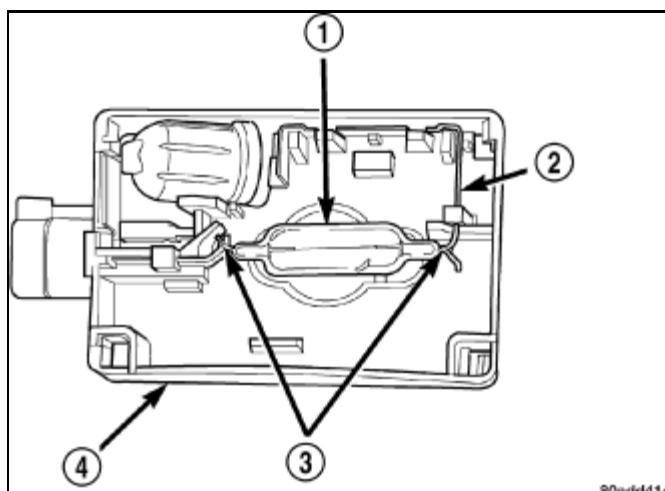
1. Disconnect and isolate the battery negative cable.
2. Disconnect the headlamp and dash wire harness connector (4) from the underhood lamp (3) connector receptacle.
3. Remove the bulb from the underhood lamp. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/UNDERHOOD LAMP BULB - REMOVAL).
4. Remove the push pin type blind rivet (2) from within the lamp housing that secures the underhood lamp mounting bracket to the inner hood panel reinforcement (1).
5. Remove the underhood lamp and bracket from the inner hood panel as a unit.



BULB

1. Disconnect and isolate the battery negative cable.
2. Insert a small flat bladed tool in the access slot between the underhood lamp housing (1) and the lamp lens (2).
3. Gently pry the lens until it unsnaps from the lamp housing.

4. Depress the bulb holder (2) inward far enough to

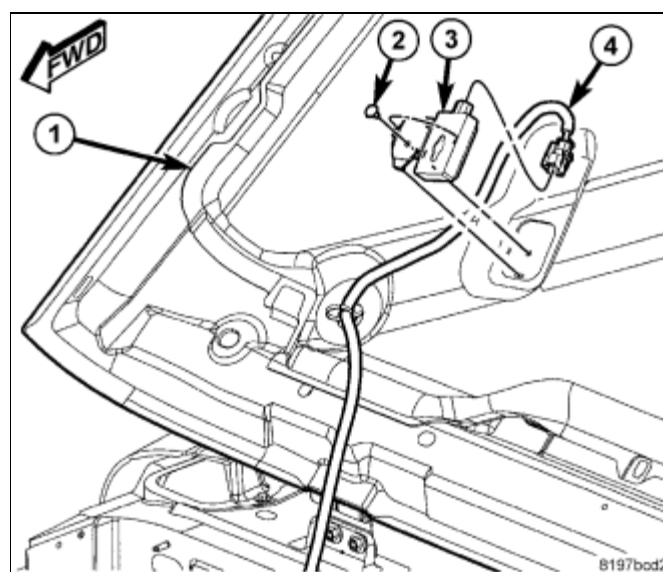


disengage the terminal loops (3) of the bulb (1) and remove the bulb from the lamp housing (4).

INSTALLATION

LAMP

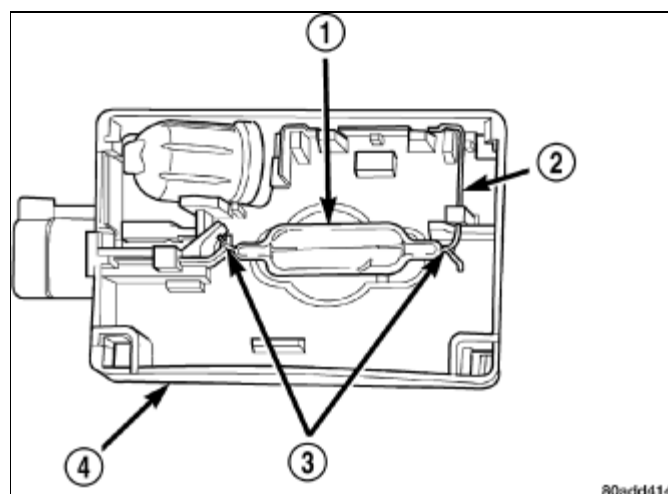
1. Position the underhood lamp and bracket (3) to the underside of the inner hood panel reinforcement (1) as a unit. Be certain that the locating tab on the lamp bracket is engaged into the locating hole in the inner hood panel reinforcement.
2. Install the push pin type blind rivet (2) that secures the underhood lamp to the inner hood panel reinforcement.
3. Reinstall the underhood lamp bulb and lens. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/UNDERHOOD LAMP BULB - INSTALLATION).
4. Reconnect the headlamp and dash wire harness connector (4) to the underhood lamp connector receptacle.
5. Reconnect the battery negative cable.



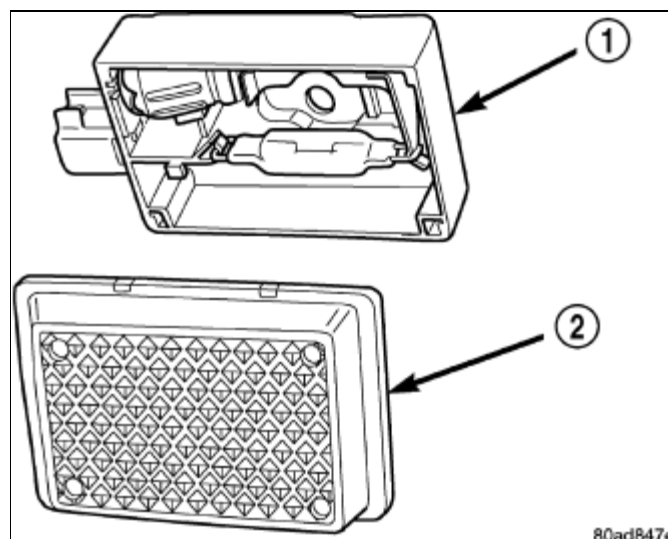
BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

1. Engage one of the terminal loops (3) of the bulb (1) over the bulb holder closest to the connector receptacle of the underhood lamp housing (4).
2. Depress the other bulb holder (2) inward far enough to engage the remaining bulb terminal loop.



3. Position the lens (2) over the lamp housing and use hand pressure to press the lens firmly and evenly onto the housing until it snaps into place.
4. Reconnect the battery negative cable.

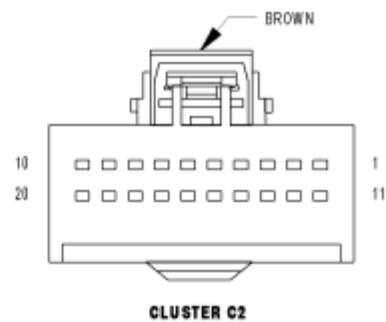
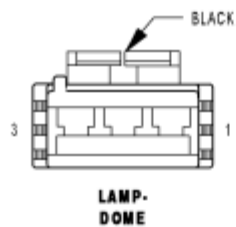
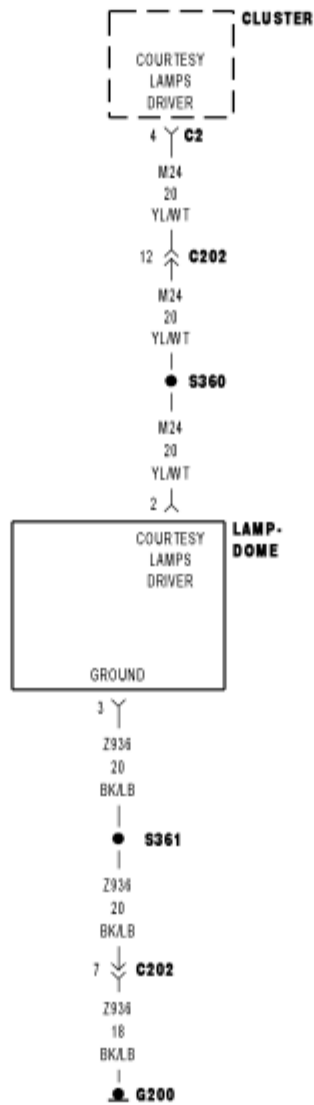


LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B161A-COURTESY/DOME LAMP CONTROL CIRCUIT



01944639

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
- Continuously

- **Set Condition:**
- When the Instrument Cluster detects a short to battery on the Control circuit.

Possible Causes
(M24) COURTESY LAMPS DRIVER CIRCUIT SHORT TO GROUND
(M24) COURTESY LAMPS DRIVER CIRCUIT OPEN
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
 Clear all Instrument Cluster DTC's
 Turn the Courtesy Lamps on.
 With the scan tool, read DTC's.

Does the scan tool read: B161A-COURTESY/DOME LAMP CONTROL CIRCUIT?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (M24) COURTESY LAMPS DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Instrument Cluster C2 harness connector.
 Measure the resistance between the (M24) Courtesy Lamp Driver circuit and ground.

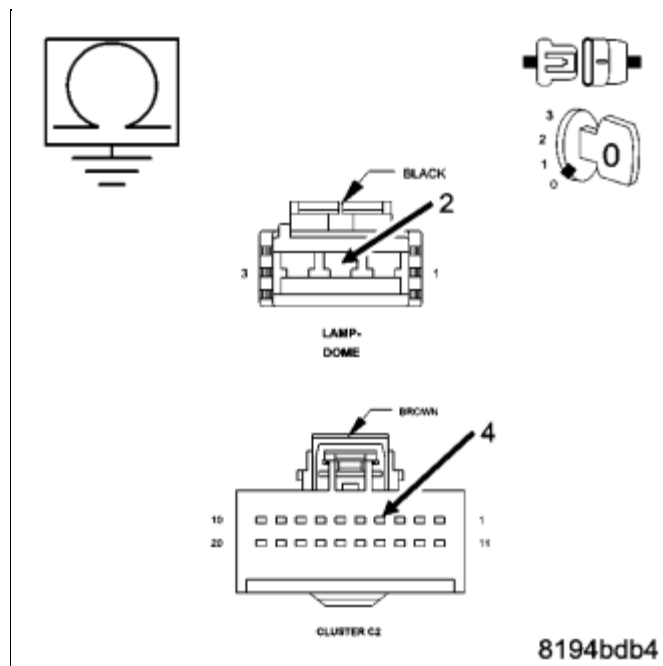
Is the resistance below 5.0 ohms?

Yes

- Repair the (M24) Courtesy Lamp Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (M24) COURTESY LAMPS DRIVER CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Instrument Cluster C2 harness connector.

Turn the ignition on.

Measure the voltage of the (M24) Courtesy Lamp Driver circuit.

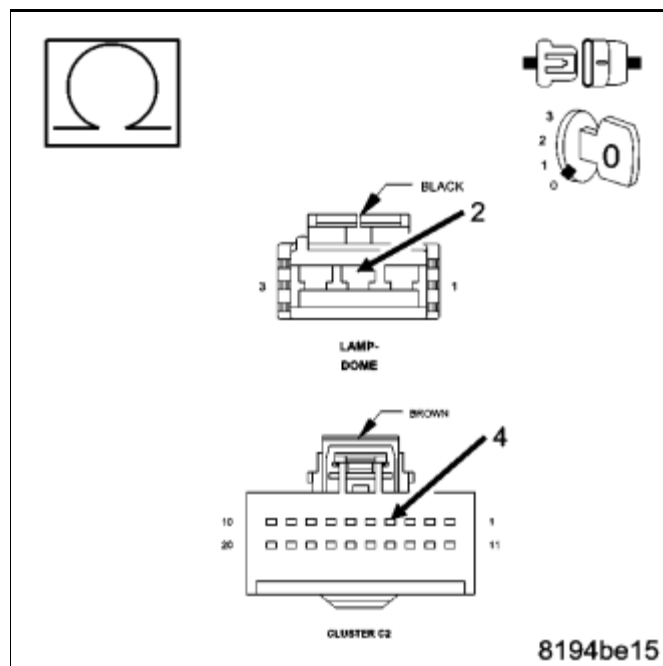
Is the voltage below 10.0 volts?

Yes

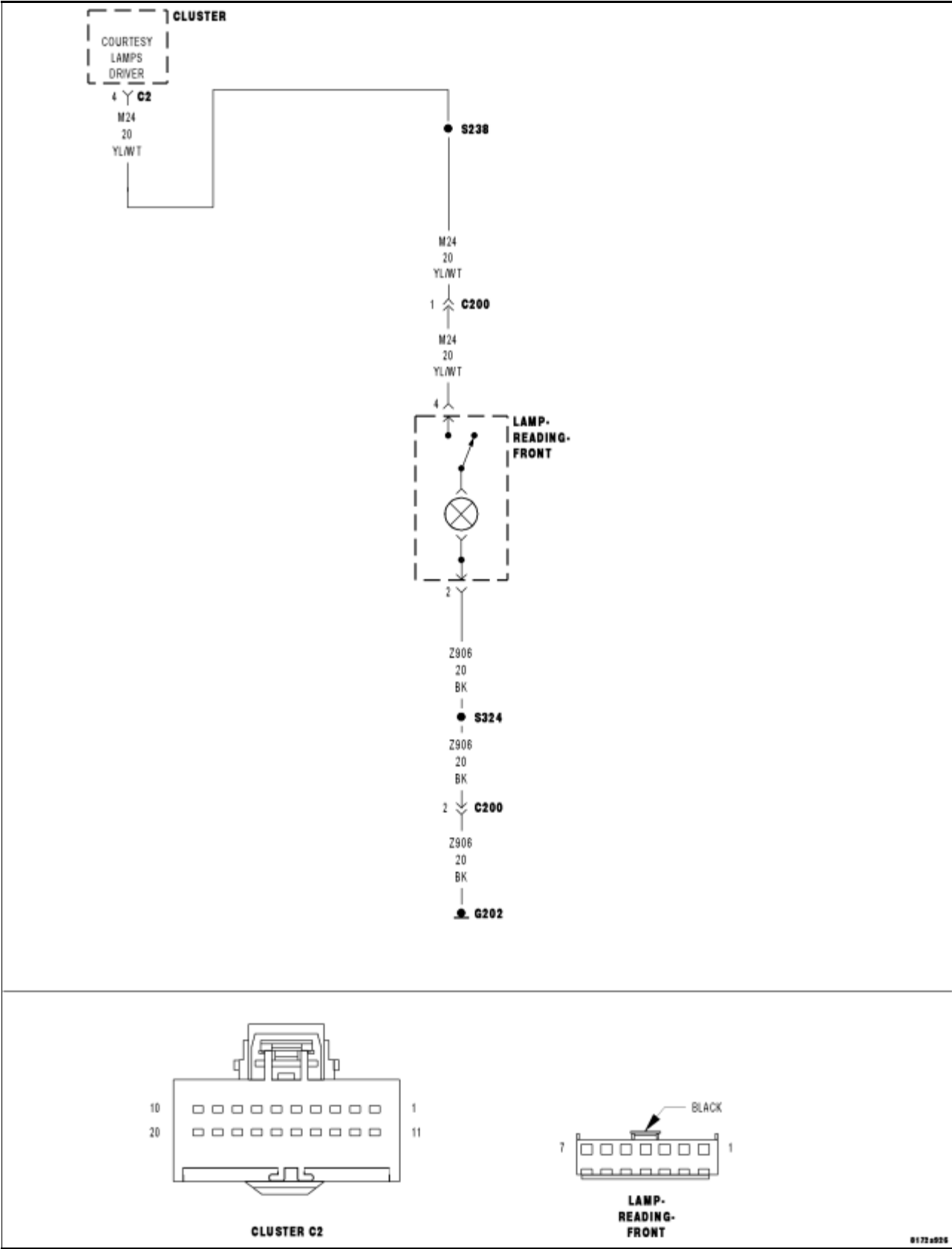
- Repair the (M24) Courtesy Lamp Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Instrument Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B161E-READING LAMP CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously

- **Set Condition:**
- When the Instrument Cluster detects a short to battery on the Control circuit.

Possible Causes
(M24) COURTESY LAMP DRIVER CIRCUIT SHORT TO GROUND
(M24) COURTESY LAMP DRIVER CIRCUIT OPEN
INSTRUMENT CLUSTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
 Clear all Instrument Cluster DTC's
 Turn the Courtesy Lamps on.
 With the scan tool, read DTC's.

Does the scan tool read: B161E-READING LAMP CONTROL CIRCUIT?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK THE (M24) COURTESY LAMP DRIVER CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Instrument Cluster C2 harness connector.
 Measure the resistance between the (M24) Courtesy Lamp Driver circuit and ground.

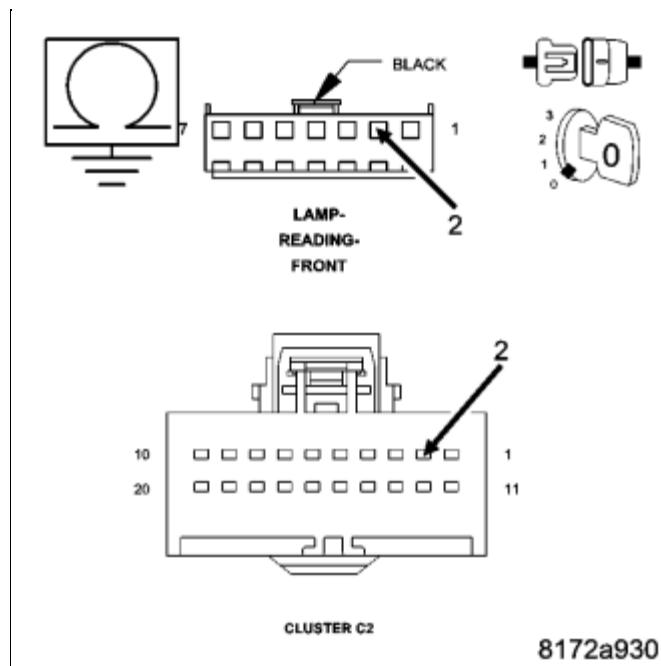
Is the resistance below 5.0 ohms?

Yes

- Repair the (M24) Courtesy Lamp Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE (M24) COURTESY LAMP DRIVER CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the Instrument Cluster C2 harness connector.

Activate the left and right vanity lamps (if equipped), the glove box lamp, and the left and right door handle lamps.

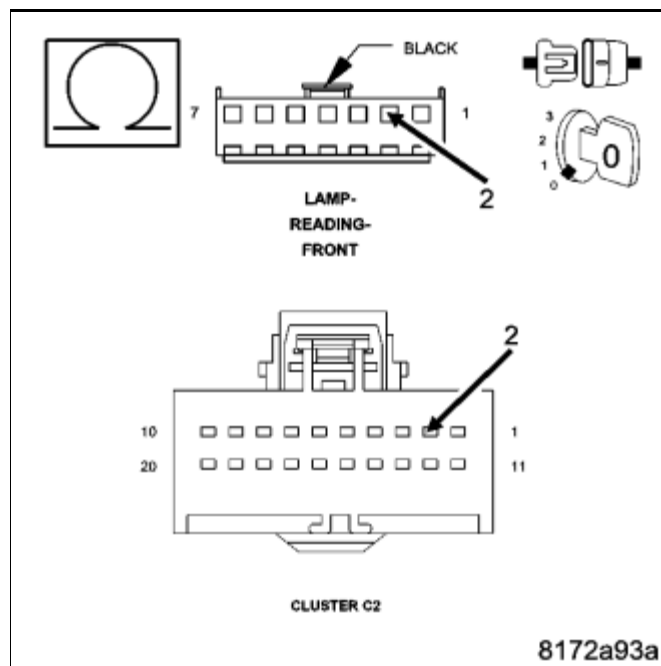
Turn the ignition on.

Measure the voltage of the (M24) Glove Box Lamp Driver circuit.

Is the voltage below 10.0 volts?

Yes

- Repair the (M24) Courtesy Lamp Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

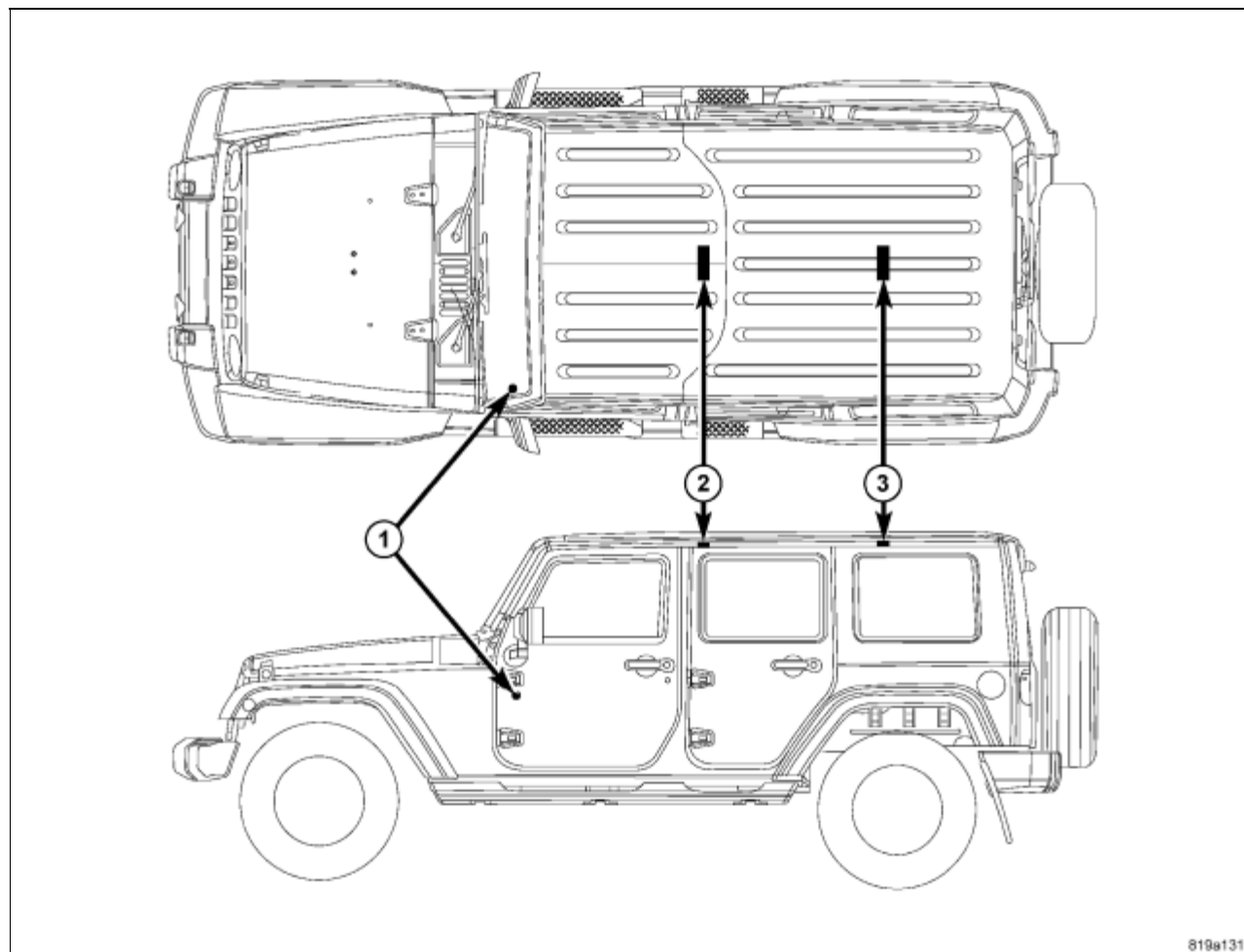
**No**

- Replace the Instrument Cluster in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

LAMPS/LIGHTING - INTERIOR

LAMPS/LIGHTING - INTERIOR

DESCRIPTION



The interior lighting system for this vehicle includes incandescent lighting on two separate circuits: the dome/courtesy lamp circuit and the panel lamps dimmer circuit. The lamps on the dome/courtesy circuit include:

- **Cargo Lamp (3)** - A switchable cargo/second row dome lamp is standard equipment only on vehicles with four doors to illuminate both the cargo and second row seat areas. This lamp is located in the lower center surface of the sport bar rear crossmember and is controlled by the courtesy lamp circuit.
- **Courtesy Lamp (1)** - An optional single courtesy lamp is located on the lower edge of the instrument panel to illuminate the driver side foot well area. On vehicles so equipped, this lamp is controlled by the courtesy lamp circuit.
- **Dome Lamp (2)** - A standard equipment dome lamp is located in the lower center surface of the speaker enclosure/sound bar to illuminate the interior of the vehicle. This lamp is controlled by the courtesy lamp circuit.

Most controls on the instrument panel and elsewhere in the interior of the vehicle are illuminated by the panel lamps dimmer circuit for night visibility. All except the automatic transmission gear selector bezel lamp have miniature incandescent bulbs, Light-Emitting Diode (LED) units or a combination of the two lighting types that are soldered to internal circuit boards and are not serviceable.

The optional automatic transmission gear selector bezel lamp is located on the left side of the gear selector lever mechanism just beneath the bezel on the floor panel transmission tunnel. This lamp has a replaceable incandescent bulb.

Other components of the interior lighting system for this vehicle include:

- **Door Ajar Switches** - A door ajar switch is integral to the door latch mechanism of each front and rear door.
- **Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) is also known as the Cab Compartment Node (CCN) in this vehicle. The EMIC/CCN is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Left Multi-Function Switch** - The left (lighting) multi-function switch is located on the steering column, just below the steering wheel. A control sleeve on the control stalk that extends from the left side of the switch is used to select the panel lamps dimmer lighting level or the courtesy lamp circuit operating mode. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - DESCRIPTION).
- **Swing Gate Ajar Switch** - A swing gate ajar switch is integral to the latch mechanism of the swing gate.
- **Steering Control Module** - The Steering Control Module (SCM) is located within the left multi-function switch housing on the top of the steering column, just below the steering wheel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/STEERING COLUMN CONTROL MODULE - DESCRIPTION).
- **Totally Integrated Power Module** - The Totally Integrated Power Module (TIPM) is located in the engine compartment near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/TOTALLY INTEGRATED POWER MODULE - DESCRIPTION).

Hard wired circuitry connects the interior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the interior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The lamps of the interior lighting system can be divided into two general classifications based upon the circuit that controls their operation: The courtesy lamp circuit, or the panel lamps dimmer circuit. Following are paragraphs that briefly describe the operation of each of these interior lighting circuits.

The lamps and the hard wired circuits between components related to the interior lighting system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the interior lighting system or the electronic controls or communication between modules and other devices that provide some features of the interior lighting system. The most reliable, efficient, and accurate means to diagnose the interior lighting system or the electronic controls and communication related to interior lighting system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

COURTESY LAMP CIRCUIT

The courtesy lamp circuit includes the dome lamp located on the speaker enclosure/sound bar near the center, the cargo/second row dome lamp located on the rear sport bar crossmember near the center of vehicles with four doors, and on vehicles so equipped a courtesy lamp located on the driver side lower edge of the instrument panel. The lamps in the courtesy lamp circuit are provided with battery voltage and ground by the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) using internal drivers through a courtesy lamp driver circuit and two ground circuits based upon electronic **ajar switch status** message inputs received from the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus. The EMIC also uses electronic **left multi-function switch** and **ignition switch status** message inputs received from the Steering Control Module (SCM) over the Local Interface Network (LIN) data bus to control these outputs.

After all of the ajar switch inputs to the TIPM transition to open, the EMIC will keep the courtesy lamps illuminated for about 30 seconds, then fade the lamps to OFF (theater dimming) over about 3 seconds. The EMIC also provides courtesy lamp operation based upon the electronic **left multi-function switch status** messages received from the SCM, and provides an illuminated entry feature in response to certain electronic message inputs received from the Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) and the Occupant Restraint Controller (ORC) over the CAN data bus. A courtesy lamp DEFEAT mode based upon an electronic **left multi-function switch status** message received from the SCM will cause the EMIC to override normal courtesy lamp operation based upon any ajar switch inputs to the TIPM.

For those lamps in the courtesy lamp circuit with independent switching, such as the cargo/second row dome lamp, the EMIC provides a second battery feed to this switch using another internal driver through a separate courtesy lamp load shed circuit. The EMIC provides a battery saver (load shedding) feature for all courtesy lamps, which will automatically turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the OFF position.

PANEL LAMPS DIMMER CIRCUIT

The panel lamps dimmer circuit actually includes several circuits. These circuits control the illumination and dimming level of the heater-air conditioner controls and the automatic transmission gear selector bezel lamp. All lamps in the panel lamps dimmer circuits are provided a path to ground at all times through a hard wired ground circuit. These lamps are illuminated by a 12-volt Pulse Width Modulated (PWM) output of the EMIC through the panel lamps dimmer circuit.

This shared PWM output synchronizes the selected illumination intensity level of all of the lamps in the panel lamps dimmer circuits. The EMIC uses electronic **left multi-function switch status** and **dimming level** message inputs received from the SCM over the LIN data bus. The SCM sends the proper **left multi-function switch status** and **dimming level** messages based upon the exterior lighting selection of the control knob and the dimming level selection of the control sleeve on the left multi-function switch control stalk.

The EMIC, the instrument panel switch pod and the radio use the **dimming level** messages from the SCM to control the illumination intensity of their own back lighting and controls. In addition, when the control sleeve of the left multi-function switch is moved to the PARADE (or funeral) mode detent position, all of the Vacuum Fluorescent Display (VFD) units in the vehicle are illuminated at their full intensity levels for increased visibility when the vehicle is driven during daylight hours with the exterior lights turned ON. The PARADE mode has no effect on the illumination intensity of incandescent panel lamps.

WARNING

WARNINGS - LAMPS/LIGHTING - INTERIOR

WARNING: To avoid serious or fatal injury, eye protection should be used when servicing any glass components.

CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owner's Manual. Damage to lamps, lenses, wiring and other related electrical components can result.

DIAGNOSIS AND TESTING

LAMPS/LIGHTING - INTERIOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: When diagnosing the interior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.

NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.

The lamps and the hard wired circuits between components related to the interior lighting system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the interior lighting system or the electronic controls or communication between modules and other devices that provide some features of the interior lighting system. The most reliable, efficient, and accurate means to diagnose the interior lighting system or the electronic controls and communication related to interior lighting system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

COURTESY LAMP CIRCUIT

CONDITION	POSSIBLE CAUSES	CORRECTION

A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT ILLUMINATE	1. Ineffective or missing bulb.	1. Test and replace the courtesy lamp bulb if required.
	2. Ineffective lamp switch.	2. Test and replace a map/reading lamp switch if required.
	3. Ineffective ground circuit.	3. Test and repair the open ground circuit if required.
	4. Ineffective feed circuit.	4. Test and repair the open feed circuit if required.
ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT ILLUMINATE	1. Ineffective ground circuit.	1. Test and repair the open ground circuit if required.
	2. Ineffective feed circuit.	2. Test and repair the open feed circuit if required.
	3. Courtesy DEFEAT feature turned ON.	3. Turn courtesy DEFEAT feature OFF.
	4. Ineffective courtesy lamp control circuit.	4. Test and repair the courtesy lamp control circuit if required.
	5. Ineffective EMIC inputs or outputs.	5. Use a diagnostic scan tool to test the EMIC inputs and outputs. Refer to the appropriate diagnostic information.
A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT EXTINGUISH	1. Ineffective lamp switch.	1. Test and replace a map/reading lamp switch if required.
ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT EXTINGUISH	1. Ineffective ajar switch.	1. Test and replace a door ajar or liftgate ajar switch if required.
	2. Ineffective ajar switch sense circuit.	2. Test and repair the shorted ajar switch sense circuit if required.
	3. Ineffective TIPM inputs or outputs.	3. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
	4. Ineffective EMIC inputs or outputs.	4. Use a diagnostic scan tool to test the EMIC inputs and outputs. Refer to the appropriate diagnostic information.

PANEL LAMPS DIMMER CIRCUIT

NOTE: As part of the exterior lighting failsafe feature, upon ignition ON, all of the panel lamps dimmer circuit lamps will illuminate at full intensity and the exterior park lamps and headlamp low beams will illuminate regardless of the left multi-function switch control knob position if the Steering Control Module (SCM) cannot detect an input from the left multi-function switch, or if there is a loss of data bus communication.

CONDITION	POSSIBLE CAUSES	CORRECTION
A SINGLE LAMP DOES NOT ILLUMINATE	1. Ineffective or missing bulb or Light Emitting Diode (LED) unit.	1. Test and replace the lamp bulb or LED unit if required.
	2. Ineffective ground circuit.	2. Test and repair the open lamp ground circuit if required.
	3. Ineffective feed circuit.	3. Test and repair the open lamp feed circuit if required.
A SINGLE LAMP DOES NOT EXTINGUISH	1. Ineffective feed circuit.	1. Test and repair the shorted lamp feed circuit if required.
ALL LAMPS DO NOT ILLUMINATE	1. Ineffective ground circuit.	1. Test and repair the open lamp ground circuit if required.
	2. Ineffective feed circuit.	2. Test and repair the open lamp feed circuit if required.
	3. Ineffective EMIC inputs or outputs.	3. Use a diagnostic scan tool to test the EMIC inputs and outputs. Refer to the appropriate diagnostic information.
ALL LAMPS ILLUMINATE AT FULL INTENSITY AT IGNITION ON	1. Ineffective EMIC inputs or outputs.	1. Use a diagnostic scan tool to test the EMIC inputs and outputs. Refer to the appropriate diagnostic information.
	2. Loss of data bus communication.	2. Use a diagnostic scan tool to test the data bus. Refer to the appropriate diagnostic information.

SPECIFICATIONS

LAMPS/LIGHTING - INTERIOR

COURTESY LAMPS

BULB APPLICATION TABLE

LAMP	BULB
COURTESY	906
CARGO	578
FRONT DOME	578

PANEL LAMPS

BULB APPLICATION TABLE

LAMP	BULB
GEAR SELECTOR BEZEL	37

AJAR SWITCH

DESCRIPTION

DOOR

This vehicle has one door ajar switch for each door. Each switch is concealed within and integral to its respective door latch unit. The switches are momentary leaf contact-type units that are actuated by the mechanisms internal to the door latch. A short pigtail wire and connector on each door latch connects the door ajar switch to the vehicle electrical system through its respective door wire harness.

The door ajar switches cannot be adjusted or repaired and, if ineffective or damaged, the door latch unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/LATCH - REMOVAL) or (Refer to 23 - BODY/DOOR - REAR/LATCH - REMOVAL).

SWING GATE

A swing gate ajar switch is standard equipment on this vehicle. The switch is concealed within and integral to the swing gate latch unit. The switch is a momentary leaf contact-type unit that is actuated by the swing gate latch mechanism. An integral connector receptacle on the swing gate latch connects the swing gate ajar switch to the vehicle electrical system through the swing gate wire harness.

The swing gate ajar switch cannot be adjusted or repaired and, if ineffective or damaged, the swing gate latch unit must be replaced. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/LATCH - REMOVAL).

OPERATION

DOOR

The door ajar switches are actuated by the mechanisms internal to the door latch. When a door is closed and properly latched, its door ajar switch is an open circuit. When a door is open or only partially latched, the door ajar switch is a closed circuit. The door ajar switches are hard wired in series between a body ground and the Totally Integrated Power Module (TIPM). The TIPM reads the hard wired door ajar switch inputs through internal pull-ups, then uses these inputs to control many electronic functions and features of the vehicle. The TIPM also sends electronic **door ajar switch status** messages over the Controller Area Network (CAN) data

bus.

The door ajar switches as well as the hard wired inputs and outputs of the switches may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

SWING GATE

The swing gate ajar switch is actuated by the swing gate latch mechanism. When the swing gate is closed and properly latched, its swing gate ajar switch is an open circuit. When the swing gate is open or only partially latched, the swing gate ajar switch is a closed circuit. The swing gate ajar switch is hard wired in series between a body ground and the Totally Integrated Power Module (TIPM). The TIPM reads the hard wired swing gate ajar switch input through an internal pull-up, then uses this input to control many electronic functions and features of the vehicle. The TIPM also sends electronic **swing gate ajar switch status** messages over the Controller Area Network (CAN) data bus.

The swing gate ajar switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

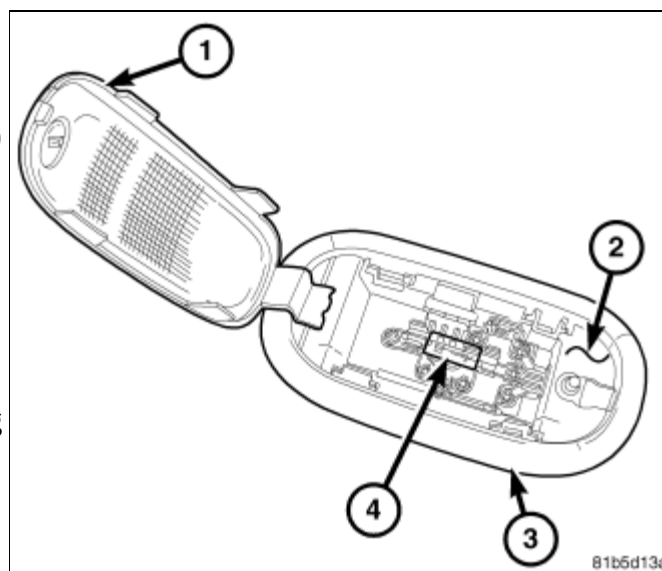
CARGO LAMP

REMOVAL

BULB

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat-bladed screwdriver into the notch on the right side of the cargo lamp between the lens (1) and the lamp housing (2).
3. Gently pry the notched edge of the lens downward until it unsnaps from the housing.
4. While holding the lamp housing bezel (3) flush with the sport bar trim, swing the notched end of the lens downward far enough to access the bulb (4).

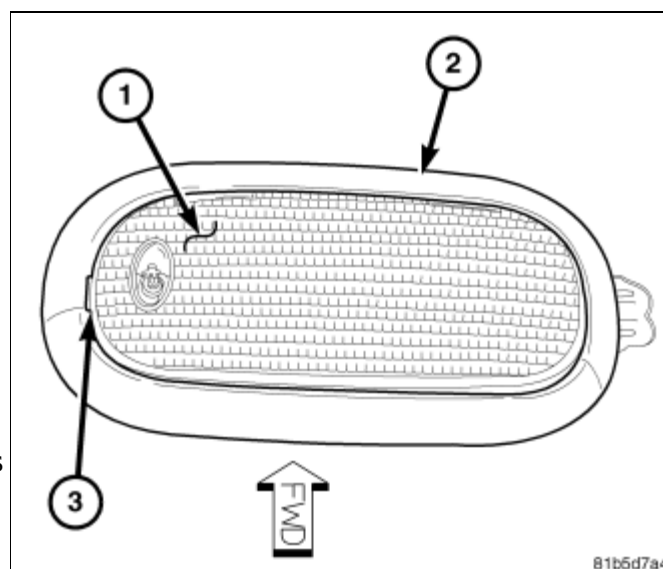
NOTE: If the lamp housing is lowered from the mounting hole, the lamp MUST be reinstalled as per the installation procedure. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO LAMP - INSTALLATION).



5. Carefully unsnap the bulb from the two bulb holders within the lamp housing.

LAMP

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (3) between the lens (1) and the housing bezel (2) on the right side of the cargo lamp unit.
3. Gently pry the end of the lens downward until it unsnaps from the housing.
4. Swing the lens downward until it is perpendicular to the housing.
5. Pull the housing downward far enough to disengage it from the sport bar trim.
6. Pull the lamp away from the mounting hole in the sport bar trim far enough to access and disconnect the wire harness connector from the connector receptacle on the back of the lamp housing.
7. Remove the lamp from the vehicle.



INSTALLATION

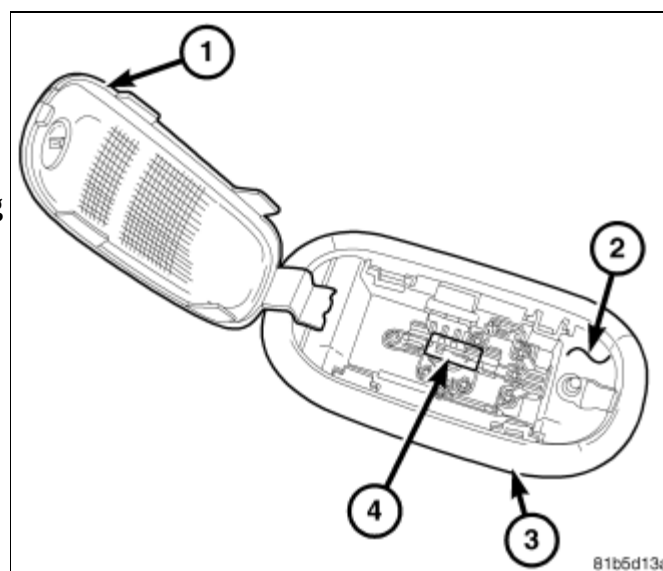
BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

1. While holding the cargo lamp housing bezel (3) flush with the sport bar trim, align the ends of the bulb (4) with the two bulb holders within the lamp housing (2).

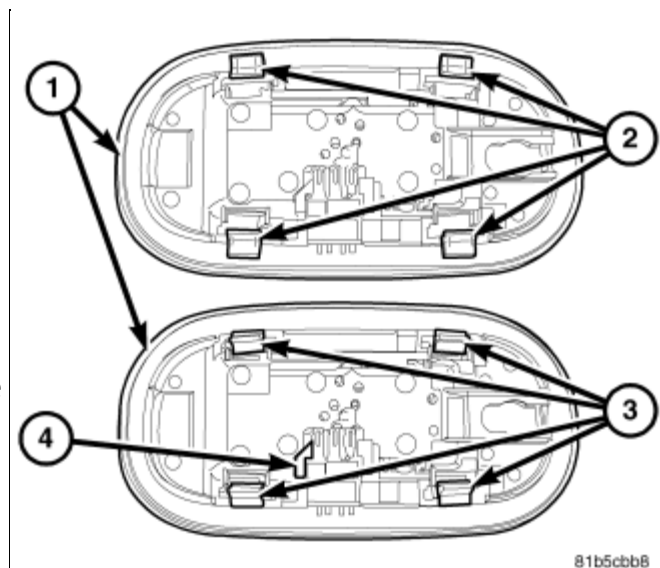
NOTE: If the lamp housing is lowered from the mounting hole, the lamp **MUST** be reinstalled as per the installation procedure. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO LAMP - INSTALLATION).

2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Swing the notched end of the lens (1) up into position against the housing, then press upward on the lens firmly and evenly until it snaps into place.
4. Reconnect the battery negative cable.



LAMP

1. Position the cargo lamp unit (1) to the mounting hole in the sport bar trim.
2. Reconnect the wire harness connector to the connector receptacle (4) on the back of the lamp housing.
3. There are four retention tabs (2) with live hinges on the back of the lamp housing that secure the lamp in the mounting hole after the lamp is installed. Be certain that all four tabs are folded inward toward the center of the lamp housing in their installation position (3) and that the lens hangs down perpendicularly from the housing, then insert the lamp housing up into the mounting hole in the sport bar trim.
4. With the bezel of the lamp housing held flush against the sport bar trim, swing the notched end of the lamp lens into position against the housing, then press on the lens firmly and evenly until it snaps into the housing.
5. Reconnect the battery negative cable.



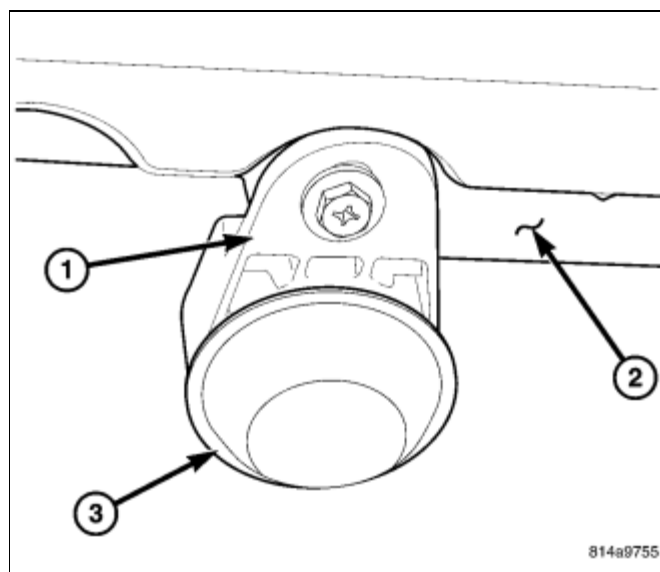
COURTESY LAMP

REMOVAL

LAMP

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the screw that secures the integral mounting bracket of the courtesy lamp (1) to the lower instrument panel (2).
3. Pull the courtesy lamp unit down from the lower instrument panel far enough to access and disconnect the instrument panel wire harness from the connector receptacle on the top of the lamp housing.
4. Remove the courtesy lamp from under the instrument panel.

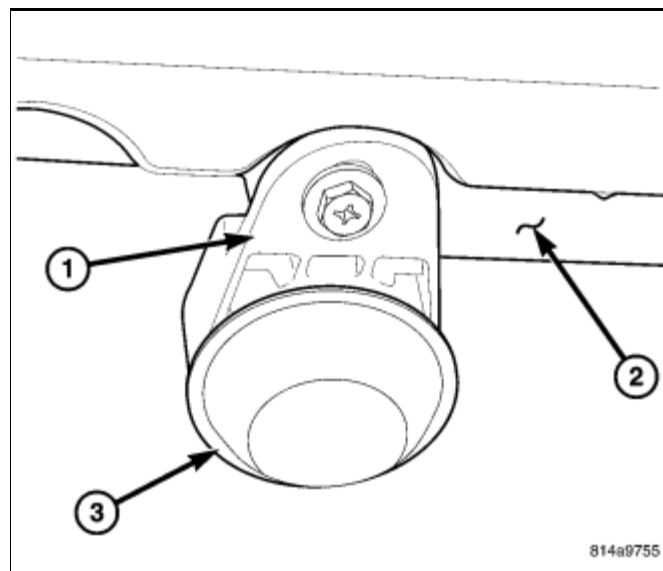


BULB

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental

Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Support the courtesy lamp housing (1) with one hand while grasping the flange on the outer circumference of the lens (3) with the other hand, then pull the lens straight down to unsnap it from the housing.

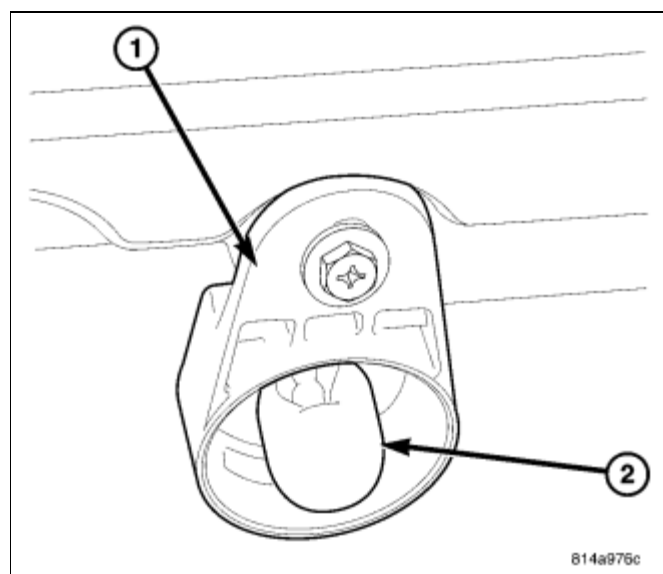


3. Pull the base of the bulb (2) straight out of the socket in the courtesy lamp housing (1).

INSTALLATION

LAMP

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.



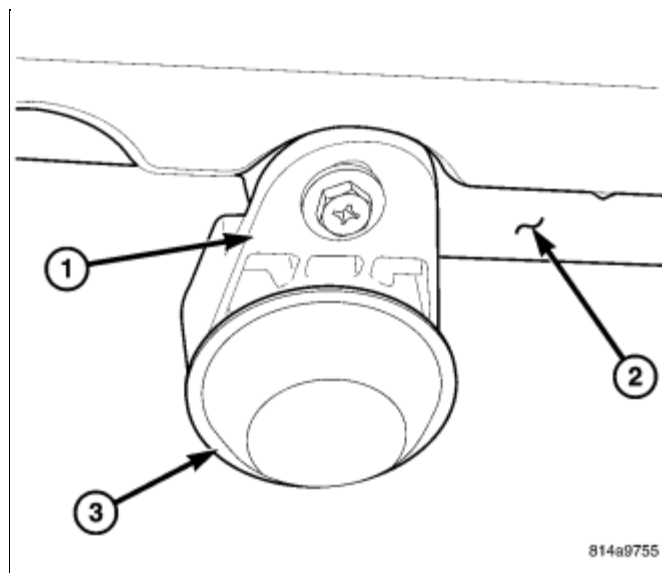
1. Position the courtesy lamp (1) under the instrument panel (2).
2. Reconnect the instrument panel wire harness to the connector receptacle on the top of the courtesy lamp housing.

3. Position the integral mounting bracket of the lamp to the lower instrument panel.
4. Install and tighten the screw that secures the lamp to the instrument panel. Tighten the screw to 2 N·m (17 in. lbs.).
5. Reconnect the battery negative cable.

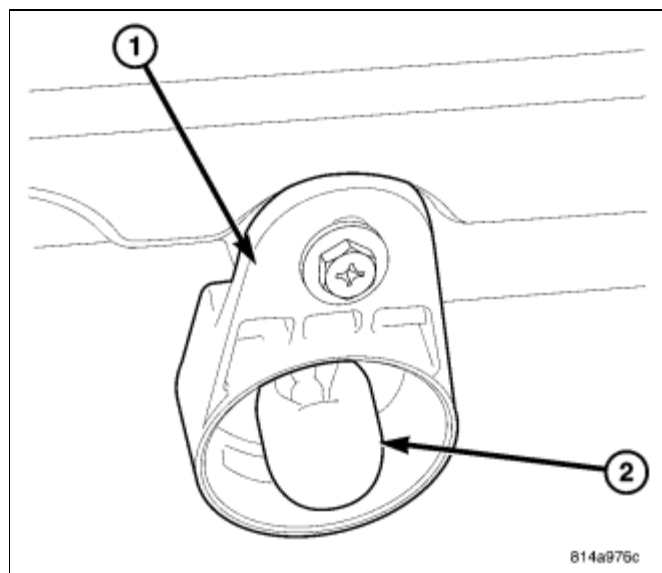
BULB

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

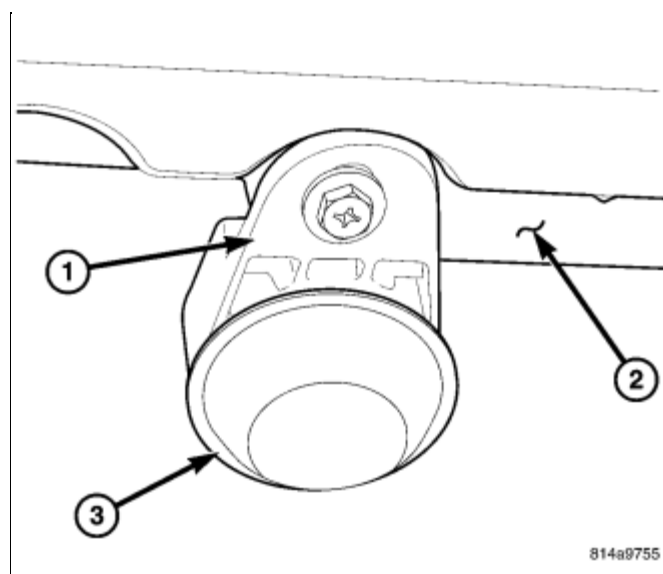


1. Align the base of the bulb (2) with the socket in the courtesy lamp housing (1).
2. Push the bulb straight into the socket until the base is firmly seated.



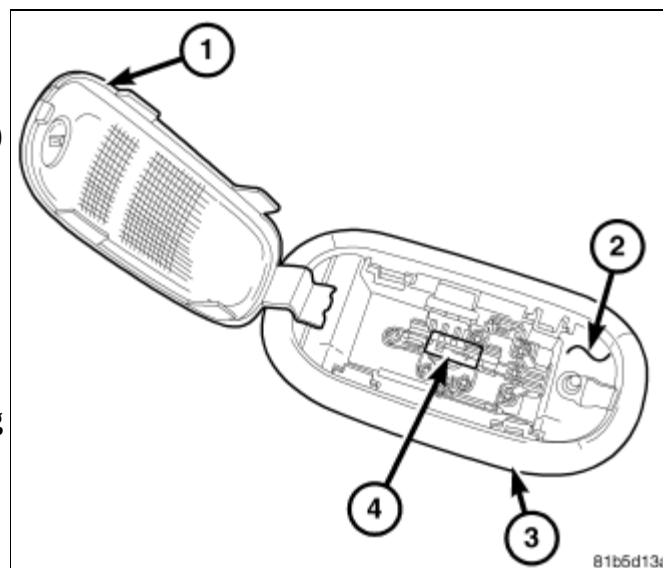
3. Align the courtesy lamp lens (3) with the lamp housing (1).
4. Support the courtesy lamp housing with one hand while firmly and evenly pushing the lens into the housing with the other hand, until the lens snaps into place.
5. Reconnect the battery negative cable.

DOME LAMP REMOVAL BULB



1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat-bladed screwdriver into the notch on the right side of the dome lamp between the lens (1) and the lamp housing (2).
3. Gently pry the notched edge of the lens downward until it unsnaps from the housing.
4. While holding the lamp housing bezel (3) flush with the rear speaker enclosure, swing the notched end of the lens downward far enough to access the bulb (4).

NOTE: If the lamp housing is lowered from the mounting hole, the lamp MUST be reinstalled as per the installation procedure. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME LAMP - INSTALLATION).

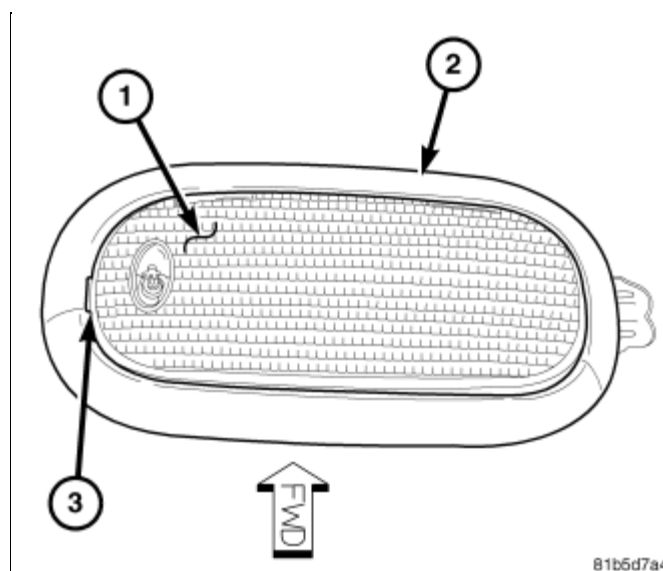


5. Carefully unsnap the bulb from the two bulb holders within the lamp housing.

LAMP

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (3) between the lens (1) and the housing (2) on the right side of the dome lamp unit.
3. Gently pry the end of the lens downward until it unsnaps from the housing.
4. Swing the lens downward until it is perpendicular to the housing.

5. Pull the housing downward far enough to disengage it from the rear speaker enclosure.
6. Pull the lamp away from the mounting hole in the speaker enclosure far enough to access and disconnect the wire harness connector from the connector receptacle on the back of the lamp housing.
7. Remove the lamp from the vehicle.



INSTALLATION

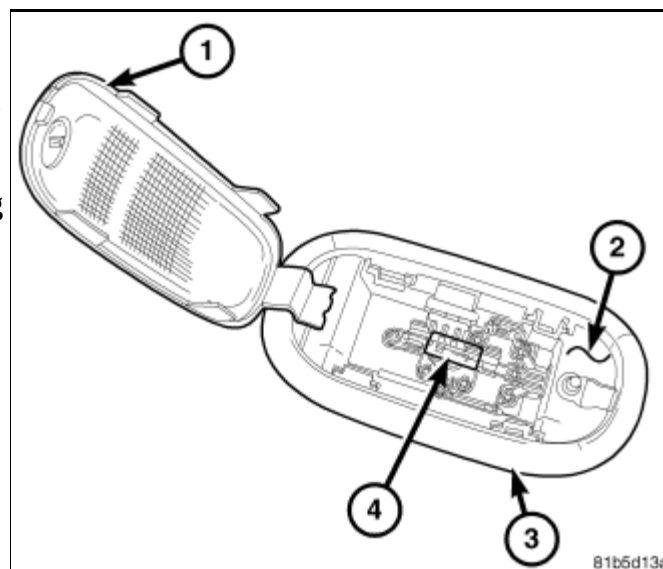
BULB

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

1. While holding the dome lamp housing bezel (3) flush with the rear speaker enclosure, align the ends of the bulb (4) with the two bulb holders within the lamp housing (2).

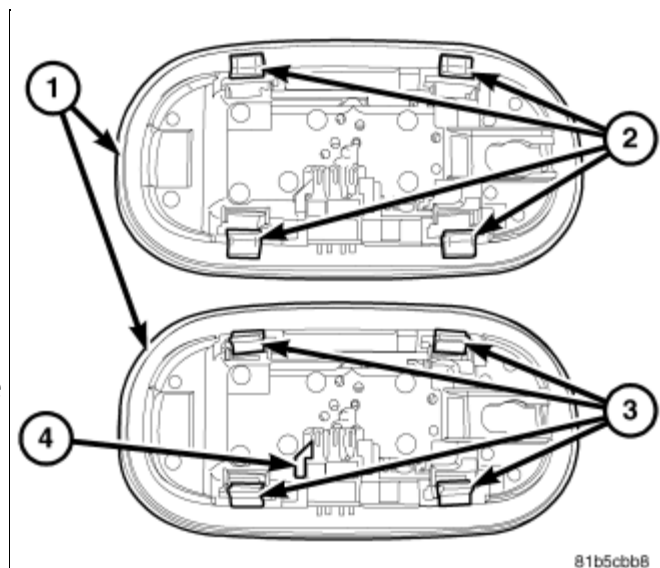
NOTE: If the lamp housing is lowered from the mounting hole, the lamp **MUST** be reinstalled as per the installation procedure. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME LAMP - INSTALLATION).

2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Swing the notched end of the lens (1) up into position against the housing, then press upward on the lens firmly and evenly until it snaps into place.
4. Reconnect the battery negative cable.



LAMP

1. Position the dome lamp unit (1) to the mounting hole in the rear speaker enclosure.
2. Reconnect the wire harness connector to the connector receptacle (4) on the back of the lamp housing.
3. There are four retention tabs (2) with live hinges on the back of the lamp housing that secure the lamp in the mounting hole after the lamp is installed. Be certain that all four tabs are folded inward toward the center of the lamp housing in their installation position (3) and that the lens hangs down perpendicularly from the housing, then insert the lamp housing up into the mounting hole in the speaker enclosure.
4. With the bezel of the lamp housing held flush against the speaker enclosure, swing the notched end of the lamp lens into position against the housing, then press on the lens firmly and evenly until it snaps into the housing.
5. Reconnect the battery negative cable.

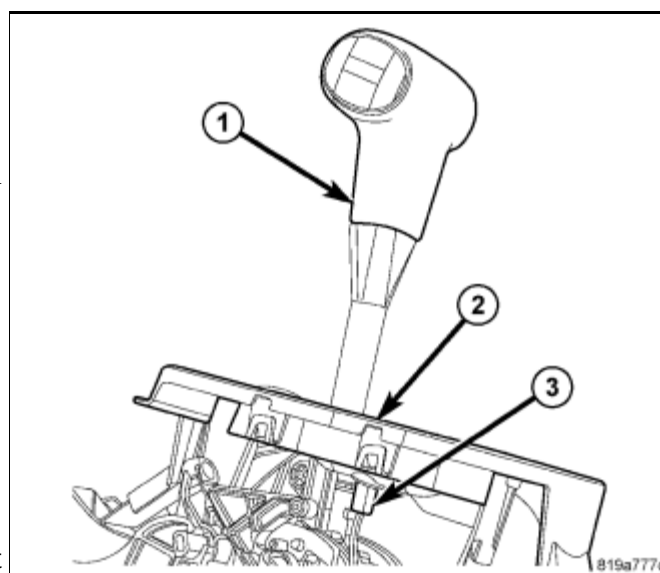


GEAR SELECTOR LAMP

REMOVAL

NOTE: This procedure applies only to vehicles equipped with an optional automatic transmission.

1. Disconnect and isolate the battery negative cable.
2. Remove the center floor console from over the gear selector lever (1) and bezel (2).
3. Firmly grasp the bulb socket (3) on the bottom of the bezel housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.

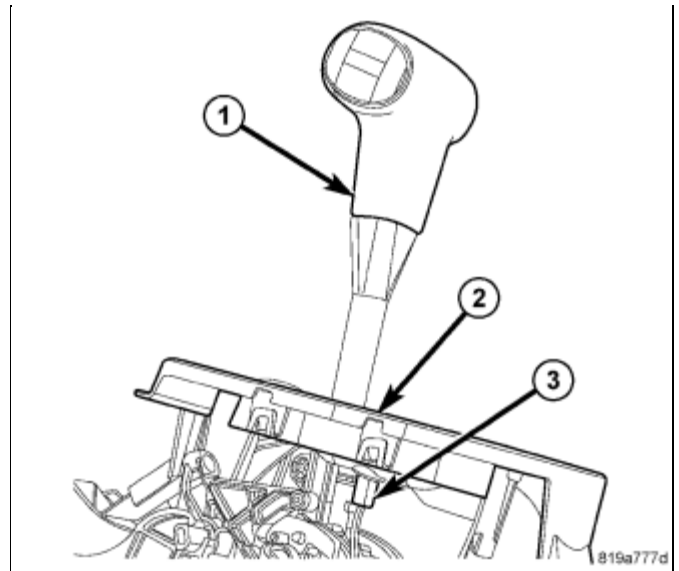


INSTALLATION

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket or the lamp wiring.

NOTE: This procedure applies only to vehicles equipped with an optional automatic transmission.

1. Align the base of the bulb with the gear selector bulb socket (3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the bottom of the gear selector bezel (2) housing.
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the center floor console over the gear selector lever (1) and bezel.
7. Reconnect the battery negative cable.

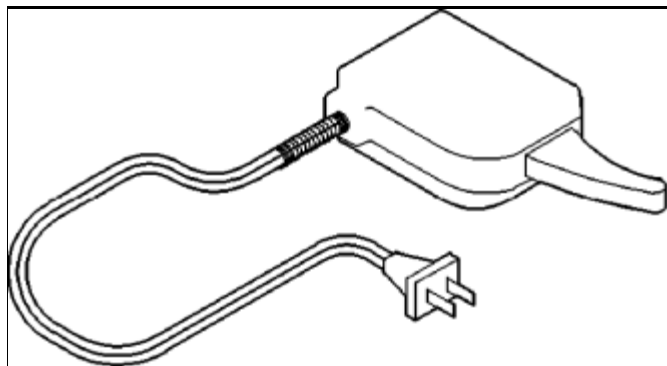


8M - MESSAGE SYSTEMS

MESSAGE CENTER - SERVICE INFORMATION

SPECIAL TOOLS

ELECTRONIC VEHICLE INFORMATION CENTER



DEGAUSSING TOOL 6029

SENSOR-AMBIENT TEMPERATURE

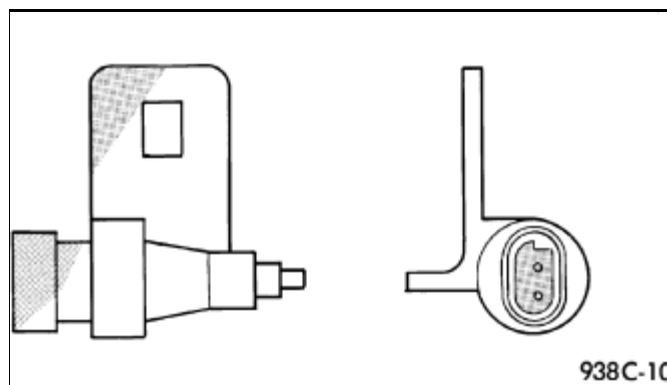
DESCRIPTION

The ambient temperature sensor is a variable resistor type sensor. It is mounted to the lower front fascia behind the radiator grille and in front of the engine compartment.

The ambient temperature sensor cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced.

OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference signal. The resistance in the sensor changes as temperature changes, changing the temperature sensor signal circuit voltage to the Totally Integrated Power Module (TIPM). Based upon the resistance in the sensor, the instrument cluster or Cab Compartment Node (CCN) display senses a specific voltage on the Controller Area Network (CAN) data bus circuit, which corresponds to a specific temperature. The compass/temperature display unit then displays the proper ambient temperature.



DIAGNOSIS AND TESTING

AMBIENT TEMPERATURE SENSOR

The thermometer function is supported by the ambient temperature sensor, the Totally Integrated Power Module (TIPM), the Controller Area Network (CAN) data bus circuit, and the instrument cluster or Cab Compartment Node (CCN) compass/temperature display unit.

If the display shows “OC” (-45° C (-49° F)) or “SC” (60° C (140° F)), there is an OPEN or SHORT CIRCUIT that must be repaired.

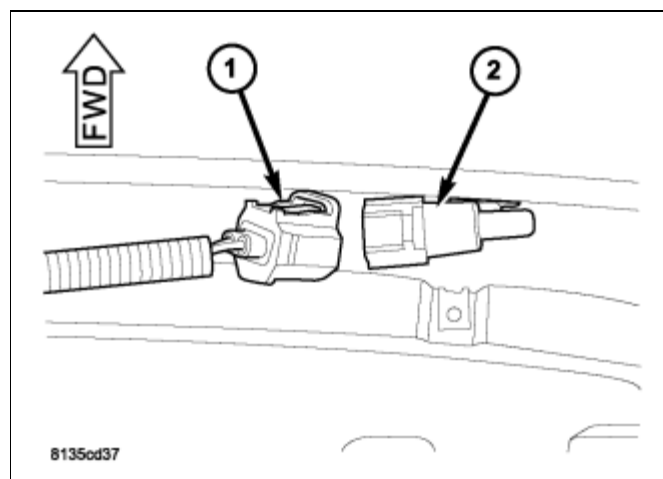
The ambient temperature sensor circuit can also be diagnosed using the following Sensor Test, and Sensor Circuit Test. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, replace the instrument cluster or CCN assembly.

SENSOR TESTING

1. Turn the ignition switch to the OFF position. Disconnect and isolate the battery negative cable.
2. Disconnect the ambient temperature sensor wire harness connector.
3. Measure the resistance of the ambient temperature sensor. At room temperature (approx. 20° C (68°F)), the sensor resistance should be between 9-11 Kilohms (9000-11000 ohms). The sensor resistance should read between these two values. If OK, refer to the appropriate diagnostic information to continue diagnosis of the Totally Integrated Power Module (TIPM), the Controller Area Network (CAN) data bus circuit, and the instrument cluster or CCN. If not OK, replace the inoperative ambient temperature sensor.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the belly pan.
3. Disconnect the wire harness connector (1) from the ambient temperature sensor (2).



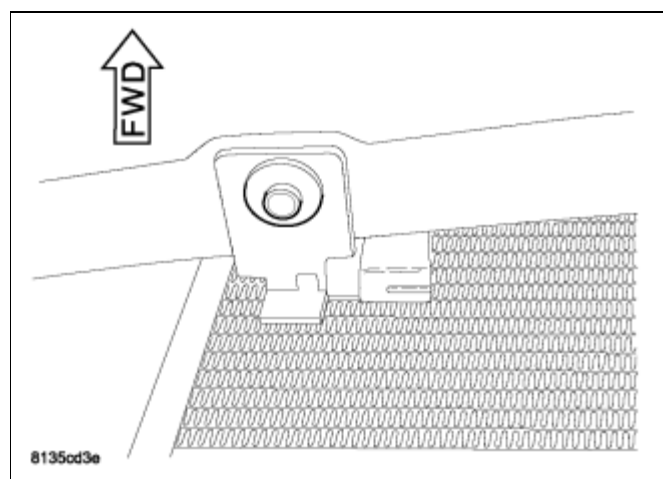
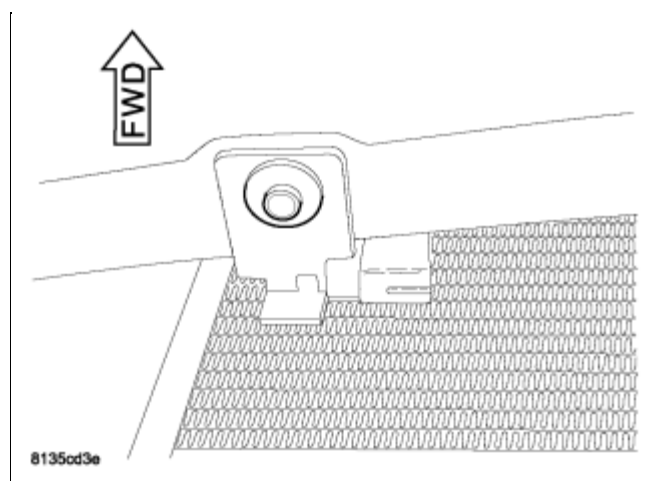
4. Remove the fastener that secures the ambient temperature

sensor bracket to the front fascia.

5. Remove the ambient temperature sensor from the vehicle.

INSTALLATION

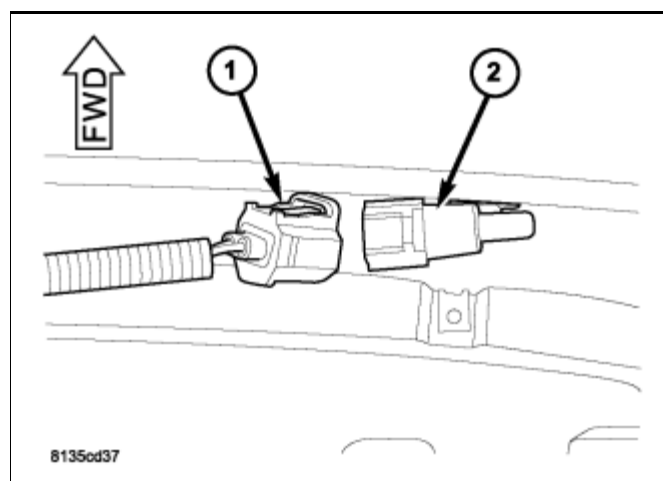
1. Position the ambient temperature sensor in the vehicle.
2. Install the fastener that secures the ambient temperature sensor to the front fascia.

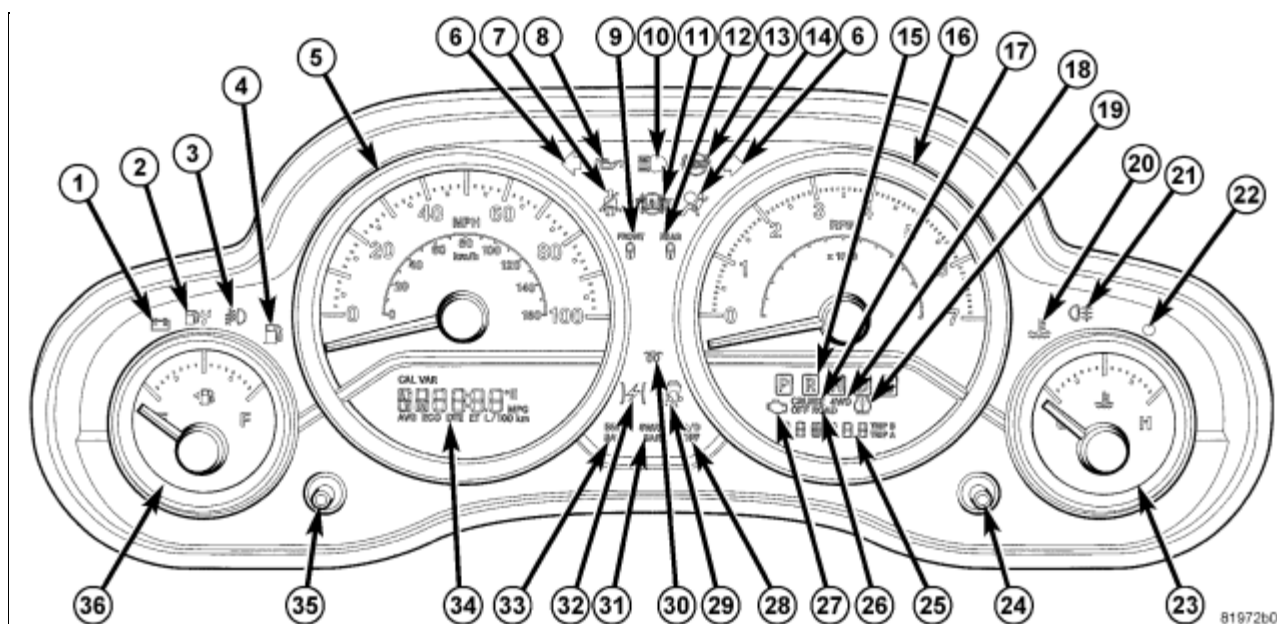


3. Connect the wire harness connector (1) to the ambient temperature sensor (2).
4. Install the belly pan.
5. Connect the battery negative cable.

COMPASS/MINI-TRIP COMPUTER

DESCRIPTION





The Compass Mini Trip Computer (CMTC) features two driver-interactive displays. The display located in the lower left part of the instrument cluster (34) at the bottom of the speedometer (5) displays the compass/temperature and trip computer functions. The display located in the lower right part of the instrument cluster (25) at the bottom of the tachometer (16) displays the odometer related functions. This system conveniently allows the driver to select a variety of useful information by pressing the left instrument cluster button (35) and right instrument cluster button (24). Once a particular system is displayed, pressing and holding one of the instrument cluster buttons once will clear the resettable function currently being displayed. Reset will only occur if a resettable function is currently being displayed. The CMTC displays information related to the following:

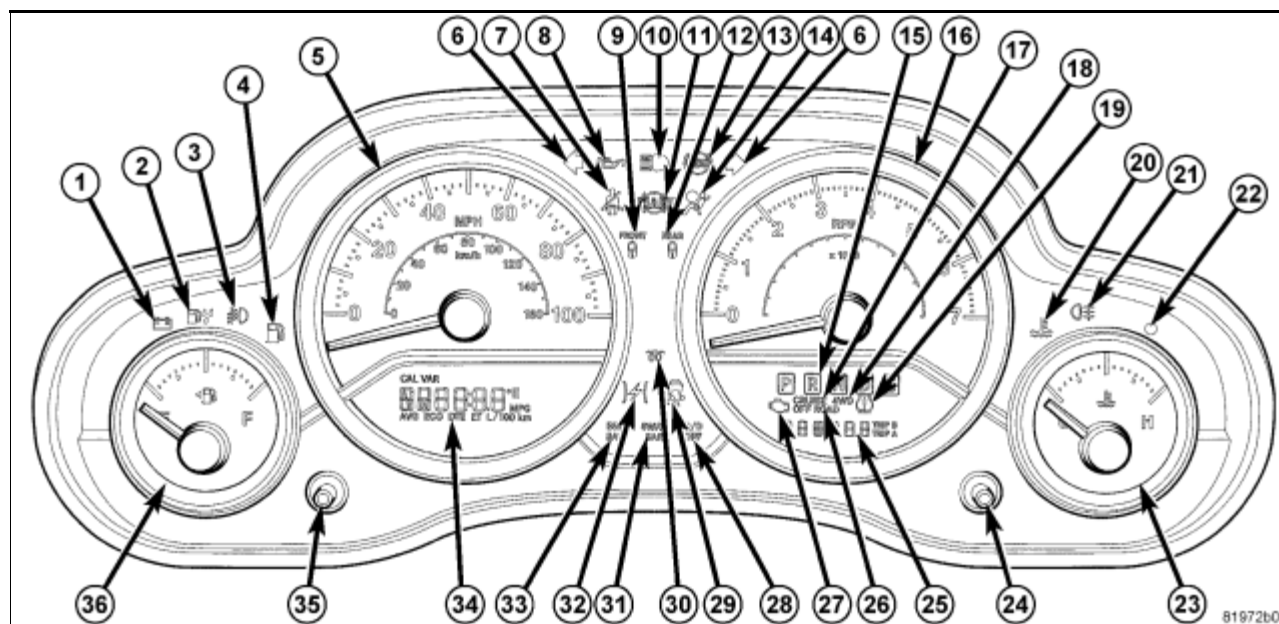
- System Status
- Vehicle information warning message displays
- Compass display
- Outside temperature display
- Trip computer functions

The CMTC system is comprised of several different components. Those components are:

- Instrument Cluster (sometimes referred to as Cab Compartment Node)
- Left instrument cluster button
- Right instrument cluster button
- Ambient Temperature Sensor
- Remote Compass Module (RCM)
- Controller Area Network (CAN) Data Bus
- Local Interface Network (LIN) Data Bus

The CMTC display and the instrument cluster buttons are part of the Instrument Cluster assembly and cannot be serviced as separate components. If the display or button are inoperative the complete Instrument Cluster assembly must be replaced, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

OPERATION



The Compass Mini Trip Computer (CMTC) uses both non-switched and ignition switched sources of battery current so that some of its features remain operational at any time, while others may only operate with the ignition switch in the ON position. When the ignition switch is turned to the ON position, the CMTC display (34) will return to the last function being displayed before the ignition was turned to the OFF position.

The CMTC system is comprised of several different components that communicate over the Controller Area Network (CAN) and Local Interface Network (LIN) Data Buses. If the system is inoperative a scan tool and the appropriate diagnostic information must be used to diagnose the system and related data buses.

The left instrument cluster button (35) is used to navigate through the different functions of the CMTC system. Pressing and releasing the button will scroll through the following displays:

- Compass/Temperature
- Average Fuel Economy (AVG ECO)
- Distance To Empty (DTE)
- Elapsed Time

Once a particular system is displayed, pressing and holding the left instrument cluster button (35) once will clear the resettable function currently being displayed. Reset will only occur if a resettable function is currently being displayed.

The right instrument cluster button (24) is used to navigate through the different functions of the odometer system. Pressing and releasing the button will scroll through the following displays:

- Trip Odometer (ODO)
- Trip A
- Trip B

Once a particular system is displayed, pressing and holding the right instrument cluster button (24) once will clear the resettable function currently being displayed. Reset will only occur if a resettable function is currently being displayed.

CMTC DISPLAY MODES

SYSTEM STATUS MODE

System display mode displays warnings and user interaction messages on the CMTC display. The driver can scroll to view multiple messages by using the left instrument cluster button.

When the appropriate conditions exist, the CMTC displays the following messages:

- Door(s) Ajar
- Swing Gate Ajar
- Loose Fuel Cap
- No Ignition Off Draw (IOD) Fuse
- Electronic Stability Program (ESP) Off

These messages can be manually turned off by pressing the left instrument cluster button.

COMPASS/TEMPERATURE

Compass heading and outside temperature are displayed on the CMTC display screen. One of eight compass headings to indicate the direction the vehicle is facing (N, S, E, W, NE, NW, SE, SW) and one of 15 compass variance settings can be displayed. Outside temperature is displayed in °C (degrees Celsius) or °F (degrees Fahrenheit).

AVERAGE FUEL ECONOMY (AVG ECO)

Shows the average fuel economy since the last reset. When the fuel economy is reset, the display will read “RESET” or show dashes for two seconds. Then, the history information will be erased, and the averaging will continue from where it was before the reset.

DISTANCE TO EMPTY (DTE)

NOTE: Significant changes in driving style or vehicle loading will greatly affect the actual drivable distance of the vehicle, regardless of the DTE displayed value.

Shows the estimated distance that can be travelled with the fuel remaining in the tank. This estimated distance is determined by a weighted average of the instantaneous and average fuel economy, according to the current fuel tank level. This is not resettable.

ELAPSED TIME

Shows the total elapsed time of travel since the last reset when the ignition switch is in the ON position.

TRIP ODOMETER (ODO)

Shows the distance traveled since the last reset. Press and release the right instrument cluster button to switch from the trip odometer to trip A or trip B function. Press and hold the right instrument cluster button while trip odometer is displayed will reset the trip odometer to 0 miles.

TRIP A

Shows the distance traveled for trip A since the last trip A reset. Press and hold the right instrument cluster button while trip A is displayed will reset the trip A to 0 miles.

TRIP B

Shows the distance traveled for trip B since the last trip B reset. Press and hold the right instrument cluster button while trip B is displayed will reset the trip B to 0 miles.

DIAGNOSIS AND TESTING

COMPASS MINI TRIP COMPUTER

CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the Remote Compass Module (RCM) located at the top center of the instrument panel. Do not place any electronic devices (cell phones, laptop computers, PDAs, portable DVD players, etc), on or near the instrument panel as the RCM performance may be effected. Do not use magnetic tools when servicing the RCM.

The Compass Mini Trip Computer (CMTC) data is obtained from several components on the Controller Area Network (CAN) and Local Interface Network (LIN) Data Bus circuits. The CMTC will not function properly if the bus messages from any of these components is not received. If no CMTC data is displayed or the display indicates dashes "– –", check the CAN Data Bus circuit communications, the Instrument Cluster functions, the Remote Compass Module (RCM) and the Totally Integrated Power Module (TIPM). Should the RCM become disconnected, the instrument cluster display will go blank.

The use of a scan tool and the proper diagnostic procedures information are recommended for further testing of the CMTC, the RCM, the CAN Data Bus and Local Interface Network (LIN) Data Bus circuits. Refer to the appropriate wiring information for complete circuit schematic or connector pin-out information.

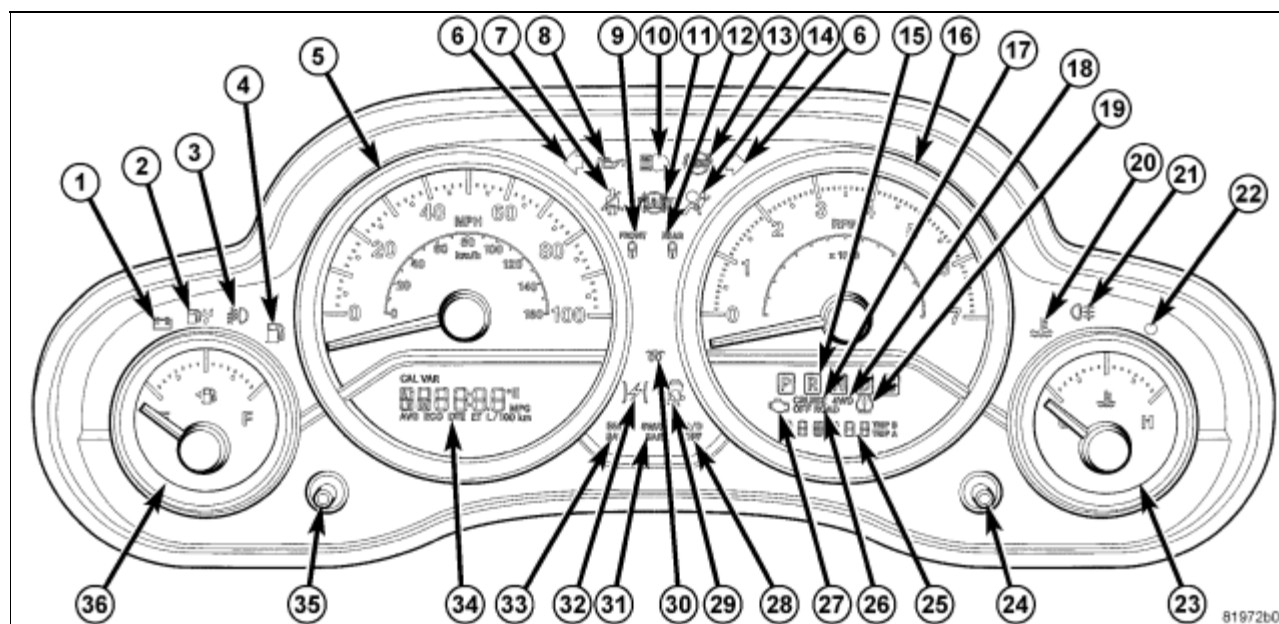
STANDARD PROCEDURE

MANUAL COMPASS CALIBRATION

CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the Remote Compass Module (RCM) located at the top center of the instrument panel. Do not place any electronic devices (cell phones, laptop computers, PDAs, portable DVD players, etc), on or near the instrument panel as the RCM performance may be effected. Do not use magnetic tools when servicing the RCM.

NOTE: Manual calibration is required anytime a new RCM is installed. The RCM can be calibrated by performing the following procedure.

The electronic compass unit features a continuous self-calibrating feature. This feature automatically updates the compass calibration as the vehicle is driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or the Compass Mini Trip Computer (CMTC) displays “CAL”, perform the following calibration procedure. Also, any time a new RCM is installed, it must be manually calibrated using this procedure.



Manually calibrate the compass as follows:

NOTE: Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

1. Start the engine but leave the vehicle in “PARK” .
2. Depress the **STEP** button (35) for approximately 10 seconds until the “VAR” menu is displayed. The current variance value will also be displayed.
3. Once in the “VAR” menu depress the **STEP** button (35) for approximately 10 seconds until the “CAL” message is displayed solidly not blinking.
4. To complete the compass calibration, drive the vehicle in one or more complete 360 degree circles under 5 mph (8 km/h) in an area free of large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines, until the “CAL” indicator turns off. The compass will now function normally.

NOTE: If the compass display indicates an inaccurate compass heading or the display is locked up, the RCM may be inoperative or the vehicle may need to be demagnetized. Perform the Compass Demagnetizing Procedure prior to performing any system diagnosis, (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE).

NOTE: If the compass display indicates dashes “- -” the RCM may be inoperative or the vehicle may

need to be demagnetized. Perform the Compass Demagnetizing Procedure prior to performing any system diagnosis, (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE).

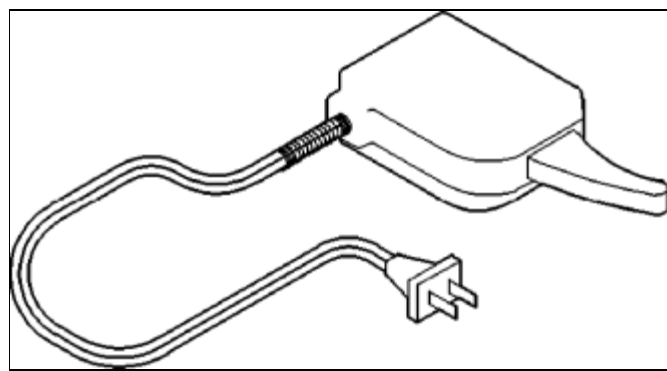
NOTE: If the “CAL” message remains in the display or if the compass heading is inaccurate following the calibration procedure and there are no internal compass faults, either there is excessive magnetism near the compass, or the unit is inoperative. Repeat the calibration procedure at least one more time prior to performing any system diagnosis.

NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

COMPASS DEMAGNETIZING

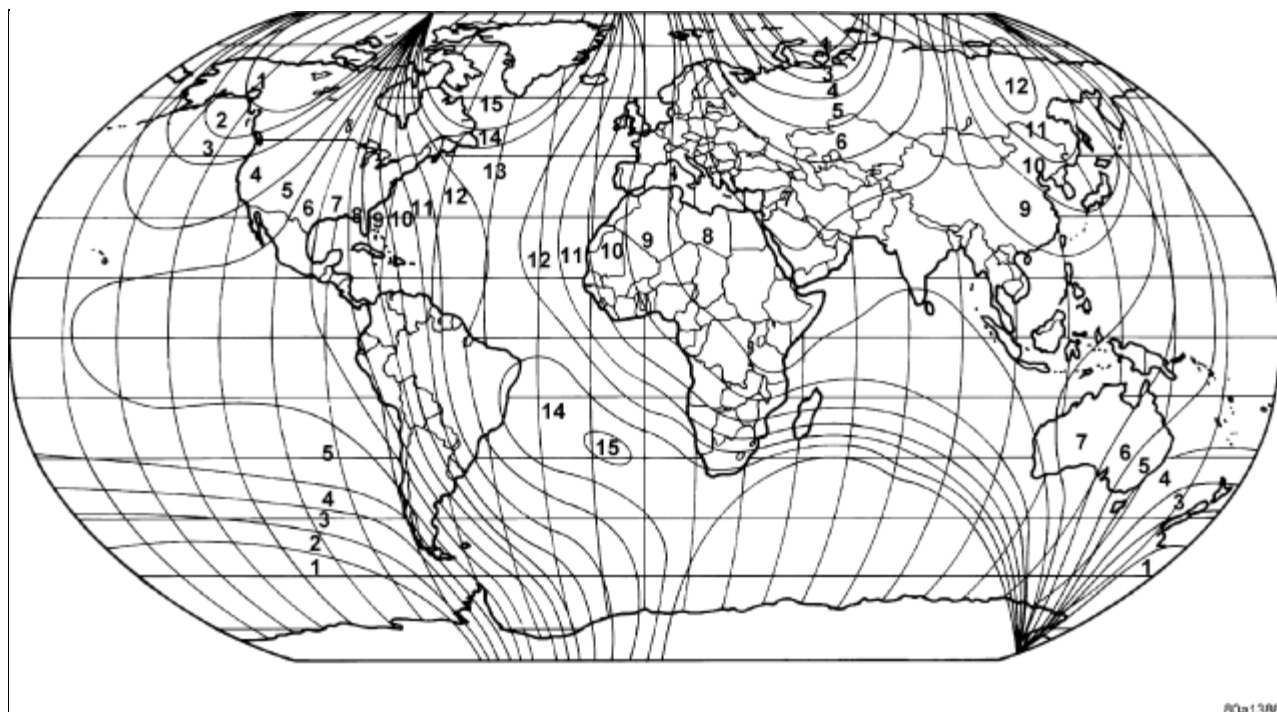
A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

To demagnetize the instrument panel, proceed as follows:



1. Be certain that the ignition switch is in the OFF position, before you begin the demagnetizing procedure.
2. Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the Remote Compass Module (RCM).
3. Slowly approach the instrument panel top cover with the degaussing tool connected.
4. Contact the instrument panel top cover with the plastic coated tip of the degaussing tool. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool side to side over the area the RCM is located.
5. With the degaussing tool still energized, slowly back it away from the instrument panel top cover. When the tip of the tool is at least 61 centimeters (2 feet) from the instrument panel top cover, disconnect the tool.
6. Calibrate the compass, (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - MANUAL COMPASS CALIBRATION) and adjust the compass variance, (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - COMPASS VARIANCE ADJUSTMENT).

COMPASS VARIANCE ADJUSTMENT



Variance Settings

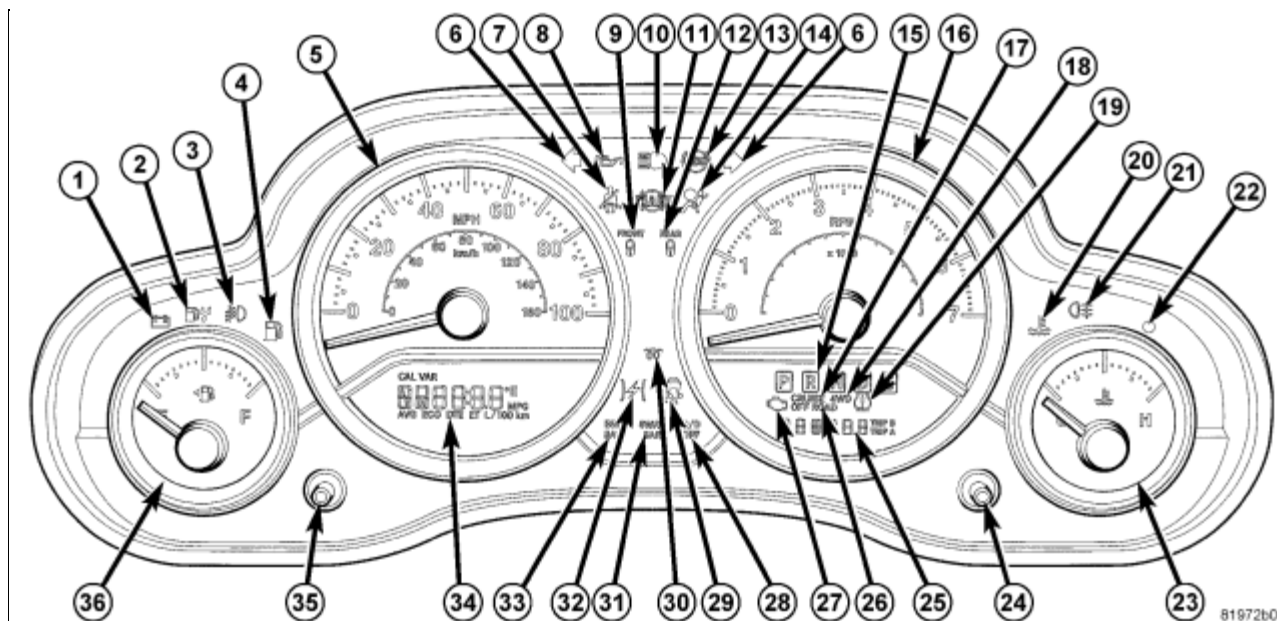
NOTE: If the vehicle is taken on long trips into a new variance zone the compass function may be effected. Compass variance may need to be adjusted to the new zone number to function properly.

NOTE: The default for the compass variance from the factory is 8.

Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give inaccurate readings. To optimize compass accuracy, the compass variance should be properly set according to the compass variance map zone for the region that the vehicle is in.

To set the compass variance:

1. Using the Variance Settings map, find your geographic location and note the zone number.



2. Turn the ignition switch to the ON position.
3. Depress the **STEP** button (35) for approximately 10 seconds until the “VAR” menu is displayed in the Compass Mini Trip Computer (CMTC) display (32). The current variance value will also be displayed. The default variance zone is 8.

NOTE: During programming, the Zone value will wrap around from Zone 15 to Zone 1.

NOTE: The US/Metric display will change from English to Metric or Metric to English before the “VAR” symbol appears, however, it will return back to the original US/Metric setting after programming the compass variance.

4. To change the zone, press and hold (longer than two seconds) the **STEP** button (35) to increment the variance one step. Repeat as necessary, with individual long (longer than two seconds) **STEP** button presses for each increment, until the desired variance is achieved. When the correct zone is displayed, wait approximately 15 seconds. The CMTC will store the new variance value in memory and the compass will resume normal operation.
5. Confirm that the correct directions are now indicated by the compass.

REMOVAL - REMOTE COMPASS MODULE

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

1. Disconnect and isolate the battery negative cable.
2. Using a trim stick C-4755 or equivalent, remove the upper instrument panel cover located over the center bezel and radio.
3. Remove the screws securing the Remote Compass Module (RCM) to the upper instrument panel cover.

4. Disconnect the RCM electrical connector and remove the RCM from the vehicle.

INSTALLATION - REMOTE COMPASS MODULE

NOTE: The Remote Compass Module (RCM) must be calibrated after installation. (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - MANUAL COMPASS CALIBRATION) for the appropriate procedure.

1. Position the Remote Compass Module (RCM) onto the upper instrument panel cover.
2. Install the screws that secure the RCM to the upper instrument panel cover.
3. Connect the RCM electrical connector.
4. Install the upper instrument panel cover located over the center bezel and seat fully.
5. Connect the battery negative cable.
6. Calibrate the RCM, (Refer to 8 - ELECTRICAL/MESSAGE CENTER/COMPASS/MINI-TRIP COMPUTER - STANDARD PROCEDURE - MANUAL COMPASS CALIBRATION).

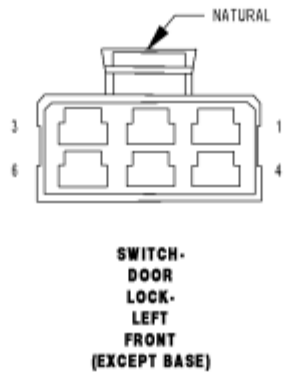
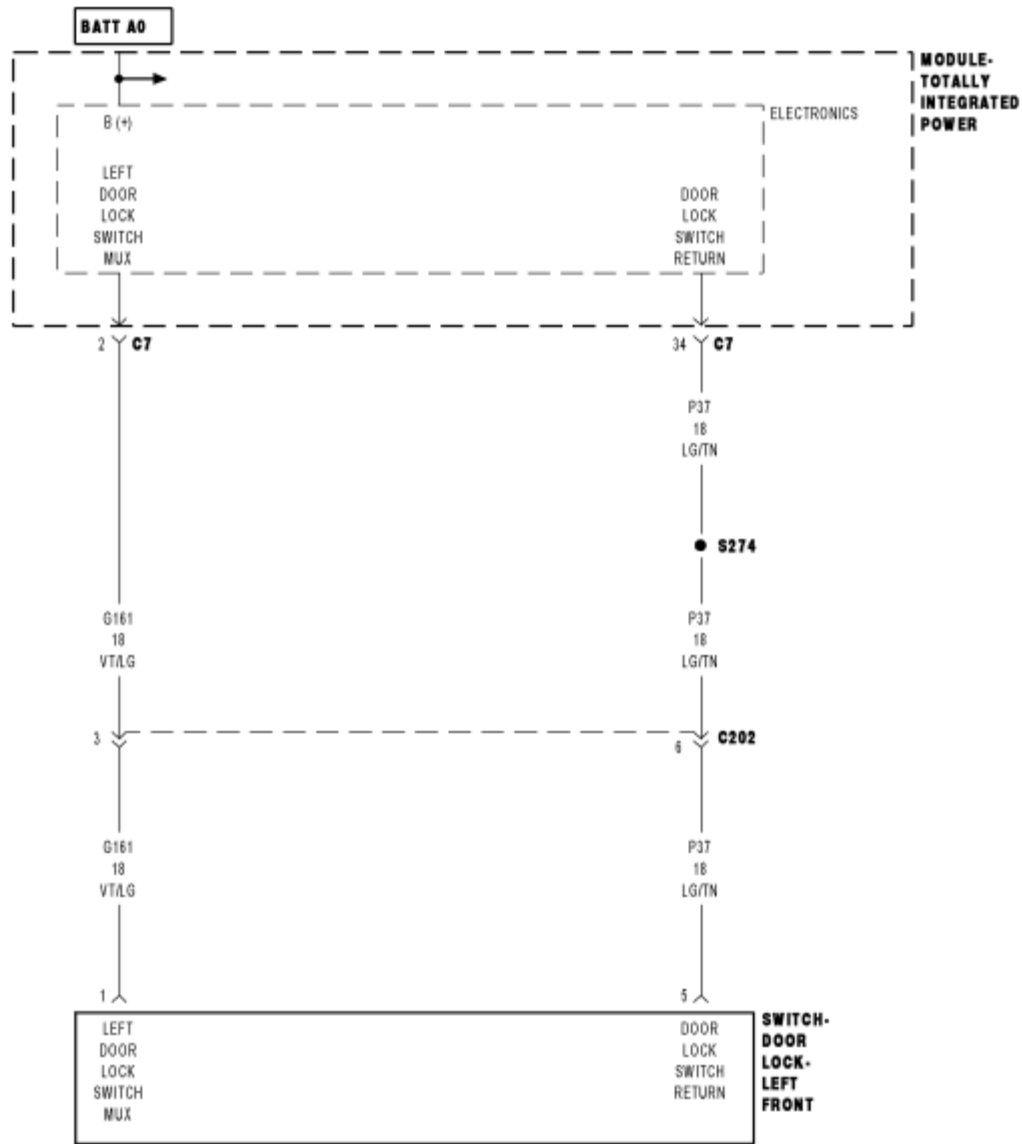
8N - POWER SYSTEMS

POWER LOCKS - ELECTRICAL DIAGNOSTICS

POWER LOCKS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1801 DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW – TIPM



010046ca

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously

- **Set Condition:**

When the Left Door Lock Switch Mux circuit is below 0.15 volts for over 10 seconds.

Possible Causes
(G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND
(G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK SWITCH RETURN CIRCUIT
DOOR LOCK SWITCH SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)

Theory of Operation

This trouble code is for the Left Door Lock Switch for all vehicles including right hand drive.

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Left Door Lock Switch in all positions several times.

Cycle the ignition from on to off.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display B1801–DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. DOOR LOCK SWITCH SHORTED

With the scan tool, erase DTC's.
Disconnect the Left Door Lock Switch connector.
With the scan tool, read DTC's.

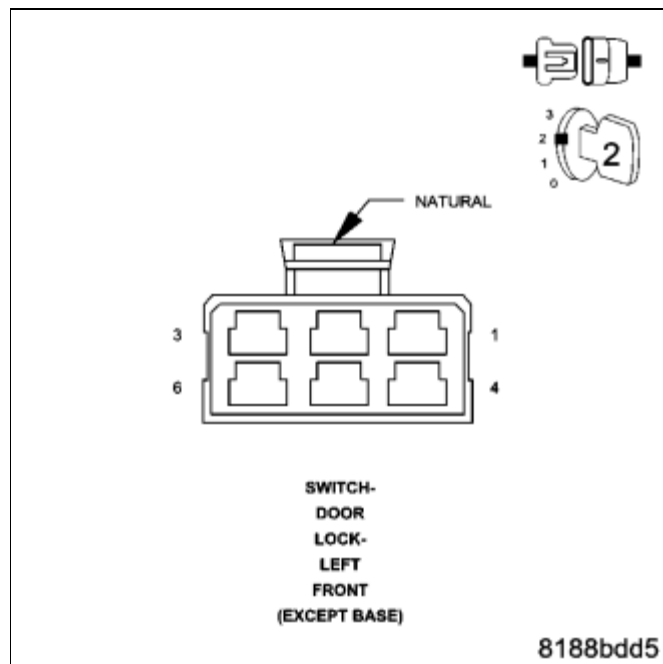
Does the scan tool display B1801–DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW?

No

- Replace the Left Door Lock Switch.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. (G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C7 connector.
Measure the resistance between ground and the (G161) Left Door Lock Switch Mux circuit.

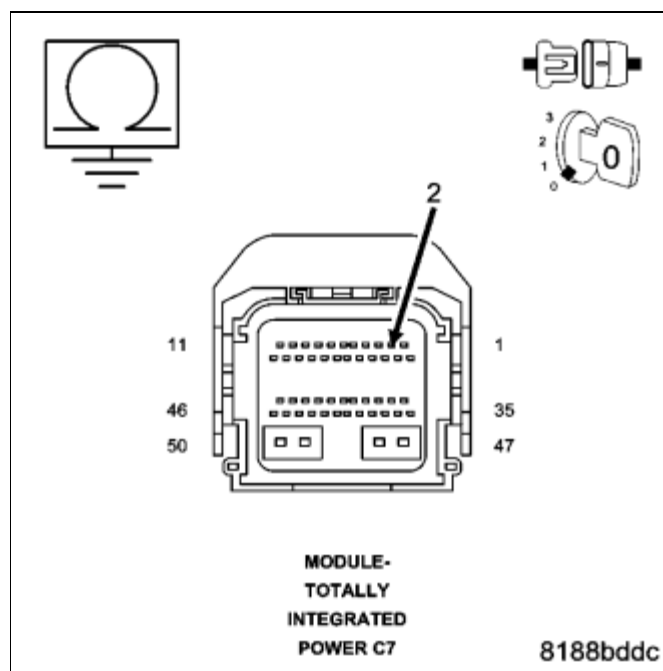
Is the resistance below 10,000.0 ohms?

Yes

- Repair the (G161) Left Door Lock Switch Mux circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK

SWITCH RETURN CIRCUIT

Measure the resistance between the (G161) Left Door Lock Switch Mux circuit and the (P37) Door Lock Switch Return circuit in the door lock switch connector.

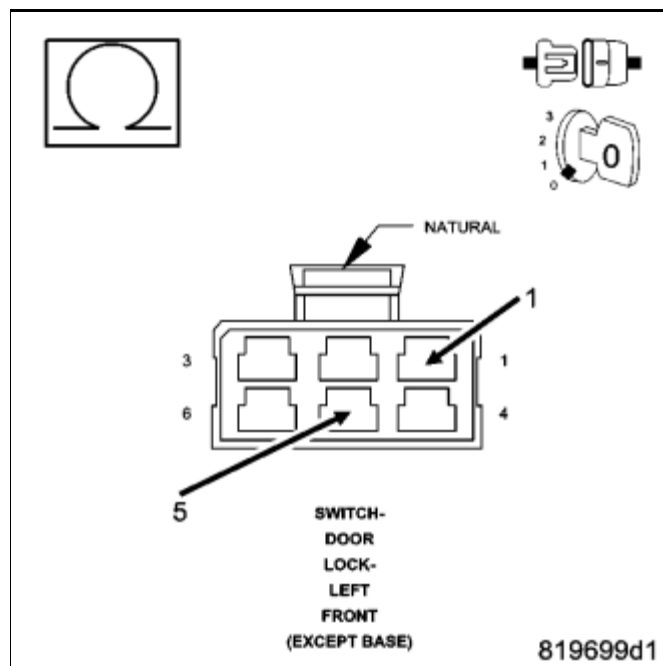
Is the resistance below 10,000.0 ohms?

Yes

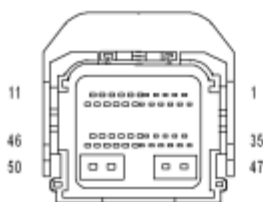
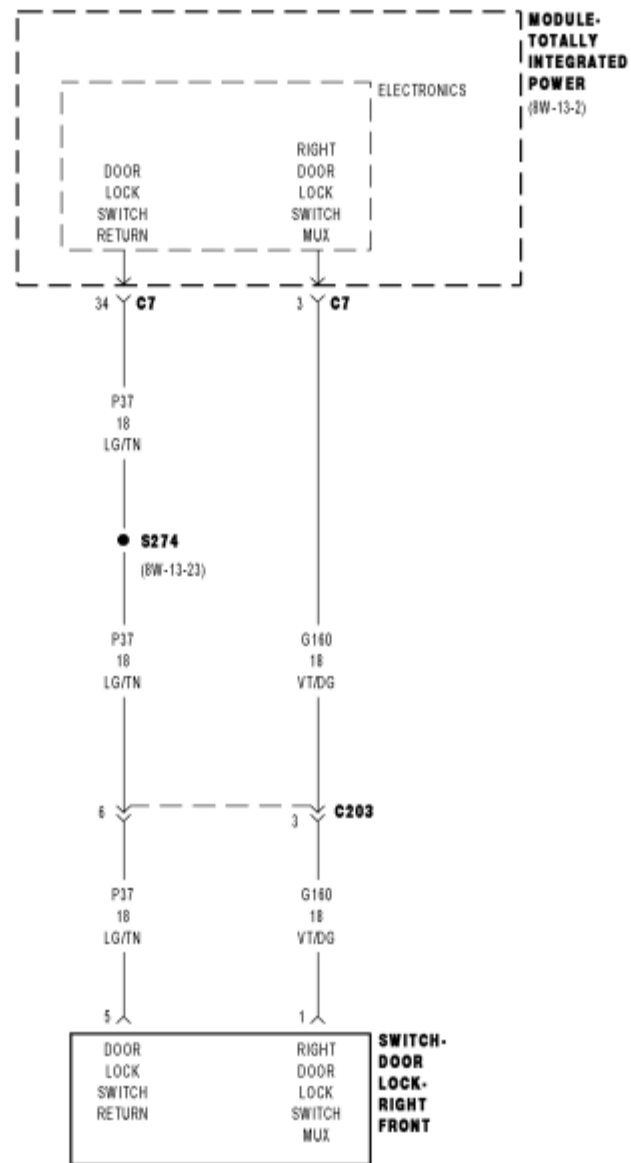
- Repair the (G161) Left Door Lock Switch Mux circuit for a short to the (P37) Door Lock Switch Return circuit.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

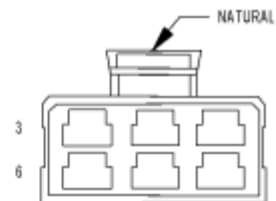
- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1806 PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW – TIPM



MODULE-TOTALLY INTEGRATED POWER C7



SWITCH-DOOR LOCK-RIGHT FRONT (EXCEPT BASE)

8188cc08

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously

- **Set Condition:**

When the Right Door Lock Switch Mux circuit is below 0.15 volts for over 10 seconds.

Possible Causes
(G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND
(G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK SWITCH RETURN
DOOR LOCK SWITCH SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)

Theory of Operation

This trouble code is for the Right Door Lock Switch for all vehicles including right hand drive.

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Right Door Lock Switch in all positions several times.

Cycle the ignition from on to off.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display B1806–PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. DOOR LOCK SWITCH SHORTED

With the scan tool, erase DTC's.
Disconnect the Right Door Lock Switch connector.
With the scan tool, read DTC's.

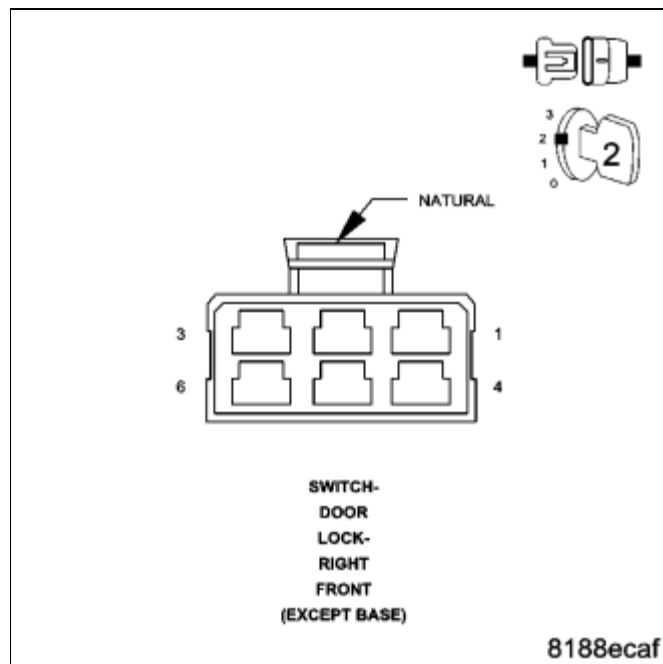
Does the scan tool display B1806-PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT LOW?

No

- Replace the Right Door Lock Switch.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. (G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C7 connector.
Measure the resistance between ground and the (G160) Right Door Lock Switch Mux circuit.

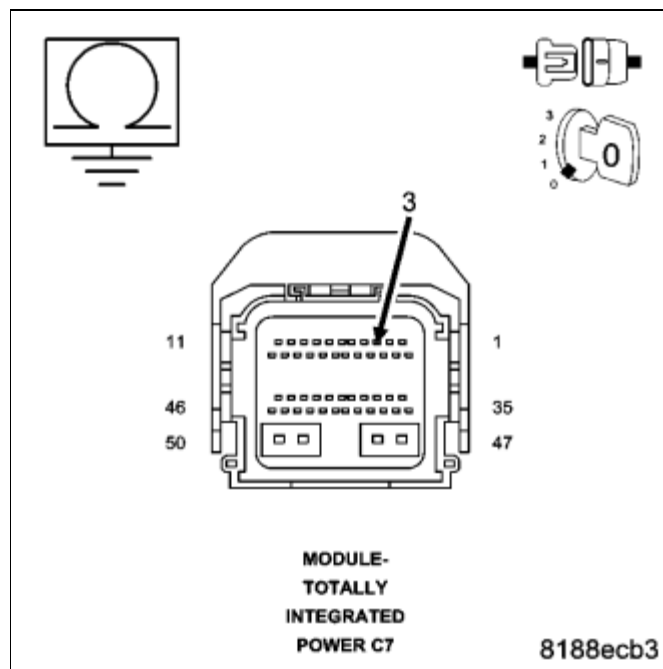
Is the resistance below 10,000.0 ohms?

Yes

- Repair the (G160) Right Door Lock Switch Mux circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK

SWITCH RETURN

Measure the resistance between the (G160) Right Door Lock Switch Mux circuit and the (P37) Door Lock Switch Return circuit in the Door Lock Switch connector.

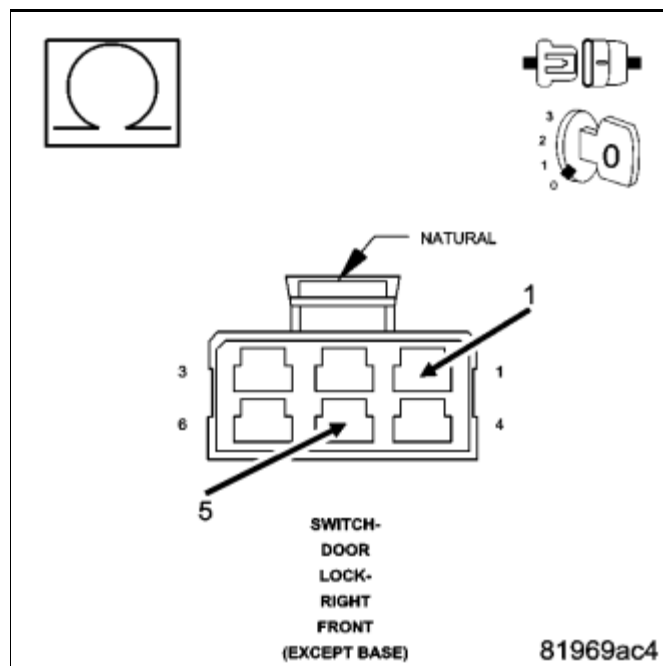
Is the resistance below 10,000.0 ohms?

Yes

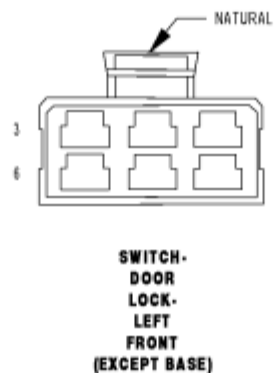
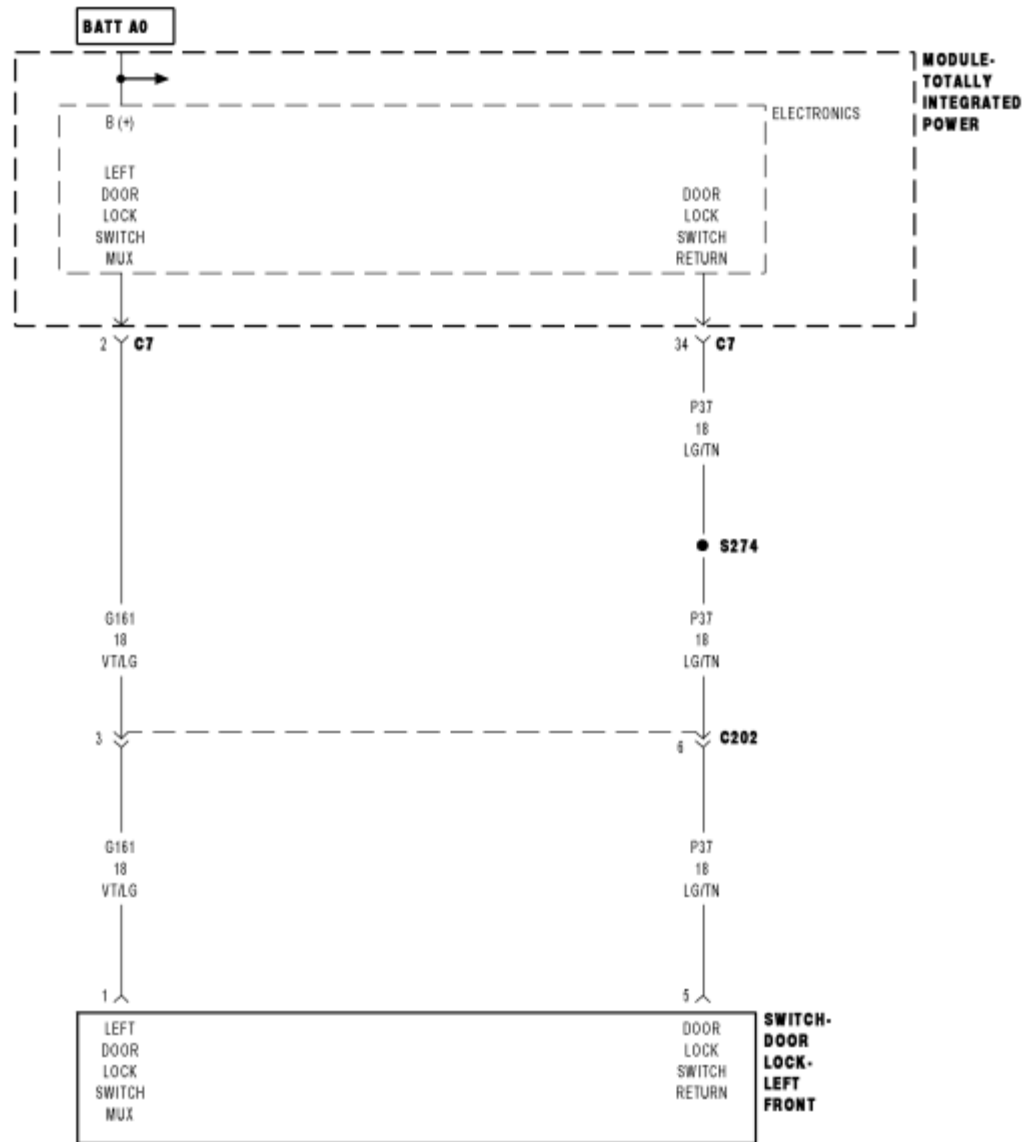
- Repair the (G160) Right Door Lock Switch Mux circuit for a short to the Door Lock Switch Return circuit.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1934–DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK – TIPM



010044ca

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously

- **Set Condition:**

When the Left Door Lock Switch Mux circuit is between 0.8 and 3.5 volts for over 10 seconds.

Possible Causes
(G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
(G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK SWITCH RETURN CIRCUIT
DOOR LOCK SWITCH SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)

Theory of Operation

This trouble code is for the Left Door Lock Switch for all vehicles including right hand drive.

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Left Door Lock Switch in all positions several times.

Cycle the ignition from on to off.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display B1934–DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. DOOR LOCK SWITCH SHORTED

With the scan tool, erase DTC's.
Disconnect the Left Door Lock Switch connector.
With the scan tool, read DTC's.

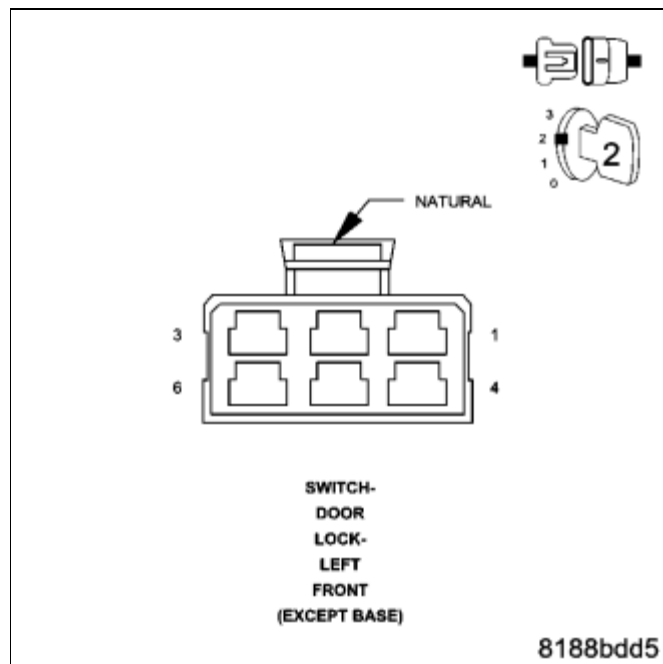
Does the scan tool display B1934-DRIVER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK?

No

- Replace the Left Door Lock Switch.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. (G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C7 connector.
Measure the resistance between ground and the (G161) Left Door Lock Switch Mux circuit.

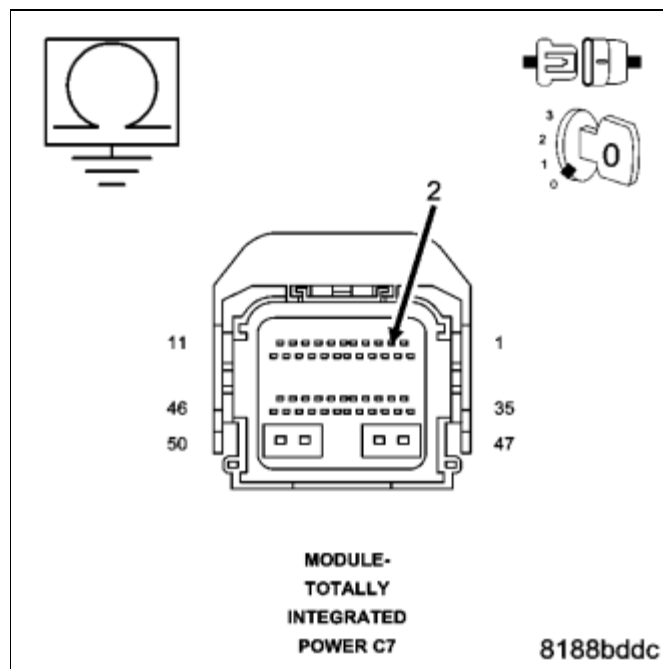
Is the resistance below 10,000.0 ohms?

Yes

- Repair the (G161) Left Door Lock Switch Mux circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (G161) LEFT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK

SWITCH RETURN CIRCUIT

Measure the resistance between the (G161) Left Door Lock Switch Mux circuit and the (P37) Door Lock Switch Return circuit in the Door Lock Switch Connector.

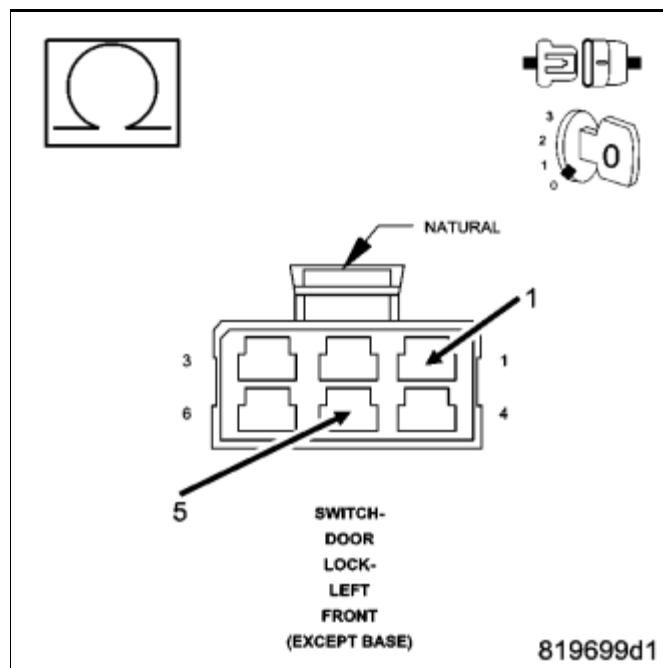
Is the resistance below 10,000.0 ohms?

Yes

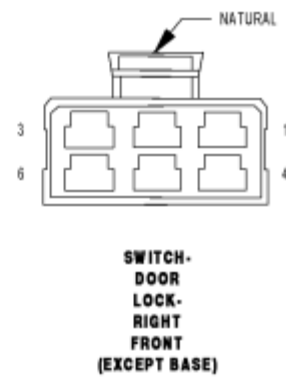
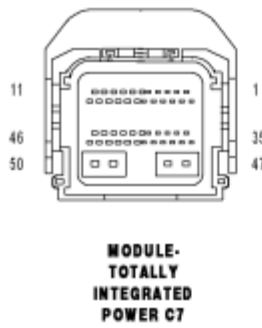
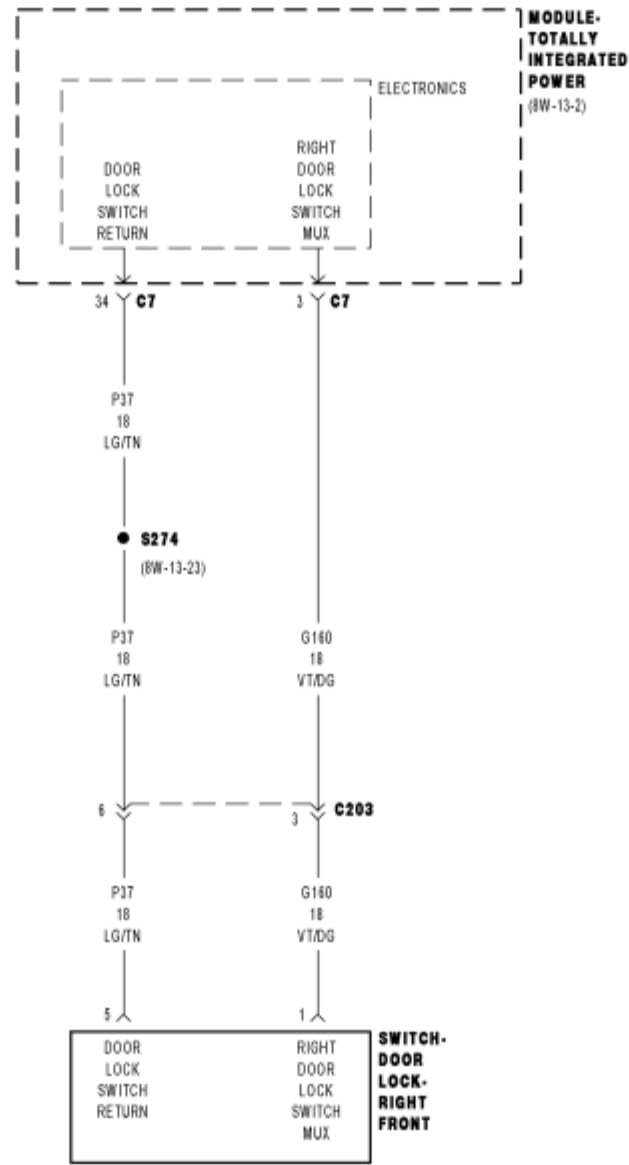
- Repair the (G161) Left Door Lock Switch Mux circuit for a short to the (P37) Door Lock Switch Return circuit.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1935-PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK – TIPM



8188cc08

For a complete wiring diagram **Refer** to Section 8W.

- **When Monitored:**

Continuously

- **Set Condition:**

When the Right Door Lock Switch Mux circuit is between 0.8 and 3.5 volts for over 10 seconds.

Possible Causes
(G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND
(G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK SWITCH RETURN
DOOR LOCK SWITCH SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)

Theory of Operation

This trouble code is for the Right Door Lock Switch for all vehicles including right hand drive.

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase DTC's

Operate the Right Door Lock Switch in all positions several times.

Cycle the ignition from on to off.

Turn the ignition on.

With the scan tool, read DTC's.

Does the scan tool display B1935–PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. DOOR LOCK SWITCH SHORTED

With the scan tool, erase DTC's.
Disconnect the Right Door Lock Switch connector.
With the scan tool, read DTC's.

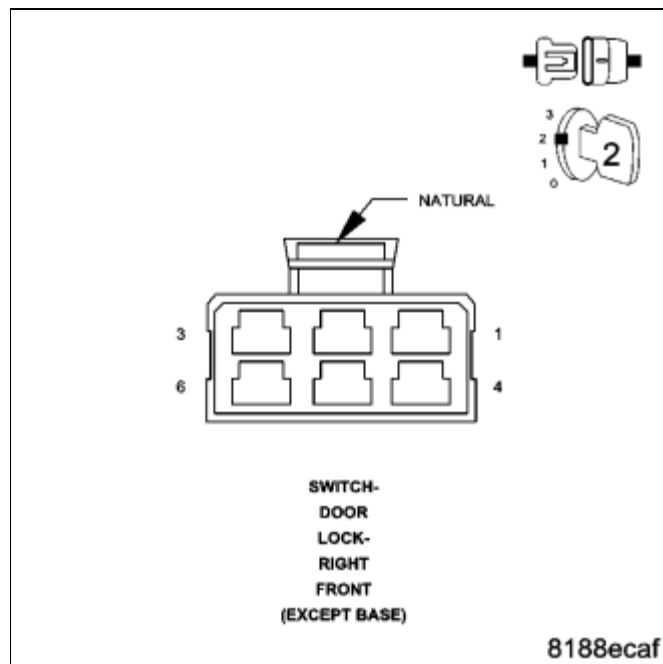
Does the scan tool display B1935-PASSENGER DOOR LOCK/UNLOCK SWITCH CIRCUIT STUCK?

No

- Replace the Right Door Lock Switch.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. (G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT PARTIAL SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C7 connector.
Measure the resistance between ground and the (G160) Right Door Lock Switch Mux circuit.

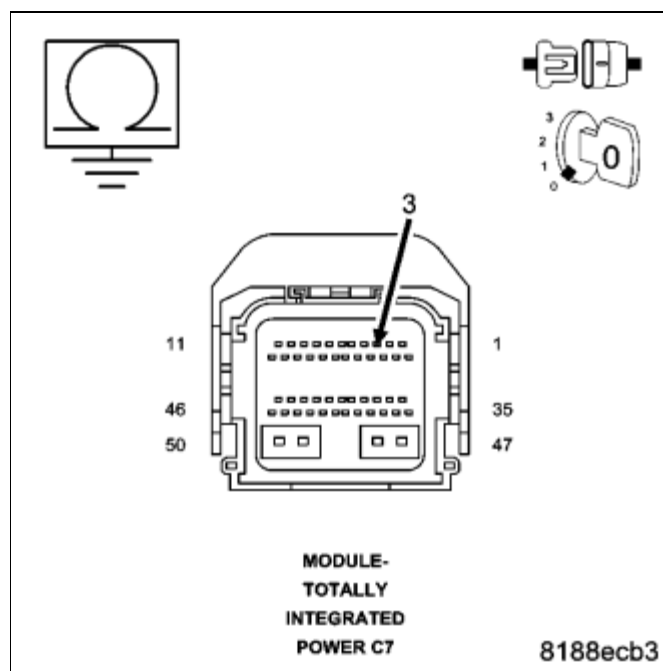
Is the resistance below 10,000.0 ohms?

Yes

- Repair the (G160) Right Door Lock Switch Mux circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- [4](#)



4. (G160) RIGHT DOOR LOCK SWITCH MUX CIRCUIT SHORT TO THE (P37) DOOR LOCK

SWITCH RETURN

Measure the resistance between the (G160) Right Door Lock Switch Mux circuit and the (P37) Door Lock Switch Return circuit.

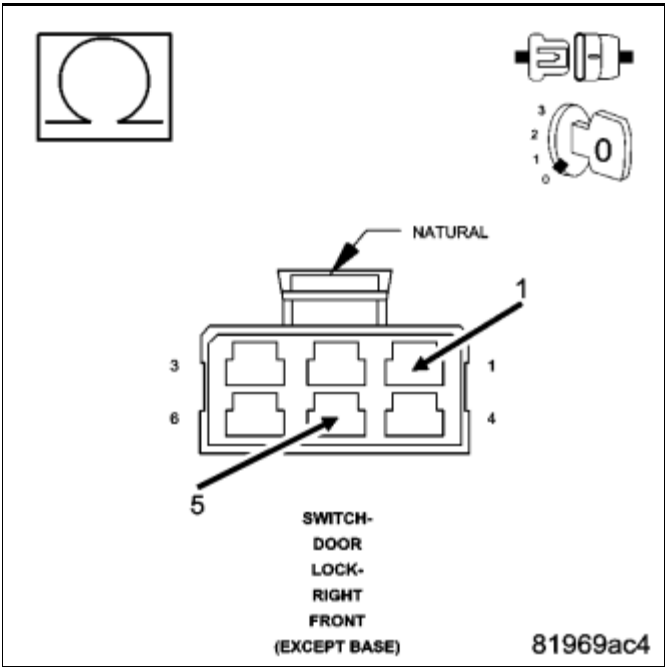
Is the resistance below 10,000.0 ohms?

Yes

- Repair the (G160) Right Door Lock Switch Mux circuit for a short to the (P37) Door Lock Switch Return circuit.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B1A08-RKE FOB 1 PERFORMANCE – WCM

For a complete wiring diagram Refer to Section 8W.

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A09-RKE FOB 2 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A09-RKE FOB 2 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0A-RKE FOB 3 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0B-RKE FOB 4 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0C-RKE FOB 5 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0D-RKE FOB 6 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0E-RKE FOB 7 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A0F-RKE FOB 8 PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

Scrambled messages to the wireless control module from the transmitter.

NOTE: The most probable cause for this code to set is if the Wireless Control Module (WCM) senses over 150 presses from the RKE transmitter, when it is out of range.

Possible Causes
EXCESSIVE PRESSES FROM TRANSMITTER WHEN OUT OF RANGE
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Put the key in the ignition and turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A08-RKE FOB 1 PERFORMANCE?

Yes

- Replace the RKE transmitter and program in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time. Inform the owner of the most probable cause for this code to set and therefore cause the RKE system to be inoperative.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A10-RKE FOB 1 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTC's

Operate the RKE transmitter in all positions several times.

With the scan tool, read DTC's.

Does the scan tool display B1A10-RKE FOB 1 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A11-RKE FOB 2 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTC's

Operate the RKE transmitter in all positions several times.

With the scan tool, read DTC's.

Does the scan tool display B1A11-RKE FOB 2 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A12-RKE FOB 3 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTC's

Operate the RKE transmitter in all positions several times.

With the scan tool, read DTC's.

Does the scan tool display B1A12-RKE FOB 3 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A13-RKE FOB 4 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

TEST FOR INTERMITTENT CONDITION

1.

Turn the ignition on.

With the scan tool, record and erase DTC's

Operate the RKE transmitter in all positions several times.

With the scan tool, read DTC's.

Does the scan tool display B1A13-RKE FOB 4 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A14-RKE FOB 5 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, record and erase DTC's
Operate the RKE transmitter in all positions several times.
With the scan tool, read DTC's.

Does the scan tool display B1A14-RKE FOB 5 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A15-RKE FOB 6 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A15-RKE FOB 6 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A16-RKE FOB 7 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.
 With the scan tool, read DTC's.

Does the scan tool display B1A16–RKE FOB 7 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A17–RKE FOB 8 BATTERY LOW – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE transmitter signal is not as strong as it ought to be, this code will set.

Possible Causes
LOW BATTERY
RKE TRANSMITTER

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, record and erase DTC's
 Operate the RKE transmitter in all positions several times.

With the scan tool, read DTC's.

Does the scan tool display B1A17–RKE FOB 8 BATTERY LOW?

Yes

- Replace the RKE transmitter battery and retry the system. If the DTC returns, replace and program the RKE transmitter in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The conditions that caused this code to set are not present at this time.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A23–RKE RECEIVER PERFORMANCE – WCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously.

◦ **Set Condition:**

When the Wireless Control Module senses that the RKE signal is jammed, this code will set.

Possible Causes
EXTERNAL ENVIRONMENT

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase DTC's

Turn the ignition off.

Operate the RKE transmitter in all positions several times.

Turn the ignition on.

With the scan tool, read DTC's.

Are there any door lock related trouble codes present or is the RKE inoperative?

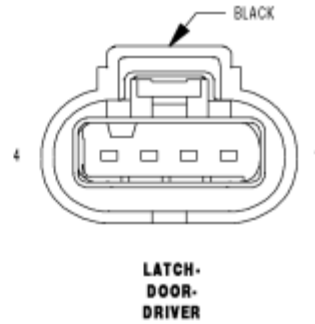
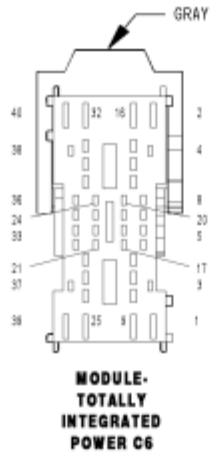
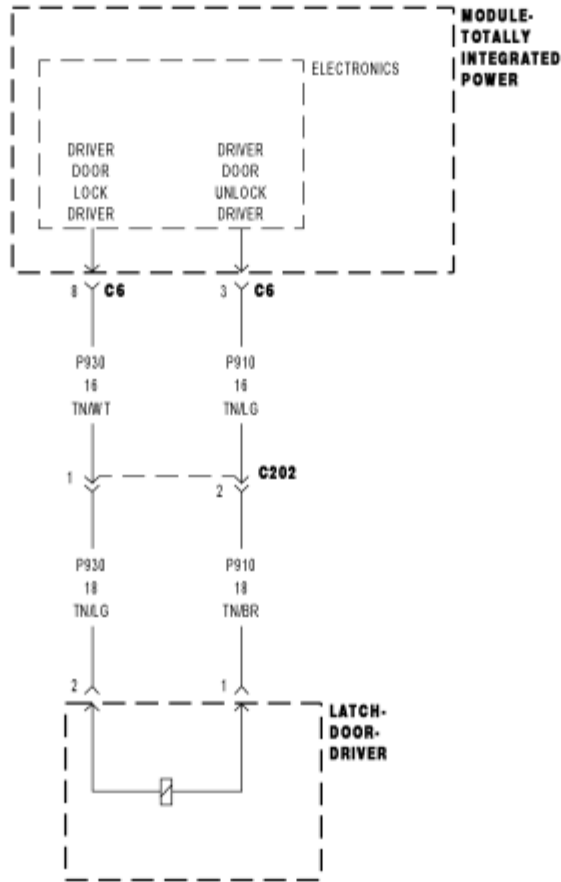
Yes

- Refer to the symptom list for problems related to Power Locks.

No

- The conditions that caused this code to set are not present at this time. This DTC is set when the vehicle is parked in a location that is affected by external environmental conditions. Suggest to the customer that they park in a slightly different location from where the RKE was inoperable.
-

***DRIVER DOOR LOCK INOPERATIVE**



81002417

For a complete wiring diagram **Refer to Section 8W.**

(P930) DRIVER DOOR LOCK DRIVER CIRCUIT OPEN
(P930) DRIVER DOOR LOCK DRIVER CIRCUIT SHORT TO GROUND
(P910) DRIVER DOOR UNLOCK DRIVER CIRCUIT OPEN
(P910) DRIVER DOOR UNLOCK DRIVER CIRCUIT SHORT TO GROUND
DRIVER DOOR LATCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. DRIVER DOOR LATCH INOPERATIVE

Disconnect the Driver Door Latch connector.
 Connect a test light between the (P930) Driver Door Lock Driver circuit and the (P910) Driver Door Unlock Driver circuit.
 Close the front doors or trip the door latches to the closed position.
 Operate the door locks in both positions and observe the test light.

Does the test light illuminate brightly for approximately 300 ms. when the door locks are actuated?

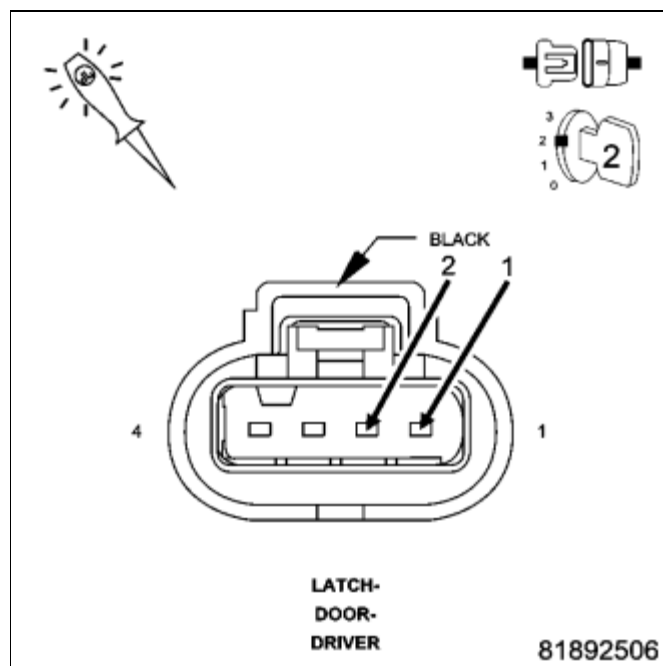
Yes

- Replace the Driver Door Latch.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CHECK (P910) DRIVER DOOR UNLOCK DRIVER CIRCUIT OPEN



Turn the ignition off.
 Disconnect the TIPM C6 connector.
 Measure the resistance of the (P910) Driver Door Unlock Driver circuit between the Latch connector and the TIPM C6 connector.

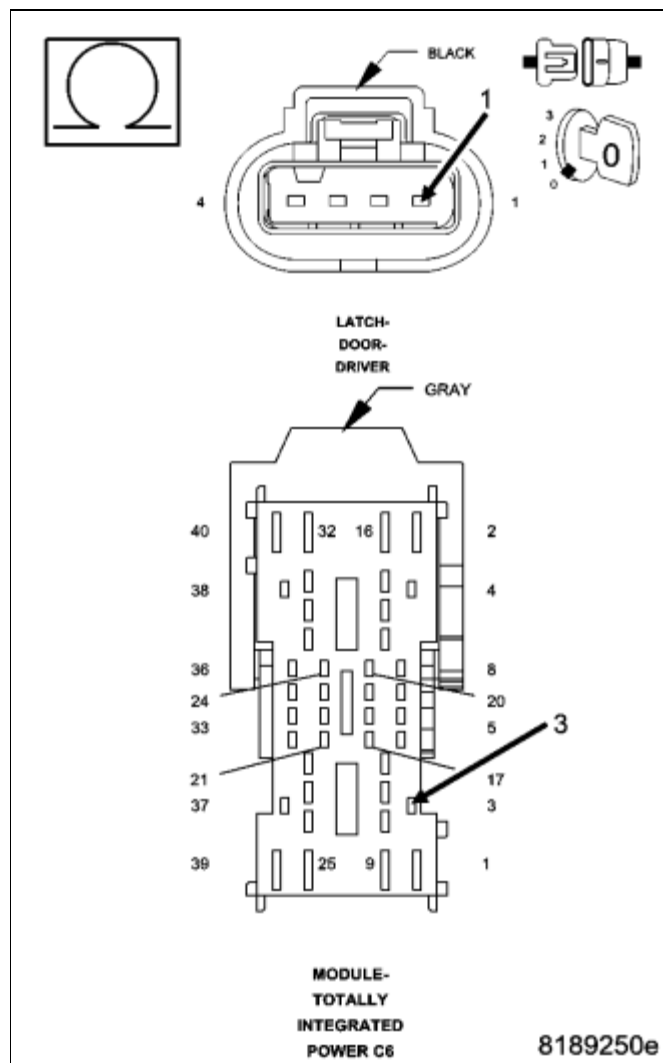
Is the resistance below 2.0 ohms?

No

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to the latch connector to determine if the wire is open in the door harness or the instrument panel harness. Repair the (P910) Driver Door Unlock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. CHECK (P910) DRIVER DOOR UNLOCK DRIVER CIRCUIT SHORT TO GROUND

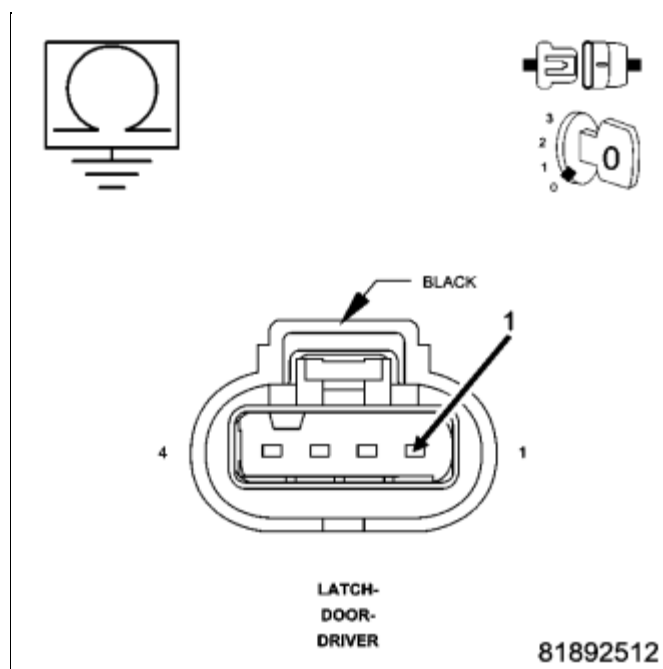
Measure the resistance between Ground and the (P910) Driver Door Unlock Driver circuit.

Is the resistance below 1000.0 ohms?

Yes

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to ground to determine if the wire is shorted in the door harness or the instrument panel harness. Repair the (P910) Driver Door Unlock Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)



No

- Go To [4](#)

4. CHECK (P930) DRIVER DOOR LOCK DRIVER CIRCUIT OPEN

Measure the resistance of the (P930) Driver Door Lock Driver circuit between the TIPM C6 connector and the Driver Door Latch connector.

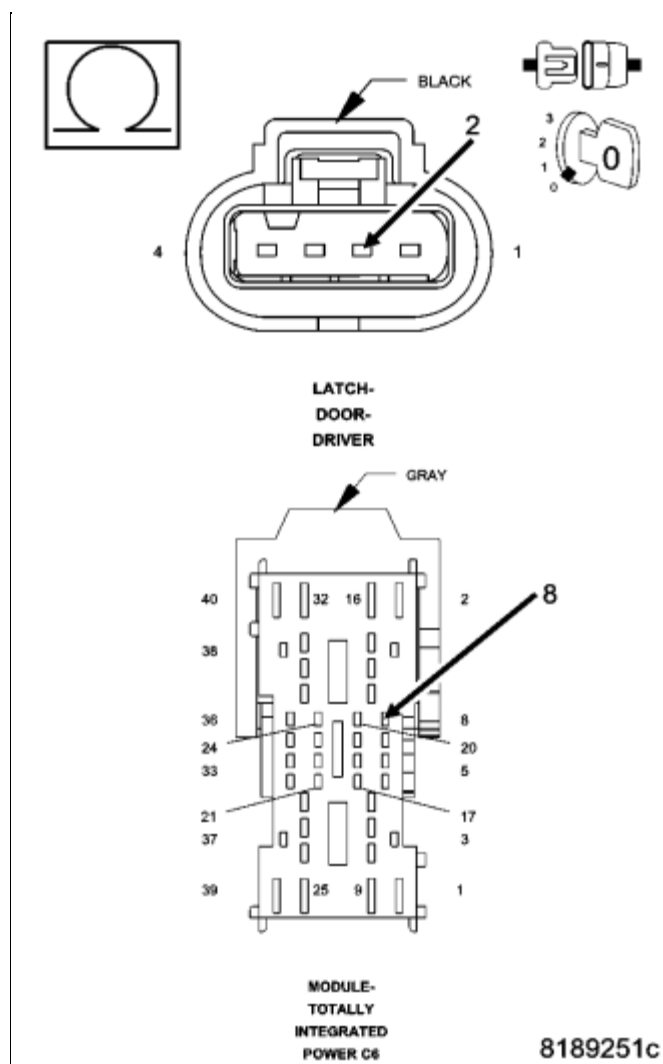
Is the resistance below 2.0 ohms?

Yes

- Go To [5](#)

No

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to the latch connector to determine if the wire is open in the door harness or the instrument panel harness. Repair the (P930) Driver Door Lock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



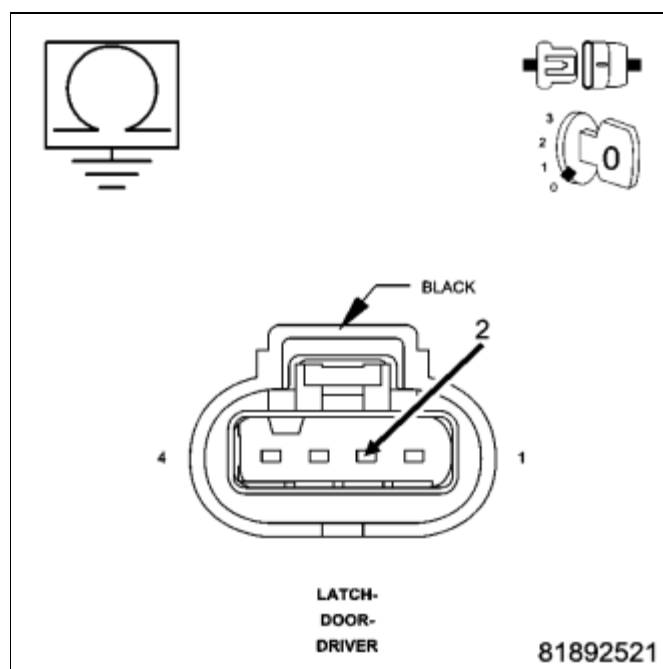
5. CHECK (P930) DRIVER DOOR LOCK DRIVER CIRCUIT SHORT TO GROUND

Measure the resistance between Ground and the (P930) Driver Door Lock Driver circuit.

Is the resistance below 1000.0 ohms?

Yes

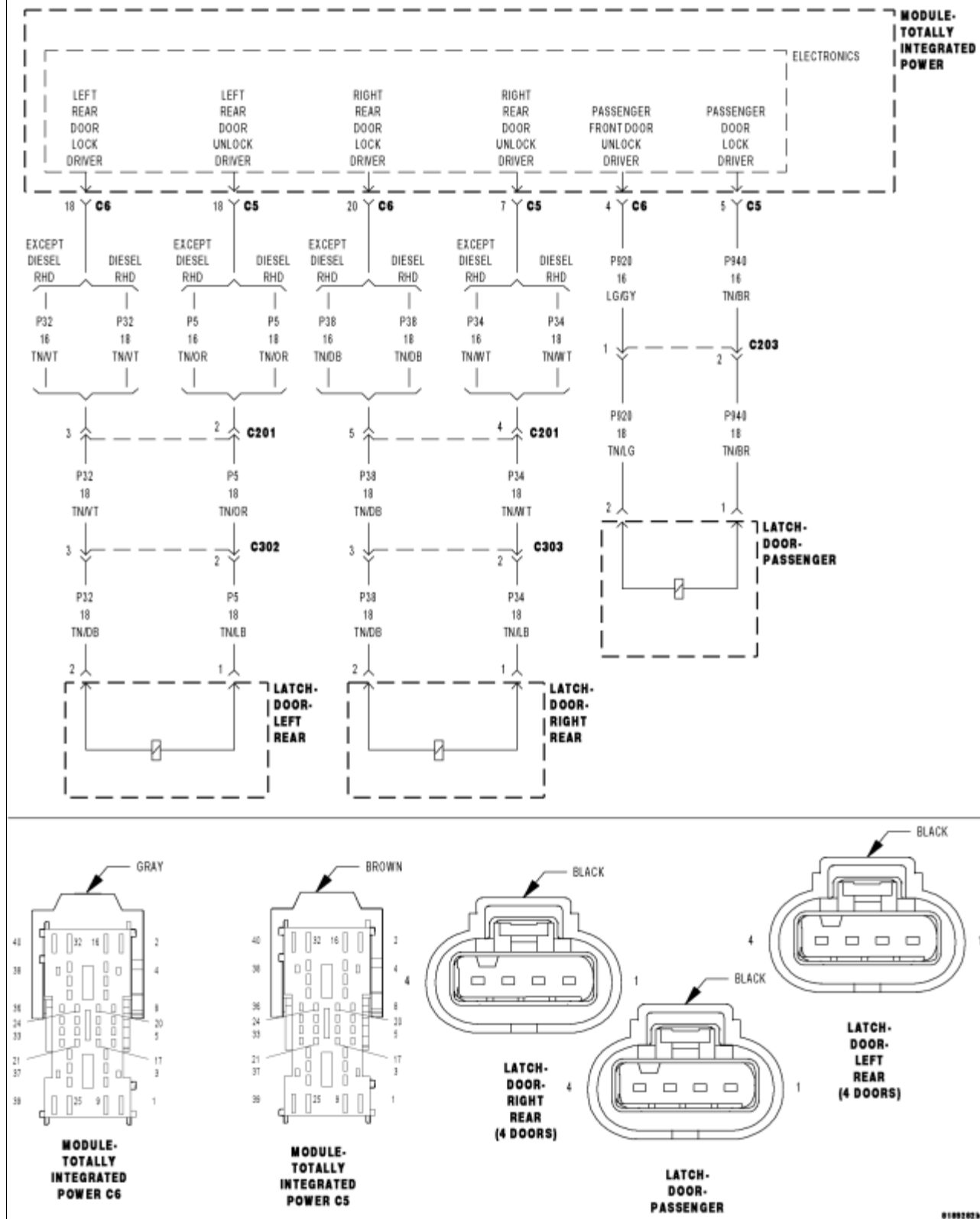
- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to ground to determine if the wire is shorted in the door harness or the instrument panel harness. Repair the (P930) Driver Door Lock Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE

***ONE PASSENGER DOOR LOCK INOPERATIVE**



For a complete wiring diagram **Refer to Section 8W.**

(P32), (P38) OR (P920) DOOR LOCK DRIVER CIRCUIT OPEN
(P32, (P38) OR (P920) DOOR LOCK DRIVER CIRCUIT SHORT TO GROUND
(P5), (P34) OR (P940) DOOR UNLOCK DRIVER CIRCUIT OPEN
(P5), (P34) OR (P940) DOOR UNLOCK DRIVER CIRCUIT SHORT TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)
DOOR LATCH

Diagnostic Test

1. PASSENGER DOOR LATCH INOPERATIVE

NOTE: Graphics in this test show Left Rear Latch but the other 2 passenger latches are similar.

Turn the ignition off.

Disconnect the inoperative Passenger Door latch connector.
Connect a test light between the Door Lock Driver circuit
and the Door Unlock Driver circuit.

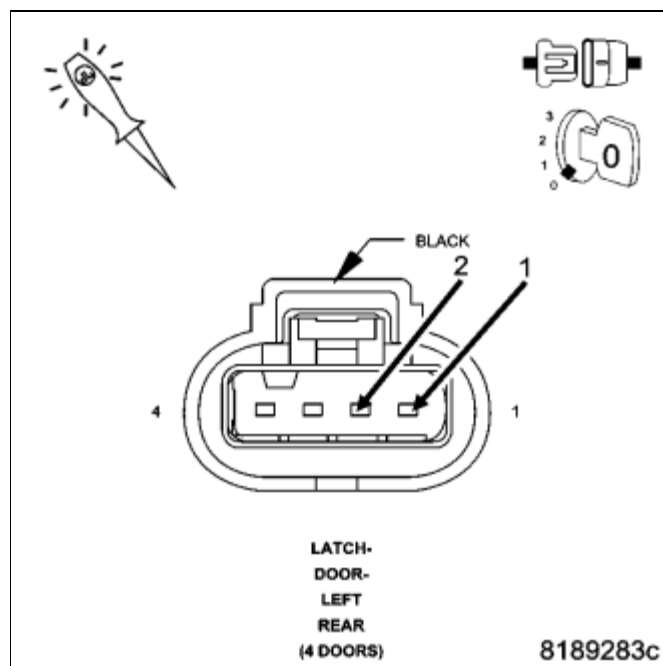
Close the front doors or trip the door latches to the closed
position.

Operate the door locks in both positions and observe the test
light.

**Does the test light illuminate brightly for approximately
300 ms. when the door locks are actuated?**

Yes

- Replace the Passenger Door Latch Assembly.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



No

- Go To [2](#)

PASSENGER DOOR UNLOCK DRIVER CIRCUIT OPEN

2.

Turn the ignition off.
 Disconnect the TIPM C5 connector.
 Measure the resistance of the appropriate Door Unlock Driver circuit between the Latch connector and the TIPM C5 connector.

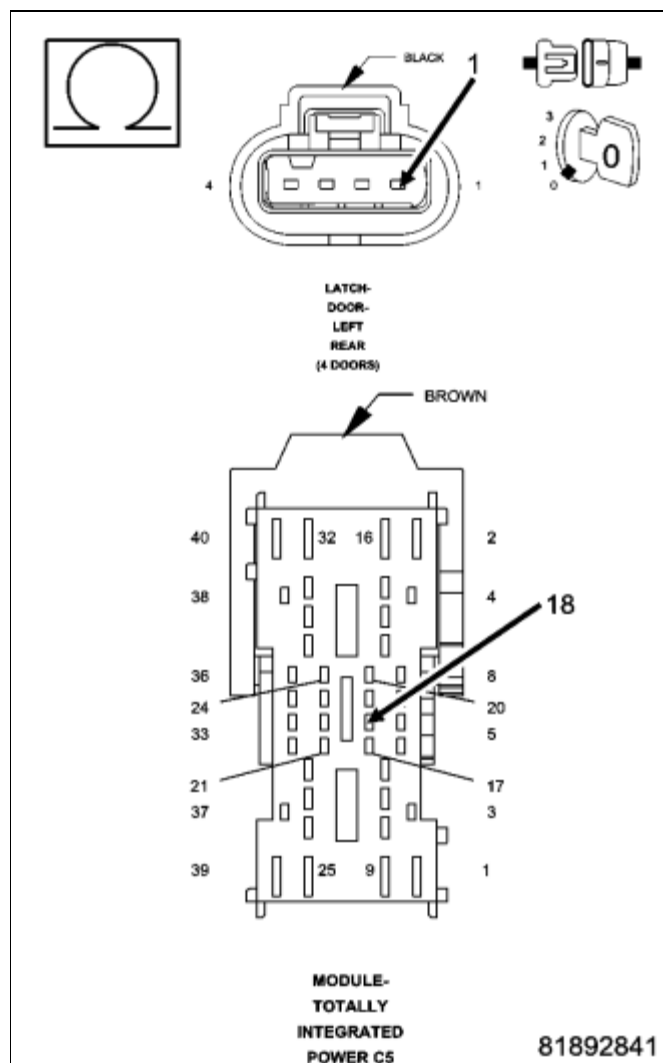
Is the resistance below 2.0 ohms?

No

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to the latch connector to determine if the wire is open in the door harness or the instrument panel harness. Repair the appropriate Door Unlock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



3. PASSENGER DOOR UNLOCK DRIVER CIRCUIT SHORT TO GROUND

Measure the resistance between Ground and the appropriate Door Unlock Driver circuit.

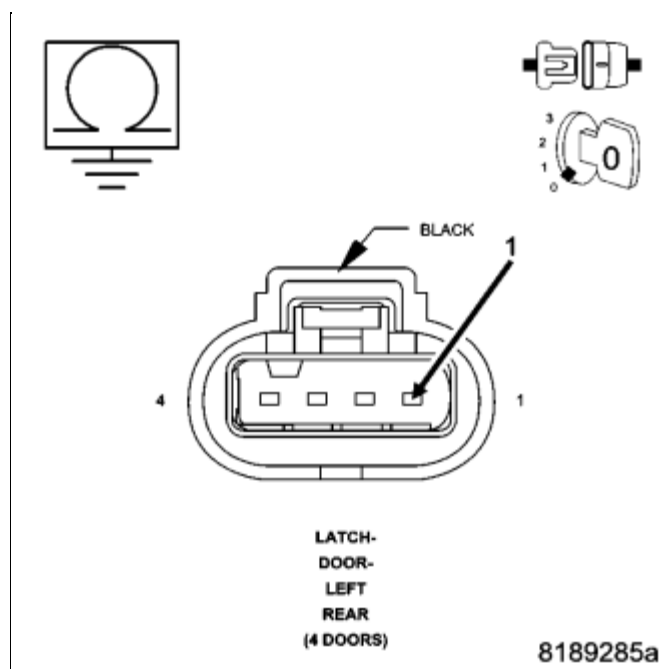
Is the resistance below 1000.0 ohms?

Yes

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to ground to determine if the wire is shorted in the door harness or the instrument panel harness. Repair the appropriate Door Unlock Driver circuit for

a short to ground.

- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



No

- Go To [4](#)

4. PASSENGER DOOR LOCK DRIVER CIRCUIT OPEN

Disconnect the TIPM C6 connector.

Measure the resistance of the appropriate Door Lock Driver circuit between the TIPM C6 connector and the appropriate Door Latch connector.

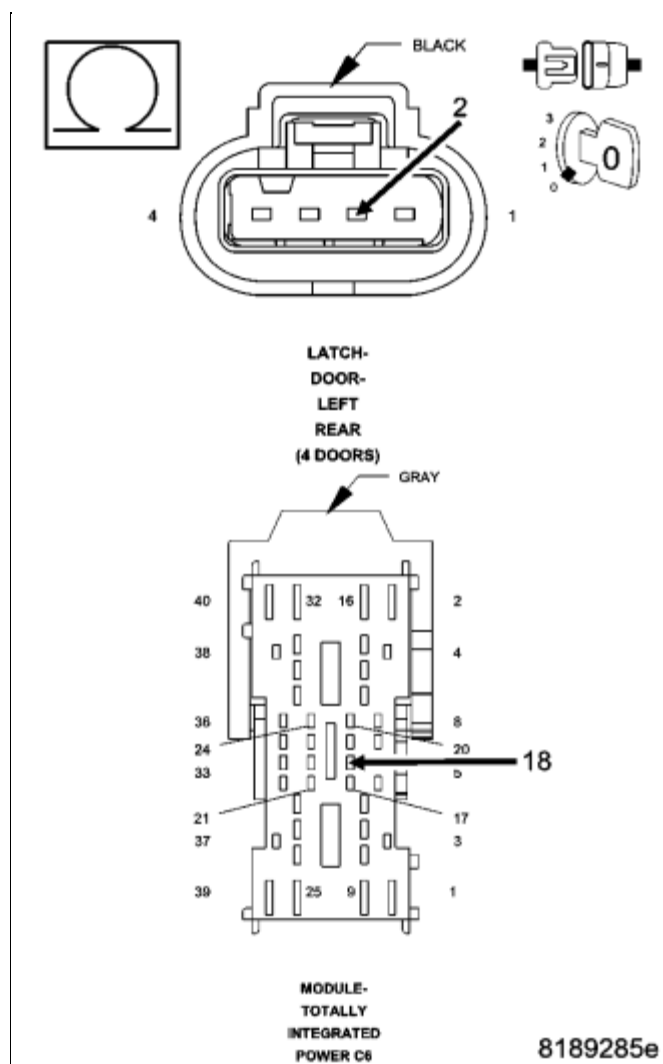
Is the resistance below 2.0 ohms?

Yes

- Go To [5](#)

No

- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to the latch connector to determine if the wire is open in the door harness or the instrument panel harness. Repair the appropriate Door Lock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



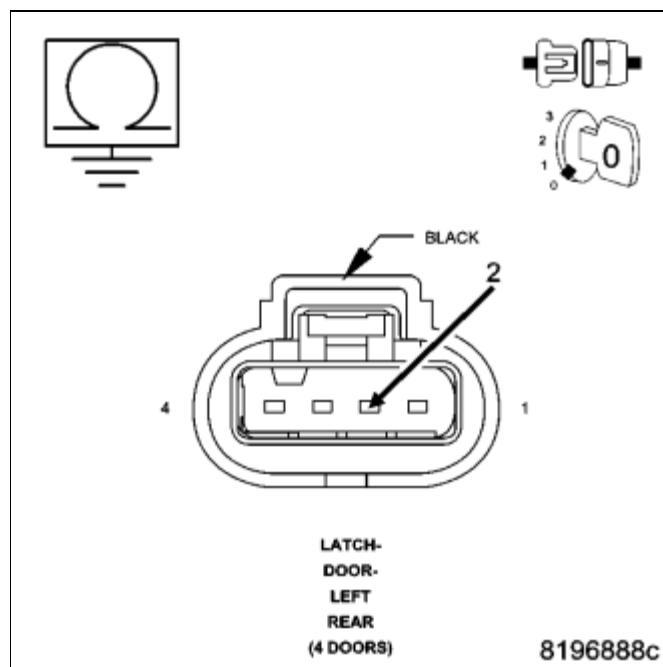
5. PASSENGER DOOR LOCK DRIVER CIRCUIT SHORT TO GROUND

Measure the resistance between Ground and the appropriate Door Lock Driver circuit.

Is the resistance below 1000.0 ohms?

Yes

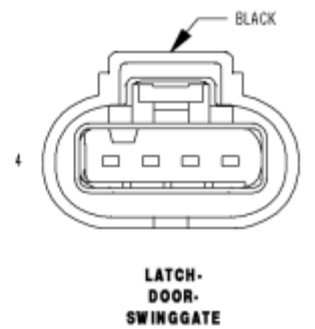
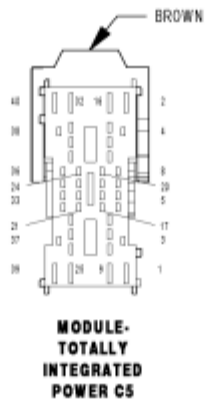
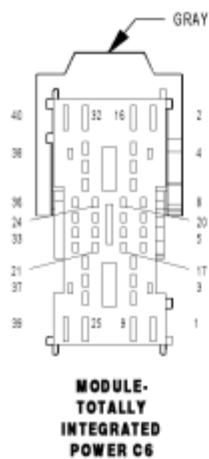
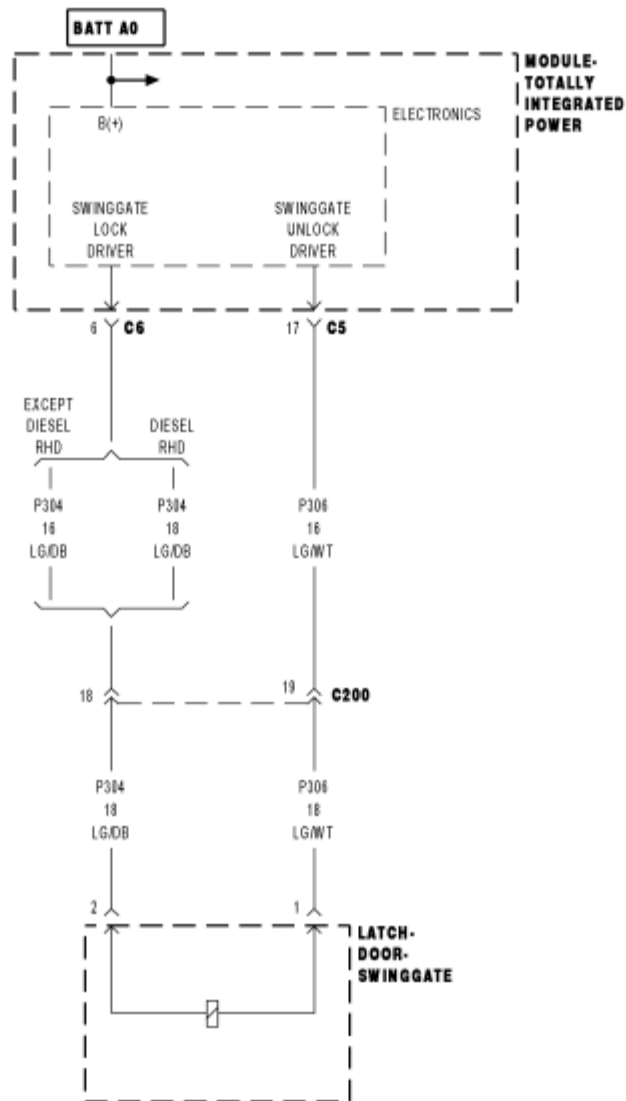
- Using the wiring diagram/schematic as a guide, measure the circuit from the in-line door harness connector to ground to determine if the wire is shorted in the door harness or the instrument panel harness. Repair the appropriate Door Lock Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

***SWING GATE LOCK INOPERATIVE**



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For a complete wiring diagram **Refer to Section 8W.**

(P304) SWIING GATE LOCK DRIVER CIRCUIT OPEN
(P304) SWING GATE LOCK DRIVER CIRCUIT SHORT TO GROUND
(P306) SWING GATE UNLOCK DRIVER CIRCUIT OPEN
(P306) SWING GATE UNLOCK DRIVER CIRCUIT SHORT TO GROUND
SWING GATE LATCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. SWING GATE LATCH INOPERATIVE

Disconnect the Swing Gate Latch connector.
 Connect a test light between the (P304) Swing Gate Lock Driver circuit and the (P406) Swing Gate Unlock Driver circuit.
 Close the front doors or trip the front door latches to the closed position.
 Operate the door locks in both positions and observe the test light.

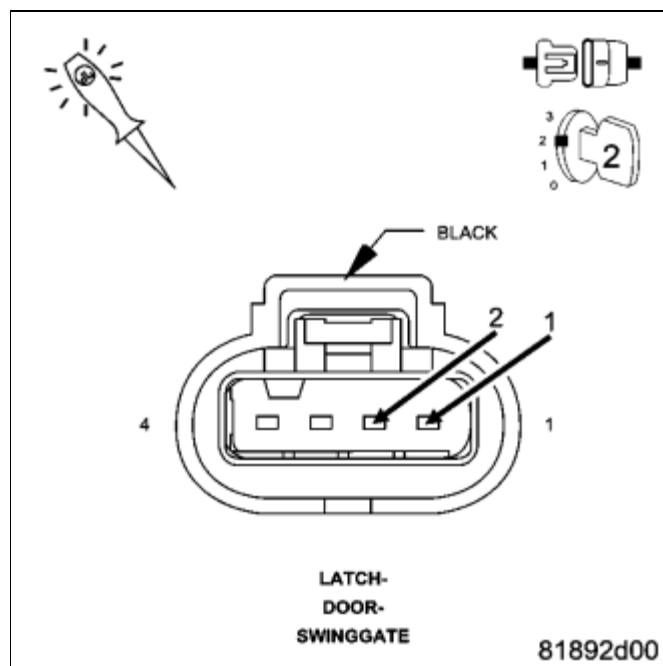
Does the test light illuminate brightly for approximately 300 ms. when the door locks are actuated?

Yes

- Replace the Swing Gate Latch.
- Perform BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)



2. (P306) SWING GATE UNLOCK DRIVER CIRCUIT OPEN

Turn the ignition off.
 Disconnect the TIPM C5 connector.
 Measure the resistance of the (P306) Swing Gate Unlock Driver circuit between the Latch connector and the TIPM C5 connector.

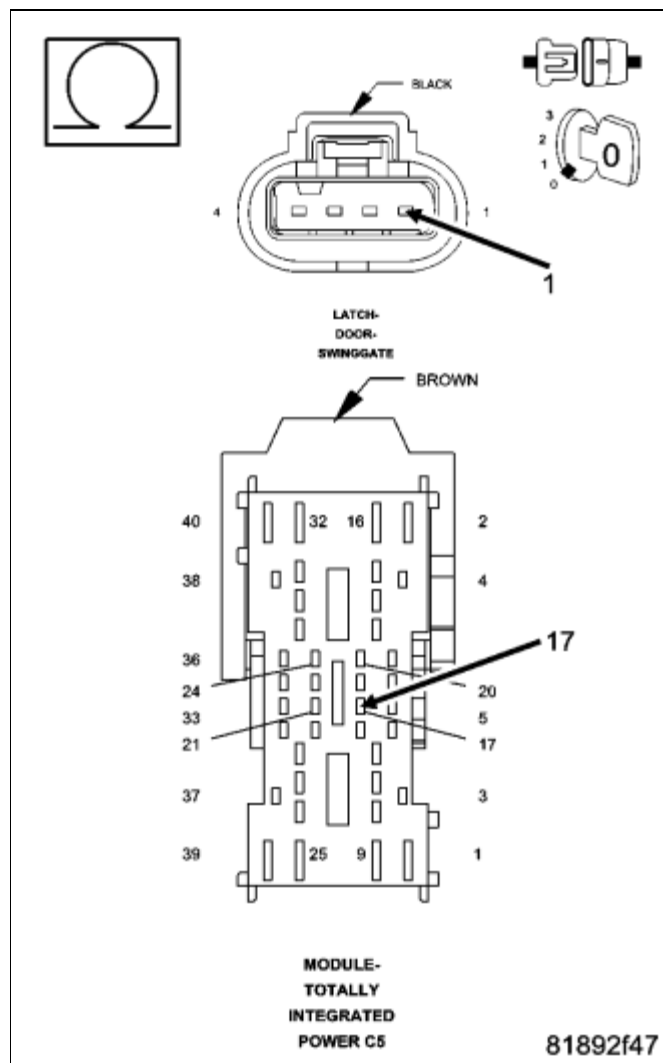
Is the resistance below 2.0 ohms?

No

- Repair the (P306) Swing Gate Unlock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

Yes

- Go To [3](#)



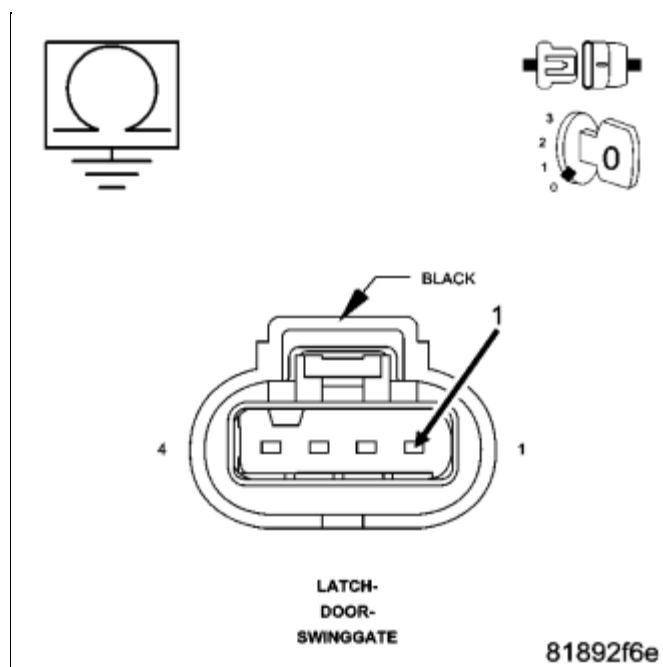
3. (P306) SWING GATE UNLOCK DRIVER CIRCUIT SHORT TO GROUND

Measure the resistance between Ground and the (P306) Swing Gate Unlock Driver circuit.

Is the resistance below 1000.0 ohms?

Yes

- Repair the (P306) Swing Gate Unlock Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



No

- Go To [4](#)

4. (P304) SWING GATE LOCK DRIVER CIRCUIT OPEN

Disconnect the TIPM C6 connector.
Measure the resistance of the (P304) Swing Gate Lock Driver circuit between the TIPM C6 connector and the Swing Gate Latch connector.

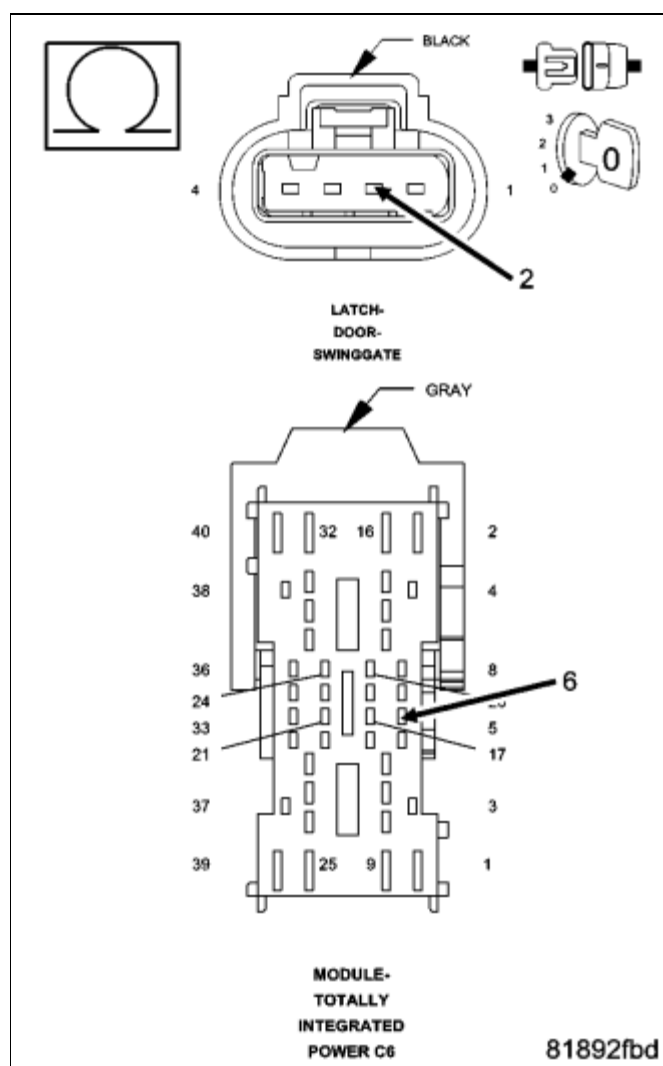
Is the resistance below 2.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (P304) Swing Gate Lock Driver circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. (P304) SWING GATE DOOR LOCK DRIVER CIRCUIT SHORT TO GROUND

Measure the resistance between Ground and the (P304) Swing Gate Lock Driver circuit.

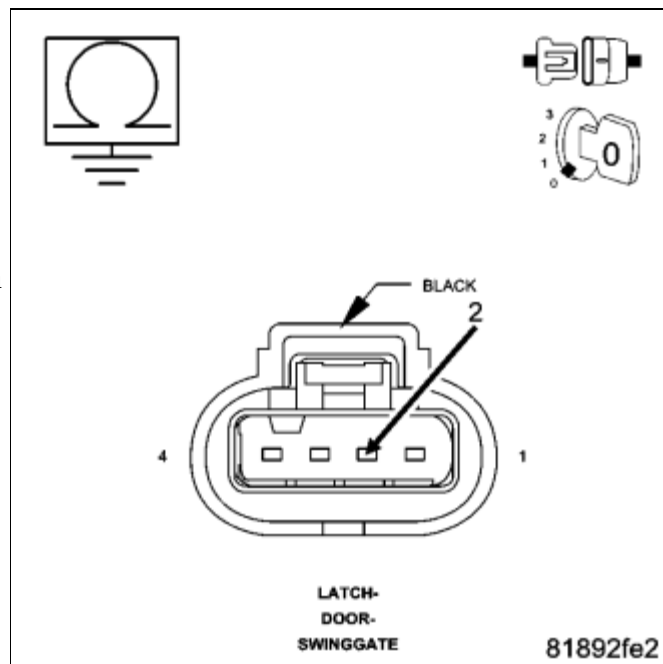
Is the resistance below 1000.0 ohms?

Yes

- Repair the (P304) Swing Gate Lock Driver circuit for a short to ground.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



POWER LOCKS

POWER LOCKS

DESCRIPTION

POWER LOCKS

The power lock system allows all of the doors and the liftgate to be locked or unlocked electrically by operating a switch on either front door trim panel. The power lock system receives non-switched battery current through a fuse in the Fuse Block, so that the power locks remain operational, regardless of the ignition switch position.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences.

The power lock system for this vehicle can also be operated remotely using the available Remote Keyless Entry (RKE) system Radio Frequency (RF) transmitters, if equipped.

Certain functions and features of the power lock system rely upon resources shared with other electronic modules in the vehicle over the Controller Area Network (CAN) data bus network. For proper diagnosis of these electronic modules or of the CAN data bus network, the use of a scan tool and the appropriate diagnostic information are required.

CHILD PROTECTION LOCKS

To provide a safer environment for children riding in the rear seat, the rear doors have the “child protection” door lock system.

The child protection locks are on the rear doors only. The lock, when engaged, will disable the inside door handle from opening the door. The lock is part of the latch/lock assembly.

DOOR LOCK INHIBIT

With the key in the ignition switch and the driver door open, the Sentry Key Remote Entry Module (SKREEM) will ignore the command to lock the power door locks using the interior door lock switches. Once the key is removed, or the drivers door is closed, the RKE module will allow the power locks to lock using the door lock switch.

REMOTE KEYLESS ENTRY

The remote keyless entry system allows locking and unlocking of the vehicle door(s) liftgate, panic alarm and arming or disarming of the vehicle theft security system (if equipped), using the hand held (RF) transmitter .

The module may receive signals from up to four transmitters. Each transmitter has its own code, and the code is programmed and stored into the module memory. If a transmitter is replaced or additional transmitters are added, the codes for all units have to be reprogrammed into the SKREEM. If a module is replaced, the transmitter codes must be stored in the new memory (by performing the steps for programming transmitters). The SKREEM is capable of retaining all transmitter codes when power is removed from the module.

OPERATION

POWER LOCKS

All doors can be locked or unlocked mechanically and independently with their respective locking knobs. The front doors can also be unlocked by actuation of the inside remote door handle.

CENTRAL LOCKING/UNLOCKING (IF EQUIPPED)

The door locks can be locked or unlocked electrically via the exterior door key cylinders to provide the central locking/unlocking feature. The central locking/unlocking feature incorporates a customer programmable "Double activation unlock" feature which operates in the following manner: When enabled, the first turn of the key cylinder to the UNLOCK position (toward the front of the vehicle) will mechanically unlock the door whose key cylinder is being turned. A second turn of the key cylinder to the UNLOCK position (within five seconds of the first turn) will cause all vehicle doors and liftgate to unlock electrically. When this feature is disabled, all vehicle doors and liftgate will be unlocked electrically upon the first turn of a key cylinder to the UNLOCK position.

The vehicle is locked electrically by turning the key cylinder to the LOCK position once, regardless of the state of the double activation unlock feature.

REMOTE KEYLESS ENTRY

The transmitter has three buttons for operation: LOCK, UNLOCK and PANIC.

- Pressing the UNLOCK button will unlock the driver side door, flash the park lamps twice and enable illuminated entry. Pressing and releasing the button once will unlock the driver side door. Pressing and releasing the button two times within a five second interval will unlock all doors.
- Pressing the LOCK button will cause the horn to sound a short chirp (if enabled) and flash the park lamps to notify that the all door lock signal was received and set. Illuminated entry is cancelled and the interior lamps are faded to off.
- Pressing the PANIC button will cause the panic alarm to sound for three minutes, until the PANIC button is pressed a second time, or the vehicle reaches a speed of 25.7 Km/h (15 mph). The receiver is capable of retaining a Vehicle Access Code (VAC) even when power is removed. Each Remote Keyless Entry (RKE) module must have at least one and no more than four transmitters.

ROLLING DOOR LOCKS

When the rolling door lock system is enabled, the RKE module will automatically lock all the vehicle doors and liftgate when all of the following conditions are met:

- All doors are closed
- The vehicle speed exceeds 25.7 Km/h (15 +/- 1 mph).
- The throttle position sensor tip-in is greater than 10 +/- 2 degrees.

The RKE module will automatically re-lock all doors if the above conditions are met and if any of the doors become ajar and then closed again.

The enabling/disabling of the rolling door lock feature is customer programmable, as well as programmable with the scan tool.

The power lock motors are also equipped with a thermal protection system which prevents the motors from burning out. The motors may chatter if they are continuously activated.

DIAGNOSIS AND TESTING

POWER LOCKS

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures manual. The scan tool can provide confirmation that the Control Area Network (CAN) is functional, that all of the electronic modules are sending and receiving the proper messages on the CAN data bus, and that the power lock motors are being sent the proper hard wired outputs by the relays for them to perform their power lock system functions.

STANDARD PROCEDURE

STANDARD PROCEDURE - DOUBLE ACTIVATION UNLOCK

The toggling of the double activation unlock feature (between enabled and disabled) can be performed with the use of the scan tool, or by the customer.

SCAN TOOL PROGRAMMING

When using the scan tool, select:

1. "CCN"
2. "Miscellaneous Functions" and then the desired function.

CUSTOMER PROGRAMMING

1. Open the driver door, sit in the driver seat, and close the driver door.
2. Turn the ignition switch to the RUN position (without starting the vehicle) and then back to OFF. Repeat this step three additional times (for a total of four key ON/OFF cycles).
3. Within 10 seconds of switching the ignition switch to the OFF position for the last time (at the end of the fourth cycle in the above step), press the driver interior door lock switch to UNLOCK.
4. A single chime will be heard to verify that the customer programmable toggle of the double activation unlock was successfully completed.

Steps 2 and 3 must be completed within 10 seconds.

NOTE: When toggling the double activation unlock feature (customer programmable), the toggle that happens will be from the last state of the double activation unlock. If the double activation unlock feature was enabled, after the toggle process, it will now be disabled and vice versa. There is no telltale to inform you of which state the double activation unlock feature is in.

STANDARD PROCEDURE - ROLLING DOOR LOCKS

The toggling of the rolling door lock feature (between enabled and disabled) can be performed with the use of the scan tool or by the customer.

SCAN TOOL PROGRAMMING

When using the scan tool, select:

1. "Theft Alarm"
2. "VTSS"
3. "Miscellaneous" and then the desired function.

CUSTOMER PROGRAMMING

1. Open the driver door, sit in the driver seat, and close the driver door.
2. Turn the ignition switch to the RUN position (without starting the vehicle) and then back to OFF. Repeat this step three additional times (for a total of four key ON/OFF cycles).
3. Within 10 seconds of switching the ignition switch to the OFF position for the last time (at the end of the

fourth cycle in the above step), press the driver interior door lock switch to LOCK.

4. A single chime will be heard to verify that the customer programmable toggle of the rolling door locks was successfully completed.

Steps 2 and 3 must be completed within 10 seconds.

NOTE: When toggling the rolling door locks (customer programmable), the toggle that happens will be from the last state of the rolling door locks. If the rolling door locks were enabled, after the toggle process, they will now be disabled and vice versa. There is no telltale to inform you of which state the rolling door locks are in.

DOOR LOCK SWITCH

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Disconnect wire connector to door lock switch.
4. Remove the switch from trim panel.

INSTALLATION

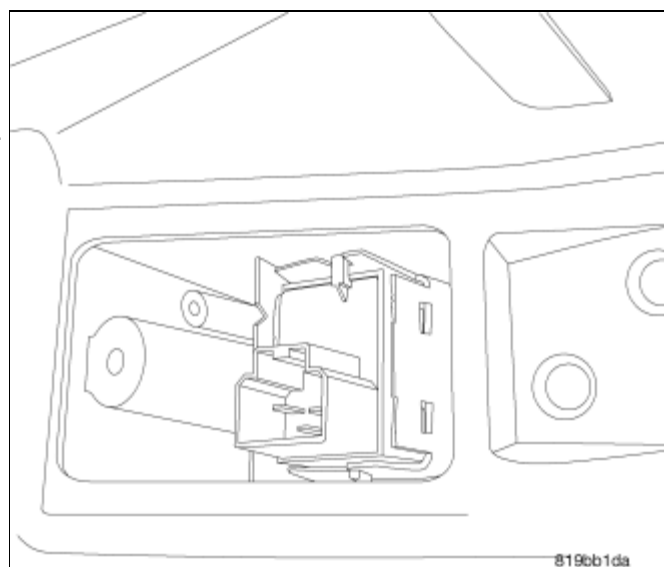
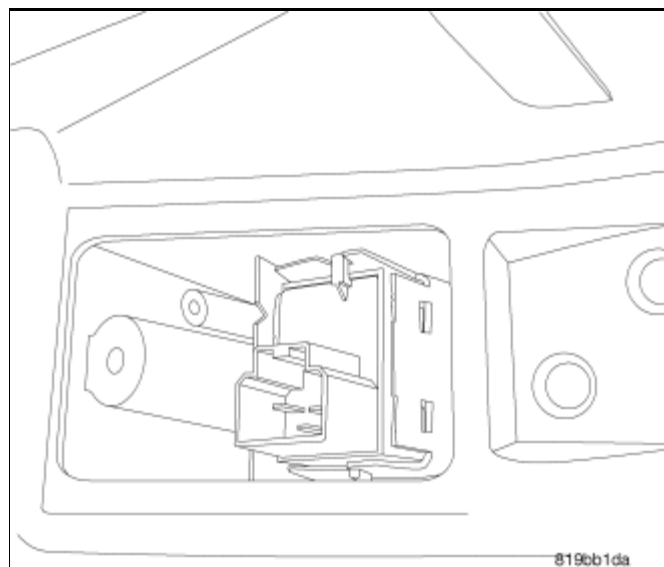
1. Install the switch on trim panel.
2. Connect wire connector to door lock switch.
3. Install front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect the battery negative cable.

DOOR LOCK MOTOR

DESCRIPTION

The lock mechanisms are actuated by a reversible electric motor mounted within each door and tailgate. The power lock motors are integral to the door latch units.

The power lock motors cannot be adjusted or repaired and, if inoperative or damaged, the door latch unit must



be replaced.

OPERATION

The door lock motors are controlled by relays. A positive and negative battery connection to the two motor terminals will cause the motor to move in one direction. Reversing the current will cause the motor to move in the opposite direction.

DIAGNOSIS AND TESTING

DOOR LOCK MOTOR

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures manual.

Refer to the appropriate wiring information.

1. Make certain battery is in normal condition and fuses powering the RKE module aren't blown before circuits are tested.
2. To determine which motor is inoperative, check each individual door for electrical lock and unlock or disconnect the motor connectors one at a time, while operating the door lock switch.
3. In the event that none of the motors work, the problem maybe caused by a shorted motor, a bad switch or a bad relay internal to the RKE module. Disconnecting a defective motor will allow the others to work.
4. To test an individual door lock motor, disconnect the electrical connector from the motor.
5. To lock the door, connect a 12 volt power source to one pin of the lock motor and a ground wire to the other pin.
6. To unlock the door, reverse the wire connections at the motor pin terminals.
7. If these results are NOT obtained, replace the motor.

REMOTE KEYLESS ENTRY MODULE

DIAGNOSIS AND TESTING

REMOTE KEYLESS ENTRY MODULE

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures manual.

Refer to the appropriate wiring information.

REMOVAL

(Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/SENTRY KEY REMOTE ENTRY MODULE - REMOVAL)

INSTALLATION

(Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/SENTRY KEY REMOTE ENTRY MODULE -

INSTALLATION)

REMOTE KEYLESS ENTRY TRANSMITTER**DESCRIPTION**

The transmitter has three buttons for operation. They are **LOCK**, **UNLOCK**, and **PANIC**.

OPERATION

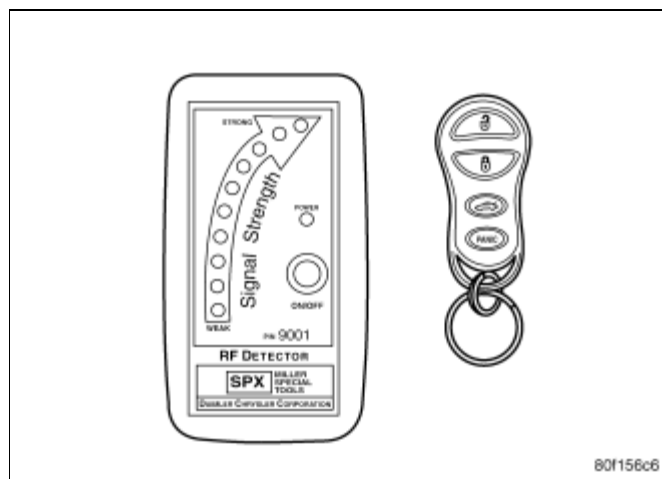
- The **UNLOCK** button will unlock the driver door, flash the Park lamps twice and enable illuminated entry. Pushing and releasing the button once will unlock the driver door. Pushing and releasing the button two times within a five second period will unlock all doors (double unlock activation enabled).
- Upon pressing the **LOCK** button, the horn will sound a short chirp (if enabled) and flash the park lamps to notify that the all door lock signal was received and acted upon. Illuminated entry is cancelled and the interior lamps are faded to off.
- Pushing the **PANIC** button will cause the panic alarm to sound for three minutes, until the panic button is pressed a second time, or until the vehicle reaches a speed of 15 m/ph (24 k/ph).



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DIAGNOSIS AND TESTING**REMOTE KEYLESS ENTRY TRANSMITTER**

Using special tool 9001, first test to ensure that the transmitter is functioning. Typical testing distance is 2.5 centimeters (1 inch) for Asian transmitters and 30.5 centimeters (12 inches) for all others. To test, position the transmitter as shown. Press any transmitter button, then test each button individually. The tool will beep if a radio signal strength that lights five or more LED's is detected. Repeat this test three times. If transmitter fails any of the test refer to the Diagnostic Procedures manual.

STANDARD PROCEDURE**STANDARD PROCEDURE - HORN**

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CHIRP TOGGLE

The toggling of the horn chirp (between enabled and disabled) can be performed with the use of the scan tool or by the customer.

SCAN TOOL PROGRAMMING

When using the scan tool, select:

1. "TIPM"
2. "Miscellaneous Functions" and then the desired function.

CUSTOMER PROGRAMMING

Using a transmitter programmed to the Sentry Key Remote Entry Module, the status of the horn chirp may be toggled by the customer.

NOTE: The SKREEM is responsible for keeping track of the horn chirp status; thus this procedure does not need to be repeated for each transmitter programmed to the system.

1. With the ignition switch in RUN position, press and hold the transmitter UNLOCK button for a minimum of 4 seconds to a maximum of 10 seconds.
2. While holding the UNLOCK button for 4-10 seconds, press the LOCK button. A chime will be heard to indicate a successful toggle, at which time both buttons may be released.

STANDARD PROCEDURE - TRANSMITTER PROGRAMMING

New Remote Keyless Entry (RKE) transmitters can be programed using the scan tool and the proper Diagnostic Procedures manual, if no functioning transmitter is available.

The following procedure can be used as long as one functioning transmitter is available:

1. Insert the key into the ignition switch, and turn the ignition switch to the RUN position (without starting the vehicle).
2. Using the RKE transmitter programmed to the RKE module, press and continuously hold down the UNLOCK button for 4-10 seconds.
3. Within the 4-10 second time range, continue to hold the UNLOCK button and press the PANIC button. Both buttons may then be released. Upon the PANIC button being depressed, the message for customer programming mode will be transmitted to the RKE module.
4. A chime will be heard to verify that the customer programming mode has been entered.
5. Press and release any button on each transmitter that is to be programmed to the RKE module, including any transmitters which were previously programmed to the RKE module (with a maximum of four possible). After each transmitter is successfully programmed, a chime will be heard to verify that successful programming of the transmitter has occurred.
6. After 30 seconds, or upon the ignition switch being turned OFF, a chime will indicate that the RKE module has exited the programming mode.

STANDARD PROCEDURE - RKE TRANSMITTER BATTERIES

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

1. Using a thin coin, gently pry at the notch in the center seam of the RKE transmitter case halves near the key ring until the two halves unsnap.
2. Lift the back half of the transmitter case off of the RKE transmitter.
3. Remove the two batteries from the RKE transmitter.
4. Replace the two batteries with new Panasonic 2016, or equivalent. Be certain that the batteries are installed with their polarity correctly oriented.
5. Align the two RKE transmitter case halves with each other, and squeeze them firmly and evenly together until they snap back into place.

SPECIFICATIONS - TRANSMITTER RANGE

Normal operation range is within 7 meters (23 ft.) of the vehicle. Range may be better or worse depending on the environment around the vehicle.

POWER MIRRORS - SERVICE INFO

AUTOMATIC DAY / NIGHT MIRROR

DESCRIPTION

The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system will automatically change the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and will only operate when the ignition switch is in the ON position.

Contained within the mirror is a compass/temperature display as well as two LED reading lamps.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is inoperative or damaged, the entire automatic day/night inside rear view mirror unit must be replaced.

OPERATION

The automatic day/night mirror is equipped with three buttons: the left switch for the left LED lamp, the right switch for the right side LED lamp and the center switch for the compass/temperature function. Pressing the left and right switch simultaneously will turn the auto dim function on or off. A green light next to the right button will indicate when the dimming feature is activated. The mirror also senses the backup lamp circuit, and will automatically disable its self-dimming feature whenever the transmission gear selector is in the Reverse position.

The compass/temperature display provides the outside temperature and one of eight compass headings. Press and release the center button once within 3 seconds to display compass/temperature (Fahrenheit). Press and release the center button twice within 3 seconds to display compass/temperature (Celsius). Press and release the center button three times within 3 seconds to deactivate the feature.

A thin layer of electrochromatic material between two pieces of conductive glass make up the face of the mirror. Two photocell sensors are used to monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward, to detect the outside light levels. The headlamp sensor is located on the mirror

housing just to the left of the switch and facing rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

DIAGNOSIS AND TESTING

AUTOMATIC DAY/NIGHT MIRROR

For complete circuit diagrams, refer to the appropriate wiring information.

1. Check for a blown fuse. If OK, go to [STEP 2](#). If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the ON position. Check for battery voltage at the fuse. If OK, go to [STEP 3](#). If not OK, repair the open circuit to the ignition switch as required.
3. Turn the ignition switch to the OFF position. Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the automatic day/night mirror. Connect the battery negative cable. Turn the ignition switch to the ON position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to [STEP 4](#). If not OK, repair the open circuit as required.
4. Turn the ignition switch to the OFF position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the automatic day/night mirror wire harness connector and a good ground. There should be continuity. If OK, go to [STEP 5](#). If not OK, repair the circuit to ground as required.
5. Connect the battery negative cable. Turn the ignition switch to the ON position. Set the parking brake. Place the transmission gear selector lever in the REVERSE position. Check for battery voltage at the backup lamp switch output circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to [STEP 6](#). If not OK, repair the open circuit as required.
6. Turn the ignition switch to the OFF position. Disconnect the battery negative cable. Plug in the automatic day/night mirror wire harness connector. Connect the battery negative cable. Turn the ignition switch to the ON position. Place the transmission gear selector lever in the Neutral position. Place the mirror switch in the ON (the LED in the mirror switch is lighted) position. Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

7. Shine a light into the rearward facing headlamp photocell sensor. The mirror glass should darken. If OK, go to [STEP 8](#). If not OK, replace the faulty automatic day/night mirror unit.
8. With the mirror glass darkened, place the transmission gear selector lever in the REVERSE position. The mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

STANDARD PROCEDURE

COMPASS CALIBRATION

AUTOMATIC CALIBRATION

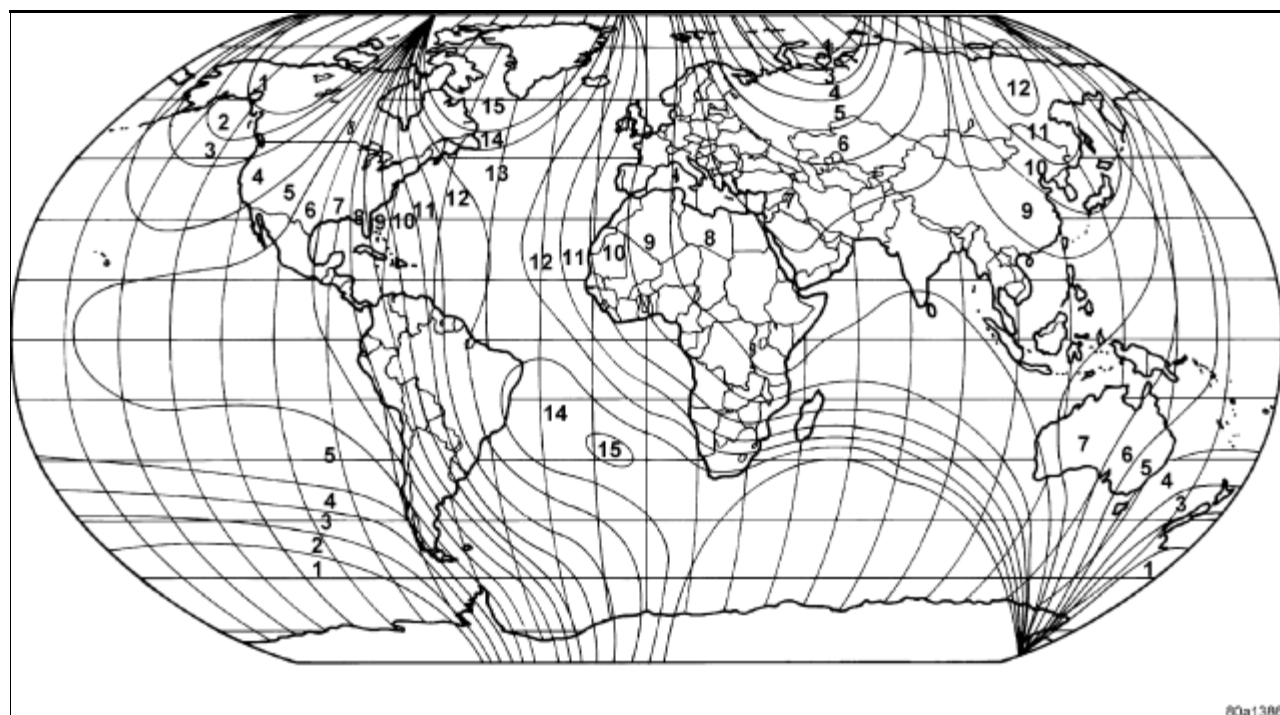
The compass is self calibrating which eliminates the need to manually set the compass. When the vehicle is new, the compass may appear erratic and CAL will be displayed. After completing one 360° turn with the vehicle traveling less than 8 km/h (5 mph) in an area free from large metal or metallic objects, CAL will turn off and the compass will function normally.

MANUAL CALIBRATION

If the compass appears erratic and CAL does not appear, you must manually put the compass into the calibration mode. To ensure proper compass calibration, make sure the compass variance is properly set before manually calibrating the compass.

To put the compass into calibration mode: Turn the ignition to the ON position. Press and hold the center button for 6 seconds to change the display between VAR (compass variance) and CAL (compass calibration) modes. To recalibrate the compass, CAL should display for a complete 1 1/2 360° turns in a area free from large metal objects or power lines. When the compass has been calibrated, the CAL symbol will turn off and the compass will function normally.

COMPASS VARIATION ADJUSTMENT



Compass variance is the difference between magnetic north and geographic north. In some areas of the country, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this occurs, the compass variance must be set according to the compass variance map.

To set the variance: Turn the ignition to the ON position. Press and hold the center button for 3 to 6 seconds. The last variance zone number will be displayed. Each press of the center button will select a new variance zone. When the proper zone is selected, wait 5 seconds to resume normal operation.

POWER WINDOWS - SERVICE INFORMATION

POWER WINDOWS - SERVICE INFORMATION

DESCRIPTION

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on the instrument panel or center console (sedan only). The front window switch allows the front occupants to lock out the individual rear switches from operation. The power window system receives battery feed through a circuit breaker in the fuse block, only when the ignition switch is in the ON position.

In each door of the convertible there is a window regulator module directly connected to each of the front door window regulator motors. The modules control window motor operation and smart glass functions. The driver window module controls the convertible top operations.

The power window system includes the power window switches on the instrument panel and center console (sedan only), the circuit breaker in the fuse block, and the power window motors.

OPERATION

The front and rear window lift motors are of the permanent magnet type. A battery positive and negative connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction.

On convertible vehicles, the convertible top switch is hard wired to both window regulator modules by the Power Top Switch Mux circuit. When a top operation input is received by the driver window module, it will ground the respective relay control circuit which in turn will operate the motor. If the convertible top switch is pressed and held to the down position second detent, it will command both modules to drop all windows to the fully down position. The windows cannot be raised when the convertible top switch is in the top down position. When the switch is held in the top up position and all four windows are fully up, the modules will lower the respective front window 40 mm (1.6 in), lower the respective rear window approximately 55 mm (2 in) and the driver window module will ground the top up relay control circuit. Once the top is back up the windows will not raise automatically.

Each individual motor is grounded through their respective switch.

DIAGNOSIS AND TESTING

POWER WINDOWS

WIRING VOLTAGE TEST

The following wiring test determines whether or not voltage is continuous through the body harness to the front switch.

1. Remove the power window switch and bezel.
2. Disconnect wire connector from back of power window switch.

3. Switch ignition to the ON position.
4. Connect the clip end of a 12 volt test light to Pin 4 of the window switch harness connector. Touch the test light probe to Pin 3.
 - If the test light illuminates, the wiring circuit between the battery and switch is OK.
 - If the lamp does not illuminate, first check 30 amp circuit breaker in the fuse block. If circuit breaker is OK, then check for a broken wire.

For complete circuit diagrams, refer to the appropriate wiring information.

POWER WINDOW MOTOR TEST

If the power window motor is receiving proper current and ground and does not operate, proceed with motor test.

For complete circuit diagrams, refer to the appropriate wiring information.

1. Remove front door trim panel as necessary to gain access to power window motor wire connector.
2. Disconnect power window motor wire connector from door harness.
3. Using two jumper wires, connect one to a battery (+) source and the other to a good ground (-).
4. Connect the Negative (-) jumper probe to one of the motor connector terminals.
5. Momentarily touch the Positive (+) jumper probe to the other motor connector terminal.

When positive probe is connected the motor should rotate in one direction to either move window up or down. If window is all the way up or down the motor will grunt and the inner door panel will flex when actuated in that one direction.

6. Reverse jumper probes at the motor connector terminals and window should now move in opposite direction. If window does not move or grunt, replace the motor.

If window moved completely up or down, reverse the jumper probes and cycle window to the opposite position to verify full operation.

If motor grunts and does not move, verify that regulator is not binding.

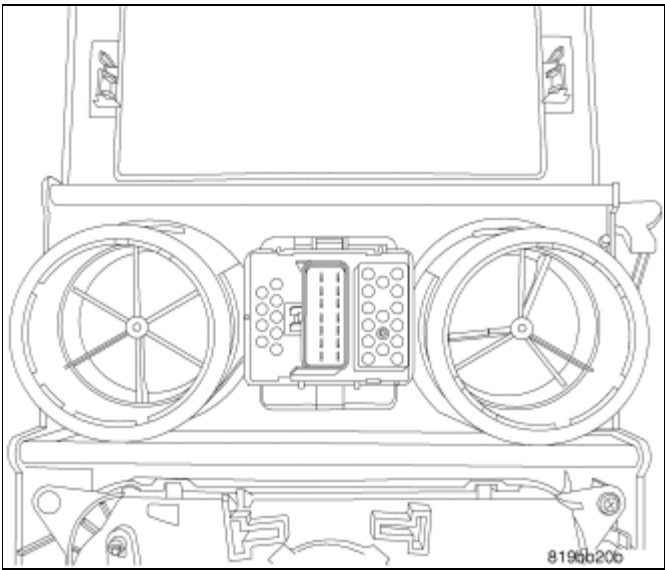
POWER WINDOW SWITCH

REMOVAL

Front	Refer to FRONT for removal procedure.
Rear	Refer to REAR for removal procedure.

FRONT

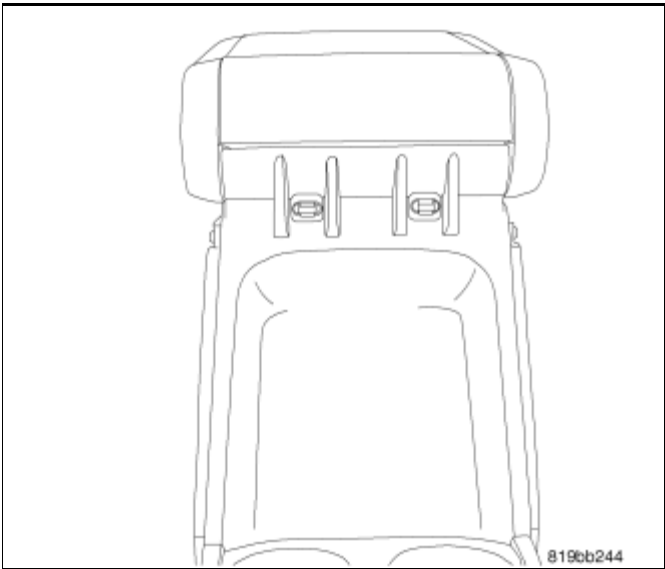
- 1. Disconnect and isolate the battery negative cable.
- 2. Remove the center bezel.
- 3. Disconnect electrical connector.
- 4. Remove switch from assembly.



REAR

- 1. Disconnect and isolate the battery negative cable.
- 2. Install switch to assembly.
- 3. Connect electrical connectors.
- 4. Install the center bezel.
- 5. Connect the battery negative cable.

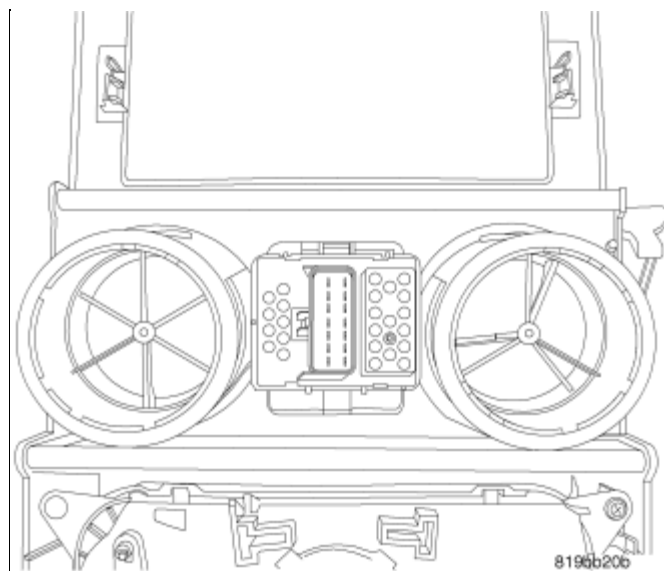
INSTALLATION



Front	Refer to FRONT installation procedure.
Rear	Refer to REAR installation procedure.

FRONT

1. Connect electrical harness connector to switch.
2. Align switch and press into position.
3. Install the center bezel.
4. Connect battery negative cable.



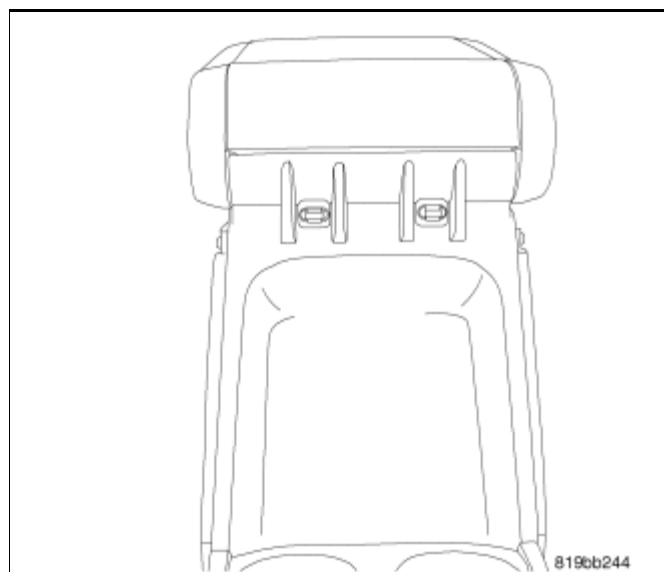
REAR

1. Connect electrical harness connector to switch.
2. Align switch and press into position.
3. Connect battery negative cable.

WINDOW MOTOR

REMOVAL

1. Move the window to the full UP position, if possible.
2. Disconnect and isolate the battery negative cable.
3. Remove door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
4. Disconnect electrical harness connector from motor.
5. Remove window regulator.
6. With regulator on bench, remove three screws retaining the motor to the regulator and remove motor.



INSTALLATION

1. With regulator on bench, install three screws retaining the motor to the regulator.
2. Install the window regulator.
3. Connect the electrical harness connector to window motor.
4. Install door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
5. Connect battery negative cable.

WINDOW REGULATOR MODULE

DESCRIPTION

The window regulator modules are directly connected to each of the front door window regulator motors. The window switches are hard wired by a mux circuit to the respective window regulator module. The respective rear window motor is hard wired to the module. The front window motor is directly attached to the module. Both front door window switches have the express down feature. The module will cease lowering the front glass when a fully down position is sensed through the hall effect sensor.

OPERATION

When a door is opened, the respective module will receive a signal from the door ajar switch or the window drop switch. The window drop switch is directly controlled by both the interior and the exterior door handle switches. The drop switch is part of the door latch. This switch is faster than the door ajar switch to signal an open door operation. At that point the module will drop the front door glass 10 mm (0.5 in). However, if the window drop switch should fail, the door ajar sense would also drop the window 10 mm (0.5 in) and the module would set a trouble code. When the module then receives a door ajar switch open (door closed) it would raise the window 10 mm (0.5 in). The module knows the position of the window by counting the motor rotation through the hall effect sensor in the module. If a door window is raised while that door is open, the module will raise the glass up, but when the door is closed it will raise the glass an additional 10 mm (0.5 in). When the convertible top down switch is pressed to the first detent, input is received by the driver window regulator module and passenger window regulator module, which will lower the front windows approximately 40 mm (1.6 in), and lower the rear windows approximately 55 mm (2.0 in). After a 200 ms delay, it energizes the power top down relay to lower the convertible top.

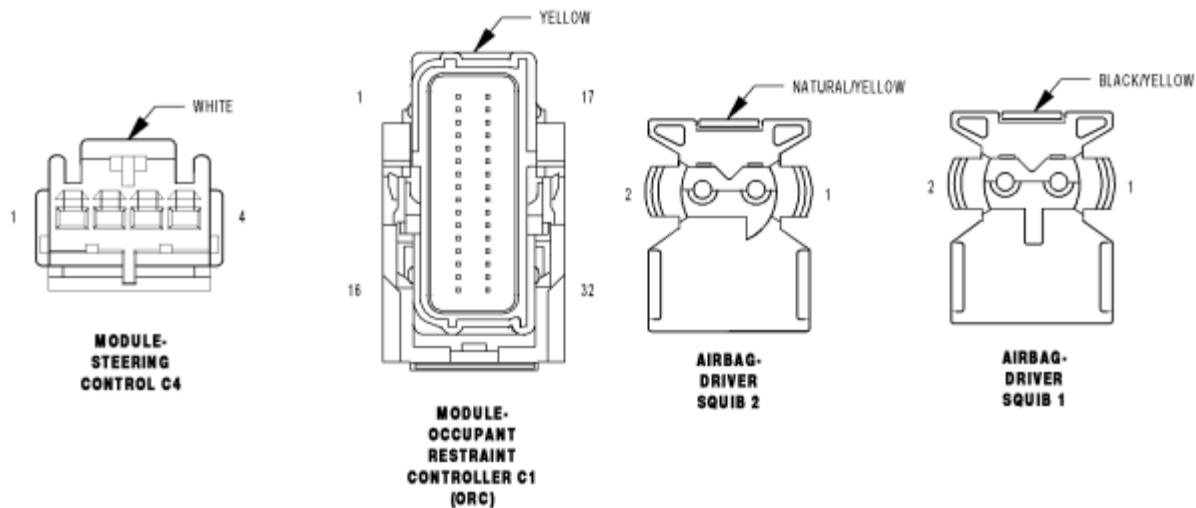
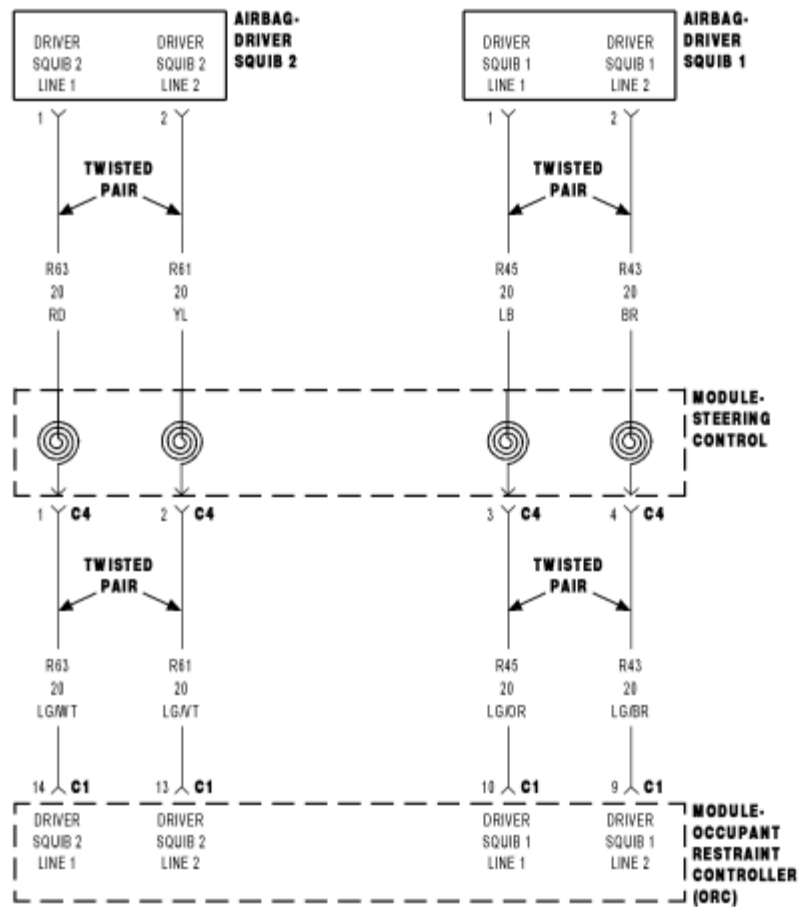
80 - RESTRAINTS

RESTRAINTS - ELECTRICAL DIAGNOSTICS

RESTRAINTS - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND
(R45) DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND
STEERING CONTROL MODULE
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select **ACTIVE** or **STORED DTC**:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

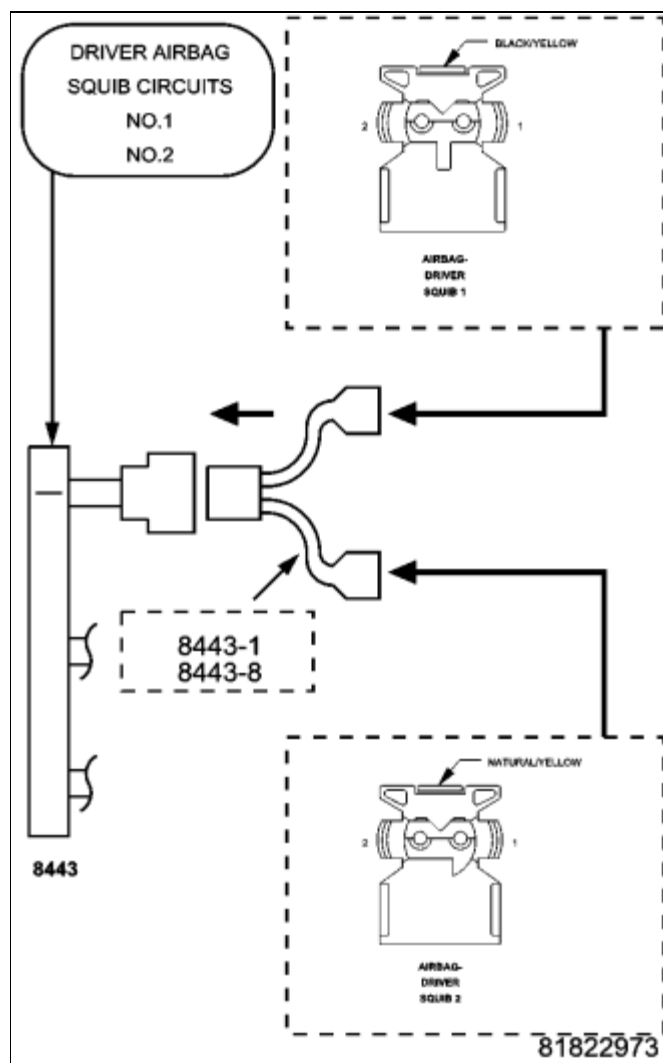
Does the scan tool display: B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes

- Go To [3](#)

No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver

Airbag Squib connectors.

Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B00-DRIVER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes

- Go To [4](#)

No

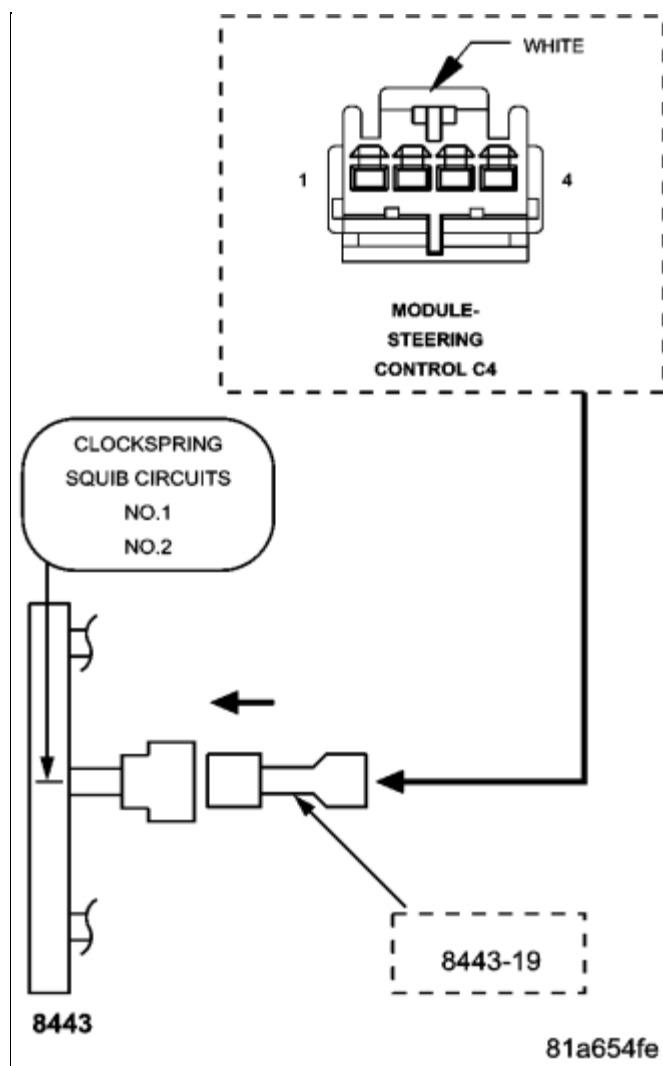
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Column Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

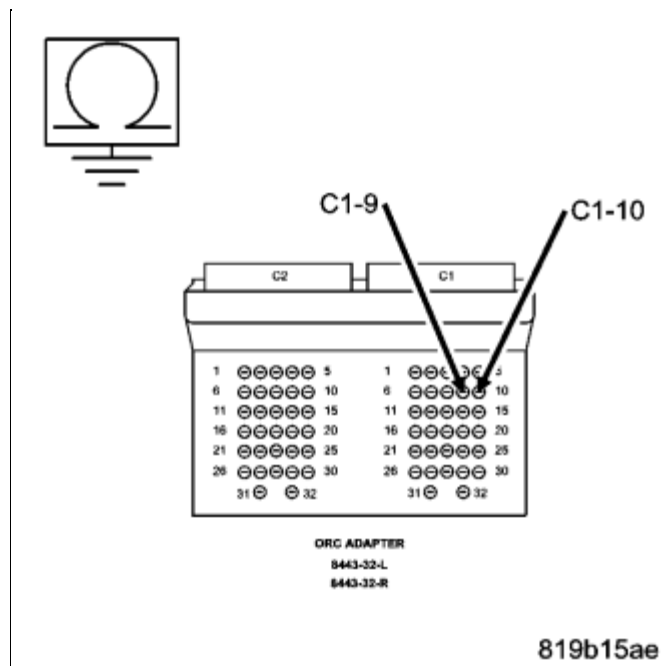
4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT AND (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module C4 connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R43) Driver Squib 1 Line 2 circuit between the 8443-32-L Adapter cavity C1-9 and ground.

Measure the resistance of the (R45) Driver Squib 1 Line 1 circuit between 8443-32-L Adapter cavity C1-10 and ground.

Is the resistance below 10k ohms for either measurement?

Yes

- Repair the Driver Squib 1 circuits with resistance below 10k ohms for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

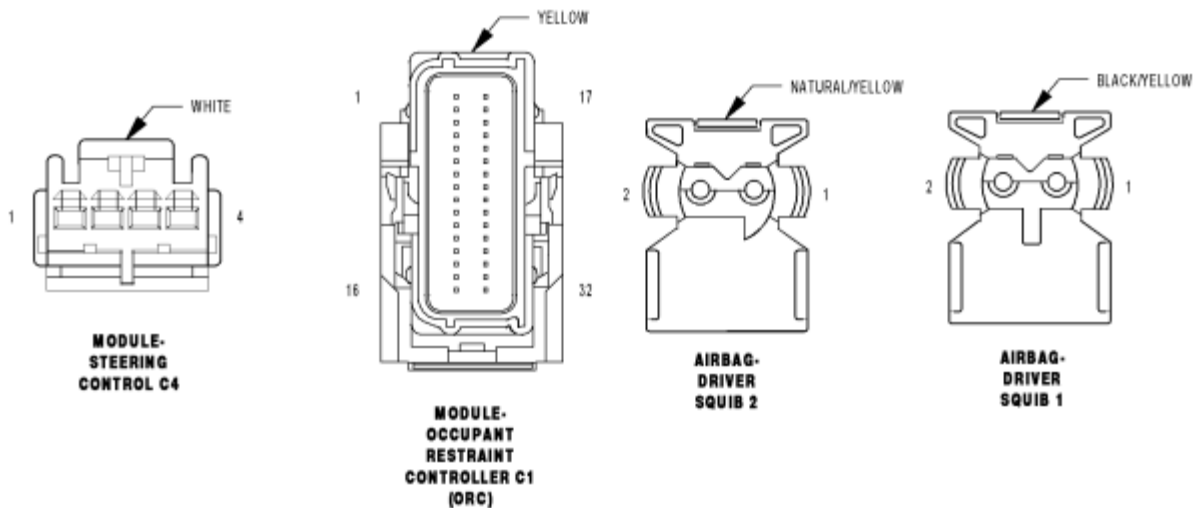
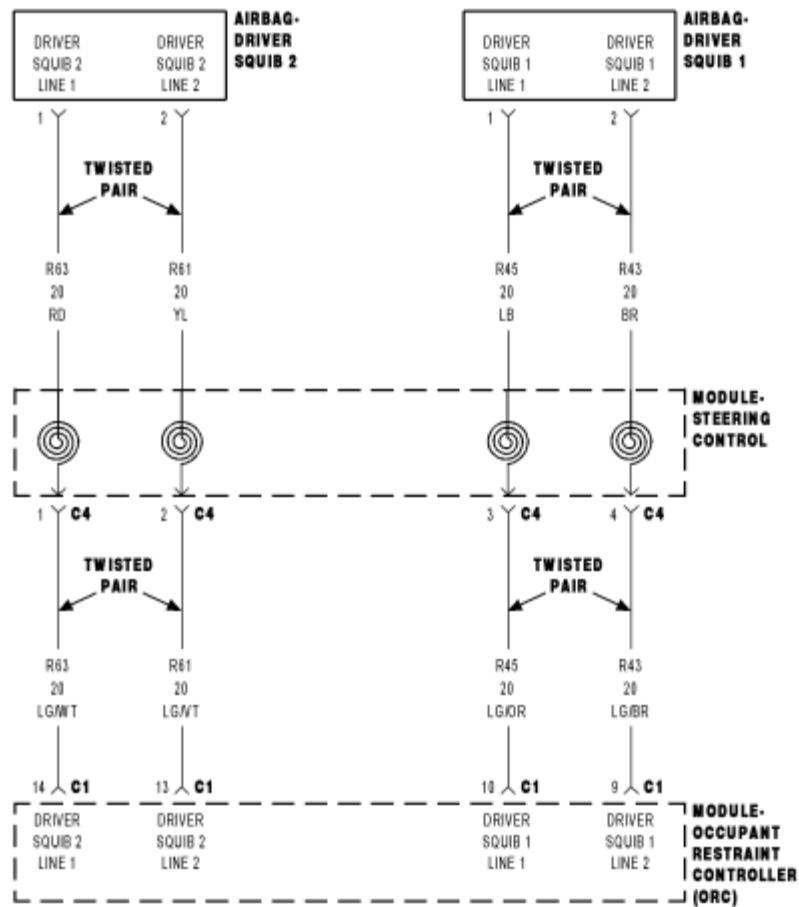
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY
(R45) DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY
STEERING CONTROL MODULE (SCM)
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH?

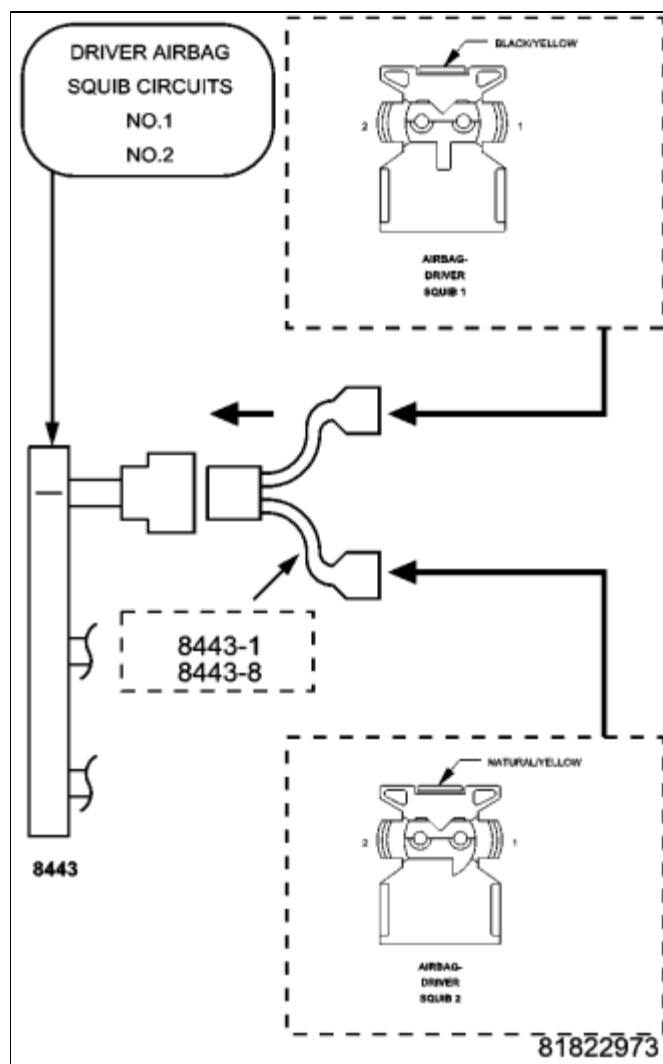
Yes

- Go To [3](#)

No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TO BATTERY



WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.
Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B01-DRIVER AIRBAG SQUIB 1 CIRCUIT HIGH?

Yes

- Go To [4](#)

No

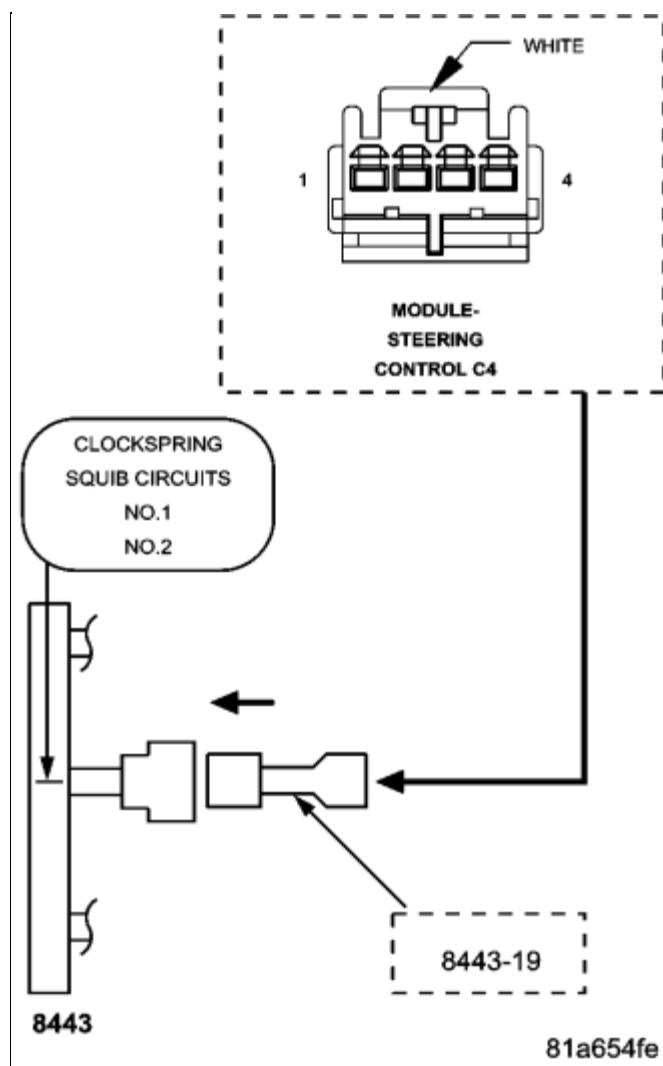
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT AND (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

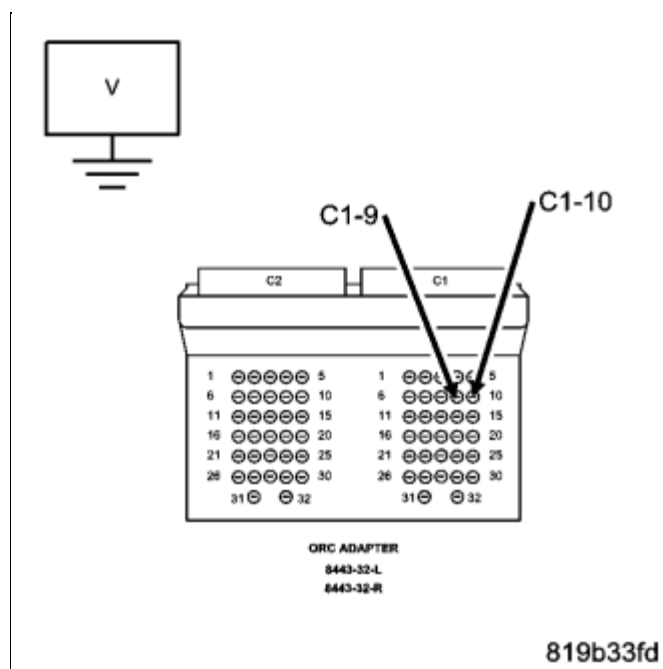
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module C4 connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.



Connect the 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R43) Driver Squib 1 Line 2 circuit between the 8443-32-L Adapter cavity C1-9 and ground.

Measure the voltage of the (R45) Driver Squib 1 Line 1 circuit between the 8443-32-L Adapter cavity C1-10 and ground.

Is there any voltage present for either measurement?

Yes

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Repair the Driver Squib 1 circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

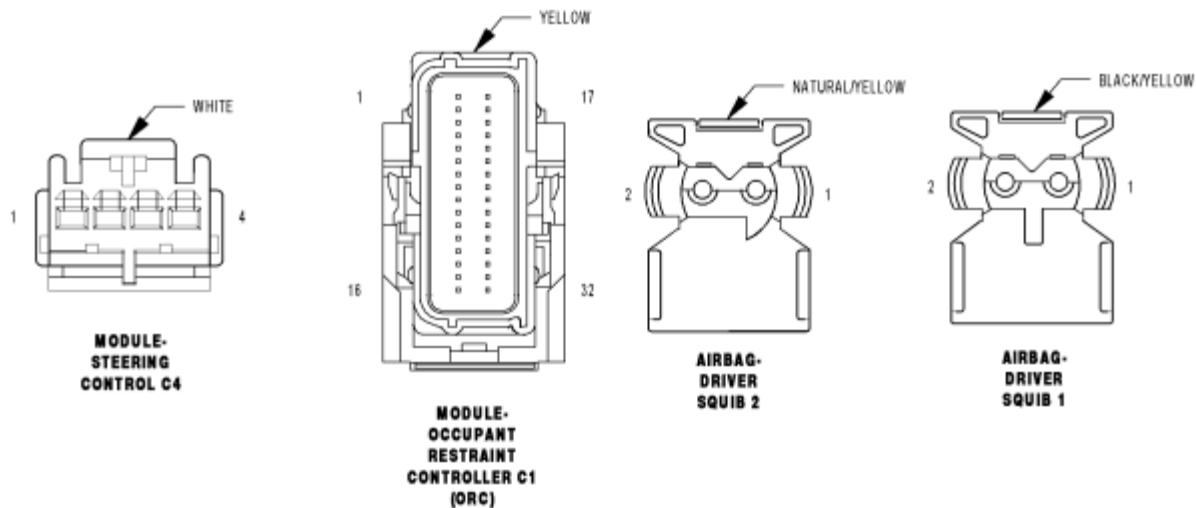
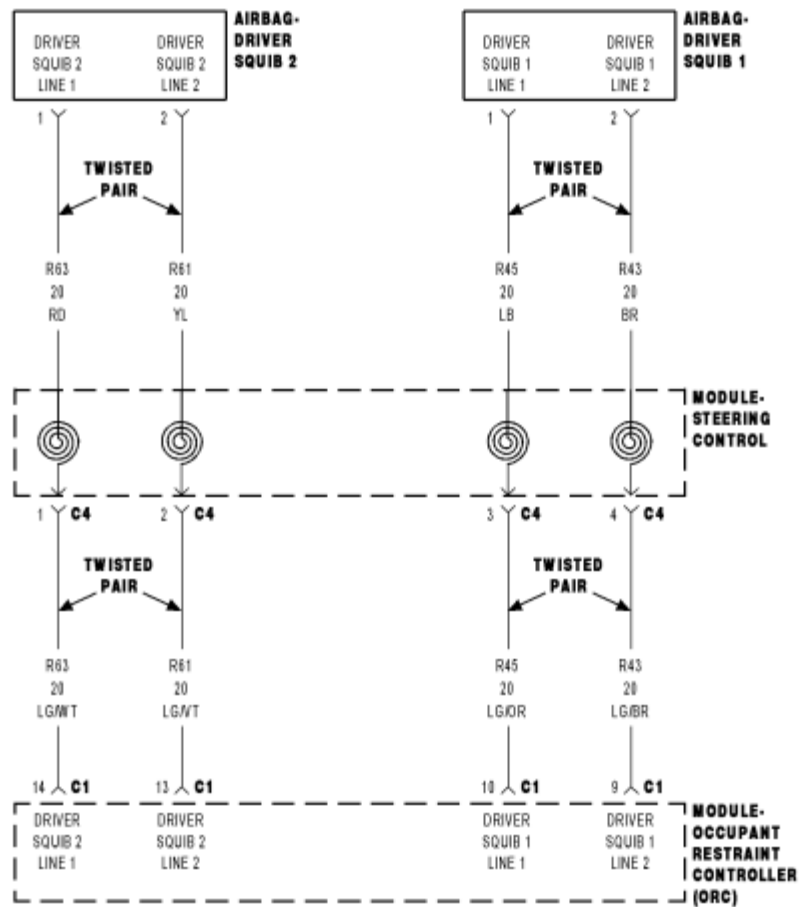
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT OPEN
(R45) DRIVER SQUIB 1 LINE 1 CIRCUIT OPEN
STEERING CONTROL MODULE
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [6](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

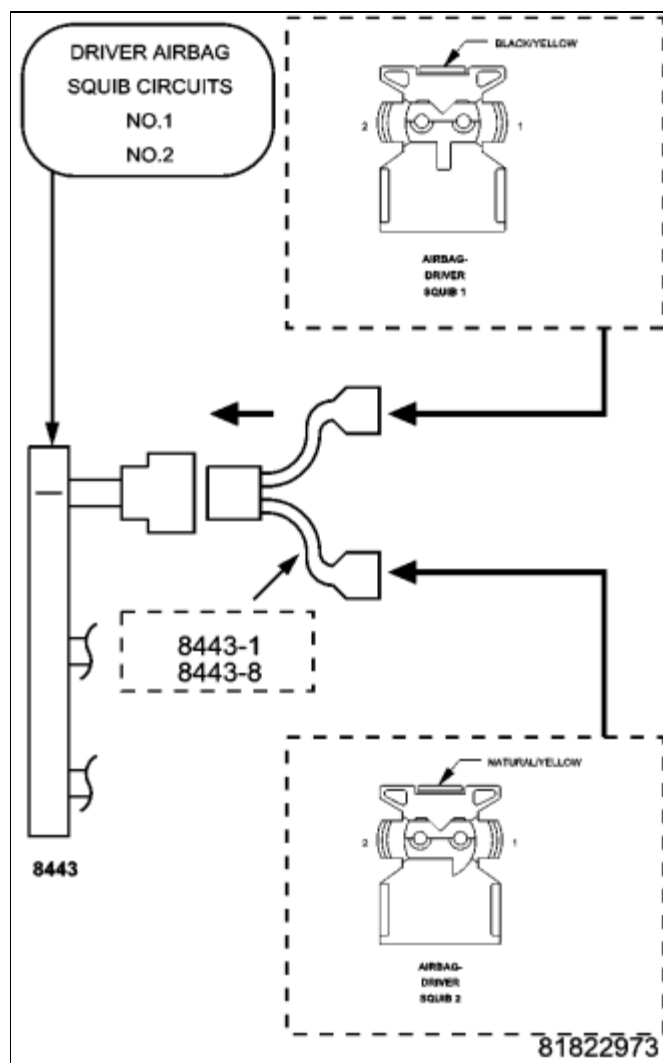
Does the scan tool display: B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes

- Go To [3](#)

No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B02-DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes

- Go To [4](#)

No

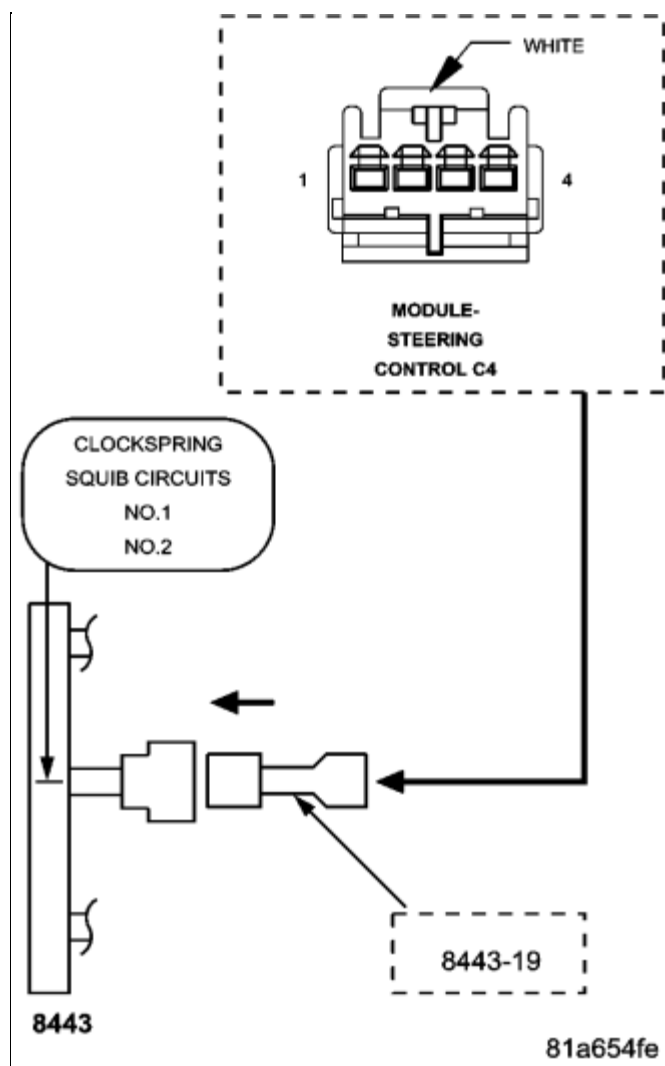
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

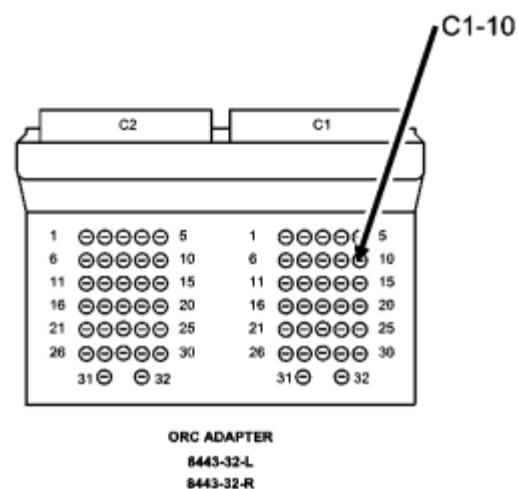
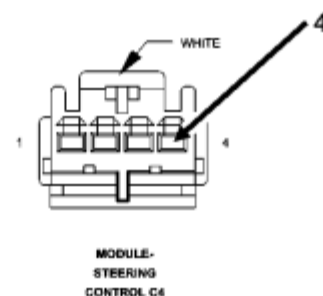
4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module C4 connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





819b3626

Connect the 8443-32 ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R43) Driver Squib 1 Line 2 circuit between the Steering Control Module C4 connector cavity 4 and the 8443-32-L ORC Adaptor cavity C1-9.

Is the resistance below 1.0 ohm?

Yes

- Go To [5](#)

No

- Repair the R43 Driver Squib 1 Line 2 circuit for an open.
- Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the (R45) Driver Squib 1 Line 1 circuit between the Steering Control Module C4 connector and the 8443-32-L ORC Adaptor cavity C1-10.

Is the resistance below 1.0 ohm?

Yes

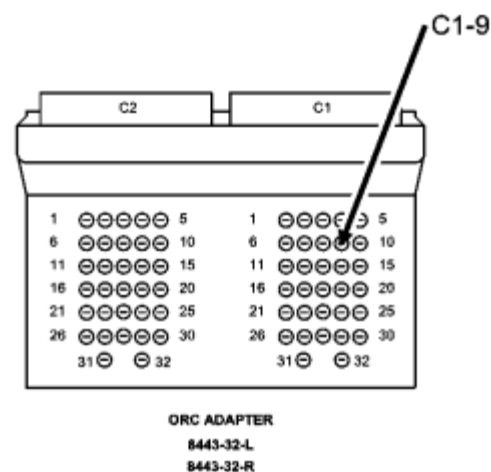
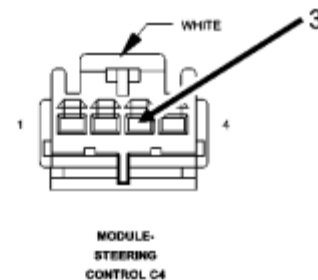
- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

Replace the ORC in accordance with Service Information.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R45) Driver Squib 1 Line 1 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



819b3634

6. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram / schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

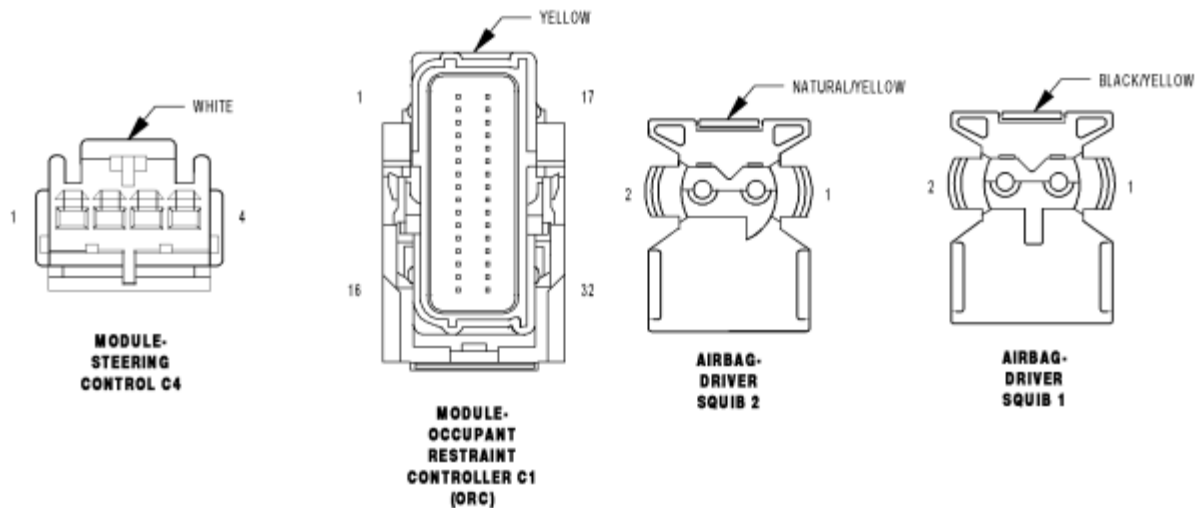
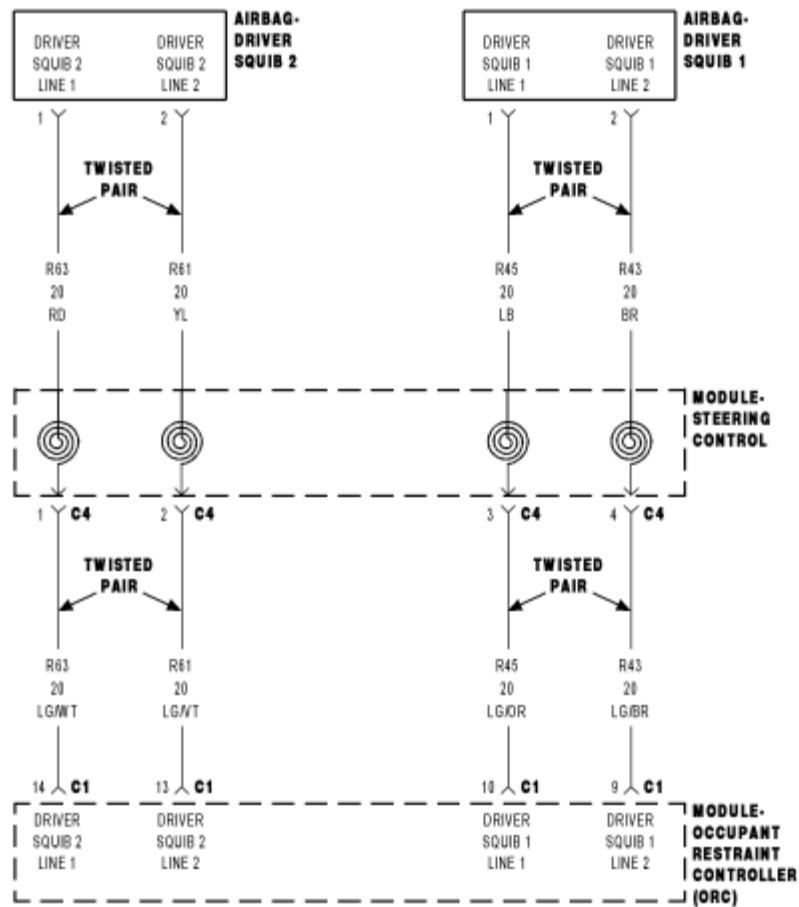
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Driver Squib 1 circuits.

Possible Causes
(R43) DRIVER SQUIB 1 LINE 2 CIRCUIT SHORTED TO (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT
STEERING CONTROL MODULE (SCM)
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

Disconnect the Driver Airbag Squib connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

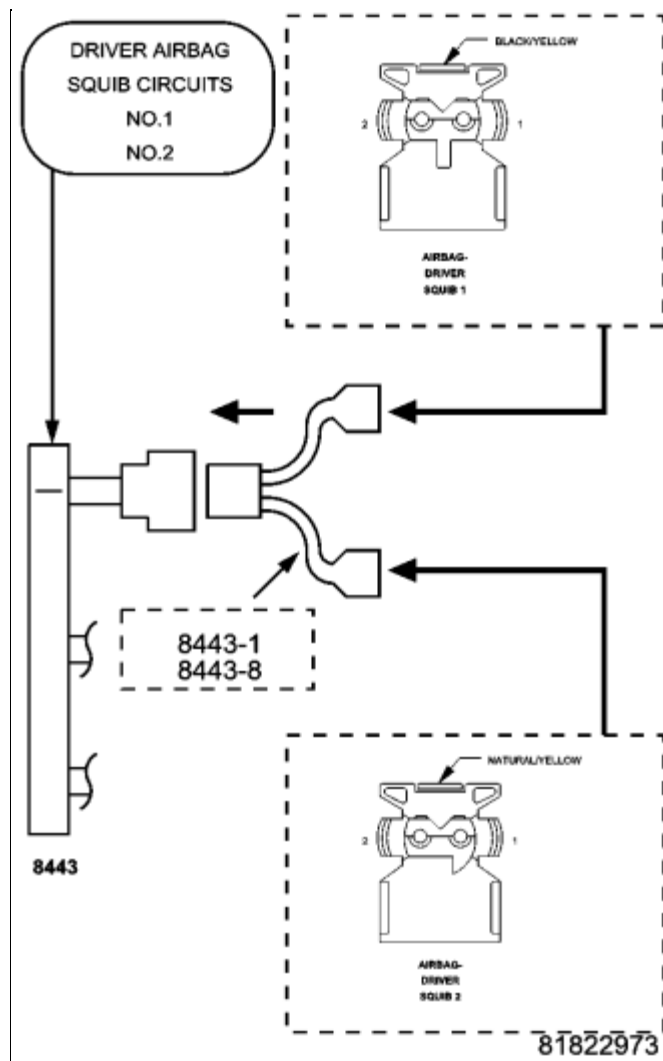
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE C4 (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TOGETHER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.
Disconnect the Steering Control Module C4 connector.



NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B03-DRIVER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [4](#)

No

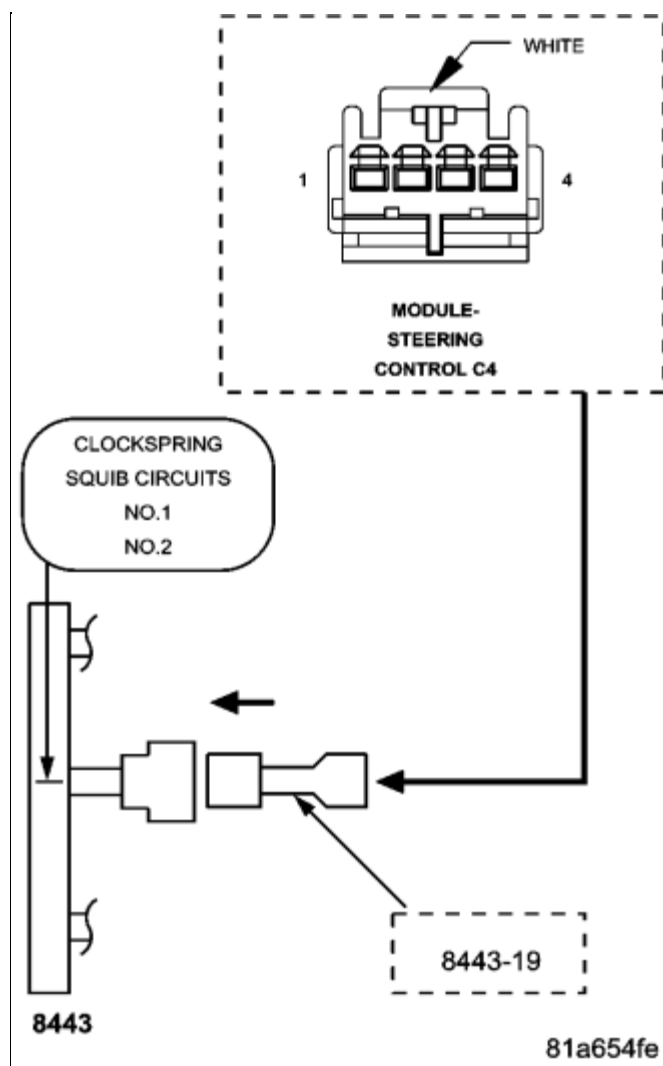
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

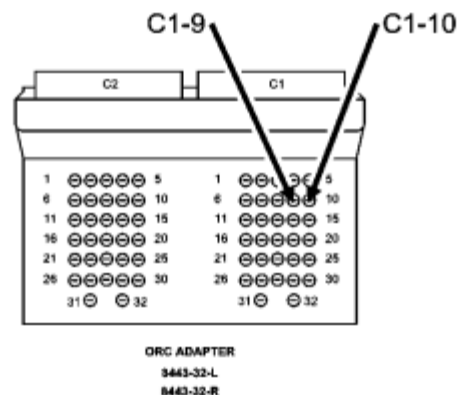
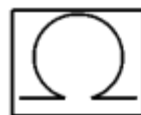
4. CHECK (R43) DRIVER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO (R45) DRIVER SQUIB 1 LINE 1 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





ORC ADAPTER
8443-32-L
8443-32-R

819b3e35

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance between the (R43) Driver Squib 1 Line 2 circuit and the (R45) Driver Squib 1 Line 1 circuit at the ORC 8443-32-L Adapter cavities C1-9 and C1-10.

Is the resistance below 10k ohms?

Yes

- Repair the (R43) Driver Squib 1 Line 2 circuit for a short to the (R45) Driver Squib 1 Line 1 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

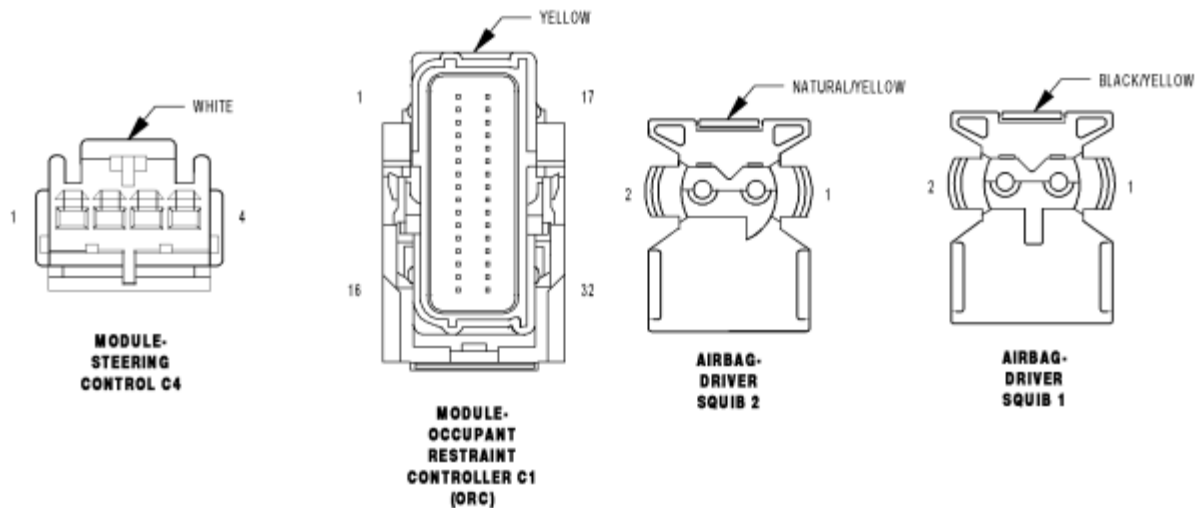
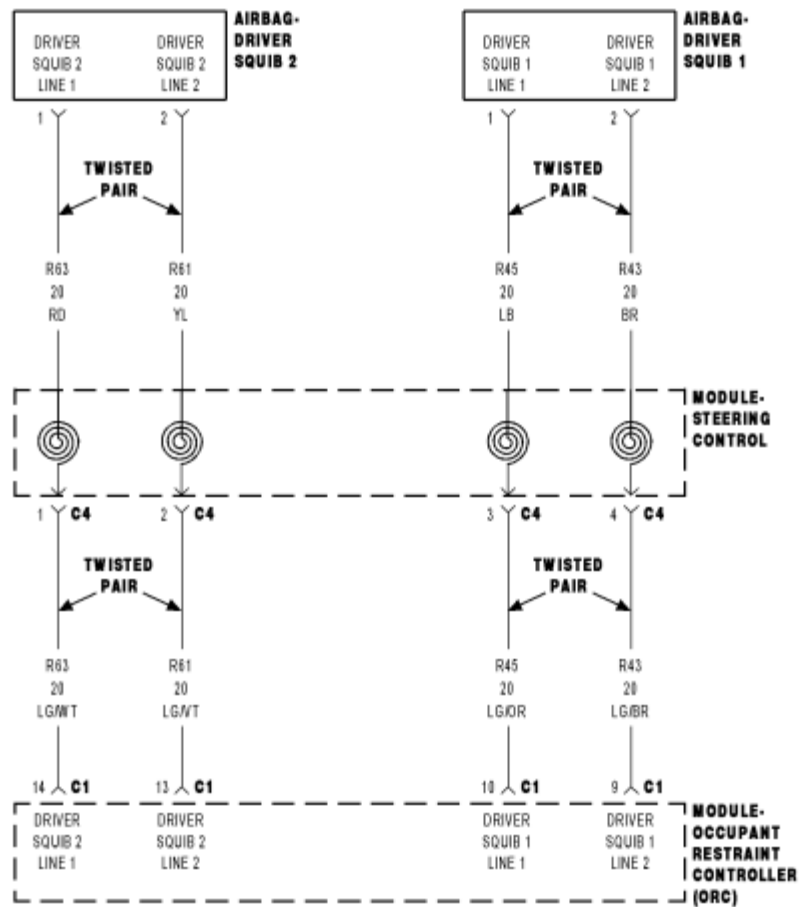
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects low resistance on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT OR (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND
STEERING CONTROL MODULE (SCM)
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes

- Go To [3](#)

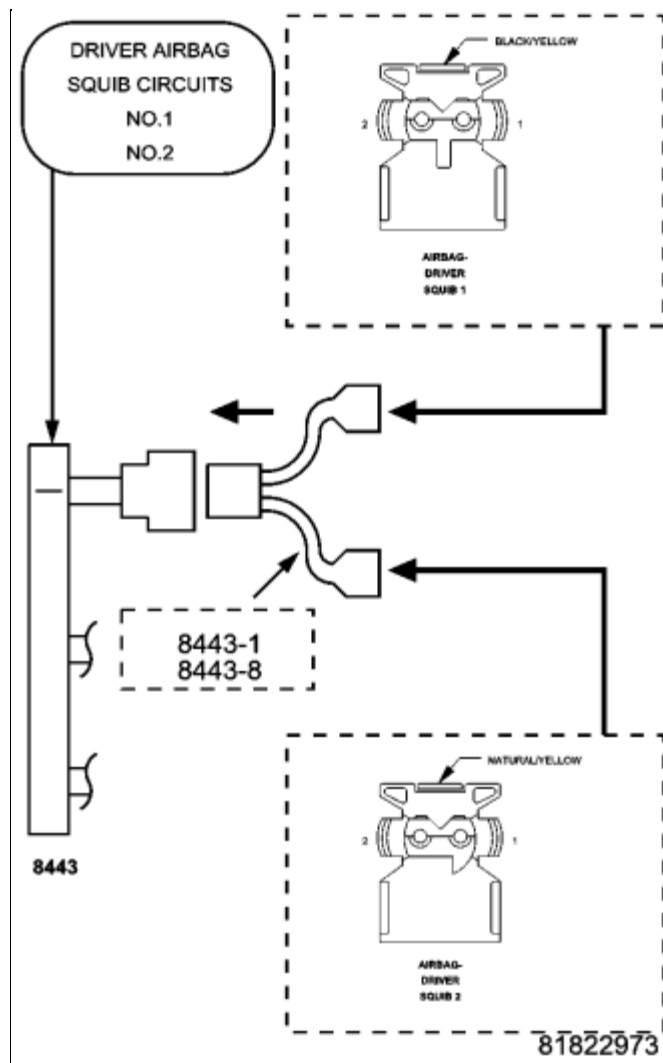
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool Jumper from the Driver



Airbag Squib connectors.

Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B04-DRIVER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes

- Go To [4](#)

No

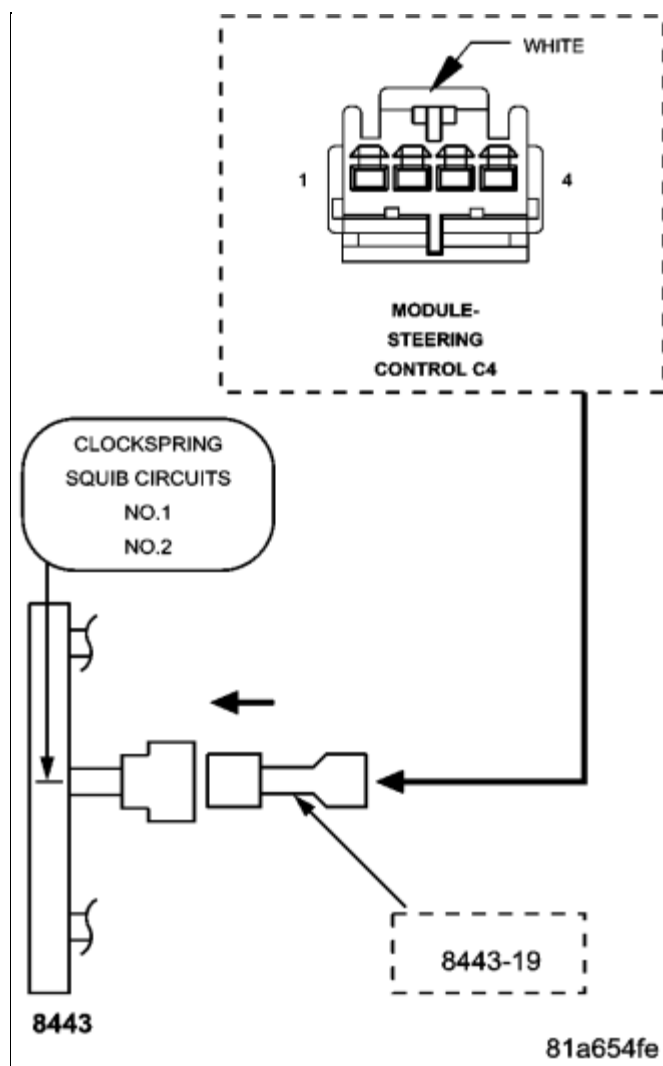
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

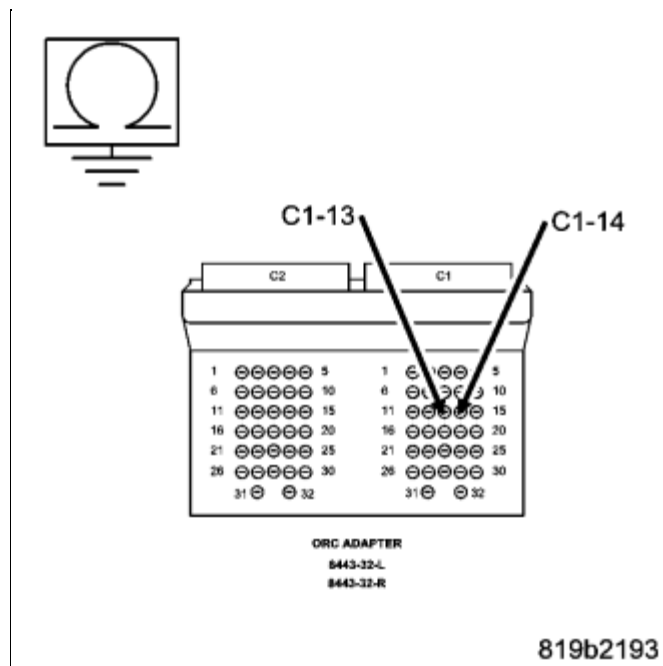
4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT AND (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module C4 connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R63) Driver Squib 2 Line 1 circuit between ground and the ORC 8443-32-L Adaptor cavity C1-14.

Measure the resistance of the (R61) Driver Squib 2 Line 2 circuit between ground and the ORC 8443-32-L Adaptor cavity C1-13.

Is the resistance below 10k ohms for either measurement?

Yes

- Repair the Driver Squib 2 circuits with resistance below 10k ohms for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

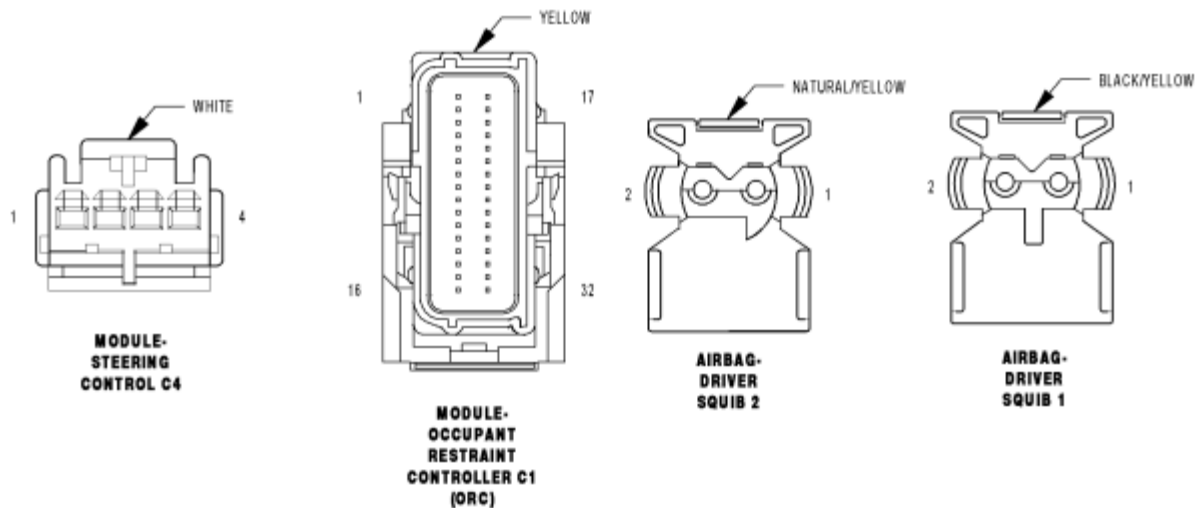
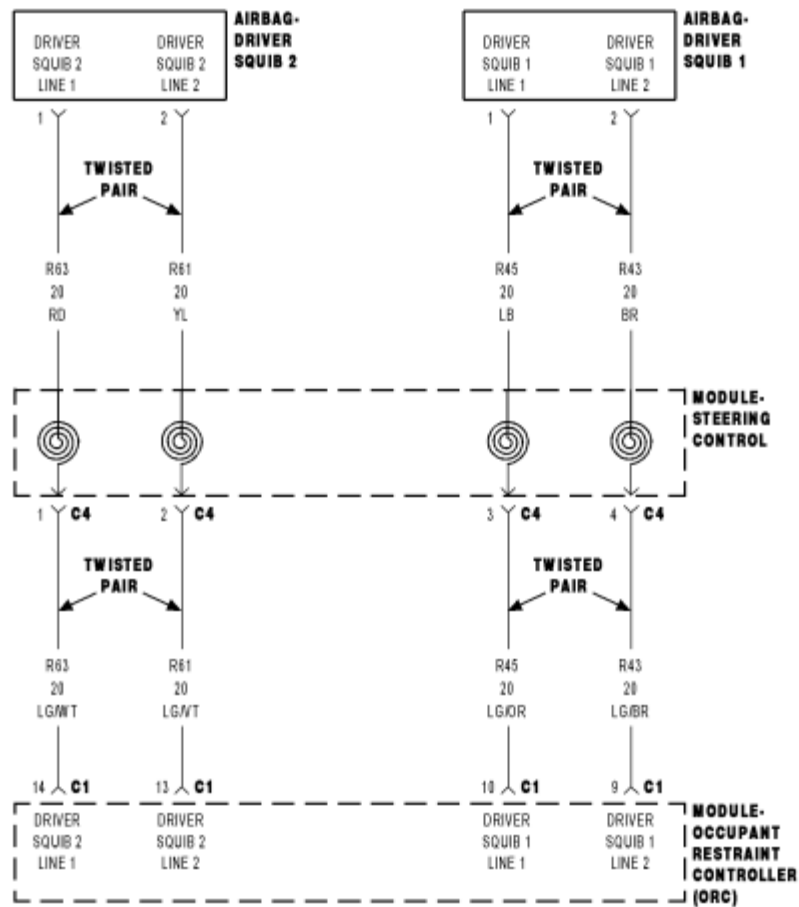
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 2 circuits. The ORC will set this DTC if it detects voltage on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT SHORTED TO BATTERY
(R61) DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY
STEERING CONTROL MODULE (SCM)
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The Scan Tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes

- Go To [3](#)

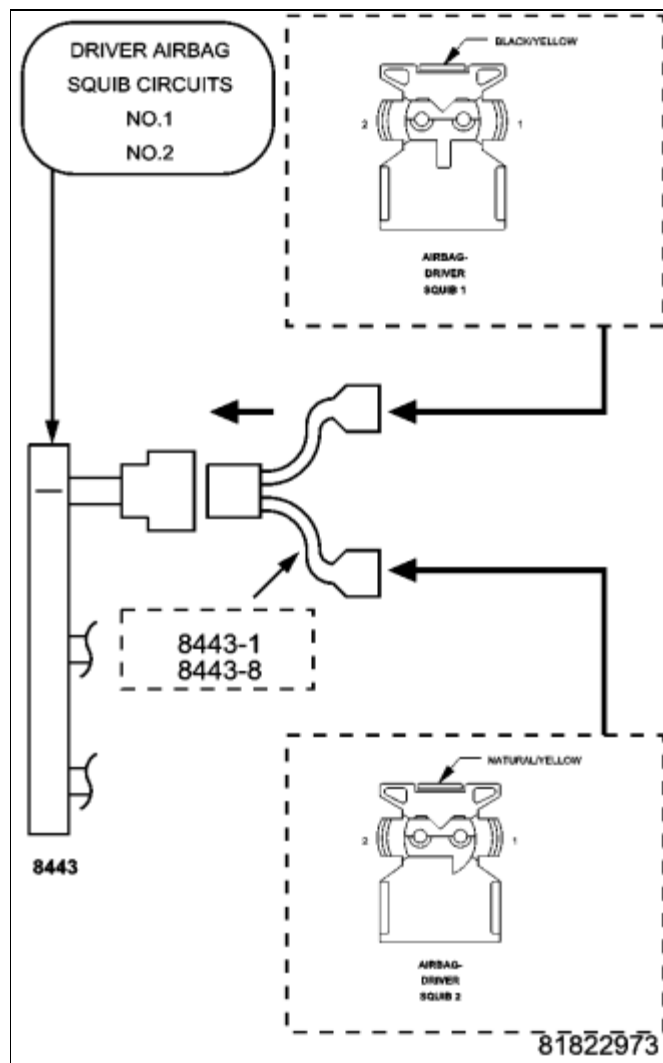
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver



Airbag Squib connectors.

Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1B05-DRIVER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes

- Go To [4](#)

No

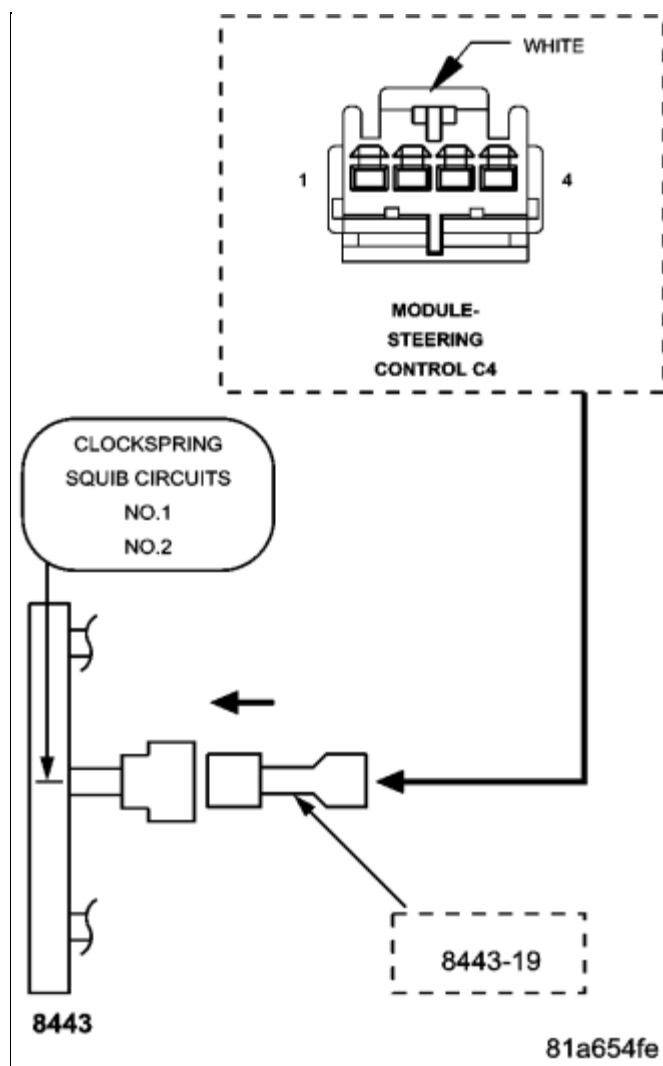
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

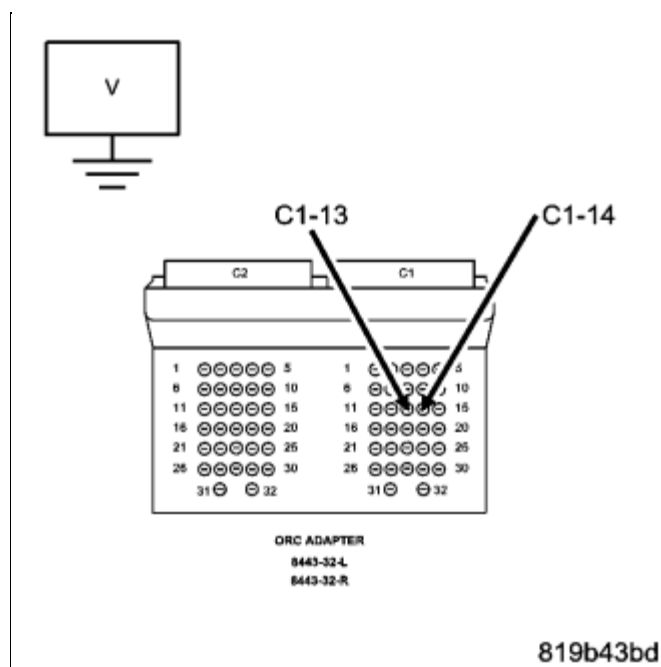
4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT AND (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R63) Driver Squib 2 Line 1 circuit between the 8443-32-L Adaptor cavity C1-14 and ground.

Measure the voltage of the (R61) Driver Squib 2 Line 2 circuit between the 8443-32-L Adaptor cavity C1-13 and ground.

Is there any voltage present for either measurement?

Yes

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Repair the Driver Squib 2 circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING:** If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTC present?

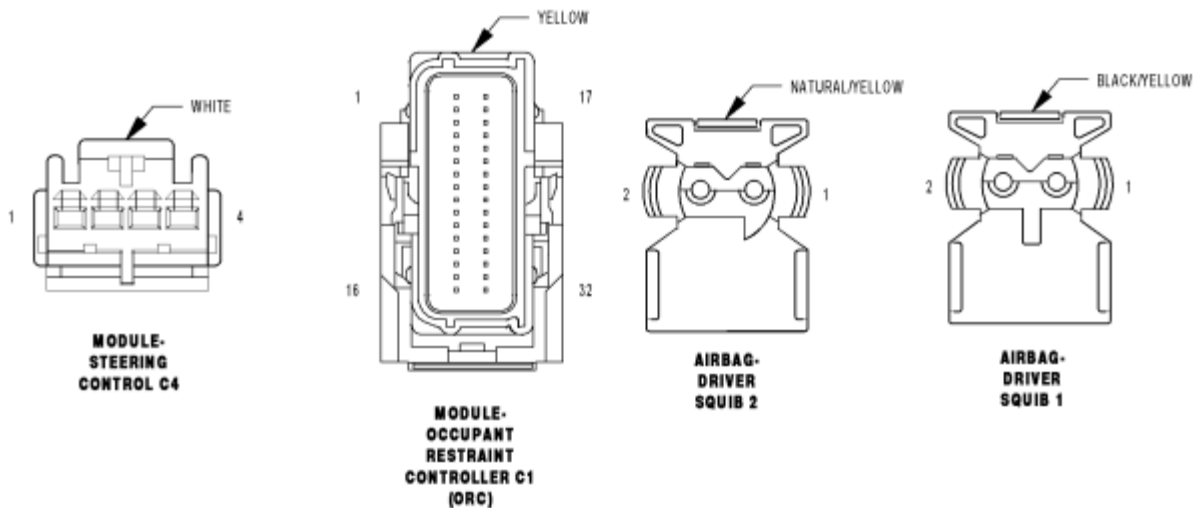
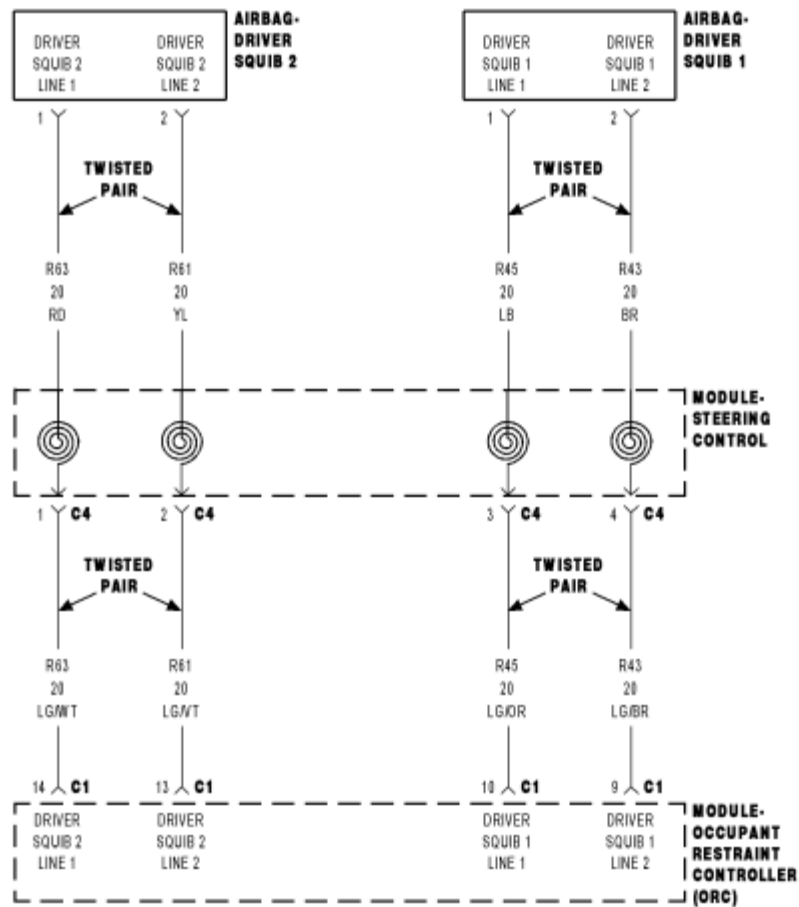
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects an open or high resistance on the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT OPEN
(R61) DRIVER SQUIB 2 LINE 2 CIRCUIT OPEN
STEERING CONTROL MODULE (SCM)
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [6](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN?

Yes

- Go To [3](#)

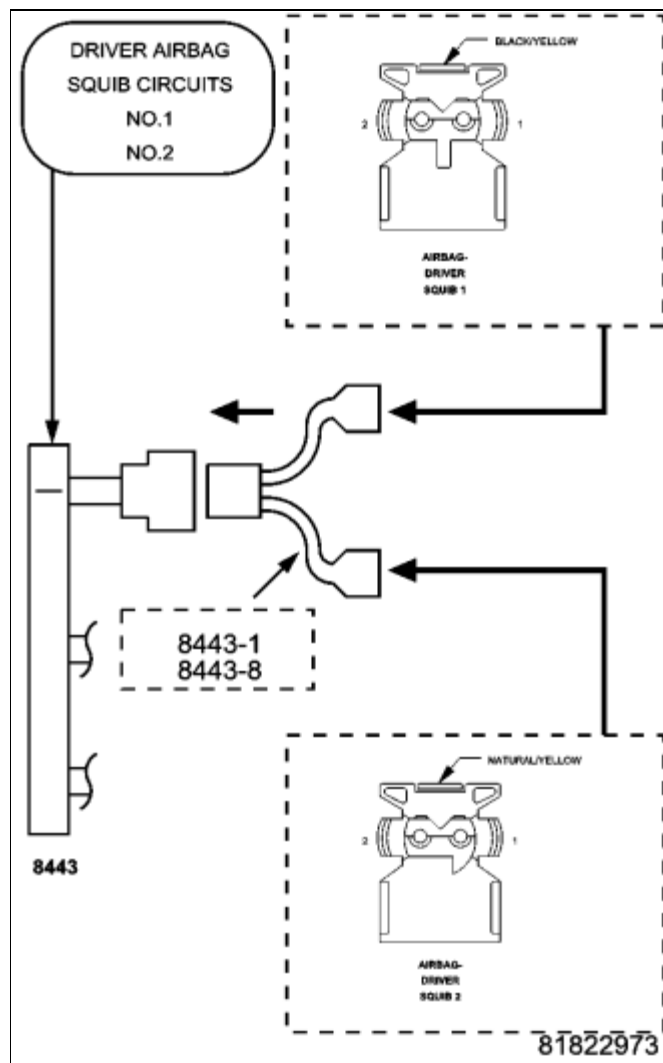
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.



Disconnect the Steering Control Module C4 connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1B06-DRIVER AIRBAG SQUIB 2 CIRCUIT OPEN?

Yes

- Go To [4](#)

No

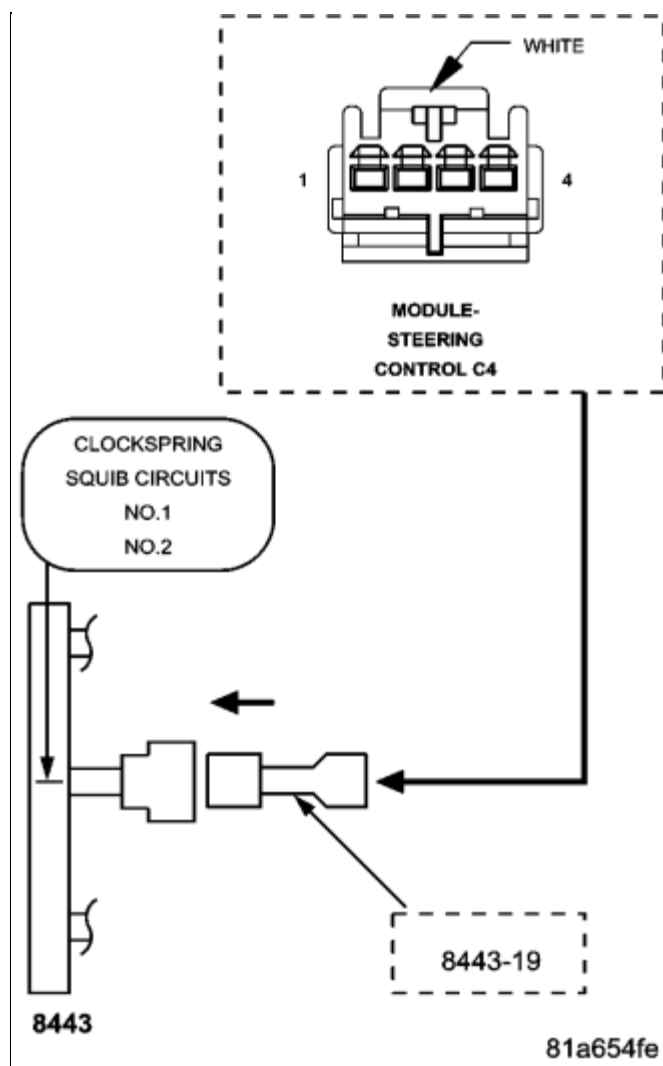
- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

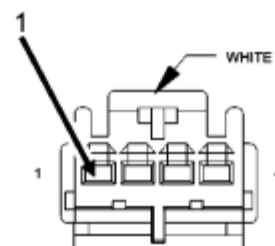
4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

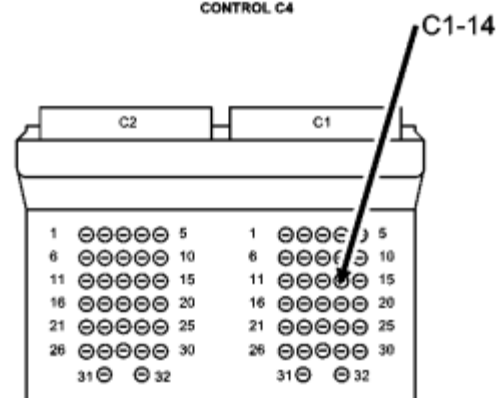
Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





MODULE-
STEERING
CONTROL C4



ORC ADAPTER
8443-32-L
8443-32-R

819b4fea

Connect the ORC 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R63) Driver Squib 2 Line 1 circuit between the Steering Control Module C4 connector cavity 1 and the 8443-32-L Adaptor cavity C1-14.

Is the resistance below 1.0 ohm?

Yes

- Go To [5](#)

No

- Repair the (R63) Driver Squib 2 Line 1 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R61) Driver Squib 2 Line 2 circuit between the Steering Control Module C4 connector cavity 2 and the ORC 8443-32-L Adaptor cavity C1-13.

Is the resistance below 1.0 ohm?

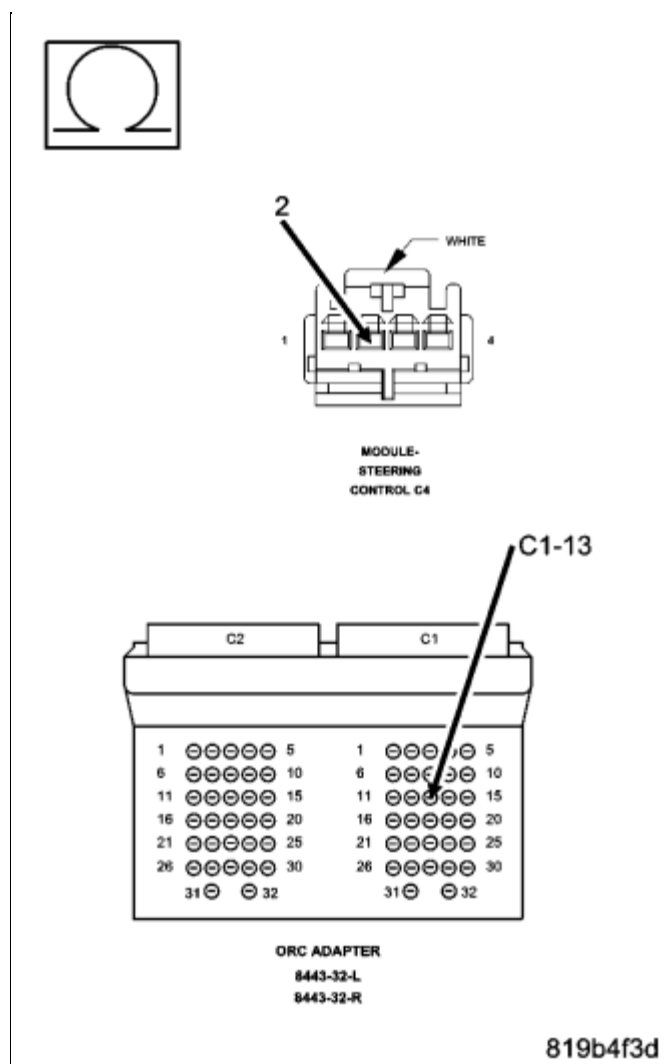
Yes

- WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R61) Driver Squib 2 Line 2 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



6. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTC present?

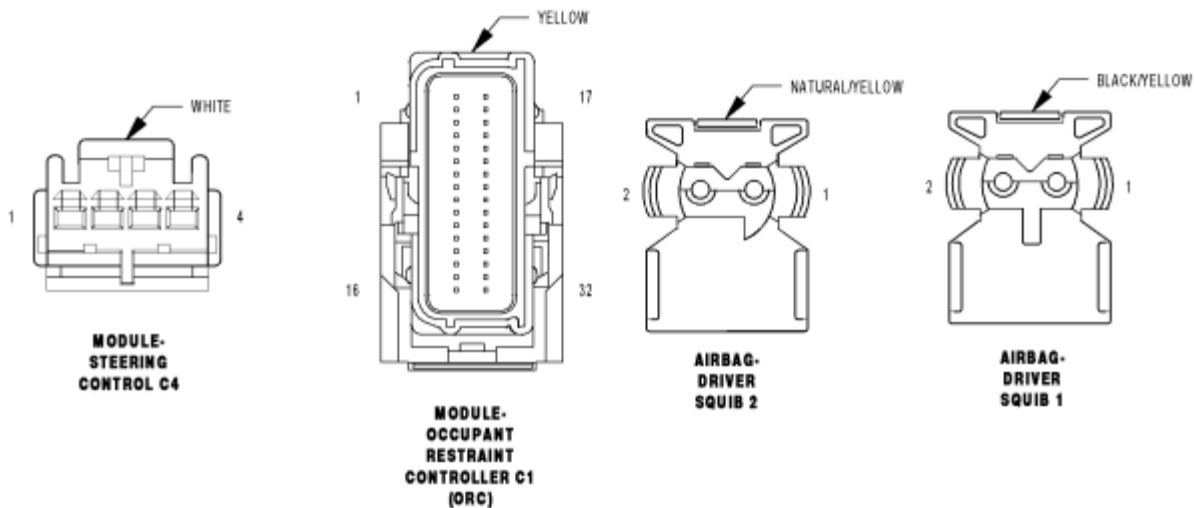
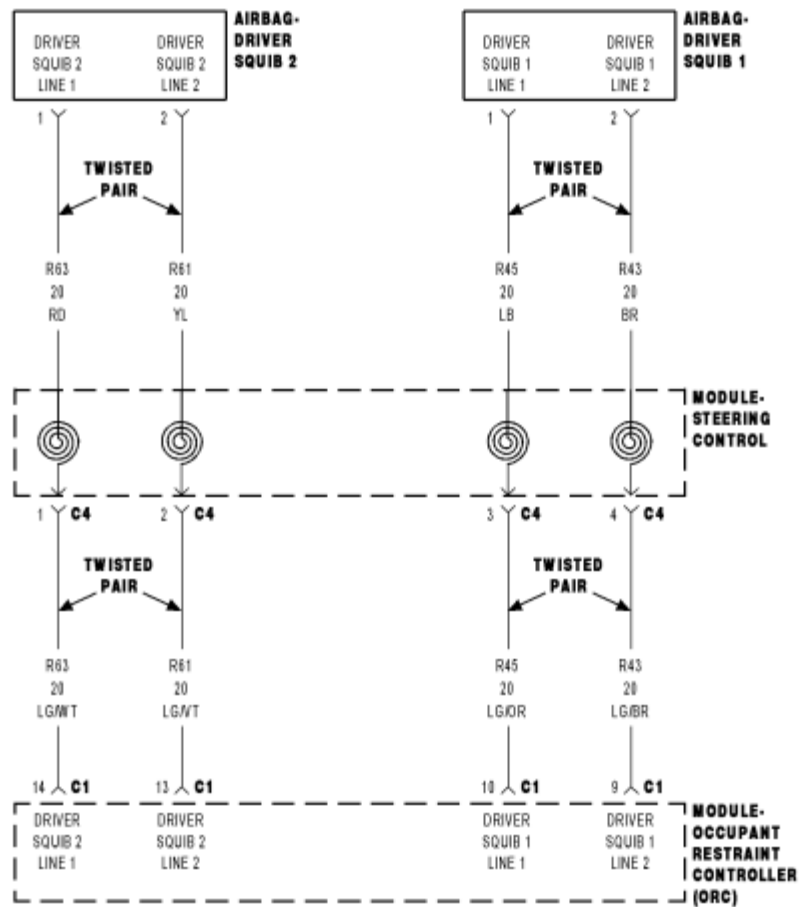
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER



01001501

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects low resistance between the Driver Squib 2 circuits.

Possible Causes
(R63) DRIVER SQUIB 2 LINE 1 CIRCUIT SHORTED TO (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT
STEERING CONTROL MODULE
DRIVER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The Scan Tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

Disconnect the Driver Airbag Squib connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Driver Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

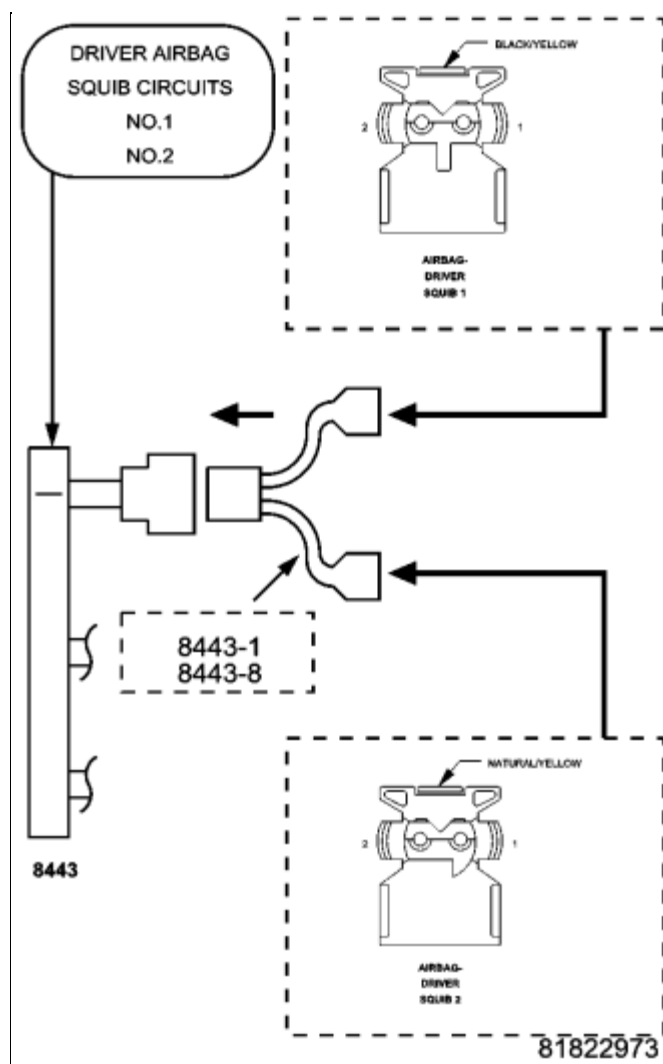
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Driver Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK STEERING CONTROL MODULE (CLOCKSPRING) SQUIB CIRCUITS FOR A SHORT TOGETHER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and jumper from the Driver Airbag Squib connectors.
Disconnect the Steering Control Module C4 connector.



NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-19 Jumper to the Steering Control Module C4 connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B07-DRIVER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [4](#)

No

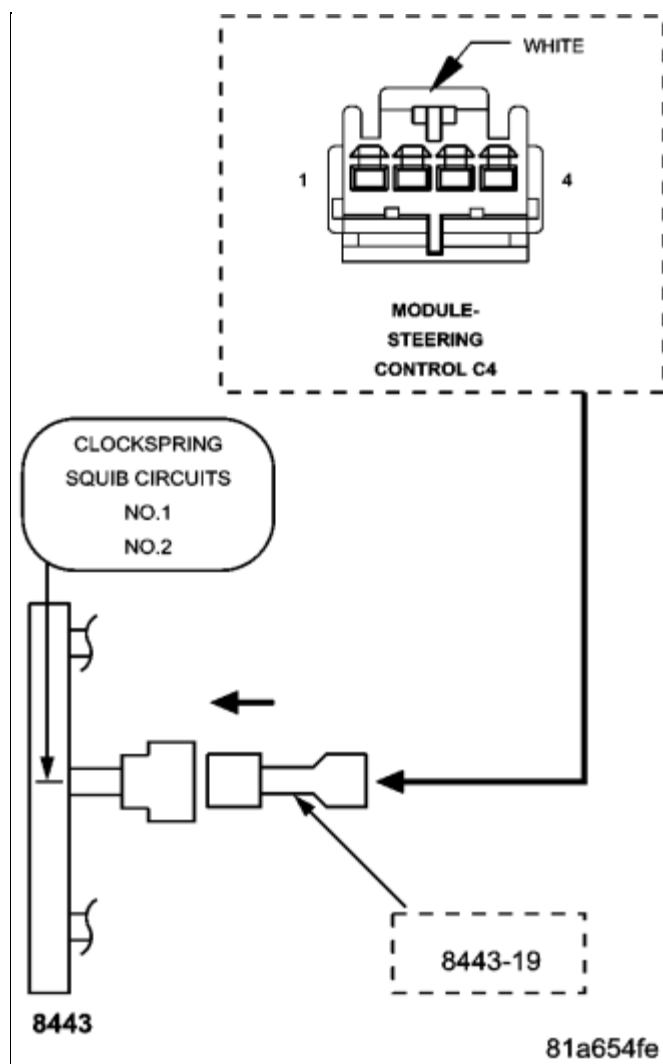
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Steering Control Module in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

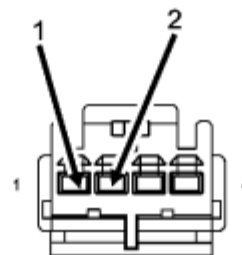
4. CHECK (R63) DRIVER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO (R61) DRIVER SQUIB 2 LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Steering Control Module connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





MODULE-
STEERING
CONTROL C4

81822a16

Connect the ORC 8443-32-L ORC Adaptor to the ORC connectors.

Measure the resistance between the (R63) Driver Squib 2 Line 1 circuit cavity 1 and the (R61) Driver Squib 2 Line 2 circuit cavity 2 in the SCM C4 connector.

Is the resistance below 10k ohms?

Yes

- Repair the (R63) Driver Squib 2 Line 1 circuit for a short to the (R61) Driver Squib 2 Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

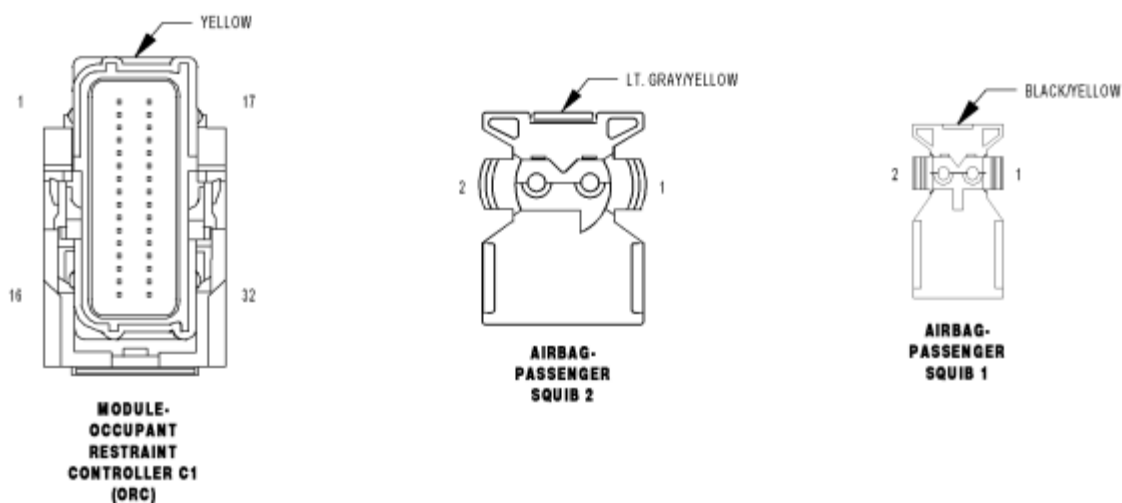
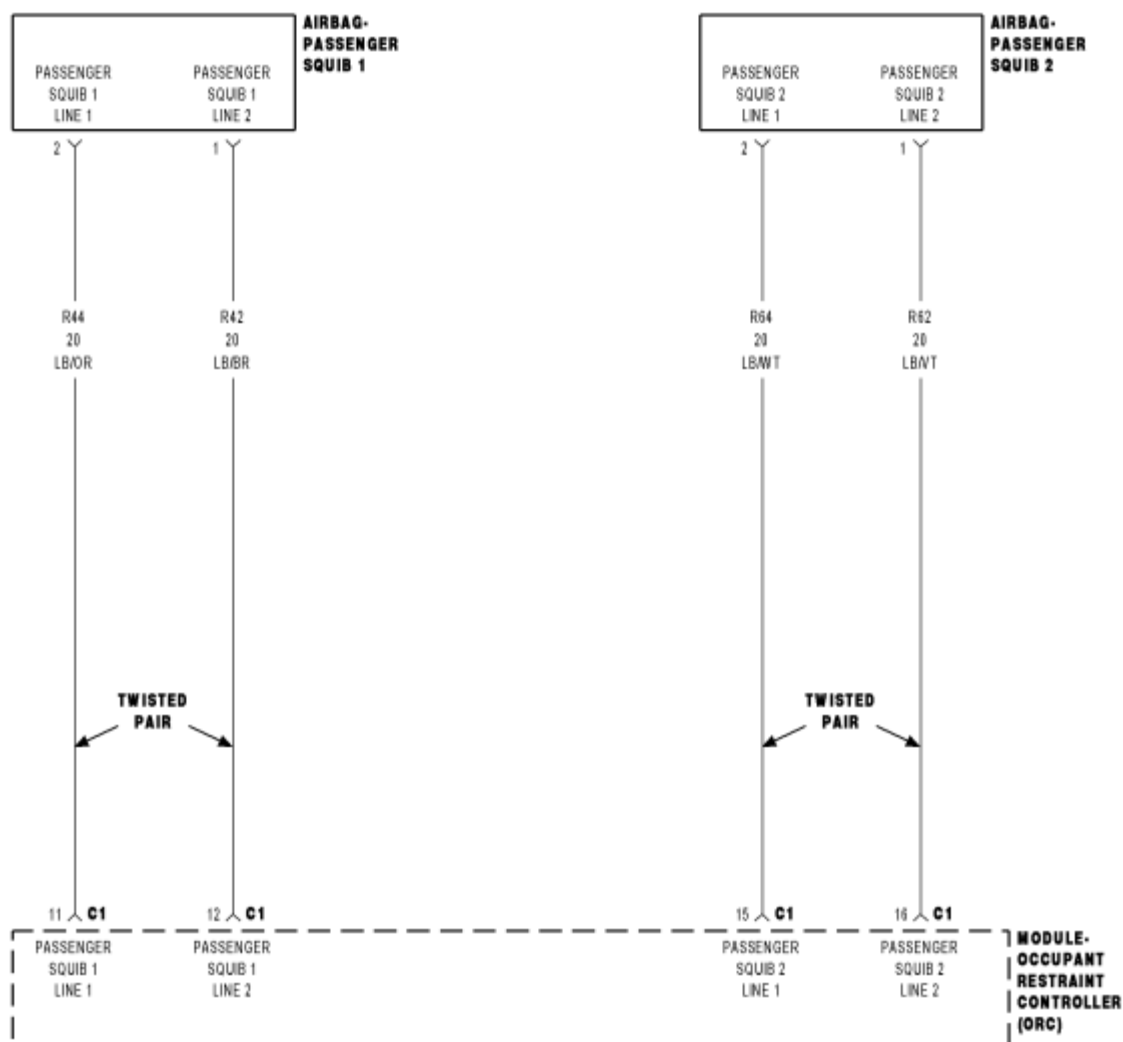
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW



01992000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND
(R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B08-PASSENGER AIRBAG SQUIB 1 CIRCUIT LOW?

Yes

- Go To [3](#)

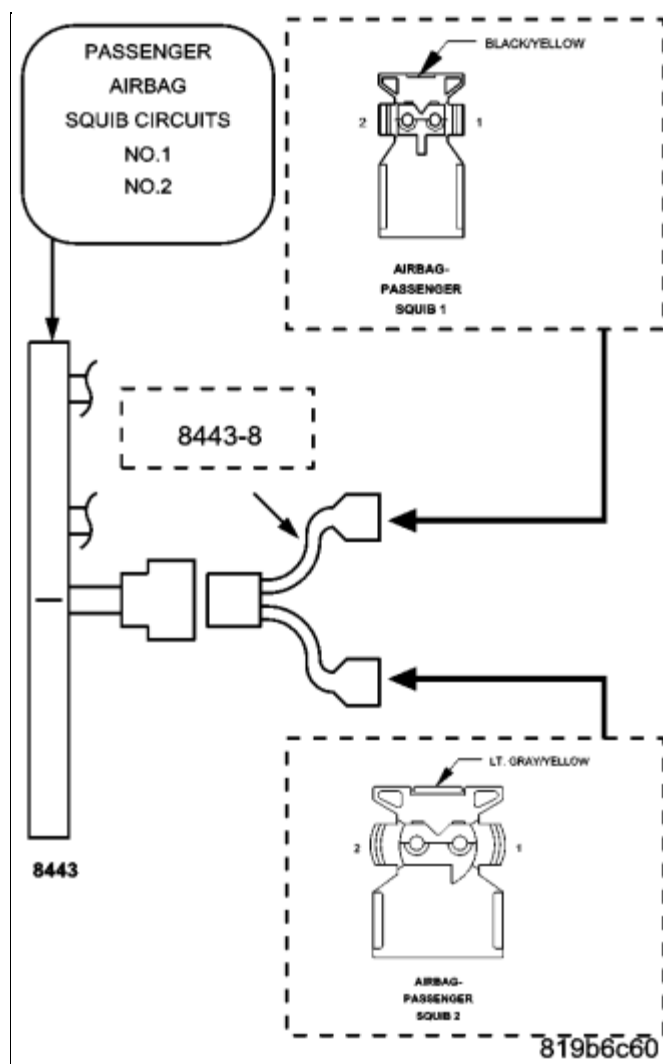
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT AND (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool from the Passenger Airbag



Squib connector.

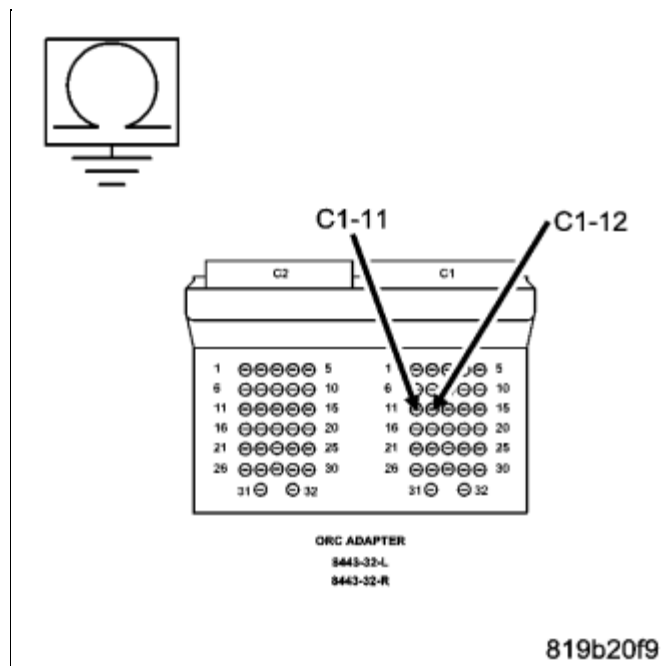
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L ORC Adaptor to the ORC connectors.

Measure the resistance of the (R42) Passenger Squib 1 Line 2 circuit between the ORC 8443-32-L Adaptor cavity C1-12 and ground.

Measure the resistance of the (R44) Passenger Squib 1 Line 1 circuit between the ORC 8443-32-L Adaptor cavity C1-11 and ground.



Is the resistance below 10k ohms on either circuit?

Yes

- Repair the Passenger Squib 1 circuits with resistance below 10k ohms for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

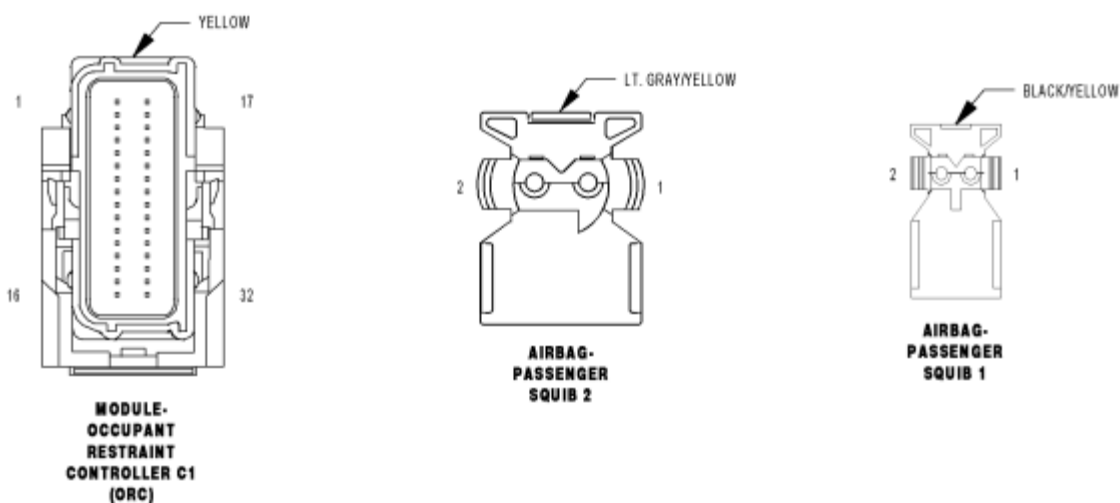
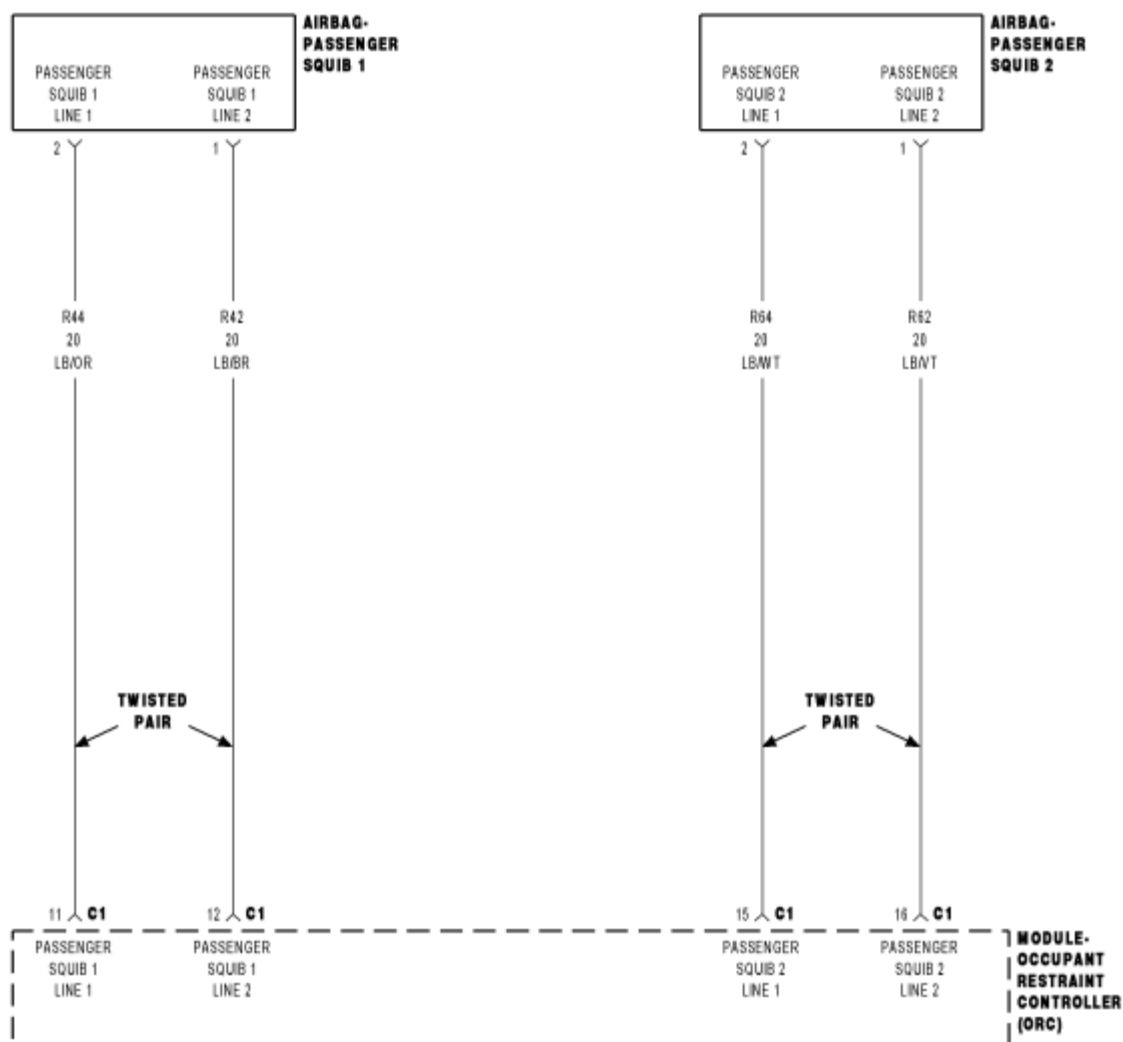
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH



01992000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY
(R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B09-PASSENGER AIRBAG SQUIB 1 CIRCUIT HIGH?

Yes

- Go To [3](#)

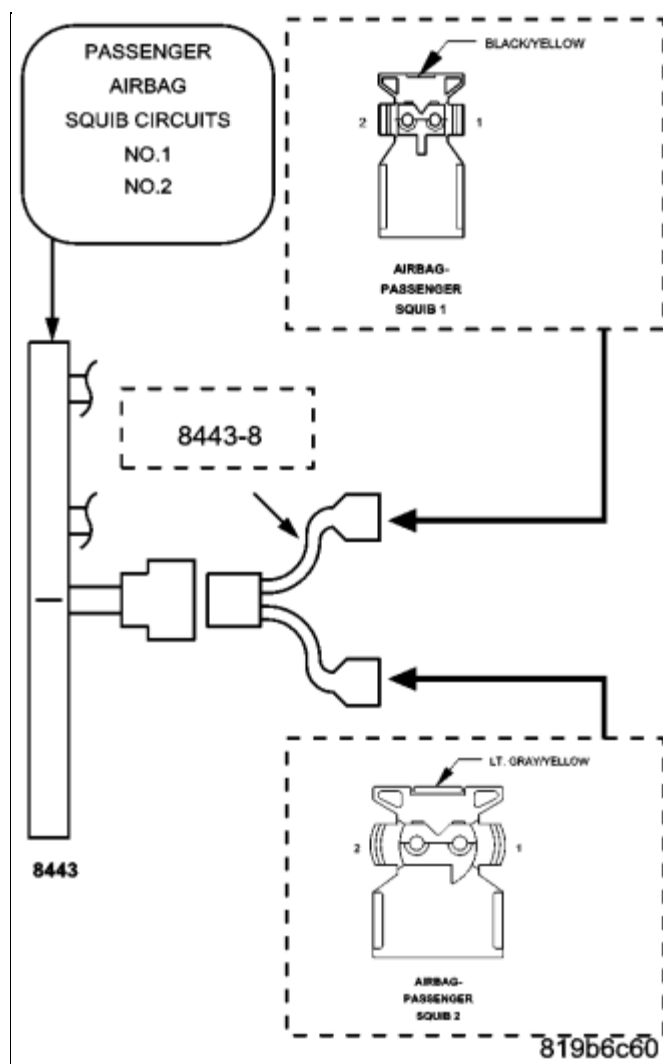
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT AND (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the

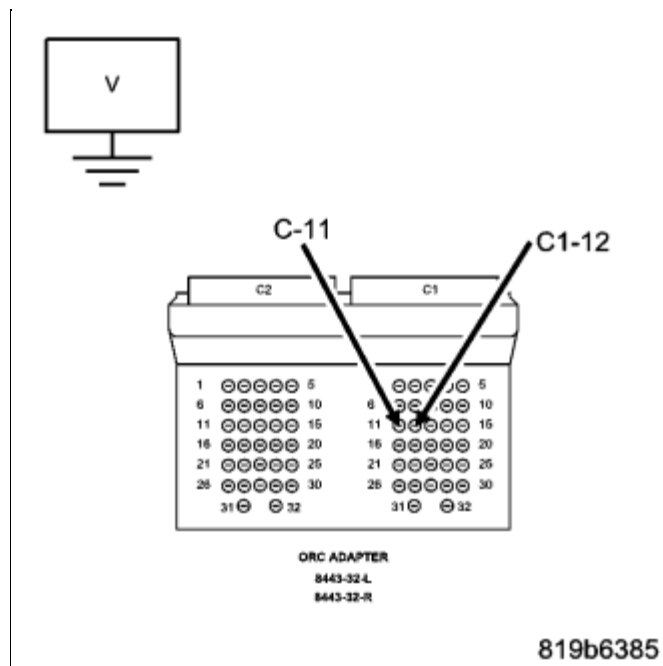


Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R42) Passenger Squib 1 Line 2 circuit between the 8443-32-L Adaptor cavity C1-12 and ground.

Measure the voltage of the (R44) Passenger Squib 1 Line 1 circuit between the 8443-32-L Adaptor cavity C1-11 and ground.

Is there any voltage present on either circuit?

Yes

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Repair the Passenger Squib 1 circuits with voltage present for short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

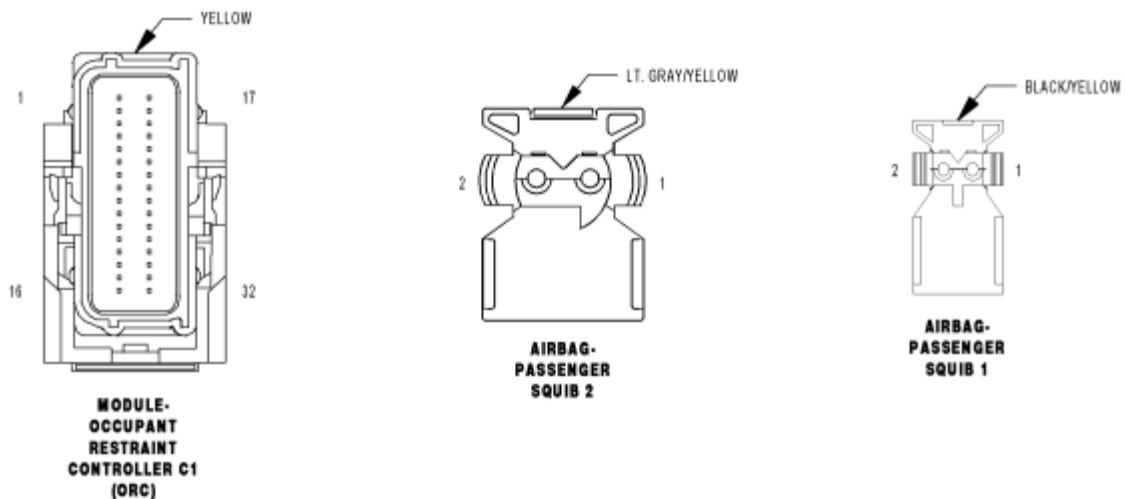
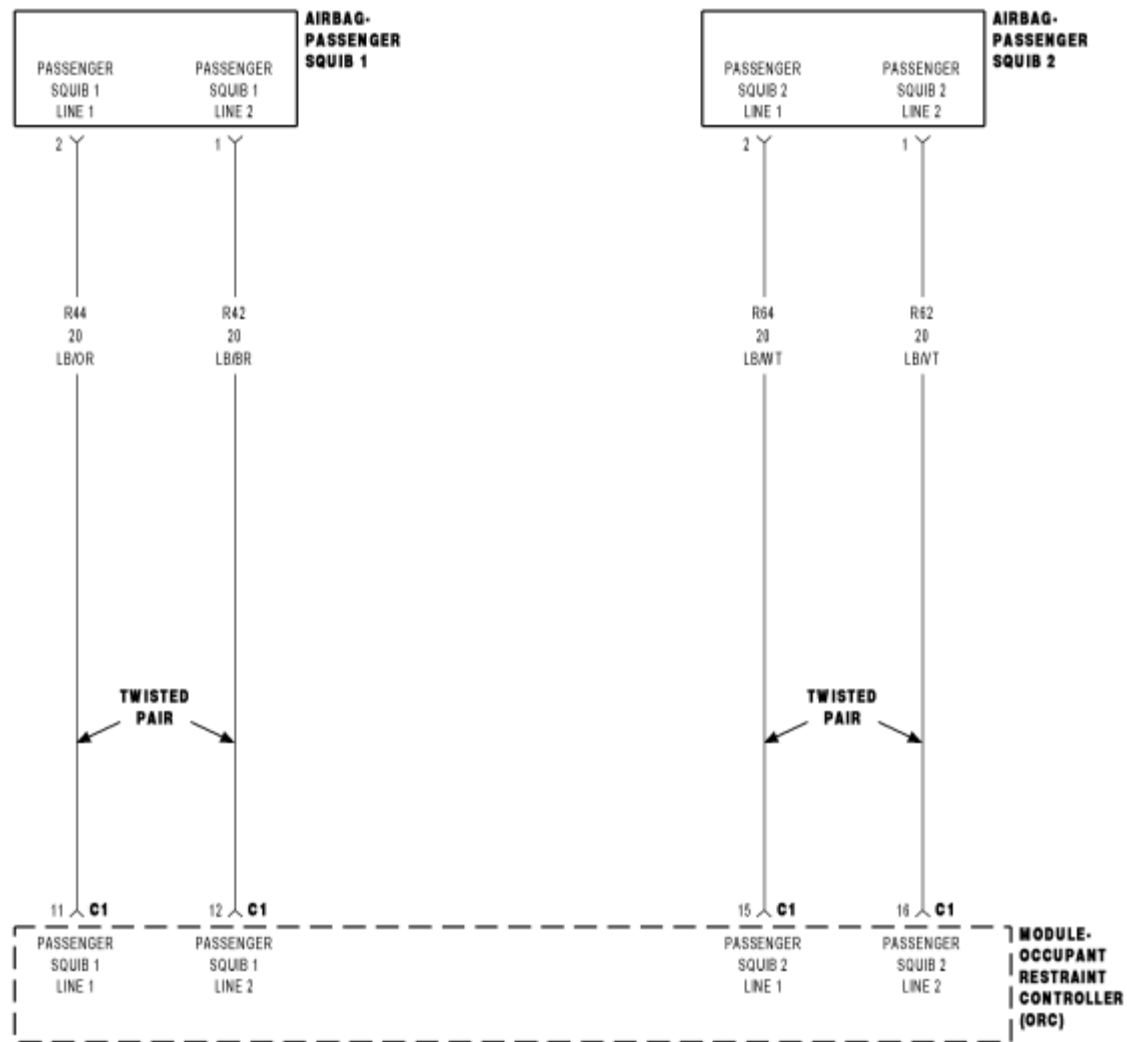
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN



01092000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT OPEN
(R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT OPEN
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

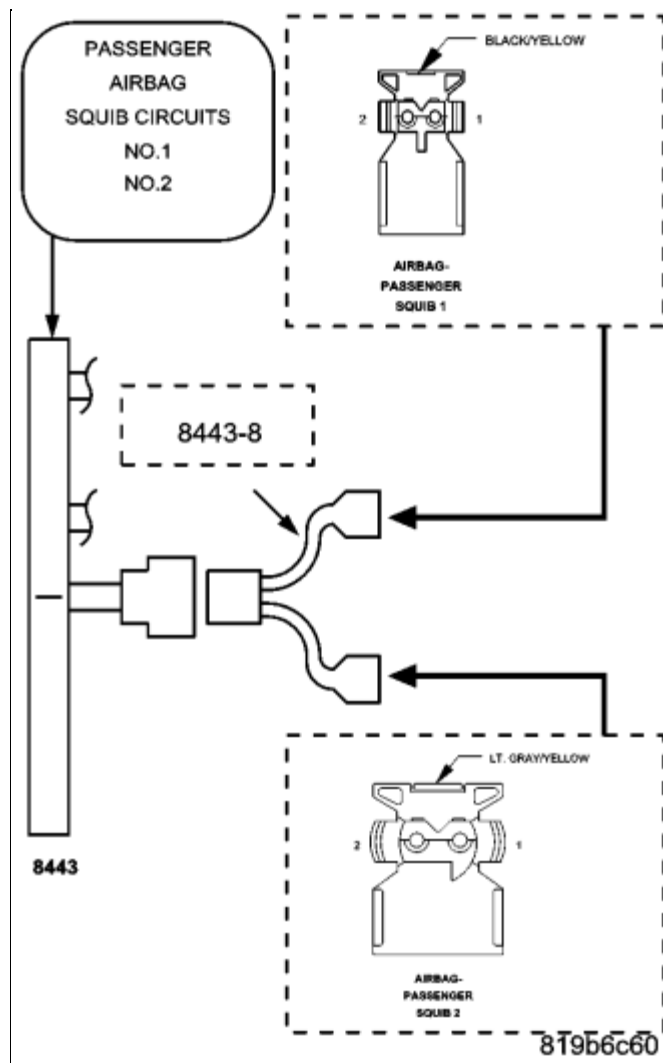
Does the scan tool display: B1B0A-PASSENGER AIRBAG SQUIB 1 CIRCUIT OPEN?

Yes

- Go To [3](#)

No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

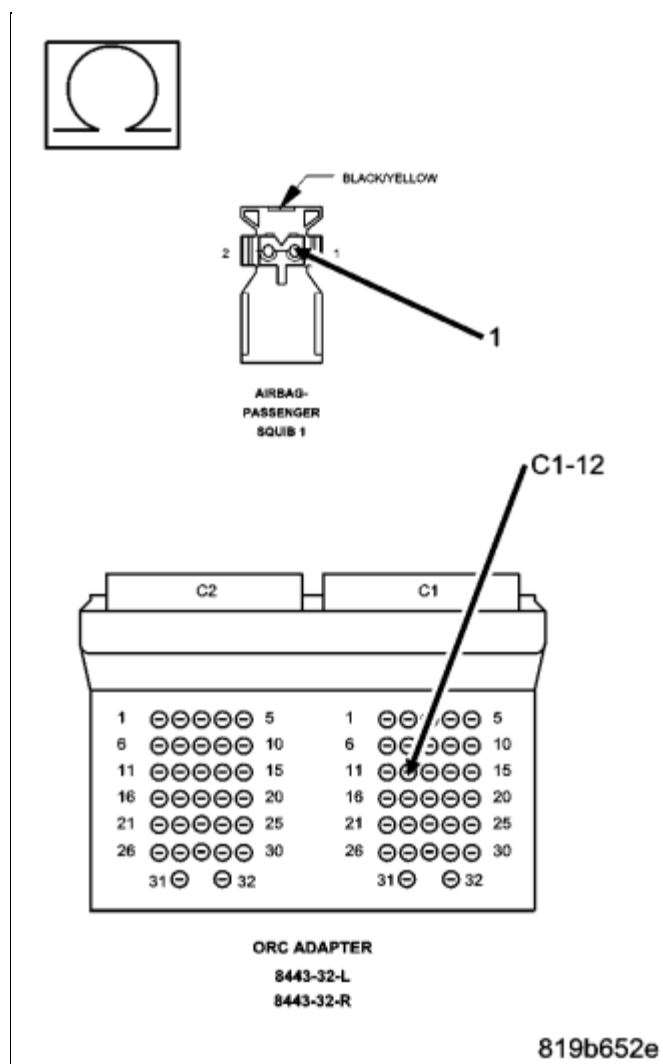


3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.



Connect the 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R42) Passenger Squib 1 Line 2 between the Passenger Airbag Squib connector cavity 1 and the 8443-32-L Adaptor cavity C1-12.

Is the resistance below 1.0 ohm?

Yes

- Go To [4](#)

No

- Repair the (R42) Passenger Squib 1 Line 2 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECK (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the (R44) Passenger Squib 1 Line 1 circuit between the Passenger Airbag Squib connector circuit cavity 2 and the 8443-32-L Adaptor cavity C1-11.

Is the resistance below 1.0 ohm?

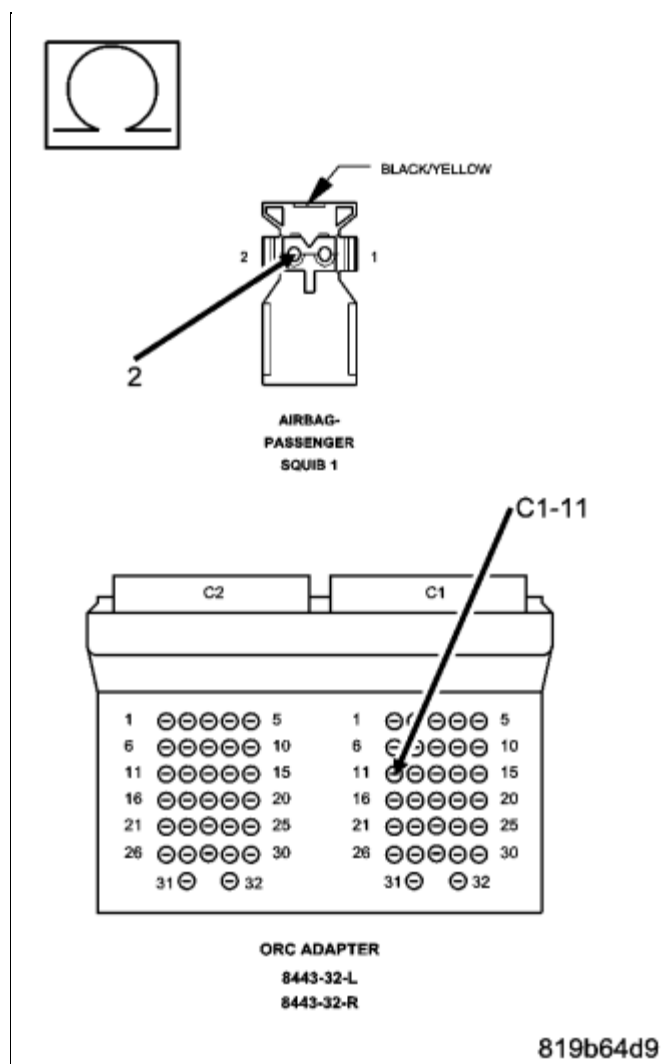
Yes

- WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R44) Passenger Squib 1 Line 1 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

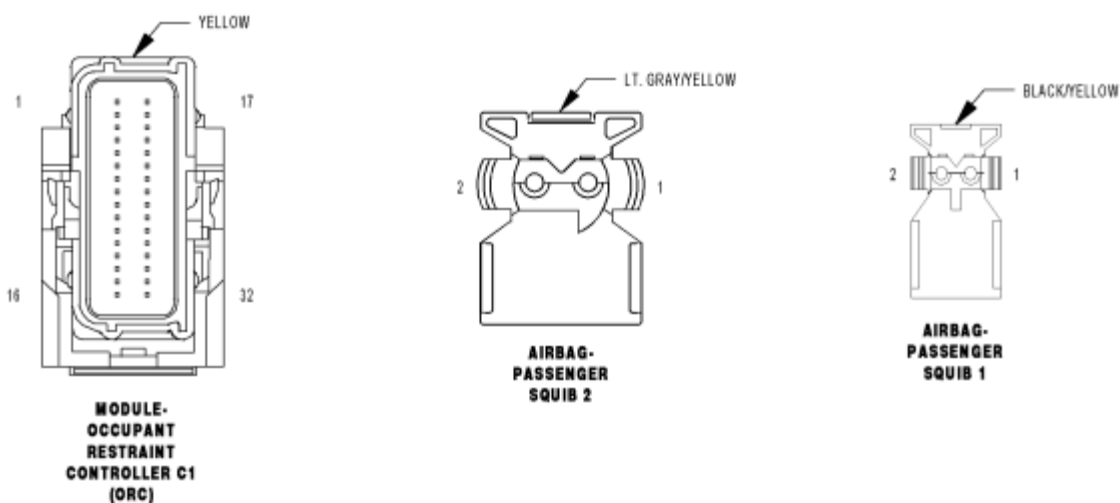
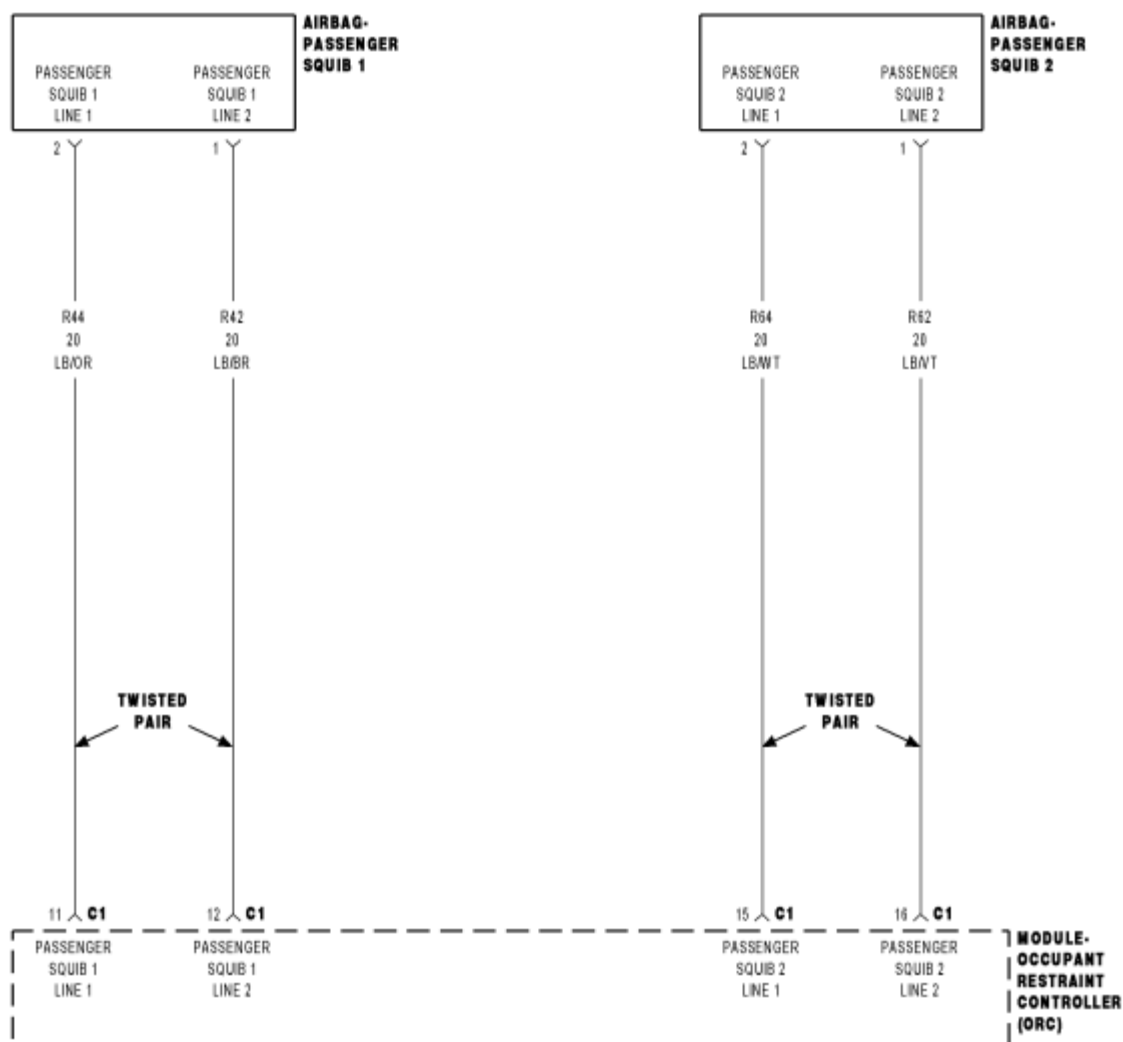
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER



01992000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Passenger Squib 1 circuits.

Possible Causes
(R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT SHORTED TO (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Airbag Squib connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

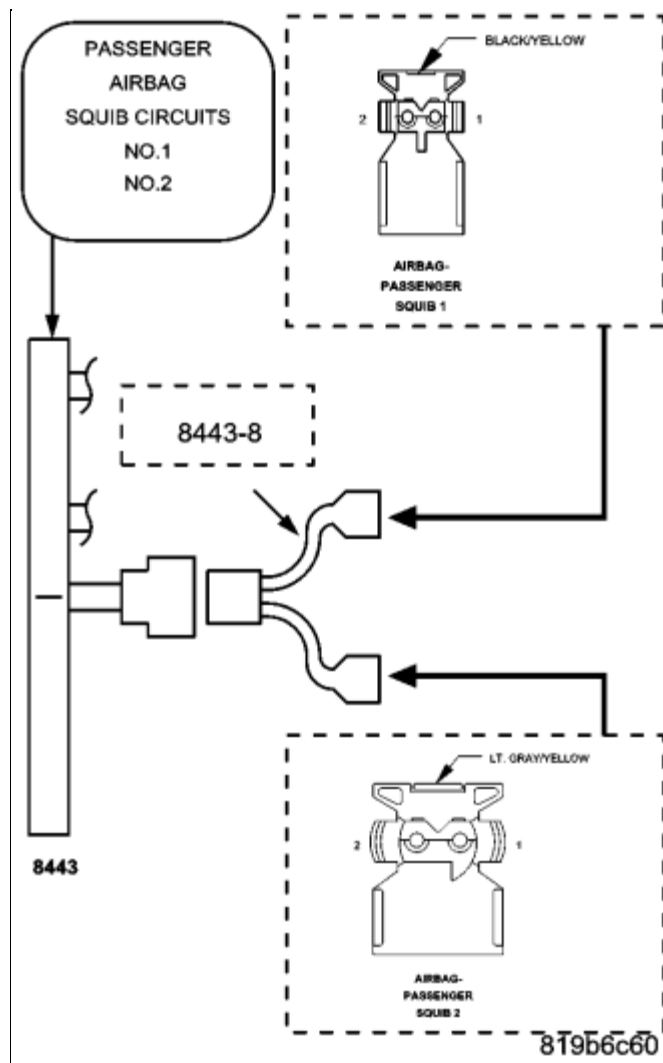
Does the scan tool display: B1B0B-PASSENGER AIRBAG SQUIB 1 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



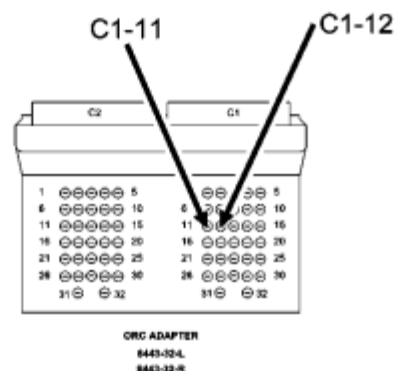
3. CHECK (R42) PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO (R44) PASSENGER SQUIB 1 LINE 1 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



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Is the resistance below 10k ohms?

Yes

- Repair the (R42) Passenger Squib 1 Line 2 circuit for a short to the (R44) Passenger Squib 1 Line 1 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

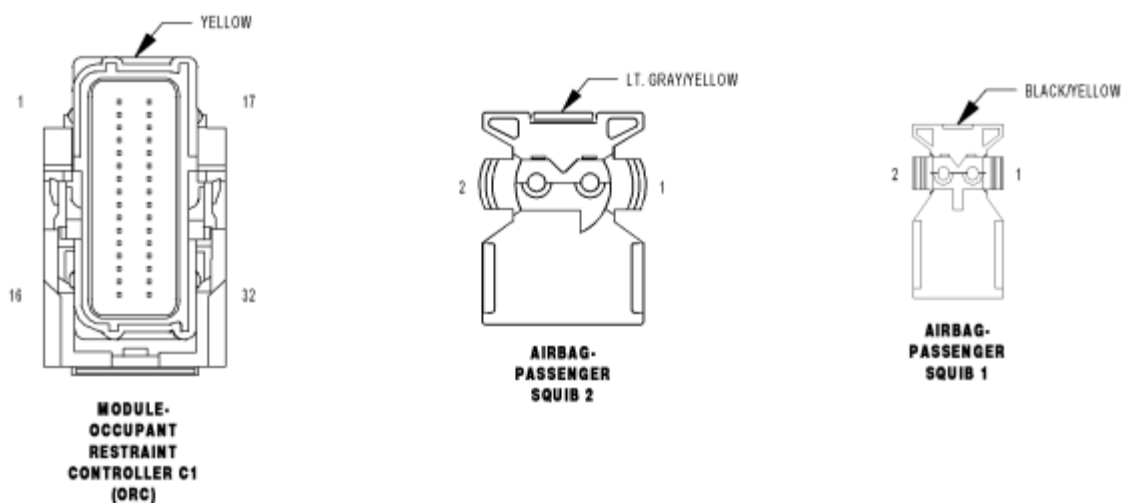
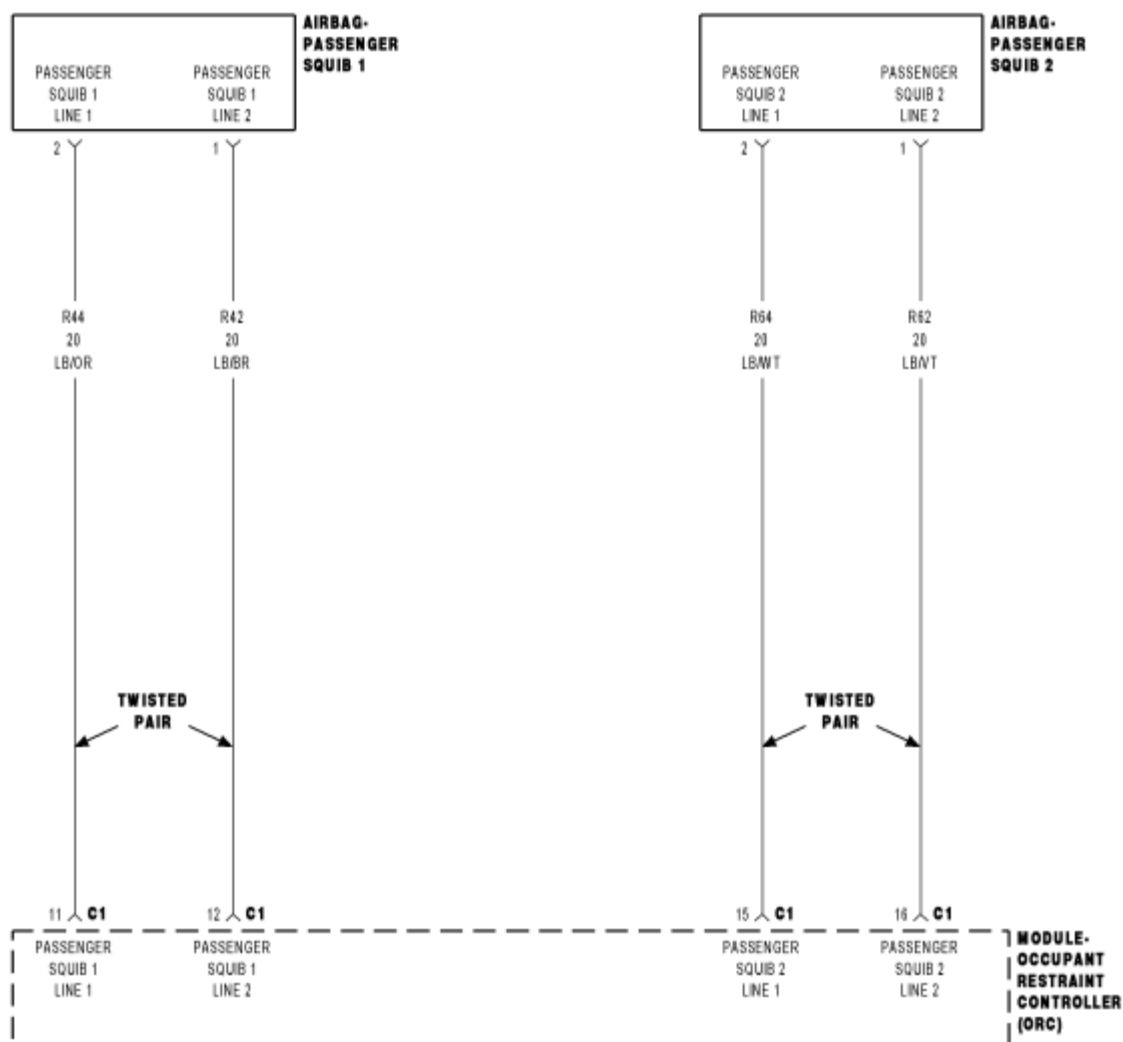
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW



01092000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects low resistance on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT SHORTED TO GROUND
(R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1B0C-PASSENGER AIRBAG SQUIB 2 CIRCUIT LOW?

Yes

- Go To [3](#)

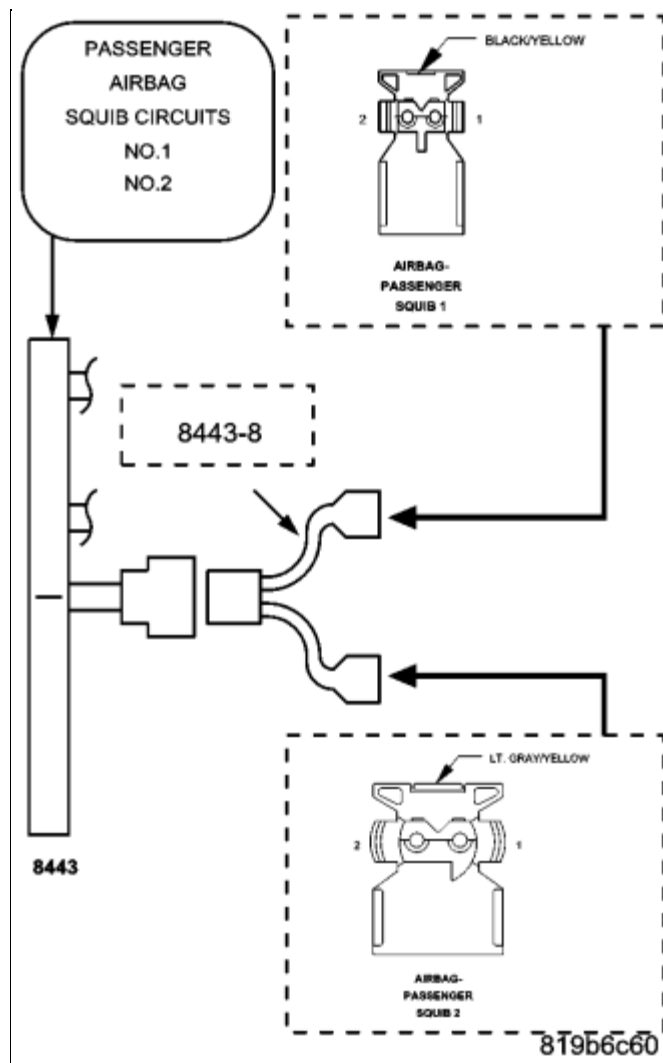
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the



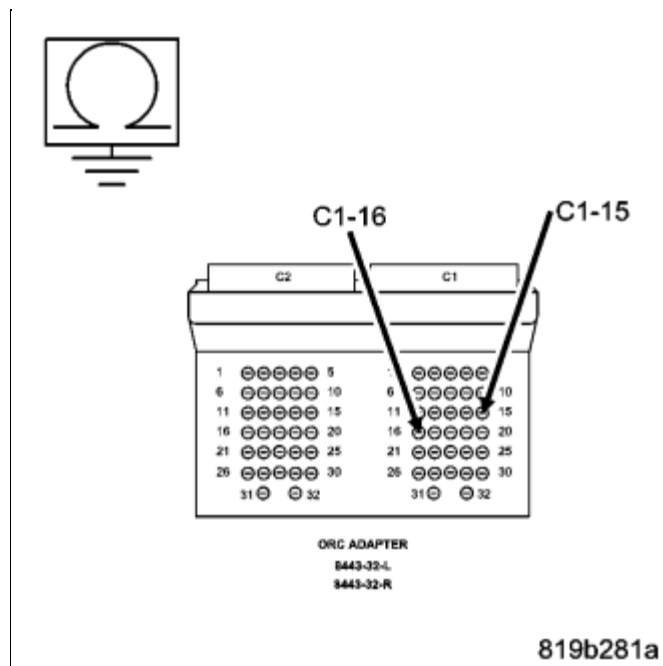
Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443-32-L ORC Adaptor to the ORC connectors.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between ORC 8443-32-L Adaptor cavity C1-15 and ground.

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between ORC 8443-32-L Adaptor cavity C1-16 and ground.



Is the resistance below 10k ohms on either circuit?

Yes

- Repair the Passenger Squib 2 circuits with resistance below 10k ohms a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTC present?

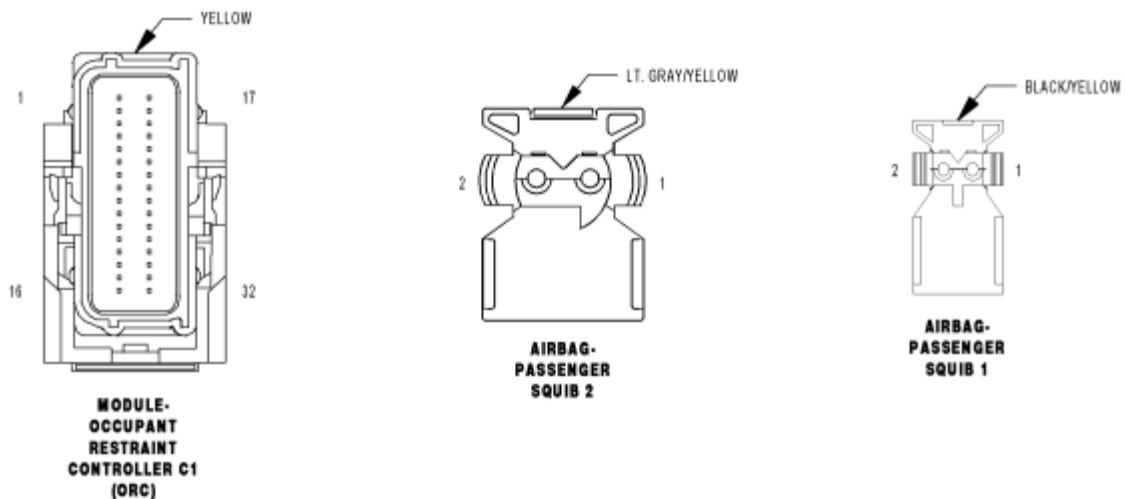
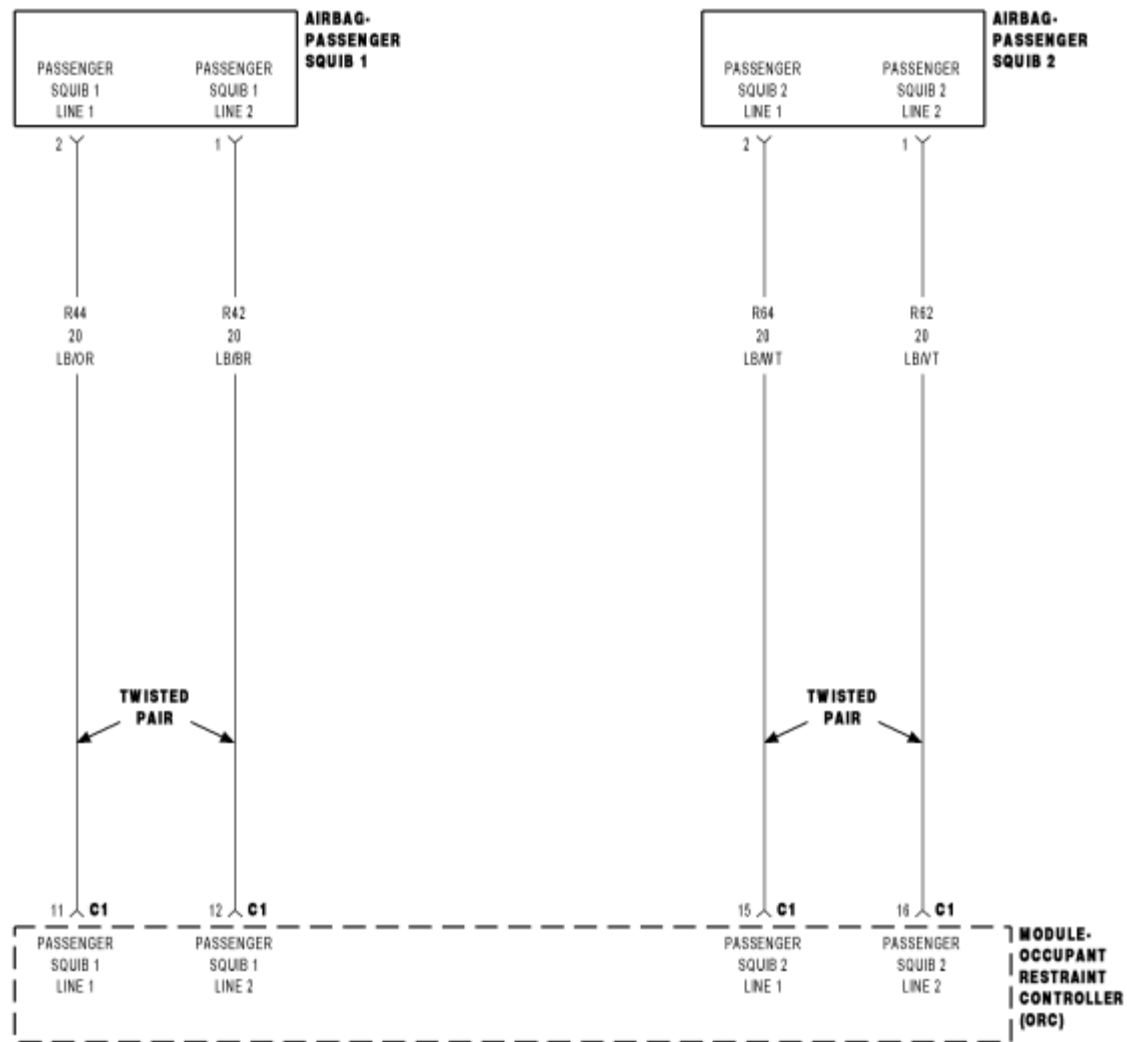
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH



01992000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects voltage on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT SHORTED TO BATTERY
(R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B0D-PASSENGER AIRBAG SQUIB 2 CIRCUIT HIGH?

Yes

- Go To [3](#)

No

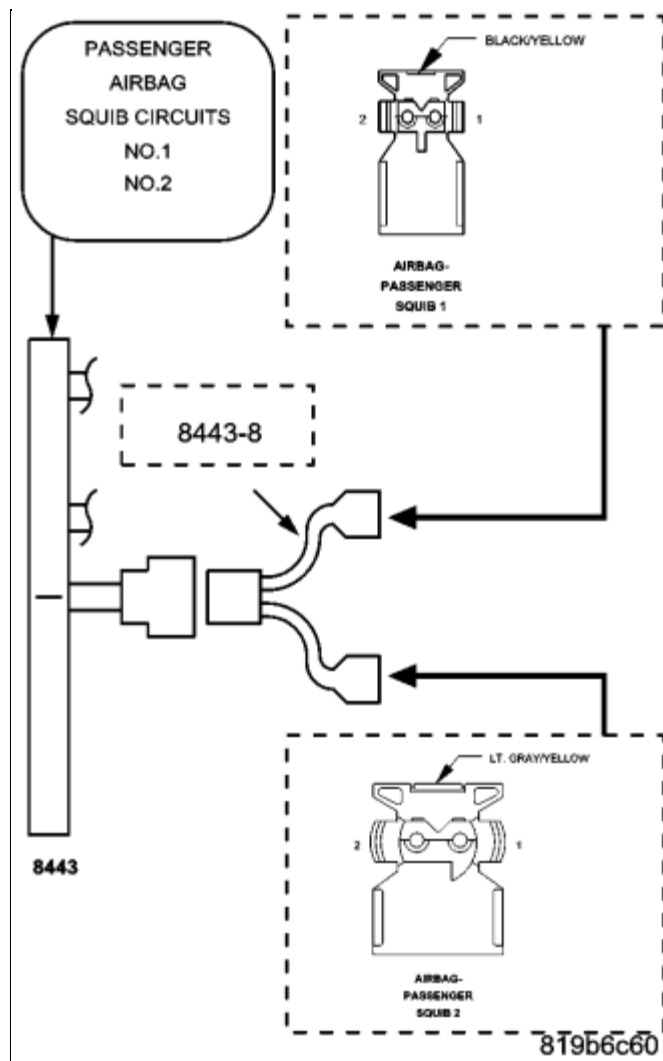
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as

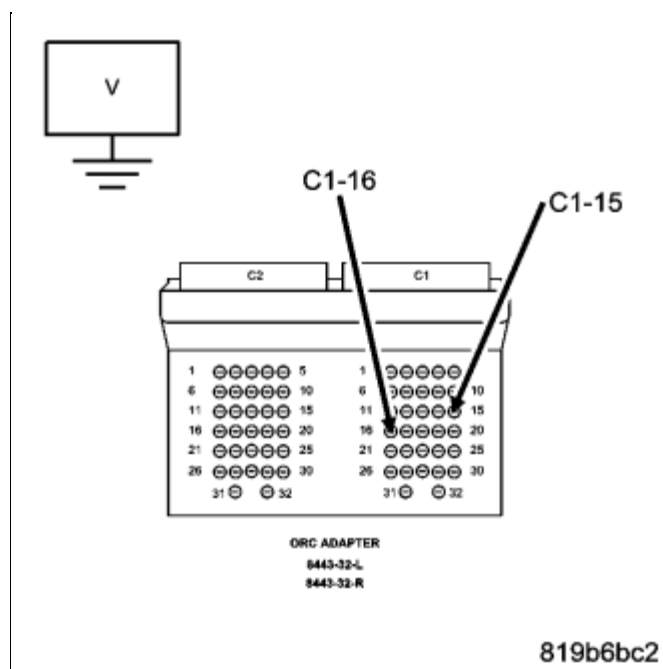


necessary.

Connect the 8443-32-L ORC Adaptor to the ORC connectors.

Measure the voltage of the (R64) Passenger Squib 2 Line 1 circuit between the 8443-32-L adaptor cavity C1-15 and ground.

Measure the voltage of the (R62) Passenger Squib 2 Line 2 circuit between the 8443-32-L adaptor cavity C1-16 and ground.



Is there any voltage present on either circuit?

Yes

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Repair the Passenger Squib 2 circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two

minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

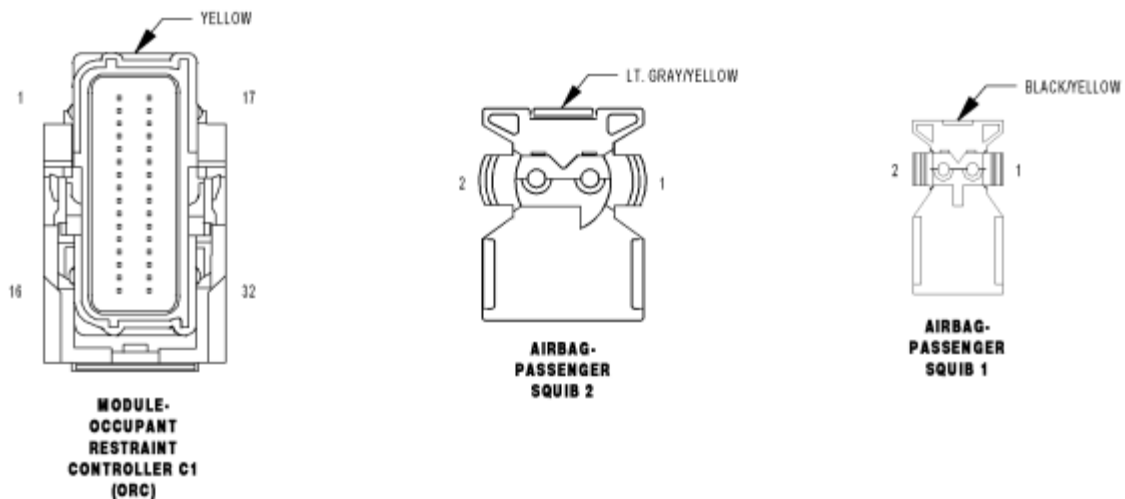
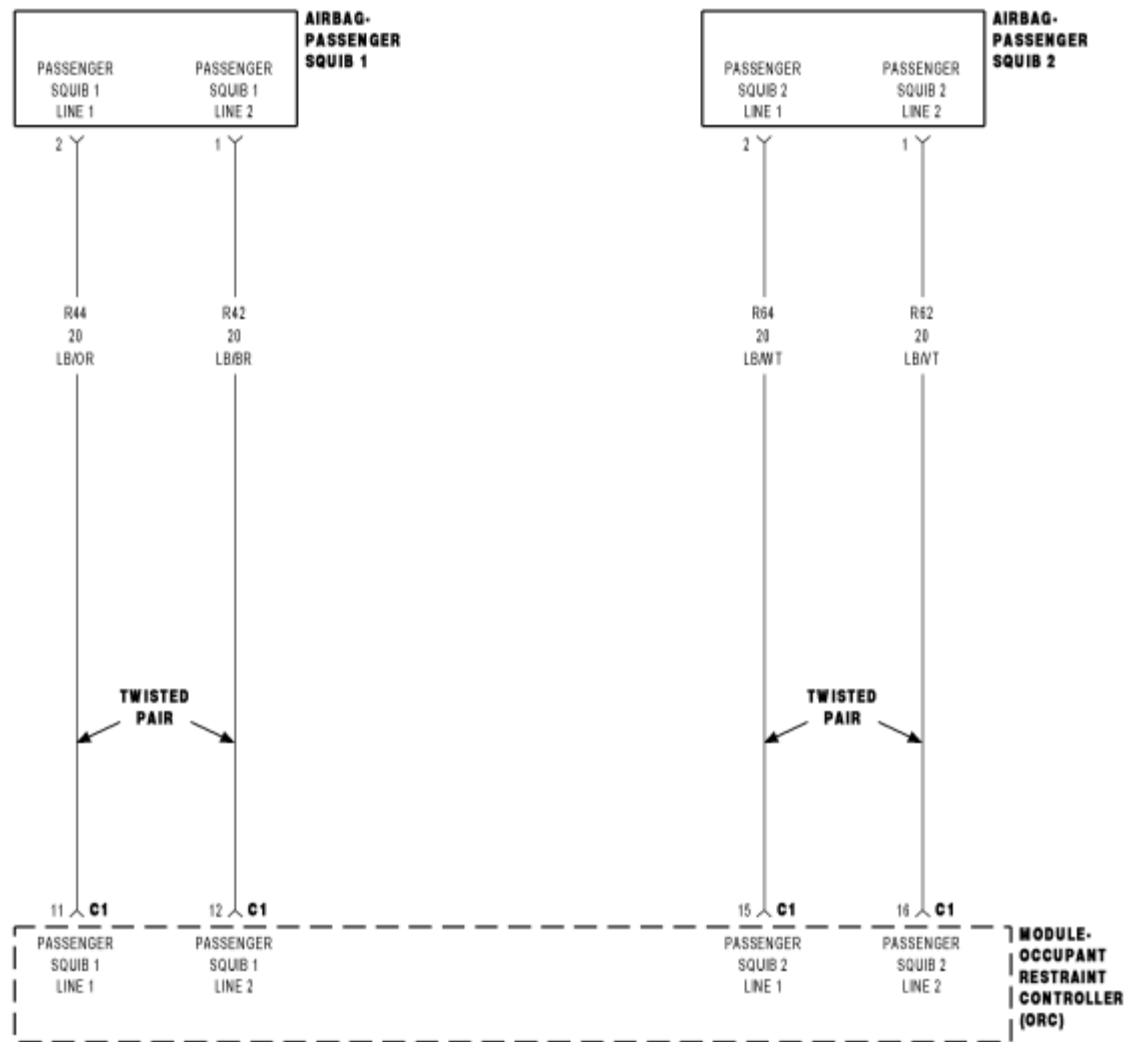
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN



01092000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects an open or high resistance on the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OPEN
(R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT OPEN
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B0E-PASSENGER AIRBAG SQUIB 2 CIRCUIT OPEN?

Yes

- Go To [3](#)

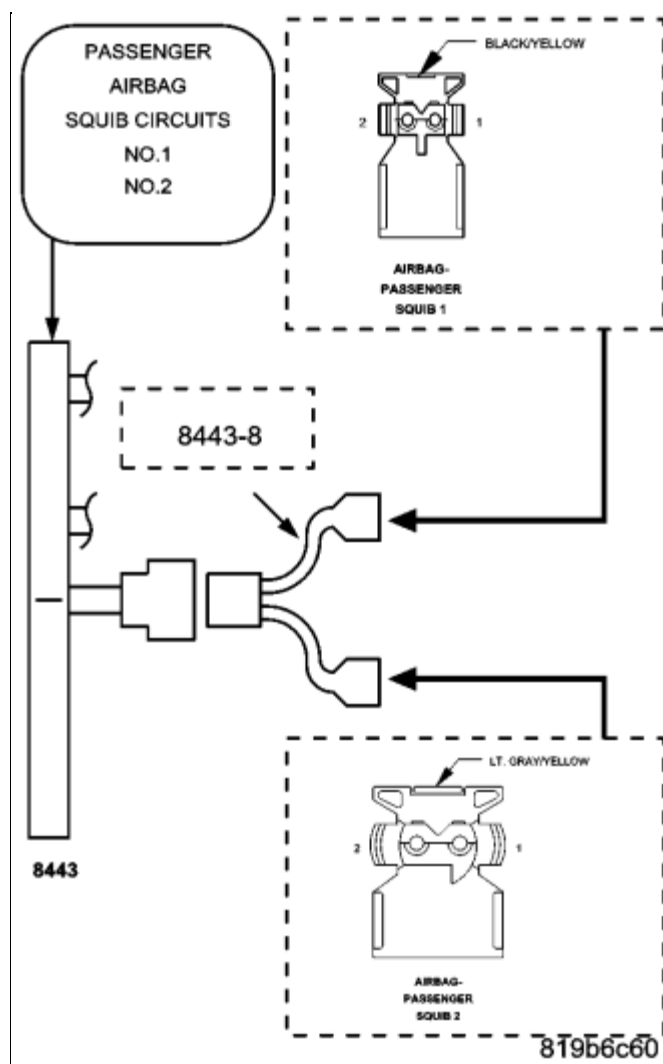
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Airbag Squib connectors.



Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adaptor.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between the Passenger Airbag Squib connector and the 8443-32-L ORC Adaptor cavity C1-15.

Is the resistance below 1.0 ohm?

Yes

- Go to [4](#)

No

- Repair the (R64) Passenger Squib 2 Line 1 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

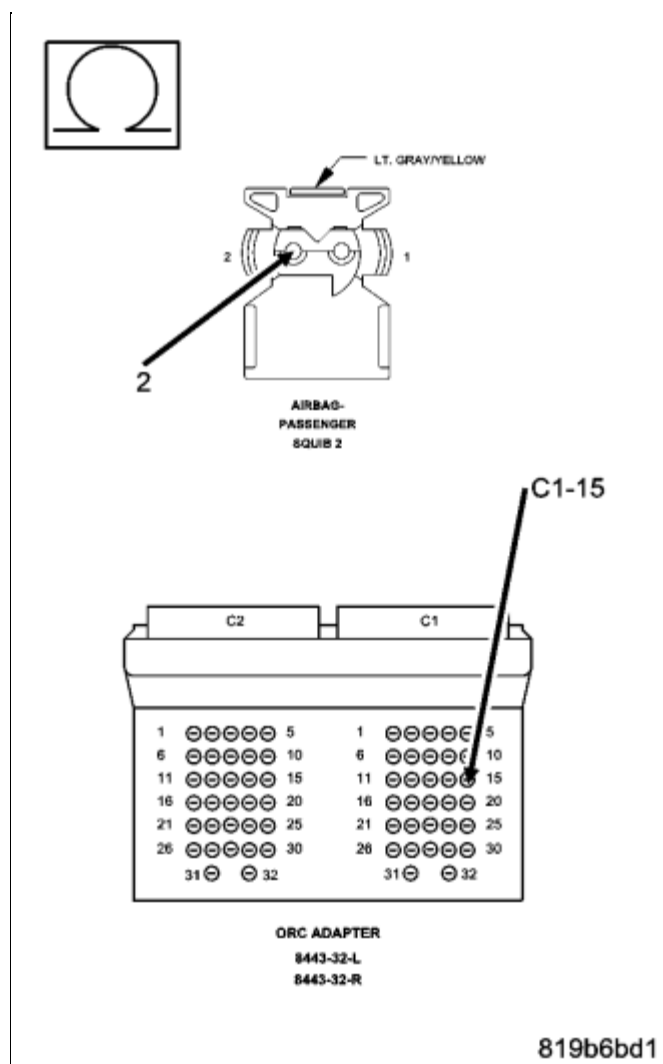
4. CHECK (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between the Passenger Airbag Squib connector and the 8443-32-L ORC Adaptor cavity C1-16.

Is the resistance below 1.0 ohm?

Yes

- WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

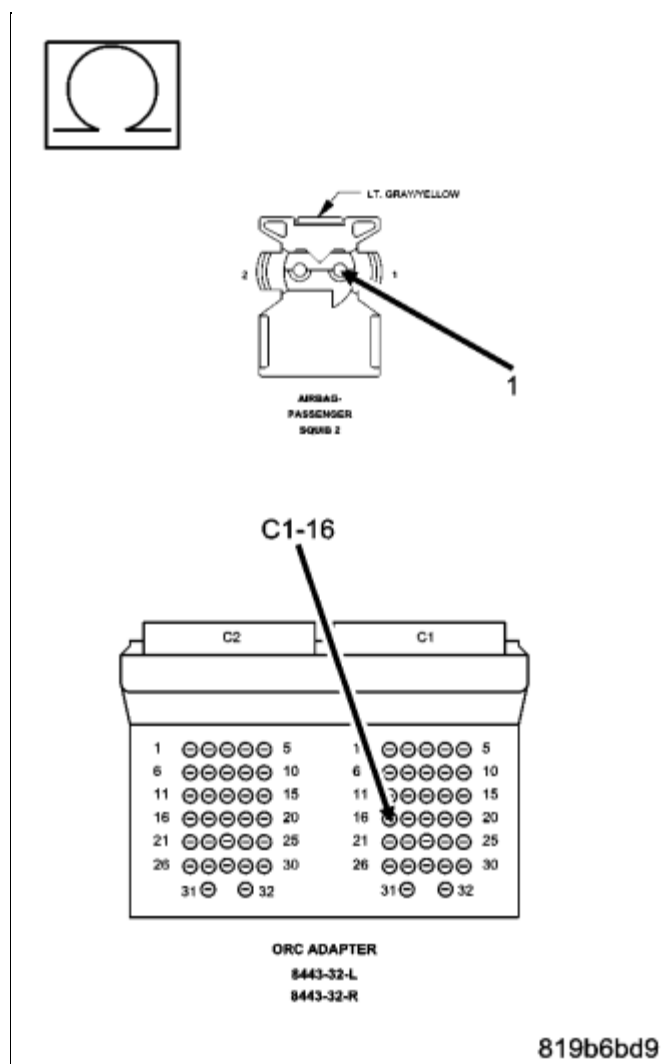


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- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R62) Passenger Squib 2 Line 2 circuit for an open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

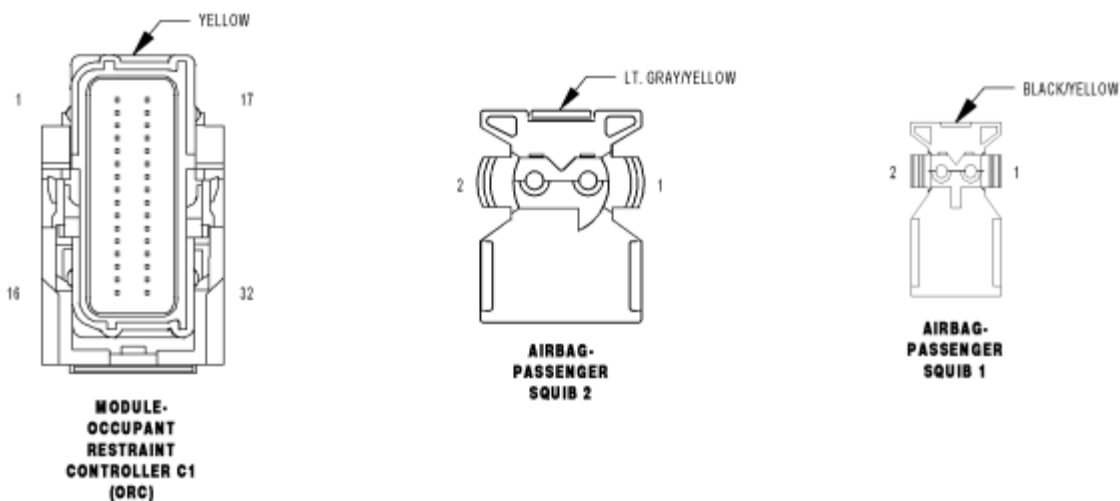
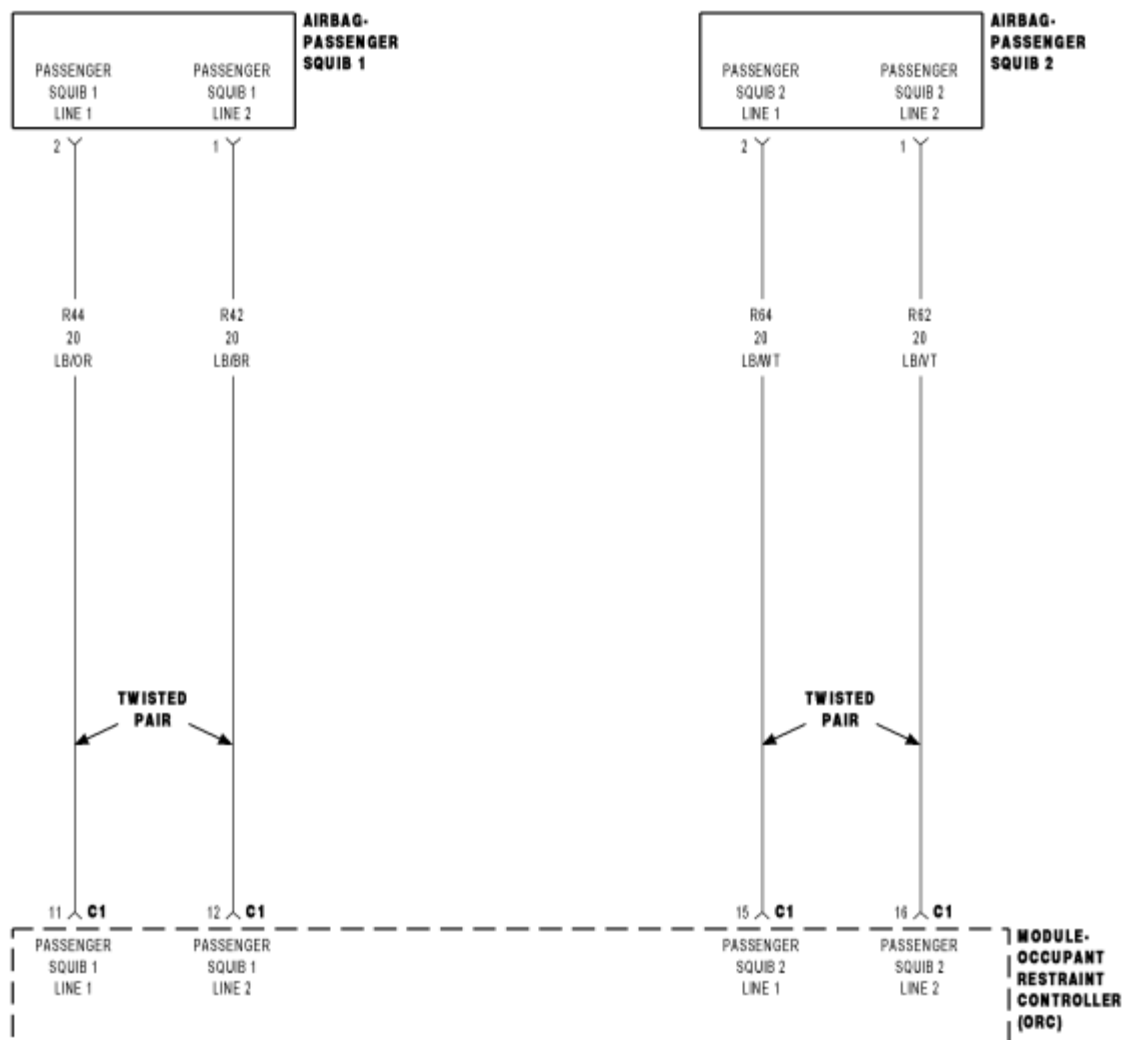
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER



01992000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects low resistance between the Passenger Squib 2 circuits.

Possible Causes
(R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT SHORTED TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT
PASSENGER AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-8 Jumper to the Passenger Airbag Squib connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery

With the scan tool, read the active ORC DTCs.

Does the scan tool display: B1B0F-PASSENGER AIRBAG SQUIB 2 CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

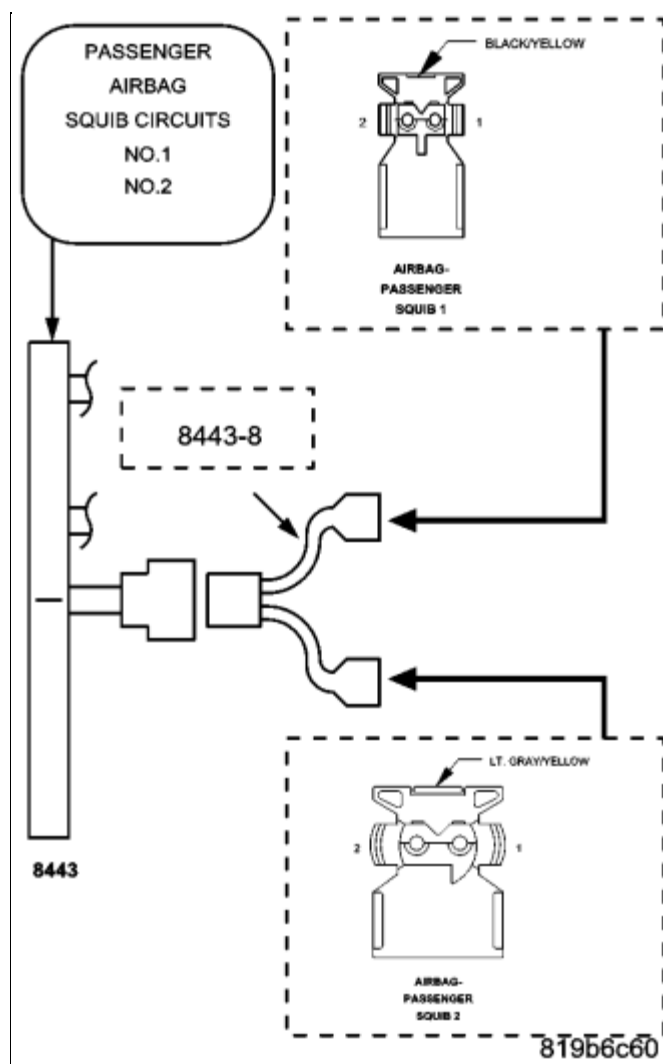
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Passenger Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the

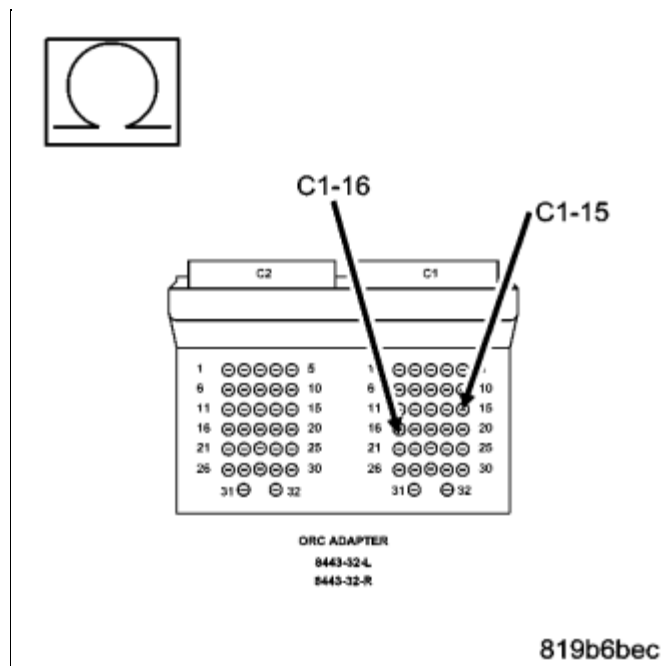


Passenger Airbag Squib connectors.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adaptor.



Measure the resistance between the (R64) Passenger Squib 2 Line 1 circuit and the (R62) Passenger Squib 2 Line 2 circuit at the 8443-32-L Adaptor cavities C1-15 and C1-16.

Is the resistance below 10k ohms?

Yes

- Repair the (R64) Passenger Squib 2 Line 1 circuit for a short to the (R62) Passenger Squib 2 Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTCs.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

Are any ACTIVE DTCs present?

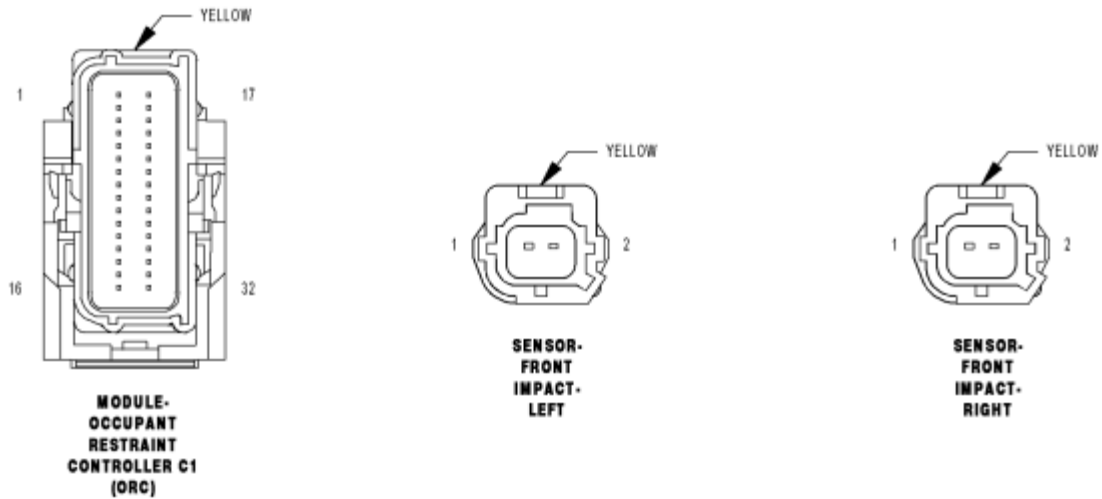
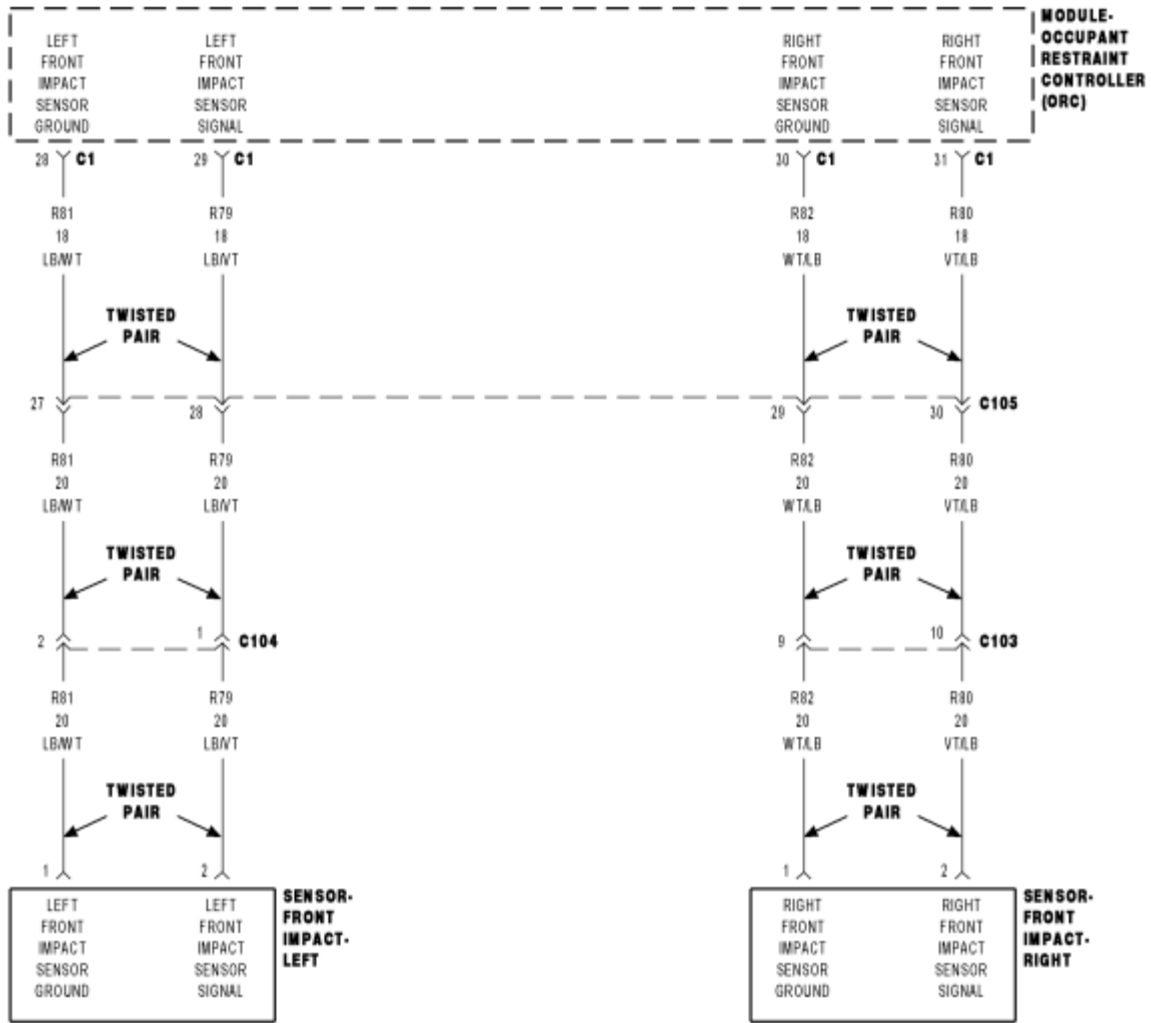
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL



0104000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Front Left Impact Sensor is equipped with on board diagnostics to monitor to sensor's internal circuits. If a problem is identified, the sensor sends the Front Left Impact Sensor Internal message to the Occupant Restraint Controller (ORC).

- **Set Condition:**

This DTC will set if the ORC receives an internal DTC from the Front Left Impact Sensor.

Possible Causes
FRONT LEFT IMPACT SENSOR
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED FAULT CODE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

Wait one minute, and read active codes.

Is the DTC: B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL active?

Yes

- Go To [2](#)

No

- Go To [4](#)
-

2. VERIFY OPERATION OF THE FRONT LEFT IMPACT SENSOR

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Replace the Front Left Impact Sensor.

Reconnect the vehicle wire harness to the sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the

Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Use the scan tool and erase the stored codes in all airbag system modules.
Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.
Wait one minute, and read active codes.

Did the active DTC: B1B70-UP-FRONT LEFT SATELLITE ACCELERATION SENSOR INTERNAL return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the ORC in accordance with Service Instructions.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

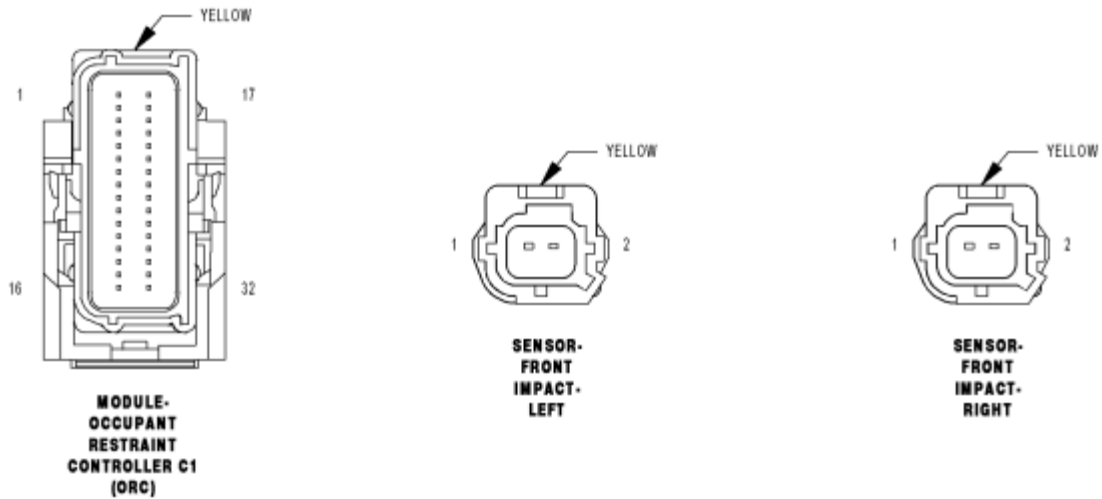
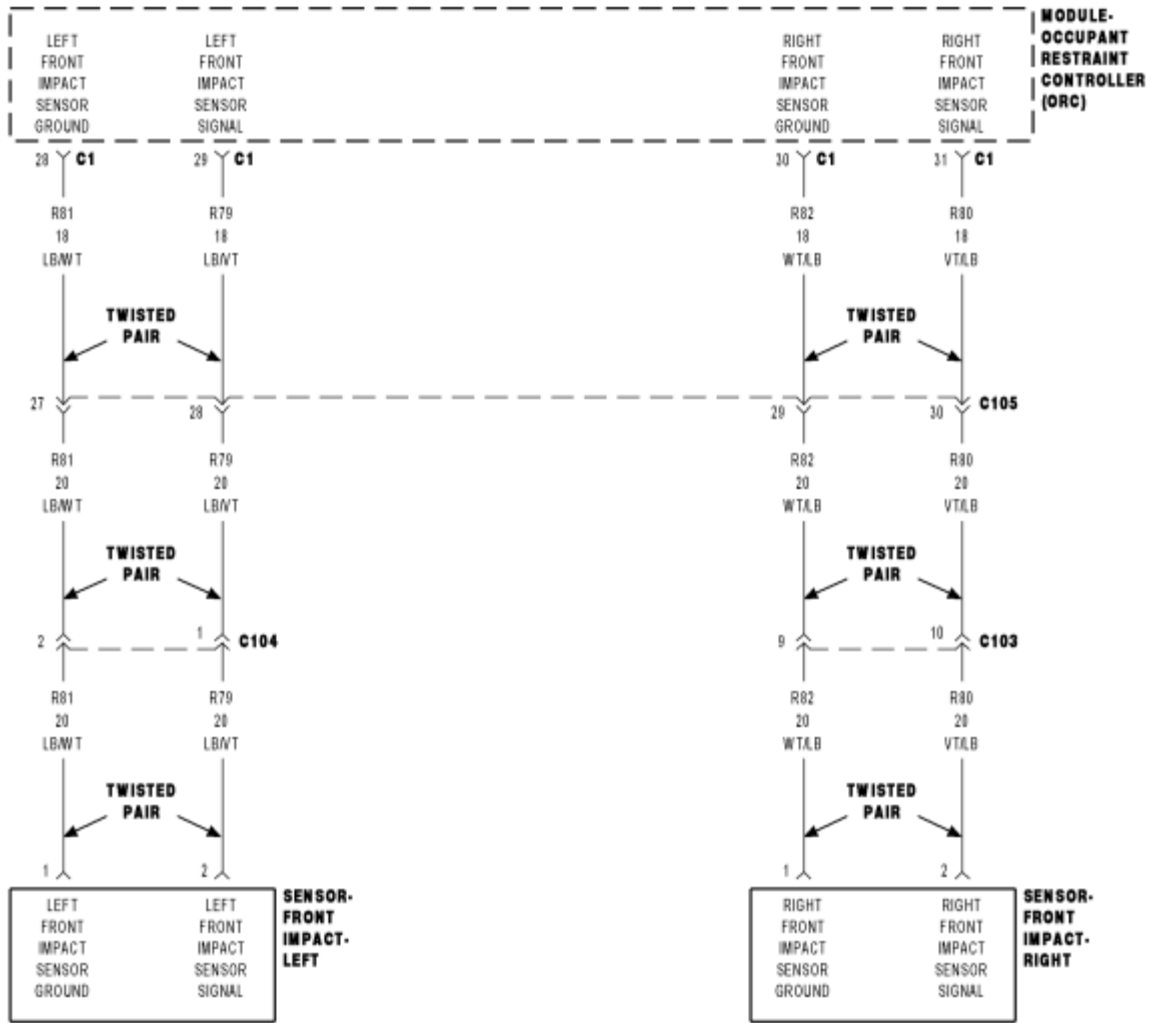
Yes

- Select appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.
-

B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL



01094000

For a complete wiring diagram Refer to Section 8W.

◦ **When Monitored:**

With the ignition on, the Front Right Impact Sensor is equipped with on board diagnostics to monitor to sensor's internal circuits. If a problem is identified, the sensor sends the Front Right Impact Sensor Internal message to the Occupant Restraint Controller (ORC).

- **Set Condition:**

This DTC will set if the ORC receives an internal DTC from the Front Right Impact Sensor.

Possible Causes
FRONT RIGHT IMPACT SENSOR
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED FAULT CODE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

Is the DTC: B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL active?

Yes

- Go To [2](#)

No

- Go To [4](#)
-

2. VERIFY OPERATION OF THE FRONT RIGHT IMPACT SENSOR

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Replace the Front Right Impact Sensor.

Reconnect the vehicle wire harness to the sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Use the scan tool and erase the stored codes in all airbag system modules.
Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.
Wait one minute, and read active codes.

Did the active DTC: B1B71-UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR INTERNAL return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the ORC in accordance with Service Instructions.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

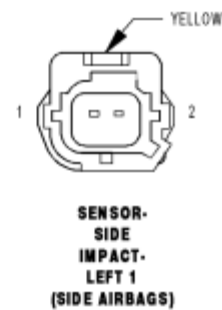
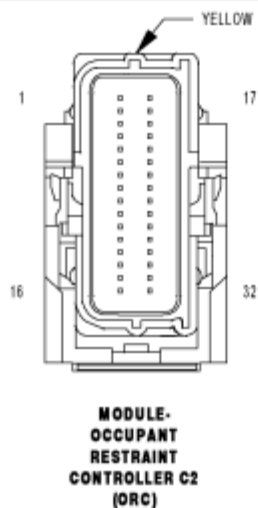
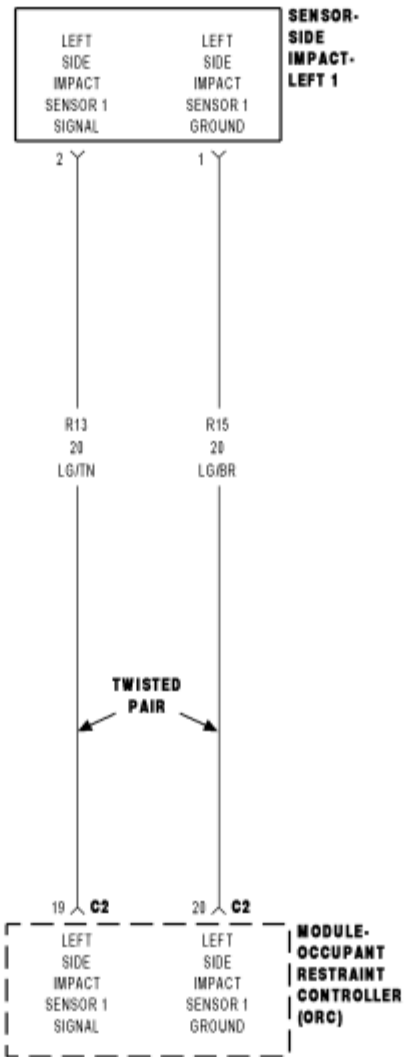
Yes

- Select appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.
-

B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL



01994197

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Left Side Impact Sensor 1 is equipped with on board diagnostics to monitor to sensor's internal circuits. If a problem is identified, the sensor sends the Left Side Impact Sensor 1 Internal message to the Occupant Restraint Controller (ORC).

- **Set Condition:**

This DTC will set if the ORC receives an internal DTC from the Left Side Impact Sensor 1.

Possible Causes
LEFT SIDE IMPACT SENSOR 1
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED FAULT CODE

Turn the ignition on.

NOTE: Ensure the battery is fully charged.

IS the DTC: B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL active?

Yes

- Go To [2](#)

No

- Go To [4](#)
-

2. VERIFY OPERATION OF THE LEFT SIDE IMPACT SENSOR 1.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Replace the Left Side Impact Sensor 1.

Reconnect the vehicle wire harness to the sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Use the scan tool and erase the stored codes in all airbag system modules.
Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.
Wait one minute, and read active codes.

Did the active DTC: B1B72-LEFT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the Occupant Restraint Controller in accordance with Service Instructions.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

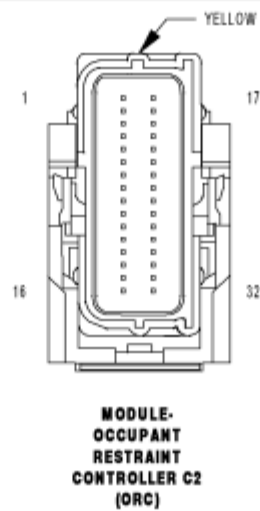
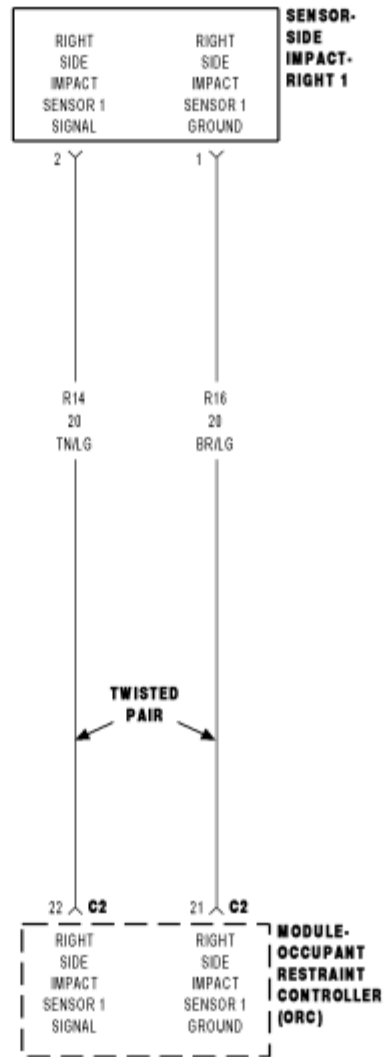
Yes

- Select appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.
-

B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL



0199419*

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Right Side Impact Sensor 1 is equipped with on board diagnostics to monitor to sensor's internal circuits. If a problem is identified, the sensor sends the Right Side Impact Sensor 1 Internal message to the Occupant Restraint Controller (ORC).

- **Set Condition:**

This DTC will set if the ORC receives an internal DTC from the Right Side Impact Sensor 1.

Possible Causes
RIGHT SIDE IMPACT SENSOR 1
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED FAULT CODE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

Is the DTC: B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL active?

Yes

- Go To [2](#)

No

- Go To [4](#)
-

2. VERIFY OPERATION OF THE RIGHT SIDE IMPACT SENSOR 1

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Replace the Right Side Impact Sensor 1.

Reconnect the vehicle wire harness to the sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Use the scan tool and erase the stored codes in all airbag system modules.
Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.
Wait one minute, and read active codes.

Did the active DTC: B1B75-RIGHT SIDE SATELLITE ACCELERATION SENSOR 1 INTERNAL return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the ORC in accordance with Service Instructions.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.
-

4. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

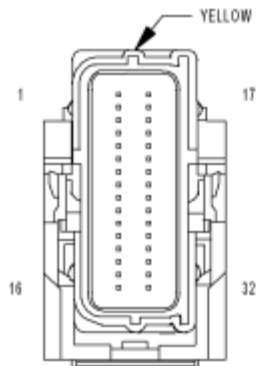
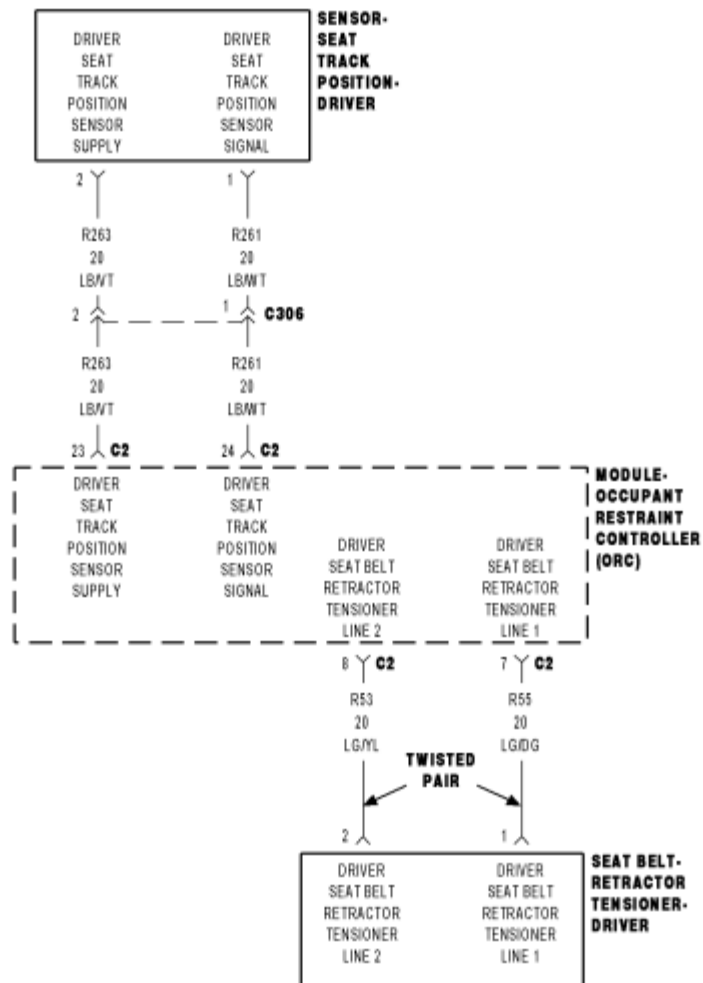
Yes

- Select appropriate symptom from Symptom List.

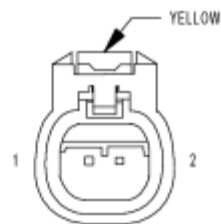
No

- No problem found at this time. Erase all codes before returning vehicle to customer.
-

B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW



**MODULE-
OCCUPANT
RESTRAINT
CONTROLLER C2
(ORC)**



**SEAT BELT-
RETRACTOR
TENSIONER-
DRIVER**

8100c003

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

While the CAN bus ignition status is in IGN_RUN and the module is configured for a Driver Seat Track Position Sensor, the module checks the sensor input current ranges.

◦ **Set Condition:**

If the module detects that the sensor input is less than or equal to 0.3 ma. This DTC may set when the current is between 0.3 mA and 2.0 mA.

Possible Causes
DRIVER SEAT HARNESS IMPROPERLY ROUTED
DRIVER SEAT HARNESS WIRES CHAFED, PIERCED, PINCHED, PARTIALLY BROKEN
DRIVER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT SHORTED TO GROUND
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT OPEN
(R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT OPEN
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. IDENTIFYING VEHICLE EQUIPMENT

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC active DTC.

Does the scan tool display active DTC: B1B8D-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT LOW?

Yes

- Go To [2](#)

No

- Go To [7](#)

Diagnostic Test

2. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, AND BATTERY FAULTS IN THE OCCUPANT RESTRAINT CONTROLLER (ORC)

With the scan tool, read Occupant restraint Controller (ORC) DTC.

Does the scan tool display any active DTC relating to internal faults, ignition faults, or battery faults?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents in this Section for a complete list of symptoms.

No

- Go To [3](#)

3. INSPECT DRIVER SEAT HARNESS WIRES AND CONNECTORS

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the driver seat harness wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**
- Replace the driver seat harness in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1

No

- Go To [4](#)

4. VERIFY THAT DRIVER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the driver seat harness is routed correctly.

Is the Driver Seat Harness routed correctly?

Yes

- Go To [5](#)

No

- Reroute the driver seat harness as necessary.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK (R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT AND (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the ORC connectors.

Connect the 8443-32-L ORC adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance between ground and the (R261) Driver Seat Position Sensor Signal circuit cavity 1.
Measure the resistance between ground and the (R263) Driver Seat Position Sensor Supply circuit cavity 2.

Is the resistance below 10k ohms on either circuit?

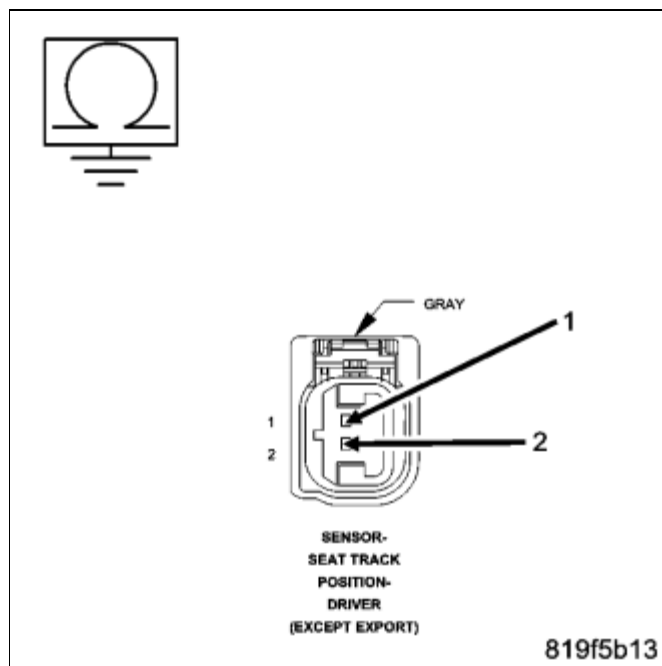
Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**
- Replace the Driver Seat Harness in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

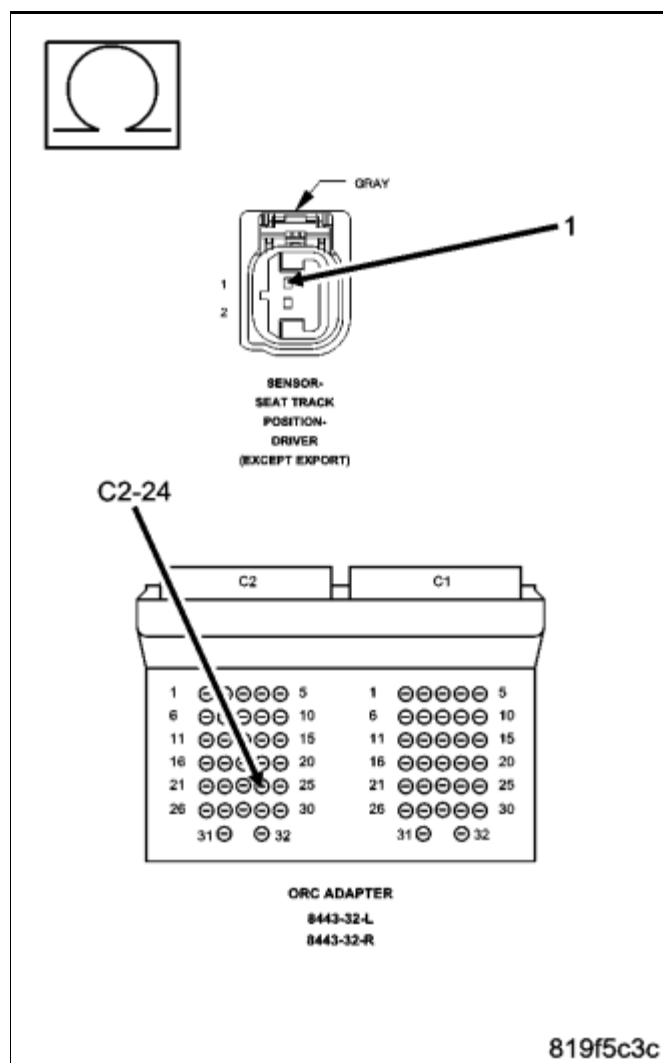
No

- Go To [6](#)

6. CHECK (R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT AND (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT FOR A SHORT TO GROUND



SEAT POSITION SENSOR SUPPLY CIRCUIT FOR AN OPEN



Measure the resistance of the (R261) Driver Seat Position Sensor Signal circuit between the ORC-C2 connector cavity C2-24 and the Driver Seat Track Position Sensor connector cavity 1.

Measure the resistance of the (R263) Driver Seat Position Sensor Supply circuit between the ORC-C2 connector cavity C2-23 and the Driver Seat Track Position Sensor connector cavity 2.

Is the resistance of either circuit above 5.0 ohms?

Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**

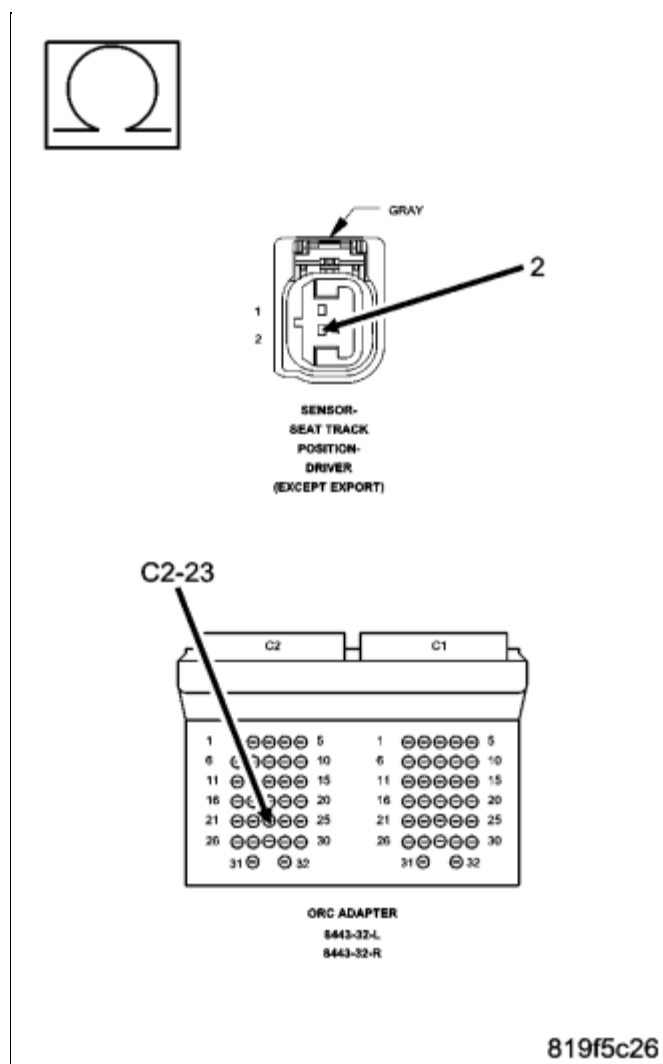
- Replace the Driver Seat Harness in accordance with the Service Information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

Replace the Occupant Restraint Controller (ORC) in accordance with the service information.

- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



7. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from the ORC.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

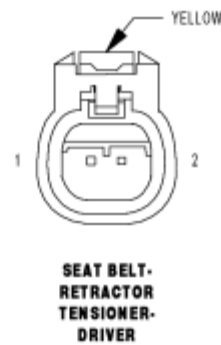
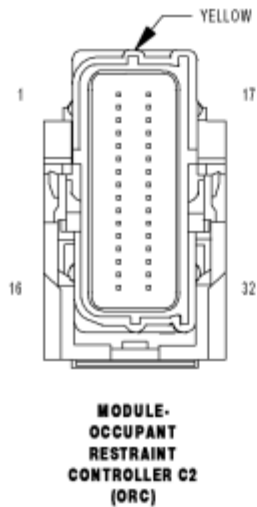
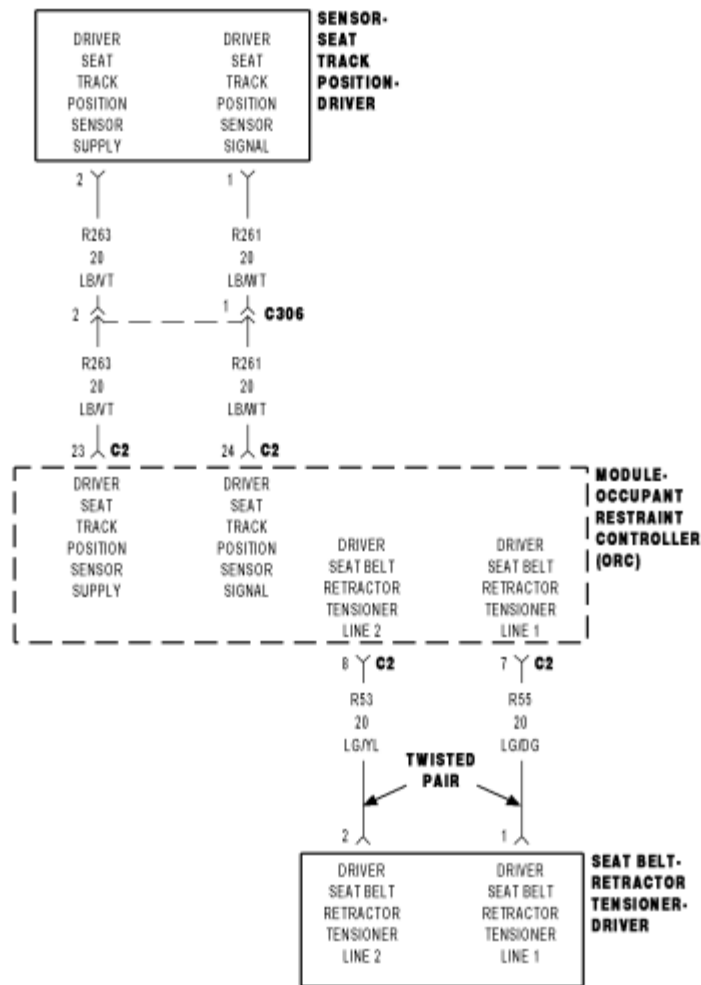
Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH



8199c193

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

While the CAN bus ignition status is in IGN_RUN and the module is configured for a Driver Seat Track Position Sensor, the module checks the sensor input current ranges.

◦ **Set Condition:**

If the module detects that the sensor input is greater than or equal to 20.5 mA. This DTC may set when the current is between 17 mA and 20.5 mA.

Possible Causes
DRIVER SEAT HARNESS IMPROPERLY ROUTED
DRIVER SEAT HARNESS WIRES CHAFED, PIERCED, PINCHED, PARTIALLY BROKEN
DRIVER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. IDENTIFYING VEHICLE EQUIPMENT

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC active DTC.

Does the scan tool display active DTC: B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- Go To [8](#)

Diagnostic Test

2. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, AND BATTERY FAULTS IN THE OCCUPANT RESTRAINT CONTROLLER (ORC)

With the scan tool, read Occupant Restraint Controller (ORC) DTC.

Does the scan tool display any active DTC relating to internal faults, ignition faults, or battery faults?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents in this Section for a complete list of symptoms.

No

- Go To [3](#)

3. INSPECT DRIVER SEAT HARNESS WIRES AND CONNECTORS

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the driver seat harness wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**
- Replace the driver seat harness in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. VERIFY THAT DRIVER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the driver seat harness is routed correctly.

Is the Driver Seat Harness routed correctly?

Yes

- Go To [5](#)

No

- Reroute the driver seat harness as necessary.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK FOR DTC B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH WITH DRIVER SEAT TRACK POSITION SENSOR DISCONNECTED

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Track Position Sensor connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Wait two minutes, and then with the scan tool, read ORC DTC.

Does the scan tool display: B1B8E-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT HIGH?

Yes

- Go To [6](#)

No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the Driver Seat Track Position Sensor in accordance with the service information.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

6. CHECK (R261) DRIVE SEAT POSITION SENSOR SIGNAL CIRCUIT AND (R263) DRIVE SEAT POSITION SENSOR SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

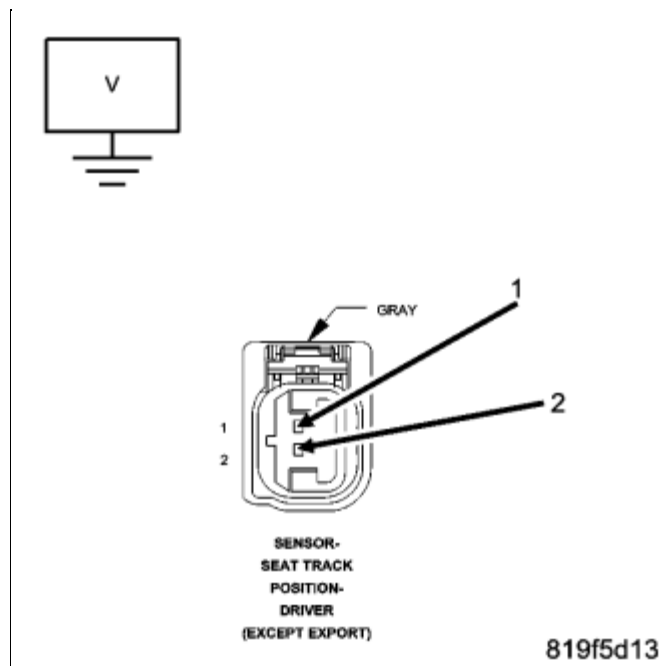
Disconnect the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R261) Driver Seat Position Sensor Signal circuit at the Driver Seat Track Position Sensor connector cavity 1.

Measure the voltage of the (R263) Driver Seat Position Sensor Supply circuit at the Driver Seat Track Position Sensor connector cavity 2.

Is the voltage above 0.2 volts on either circuit?



Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the Driver Seat Harness in accordance with the Service Information.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

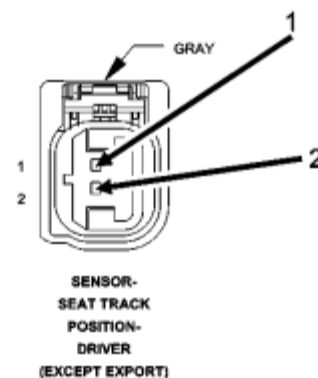
- Go To [7](#)

7. CHECK (R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Measure the resistance between the (R261) Driver Seat Position Sensor Signal circuit cavity 1 and the (R263) Driver Seat Position Sensor Supply circuit cavity 2 in the Driver Seat Track Position Sensor connector.

Is the resistance below 10k ohms?



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Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if the condition inspecting or testing for is present in the Seat Harness.**
- Replace the Driver Seat Harness in accordance with the service information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace the ORC in accordance with the Service information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from the ORC.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

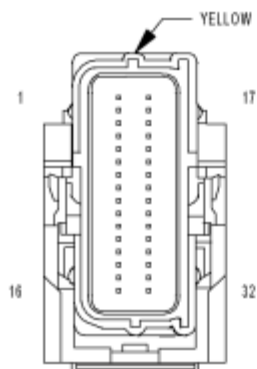
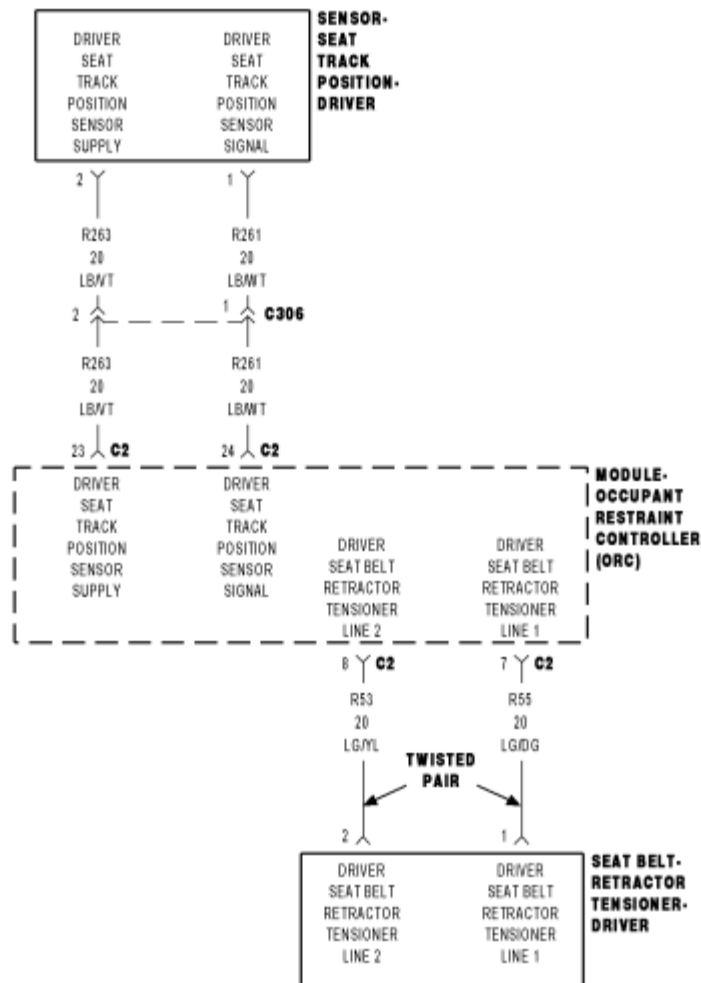
Yes

- Select the appropriate symptom from Symptom List.

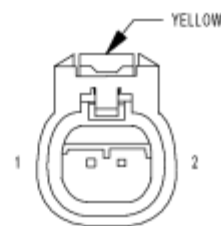
No

- No problem found at this time. Erase all codes before returning vehicle to customer.

**B1B8F-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT
OPEN**



MODULE-OCCUPANT RESTRAINT CONTROLLER C2 (ORC)



SEAT BELT-RETRACTOR TENSIONER-DRIVER

8100c003

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

While the CAN bus ignition status is in IGN_RUN and the module is configured for a Seat Track Position Sensor, the module checks the sensor input current ranges.

◦ **Set Condition:**

This DTC may set when the module detects that the sensor input current is below 1 mA.

Possible Causes
DRIVER SEAT HARNESS IMPROPERLY ROUTED
DRIVER SEAT HARNESS WIRES CHAFED, PIERCED, PINCHED, PARTIALLY BROKEN
DRIVER SEAT HARNESS CONNECTOR TERMINALS BROKEN, BENT, PUSHED OUT, SPREAD, CORRODED, CONTAMINATED
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE
(R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT
DRIVER SEAT TRACK POSITION SENSOR
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. CHECK FOR ACTIVE INTERNAL FAULTS, IGNITION FAULTS, AND BATTERY FAULTS IN THE OCCUPANT RESTRAINT CONTROLLER (ORC)

With the scan tool, read Occupant Restraint Controller (ORC) DTC.

Does the scan tool display any active DTC relating to internal faults, ignition faults, or battery faults?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents in this Section for a complete list of symptoms.

No

- Go To [2](#)

2. VERIFY THAT DTC B1B8F-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT OPEN IS ACTIVE

Does the scan tool display active: B1B8F-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT OPEN?

Yes

- Go To [3](#)

No

- Go To [8](#)

3. INSPECT DRIVER SEAT HARNESS WIRES AND CONNECTORS

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the Driver Seat Harness wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

Are any of these conditions present?

Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if any of these conditions exist**
- Replace the Driver Seat Harness in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. VERIFY THAT DRIVER SEAT HARNESS IS ROUTED CORRECTLY

Verify that the Driver Seat Harness is routed correctly.

Is the Driver Seat Harness routed correctly?

Yes

- Go To [5](#)

No

- Reroute the Driver Seat Harness as necessary.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK FOR DTC B1B8F-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT OPEN WITH DRIVER SEAT TRACK POSITION SENSOR DISCONNECTED

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Track Position Sensor connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Wait two minutes, and then with the scan tool, read ORC DTC.

Does the scan tool display: B1B8F-DRIVER SEAT TRACK POSITION SENSOR CIRCUIT OPEN?

Yes

- Go To [6](#)

No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the Driver Seat Track Position Sensor in accordance with the service information.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

6. CHECK (R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT AND (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R261) Driver Seat Position Sensor Signal circuit between the Driver Seat Track Position Sensor connector and ground.

Measure the voltage of the (R263) Driver Seat Position Sensor Supply circuit between the Driver Seat Track Position Sensor connector and ground.

Is the voltage above 0.2 volts on either circuit?

Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if any of these conditions exist**
- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the Driver Seat Harness in accordance with the Service Information.

- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

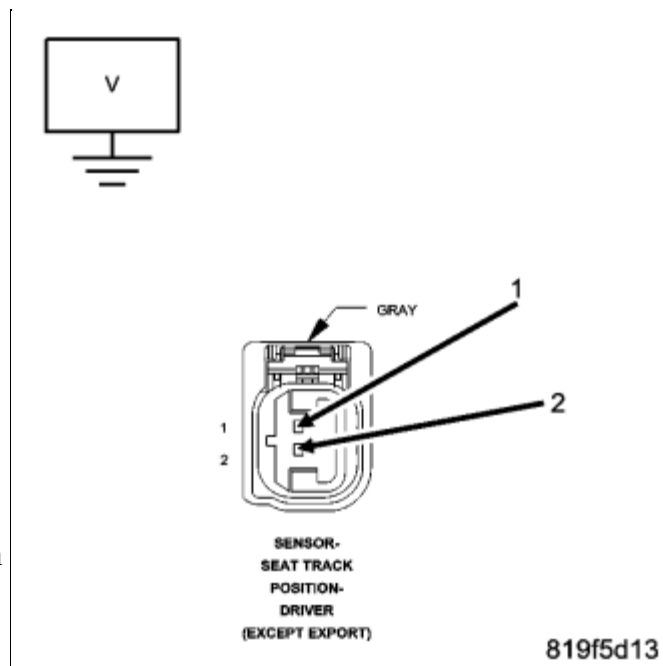
- Go To [7](#)

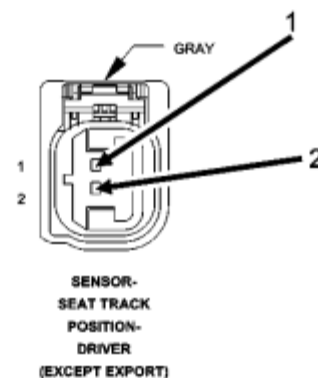
7. CHECK (R261) DRIVER SEAT POSITION SENSOR SIGNAL CIRCUIT FOR A SHORT TO (R263) DRIVER SEAT POSITION SENSOR SUPPLY CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Measure the resistance between the (R261) Driver Seat Position Sensor Signal circuit and the (R263) Driver Seat Position Sensor Supply circuit in the Driver Seat Track Position Sensor connector.

Is the resistance below 10k ohms?





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Yes

- **NOTE: Do not attempt to repair the Seat Harness. Replace the Seat Harness if any of these conditions exist**
- Replace the Driver Seat Harness in accordance with the service information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace the ORC in accordance with the Service information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from the ORC.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1BA5-AIRBAG SQUIB CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If an Occupant Restraint Controller (ORC) configured for vehicles without side airbags is installed in a vehicle with side airbags.

Possible Causes
TOTALLY INTEGRATED POWER MODULE (TIPM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B1BA5-AIRBAG SQUIB CONFIGURATION MISMATCH IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active: B1BA5-AIRBAG SQUIB CONFIGURATION MISMATCH?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. CHECK FOR ACTIVE TIPM DTC

Verify that the vehicle is equipped with a Occupant Classification System (OCS).
With the scan tool, read the active TIPM DTC.

Is active TIPM DTC present?**Yes**

- Diagnose and repair the active TIPM DTC.
- Refer to the Table of Contents in this Section for a complete list of symptoms.

No

- Go To [3](#)
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK ORC PART NUMBER WITH SCAN TOOL

With the scan tool, select ECU View, select ORC, select ECU Details, and read the ORC part number.

Is the part number correct for the vehicle?**Yes**

- Go To [4](#)

No

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECK VIN WITH SCAN TOOL

With the scan tool, read the VIN.

Is the correct VIN displayed?**Yes**

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace or reprogram the Totally Integrated Power Module (TIPM) in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTC?

Yes

- Select appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1BA6-OCCUPANT CLASSIFICATION UNDETERMINED

- **When Monitored:**

With the ignition on.

- **Set Condition:**

Because another DTC made occupant detection impossible. This DTC will set in addition to all sensor and module trouble codes and will be erased when the repairs are completed.

Refer to **B1BA7-OCCUPANT CLASSIFICATION SYSTEM VERIFICATION REQUIRED** for the diagnostic test procedure.

B1BAA-OCCUPANT CLASSIFICATION MODULE CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**

While the CAN bus ignition status is IGN_RUN.

- **Set Condition:**

This DTC will set if the ORC is not configured for Occupant Classification Module and the OCM is active on the CAN Bus.

Possible Causes
LOSS OF COMMUNICATION BETWEEN ORC AND TIPM
MISSING CAN BUS CONFIGURATION MESSAGE
CORRUPT CONFIGURATION MESSAGE
OCCUPANT RESTRAINT CONTROLLER (ORC)

1. CHECK FOR ACTIVE B1BAA-OCCUPANT CLASSIFICATION MODULE CONFIGURATION MISMATCH

With the scan tool, read Occupant Restraints Controller (ORC) DTC.

Does the scan tool display an active: B1BAA-OCCUPANT CLASSIFICATION MODULE CONFIGURATION MISMATCH DTC?

Yes

- Go To [2](#)

No

Go To [5](#)

2. CHECKING FOR CORRUPT CONFIGURATION MESSAGE

With the scan tool, read Occupant Restraints Controller (ORC) DTC.

Does the scan tool display an active: U1414-IMPLAUSIBLE/MISSING ECU NETWORK CONFIGURATION DATA DTC?

Yes

- Perform the U1414-IMPLAUSIBLE/MISSING ECU NETWORK CONFIGURATION DATA diagnostic test.

No

- Go To [3](#)

3. CHECKING FOR LOSS OF CAN BUS CONFIGURATION MESSAGE

With the scan tool, read Occupant Restraints Controller (ORC) DTC

Does the scan tool display an active U1415-IMPLAUSIBLE/MISSING VEHICLE CONFIGURATION DATA DTC?

Yes

- Perform the U1415-IMPLAUSIBLE/MISSING VEHICLE CONFIGURATION DATA diagnostic test.

No

- Go To [4](#)

4. CHECKING FOR LOSS OF COMMUNICATION WITH THE TIPM

With the scan tool, read Occupant Restraints Controller (ORC) DTC.

Does the scan tool display an active: U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TOTALLY INTEGRATED POWER MODULE)?

Yes

- Perform the U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

No

- Go To [6](#)

5. VERIFYING STORED B1BAA-OCCUPANT CLASSIFICATION MODULE CONFIGURATION MISMATCH DTC

With the scan tool, record and erase all DTC from the Occupant Restraint Controller.
Turn the ignition off, and wait 15 seconds, then turn the ignition on.
Wait one minute, and read active and stored codes.

Does the scan tool display an active or stored B1BAA-OCCUPANT CLASSIFICATION MODULE CONFIGURATION MISMATCH DTC?

Yes

- For active DTC-Go To [2](#)

Yes

- For stored-Go To [6](#)

No

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

6. REPLACE THE ORC

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B1BC7-DEPLOYMENT DATA RECORD FULL

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

With the ignition on. The Occupant Restraint Controller (ORC) on board diagnostics continuously

monitors the deployment register.

The register counts the number of airbag deployment for this vehicle.

- **Set Condition:**

This DTC will set if the ORC deployment register increments to 3.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

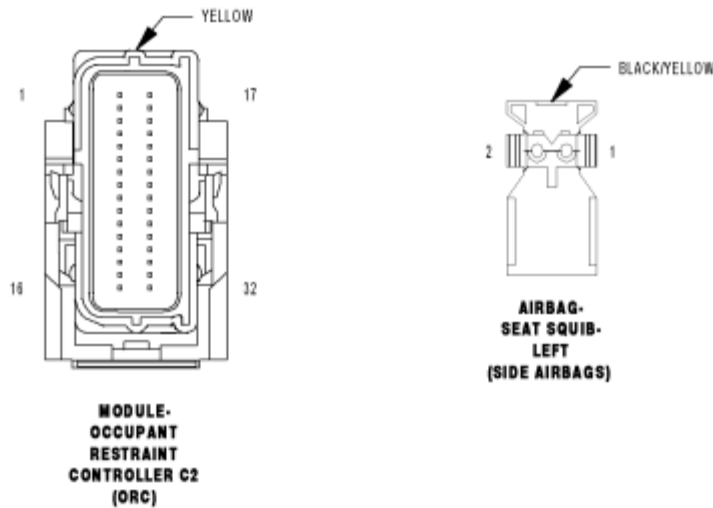
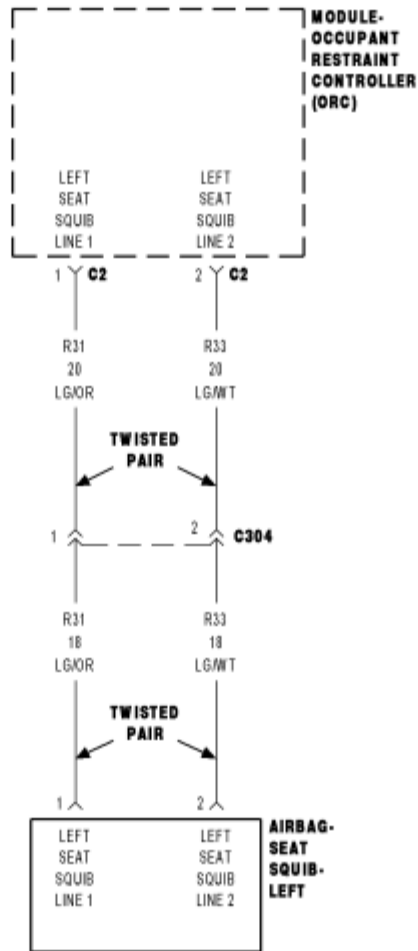
WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

View repair.

Repair

- Replace the Occupant Restraint Controller in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B1C27-LEFT SIDE SEAT THORAX SQUIB 1 LOW



019kcc04

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Left Seat Squib circuits. The ORC will set this DTC if it detects low resistance of the Left Seat Squib circuits.

Possible Causes
(R31) LEFT SEAT SQUIB LINE 1 CIRCUIT SHORTED TO GROUND
(R33) LEFT SEAT SQUIB LINE 2 CIRCUIT SHORTED TO GROUND
LEFT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS AT THE LEFT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed Left Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C27-LEFT SIDE SEAT THORAX SQUIB 1 LOW?

Yes

- Go To [3](#)

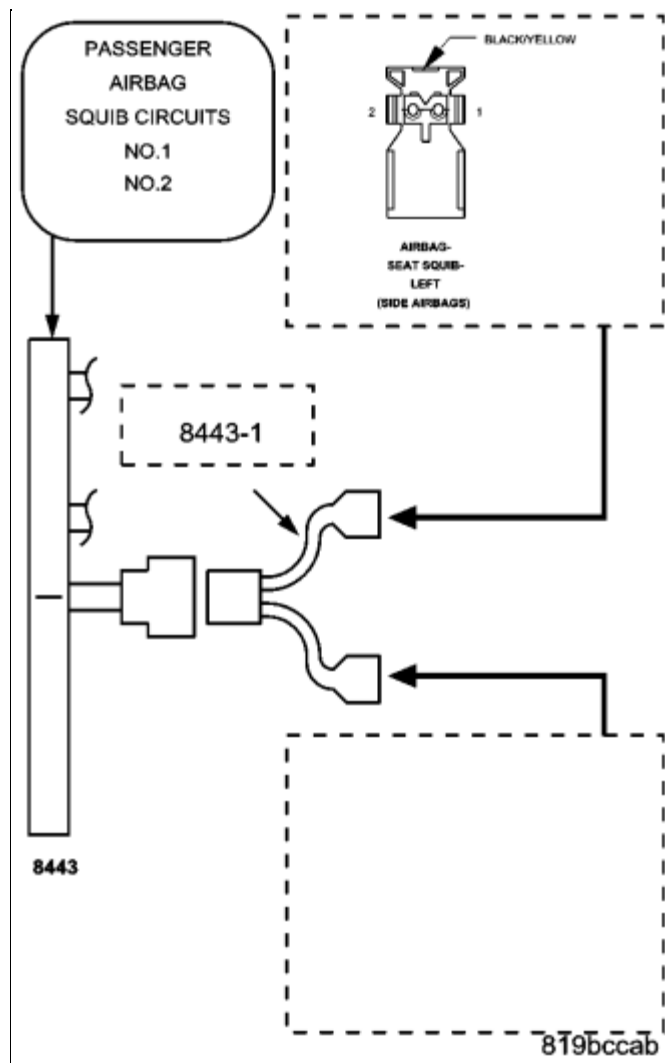
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Left Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R31) LEFT SEAT SQUIB LINE 1 CIRCUIT OR (R33) LEFT SEAT SQUIB LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Left

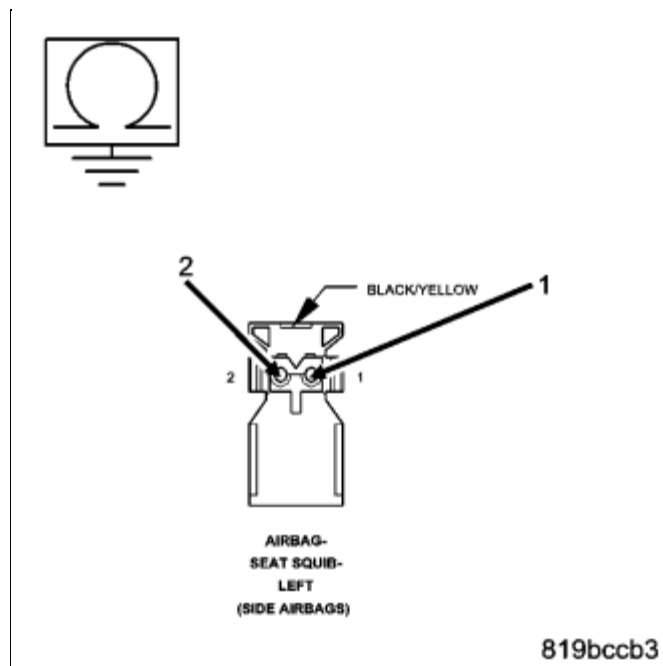


Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (R31) Left Seat Squib Line 1 circuit between ground and the ORC 8443-32-L Adaptor.
Measure the resistance of the (R33) Left Seat Squib Line 2 circuit between ground and the ORC 8443-32-L Adaptor.



Is the resistance below 10k ohms on either circuit?

Yes

- Repair the Left Seat Squib circuits with resistance below 10k ohms for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

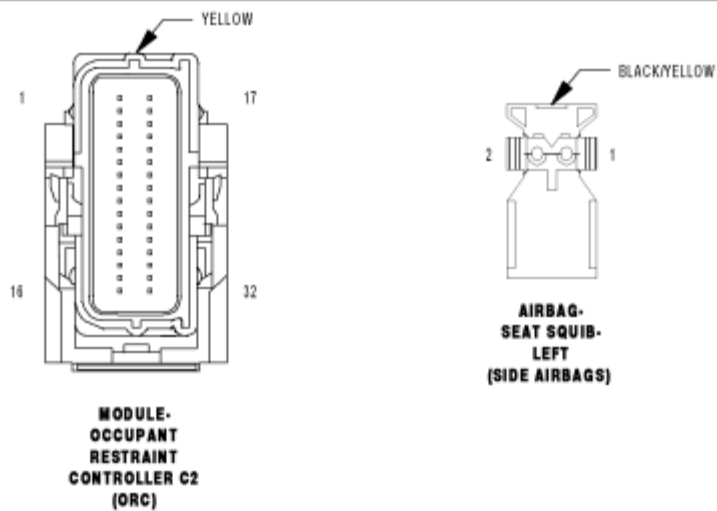
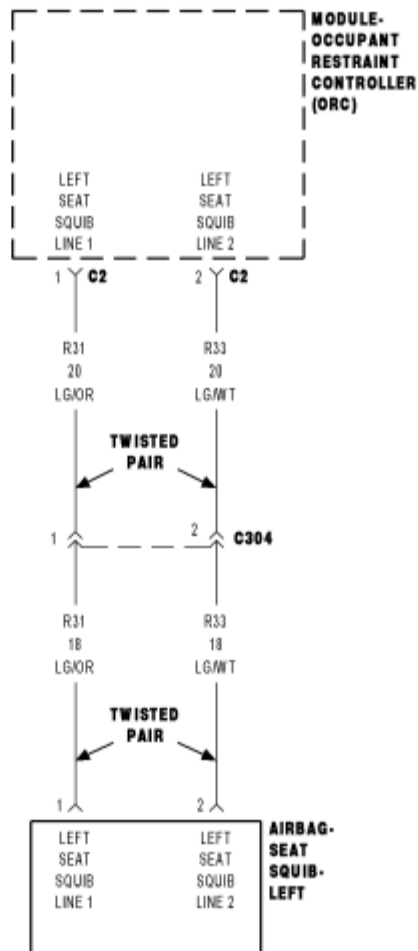
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C28-LEFT SIDE SEAT THORAX SQUIB 1 HIGH



019kcc04

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage on the Left Seat Squib circuits. The ORC will set this DTC if it detects voltage on the Left Seat Squib circuits.

Possible Causes
(R31) LEFT SEAT SQUIB LINE 1 CIRCUIT SHORTED TO BATTERY
(R33) LEFT SEAT SQUIB LINE 2 CIRCUIT SHORTED TO BATTERY
LEFT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed Left Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display : B1C28-LEFT SIDE SEAT THORAX SQUIB 1 HIGH

Yes

- Go To [3](#)

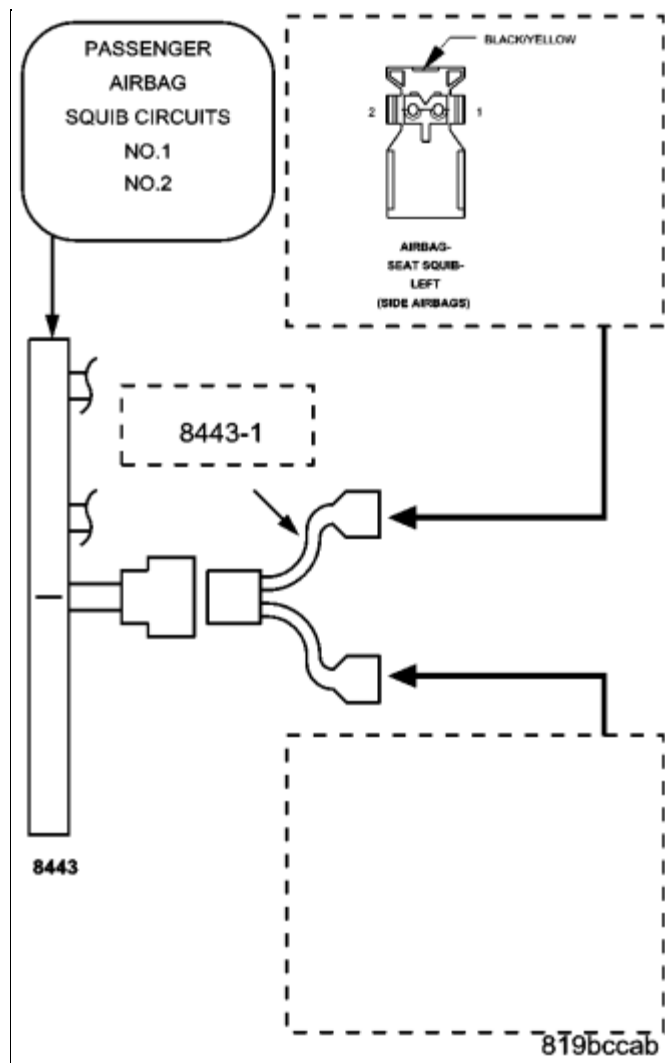
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Left Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK THE (R31) LEFT SEAT SQUIB LINE 1 CIRCUIT OR (R33) LEFT SEAT SQUIB LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Left

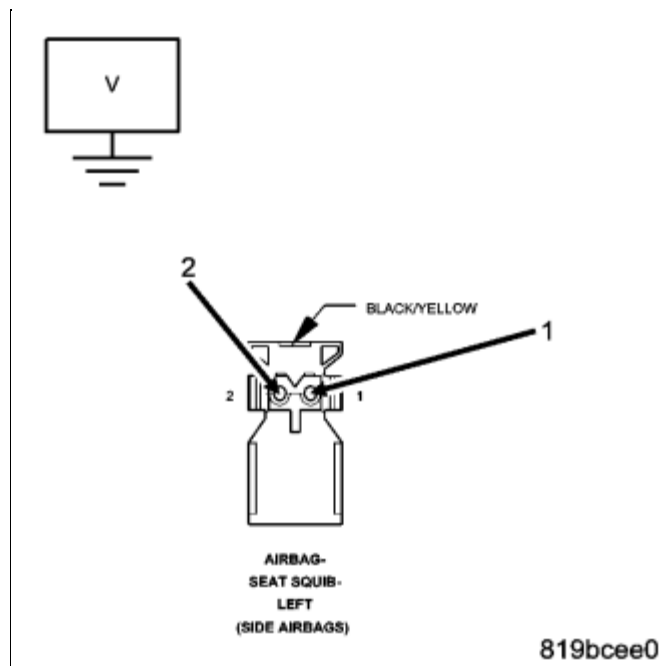


Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.



Measure the voltage of the (R31) Left Seat Squib Line 1 circuit between the ORC 8443-32-L Adaptor and ground.

Measure the voltage of the (R33) Left Seat Squib Line 2 circuit between the ORC 8443-32-L Adaptor and ground.

Is there any voltage present on either circuit?

Yes

- Repair the Left Seat Squib circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

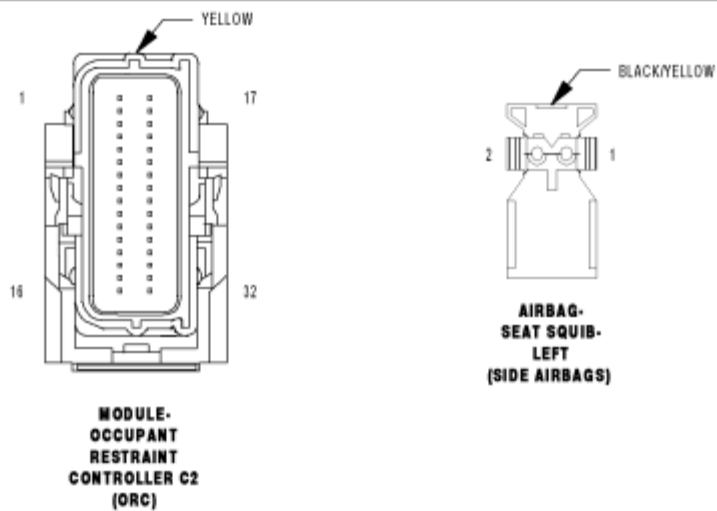
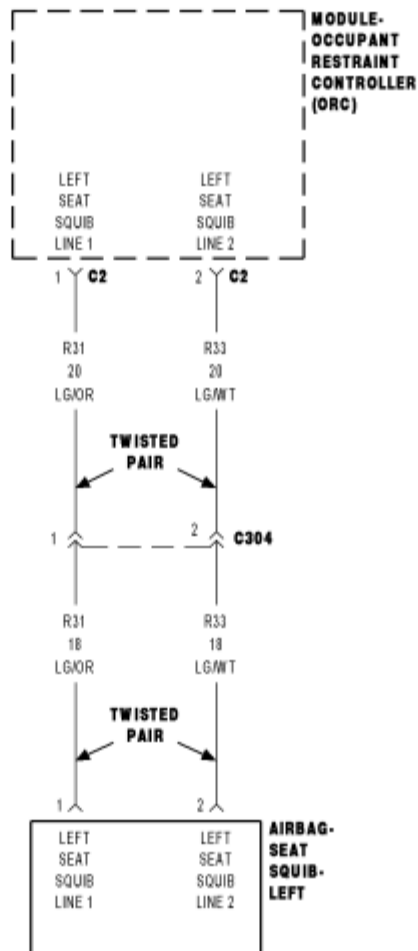
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C29-LEFT SIDE SEAT THORAX SQUIB 1 OPEN



019kcc04

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Left Seat Squib circuits. The ORC will set this DTC if it detects an open or high resistance on the Left Seat Squib circuits.

Possible Causes
(R31) LEFT SEAT SQUIB LINE 1 CIRCUIT OPEN
(R33) LEFT SEAT SQUIB LINE 2 CIRCUIT OPEN
LEFT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN LEFT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C29-LEFT SIDE SEAT THORAX SQUIB 1 OPEN?

Yes

- Go To [3](#)

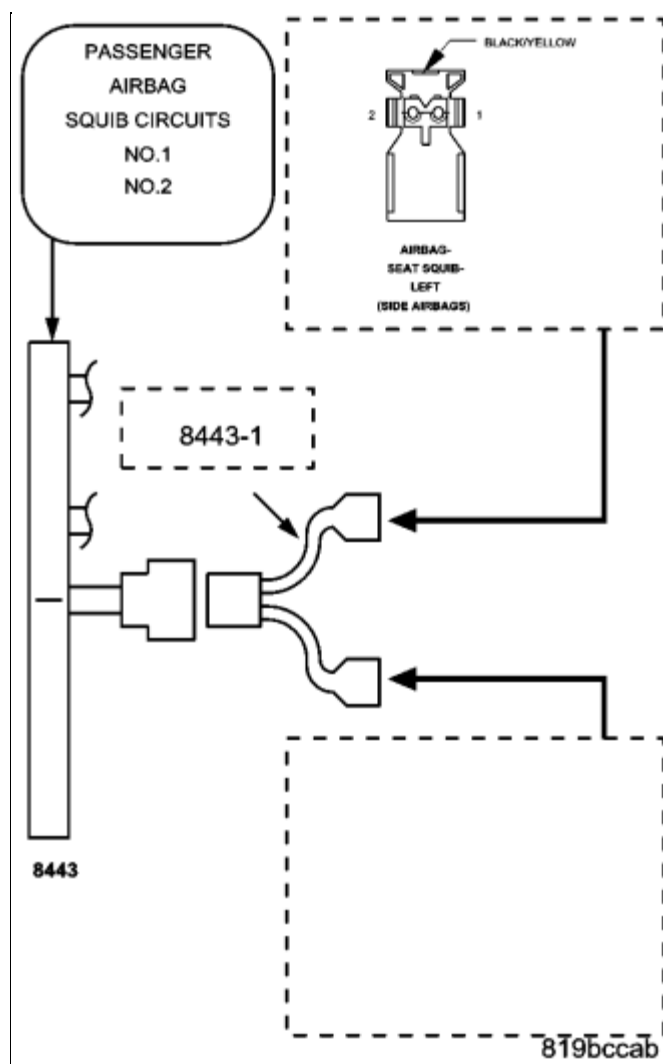
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Left Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R31) LEFT SEAT SQUIB LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Left Seat Squib Airbag connector.



Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (R31) Left Seat Squib Line 1 circuit between the Left Seat Squib Airbag connector and the ORC 8443-32-L Adaptor.

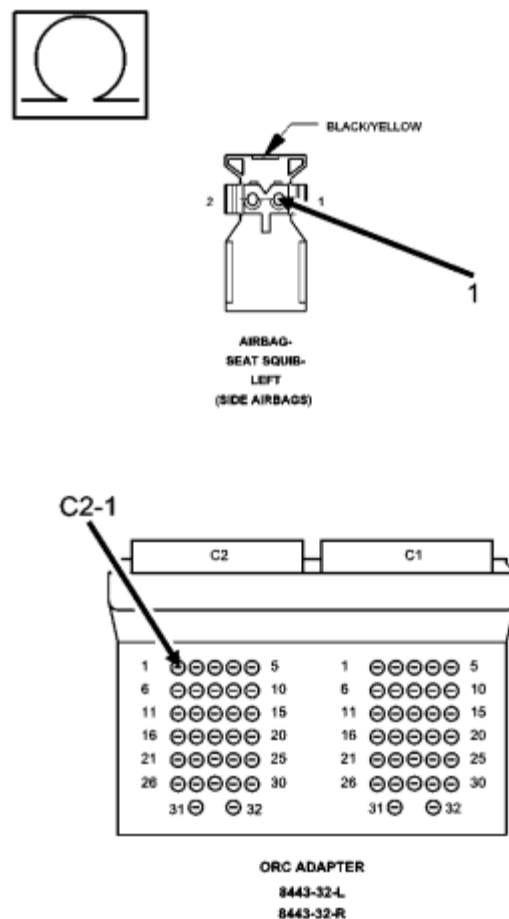
Is the resistance below 1.0 ohm?

Yes

- Go To [4](#)

No

- Repair the (R31) Left Seat Squib Line 1 circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



819bcecd

4. CHECK (R33) LEFT SEAT SQUIB LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R33) Left Seat Squib Line 2 circuit between the Left Side Seat Squib Airbag connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

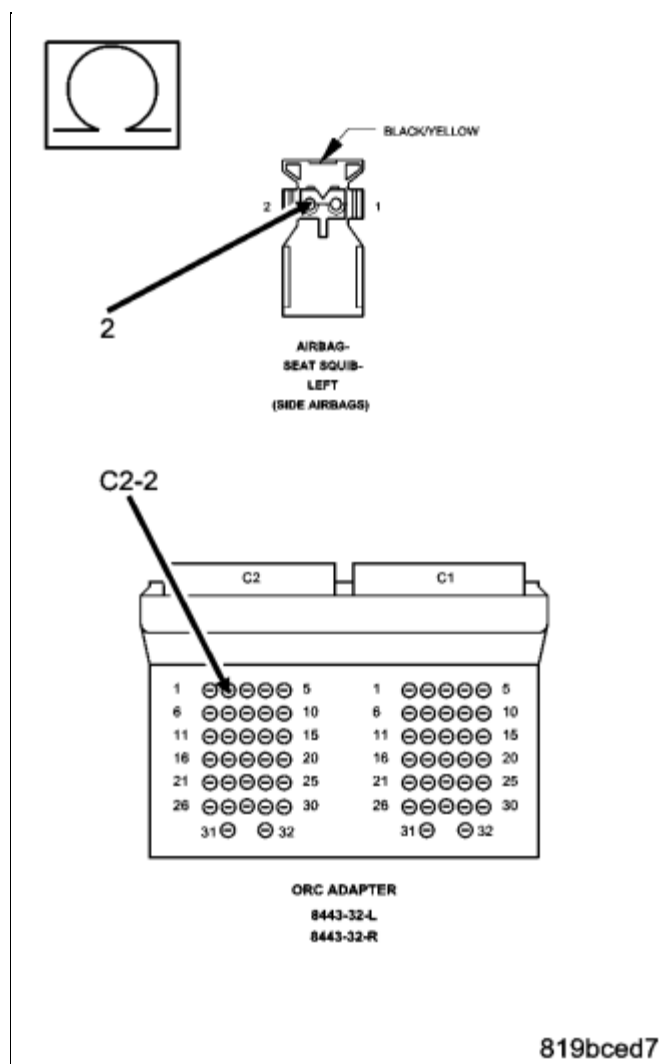
Yes

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R33) Left Seat Squib Line 2 circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

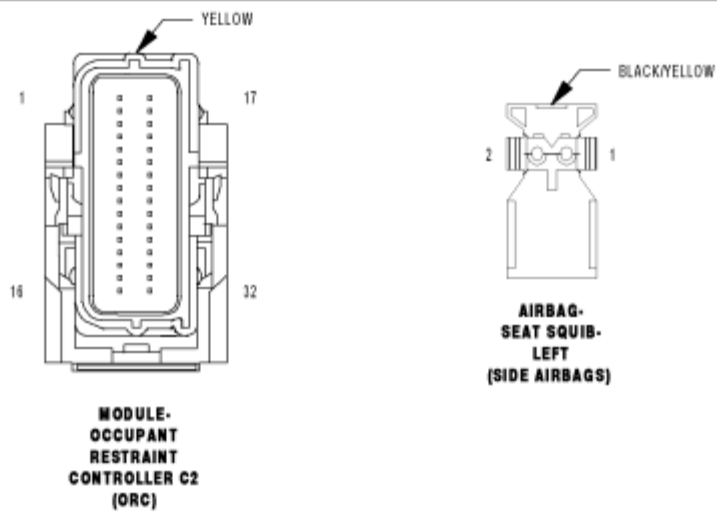
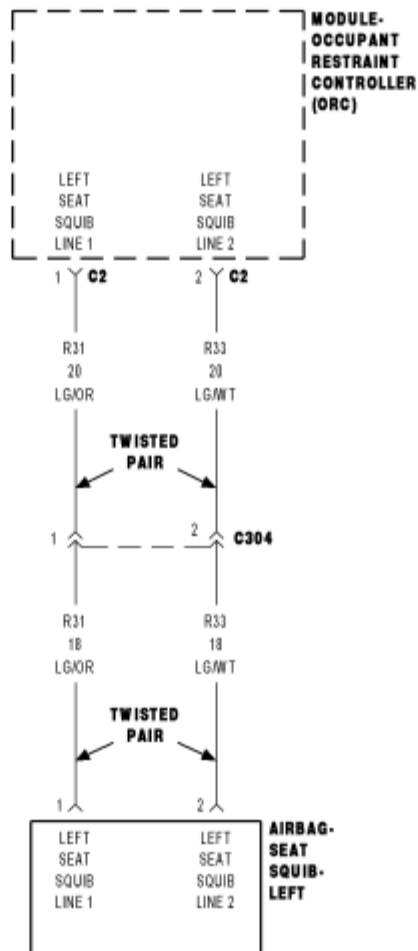
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C2A-LEFT SIDE SEAT THORAX SQUIB 1 SHORTED TOGETHER



019kcc04

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Left Seat Squib circuits. The ORC will set this DTC if it detects low resistance between the Left Seat Squib circuits.

Possible Causes
(R31) LEFT SEAT SQUIB LINE 1 CIRCUIT SHORTED TO (R33) LEFT SEAT SQUIB LINE 2 CIRCUIT
LEFT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN THE LEFT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Left Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Left Seat Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C2A-LEFT SIDE SEAT THORAX SQUIB 1 SHORTED TOGETHER?

Yes

- Go To [3](#)

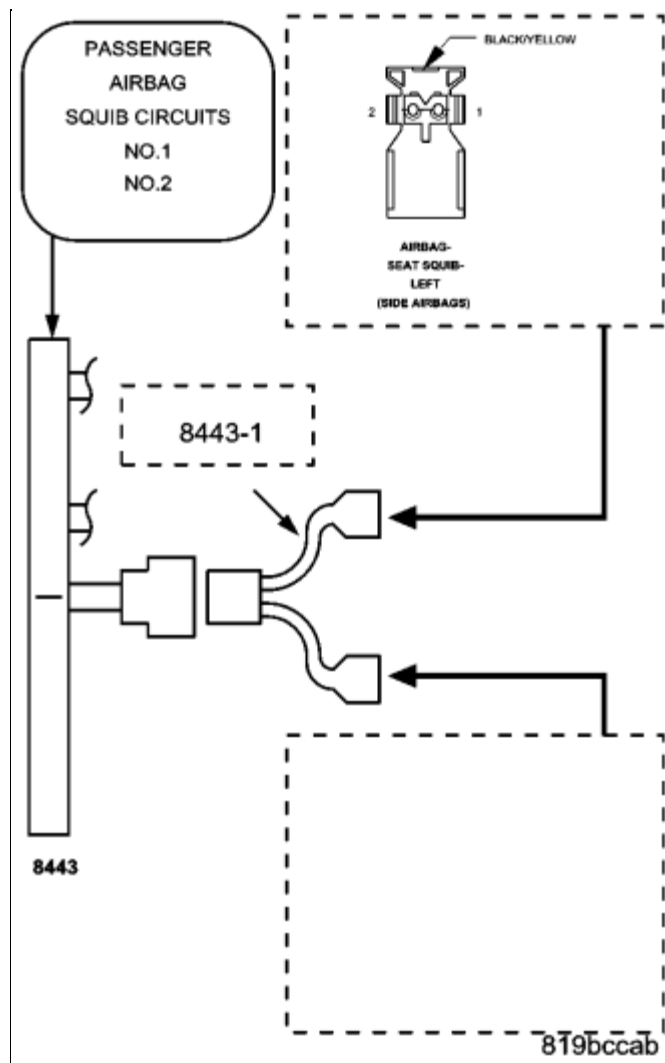
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Left Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R31) LEFT SEAT SQUIB LINE 1 CIRCUIT FOR A SHORT TO (R33) LEFT SEAT SQUIB LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Left

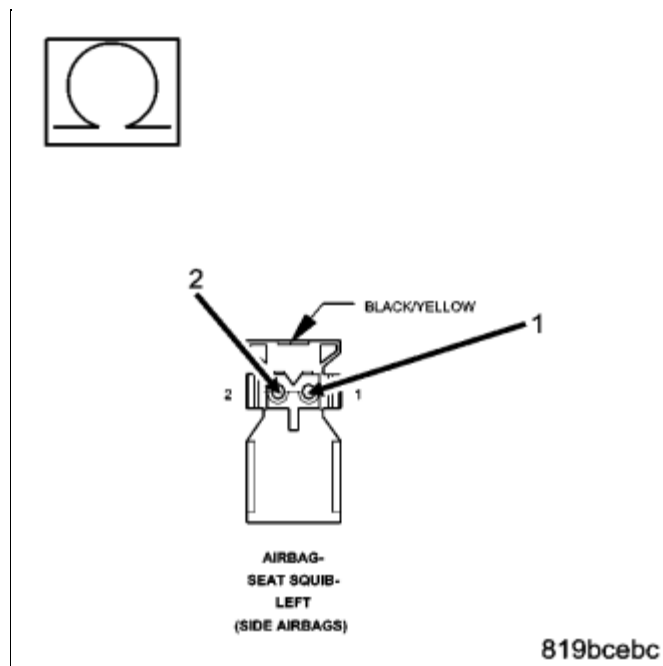


Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance between the (R31) Left Seat Squib Line 1 circuit and the (R33) Left Seat Squib Line 2 circuit at the ORC 8443-32-L Adaptor.



Is the resistance below 10k ohms?

Yes

- Repair the (R31) Left Seat Squib Line 1 circuit for a short to the (R33) Left Seat Squib Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

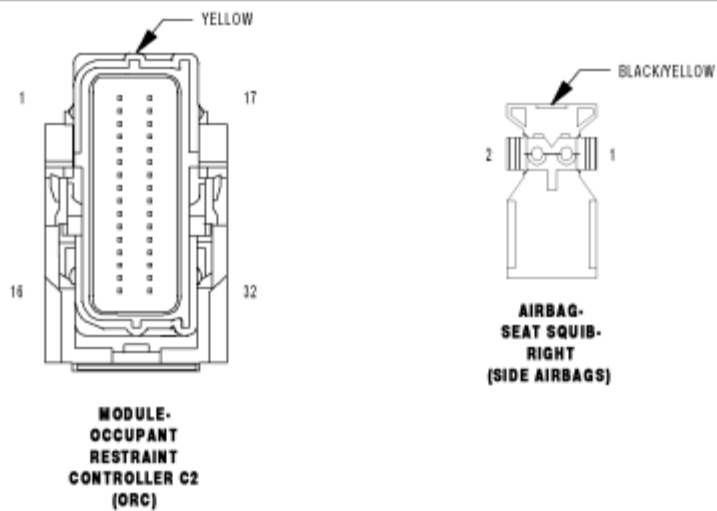
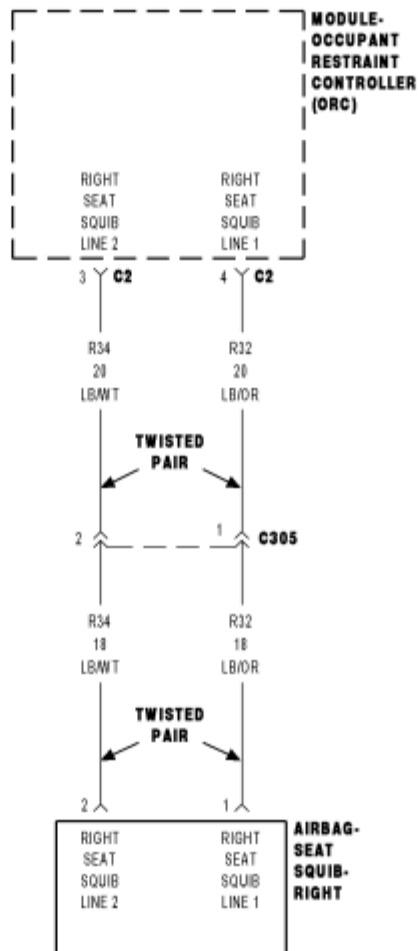
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C2B-RIGHT SIDE SEAT THORAX SQUIB 1 LOW



0150cccc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Right Seat Squib circuits. The ORC will set this DTC if it detects low resistance on the Right Seat Squib circuits.

Possible Causes
(R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT SHORTED TO GROUND
(R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT SHORTED TO GROUND
RIGHT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact undeployed Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C2B-RIGHT SIDE SEAT THORAX SQUIB 1 LOW?

Yes

- Go To [3](#)

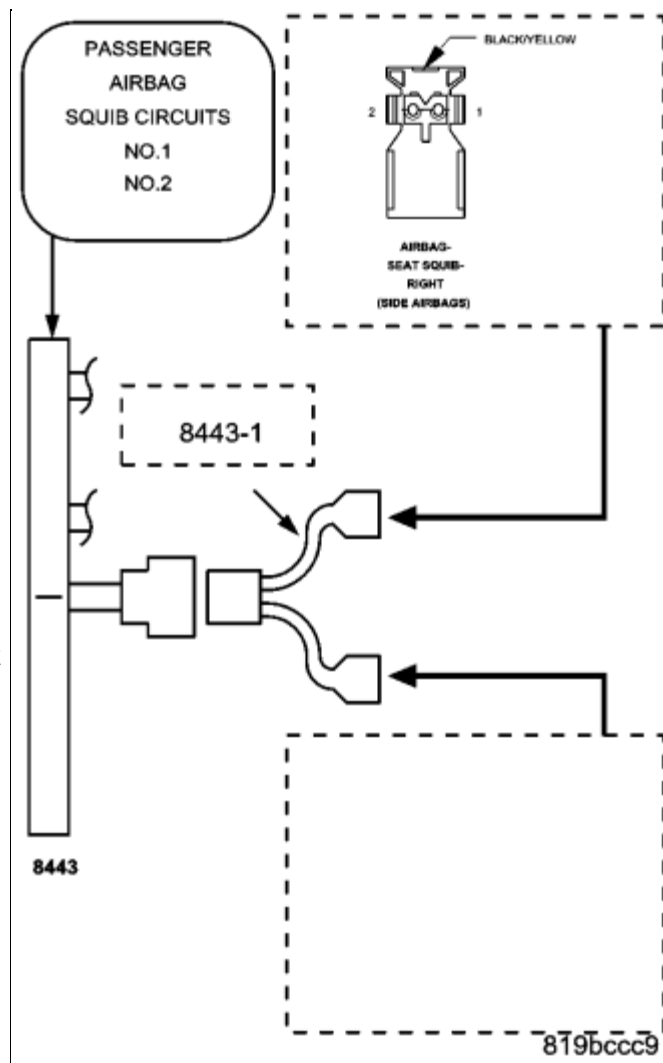
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Right Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT AND (R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Right

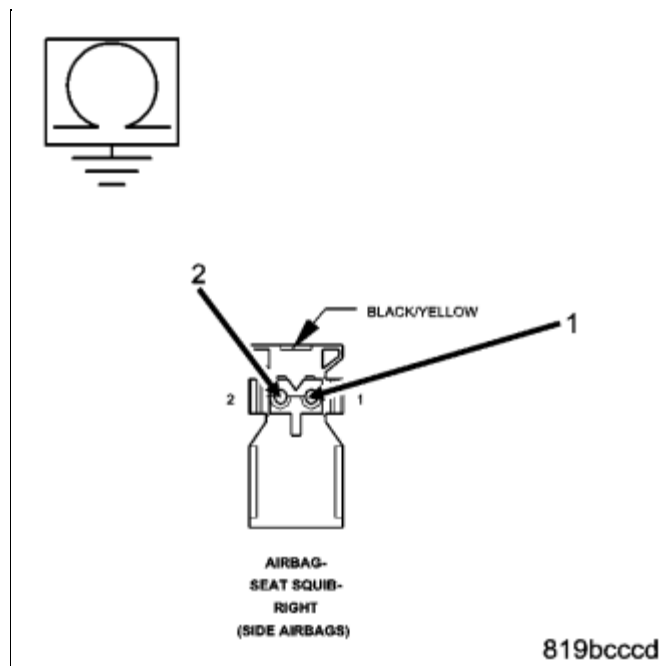


Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (R32) Right Seat Squib Line 1 circuit between ground and the ORC 8443-32-L Adaptor.
Measure the resistance of the (R34) Right Seat Squib Line 2 circuit between ground and the ORC 8443-32-L Adaptor.



Is the resistance below 10k ohms on either circuit?

Yes

- Repair the Right Seat Squib circuits with resistance below 10k ohms for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

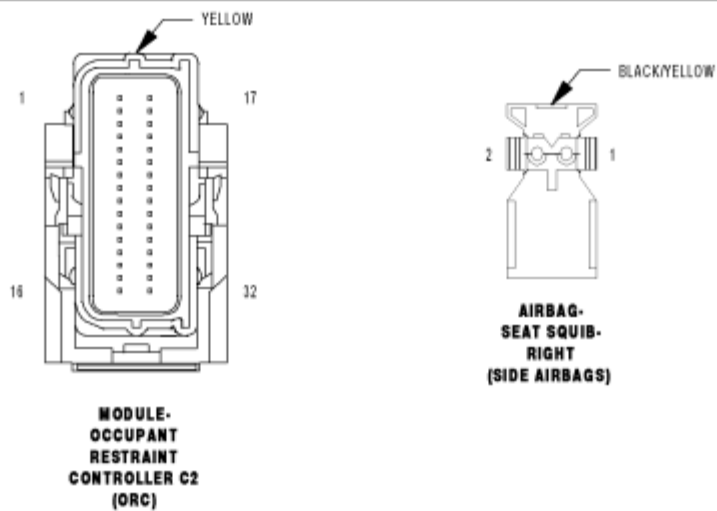
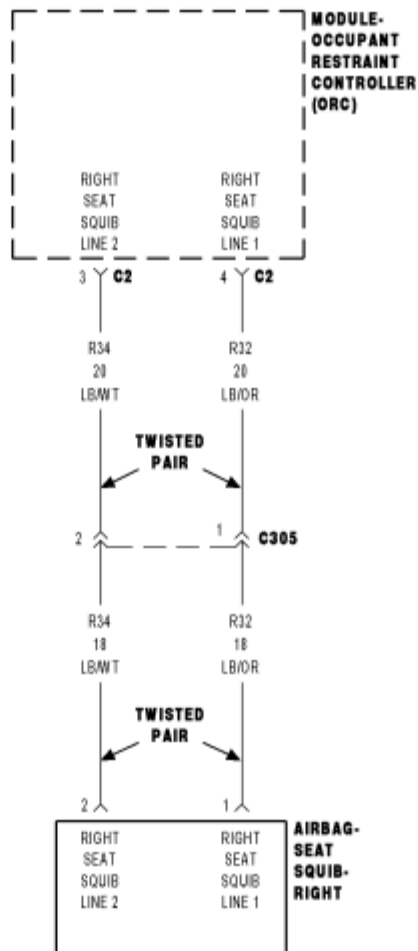
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C2C-RIGHT SIDE SEAT THORAX SQUIB 1 HIGH



0150cccc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the voltage on the Right Seat Squib circuits. The ORC will set this DTC if it detects voltage on the Right Seat Squib circuits.

Possible Causes
(R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT SHORTED TO GROUND
(R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT SHORTED TO GROUND
RIGHT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SEAT SQUIB AIRBAG

WARNING: To serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before

proceeding.

Disconnect the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact uncoupled Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C2C-RIGHT SIDE SEAT THORAX SQUIB 1 HIGH?

Yes

- Go To [3](#)

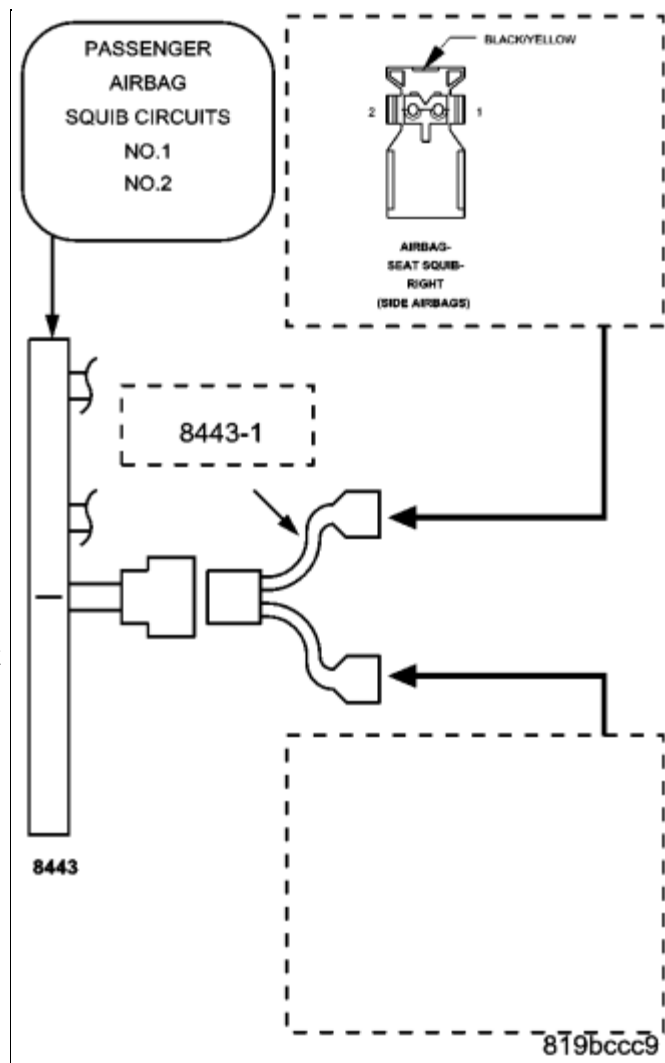
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Right Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT AND (R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Right

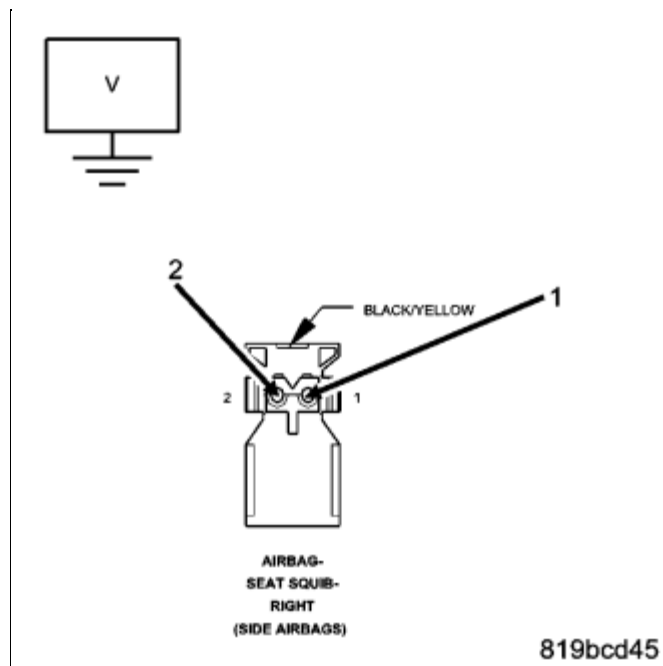


Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.



Measure the voltage of the (R32) Right Seat Squib Line 1 circuit between the ORC 8443-32-L Adaptor and ground.

Measure the voltage of the (R34) Right Seat Squib Line 2 circuit between the ORC 8443-32-L Adaptor and ground.

Is there any voltage present on either circuit?

Yes

- Repair the Right Seat Squib circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two

minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

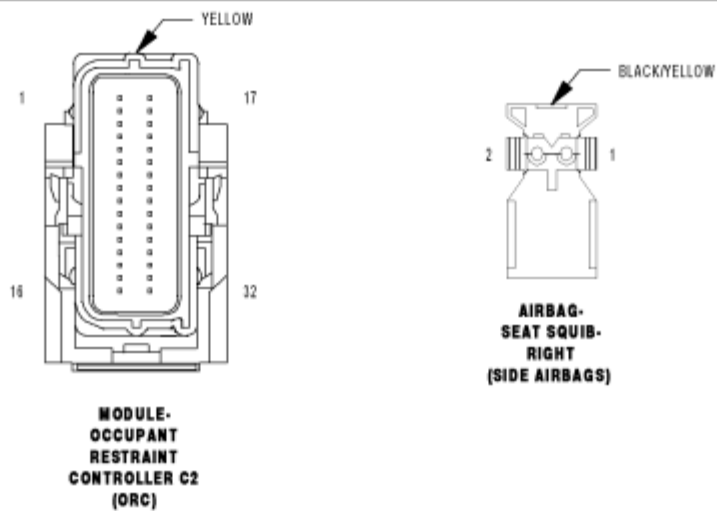
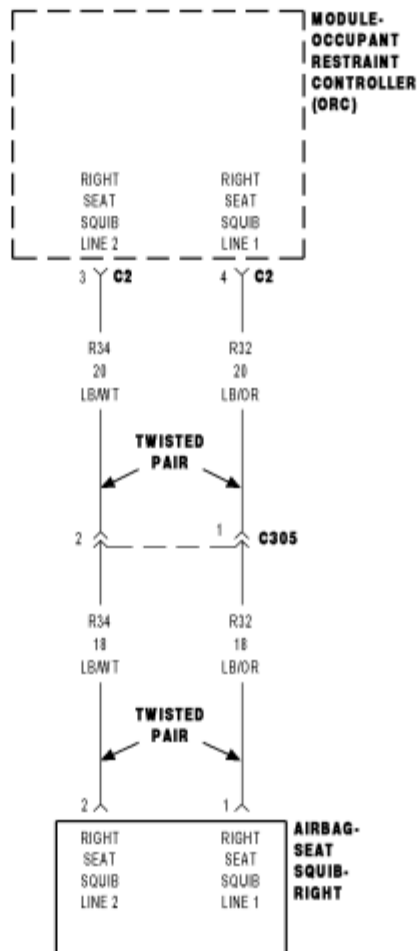
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C2D-RIGHT SIDE SEAT THORAX SQUIB 1 OPEN



0150cccc5

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Right Seat Squib circuits. The ORC will set this DTC if it detects an open or high resistance on the Right Seat Squib circuits.

Possible Causes
(R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT OPEN
(R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT OPEN
RIGHT SEAT SQUIB AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [5](#)

2. CHECK FOR OPEN SQUIB CIRCUITS IN RIGHT SEAT SQUIB AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes

before proceeding.

Disconnect the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact uncoupled Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C2D-RIGHT SIDE SEAT THORAX SQUIB 1 OPEN?

Yes

- Go To [3](#)

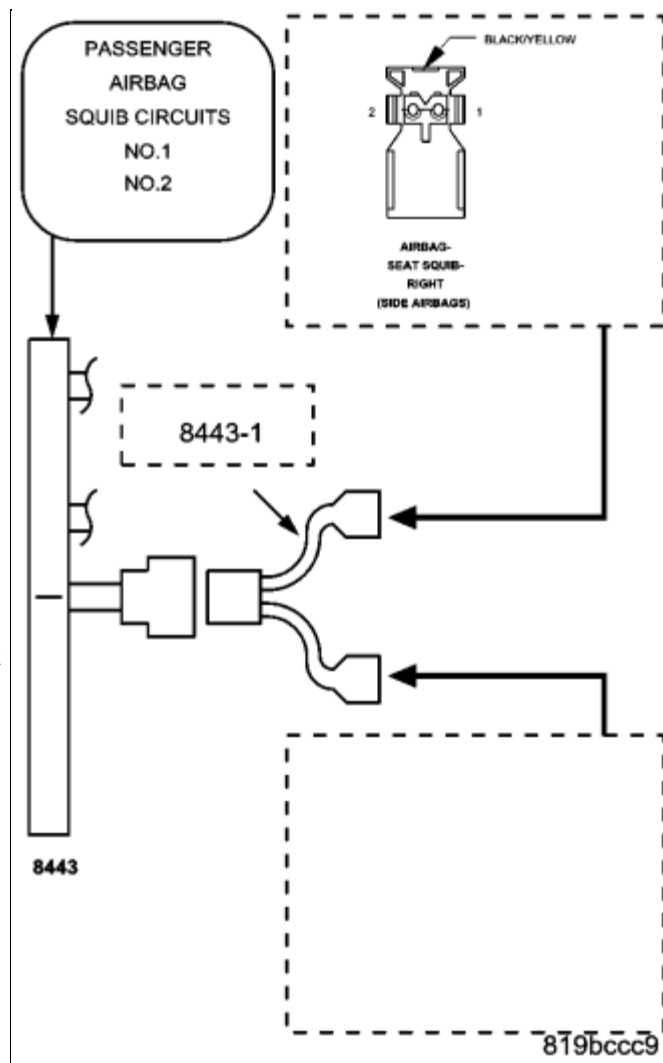
No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Replace the Right Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Right Seat Squib Airbag connector.



Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (R32) Right Seat Squib Line 1 circuit between the Right Seat Squib Airbag connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

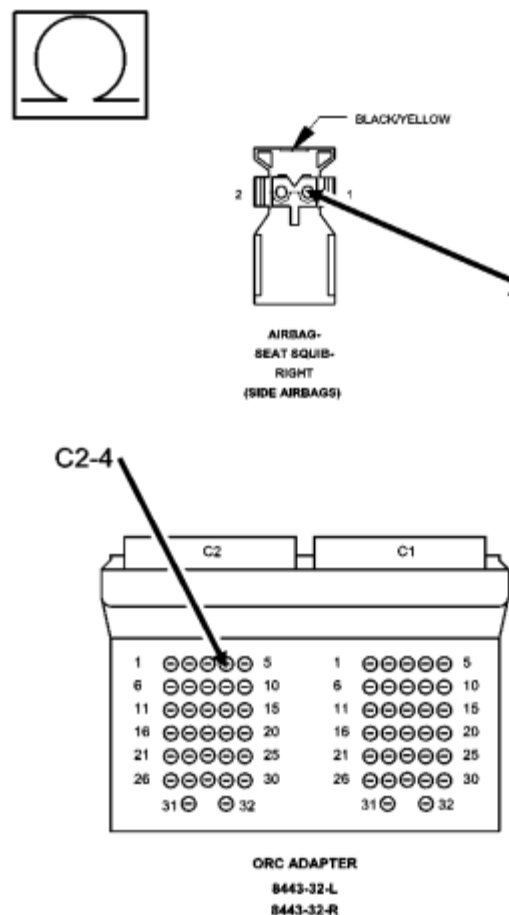
Yes

- Go To [4](#)

No

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

- Repair the (R32) Right Seat Squib Line 1 circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



819bce86

4. CHECK (R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R34) Right Seat Squib Line 2 circuit between the Right Seat Squib Airbag connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

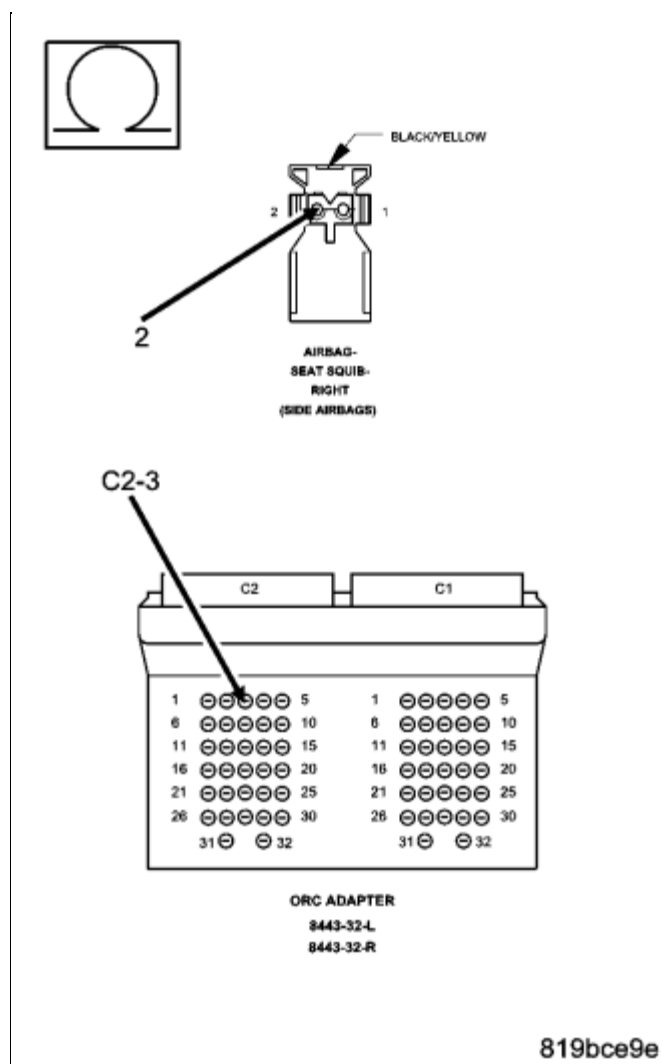
Yes

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Repair the (R34) Right Seat Squib Line 2 circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

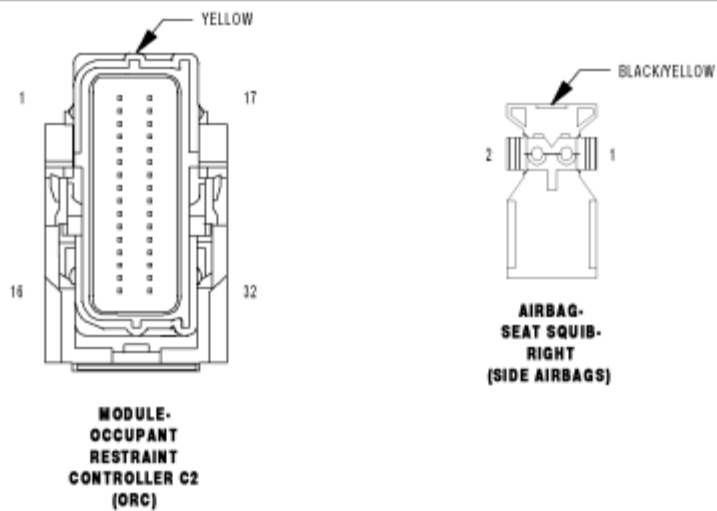
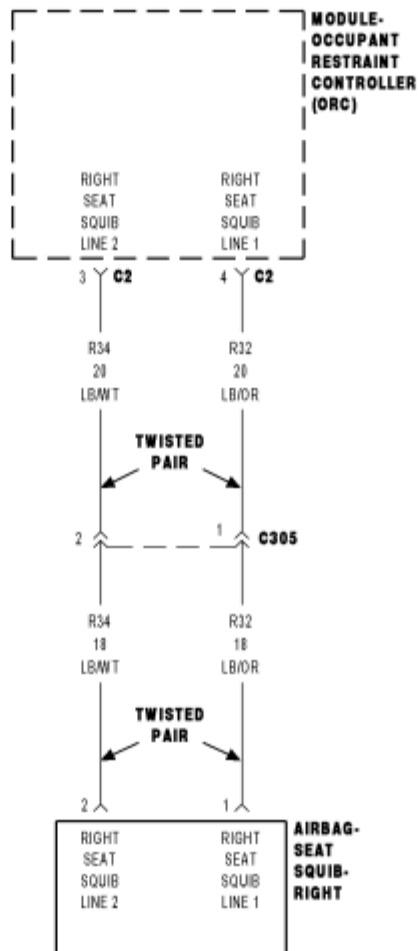
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C2E-RIGHT SIDE SEAT THORAX SQUIB 1 SHORTED TOGETHER



01500005

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) monitors the resistance of the Right Seat Squib circuits. The ORC will set this DTC if it detects low resistance between the Right Seat Squib circuits.

Possible Causes
(R8) RIGHT THORAX SQUIB VOLTAGE CIRCUIT SHORTED TO (R6) RIGHT THORAX SQUIB DATA CIRCUIT
RIGHT SEAT THORAX AIRBAG
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure that the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Turn the ignition on.

Select ACTIVE or STORED DTC:

ACTIVE DTC

- Go To [2](#)

STORED DTC

- Go To [4](#)

2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE SEAT THORAX AIRBAG

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, do not place an intact uncoupled Right Seat Squib Airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-1 Jumper to the Right Seat Squib Airbag connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C2E-RIGHT SIDE SEAT THORAX SQUIB 1 SHORTED TOGETHER?

Yes

- Go To [3](#)

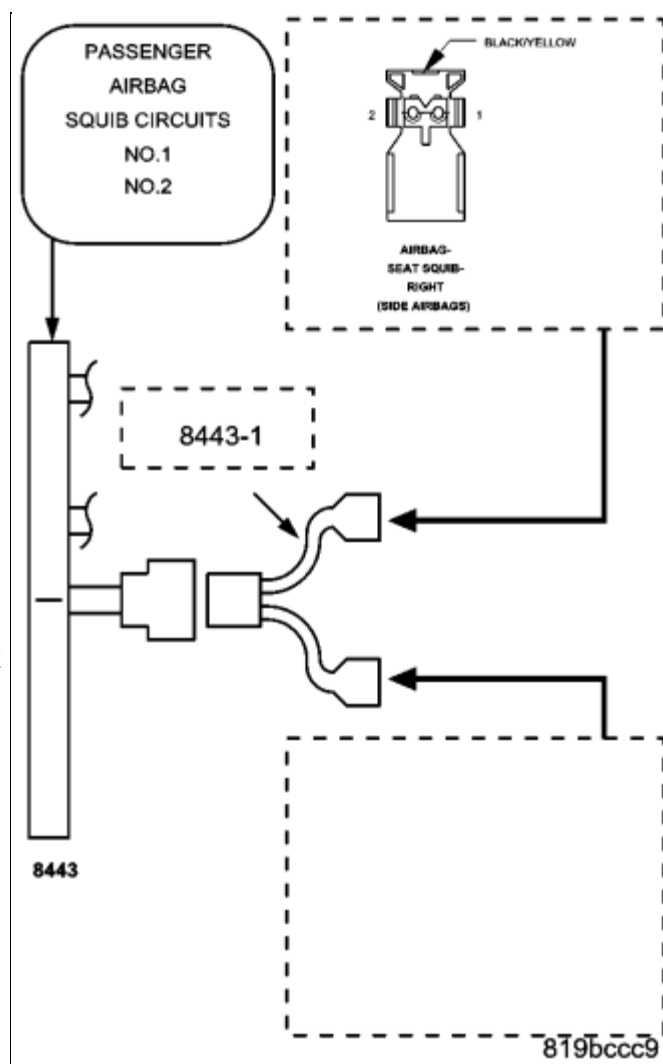
No

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Replace the Right Seat Squib Airbag in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R32) RIGHT SEAT SQUIB LINE 1 CIRCUIT FOR A SHORT TO (R34) RIGHT SEAT SQUIB LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

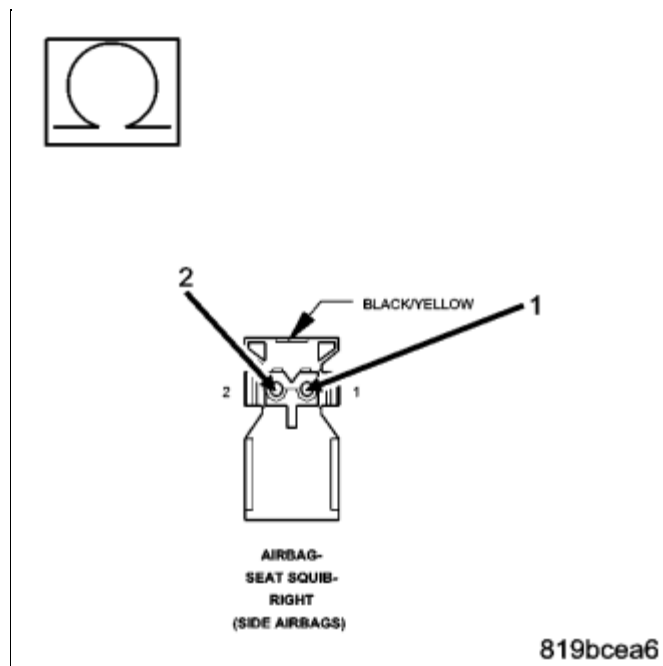
Disconnect the 8443 Load Tool and Jumper from the Right



Seat Squib Airbag connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the ORC 8443-32-L Adaptor to the ORC connectors.
Measure the resistance between the (R32) Right Seat Squib Line 1 circuit and the (R34) Right Seat Squib Line 2 circuit at the ORC 8443-32-L Adaptor.



Is the resistance below 10k ohms?

Yes

- Repair the (R32) Right Seat Squib Line 1 circuit for a short to the (R34) Right Seat Squib Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- **WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.**
- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECKING STORED OR INTERMITTENT CODES

NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

With the scan tool, record and erase all Airbag System Module DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question/causing the intermittent condition.

Are any ACTIVE DTC present?

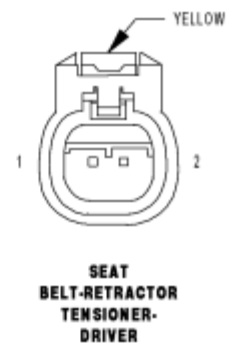
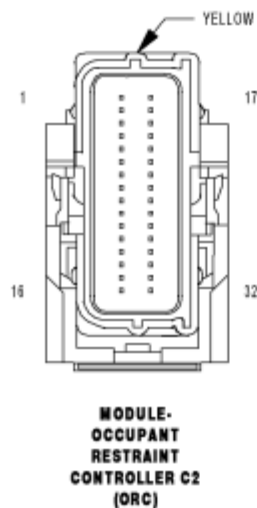
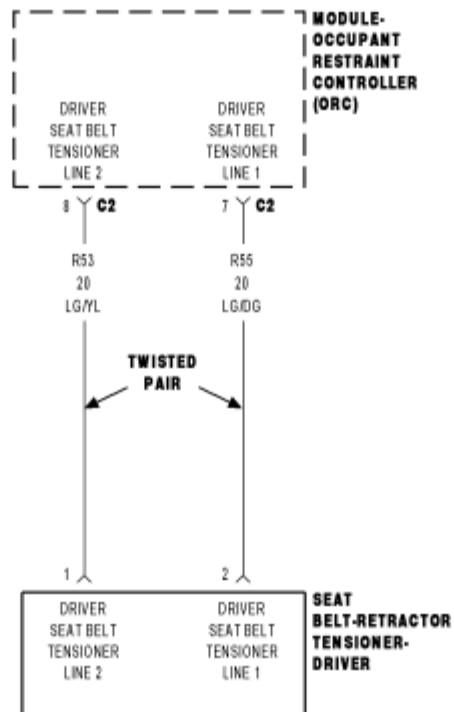
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning the vehicle to the customer.

B1C38-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT LOW



01590400

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected low resistance on the Driver Seat Belt Retractor Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND
DRIVER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED DRIVER SEAT BELT RETRACTOR TENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Belt Retractor Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C38-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT LOW?

Yes

- Go To [3](#)

No

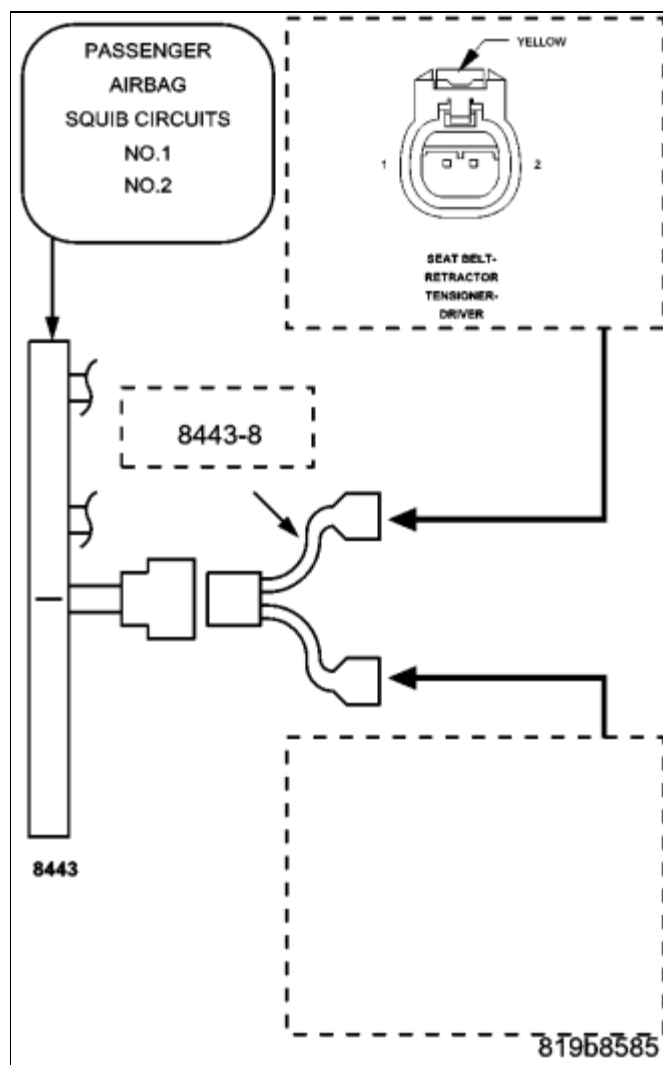
- Replace the Driver Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

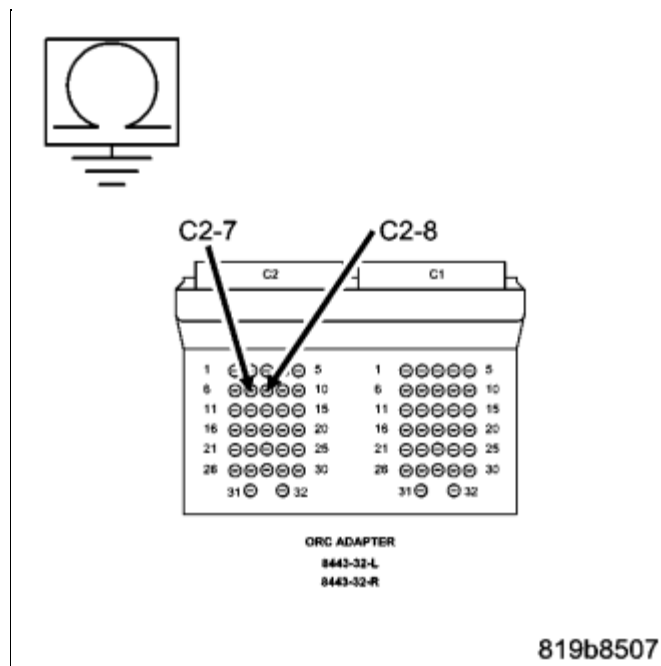
3. CHECK (R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the Load Tool ORC 8443-32-L Adaptor to the ORC C2 connector.

Measure the resistance of the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit between ground and the Driver Seat Belt Retractor Tensioner connector.

Measure the resistance of the (R53) Driver Seat Belt Retractor Tensioner Line 1 circuit between ground and the Driver Seat Belt Retractor Tensioner connector.

Is the resistance below 10K ohms on either circuit?

Yes

- Repair the Driver Seat Belt Retractor Tensioner circuits for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
The following additional checks may assist you in identifying a possible intermittent problem.
Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.
If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
If only stored codes return continue the test until the problem area has been isolated.
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

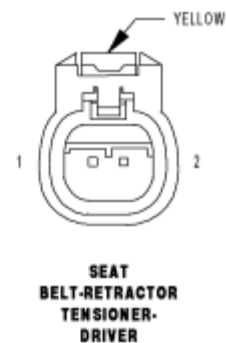
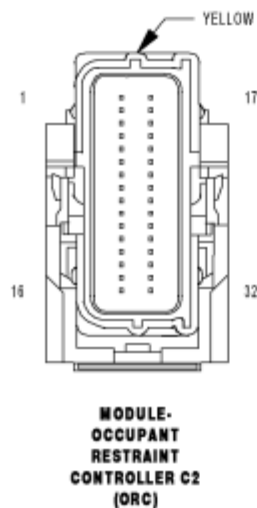
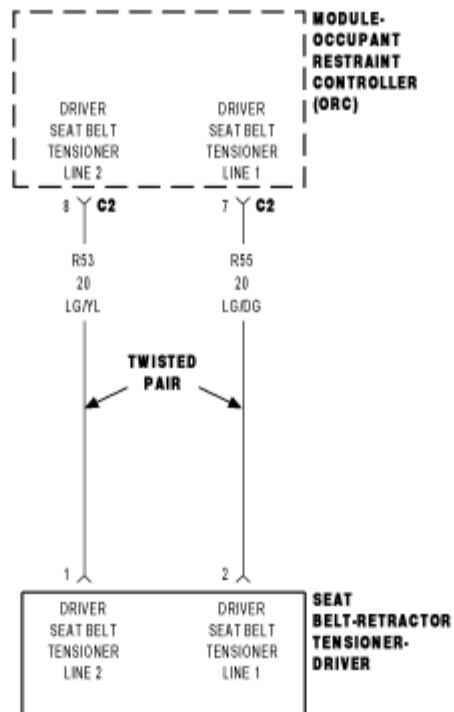
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C39-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT HIGH



01590400

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Driver Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC detects voltage on the Driver Seat Belt Retractor Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT SHORTED TO BATTERY
(R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT SHORTED TO BATTERY
DRIVER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED DRIVER SEAT BELT RETRACTOR TENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Belt Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Driver Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

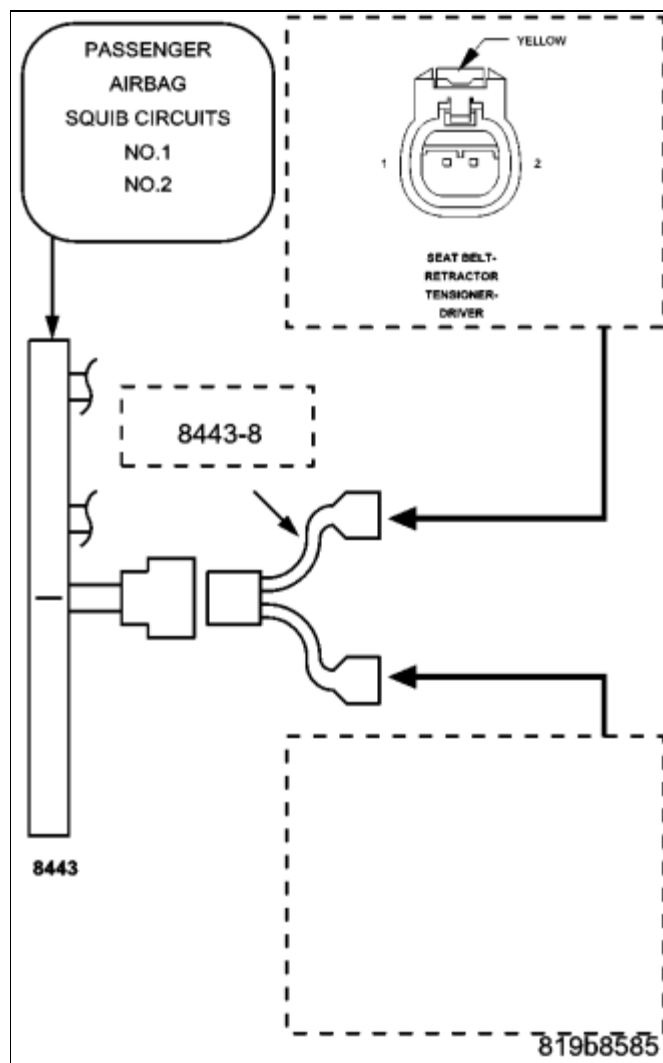
Does the scan tool display: B1C39-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT HIGH?

Yes

- Go To [3](#)

No

- Replace the Driver Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



3. CHECK (R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

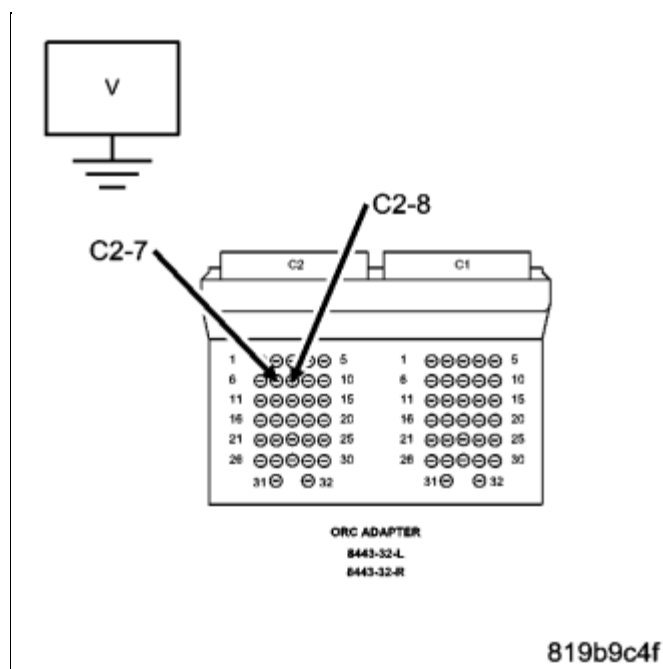
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as

necessary.

Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



Measure the voltage of the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit between the Driver Seat Belt Tensioner connector and ground.

Measure the voltage of the (R53) Driver Seat Belt Retractor Tensioner Line 2 circuit between the Driver Seat Belt Tensioner connector and ground.

Is there any voltage present on either circuit?

Yes

- Repair the Driver Seat Belt Retractor Tensioner circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

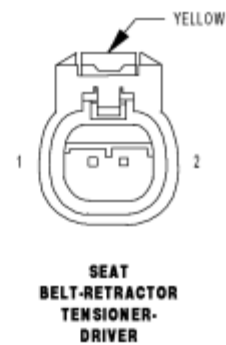
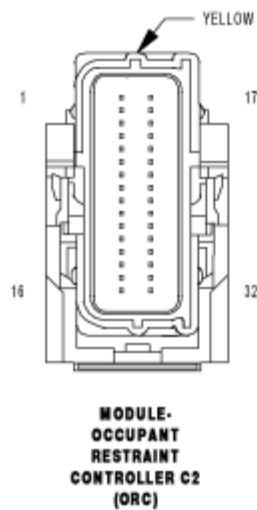
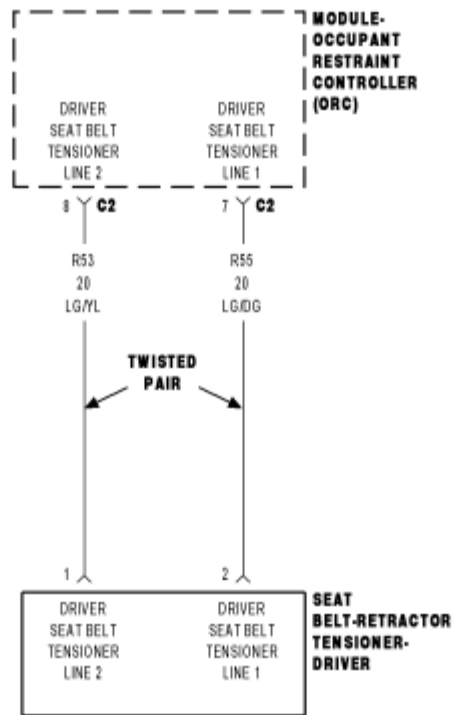
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C3A-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT OPEN



01590400

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected an open or high resistance on the Driver Seat Belt Retractor Tensioner circuits.

Possible Causes
(R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT OPEN
(R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT OPEN
DRIVER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [6](#)

2. CHECK FOR DRIVER SEAT BELT RETRACTOR TENSIONER CIRCUIT OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Belt Retractor Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Driver Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C3A-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT OPEN?

Yes

- Go To [3](#)

No

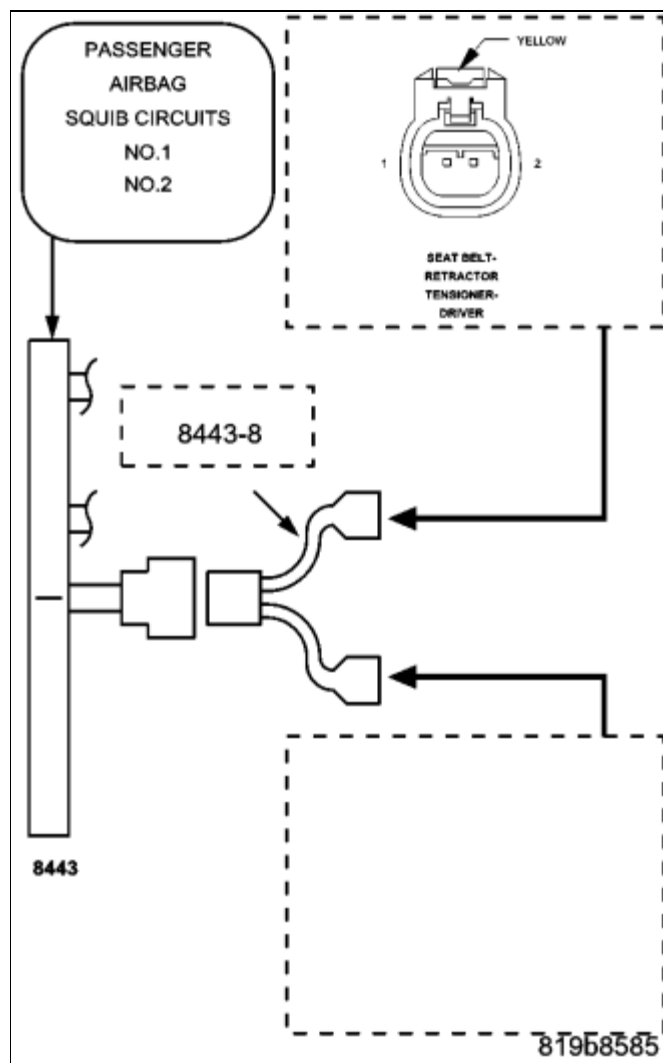
- Replace the Driver Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as



necessary.

Connect the Load Tool 8443-32-L ORC Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance of the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit between the Driver Seat Belt Retractor Tensioner connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

Yes

- Go To [4](#)

No

- Repair the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit for and open. Then Go To [4](#)

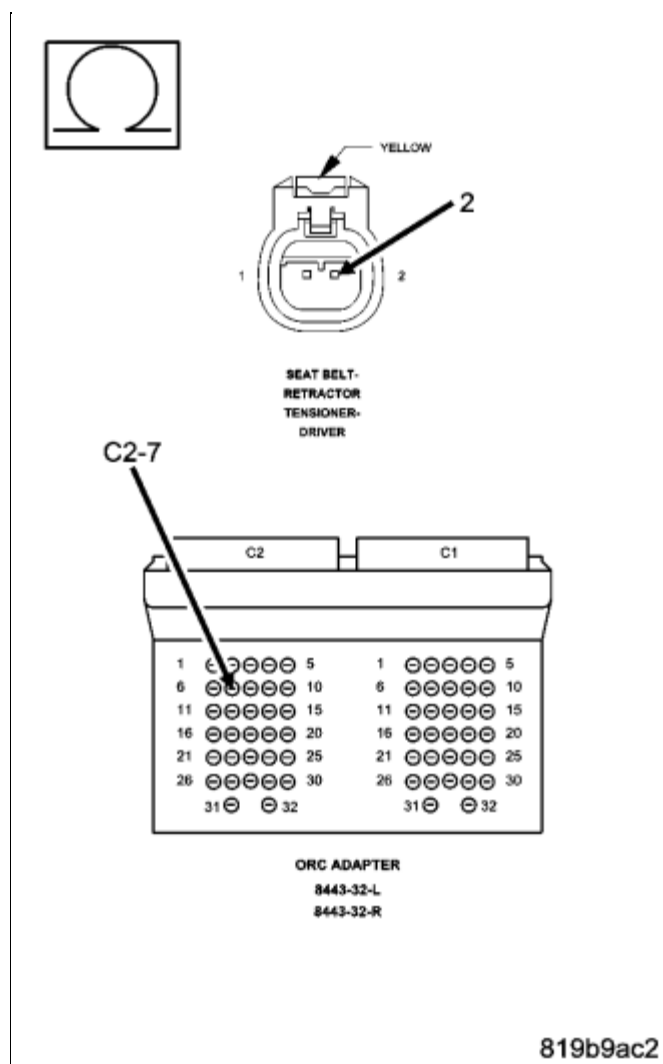
4. CHECK (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R53) Driver Seat Belt Retractor Tensioner Line 1 circuit between the Driver Seat Belt Retractor Tensioner connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

Yes

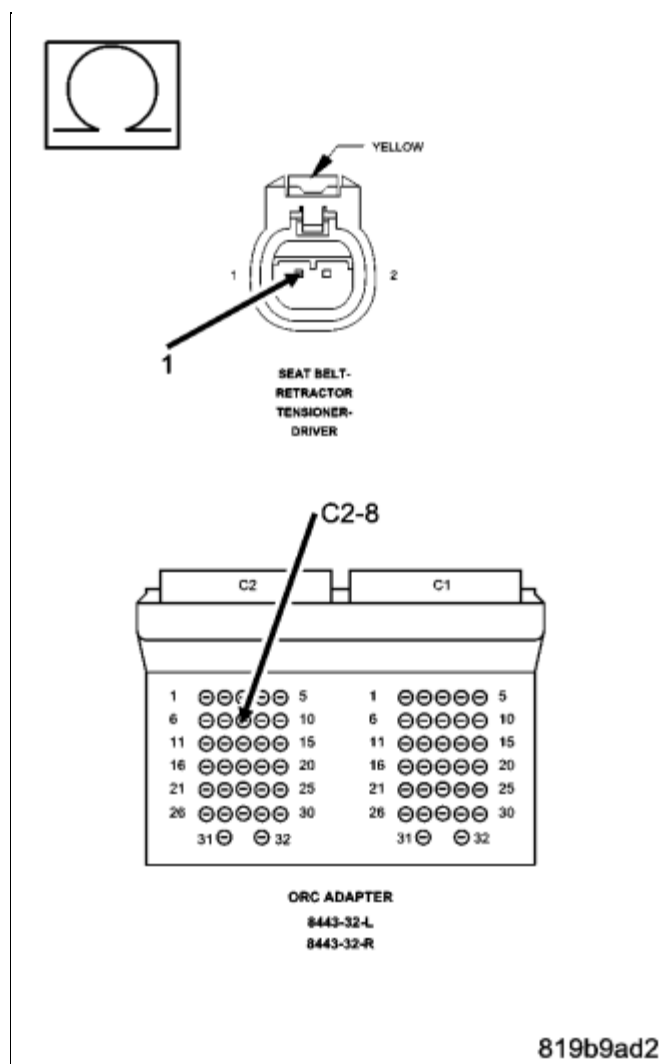
- Go To [5](#)



819b9ac2

No

- Repair the (R53) Driver Seat Belt Retractor Tensioner Line 1 circuit for and open.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

6. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

Yes

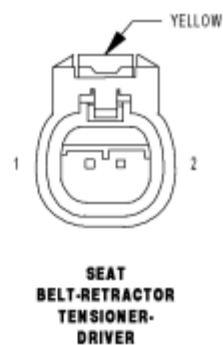
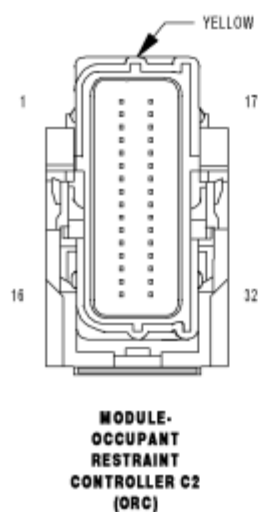
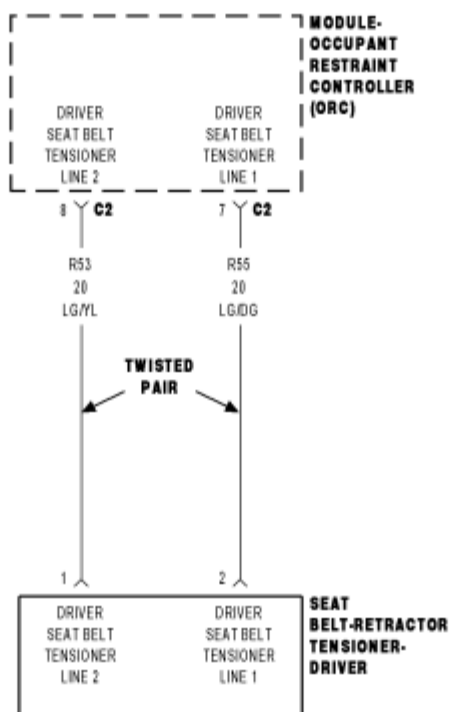
- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C3B-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT SHORTED TOGETHER

For a complete wiring diagram **Refer to Section 8W.**



015944a

- **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected low resistance between the Driver Seat Belt Retractor Tensioner circuits.

Possible Causes
CIRCUIT (R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 SHORTED TO CIRCUIT (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT
DRIVER SEAT BELT RETRACTOR PRETENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. SELECT ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED DRIVER SEAT BELT RETRACTOR TENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Driver Seat Belt Retractor Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Driver Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C3B-1ST ROW DRIVER RETRACTOR PRETENSIONER CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

No

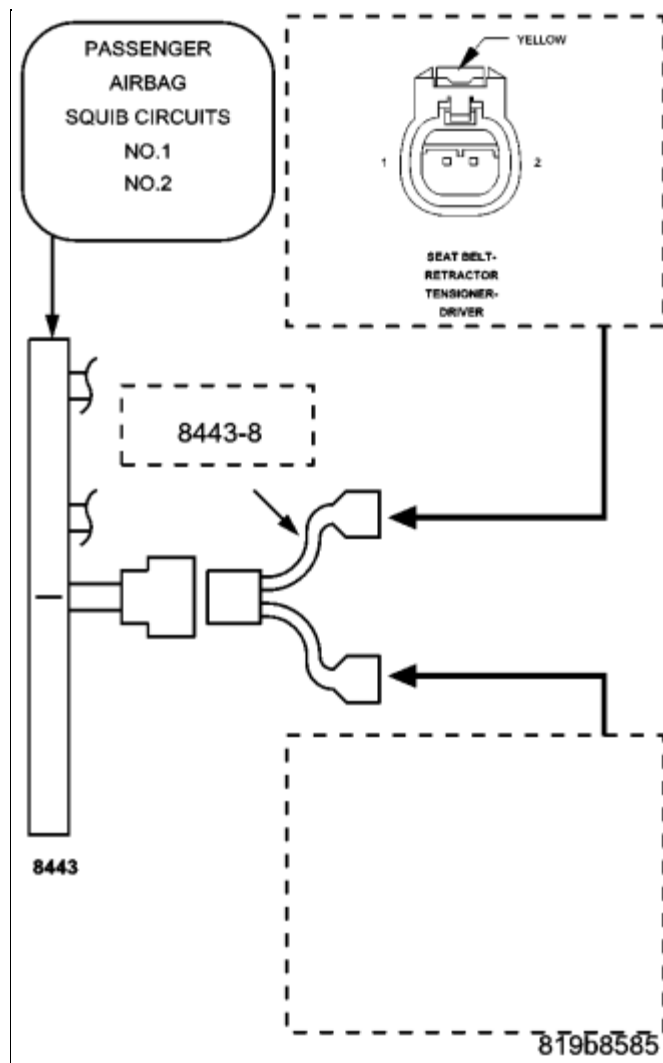
- Replace the Driver Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

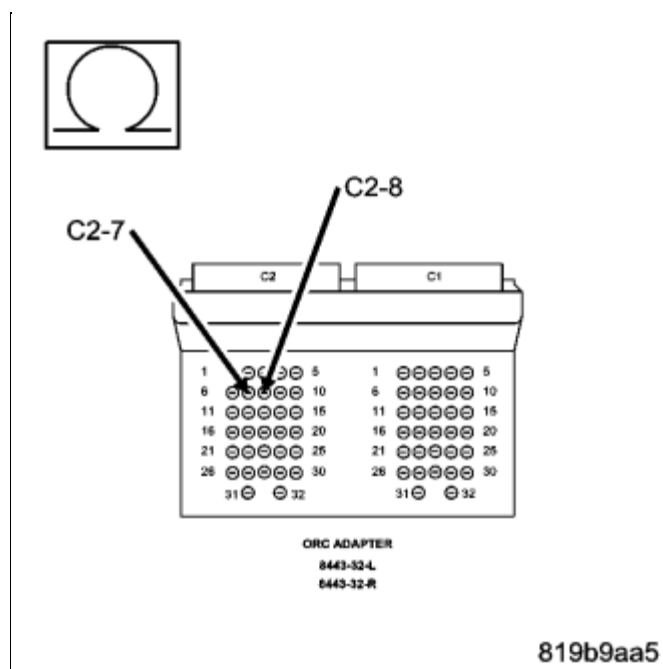
3. CHECK (R55) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT FOR A SHORT TO (R53) DRIVER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance between the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit and the (R53) Driver Seat Belt Retractor Tensioner Line 2 circuit at the Driver Seat Belt Retractor Tensioner connector.

Is the resistance below 10K ohms?

Yes

- Repair the (R55) Driver Seat Belt Retractor Tensioner Line 1 circuit for a short to the (R53) Driver Seat Belt Retractor Tensioner Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

STORED ORC DTC

5.

With the scan tool, record and erase all DTC from all Airbag System Modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
The following additional checks may assist you in identifying a possible intermittent problem.
Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.
If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
If only stored codes return continue the test until the problem area has been isolated.
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

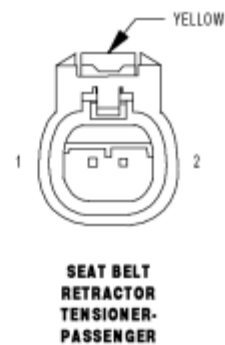
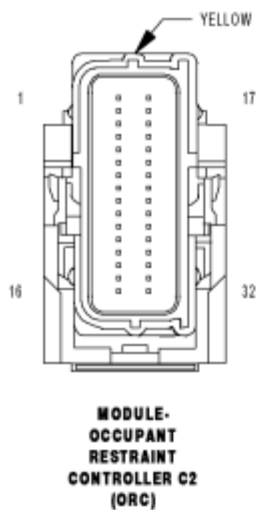
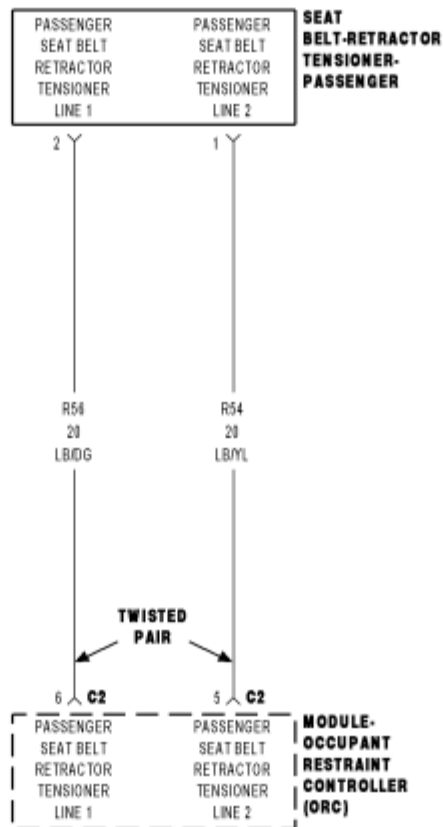
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C47-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT LOW



01590005

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected low resistance on the Passenger Seat Belt Retractor Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT SHORTED TO GROUND
(R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND
PASSENGER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAIN CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED PASSENGER SEAT BELT RETRACTOR TENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Seat Belt Retractor Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Passenger Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C47-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT LOW?

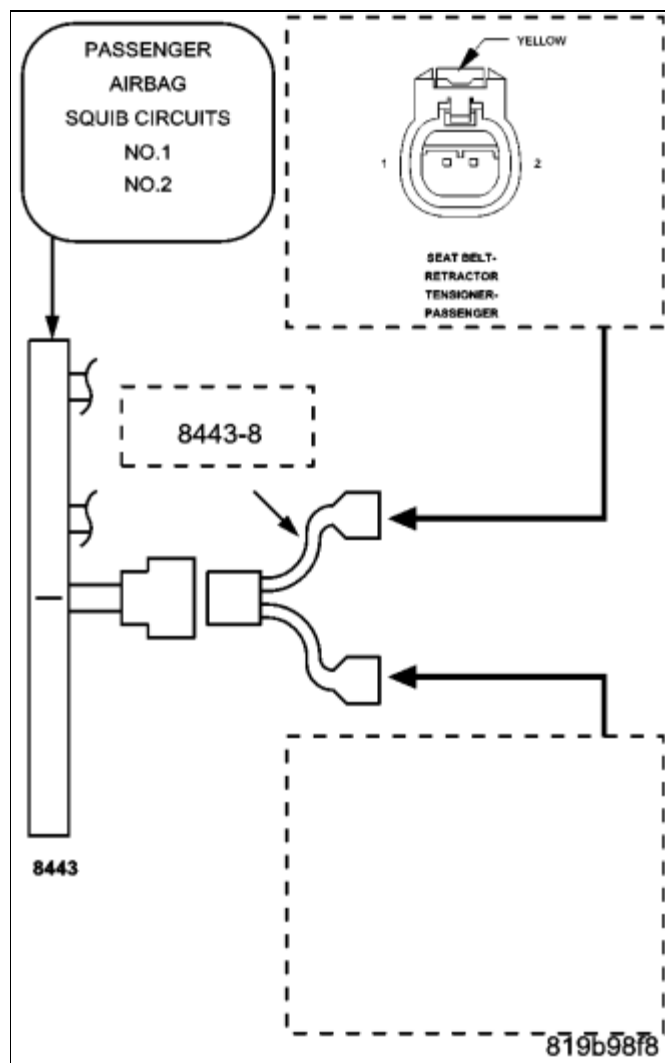
Yes

- Go To [3](#)

No

- Replace the Passenger Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND



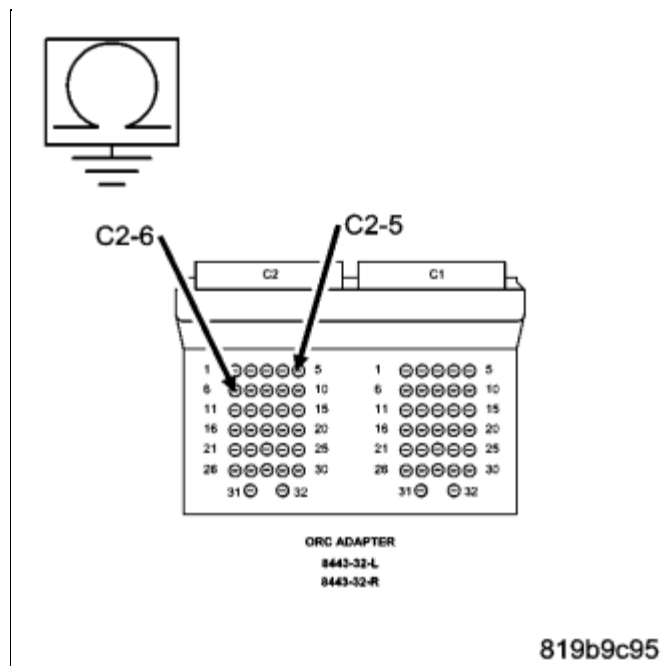
WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



Measure the resistance of the (R56) Passenger Seat Belt Retractor Tensioner Line 1 circuit between the Passenger Seat Belt Retractor Pretensioner connector and ground.
Measure the resistance of the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit between the Passenger Seat Belt Retractor Tensioner connector and ground.

Is the resistance below 10K ohms on either circuit?

Yes

- Repair the Passenger Seat Belt Retractor Tensioner circuits shorted to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid personal serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
The following additional checks may assist you in identifying a possible intermittent problem.
Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.
If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
If only stored codes return continue the test until the problem area has been isolated.
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

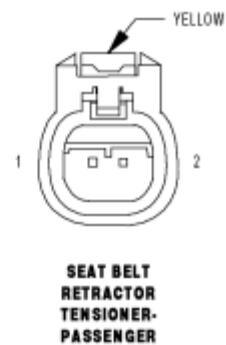
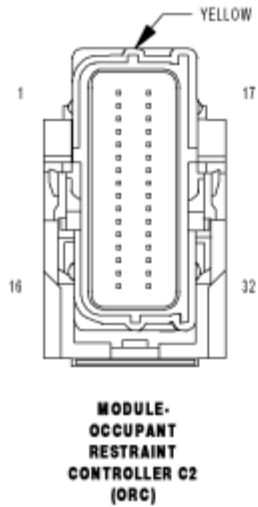
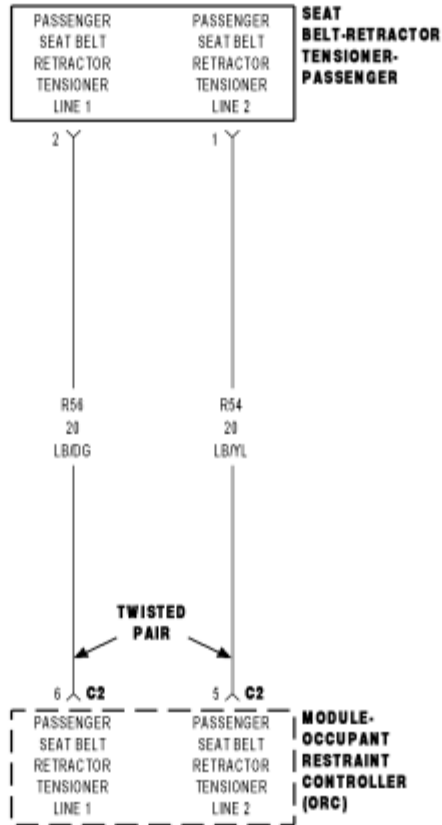
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C48-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT HIGH



01590005

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Seat Belt Retractor Pretensioner circuits.

- **Set Condition:**

The ORC detects voltage on the Passenger Seat Belt Retractor Pretensioner circuits.

Possible Causes
(R506) PASSENGER SEAT BELT RETRACTOR PRETENSIONER DATA CIRCUIT SHORTED TO BATTERY
(R504) PASSENGER SEAT BELT RETRACTOR PRETENSIONER VOLTAGE CIRCUIT SHORTED TO BATTERY
PASSENGER SEAT BELT RETRACTOR PRETENSIONER
ORC

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED PASSENGER SEAT BELT RETRACTOR PRETENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Seat Belt Retractor Pretensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Passenger Seat Belt Pretensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C48-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT HIGH?

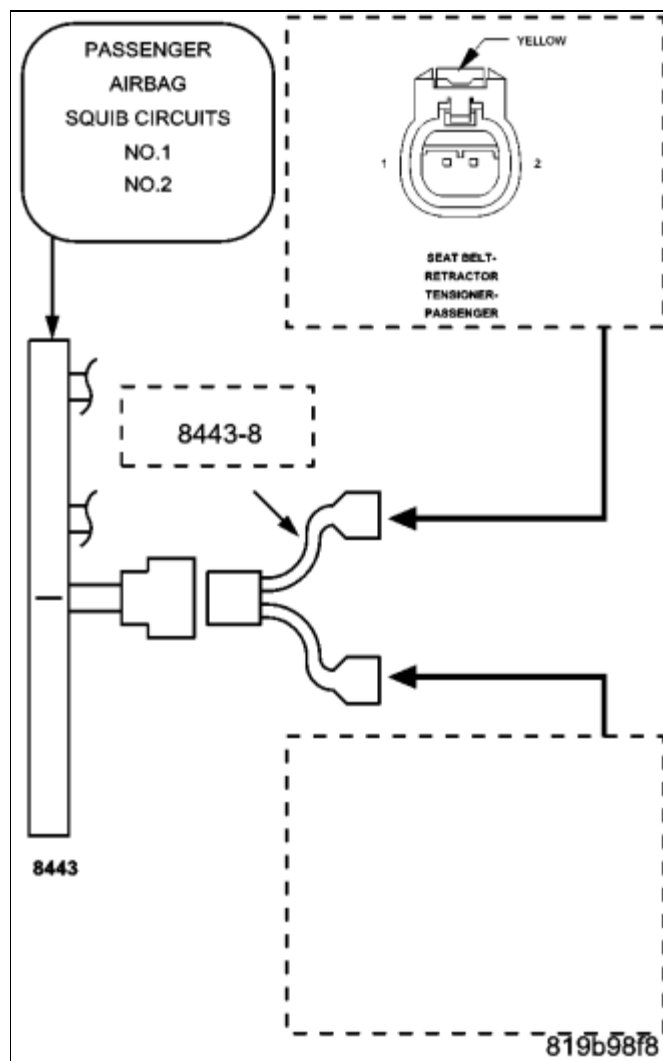
Yes

- Go To [3](#)

No

- Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY



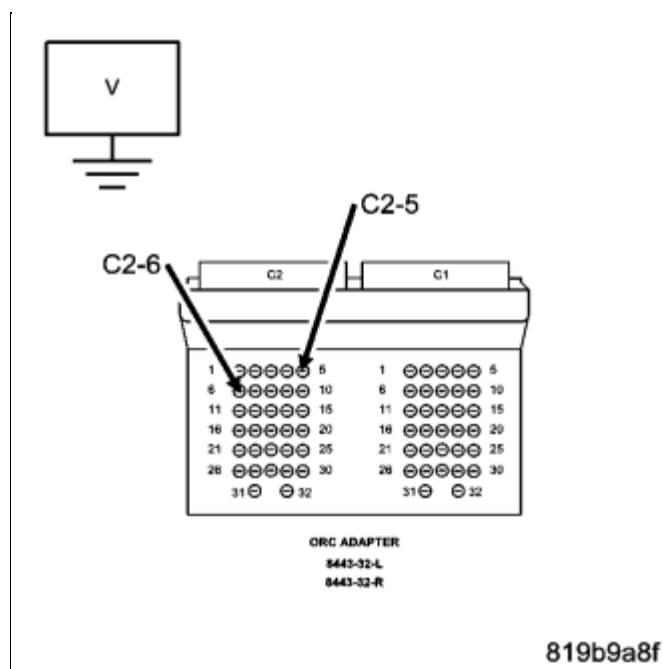
WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.



Measure the voltage of the (R56) Passenger Seat Belt Retractor Tensioner Line 1 circuit between the Passenger Seat Belt Tensioner connector and ground.

Measure the voltage of the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit between the Passenger Seat Belt Tensioner connector and ground.

Is there any voltage present on either circuit?

Yes

- Repair the Passenger Seat Belt Retractor Tensioner circuits with voltage present for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

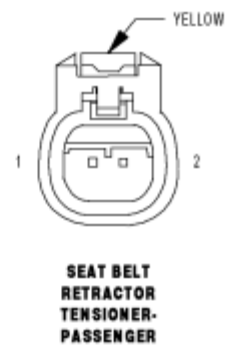
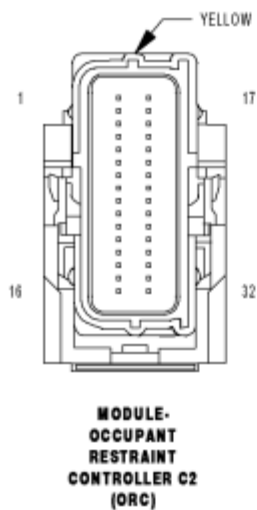
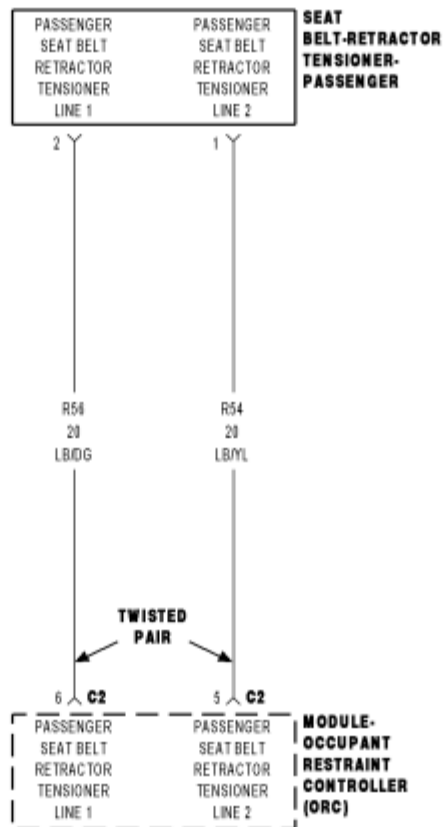
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C49-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT OPEN



01590005

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected an open or high resistance on the Passenger Seat Belt Retractor Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT OPEN
(R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT OPEN
PASSENGER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. DETERMINE ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [6](#)

2. CHECK FOR PASSENGER SEAT BELT RETRACTOR TENSIONER CIRCUIT OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Seat Belt Retractor Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Passenger Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C49-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT OPEN?

Yes

- Go To [3](#)

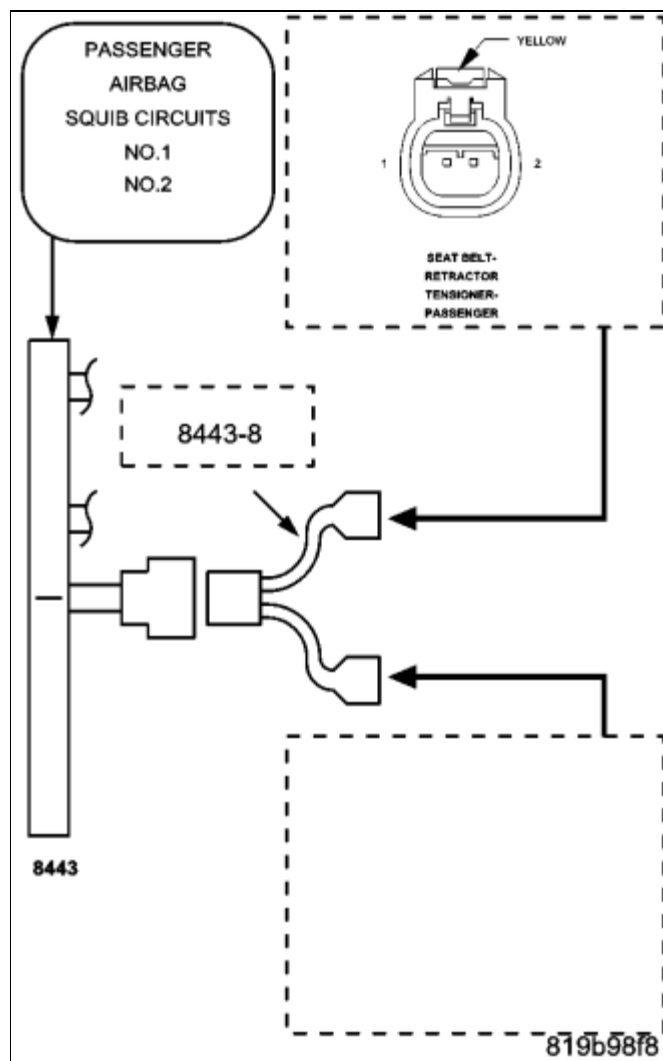
No

- Replace the Passenger Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. CHECK (R56) PASSENGER SEAT BELT RETRACTOR TENSIONER DATA CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.



NOTE: Check connectors - Clean and repair as necessary.

Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (R56) Passenger Seat Belt Retractor Tensioner Line 1 circuit between the Passenger Seat Belt Retractor Tensioner connector and the ORC 8443-32-L Adaptor.

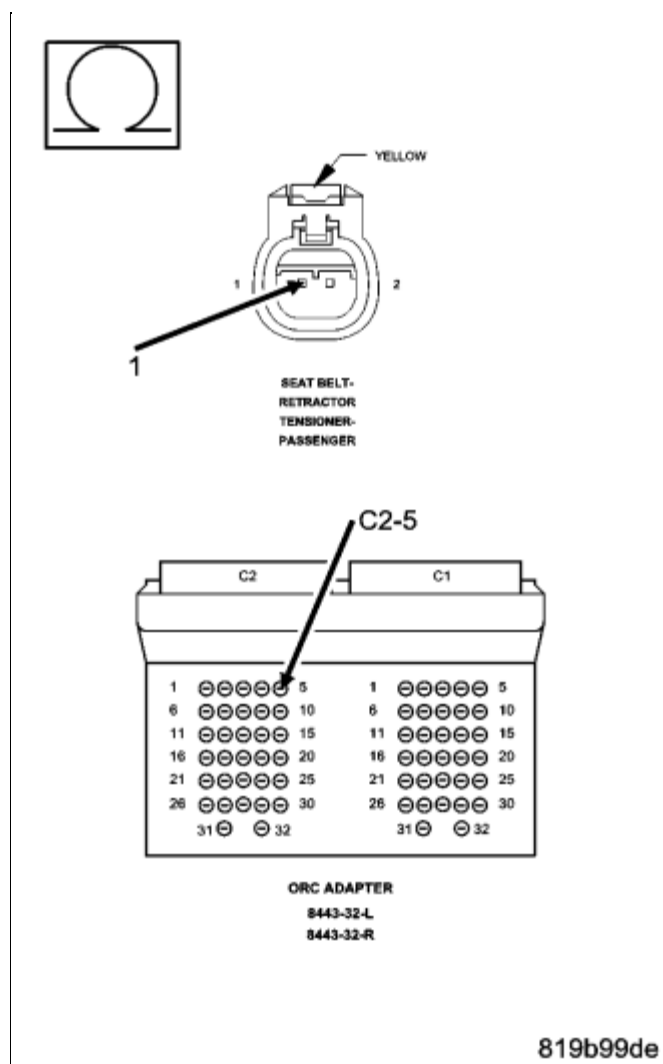
Is the resistance below 1.0 ohm?

Yes

- Go To [4](#)

No

- Repair the (R506) Passenger Seat Belt Retractor Pretensioner Line 1 circuit for and open. Then Go To [4](#)



4. CHECK (R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit between the Passenger Seat Belt Retractor Tensioner connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1.0 ohm?

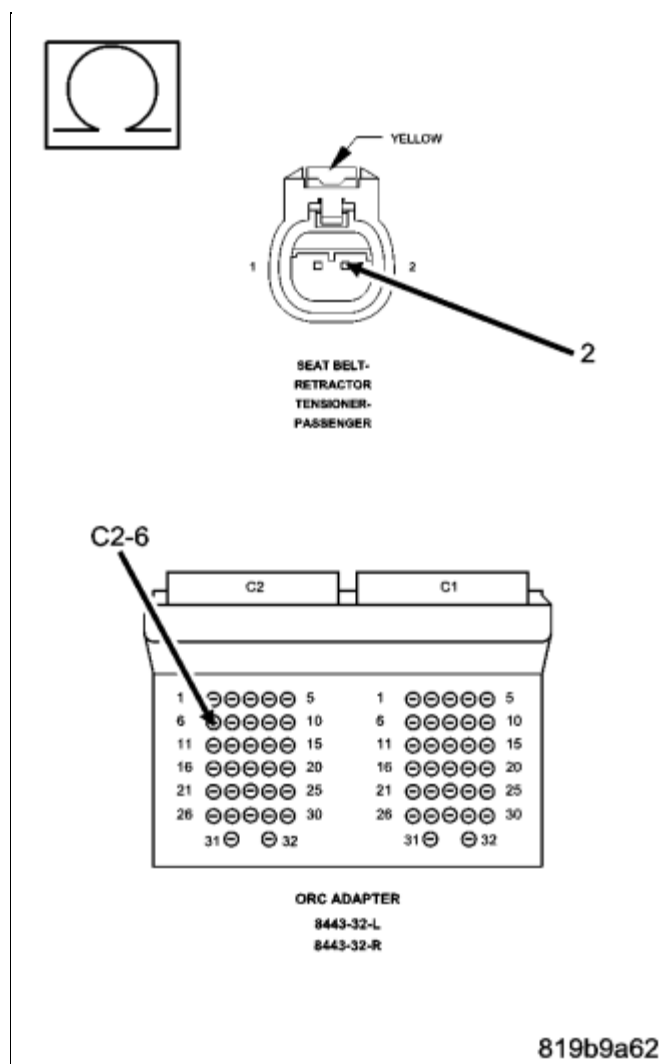
Yes

- Go To [5](#)

No

- Repair the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit for and open.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



5. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

6. STORED ORC DTC

With the scan tool, record and erase all DTC from all Airbag System Modules. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

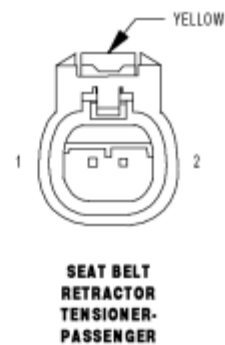
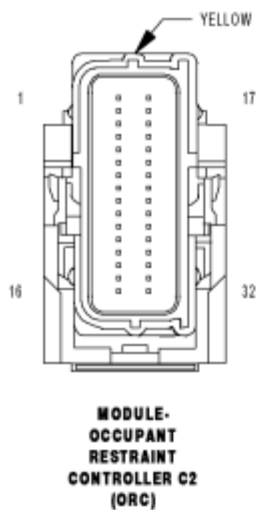
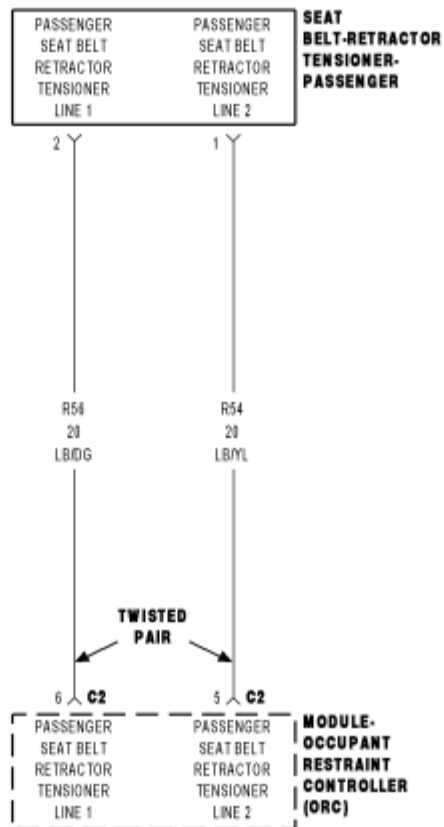
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B1C4A-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT SHORTED TOGETHER



01590005

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Retractor Tensioner circuits.

- **Set Condition:**

The ORC has detected low resistance between the Passenger Seat Belt Retractor Tensioner circuits.

Possible Causes
(R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT SHORTED TO (R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT
PASSENGER SEAT BELT RETRACTOR TENSIONER
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. SELECT ACTIVE OR STORED DTC

NOTE: Ensure the battery is fully charged.

NOTE: The scan tool, SRS Airbag Load Tool 8443, and DVOM are required to perform the following test.

Select Active or Stored DTC.

Is the DTC active or stored?

ORC - ACTIVE DTC

- Go To [2](#)

ORC - STORED DTC

- Go To [5](#)

2. CHECK FOR SHORTED PASSENGER SEAT BELT RETRACTOR TENSIONER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Passenger Seat Belt Tensioner connector.

NOTE: Check connectors - Clean and repair as necessary.

Connect the 8443 Load Tool and 8443-10 Jumper to the Passenger Seat Belt Retractor Tensioner connector.

WARNING: To avoid serious or fatal injury, turn the ignition on then reconnect the battery.

With the scan tool, read the active ORC DTC.

Does the scan tool display: B1C4A-1ST ROW PASSENGER RETRACTOR PRETENSIONER CIRCUIT SHORTED TOGETHER?

Yes

- Go To [3](#)

No

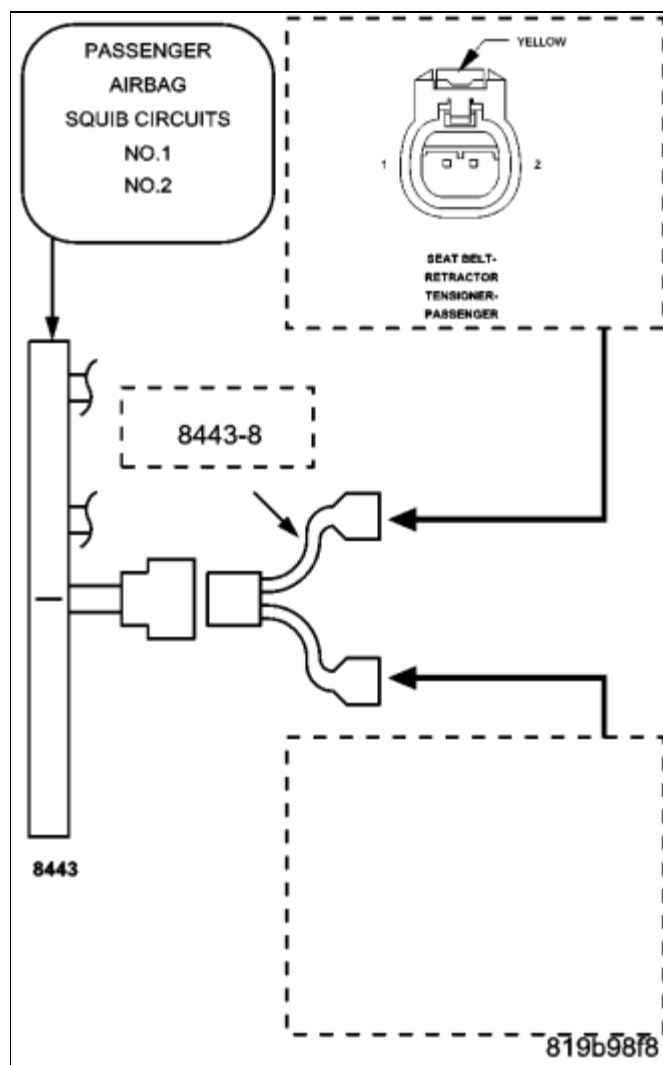
- Replace the Passenger Seat Belt Retractor Tensioner in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

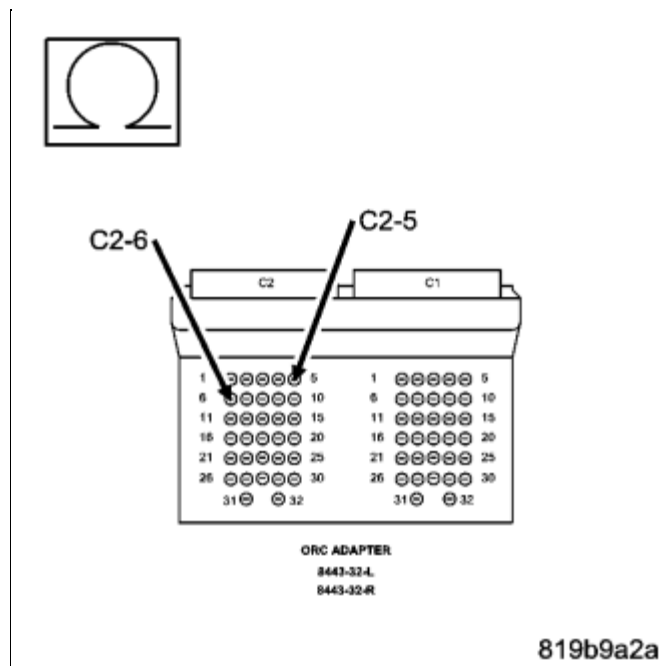
3. CHECK (R56) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 1 CIRCUIT FOR A SHORT TO (R54) PASSENGER SEAT BELT RETRACTOR TENSIONER LINE 2 CIRCUIT

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Retractor Tensioner connector.
Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.





Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

Measure the resistance between the (R56) Passenger Seat Belt Retractor Tensioner Line 1 circuit and the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit at the Passenger Seat Belt Retractor Tensioner connector.

Is the resistance below 10K ohms?

Yes

- Repair the (R56) Passenger Seat Belt Retractor Tensioner Line 1 circuit for a short to the (R54) Passenger Seat Belt Retractor Tensioner Line 2 circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. REPLACE THE ORC

WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

STORED ORC DTC

5.

With the scan tool, record and erase all DTC from all Airbag System Modules.
If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
The following additional checks may assist you in identifying a possible intermittent problem.
Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.
Wiggle the wiring harness and connectors of the related airbag circuit or component.
If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
If only stored codes return continue the test until the problem area has been isolated.
In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

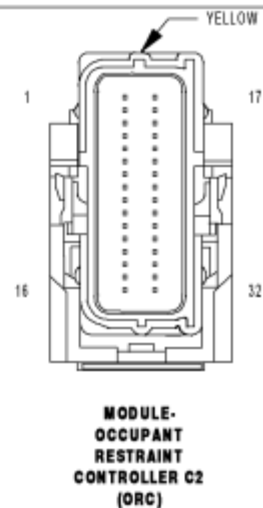
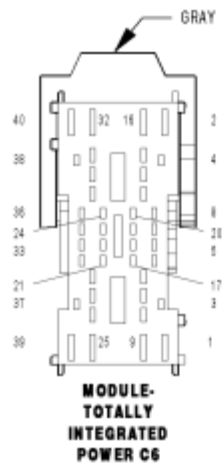
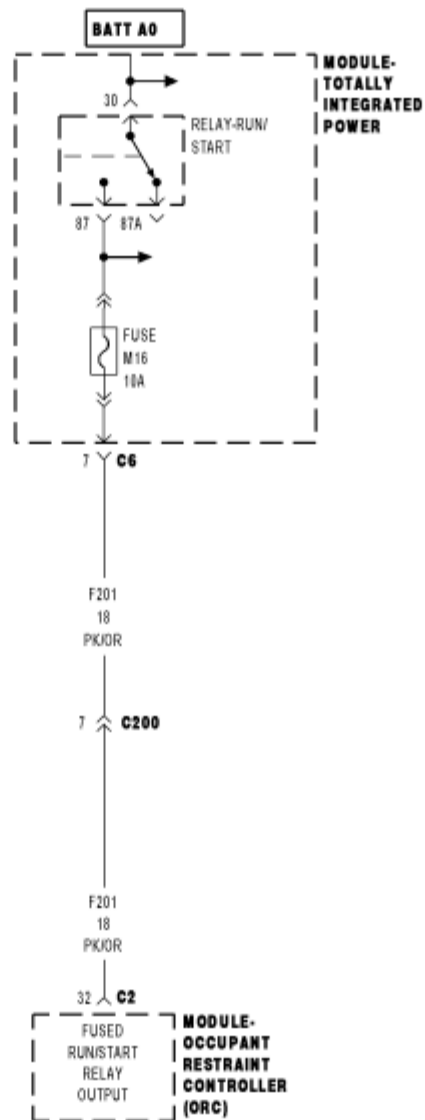
Yes

- Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

B212C-IGNITION RUN/START INPUT CIRCUIT OPEN



0159cc06

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition in the Run-Start position.

- **Set Condition:**

If voltage on the (F201) Fused Run/Start Relay Output circuit drops below 6.0 ± 0.25 volts.

Possible Causes
(F201) FUSED RUN/START RELAY OUTPUT CIRCUIT OPEN
(F201) FUSED RUN/START RELAY OUTPUT CIRCUIT SHORTED TO GROUND
OPEN TIPM FUSE M16
TOTALLY INTEGRATED POWER MODULE (TIPM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B212C-IGNITION RUN/START INPUT CIRCUIT OPEN IS ACTIVE IN THE ORC.

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

Wait 10 seconds.

With the scan tool, read Occupant Restraint Controller (ORC) DTC.

Does the scan tool display active: B212C-IGNITION RUN/START INPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. INSPECT AIRBAG RUN-START FUSE

Turn the ignition off.

Remove the Airbag Run-Start TIPM Fuse M16 from the TIPM and inspect the fuse.

NOTE: Check connectors - Clean and repair as necessary.

Is the Run/Start fuse open?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK (F201) FUSED RUN/START RELAY OUTPUT (RUN-START) CIRCUIT RESISTANCE

Measure the resistance of the (F201) Fused Run/Start Relay Output circuit between ground and the Airbag Run-Start Fuse M16 (output side) terminal.

Is the resistance below 100.0 ohms?

Yes

- Go To [4](#)

No

- Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Replace Airbag Run-Start TIPM Fuse M16.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECK (F201) FUSED RUN/START RELAY OUTPUT CIRCUIT RESISTANCE WITH ORC DISCONNECTED

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the Load Tool ORC 8443-32-L Adaptor to the ORC connectors.

Measure the resistance of the (F201) Fused run/Start Relay Output circuit between C2-32 of the 8443-32-L Adaptor and ground.

Is the resistance below 100.0 ohms?

Yes

- Repair the (F201) Fused Run/Start Relay Output circuit for a short to ground.
- Replace the Airbag Run-Start TIPM Fuse M16.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace the ORC in accordance with the Service Information.
- Replace the Airbag Run-Start TIPM Fuse M16.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK AIRBAG RUN/START TIPM FUSE M16 SUPPLY VOLTAGE

Turn the ignition on.

Measure the voltage between Ground and the Airbag Run-Start TIPM Fuse M16 (supply side) terminal.

Is the voltage above 6.0 volts?

Yes

- Go To [6](#)

No

- Replace the TIPM in accordance with the Service Information.
- Perform *BODY SYSTEM VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

6. CHECK (F201) FUSED RUN/START RELAY OUTPUT CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Reinstall the Airbag Run-Start TIPM Fuse M16.

Disconnect the both ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Install the Airbag Load tool ORC 8443-32-L adaptor to the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (F201) Fused Run/Start Relay Output circuit between the 8443-32-L connector cavity C2-32 and ground.

Is the voltage above 6.0 volts?

Yes

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [7](#)

7. CHECK (F201) FUSED RUN/START RELAY OUTPUT CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the TIPM C6 connector.

NOTE: Check connectors - Clean and repair as necessary.

Measure the resistance of the (F201) Fused Run/Start Relay Output Circuit between the 8443-32-L connector cavity C2-32 and cavity 7 of the TIPM C6 connector.

Is the below 5.0 ohms?

Yes

- Replace the TIPM in accordance with the Service Information.
- Perform *BODY SYSTEM VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the open (F201) Fused Run/Start Relay Output circuit.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTC?

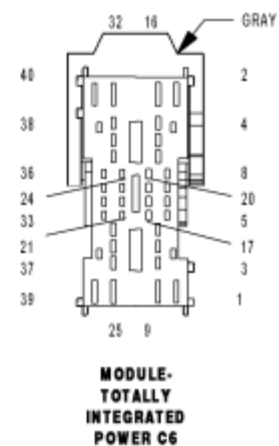
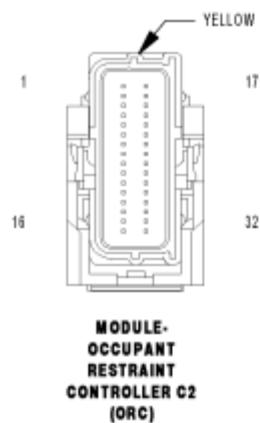
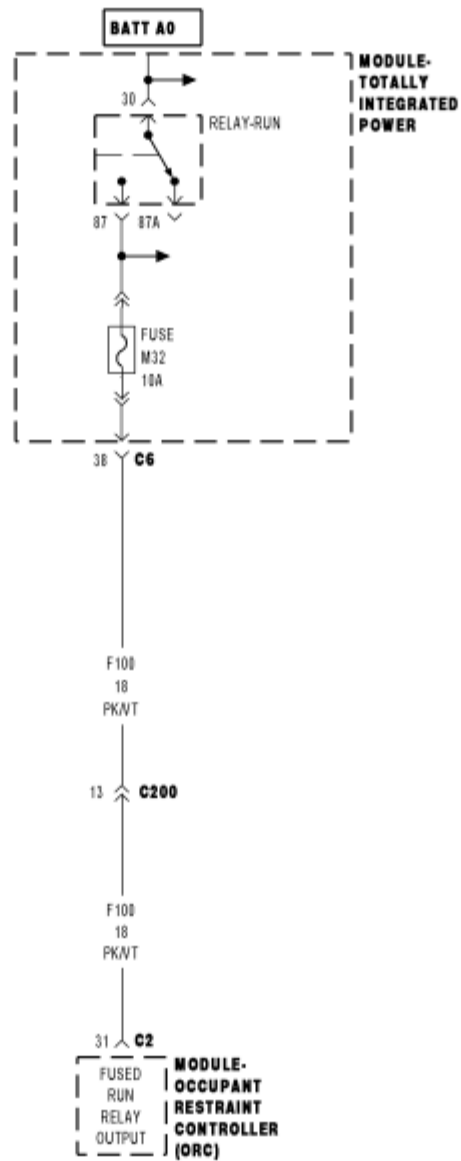
Yes

- Select appropriate symptom from Symptom List.

No

- No problem found. Erase all codes before returning the vehicle to the customer.

B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN



0159cc02

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition in the Run position.

- **Set Condition:**

If voltage on the (F100) Fused Ignition Switch Output (RUN) circuit drops below 6.0 volts.

Possible Causes
TIPM FUSE M32 OPEN
TIPM FUSE M32 SUPPLY VOLTAGE LOW
(F100) FUSED RUN RELAY OUTPUT CIRCUIT OPEN
(F100) FUSED RUN RELAY OUTPUT CIRCUIT SHORT TO GROUND
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

Wait 10 seconds.

With the scan tool, read Occupant Restraint Controller (ORC) DTC.

Does the scan tool display active: B212D-IGNITION RUN ONLY INPUT CIRCUIT OPEN?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. INSPECT AIRBAG RUN CIRCUIT FUSE

Turn the ignition off.

Remove the TIPM Fuse M32 and inspect the fuse.

NOTE: Check connectors - Clean and repair as necessary.

Is the fuse open?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT SHORT TO GROUND

Measure the resistance of the (F100) Fused Run Relay Output (Run) circuit between the TIPM Fuse M32 (output side) terminal and ground.

Is the resistance below 100.0 ohms?

Yes

- Go To [4](#)

No

- Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.
- Replace TIPM Fuse M32.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

4. CHECK (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT RESISTANCE WITH ORC DISCONNECTED

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the Load Tool ORC 8443-32 Adapter to the ORC connectors.

Measure the resistance of the (F100) Fused Run Relay Output (Run) circuit between 8443-32-L Adapter cavity C2-31 and ground.

Is the resistance below 100.0 ohms?

Yes

- Repair the (F100) Fused Run Relay Output (Run) circuit for a short to ground.
- Replace the TIPM Fuse M32.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace the ORC in accordance with the Service Information.
- Replace the TIPM Fuse 27.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

5. CHECK TIPM FUSE M32 SUPPLY SIDE CIRCUIT VOLTAGE

Turn the ignition on.

Measure the voltage of the TIPM Fuse M32 (supply side) of the fuse to ground.

Is the voltage above 6.0 volts?

Yes

- Go To [6](#)

No

- Replace the TIPM in accordance with the Service Information.
- Perform *BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

6. CHECK (F100) FUSED RUN RELAY OUTPUT (RUN) OUTPUT CIRCUIT FOR AN OPEN

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Reinstall the TIPM Fuse M32.

Disconnect the ORC connectors.

NOTE: Check connectors - Clean and repair as necessary.

Connect the Airbag Load Tool ORC 8443-32-L Adapter to the ORC harness connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (F100) Fused Run Relay Output (Run) circuit between the 8443-32-L Adaptor cavity C2-31 and ground.

Is the voltage above 6.0 volts?

Yes

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [7](#)

7. CHECK FUSE M32 OUTPUT TO CAVITY 38 OF THE TIPM C6 CONNECTOR

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the TIPM C6 connector.

NOTE: Check connectors - Clean and repair as necessary.

Measure the resistance of the (F100) Fused Run Relay Output (Run) circuit between cavity C2-31 of the 8443-32-L Adaptor and TIPM C6 cavity 38 connector.

Is the resistance below 5.0 ohms?

Yes

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Replace the TIPM in accordance with the Service Information.
- Perform *BODY VERIFICATION TEST - VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

8. TEST FOR INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool, monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If only stored codes return, continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the active DTC in question.

Does the scan tool display any ACTIVE DTC?

Yes

- Select appropriate symptom from Symptom List.

No

- No problem found. Erase all codes before returning vehicle to customer.

B2201-CALIBRATION MISMATCH

- **When Monitored:**

With the Ignition on.

- **Set Condition:**

This DTC will be set when the VIN stored in the PCM does not match the VIN stored in the Occupant Restraint Controller (ORC). The ORC does not support a stored B2201 DTC.

Possible Causes
INCORRECT PCM
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B2201-CALIBRATION MISMATCH IS ACTIVE

Turn the ignition on.

With the scan tool, read ORC DTC.

NOTE: Ensure the battery is fully charged.

Does the scan tool display active: B2201-CALIBRATION MISMATCH?

Yes

- Go To [2](#)

No

- Test Complete.
-

2. CHECK VIN IN PCM

With the scan tool compare the VIN that is programmed into the PCM to the VIN stored in the ORC.

Does the VIN programmed into the PCM match the VIN stored in the ORC?

Yes

- Go To [3](#)

No

- Replace and program the Powertrain Control Module in accordance with the service information. Ensure the PCM is replaced with the correct vehicle line PCM.

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

View repair.

Repair

- Replace the ORC in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1

B2205-ORIGINAL VIN MISSING/MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Occupant Restraint Controller (ORC) will receive and monitor the VIN message from the PCM and record the VIN if different from the last VIN.

Possible Causes
INCORRECT VIN PROGRAMMED IN PCM
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B2205-ORIGINAL VIN MISSING/MISMATCH

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active : B2205-ORIGINAL VIN MISSING/MISMATCH?

Yes

- Go To [2](#)

No

- If the DTC is stored, check for an intermittent condition. Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

2. CHECK VIN IN PCM

With the scan tool compare the VIN that is programmed into the PCM to the VIN on the vehicle.

Does the VIN programmed into the PCM match the vehicles VIN?

Yes

- Go To [3](#)

No

- Replace the Powertrain Control Module in accordance with Service Information.

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

View repair.

Repair

- Replace the ORC in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B2207-OCCUPANT RESTRAINT CONTROLLER INTERNAL 1

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.
With the scan tool, erase and read ORC DTC.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B2208-OCCUPANT RESTRAINT CONTROLLER INTERNAL 2

- **When Monitored:**

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

- **Set Condition:**

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B2209-OCCUPANT RESTRAINT CONTROLLER INTERNAL 3

◦ When Monitored:

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

◦ Set Condition:

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B220A-OCCUPANT RESTRAINT CONTROLLER INTERNAL 4

- **When Monitored:**

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

- **Set Condition:**

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B220B-OCCUPANT RESTRAINT CONTROLLER FIRING STORED ENERGY

- **When Monitored:**

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

- **Set Condition:**

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B220C-OCCUPANT RESTRAINT CONTROLLER ACCELEROMETER 1 INTERNAL

- **When Monitored:**

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

- **Set Condition:**

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B220D-OCCUPANT RESTRAINT CONTROLLER ACCELEROMETER 2 INTERNAL

◦ When Monitored:

With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.

◦ Set Condition:

This DTC will set if the module identifies an out of range internal circuit.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. REPLACE OCCUPANT RESTRAINT CONTROLLER

Turn the ignition on.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take proper precautions can result in accidental airbag deployment and serious or fatal injury.

Repair

- Replace the ORC in accordance with the Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B222A-VEHICLE LINE MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) sends a Bus Message to the Occupant Restraint Controller (ORC) containing the vehicle line but the ORC original VIN does not march the broadcast VIN.

Possible Causes
TOTALLY INTEGRATED POWER MODULE (TIPM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC B222A-VEHICLE LINE MISMATCH IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active: B222A-VEHICLE LINE MISMATCH?

Yes

- Go To [2](#)

No

- Erase DTC, see if code returns
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

2. COMPARE STORED VIN IN THE TIPM AND ORC

With the scan tool in ORC select More Options select ECU Details, compare Original VIN and current VIN. With the scan tool, read and record the VIN that is stored in the ORC.

Does the stored VIN match the current VIN?

Yes

- Go To [3](#)

No

- Replace or reprogram the TIPM in accordance with the Service Information.

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

View repair

Repair

- Replace the ORC in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

B223B-VEHICLE CONFIGURATION MISMATCH

- **When Monitored:**

With the ignition on.

- **Set Condition:**

This DTC will set if the Occupant Restraint Controller (ORC) is not configured for Occupant Classification Module (OCM) and the OCM is active on the CAN Bus.

Possible Causes
TOTALLY INTEGRATED POWER MODULE (TIPM)
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test**1. VERIFY THAT DTC B223B-VEHICLE CONFIGURATION MISMATCH IS ACTIVE**

Turn the ignition on.

With the scan tool, read ORC DTC.

NOTE: Ensure the battery is fully charged.

Does the scan tool display active: B223B-VEHICLE CONFIGURATION MISMATCH?

Yes

- Go To [2](#)

No

- Erase DTC, see if code returns
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

2. COMPARE STORED VIN IN THE TIPM AND ORC

With the scan tool in ORC select More Options select ECU Details, compare Original VIN and current VIN. With the scan tool, read and record the VIN that is stored in the ORC.

Does the stored VIN match the current VIN?

Yes

- Go To [3](#)

No

- Replace or reprogram the TIPM in accordance with the Service Information.

3. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and serious or fatal injury.

View repair

Repair

- Replace the ORC in accordance with the service information.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

U0001-CAN C BUS

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0167-LOST COMMUNICATION WITH INTRUSION TRANSCIEVER CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W.**

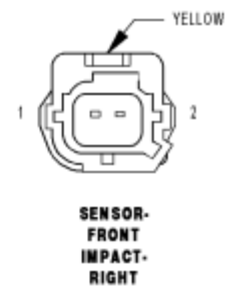
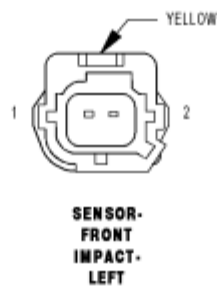
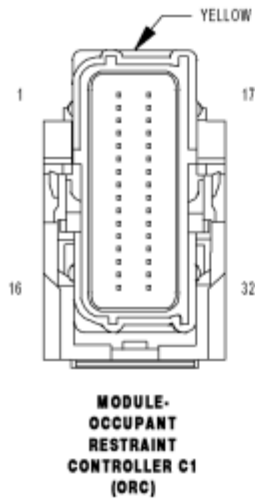
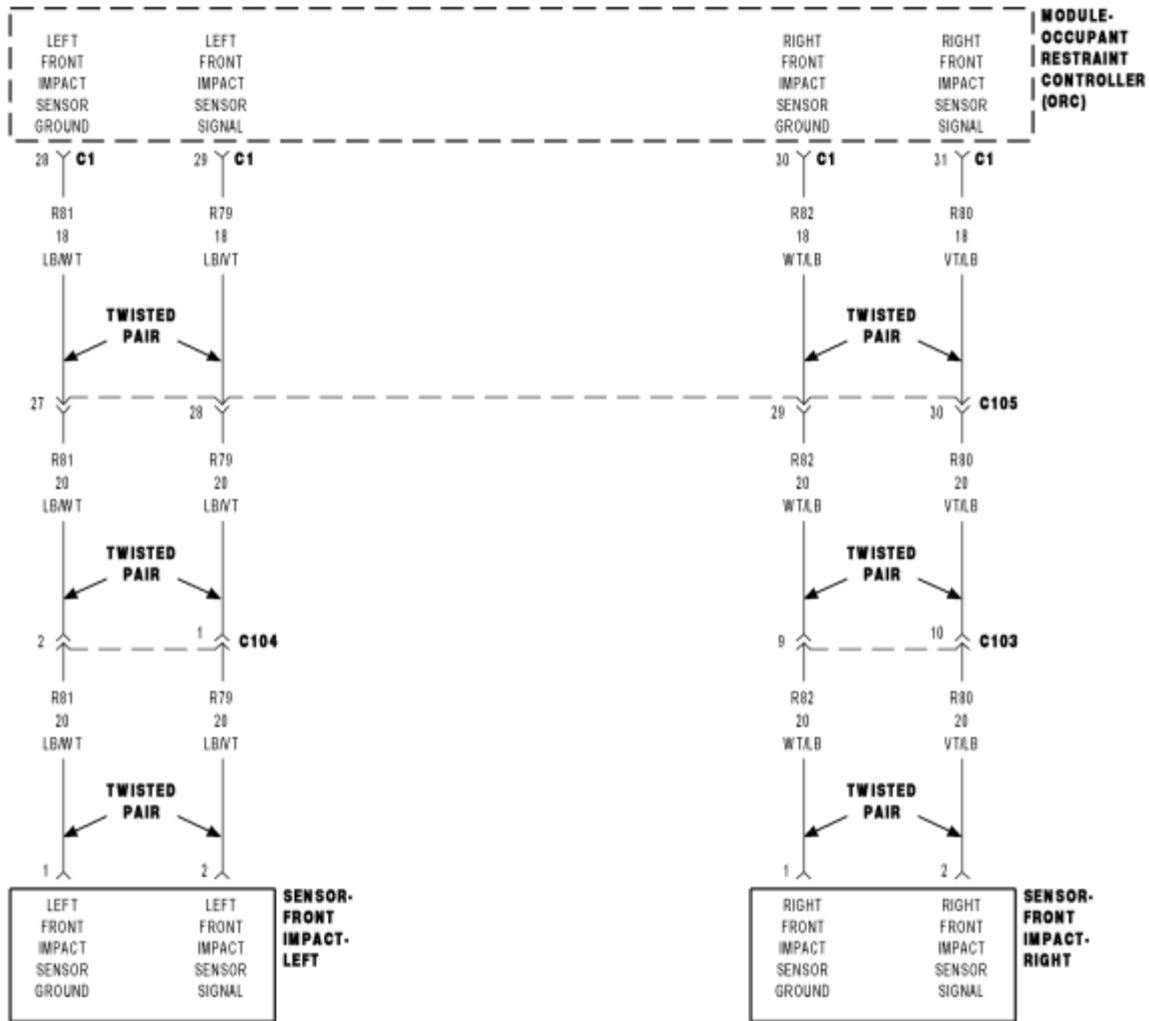
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM/WCM)

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR



0194008

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The Occupant Restraint Controller (ORC) continuously communicates with the Front Left Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.

◦ **Set Condition:**

This code will set, if the ORC and the Front Left Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R79) SIGNAL CIRCUIT SHORTED TO BATTERY
(R79) SIGNAL CIRCUIT SHORTED TO GROUND
(R79, R81) FRONT LEFT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT OPEN
(R79) FRONT LEFT IMPACT SENSOR SIGNAL CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active: U0170-LOST COMMUNICATION W/UP-FRONT LEFT SATELLITE ACCELERATION SENSOR?

Yes

- Go To [2](#)

No

- Go To [9](#)

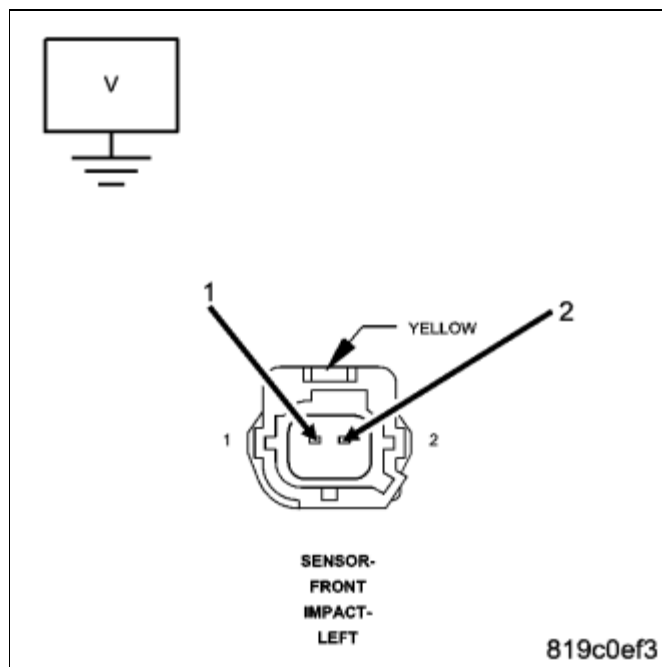
2. CHECK THE (R79) and (R81) FRONT LEFT IMPACT SENSOR SIGNAL AND GROUND CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Front Left Impact Sensor connector.
Disconnect the ORC connectors.
Connect the ORC 8443-32-L Adaptor to the ORC connectors.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.



Measure the (R79) Front Left Impact Sensor Signal cavity 1 and (R81) Front Left Impact Sensor Ground cavity 2 circuit voltage between the Front Left Impact Sensor connector and ground.

Is there any voltage present?

Yes

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Repair the (R79) and (R81) Front Left Impact Sensor circuits for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [3](#)

3. CHECK THE (R79) AND (R81) FRONT LEFT IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn the

ignition off, disconnect the battery and wait two minutes before proceeding.

Measure the resistance of the (R79) Front Left Impact Sensor Signal circuit cavity 2 and (R81) Front Left Impact Sensor Ground circuit cavity 1 between the Front Left Impact Sensor connector and ground.

Is the resistance below 100K ohms?

Yes

- Repair the (R79) and (R81) Front Left Impact Sensor circuits for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. CHECK THE (R79) AND (R81) FRONT LEFT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R79) Front Left Impact Sensor Signal and (R81) Front Left Impact Sensor Ground circuits at the Front Left Impact Sensor connector.

Is the resistance below 100K ohms?

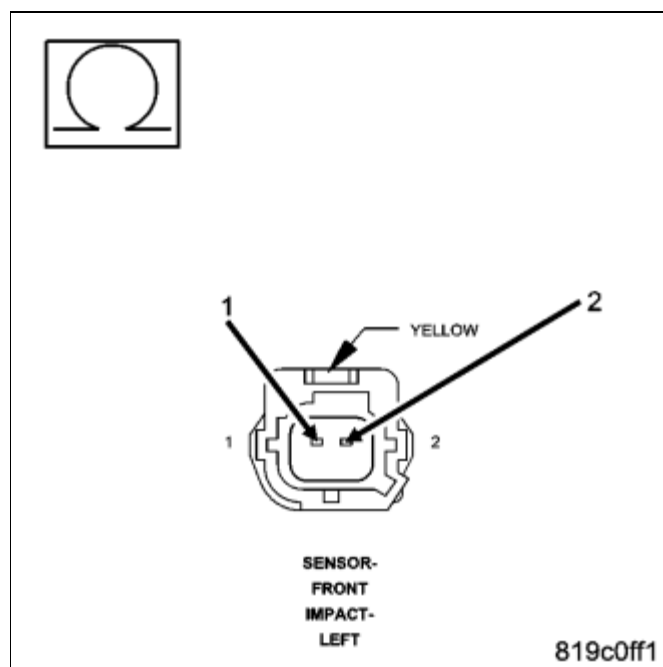
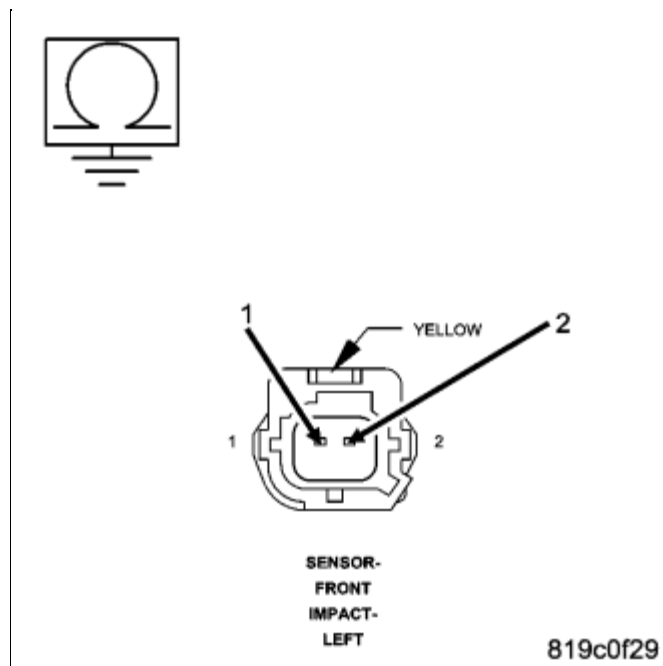
Yes

- Repair the (R79) and (R81) Front Left Impact Sensor circuits shorted together.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [5](#)

5. CHECK THE (R81) FRONT LEFT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE



Measure the resistance of the (R81) Front Left Impact Sensor Ground circuit cavity 1 between the Front Left Impact Sensor connector and the ORC 8443-32-L Adaptor cavity C1-28.

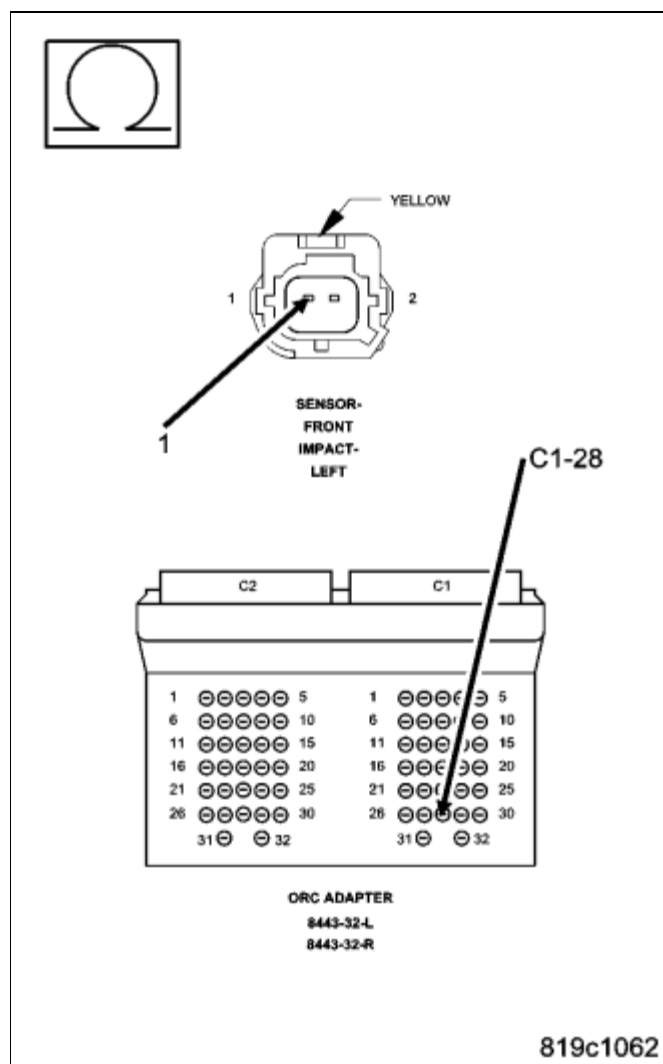
Is the resistance below 1 ohm?

Yes

- Go To [6](#)

No

- Repair the (R81) Front Left Impact Sensor 1 Ground circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



6. CHECK THE (R79) FRONT LEFT IMPACT SENSOR CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R79) Front Left Impact Sensor Signal circuit cavity 2 between the Front Left Impact Sensor connector and the ORC 8443-32-L Adaptor cavity 29.

Is the resistance below 1 ohm?

Yes

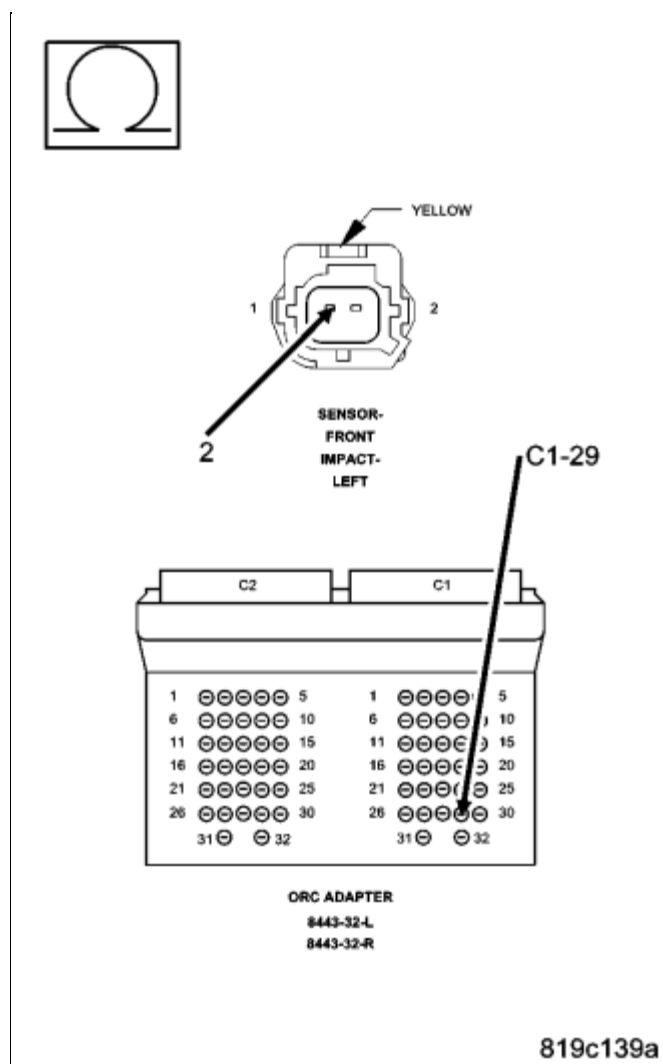
- Go To [7](#)

No

- Repair the (R79) Front Left Impact Sensor Signal

circuit for an open or high resistance.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE FRONT LEFT IMPACT SENSOR

Replace the Front Left Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Left Impact Sensor DTC return?

Yes

- Go To [8](#)

No

- Repair is complete.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

Disconnect the ORC 8443-32-L Adaptor.

If there are no possible causes remaining, view repair.

Repair

- Replace the Occupant Restraint Controller in accordance with Service Information.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram / schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

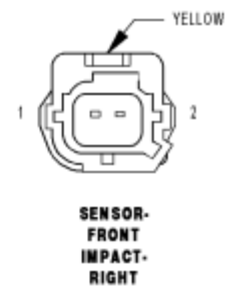
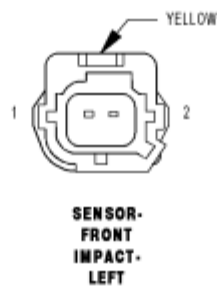
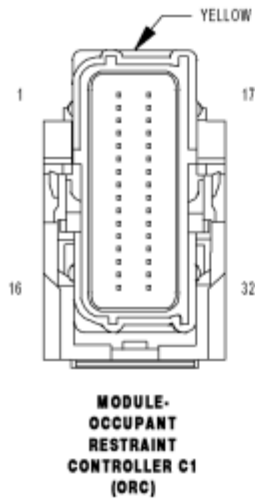
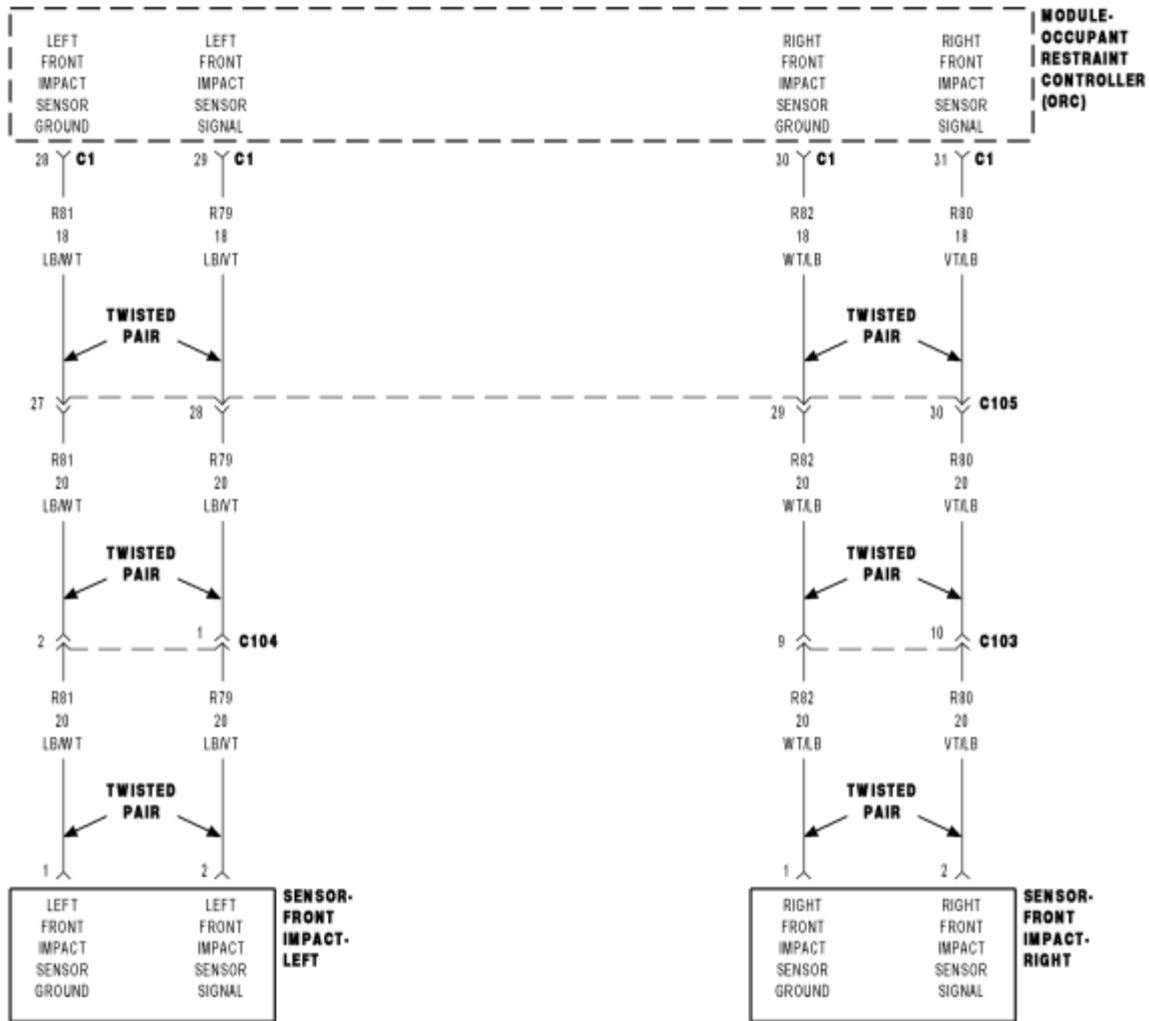
Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

**U0171-LOST COMMUNICATION W/UP-FRONT RIGHT
SATELLITE ACCELERATION SENSOR**



0194000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The Occupant Restraint Controller (ORC) continuously communicates with the Front Right Impact Sensor over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.

◦ **Set Condition:**

This code will set, if the ORC and the Front Right Impact Sensor do not establish and maintain valid data communications.

Possible Causes
(R80) SIGNAL CIRCUIT SHORTED TO BATTERY
(R80) SIGNAL CIRCUIT SHORTED TO GROUND
(R80, R82) FRONT RIGHT IMPACT SENSOR CIRCUITS SHORTED TOGETHER
(R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT OPEN
(R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active: U0171-LOST COMMUNICATION W/UP-FRONT RIGHT SATELLITE ACCELERATION SENSOR?

Yes

- Go To [2](#)

No

- Go To [9](#)

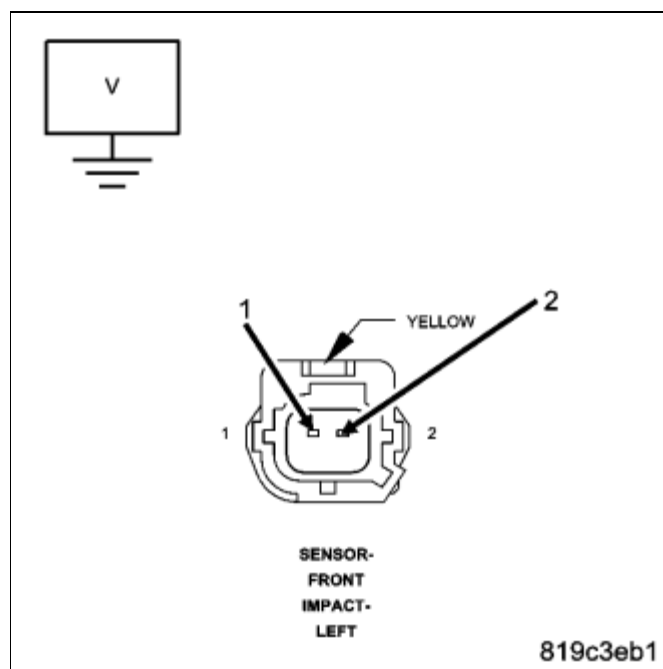
2. CHECK THE (R80) and (R82) FRONT RIGHT IMPACT SENSOR CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Front Right Impact Sensor connector.
Disconnect the ORC connectors.
Connect the ORC 8443-32-L Adaptor to the ORC connector.

NOTE: The IP Harness is always connected to the right side (C1) of the 8443-32-L Adapter.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.



Measure the (R80) Front Right Impact Sensor Signal circuit cavity 2 and (R82) Sensor Ground circuit at the Front Right Impact Sensor cavity 1 circuit voltage between the Front Right Impact Sensor connector and ground.

Is there any voltage present?

Yes

- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Repair the (R80) and (R82) Front Right Impact Sensor circuits for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [3](#)

3. CHECK THE (R80) AND (R82) FRONT RIGHT IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn ignition on, then reconnect the battery.

Measure the resistance of the (R80) cavity 2 and (R82) Front Right Impact Sensor circuit cavity 1 between the Front Right Impact Sensor connector and ground.

Is the resistance below 100K ohms?

Yes

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Repair the (R80) and (R82) Front Right Impact Sensor circuits for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. CHECK THE (R80) AND (R82) FRONT RIGHT IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R80) Front Right Impact Sensor Signal cavity 2 and (R82) Front Right Impact Sensor Ground cavity 1 circuit at the Front Right Impact Sensor connector.

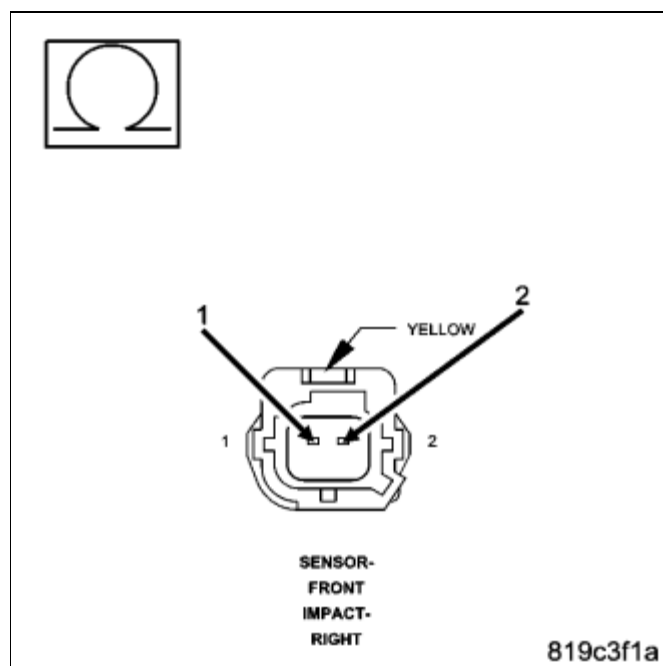
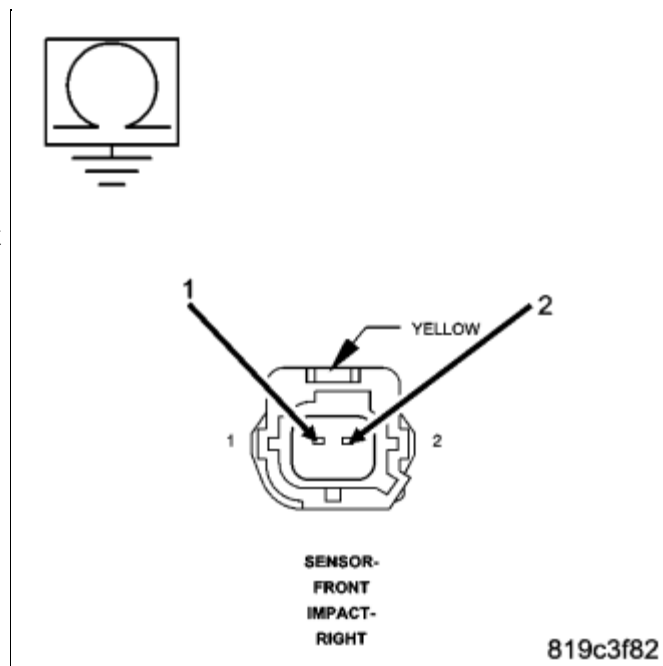
Is the resistance below 100K ohms?

Yes

- Repair the (R80) and (R82) Front Right Impact Sensor circuits shorted together.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [5](#)



5. CHECK THE (R82) FRONT RIGHT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN OR

HIGH RESISTANCE

Measure the resistance of the (R82) Front Right Impact Sensor Ground circuit cavity 1 between the Front Right Impact Sensor connector and the ORC 8443-32-L Adaptor C1-30.

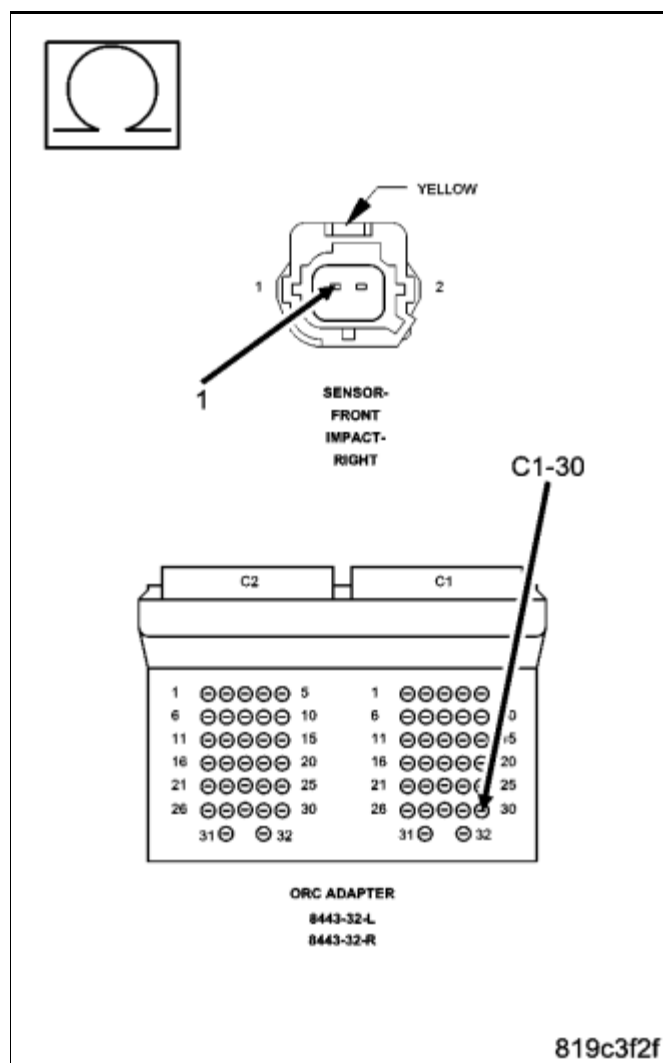
Is the resistance below 1 ohm?

Yes

- Go To [6](#)

No

- Repair the (R82) Front Right Impact Sensor 2 Ground circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



6. CHECK THE (R80) FRONT RIGHT IMPACT SENSOR SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R80) Front Right Impact Sensor Signal circuit cavity 1 between the Front Right Impact Sensor connector and the ORC 8443-32-L Adaptor cavity 31.

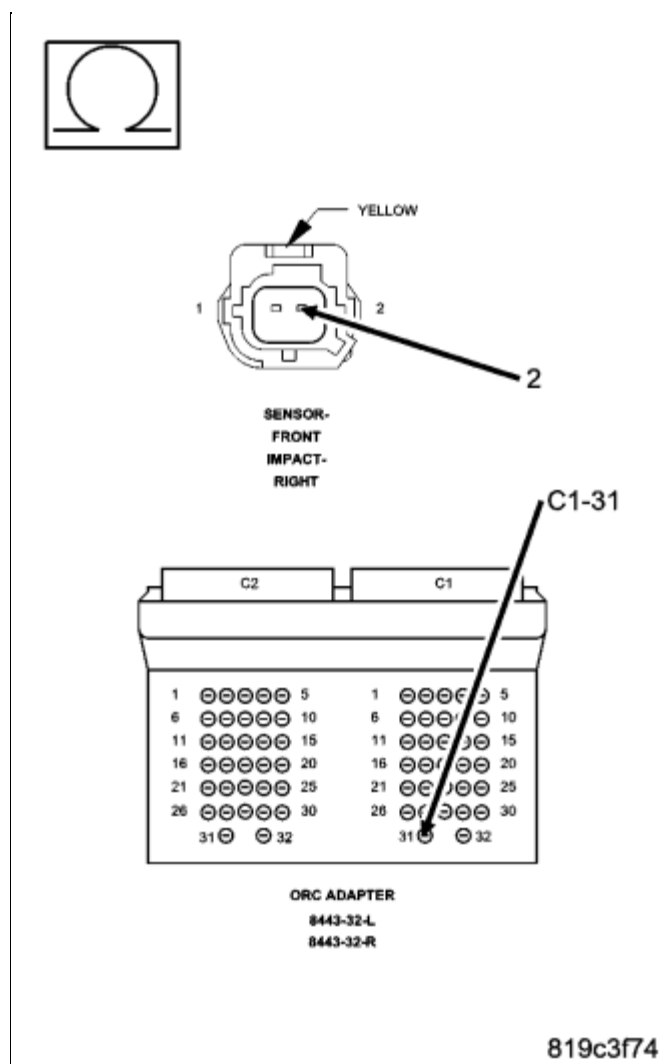
Is the resistance below 1 ohm?

Yes

- Go To [7](#)

No

- Repair the (R80) Front Right Impact Sensor Signal circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE FRONT RIGHT IMPACT SENSOR

Replace the Front Right Impact Sensor.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Front Right Impact Sensor DTC return?

Yes

- Go To [8](#)

No

- Repair is complete.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the Occupant Restraint Controller in accordance with Service Instructions.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

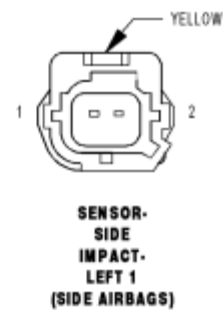
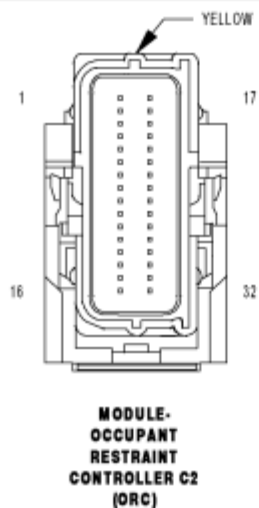
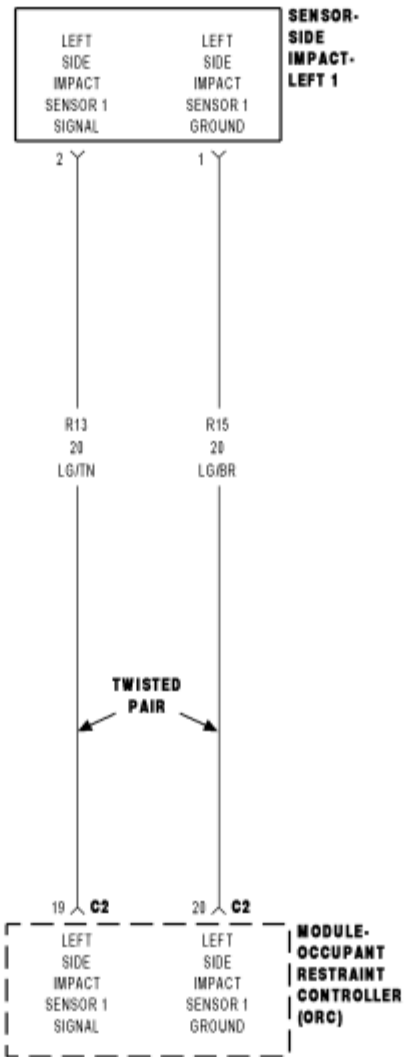
Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1



01934197

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The Occupant Restraint Controller (ORC) continuously communicates with the Left Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.

◦ **Set Condition:**

This code will set, if the ORC and the Left Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R13) SIGNAL CIRCUIT SHORTED TO BATTERY
(R13) SIGNAL CIRCUIT SHORTED TO GROUND
(R13, R15) LEFT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
ORC, LEFT SIDE IMPACT SENSOR 1

Diagnostic Test

1. VERIFY THAT DTC U0172-LOST COMMUNICATION W/LEFT SIDE SATELLITE ACCELERATION SENSOR 1 IS ACTIVE

NOTE: Ensure the battery is fully charged.

Turn the ignition on.

With the scan tool, read ORC DTC.

Does the scan tool display active: U0172-LOST COMMUNICATION W/LEFT SIDE IMPACT SENSOR 1?

Yes

- Go To [2](#)

No

- Go To [9](#)

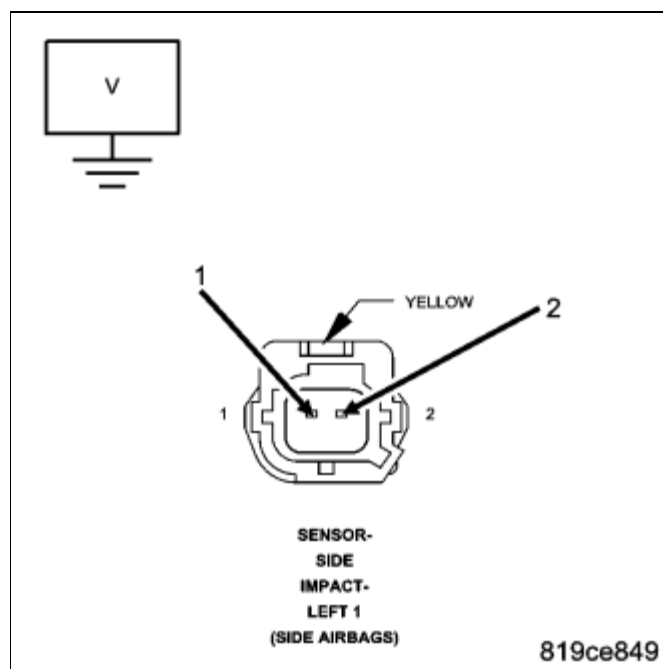
2. CHECK THE (R13) and (R15) LEFT SIDE IMPACT SENSOR 1 CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Left Side Impact Sensor 1 connector.
Disconnect the ORC connectors.
Connect the ORC 8443-32-L Adaptor to the ORC connectors.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R13) Left Side Impact Sensor 1 Signal circuit and (R15) Sensor Ground circuit between the Left Side Impact Sensor 1 connector and ground.



Is there any voltage present?

Yes

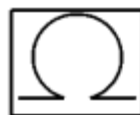
- **WARNING:** To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.
- Repair the (R13) and (R15) Left Side Impact Sensor 1 circuits for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [3](#)

3. CHECK THE (R13) and (R15) LEFT SIDE IMPACT SENSOR 1 CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn ignition on, then reconnect the battery.



Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and ground.

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and ground.

Is the resistance below 100K ohms on either circuit?

Yes

- **WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
- Repair the (R13) and (R15) Left Side Impact Sensor 1 Signal and Ground circuit for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. CHECK THE (R13) and (R15) LEFT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R13) Left Side Impact Sensor 1 Signal and (R15) Sensor Ground circuits at the Left Side Impact Sensor 1 connector.

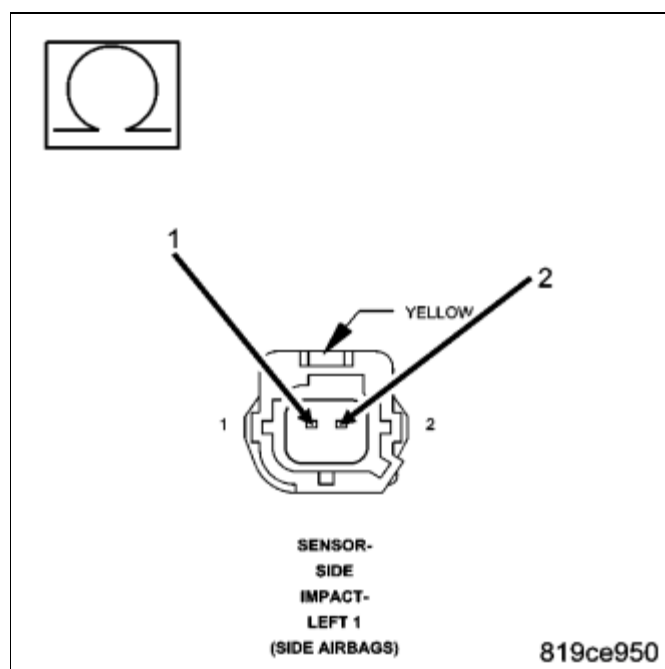
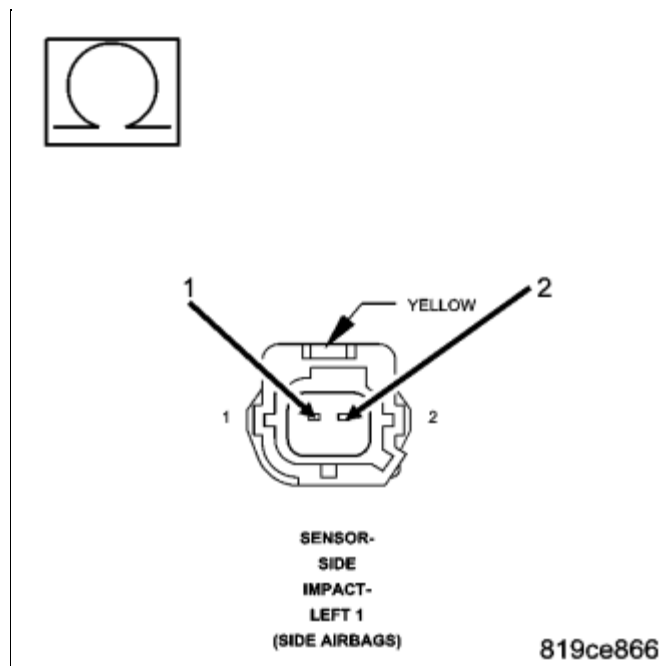
Is the resistance below 100K ohms?

Yes

- Repair the (R13) and (R15) Left Side Impact Sensor 1 circuits shorted together.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [5](#)



5. CHECK THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and the ORC 8443-32-L Adaptor.

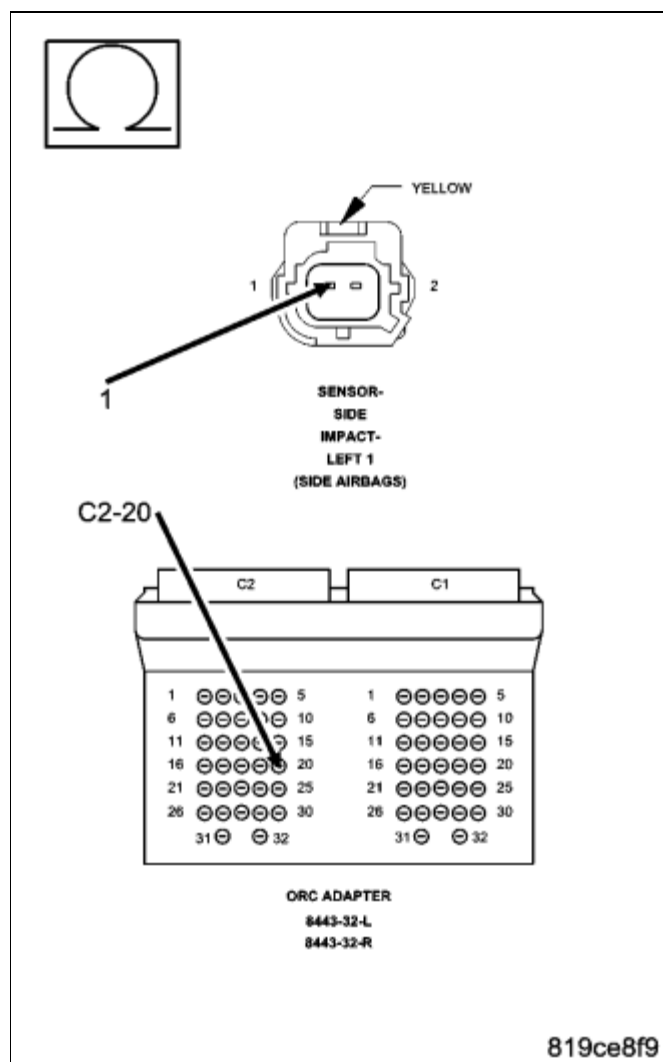
Is the resistance below 1 ohm?

Yes

- Go To [6](#)

No

- Repair the (R15) Left Side Impact Sensor 1 Ground circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



6. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and the ORC 8443-32-L Adaptor.

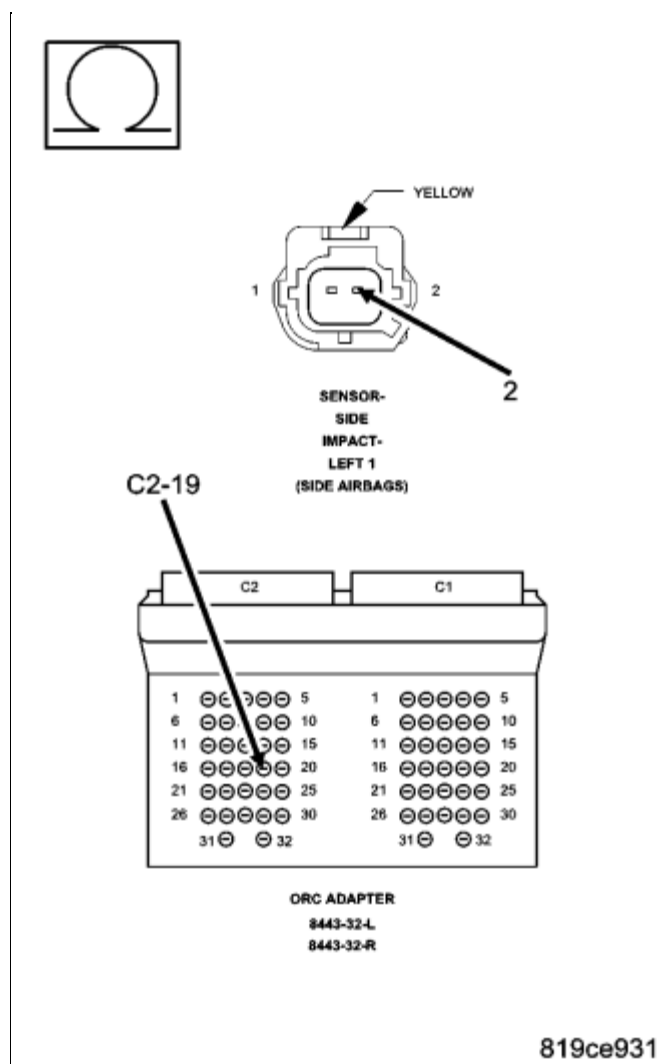
Is the resistance below 1 ohm?

Yes

- Go To [7](#)

No

- Repair the (R13) Left Side Impact Sensor 1 Signal circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE LEFT SIDE IMPACT SENSOR 1

Replace the Left Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Left Side Impact Sensor 1 DTC return?

Yes

- Go To [8](#)

No

- Repair is complete.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the Occupant Restraint Controller in accordance with Service Instructions.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

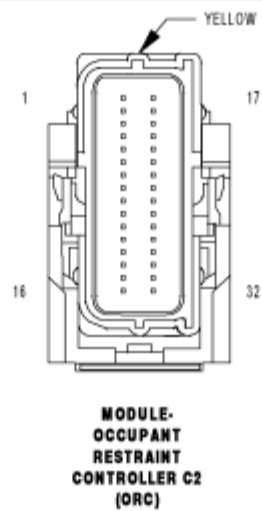
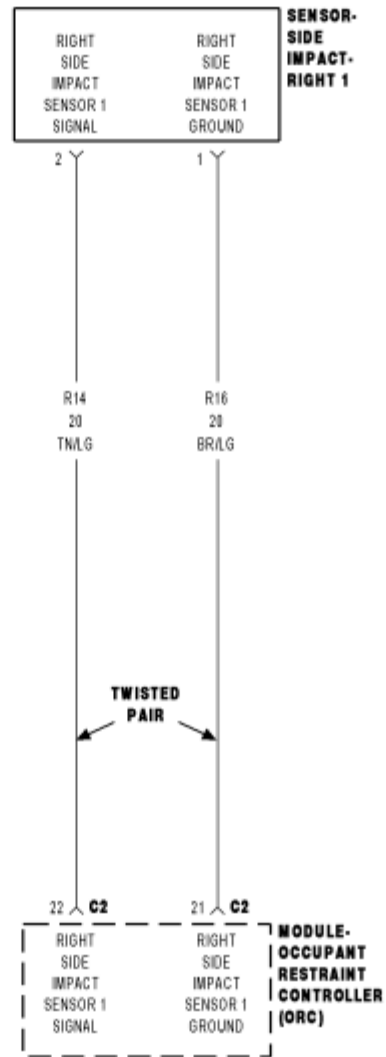
Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1



0199419*

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The Occupant Restraint Controller (ORC) continuously communicates with the Right Side Impact Sensor 1 over the sensor signal circuit. The sensor communication and on board diagnostics are powered by the ORC signal.

◦ **Set Condition:**

This code will set, if the ORC and the Right Side Impact Sensor 1 do not establish and maintain valid data communications.

Possible Causes
(R14) SIGNAL CIRCUIT SHORTED TO BATTERY
(R14) SIGNAL CIRCUIT SHORTED TO GROUND
(R14, R16) RIGHT SIDE IMPACT SENSOR 1 CIRCUITS SHORTED TOGETHER
(R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN
(R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROLLER (ORC)

Diagnostic Test

1. VERIFY THAT DTC U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1

NOTE: Ensure the battery is fully charged.

Turn the ignition on.
With the scan tool, read ORC DTC.

Does the scan tool display active: U0175-LOST COMMUNICATION W/RIGHT SIDE SATELLITE ACCELERATION SENSOR 1?

Yes

- Go To [2](#)

No

- Go To [9](#)

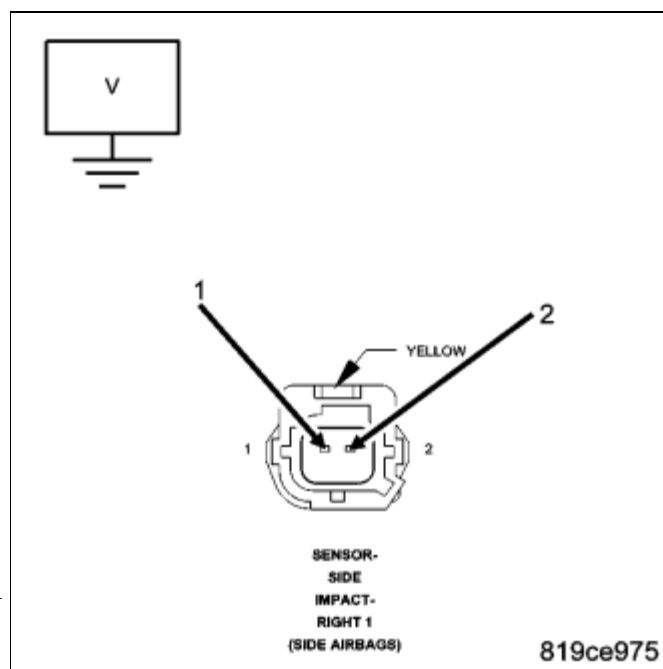
2. CHECK THE (R14) and (R16) RIGHT SIDE IMPACT SENSOR 1 CIRCUITS FOR A SHORT TO BATTERY

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Disconnect the Right Side Impact Sensor 1 connector.
Disconnect the ORC connectors.
Connect the ORC 8443-32-L Adaptor to the ORC connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Measure the voltage of the (R14) Right Side Impact Sensor 1 Signal circuit and (R16) Sensor Ground circuit at the Right Side Impact Sensor 1 connector and ground.



Is there any voltage present?

Yes

- Repair the (R14) and (R16) Right Side Impact Sensor 1 circuits for a short to battery.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [3](#)

3. CHECK THE (R14) and (R16) RIGHT SIDE IMPACT SENSOR 1 CIRCUITS FOR A SHORT TO GROUND

WARNING: To avoid serious or fatal injury, turn ignition on, then reconnect the battery.

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and ground.
Measure the resistance of the (R16) Right Side Impact

Sensor Ground circuit between the Right Side Impact Sensor 1 connector and ground.

Is the resistance below 100K ohms on either circuit?

Yes

- Repair the (R14) Right Side Impact Sensor 1 Signal or (R16) Right Side Impact Sensor 1 Ground circuit for a short to ground.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [4](#)

4. CHECK THE (R14) and (R16) RIGHT SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TOGETHER

Measure the resistance between the (R14) Right Side Impact Sensor 1 Signal and (R16) Sensor Ground circuits at the Right Side Impact Sensor 1 connector.

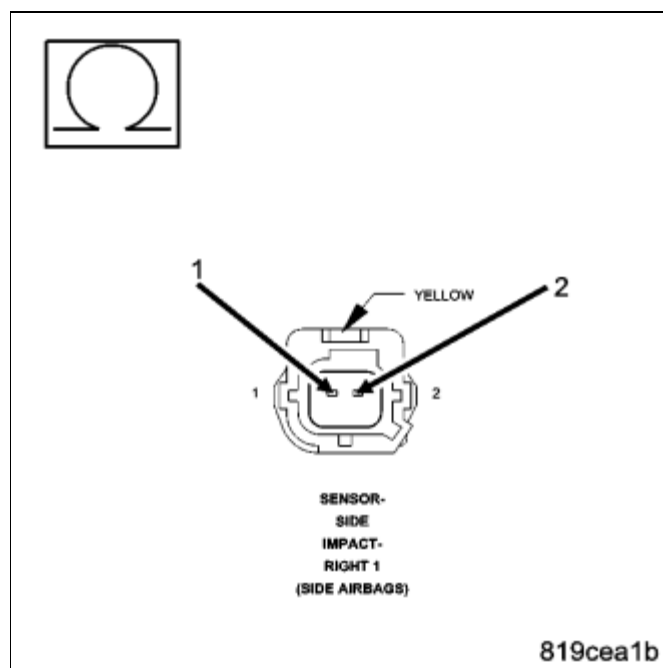
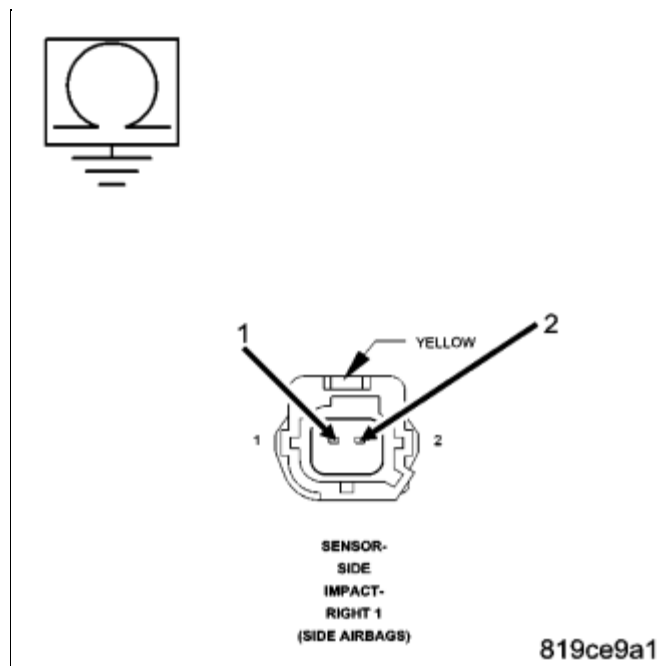
Is the resistance below 100K ohms?

Yes

- Repair the (R14) and (R16) Right Side Impact Sensor 1 circuits shorted together.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

No

- Go To [5](#)



5. CHECK THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and the ORC 8443-32-L Adaptor.

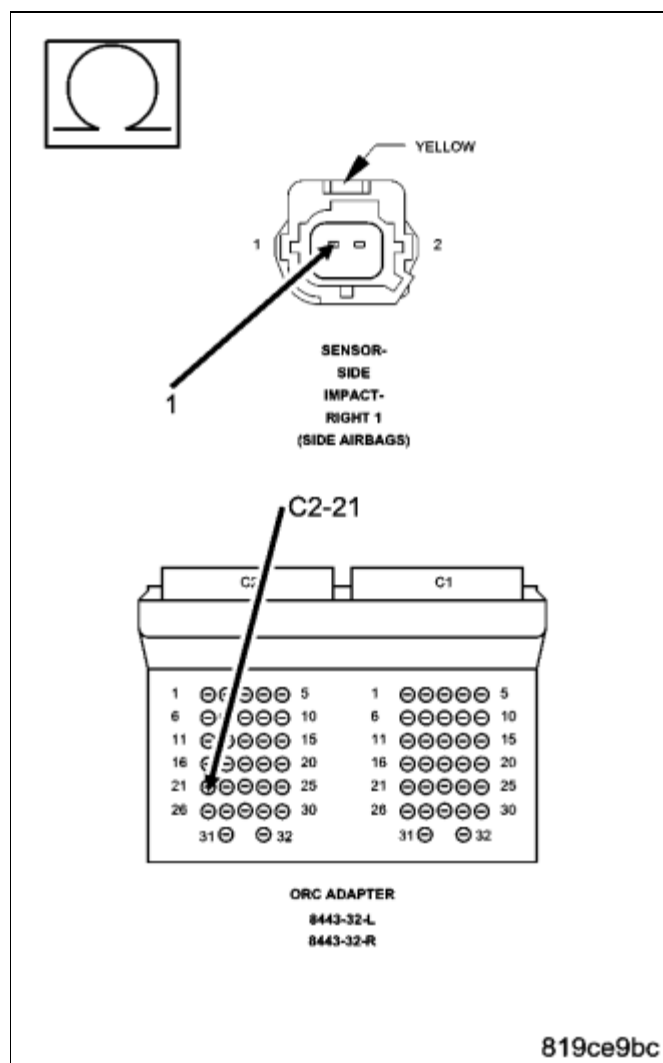
Is the resistance below 1 ohm?

Yes

- Go To [6](#)

No

- Repair the (R16) Right Side Impact Sensor 1 Ground circuit for an open or high resistance.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



6. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and the ORC 8443-32-L Adaptor.

Is the resistance below 1 ohm?

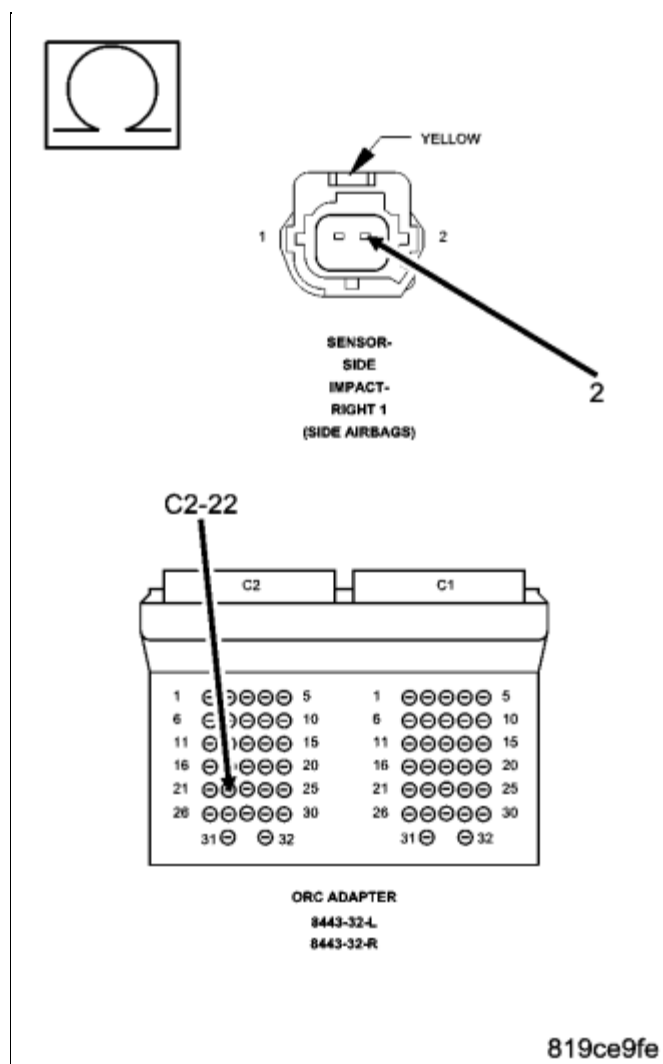
Yes

- Go To [7](#)

No

- Repair the (R14) Right Side Impact Sensor 1 Signal circuit for an open or high resistance.

- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



7. CHECK OPERATION OF THE RIGHT SIDE IMPACT SENSOR 1

Replace the Right Side Impact Sensor 1.

Reconnect the vehicle body harness to the impact sensor.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.

Use the scan tool and erase the stored codes in all airbag system modules.

Turn the Ignition Off, and wait 15 seconds before turning the Ignition On.

Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active Right Side Impact Sensor 1 DTC return?

Yes

- Go To [8](#)

No

- Repair is complete.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

8. REPLACE THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

If there are no possible causes remaining, view repair.

Repair

- Replace the Occupant Restraint Controller in accordance with Service Instructions.
- Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

9. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, record and erase all DTC from all Airbag modules.

If any ACTIVE codes are present they must be resolved before diagnosing any stored codes.

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals.

The following additional checks may assist you in identifying a possible intermittent problem.

Reconnect any disconnected components and harness connector.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

With the scan tool monitor active codes as you work through the following steps.

WARNING: To avoid serious or fatal injury, maintain a safe distance from all airbags while performing the following steps.

Wiggle the wiring harness and connectors of the related airbag circuit or component.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

If only stored codes return continue the test until the problem area has been isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting active DTC in question.

Are any ACTIVE DTC present?

Yes

- Select the appropriate symptom from Symptom List.

No

- No problem found at this time. Erase all codes before returning vehicle to customer.

U0184-LOST COMMUNICATION WITH RADIO

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0186-LOST COMMUNICATION WITH AUDIO AMPLIFIER

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0193-LOST COMMUNICATION WITH TRAFFIC INFORMATION RECEIVER MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0195-LOST COMMUNICATION WITH SDARS

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0197-LOST COMMUNICATION WITH HANDS FREE PHONE MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U1414-IMPLAUSIBLE/MISSING ECU CONFIGURATION DATA

For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**

With the ignition on. The Occupant Restraint Controller (ORC) on board diagnostics continuously monitors the CAN Bus message from the TIPM containing the ORC configuration data.

- **Set Condition:**

This DTC will set if the data is invalid or missing.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. VERIFY TOTALLY INTEGRATED POWER MODULE (TIPM) OPERATION

Turn the ignition on.

With the scan tool, read TIPM DTC.

Does the scan tool display any TIPM DTC?

Yes

- Select appropriate symptom from Symptom List. Repair all TIPM active DTC or reprogram the TIPM before diagnosing the ORC DTC.

No

- Go To [2](#)

2. CHECK OPERATION OF THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

Replace the Occupant Restraint Controller in accordance with the service information.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.
Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active U1414-IMPLAUSIBLE/MISSING ECU CONFIGURATION DATA DTC return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. REPLACE THE TOTALLY INTEGRATED POWER MODULE (TIPM)

View repair.

Repair

- Replace the Totally Integrated Power Module (TIPM) in accordance with Service Information.

U1415-IMPLAUSIBLE/MISSING VEHICLE CONFIGURATION DATA

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. The Occupant Restraint Controller (ORC) on board diagnostics continuously monitors the CAN Bus message from the TIPM containing the ORC configuration data.

- **Set Condition:**

This DTC will set if the data is invalid or missing.

Possible Causes
OCCUPANT RESTRAINT CONTROLLER (ORC)
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. VERIFY TOTALLY INTEGRATED POWER MODULE (TIPM) OPERATION

Turn the ignition on.

With the scan tool, read TIPM DTCs.

Does the scan tool display any TIPM DTCs?

Yes

- Select appropriate symptom from Symptom List. Repair all TIPM active DTCs or reprogram the TIPM before diagnosing the ORC DTCs.

No

- Go To [2](#)

2. CHECK OPERATION OF THE OCCUPANT RESTRAINT CONTROLLER

WARNING: To avoid serious or fatal injury, turn the ignition off, disconnect the battery and wait two minutes before proceeding.

WARNING: If the airbag control module is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and serious or fatal injury.

Replace the Occupant Restraint Controller in accordance with the service information.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

Connect the scan tool to the Data Link Connector - use the most current software available.
Wait one minute, and read active codes and if there are none present read the stored codes.

Did the active U1415-IMPLAUSIBLE/MISSING VEHICLE CONFIGURATION DATA DTC return?

Yes

- Go To [3](#)

No

- Repair is complete.
- Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

3. REPLACE THE TOTALLY INTEGRATED POWER MODULE (TIPM)

View repair.

Repair

- Replace the Totally Integrated Power Module (TIPM) in accordance with Service Information.

***AIRBAG SYSTEM VERIFICATION TEST - VER 1**

1. *AIRBAG SYSTEM VERIFICATION TEST - VER 1

1. Remove all special tools and jumper wires and reconnect all previously disconnected components - except the Battery.

WARNING: To avoid serious or fatal injury, turn the ignition on, then reconnect the battery.

2. Connect the scan tool to the Data Link Connector - use the most current software available.
3. With the scan tool, erase stored DTCs in all Airbag System Modules.
4. Turn the ignition off, and wait 30 seconds, then turn the ignition on.
5. Wait one minute, and read active DTCs in all Airbag System Modules.
6. Read the stored DTCs in all Airbag System Modules.

Are any DTCs present or if the original condition still present?

Yes

- Repair is not complete. Select the appropriate diagnostic procedure from the Table of Contents in this section.

No

- Repair is complete.

RESTRAINTS

RESTRAINTS

DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this vehicle. Available occupant restraints for this vehicle include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed.

ACTIVE RESTRAINTS

The active restraints for this vehicle include:

- **Child Restraint Anchors** - All two-door vehicles are equipped with two, fixed-position, child seat upper tether anchors for the second row seating. The two upper tether anchors are integral to the back of the seat cushion frame. All four-door vehicles are equipped with three, fixed-position, child seat upper tether anchors for the second row seating. A single upper tether anchor is integral to the back of the left seat cushion frame, and two more are integral to the back of the right cushion frame. Two lower anchors are provided for each outboard second row seating position on both two-door and four-door vehicles. The lower anchors are integral to the seat cushion frame on two-door vehicles. The lower inboard anchors are integral to the seat back panels of four-door vehicles, while the lower outboard anchors are integral to the seat back hinge brackets. All lower anchors are accessed from the front of the second row seat where the seat back meets the seat cushion.
- **Front Seat Belts** - Both front seating positions are equipped with three-point seat belt systems employing a lower B-pillar mounted inertia latch-type emergency locking retractors, height-adjustable upper sport bar (two-door) or B-pillar (four-door) mounted turning loops and a traveling end-release seat belt buckle secured to the inboard side of the seat frame. A traveling lower seat belt anchor is secured to the outboard side of the seat frame on all four-door vehicles, while all two-door vehicles have a fixed lower seat belt anchor secured to the base of the B-pillar. The driver side front seat belt buckle includes an integral seat belt switch that detects whether the driver side front seat belt has been fastened.
- **Second Row Seat Belts** - All second row seating positions are equipped with three-point seat belt systems. The outboard seating position belts employ lower sport bar mounted inertia latch-type emergency locking retractors, fixed position upper sport bar mounted turning loops and fixed lower seat belt anchors secured to the rear floor panel. The second row seat center seating position of four-door vehicles has an inertia latch-type emergency locking retractor that is secured within the right seat back panel and a lower anchor secured to the rear floor panel along with the right outboard buckle. All of the second row seat belt retractors for this vehicle are also switchable from an emergency locking retractor to an automatic locking retractor for compatibility with child seats. The center seating position and left outboard buckles are secured to the seat back hinge bracket. All second row seat belts have fixed end-release seat belt buckles.

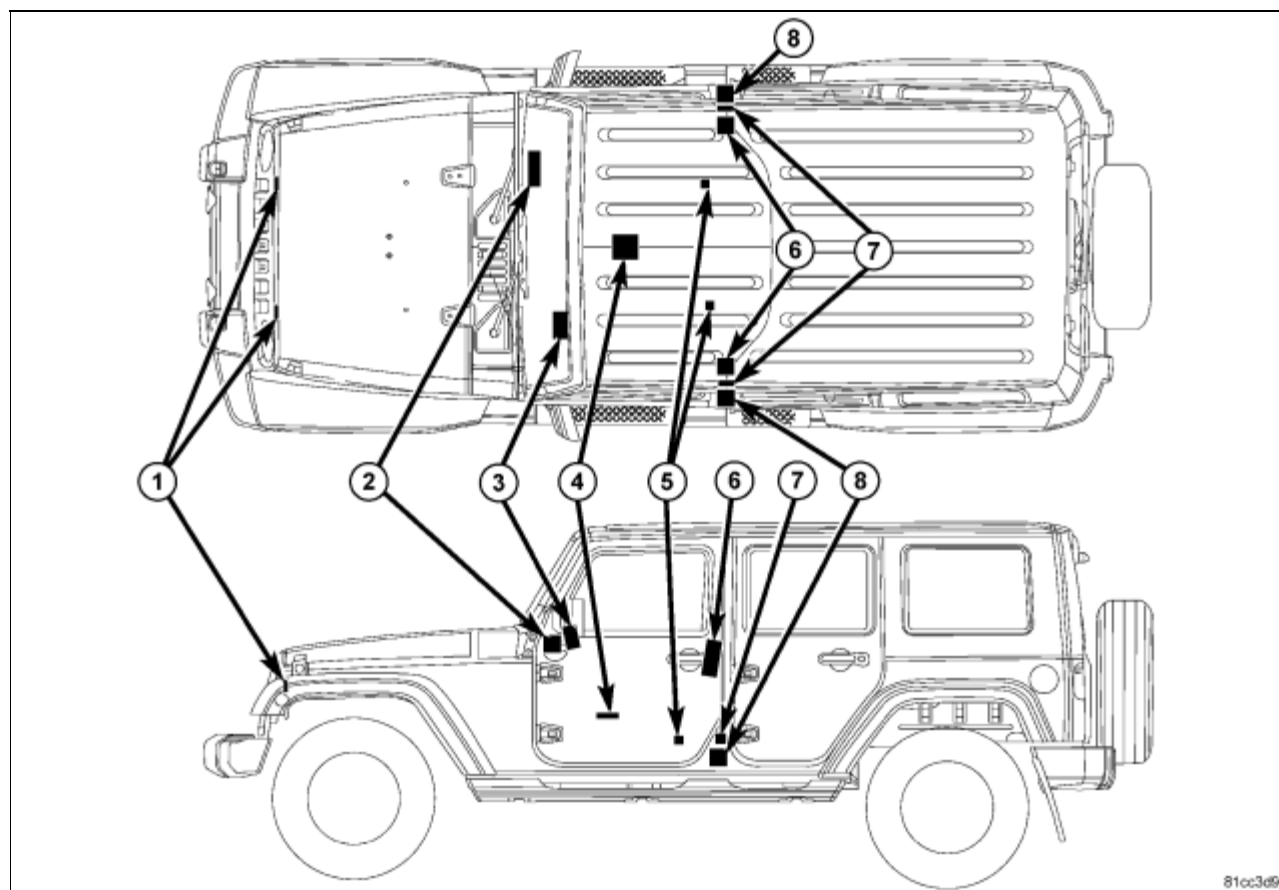
PASSIVE RESTRAINTS

The passive restraints available for this vehicle include the following:

- **Dual Front Airbags** - Multistage driver and front passenger airbags are used in this vehicle. This airbag system consists of passive, inflatable, Supplemental Restraint System (SRS) components and vehicles with

this equipment can be readily identified by the **SRS - AIRBAG** logo molded into the driver airbag trim cover in the center of the steering wheel and also into the passenger airbag door on the instrument panel above the glove box. Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) for about seven seconds as a bulb test each time the ignition switch is turned to the ON position. A pyrotechnic-type seat belt tensioner is also integral to the front seat belt retractors mounted on the lower inner B-pillars to work in conjunction with the dual front airbags.

- **Seat Airbags** - Seat integrated side airbags are optional equipment in this vehicle. This airbag system consists of passive, inflatable, SRS components and vehicles with this equipment can be readily identified by a sewn tag with the **SRS - AIRBAG** logo located on the outboard side of the front seat back trim cover.



The SRS includes the following major components, which are described in further detail elsewhere in this service information:

- **Airbag Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN), which is located on the instrument panel in front of the driver.
- **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel.
- **Driver Airbag (3)** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.
- **Driver Knee Blocker** - The driver knee blocker is a structural unit secured to the back side of and integral to the instrument panel steering column opening cover.
- **Front Impact Sensor (1)** - Two front impact sensors are used on vehicles equipped with dual front airbags, one left side and one right side. One sensor is located on the back side of the front end module carrier on either side of the radiator and inboard of the headlamp within the engine compartment.
- **Occupant Restraint Controller (4)** - The Occupant Restraint Controller (ORC) is located on a mount on the floor panel transmission tunnel rearward of the transmission gear selector, and is concealed beneath the center floor console.
- **Passenger Airbag (2)** - The passenger airbag is located in the instrument panel, beneath the passenger airbag door on the instrument panel above the glove box on the passenger side of the vehicle.
- **Passenger Knee Blocker** - The passenger knee blocker is a structural reinforcement that is integral to and concealed within the glove box door.
- **Seat Airbag (6)** - An optional seat airbag unit is secured to each outboard front seat back frame, where it is concealed beneath the seat back trim cover and foam.
- **Seat Belt Tensioner (8)** - A seat belt tensioner is integral to both front seat belt retractor units on vehicles equipped with dual front airbags. The seat belt retractor tensioner units are secured to each lower inner B-pillar and are concealed behind the lower B-pillar trim.
- **Seat Track Position Sensor (5)** - Two seat track position sensors are standard equipment in this vehicle. One sensor is located on the inboard side of one of the seat adjuster tracks on both the driver and the passenger side front seats.
- **Side Impact Sensor (7)** - Two side impact sensors are used on vehicles equipped with the optional seat airbags, one on each side of the vehicle. One sensor is located behind the B-pillar trim near the belt line of each B-pillar.

The ORC and the EMIC each contain a microprocessor and programming that allow them to communicate with each other using the Controller Area Network (CAN) data bus. This method of communication is used by the ORC for control of the airbag indicator in the EMIC. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION).

Hard wired circuitry connects the SRS components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the SRS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts and child restraint anchors. Seat belts and child restraint anchors are referred to as an active restraint

because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them.

PASSIVE RESTRAINTS

The passive restraints are referred to as a Supplemental Restraint System (SRS) because they were designed and are intended to enhance the protection for the occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive restraints because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed SRS components.

The SRS electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Occupant Restraint Controller (ORC). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the ON or START positions. Following the bulb test, the airbag indicator is turned ON or OFF by the ORC to indicate the status of the SRS. If the airbag indicator comes ON at any time other than during the bulb test, it indicates that there is a problem in the SRS electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the SRS components depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the acceleration-type impact sensors. When an impact is severe enough, the microprocessor in the ORC signals the inflator of the appropriate airbag units to deploy their airbag cushions. The front seat belt retractor tensioners are provided with a deployment signal by the ORC in conjunction with the front airbags. The optional seat airbags are provided with a deployment signal individually by the ORC based upon a side impact sensor input for the same side of the vehicle.

During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the front seat passenger to the structure of the instrument panel. The seat belt tensioners remove the slack from the front seat belts to provide further assurance that the driver and front seat passenger are properly positioned and restrained for an airbag deployment.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they do of an airbag deployment itself. This is because the airbag deployment and deflation occur very rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes about 40 milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat, depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ORC monitors a problem in any of the SRS circuits or components, including the seat belt tensioners, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends an electronic message to the EMIC to turn ON the airbag indicator. The hard wired circuits between components related to the SRS may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SRS or the

electronic controls or communication between other modules and devices that provide features of the SRS. The most reliable, efficient, and accurate means to diagnose the SRS or the electronic controls and communication related to SRS operation, as well as the retrieval or erasure of a DTC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

WARNING

WARNINGS - RESTRAINT SYSTEM

WARNING: To avoid serious or fatal injury on vehicles equipped with the Supplemental Restraint System (SRS), never attempt to repair the electrically conductive circuits or wiring components related to the SRS. Such repairs can compromise the conductivity and current carrying capacity of those critical electrical circuits, which may cause SRS components not to deploy when required, or to deploy when not required. Any wire harness containing broken, cut, burned or otherwise damaged electrically conductive SRS wiring, terminals or connector components must be removed and replaced with an entire new wire harness. Only minor cuts or abrasions of wire and terminal insulation where the conductive material has not been damaged, or connector insulators where the integrity of the latching and locking mechanisms have not been compromised may be repaired using appropriate methods.

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury on vehicles equipped with seat airbags, disable the Supplemental Restraint System (SRS) before attempting any Occupant Restraint Controller (ORC) diagnosis or service. The ORC contains a rollover sensor, which enables the system to deploy the seat airbags in the event of a vehicle rollover event. If an ORC is accidentally rolled during service while still connected to battery power, the seat airbags will deploy. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the Occupant Restraint Controller (ORC). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the Supplemental Restraint System (SRS) circuits and components.

WARNING: To avoid serious or fatal injury, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at

temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 17.24 kPa (2500 psi).

WARNING: To avoid serious or fatal injury when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.

WARNING: To avoid serious or fatal injury, replace all Supplemental Restraint System (SRS) components only with parts specified in the DaimlerChrysler Mopar® Parts Catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.

WARNING: To avoid serious or fatal injury, the fasteners, screws, and bolts originally used for the Supplemental Restraint System (SRS) components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the SRS. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.

DIAGNOSIS AND TESTING

SUPPLEMENTAL RESTRAINT SYSTEM

The hard wired circuits between modules and components related to the Supplemental Restraint System (SRS) may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SRS or the electronic controls or communication between other modules and devices that provide features of the SRS. The most reliable, efficient, and accurate means to diagnose the SRS or the electronic controls and communication related to SRS operation, as well as the retrieval or erasure of a DTC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

In addition to a diagnostic scan tool that contains the latest version of the proper diagnostic software, certain diagnostic procedures for the SRS may require the use of the SRS Load Tool special tool along with the appropriate Load Tool Jumpers and Adapters. Refer to the appropriate diagnostic information.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

STANDARD PROCEDURE

HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag or seat belt tensioner. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment.

When handling a non-deployed seat belt tensioner, take proper care to keep fingers away from the retractor cover and away from the seat belt webbing where it exits from the retractor cover. In addition, the Supplemental Restraint System (SRS) should be disarmed whenever any steering wheel, steering column, seat belt tensioner, airbag, impact sensor or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury.

All damaged, ineffective or non-deployed airbags and seat belt tensioners which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is ineffective or damaged and non-deployed, refer to the Hazardous Substance Control System for information regarding the potentially hazardous properties of the subject component and the proper safe handling procedures. Then dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.

SUPPLEMENTAL RESTRAINT STORAGE

Airbags and seat belt tensioners must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a Supplemental Restraint System (SRS) component deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring and the steering column must be replaced. If the passenger airbag is deployed, the passenger airbag door and the passenger airbag squib connectors must be replaced. The seat belt tensioners are deployed by the same signal that deploys the driver and passenger airbags and must also be replaced along with their squib connectors if either front airbag has been deployed.

If a seat airbag has been deployed, the seat back trim cover, the seat back foam, the seat back frame and the seat airbag jumper wire harness must be replaced. These components are not intended for reuse and will be damaged or weakened as a result of a SRS component deployment, which may or may not be obvious during a visual inspection.

It is also critical that the mounting surfaces and mounting brackets for the Occupant Restraint Controller (ORC), side impact sensors and front impact sensors be closely inspected and restored to their original conditions following any vehicle impact damage. Because the ORC and each impact sensor are used by the SRS to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of these components may cause airbags not to deploy when required, or to deploy when not required.

Never attempt to repair the electrically conductive circuits or wiring components related to the SRS. Such

repairs can compromise the conductivity and current carrying capacity of those critical electrical circuits, which may cause SRS components not to deploy when required, or to deploy when not required. Any wire harness containing broken, cut, burned or otherwise damaged electrically conductive SRS wiring, terminals or connector components must be removed and replaced with an entire new wire harness. Only minor cuts or abrasions of wire and terminal insulation where the conductive material has not been damaged, or connector insulators where the integrity of the latching and locking mechanisms have not been compromised may be repaired using appropriate methods.

All other vehicle components should be closely inspected following any SRS component deployment, but are to be replaced only as required by the extent of the visible damage incurred.

AIRBAG SQUIB STATUS

Multistage airbags with multiple initiators (squibs) must be checked to determine that all squibs were used during the deployment event. The driver and passenger airbags in this vehicle are deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the driver or passenger squib 1 and squib 2 circuits to the two initiators in the airbag inflators. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used due to an airbag system fault; therefore, it is always necessary to confirm that both initiators have been used in order to avoid the improper handling or disposal of potentially live pyrotechnic or hazardous materials. The following procedure should be performed using a diagnostic scan tool to verify the status of both airbag squibs before either deployed airbag is removed from the vehicle for disposal.

CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are certain of complete deployment. Refer to the Hazardous Substance Control System for information regarding the potentially hazardous properties of the subject component and the proper safe handling procedures. Then dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.

1. Be certain that the diagnostic scan tool contains the latest version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column.
2. Turn the ignition switch to the ON position.
3. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.

Using the active DTC information, refer to the **Airbag Squib Status** table to determine the status of both driver and passenger airbag squibs.

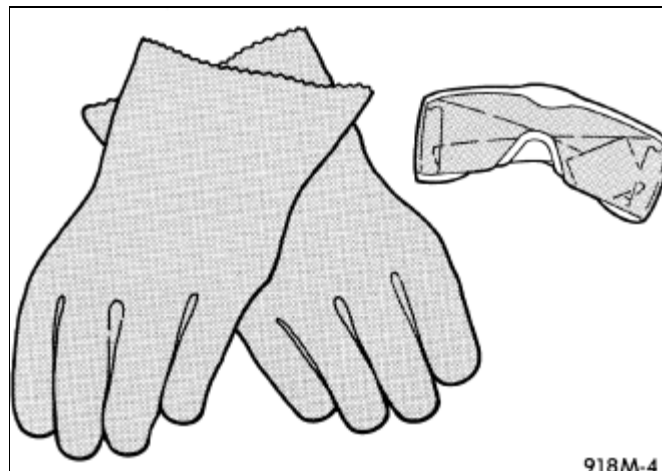
AIRBAG SQUIB STATUS		
IF THE ACTIVE DTC IS:	CONDITIONS	SQUIB STATUS
Driver or Passenger Squib 1 open	AND the stored DTC minutes for both Driver or Passenger squibs are within 15 minutes of each other	Both Squib 1 and 2 were used.
Driver or Passenger Squib 2		

open		
Driver or Passenger Squib 1 open	AND the stored DTC minutes for Driver or Passenger Squib 2 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 1 by 15 minutes or more	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 2 open		
Driver or Passenger Squib 1 open	AND the stored DTC minutes for Driver or Passenger Squib 1 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 2 by 15 minutes or more	Squib 1 is live; Squib 2 was used.
Driver or Passenger Squib 2 open		
Driver or Passenger Squib 1 open	AND Driver or Passenger Squib 2 open is NOT an active code	Squib 1 was used; Squib 2 is live.
Driver or Passenger Squib 2 open	AND Driver or Passenger Squib 1 open is NOT an active code	Squib 1 is live; Squib 2 was used.

NOTE: If none of the Driver or Passenger Squib 1 or 2 open are active codes, the status of the airbag squibs is unknown. In this case the airbag should be handled and disposed of as if the squibs were both live.

CLEANUP PROCEDURE

Following a Supplemental Restraint System (SRS) component deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a SRS component. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be certain to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup.

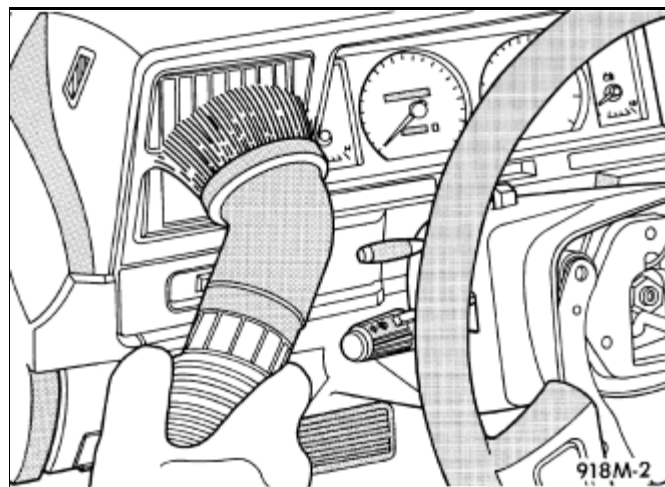


WARNING: To avoid serious or fatal injury, if you experience skin irritation during cleanup, run cool water over the affected area. Also, if you experience irritation of the nose or throat, exit the vehicle for fresh air

until the irritation ceases. If irritation continues, see a physician.

1. Begin the cleanup by using a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.
2. Be certain to vacuum the heater and air conditioning outlets as well. Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.

CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are certain of complete deployment. Refer to [AIRBAG SQUIB STATUS](#). All damaged, ineffective, or non-deployed Supplemental Restraint System (SRS) components which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is ineffective or damaged and non-deployed, refer to the Hazardous Substance Control System for information regarding the potentially hazardous properties of the subject component and the proper safe handling procedures. Then dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.



3. Next, remove the deployed SRS components from the vehicle. Refer to the appropriate service removal procedures.
4. You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

SUPPLEMENTAL RESTRAINTS VERIFICATION TEST

NOTE: The following procedure should be performed using a diagnostic scan tool to verify proper Supplemental Restraint System (SRS) operation following the service or replacement of any SRS component. Refer to the appropriate diagnostic procedures.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. During the following test, the battery negative cable remains disconnected and isolated, as it was during the Supplemental Restraint System (SRS) component removal and installation procedures.
2. Be certain that the diagnostic scan tool contains the latest

version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC) (2). The DLC is located on the driver side lower edge of the instrument panel (1), near the cowl side inner panel (3).
3. Turn the ignition switch to the ON position and exit the vehicle with the scan tool.

4. Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.

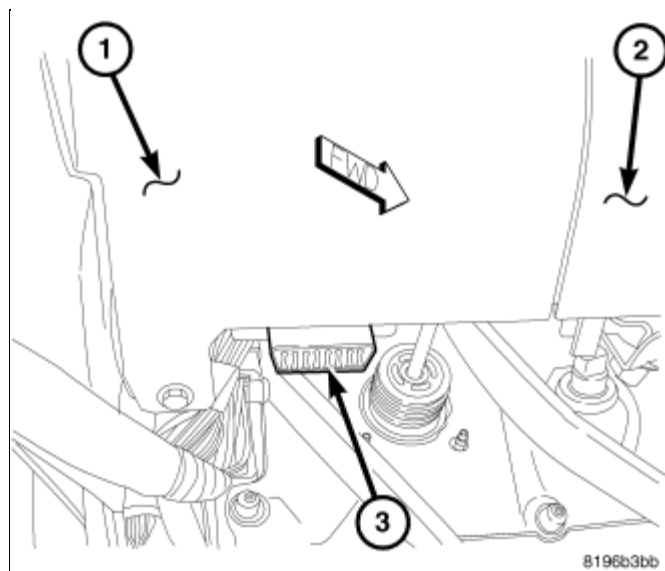
5. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.

6. Next, use the scan tool to read and record any stored (historical) DTC data.

7. If any DTC is found in [STEP 5](#) or [STEP 6](#), refer to the appropriate diagnostic information.

8. Use the scan tool to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to [STEP 9](#).

9. Turn the ignition switch to the OFF position for about 15 seconds, and then back to the ON position. Observe the airbag indicator in the instrument cluster. It should light for six to eight seconds, and then go out. This indicates that the SRS is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays ON, there is still an active SRS fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.



SPECIFICATIONS

RESTRAINT SYSTEMS

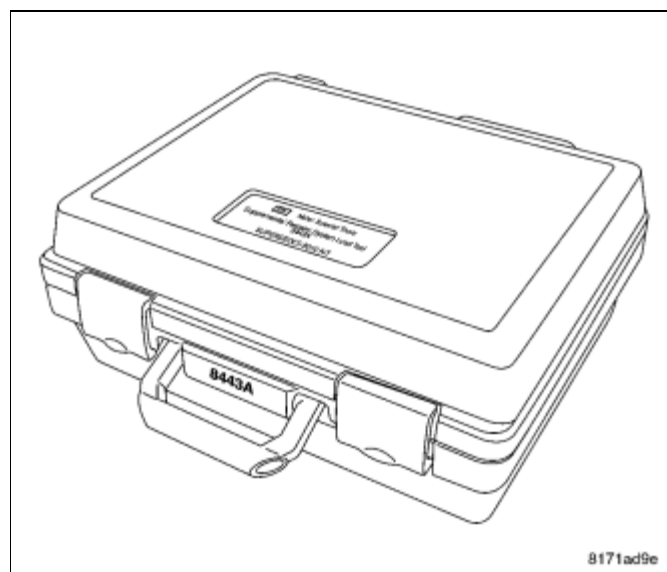
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Clockspring Mounting Screw	3	-	27
Front Impact Sensor Mounting Screw	8	-	70
Side Impact Sensor Mounting Nut	8	-	70
Occupant Restraint Controller Mounting Nut	9	-	80
Passenger Airbag Mounting Nut	6	-	55
Seat Airbag Mounting Nut	10	-	89
Front Seat Belt Buckle Lower Anchor Mounting Screw	45	33	-

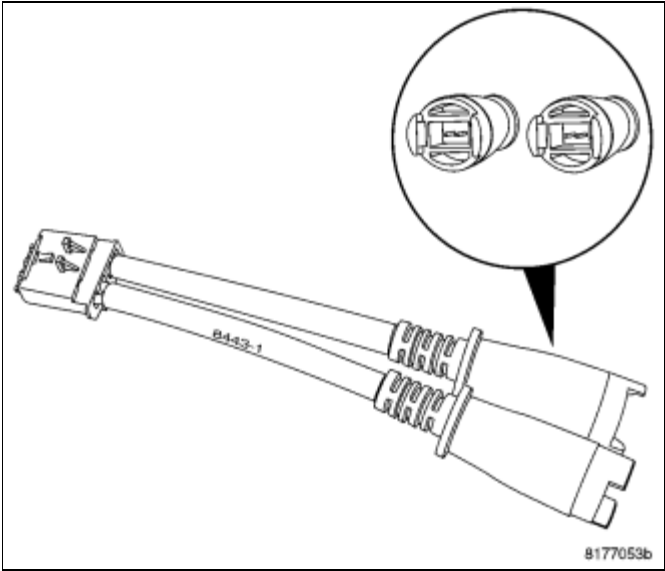
Two-Door Second Row Seat Belt Buckle Anchor Plate Mounting Screw	55	41	-
Four-Door Second Row Right Seat Belt Buckle Anchor Plate Mounting Screw	61	45	-
Four-Door Second Row Center or Left Seat Belt Buckle Anchor Plate Mounting Nut	45	33	-
Front Seat Belt Retractor Mounting Screw	40	30	-
Front Seat Belt Turning Loop Mounting Screw	40	30	-
Front Seat Belt Lower Anchor Mounting Screw	40	30	-
Second Row Outboard Seat Belt Retractor Mounting Screw	40	30	-
Second Row Outboard Seat Belt Turning Loop Mounting Screw	40	30	-
Second Row Outboard Seat Belt Lower Anchor Mounting Nut	40	30	-
Second Row Center Seat Belt Retractor Mounting Screw	55	41	-
Second Row Center Seat Belt Lower Anchor Mounting Screw	61	45	-
Turning Loop Height Adjuster Mounting Screw	40	30	-

SPECIAL TOOLS

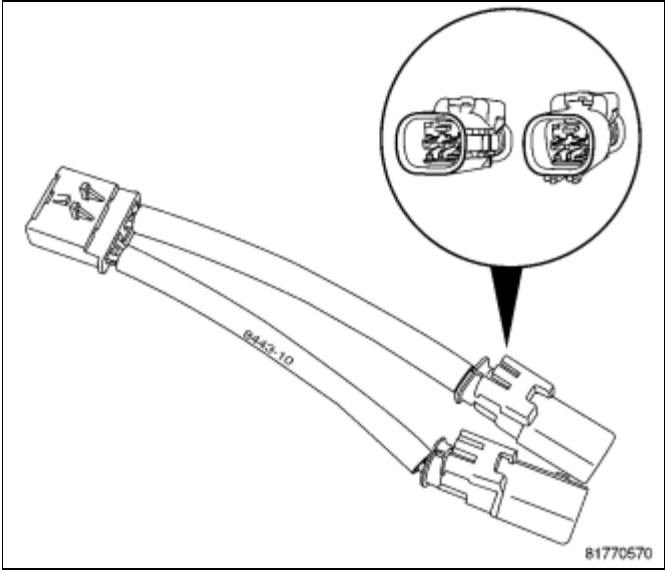
RESTRAINT SYSTEMS



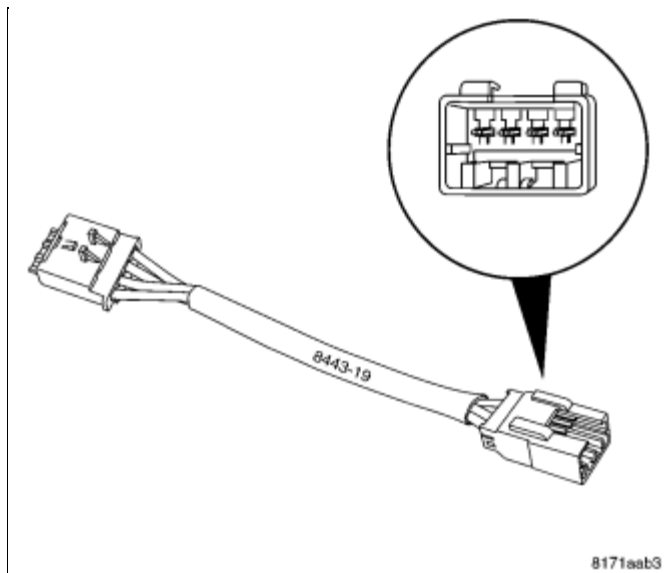
SRS Load Tool No. 8443 or 8443A



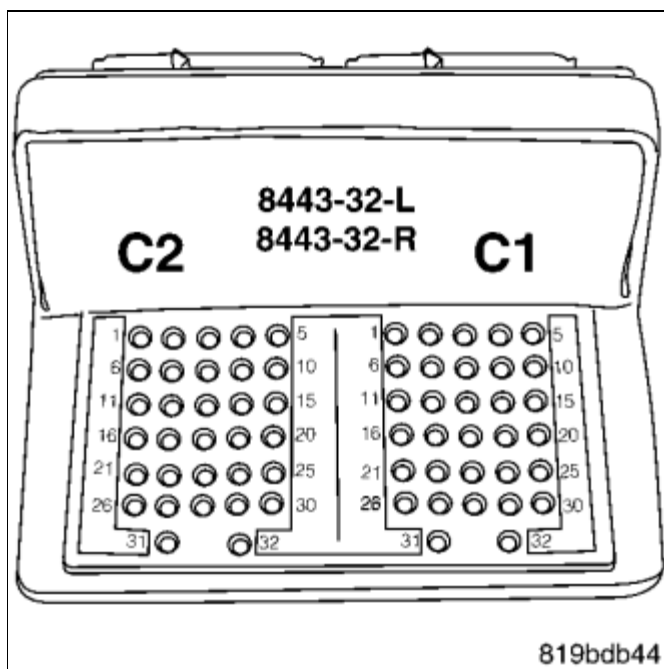
Jumper No. 8443-1



Jumper No. 8443-10



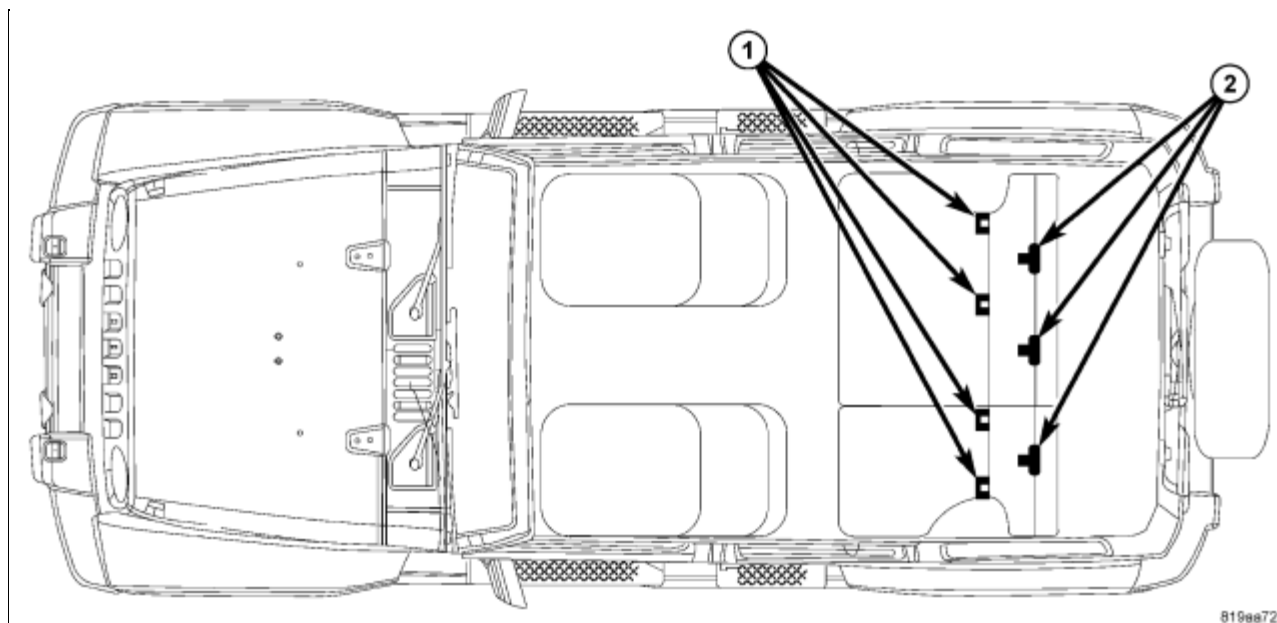
Jumper No. 8443-19



Adapter No. 8443-32-L (GRAY)

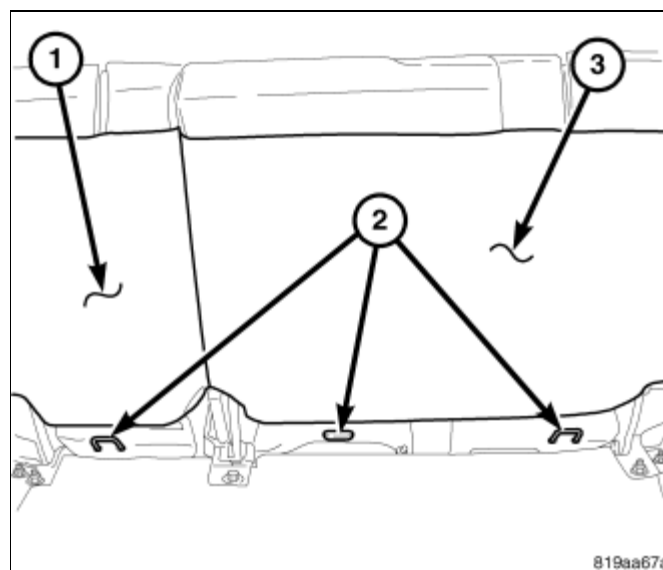
CHILD RESTRAINT ANCHOR

DESCRIPTION



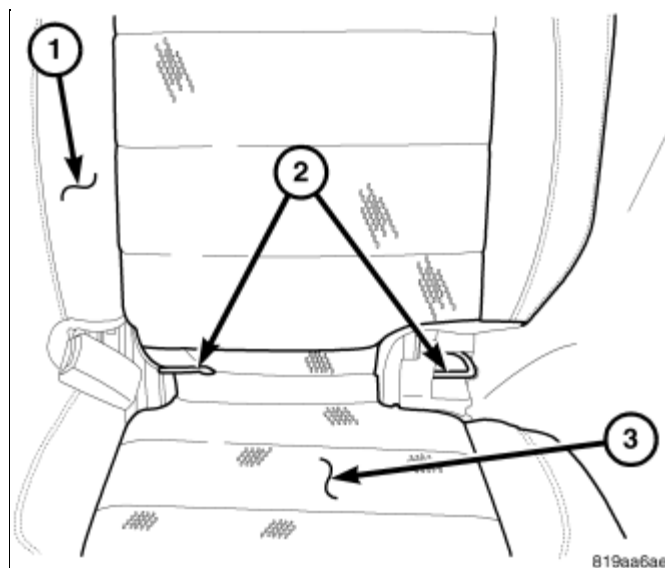
This vehicle is equipped with a Lower Anchors and Tether for CHildren, or LATCH child restraint anchorage system. The second row seats in these vehicles are equipped with a fixed-position child restraint upper tether anchor (2) for the two outboard seating positions and child restraint lower anchors (1) for the two outboard seating positions. Vehicles with four doors have an additional upper tether anchor for the center seating position.

The upper tether anchors (2) are each integral to the second row seat cushion frames. One anchor is located on the 40 percent seat (1) and 2 are located on the 60 percent seat (3). These anchors are each constructed from a heavy-gauge steel wire loop that is securely welded to the seat cushion frames. The child restraint upper tether anchors cannot be adjusted or repaired and, if ineffective or damaged, they must be replaced as a unit with their respective second row seat cushion frames.



The right and left outboard lower anchors (2) are integral to the second row seat back hinges, which are secured to the rear floor panel. These anchors are each constructed from a short length of heavy-gauge steel wire that is securely welded to the outboard seat back hinges. The right and left inboard lower anchors are integral to the seat cushion frames. These anchors are each constructed from a heavy-gauge steel wire loop that is securely welded to the seat cushion frames. The anchors are located where the second row seat

back (1) meets the seat cushion (3). The child restraint lower tether anchors cannot be adjusted or repaired and, if ineffective or damaged, they must be replaced as a unit with their respective second row seat hinge or child anchor brackets.



WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

OPERATION

All vehicles manufactured for sale in the United States and Canada are required to be equipped with a Lower Anchors and Tether for CHildren, or LATCH child restraint anchorage system. The second row seats in this vehicle have two pairs of anchor provisions for installing a LATCH-compatible child seat. On vehicles with four doors a single seat may be mounted in the center seating position, or one in each outboard seating position.

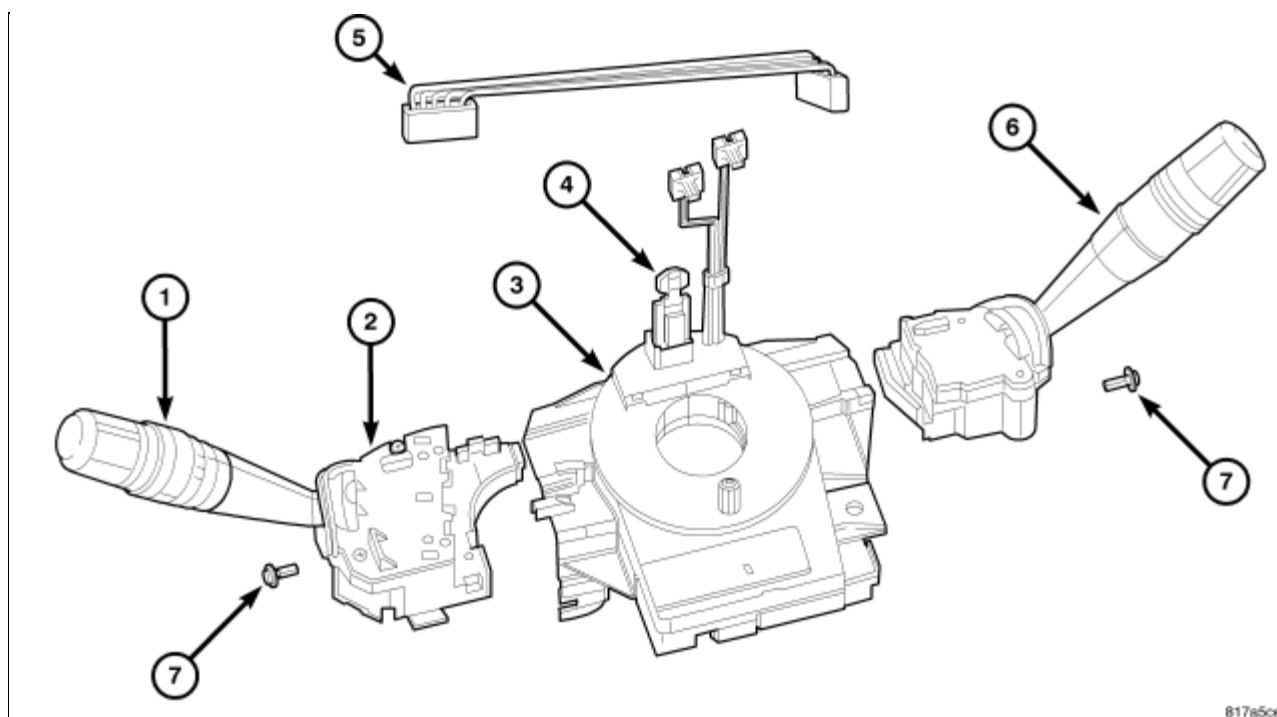
With LATCH, child seats are secured by direct attachment to the vehicle seat structure, rather than by the seat belts. With LATCH-compatible child seats, lower anchors attach to the seat structure through heavy-gauge wire loops located at the intersection between the seat cushion and the seat back surfaces.

The upper tether anchors are integral to the second row seat back frames to secure the top tether strap of child seats equipped with this feature. These upper tether anchors work with both LATCH-compatible and other child seats equipped with a top tether strap.

The owner's information packet in the vehicle glove box contains details and suggestions on the proper use of all of the factory-installed child restraint anchors.

CLOCKSPRING

DESCRIPTION



The clockspring (3) for this vehicle is secured near the top of the steering column below the steering wheel. The clockspring also includes an integral, internal turn signal cancel cam and a Steering Angle Sensor (SAS) that are both serviced as a unit with the clockspring. The clockspring also supports the left (lighting) multi-function switch (1), the Steering Control Module (SCM) internal to the left multi-function switch housing (2), and the right (wiper) multi-function switch (6). Each of these switches and the jumper wire harness (5) between the two multi-function switches can be separated from and are serviced individually from the clockspring.

The clockspring case includes integral tabs for mounting the unit with three screws to the steering column lock housing as well as integral provisions for mounting and supporting both multi-function switches. The multi-function switches are each secured to the clockspring with a single screw (7). The SAS within the clockspring includes an electronic circuit board and a microprocessor, which allows it to communicate with other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. The SAS circuitry, the clockspring, and the turn signal cancel cam are all contained within a flat, molded plastic case.

The clockspring case includes three connector receptacles that face toward the instrument panel. Within the plastic case is a spool-like molded plastic rotor with a large exposed hub. The upper surface of the rotor hub has a large center hole, two short pigtail wires with connectors, and a connector receptacle that faces toward the steering wheel. The lower surface of the rotor has an integral dowel or drive pin that also faces toward the steering wheel. Wound around the rotor spool within the case is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at two of the connector receptacles that face the instrument panel, while the inner end of the tape terminates at the pigtail wires and connector receptacle on the hub of the clockspring rotor that face the steering wheel. The outer surface of the rotor hub rim within the clockspring case also has the integral lobes of the turn signal cancel cam.

The service replacement clockspring is shipped pre-centered and with a molded plastic locking pin (4) installed. The locking pin secures the centered clockspring rotor to the clockspring case during shipment and handling, but must be removed after the clockspring is installed on the steering column and the steering wheel is installed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

The clockspring cannot be repaired. If the clockspring is ineffective, damaged, or if the driver airbag has been deployed, the clockspring/turn signal cancel cam/SAS unit must be replaced.

OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed instrument panel wire harness and certain electrical components mounted on or in the rotating steering wheel. On this vehicle the rotating electrical components include the driver airbag, the horn switch, the speed control switch, and the remote radio switches, if the vehicle is so equipped. The clockspring is positioned and secured near the top of the steering column. The fixed connector receptacles on the back of the fixed clockspring case connect the clockspring to the vehicle electrical system through three take outs with connectors from the instrument panel wire harness.

The turn signal cancel cam is integral to the rim of the clockspring rotor hub within the clockspring case so it also moves with the rotation of the steering wheel. Two short, black-sleeved pigtail wires on the upper surface of the clockspring rotor connect the clockspring to the driver airbag, while a steering wheel wire harness connected to the connector receptacle on the upper surface of the clockspring rotor complete circuits to the horn switch, the speed control switch and, if the vehicle is so equipped, to the optional remote radio switches on the steering wheel. The third connector receptacle is dedicated to the inputs and outputs of the Steering Angle Sensor (SAS) internal to the clockspring case.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to the movable steering components so that the tape can operate within its designed travel limits. However, if the steering wheel is removed from the steering column, if the clockspring is removed from the steering column, or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the other steering components. The clockspring must be re-centered following completion of this service or the tape may be damaged.

Service replacement clocksprings are shipped pre-centered and with a plastic locking pin installed. This locking pin should not be removed until the steering wheel has been installed on the steering column. If the locking pin is removed before the steering wheel is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING). Proper clockspring installation may be confirmed by viewing the SAS data using a diagnostic scan tool.

The hard wired clockspring circuits as well as the hard wired inputs and outputs of the SAS may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SAS or the electronic controls or communication between other modules and devices that provide features of the Electronic Stability Program (ESP) or Supplemental Restraint System (SRS). The most reliable, efficient, and accurate means to diagnose the SAS or the electronic controls and communication related to ESP or SRS operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

STANDARD PROCEDURE

CLOCKSPRING CENTERING

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A service replacement clockspring is shipped with the clockspring pre-centered and with a molded plastic locking pin installed. This locking pin should not be removed until the steering wheel has been installed on the steering column. If the locking pin is removed before the steering wheel is installed, the clockspring centering procedure must be performed.

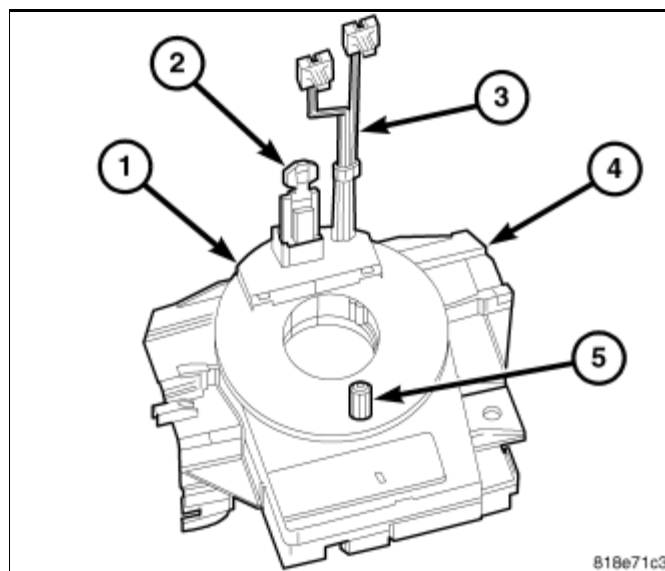
NOTE: When a clockspring is installed into a vehicle without properly centering and locking the entire steering system, the Steering Angle Sensor (SAS) data does not agree with the true position of the steering system and causes the Electronic Stability Program (ESP) system to shut down. This may also damage the clockspring without any immediate malfunction. Unlike some other DaimlerChrysler vehicles, this SAS never requires calibration. However, upon each new ignition ON cycle, the steering wheel must be rotated slightly to initialize the SAS.

NOTE: Determining if the clockspring/SAS is centered is also possible electrically using the diagnostic scan tool. Steering wheel position is displayed as ANGLE with a range of up to 900 degrees. Refer to the appropriate menu item on the diagnostic scan tool.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position and that the entire steering system is locked or inhibited from rotation.

NOTE: The clockspring may be centered and the rotor may be rotated freely once the steering wheel has been removed.

1. Place the front wheels in the straight-ahead position and inhibit the steering column shaft from rotation.
2. Remove the steering wheel from the steering shaft. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).
3. Rotate the clockspring rotor (1) clockwise to the end of its travel. **Do not apply excessive torque.**
4. From the end of the clockwise travel, rotate the rotor about two and one-half turns counterclockwise. Turn the rotor slightly clockwise or counterclockwise as necessary so that the clockspring airbag pigtail wires (3) and connector receptacle are at the top and the dowel or drive pin (5) is at the bottom.
5. The clockspring is now centered. Secure the clockspring rotor to the clockspring case using a locking pin (2) or some similar device to maintain clockspring centering until the steering wheel is reinstalled on the steering column.



REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: A service replacement clockspring is shipped with the clockspring pre-centered and with a

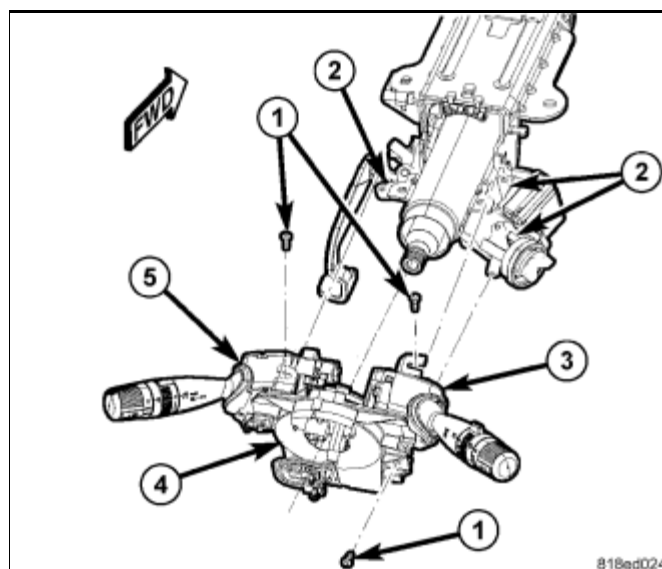
molded plastic locking pin installed. This locking pin should not be removed until the steering wheel has been installed on the steering column. If the locking pin is removed before the steering wheel is installed, the clockspring centering procedure must be performed.

NOTE: When a clockspring is installed into a vehicle without properly centering and locking the entire steering system, the Steering Angle Sensor (SAS) data does not agree with the true position of the steering system and causes the Electronic Stability Program (ESP) system to shut down. This may also damage the clockspring without any immediate malfunction. Unlike some other DaimlerChrysler vehicles, this SAS never requires calibration. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

NOTE: Determining if the clockspring/SAS is centered is also possible electrically using the diagnostic scan tool. Steering wheel position is displayed as ANGLE with a range of up to 900 degrees. Refer to the appropriate menu item on the diagnostic scan tool.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position and that the entire steering system is locked or inhibited from rotation.

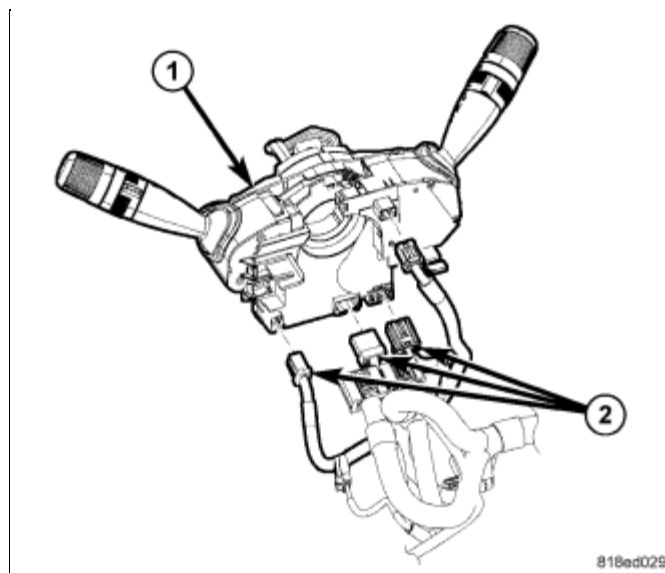
1. Place the front wheels in the straight ahead position and inhibit the steering column shaft from rotation.
2. Disconnect and isolate the battery negative cable.
3. Remove the steering wheel from the steering shaft. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).
4. If the removed clockspring is to be reused, be certain to secure the clockspring rotor to the clockspring case to maintain clockspring centering until the steering wheel is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before the steering wheel is reinstalled. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).



5. Move the steering column to the fully lowered position and leave the tilt release lever in the released (down) position.
6. Remove the upper and lower shrouds from the steering column. (Refer to 19 - STEERING/COLUMN - REMOVAL).
7. Remove the right multi-function switch (3) from the clockspring (4). (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - REMOVAL).
8. Remove the left multi-function switch (5) from the clockspring. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - REMOVAL).
9. Remove the three screws (1) that secure the clockspring to the steering column lock housing (2).
10. Pull the clockspring (1) away from the steering column lock housing far enough to access and disconnect the three instrument panel wire harness connectors (2) from the receptacles on the back of the clockspring case.
11. Remove the clockspring from the steering column.

INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.



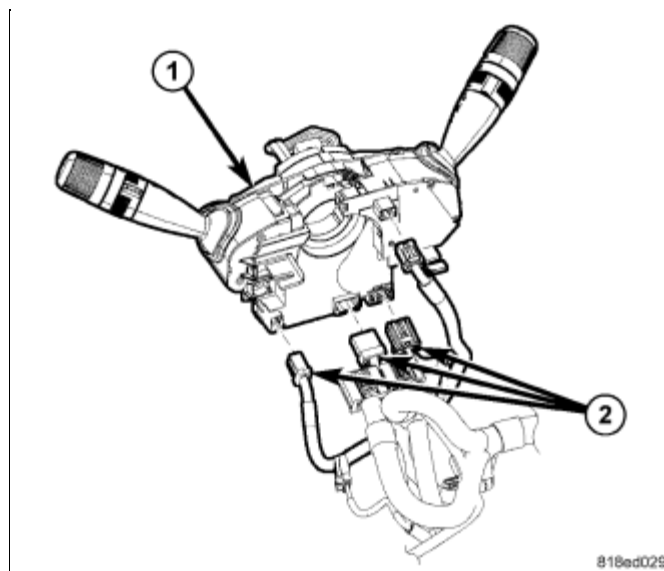
NOTE: A service replacement clockspring is shipped with the clockspring pre-centered and with a molded plastic locking pin installed. This locking pin should not be removed until the steering wheel has been installed on the steering column. If the locking pin is removed before the steering wheel is installed, the clockspring centering procedure must be performed.

NOTE: When a clockspring is installed into a vehicle without properly centering and locking the entire steering system, the Steering Angle Sensor (SAS) data does not agree with the true position of the steering system and causes the Electronic Stability Program (ESP) system to shut down. This may also damage the clockspring without any immediate malfunction. Unlike some other DaimlerChrysler vehicles, this SAS never requires calibration. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

NOTE: Determining if the clockspring/SAS is centered is also possible electrically using the diagnostic scan tool. Steering wheel position is displayed as ANGLE with a range of up to 900 degrees. Refer to the appropriate menu item on the diagnostic scan tool.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position and that the entire steering system is locked or inhibited from rotation.

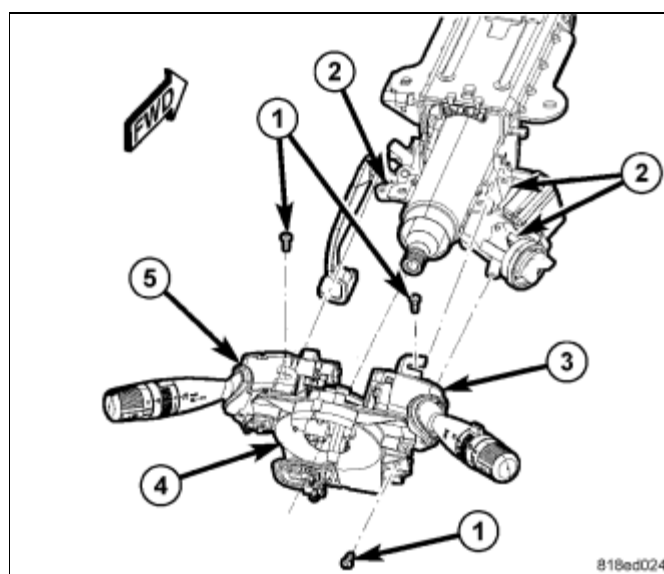
1. If a new clockspring (1) is being installed, transfer the multifunction switch jumper harness from the old clockspring or position a new jumper harness onto the new clockspring.
2. Carefully slide the clockspring down over the steering column upper shaft far enough to reconnect the three instrument panel wire harness connectors (2) to the receptacles on the back of the clockspring case.



3. Position the clockspring (4) onto the steering column lock housing (2).

4. Install and tighten the three screws (1) that secure the clockspring to the lock housing in the following sequence: lower right, upper left, upper right. Tighten the screws to 3 N·m (27 in. lbs.).

NOTE: Use of an improper sequence when tightening the clockspring mounting screws may result in an audible ticking noise as the steering wheel is rotated.



5. Reinstall the left multi-function switch (5) onto the clockspring. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - INSTALLATION).

6. Reinstall the right multi-function switch (3) onto the clockspring. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - INSTALLATION).

7. Reinstall the upper and lower shrouds onto the steering column. (Refer to 19 - STEERING/COLUMN - INSTALLATION).

8. Move the steering column back to the fully raised position and move the tilt release lever back to the locked (up) position.

9. Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

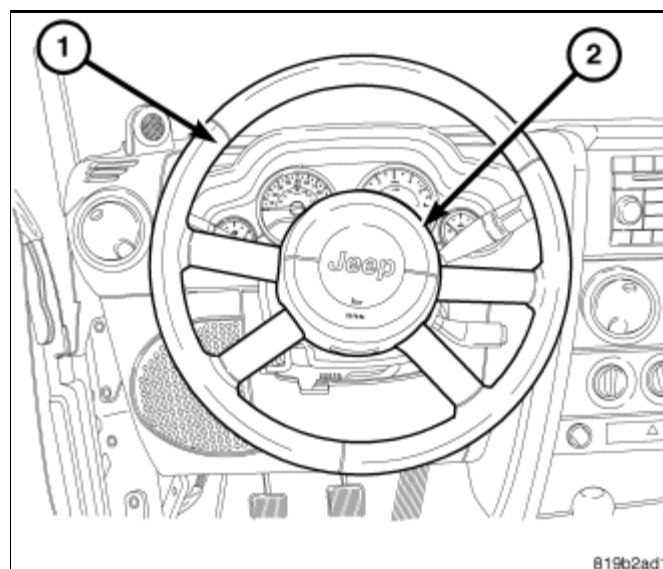
10. Remove the plastic locking pin that secures the clockspring rotor to the clockspring case to maintain clockspring centering.

11. Reconnect the battery negative cable.

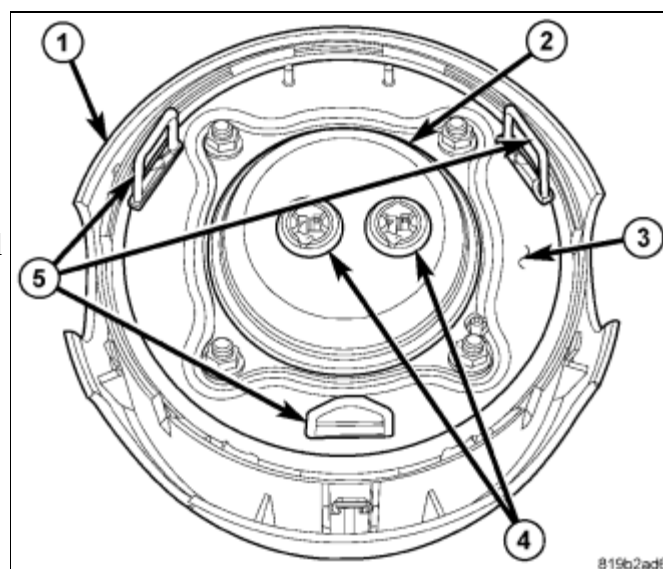
DRIVER AIRBAG

DESCRIPTION

The injection molded, thermoplastic driver airbag protective trim cover (2) is the most visible part of the driver airbag. The driver airbag is located in the center of the steering wheel (1), where it is secured to the armature within the hub cavity of the four-spoke steering wheel. An injection molded, bright emblem with the Jeep® logo is applied to the center of the trim cover.



Concealed beneath the driver air bag trim cover are the folded airbag cushion, the airbag housing, the airbag inflator and the retainers that secure the inflator to the housing. The airbag cushion, housing (3), and inflator (2) are secured within an integral receptacle molded into the back of the trim cover (1). The vertical walls of this receptacle have numerous small windows with blocking tabs that are engaged by numerous hook formations around the perimeter of the airbag housing. Each hook is inserted through one of the windows and the blocking tab in each window keeps the hook properly engaged with the trim cover, locking the trim cover securely into place on the airbag housing. Three wire loop snap retainers (5) extend from the housing to secure the airbag to the steering wheel armature. The snap retainer at the 6 o'clock position has a distinctive V-shape to ensure proper orientation of the airbag when it is installed onto the steering wheel.



The airbag used in this vehicle is a multistage-type that complies with revised federal airbag standards to deploy with less force than those used in some prior vehicles. A radial deploying 67.3 centimeter (26.5 inch) diameter fabric airbag cushion with internal tethers is used. The airbag inflator is a dual-initiator, non-azide, pyrotechnic-type unit and is secured to the stamped metal airbag housing using four flanged hex nuts. Two keyed and color-coded connector receptacles (4) on the driver airbag inflator connect the two inflator initiators to the vehicle electrical system through two yellow-jacketed, two-wire pigtail harnesses of the clockspring.

The driver airbag cannot be repaired, and must be replaced if deployed, ineffective, or in any way damaged. The driver airbag trim cover may be disassembled from the driver airbag unit, and is available for individual service replacement.

OPERATION

The multistage driver airbag is deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the driver airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ORC to suit the monitored impact conditions by providing one of several delay intervals between the electrical signals

provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

When the ORC sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas towards the instrument panel through vent holes within the fabric used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic or hazardous materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

The inert gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

Proper diagnosis of the driver airbag inflator and squib circuits requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

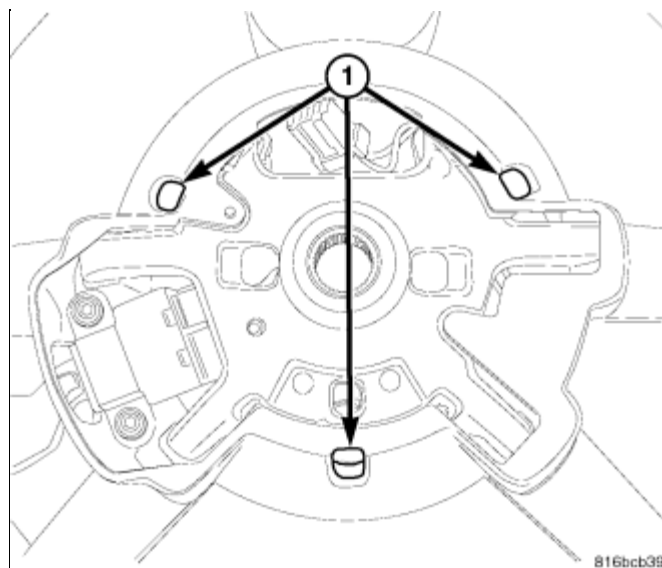
WARNING: To avoid serious or fatal injury when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag cushion and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

NOTE: The following procedure is for replacement of an ineffective or damaged driver airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

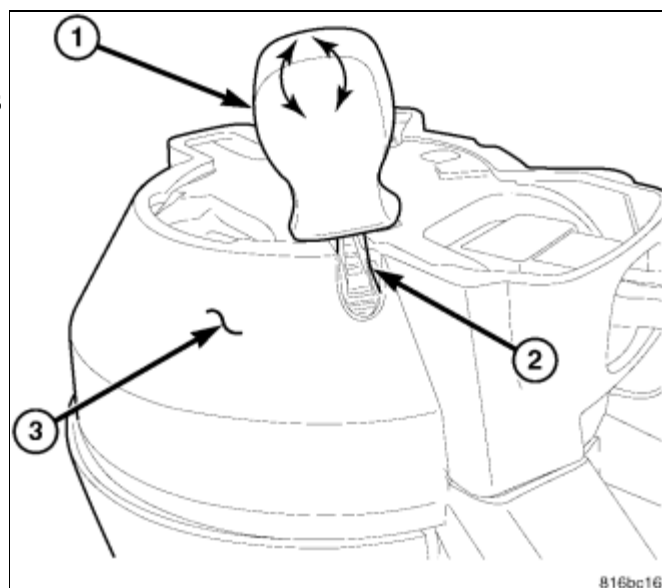
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Release the steering column tilt lever and lower the column to its most downward position for easiest driver airbag removal access.

NOTE: It may be helpful to use a small mirror to aid visibility during the initial attempt to remove the driver airbag from the steering wheel.

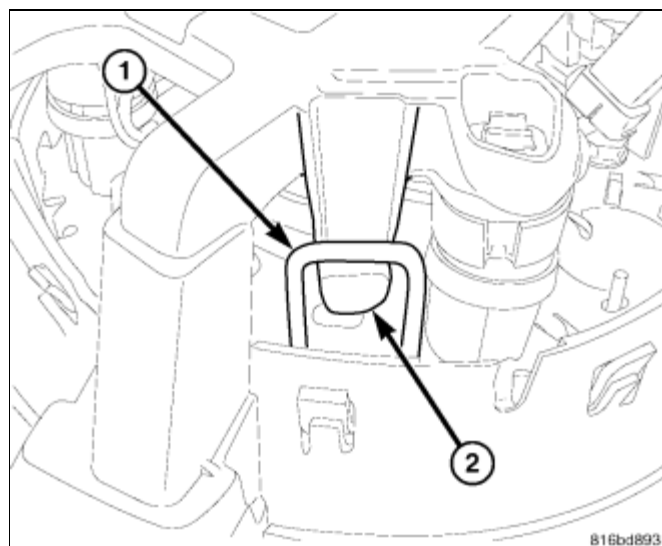
3. There are three airbag retainer access holes (1) on the instrument panel side of the steering wheel hub trim cover located at the two o'clock, six o'clock and ten o'clock positions of the steering wheel. The steering wheel must be rotated to bring each of these access holes up to the twelve o'clock position of the steering column one at a time for removal.



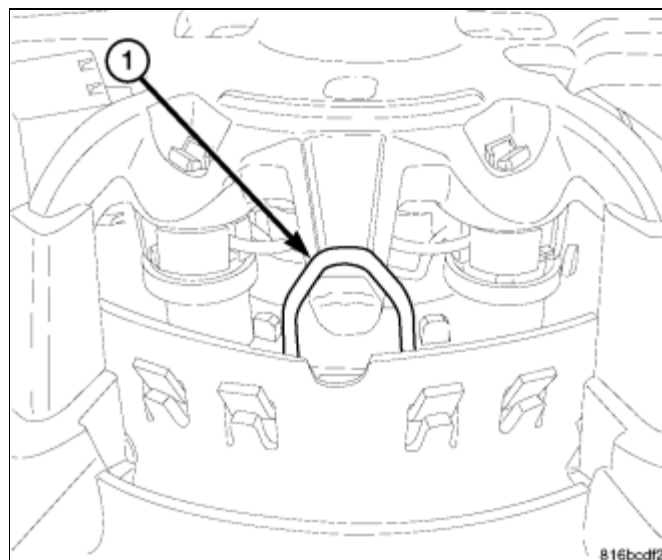
4. Insert the tip of a short handled, flat-bladed screwdriver (1) into either of the upper (two o'clock or ten o'clock) access holes of the steering wheel hub trim cover (3) being certain to place the screwdriver blade (2) on the inboard side of the airbag snap retainer wire loop.



5. Twist the screwdriver handle in either direction far enough to disengage the snap retainer wire loop (1) from the hook (2) of the steering wheel armature. At the same time, gently pull the driver airbag away from the steering wheel to prevent the retainer from snapping back into place over the hook once it is disengaged.
6. Repeat [STEP 4](#) and [STEP 5](#) at the other upper (two o'clock or ten o'clock) access hole to disengage the other upper snap retainer wire loop.



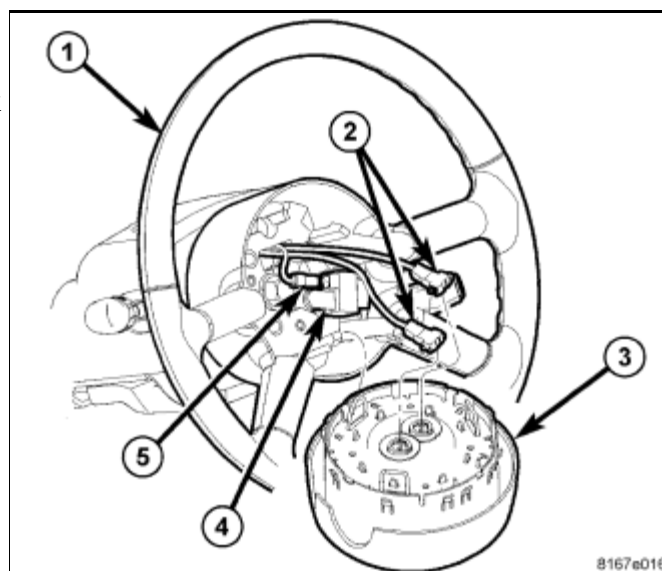
7. Repeat [STEP 4](#) and [STEP 5](#) at the lower (six o'clock) access hole to disengage the lower snap retainer wire loop (1). The lower snap retainer wire loop has a distinctive V-shape and must always be installed onto the six o'clock hook of the steering wheel armature.



8. Pull the driver airbag (3) away from the steering wheel (1) far enough to access the electrical connections (2) at the back of the airbag housing.

CAUTION: Do not pull on the clockspring pigtail wires or pry on the connector insulator to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulators can result in damage to the airbag circuits or the connector insulators.

9. The clockspring driver airbag pigtail wire connectors are secured by an integral lock to the airbag inflator connector receptacles, which are located on the back of the driver airbag housing. Firmly grasp and pull the lock straight out from the connector insulator, then pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.



10. Remove the driver airbag from the steering wheel.

11. If the driver airbag has been deployed, the clockspring must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

DISASSEMBLY

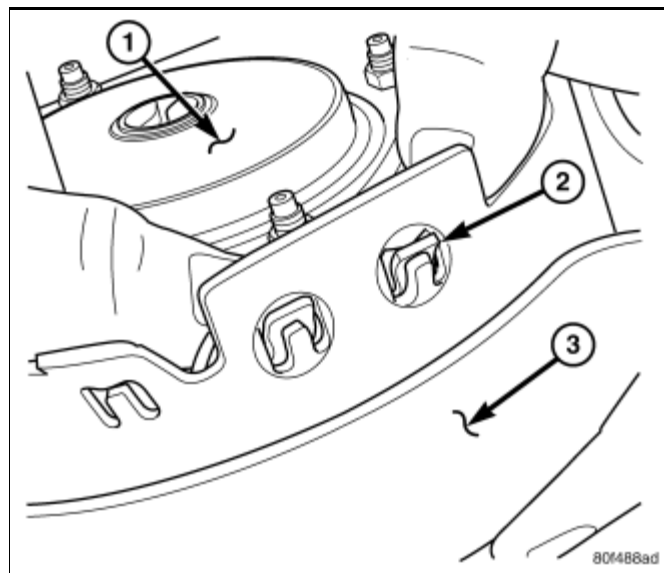
WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, service of this unit should be performed only by DaimlerChrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the driver airbag trim cover must never be painted. Replacement trim covers are serviced in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Place the driver airbag on a suitable work surface with the trim cover (3) facing down. If the trim cover will be reused, be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.
4. Disengage each of the hooks (2) of the airbag housing unit from the windows in the vertical walls of the trim cover. To disengage the hooks, use hand pressure to push the adjacent edge of the airbag inflator (1) or housing firmly and evenly downward into the trim cover receptacle, while at the same time pulling outward on the upper edge of the receptacle wall.
5. With all of the hooks disengaged, lift the housing, inflator and cushion as a unit from the receptacle on the back of the driver airbag trim cover.



ASSEMBLY

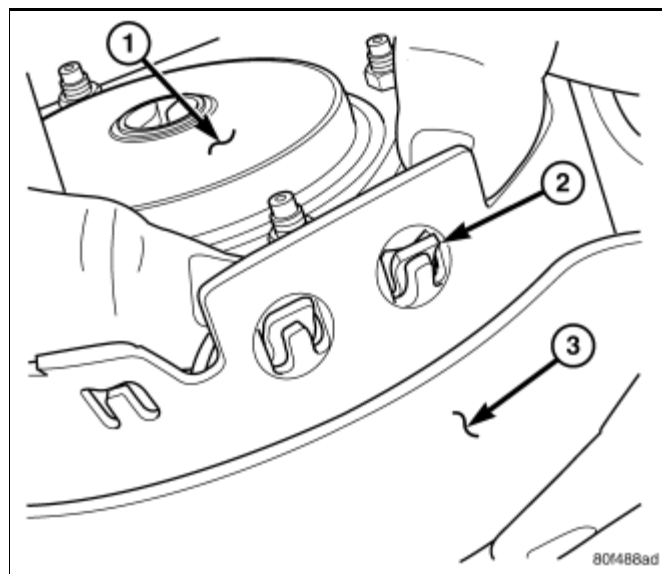
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WARNING: To avoid serious or fatal injury, service of this unit should be performed only by DaimlerChrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

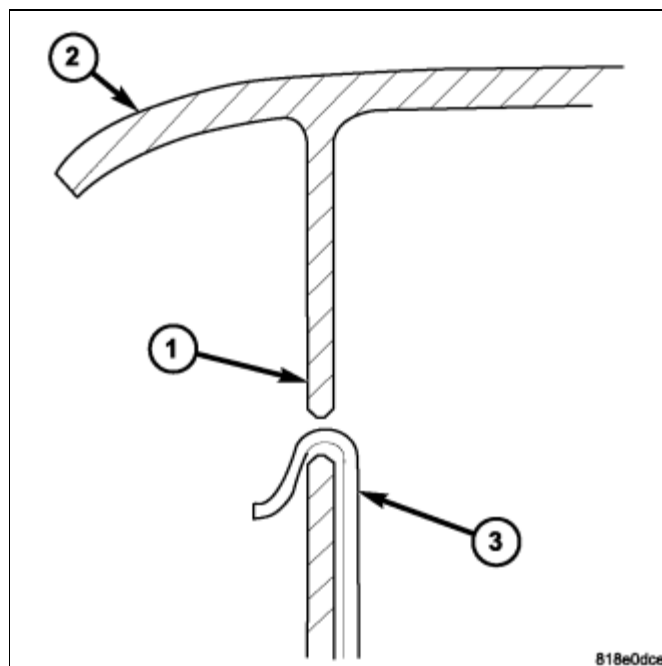
WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the driver airbag trim cover must never be painted. Replacement trim covers are serviced in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

1. Place the driver airbag trim cover (3) on a suitable work surface with the airbag receptacle facing up. Be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.
2. Carefully position the driver airbag housing and inflator unit (1) into the trim cover receptacle.
3. Work around the perimeter of the unit engaging each of the hooks (2) on the driver airbag housing through the windows in the walls of the trim cover receptacle.
4. After the driver airbag has been assembled, try pulling the trim cover and the airbag housing away from each other. This action will fully seat the edges of the trim cover windows into the cradles of the housing hooks.



5. Before reinstalling the airbag onto the steering wheel, check that the blocking tab (1) in each of the trim cover (2) windows is oriented over the airbag housing hook (3) as shown.
6. Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

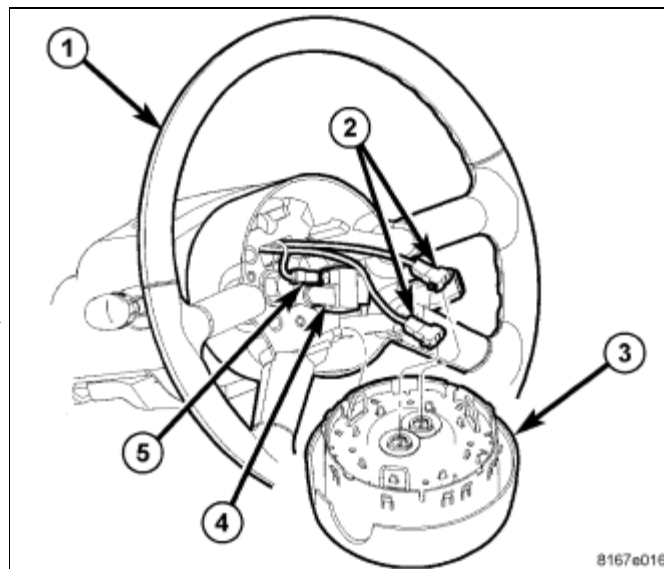
WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the driver airbag trim cover must never be painted. Replacement airbags are serviced with trim covers in the original colors. Paint may change the way in

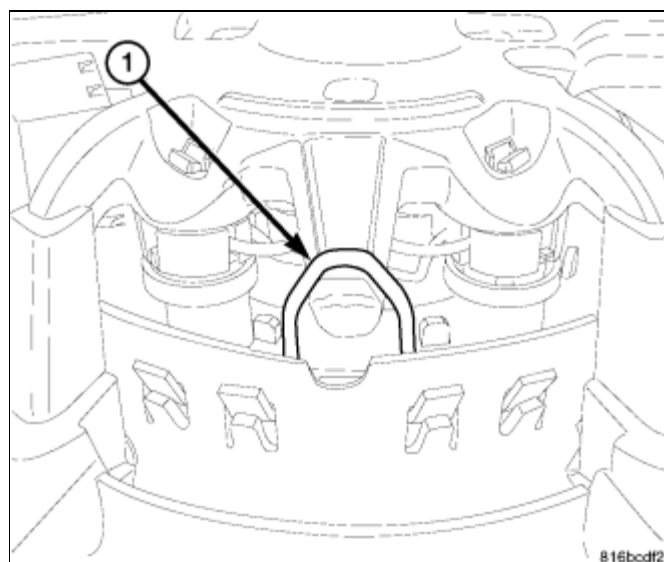
which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of an ineffective or damaged driver airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Position the driver airbag (3) close enough to the steering wheel (1) to reconnect the electrical connections on the back of the airbag housing.
2. When installing the driver airbag, reconnect the two clockspring driver airbag pigtail wire connectors (2) to the airbag inflator connector receptacles by pressing straight in on the connectors, then push the locks straight into the connectors. Be certain to engage each keyed and color-coded connector to the matching connector receptacle.



3. Carefully position the driver airbag in the steering wheel. Be certain that the clockspring pigtail wires are not pinched between the driver airbag and the horn switch or the steering wheel armature.
4. Engage the lower airbag snap retainer wire loop (1) onto the lower hook of the steering wheel armature. The lower snap retainer wire loop has a distinctive V-shape and must always be installed onto the six o'clock hook of the steering wheel armature.



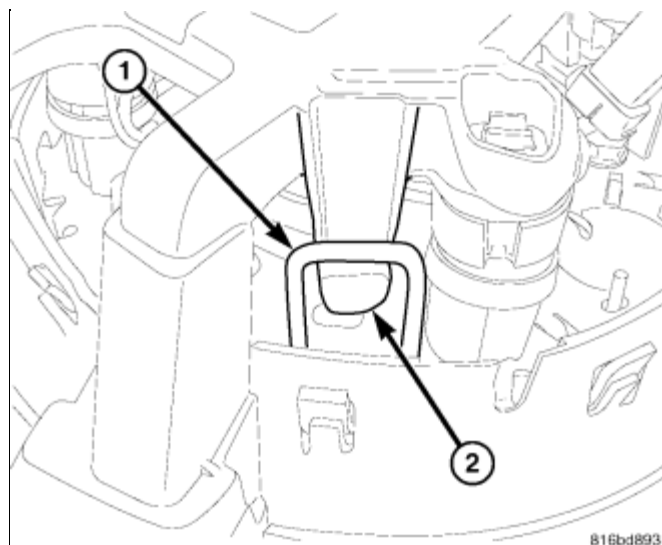
5. Roll the driver airbag upwards and press firmly and evenly over the two upper snap retainer wire loop (1) locations simultaneously until they snap into place over the two upper hooks (2) of the steering wheel armature.

6. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

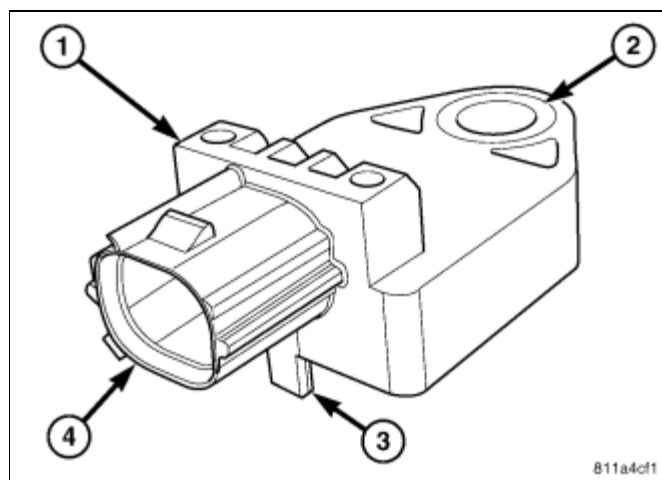
IMPACT SENSOR

DESCRIPTION

FRONT



Two front impact sensors (1) are used on this vehicle, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Occupant Restraint Controller (ORC). Each front sensor is secured with a screw to the back of the front end module carrier on either side of the cooling module and inboard of the headlamp within the engine compartment. The sensor housing has an integral connector receptacle (4), an integral anti-rotation pin (3), and an integral mounting hole (2) with a metal sleeve to provide crush protection.



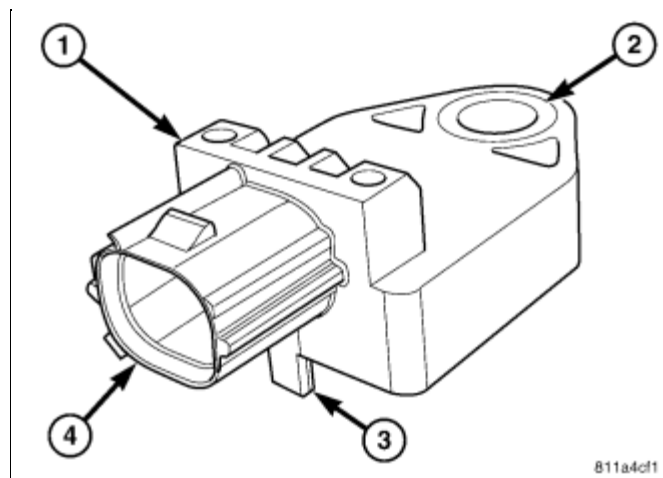
The right and left front impact sensors are identical in construction and calibration. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. A nylon cover is laser-welded over the cavity to seal and protect the internal electronic circuitry and components. The front impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the front end module wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or ineffective, they must be replaced.

SIDE

Two side impact sensors (1) are used with the optional seat airbags, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Occupant Restraint Controller (ORC). Each side sensor is secured with a nut to a stud on the inner

right or left B-pillar within the passenger compartment. The sensor housing has an integral connector receptacle (4), an integral anti-rotation pin (3), and an integral mounting hole (2) with a metal sleeve to provide crush protection.



The right and left side impact sensors are identical in construction and calibration. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. A nylon cover is laser-welded over the cavity to seal and protect the internal electronic circuitry and components. The side impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the body wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or ineffective, they must be replaced.

OPERATION

FRONT

The front impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Occupant Restraint Controller (ORC).

The ORC microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ORC. The impact sensors and the ORC communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the front impact sensors and the ORC may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the impact sensors or the electronic controls or communication between other modules and devices that provide features of the supplemental restraint system. The most reliable, efficient, and accurate means to diagnose the impact sensors or the electronic controls and communication related to front impact sensor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

SIDE

The side impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Occupant Restraint Controller (ORC).

The ORC microprocessor continuously monitors all of the side passive restraint system electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets a Diagnostic Trouble Code

(DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through the same left or right sensor plus and minus circuits in a series arrangement from the ORC. The impact sensors and the ORC communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the side impact sensors and the ORC may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the impact sensors or the electronic controls or communication between other modules and devices that provide features of the supplemental restraint system. The most reliable, efficient, and accurate means to diagnose the impact sensors or the electronic controls and communication related to side impact sensor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

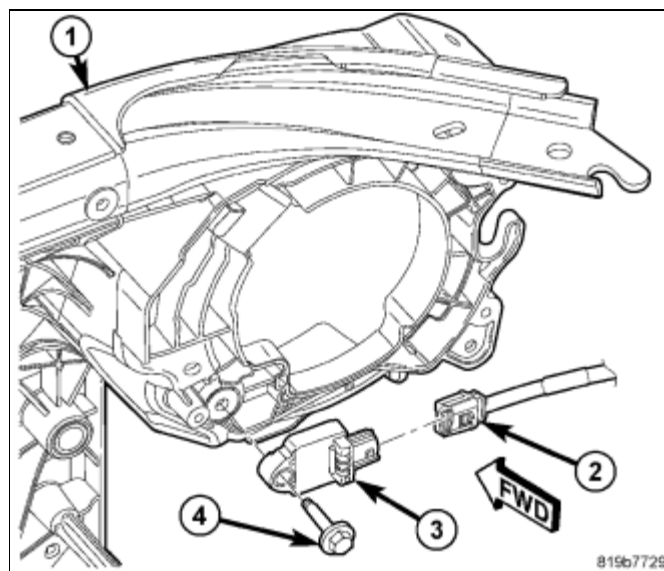
FRONT

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the screw (4) that secures the impact sensor (3) to the back (engine compartment side) of the front end module carrier (1) inboard of the right or left headlamp.
3. Disconnect the engine compartment wire harness connector (2) from the right or left front impact sensor connector receptacle.
4. Remove the right or left front impact sensor from the engine compartment.



SIDE - TWO-DOOR

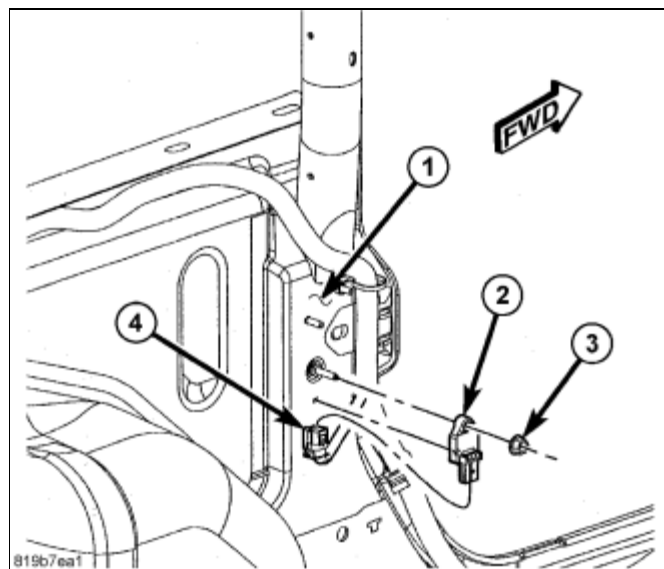
WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component

diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Adjust the driver or passenger side front seat to its most forward position for easiest access to the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the trim from the inside of the lower right or left B-pillar (1). (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).
4. Remove the nut (3) that secures the side impact sensor (2) to the weld stud on the lower B-pillar.
5. Remove the sensor from the weld stud on the inner B-pillar.
6. Disconnect the body wire harness connector (4) from the sensor connector receptacle.



SIDE - FOUR-DOOR

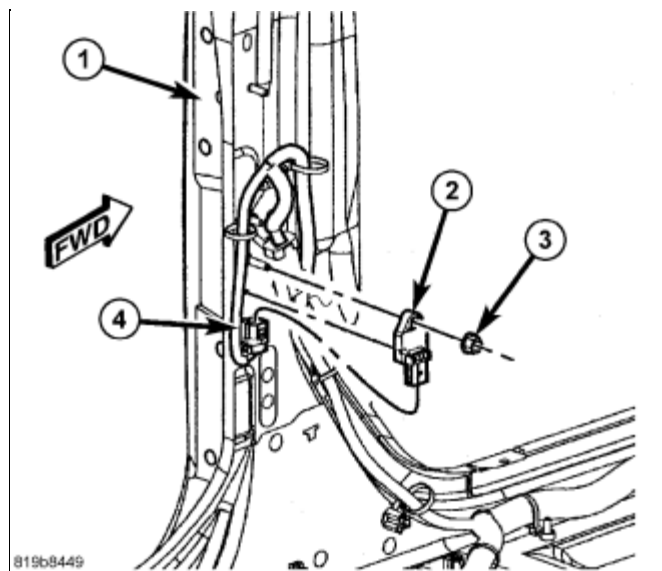
WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Adjust the driver or passenger side front seat to its most

- forward position for easiest access to the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
 3. Remove the trim from the inside of the lower right or left B-pillar (1). (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).
 4. Remove the nut (3) that secures the side impact sensor (2) to the weld stud on the lower B-pillar.
 5. Remove the sensor from the weld stud on the inner B-pillar.
 6. Disconnect the body wire harness connector (4) from the sensor connector receptacle.



INSTALLATION

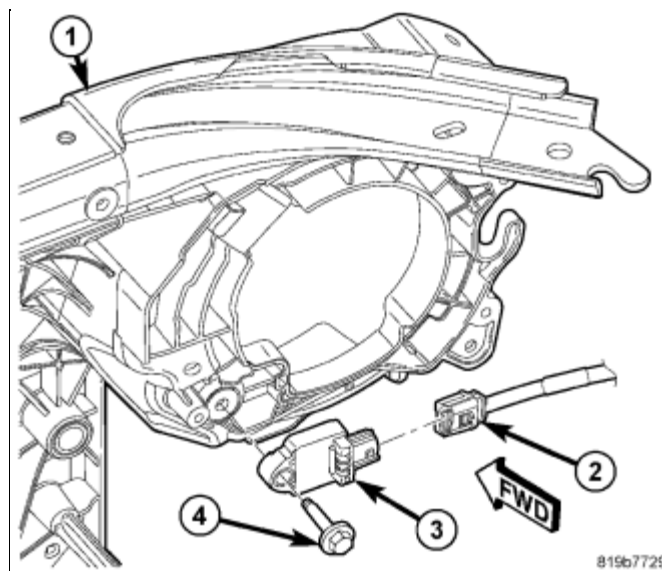
FRONT

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Position the right or left front impact sensor (3) into the engine compartment.
2. Reconnect the engine compartment wire harness connector (2) to the sensor connector receptacle.
3. Carefully position the sensor onto the back (engine compartment side) of the front end module carrier (1) inboard of the right or left headlamp. Be certain that the anti-rotation pin on the back of the sensor is engaged in the clearance hole of the carrier.
4. Install and tighten the screw (4) that secures the sensor to the back of the carrier. Tighten the screw to 8 N·m (70 in. lbs.).
5. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test



procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

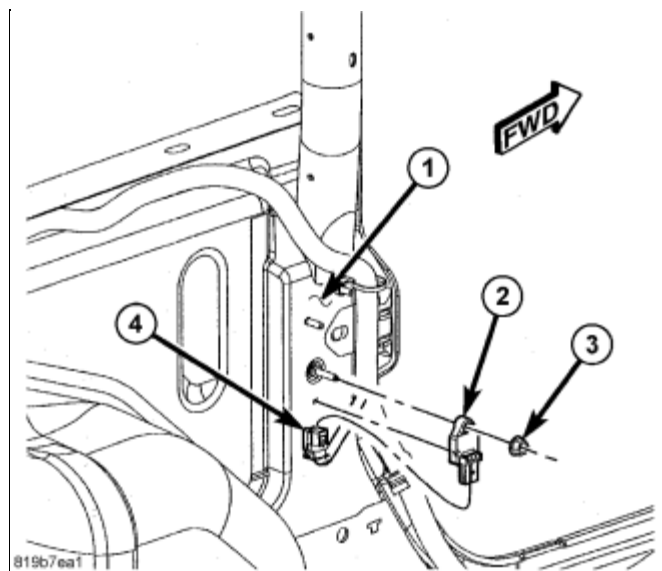
SIDE - TWO-DOOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Reconnect the body wire harness connector (4) to the side impact sensor (2) connector receptacle.
2. Position the sensor onto the weld stud on the inner B-pillar (1). Be certain that the anti-rotation pin on the back of the sensor is engaged in the clearance hole of the B-pillar.
3. Install and tighten the nut (3) that secures the sensor to the weld stud on the inner B-pillar. Tighten the nut to 8 N·m (70 in. lbs.).
4. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).
5. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test



procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

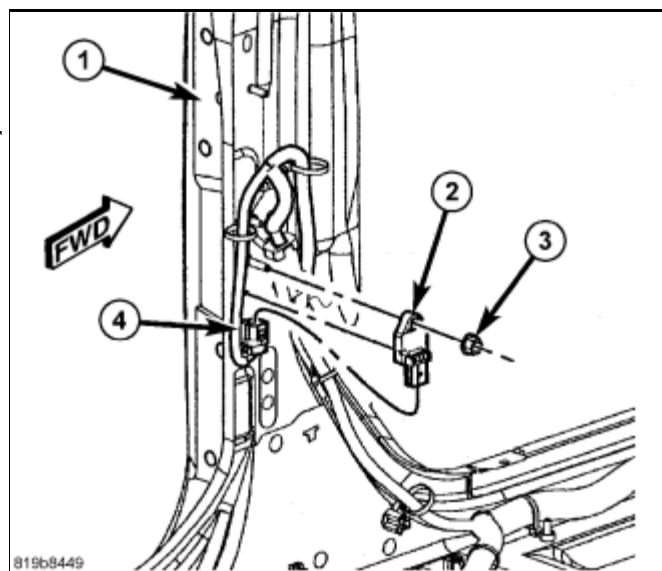
SIDE - FOUR-DOOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side Supplemental Restraint System (SRS) components. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side SRS component deployment.

NOTE: The front and side impact sensors are interchangeable.

1. Reconnect the body wire harness connector (4) to the side impact sensor (2) connector receptacle.
2. Position the sensor onto the weld stud on the inner B-pillar (1). Be certain that the anti-rotation pin on the back of the sensor is engaged in the clearance hole of the B-pillar.
3. Install and tighten the nut (3) that secures the sensor to the weld stud on the inner B-pillar. Tighten the nut to 8 N·m (70 in. lbs.).
4. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).
5. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS

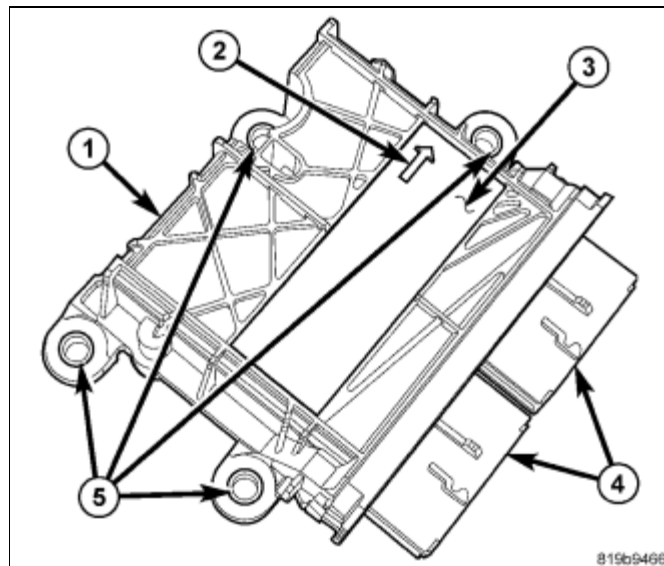


component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

OCCUPANT RESTRAINT CONTROLLER

DESCRIPTION

The Occupant Restraint Controller (ORC) (1) is secured with four nuts to four studs on a stamped steel mounting bracket welded onto the top of the floor panel transmission tunnel between the two front seats beneath the floor console and rearward of the transmission gearshift mechanism in the passenger compartment of the vehicle. Concealed within a hollow in the center of the molded plastic ORC housing is the electronic circuitry of the ORC which includes a microprocessor, an electronic impact sensor, an electronic safing sensor, and an energy storage capacitor. A molded plastic end cover plate with a rubber O-ring seal is secured to the open end of the ORC housing with two integral latch features to enclose and protect the internal electronic circuitry and components.



An arrow (2) printed on the label (3) on the top of the ORC housing provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle. The ORC housing has four integral mounting flanges (5) with metal sleeves to provide crush protection. Two molded plastic electrical connector receptacles (4) are integral to the end cover plate. These receptacles connect the ORC to the vehicle electrical system through dedicated take outs and connectors from the instrument panel and the body wire harnesses.

The impact sensor and safing sensor internal to the ORC are calibrated for the specific vehicle, and are only serviced as a unit with the ORC. In addition, there are unique versions of the ORC for vehicles with or without optional seat-mounted side airbags. The ORC cannot be repaired or adjusted and, if damaged or ineffective, it must be replaced.

OPERATION

The microprocessor in the Occupant Restraint Controller (ORC) contains the Supplemental Restraint System (SRS) logic circuits and controls all of the SRS components. The ORC uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the diagnostic scan tool using the Controller Area Network (CAN) data bus. This method of communication is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and for SRS diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/AIRBAG INDICATOR - OPERATION).

The ORC microprocessor continuously monitors all of the SRS electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends electronic messages to the EMIC over the CAN data bus to turn ON the airbag indicator. An active fault only remains for the duration of the fault, or in some cases for the duration of the current ignition

switch cycle, while a stored fault causes a DTC to be stored in memory by the ORC. For some DTCs, if a fault does not recur for a number of ignition cycles, the ORC will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

On vehicles so equipped, the ORC provides voltage to the seat track position sensors on the inboard passenger and driver side front seat upper seat tracks. The ORC then monitors return inputs from each of the sensors on dedicated hard wired data communication circuits. The seat track position sensors provide additional logic inputs to the ORC microprocessor that allow it to determine the position of the front seat passenger and the driver relative to the front airbags for determining the force level with which to deploy the multistage front airbags.

The ORC receives battery current through two circuits; a fused ignition switch output (run) circuit through a fuse in the Totally Integrated Power Module (TIPM), and a fused ignition switch output (run-start) circuit through a second fuse in the TIPM. The ORC receives ground through a ground circuit and take out of the instrument panel wire harness. These connections allow the ORC to be operational whenever the ignition switch is in the START or ON positions. Refer to the appropriate wiring information for additional details.

The ORC also contains an energy-storage capacitor. When the ignition switch is in the START or ON positions, this capacitor is continually being charged with enough electrical energy to deploy the SRS components for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup SRS protection in case there is a loss of battery current supply to the ORC during an impact.

Two sensors are contained within the ORC, an electronic impact sensor and a safing sensor. The ORC also monitors inputs from two remote front impact sensors located on the back of the right and left ends of the front end module carrier inboard of the headlamps near the front of the vehicle. The electronic impact sensors are accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. On vehicles equipped with optional seat-mounted side airbags the ORC also monitors inputs from an internal rollover sensor and two additional remote impact sensors located on the left and right inner B-pillars to control deployment of the seat airbag units.

The safing sensor is an electronic accelerometer sensor within the ORC that provides an additional logic input to the ORC microprocessor. The safing sensor is used to verify the need for a SRS component deployment by detecting impact energy of a lesser magnitude than that of the primary electronic impact sensors, and must exceed a safing threshold in order for the airbags to deploy. Vehicles equipped with optional seat-mounted side airbags feature a second safing sensor within the ORC to provide confirmation to the ORC microprocessor of side impact forces. This second safing sensor is a bi-directional unit that detects impact forces from either side of the vehicle.

Pre-programmed decision algorithms in the ORC microprocessor determine when the deceleration rate as signaled by the impact sensors and the safing sensors indicate an impact that is severe enough to require SRS protection and, based upon the severity of the monitored impact, determines the level of front airbag deployment force required for each front seating position. When the programmed conditions are met, the ORC sends the proper electrical signals to deploy the dual multistage front airbags at the programmed force levels, the front seat belt tensioners and, if the vehicle is so equipped, either side airbag unit.

The hard wired inputs and outputs for the ORC may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ORC or the electronic controls or communication between other modules and devices that provide features of the SRS. The most reliable, efficient, and accurate means to diagnose the ORC or the electronic controls and communication related to ORC operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with optional seat-mounted side

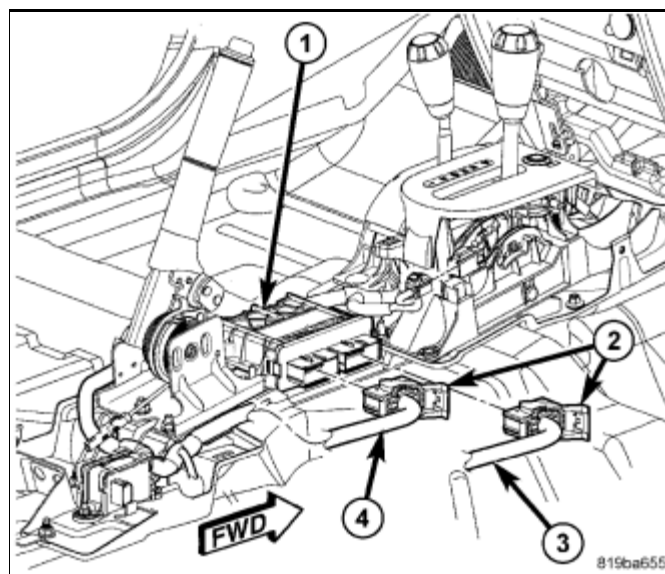
airbags, disable the Supplemental Restraint System (SRS) before attempting any Occupant Restraint Controller (ORC) diagnosis or service. The ORC contains a rollover sensor, which enables the system to deploy the side airbags in the event of a vehicle rollover event. If an ORC is accidentally rolled during service while still connected to battery power, the side airbags will deploy. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the Occupant Restraint Controller (ORC), as it can damage the impact sensor or affect its calibration. The ORC contains the impact sensor, which enables the system to deploy the Supplemental Restraint System (SRS) components. If an ORC is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper SRS component deployment.

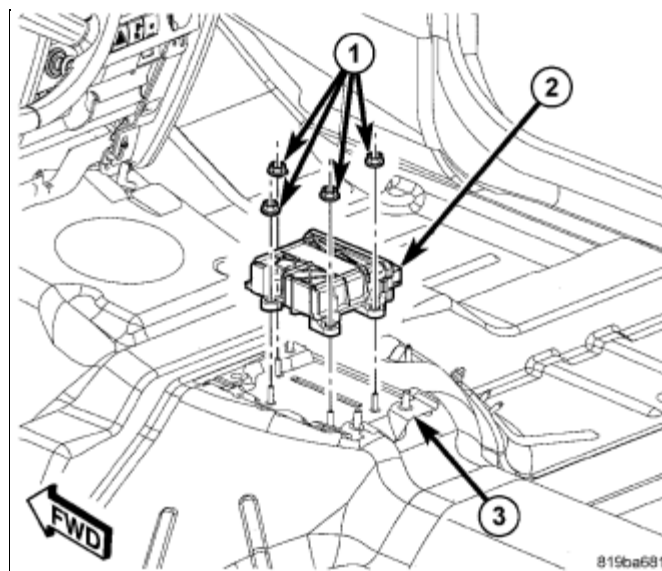
NOTE: Several different Occupant Restraint Controllers (ORC) are available for this vehicle. For vehicles equipped with the optional seat-mounted side airbags the ORC contains a second bi-directional safing sensor.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the center console from the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).
3. Unlatch and disconnect the instrument panel wire harness (4) and body wire harness (3) connectors (2) from the Occupant Restraint Controller (ORC) (1) connector receptacles located on the right side of the module. To disconnect the wire harness connectors from the ORC, depress the release tab and lift the lever arm on each connector.



4. Remove the four nuts (1) that secure the ORC (2) to the three studs on the ORC mount (3) welded onto the top of the floor panel transmission tunnel.
5. Remove the ORC from the ORC mount.

INSTALLATION



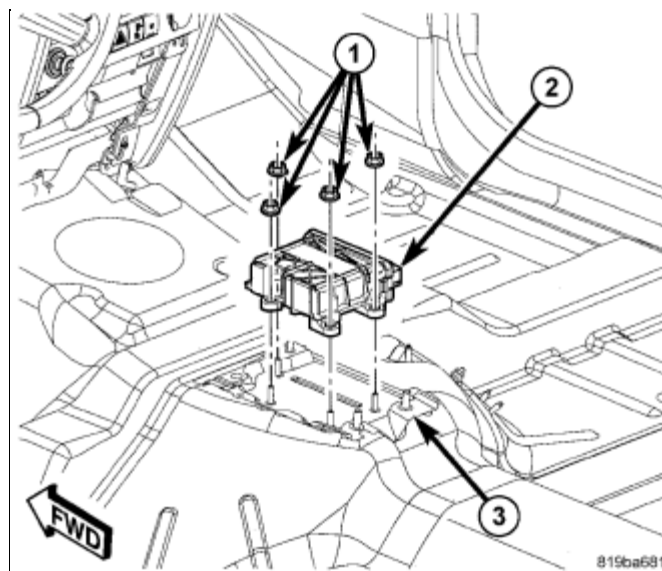
WARNING: To avoid serious or fatal injury on vehicles equipped with optional seat-mounted side airbags, disable the Supplemental Restraint System (SRS) before attempting any Occupant Restraint Controller (ORC) diagnosis or service. The ORC contains a rollover sensor, which enables the system to deploy the side airbags in the event of a vehicle rollover event. If an ORC is accidentally rolled during service while still connected to battery power, the side airbags will deploy. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, never strike or drop the Occupant Restraint Controller (ORC), as it can damage the impact sensor or affect its calibration. The ORC contains the impact sensor, which enables the system to deploy the Supplemental Restraint System (SRS) components. If an ORC is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper SRS component deployment.

NOTE: Several different Occupant Restraint Controllers (ORC) are available for this vehicle. For vehicles equipped with the optional seat-mounted side airbags the ORC contains a second bi-directional safing sensor.

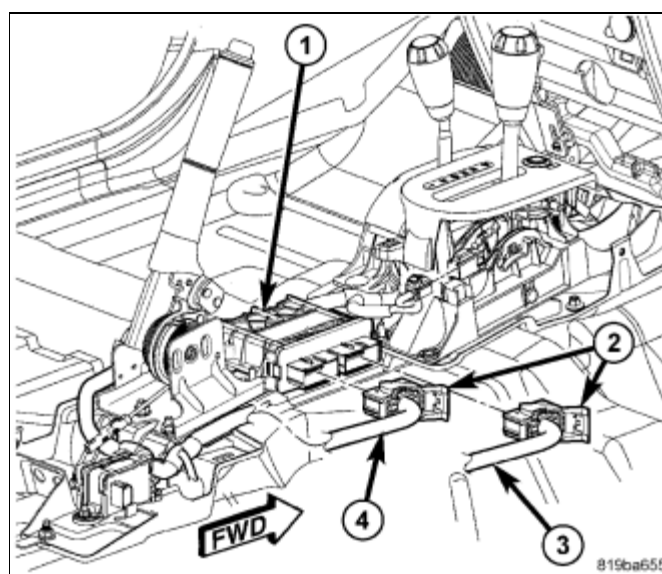
1. Carefully position the Occupant Restraint Controller (ORC) (2) onto the four studs of the ORC mount (3) on the floor panel transmission tunnel. When the ORC is correctly positioned, the bottom of the housing will fit flush with the mount and the orientation arrow on the label on top of the housing will be pointed forward in the vehicle.
2. Install and tighten the four nuts (1) that secure the ORC to the studs of the ORC mount. Tighten the nuts to 9 N·m (80 in. lbs.).



3. Reconnect the body wire harness (3) and instrument panel wire harness (4) connectors (2) to the ORC connector receptacles located on the right side of the module (1). Be certain that the latches on the connectors are each fully engaged.

4. Reinstall the center console onto the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

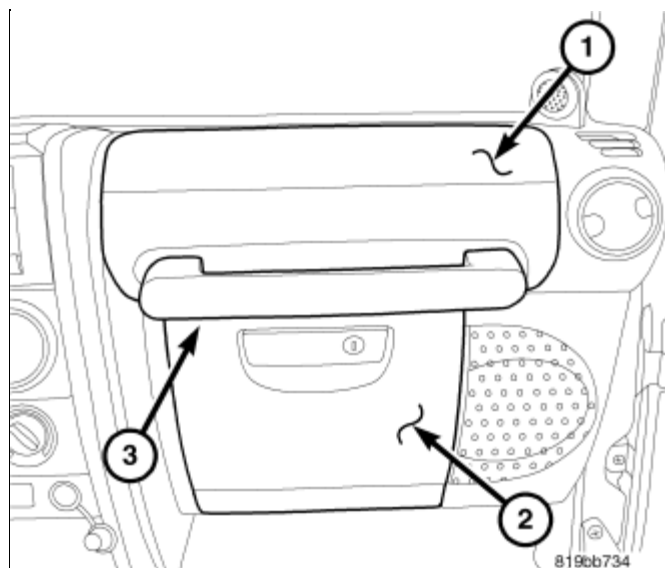
5. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



PASSENGER AIRBAG

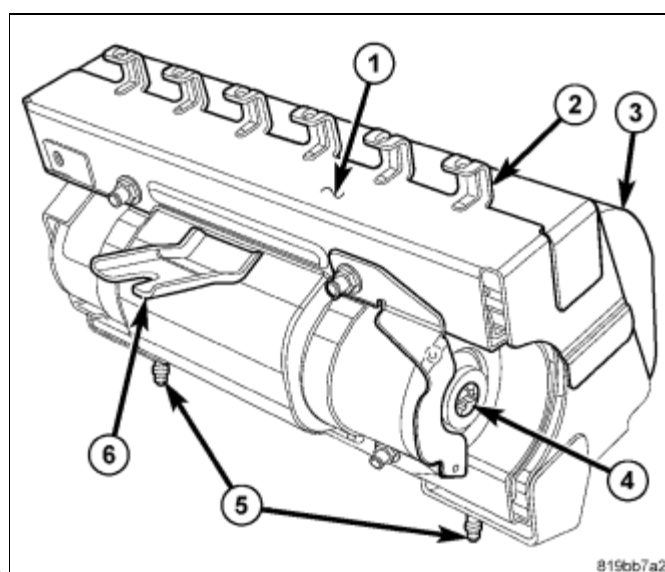
DESCRIPTION

The rearward-facing surface of the injection molded, thermoplastic passenger airbag door (1) is the most visible part of the passenger airbag. The passenger airbag door is located above the glove box (2) opening on the top and face of the instrument panel in front of the front seat passenger seating position. The airbag door also includes a depressed area and clearance holes to accommodate the instrument panel grab handle (3). The edges of the airbag door are secured with integral snap features to the instrument panel base trim.



Located below the passenger airbag door within the instrument panel is the passenger airbag unit. The passenger airbag unit is secured through two lower studs (5) and a stamped upper mounting bracket (6) to the die cast instrument panel structural support armature.

The passenger airbag housing (1) fits into a molded receptacle on the back of the airbag door, where several stamped hook formations (2) on the upper and lower edges of the airbag housing are engaged in mating small window openings on the upper and lower flanges of the receptacle to secure the airbag door to the airbag housing. These airbag door fasteners and mounting provisions are all concealed beneath the instrument panel base trim.



The passenger airbag unit used in this vehicle is a multistage, Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior vehicles. The passenger airbag unit consists of a stamped and welded metal housing, the airbag cushion (3), and dual airbag inflators. The airbag housing contains the airbag inflators and the folded airbag cushion. An approximately 80 centimeter (31.5 inch) wide by 90 centimeter (35.5 inch) high rectangular fabric cushion is used.

The airbag inflator is a non-azide, pyrotechnic-type unit that is secured to and sealed within the airbag housing. Two inflator initiators (4) are connected to the vehicle electrical system through dedicated take outs and connectors of the instrument panel wire harness.

A service replacement passenger airbag does not include the airbag door. The passenger airbag door may be disassembled from the passenger airbag and is available for individual service replacement. The passenger airbag unit cannot be repaired and must be replaced if deployed, ineffective, or in any way damaged.

OPERATION

The multistage passenger airbag is deployed by electrical signals generated by the Occupant Restraint Controller (ORC) through the passenger airbag squib 1 and squib 2 circuits to the two initiators for the dual airbag inflators. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ORC to suit the monitored impact conditions by providing one of several delay intervals between the

electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

When the ORC sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the airbag cushion and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the passenger airbag door will split at predetermined tear seam lines concealed on the inside surface of the door, then the door will pivot up over the top of the instrument panel and out of the way. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas through a vent hole in each fabric side panel of the airbag cushion.

Typically, both initiators are used during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

Proper diagnosis of the passenger airbag inflator and the passenger airbag squib circuits requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

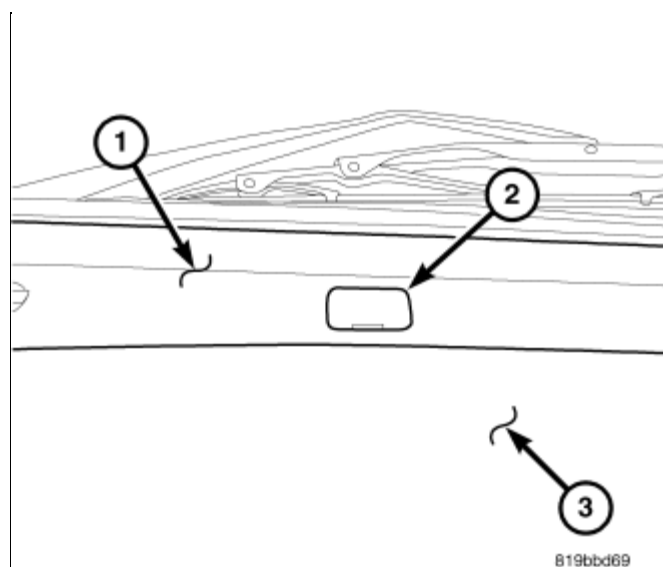
WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

NOTE: The following procedure is for replacement of an ineffective or damaged passenger airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the trim plug (2) from the access hole in the top of the instrument panel (1) between the windshield and the forward edge of the passenger airbag door (3).
3. Working through the access hole, loosen the nut that secures the passenger airbag upper bracket and the

instrument panel armature to the stud near the windshield fence line.



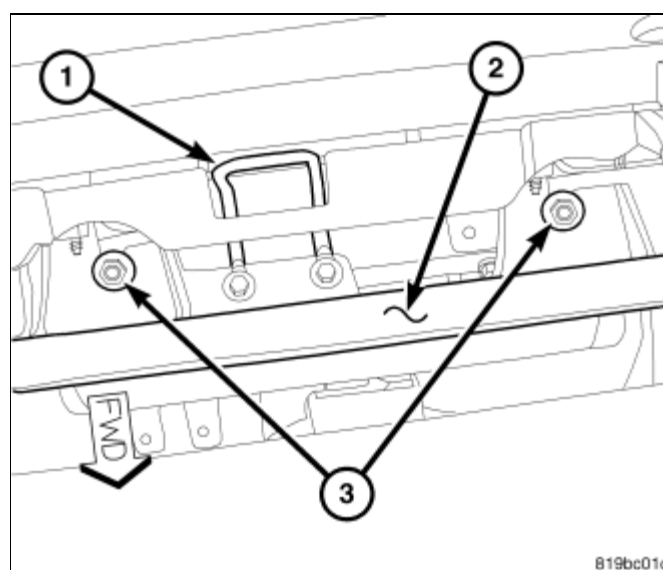
4. Remove the grab handle above the glove box door from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE - REMOVAL).

5. Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

6. Reach up into the instrument panel glove box opening to access and remove the two nuts (3) that secure the passenger airbag lower studs to the instrument panel armature (2) on each side of the glove box latch striker (1).

7. Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the passenger airbag door rearward far enough to disengage the snap features on the door from the receptacles in the instrument panel base trim.

8. Grasp the lower edge of the passenger airbag door and pull the door and airbag rearward far enough to access the two instrument panel wire harness connections to the airbag inflators at each side of the airbag housing.



CAUTION: Do not pull on the instrument panel wire harness take outs or pry on the connector insulators to disengage the connectors from the passenger airbag inflator connector receptacles. Improper removal of these take outs and their connector insulators can result in damage to the airbag circuits or the connector insulators.

9. Disconnect the instrument panel wire harness connectors from the airbag inflators. Firmly grasp and pull the lock straight out from the connector insulator, then pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.

10. Remove the passenger airbag and airbag door from the instrument panel as a unit.

DISASSEMBLY

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing

further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

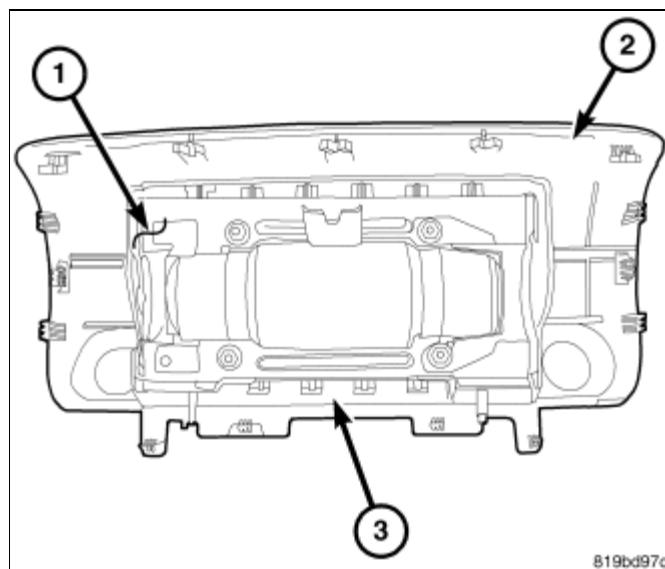
WARNING: To avoid serious or fatal injury, service of this unit should be performed only by DaimlerChrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the passenger airbag, or becoming entrapped between the passenger airbag cushion and the passenger airbag door. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the passenger airbag door must never be painted. Replacement airbag doors are serviced in the original colors. Paint may change the way in which the material of the airbag door responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedures can be used to replace the passenger airbag door. If the passenger airbag is deployed, the passenger airbag unit and the airbag door must both be replaced.

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the passenger airbag from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).
3. Place the passenger airbag on a suitable work surface with the passenger airbag door (2) facing down. If the airbag door will be reused, be certain to take the proper precautions to prevent the airbag door from receiving cosmetic damage during the following procedures.
4. Disengage each of the 12 hooks (3) of the airbag housing (1) from the 12 windows in the vertical walls of the receptacle on the back of the airbag door. To disengage the hooks:



- a. Use hand pressure to push the airbag housing fully against the upper or lower wall of the airbag door receptacle.
- b. Insert a trim stick or another suitable prying tool into the large gap between the airbag housing and the opposite wall of the receptacle.
- c. Pry outward between the airbag housing and the receptacle wall far enough to disengage all 6 upper or lower hooks from their corresponding windows.
- d. Rotate the disengaged edge of the airbag housing upward far enough to disengage the remaining 6 hooks from their corresponding windows in the receptacle wall.
5. With all of the hooks disengaged, lift the housing, inflator and cushion from the receptacle on the back of the passenger airbag door.

ASSEMBLY

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental

Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

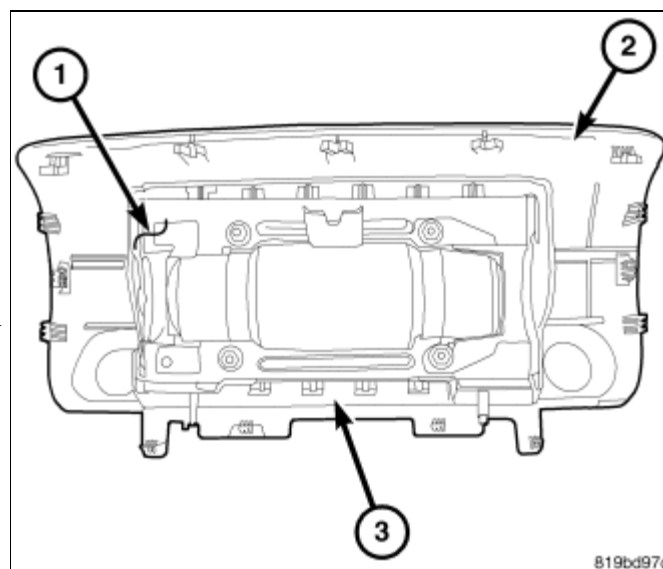
WARNING: To avoid serious or fatal injury, service of this unit should be performed only by DaimlerChrysler-trained and authorized dealer service technicians. Failure to take the proper precautions or to follow the proper procedures could result in accidental, incomplete, or improper airbag deployment and possible occupant injuries.

WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the passenger airbag, or becoming entrapped between the passenger airbag cushion and the passenger airbag door. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the passenger airbag door must never be painted. Replacement airbag doors are serviced in the original colors. Paint may change the way in which the material of the airbag door responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedures can be used to replace the passenger airbag door. If the passenger airbag is deployed, the passenger airbag unit and the airbag door must both be replaced.

1. Place the passenger airbag door (2) on a suitable work surface with the airbag receptacle facing up. Be certain to take the proper precautions to prevent the airbag door from receiving cosmetic damage during the following procedures.
2. Carefully position the passenger airbag housing (1) into the airbag door receptacle.
3. Engage each of the 12 hooks (3) of the airbag housing (1) with the 12 windows in the vertical walls of the receptacle on the back of the airbag door. To engage the hooks:
 - a. Rotate the 6 hooks on either the upper or lower edge of the passenger airbag housing through their corresponding windows in the upper or lower wall of the airbag door receptacle.
 - b. Press the opposite edge of the housing down into the receptacle far enough to engage the remaining 6 hooks through their corresponding windows in the receptacle wall.
4. After the passenger airbag has been assembled, try pulling the airbag door and the airbag housing away from each other. This action will fully seat the edges of the windows into the cradles of the hooks.
5. Reinstall the passenger airbag onto the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery

negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury, use extreme care to prevent any foreign material from entering the passenger airbag, or becoming entrapped between the passenger airbag cushion and the passenger airbag door. Failure to observe this warning could result in occupant injuries upon airbag deployment.

WARNING: To avoid serious or fatal injury, the passenger airbag door must never be painted. Replacement passenger airbag units are serviced with doors in the original colors. Paint may change the way in which the material of the airbag door responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.

NOTE: The following procedure is for replacement of an ineffective or damaged passenger airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Position the passenger airbag and airbag door to the opening in the face of the instrument panel base trim as a unit.

2. Reconnect the two connector insulators of the instrument panel wire harness take outs to the airbag inflator connector receptacles on each side of the airbag housing by pressing straight in on the connectors, then pushing the locks straight into the connectors. Be certain to engage each keyed and color-coded connector to the matching connector receptacle.

3. Slide the passenger airbag forward being certain that the upper passenger airbag bracket is engaged with the stud and under the nut on the windshield fence line and that the two lower studs of the airbag are engaged in the holes of the instrument panel armature (2).

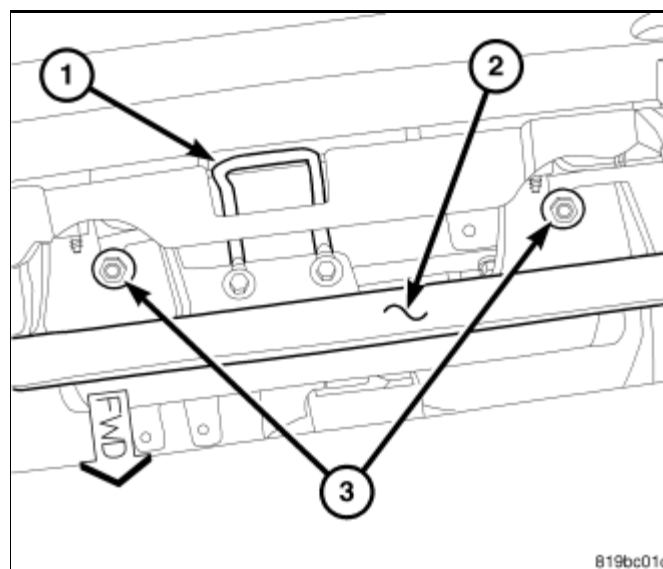
4. Install and tighten the two nuts (3) that secure the passenger airbag lower studs to the instrument panel armature. Tighten the nuts to 6 N·m (55 in. lbs.).

5. Using hand pressure, press the passenger airbag door forward and downward until each snap feature on the edges of the airbag door is fully engaged into its receptacle in the instrument panel base trim.

6. Reinstall the grab handle onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE - INSTALLATION).

7. Reinstall the glove box into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

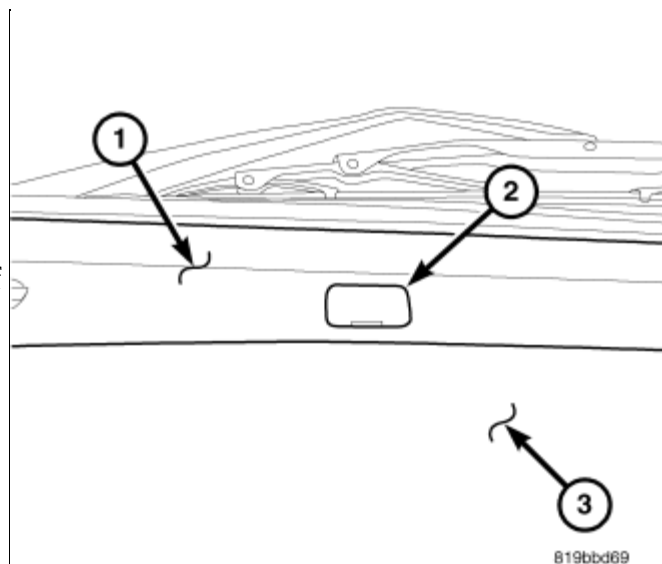
8. Working through the access hole in the top of the instrument panel (1) between the windshield and the forward edge of the passenger airbag door (3), tighten the nut that



secures the passenger airbag upper bracket and the instrument panel armature to the stud near the windshield fence line. Tighten the nut to 6 N·m (55 in. lbs.).

9. Reinstall the trim plug (2) into the access hole in the top of the instrument panel.

10. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

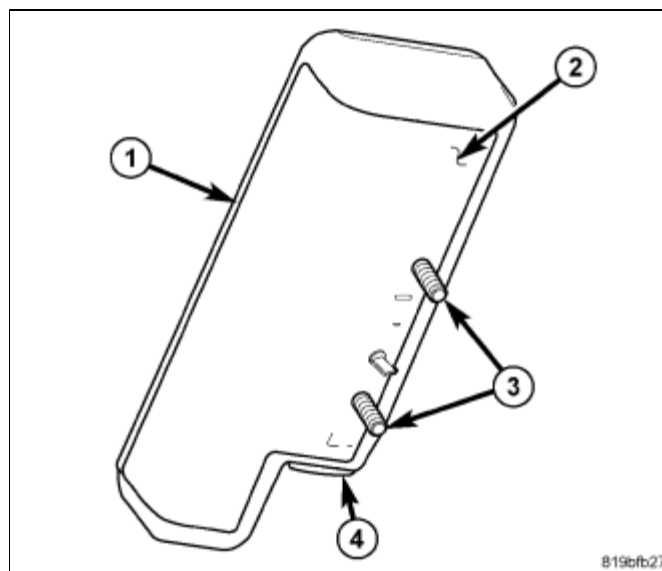


SEAT AIRBAG

DESCRIPTION

The seat airbags are completely concealed beneath the seat back trim cover on the upper outboard sides of both front seat backs. These airbags are inserted into a sewn pouch on the inside of the trim cover, then secured to the seat back frame by nuts on two studs (3). The two studs are located on the stamped metal airbag housing (2), while a metal locator tab between the two studs is integral to the stamped metal housing.

The folded seat airbag cushion is contained within a retainer wrap (1) constructed of the same material as the airbag cushion. The inner wrap cover completely encloses the airbag cushion and is engaged over the studs on the housing for retention. The airbag cushion is constructed of a coated nylon fabric. The airbag housing contains the airbag inflator and a heat shield.



The airbag inflator is a single-initiator, pyrotechnic-type unit that is secured to and sealed within the airbag housing. The seat airbag is connected to the vehicle electrical system through a dedicated jumper wire harness with a connector insulator that connects directly to the inflator initiator (4). The connector insulators are uniquely keyed and color-coded to ensure they can only be connected to the initiator.

The seat airbag cannot be repaired, and must be replaced if deployed, ineffective, or in any way damaged. If the seat airbag is deployed, the seat back frame, the seat back foam, the seat back trim cover and the airbag jumper wire harness must also be replaced.

OPERATION

Each seat airbag is deployed individually by an electrical signal generated by the Occupant Restraint Controller (ORC) to which it is connected through left or right seat airbag line 1 and line 2 (or squib) circuits. The hybrid-

type inflator assembly for each airbag contains a small canister of highly compressed inert gas. When the ORC sends the proper electrical signal to the airbag inflator, the electrical energy creates enough heat to ignite chemical pellets within the inflator.

Once ignited, these chemicals burn rapidly and produce the pressure necessary to rupture a containment disk in the inert gas canister. The inflator and inert gas canister are sealed and connected so that all of the released gas is directed into the folded seat airbag cushion, causing the cushion to inflate. As the airbag cushion inflates it will split the inner retainer wrap, the sewn pouch and the outboard side of the seat back trim cover and expand into the area between the outboard side of the front seat and the front door to form a cushion to protect the front seat occupant during a side impact collision or a vehicle rollover incident.

Following the airbag deployment, the airbag cushion slowly deflates by venting the inert gas through the loose weave of the cushion fabric, and the deflated cushion hangs down loosely from the outboard side of the front seat back.

Proper diagnosis of the seat airbag inflator and squib circuits requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

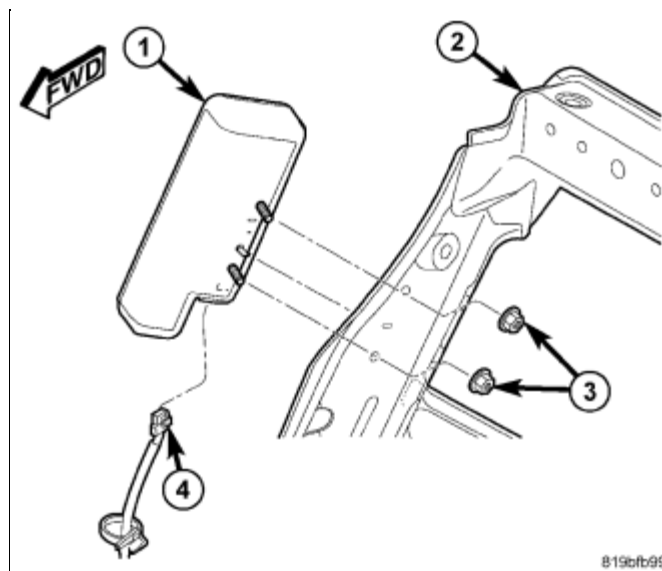
REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.

NOTE: The following procedure is for replacement of an ineffective or damaged seat airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Position the front seat to its most forward position for easiest access to the front seat back.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Fold the seat back rearward for easiest access to the J-hook retainers at the base of the seat back trim cover
4. Disengage the J-hook retainers that secure the front and rear lower edges of the seat back trim cover to each other at the base of the seat back.
5. Fold the seat back forward for easiest access to the back of



the seat back trim cover

6. Remove the recliner handle and, on the passenger side only, the easy entry handle from the outboard side of the seat.

7. Pull up the front and rear lower edges of the seat back trim cover far enough to access the seat airbag unit on the outboard side of the seat back frame.

CAUTION: Do not pull on the seat airbag jumper wire harness (4) or pry on the connector insulator to disengage the connector from the seat airbag (1) inflator connector receptacle. Improper removal of this jumper wire and its connector insulator can result in damage to the airbag circuits or the connector insulator.

8. Reach between the seat back trim cover and the foam pad on the outboard side of the seat back frame to access and disconnect the seat airbag jumper wire harness connector from the seat airbag inflator. Squeeze the black latch tabs on each side of the connector insulator, then pull the insulator straight out from the airbag inflator initiator to disconnect it from the connector receptacle.

CAUTION: During removal of the seat airbag, be certain not to tear or damage the sewn nylon pouch integral to the inside of the seat back trim cover that contains the seat airbag. If the nylon pouch or the trim cover are torn or damaged, the entire front seat back trim cover must be replaced with a new unit.

9. Remove the two nuts (3) from the inboard side of the outboard seat back frame that secure the seat airbag to the side of the seat back.

10. Pull the seat airbag outward from the seat back far enough to disengage the airbag mounting studs from the seat back frame.

11. Disengage the seat airbag from the sewn pouch on the inside of the seat back trim cover and remove the airbag from the seat back.

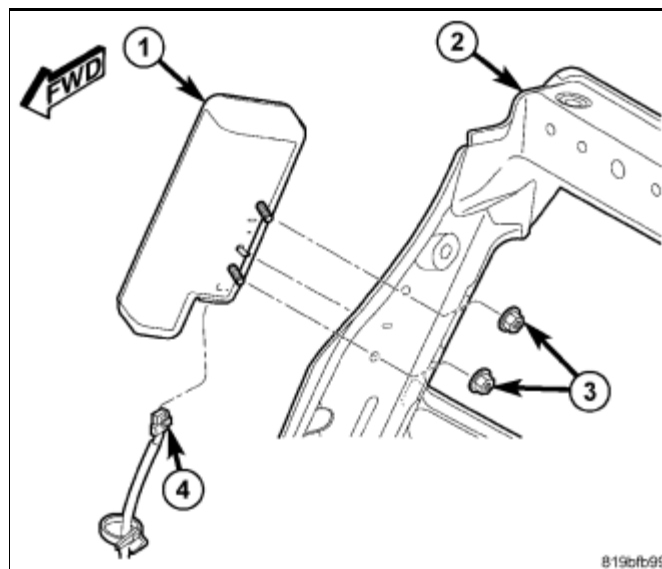
INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: The following procedure is for replacement of an ineffective or damaged seat airbag. If the airbag is ineffective or damaged, but not deployed, review the recommended procedures for handling non-

deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

1. Insert the seat airbag (1) into the sewn nylon pouch on the inside of the outboard seat back trim cover.
2. Position the seat airbag and pouch to the outboard side of the seat back frame (2) and insert the studs through the mounting holes in the frame.
3. Install and tighten the two nuts (3) that secure the seat airbag to the side of the seat back frame. Tighten the nuts to 10 N·m (89 in. lbs.).
4. Reach between the seat back trim cover and the foam pad on the outboard side of the seat back frame to access and reconnect the seat airbag jumper wire harness (4) connector to the seat airbag inflator. Be certain that the connector latches are fully engaged.



CAUTION: Be certain that all of the trim is properly reinstalled on the front seat back frame. Failure to do so will adversely affect the function of the seat airbag system.

5. Restore the front and rear lower edges of the seat back trim cover to the base of the seat back frame.
6. Reinstall the recliner handle and, on the passenger side only, the easy entry handle to the outboard side of the seat.
7. Fold the seat back rearward for easiest access to the J-hook retainers at the base of the seat back trim cover
8. Engage the J-hook retainers that secure the front and rear lower edges of the seat back trim cover to each other at the base of the seat back.
9. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

SEAT BELT BUCKLE

REMOVAL

FRONT

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and

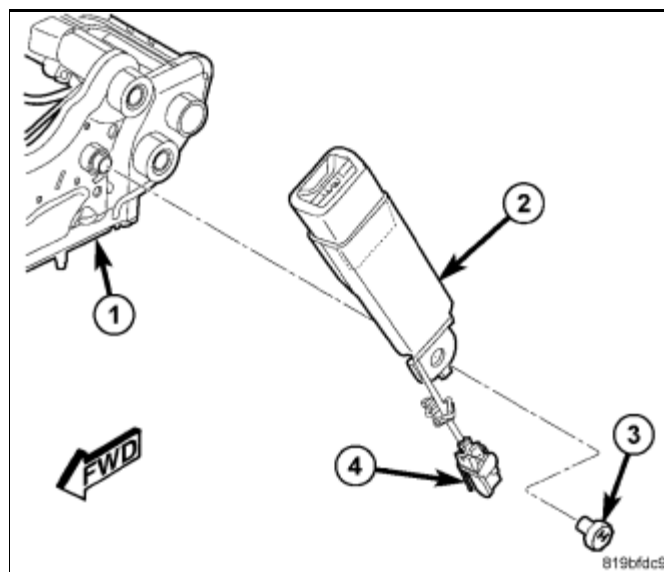
child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar® Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.

WARNING: To avoid serious or fatal injury, never strike or drop a seat weight sensor or the passenger side front seat assembly to which the sensors are secured as it can damage the sensors or affect their calibration. The seat weight sensors and the passenger side front seat assembly must be handled with care to avoid damage to the sensors. Do not sit upon or place any loads upon a passenger side front seat while it is removed from its mounts in or outside of the vehicle. If an individual sensor is dropped or damaged, replace the sensor with a new and unused unit. If a seat has been dropped during removal or loaded while removed from its mounts, replace each of the seat weight sensors with new and unused units. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

1. Move the front seat to its middle position for easiest access to the front seat mounting provisions.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the front seat from the vehicle. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
4. Disengage the inboard seat cushion trim cover J-clip from the seat cushion trim wire, and pull the inboard side of the trim cover upward far enough to access the front seat belt buckle lower anchor.
5. On the driver side only, disconnect the seat belt switch pigtail wire connector (4) from the seat wire harness.
6. Remove the screw (3) that secures the front seat belt buckle lower anchor to the inboard side of the front seat cushion frame (1).
7. Remove the seat belt buckle from the front seat cushion frame.



SECOND ROW - TWO DOOR

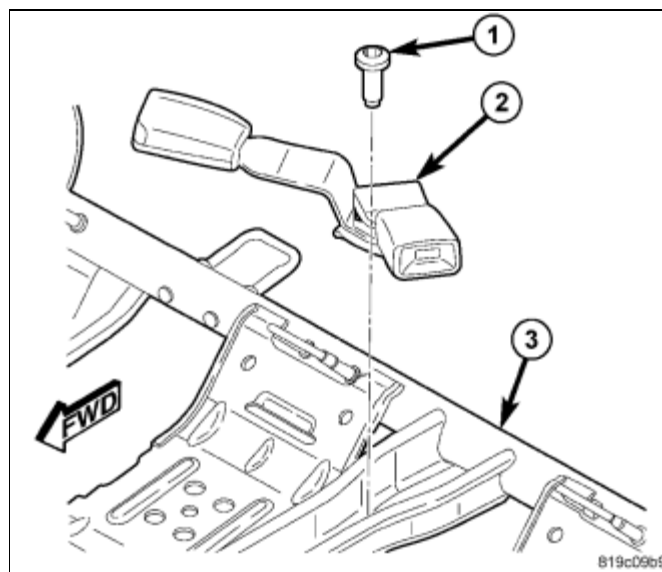
WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor

service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

1. Remove the screw (1) that secures the right and left seat belt buckle unit (2) anchor plate to the second row seat cushion frame (3).
2. Remove the buckle unit from the second row seat.

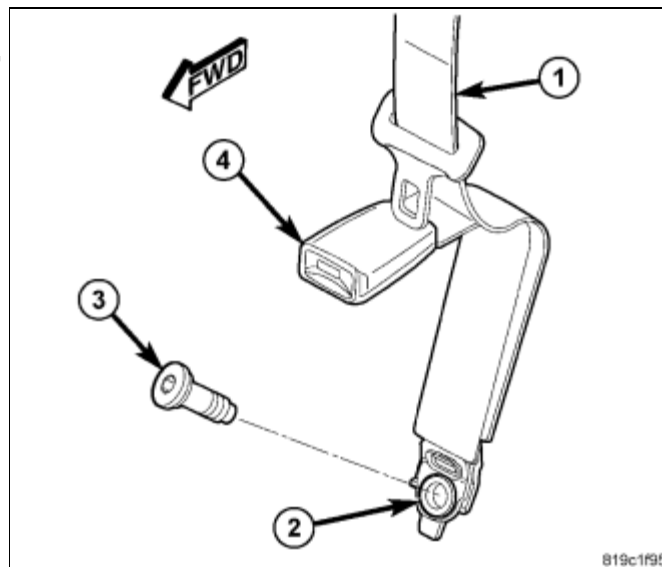
SECOND ROW - RIGHT - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.



NOTE: The anchor plates for the right second row seat belt buckle (4) and the second row center seat belt anchor (1) are secured to each other by a soft metal grommet as an assembly aid during the manufacturing process and, once removed, the grommet does not require reinstallation.

1. Fold the 60 percent second row seat back flat for easiest access to the right second row seat belt buckle (4) and the second row center seat belt anchor (1) screw.
2. Remove the screw (3) that secures the right second row seat belt buckle anchor plate and the center second row seat belt anchor plate to the rear floor panel.
3. Remove the two anchor plates from the rear floor panel as a unit.

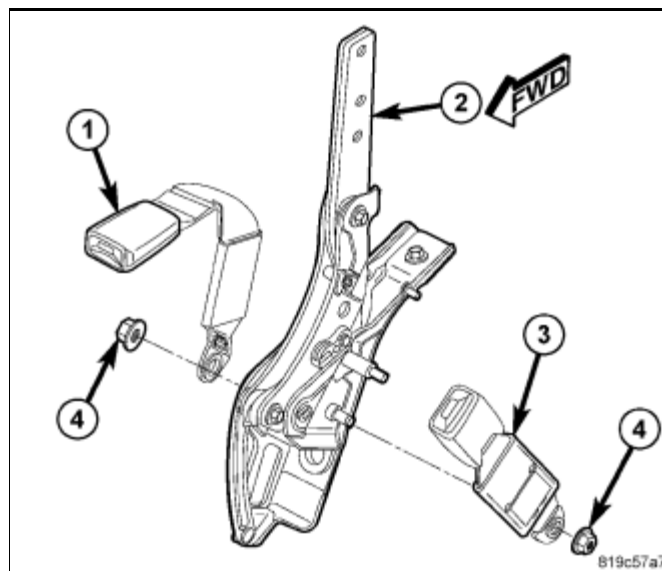


4. Using an appropriate drill or chisel, carefully remove the soft metal grommet (2) that secures the two anchor plates to each other.
5. Move the 60 percent second row seat back to the upright position.
6. Disengage the right second row seat belt buckle unit from the elastic loop integral to the seat cushion trim cover and remove the buckle from the vehicle.

SECOND ROW - CENTER AND LEFT - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

1. Fold the 60 percent second row seat back flat for easiest access to the center seat belt buckle (1) anchor, or the 40 percent seat back flat for easiest access to the left seat belt buckle (3) anchor.
2. Remove the nut (4) that secures the center or the left seat belt buckle anchor plate to the stud on the center seat bracket, hinge and latch unit (2).
3. Remove the buckle anchor plate from the stud.
4. Move the second row seat back to the upright position.
5. Disengage the center or left second row seat belt buckle unit from the elastic loop integral to the seat cushion trim cover and remove the buckle from the vehicle.



INSTALLATION

FRONT

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect

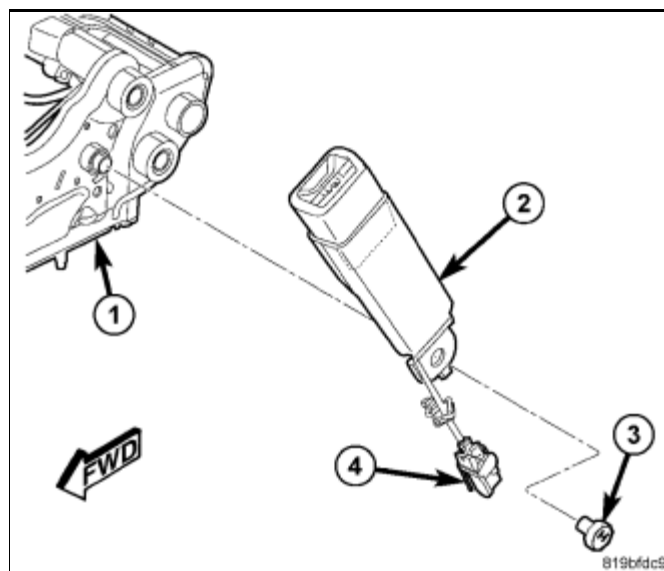
and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar® Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.

WARNING: To avoid serious or fatal injury, never strike or drop a seat weight sensor or the passenger side front seat assembly to which the sensors are secured as it can damage the sensors or affect their calibration. The seat weight sensors and the passenger side front seat assembly must be handled with care to avoid damage to the sensors. Do not sit upon or place any loads upon a passenger side front seat while it is removed from its mounts in or outside of the vehicle. If an individual sensor is dropped or damaged, replace the sensor with a new and unused unit. If a seat has been dropped during removal or loaded while removed from its mounts, replace each of the seat weight sensors with new and unused units. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with the Occupant Classification System (OCS), any time the passenger side front seat assembly has been removed or loosened from the vehicle for service of any vehicle component or system the Occupant Classification System Verification Test must be performed using a diagnostic scan tool and the Occupant Classification Seat Weight special tool following reinstallation. Refer to the appropriate diagnostic procedures. Failure to observe this warning could result in an accidental, incomplete, or improper passenger side front supplemental restraint deployment.

1. Position the front seat belt buckle (2) lower anchor onto the inboard side of the seat cushion frame (1).
2. Install and tighten the screw (3) that secures the front seat belt buckle lower anchor to the seat cushion frame. Tighten the screw to 45 N·m (33 ft. lbs.).
3. On the driver side only, reconnect the seat belt switch pigtail wire connector (4) to the seat wire harness.
4. Reinstall the inboard seat cushion trim cover J-clip onto the seat cushion trim wire.
5. Reinstall the front seat into the vehicle. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION).
6. For the driver side on all vehicles or the passenger side on vehicles that are not equipped with the Occupant Classification System (OCS), reconnect the battery negative cable.



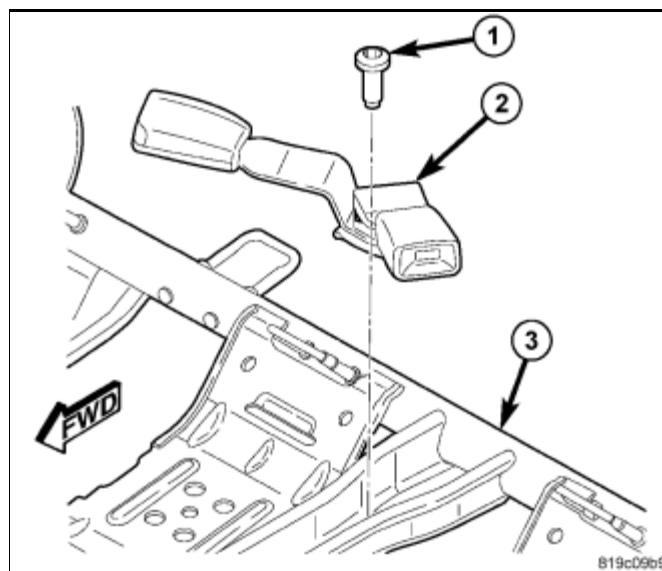
7. For the passenger side on vehicles equipped with the (OCS) only, do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

8. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool and the Occupant Classification Seat Weight special tool. Refer to the appropriate diagnostic procedures.

SECOND ROW - TWO DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

1. Position the right and left seat belt buckle unit (2) anchor plate to the second row seat cushion frame (3).
2. Install and tighten the screw (1) that secures the anchor plate and buckle unit to the seat cushion frame. Tighten the screw to 55 N·m (41 ft. lbs.).



SECOND ROW - RIGHT - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

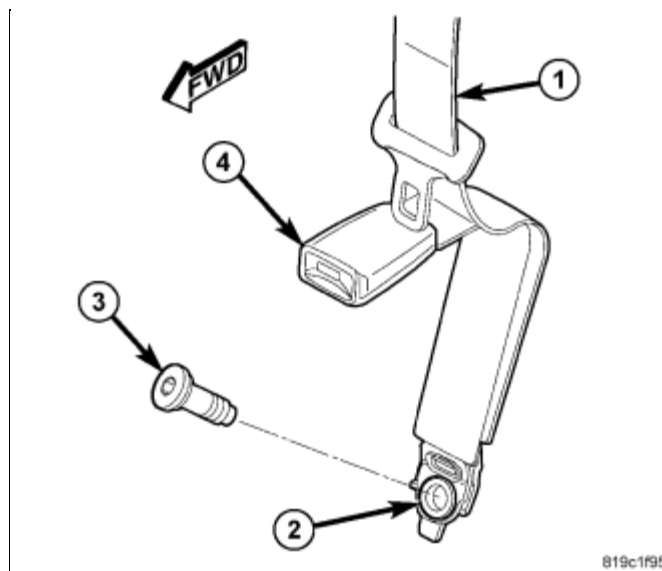
NOTE: The anchor plates for the right second row seat belt buckle (4) and the second row center seat belt anchor (1) are secured to each other by a soft metal grommet as an assembly aid during the manufacturing process and, once removed, the grommet does not require reinstallation.

1. With the 60 percent second row seat back in the upright position, engage the anchor plate and webbing for the right second row seat belt buckle unit through the elastic loop integral to the seat cushion trim cover and between the seat back and cushion.

2. Fold the 60 percent second row seat back flat for easiest access to the right second row seat belt buckle (4) and the second row center seat belt anchor (1) location.

3. Install and tighten the screw (3) that secures the anchor plates to the rear floor panel. Tighten the screw to 61 N·m (45 ft. lbs.).

4. Restore the 60 percent second row seat back to the upright position.



SECOND ROW - CENTER AND LEFT - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

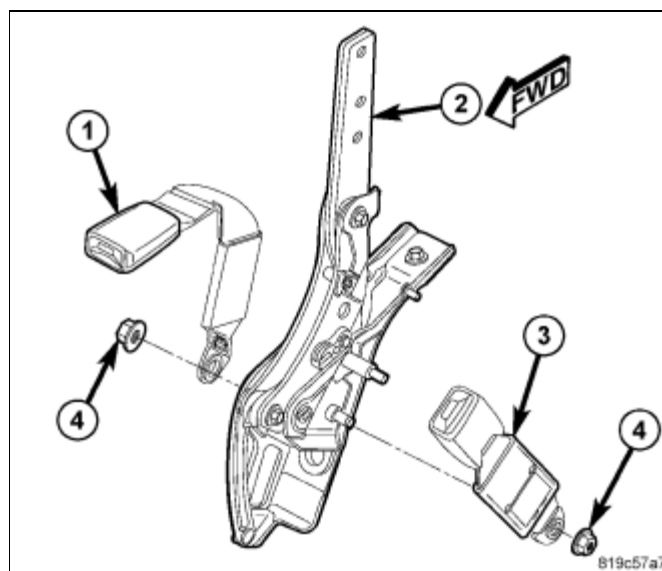
1. With both second row seat backs in the upright position, engage the anchor plate and webbing for the center or left second row seat belt buckle unit through the elastic loop integral to the seat cushion trim cover and between the seat back and cushion.

2. Fold the 60 percent second row seat back flat for easiest access to the center seat belt buckle (1) anchor, or the 40 percent seat back flat for easiest access to the left seat belt buckle (3) anchor.

3. Position the center or left seat belt buckle unit anchor plate onto the stud on the center seat bracket, hinge and latch unit (2).

4. Install and tighten the nut (4) that secures the buckle unit to the stud. Tighten the nut to 45 N·m (33 ft. lbs.).

5. Restore the second row seat back to the upright position.



SEAT BELT AND RETRACTOR

DESCRIPTION

The seat belt retractors used in all seating positions include an inertia-type, emergency locking mechanism as standard equipment. However, the retractor locking mechanisms for all seating positions except for the driver side front are mechanically switchable from an emergency locking retractor to an automatic locking retractor. The primary function of this feature is to securely accommodate a child seat in any of these seating positions of the vehicle without the need for a self-cinching seat belt tip half latch plate unit or another supplemental device that would be required to prevent the seat belt webbing from unwinding freely from the retractor spool of an inertia-type emergency locking retractor mechanism.

The automatic locking mechanism is integral to the seat belt and retractor unit and is concealed beneath a molded plastic cover located on one side of the retractor spool. The automatic locking mechanism cannot be adjusted or repaired and, if ineffective or damaged, the entire seat belt and retractor unit must be replaced.

OPERATION

The locked mode of the automatic locking retractor is engaged and the retractor is switched from operating as a standard inertia-type emergency locking retractor by first buckling the combination lap and shoulder belt buckle. Then grasp the shoulder belt and pull all of the webbing out of the retractor. Once all of the belt webbing is extracted from the spool, the retractor will automatically become engaged in the pre-locked automatic locking mode and will make a light, audible clicking or ratcheting sound as the shoulder belt is allowed to retract to confirm that the automatic locking mode is now engaged. Once the automatic locking mode is engaged, the retractor will remain locked and the belt will remain tight around whatever it is restraining.

The retractor is returned to standard emergency locking (inertia) mode by unbuckling the combination lap and shoulder belt buckle and allowing the belt webbing to be almost fully retracted onto the retractor spool. The emergency locking mode is confirmed by the absence of the light, audible clicking or ratcheting sound as the belt webbing retracts. This mode will allow the belt to unwind from and wind onto the retractor spool freely unless and until a predetermined inertia load is sensed, or until the retractor is again switched to the automatic locking mode.

REMOVAL

FRONT - TWO DOOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

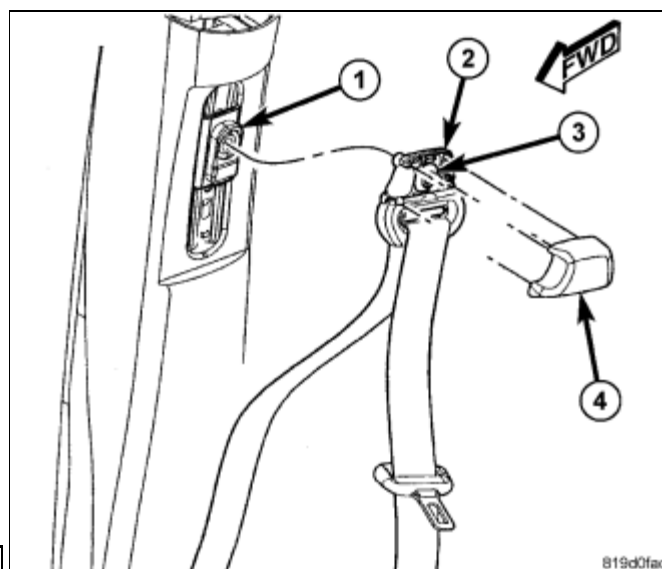
WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the

DaimlerChrysler Mopar® Parts Catalog.

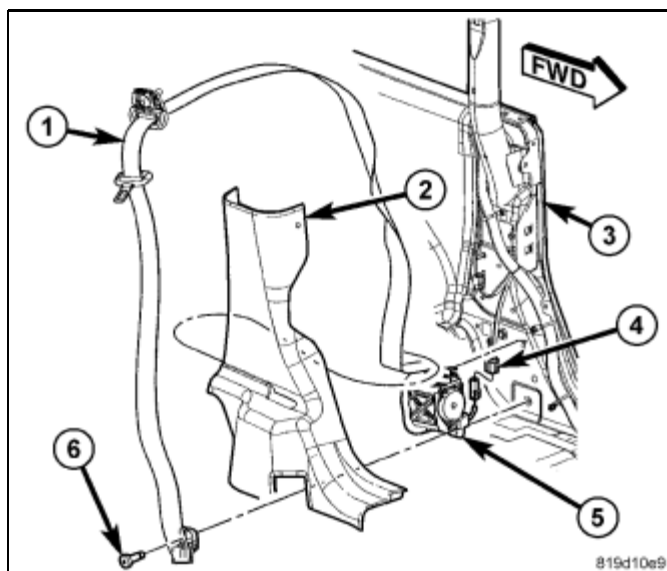
NOTE: The following procedure is for replacement of an ineffective or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is ineffective or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Adjust the front seat to its most forward position for easiest access to the front seat belt lower anchor and the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Unsnap the trim cover (4) from the front seat belt turning loop (2) and discard.
4. Remove the screw (3) that secures the seat belt turning loop to the height adjuster (1) on the upper sport bar.
5. Remove the seat belt turning loop from the height adjuster.



6. Remove the trim (2) from the lower B-pillar (3). (Refer to 23 -



BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

7. Disengage the seat belt webbing (1) through the slot from the seat belt opening in the lower B-pillar trim.
8. Disconnect the yellow body wire harness connector (4) from the seat belt tensioner initiator on the retractor (5).

9. Remove the screw (6) that secures the seat belt lower anchor and the retractor lower bracket to the base of the inner B-pillar.
10. Remove the front seat belt and retractor from the B-pillar as a unit.

FRONT - FOUR DOOR

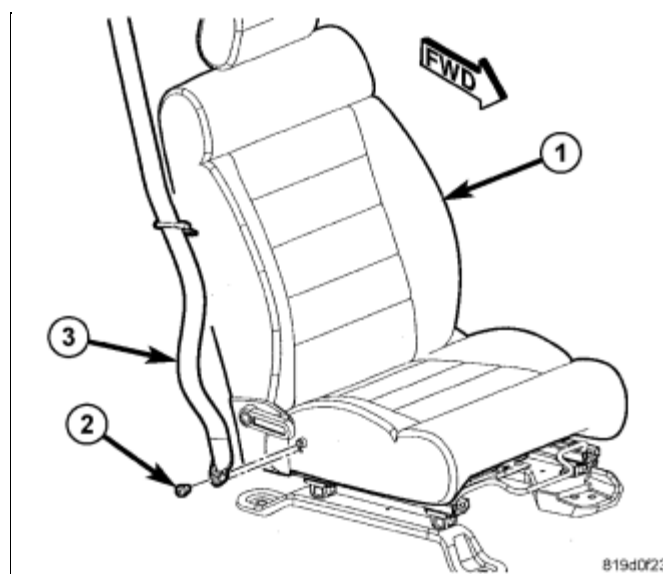
WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

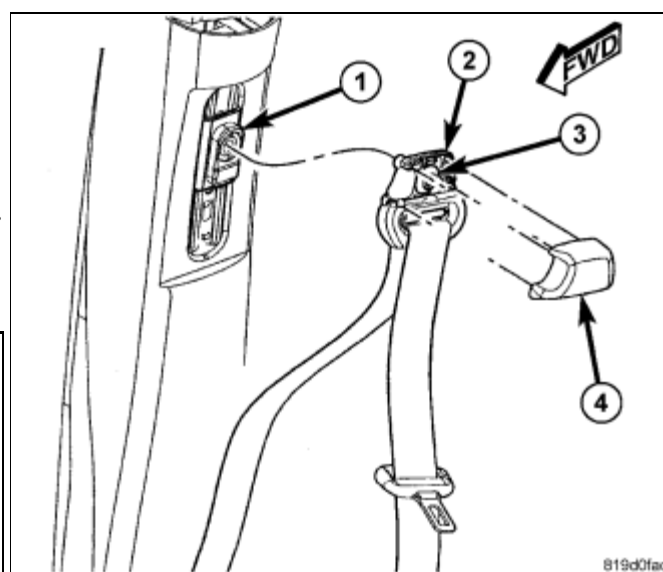
NOTE: The following procedure is for replacement of an ineffective or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is ineffective or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

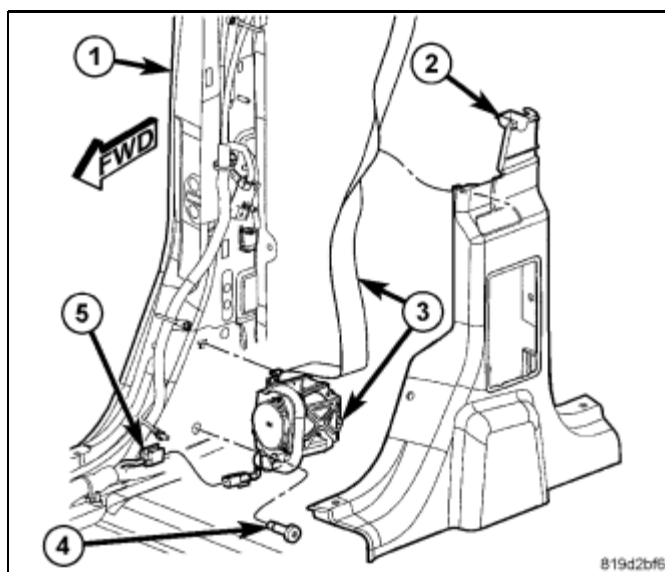
1. Adjust the front seat (1) to its most forward position for easiest access to the front seat belt (3) lower anchor and the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the screw (2) that secures the lower anchor to the outboard side of the front seat cushion frame.



4. Unsnap the trim cover (4) from the front seat belt turning loop (2) and discard.
5. Remove the screw (3) that secures the seat belt turning loop to the height adjuster (1) on the upper B-pillar.
6. Remove the seat belt turning loop from the height adjuster.



7. Remove the lower trim (2) from the inside of the B-pillar (1). (Refer to 23 -



BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

8. Disengage the seat belt webbing (3) through the slot from the seat belt opening in the lower B-pillar trim.
9. Disconnect the yellow body wire harness connector (5) from the seat belt tensioner initiator on the retractor.
10. Remove the screw (4) that secures the lower retractor bracket to the B-pillar.
11. Remove the front seat belt and retractor from the B-pillar as a unit.

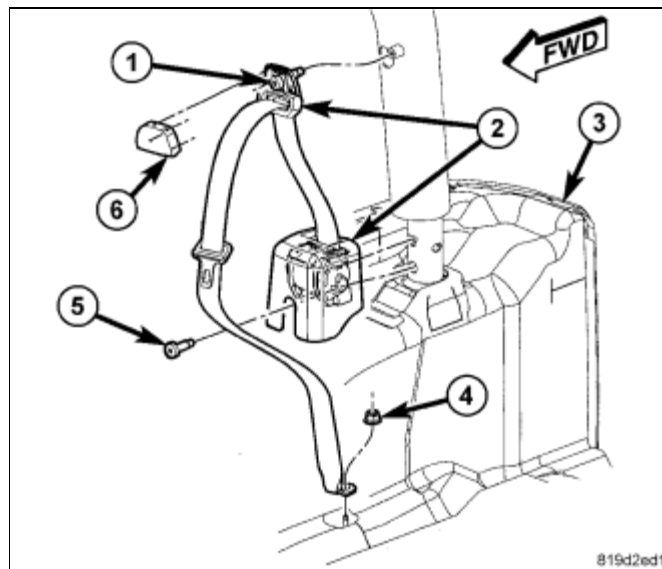
SECOND ROW - TWO DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any

belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

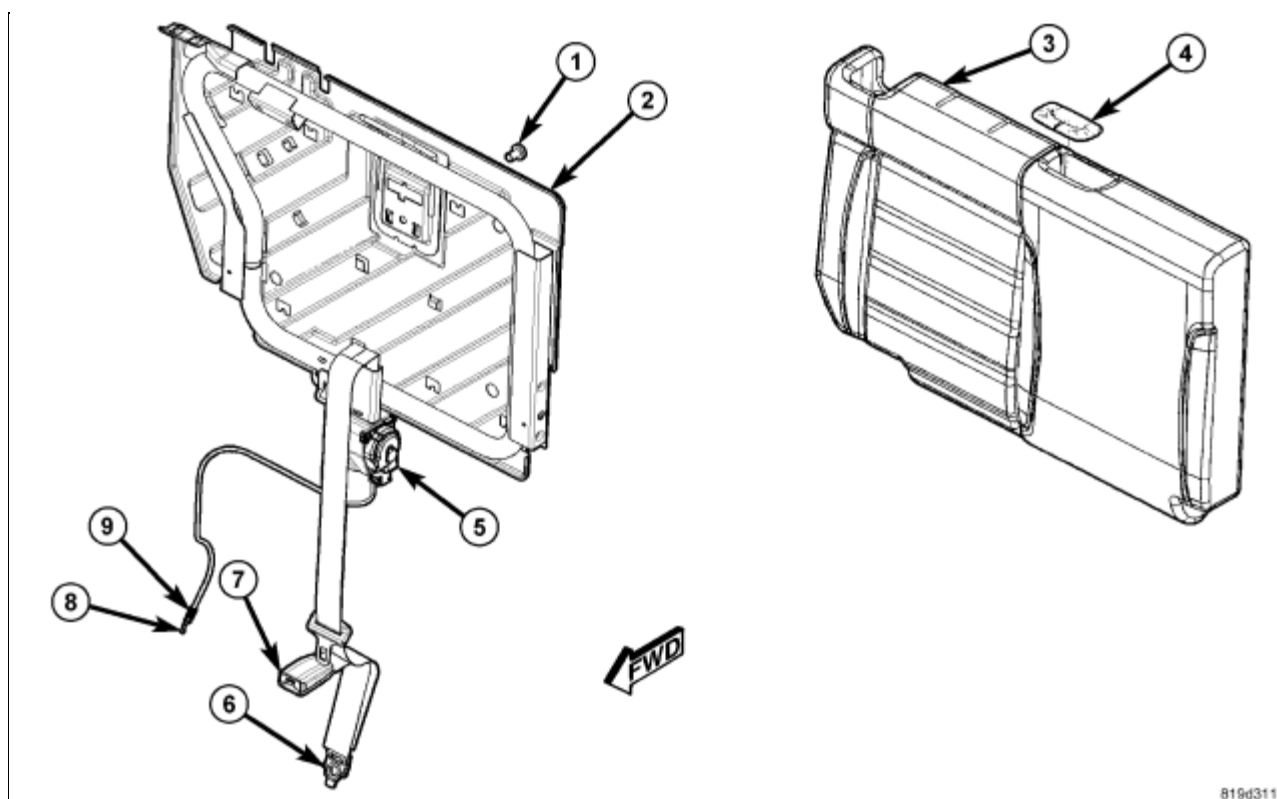
1. Remove the nut (4) that secures the second row seat belt lower anchor to the stud on the rear floor panel.
2. Unsnap the trim cover (6) from the second row seat belt turning loop and discard.
3. Remove the screw (1) that secures the turning loop to the upper rear sport bar.
4. Remove the screw (5) that secures the second row retractor lower bracket to the base of the rear sport bar.
5. Remove the second row seat belt and retractor unit (2) from the rear sport bar.



SECOND ROW CENTER - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).



NOTE: The anchor plates for the right second row seat belt buckle (7) and the second row center seat belt anchor (6) are secured to each other by a soft metal grommet as an assembly aid during the manufacturing process and, once removed, the grommet does not require reinstallation.

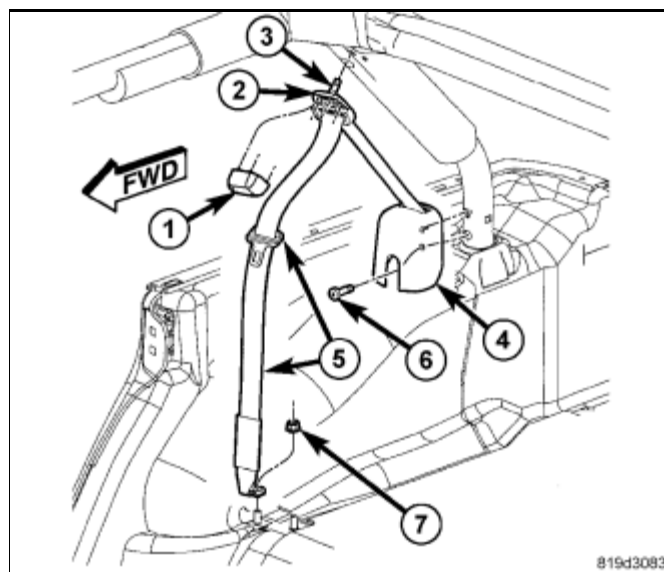
1. Remove the right second row seat belt buckle (7) and center seat belt lower anchor unit (6) from the rear floor panel and separate them from each other. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - SECOND ROW CENTER - FOUR DOOR - REMOVAL)
2. Remove the second row seat from the vehicle as a unit and place it on a suitable work surface. Be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL).
3. Remove the bezel (4), trim cover (3) and foam from the 60 percent seat back panel (2). (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - REMOVAL).
4. Disengage the retractor locking cable housing (9) and cable end (8) from the right outboard seat back latch mechanism.
5. Remove the screw (1) that secures the second row center seat belt retractor (5) to the seat back panel.
6. Remove the second row center seat belt and retractor unit from the seat back panel.

SECOND ROW OUTBOARD - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Remove the nut (7) that secures the second row seat belt (5) lower anchor to the stud on the rear floor panel.
2. Unsnap the trim cover (1) from the second row seat belt turning loop (2) and discard.
3. Remove the screw (3) that secures the turning loop to the upper rear sport bar.
4. Remove the screw (6) that secures the second row retractor (4) lower bracket to the base of the rear sport bar.
5. Remove the second row seat belt and retractor unit from the rear sport bar.



INSTALLATION

FRONT - TWO DOOR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

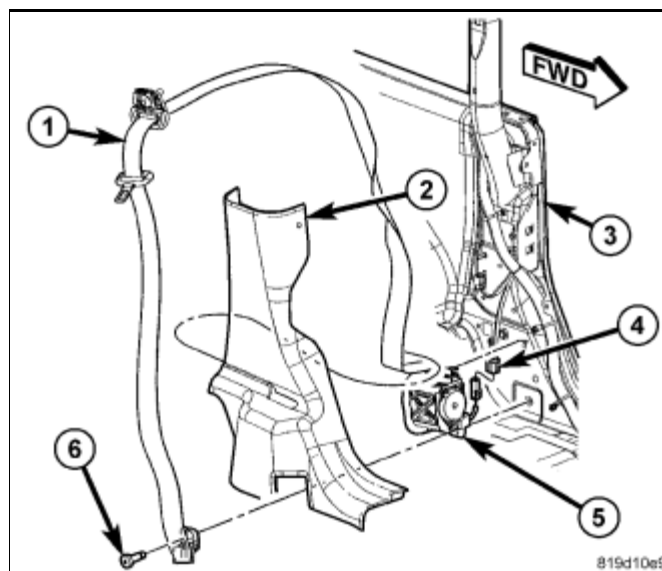
WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: The following procedure is for replacement of an ineffective or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is ineffective or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

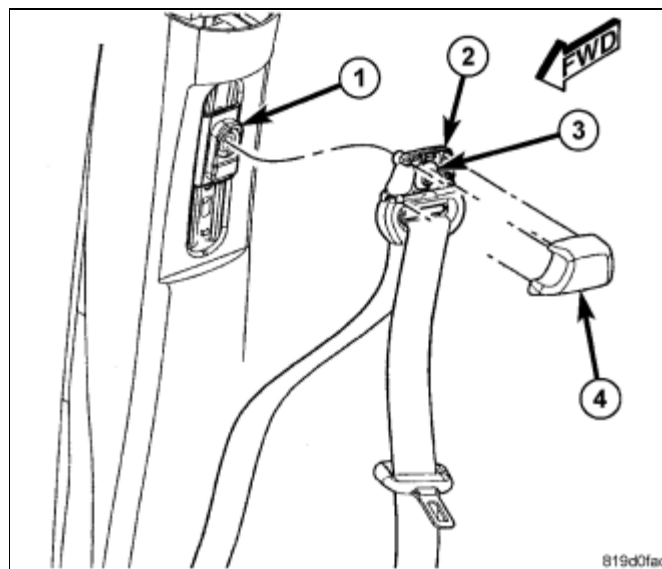
NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND

RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Position the seat belt (1) and retractor (5) to the inner B-pillar (3) as a unit. Be certain to engage the tab on the upper retractor bracket into the hole in the B-pillar.
2. Position the seat belt lower anchor to the mounting hole in the lower retractor bracket. Be certain that the seat belt webbing between the retractor and the lower anchor is not twisted.
3. Install and tighten the screw (6) that secures the lower retractor bracket and the seat belt lower anchor to the base of the inner B-pillar. Tighten the screw to 40 N·m (30 ft. lbs.).
4. Reconnect the yellow body wire harness connector (4) to the seat belt tensioner initiator on the retractor.
5. Engage the seat belt webbing through the slot into the seat belt opening in the lower B-pillar trim (2).
6. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).



7. Position the seat belt turning loop (2) onto the height adjuster (1) on the upper sport bar. Be certain that the seat belt webbing between the retractor and the lower anchor is not twisted.
8. Install and tighten the screw (3) that secures the turning loop to the height adjuster. Tighten the screw to 40 N·m (30 ft. lbs.).
9. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.
10. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

**FRONT - FOUR DOOR**

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

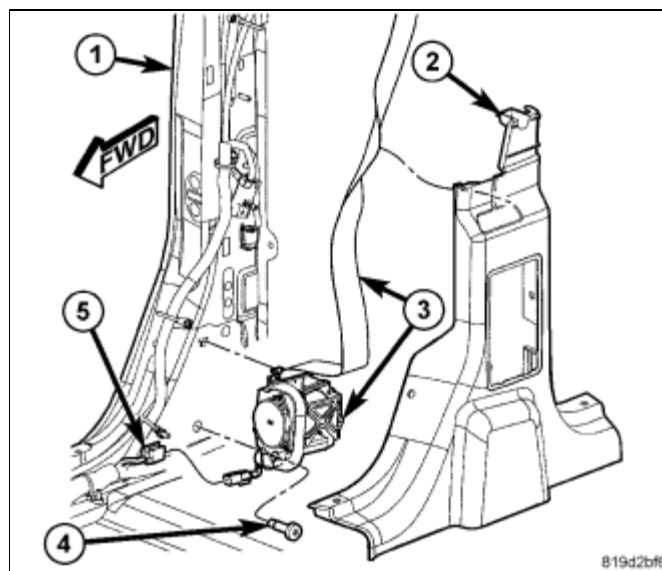
WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor

service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: The following procedure is for replacement of an ineffective or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is ineffective or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

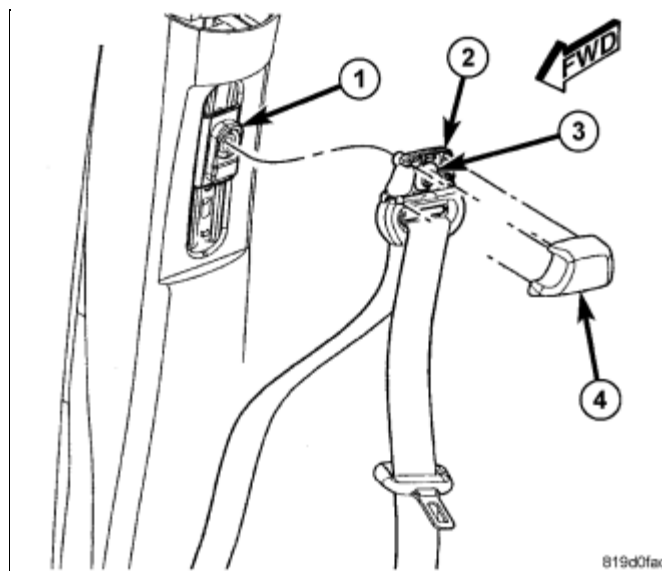
NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Position the seat belt and retractor (3) to the inner B-pillar (1) as a unit. Be certain to engage the tab on the upper retractor bracket into the hole in the B-pillar.
2. Install and tighten the screw (4) that secures the retractor lower bracket to the base of the inner B-pillar. Tighten the screw to 40 N·m (30 ft. lbs.).
3. Reconnect the yellow body wire harness connector (5) to the seat belt tensioner initiator on the retractor.
4. Engage the seat belt webbing through the slot into the seat belt opening in the lower B-pillar trim (2).
5. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).



6. Position the seat belt turning loop (2) onto the height adjuster (1) on the upper sport bar. Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.
7. Install and tighten the screw (3) that secures the turning loop to the height adjuster. Tighten the screw to 40 N·m (30 ft. lbs.).
8. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the

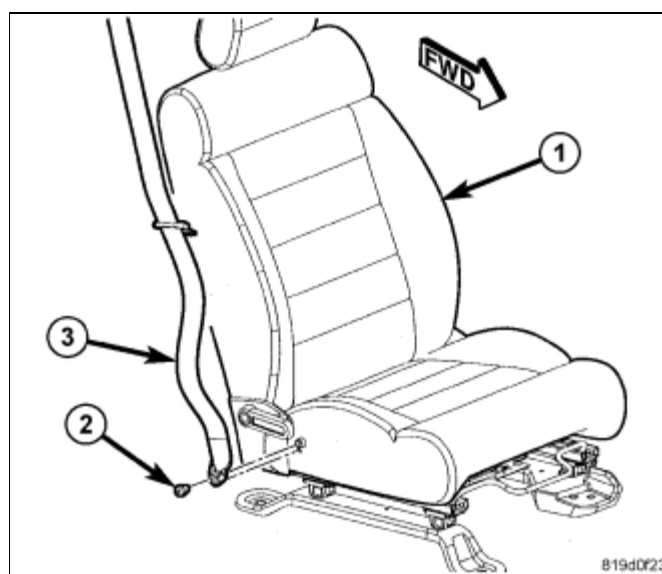
trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.



9. Position the seat belt (3) lower anchor to the mounting hole on the outboard side of the front seat (1) cushion frame. Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.

10. Install and tighten the screw (2) that secures the lower anchor to the seat. Tighten the screw to 40 N·m (30 ft. lbs.).

11. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



SECOND ROW - TWO DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Position the second row seat belt and retractor unit (2) to the base of the rear sport bar. Be certain to engage the tab on the upper retractor bracket into the hole in the sport bar.

2. Install and tighten the screw (5) that secures the retractor lower bracket to the base of the rear sport bar. Tighten the screw to 40 N·m (30 ft. lbs.).

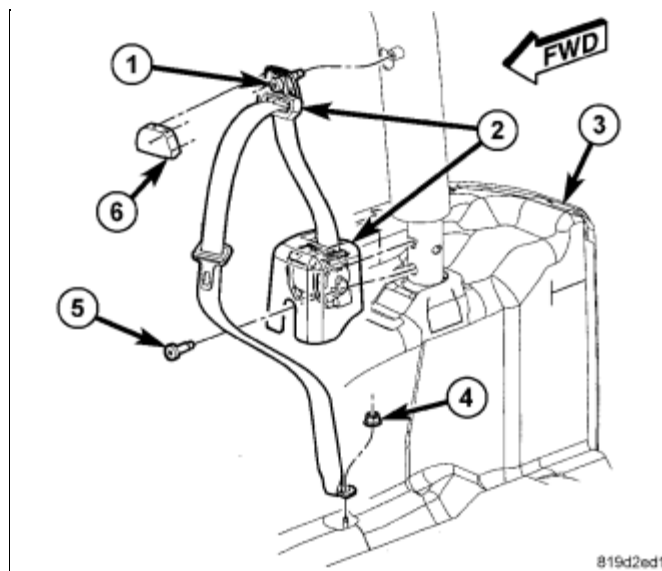
3. Position the second row seat belt turning loop to the upper rear sport bar. Be certain the seat belt webbing between the retractor and the turning loop is not twisted.

4. Install and tighten the screw (1) that secures the turning loop to the sport bar. Tighten the screw to 40 N·m (30 ft. lbs.).

5. Engage the upper edge of a new trim cover (6) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

6. Position the second row seat belt lower anchor onto the stud on the rear floor panel. Be certain the seat belt webbing between the turning loop and the lower anchor is not twisted.

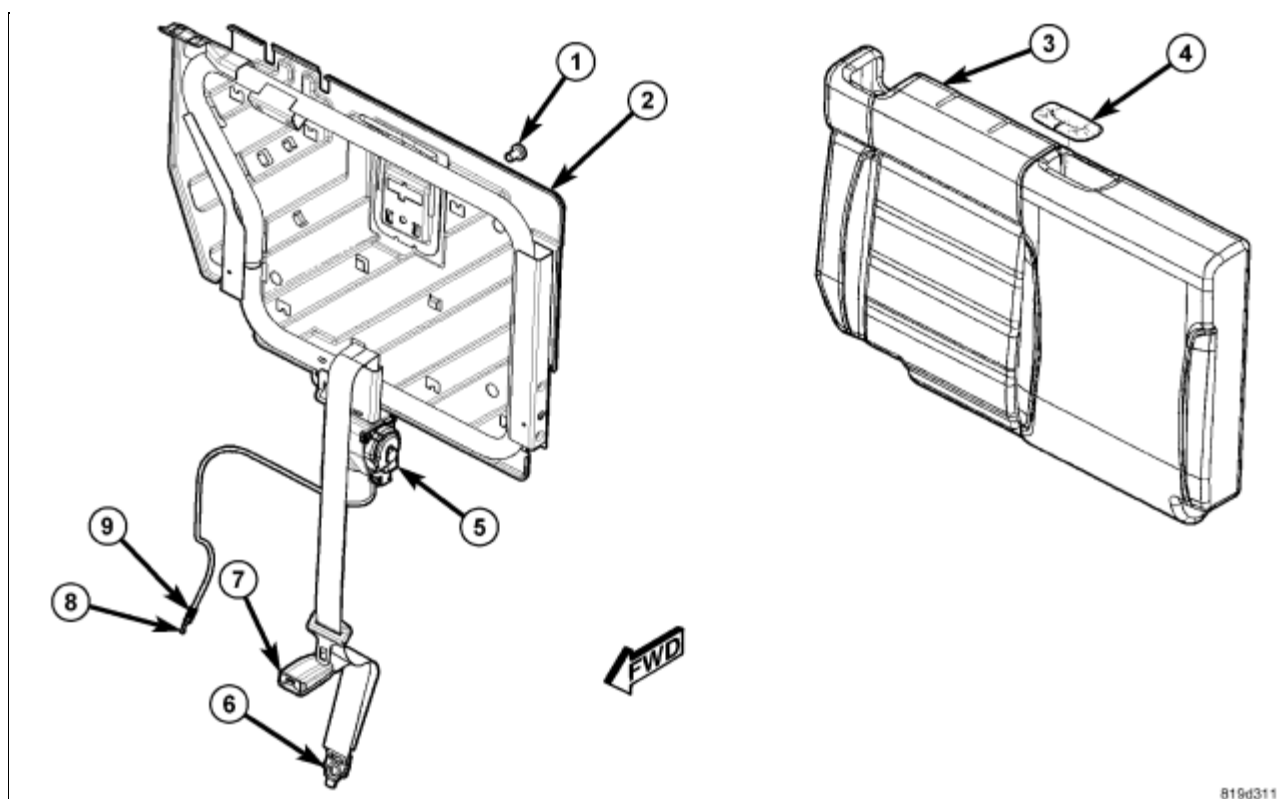
7. Install and tighten the nut (4) that secures the lower anchor to the stud on the rear floor panel. Tighten the nut to 40 N·m (30 ft. lbs.).



SECOND ROW CENTER - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).



NOTE: The anchor plates for the right second row seat belt buckle (7) and the second row center seat belt anchor (6) are secured to each other by a soft metal grommet as an assembly aid during the manufacturing process and, once removed, the grommet does not require reinstallation.

1. Position the second row center seat belt and retractor unit (5) onto the 60 percent seat back panel (2). Be certain to engage the tab on the retractor frame into the hole in the back panel.
2. Install and tighten the screw (1) that secures the retractor to the seat back panel. Tighten the screw to 55 N·m (41 ft. lbs.).
3. Engage the retractor locking cable end (8) and cable housing with the right outboard seat back latch mechanism.
4. Reinstall the foam, trim cover (3) and bezel (4) onto the seat back panel. Be certain the seat belt webbing between the retractor and the bezel is not twisted. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - INSTALLATION).
5. Reinstall the second row seat into the vehicle as a unit. (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).
6. Reinstall the right second row seat belt buckle (7) and center seat belt lower anchor unit (6) onto the rear floor panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - SECOND ROW RIGHT - FOUR DOOR - INSTALLATION).

SECOND ROW OUTBOARD - FOUR DOOR

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and

child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

NOTE: All seat belt retractors except the driver side front retractor include a switchable automatic locking mechanism. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT AND RETRACTOR/AUTOMATIC LOCKING RETRACTOR - DESCRIPTION).

1. Position the second row seat belt and retractor unit (4) to the base of the rear sport bar. Be certain to engage the tab on the upper retractor bracket into the hole in the sport bar.

2. Install and tighten the screw (6) that secures the retractor lower bracket to the base of the rear sport bar. Tighten the screw to 40 N·m (30 ft. lbs.).

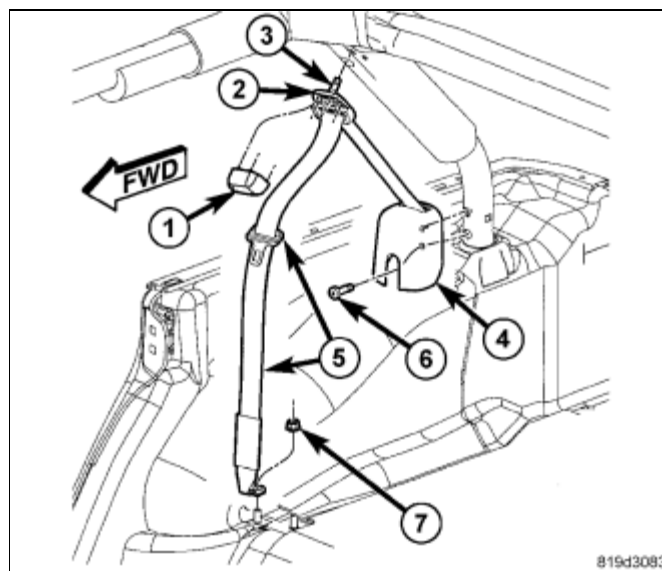
3. Position the second row seat belt turning loop (2) to the upper rear sport bar. Be certain the seat belt webbing between the retractor and the turning loop is not twisted.

4. Install and tighten the screw (3) that secures the turning loop to the sport bar. Tighten the screw to 40 N·m (30 ft. lbs.).

5. Engage the upper edge of a new trim cover (1) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

6. Position the second row seat belt (5) lower anchor onto the stud on the rear floor panel. Be certain the seat belt webbing between the turning loop and the lower anchor is not twisted.

7. Install and tighten the nut (7) that secures the lower anchor to the stud on the rear floor panel. Tighten the nut to 40 N·m (30 ft. lbs.).



SEAT BELT SWITCH

DESCRIPTION

All vehicles are equipped with a driver side seat belt switch that is a small, normally open, single pole, single throw, leaf contact, momentary switch. The driver side seat belt switch is integral to the buckle of the driver side front seat belt buckle, which is secured by a screw to the inboard side of the driver side front seat cushion frame.

The seat belt switch is connected to the vehicle electrical system through a two-lead pigtail wire and connector (4) on the seat belt buckle-half, which is connected to a wire harness connector and take out of the seat wire harness routed beneath the driver side front seat cushion in the passenger compartment.

The seat belt switch cannot be adjusted or repaired. If ineffective or damaged, the entire driver side front seat belt buckle-half unit must be replaced.

OPERATION

The driver side seat belt switch is a hard wired input to the Totally Integrated Power Module (TIPM), which provides electronic driver side seat belt switch status messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the Controller Area Network (CAN) data bus.

The EMIC controls the seat belt indicator based upon the electronic seat belt switch status message inputs.

When the driver side front seat belt tip-half is inserted into the seat belt buckle, the switch closes the path to ground; and, when the driver side front seat belt tip-half is removed from the seat belt buckle, the switch opens the ground path. The switch is actuated by the latch mechanism within the seat belt buckle.

The seat belt switch is connected in series between ground and the seat belt switch sense input of the TIPM. The seat belt switch receives ground at all times through its pigtail wire connection to the seat wire harness from a take out of the body wire harness. An eyelet terminal connector on the body wire harness ground take out is secured beneath a ground screw on the left cowl side inner panel, beneath the instrument panel.

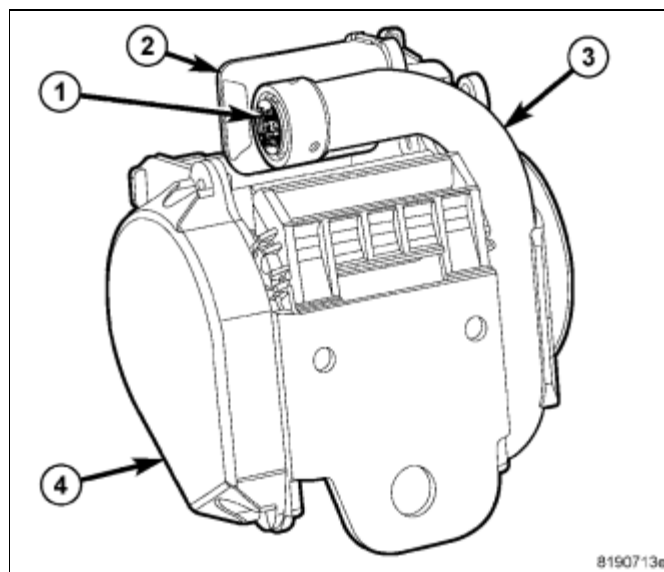
The seat belt switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the electronic controls or communication between other modules and devices that provide features of the supplemental restraint system. The most reliable, efficient, and accurate means to diagnose the seat belt switch or the electronic controls and communication related to seat belt switch operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

SEAT BELT TENSIONER

DESCRIPTION

Seat belt tensioners supplement the dual front airbags for this vehicle. The seat belt tensioners are integral to the front seat belt retractor units (4), which are secured to the inner B-pillar on the right and left sides of the vehicle. The retractor is concealed beneath the molded plastic inner B-pillar trim.

The seat belt tensioner consists primarily of a sprocket/pinion, a steel tube (3), a cast metal housing, numerous steel balls, a stamped metal ball trap (2), a torsion bar and a small pyrotechnically activated gas generator with a connector receptacle (1). All of these components are located on one side of the retractor spool on the outside of the retractor housing except for the torsion bar, which serves as the spindle upon which the retractor spool rides. The seat belt tensioners are controlled by the Occupant Restraint Controller (ORC) and are connected to the vehicle electrical system through a dedicated take out of the body wire harness by a keyed and latching yellow molded plastic connector insulator to ensure a secure connection.



The seat belt tensioners cannot be repaired and, if ineffective or damaged, the entire front seat belt and retractor unit must be replaced. If the front airbags have been deployed, the seat belt tensioners have also been deployed. The seat belt tensioners are not intended for reuse and must be replaced following any front airbag deployment. A growling or grinding sound while attempting to operate the seat belt retractor is a sure indication that the seat belt tensioner has been deployed and requires replacement. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT AND RETRACTOR - REMOVAL).

OPERATION

The seat belt tensioners are deployed in conjunction with the dual front airbags by a signal generated by the Occupant Restraint Controller (ORC) through the driver or passenger seat belt tensioner line 1 and line 2 (or squib) circuits. When the ORC sends the proper electrical signal to the tensioners, the electrical energy generates enough heat to initiate a small pyrotechnic gas generator.

The gas generator is installed in one end of a steel tube that contains numerous steel balls. As the gas expands, it pushes the steel balls through the tube into a cast metal housing, where a ball guide directs the balls into engagement with the teeth of a sprocket that is geared to one end of the retractor spool. As the balls drive past the sprocket, the sprocket turns and drives the seat belt retractor spool causing the slack to be removed from the front seat belts. The ball trap captures the balls as they leave the sprocket and are expelled from the housing.

Removing excess slack from the front seat belts not only keeps the occupants properly positioned for an airbag deployment following a frontal impact of the vehicle, but also helps to reduce injuries that the occupant might experience in these situations as a result of harmful contact with the steering wheel, steering column, instrument panel or windshield. Also, the seat belt tensioner torsion bar that the retractor spool rides upon is designed to deform in order to control the loading being applied to the occupants by the seat belts during a frontal impact, further reducing the potential for occupant injuries.

The ORC monitors the condition of the seat belt tensioners through circuit resistance, and will illuminate the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and store a Diagnostic Trouble Code (DTC) for any fault that is detected. Proper diagnosis of the seat belt tensioner gas generator and the seat belt tensioner squib circuits requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

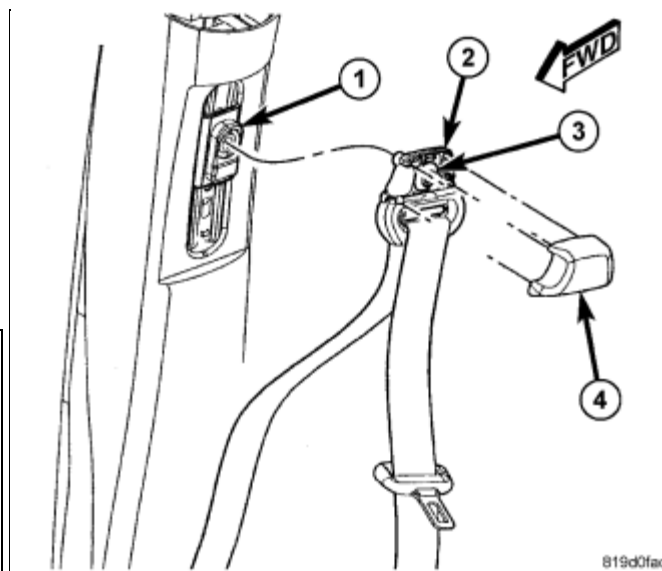
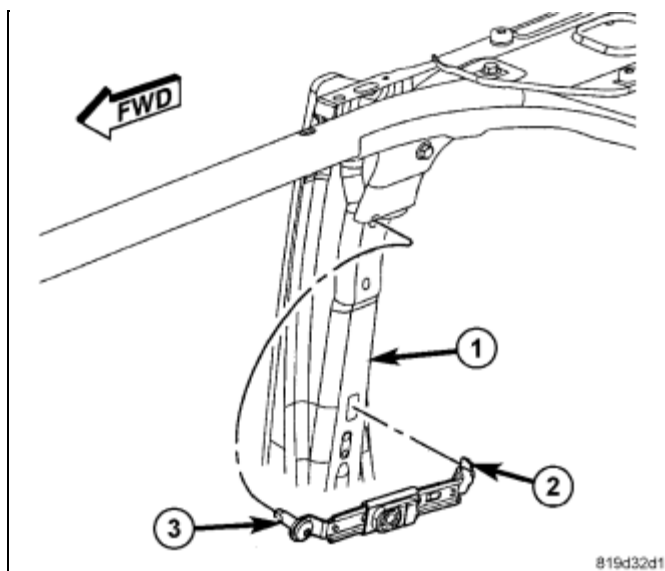
SEAT BELT TURNING LOOP ADJUSTER

REMOVAL

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

1. Unsnap the trim cover (4) from the front seat belt turning loop (2) and discard.
2. Remove the screw (3) that secures the seat belt turning loop to the height adjuster (1) on the upper sport bar.
3. Remove the seat belt turning loop from the height adjuster.

4. Remove the trim from the upper inner sport bar (2-door) or B-pillar (4-door) (1). (Refer to 23 -



BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

5. Remove the screw (3) that secures the seat belt turning loop height adjuster to the upper inner sport bar (2-door) or B-pillar (4-door).
 6. Rotate the top of the adjuster downward 90 degrees, then pull the lower tab (2) out of the slot in the sport bar (2-door) or B-pillar (4-door).
 7. Remove the adjuster from the vehicle.

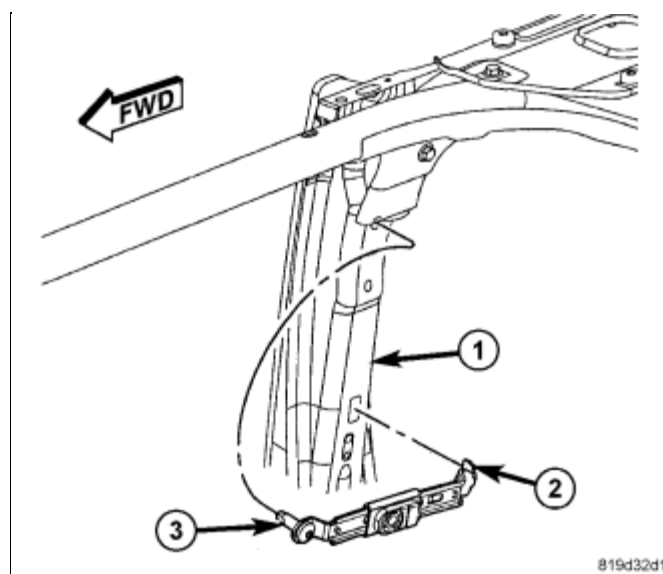
INSTALLATION

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

1. Holding the seat belt turning loop adjuster horizontally, insert the tab (2) on the lower end of the adjuster into the slot in the upper inner sport bar (2-door) or B-pillar (4-door) (1).
2. Rotate the top of the adjuster upward 90 degrees.
3. Install and tighten the screw (3) that secures the top of the

adjuster to the upper inner sport bar (2-door) or B-pillar (4-door). Tighten the screw to 40 N·m (30 ft. lbs.).

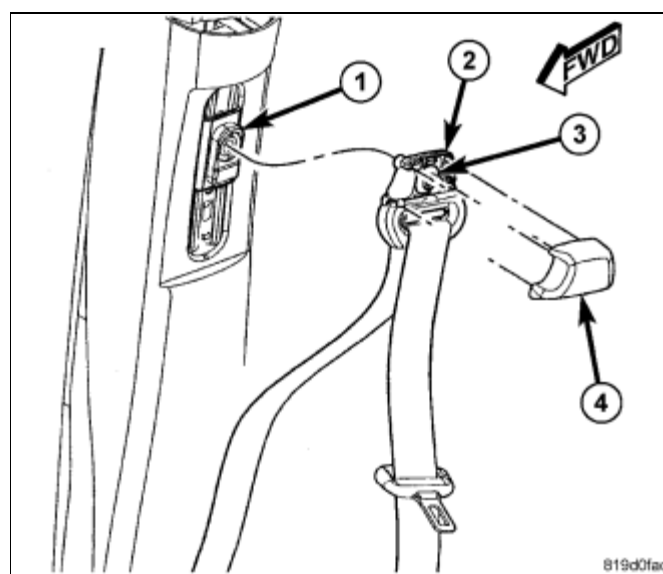
4. Reinstall the trim onto the upper inner sport bar (2-door) or B-pillar (4-door). (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).



5. Position the seat belt turning loop (2) onto the height adjuster (1) on the upper sport bar. Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.

6. Install and tighten the screw (3) that secures the turning loop to the height adjuster. Tighten the screw to 40 N·m (30 ft. lbs.).

7. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

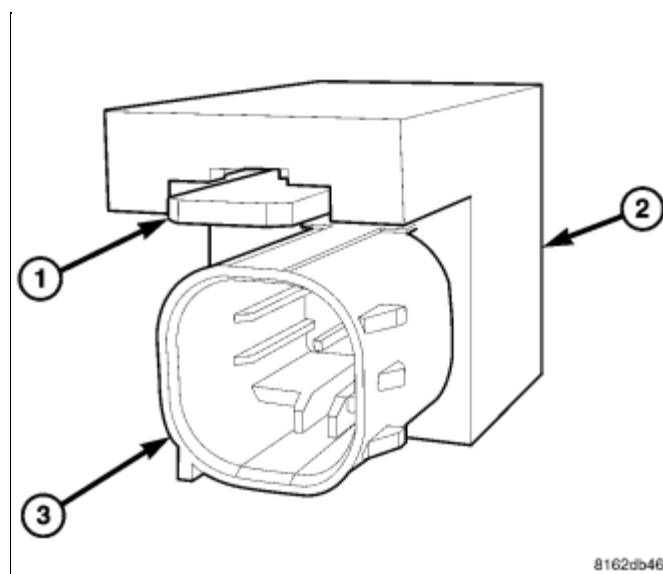


SEAT TRACK POSITION SENSOR

DESCRIPTION

The seat track position sensor (2) is a Hall Effect-type sensor used on some vehicles. This sensor consists of a Hall Effect Integrated Circuit (IC) chip encased in potting material within a cavity of the molded plastic sensor housing.

The sensor housing has a mounting slot containing an integral latch feature (1) and slides and latches onto a stamped metal blade-type bracket located on the inboard side of the upper inboard seat adjuster track near the rear of both the passenger and driver front seats. A molded connector receptacle (3) integral to the sensor housing is connected to the vehicle electrical system through a connector and take out of the seat wire harness beneath the front seat cushion frame.



The seat track position sensor cannot be adjusted or repaired and, if ineffective or damaged, the entire sensor must be replaced.

OPERATION

The seat track position sensor is designed to provide a seat position data input to the Occupant Restraint Controller (ORC) indicating whether the driver or passenger front seat is in a full forward or a not full forward position. The ORC uses this data as an additional logic input for use in determining the appropriate deployment force to be used when deploying the multistage driver side front airbag.

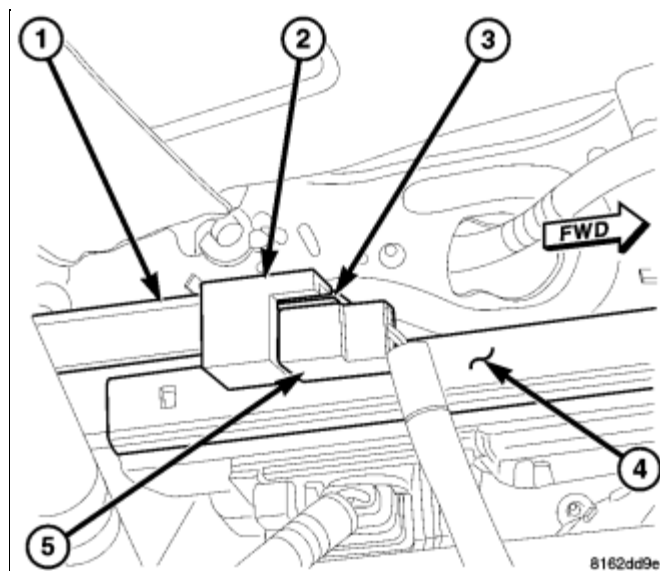
The seat track position sensor receives a nominal five volt supply from the ORC. The sensor communicates the seat position by modulating the voltage returned to the ORC on a sensor data circuit. The ORC also monitors the condition of the sensor circuits and will store a Diagnostic Trouble Code (DTC) for any fault that is detected. The ORC then sends messages over the CAN data bus to control the illumination of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN).

The hard wired circuits between the seat track position sensor and the ORC may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the seat track position sensor or the electronic controls and communication between other modules and devices that provide features of the Supplemental Restraint System (SRS). The most reliable, efficient, and accurate means to diagnose the seat track position sensor or the electronic controls and communication related to seat track position sensor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

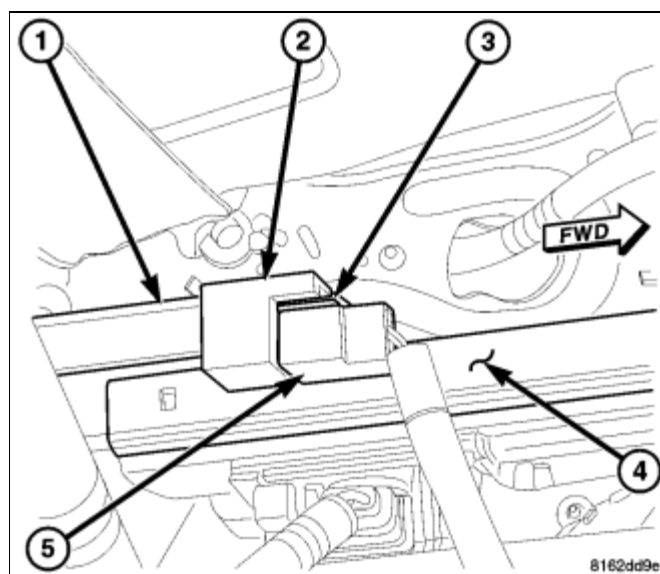
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Reach under the front seat cushion to access the seat track position sensor (2) on a bracket (1) located on the inboard side near the rear of the upper inboard seat track (4).
3. Using a small screwdriver, hold the latch feature (3) depressed while sliding the connector end of the sensor off of the bracket.
4. Disconnect the seat wire harness connector (5) from the sensor connector receptacle.
5. Remove the sensor from under the front seat.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Reach under the front seat cushion to reconnect the seat wire harness connector (5) to the seat track position sensor (2) connector receptacle. Be certain that the latch on the connector is fully engaged.
2. Align the open end of the sensor to the slide tab of the sensor bracket (1) located on the inboard side near the rear of the upper inboard seat track (4).
3. Push the sensor firmly onto the bracket until the latch feature (3) snaps into place with an audible click.
4. Do not reconnect the battery negative cable at this time. The Supplemental Restraint System (SRS) verification test procedure should be performed following service of any SRS component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



8P - SPEED CONTROL

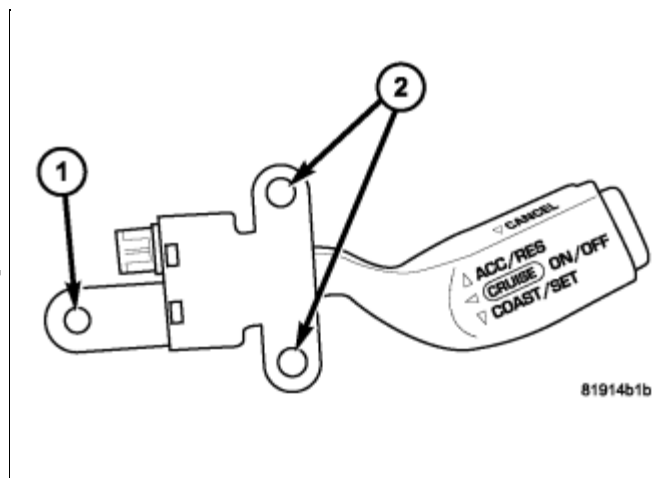
SWITCH

REMOVAL

Mounting hole (1) uses a screw. Depending on model line, mounting holes (2) may use either two screws, or one screw and a locating pin.

WARNING:

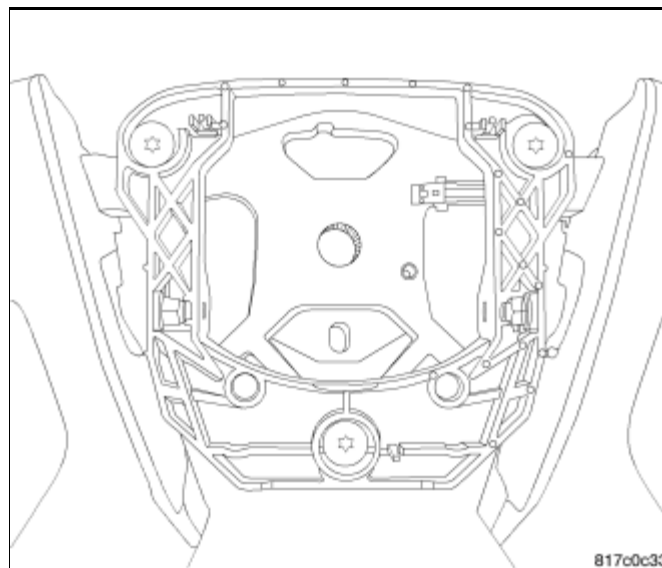
- **Do not place a non-deployed airbag face down on a hard surface as the airbag will propel into the air if accidentally deployed, and could result in serious or fatal injury.**
- **Disconnect and isolate the battery negative (ground) cable before beginning steering wheel removal or installation. This will disable the front airbag system. Failure to disconnect the battery could result in accidental front airbag module deployment and possible personal injury.**
- **Allow the front airbag system capacitor to discharge for two minutes before removing the steering wheel or any front airbag system component.**



The speed control switch is mounted in the steering wheel and wired through the clock spring device under the airbag module.

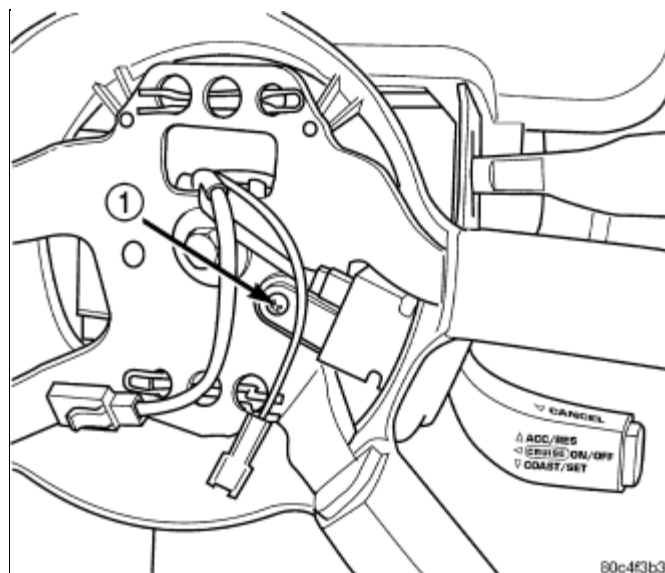
1. Adjust steering wheel until tires are in STRAIGHT-AHEAD position.
2. Remove negative battery cable.
3. Turn off ignition.
4. Remove air bag. Refer to the Restraint systems section.

5. Disconnect connector from clockspring.
6. Remove three mounting fasteners.
7. Remove horn switch.

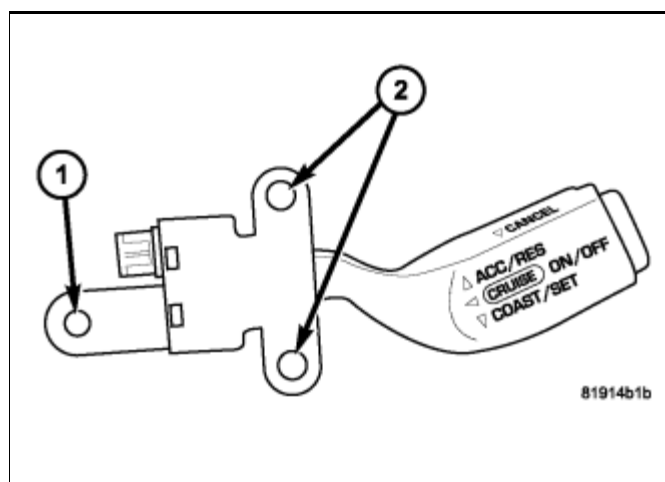


8. Remove either two or three speed control switch mounting screws (1).
9. Disconnect electrical connector.
10. Remove switch.

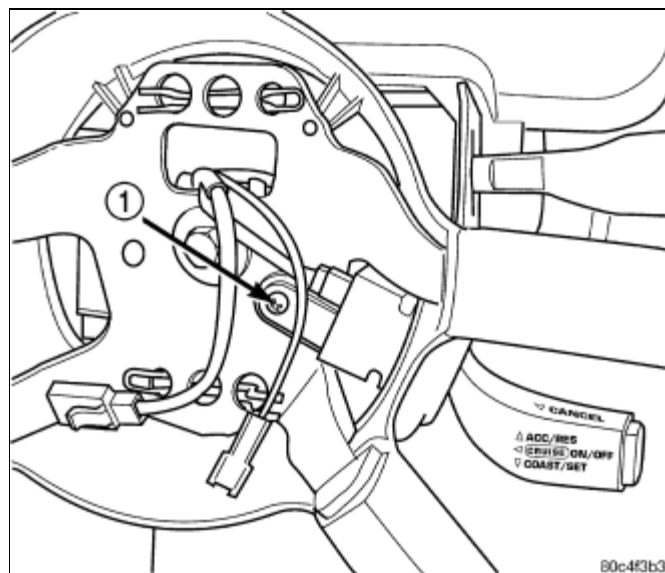
INSTALLATION



Mounting hole (1) uses a screw. Depending on model line, mounting holes (2) may use either two screws, or one screw and a locating pin.



1. Connect electrical connector to speed control switch.
2. Install speed control switch mounting screws.
3. Tighten screws (1) to 1.6 N·m (15 in. lbs.). Make sure rubber seal is in place around switch.

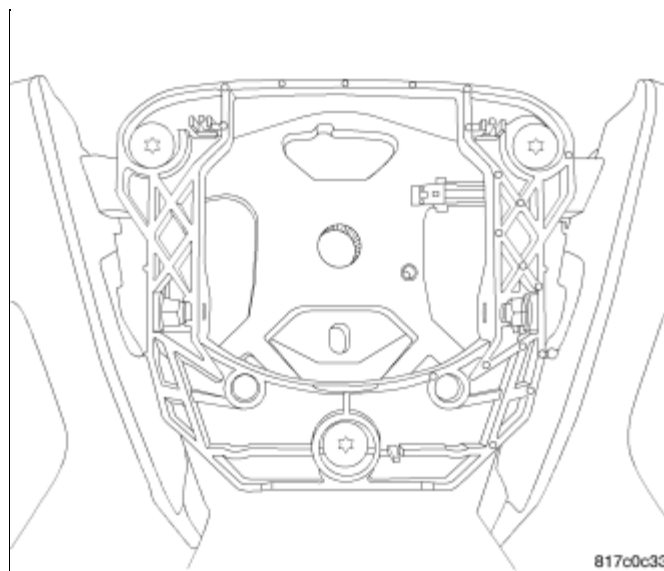


4. Install horn switch.
5. Install three mounting fasteners.

6. Connect electrical connector to clockspring.
7. Install driver airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION)

WARNING: Do not connect battery negative cable yet. Refer first to airbag system test. (Refer to 8 - ELECTRICAL/RESTRAINTS - DIAGNOSIS AND TESTING)

8. Reconnect battery using Airbag System Test procedure in Restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - DIAGNOSIS AND TESTING)
9. Close hood.
10. Verify vehicle and system operation.



8Q - VEHICLE THEFT SECURITY

VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1A20-PRE-ARM TIMEOUT

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the VTSS pre-arm process.

- **Set Condition:**

If the VTSS pre-arm sequence is interrupted within 16 seconds after securing the vehicle.

Possible Causes
INTERMITTENT PROBLEM WITH FUSED (B+) TO CLUSTER
INTERMITTENT PROBLEM WITH CAN INTERIOR BUS CIRCUITS TO CLUSTER

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Communication DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

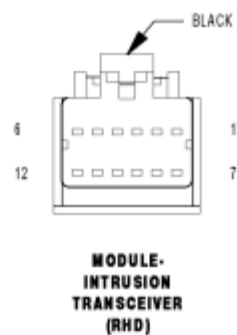
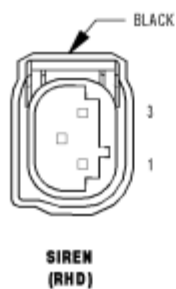
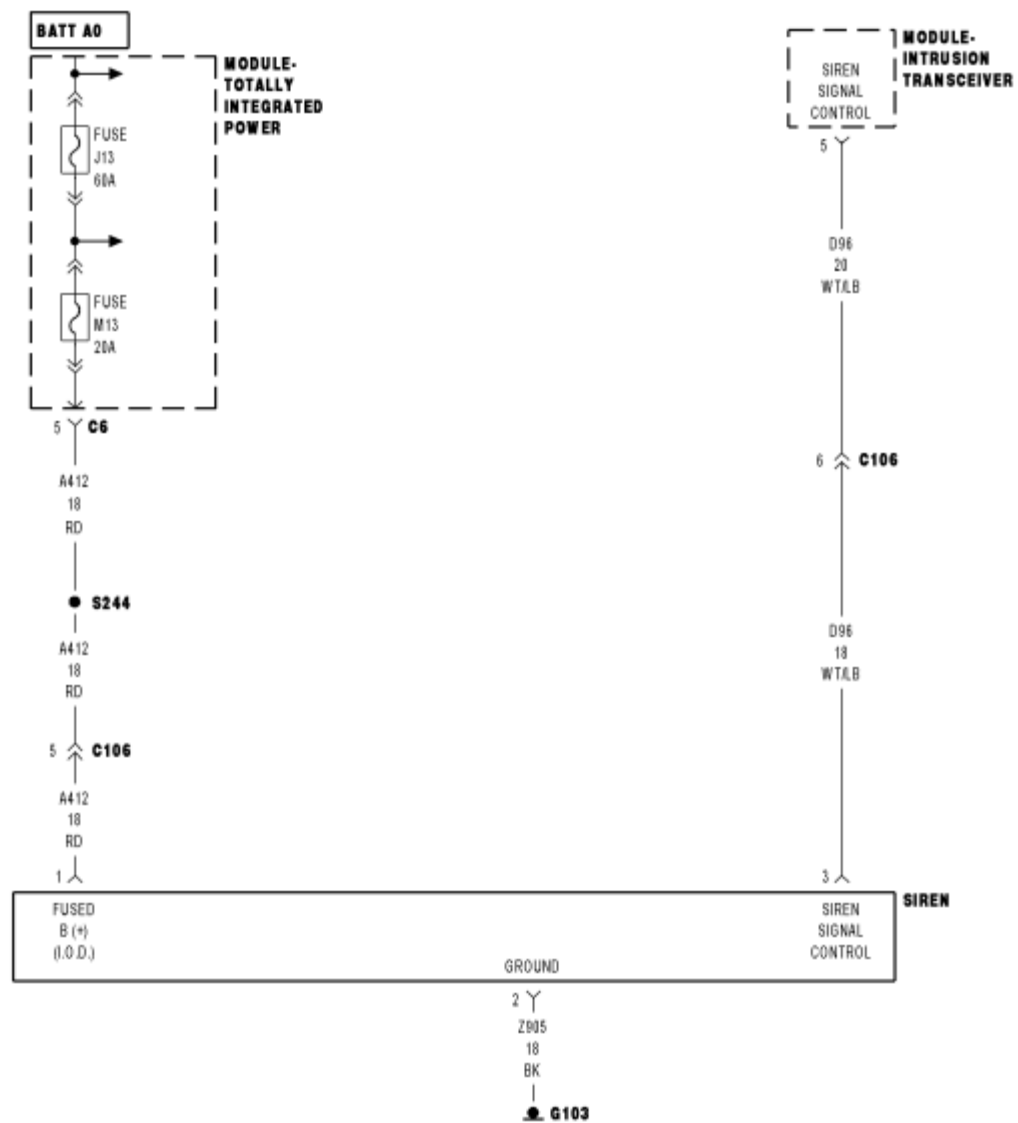
Yes

- Remove the Cluster and inspect the Fused B (+) and both CAN INTERIOR BUS circuits for spread terminals, corrosion or intermittent opens.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

B1A3C-INTERNAL SIREN BATTERY



01000206

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously with the engine over 600 RPM.

◦ **Set Condition:**

When the internal battery within the siren does not charge as expected, the ITM sets this code.

Possible Causes
VEHICLE STORED WITH NO BATTERY VOLTAGE FOR EXTENDED PERIOD OF TIME
SIREN

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Start the engine and allow it to idle for 2 minutes then turn the engine off.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

Yes

- Go To [2](#)

No

- DTC is not active at this time. Test complete.
-

2. VEHICLE STORED WITH NO BATTERY VOLTAGE FOR EXTENDED PERIOD OF TIME

NOTE: If the vehicle was stored with the battery disconnected for an extended period of time the back up battery located in the siren may discharge and need to be recharged.

Was the vehicle battery power just restored after the vehicle was stored with no power for an extended period of time?

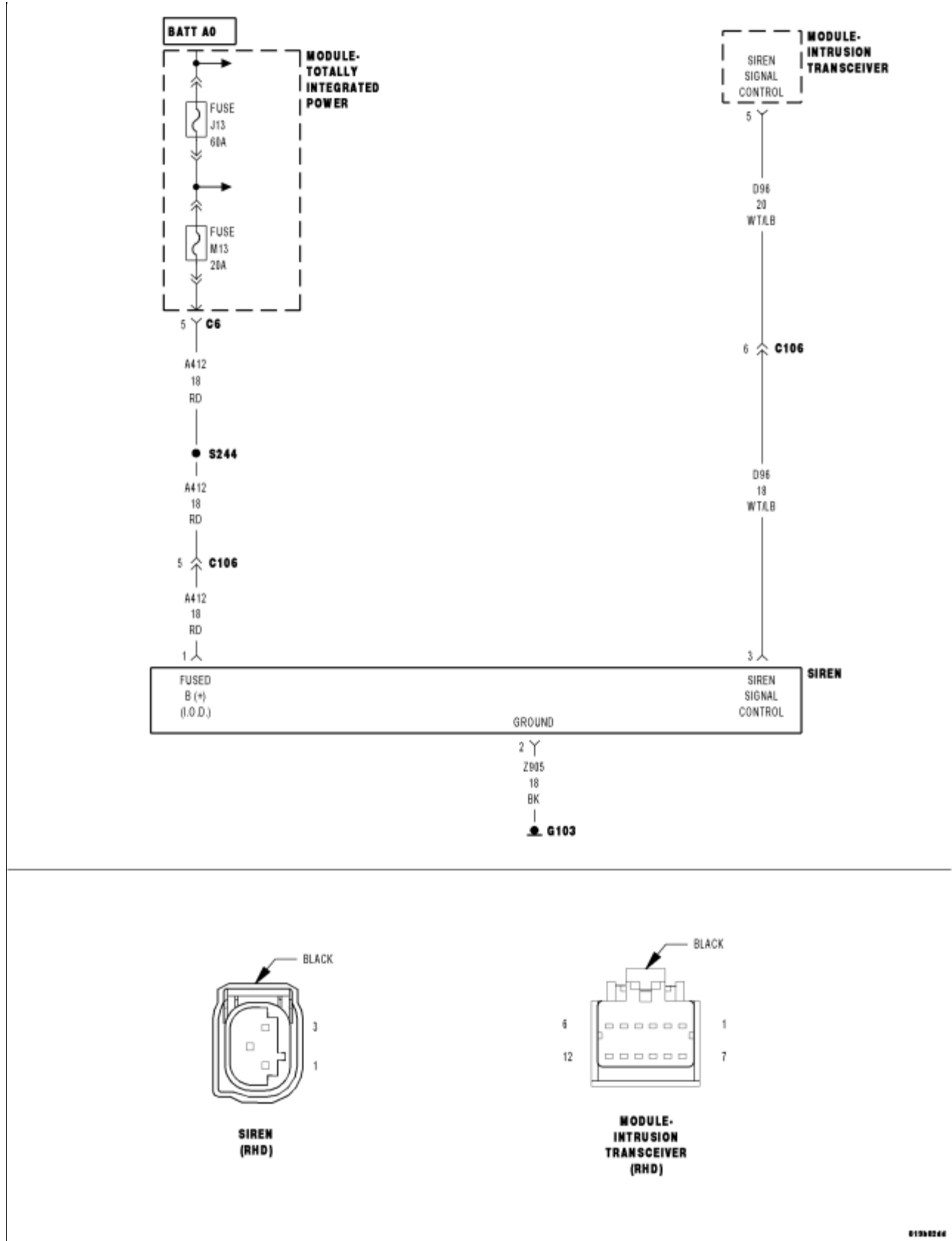
Yes

- Allow the vehicle to sit with a fully charged battery for two hours then restart this procedure.

No

- Replace the Siren the in accordance with the Service Information. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE) .

B1A3D-SIREN BATTERY TAMPER / LOSS OF POWER SUPPLY



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the VTSS armed.

- **Set Condition:**

If the ITM detects incorrect voltage at the siren this code will set.

Possible Causes
HARNESS TAMPERING / INTERMITTENT CONDITION
(A412) FUSED B(+) CIRCUIT
(Z905) GROUND OPEN
SIREN

Diagnostic Test

1. INSPECT SIREN HARNESS

Inspect the wiring harness to the siren for any signs of tampering or intermittent condition.

Were there any problems found?

Yes

- Repair wiring as necessary.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)
-

2. DETERMINING IF DTC IS CURRENT

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?**Yes**

- Go To [3](#)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. CHECK THE (A412) FUSED B(+) CIRCUIT AT THE SIREN

Turn the ignition off.

Disconnect the Siren connector.

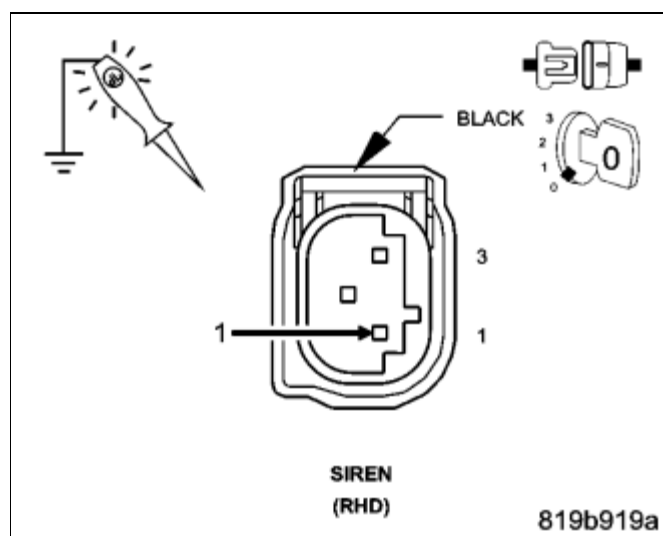
Using a 12-volt test light connected to ground, check the (A412) Fused B(+) circuit at the siren connector.

Does the test light illuminate brightly?**Yes**

- Go To [4](#)

No

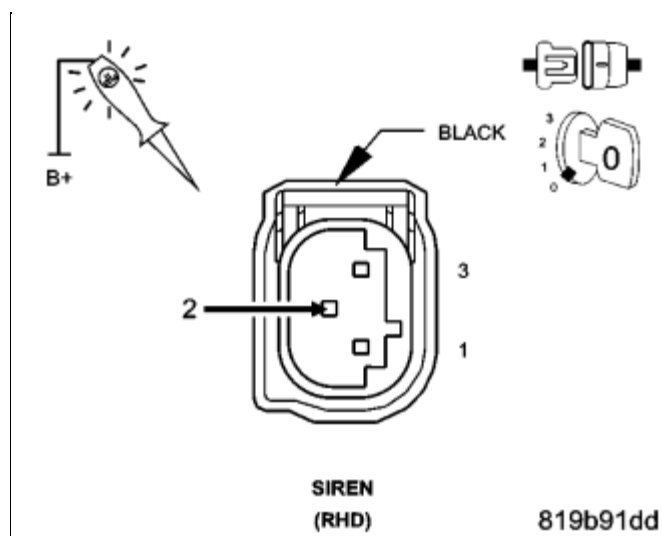
- Repair the (A412) Fused B(+) circuit for an open.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**4. CHECK THE (Z905) GROUND CIRCUIT AT THE SIREN**

Using a 12-volt test light connected to 12-volts, check the (Z905) Ground circuit at the siren connector.

Does the test light illuminate brightly?**Yes**

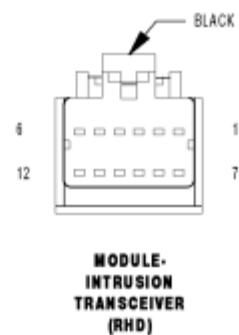
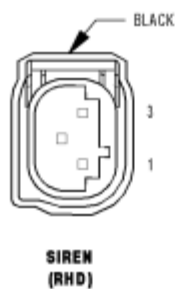
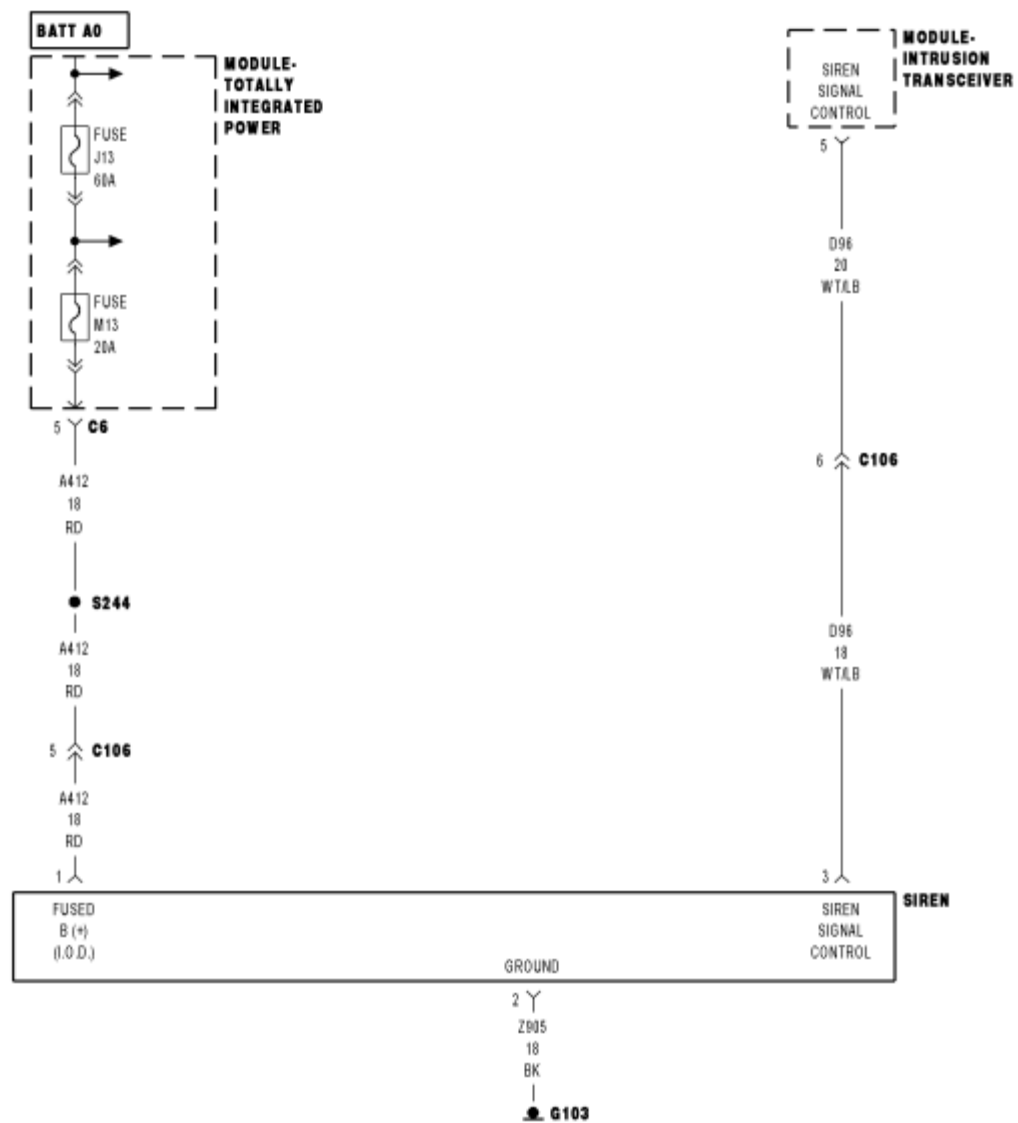
- Replace the Siren in accordance with the Service Information.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



No

- Repair the (Z905) Ground circuit for an open.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A3E-SIREN / ITM MISMATCH



01000206

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

While the VTSS is armed.

- **Set Condition:**

When the learned Siren information stored in the ITM does not match.

Possible Causes
INTERMITTENT CONDITION
SIREN

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Communication DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

Yes

- Inspect wiring from ITM to Siren for an intermittent open condition. Check connector terminals for push out, corrosion or loose terminal contact. If OK, replace the Siren.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)
-

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**

- **Pushed out or loose terminals**
- **Broken wire internal to the insulation**

Were there any problems found?

Yes

- Repair the wiring as necessary.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.

B1A3F-ITM ARMING SEQUENCE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

During the VTSS pre-arm process.

- **Set Condition:**

ITM arming process did not complete in a predetermined amount time.

Possible Causes
INTERMITTENT CAN INTERIOR BUS COMMUNICATION
SOFTWARE UPDATE FOR ITM OR TIPM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Communication DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.
Disarm the VTSS.
Using the scan tool, read ITM DTC(s).

Does the DTC reset?**Yes**

- Check for and correct any CAN INTERIOR Bus DTC's set in the ITM or the TIPM. Also check for related software updates for the ITM and/or TIPM.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

B1A48–INTRUSION SENSOR 1 INTERNAL

Continuously while the VTSS is armed.

◦ **Set Condition:**

If the Intrusion Transceiver Module does not receive the correct message back from the Intrusion Sensor.

Possible Causes
CARGO INTRUSION SENSOR

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.
Turn the ignition off.
Arm the VTSS and wait 1 minute.
Disarm the VTSS and turn the ignition on.
With the scan tool, read ITM DTC's.

Does the scan tool display the same DTC?

Yes

- Replace the Cargo Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The condition that caused this symptom is currently not present. Test complete.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A5F–INTRUSION SENSOR 2 INTERNAL

Continuously while the VTSS is armed.

- **Set Condition:**

If the Intrusion Transceiver Module does not receive the correct message back from the Intrusion Sensor.

Possible Causes
FRONT INTRUSION SENSOR

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.

Turn the ignition off.

Arm the VTSS and wait 1 minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTC's.

Does the scan tool display the same DTC?

Yes

- Replace the Front Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B1A6D–INTRUSION SENSOR 3 INTERNAL

Continuously while the VTSS is armed.

◦ **Set Condition:**

If the Intrusion Transceiver Module does not receive the correct message back from the Intrusion Sensor.

Possible Causes
CONSOLE INTRUSION SENSOR

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.
Turn the ignition off.
Arm the VTSS and wait 1 minute.
Disarm the VTSS and turn the ignition on.
Using the scan tool, read ITM DTC(s).

Does the scan tool display the same DTC?

Yes

- Replace the Console Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B2206-CURRENT VIN MISSING/MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Anytime the ignition key is in the ON position.

◦ **Set Condition:**

VIN stored in Intrusion Transceiver Module does not match the VIN stored in the Cluster.

Possible Causes
INTRUSION TRANSCIVER MODULE SWAPPED FROM DIFFERENT VEHICLE

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

Yes

- Using the scan tool under Miscellaneous functions initialize the Intrusion Transceiver Module.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

B223B-VEHICLE CONFIGURATION MISMATCH

Anytime the ignition key is in the ON position.

◦ **Set Condition:**

If the Intrusion Transceiver Module configuration does not match the Intrusion Sensor(s) installed in the vehicle.

Possible Causes
INTRUSION TRANSCIEVER MODULE CONFIGURATION

Diagnostic Test

1. CONFIGURE THE INTRUSION TRANSCIEVER MODULE

NOTE: Before proceeding check the vehicles Intrusion Sensor(s) for the correct part number for this vehicle and replace if necessary.

Using the scan tool under miscellaneous functions perform the initialization procedure for the Intrusion Transceiver Module.

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

Yes

- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

B223C-INTRUSION TRANSCIEVER MODULE INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

Internal Intrusion Transceiver Module test failed.

Possible Causes
INTRUSION TRANSCIEVER MODULE

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

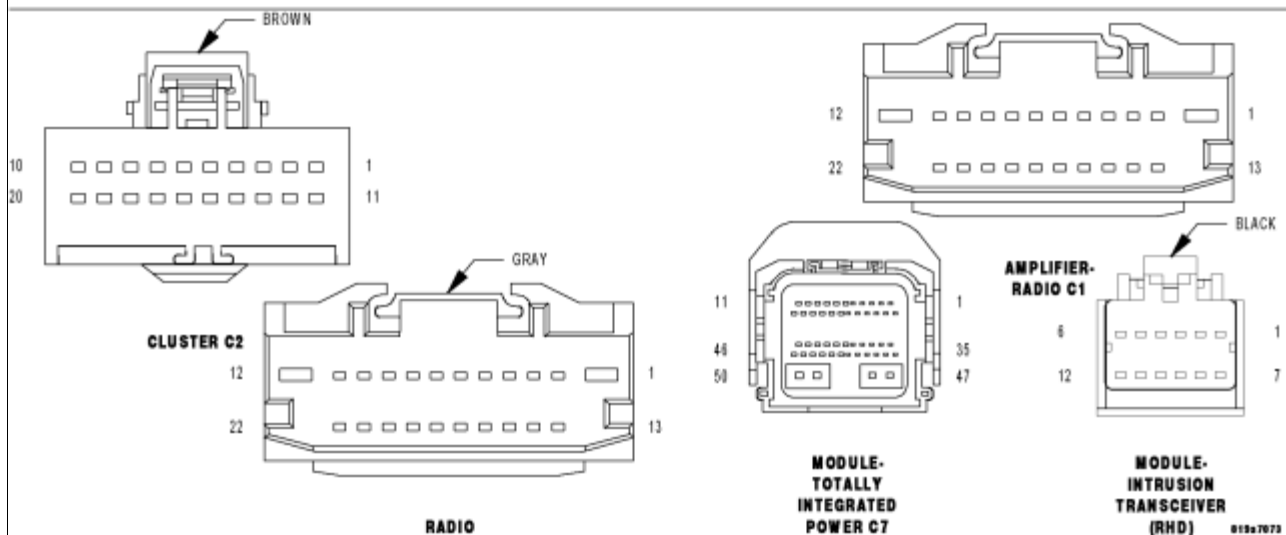
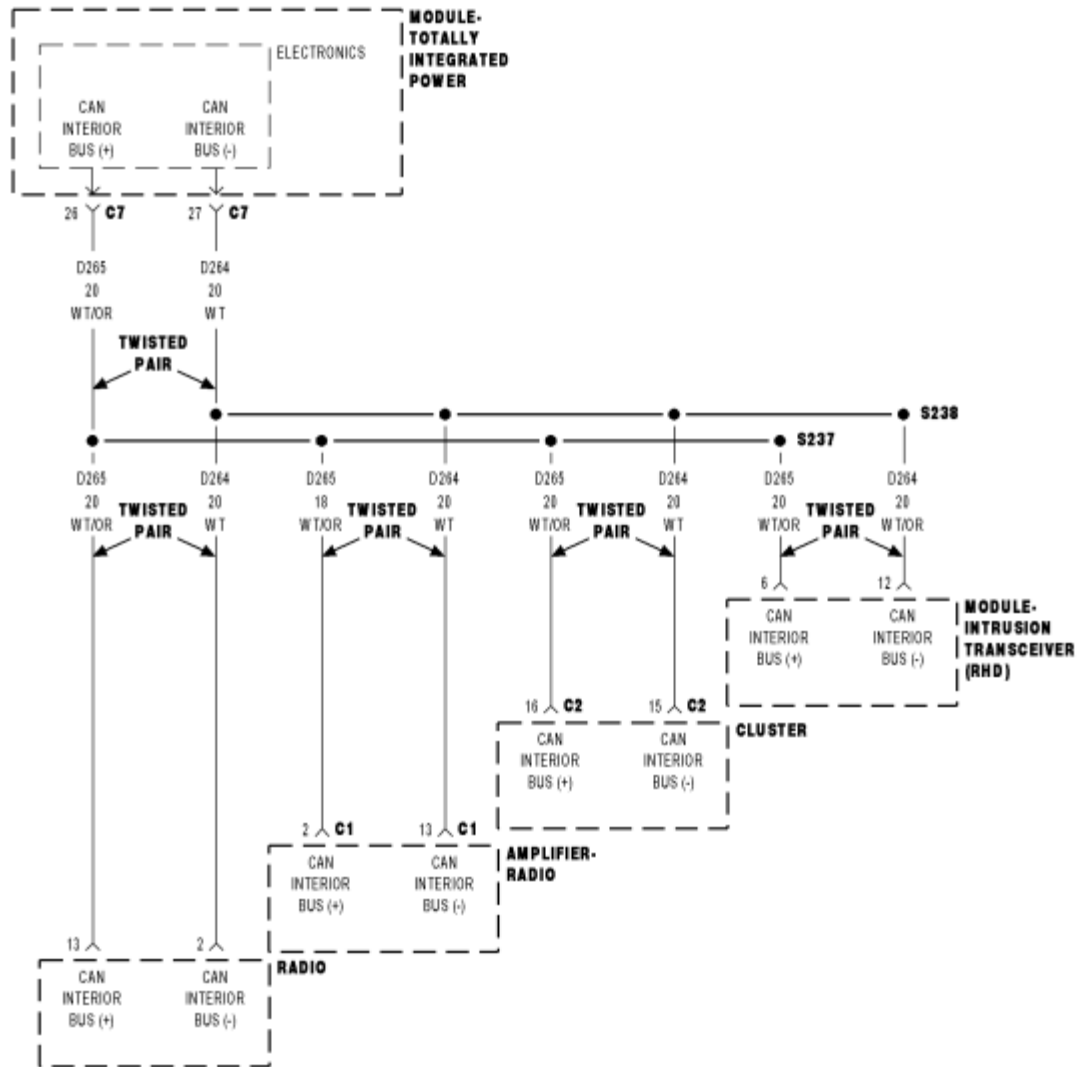
Yes

- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)
-

U0010-CAN INTERIOR BUS



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The TIPM detects a short to ground on either CAN Interior Bus (125K) circuit.

Possible Causes
(D265) CAN INTERIOR BUS (125K)(+) CIRCUIT SHORTED TO GROUND
ANY CAN INTERIOR BUS MODULE
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, record and erase TIPM DTC's.

Cycle the ignition from on to off 3 times.

Turn the ignition on.

With the scan tool, read active TIPM DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The conditions that caused this code to set are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

2. ANY CAN INTERIOR BUS (125K) MODULE— INTERNAL SHORT

NOTE: When performing this step, turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on.

NOTE: This step is to determine if the fault is internal within a module.

While monitoring the scan tool, disconnect each CAN Interior Bus (125K) module one at a time.

Check for this DTC to become active after disconnecting each CAN Interior Bus (125K) module the vehicle is

equipped with.

NOTE: If the DTC becomes stored when a particular module is disconnected, that module is causing the DTC to set.

With all the CAN Interior Bus modules disconnected does the scan tool display this DTC as active?

Yes

- Go To [3](#)

No

- Replace the module that when disconnected caused this DTC to become stored in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

3. (D265) CAN INTERIOR BUS (125K)(+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D265) CAN Interior Bus (125K)(+) circuit at the TIPM C7 harness connector.

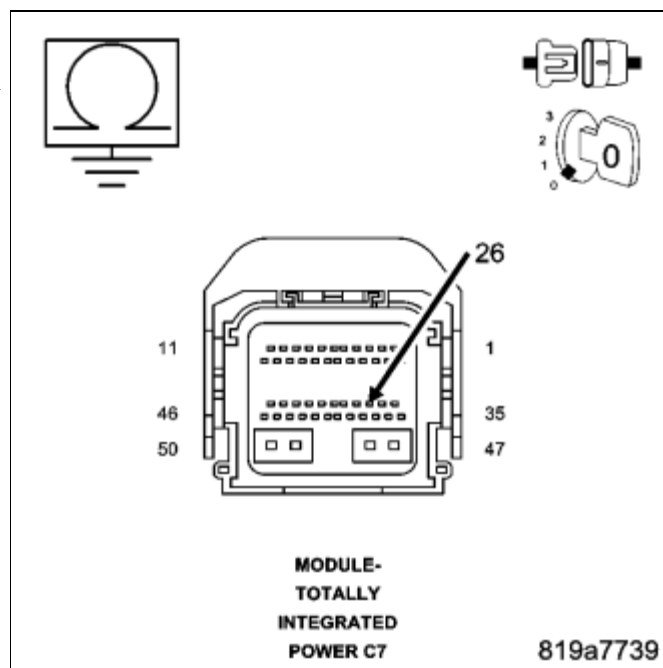
Is any resistance present?

Yes

- Repair the (D265) CAN Interior Bus (125K)(+) circuit for a short to ground.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Totally Integrated Power Module in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM)

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U1008-LIN 1 BUS

Continuously while the VTSS is armed.

- **Set Condition:**

If the Intrusion Transceiver Module detects incorrect voltage on the LIN Bus circuit.

Possible Causes
INTERMITTENT CONDITION
(D122) LIN BUS CIRCUIT SHORT TO BATTERY
(D122) LIN BUS CIRCUIT SHORT TO GROUND
INTRUSION SENSOR
INTRUSION TRANSCIEVER MODULE

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.

Turn the ignition off.

Arm the VTSS and wait 1 minute.

Disarm the VTSS and turn the ignition on.

Using the scan tool, read the ITM DTCs.

Does the scan tool display the same DTC?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. DISCONNECT INTRUSION SENSOR AND RECHECK DTC

Disconnect each of the Intrusion Sensor connectors one at a time and recheck for DTC using the following steps.

With the scan tool, erase the current Intrusion Transceiver Module DTC's.
 Turn the ignition off.
 Arm the VTSS and wait 1 minute.
 Disarm the VTSS and turn the ignition on.
 Using the scan tool, read the ITM DTCs.

Does the scan tool display U1008-LIN 1 BUS?

Yes

- Go To [3](#)

No

- Replace the Intrusion Sensor that sets the DTC in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. (D122) LIN BUS CIRCUIT SHORT TO BATTERY

Ensure all Intrusion Sensors are disconnected.
 Disconnect the Intrusion Transceiver Module connector.
 Measure the voltage of the (D122) LIN Bus circuit with the ignition switch Off and On.

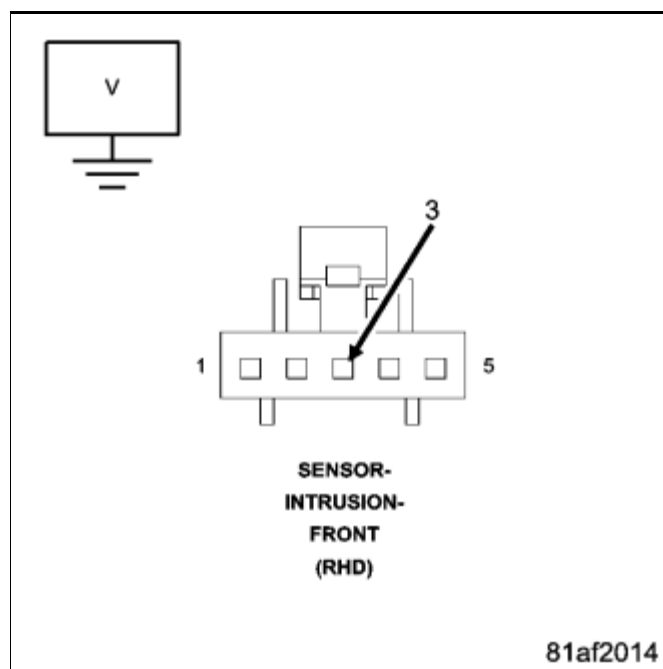
Is there any voltage present?

Yes

- Repair the (D122) LIN Bus circuit for a short to voltage.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (D122) LIN BUS CIRCUIT SHORT TO GROUND

Turn the ignition Off.
 Measure the resistance between ground and the (D122) LIN

Bus circuit.

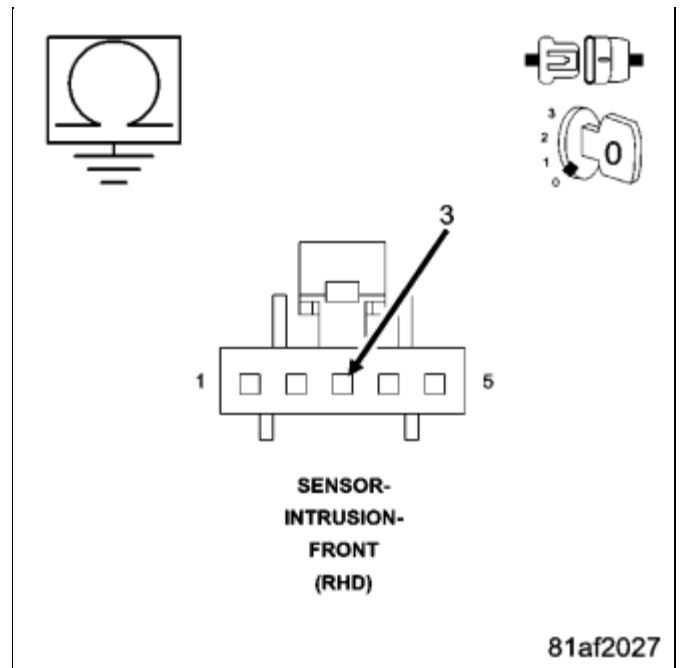
Is the resistance above 1000 ohms?

Yes

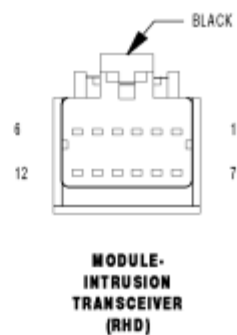
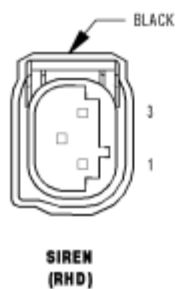
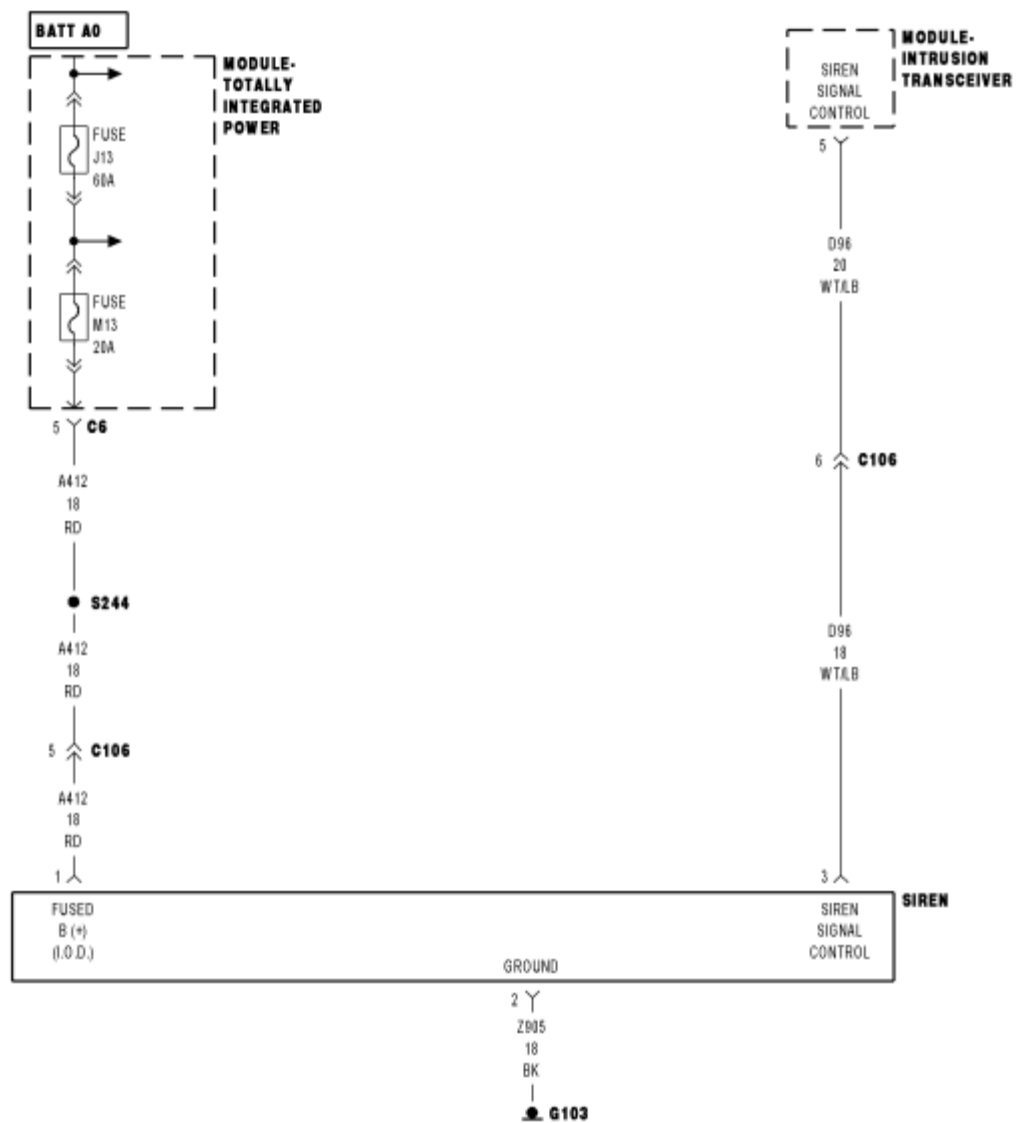
- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D122) LIN Bus circuit for a short to ground.
- Perform BODY VERIFICATION TEST - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



U110D-LOST COMMUNICATION WITH SECURITY SIREN



01000206

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the VTSS is armed.

- **Set Condition:**

If the Intrusion Transceiver Module does not receive messages from the Siren.

Possible Causes
INTERMITTENT CONDITION
(A412) FUSED B+ CIRCUIT OPEN
(Z905) GROUND CIRCUIT OPEN
(D96) SIREN SIGNAL CONTROL CIRCUIT SHORT TO BATTERY
(D96) SIREN SIGNAL CONTROL CIRCUIT OPEN
(D96) SIREN SIGNAL CONTROL CIRCUIT SHORT TO GROUND
SIREN
INTRUSION TRANSCIVER MODULE

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.

Turn the ignition off.

Arm the VTSS and wait 1 minute.

Disarm the VTSS and turn the ignition on.

Using the scan tool, read ITM DTC(s).

Does the scan tool display the same DTC?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE)

2. (A412) FUSED B+ OPEN

Gain access to the VTSS Siren.
Disconnect the Siren connector.
Using a 12-volt test light connected to ground, check the (A412) Fused B(+) circuit in the Siren connector.

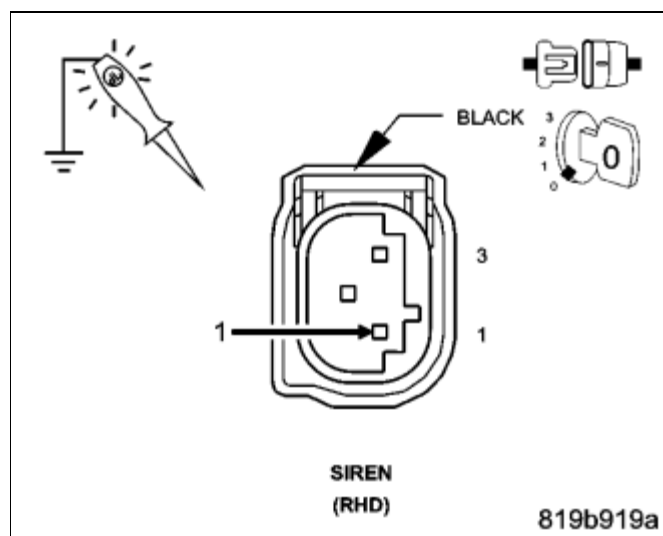
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A412) Fused B+ circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (Z905) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z905) Ground circuit at the siren connector.

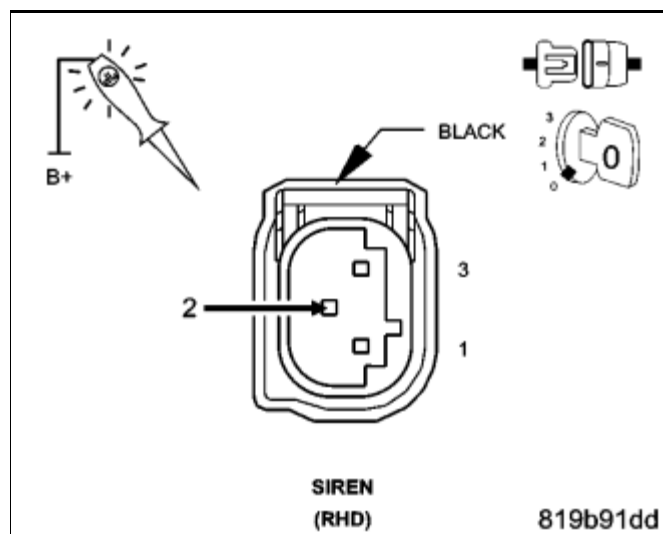
Does the test light illuminate brightly?

Yes

- Go To [4](#)

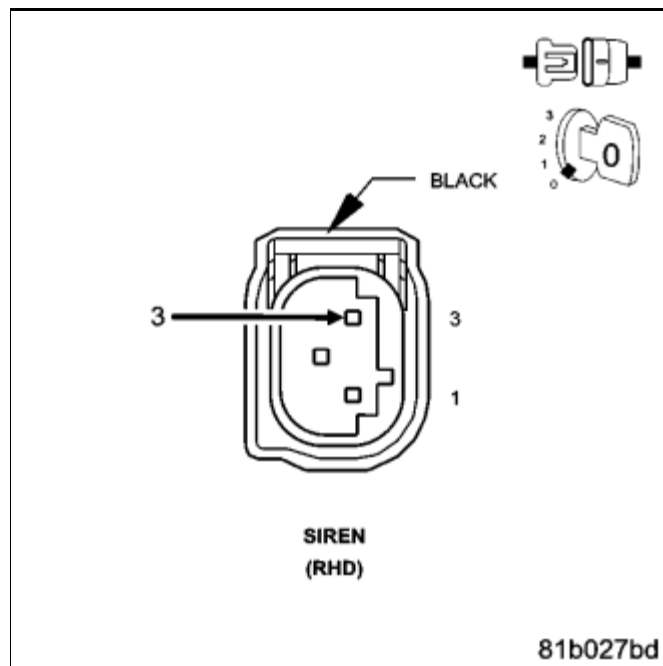
No

- Repair the (Z905) Ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. FAULTY SIREN

Use the DRBIII® and set up as follows:
 Use the Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.
 Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable.
 Select DRBIII® Stand-alone.
 Select lab scope.
 Select Live.
 Select 12 volt square wave.
 Press F2 for Scope.
 Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete.
 Disconnect the Siren connector.
 Connect the black lead to the chassis ground. Connect the red lead to the (D96) Siren Signal Control circuit in the Siren connector.
 Close all doors and arm the VTSS.
 Observe the voltage displayed on the DRBIII® Lab Scope.



Is there a voltage square wave present 1 to 2 seconds?

Yes

- Connect a known good siren and try to reset the DTC. If the DTC does not reset the original siren needs to be replaced. If the DTC does reset replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)

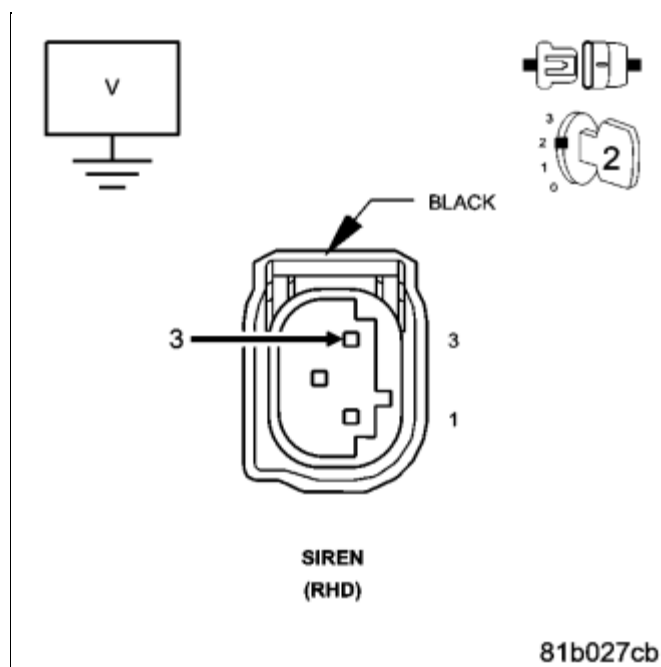
5. (D96) SIREN SIGNAL CONTROL CIRCUIT SHORT TO BATTERY

Disconnect the Siren harness connector.
 Measure the voltage of the (D96) Siren Signal Control circuit.

Is there any voltage present?

Yes

- Repair the (D96) Siren Signal Control circuit for a short to voltage.
- Perform BODY VERIFICATION TEST - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



No

- Go To [6](#)

6. (D96) SIREN SIGNAL CONTROL CIRCUIT SHORT TO GROUND

Disconnect the Siren harness connector.
Disconnect the Intrusion Transceiver Module harness connector.
Measure the resistance between ground and the (D96) Siren Signal Control circuit.

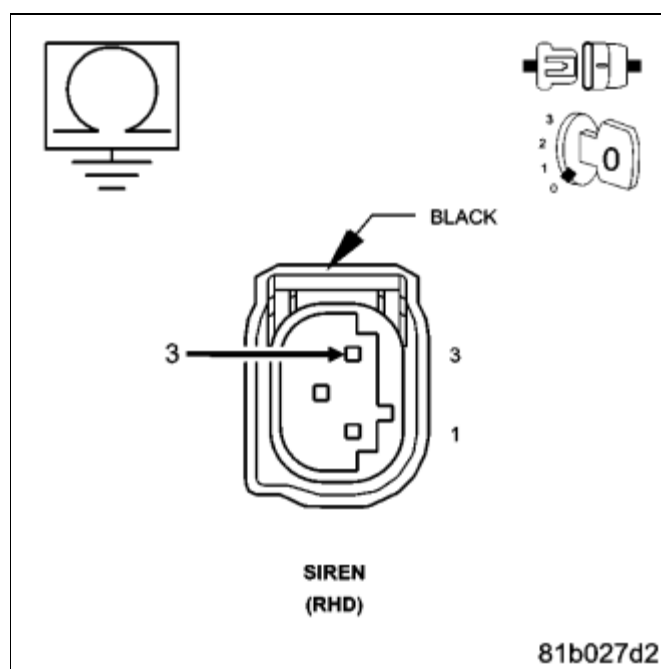
Is the resistance above 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (D96) Siren Signal Control circuit for a short to ground.
- Perform BODY VERIFICATION TEST - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



7. (D96) SIREN SIGNAL CONTROL CIRCUIT OPEN

Disconnect the Intrusion Transceiver Module harness connector.

Measure the resistance of the (D96) Siren Signal Control circuit between the Intrusion Transceiver Module and the Siren connector.

Is the resistance below 5.0 ohms?

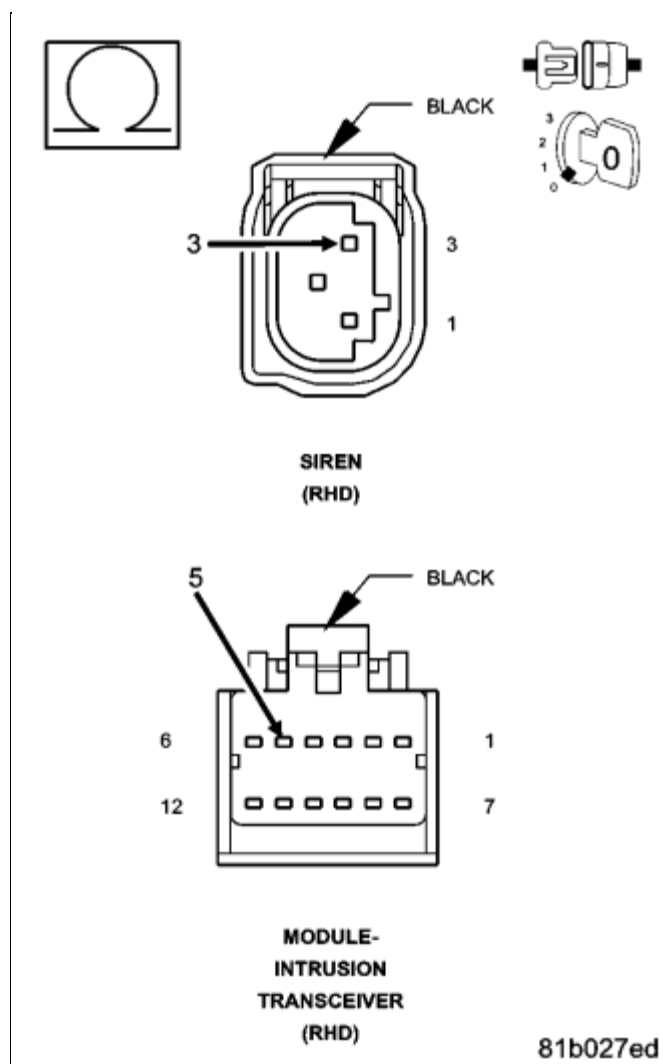
Yes

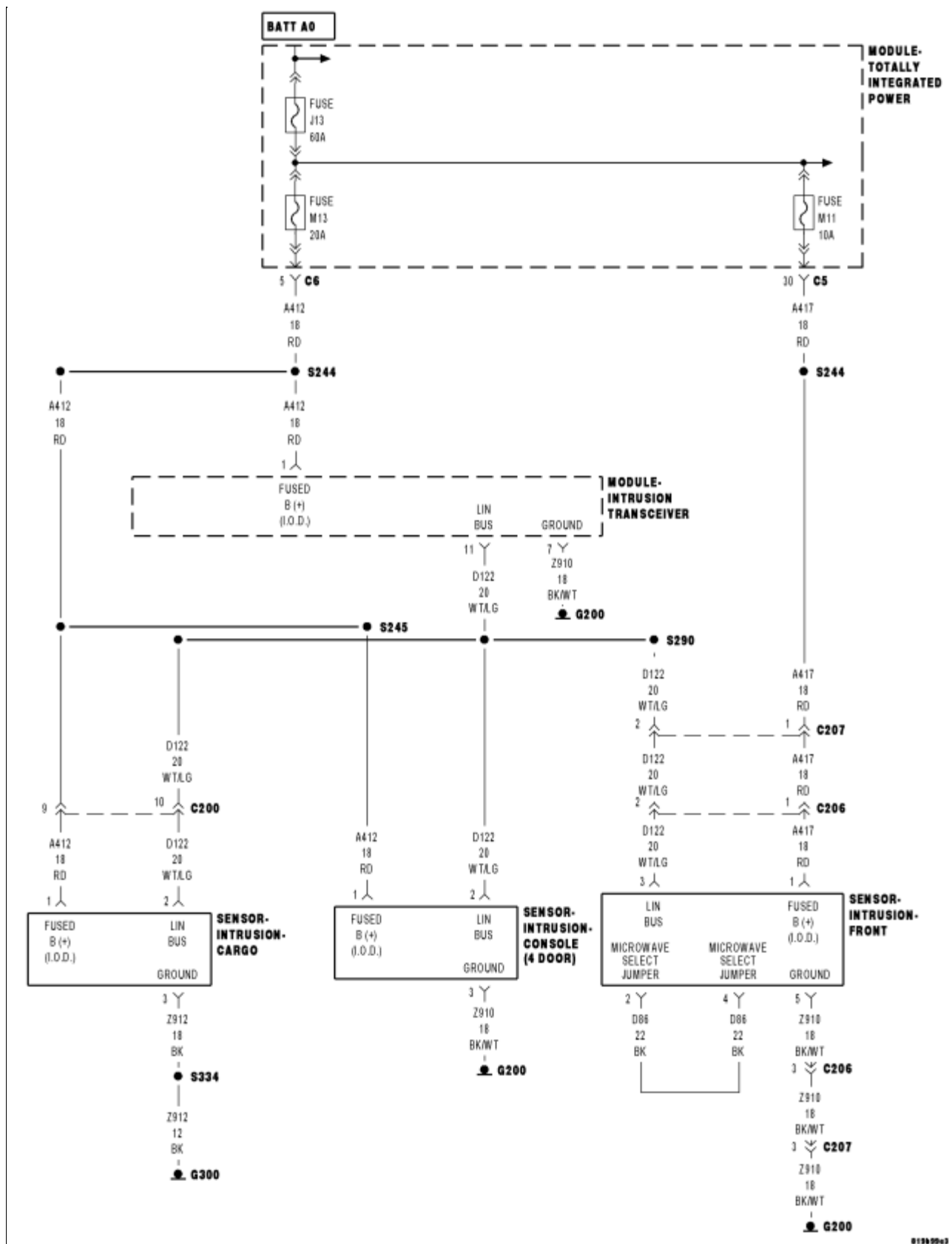
- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D96) Siren Signal Control circuit for an open.
- Perform BODY VERIFICATION TEST - VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U1169–LOST COMMUNICATION WITH INTRUSION SENSOR 1





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the VTSS is armed.

◦ **Set Condition:**

If the Intrusion Transceiver Module does not receive messages from the Cargo Intrusion Sensor over the LIN bus.

Possible Causes
INTERMITTENT CONDITION
(A412) FUSED B+ CIRCUIT OPEN
(Z912) GROUND CIRCUIT OPEN
(D122) LIN BUS CIRCUIT OPEN
CARGO INTRUSION SENSOR
INTRUSION TRANSCIEVER MODULE

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.
 Turn the ignition off.
 Arm the VTSS and wait 1 minute.
 Disarm the VTSS and turn the ignition on.
 Using the scan tool, read ITM DTC(s).

Does the scan tool display the same DTC?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (A412) FUSED B+ OPEN

Disconnect the Cargo Intrusion Sensor connector.
Using a 12-volt test light connected to ground, check the (A412) Fused B(+) circuit in the Intrusion Sensor connector.

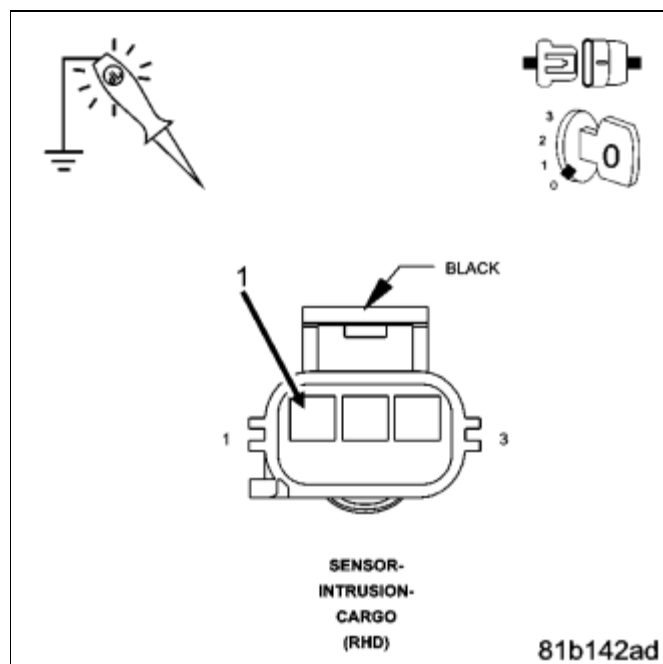
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A412) Fused B+ circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



3. (Z912) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z912) Ground circuit at the Intrusion Sensor connector.

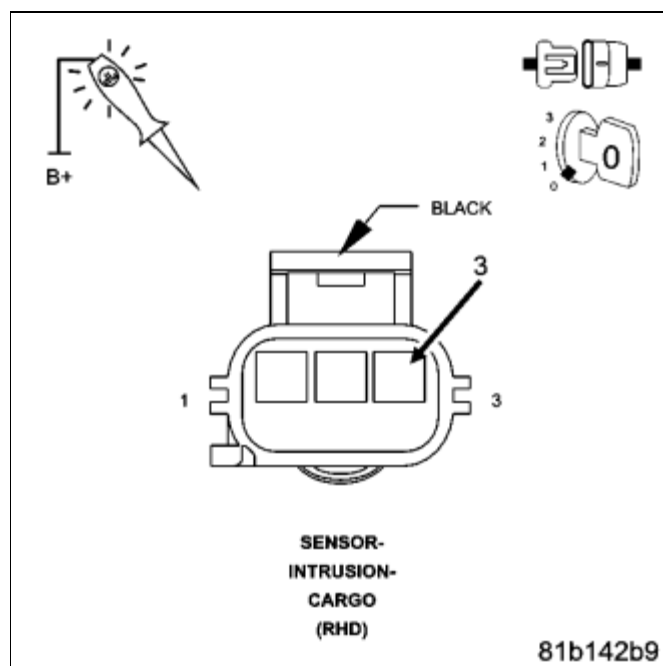
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z912) Ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



4. LIN BUS VOLTAGE

The Cargo Intrusion Sensor connector is disconnected. Measure the voltage of the (D122) LIN Bus circuit at the Intrusion Sensor connector with the key on and off. Observe the voltage displayed on the voltmeter.

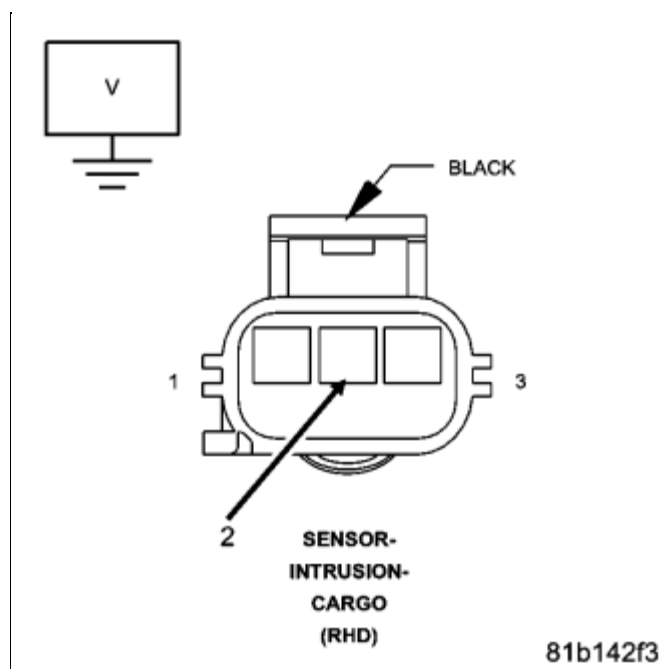
Is the voltage between 1 and 12 volts?

Yes

- Replace the Front Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (D122) LIN BUS CIRCUIT OPEN

Disconnect the Intrusion Transceiver Module harness connector. Measure the resistance of the (D122) LIN Bus circuit between the Intrusion Transceiver Module and the Cargo Intrusion Sensor connector.

Is the resistance below 3.0 ohms?

Yes

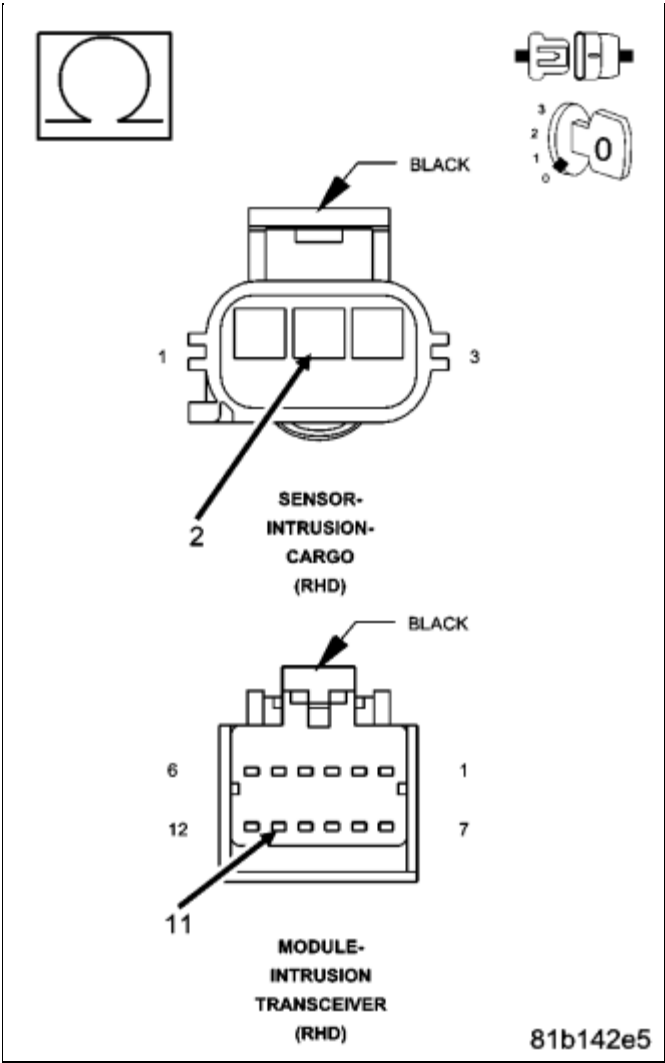
- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

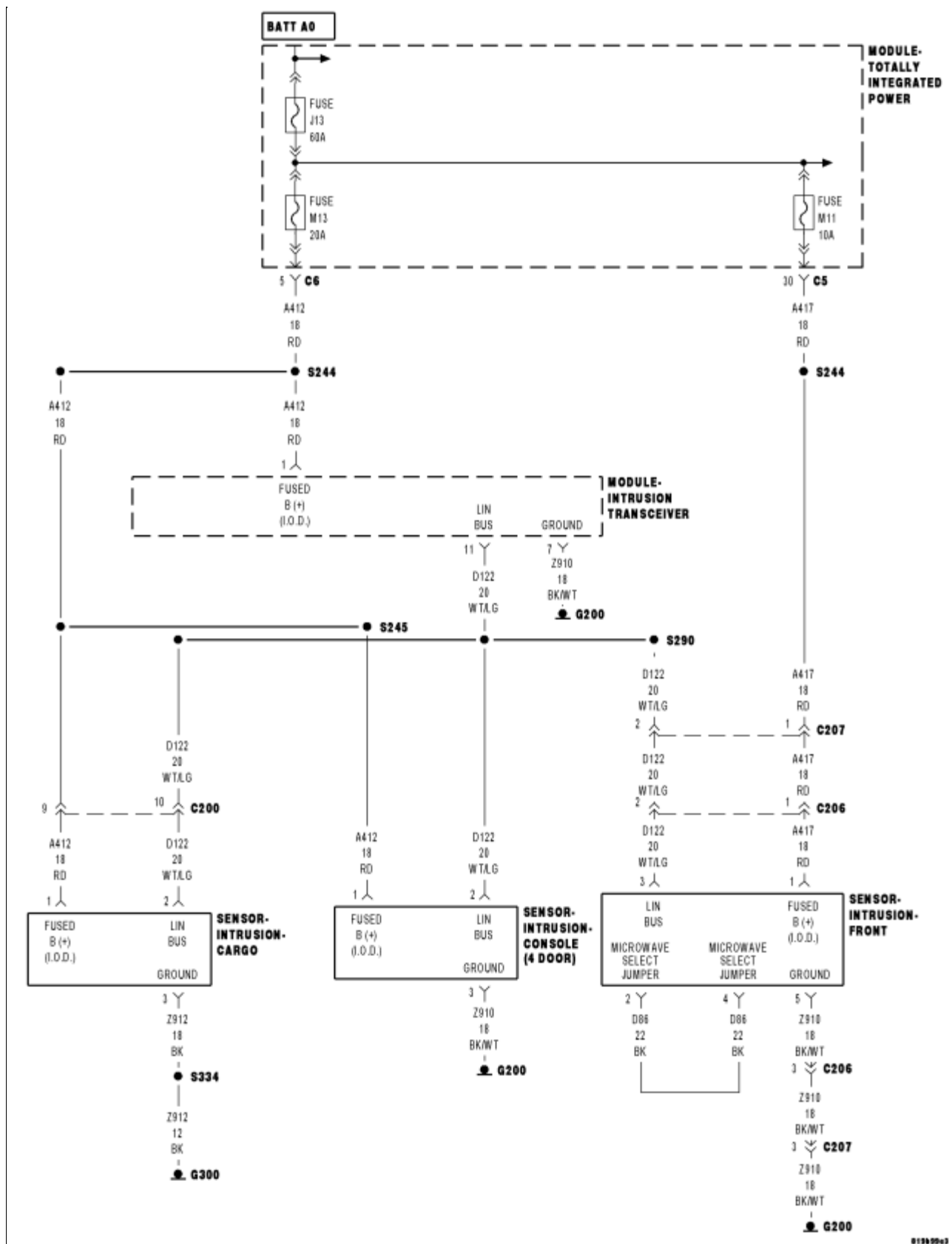
No

- Repair the (D122) LIN Bus circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U1170—LOST COMMUNICATION

WITH INTRUSION SENSOR 2





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the VTSS is armed.

◦ **Set Condition:**

If the Intrusion Transceiver Module does not receive messages from the Front Intrusion Sensor over the LIN bus.

Possible Causes
INTERMITTENT CONDITION
D86 MICROWAVE SELECT JUMPER OPEN
(A417) FUSED B+ CIRCUIT OPEN
(Z910) GROUND CIRCUIT OPEN
(D122) LIN BUS CIRCUIT OPEN
FRONT INTRUSION SENSOR
INTRUSION TRANSCIVER MODULE

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.

Turn the ignition off.

Arm the VTSS and wait 1 minute.

Disarm the VTSS and turn the ignition on.

Using the scan tool, read ITM DTC(s).

Does the scan tool display the same DTC?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (D86) MICROWAVE SELECT JUMPER OPEN

Disconnect the Front Intrusion Sensor connector.
Measure the resistance of the (D86) Microwave Select Jumper at the Front Intrusion Sensor connector.

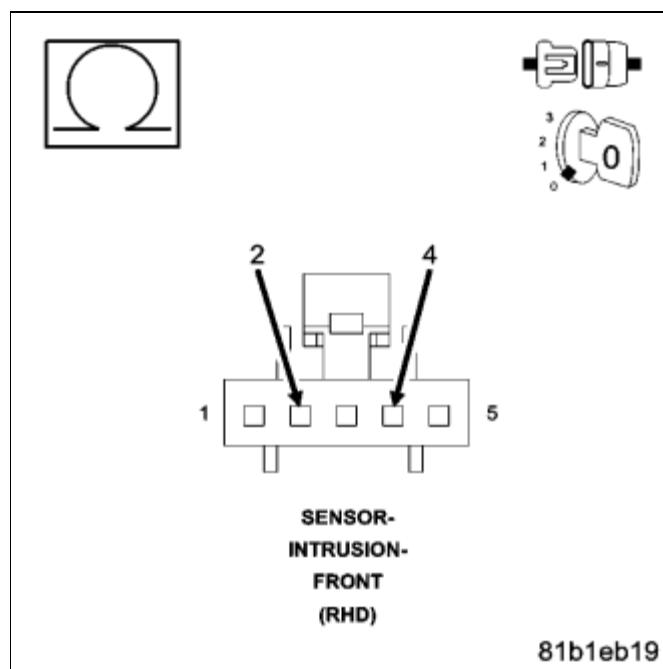
Is the resistance below 1.0 ohm?

Yes

- Go To [3](#)

No

- Repair the (D86) Microwave Select Jumper for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



3. (A417) FUSED B+ OPEN

Using a 12-volt test light connected to ground, check the (A417) Fused B(+) circuit in the Front Intrusion Sensor connector.

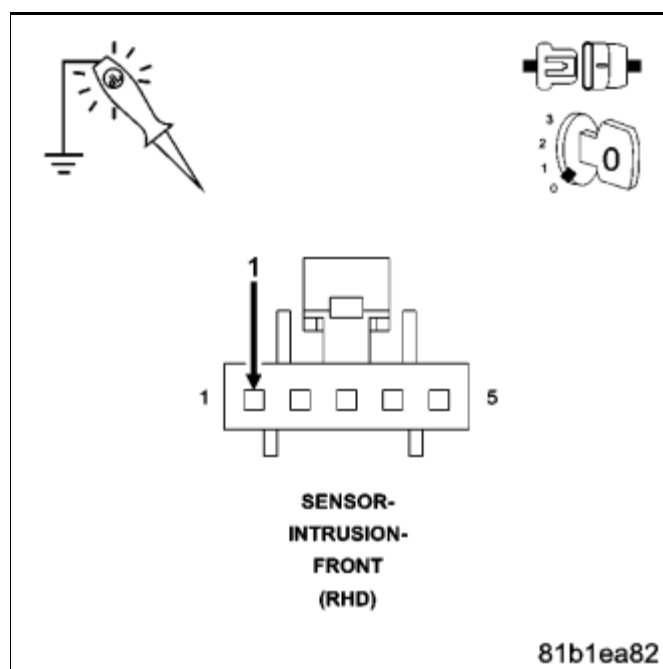
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (A417) Fused B+ circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC
CONTROL MODULES - STANDARD
PROCEDURE)



4. (Z910) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z910) Ground circuit at the Front Intrusion Sensor connector.

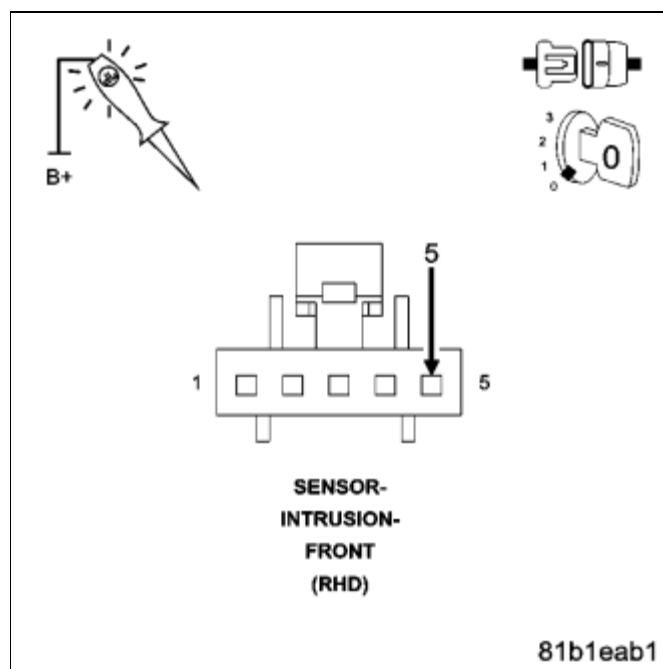
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the (Z910) Ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



5. LIN BUS VOLTAGE

The Front Intrusion Sensor connector is disconnected. Measure the voltage of the (D122) LIN Bus circuit at the Intrusion Sensor connector with the key on and off. Observe the voltage displayed on the voltmeter.

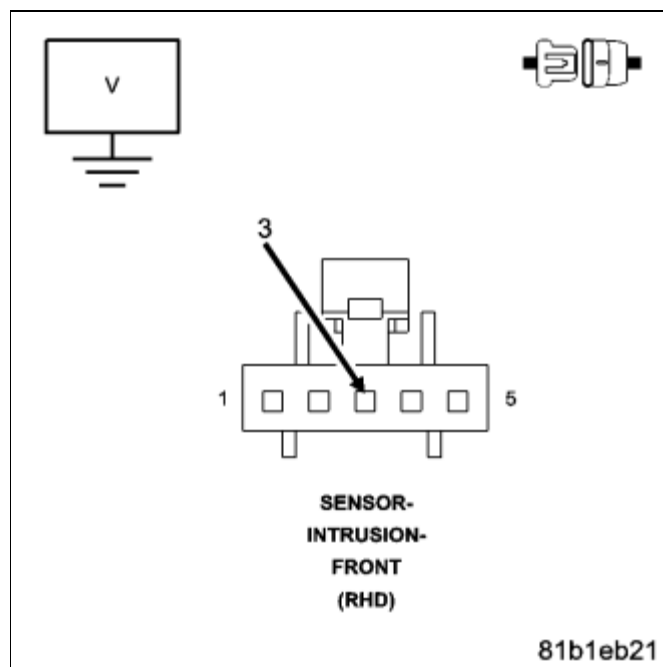
Is the voltage between 1 and 12 volts?

Yes

- Replace the Front Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (D122) LIN BUS CIRCUIT OPEN

Disconnect the Intrusion Transceiver Module harness connector.
 Measure the resistance of the (D122) LIN Bus circuit between the Intrusion Transceiver Module and the Intrusion Sensor connector.

Is the resistance below 3.0 ohms?

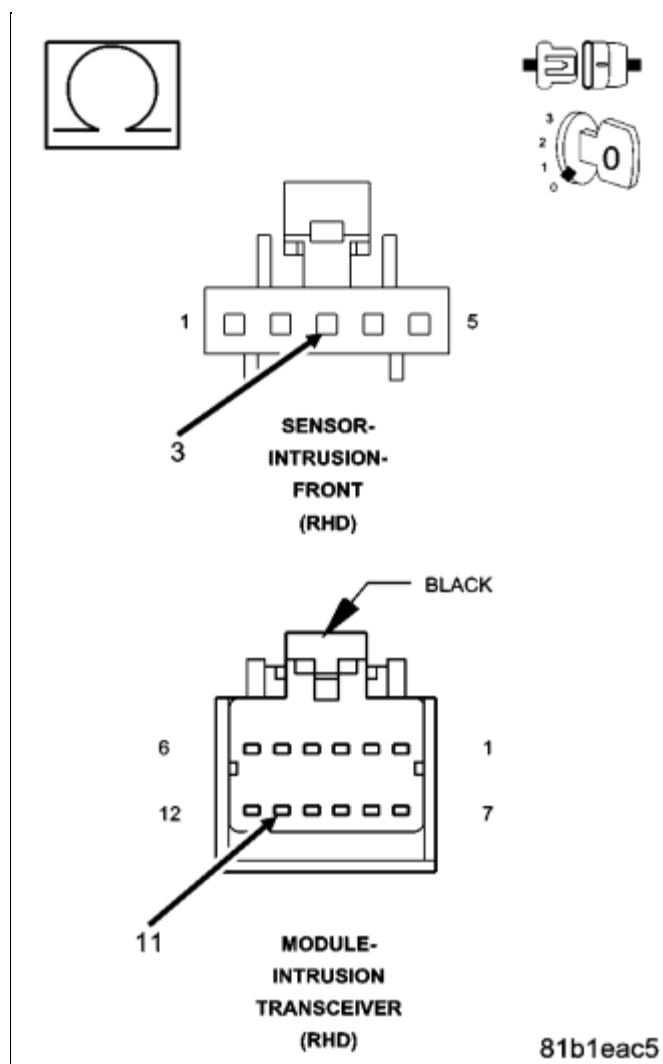
Yes

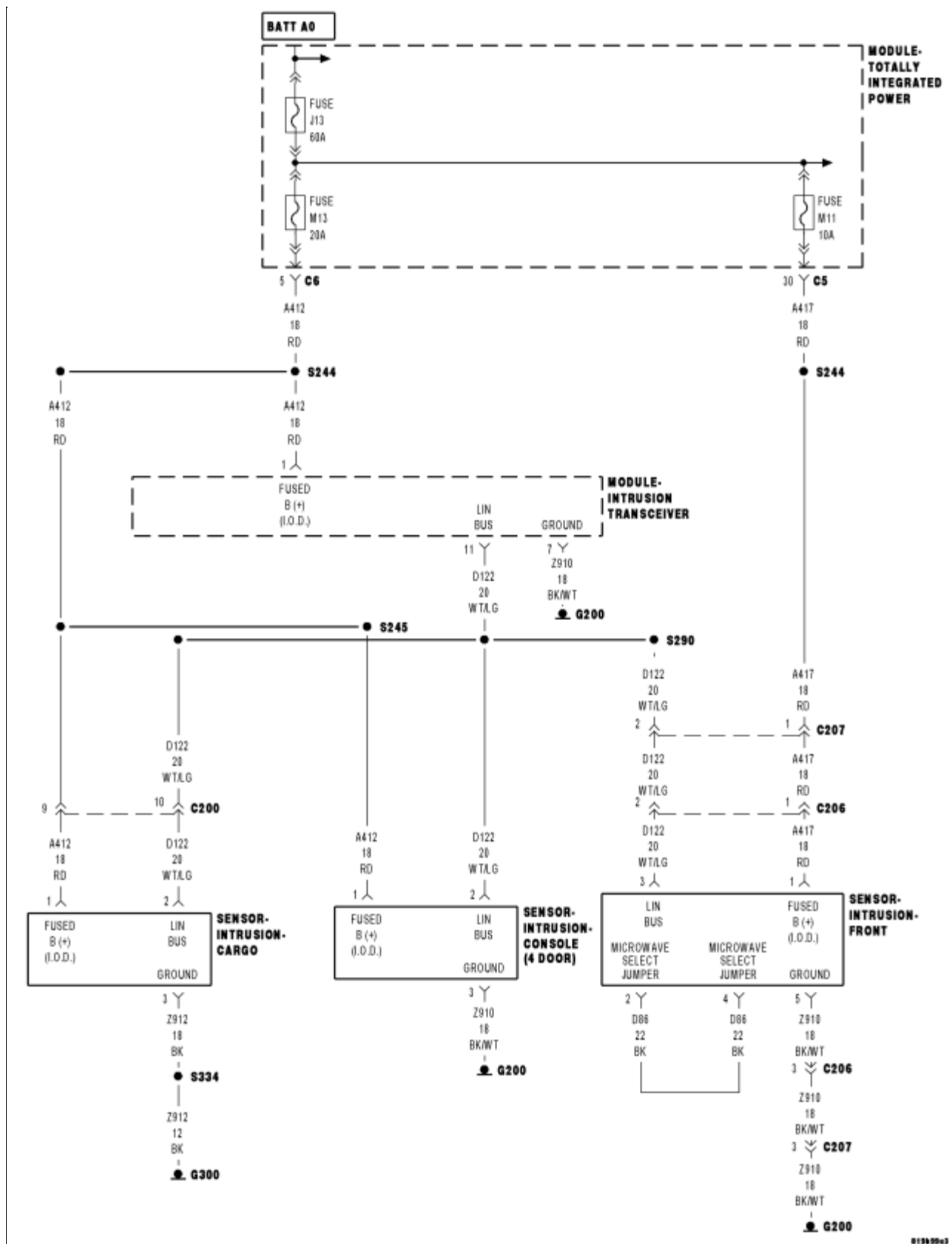
- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D122) LIN Bus circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U1179-LOST COMMUNICATION WITH INTRUSION SENSOR 3





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the VTSS is armed.

◦ **Set Condition:**

If the Intrusion Transceiver Module does not receive messages from the Console Intrusion Sensor over the LIN bus.

Possible Causes
INTERMITTENT CONDITION
(A412) FUSED B+ CIRCUIT OPEN
(Z910) GROUND CIRCUIT OPEN
(D122) LIN BUS CIRCUIT OPEN
CONSOLE INTRUSION SENSOR
INTRUSION TRANSCIEVER MODULE

Diagnostic Test

1. INTERMITTENT DTC

With the scan tool, erase the current Intrusion Transceiver Module DTC's.

Turn the ignition off.

Arm the VTSS and wait 1 minute.

Disarm the VTSS and turn the ignition on.

Using the scan tool, read ITM DTC(s).

Does the scan tool display the same DTC?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (A412) FUSED B+ OPEN

Disconnect the Console Intrusion Sensor connector.
Using a 12-volt test light connected to ground, check the (A412) Fused B(+) circuit in the Console Intrusion Sensor connector.

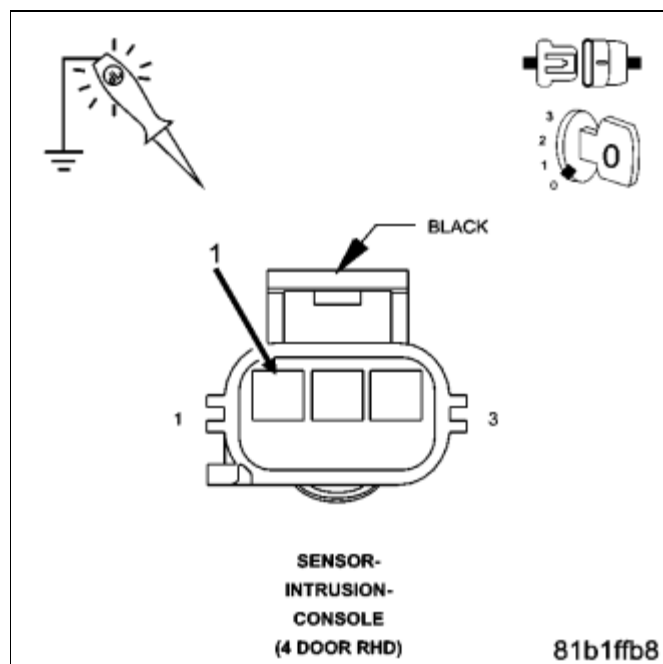
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (A412) Fused B+ circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



3. (Z910) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z910) Ground circuit at the Console Intrusion Sensor connector.

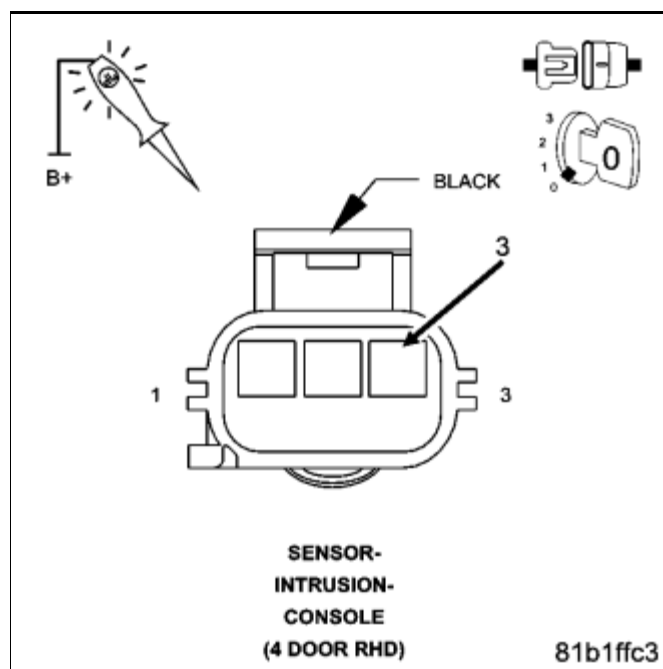
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z910) Ground circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



4. LIN BUS VOLTAGE

Measure the voltage of the (D122) LIN Bus circuit at the Console Intrusion Sensor connector with the key on and off. Observe the voltage displayed on the voltmeter.

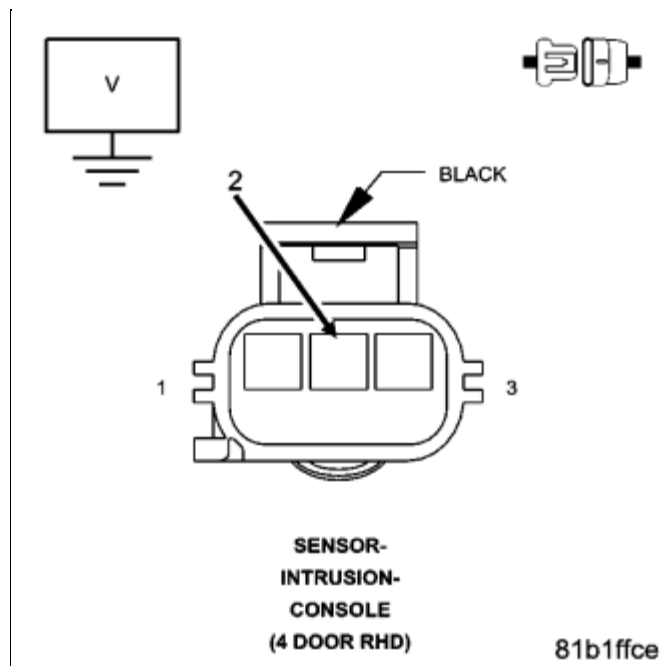
Is the voltage between 1 and 12 volts?

Yes

- Replace the Console Intrusion Sensor in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (D122) LIN BUS CIRCUIT OPEN

Disconnect the Intrusion Transceiver Module harness connector.

Measure the resistance of the (D122) LIN Bus circuit between the Intrusion Transceiver Module and the Console Intrusion Sensor connector.

Is the resistance below 3.0 ohms?

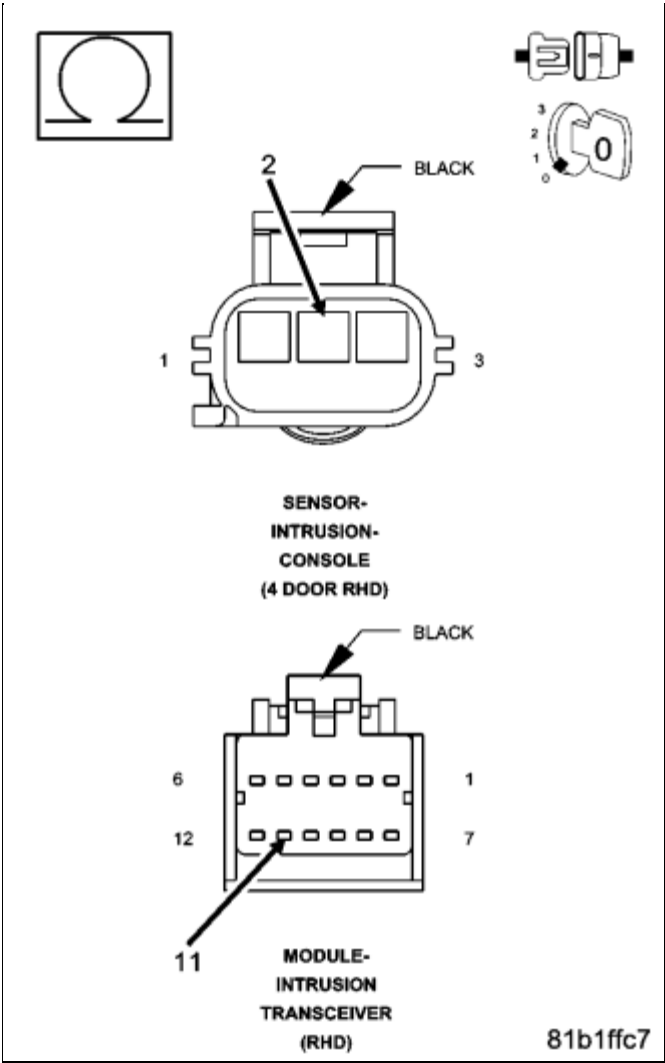
Yes

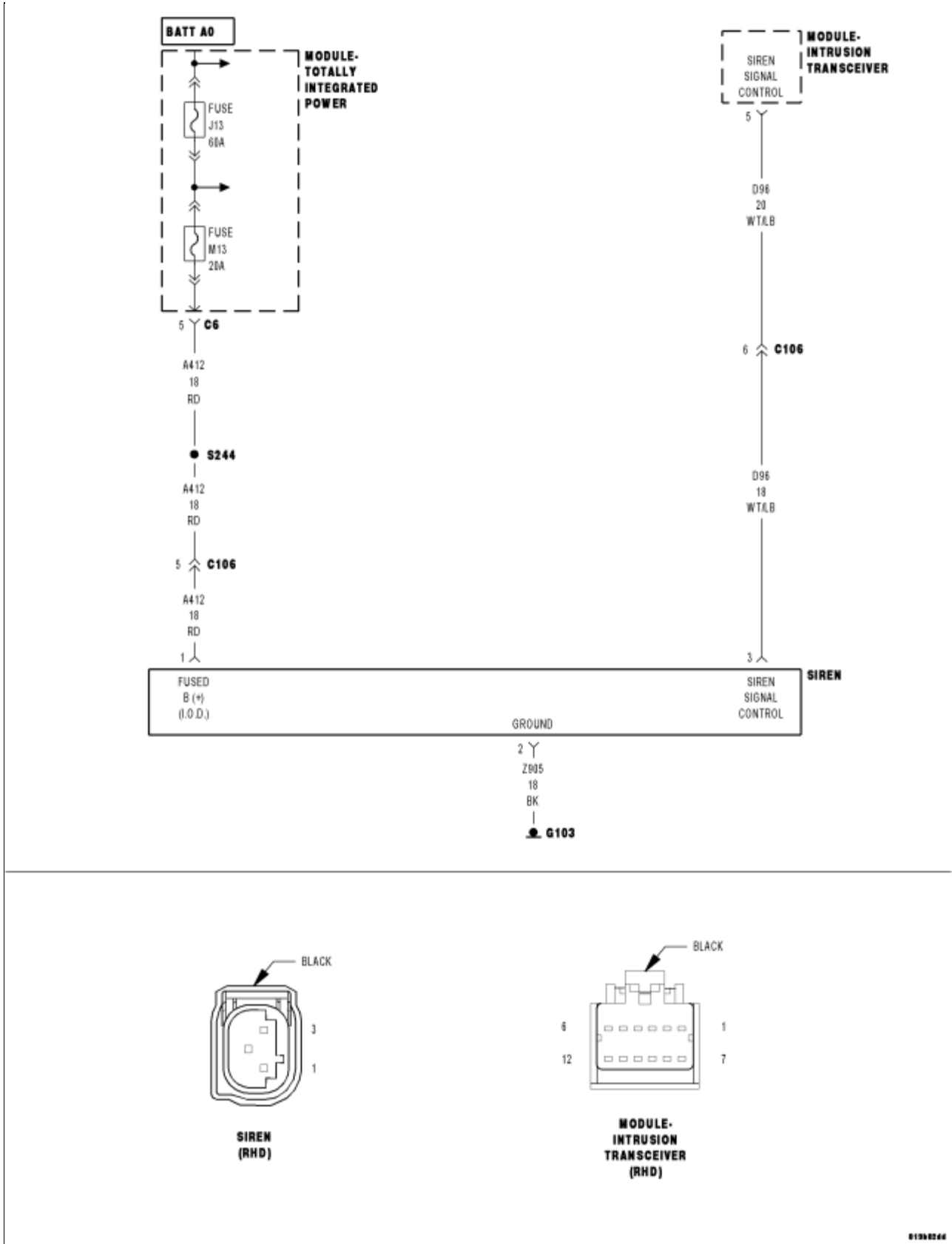
- Replace the Intrusion Transceiver Module in accordance with the Service Information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (D122) LIN Bus circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

U1416-IMPLAUSIBLE SECURITY SIREN SIGNAL RECEIVED





For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

While the VTSS is armed.

- **Set Condition:**

When the learned Siren information stored in the ITM does not match.

Possible Causes
INTERMITTENT CONDITION
SIREN

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Communication DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Turn the ignition off and remove the key from the ignition.

Lock and close all doors to allow the VTSS to go from pre-arm to armed status and wait one minute.

Disarm the VTSS.

Using the scan tool, read ITM DTC(s).

Does the DTC reset?

Yes

- Inspect wiring from ITM to Siren for an intermittent open condition. Check connector terminals for push out, corrosion or loose terminal contact. If OK, replace the Siren.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [2](#)
-

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**

- **Pushed out or loose terminals**
- **Broken wire internal to the insulation**

Were there any problems found?

Yes

- Repair the wiring as necessary.
- Perform BODY VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- DTC is not active at this time. Test complete.

B1A24–KEY NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

Possible Causes
KEY NOT PROGRAMMED
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. PROGRAM ALL OF THE IGNITION KEYS

Turn the ignition on.

With the scan tool, attempt to program the key(s) into the SKREEM.

Was the programming of the key(s) successful?

Yes

- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Replace the ignition key and attempt to program it into the SKREEM. If the DTC resets, replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.

NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.

- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

B1A25-INVALID KEY

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

At ignition on and during Key Programming Mode.

- **Set Condition:**

When the Sentry Key Remote Entry Module (SKREEM) does not receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds. When the key that is being used is programmed for a different vehicle.

Possible Causes
KEY THAT HAS BEEN PREVIOUSLY PROGRAMMED FOR ANOTHER VEHICLE
MULTIPLE KEY OPERATION
IGNITION KEY
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)
INTERMITTENT WIRING HARNESS PROBLEM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Verify the key being used is the proper key for this vehicle and a blank key. If the key being programmed is not blank (one that has been programmed for another vehicle) this fault will set.

With the scan tool, read and record the SKREEM DTCs.

With the scan tool, erase the SKREEM DTCs

NOTE: Perform the following test several times to ensure the DTC is current.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECKING FOR MULTIPLE KEYS

Are there multiple vehicle ignition keys available?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. MULTIPLE KEY OPERATION

NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each of the other vehicle keys, one at a time.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on

With the scan tool, read the SKREEM DTCs.

Is the DTC present for all ignition keys?

Yes

- Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT

SECURITY - STANDARD PROCEDURE).

No

- Replace the ignition key(s) that cause the SKIM DTC.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

4. REPROGRAM KEY

With the scan tool, attempt to reprogram the ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes

- Go To [5](#)

No

- Test complete.

5. PROGRAM NEW IGNITION KEY

Replace the ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM.

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the DTC set again?

Yes

- Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Test complete.

6. INTERMITTENT WIRING HARNESS PROBLEM

Turn the ignition off.

NOTE: Check the following items:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes

- Repair wiring harness/connectors as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Test Complete.

B1A26—MAXIMUM NUMBER OF KEYS PROGRAMMED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

When the maximum number of keys (8) have been programmed into the Sentry Key Remote Entry Module (SKREEM).

Possible Causes
MAXIMUM AMOUNT OF KEY PROGRAMMED INTO SKREEM
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. REPROGRAM ALL IGNITION KEYS

NOTE: This procedure will clear all the key information from the SKREEM. It is important to obtain all of the customer's ignition keys so they may be reprogrammed into the module.

NOTE: If the total number of keys already programmed is equal to Eight and another Key is trying to be programmed, this fault is valid. Explain to the customer no more Keys are allowed to be programmed.

Turn the ignition on.

With the scan tool, clear all the key information in the SKREEM.

Program the all of the customer keys into the SKREEM (maximum eight).

Did the “Maximum Number of Keys Programmed” display again?

Yes

- Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.

NOTE: If this vehicle is equipped with a Steering Column Lock Module it must be replaced along with the SKREEM.

- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Programming of the keys was successful. Test complete.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

B1A27–SKREEM PROGRAMMING PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Possible Causes
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

NOTE: Before continuing, review and check for the following:

- **Review the repair history of the vehicle.**
- **Ensure that the vehicle has the correct PCM and SKREEM installed by verifying the part numbers.**
- **With the scan tool, ensure that the PCM and SKREEM are programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINs match.**

With the scan tool, clear DTCs.
Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.
With the scan tool, read DTCs.

Does the DTC reset?

Yes

- Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.
- NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.**
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- The DTC is not active at this time. Test complete.

B1A28-ECM MISMATCH WITH SKIM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.
- **Set Condition:**

When a PCM/ECM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM/ECM.

Possible Causes
VERIFYING PCM VIN
INTERMITTENT WIRING HARNESS PROBLEM
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on and wait 2 minutes.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes

- Go To [2](#)

No

- Go To [4](#)

2. VERIFYING THE PCM VIN

Turn the ignition on.

With the scan tool, select Engine system from the main menu.

Display and record the Vehicle Identification Number.

NOTE: Ensure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes

- Go To [3](#)

No

- Using the scan tool perform the PCM Replace procedure to update the VIN in the PCM.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

3. REPLACE SKREEM AND CHECK DTC'S

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTC's.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes

- Replace and program the Powertrain Control Module in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- The repair is complete.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes

- Repair wiring harness/connectors as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Test Complete.

B1A29-SKIM BASESTATION MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM/SKREEM or PCM reset.

- **Set Condition:**

When a PCM STATUS message with a Valid Key status is not received by the SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

Possible Causes
VERIFYING PCM VIN
INTERMITTENT WIRING HARNESS PROBLEM
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on and wait 2 minutes.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes

- Go To [2](#)

No

- Go To [4](#)

2. VERIFYING THE PCM VIN

Turn the ignition on.

With the scan tool, select Engine system from the main menu.

Display and record the Vehicle Identification Number.

NOTE: Ensure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes

- Go To [3](#)

No

- Using the scan tool perform the PCM Replace procedure to update the VIN in the PCM.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

3. REPLACE SKREEM AND CHECK DTCS

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTCs.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes

- Using the scan tool perform the PCM Replace procedure to update the VIN in the PCM.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- The repair is complete.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?**Yes**

- Repair wiring harness/connectors as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Test Complete.

B210A-SYSTEM VOLTAGE LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition key in the run position.

- **Set Condition:**

The Sentry Key Remote Entry Module (SKREEM) has detected the system voltage is below 9 volts.

Possible Causes
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
FUSED (B+) CIRCUIT OPEN
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test**1. DETERMINING IF DTC IS CURRENT**

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?**Yes**

- Go To [3](#)

No

- Go to [2](#)

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.
Using a scan tool, read DTC(s).

Does the DTC reset?**Yes**

- Repair the wiring as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

DTC is not active at this time. Test complete.

3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN

NOTE: Check the related fuses to the Fused Ignition Switch Output (Run-Start) circuit. If the fuse is found to be open repair the circuit for a shorted condition.

Turn the ignition off.

Disconnect the SKREEM harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?**Yes**

- Go to [4](#)

No

- Repair the Fused Ignition Switch Output (Run-Start) circuit for an open.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

4. FUSED (B+) CIRCUIT OPEN

Turn the ignition off.

Using a 12 volt test light connected to ground, probe the Fused (B+) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?**Yes**

- Go to [5](#)

No

- Repair the Fused (B+) circuit for an open.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

5. SKREEM

NOTE: Repeat the below procedure for both the Fused Ignition Switch Output (Run-Start) circuit and the Fused (B+) circuit.

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Ensure the module has a good ground before continuing.

Turn the ignition off.

Reconnect the SKREEM connector.

Back probe the Fused Ignition Switch Output (Run-Start) circuit and then the Fused (B+) circuit.

Start the engine.

Using the scan tool, view battery voltage under Data Display in the Engine category.

Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?**Yes**

- Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Repair the circuit(s) that indicated the incorrect voltage.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

B210B-SYSTEM VOLTAGE HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition key in the run position.

- **Set Condition:**

The Sentry Key Remote Entry Module (SKREEM) has detected the system voltage above 16 volts.

Possible Causes
FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTC(s).

With the scan tool, clear DTC(s).

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read DTC(s).

Does the DTC reset?

Yes

- Go To [3](#)

No

- Go to [2](#)

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.
Using a scan tool, read DTC(s).

Does the DTC reset?

Yes

- Repair the wiring as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

DTC is not active at this time. Test complete.

3. FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Ensure the module has a good ground before continuing.

Turn the ignition off.

Disconnect the SKREEM harness connector.

Using a 12 volt test light connected to ground, probe the Fused Ignition Switch Output (Run-Start) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes

- Repair the Fused Ignition Switch Output (Run-Start) circuit for a short to voltage.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Replace and reprogram the SKREEM in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

B210D-BATTERY VOLTAGE LOW — (WCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition key in any position but run.

◦ **Set Condition:**

The Sentry Key Remote Entry Module (SKREEM) has detected the Fused (B+) input voltage below 9 volts with the Key in any position except for RUN.

Possible Causes
FUSED (B+) CIRCUIT OPEN
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

NOTE: Diagnose any related Powertrain DTC(s) before continuing.

With a scan tool, read and record DTCs.

With the scan tool, clear DTCs.

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, select View DTCs.

Does the DTC reset?

Yes

- Go To [3](#)

No

- Go to [2](#)
-

2. INTERMITTENT CONDITION

NOTE: Check for any of the follow conditions:

- **Poor wire to terminal connection**
- **Corroded terminals**
- **Backed out or loose terminals**
- **Broken wire internal to the insulation**
- **Dirty (partial) module ground**

With the ignition on, wiggle the related wires.
Using a scan tool, View DTC(s).

Does the DTC reset?

Yes

- Repair the wiring as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

DTC is not active at this time. Test complete.

3. FUSED (B+) CIRCUIT OPEN

NOTE: Check the related fuses to the Fused (B+) circuit. If the fuse is found to be open repair the circuit for a shorted condition.

Turn the ignition off.

Disconnect the SKREEM harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, probe the Fused (B+) circuit in the SKREEM harness connector.

Does the test light illuminate brightly?

Yes

- Go to [4](#)

No

- Repair the Fused (B+) circuit for an open.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

4. SKREEM

NOTE: A dirty (partial) ground can cause abnormal conditions within a system. Ensure the module has a good ground before continuing.

Turn the ignition off.

Reconnect the SKREEM connector

Back probe the Fused (B+) circuit.

Start the engine.

Using the scan tool, view battery voltage under Data Display in the Engine category.

Compare the voltage on the scan tool to the voltage reading on the voltmeter.

Is the voltage on the scan tool equal to the voltmeter reading +/- .5 volt?

Yes

- Replace and program the SKREEM in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- Repair the Fused (B+) circuit for high resistances.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

B210E-BATTERY VOLTAGE HIGH — (WCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition key in any position but run.

- **Set Condition:**

The Sentry Key Remote Entry Module (SKREEM) has detected the Fused (B+) input voltage above 16 volts in all Key Positions except for RUN.

Possible Causes
VEHICLE CHARGING SYSTEM
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test**1. DETERMINING IF DTC IS CURRENT**

CAUTION: Diagnose and repair all Powertrain DTCs before continuing.

Turn the ignition on.

With the scan tool, record and erase the SKREEM DTCs.

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

Using the scan tool, read the SKREEM DTCs.

Does the DTC reset?

Yes

- Replace and program the SKREEM in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- The DTC is not active at this time. Test complete.

B2204-ECU CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The WCM receives different information than is configured within the module. Examples include Model Year, Country Code, Body Style, Platform, Remote Start, Sun Roof.

Possible Causes
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test**1. VERIFY THAT THE DTC IS ACTIVE**

Turn the ignition on.

NOTE: Before continuing, review and check for the following:

- **Review the repair history of the vehicle.**
- **Ensure that the vehicle has the correct PCM and SKREEM installed by verifying the part numbers.**
- **With the scan tool, ensure that the PCM and SKREEM are programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINs match.**

With the scan tool, clear DTCs.

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

With the scan tool, select View DTCs.

Does the DTC reset?

Yes

- Replace and program the SKREEM in accordance with the Service Information.

NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.

- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- The DTC is not active at this time. Test complete.

B2205-ORIGINAL VIN MISSING/MISMATCH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKIM or PCM reset.

- **Set Condition:**

A valid key is recognized but the programmed VIN does not match between the WCM and PCM/ECM.

Possible Causes
VERIFYING PCM VIN
INTERMITTENT WIRING HARNESS PROBLEM
PCM

Diagnostic Test

1. DETERMINING IF DTC IS CURRENT

With the scan tool, erase the SKREEM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on and wait 2 minutes.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display the DTC that was previously erased?

Yes

- Go To [2](#)

No

- Go To [4](#)

2. VERIFYING THE PCM VIN

Turn the ignition on.

With the scan tool, select Engine system from the main menu.

Display and record the Vehicle Identification Number.

NOTE: Ensure that a VIN has been programmed into the PCM. If a VIN is not displayed, attempt to program the PCM with the correct VIN before continuing.

Does the VIN recorded from the PCM match the VIN of the vehicle?

Yes

- Go To [3](#)

No

- Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

3. REPLACE SKREEM AND CHECK DTC'S

Turn the ignition off.

Replace and program the Sentry Key Remote Entry Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, display and clear all PCM and SKREEM DTC's.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM DTCs.

Does the scan tool display the same DTC?

Yes

- Replace and program the Powertrain Control Module in accordance with the Service Information.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- The repair is complete.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

4. INTERMITTENT

Turn the ignition off.

NOTE: Check for the following conditions:

- **Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.**
- **Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.**
- **Refer to any Technical Service Bulletins (TSB) that may apply.**

Were any problems found?

Yes

- Repair wiring harness/connectors as necessary.
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

No

- Test Complete.

B2224–SKREEM INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

Sentry Key Remote Entry Module (SKREEM) watchdog resets.

Possible Causes
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

NOTE: Before continuing, review and check for the following:

- **Review the repair history of the vehicle.**
- **Ensure that the vehicle has the correct PCM and SKREEM installed by verifying the part numbers.**
- **With the scan tool, ensure that the PCM and SKREEM are programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINs match.**

With the scan tool, clear DTCs.
Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.
With the scan tool, read DTCs.

Does the DTC reset?

Yes

- Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.
- NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.**
- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- The DTC is not active at this time. Test complete.

B2229-SKREEM INTERNAL - SKIM IMMOBILIZER

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.
- **Set Condition:**

When the Antenna diagnostic test fails.

Possible Causes
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

NOTE: Before continuing, review and check for the following:

- **Review the repair history of the vehicle.**
- **Ensure that the vehicle has the correct PCM and SKREEM installed by verifying the part numbers.**
- **With the scan tool, ensure that the PCM and SKREEM are programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINs match.**

With the scan tool, clear DTCs.

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

With the scan tool, read DTCs.

Does the DTC reset?

Yes

- Replace and program the Sentry Key Remote Entry Module (SKREEM) in accordance with the Service Information.

NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.

- Perform the SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- The DTC is not active at this time. Test complete.

B2254-COLUMN LOCK MODULE INTERNAL

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition key in the run position.

- **Set Condition:**

The alarm message fails three times.

Possible Causes
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

Diagnostic Test

1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

NOTE: Before continuing, review and check for the following:

- The battery voltage must be above 10 volts.
- Review the repair history of the vehicle.
- Ensure that the PCM and SKREEM are programmed correctly. Compare the PCM VIN to the SKREEM VIN and ensure the two VINs match.

With the scan tool, clear DTCs.

Perform 5 ignition cycles, leaving the ignition switch on for a minimum of 90 seconds per cycle.

With the scan tool, read DTCs.

Is the DTC active?

Yes

- Replace and program the SKREEM and Steering Column Lock Module in accordance with the Service Information.
- Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No

- The DTC is not active at this time. Test complete.

U0100-LOST COMMUNICATION WITH ECM/PCM

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure. Perform the No Response From ECM or PCM procedure.

U0141-LOST COMMUNICATION WITH FRONT CONTROL

MODULE

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

U0155-LOST COMMUNICATION WITH CLUSTER/CCN

For a complete wiring diagram **Refer to Section 8W.**

(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the diagnostic test procedure.

STANDARD PROCEDURE

SENTRY KEY REMOTE ENTRY MODULE (SKREEM/SKIM) VERIFICATION

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. SKREEM/SKIM VERIFICATION

NOTE: When entering the PIN, care should be taken because the SKREEM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PIN's are entered the SKREEM will Lock Out the scan tool. To exit Lock Mode, the ignition key must remain in the Run position for 1 hour. All accessories must be off. A battery charger connected to the battery during this time period is recommended.

NOTE: On vehicles equipped with a premium Tire Pressure Monitoring (TPM) system, when the SKREEM and/or the spare tire pressure sensor is replaced with a new unit, a diagnostic scan tool **MUST** be used to run a routine that allows the SKREEM to be programmed with the ID number and location of the spare tire pressure sensor mounted in the wheel of the spare tire. Follow the programming steps outlined in the diagnostic scan tool for “Learn Spare Tire Sensor ID” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item as appropriate. In addition, if the SKREEM is replaced, the spare tire must be dismounted from its wheel to access and note the ID number on the spare tire pressure sensor so that the ID code for that sensor can be programmed into the new SKREEM.

- Reconnect the previously disconnected components and connectors.
- Obtain the vehicle's unique Personal Identification Number (PIN) assigned to its original SKREEM. This

number can be obtained from the vehicle invoice or from the DaimlerChrysler Customer Center (Phone 1-800-992-1997).

- **NOTE: If the PCM and the SKREEM are replaced at the same time, program the PCM VIN into the PCM first.**
- **NOTE: During PCM/ECM replacement, use the following steps to ensure transfer of the secret key information from the SKREEM to the new PCM. The PCM stores this information only. If the SKREEM ever needs to be replaced, the secret key information can be retrieved from the PCM and then transferred to the SKREEM for security use.**
- First replace the PCM/ECM with the original WCM still connected to the vehicle.
- Using the appropriate service information program the new PCM/ECM. (This will ensure the Secret Key Transfer from the original WCM into the new PCM/ECM).
- Now replace and program the WCM (if necessary). This will retain the Secret Key from the PCM/ECM back into the new WCM.
- With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
- If the vehicle is equipped with Tire Pressure Monitoring System program the Placard Pressure Values into the WCM/SKREEM.
- Ensure all the customer's keys have been programmed into the new module if necessary.
- With the scan tool, erase all DTCs. Perform 5 ignition key cycles, leaving the key on for at least 90 seconds per cycle.
- With the scan tool, read SKREEM DTC(s).
- **NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.**

Are there any SKREEM DTC(s) present?

Yes

- Repair not complete, refer to the appropriate symptom.

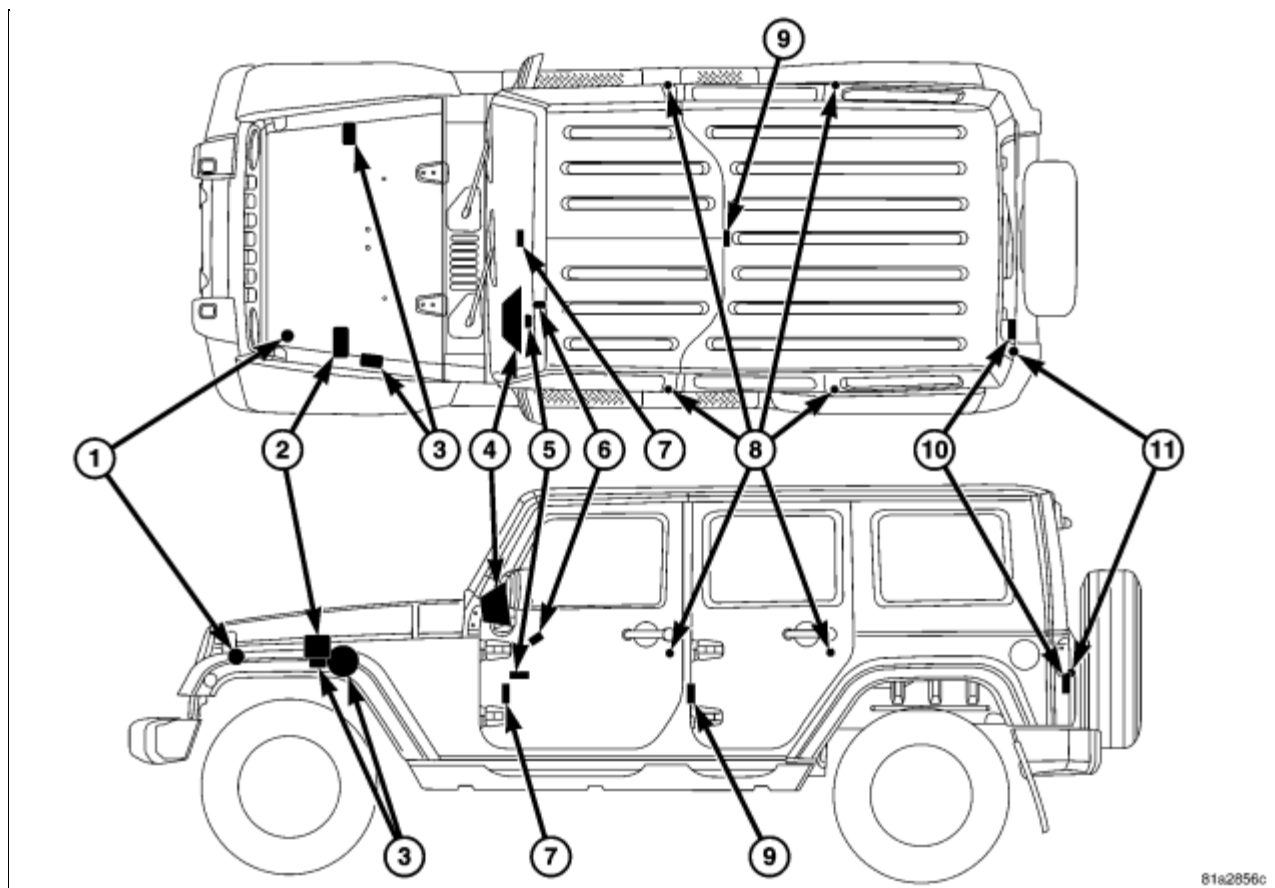
No

- Repair is complete.

VEHICLE THEFT SECURITY

VEHICLE THEFT SECURITY

DESCRIPTION



The Vehicle Theft Security System (VTSS) is an available factory-installed feature on this vehicle. The VTSS is comprised of two primary subsystems: the optional Vehicle Theft Alarm (VTA) and the standard Sentry Key Immobilizer System (SKIS). The VTA is an active system that provides visual and audible responses as deterrents to and warnings of unauthorized vehicle tampering. The SKIS is a passive system that effectively immobilizes the vehicle against unauthorized operation. Following are paragraphs which describe these subsystems of the VTSS.

Certain functions and features of the VTSS rely upon resources shared with or controlled by other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. Other modules that may affect VTSS operation are:

- **ElectroMechanical Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) provides security indicator control. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Powertrain Control Module** - The Powertrain Control Module (PCM) provides the SKIS engine control logic.
- **Totally Integrated Power Module (2)** - The Totally Integrated Power Module (TIPM) is located in the engine compartment, near the battery. The TIPM monitors door, swing gate and hood ajar switch status and provides the VTA system logic. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/TOTALLY INTEGRATED POWER MODULE - DESCRIPTION).

Except for the Sentry Key transponders, which rely upon Radio Frequency (RF) communication, hard wired circuitry connects the VTA and SKIS components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the SKIS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information.

The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

VEHICLE THEFT ALARM

The VTA is available in two different configurations for this vehicle: One configuration is designed for vehicles manufactured for sale in North America; while, the other configuration is designed for vehicles manufactured for sale in markets outside of North America, also referred to as export markets within the context of this service information. In addition, the VTA for export is available in two versions: base and premium. All vehicles equipped with VTA are also equipped with the Remote Keyless Entry (RKE) system and the Sentry Key Immobilizer System (SKIS), regardless of their market destination.

The North American and export base version of the VTA system provide perimeter vehicle protection by monitoring the vehicle doors, the ignition switch, the swing gate and, for vehicles built for certain markets where it is required equipment, the hood. If unauthorized vehicle use or tampering is detected, these systems respond by pulsing the vehicle horn as an audible deterrent and flashing certain exterior lamps as a visual deterrent.

The export premium version of the VTA system is only available in vehicles manufactured for sale in certain markets where it is required equipment. The export premium version of the VTA provides the same perimeter protection features as the base version, but adds interior vehicle intrusion protection. The export premium VTA also enhances the pulsing horn feature of the base version with an alarm siren as the audible deterrent, while retaining the flashing exterior lamps as the visual deterrent.

The VTA includes the following major components, which are described in further detail elsewhere in this service information:

- **Door Ajar Switches (8)** - A door ajar switch is integral to the door latch mechanism of each front and rear door. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/AJAR SWITCH - DESCRIPTION - DOOR AJAR SWITCH).
- **Hood Ajar Switch (1)** - A hood ajar switch is located in a bracket on the inboard side of the left front fender load path beam within the engine compartment of vehicles built for sale in certain export markets where it is required equipment.
- **Intrusion Module (5)** - An intrusion module is located on a bracket on the lower instrument panel reinforcement beneath the driver side instrument panel in the passenger compartment of vehicles built for sale in certain export markets where it is required equipment.
- **Intrusion Sensors (7, 9 and 10)** - Two (two-door vehicles) or three (four-door vehicles) microwave intrusion sensors are located within the passenger compartment of vehicles built for sale in certain export markets where it is required equipment. One sensor is located within the lower center stack area of the instrument panel, another is located within the rear of the center floor console (four-door vehicles only) and the third is located within the swing gate.
- **Swing Gate Ajar Switch (11)** - A swing gate ajar switch is integral to the latch for the swing gate in the vehicle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/AJAR SWITCH - DESCRIPTION - SWING GATE AJAR SWITCH).
- **Security Indicator (4)** - A security indicator is integral to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).
- **Siren (3)** - An alarm siren is located on the right component tray (gasoline engine) or on the inboard side of the left front fender load path beam (diesel engine) within the engine compartment of vehicles built for sale in certain export markets where it is required equipment.

SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is standard factory-installed equipment on this vehicle. The SKIS provides passive vehicle protection by preventing the engine from operating unless a valid electronically encoded key is detected in the ignition lock cylinder.

The SKIS includes the following major components, which are described in further detail elsewhere in this service information:

- **Security Indicator** - A security indicator is integral to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).
- **Sentry Key Remote Entry Module (6)** - The Sentry Key REmote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) is located on the right side of the steering column near the ignition lock cylinder housing and an integral molded plastic antenna ring circles the ignition lock cylinder like a halo. The SKREEM and its antenna are concealed beneath the shrouds on the steering column. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/SENTRY KEY REMOTE ENTRY MODULE - DESCRIPTION).
- **Sentry Key Transponder** - The Sentry Key transponder is contained within the Remote Keyless Entry (RKE) transmitter integral to the head of the ignition key. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/TRANSPONDER KEY - DESCRIPTION).

OPERATION

The Vehicle Theft Security System (VTSS) is divided into two basic subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS). Following are paragraphs that briefly describe the operation of each of these two subsystems.

VEHICLE THEFT ALARM

The Totally Integrated Power Module (TIPM) is used on this vehicle to control and integrate many of the functions and features included in the Vehicle Theft Alarm (VTA). In the VTA system, the TIPM receives inputs indicating the status of the door ajar switches, the ignition switch, the swing gate ajar switch and the power lock switches. In vehicles built for certain export markets where it is required, the hood ajar switch also provides a hard wired input to the TIPM and the intrusion module provides electronic message inputs to the TIPM over the Controller Area Network (CAN) data bus. The TIPM processes the information from all of these inputs and sends electronic messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over the CAN data bus to control the security indicator as appropriate. The TIPM internally controls the output to the hazard warning lamps and sends a control output to energize or de-energize the horn relay as appropriate. On vehicles with an intrusion module, the horn output of the TIPM is replaced by an output of the siren module that is controlled by the intrusion module.

The hard wired circuits between components related to the VTA system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the VTA system or the electronic controls or communication between modules and devices that provide some features of the VTA system. The most reliable, efficient, and accurate means to diagnose the VTA system or the electronic controls and communication related to VTA system operation requires the use of a diagnostic scan tool. See the **Vehicle**

Theft Security System menu item on the scan tool. Refer to the appropriate diagnostic information.

Following are paragraphs that briefly describe the operation of each of the VTA features.

ENABLING

The TIPM must have the VTA function electronically enabled in order for the VTA to perform as designed. The logic in the TIPM keeps its VTA function dormant until it is enabled using a diagnostic scan tool. The VTA function of the TIPM is enabled on vehicles equipped with the VTA option at the factory, but a service replacement TIPM must be VTA-enabled by the dealer using a diagnostic scan tool. Refer to the appropriate diagnostic information.

ARMING

Passive arming of the VTA occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned OFF, and the doors are locked while they are open using the power lock switch. Active arming occurs when the LOCK button on the Remote Keyless Entry (RKE) transmitter is depressed to lock the vehicle. For active arming to occur, the doors must be closed and the ignition switch must be in the OFF position when the RKE transmitter LOCK button is depressed. The power lock switch will not function if the key is in the ignition switch or the headlamps are turned ON with the driver side front door open.

Pre-arming of the VTA is initiated when a door is open when the vehicle is locked using a power door lock switch or when the RKE transmitter LOCK button is depressed. Pre-arming will not occur if the key is in the ignition switch or the headlamps are turned ON with the driver side front door open. When the VTA is pre-armed, the arming sequence is delayed until all of the doors have been closed. The VTA will remain in pre-armed mode for up to 16 seconds after all doors have been closed.

Once the VTA begins the passive or active arming sequence, the security indicator in the instrument cluster will flash rapidly for about 16 seconds. This indicates that VTA arming is in progress. If the ignition switch is turned to the ON position, if a door or the swing gate is unlocked or opened by any means, or if the RKE PANIC button (if equipped) is depressed during the 16 second arming process, the security indicator will stop flashing and the arming process will abort. Once the arming sequence is successfully completed, the security indicator will flash at a slower rate, indicating that the VTA is armed.

For the swing gate and the hood of vehicles equipped with the hood ajar switch, the VTA arming sequence will occur regardless of whether the swing gate or the hood is open or closed, but the security indicator will illuminate solid and the swing gate or underhood area will not be protected until the swing gate or the hood is closed. Also, if the status of the swing gate ajar or the hood ajar switch changes from open to closed during the 16 second arming process, the security indicator will switch from solid to flashing and the VTA arming sequence will abort. Once the arming process is successfully completed, the security indicator will flash at a slower rate, indicating that the VTA is armed.

DISARMING

For vehicles built for the North American market, passive disarming of the VTA occurs by inserting a valid Sentry Key Immobilizer System (SKIS) key into the ignition lock cylinder or by turning the ignition switch to the ON position. Active disarming of the VTA for all markets occurs when the vehicle is unlocked by depressing the UNLOCK button of the RKE transmitter. Once the alarm has been activated, either disarming method will

also deactivate the alarm. Depressing the PANIC button (if equipped) on the RKE transmitter will **not** disarm the VTA.

POWER-UP MODE

When the armed VTA senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode, the alarm system remains armed following a battery failure or disconnect. If the VTA was armed prior to a battery disconnect or failure, the technician or vehicle operator will have to actively or passively disarm the alarm system after the battery is reconnected. The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is attempted. The VTA will be armed until the technician or vehicle operator has actively or passively disarmed the alarm system. If the VTA is in the disarmed mode prior to a battery disconnect or failure, it will remain disarmed after the battery is reconnected or replaced, or if jump-starting is attempted.

ALARM

The VTA alarm output varies by the version of the VTA with which the vehicle is equipped. In all cases, the alarm provides both visual and audible outputs; however, the time intervals of these outputs vary by the requirements of the market for which the vehicle is manufactured. In all cases, the visual output will be a flashing ON and OFF of the exterior lamps. For vehicles equipped with the North American or the export base version of the VTA, the audible output will be a pulsing of the horn. For vehicles with the export premium version of the VTA, the audible output will be a cycling of the alarm siren in addition to the pulsing horn. The inputs that will trigger the alarm include the ignition switch, the door ajar switches, the swing gate ajar switch and, in vehicles built for certain markets where they are required, the hood ajar switch and the intrusion module.

TAMPER ALERT

The VTA tamper alert feature will pulse the horn three times upon VTA disarming if the alarm was triggered and has since timed out. This feature alerts the vehicle operator that the VTA alarm was activated while the vehicle was unattended.

INTRUSION ALARM

The intrusion alarm is an exclusive feature of the export premium version of the VTA, which is only available in certain markets where it is required. When the VTA is armed, the intrusion module uses hard wired outputs to control two (two-door vehicles) or three (four-door vehicles) microwave intrusion sensors which allow the module to monitor the interior of the vehicle for movement. If motion is detected, the intrusion module sends an electronic message to the TIPM over the CAN data bus to invoke the visual alarm features, and sends an electronic message to the alarm siren in the engine compartment over a dedicated serial bus to invoke the audible alarm feature.

The motion detect feature of the intrusion module can be disabled by depressing the LOCK button on the RKE transmitter 3 times within 15 seconds during VTA arming, while the security indicator is still flashing rapidly. The VTA provides a single short siren chirp as an audible confirmation that the motion detect disable request has been received.

The intrusion module must be electronically enabled in order for the intrusion alarm to perform as designed. The intrusion alarm function of the intrusion module is enabled on vehicles equipped with this option at the factory, but a service replacement module must be configured and enabled by the dealer using a diagnostic scan tool. Refer to the appropriate diagnostic information. The intrusion module monitors the condition of the intrusion sensors as well as the siren, and will store fault information in the form of a Diagnostic Trouble Code (DTC) if a system malfunction is detected. The intrusion module may be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by disabling the engine after about two seconds of running whenever any method other than a valid Sentry Key is used to start the vehicle. The SKIS is considered a passive protection system because it is always active when the ignition system is energized and does not require any customer intervention. The SKIS uses Radio Frequency (RF) communication to obtain confirmation that the key in the ignition switch is a valid key for operating the vehicle. The microprocessor-based SKIS hardware and software also uses electronic messages to communicate with other electronic modules in the vehicle over the Controller Area Network (CAN) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

Pre-programmed Sentry Key transponders are provided with the vehicle from the factory. Each Sentry Key REMote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) will recognize a maximum of eight Sentry Keys. If the customer would like additional keys other than those provided with the vehicle, they may be purchased from any authorized dealer. These additional keys must be programmed to the SKREEM in the vehicle in order for the system to recognize them as valid keys. This can be done by the dealer using a diagnostic scan tool or, if Customer Learn programming is an available SKIS feature in the market where the vehicle was purchased, the customer can program the additional keys, as long as at least two valid Sentry Keys are already available. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKREEM performs a self-test of the SKIS each time the ignition switch is turned to the ON position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) if a system malfunction is detected. The SKREEM will also send an electronic message to the instrument cluster if a fault is detected, and the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) illuminates the security indicator as appropriate.

The hard wired circuits between components related to the SKIS may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SKIS or the electronic controls or communication between other modules and devices that provide some features of the SKIS. The most reliable, efficient, and accurate means to diagnose the SKIS or the electronic controls and communication related to SKIS operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING

VEHICLE THEFT SECURITY SYSTEM

The Vehicle Theft Security System (VTSS) is divided into two basic subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS). Following are the recommended procedures for diagnosis of each of these two subsystems.

VEHICLE THEFT ALARM

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired circuits between components related to the VTA system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the VTA system or the electronic controls or communication between other modules and devices that provide some features of the VTA system. The most reliable, efficient, and accurate means to diagnose the VTA system or the electronic controls and communication related to VTA system operation requires the use of a diagnostic scan tool. See the **Vehicle Theft Security System** menu item on the scan tool. Refer to the appropriate diagnostic information.

SENTRY KEY IMMOBILIZER SYSTEM

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The hard wired circuits between components related to the SKIS may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SKIS or the electronic controls or communication between other modules and devices that provide some features of the SKIS. The most reliable, efficient, and accurate means to diagnose the SKIS or the electronic controls and communication related to SKIS operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION

SECURITY INDICATOR FAILS TO LIGHT DURING BULB TEST	1. Ineffective Light-Emitting Diode (LED).	1. Use a diagnostic scan tool to perform the instrument cluster actuator test. Refer to the appropriate diagnostic information.
	2. Ineffective fuse.	2. Check the SKREEM/WCM fused B(+) fuse and the fused ignition switch output (run-start) fuse in the Totally Integrated Power Module (TIPM). Replace the fuses, if required.
	3. Ineffective ground circuit.	3. Test and repair the open ground circuit at the connector for the SKREEM, if required.
	4. Ineffective battery feed circuit.	4. Test and repair the open battery feed circuit at the connector for the SKREEM, if required.
	5. Ineffective ignition feed circuit.	5. Test and repair the open ignition feed circuit at the connector for the SKREEM, if required.
SECURITY INDICATOR FLASHES FOLLOWING BULB TEST	1. Invalid key in ignition switch lock cylinder.	1. Replace the key with a known valid key.
	2. Key-related fault.	2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.
SECURITY INDICATOR LIGHTS SOLID FOLLOWING BULB TEST	1. SKIS system malfunction/fault detected.	1. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.
	2. SKIS system ineffective.	2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis.

STANDARD PROCEDURE

SKIS INITIALIZATION

The Sentry Key Immobilizer System (SKIS) must be initialized following a Sentry Key REmote Entry Module (SKREEM) (also known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) replacement. SKIS initialization requires the use of a diagnostic scan tool. Initialization will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - SKREEM PROGRAMMING).

NOTE: If a Powertrain Control Module (PCM) is replaced on a vehicle equipped with the Sentry Key Immobilizer System (SKIS), the unique Secret Key data must be transferred from the Sentry Key REmote Entry Module (SKREEM) (also known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) to the new PCM using the appropriate programming procedure. This procedure also requires the use of a diagnostic scan tool and the unique four-digit PIN code to enter the Secured Access Mode in the SKREEM. Refer to the appropriate service and diagnostic information for the proper PCM replacement procedure.

SENTRY KEY TRANSPONDER PROGRAMMING

All Sentry Keys included with the vehicle are pre-programmed to work with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key REmote Entry Module (SKREEM) (also known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) may be programmed to recognize up to a total of eight Sentry Keys. When programming a blank Sentry Key transponder, the key must first be cut to match the ignition switch lock cylinder in the vehicle for which it will be used. Once the additional or new key has been cut, the SKREEM must be programmed to recognize it as a valid key. There are two possible methods to program the SKREEM to recognize a new or additional valid key, the Secured Access Method and the Customer Learn Method. Following are the details of these two programming methods.

SECURED ACCESS METHOD

The Secured Access method applies to all vehicles. This method requires the use of a diagnostic scan tool. This method will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKREEM PROGRAMMING).

CUSTOMER LEARN METHOD

NOTE: The Customer Learn feature is only available on domestic vehicles, or those vehicles which have a U.S. country code designator. This programming method also requires access to at least two valid Sentry Keys. If two valid Sentry Keys are not available, or if the vehicle does not have a U.S. country code designator, the Secured Access Method MUST be used to program new or additional valid keys to the SKREEM.

The Customer Learn programming method procedures are as follows:

1. Obtain the blank Sentry Key(s) that are to be programmed as valid keys for the vehicle. Cut the blank key(s) to match the ignition switch lock cylinder mechanical key codes.
2. Insert one of the two valid Sentry Keys into the ignition switch and turn the ignition switch to the ON position.
3. After the ignition switch has been in the ON position for longer than 3 seconds, but no more than 15 seconds, cycle the ignition switch back to the OFF position. Replace the first valid Sentry Key in the ignition switch lock cylinder with the second valid Sentry Key and turn the ignition switch back to the ON position. The second valid Sentry Key must be inserted in the lock cylinder within 15 seconds of removing the first valid key.
4. About 10 seconds after the completion of [STEP 3](#), the security indicator in the instrument cluster will start to flash and a single audible chime will sound to indicate that the system has entered the Customer Learn programming mode.
5. Within 60 seconds of entering the Customer Learn programming mode, turn the ignition switch to the OFF position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the ON position.
6. About 10 seconds after the completion of [STEP 5](#), a single audible chime will sound and the security indicator will stop flashing, stay ON solid for 3 seconds, then turn OFF to indicate that the blank Sentry Key has been successfully programmed. The SKIS will immediately exit the Customer Learn programming mode. After the

ignition is cycled the vehicle may be started using the newly programmed valid Sentry Key.

Each of these steps must be repeated and completed in their entirety for each additional Sentry Key that is to be programmed. If the above steps are not completed in the given sequence, or within the allotted time, the SKIS will exit the Customer Learn programming mode and the programming will be unsuccessful. The SKREEM will also automatically exit the Customer Learn programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed 8 valid Sentry Keys, or if the ignition switch is turned to the OFF position for more than about 50 seconds.

NOTE: If an attempt is made to start the vehicle while in the Customer Learn mode (security indicator flashing), the SKIS will respond as though the vehicle were being started with an invalid key. In other words, the engine will stall after about two seconds of operation. No faults will be set.

NOTE: Once a Sentry Key has been programmed as a valid key to a vehicle, it cannot be programmed as a valid key for use on any other vehicle.

SPECIFICATIONS

VEHICLE THEFT SECURITY SYSTEMS

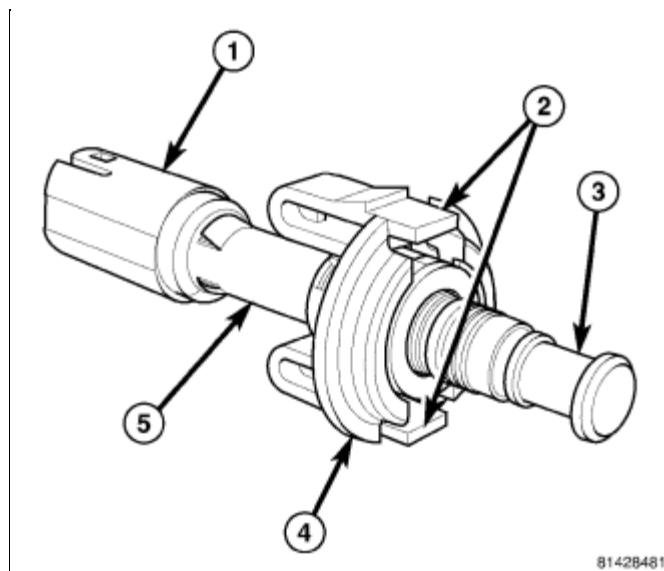
TORQUE SPECIFICATIONS

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Hood Ajar Switch Bracket Screw	8	-	71
Intrusion Module Mounting Screws	8	-	71
SKREEM Mounting Screw	2	-	20
Siren Mounting Screws	8	-	71

HOOD AJAR SWITCH

DESCRIPTION

The hood ajar switch is a normally closed, single pole, spring-loaded plunger actuated switch. This switch has two unique versions that are used in two different applications. One switch is used only on vehicles equipped with the Vehicle Theft Alarm (VTA) system for sale in certain export markets where protection of the underhood area is required equipment. The second switch is used only on domestic



vehicles equipped with an optional remote starter system.

The molded plastic switch body (5) has an integral molded connector receptacle (1) on the lower end containing two terminal pins. The switch is connected to the vehicle electrical system through a dedicated take out of the engine compartment wire harness. Two integral latches (2) lock the switch into a keyed mounting hole in the stamped steel switch mounting bracket. The mounting bracket is secured with a screw to the forward end of the left load beam in the left front corner of the engine compartment. The underside of the hood panel inner reinforcement actuates the switch plunger as the hood panel is closed.

The switch plunger (3) extends through a mounting collar (4) and a sleeve-like retainer ring on the upper end of the switch body. The retainer ring has a one time, self-adjustment feature that is activated after the switch is installed by closing the hood. The retainer ring is also color-coded to aid in identifying the switch application. A dark brown retainer ring identifies the underhood security switch application, while a white retainer ring identifies the remote starter system application.

An installed hood ajar switch cannot be readjusted or repaired. If the switch is damaged, ineffective, or requires readjustment, it must be replaced with a new unit.

OPERATION

The hood ajar switches are interchangeable physically, but not functionally. In each case, the hood ajar switch is a normally closed switch that is held open as the spring-loaded switch plunger is depressed by the inner hood panel reinforcement when the hood panel is closed and latched. When the hood is opened, the spring-loaded switch plunger extends from the switch body and the switch contacts are closed.

In the underhood security application (export vehicles only - dark brown retainer ring), the switch is connected in series between ground and the hood ajar switch sense input of the Totally Integrated Power Module (TIPM). The TIPM uses an internal resistor pull up to monitor the state of the hood ajar switch contacts.

In the remote starter system application (domestic vehicles only - white retainer ring) the switch has a 1 kilohm diagnostic resistor connected in parallel to the switch contacts between the two switch terminals. The switch is connected in series between an output of the TIPM and the hood ajar switch sense input of the TIPM. The TIPM continually monitors this circuit and will store a Diagnostic Trouble Code (DTC) for any fault that it detects.

The components of the switch self-adjustment feature include an integral stop on the shaft of the plunger and a ribbed, ratcheting sleeve-like retainer ring at the top of the switch body from which the plunger extends. With the switch mounting collar secured in its mounting bracket, the plunger is depressed by the striker cap on the hood inner reinforcement as the hood is closed. As the plunger is depressed, the plunger stop contacts the top of the retainer ring and it is driven downward, ratcheting through the switch mounting collar until the hood is fully closed and latched. The ribs on the retainer ring are engaged within the mounting collar to maintain this adjusted position.

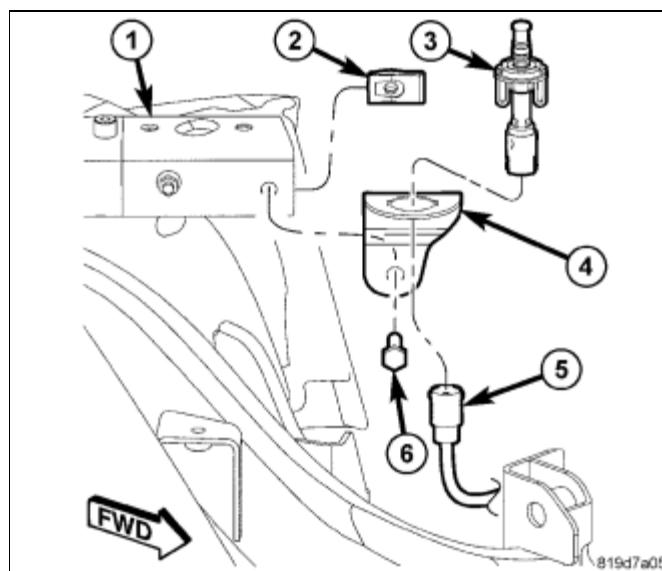
The hood ajar switch as well as the hard wired circuits between the switch and the TIPM may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However,

conventional diagnostic methods will not prove conclusive in the diagnosis of the electronic controls or communication between modules and other devices related to hood ajar switch operation that provide some features of the export vehicle theft or domestic remote starter systems. The most reliable, efficient, and accurate means to diagnose the electronic controls and communication related to hood ajar switch operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

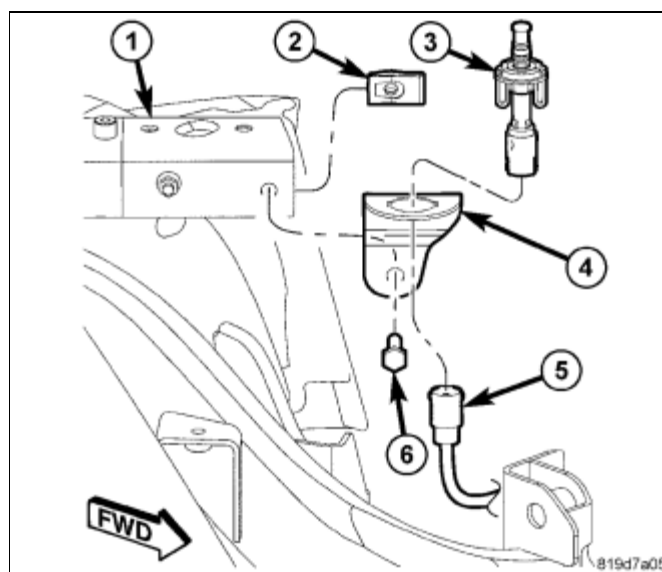
BRACKET

1. Remove the hood ajar switch (3) from the mounting bracket (4). (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - REMOVAL).
2. Remove the screw (6) that secures the hood ajar switch bracket to the front of the left front load beam (1) in the engine compartment.
3. Remove the hood ajar switch bracket from the load beam.



SWITCH

1. Unlatch and open the hood.
2. Disconnect and isolate the battery negative cable.
3. From the top of the mounting bracket (4) in the left front corner of the engine compartment, squeeze the two hood ajar switch (3) latch tabs together and pull the switch upward.
4. Pull the hood ajar switch up through the hole in the mounting bracket far enough to access and disconnect the wire harness connector (5) from the switch connector receptacle.
5. Remove the hood ajar switch from the engine compartment.



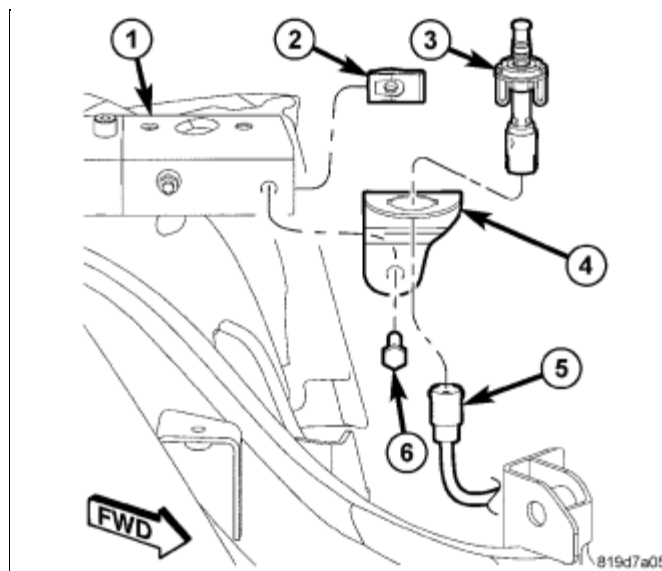
INSTALLATION

BRACKET

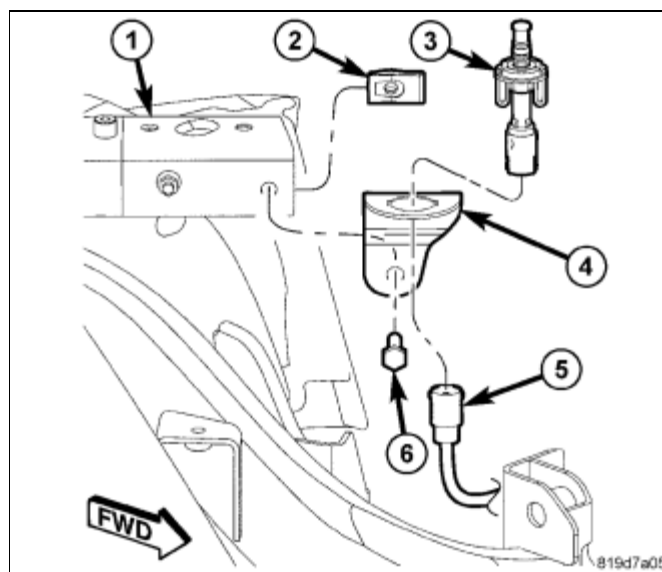
Check to be certain that the U-nut (2) is in good condition

- and properly installed in the front of the left load beam (1).
1. Position the hood ajar switch bracket (4) onto the left load beam.
 2. Install and tighten the screw (6) that secures the hood ajar switch bracket to the load beam. Tighten the screw to 8 N·m (71 in. lbs.).
 3. Reinstall the hood ajar switch (3) into the mounting bracket. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - INSTALLATION).

SWITCH



1. Position the hood ajar switch (3) near the hole in the mounting bracket (4) on the front of the left load beam (1) in the left front corner of the engine compartment.
2. Route the wire harness connector (5) through the switch mounting bracket and reconnect it to the switch connector receptacle.
3. From the top of the mounting bracket, press the switch downward into the mounting hole until the integral switch latch tabs lock it into place.
4. Reconnect the battery negative cable.
5. Close and latch the hood.

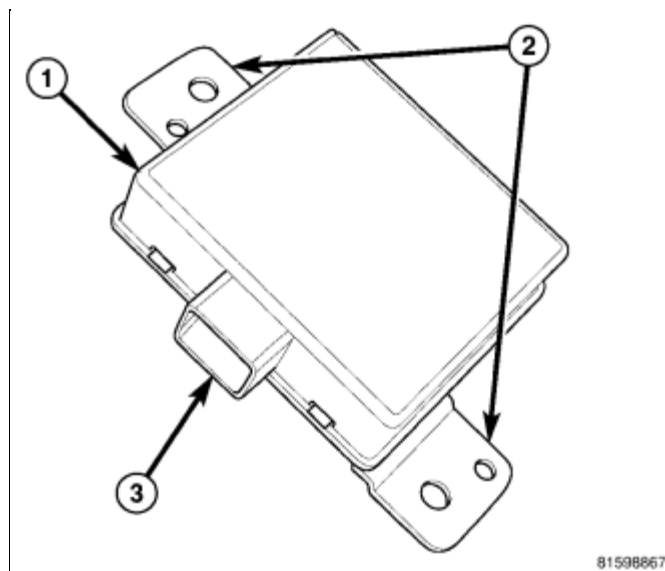


INTRUSION MODULE - EXPORT

DESCRIPTION

An intrusion module (1) is part of the premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS). The premium version of the VTA is only available in vehicles built for certain markets, where the additional features offered by this system are required. The intrusion module is located under the instrument panel within the passenger compartment. This unit is designed to work in conjunction with the remote microwave intrusion sensor transducers to provide interior motion detection and serves as an interface between the Totally Integrated Power Module (TIPM), the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and the alarm siren.

The molded plastic intrusion module housing has two integral



mounts (2) that secure the module with two screws to U-nuts on a stamped steel mounting bracket. The mounting bracket is secured with two additional U-nuts and screws to the lower instrument panel reinforcement behind the steering column opening cover under the driver side instrument panel. Concealed within the module housing is the electronic circuitry of the module, which includes a microprocessor. The module is connected to the vehicle electrical system through an integral connector receptacle (3) by a dedicated take out and connector of the instrument panel wire harness.

The intrusion module unit cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

OPERATION

The microprocessor in the intrusion module controls all of the features of the export premium version of the Vehicle Theft Alarm (VTA). The module uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with a diagnostic scan tool using the Controller Area Network (CAN) data bus. This method of communication is used by the module to communicate with the Totally Integrated Power Module (TIPM) and for diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. The intrusion module also communicates with the alarm siren module and the remote intrusion sensors over dedicated serial bus circuits.

The intrusion module microprocessor continuously monitors inputs from the two (two-door vehicles) or three (four-door vehicles) microwave intrusion sensor transducers as well as inputs from the TIPM and the alarm siren module. The module energizes the intrusion sensors when the system is armed, then monitors inputs from the sensors related to both motion detection and to detect problems with the sensors or sensor circuits. If an object is moving in the interior, a detection circuit in the intrusion sensor senses this movement through the modulation of the returning microwave signals that occurs due to the Doppler effect. The motion detection function of the intrusion module can be disabled by depressing the LOCK button on the Remote Keyless Entry (RKE) transmitter three times within 15 seconds while the VTA is arming (security indicator is flashing rapidly). The intrusion module will signal the alarm siren module to provide a single siren chirp as an audible confirmation that the motion sensor function has been disabled.

If movement is detected while the VTA is armed, the intrusion module sends an electronic status message to the TIPM over the CAN data bus to flash the exterior lighting, and sends an electronic message to the alarm siren module over a dedicated serial bus line to sound the siren. When the TIPM detects a breach in the perimeter protection through a hard wired door, swing gate or hood ajar switch input, it sends an electronic message to the intrusion module and the module sends an electronic message to the alarm siren over a dedicated serial bus line to sound the siren.

The intrusion module also monitors inputs from the alarm siren module for siren battery or siren input/output

circuit tamper alerts, and for siren battery condition alerts, then sets active and stored Diagnostic Trouble Codes (DTC) for any monitored system faults it detects. An active fault only remains for the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the intrusion module. If a fault does not recur for 50 ignition cycles, the module will automatically erase the stored DTC.

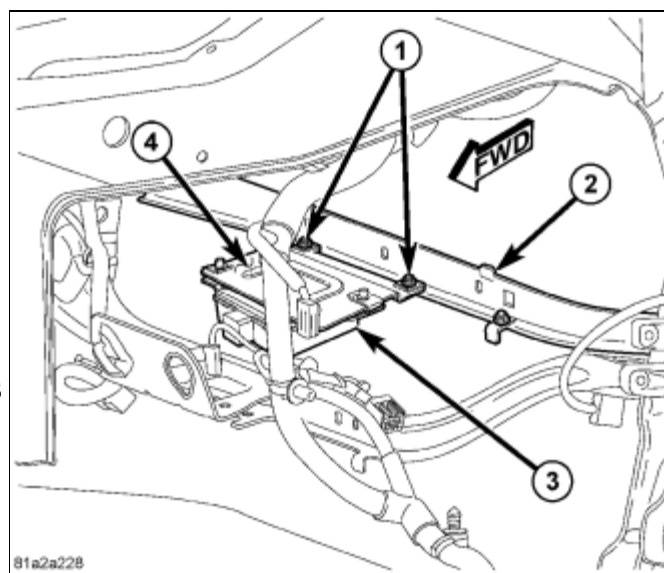
The intrusion module is connected to the vehicle electrical system through the instrument panel wire harness. The module receives battery current through a fuse in the TIPM, and receives ground through the instrument panel wire harness. These connections allow the module to remain operational, regardless of the ignition switch position.

The hard wired circuits of the intrusion module may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the intrusion module or the electronic controls or communication between modules and other devices that provide some features of the VTA. The most reliable, efficient, and accurate means to diagnose the intrusion module or the electronic controls and communication related to intrusion module operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
3. Remove the two screws (1) that secure the intrusion module mounting bracket (4) to the lower instrument panel reinforcement (2).
4. Lower the intrusion module (3) and mounting bracket from the instrument panel reinforcement far enough to access and disconnect the instrument panel wire harness connector from the connector receptacle at the forward-facing end of the module housing.
5. Remove the module and mounting bracket from under the instrument panel as a unit.

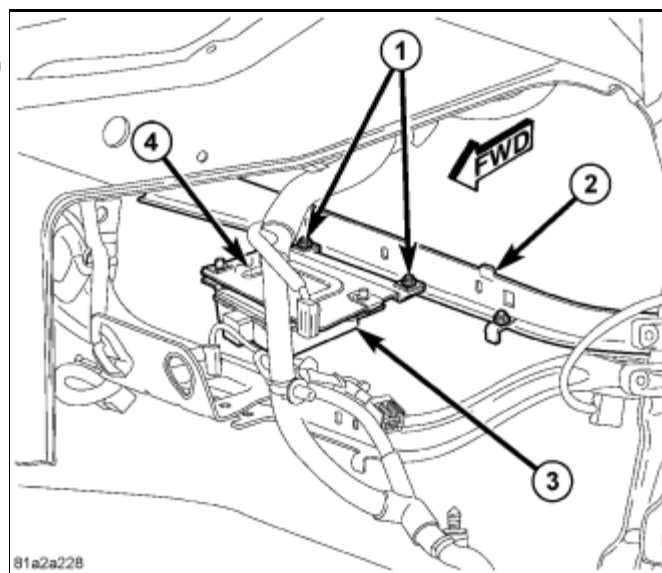


INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper

precautions could result in accidental airbag deployment.

1. Position the intrusion module (3) and mounting bracket (4) under the instrument panel as a unit.
2. Reconnect the instrument panel wire harness connector to the connector receptacle at the forward-facing of the module housing.
3. Position the module mounting bracket to the lower instrument panel reinforcement (2).
4. Install and tighten the two screws (1) that secure the mounting bracket to the lower instrument panel reinforcement. Tighten the screws to 8 N·m (71 in. lbs.).
5. Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
6. Reconnect the battery negative cable.



INTRUSION SENSOR

DESCRIPTION

Intrusion sensor microwave transducers are part of the premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS). The premium version of the VTA is only available in vehicles built for certain markets, where the additional features offered by this system are required. There are two (two-door vehicles) or three (four-door vehicles) sensors used in each vehicle. These units are designed to provide interior motion detection inputs to the intrusion module, which serves as the interface between the Front Control Module (FCM), the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) and the alarm siren.

The sensors are each located within the passenger compartment of the vehicle, concealed behind the interior trim components. A sensor located in the lower center stack of the instrument panel monitors the front seating area of the vehicle. This sensor is concealed behind a lower center trim panel below the instrument panel switch pod. A second sensor is located within the swing gate and monitors the cargo area of all vehicles as well as the second row seating area of two-door vehicles. This sensor is concealed behind a molded plastic grille near the left end of the swing gate inner panel.

A third sensor is used only on four-door vehicles. This sensor is located within the center floor console to monitor the second row seating area of four-door vehicles. This sensor is concealed behind the rear trim cover of the console on the back of the console bin.

Concealed within the molded plastic sensor housing is the circuitry of the sensor which includes the microwave send and receive transducer. The housings each include integral mounting provisions dedicated to the intended sensor mounting location. Each sensor is connected through either an integral connector receptacle or an integral pigtail wire to the vehicle electrical system.

An intrusion sensor microwave transducer cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

OPERATION

The intrusion sensor microwave transducers operate only when they are energized by the intrusion module. The sensors transmit microwave signals throughout the vehicle cabin through a transducer. The sensor then listens to the returned microwave signals as they bounce off of objects in the vehicle interior and provide input signals to the intrusion module. If an object is moving in the interior, a detection circuit in the intrusion module senses this movement through the modulation of the returning signals that occur due to the Doppler effect. The intrusion module monitors the current draw of the sensor circuits to determine the condition of the sensors and, if the draw is too high or too low, it will store a Diagnostic Trouble Code (DTC) for any fault that is detected.

The hard wired circuits for the intrusion sensor microwave transducers may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the intrusion sensors or the electronic controls and communication between other modules and devices that provide some features of the VTA system. The most reliable, efficient, and accurate means to diagnose the intrusion sensor or the electronic controls and communication related to intrusion sensor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

CONSOLE

NOTE: An intrusion sensor is installed within the center floor console only on four-door vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

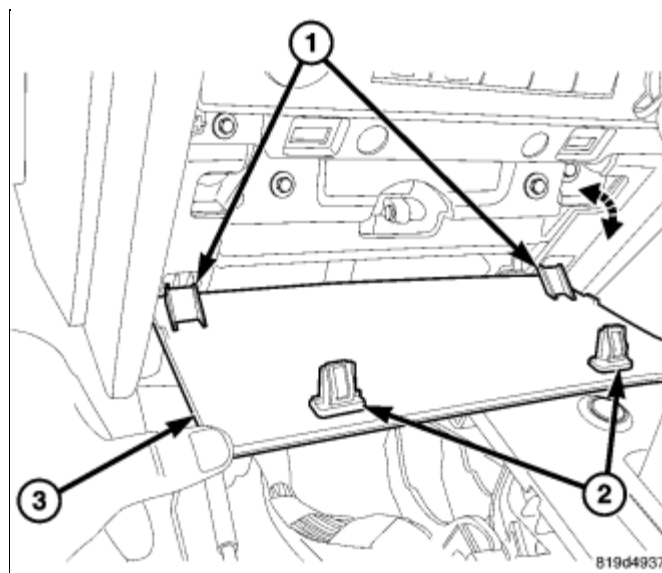
1. Disconnect and isolate the battery negative cable.
2. Remove the center console from the vehicle. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).
3. Place the center console on a suitable work surface. Be certain to take the proper precautions to protect the console from receiving cosmetic damage during the service procedure.
4. Remove the screws at each rear side of the console that secure the rear trim cover to the console.
5. Remove the rear trim cover from the console.
6. Remove the fasteners securing the intrusion sensor to the rear outer surface of the center console bin.
7. Remove the intrusion sensor from the center console bin.

INSTRUMENT PANEL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: An intrusion sensor is installed within the instrument panel only on vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

1. Disconnect and isolate the battery negative cable.
2. Using a trim stick or another suitable wide flat-bladed tool, gently and evenly pry the upper edges of the lower center trim panel (3) away from the instrument panel far enough to disengage the two snap clips (2) that secure the top of the panel to the base trim of the instrument panel center stack.
3. Rotate the lower center trim panel downward far enough to disengage the two tabs (1) at the bottom of the panel from the base trim of the instrument panel center stack.
4. Disconnect the intrusion sensor pigtail wire from the instrument panel wire harness.
5. Remove the fasteners securing the intrusion sensor to the base trim of the instrument panel center stack.
6. Remove the intrusion sensor from the instrument panel.



SWING GATE

NOTE: An intrusion sensor is installed within the swing gate only on vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

1. Disconnect and isolate the battery negative cable.
2. Unlatch and open the swing gate.
3. Unsnap the inboard side of the louvered plastic access panel and unhook it from the outboard edge of the access hole on the inside of the swing gate near the latch.
4. Reach through the access hole to disconnect the intrusion sensor pigtail connector from the swing gate wire harness connector.
5. Remove the fasteners securing the intrusion sensor to the inside of the swing gate.
6. Remove the intrusion sensor from the swing gate.

INSTALLATION

CONSOLE

NOTE: An intrusion sensor is installed within the center floor console only on four-door vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

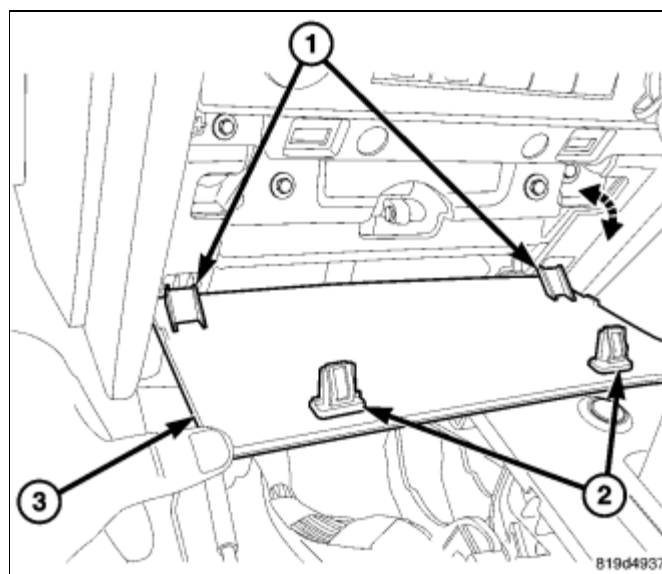
1. Position the intrusion sensor to the rear outer surface of the center console bin.
2. Install the fasteners that secure the intrusion sensor to the center console bin.
3. Position the rear trim cover to the console.
4. Install and tighten the screws at each rear side of the console that secure the rear trim cover to the console. Tighten the screws to 2 N·m (18 in. lbs.).
5. Reinstall the center console into the vehicle. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).
6. Reconnect the battery negative cable.

INSTRUMENT PANEL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

NOTE: An intrusion sensor is installed within the instrument panel only on vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

1. Position the intrusion sensor to the base trim of the instrument panel center stack.
2. Install the fasteners that secure the intrusion sensor to the instrument panel.
3. Reconnect the intrusion sensor pigtail wire to the instrument panel wire harness.
4. Engage the two tabs (1) at the bottom of the lower center trim panel (3) into the receptacles in the base trim of the instrument panel center stack and roll the top of the panel upward.
5. Using hand pressure, press firmly and evenly on the trim panel over each of the two snap clips (2) until they snap into their receptacles in the instrument panel.
6. Reconnect the battery negative cable.



SWING GATE

NOTE: An intrusion sensor is installed within the swing gate only on vehicles equipped with the export premium version of the Vehicle Theft Alarm (VTA).

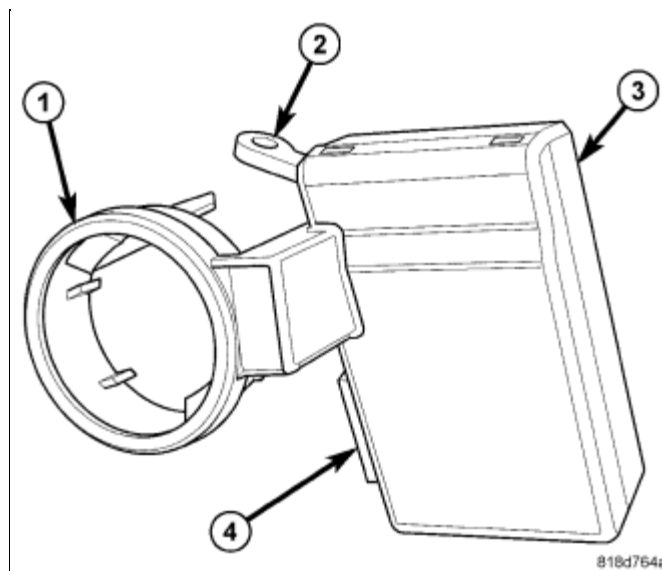
1. Reach through the access hole on the inside of the swing gate near the latch to position the intrusion sensor to the inside of the swing gate.
2. Install the fasteners that secure the intrusion sensor to the swing gate.
3. Reconnect the intrusion sensor pigtail connector to the swing gate wire harness connector.
4. Reinstall the louvered plastic access panel over the access hole by hooking it into the outboard edge of the hole, then pressing firmly and evenly over the two snap clip locations on the inboard side of the panel until it snaps into place.
5. Reconnect the battery negative cable.

SENTRY KEY REMOTE ENTRY MODULE

DESCRIPTION

The Sentry Key REmote Entry Module (SKREEM) (3) (also

known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) is the primary component of the Sentry Key Immobilizer System (SKIS). It is also the receiver for the Remote Keyless Entry (RKE) system and the Tire Pressure Monitor (TPM) system. The SKREEM is located on the right side of the steering column near the ignition lock cylinder housing and is concealed beneath the column shrouds. The molded black plastic housing for the SKREEM has an integral molded plastic halo-like antenna ring (1) that extends from one side. When the SKREEM is properly installed, the antenna ring is oriented around the circumference of the ignition lock cylinder housing.



A single integral connector receptacle (4) is located adjacent to the antenna ring on the SKREEM housing. An integral molded plastic mounting tab (2) on the SKREEM housing has a hole in the center through which a screw passes to secure the unit to the steering column lock housing. The SKREEM is connected to the vehicle electrical system through a single take out and connector of the instrument panel wire harness.

The SKREEM cannot be adjusted or repaired. If ineffective or damaged, the entire SKREEM unit must be replaced.

OPERATION

The Sentry Key Remote Entry Module (SKREEM) (also known as the Sentry Key Immobilizer Module/SKIM or the Wireless Control Module/WCM) contains a Radio Frequency (RF) transceiver and a microprocessor. The SKREEM transmits RF signals to, and receives RF signals from the Sentry Key transponder through a tuned antenna enclosed within the molded plastic antenna ring integral to the SKREEM housing. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKREEM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults.

The SKREEM also serves as the Remote Keyless Entry (RKE) RF receiver and, if the vehicle is so equipped, the receiver for the Tire Pressure Monitoring (TPM) system. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION) or (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - DESCRIPTION). The SKREEM communicates over the Controller Area Network (CAN) data bus with the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN), the Powertrain Control Module (PCM), the Totally Integrated Power Module (TIPM) or the diagnostic scan tool.

The SKREEM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized Sentry Key Immobilizer System (SKIS) disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKREEM or the PCM. However, the use of this strategy also means that replacement of either the SKREEM or the PCM units will require a system initialization procedure to restore system operation.

The SKREEM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight Sentry Key transponders can be programmed into the SKREEM. For added system security, each SKREEM is programmed with a unique Secret Key code. This code is stored in memory, sent over the CAN data bus to the PCM, and is encoded to the transponder of every Sentry Key that is programmed into the SKREEM. Therefore, the Secret Key code is a common element that is found in every component of the SKIS.

Another security code, called a PIN, is used to gain access to the SKREEM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder

programming procedures. The SKREEM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a CAN data bus message from the PCM during SKIS initialization.

In the event that a SKREEM replacement is required, the Secret Key code can be transferred to the new SKREEM from the PCM using the diagnostic scan tool and the SKIS initialization procedure. Proper completion of the SKIS initialization will allow the existing Sentry Keys to be programmed into the new SKREEM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKREEM replacement will also require new Sentry Keys. The diagnostic scan tool will alert the technician during the SKIS initialization procedure if new Sentry Keys are required.

When the key is inserted into the ignition switch and when the ignition switch is turned to the ON position, the SKREEM transmits an RF signal to excite the transponder in the ignition key. The SKREEM then waits for an RF signal response from the transponder. If the response received identifies the key as valid, the SKREEM sends an electronic **valid key** message over the CAN data bus. If the response received identifies the key as invalid or if no response is received from the key transponder, the SKREEM sends an **invalid key** message. The PCM will enable or disable engine operation based upon the status of the SKREEM messages. It is important to note that the default condition in the PCM is an **invalid key**; therefore, if no message is received from the SKREEM by the PCM, the engine will be disabled and the vehicle immobilized after two seconds of running.

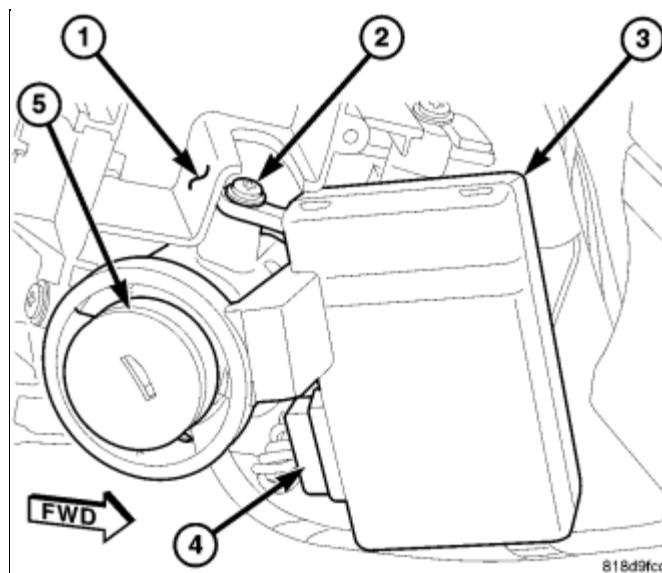
The SKREEM also sends electronic **security indicator** request messages to the EMIC over the CAN data bus to tell the EMIC how to operate the security indicator. The **security indicator** request message from the SKREEM tells the EMIC to turn the indicator ON for about three seconds each time the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKREEM sends **security indicator** request messages to the EMIC to turn the indicator OFF, turn the indicator ON, or to flash the indicator ON and OFF. If the security indicator flashes or stays ON solid after the bulb test, it signifies a SKIS fault. If the SKREEM detects a system malfunction or the SKIS has become ineffective, the security indicator will stay ON solid. If the SKREEM detects an invalid key or if a key transponder-related fault exists, the security indicator will flash. If the vehicle is equipped with the Customer Learn transponder programming feature, the SKREEM will also send messages to the EMIC to flash the security indicator whenever the Customer Learn programming mode is being utilized (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the ON position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a system malfunction is detected. The hard wired circuits of the SKREEM may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the SKREEM or the electronic controls or communication between other modules and devices that provide some features of the SKIS. The most reliable, efficient, and accurate means to diagnose the SKREEM or the electronic controls and communication related to SKREEM operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

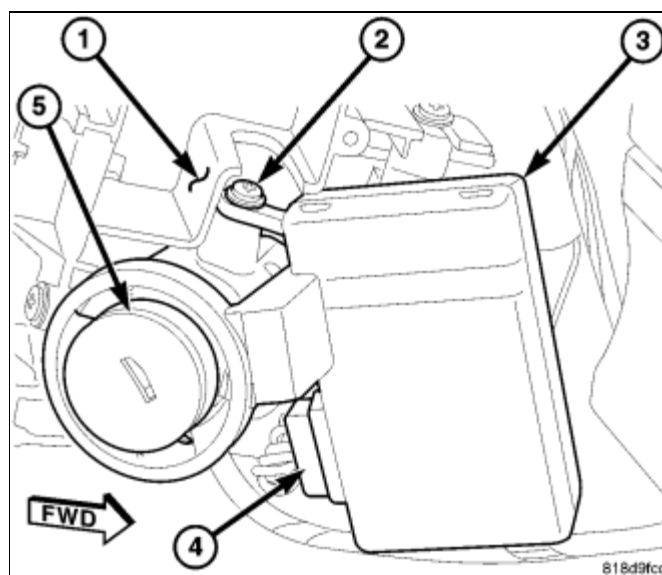
1. Disconnect and isolate the battery negative cable.
2. Remove but do not disconnect the right multi-function switch from the integral mounting bracket (1) on the right side of the clockspring and position it so that the Sentry Key REmote Entry Module (SKREEM) mounting screw (2) may be accessed. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - REMOVAL).
3. Disconnect the instrument panel wire harness connector (4) from the SKREEM (3) connector receptacle.
4. Remove the screw that secures the SKREEM to the boss on the top of the ignition lock cylinder housing (5).
5. Disengage the SKREEM antenna ring from around the ignition lock housing and remove the SKREEM from the steering column.



INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the Sentry Key REmote Entry Module (SKREEM) (3) onto the steering column ignition lock housing with the antenna ring oriented around the lock cylinder (5).
2. Install and tighten the screw (2) that secures the SKREEM mounting bracket to the boss on the top of the ignition lock housing. Tighten the screw to 2 N·m (20 in. lbs.).
3. Reconnect the instrument panel wire harness connector (4) to the SKREEM connector receptacle.
4. Reinstall the right multi-function switch onto the integral mounting bracket (1) on the right side of the clockspring.
5. Reconnect the battery negative cable.



NOTE: On vehicles equipped with the Sentry Key Immobilizer System (SKIS), when the SKREEM is replaced with a new unit, a diagnostic scan tool **MUST** be used to initialize the new SKREEM and to program at least two Sentry Key transponders before the vehicle can be operated. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SKIS INITIALIZATION).

NOTE: On vehicles equipped with a Tire Pressure Monitoring (TPM) system and a full-sized matching spare tire and wheel assembly, when the SKREEM or the spare tire pressure sensor is replaced with a

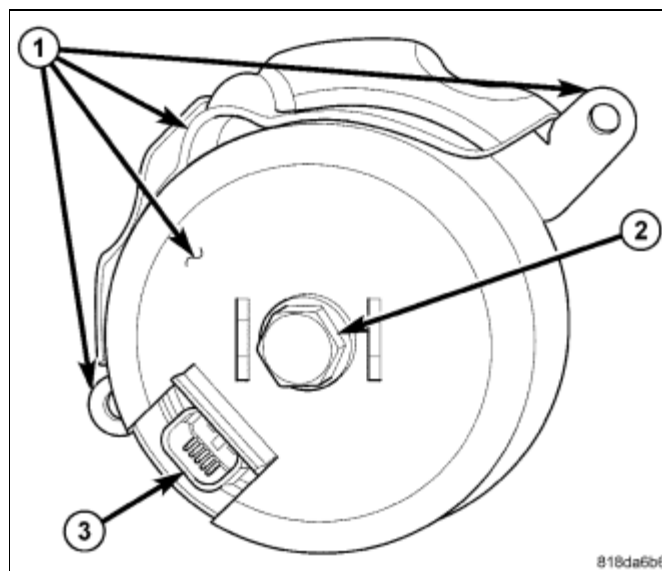
new unit, a diagnostic scan tool **MUST** be used to run a routine that allows the SKREEM to be programmed with the ID number and location of the spare tire pressure sensor mounted in the wheel of the spare tire. This may be done using a TPM-RKE Analyzer special tool by following the programming steps outlined in the diagnostic scan tool for Program Tire Sensor ID w/TPM Tool under Miscellaneous Functions for the WCM/Wireless Control Module menu item. If a TPM-RKE Analyzer special tool is not available, the spare tire must be dismounted from its wheel to access and note the ID number on the spare tire pressure sensor so that the ID code for that sensor can be programmed into the new SKREEM. Follow the programming steps outlined in the diagnostic scan tool for Learn Spare Tire Sensor ID also found under Miscellaneous Functions for the WCM/Wireless Control Module menu item. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING/SENSOR - INSTALLATION).

SIREN

DESCRIPTION

An alarm siren module is part of the premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS). The premium version of the VTA is only available in vehicles built for certain markets, where the additional features offered by this system are required. This unit is designed to provide the audible alert requirements for the premium VTA.

The alarm siren module consists of microprocessor-based electronic control circuitry, the siren, and a nickel metal hydride backup battery. All of the alarm module components are protected and sealed within a molded plastic housing. An integral connector receptacle (3) extends from the housing and connects the unit to the vehicle electrical system through a dedicated take out and connector of the engine compartment wire harness. The housing also has a threaded insert within a mounting hole through which a screw (2) secures it to one of two mounting brackets.



A bell-shaped stamped metal mounting bracket (1) is used on vehicles with a diesel engine, while an L-shaped stamped metal mounting bracket is used on vehicles with a gasoline engine. The diesel engine siren and bracket unit is secured by two screws and two spring nuts to the inboard side of the front fender load path beam on the left side of the engine compartment, while the gasoline engine bracket is secured by a single screw and U-nut to an integral stanchion of the molded plastic component tray on the right side of the engine compartment.

The alarm siren module cannot be repaired or adjusted and, if ineffective or damaged, it must be replaced.

OPERATION

The microprocessor within the alarm siren module provides the siren unit features and functions based upon internal programming and electronic **arm** and **disarm** messages received from the intrusion module over a dedicated serial bus communication circuit. The siren module receives battery voltage on a fused B(+) circuit through a fuse in the Totally Integrated Power Module (TIPM), and receives a path to ground through a ground circuit in the engine compartment wire harness. These connections allow the siren to remain operational, regardless of the ignition switch position.

When the premium version of the Vehicle Theft Alarm (VTA) is armed, the siren module continuously monitors electronic message inputs from the intrusion module to sound its internal siren. While armed, the siren also enters its auto-detect mode. While in the auto-detect mode, if the siren module detects that its power supply or communication circuits are being tampered with or have been sabotaged, it will sound an audible alarm and continue to operate through an on-board backup battery. If the siren module is in its disarmed mode when its power supply or communication circuits are interrupted, the siren will not sound.

The state of charge of the siren module backup battery is automatically maintained. The battery is trickle charged approximately 2 minutes during every hour of operation through the battery voltage and ground circuits to the siren module.

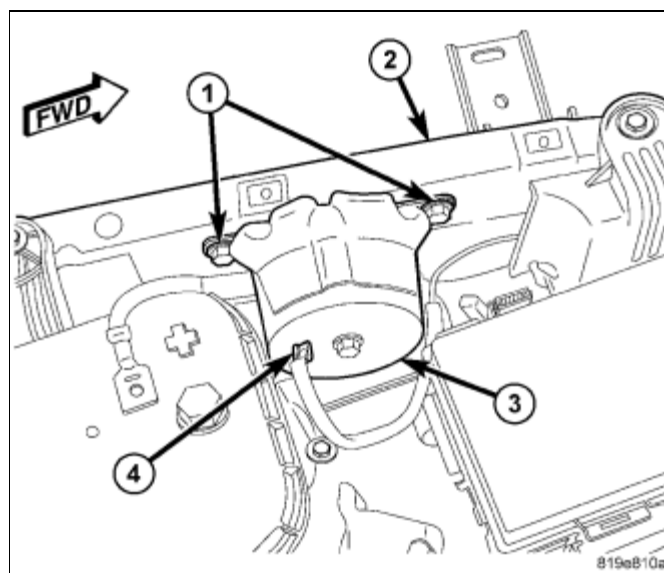
The siren will self-detect problems with its internal and external power supply and communication circuits, then send electronic messages indicating the problem to the intrusion module upon receiving an **arm** or **disarm** request message. The intrusion module will store a Diagnostic Trouble Code (DTC) for any detected alarm siren module fault. The DTC can then be retrieved with a diagnostic scan tool through the 16-way Data Link Connector (DLC) located under the driver side lower edge of the instrument panel over the Controller Area Network (CAN) data bus.

The hard wired inputs and outputs for the alarm siren module may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the alarm siren module or the electronic controls or communication between other modules and devices that provide some features of the VTA system. The most reliable, efficient, and accurate means to diagnose the alarm siren module or the electronic controls and communication related to alarm siren module operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

DIESEL ENGINE

1. Disconnect and isolate the battery negative cable.
2. Locate the alarm siren module (3) on the inboard side of the left front fender load path beam (2).
3. Disconnect the engine compartment wire harness connector (4) from the connector receptacle for the siren.
4. Remove the two screws (1) that secure the siren mounting bracket to the spring nuts in the load path beam.
5. Remove the siren and mounting bracket from the load path beam as a unit.



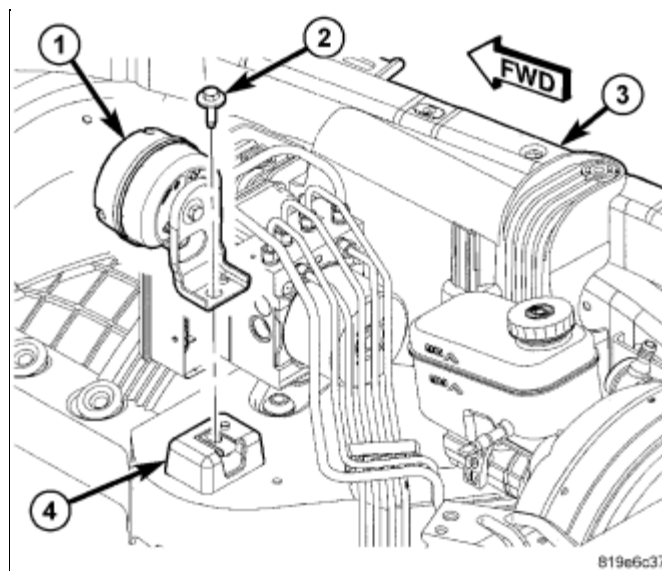
GASOLINE ENGINE

1. Disconnect and isolate the battery negative cable.

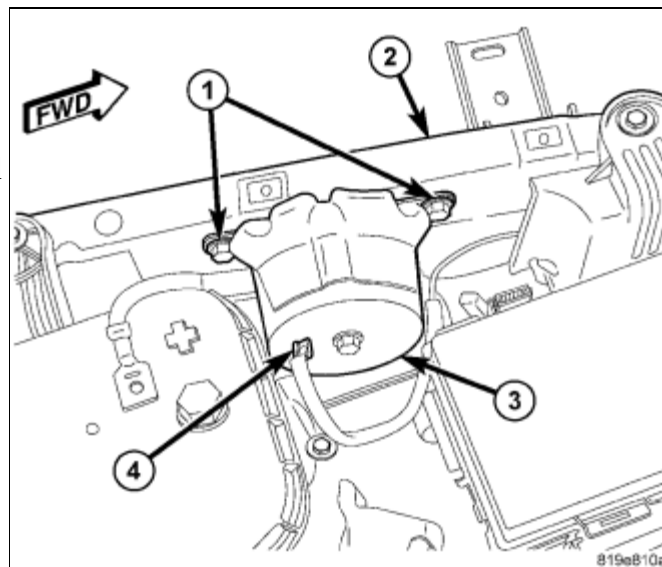
2. Locate the alarm siren module (1) on the component tray on the inboard side of the right front fender load path beam (3).
3. Disconnect the engine compartment wire harness connector from the connector receptacle of the siren.
4. Remove the screw (2) that secures the siren mounting bracket to the U-nut and stanchion on the component tray.
5. Remove the siren and mounting bracket from the component tray as a unit.

INSTALLATION

DIESEL ENGINE



1. Check to be certain that the two spring nuts are in good condition and properly installed in the inboard side of the left front fender load path beam (2).
2. Position the alarm siren module and bracket (3) to the load path beam as a unit.
3. Install and tighten the two screws (1) that secure the siren mounting bracket to the two spring nuts in the load path beam. Tighten the screws to 8 N·m (71 in. lbs.).
4. Reconnect the engine compartment wire harness connector (4) to the connector receptacle of the siren.
5. Reconnect the battery negative cable.



NOTE: If the alarm siren module has been replaced with a new unit, a diagnostic scan tool MUST be used to initialize and configure the new unit in the Intrusion Transceiver Module (ITM) before the Vehicle Theft Security System (VTSS) can operate as designed. Follow the programming steps outlined in the diagnostic scan tool for INITIALIZE SIREN under MISCELLANEOUS FUNCTIONS for the INTRUSION TRANSCIEVER MODULE/ITM menu item as appropriate.

GASOLINE ENGINE

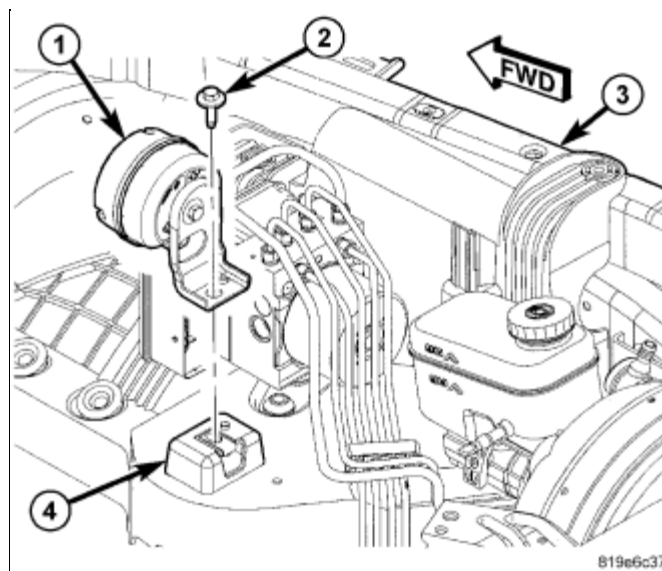
1. Check to be certain that the U-nut on the component tray stanchion (4) is in good condition and properly installed.
2. Position the alarm siren module and bracket (1) to the component tray as a unit.
3. Install and tighten the screw (2) that secures the siren mounting bracket to the U-nut in the component tray.

Tighten the screw to 8 N·m (71 in. lbs.).

4. Reconnect the engine compartment wire harness connector to the connector receptacle of the siren.

5. Reconnect the battery negative cable.

NOTE: If the alarm siren module has been replaced with a new unit, a diagnostic scan tool **MUST** be used to initialize and configure the new unit in the Intrusion Transceiver Module (ITM) before the Vehicle Theft Security System (VTSS) can operate as designed. Follow the programming steps outlined in the diagnostic scan tool for INITIALIZE SIREN under MISCELLANEOUS FUNCTIONS for the INTRUSION TRANSCIVER MODULE/ITM menu item as appropriate.

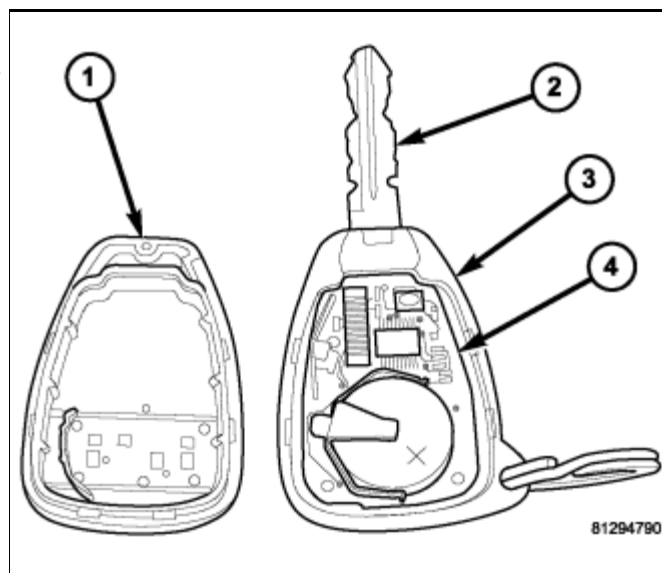


TRANSPONDER KEY

DESCRIPTION

Each ignition key (2) used in the Sentry Key Immobilizer System (SKIS) has a transponder chip included on the circuit board (4) beneath the cover (1) of the integral Remote Keyless Entry (RKE) transmitter (3). In addition to having to be cut to match the mechanical coding of the ignition lock cylinder and programmed for operation of the RKE system, each new Sentry Key has a unique transponder identification code that is permanently programmed into it by the manufacturer, and which must be programmed into the Sentry Key REMote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) to be recognized by the SKIS as a valid key.

The Sentry Key transponder cannot be adjusted or repaired. If ineffective or damaged, the entire key and RKE transmitter unit must be replaced.



OPERATION

When the ignition switch is turned to the ON position, the Sentry Key REMote Entry Module (SKREEM) (also known as the Wireless Control Module/WCM) communicates through its antenna with the Sentry Key transponder using a Radio Frequency (RF) signal. The SKREEM then listens for a RF response from the transponder through the same antenna. The Sentry Key transponder chip is within the range of the SKREEM transceiver antenna ring when it is inserted into the ignition lock cylinder. The SKREEM determines whether a valid key is present in the ignition lock cylinder based upon the response from the transponder. If a valid key is

detected, that fact is communicated by the SKREEM to the Powertrain Control Module (PCM) over the Controller Area Network (CAN) data bus, and the PCM allows the engine to continue running. If the PCM receives an **invalid key** message, or receives no message from the SKREEM over the CAN data bus, the engine will be disabled after about two seconds of operation. The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) will also respond to the **invalid key** message on the CAN data bus by flashing the security indicator ON and OFF.

Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the SKREEM has a unique Secret Key code programmed into it by the manufacturer. When a Sentry Key is programmed into the memory of the SKREEM, the SKREEM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the Secret Key code from the SKREEM. Once the Sentry Key learns the Secret Key code of the SKREEM, it is permanently stored in the memory of the transponder. Therefore, once a Sentry Key has been programmed to a particular vehicle, it cannot be used on any other vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The Sentry Key Immobilizer System (SKIS) performs a self-test each time the ignition switch is turned to the ON position, and will store key-related fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a Sentry Key transponder problem is detected. The Sentry Key transponder chip can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

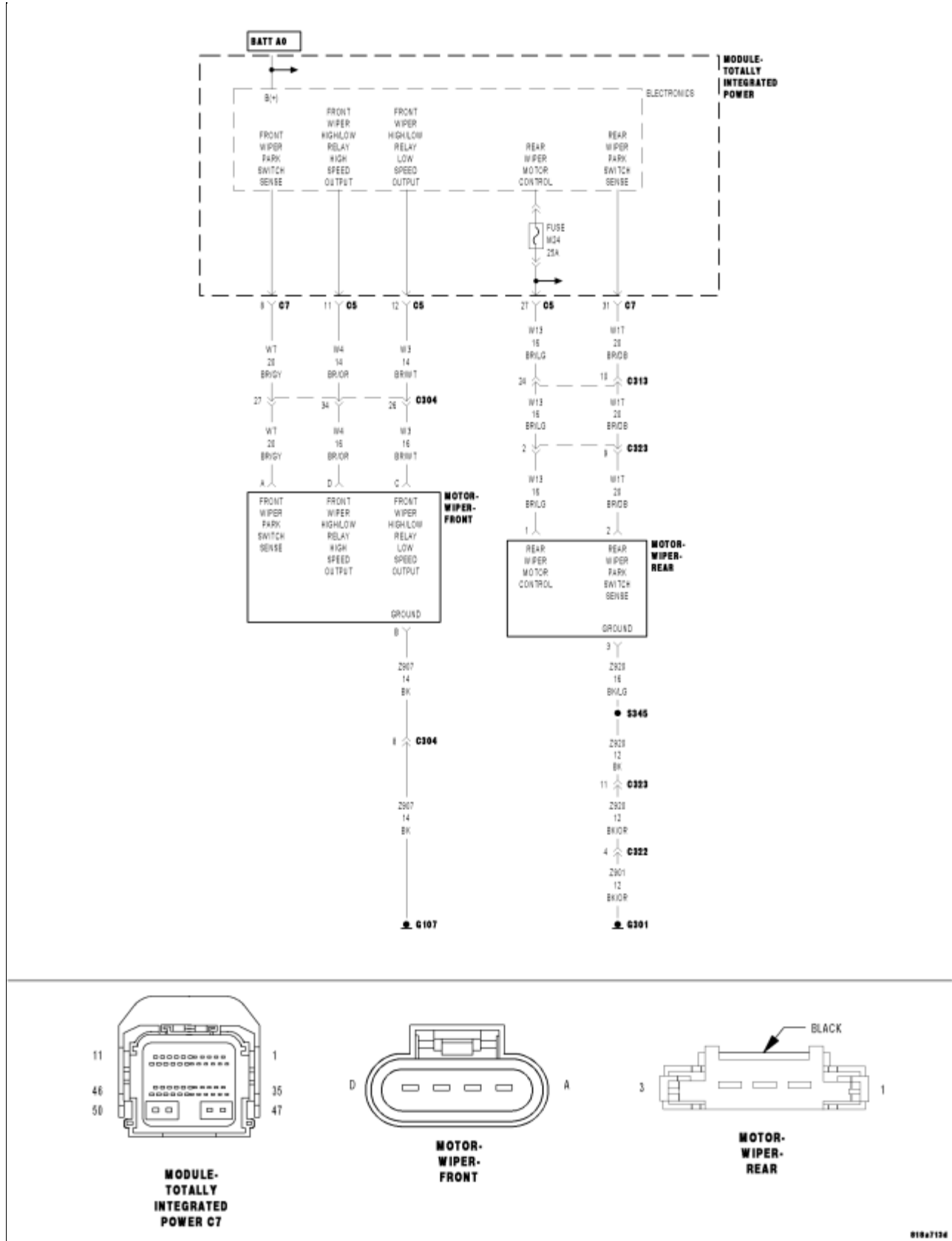
8R - WIPERS/WASHERS

WIPERS/WASHERS-ELECTRICAL/DIAGNOSTICS

WIPERS/WASHERS-ELECTRICAL/DIAGNOSTICS

DIAGNOSIS AND TESTING

B2304-WIPER PARK SWITCH INPUT CIRCUIT LOW (STUCK LOW)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The Totally Integrated Power Module (TIPM) detects a short to ground on the Wiper Park Switch Sense circuit.

Possible Causes
(W7) WIPER PARK SWITCH SENSE CIRCUIT SHORT TO GROUND
FRONT WIPER MOTOR
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Cycle the Wiper Switch on and off 3 times.

With the scan tool, read DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. FRONT WIPER MOTOR

Turn the ignition off.
 Disconnect the Front Wiper Motor harness connector.
 Turn the ignition on.
 Wait 30 seconds.
 With the scan tool, read the Front Wiper Park Switch Sense.

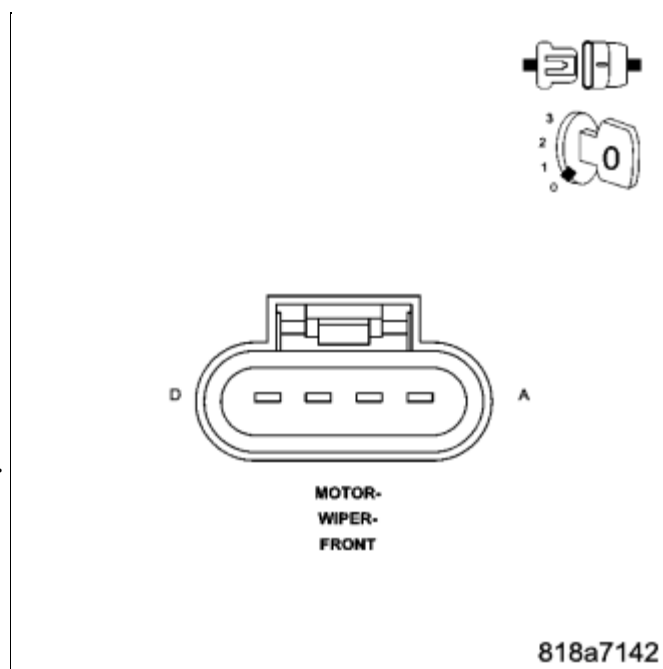
Does the Front Wiper Park Switch Sense display: False?

Yes

- Replace the Front Wiper Motor in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK (W7) WIPER PARK SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Measure the resistance between ground and the (W7) Wiper Park Sense Circuit.

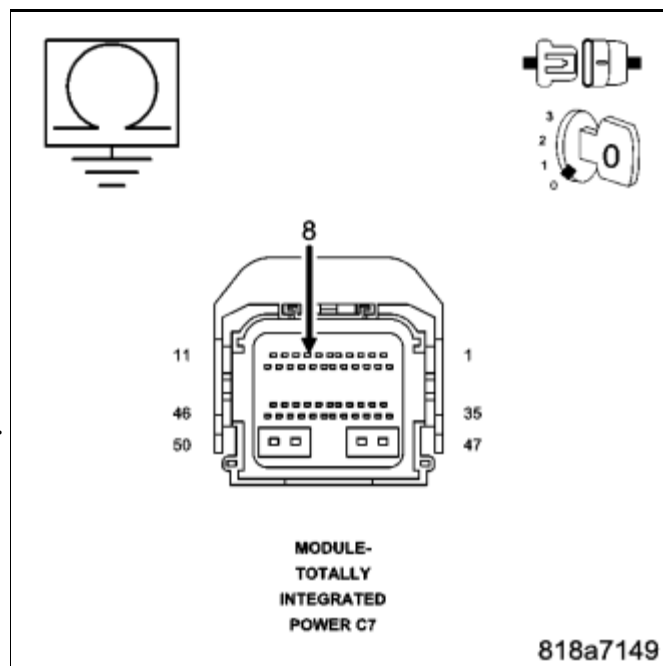
Is the resistance above 10k ohms?

Yes

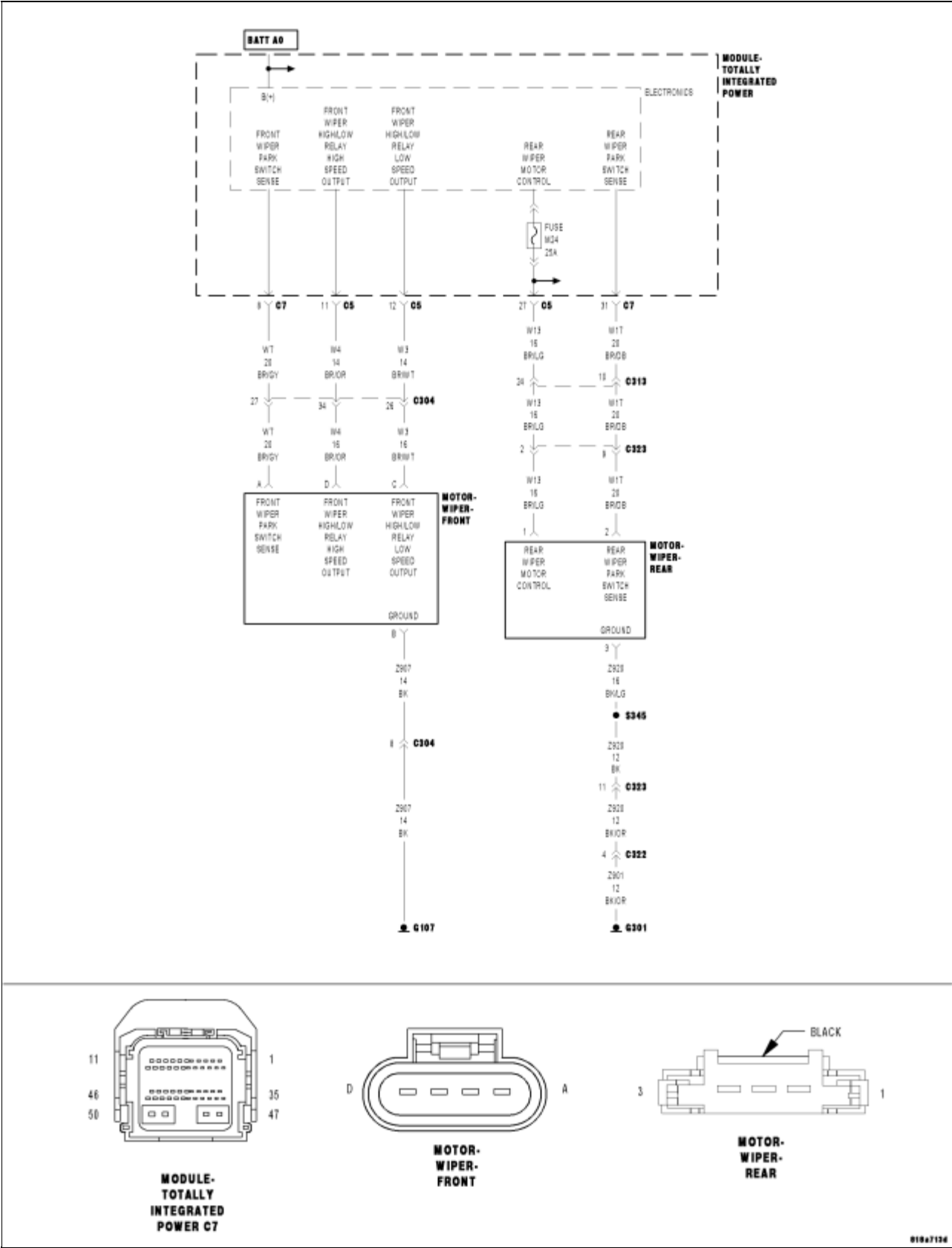
- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (W7) Wiper Park Switch Sense circuit for a short to ground.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B2305-WIPER PARK SWITCH INPUT CIRCUIT HIGH (STUCK HIGH)



For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Totally Integrated Power Module (TIPM) does not detect a change from High to Low voltage on the Wiper Park Switch Sense Circuit.

Possible Causes
(W7) WIPER PARK SWITCH SENSE CIRCUIT OPEN
(W7) WIPER PARK SWITCH SENSE CIRCUIT SHORTED TO VOLTAGE
FRONT WIPER MOTOR
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Cycle the Wiper Switch on and off 3 times.

With the scan tool, read DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (W7) WIPER PARK SWITCH SENSE CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Front Wiper Motor harness connector.
 Turn the ignition on.
 Using a 12-volt test light connected to ground, probe the (W7) Wiper Park Switch Sense circuit.

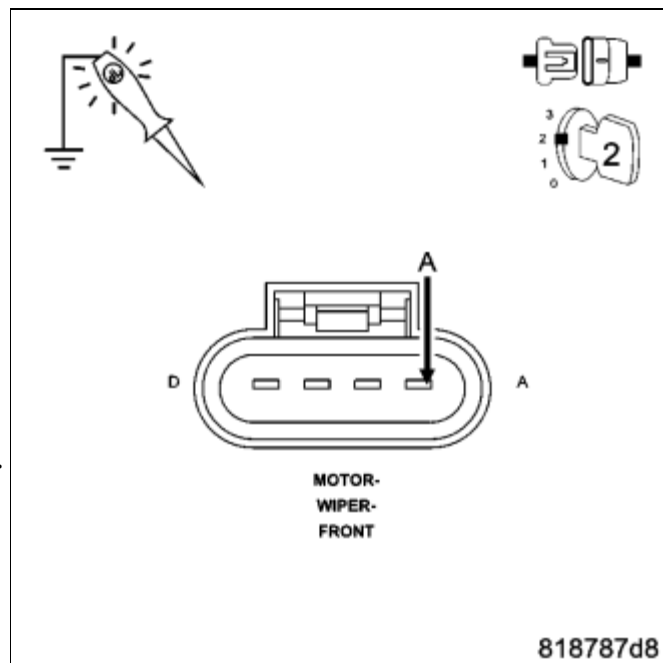
Does the test light illuminate brightly?

Yes

- Repair the (W7) Wiper Park Switch Sense circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)



3. CHECK THE FRONT WIPER MOTOR

Connect a jumper wire between the (W7) Wiper Park Switch Sense circuit and ground.
 With the scan tool, read the Front Wiper Park Switch Sense.

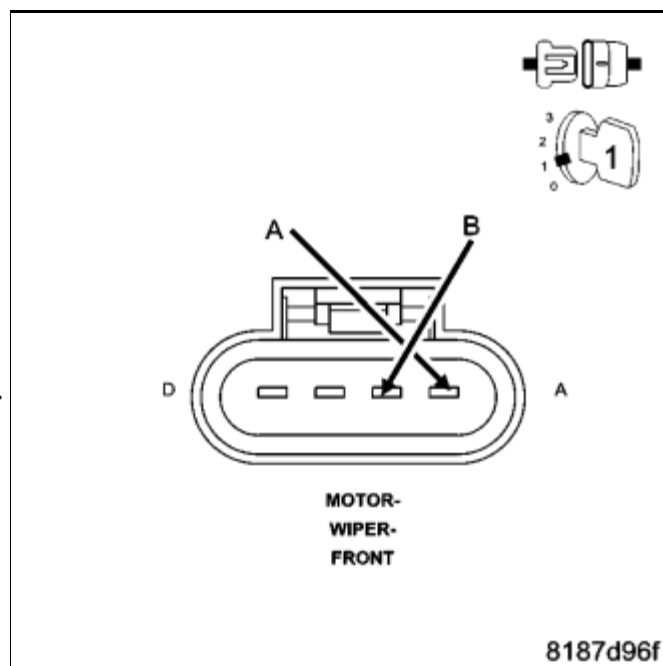
Does the Front Wiper Park Switch Sense display: True?

Yes

- Replace the Front Wiper Motor in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK (W7) WIPER PARK SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the TIPM C7 harness connector.

Measure the resistance of the (W7) Wiper Park Switch Sense circuit between the Front Wiper Motor harness connector and the TIPM C7 harness connector.

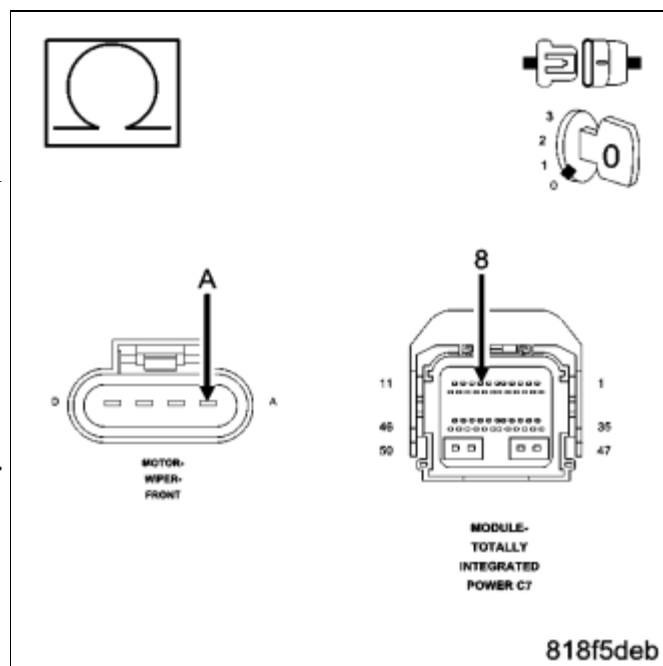
Is the resistance below 10.0 ohms?

Yes

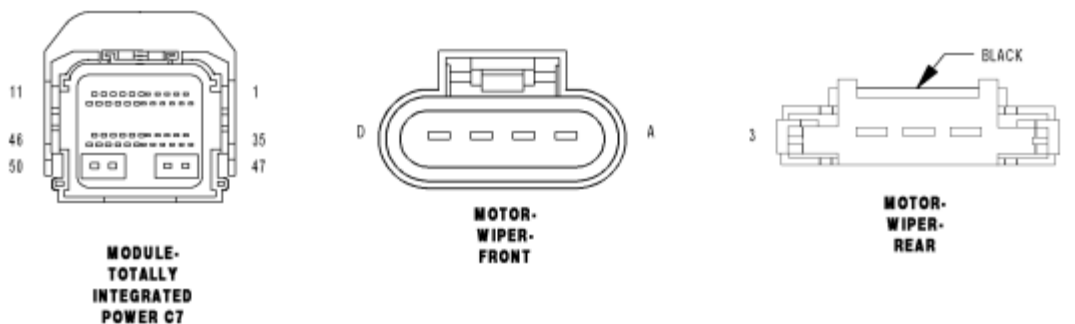
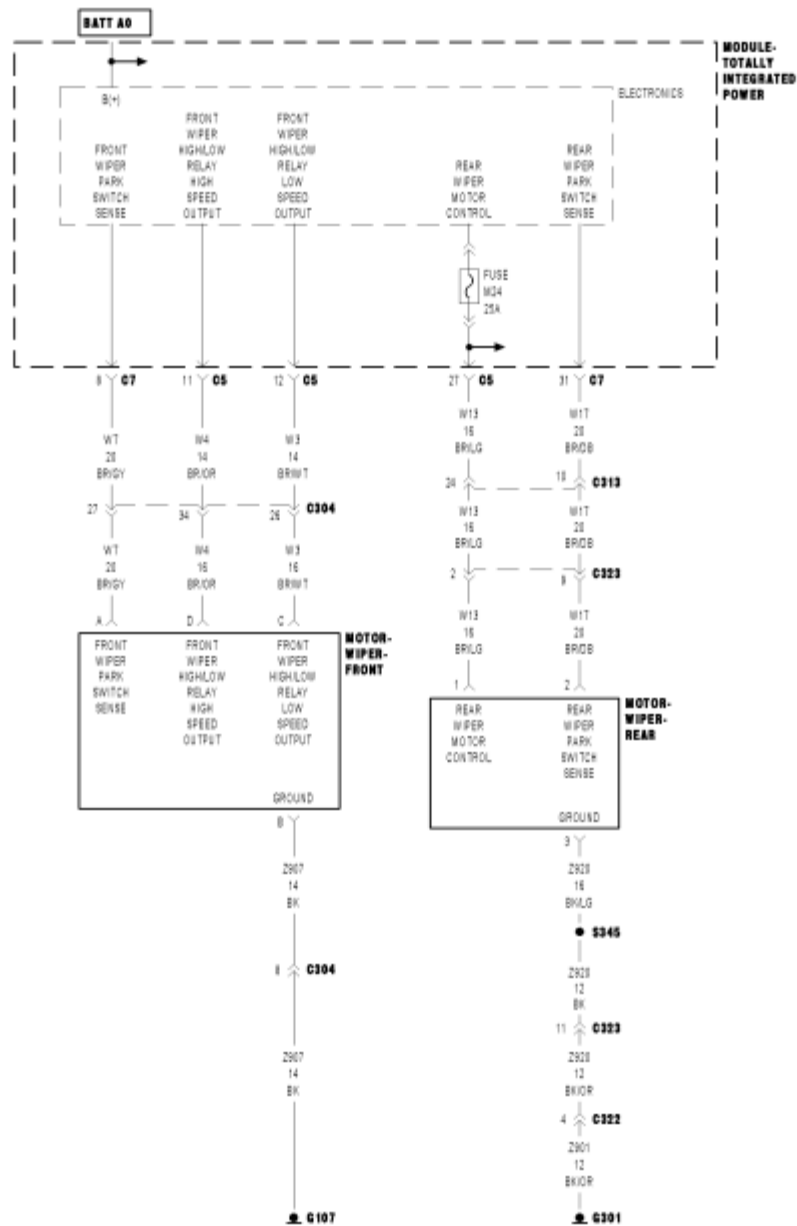
- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (W7) Wiper Park Switch Sense circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



B230D-REAR WIPER PARK SWITCH INPUT CIRCUIT LOW (STUCK LOW)



010a713d

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

With the ignition on.

◦ **Set Condition:**

The Totally Integrated Power Module (TIPM) detects a short to ground on the Rear Wiper Park Switch Sense circuit.

Possible Causes
(W17) REAR WIPER PARK SWITCH SENSE CIRCUIT SHORTED TO GROUND
REAR WIPER MOTOR
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Turn the Rear Wipers on then off.

With the scan tool, read DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

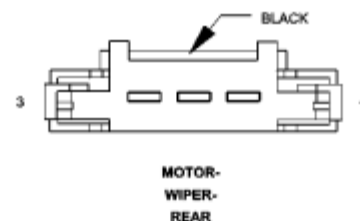
2. REAR WIPER MOTOR

Turn the ignition off.
 Disconnect the Rear Wiper Motor harness connector.
 Turn the ignition on.
 With the scan tool, read the Rear Wiper Park Switch Sense.

Does the Rear Wiper Park Switch Sense display: True?

Yes

- Replace the Rear Wiper Motor in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



818d20c1

No

- Go To [3](#)

3. CHECK (W17) REAR WIPER PARK SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Measure the resistance between ground and the (W17) Rear Wiper Park Switch Sense Circuit.

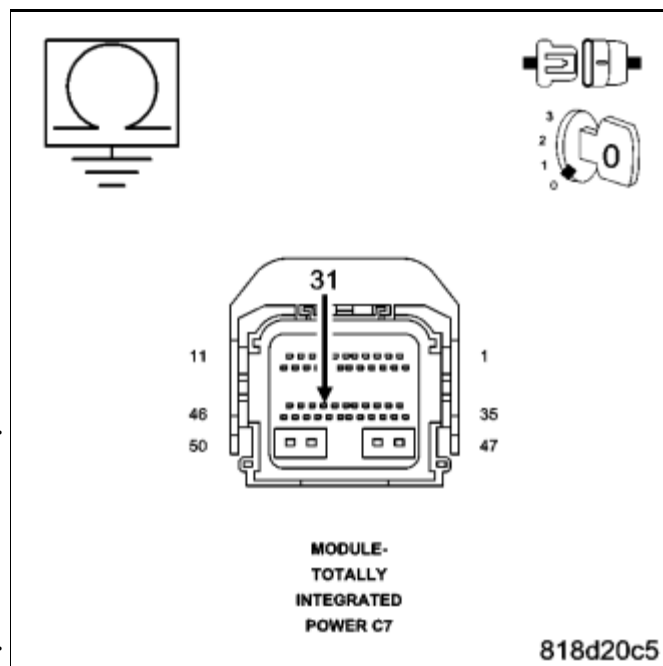
Is the resistance above 10k ohms?

Yes

- Replace the TIPM in accordance with the service information.
- Perform the BODY VERIFICATION TEST — VER 1.

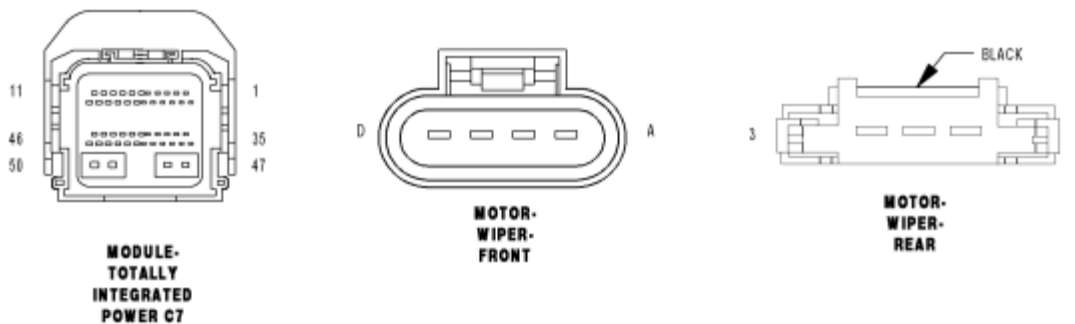
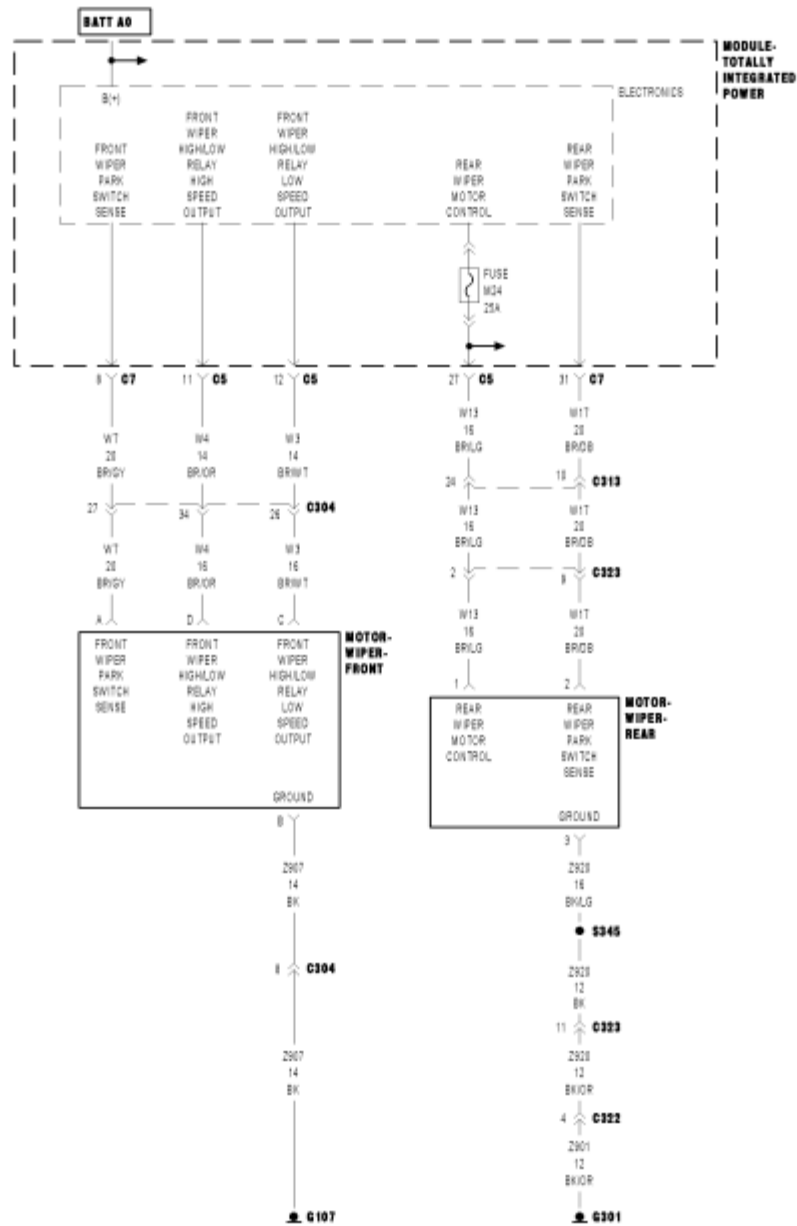
No

- Repair the (W7) Wiper Park Switch Sense circuit for a short to ground.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



818d20c5

B230E-REAR WIPER PARK SWITCH INPUT CIRCUIT HIGH (STUCK HIGH)



018a713d

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The Totally Integrated Power Module (TIPM) does not detect a change from High to Low voltage on the Rear Wiper Park Switch Sense Circuit.

Possible Causes
(W17) REAR WIPER PARK SWITCH SENSE CIRCUIT OPEN
(W17) REAR WIPER PARK SWITCH SENSE CIRCUIT SHORTED TO VOLTAGE
REAR WIPER MOTOR
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all DTC's.

Cycle the Wiper Switch on and off 3 times.

With the scan tool, read DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (W17) WIPER PARK SWITCH SENSE CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Rear Wiper Motor harness connector.
 Turn the ignition on.
 Using a 12-volt test light connected to ground, probe the (W17) Rear Wiper Park Switch Sense circuit.

Does the test light illuminate brightly?

Yes

- Repair the (W17) Rear Wiper Park Switch Sense circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE REAR WIPER MOTOR

Connect a jumper wire between the (W17) Rear Wiper Park Switch Sense circuit and ground.
 With the scan tool, read the Rear Wiper Park Switch Sense.

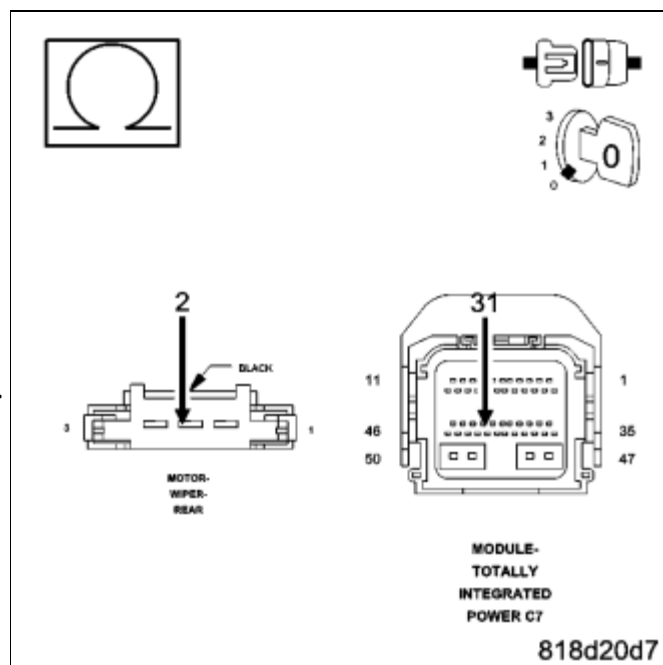
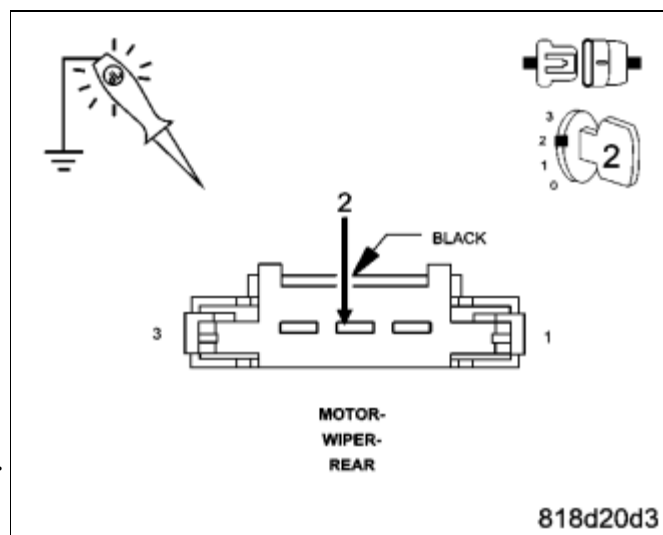
Does the Rear Wiper Park Switch Sense display: True?

Yes

- Replace the Rear Wiper Motor in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (W17) REAR WIPER PARK SWITCH SENSE CIRCUIT OPEN

Turn the ignition off.
 Disconnect the TIPM C7 harness connector.
 Measure the resistance of the (W17) Rear Wiper Park Switch Sense circuit between the Rear Wiper Motor

harness connector and the TIPM C7 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Repair the (W17) Rear Wiper Park Switch Sense circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B2323–HEADLAMP WASHER MOTOR CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

With the Headlamp Washers activated.

◦ Set Condition:

When the Totally Integrated Power Module (TIPM) detects an shorted low condition.

Possible Causes
(W28) HEADLAMP WASHER RELAY SUPPLY CIRCUIT OPEN
(W20) HEADLAMP WASHER RELAY CONTROL CIRCUIT SHORT TO GROUND
HEADLAMP WASHER RELAY
HEADLAMP WASHER MOTOR
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, clear all DTC's.
 Turn the Headlamp Washers on.
 With the scan tool read DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST-VER1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. (W28) HEADLAMP WASHER RELAY SUPPLY CIRCUIT OPEN

NOTE: Check all fuses and circuit breakers before proceeding with the diagnosis of this DTC.

Turn the ignition off.
 Remove the Headlamp Washer relay.
 Turn the ignition on.
 Measure the voltage on the (W28) Headlamp Washer Relay Supply circuit at the Headlamp Washer relay.

Is the voltage above 10.0 volts?

Yes

- Go To [3](#)

No

- Repair the (W28) Headlamp Washer Relay Supply circuit for an open.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

3. HEADLAMP WASHER RELAY

Turn the ignition off.
 Replace the Headlamp Washer relay with a known good relay.
 Turn the ignition on.
 With the Scan Tool, clear all DTC's.
 Activate the Headlamp Washers.
 With the Scan Tool, read the DTC's.

Does the scan tool display this DTC as active?

Yes

- Go To [4](#)

No

- Replace the Headlamp Washer relay in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (W20) HEADLAMP WASHER RELAY CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the TIPM C3 Connector.

Measure the resistance to ground of the (W20) Headlamp Washer Relay Control circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (W20) Headlamp Washer Relay Control circuit for a short to ground.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST — VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

B2324–HEADLAMP WASHER MOTOR CONTROL CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the Headlamp Washers activated.

- **Set Condition:**

When the Totally Integrated Power Module (TIPM) detects an HIGH condition.

Possible Causes
(W24) HEADLAMP WASHER RELAY CONTROL CIRCUIT OPEN
(W24) HEADLAMP WASHER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

(W23) HEADLAMP WASHER MOTOR CONTROL CIRCUIT OPEN
(W23) HEADLAMP WASHER MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
HEADLAMP WASHER RELAY
TOTALLY INTEGRATED POWER MODULE

Diagnostic Test

1. INTERMITTENT CONDITION

Turn the ignition on.
 With the scan tool, clear all DTC's.
 Turn the Headlamp Washers on.
 With the scan tool, read DTC's.

Does the scan tool display active: B2324–HEADLAMP WASHER MOTOR CONTROL CIRCUIT HIGH?

Yes

- Go To [2](#)

No

- The condition that caused this symptom is currently not present. Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

2. CHECK HEADLAMP WASHER RELAY

Turn the ignition off.
 Remove the Headlamp Washer relay.
 Turn the ignition on.
 Turn the Headlamp Washers on.
 With the scan tool, read DTC's.

Does the scan tool display active: B2324–HEADLAMP WASHER MOTOR CONTROL CIRCUIT HIGH?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. (W24) HEADLAMP WASHER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the TIPM C3 harness connector.

Measure the resistance of the (W24) Headlamp Washer Relay Control circuit between the Headlamp Washer Relay connector and the TIPM C3 harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [4](#)

No

- Repair the (W24) Headlamp Washer Relay Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

4. (W24) HEADLAMP WASHER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure for voltage on the (W24) Headlamp Washer Relay Control circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (W24) Headlamp Washer Relay Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module (TIPM) in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

5. HEADLAMP WASHER RELAY

Turn the ignition off.

Replace the Headlamp Washer relay with a known good relay.

Turn the ignition on.
Turn the Headlamp Washers on.
With the scan tool, read DTC's.

Does the scan tool display active: B2324–HEADLAMP WASHER MOTOR CONTROL CIRCUIT HIGH?

Yes

- Go To [6](#)

No

- Test Complete.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

6. (W23) HEADLAMP WASHER MOTOR CONTROL CIRCUIT OPEN

Turn the ignition off.
Remove the Headlamp Washer relay.
Disconnect the Headlamp Washer Motor harness connector.
Measure the resistance of the (W23) Headlamp Washer Motor Control circuit at the Headlamp Washer Motor harness connector and the Headlamp Washer Relay connector.

Is the resistance below 10.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (W23) Headlamp Washer Motor Control circuit for an open.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

7. (W23) HEADLAMP WASHER MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure for voltage on the (W23) Headlamp Washer Motor Control circuit.

Is the voltage above 10.0 volts?

Yes

- Repair the (W23) Headlamp Washer Motor Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

No

Replace the Headlamp Washer Motor in accordance with the Service Information.

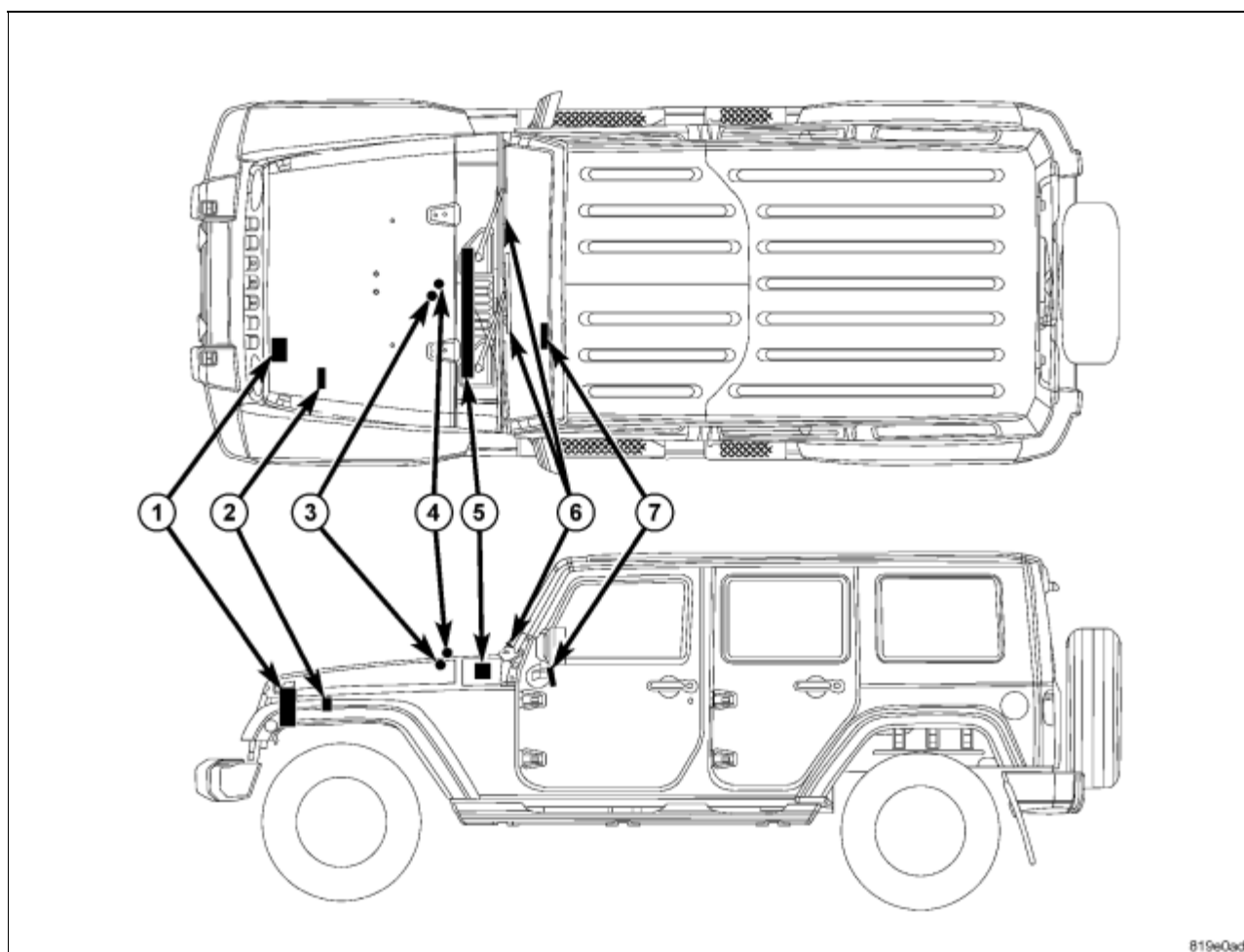
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

WIPERS/WASHERS

WIPERS/WASHERS

DESCRIPTION

FRONT



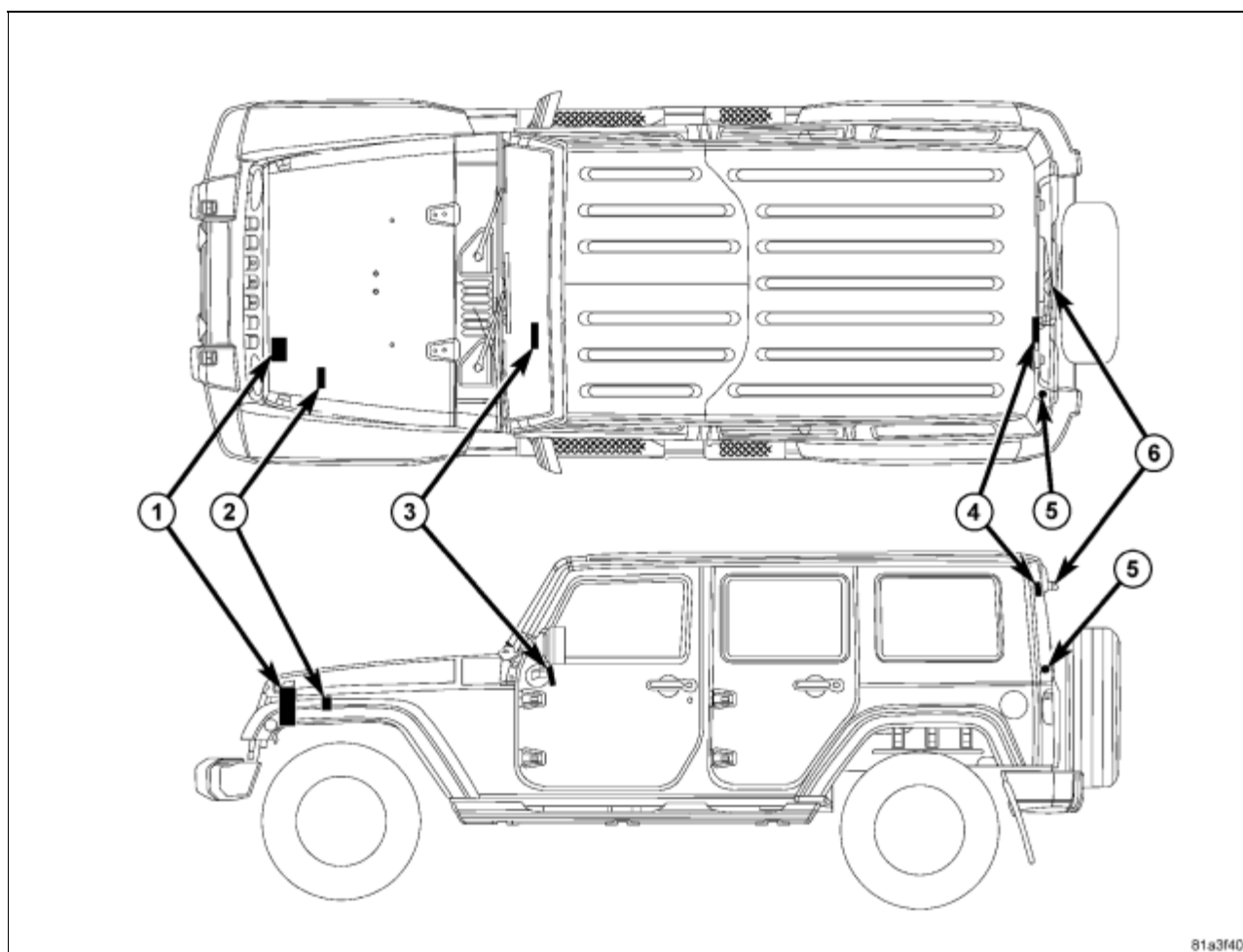
An electrically operated intermittent front wiper and washer system is standard factory-installed safety equipment on this vehicle. The wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **ElectroMechanical Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) is located on the instrument panel directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).

- **Front Washer Check Valve (3)** - A check valve is located in the front washer plumbing on the underside of the hood panel near the front washer nozzle.
- **Front Washer Nozzle (4)** - A single fluidic front washer nozzle is secured by an integral latch feature to a dedicated opening in the center of the hood panel near the base of the windshield.
- **Front Washer Plumbing** - The plumbing for the washer system consists of rubber hoses and molded rubber or plastic fittings. The plumbing is routed from the washer reservoir along the left side of the engine compartment to the dash panel, then across the underside of the inner hood panel reinforcement to the washer nozzle.
- **Front Wiper Arms And Blades (6)** - The two front wiper arms are secured with nuts to the threaded ends of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield. The two equal length front wiper blades are each secured to their wiper arm with an integral latch, and are parked on the glass near the bottom of the windshield when the front wiper system is not in operation.
- **Front Wiper Module (5)** - The wiper pivot shafts are the only visible components of the front wiper module. The remainder of the module is concealed within the cowl plenum beneath the cowl plenum cover/grille panel. The wiper module includes the wiper module bracket, three rubber-isolated wiper module mounts, the wiper motor, the wiper motor crank arm, the two wiper drive links, the two wiper pivots and the two pivot water shields.
- **Right Multi-Function Switch (7)** - The right (wiper) multi-function switch and the left (lighting) multi-function switch are secured to brackets integral to the clockspring housing on the top of the steering column just below the steering wheel. The right multi-function switch is connected by a short jumper harness to the Steering Control Module (SCM), which is internal to the left multi-function switch housing. Only the switch control stalk extending from the right side of the steering column is visible, while the remainder of the switch is concealed beneath the steering column shrouds. The right multi-function switch is dedicated to providing all of the driver controls for both the front and rear wiper and washer systems.
- **Steering Control Module** - The Steering Control Module (SCM) is internal to the left multi-function switch housing, which is secured to a bracket integral to the left side of the clockspring housing on the top of the steering column just below the steering wheel. Only the left switch control stalk extending from the left side of the steering column is visible, while the remainder of the switch housing containing the SCM is concealed beneath the steering column shrouds. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/STEERING COLUMN CONTROL MODULE - DESCRIPTION).
- **Totally Integrated Power Module (2)** - The Totally Integrated Power Module (TIPM) is located in the engine compartment, near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/TOTALLY INTEGRATED POWER MODULE - DESCRIPTION).
- **Washer Pump/Motor** - The single or reversible dual electric washer pump/motor unit is located in a dedicated hole in a sump area on the lower washer reservoir. The reversible dual washer pump/motor provides washer fluid to either the front or rear washer system plumbing, depending upon the direction of the pump motor rotation.
- **Washer Reservoir (1)** - The washer reservoir is located in the left front corner of the engine compartment. The reservoir filler cap is also accessed from the left front corner of the engine compartment.

Hard wired circuitry connects the front wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the front wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

REAR



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An electrically operated fixed interval intermittent rear wiper and washer system is standard factory-installed equipment on this vehicle when it is equipped with an optional hard top. The rear wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **ElectroMechanical Instrument Cluster** - The ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) is located on the instrument panel directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Rear Washer Check Valve (5)** - A check valve is located in the hard top disconnect plate between the hard top washer supply hose and the body washer supply hose on the left inner D-pillar of the hard top.
- **Rear Washer Nozzle** - The fluidic rear washer nozzle is integral to the output shaft of the rear wiper motor on the left upper corner of the rear lift glass.
- **Rear Washer Plumbing** - The plumbing for the rear washer system consists of rubber hoses and molded plastic or rubber fittings. The plumbing is routed along the left side of the engine compartment from the washer reservoir, through the dash into the passenger compartment, down the left cowl side and sill to the body wire harness. The hose exits the body wire harness at the belt line of the left D-pillar where it connects through the rear check valve to a hard top hose that is routed up the D-pillar of the hard top to the upper lift glass opening header and then to the rear wiper motor.
- **Rear Wiper Arm And Blade (6)** - The single molded plastic rear wiper arm is secured by a nut directly to the rear wiper motor output shaft, which extends through a clearance hole near the upper left corner of the lift glass. The molded plastic rear wiper blade is secured by an integral pin to latches integral to the rear wiper arm, and is parked near the top of the lift glass when the rear wiper system is not in operation.

- **Rear Wiper Motor (4)** - The rear wiper motor includes the motor bracket and two rubber-isolated mounting tabs. The wiper motor output shaft is the only visible component of the rear wiper motor. The remainder of the motor is concealed by a molded plastic trim cover on the inner lift glass just below the lift glass opening header.
- **Right Multi-Function Switch (3)** - The right (wiper) multi-function switch and the left (lighting) multi-function switch are secured to brackets integral to the clockspring housing, on the top of the steering column just below the steering wheel. The right multi-function switch is connected by a short jumper harness to the Steering Control Module (SCM), which is internal to the left multi-function switch housing. Only the switch control stalk extending from the right side of the steering column is visible, while the remainder of the switch is concealed beneath the steering column shrouds. The right multi-function switch is dedicated to providing all of the driver controls for both the front and rear wiper and washer systems.
- **Steering Control Module** - The Steering Control Module (SCM) is internal to the left multi-function switch housing, which is secured to a bracket integral to the left side of the clockspring housing on the top of the steering column just below the steering wheel. Only the left switch control stalk extending from the left side of the steering column is visible, while the remainder of the switch housing containing the SCM is concealed beneath the steering column shrouds. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/STEERING COLUMN CONTROL MODULE - DESCRIPTION).
- **Totally Integrated Power Module (2)** - The Totally Integrated Power Module (TIPM) is located in the engine compartment, near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/TOTALLY INTEGRATED POWER MODULE - DESCRIPTION).
- **Washer Pump/Motor** - The reversible dual electric washer pump/motor unit is located in a dedicated hole in a sump area on the lower washer reservoir. The dual washer pump/motor provides washer fluid to either the front or rear washer system plumbing, depending upon the direction of the pump motor rotation.
- **Washer Reservoir (1)** - The rear washer system shares a single reservoir and reversible pump with the front washer system, but has its own dedicated plumbing. The washer reservoir is located in the left front corner of the engine compartment. The filler cap is also accessed from the left front corner of the engine compartment.

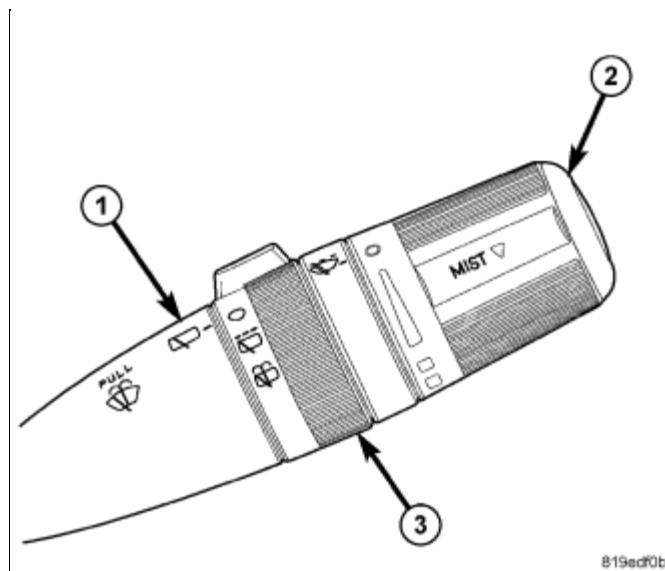
Hard wired circuitry connects the rear wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the rear wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

FRONT

The front wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be

wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outer surface of the windshield glass that might be encountered while driving the vehicle under numerous types of inclement operating conditions.



The vehicle operator initiates all front and rear wiper and washer system functions with the control stalk of the right (wiper) multi-function switch (1) that extends from the right side of the steering column, just below the steering wheel. Rotating the control knob (2) on the end of the control stalk, selects the OFF, DELAY, LOW, or HIGH front wiper system operating modes. In the DELAY mode, the control knob also allows the vehicle operator to select from one of five intermittent wipe delay intervals.

Pulling the control stalk rearward actuates the momentary front washer system switch, which selects the WASH and WIPE-AFTER-WASH modes, depending upon when and how long the switch is held closed. Pushing the control stalk downward actuates a momentary switch and selects the MIST mode, which cycles the wiper blades for as long as the switch is held closed then completes the current cycle and parks the blades at the base of the windshield after the switch is released.

The right multi-function switch provides hard wired analog and resistor multiplexed inputs to the Steering Control Module (SCM) internal to the left (lighting) multi-function switch housing for all of the wiper and washer system functions. The SCM then sends electronic **wiper** and **washer switch** status messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN), over a Local Interface Network (LIN) data bus. The EMIC responds to the SCM inputs by sending electronic **wiper** and **washer system** request messages to the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus requesting the appropriate wiper and washer system operating modes.

Front wiper and washer system operation is completely controlled by the SCM, EMIC and TIPM logic circuits, and that logic will only allow these systems to operate when the ignition switch is in the ACCESSORY or ON positions. The TIPM uses intelligent, high current, self-protected high side switches to control wiper system operation by energizing or de-energizing the wiper motor low and high speed brushes. The TIPM uses an H-bridge circuit to control the operation of the reversible washer pump/motor unit. The right multi-function switch circuitry receives battery current and a clean ground output from the SCM, then provides analog and multiplexed inputs to the SCM to indicate the selected front wiper and front washer system mode.

The hard wired circuits and components of the front wiper and washer system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the front wiper and washer system or the electronic controls or communication between other modules and devices that provide some features of the front wiper and washer system. The most reliable, efficient, and accurate means to diagnose the front wiper and washer system or the electronic controls and communication related to front wiper and washer system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the front wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the LOW position of the control knob on the control stalk of the right (wiper) multi-function switch is selected the SCM sends an electronic **wiper switch low** status message to the EMIC over the LIN data bus, the EMIC relays an electronic **wiper switch low** request message to the TIPM over the CAN data bus, then the TIPM directs battery current to the low speed brush of the wiper motor, causing the wipers to cycle at low speed.

When the HIGH position of the control knob is selected the SCM sends an electronic **wiper switch high** status message to the EMIC, the EMIC relays an electronic **wiper switch high** request message to the TIPM, then the TIPM directs battery current to the high speed brush of the wiper motor, causing the wipers to cycle at high speed.

When the OFF position of the multi-function switch control knob is selected, the SCM sends an electronic **wiper switch off** status message to the EMIC, the EMIC relays an electronic **wiper switch off** request message to the TIPM, then one of two events will occur. The event that occurs depends upon the position of the wiper blades on the windshield at the moment that the control knob OFF position is selected.

If the wiper blades are in the down position on the windshield when the OFF position is selected, the park switch that is integral to the wiper motor is closed to ground, which provides a hard wired park switch sense input to the TIPM. The TIPM then de-energizes the wiper motor and the wiper motor ceases to operate. If the wiper blades are not in the down position on the windshield at the moment the OFF position is selected, the park switch is an open circuit and the TIPM continues running the wiper motor at low speed until the wiper blades are in the down position on the windshield and the park switch input to the TIPM is again closed to ground.

INTERMITTENT WIPE MODE

When the control knob on the control stalk of the right (wiper) multi-function switch is moved to one of the five DELAY interval positions the SCM sends an electronic **wiper switch delay interval** status message to the EMIC, the EMIC relays an electronic **wiper switch delay interval** request message to the TIPM, then the TIPM electronic intermittent wipe logic circuit responds by calculating the correct length of time between wiper sweeps based upon the selected delay interval input.

The TIPM monitors the changing state of the wiper motor park switch through a hard wired park switch sense input. This input allows the TIPM to determine the proper intervals at which to energize and de-energize the wiper motor intermittently for one low speed cycle at a time.

The TIPM logic is also programmed to provide vehicle speed sensitivity to the selected intermittent wipe delay intervals. In order to provide this feature the TIPM monitors electronic **vehicle speed** messages from the Controller Antilock Brake (CAB) or the Powertrain Control Module (PCM) and doubles the selected delay interval whenever the vehicle speed is about 16 kilometers-per-hour (10 miles-per-hour) or less.

MIST WIPE MODE

When the control stalk of the right (wiper) multi-function switch is moved downward to the momentary MIST position, the SCM sends an electronic **wiper mist mode** status message to the EMIC, the EMIC relays an electronic **wiper mist mode** request message to the TIPM, then the TIPM energizes the low speed brush of the wiper motor for as long as the switch is held closed, then de-energizes the motor when the state of the switch changes to open, parking the wiper blades near the base of the windshield. The TIPM can operate the front wiper motor in this mode for only one low speed cycle at a time, or for an indefinite number of sequential low speed cycles, depending upon how long the switch is held closed.

WASH MODE

When the control stalk of the right (wiper) multi-function switch is pulled rearward to the front momentary WASH position for more than about one-half second with the wiper system operating, the SCM sends an electronic **washer switch** status message to the EMIC, the EMIC relays an electronic **washer switch** request message to the TIPM, then the TIPM directs battery current and ground to the washer pump/motor. This will cause the washer pump/motor to be energized in the front wash direction for as long as the switch is held closed (up to approximately 10 seconds) and to be de-energized when the control stalk is released.

When the control stalk is pulled rearward to the front momentary WASH position while the front wiper system is operating in one of the DELAY interval positions, the washer pump/motor operation is the same. However, the TIPM also overrides the selected delay interval and operates the front wiper motor in a continuous low speed mode for as long as the control stalk is held in the front momentary WASH position, then reverts to the selected delay interval several wipe cycles after the control stalk is released. If the WASH switch is held closed for more than approximately 10 seconds, the TIPM will suspend washer pump/motor operation until the control stalk is released for about 2 seconds and then cycled back to the WASH position.

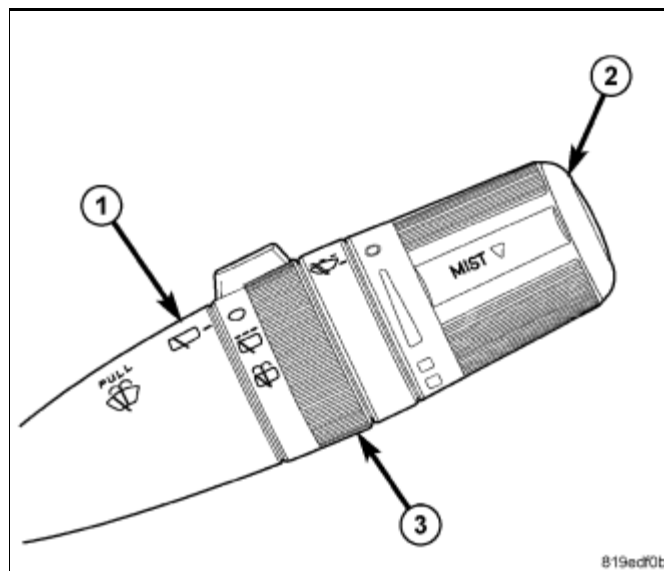
WIPE-AFTER-WASH MODE

When the control stalk of the right (wiper) multi-function switch is pulled rearward to the front momentary WASH position for more than about one-half second while the wiper system is not operating, the SCM sends an electronic **washer switch** status message to the EMIC, the EMIC relays an electronic **washer switch** request message to the TIPM, and the TIPM directs battery current and ground to the washer pump/motor and energizes the wiper motor in a continuous low speed mode for as long as the switch is held closed (up to approximately 10 seconds). When the control stalk is released, the TIPM de-energizes the washer pump/motor immediately, but allows the wiper motor to operate for two or three additional wipe cycles before it de-energizes the wiper motor and parks the wiper blades near the base of the windshield.

If the control stalk is held rearward for more than about 10 seconds, the TIPM will suspend washer pump/motor operation until the stalk is released for about 2 seconds and then cycled back to the WASH position; however, the wipers will continue to operate for as long as the switch is held closed. The TIPM monitors the changing state of the wiper motor park switch through a hard wired wiper park switch sense circuit input. This input allows the TIPM to count the number of wipe cycles that occur after the control stalk is released, and to determine the proper interval at which to de-energize the wiper motor to complete the WIPE-AFTER-WASH mode cycle.

REAR

The rear wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the liftgate glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blade to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outer surface of the liftgate glass that might be encountered while driving the vehicle under numerous types of inclement operating conditions.



The vehicle operator initiates all front and rear wiper and washer system functions with the control stalk (1) of the right (wiper) multi-function switch that extends from the right side of the steering column, just below the steering wheel. Rotating the control sleeve (3) on the control stalk to the OFF or INTERMITTENT detent positions or the momentary WASH position selects the rear wiper and washer system operating modes.

The right multi-function switch provides hard wired analog and resistor multiplexed inputs to the Steering Control Module (SCM) integral to the left (lighting) multi-function switch for all of the wiper and washer system functions. The SCM then sends electronic **rear wiper/washer switch** status messages to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) over a Local Interface Network (LIN) data bus. The EMIC then sends electronic **rear wiper/washer switch** request messages to the Totally Integrated Power Module (TIPM) over the Controller Area Network (CAN) data bus requesting the appropriate rear wiper and washer system operating modes.

Rear wiper and washer system operation is completely controlled by the SCM, EMIC and TIPM logic circuits, and that logic will only allow these systems to operate when the ignition switch is in the ACCESSORY or ON positions. The TIPM uses intelligent, high current, self-protected high side switches to control wiper system operation by energizing or de-energizing the rear wiper motor. The TIPM uses an H-bridge circuit to control the operation of the reversible washer pump/motor unit. The right multi-function switch circuitry receives a clean ground output from the SCM on a multi-function switch return circuit, then provides analog and resistor multiplexed inputs to the SCM to indicate the selected rear wiper and rear washer system mode.

The hard wired circuits and components of the rear wiper and washer system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the rear wiper and washer system or the electronic controls or communication between other modules and devices that provide some features of the rear wiper and washer system. The most reliable, efficient, and accurate means to diagnose the rear wiper and washer system or the electronic controls and communication related to rear wiper and washer system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the rear wiper and washer system operating modes.

INTERMITTENT WIPE MODE

When the INTERMITTENT WIPE position of the control sleeve on the control stalk of the right multi-function switch is selected, the SCM sends an electronic **rear wiper switch** status message to the EMIC over the LIN data bus, then the EMIC relays an electronic **rear wiper switch** request message to the TIPM over the CAN data bus, and the TIPM directs battery current to the rear wiper motor at fixed delay intervals to enable the rear wiper motor intermittent wipe mode.

WASH MODE

When the control sleeve of the right multi-function switch is rotated counterclockwise past the INTERMITTENT detent position to the momentary rear WASH position, the SCM sends an electronic **rear washer switch** status message to the EMIC over the LIN data bus, then the EMIC relays an electronic **rear washer switch** request message to the TIPM over the CAN data bus, and the TIPM directs battery current to the rear wiper motor and directs battery current and ground to the washer pump/motor unit. These outputs will cause the washer pump motor and the rear wiper motor to operate continuously for as long as the switch is held closed up to approximately 10 seconds. The washer pump is de-energized as soon as the control sleeve is released, but the rear wiper motor continues to operate for two to three continuous cycles before reverting to the fixed delay interval operation. The TIPM uses a hard wired output from a park switch internal to the rear wiper motor as an additional logic input to monitor the position of the rear wiper blade on the glass and to control the number of continuous wiper sweeps following washer operation.

DIAGNOSIS AND TESTING

FRONT

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

If the front wiper motor operates, but the wipers do not move on the windshield, replace the ineffective front wiper module. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the front wiper and washer system components as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - FRONT) and (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - INSPECTION - FRONT).

The hard wired front wiper and washer system circuits and components may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the front wiper and washer system or the electronic controls or communication between other modules and devices that provide some features of the front wiper and washer system. The most reliable, efficient, and accurate means to diagnose the front wiper and washer system or the electronic controls and communication related to front wiper and washer system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

NOTE: The front wiper and washer switches are integral to the right multi-function switch. The right multi-function switch is hard wired to the left multi-function switch/Steering Control Module (SCM), which communicates with the ElectroMechanical Instrument Cluster (EMIC)/Cab Compartment Node (CCN) over the Local Interface Network (LIN) data bus. Before performing any of the following tests, determine whether the other functions of the right and left multi-function switch/SCM are operational. If only the right multi-function switch functions are inoperative, test and repair the right multi-function switch or the jumper harness between the right and left multi-function switches before attempting to repair the Front Wiper and Washer System. If both the right and left multi-function switch/SCM functions are ineffective, diagnose and repair that problem before attempting to repair the Front Wiper and Washer System.

CONDITION	POSSIBLE CAUSES	CORRECTION
WIPER MOTOR DOES NOT OPERATE IN ANY SWITCH POSITION	1. Ineffective motor ground circuit.	1. Test and repair open wiper motor ground circuit if required.
	2. Ineffective motor feed circuits.	2. Test and repair low speed and high speed feed circuits between TIPM and front wiper motor if required.
	3. Ineffective EMIC (CCN) inputs or outputs.	3. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.
	4. Ineffective TIPM inputs or outputs.	4. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
	5. Ineffective wiper motor.	5. Test and replace open or shorted wiper motor as required.
WIPER MOTOR OPERATES SLOWLY IN ALL SWITCH POSITIONS	1. Ineffective wiper motor.	1. Check amperage draw with linkage disconnected from wiper motor crank arm. Correct draw should be about 6 amperes. If incorrect, refer to the appropriate Possible Cause that follows:
	2. Amperage draw too low.	2. Test and repair shorted low and high speed feed circuits if required.
	3. Amperage draw too high.	3. With linkage disconnected from wiper motor crank arm check linkage and pivots for binding. If binding is detected, repair or replace front wiper module if required. If no linkage binding detected, replace the front wiper motor if required.
WIPERS RUN AT HIGH SPEED WITH SWITCH LOW SPEED SELECTED OR AT LOW SPEED WITH SWITCH HIGH SPEED SELECTED	1. Ineffective motor feed circuit wiring.	1. Test and repair low speed and high speed feed circuits between TIPM and front wiper motor if required.

REAR

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

If the rear wiper motor operates, but the wiper motor output shaft does not move, replace the ineffective rear wiper motor. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wiper operates, but chatters, lifts, or does not clear the glass, clean and inspect the rear wiper and washer system components as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - REAR) and (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - INSPECTION - REAR).

The hard wired rear wiper and washer system circuits and components may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the rear wiper and washer system or the electronic controls or communication between other modules and devices that provide some features of the rear wiper and washer system. The most reliable, efficient, and accurate means to diagnose the rear wiper and washer system or the electronic controls and communication related to rear wiper and washer system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

NOTE: The rear wiper and washer switches are integral to the right multi-function switch. The right multi-function switch is hard wired to the left multi-function switch/Steering Control Module (SCM), which communicates with the ElectroMechanical Instrument Cluster (EMIC)/Cab Compartment Node (CCN) over the Local Interface Network (LIN) data bus. Before performing any of the following tests, determine whether the other functions of the right and left multi-function switch/SCM are operational. If only the right multi-function switch functions are inoperative, test and repair the right multi-function switch or the jumper harness between the right and left multi-function switches before attempting to repair the Rear Wiper and Washer System. If both the right and left multi-function switch/SCM functions are ineffective, diagnose and repair that problem before attempting to repair the Rear Wiper and Washer System.

CONDITION	POSSIBLE CAUSES	CORRECTION
WIPER MOTOR DOES NOT OPERATE IN ANY SWITCH POSITION	1. Ineffective motor ground circuit.	1. Test and repair open wiper motor ground circuit if required.
	2. Ineffective motor feed circuits.	2. Test and repair motor feed circuit between TIPM and rear wiper motor if required.
	3. Ineffective EMIC (CCN) inputs or outputs.	3. Use a diagnostic scan tool to test the EMIC (CCN) inputs and outputs. Refer to the appropriate diagnostic information.

	4. Ineffective TIPM inputs or outputs.	4. Use a diagnostic scan tool to test the TIPM inputs and outputs. Refer to the appropriate diagnostic information.
	5. Ineffective wiper motor.	5. Test and replace open or shorted wiper motor if required.
WIPER MOTOR OPERATES SLOWLY	1. Improper wiper motor amperage draw.	1. Check amperage draw with wiper arm disconnected from rear wiper motor output shaft. Correct draw should be about 6 amperes. If incorrect, refer to the appropriate Possible Cause that follows:
	2. Amperage draw too low.	2. Test and repair the shorted rear wiper motor signal and fused ignition switch output (run - accessory) circuits if required.
	3. Amperage draw too high.	3. With wiper arm disconnected from wiper motor output shaft check for binding between output shaft and rubber grommet in liftgate glass. If binding is detected, lubricate or replace grommet if required. If no binding is detected, replace the wiper motor if required.

CLEANING

FRONT

WIPER SYSTEM

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

WASHER SYSTEM

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the washer

pump/motor unit from the reservoir. Clean foreign material from the inside of the washer pump inlet filter screen and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hose from the washer nozzle, then running the washer pump/motor to run clean washer fluid or water through the system. A plugged or restricted washer nozzle should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

REAR

WIPER SYSTEM

The squeegee of a wiper blade exposed to the elements for a long time tends to lose its wiping effectiveness. Periodic cleaning of the squeegee is suggested to remove any deposits of salt or road film. The wiper blade, arm, and lift glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blade continues to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegee of the wiper blade from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegee.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet filter screen and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hose from the rear wiper motor, then running the washer pump/motor to run clean washer fluid or water through the system. A plugged or restricted rear washer nozzle should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the rear wiper motor.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegee of the wiper blade.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

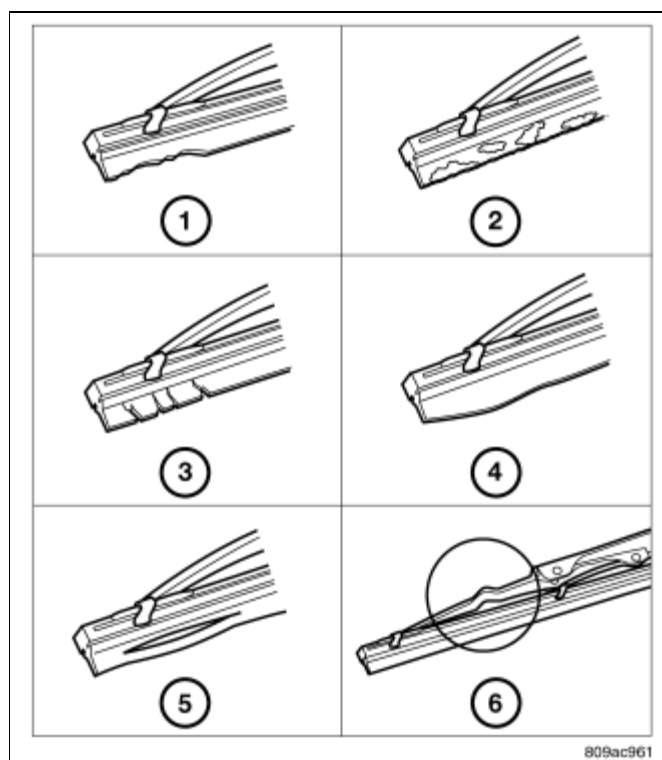
INSPECTION

FRONT

WIPER SYSTEM

The wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

1. Carefully inspect the wiper blades for any indications of worn or uneven edges (1), foreign material deposits (2), hardening or cracking (3), deformation or fatigue (4), or splitting (5). Inspect the wiper blade support components and the wiper arms for damage (6) or corrosion. If the wiper arms and blades are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - FRONT). If a wiper blade or arm is damaged, or if corrosion is evident, replace the affected wiper arm or blade with a new unit. Do not attempt to repair a wiper arm or blade that is damaged or corroded.
2. Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or if there is evident lateral play in the wiper arm hinge, replace the wiper arm.



CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

3. Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. On vehicles with unequal wiper arm lengths, be certain that measurements on both arms are taken at a point an equal distance from their wiper arm hinge pins. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.
4. After cleaning and inspecting the wiper components and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade.

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

1. Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - FRONT).
2. Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must

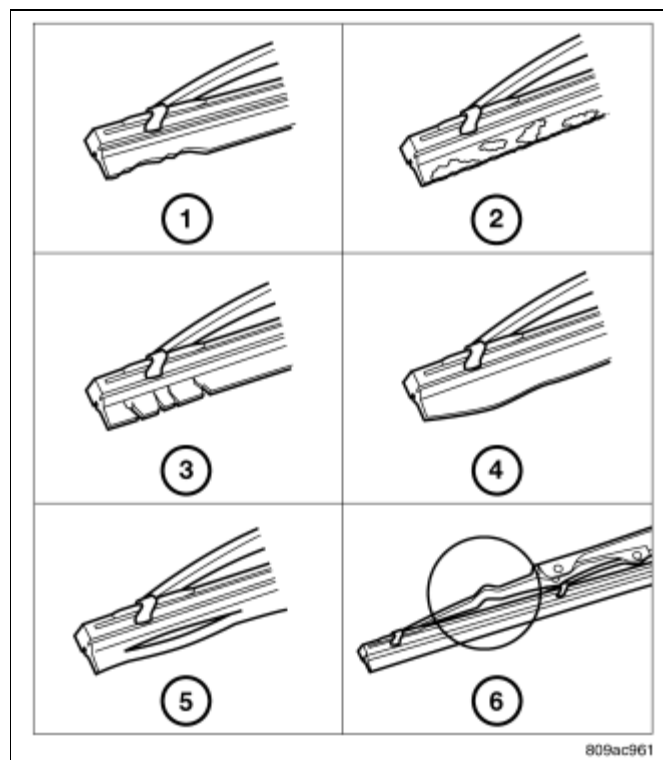
be avoided.

REAR

WIPER SYSTEM

The rear wiper blade and wiper arm should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

1. Carefully inspect the wiper blade for any indications of worn or uneven edges (1), foreign material deposits (2), hardening or cracking (3), deformation or fatigue (4), or splitting (5). Inspect the wiper blade support components and the wiper arm for damage (6). If the wiper arm and blade are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - REAR). If the wiper blade or arm is damaged, replace it with a new unit. Do not attempt to repair a wiper arm or blade that is damaged or corroded.
2. Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.



CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

3. Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. The spring tension of the wiper arm should be sufficient to cause the rubber squeegee to conform to the curvature of the glass. Replace a wiper arm if it has insufficient spring tension to maintain contact between the squeegee and the glass.
4. After cleaning and inspecting the wiper components and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade.

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

1. Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer

system. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING - REAR).

2. Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

SPECIFICATIONS

WIPER AND WASHER SYSTEMS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Right Multi-Function Switch Mounting Screw	1	-	10
Washer Reservoir Mounting Screw (Diesel)	9	-	79
Front Wiper Arm Mounting Nut	23	17	-
Rear Wiper Arm Mounting Nut	19.5	14	-
Front Wiper Module Mounting Screws	9.5	-	85
Rear Wiper Motor Mounting Bracket Nut	6	-	53
Rear Wiper Motor Mounting Bracket Special Fastener	4	-	35
Rear Wiper Motor Output Shaft Nut	4	-	35

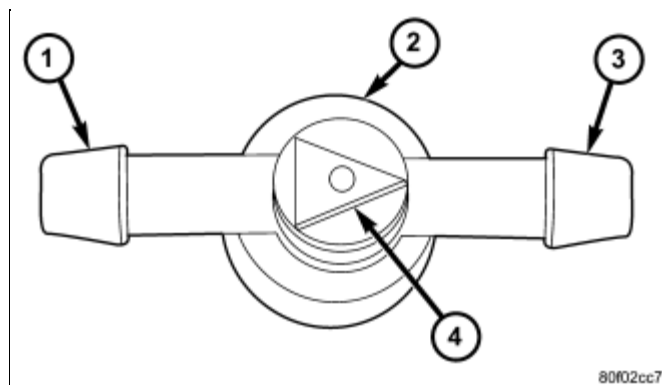
CHECK VALVE

DESCRIPTION

FRONT

The front check valve (2) is standard equipment on this vehicle, and is located in the engine compartment in the

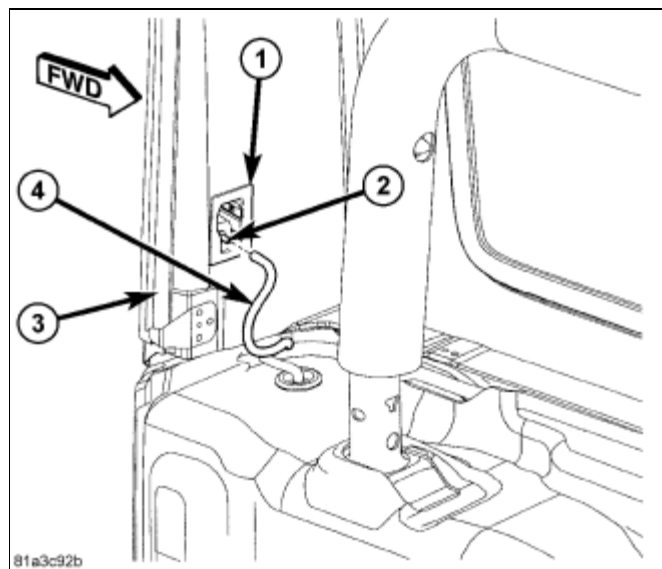
washer supply hose on the underside of the hood panel just outboard of the front washer nozzle. The check valve consists of a molded plastic valve body with a raised arrowhead (4) molded into its center section indicating the direction of the flow through the valve. A barbed hose nipple (1 and 3) is formed on each side of the raised center section of the valve body. Within the check valve body, a small diaphragm is held against the lip of an integral sump well by a small plastic piston and a coiled spring.



The front check valve cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

REAR

The rear check valve (2) is located in the hardtop disconnect plate (1) located in the left inner D-pillar (3) of the removable hardtop. The disconnect plate provides a washer plumbing interconnect between the rear washer hose (4) contained within the body wire harness and the hardtop washer hose connected to the rear wiper motor. The disconnect plate also provides an electrical interconnect between the body wire harness and the hardtop wiring connected to the rear wiper motor.



The check valve consists of a molded white plastic valve body with a raised center flange and two raised wedge locks that secure the unit in the disconnect plate. A barbed outlet hose nipple is formed on the side of the valve body oriented toward the rear washer nozzle, and a straight inlet hose nipple is formed on the side of the valve body oriented toward the washer pump. Within the check valve body, a small check ball is held against an integral valve seat by a small coiled spring.

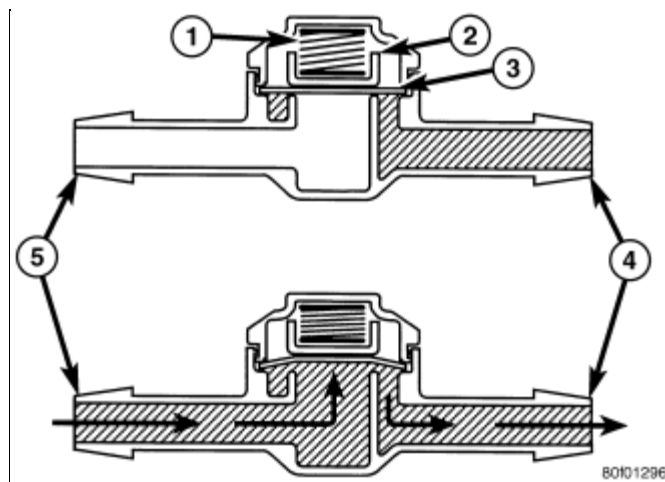
The rear check valve cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

OPERATION

FRONT

The front check valve provides more than one function in this application. It prevents washer fluid from draining out of the front washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the front washer switch is actuated until washer

fluid was dispensed through the front washer nozzle, because the washer pump would have to refill the front washer plumbing from the reservoir to the nozzle. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the front check valve prevents washer fluid from siphoning out through the front washer nozzle after the front washer system is turned OFF.



When the washer pump pressurizes and pumps washer fluid from the reservoir through the front washer plumbing (5), the fluid pressure unseats a diaphragm (3) from over a sump well within the valve by overriding the pressure applied to it by a piston (2) and coiled spring (1). With the diaphragm unseated, washer fluid is allowed to flow toward the front washer nozzle (4). When the washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the front washer plumbing is prevented.

REAR

The rear check valve provides more than one function in this application. It prevents washer fluid from draining out of the rear washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the rear washer switch is actuated until washer fluid was dispensed through the rear washer nozzle, because the washer pump would have to refill the rear washer plumbing from the reservoir to the nozzle. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the rear check valve prevents washer fluid from siphoning out through the rear washer nozzle after the rear washer system is turned OFF.

When the washer pump pressurizes and pumps washer fluid from the reservoir through the rear washer plumbing, the fluid pressure unseats a check ball from a seat within the valve by overriding the pressure applied to the ball within the valve by a small coiled spring. With the check ball unseated, washer fluid is allowed to flow toward the rear washer nozzle. When the washer pump stops operating, the spring pressure on the check ball seats the ball in the valve and fluid flow in either direction within the rear washer plumbing is prevented.

REMOVAL

FRONT

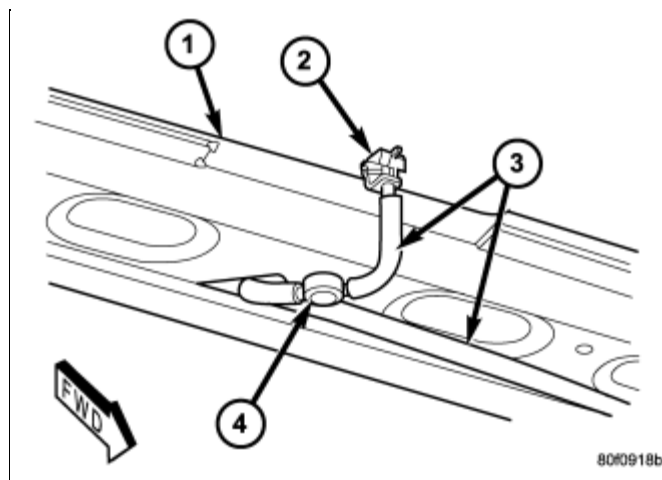
1. Unlatch, open and support the hood.
2. Locate the front check valve (4) in the washer supply hose

(3) for the front washer nozzle. The check valve is installed in the washer supply hose just outboard from the front washer nozzle (2) near the rear hood panel reinforcement (1).

3. Disconnect the washer supply hose for the front washer nozzle from the barbed outlet nipple on the front washer system check valve. A small quantity of washer fluid may drain from the disconnected hose.

4. Disconnect the washer supply hose for the reservoir from the barbed inlet nipple of the front check valve. Either install a temporary plug in the washer supply hose for the reservoir or secure the loose end of this hose at a point higher than the washer reservoir to prevent the contents of the washer reservoir from draining through this hose.

5. Remove the front check valve from the engine compartment.



REAR

1. Disconnect and isolate the battery negative cable.

2. Unlatch and disconnect the body wire harness connector from the hardtop disconnect plate (1) connector receptacle located above the rear washer check valve (2) on the inner D-pillar (3) of the hardtop.

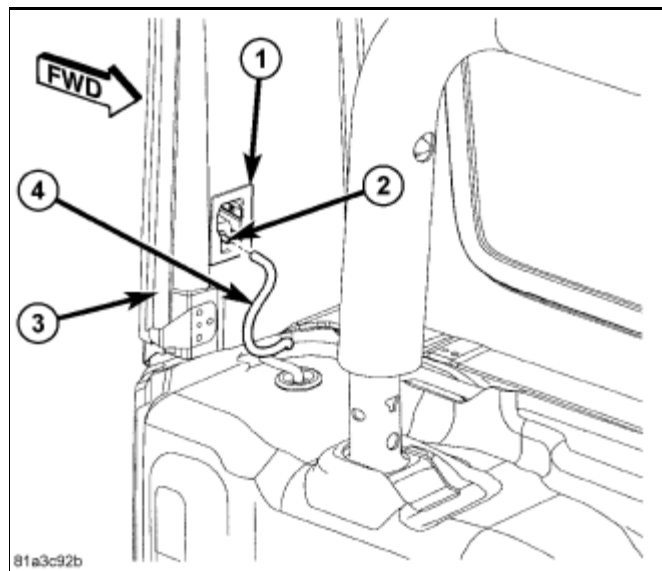
3. Disconnect the rear washer supply hose (4) from the straight inlet nipple of the rear check valve. A small quantity of washer fluid may drain from the disconnected hose.

4. Use a small screwdriver or a pocket knife to gently pry the latch features within each side of the disconnect plate pocket while pulling the plate away from the D-pillar.

5. Pull the hardtop disconnect plate away from the D-pillar far enough to access and disconnect the hardtop washer hose from the barbed outlet nipple on the back of the check valve. A small quantity of washer fluid may drain from the disconnected hose.

6. From the face of the disconnect plate, firmly grasp the straight nipple of the check valve and rotate it counterclockwise about 30 degrees to unlock it.

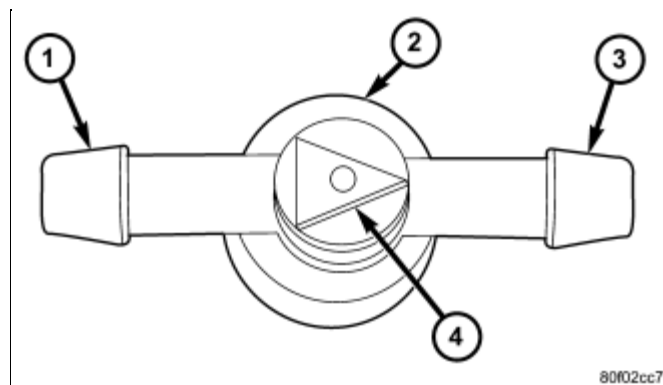
7. Pull the check valve straight out of the keyed opening in the disconnect plate.



INSTALLATION

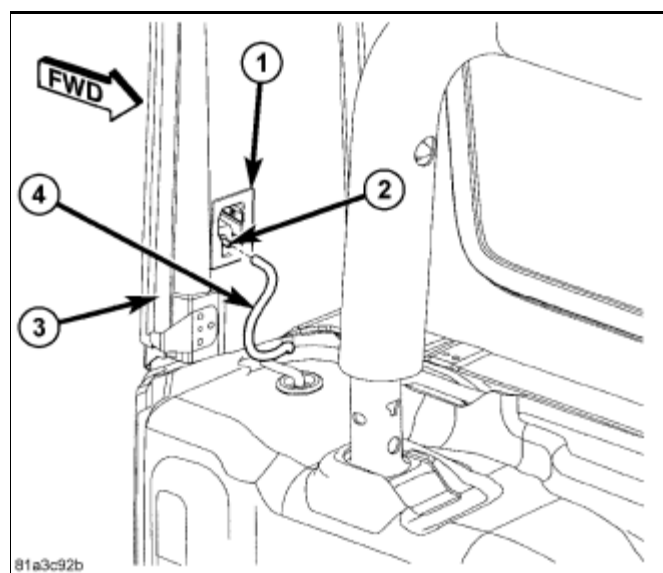
FRONT

1. Position the front check valve (2) in the engine compartment.
2. With the directional arrow (4) on the check valve pointed in the direction of the system flow, reconnect the washer supply hose from the reservoir to the barbed inlet nipple (1) of the front check valve.
3. Reconnect the washer supply hose from the front washer nozzle to the barbed outlet nipple (3) of the front check valve.
4. Check that the washer supply hoses are properly routed and are not pinched.
5. Close and latch the hood.



REAR

1. Grasp the rear check valve by the straight nipple (2).
2. Align the check valve with the keyed opening within the pocket of the hardtop disconnect plate (1).
3. Insert the check valve into the disconnect plate until the flange is firmly seated.
4. Rotate the check valve about 30 degrees to lock it into place.
5. Reconnect the hardtop washer hose from the rear washer nozzle to the barbed outlet nipple on the back of the check valve.
6. Align the disconnect plate with the mounting hole in the inner D-pillar (3) of the hardtop and press it firmly and evenly until it snaps back into place.
7. Reconnect the washer supply hose (4) from the body wire harness to the straight inlet nipple of the check valve.
8. Reconnect and latch the body wire harness connector to the disconnect plate connector receptacle located above the check valve.
9. Reconnect the battery negative cable.

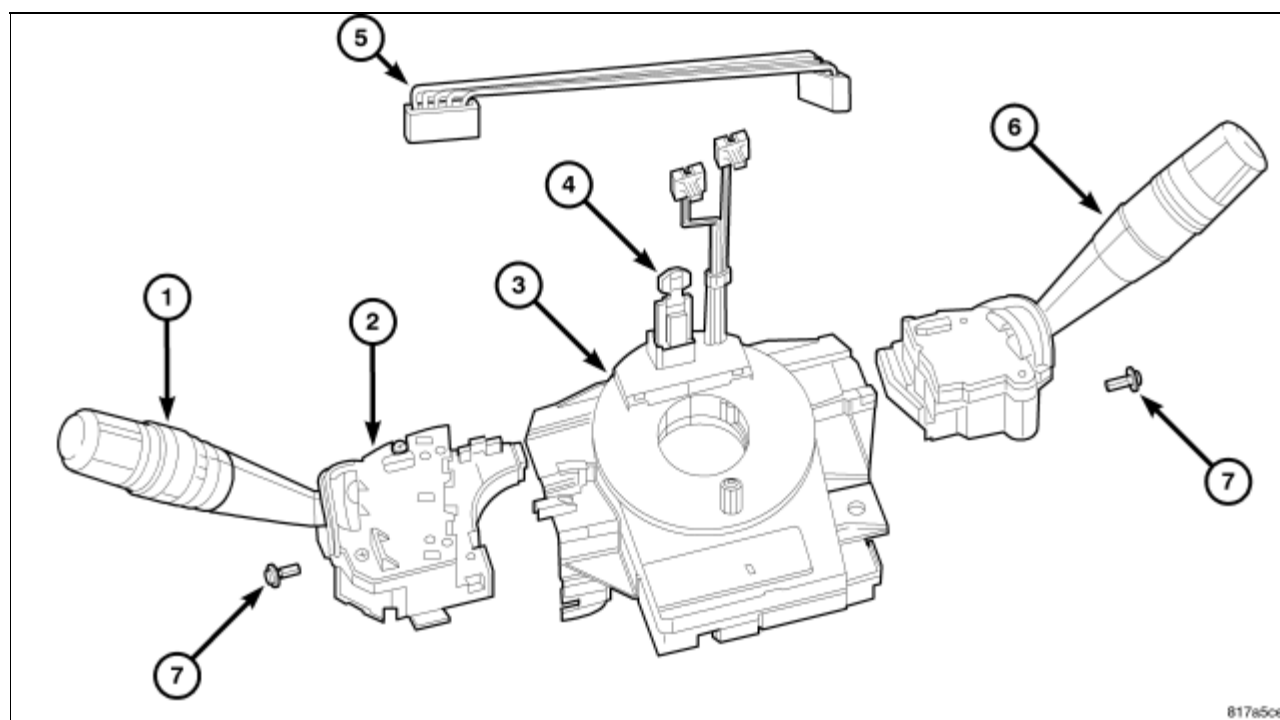
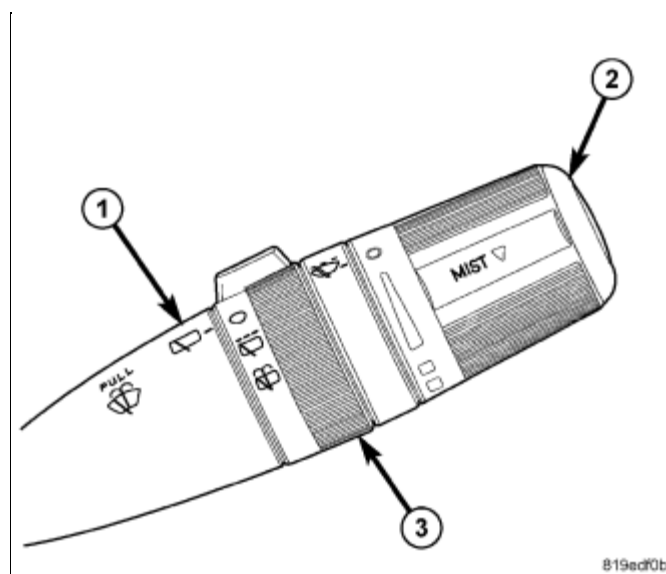


RIGHT MULTI-FUNCTION SWITCH

DESCRIPTION

The right (wiper) multi-function switch is located on the right side of the steering column, just below the steering wheel. This switch is the primary control for the front and rear wiper and washer systems. The only visible components of the switch are the control stalk (1), control knob (2) and control sleeve (3) that extend through the steering column

shrouds on the right side of the column. The remainder of the switch including its mounting provisions and electrical connection are concealed beneath the shrouds.



The switch housing and controls (6) are constructed of molded black plastic. Each of the switch controls has white International Control and Display Symbol graphics applied to it, which clearly identify its many functions. A single screw (7) through a mounting tab integral to the back of the switch housing, and a slide tab integral to the bottom of the switch housing secure the switch to the mounting bracket integral to the clockspring (3). A single connector receptacle containing seven terminal pins is integral to the inboard end of the switch housing and is connected by a jumper wire harness (5) directly to the Steering Control Module (SCM), which is internal to the housing (2) of the left multi-function switch (1).

The right (wiper) multi-function switch provides the vehicle operator with a control interface for the following wiper and washer system functions:

- **Continuous Front Wipers** - The right multi-function switch control knob provides detent switching for two continuous front wipe modes, low speed or high speed.
- **Intermittent Front Wipers** - The right multi-function switch control knob provides detent switching for

the intermittent front wiper mode with five minor detent delay interval positions.

- **Front Wiper Mist Mode** - The right multi-function switch control stalk includes momentary switching of the front wiper motor low speed circuit to provide a mist mode features (sometimes referred to as pulse wipe), which allows the vehicle operator to momentarily operate the front wipers for one or more complete cycles.
- **Front Washer Mode** - The right multi-function switch control stalk provides momentary switching for control of the front washer system operation.
- **Intermittent Rear Wipe Mode** - The right multi-function switch control sleeve provides detent switching for a single fixed interval intermittent rear wiper mode.
- **Rear Washer Mode** - The right multi-function switch control sleeve provides two momentary switch positions for control of rear washer system operation.

The right multi-function switch cannot be adjusted or repaired. If any function of the switch is ineffective, or if the switch is damaged, the entire switch unit must be replaced. The clockspring (with the multi-function switch mounting bracket), the left multi-function switch (with the SCM), the right multi-function switch and the jumper wire harness are each available for separate service replacement.

OPERATION

The right (wiper) multi-function switch uses a combination of resistor multiplexing and conventional analog switching to control the many functions and features it provides. The switch receives a clean ground from the Steering Control Module (SCM), then provides resistor multiplexed and conventional analog return outputs to the SCM to indicate the selected switch positions. The SCM then sends electronic **switch status** messages over a Local Interface Network (LIN) data bus to the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN), and the EMIC relays electronic **wiper** and **washer switch** request messages over the Controller Area Network (CAN) data bus to other electronic modules in the vehicle.

If the SCM detects no inputs from the right multi-function switch, it transmits an electronic **Signal Not Available (SNA)** status message over the LIN data bus. The SNA status signals the EMIC to request other electronic modules to implement a failsafe mode of operation for the front and rear wiper systems. The failsafe mode will maintain the last selected front and rear wiper system operation for the remainder of the current ignition cycle, after which both wiper systems will default to OFF.

The right multi-function switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, the most reliable, efficient and accurate means to diagnose this component requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

Following are descriptions of how the right multi-function switch is operated to control the many front and rear wiper and washer system functions and features it provides:

- **Front Wiper Control** - The control knob on the end of the right multi-function switch control stalk is rotated to one of the two continuous wiper detents, to one of five intermittent wiper detents, or to the OFF position to select the front wiper mode. The SCM reads the input from the right multi-function switch and sends electronic **wiper switch** status messages over the LIN data bus to the EMIC, which relays an electronic **wiper switch** request message over the CAN data bus to other electronic modules in the vehicle.
- **Front Wiper Mist Mode** - The front wiper mist mode is requested when the right multi-function switch control stalk is depressed downward towards the floor to a momentary MIST position. The front wiper motor will continue to operate, one complete cycle at a time, for as long as the control stalk is held in this position. The SCM reads the resistor multiplexed input from the right multi-function switch and sends an electronic **wiper switch** status message over the LIN data bus to the EMIC, which relays an electronic **wiper switch** request message over the CAN data bus to other electronic modules in the vehicle.
- **Front Washer Control** - The right multi-function switch control stalk is pulled rearward towards the

steering wheel to a momentary WASH position to activate the washer pump/motor in the front washer mode. The washer pump/motor will continue to operate for as long as the control stalk is held in this position. The SCM reads the resistor multiplexed input from the right multi-function switch and sends an electronic **washer switch** status message over the LIN data bus to the EMIC, which relays an electronic **washer switch** request message over the CAN data bus to other electronic modules in the vehicle.

- **Rear Wiper Control** - The rear wiper mode is selected when the right multi-function switch control sleeve is rotated to the fixed interval intermittent rear wipe detent position, or the OFF detent position. The SCM reads the input from the right multi-function switch and sends an electronic **wiper switch** status message over the LIN data bus to the EMIC, which relays an electronic **wiper switch** request message over the CAN data bus to other electronic modules in the vehicle.
- **Rear Washer Control** - The right multi-function switch control sleeve is rotated to one of two momentary WASH positions, either fully forward or fully rearward, to activate the washer pump/motor in the rear washer mode. The washer pump/motor will continue to operate in the rear washer mode until the control sleeve is released. The SCM reads the input from the right multi-function switch and sends an electronic **washer switch** status message over the LIN data bus to the EMIC, which relays an electronic **washer switch** request message over the CAN data bus to other electronic modules in the vehicle.

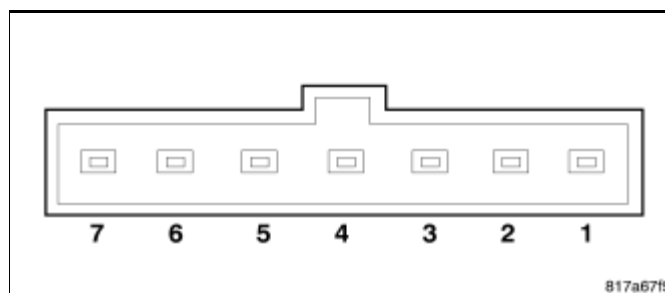
DIAGNOSIS AND TESTING

RIGHT MULTI-FUNCTION SWITCH

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

The right multi-function switch as well as the hard wired inputs and outputs of the switch may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the Steering Control Module (SCM) or the electronic controls or communication between other modules and devices that provide some features of the front and rear wiper and washer systems. The most reliable, efficient and accurate means to diagnose the SCM or the electronic controls and communication related to SCM operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.



1. Remove the right multi-function switch from the integral mounting bracket on the right side of the clockspring. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - REMOVAL).
2. Using an ohmmeter, test the resistance between the terminals of the switch as shown in the three Function Tests tables. For all functions except those of the control stalk the values should be either less than 100 ohms (switch CLOSED) or greater than 1 megohm (switch OPEN).

CONTROL STALK FUNCTION TESTS

FUNCTION	PINS		RESISTANCE
	1	7	
Front Wash	X	X	10000 Ohms
Front Mist	X	X	5490 Ohms

CONTROL KNOB FUNCTION TESTS			
FUNCTION	BETWEEN PIN 7 (GROUND) AND PINS		
	4	5	6
Off	CLOSED	CLOSED	OPEN
Front Delay 1	CLOSED	CLOSED	CLOSED
Front Delay 2	CLOSED	OPEN	CLOSED
Front Delay 3	OPEN	OPEN	CLOSED
Front Delay 4	OPEN	CLOSED	CLOSED
Front Delay 5	OPEN	CLOSED	OPEN
Front Wiper Low	OPEN	OPEN	OPEN
Front Wiper High	CLOSED	OPEN	OPEN

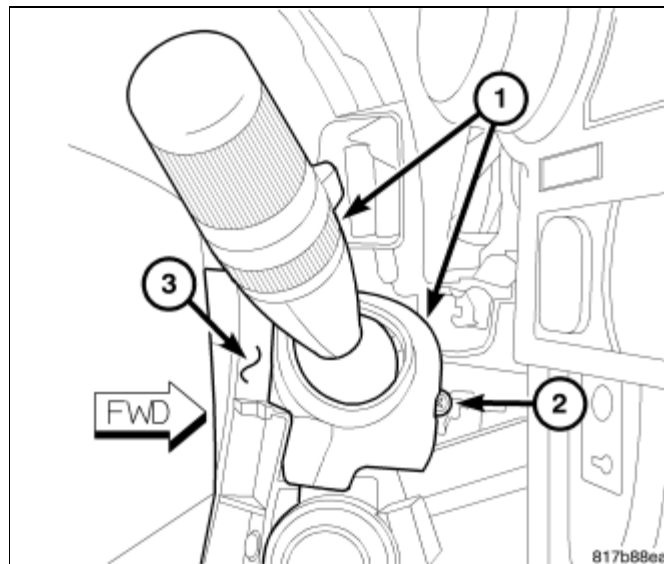
CONTROL SLEEVE FUNCTION TESTS		
FUNCTION	BETWEEN PIN 7 (GROUND) AND PINS	
	2	3
Off	CLOSED	OPEN
Rear Wipe	CLOSED	CLOSED
Rear Wash	OPEN	CLOSED

3. If the switch fails any of the tests, replace the ineffective right multi-function switch as required. If the switch tests okay, but the switch input to the Steering Control Module (SCM) remains incorrect, be certain to check for a short or open in the jumper harness between the right multi-function switch and the SCM.

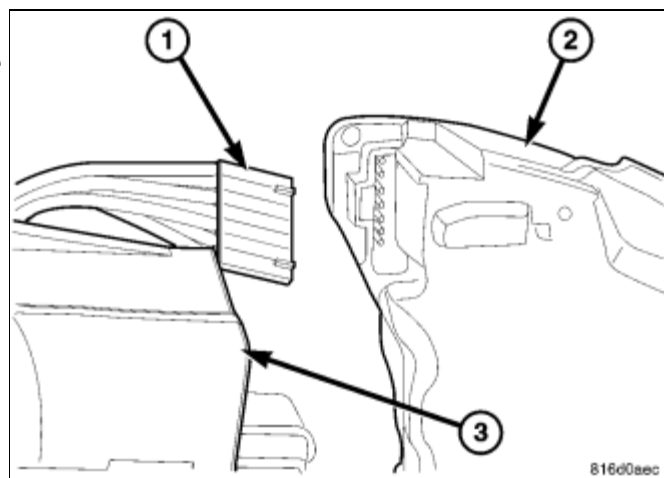
REMOVAL

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Disconnect and isolate the battery negative cable.
2. Remove both the upper and lower shrouds from the steering column. (Refer to 19 - STEERING/COLUMN - REMOVAL).
3. Remove the screw (2) that secures the right multi-function switch (1) to the mounting bracket integral to the right side of the clockspring (3) on the steering column.
4. Slide the switch away from the clockspring far enough to disengage the slide tabs on the switch housing from the channel formations in the mounting bracket.



5. Disconnect the jumper wire harness connector (1) from the connector receptacle on the inboard end of the right multi-function switch (2).
6. Remove the switch from the clockspring (3).



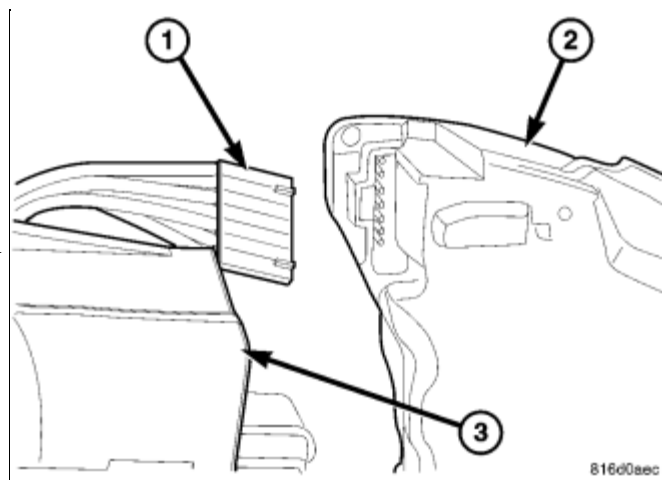
INSTALLATION

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

1. Position the right multi-function switch (2) close enough to the mounting bracket (3) integral to the right side of the

clockspring to reconnect the jumper wire harness connector (1) to the connector receptacle on the inboard side of the switch housing.

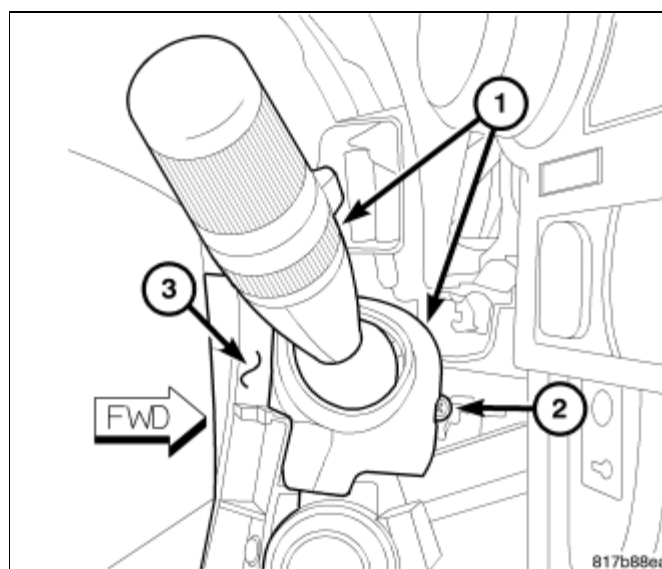
2. Align the slide tabs on the switch housing with the channel formations integral to the clockspring mounting bracket, then slide the switch into the bracket until it is firmly seated.



3. Install and tighten the screw (2) that secures the mounting tab on the back of the right multi-function switch (1) to the mounting bracket on the clockspring (3). Tighten the screw to 1 N·m (10 in. lbs.).

4. Reinstall the upper and lower shrouds onto the steering column. (Refer to 19 - STEERING/COLUMN - INSTALLATION).

5. Reconnect the battery negative cable.



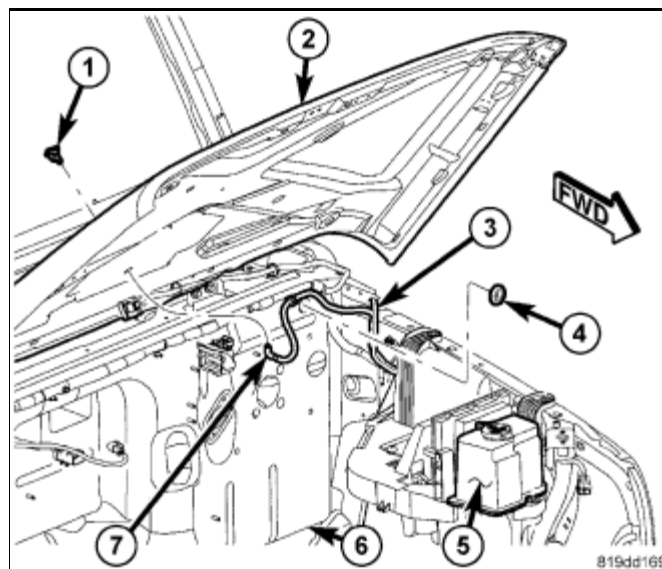
HOSE-WINDSHIELD WASHER

DESCRIPTION

FRONT

The front washer plumbing (7) consists of a small diameter rubber hose that is routed along with the rear washer plumbing (3) (if the vehicle is so equipped) from the washer reservoir (5) located at the left front corner of the engine compartment. Both hoses are attached to their respective front or rear outlet nipple of the washer pump/motor unit near the bottom of the reservoir. The hoses are then routed through molded clips integral to the underside of the molded plastic component tray to the dash panel (6) within the engine compartment. From the dash panel, the two washer hoses are routed separately.

The front hose is routed up to the hood panel (2) inner rear reinforcement, then across the rear of the hood to the front washer nozzle (1). If the vehicle is equipped with the rear wiper and washer system, the rear hose is routed through a rubber grommet and a hole near the top of the dash panel into the passenger compartment. If the vehicle does not have the rear wiper and washer system, the clearance hole in the dash panel is sealed with a rubber plug (4).



The front hose is secured to the hood inner reinforcement by plastic push-in type retainers, then is routed through a clearance hole in the hood silencer on the underside of the inner hood panel. A plastic in-line fitting, a molded rubber elbow and the front washer system check valve complete the front washer plumbing.

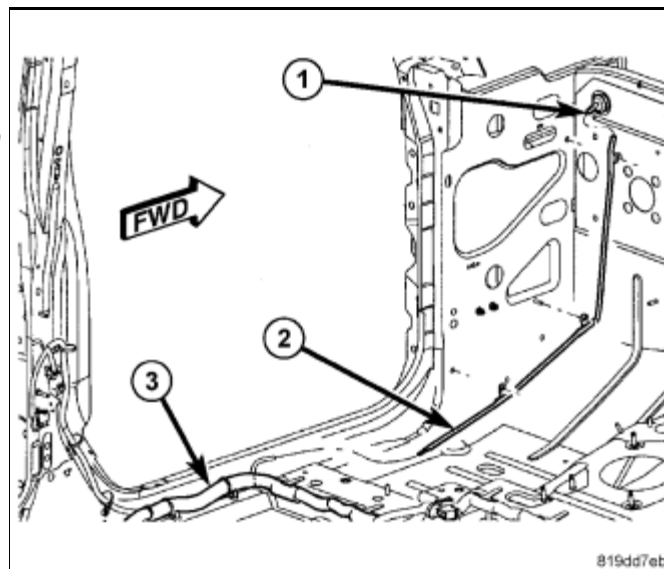
Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic or rubber washer hose fittings cannot be repaired. If these fittings are ineffective or damaged, they must be replaced.

REAR

The rear washer plumbing consists of a small diameter rubber hose that is routed along with the front washer plumbing from the washer reservoir located at the left front corner of the engine compartment. Both hoses are attached to their respective front or rear outlet nipple of the washer pump/motor unit near the bottom of the reservoir. The hoses are then routed through molded clips integral to the underside of the molded plastic component tray to the dash panel (6) within the engine compartment. From the dash panel, the two washer hoses are routed separately.

A rear washer jumper hose (2) is connected to the rear washer hose in the engine compartment by a molded plastic in-line fitting with barbed nipples and is then routed through a clearance hole with a rubber grommet in the upper left corner of the dash panel into the passenger compartment.

The jumper hose is routed down the cowl side inner panel where it is secured by plastic push-in type retainers to the left sill. It follows the sill back to the front seat crossmember, where it is connected by another plastic in-line fitting to the rear washer hose contained within the body wire harness (3).



The rear washer hose exits the body wire harness at the left D-pillar below the belt line, where the hose and a take out of the body wire harness are connected to a nipple and check valve integral to the hardtop disconnect plate. A hardtop hose is then routed up through the roof D-pillar and across the rear lift glass opening header to a barbed fitting on the rear wiper motor on the upper left inner corner of the lift glass.

Washer hose is available for service only as roll stock, which must then be cut to length. The headliner washer hose is integral to the headliner and, if ineffective or damaged, the headliner unit must be replaced. The molded plastic washer hose fittings and routing clips cannot be repaired. If these fittings or clips are ineffective or damaged, they must be replaced.

OPERATION

FRONT

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor unit through the front washer system plumbing and fittings to the front washer nozzle. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

REAR

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor unit through the rear washer system plumbing and fittings to the rear washer nozzle integral to the rear wiper motor located on the upper left corner of the rear lift glass. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, any sharp bends that might pinch the hose must be avoided.

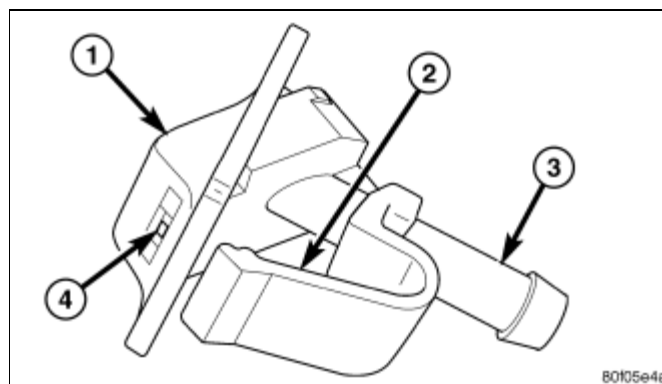
WASHER NOZZLE

DESCRIPTION

FRONT

The fluidic front washer nozzle (1) is constructed of molded plastic and has an integral latch feature (2) that secures it in a dedicated mounting hole located at the center, rear edge of the hood panel near the windshield. The domed upper surface of the washer nozzle is visible on the outside of the hood panel, and the nozzle orifice (4) is oriented towards the windshield glass.

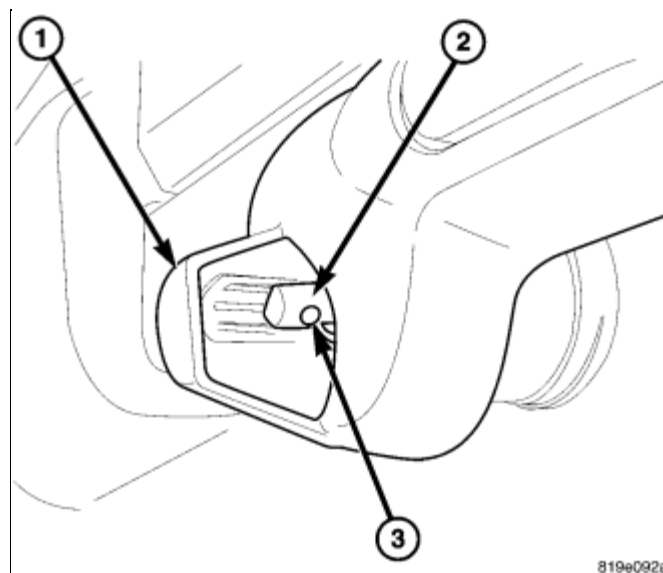
The washer plumbing fitting (3) for the washer nozzle extends below the hood panel and is accessible from the engine compartment.



The front washer nozzle cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

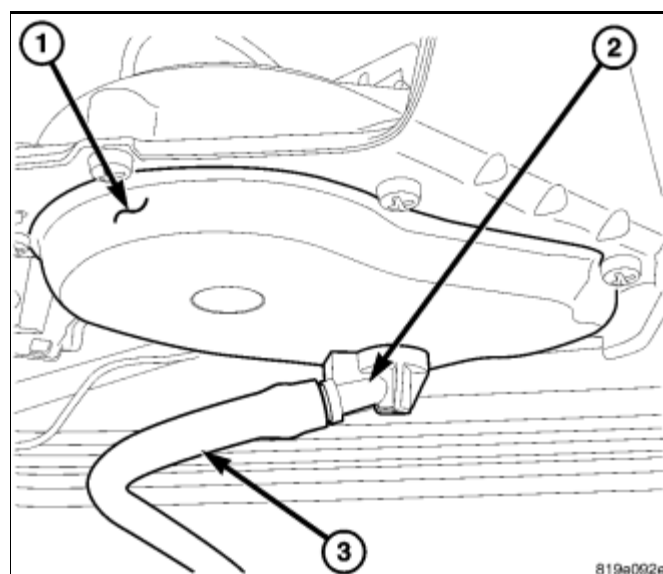
REAR

The fluidic rear washer nozzle (2) is constructed of molded plastic with an integral metal orifice insert (3). The rear washer nozzle is integral to the rear wiper motor output shaft and is visible through a cutout in the rear wiper arm nut cover (1) on the upper left corner of the outer rear lift glass. The nozzle orifice is oriented toward the lower path of the rear wiper blade on the lift glass and moves in concert with the rear wiper motor output shaft and the rear wiper arm.



The rear washer nozzle receives washer fluid through the rear wiper motor output shaft. Washer fluid is supplied to the rear wiper motor through the hardtop washer hose (3) which is connected to a molded plastic barbed fitting (2) on the motor transmission housing (1) on the upper left corner of the inner rear lift glass. The washer supply hose and rear wiper motor are concealed on the inside of the lift glass by a molded plastic trim cover.

The rear washer nozzle cannot be adjusted or repaired and, if ineffective or damaged, the rear wiper motor unit must be replaced.



OPERATION

FRONT

The front washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the washer pump/motor unit through a single hose, which is attached to a barbed nipple on the washer nozzle below the inner hood panel. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as a fan-like stream to more effectively cover a larger area of the glass to be cleaned.

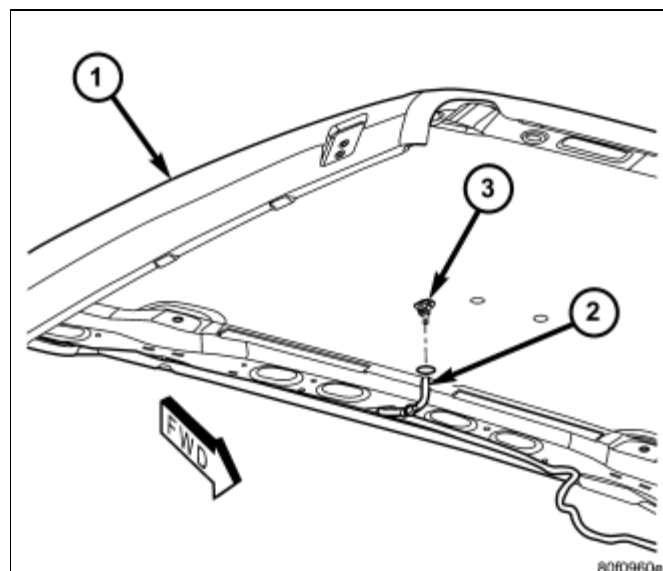
REAR

The rear washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the lift glass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the washer pump/motor through a single hose, which is attached to a barbed nipple on the back of the rear wiper motor transmission housing cover. A fluidic matrix within the nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as an oscillating stream which, when combined with the wet arm-like movement of the nozzle with the rear wiper motor output shaft, more effectively covers a larger area of the glass to be cleaned.

REMOVAL

FRONT

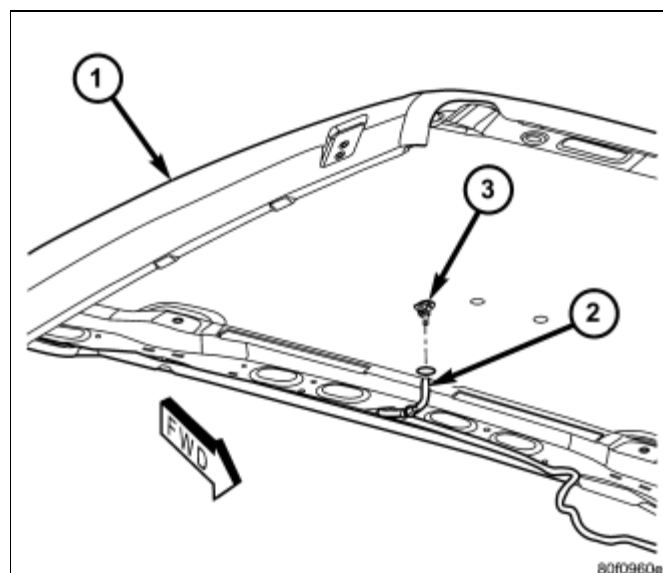
1. Unlatch, open and support the hood (1).
2. From the underside of the hood near the rear edge, disconnect the hose connection (2) from the barbed nipple of the front washer nozzle (3).
3. From the underside of the hood, depress the integral latch feature of the front washer nozzle and push the nozzle out through the mounting hole toward the top side of the hood.
4. Remove the nozzle from the top of the hood panel.



INSTALLATION

FRONT

1. Position the front washer nozzle (3) to the mounting hole on the outside of the hood panel (1).
2. Align the anti-rotation tab of the nozzle with the anti-rotation notch in the mounting hole.
3. Using hand pressure, push firmly and evenly on the top of the nozzle until the integral latch feature locks into place on the underside of the hood panel.
4. From the underside of the hood, reconnect the washer hose connector (2) to the barbed nipple of the nozzle.
5. Close and latch the hood.



PUMP-WASHER

DESCRIPTION

There are two washer pump/motor units available on this vehicle: a single unit (1) for vehicles with only the front wiper and washer system, and a dual unit (2) for vehicles with both the front and rear wiper and washer systems. Both washer pump/motor units are located at the top of a sump area of the washer reservoir within the engine compartment. A small permanently lubricated and sealed reversible electric motor (10) is coupled to the rotor-type washer pump (9). The use of an integral valve body (6) allows the dual washer pump/motor unit to provide washer fluid to either the front

or the rear washer systems, depending upon the direction of the motor/pump impeller rotation.

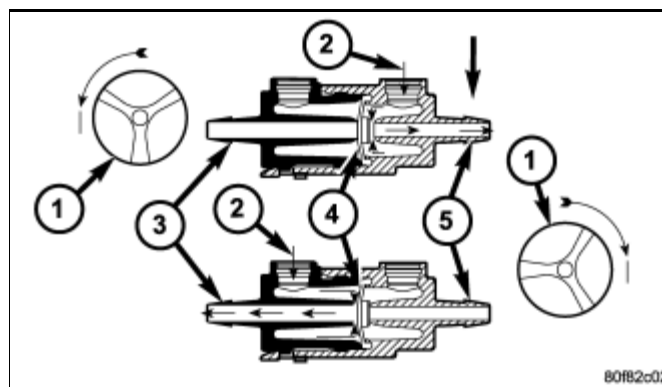
An inlet nipple (7) on the pump housing passes through a rubber grommet seal/filter screen installed in a dedicated mounting hole of the washer reservoir sump. The filter screen prevents most debris from entering the pump housing. When the pump is installed in the reservoir one barbed outlet nipple (8) on the pump valve body housing connects the unit to the front washer hose, while the second nipple (5) on the dual pump connects the unit to the rear washer hose.

The washer pump/motor unit is retained on the reservoir by the interference fit between the pump inlet nipple and the grommet seal, and by a snap post (3) at the top of the pump motor housing that is engaged into a receptacle on the reservoir which is a light snap fit. An integral connector receptacle (4) on the top of the motor housing connects the unit to the vehicle electrical system through a dedicated take out and connector of the engine compartment wire harness.

The washer pump/motor unit cannot be repaired. If ineffective or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The dual washer pump/motor unit features a reversible electric motor. The direction of the motor is controlled by hard wired outputs from the Totally Integrated Power Module (TIPM). When battery current and ground are applied to the two pump motor terminals, the motor rotates in one direction. When the polarity of these connections is reversed, the motor rotates in the opposite direction. When either the single or the dual pump motor is energized, the rotor-type pump pressurizes the washer fluid and forces it through one of the pump outlet nipples, and into the front or rear washer plumbing.



The TIPM controls the hard wired outputs to the pump motor based upon electronic **washer request** messages received over the Controller Area Network (CAN) data bus from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN). The EMIC receives electronic **washer switch** status messages over a Local Interface Network (LIN) bus connection from the Steering Control Module (SCM) within the left (lighting) multi-function switch housing. The SCM monitors hard wired analog and multiplex inputs from the washer switch circuitry contained within the right (wiper) multi-function switch to determine the proper electronic messages to send.

Washer fluid is drawn through the pump inlet nipple from the washer reservoir to the inlet port of the washer pump housing. An integral valve body is located in a housing on the outlet port side (2) of the dual pump housing. A diaphragm (4) in this valve body controls which washer system plumbing receives the washer fluid being pressurized by the pump.

When the dual pump impeller (1) rotates in the counterclockwise direction (viewed from the bottom), the biased diaphragm is sealing off the rear washer system outlet and nipple so the pressurized washer fluid is pushed out through the pump front outlet port and the front washer outlet nipple (5). When the pump impeller rotates in the clockwise direction (viewed from the bottom), pressurized washer fluid is pushed out through the pump rear outlet port and moves the diaphragm to open the rear washer outlet nipple and seal off the front washer outlet nipple, then the pressurized washer fluid is pushed out through the rear washer outlet nipple (3).

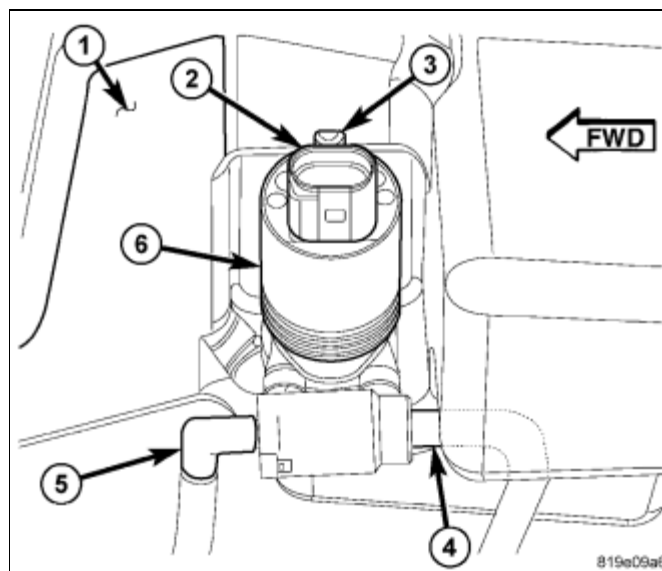
The washer pump/motor unit and the hard wired motor control circuits from the TIPM may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the washer pump/motor unit or the electronic controls or communication between other modules and devices that provide some features of the front and rear wiper and washer system. The most reliable, efficient, and accurate means to diagnose the washer pump/motor unit or the electronic controls and communication related to washer pump/motor unit operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

DIESEL ENGINE

NOTE: Both the single and dual washer pump/motor unit can be removed from the washer reservoir without removing the reservoir from the vehicle using the following procedure.

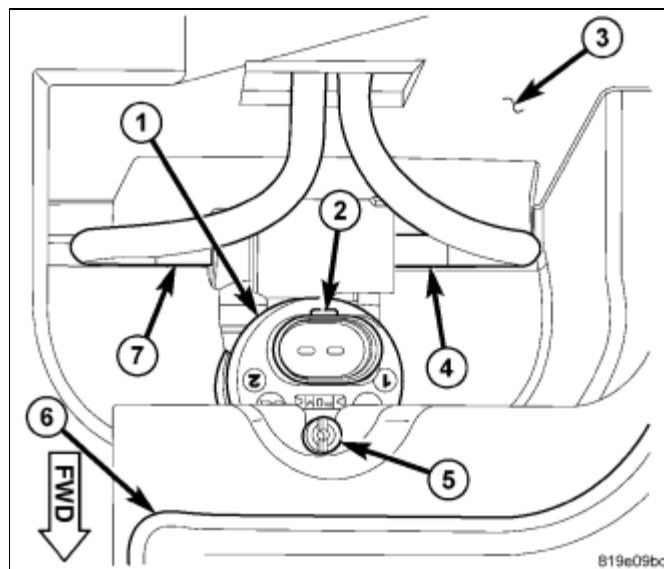
1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir (1) on the left side of the radiator shroud into a clean container for reuse.
3. Disconnect the engine compartment wire harness connector from the washer pump/motor unit (6) connector receptacle (2) on the top of the motor housing.
4. Disconnect the front washer hose (5) from the washer pump/motor unit outlet nipple.
5. Disconnect the rear washer hose (4) from the washer pump/motor unit outlet nipple, if the vehicle is so equipped.
6. Pull the top of the washer pump/motor unit away from the reservoir far enough to disengage the snap post (3) on the top of the motor housing from the receptacle in the reservoir.
7. Pull the washer pump/motor unit straight up and out of the washer reservoir far enough to disengage the inlet nipple from the rubber grommet seal/filter screen in the reservoir. Care must be taken not to damage the reservoir.
8. Remove the rubber grommet seal/filter screen for the washer pump from the pump mounting hole in the washer reservoir and discard.



GASOLINE ENGINE

NOTE: Both the single and dual washer pump/motor unit can be removed from the washer reservoir without removing the reservoir and component tray unit from the vehicle using the following procedure.

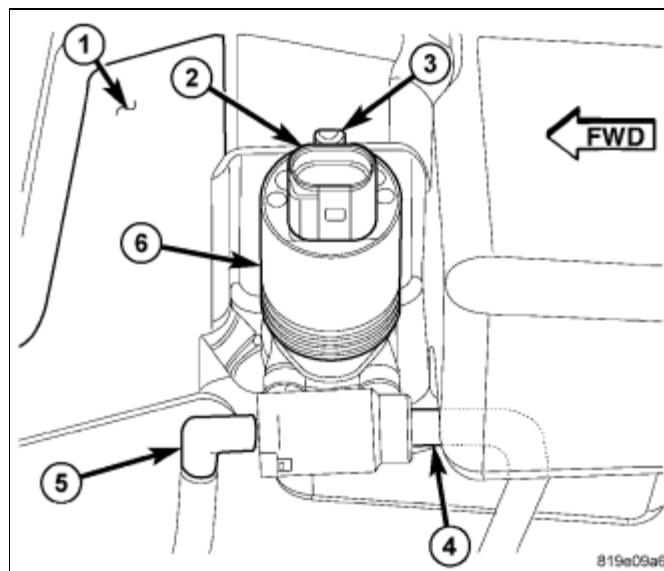
1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir (6) on the forward end of the component tray (3) on the left side of the engine compartment into a clean container for reuse.
3. Reach into the well of the component tray directly behind the washer reservoir to access and disconnect the engine compartment wire harness connector from the washer pump/motor unit (1) connector receptacle (2) on the top of the motor housing.
4. Disconnect the front washer hose (4) from the washer pump/motor unit outlet nipple.
5. Disconnect the rear washer hose (7) from the washer pump/motor unit outlet nipple, if the vehicle is so equipped.
6. Pull the top of the washer pump/motor unit away from the reservoir far enough to disengage the snap post (5) on the top of the motor housing from the receptacle in the reservoir.
7. Pull the washer pump/motor unit straight up and out of the washer reservoir far enough to disengage the inlet nipple from the rubber grommet seal/filter screen in the reservoir. Care must be taken not to damage the reservoir.
8. Remove the rubber grommet seal/filter screen for the washer pump from the pump mounting hole in the washer reservoir and discard.



INSTALLATION

DIESEL ENGINE

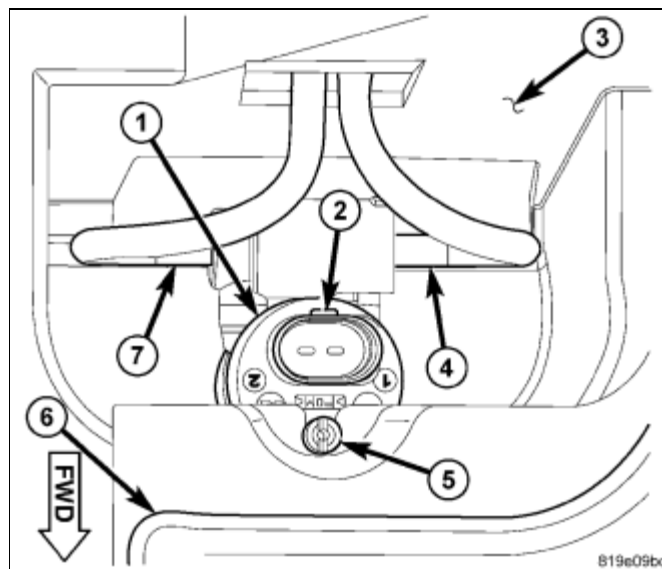
1. Install a new rubber grommet seal/filter screen unit into the washer pump mounting hole in the washer reservoir (1). Always use a new rubber grommet seal/filter screen on the reservoir.
2. Position the inlet nipple of the washer pump (6) to the rubber grommet seal/filter screen in the washer reservoir.
3. Using hand pressure, press firmly and evenly downward on the washer pump/motor unit until the inlet nipple is fully seated in the rubber grommet seal/filter screen in the pump mounting hole of the reservoir.
4. Press the top of the washer pump/motor unit toward the reservoir far enough to engage the snap post (3) on the top of the motor housing into the receptacle in the reservoir.
5. If the vehicle is so equipped, reconnect the rear washer hose (4) to the barbed pump outlet nipple.



6. Reconnect the front washer hose (5) to the barbed pump outlet nipple.
7. Reconnect the engine compartment wire harness connector for the washer pump/motor unit to the connector receptacle (2) on the top of the motor housing.
8. Reconnect the battery negative cable.
9. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.

GASOLINE ENGINE

1. Reach into the well of the component tray (3) directly behind the washer reservoir to access and install a new rubber grommet seal/filter screen unit into the washer pump mounting hole in the washer reservoir (6). Always use a new rubber grommet seal/filter screen on the reservoir.
2. Position the inlet nipple of the washer pump (1) to the rubber grommet seal/filter screen in the washer reservoir.
3. Using hand pressure, press firmly and evenly downward on the washer pump/motor unit until the inlet nipple is fully seated in the rubber grommet seal/filter screen in the pump mounting hole of the reservoir.
4. Press the top of the washer pump/motor unit toward the reservoir far enough to engage the snap post (5) on the top of the motor housing into the receptacle in the reservoir.
5. If the vehicle is so equipped, reconnect the rear washer hose (7) to the barbed pump outlet nipple.
6. Reconnect the front washer hose (4) to the barbed pump outlet nipple.
7. Reconnect the engine compartment wire harness connector for the washer pump/motor unit to the connector receptacle (2) on the top of the motor housing.
8. Reconnect the battery negative cable.
9. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.



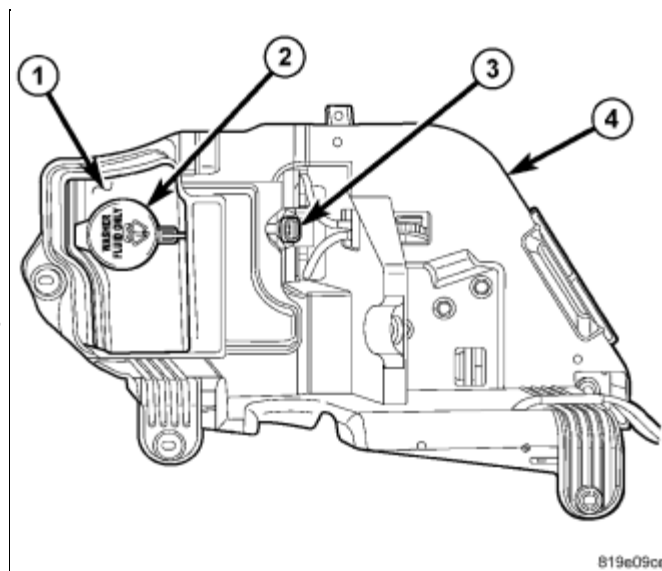
WASHER RESERVOIR

DESCRIPTION

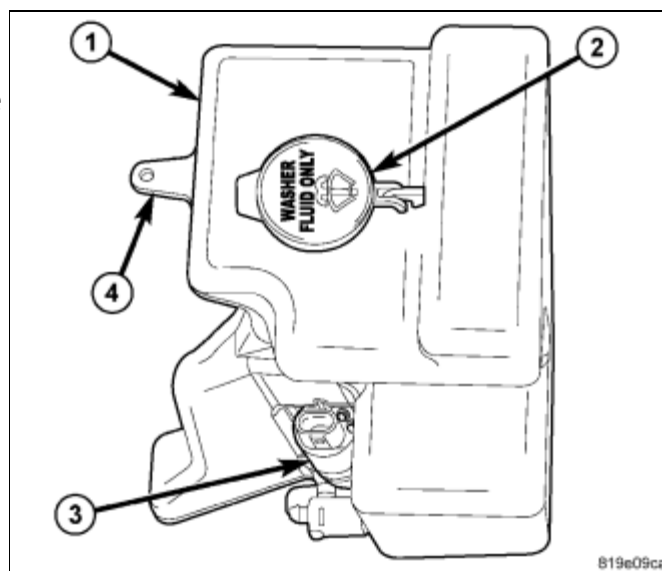
Two unique washer reservoirs are used in this vehicle: one is used for gasoline engine applications, while the other is used for diesel engine applications.

The gasoline engine washer fluid reservoir (1) is integral to the molded plastic component tray (4) located in the left front corner of the engine compartment. The same reservoir is used for vehicles regardless of whether they have only the front washer system or both the front and rear washer systems. Vehicles with both front and rear washer systems have a bi-directional washer pump/motor unit (3) installed in the reservoir in place of a single direction pump. The upper

portion of the reservoir is constructed of a translucent plastic, while the lower portion of the reservoir is constructed of the same opaque plastic as the remainder of the component tray. A bright yellow plastic filler cap (2) with an International Control and Display Symbol icon for **Windshield Washer** molded into it snaps over the open end of the filler neck. The cap hinges on and is secured to a molded-in hook formation on the top of the reservoir behind the filler neck.



The diesel engine washer fluid reservoir (1) is also located in the left front corner of the engine compartment, but is secured to the left side of the radiator fan shroud. As with the gasoline engine version, the same reservoir is used for vehicles regardless of whether they have only the front washer system or both the front and rear washer systems. Vehicles with both front and rear washer systems have a bi-directional washer pump/motor unit (3) installed in the reservoir in place of a single direction pump. This reservoir is molded entirely of translucent plastic and is secured to the fan shroud through an integral mounting tab at the top (4) with a screw and a U-nut to the top of the shroud, an integral T-tab on the front of the reservoir that engages a slot in the shroud, and two integral tabs at the bottom that engage two slots in the shroud. This reservoir also has a bright yellow plastic filler cap (2) with an International Control and Display Symbol icon for **Windshield Washer** molded into it snaps over the open end of the filler neck. The cap hinges on and is secured to a molded-in hook formation on the top of the reservoir behind the filler neck.



There is a dedicated hole in the sump area of each reservoir provided for the washer pump/motor unit. The component tray has a well just behind the reservoir that allows service access to the washer pump, while the diesel engine pump is accessed on the lower left side of the reservoir. Both reservoirs include an integral receptacle to accept the snap post on the top of the washer pump/motor units. The component tray has integral clips on its lower surface for routing the washer hoses, while the diesel washer hoses are retained by plastic routing clips to the engine compartment wire harness on the left side of the engine compartment.

Washer reservoirs cannot be repaired and, if ineffective or damaged, they must be replaced. The gasoline engine reservoir is service only as a unit with the left component tray. The diesel engine washer reservoir, the rubber grommet seal/filter screens for the washer pump/motor units and the filler caps are each available for individual service replacement.

OPERATION

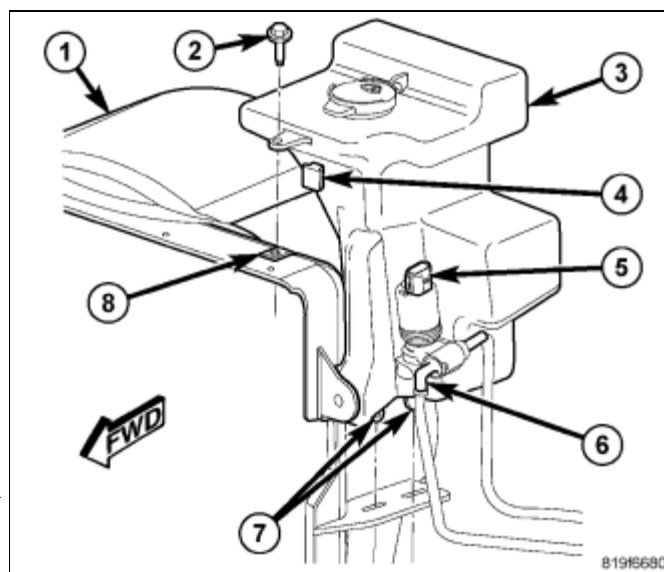
The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the front and rear washer systems. The washer reservoir filler cap provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The washer pump/motor unit is located in a sump area near the base of the reservoir to be certain that washer fluid will be available to the pump as the fluid level in the reservoir becomes depleted. The washer pump/motor unit is mounted in the lowest position in the sump.

REMOVAL

NOTE: The following procedure applies only to the washer reservoir used with an optional diesel engine. The washer reservoir for vehicles with a gasoline engine is integral to the molded plastic component tray on the left side of the engine compartment.

1. Disconnect and isolate the negative battery cable.
2. Siphon the washer fluid from the washer reservoir (3) into a clean container for reuse.
3. Disconnect the engine compartment wire harness connector from the washer pump/motor (5).

NOTE: To aid in reinstallation, note the installed position of the washer hoses prior to disconnecting them.

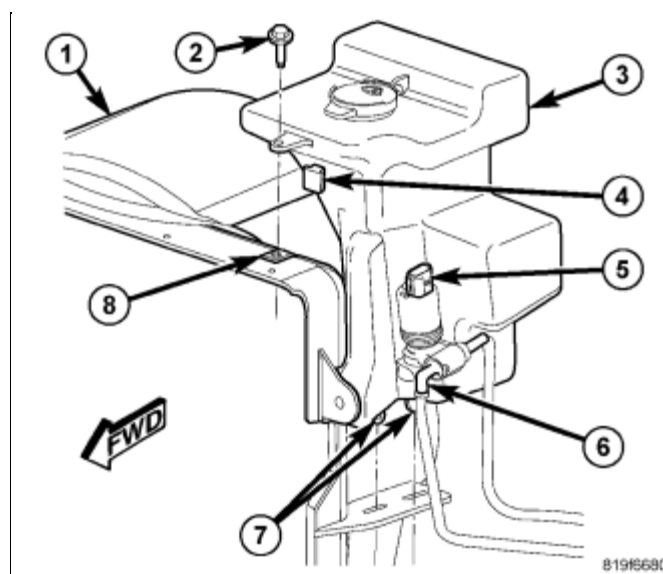


4. Disconnect the front and rear washer hoses (6) from the washer pump on the outboard side of the reservoir.
5. Remove the screw (2) that secures the mounting tab on the top of the reservoir to the U-nut (8) in the top of the radiator fan shroud (1).
6. Pull the washer reservoir upward far enough to disengage the integral T-tab (4) on the front of the reservoir and the two integral tabs (7) on the bottom of the reservoir from their respective slots in the shroud.
7. Remove the washer reservoir from the engine compartment.

INSTALLATION

NOTE: The following procedure applies only to the washer reservoir used with an optional diesel engine. The washer reservoir for vehicles with a gasoline engine is integral to the molded plastic component tray on the left side of the engine compartment.

1. Check to be certain that the U-nut (8) is in good condition and properly installed in the top of the radiator fan shroud (1).
2. Position the washer reservoir (3) into the left front corner of the engine compartment.



3. Align and engage the integral T-tab (4) on the front of the reservoir and the two integral tabs (7) on the bottom of the reservoir with their respective slots in the shroud.

4. Install and tighten the screw (2) that secures the integral mounting tab on the top of the reservoir to the U-nut on the top of the shroud. Tighten the screw to 9 N·m (79 in. lbs.).

NOTE: Be certain to reconnect the front and rear washer hoses to the proper outlet nipples from the washer pump. Failure to properly connect the hoses will cause the front and rear washer systems to operate incorrectly.

5. Reconnect the front and rear washer hoses (6) to the washer pump on the outboard side of the reservoir.

6. Reconnect the engine compartment wire harness connector to the washer pump/motor unit (5).

7. Refill the washer reservoir with the washer fluid drained during removal.

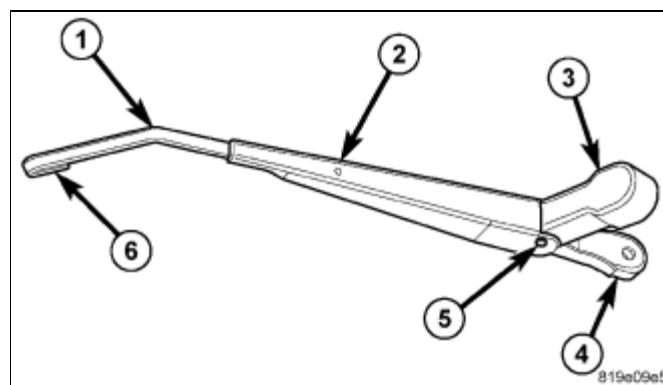
8. Reconnect the battery negative cable.

WIPER ARM

DESCRIPTION

FRONT

The front wiper arms are the rigid members located between the wiper pivots that protrude from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass. These wiper arms feature an over-center hinge (5) that allows easy access to the windshield glass for cleaning. The wiper arm has a die cast metal pivot end (4) with a large tapered mounting hole at one end. A molded black plastic cap (3) snaps over the pivot end to conceal the retaining nut and mounting hole following wiper arm installation.



The wide end of a tapered, stamped steel channel (2) hinges on and is secured with a hinge pin to the blade end of the wiper arm pivot end. One end of a long, rigid, stamped steel strap (1), with a small hole near the end closest to the pivot, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the

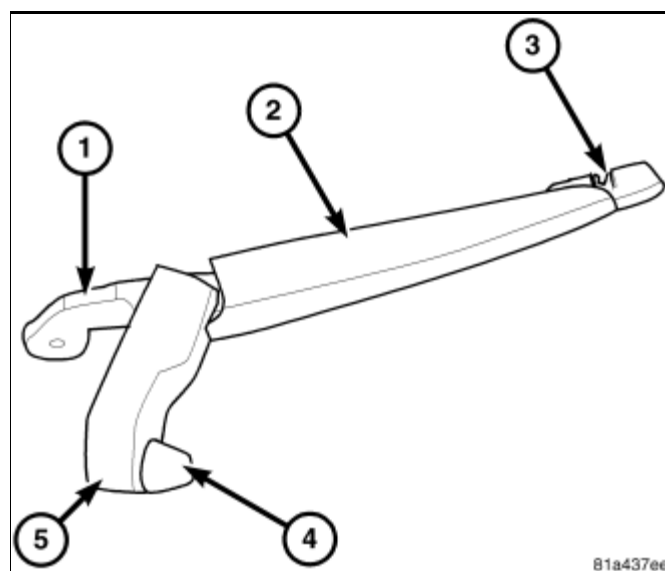
wiper blade end of this strap is bent back under itself to form a small hook (6). Concealed within the stamped steel channel is a long tension spring which is engaged with a wire hook to the underside of the die cast pivot end and is hooked through a small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

There are unique wiper arms for right-hand-drive and left-hand-drive vehicles. The driver and passenger side arms are interchangeable. A wiper arm cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

REAR

The rear wiper arm (2) is the rigid member located between the rear wiper motor output shaft that protrudes through a rubber nut cover near the upper left corner of the lift glass and the wiper blade on the outside of the glass. The wiper arm is constructed of molded black plastic. A hinged pivot end (1) is also molded plastic.

A molded black plastic nut cover (5) with two pivot pins on one end and a snap feature on the other fits over the wiper arm retaining nut to conceal the nut and mounting hole following wiper arm installation. The rear washer nozzle integral to the motor output shaft is aimed through a large hole (4) in the side of the nut cover oriented towards the downward path of the wiper blade. The wiper arm hinge and tension spring are concealed on the underside of the wide end of the arm, while integral latch features (3) concealed on the underside of the narrow end of the wiper arm accept the pivot pin of the matching molded plastic wiper blade unit.



The rear wiper arm cannot be adjusted or repaired. If damaged or ineffective, the entire wiper arm unit must be replaced.

OPERATION

FRONT

The front wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The tapered mounting hole in the wiper arm pivot end interlocks with the serrations on the tapered outer circumference of the wiper pivot shaft, allowing positive engagement and finite adjustment of this connection.

The mounting nuts lock the wiper arms to the threaded studs of the wiper pivot shafts. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REAR

The rear wiper arm is designed to mechanically transmit the motion from the rear wiper motor output shaft to the rear wiper blade. The wiper arm must be properly indexed to the motor output shaft in order to maintain the proper wiper blade travel on the glass. The tapered hole in the wiper arm pivot end interlocks with the serrations on the outer circumference of the tapered motor output shaft, allowing positive engagement and finite adjustment of this connection.

A hex nut secures the wiper arm pivot end to the threads on the rear wiper motor output shaft and the plastic cover snaps over this connection for a neat appearance. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The latch formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot pin to the wiper arm.

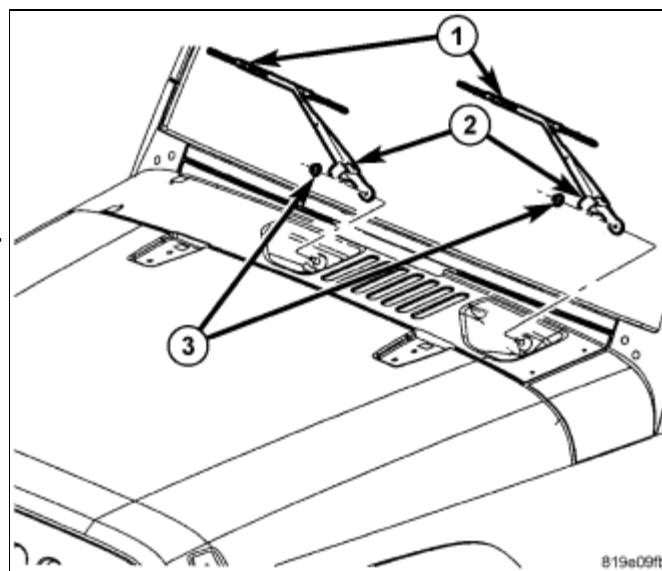
REMOVAL

FRONT

1. Lift the front wiper arm (1) to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to pivot shaft connection.
2. Carefully unsnap the plastic cap (2) off of the pivot end of the wiper arm and swing it out of the way.
3. Remove the nut (3) that secures the wiper arm to the wiper pivot shaft.

CAUTION: The use of a battery terminal puller when removing the front wiper arm is NOT recommended as this may damage the front wiper arm.

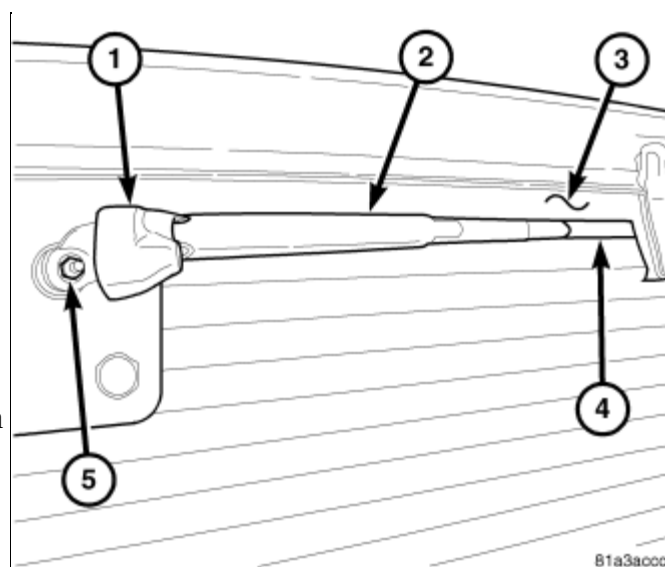
4. Use a slight rocking action to disengage the front wiper arm pivot end from the pivot shaft and remove the wiper arm.



REAR

1. Unsnap and swing the molded plastic nut cover (1) off of the pivot end of the wiper arm (2).
2. Remove the nut (5) that secures the wiper arm to the rear wiper motor output shaft.

CAUTION: The use of a battery terminal puller when removing the rear wiper arm is NOT recommended as this may damage the rear wiper arm.



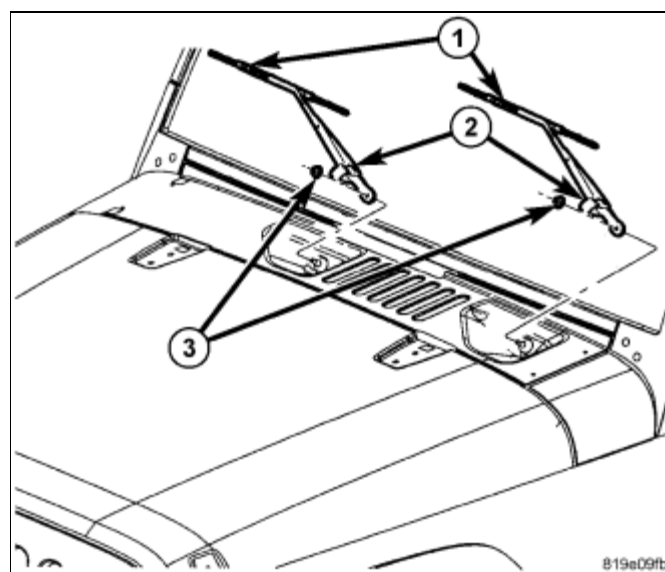
3. Use a slight rocking action to disengage the rear wiper arm pivot end from the output shaft and remove the wiper arm.

INSTALLATION

FRONT

NOTE: Be certain that the wiper motor is in the park position before attempting to install the front wiper arms. Turn the ignition switch to the ON position and move the right (wiper) multi-function switch control knob to its OFF position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the OFF position. The front wiper motor is now in its park position.

1. The front wiper arms (1) must be indexed to the pivot shafts with the front wiper motor in the park position to be properly installed. Position the wiper arm pivot end onto the wiper pivot shaft so that the lug on the pivot shaft engages the pocket on the underside of the wiper arm pivot end.
2. Once the wiper blade is aligned, lift the wiper arm away from the windshield slightly to relieve the spring tension on the pivot end and push the pivot end of the wiper arm down firmly and evenly over the pivot shaft.
3. Install and tighten the nut (3) that secures the wiper arm to the pivot shaft. Tighten the nut to 23 N·m (17 ft. lbs.).
4. Snap the plastic cap (2) over the wiper arm pivot end.



REAR

NOTE: Be certain that the rear wiper motor is in the park position before attempting to install the rear wiper arm. Turn the ignition switch to the ON position and move the rear wiper switch to its OFF position. If the wiper motor output shaft moves, wait until it stops moving, then turn the ignition switch back to the OFF position. The wiper motor is now in its park position.

1. The rear wiper arm (2) must be indexed to the rear wiper

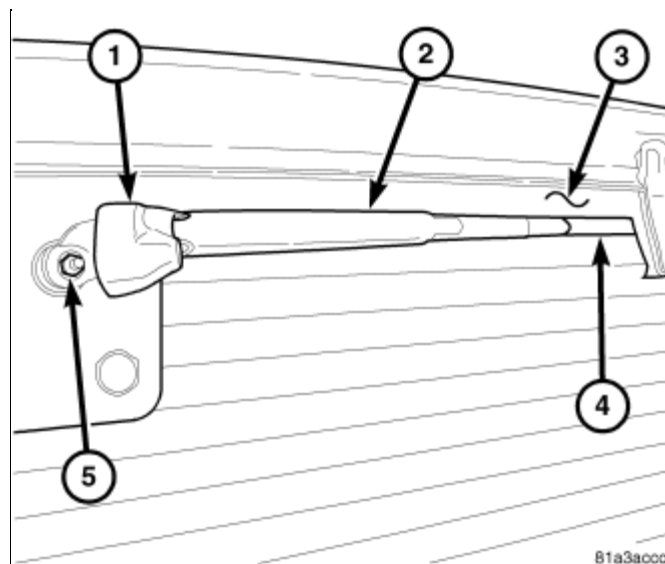
motor output shaft with the motor in the park position to be properly installed. Position the wiper arm pivot end onto the output shaft so that the wiper arm is horizontal and the tip of the wiper blade is midway between the uppermost horizontal line (4) of the rear window defogger grid and the lower edge of the upper glass blackout area (3).

2. With the rear wiper arm properly indexed, push the tapered mounting hole on the pivot end of the wiper arm down over the output shaft.

3. Install and tighten the nut (5) that secures the rear wiper arm to the output shaft. Tighten the nut to 19.5 N·m (14 ft. lbs.).

4. Fold and snap the molded plastic nut cover (1) over the nut on the pivot end of the rear wiper arm.

5. Wet the lift glass and operate the rear wiper. Turn the rear wiper switch to the OFF position, then check for correct wiper arm position and readjust as required.



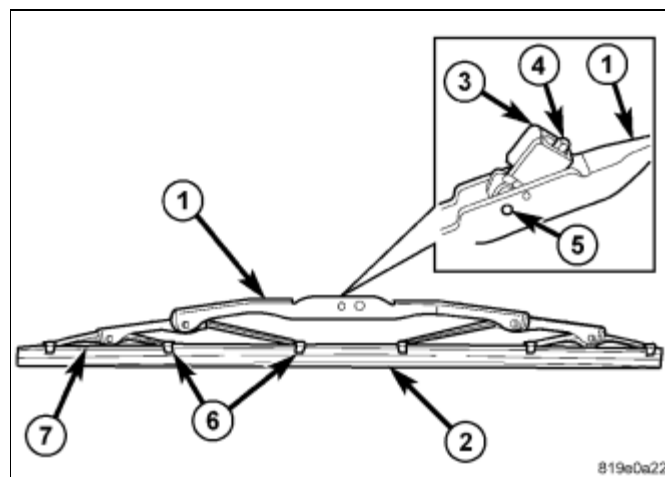
WIPER BLADE

DESCRIPTION

FRONT

Each front wiper blade is secured by an integral latching pivot block (3) to the hook formation on the tip of each wiper arm, and rests on the glass near the base of the windshield when the wipers are not in operation. The wiper blade consists of the following components:

- **Superstructure (1)** - The superstructure includes several stamped steel bridges and links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.
- **Element (2)** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor (7)** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws (6) of the superstructure.

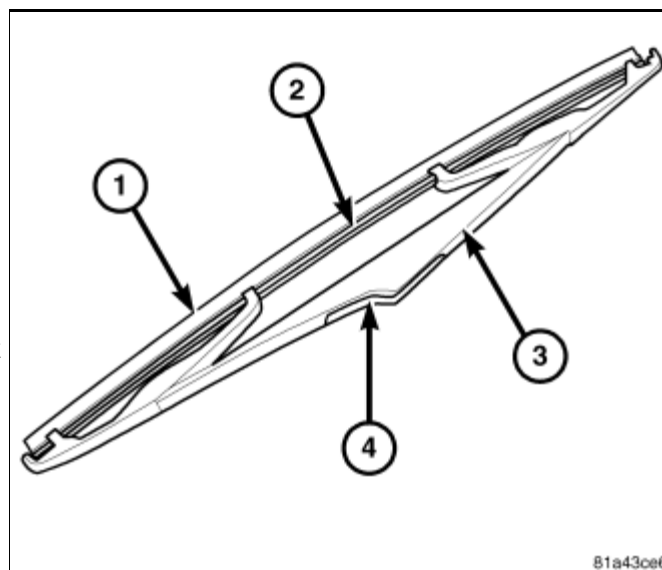


All vehicles have interchangeable windshield wiper blades with non-replaceable rubber elements (squeegees). The blades are 37.50 centimeters (14.76 inches) long. The wiper blades cannot be adjusted or repaired and, if ineffective, worn, or damaged, the entire wiper blade unit must be replaced.

REAR

The rear wiper blade is secured by an integral pivot pin (4) to the latch formations on the underside of the tip of the rear wiper arm, and rests near the top of the lift glass when the rear wiper system is not in operation. The rear wiper blade consists of the following components:

- **Superstructure (3)** - The superstructure includes a molded black plastic bridge and plastic links with claw formations that grip the wiper blade element. Also included in this unit is the molded plastic pivot pin that secures the superstructure to the wiper arm.
- **Element (1)** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor (2)** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.



The rear wiper blade is 27.90 centimeters (10.98 inches) long with a replaceable element (squeegee). The wiper blade superstructure cannot be adjusted or repaired. If ineffective, worn or damaged the entire wiper blade unit must be replaced.

OPERATION

FRONT

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface.

The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, yet resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REAR

The rear wiper blade is moved back and forth across the lift glass by the wiper arm when the rear wiper system is in operation. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature found across the glass surface.

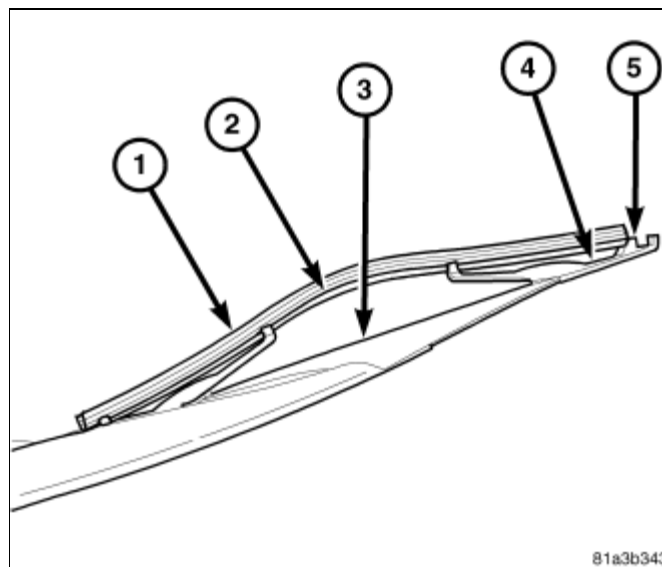
The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from

one cleaning edge to the other each time the wiper blade changes directions.

STANDARD PROCEDURE

REAR WIPER ELEMENT REPLACEMENT

1. Remove the rear wiper blade (3) from the wiper arm. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER BLADE - REMOVAL).
2. Grasp one of the wiper blade links (4) firmly with one hand, and grasp the wiper element (1) and flexors (2) midway between the two links with the other hand.
3. Pull the element and flexor away from the blade far enough to disengage them from the end pair of claws (5) of one link.
4. Slide the element and flexor toward the loose end to disengage them from the remaining sets of claws.
5. Reverse this process to install a new element and flexors into the wiper blade.
6. Reinstall the wiper blade onto the wiper arm. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER BLADE - INSTALLATION).



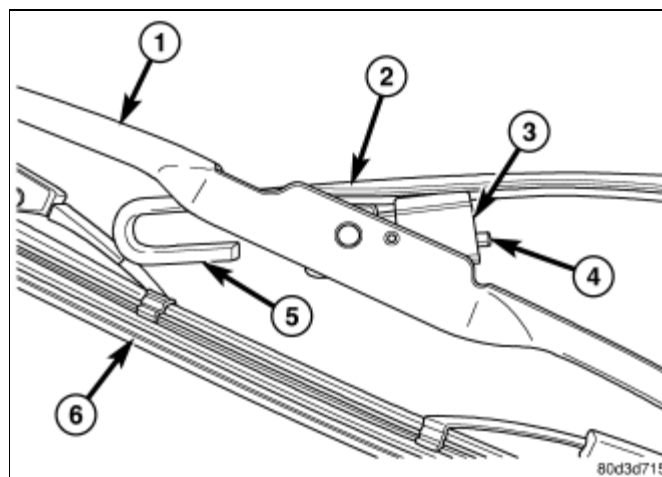
REMOVAL

FRONT

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

1. Lift the wiper arm (2) to raise the wiper blade and element (6) off of the glass, until the wiper arm hinge is in its over-center position.
2. To remove the blade from the arm, depress the latch release tab (4) on the pivot block (3) under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook formation (5) on the end of the arm.
3. Extract the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure (1) just ahead of the pivot block.

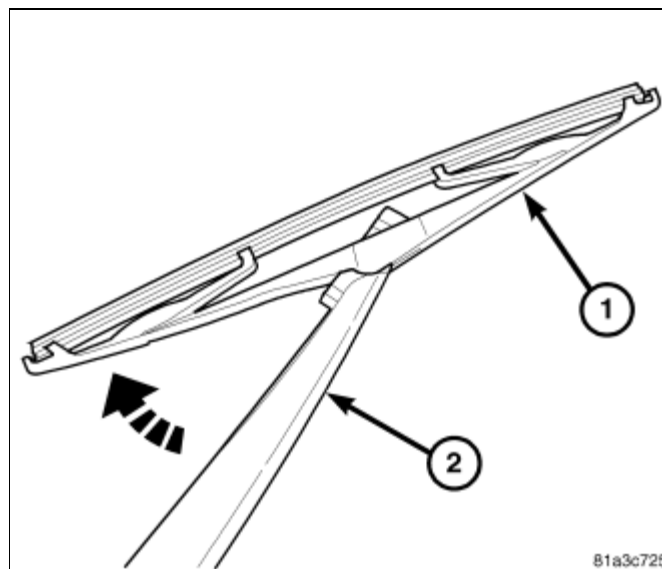


4. Gently lower the tip of the wiper arm onto the glass.

REAR

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

1. Lift the wiper arm (2) to raise the wiper blade and element (1) off of the glass.
2. To remove the blade from the arm, swing the end of the wiper blade nearest to the wiper motor away from the wiper arm to its travel limit.
3. Now press the end of the wiper blade nearest to the wiper motor away from the wiper arm against its stop far enough to unsnap the wiper blade pivot pin from the latch features on the underside of the wiper arm.
4. Gently lower the tip of the wiper arm onto the glass.



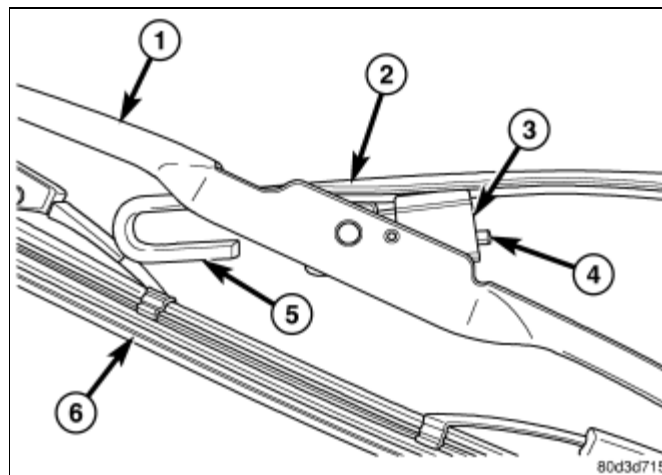
INSTALLATION

FRONT

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

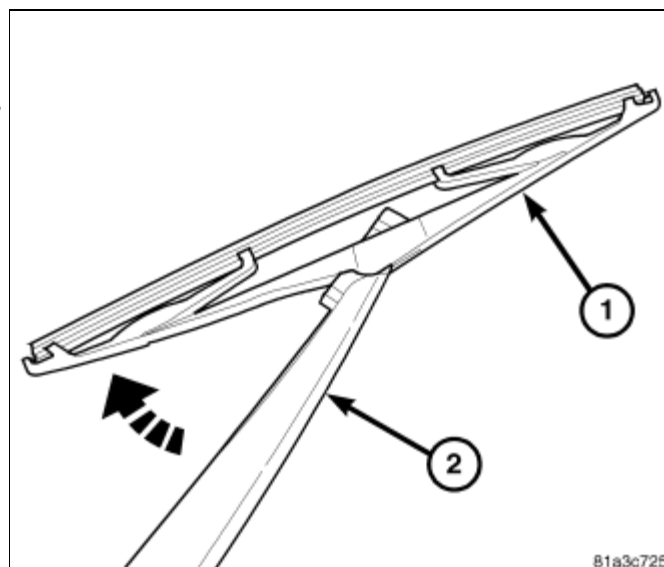
1. Lift the wiper arm (2) off of the windshield glass, until the wiper arm hinge is in its over-center position.
2. Position the wiper blade near the hook formation (5) on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the wiper pivot.
3. Insert the hook formation on the tip of the arm through the opening in the blade superstructure (1) ahead of the pivot block (3) far enough to engage the pivot block into the hook.
4. Slide the pivot block up into the hook formation on the tip of the wiper arm until the latch release tab (4) snaps into its locked position. Latch engagement will be accompanied by an audible click.
5. Gently lower the wiper blade and element (6) onto the glass.



REAR

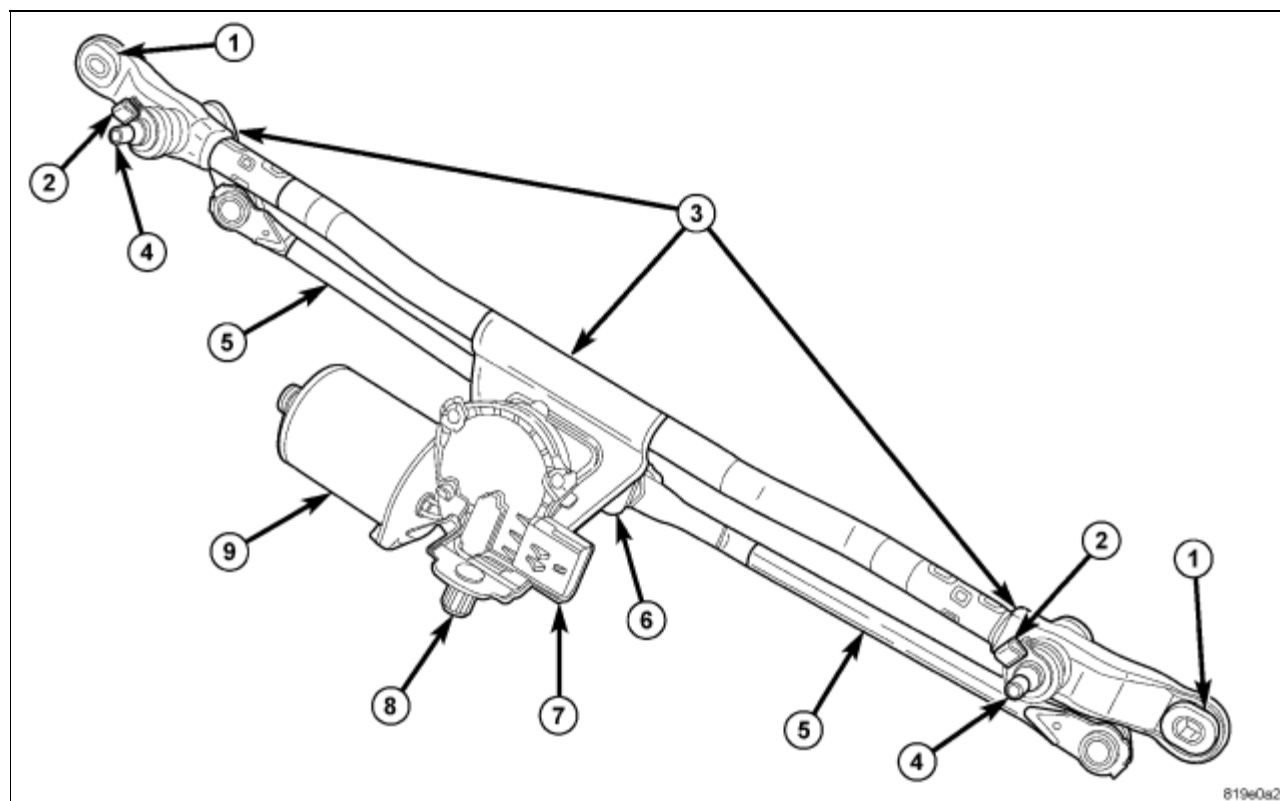
CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

1. Lift the wiper arm (2) off of the lift glass.
2. Position the wiper blade (1) under the tip of the wiper arm, aligning the pivot pin near the center of the blade superstructure with the latch features on the underside of the tip of the arm.
3. Squeeze the arm and blade together until the blade pivot pin snaps into the latch features of the arm.
4. Gently lower the wiper blade and element onto the glass.



WIPER MODULE

DESCRIPTION



The front wiper module is secured within the cowl plenum panel beneath the cowl plenum cover/grille panel. The ends of the wiper pivot shafts protrude through dedicated openings in the cowl plenum cover/grille panel to drive the wiper arms and blades and are the only visible components of the front wiper module.

The front wiper module consists of the following major components:

- **Bracket** - The front wiper module bracket (3) consists of a long tubular steel main member that has a stamped pivot bracket formation near each end where the two wiper pivots are secured, and a stamped motor mounting plate near the center. The front wiper module bracket is secured within the cowl plenum by two screws through a rubber insulator (1) in each pivot bracket. A knob-like rubber insulator (8) on a locator stud integral to the bottom of the motor mounting plate is engaged in a slot in the forward wall of the cowl plenum.
- **Crank Arm** - The front wiper motor crank arm (6) is a stamped steel unit with a hole on the driven end that is secured to the wiper motor output shaft with a nut. A ball stud secured to the drive end of the crank arm engages the bushings of the two drive links.
- **Linkage** - Two stamped steel drive links (5) connect the wiper motor crank arm to the two wiper pivot lever arms. The passenger side link has a plastic socket-type bushing on each end, while the driver side link has a socket-type bushing on the pivot end and a sleeve-type bushing on the crank arm end. The bushing on the pivot end of each link is snap-fit over a ball stud on the pivot lever arm. The sleeve-type bushing on the driver side link is snap fit over the inner ball formation of a double ball stud on the crank arm, then the socket-type bushing of the passenger side drive link is snapped over the outer ball formation.
- **Motor** - The front wiper motor (9) is secured to the motor mounting plate of the wiper module bracket by the motor transmission housing with three screws. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker.
- **Pivots** - The two front wiper pivots (4) are secured to the ends of the wiper module bracket. The lever arms that extend from the bottom of the pivot shafts each have a ball stud that engages a drive link bushing. A shield on the top of each pivot has a lug (2) that engages a pocket on the underside of the wiper arm pivot end to maintain proper wiper blade alignment. The upper end of each pivot shaft where the wiper arms will be fastened is tapered and serrated with a threaded stud formation at the tip.

The front wiper module cannot be adjusted or repaired. If any component of the module is ineffective or damaged, the entire front wiper module unit must be replaced.

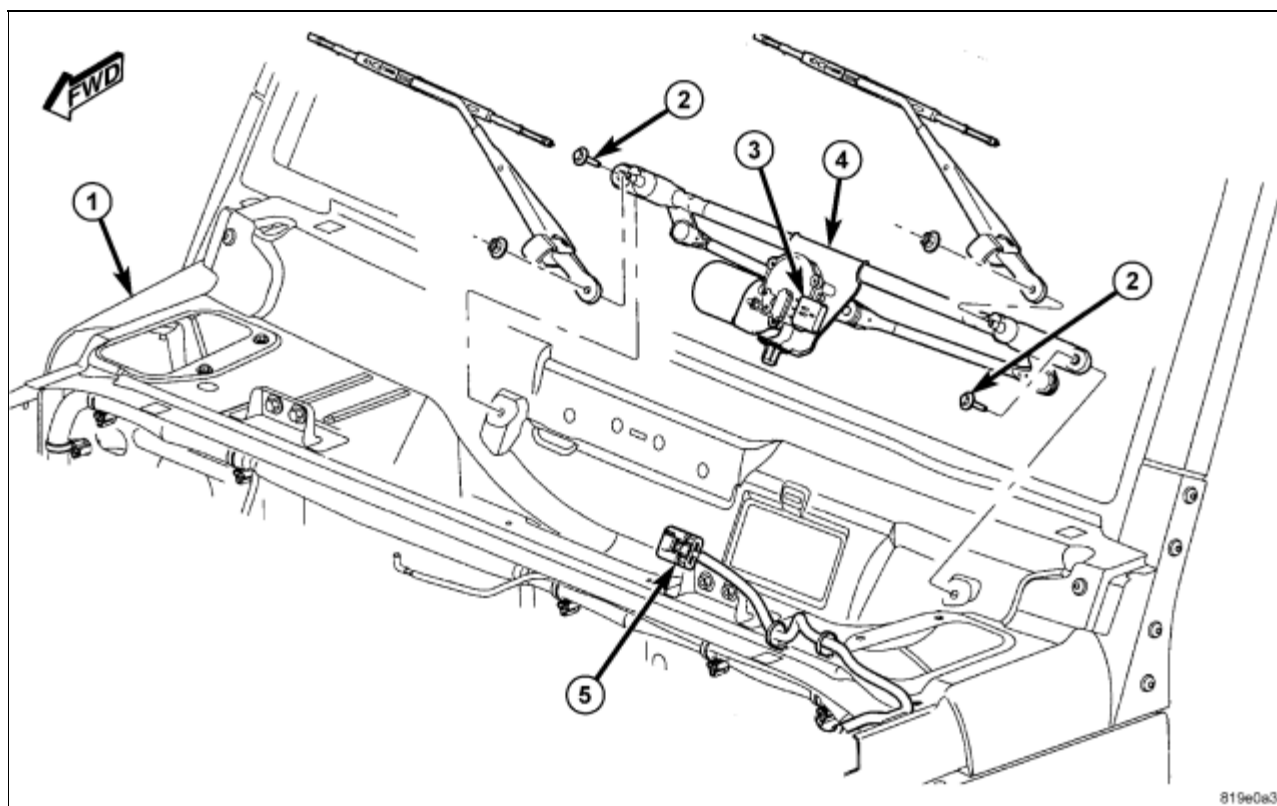
OPERATION

The front wiper module operation is controlled by the battery current inputs received by the wiper motor through the Totally Integrated Power Module (TIPM). The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes the wiper park switch sense circuit to ground or to battery current, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned OFF, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads.

The wiper motor crank arm, the two wiper linkage members and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

The hard wired inputs and outputs of the front wiper motor may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the front wiper motor or the electronic controls or communication between other modules and devices that provide some features of the front wiper and washer system. The most reliable, efficient, and accurate means to diagnose the front wiper motor or the electronic controls and communication related to front wiper motor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

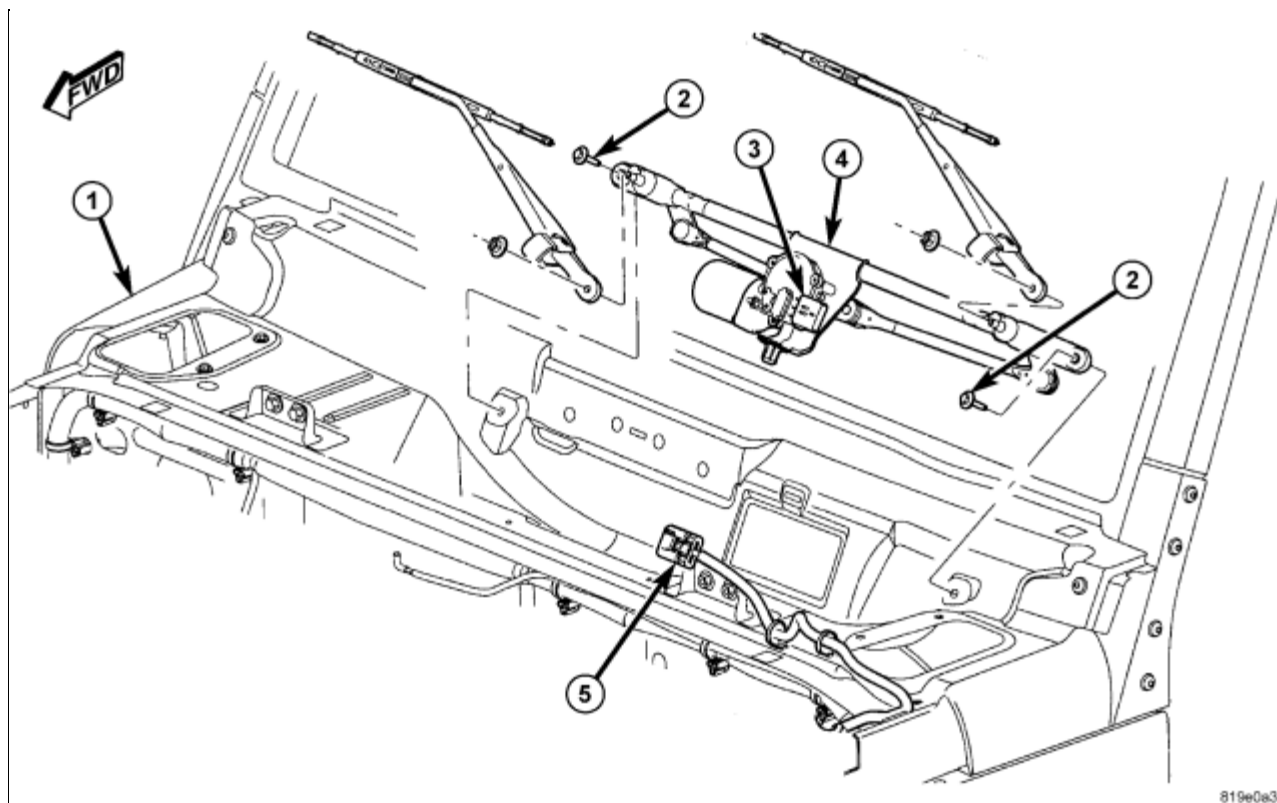
REMOVAL



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1. Disconnect and isolate the battery negative cable.
2. Remove both front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL - FRONT).
3. Remove the cowl plenum cover/grille panel from over the front wiper module. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL).
4. Disconnect the wire harness connector (5) from the connector receptacle for the front wiper motor (3).
5. Remove the two screws (2) that secure the ends of the front wiper module (4) bracket to the cowl plenum.
6. Pull the front wiper module upward to disengage the knob-like rubber isolator from the slot in the forward wall of the cowl plenum.
7. Remove the front wiper module from the cowl plenum as a unit.

INSTALLATION



1. Position the front wiper module (4) into the cowl plenum as a unit.
2. Position the knob-like rubber isolator to the slot in the forward wall of the cowl plenum.
3. Install and tighten the two screws (2) that secure the ends of the front wiper module bracket to the cowl plenum. Tighten the screws 9.5 N·m (85 in. lbs.).
4. Reconnect the wire harness connector (5) to the connector receptacle for the front wiper motor (3).
5. Reinstall the cowl plenum cover/grille panel over the front wiper module. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - INSTALLATION).

NOTE: Be certain to turn the ignition switch to the ON position, then turn the front wiper switch ON and OFF again to cycle the wiper motor and linkage to their natural park position before reinstalling the front wiper arms onto the wiper pivots.

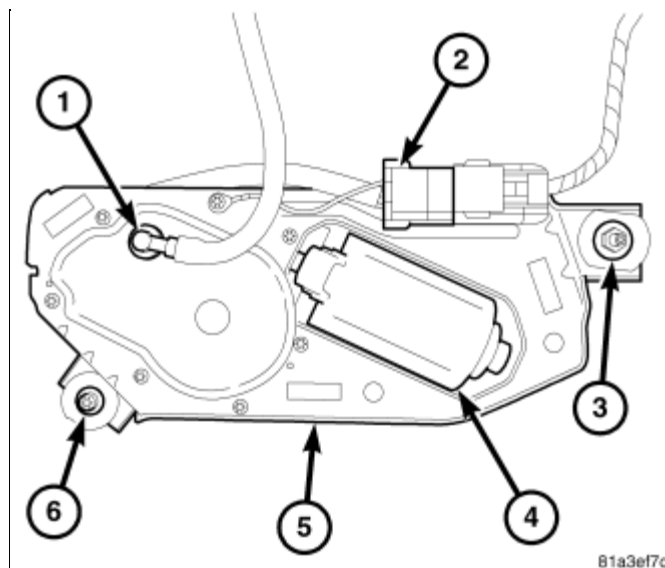
6. Reinstall both front wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - INSTALLATION - FRONT).
7. Reconnect the battery negative cable.

WIPER MOTOR

DESCRIPTION

The rear wiper motor is concealed behind a molded plastic trim cover on the inside of the lift glass near the left liftglass hinge at the top of the glass. A large blackout area of the lift

glass conceals the unit from the exterior of the vehicle. The end of the motor output shaft that protrudes through and is sealed to a clearance hole in the lift glass to drive the rear wiper arm and blade is the only visible component of the rear wiper motor. Rubber inner and outer seals, plastic inner and outer spacers and a large nut secure and seal the motor output shaft housing to the lift glass. A motor pigtail harness connector (2) is secured to the outboard upper corner of the motor bracket, and connects the rear wiper motor to the vehicle electrical system through a dedicated take out and connector of the hard top wire harness. The rear wiper motor consists of the following major components:



- **Bracket (5)** - The rear wiper motor bracket consists of a stamped steel mounting plate that is secured with screws to the wiper motor and transmission. A rubber insulator in a tab on the upper outboard corner of the bracket is secured by a nut and washer (3) to a stud that also secures the lower end of the left lift glass hinge to the glass. Another tab with a rubber insulator and a threaded metal insert on the inboard lower corner of the bracket is secured by a special threaded fastener (6) to the outside surface of the lift glass.
- **Motor (4)** - The single-speed permanent magnet rear wiper motor is secured with screws to the rear wiper motor bracket. The wiper motor includes an integral transmission, a motor output shaft, an automatic resetting circuit breaker and the rear wiper motor park switch. Washer fluid is fed through a nipple (1) on the transmission housing through the output shaft to the rear washer nozzle on the end of the output shaft.

The rear wiper motor cannot be adjusted or repaired. If any component of the motor is faulty or damaged, the entire rear wiper motor unit must be replaced. The motor output shaft housing rubber seals, spacers, nut and nut cover are available for individual service replacement.

OPERATION

The rear wiper motor operation is controlled by the Totally Integrated Power Module (TIPM), which uses intelligent, high current, self-protected high side switches to control rear wiper system operation for energizing or de-energizing the rear wiper motor. The TIPM uses internal programming and electronic messages received over the Controller Area Network (CAN) data bus from the ElectroMechanical Instrument Cluster (EMIC) (also known as the Cab Compartment Node/CCN) to provide the appropriate rear wiper and washer system operating modes. The EMIC uses electronic messages received from the Steering Control Module (SCM) over a Local Interconnect Network (LIN) data bus to determine when to send electronic rear wiper system requests to the TIPM.

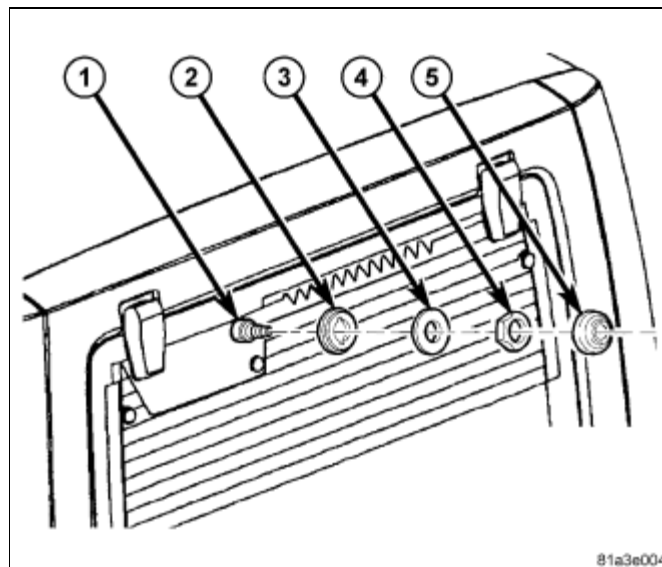
The rear wiper motor park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes and opens a path to ground for the rear wiper motor electronic control logic circuitry of the TIPM, depending upon the position of the rear wiper blade on the liftgate glass. This input allows the electronic logic circuits of the TIPM to control all of the electronic features of rear wiper motor operation and to keep the motor energized long enough to complete its current wipe cycle and park the wiper blade after the wiper system or the ignition switch has been turned OFF.

The rear wiper motor is grounded at all times through a take out in the body wire harness that is secured to a ground location in the passenger compartment. The automatic resetting circuit breaker protects the motor from overloads. The rear wiper motor transmission converts the rotary output of the wiper motor to the back and forth wiping motion of the rear wiper arm and blade on the liftgate glass.

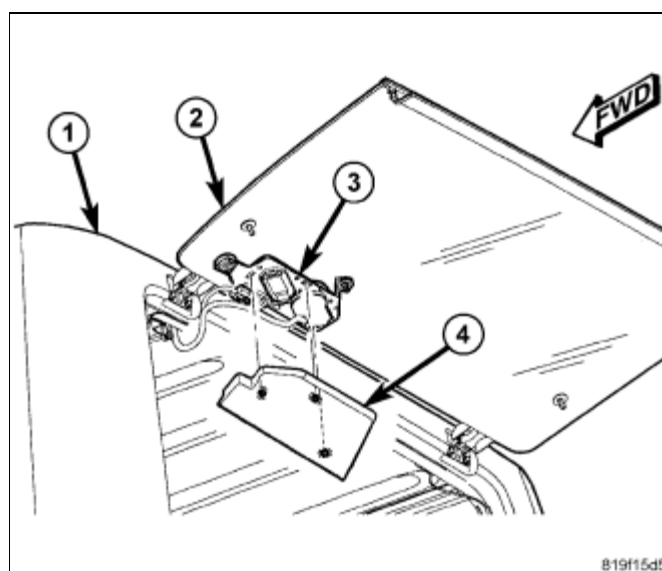
The hard wired inputs and outputs of the rear wiper motor may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the rear wiper motor or the electronic controls or communication between other modules and devices that provide some features of the rear wiper and washer system. The most reliable, efficient, and accurate means to diagnose the rear wiper motor or the electronic controls and communication related to rear wiper motor operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the rear wiper arm from the rear wiper motor output shaft (1). (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL - REAR).
3. Remove the plastic nut cover (5) from the output shaft.
4. Remove the nut (4) that secures the output shaft to the lift glass.
5. Remove the plastic spacer (3) and the rubber seal (2) from the output shaft.



6. Open the swing gate and raise the lift glass (2).
7. Grasp the edges of the rear wiper motor cover (4) and pull it firmly downward to disengage the three snap clip retainers that secure it to the rear wiper motor bracket (3).



8. Disconnect the hardtop washer hose (6) from the rear washer nozzle nipple (5) on the rear wiper motor (3) transmission housing.
9. Disconnect the hardtop wire harness connector (7) from

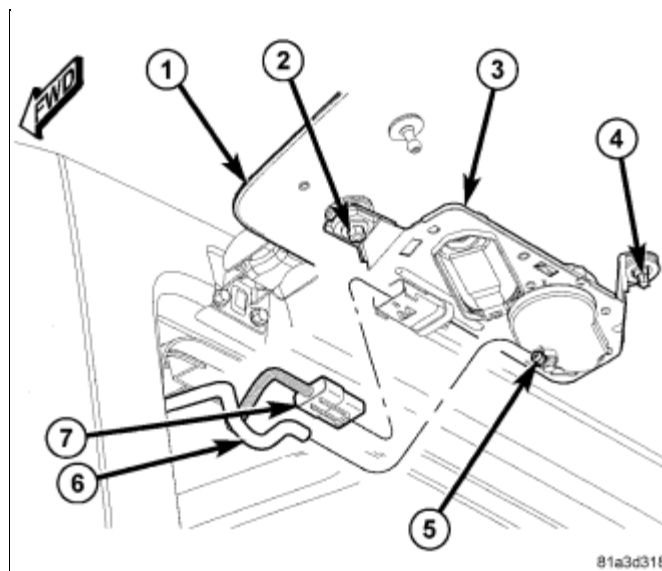
the rear wiper motor pigtail wire harness connector.

NOTE: The special fastener does not have a left-hand thread, but because it is being driven from the threaded end of the fastener rather than from the head, it must be rotated clockwise to loosen and counterclockwise to tighten.

10. While supporting the rear wiper motor with one hand, remove the special fastener (4) that secures the motor mounting bracket to the outside of the lift glass (1).

11. While still supporting the rear wiper motor, remove the nut (2) that secures the motor mounting bracket to the left lift glass hinge lower stud.

12. Remove the motor and bracket unit from the inside of the lift glass.

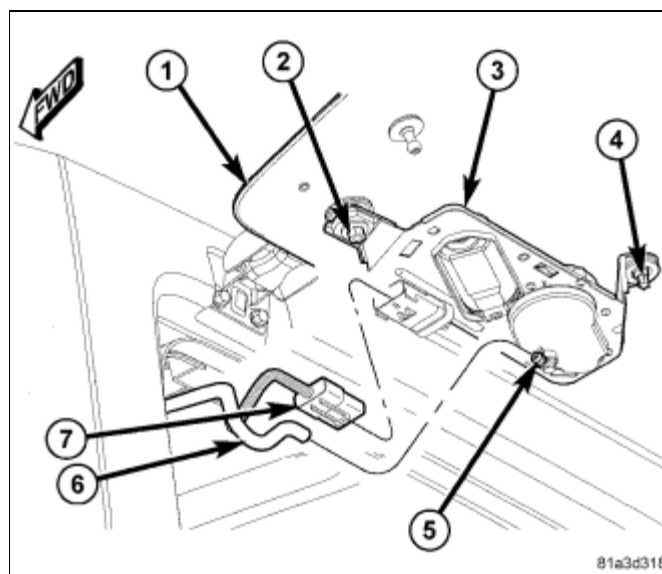


INSTALLATION

1. Position the rear wiper motor and bracket unit (3) to the inside of the lift glass (1). Be certain that the plastic inner spacer and rubber seal on the output shaft housing are in place between the output shaft housing and the clearance hole in the lift glass.

2. While supporting the rear wiper motor with one hand, install and tighten the nut (2) that secures the motor mounting bracket to the left lift glass hinge lower stud. Tighten the nut to 6 N·m (53 in. lbs.).

NOTE: The special fastener does not have a left-hand thread, but because it is being driven from the threaded end of the fastener rather than from the head, it must be rotated clockwise to loosen and counterclockwise to tighten.



3. While still supporting the wiper motor with one hand, install and tighten the special fastener (4) that secures the motor mounting bracket to the outside of the lift glass. Tighten the special fastener to 4 N·m (35 in. lbs.).

4. Reconnect the hardtop wire harness connector (7) to the rear wiper motor pigtail wire harness connector.

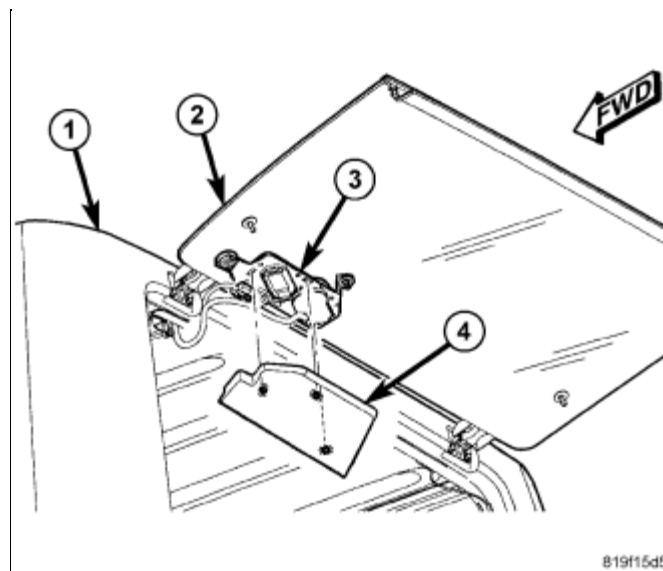
5. Reconnect the hardtop washer hose (6) to the rear washer nozzle nipple (5) on the rear wiper motor transmission housing.

6. Insert the guide pins on the rear surface of the rear wiper motor cover (4) into the round clearance holes in the rear

wiper motor bracket (3).

7. Using hand pressure, press the cover against wiper motor bracket until the three snap clip retainers that secure it snap into place.

8. Lower the lift glass (2) and close the swing gate.



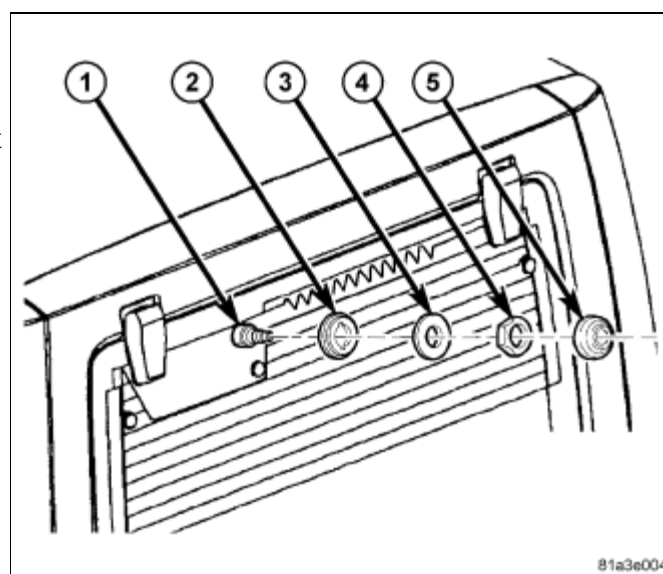
9. Install the rubber seal (2) and the plastic spacer (3) over the rear wiper motor output shaft (1).

10. Install and tighten the nut (4) that secures the output shaft to the lift glass. Tighten the nut to 4 N·m (35 in. lbs.).

11. Install the plastic nut cover (5) over the output shaft.

12. Reinstall the rear wiper arm onto the output shaft. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - INSTALLATION - REAR).

13. Reconnect the battery negative cable.



8T - NAVIGATION/TELECOMMUNICATION

NAVIGATION/TELECOMMUNICATION - SERVICE INFORMATION

NAVIGATION/TELECOMMUNICATION - SERVICE INFORMATION

DESCRIPTION

NAVIGATION

The GPS antenna collects information from orbiting satellites to provide the users location. The navigation radio uses this information in route planning to the desired location given by the operator.

The navigation information is displayed in map format, as turn-by-turn instruction or a combination of the two. The system also provides audio prompts for turns through the vehicle's audio system, overriding all other audio outputs (except hands free cellular system) to the front speakers that are active at the same time. Spoken prompts are recordings of a human voice.

The navigation portion of the radio is not repairable and if found to be defective the entire radio unit must be replaced. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL) for removal procedure of the radio.

ANTENNA-NAVIGATION

REMOVAL

1. Disconnect the battery negative cable.
2. Remove the center bezel.
3. Remove the radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).
4. Remove the push pins securing the GPS antenna.
5. Remove the GPS antenna.

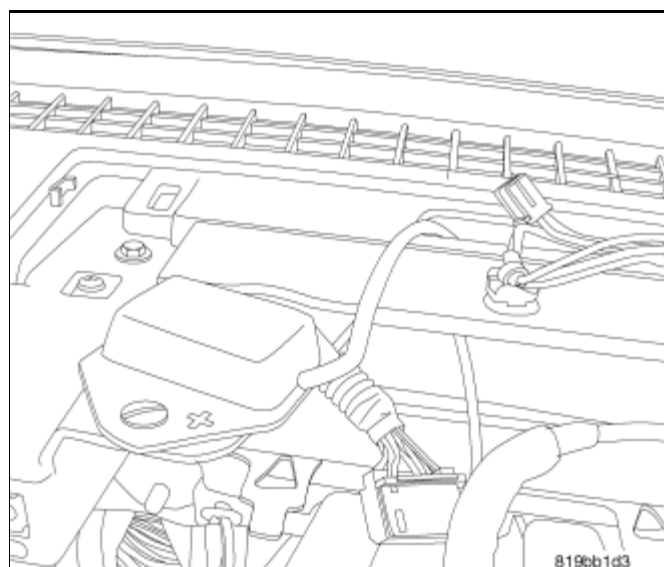
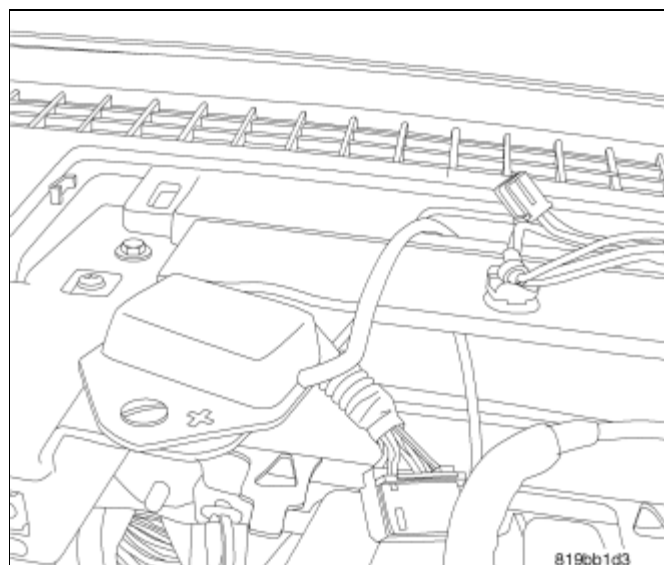
INSTALLATION

1. Install the GPS antenna.
2. Secure the GPS antenna using the push pins.
3. Install the radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
4. Install the center bezel.
5. Connect the battery negative cable.

8W - WIRING

WIRING DIAGRAM INFORMATION

WIRING DIAGRAM INFORMATION



DESCRIPTION

DESCRIPTION - HOW TO USE WIRING DIAGRAMS

DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, it is important to understand all of their features and characteristics.

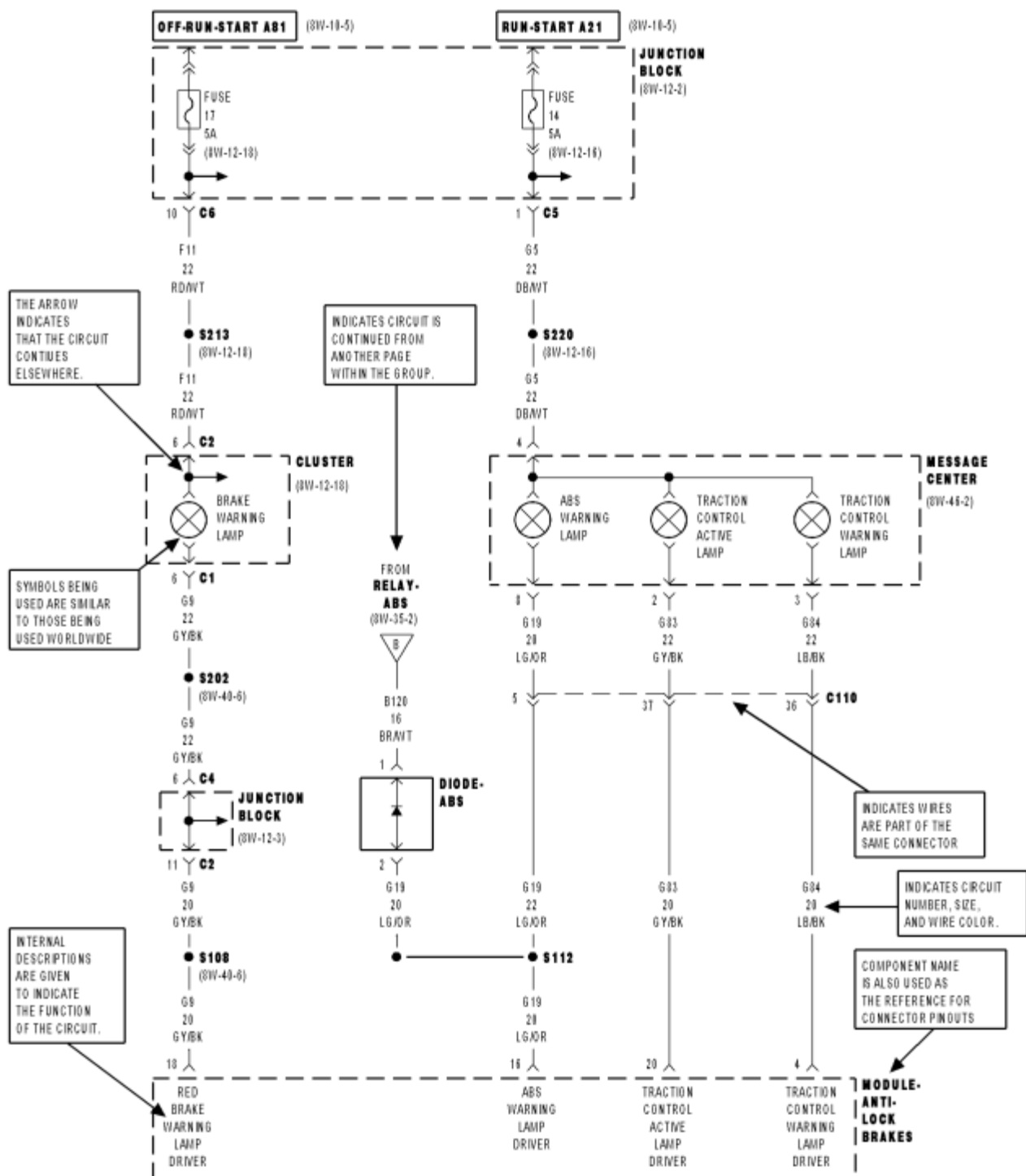
Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

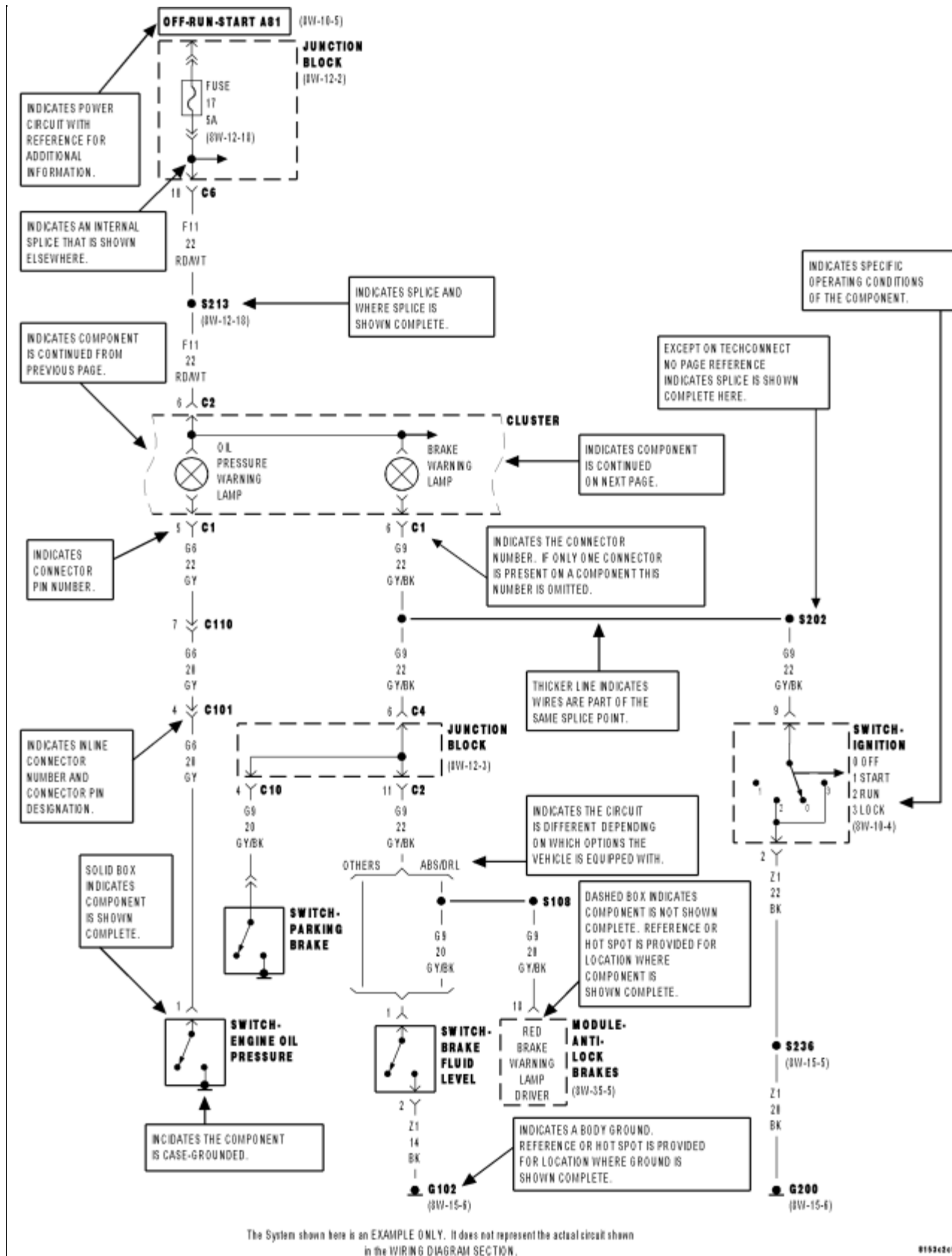
It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

DIAGRAMS ARE ARRANGED WITH THE POWER B+ SIDE OF THE CIRCUIT NEAR THE TOP OF THE PAGE AND THE GROUND SIDE OF THE CIRCUIT NEAR THE BOTTOM OF THE PAGE.



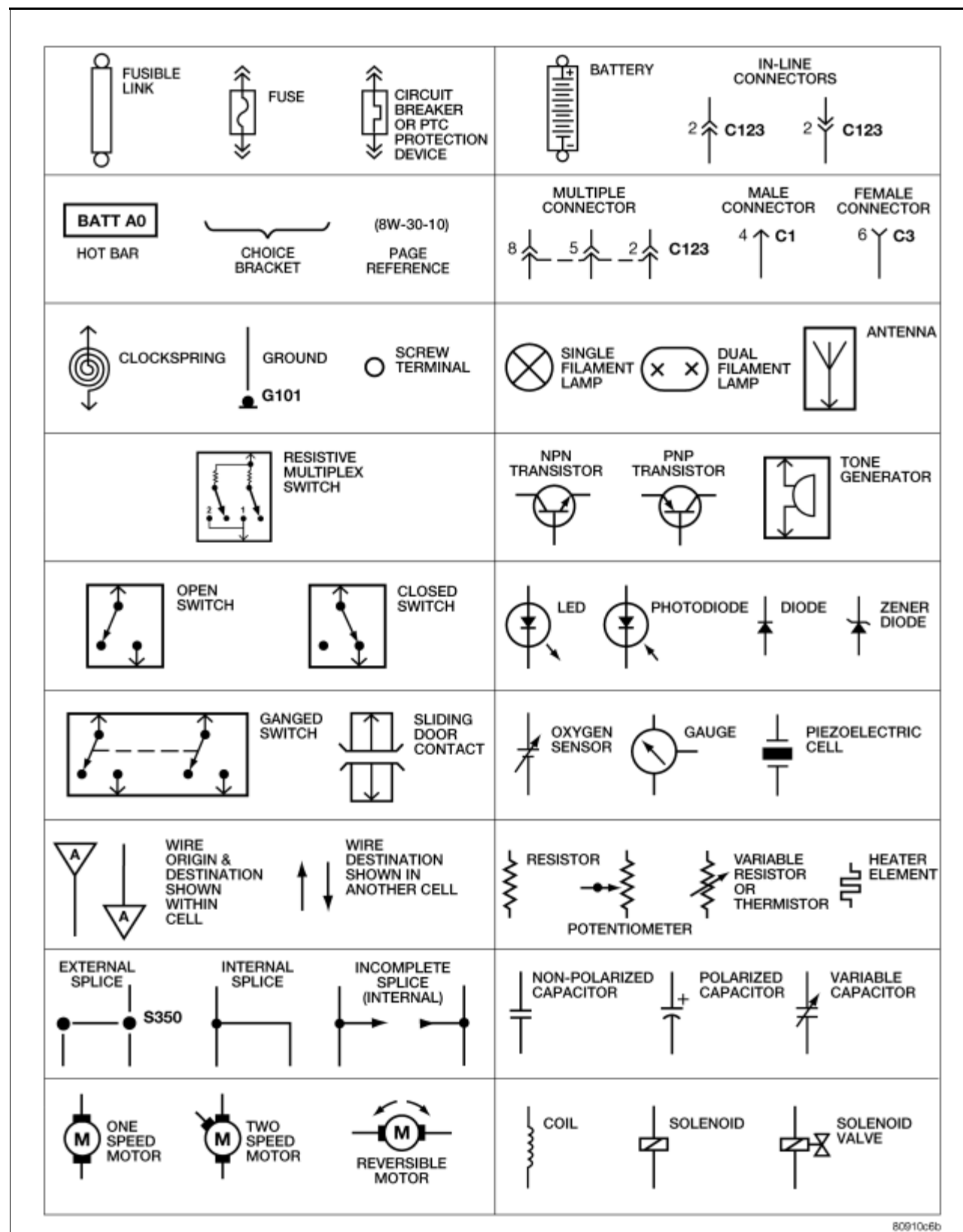
The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

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SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world.



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TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD - Left Hand Drive Vehicles

RHD - Right Hand Drive Vehicles

ATX - Automatic Transmissions-Front Wheel Drive

MTX - Manual Transmissions-Front Wheel Drive

AT - Automatic Transmissions-Rear Wheel Drive

MT - Manual Transmissions-Rear Wheel Drive

SOHC - Single Over Head Cam Engine

DOHC - Double Over Head Cam Engine

Export - Vehicles Built For Sale In Markets Other Than North America

Except Export - Vehicles Built For Sale In North America

DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, a specific part of the main circuit, gage of wire, and color. An example would be **A 2 18 LB/YL**. This is a Battery Feed circuit, level two, eighteen gauge, light blue with a yellow tracer.

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE
DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED

TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

DESCRIPTION - CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and it's function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	MULTIPLE
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING

N	MULTIPLE
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	WIPERS
X	AUDIO SYSTEMS
Y	TEMPORARY
Z	GROUND

DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the diagram pages.

DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located in the engine compartment are C100 series numbers.
- In-line connectors located in the instrument panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.
- Grounds and ground connectors are identified with a “G” and follow the same series numbering as the in-line connectors.
- Splices are identified with an “S” and follow the same series numbering as the in-line connectors. In addition, S001–S099 numbers are located in the engine compartment.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component. The abbreviation N/S means Not Shown in the illustrations

WARNING

WARNINGS - GENERAL

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: Always wear safety glasses for eye protection.

WARNING: Use safety stands anytime a procedure requires being under a vehicle.

WARNING: Be sure that the ignition switch always is in the off position, unless the procedure requires it to be on.

WARNING: Set the parking brake when working on any vehicle. An automatic transmission should be in park. A manual transmission should be in neutral.

WARNING: Operate the engine only in a well-ventilated area.

WARNING: Keep away from moving parts when the engine is running, especially the fan and belts.

WARNING: To prevent serious burns, avoid contact with hot parts such as the radiator, exhaust manifold(s), tail pipe, catalytic converter and muffler.

WARNING: Do not allow flame or sparks near the battery. Gases are always present in and around the battery.

WARNING: Always remove rings, watches, loose hanging jewelry and avoid loose clothing.

DIAGNOSIS AND TESTING - WIRING HARNESS

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: Never use a jumper wire across a load, such as a motor, connected between a battery feed and ground.

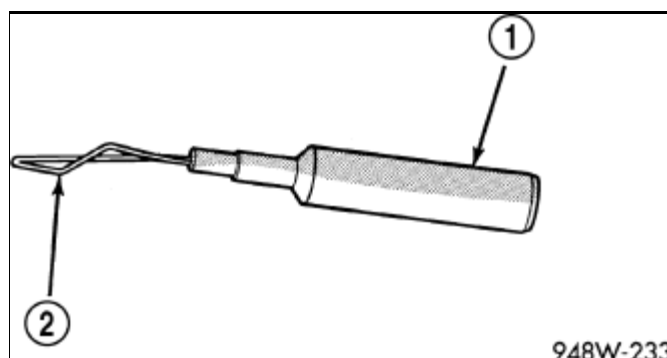
- Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.

- Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.

- Probing Tools - These tools are used for probing terminals in connectors. Select the proper size tool from Special Tool Package 6807, and insert the probing end (2) into the terminal being tested. Use the other end of the tool (1) to insert the meter probe.



INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly, check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out

- Terminals in the wiring assembly are fully seated into the connector/component and locked into position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt or moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation
- Wiring broken inside of the insulation

TROUBLESHOOTING WIRING PROBLEMS

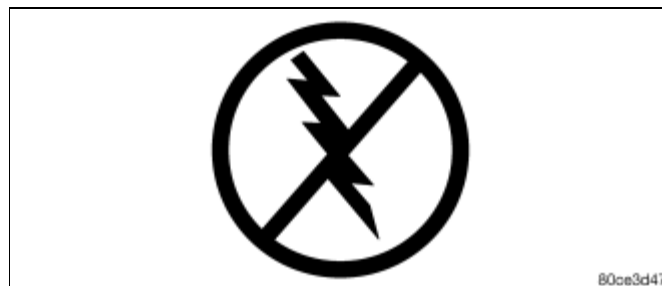
When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

1. Verify the problem.
2. Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.
3. Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.
4. Isolate the problem area.
5. Repair the problem area.
6. Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

STANDARD PROCEDURE

STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.



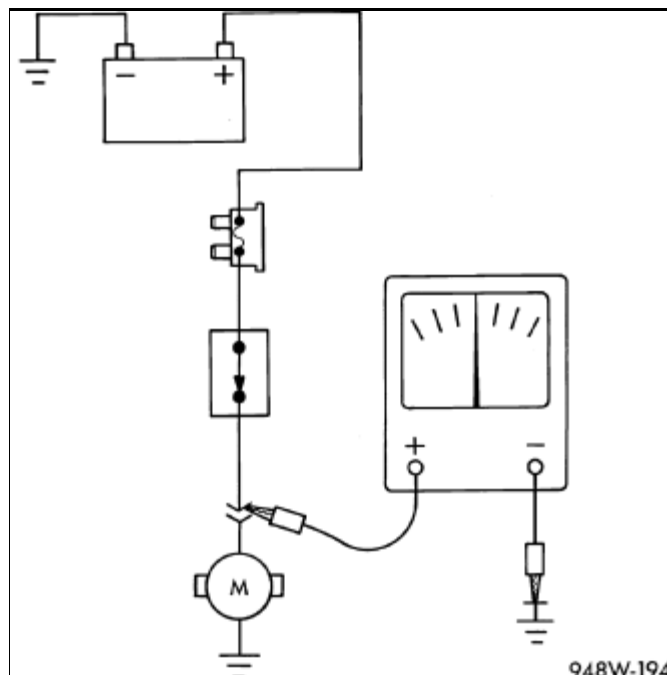
1. Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.
2. Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.
3. When using a voltmeter, be sure to connect the ground lead first.
4. Do not remove the part from it's protective packing until it is time to install the part.
5. Before removing the part from it's package, ground the package to a known good ground on the vehicle.

STANDARD PROCEDURE - TESTING OF VOLTAGE

POTENTIAL

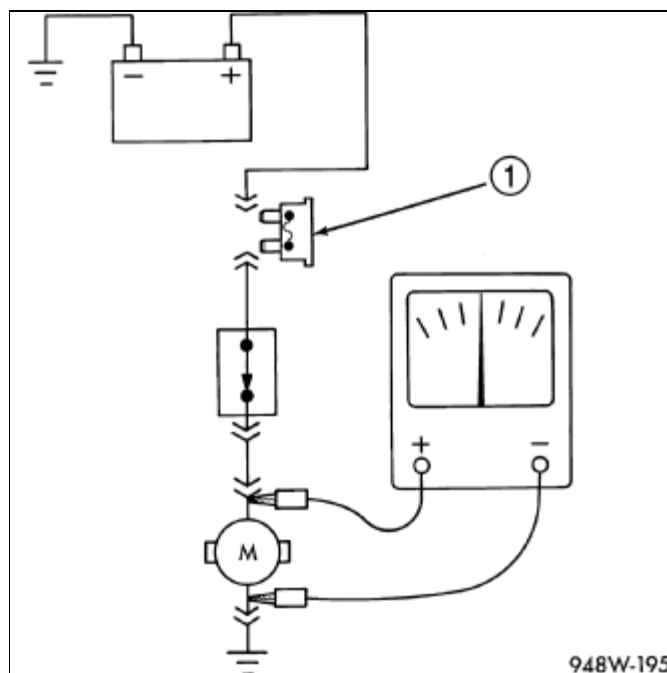
1. Connect the ground lead of a voltmeter to a known good ground .
2. Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

STANDARD PROCEDURE - TESTING FOR CONTINUITY



1. Remove the fuse (1) for the circuit being checked or, disconnect the battery.
2. Connect one lead of the ohmmeter to one side of the circuit being tested
3. Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND



1. Remove the fuse and disconnect all items involved with the fuse.
2. Connect a test light or a voltmeter across the terminals of the fuse.
3. Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.
4. If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

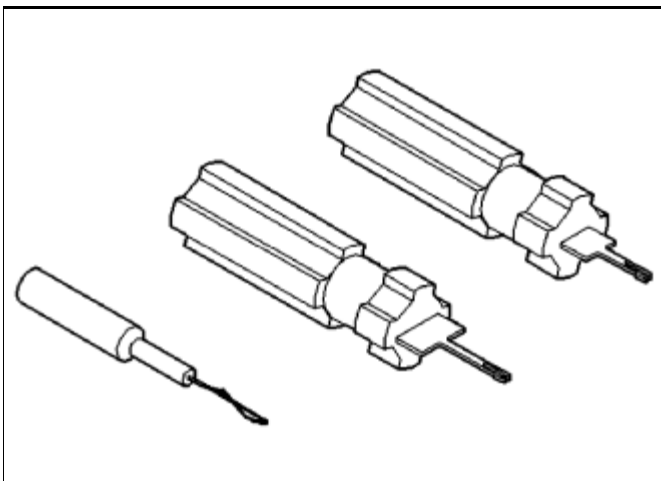
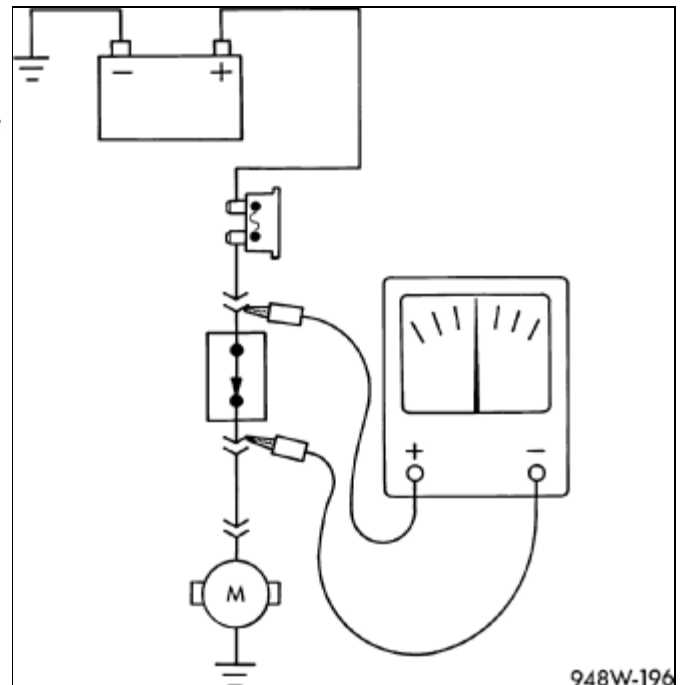
1. Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.
2. Replace the blown fuse.
3. Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.
4. Start connecting or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

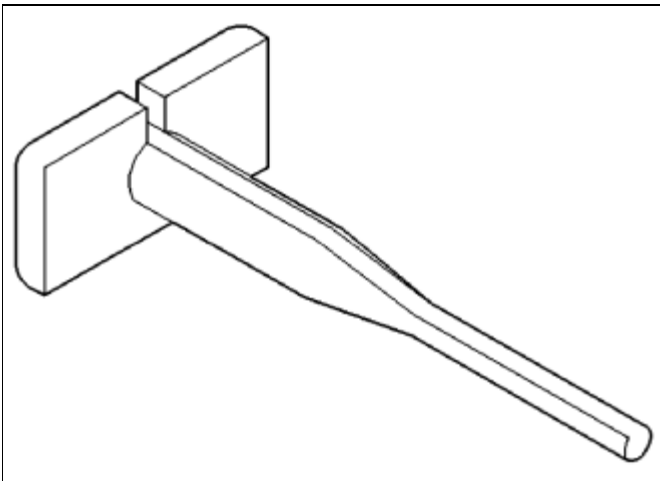
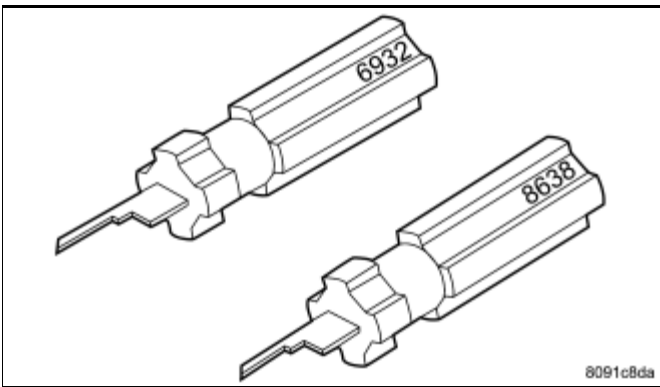
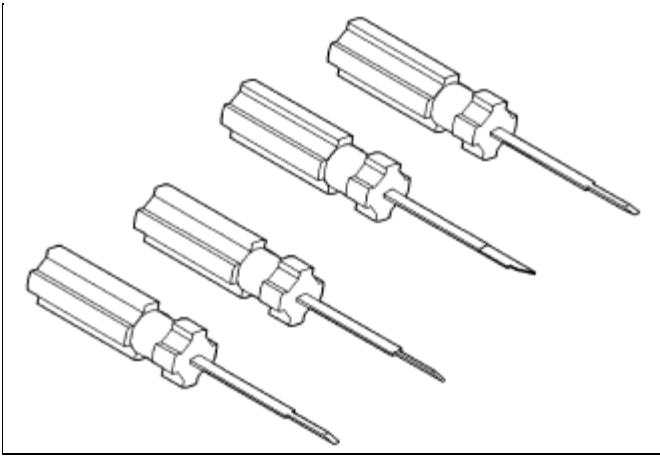
STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP

1. Connect the positive lead of the voltmeter to the side of the circuit closest to the battery .
2. Connect the other lead of the voltmeter to the other side of the switch, component or circuit.
3. Operate the item.
4. The voltmeter will show the difference in voltage between the two points.

SPECIAL TOOLS

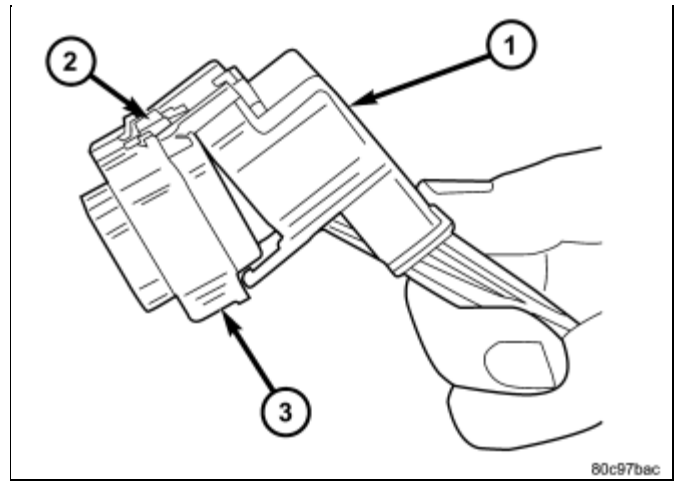
WIRING/TERMINAL

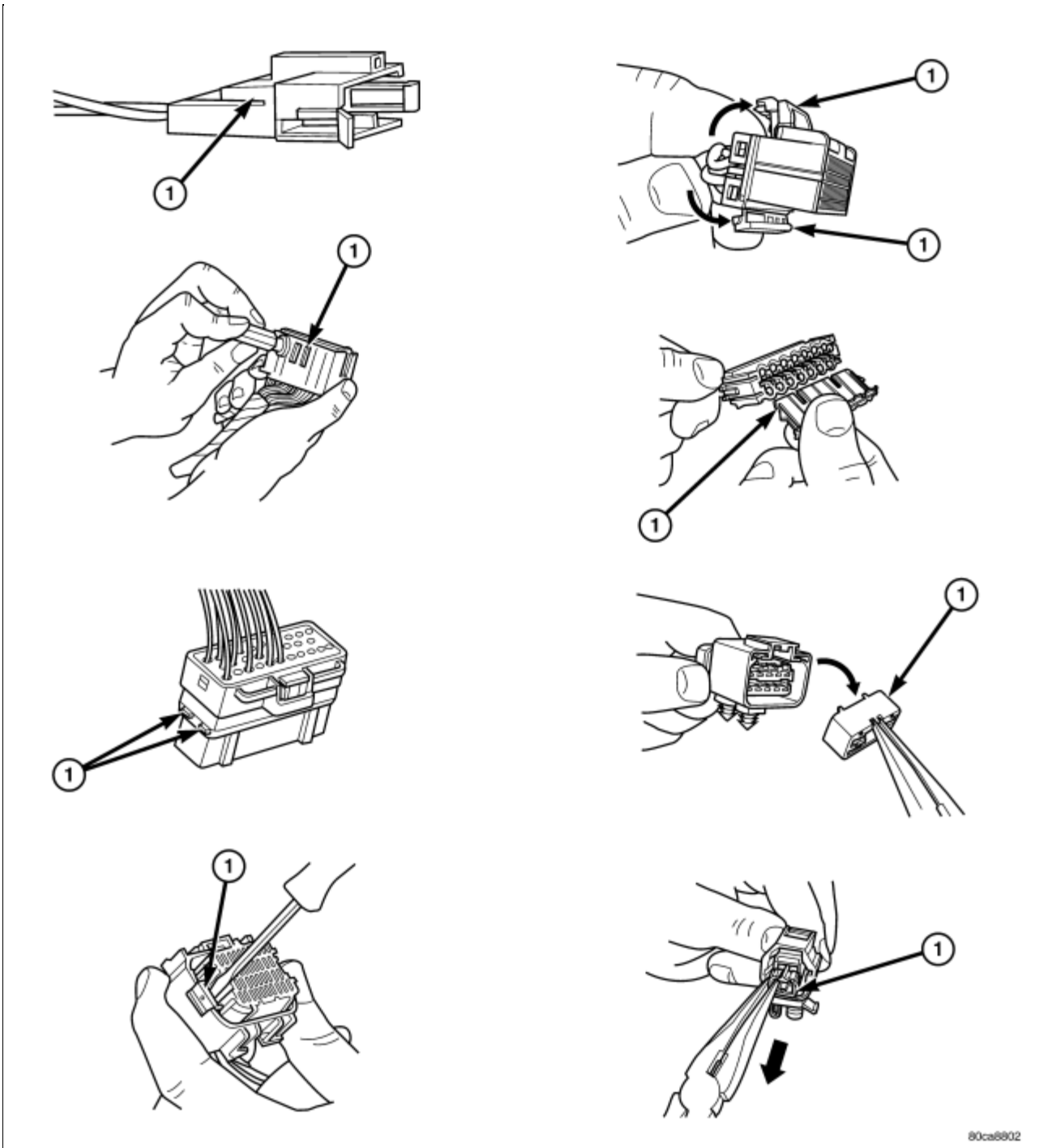




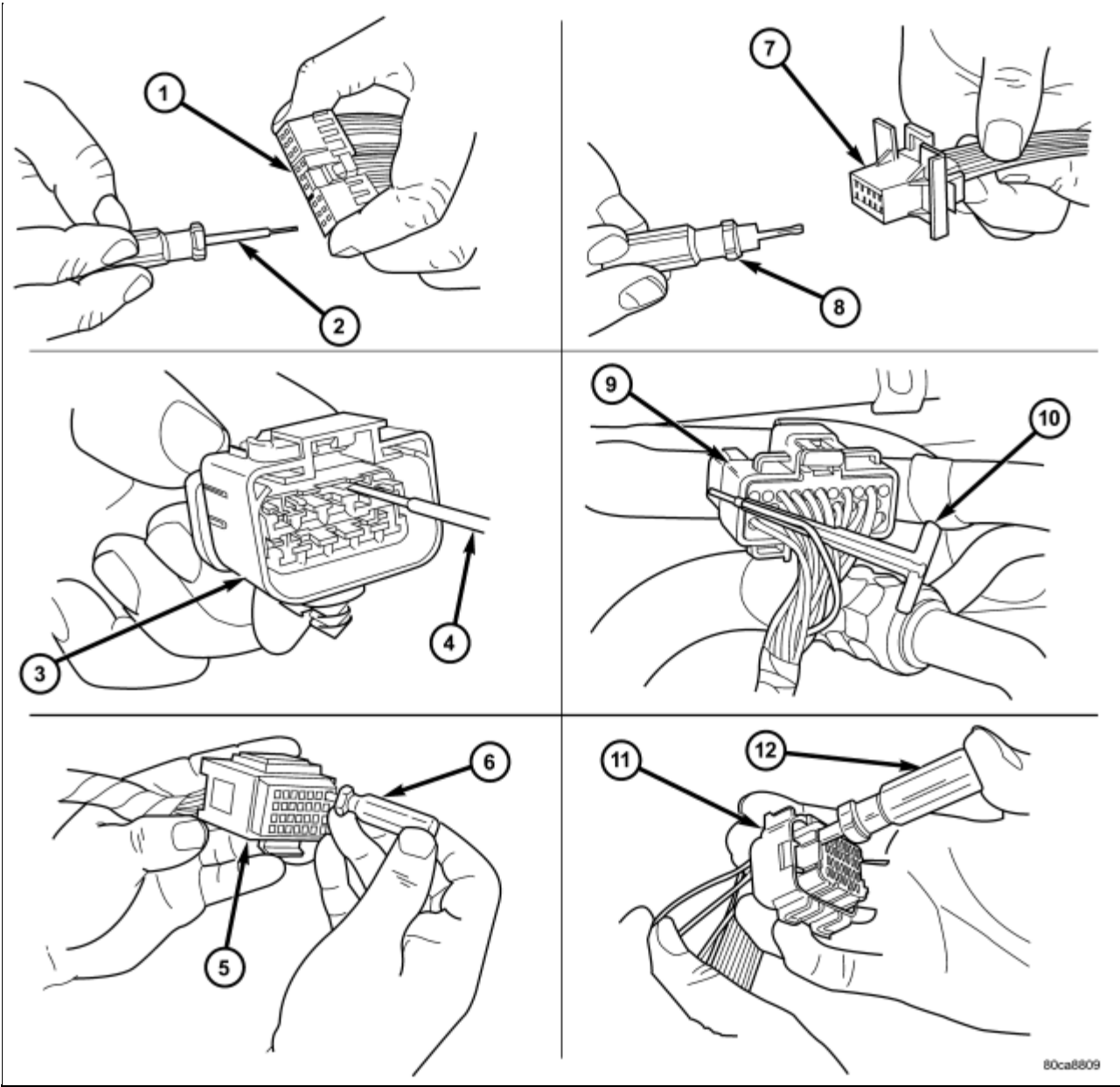
CONNECTOR REMOVAL

1. Disconnect battery.
2. Release Connector Lock (2).
3. Disconnect the connector (3) being repaired from its mating half/component.
4. Remove the dress cover (if applicable) (1).





5. Release the Secondary Terminal Lock, if required (1).



1 - TYPICAL CONNECTOR
2 - PICK FROM SPECIAL TOOL KIT 6680
3 - APEX CONNECTOR
4 - PICK FROM SPECIAL TOOL KIT 6680
5 - AUGAT CONNECTOR
6 - SPECIAL TOOL 6932
7 - MOLEX CONNECTOR
8 - SPECIAL TOOL 6742

9 - THOMAS AND BETTS CONNECTOR
10 - SPECIAL TOOL 6934
11 - TYCO CONNECTOR
12 - SPECIAL TOOL 8638

6. Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector .

INSTALLATION

1. Insert the removed terminal in the same cavity on the repair connector.
2. Repeat steps for each terminal in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.
3. When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.
4. Replace dress cover (if applicable).
5. Connect connector to its mating half/component.
6. Connect battery and test all affected systems.

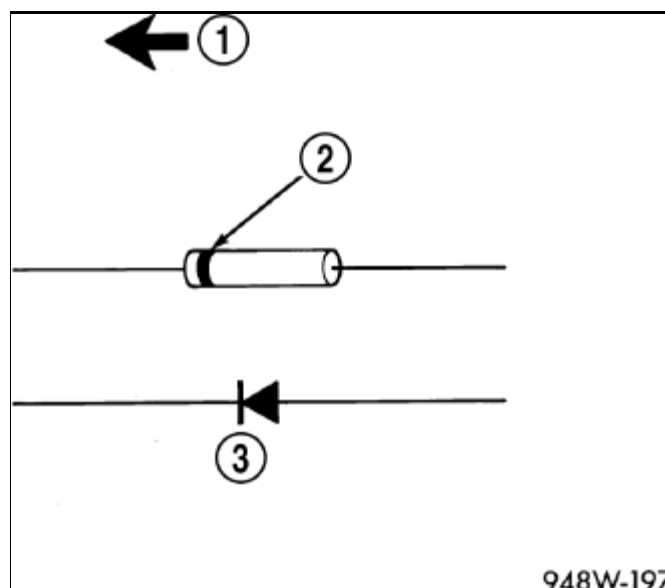
DIODE

REMOVAL

1. Disconnect the battery.
2. Locate the diode in the harness, and remove the protective covering.
3. Remove the diode from the harness, pay attention to the current flow direction (1) (2) (3).

INSTALLATION

1. Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.
2. Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow.
3. Solder the connection together using rosin core type solder only. **Do not use acid core solder.**
4. Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the



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elements.

5. Re-connect the battery and test affected systems.

TERMINAL

REMOVAL

1. Follow steps for removing terminals described in the connector removal section.
2. Cut the wire 6 inches from the back of the connector.

INSTALLATION

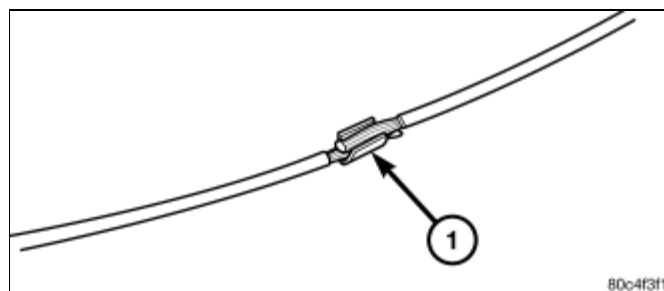
1. Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.
2. Cut the repair wire to the proper length and remove one-half (1/2) inch of insulation.
3. Splice the repair wire to the wire harness (see wire splicing procedure) (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION/WIRE - STANDARD PROCEDURE).
4. Insert the repaired wire into the connector.
5. Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.
6. Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.
7. Connect battery and test all affected systems.

WIRE

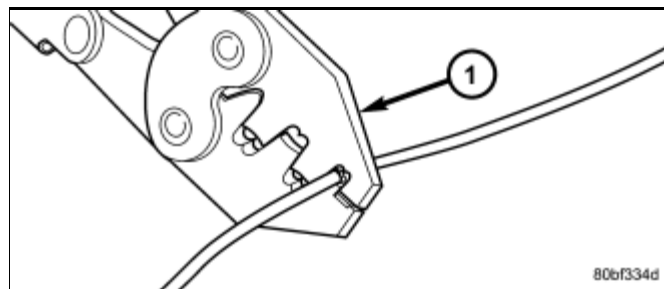
STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

1. Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.
2. Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.
3. Place the strands of wire overlapping each other inside of the splice clip (1).

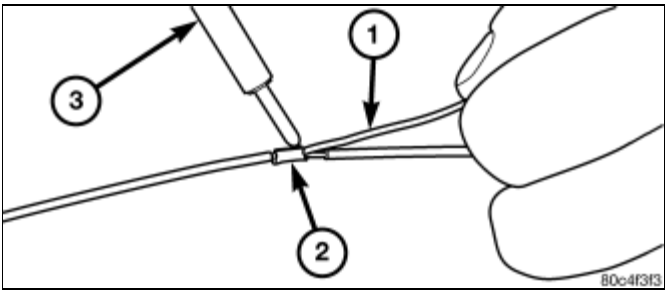


4. Using crimping tool (1), Mopar p/n 05019912AA, crimp the splice clip and wires together.

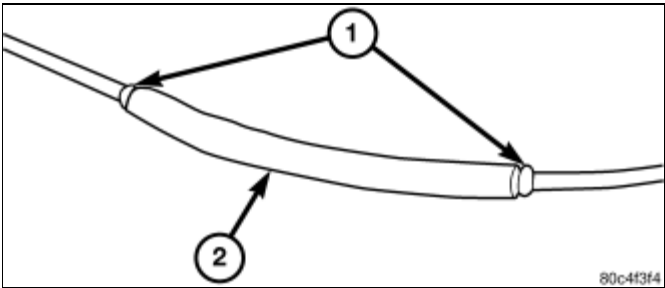


5. Solder (3) the connection (2) together using rosin core type solder (1) only.

CAUTION: DO NOT USE ACID CORE SOLDER.



6. Center the heat shrink tubing (2) over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant (1) comes out of both ends of the tubing.



CONNECTOR/GROUND/SPLICE LOCATION

CONNECTOR/GROUND/SPLICE LOCATION

DESCRIPTION

This section provides illustrations identifying connector, ground, and splice locations in the vehicle. Connector, ground, and splice indexes are provided. Use the wiring diagrams in each section for connector, ground, and splice identification. Refer to the index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

CONNECTORS

Connector Name/Number	Color	Location	Fig.
Actuator-Recirculation Door	Black	Passenger Side Instrument Panel	N/S
Airbag-Driver Squib 1	Black/Yellow	On Steering Wheel	N/S
Airbag-Driver Squib 2	Natural/Yellow	On Steering Wheel	N/S
Airbag-Passenger Squib 1	Black/Yellow	Passenger Side Instrument Panel	N/S
Airbag-Passenger Squib 2	Lt.Gray/Yellow	Passenger Side Instrument Panel	N/S
Airbag-Seat Squib-	Black/Yellow	Left Side of Left	N/S

Left (Side Airbags)		Seat	
Airbag-Seat Squib-Right (Side Airbags)	Black/Yellow	Right Side of Right Seat	N/S
Amplifier-Radio C1		Below Driver Side Instrument Panel	N/S
Amplifier-Radio C2	Black	Below Driver Side Instrument Panel	N/S
Antenna-Global Positioning System (Navigation)	Gray	Near Antenna	N/S
Antenna-Radio	Black	Right Side Instrument Panel	RIGHT SIDE INSTRUMENT PANEL
Antenna-Satellite	Black	Roof Near Right B-Pillar	ROOF
Assembly-EGR Valve (Gas)	Black	On Engine	N/S
Assembly-Glow Plug (Diesel)	Black	On Engine	N/S
Assembly-Shifter Lever (EATX)	Lt.Gray	Front Center Body	FRONT CENTER BODY
Assembly-Tail Lamp-Left	Dk. Gray	Left Rear Body	LEFT REAR BODY (4 DOOR), LEFT REAR BODY (2 DOOR)
Assembly-Tail Lamp-Right	Dk. Gray	Right Rear Body	REAR BODY AND SWINGGATE
Assembly-Transmission Solenoid/Pressure Switch (RLE)	Brown	On Transmission	N/S
Assembly-Transmission Solenoid/Trs (RFE)	Black	On Transmission	N/S
Assembly-Line Pressure Sensor/Variable Force Solenoid (RLE)	Black	On Transmission	N/S
Backlite-Electric Heated (Ground)	—	On Backlite	N/S

Backlite-Electric Heated (Power)	-	On Backlite	N/S
Battery-Cabin Heater-Eyelet (Diesel)	-	Passenger Side Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
Battery-Generator-Eyelet (Gas)	-	On Battery	N/S
Battery-Glow Plug-Eyelet (Diesel)	-	On Battery	N/S
Battery-Negative (Diesel)	-	At Battery	PASSENGER SIDE ENGINE COMPARTMENT
Battery-Negative (Gas)	-	At Battery	PASSENGER SIDE ENGINE COMPARTMENT
Battery-Negative-Eyelet	-	On Engine Harness	N/S
Battery-Positive (Diesel)	-	At Battery	PASSENGER SIDE ENGINE COMPARTMENT
Battery-Positive (Gas)	-	At Battery	PASSENGER SIDE ENGINE COMPARTMENT
C100	Black	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C101 (Diesel)	Dk. Gray	Engine Harness to Battery Harness	N/S
C102 (Gas)	Black	Engine Harness to Intake Harness	N/S
C103	Black	Passenger Side Front Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C104	Dk. Gray	Driver Side Front Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
C105	Black	Passenger Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C106	Black	Rear Engine	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE

		Compartment	COMPARTMENT (RHD GAS) , LEFT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C107 (Diesel)	Dk. Gray	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C108	Black	Left Front Engine Compartment	N/S
C109	Black	Right Front Engine Compartment	N/S
C110	-	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C200	Black	Passenger Side Instrument Panel	LOWER RIGHT INSTRUMENT PANEL , LEFT FRONT BODY (RHD) , RIGHT BODY (4 DOOR) , RIGHT BODY (2 DOOR)
C201 (4 Door Except Base)	Black	Passenger Side Instrument Panel	LOWER RIGHT INSTRUMENT PANEL , LEFT FRONT BODY (RHD) , RIGHT BODY (4 DOOR)
C202	Black	Front of Left Front Door	DOORS
C203	Black	Front of Right Front Door	DOORS
C207	Black	Instrument Panel Inline to Front Intrusion Sensor Jumper	N/S
C300	Black	Right Front Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
C301 (Export)	Dk. Gray	Left Rear Body	LEFT REAR BODY (4 DOOR) , LEFT REAR BODY (2 DOOR)
C302 (4 Door)	Black	Lower Left B-Pillar	LEFT BODY , DOORS
C303 (4 Door)	Black	Lower Right B-Pillar	RIGHT BODY (4 DOOR) , DOORS
C304 (Side Airbags)	Yellow	Body Floor Under Left Seat	CENTER BODY , DRIVER SEAT TRACK
C305 (Side Airbags)	Yellow	Body Floor Under Right Seat	CENTER BODY
C306 (Except Export)	Dk. Gray	Body Floor Under Left Seat	CENTER BODY , DRIVER SEAT TRACK

C306 (Export)	Black	Body Floor Under Right Seat	CENTER BODY
C308	Lt. Gray	Roof Near Right B-Pillar	RIGHT BODY (4 DOOR) , RIGHT BODY (2 DOOR)
C309 (Hard Top)	Black	Left Rear Body	LEFT REAR BODY (4 DOOR) , LEFT REAR BODY (2 DOOR)
C310 (4 Door Except Base)	Lt. Gray	Body Floor Between Front Seats	CENTER BODY
C311 (Trailer Tow)	Dk. Gray	On Trailer Tow Harness	N/S
Cluster C1	Black	Driver Side Instrument Panel	N/S
Cluster C2	Brown	Driver Side Instrument Panel	N/S
Cluster C3	Black	Driver Side Instrument Panel	N/S
Clutch-A/C Compressor	Black	On Engine	N/S
Coil-Ignition (Gas)	Dk. Gray	on Engine	N/S
Control-A/C-Heater C1	Black	Center Instrument Panel	N/S
Control-A/C-Heater C2	Black	Center Instrument Panel	N/S
Data Link Connector	Black	Lower Driver Side Instrument Panel	N/S
Fan Module-Radiator Cooling	Dk. Gray	Front Engine Compartment	N/S
Generator (Diesel)	-	On Engine	N/S
Generator (Gas)	Black	On Engine	N/S
Generator-Eyelet (Diesel)	-	At Generator	N/S
Generator-Eyelet (Gas)	-	At Generator	N/S

Heater-Cabin (Diesel)	Black	Lower Left Instrument Panel	N/S
Heater-Crankcase Vent (Diesel)	Black	On Engine	N/S
Heater-Fuel (Diesel)	Black	Left Rear Engine	N/S
Horn 1 C1	-	Right Front Engine Compartment	N/S
Horn 1 C2	-	Right Front Engine Compartment	N/S
Horn 2 C1	-	Right Front Engine Compartment	N/S
Horn 2 C2	-	Right Front Engine Compartment	N/S
Injector-Fuel 1 (Diesel)	Black	On Engine	N/S
Injector-Fuel 1 (Gas)	Black	On Engine	N/S
Injector-Fuel 2 (Diesel)	Black	On Engine	N/S
Injector-Fuel 2 (Gas)	Black	On Engine	N/S
Injector-Fuel 3 (Diesel)	Black	On Engine	N/S
Injector-Fuel 3 (Gas)	Black	On Engine	N/S
Injector-Fuel 4 (Diesel)	Black	On Engine	N/S
Injector-Fuel 4 (Gas)	Black	On Engine	N/S
Injector-Fuel 5 (Gas)	Black	On Engine	N/S
Injector-Fuel 6 (Gas)	Black	On Engine	N/S
Lamp-Cargo (4 Door)	Black	Center Rear Roof	TOP REAR BODY
Lamp-Center High Mounted Stop	Lt. Gray	Left Side of Swinggate	REAR BODY AND SWINGGATE

Lamp-Dome	Black	Center of Sport Bar	N/S
Lamp-Fog-Left Front	Black	Lower Left Front Fascia	N/S
Lamp-Fog-Left Rear (Export)	Gray	Lower Left Rear Fascia	N/S
Lamp-Fog-Right Front	Black	Lower Right Front Fascia	N/S
Lamp-Fog-Right Rear (Export)	Gray	Lower Right Rear Fascia	N/S
Lamp-Headlamp-Left (Except Export)	Green	Left Front Engine Compartment	N/S
Lamp-Headlamp-Left (Export)	Black	Left Front Engine Compartment	N/S
Lamp-Headlamp-Right (Except Export)	Green	Right Front Engine Compartment	N/S
Lamp-Headlamp-Right (Export)	Black	Right Front Engine Compartment	N/S
Lamp-License (Except Export)	Black	Left Rear Body	LEFT REAR BODY (4 DOOR) , LEFT REAR BODY (2 DOOR)
Lamp-License (Export)	Black	Center of Rear Fascia	N/S
Lamp-Park/Turn-Left Front (Except Export)	Black	Left Front Engine Component	N/S
Lamp-Park/Turn-Right Front (Except Export)	Black	Right Front Engine Component	N/S
Lamp-Park-Left Front (Export)	Black	Left Front Engine Component	N/S
Lamp-Park-Right Front (Export)	Black	Right Front Engine Component	N/S
Lamp-Side Marker-	Gray	Left Side Engine	N/S

Left Front (Except Export)		Component	
Lamp-Side Marker-Right Front (Except Export)	Gray	Right Side Engine Component	N/S
Lamp-Side Repeater-Left (Export)	Gray	Left Side Engine Component	N/S
Lamp-Side Repeater-Right (Export)	Gray	Right Side Engine Component	N/S
Lamp-Turn-Left Front (Export)	-	Left Front Engine Component	N/S
Lamp-Turn-Right Front (Export)	-	Right Front Engine Component	N/S
Latch-Door-Driver	Black	Rear of Driver Door	DOORS
Latch-Door-Left Rear (4 Door)	Black	Rear of Left Rear Door	DOORS
Latch-Door-Passenger	Black	Rear of Passenger Door	DOORS
Latch-Door-Right Rear (4 Door)	Black	Rear of Right Rear Door	DOORS
Latch-Door-Swinggate	Black	Left Side of Swinggate	REAR BODY AND SWINGGATE
Lighter-Cigar	Gray	Center Instrument Panel	N/S
Module-Anti-Lock Brakes (ESP)	Black	Driver Side Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (LHD DIESEL)
Module-Compass	Black	Center Instrument Panel	N/S
Module-Engine Control C1 (Diesel)	-	Engine Compartment	N/S
Module-Engine Control C2 (Diesel)	-	Left Side Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)

Module-Fuel Pump	Lt. Gray	At Fuel Tank	FUEL PUMP MODULE
Module-Glow Plug (Diesel)	Black	Engine Compartment	N/S
Module-Headlamp Leveling-Left (Export)	-	Left Front Engine Compartment	N/S
Module-Headlamp Leveling-Right (Export)	-	Right Front Engine Compartment	N/S
Module-Intrusion Transceiver (RHD)	Black	Below Driver Side Instrument Panel	N/S
Module-Occupant Restraint Controller C1 (ORC)	Yellow	Front Center Body	FRONT CENTER BODY
Module-Occupant Restraint Controller C2 (ORC)	Yellow	Center Body Floor	CENTER BODY
Module-Powertrain Control C1 (Gas)	Black/Black	Left Side Engine Compartment	POWERTRAIN CONTROL MODULE
Module-Powertrain Control C1 (Diesel)	Black/Black	Left Side Engine Compartment	N/S
Module-Powertrain Control C2 (Gas)	Black/Orange	Left Side Engine Compartment	POWERTRAIN CONTROL MODULE
Module-Powertrain Control C3 (Gas)	Black/Natural	Left Side Engine Compartment	POWERTRAIN CONTROL MODULE, LEFT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS)
Module-Powertrain Control C4 (RLE)	Black/Green	Left Side Engine Compartment	POWERTRAIN CONTROL MODULE
Module-Powertrain Control C4 (Diesel)(RFE)	Black/Green	Left Side Engine Compartment	N/S
Module-Sentry Key Remote Entry/WCM	Black	Steering Column	N/S
Module-Steering Control C1	-	Steering Column	N/S
Module-Steering Control C2	Natural	Steering Column	N/S
Module-Steering	White	Steering Column	N/S

Control C4			
Module-Steering Control C5	White	On Steering Wheel	N/S
Module-Totally Integrated Power C1	Black	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE, RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
Module-Totally Integrated Power C2	Blue	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE, RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
Module-Totally Integrated Power C3	Green	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE
Module-Totally Integrated Power C4	Lt. Gray	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE
Module-Totally Integrated Power C5	Brown	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE
Module-Totally Integrated Power C6	Gray	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE
Module-Totally Integrated Power C7	-	Passenger Side Engine Compartment	TOTALLY INTEGRATED POWER MODULE
Module-Totally Integrated Power C8	-	Passenger Side Engine Compartment	PASSENGER SIDE ENGINE COMPARTMENT
Motor-Blower	Natural	Passenger Side Instrument Panel	N/S
Motor-Boost Pressure Servo (Diesel)	Natural	On Engine	N/S
Motor-Window-Left Front	Lt. Gray	On Left Front Door	N/S
Motor-Window-Left Rear (4 Door)	Lt. Gray	Left Rear Door	N/S
Motor-Window-Right Front	Lt. Gray	On Right Front Door	N/S

Motor-Window-Right Rear (4 Door)	Lt. Gray	Right Rear Door	N/S
Motor-Wiper-Front	Black	Left Rear Engine Compartment	REAR ENGINE COMPARTMENT
Motor-Wiper-Rear (Hard Top)	Black	Rear Roof	N/S
Power Outlet-Console	Gray	Center Instrument Panel	N/S
Pump-Washer-Windshield	Black	Left Front Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS) , LEFT ENGINE COMPARTMENT (RHD GAS) , LEFT ENGINE COMPARTMENT (RHD DIESEL) , LEFT ENGINE COMPARTMENT (LHD DIESEL)
Radio	Gray	Center Instrument Panel	N/S
Relay-Cabin Heater 1 (Diesel)	Lt. Gray	Right Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
Relay-Cabin Heater 2 (Diesel)	Lt. Gray	Right Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
Relay-Cabin Heater 3 (Diesel)	Lt. Gray	Left Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , LEFT ENGINE COMPARTMENT (LHD DIESEL)
Relay-Fuel Heater (Diesel)	-	Left Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , LEFT ENGINE COMPARTMENT (LHD DIESEL)
Relay-Locker-Front (Off-Road)	-	Passenger Side Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , LEFT ENGINE COMPARTMENT (RHD GAS) , LEFT REAR ENGINE COMPARTMENT (LHD DIESEL)
Relay-Locker-Rear (Off-Road)	-	Passenger Side Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , LEFT ENGINE COMPARTMENT (RHD GAS) , LEFT REAR ENGINE COMPARTMENT (LHD DIESEL)
Relay-Radiator Fan High	Lt. Gray	Left Front Engine Compartment	N/S
Resistor Block-Blower Motor	Gray	Passenger Side Instrument Panel	N/S
Seat Belt-Retractor Tensioner-Driver	Yellow	Driver Side Body at Base of B-Pillar	LEFT BODY , RIGHT BODY (4 DOOR) , LEFT REAR BODY (2 DOOR) , RIGHT BODY (2 DOOR)
Seat Belt-Retractor Tensioner-Passenger	Yellow	Passenger Side Body at Base of B-Pillar	LEFT BODY , RIGHT BODY (4 DOOR) , LEFT REAR BODY (2 DOOR) , RIGHT BODY (2 DOOR)

Sensor-Accelerator Pedal Position	Black	At Base of Pedal	N/S
Sensor-Ambient Air Temperature	Black	Center Front Engine Compartment	N/S
Sensor-Brake Fluid Level	Black	Driver Side Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (LHD DIESEL)
Sensor-Camshaft Position (Diesel)	Black	On Engine	N/S
Sensor-Camshaft Position (Gas)	Black	On Engine	N/S
Sensor-Crankshaft Position (Diesel)	Black	On Engine	N/S
Sensor-Crankshaft Position (Gas)	Black	On Engine	N/S
Sensor-Dynamics (ESP)	Black	Front Center Body	FRONT CENTER BODY
Sensor-Engine Coolant Temperature (Diesel)	Black	On Engine	N/S
Sensor-Engine Coolant Temperature (Gas)	Black	On Engine	N/S
Sensor-Evaporator Temperature	Natural	Below Driver Side Instrument Panel	N/S
Sensor-Exhaust Differential Pressure (Diesel)	Black	Rear of Engine	N/S
Sensor-Front Impact-Left	Yellow	Left Front Engine Compartment	N/S
Sensor-Front Impact-Right	Yellow	Right Front Engine Compartment	N/S
Sensor-Fuel Pressure (Diesel)	Black	On Engine	N/S

Sensor-Fuel Temperature (Diesel)	Black	Left Rear Engine	N/S
Sensor-Inlet Air Pressure (Diesel)	Black	On Engine	N/S
Sensor-Input Speed (EATX)	Black	On Transmission	N/S
Sensor-Intake Air Temperature (Gas)	Black	On Engine	N/S
Sensor-Intake Air Temperature/Boost Pressure (Diesel)	Black	On Engine	N/S
Sensor-Intrusion-Cargo (RHD)	Black	Left Side of Swinggate	REAR BODY AND SWINGGATE
Sensor-Intrusion-Console (RHD)	Black	Center Body Floor	N/S
Sensor-Intrusion-Front (RHD)	Black	Front of Shift Lever	N/S
Sensor-Knock (Gas)	Black	On Engine	N/S
Sensor-Line Pressure (RFE)	Black	On Transmission	N/S
Sensor-Map (Gas)	Gray	On Engine	N/S
Sensor-Mass Air Flow (Diesel)	-	On Engine	N/S
Sensor-Oil Pressure (Diesel)	Dk. Green	On Engine	N/S
Sensor-Output Speed (EATX)	Black	On Transmission	N/S
Sensor-Oxygen 1/1 (Gas)	Natural	Rear of Engine	N/S
Sensor-Oxygen 1/2 (Gas)	Black	Rear of Engine	N/S
Sensor-Oxygen 2/1 (Gas LHD)	Gray	Rear of Engine	N/S
Sensor-Oxygen 2/1 (Gas RHD)	Black	Rear of Engine	N/S
Sensor-Oxygen 2/2	Black	Rear of Engine	N/S

(Gas)			
Sensor-Post-Catalyst Exhaust Gas Temperature (Diesel)	-	Rear of Engine	N/S
Sensor-Seat Track Position-Driver (Except Export)	Gray	Under Driver Seat	DRIVER SEAT TRACK
Sensor-Side Impact-Left 1 (Side Airbags)	Yellow	Lower Left B-Pillar	LEFT BODY, LEFT REAR BODY (2 DOOR)
Sensor-Side Impact-Right 1 (Side Airbags)	Yellow	Lower Right B-Pillar	RIGHT BODY (4 DOOR), RIGHT BODY (2 DOOR)
Sensor-Steering Angle (ESP)	-	Steering Column	N/S
Sensor-Transmission Range (RLE)	Lt. Green	On Transmission	N/S
Sensor-Water in Fuel (Diesel)	Green	Left Rear Engine	N/S
Sensor-Wheel Speed-ABS-Left Front	Black	Near Left Front Wheel	N/S
Sensor-Wheel Speed-ABS-Left Rear	Black	Near Left Rear Wheel	N/S
Sensor-Wheel Speed-ABS-Right Front	Black	Near Right Front Wheel	N/S
Sensor-Wheel Speed-ABS-Right Rear	Black	Near Right Rear Wheel	N/S
Siren (RHD)	Black	Left Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL)
Solenoid-EGR (Diesel)	-	On Engine	N/S
Solenoid-Evap/Purge (Gas)	Black	Right Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS)
Solenoid-Fuel Pressure (Diesel)	Black	On Engine	N/S

Solenoid-Fuel Quantity (Diesel)	Black	On Engine	N/S
Solenoid-Locker-Front (Off Road)	Black	At Front Differential	N/S
Solenoid-Locker-Rear (Off Road)	Black	At Rear Differential	N/S
Solenoid-Throttle Valve (Diesel)	Black	On Engine	N/S
Speaker-Instrument Panel-Left	Lt. Gray	Left Instrument Panel	N/S
Speaker-Instrument Panel-Right	Lt. Gray	Right Instrument Panel	N/S
Speaker-Left Front	Black	Left Instrument Panel	N/S
Speaker-Left Rear	White	Left of Sport Bar	N/S
Speaker-Right Front	Black	Right Instrument Panel	N/S
Speaker-Right Rear	White	Right of Sport Bar	N/S
Speaker-Subwoofer (Premium)	Black	Right Rear Body	REAR BODY AND SWINGGATE
Starter	-	On Engine	N/S
Starter-Eyelet (Diesel)	-	At Starter	N/S
Starter-Eyelet (Gas)	-	At Starter	N/S
Switch-Backup Lamp (MTX)	Black	On Transmission	N/S
Switch-Bank	Black	Center Instrument Panel	N/S
Switch-Clutch Interlock (MTX)	-	Rear Engine Component	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
Switch-Door Lock-Left Front (Except Base)	Natural	On left Front Door	N/S

Switch-Door Lock-Right Front (Except Base)	Natural	On Right Front Door	N/S
Switch-Evap System Monitor (Gas)	Black	At Evap Canister Near Fuel Tank	N/S
Switch-Hood Ajar	Black	Left Front Engine Compartment	N/S
Switch-Horn	Black	On Steering Wheel	N/S
Switch-Ignition	Black	Steering Column	N/S
Switch-Locker-Front (Off Road)	Black	At Front Differential	N/S
Switch-Locker-Rear (Off Road)	Black	At Rear Differential	N/S
Switch-Oil Pressure (Gas)	Black	On Engine	N/S
Switch-Parking Brake	Black	Base of Brake Lever	FRONT CENTER BODY
Switch-Power Window-Front (Except Base)	Black	Center Instrument Panel	N/S
Switch-Power Window-Rear (4 Door Except Base)	White	Rear of Center Console	N/S
Switch-Seat Belt-Driver	Lt. Gray	Under Driver Seat at Retractor	N/S
Switch-Speed Control	Black	On Steering Wheel	N/S
Switch-Stop Lamp	Lt. Gray	At Base of Brake Pedal	N/S
Switch-Transfer Case (4WD)	Black	On Transmission	N/S
Throttle Body (Gas)	Black	On Engine	N/S
Transducer-A/C Pressure	Gray	On Engine	N/S
Wiring-Trailer Tow	Black	Center Rear	N/S

4-Way		Chassis	
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GROUNDS

Connector Name/Number	Location	Fig.
G100	On Battery Cable	N/S
G101	On Battery Cable	N/S
G102	Right Front Engine Compartment Near Headlamp Assembly	N/S
G103	Passenger Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
G104	On Engine Harness	N/S
G105	Passenger Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
G106 (ESP)	Driver Side Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
G107 (ESP)	Driver Side Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), RIGHT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
G200	Lower Driver Side Instrument Panel	LEFT KICK PANEL
G201	Passenger Side Instrument Panel	LOWER RIGHT INSTRUMENT PANEL
G202	Lower Driver Side Instrument Panel	LEFT KICK PANEL
G203	Passenger Side Instrument Panel	LOWER RIGHT INSTRUMENT PANEL
G300	Body Floor Between Front Seats	CENTER BODY
G301	Body Floor Below Right Front Seat	CENTER BODY

SPLICES

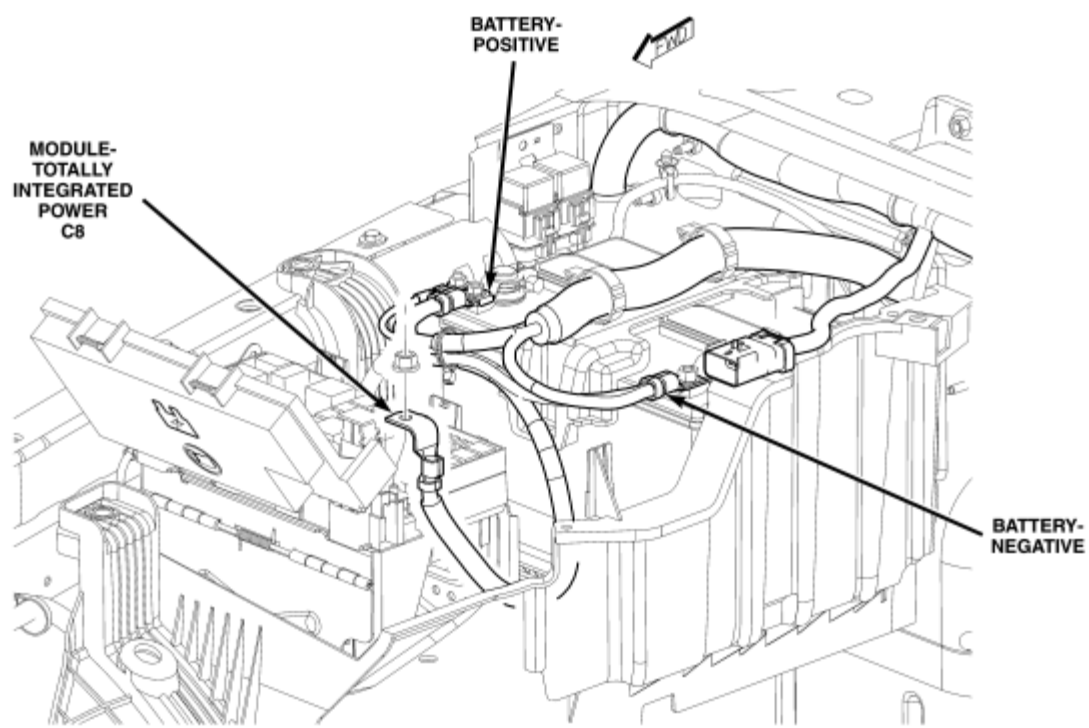
Splice Number	Location	Fig.
S102 (Gas)	On Engine	N/S
S110 (Diesel)	On Battery Cable	N/S
S111	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
S112	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), LEFT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
S113 (Export)	Front Engine Compartment Near Ambient Air Temp Sensor T/O	N/S
S116 (Except Export)	Front Engine Compartment Near Ambient Air Temp Sensor T/O	N/S
S117 (Except Export)	Right Front Engine Compartment Near Headlamp Assembly	N/S
S118 (Export)	Left Front Engine Compartment Near Headlamp Assembly	N/S
S120 (Gas)	Passenger Side Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS)
S121 (Gas)	On Engine	N/S
S122 (Gas)	On Engine	N/S
S123 (Diesel)	On Engine	N/S
S128	On Engine	N/S
S129 (Gas)	On Engine	N/S

S130 (Gas)	On Engine	N/S
S131 (Gas)	On Engine	N/S
S132 (Gas)	On Engine	N/S
S133 (Gas)	On Engine	N/S
S135 (Export)	Front Engine Compartment Near Ambient Air Temp Sensor T/O	N/S
S136	On Engine	N/S
S137	On Engine	N/S
S138	On Engine	N/S
S140	On Headlamp Harness	N/S
S143	On Engine	N/S
S144	On Engine Harness	N/S
S152 (Off-Road)	Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), LEFT ENGINE COMPARTMENT (LHD DIESEL)
S162 (Diesel)	On Engine	N/S
S163 (Diesel)	On Engine	N/S
S164	On Engine Harness	N/S
S165	On Engine Harness	N/S
S166	On Engine Harness	N/S
S169	Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS), LEFT ENGINE COMPARTMENT (RHD GAS), RIGHT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S171 (Diesel)	Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S172	Passenger Side Rear Engine	LEFT ENGINE COMPARTMENT (RHD DIESEL), RIGHT ENGINE COMPARTMENT (LHD

(Diesel)	Compartment	DIESEL
S174 (Diesel)	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S175 (Diesel)	Right Rear Engine Compartment	RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S176 (Diesel)	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , LEFT ENGINE COMPARTMENT (LHD DIESEL)
S178 (Diesel)	Rear Engine Compartment	LEFT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S179	Right Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , RIGHT ENGINE COMPARTMENT (RHD GAS) , RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S180	Right Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , RIGHT ENGINE COMPARTMENT (RHD GAS) , RIGHT ENGINE COMPARTMENT (RHD DIESEL) , RIGHT ENGINE COMPARTMENT (LHD DIESEL)
S181	Right Side Engine Compartment	RIGHT ENGINE COMPARTMENT (LHD GAS) , RIGHT ENGINE COMPARTMENT (RHD GAS) , LEFT ENGINE COMPARTMENT (RHD DIESEL) , LEFT ENGINE COMPARTMENT (LHD DIESEL)
S221	Lower Driver Side Instrument Panel Near Stop Lamp Switch T/O	N/S
S222	Rear Engine Compartment Near Grommet to IP	N/S
S223	Lower Driver Side Instrument Panel Near Stop Lamp Switch T/O	N/S
S224	Rear Engine Compartment Near Grommet to IP	N/S
S233	Driver Side Instrument Panel Near Cluster T/Os	N/S
S234	Passenger Side Instrument Panel Near Blower T/O	N/S
S237	Steering Column Near Ignition Switch T/O	N/S
S238	Steering Column Near Ignition Switch T/O	N/S
S242	Driver Side Instrument Panel Near Cluster T/Os	N/S

S243	Center Instrument Panel Near Center Stack T/O	N/S
S244	Center Instrument Panel Near Center Stack T/O	N/S
S245	Right Instrument Panel Near Tweeter T/O	N/S
S246	Driver Side Instrument Panel Near Cluster T/Os	N/S
S251	Rear Engine Compartment Near Grommet to IP	N/S
S253	Passenger Side Instrument Panel Near Blower T/O	N/S
S273	Passenger Side Instrument Panel Near Speaker T/O	N/S
S274	Passenger Side Instrument Panel Near Blower T/O	N/S
S290 (RHD)	Driver Side Front of Shifter	N/S
S291	Driver Side Front of Shifter	N/S
S292	Driver Side Front of Shifter	N/S
S295	Passenger Side Instrument Panel Near Window Switch T/O	N/S
S296	Passenger Side Instrument Panel Near Speaker T/O	N/S
S297	Rear Engine Compartment Near Grommet to IP	N/S
S298	Instrument Panel	N/S
S301	Rear Fascia Near License Lamp T/O	N/S
S302	Rear Fascia Near C301 T/O	N/S
S307(Gas Off- Road)	Right Front Chassis Harness Near Wheel Speed Sensor T/O	N/S

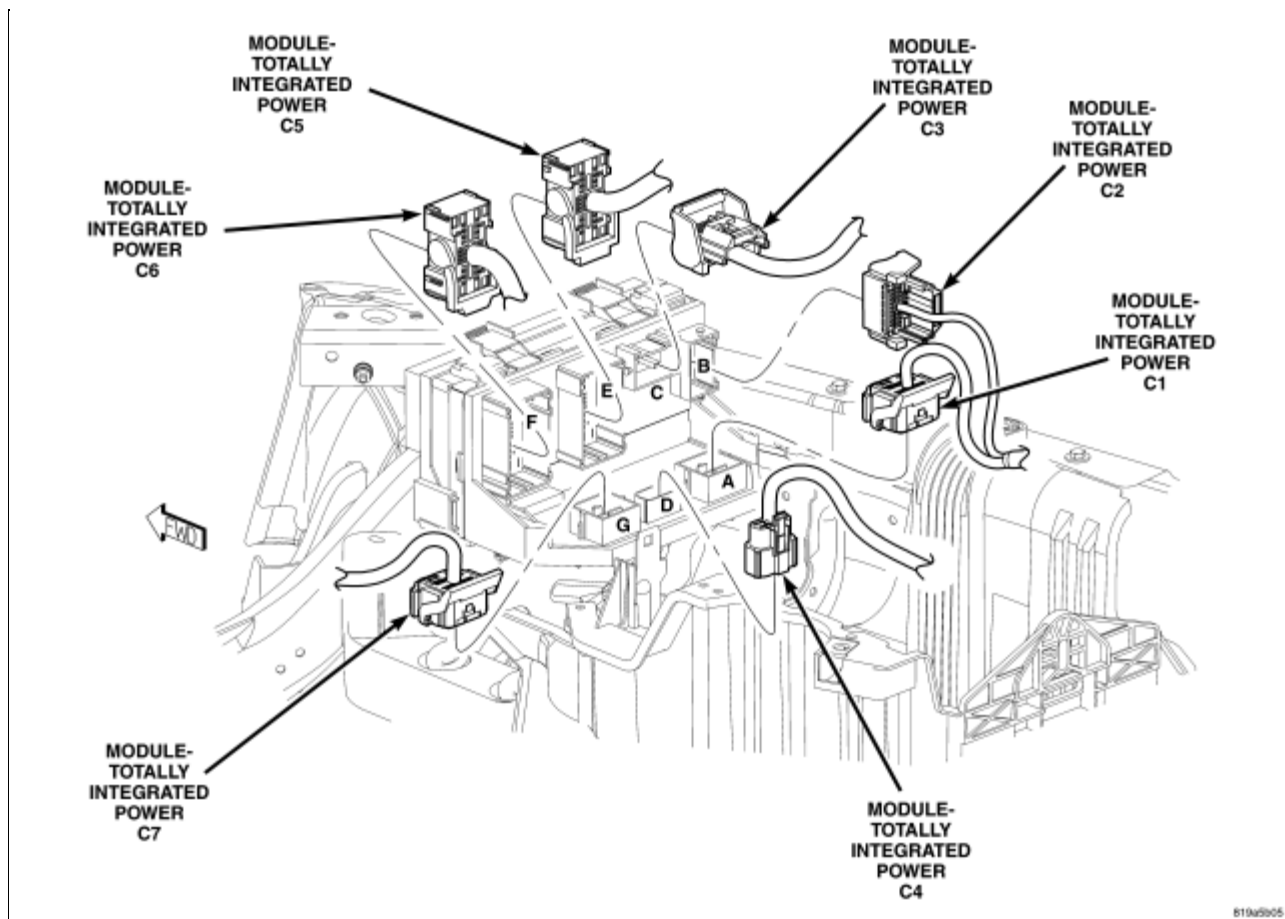
S308	Right Front Chassis Harness Near Wheel Speed Sensor T/O	N/S
S309	On Chassis Harness	N/S
S310	On Chassis Harness	N/S
S311	On Chassis Harness	N/S
S312	On Chassis Harness	N/S
S330	Body Floor Under Right Seat	CENTER BODY
S331	Body Floor Under Left Seat	CENTER BODY
S332	Body Floor Under Right Seat	CENTER BODY
S333	Body Floor Under Right Seat	CENTER BODY
S334	Body Floor Under Left Seat	CENTER BODY
S335	Right Rear Body	REAR BODY AND SWINGGATE
S353	Near Rear Power Window Switch	N/S
S371 (Trailer Tow)	Trailer Tow Jumper Near C311 T/O	N/S
S372 (Trailer Tow))	Trailer Tow Jumper Near C311 T/O	N/S
S373 (Trailer Tow)	Trailer Tow Jumper Near C311 T/O	N/S



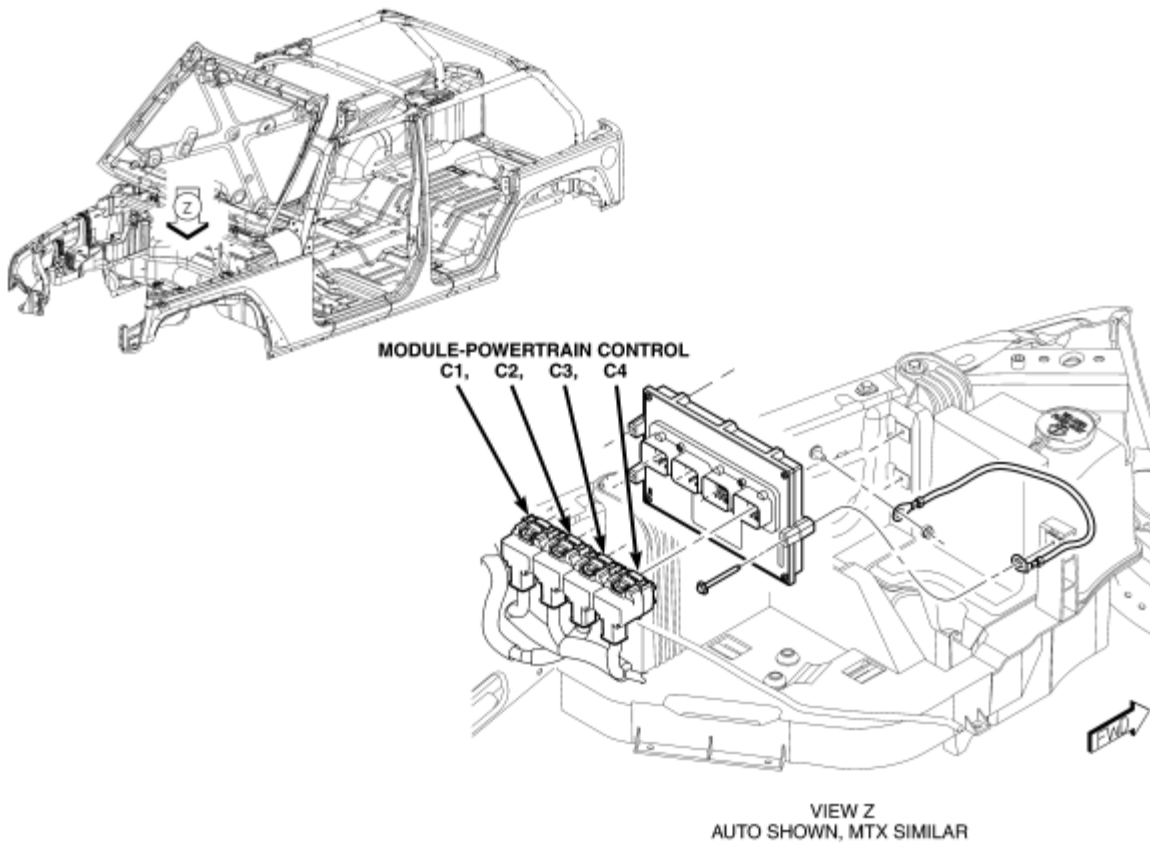
LHD SHOWN, RHD SIMILAR

819650/1

PASSENGER SIDE ENGINE COMPARTMENT

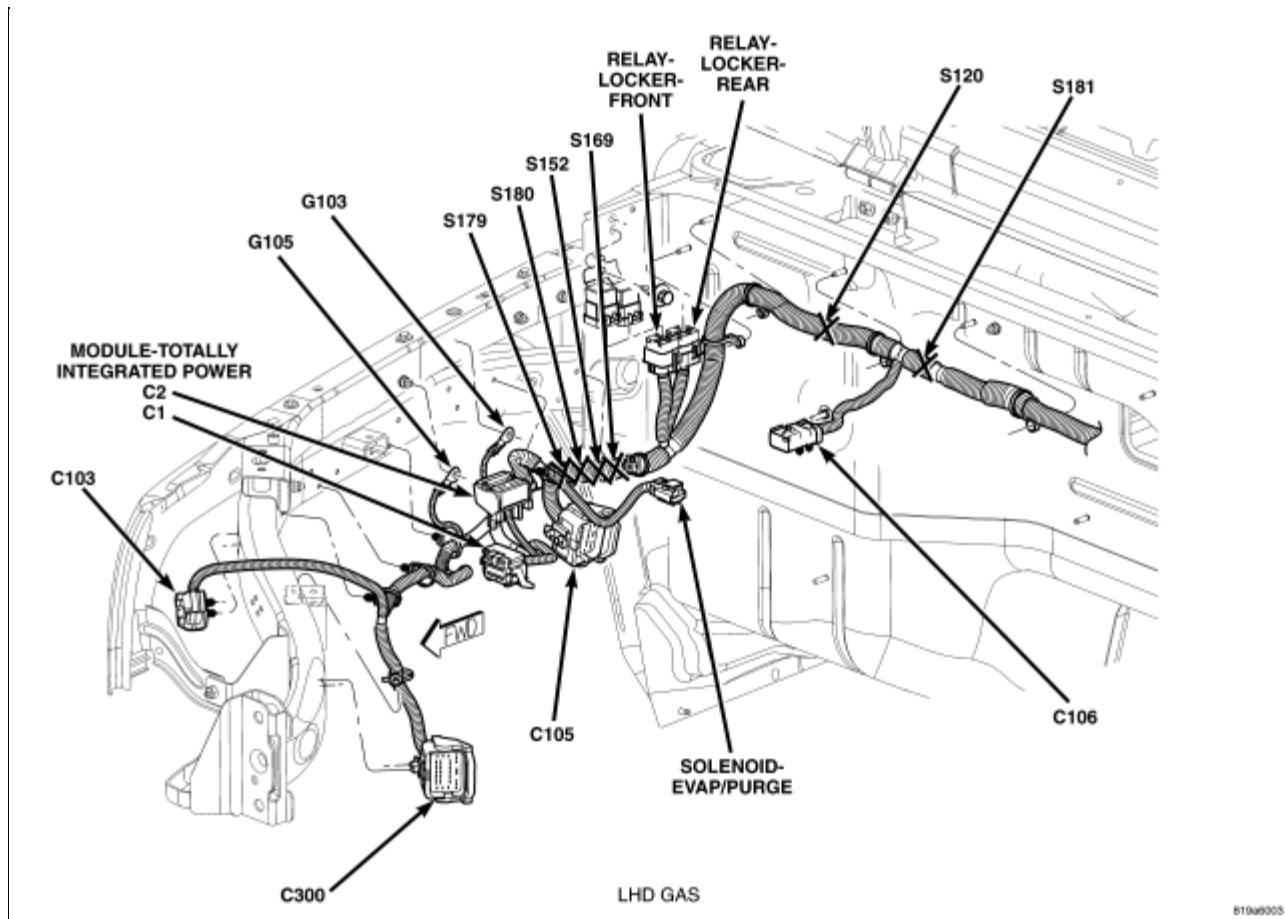


TOTALLY INTEGRATED POWER MODULE

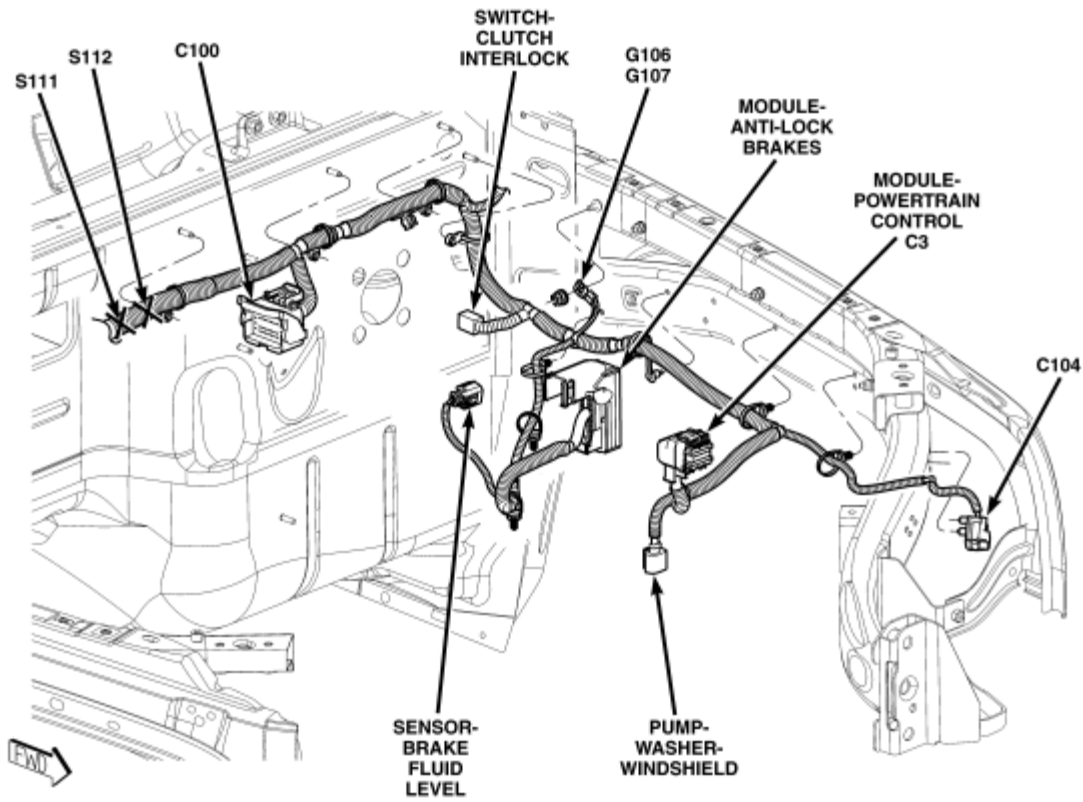


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POWERTRAIN CONTROL MODULE

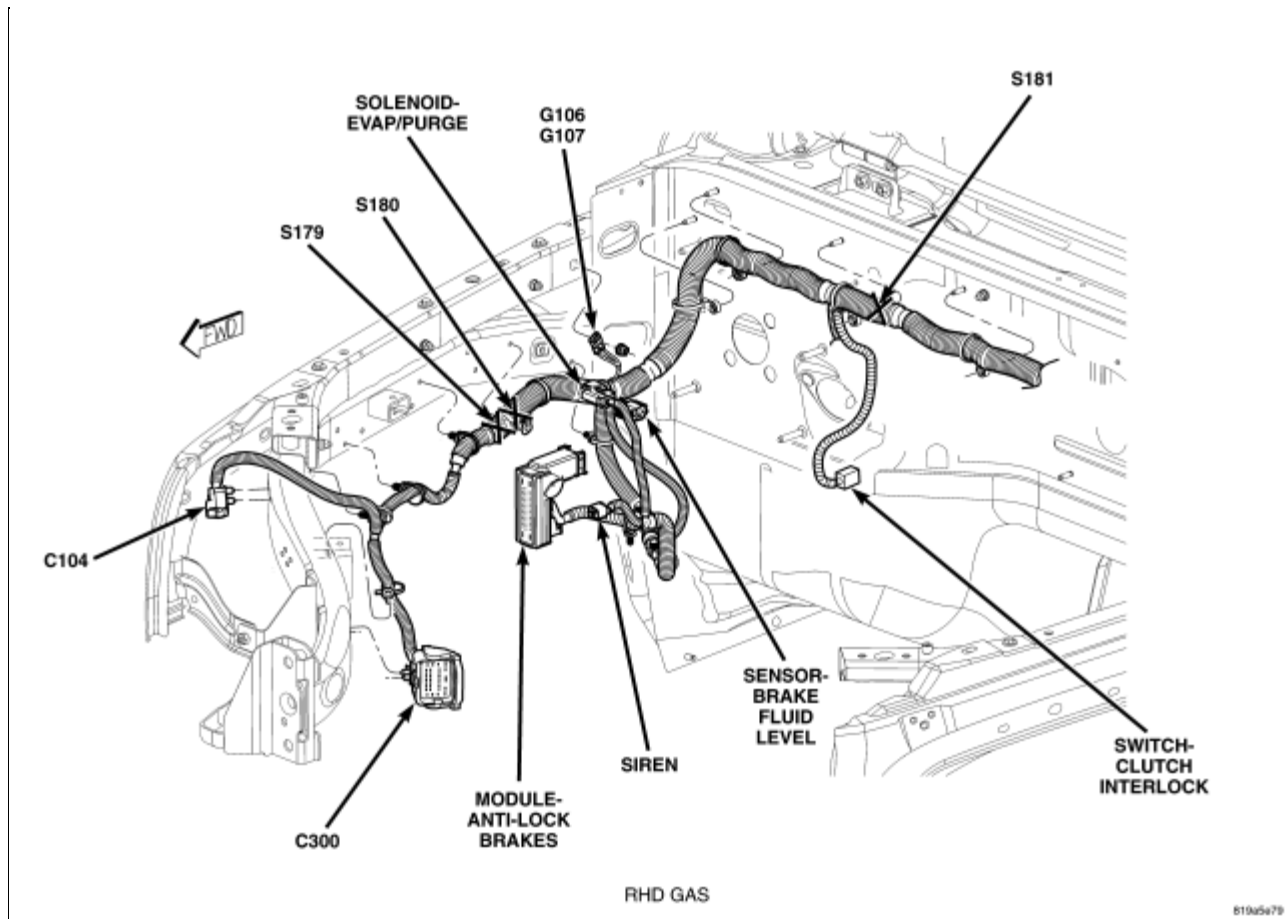


RIGHT ENGINE COMPARTMENT (LHD GAS)

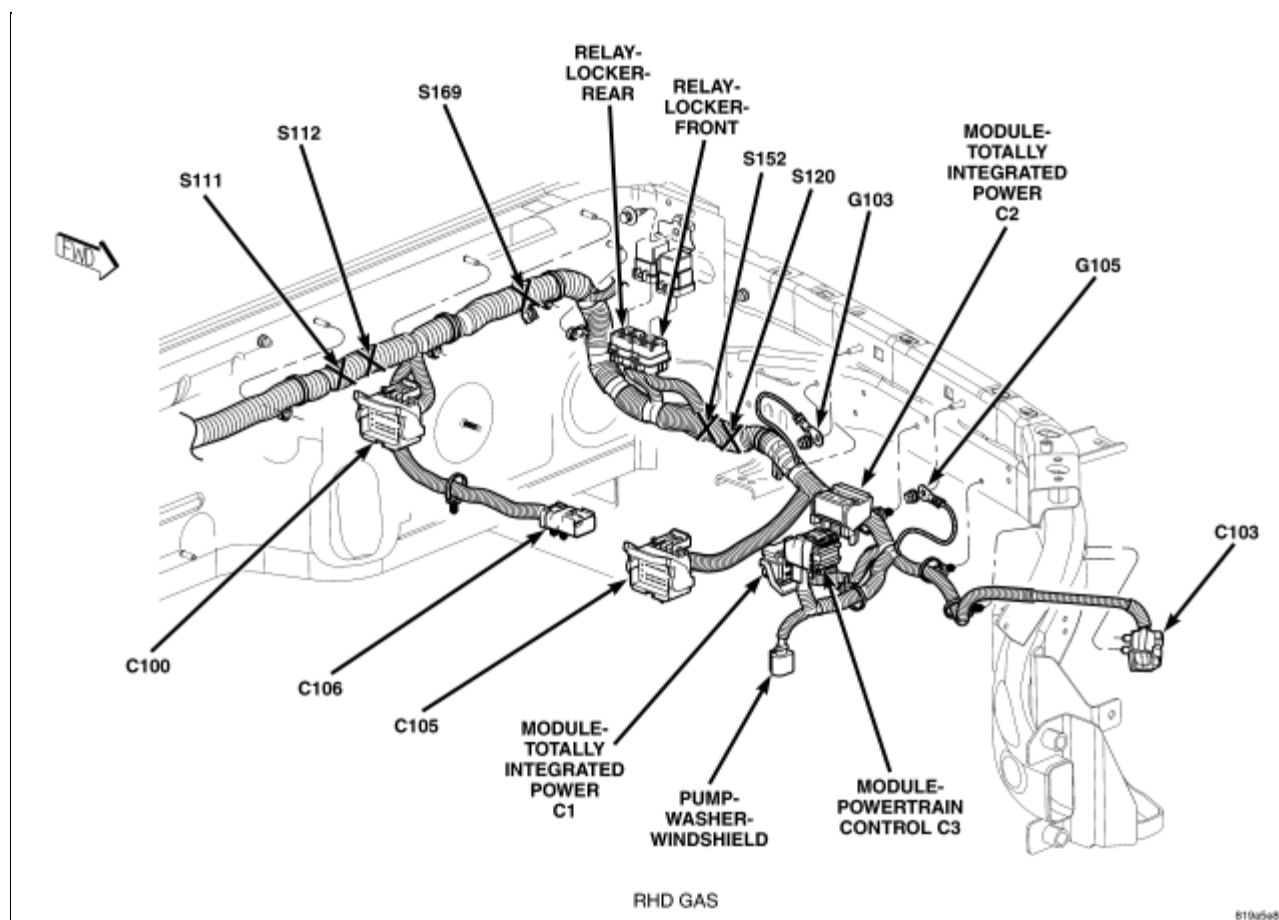


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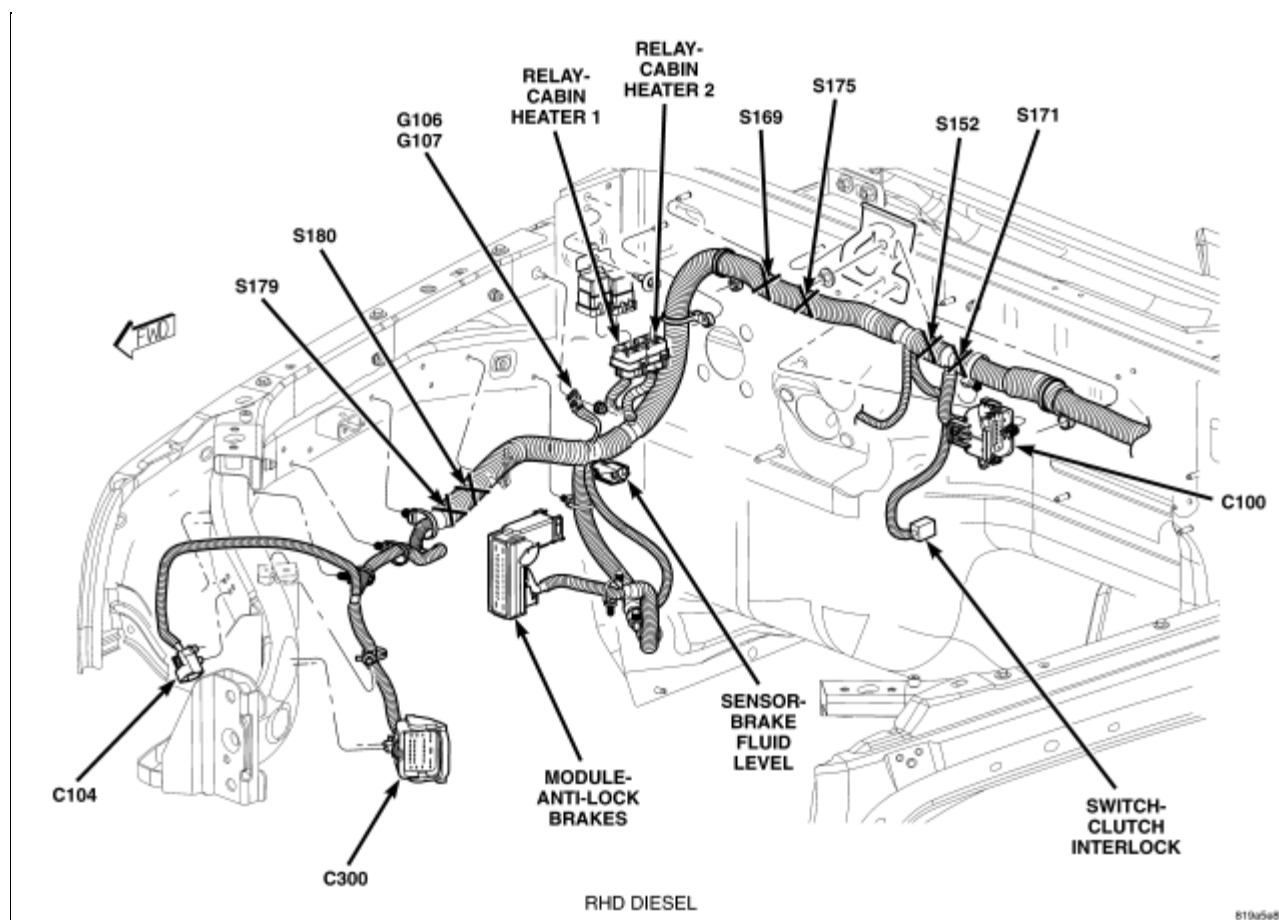
LEFT ENGINE COMPARTMENT (LHD GAS)



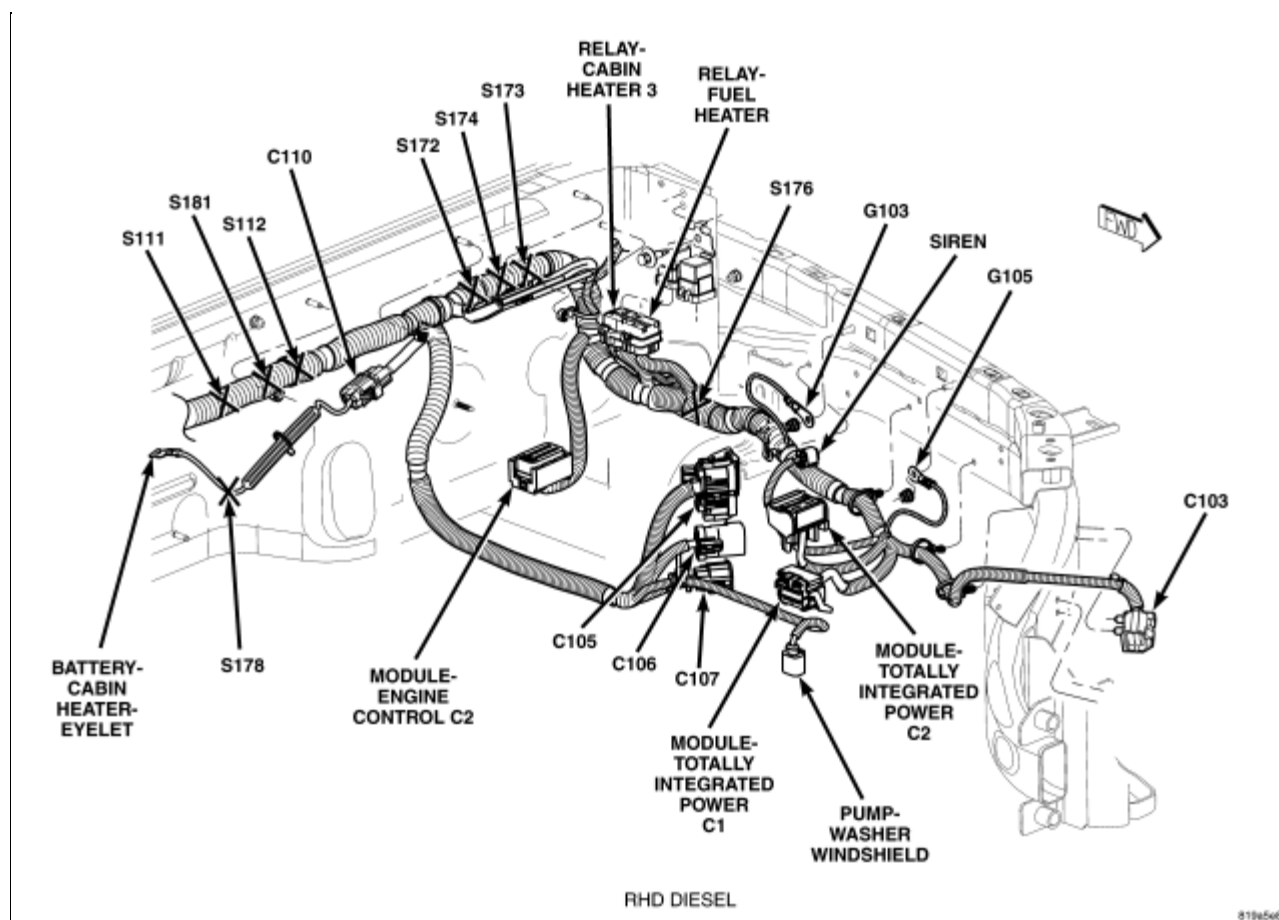
RIGHT ENGINE COMPARTMENT (RHD GAS)



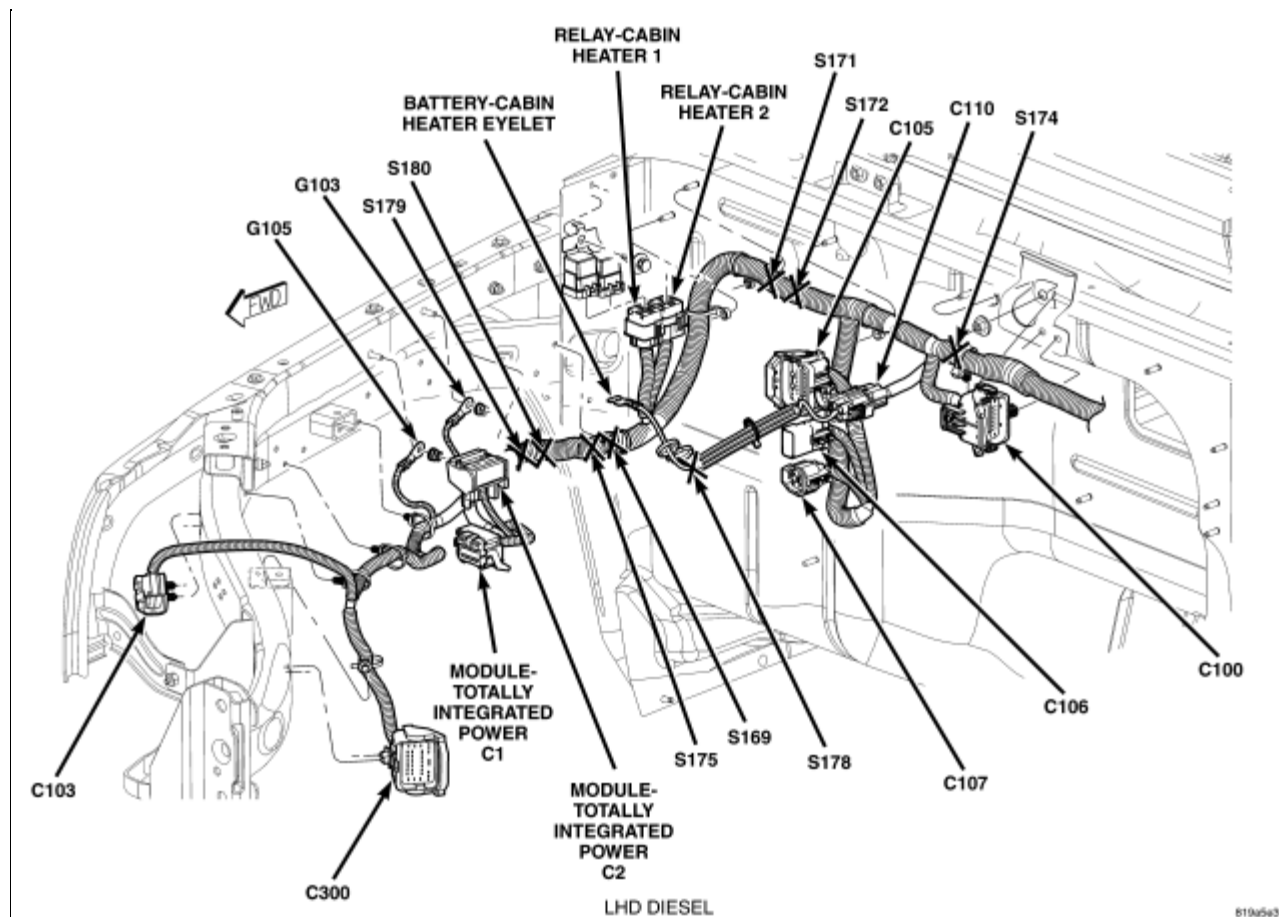
LEFT ENGINE COMPARTMENT (RHD GAS)



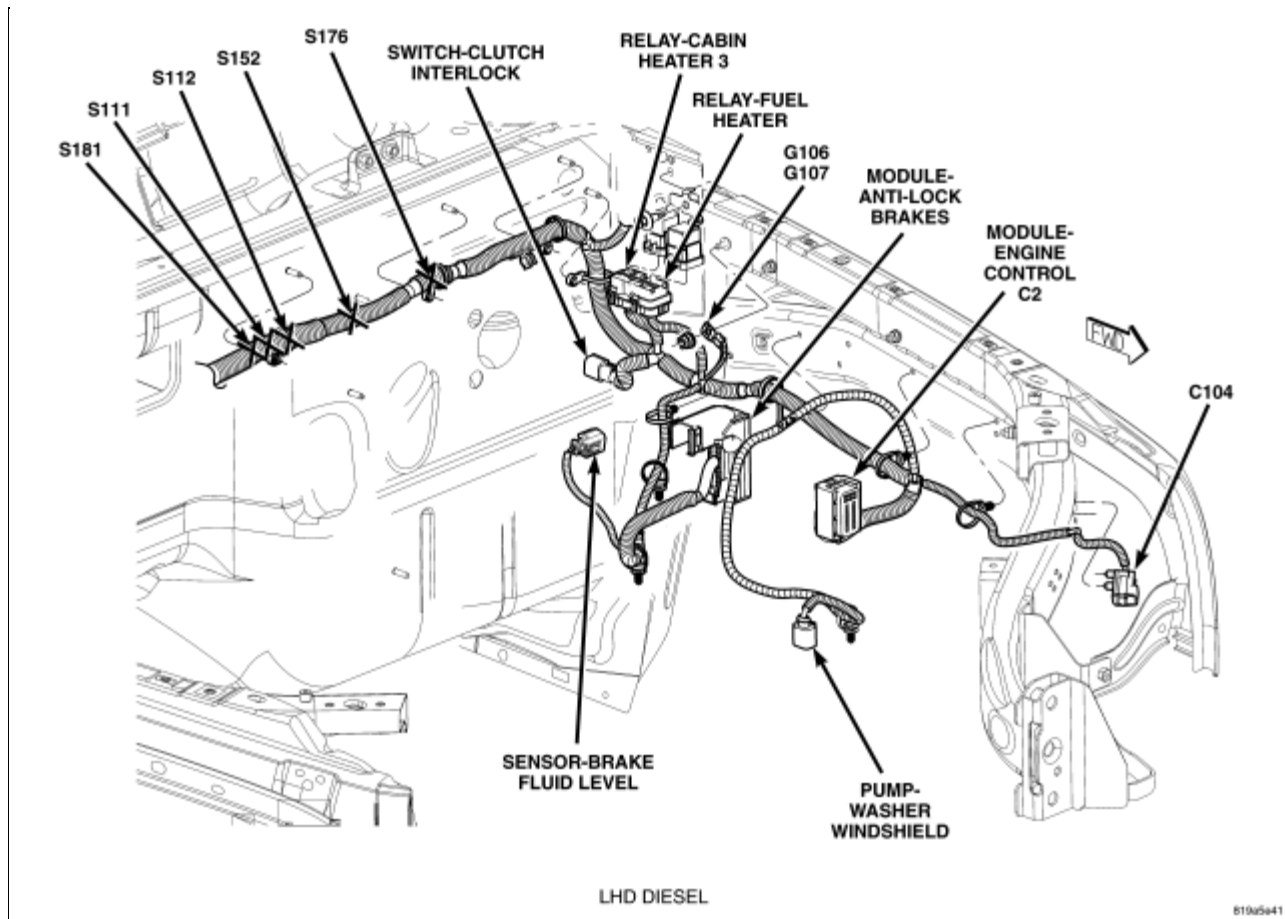
RIGHT ENGINE COMPARTMENT (RHD DIESEL)



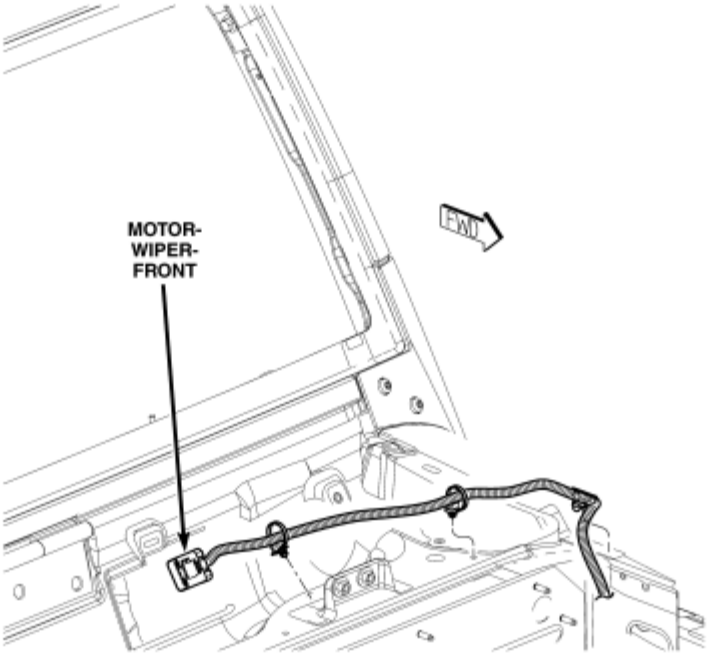
LEFT ENGINE COMPARTMENT (RHD DIESEL)



RIGHT ENGINE COMPARTMENT (LHD DIESEL)

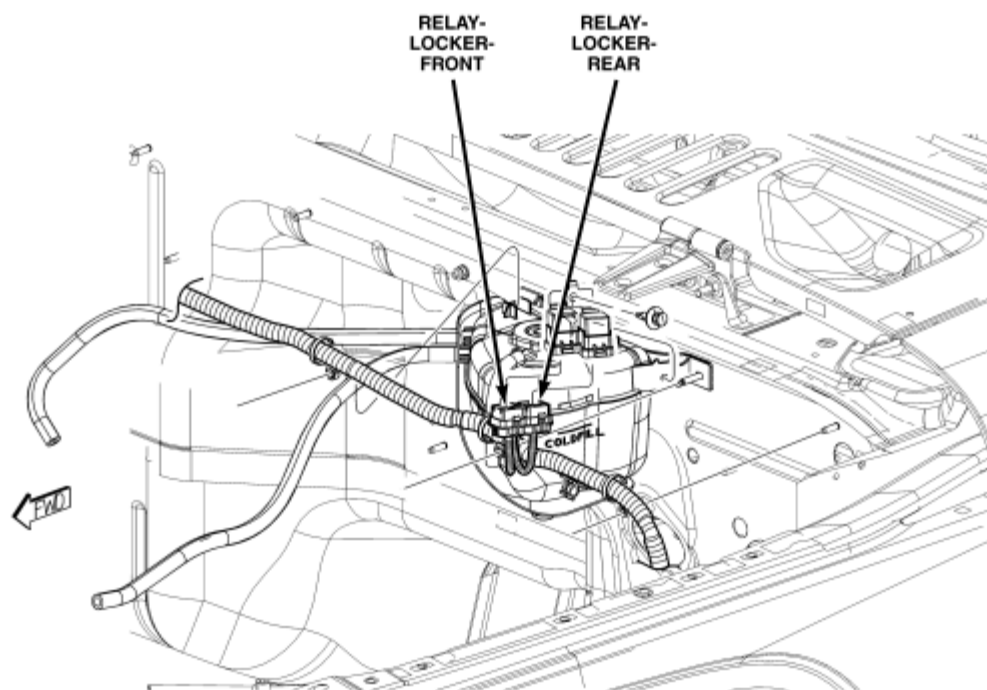


LEFT ENGINE COMPARTMENT (LHD DIESEL)



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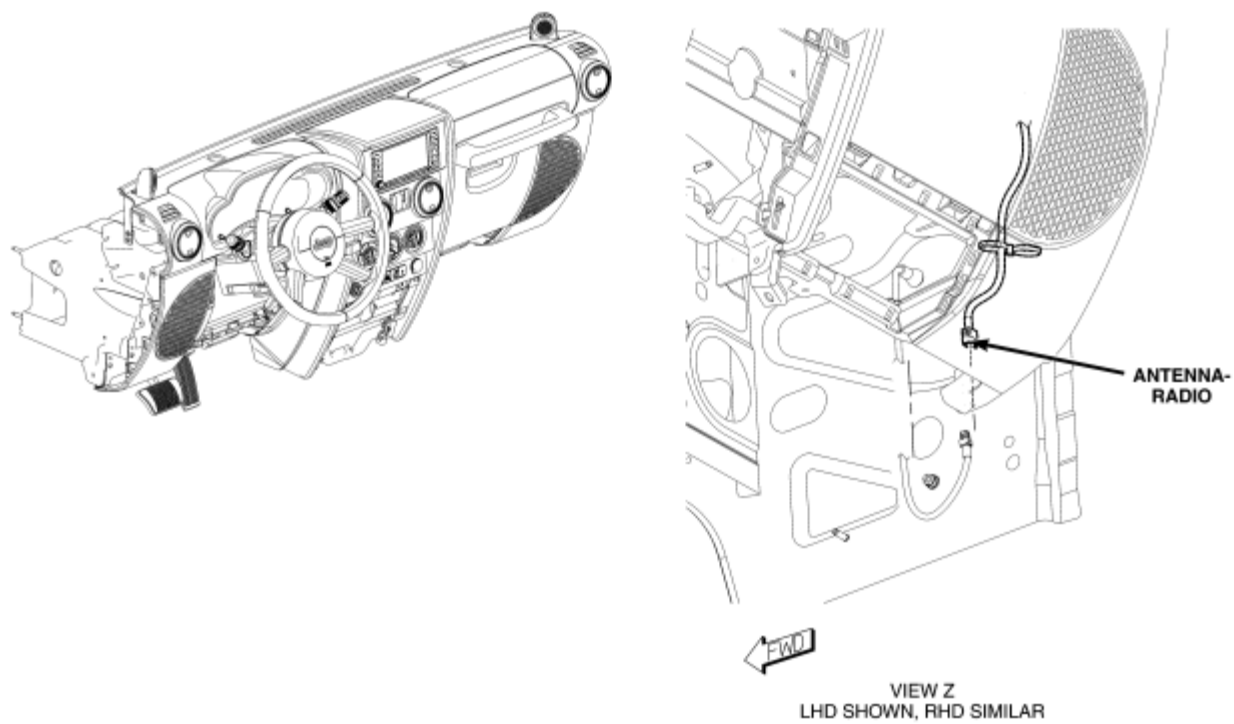
REAR ENGINE COMPARTMENT



LHD DIESEL

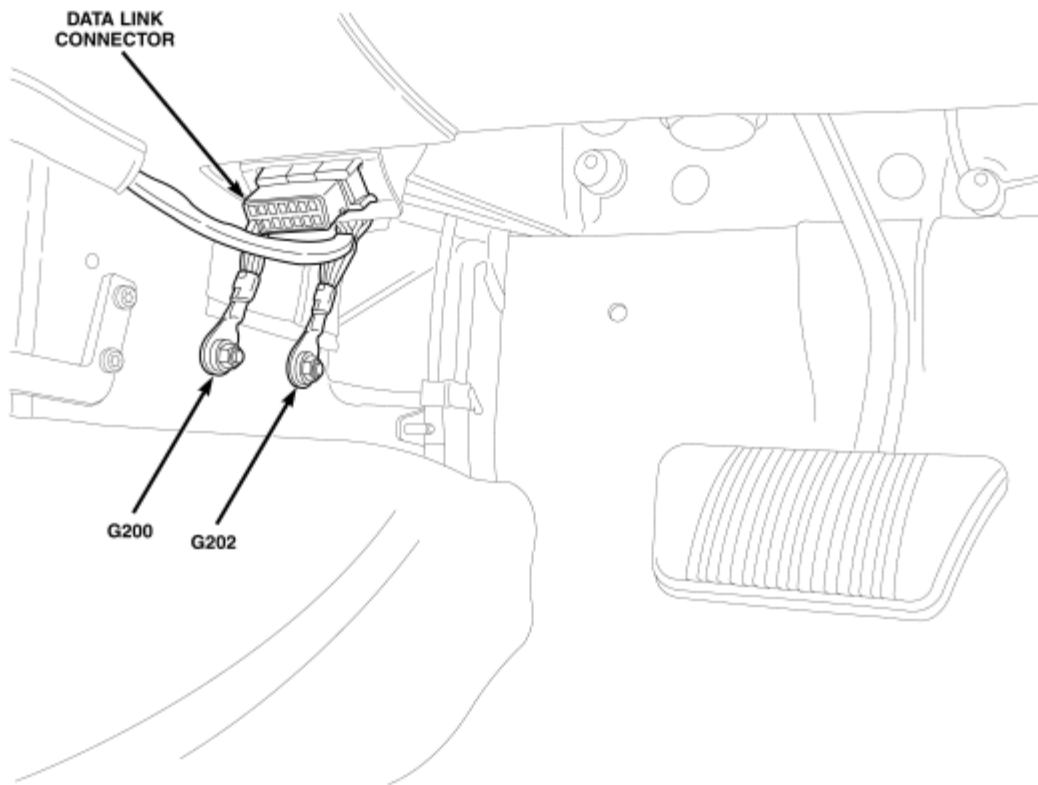
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LEFT REAR ENGINE COMPARTMENT (LHD DIESEL)



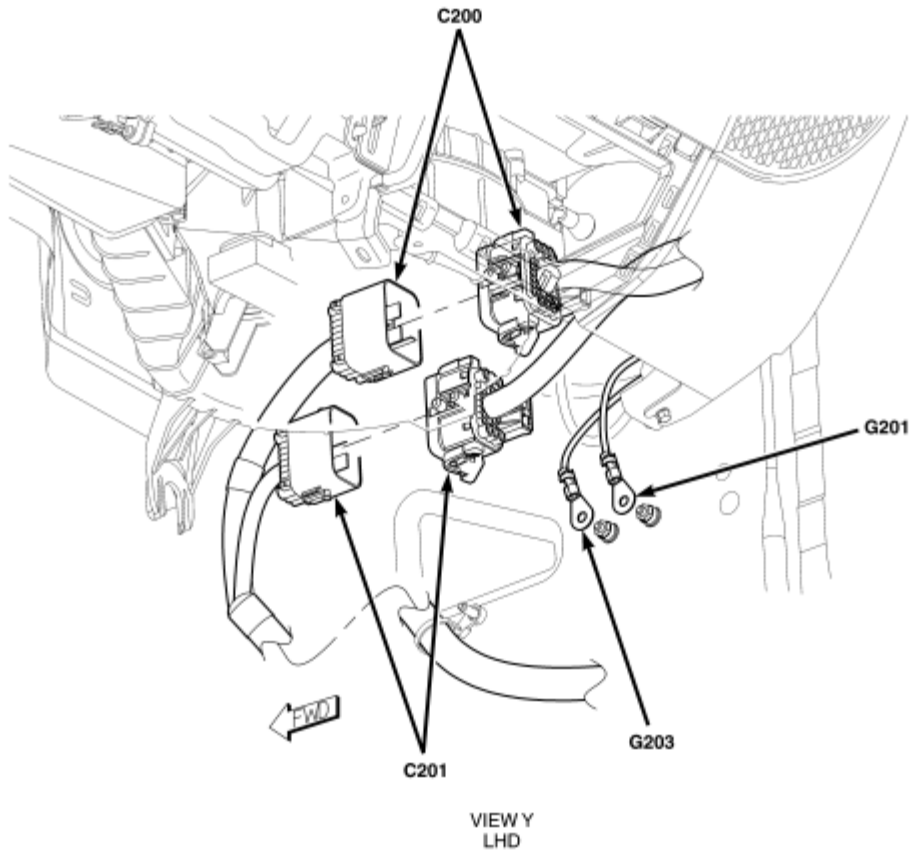
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RIGHT SIDE INSTRUMENT PANEL



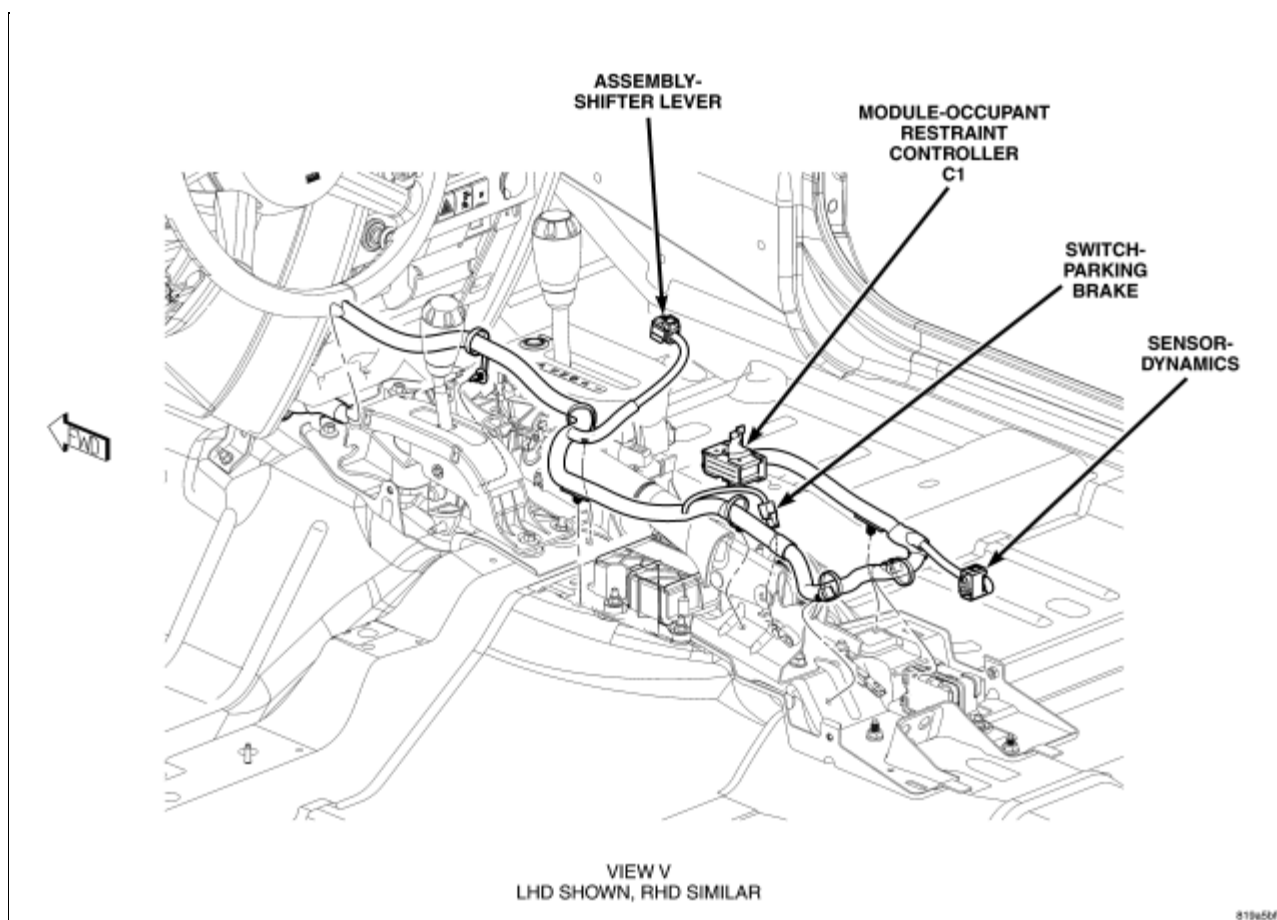
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LEFT KICK PANEL

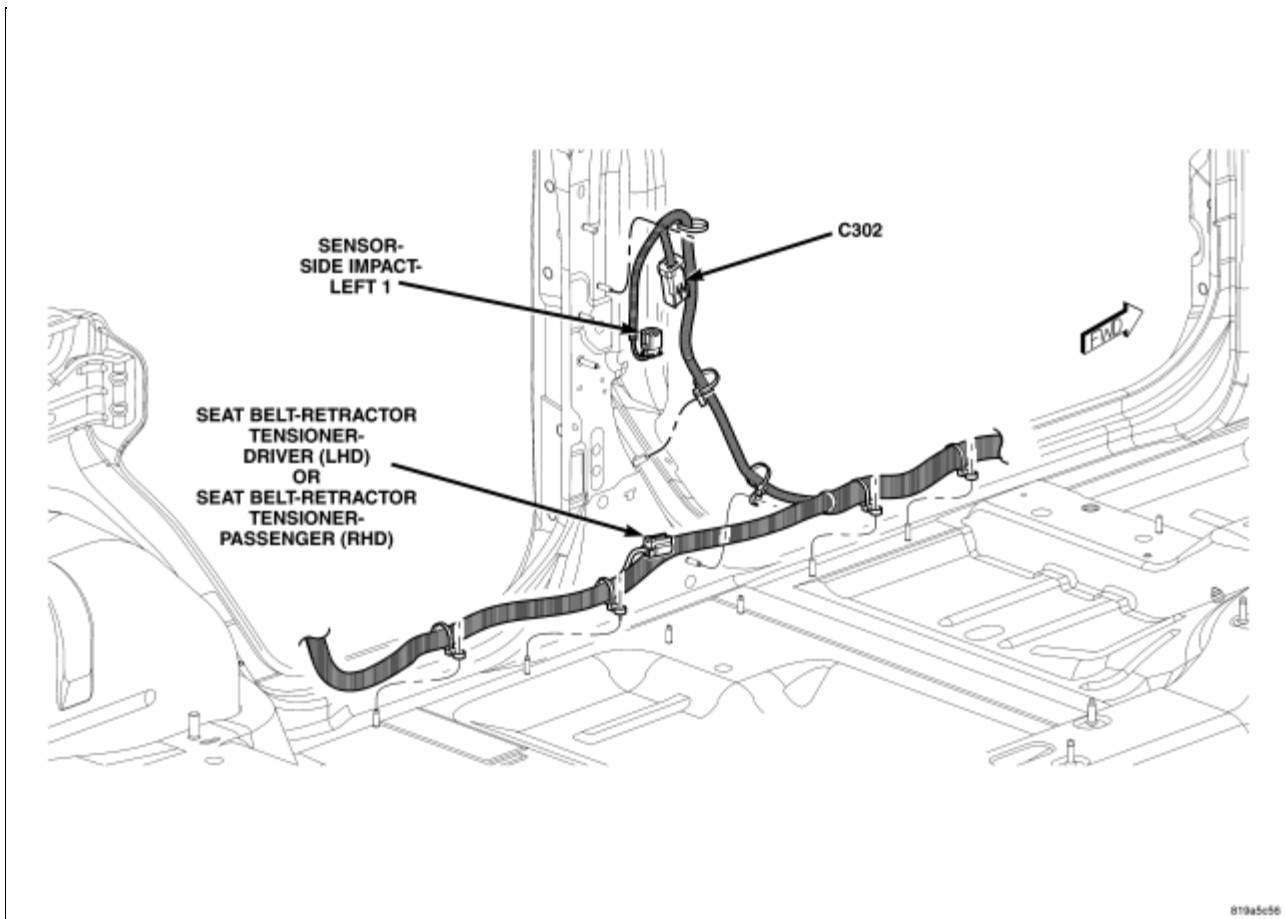


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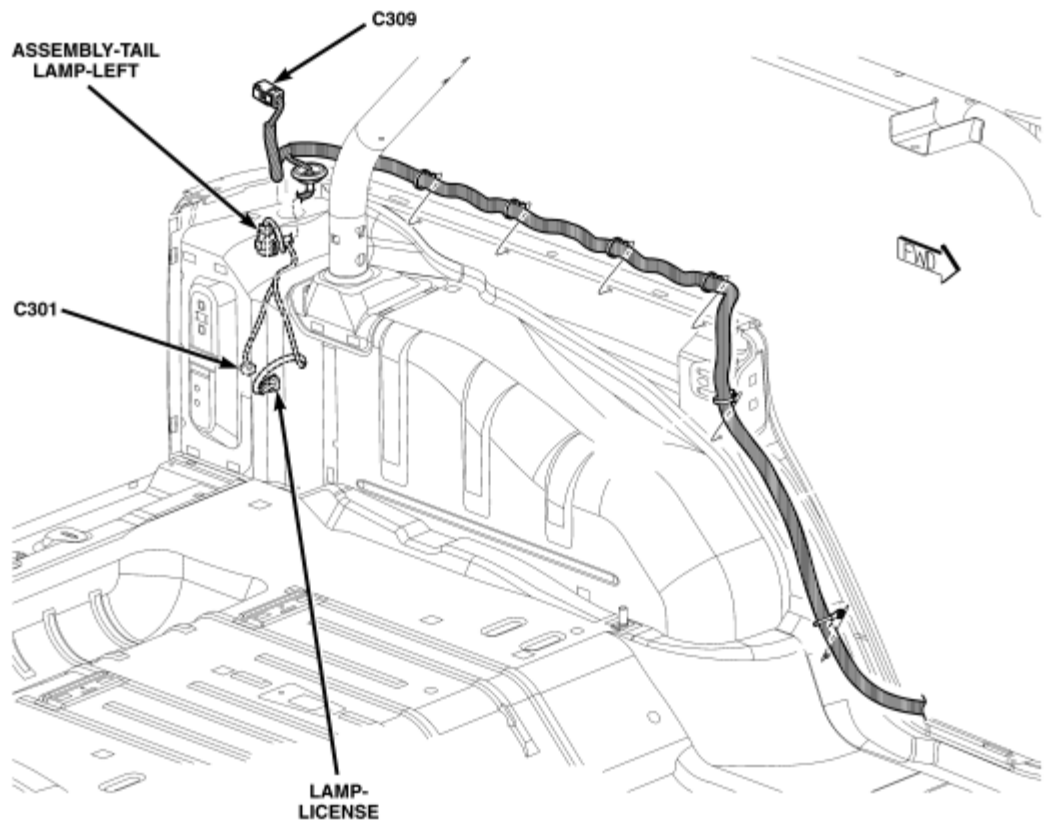
LOWER RIGHT INSTRUMENT PANEL



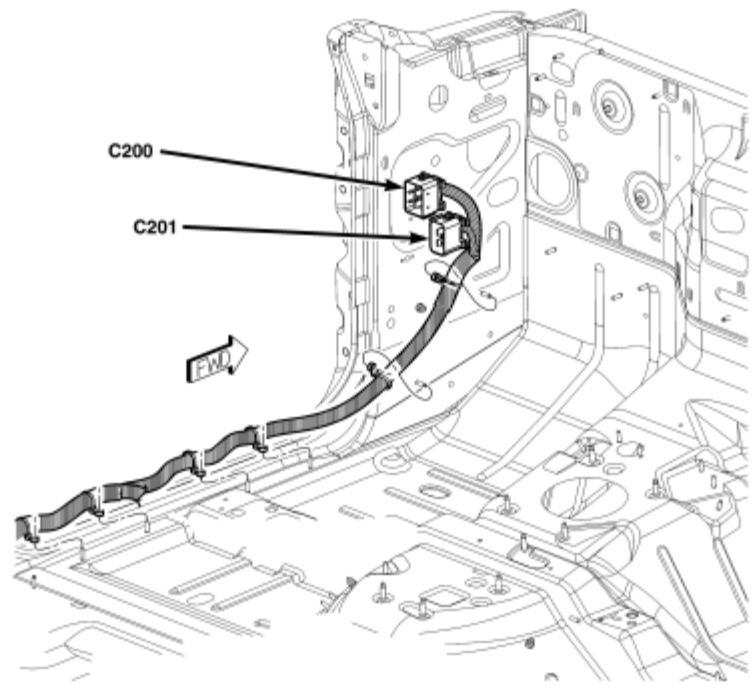
FRONT CENTER BODY



LEFT BODY

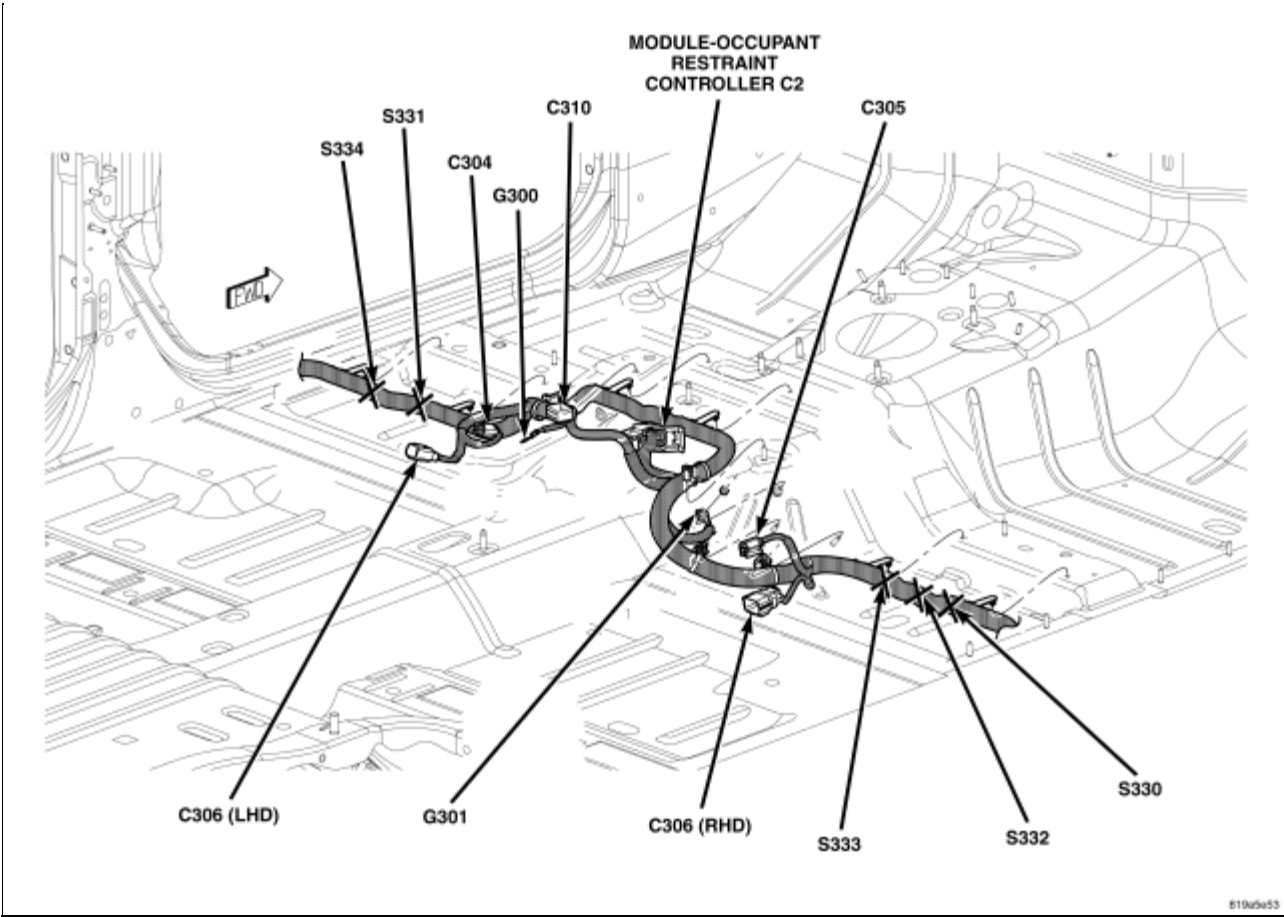


LEFT REAR BODY (4 DOOR)

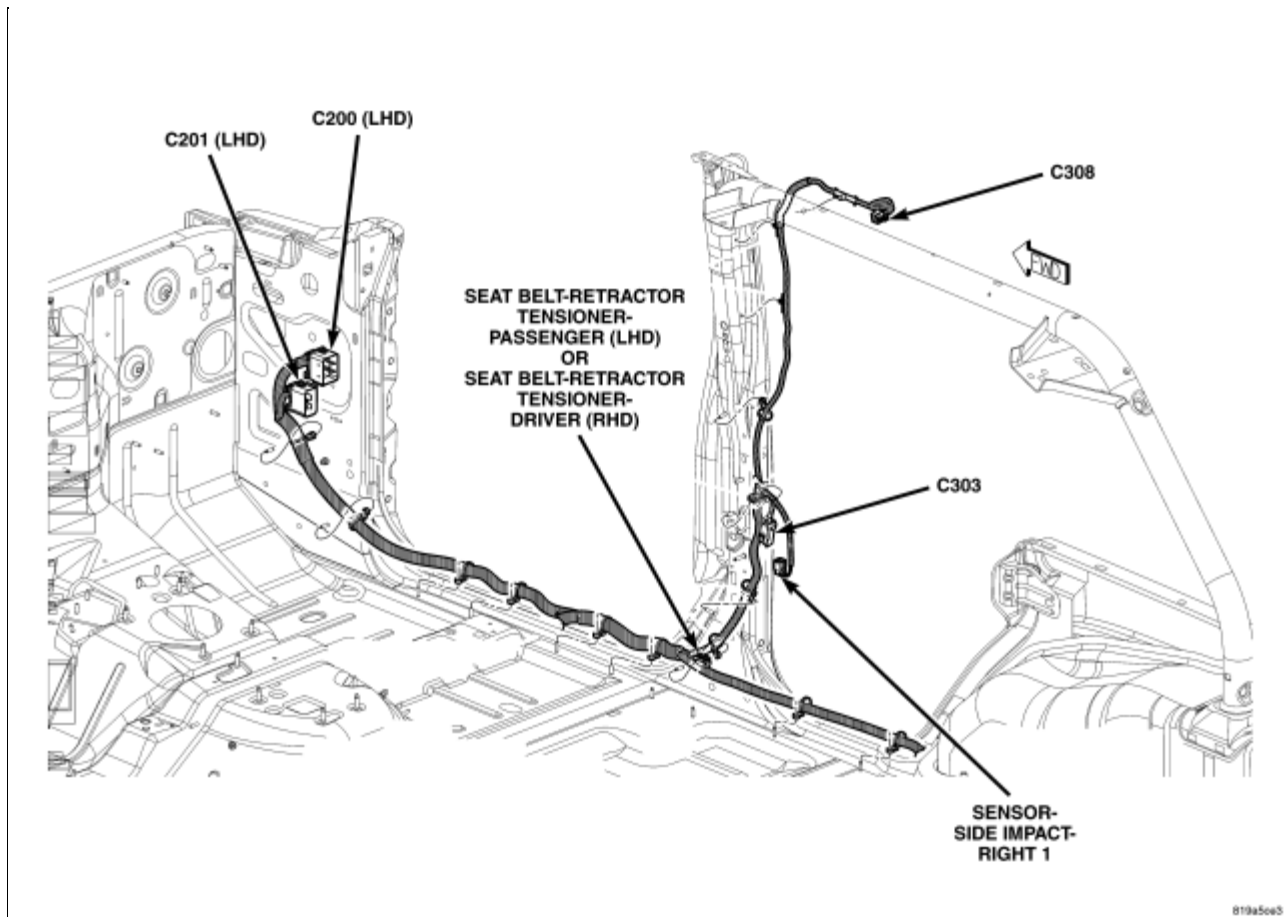


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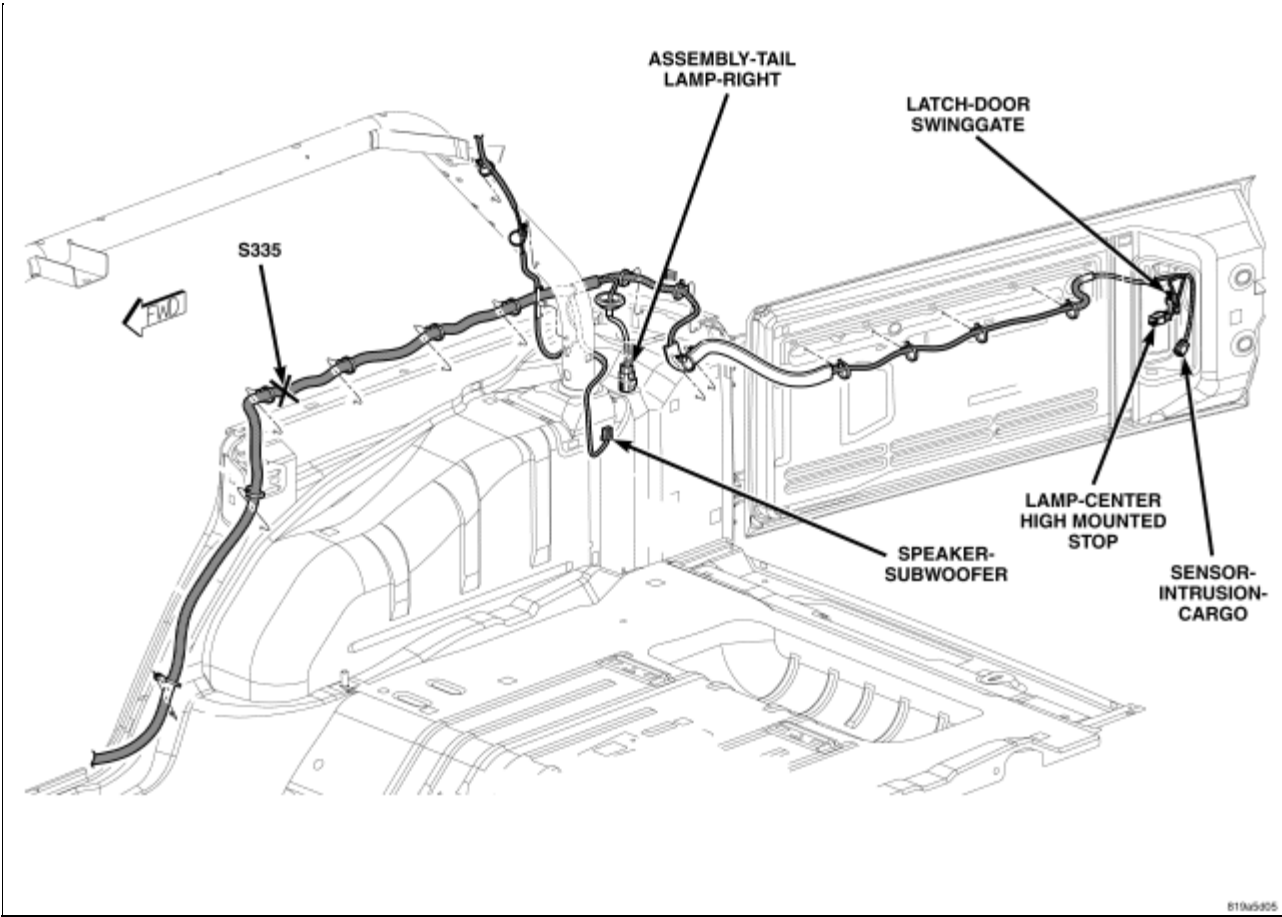
LEFT FRONT BODY (RHD)



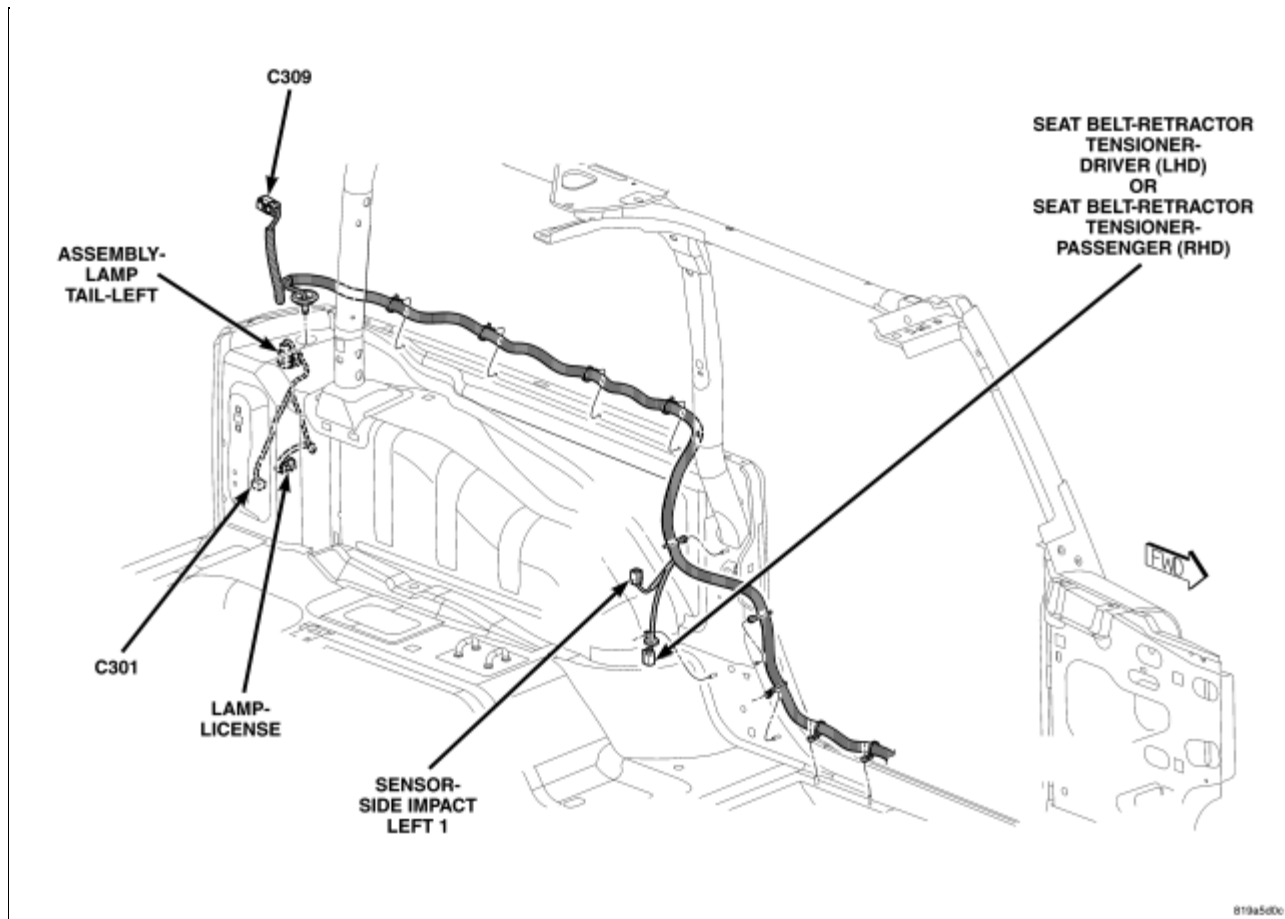
CENTER BODY



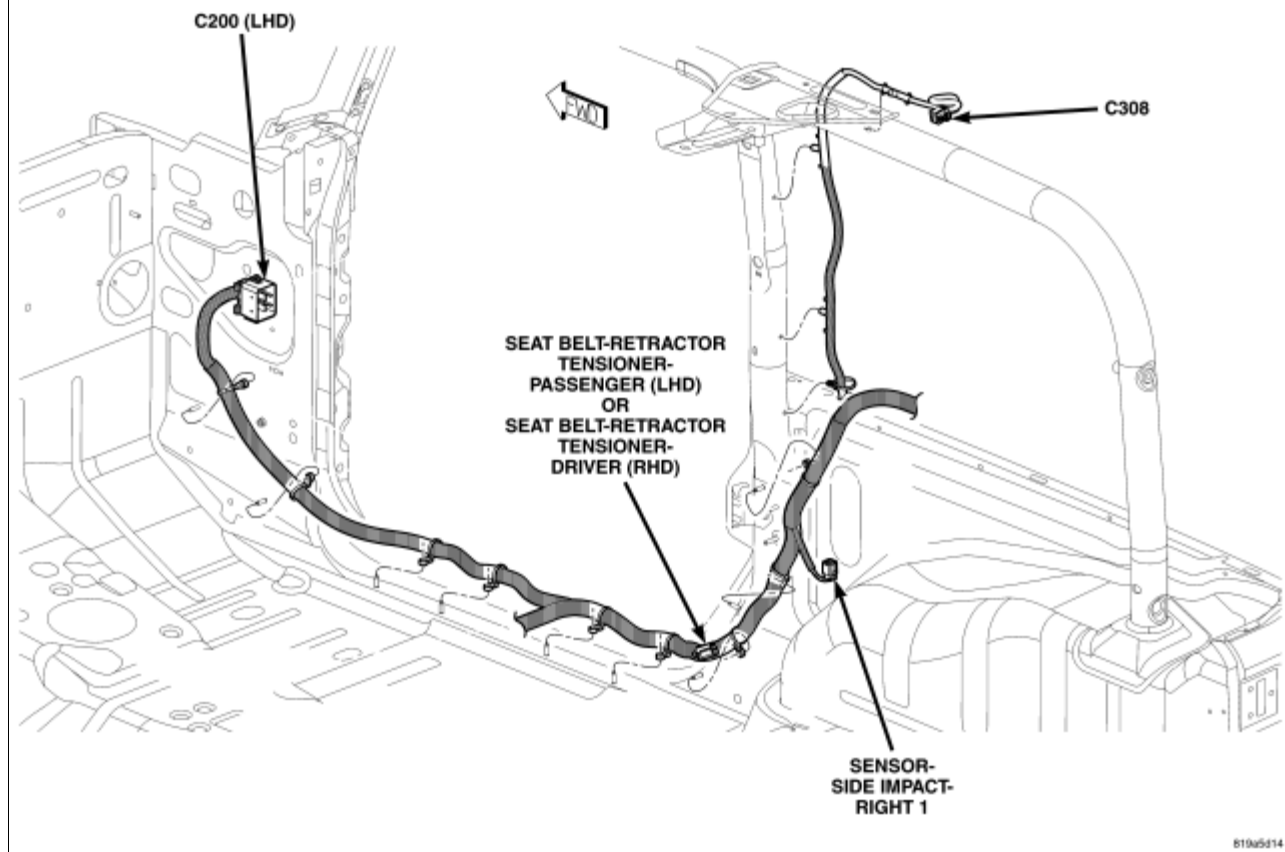
RIGHT BODY (4 DOOR)



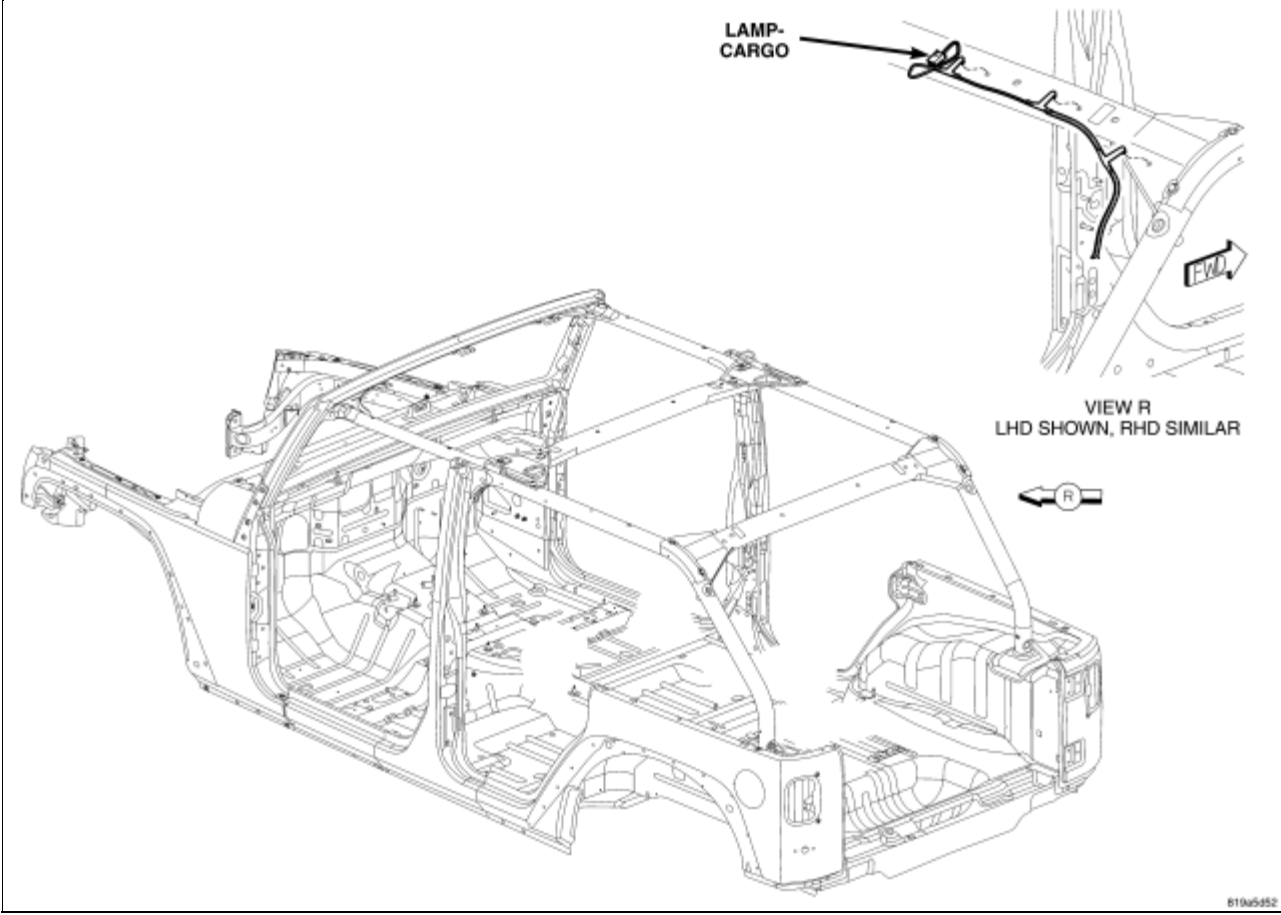
REAR BODY AND SWINGGATE



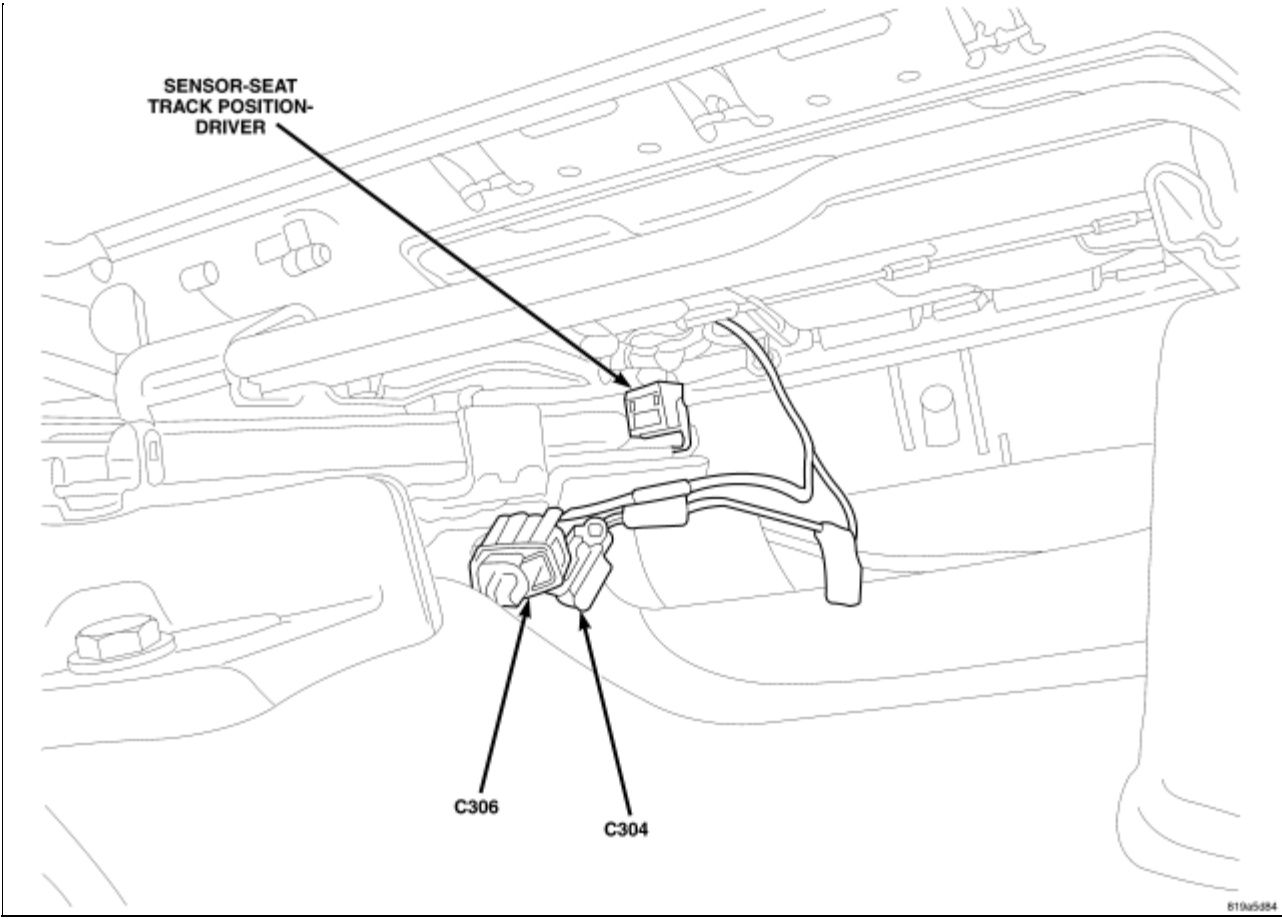
LEFT REAR BODY (2 DOOR)



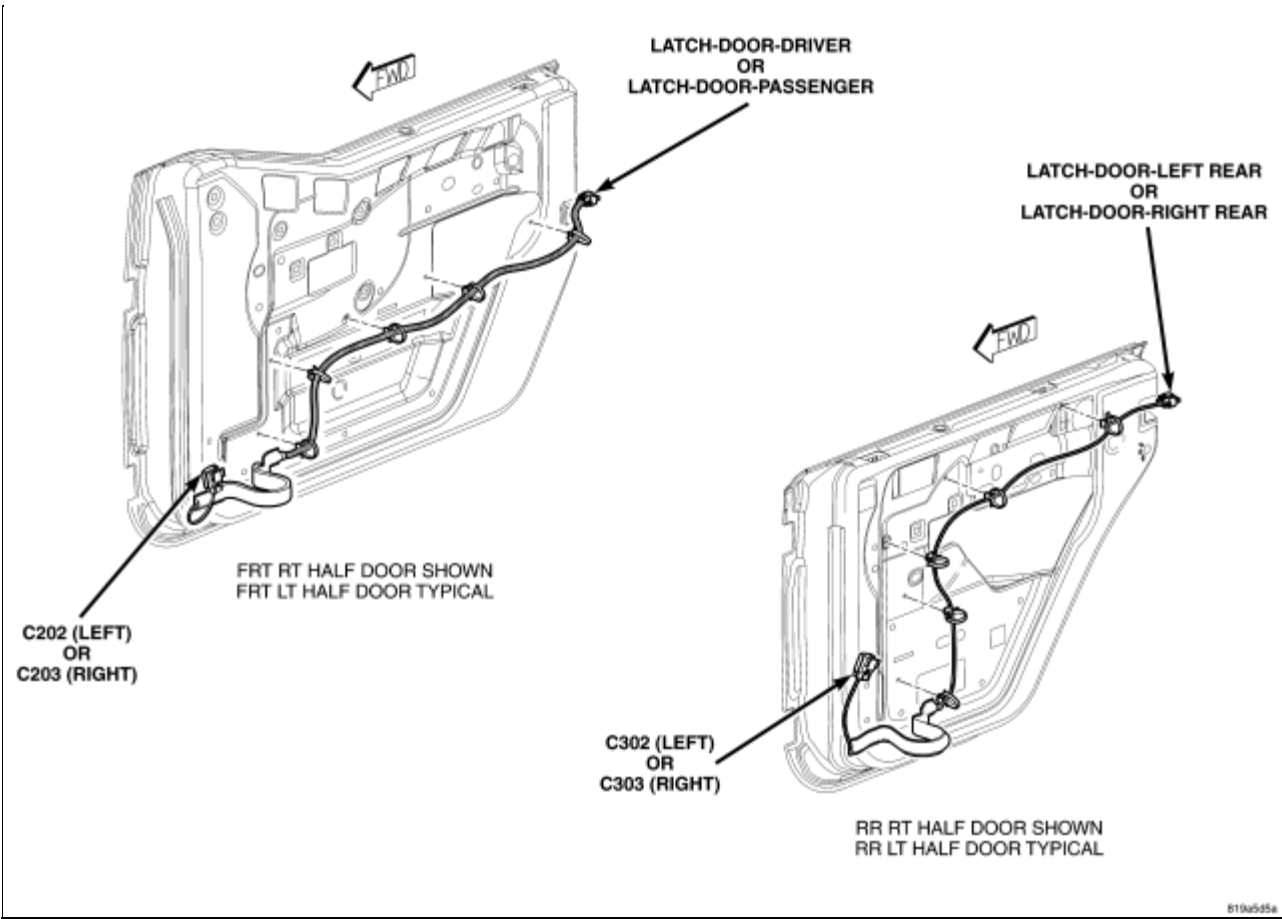
RIGHT BODY (2 DOOR)



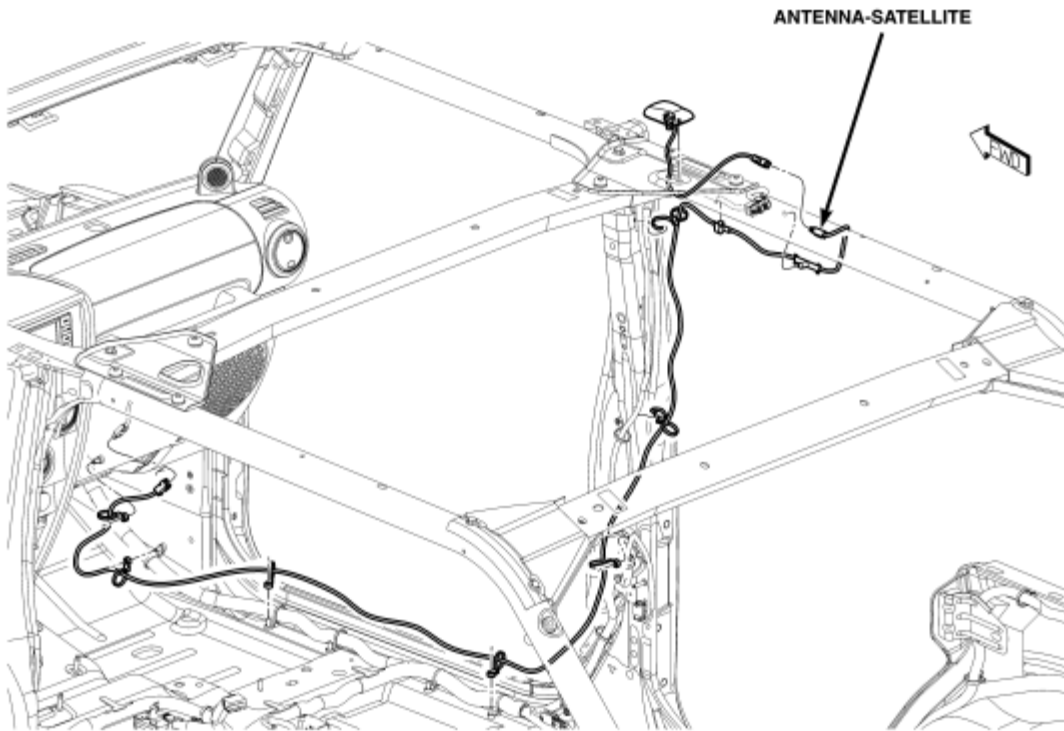
TOP REAR BODY



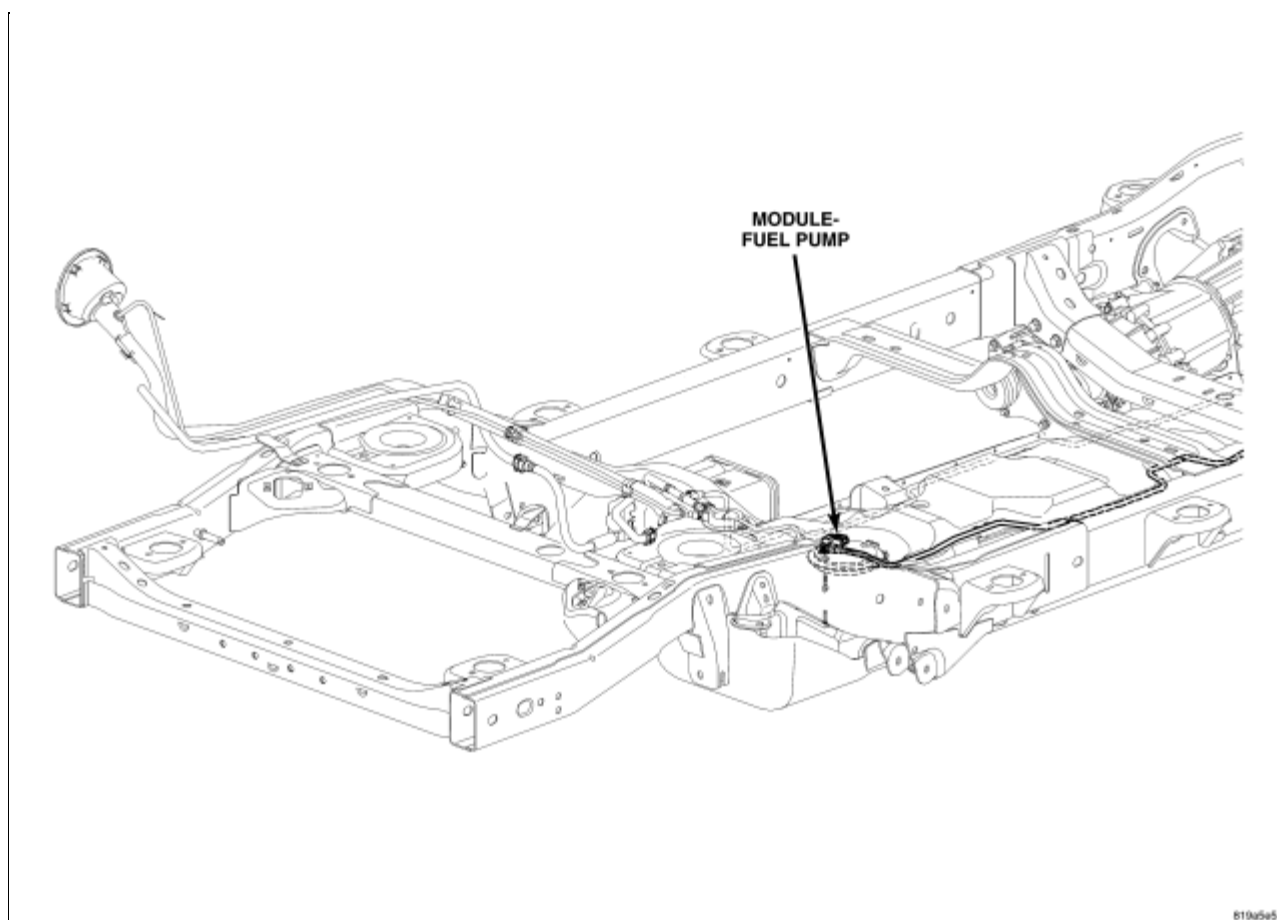
DRIVER SEAT TRACK



DOORS



ROOF



FUEL PUMP MODULE

POWER DISTRIBUTION - SERVICE INFORMATION

POWER DISTRIBUTION - SERVICE INFORMATION

DESCRIPTION

The power distribution system for this vehicle consists of the Totally Integrated Power Module (TIPM) and related fuses, relays and wiring connectors.

OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, centralized, and convenient to access, distribution of the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, comfort and convenience systems. At the same time, these systems were designed to provide centralized locations for conducting diagnosis of faulty circuits, and for sourcing the additional current requirements of many aftermarket vehicle accessory and convenience items.

These power distribution systems also incorporate various types of circuit control and protection features, including fuses and relays.

CIGAR LIGHTER/POWER OUTLET

DESCRIPTION

INSTRUMENT PANEL MOUNTED

An instrument panel mounted cigar lighter/power outlet receptacle is optional equipment on this model. On models equipped with the optional Smoker's Package, the cigar lighter knob and heating element are included. On models without the Smoker's Package, the cigar lighter receptacle is equipped with a snap fit plastic cap and is treated as an auxiliary power outlet. The cigar lighter receptacle is installed in the instrument panel accessory switch bezel, which is located near the bottom of the instrument panel center stack area, below the radio. The cigar lighter base is secured by a snap fit within the center lower bezel. This power outlet has a constant 12 volt battery feed.

The cigar lighter receptacle is serviced with the accessory switch bezel and if defective, the entire switch bezel must be replaced. The plastic cap and the knob and heating element unit are available for service replacement. These components cannot be repaired and, if faulty or damaged, they must be replaced.

FRONT CONSOLE AND REAR CARGO MOUNTED

A front console mounted power outlet is standard equipment and a rear cargo area power outlet is optional equipment on this model. The front console mounted power outlet is mounted near the front of the console just in front of the cup holders. This outlet can be used as a cigar lighter or power outlet, but only has 12 volt battery voltage when the ignition is in the ON or ACC positions. The rear power outlet is installed in the right rear quarter trim panel, near the spare tire jack. The power outlet base and mount are secured by a snap fit within the quarter trim panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use. While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact. It has 12 volt battery voltage when the ignition is in the ON or ACC positions.

OPERATION

CIGAR LIGHTER/POWER OUTLET

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or receptacle shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current.

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the receptacle shell, the heating element resistor coil is grounded through its housing to the receptacle shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the receptacle shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the receptacle shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

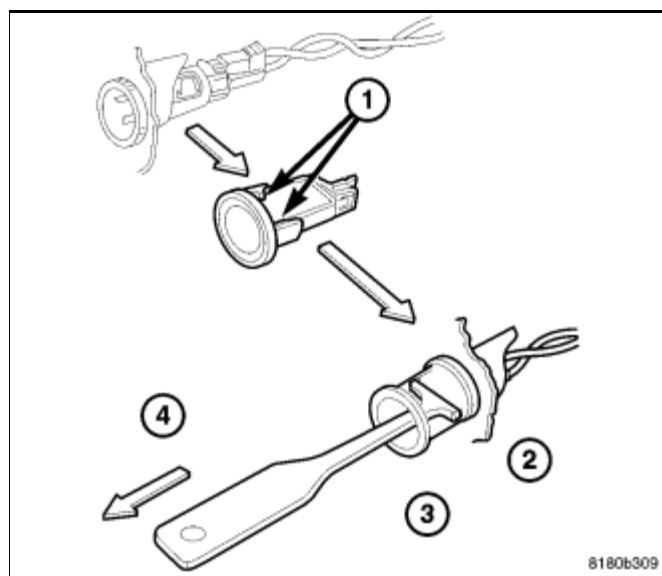
When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the receptacle shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

POWER OUTLET

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Totally Integrated Power Module (TIPM) when the ignition is in the ON or ACC positions.

REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Look inside and note position of the retaining bosses (1).
3. Using special tool 9857 Power Outlet Remover. Insert the tool forcing the bosses out of base.
4. Pull out the base through mounting ring by gently rocking the tool (3).
5. Disconnect the base wires.
6. Set base aside and remove base mount ring.



INSTALLATION

1. Position mount ring to the instrument panel and feed the wires through ring. Index the cap and the mount ring with the index tab at 9 o'clock to the key in the instrument panel. Install the ring.
2. Connect wires to base. Orient base alignment rib at 11 o'clock to mate the groove in mount ring at the same location.
3. Push base into the bezel till it locks.
4. Install cigar lighter cap.
5. Connect the battery negative cable.

IOD FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is disconnected within the Totally Integrated Power Module (TIPM) when the vehicle is shipped from the factory. Dealer personnel are to push the IOD fuse down until fully seated in the TIPM as part of the preparation procedures performed just prior to new vehicle delivery.

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position, including the clock. The only reason the IOD fuse is pulled out is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is pulled out from the Totally Integrated Power Module (TIPM) fuse cavity J13 when the vehicle is shipped from the assembly plant. Dealer personnel must push the IOD fuse down until fully seated in the TIPM when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse. The IOD fuse serves no useful purpose to the dealer technician in the service or diagnosis of any vehicle system or condition, other than the same purpose as that of any other standard circuit protection device.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that pulling out the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged.

REMOVAL

NOTE: When removing or installing the IOD fuse, it is important that the ignition switch be in the Off position. Failure to place the ignition switch in the Off position can cause the radio display to become scrambled when the IOD fuse is installed. Removing and installing the IOD fuse again with the ignition switch in the Off position will usually correct the scrambled radio display condition.

1. Turn the ignition switch to the Off position.
2. Open the cover of the Totally Integrated Power Module (TIPM).
3. Pull up fuse J13 until it is in the pre-stage position from the TIPM.

INSTALLATION

CAUTION: It is extremely important that the Ignition Off Draw (IOD) fuse is fully seated into the Totally Integrated Power Module (TIPM) fuse cavity. Failure to install the fuse correctly could result in erratic electrical systems behavior.

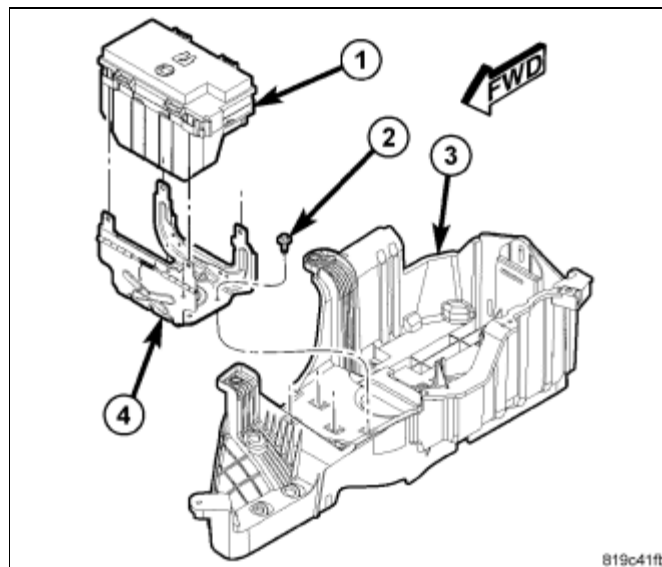
1. Open the TIPM cover.
2. Insert fuse J13 into the TIPM. Push fuse down until it is fully seated in the TIPM cavity.
3. Close the TIPM cover.

MODULE-TOTALLY INTEGRATED POWER

DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Totally Integrated Power Module (TIPM) (1). The molded plastic TIPM housing is located in the right front corner of the engine compartment, just behind the air cleaner housing and in front of the battery. The TIPM housing has a molded plastic cover. The TIPM cover is easily removed for service access and has a convenient fuse layout label affixed to the inside surface of the cover to ensure proper component identification.

The TIPM housing is secured to the TIPM mounting bracket (4) by four clips integral to the TIPM housing. The TIPM mounting bracket is secured to the battery tray (3) with four screws (2). All of the TIPM outputs are through the integral engine compartment wire harness.



OPERATION

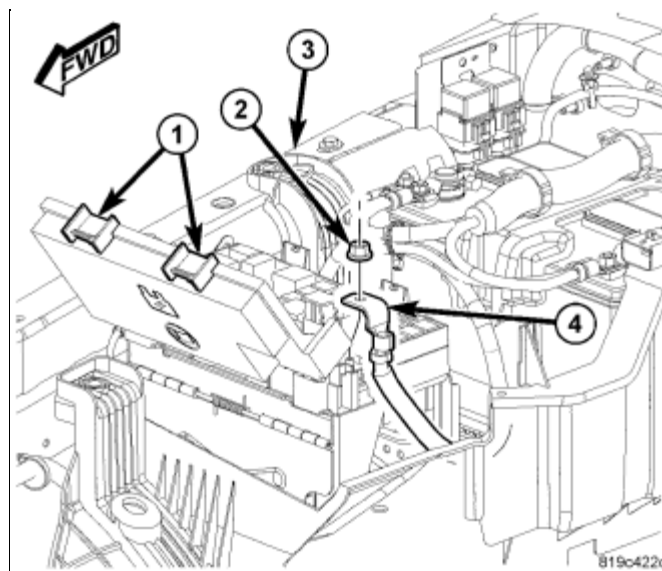
All of the current to the Totally Integrated Power Module (TIPM) comes directly from the positive battery cable to a stud located on the top of the TIPM. The cable is secured to the TIPM stud with a nut. Internal connection of all the TIPM circuits is accomplished by an intricate network of hard wiring and bus bars. Refer to Wiring Diagrams for complete circuit diagrams.

The fuses, relays and TIPM housing assembly are available for service replacement.

REMOVAL

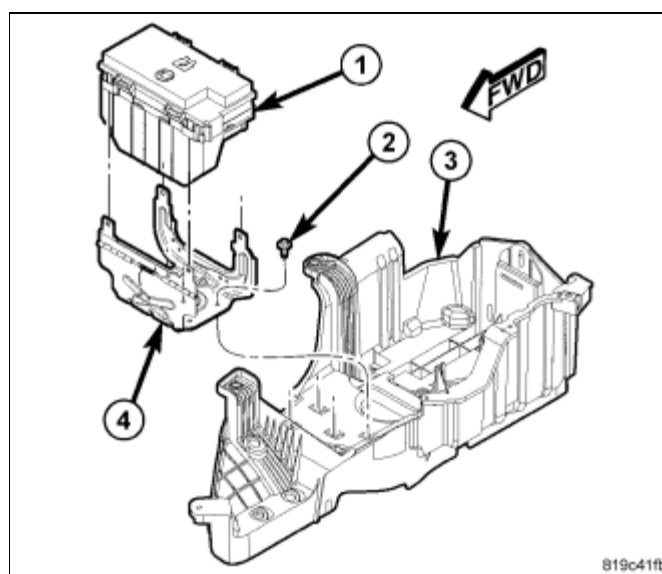
NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.

1. Open hood.
2. Disconnect and isolate the battery negative cable.
3. Release the Totally Integrated Power Module (TIPM) cover retaining clips (1) and open the TIPM cover.
4. Remove the TIPM positive cable retaining nut (2) and remove the cable (4) from the stud.



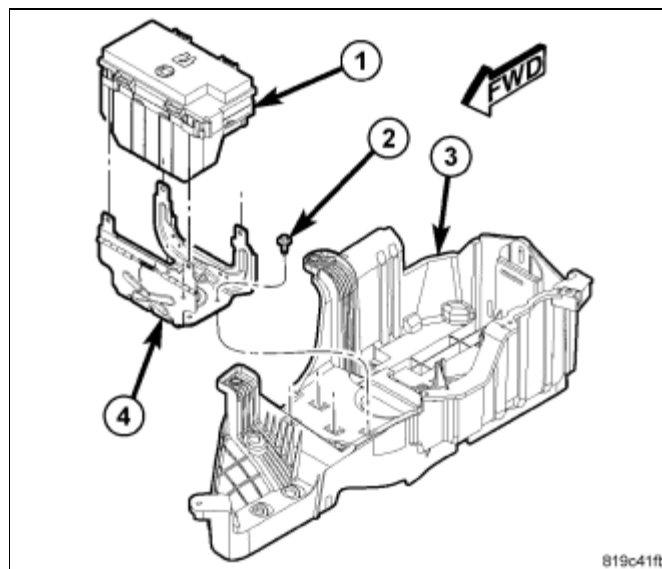
5. Depress the four mounting clips to disengage and remove the TIPM housing (1) from its mounting bracket (4).
6. Disconnect each of the seven TIPM wire harness connectors.
7. Remove the TIPM from the vehicle.

INSTALLATION



CAUTION: The original Cab Compartment Node (CCN) and Powertrain Control Module (PCM) must be installed and functioning properly prior to powering up the new Totally Integrated Power Module (TIPM). The TIPM receives vehicle configuration data from the CCN and Vehicle Identification Number information from the PCM. If configuration information becomes lost or corrupted, the data can be obtained from DealerCONNECT

NOTE: Left hand drive gasoline engine shown, left hand drive diesel similar. Right hand drive gasoline and diesel similar with the battery and related components packaged on the left side of the engine compartment.



1. Position the TIPM (1) into the engine compartment.
2. Connect each of the seven TIPM wire harness connectors.

3. Position the TIPM (1) onto the mounting bracket (4) and push down until the mounting clips are fully seated.

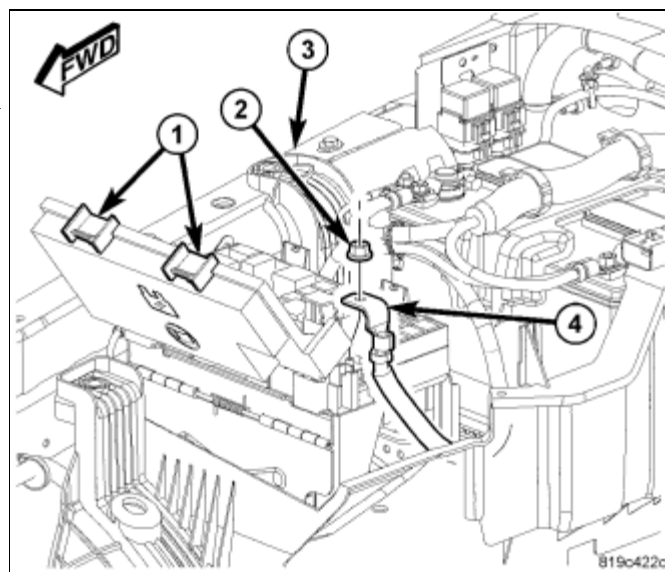
4. Position the TIPM positive cable (4) onto the mounting stud and install the retaining nut (2). Tighten the nut to 9 - 11 N·m (80 - 100 in. lbs.).

5. Open the TIPM cover (1) and fully seat the Airbag fuse holder (two fuses in one yellow carrier) and the Ignition Off Draw (IOD) fuse.

6. Connect the battery negative cable.

7. Close the hood.

8. Insert the ignition key and turn it to the “RUN” position and wait twelve seconds. The TIPM will collect the necessary vehicle configuration and VIN data from the CCM and PCM at this time. After twelve seconds turn the ignition key to the “OFF” position and then back to the “ON” position and verify proper vehicle systems operation.



9 - ENGINE

ENGINE - ELECTRICAL DIAGNOSTICS - GAS

ENGINE - ELECTRICAL DIAGNOSTICS - GAS

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

Diagnostic Test

1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

Are you currently experiencing a NO RESPONSE condition?

Yes

- The NO RESPONSE condition must be properly diagnosed before continuing.
- Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No

- Go To [2](#)

2. NO START

Is the customer complaint a NO START condition?

Yes

- Check the vehicle for any NO START related PCM DTCs or Vehicle Theft Security related DTCs.
- If no Theft related DTCs are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No

- Go To [3](#)
-

3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTCs and record the related Freeze Frame data if any DTCs are present. Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSBs related to the customer's complaint or DTCs.

If a TSB applies, follow the instructions per the TSB.

Choose the following scenario that best applies.

The TSB repaired the customer's complaint.

- Testing complete.

A DTC is present, no TSB applies, or the TSB didn't repair the customer's complaint.

- Go To [4](#)

No DTCs are present.

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

4. WIRE HARNESS INSPECTION

Clear the DTCs.

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTCs that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTCs are fuel or air related, check the fuel level and quality.

Were any repairs made that fixed the customer's complaint?

Yes

- Testing complete.

No

- Refer to the diagnostic test procedure related to the DTC.
-

INTERMITTENT CONDITION

INTERMITTENT CONDITION

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected inoperative component and the PCM.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTCs check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

Were any problems found during the above inspections?

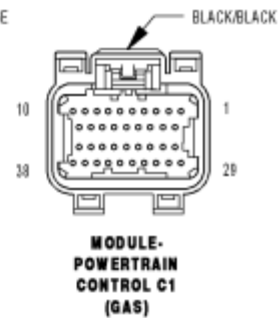
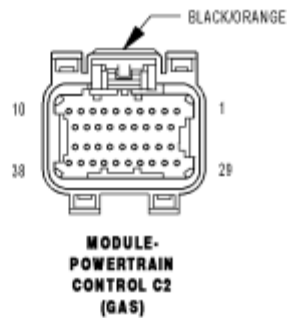
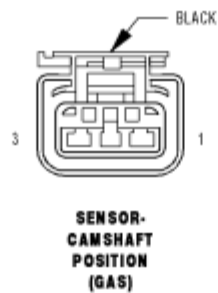
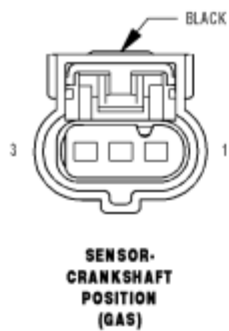
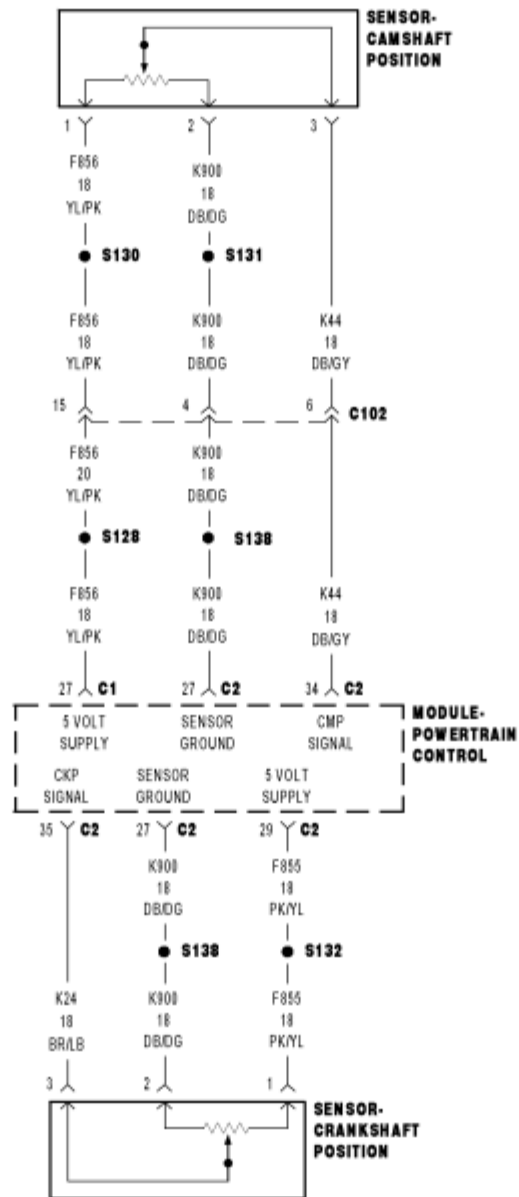
Yes

- Perform the necessary repairs.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

P0016-CRANKSHAFT/CAMSHAFT TIMING MISALIGNMENT



01011274

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine speed between 480 and 6816 RPM and no CMP or CKP sensor DTCs detected.

- **Set Condition:**

The PCM detects that the deviation between the camshaft position and the crankshaft position has exceeded the maximum acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ERRATIC CAM POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
TIMING SPROCKET ALIGNMENT
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.
 With the scan tool select View DTCs.
 Record the related Freeze Frame data.
 With the scan tool clear DTCs.
 Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool select View DTCs.

NOTE: If the DTC does not reset it may be necessary to test drive the vehicle.

Is the DTC Active at this time?**Yes**

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CAMSHAFT POSITION SENSOR CIRCUIT WIRING OR CONNECTORS

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Inspect the Camshaft Position Sensor for conditions such as loose mounting screws, damage, or cracks.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CAMSHAFT POSITION SENSOR CIRCUIT WIRING OR CONNECTORS

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Inspect the Camshaft Position Sensor for conditions such as loose mounting screws, damage, or cracks.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

Go To [4](#)

4. CRANKSHAFT, TONE WHEEL OR FLEX PLATE

Turn the ignition off.

Remove the Crankshaft Position Sensor.

Inspect the Crankshaft Position Sensor and mounting area for any condition that would result in an incorrect signal, such as damage, evidence of foreign material, or excessive movement.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

5. CAMSHAFT, TONE WHEEL OR PULSE RING

Turn the ignition off.

Remove the Camshaft Position Sensor.

Inspect the Camshaft Position Sensor and mounting area for any condition that would result in an incorrect signal, such as damage, evidence of foreign material, or excessive movement.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. TIMING SPROCKET ALIGNMENT

Turn the ignition off.

Verify proper timing sprocket alignment in accordance with the Service Information.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)

7. CAMSHAFT POSITION SENSOR IRREGULAR SIGNAL

Turn the ignition off.

Install any previously removed components. Connect all connectors.

Using a lab scope and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Camshaft Position Sensor harness connector.

Turn the ignition on.

Wiggle the related wire harness and lightly tap on the Camshaft Position Sensor while monitoring the lab scope screen.

Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Monitor the Camshaft Position Sensor signal on the lab scope screen.

Were any Camshaft Position Sensor signals irregular or missing?

Yes

- Go To [9](#)

No

- Go To [8](#)

8. CRANKSHAFT POSITION SENSOR IRREGULAR SIGNAL

Turn the ignition off.

Using a lab scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Crankshaft Position Sensor harness connector.

Turn the ignition on.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor while monitoring the lab scope screen.

Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Monitor the Crankshaft Position Sensor signal on the lab scope screen.

Were any Crankshaft Position Sensor signals irregular or missing?**Yes**

- Go To [10](#)

No

- Go To [11](#)

9. CAMSHAFT POSITION SENSOR

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Camshaft Position Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

10. CRANKSHAFT POSITION SENSOR

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Crankshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Crankshaft Position Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

11. POWERTRAIN CONTROL MODULE (PCM)

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM) and between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Turn the ignition on.

With the scan tool clear DTCs.

Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

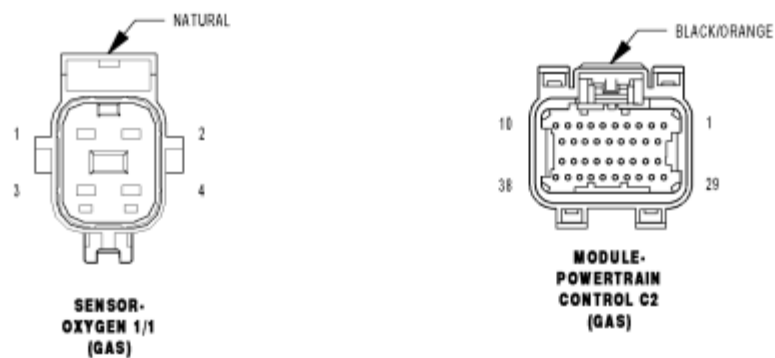
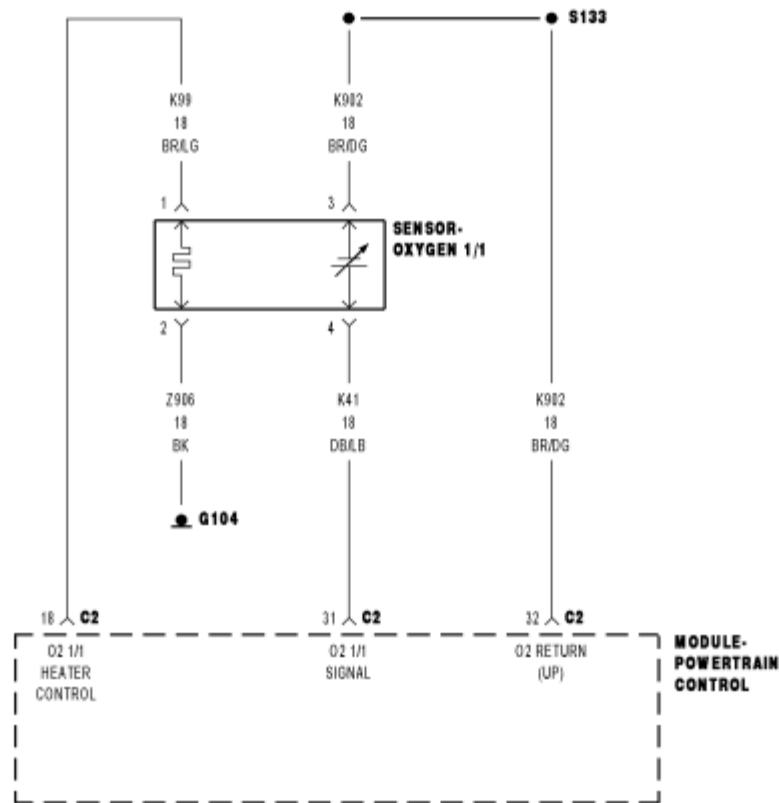
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW



01011204

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is powered.

◦ **Set Condition:**

The PCM detects that the O2 sensor heater element input is below the minimum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT
1/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

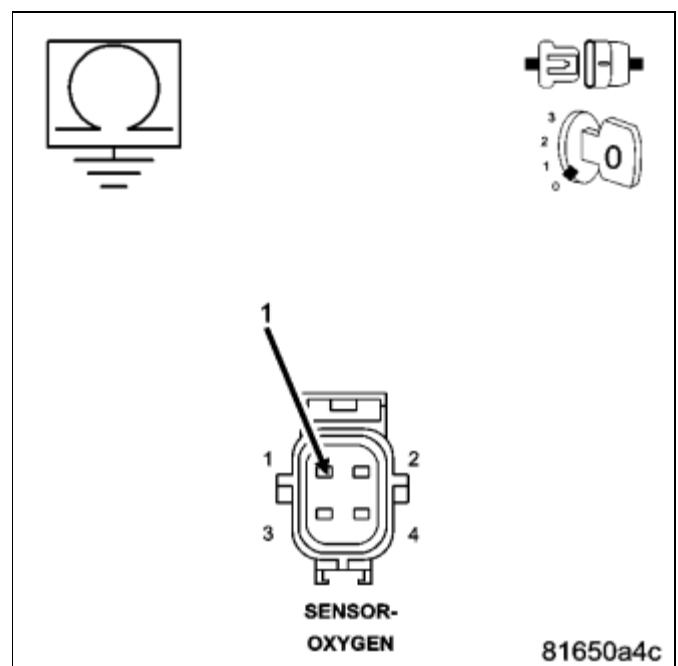
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K99) O2 1/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. EXCESSIVE RESISTANCE IN THE (K99) O2 1/1 HEATER CONTROL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit between the 1/1 Oxygen Sensor harness connector and the appropriate terminal of special tool #8815.

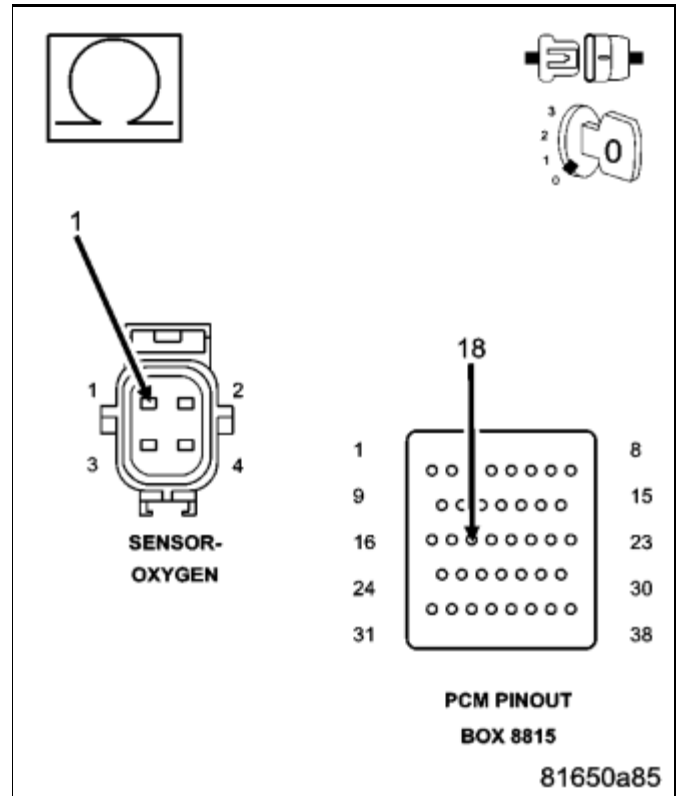
Is the resistance below 0.5 ohms?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/1 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

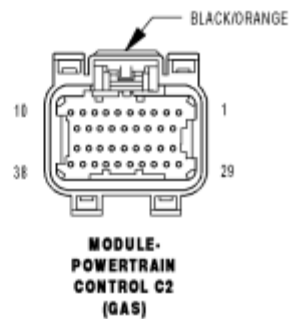
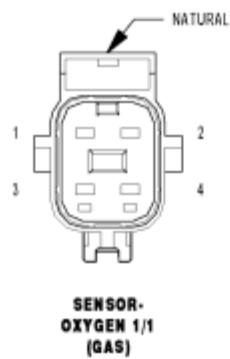
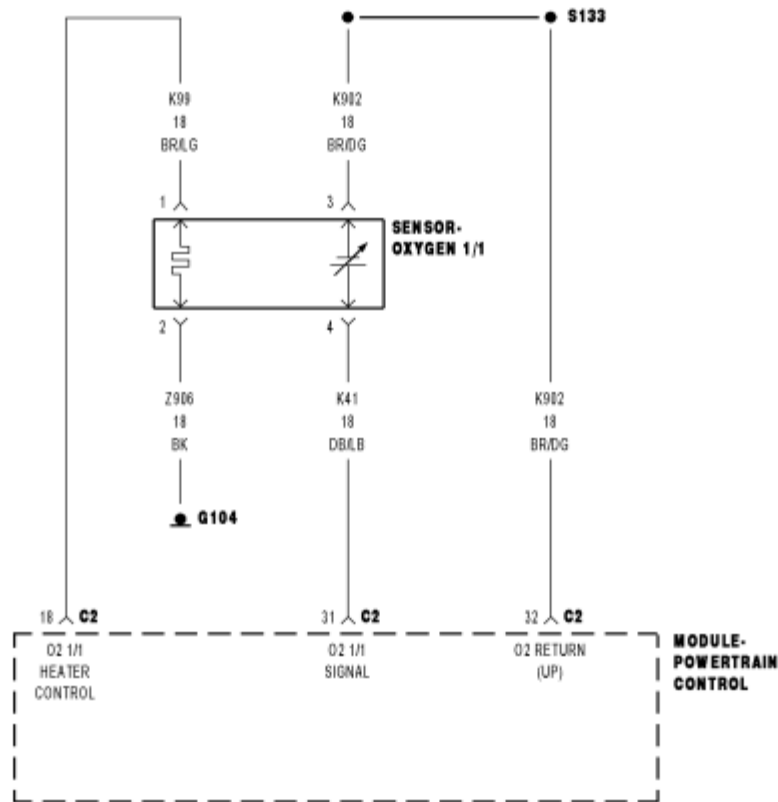
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH



81811284

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

- **Set Condition:**

The PCM detects that the O2 sensor heater element input is above the maximum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 1/1 HEATER GROUND CIRCUIT OPEN
(K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
1/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.

NOTE: If P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW has set along with any of the O2 SENSOR HEATER CIRCUIT HIGH DTCs, all of the O2 Sensor Heater Control circuits need to be checked for a short to battery voltage.

Start the engine and allow it to idle for at least 60 seconds.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

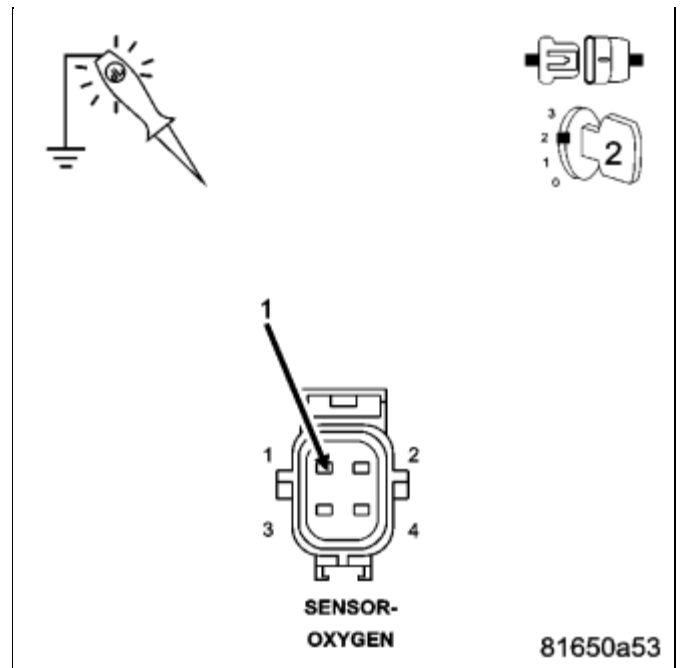
3. (K99) O2 1/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

NOTE: Make sure the test light is probing the circuit before actuating the Heater Test or a DTC may set and not allow the actuation.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

With a scan tool, actuate the O2 1/1 Heater Test with the



Sensor harness connector still disconnected.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. (Z906) O2 HEATER GROUND CIRCUIT OPEN

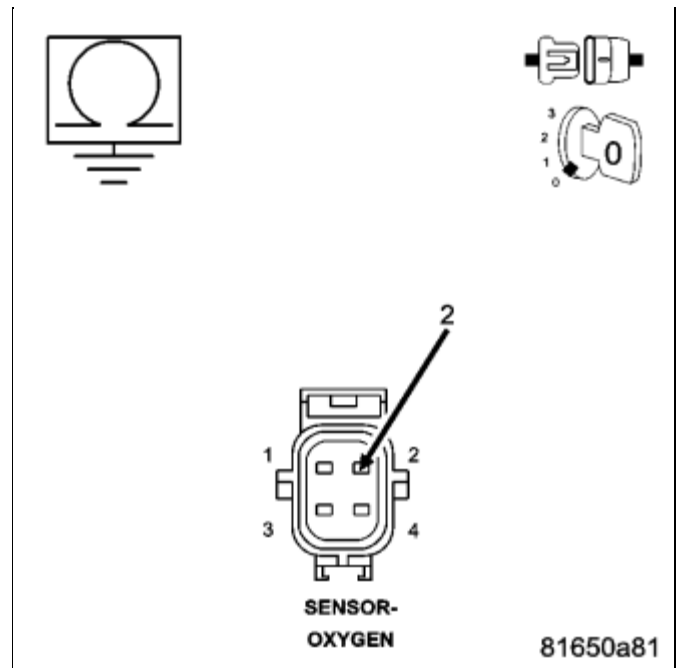
Turn the ignition off.

Measure the resistance between an engine ground and the (Z906) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Repair the open in the (Z906) O2 1/1 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

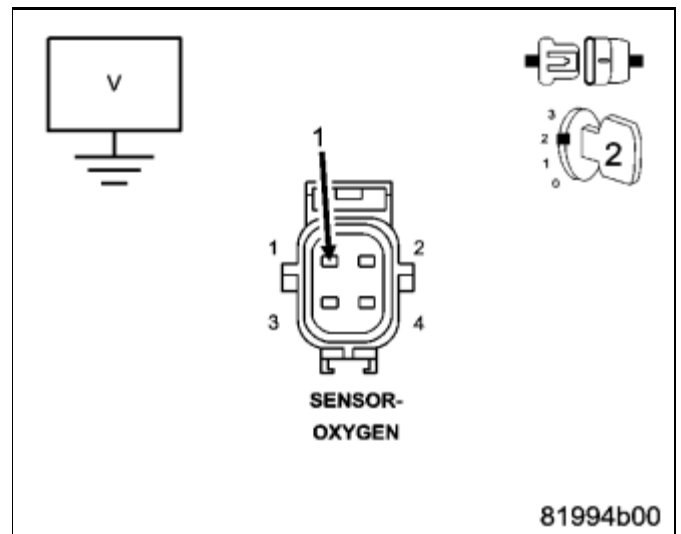
5. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K99) O2 1/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [6](#)

6. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

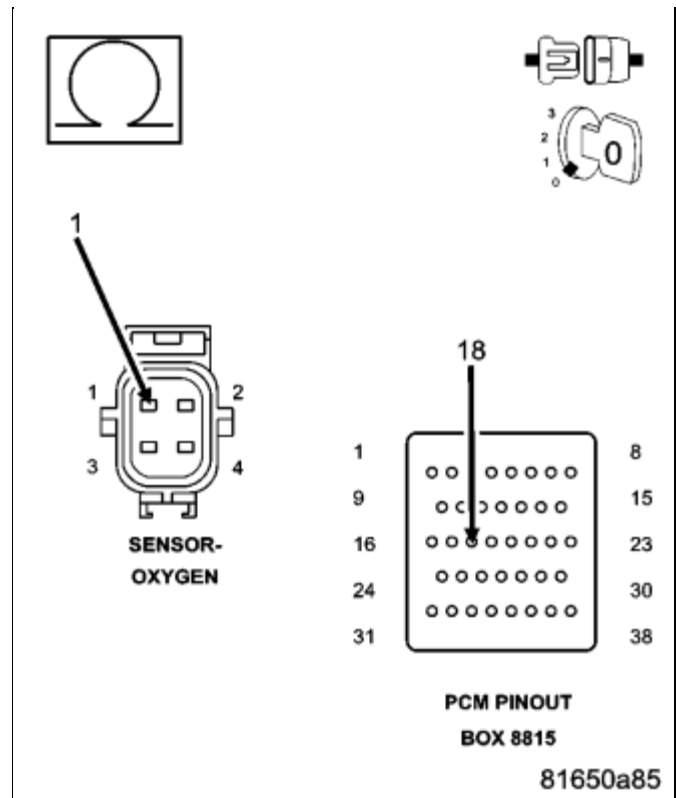
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K99) O2 1/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

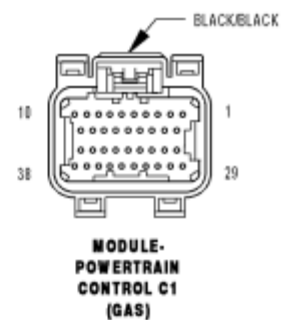
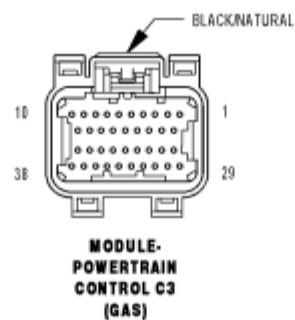
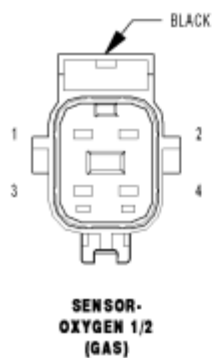
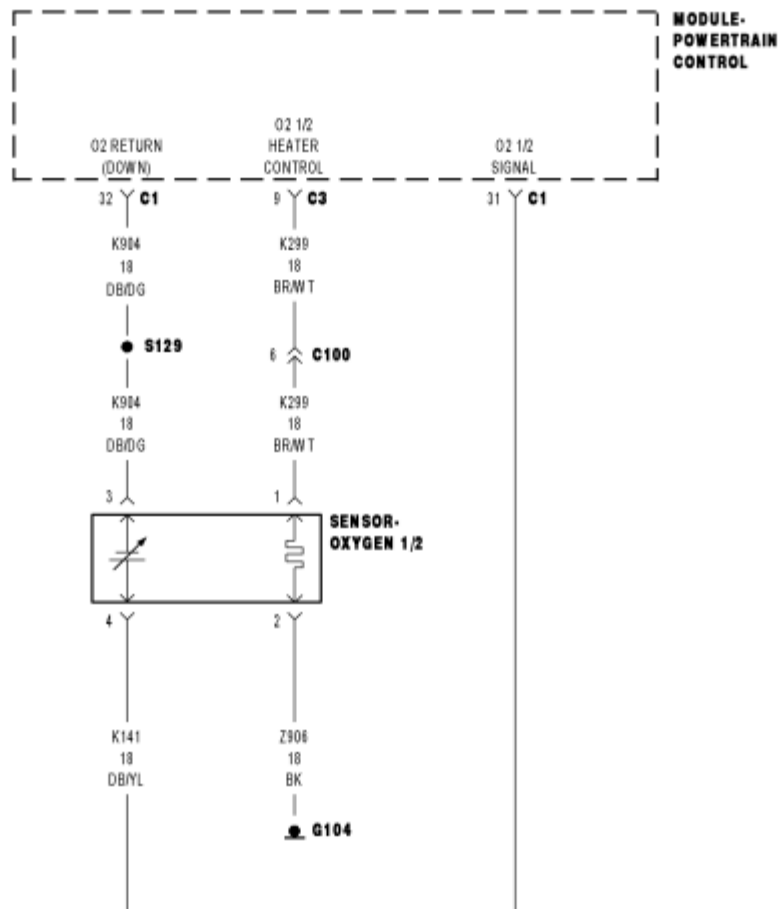
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW



8191144x

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

- **Set Condition:**

The PCM detects that the O2 sensor heater element input is below the minimum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 1/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

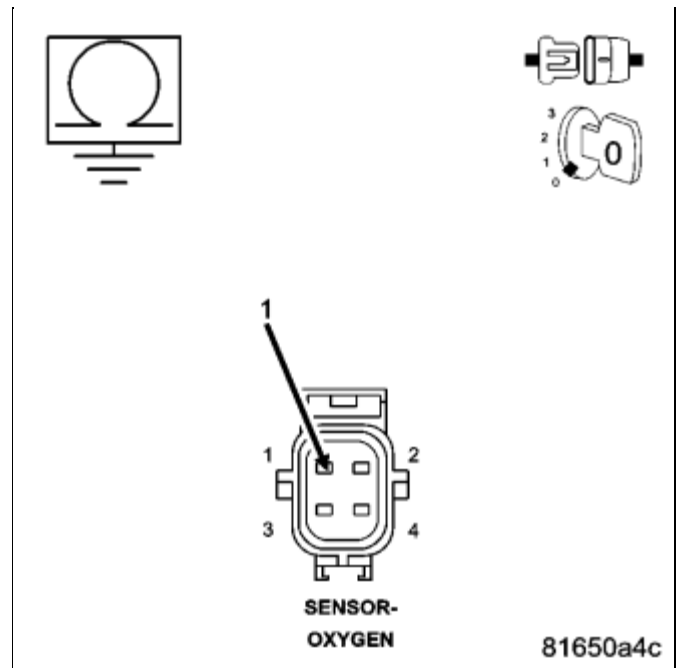
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K299) O2 1/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. EXCESSIVE RESISTANCE IN THE (K299) O2 1/2 HEATER CONTROL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit between the 1/2 Oxygen Sensor harness connector and the appropriate terminal of special tool #8815.

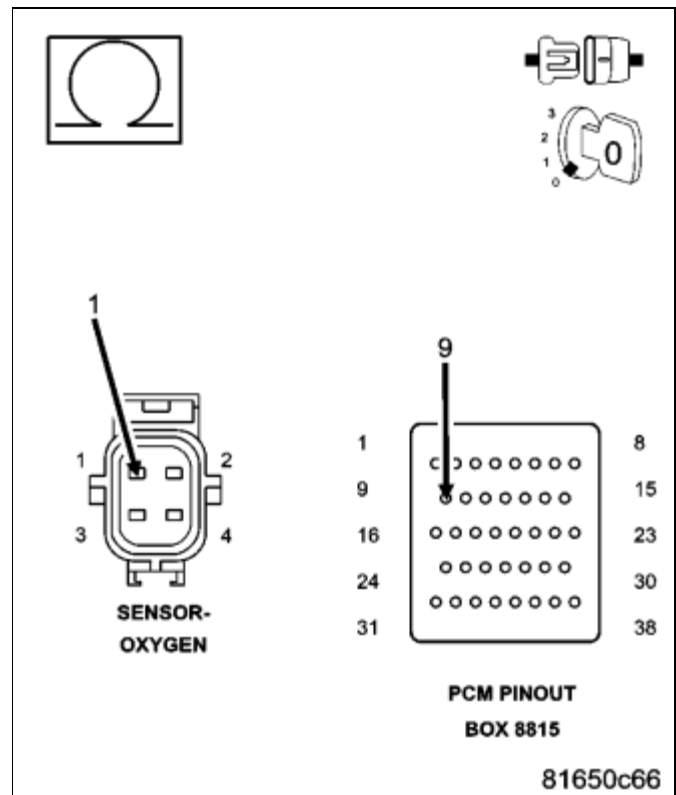
Is the resistance below 0.5 ohms?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K299) O2 1/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 1/2 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

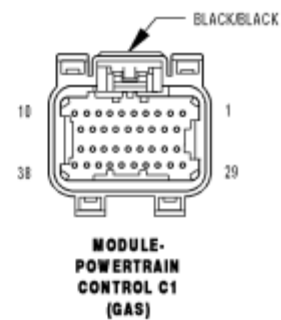
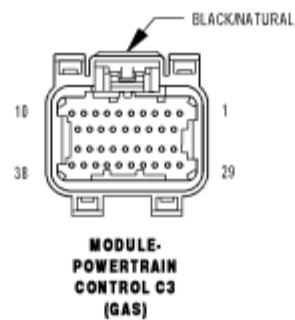
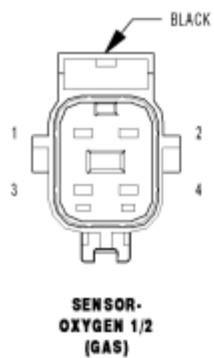
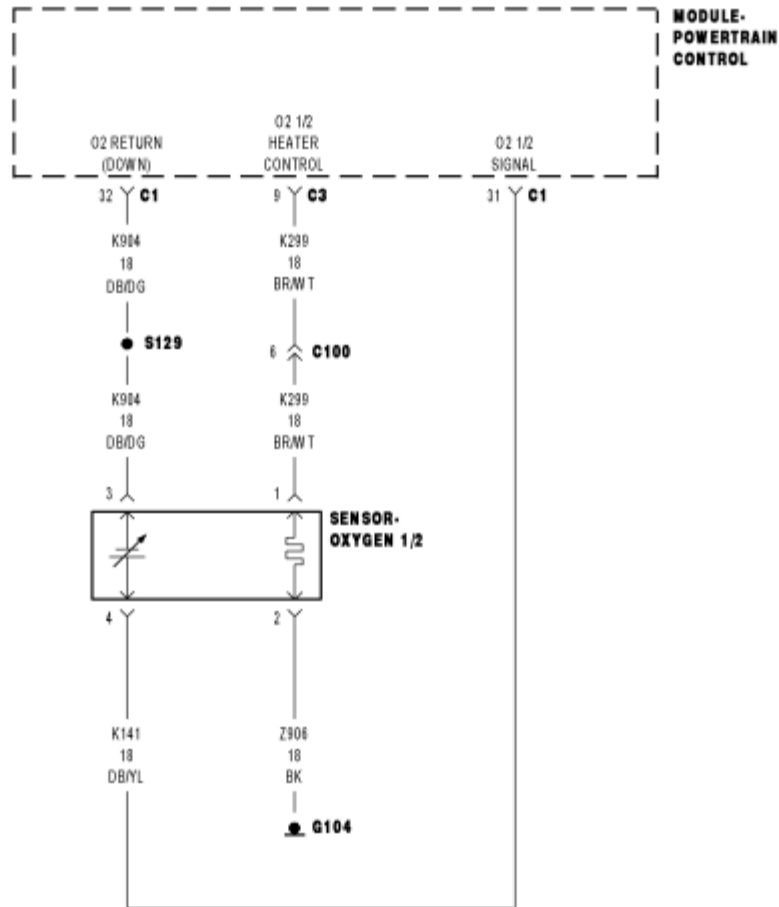
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

◦ **Set Condition:**

The PCM detects that the O2 sensor heater element input is above the maximum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 1/2 HEATER GROUND CIRCUIT OPEN
(K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.

NOTE: If P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW has set along with any of the O2 SENSOR HEATER CIRCUIT HIGH DTCs, all of the O2 Sensor Heater Control circuits need to be checked for a short to battery voltage.

Start the engine and allow it to idle for at least 60 seconds.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 1/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT

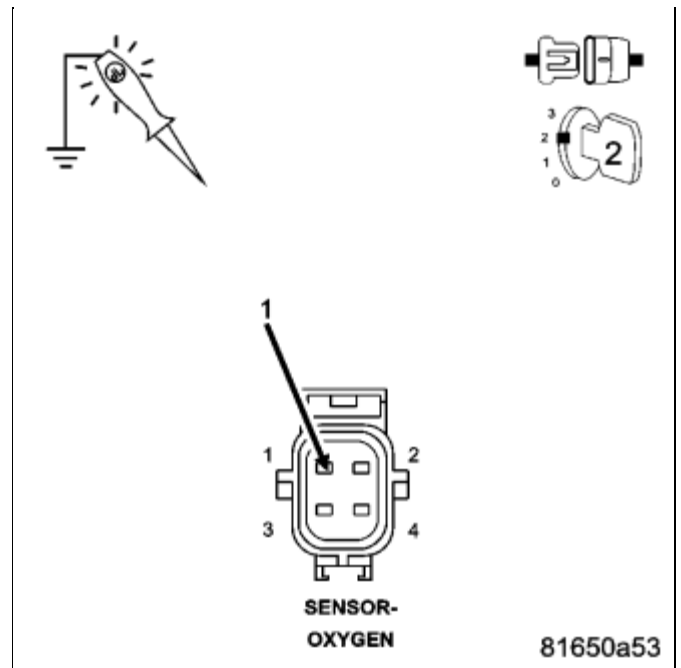
Ignition on, engine not running.

NOTE: Make sure the test light is probing the circuit before actuating the Heater Test or a DTC may set and not allow the actuation.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

With a scan tool, actuate the O2 1/2 Heater Test with the O2 Sensor harness connector still disconnected.

NOTE: The test light should be illuminated and bright



proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. (Z906) O2 HEATER GROUND CIRCUIT OPEN

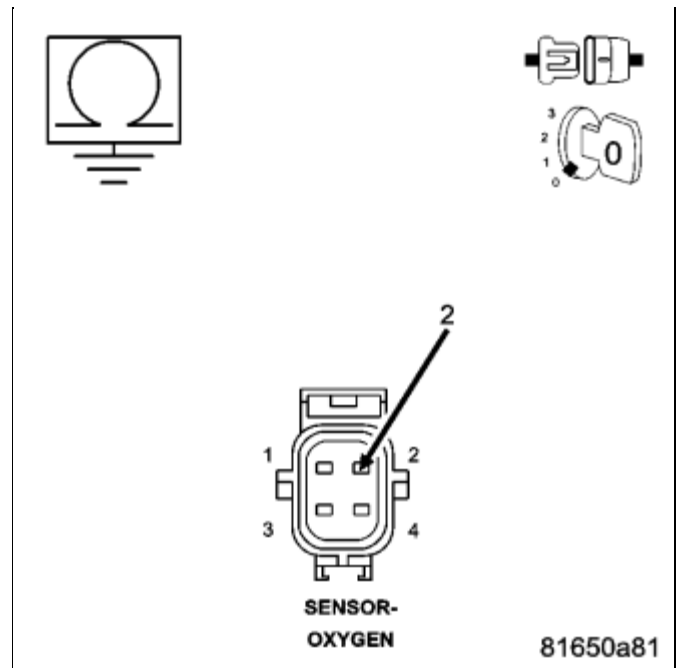
Turn the ignition off.

Measure the resistance between an engine ground and the (Z906) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes

- Verify that there is good pin to terminal contact in the 1/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Repair the open in the (Z906) O2 1/2 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

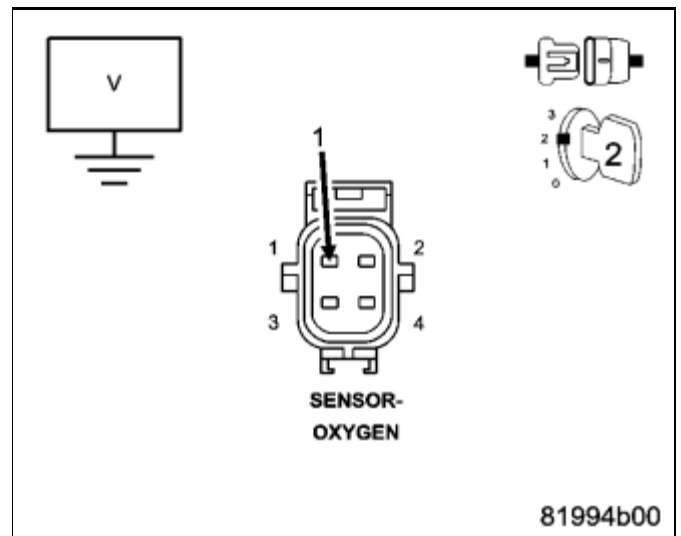
5. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C3 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage of the (K299) O2 1/2 Heater Control circuit in the 1/2 Oxygen Sensor harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K299) O2 1/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [6](#)

6. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

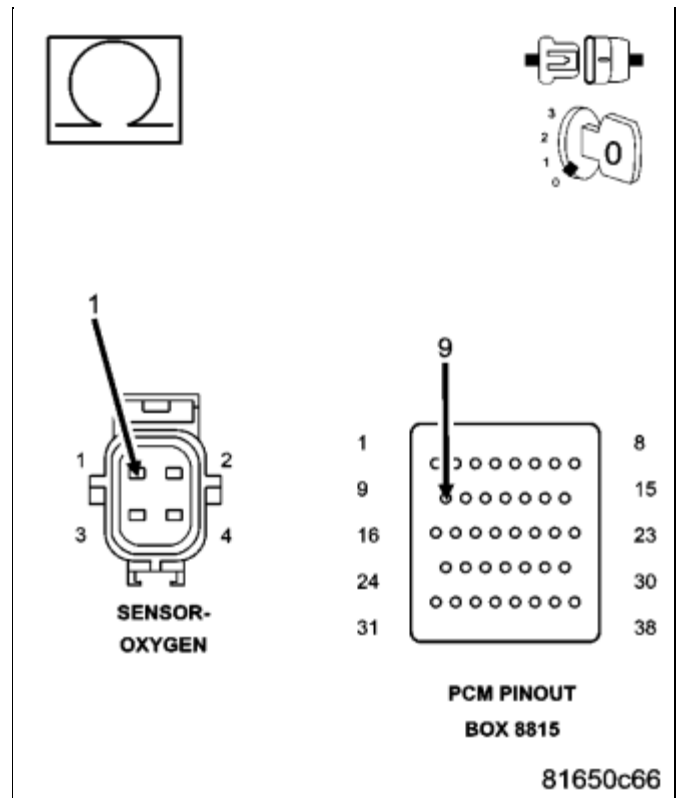
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K299) O2 1/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 1/2 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

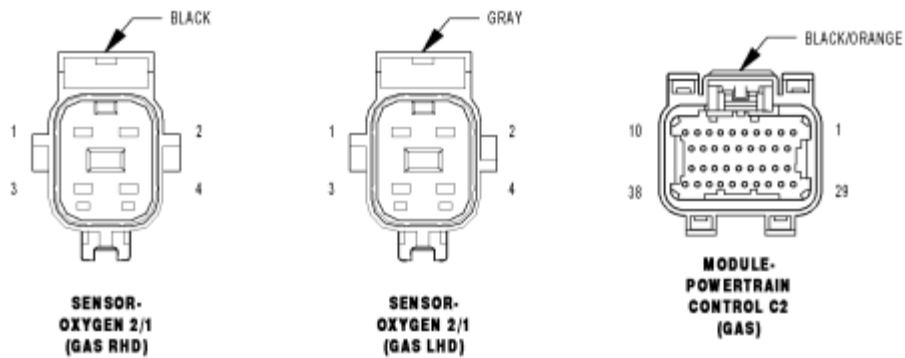
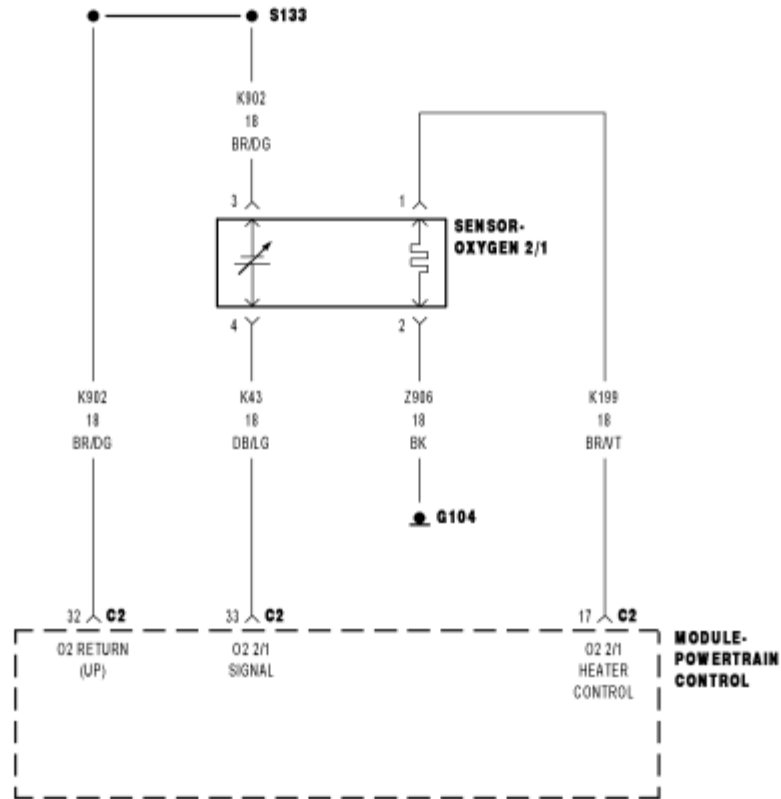
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW



0101146x

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

- **Set Condition:**

The PCM detects that the O2 sensor heater element input is below the minimum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (K199) O2 2/1 HEATER CONTROL CIRCUIT
2/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

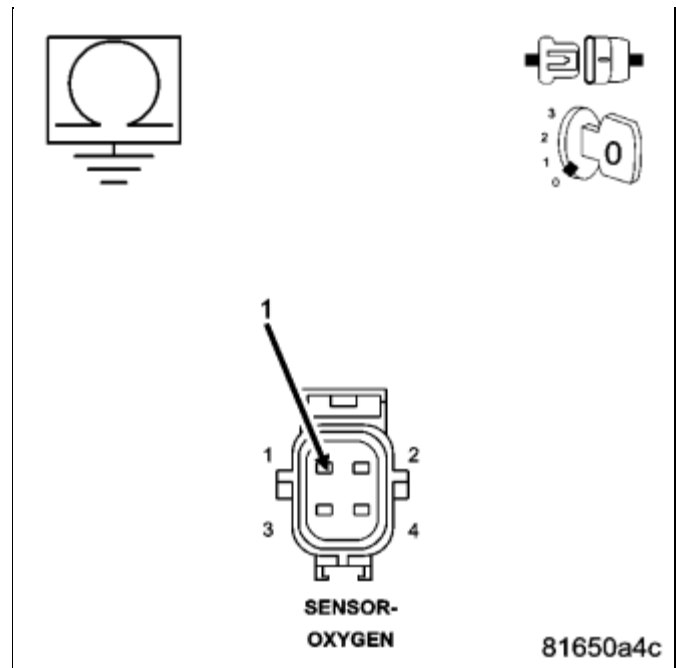
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K199) O2 2/1 Sensor Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. EXCESSIVE RESISTANCE IN THE (K199) O2 2/1 HEATER CONTROL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit between the 2/1 Oxygen Sensor harness connector and the appropriate terminal of special tool #8815.

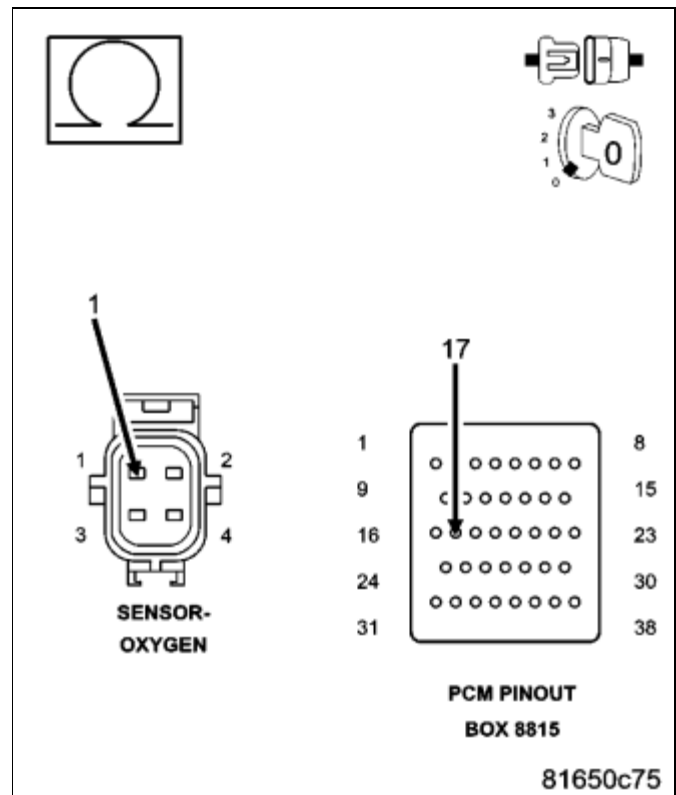
Is the resistance below 0.5 ohms?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

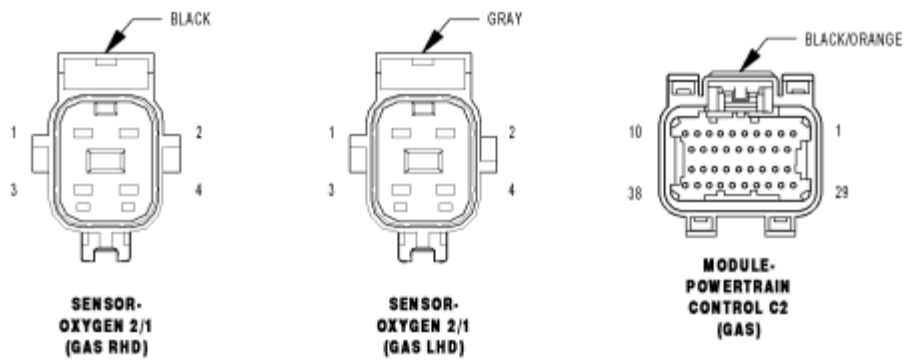
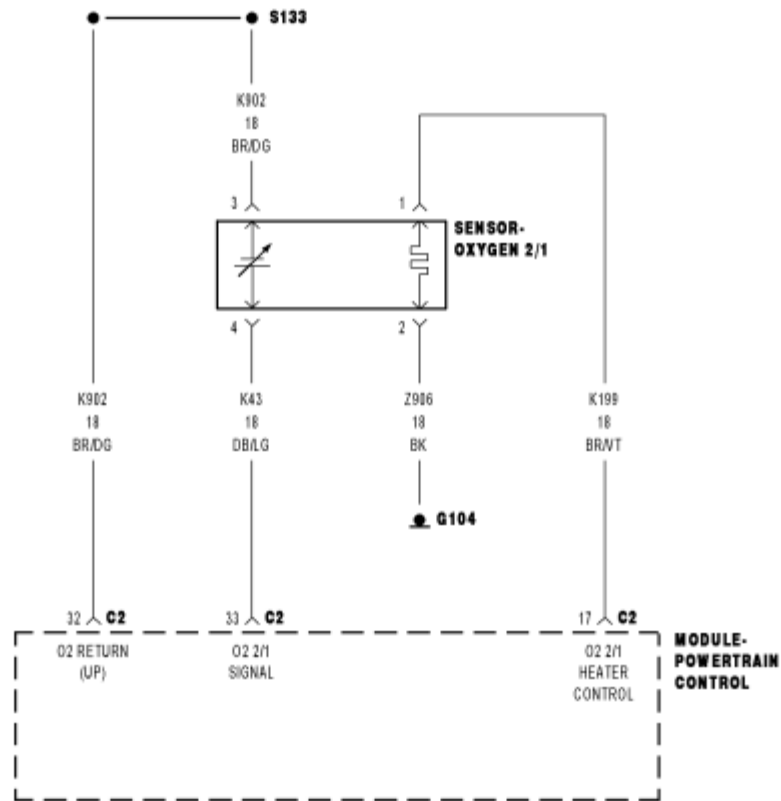
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH



0101146a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

◦ **Set Condition:**

The PCM detects that the O2 sensor heater element input is above the maximum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 2/1 HEATER GROUND CIRCUIT OPEN
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
2/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.

NOTE: If P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW has set along with any of the O2 SENSOR HEATER CIRCUIT HIGH DTCs, all of the O2 Sensor Heater Control circuits need to be checked for a short to battery voltage.

Start the engine and allow it to idle for at least 60 seconds.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the Heater ground terminal at the component connector.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT

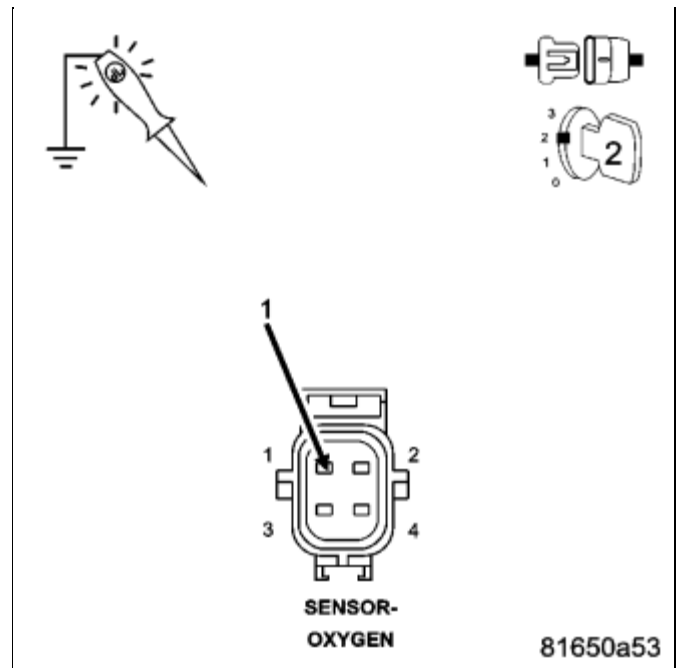
Ignition on, engine not running.

NOTE: Make sure the test light is probing the circuit before actuating the Heater Test or a DTC may set and not allow the actuation.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

With the scan tool, actuate the O2 Heater Test with the Sensor harness connector still disconnected.

NOTE: The test light should be illuminated and bright



proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. (Z906) O2 2/1 HEATER GROUND CIRCUIT OPEN

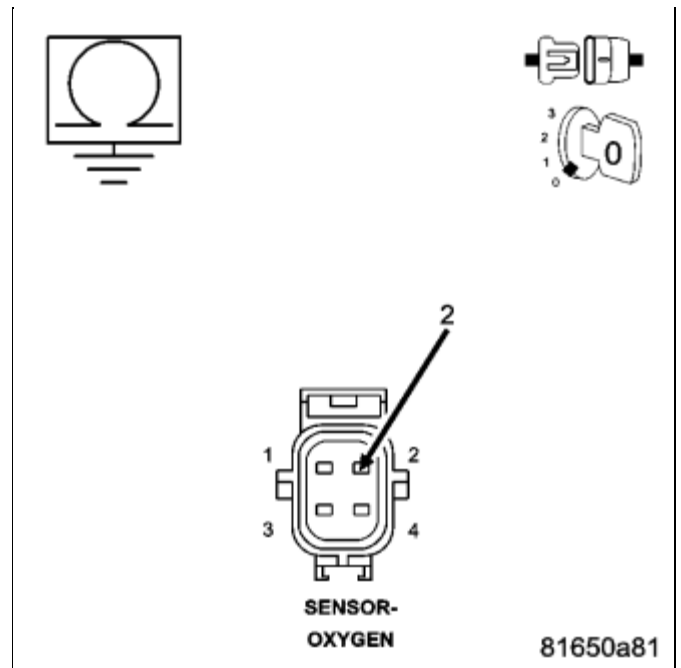
Turn the ignition off.

Measure the resistance between an engine ground and the (Z906) O2 2/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes

- Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Repair the open in the (Z906) O2 2/1 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

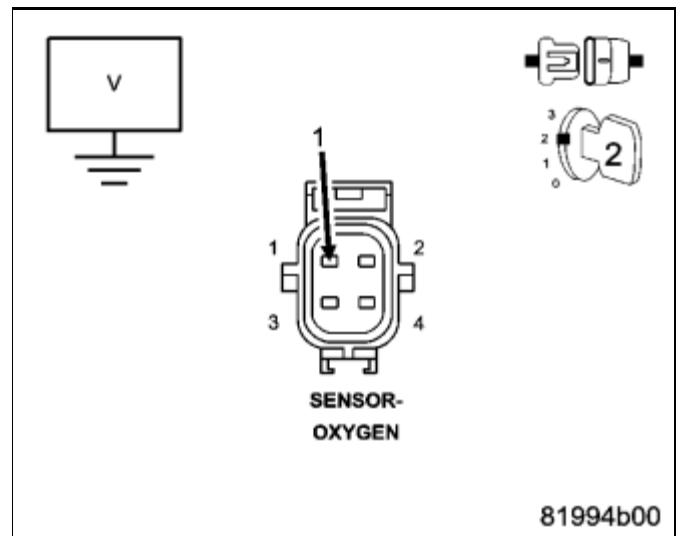
5. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Disconnect the C2 PCM harness connector.
Ignition on, engine not running.
Measure the voltage on the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K199) O2 2/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [6](#)

6. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

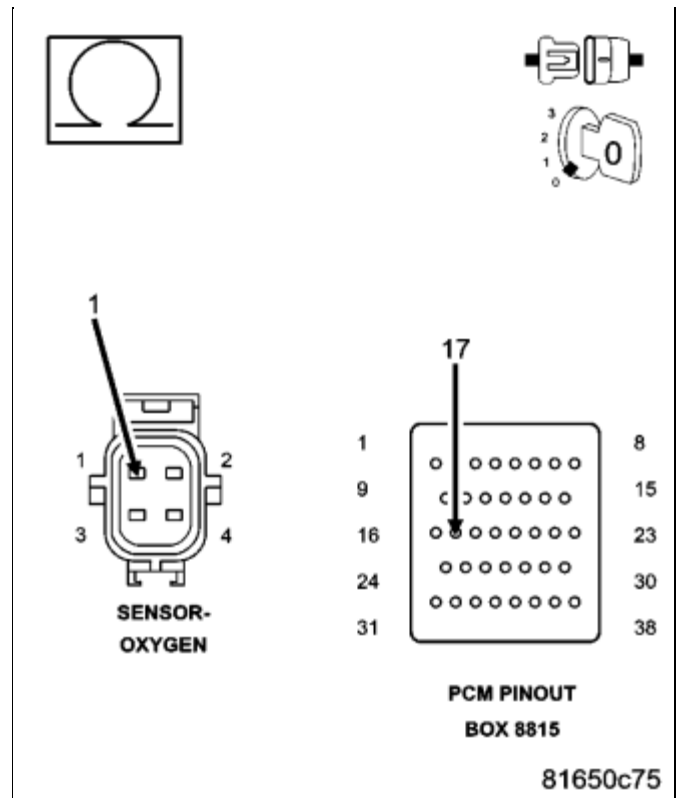
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K199) O2 2/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

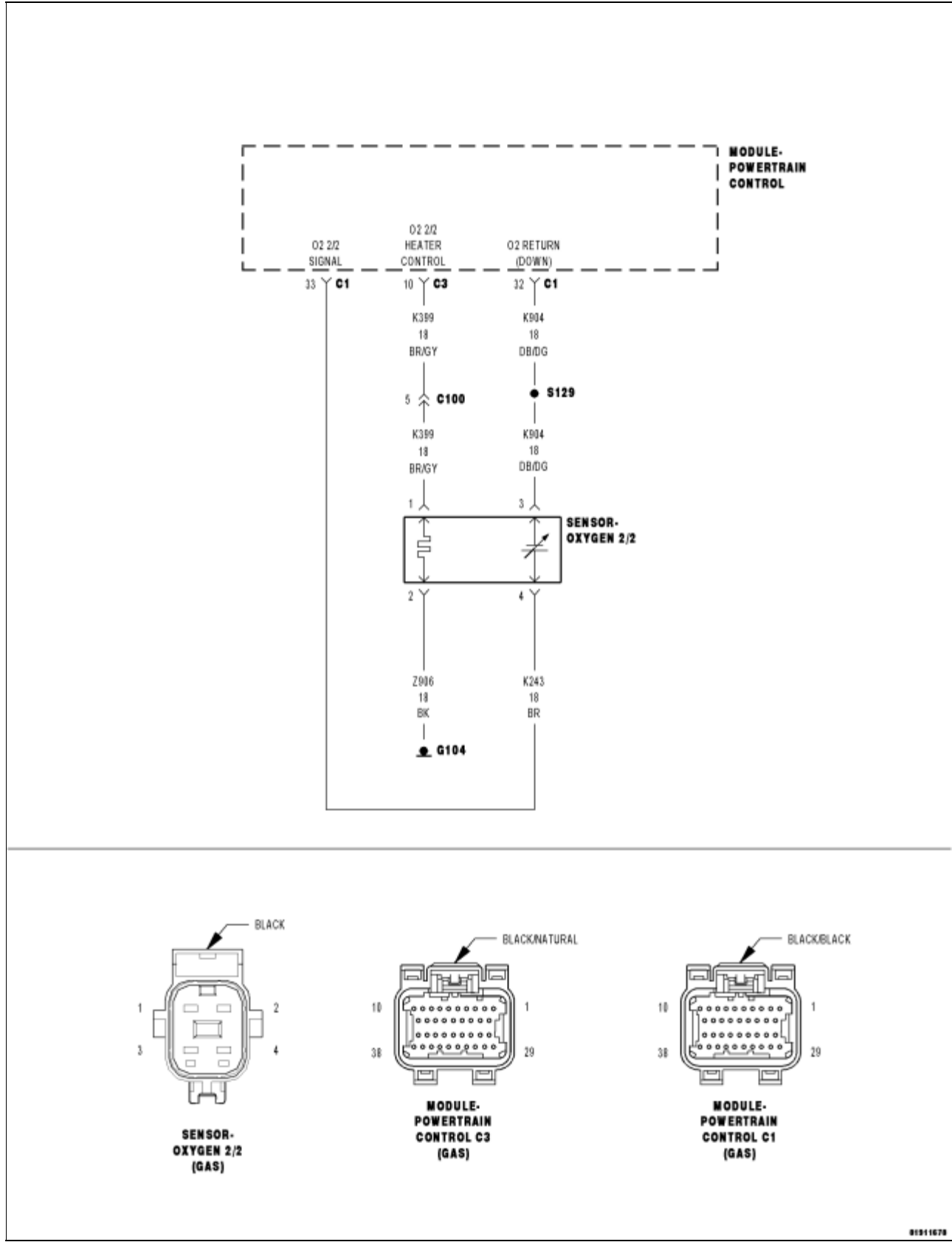
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW



- **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

- **Set Condition:**

The PCM detects that the O2 sensor heater element input is below the minimum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 2/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

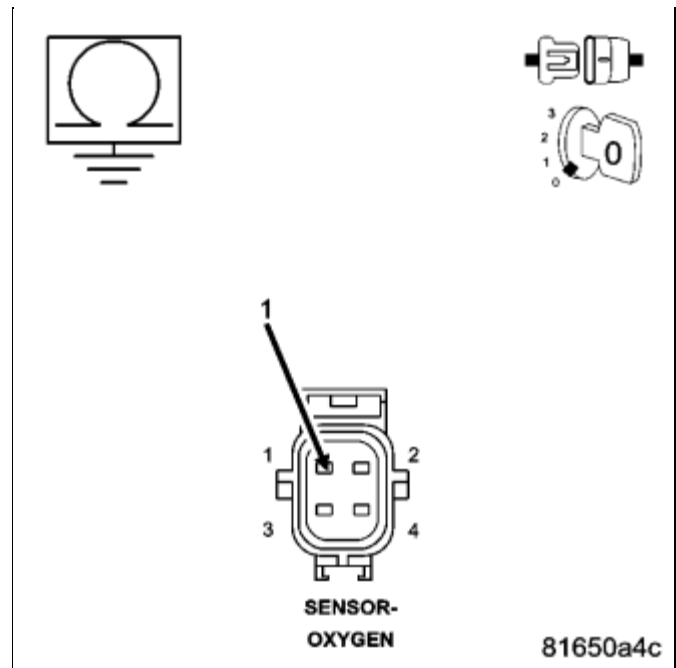
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K399) O2 2/2 Sensor Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. EXCESSIVE RESISTANCE IN THE (K399) O2 2/2 HEATER CONTROL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit between the 2/2 Oxygen Sensor harness connector and the appropriate terminal of special tool #8815.

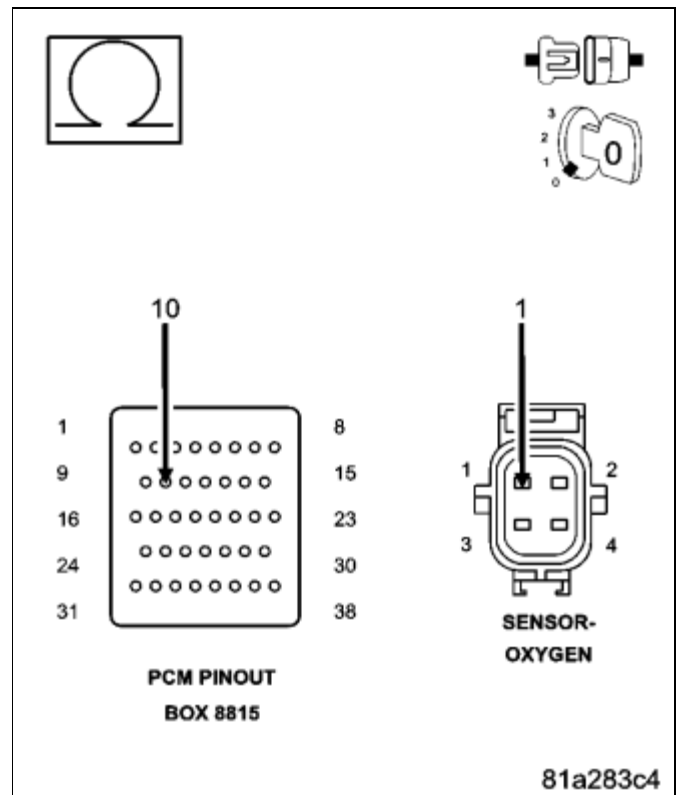
Is the resistance below 0.5 ohms?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K399) O2 2/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/2 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

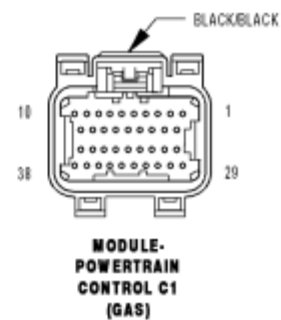
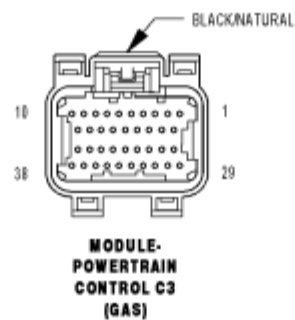
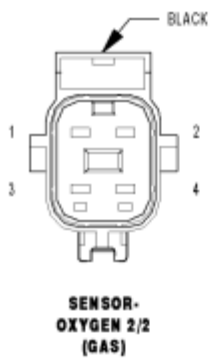
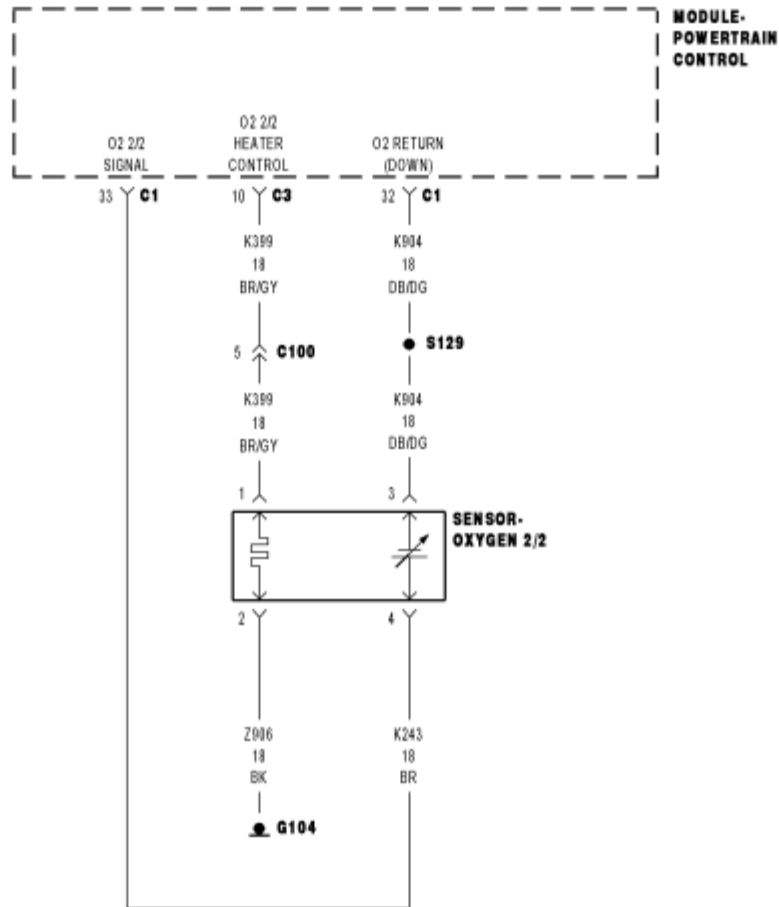
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH



00011678

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously during O2 heater operation with battery voltage between 10.4 and 15.75 volts.

◦ **Set Condition:**

The PCM detects that the O2 sensor heater element input is above the maximum acceptable voltage. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 2/2 HEATER GROUND CIRCUIT OPEN
(K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.

NOTE: If P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW has set along with any of the O2 SENSOR HEATER CIRCUIT HIGH DTCs, all of the O2 Sensor Heater Control circuits need to be checked for a short to battery voltage.

Start the engine and allow it to idle for at least 60 seconds.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the 2/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT

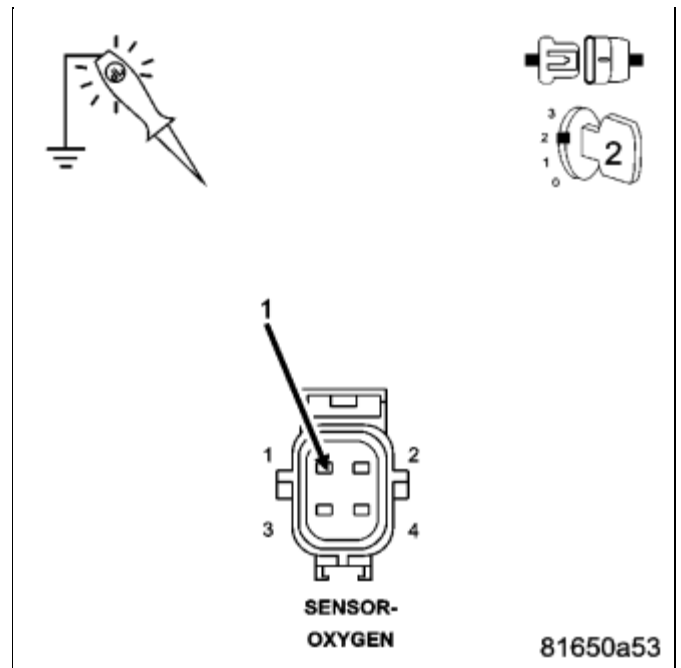
Ignition on, engine not running.

NOTE: Make sure the test light is probing the circuit before actuating the Heater Test or a DTC may set and not allow the actuation.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

With a scan tool, actuate the O2 2/2 Heater Test with the Sensor harness connector still disconnected.

NOTE: The test light should be illuminated and bright



proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate accordingly during the actuation?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. (Z906) O2 HEATER GROUND CIRCUIT OPEN

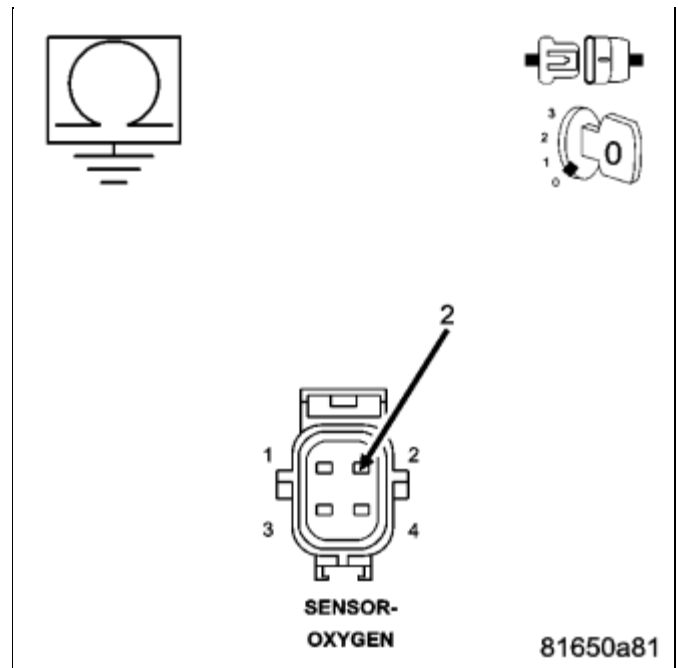
Turn the ignition off.

Measure the resistance between an engine ground and the (Z906) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes

- Verify that there is good pin to terminal contact in the 2/2 O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Repair the open in the (Z906) O2 2/2 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

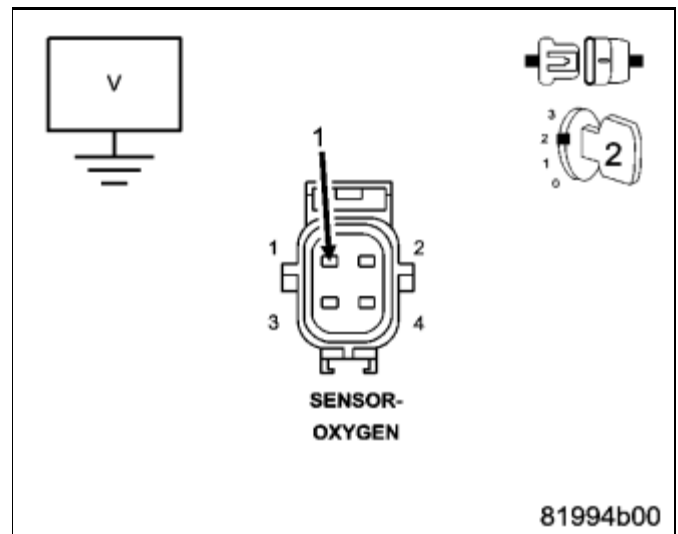
5. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C3 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage of the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K399) O2 2/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [6](#)

6. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

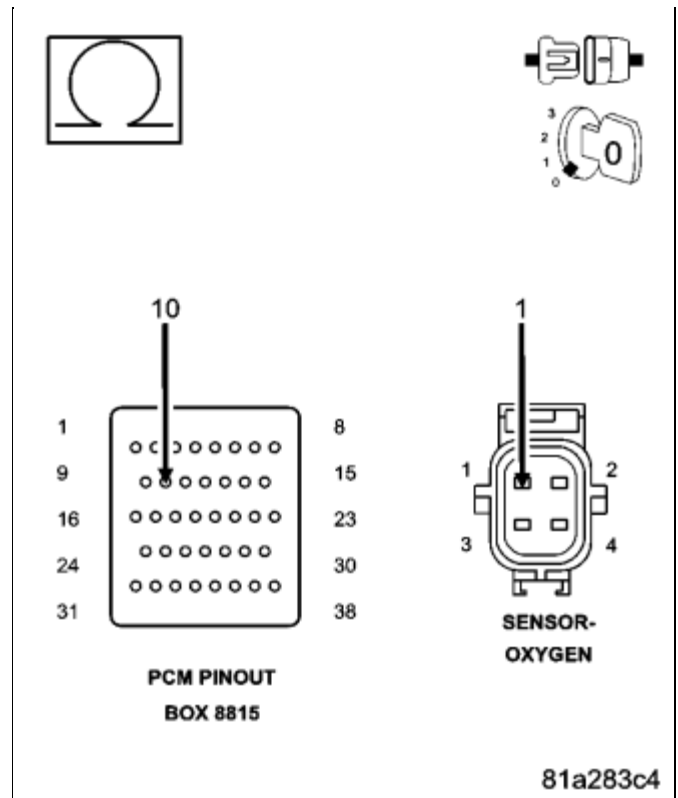
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K399) O2 2/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/2 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

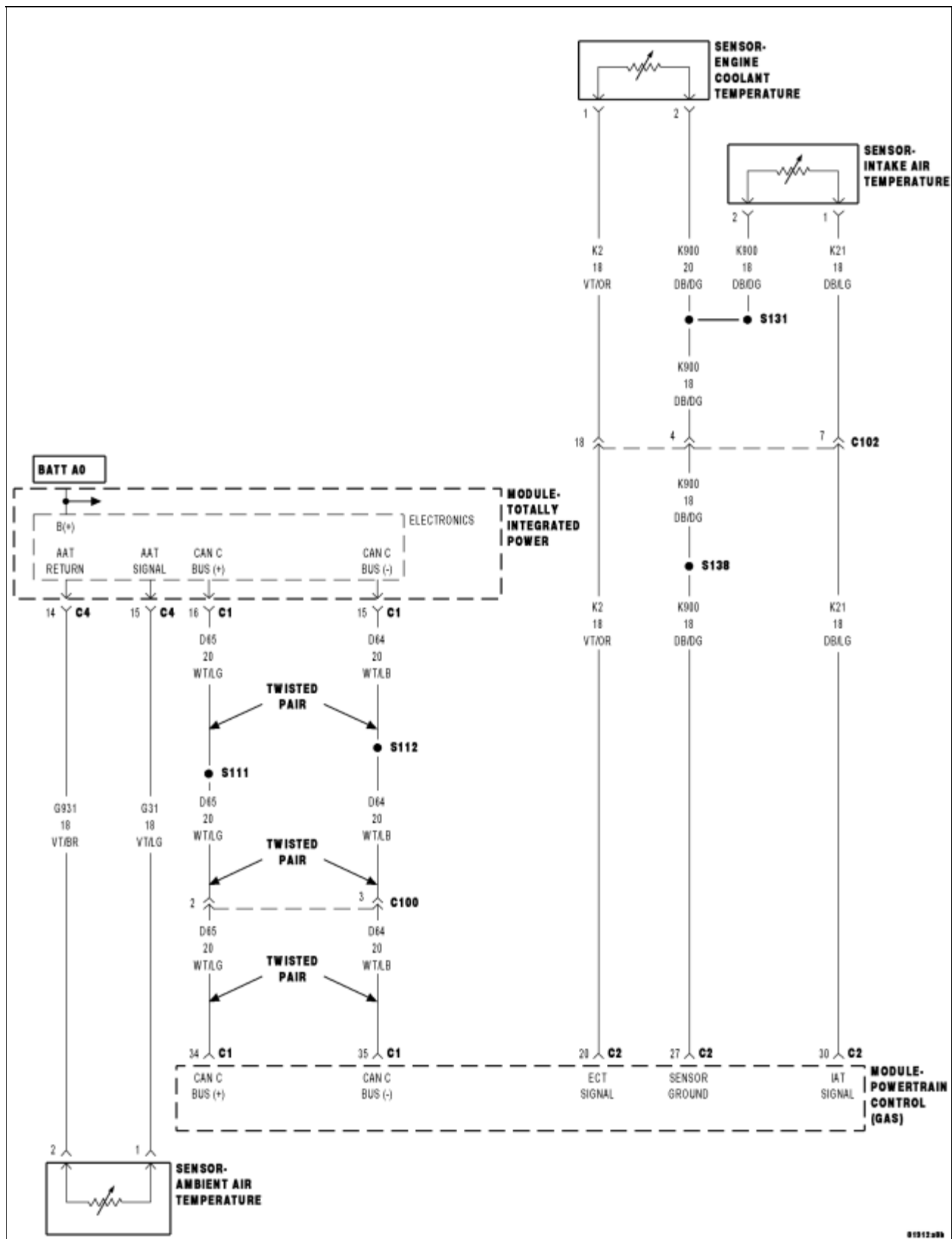
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Ambient Air Temperature Sensor performance looks at the outputs of three temperature sensors and compares them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and intake air temperature sensors agree and the ambient air temperature does not agree, the ambient air temperature sensor is declared as irrational. If declared irrational a second comparison will be done after a short drive cycle.

- **When Monitored:**

Engine off time is greater than 480 minutes and the vehicle has been driven for one minute over 35 mph. Ambient temperature is greater than -64° C (-83° F).

- **Set Condition:**

The PCM compares the ambient, engine coolant, and intake air temperature sensor values. If engine coolant and intake air temperature sensors agree with each other but ambient air temperature does not agree with them, the ambient air temperature sensor is declared as irrational. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT HIGH RESISTANCE
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT
(G31) AAT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G931) SENSOR GROUND HIGH RESISTANCE
AMBIENT AIR TEMPERATURE SENSOR
CAN C BUS CIRCUITS
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

Turn the ignition off.

If possible, allow the vehicle to sit with the ignition off for more than 480 minutes in an environment where the temperature is consistent and above -7° C (19.4° F).

Test drive the vehicle. The vehicle must exceed 48 km/h (30 mph) during the test drive. Do not cycle the ignition off when the test drive is completed.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. AMBIENT AIR TEMPERATURE

Turn the ignition off.

Allow the vehicle to sit with the ignition off in an environment where the temperature is consistent and above -7° C (19.4° F) until the engine coolant temperature is equal to ambient temperature.

Turn the ignition on.

With a scan tool, compare the AAT, ECT, and IAT sensor values.

Is the Ambient Air Temperature Sensor value within 10° C (18° F) of the other two sensor values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [3](#)

3. AAT SENSOR VOLTAGE

Turn the ignition off.

Disconnect the AAT sensor harness connector.
 Ignition on, engine not running.
 With a scan tool, read the AAT voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. AAT SENSOR

With a scan tool, read the AAT voltage.
 Connect a jumper wire between the (G31) AAT Signal circuit and the (G931) Sensor ground circuit in the AAT Sensor harness connector.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

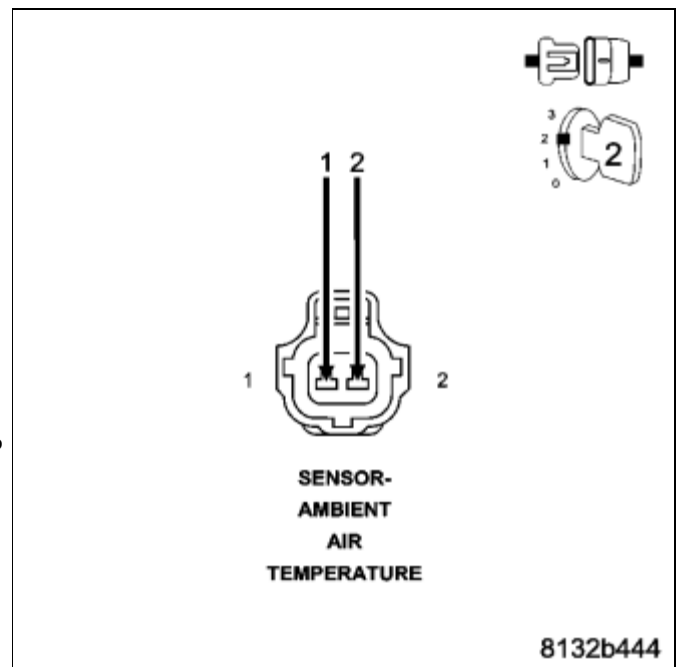
Yes

- Verify that there is good pin to terminal contact in the Sensor and Control Module connectors. If OK, replace the AAT Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.



5. (G31) AAT SIGNAL CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Reconnect the AAT sensor harness connector.

Using a voltmeter perform a voltage drop test. Backprobe the (G31) AAT Signal circuit at the AAT sensor harness connector and the C4 TIPM harness connector.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Is the voltage below 0.5 volts?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

6. (G931) SENSOR GROUND CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Using a voltmeter perform a voltage drop test. Backprobe the (G931) Sensor ground circuit at the AAT sensor harness connector and the C4 TIPM harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Is the voltage below 0.5 volts?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (G931) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (G31) AAT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C4 TIPM harness connector and remove special tool #8815.
 Ignition on, engine not running.
 Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

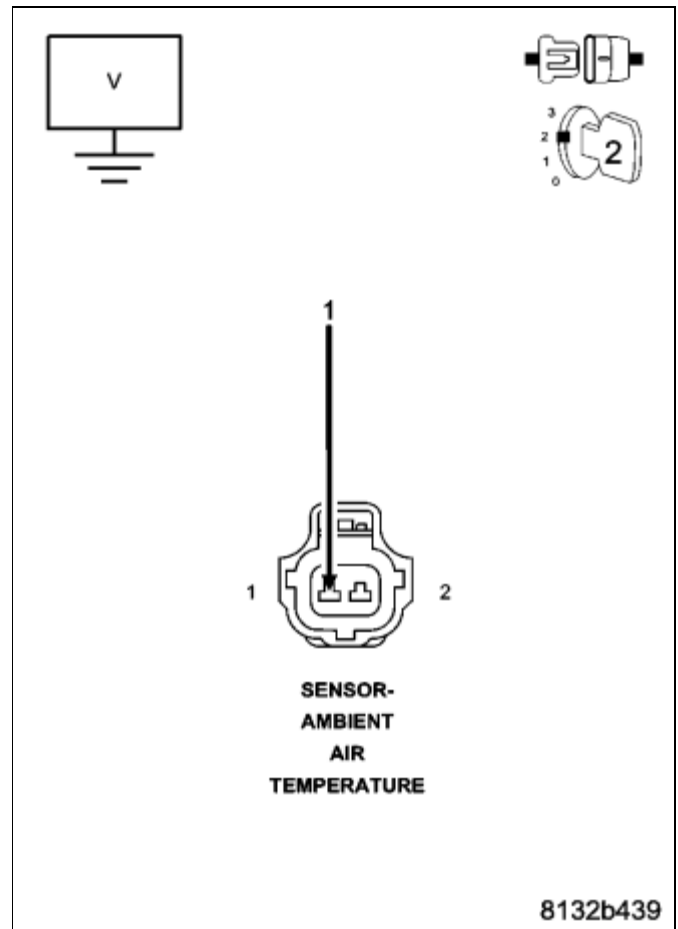
Is there any voltage present?

Yes

- Repair the short to voltage in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

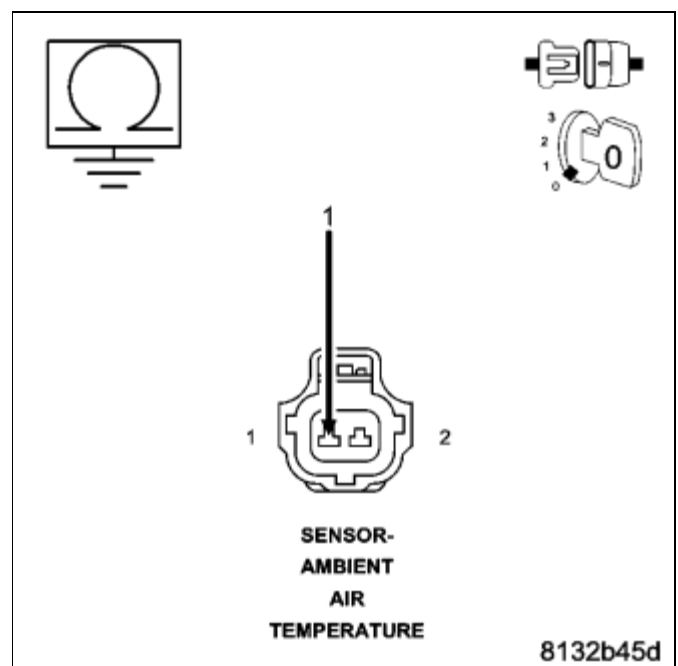
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT

9.

Measure the resistance between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

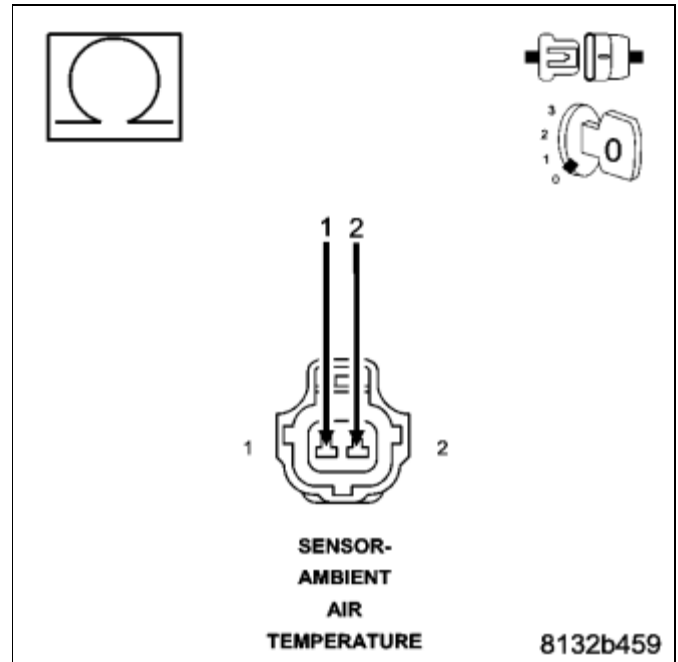
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the AAT Sensor and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

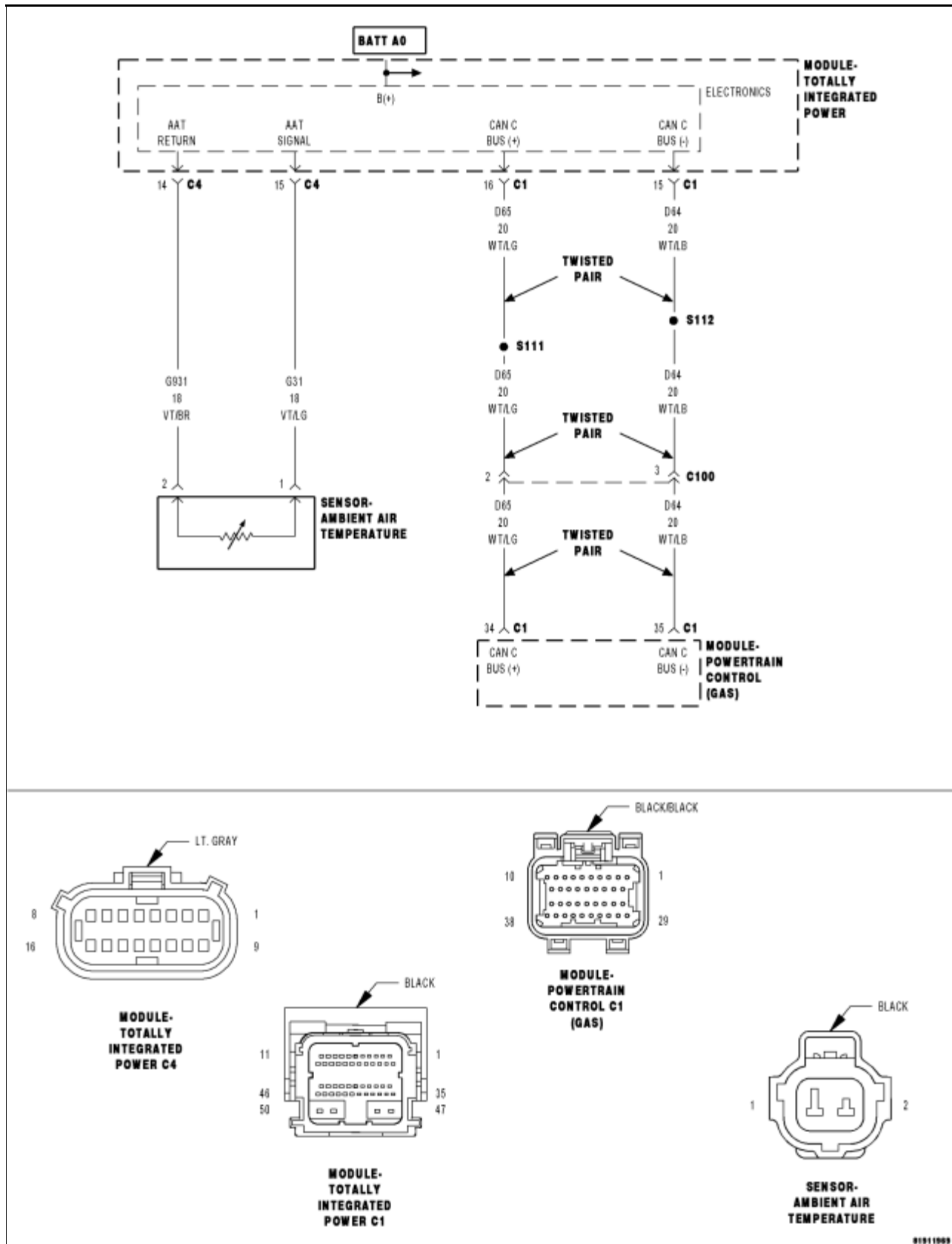
Yes

- Repair as necessary.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The ignition key on.

◦ **Set Condition:**

Ambient Temperature Sensor is less than the minimum acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (G31) AAT SIGNAL CIRCUIT
AMBIENT AIR TEMPERATURE SENSOR
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN C Bus Communication DTCs before continuing.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING AAT SENSOR

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

Ignition on, engine not running.

With a scan tool, read the AAT Sensor voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the Sensor and Control Module connectors. If OK, replace the Ambient Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C4 TIPM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

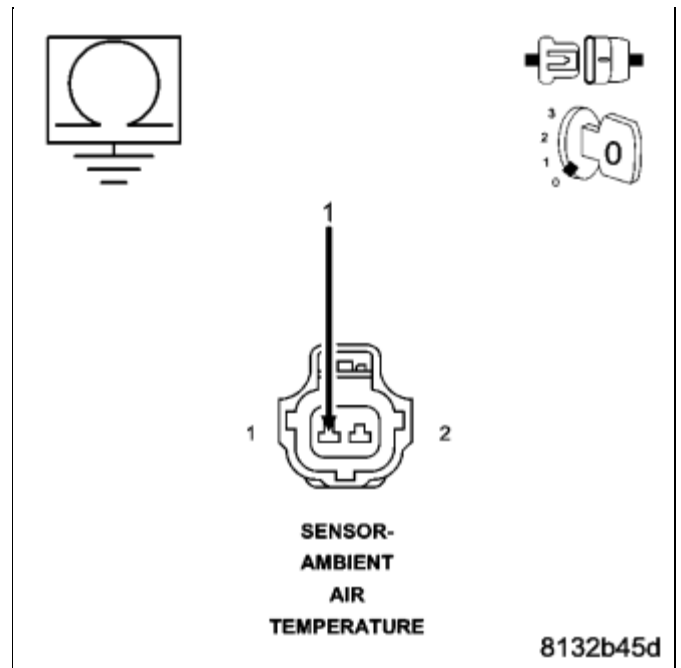
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) SENSOR GROUND CIRCUIT

Measure the resistance between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

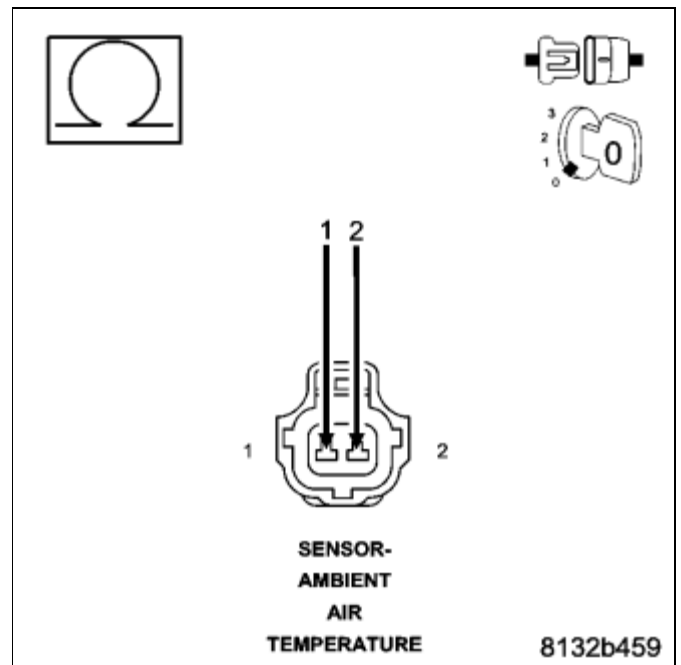
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (G931) Sensor ground circuit and the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. EXCESSIVE RESISTANCE IN THE (G31) AAT SIGNAL CIRCUIT

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the C4 TIPM harness connector.

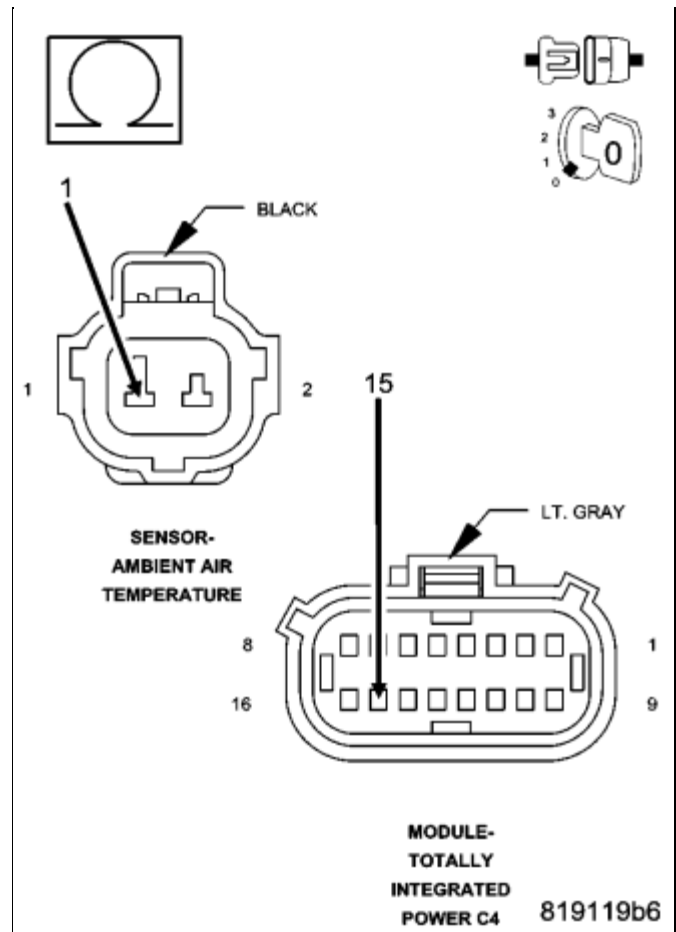
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the AAT Sensor and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

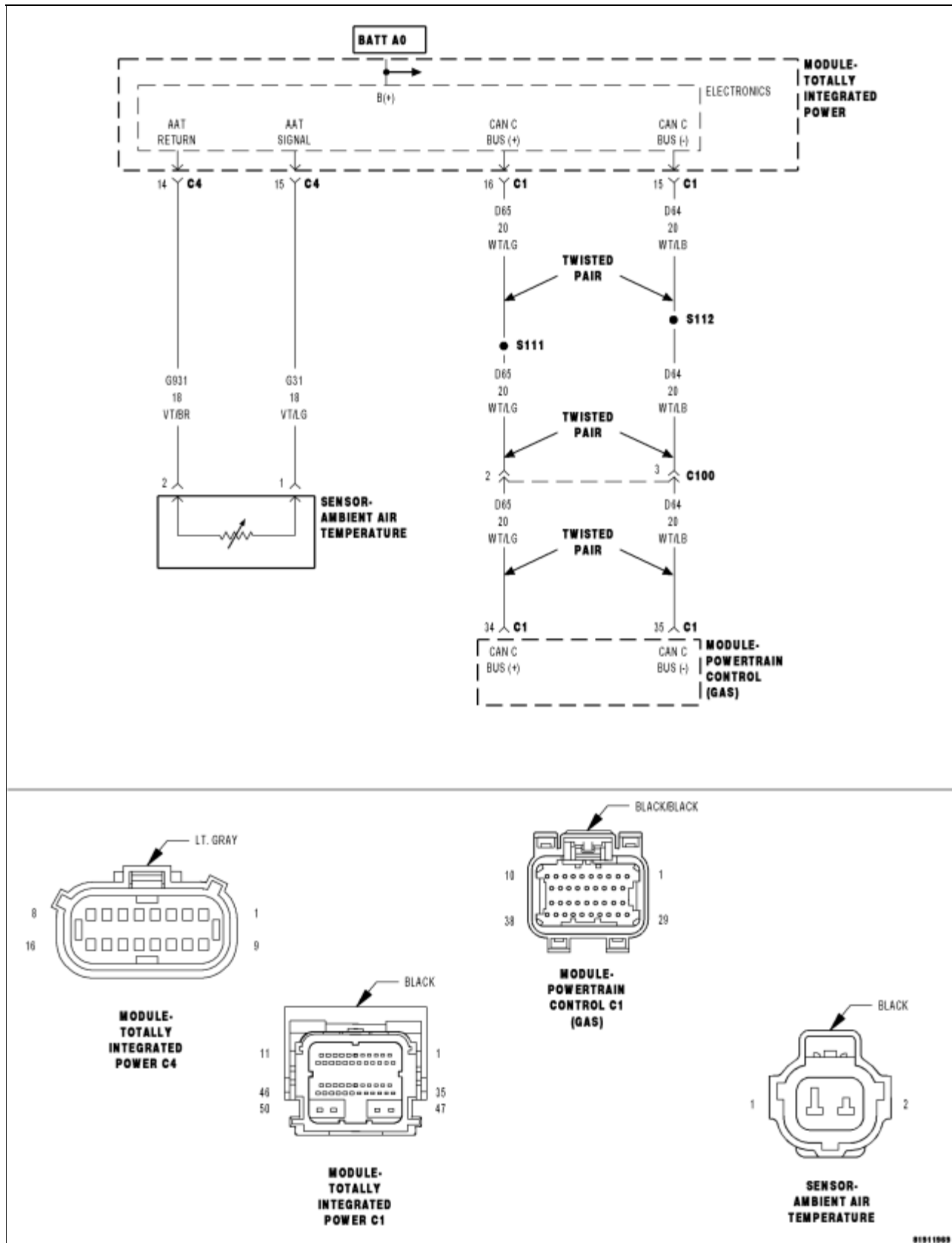
Yes

- Repair as necessary.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace and program the Totally Integrated Power Module per Service Information.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

P0073-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH



For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

The Ambient Temperature Sensor voltage is greater than the maximum allowable voltage. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(G931) SENSOR GROUND CIRCUIT OPEN
AMBIENT AIR TEMPERATURE SENSOR
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN C Bus Communication DTCs before continuing.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. AAT SENSOR

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

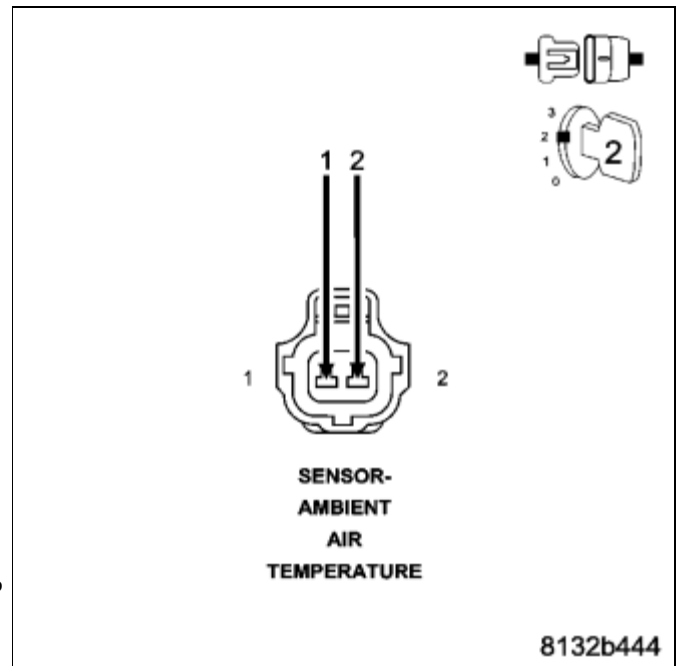
Ignition on, engine not running.

With a scan tool, read AAT Sensor voltage.

Connect a jumper wire between the (G31) AAT Signal circuit and the (G931) Sensor ground circuit in the AAT Sensor harness connector.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

**Yes**

- Verify that there is good pin to terminal contact in the Sensor and Control Module connectors. If OK, replace the Ambient Air Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C4 TIPM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (G31) AAT Signal circuit in the
 AAT Sensor harness connector.

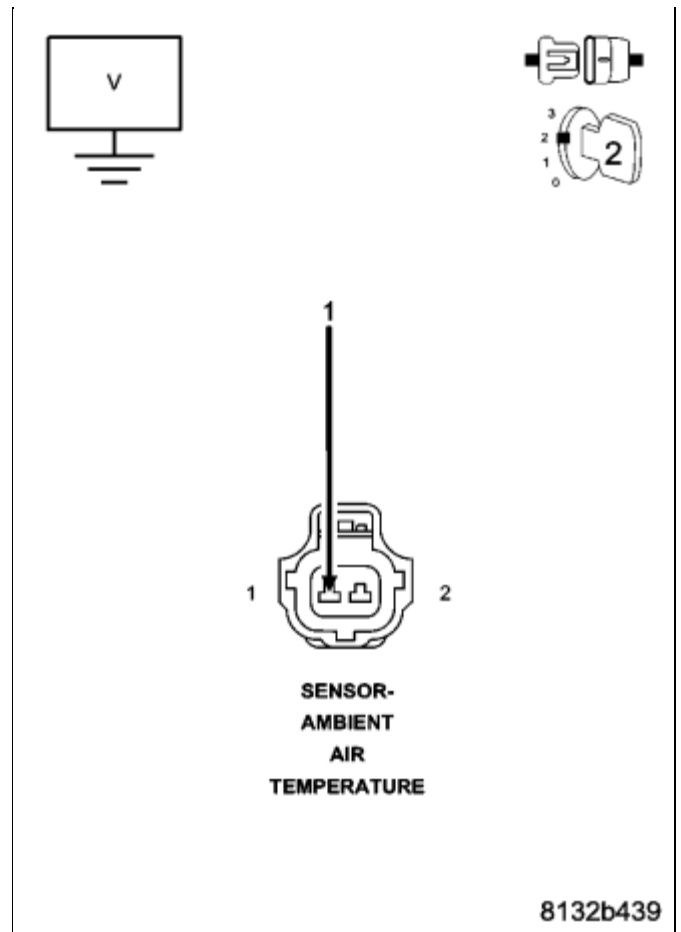
Is there any voltage present?

Yes

- Repair the short to voltage in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Measure the resistance of the (G31) AAT Signal circuit from
 the AAT Sensor harness connector to the C4 TIPM harness
 connector.

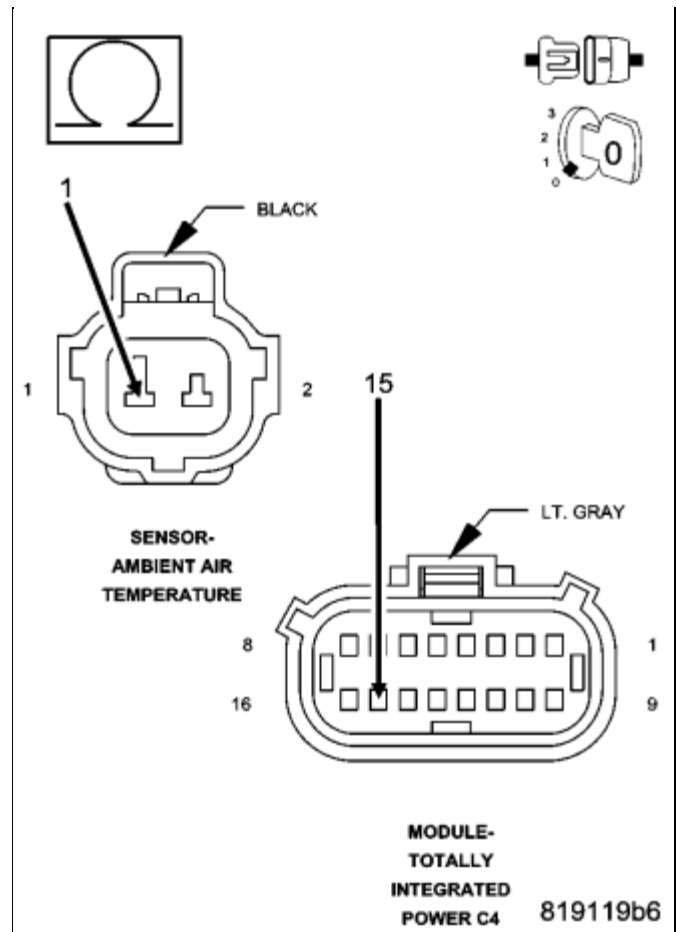
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (G31) AAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (G931) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C4 TIPM harness connector.

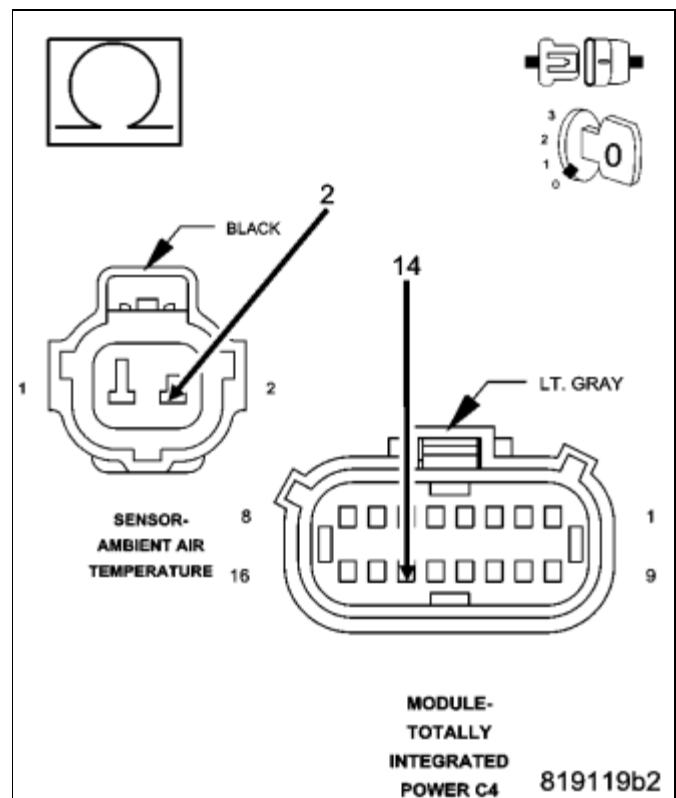
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (G931) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the AAT Sensor and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

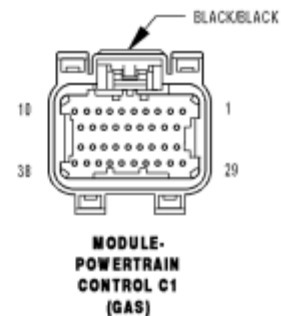
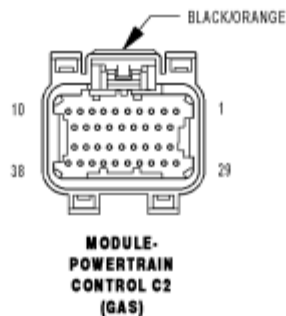
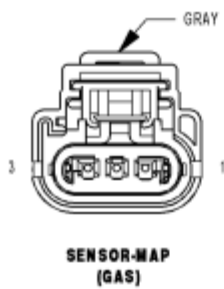
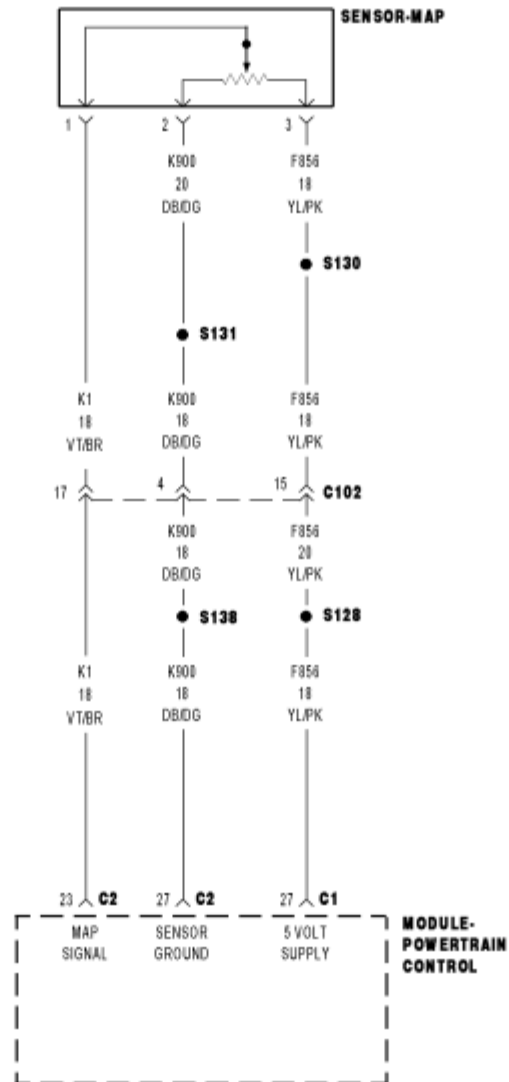
Yes

- Repair as necessary.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW



01012091

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine speed between 600 to 3500 RPM. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM detects that the MAP Sensor input voltage is below the minimum acceptable value. One Trip Fault. Three good trips to turn off the MIL. The MIL will illuminate and the ETC light will flash if equipped.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
MAP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

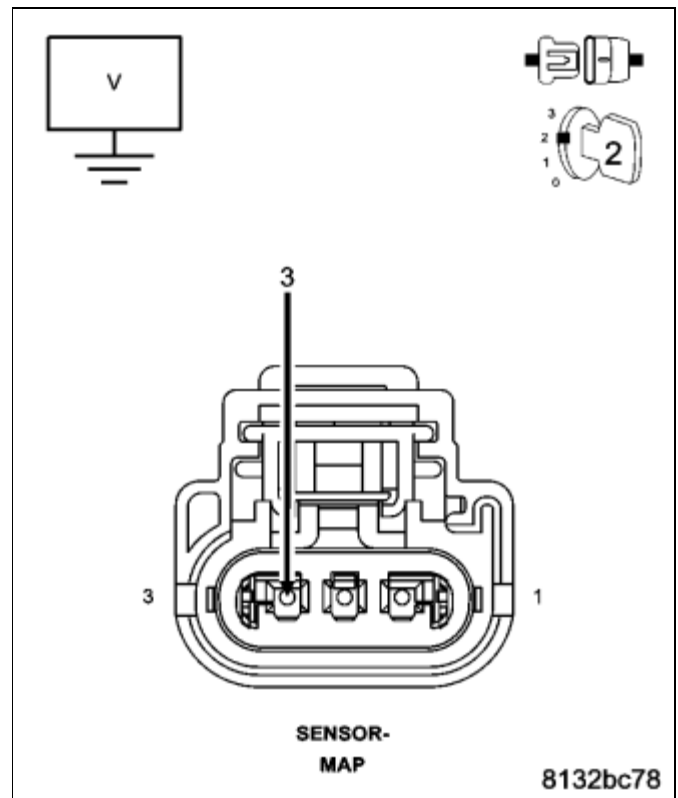
Is the voltage between 4.5 to 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [7](#)



3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Is the voltage above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the Sensor and Powertrain Control Module connectors. If OK, replace the MAP Sensors.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

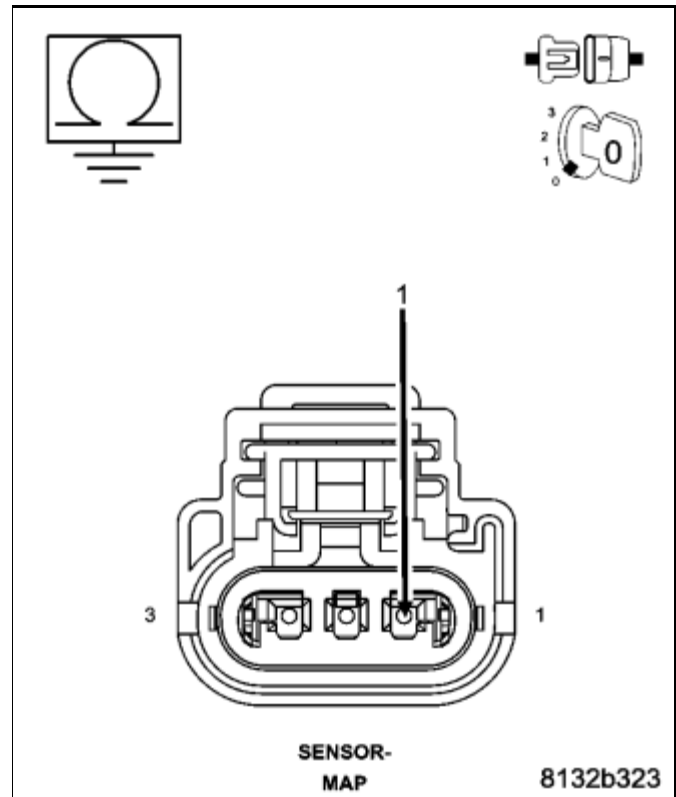
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

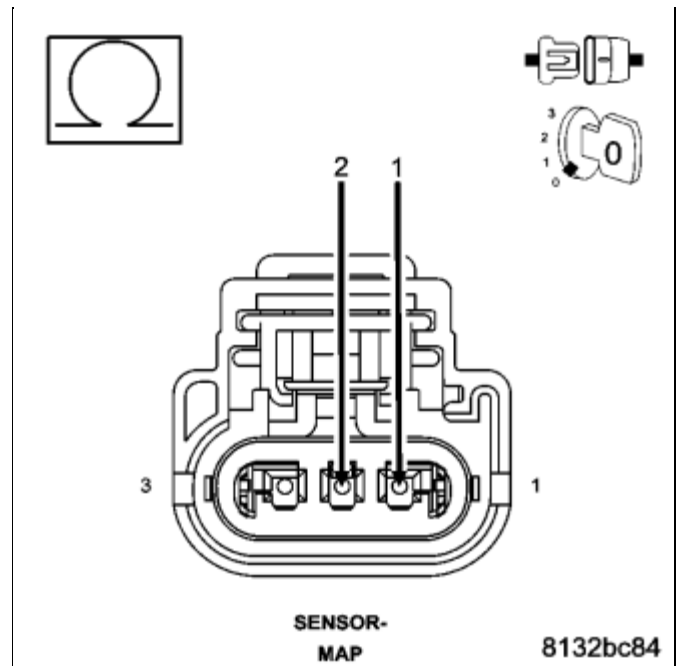
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K900) Sensor ground and the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



6. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit between the MAP Sensor harness connector and the appropriate terminal of special tool #8815.

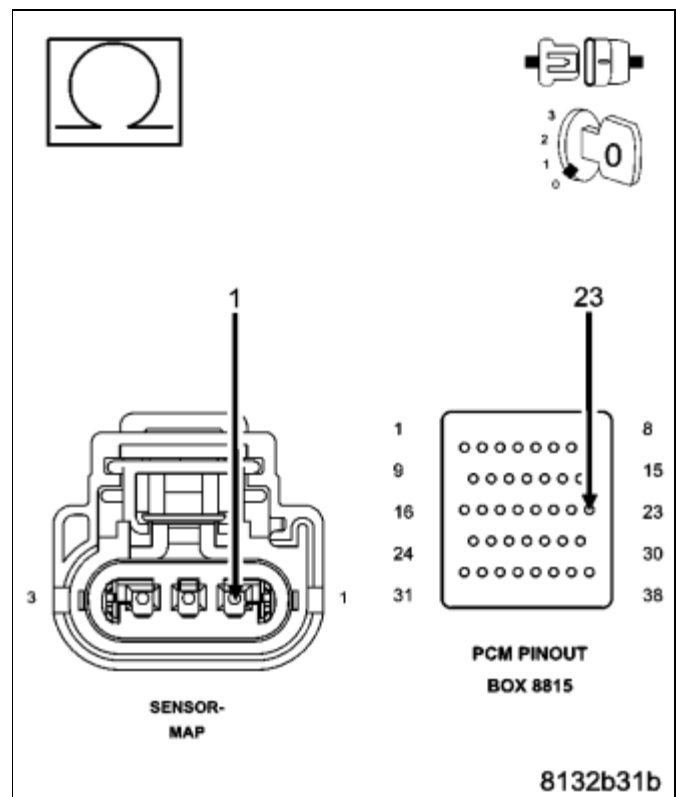
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the excessive resistance in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

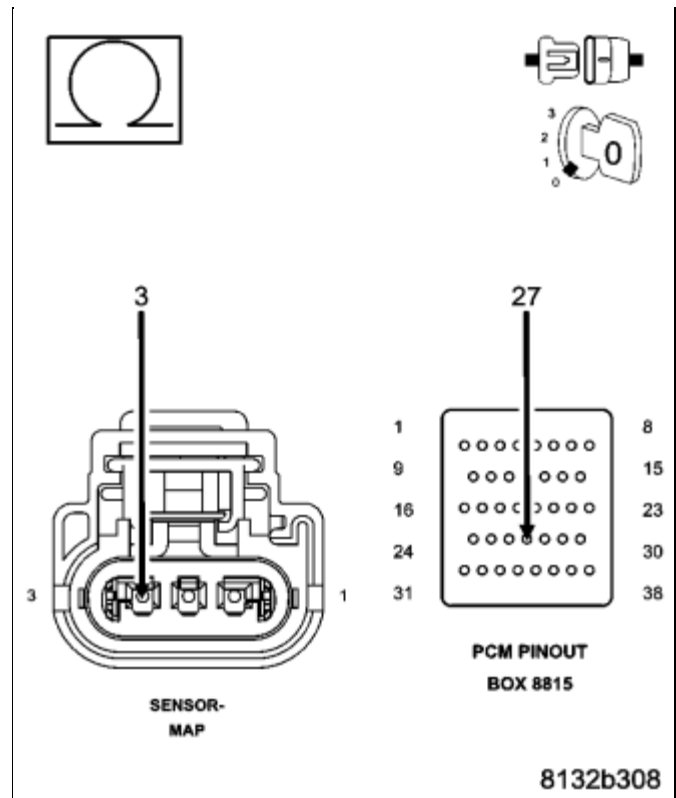
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



8. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

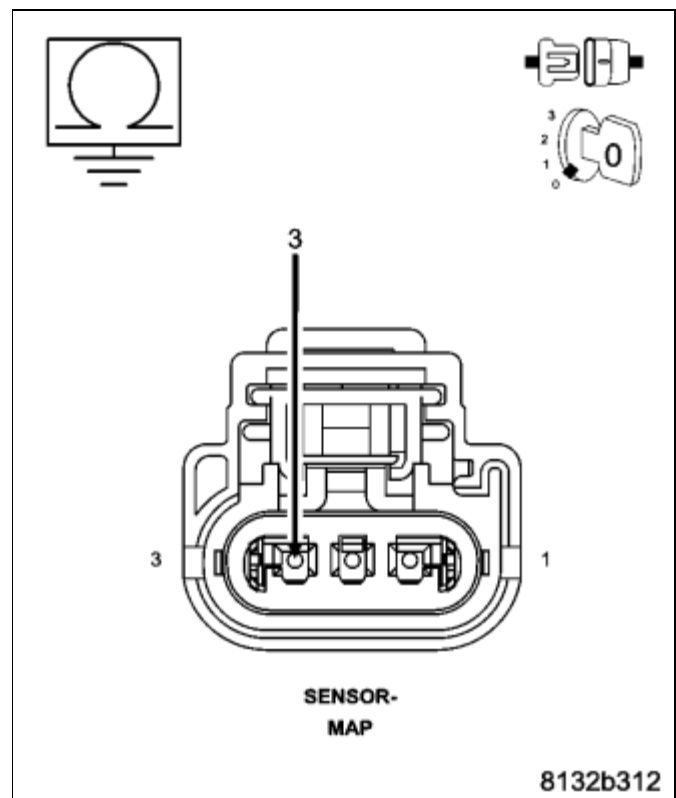
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

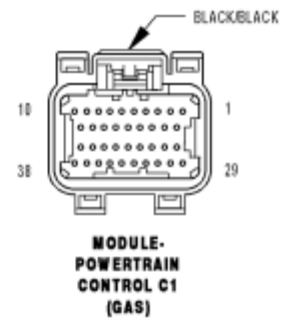
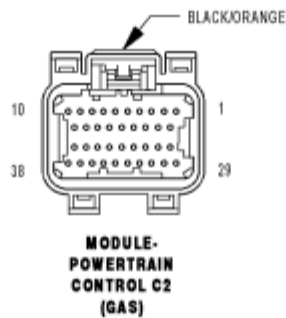
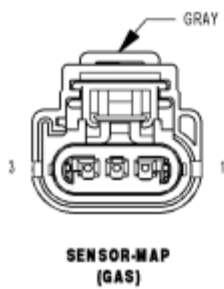
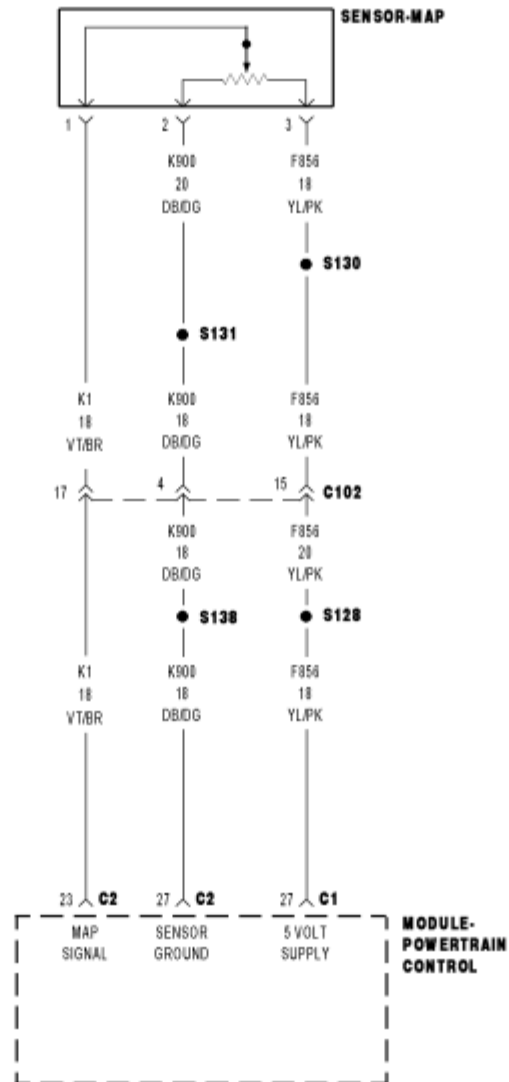
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH



01012091

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine speed between 600 to 3500 RPM. Battery voltage greater than 10.37 volts.

◦ **Set Condition:**

The MAP sensor signal voltage is greater than maximum acceptable voltage. One trip fault. Three good trips to turn off the MIL. MIL will illuminate and the ETC light will flash.

Possible Causes
(K1) MAP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
MAP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. MAP SENSOR

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

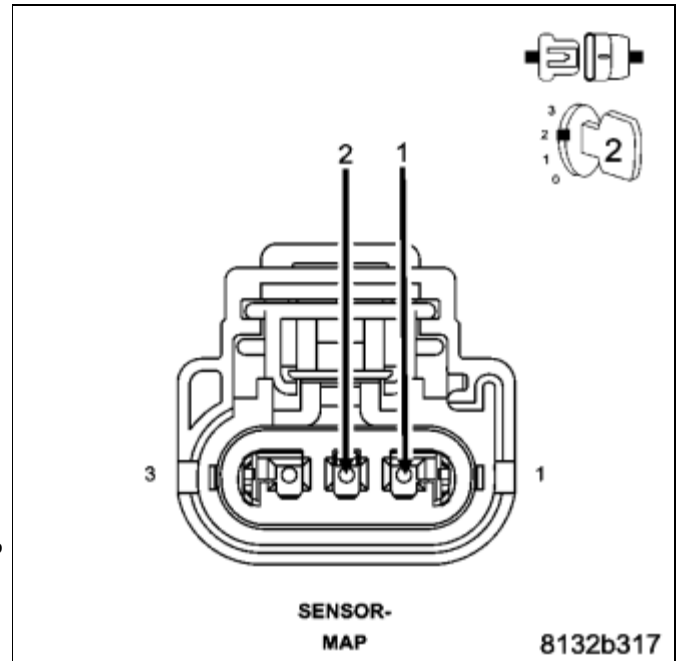
Yes

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. If OK, replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (K1) MAP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K1) MAP Signal circuit in the MAP Sensor harness connector.

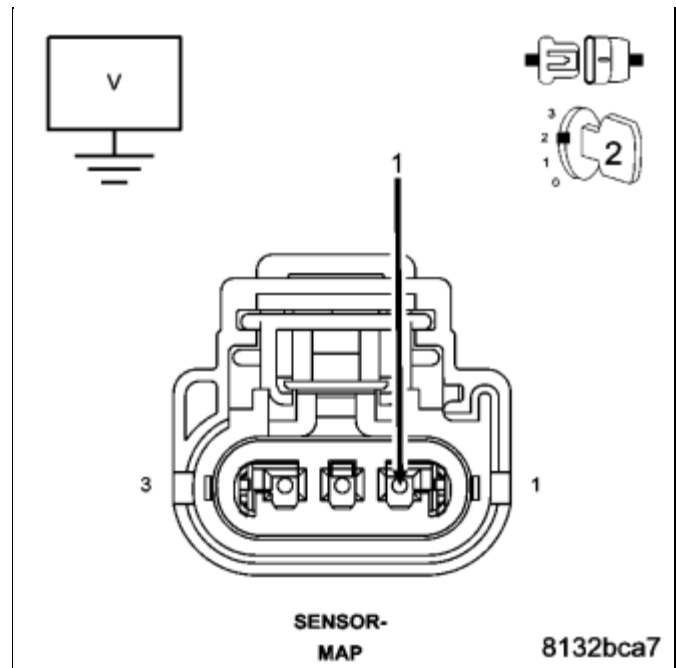
Is there any voltage present?

Yes

- Repair the short to voltage in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

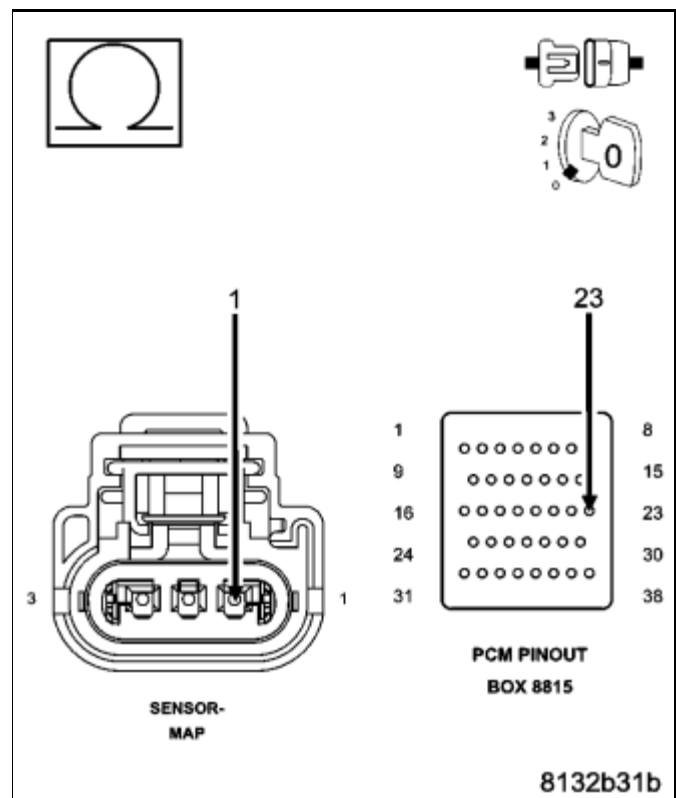
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

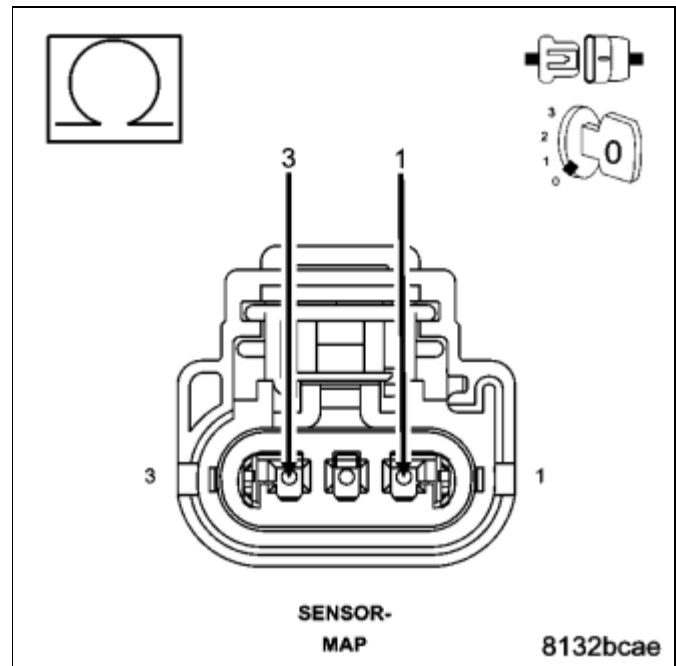
Is the resistance below 100 ohms?

Yes

- Repair the short between the (F856) 5-volt Supply circuit and the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

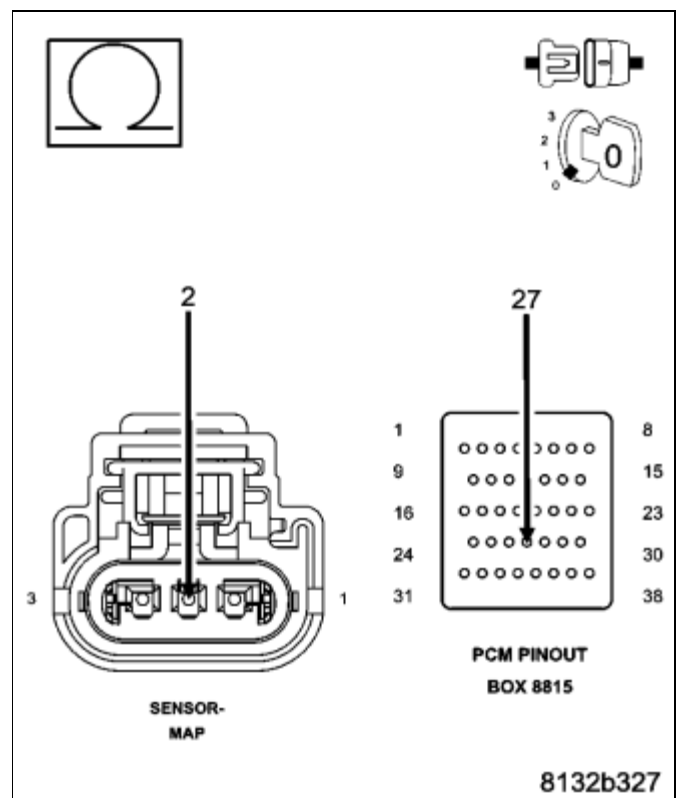
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor and

the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

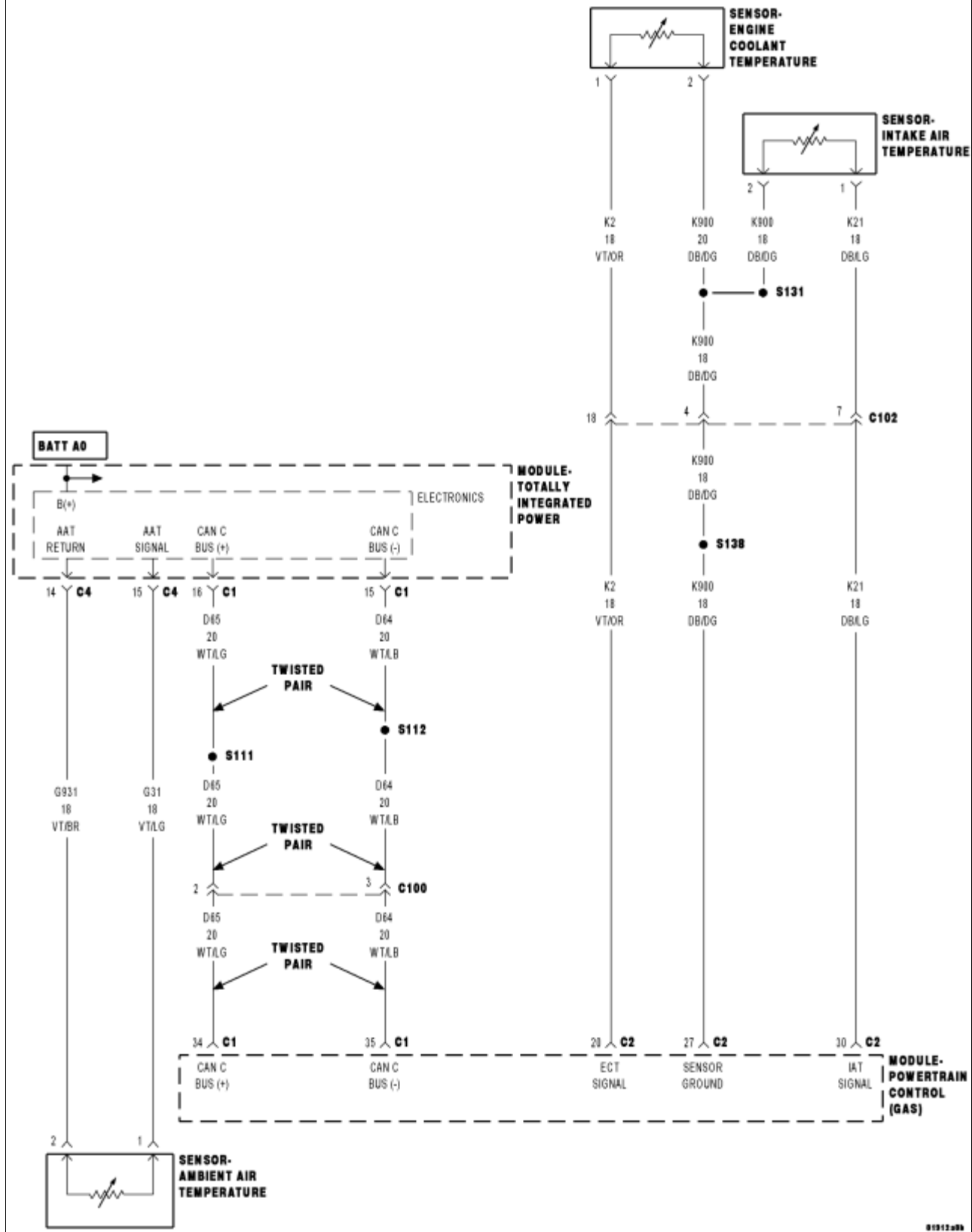
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Intake Air Temperature Sensor performance looks at the outputs of three temperature sensors and compares them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and ambient air temperature sensors agree and the intake air temperature does not agree, the intake air temperature sensor is declared as irrational. If declared irrational a second comparison will be done after a short drive cycle.

- **When Monitored:**

The engine off time is greater than 480 minutes. Ambient Temperature if greater than -64° C (-83° F).

- **Set Condition:**

Once the vehicle is soaked for a calibrated engine off time and then driven over calibrated speed and load conditions for some calibrated time, the PCM compares the ambient, engine coolant, and intake air temperature sensor values. If engine coolant and ambient air temperature sensors agree with each other but intake air temperature does not agree with them, the intake air temperature sensor is declared as irrational. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE (K21) IAT SIGNAL CIRCUIT
(K21) IAT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition off.

If possible, allow the vehicle to sit with the ignition off for more than 480 minutes in an environment where the

temperature is consistent and above -7° C (19.4° F).

Test drive the vehicle. The vehicle must exceed 48 km/h (30 mph) during the test drive. Do not cycle the ignition off when the test drive is completed.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. INTAKE AIR TEMPERATURE

Turn the ignition off.

Allow the vehicle to sit with the ignition off in an environment where the temperature is consistent and above -7° C (19.4° F) until the engine coolant temperature is equal to ambient temperature.

Turn the ignition on.

With a scan tool, compare the AAT, ECT, and IAT sensor values.

Is the Intake Air Temperature Sensor value within 10° C (18° F) of the other two sensor values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [3](#)

3. IAT SENSOR VOLTAGE

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Turn the ignition on.

With a scan tool, read the Intake Air Temperature Sensor voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. IAT SENSOR

With a scan tool, read the IAT voltage.
Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

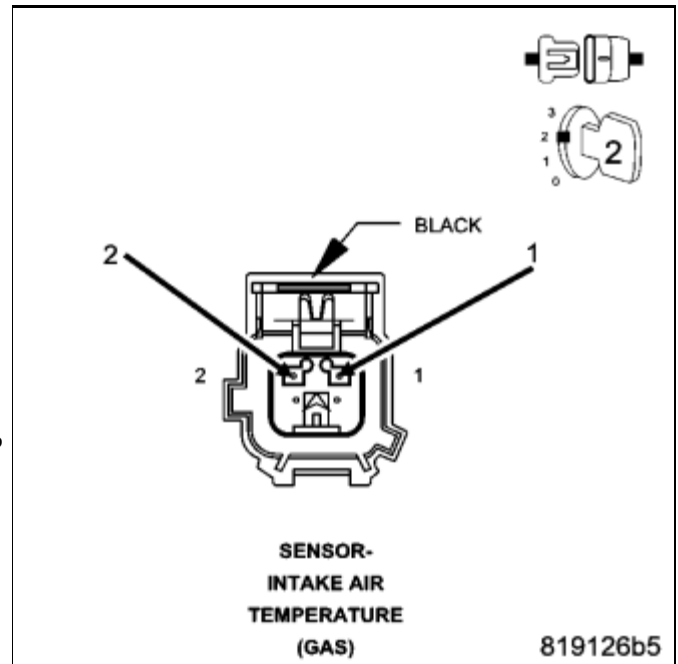
Yes

- Verify that there is good pin to terminal contact in the Sensor and Powertrain Control Module connectors. Replace the IAT Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.



5. EXCESSIVE RESISTANCE IN THE (K21) IAT SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K21) IAT Signal circuit at the IAT Sensor harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the open in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K900) Sensor Ground circuit at the IAT Sensor harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 volts?

Yes

- Go To [7](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. (K21) IAT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the special tool #8815 from the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

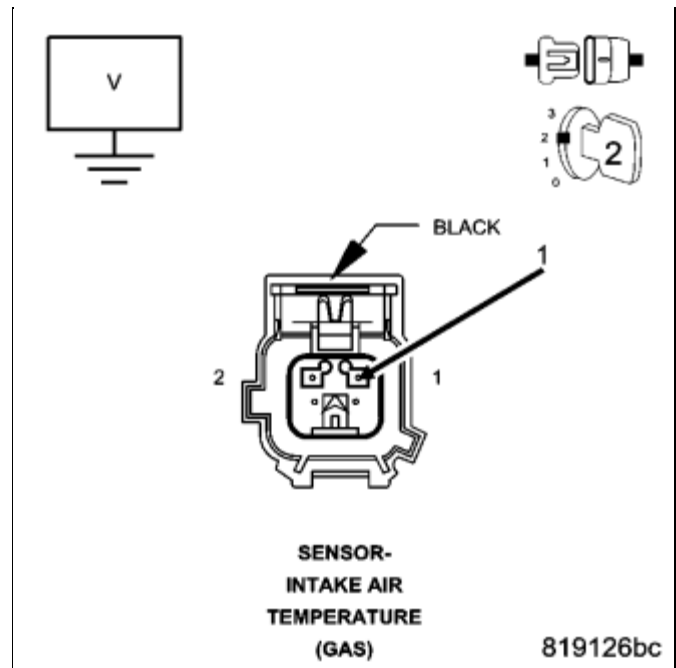
Is there any voltage present?

Yes

- Repair the short to voltage in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.

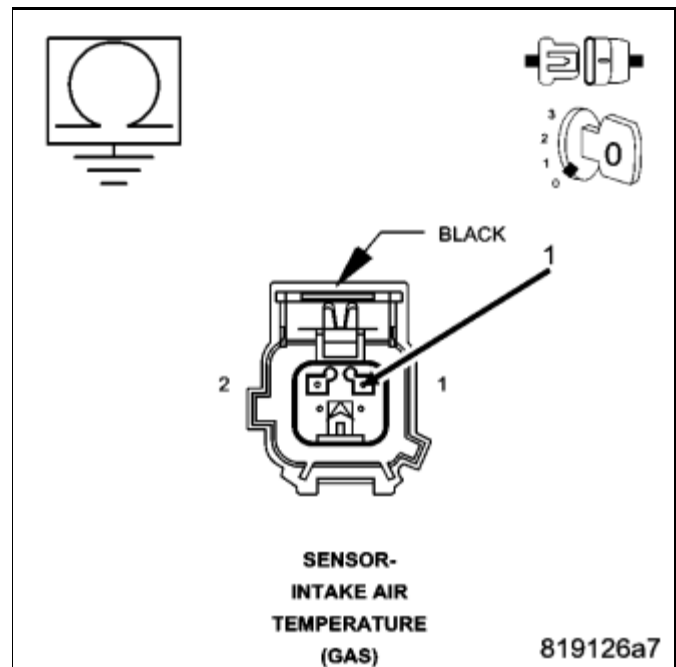
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



9. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor

harness connector.

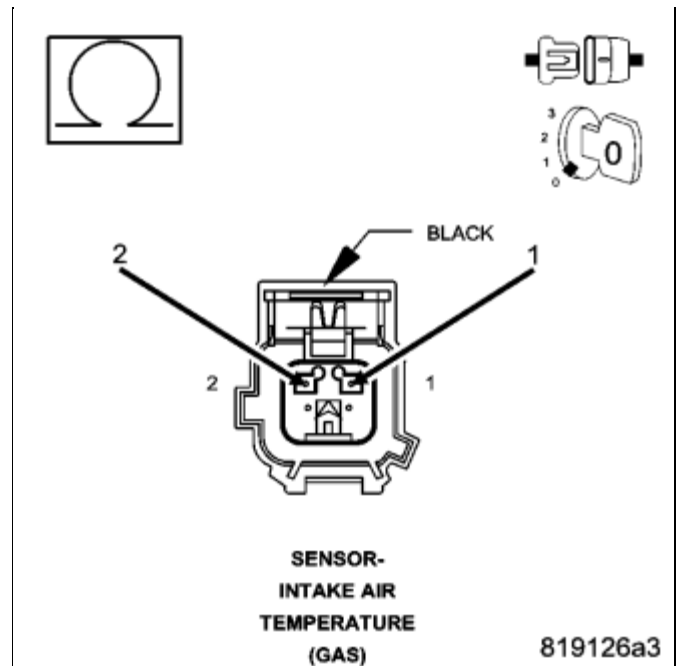
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the IAT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Intake Air Temperature Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

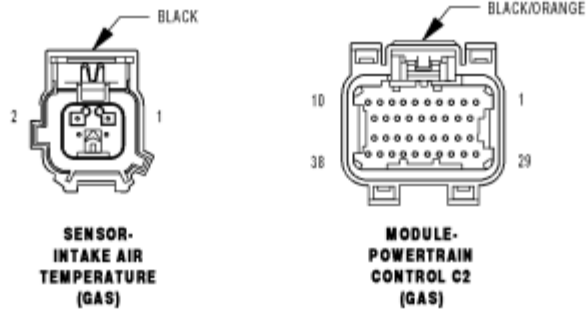
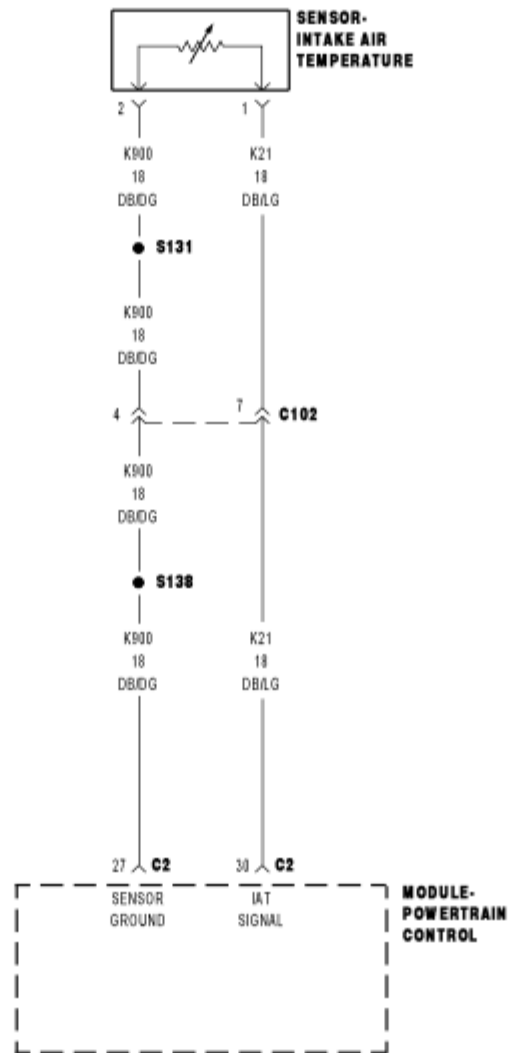
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW



8181289*

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and battery voltage greater than 10.4 volts.

◦ **Set Condition:**

When the Inlet Air Temp Sensor Signal circuit voltage is less than the minimum acceptable voltage. One trip failure. Three good trips to clear the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (K21) IAT SIGNAL CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. IAT SENSOR

Turn the ignition off.

Disconnect the IAT Sensor harness connector.

Ignition on, engine not running.

With a scan tool, read IAT voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the IAT Sensor and Powertrain Control Module connectors. If OK, replace the Intake Air Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.

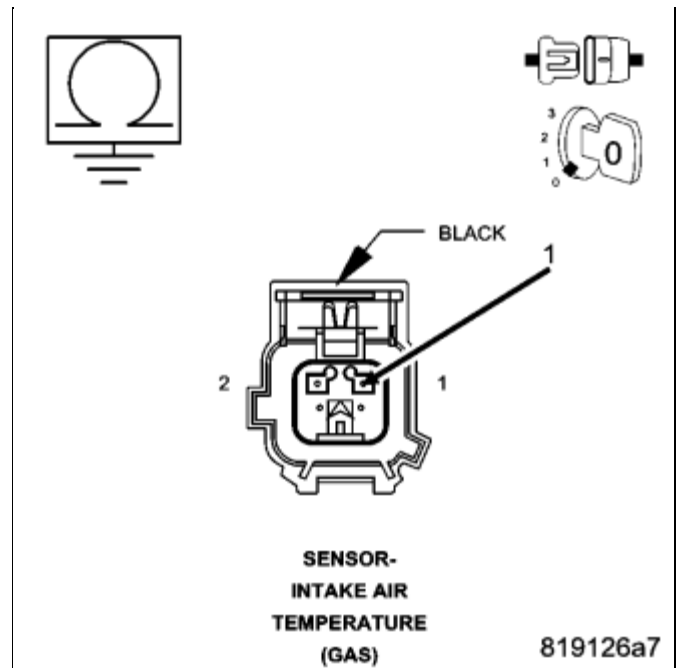
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

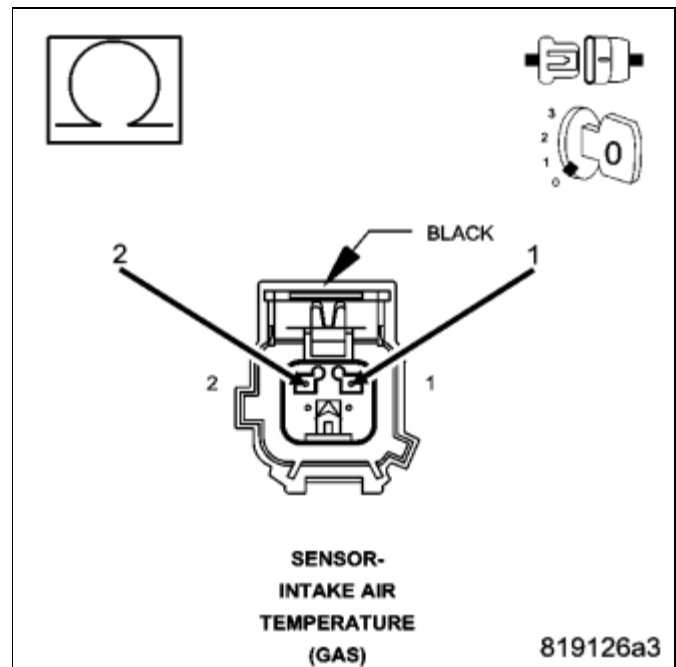
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. EXCESSIVE RESISTANCE IN THE (K21) IAT SIGNAL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit between the Intake Air Temperature Sensor harness connector and the appropriate terminal of special tool #8815.

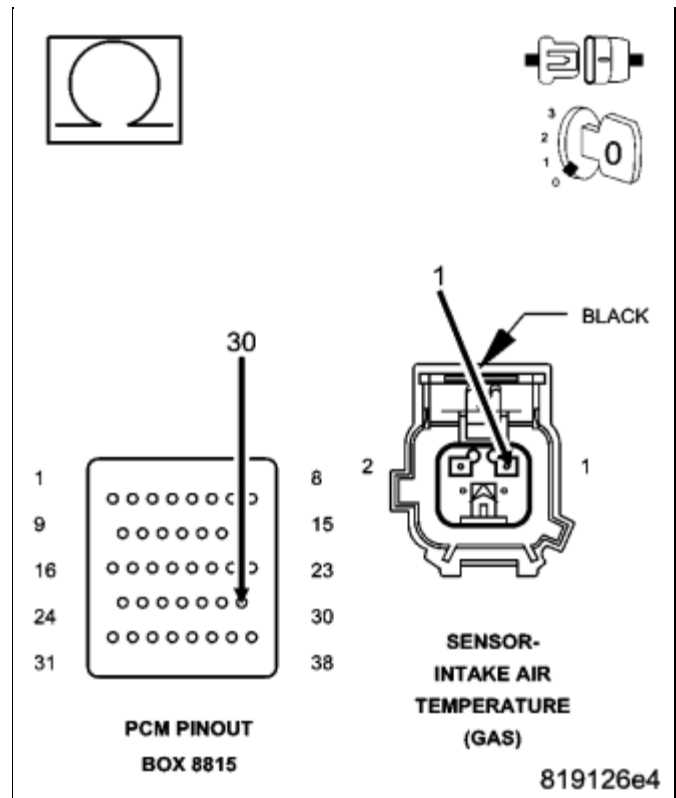
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the IAT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the IAT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

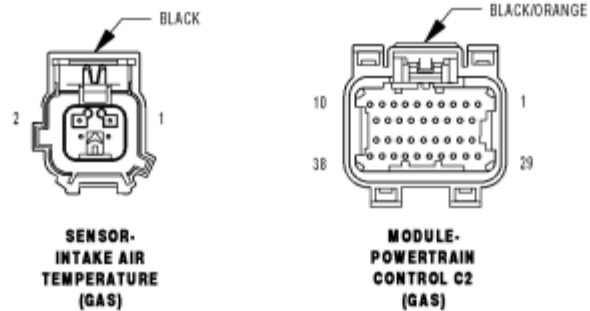
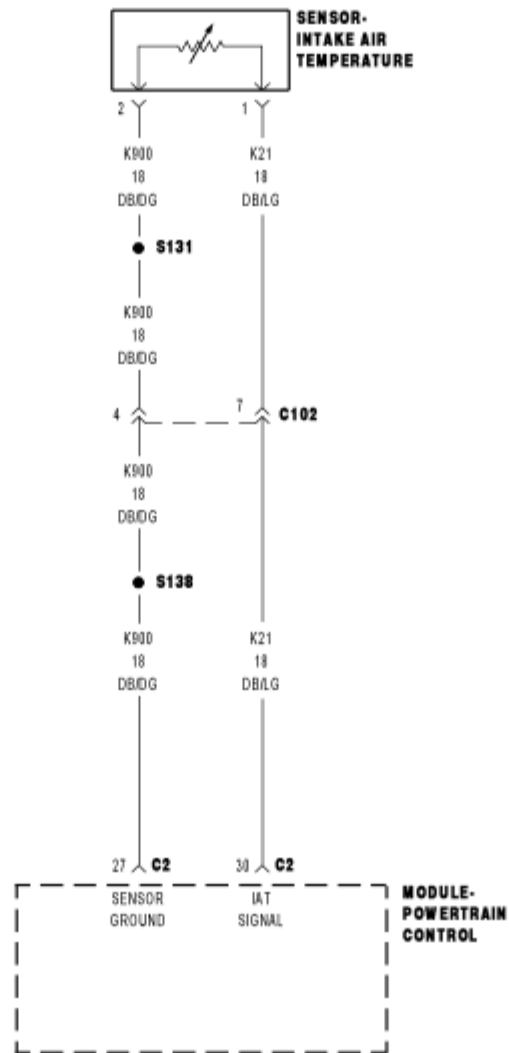
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH



8181289*

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The Intake Air Temperature (IAT) sensor circuit voltage at the PCM goes above the maximum acceptable voltage. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
IAT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. IAT SENSOR

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

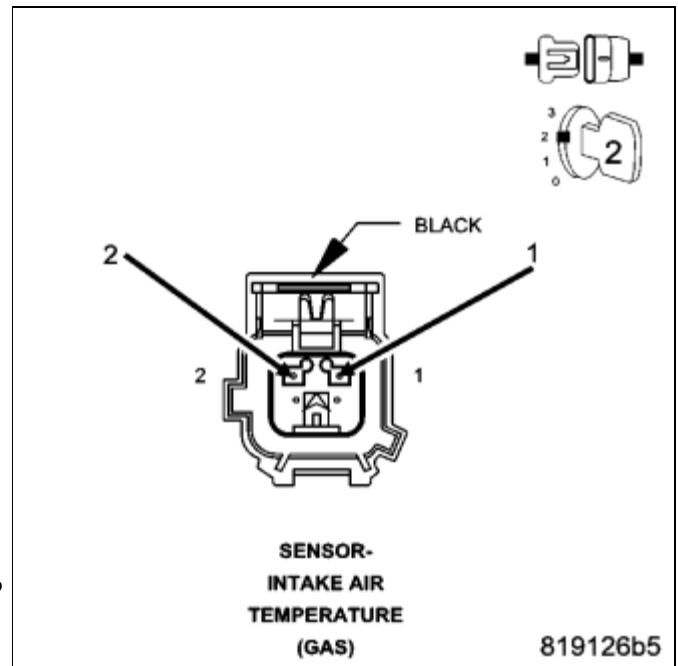
Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Ignition on, engine not running.

With a scan tool, read the IAT Sensor voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?



Yes

- Verify that there is good pin to terminal contact in the IAT Sensor and Powertrain Control Module connectors. If OK, replace the IAT Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

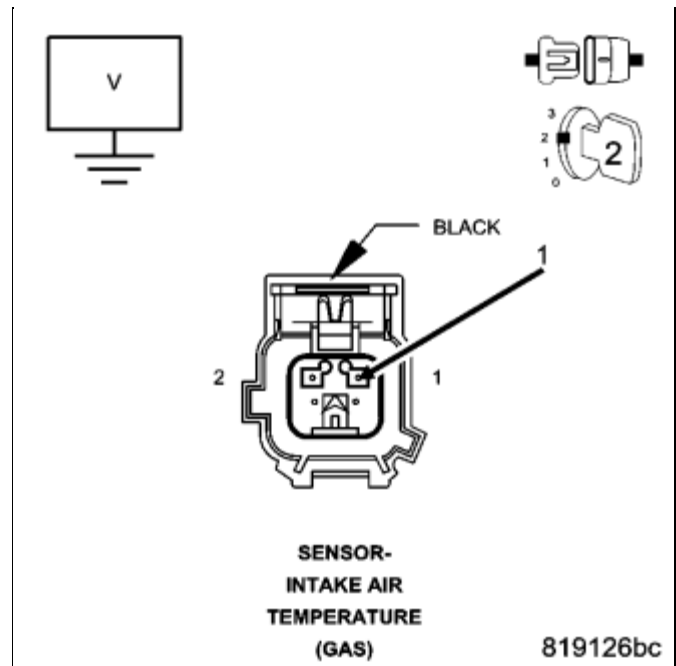
Is there any voltage present?

Yes

- Repair the short to voltage in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

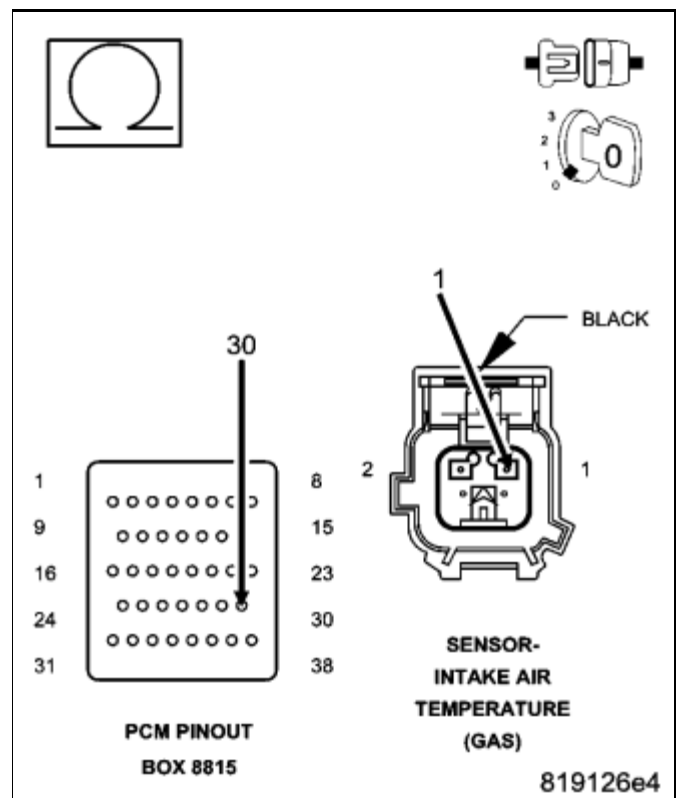
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K21) IAT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

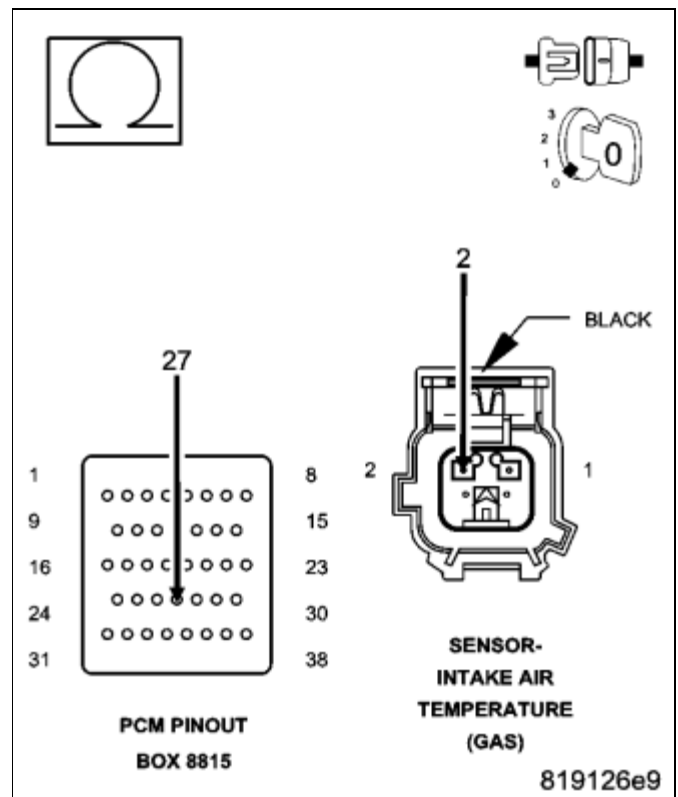
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the IAT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the IAT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0116-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE

Engine Coolant Temperature Sensor performance looks at the outputs of three temperature sensors and compares them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the intake air and ambient air temperature sensors agree and the intake air temperature does not agree, the engine coolant temperature sensor is declared as irrational.

- **When Monitored:**

Engine off time is greater than 480 minutes and the vehicle has been driven for one minute over 35 mph. Ambient temperature is greater than -64° C (-83° F).

- **Set Condition:**

Once the vehicle is soaked for a calibrated engine off time and then driven over calibrated speed and load conditions for some calibrated time, the PCM compares the ambient, engine coolant, and intake air temperature sensor values. If ambient air and intake air temperature sensors agree with each other but engine coolant temperature does not agree with them, the engine coolant temperature sensor is declared as irrational. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE (K2) ECT SIGNAL CIRCUIT
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE
EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
ENGINE COOLANT TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

Turn the ignition off.

If possible, allow the vehicle to sit with the ignition off for more than 480 minutes in an environment where the temperature is consistent and above -7° C (19.4° F).

Test drive the vehicle. The vehicle must exceed 48 km/h (30 mph) during the test drive. Do not cycle the ignition off when the test drive is completed.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. ENGINE COOLANT TEMPERATURE

Turn the ignition off.

Allow the vehicle to sit with the ignition off in an environment where the temperature is consistent and above -7° C (19.4° F) until the engine coolant temperature is equal to ambient temperature.

Turn the ignition on.

With a scan tool, compare the AAT, ECT, and IAT sensor values.

Is the Engine Coolant Temperature Sensor value within 10° C (18° F) of the other two sensor values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [3](#)

3. ECT SENSOR VOLTAGE

Turn the ignition off.

Disconnect the Engine Coolant Temperature Sensor harness connector.

Turn the ignition on.

With a scan tool, read the Engine Coolant Temperature Sensor voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. ECT SENSOR

Turn the ignition off.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor Ground circuit in the Engine Coolant Temperature Sensor harness connector.

Turn the ignition on.

With a scan tool, read the Engine Coolant Temperature Sensor voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

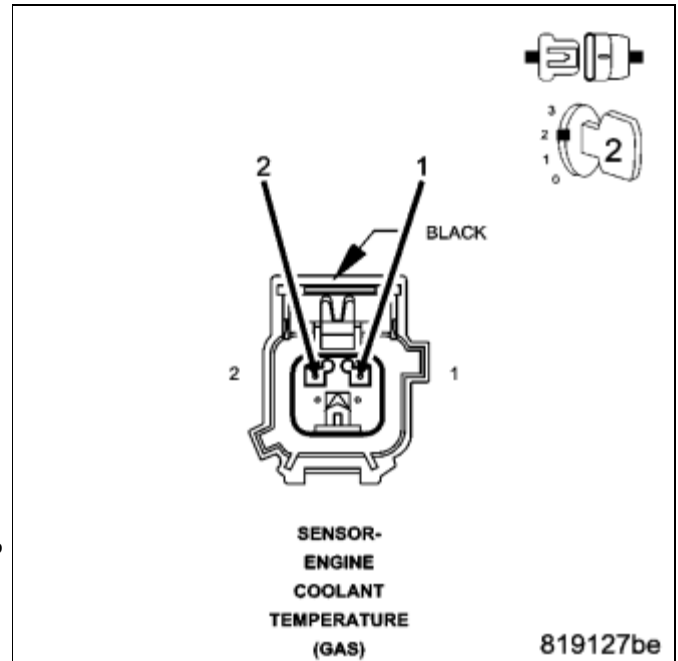
Yes

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. If OK, replace the ECT Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.



5. EXCESSIVE RESISTANCE IN THE (K2) ECT SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K2) ECT Signal circuit at the ECT Sensor harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the open in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

6. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K900) Sensor Ground circuit at the ECT Sensor harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is indicated on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 volts?

Yes

- Go To [7](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

(K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE

7.

Turn the ignition off.
 Disconnect the C2 PCM harness connector and remove special tool #8815.
 Ignition on, engine not running.
 Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

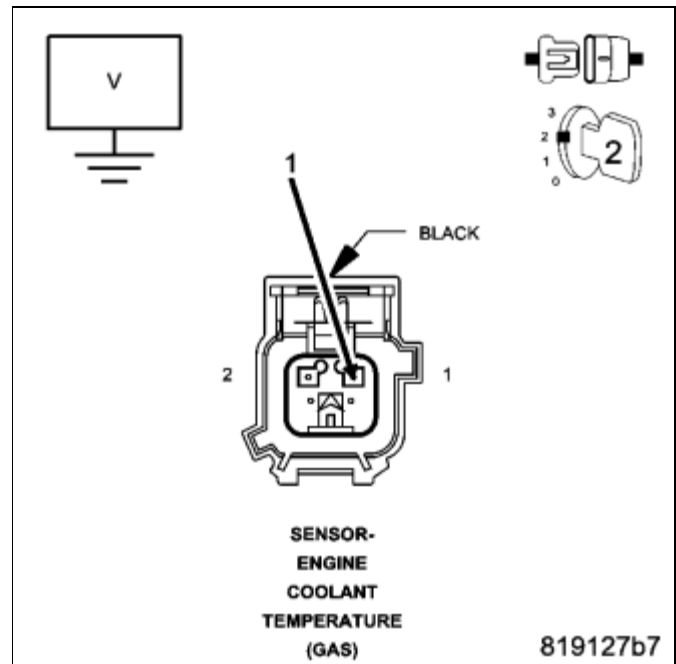
Is there any voltage present?

Yes

- Repair the short to voltage in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.
 Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

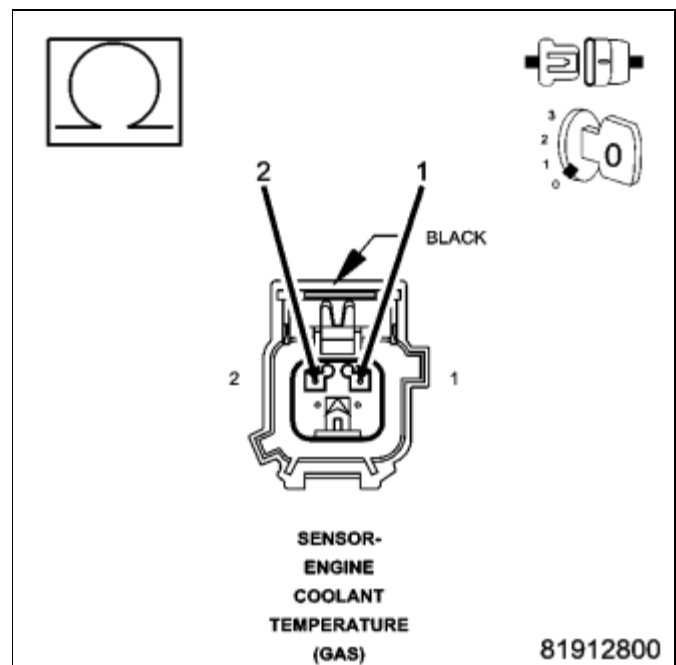
Is the resistance below 5.0 ohms?

Yes

- Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



9. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

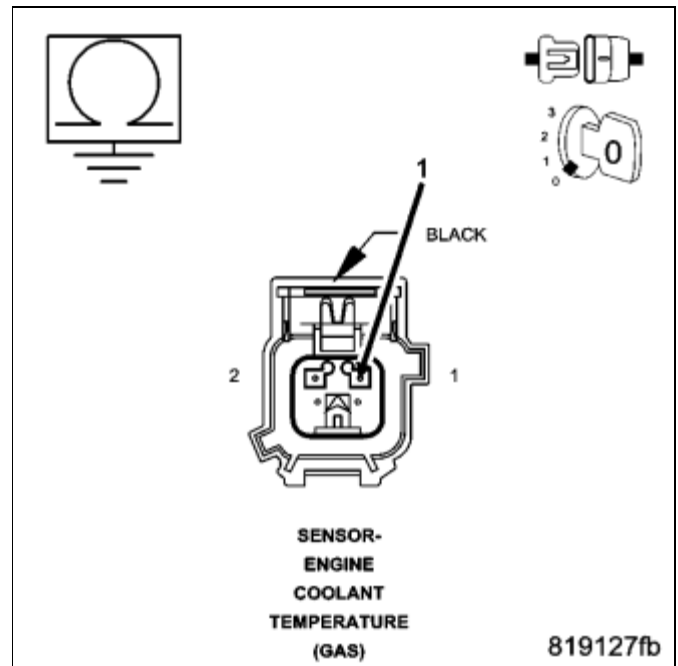
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the ECT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

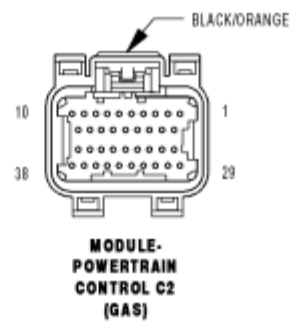
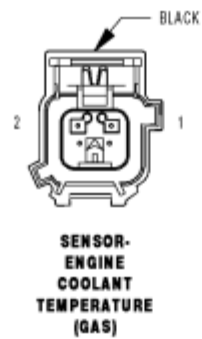
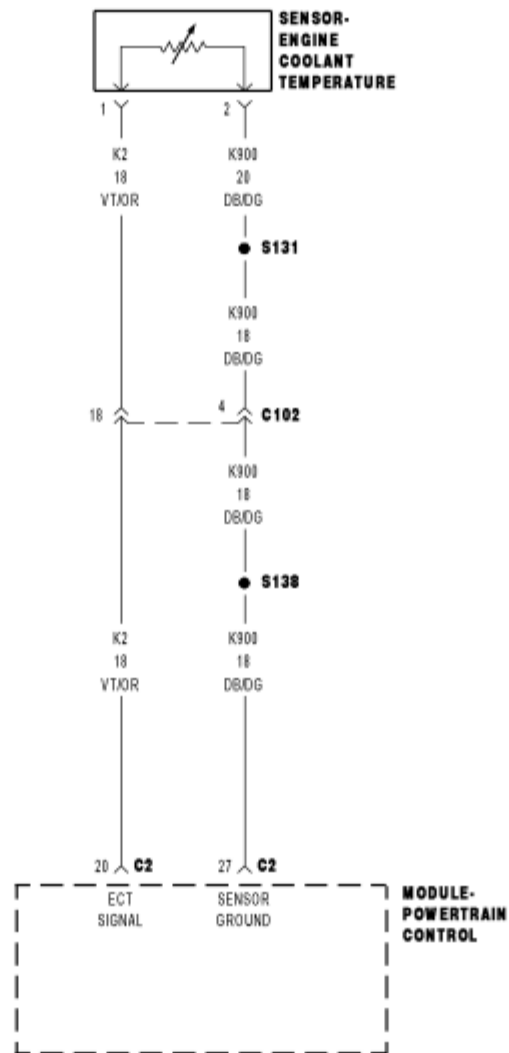
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW



010127m

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts.

- **Set Condition:**

The PCM detects that the Engine Coolant Temperature Sensor input voltage is below the minimum acceptable value. One Trip Fault. Three good trips to clear the MIL. The MIL and ETC light will illuminate if equipped.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (K2) ECT SIGNAL CIRCUIT
ECT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. If OK, replace the ECT Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

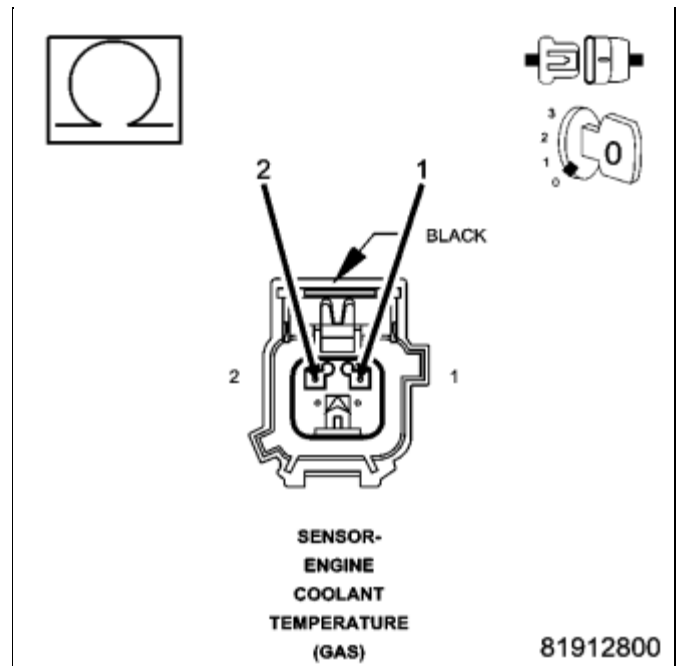
Is the resistance below 5.0 ohms?

Yes

- Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

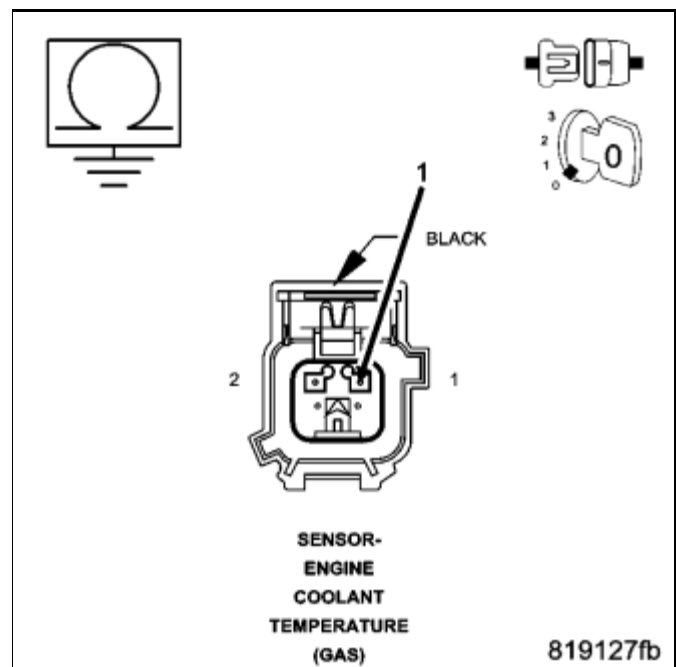
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. EXCESSIVE RESISTANCE IN THE (K2) ECT SIGNAL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform

diagnosis.

Measure the resistance of the (K2) ECT Signal circuit between the Engine Coolant Temperature Sensor harness connector and the appropriate terminal of special tool #8815.

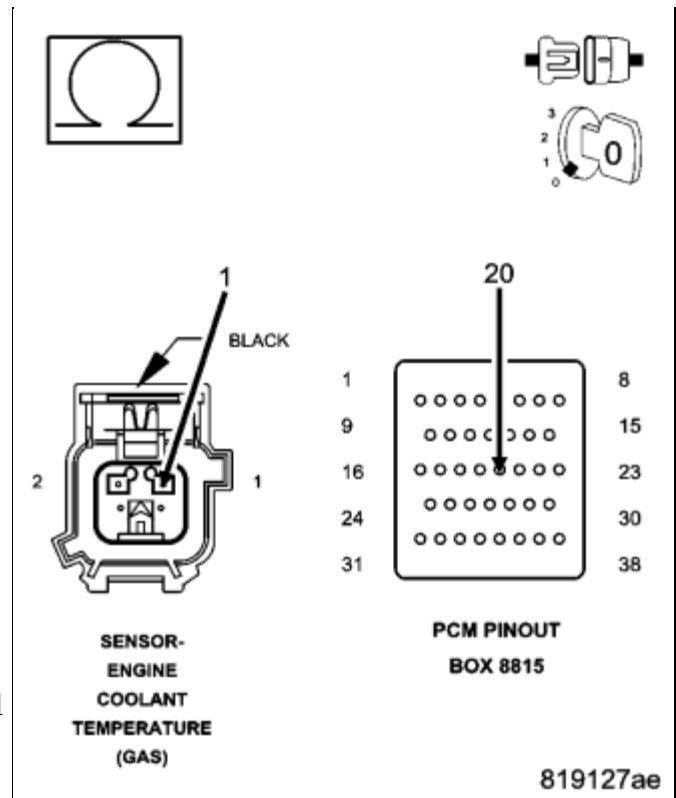
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the ECT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

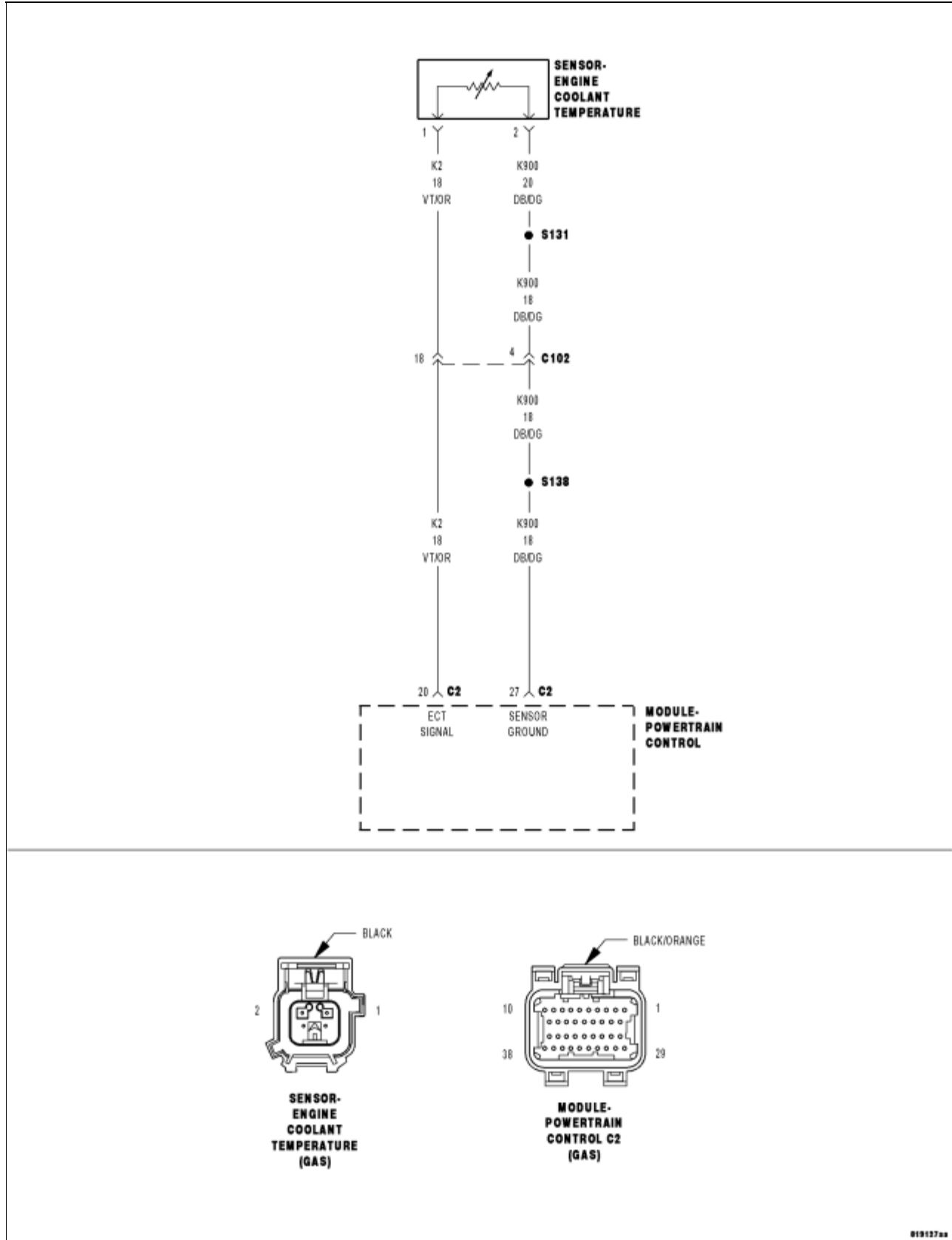
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH



- **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts.

- **Set Condition:**

The PCM detects that the Engine Coolant Temperature Sensor input voltage is above the maximum acceptable value. One Trip Fault. Three good trips to turn off the MIL. The MIL and ETC light will illuminate if equipped.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
ECT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

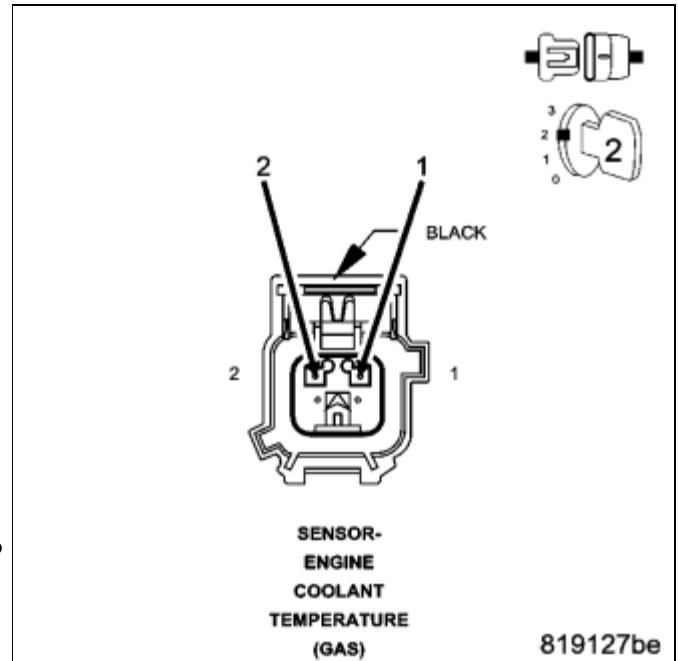
Yes

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. If OK, replace the ECT Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

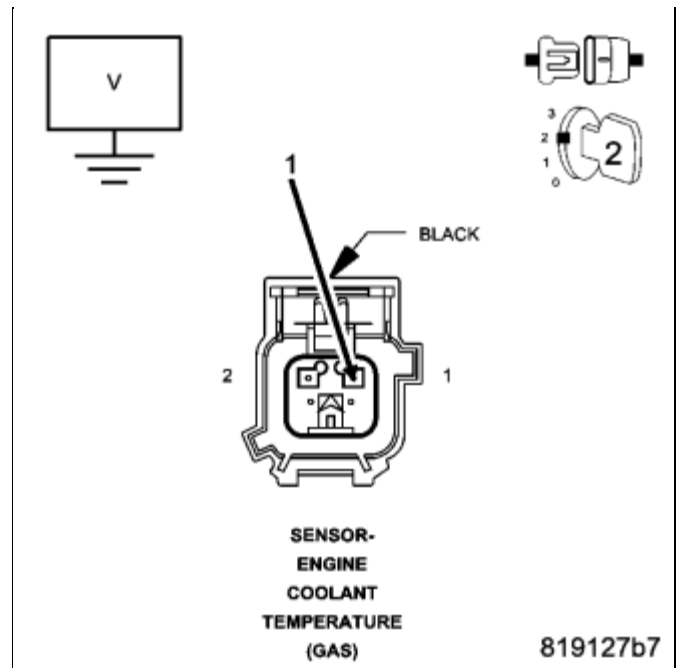
Is there any voltage present?

Yes

- Repair the short to voltage in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

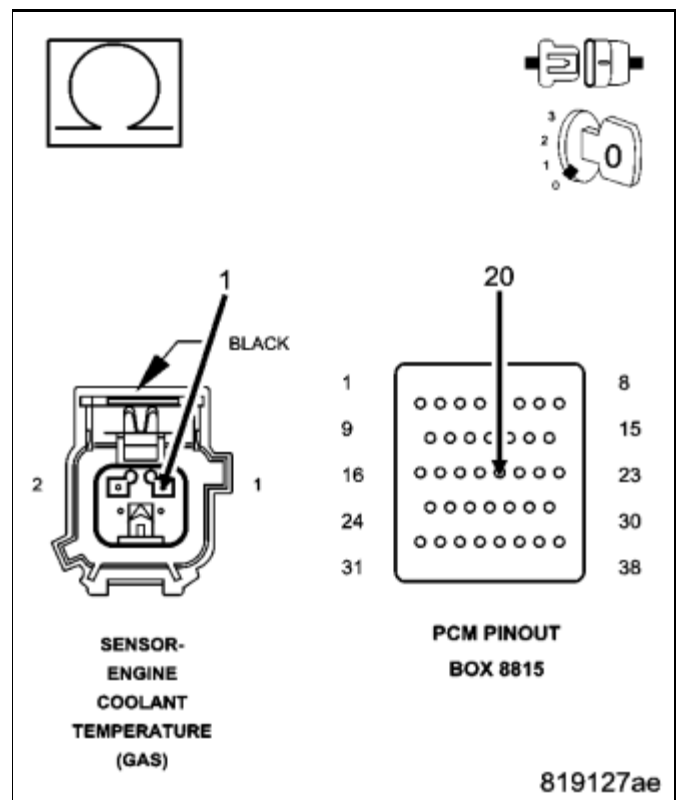
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

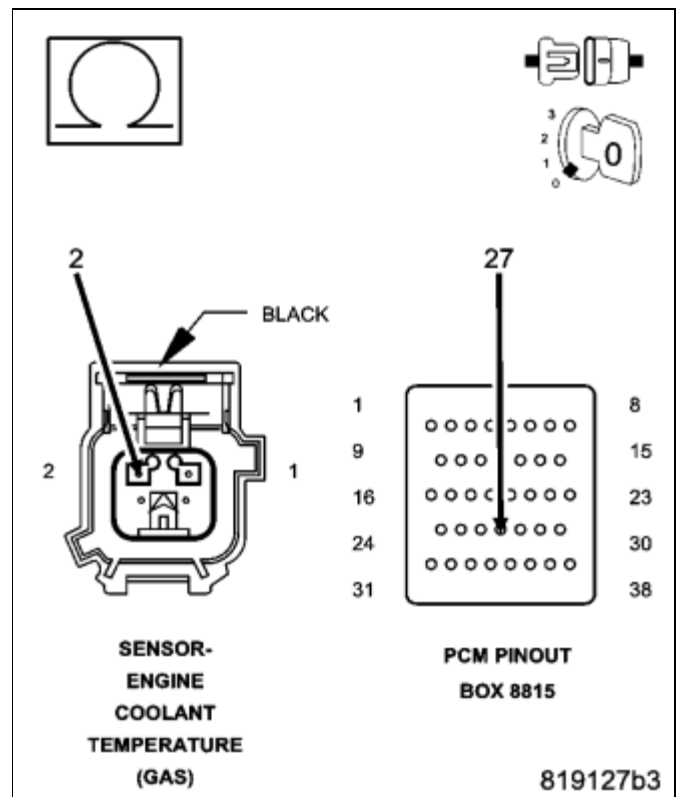
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the ECT Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

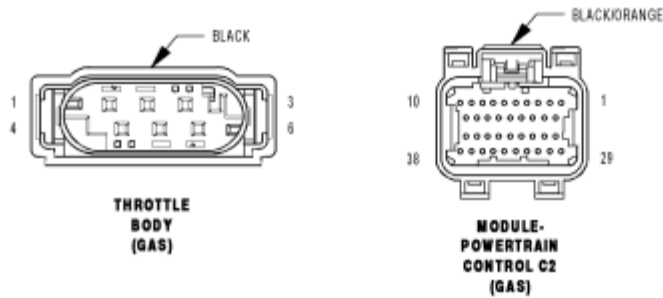
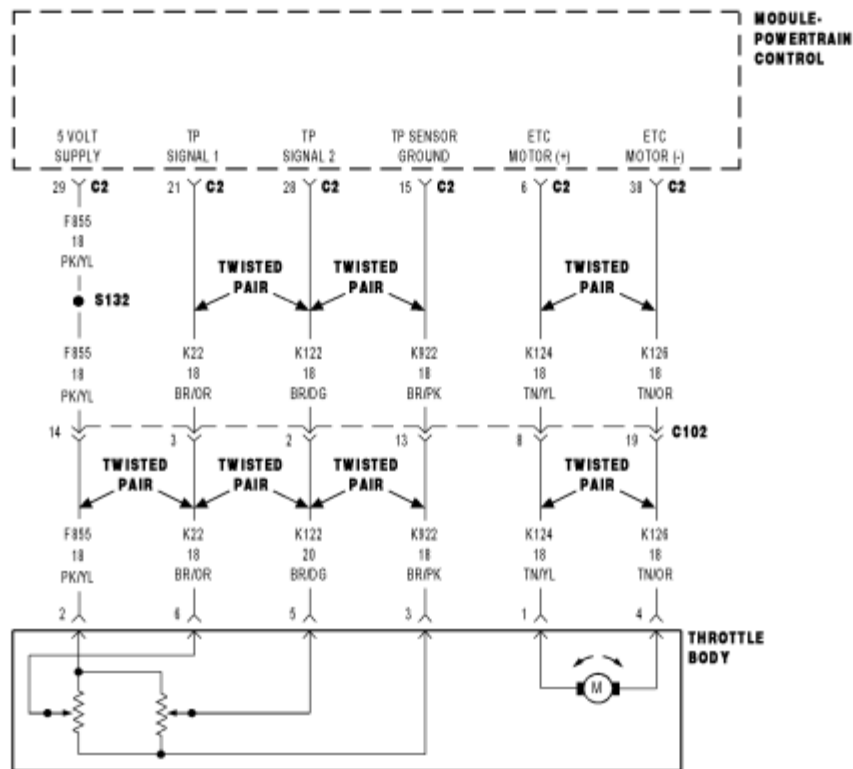
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE



81000000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and No MAP Sensor DTCs set.

◦ **Set Condition:**

TP Sensor signals do not correlate to the MAP Sensor signal. Two Trip Fault. ETC light will illuminate. P2135 should set with this code also.

Possible Causes
EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT
EXCESSIVE RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT
EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (K922) TP SENSOR GROUND CIRCUIT
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K122) TP SIGNAL 2 CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: Diagnose any other TP Sensor DTC(s) before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

NOTE: Inspect the engine for vacuum leaks.

Start the engine and allow the engine to idle.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [9](#)

2. EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K22) TP Signal 1 circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. EXCESSIVE RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K122) TP Signal 2 circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (F855) 5-volt Supply circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. EXCESSIVE RESISTANCE IN THE (K922) TP SENSOR GROUND CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K922) TP Sensor Ground circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K922) TP Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

6. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K122) TP SIGNAL 2 CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Disconnect the Throttle Body harness connector.
Measure the resistance between the (K22) TP Signal 1 circuit
and the (K122) TP Signal 2 circuit in the Throttle Body
harness connector.

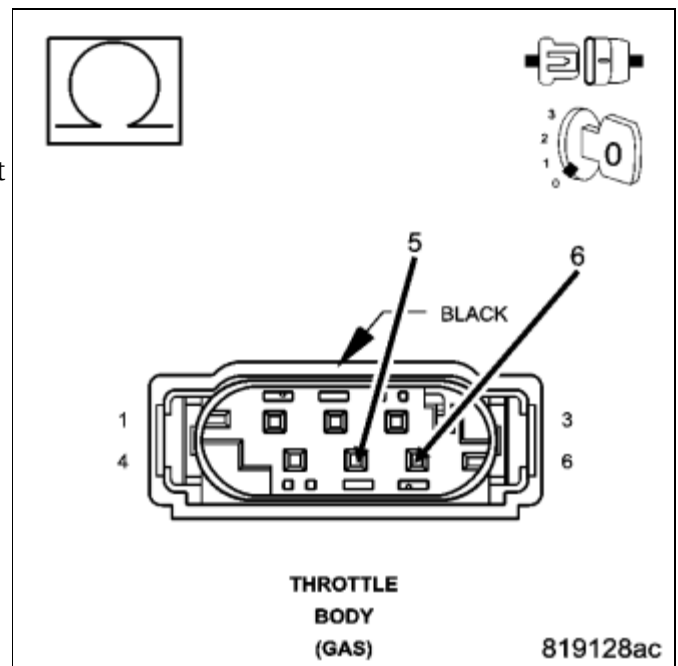
Is the resistance below 5.0 ohms?

Yes

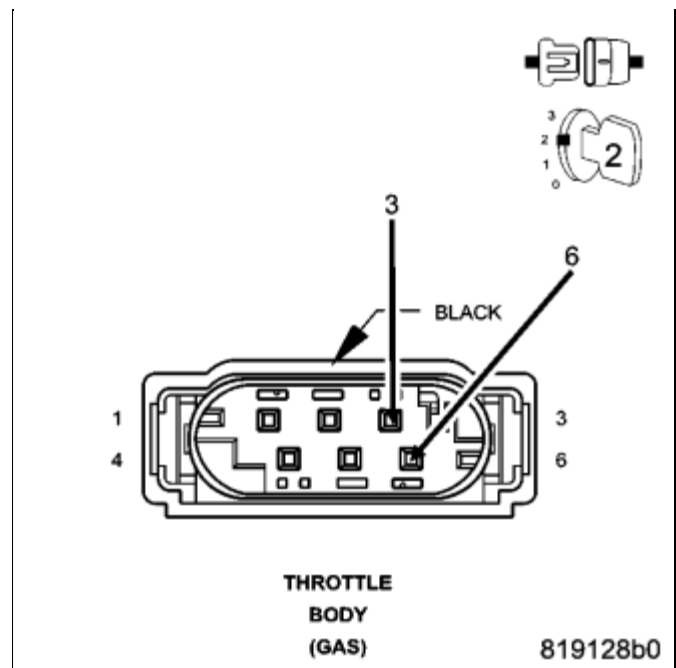
- Repair the short between the (K122) TP Signal 2 circuit and the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. THROTTLE POSITION SENSOR



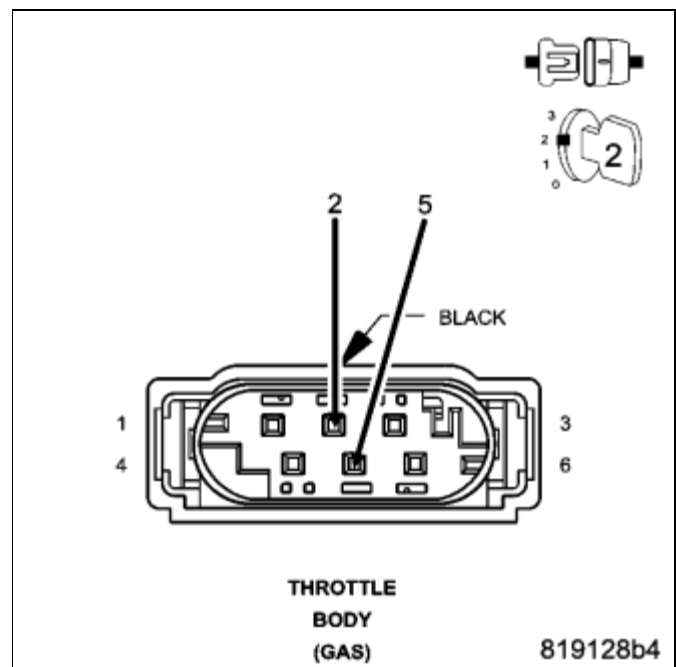
Connect the C2 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the TP Sensor No.1 and No.2 voltage.

Connect a jumper wire between the (K922) TP Sensor Ground circuit and the (K22) TP Signal 1 circuit.

NOTE: TP Sensor No.1 voltage should change from approximately 4.5 volts to less than 0.5 of a volt.

For TP Sensor No.2, connect a jumper wire between (F855) 5-volt Supply circuit and the (K122) TP Signal 2 circuit.

NOTE: TP Sensor No.2 voltage should change from approximately 0 volts to 5.0 volts?



Is the voltage reading within the listed specification when the jumper wire is installed?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

- **NOTE: Remove the jumper wire before continuing.**

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

9. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test and monitor the TP Sensor No.1 or No.2 voltage.

Slowly press the throttle pedal down.

The voltage for TP Sensor No.1 should start at approximately 0.7 of a volt and increase to approximately 4.3 volts.

The voltage for TP Sensor No.2 should start at approximately 4.3 volts and decrease to approximately 0.7 of a volt.

Is the voltage within the range of the listed specification for the appropriate Sensor?

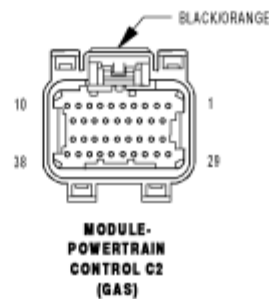
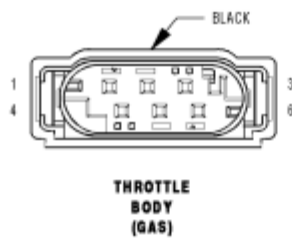
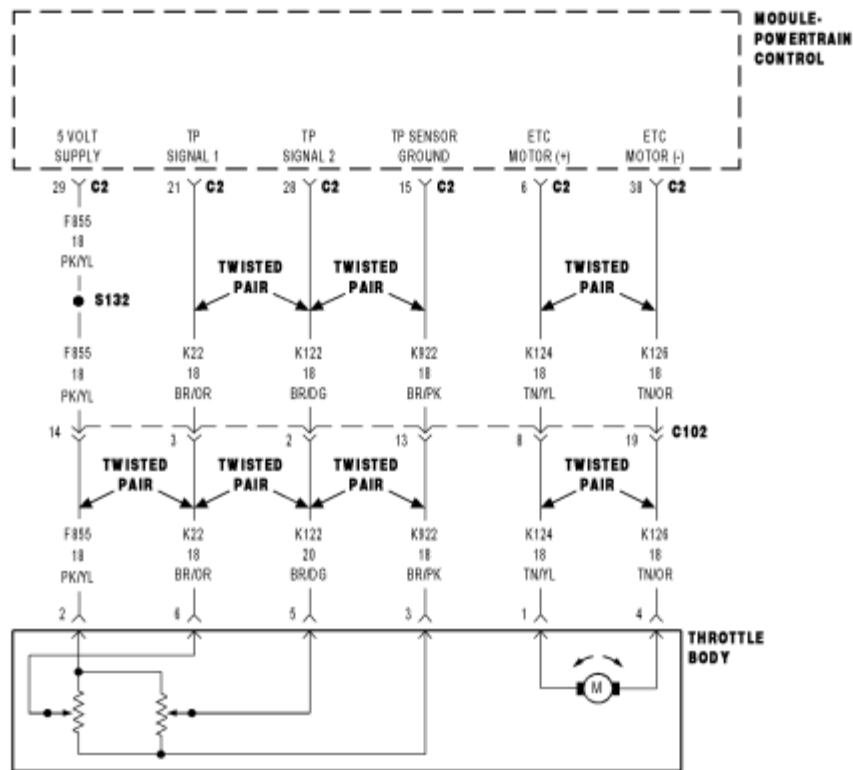
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

PROCEDURE).

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW

810028a5

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

Throttle Position Sensor voltage at the PCM is less than 0.16 of a volt for 0.7 of a second. One Trip Fault. Three good trips to turn off the MIL. ETC light will illuminate.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K922) TP SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If a 5-Volt Supply DTC has also set, diagnose the 5-Volt DTC before continuing.

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

Ignition on, engine not running.
With a scan tool, select View DTCs.

NOTE: If the P2122-APP Sensor 1 Circuit Low DTC is also Active, diagnose the P2122 before continuing

with the P0122 diagnostic procedure.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. P0222 ALSO SET

Was the P0222-TP SENSOR NO.2 VOLTAGE LOW DTC set along with the P0122?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

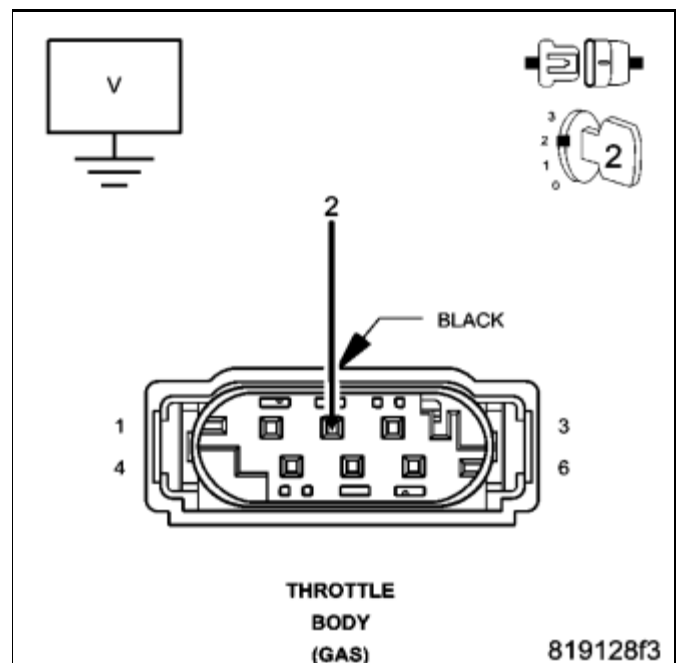
Is the voltage between 4.8 to 5.2 volts?

Yes

- Go To [4](#)

No

- Go To [8](#)



4. THROTTLE POSITION SENSOR

With a scan tool, monitor the TP Sensor No.1 voltage with the Sensor harness connector disconnected.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

5. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance between ground and the (K22) TP Signal 1 circuit in the Throttle Body harness connector.

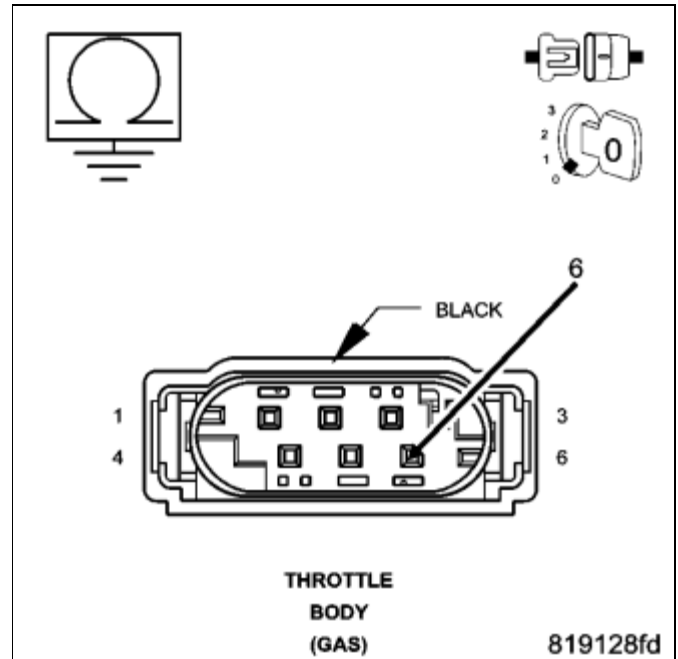
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K922) TP SENSOR GROUND CIRCUIT

Measure the resistance between the (K22) TP Signal 1 circuit

and the (K922) TP Sensor Ground circuit in the Throttle Body harness connector.

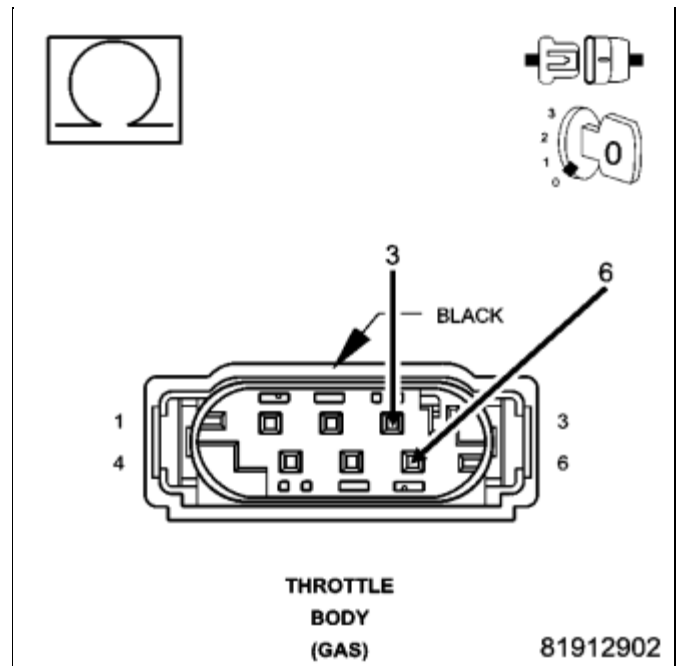
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K922) TP Sensor Ground circuit and the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Signal 1 circuit between the Throttle Body harness connector and the Powertrain Control Module (PCM) harness connector.

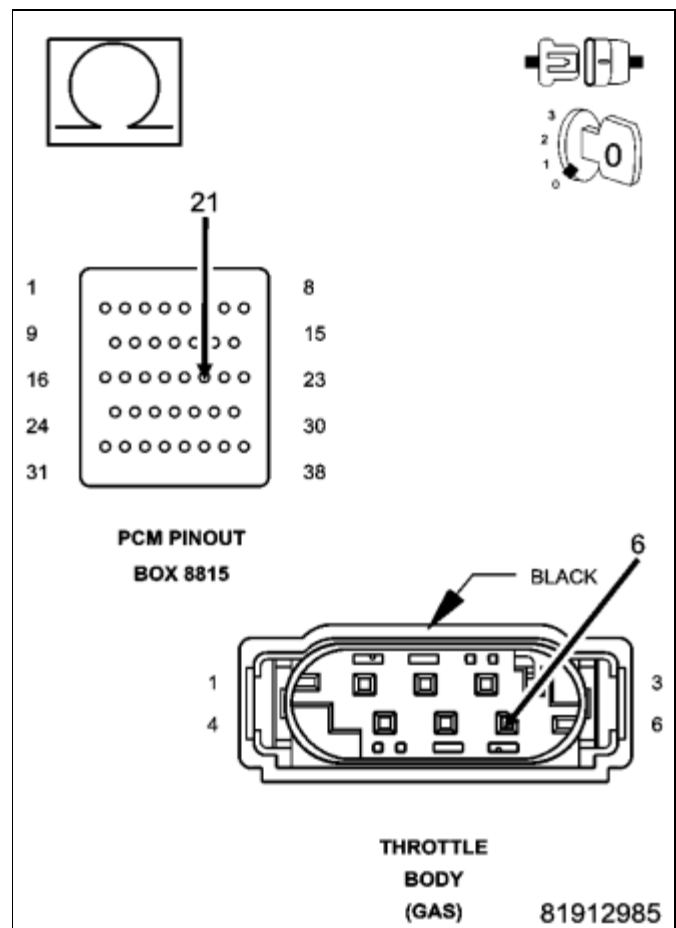
Is the resistance below 5.0 ohms?

Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnostics.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

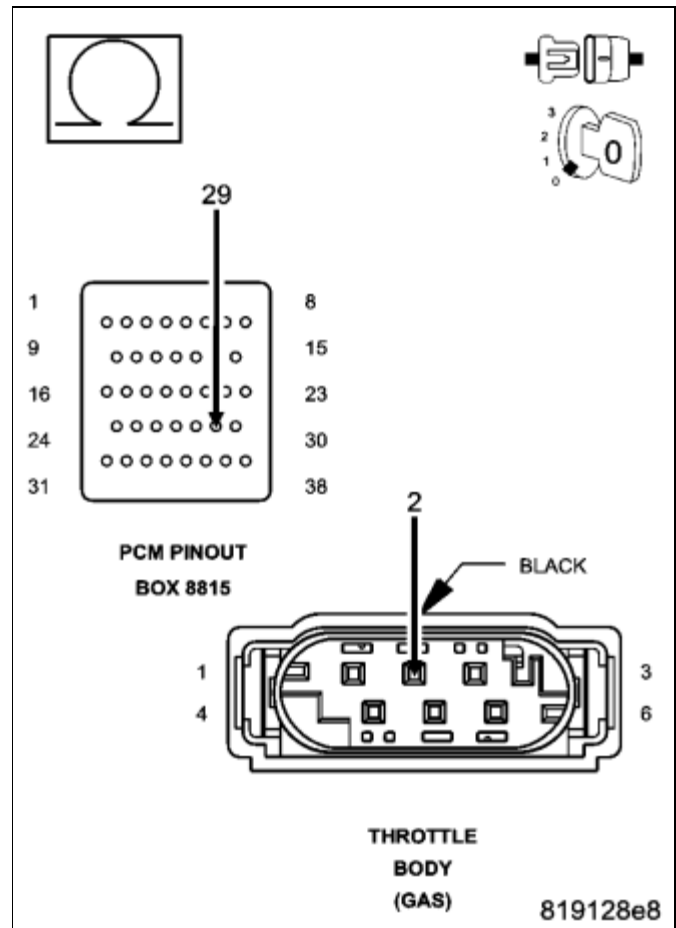
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

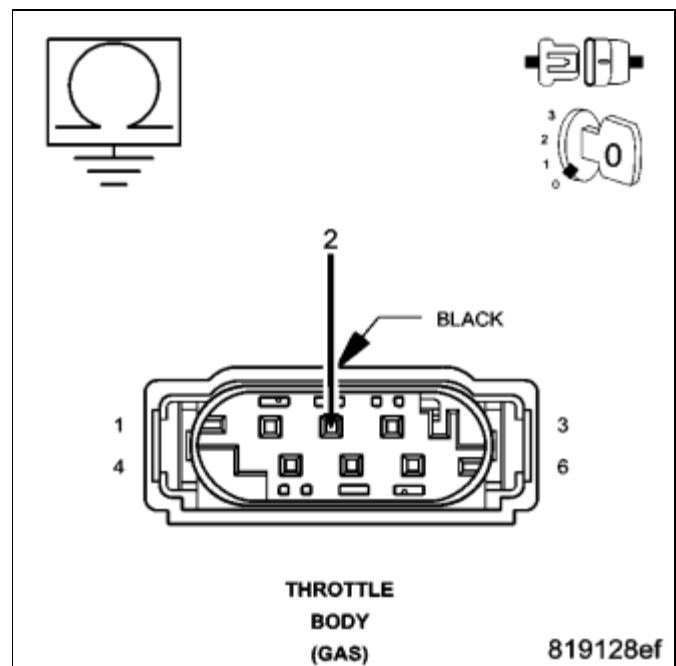
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

11. THROTTLE FOLLOWER TEST

With a scan tool, perform the ETC Throttle Follower Test.

Monitor the TP Sensor No.1 voltage.

Does voltage start at approximately 0.7 of a volt and increase to approximately 4.3 volts with a smooth transition?

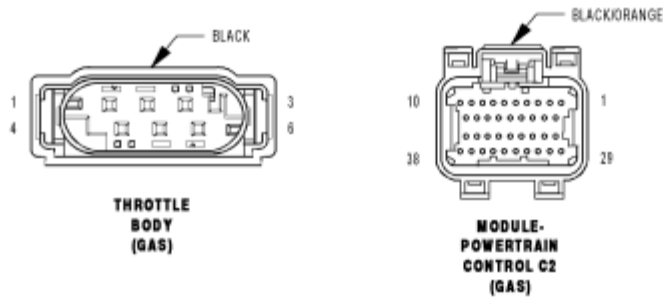
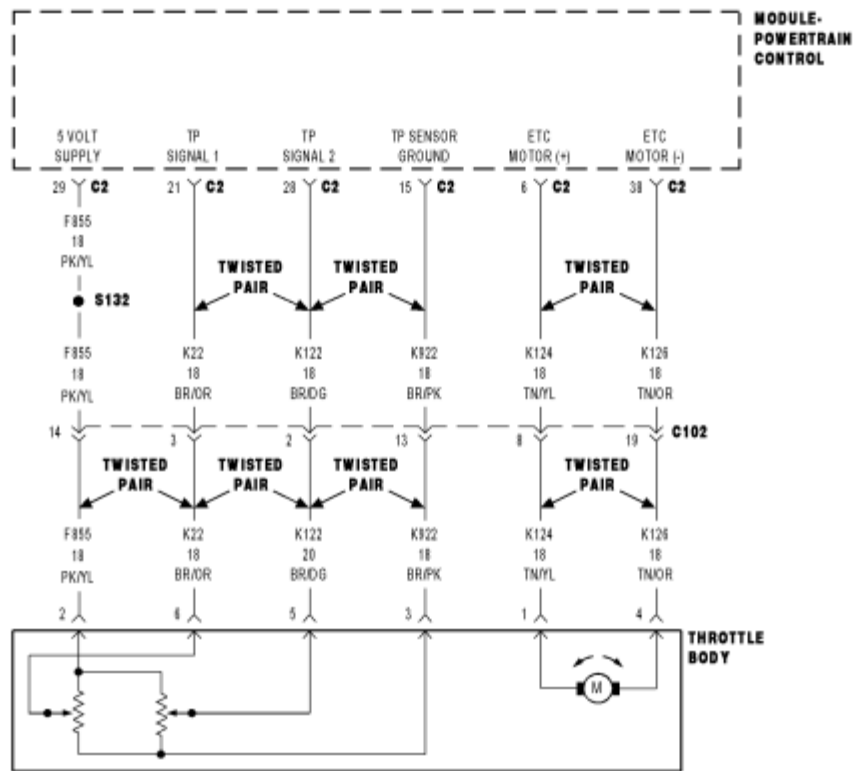
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH



81000000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

Throttle Position Sensor No.1 voltage is greater than 4.8 volts for 25 ms. One Trip Fault. ETC light will illuminate.

Possible Causes
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE
(K22) TP SIGNAL 1 CIRCUIT OPEN
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K922) TP SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR/THROTTLE BODY
THROTTLE PLATE JAMMED AGAINST THE MAXIMUM STOP
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: Make sure the throttle is fully closed and free from binding or carbon build up.

NOTE: If a 5-Volt Supply DTC has also set, diagnose the 5-Volt DTC before continuing.

NOTE: If P2101 is also set, then make sure that the blade moves freely and does not hang up near Wide Open Throttle before trying to repair P0123.

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: If the P2123-APP Sensor 1 Circuit High DTC is also Active, diagnose the P2123 before continuing with the P0123 diagnostic procedure.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. THROTTLE POSITION SENSOR

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Connect a jumper wire between the (K22) TP Signal 1 circuit and the (K922) TP Sensor Ground circuit in the Throttle Body harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor No.1 voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

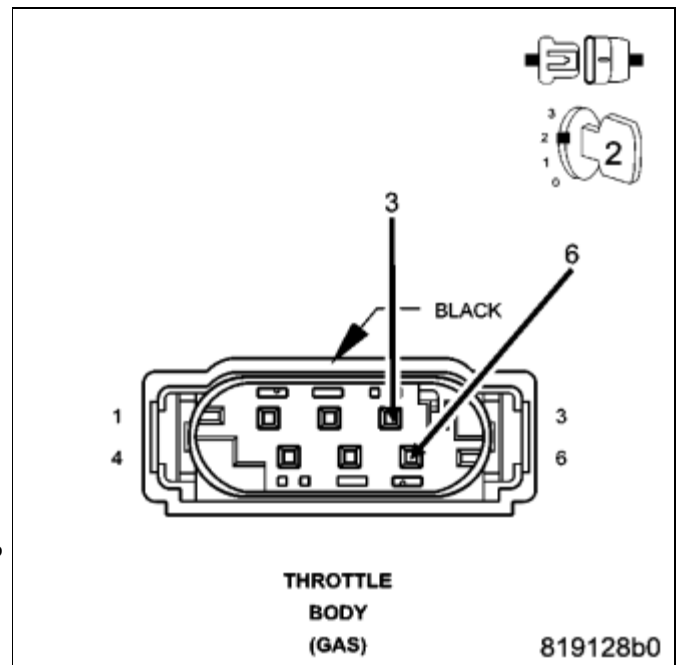
Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K22) TP Signal 1 circuit in the Throttle Body harness connector.

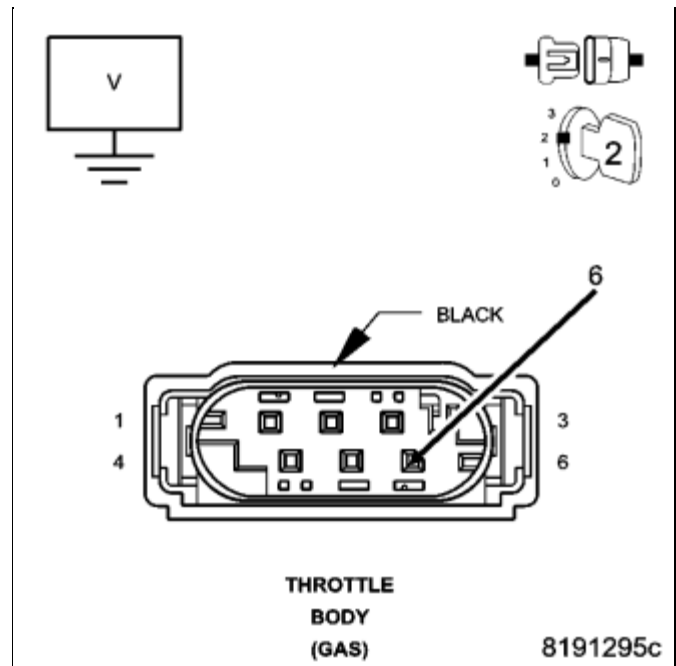
Is there any voltage present?

Yes

- Repair the short to voltage in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K22) TP SIGNAL 1 CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Signal 1 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

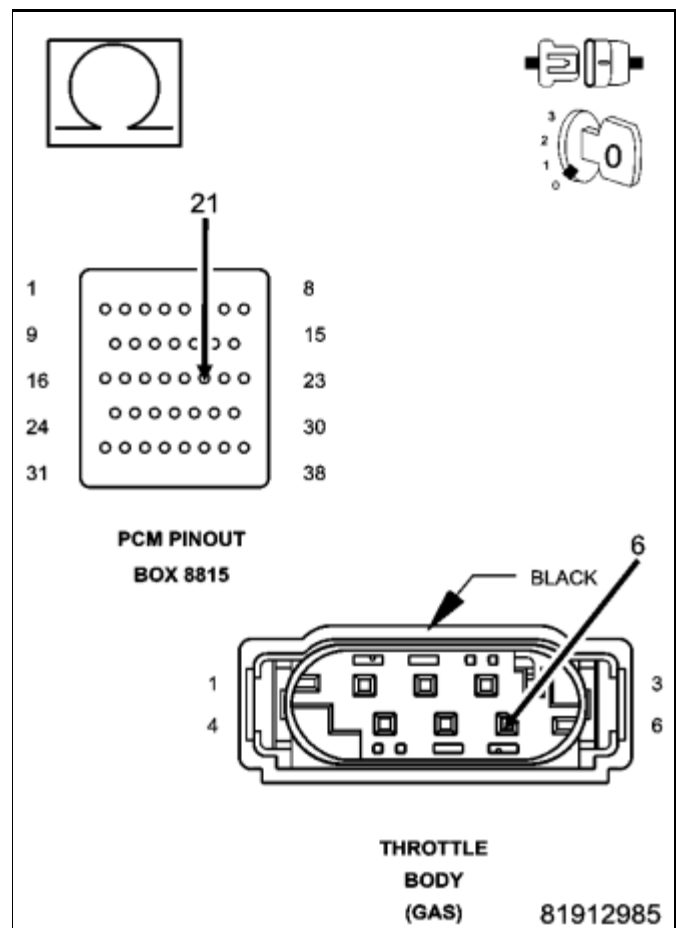
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K22) TP Signal 1 circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

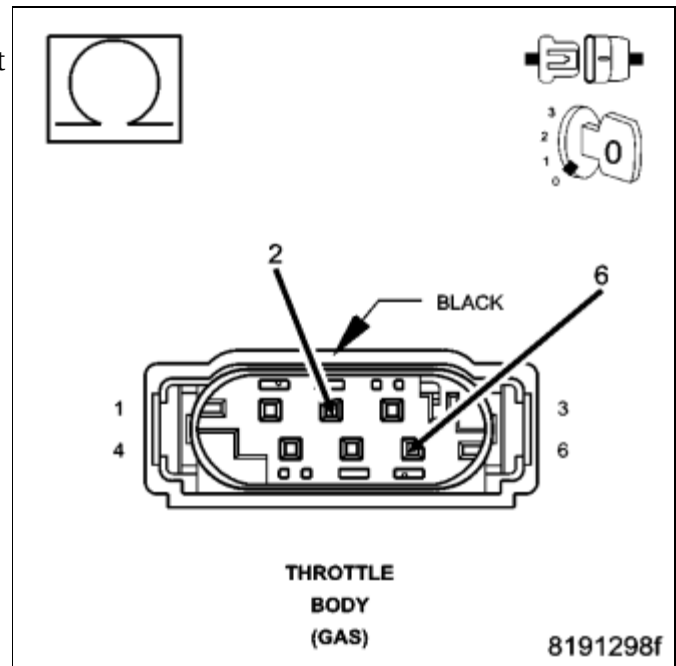
Is the resistance below 100 ohms?

Yes

- Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K922) TP SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K922) TP Sensor Ground circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

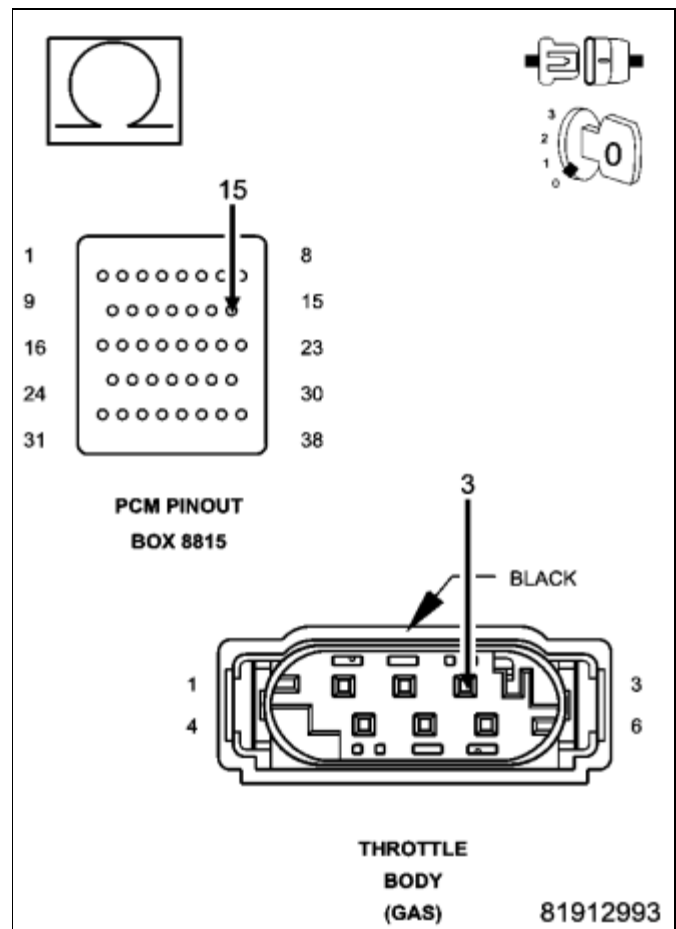
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K922) TP Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. THROTTLE FOLLOWER TEST

With a scan tool, perform the ETC Throttle Follower Test.

Monitor the TP Sensor No.1 voltage.

Does voltage start at approximately 0.7 of a volt and increase to approximately 4.3 volts with a smooth transition?

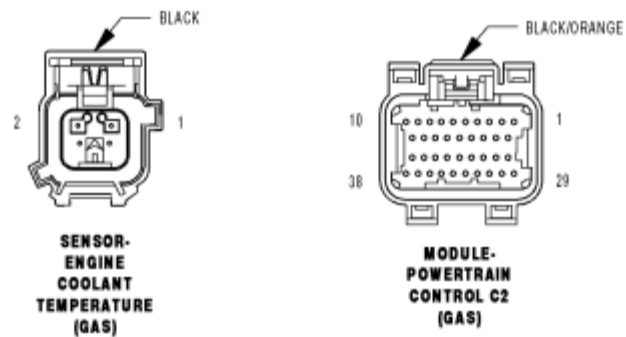
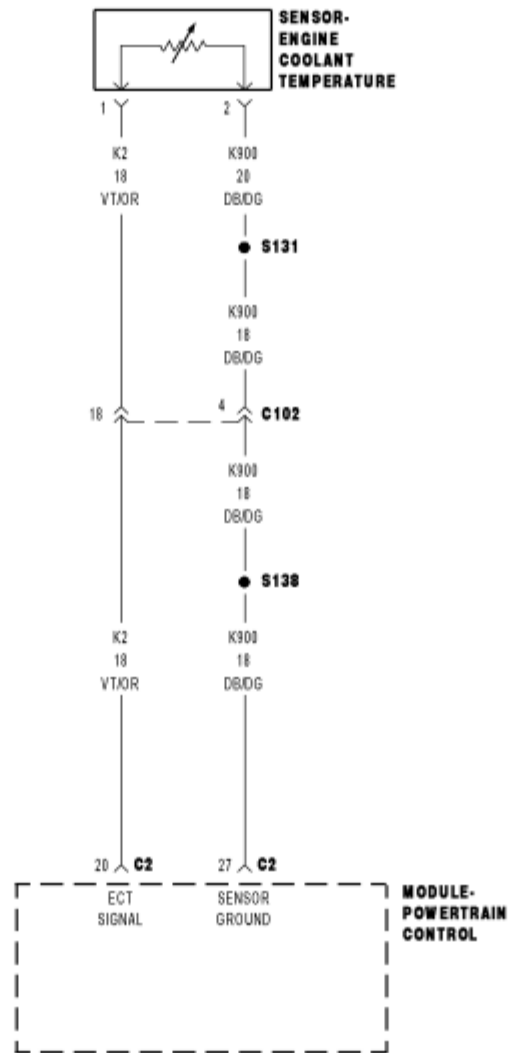
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL



010127as

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low. The INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL determines if the engine coolant temperature will reach the closed loop fueling control temperature limit in a regulated time after start.

- **When Monitored:**

With battery voltage greater than 10.4 volts and after engine is started.

- **Set Condition:**

The engine temperature does not go above -10° C (15° F). Failure time depends on start-up coolant temperature and ambient temperature. (i.e. 2 minutes for a start temp of -10° C (15° F) or up to 10 minutes for a vehicle with a start-up temp of -28° C (5° F). Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT
ECT SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CHECKING COOLANT LEVEL AND CONDITION

Ignition on, engine not running.
With a scan tool, select View DTCs.

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes

- Go To [2](#)

No

- Inspect the vehicle for a coolant leak, make the appropriate repairs, and add the correct amount of coolant.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

2. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82° C (180° F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool Eng Coolant Tmp Deg values should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes

- Go To [3](#)

No

- Replace the thermostat.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. ECT SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82° C (180° F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tools Eng Coolant Tmp Deg value should stay relatively close to each other.

Is the thermometer reading relatively close to the scan tool ECT reading?

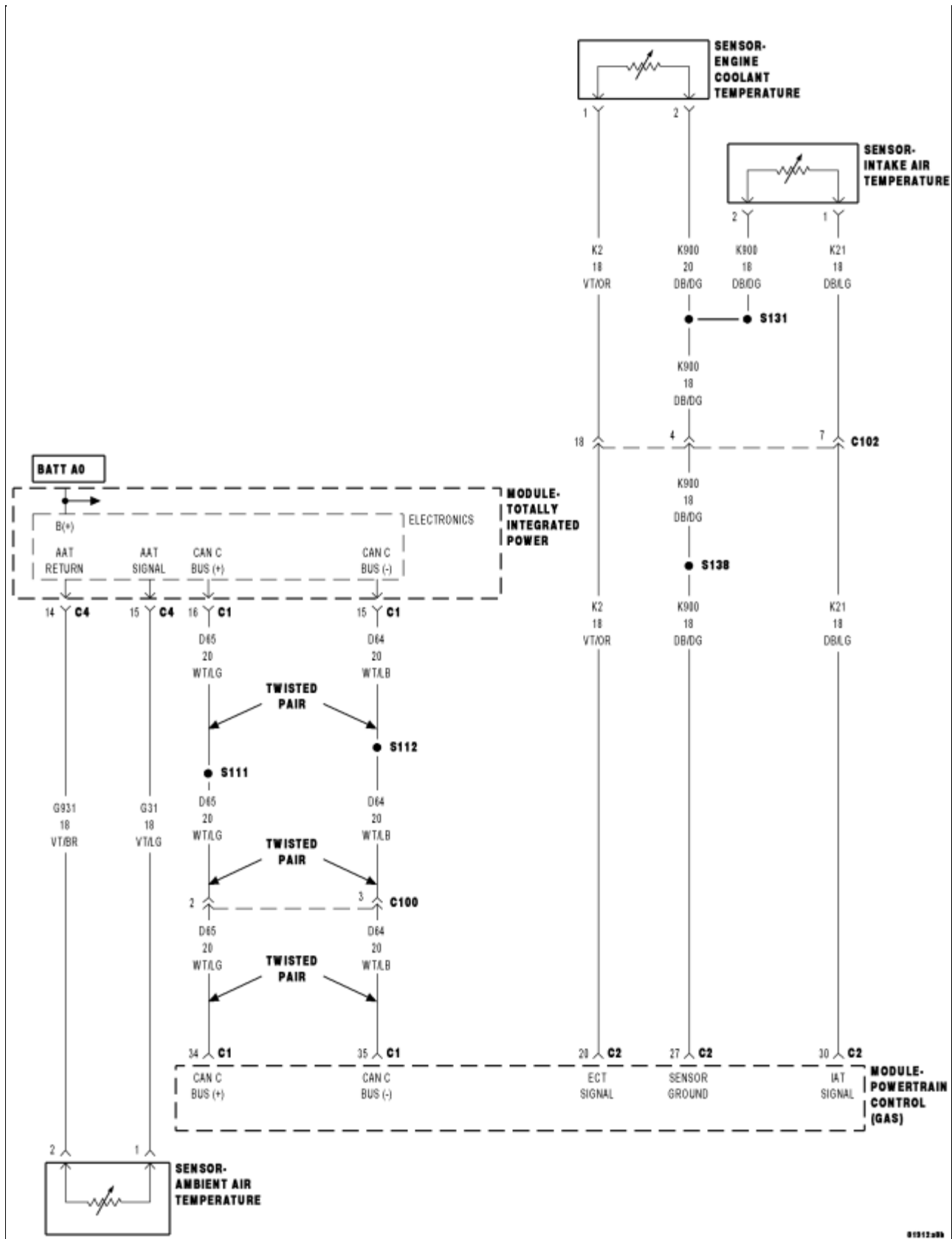
Yes

- The conditions that set this DTC are no longer present. Test Complete.

No

- Replace the Engine Coolant Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0128-THERMOSTAT RATIONALITY



01012a00

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The PCM predicts what the engine coolant temperature should be, based on the engine coolant temperature at start-up, ambient temperature and how the vehicle is subsequently driven. The predicted engine coolant temperature is compared to the Engine Coolant Temperature Sensor reading. The error between the two is calculated and integrated with respect to time. When the Thermostat diagnostic runs, the integrated error is compared to a calibrated threshold and pass/fail is determined. Separate pass and fail thresholds are used in order to improve accuracy of the diagnostic.

- **When Monitored:**

With the engine running, ambient temperature between -8° C (17.6° F) and 50° C (122° F), start up coolant temperature less than 50° C (122° F), and average vehicle speed greater than 16 kph (10 mph) until coolant temperature reaches 85° C (185° F).

- **Set Condition:**

The PCM detects that the actual engine coolant temperature falls too far below the predicted engine coolant temperature and the predicted coolant temperature reaches the predicted target value before the actual coolant temperature reaches the actual coolant temperature target value. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT OPERATION
SIGNAL CIRCUIT SHORTED TO VOLTAGE
TEMPERATURE SENSOR
SIGNAL CIRCUIT OPEN
SENSOR GROUND CIRCUIT OPEN
SIGNAL CIRCUIT SHORTED TO GROUND
SIGNAL CIRCUIT SHORTED TO THE (K900), (G931) SENSOR GROUND CIRCUIT
OTHER POSSIBLE CAUSES
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any ECT, AAT, CMP or CKP sensor DTCs have set along with P0128, diagnose them before continuing.

NOTE: Make sure that the Pinion Factor has been programmed correctly into the PCM.

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. LOW COOLANT LEVEL

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death. Allow the engine to cool before opening the cooling system.

Check the coolant system to make sure that the coolant is in good condition and at the proper level.

Is the coolant level and condition OK?**Yes**

- Go To [3](#)

No

- Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the ECT Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82° C (180° F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool, ECT Temperature value should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?**Yes**

- Go To [4](#)

No

- Replace the thermostat.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. AMBIENT AIR TEMP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read and record the AAT Sensor Temperature value.

Using the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the ambient air temperature near the AAT Sensor.

Is the AAT Sensor value with -15° C (5° F) of the temperature probe reading?

Yes

- Go To [5](#)

No

- Go To [7](#)

5. ECT SENSOR OPERATION

WARNING: Make sure the engine cooling system is cool before removing the pressure cap or any hose. The cooling system is pressurized when hot. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death.

With a scan tool, read and record the ECT Sensor Temperature value.

Use the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the engine coolant temperature.

Is the ECT Sensor value with -15° C (5° F) of the temperature probe reading?

Yes

- Go To [6](#)

No

- Go To [7](#)

6. OTHER POSSIBLE CAUSES

Inspect the Temperature Sensors for any physical damage.

Inspect the engine coolant. Make sure the coolant is at the proper level. Refer to the Service Information COOLING.

Make sure the Temperature Sensors are properly installed.

Make sure the CMP and CKP sensors are installed properly. Check the connectors for any signs of damage.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

With the engine running at normal operating temperature, monitor the Temperature sensor parameters while wiggling the wire harness. Look for parameter values to change.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds.

Were any problems found during the above inspections?

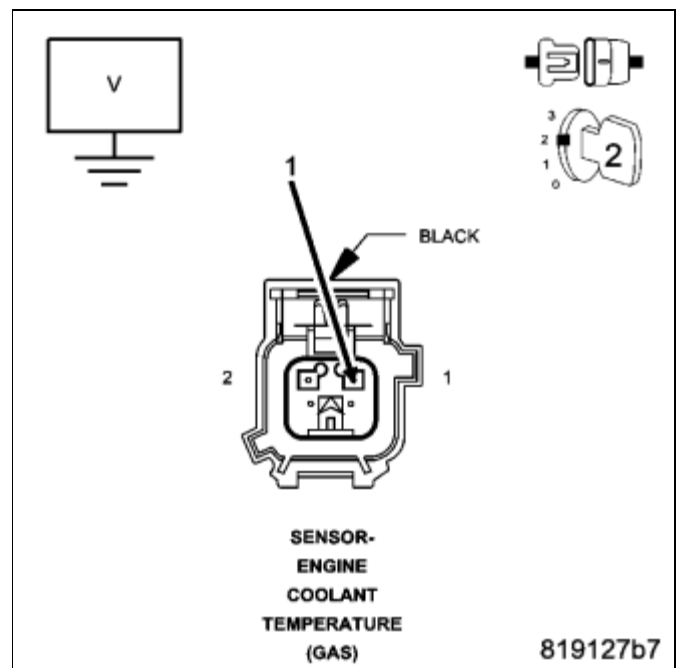
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Test Complete, the conditions that set this DTC are not present at this time.

7. SIGNAL CIRCUIT SHORTED TO VOLTAGE



NOTE: Visually inspect both the component and the PCM connectors. Look for damage, partially broken wires and backed out or corroded terminals

Turn the ignition off.

Disconnect the applicable Temperature Sensor harness connector.

Disconnect the C4 TIPM harness connector and the C2 PCM

harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit and the (G31) AAT Signal circuit at the appropriate Temperature Sensor harness connector.

Is there any voltage present?

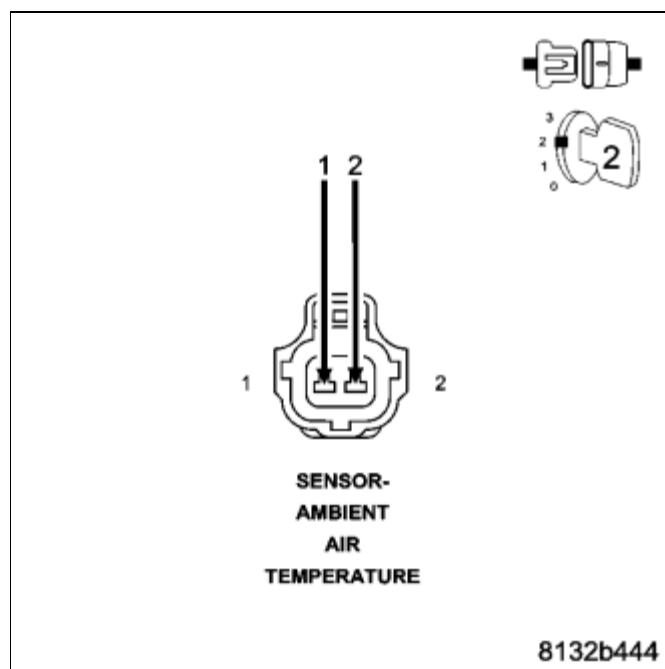
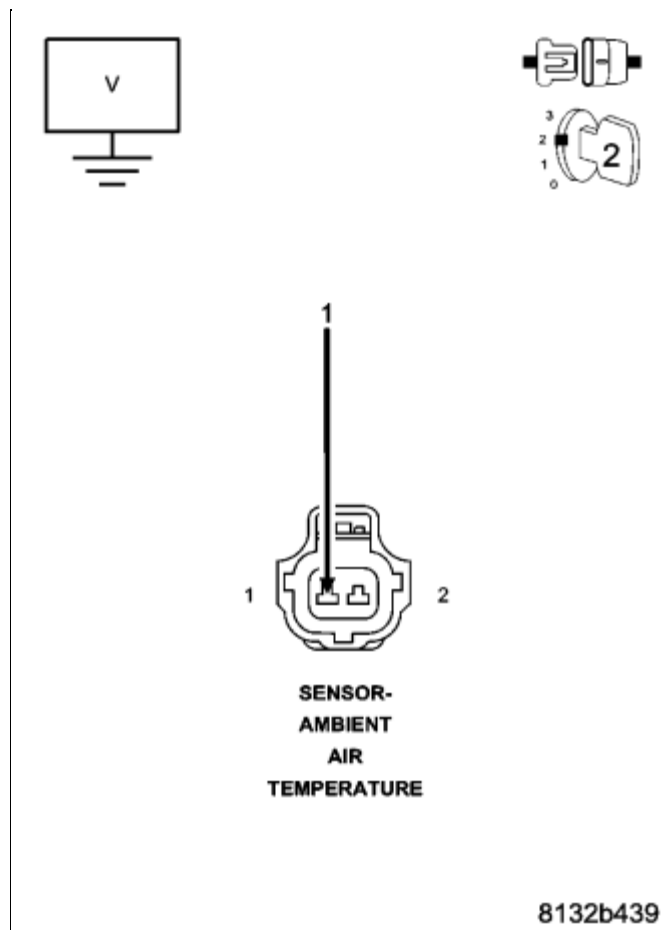
Yes

- Repair the short to voltage in the Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. TEMPERATURE SENSOR



Turn the ignition off.

Connect the C4 TIPM harness connector and the C2 PCM harness connector.

Connect a jumper wire across the ECT and AAT Sensor harness connectors.

Ignition on, engine not running.

With a scan tool, read the Temperature Sensor voltage.

Does the voltage start at 5.0 volts and drop below 1.0 volt when the jumper wire is installed?

Yes

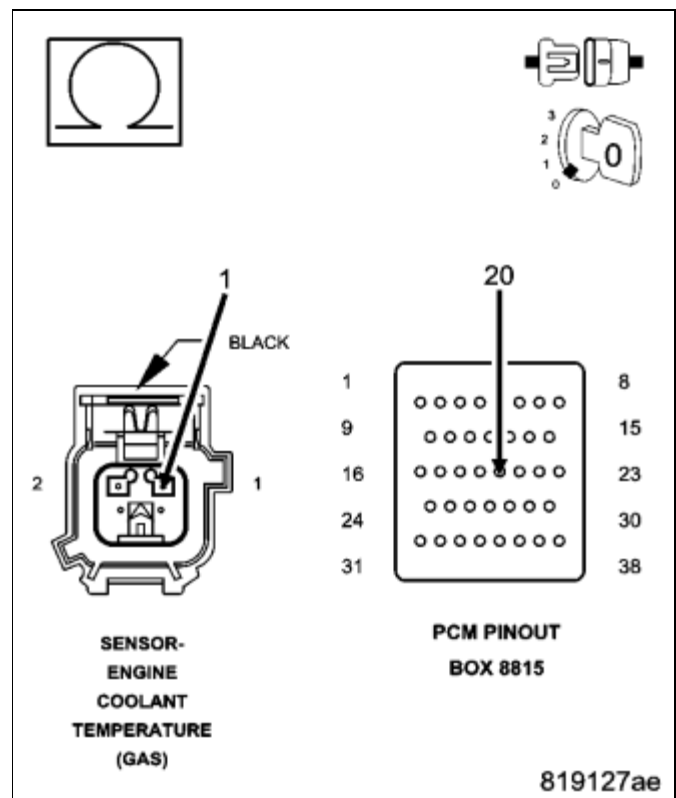
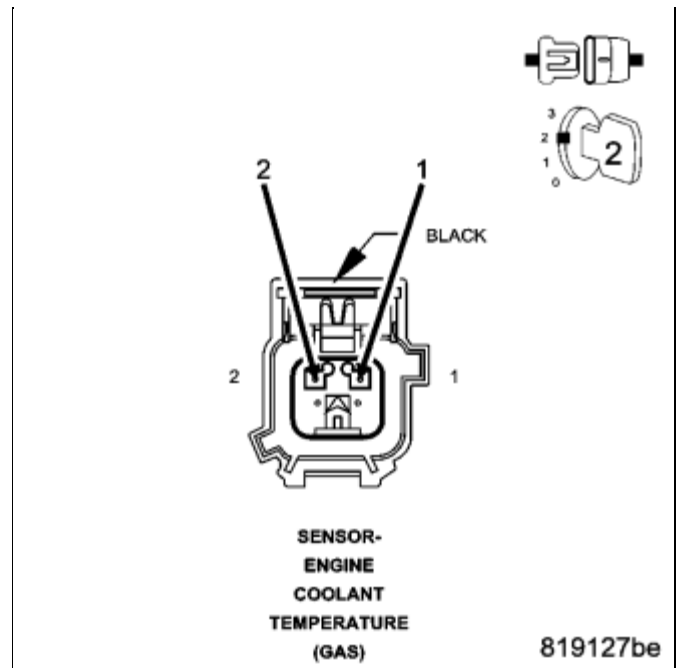
- Verify that there is good pin to terminal contact in the Sensor and Control Module connectors. If OK, replace the appropriate Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)

NOTE: Disconnect the jumper wire before continuing.

9. SIGNAL CIRCUIT OPEN



Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Sensor Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Measure the resistance of the (G31) AAT Sensor Signal circuit from the AAT Sensor harness connector to the C4 TIPM harness connector.

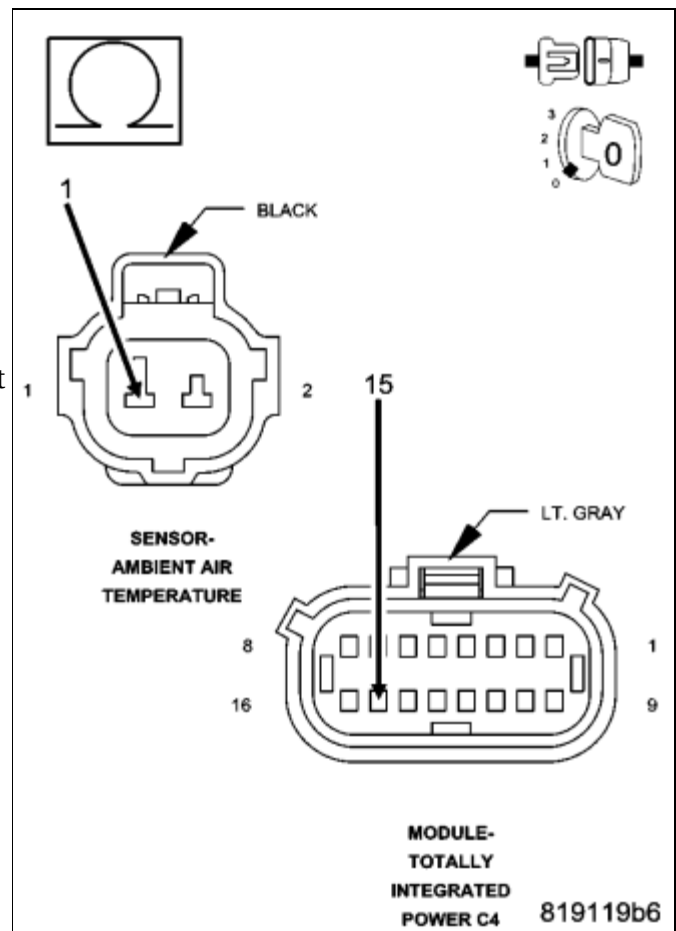
Is the resistance below 5.0 ohms?

Yes

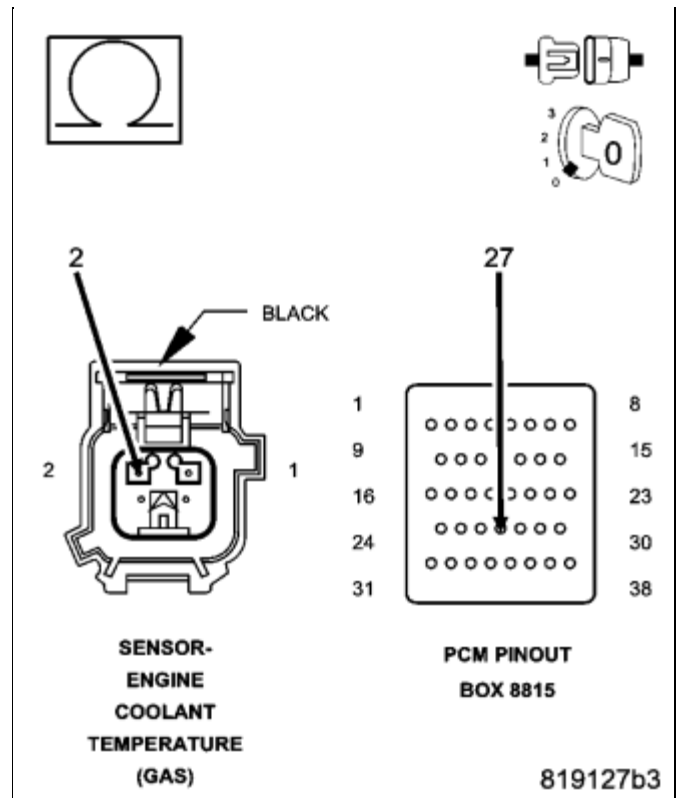
- Go To [10](#)

No

- Repair the open in the Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



10. SENSOR GROUND CIRCUIT OPEN



Measure the resistance of the (K900) Sensor ground circuit from the appropriate Temperature Sensor harness connector to the appropriate terminal of special tool #8815. Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C4 TIPM harness connector.

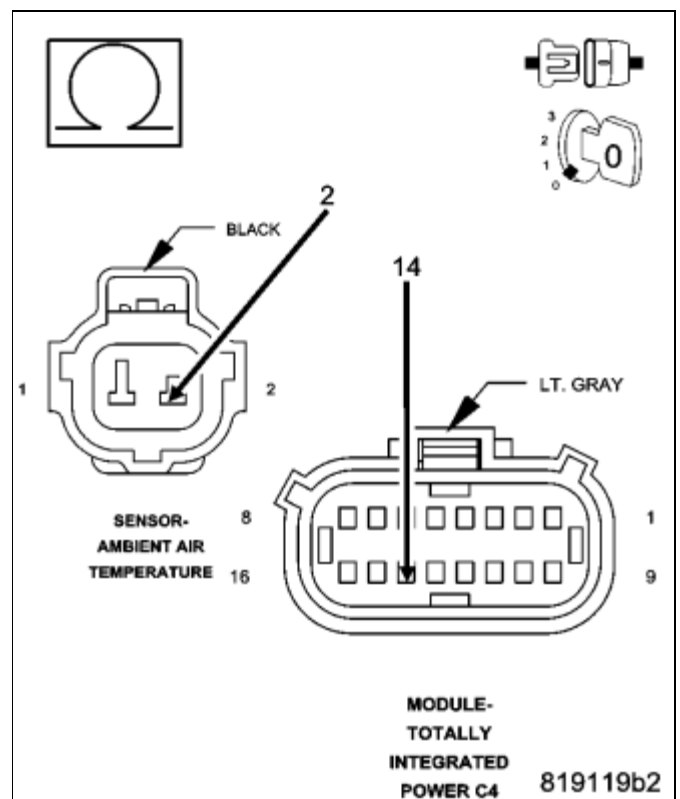
Is the resistance below 5.0 ohms?

Yes

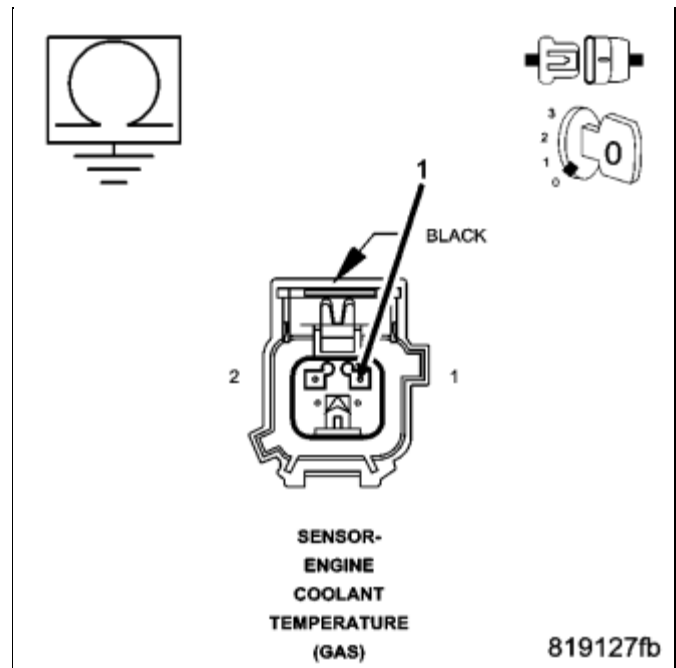
- Go To [11](#)

No

- Repair the open in the Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



11. SIGNAL CIRCUIT SHORTED TO GROUND



Measure the resistance between ground and the Sensor Signal circuit in the Temperature Sensor harness connector.

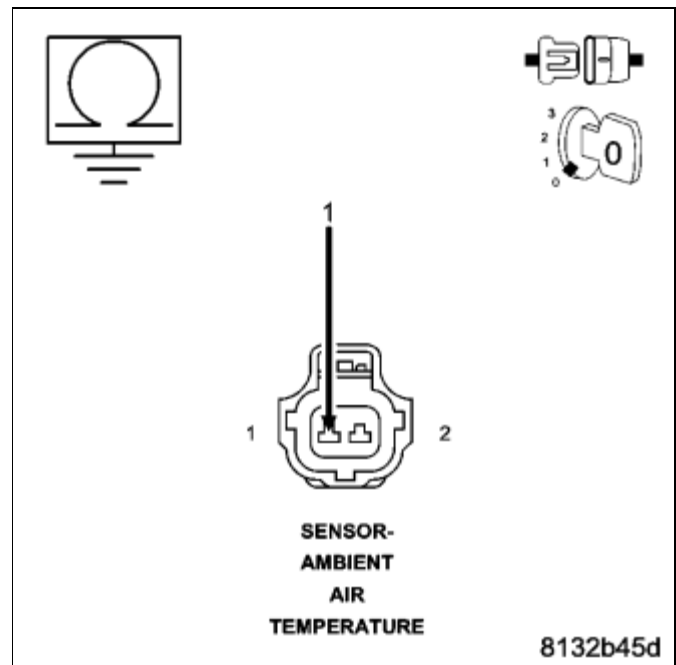
Is the resistance below 100 ohms?

Yes

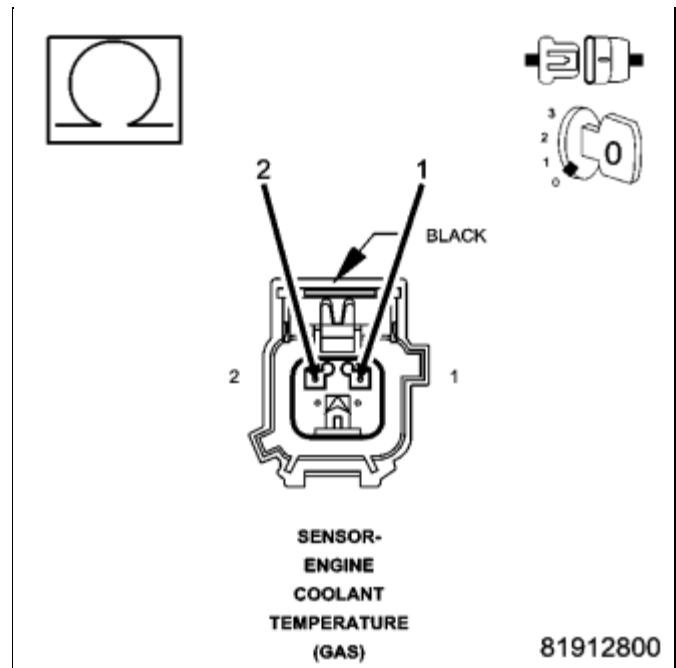
- Repair the short to ground in the Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)



12. SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT OR THE (G931) SENSOR GROUND CIRCUIT



Measure the resistance between the Signal circuit and the (K900) Sensor ground circuit in the (K2) ECT Sensor harness connector.

Measure the resistance between the Signal circuit and the (G931) Sensor ground circuit in the (G31) AAT Sensor harness connector.

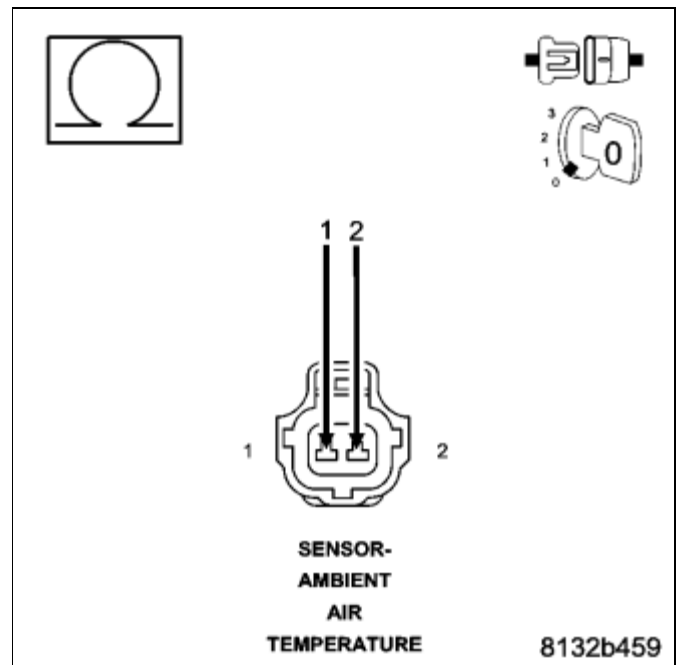
Is the resistance below 100 ohms?

Yes

- Repair the short between the Sensor ground circuit and the Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)



13. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Temperature Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

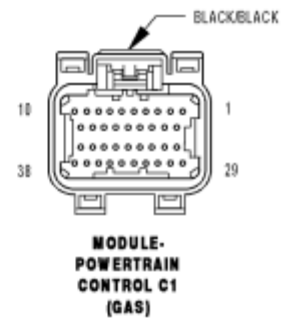
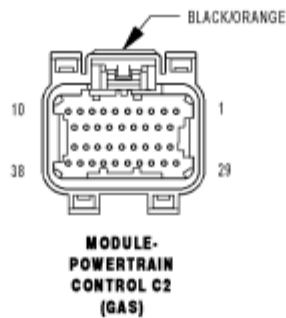
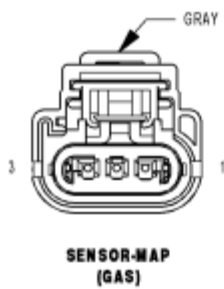
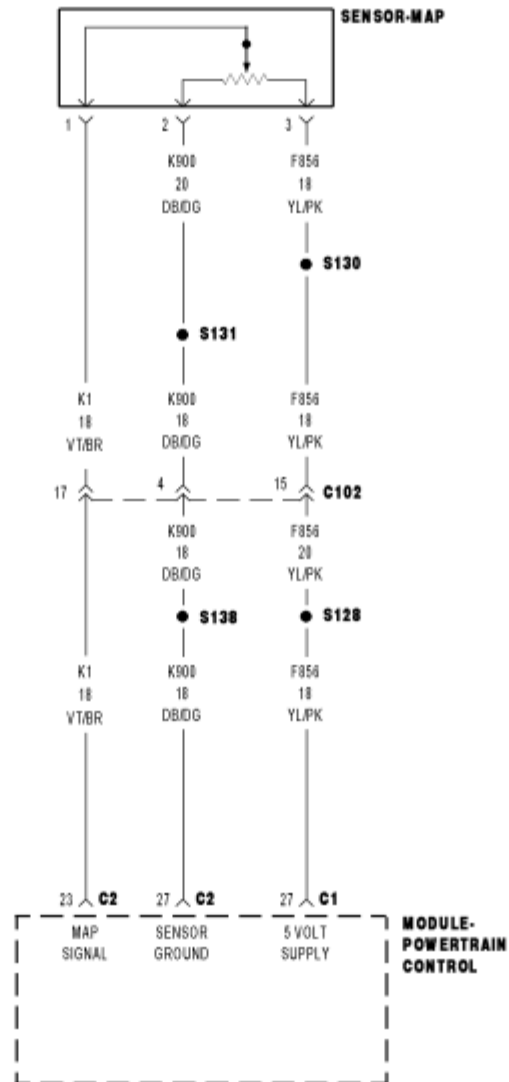
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW



01012091

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on. No Cam or Crank signal within 75 ms. Engine speed less than 250 RPM.

◦ **Set Condition:**

The PCM senses the voltage from the MAP sensor to be less than 2.2 volts but above 0.04 of a volt for 300 milliseconds. One Trip Fault. Three good trips to turn off the MIL. MIL is illuminated and the ETC lamp will flash.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
MAP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time.

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING).

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
 Disconnect the MAP Sensor harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

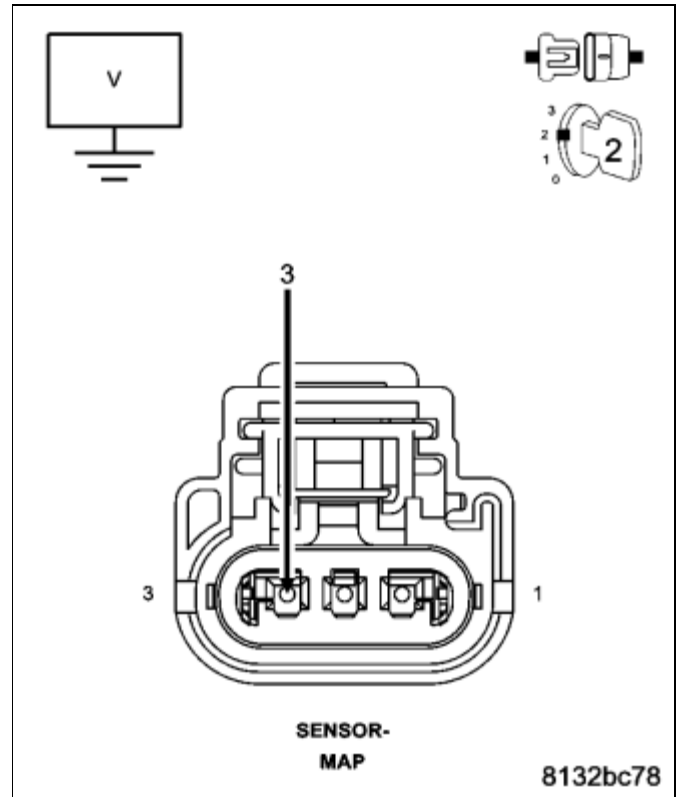
Is the voltage between 4.5 to 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [7](#)



3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 2.2 volts?

Yes

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. If OK, replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

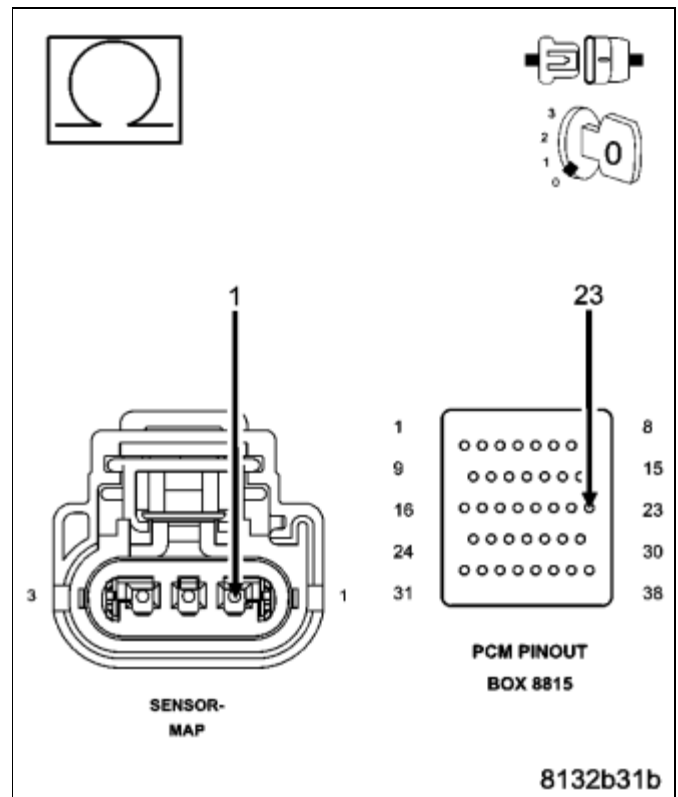
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

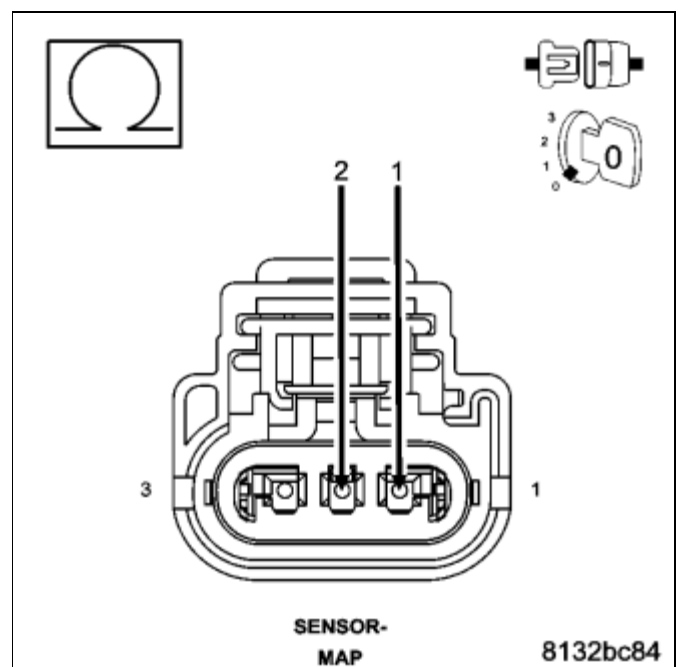
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

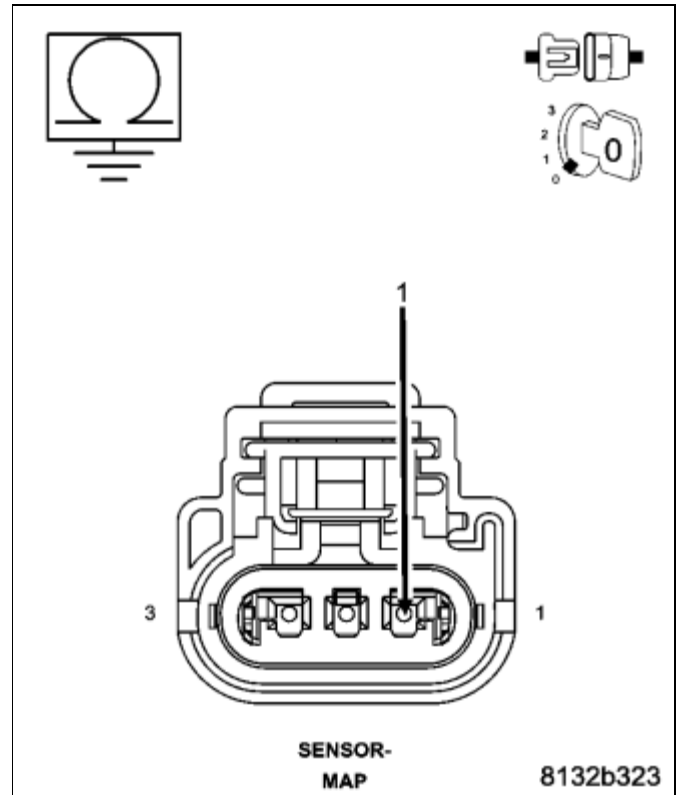
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

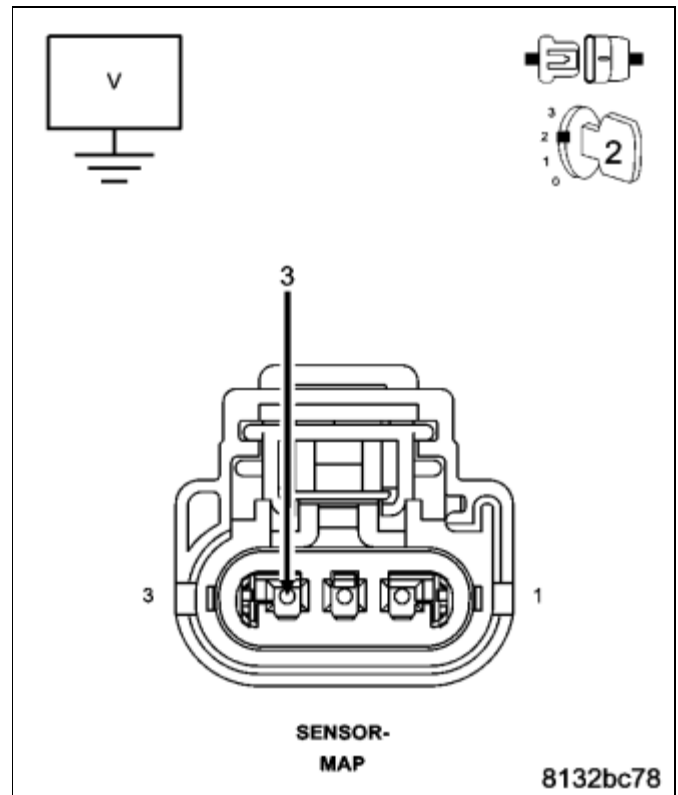
Is there any voltage present?

Yes

- Repair the short to voltage in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

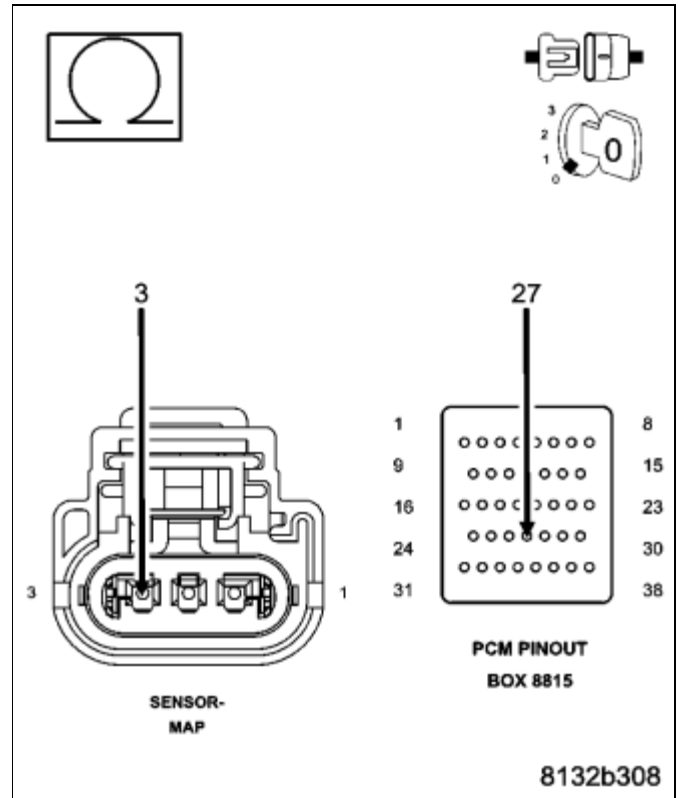
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

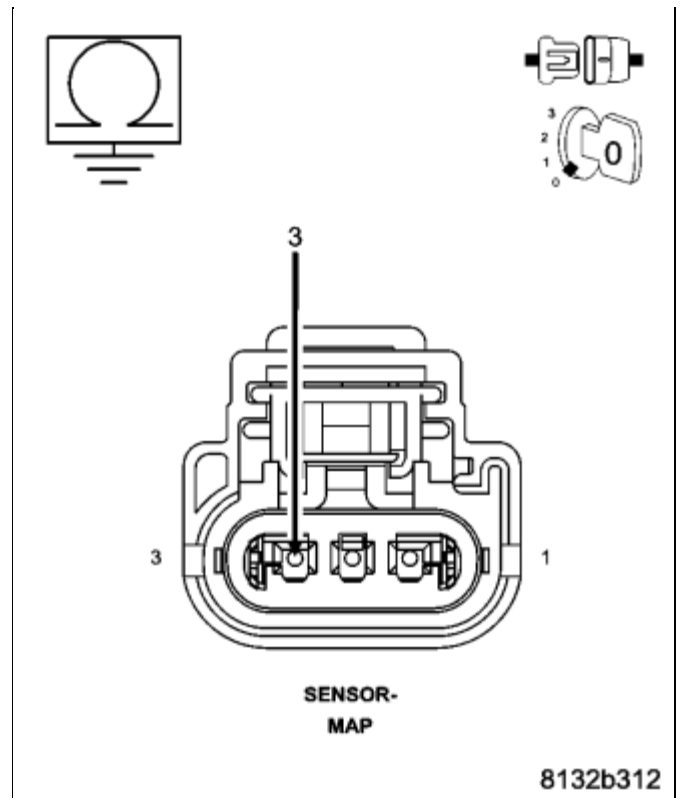
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

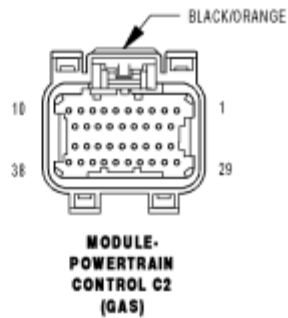
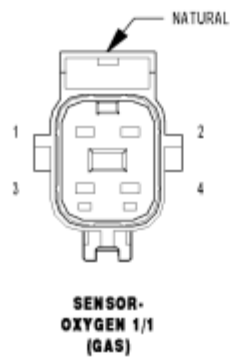
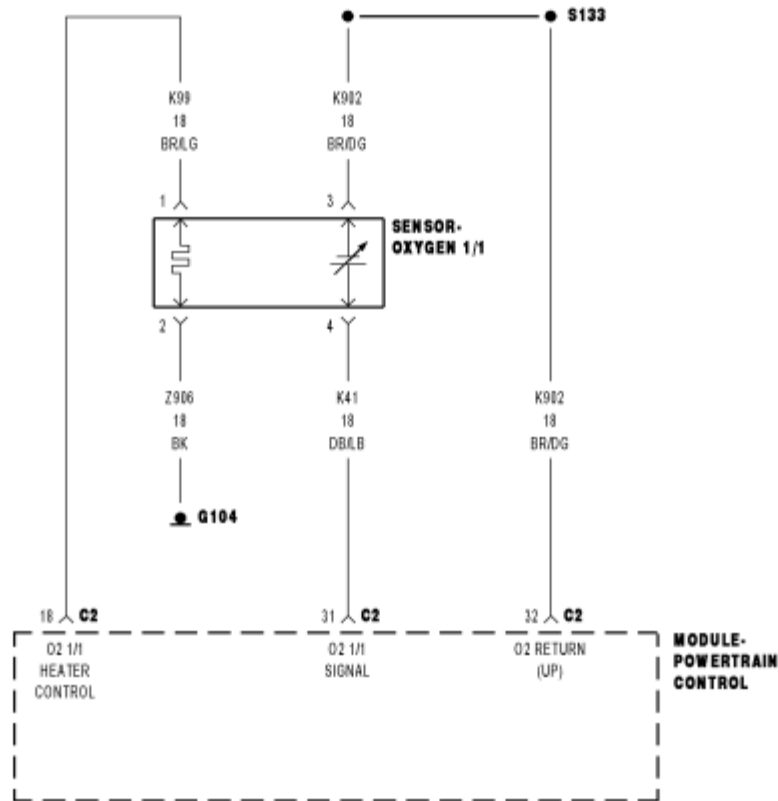
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0131-O2 SENSOR 1/1 CIRCUIT LOW



01011204

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251° C (484° F) with battery voltage greater 10.4 volts.

◦ **Set Condition:**

The PCM detects that the 1/1 Oxygen Sensor signal voltage is below the minimum acceptable value. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 1/1 HEATER GROUND CIRCUIT
1/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With a scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the O2 Sensor voltage.

Is the 1/1 O2 Sensor voltage between 4.1 and 5.0 volts?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

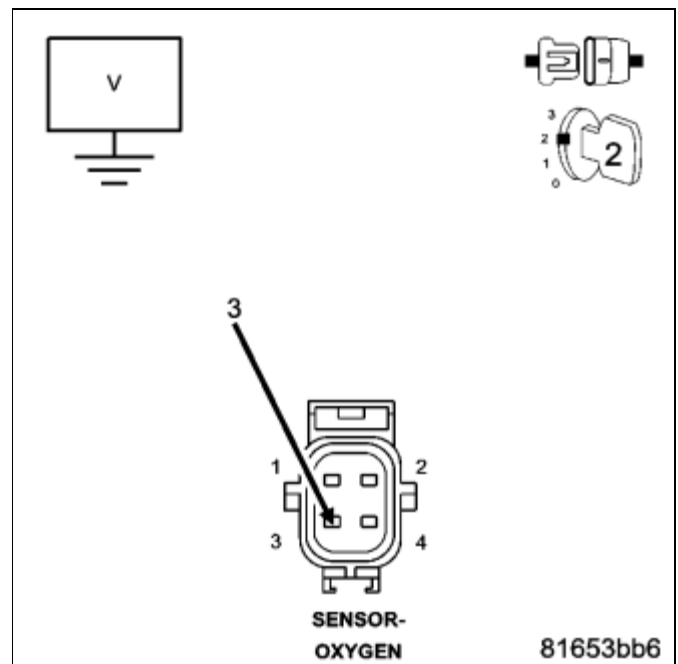
Is the voltage at 2.5 volts?

Yes

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

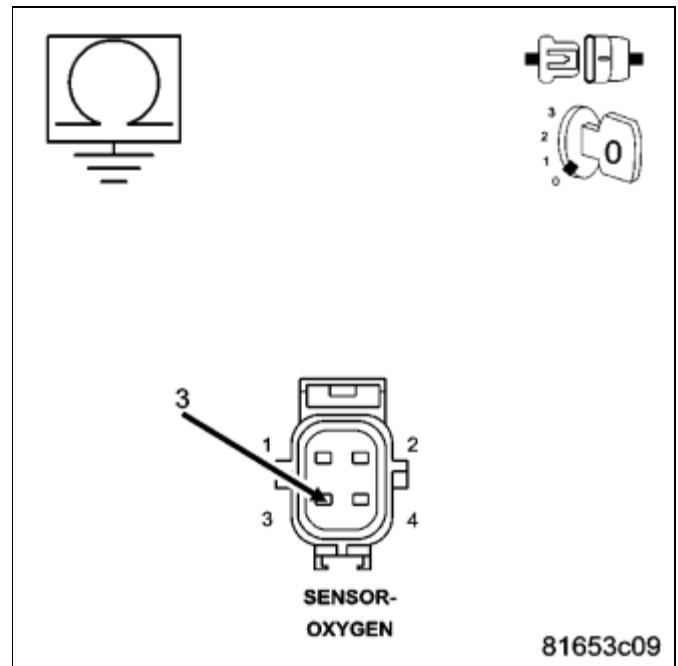
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



5. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

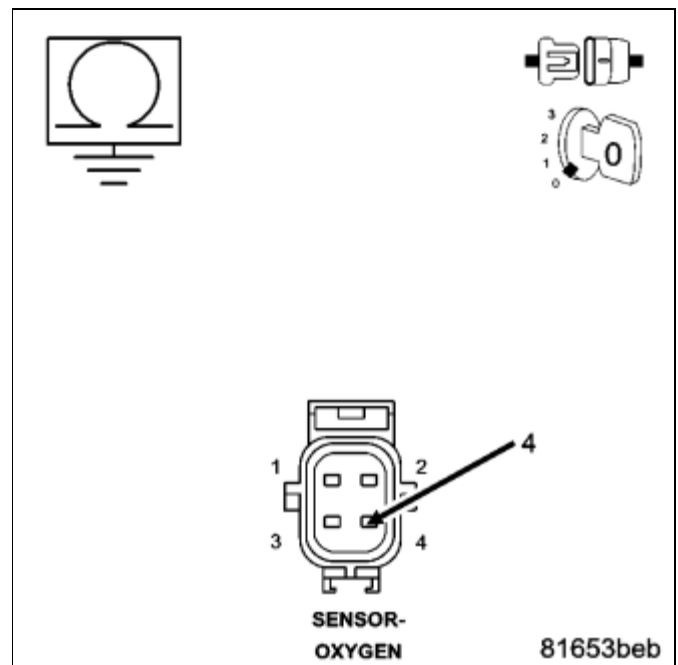
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K41) O2 Sensor 1/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1

Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

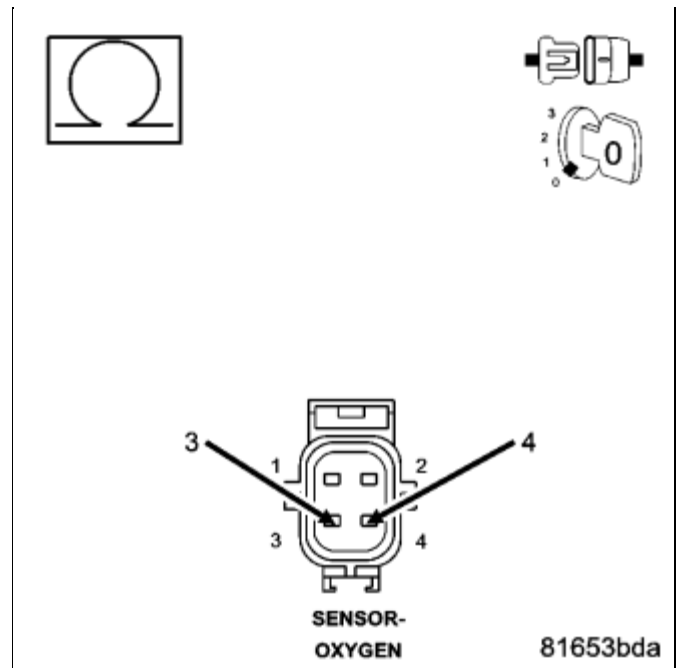
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K902) O2 Return Upstream circuit and the (K41) O2 Sensor 1/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 1/1 HEATER GROUND CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (Z906) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.

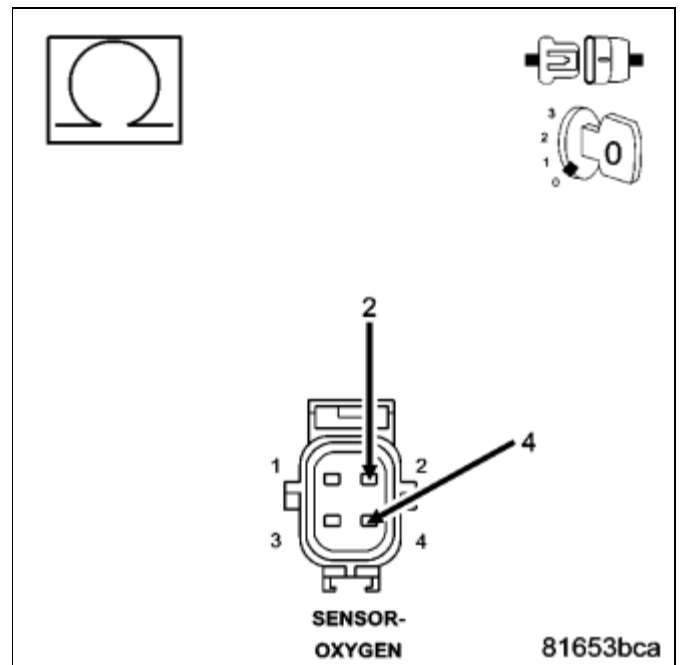
Is the resistance below 100 ohms?

Yes

- Repair the short between the (Z906) O2 1/1 Heater ground circuit and the (K41) O2 Sensor 1/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

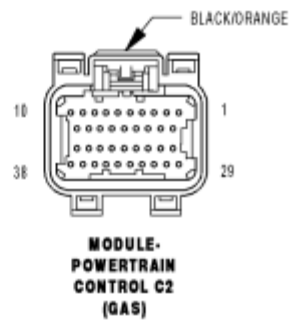
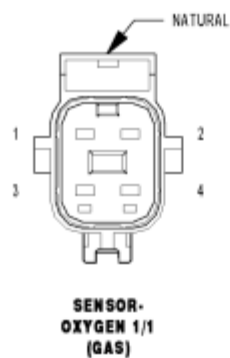
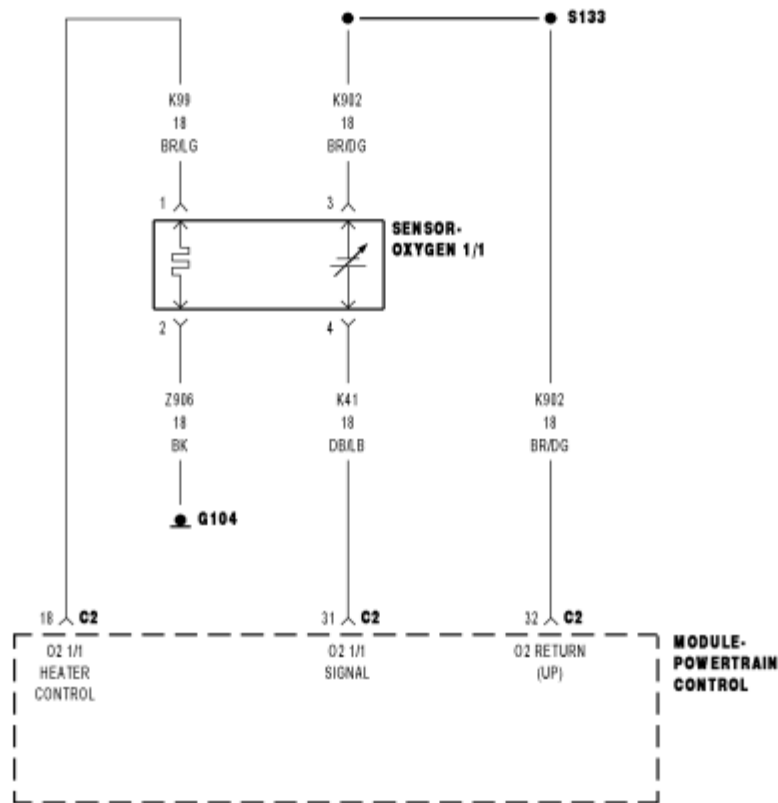
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0132-O2 SENSOR 1/1 CIRCUIT HIGH



01011204

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously with the engine running, no O2 sensor heater DTCs present, 1/1 Oxygen Sensor heater temperature within a specific range, and battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The Oxygen Sensor voltage is above maximum acceptable value. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT TO VOLTAGE
(K41) O2 1/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
1/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If an O2 sensor signal circuit is shorted to voltage, all O2 sensor voltage readings displayed on the scan tool will be approximately 5.0 volts. Diagnose the sensor that set the most current DTC.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Disconnect the 1/1 O2 Sensor harness connector.

Turn the ignition on.

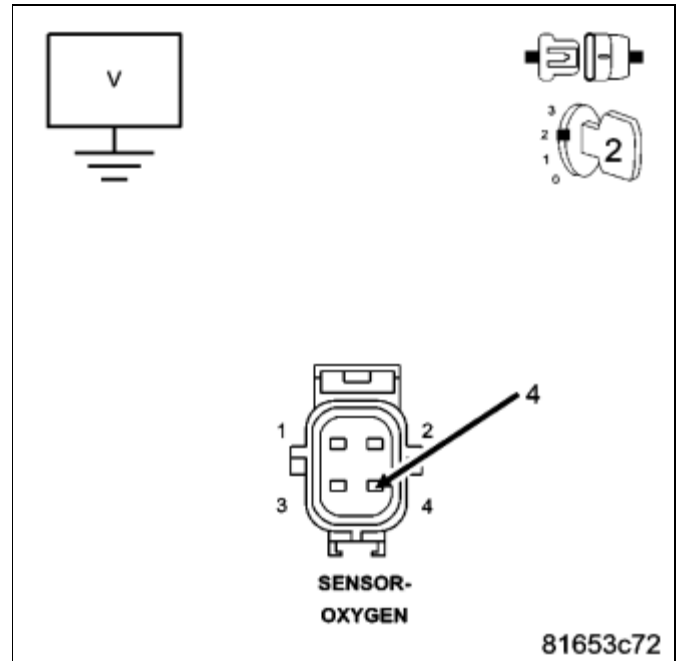
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the 1/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K41) O2 Sensor 1/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [3](#)

3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

Is there any voltage present?

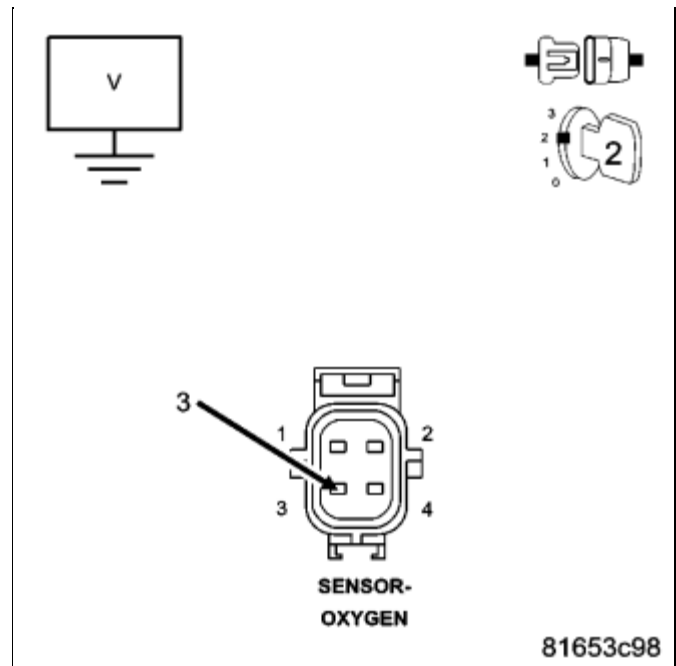
Yes

- Repair the short to voltage in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. 1/1 O2 SENSOR

Turn the ignition off.

Connect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

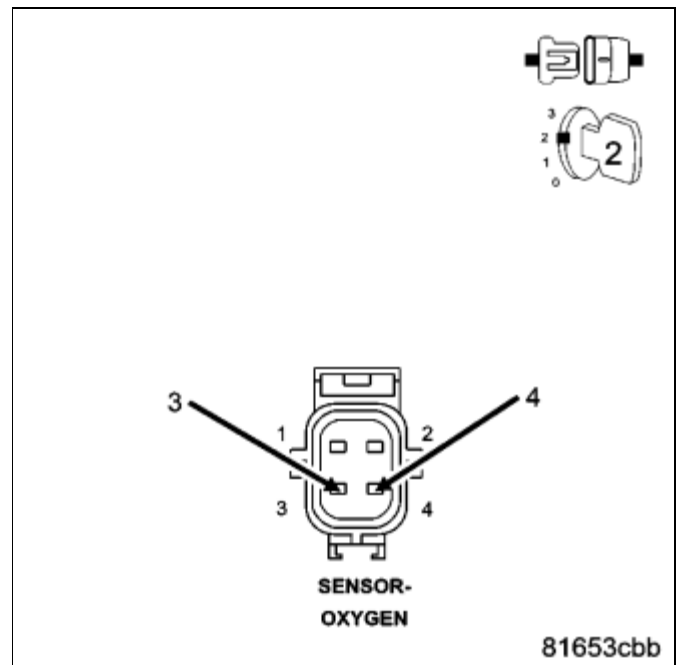
With a scan tool, monitor the 1/1 O2 Sensor voltage.

Connect a jumper wire between the (K41) O2 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.

5. (K41) O2 1/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K41) O2 1/1 Signal circuit from the 1/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

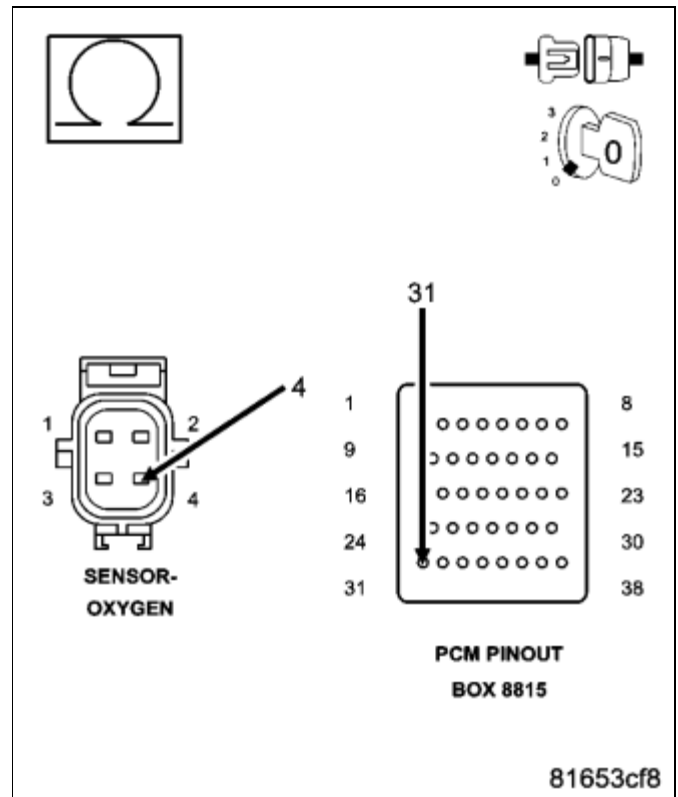
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K41) O2 1/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

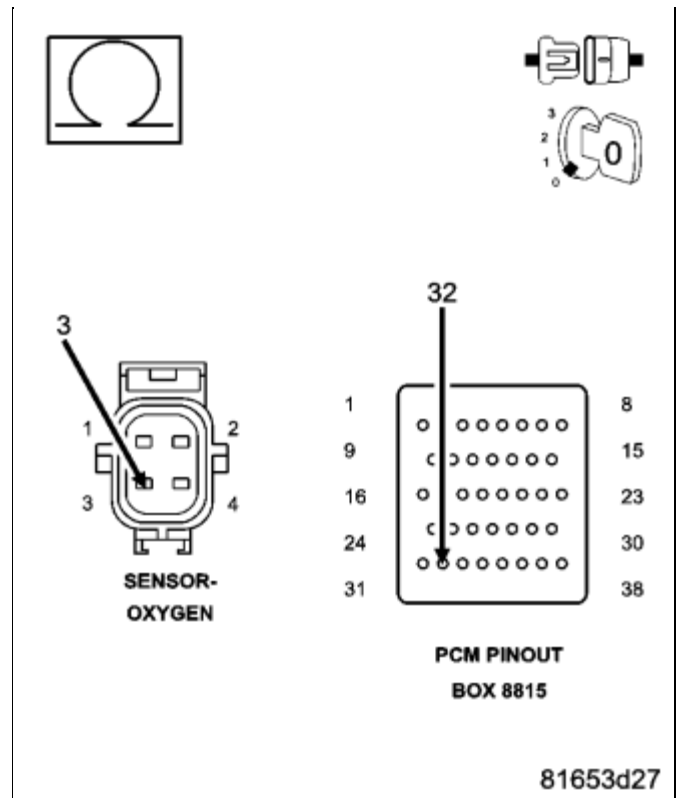
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

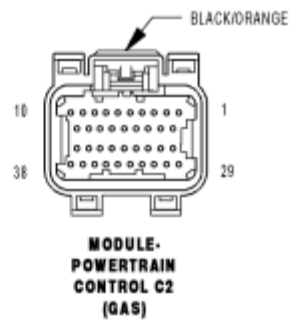
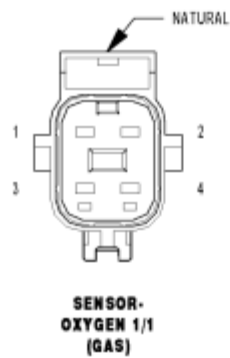
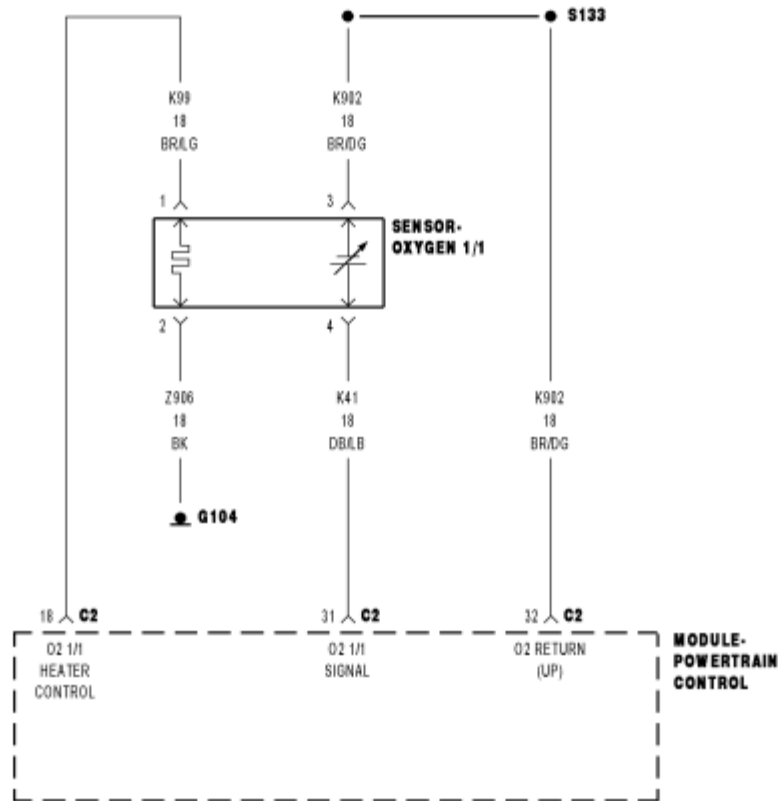
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0133-O2 SENSOR 1/1 SLOW RESPONSE



01011204

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

For an aged O2 sensor, the response rate to the air/fuel change is slower than when it was new. The O2 sensor tends to move less with the same air/fuel changes in a given time frame. Therefore by observing the activity of voltage readings from the upstream O2 sensor, the quality of the O2 sensor can be detected.

- **When Monitored:**

With the ECT above 70° C (158° F), engine RPM between 1400 and 2300, vehicle speed between 64 and 96 kph (40 and 60 mph), and engine run time greater than 3 minutes.

- **Set Condition:**

The PCM detects that the oxygen sensor signal does not switch adequately during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K41) O2 1/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
1/1 O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.

Allow the engine to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:
Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K41) O2 1/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K41) O2 1/1 Signal circuit in the O2 Sensor harness connector.

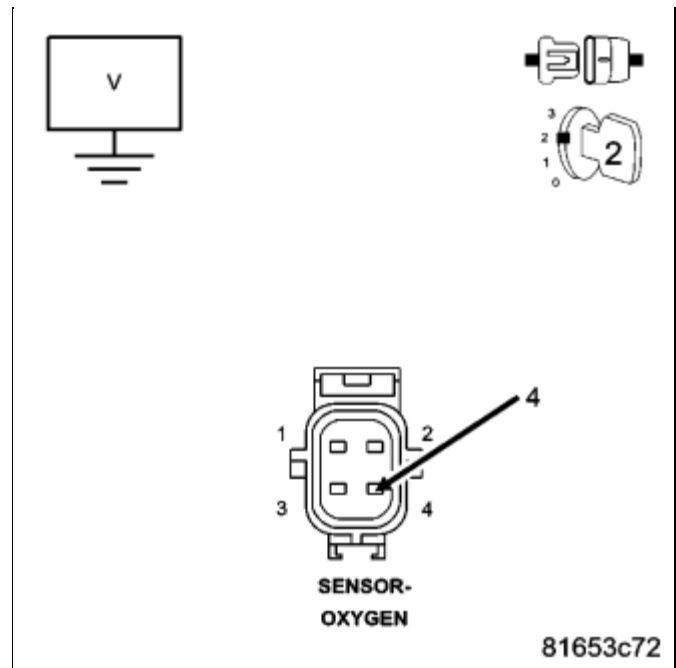
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K41) O2 1/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

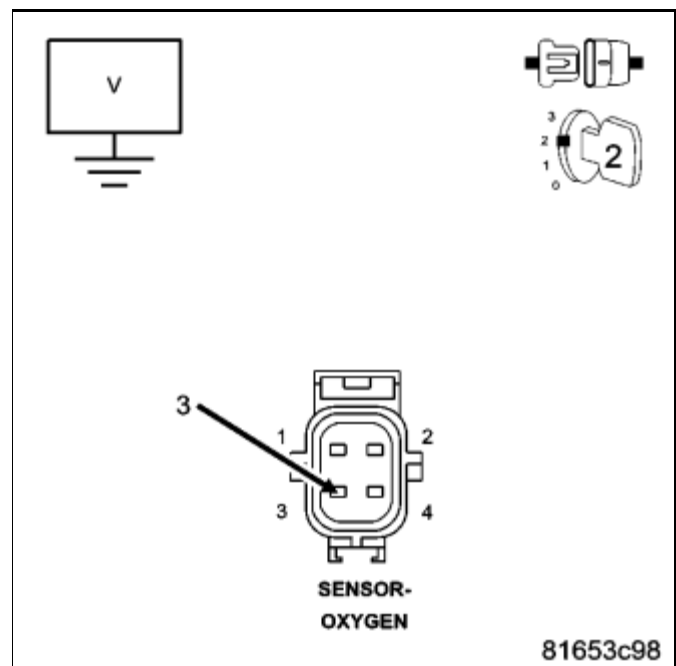
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. O2 SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 1/1 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

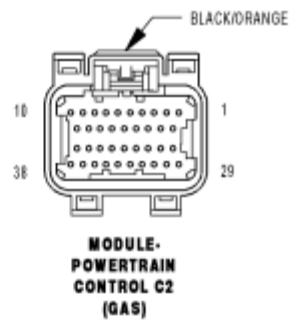
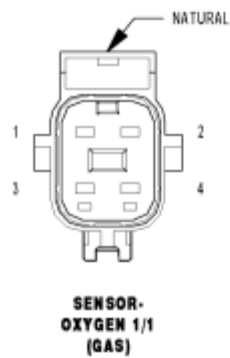
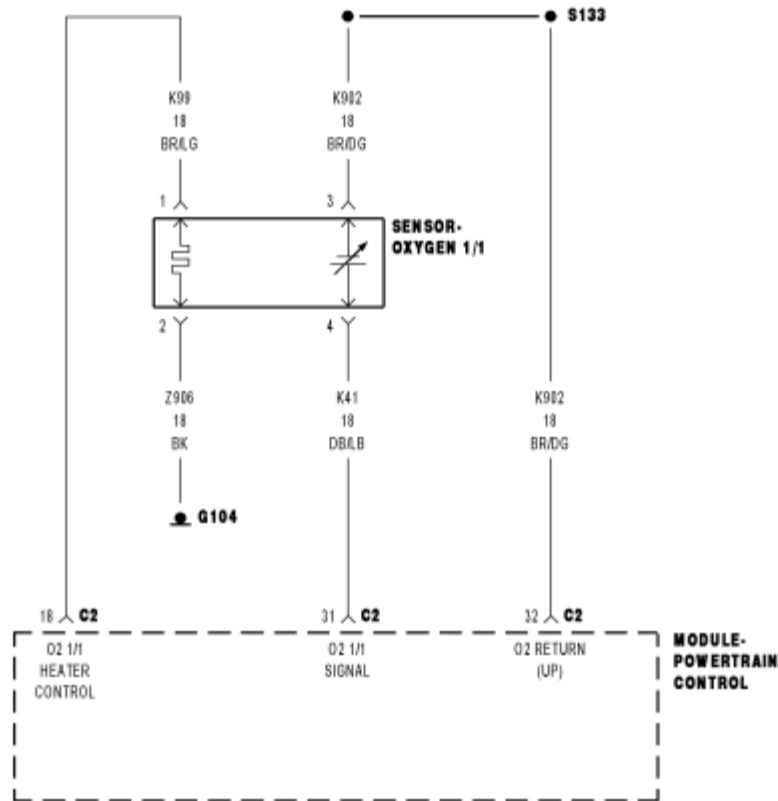
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 1/1 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE



01011204

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**

Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.

- **Set Condition:**

No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 1/1 HEATER GROUND CIRCUIT OPEN
1/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 1/1 O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the Sensor and Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.

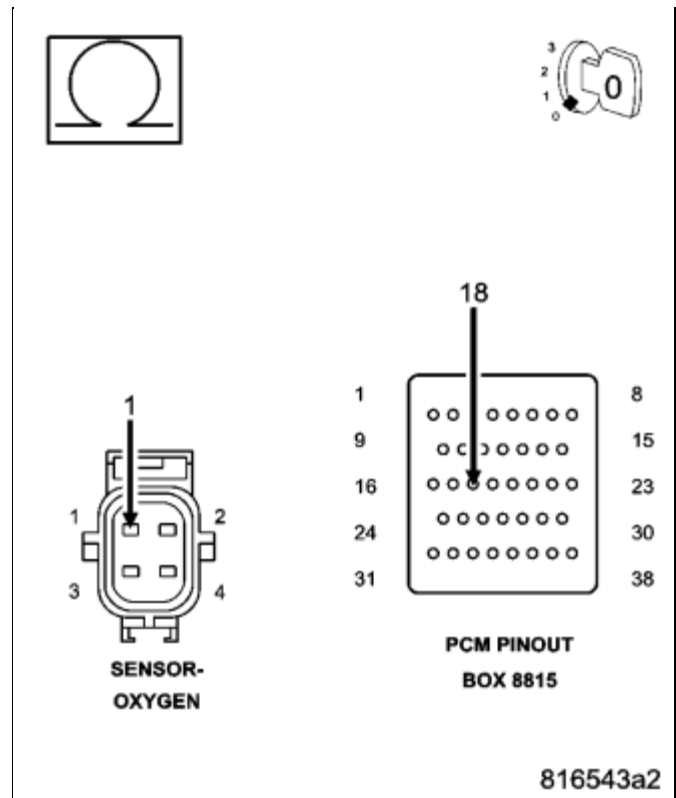
Is the resistance below 0.5 of an ohm?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (Z906) O2 1/1 HEATER GROUND CIRCUIT OPEN

Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the 1/1 Oxygen Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

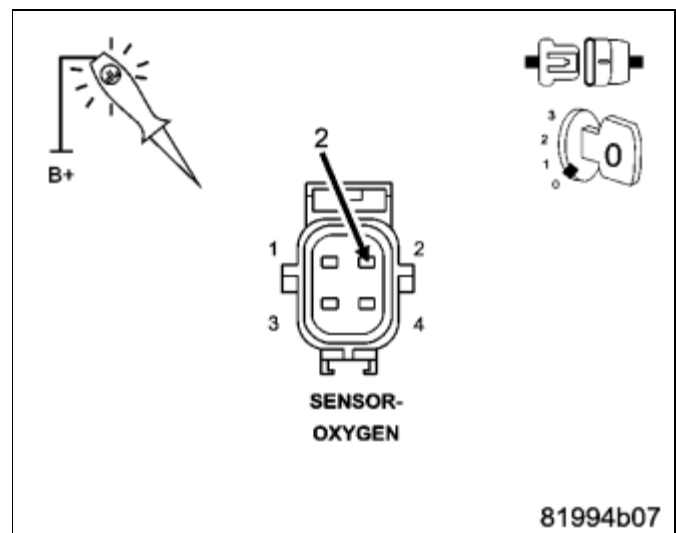
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (Z906) O2 1/1 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

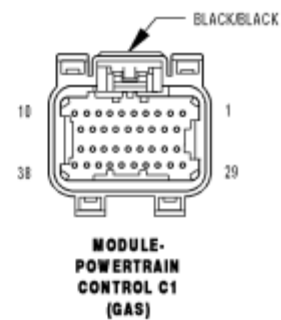
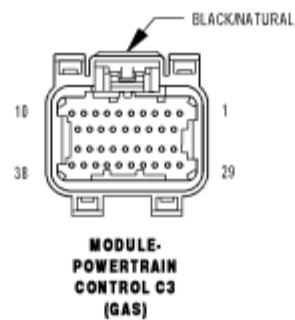
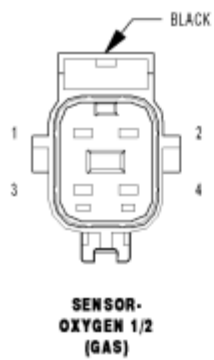
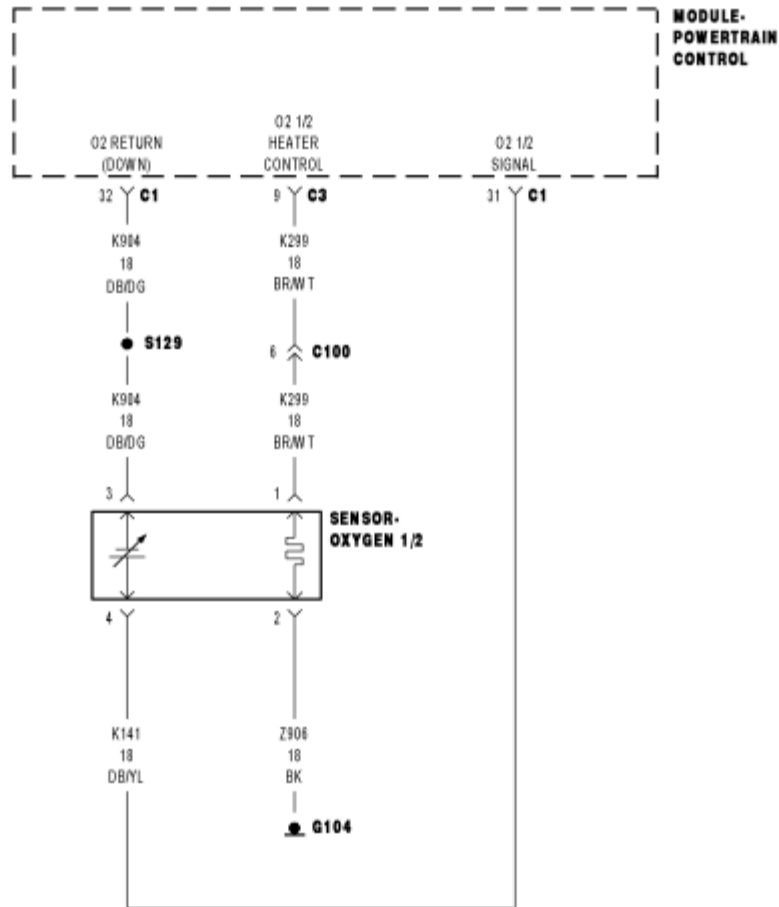
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0137-O2 SENSOR 1/2 CIRCUIT LOW



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251° C (484° F) with battery voltage greater 10.99 volts.

◦ **Set Condition:**

The PCM detects that the 1/2 Oxygen Sensor signal voltage is below approximately 1.5 volts for 2.8 seconds after engine startup. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 1/2 HEATER GROUND CIRCUIT
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With a scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/2 O2 Sensor voltage.

Is the O2 Sensor voltage between 4.1 and 5.0 volts?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

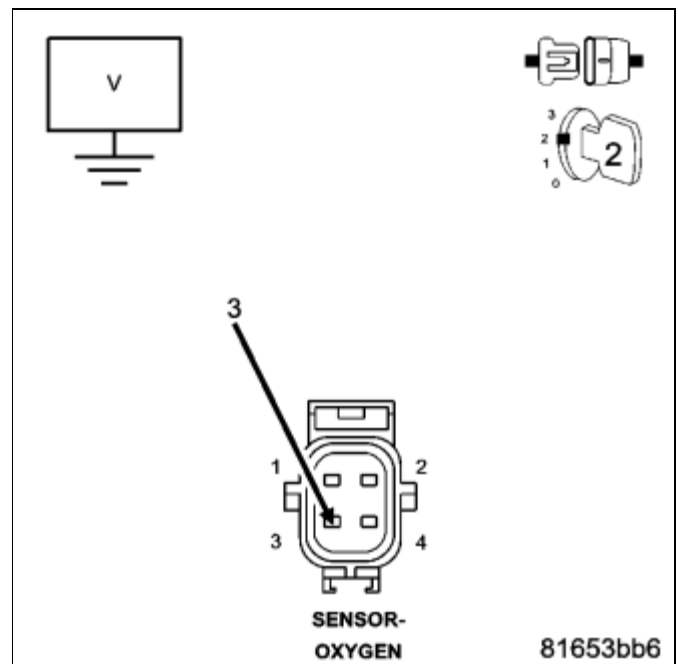
Is the voltage at 2.5 volts?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K904) O2
 Return Downstream circuit in the O2 Sensor harness
 connector.

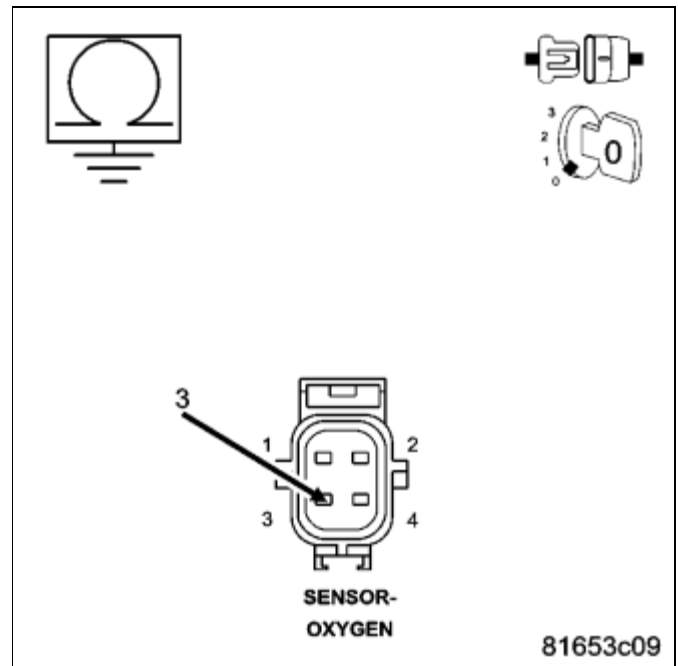
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



5. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K141) O2
 1/2 Signal circuit in the O2 Sensor harness connector.

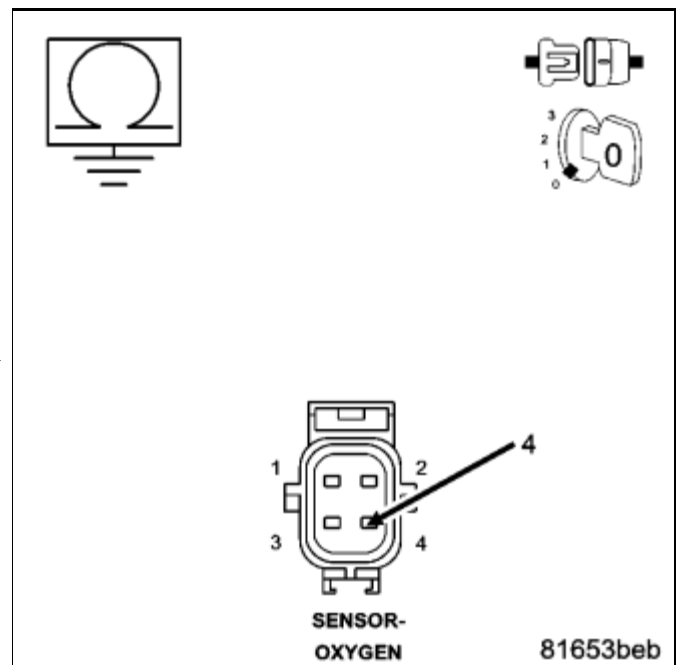
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K141) O2 1/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

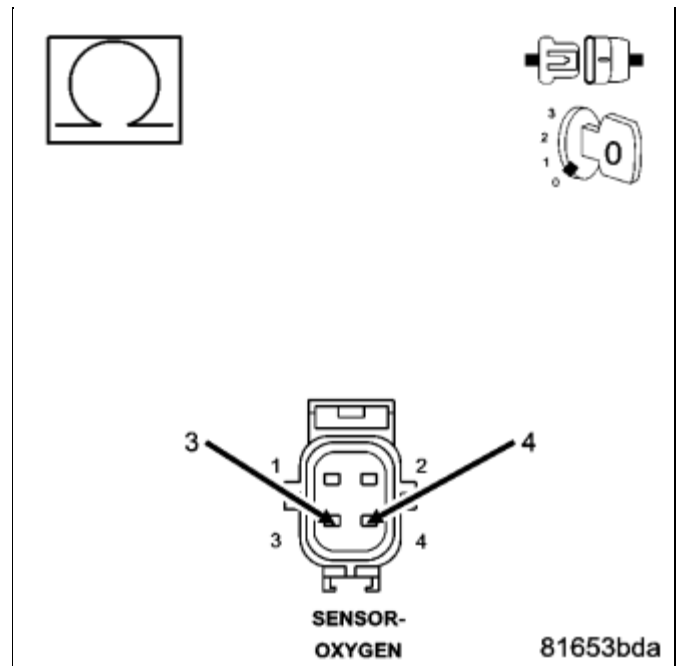
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K904) O2 Return Downstream circuit and the (K141) O2 1/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 1/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (Z906) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.

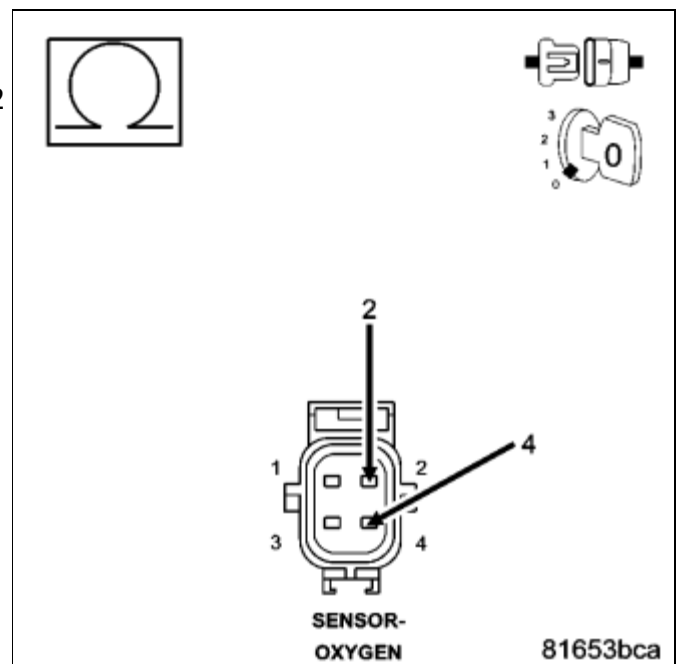
Is the resistance below 100 ohms?

Yes

- Repair the short between the (Z906) O2 1/2 Heater ground circuit and the (K141) O2 1/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

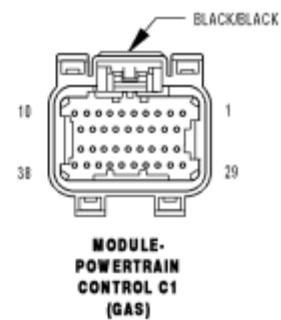
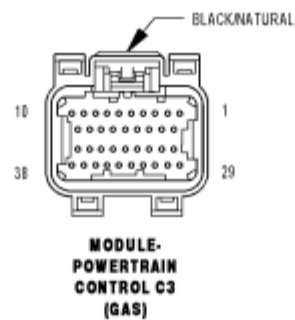
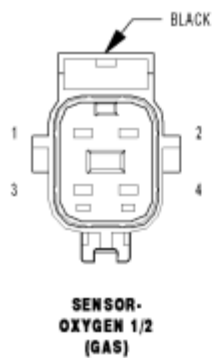
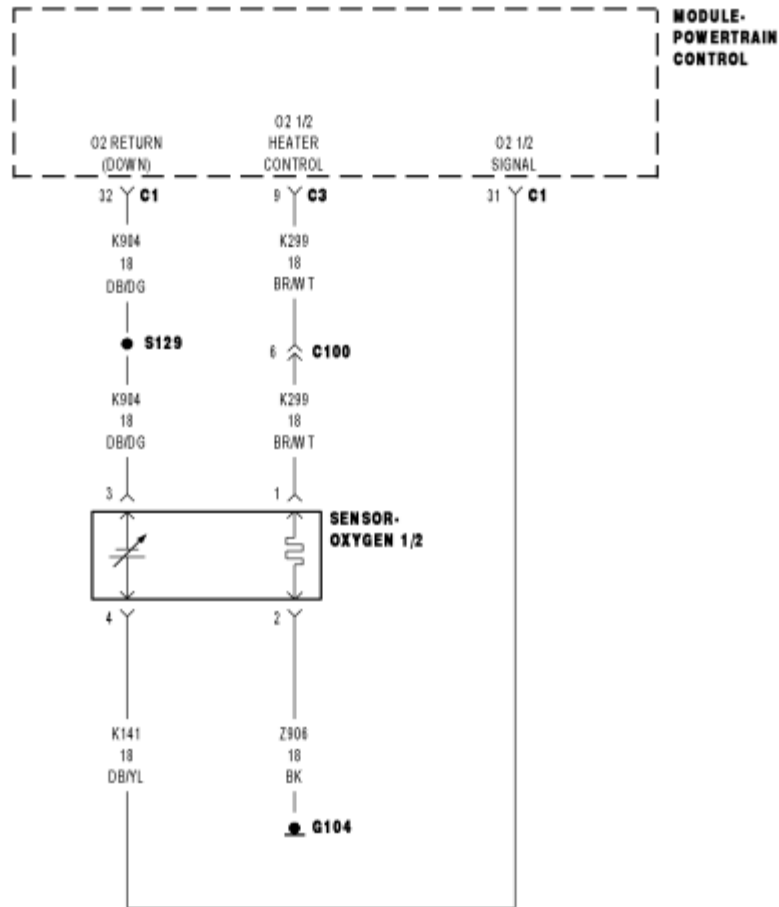
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0138-O2 SENSOR 1/2 CIRCUIT HIGH



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously with the engine running, no O2 sensor heater DTCs present, 1/2 Oxygen Sensor heater temperature within a specific range, and battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The PCM detects that the 1/2 Oxygen Sensor voltage is greater than the maximum acceptable value for a specific amount of time, based on O2 sensor heater temperature. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO VOLTAGE
(K141) O2 1/2 SENSOR SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If an O2 sensor signal circuit is shorted to voltage, all O2 sensor voltage readings displayed on the scan tool will be approximately 5.0 volts. Diagnose the sensor that set the most current DTC.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connector.

Disconnect the 1/2 O2 Sensor harness connector.

Turn the ignition on.

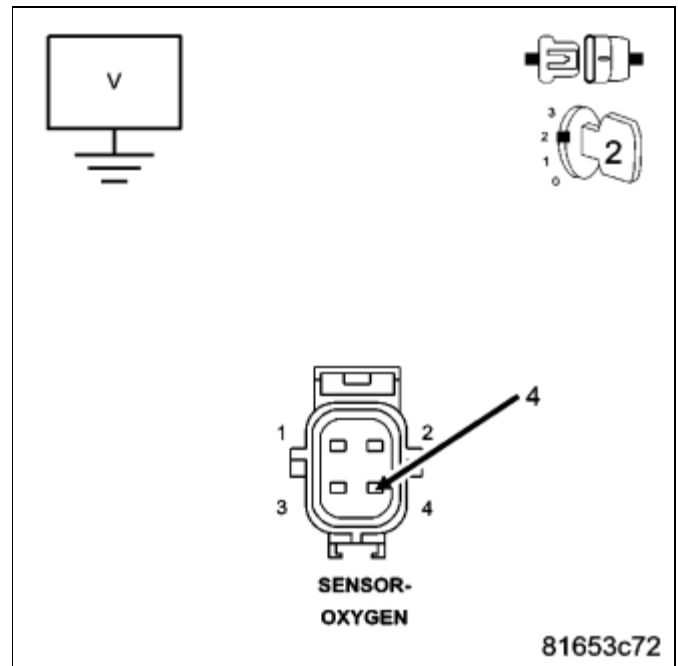
Measure the voltage on the (K141) O2 Sensor 1/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K141) O2 Sensor 1/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

**No**

- Go To [3](#)

3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is there any voltage present?

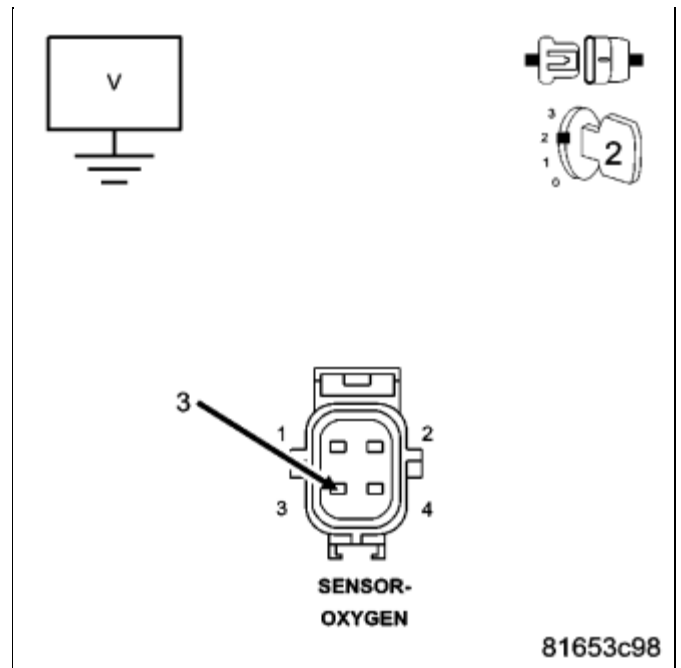
Yes

- Repair the short to voltage in the (K904) O2 Return Downstream circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. O2 SENSOR

Turn the ignition off.

Connect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

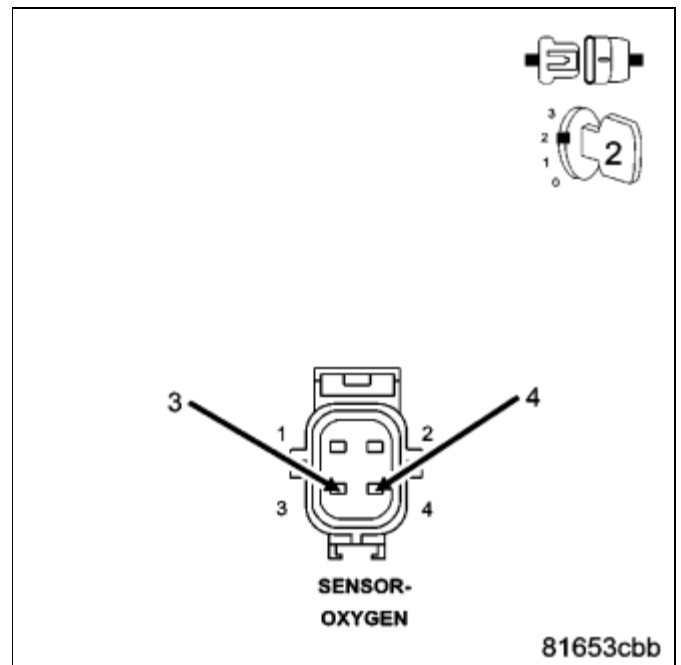
With a scan tool, monitor the 1/2 O2 Sensor voltage.

Connect a jumper wire between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.

5. (K141) O2 1/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K141) O2 1/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

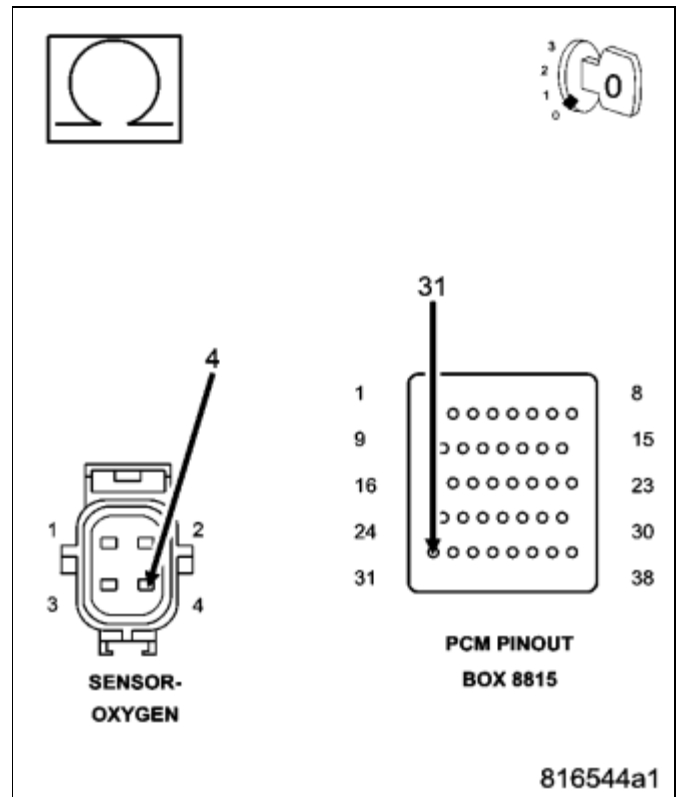
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K141) O2 1/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

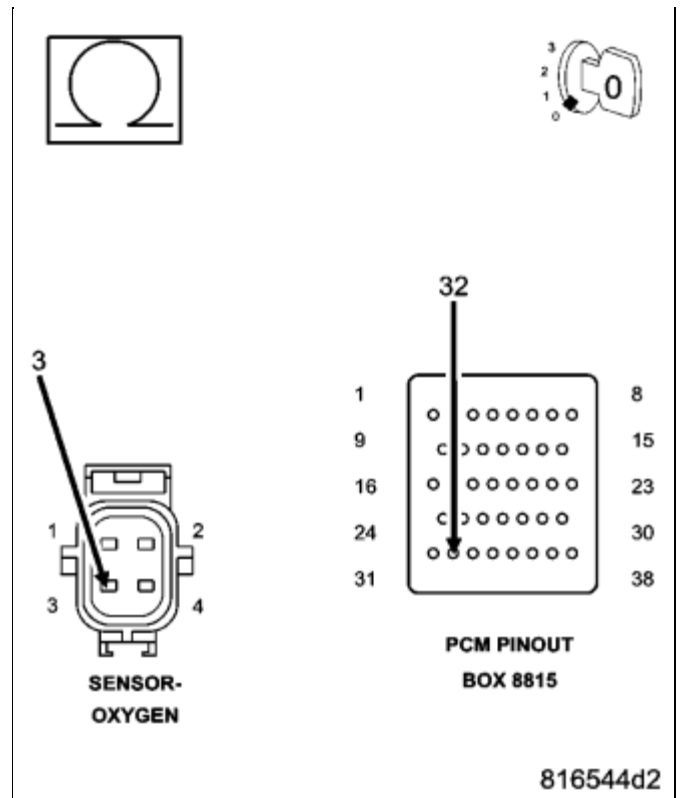
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

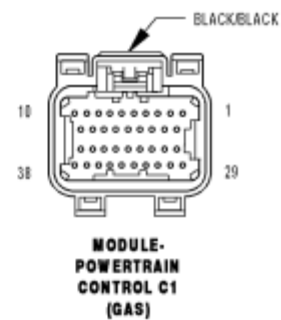
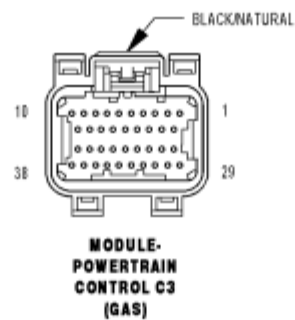
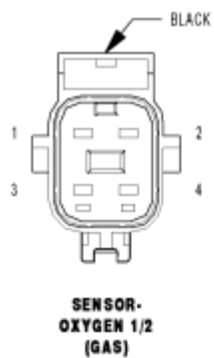
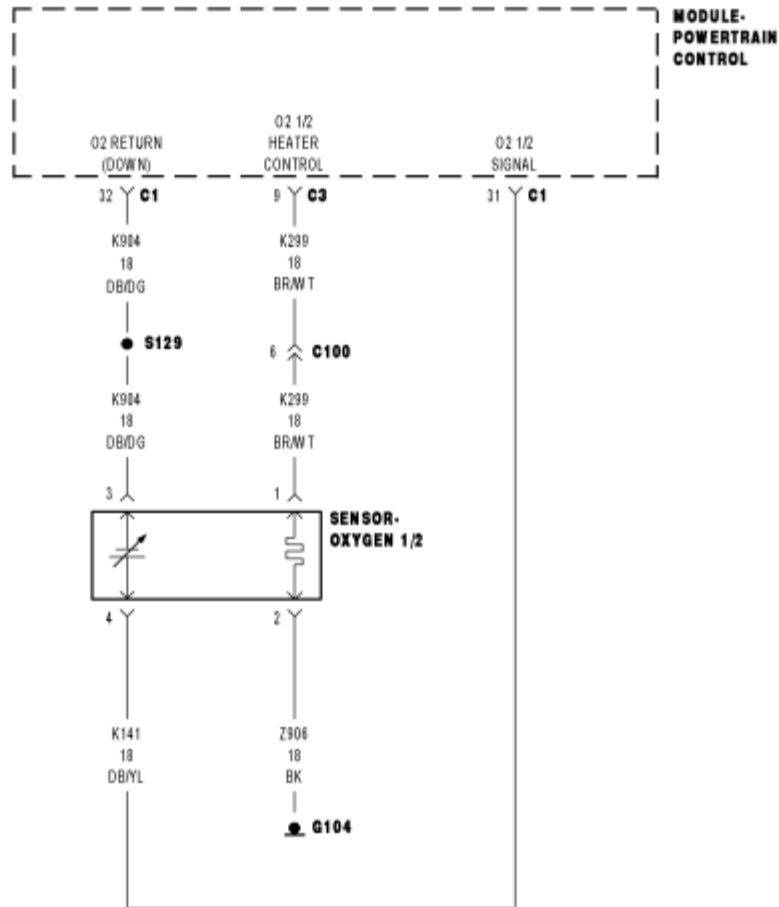
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0139-O2 SENSOR 1/2 SLOW RESPONSE



81811440

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**

Vehicle is started and driven between 32 and 88.5 km/h (20 and 55 mph) with the Throttle open for a minimum of 120 seconds. Coolant greater than 70° C (158° F). Catalytic Converter Temp greater than 600° C (1112° F) and EVAP Purge is active.

- **Set Condition:**

The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K141) O2 1/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
1/2 O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.

Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.

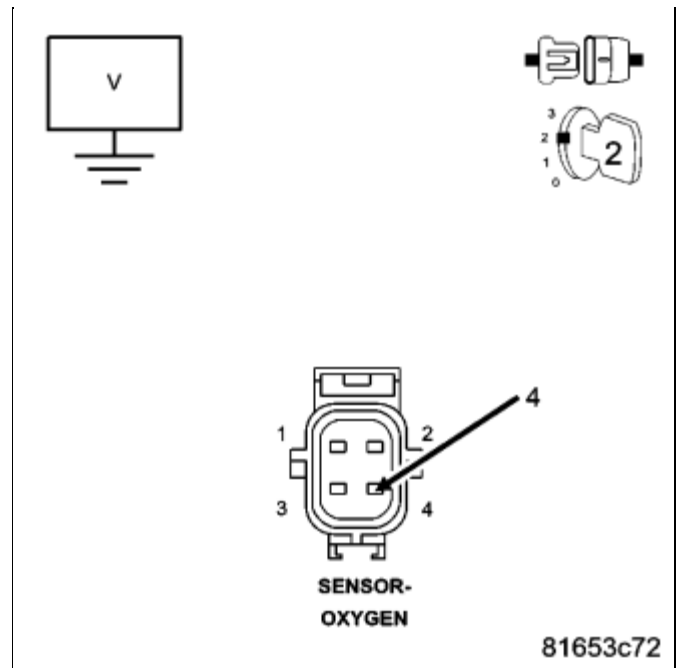
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K141) O2 1/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

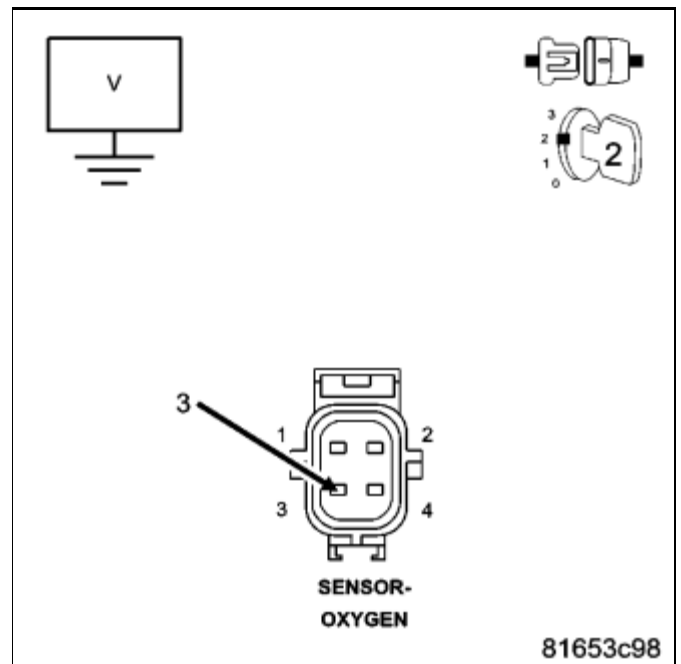
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. O2 SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 1/2 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

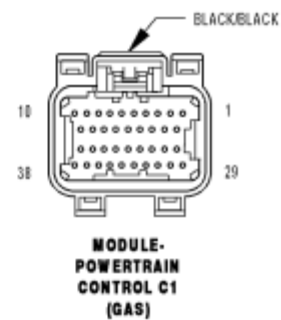
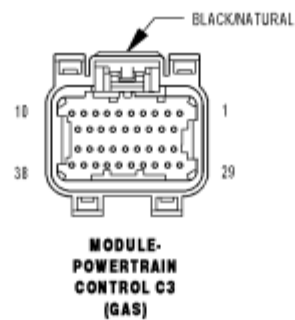
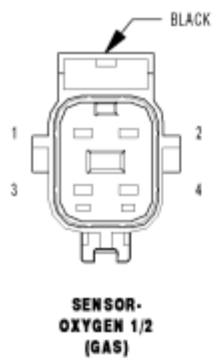
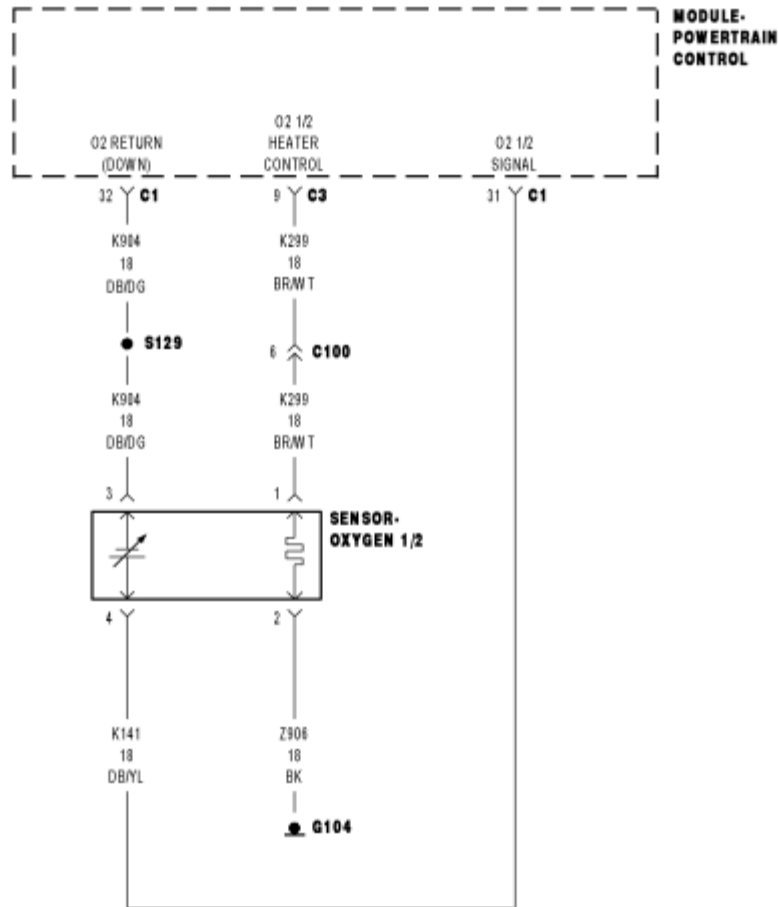
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 1/2 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P013A-O2 SENSOR 1/2 SLOW RESPONSE - RICH TO LEAN



81811440

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**

With the engine running, vehicle speed above 96 kph (60 mph), throttle open for a minimum of 120 seconds, ECT greater than 70° C (158° F), catalytic converter temperature greater than 600° C (1112° F), and downstream oxygen sensor in a rich state. During a decel fuel shutoff event, the downstream oxygen sensor should switch from rich to lean within a specific time.

- **Set Condition:**

The PCM monitors the downstream O2 sensor. If the PCM does not detect a rich to lean switch within a specific time during a decel fuel shutoff event, the monitor will fail. One trip fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K141) O2 1/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
1/2 O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.
 Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear.

Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear.

Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.

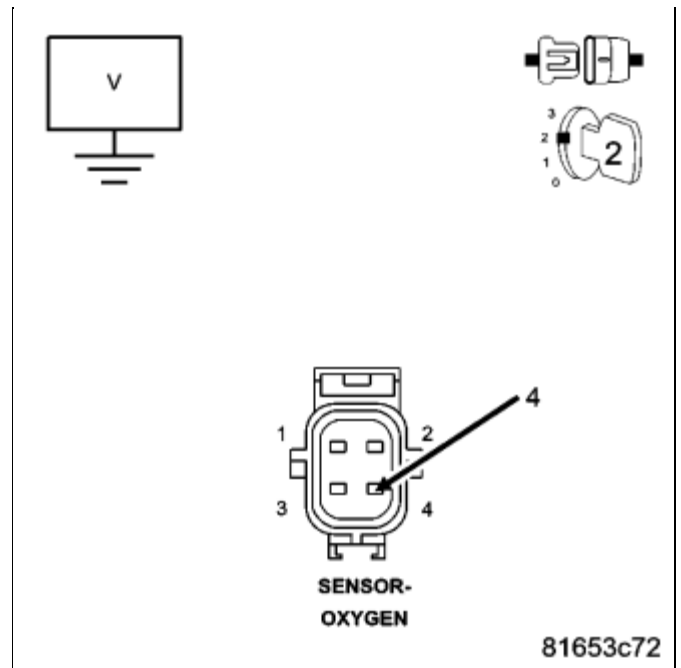
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K141) O2 1/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

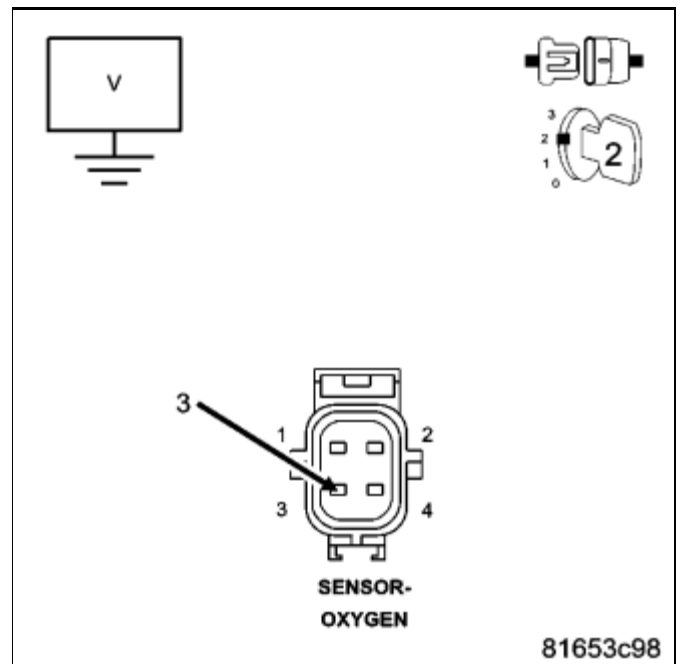
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. O2 SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 1/2 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 1/2 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P013C-O2 SENSOR 2/2 SLOW RESPONSE - RICH TO LEAN

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**

With the engine running, vehicle speed above 96 kph (60 mph), throttle open for a minimum of 120 seconds, ECT greater than 70° C (158° F), catalytic converter temperature greater than 600° C (1112° F), and downstream oxygen sensor in a rich state. During a decel fuel shutoff event, the downstream oxygen sensor should switch from rich to lean within a specific time.

- **Set Condition:**

The PCM monitors the downstream O2 sensor. If the PCM does not detect a rich to lean switch within a specific time during a decel fuel shutoff event, the monitor will fail. One trip fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K243) O2 2/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
2/2 O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.
 Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear.

Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear.

Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

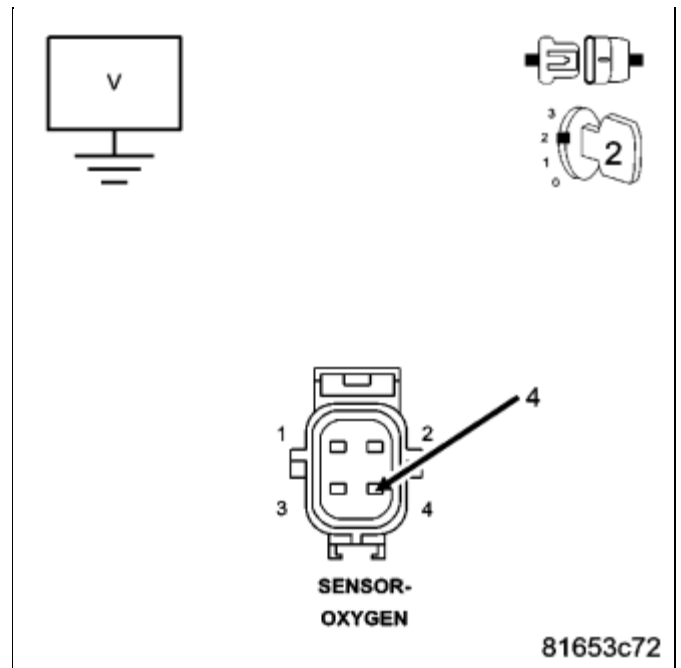
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K243) O2 2/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

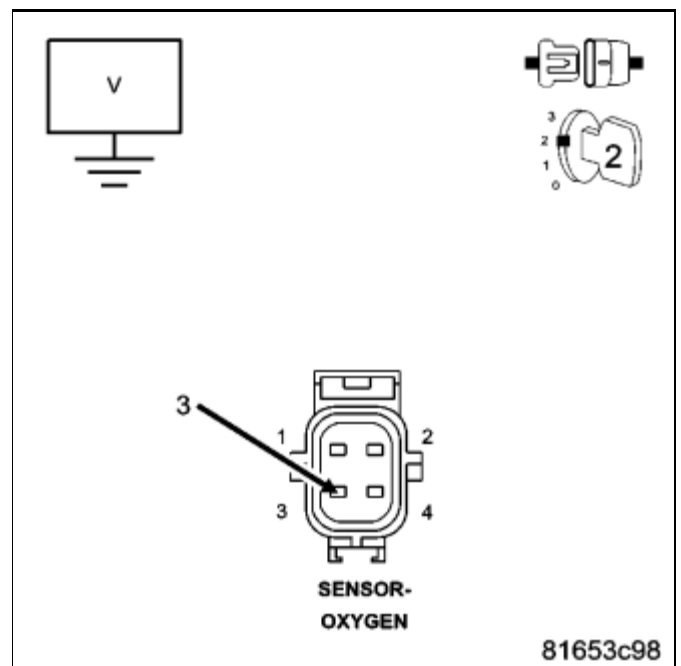
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. O2 SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 2/2 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

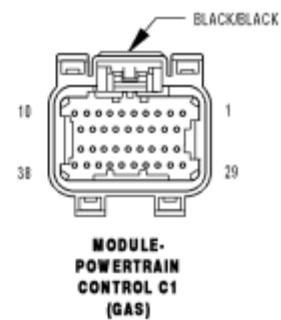
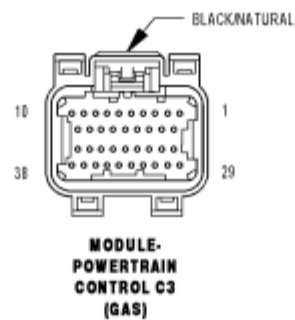
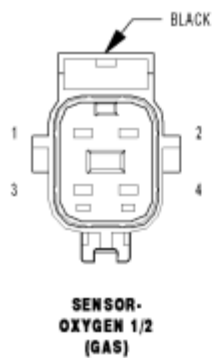
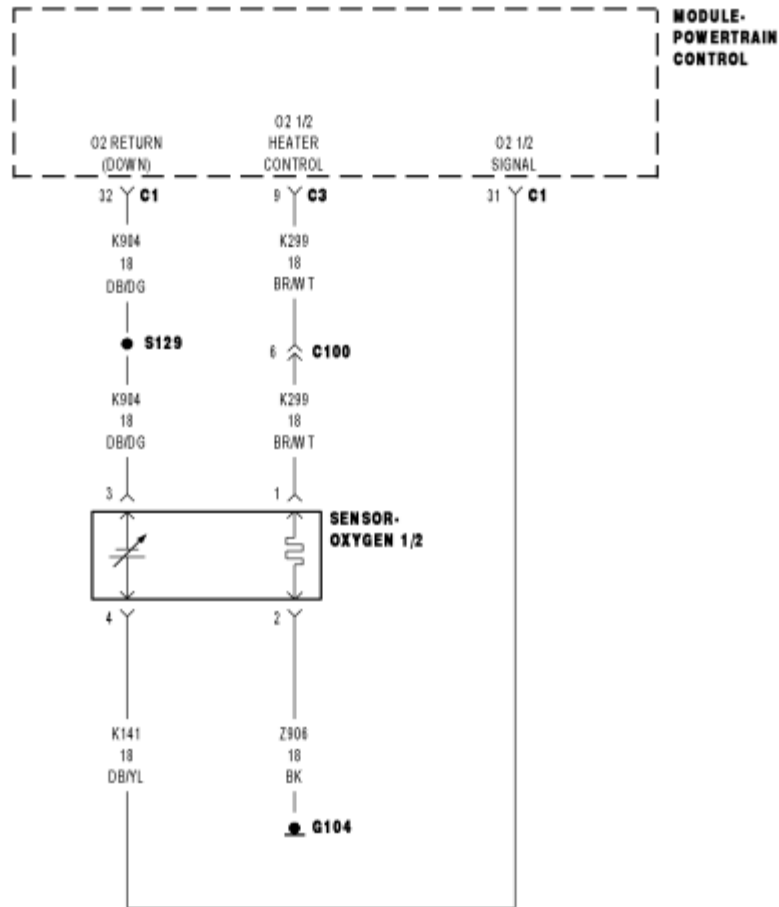
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 2/2 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE



81811440

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**

Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.

- **Set Condition:**

No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 HEATER GROUND CIRCUIT OPEN
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.

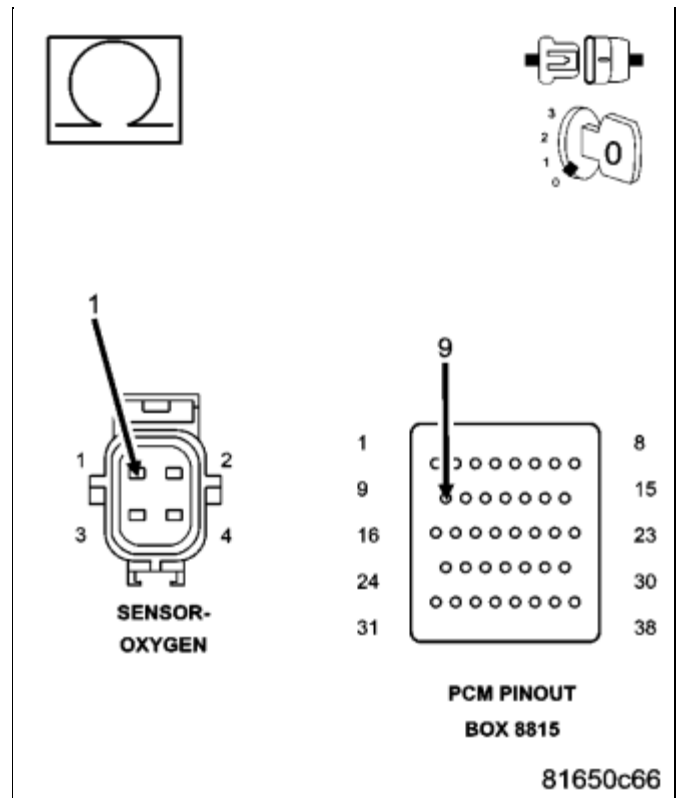
Is the resistance below 0.5 of an ohm?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K299) O2 1/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (Z906) O2 1/2 HEATER GROUND CIRCUIT OPEN

Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the 1/1 Oxygen Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

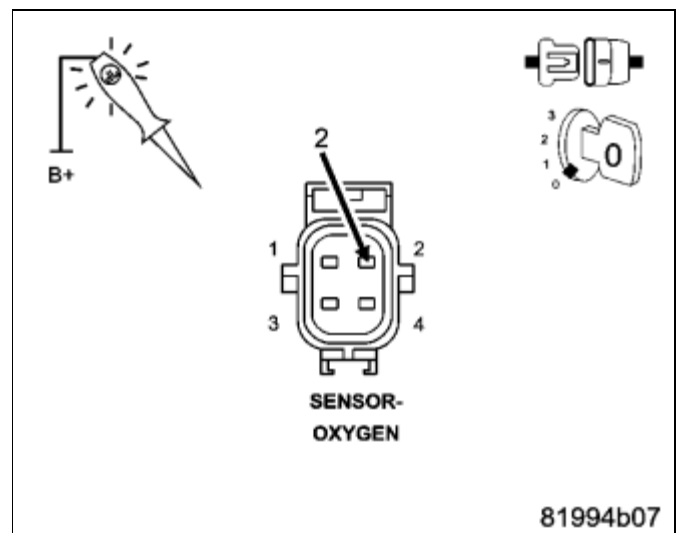
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (Z906) O2 1/2 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 1/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

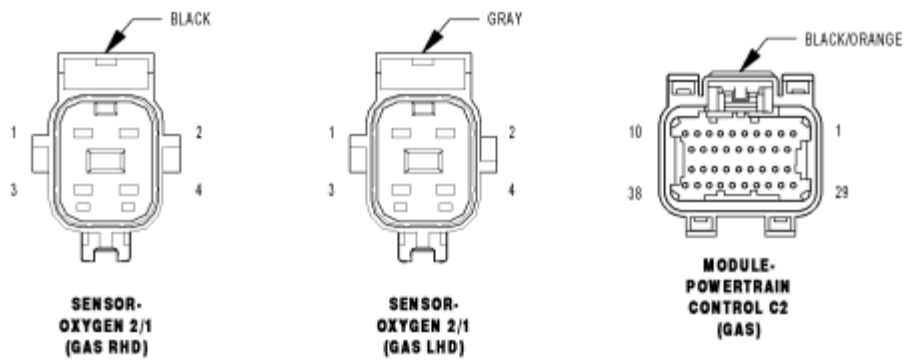
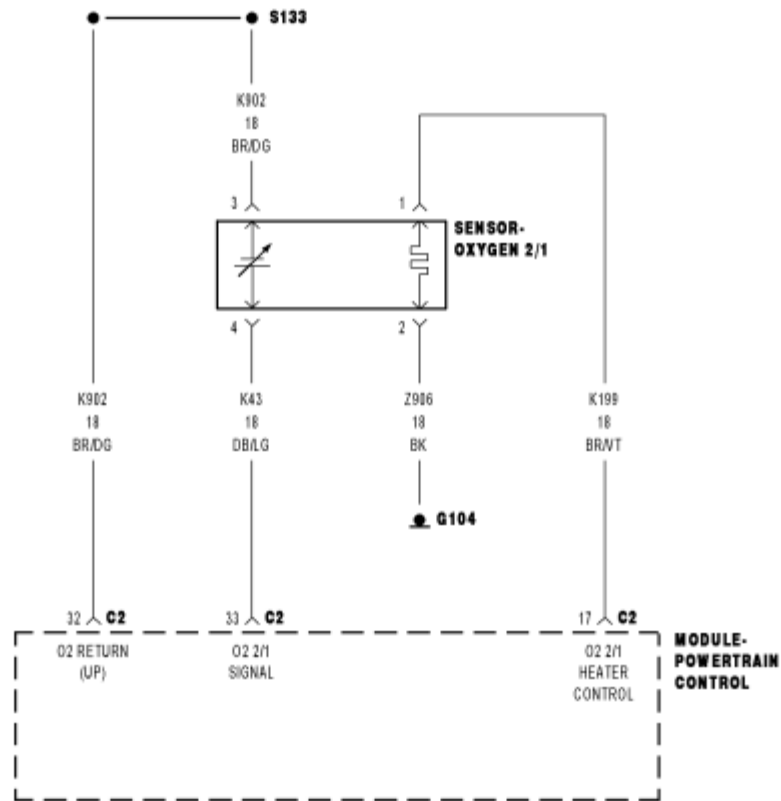
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0151-O2 SENSOR 2/1 CIRCUIT LOW



0101146a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251° C (484° F) with battery voltage greater 10.99 volts.

◦ **Set Condition:**

The PCM detects that the 2/1 Oxygen Sensor signal voltage is below approximately 1.5 volts for 2.8 seconds after engine startup. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z906) HEATER GROUND CIRCUIT
2/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With a scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/1 O2 Sensor voltage.

Is the O2 Sensor voltage between 4.1 and 5.0 volts?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

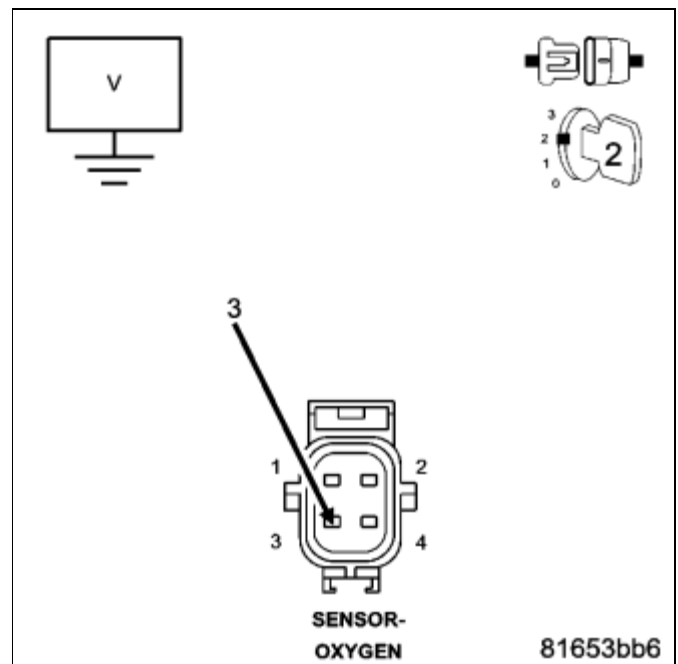
Is the voltage at 2.5 volts?

Yes

- Verify that there is good pin to terminal contact in the 2/1 Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the 2/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

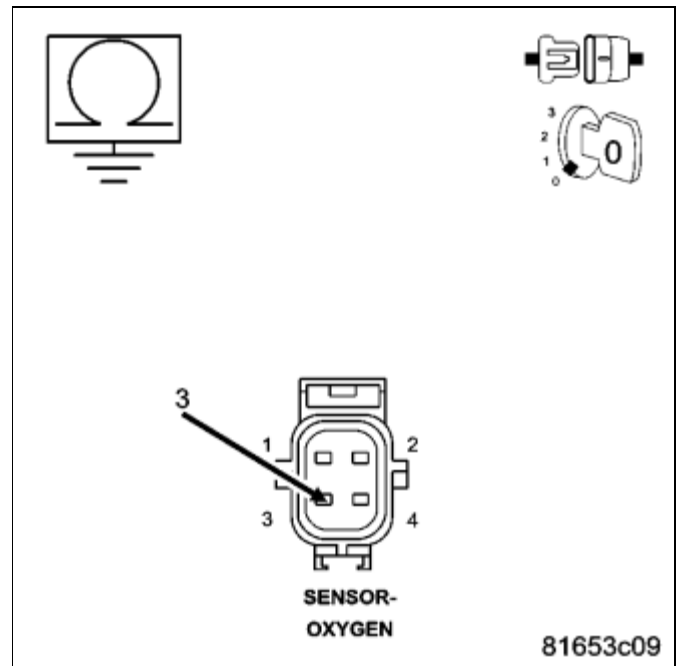
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



5. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.

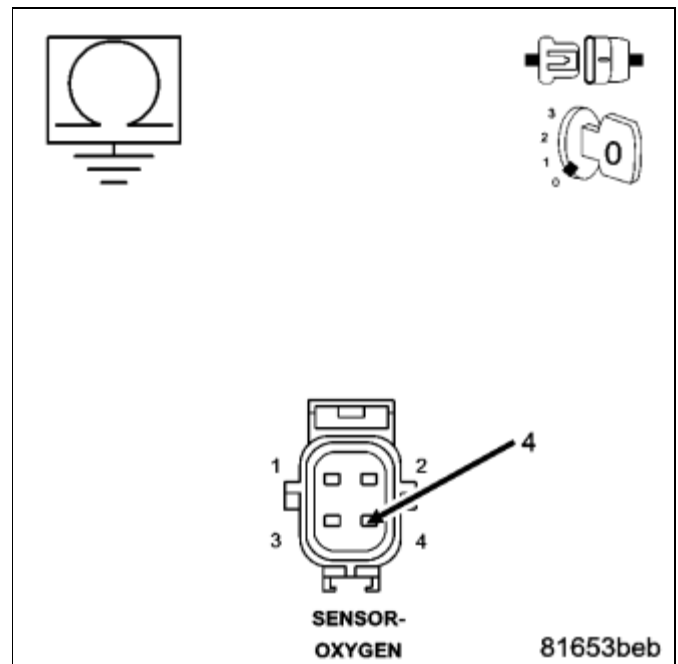
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K43) O2 2/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2

Sensor harness connector.

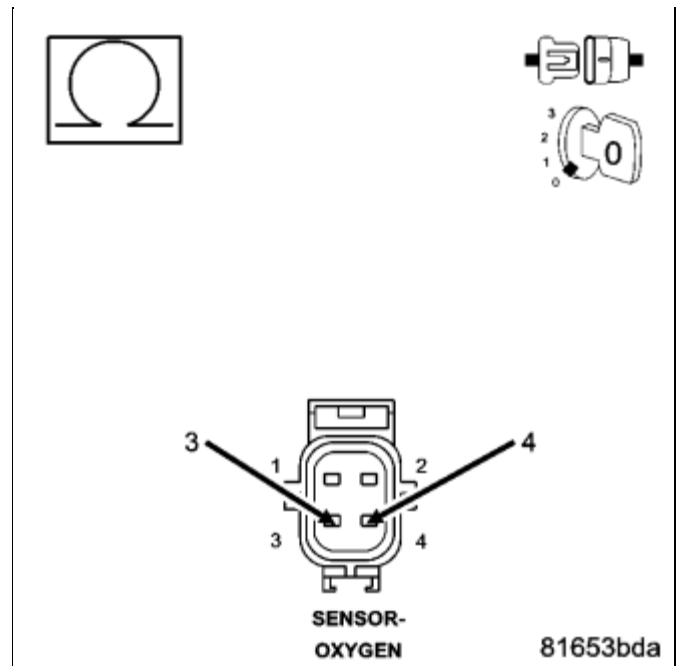
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K902) O2 Return Upstream circuit and the (K43) O2 2/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z906) HEATER GROUND CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (Z906) O2 Heater ground circuit in the O2 Sensor harness connector.

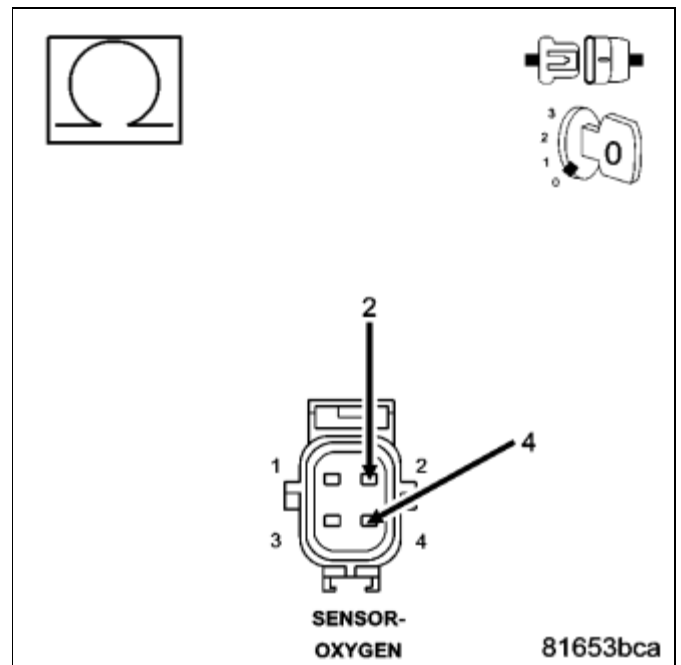
Is the resistance below 100 ohms?

Yes

- Repair the short between the (Z906) O2 Heater ground circuit and the (K43) O2 2/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

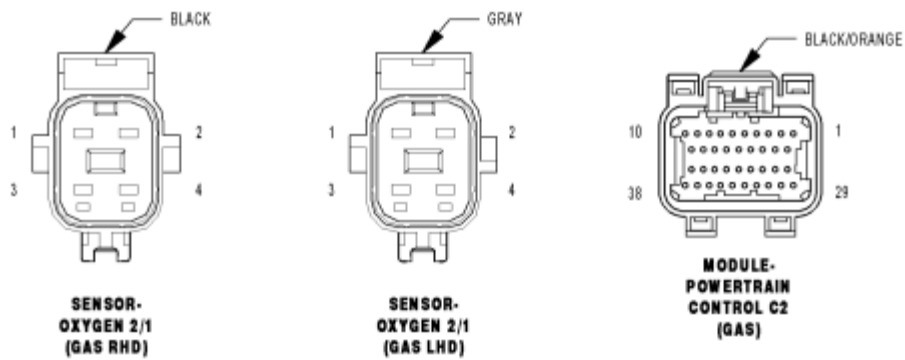
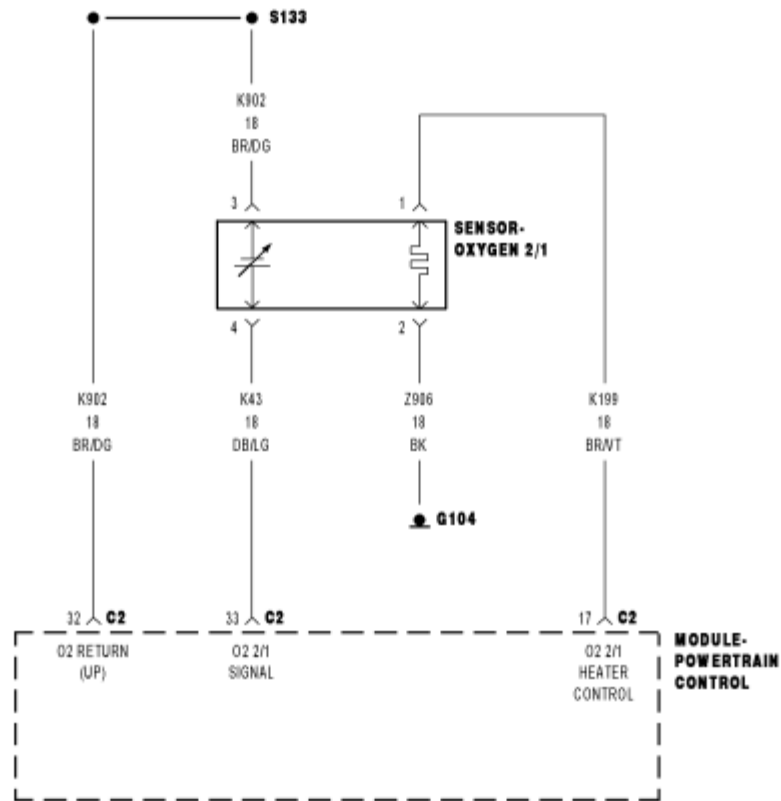
Were there any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0152-O2 SENSOR 2/1 CIRCUIT HIGH



0101146a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Continuously with the engine running, no O2 sensor heater DTCs present, 2/1 Oxygen Sensor heater temperature within a specific range, and battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The PCM detects that the 2/1 Oxygen Sensor voltage is greater than the maximum acceptable value for a specific amount of time, based on O2 sensor heater temperature. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT TO VOLTAGE
(K43) O2 2/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
2/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If an O2 sensor signal circuit is shorted to voltage, all O2 sensor voltage readings displayed on the scan tool will be approximately 5.0 volts. Diagnose the sensor that set the most current DTC.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

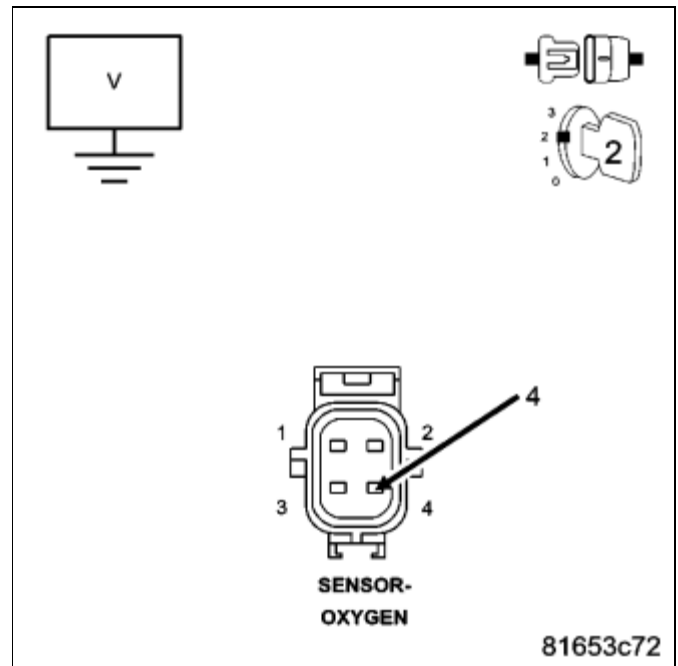
Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Disconnect the 2/1 O2 Sensor harness connector.
 Turn the ignition on.
 Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the 2/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K43) O2 Sensor 2/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

**No**

- Go To [3](#)

3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K902) O2 Return Upstream circuit in the 2/1 O2 Sensor harness connector.

Is there any voltage present?

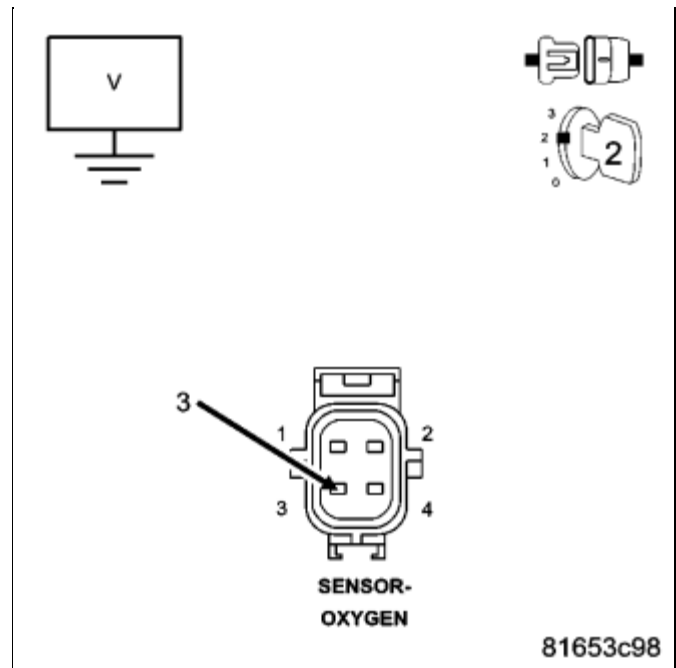
Yes

- Repair the short to voltage in the (K902) O2 Return Upstream circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. O2 SENSOR

Turn the ignition off.

Connect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

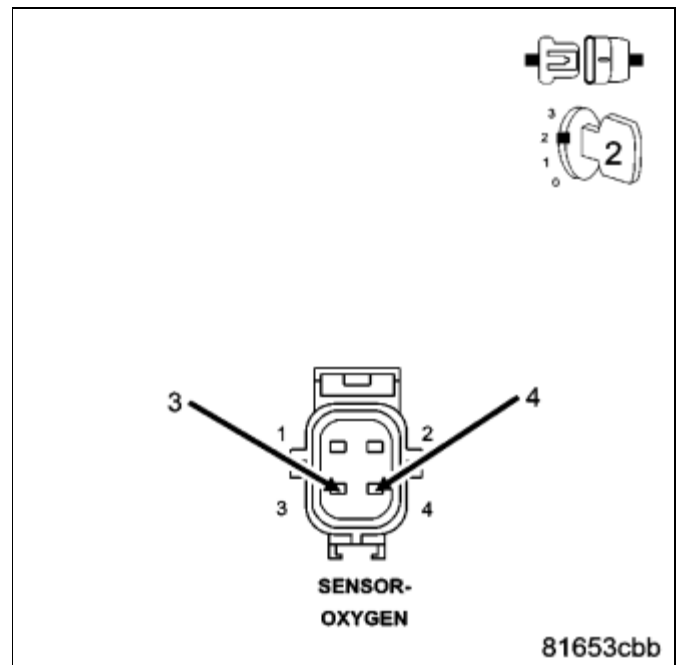
With a scan tool, monitor the 2/1 O2 Sensor voltage.

Connect a jumper wire between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage between 2.3 and 2.7 volts with the jumper wire in place?

Yes

- Verify that there is good pin to terminal contact in the 2/1 Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the 2/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.

5. (K43) O2 2/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K43) O2 2/1 Signal circuit from the 2/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

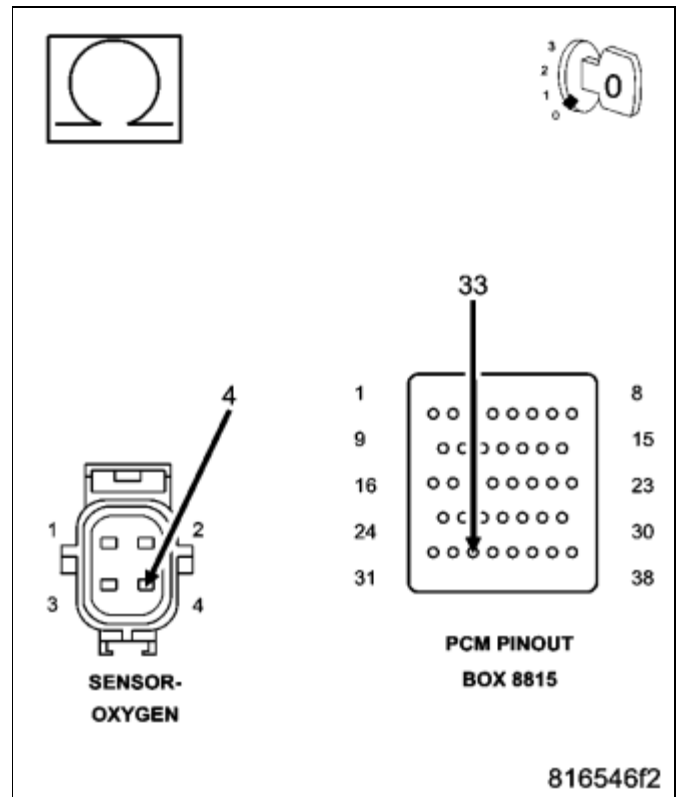
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K43) O2 2/1 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

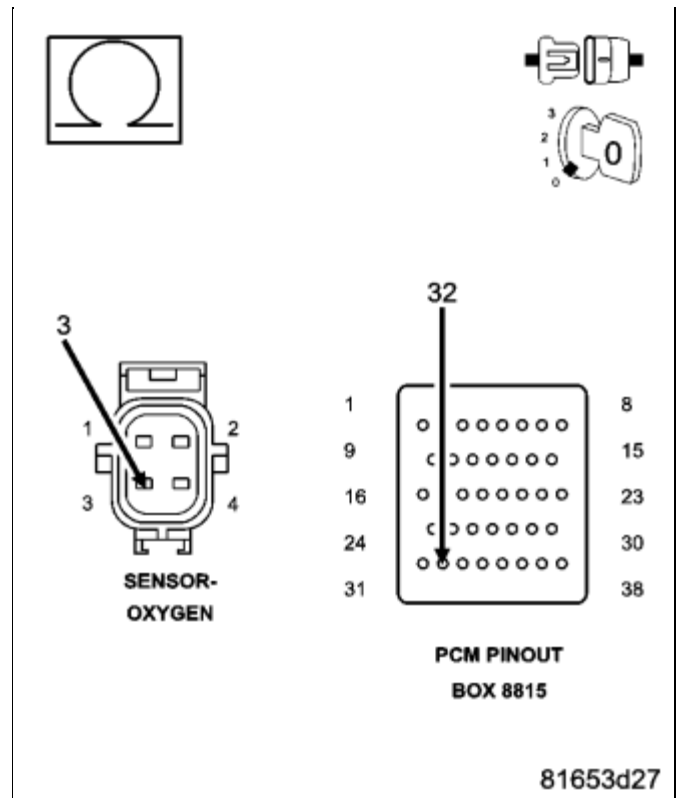
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 2/1 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the 2/1 O₂ Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

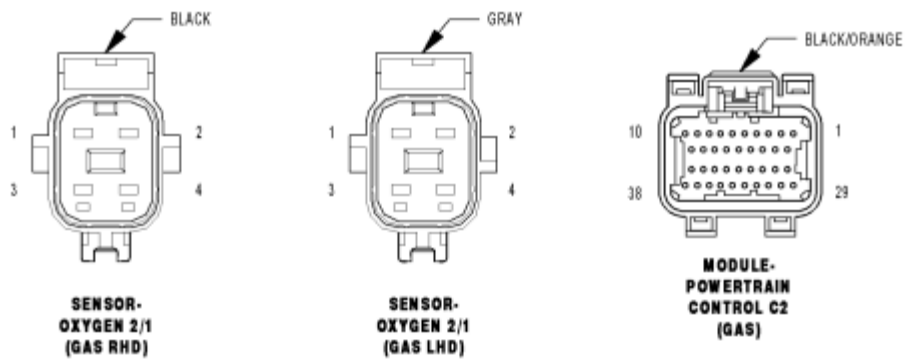
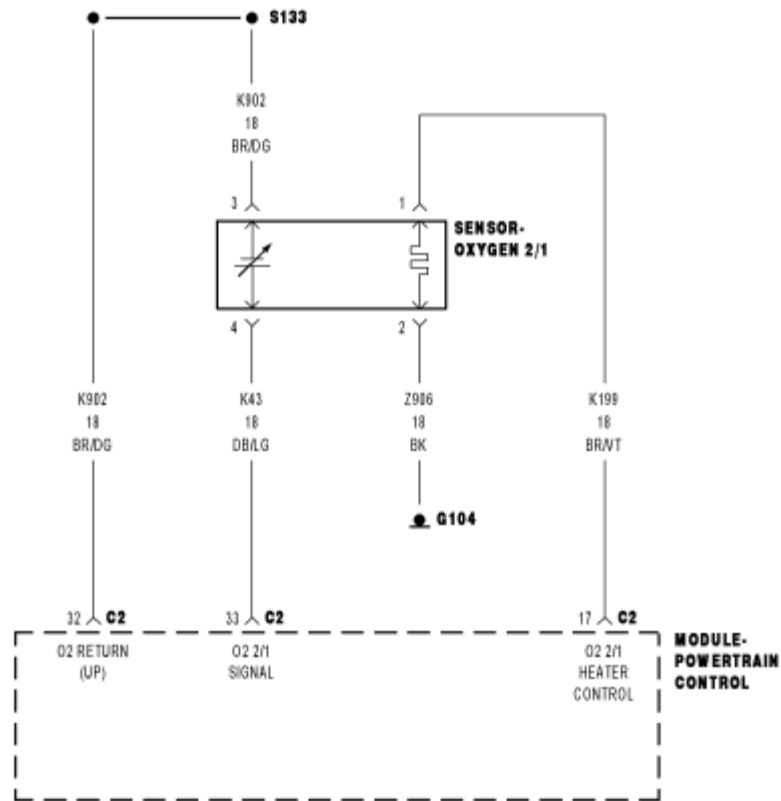
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0153-O₂ SENSOR 2/1 SLOW RESPONSE



0101146a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

For an aged O2 sensor, the response rate to the air/fuel change is slower than when it was new. The O2 sensor tends to move less with the same air/fuel changes in a given time frame. Therefore by observing the activity of voltage readings from the upstream O2 sensor, the quality of the O2 sensor can be detected.

- **When Monitored:**

With the ECT above 70 °C (158 °F), engine RPM between 1400 and 2300, vehicle speed between 64 and 96 kph (40 and 60 mph), and engine run time greater than 3 minutes.

- **Set Condition:**

The PCM detects that the oxygen sensor signal does not switch adequately during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K43) O2 2/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
2/1 O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.

Allow the engine to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:
Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.

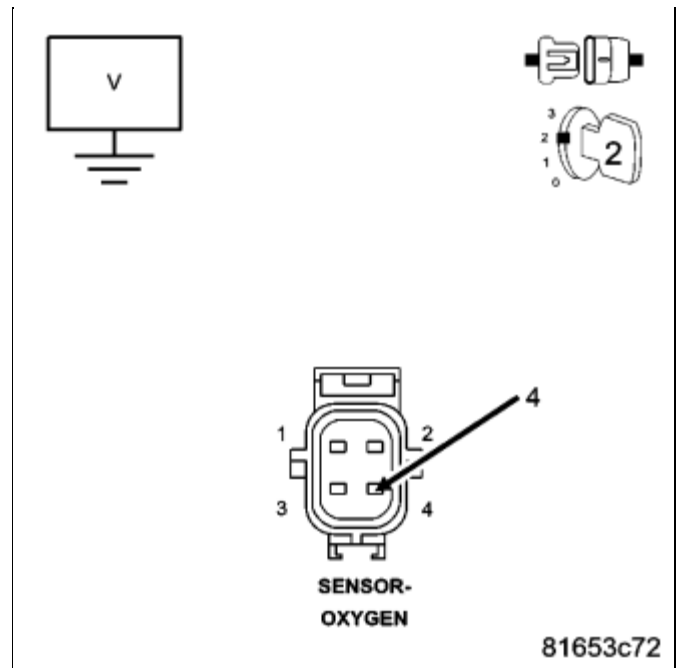
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K43) O2 2/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

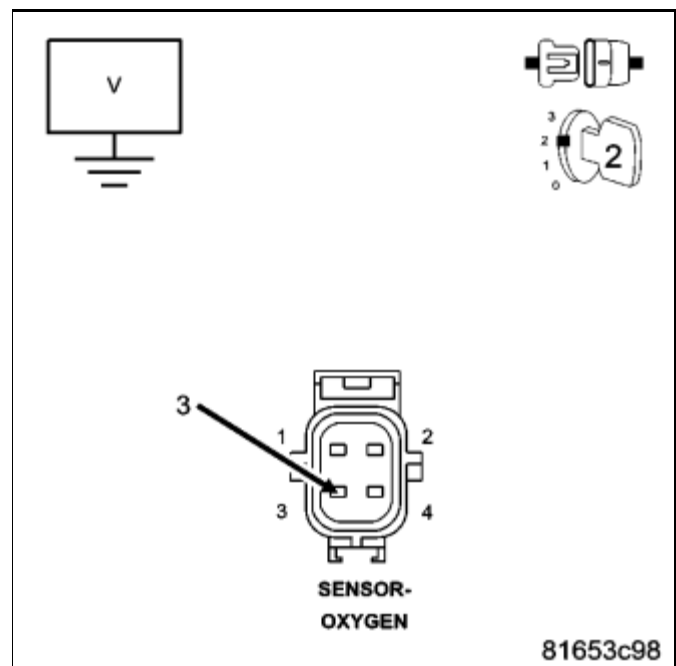
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. OXYGEN SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 2/1 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

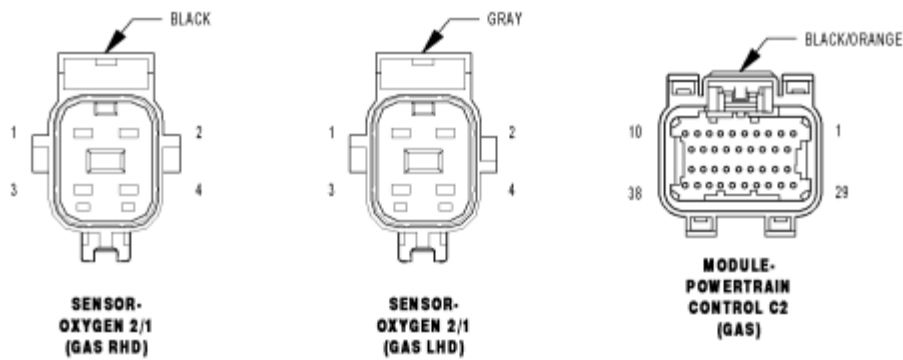
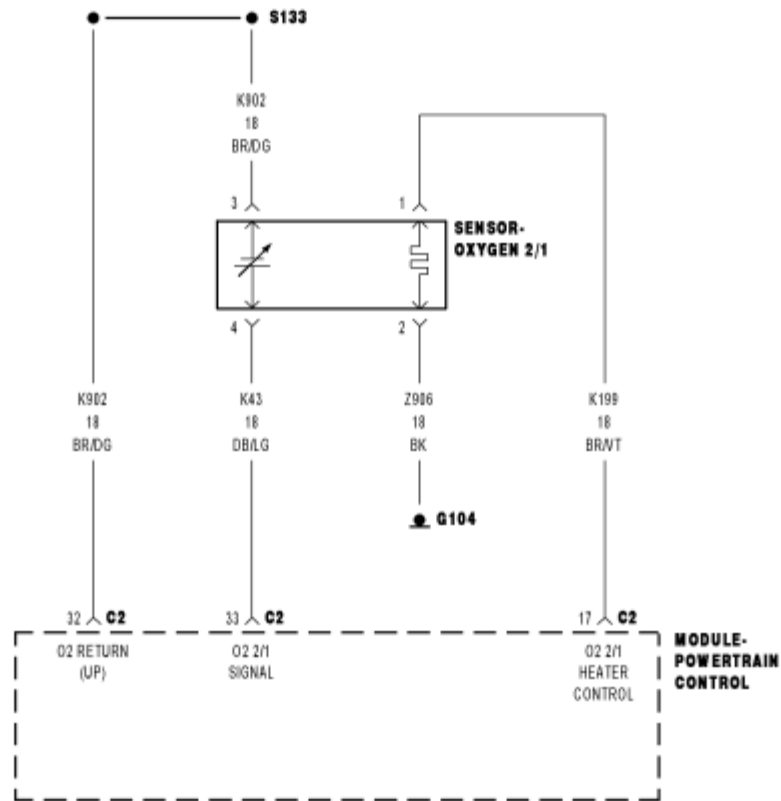
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 2/1 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE



0101146a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**

Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.

- **Set Condition:**

No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 HEATER GROUND CIRCUIT OPEN
2/1 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the O2 Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.

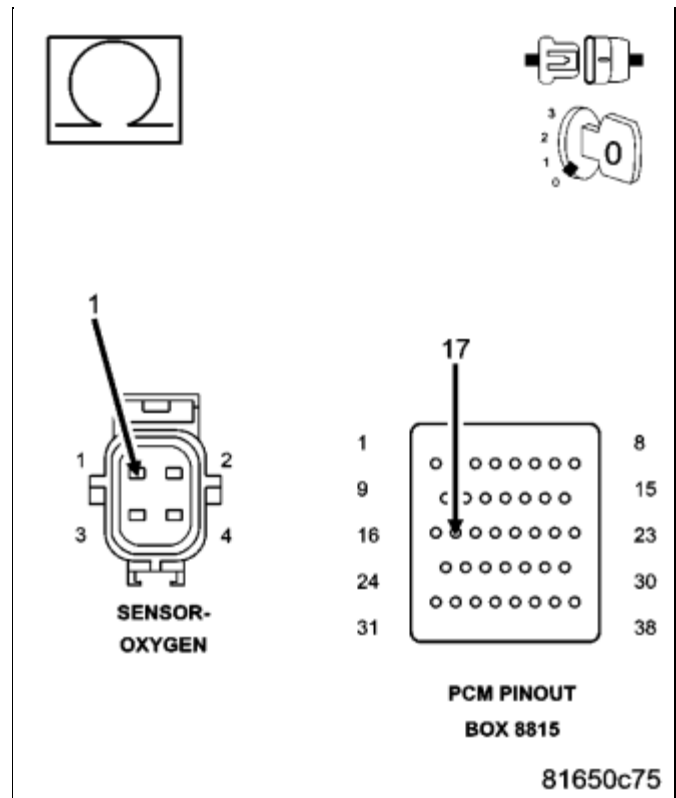
Is the resistance below 0.5 of an ohm?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (Z906) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the 1/1 Oxygen Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

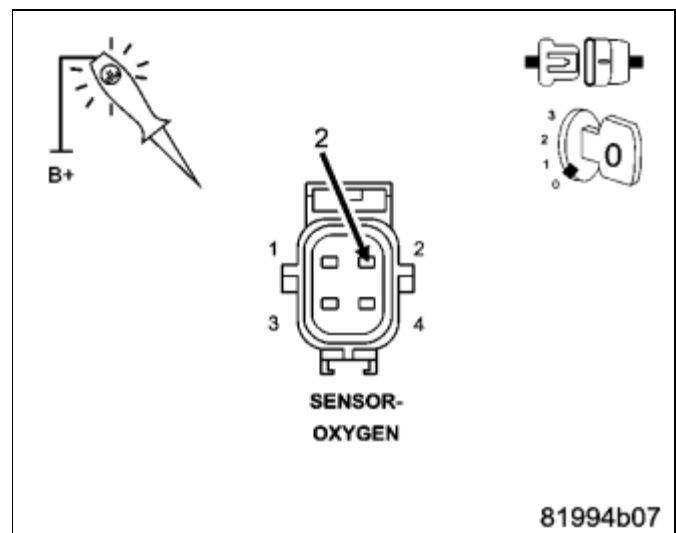
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (Z906) O2 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

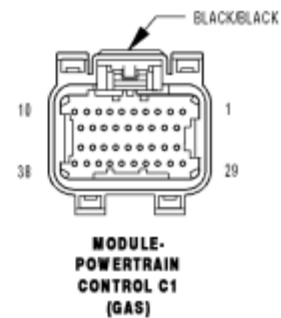
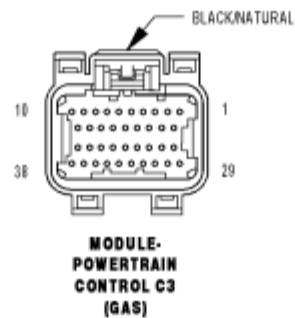
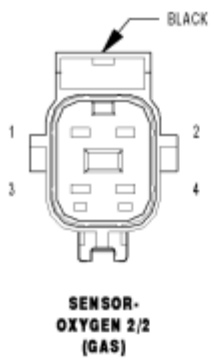
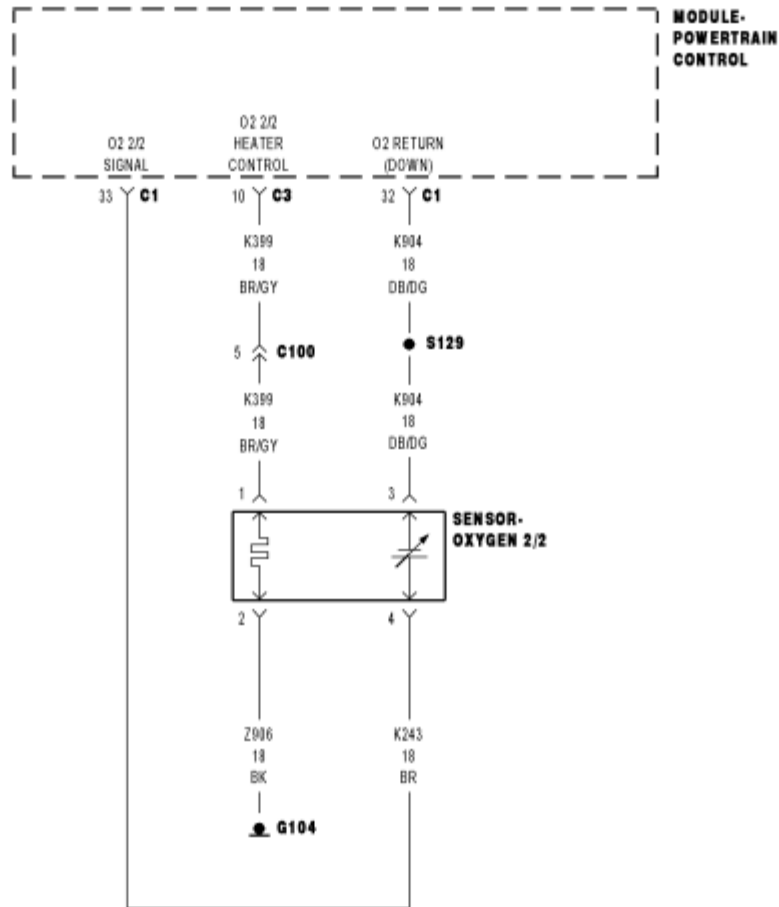
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0157-O2 SENSOR 2/2 CIRCUIT LOW



00011678

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running, battery voltage greater than 10.4 volts, and no O2 sensor heater DTCs present.

◦ **Set Condition:**

The PCM detects that the 2/2 Oxygen Sensor signal voltage is below approximately 1.5 volts for 2.8 seconds after engine startup. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 2/2 HEATER GROUND CIRCUIT
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With a scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/2 O2 Sensor voltage.

Is the O2 Sensor voltage between 4.1 and 5.0 volts?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

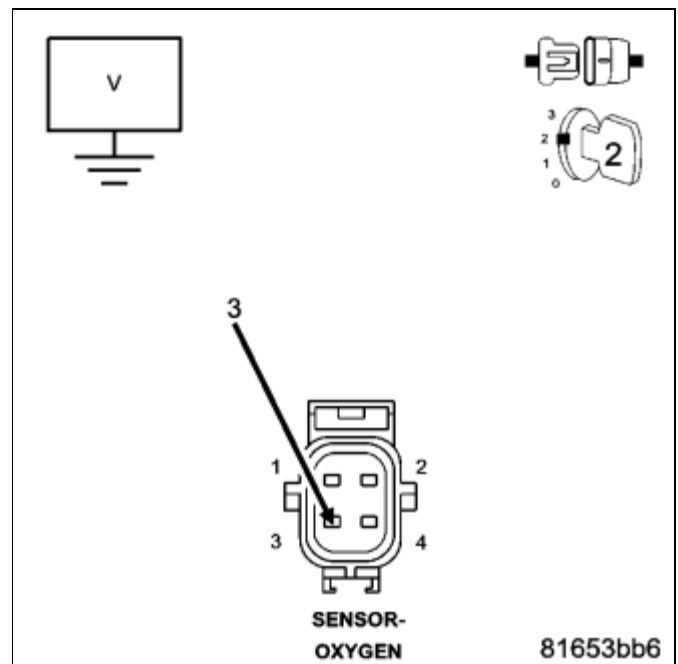
Is the voltage at 2.5 volts?

Yes

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

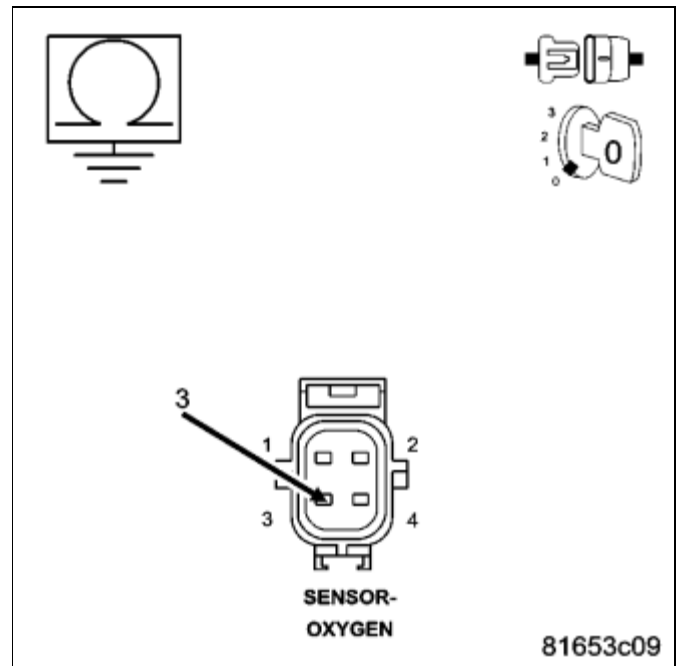
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



5. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

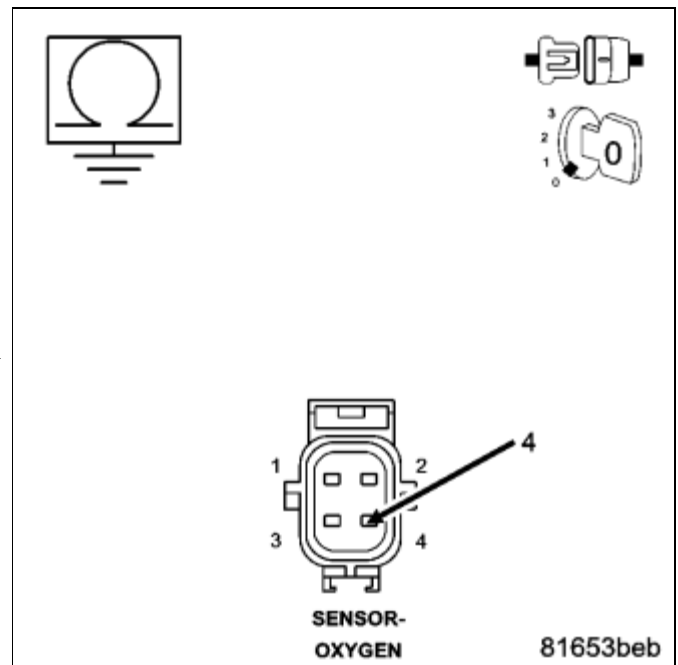
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K243) O2 2/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal

circuit and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

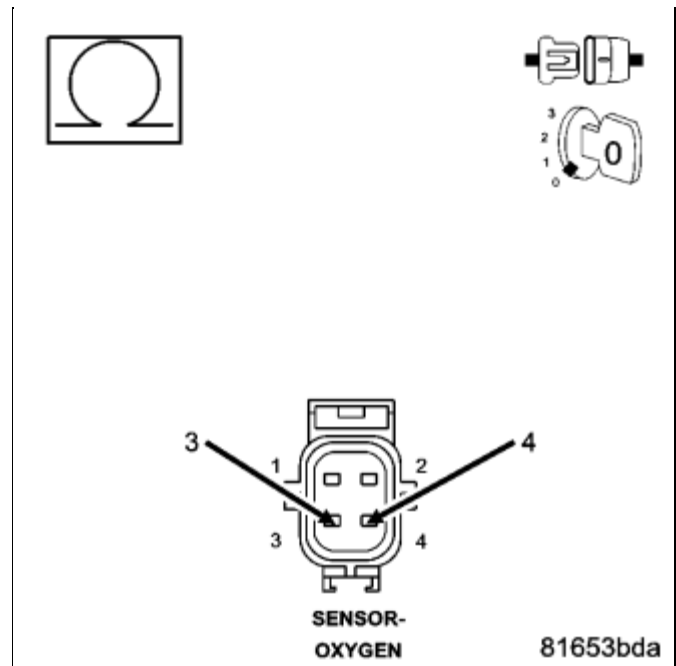
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K904) O2 Return Downstream circuit and the (K243) O2 2/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (Z906) O2 2/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal circuit and the (Z906) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.

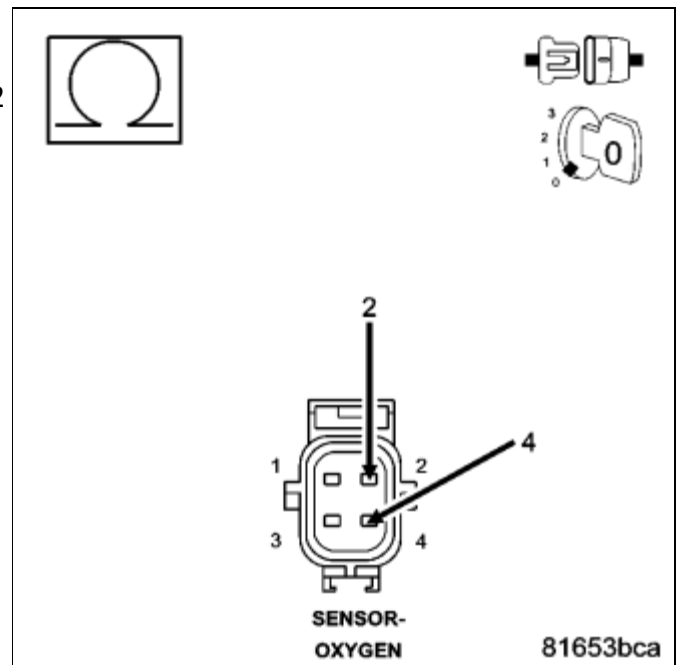
Is the resistance below 100 ohms?

Yes

- Repair the short between the (Z906) O2 2/2 Heater ground circuit and the (K243) O2 2/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/2 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0158-O2 SENSOR 2/2 CIRCUIT HIGH

Continuously with the engine running, no O2 sensor heater DTCs present, 2/2 Oxygen Sensor heater temperature within a specific range, and battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The PCM detects that the 2/2 Oxygen Sensor voltage is greater than the maximum acceptable value for a specific amount of time, based on O2 sensor heater temperature. The DTC will set as Pending after one trip and Active after two trips. Three good trips to turn off the MIL.

Possible Causes
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO VOLTAGE
(K243) O2 2/2 SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If an O2 sensor signal circuit is shorted to voltage, all O2 sensor voltage readings displayed on the scan tool will be approximately 5.0 volts. Diagnose the sensor that set the most current DTC.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect the 2/2 O2 Sensor harness connector.

Turn the ignition on.

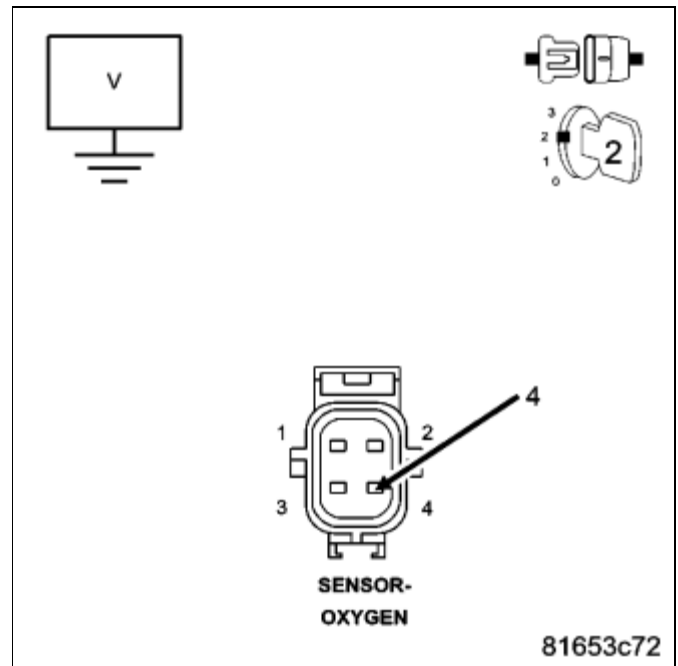
Measure the voltage on the (K243) O2 Sensor 2/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K243) O2 Sensor 2/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

**No**

- Go To [3](#)

3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Is there any voltage present?

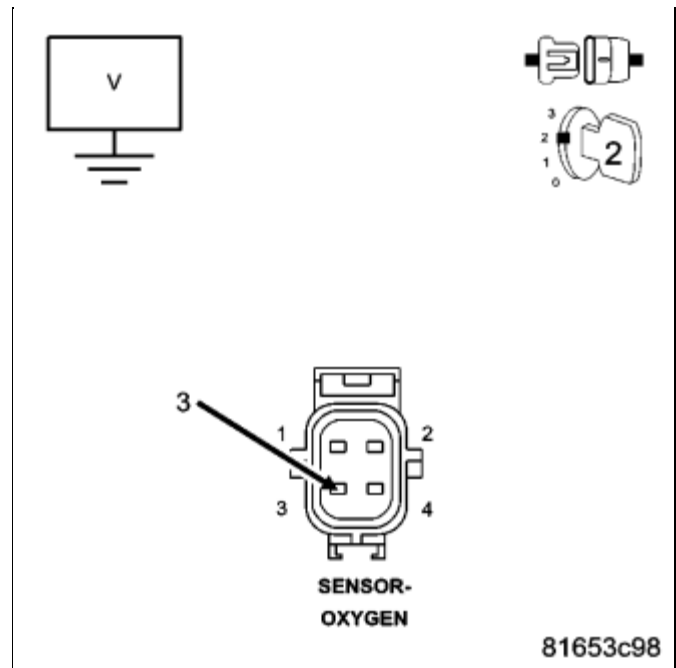
Yes

- Repair the short to voltage in the (K904) O2 Return Downstream circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. O2 SENSOR

Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

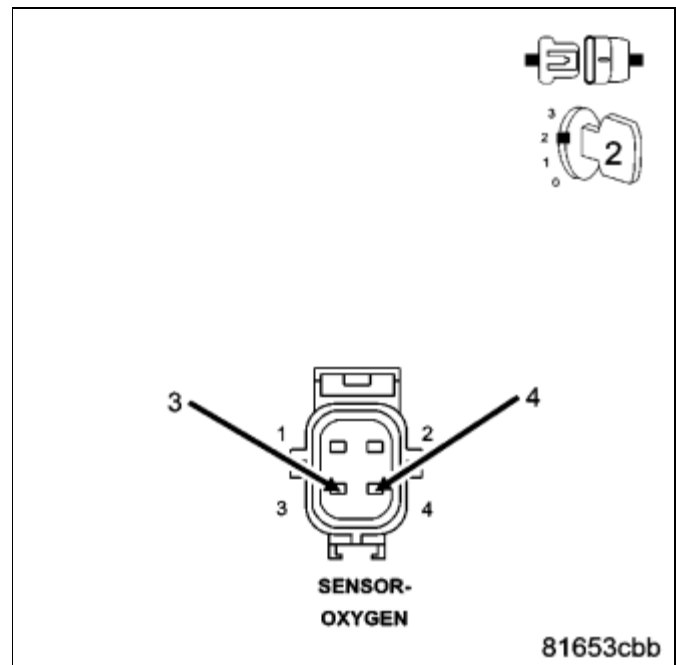
With a scan tool, monitor the 2/2 O2 Sensor voltage.

Connect a jumper wire between the (K243) O2 2/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.

5. (K243) O2 2/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K243) O2 2/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

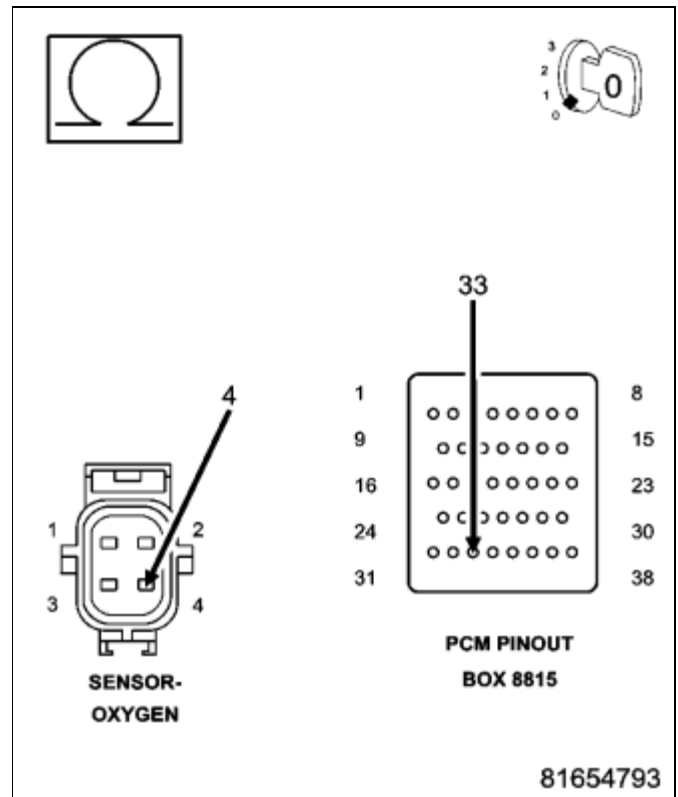
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K243) O2 2/2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

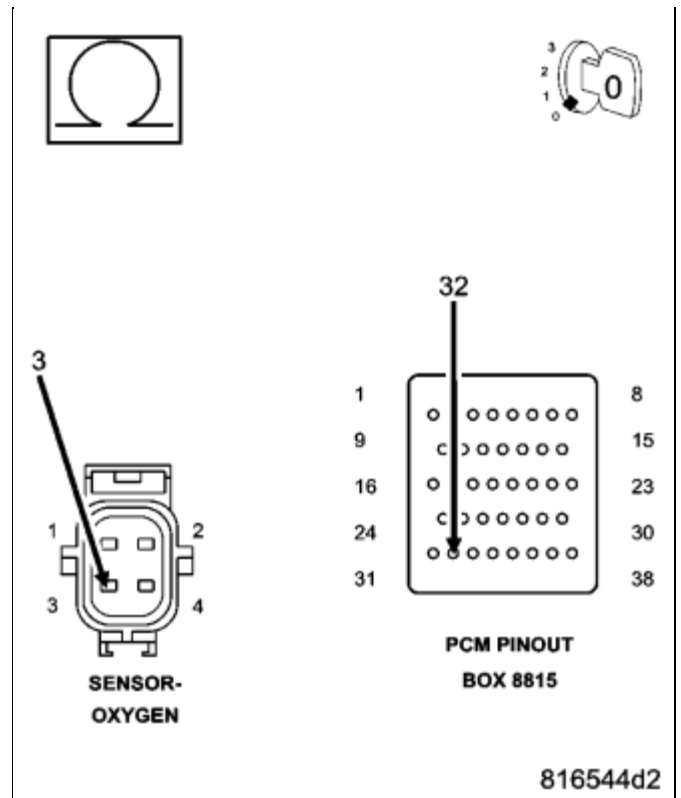
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

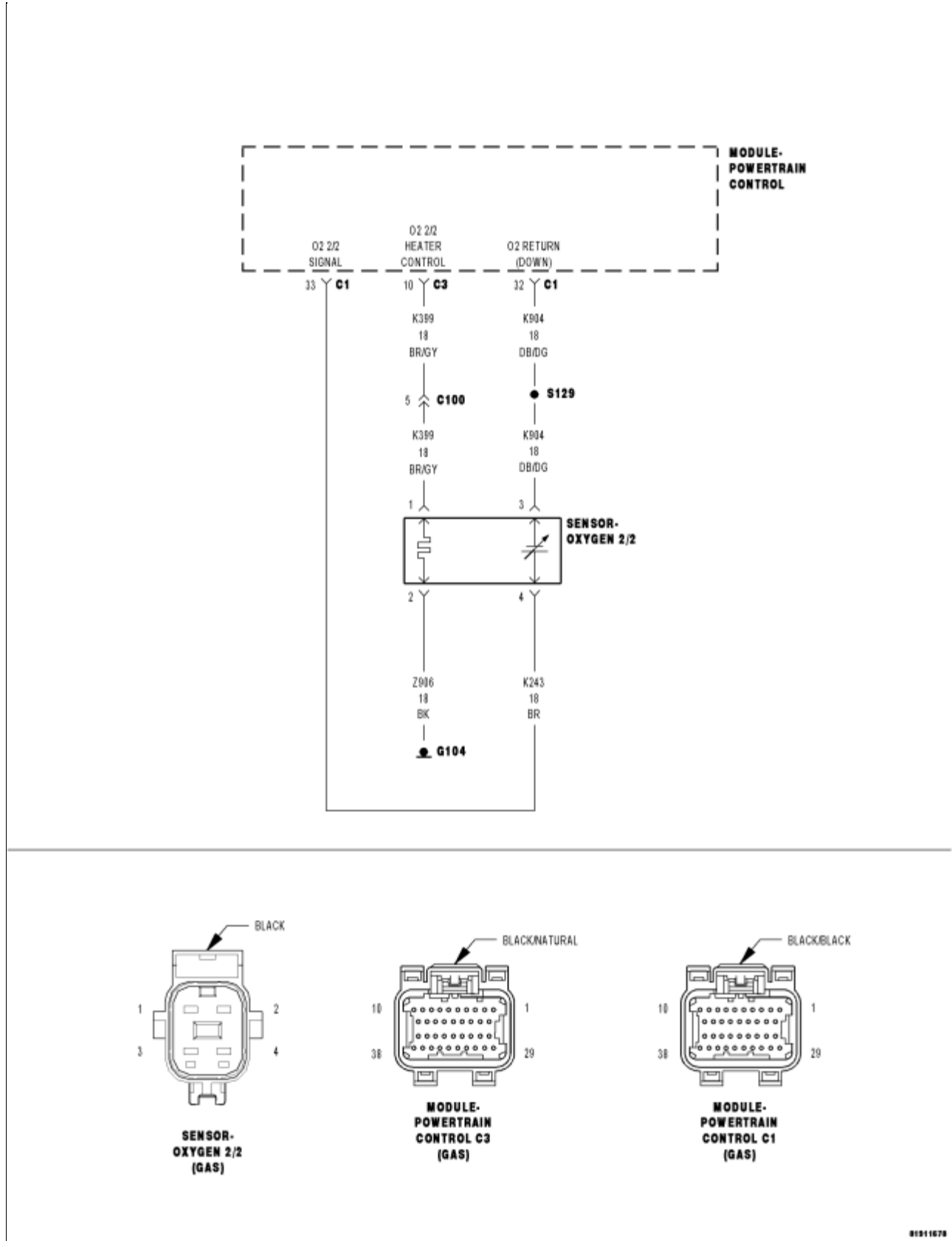
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0159-O2 SENSOR 2/2 SLOW RESPONSE



The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**

Vehicle is started and driven between 32 and 88.5 km/h (20 and 55 mph) with the Throttle open for a minimum of 120 seconds. Coolant greater than 70° C (158° F). Catalytic Converter Temp greater than 600° C (1112° F) and EVAP Purge is active.

- **Set Condition:**

The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K243) O2 2/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

Start the engine.

Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.
Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

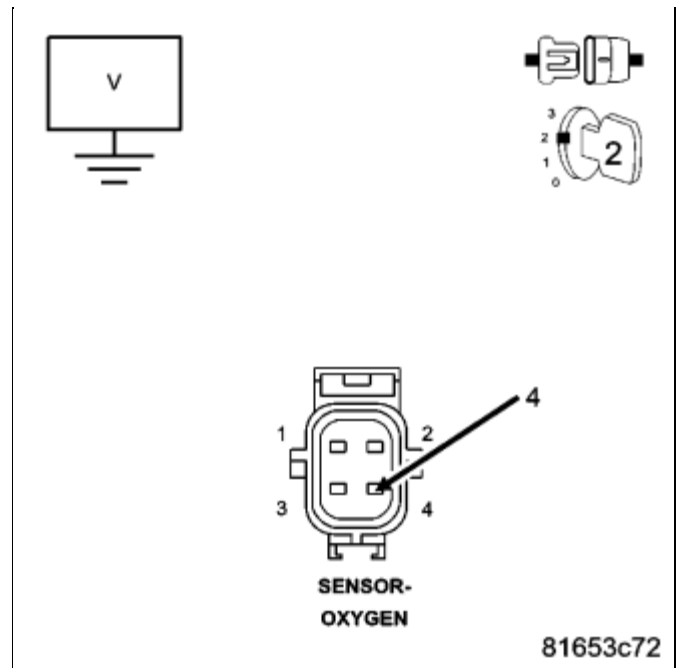
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [4](#)

No

- Check the (K243) O2 2/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

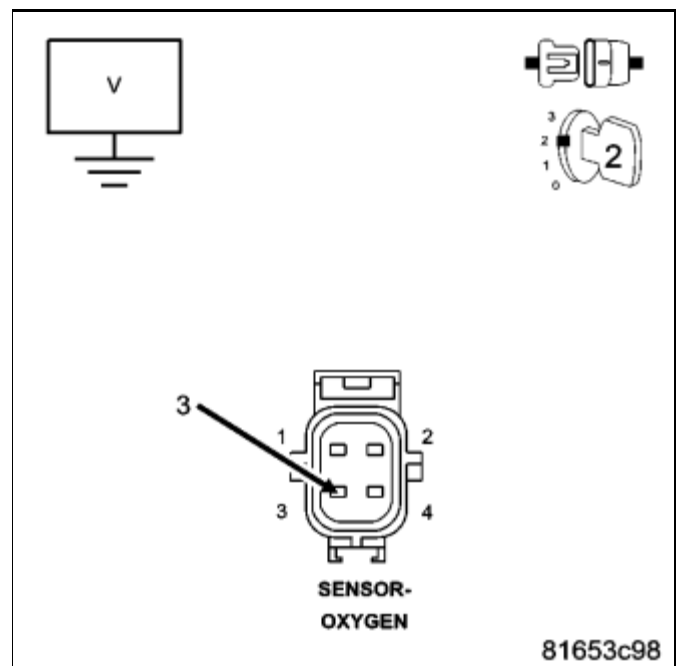
Is the voltage at 2.5 volts?

Yes

- Go To [5](#)

No

- Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. OXYGEN SENSOR

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 2/2 Oxygen Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the 2/2 Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

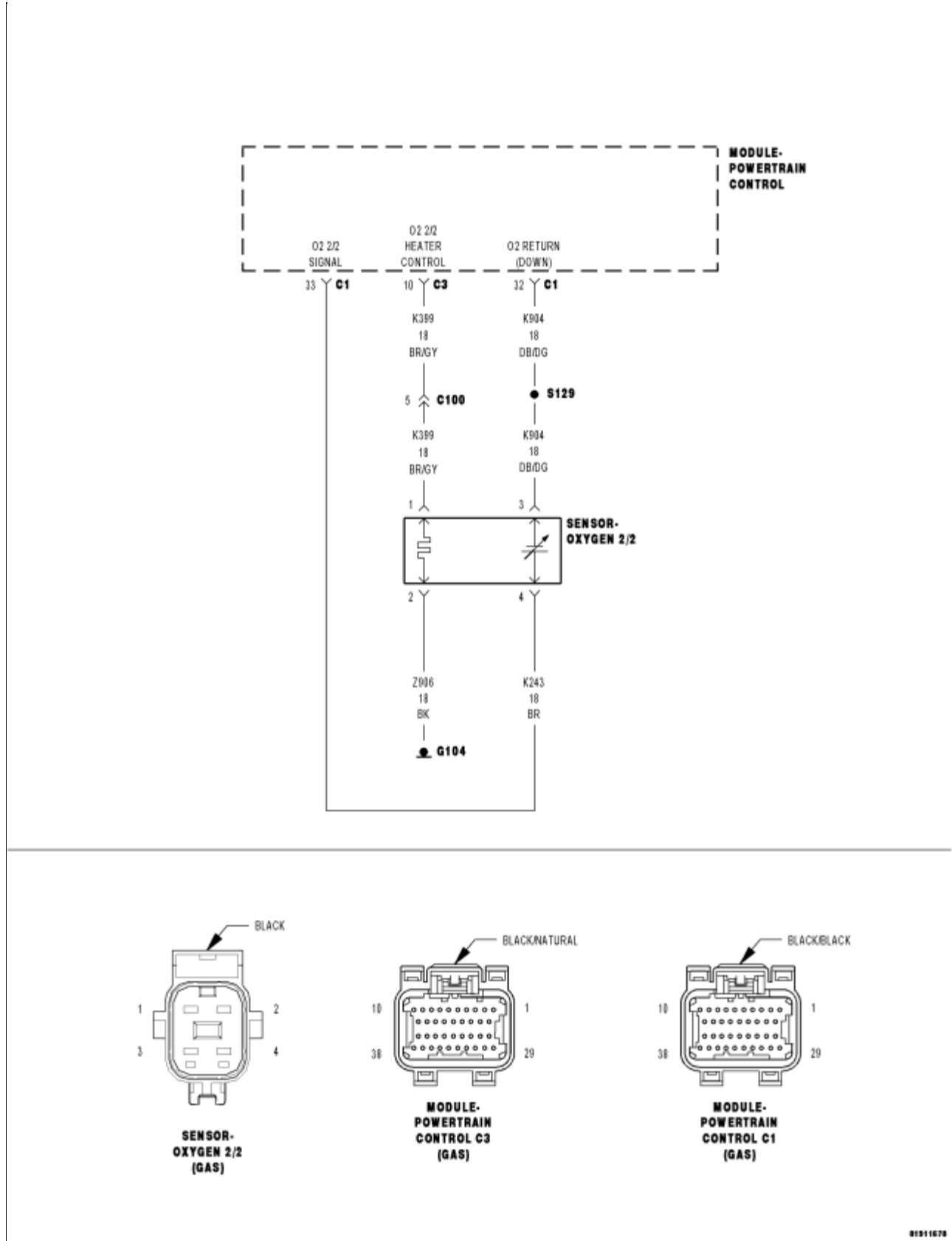
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the 2/2 Oxygen Sensor in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**

Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.

- **Set Condition:**

No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z906) O2 2/2 HEATER GROUND CIRCUIT OPEN
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 2/2 O2 Heater Test.

With a scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the 2/2 O2 Heater Element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the O2 Sensor connector.

NOTE: O2 Heater Element resistance values should be measured at 21.1° C (70° F. The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors. If OK, replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.

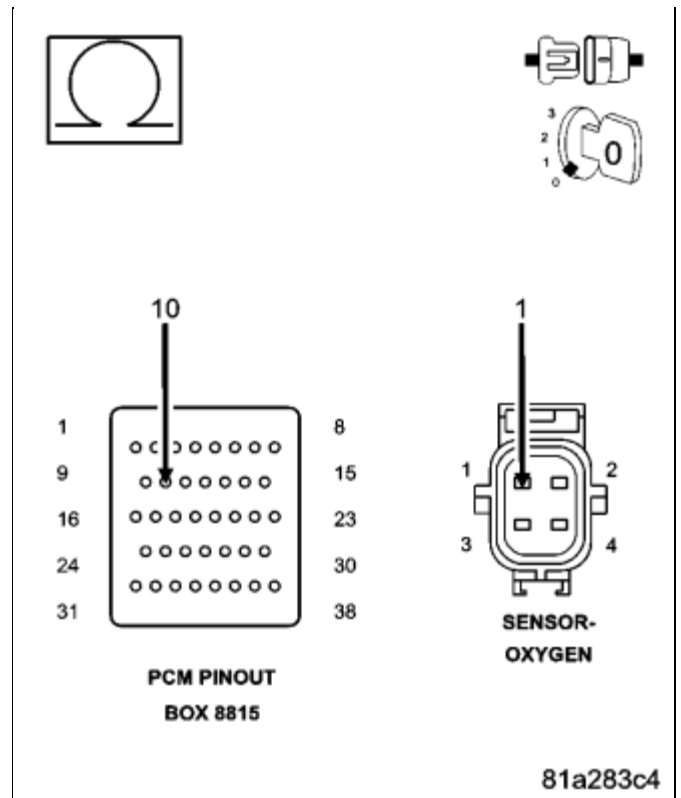
Is the resistance below 0.5 of an ohm?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K399) O2 2/2 Heater Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (Z906) O2 2/2 HEATER GROUND CIRCUIT OPEN

Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the 1/1 Oxygen Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

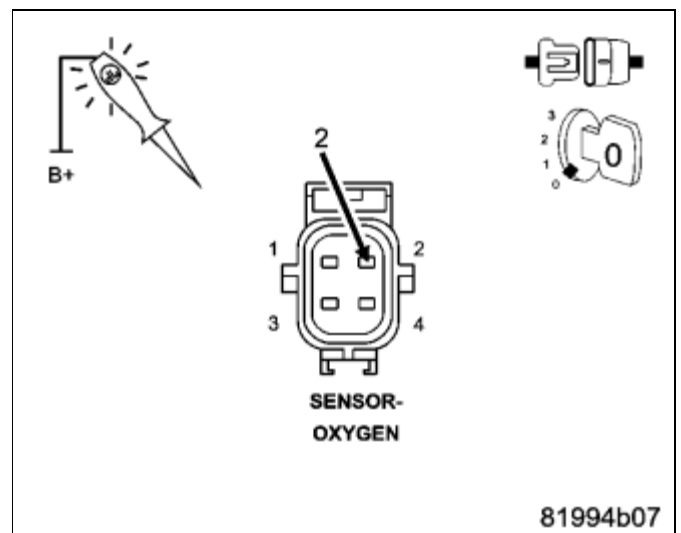
Is the test light illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (Z906) O2 2/2 Heater ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor 2/2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oxygen Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

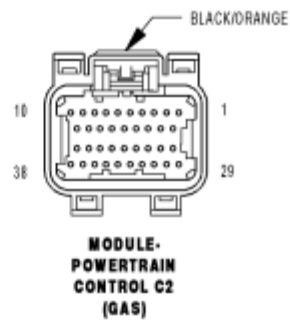
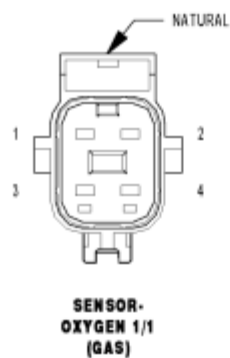
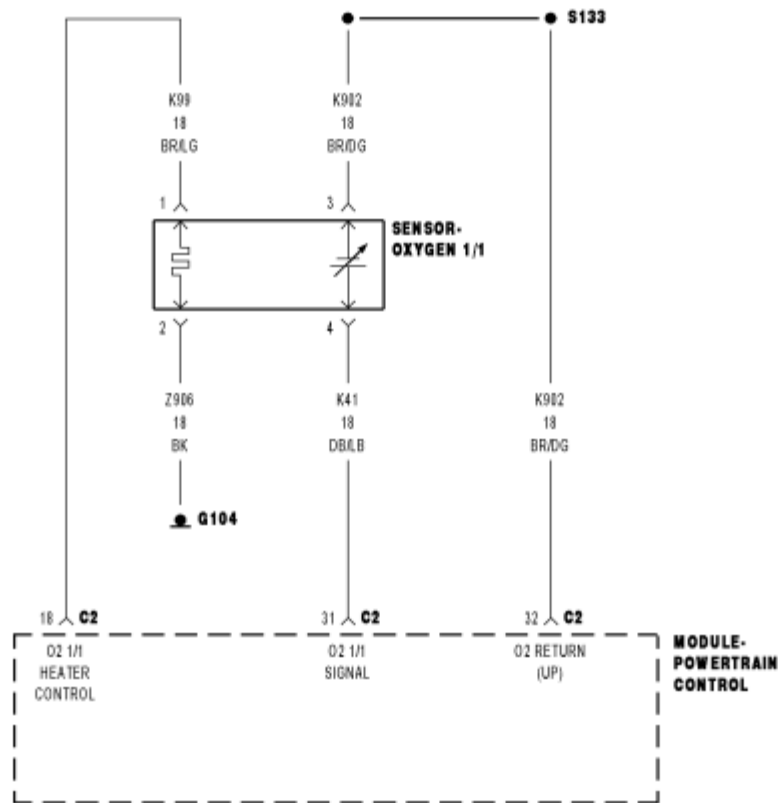
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0171-FUEL SYSTEM 1/1 LEAN



01011204

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fuel feedback system will maintain a stoichiometric fuel/air mixture, 14.7:1, by modifying the injector pulse width according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoichiometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O₂ sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7°C (20°F) and altitude below 2590.8 m (8500 ft).

- **Set Condition:**

If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O ₂ SIGNAL CIRCUIT
O ₂ RETURN CIRCUIT
O ₂ SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.
Install a fuel pressure gauge to the fuel rail.
Ignition on, engine not running.
With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

Below Specification

- Go To [13](#)

CAUTION: Stop All Actuations.

3. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. O2 SENSOR OPERATION

Start the engine.
Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With a scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?

Yes

- Go To [5](#)

No

- Go To [9](#)

5. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 1/1 O2 Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. MAP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Barometric Pressure.

NOTE: The Barometric Pressure should be approximately equal to the actual barometric pressure. If necessary, compare the value to the value of a known good vehicle of a similar make and model.

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1" of Hg on the Vacuum Gauge reading and the barometric pressure comparable to a know good vehicle?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. Replace the MAP Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. Replace the ECT Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)

9. 1/1 O2 SENSOR

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

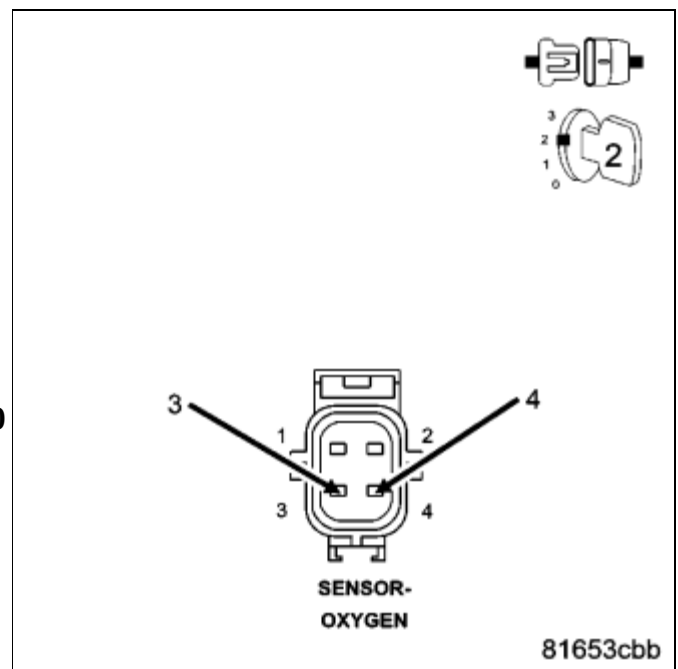
Connect a jumper wire between the (K41) Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 1/1 O2 Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD



PROCEDURE).

No

- Go To [10](#)

NOTE: Remove the jumper wire before continuing.

10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [11](#)

No

- Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

11. (K902) O2 RETURN UPSTREAM CIRCUIT

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

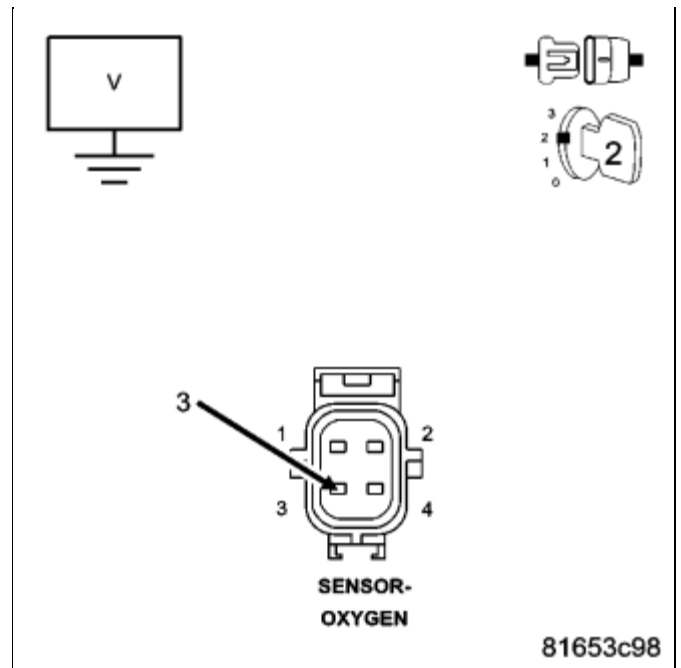
Is the voltage at 2.5 volts?

Yes

- Go To [12](#)

No

- Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

13. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.
Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.
Attach a fuel pressure test gauge to the T fitting on tool #6539.
Ignition on, engine not running.
With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [14](#)

CAUTION: Stop All Actuations.

14. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.
Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

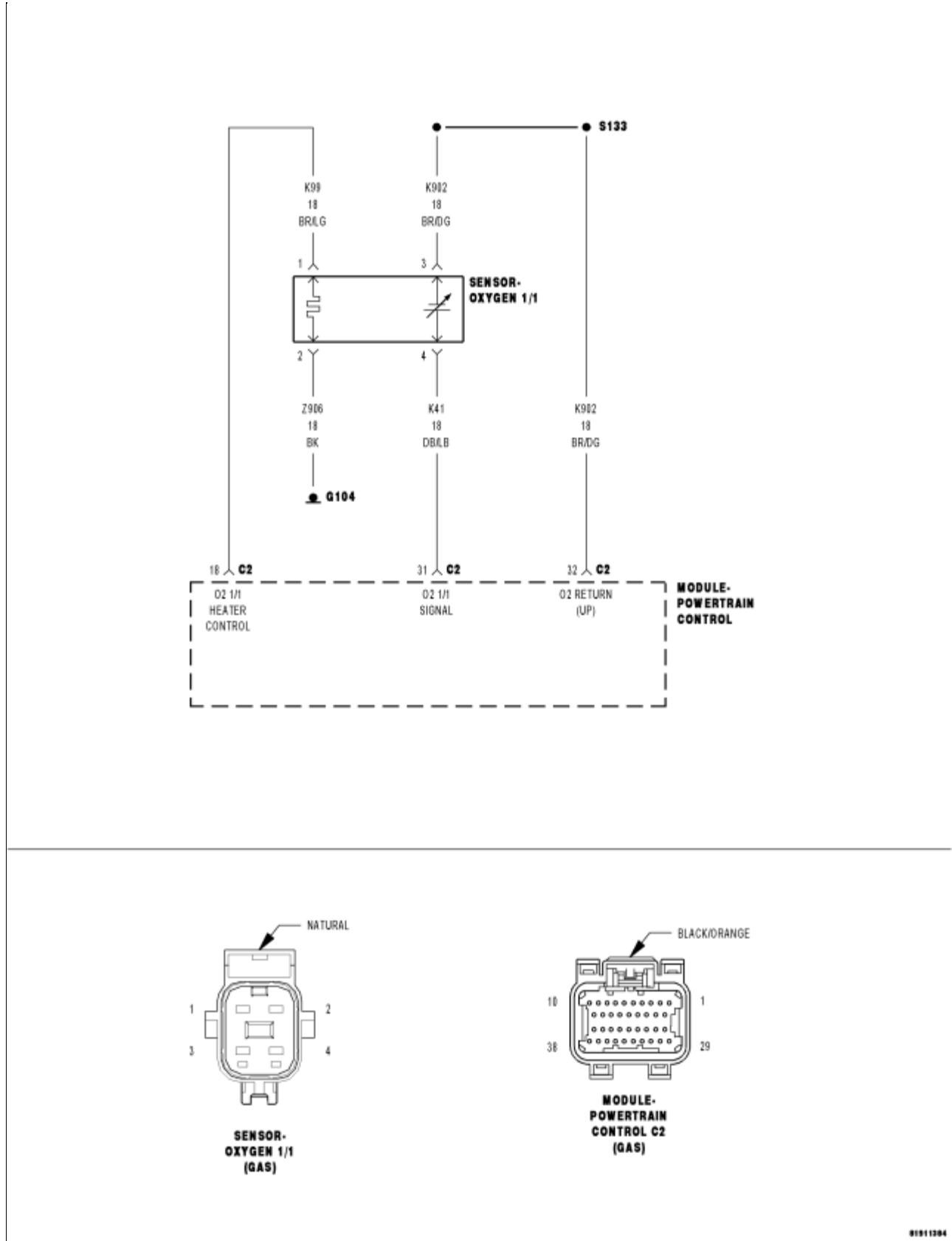
15. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Fuel Pump Module, TIPM, and Powertrain Control Module connectors. Replace the Fuel Pump Module if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0172-FUEL SYSTEM 1/1 RICH



The fuel feedback system will maintain a stoichiometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoichiometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O₂ sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7°C (20°F) and altitude below 2590.8 m (8500 ft).

- **Set Condition:**

If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O ₂ SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O ₂ SIGNAL CIRCUIT
O ₂ RETURN CIRCUIT
O ₂ SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

CAUTION: Stop All Actuations.

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 1/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes

- Go To [4](#)

No

- Go To [9](#)

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 1/1 O2 Heater Test.

With the scan tool, monitor the O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts during the Heater test?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 1/1 O2 Sensor if no problems were found with the connectors.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

5. MAP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Barometric Pressure.

NOTE: The Barometric Pressure should be approximately equal to the actual barometric pressure. If necessary, compare the Barometric Pressure value of this vehicle to the value of a known good vehicle of a similar make and model.

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With a scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading for MAP Vacuum within 1 inch of Hg on the Vacuum Gauge reading and is the Barometric Pressure reading of the vehicle the approximately the same as actual Barometric Pressure?

Yes

- Go To [6](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. Replace the MAP Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Remove the vacuum gauge before continuing.

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and reach at least 82° C (180° F)?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. Replace the Engine Coolant Temperature Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the Solenoid and Powertrain Control Module connectors. Replace the Evap Purge Solenoid if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Connect the vacuum hoses before continuing.

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from restrictions.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)

9. 1/1 O2 SENSOR

NOTE: Perform the following test on the O2 Sensors whose voltage was not switching properly in the previous step.

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

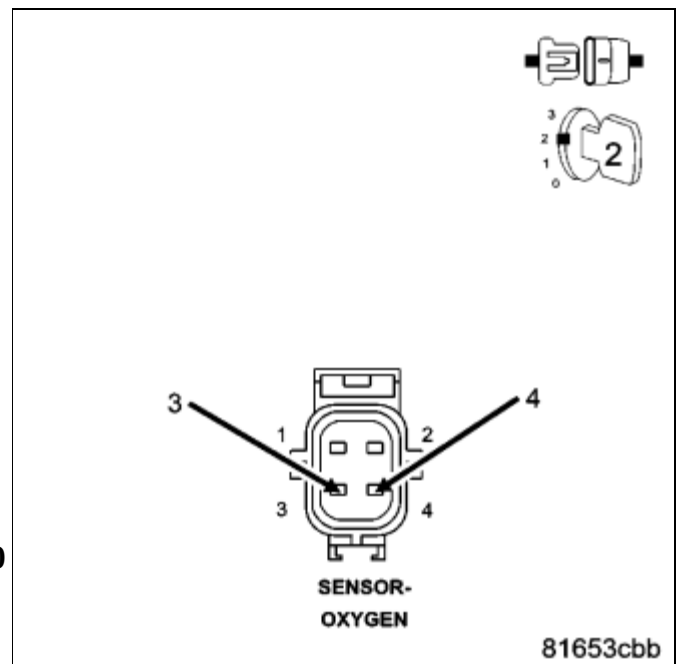
Ignition on, engine not running.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

Connect a jumper wire between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

NOTE: The voltage should drop from between 4.1 and 5.0 volts down to 2.5 volts with the jumper wire connected.



Did the O2 Sensor voltage drop from between 4.1 and 5.0 volts to 2.5 volts when the jumper wire was installed?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module

connectors. Replace the 1/1 O2 Sensor if no problems were found with the connectors.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)

NOTE: Remove the jumper wire before continuing.

10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

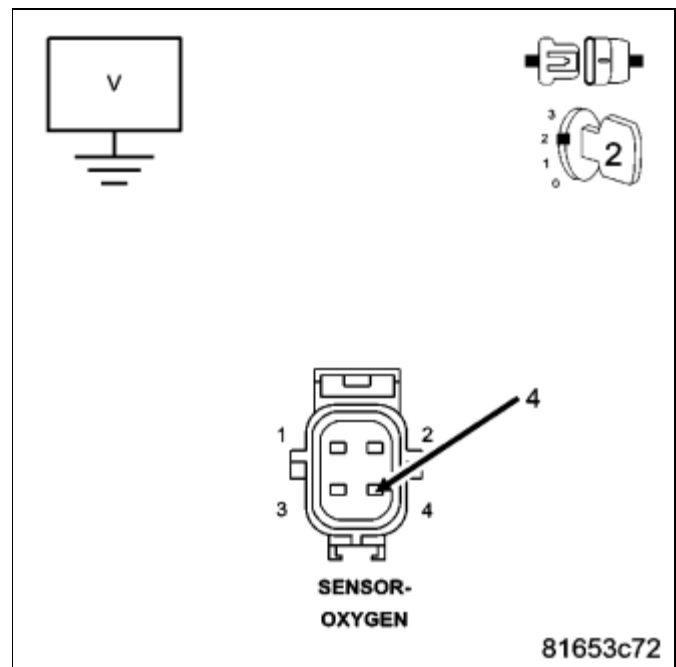
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [11](#)

No

- Check the (K41) O2 Sensor 1/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes

- Go To [12](#)

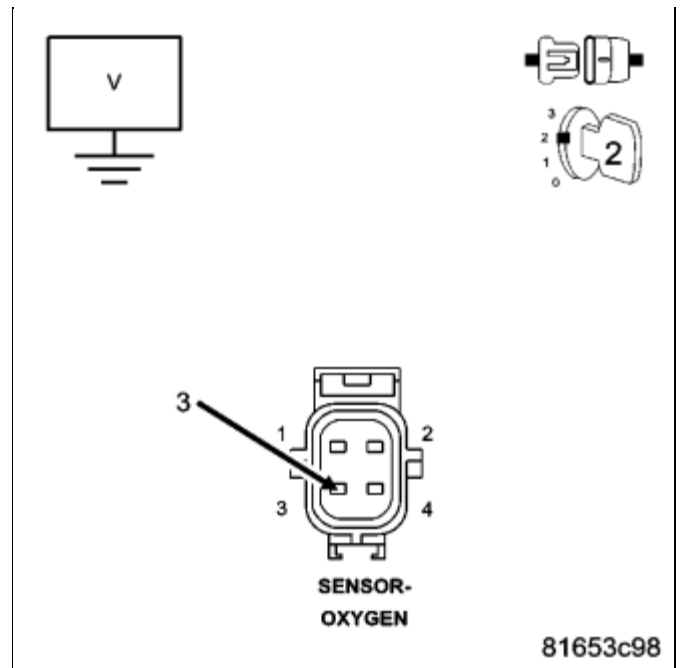
No

- Check the (K902) O2 Return Upstream circuit for

damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Turn the ignition off before continuing.



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

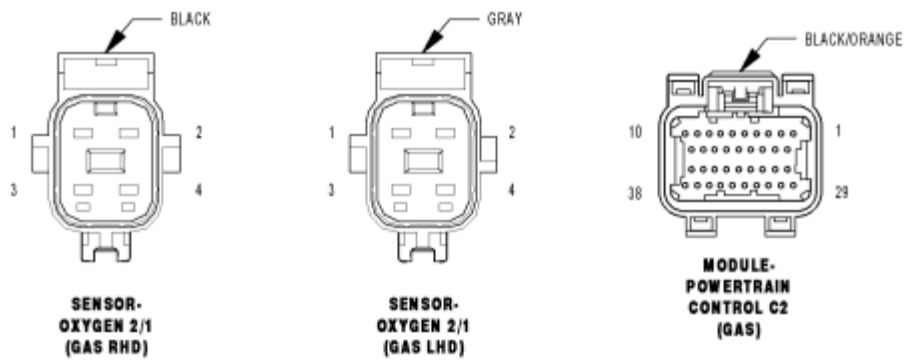
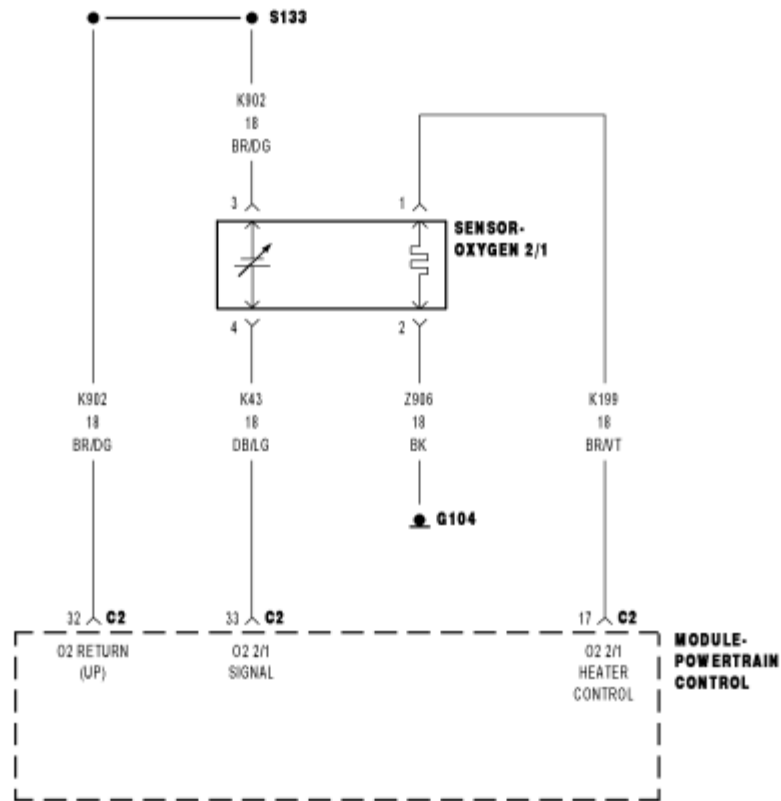
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0174-FUEL SYSTEM 2/1 LEAN



0101146a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fuel feedback system will maintain a stoichiometric fuel/air mixture, 14.7:1, by modifying the injector pulse width according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoichiometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O₂ sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7°C (20°F) and altitude below 2590.8 m (8500 ft).

- **Set Condition:**

If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O ₂ SIGNAL CIRCUIT
O ₂ RETURN CIRCUIT
O ₂ SENSOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.
Install a fuel pressure gauge to the fuel rail.
Ignition on, engine not running.
With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

Below Specification

- Go To [13](#)

CAUTION: Stop All Actuations.

3. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes

- Go To [5](#)

No

- Go To [9](#)

5. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

NOTE: Perform the following test on all O2 Sensors.

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 2/1 O2 Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. MAP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Barometric Pressure.

NOTE: The Barometric Pressure should be approximately equal to the actual barometric pressure. If necessary, compare the value to the value of a known good vehicle of a similar make and model.

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading for MAP Vacuum within 1 inch of Hg on the Vacuum Gauge reading and is the Barometric Pressure reading of the vehicle the approximately the same as actual Barometric Pressure?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. Replace the MAP Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. Replace the Engine Coolant Temperature Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)

9. O2 SENSOR

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Ignition on, engine not running.

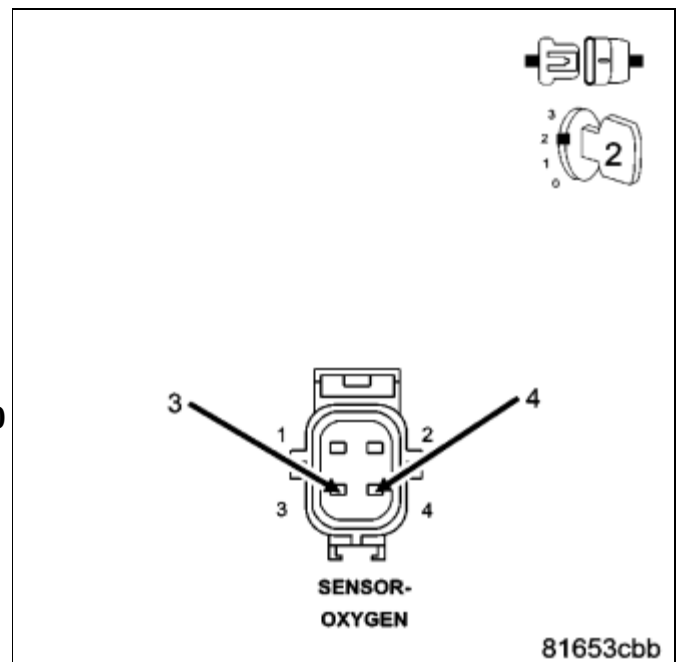
With the scan tool, monitor the 2/1 O2 Sensor voltage.

Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

NOTE: The voltage should drop from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from between 4.1 and 5.0 volts to 2.5 volts when the jumper wire was installed?



Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 2/1 O2 Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)

NOTE: Remove the jumper wire before continuing.

10. O2 SENSOR SIGNAL CIRCUIT

With the scan tool, monitor all the O2 Sensor voltage readings with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [11](#)

No

- Check all the O2 Signal circuits for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

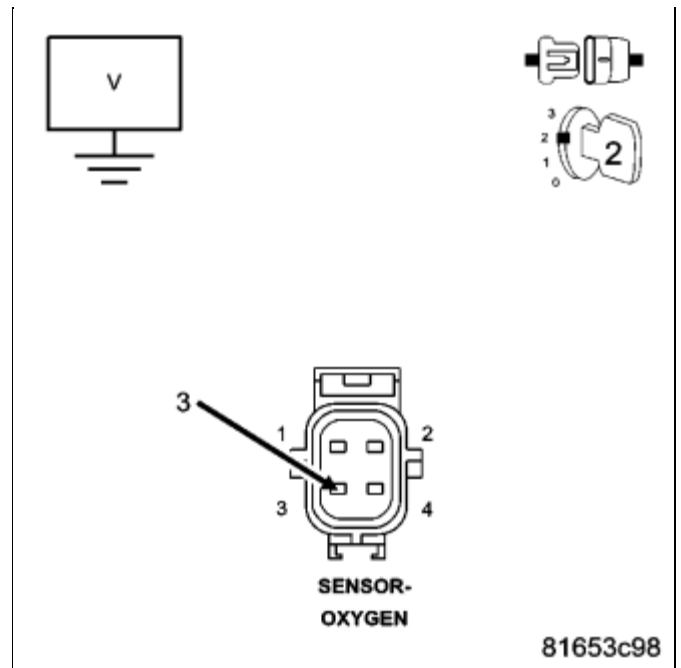
11. (K902) O2 RETURN UPSTREAM CIRCUIT

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes

- Go To [12](#)

No

- Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

13. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.
 Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.
 Attach a fuel pressure test gauge to the T fitting on tool #6539.
 Ignition on, engine not running.
 With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [14](#)

CAUTION: Stop All Actuations.

14. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.
 Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

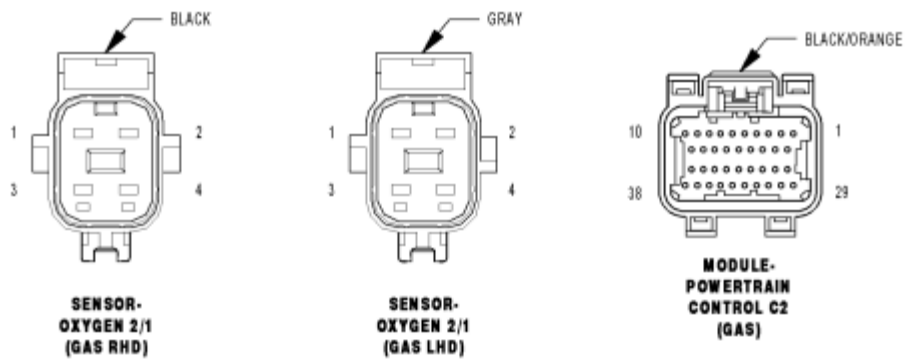
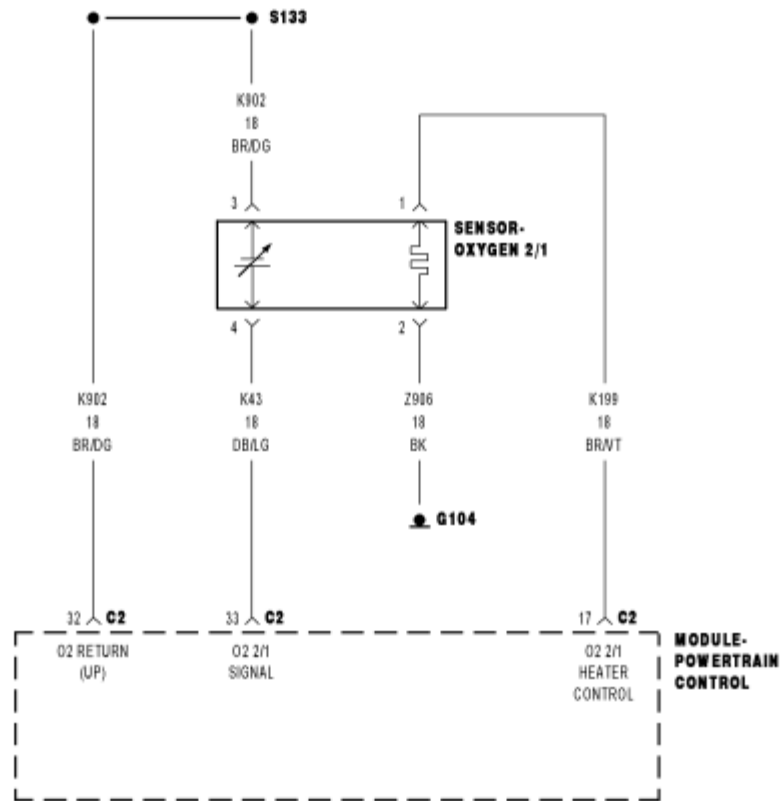
15. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Fuel Pump Module, TIPM, and Powertrain Control Module connectors. Replace the Fuel Pump Module if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0175-FUEL SYSTEM 2/1 RICH



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For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fuel feedback system will maintain a stoichiometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoichiometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O₂ sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7°C (20°F) and altitude below 2590.8 m (8500 ft).

- **Set Condition:**

If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O ₂ SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O ₂ SIGNAL CIRCUIT
O ₂ RETURN CIRCUIT
O ₂ SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

CAUTION: Stop All Actuations.

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes

- Go To [4](#)

No

- Go To [9](#)

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 2/1 O2 Heater Test for each O2 Sensor.

With the scan tool, monitor the 2/1 O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts for each Sensor?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 2/1 O2 Sensor if no problems were found with the connectors.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

5. MAP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Barometric Pressure.

NOTE: The Barometric Pressure should be approximately equal to the actual barometric pressure. If necessary, compare the Barometric Pressure value of this vehicle to the value of a known good vehicle of a similar make and model.

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading for MAP Vacuum within 1 inch of Hg on the Vacuum Gauge reading and is the Barometric Pressure reading of the vehicle the approximately the same as actual Barometric Pressure?

Yes

- Go To [6](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. Replace the MAP Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Remove the vacuum gauge before continuing.

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and reach at least 82° C (180° F)?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. Replace the Engine Coolant Temperature Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the Evap Purge Solenoid and Powertrain Control Module connectors. Replace the Evap Purge Solenoid if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Connect the vacuum hoses before continuing.

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from restrictions.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)

9. 2/1 O2 SENSOR

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Ignition on, engine not running.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

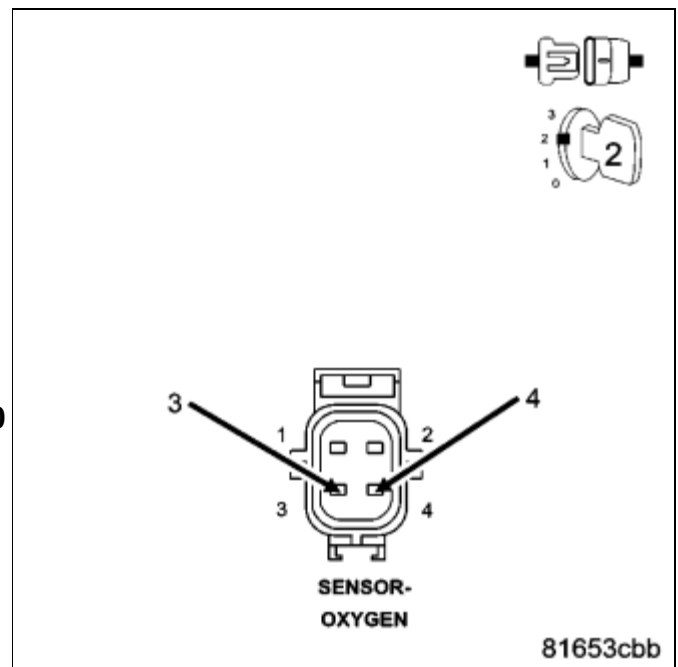
Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from between 4.1 and 5.0 volts down to 2.5 volts with the jumper wire connected.

Did the O2 Sensor voltage drop from between 4.1 and 5.0 volts to 2.5 volts when the jumper wire was installed?

Yes

- Verify that there is good pin to terminal contact in the O2 Sensor and Powertrain Control Module connectors. Replace the 2/1 O2 Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [10](#)

NOTE: Remove the jumper wire before continuing.

10. O2 SENSOR SIGNAL CIRCUIT

Ignition on, engine not running.

Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the O2 Sensor harness connector.

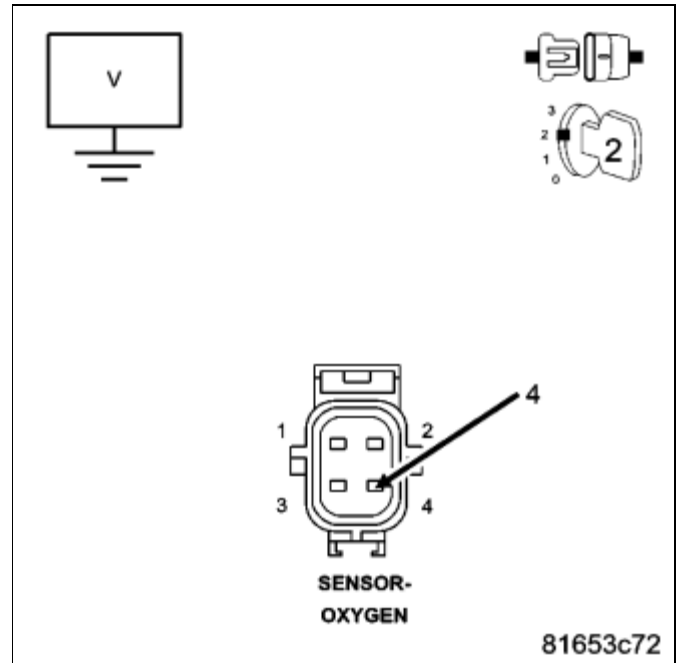
Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [11](#)

No

- Check the (K43) O2 Sensor 2/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes

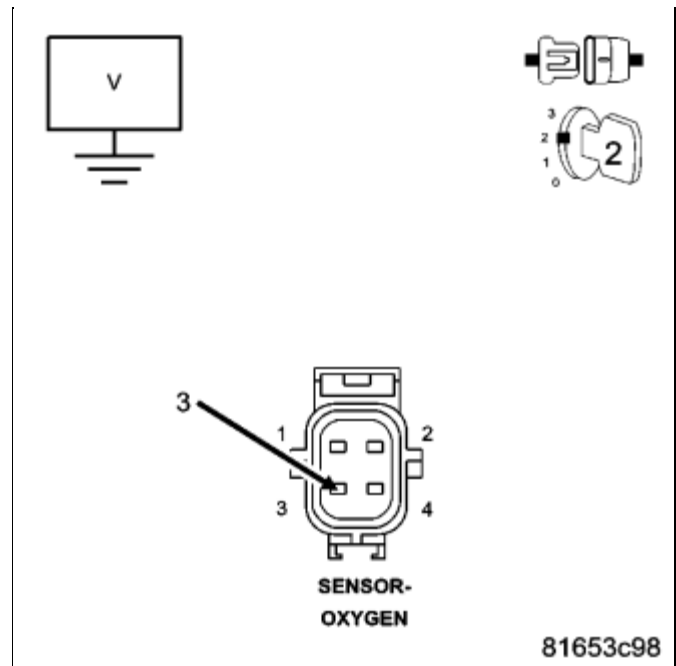
- Go To [12](#)

No

- Check the (K902) O2 Return Upstream circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain

- Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Turn the ignition off before continuing.



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0201-FUEL INJECTOR 1 CIRCUIT

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K11) INJECTOR 1 CONTROL CIRCUIT OPEN
(K11) INJECTOR 1 CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 1 CIRCUIT RESISTANCE

Turn the ignition off.

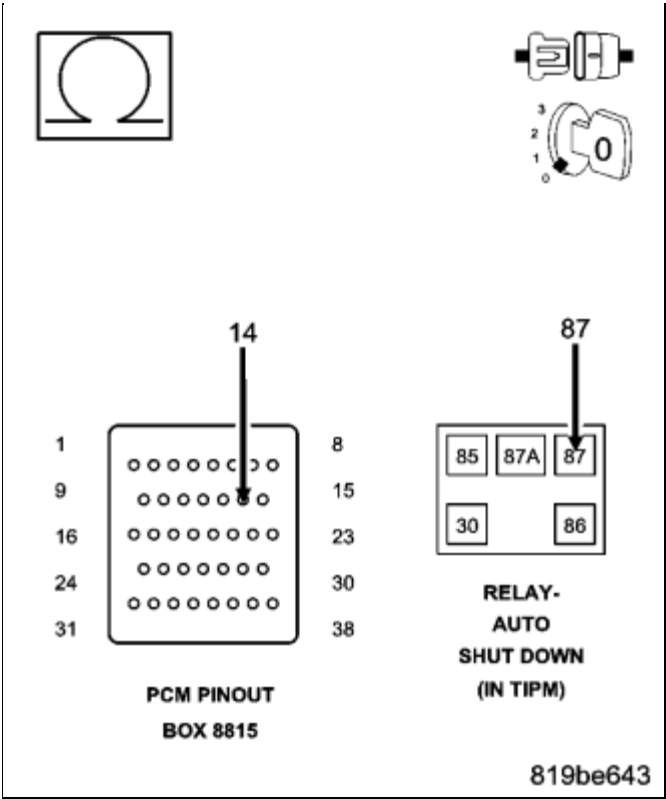
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 1 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature	
Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 1 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.
Verify that the Fuel Injector 1 is properly connected to the injector. Disconnect the Fuel Injector 1 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 1 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 1 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

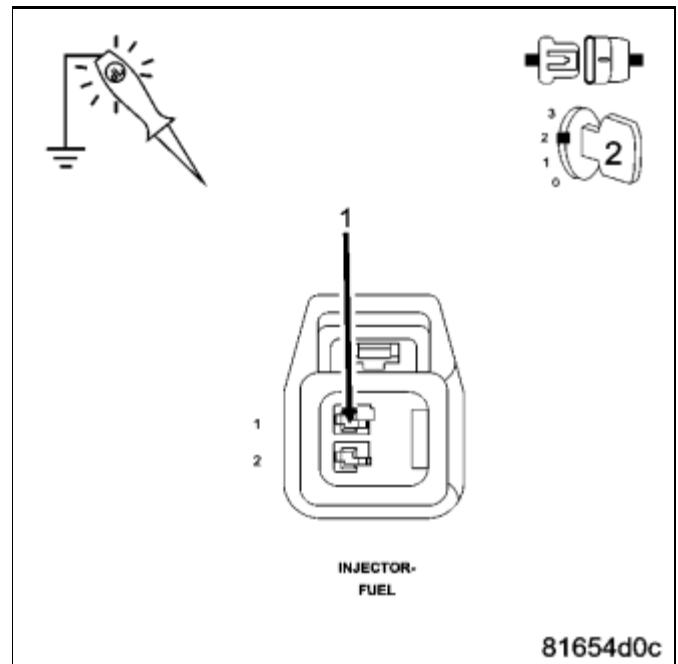
Yes

- Go To [5](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K11) INJECTOR 1 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance of the (K11) Injector 1 Control circuit between the Fuel Injector 1 harness connector and the appropriate terminal of special tool #8815.

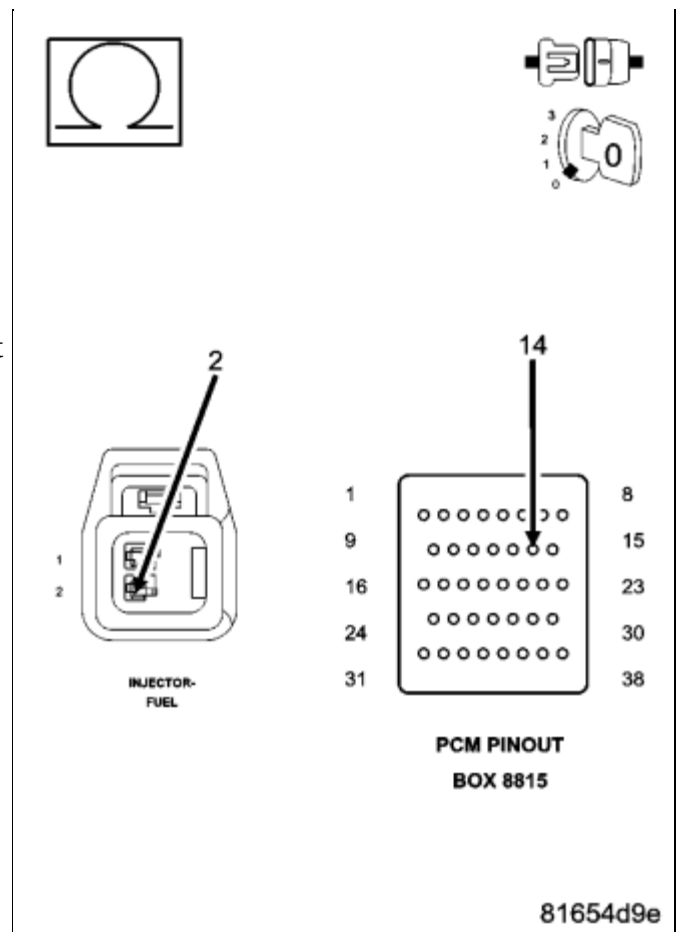
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K11) Injector 1 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 1

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 1 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K11) INJECTOR 1 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K11) Injector 1 Control circuit in the Fuel Injector 1 harness connector.

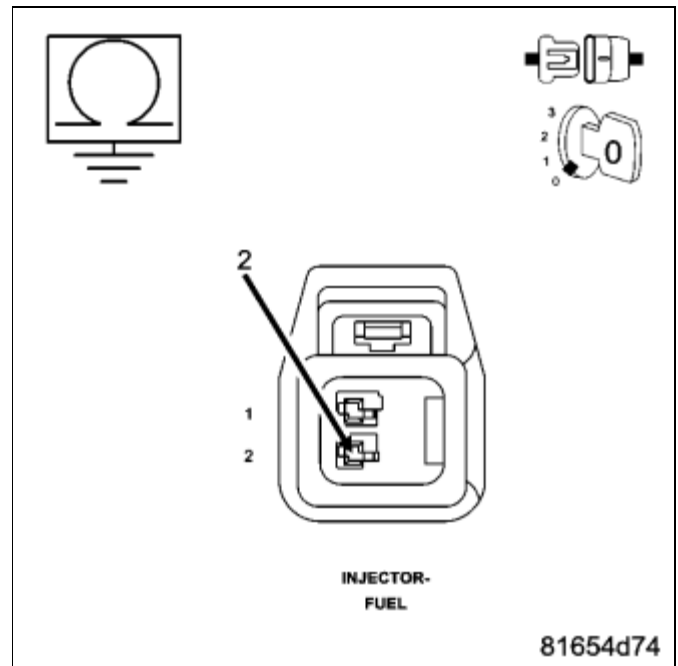
Is the resistance below 100 ohms?

Yes

- Go To [8](#)

No

- Repair the (K11) Injector 1 Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

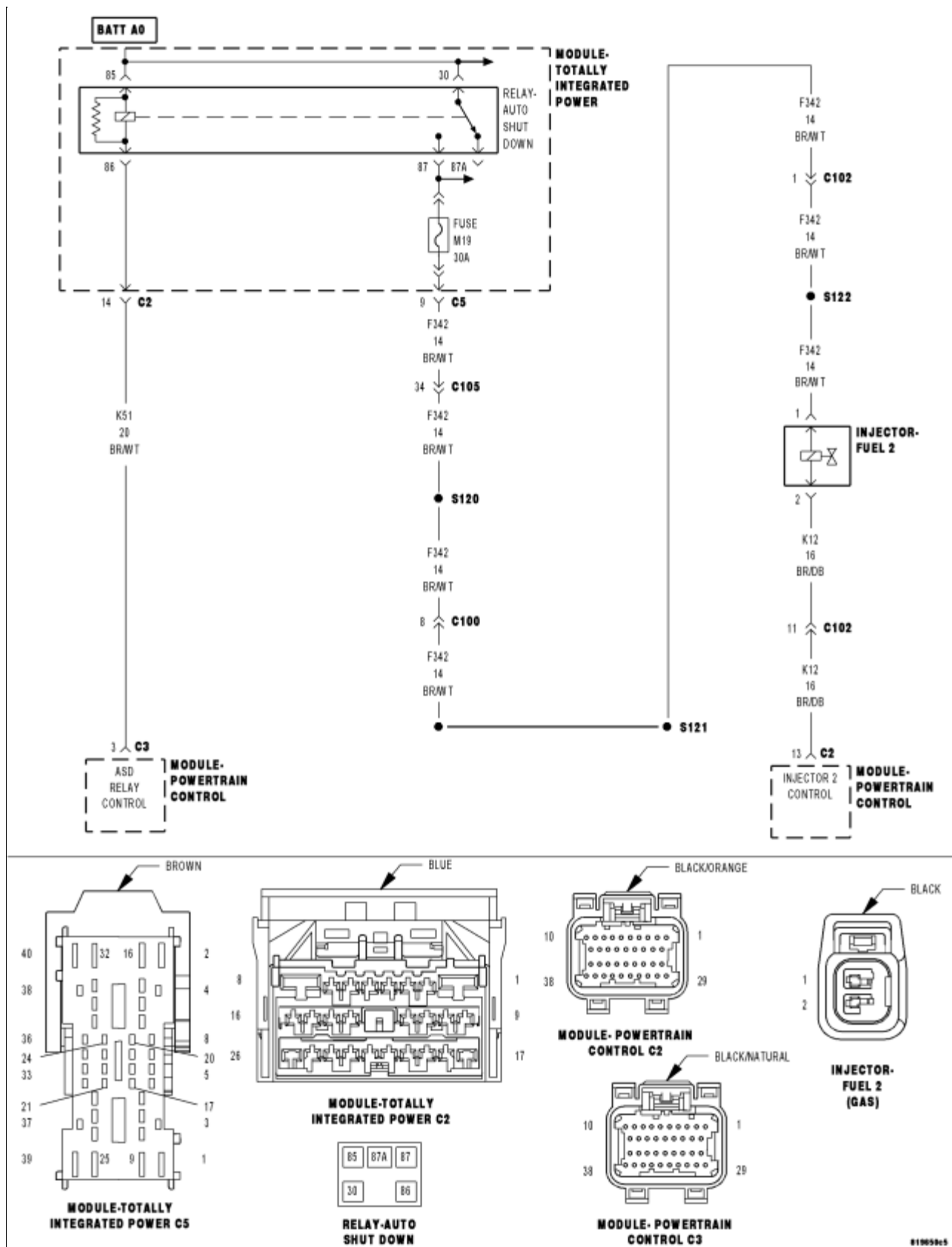
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0202-FUEL INJECTOR 2 CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR 2 CONTROL CIRCUIT OPEN
(K12) INJECTOR 2 CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 2 CIRCUIT RESISTANCE

Turn the ignition off.

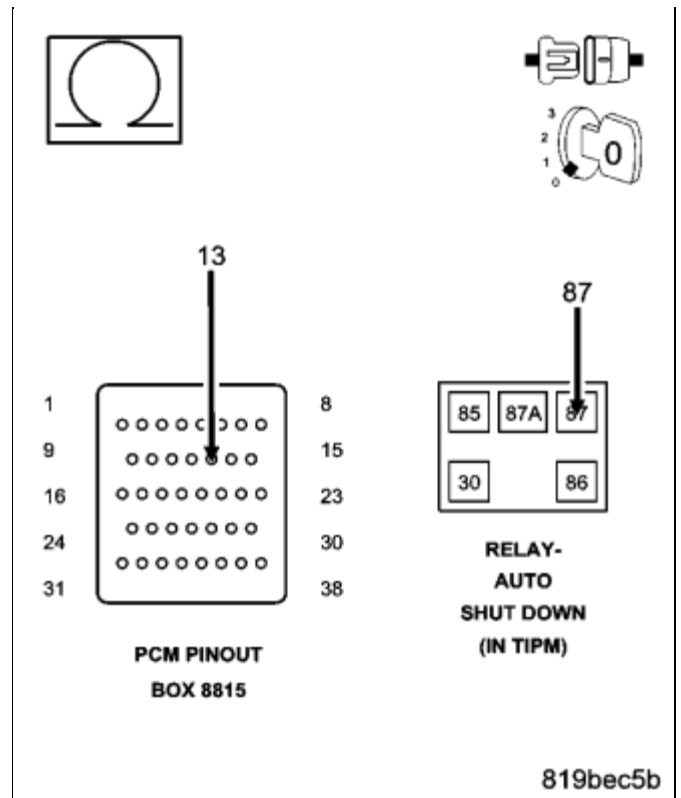
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 2 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature	
Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 2 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.

Verify that the Fuel Injector 2 is properly connected to the injector. Disconnect the Fuel Injector 2 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 2 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 2 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

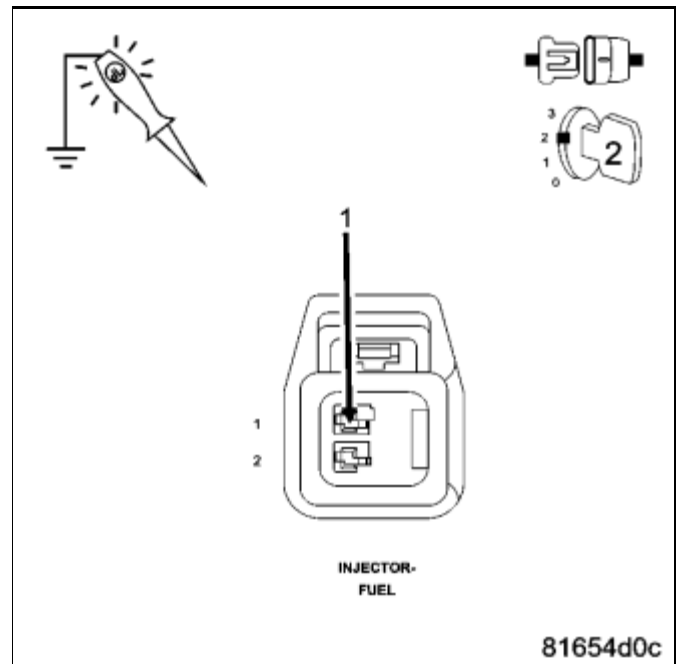
Yes.

- Go To [5](#)

No.

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K12) INJECTOR 2 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance of the (K12) Injector 2 Control circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.

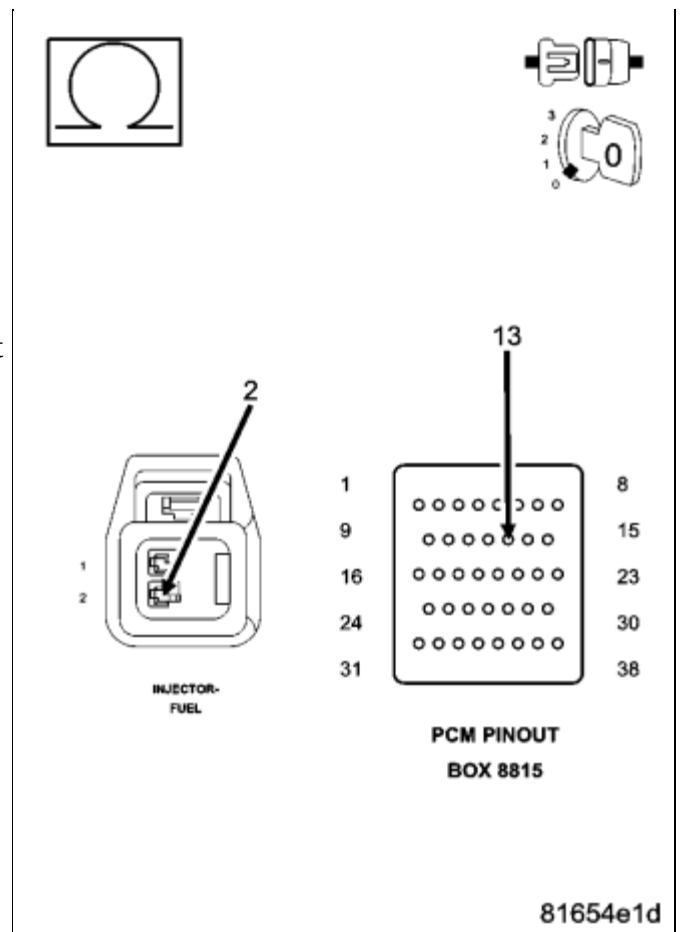
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K12) Injector 2 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 2

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 2 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 2 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K12) INJECTOR 2 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K12)
 Injector 2 Control circuit in the Injector harness connector.

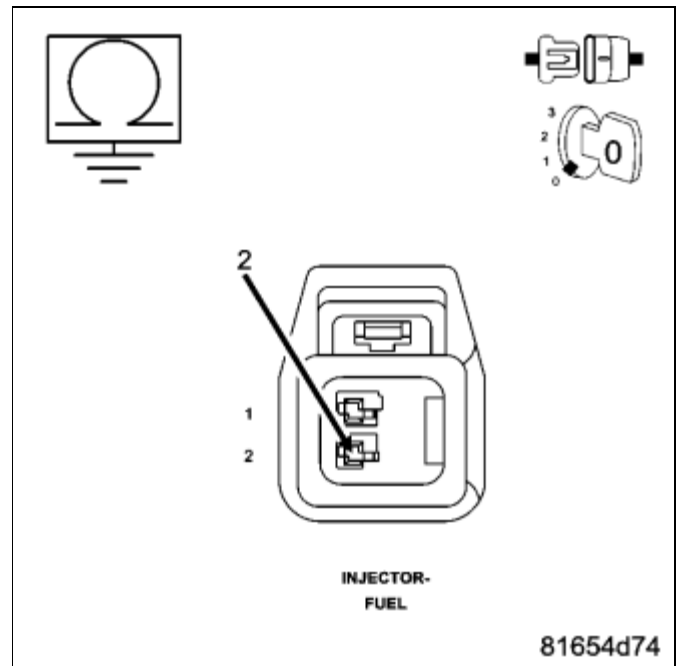
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K12) Injector 2 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 2 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

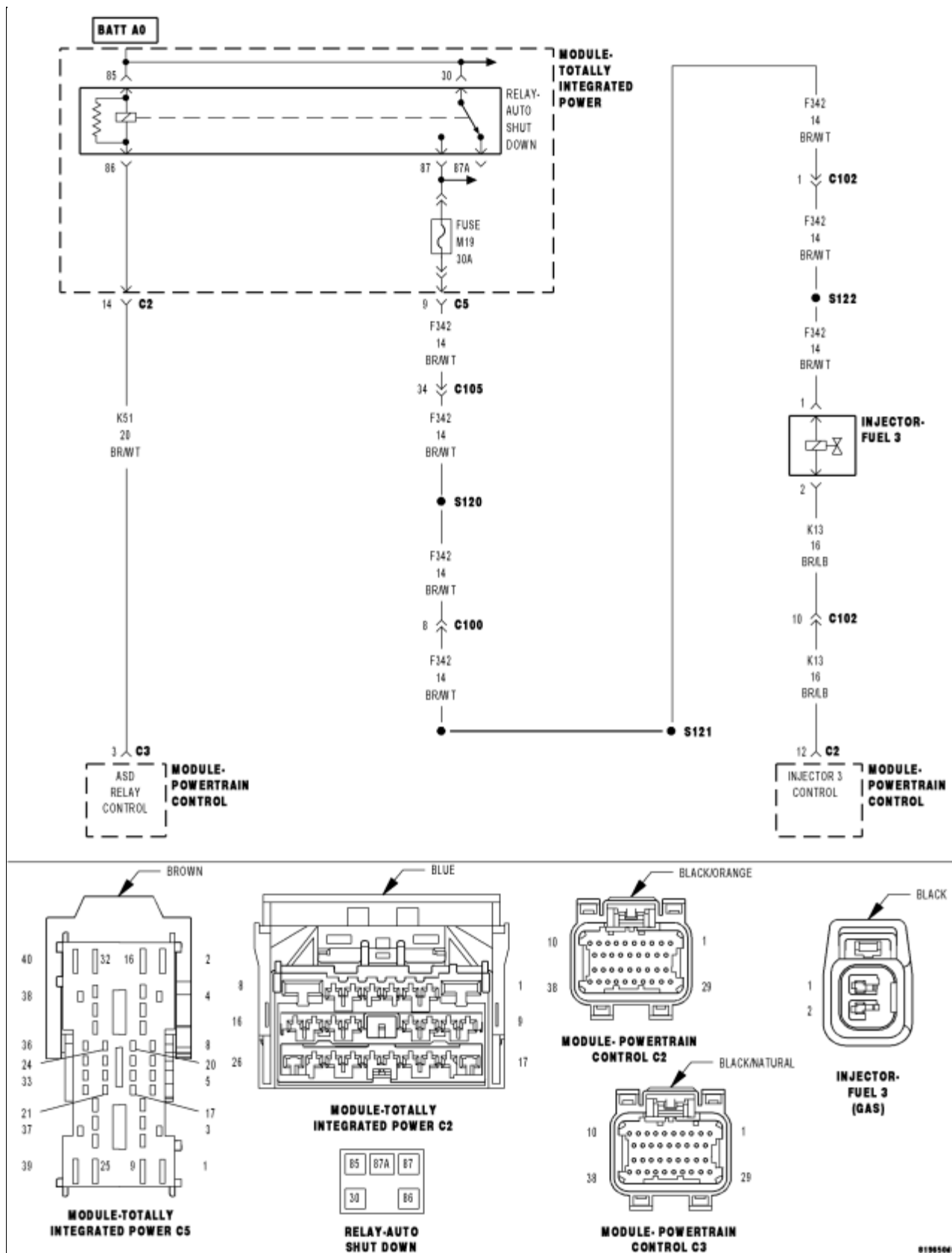
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0203-FUEL INJECTOR 3 CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN
(K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 3 CIRCUIT RESISTANCE

Turn the ignition off.

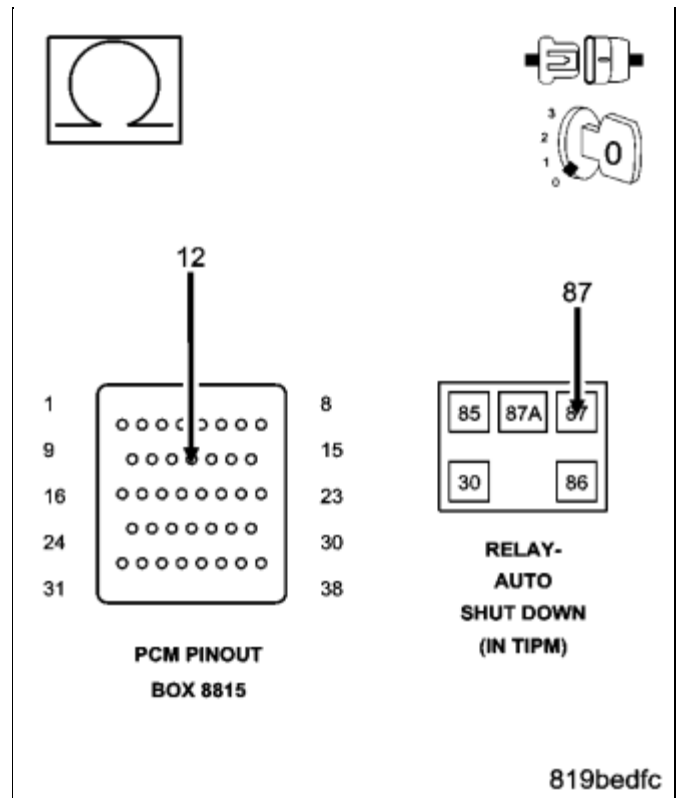
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 3 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature	
Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 3 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.

Verify that the Fuel Injector 3 is properly connected to the injector. Disconnect the Fuel Injector 3 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 3 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 3 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

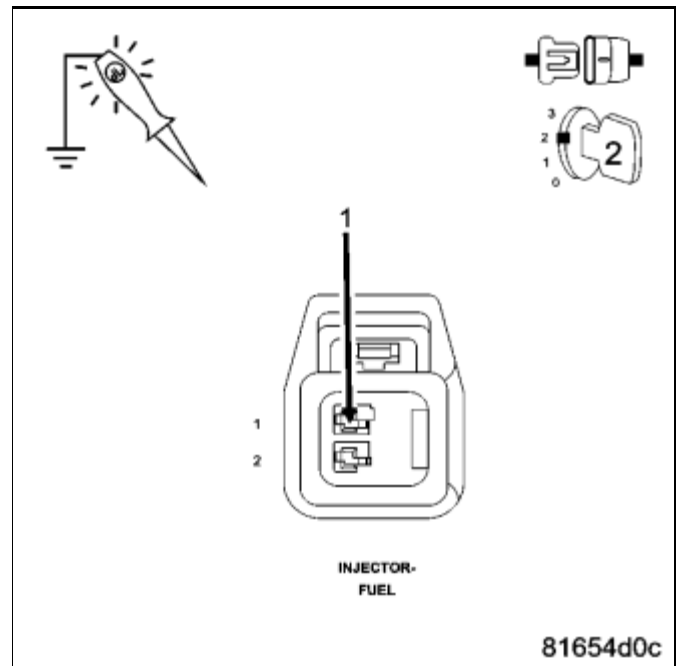
Yes.

- Go To [5](#)

No.

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K13) INJECTOR 3 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance of the (K13) Injector 3 Control circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.

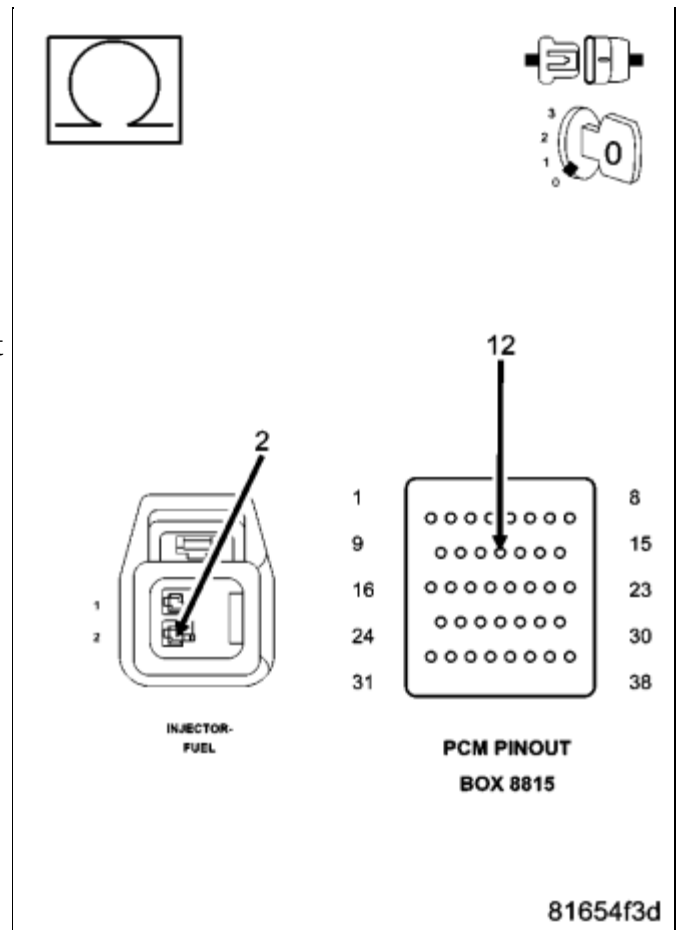
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K13) Injector 3 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 3

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 3 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 3 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K13) INJECTOR 3 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K13)
 Injector 3 Control circuit in the Injector harness connector.

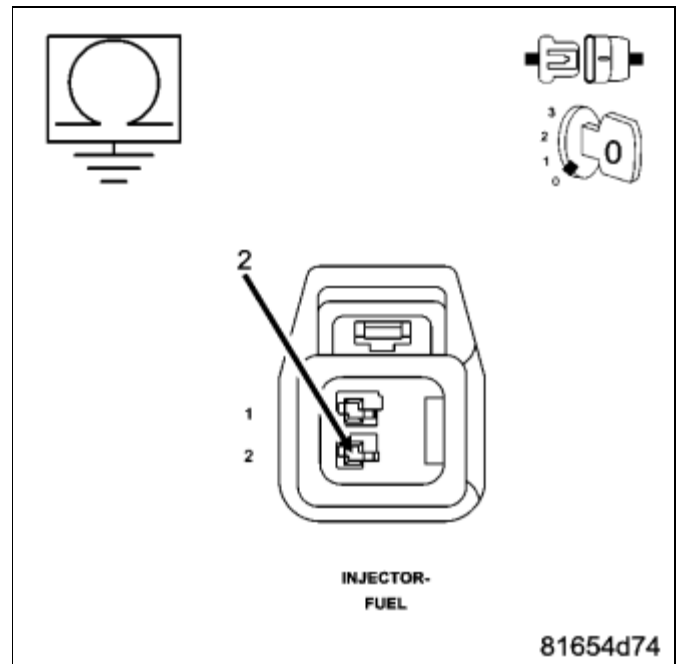
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K13) Injector 3 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 3 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0204-FUEL INJECTOR 4 CIRCUIT

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K14) INJECTOR 4 CONTROL CIRCUIT OPEN
(K14) INJECTOR 4 CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 4 CIRCUIT RESISTANCE

Turn the ignition off.

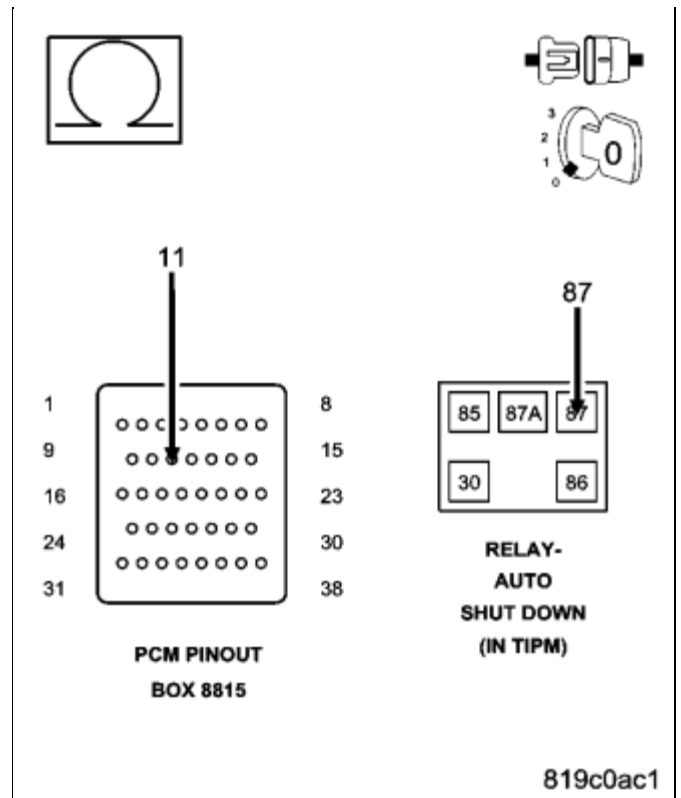
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 4 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature	
Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 4 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.

Verify that the Fuel Injector 4 is properly connected to the injector. Disconnect the Fuel Injector 4 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 4 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 4 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

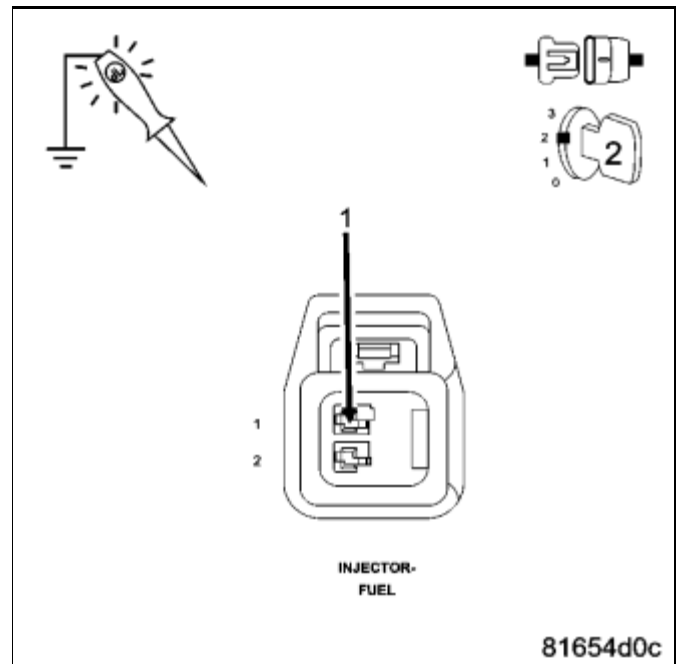
Yes.

- Go To [5](#)

No.

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K14) INJECTOR 4 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the Ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance of the (K14) Injector 4 Control circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.

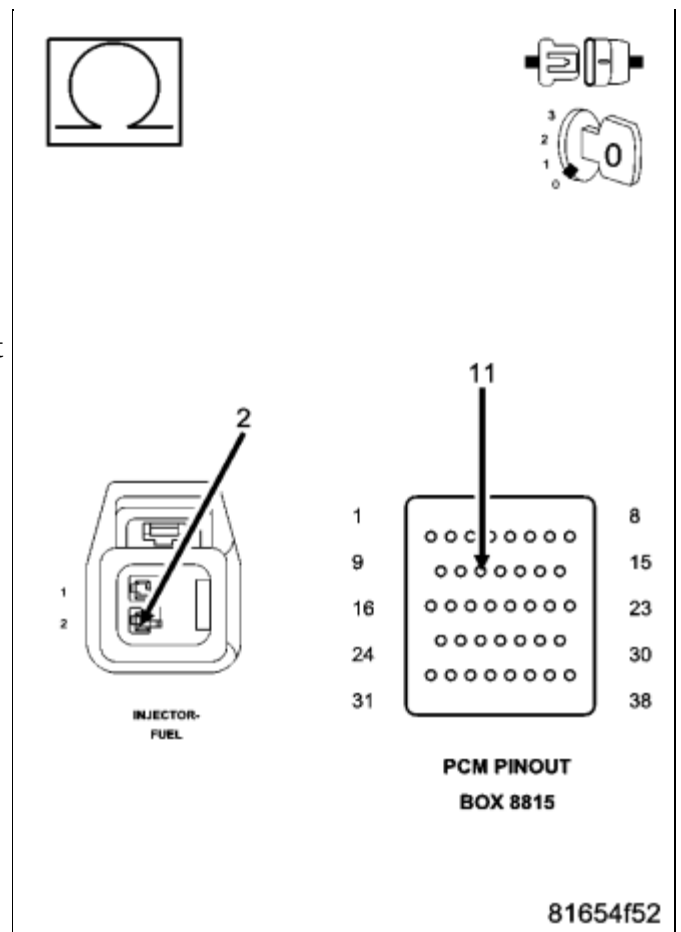
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K14) Injector 4 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 4

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 4 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 4 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K14) INJECTOR 4 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K14)
 Injector 4 Control circuit in the Injector harness connector.

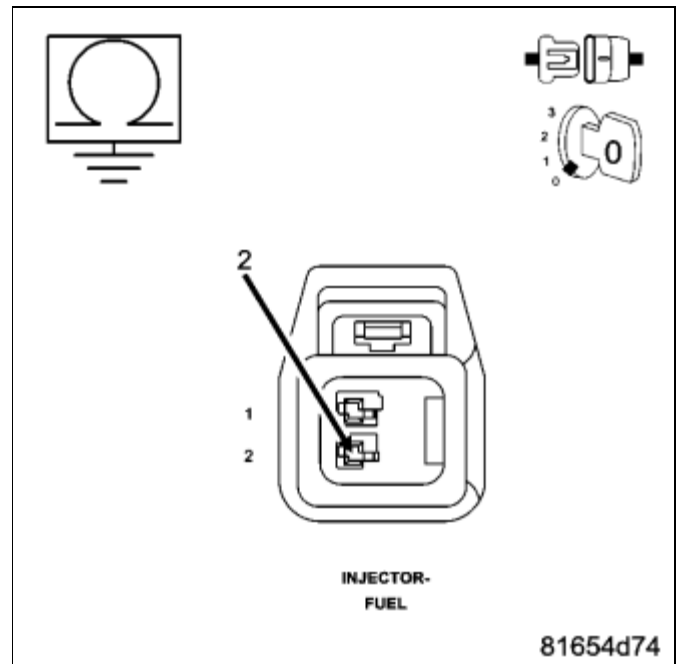
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K14) Injector 4 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 4 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

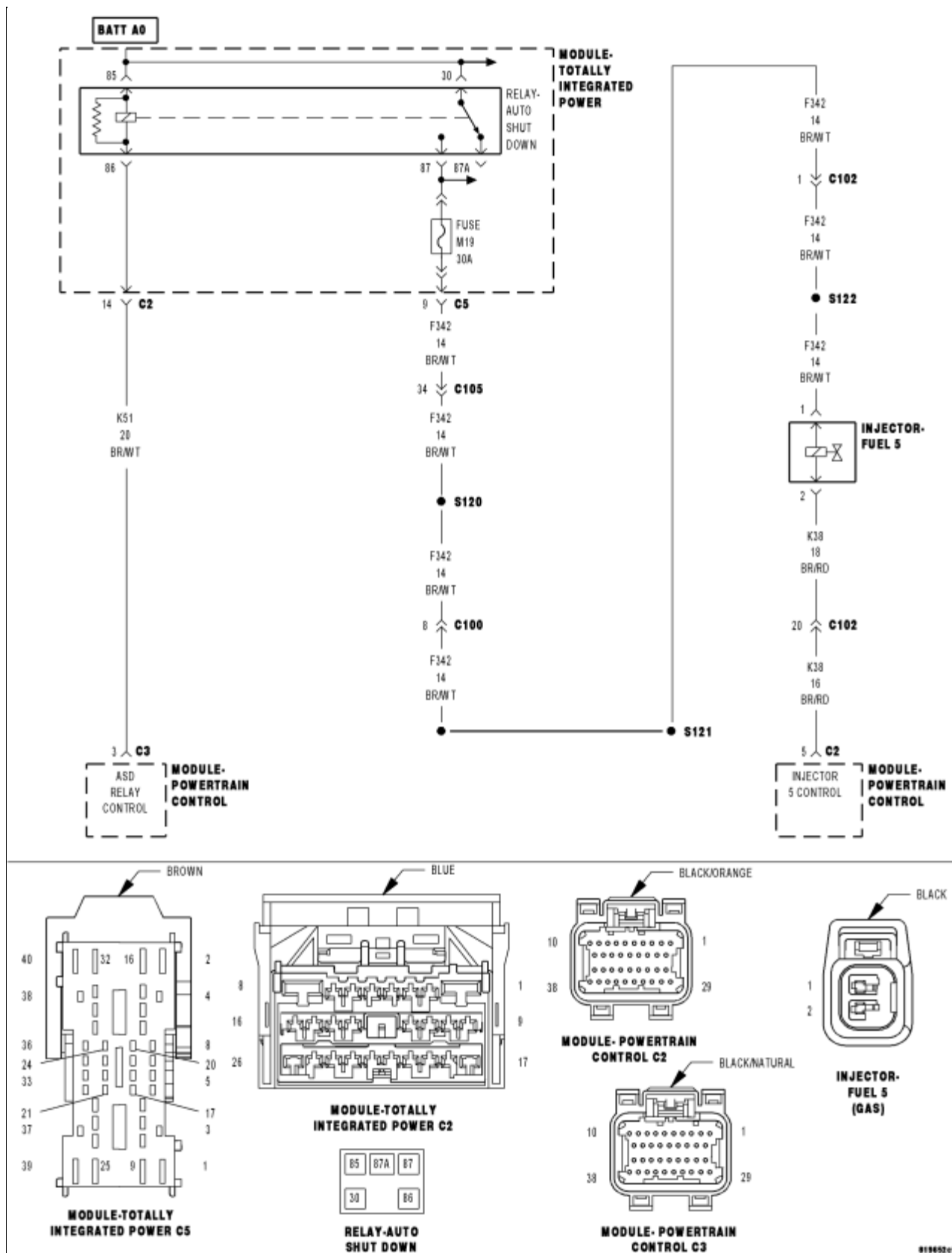
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0205-FUEL INJECTOR 5 CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K38) INJECTOR 5 CONTROL CIRCUIT OPEN
(K38) INJECTOR 5 CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 5 CIRCUIT RESISTANCE

Turn the ignition off.

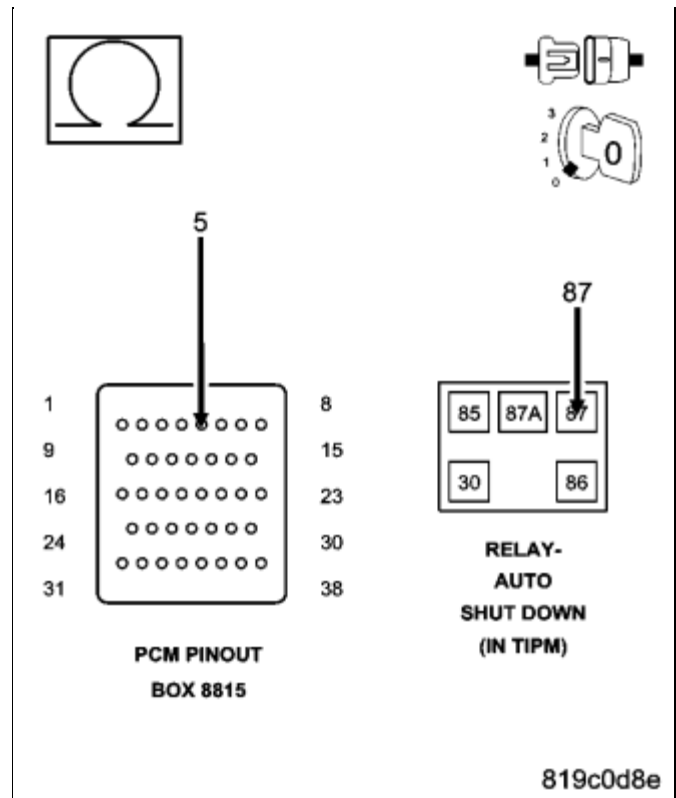
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 5 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature	
Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 5 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.

Verify that the Fuel Injector 5 is properly connected to the injector. Disconnect the Fuel Injector 5 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 5 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 5 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

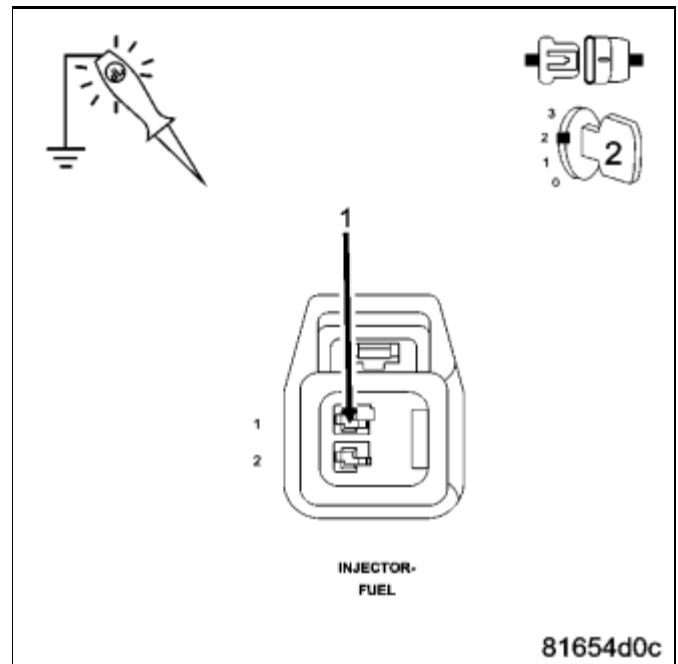
Yes.

- Go To [5](#)

No.

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K38) INJECTOR 5 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance of the (K38) Injector 5 Control circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.

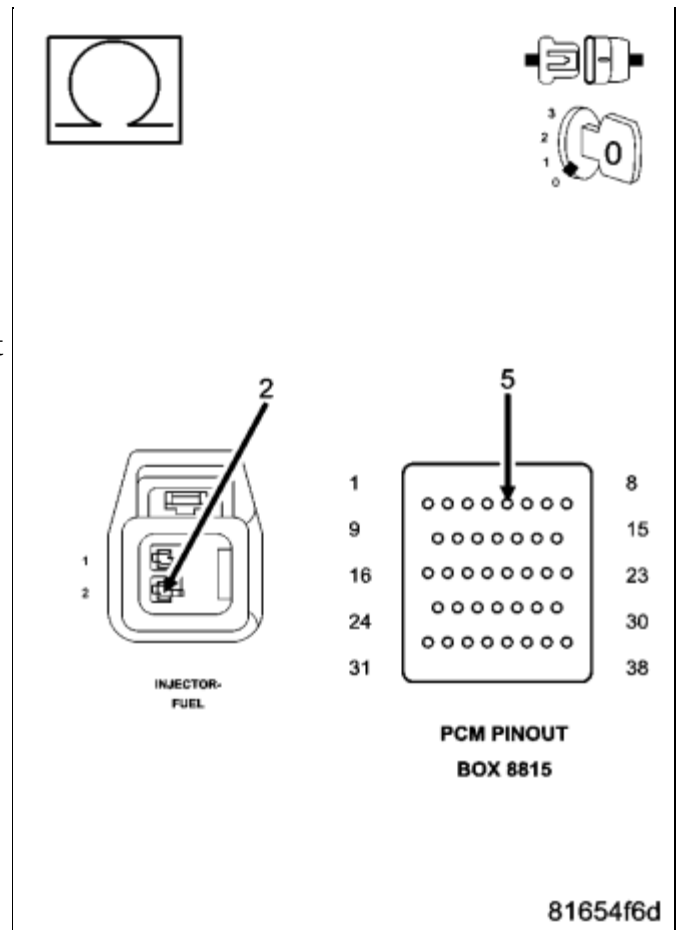
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K38) Injector 5 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 5

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 5 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 5 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K38) INJECTOR 5 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K38) Injector 5 Control circuit in the Injector harness connector.

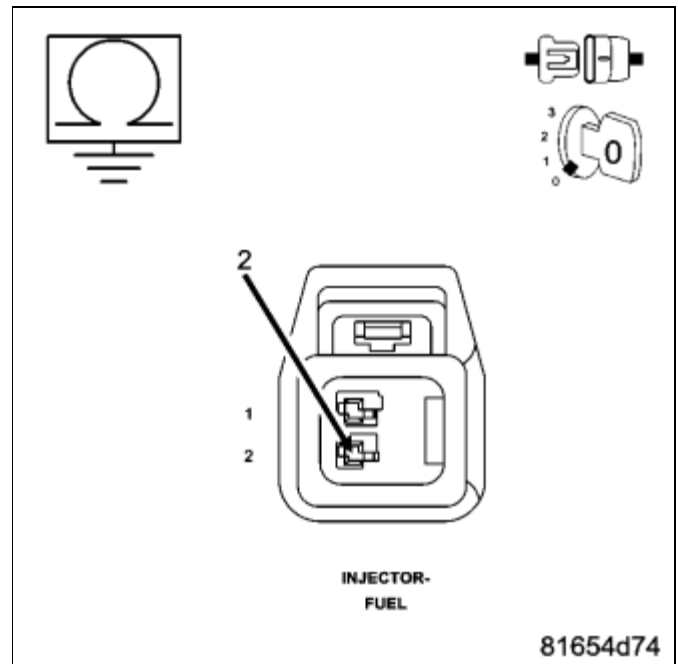
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K38) Injector 5 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 5 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

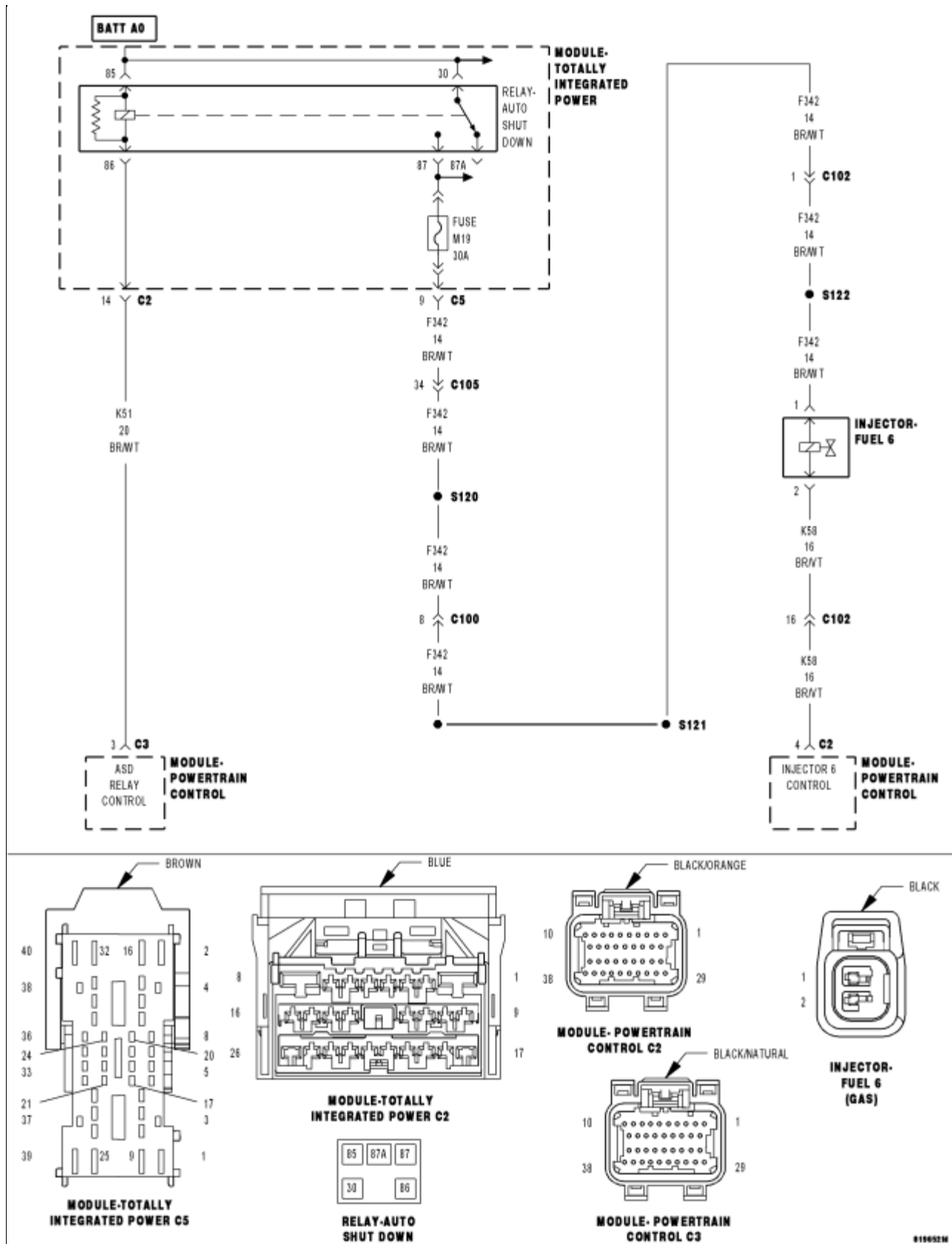
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0206-FUEL INJECTOR 6 CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The fueling strategy for NGC requires potentially three fuel pulses per cylinder per cycle. The first pulse is delivered starting at a programmed angle soon after the intake valve closes, for specified time duration. This is for two reasons, one to prevent any fuel from this pulse being delivered in the previous cycle and second to allow fueling to begin as early as possible in the current cycle. The second pulse is delivered for a specified time and is set to end at a programmed angle. The pulse must not extend past the end angle. There can be a separate value for each cylinder under the same operating conditions. This is done for two reasons, one to prevent any fuel from this pulse being delivered during the intake/exhaust valve overlap period, which tends to cause elevated emission levels. Also, allowing fuel to enter each cylinder at a slightly different angle tends to reduce any fuel pressure standing waves in the fuel rail. If the desired total fuel pulse-width increases, a third fuel pulse must be delivered. The third pulse, if necessary, is delivered for a specified time and must end at a programmed angle before the valve closes again. The third pulse in the cycle is controlled by its ending angle. This is also for two reasons, one to prevent any fuel from this pulse being delivered in the next cycle and second to allow fueling to end as late as possible in the current cycle. At high engine speeds, one or more of the pulses may be dropped from the fueling strategy.

- **When Monitored:**

With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.

- **Set Condition:**

The PCM monitors the continuity of the injector circuits as well as the voltage spike created by the collapse of the magnetic field in the injector coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC to set.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K58) INJECTOR 6 CONTROL CIRCUIT OPEN
(K58) INJECTOR 6 CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Review Freeze Frame information. Operate the vehicle under conditions similar to which the DTC was set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL INJECTOR 6 CIRCUIT RESISTANCE

Turn the ignition off.

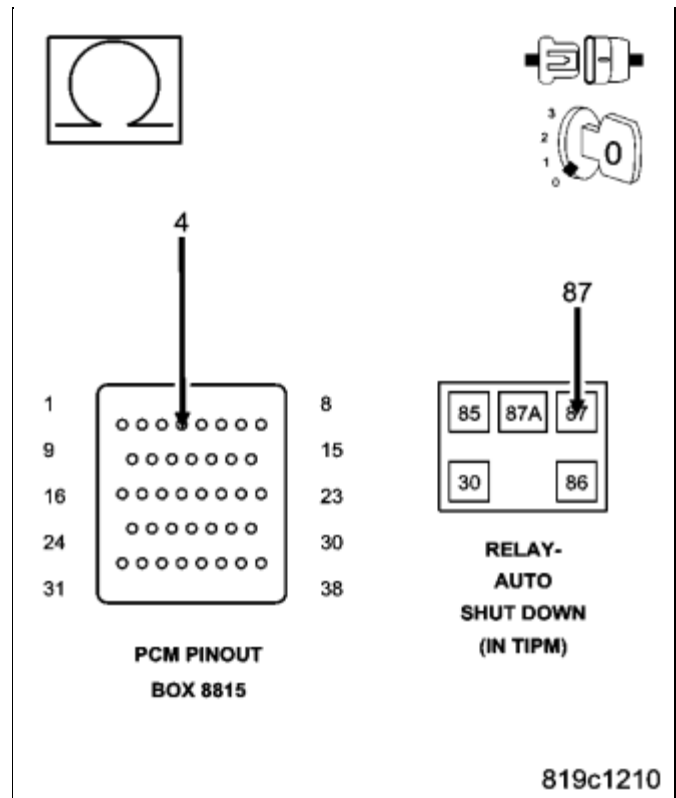
Disconnect the C2 PCM harness connector.

Remove the ASD Relay.

NOTE: The resistance of the circuit will vary according to the temperature of the injector coil. Use the table below to determine the resistance range of the injector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Fuel Injector 6 circuit from the appropriate terminal of special tool #8815 and the ASD Relay connector.



Fuel Injector Coil Resistance Based on Engine Temperature

Temperature	Resistance
-20° C (-4° F)	10 ohms (+/- .6 of an ohm)
20° C (68° F)	12 ohms (+/- .6 of an ohm)
60° C (140° F)	14 ohms (+/- .6 of an ohm)
100° C (212° F)	16 ohms (+/- .6 of an ohm)

Is the resistance of the injector within the specified range?

Yes

- Go To [7](#)

No

- Go To [3](#)

3. FUEL INJECTOR 6 WIRING AND CONNECTOR INSPECTION

Turn the ignition off.

Verify that the Fuel Injector 6 is properly connected to the injector. Disconnect the Fuel Injector 6 connector and Inspect the terminals for any condition that would result in a poor connection.

Using the wiring diagram/schematic as a guide, inspect the Fuel Injector 6 wiring and connector. Look for any chafed, pierced, pinched, or partially broken wires. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F342) ASD RELAY OUTPUT CIRCUIT CHECK

Connect the C2 PCM harness connector.
Turn the ignition on.
With the scan tool, actuate the Auto Shutdown (ASD) Relay Control State.
Using a 12-volt test light connected to ground, check the (F342) ASD Relay Output circuit in the Fuel Injector 6 harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

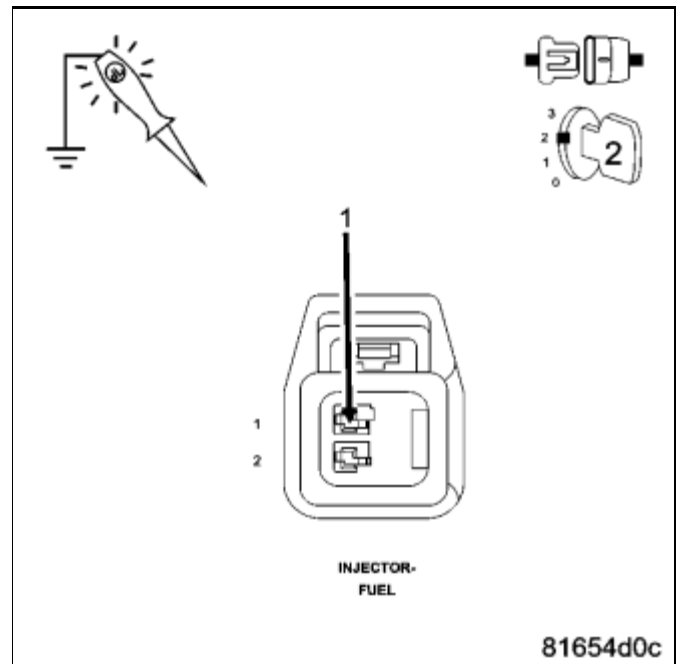
Yes.

- Go To [5](#)

No.

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (K58) INJECTOR 6 CONTROL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8816 to perform diagnosis.

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance of the (K58) Injector 6 Control circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.

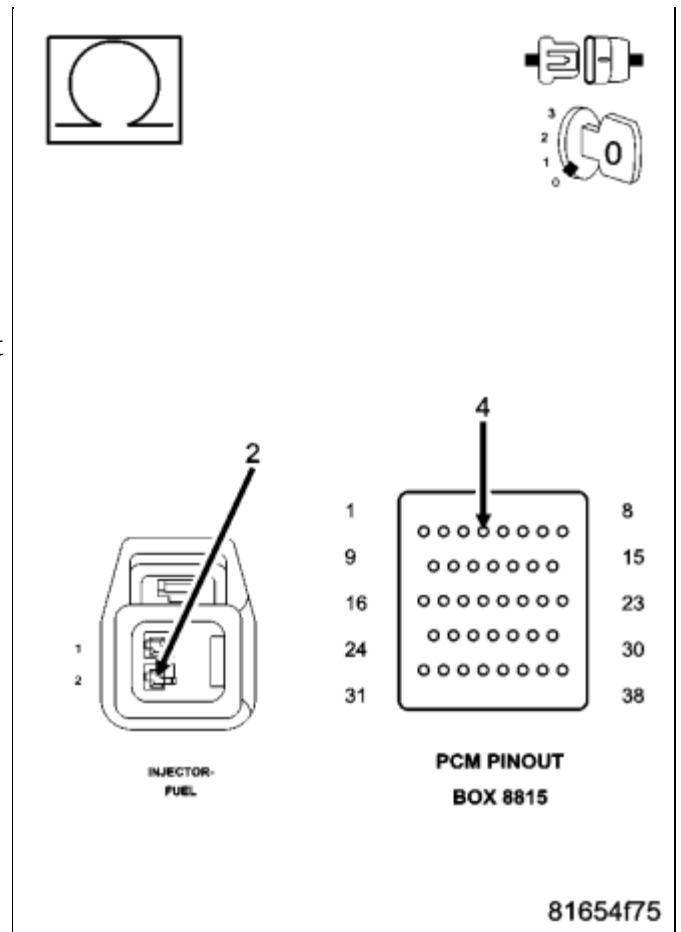
Is the resistance below 6.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K58) Injector 6 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. FUEL INJECTOR 6

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 6 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Fuel Injector 6 in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K58) INJECTOR 6 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance between ground and the (K58)
 Injector 6 Control circuit in the Injector harness connector.

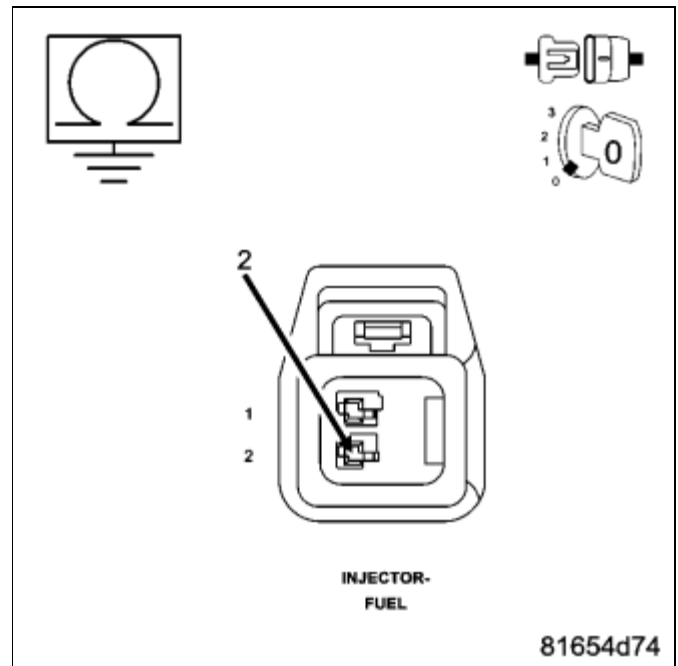
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K58) Injector 6 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector 6 and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Injector and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

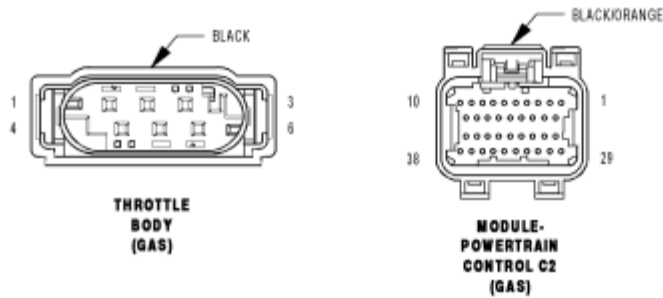
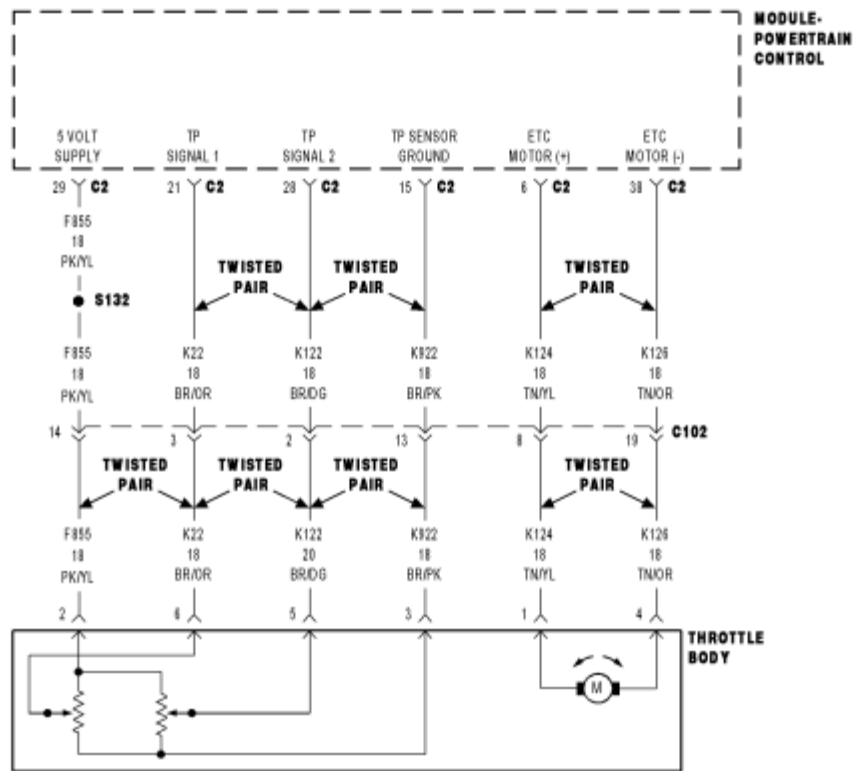
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE



81000000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and No MAP Sensor DTCs set.

◦ **Set Condition:**

TP Sensor signals do not correlate to the MAP Sensor signal. Two Trip Fault. ETC light will illuminate. P2135 should set with this code also.

Possible Causes
EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT
EXCESSIVE RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT
EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (K922) TP SENSOR GROUND CIRCUIT
(K22) TP SIGNAL 1 SIGNAL CIRCUIT SHORTED TO THE (K122) TP SIGNAL 2 CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: Diagnose any other TP Sensor DTC(s) before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Inspect the engine for vacuum leaks.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [9](#)

2. EXCESSIVE RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K122) TP Signal 2 circuit at the Throttle Body harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K22) TP Signal 1 circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (F855) 5-volt Supply circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. EXCESSIVE RESISTANCE IN THE (K922) TP SENSOR GROUND CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K922) TP Sensor Ground circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K922) TP Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

6. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K122) TP SIGNAL 2 CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Disconnect the Throttle Body harness connector.
Measure the resistance between the (K22) TP Signal 1 circuit
and the (K122) TP Signal 2 circuit at the Throttle Body
harness connector.

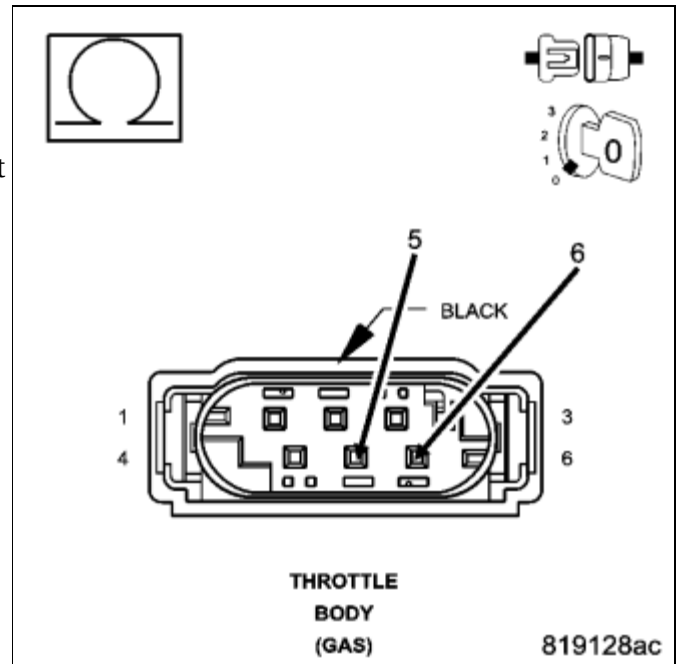
Is the resistance below 5.0 ohms?

Yes

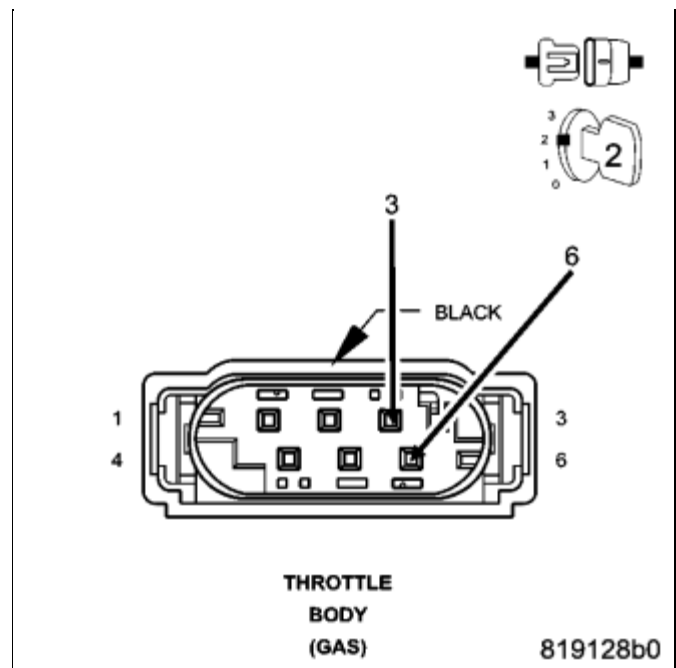
- Repair the short between the (K122) TP Signal 2 circuit and the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. THROTTLE POSITION SENSOR

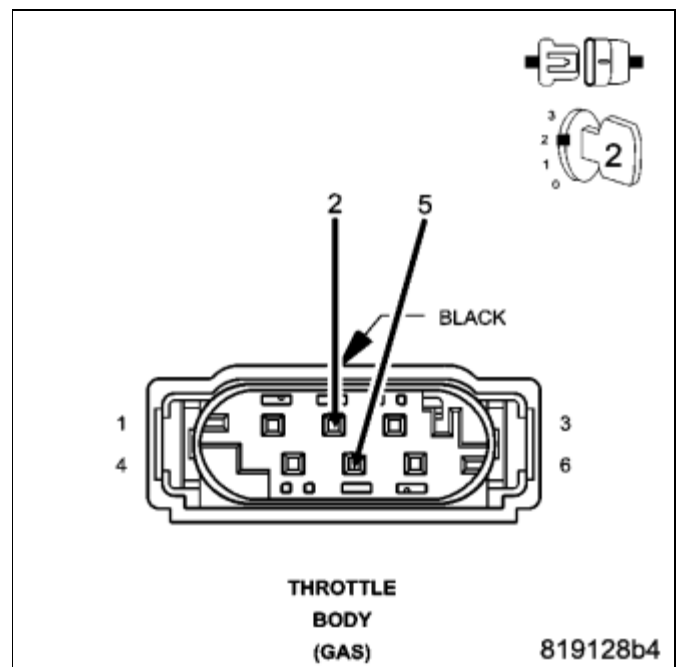


Connect the C2 PCM harness connector.
 Ignition on, engine not running.
 With the scan tool, monitor the TP Signal 1 and 2 voltage.
 Connect a jumper wire between the (K922) TP Sensor
 Ground circuit and the (K22) TP Signal 1 Signal circuit.

NOTE: TP Sensor 1 voltage should change from approximately 4.7 volts to 0.3 of a volt.

For TP Sensor 2, connect a jumper wire between (F855) 5-volt supply circuit and the (K122) TP Signal 2 circuit.

NOTE: TP Sensor 2 voltage should change from approximately 0 volts to 5.0 volts.



Is the voltage reading within the listed specification with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)
- **NOTE: Remove the jumper wire before continuing.**

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

9. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With the scan tool, perform the ETC Throttle Follower Test and monitor the TP Signal 1 or 2 voltage.

Slowly press the throttle pedal down.

The voltage for TP Signal 1 should start at approximately 0.7 of a volt and increase to approximately 4.3 volts.

The voltage for TP Signal 2 should start at approximately 4.3 volts and decrease to approximately 0.7 of a volt.

Is the voltage within the range of the listed specification for the appropriate Sensor?

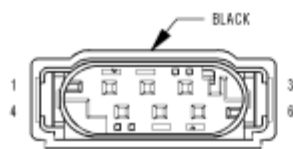
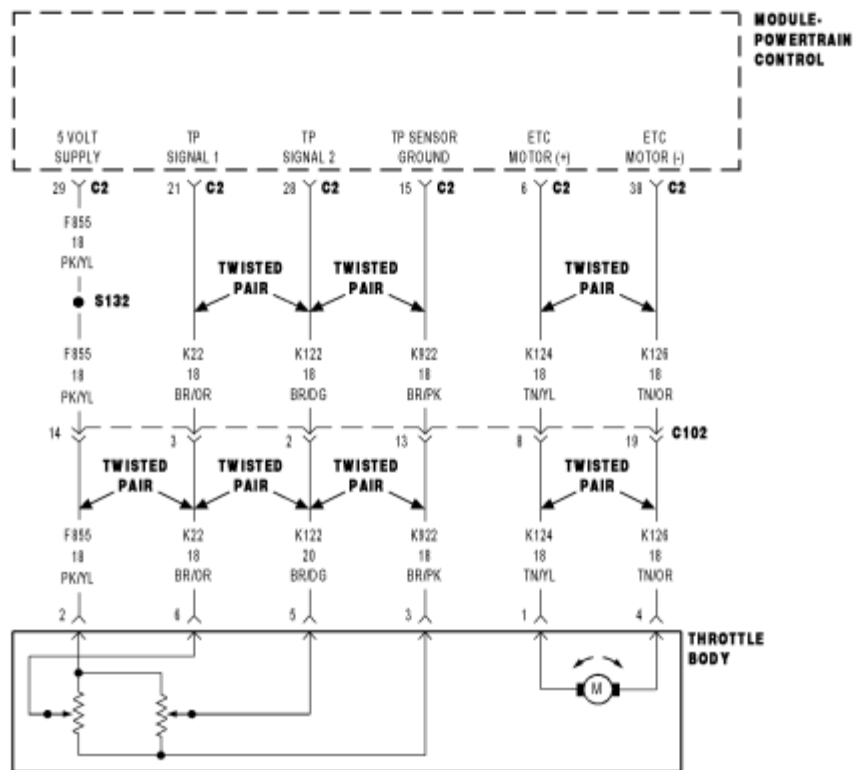
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

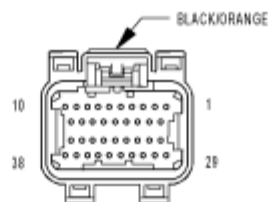
No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW



**THROTTLE
BODY
(GAS)**



**MODULE-
POWERTRAIN
CONTROL C2
(GAS)**

010128a5

For a complete Engine wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

Throttle Position Sensor voltage at the PCM is less than 0.16 of a volt for 0.7 of a second. One Trip Fault. Three good trips to turn off the MIL. ETC light will illuminate.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K122) TP SIGNAL 2 CIRCUIT OPEN
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO THE (K922) TP SENSOR GROUND CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
THROTTLE PLATE JAMMED AGAINST THE MAXIMUM STOP
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: If a 5-Volt supply DTC has also set, diagnose the 5-Volt DTC before continuing.

NOTE: Make sure the throttle moves freely and does not hang up at Wide Open Throttle, by performing the Throttle Follower Test

NOTE: If P2101 is also set, then make sure that the blade moves freely and does not hang up near Wide Open Throttle before trying to repair P0222.

Ignition on, engine not running.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. P0122 ALSO SET

Was the P0122-TP SENSOR NO.1 VOLTAGE LOW DTC set along with the P0222?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

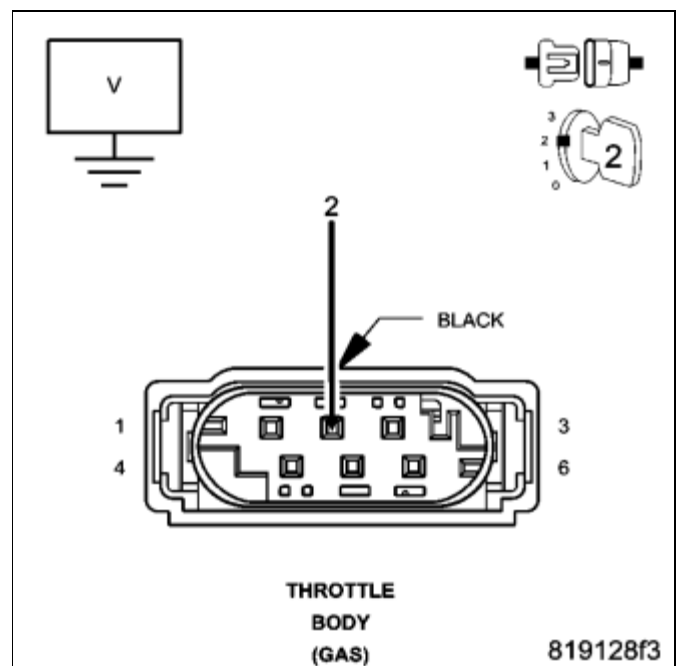
Is the voltage between 4.5 to 5.2 volts?

Yes

- Go To [4](#)

No

- Go To [8](#)



4. THROTTLE POSITION SENSOR

Connect a jumper wire between the (F855) 5-volt Supply circuit and the (K122) TP Signal 2 circuit in the Throttle Body harness connector.

With the scan tool, monitor the TP Sensor No.2 voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

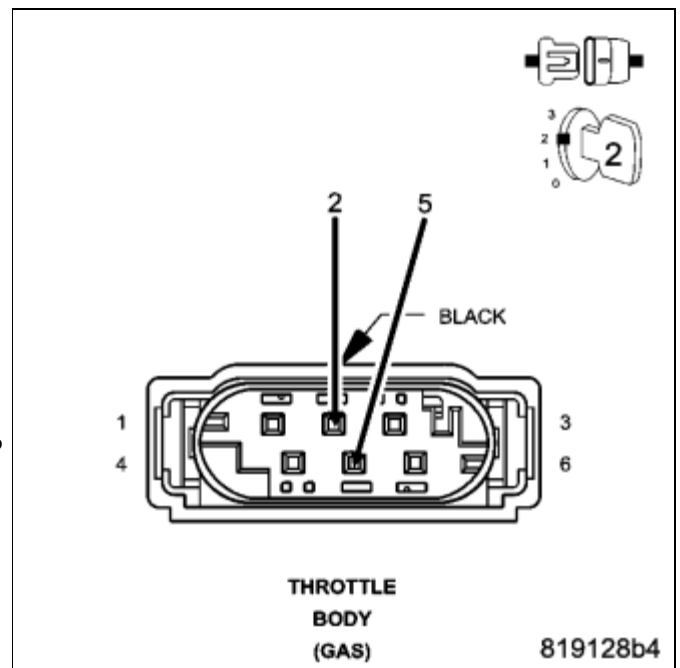
Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

NOTE: Remove the jumper wire before continuing.



5. (K122) TP SIGNAL 2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

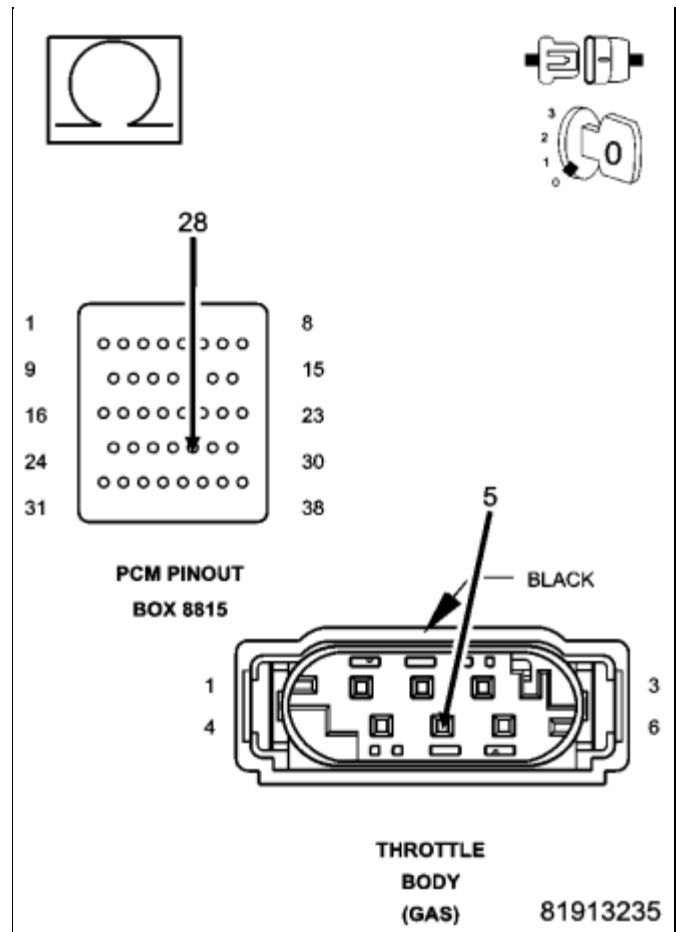
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

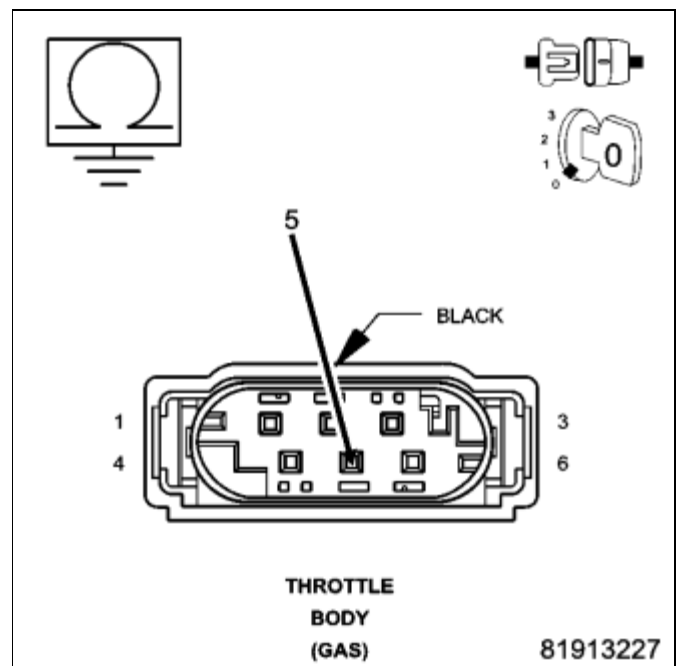
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K122) TP Signal 2.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO THE (K922) TP SENSOR GROUND CIRCUIT

Measure the resistance between the (K122) TP Signal 2 circuit and the (K922) TP Sensor Ground circuit at the Throttle Body harness connector.

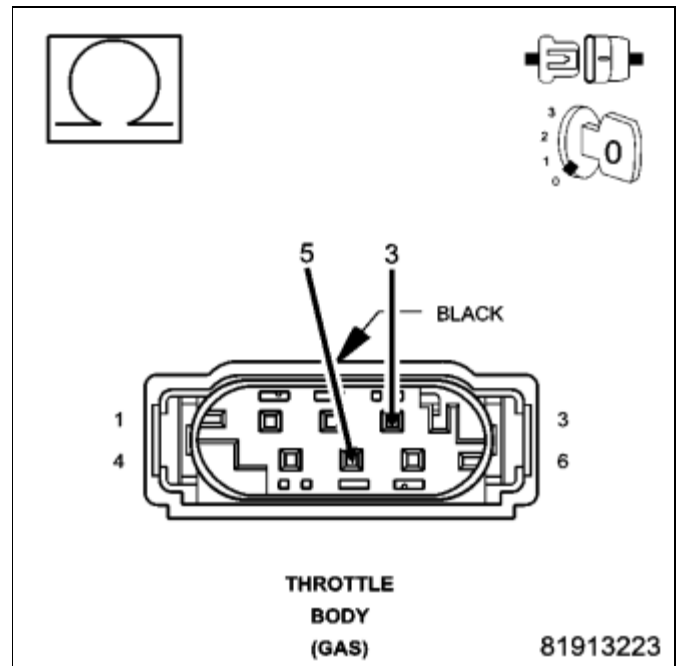
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K922) TP Sensor Ground circuit and the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

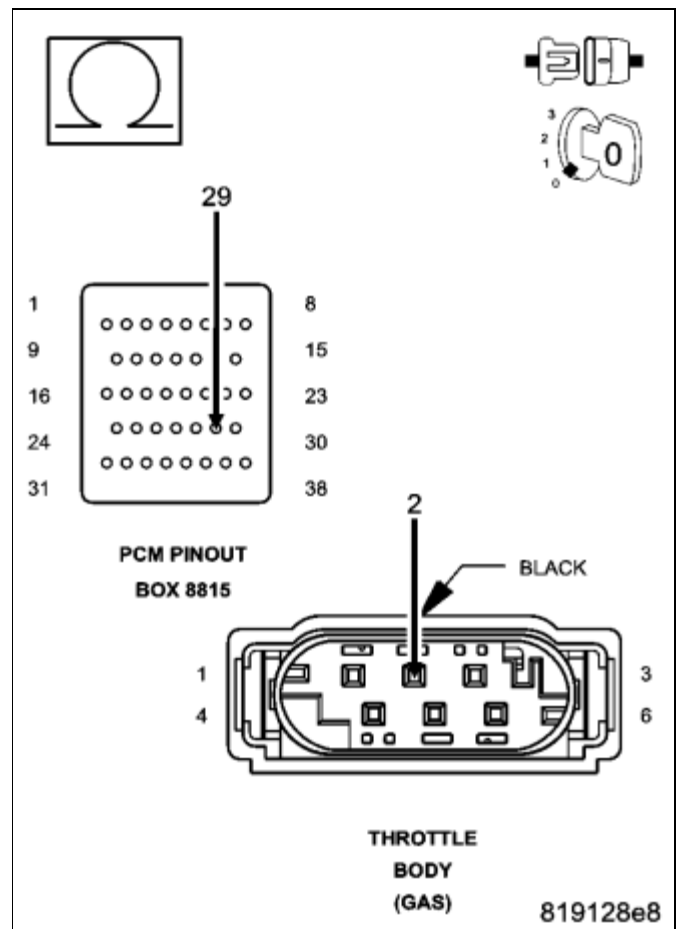
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.

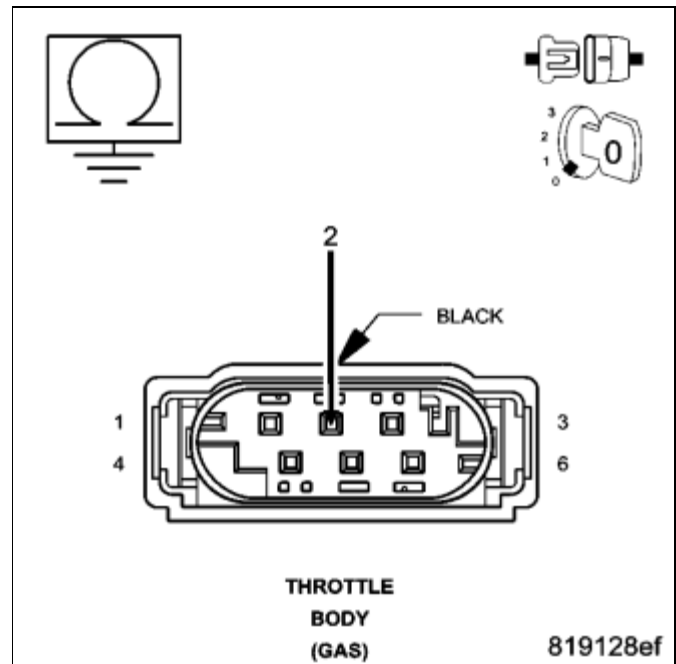
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

11. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With the scan tool, perform the ETC Throttle Follower Test.
Monitor the TP Sensor No.2 voltage while slowly pressing the Throttle pedal down.

Is there a smooth voltage change from approximately 4.3 volts and decrease to approximately 0.7 of a volt?

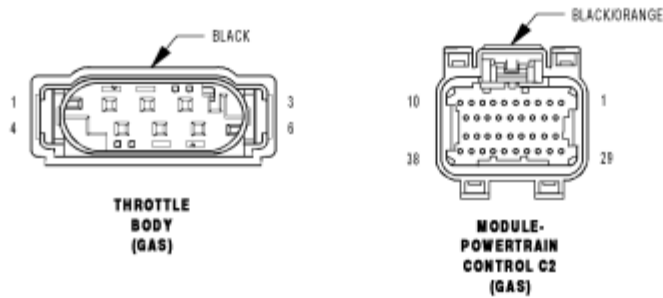
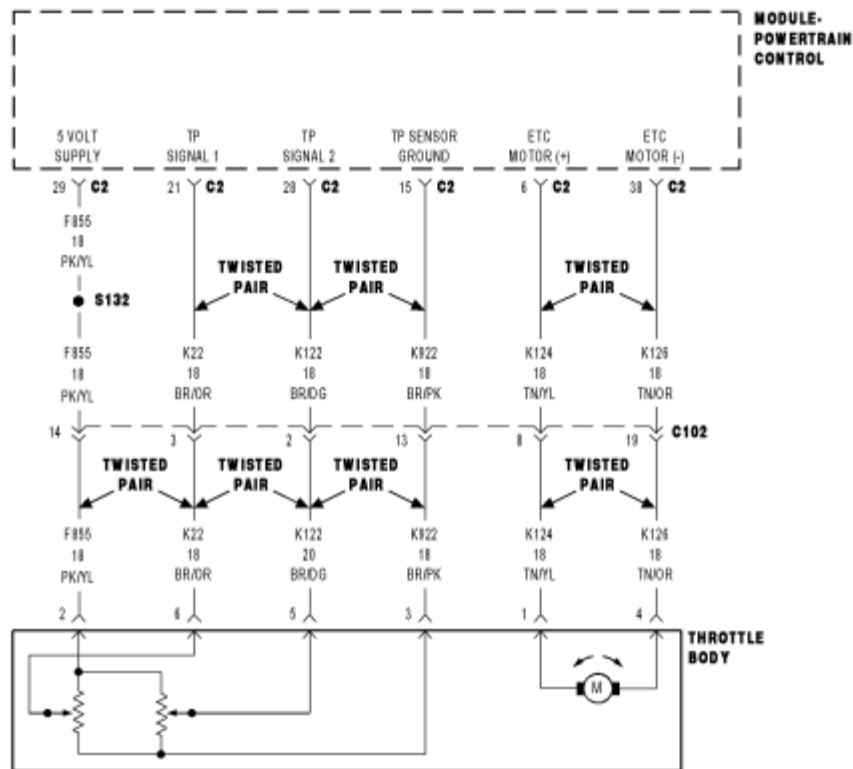
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH



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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

Throttle Position Sensor No.2 Signal circuit voltage is greater than the maximum acceptable value. One Trip Fault. ETC light will illuminate.

Possible Causes
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K922) TP SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: If a 5-Volt supply DTC has also set, diagnose the 5-Volt DTC before continuing.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [7](#)

2. THROTTLE POSITION SENSOR

Turn the ignition off.
 Disconnect the Throttle Body Assembly harness connector.
 Ignition on, engine not running.
 With the scan tool monitor the TP Sensor No.2 voltage.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the connector disconnect.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

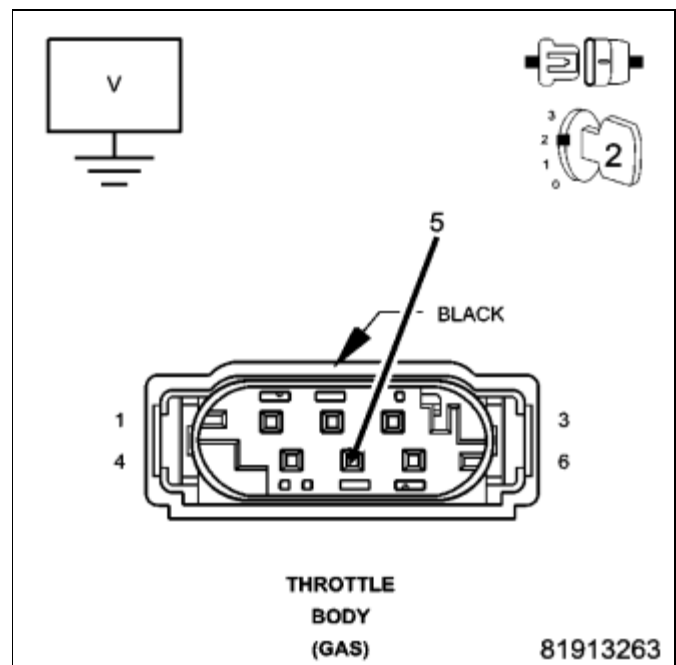
Is there any voltage present?

Yes

- Repair the short to voltage in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Measure the resistance between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.

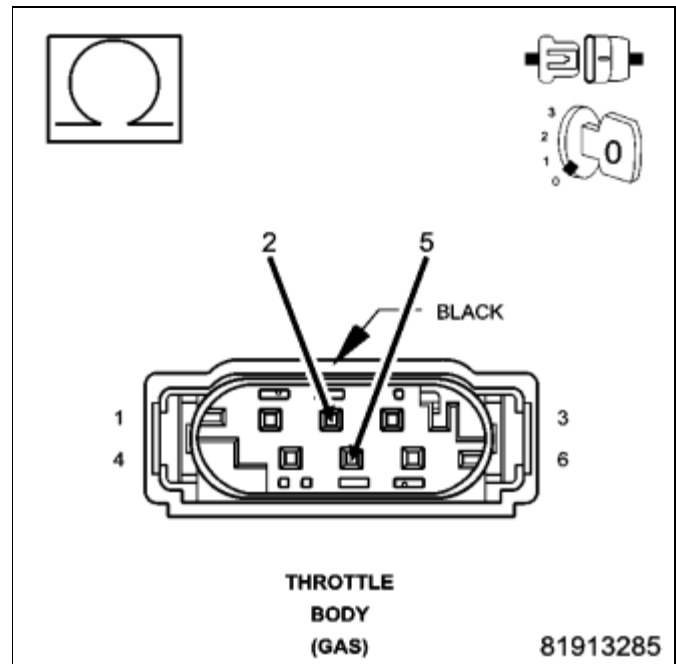
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. (K922) TP SENSOR GROUND CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K922) TP Sensor Ground circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

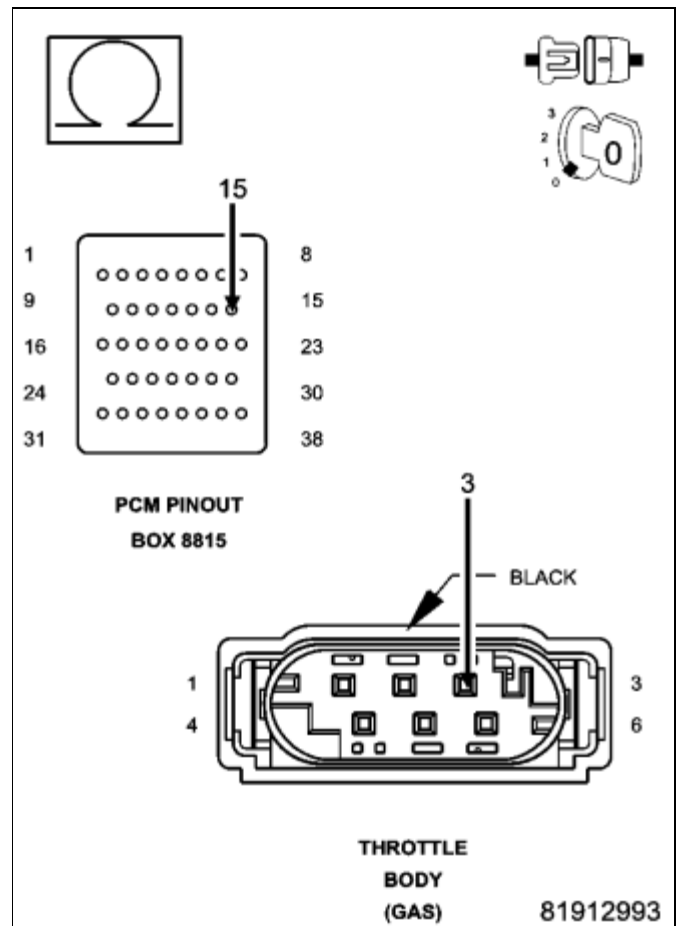
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K922) TP Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. THROTTLE FOLLOWER TEST

With the scan tool, perform the ETC Throttle Follower Test.

Monitor the TP Sensor No.2 voltage while slowly pressing the Throttle pedal down.

Is there a smooth voltage change from approximately 4.3 volts and decrease to approximately 0.7 of a volt?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0300-MULTIPLE CYLINDER MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
INJECTOR CONTROL CIRCUIT
COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector of the misfiring cylinders.

Disconnect the Fuel Injector harness connector of the misfiring cylinders.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil harness connector.

Remove the Spark Plug wire from the spark plug of the cylinder being tested.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Spark plug wire.

While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Does the Spark Plug have any problems?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/ replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow

these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)

10. FUEL INJECTOR

Turn the ignition off.

Disconnect the Fuel Injector harness connector of one of the cylinders detecting a mis-fire.

Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Fuel Injector harness connector.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes

- Repair the excessive resistance or short in the Injector Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the Ignition Coil harness connector.

Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit.

Crank the engine for 5 seconds while observing the test light.

Does the test light brightly blink/flicker?

Yes

- Verify that there is good pin to terminal contact in the related Coil and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the Coil Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Coil Control circuit?

Yes

- Repair the Coil Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)

16. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0301-CYLINDER 1 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR 1 CONTROL CIRCUIT
(K19) COIL CONTROL 1 CIRCUIT
IGNITION WIRE

SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

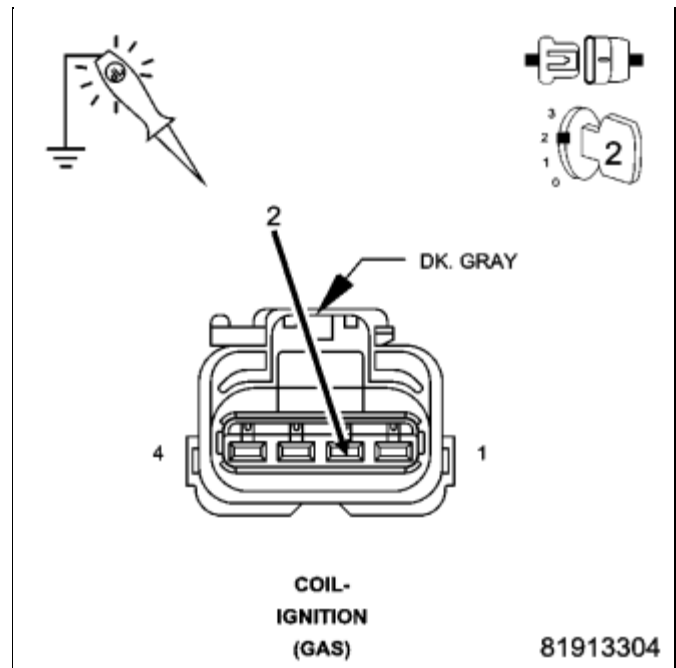
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.
 Disconnect the Ignition Coil harness connector.
 Disconnect the Fuel Injector No.1 harness connector.
 Ignition on, engine not running.
 With the scan tool, actuate the ASD Relay.
 Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the ASD Relay is actuating.

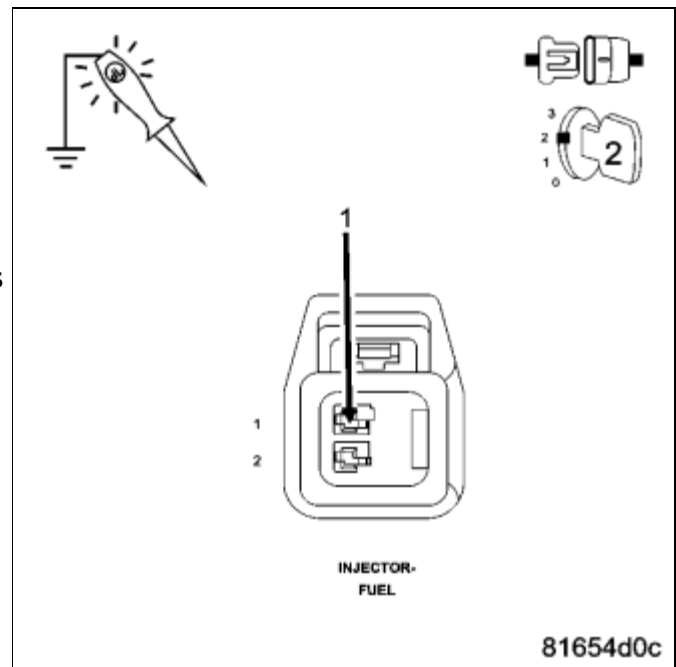
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
 Connect the Ignition Coil harness connector.
 Remove the Ignition wire from the Cylinder 1 Spark Plug.
 Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
 Install a spark tester on the Ignition wire.
 While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Turn the ignition off.
Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.
Install the fuel pressure gauge.
Start the engine and allow the fuel system to reach maximum pressure.
Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.
Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi).

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.1 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.1 Fuel Injector harness connector.

Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K11) INJECTOR 1 CONTROL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform

diagnosis.

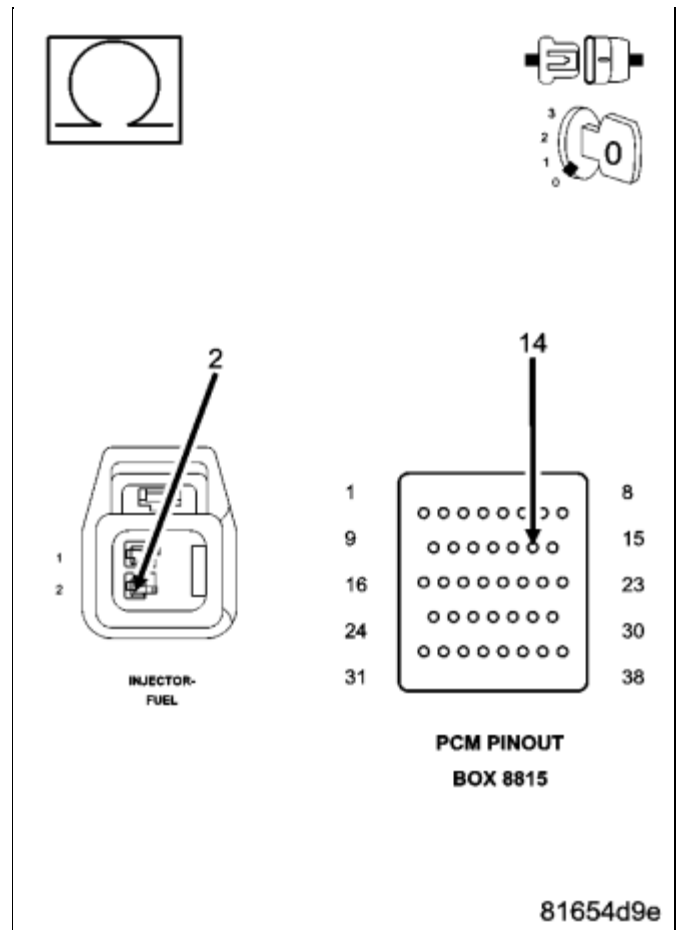
Check the (K11) Injector 1 Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the (K11) Injector Control No.1 circuit?**Yes**

- Repair the excessive resistance or short in the (K11) Injector 1 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?**Yes**

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 1 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 1 Ignition wire.

Is the resistance above 22.5K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K19) Coil Control 1 circuit.
Crank the engine for 5 seconds while observing the test light.

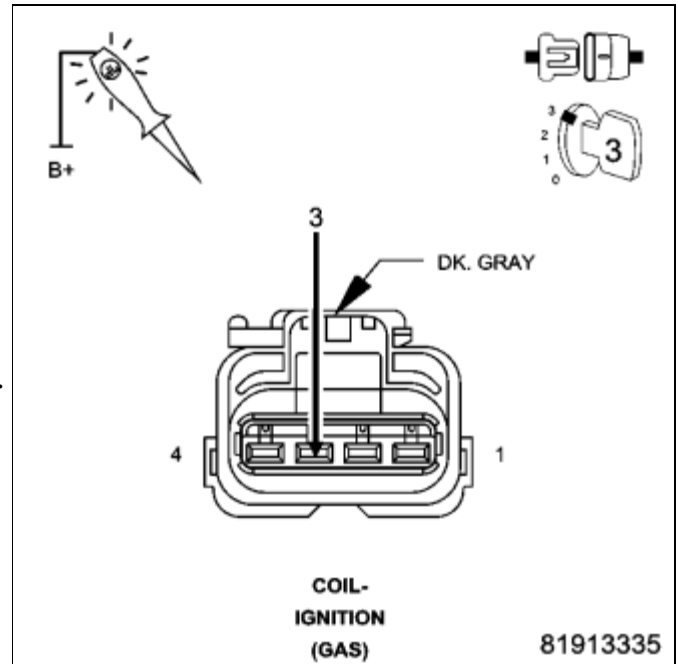
Does the test light brightly blink/flicker while the engine was cranking?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)



16. (K19) COIL CONTROL 1 CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K19) Coil Control 1 circuit for an open, short to ground, and short to voltage.

Was a problem found with the (K19) Coil Control 1

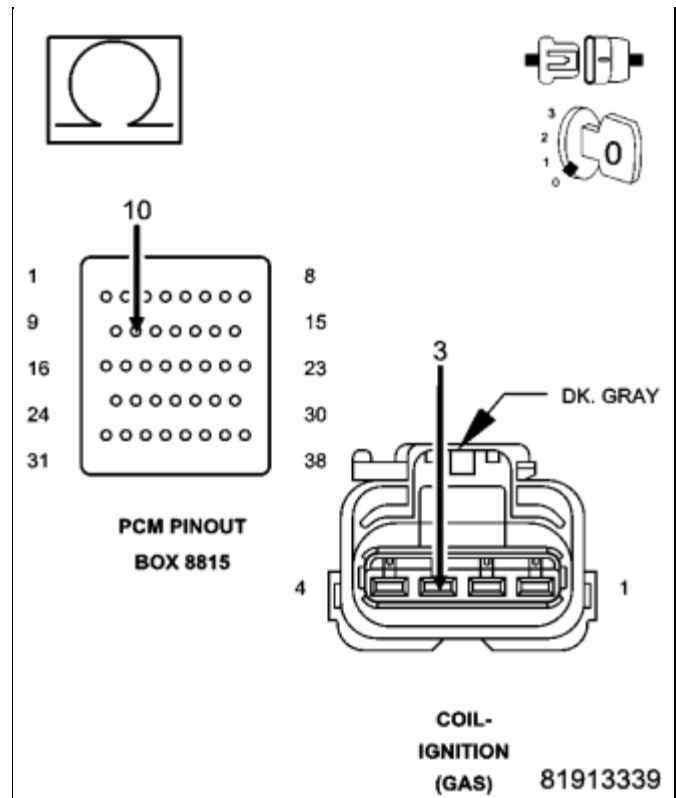
circuit?

Yes

- Repair the (K19) Coil Control 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0302-CYLINDER 2 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR 2 CONTROL CIRCUIT
(K17) COIL CONTROL 2 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.
Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

Were any of the above conditions present?

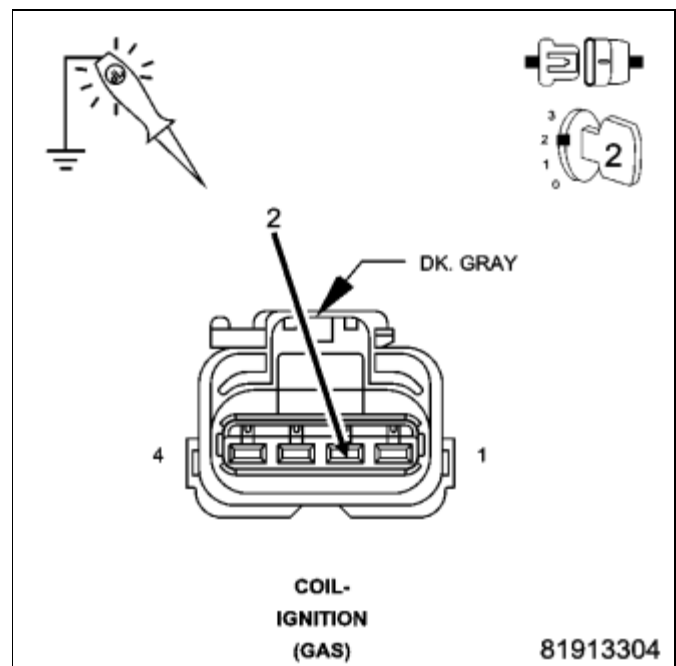
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the Fuel Injector No.2 harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the ASD Relay is actuating.

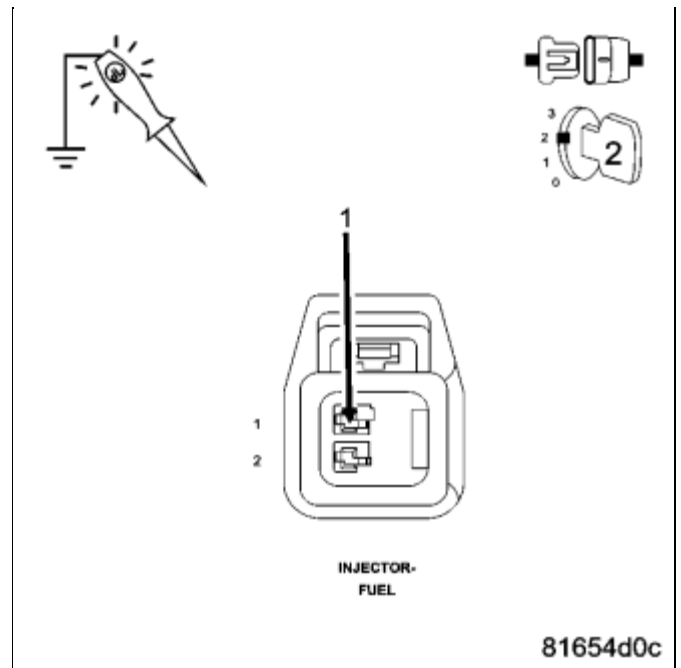
Does the test light illuminate brightly?

Yes

Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition harness connector.

Remove the Ignition wire from the Cylinder 2 Spark Plug.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition wire.

While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.
 Remove the Spark Plug.
 Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
 Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.
 Using scan tool, actuate the No.2 Fuel Injector.
 Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
 ENGINE VACUUM - must be at least 13 inches in neutral
 ENGINE VALVE TIMING - must be within specifications
 ENGINE COMPRESSION - must be within specifications
 ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
 ENGINE PCV SYSTEM - must flow freely
 TORQUE CONVERTER STALL SPEED - must be within specifications
 POWER BRAKE BOOSTER - no internal vacuum leaks
 FUEL - must be free of contamination
 CAM LOBES - must not be worn excessively
 CYLINDER LEAKAGE TEST - must be within specifications
 VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.
 Disconnect the No.2 Fuel Injector harness connector.
 Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's

Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K12) INJECTOR 2 CONTROL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K12) Injector 2 Control circuit for an open, short to ground, and short to voltage.

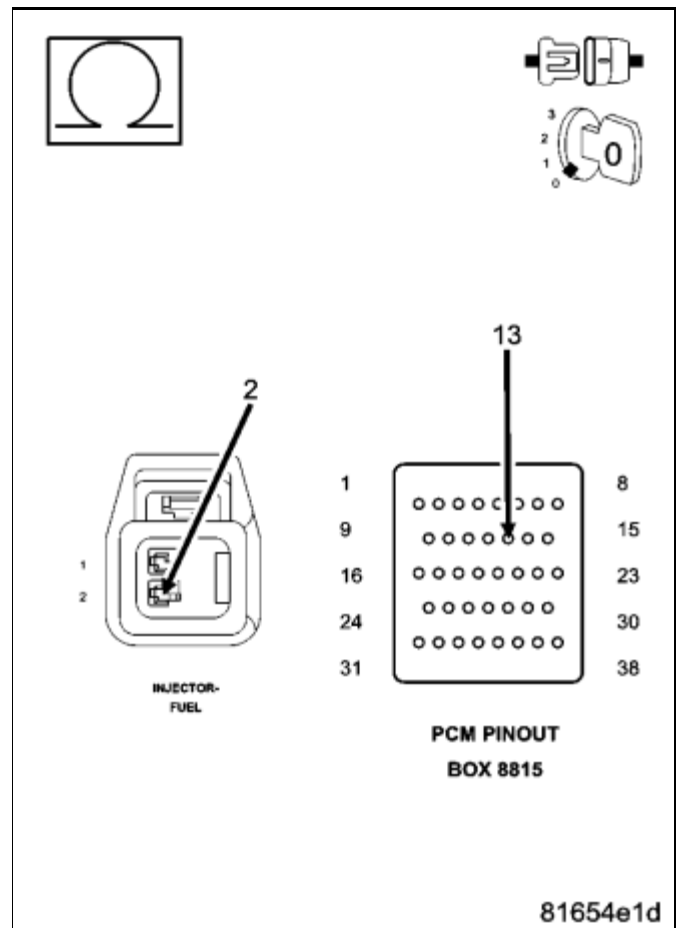
Was a problem found with the (K12) Injector 2 Control circuit?

Yes

- Repair the excessive resistance or short in the (K12) Injector 2 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 2 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 2 Ignition wire.

Is the resistance above 22.8K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

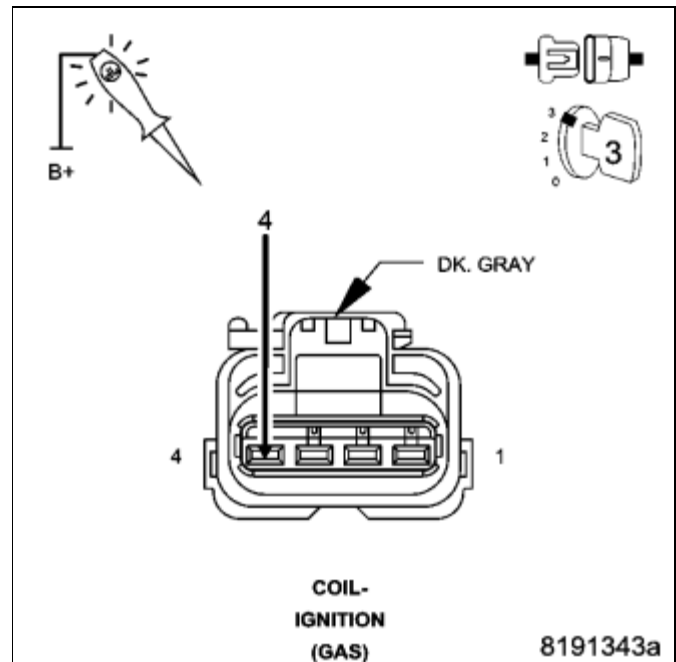
Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control 2 circuit.
Crank the engine for 5 seconds.

Does the test light brightly blink/flicker while the engine is cranking?

Yes

- Verify that there is good pin to terminal contact in the related Coils and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No



- Go To [16](#)

16. (K17) COIL CONTROL 2 CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K17) Coil Control 2 circuit for an open, short to ground, and short to voltage.

Was a problem found with the (K17) Coil Control 2 circuit?

Yes

- Repair the (K17) Coil Control 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

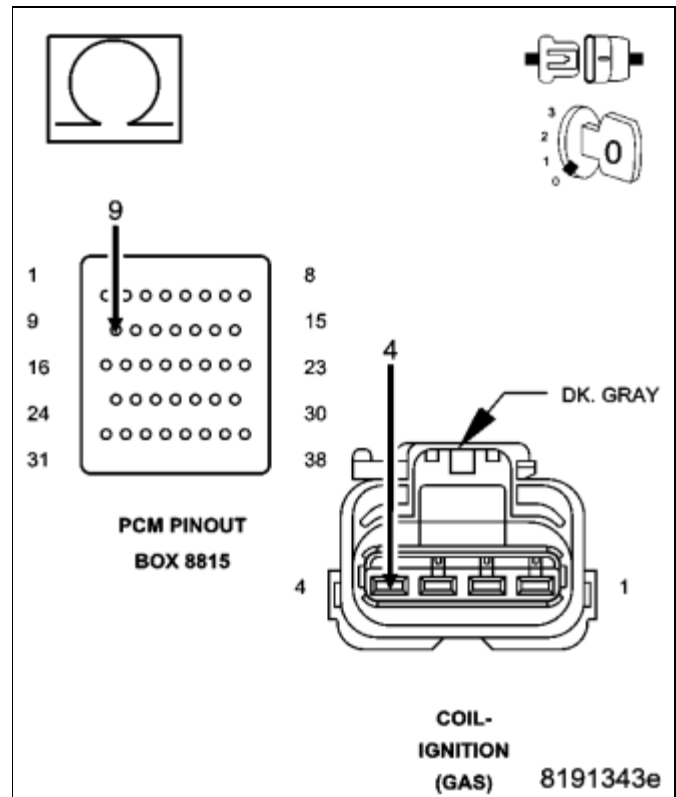
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No



- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0303-CYLINDER 3 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR 3 CONTROL CIRCUIT
(K18) COIL CONTROL 3 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.

- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys.
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

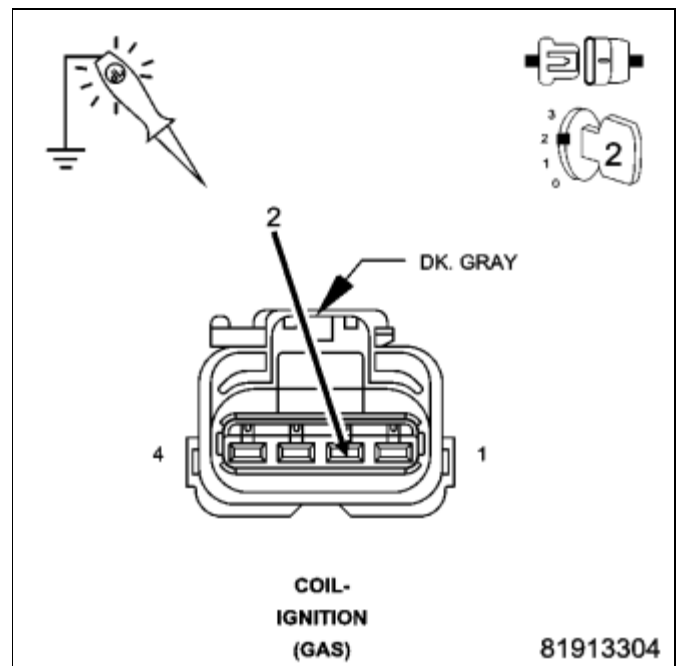
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the ASD Relay is actuating.

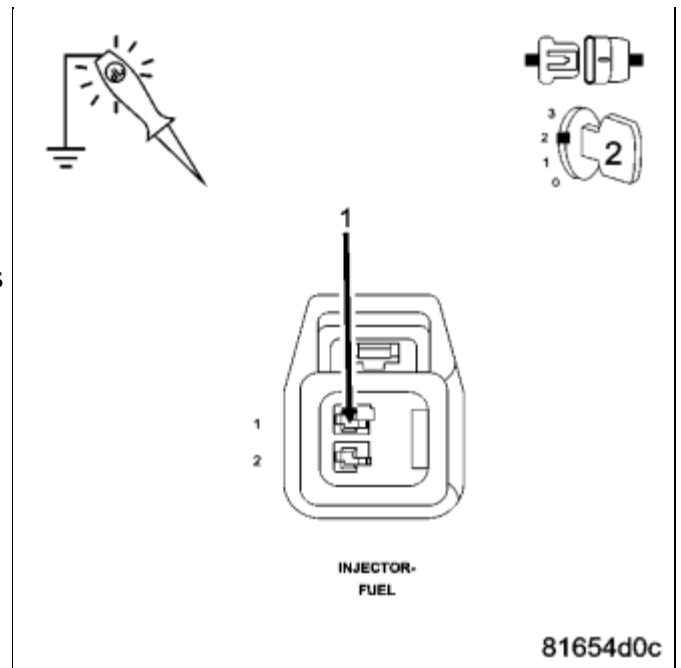
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition coil harness connector.

Remove the Ignition wire from the Cylinder 3 Spark Plug.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition wire.

While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi).

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.
 Using a scan tool, actuate the No.3 Fuel Injector.
 Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
 ENGINE VACUUM - must be at least 13 inches in neutral
 ENGINE VALVE TIMING - must be within specifications
 ENGINE COMPRESSION - must be within specifications
 ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
 ENGINE PCV SYSTEM - must flow freely
 TORQUE CONVERTER STALL SPEED - must be within specifications
 POWER BRAKE BOOSTER - no internal vacuum leaks
 FUEL - must be free of contamination
 CAM LOBES - must not be worn excessively
 CYLINDER LEAKAGE TEST - must be within specifications
 VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.
 Disconnect the No.3 Fuel Injector harness connector.
 Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's

Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K13) INJECTOR 3 CONTROL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K13) Injector 3 Control circuit for an open, short to ground, and short to voltage.

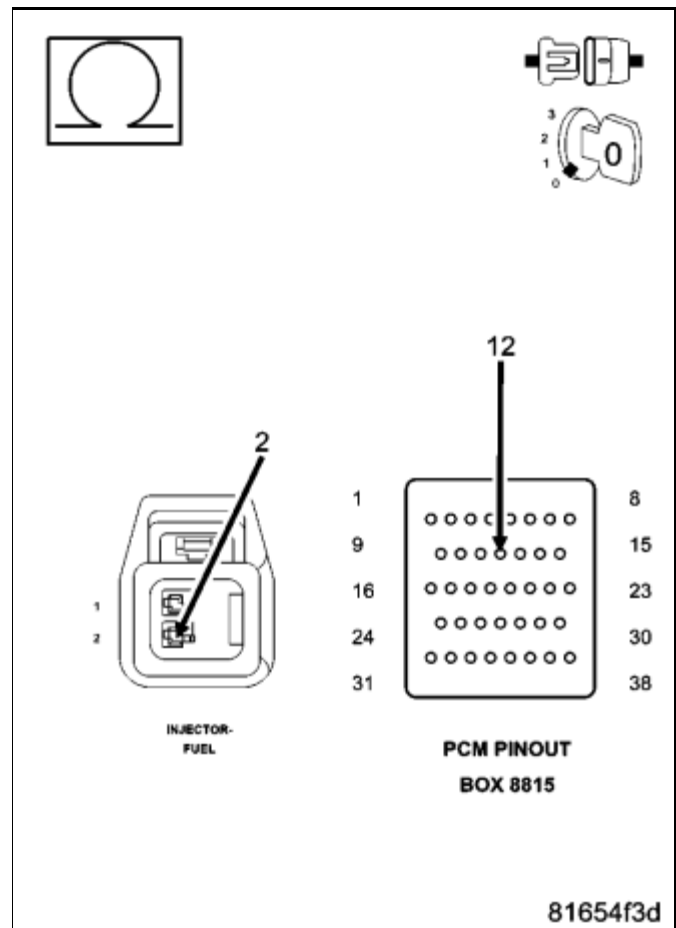
Was a problem found with the (K13) Injector 3 Control circuit?

Yes

- Repair the excessive resistance or short in the (K13) Injector 3 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 3 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 3 Ignition wire.

Is the resistance above 19.3K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

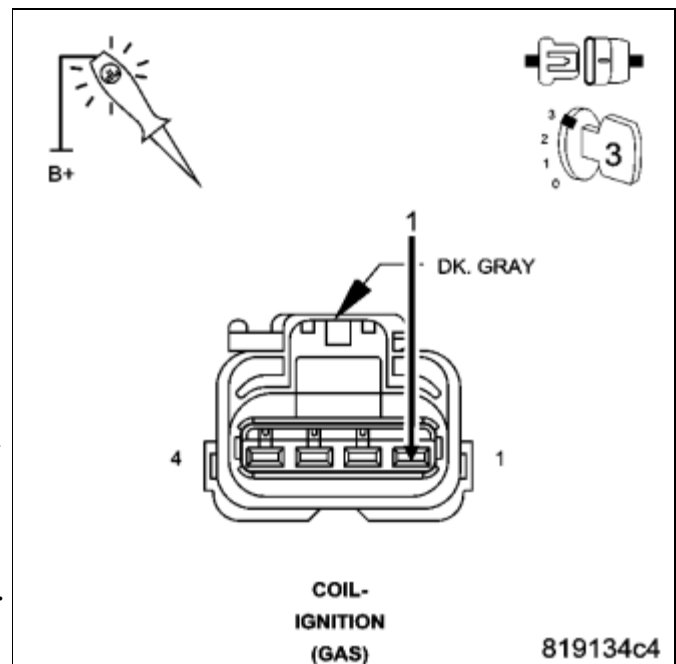
15. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the No.3 Ignition Coil harness connector. Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control 3 circuit.

NOTE: Make sure the test light is probing the circuit before actuating the Coil or a DTC may set and not allow the actuation.

Crank the engine for 5 seconds while observing the test light.



Does the test light brightly blink/flicker while the engine is cranking?

Yes

- Verify that there is good pin to terminal contact in the related Coil and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)

16. (K18) COIL CONTROL 3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K18) Coil Control 3 circuit for an open, short to ground, and short to voltage.

Was a problem found with the (K18) Coil Control 3 circuit?

Yes

- Repair the (K18) Coil Control 3 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

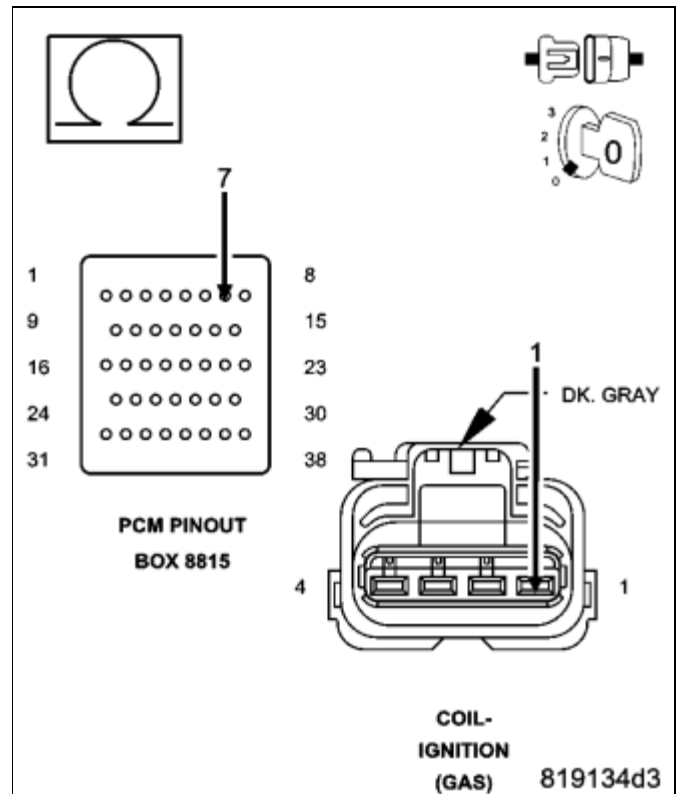
Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.



- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0304-CYLINDER 4 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR 4 CONTROL CIRCUIT
(K19) COIL CONTROL 1 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's

Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

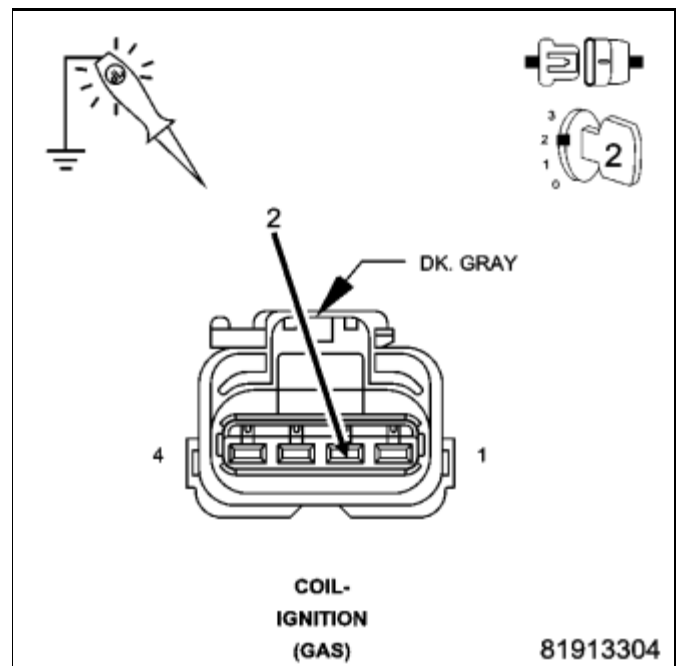
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.
 Disconnect the Ignition Coil harness connector.
 Disconnect the No.4 Fuel Injector harness connector.
 Ignition on, engine not running.
 With the scan tool, actuate the ASD Relay.
 Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the ASD Relay is actuating.

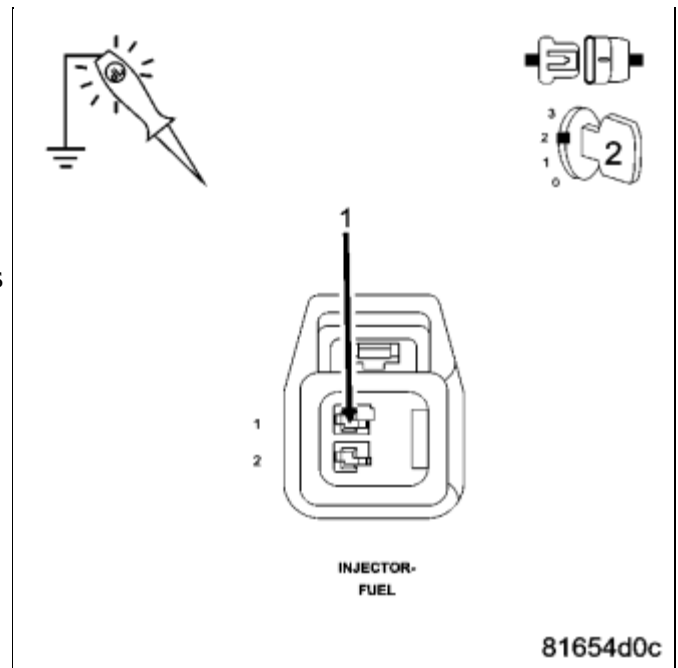
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
 Connect the Ignition Coil harness connector.
 Disconnect the Ignition wire from the Cylinder 4 Spark Plug.
 Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
 Install a spark tester on the Ignition wire.
 While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Turn the ignition off.
Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.
Install the fuel pressure gauge.
Start the engine and allow the fuel system to reach maximum pressure.
Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.
Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.
Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.
 Using the scan tool, actuate the No.4 Fuel Injector.
 Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
 ENGINE VACUUM - must be at least 13 inches in neutral
 ENGINE VALVE TIMING - must be within specifications
 ENGINE COMPRESSION - must be within specifications
 ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
 ENGINE PCV SYSTEM - must flow freely
 TORQUE CONVERTER STALL SPEED - must be within specifications
 POWER BRAKE BOOSTER - no internal vacuum leaks
 FUEL - must be free of contamination
 CAM LOBES - must not be worn excessively
 CYLINDER LEAKAGE TEST - must be within specifications
 VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.
 Disconnect the No.4 Fuel Injector harness connector.
 Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's

Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K14) INJECTOR 4 CONTROL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K14) Injector 4 Control circuit for an open, short to ground, and short to voltage.

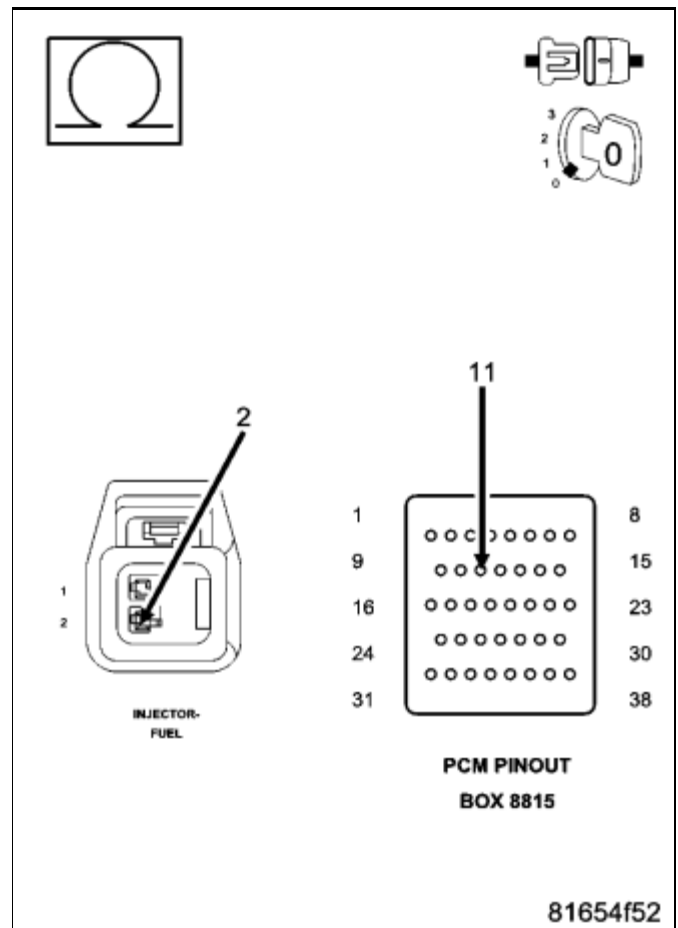
Was a problem found with the (K14) Injector 4 Control circuit?

Yes

- Repair the excessive resistance or short in the (K14) Injector 4 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 4 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 4 Ignition wire.

Is the resistance above 19.3K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K19) Coil Control 1 circuit.
With a scan tool, actuate the No.4 Ignition Coil.

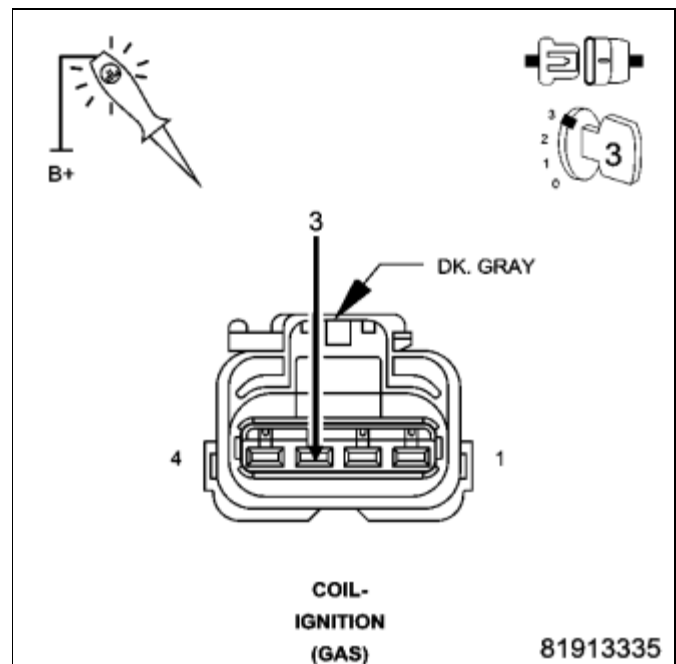
Does the test light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Coil and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)



16. (K19) COIL CONTROL 1 CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K19) Coil Control 1 circuit.
Crank the engine for 5 seconds while observing the test light.

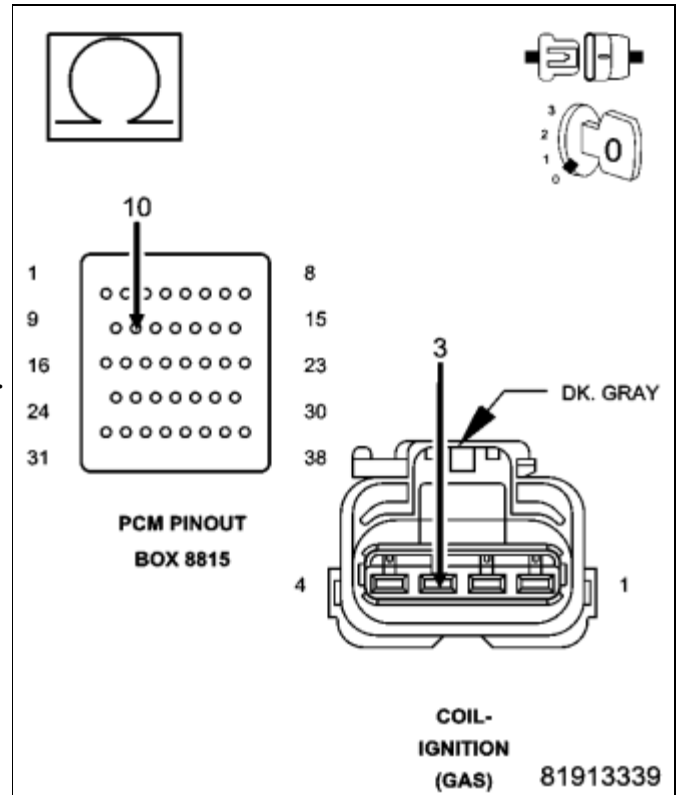
Does the test light brightly blink/flicker while the engine was cranking?

Yes

- Repair the (K19) Coil Control 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0305-CYLINDER 5 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR 5 CONTROL CIRCUIT
(K17) COIL CONTROL 2 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting

- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

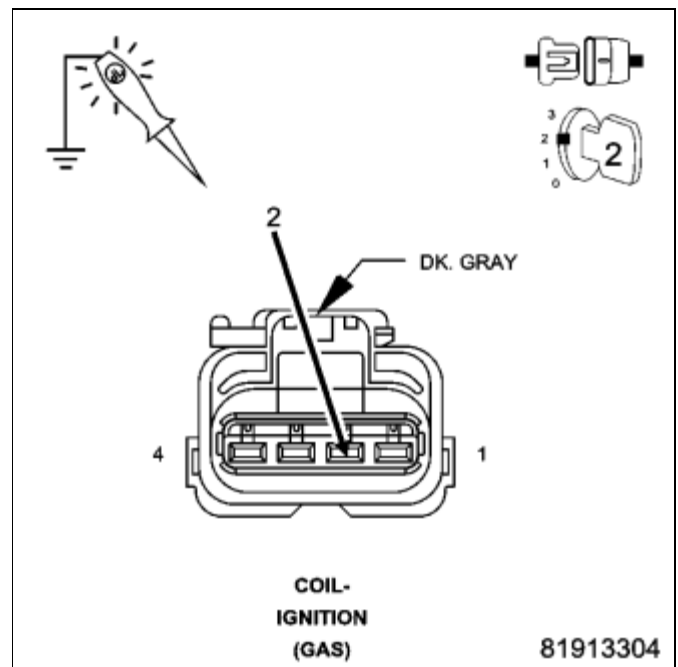
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

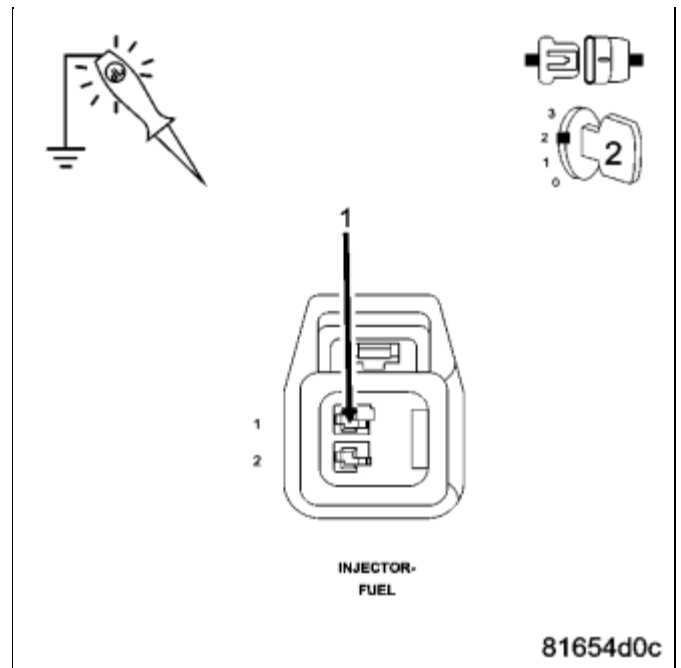
No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.
 Disconnect the Ignition Coil harness connector.
 Disconnect the No.5 Fuel Injector harness connector.
 Ignition on, engine not running.
 With the scan tool, actuate the ASD Relay .
 Using a 12-volt test light connected to ground, probe the
 (F342) ASD Relay Output circuit in the Ignition Coil harness
 connector and Fuel Injector harness connector while the
 ASD Relay is actuating.



Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil harness connector.

Disconnect the Ignition wire from the cylinder 5 spark plug.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition wire.

While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.
 Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.
 Install the fuel pressure gauge.
 Start the engine and allow the fuel system to reach maximum pressure.
 Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.
 Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi).

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.
 Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.
 Using the scan tool, actuate the No.5 Fuel Injector.
 Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
 ENGINE VACUUM - must be at least 13 inches in neutral
 ENGINE VALVE TIMING - must be within specifications
 ENGINE COMPRESSION - must be within specifications
 ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
 ENGINE PCV SYSTEM - must flow freely
 TORQUE CONVERTER STALL SPEED - must be within specifications
 POWER BRAKE BOOSTER - no internal vacuum leaks
 FUEL - must be free of contamination
 CAM LOBES - must not be worn excessively
 CYLINDER LEAKAGE TEST - must be within specifications
 VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.
 Disconnect the No.5 Fuel Injector harness connector.
 Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's

Injector Control circuit.

With the scan tool, erase DTCs.

Install an Injector Noid light.

With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K38) INJECTOR 5 CONTROL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K38) Injector 5 Control circuit for an open, short to ground, and short to voltage.

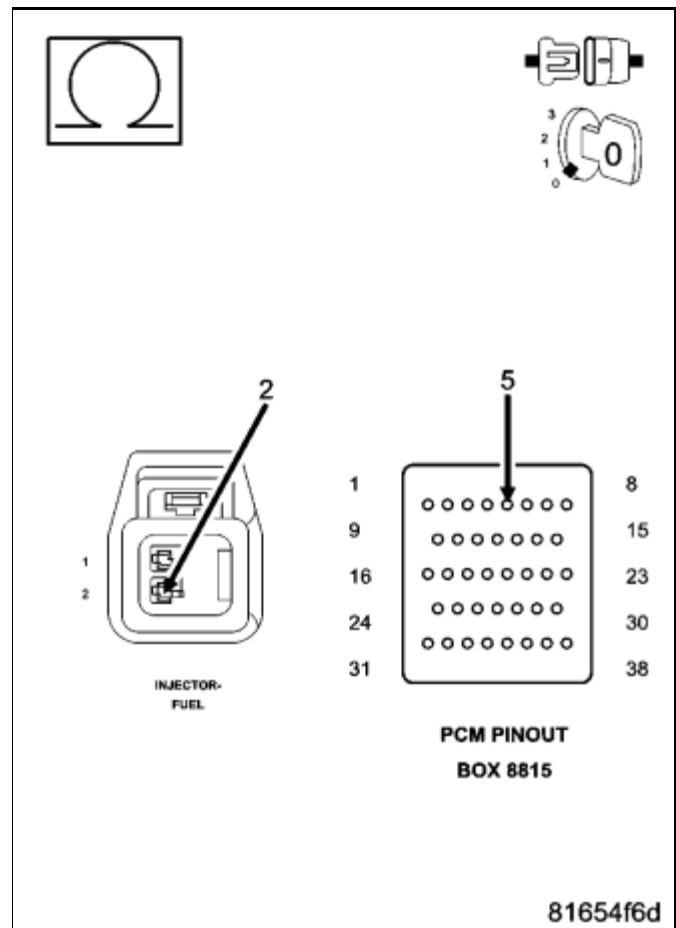
Was a problem found with the (K38) Injector 5 Control circuit?

Yes

- Repair the excessive resistance or short in the (K38) Injector 5 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 5 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 5 Ignition wire.

Is the resistance above 13.6K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. IGNITION COIL

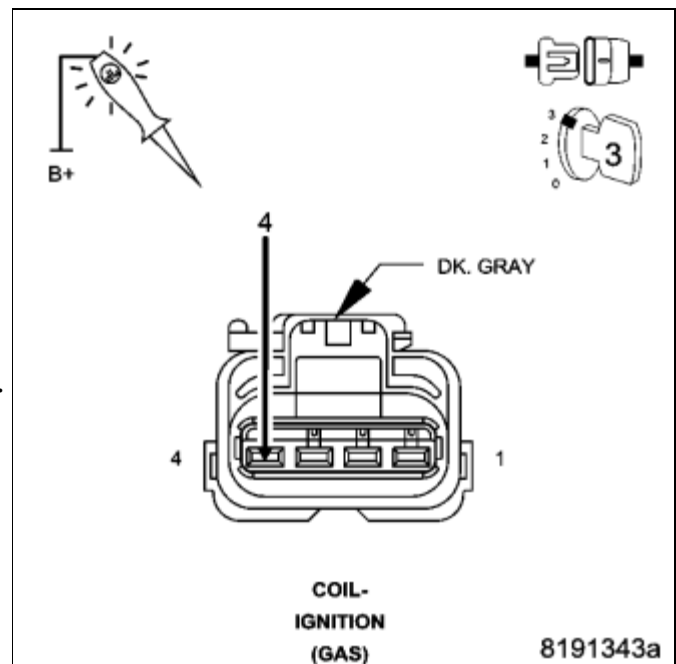
WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control 2 circuit.
Crank the engine for 5 seconds while observing the test light.

Does the test light brightly blink/flicker while the engine was cranking?

Yes

- Verify that there is good pin to terminal contact in the related Coil and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Go To [16](#)

16. (K17) COIL CONTROL 2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K17) Coil Control 2 circuit for an open, short to ground, and short to voltage.

Was a problem found with the (K17) Coil Control 2 circuit?

Yes

- Repair the (K17) Coil Control No.5 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

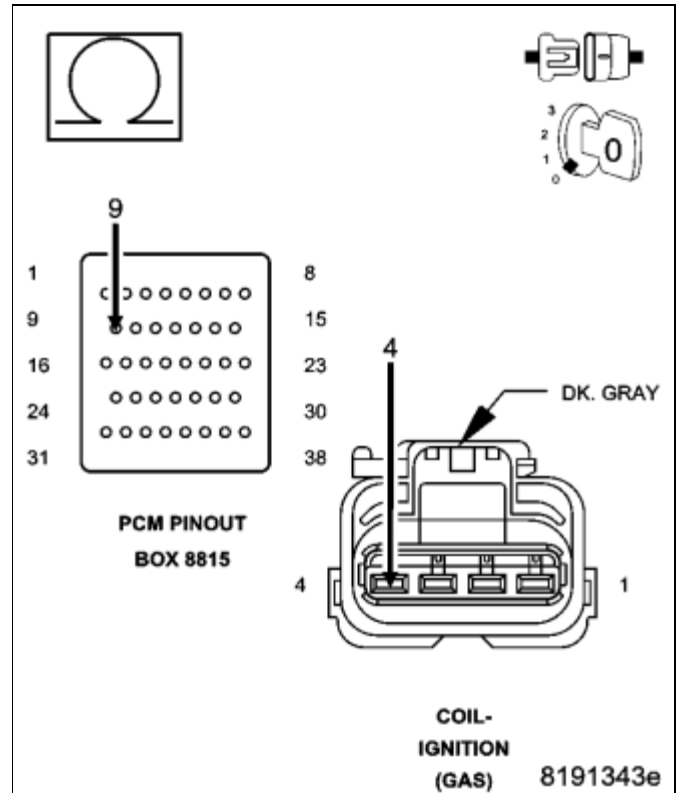
Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0306-CYLINDER 6 MISFIRE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Any time the engine is running, and the adaptive numerator has been successfully updated.

- **Set Condition:**

The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR 6 CONTROL CIRCUIT
(K18) COIL CONTROL 3 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose and repair any other active component or circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

Turn the ignition off.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ignition coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

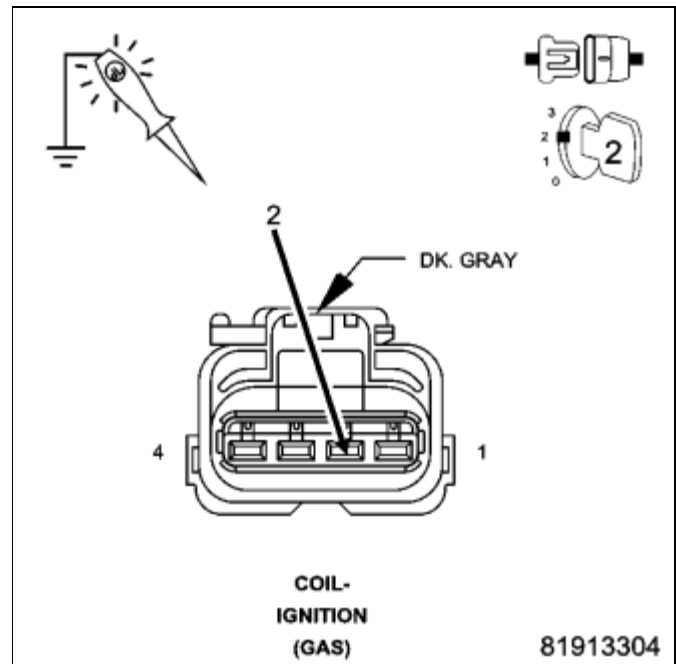
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. (F342) ASD RELAY OUTPUT CIRCUIT



Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay .
Using a 12-volt test light connected to ground, probe the (F342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the ASD Relay is actuating.

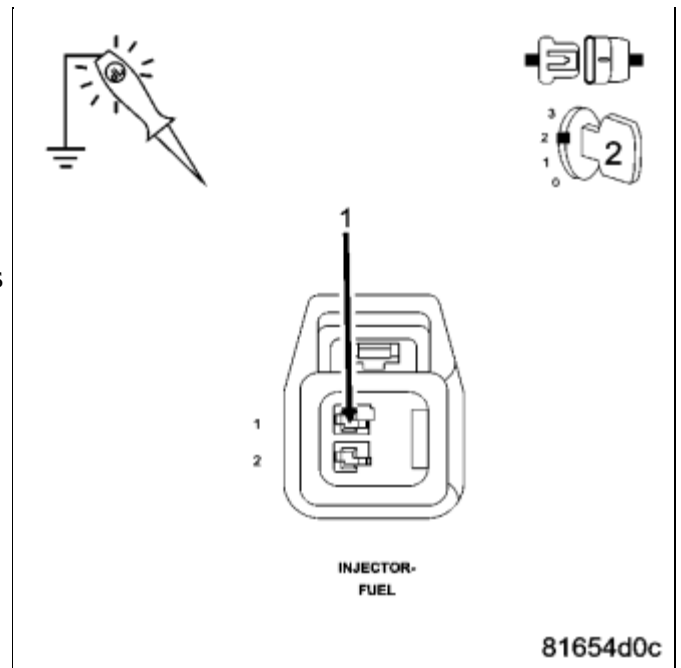
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance or short to ground in the (F342) ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Disconnect the Ignition wire from the spark plug.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition wire.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes

- Go To [5](#)

No

- Go To [14](#)

NOTE: Connect the Fuel Injector harness connector before continuing.

5. SPARK PLUG

Turn the ignition off.
 Remove the Spark Plug.
 Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broken electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes

- Replace the Spark Plug.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.
 Start the engine and observe the fuel pressure reading.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [7](#)

Below Specification

- Go To [12](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi).

Does the pressure fall below the listed specification?

Yes

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.6 Fuel Injector.
Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes

- Go To [9](#)

No

- Go To [10](#)

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)

10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinder's Injector Control circuit.

With the scan tool, erase DTCs.
 Install an Injector Noid light.
 With the scan tool, actuate the Fuel Injector.

Does the Noid light blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Injector and the Powertrain Control Module connectors. If OK, replace the Fuel Injector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)

11. (K58) INJECTOR 6 CONTROL CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K58) Injector 6 Control circuit for an open, short to ground, and short to voltage.

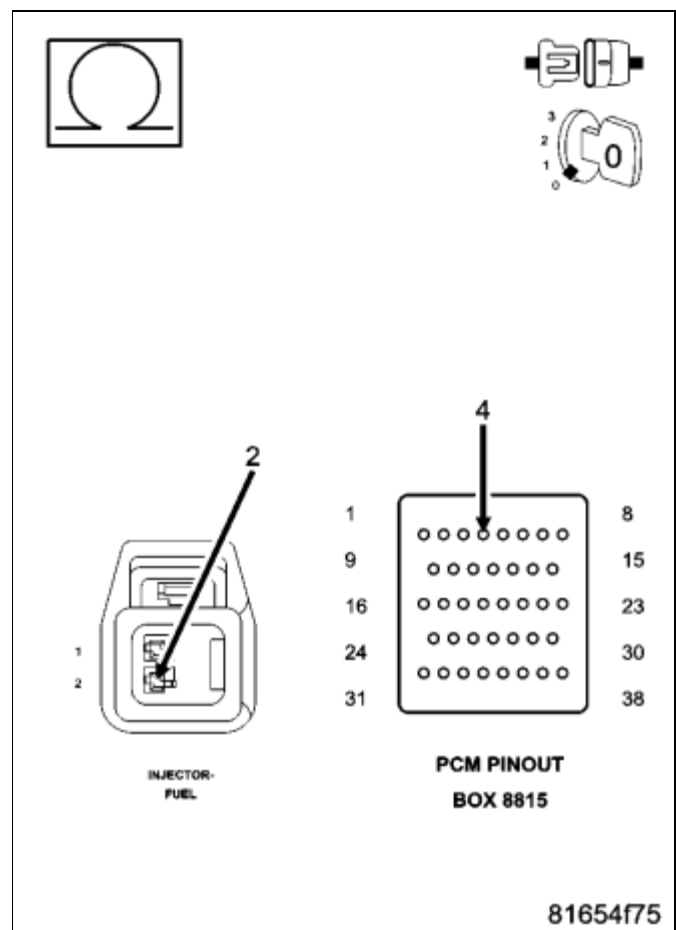
Was a problem found with the (K58) Injector 6 Control circuit?

Yes

- Repair the excessive resistance or short in the (K58) Injector 6 Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



12. FUEL SUPPLY LINE RESTRICTED

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. IGNITION WIRE

Disconnect the Cylinder 6 Ignition wire from the Ignition Coil and Spark Plug.

NOTE: Inspect both ends of the Ignition Wire and the terminals on the Spark Plug and Ignition Coil for excessive corrosion. Clean/Repair as necessary.

Measure the resistance of the Cylinder 6 Ignition wire.

Is the resistance above 16.4K ohms?

Yes

- Replace the Ignition Wire.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Disconnect the Ignition Coil harness connector.
Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control 3 circuit.
Using a scan tool, actuate the No.3 Ignition Coil.

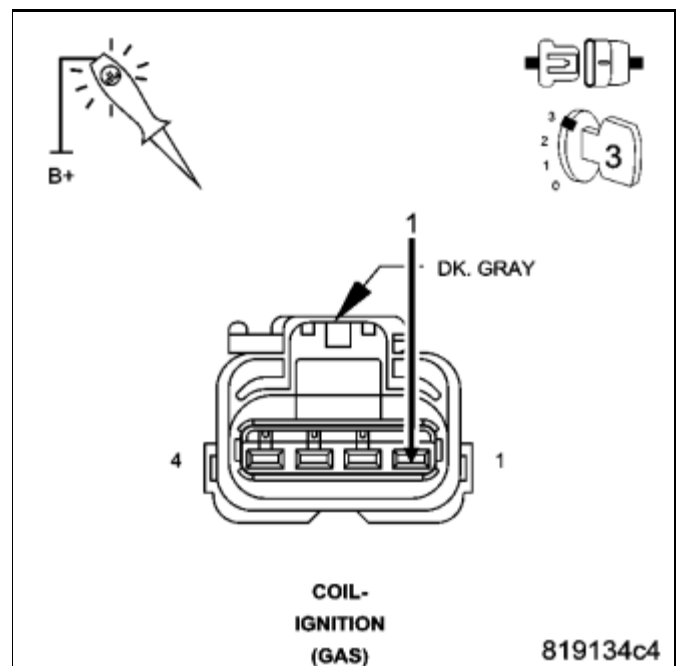
Does the test light brightly blink/flicker during the actuation?

Yes

- Verify that there is good pin to terminal contact in the related Coil and the Powertrain Control Module connectors. If OK, replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [16](#)



16. (K18) COIL CONTROL 3 CIRCUIT

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K18) Coil Control 3 circuit for an open, short to ground, and short to voltage.

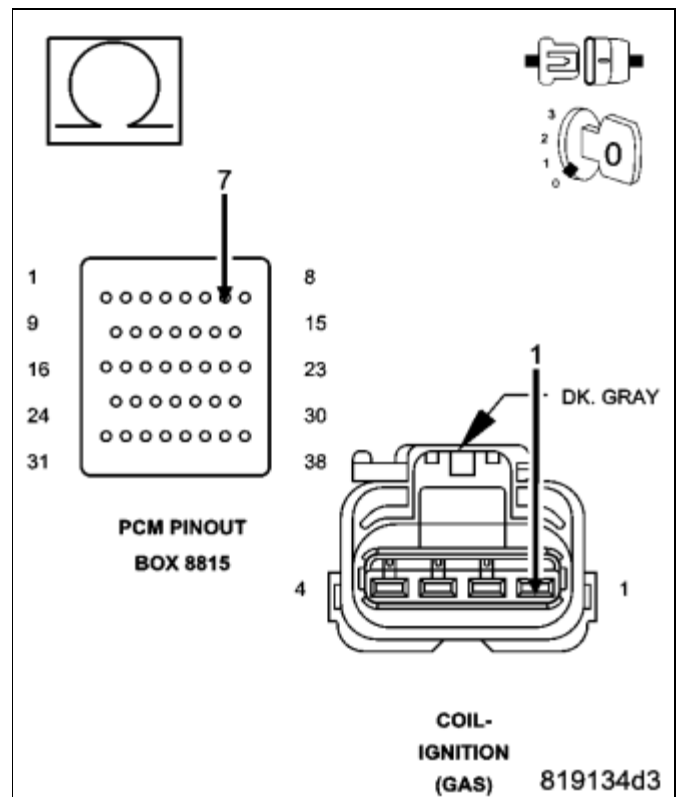
Was a problem found with the (K18) Coil Control No.3 circuit?

Yes

- Repair the (K18) Coil Control 3 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [17](#)



17. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor, Coil, Injector, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors, Coils, Injectors, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

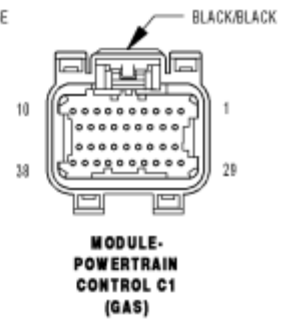
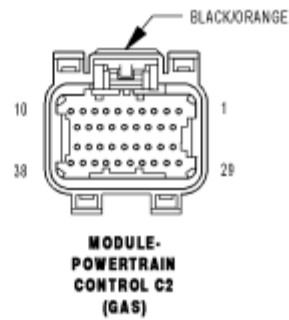
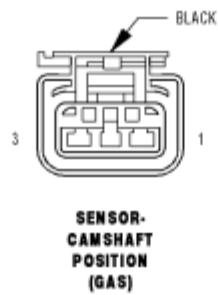
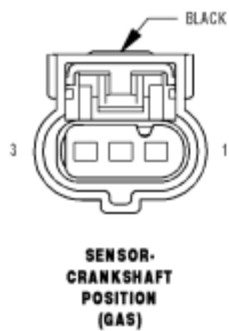
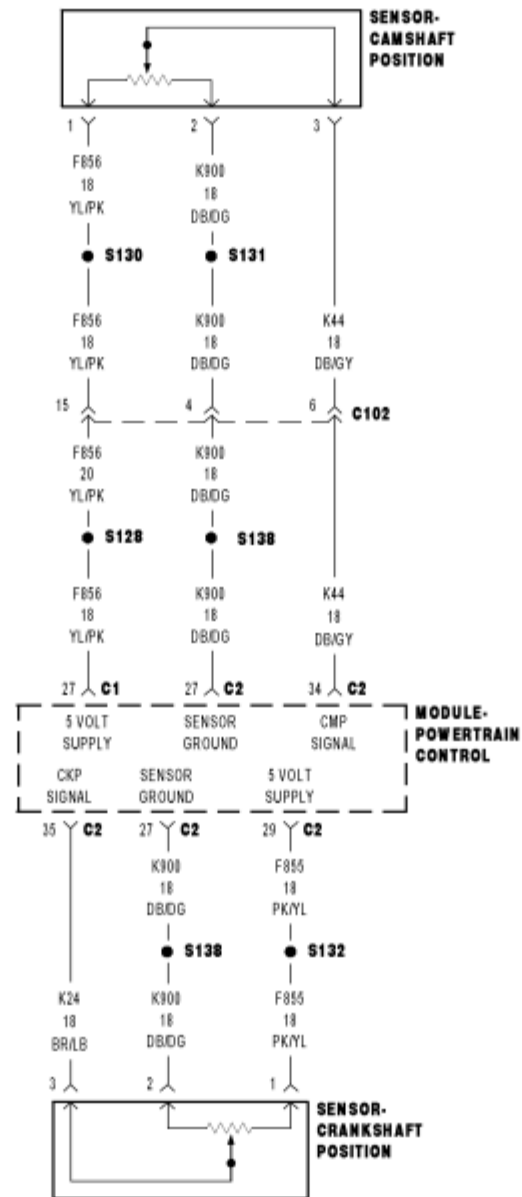
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0315-NO CRANK SENSOR LEARNED



01011274

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Under closed throttle decel and A/C off. ECT above 75° C (167° F). Engine start time is greater than 50 seconds.

◦ **Set Condition:**

One of the CKP sensor target windows has more than 2.86% variance from the reference. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
TONE WHEEL/PULSE RING
WIRE HARNESS
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, select View DTCs and read and record the related Freeze Frame data.

With a scan tool, clear DTCs, PCM battery disconnect to reset the PCM.

Start the engine.

If the MIL has not yet illuminated, test drive the vehicle to try to get the code to reset.

Does the code reset while cranking or during the test drive?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the CKP wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the CKP wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Make sure the Crankshaft Position Sensor is properly installed and the mounting bolt(s) are torqued to the proper specification.

Were any of the above conditions present?

Yes

- Repair as necessary
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)

3. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.
Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes

- Repair or replace the Tone Wheel/Flex Plate as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

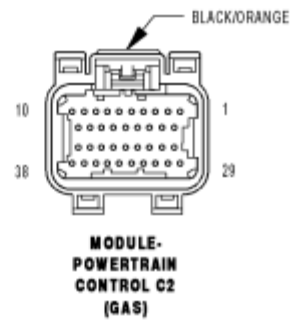
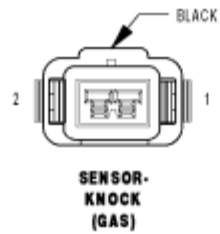
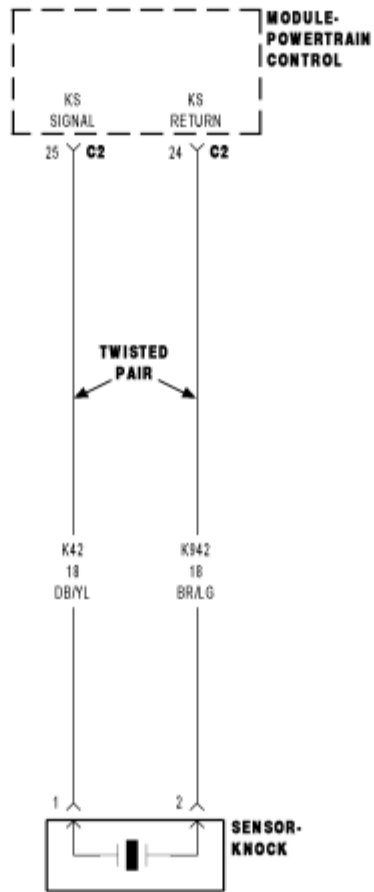
4. CRANKSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Sensor and Powertrain Control Module connectors. Replace the Crank Position Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0325-KNOCK SENSOR 1 CIRCUIT



819145a7

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Knock is the spontaneous auto-ignition of the remaining fuel/air mixture in the engine combustion chamber that occurs after normal combustion has started. It can occur under extreme vehicle operating conditions such as high engine temperature, high MAP, low humidity, and heavy loads to the engine. Knock is caused by excessive spark advance for the given engine operating conditions. Severe, continuous knock may be caused by carbon deposits, bad gasoline, and/or low octane fuel. Avoiding light audible knock is important for customer satisfaction while preventing excessive knock is important to protect engine components. The output voltage from the knock circuit represents the strength of the engine knock and is read by the engine controller. The knock system output voltage is not zero due to engine background noise, even when knock is not present. When the engine is operated under high load conditions where knock is possible, the knock voltage is tested to decide if it exceeds the knock voltage threshold. Knock has occurred when the knock voltage is at or above this knock threshold. When knock is detected a calibrated short term knock spark retard to be subtracted from the spark advance is calculated. The amount of retarded spark advance is based off a calibrated severity of the knock event. This retarded spark advance is used in the next ignition event to prevent further knock events. If knock continues, an additional amount of short term spark advance retard is added. When knock stops, short term knock spark retard is eliminated, the long term knock spark retard is reduced by a calibrated amount to recover some previously retarded spark advance. This decreases spark retard to improve engine performance.

- **When Monitored:**

This monitor runs above 2000 rpm, under open throttle conditions. The Knock diagnostic does not run at idle or during decelerations. The high voltage test runs all the times the engine is running.

- **Set Condition:**

The PCM detects the Knock Sensor voltage out of limits. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K42) KS SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K42) KS SIGNAL CIRCUIT OPEN
(K942) KS RETURN CIRCUIT OPEN
(K42) KS SIGNAL CIRCUIT SHORTED TO THE (K942) KS RETURN CIRCUIT
(K42) KS SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K42) KS SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

Ignition on engine not running.

Measure the voltage on the (K42) KS Signal circuit in the Knock Sensor harness connector.

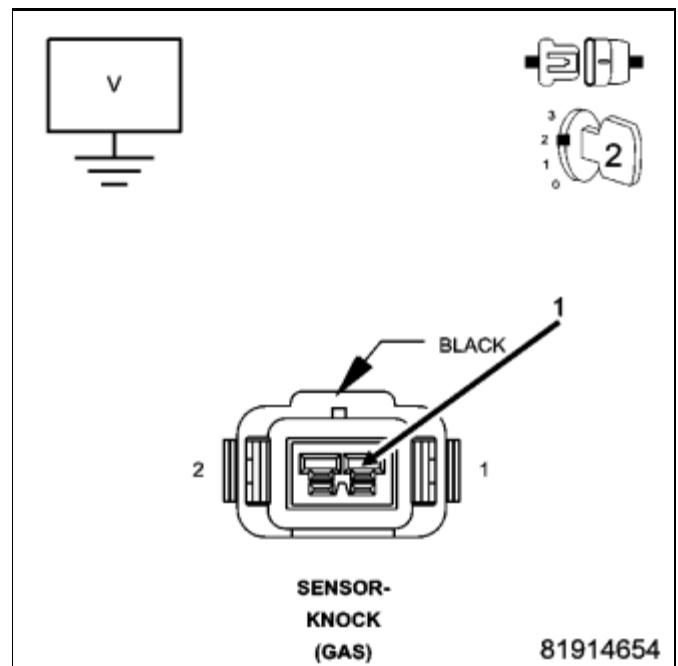
Is there any voltage present?

Yes

- Repair the short to voltage in the (K42) KS Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)



3. (K42) KS SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K42) KS Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

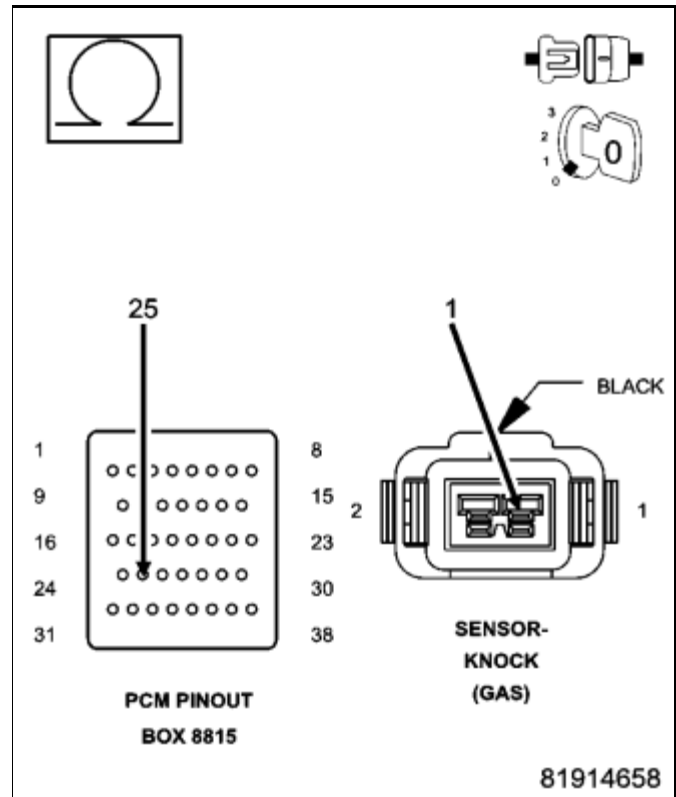
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K42) KS Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K942) KS RETURN CIRCUIT OPEN

Measure the resistance of the (K942) KS Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

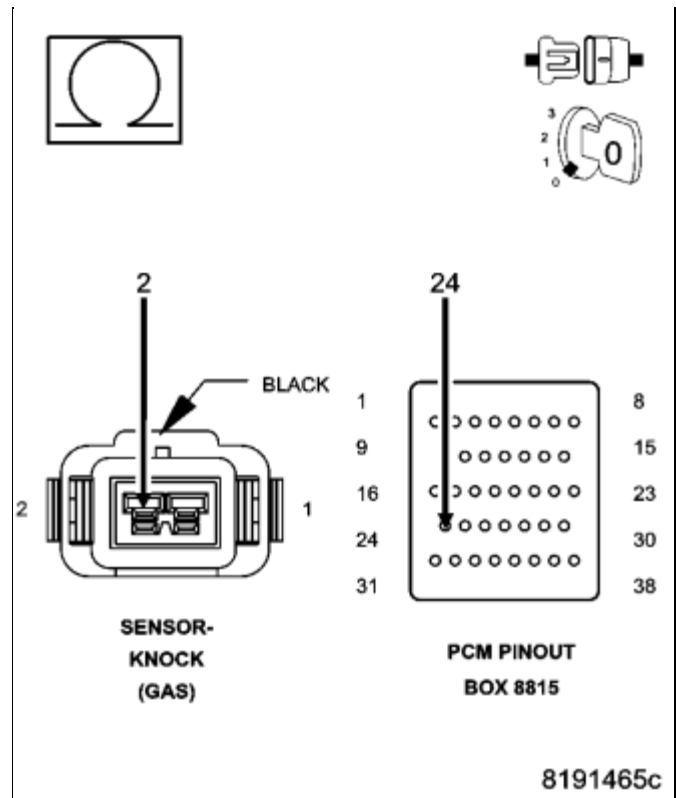
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K942) KS Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K42) KS SIGNAL CIRCUIT SHORTED TO THE (K942) KS RETURN CIRCUIT

Measure the resistance between the (K42) KS Signal circuit and the (K942) KS Return circuit in the Knock Sensor harness connector.

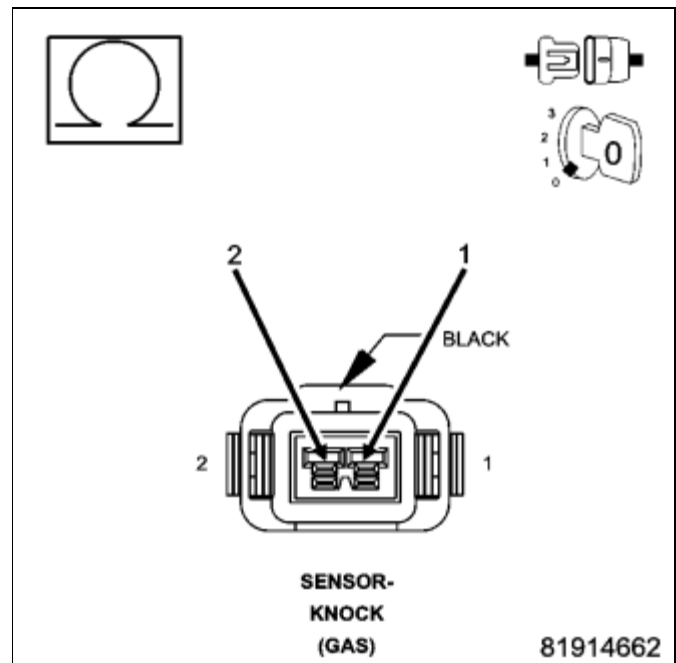
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K42) KS Signal circuit and the (K942) KS Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. (K42) KS SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K42) KS Signal circuit in the Knock Sensor harness connector.

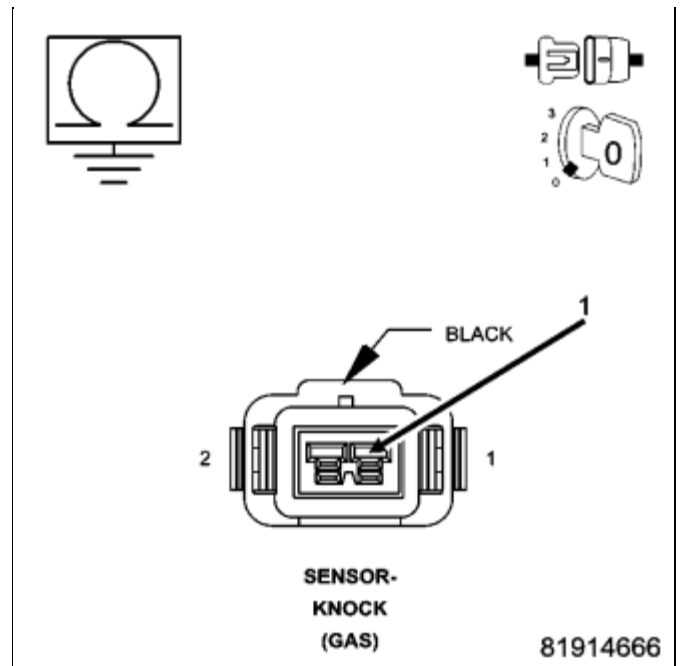
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K42) KS Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. KNOCK SENSOR 1

Verify that there is good pin to terminal contact at the Knock Sensor and the Powertrain Control Module connectors.

If no problems were found in the connectors, replace the Knock Sensor 1. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/KNOCK SENSOR - REMOVAL).

Connect the Powertrain Control Module (PCM) connector.

Turn the ignition on.

With the scan tool, clear DTCs.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to reset.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go to [8](#)

No

- Test complete.
- Perform the Powertrain Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. POWERTRAIN CONTROL MODULE (PCM)

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Knock Sensor 1 and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

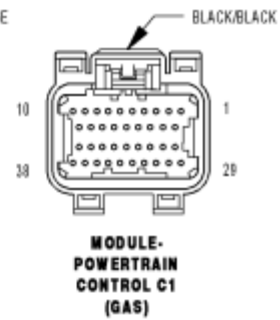
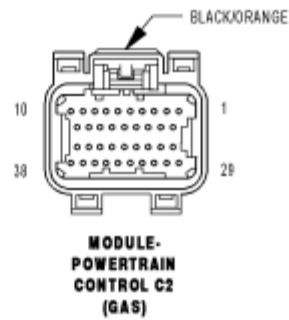
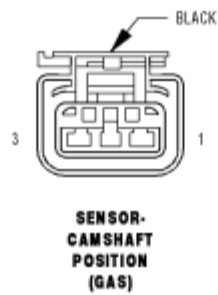
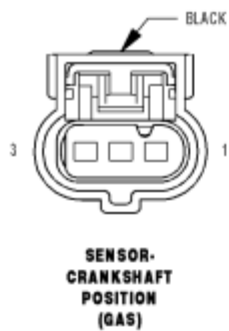
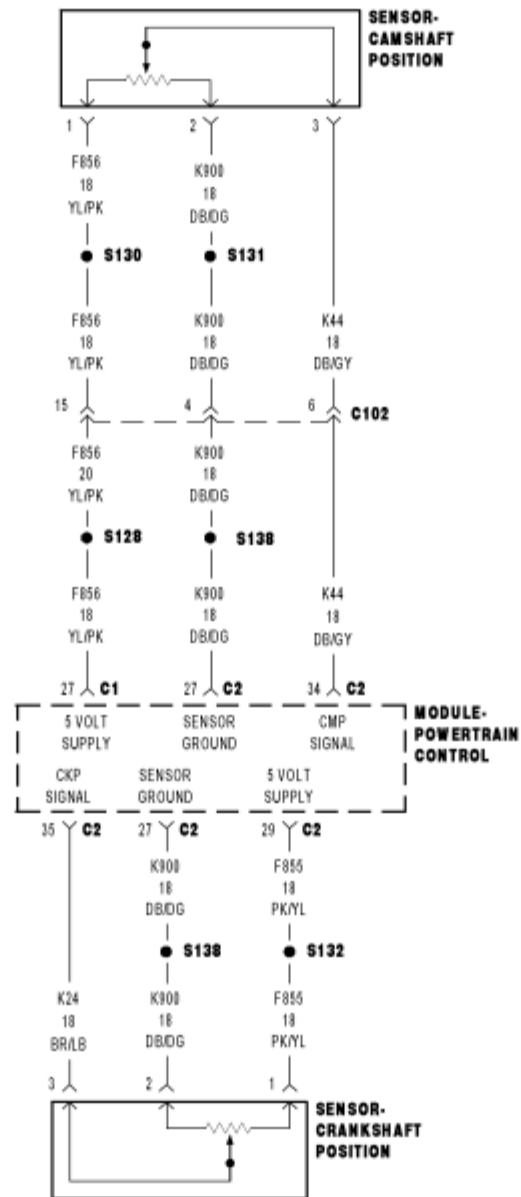
Yes

- Repair as necessary.
- Perform the Powertrain Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the Powertrain Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT



01011270

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine cranking.

◦ **Set Condition:**

No CKP signal is present during engine cranking, and at least 8 camshaft position sensor signals have occurred. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K24) CKP SIGNAL CIRCUIT SHORTED GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CRANKSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.

Ignition on, engine not running.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [14](#)

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

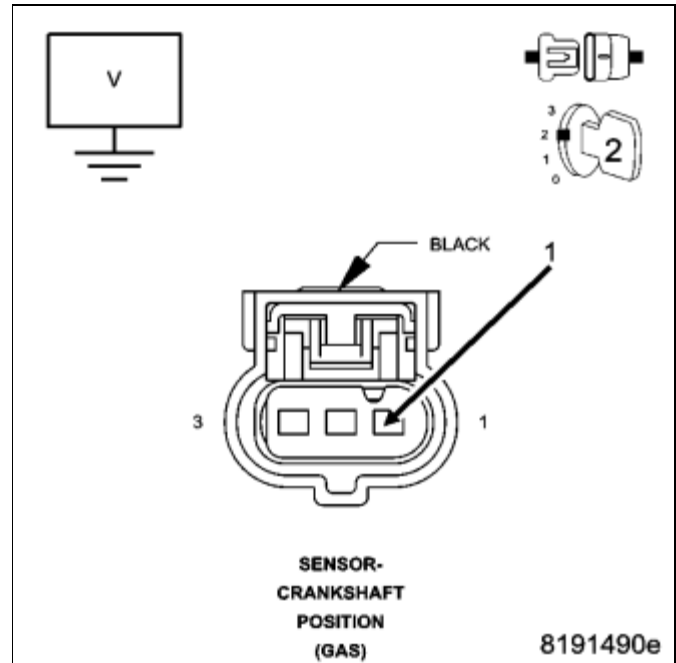
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [10](#)



3. (K24) CKP SIGNAL CIRCUIT

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.

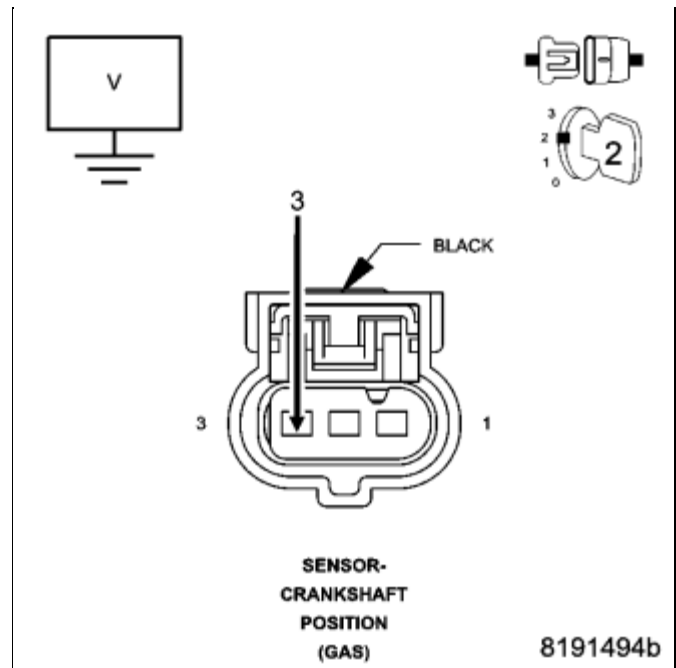
Is the voltage between 4.5 and 5.0 volts?

Yes

- Go To [4](#)

No

- Go To [7](#)



4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

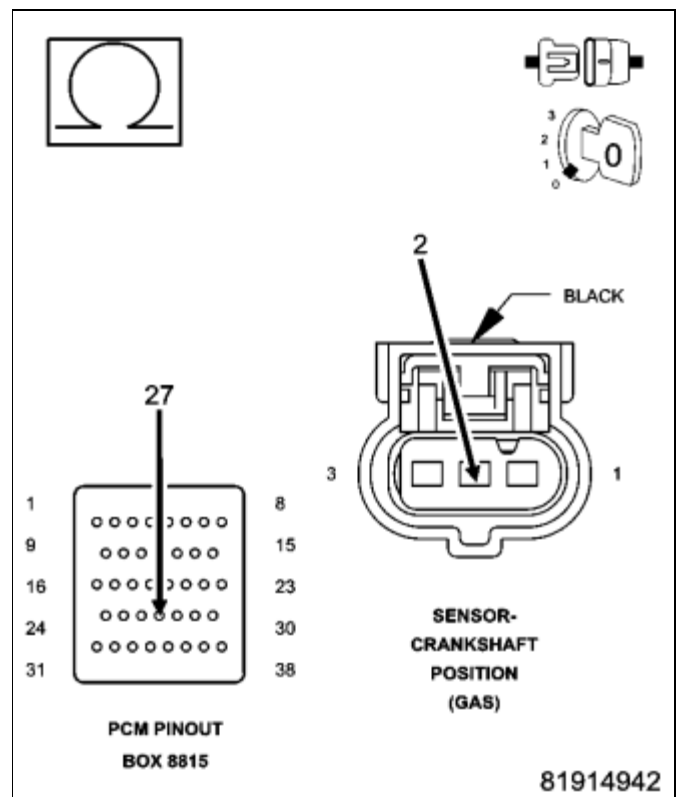
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

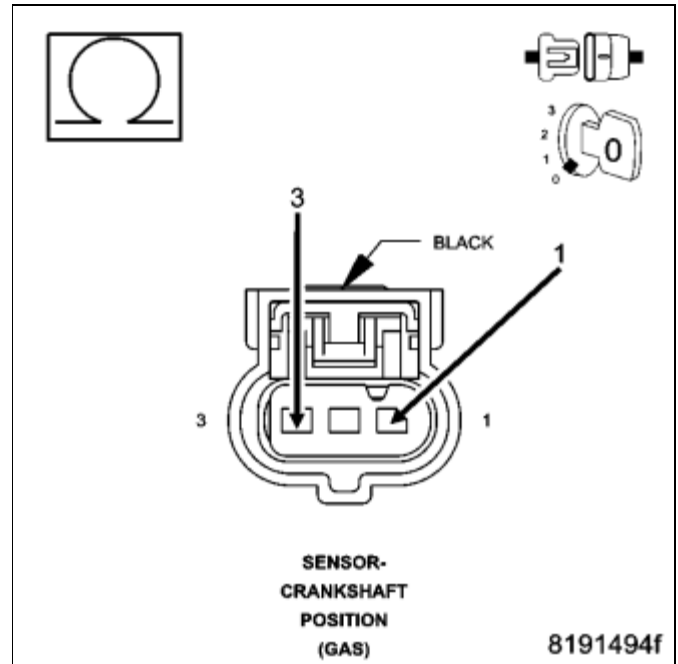
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. CRANKSHAFT POSITION SENSOR

NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Crank Position Sensor and Powertrain Control Module connectors. Replace the Crank Position Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K24) CKP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Is there any voltage present?

Yes

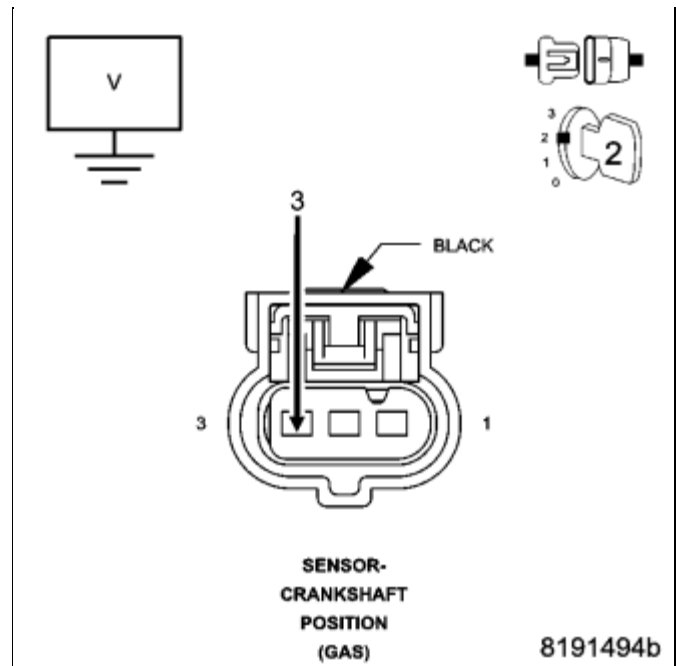
- Repair the short to voltage in the (K24) CKP Signal

circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K24) CKP Signal circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

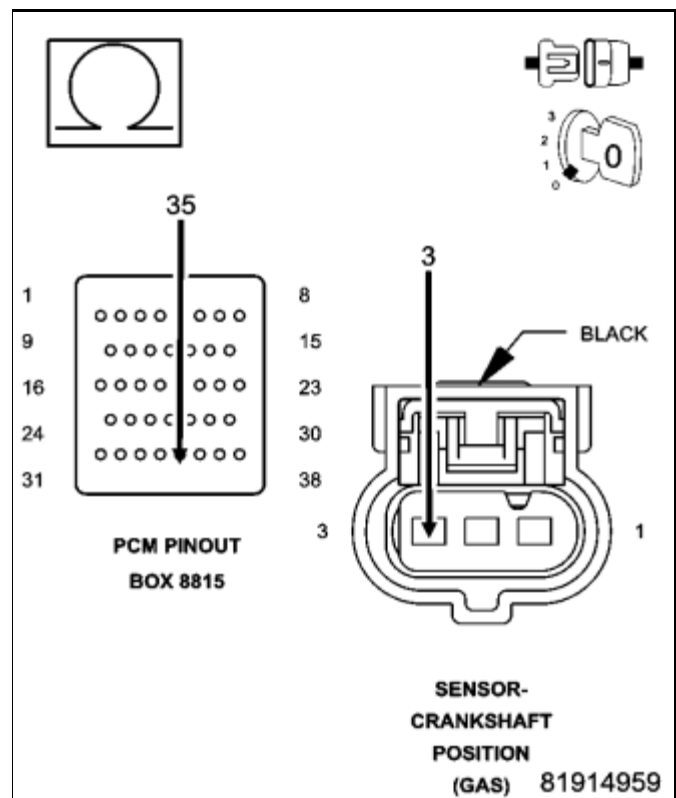
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K24) CKP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

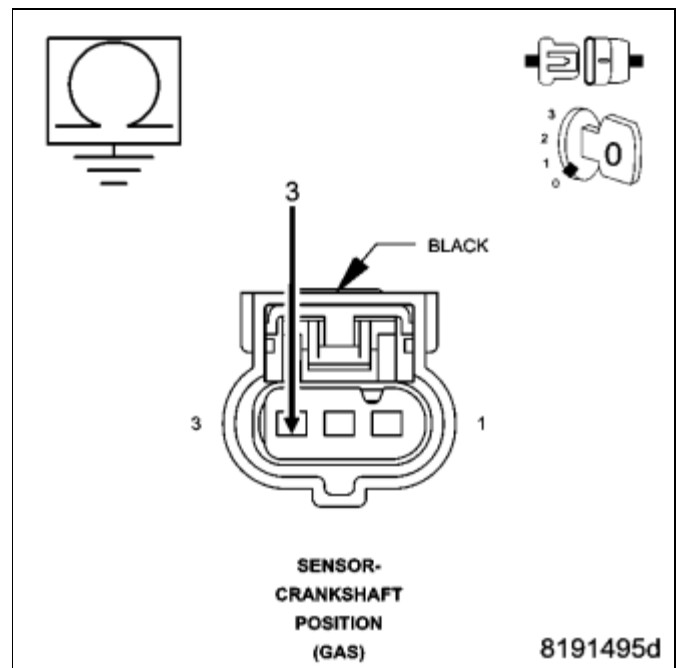
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K24) CKP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)



10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

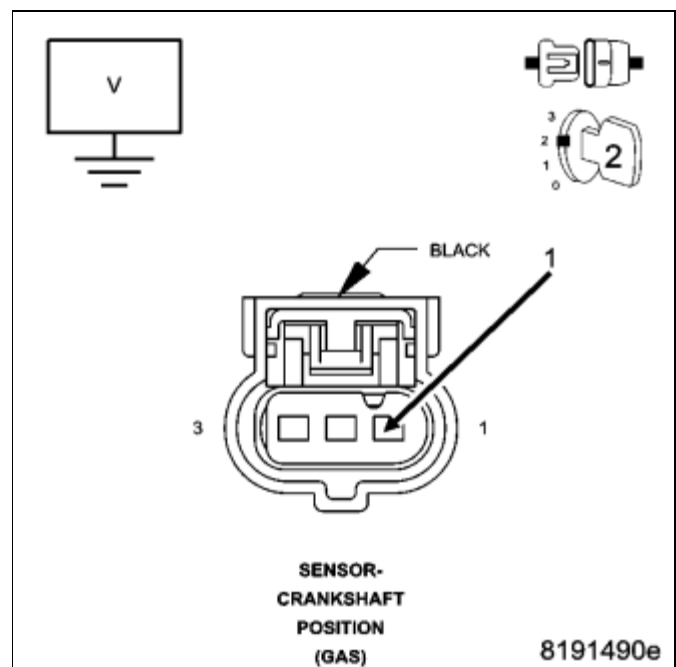
Is there any voltage present?

Yes

- Repair the short to voltage in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)



11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

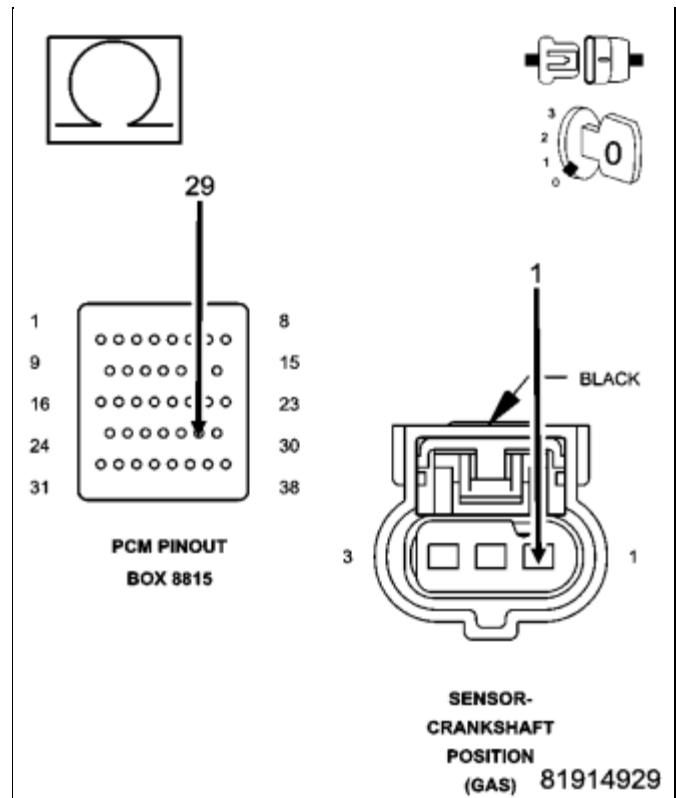
Is the resistance below 5.0 ohms?

Yes

- Go To [12](#)

No

- Repair the open in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

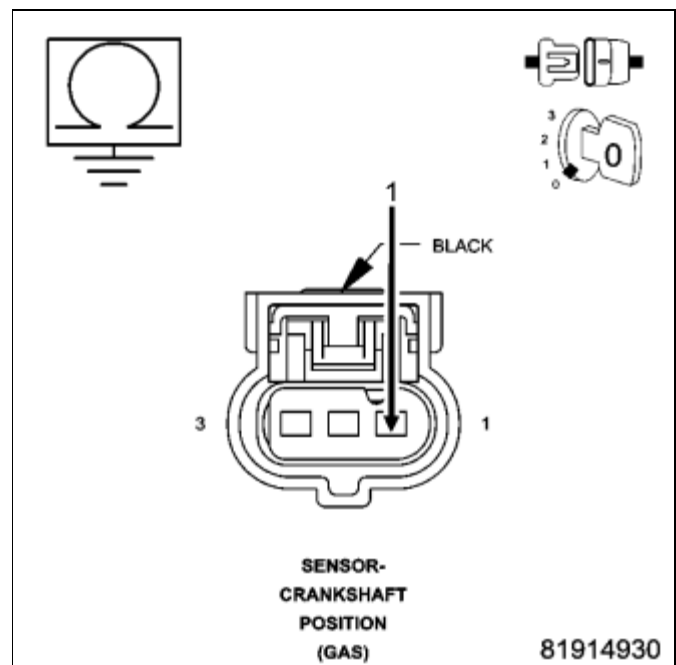
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)



13. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. ERRATIC CKP SENSOR SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CKP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

Did the CKP Sensor generate any erratic pulses?

Yes

- Verify that there is good pin to terminal contact in the Crank Position Sensor and Powertrain Control Module connectors. Replace the Crank Position Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. ERRATIC CMP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CMP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

Did the CMP Sensor generate any pulses?

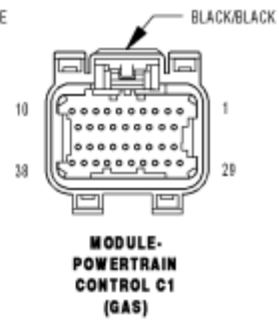
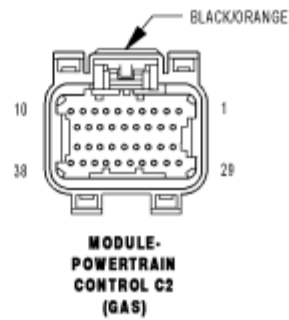
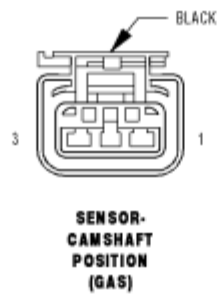
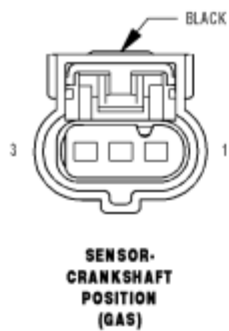
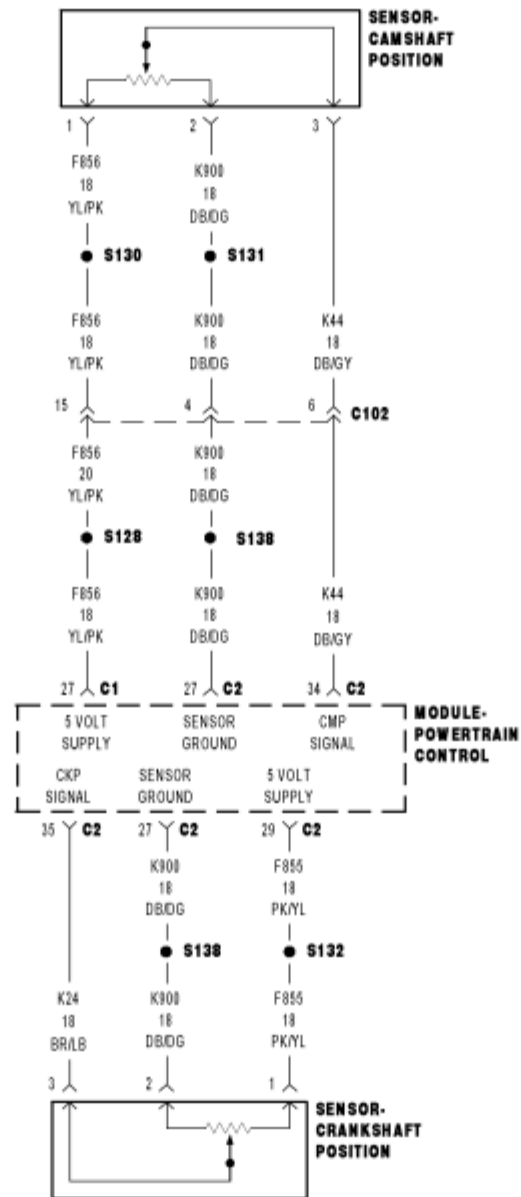
Yes

- Verify that there is good pin to terminal contact in the CMP Sensor and Powertrain Control Module connectors. Replace the Camshaft Position Sensor if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Test complete, the conditions that set this DTC are not present at this time.

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT



01011274

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

While cranking the engine and with the engine running.

◦ **Set Condition:**

When the CKP Sensor failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
CRANKSHAFT POSITION SENSOR
TONE WHEEL/PULSE RING
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING).

2. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes

- Go To [3](#)

No

- Go To [8](#)

3. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F855) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CKP Sensor connector.
 Ignition on, engine not running.
 Measure the voltage on the (F855) 5-volt Supply circuit in the Sensor harness connector.

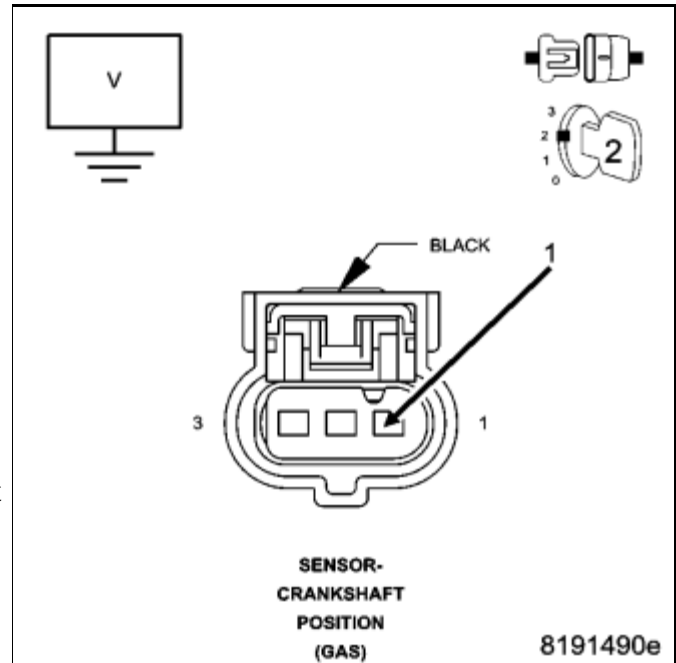
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [5](#)

No

- Repair the open or short to ground in the (F855) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. TONE WHEEL/FLEX PLATE INSPECTION

Turn the ignition off.
 Carefully disconnect the Negative Battery (Ground) cable.
 Remove the Crankshaft Position Sensor.
 Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes

- Repair or replace the Tone Wheel/Flex Plate as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Install the CKP Sensor and connect the battery cable.

NOTE: An intermittent condition in the Cam Position Sensor can cause the P0339 to set.

With the a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes

- Replace the Cam Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)

7. CRANKSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the CKP Sensor and the Powertrain Control Module connectors. If OK, replace the Crankshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. (K24) CKP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the Sensor harness connector.

Wiggle the related wire harness while taking this measurement.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K24) CKP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (K24) CKP Signal circuit from the CKP harness connector to the appropriate terminal of special tool #8815.

Wiggle the wire harness while taking this measurement.

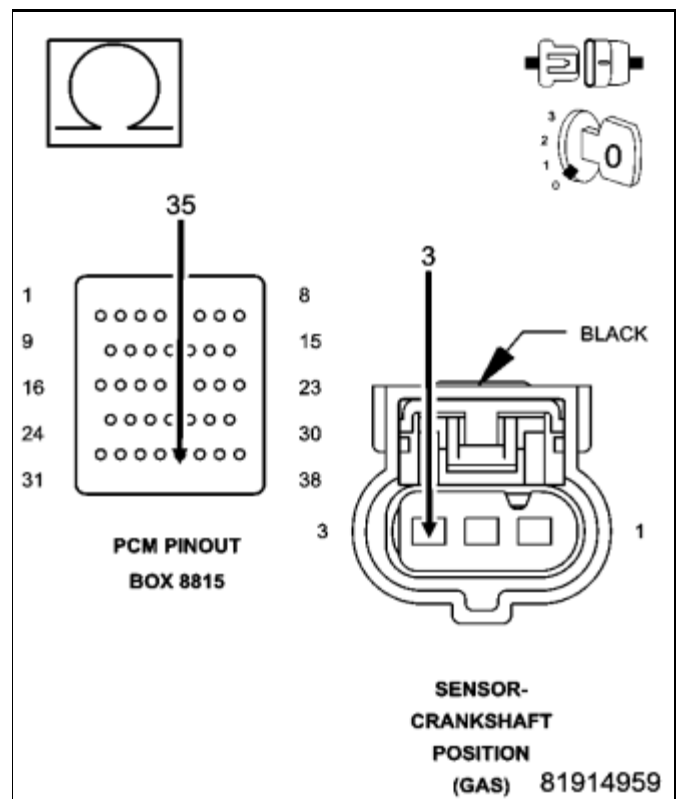
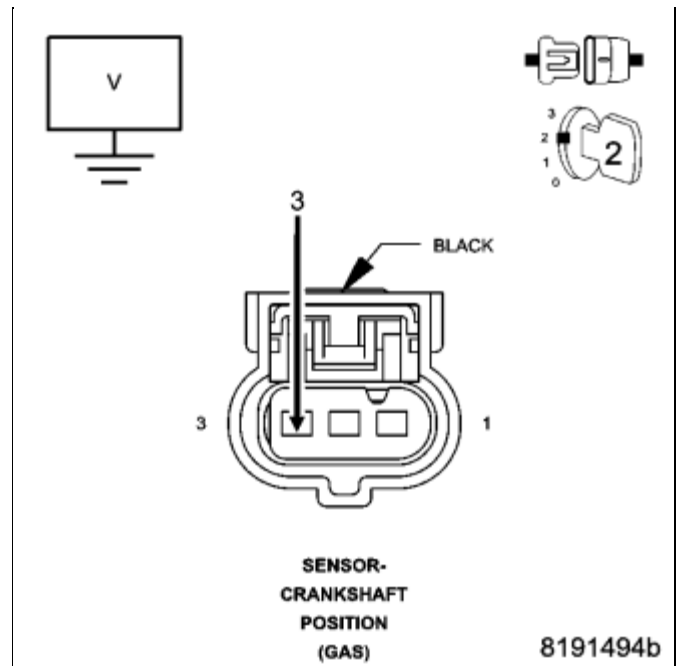
Is the resistance below 1.0 ohm?

Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K24) CKP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



10. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector. Wiggle the related wire harness while monitoring the resistance value.

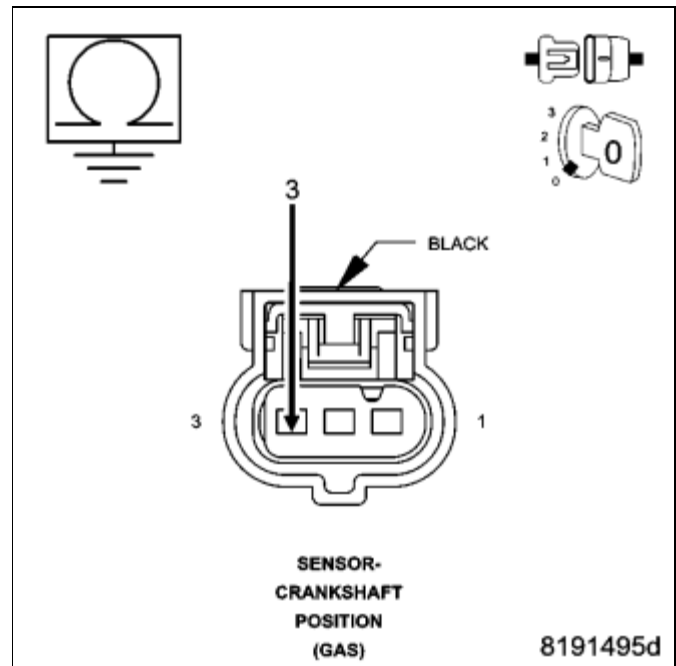
Does the resistance ever drop below 100 ohms?

Yes

- Repair the short to ground in the (K24) Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)



11. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit in the CKP harness connector. Wiggle the related wire harness while taking this measurement.

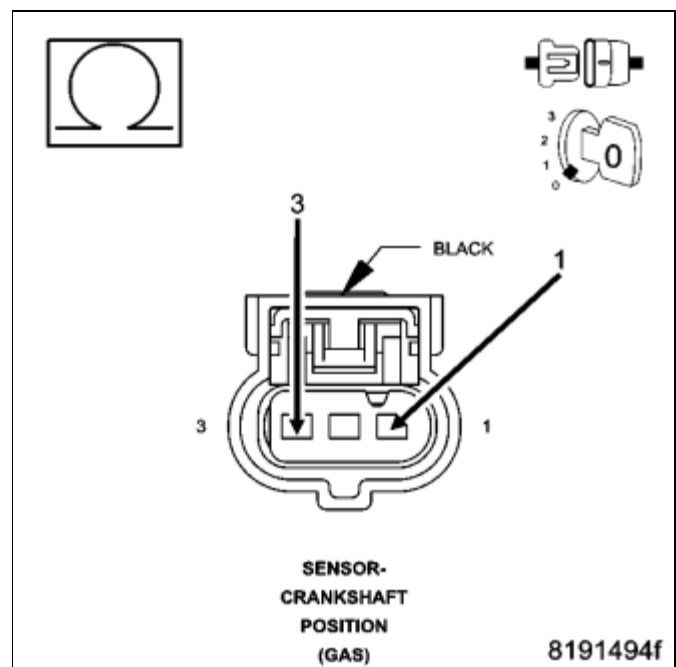
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the CKP Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the CKP Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

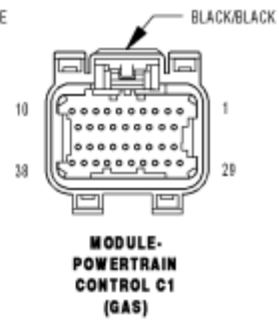
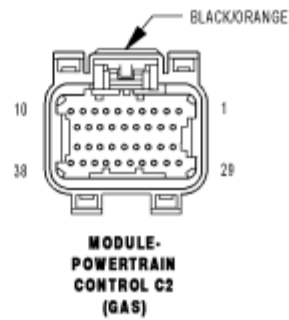
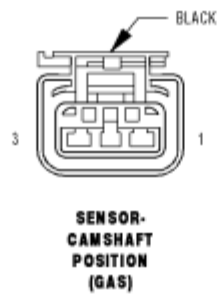
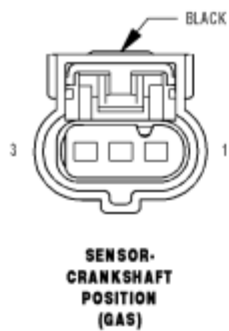
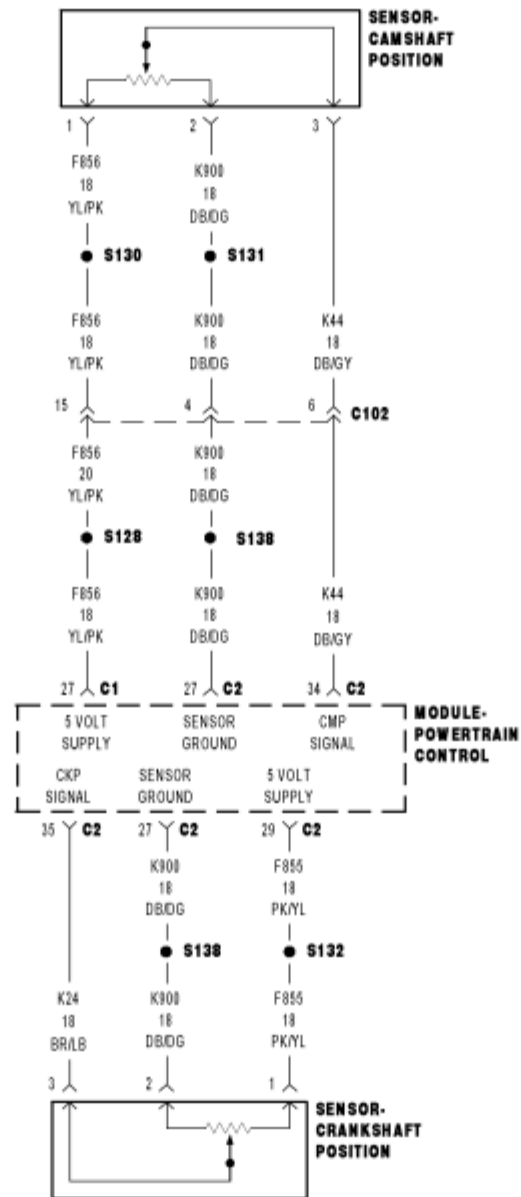
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0340-CAMSHAFT POSITION SENSOR CIRCUIT



01011274

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

During engine cranking and with the engine running. Battery voltage greater than 10 volts.

◦ **Set Condition:**

At least 5 seconds or 2.5 engine revolutions have elapsed with crankshaft position sensor signals present but no camshaft position sensor signal. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.

Ignition on, engine not running.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [14](#)

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

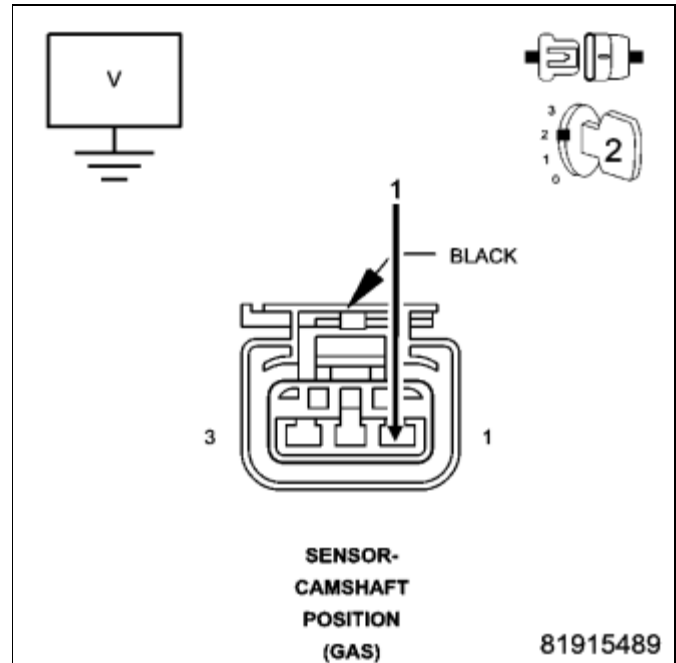
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [10](#)



3. (K44) CMP SIGNAL CIRCUIT

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

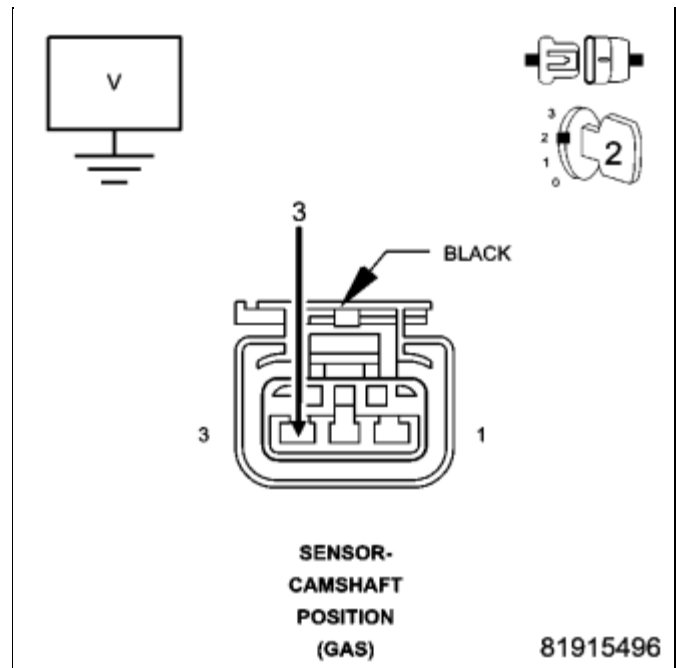
Is the voltage between 4.5 and 5.0 volts?

Yes

- Go To [4](#)

No

- Go To [7](#)



4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

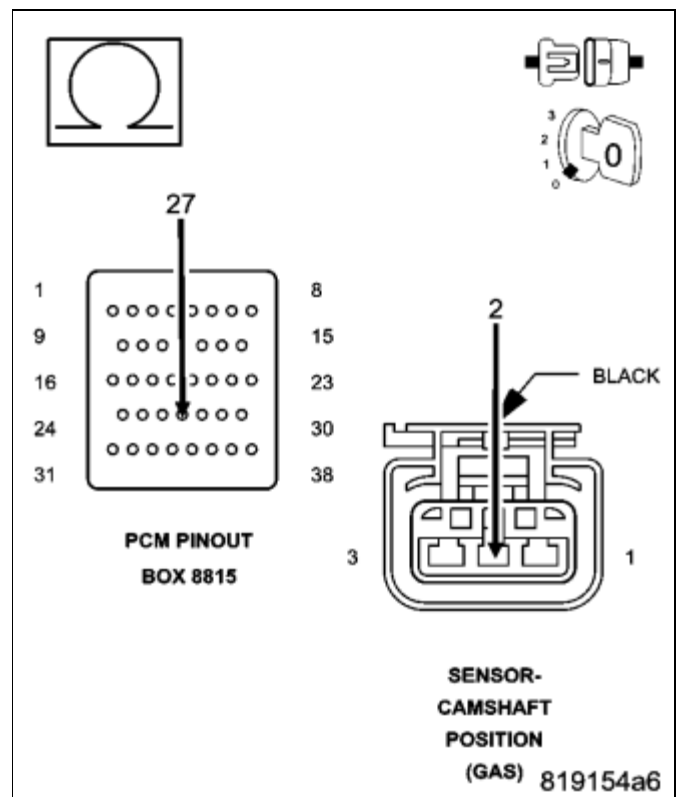
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

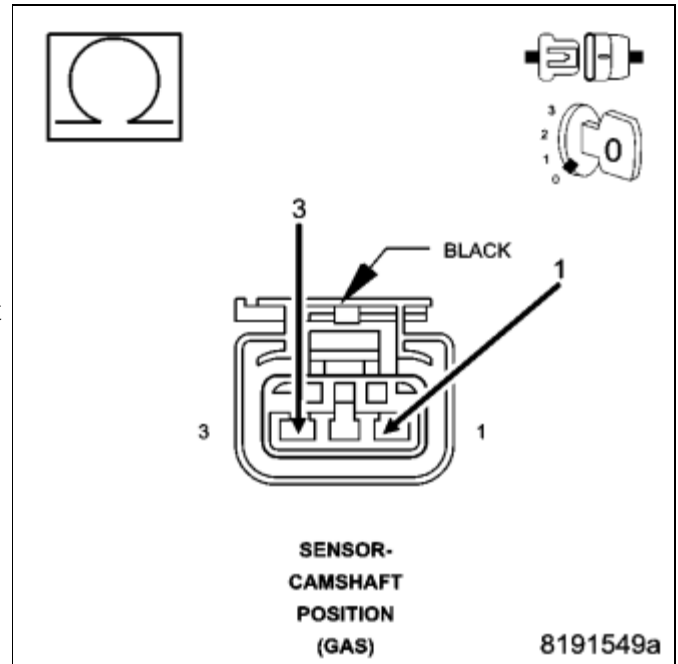
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)



6. CAMSHAFT POSITION SENSOR

NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the CMP Sensor and the Powertrain Control Module connectors. If OK, replace the Camshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. (K44) CMP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

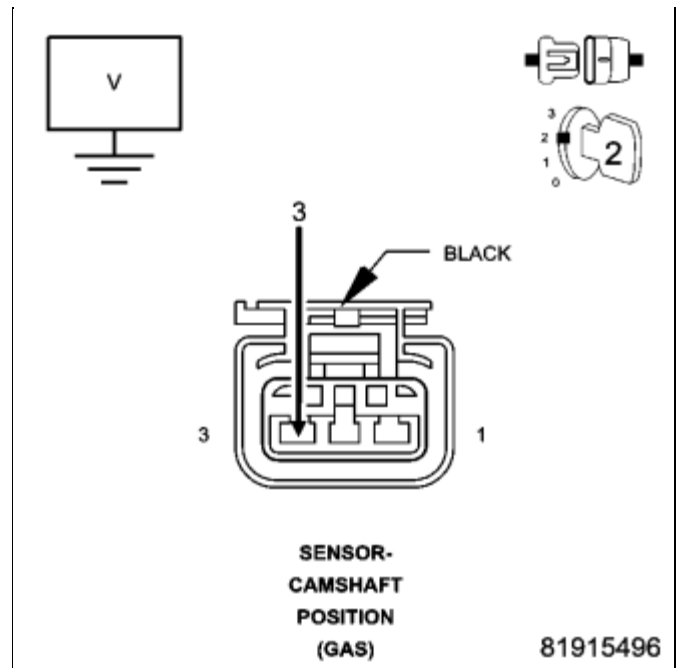
Is there any voltage present?

Yes

- Repair the short to voltage in the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K44) CMP Signal circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

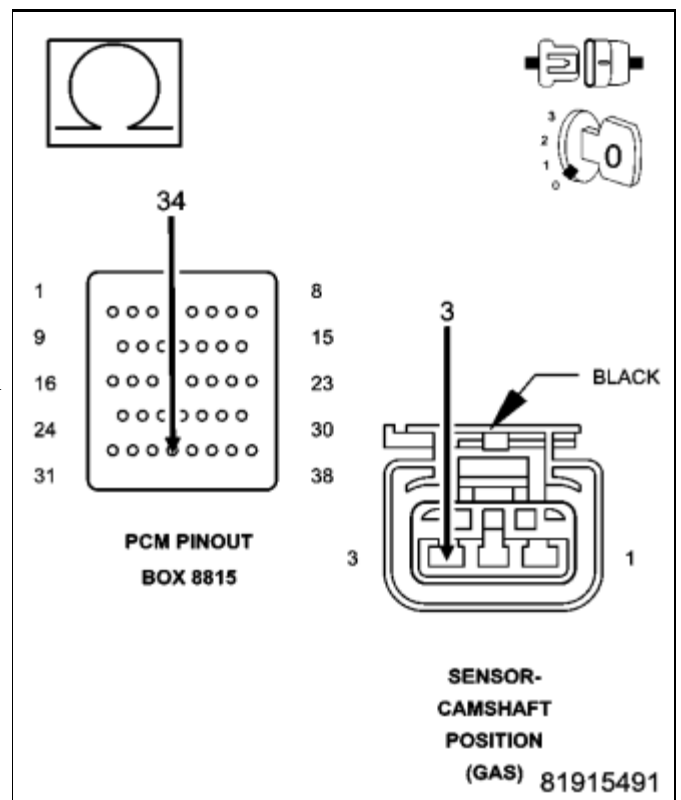
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.

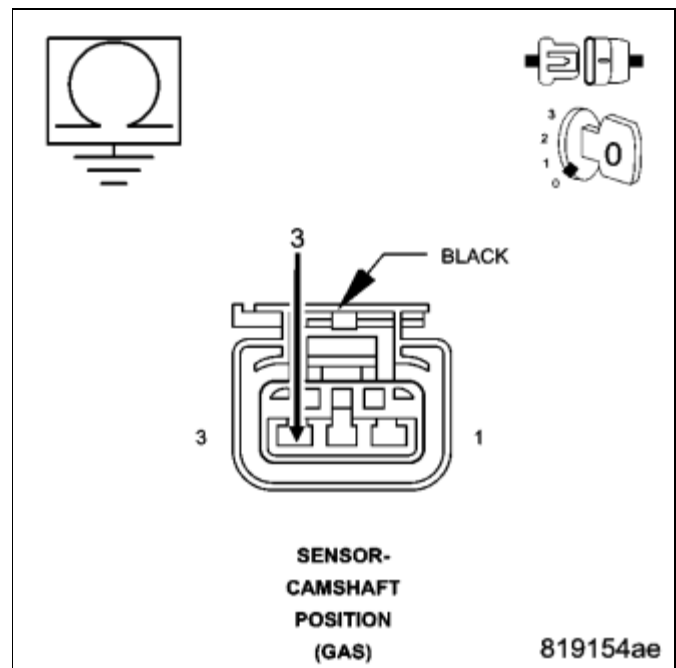
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K44) CMP Signal circuit
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [10](#)



10. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

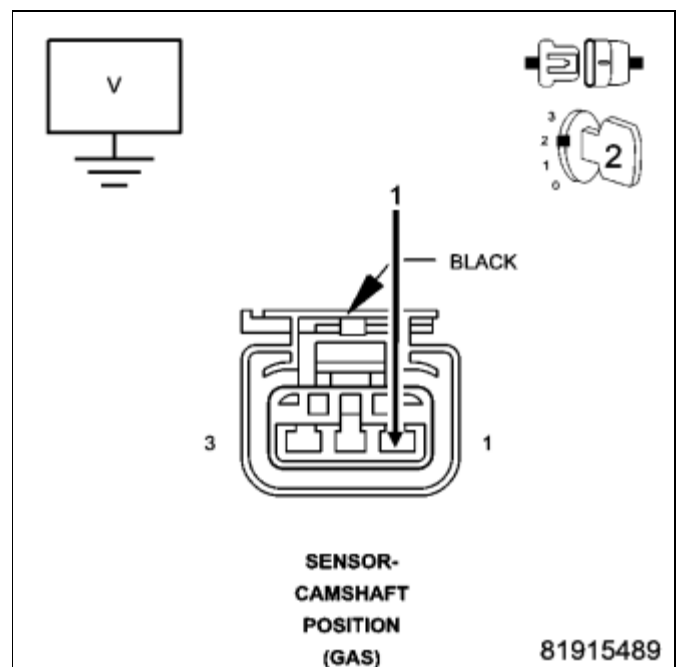
Is there any voltage present?

Yes

- Repair the short to voltage in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)



11. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

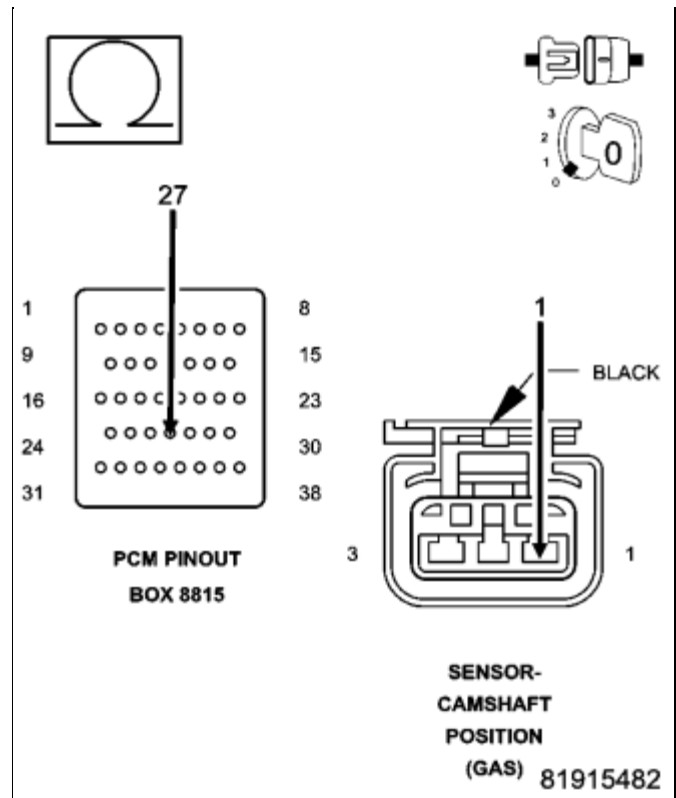
Is the resistance below 5.0 ohms?

Yes

- Go To [12](#)

No

- Repair the open in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

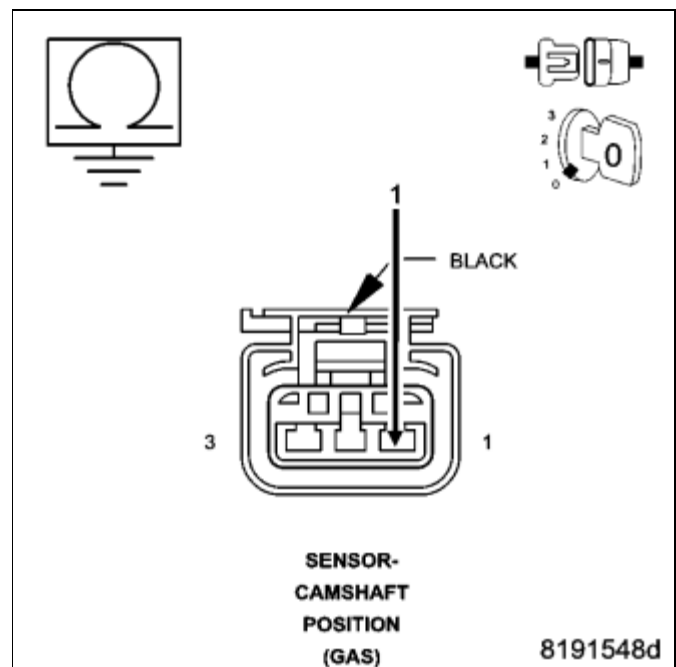
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)



13. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the CMP Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

14. ERRATIC CMP SIGNAL

With a lab scope probe and the Miller special tool #6801, back probe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap the Camshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

Did the CMP Sensor generate any erratic pulses?

Yes

- Verify that there is good pin to terminal contact in the CMP Sensor and the Powertrain Control Module connectors. If OK, replace the Camshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [15](#)

15. ERRATIC CKP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

Did the CKP Sensor generate any erratic pulses?

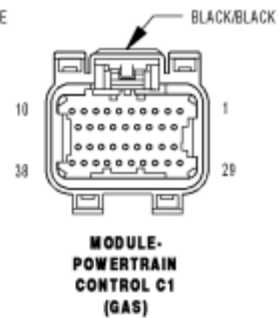
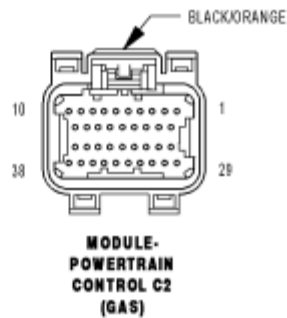
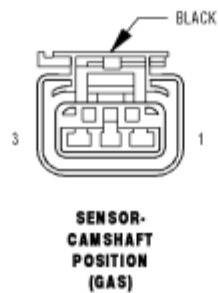
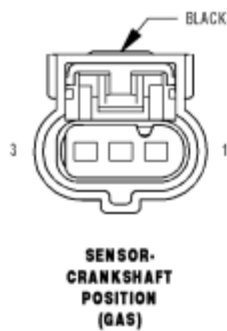
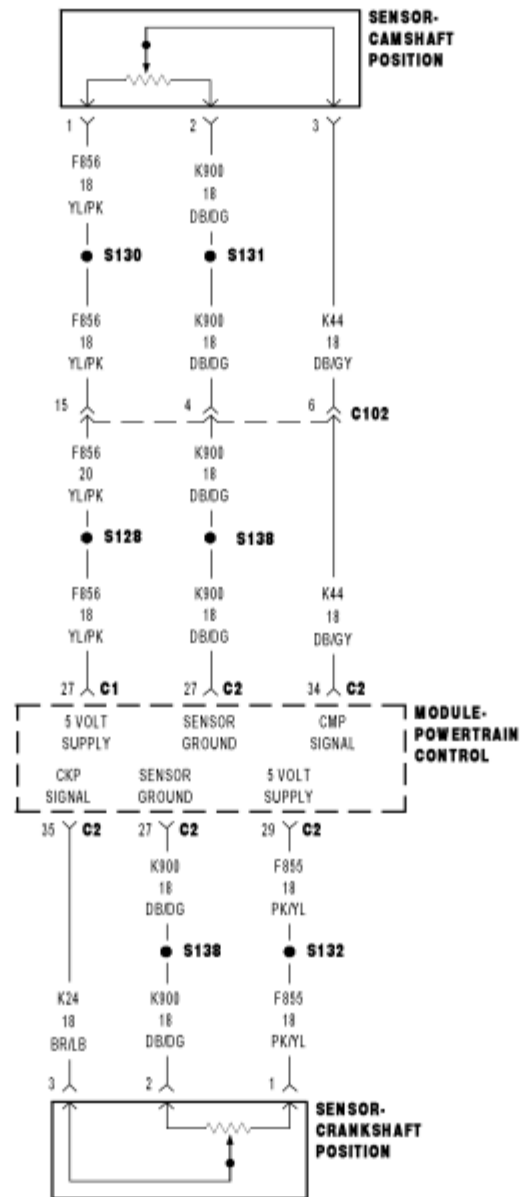
Yes

- Verify that there is good pin to terminal contact in the CKP Sensor and the Powertrain Control Module connectors. If OK, replace the Crankshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Test complete, the conditions that set this DTC are not present at this time

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT



01011274

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

While cranking the engine and engine running.

- **Set Condition:**

When the failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
TONE WHEEL/PULSE RING
CAMSHAFT POSITION SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING).

2. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes

- Go To [3](#)

No

- Go To [8](#)

3. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Verify that there is good pin to terminal contact in the Camshaft Position Sensor and the Powertrain Control Module connectors.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. (F856) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CMP Sensor connector.
 Ignition on, engine not running.
 Measure the voltage on the (F856) 5-volt Supply circuit in the CMP harness connector.

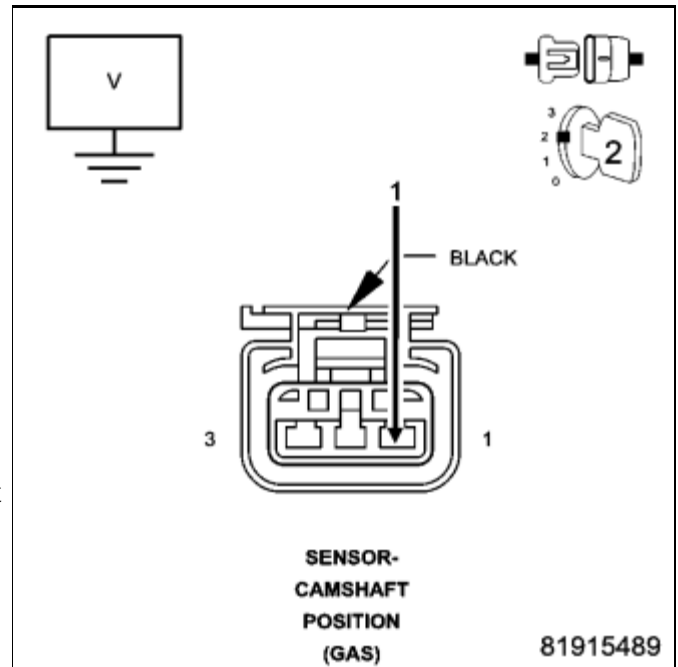
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [5](#)

No

- Repair the open or short to ground in the (F856) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. TONE WHEEL/PULSE RING INSPECTION

Turn the ignition off.
 Carefully disconnect the Battery Ground cable.
 Remove the Camshaft Position Sensor.
 Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes

- Repair or replace the Tone Wheel/Pulse Ring as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

NOTE: An intermittent condition in the Crank Position Sensor can cause the P0344 to set.

Install the CMP Sensor and connect the Battery cable.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes

- Verify that there is good pin to terminal contact in the Crankshaft Position Sensor and the Powertrain Control Module connectors. If OK, replace the Crankshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)

7. CAMSHAFT POSITION SENSOR

Verify that there is good pin to terminal contact in the Camshaft Position Sensor and the Powertrain Control Module connectors. Repair as necessary.

If there are no possible causes remaining, view repair.

Repair

- Replace the Camshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. (K44) CMP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the CMP Sensor connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit.

Wiggle the related wire harness while taking this measurement.

Does the voltage ever increase above 0 volts?

Yes

- Repair the short to voltage in the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)

9. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (K44) CMP Signal circuit from the CMP harness connector to the appropriate terminal of special tool #8815.

Wiggle the related wire harness while taking this measurement.

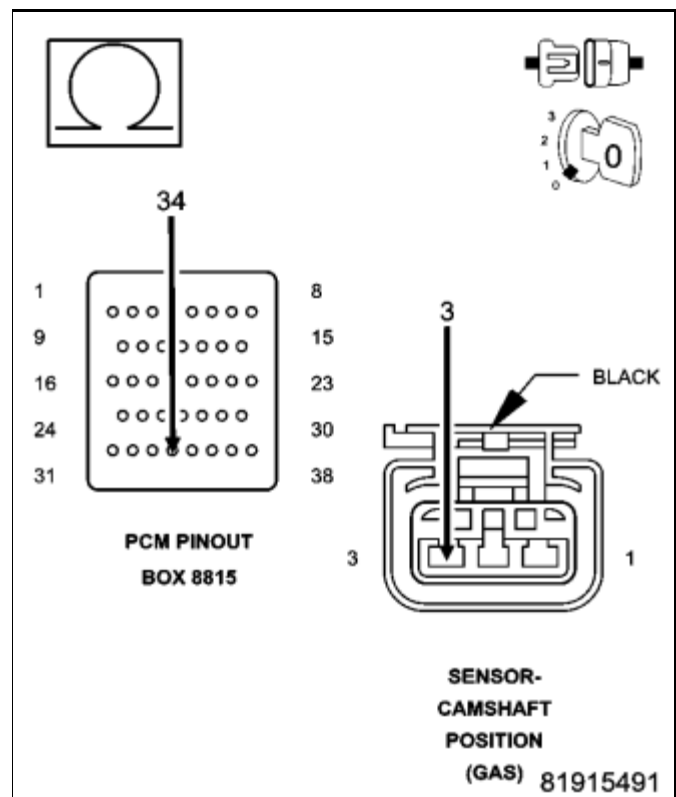
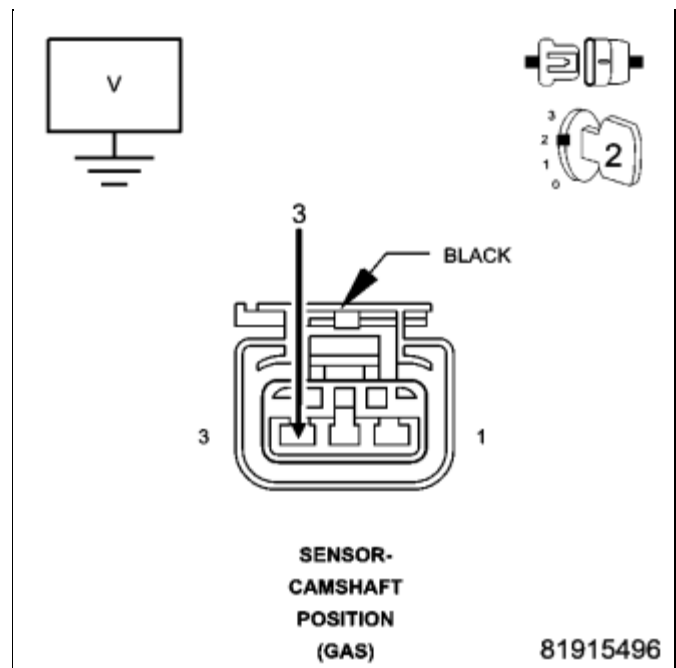
Is the resistance below 5.0 ohms?

Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



10. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector. Wiggle the related wire harness while monitoring the resistance value.

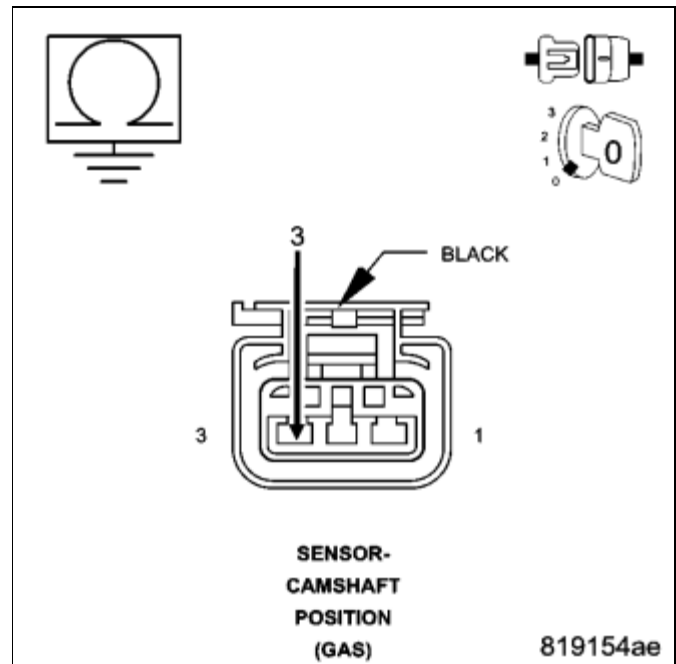
Does the resistance ever drop below 100 ohms?

Yes

- Repair the short to ground in the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [11](#)



11. (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit in the CMP harness connector. Wiggle the related wire harness while taking this measurement.

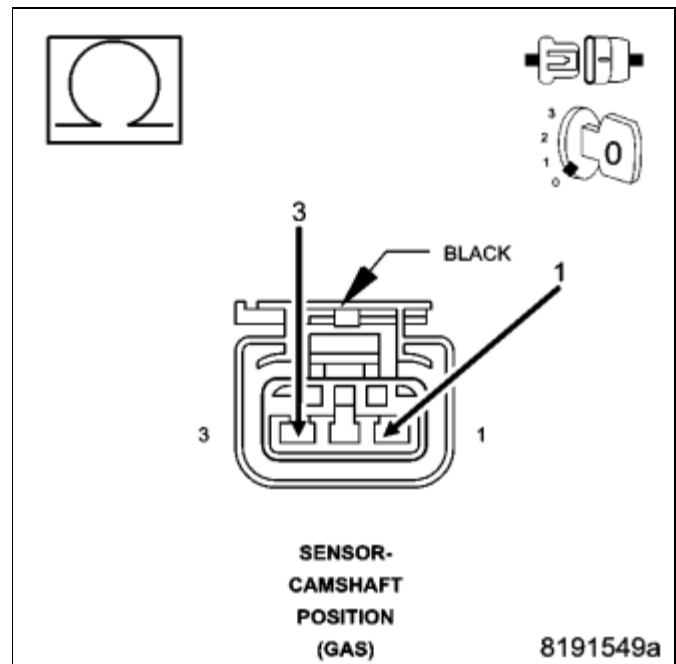
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [12](#)



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the CMP Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Camshaft Position Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

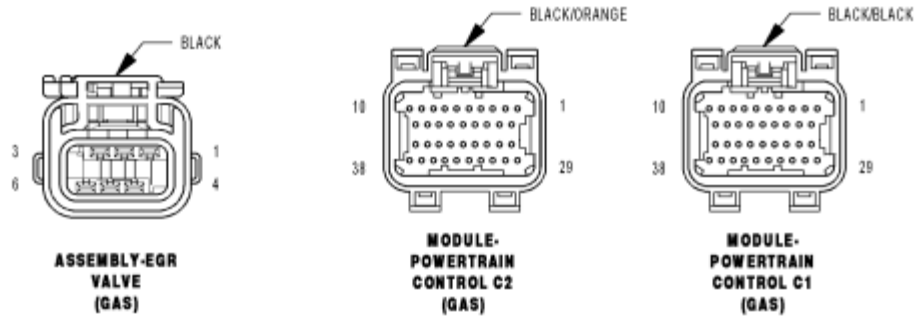
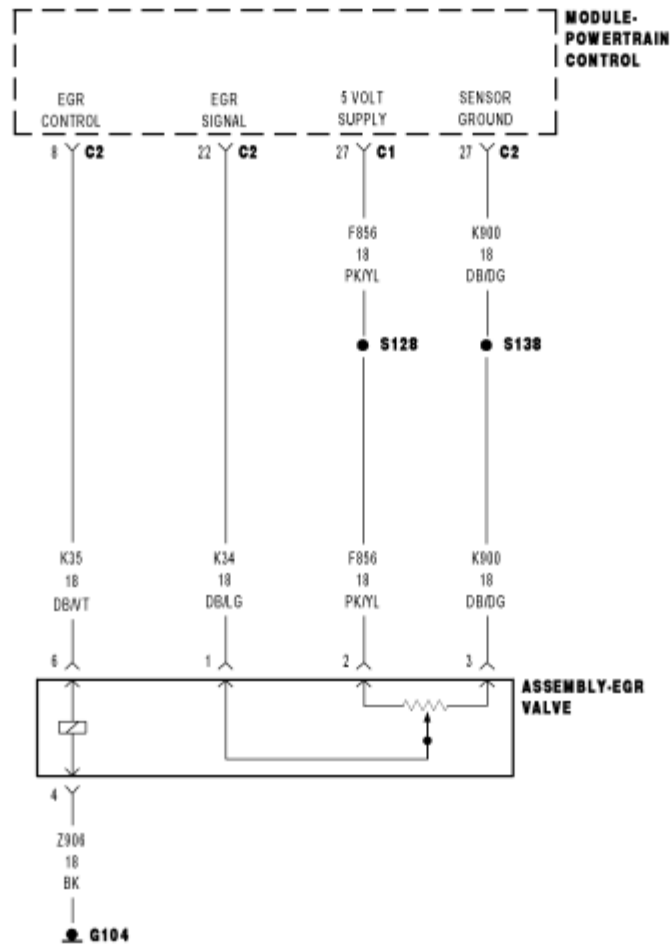
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0401-EGR SYSTEM PERFORMANCE



818158cc

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Exhaust gas recirculation is a method of reducing emissions of oxides of nitrogen. As the inert exhaust gas is recirculated, the mixture absorbs heat in the combustion chamber without interacting with the fuel/air mixture and reduces the formation of NO_x emissions. After the EGR monitor conditions are met, the EGR valve is turned on and off momentarily. The EGR monitor calculated the difference in engine roughness from the EGR off condition to the EGR condition. This engine combustion stability difference as measured by engine roughness is the measure of a functional EGR system.

- **When Monitored:**

Engine running for greater than two minutes with the Engine Coolant Temp greater than 70° C (158° F).
EGR active. Less than 8500 feet. Ambient temperature greater than -6° C (20° F).

- **Set Condition:**

The PCM closes the EGR valve while monitoring the O₂ Sensor signal. Once a closed EGR fueling sample has been established the PCM then ramps in EGR and additional fueling while monitoring the O₂ sensor signal in the open state. A fueling sample is again established. The PCM then compares the different O₂ Sensor signal readings (fueling samples). If a larger than expected variation is detected, a soft failure is recorded. Three soft failures set a one trip failure. After two failed trips, a DTC is set and the MIL is illuminated.

Possible Causes
(Z906) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose and repair any EGR circuit DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Copy DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. ROUGH IDLE OR STALLING AT IDLE

Turn the ignition off.

Turn all accessories off.

Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Does the engine run rough or stall at idle?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. EGR VALVE ASSEMBLY CONTROL CIRCUIT

Turn the ignition off.
Disconnect the EGR Valve Assembly harness connector.
Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Does the engine continue to run rough or stall with the EGR Valve Assembly connector disconnected?

Yes

- Go To [8](#)

No

- Go To [4](#)

4. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Disconnect the EGR Solenoid harness connector.
Ignition on, engine not running.
Measure the voltage on the (K35) EGR Solenoid Control circuit in the EGR Solenoid connector.

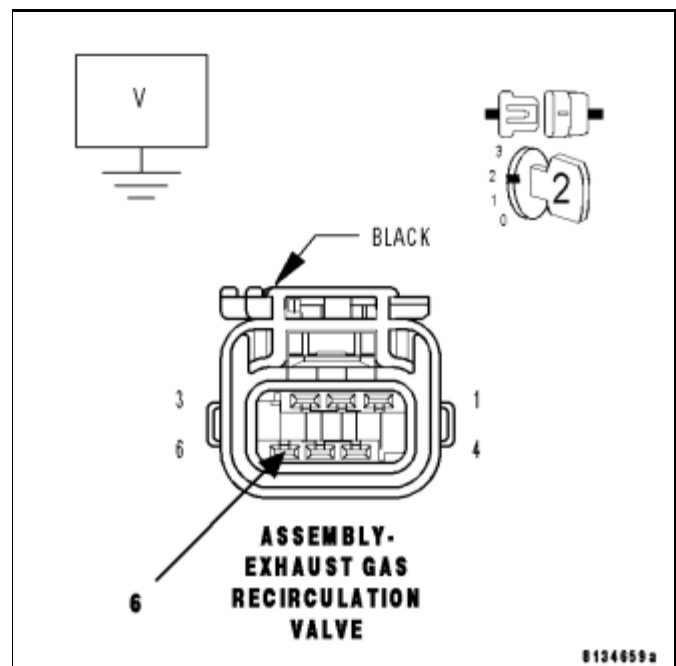
Is there and voltage present?

Yes

- Repair the short to voltage in the (K35) EGR Solenoid Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



5. EGR SYSTEM TEST

Turn all accessories off.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, perform the EGR System Test.
Select OPEN to open the EGR valve.

Did the engine run rough or stall when the valve was opened during the system test?

Yes

- Go To [8](#)

No

- Go To [6](#)

6. (Z906) EGR SOLENOID GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to battery voltage, probe the (Z906) EGR Solenoid ground circuit in the EGR Solenoid harness connector.

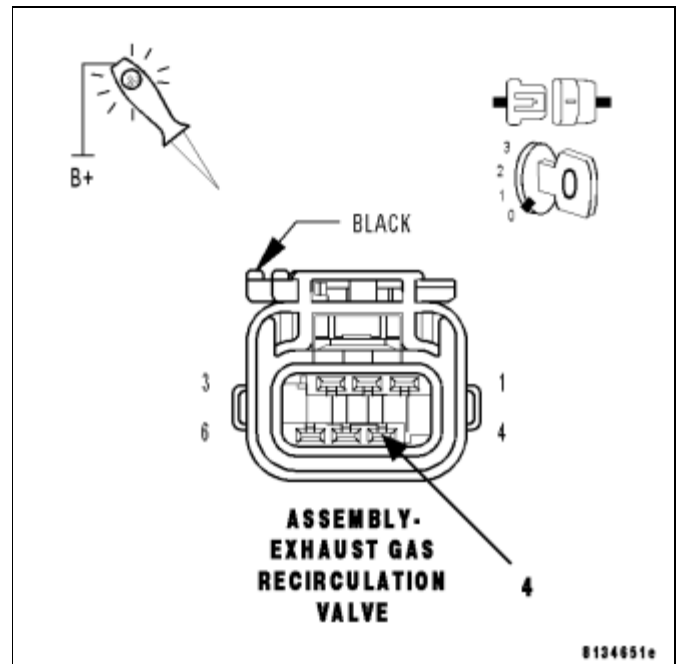
Does the 12-volt test light illuminate brightly?

Yes

- Go To [7](#)

No

- Repair the open in the (Z906) EGR Solenoid ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K35) EGR CONTROL CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Connect the EGR Valve Assembly connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (K35) EGR Control circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter. Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, perform the EGR System Test.
Select OPEN to open the EGR valve.
Monitor the circuit voltage on the voltmeter.

Is the voltage below 0.5 volts when the valve was opened during the system test?

Yes

- Go To [8](#)

No

- Repair the (K35) EGR Control circuit for excessive resistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

8. EGR VALVE ASSEMBLY

WARNING: The normal operating temperature of the EGR system is very high. Never work around or attempt to service any part of the EGR system until it has cooled.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Valve Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Inspect the EGR Valve Assembly for the following:

- Proper mounting, leaking gasket(s)
- Damaged, leaking, or obstructed EGR tube(s)
- Carbon build up on or near the EGR pintle or within passages.

Were any problem found?

Yes

- Repair or replace the EGR system components as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the EGR Valve Assembly.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0403-EGR SOLENOID CIRCUIT

Engine running. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The EGR solenoid control circuit is not in the expected state when requested to operate by the PCM. One Trip Fault.

Possible Causes
(Z906) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.

With the scan tool, Clear DTCs in the Powertrain Control Module (PCM).

With the scan tool, actuate the EGR Valve Solenoid Duty Cycle.

Select the Duty Cycle reading of 79.9%

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K35) EGR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the EGR Valve Assembly connector.
 Disconnect the C2 PCM harness connector.
 Turn the ignition on.
 Measure the voltage of the (K35) EGR Control circuit in the EGR Valve Assembly harness connector.

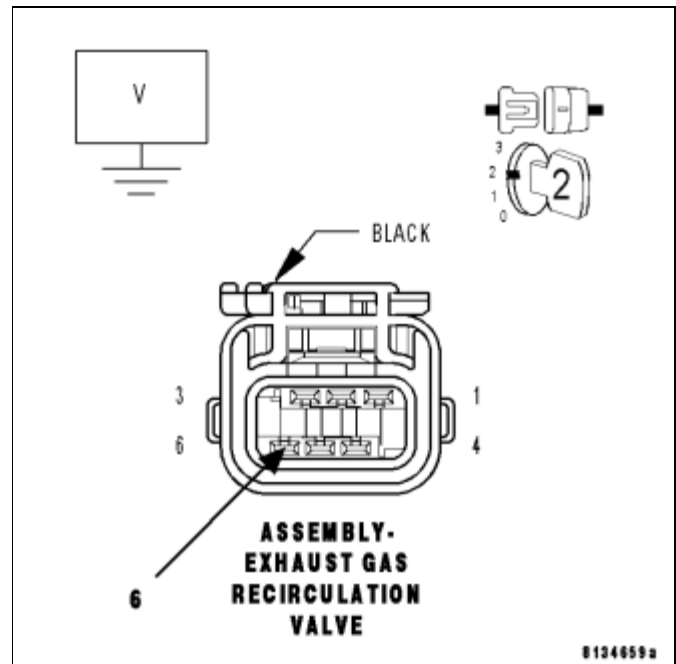
Is there any voltage present?

Yes

- Repair the short to voltage in the (K35) EGR Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)



3. (K35) EGR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Measure the resistance between ground and the (K35) EGR Control circuit in the EGR Valve Assembly harness connector.

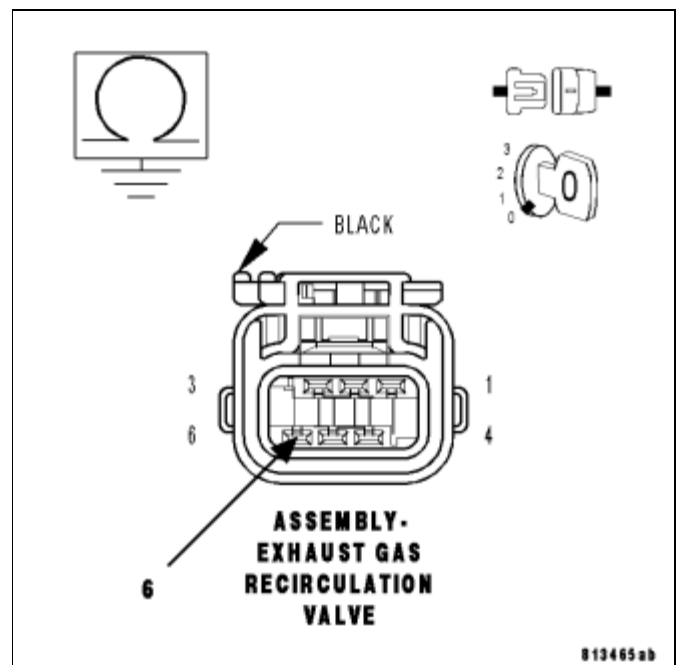
Is the resistance above 100 ohms?

Yes

- Go To [4](#)

No

- Repair the short to ground in the (K35) EGR Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



4. (K35) EGR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K35) EGR Control circuit between the EGR Valve Assembly harness connector and the appropriate terminal of special tool #8815.

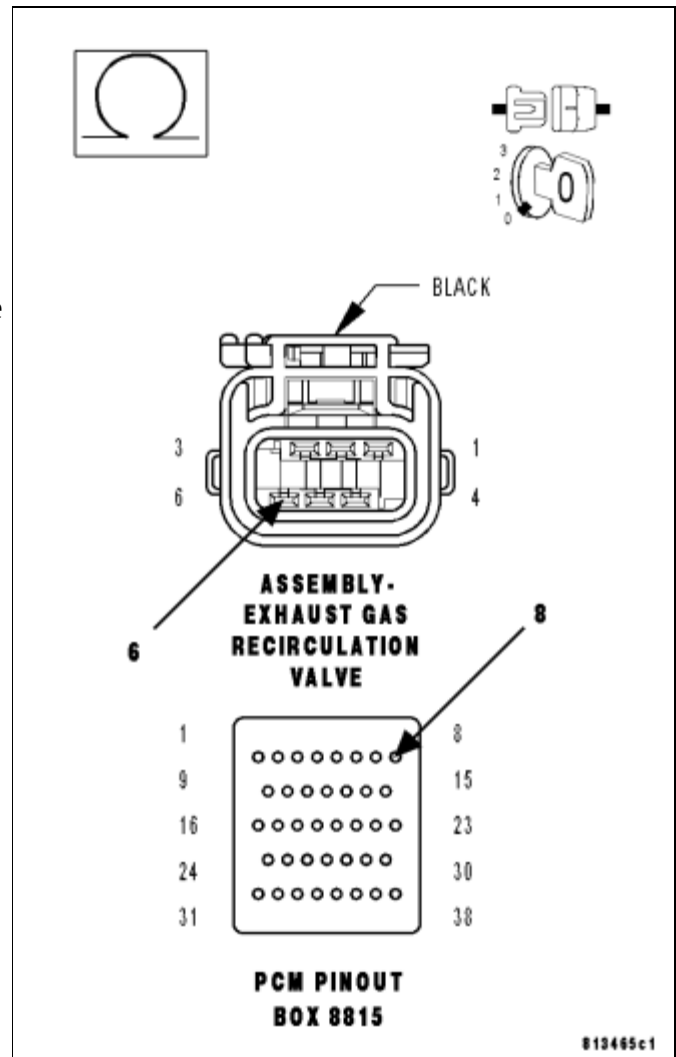
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K35) EGR Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



5. (Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

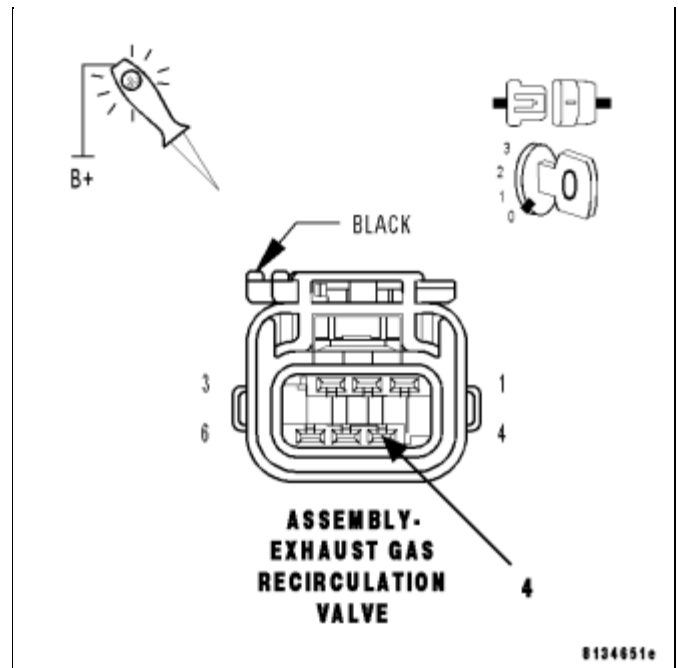
Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the EGR Valve Assembly harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go To [6](#)



No

- Repair the excessive resistance in the (Z906) Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

6. EGR VALVE ASSEMBLY

Connect the C2 PCM harness connector.

Turn the ignition on.

With the scan tool, actuate the EGR Valve Solenoid Duty Cycle.

Select the Duty Cycle reading of 79.9%

Using a 12 volt test light connected to ground, check the (K35) EGR Control circuit in the EGR Valve Assembly harness connector.

NOTE: If the DTC is active, the actuation test may not be allowed by the PCM. If may be necessary to clear the DTCs before starting the actuation.

NOTE: The voltage supplied to the solenoid circuit during the actuation may be less than battery voltage. The test light should be illuminated, but may not be as bright as a direct connection to the battery.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Is the test light illuminated during the actuation?

Yes

Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. If OK, replace the EGR Valve Assembly in accordance with the Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

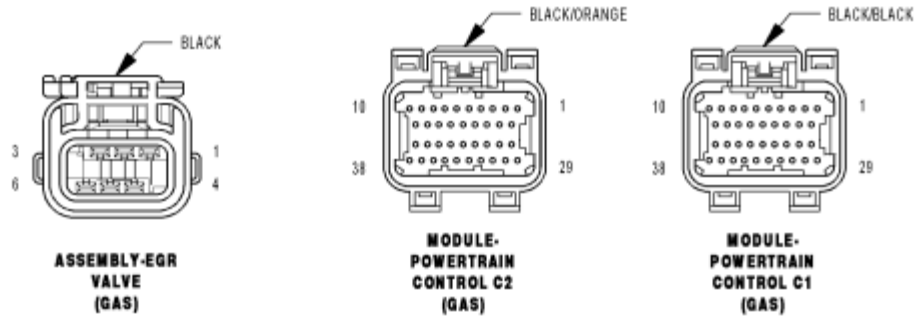
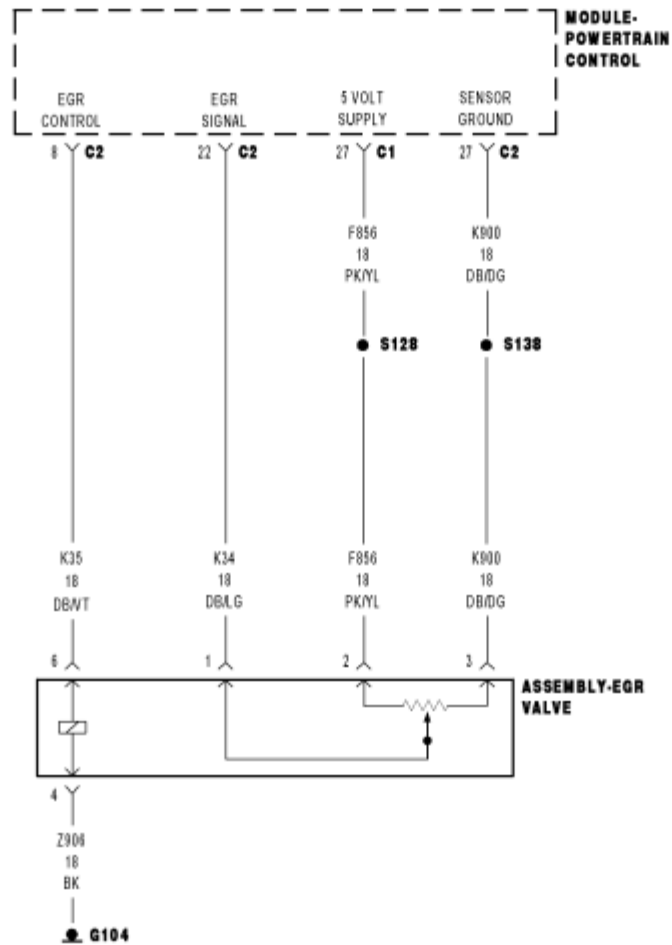
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0404-EGR POSITION SENSOR RATIONALITY OPEN



818158cc

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The EGR valve has a position sensor and the EGR position rationality is designed to make sure that the valve moves freely within its operating range. Closed valve position reference check verifies that the valve is within its allowable upper and lower limits. The EGR position rationality test looks for a sustained error relative to commanded valve position.

- **When Monitored:**

Engine running.

- **Set Condition:**

The EGR flow or valve movement is not what is expected. A rationality error has been detected from the EGR Close Position Performance. Two trip fault.

Possible Causes
EXCESSIVE RESISTANCE IN THE (K34) EGR SENSOR SIGNAL CIRCUIT
EXCESSIVE RESISTANCE IN THE (F856) 5 VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (K35) EGR SOLENOID CONTROL CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
(Z906) EGR SOLENOID GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose and repair any EGR signal circuit high or low DTCs before continuing with this procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

WARNING: The normal operating temperature of the EGR system is very high. Never work around or attempt to service any part of the EGR system until it has cooled.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (F856) 5 VOLT SUPPLY CIRCUIT HIGH RESISTANCE

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (F856) 5 Volt Supply circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Is the voltage below 0.5 volts?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (F856) 5 Volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. (K34) EGR SIGNAL CIRCUIT HIGH RESISTANCE

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (K34) EGR Signal circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Is the voltage below 0.5 volts?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K34) EGR Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. (K900) SENSOR GROUND CIRCUIT HIGH RESISTANCE

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (K900) Sensor Ground circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Is the voltage below 0.5 volts?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K900) Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

5. (Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the EGR Valve Assembly harness connector.

Using a 12 volt test light connected to the 12 volts, check the (Z906) Ground circuit in the EGR Valve Assembly harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

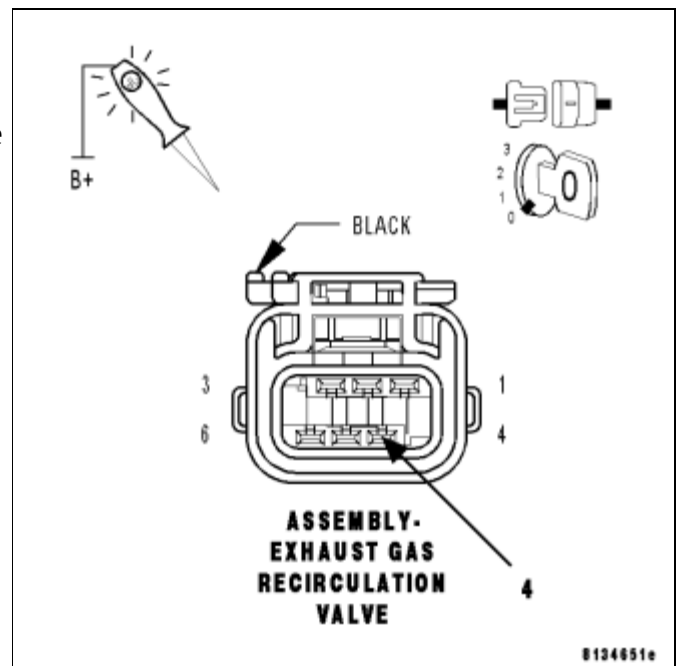
Is the test light illuminated and bright?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (Z906) Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K35) EGR CONTROL CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Connect the EGR Valve Assembly connector.

CAUTION: CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (K35) EGR Control circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, perform the EGR System Test.

Select OPEN to open the EGR valve.

Monitor the circuit voltage on the voltmeter.

Is the voltage below 0.5 volts when the valve was opened during the system test?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (K35) EGR Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

7. EGR VALVE ASSEMBLY

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Valve Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the EGR Valve Assembly in accordance with the Service Information if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0405-EGR POSITION SENSOR CIRCUIT LOW

With the ignition on. Battery voltage above 10.0 volts.

- **Set Condition:**

EGR Position Sensor Signal is less than the minimum acceptable value. One trip Fault.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(K34) EGR SIGNAL CIRCUIT SHORTED TO GROUND
(K34) EGR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K34) EGR SIGNAL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

WARNING: The normal operating temperature of the EGR system is very high. Never work around or attempt to service any part of the EGR system until it has cooled.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

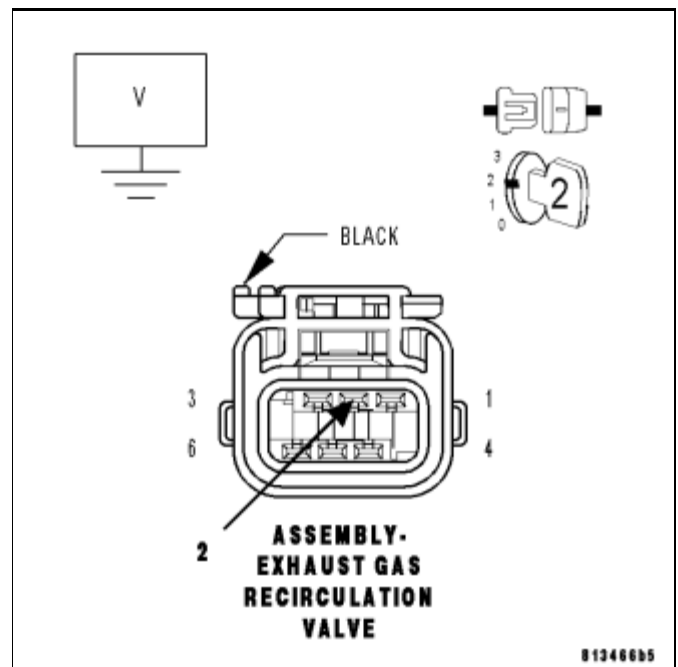
Is the voltage between 4.5 to 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [7](#)



3. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K34) EGR Position Sensor Signal circuit in the EGR Solenoid harness

connector.

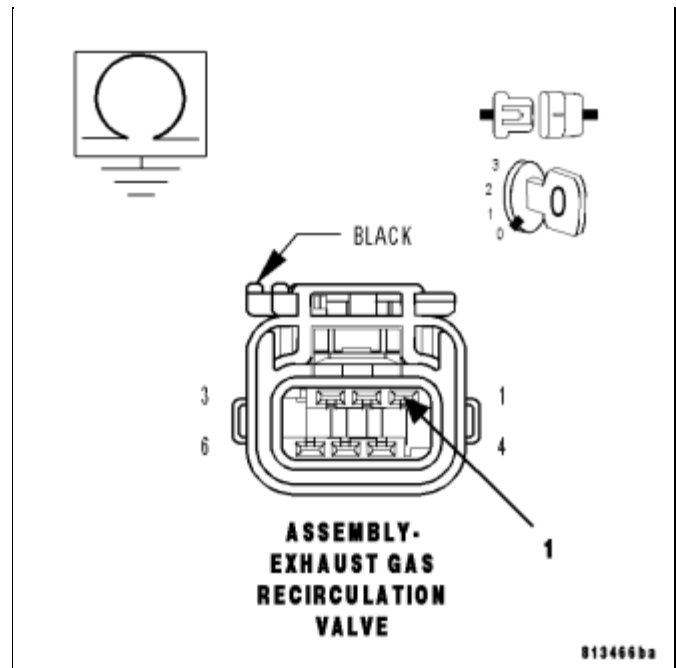
Is the resistance below 100 ohms?

Yes

- Repair the short to ground circuit in the (K34) EGR Position Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and (K900) Sensor ground circuit in the EGR Solenoid harness connector.

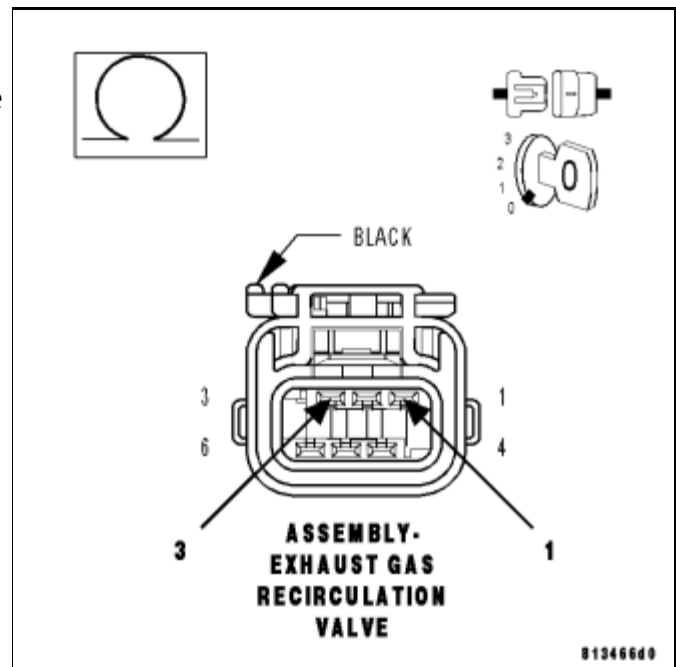
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K900) Sensor ground and the (K34) EGR Position Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



5. EXCESSIVE RESISTANCE IN THE (K34) EGR SIGNAL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals, resulting in poor terminal to pin

connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K34) EGR Signal circuit between the Exhaust Gas Recirculation Valve harness connector and the appropriate terminal of special tool #8815.

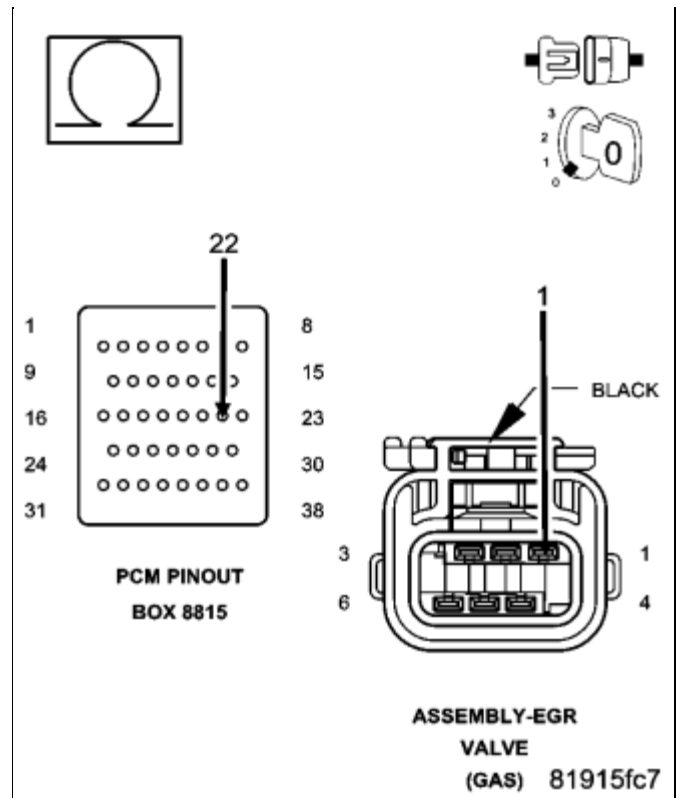
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K34) EGR Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. EXHAUST GAS RECIRCULATION VALVE

Turn the ignition off.

Connect the C2 PCM harness connector.

Turn the ignition on.

With the scan tool, read the Exhaust Gas Recirculation Valve signal voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. If OK, replace the EGR Valve Assembly in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)

7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Measure the resistance between ground and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

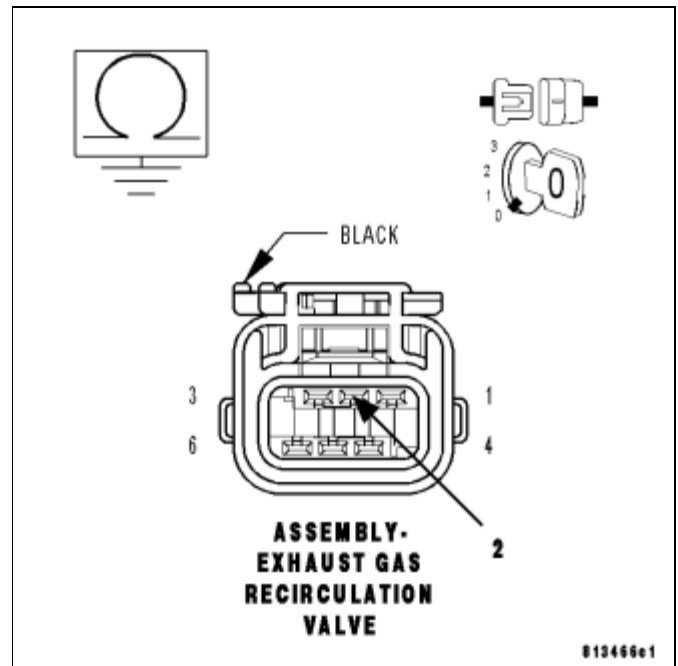
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [8](#)



8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

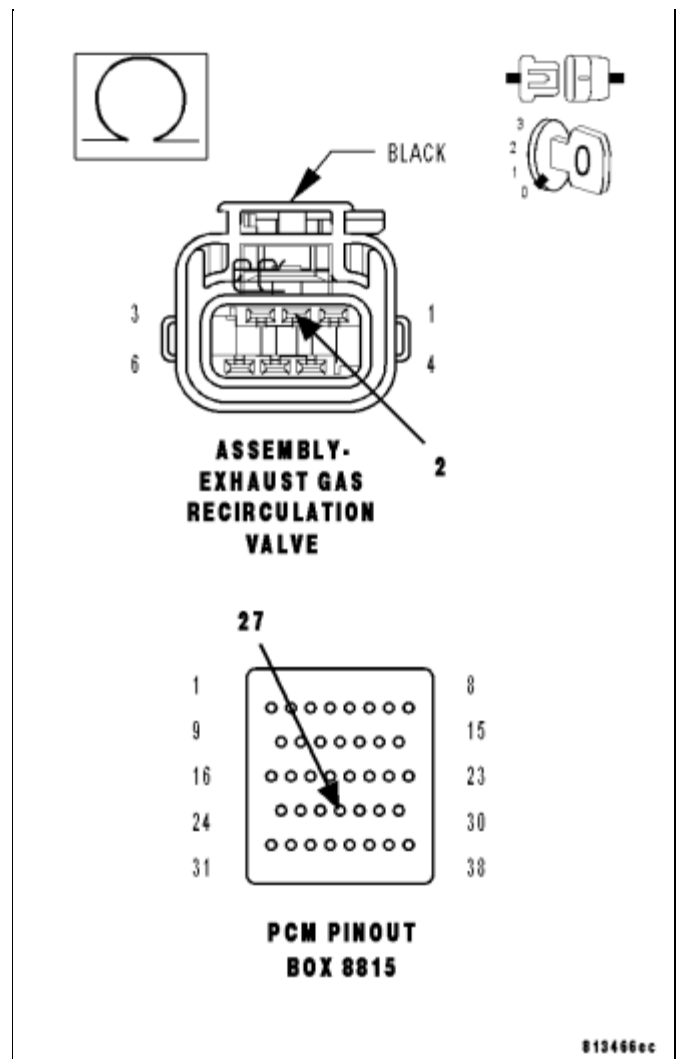
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE).



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

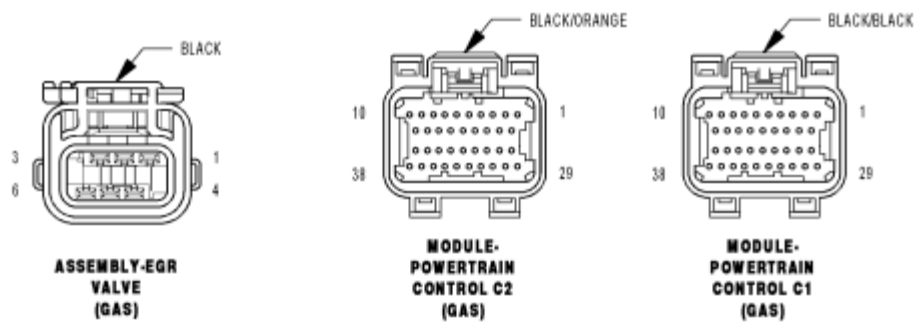
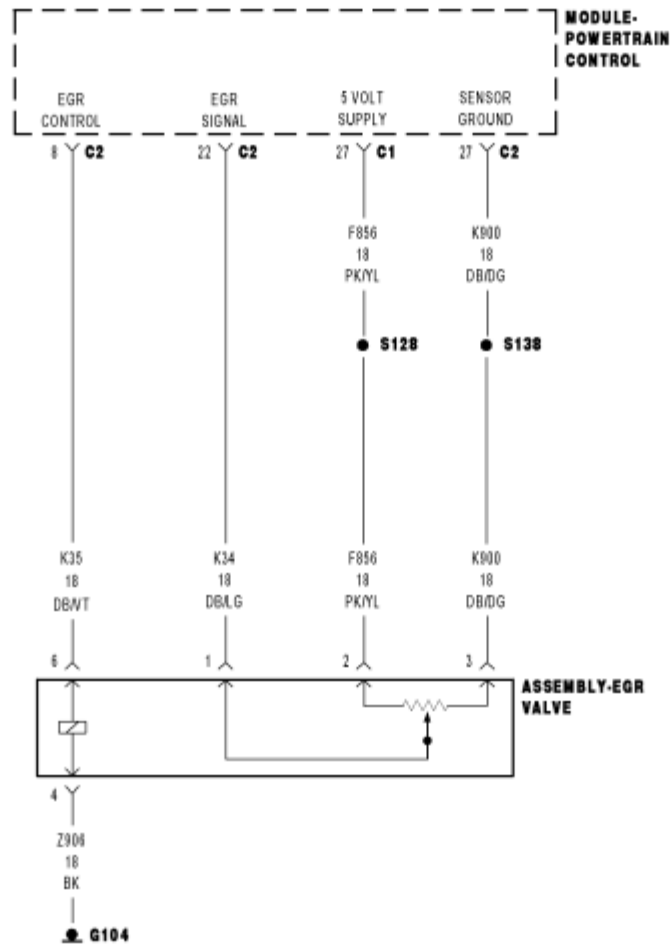
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0406-EGR POSITION SENSOR CIRCUIT HIGH



818156a

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

EGR position sensor signal is greater than the maximum acceptable value. One trip Fault.

Possible Causes
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

WARNING: The normal operating temperature of the EGR system is very high. Never work around or attempt to service any part of the EGR system until it has cooled.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

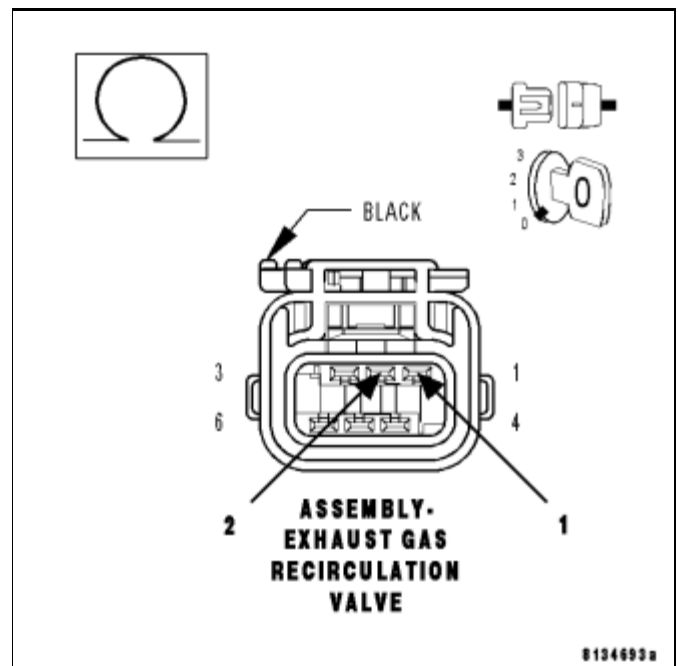
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [3](#)



3. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Ignition on, engine not running.

Measure the voltage on the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.

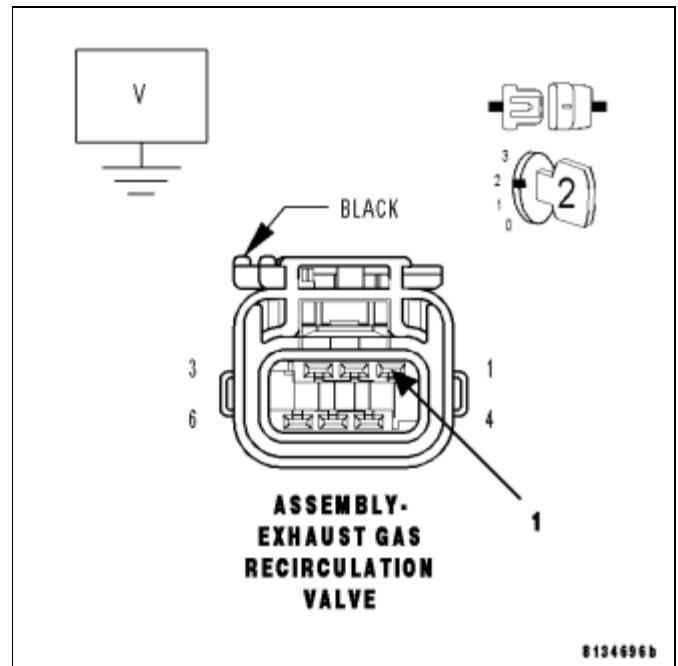
Is there any voltage present?

Yes

- Repair the short to voltage in the (K34) EGR Position Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)



4. EGR SOLENOID ASSEMBLY

Turn the ignition off.

Connect the PCM harness connectors.

Ignition on, engine not running.

With the scan tool, monitor the EGR Position Sensor voltage.

Connect a jumper wire between the (K34) EGR Position Sensor Signal circuit and the (K900) Sensor ground circuit.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

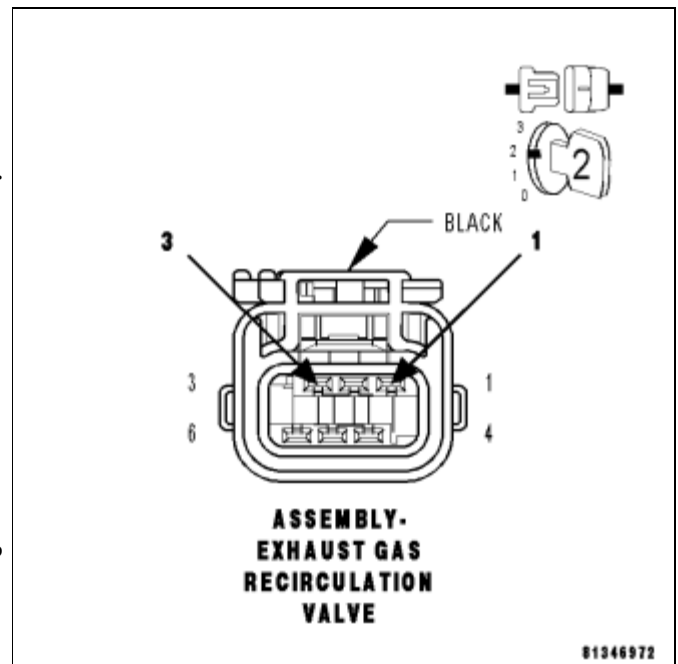
Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. If OK, replace the EGR Valve Assembly in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)



- **NOTE: Remove the jumper wire before continuing.**

5. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K34) EGR Position Sensor Signal circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

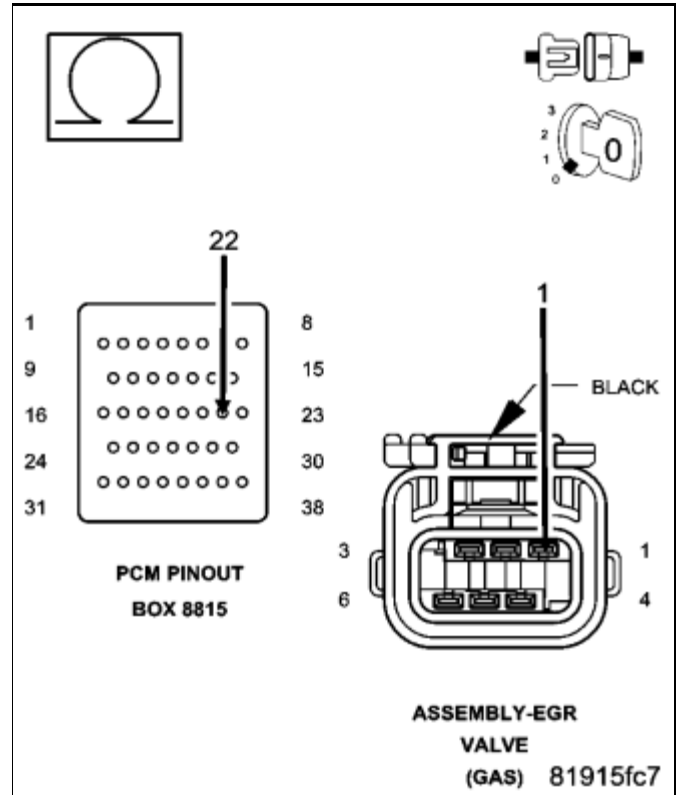
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K34) EGR Position Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

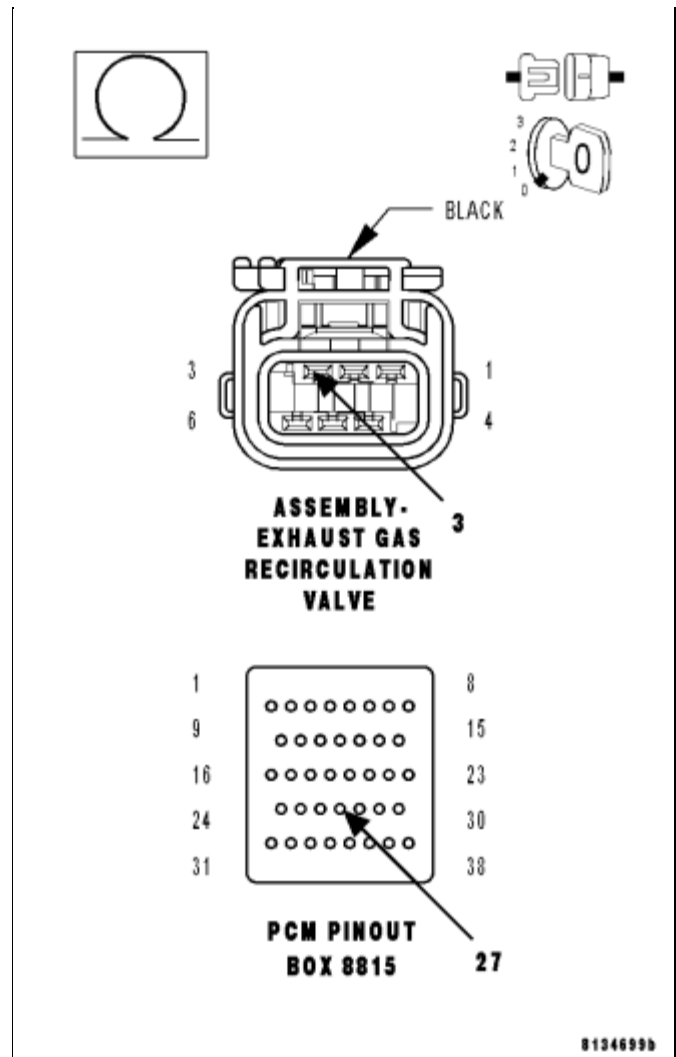
Is the resistance below 30 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0420-CATALYST EFFICIENCY (BANK 1)

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The State of Change (SOC) catalyst monitor uses the signals from both the upstream and downstream O₂ sensors to detect aging of the catalyst. Based on the fact that when a catalyst ages, it loses some of its Oxygen Storage Capacity (OSC). As a result, part of the untreated exhaust gases can breakthrough the catalyst and causes the downstream O₂ sensor to deviate from its neutral (Stoichiometric) position. By observing the activities in the downstream O₂ signal, the degradation level of catalyst can be detected. In general, the higher the downstream O₂ sensor SOC value, the more exhaust gas breakthrough and the lower the OSC of the catalytic converter.

- **When Monitored:**

The monitor will run at between 1400 and 2300 RPM. It also runs between 40 and 70 kPa.

- **Set Condition:**

If the final State of Change index is within the calibrated fail threshold. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O ₂ RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K904) O ₂ RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K902) O ₂ RETURN UPSTREAM CIRCUIT OPEN
(K904) O ₂ RETURN DOWNSTREAM CIRCUIT OPEN
EXHAUST LEAK
ENGINE MECHANICAL CONDITION
AGING O ₂ SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.

Damage Catalytic Converter, dents or holes.

Severe discoloration caused by overheating the Catalytic Converter.

Catalytic Converter broke internally.

Inspect both ends of the converter, inlet and outlet.

Leaking Catalytic Converter.

Were any problems found?

Yes

- Replace the Catalytic Converter. Repair the condition that may have caused the failure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

Go To [3](#)

3. (K902) O2 RETURN UPSTREAM CIRCUIT VOLTAGE CHECK

Turn the ignition off.
 Disconnect the 1/1 O2 Sensor harness connector.
 Turn the ignition on.
 Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

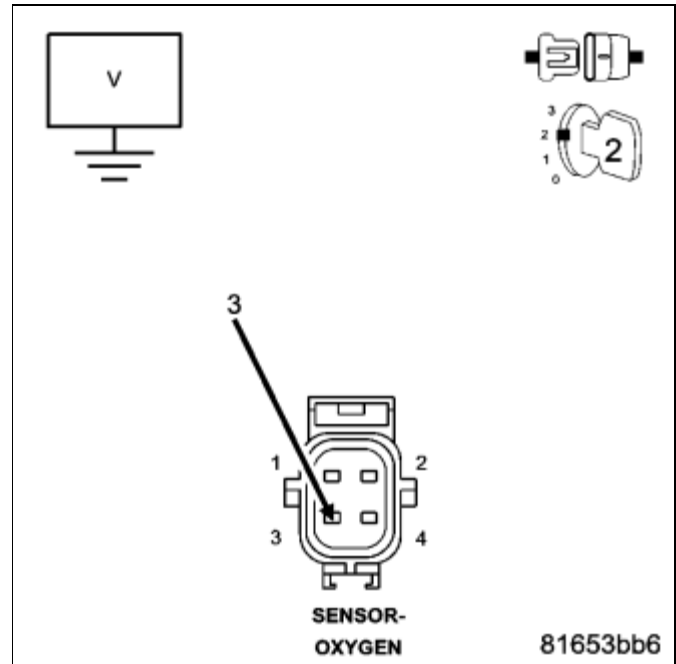
Is the voltage at 2.5 volts?

Yes

- Go To [4](#)

No

- Go To [5](#)



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT VOLTAGE CHECK

Turn the ignition off.
 Disconnect the 1/2 O2 Sensor harness connector.
 Turn the ignition on.
 Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

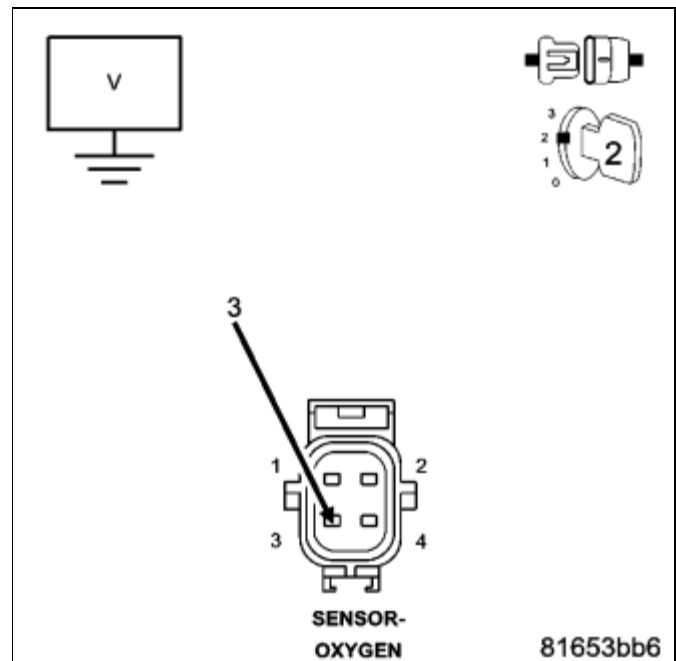
Is the voltage at 2.5 volts?

Yes

- Go To [10](#)

No

- Go To [7](#)



5. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

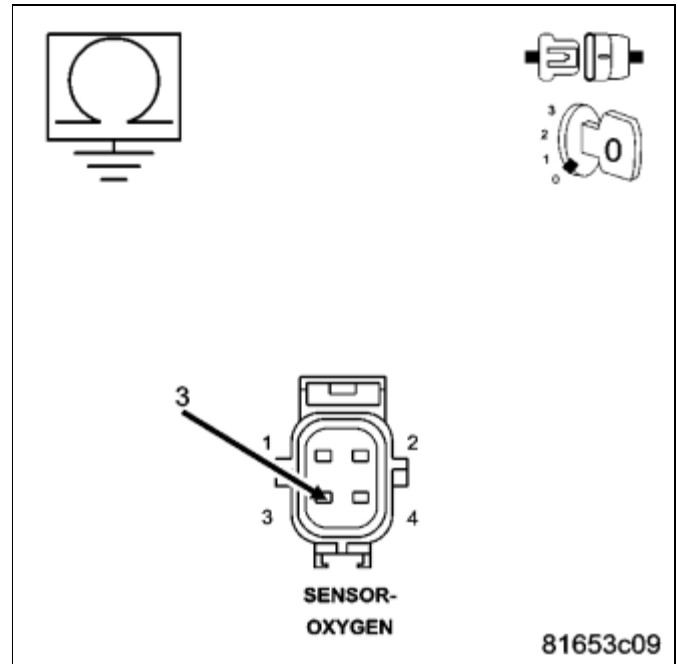
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the 1/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

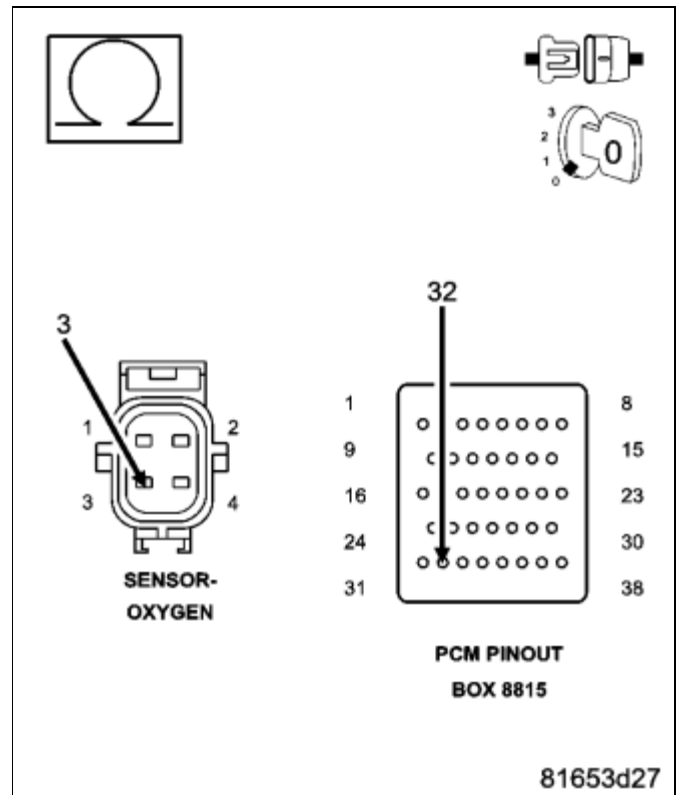
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the 1/2 O2 harness connector.
 Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

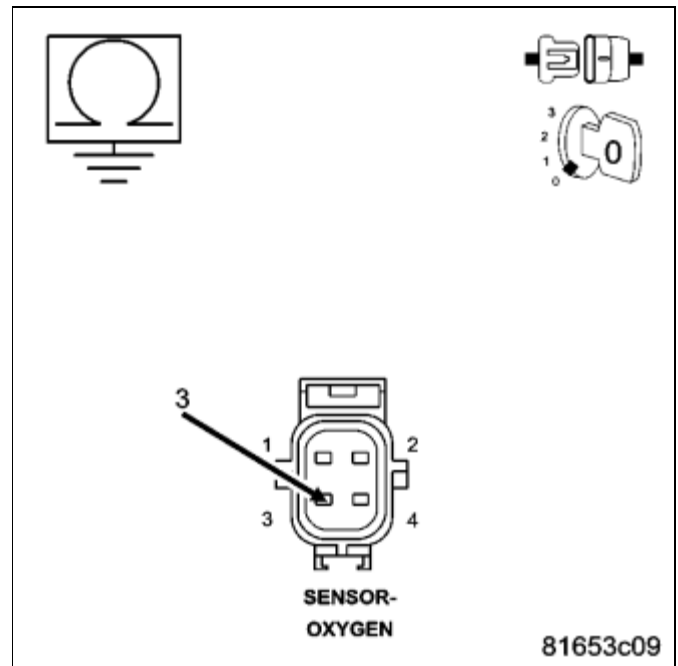
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the 1/2 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

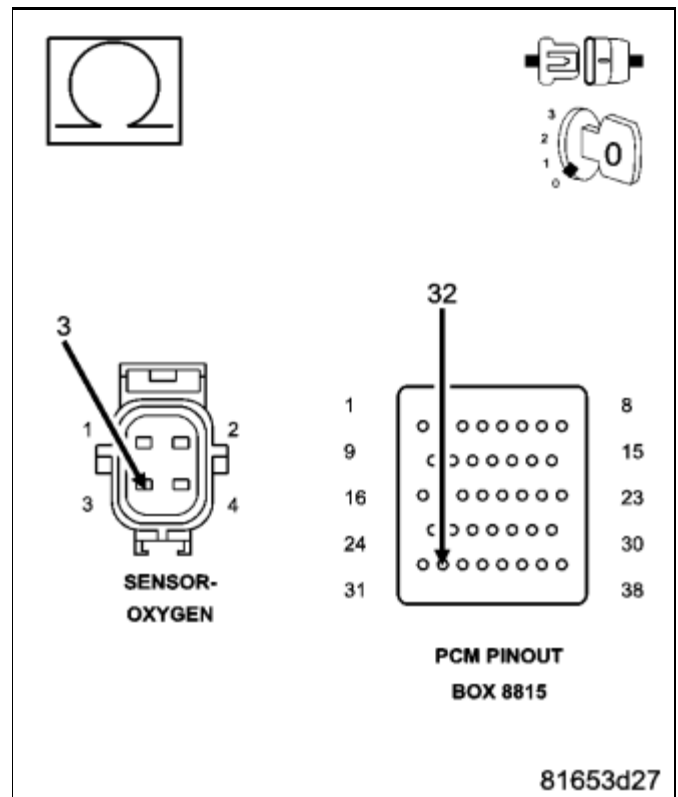
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

10. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time.

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 4 psi reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)

11. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes

- Repair the engine mechanical condition as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [12](#)

12. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes

- Replace the Front O2 Sensor as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)

13. CATALYTIC CONVERTER

If there are no possible cause remaining, view repair.

Repair

- Replace the Catalytic Converter.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0430-CATALYST EFFICIENCY (BANK 2)

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The State of Change (SOC) catalyst monitor uses the signals from both the upstream and downstream O2 sensors to detect aging of the catalyst. Based on the fact that when a catalyst ages, it loses some of its Oxygen Storage Capacity (OSC). As a result, part of the untreated exhaust gases can breakthrough the catalyst and causes the downstream O2 sensor to deviate from its neutral (Stoichiometric) position. By observing the activities in the downstream O2 signal, the degradation level of catalyst can be detected. In general, the higher the downstream O2 sensor SOC value, the more exhaust gas breakthrough and the lower the OSC of the catalytic converter.

- **When Monitored:**

ECT above 70° C (158° F), engine RPM between 1400 and 2300, vehicle speed between 64 and 96 kph (40 and 60 mph), and engine run time greater than 3 minutes.

- **Set Condition:**

If the final State of Change index is within the calibrated fail threshold. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
EXHAUST LEAK
ENGINE MECHANICAL CONDITION
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?**Yes**

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.

Damage Catalytic Converter, dents or holes.

Severe discoloration caused by overheating the Catalytic Converter.

Catalytic Converter broke internally.

Inspect both ends of the converter, inlet and outlet.

Leaking Catalytic Converter.

Were any problems found?**Yes**

- Replace the Catalytic Converter. Repair the condition that may have caused the failure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K902) O2 RETURN UPSTREAM CIRCUIT VOLTAGE CHECK

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Turn the ignition on.

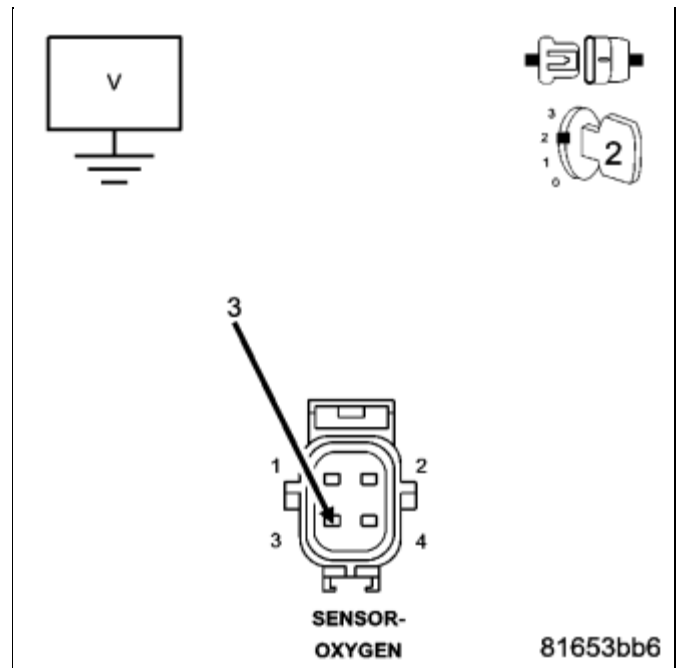
Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?**Yes**

- Go To [4](#)

No

- Go To [5](#)



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT VOLTAGE CHECK

Turn the ignition off.
 Disconnect the 2/2 O2 Sensor harness connector.
 Turn the ignition on.
 Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

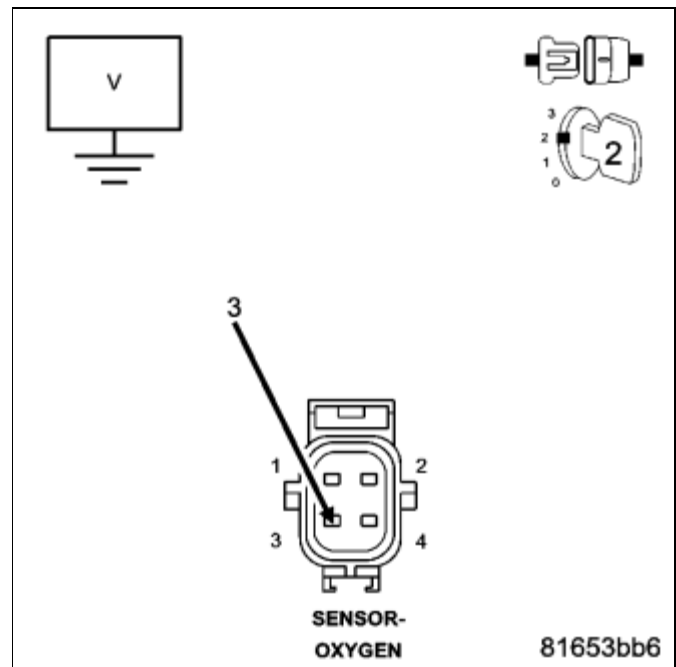
Is the voltage at 2.5 volts?

Yes

- Go To [10](#)

No

- Go To [7](#)



5. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 and C2 PCM harness connectors.
 Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the 2/1 O2 Sensor harness

connector.

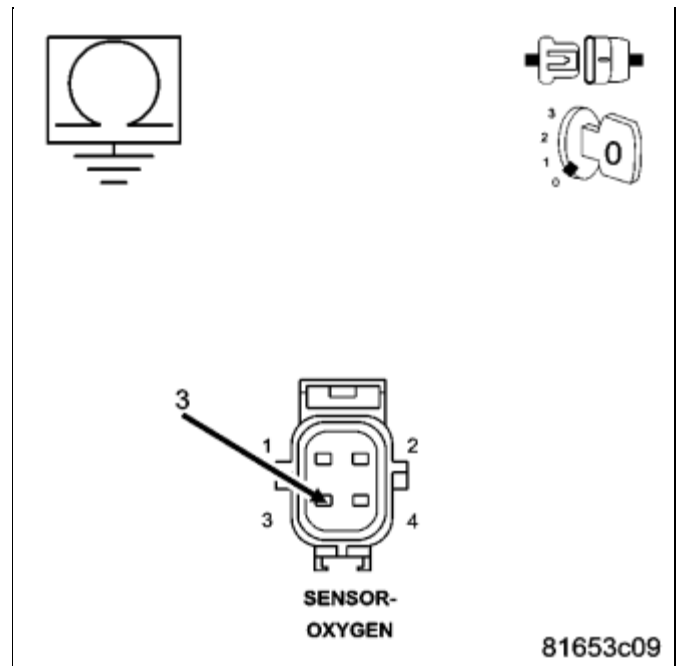
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the 2/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

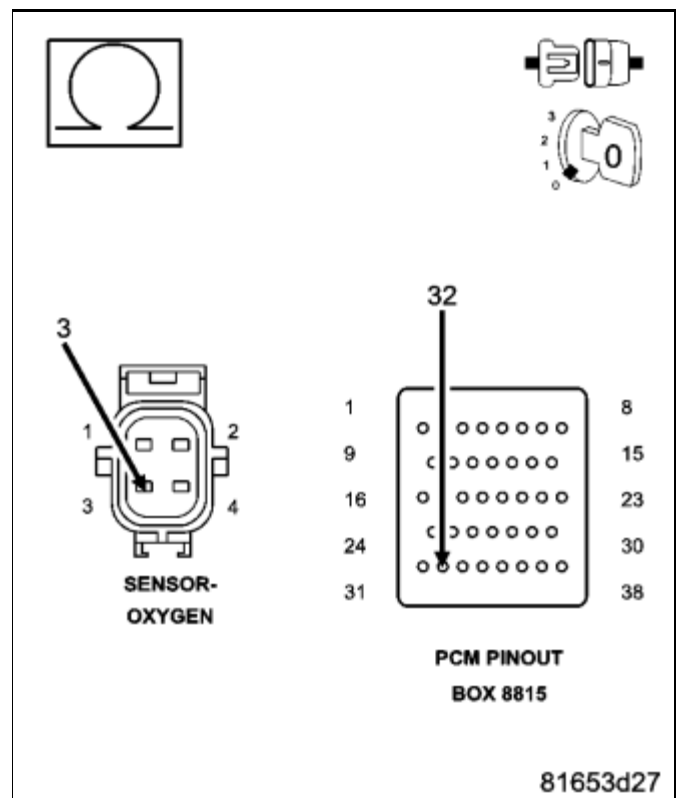
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K902) O2 Return Upstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the 2/2 O2 harness connector.
 Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

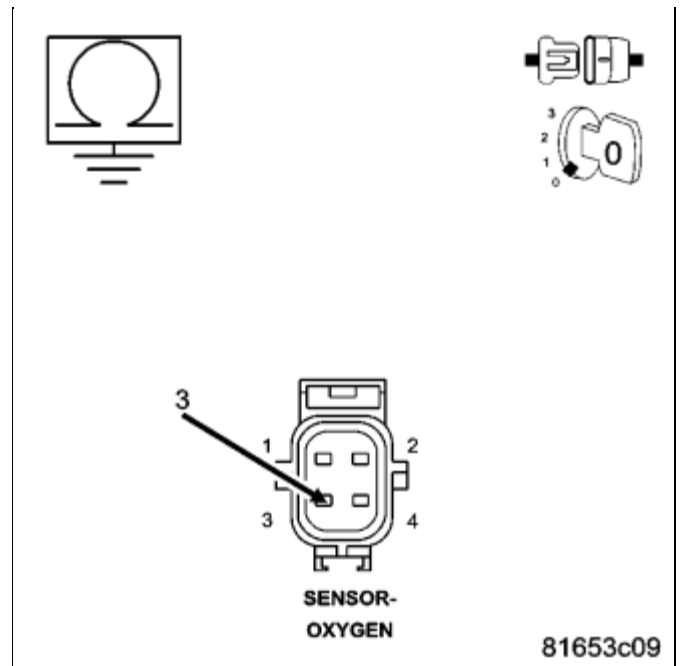
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the 2/2 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

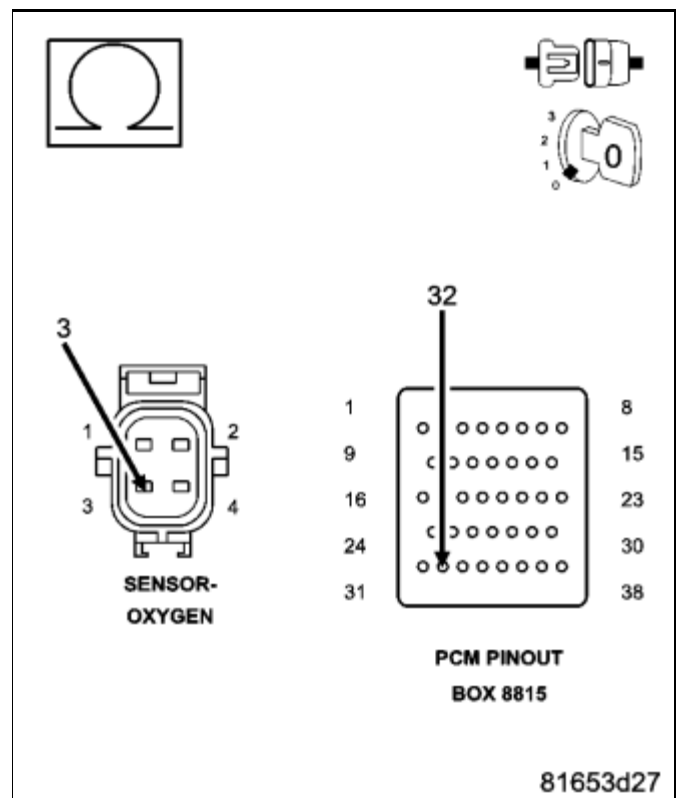
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K904) O2 Return Downstream circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

10. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time.

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear.

Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 4 psi reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)

11. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes

- Repair the engine mechanical condition as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [12](#)

12. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes

- Replace the Front O2 Sensor as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)

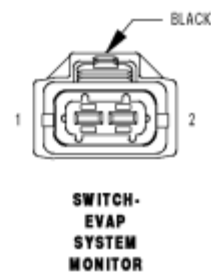
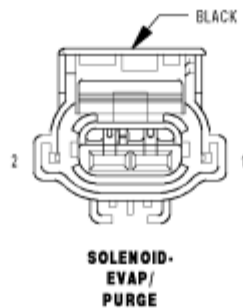
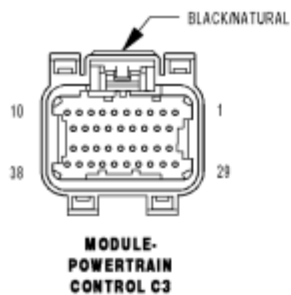
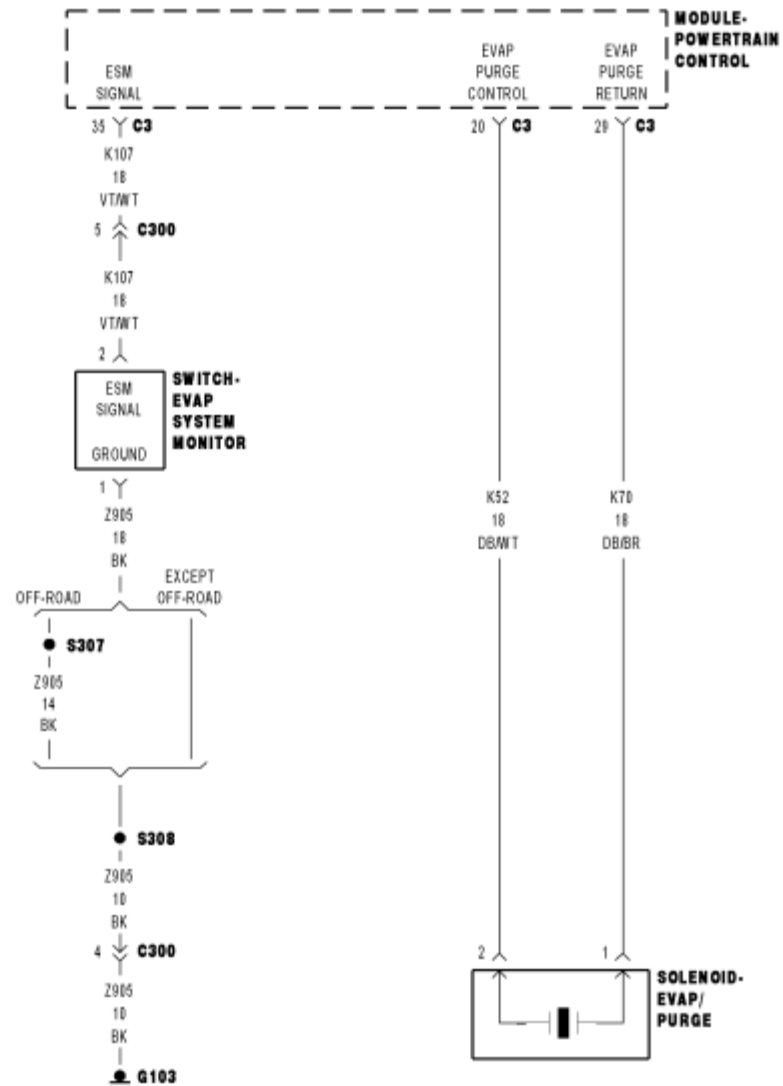
13. CATALYTIC CONVERTER

If there are no possible cause remaining, view repair.

Repair

- Replace the Catalytic Converter.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0440-GENERAL EVAP SYSTEM FAILURE



01016673

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Evap Purge Monitor tests the integrity of the hoses/tube between the throttle body/intake and the fuel tank. The monitor is a two stage test and runs only after the Evap system passes the small leak test. Stage one is non-intrusive. The PCM monitors the purge vapor ratio and the ESM switch closed ratio. If the purge vapor ratio is above a calculated value, the monitor passes. If the ESM switch closed ratio is greater than calculated value when purge flow is greater than a minimum value, the monitor passes. Stage two is an intrusive test and runs only if stage one does not pass. The PCM commands the purge solenoid to flow at a specified rate to force the purge vapor ratio to update. The ratio is compared to a calibrated specification. If it is less than specified, a one trip failure is recorded. This test can detect if the purge hose is off, obstructed, or the purge valve is not operational.

- **When Monitored:**

Engine running after a cold start with the difference between ECT and AAT is less than 10° C (19° F).
 Fuel Level between 12% and 88% full. Manifold vacuum greater than a calculated minimum value.
 Ambient Temperature between 4° C and 32° C (39° F and 89° F).

- **Set Condition:**

When the monitor conditions are met, the PCM will ramp in purge flow. If the PCM does not sense an ESM switch closure after a calculated amount of purge flow accumulation, an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION
(Z905) GROUND CIRCUIT OPEN
(K107) ESM SIGNAL CIRCUIT OPEN
EVAPORATIVE EMISSION LEAK
EVAP SYSTEM MONITOR SWITCH
EVAP PURGE SOLENOID
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTCs. Record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are active you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

NOTE: Allow the vehicle to reach ambient temperature before continuing with this procedure.

NOTE: A loose gas cap could have caused this DTC to set. Make sure the gas cap is tight and in good condition.

NOTE: If the customer is experiencing an early fuel shut off during the fuel filling process along with P0440, P0441, and P0452 setting, you need to check for restrictions in the EVAP Purge tubes/hoses as well as the Fresh Air Filter before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [3](#)

No

Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

3. VISUAL AND PHYSICAL INSPECTION

Turn the ignition off.

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the following conditions:

- Hoses disconnected or left off
- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap left off or bad gasket seal

Were any of the above conditions found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. EVAP VACUUM SUPPLY HOSE INSPECTION

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Make sure the vacuum port at the throttle body or intake manifold is free from any blockage.

Were any problems found?

Yes

- Repair the vacuum supply, hose/tube as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [5](#)

5. EVAP PURGE SOLENOID

NOTE: To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to

prevent the ignition of explosive gases, Keep the test area well ventilated.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Connect the SMOKE supply tip (black hose) to the "CAN" port on the Evap Purge Solenoid.

Set the smoke/air control switch to SMOKE.

While still holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

NOTE: This is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Disconnect the Smoke supply tip from the vacuum supply hoses at the EVAP Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the "CAN" side of the EVAP Purge Solenoid.

Observe the vacuum gauge for at least 15 seconds.

Is smoke visible from the EVAP Purge Solenoid or NOT hold a vacuum?

Yes

- Replace the Evap Purge Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [6](#)

6. ESIM SWITCH STATE

Turn the ignition off.

Connect the previously disconnected vacuum hose.

Disconnect the Evap System Monitor Switch harness connector.

Ignition on, engine not running.

Monitor the ESIM Switch state on the scan tool.

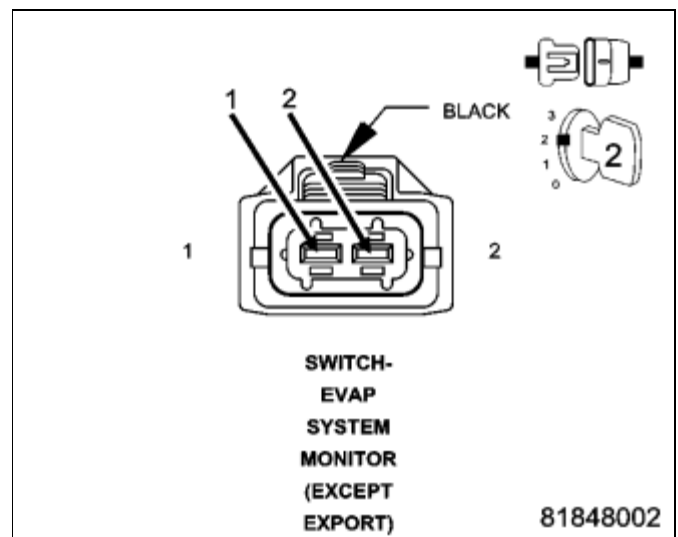
Carefully connect a jumper wire between the (K107) ESM Signal circuit and the (Z905) Ground circuit in the Evap System Monitor Switch harness connector.

Monitor the ESIM Switch state on the scan tool.

Did the Switch change from OPEN to CLOSED when the jumper wire was installed?

Yes

- Go To [9](#)



No

- Go To [7](#)

7. EXCESSIVE RESISTANCE IN THE (K107) ESM SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K107) ESM Signal circuit from the ESM harness connector to the appropriate terminal of special tool #8815.

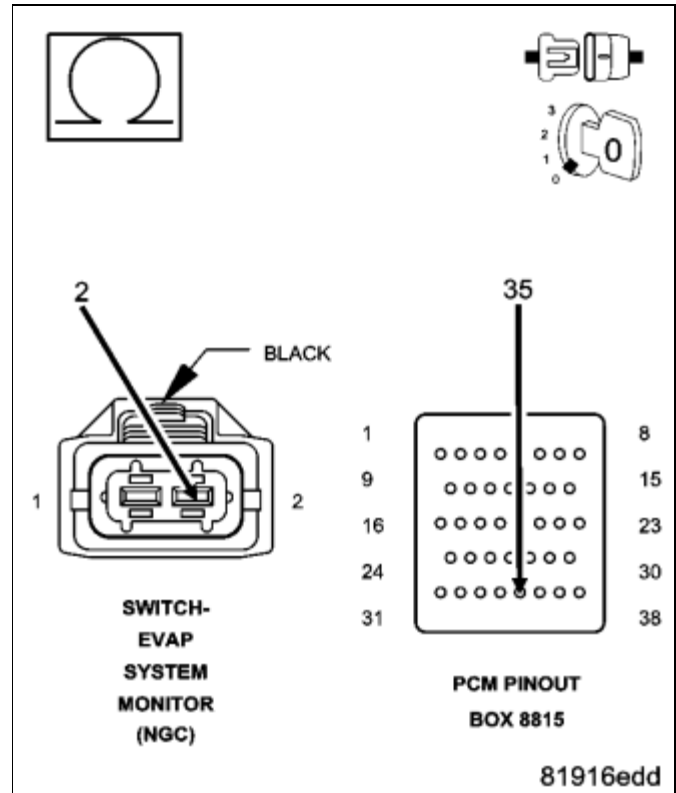
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the excessive resistance in the (K107) ESM Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



8. EXCESSIVE RESISTANCE IN THE (Z905) GROUND CIRCUIT

Using a 12-volt test light connected to B+, probe the (Z905) Ground circuit in the ESM harness connector.

NOTE: The test light should illuminate brightly. Compare the brightness to that of a direct connection to B- (ground).

Does the test light illuminate brightly?

Yes

- Go To [10](#)

No

- Go To [12](#)

10. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

Remove the Air supply hose from the service port or the #8404-ADP adapter.
Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.
Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move at this point.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that are left behind by the smoke.

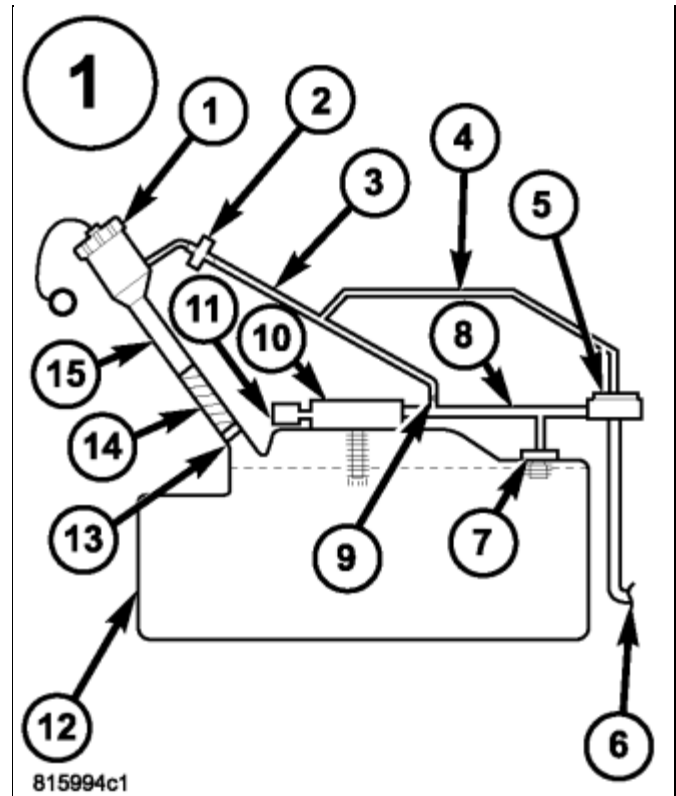
The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

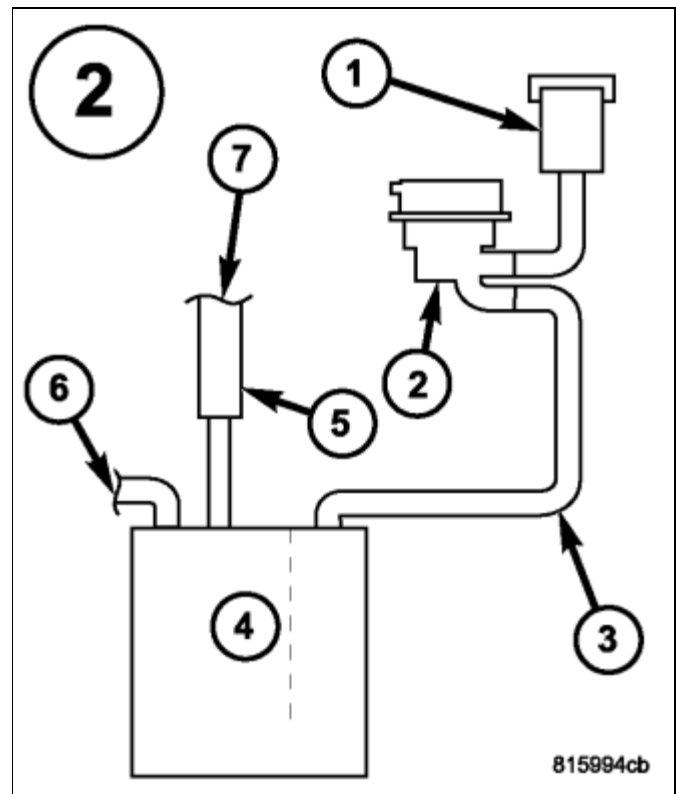
1 Fuel Cap.

- 2 Recirculation Check Valve.
 - 3 Vapor Recirculation Line.
 - 4 Signal Vapor Line for FVM.
 - 5 Flow Management Valve.
 - 6 Fuel Tank to Canister Vapor Line connection.
 - 7 Fuel Tank Vent (Check Valve).
 - 8 Vapor Line to Canister.
 - 9 Flow Control Orifice.
 - 10 Control Valve.
 - 11 Liquid Trap.
 - 12 Fuel Tank.
 - 13 Check valve.
 - 14 Fuel Fill Tube to Tank connector.
 - 15 Fuel Fill Tube.
- Damaged or disconnected EVAP system components.



◦ ZONE 2

- 1 Filter.
- 2 ESIM.
- 3 Canister Vent Line.
- 4 Evap Canister.
- 5 Chassis Purge Valve.
- 6 Fuel Tank to Canister Vapor Line connection.
- 7 Evap Purge connection.



◦ ZONE 3

- 1 Evap Purge Vacuum Line.
- 2 Connection to Chassis Line.
- 3 Connection to Canister.
- 4 Chassis Purge Line.

- 5 Evap Purge Vacuum Line.
- 6 Connection to Evap Purge Harness.
- 7 Chassis Evap Purge Line connection to Engine Vacuum.
- 8 Evap Purge Valve.
- 9 Service Port.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke or dye may or may not be visible. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Select the appropriate response from the list below:

A leak was found at the gas cap or fuel filler tube.

- Go To [11](#)

A leak was found in one or more of the EVAP System zones.

- If the leak is at a hose connection, remove the hose then reconnect the hose and check for a leak again. All other leaks repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No leaks were detected.

- Go To [12](#)

11. LEAK AT GAS CAP

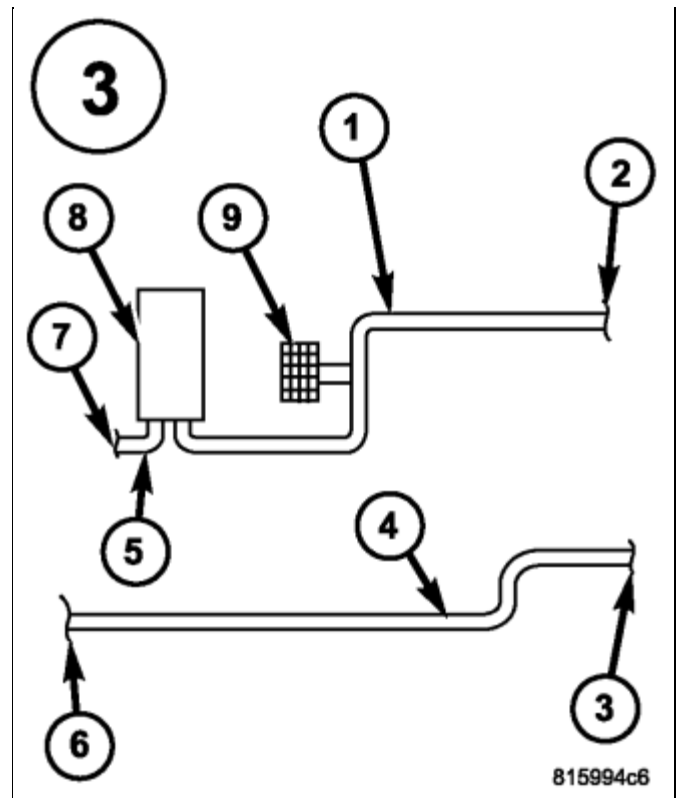
Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404-ADP adapter. Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

NOTE: The gas cap adapter is being used as a known good cap.

Was a leak found at the gas cap adapter?

Yes

- Replace the Fuel Filler tube assembly.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



No

- Replace the gas cap.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

12. EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION

Inspect the Evap Purge hose/tube for proper routing and installation between the Evap Purge Solenoid and the Fuel Tank between the Fuel Tank and the Evap Purge Canister

Make sure the hose/tube and fresh air filter are not damaged, kinked, and free from any obstructions.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [13](#)

13. EVAP SYSTEM MONITOR SWITCH

Use the wiring diagram/schematic as a guide, inspect the wiring and connections between the Evap System Monitor Switch and the PCM.

Look for any chafed, pierced, pinched, or partially broken wires.

Verify that there is good pin to terminal contact in the ESIM Switch and the Powertrain Control Module connectors.

Look for any broken, bent, pushed out, or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?**Yes**

- Repair and Replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace the Evap System Monitor Switch per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)..

14. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap Purge Solenoid Assembly, ESIM Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch, Solenoid, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

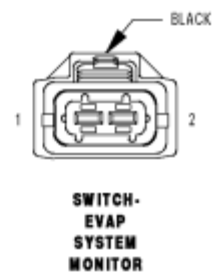
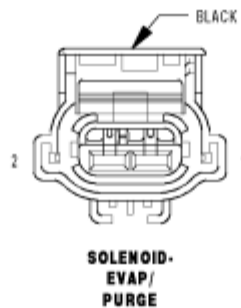
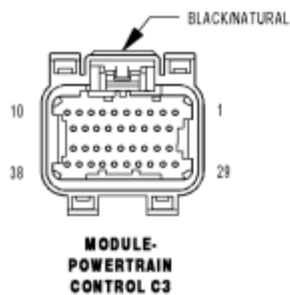
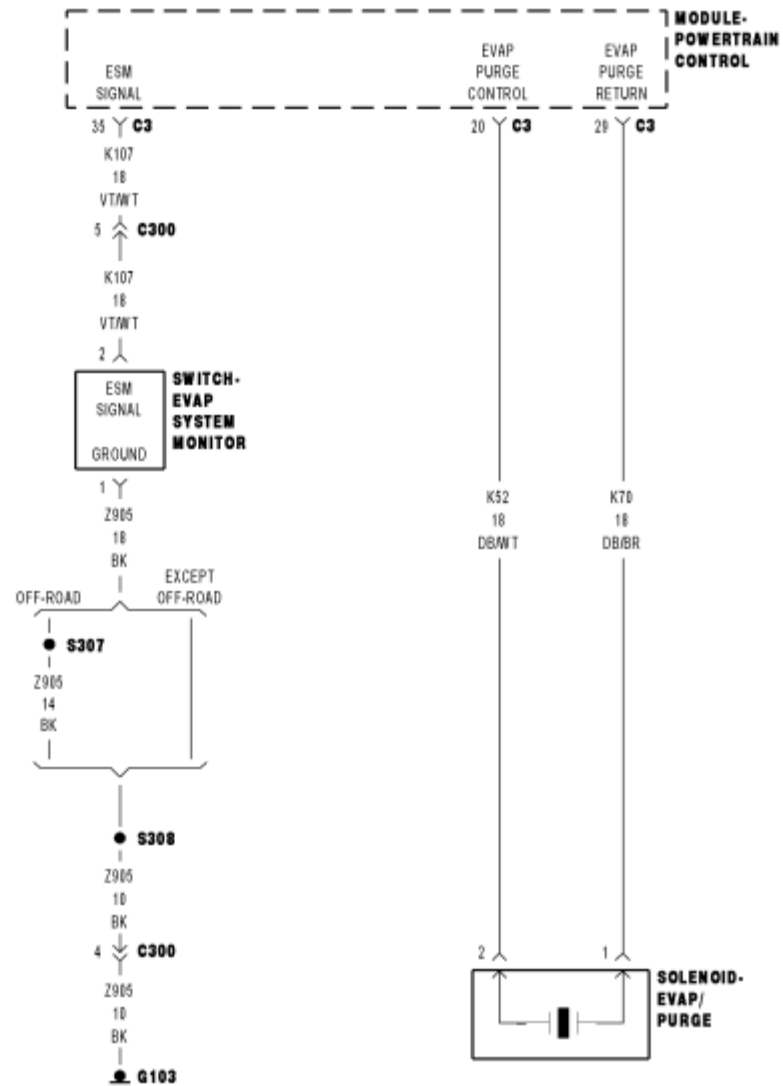
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P0441-EVAP PURGE SYSTEM PERFORMANCE



01016673

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Evap Purge Monitor tests the integrity of the hoses/tube between the throttle body/intake and the fuel tank. The monitor is a two stage test and runs only after the Evap system passes the small leak test. Stage one is non-intrusive. The PCM monitors the purge vapor ratio and the ESM switch closed ratio. If the purge vapor ratio is above a calculated value, the monitor passes. If the ESM switch closed ratio is greater than calculated value when purge flow is greater than a minimum value, the monitor passes. Stage two is an intrusive test and runs only if stage one does not pass. The PCM commands the purge solenoid to flow at a specified rate to force the purge vapor ratio to update. The ratio is compared to a calibrated specification. If it is less than specified, a one trip failure is recorded. This test can detect if the purge hose is off, obstructed, or the purge valve is not operational.

- **When Monitored:**

After the Evap System small leak test has passed, with the engine running, ambient temperature between 4° C (39° F) and 35° (95° F), with the engine at idle after a calibrated amount of drive time has accumulated.

- **Set Condition:**

If the PCM detects that the purge vapor ratio and the ESM switch closed ratio are below a calculated value, the PCM commands the purge solenoid to flow at a specified rate to update the purge vapor ratio. If the ratio remains below a specified value, a one trip failure is recorded. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION
EVAP PURGE SOLENOID
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTCs. Record the Freeze Frame data if any DTCs are present.

Whether or not any DTC(s) are Active you will want to check the following items which may assist in repairing

the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

NOTE: If P0443 is set along with this DTC, perform the diagnostic procedure for P0443 before continuing with this test.

NOTE: If the customer is experiencing an early fuel shut off during the fuel filling process along with P0440, P0441, and P0452 setting, you need to check for restrictions in the EVAP Purge tubes/hoses as well as the Fresh Air Filter before continuing.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the ESIM FORCED MONITOR TEST. Allow the test to complete.

With a scan tool, select View DTCs.

NOTE: If any other DTC sets, active or pending, perform the diagnostic procedure for that DTC before proceeding with this test.

Is the DTC Active at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

3. VISUAL INSPECTION

Inspect the EVAP System for any of the following conditions:

- Holes or cracks
- Loose seal points
- Damaged or missing components
- Incorrect routing of hoses and tubes
- Loose or missing Fuel Cap
- Damaged or missing Fuel Cap seal
- Improper installation of the Fuel Cap
- Damaged Locking tabs on the Fuel Cap and/or filler tube
- Damaged seal points on the Fuel Cap and/or filler tube

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. INSUFFICIENT VACUUM SUPPLY TO THE EVAP PURGE SOLENOID

Turn the ignition off.

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Inspect the vacuum port at the throttle body or intake manifold for any damage or obstructions.

Were any problems found?

Yes

- Repair the vacuum supply hose/tube as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [5](#)

5. EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION

Inspect the Evap Purge hose/tube for proper routing and installation between the EVAP Purge Solenoid and the Fuel Tank and between the Fuel Tank and the Evap Purge Canister.

Make sure the hose/tube and fresh air filter are not damaged, kinked, and free from any obstructions.

Were any problems found?

Yes

- Repair or replace as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. EVAP PURGE SOLENOID

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for signs of contamination.

Using a hand vacuum pump, apply 10 in Hg to the "CAN" side of the EVAP Purge Solenoid.

NOTE: The solenoid should hold vacuum for a minimum of 15 seconds.

Ignition on, engine not running.

With the scan tool, actuate the EVAP Purge Solenoid to the ON position.

NOTE: The vacuum should drop when the solenoid is actuated.

Does the solenoid function as described above?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. Replace the EVAP Purge Solenoid if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap Purge Solenoid Assembly, ESIM Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch, Solenoid, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

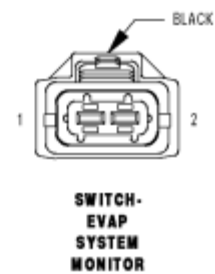
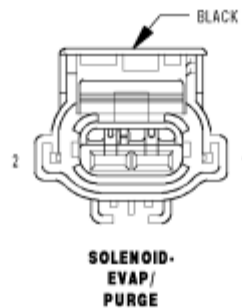
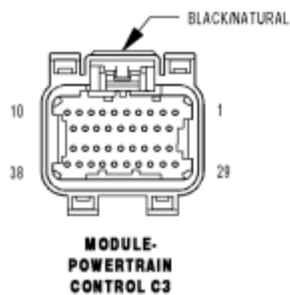
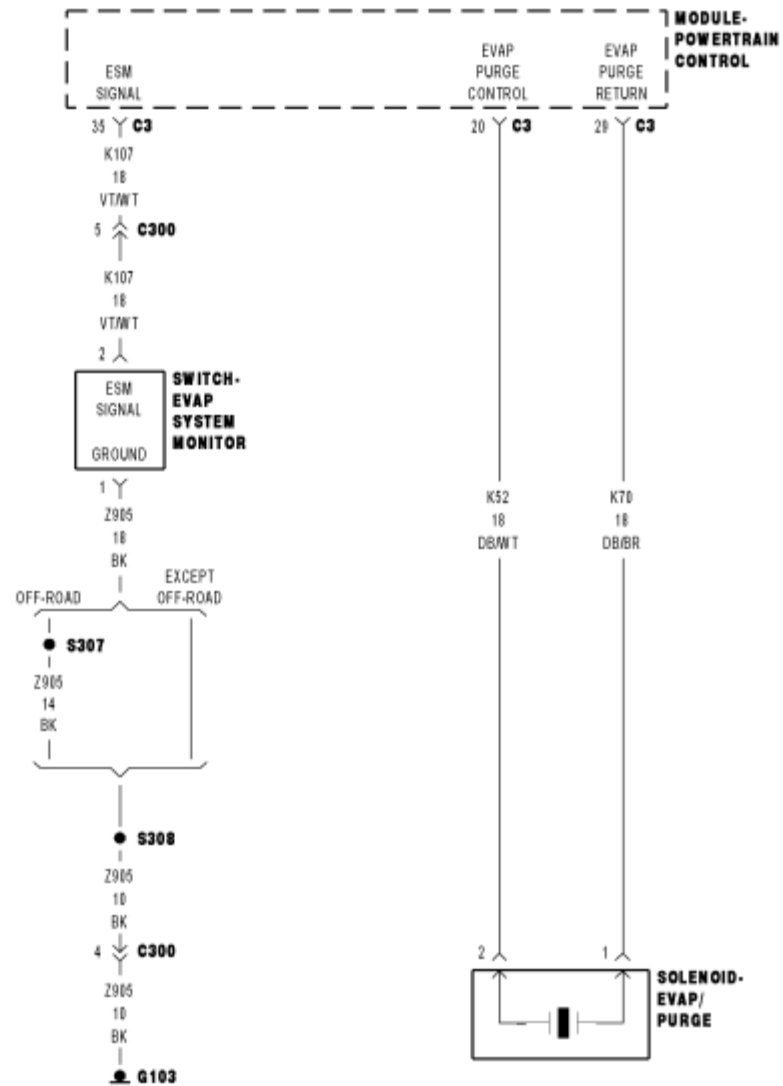
- Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0443-EVAP PURGE SOLENOID CIRCUIT



01016673

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The ignition on or engine running. Battery voltage greater than 10 volts.

- **Set Condition:**

The PCM will set a trouble code if the actual state of the solenoid does not match the intended state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K70) EVAP PURGE RETURN CIRCUIT SHORTED TO VOLTAGE
(K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (K52) EVAP PURGE CONTROL CIRCUIT
EXCESSIVE RESISTANCE IN THE (K70) EVAP PURGE RETURN CIRCUIT
EVAP PURGE SOLENOID
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are Active you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, Select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

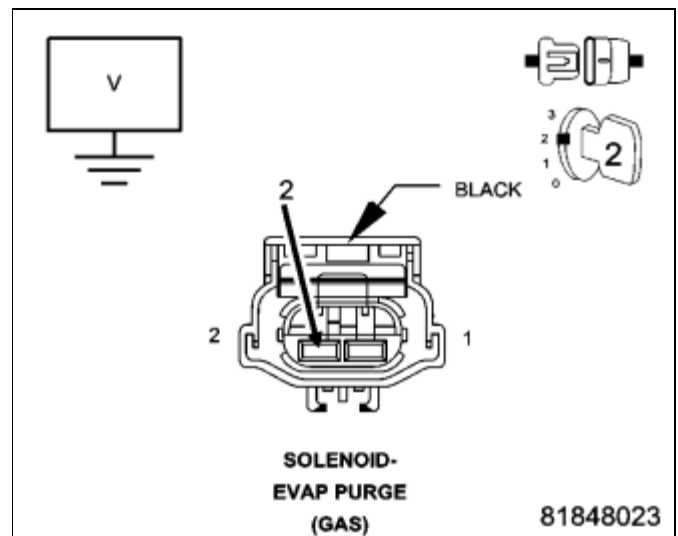
3. (K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the EVAP Purge Solenoid harness connector.
Disconnect the C3 PCM harness connector.
Ignition on, engine not running.
Measure the voltage of the (K52) Evap Purge Control circuit in the Evap Purge Solenoid harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (K52) Evap Purge Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [4](#)

4. (K70) EVAP PURGE RETURN CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K70) Evap Purge Return circuit in the Evap Purge Solenoid harness connector.

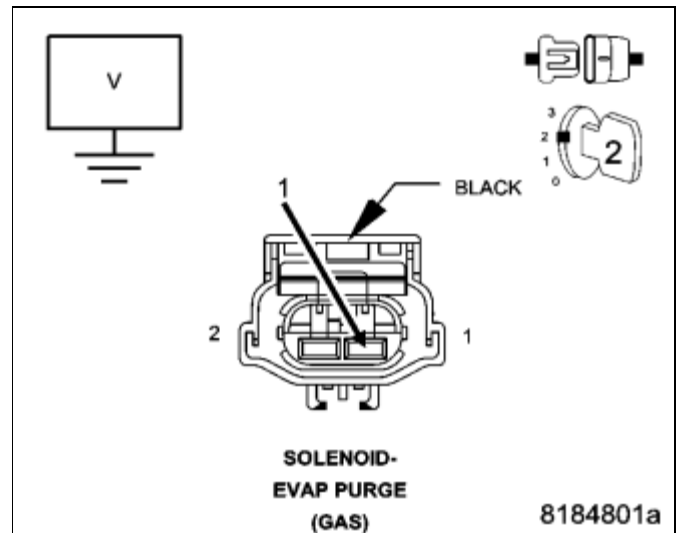
Is there any voltage present?

Yes

- Repair the short to voltage in the (K70) Evap Purge Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [5](#)



5. (K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K52) Evap Purge Control circuit in the Evap Purge Solenoid harness connector.

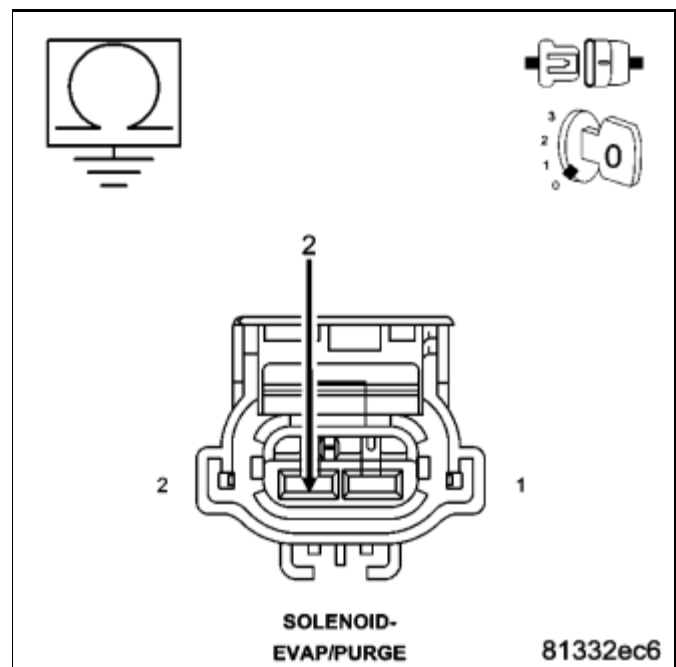
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K52) Evap Purge Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [6](#)



6. (K52) EVAP PURGE CONTROL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K52) Evap Purge Control circuit from the Evap Purge Solenoid harness connector to the appropriate terminal of special tool #8815.

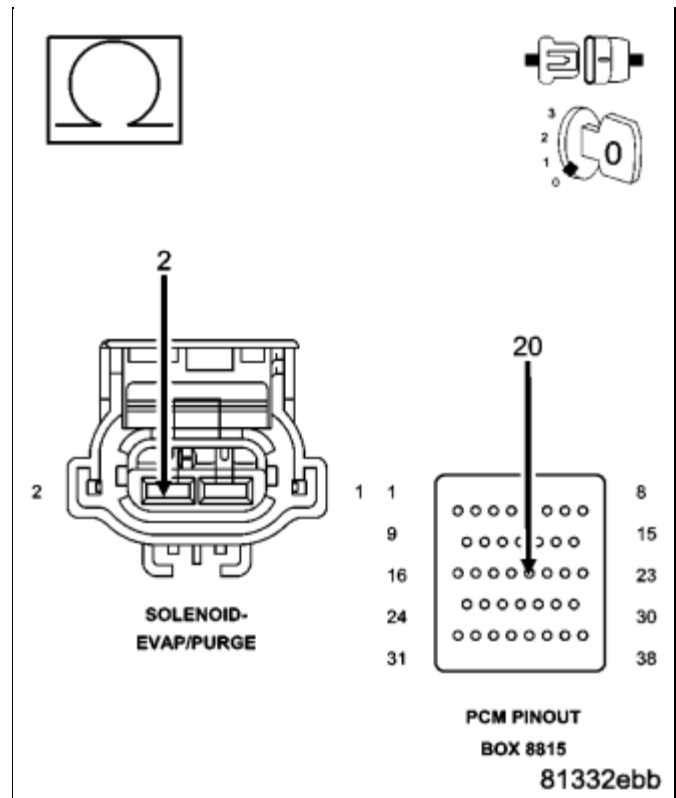
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K52) EVAP Purge Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K70) EVAP PURGE RETURN CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K70) Evap Purge Return circuit from the EVAP Purge Solenoid harness connector to the appropriate terminal of special tool #8815.

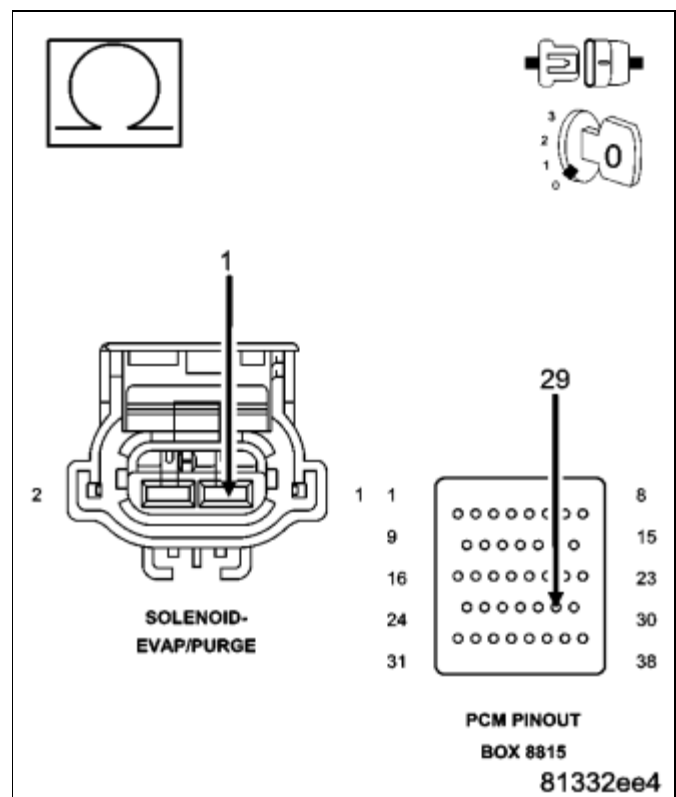
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (K70) Evap Purge Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



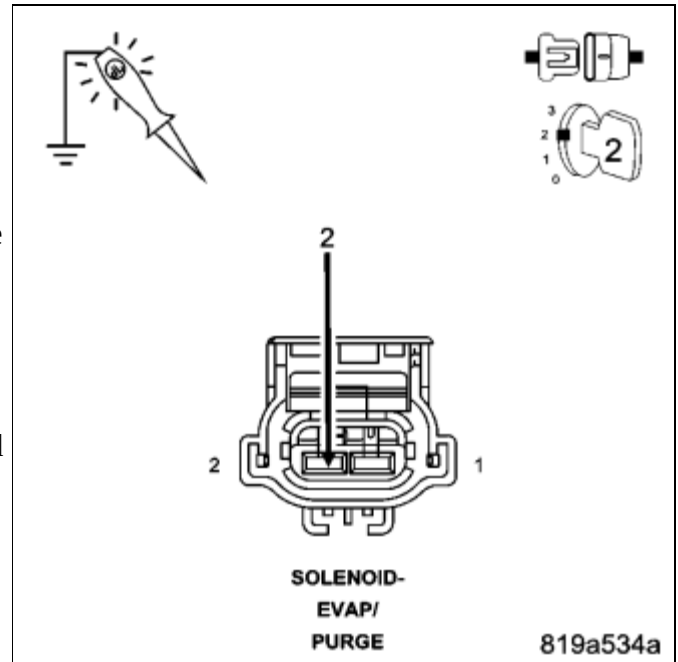
8. EVAP PURGE SOLENOID

Connect the C3 PCM harness connector.
 Ignition on, engine not running.
 With the scan tool, actuate the Evap Purge Solenoid control to the ON (100%) position.

NOTE: The DTC needs to be cleared before actuating the Purge Solenoid, if the DTC is not cleared, the Solenoid may not be allowed to actuate.

Using a 12-volt test light connected to ground, check the (K52) Evap Purge Control circuit in the Evap Purge Solenoid harness connector.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Is the test light illuminated?

Yes

- Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. If OK, replace the EVAP Purge Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [9](#)

9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap Purge Solenoid Assembly, ESIM Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch, Solenoid, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

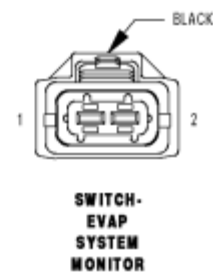
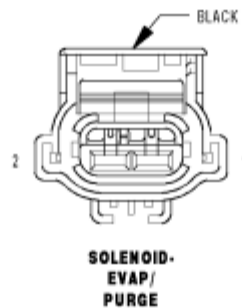
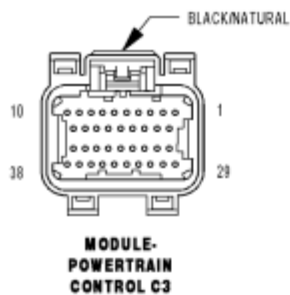
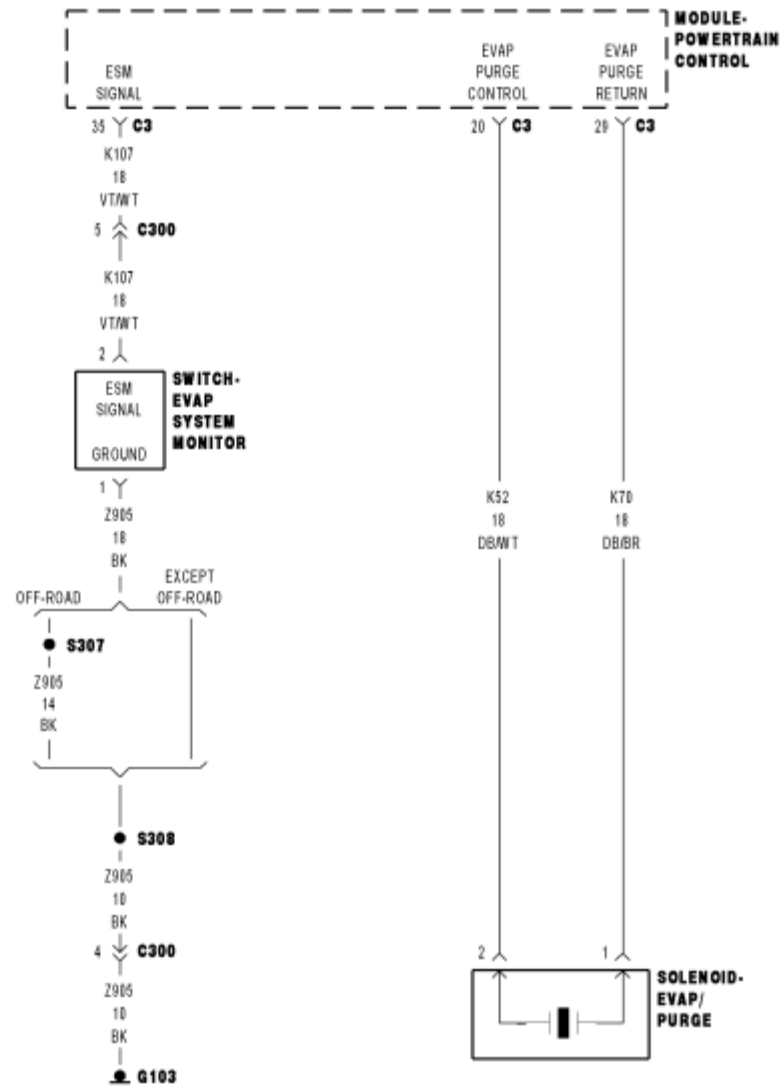
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0452-EVAP PRESSURE SWITCH STUCK CLOSED



01016673

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Immediately after the ignition has been turned off.

- **Set Condition:**

At key off, the PCM energizes the Purge Solenoid for a calibrated amount of time (30 seconds maximum) and stores the state of the ESIM switch. The state is evaluated again at the next key on. If the PCM does not detect that the ESIM switch is open, an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION
(K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO GROUND
(K107) ESM SIGNAL CIRCUIT SHORTED TO GROUND
ESM SWITCH
EVAP PURGE SOLENOID
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTC(s) and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are Active you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

NOTE: If the customer is experiencing an early fuel shut off during the fuel filling process along with P0440, P0441, and P0452 setting, you need to check for restrictions in the EVAP Purge tubes/hoses as well as the Fresh Air Filter before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs and record the related Freeze Frame data.

It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

3. ESIM SWITCH STATE

With a scan tool, select Data Display and view the ESIM Switch state.

Disconnect the purge hose from the Evap canister.

Is the ESIM Switch state change from 'Closed' to 'Open' when the purge hose was disconnected?

Yes

- Go To [4](#)

No

- Go To [7](#)

4. EVAP PURGE HOSE/TUBE AND FRESH AIR FILTER OBSTRUCTION

Turn the ignition off.

Inspect the Evap Purge hose/tube for proper routing and installation between the Evap Purge Solenoid and the Fuel Tank and between the Fuel Tank and the Evap Purge Canister.

Make sure the hose/tube and fresh air filter are not damaged, kinked, and free from any obstructions. Check for any kink in the purge line connecting the LPV (Linear Purge Valve) to intake manifold.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. (K52) EVAP PURGE CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector. Measure the resistance between ground and the (K52) Evap Purge Control circuit in the Evap Purge Solenoid harness connector.

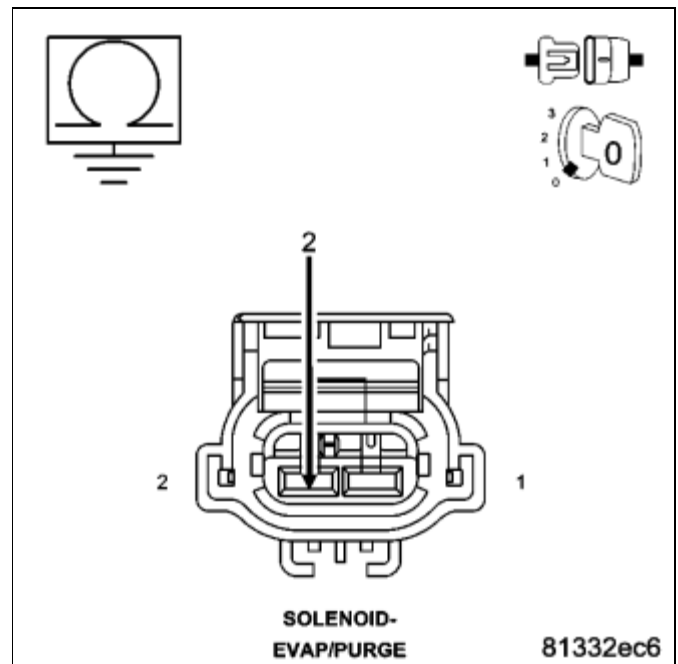
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K52) Evap Purge Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. EVAP PURGE SOLENOID

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap Purge Solenoid and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Evap Purge Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Evap Purge Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. ESIM ASSEMBLY

With a scan tool, select Data Display and view the ESIM Switch state.
Disconnect the Evap System Monitor Switch electrical connector.

Does the ESIM Switch state change from CLOSED to OPEN when the switch is disconnected?

Yes

- Verify that there is good pin to terminal contact in the Switch and the Powertrain Control Module connectors. If OK, replace the ESIM Switch Assembly if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)

8. (K107) ESM SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C3 PCM harness connector.
Measure the resistance between ground and the (K107) ESM Signal circuit in the ESIM Assembly harness connector.

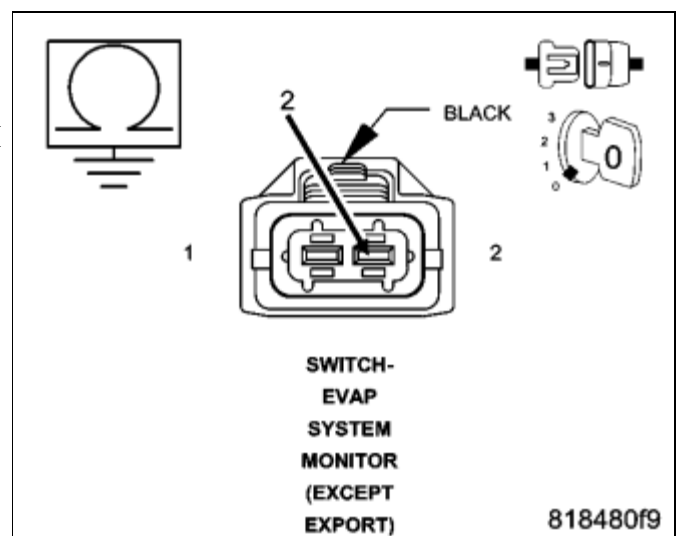
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K107) ESM Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap Purge Solenoid Assembly, ESIM Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ESIM, Evap Purge Solenoid, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

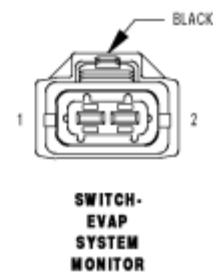
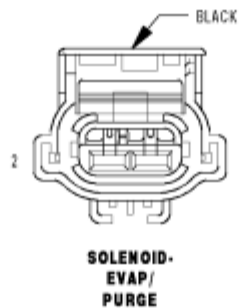
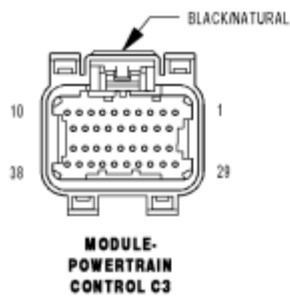
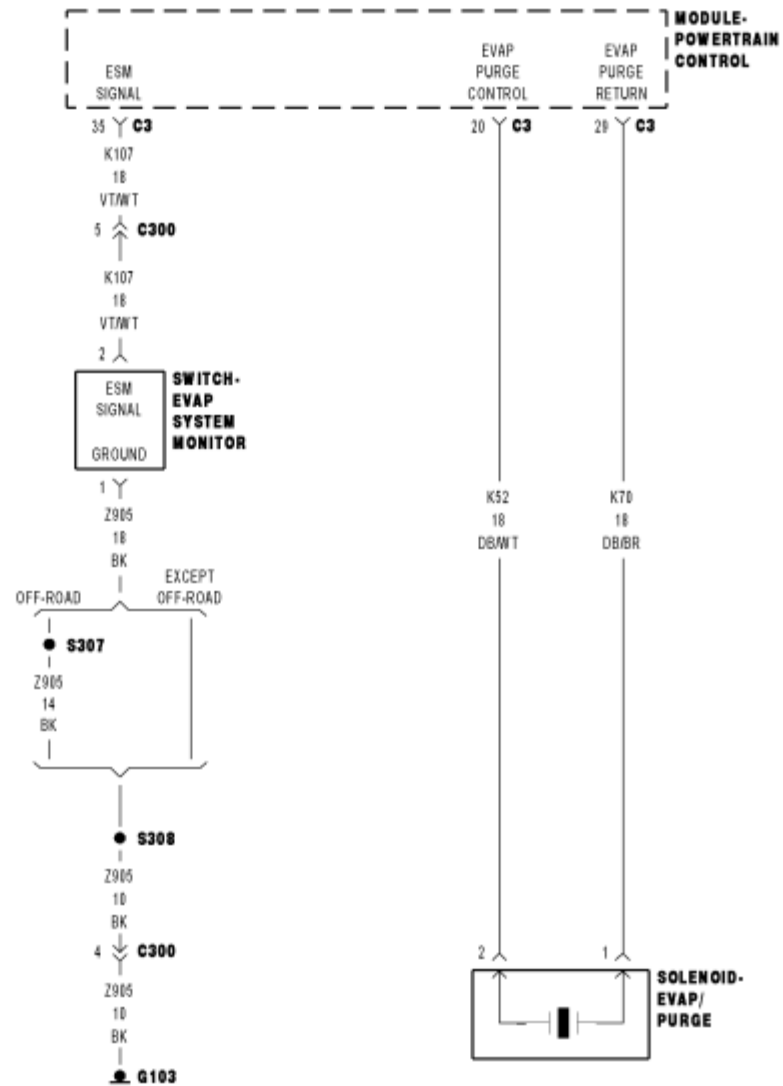
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0455-EVAP PURGE SYSTEM LARGE LEAK



01016673

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running, during a cold start test with the fuel level above 12%, ambient temperature between 4° C and 32° C (39° F and 89° F) and the fuel system in closed loop. The test runs when the small leak test is maturing.

- **Set Condition:**

The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the ESM switch. Once the ESM switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the ESM switch reopens before the calibrated amount of time, a large leak error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
EVAP SYSTEM MONITOR SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are Active you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the ESIM FORCED MONITOR TEST. Allow the test to complete.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

3. EVAPORATIVE SYSTEM INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the following conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Loose or missing Fuel Filler Cap
- Improper installation of the Fuel Fill Cap
- Damaged Locking tabs on Cap and/or fill tube
- Damaged seal points on Cap and/or fill tube
- Fuel cap gasket seal

Were any of the above conditions found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. VERIFY EVAPORATIVE EMISSION LEAK

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes

- Go To [5](#)

No

- Refer to the Freeze Frame data recorded in step 1. If the data indicates that the vehicle was in motion when the DTC was set, verify that all hoses are properly connected.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in

your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD). Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter. Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter. Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

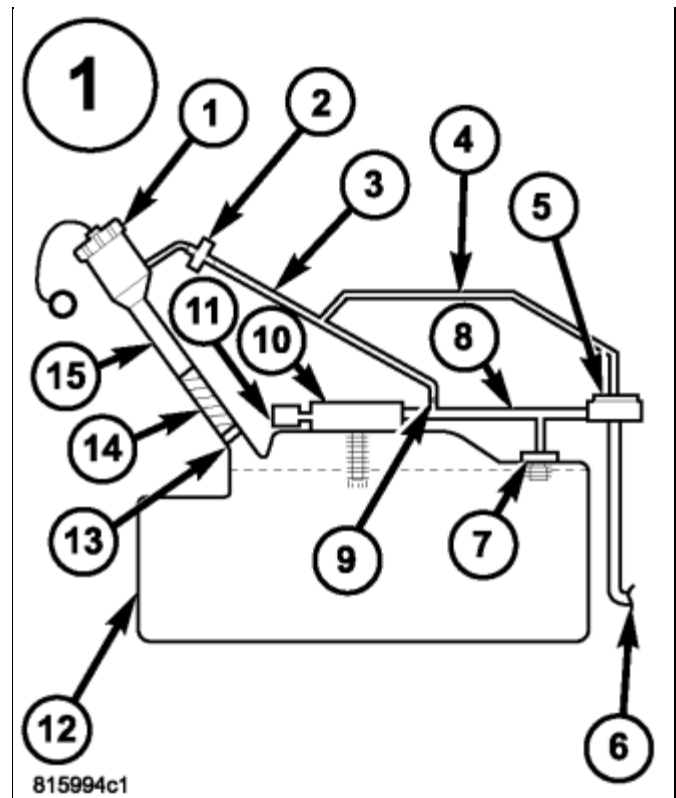
The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

◦ ZONE 1

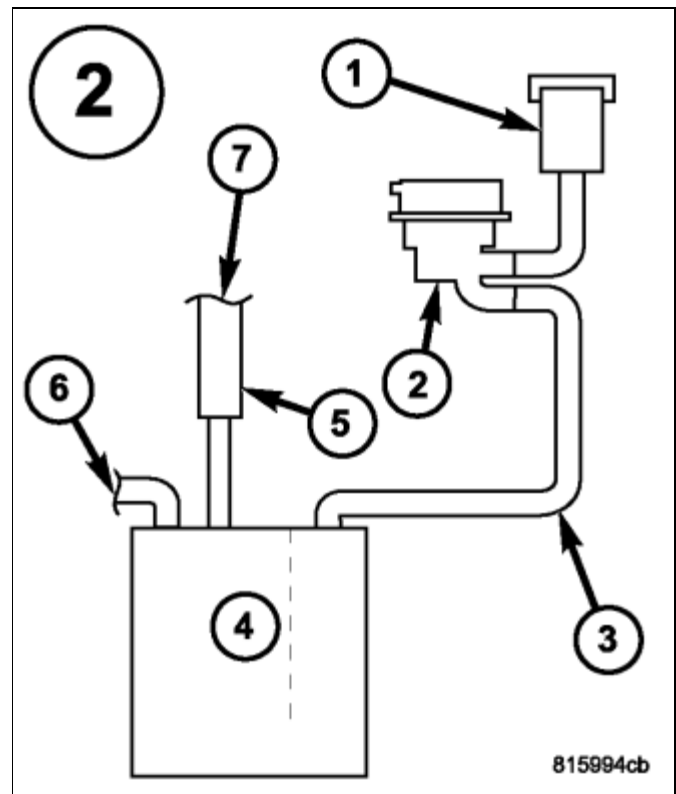
- 1 Fuel Cap.
- 2 Recirculation Check Valve.
- 3 Vapor Recirculation Line.
- 4 Signal Vapor Line for FVM.
- 5 Flow Management Valve.
- 6 Fuel Tank to Canister Vapor Line connection.
- 7 Fuel Tank Vent (Check Valve).
- 8 Vapor Line to Canister.
- 9 Flow Control Orifice.
- 10 Control Valve.
- 11 Liquid Trap.
- 12 Fuel Tank.
- 13 Check valve.

14 Fuel Fill Tube to Tank connector.
 15 Fuel Fill Tube.
 Damaged or disconnected EVAP system components.



◦ ZONE 2

1 Filter.
 2 ESM.
 3 Canister Vent Line.
 4 Evap Canister.
 5 Chassis Purge Valve.
 6 Fuel Tank to Canister Vapor Line connection.
 7 Evap Purge connection.



◦ ZONE 3

1 Evap Purge Vacuum Line.
 2 Connection to Chassis Line.
 3 Connection to Canister.
 4 Chassis Purge Line.

- 5 Evap Purge Vacuum Line.
- 6 Connection to Evap Purge Harness.
- 7 Chassis Evap Purge Line connection to Engine Vacuum.
- 8 Evap Purge Valve.
- 9 Service Port.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Select the appropriate response from the list below:

A leak was found at the gas cap or fuel filler tube

- Go To [6](#)

A leak was found in one or more of the EVAP System zones

- If the leak is at a hose connection, remove the hose then reconnect the hose and check for a leak again. All other leaks repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No leaks were detected

- Go To [7](#)

6. LEAK AT GAS CAP

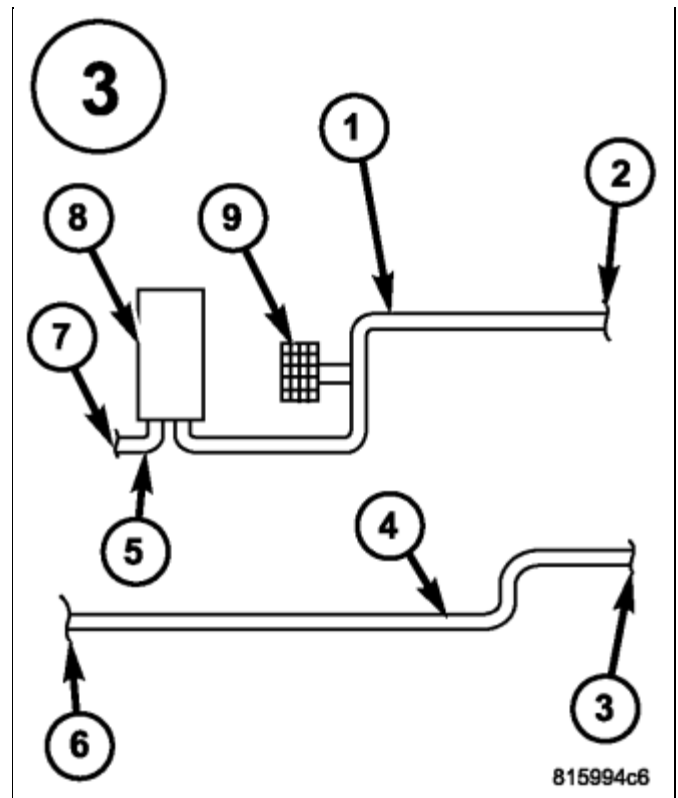
Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404-ADP adapter. Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

NOTE: The gas cap adapter is being used as a known good cap.

Was a leak found at the gas cap adapter?

Yes

- Replace the Fuel Filler tube assembly.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Replace the gas cap.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister.

Turn the ignition off.

Disconnect the Evap Purge Solenoid Vacuum hose at the Throttle Body.

NOTE: You are disconnecting the vacuum line at the Throttle Body so you are not disturbing the vacuum connection at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the Evap Purge Solenoid Vacuum hose at the Throttle Body. This indicates that there is a leak internal to the purge valve.

NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Is smoke visible from the EVAP Purge Solenoid Vacuum hose if using the EELD, or will it not hold a vacuum?

Yes

- Replace the Evap Purge Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)

8. EVAP SYSTEM MONITOR SWITCH

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap System Monitor Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Switch and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

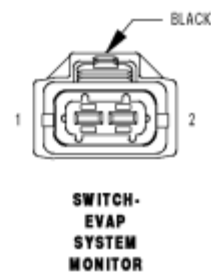
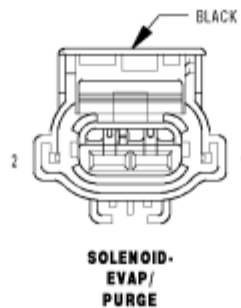
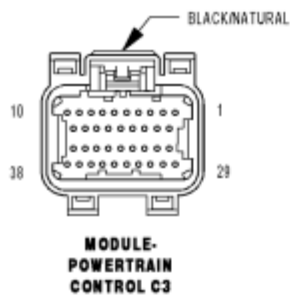
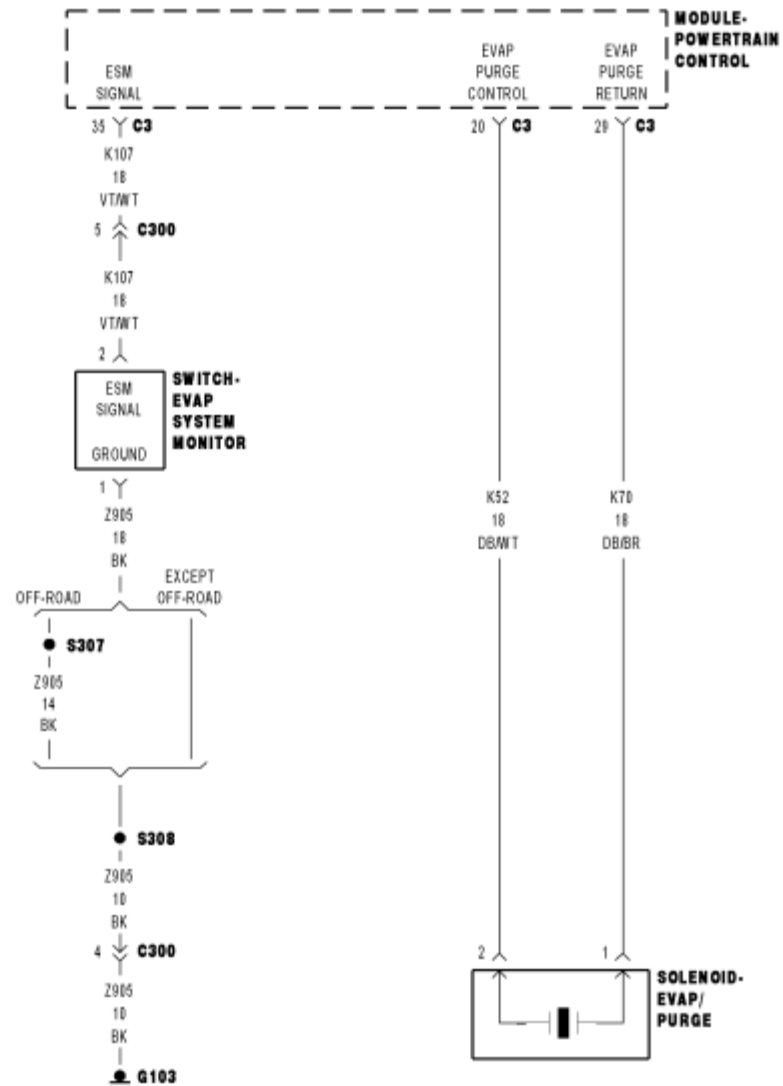
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the ESIM Switch Assembly.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0456-EVAP PURGE SYSTEM SMALL LEAK



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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition off, fuel level less than 88%, ambient temperature between 4° C and 43° C (39° F and 109° F), and the fuel system in closed loop.

◦ **Set Condition:**

As temperatures change, a vacuum is created in the fuel tank and EVAP system. With the EVAP system sealed, the PCM monitors the ESM switch. If the ESM switch does not close within a calibrated time, an error is detected by the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
EVAP SYSTEM MONITOR SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are Active you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicle's repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.

- Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.

- Go To [2](#)

2. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

3. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.
Check for the following conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Loose or missing Fuel Filler Cap
- Improper installation of the Fuel Fill Cap
- Damaged Locking tabs on Cap and/or fill tube
- Damaged seal points on Cap and/or fill tube
- Fuel cap gasket seal

Were any of the above conditions found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. VERIFY EVAPORATIVE EMISSION LEAK

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to

prevent the ignition of explosive gases. Keep the test area well ventilated.

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes

- Go To [5](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

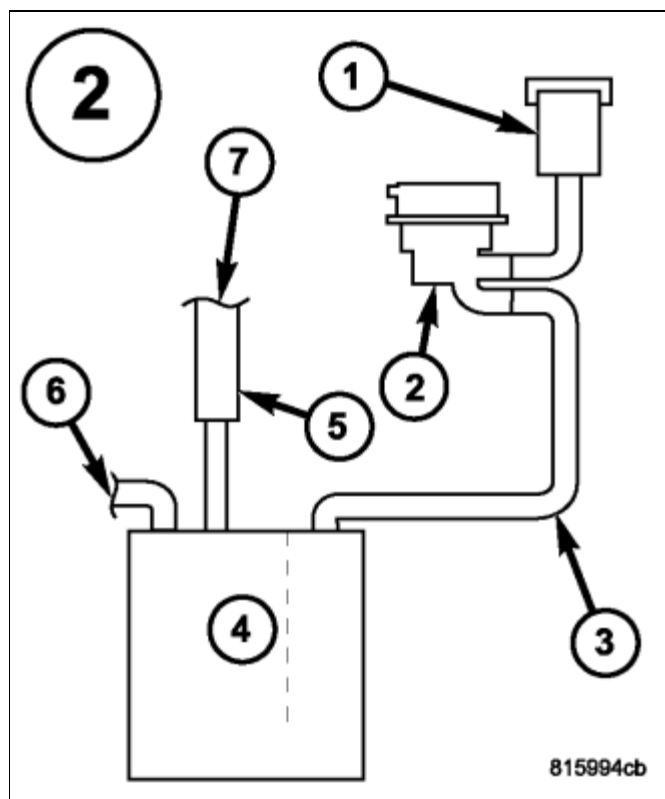
NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

- 1 Fuel Cap.
- 2 Recirculation Check Valve.
- 3 Vapor Recirculation Line.
- 4 Signal Vapor Line for FVM.
- 5 Flow Management Valve.
- 6 Fuel Tank to Canister Vapor Line connection.
- 7 Fuel Tank Vent (Check Valve).
- 8 Vapor Line to Canister.
- 9 Flow Control Orifice.
- 10 Control Valve.
- 11 Liquid Trap.
- 12 Fuel Tank.
- 13 Check valve.
- 14 Fuel Fill Tube to Tank connector.
- 15 Fuel Fill Tube.
- Damaged or disconnected EVAP system components.

◦ ZONE 2

- 1 Filter.
- 2 ESM.
- 3 Canister Vent Line.
- 4 Evap Canister.
- 5 Chassis Purge Valve.
- 6 Fuel Tank to Canister Vapor Line connection.
- 7 Evap Purge connection.



◦ ZONE 3

- 1 Evap Purge Vacuum Line.
- 2 Connection to Chassis Line.
- 3 Connection to Canister.
- 4 Chassis Purge Line.

- 5 Evap Purge Vacuum Line.
- 6 Connection to Evap Purge Harness.
- 7 Chassis Evap Purge Line connection to Engine Vacuum.
- 8 Evap Purge Valve.
- 9 Service Port.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Select the appropriate response from the list below:

A leak was found at the gas cap or fuel filler tube

- Go To [6](#)

A leak was found in one or more of the EVAP System zones

- If the leak is at a hose connection, remove the hose then reconnect the hose and check for a leak again. All other leaks repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No leaks were detected

- Go To [7](#)

6. LEAK AT GAS CAP

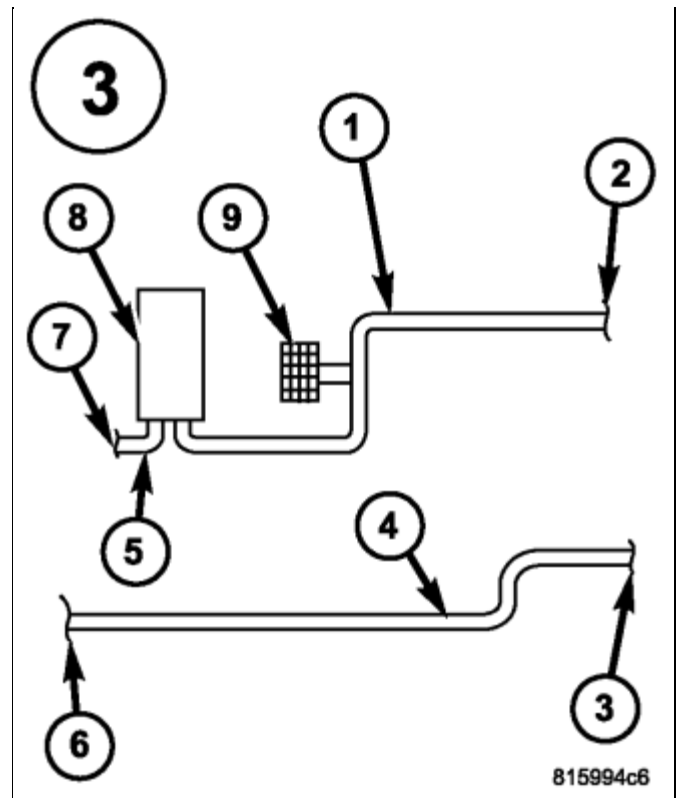
Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404-ADP adapter. Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

NOTE: The gas cap adapter is being used as a known good cap.

Was a leak found at the gas cap adapter?

Yes

- Replace the Fuel Filler tube assembly.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



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No

- Replace the gas cap.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. EVAP PURGE SOLENOID

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the Evap Purge Solenoid Vacuum hose at the Throttle Body.

NOTE: You are disconnecting the vacuum line at the Throttle Body so you are not disturbing the vacuum connection at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the Evap Purge Solenoid Vacuum hose at the Throttle Body. This indicates that there is a leak internal to the purge valve.

NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Turn the ignition off.

Disconnect the vacuum supply hose at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?

Yes

- Replace the Evap Purge Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)

8. EVAP SYSTEM MONITOR SWITCH

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Evap System Monitor Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Verify that there is good pin to terminal contact in the Switch and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Evap System Monitor Switch per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0457-LOOSE FUEL CAP

Fuel level is recorded when the ignition key is turned off and is compared to the fuel level when the ignition key is turned back on. The PCM recognizes an increase in fuel level and will fail the Medium leak test because the fuel cap is broken or not installed properly. GAS CAP will be displayed in odometer to inform the owner that the cap is off of loose.

- **When Monitored:**

Ignition on. Ambient Temperature between 4° C and 32° C (39° F and 89° F) Close Loop fuel system.
Test runs after the medium leak test is inconclusive and the PCM has senses a fuel increase.

- **Set Condition:**

If a leak greater than .090” is detected by the PCM for two consecutive cold start trips after a significant fuel level change, this DTC will set. One good trip turns off the MIL.

Possible Causes
LOOSE OR MISSING FUEL CAP

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If DTC P0455-EVAP SYSTEM LARGE LEAK is set along with this DTC, perform the diagnostic procedure for P0455 before continuing with this test.

NOTE: Do not replace the gas cap for DTC P0457-EVAP SYSTEM - LOOSE FUEL CAP.

With a scan tool, select View DTCs.

Is the status Active for DTC P0455-EVAP SYSTEM LARGE LEAK along with this DTC?

Yes

- Perform the diagnostic procedure for P0455-EVAP SYSTEM LARGE LEAK.

No

- No repair is necessary. Verify that the gas cap is in place and tight. Clear DTCs and follow the directions outlined in the service information under Instrument Cluster on resetting the odometer or message center

display.

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE

The fuel level rationality will set a fault for a fuel level reading that does not change over an accumulated mileage threshold to keep stuck high or stuck low fuel levels from disabling OBD monitors. If the vehicle is fitted with a saddle tank fuel system this feature includes diagnostics for both of the sending units and diagnostics for a siphon tube that has become disconnected or plugged. The power up test looks to see a large enough fuel level voltage change from the last key-off to the following engine run. The engine run test looks to see a fuel level voltage change over an accumulated mileage.

- **When Monitored:**

TEST No.1: With the ignition on, the fuel level is compared to the previous key down after a 20 second delay. TEST No.2: The PCM monitors the fuel level at ignition on.

- **Set Condition:**

TEST No.1: If the PCM does not see a difference in fuel level of greater than 0.1 volt the test will fail. TEST No.2: If the PCM does not see a change in the fuel level of .1765 over a set amount of miles the test will fail. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(K900) SENSOR GROUND CIRCUIT OPEN
FUEL TANK
FUEL LEVEL SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C or CAN - B Communication DTCs before continuing.

NOTE: Diagnose P0462 or P0463 first, if set along with P0461.

Start the engine.

Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs and record the related Freeze Frame data.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUALLY INSPECT FUEL TANK

Turn the ignition off.
Visually inspect the Fuel Tank for damage that may restrict the Fuel Sending Unit float from moving.

Is the Fuel Tank OK?

Yes

- Go To [3](#)

No

- Replace the Fuel Tank as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Disconnect the Fuel Pump Module harness connector.
Disconnect the C7 TIPM harness connector.
Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the TIPM harness connector.

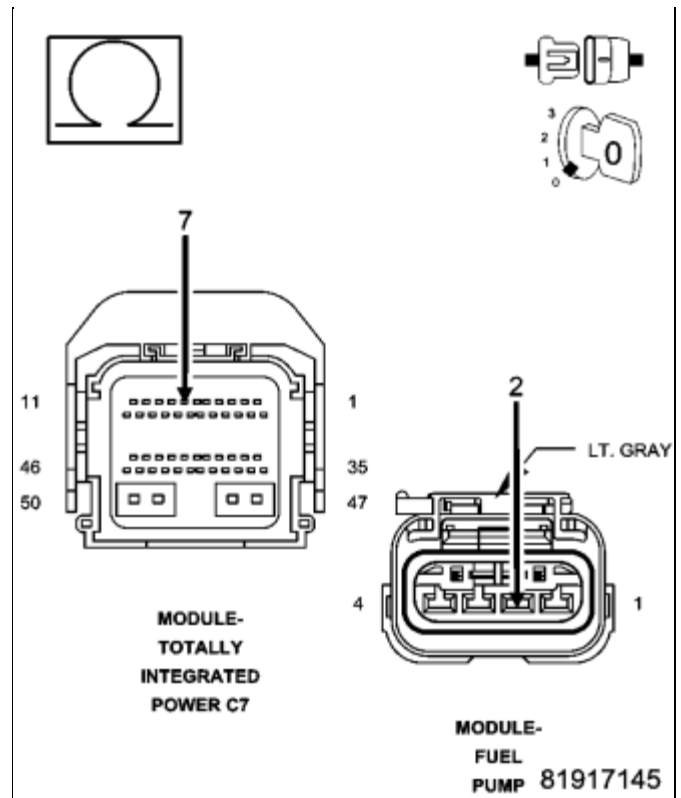
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (N4) Fuel Level Signal circuit.
- Perform BODY VERIFICATION TEST-VER 1.
(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)



4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.

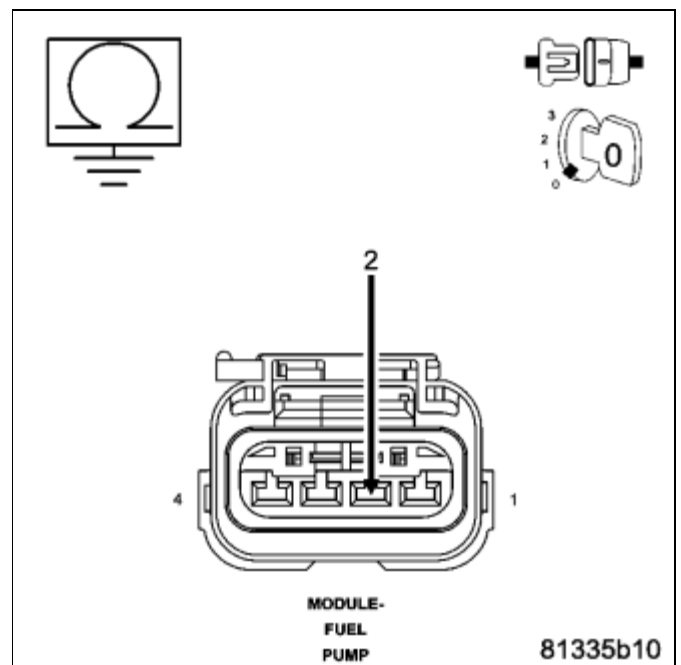
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K900) SENSOR GROUND CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.

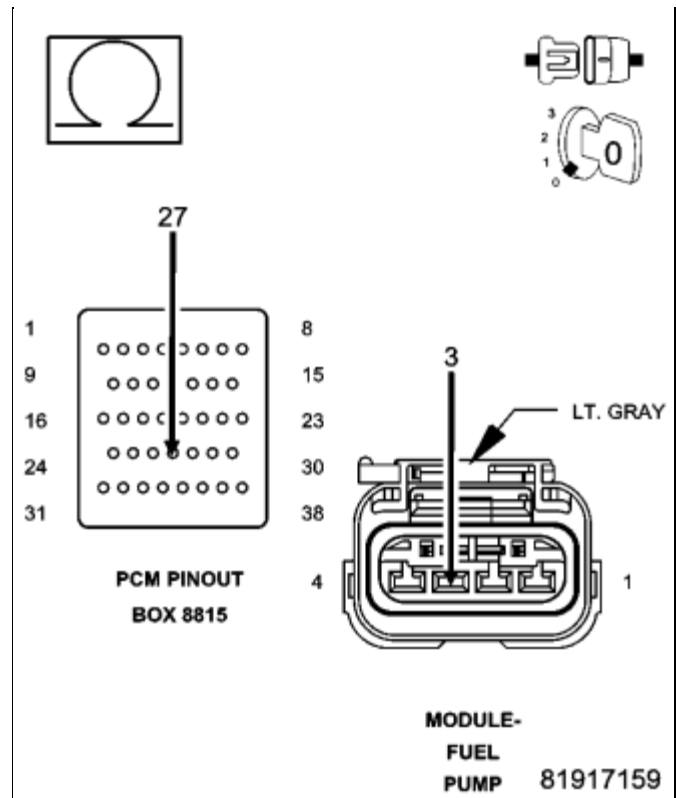
Is the resistance below 100 ohms?

Yes

- Repair the open in the (K900) Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. INTERNAL INSPECTION OF THE FUEL TANK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Tank per Service Information.

Remove the Fuel Pump Module.

Visually inspect the inside of the Fuel Tank for any obstructions or deformities.

Inspect the Fuel Pump Module Float arm for damage.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)

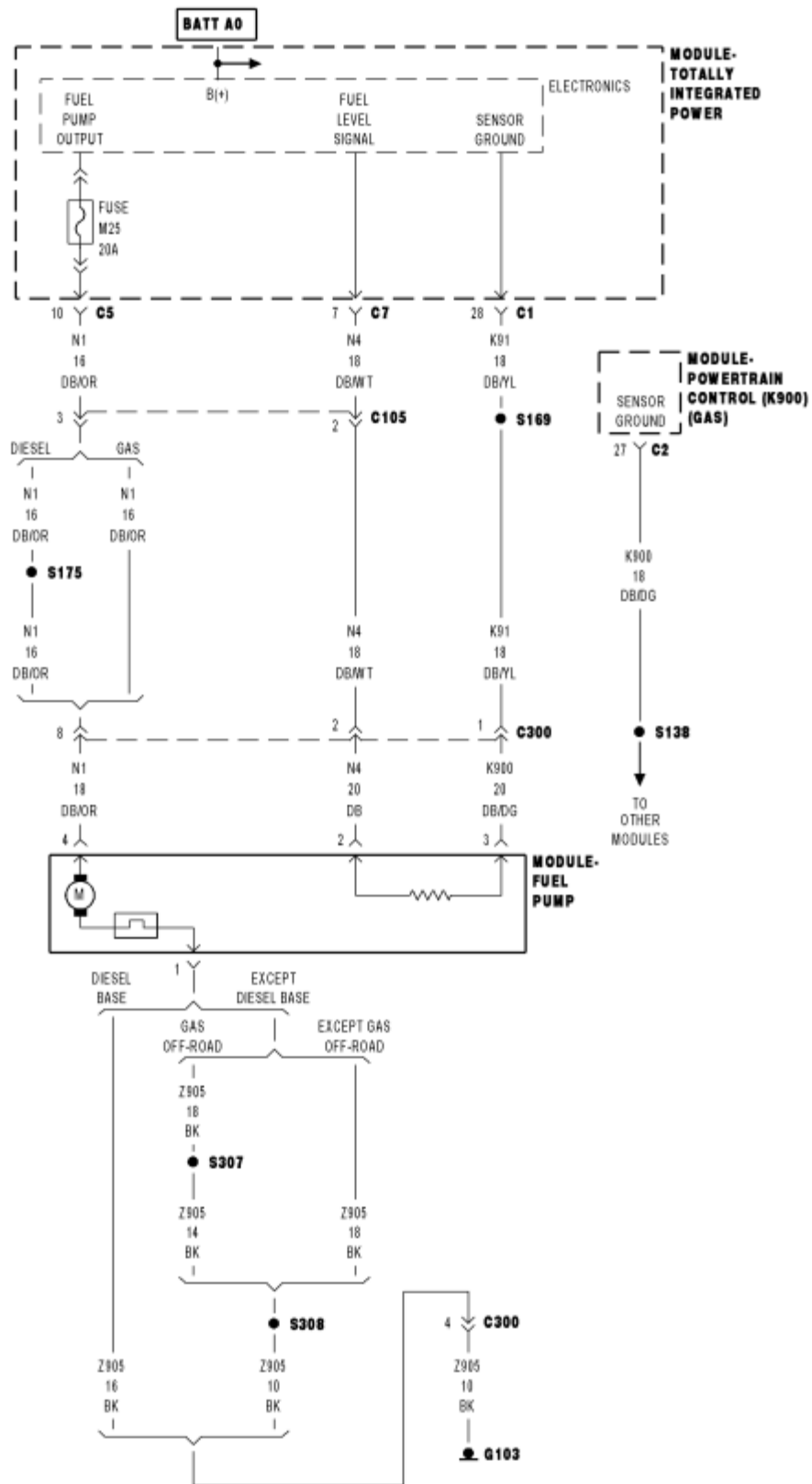
7. FUEL LEVEL SENSOR

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact at the Fuel Pump Module and the Powertrain Control Module connectors. Replace the Fuel Level Sensor if no problems were found at the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and battery voltage above 10.4 volts.

◦ **Set Condition:**

The fuel level sensor signal voltage goes below the acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (N4) FUEL LEVEL SIGNAL CIRCUIT
FUEL LEVEL SENSOR
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C or CAN - B Communication DTCs before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs and record the related Freeze Frame data.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Ignition on, engine not running.

Using a fused jumper wire, jump the (K900) Sensor Ground circuit to the (N4) Fuel Level Sensor No.1 Signal circuit in the Fuel Pump Motor harness connector.

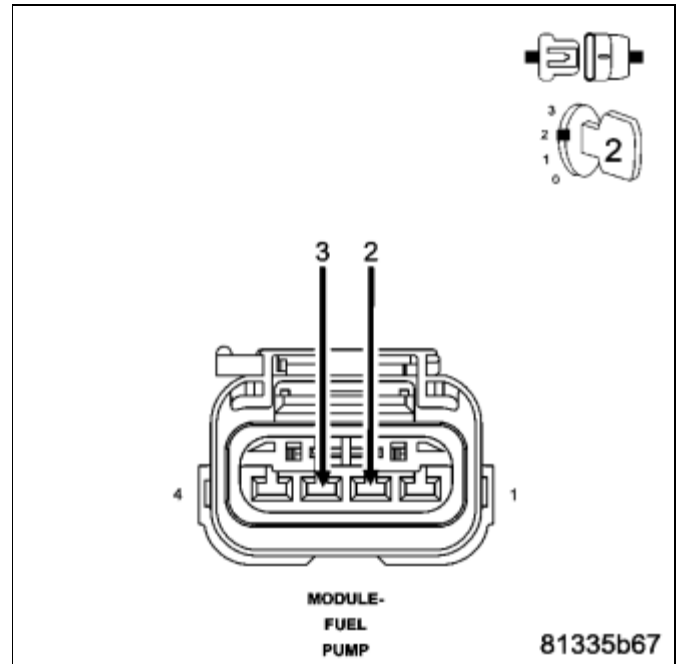
Did the Fuel gauge level change from empty to full?

Yes

- Verify that there is good pin to terminal contact at the Fuel Pump Module, and the Totally Integrated Power Module connectors. If OK, replace the Fuel Level Sensor/Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C7 TIPM harness connector.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.

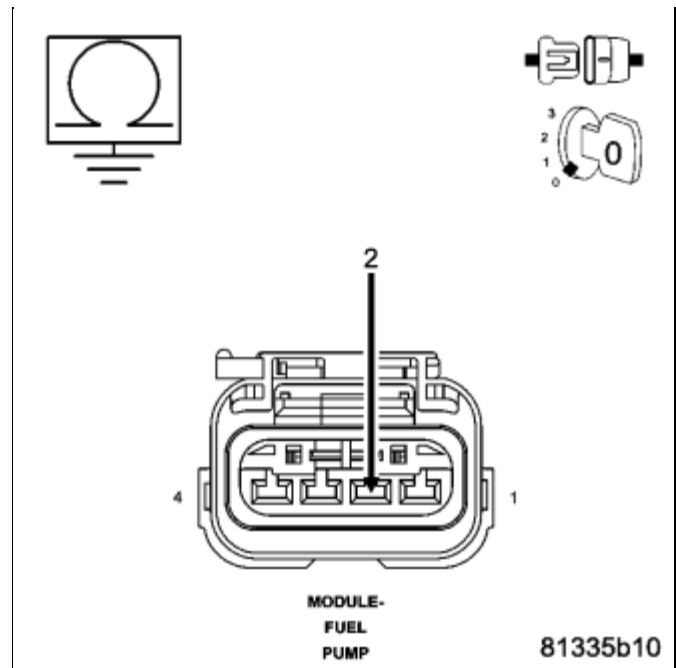
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C7 TIPM harness connector.

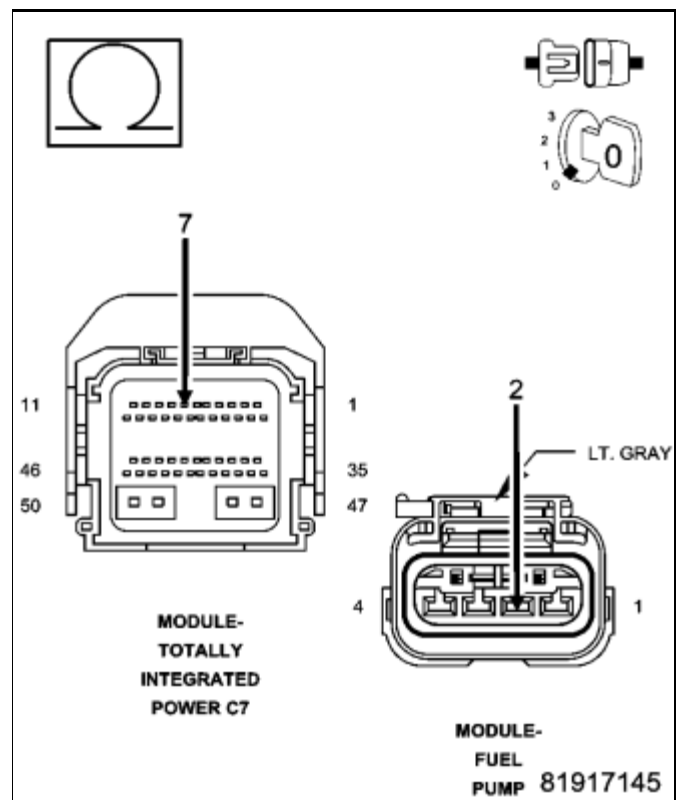
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector.

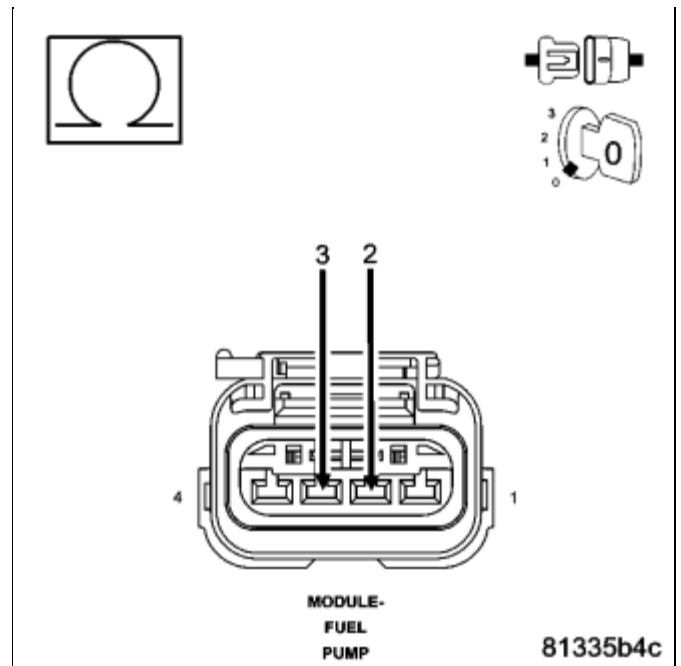
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K900) Sensor Ground circuit and the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pump Module and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Fuel Pump Module and the TIPM connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH

Ignition on and battery voltage above 10.4 volts.

◦ **Set Condition:**

The fuel level sensor signal voltage at the PCM goes above the maximum acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
FUEL LEVEL SENSOR
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C or CAN - B Communication DTCs before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs and record the related Freeze Frame data.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Ignition on, engine not running.

With a scan tool, monitor the Fuel Level Signal voltage.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (K900) Sensor ground circuit.

Did the Fuel Level voltage change from approximately 5 volts to 0 volts?

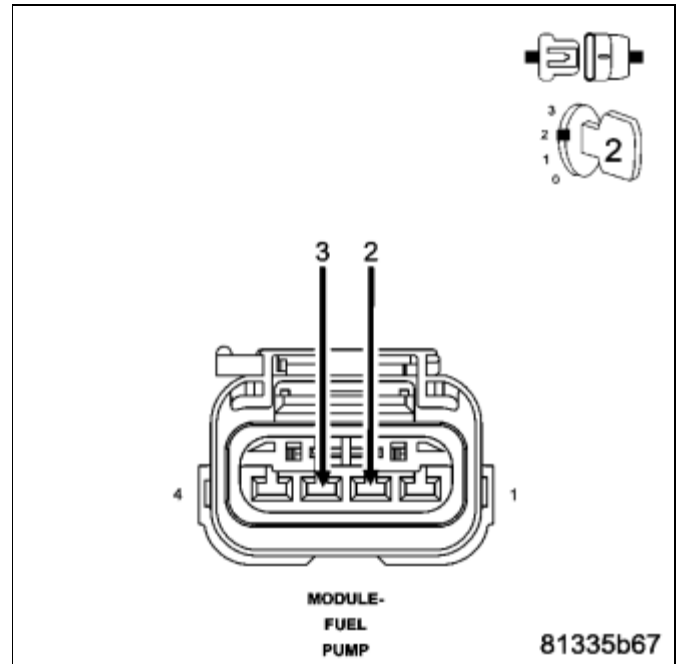
Yes

- Verify that there is good pin to terminal contact in the Fuel Pump Module and the TIPM connectors. If OK, replace the Fuel Level Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C7 TIPM harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.

Is there any voltage present?

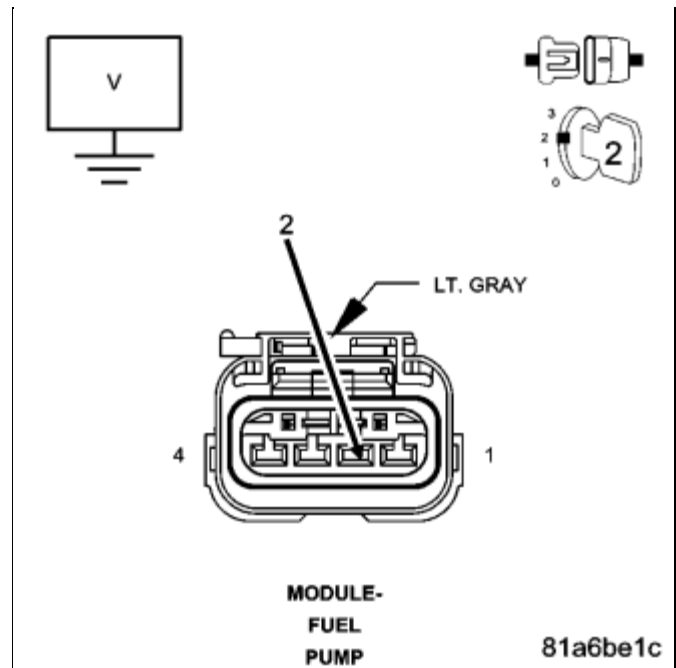
Yes

- Repair the short to voltage in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C7 TIPM harness connector.

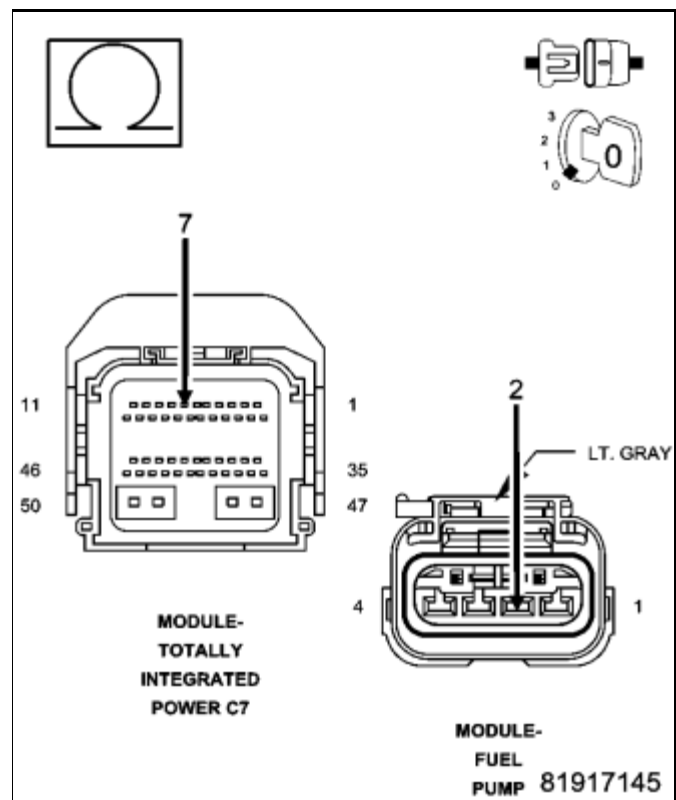
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (K900) SENSOR GROUND CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the TIPM harness connector.

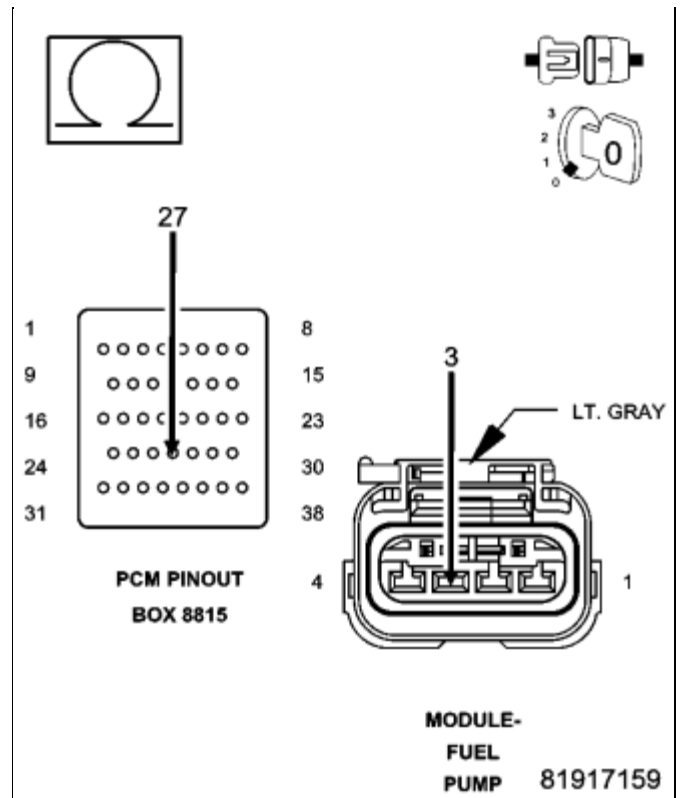
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K900) Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pump Module and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Fuel Pump Module and the TIPM connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

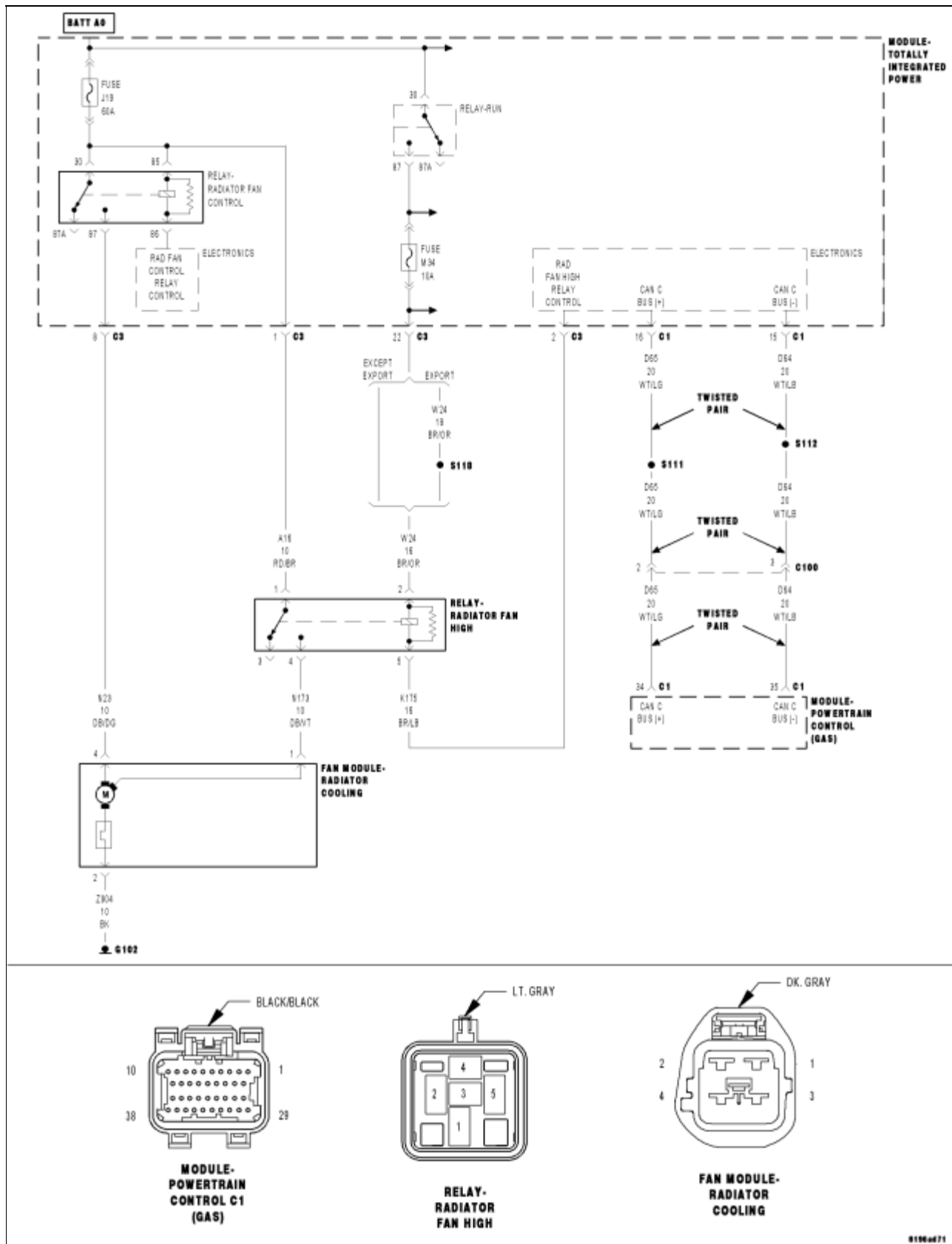
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0480-COOLING FAN 1 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
CAN C BUS FAILURE
ENGINE COOLANT TEMP SENSOR DTCS SET
COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.
With a scan tool, actuate the Cooling Fan.

Is the Cooling Fan operating?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [2](#)

2. CAN C or ECT DTCS CURRENTLY ACTIVE

Are any CAN C or ECT DTCs Active at this time?

Yes

- Refer to the appropriate diagnostics for the ECT Sensor or CAN C Bus DTC.

No

- Go To [3](#)

3. COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM

Are any Cooling Fan Control Circuit DTCs set in the TIPM?

Yes

- Diagnose the appropriate Cooling Fan Control Circuit DTC in the TIPM.

No

- Go To [4](#)

4. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Relay, Totally Integrated Power Module (TIPM), and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Relay, Totally Integrated Power Module (TIPM), and the Powertrain Control Module (PCM) connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

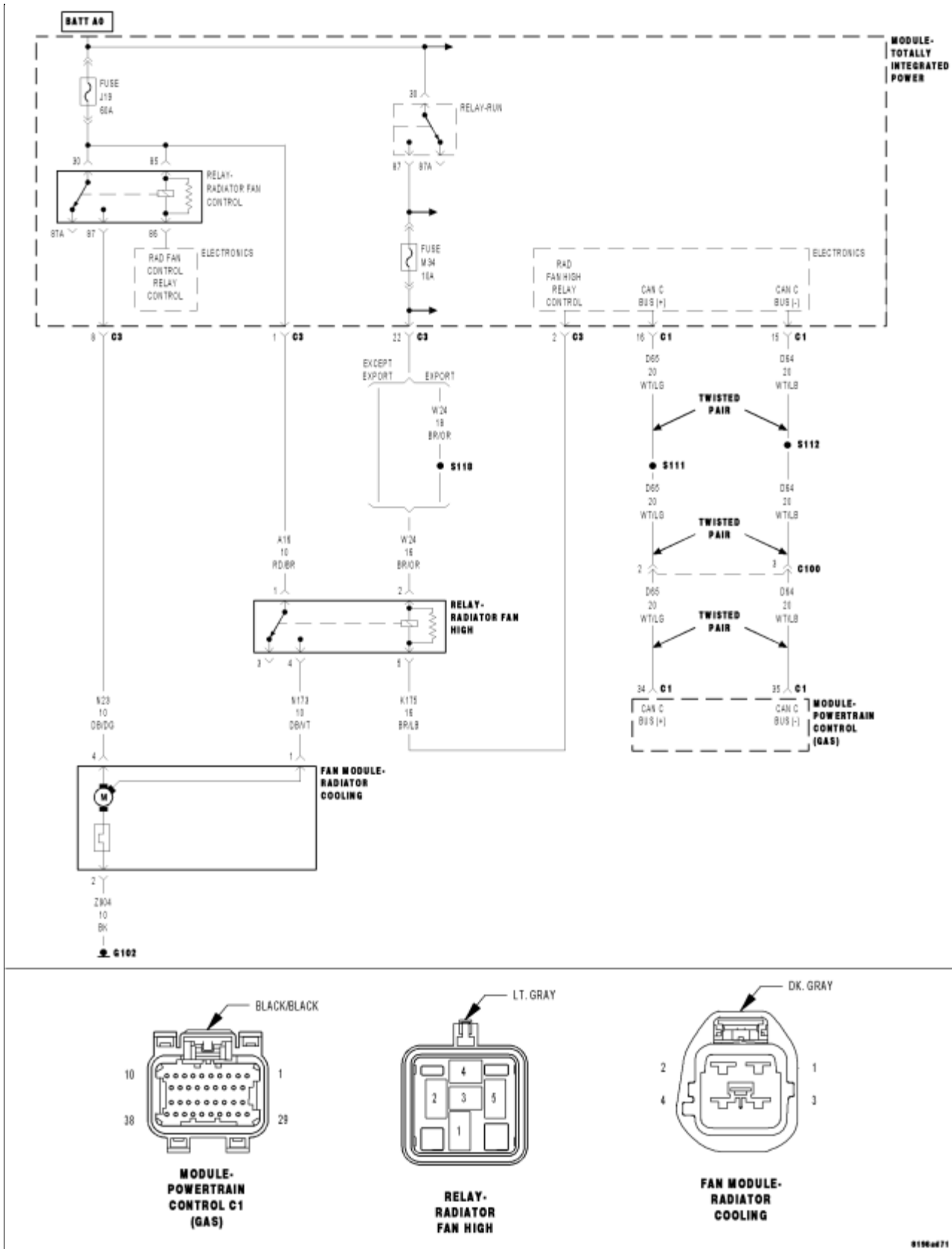
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0481-COOLING FAN 2 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
CAN C BUS FAILURE
ENGINE COOLANT TEMP SENSOR DTCS SET
COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.
With a scan tool, actuate the Cooling Fan High Speed Relay.

Is the Cooling Fan operating?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [2](#)

2. CAN C or ECT DTCS CURRENTLY ACTIVE

Are any CAN C or ECT DTCs Active at this time?

Yes

- Refer to the appropriate diagnostics for the ECT Sensor or CAN C Bus DTC.

No

- Go To [3](#)

3. COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM

Are any Cooling Fan Control Circuit DTCs set in the TIPM?

Yes

- Diagnose the appropriate Cooling Fan Control Circuit DTC in the TIPM

No

- Go To [4](#)

4. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Relay, Totally Integrated Power Module (TIPM), and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Relay, Totally Integrated Power Module (TIPM), and the Powertrain Control Module (PCM) connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

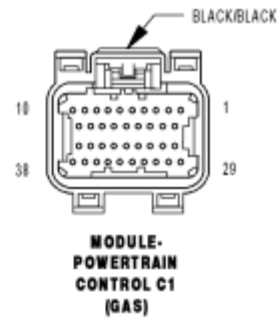
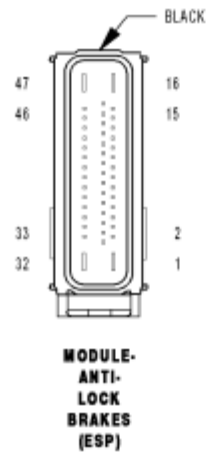
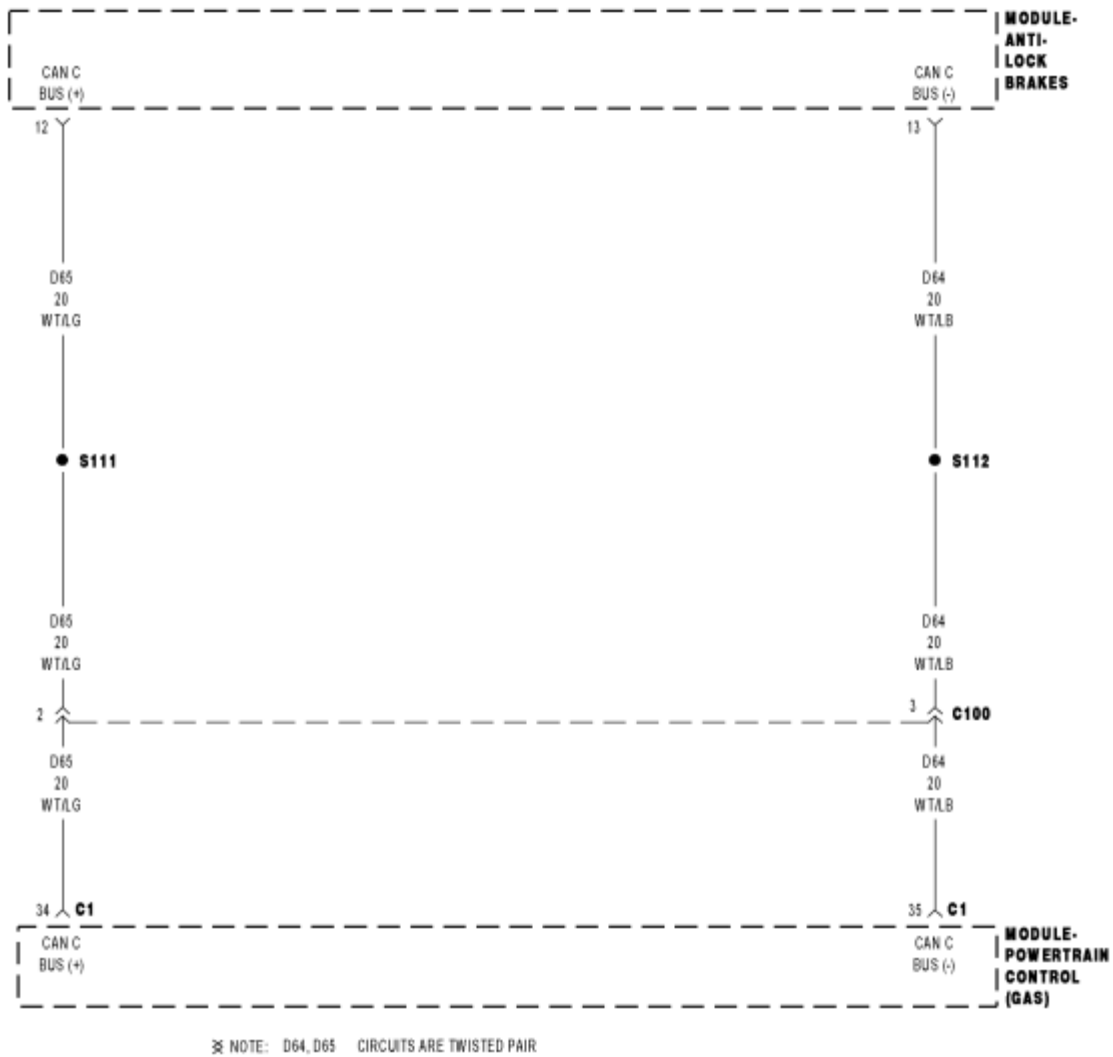
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE



8181750a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**

With the engine running, transmission not in park or neutral, brakes not applied, and engine rpm greater than 1500.

- **Set Condition:**

This code will set if no vehicle speed signal is received from the ABS Module up to 120 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

Start the engine.
Allow the engine to idle.

NOTE: It may be necessary to drive the vehicle for the fault to become Active.

With a scan tool, select View DTCs.

Is the status Active or Pending for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Wheel Speed Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Wheel Speed Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

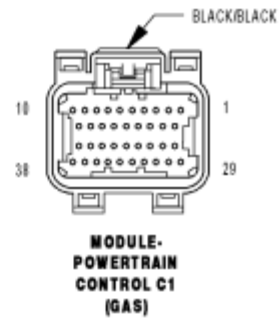
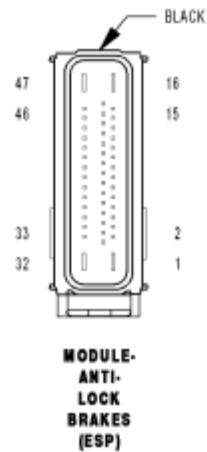
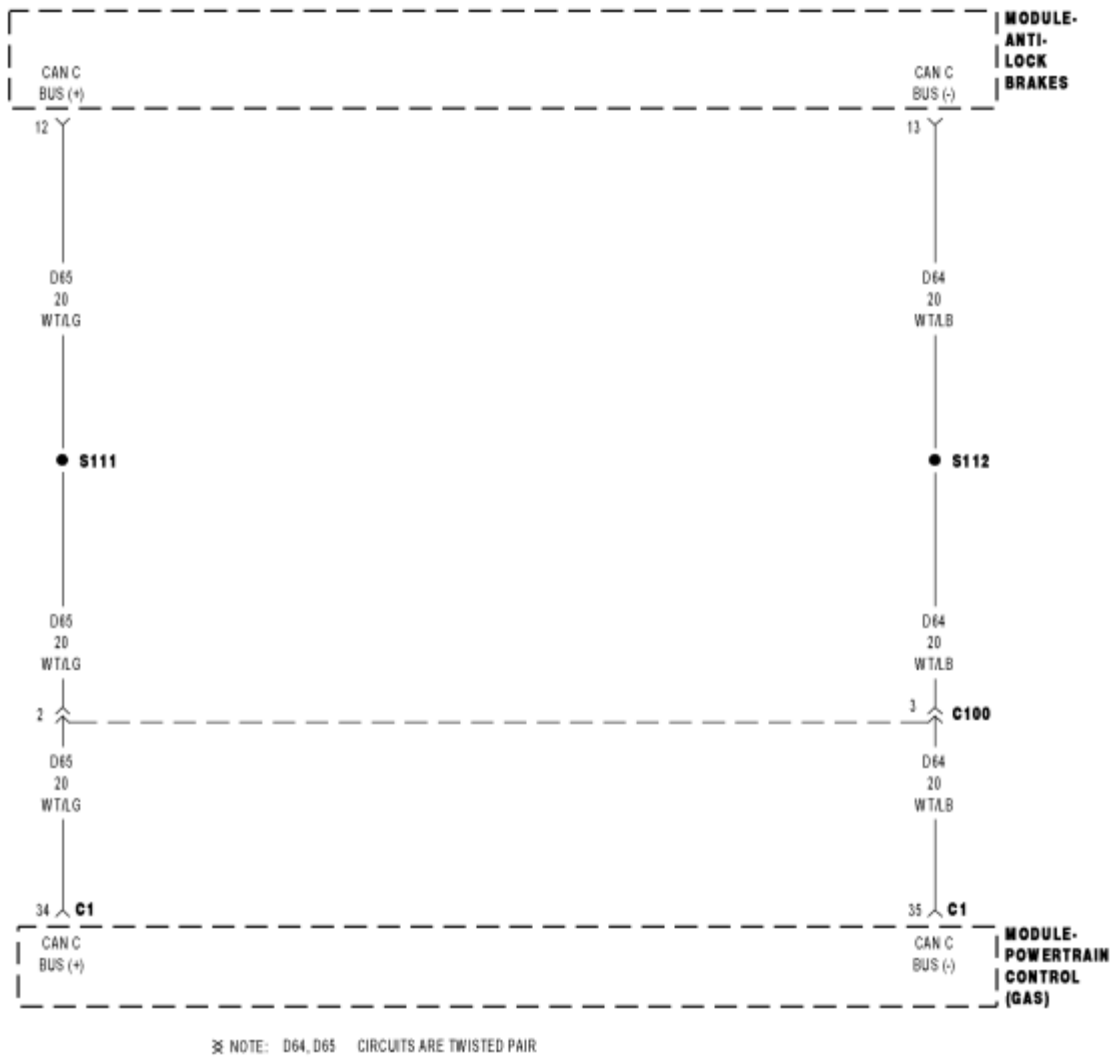
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0503-VEHICLE SPEED SENSOR 1 ERRATIC



8181750a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**

Ignition on and battery voltage greater than 10 volts. Transmission in Drive or Reverse.

- **Set Condition:**

This code will set if no vehicle speed signal is received from the ABS Module up to 120 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

Start the engine.

Allow the engine to idle.

NOTE: It may be necessary to drive the vehicle for the fault to become Active.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Wheel Speed Sensors, ABS Module, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Wheel Speed Sensors, ABS Module, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0506-IDLE SPEED PERFORMANCE LOWER THAN EXPECTED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The objective of the Idle Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**

With the engine idling in drive, the brake applied, engine run time above a minimum calibrated value, and no VSS, MAF/MAP, ECT, TPS, ETC, CKP Sensor, fuel system, or injector DTCs present.

- **Set Condition:**

Engine speed is 100 RPM or more below target idle speed for 30 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM
PCV SYSTEM RESTRICTIONS
THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other Throttle Body DTCs are present, they must be diagnosed and repaired before continuing this test.

Start the engine.

Allow the engine to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems:

Restrictions: Dirty Air Cleaner, Foreign material trapped in the air intake tube, etc.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. PCV SYSTEM

Inspect the PCV system for the following problems:

Restrictions - sticking valve, collapsed hoses or tubes, obstructed passages or ports, etc.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [4](#)

4. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

While the vehicle is running, lightly tap on ETC Motor with your hand and listen for idle to raise.

Were any problems found or did the idle fluctuate while tapping on the ETC Motor?

Yes

- Verify that there is good pin to terminal contact at the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXPECTED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The objective of the Idle Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

◦ **When Monitored:**

With the engine idling in drive, the brake applied, engine run time above a minimum calibrated value, and no VSS, MAF/MAP, ECT, TPS, ETC, CKP Sensor, fuel system, or injector DTCs present.

◦ **Set Condition:**

Engine speed is 200 RPM or more above target idle speed for 30 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM LEAKS
PCV SYSTEM LEAKS
ENGINE VACUUM LEAKS
THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other Throttle Body DTCs are present, they must be diagnosed and repaired before continuing this test.

Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Allow the engine to reach normal operating temperature.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems:
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. PCV SYSTEM

Inspect the PCV system for the following problems:

Leaks - cracked or damaged hoses or tubes, poor hose or tube connections, PCV valve stuck open, etc.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. ENGINE VACUUM LEAKS

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Inspect the vehicle for external vacuum leaks.

Inspect the engine for internal leaks.

Were any vacuum leaks found?

Yes

- Repair the vacuum leak as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

While the vehicle is running, lightly tap on ETC Motor with your hand and listen for idle to raise.

Were any problems found or did the idle fluctuate while tapping on the ETC Motor?

Yes

- Verify that there is good pin to terminal contact at the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

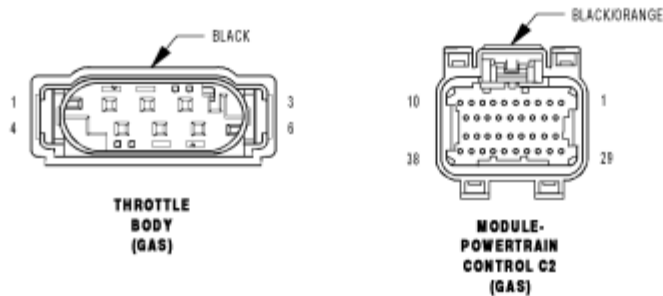
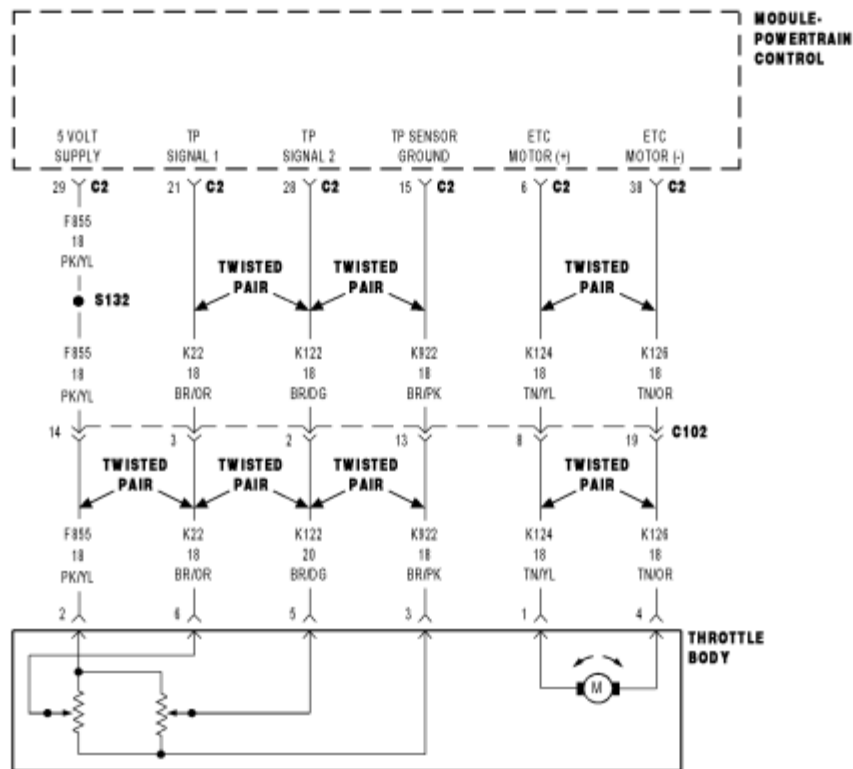
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P050B-COLD START IGNITION TIMING PERFORMANCE



2940

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Spark adjustment during a cold start is intended to provide quick response to idle speed variations. The spark adjust diagnostics monitors spark advance on a cold start over a period of time, then compares the average spark

advance to a threshold.

- **When Monitored:**

Cold start condition. Ambient Air temperature between -7°C and 50°C (19.4°F and 122°F). Engine Coolant temperature between -7°C and 50°C (19.4°F and 122°F). The difference between the Ambient Air temp and ECT temp at Start is equal to or less than 10°C (50°F). Engine running at idle only.

- **Set Condition:**

Engine RPM is 50 RPM or more (depending on vehicle specifications), below idle speed for at least 3 seconds and the average spark advance is above the threshold, too much spark advance, for a specified time limit. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
RESTRICTED INTAKE AIR SYSTEM
LOW BATTERY VOLTAGE
FUEL CONTAMINATION
EXCESSIVE RESISTANCE IN THE (K124) ETC MOTOR (+) CIRCUIT
EXCESSIVE RESISTANCE IN THE (K126) ETC MOTOR (-) CIRCUIT
ETC MOTOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Low battery voltage can also cause excessive current draw, in very hot and very cold ambient temperatures. Make sure the battery can pass a load test before continuing.

With a scan tool, select View DTCs.
Diagnose any other PCM DTCs before continuing.

Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE PLATE INSPECTION

Turn the ignition off.
 Remove the Air Cleaner Assembly from the Throttle Body.
 Check for any signs of a foreign material (ice, dirt, or excessive carbon build up) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Were any signs of foreign material or scoring of the throttle plate or bore found?

Yes

- Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. DIRTY AIR FILTER

Remove and inspect the Air Filter.

Is the Air Filter dirty?

Yes

- Replace the Air Filter.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CONTAMINATED FUEL

Inspect the Fuel for contamination. (Dirt, water, or other foreign material)

Is the fuel contaminated?

Yes

- Drain the Fuel from the fuel tank into an approved gas holding tank and add clean fuel.

No

- Go To [5](#)

5. EXCESSIVE RESISTANCE IN THE (K124) ETC MOTOR (+) CIRCUIT

Turn the ignition off.

Disconnect the C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K124) ETC Motor (+) circuit at the Throttle Body harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. EXCESSIVE RESISTANCE IN THE (K126) ETC MOTOR (-) CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K126) ETC Motor (-) circuit at the Throttle Body harness connector and to probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (K126) ETC Negative circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. ETC MOTOR

Turn the ignition off.

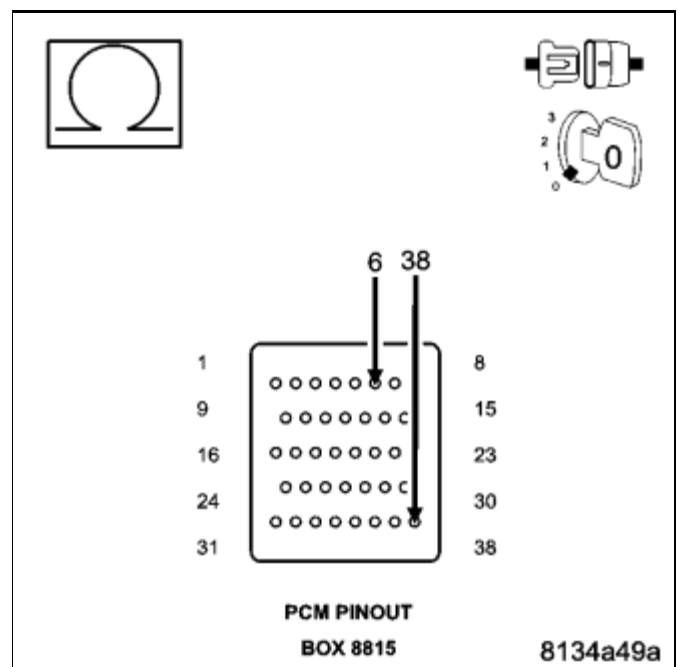
NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.

Connect the Throttle Body harness connector.
Disconnect special tool #8815-1 from the C2 PCM harness connector.
Measure the resistance of the ETC Motor by probing the appropriate terminals of special tool #8815 for the (K124) ETC Positive circuit and the (K126) ETC Negative circuit.

Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes

- Go To [8](#)



No

- Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P050D-COLD START ROUGH IDLE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The objective of the Dynamic Crankshaft Fuel Control is to reduce the fuel as much as possible during a cold start. The DCFC begins subtracting fuel from a high limit upon a cold start and keeps removing fuel in an attempt to get to a calibrated lean limit. DCFC stops removing fuel when rough idle is detected or the lean limit is reached.

- **When Monitored:**

Cold start condition. Ambient Air temperature between -7° C and 50° C (19.4° F and 122° F). Engine Coolant temperature between -7° C and 50° C (19.4° F and 122° F). The difference between the Ambient Air temp and ECT temp at Start is equal to or less than 10° C (50° F). Engine running at idle only.

- **Set Condition:**

If a rough idle is detected and the Dynamic Crankshaft Fuel Control remains or returns to the high limit window for a calibrated time. Two trip fault.

Possible Causes
ENGINE MECHANICAL PROBLEM
1/1 O2 SENSOR
MAP SENSOR
ECT SENSOR
IGNITION COIL
SPARK PLUG
FUEL INJECTOR
INTERNAL FUEL LEAK
FUEL PUMP MODULE
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
POWERTRAIN CONTROL MODULE (PCM)

Diagnostic Test

1. CHECKING FOR CYLINDER MISFIRE CONDITION PRESENT

NOTE: Check for any TSBs that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.

NOTE: Reviewing the vehicle repair history may aid in the repair of the misfire condition.

Start the engine.

Allow the engine to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is P0300 or any other Misfire DTCs set along with the P050D.

Is there a misfire present at this time?

Yes

- Refer to the appropriate Cylinder Misfire Diagnostic procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [2](#)

2. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [3](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

3. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: The DTC needs to be cleared before actuating the System Test, if the DTC is not cleared, the System Test may not be allowed to actuate.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [4](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

Below Specification

- Go To [13](#)
- **CAUTION: Stop All Actuations.**

4. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With a scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?

Yes

- Go To [5](#)

No

- Go To [9](#)

5. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

NOTE: The DTC needs to be cleared before actuating the Heater Test, if the DTC is not cleared, the Heater Test may not be allowed to actuate.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and the Powertrain Control Module connectors. Replace the 1/1 O2 Sensor if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1" of Hg on the Vacuum Gauge reading?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and the Powertrain Control Module connectors. Replace the MAP Sensor if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the ETC Sensor and the Powertrain Control Module connectors. Replace the Engine Coolant Temperature Sensor if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. ENGINE MECHANICAL PROBLEM

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.
 ENGINE VACUUM - must be at least 13 inches in neutral
 ENGINE VALVE TIMING - must be within specifications
 ENGINE COMPRESSION - must be within specifications
 ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
 ENGINE PCV SYSTEM - must flow freely
 TORQUE CONVERTER STALL SPEED - must be within specifications
 POWER BRAKE BOOSTER - no internal vacuum leaks
 FUEL - must be free of contamination
 FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [12](#)

9. 1/1 O2 SENSOR

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

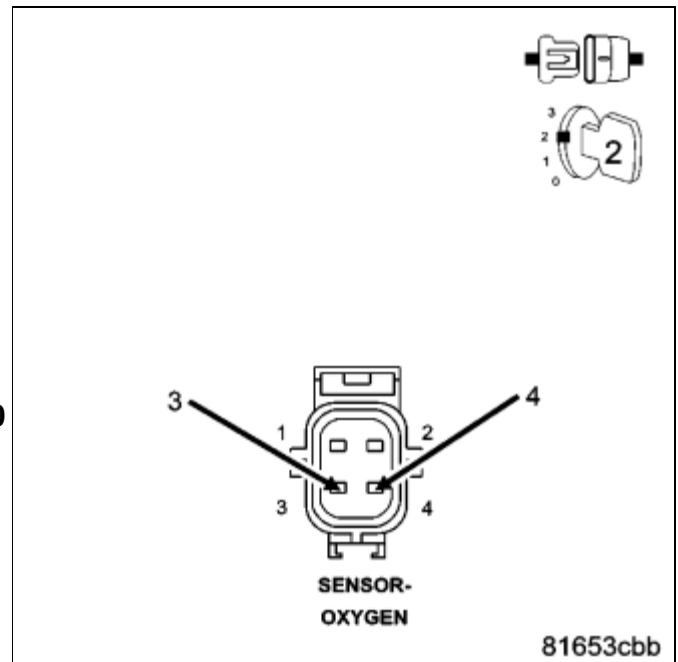
Connect a jumper wire between the (K41) O2 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the related Sensors and the Powertrain Control Module connectors. Replace the 1/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [10](#)

NOTE: Remove the jumper wire before continuing.

10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [11](#)

No

- Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

11. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes

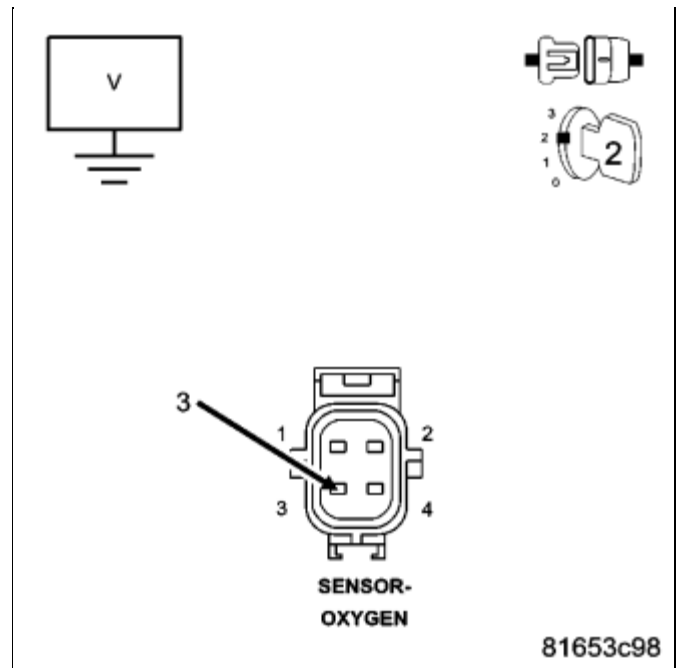
- Go To [12](#)

No

- Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor

connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out, or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

13. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: The DTC needs to be cleared before actuating the System Test, if the DTC is not cleared, the System Test may not be allowed to actuate.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [14](#)
- **CAUTION: Stop All Actuations.**

14. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [15](#)

15. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Fuel Pump Module, Relay, Cluster, and Powertrain Control Module connectors. Replace the Fuel Pump Module if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0513-INVALID SKIM KEY

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

The PCM detects an invalid SKREEM key. One Trip Fault.

Possible Causes
INCORRECT VIN PROGRAMMED IN THE PCM
NO COMMUNICATION WITH SKREEM
NO VIN PROGRAMMED IN THE PCM
IGNITION KEY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test**1. ACTIVE DTC**

NOTE: Diagnose any Can C or Can B failures before continuing.

Ignition on, engine not running.
With the scan tool, View DTCs.

Is the DTC Active at this time?**Yes**

- Go To [2](#)

No

- Go To [6](#)

2. NO COMMUNICATION WITH SKREEM

With the scan tool, attempt to communicate with the SKREEM.

Can the scan tool communicate with the SKREEM?**Yes**

- Go To [3](#)

No

- Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.

3. SKREEM TROUBLE CODES SET

With the scan tool, check for SKREEM DTCs.

Are any DTCs present in the SKREEM?**Yes**

- Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.

No

- Go To [4](#)

4. VIN PROGRAMMED INTO PCM

With the scan tool, display the VIN that is programmed in the PCM.

Has a VIN been programmed into the PCM?**Yes**

- Go To [5](#)

No

- Program the correct VIN into the PCM and retest.
- Perform the SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE.)

5. PCM

Turn the ignition off.

Replace and program the SKREEM per Service Information.

NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.

Ignition on, engine not running.

With the scan tool, erase all SKREEM and PCM DTCs.

Attempt to start and idle the engine.

With the scan tool, read the PCM DTCs.

Does the scan tool display this code?

Yes

- **NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.**
- Perform the SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE.)

No

- Test Complete.

6. IGNITION KEY

NOTE: You must obtain the SKREEM pin number.

NOTE: This DTC could have been set if the SKREEM harness connector was disconnected, or if the SKREEM was replaced recently.

NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.

Ignition on, engine not running.

Verify the correct VIN is programmed into the PCM and SKREEM.

Turn the ignition off.

With each customer key turn the ignition key on and crank the engine to start.

With the scan tool, read the PCM DTCs. Look for P0513.

Is the DTC P0513 still active?

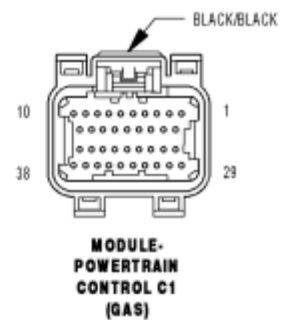
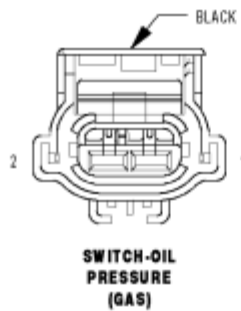
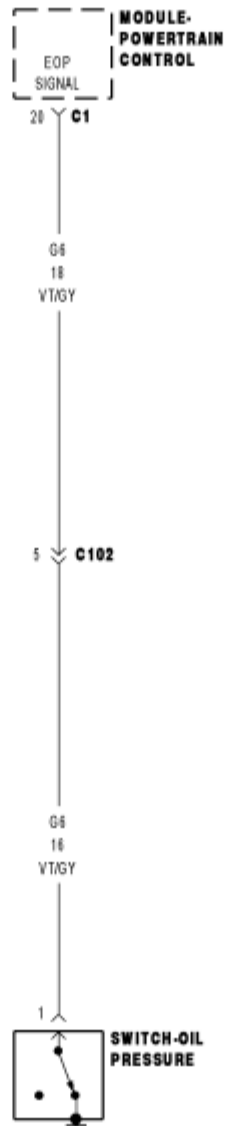
Yes

- Replace the Ignition Key.
- Perform the SKREEM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE.)

No

- Test Complete.
- **NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.**

P0522-OIL PRESSURE TOO LOW



81017902

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on and battery voltage above 10.4 volts.

- **Set Condition:**

The oil pressure sensor voltage at PCM drops below the minimum acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G6) OIL PRESSURE SIGNAL CIRCUIT OPEN
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
OIL PRESSURE SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure that the engine oil is at the proper level. Also, check the customers oil change history to ensure that the oil is being changed at the correct intervals and that the proper oil viscosity is being used.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. OIL PRESSURE SWITCH

Turn the ignition off.

Disconnect the Oil Pressure Switch harness connector.

Ignition on, engine not running.

With the scan tool monitor the Oil Pressure Switch state.

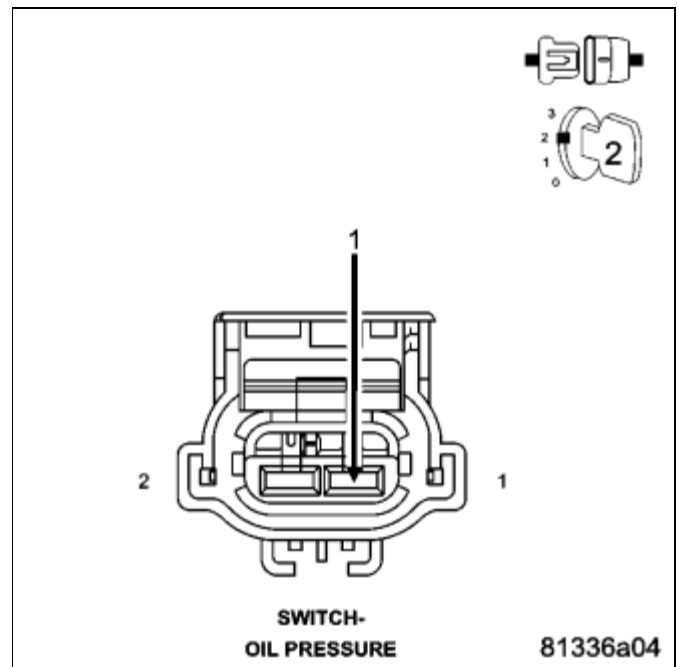
Connect a jumper wire to the (G6) Oil Pressure Signal circuit in the Sensor harness connector.

Touch the other end of the jumper wire to a known good Ground several times.

Did the Oil Pressure Switch state change from High to Low when connecting and disconnecting the jumper wire to ground?

Yes

- Verify that there is good pin to terminal contact in the Oil Pressure Switch and the Powertrain Control Module connectors. If OK, replace the Engine Oil Pressure Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

**No**

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.

3. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (G6) Oil Pressure Signal circuit in the Switch harness connector.

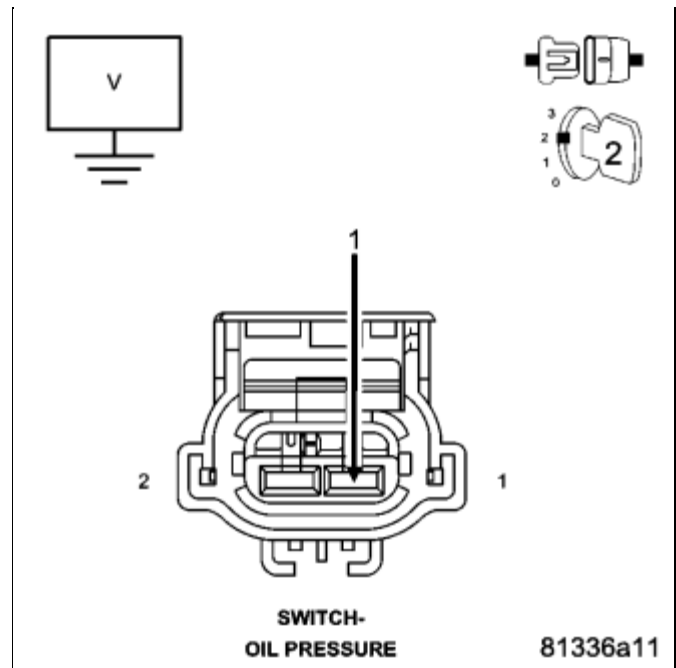
Is there any voltage present?

Yes

- Repair the short to voltage on the (G6) Oil Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (G6) OIL PRESSURE SWITCH SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (G6) Oil Pressure Signal circuit from the Oil Pressure Switch harness connector to the appropriate terminal of special tool #8815.

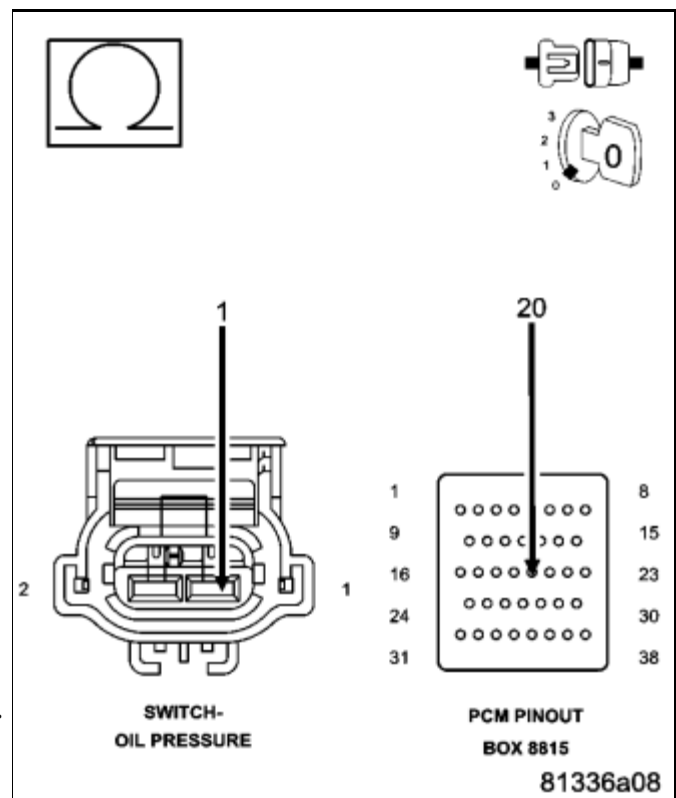
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (G6) Oil Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (G6) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (G6) Oil Pressure Signal circuit in the Switch connector.

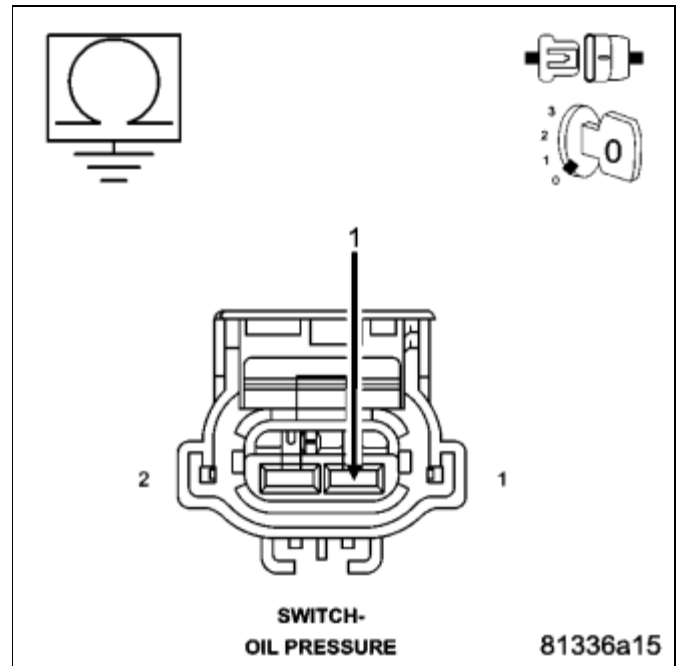
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (G6) Oil Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Oil Pressure Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Oil Pressure Switch and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

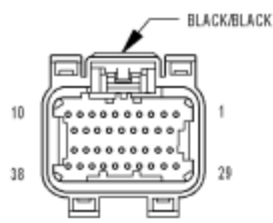
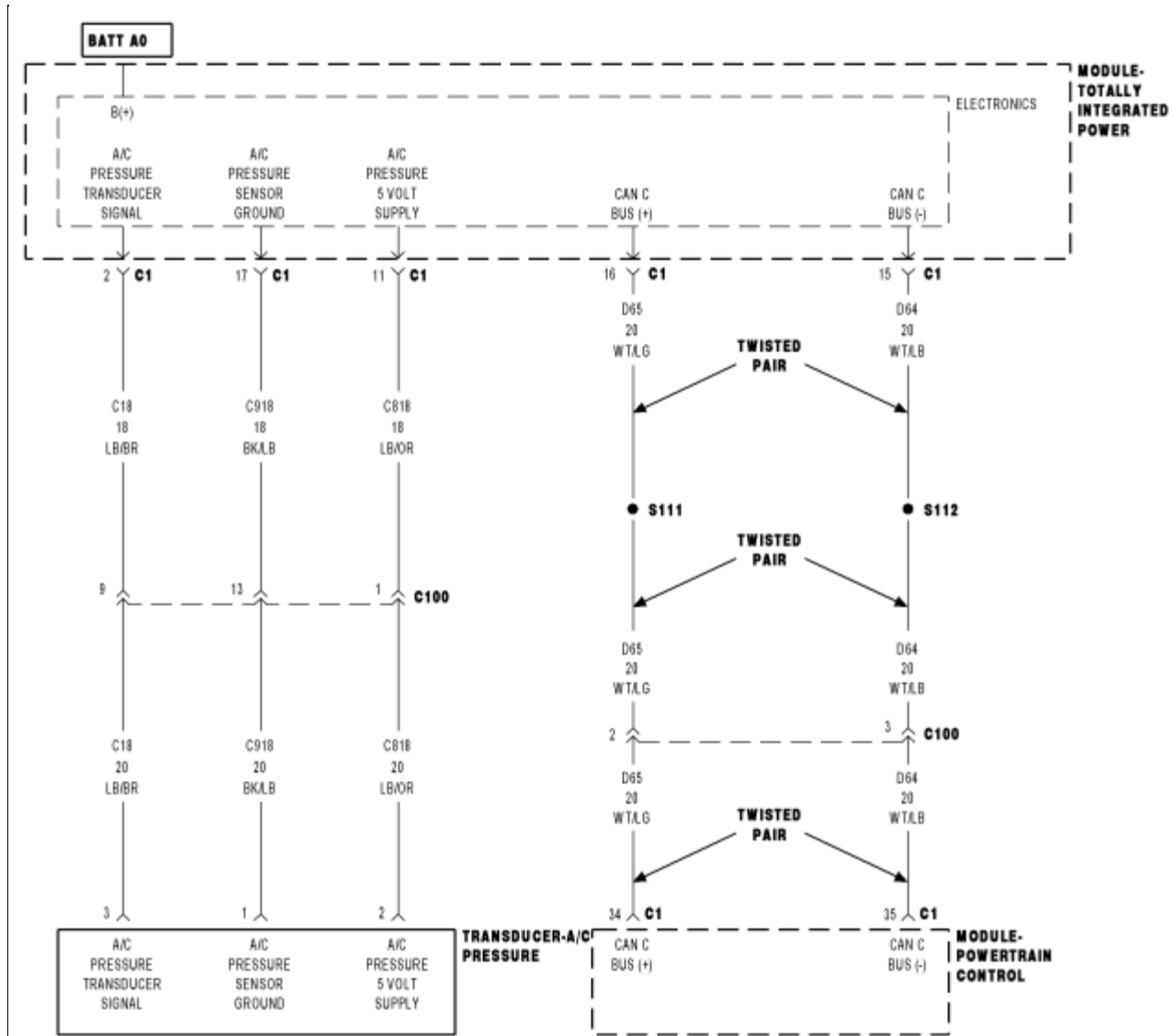
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

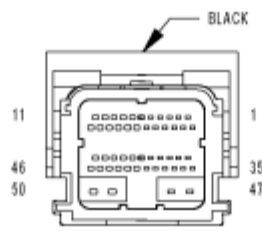
No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

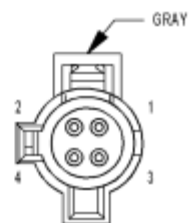
P0532-A/C PRESSURE SENSOR CIRCUIT LOW



**MODULE-
POWERTRAIN
CONTROL C1
(GAS)**



**MODULE-
TOTALLY
INTEGRATED
POWER C1**



**TRANSDUCER-A/C
PRESSURE**

01017401

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running, AC is learned, and AC Clutch Relay energized.

- **Set Condition:**

The A/C pressure transducer signal voltage at the PCM goes below the minimum acceptable value. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C818) 5-VOLT SUPPLY CIRCUIT OPEN
(C818) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
A/C PRESSURE TRANSDUCER
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (C918) A/C PRESSURE TRANSDUCER GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (C18) A/C PRESSURE SIGNAL CIRCUIT
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (C818) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the A/C Pressure Transducer harness connector.
Ignition on, engine not running.
Measure the voltage on the (C818) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

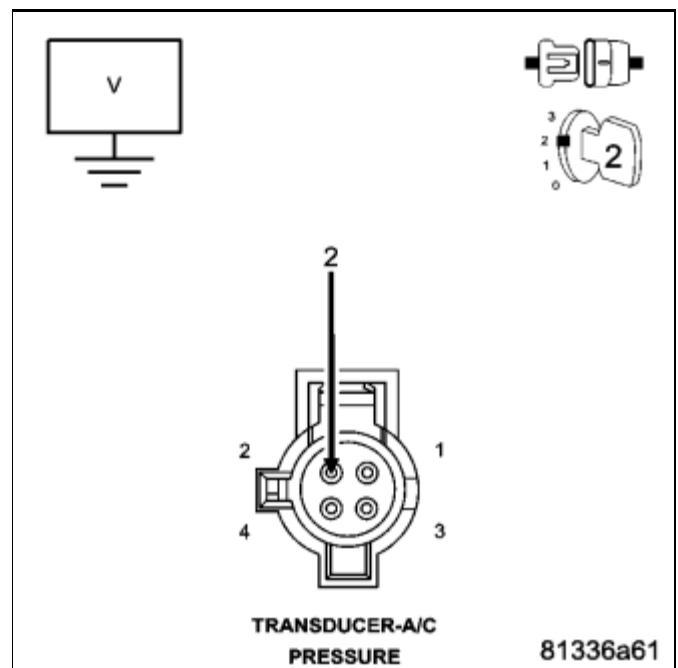
Is the voltage between 4.5 to 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [7](#)



3. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C1 TIPM harness connector.
Measure the resistance between ground and the (C18) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.

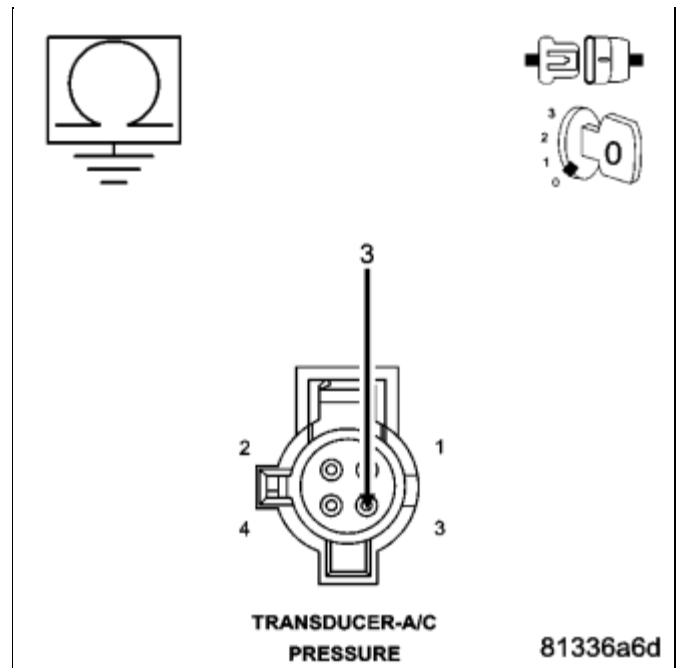
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (C918) SENSOR GROUND CIRCUIT

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (C918) Sensor Ground circuit in the A/C Pressure Transducer harness connector.

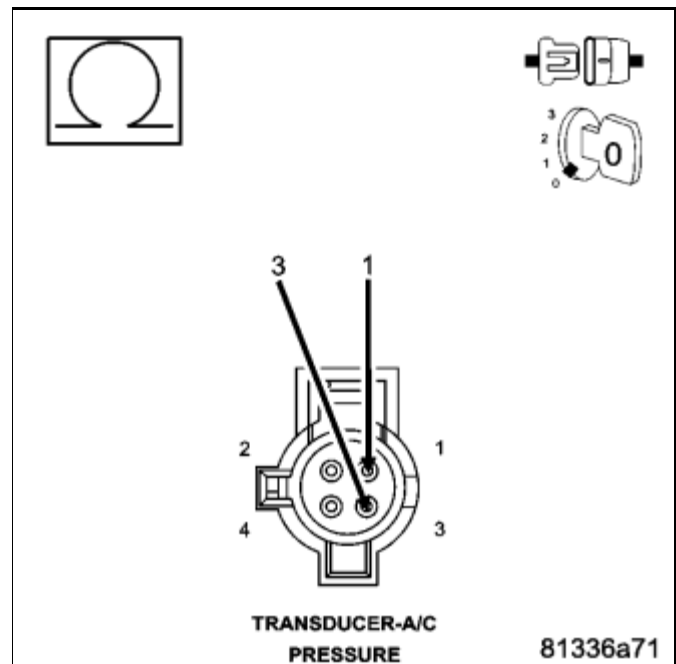
Is the resistance below 100 ohms?

Yes

- Repair the short between the (C918) Sensor Ground circuit and the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN

Measure the resistance of the (C18) A/C Pressure Signal circuit from the A/C Pressure Transducer harness connector

to C1 TIPM harness connector.

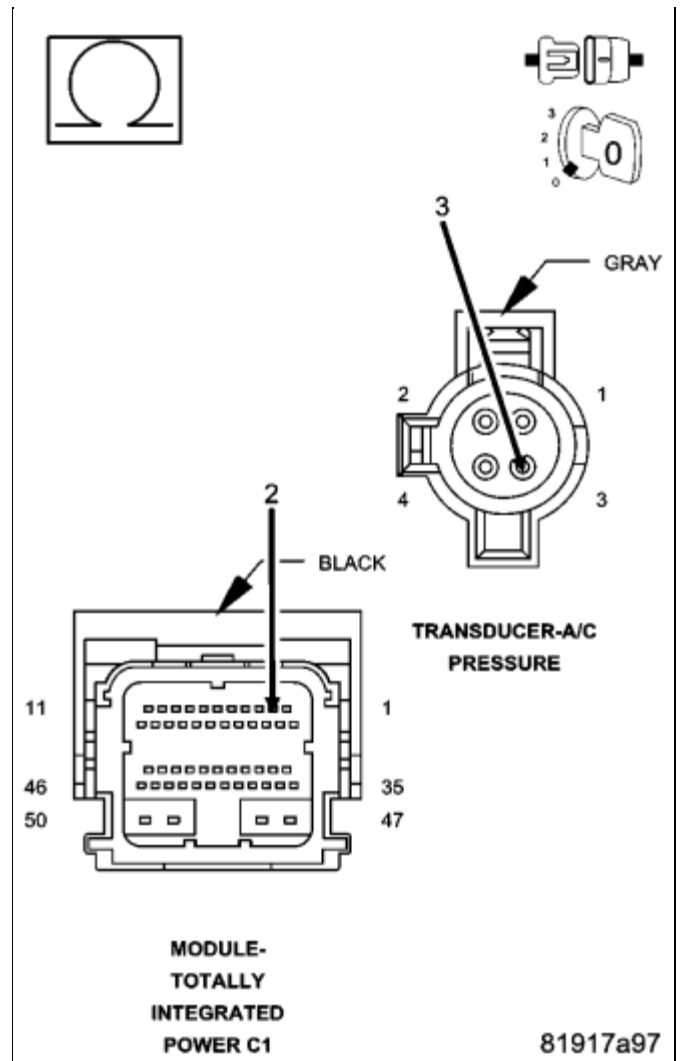
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. A/C PRESSURE TRANSDUCER

Connect the C1 TIPM harness connector.

Turn the ignition on.

With the scan tool, monitor the A/C Pressure Transducer voltage.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the connector disconnected.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the A/C Pressure Transducer and the Powertrain Control Module connectors. If OK, replace the A/C Pressure Transducer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

7. (C818) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
 Disconnect the C1 TIPM harness connector.
 Measure the resistance of the (C818) 5-volt Supply circuit from the A/C Pressure Transducer harness connector to the C1 TIPM harness connector.

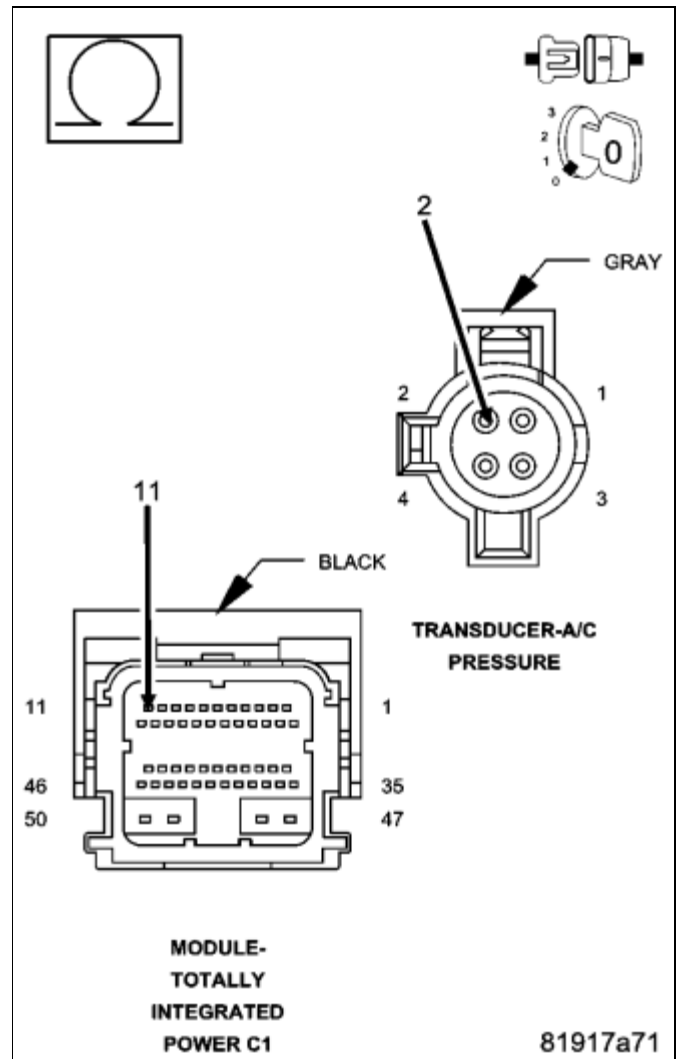
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (C818) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



8. (C818) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C818) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 100 ohms?

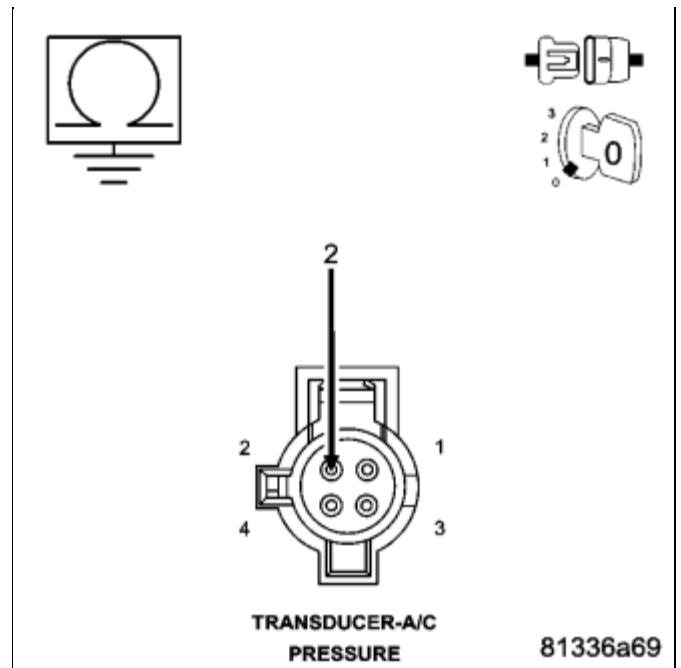
Yes

- Repair the short to ground in the (C818) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. TOTALLY INTEGRATED POWER MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related A/C Pressure Transducer and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the A/C Pressure Transducer and the Totally Integrated Power Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

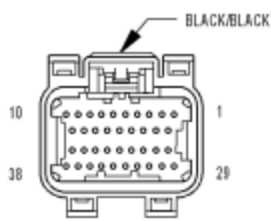
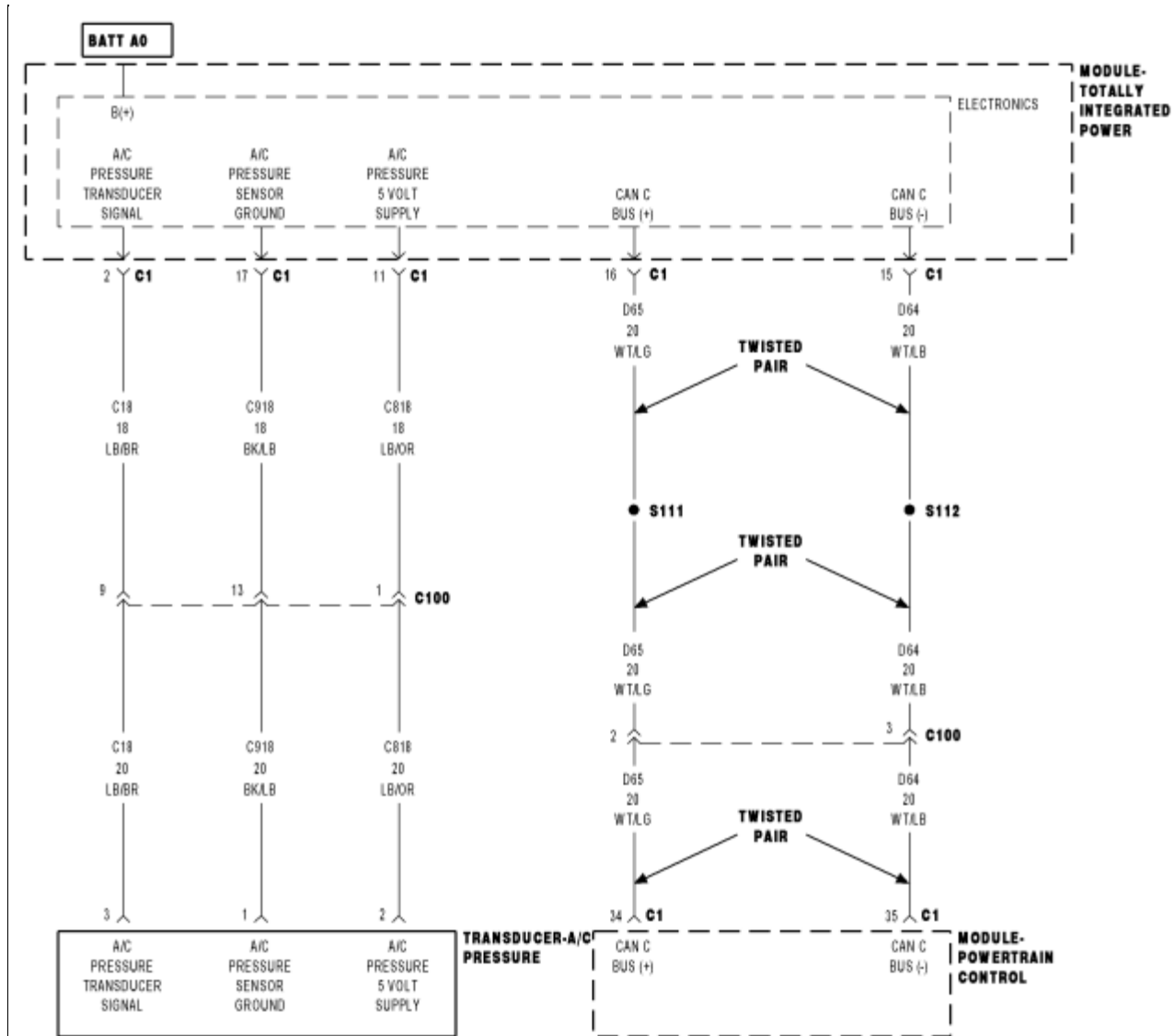
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

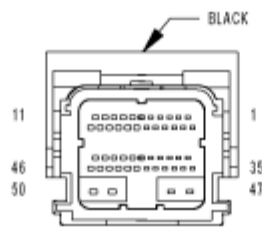
No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

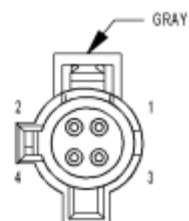
P0533-A/C PRESSURE SENSOR CIRCUIT HIGH



**MODULE-
POWERTRAIN
CONTROL C1
(GAS)**



**MODULE-
TOTALLY
INTEGRATED
POWER C1**



**TRANSDUCER-A/C
PRESSURE**

01017401

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running and the A/C Clutch Relay energized.

◦ **Set Condition:**

The A/C pressure transducer signal at the PCM goes above the maximum allowable value. One trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(C18) A/C PRESSURE SIGNAL CIRCUIT OPEN
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (C818) 5-VOLT SUPPLY CIRCUIT
(C918) A/C PRESSURE GROUND CIRCUIT OPEN
A/C PRESSURE TRANSDUCER
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any CAN - C Communication DTCs before continuing.

NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. A/C PRESSURE TRANSDUCER

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Ignition on, engine not running.

With the scan tool, monitor the A/C Pressure Transducer voltage.

Connect a jumper wire between the (C18) A/C Pressure Signal circuit and the (C918) Sensor Ground circuit in the Transducer harness connector.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

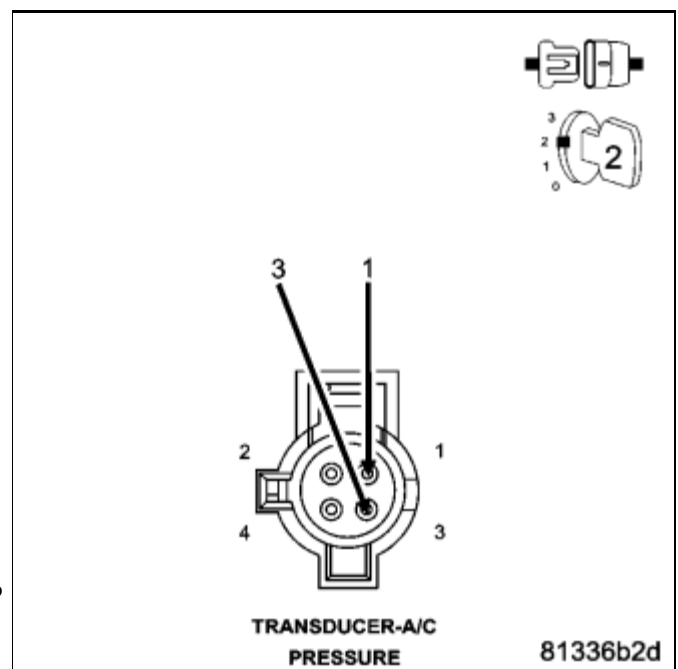
Yes

- Verify that there is good pin to terminal contact in the A/C Pressure Transducer and the Totally Integrated Power Module connectors. If OK, replace the A/C Pressure Transducer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C1 TIPM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (C18) A/C Pressure Signal circuit
 in the A/C Pressure Transducer harness connector.

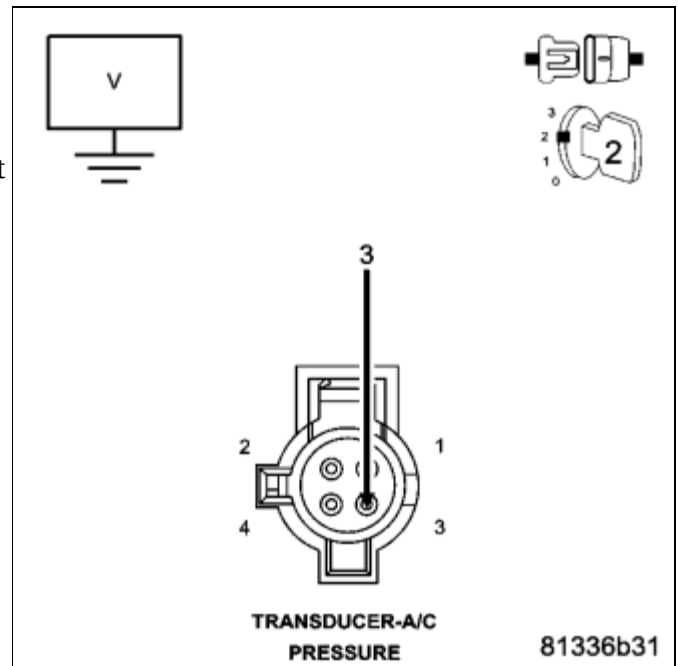
Is there any voltage present?

Yes

- Repair the short to voltage in the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Measure the resistance of the (C18) A/C Pressure Signal
 circuit from the A/C Pressure Transducer harness connector
 to C1 TIPM harness connector.

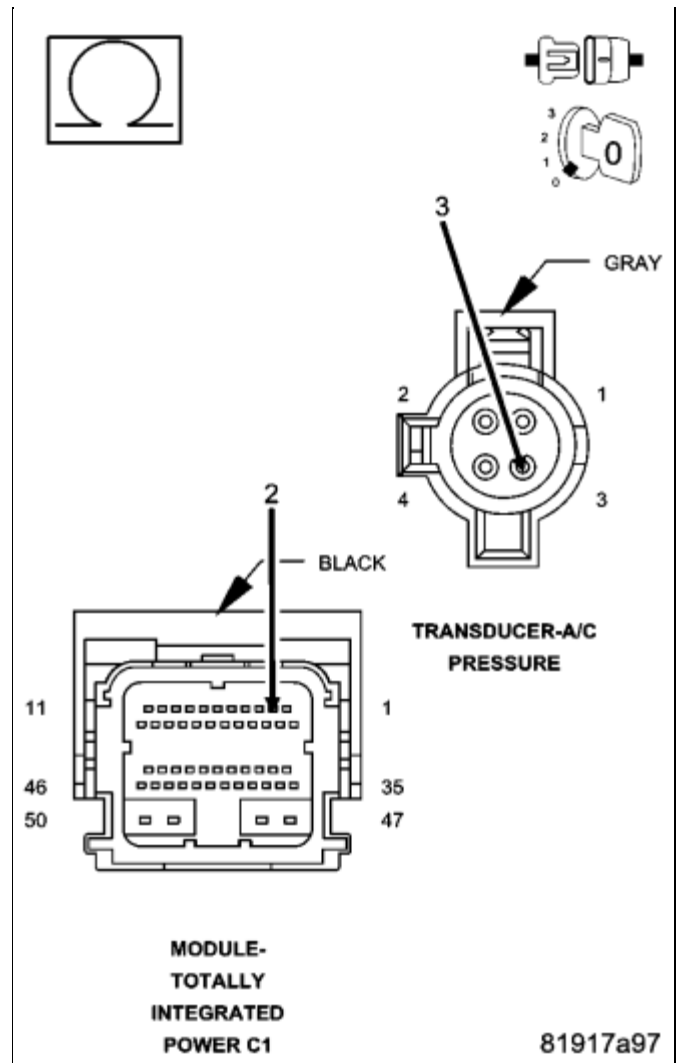
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (C818) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (C818) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

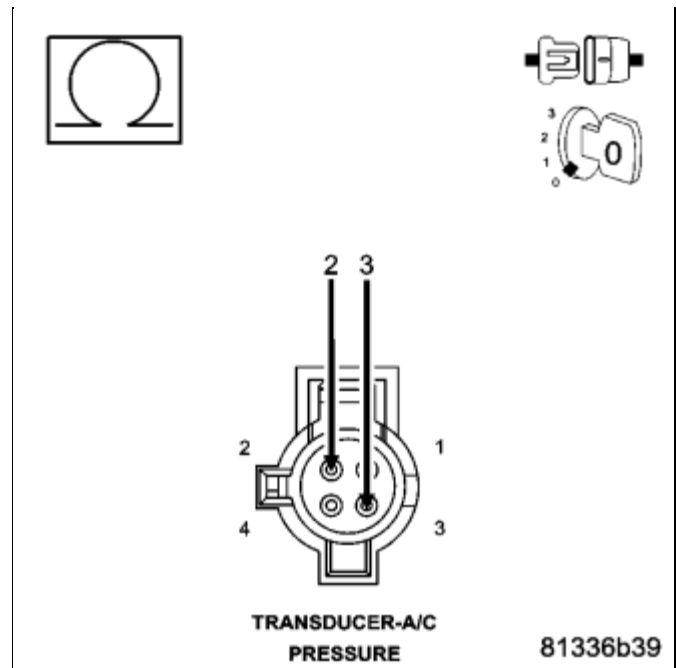
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (C818) 5-volt Supply circuit and the (C18) A/C Pressure Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (C918) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (C918) Sensor Ground circuit from the A/C Pressure Sensor harness connector to the C1 TIPM harness connector.

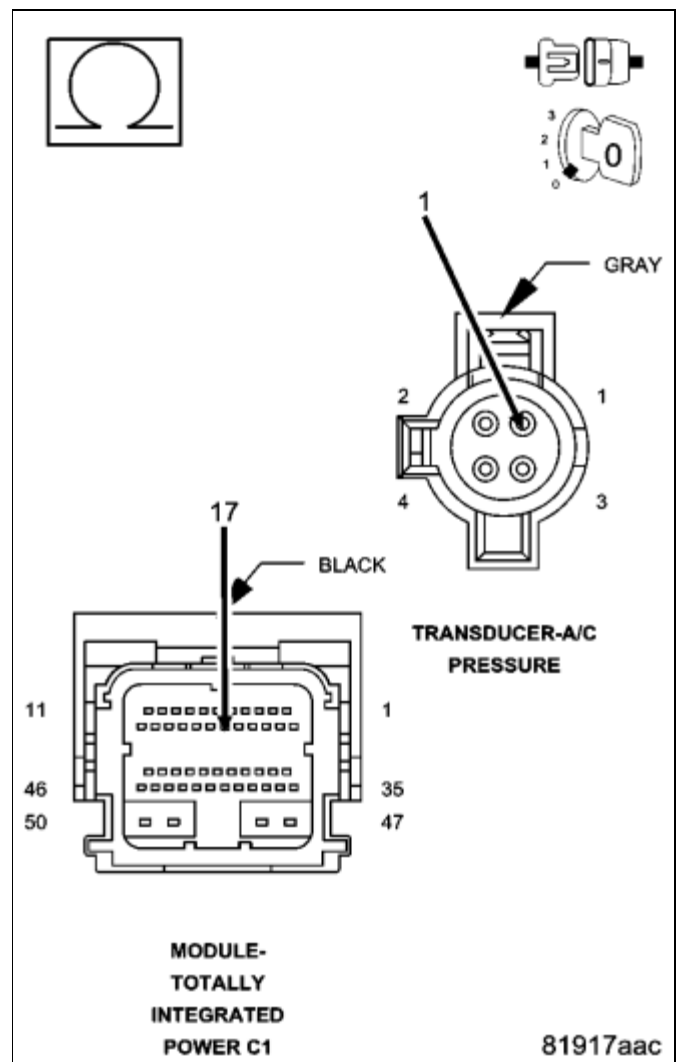
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (C918) Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related A/C Pressure Transducer and the Totally Integrated Power Module (TIPM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the A/C Pressure Transducer and the Totally Integrated Power Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

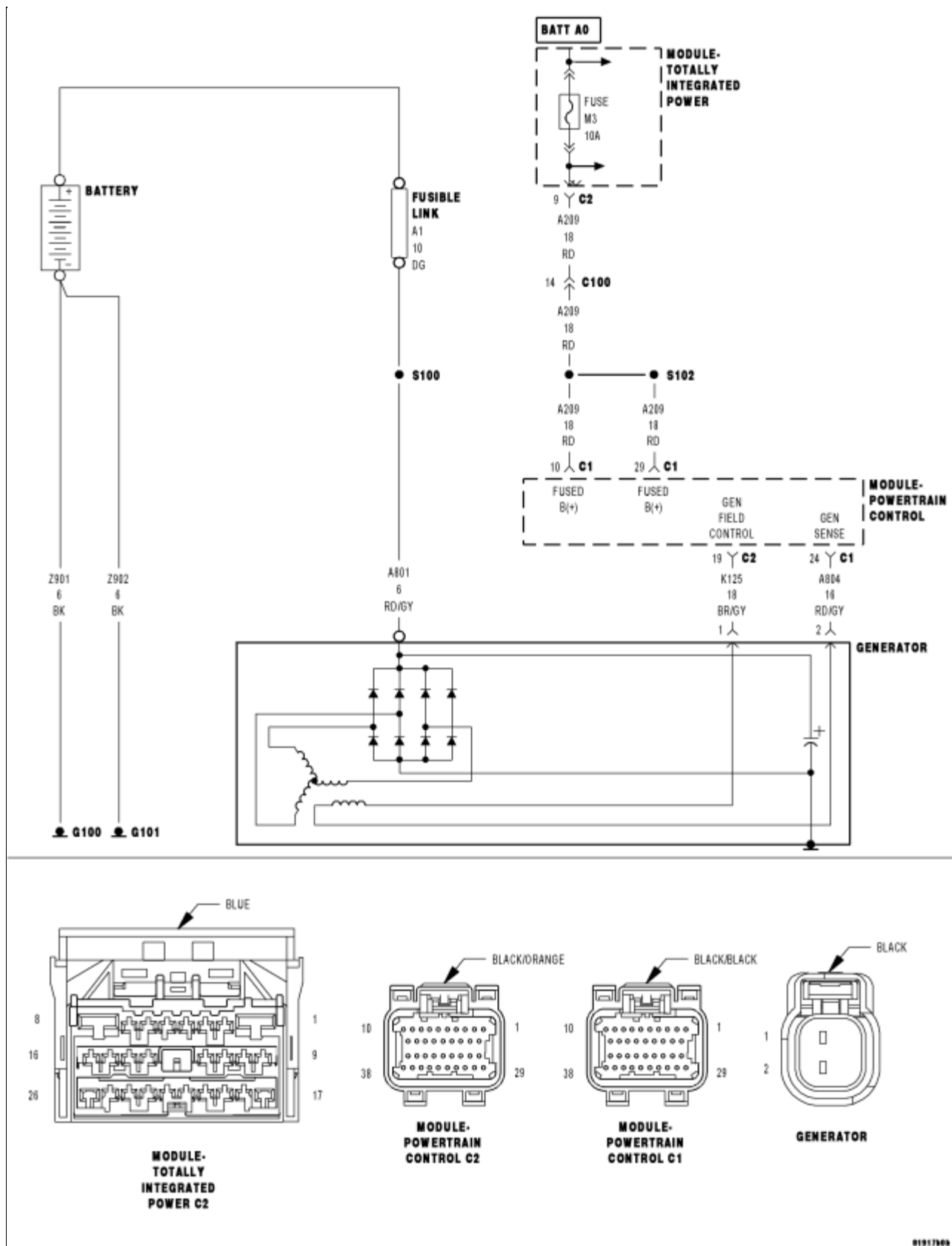
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P0562-BATTERY VOLTAGE LOW



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The engine running. The engine speed greater than 1000 RPM.

- **Set Condition:**

Battery voltage is less than 6 volts for a set period of time. One Trip Fault.

Possible Causes
RESISTANCE IN THE (A801) BATTERY POSITIVE CIRCUIT
RESISTANCE IN THE GENERATOR CASE GROUND
(K125) GENERATOR FIELD CONTROL CIRCUIT OPEN
(K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the TIPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. BATTERY

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester or an equivalent Battery tester, test the Battery before continuing.

Does the Battery pass the load test for this specific application?

Yes

- Replace the Battery per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

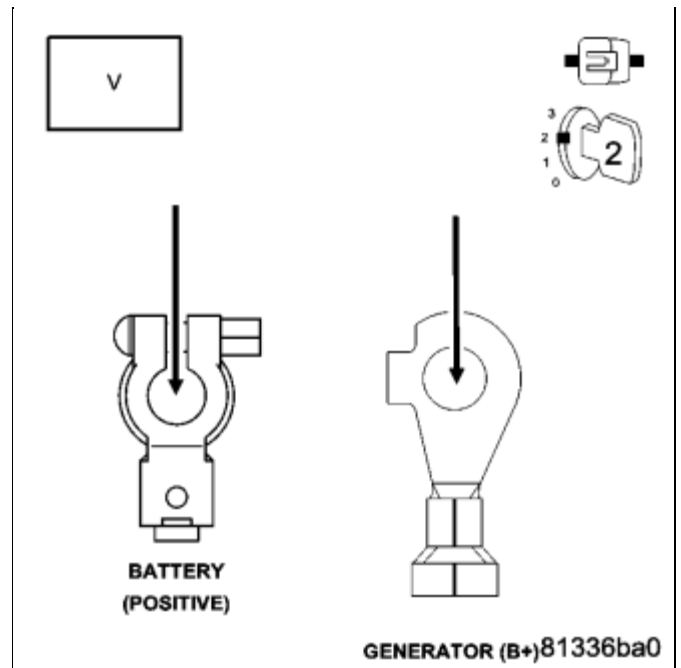
3. (A801) B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Make sure all wires are clear of the engine's moving parts.

Measure the voltage between the (A801) B+ Terminal at the Generator and the Battery + Post.
Start the engine.

Is the voltage above 0.4 of a volt?

**Yes**

- Repair the excessive resistance in the (A801) B+ circuit between the Generator and Battery.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. GENERATOR CASE GROUND HIGH RESISTANCE

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: Make sure all wires are clear of the engine's moving parts.

Measure the voltage between the Generator case and Battery ground post.

Is the voltage above 0.1 of a volt?

Yes

- Repair excessive resistance in the Generator Ground between the Generator Case and Battery ground side.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

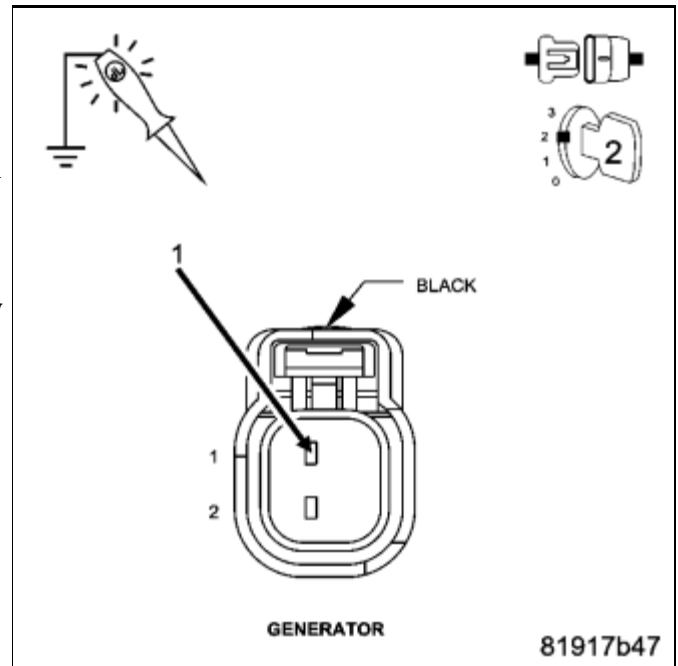
5. GENERATOR OPERATION

Turn the ignition off.
 Disconnect the Generator Field harness connector.
 Using a 12-volt test light connected to ground, probe the (K125) Generator Field Control circuit in the Generator Field harness connector.

NOTE: Make sure the test light is probing the circuit before actuating the Test or a DTC may set and not allow the actuation.

Ignition on, engine not running.
 With a scan tool, actuate the Generator Field Driver.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors. Replace the Generator if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. (K125) GENERATOR FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K125) Gen Field Control circuit from the Generator harness connector to the appropriate terminal of the special tool #8815.

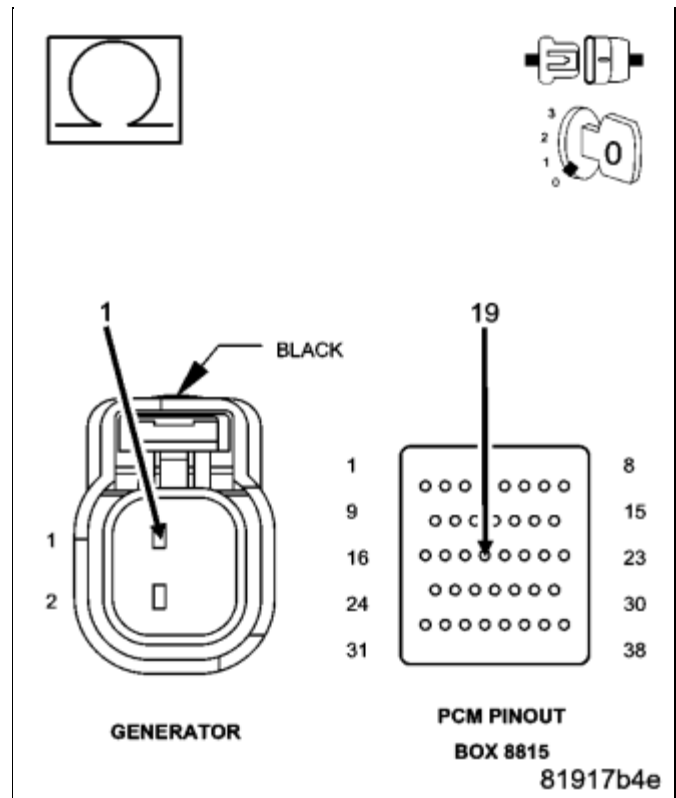
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K125) Gen Field Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K125) Gen Field Control circuit in the Generator Field harness connector.

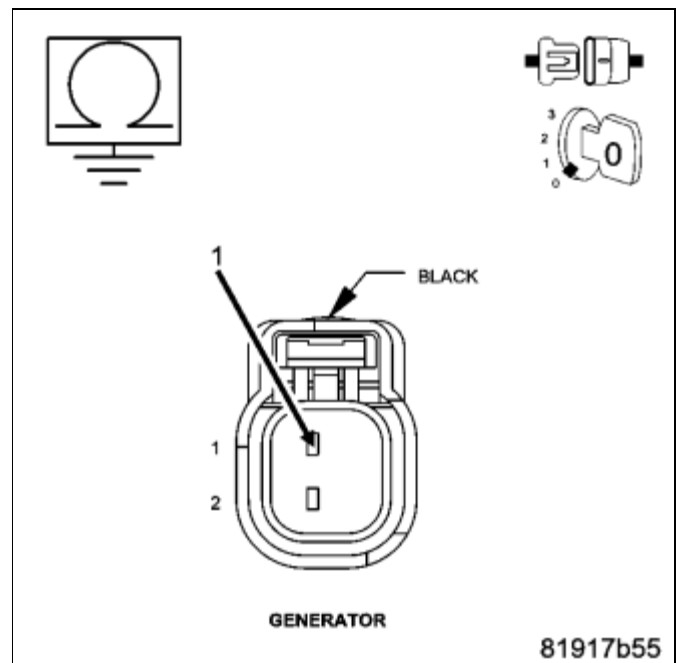
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K125) Gen Field Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

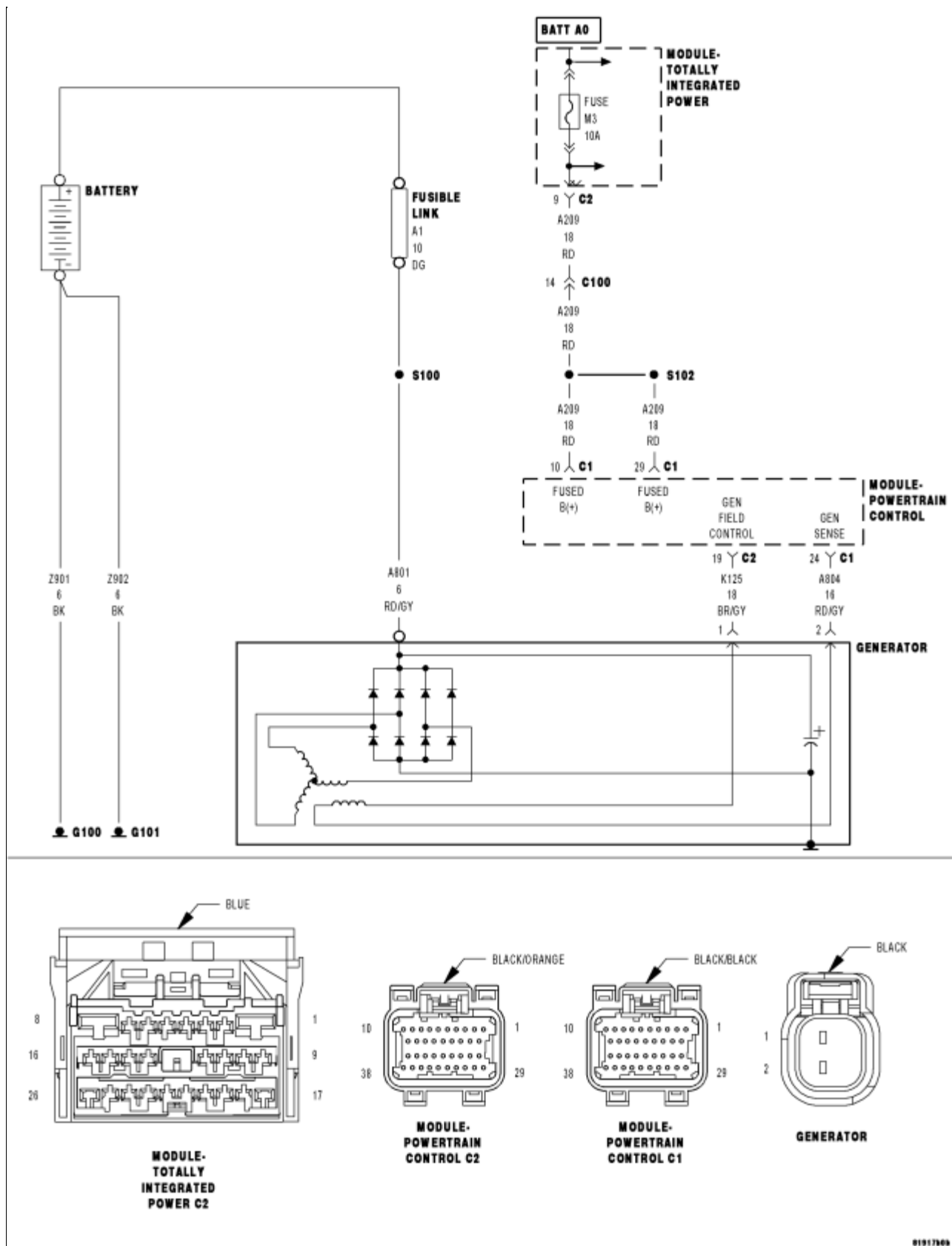
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0563-BATTERY VOLTAGE HIGH



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Engine RPM greater than 1000 RPM. With no other charging system codes set.

◦ **Set Condition:**

Battery voltage is 1 volt greater than desired voltage for more than 10 seconds. Battery voltage greater than 15.75 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
GENERATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.

NOTE: Inspect the fuses in the TIPM. If a fuse is open use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.

Start the engine.
Allow the engine to idle.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

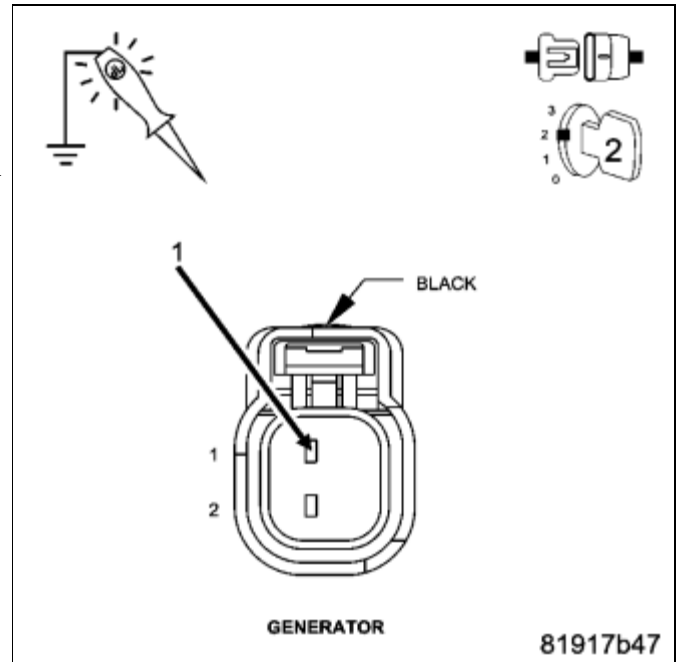
No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. GENERATOR OPERATION

Turn the ignition off.
 Disconnect the Generator Field harness connector.
 Using a 12-volt test light connected to ground, probe the (K125) Generator Field Control circuit in the Generator Field harness connector.
 Ignition on, engine not running.
 With a scan tool, actuate the Generator Field Driver.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors. Replace the Generator if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K125) FIELD CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K125) Gen Field Control circuit at the Generator Field harness connector.

Is there any voltage present?

Yes

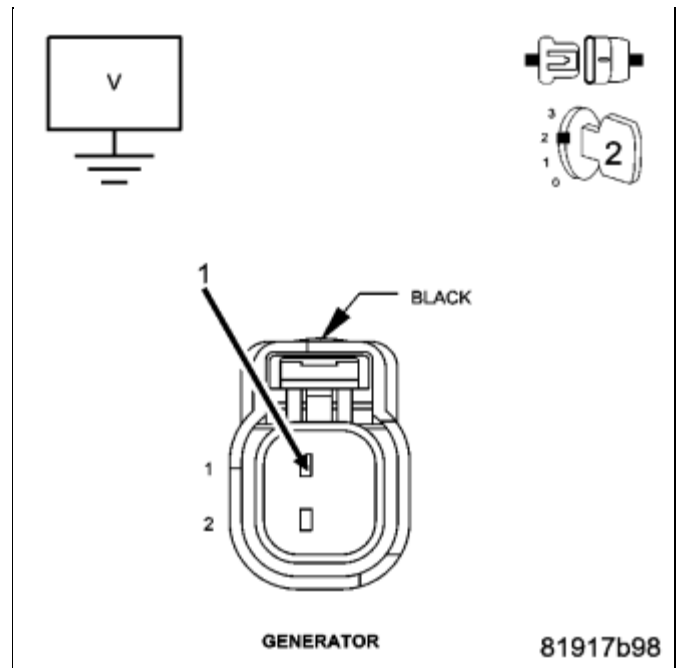
- Repair the short to voltage in the (K125) Gen Field

Control circuit.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

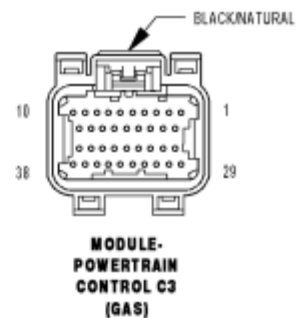
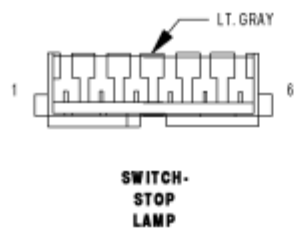
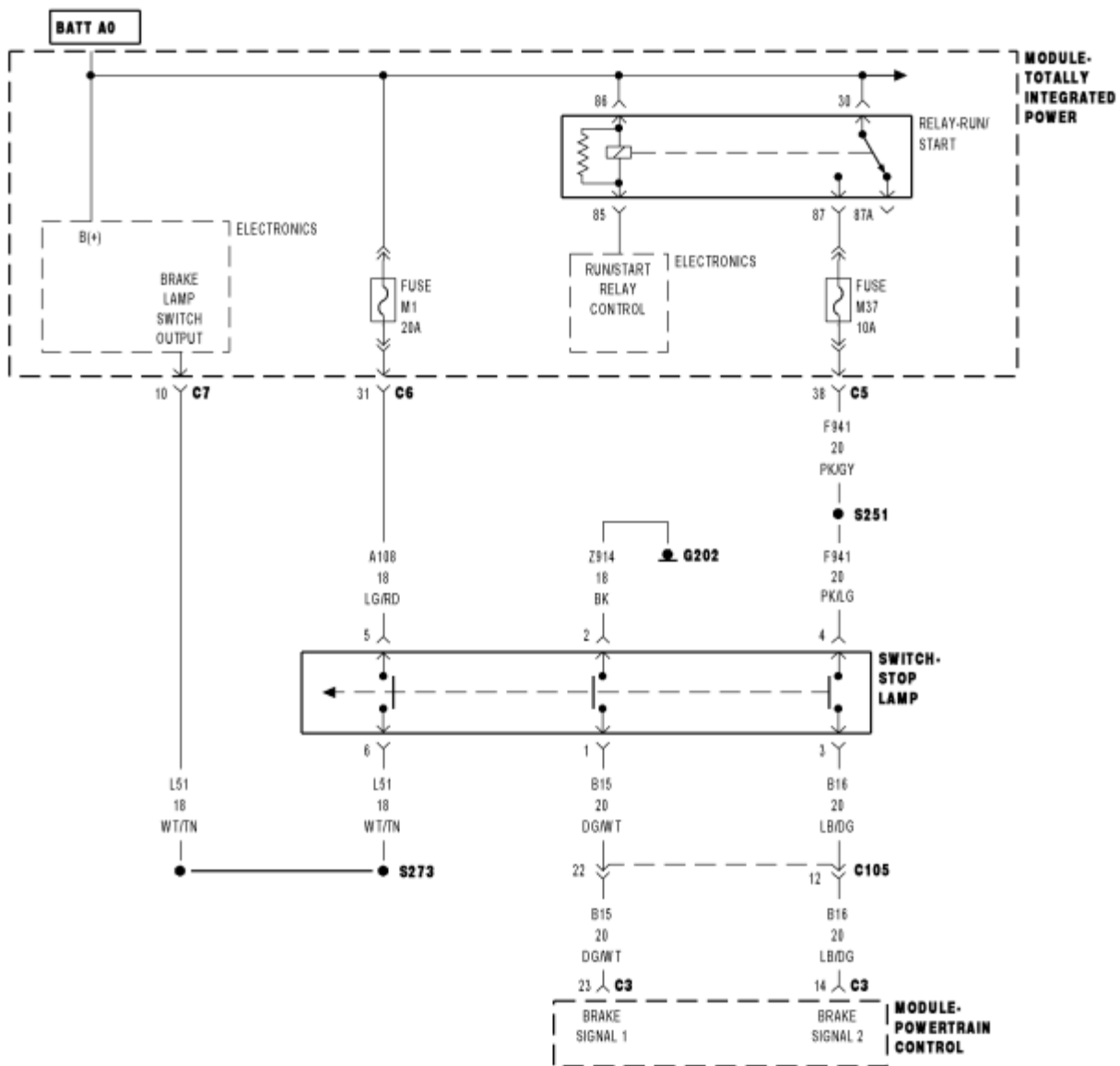
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0571-BRAKE SWITCH 1 PERFORMANCE



81917095

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The brake switch rationality checks both failure modes of the brake switch. The brake switch stuck on test checks for a high vehicle speed condition where the brake switch is unexpectedly depressed. The brake switch stuck off test checks for repeated vehicle stop maneuvers without the brake switch depressed.

- **When Monitored:**

Ignition on.

- **Set Condition:**

If the output of Brake Switch No.1 to the PCM looks like it is not applied, while Brake Lamp Switch Output circuit is applied the fault will mature in 60ms. One Trip Fault.

Possible Causes
(B15) BRAKE SIGNAL 1 CIRCUIT SHORTED TO GROUND
(B16) BRAKE SIGNAL 2 CIRCUIT OPEN
(B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND
(Z914) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is properly adjusted before continuing.

NOTE: Make sure the Stop Lamp Switch is properly wired, such as (B15) Brake Signal 1 and (B16) Brake Signal 2 circuits are not switched at the harness connector.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (B15) BRAKE SIGNAL 1 SHORTED TO GROUND

NOTE: Check the related fuse and relay for proper operation before continuing.

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B15) Brake Signal 1 circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

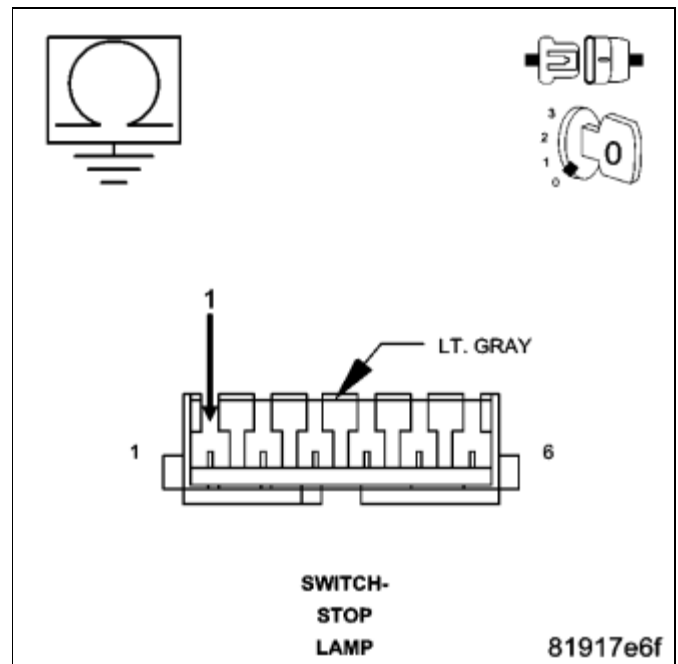
No

- Go To [3](#)

3. (B16) BRAKE SIGNAL 2 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B16) Brake Signal 2 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



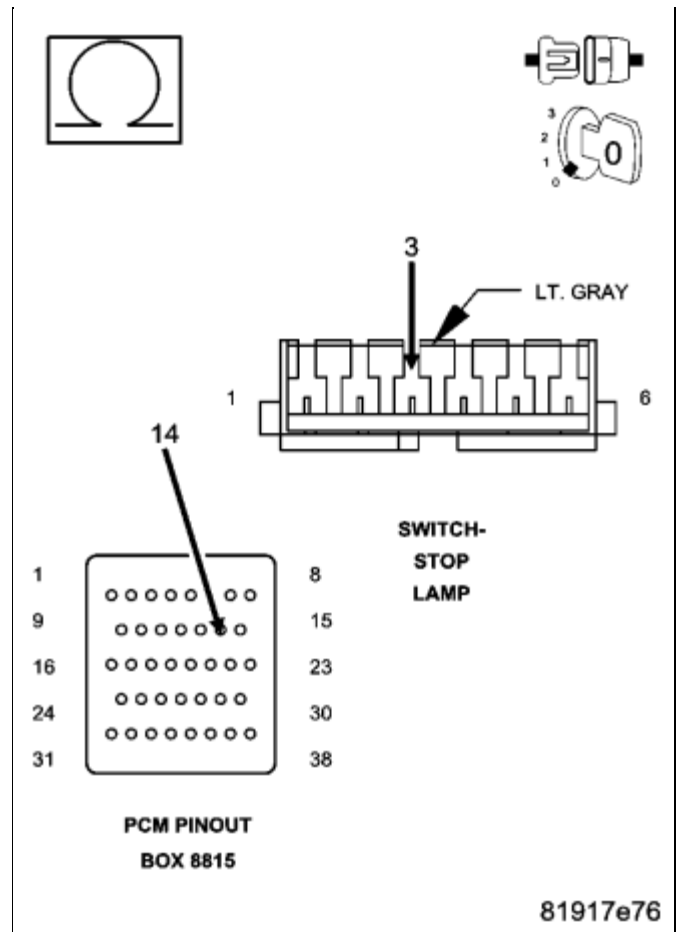
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B16) Brake Signal 2 circuit in the Stop Lamp Switch harness connector.

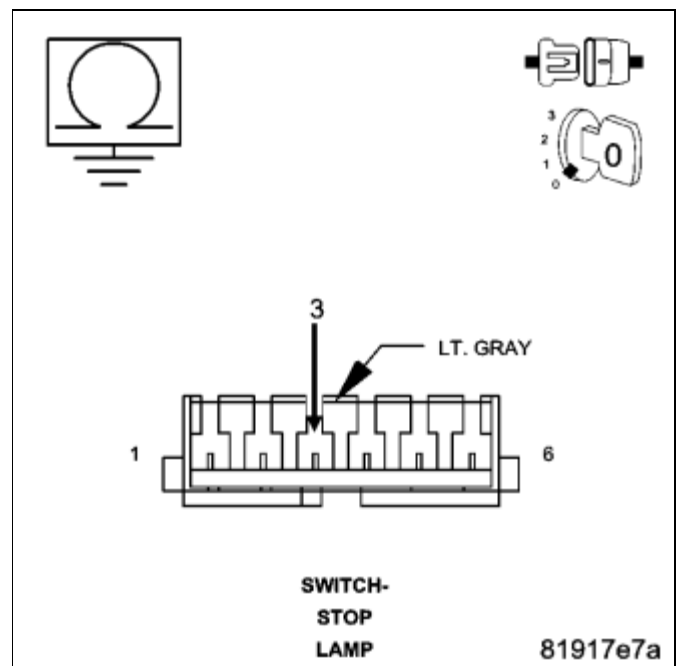
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (Z914) GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z914) Ground circuit in the Stop Lamp Switch harness connector.

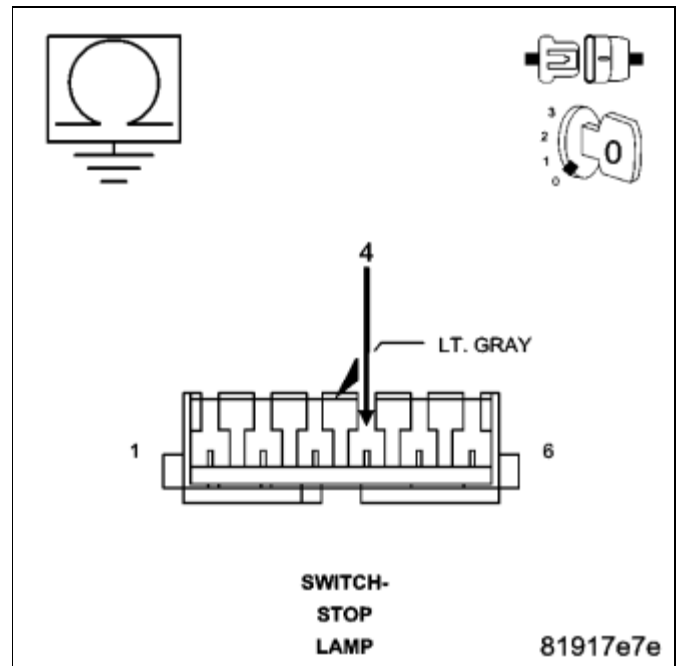
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (Z914) Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. STOP LAMP SWITCH

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 circuit terminal in the Stop Lamp Switch.

Next, measure the resistance between the (F941) Fused Ignition Switch Output circuit terminal and the (B16) Brake Signal 2 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit for one or both of the measurements taken?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the Switch and Control Module connectors. If OK, replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

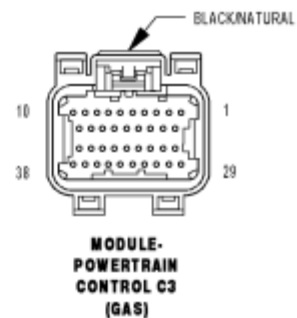
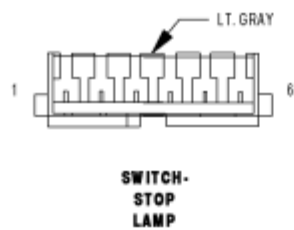
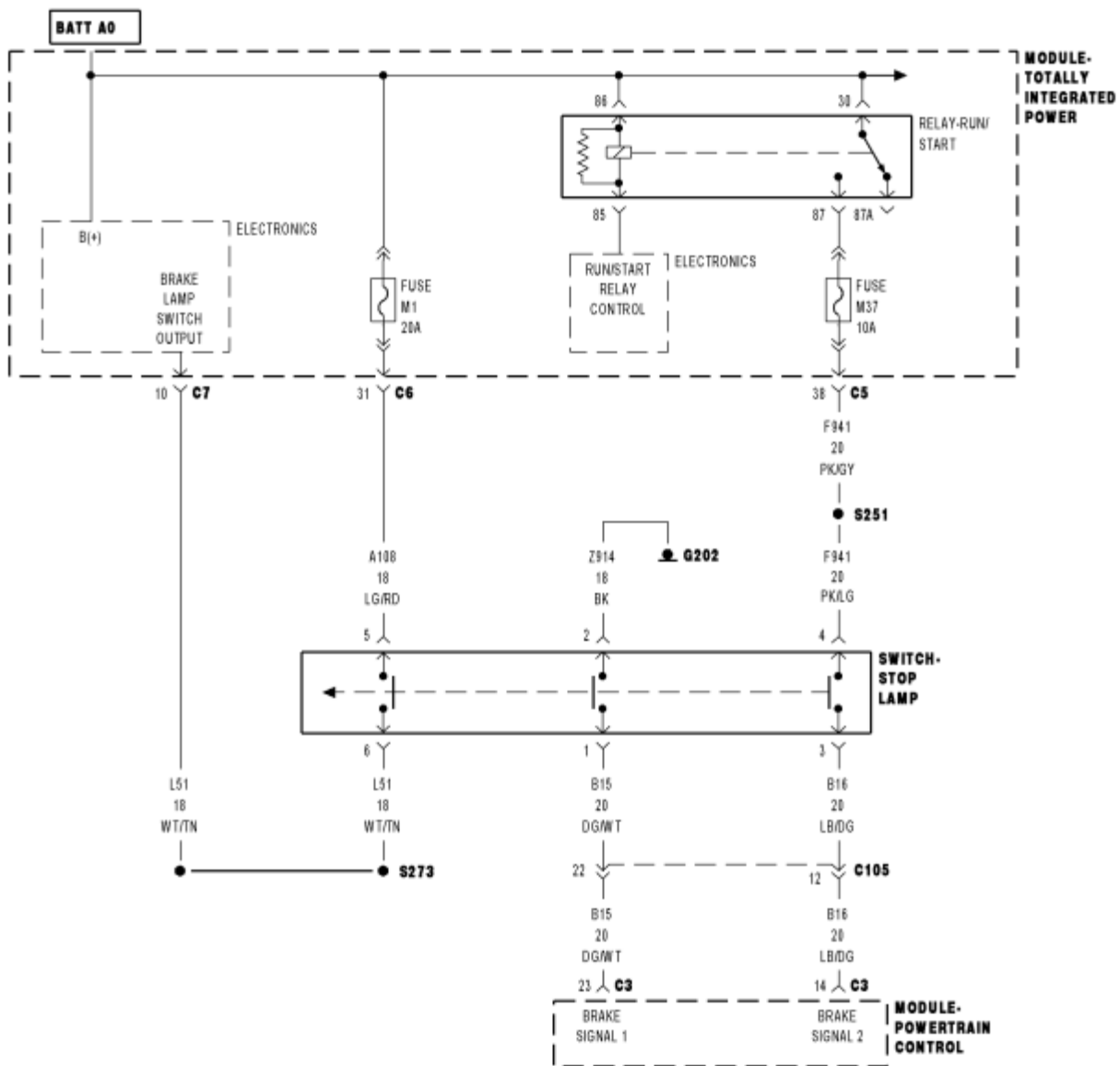
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0572-BRAKE SWITCH 1 STUCK ON



81917095

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

When vehicle speed cycles from 0 kph to 48 kph (30 mph) at least 10 times.

◦ **Set Condition:**

When the PCM recognizes Brake Switch No.1 is mechanically stuck in the low/on position. Two Trip Fault. Three Global Good Trips to Clear.

Possible Causes
(B15) BRAKE SIGNAL 1 CIRCUIT SHORTED TO GROUND
(B16) BRAKE SIGNAL 2 CIRCUIT OPEN
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Verify battery voltage is greater than 10 volts.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. STOP LAMP SWITCH

NOTE: Check the related fuse and relay for proper operation before continuing.

Turn the ignition off.

Remove the Stop Lamp Switch and disconnect the harness connector.

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 circuit terminal in the Stop Lamp Switch.

Measure the resistance between the (F941) Fused Ignition Switch Output circuit terminal and the (B16) Brake Signal 2 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch plunger while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the Switch and Control Module connectors. If OK, replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (B15) BRAKE SIGNAL 1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B15) Brake Signal 1 circuit in the Stop Lamp Switch harness connector.

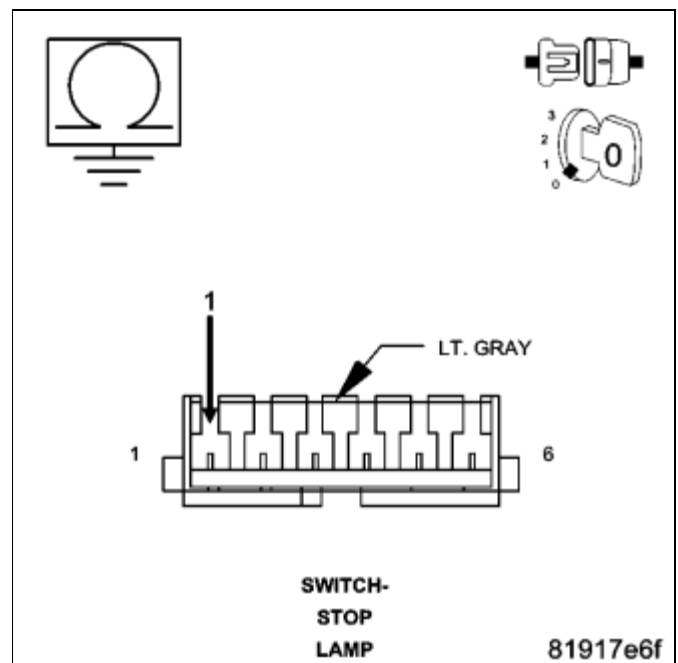
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (B16) BRAKE SIGNAL 2 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B16) Brake Signal 2 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

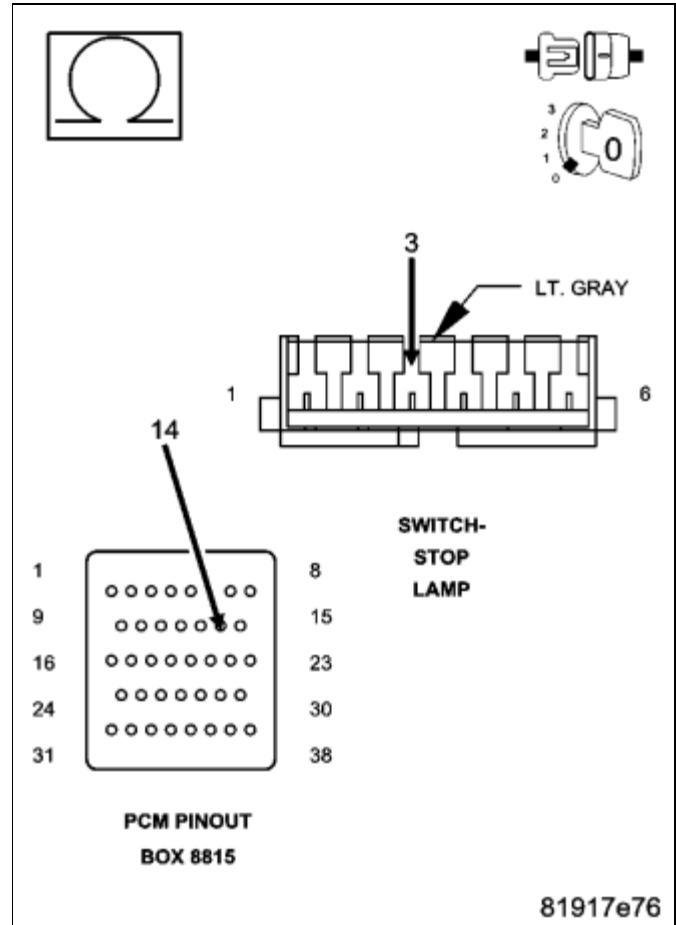
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

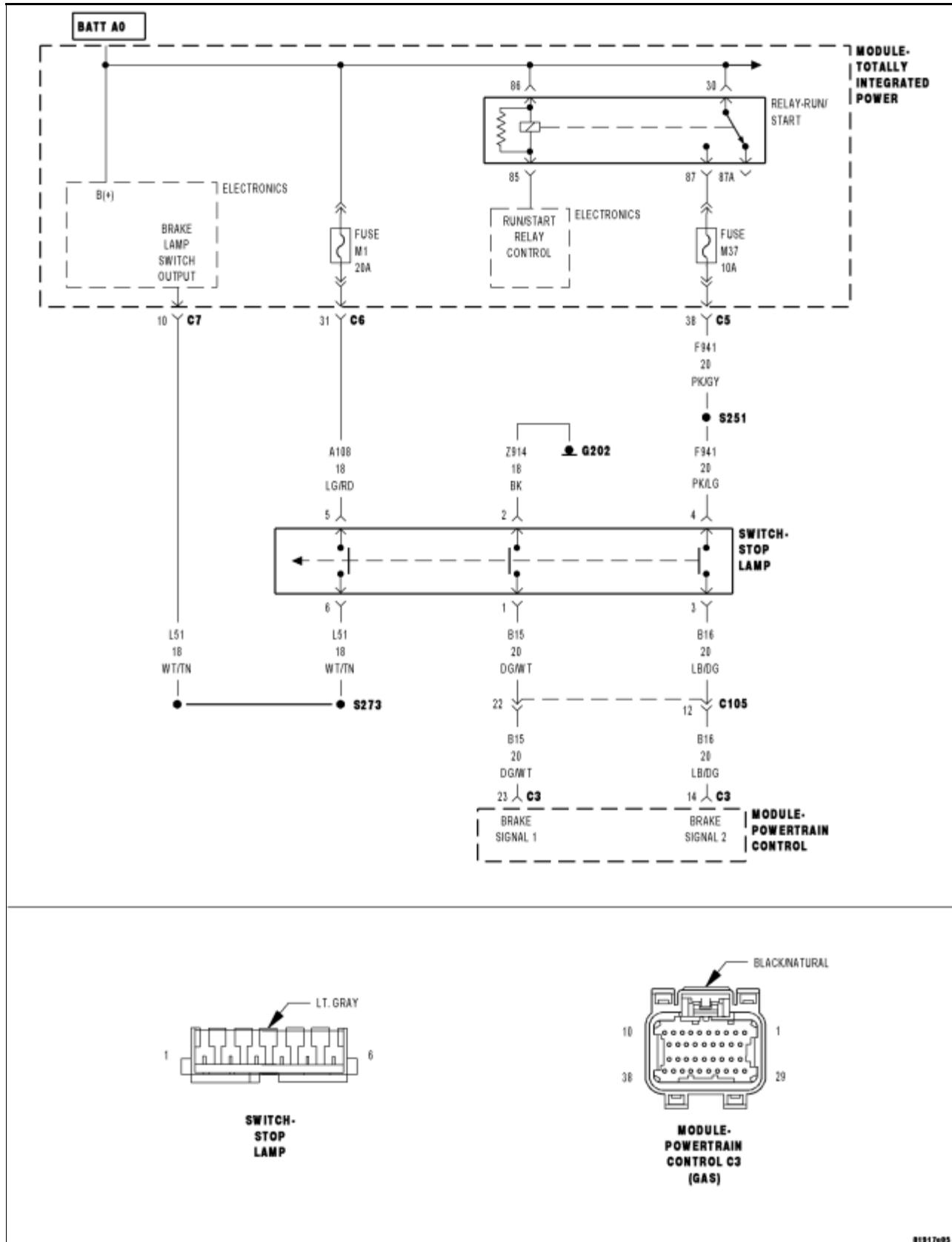
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0573-BRAKE SWITCH 1 STUCK OFF



81917u05

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

When vehicle speed cycles from 0 kph to 48 kph (30 mph) at least 10 times.

- **Set Condition:**

When the PCM recognizes Brake Switch No.1 is stuck in the high/off position. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(B15) BRAKE SIGNAL 1 CIRCUIT OPEN
(B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND
(Z914) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. STOP LAMP SWITCH

NOTE: Check the related fuse and relay for proper operation before continuing.

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes

- Go To [3](#)

No

- Verify that there is good pin to terminal contact in the Switch and Control Module connectors. If OK, replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (B15) BRAKE SIGNAL 1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B15) Brake Signal 1 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

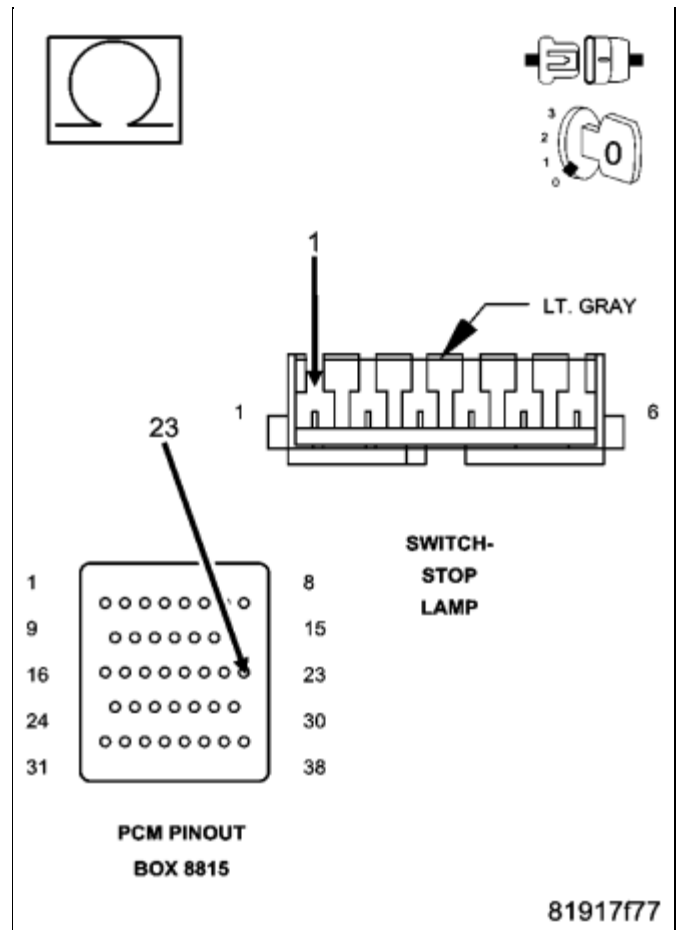
Is the resistance below 5.0 ohms?

Yes

Go To [4](#)

No

- Repair the open in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B16) Brake Signal 2 circuit in the Stop Lamp Switch harness connector.

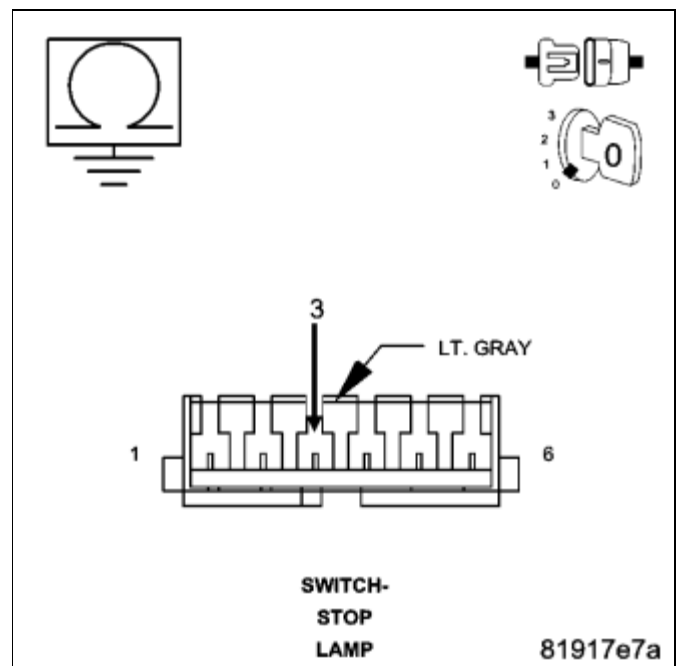
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (Z914) GROUND CIRCUIT OPEN

Measure the resistance between the (Z914) Ground circuit and ground in the Stop Lamp Switch harness connector.

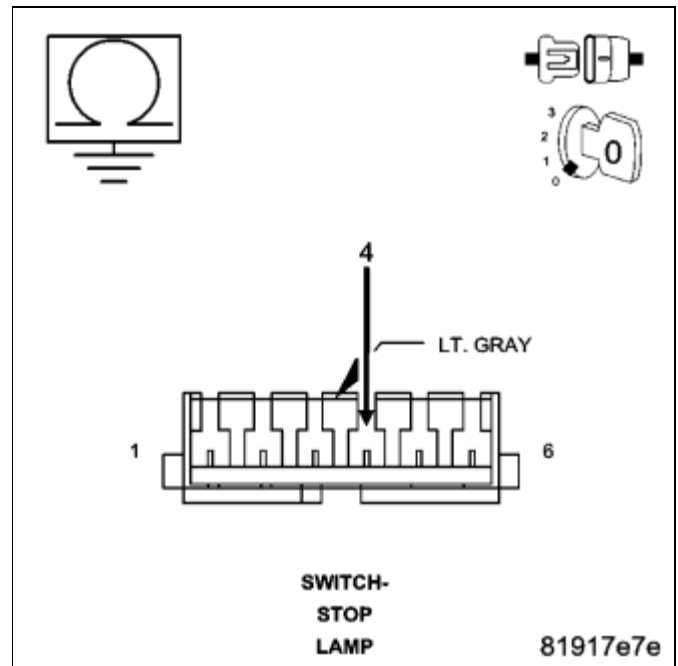
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (Z914) Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

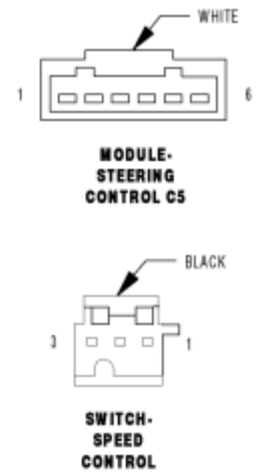
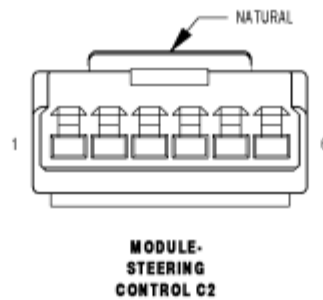
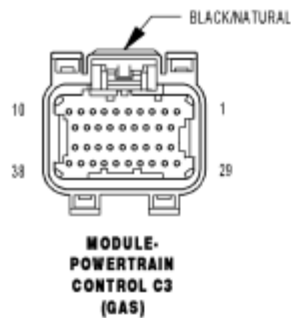
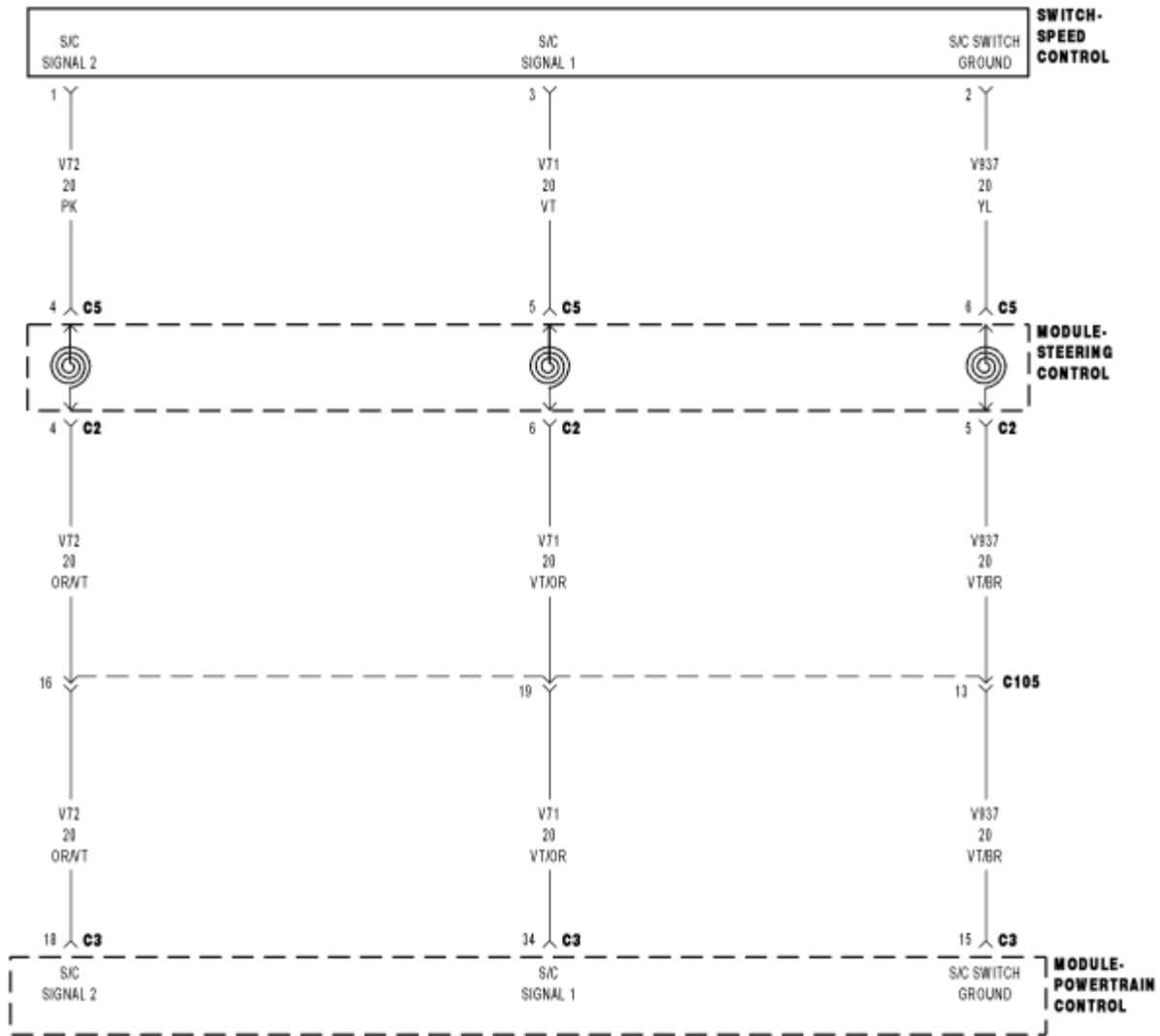
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

◦ **Set Condition:**

Cruise switch voltage output is not out of range but it does not equal any of the values for any of the button positions. One trip fault.

Possible Causes
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE
(V71) S/C SIGNAL 1 CIRCUIT OPEN
(V937) S/C SWITCH GROUND CIRCUIT OPEN
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO GROUND
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle and operate the speed control in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCH

Turn the ignition off.

Remove and disconnect the Speed Control Switch from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on the switch.

The following resistance specs are taken between terminals (V71) S/C Signal 1 and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch that had the incorrect resistance value.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V71) S/C Signal 1 circuit in the S/C Switch harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (V71) S/C Signal 1

circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (V71) S/C SIGNAL 1 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (V71) S/C Signal 1 circuit from the Speed Control Switch to the appropriate terminal of special tool #8815.

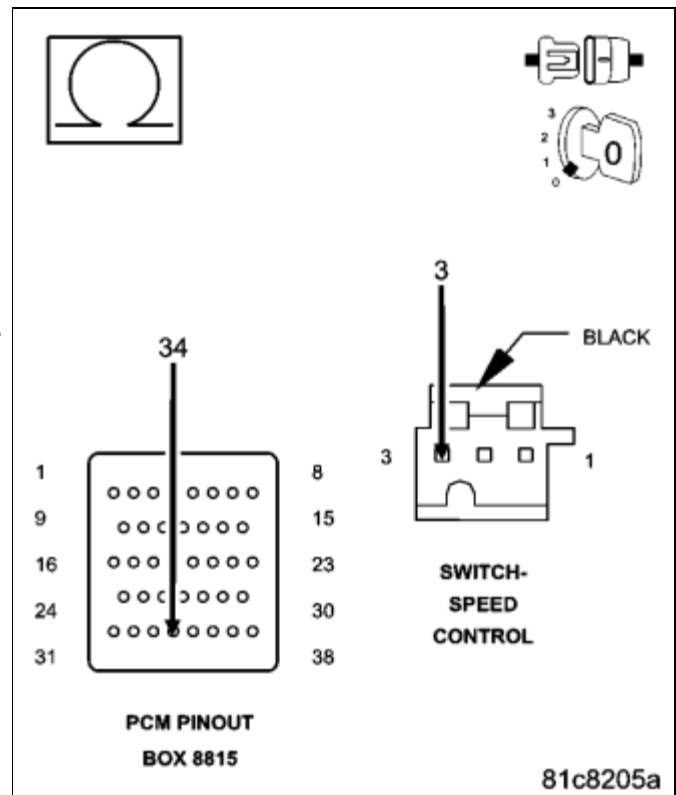
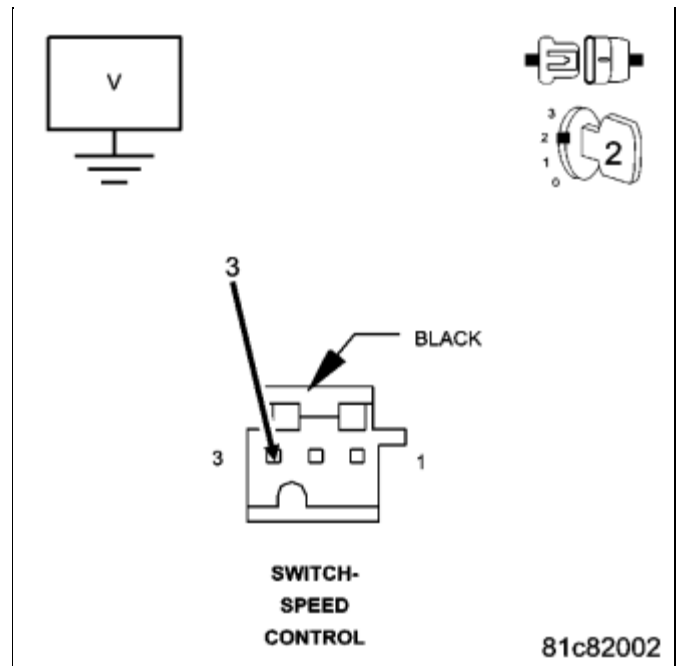
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [5](#)

No

- Repair the open in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (V937) S/C SWITCH GROUND CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V937) S/C Switch Ground circuit from the S/C Switch harness connector to the appropriate terminals of special tool #8815.

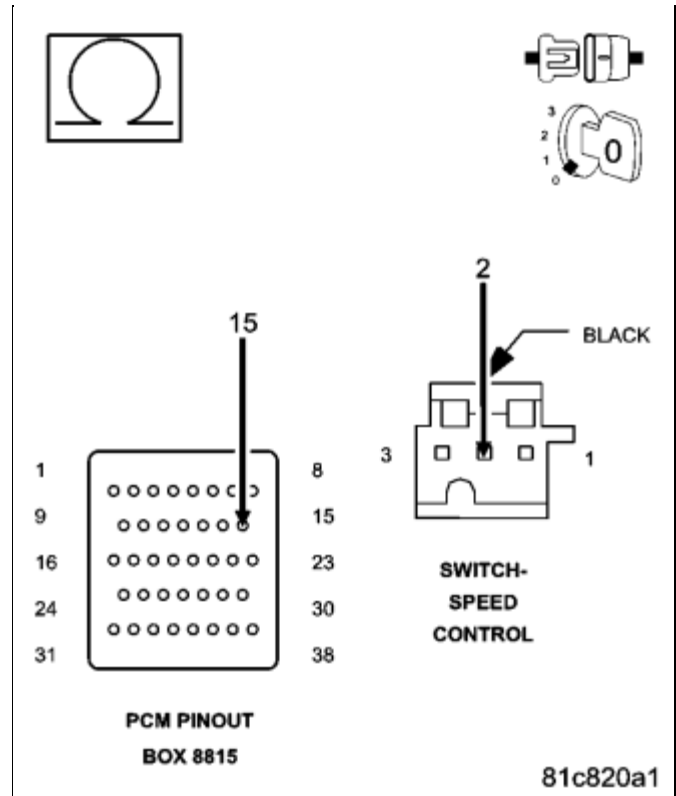
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the open in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V71) S/C Signal 1 circuit in the S/C Switch harness connector.

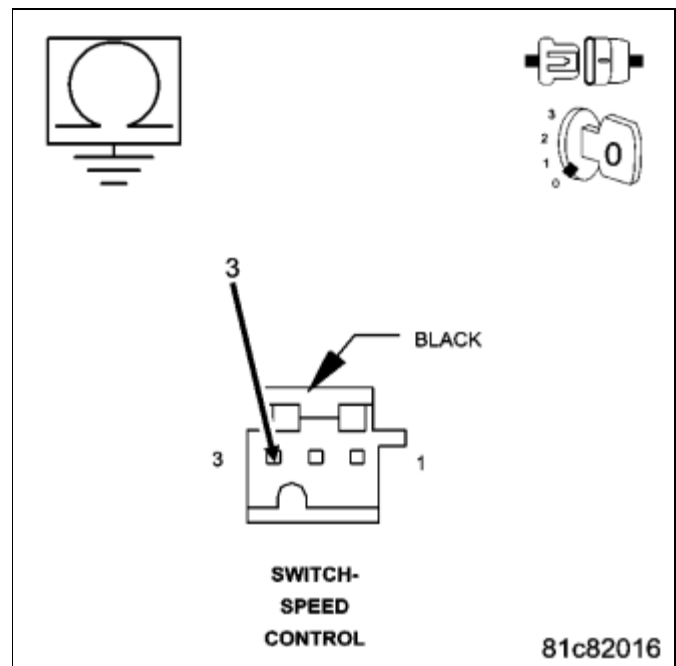
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Measure the resistance between the (V71) S/C Signal 1 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

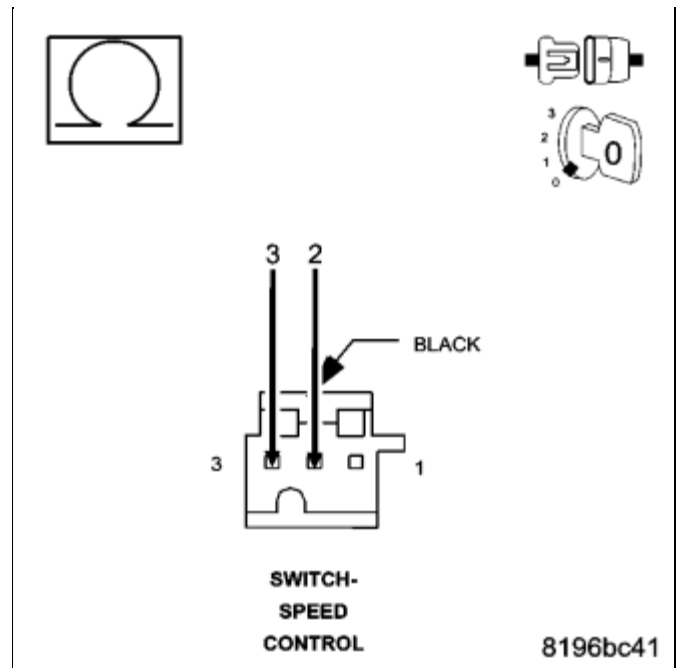
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V71) S/C Signal 1 circuit and the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit and the (V38) S/C Signal 2 circuit at the appropriate terminals of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

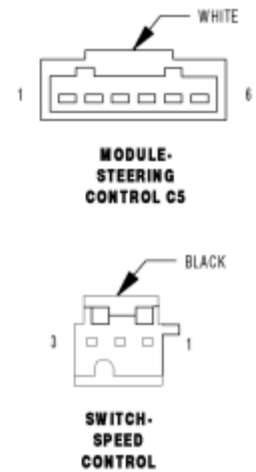
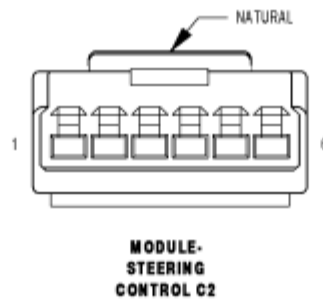
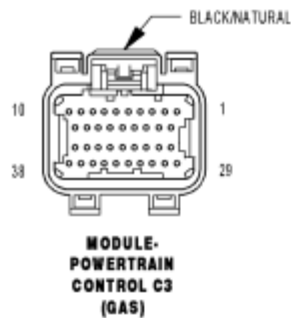
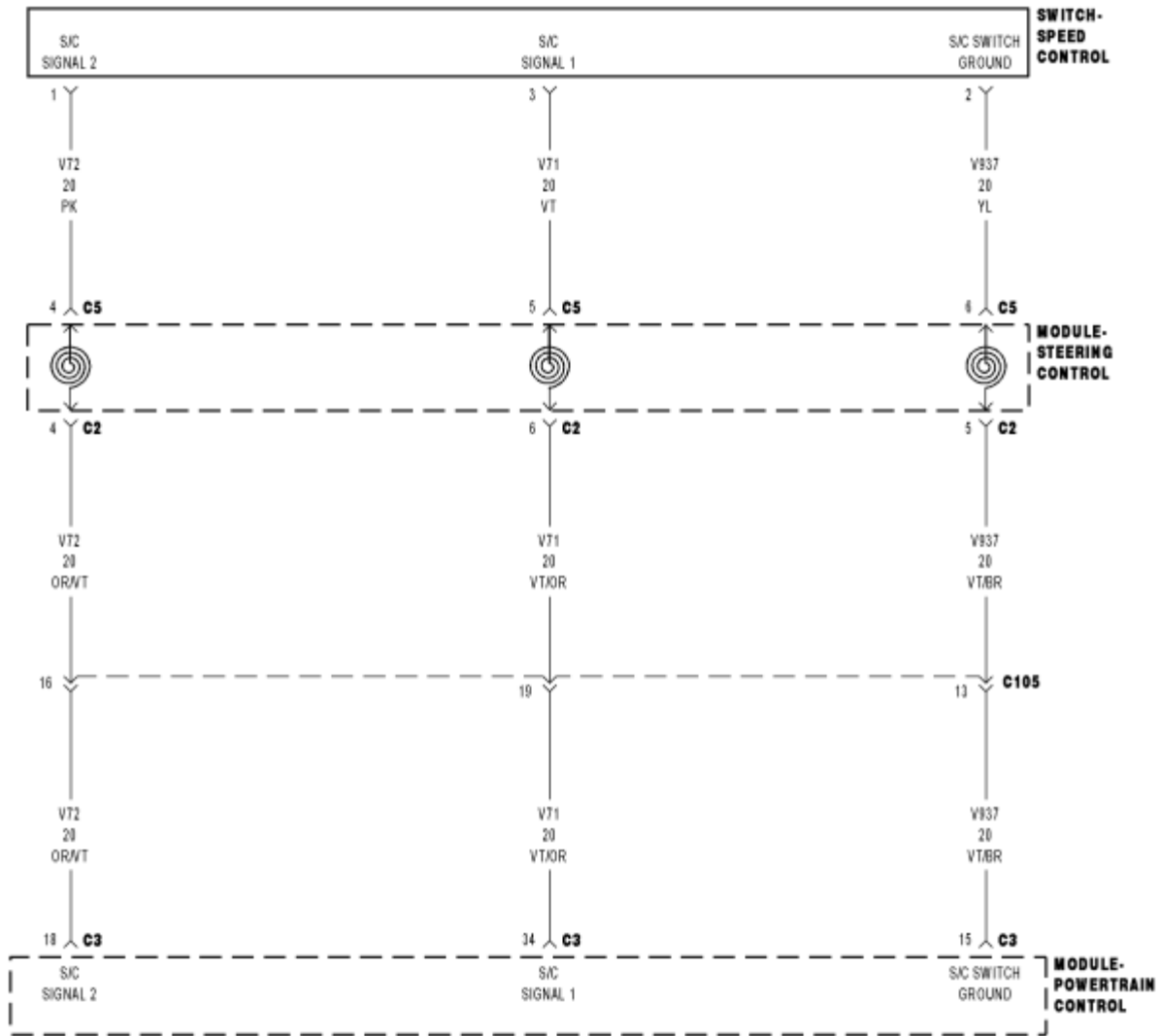
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

- **Set Condition:**

Speed control switch input No.1 is below the minimum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO GROUND
EXCESSIVE RESISTANCE IN THE (V71) S/C SIGNAL 1 CIRCUIT
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle using the Speed Control for the fault to become Active.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCH

Turn the ignition off.

Remove and disconnect the Speed Control Switch from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button for each switch.

The following resistance specs are taken between terminals (V71) S/C Signal 1 circuit and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following positions.

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switch have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. SPEED CONTROL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control Switch harness connector per Service Information.

Did the voltage change to above 4.8 volts?

Yes

- Replace the Speed Control Resume/Accel Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between the (V937) S/C Switch

Ground circuit and the (V71) S/C Signal 1 circuit at the S/C Switch harness connector.

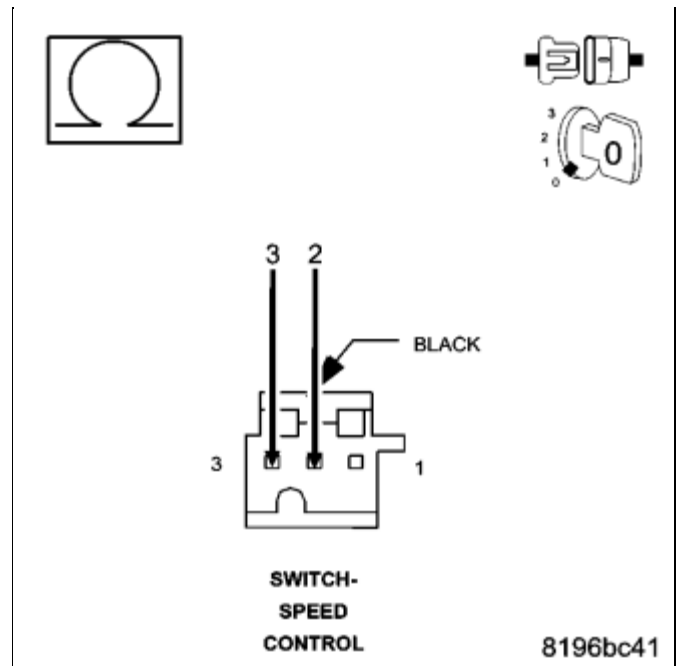
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V71) S/C Signal 1 circuit and the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V71) S/C Signal 1 circuit in the S/C Switch harness connector. To help determine the location of a short, disconnect the Steering Column Control Module C2 and C5 harness connectors and see if the short goes away.

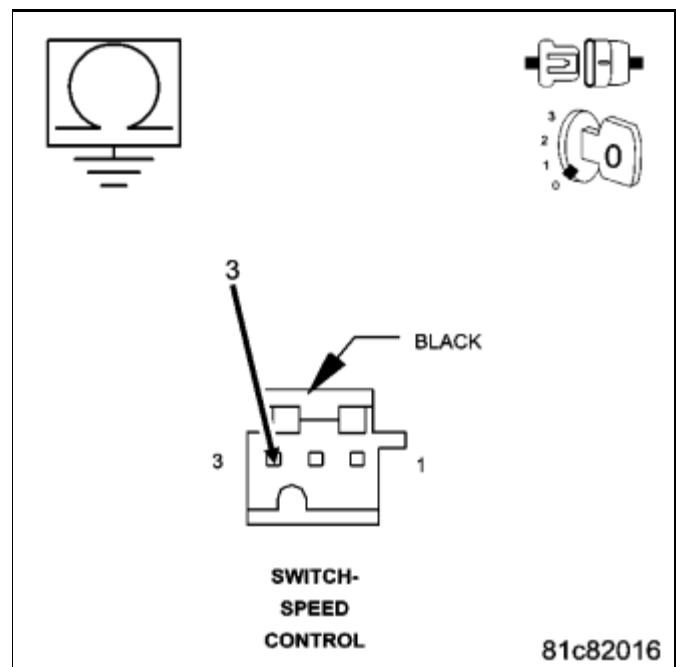
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. EXCESSIVE RESISTANCE IN THE (V71) S/C SIGNAL 1 CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin

connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V71) S/C Signal 1 circuit from the Speed Control Switch to the appropriate terminal of special tool #8815.

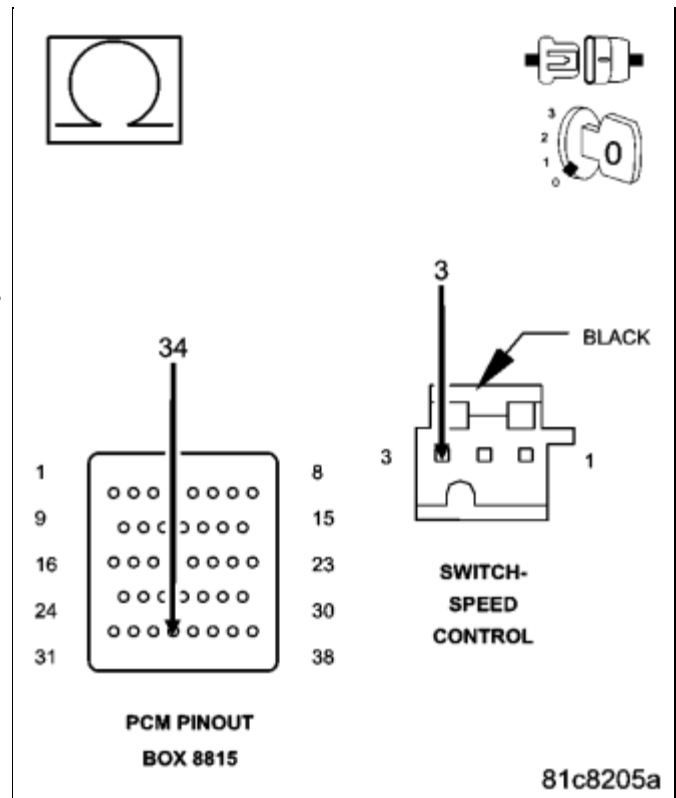
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit at the appropriate terminal of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts

COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

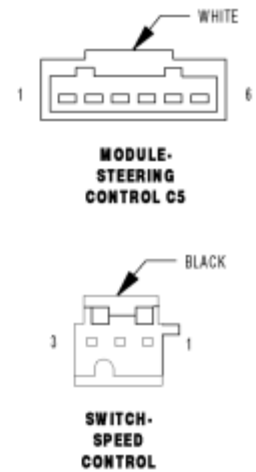
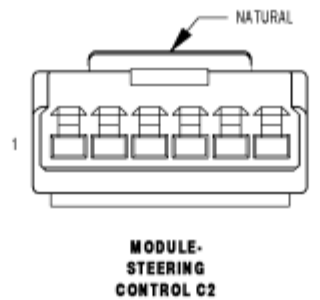
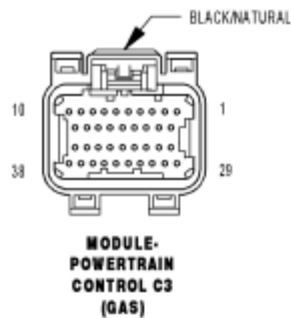
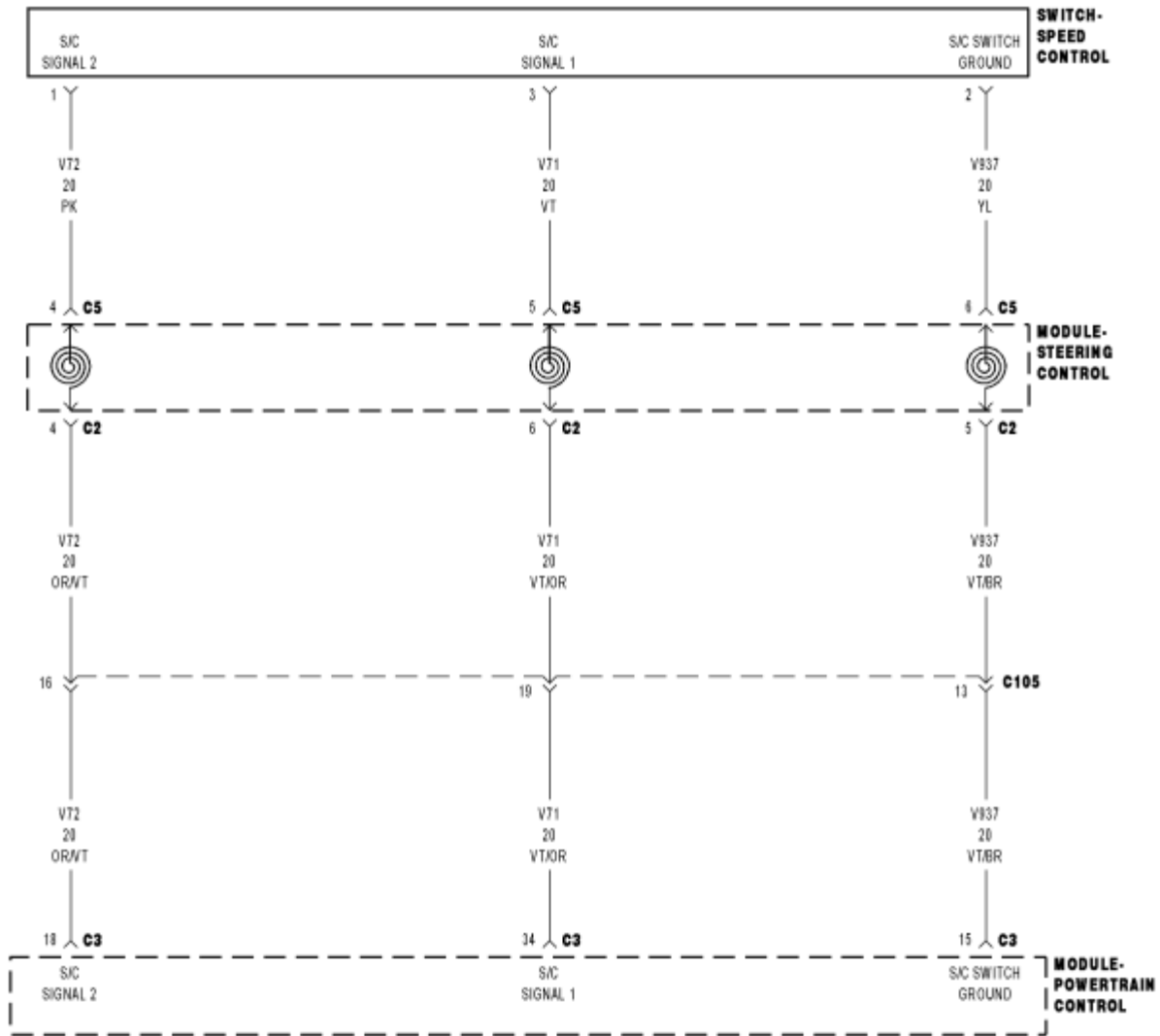
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

- **Set Condition:**

Speed control switch input above the maximum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE
(V71) S/C SIGNAL 1 CIRCUIT OPEN
(V937) S/C SWITCH GROUND CIRCUIT OPEN
SCCM
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle using the Speed Control for the fault to become Active.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V71) S/C Signal 1 and (V937) S/C Switch Ground circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch that had the incorrect resistance value.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V71) S/C Signal 1 circuit in the S/C Switch harness connector.

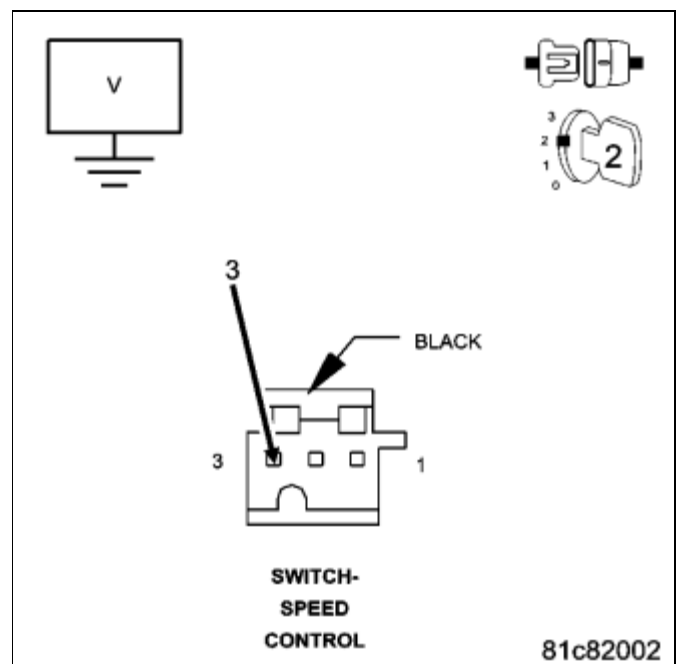
Is there any voltage present?

Yes

- Repair the short to voltage in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (V71) S/C SIGNAL 1 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (V71) S/C Signal 1 circuit from the Speed Control Switch to the appropriate terminal of special tool #8815.

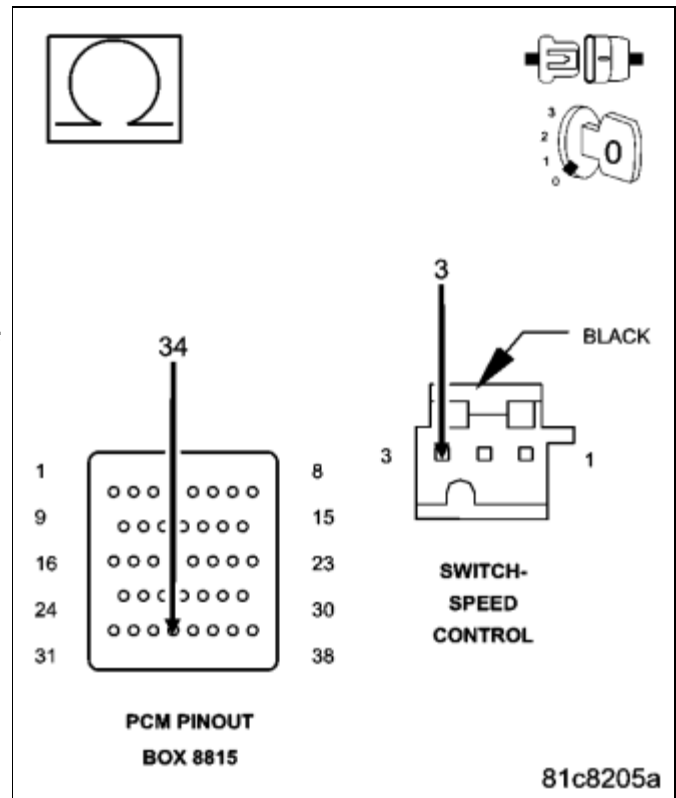
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [5](#)

No

- Repair the open in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (V937) S/C SWITCH GROUND CIRCUIT OPEN

Measure the resistance of the (V937) S/C Switch Ground circuit from the S/C Switch harness connector to the appropriate terminals of special tool #8815.

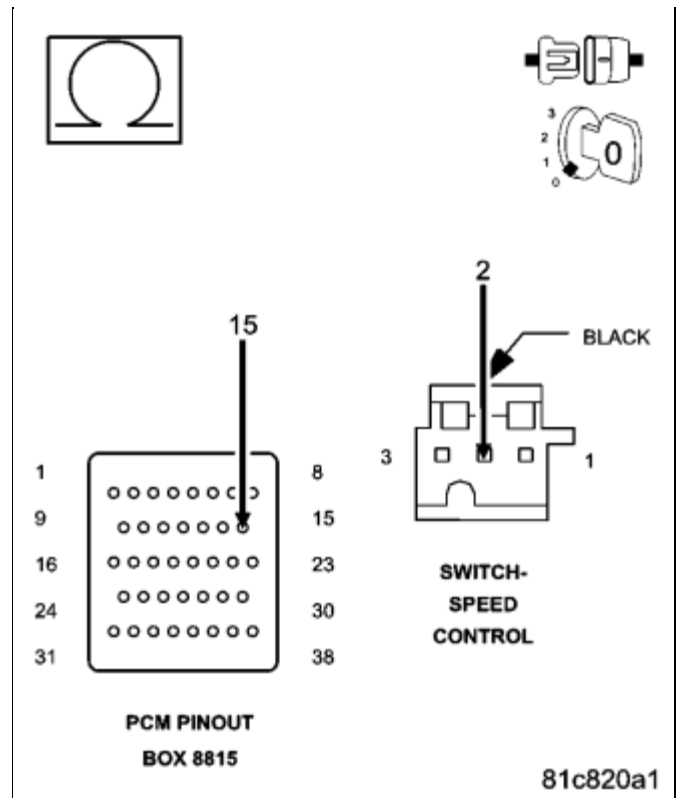
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the open in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit at the appropriate terminal of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts

COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

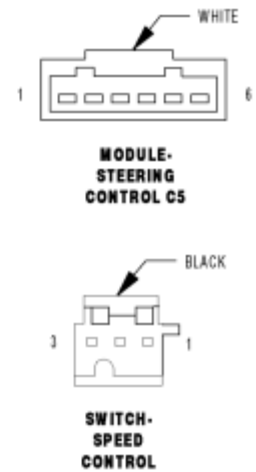
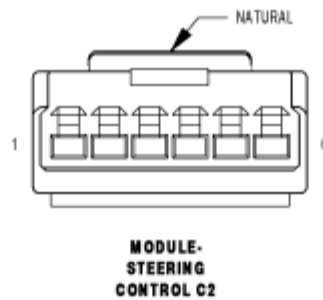
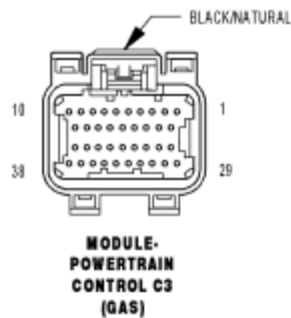
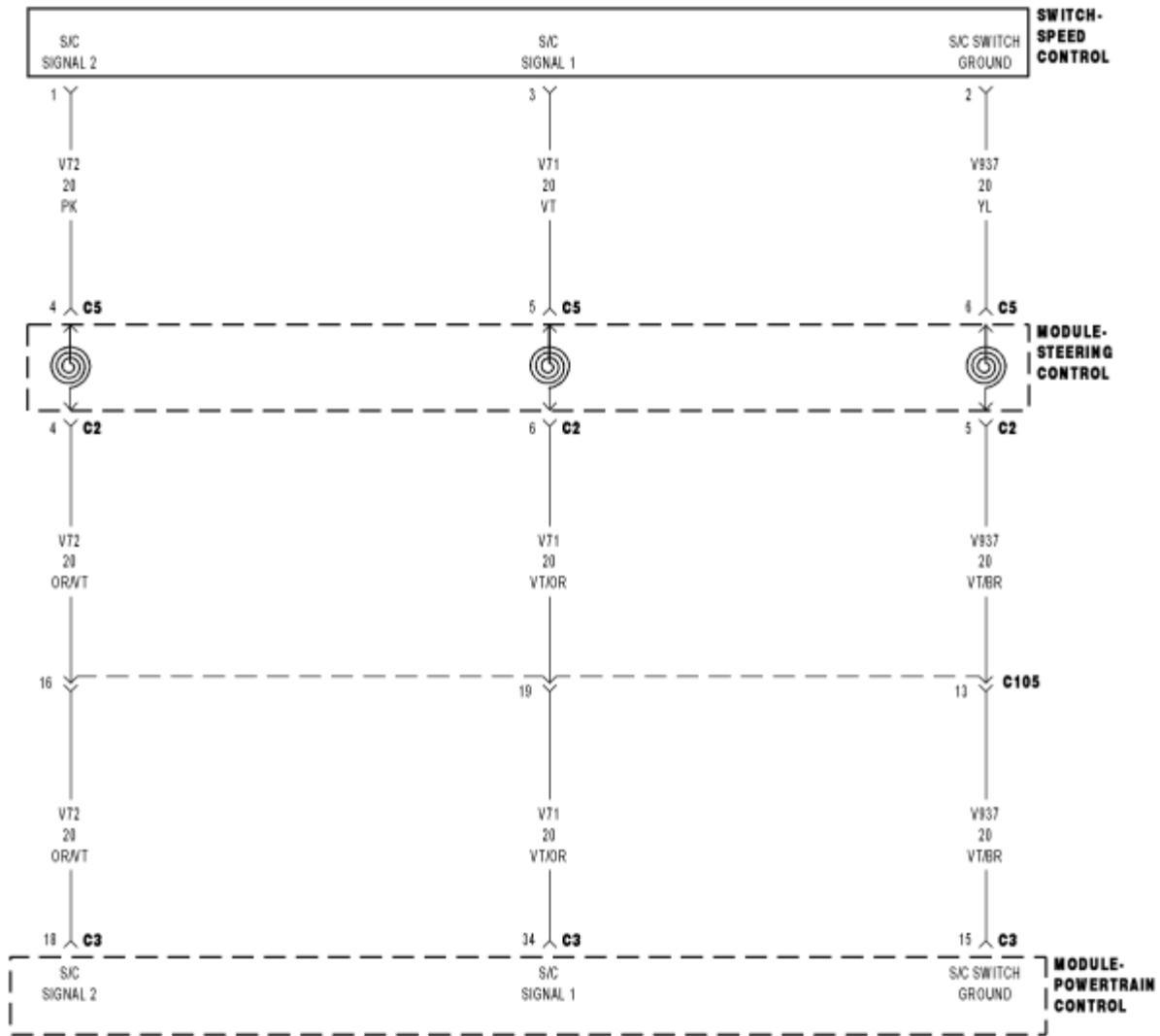
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION



81c801a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

Cruise Switch inputs are not coherent with each other. Example: PCM is reading Switch No.1 as Accel and Switch No.2 as Coast at the same time. One trip fault.

Possible Causes
S/C SWITCH SIGNAL CIRCUITS SHORTED TO VOLTAGE
RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUITS
RESISTANCE IN THE (V937) S/C SWITCH GROUND CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V72) S/C SIGNAL 2 CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO GROUND
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: This DTC is a two trip fault. If the scan tool indicates a one trip failure, the possible cause may have been the customer pressing the switch in two positions simultaneously. Test drive the vehicle and activate the Speed Control system. If the DTC matures to an active fault a repair is necessary.

Ask the customer if it is possible that button was held in two positions at the same time before this DTC set. If this is the case, no repair is necessary.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle using the Speed Control to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control Switch harness connector.

Did the voltage change to above 4.8 volts?

Yes

- Replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switch from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V72) S/C Signal 2 and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V71) S/C Signal 1 and (V937) S/C Switch Ground circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms
 Coast - 2.94 kohms
 Cancel - 1.24 kohms
 Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switch have the correct resistance value?

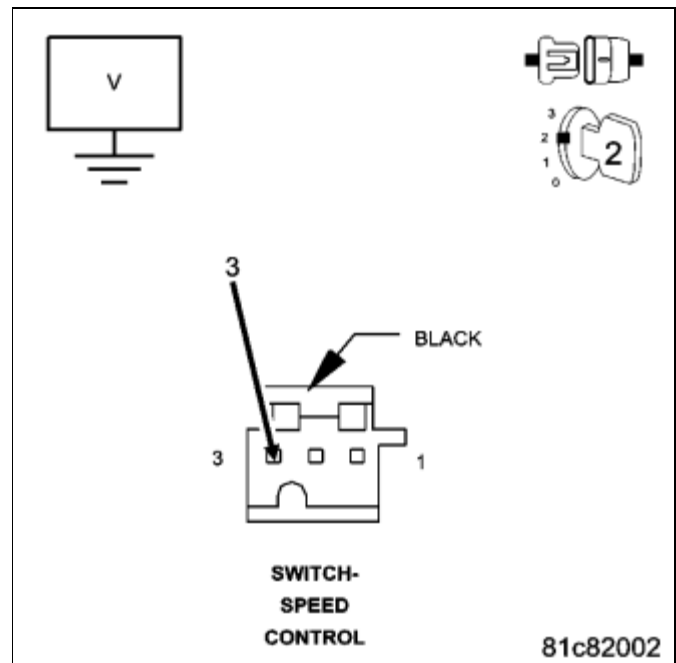
Yes

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE



Disconnect the C3 PCM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (V71) and (V72) S/C Signal circuits at the Speed Control harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (V71) or (V72) S/C

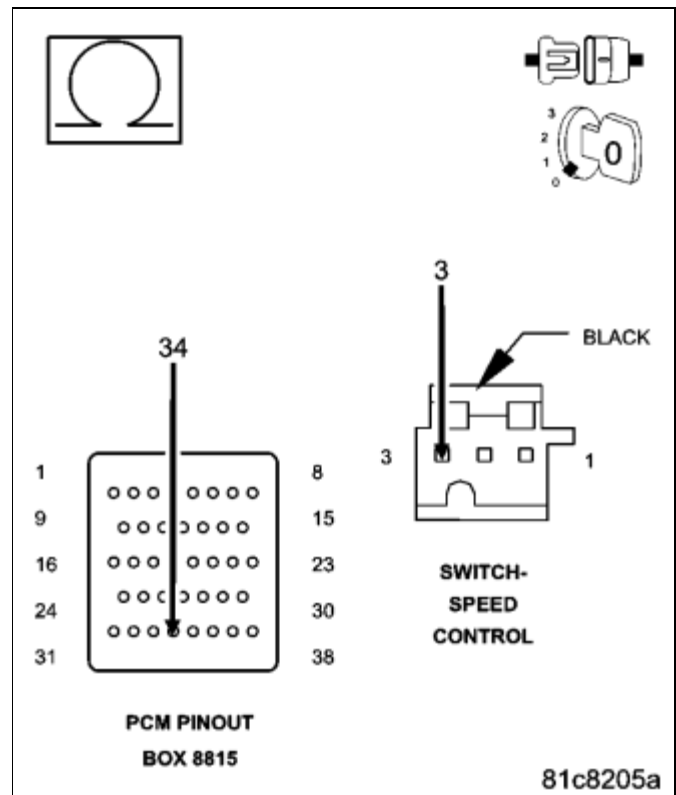
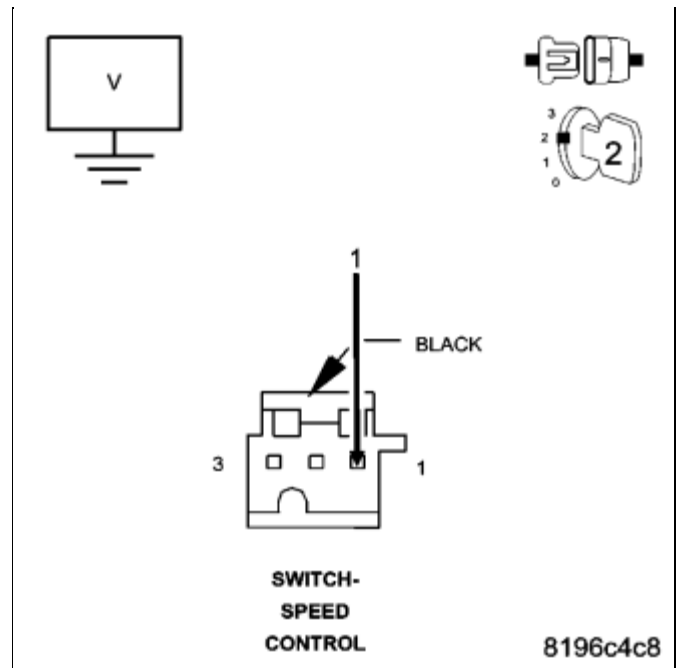
Signal circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. S/C SWITCH SIGNAL CIRCUIT OPEN



CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (V71) and (V72) S/C Signal circuits from both Speed Control harness connector to the appropriate terminals of special tool #8815.

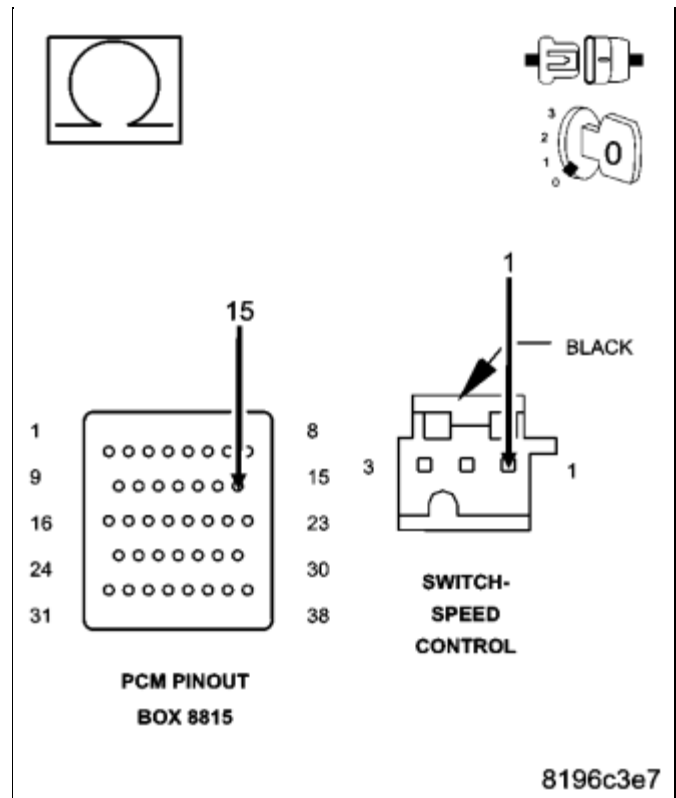
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (V71) or (V72) S/C Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (V937) SWITCH GROUND CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) S/C Switch Ground circuit at the Speed Control harness connector to the appropriate terminal of special tool #8815.

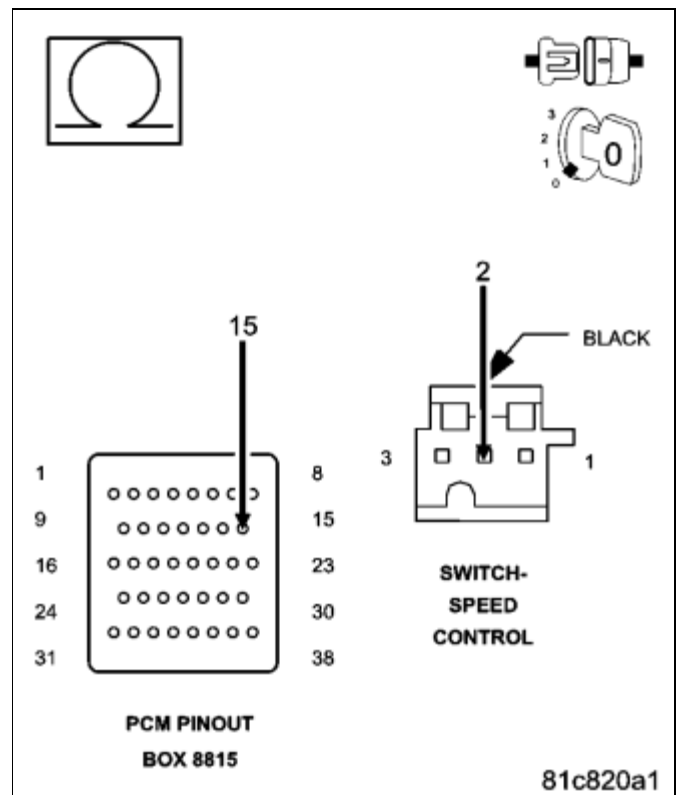
Is the resistance below 5.0 ohms for both measurements?

Yes

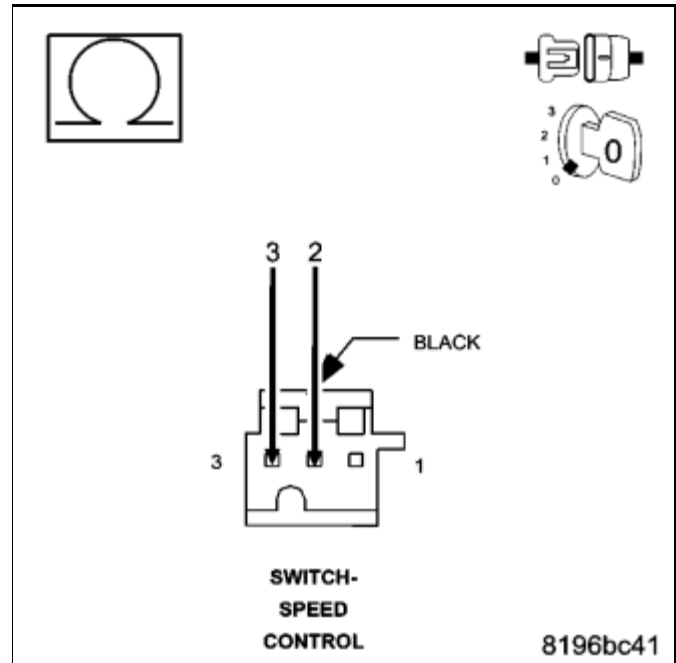
- Go To [7](#)

No

- Repair the excessive resistance in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. S/C SWITCH SIGNAL CIRCUITS SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT



Measure the resistance between the (V937) S/C Switch Ground circuit and both of the (V71) and (V72) S/C Signal circuits in the S/C Switch harness connector.

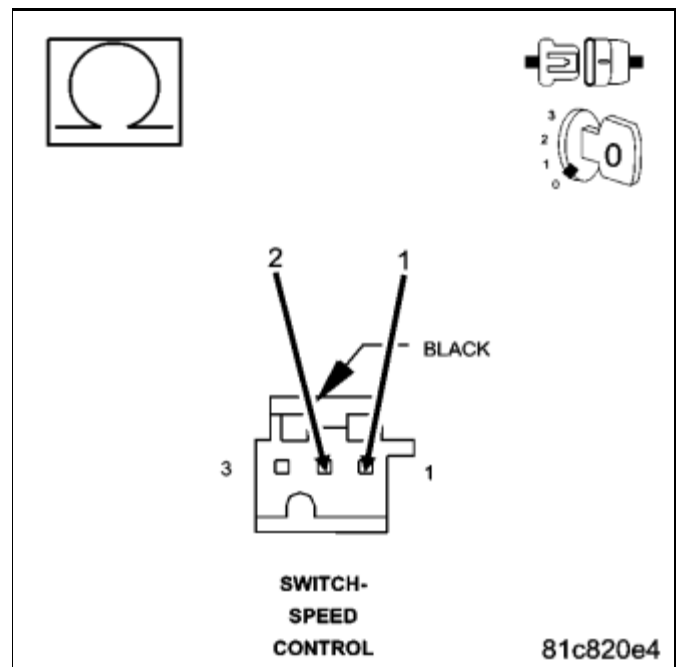
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V937) S/C Switch Ground circuit and the (V71) or (V72) S/C Switch Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V72) S/C SIGNAL 2 CIRCUIT

Measure the resistance between the (V71) S/C Signal 1 circuit and the (V72) S/C Signal 2 circuit at the Speed Control harness connector.

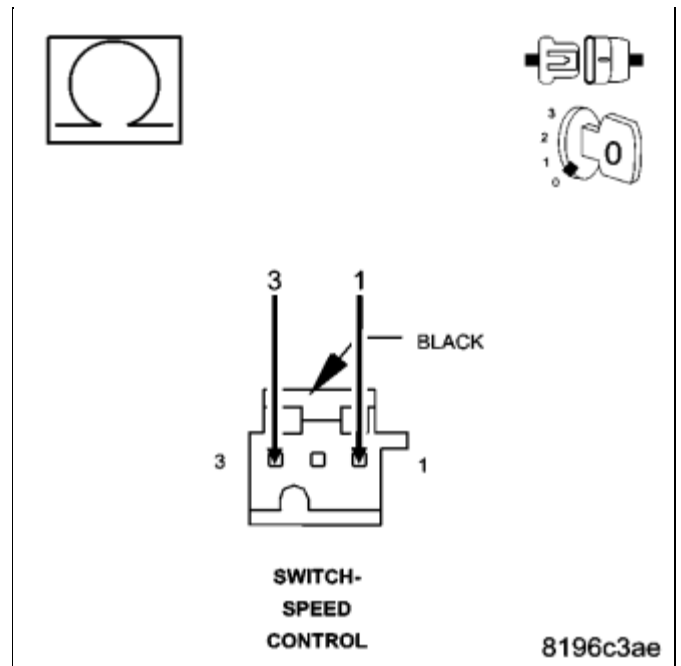
Is the resistance below 100 ohms for each circuit?

Yes

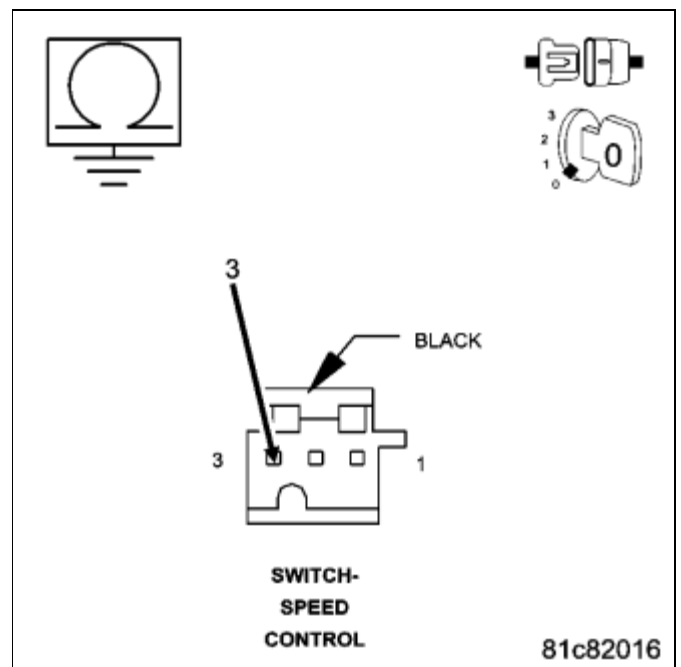
- Repair the short between the (V72) S/C Signal 2 circuit and the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. S/C SWITCH SIGNAL CIRCUITS SHORTED TO GROUND



Measure the resistance between ground and the (V71) and (V72) S/C Switch Signal circuits at both S/C Switch harness connectors.

Is the resistance below 100 ohms?

Yes

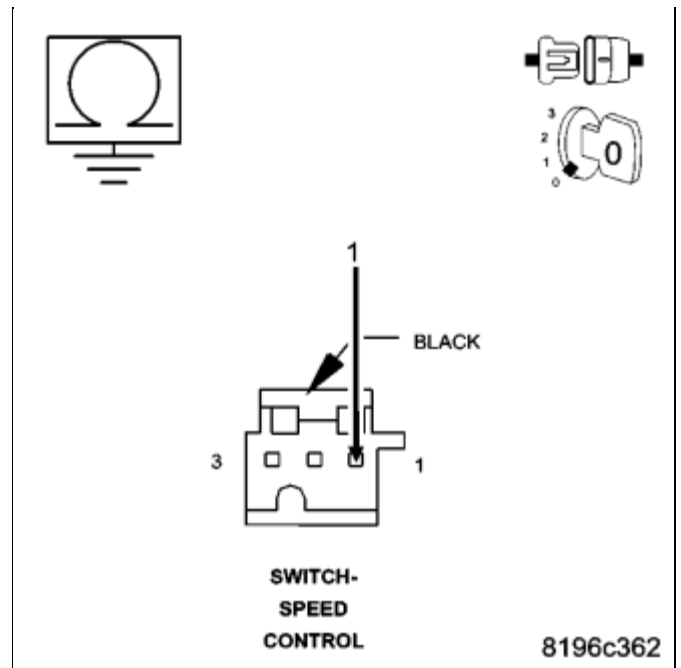
- Repair the short to ground in the (V71) or (V72) S/C

Signal circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit and the (V38) S/C Signal 2 circuit at the appropriate terminals of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)

11. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

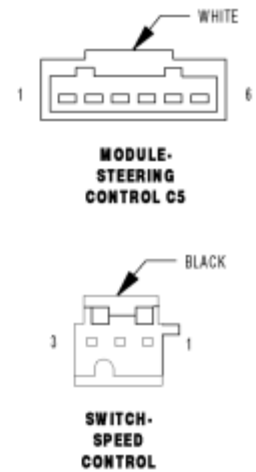
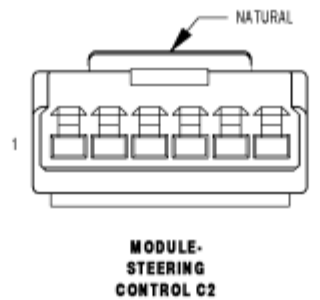
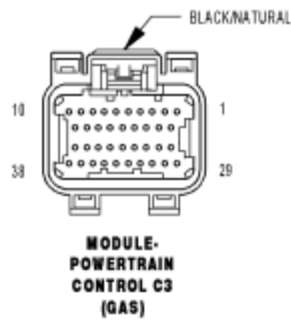
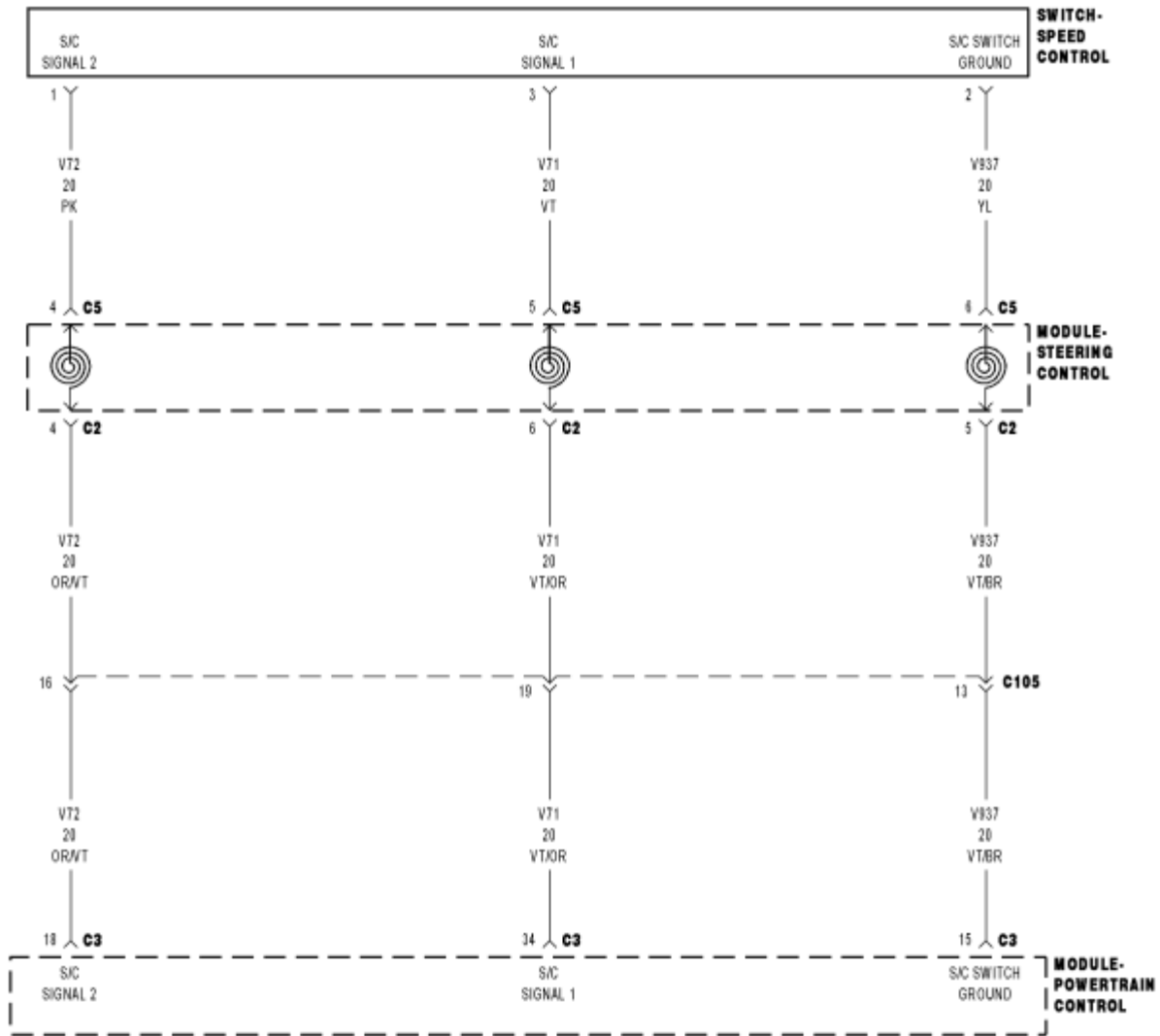
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0591-SPEED CONTROL SWITCH 2 PERFORMANCE



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

◦ **Set Condition:**

Cruise switch voltage output is not out of range but it does not equal any of the values for any of the button positions. One trip fault.

Possible Causes
(V72) S/C SIGNAL 2 CIRCUIT OPEN
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(V937) S/C SWITCH GROUND CIRCUIT OPEN
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO GROUND
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle and operate the speed control in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove the Speed Control Switch from the steering wheel.

Measure the resistance across the Speed Control Switch.

Monitor the ohmmeter while pressing each function button on the switch.

The following resistance specs are taken between terminals (V72) S/C Signal 2 circuit and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V71) S/C Signal 1 and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switch have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch that had the incorrect resistance value.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.
Measure the voltage on the (V72) S/C Signal 2 circuit in the Switch harness connector.

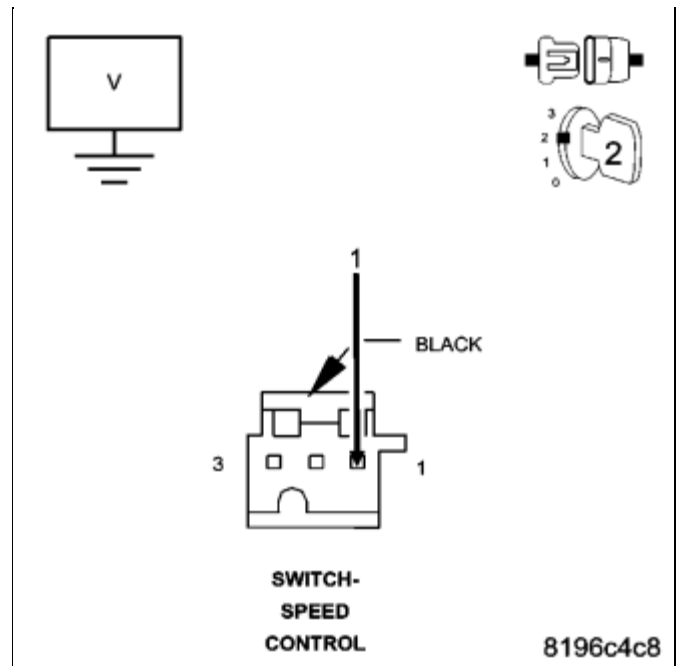
Is there any voltage present?

Yes

- Repair the short to voltage in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (V72) S/C SIGNAL 2 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.
Measure the resistance of the (V72) S/C Signal 2 circuit from the Switch harness connector to the appropriate terminal of special tool #8815.

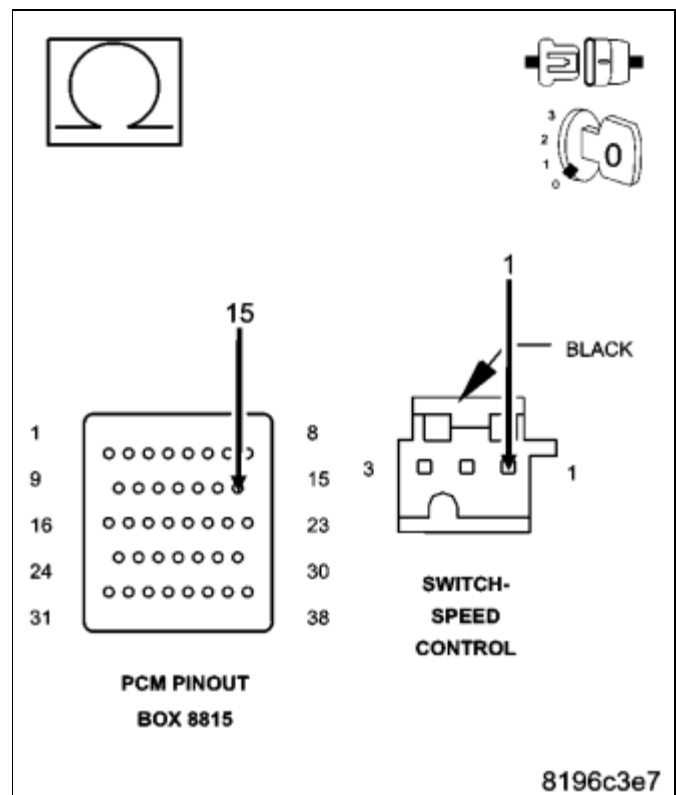
Is the resistance below 5.0 ohms for both measurements?

Yes

- Go To [5](#)

No

- Repair the open in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (V937) S/C SWITCH GROUND OPEN

Measure the resistance of the (V937) S/C Switch Ground circuit from the Switch harness connector to the appropriate terminal of special tool #8815.

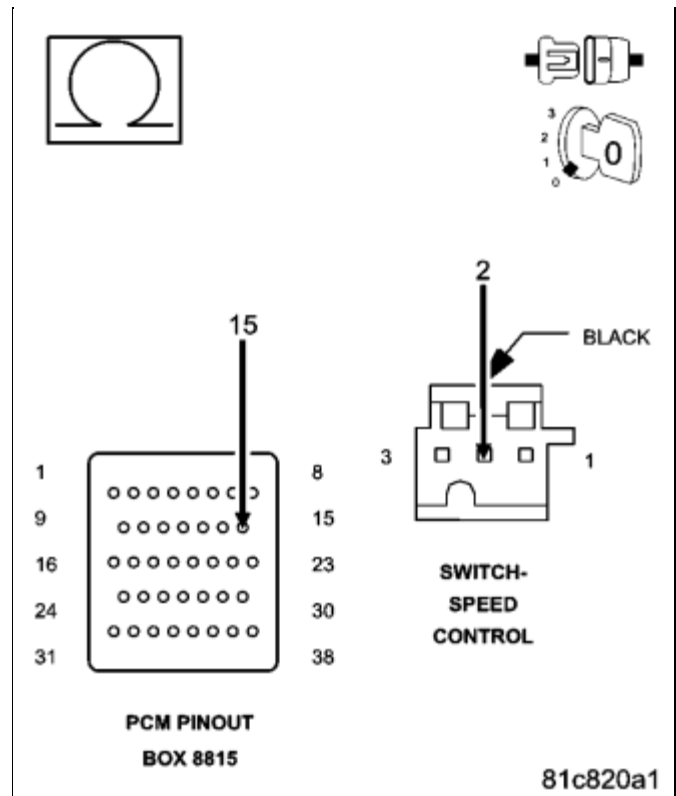
Is the resistance below 5.0 ohms for both measurement?

Yes

- Go To [6](#)

No

- Repair the open in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V72) S/C Signal 2 circuit in the Switch harness connector.

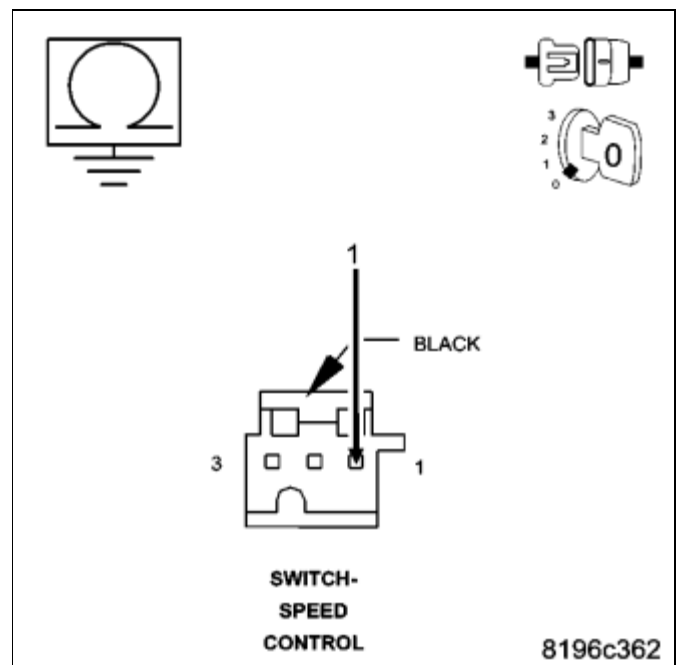
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Measure the resistance between the (V72) S/C Signal 2 circuit and the (V937) S/C Switch Ground circuit in the Switch harness connector.

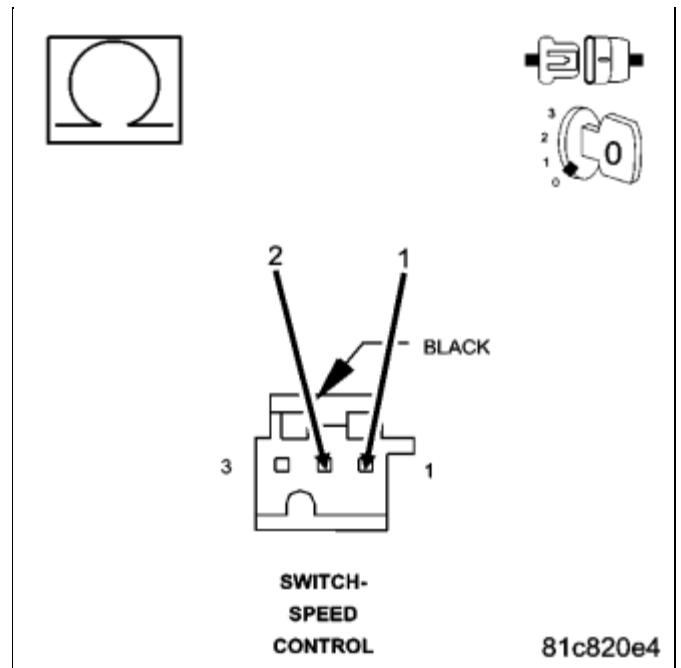
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V72) S/C Signal 2 circuit and the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit and the (V38) S/C Signal 2 circuit at the appropriate terminals of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. Replace the Speed Control Switch if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

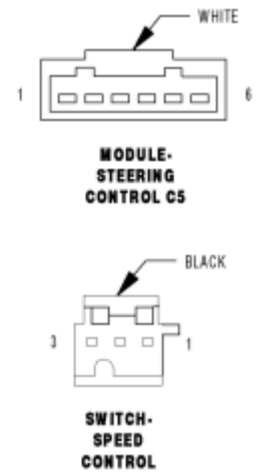
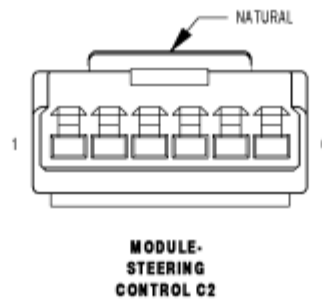
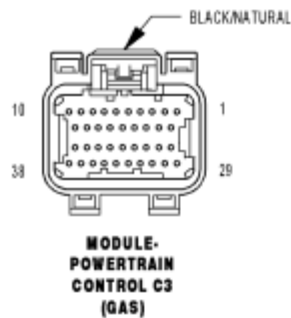
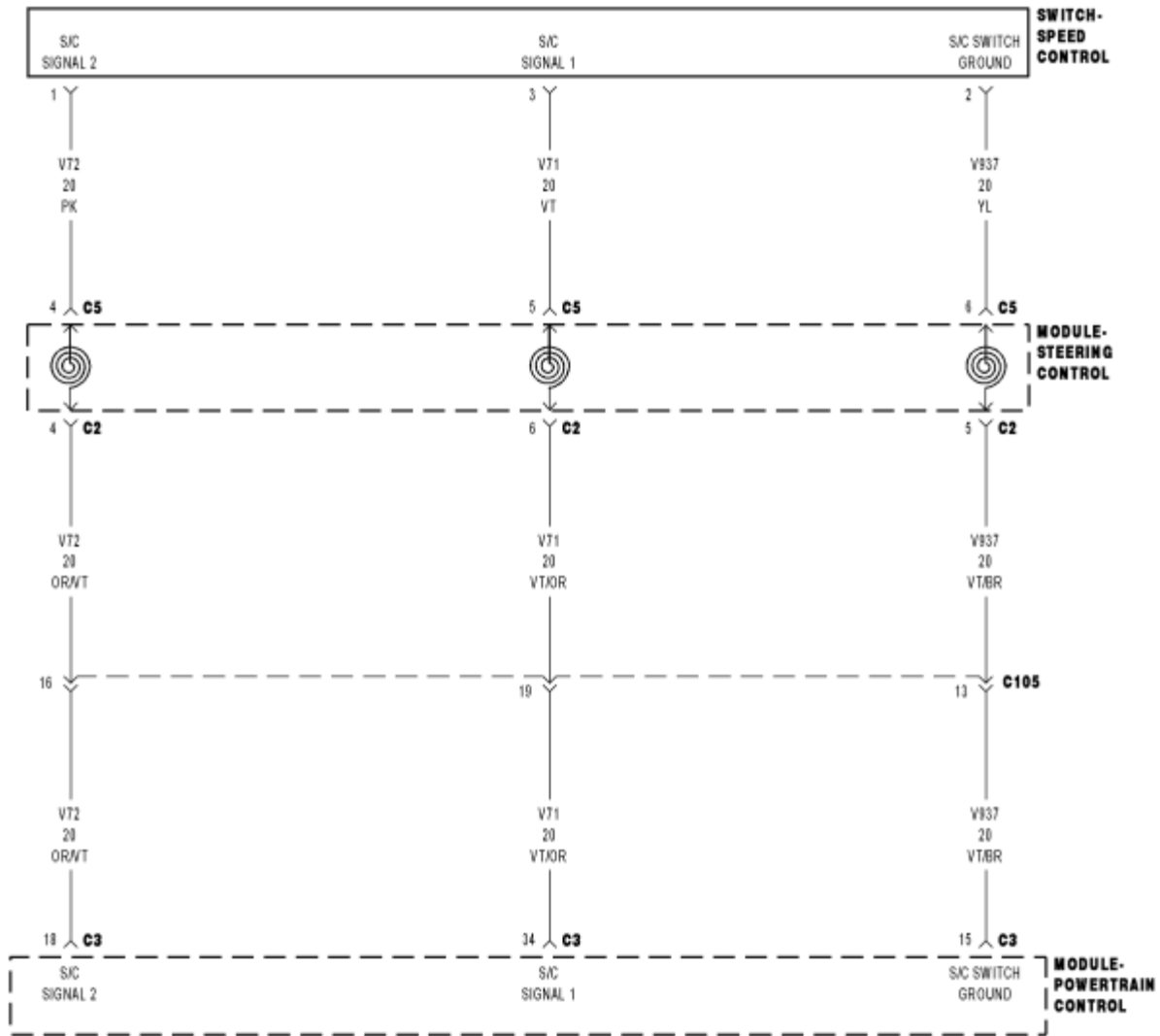
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

- **Set Condition:**

Speed control switch input No.2 is below the minimum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO GROUND
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
EXCESSIVE RESISTANCE IN THE (V72) S/C SIGNAL 2 CIRCUIT
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle and operate the speed control in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control Switch harness connector.

Did the voltage change to above 4.7 volts?

Yes

- Replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C3 PCM harness connector.
Measure the resistance between ground and the (V72) S/C Signal 2 circuit in the Switch harness connector.

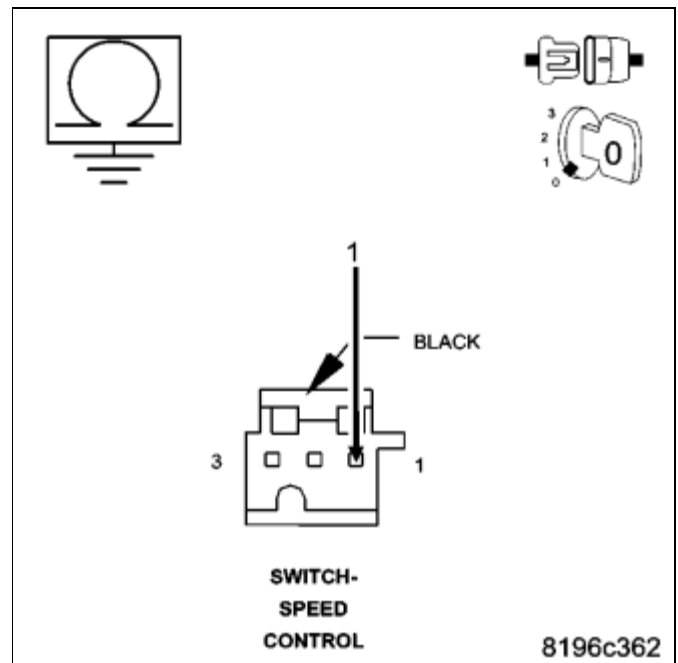
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Measure the resistance between the (V72) S/C Signal 2 circuit and the (V937) S/C Switch Ground circuit in the Switch harness connector.

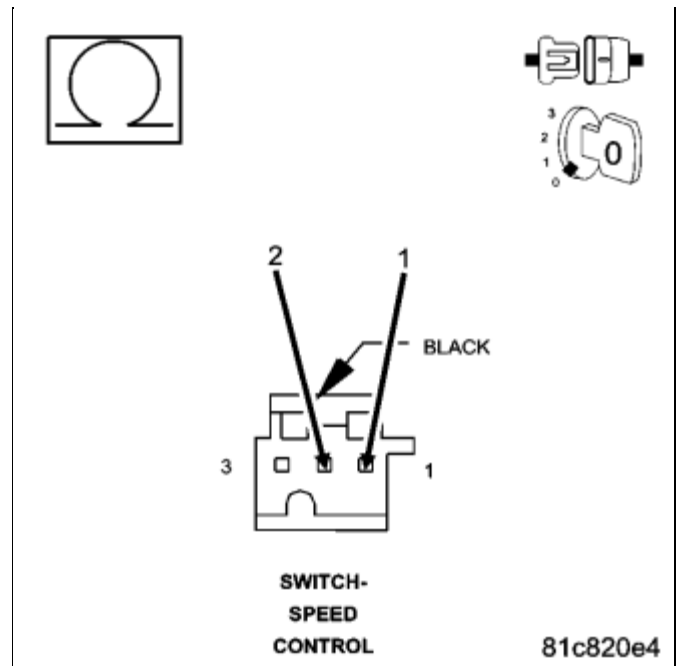
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V72) S/C Signal 2 circuit and the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. EXCESSIVE RESISTANCE IN THE (V72) S/C SIGNAL 2 CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V72) S/C Signal 2 circuit from the Speed Control Switch to the appropriate terminal of special tool #8815.

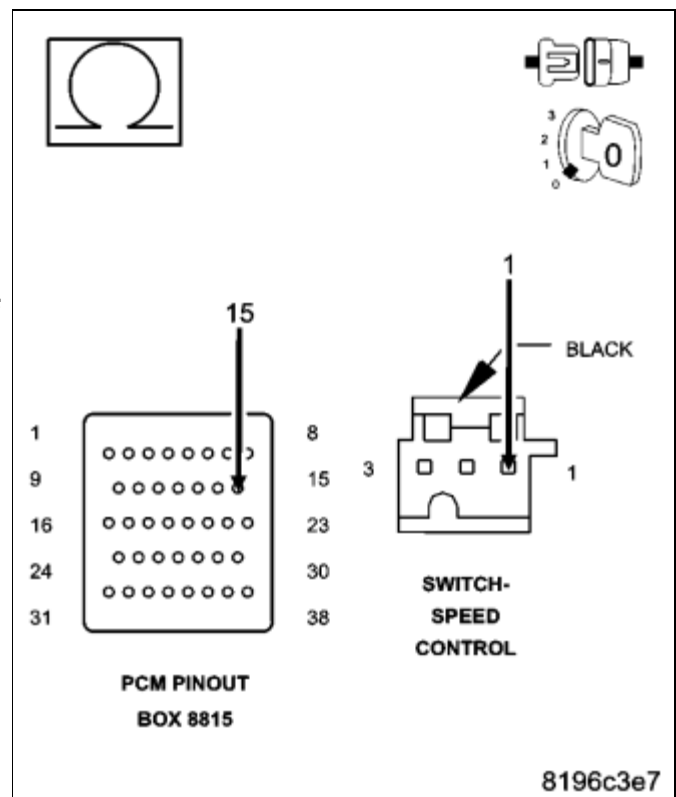
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V38) S/C Signal 2 circuit at the appropriate terminals of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes

- Verify that there is good pin to terminal contact in the Switches and Powertrain Control Module connectors. Replace the Speed Control Switch if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

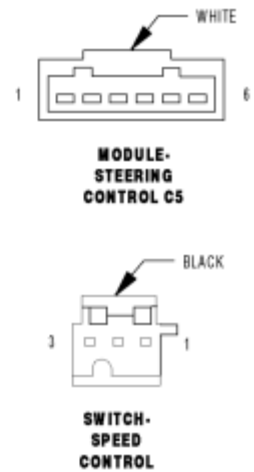
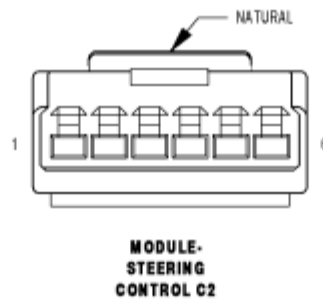
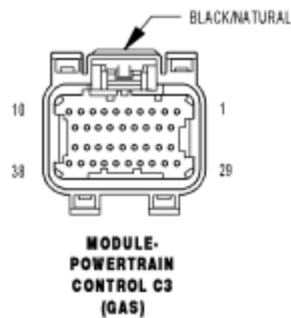
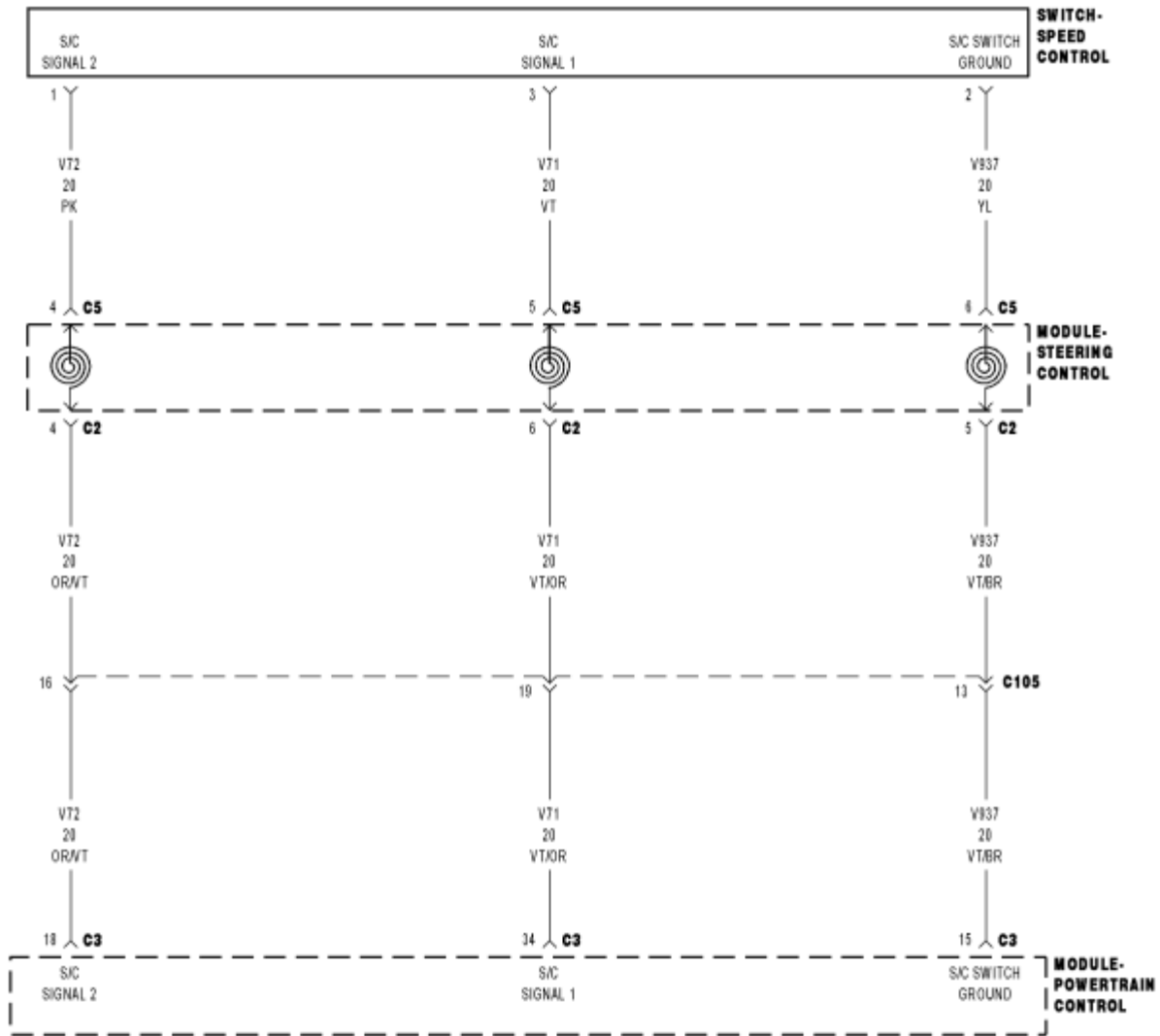
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition key on.

- **Set Condition:**

Speed control switch input above the maximum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V72) S/C SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(V72) S/C SIGNAL 2 CIRCUIT OPEN
(V937) S/C SWITCH GROUND CIRCUIT OPEN
SCCM
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle and operate the speed control in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V72) S/C Switch No.1 Signal and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch that had the incorrect resistance value.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V72) S/C Signal 2 circuit in the S/C Switch harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (V72) S/C SIGNAL 2 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (V72) S/C Signal 2 circuit from the Speed Control Switch to the appropriate terminal of special tool #8815.

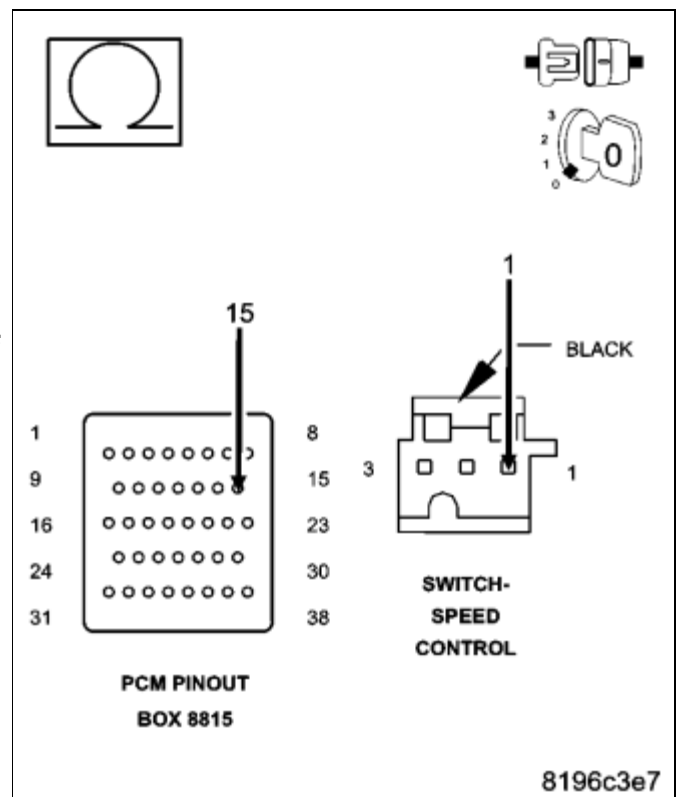
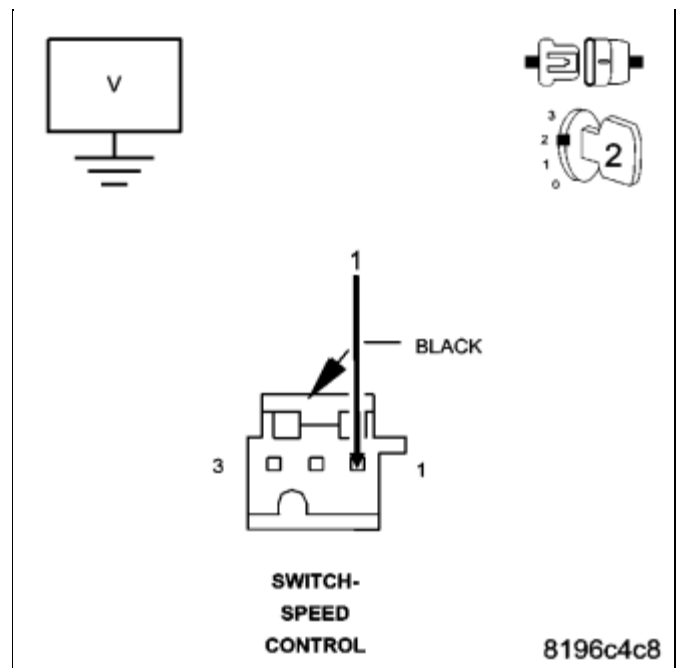
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [5](#)

No

- Repair the open in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (V937) S/C SWITCH GROUND CIRCUIT OPEN

Measure the resistance of the (V937) S/C Switch Ground circuit from the S/C Switch harness connector to the appropriate terminals of special tool #8815.

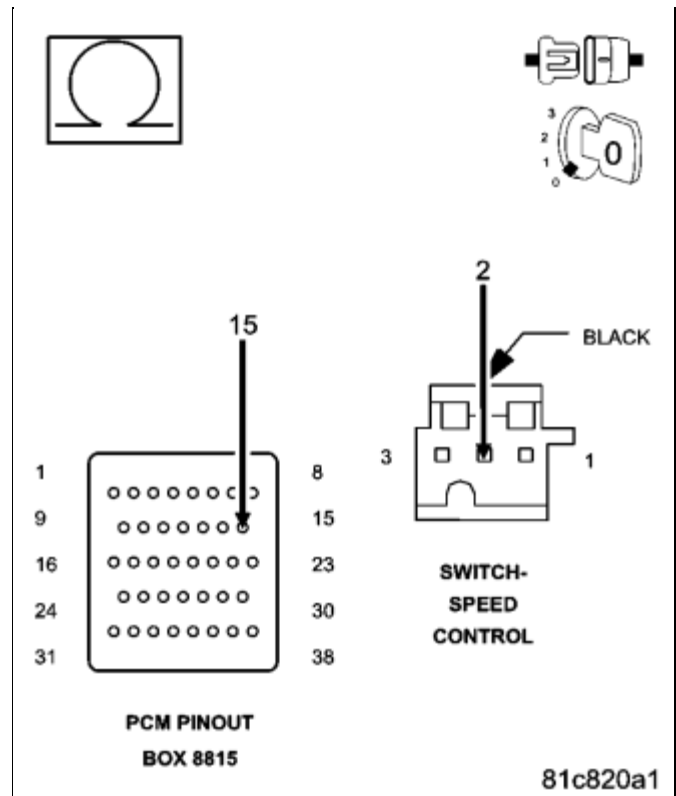
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the open in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Using a voltmeter check the voltage on the (V38) S/C Signal 2 circuit at the appropriate terminal of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts

COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes

- Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors. If OK, replace the Speed Control Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0600-SERIAL COMMUNICATION LINK

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

Internal Bus communication failure between processors. One Trip Fault. Three Global Good Trips to Clear.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. POWERTRAIN CONTROL MODULE (PCM)

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0601-INTERNAL MEMORY CHECKSUM INVALID

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

Internal checksum for software failed, does not match calculated value. One Trip Fault, Three Good Trips to clear.

Possible Causes

POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. POWERTRAIN CONTROL MODULE (PCM)

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0600-SERIAL COMMUNICATION LINK

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The Powertrain Control Module (PCM) detects an internal error.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) SOFTWARE UPDATE
EXCESSIVE RESISTANCE IN THE PCM POWER OR GROUND CIRCUITS
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose and repair any other DTCs set in the PCM before proceeding with this test.

Turn the ignition on.

With the scan tool, Clear DTCs in the Powertrain Control Module (PCM).

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING THE PCM POWER AND GROUND CIRCUITS

Perform the diagnostic procedure for *CHECKING THE PCM POWER AND GROUND CIRCUITS.

Were any problems found?

Yes

- Repair the PCM power and ground circuit(s) as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the applicable component and the Powertrain Control Module (PCM).
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0606-INTERNAL ECM PROCESSOR

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Engine running.

- **Set Condition:**

When the PCM recognizes an internal failure to communicate with the ECM or the CMP and CKP Sensor count periods are too short. One trip fault. ETC light is flashing.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. POWERTRAIN CONTROL MODULE (PCM)

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P060B-ETC A/D GROUND PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

When the Throttle Motor is powered.

◦ Set Condition:

When A2D reading does not return to ground within a set period of time of test activation, this fault sets. The test typically runs a couple of times per second, and is the reason why APP2 signal spikes to ground a couple of times per second in normal running. Reprogramming the module may not always fix this fault. One trip fault. ETC lamp is illuminated.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

NOTE: Diagnose any other DTCs that may have set with the P060B.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, select View DTCs.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P060D-ETC LEVEL 2 APP PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Throttle motor is powered and no matured faults related to APP Sensors.

- **Set Condition:**

When secondary software determines that APPS 1 and APPS 2 signals do not match for a period of time.
One trip fault. ETC lamp will flash

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060D.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P060E-ETC LEVEL 2 TPS PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Throttle motor is powered and no matured faults related to TP Sensors.

◦ **Set Condition:**

When secondary software determines that TPS 1 and TPS 2 signals do not match for a period of time. One trip fault. ETC lamp will flash.

Possible Causes

PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060E.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P060F-ETC LEVEL 2 ECT PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

Throttle motor is powered and no matured faults related to the Engine Coolant Temp Sensor.

- **Set Condition:**

When secondary software determines that the Coolant Temperature is implausible for a period of time. One trip fault. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Diagnose any Engine Coolant Temperature Sensor DTCs before continuing.

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060F.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P061A-ETC LEVEL 2 TORQUE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Throttle motor is powered.

- **Set Condition:**

When secondary software determines that the customer requested output is not being achieved by the engine for a period of time. One trip fault. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Check the engine for air/vacuum leaks and diagnose any Fuel System Lean/Rich as well as MAP Sensor DTCs before continuing.

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.
Start the engine.

Allow the engine to reach normal operating temperature.
 Operate the accelerator pedal. (do not exceed 3500 rpm)
 With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P061A.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P061C-ETC LEVEL 2 RPM PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Throttle motor is powered and no camshaft or crankshaft electrical signal related DTCs are set.

◦ **Set Condition:**

When secondary software determines that the engine speed is implausible for a period of time. One trip fault. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Diagnose any Camshaft Position and Crankshaft Position Sensor DTCs before continuing.

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P061C.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P0622-GENERATOR FIELD CONTROL CIRCUIT

With the ignition on. Engine running.

◦ **Set Condition:**

When the PCM tries to regulate the generator field with no result during monitoring. One Trip Fault.
Three good trips to turn off the MIL.

Possible Causes
(K125) GEN FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE
(K125) GEN FIELD CONTROL CIRCUIT OPEN
(K125) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Increase engine speed by pressing the accelerator pedal. Do not exceed 3500 rpm.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

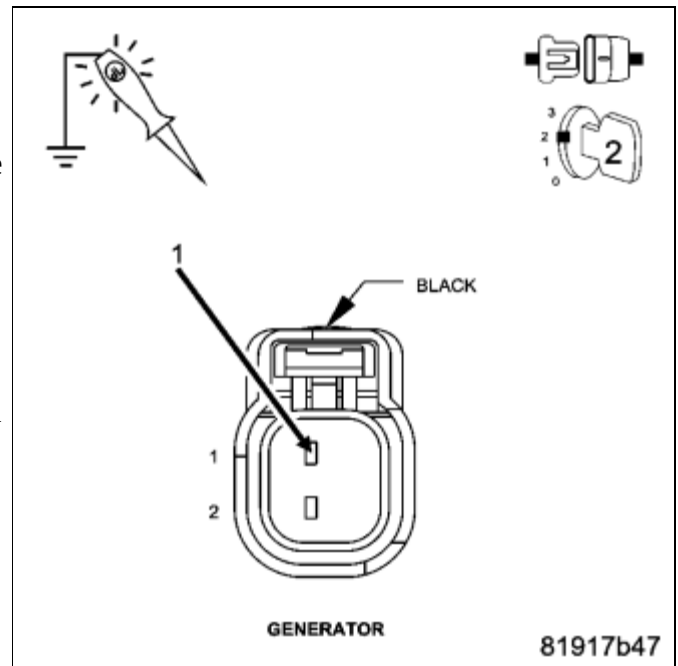
2. GENERATOR OPERATION

Turn the ignition off.
Disconnect the Generator Field harness connector.

NOTE: The DTC needs to be cleared before actuating the Generator Field, if the DTC is not cleared, the Generator Field may not be allowed to actuate.

Ignition on, engine not running.
Using a 12-volt test light connected to ground, probe the (K125) Generator Field Control circuit in the Generator Field harness connector.
With a scan tool, actuate the Generator Field Driver.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors. Replace the Generator if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K125) GEN FIELD CIRCUIT SHORTED VOLTAGE

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Ignition on, engine not running.
Measure the voltage on the (K125) Gen Field Control circuit

in the Generator Field harness connector.

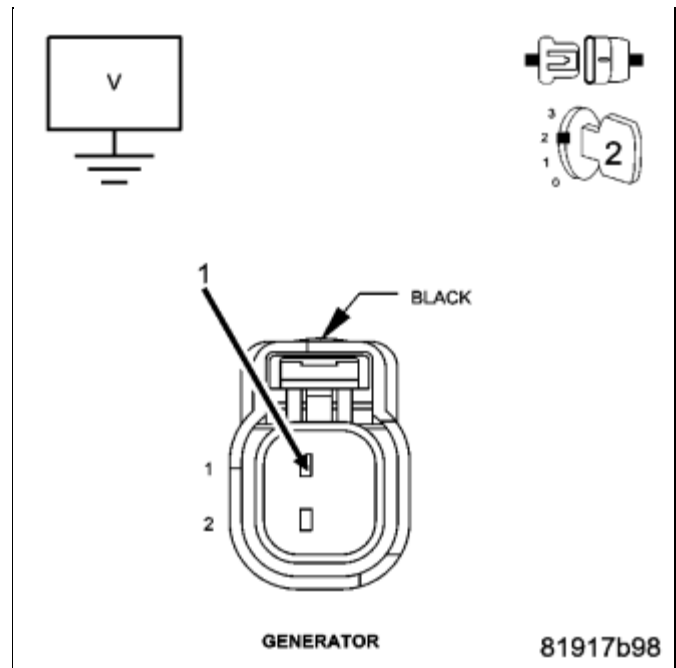
Is there any voltage present?

Yes

- Repair the short to voltage in the (K125) Gen Field Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (K125) GEN FIELD CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K125) Gen Field Control circuit from the Generator Field harness connector to appropriate terminal of the special tool #8815.

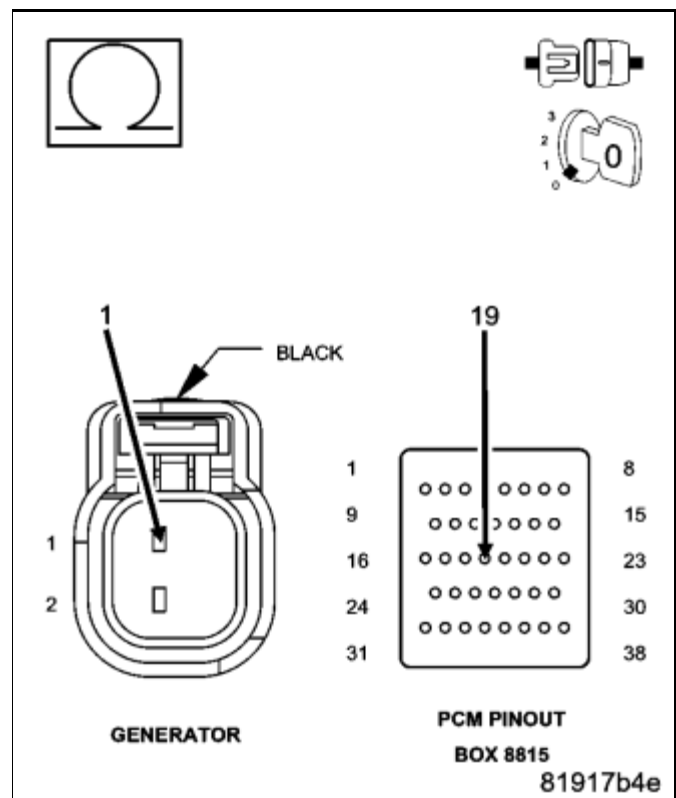
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K125) Gen Field Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (K125) GEN FIELD CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K125) Gen Field Control circuit in the Generator Field harness connector.

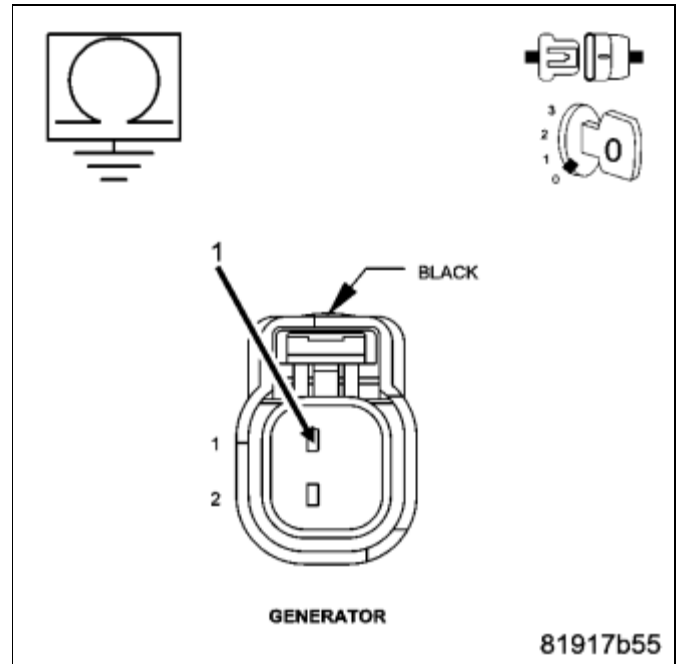
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K125) Gen Field Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

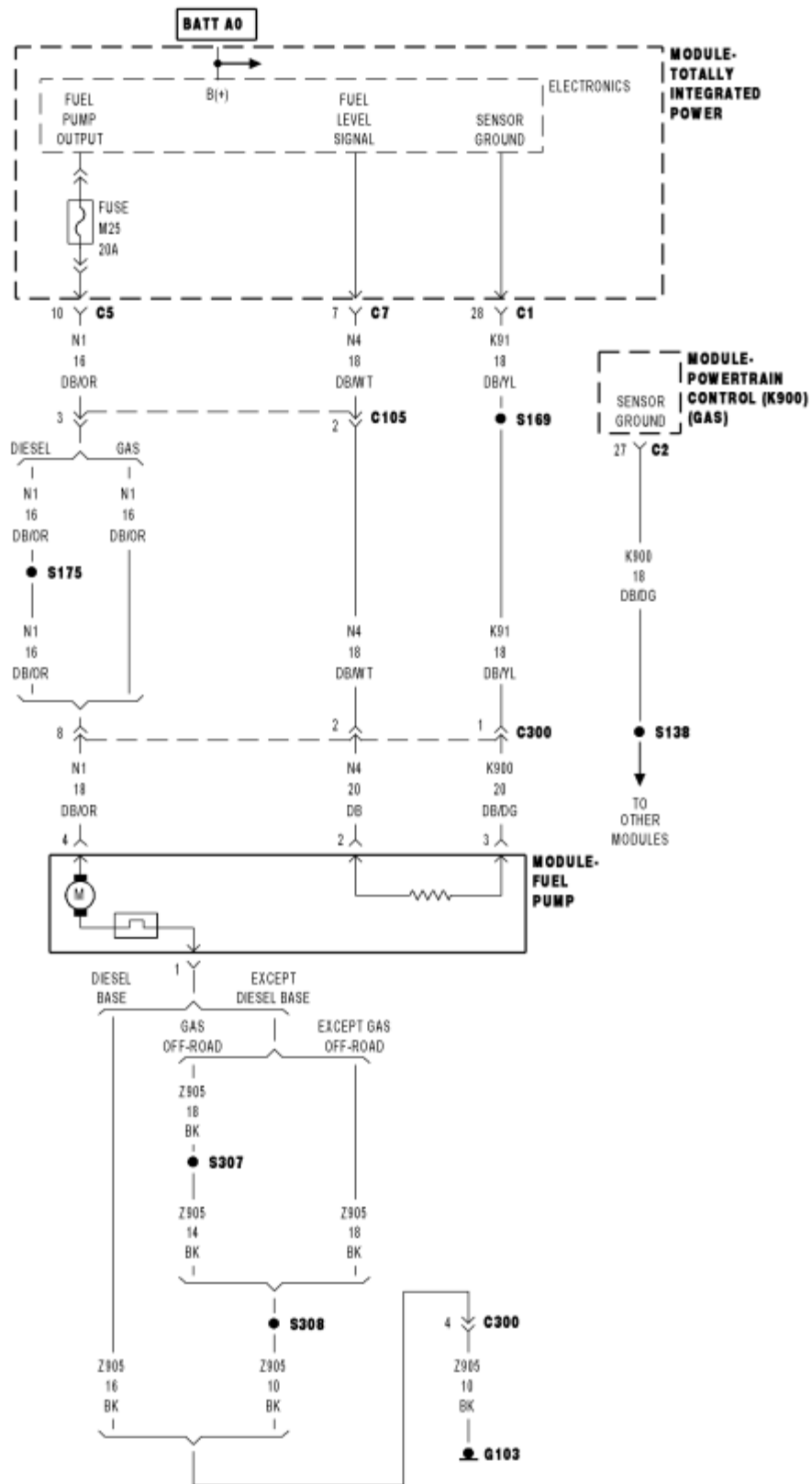
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0627-FUEL PUMP CONTROL CIRCUIT



01017141

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts and the ASD sense switch is on.

◦ **Set Condition:**

Actual Fuel Pump state is not equal to desired state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO VOLTAGE
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND
(K31) FUEL PUMP CONTROL CIRCUIT OPEN
(N1) FUSED FUEL PUMP OUTPUT OPEN
(N1) FUSED FUEL PUMP OUTPUT SHORTED TO GROUND
FUEL PUMP MODULE
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

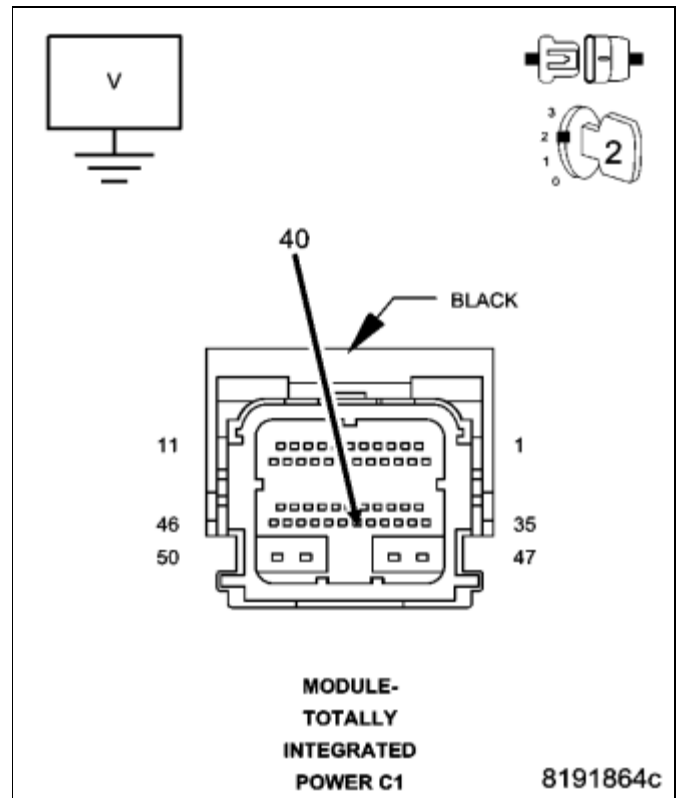
2. FUEL PUMP CONTROL OPERATION FROM THE PCM

Stop the Fuel Pump actuation.
Turn the ignition off.
Disconnect the C1 TIPM harness connector.

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Ignition on, engine not running.
Using a 12-volt test light connected to B+ probe the (K31 Fuel Pump Control circuit in the C1 TIPM harness connector.
Using a scan tool actuate the Fuel Pump under the PCM actuations.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Does the test light illuminate accordingly during the actuation?

Yes

- Go To [5](#)

No

- Go To [3](#)

3. (K31) FUEL PUMP CONTROL CIRCUIT OPEN

Turn the ignition off.
Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the

PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K31) Fuel Pump Control circuit from the C1 TIPM harness connector to the appropriate terminal of special tool #8815.

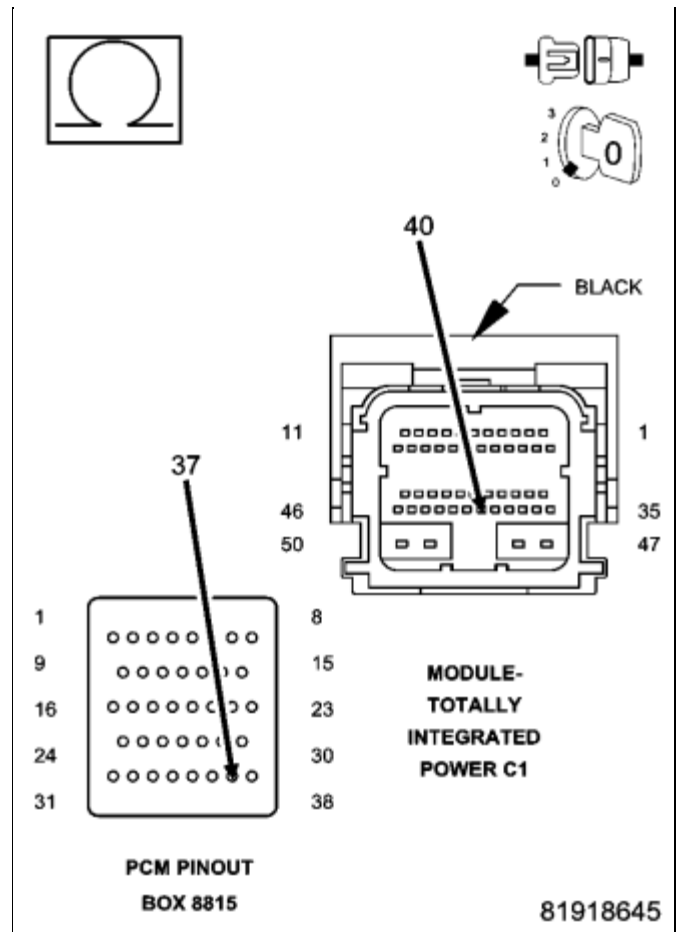
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K31) Fuel Pump Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Control circuit in the TIPM C1 harness connector.

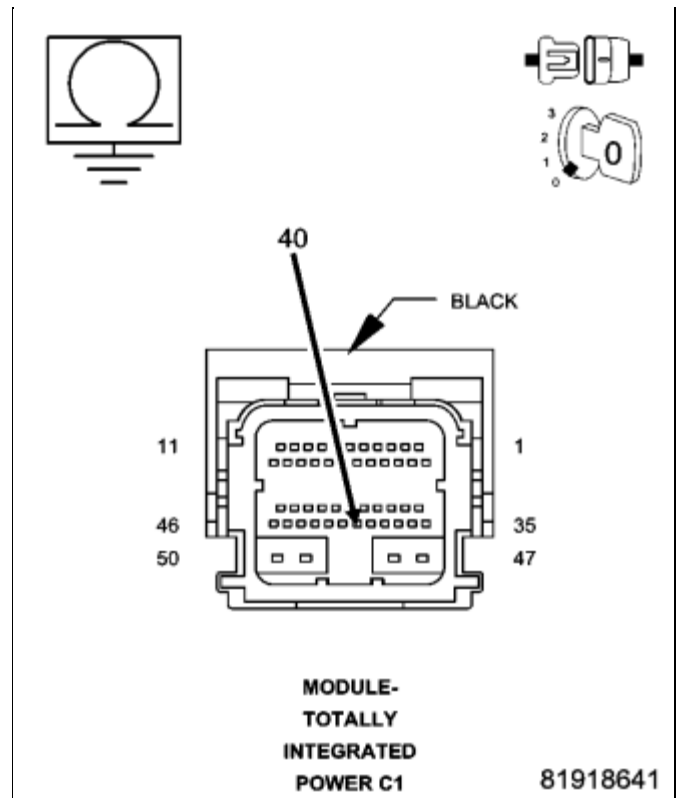
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K31) Fuel Pump Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



5. (N1) FUEL PUMP OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the C5 TIPM harness connector.

Disconnect the Fuel Pump Module harness connector.

Measure the resistance of the (N1) Fused Fuel Pump Output circuit from the C5 TIPM harness connector and the Fuel Pump Module harness connector.

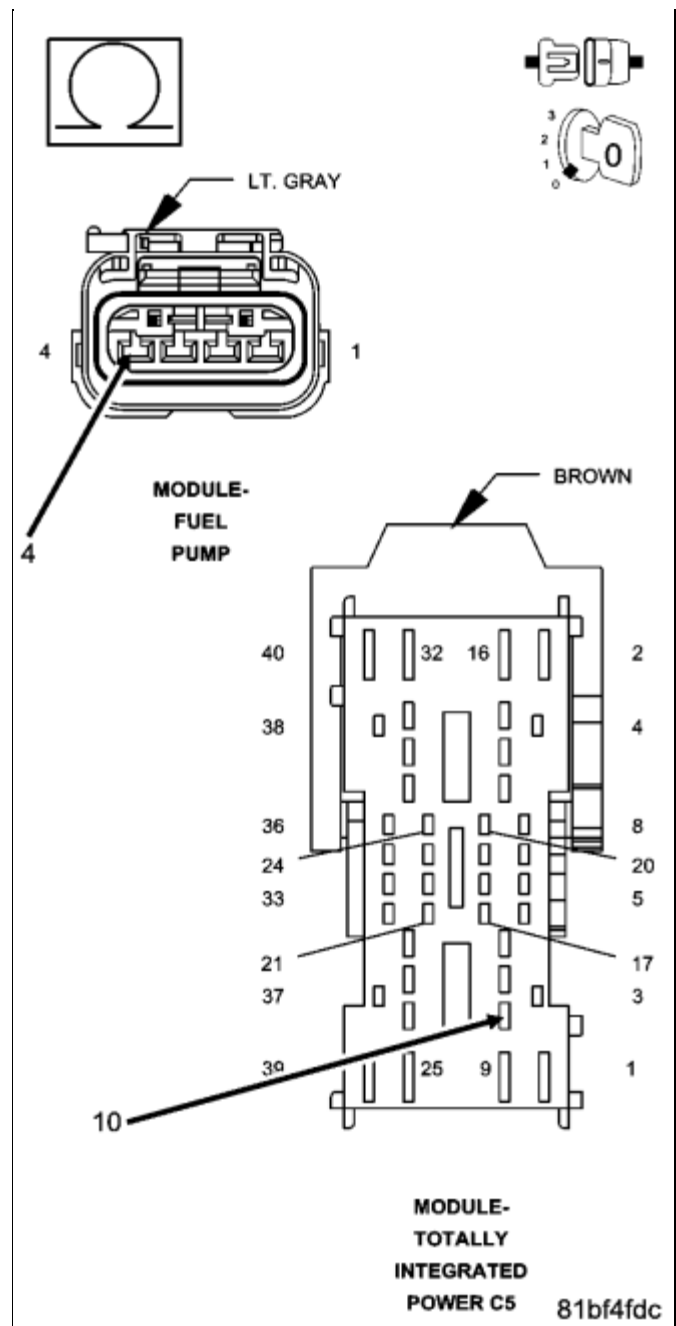
Is the resistance above 5.0 ohms?

Yes

- Repair the open in the (N1) Fused Fuel Pump Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (N1) FUEL PUMP OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N1) Fused Fuel Pump Output circuit at the Fuel Pump Module harness connector.

Is the resistance below 100 ohms?

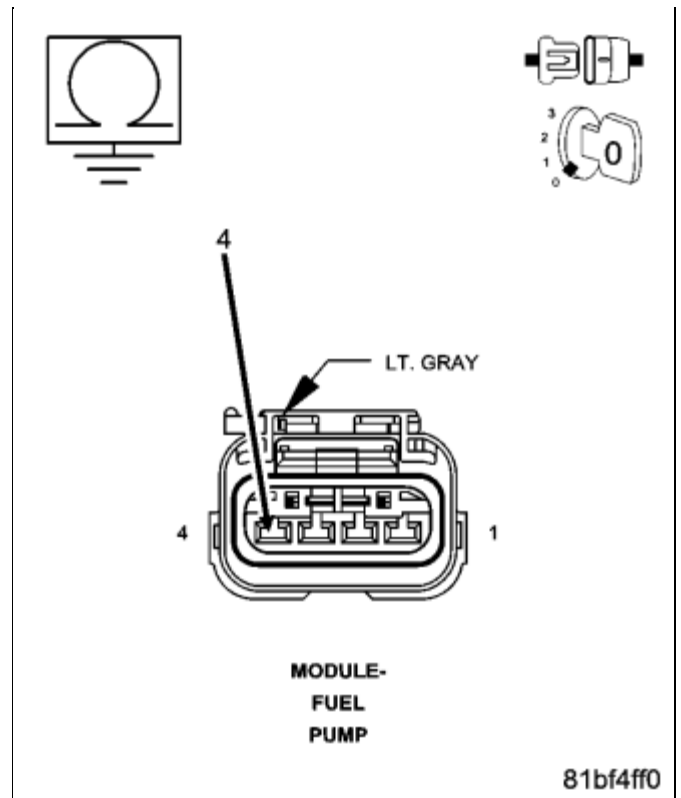
Yes

- Repair the short to ground in the (N1) Fused Fuel Pump Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. FUEL PUMP MODULE/TIPM

Connect the C3 PCM harness connector.
 Connect the C1 and C5 TIPM harness connectors.
 Turn the ignition on.
 Using a 12-volt test light connected to ground, probe the (N1) Fused Fuel Pump Output circuit at the Fuel Pump Module harness connector.
 Using a scan tool actuate the Fuel Pump Module.

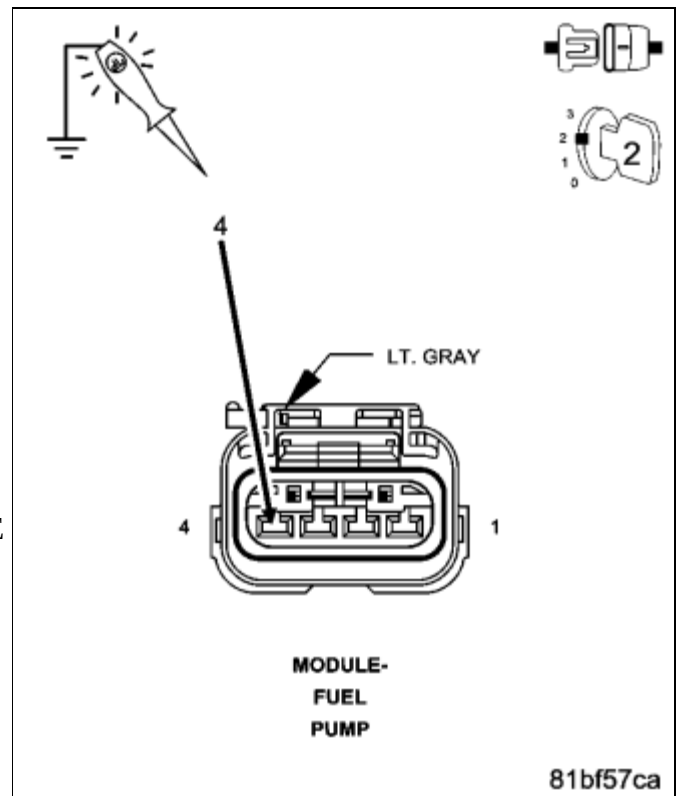
Does the test light illuminate?

Yes

- Replace the Fuel Pump Module in accordance with the Service Information. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP MODULE - REMOVAL.)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module in accordance with the Service Information. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL.)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD



PROCEDURE.)

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pump Module and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Fuel Pump and Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P062C-ETC LEVEL 2 MPH PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Throttle motor is powered and no vehicle speed related DTCs have matured.

◦ **Set Condition:**

When secondary software determines that the vehicle speed is implausible for a period of time. One trip fault. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.
Start the engine.
Allow the engine to reach normal operating temperature.
Operate the accelerator pedal. (do not exceed 3500 rpm)
With a scan tool, select View DTCs.

NOTE: Diagnose any other DTCs that may have set with the P062C.

Does this DTC reset by itself?

Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P0630-VIN NOT PROGRAMMED IN PCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

At initialization.

- **Set Condition:**

The VIN has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING VIN INTO PCM

POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING VIN INTO THE PCM

Ignition on, engine not running.

Using the scan tool, program VIN into the PCM.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Does the DTC reset?

Yes

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- The VIN has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0632-ODOMETER NOT PROGRAMMED IN PCM

For a complete wiring diagram **Refer to Section 8W.**

◦ When Monitored:

Ignition on.

◦ Set Condition:

Odometer is not programed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING MILEAGE INTO THE PCM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING MILEAGE INTO THE PCM

Ignition on, engine not running.
 With the scan tool, erase DTCs.
 Using a scan tool, program the mileage into the PCM.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

Does the DTC reset?

Yes

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- The mileage has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0633-SKIM SECRET KEY NOT STORED IN PCM

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The SKIM Key information has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING SKIM KEY INTO THE PCM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING SKIM KEY INTO THE PCM

Ignition on, engine not running.

With a scan tool, erase DTCs.

Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Does the DTC reset?

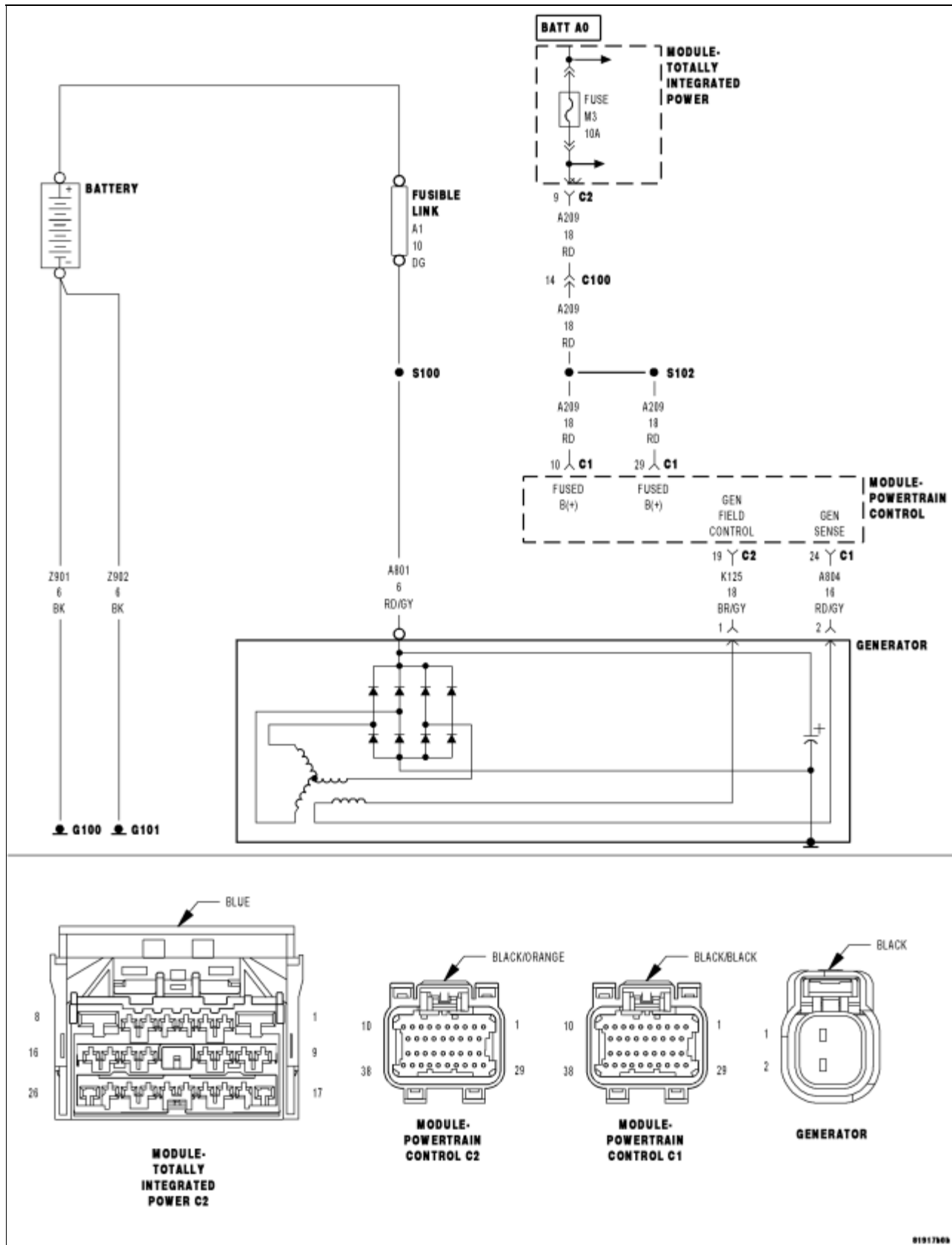
Yes

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- The SKIM KEY information has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P063A-GENERATOR VOLTAGE SENSE CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

The engine running. The engine speed greater than 1157 RPM.

- **Set Condition:**

The PCM recognizes the alternator output voltage is less than the Battery feed circuit voltage. One trip failure. The Generator light will illuminate. The fault will be checked again on the next key cycle.

Possible Causes
EXCESSIVE RESISTANCE IN THE (A804) GENERATOR SENSE CIRCUIT
(A804) GENERATOR SENSE CIRCUIT SHORTED TO GROUND
GENERATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

NOTE: The battery must be fully charged.

NOTE: The Generator belt tension and condition must be checked before continuing.

Ignition on, engine not running.

With a scan tool, select View DTCs.

Start the engine.

Allow the idle to stabilize.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. EXCESSIVE RESISTANCE IN THE (A804) GENERATOR SENSE CIRCUIT

Turn the ignition off.
Disconnect the Generator harness connector.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (A804) Generator Sense circuit from the Generator harness connector to the appropriate terminal of special tool #8815.

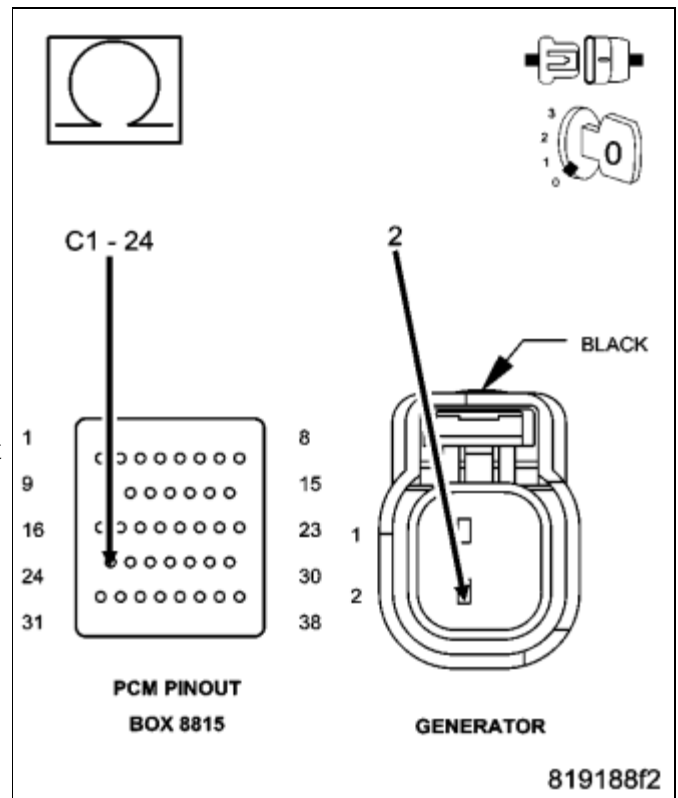
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (A804) Generator Sense circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. (A804) GENERATOR SENSE CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A804) Generator Sense circuit at the Generator harness connector.

Is the resistance below 100 ohms?

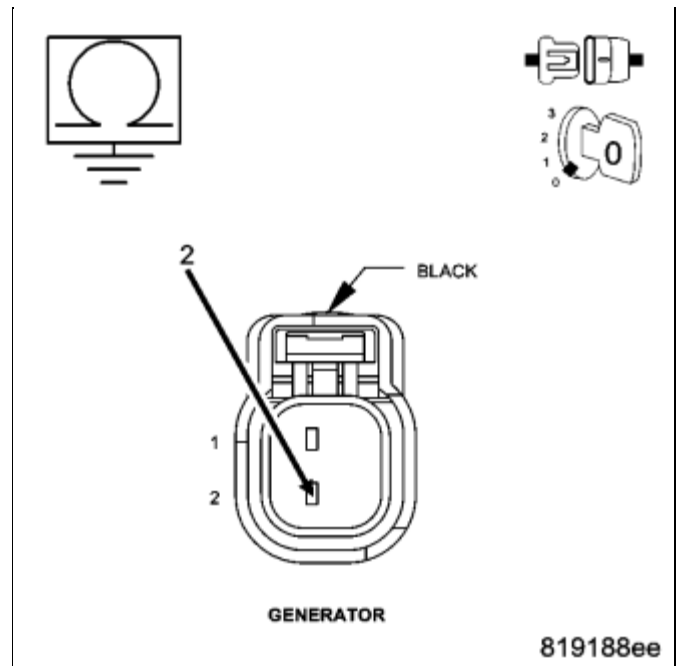
Yes

- Repair the short to ground in the (A804) Generator Sense circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. GENERATOR OPERATION

Connect the C1 PCM harness connector.

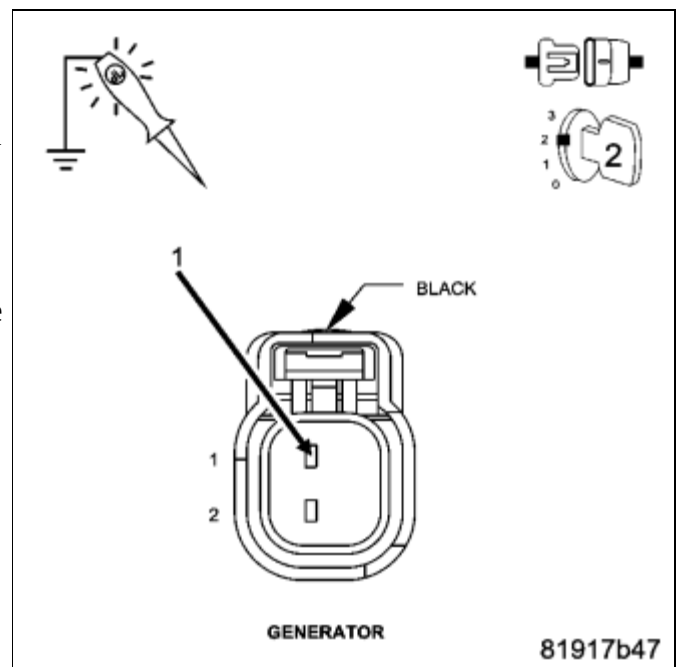
Using a 12-volt test light connected to ground, probe the (K125) Generator Field Control circuit in the Generator Field harness connector.

Ignition on, engine not running.

With a scan tool, actuate the Generator Field Driver.

NOTE: The DTC needs to be cleared before actuating the Solenoid, if the DTC is not cleared, the Solenoid may not be allowed to actuate.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.



Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors. If OK, replace the Generator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

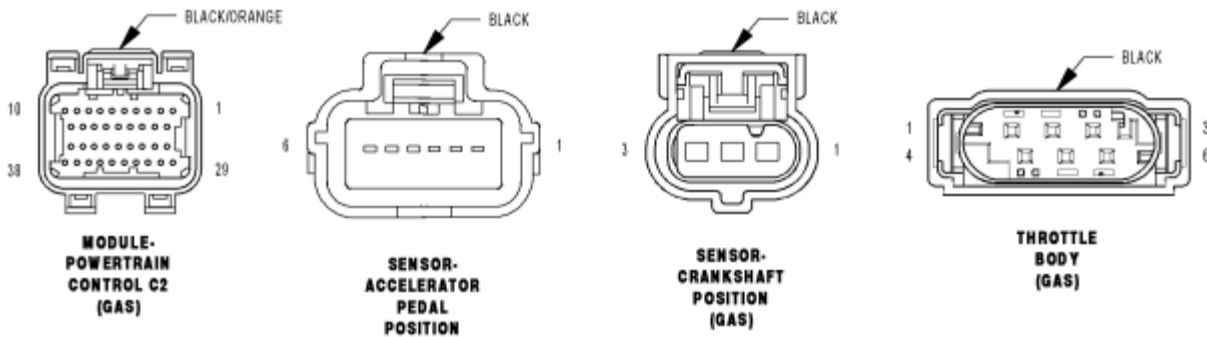
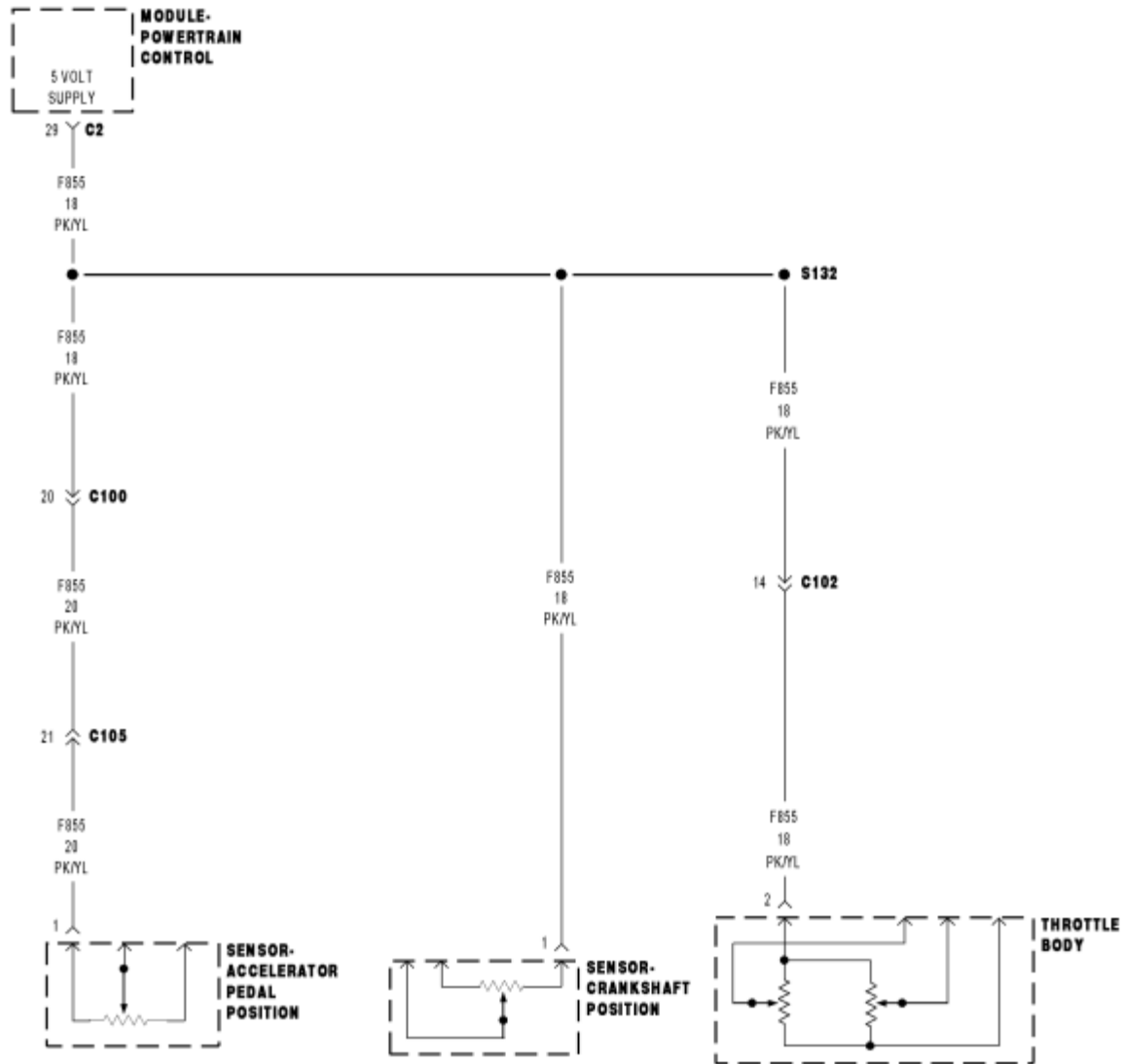
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW



81810042

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

- **Set Condition:**

When the PCM recognizes the Primary 5-volt Supply circuit voltage is too low. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO GROUND
SENSOR SHORTED TO GROUND
5-VOLT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.
 Measure the resistance between ground and the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

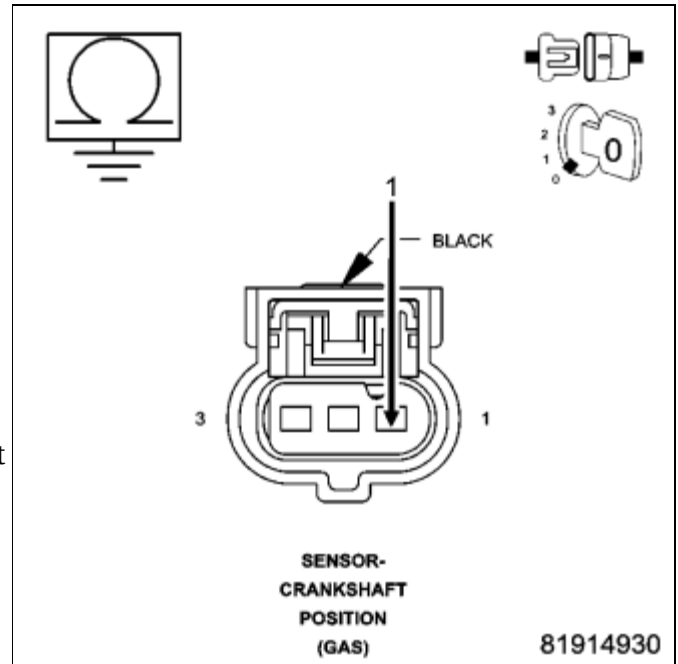
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) Primary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. 5-VOLT SENSOR

Reconnect all the previously disconnected Sensors except for the CKP Sensor harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

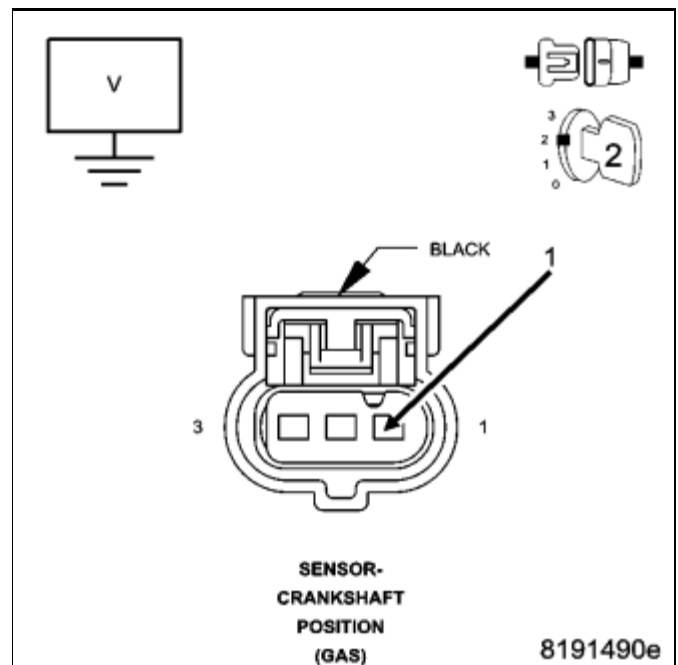
Is the voltage below 4.5 volts?

Yes

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors. If OK, replace the CKP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. 5-VOLT SENSOR SHORTED TO GROUND

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.

NOTE: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F855) Primary 5-volt Supply circuit, one at a time.

NOTE: Reconnect all the Sensors and clear all trouble codes before continuing.

Does the voltage increase above 4.5 volts when disconnecting any of the remaining Sensors?

Yes

- Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors. If OK, replace the Sensor that causes the (F855) Primary 5-volt Supply circuit voltage to increase when disconnected.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

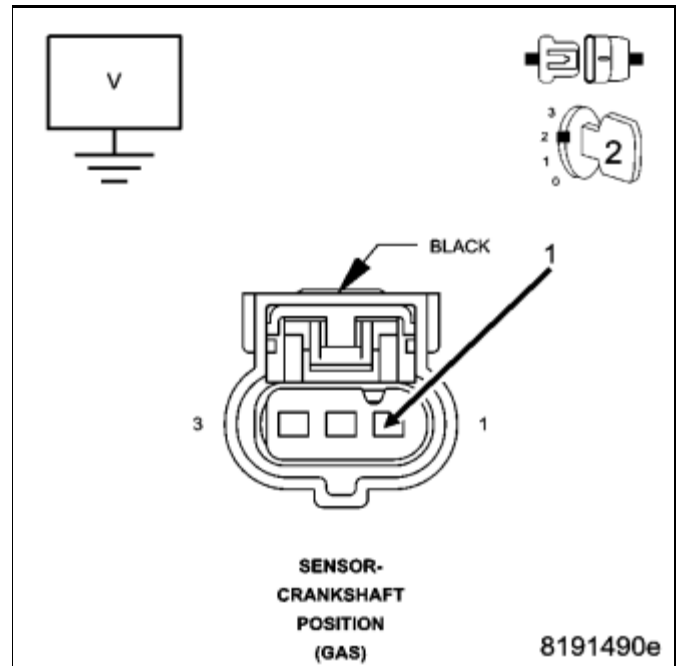
Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.

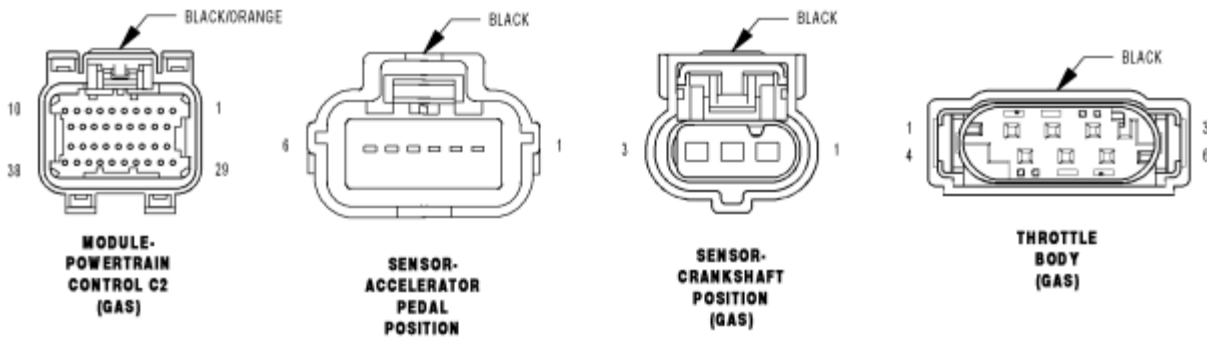
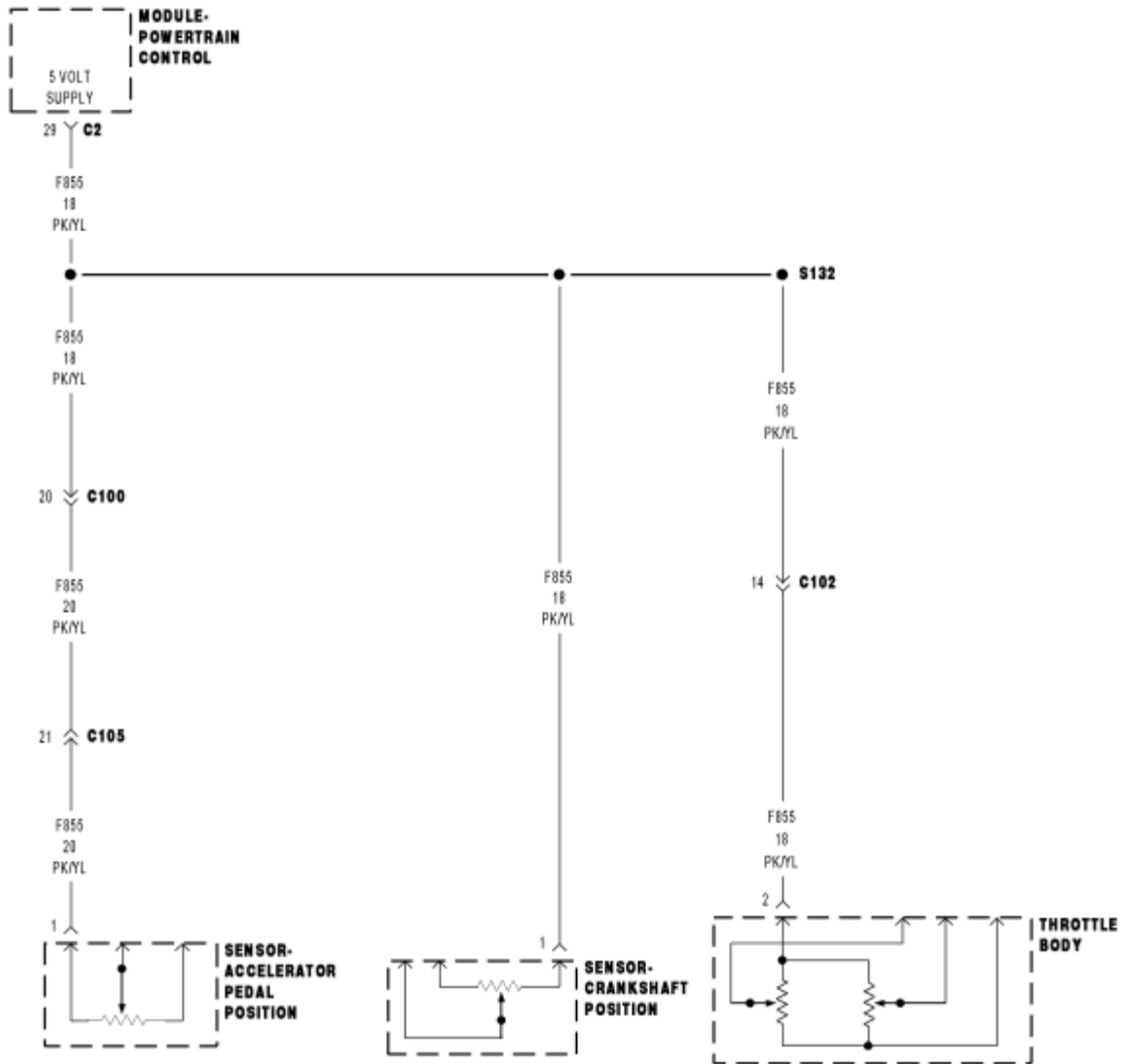


- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0643-PRIMARY 5-VOLT SUPPLY CIRCUIT HIGH



81810042

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

- **Set Condition:**

When the PCM recognizes the Primary 5-volt Supply circuit voltage is too high. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO VOLTAGE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F855) PRIMARY 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

Ignition on, engine not running.
Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.

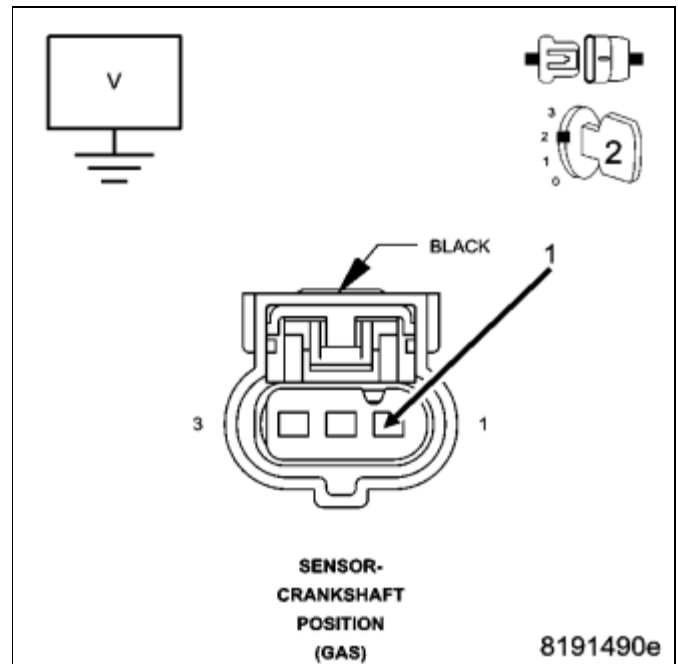
Is there any voltage present?

Yes

- Repair the short to voltage in the (F855) Primary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Control Module connectors.
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

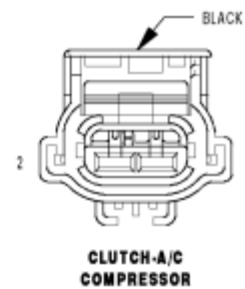
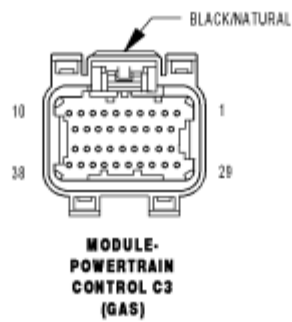
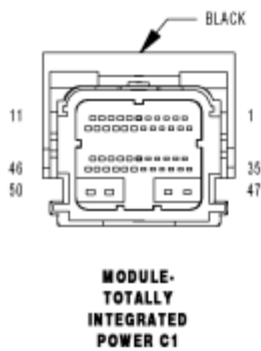
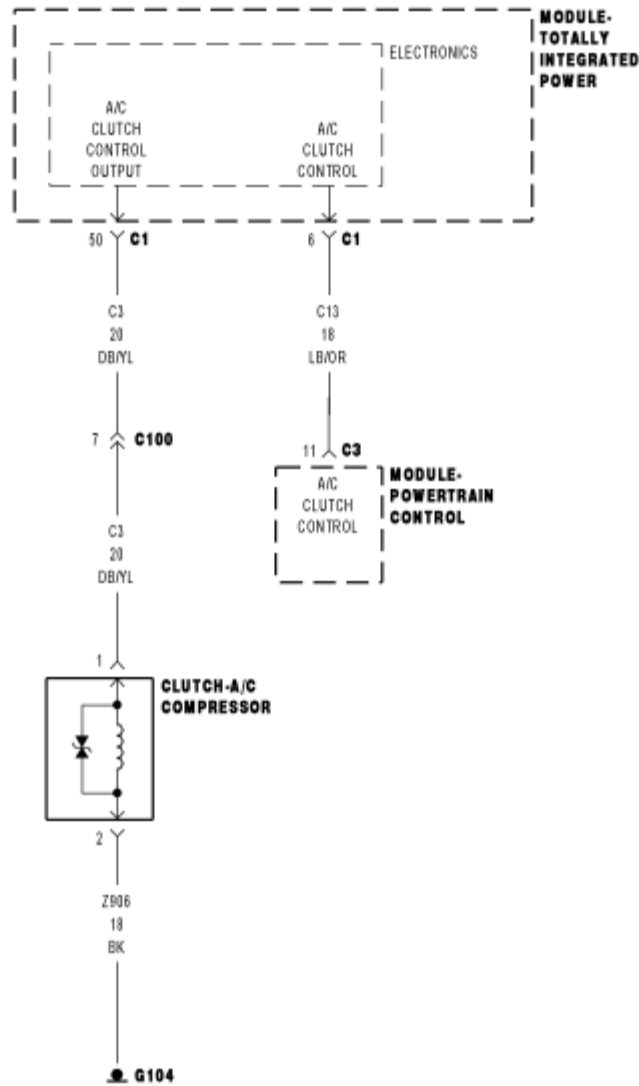
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0645-A/C CLUTCH CONTROL CIRCUIT



818100cc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.

◦ **Set Condition:**

An open or shorted condition is detected in the A/C clutch control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO VOLTAGE
(C13) A/C CLUTCH CONTROL CIRCUIT OPEN
(C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine.

Allow the engine to reach normal operating temperature.

Turn the A/C on.

With a scan tool, select View DTCs and record any related Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C3 PCM harness connector.
 Disconnect the C1 TIPM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (C13) A/C Clutch Control circuit at the C1 TIPM harness connector.

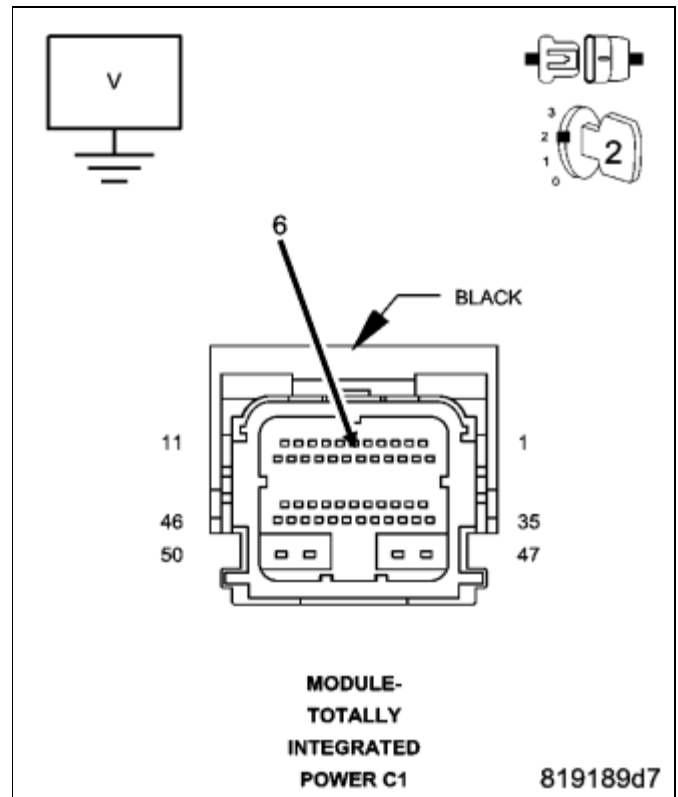
Does the voltmeter indicate voltage present?

Yes

- Repair the short to voltage in the (C13) A/C Clutch Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. (C13) A/C CLUTCH CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (C13) A/C Clutch Control circuit from the C1 TIPM harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

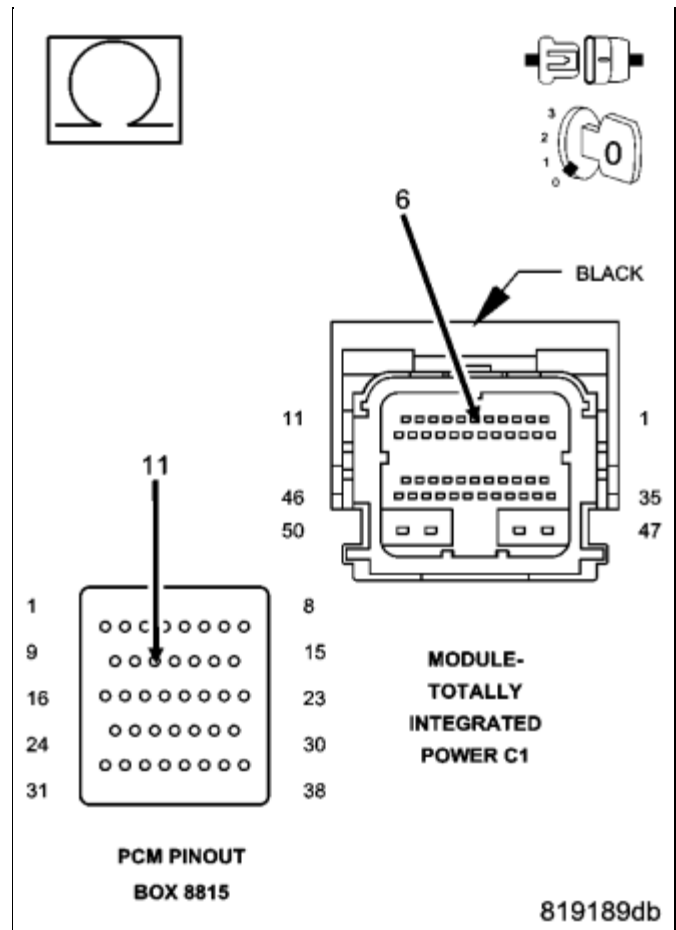
Yes

- Go To [4](#)

No

- Repair the open in the (C13) A/C Clutch Control circuit.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C13) A/C Clutch Control circuit at the C1 TIPM harness connector.

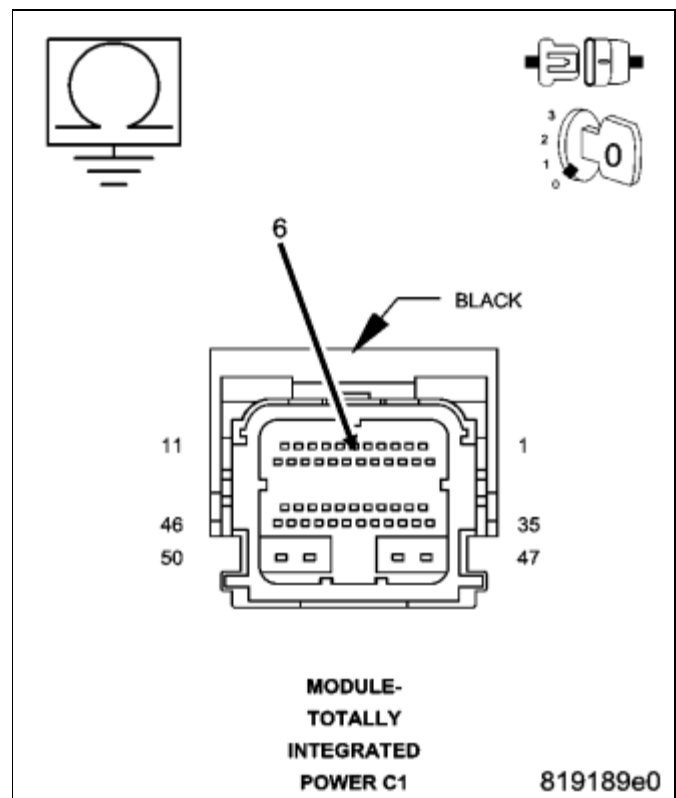
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (C13) A/C Clutch Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. A/C CLUTCH CONTROL OPERATION FROM THE PCM

Turn the ignition off.
 Connect the C3 PCM harness connector.
 Ignition on, engine not running.
 Using the scan tool in the PCM, actuate the A/C Clutch.
 With a 12-volt test light connected to ground, probe the (C13) A/C Clutch Control circuit in the C1 TIPM harness connector.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate accordingly during the actuation?

Yes

- **NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

If OK, replace the TIPM in accordance with the Service Information.

No

- Go To [6](#)

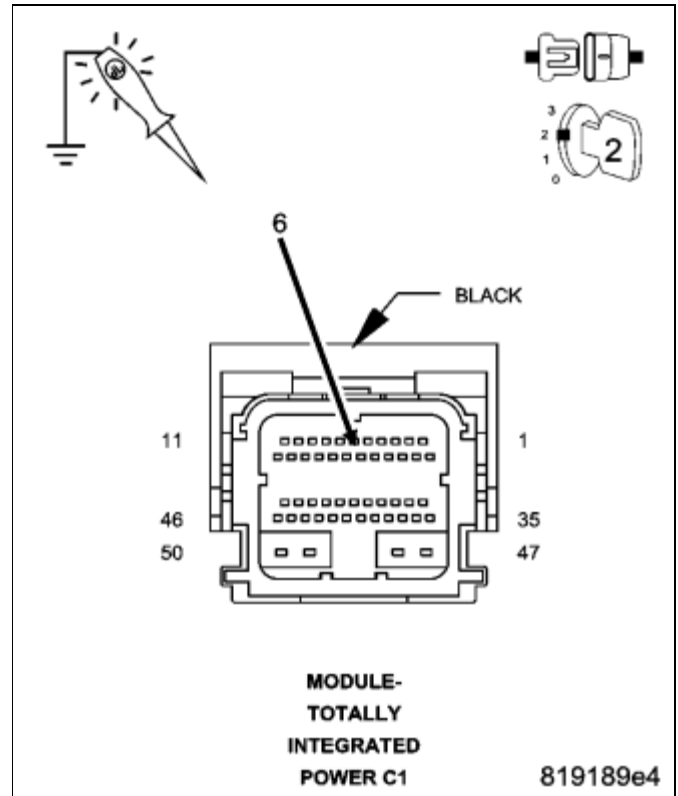
6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the A/C Clutch and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the A/C Clutch and Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.

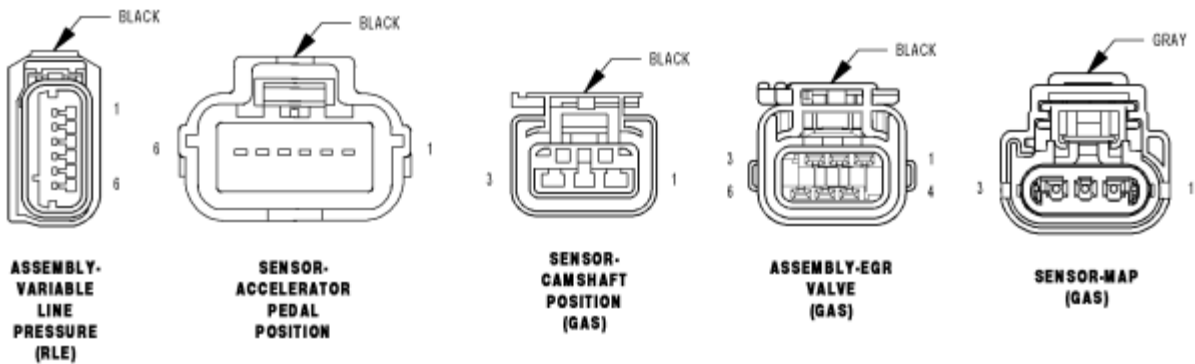
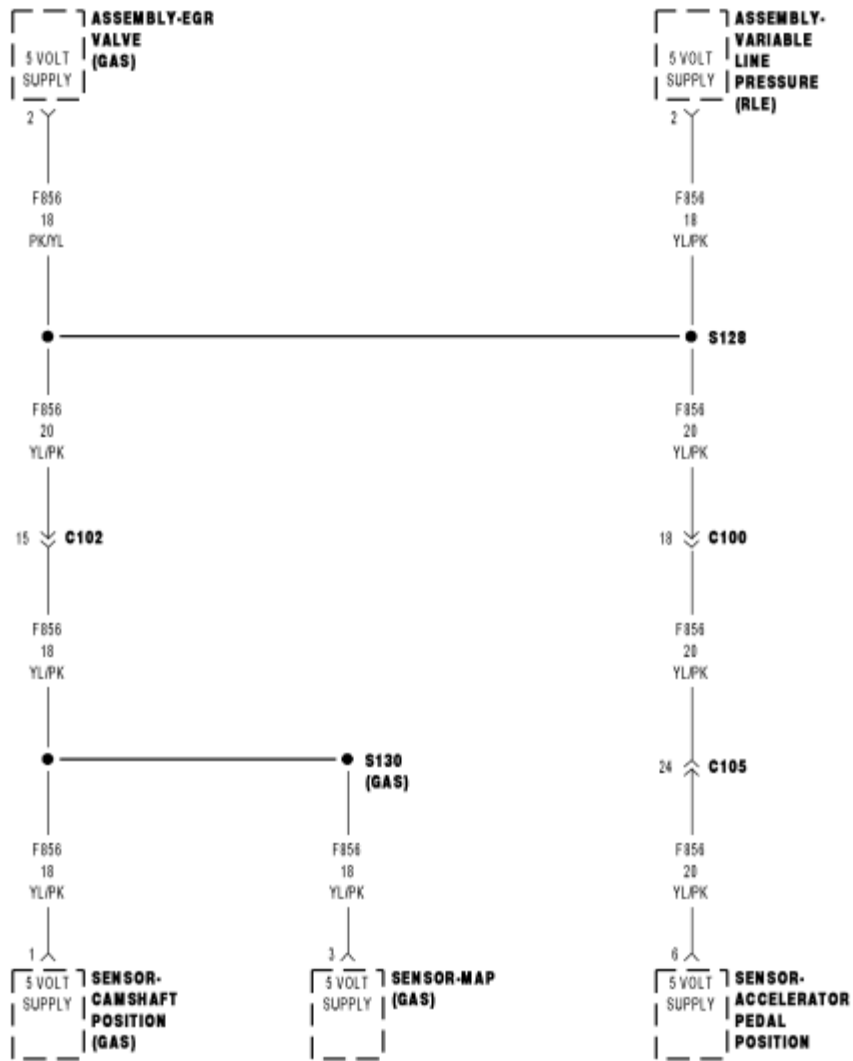


- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0652-SENSOR REFERENCE VOLTAGE 2 CIRCUIT LOW



81010011

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

- **Set Condition:**

When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is too low. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO GROUND
SENSOR SHORTED TO GROUND
CAM POSITION SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. (F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO GROUND

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.
 Measure the resistance between ground and the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.

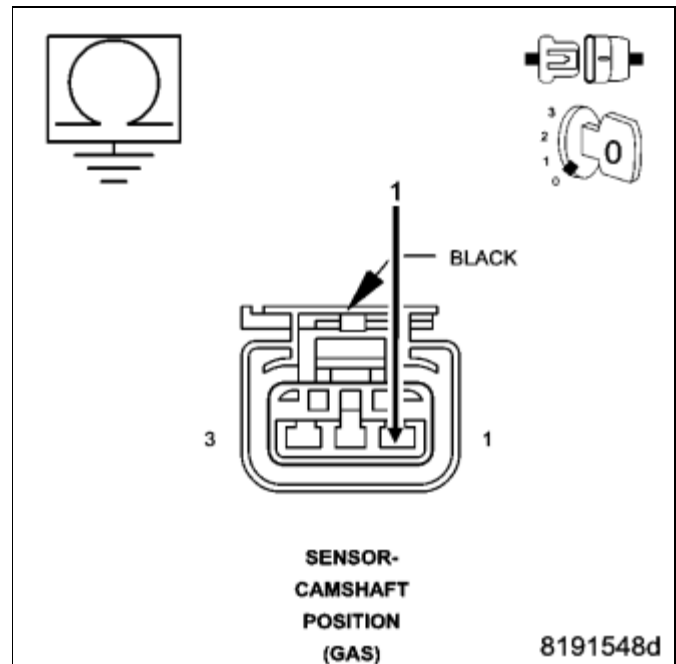
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) Auxiliary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. CMP SENSOR

Turn the ignition off.
 Reconnect all the previously disconnected Sensors except for the CMP Sensor harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.

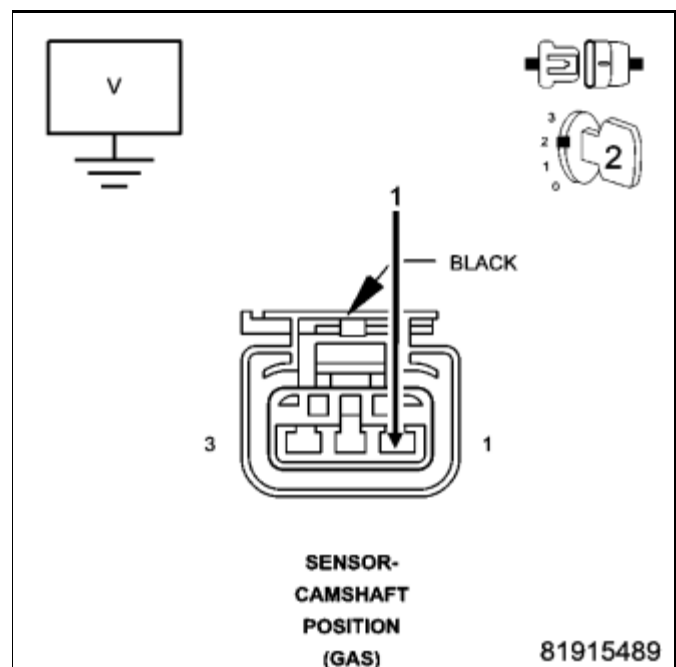
Is the voltage below 4.5 volts?

Yes

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors. If OK, replace the Cam Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST.



(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. 5-VOLT SENSOR SHORTED TO GROUND

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.

NOTE: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F856) Auxiliary 5-volt Supply circuit, one at a time.

Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes

- Replace the Sensor that causes the (F856) Auxiliary 5-volt Supply circuit voltage to increase when disconnected.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

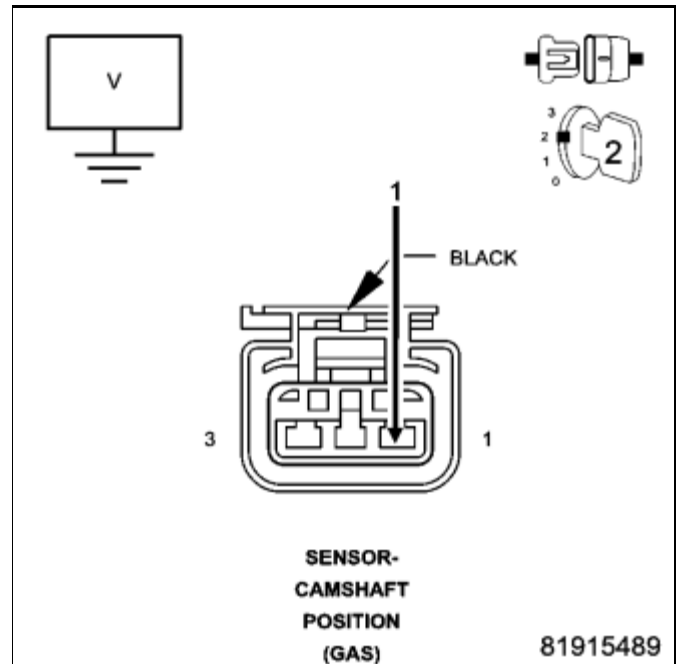
Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

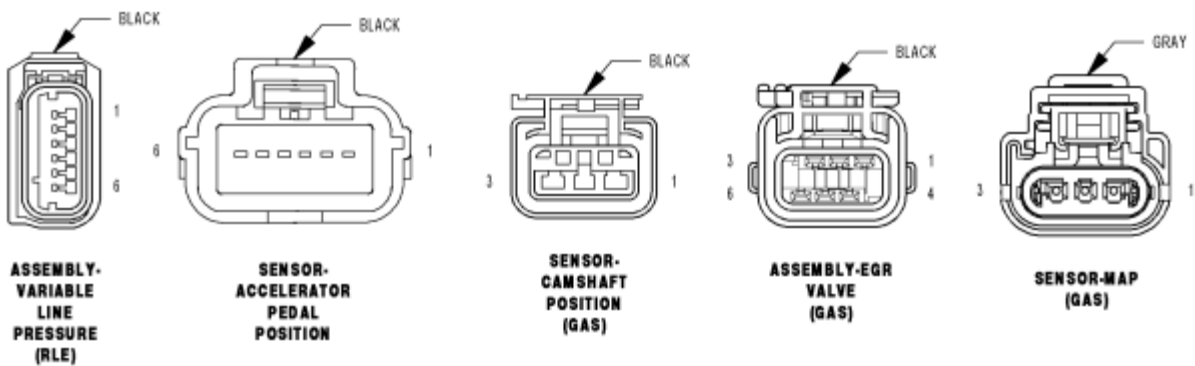
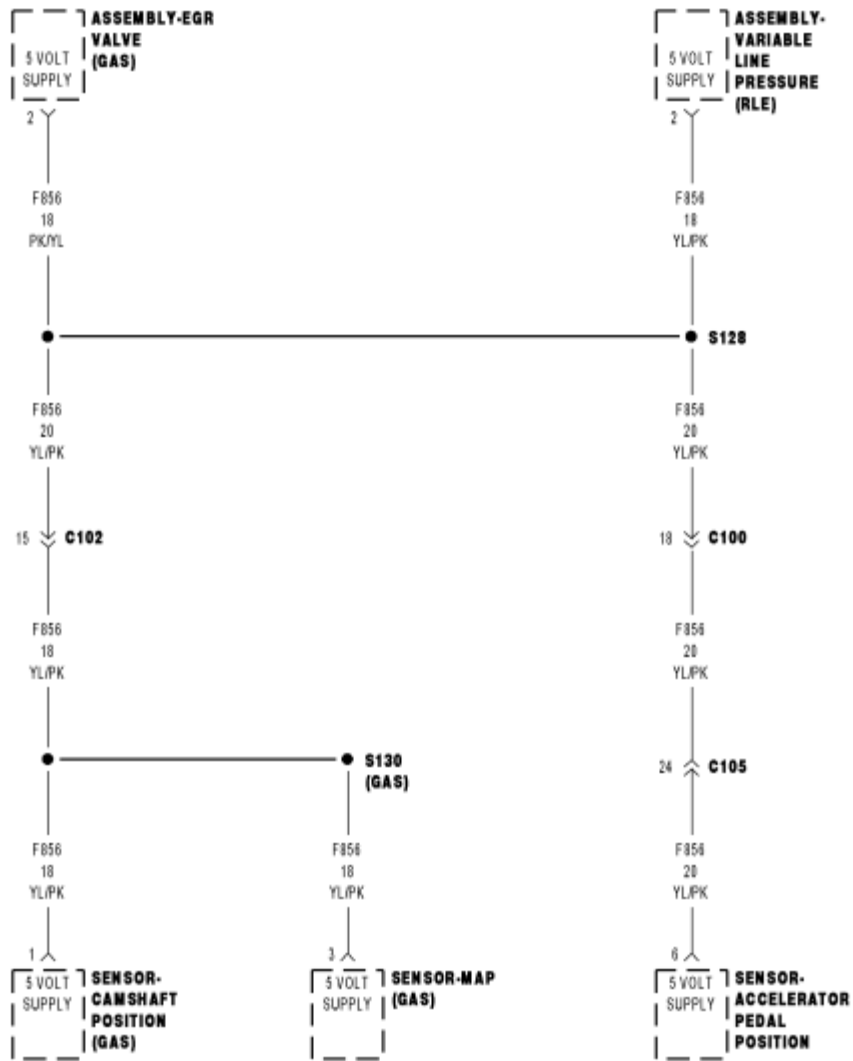
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0653-SENSOR REFERENCE VOLTAGE 2 CIRCUIT HIGH



81010011

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is too high. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO VOLTAGE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

Ignition on, engine not running.
 Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.

Is there any voltage present?

Yes

- Repair the short to voltage in the (F856) Auxiliary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.
 Refer to any Technical Service Bulletins that may apply.

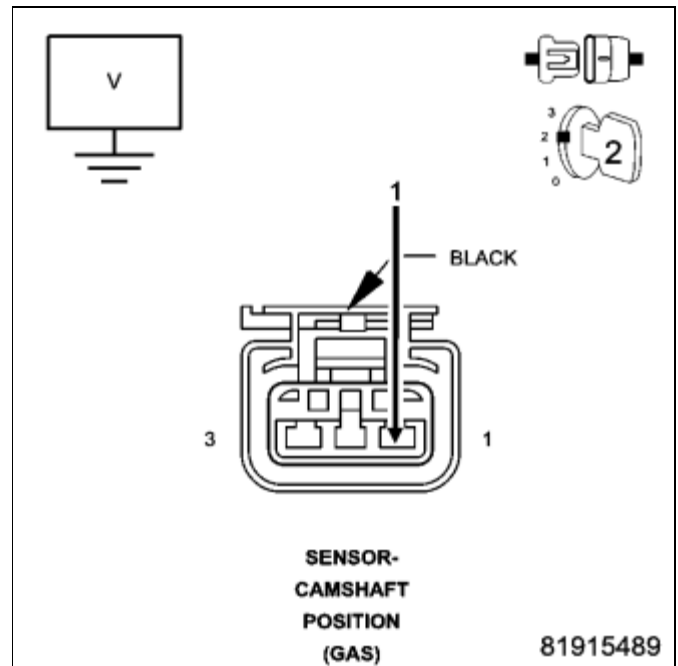
Were there any problems found?

Yes

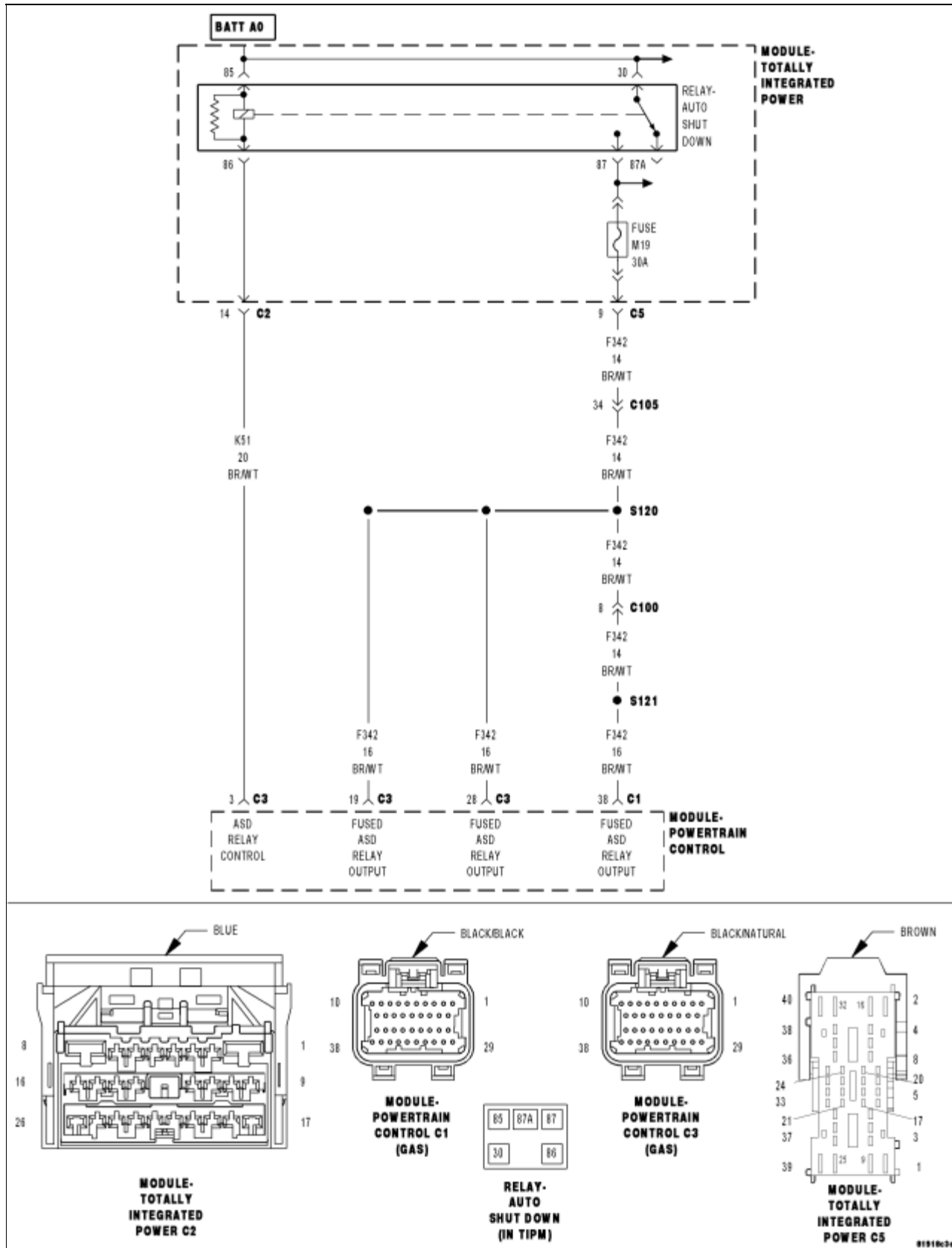
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



P0685-AUTO SHUTDOWN CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With ignition on. Battery voltage above 10 volts.

- **Set Condition:**

The actual ASD state is not equal to the desired ASD state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K51) ASD CONTROL CIRCUIT SHORTED TO VOLTAGE
(K51) ASD CONTROL CIRCUIT OPEN
(K51) ASD CONTROL CIRCUIT SHORTED TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (K51) ASD CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C3 PCM harness connector.
 Disconnect the C2 TIPM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K51) ASD Control circuit at the C2 TIPM harness connector.

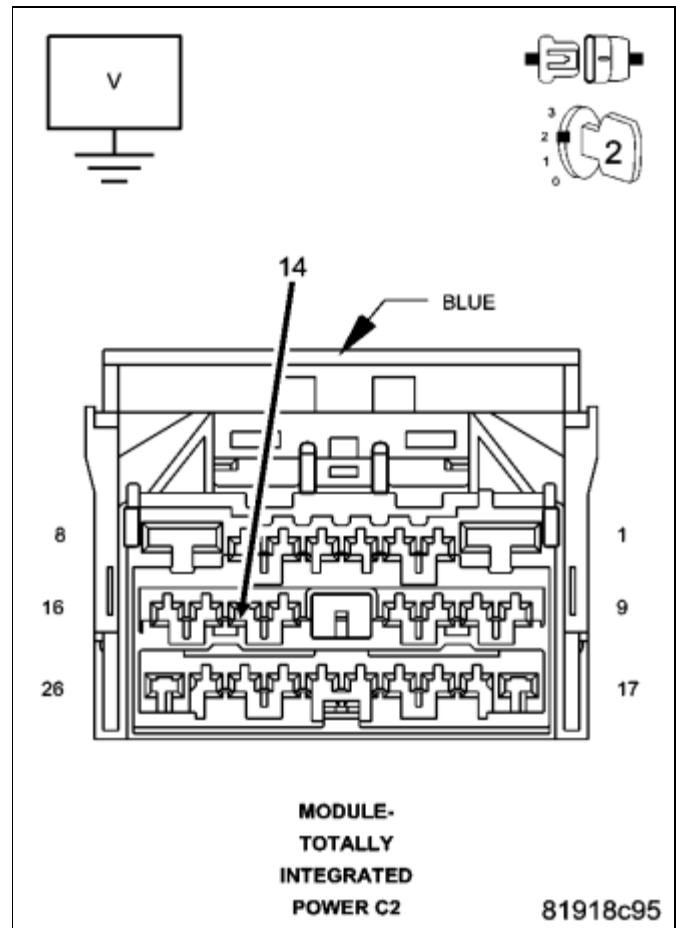
Does the voltmeter indicate voltage present?

Yes

- Go To [3](#)

No

- Repair the short to voltage in the (K51) ASD Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. (K51) ASD CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K51) ASD Control circuit from the TIPM harness connector to the appropriate terminals of special tool #8815.

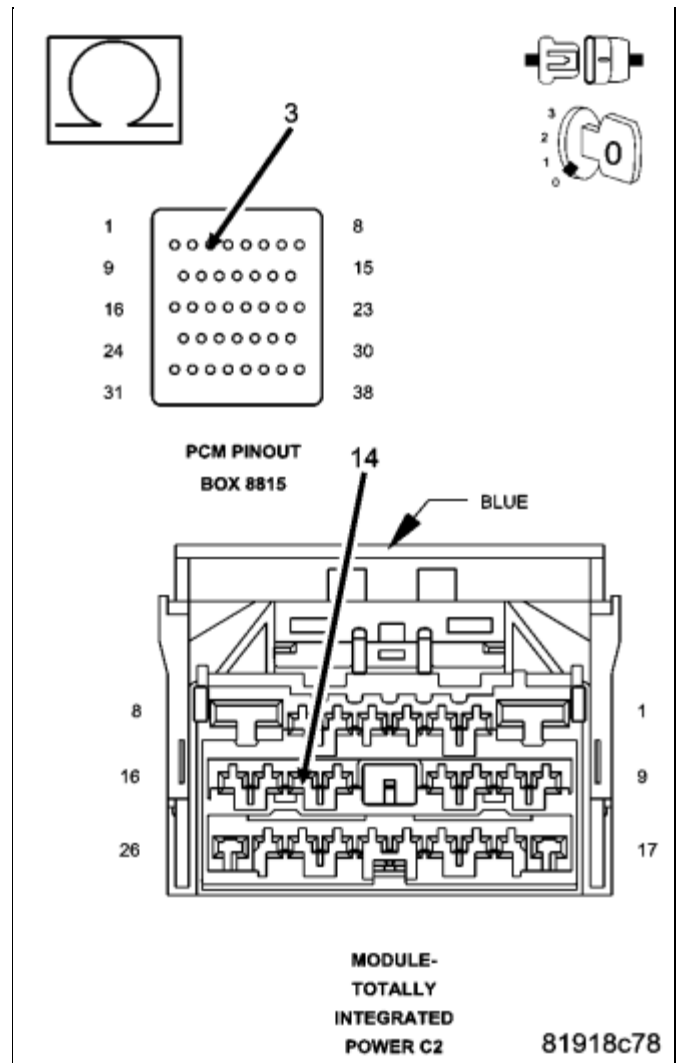
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K51) ASD Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K51) ASD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K51) ASD Control circuit at the C2 TIPM harness connector.

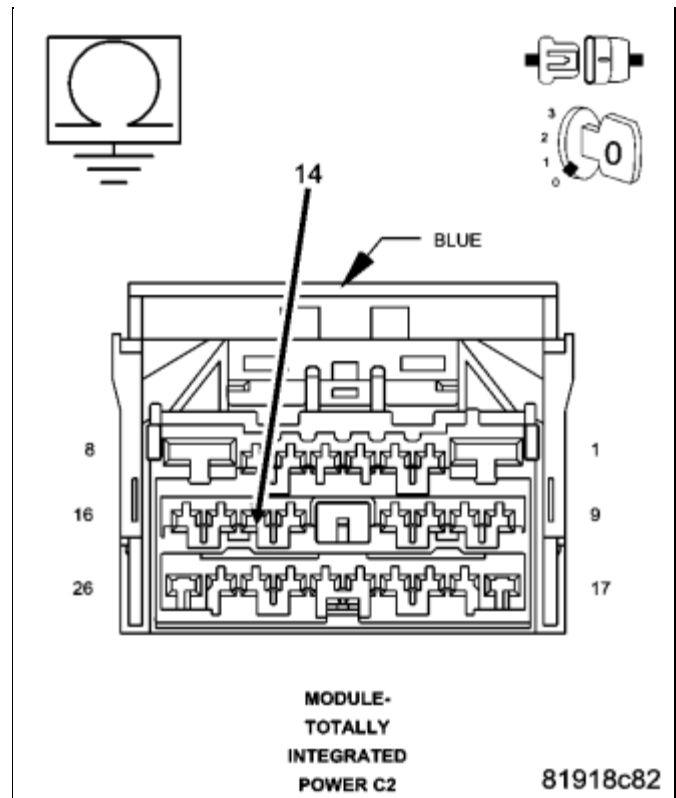
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K51) ASD Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. ASD CONTROL OPERATION FROM THE PCM

Connect the C3 PCM harness connector.
 Ignition on, engine not running.
 Using the scan tool in the PCM, actuate the ASD.
 With a 12-volt test light connected to ground, probe the (K51) ASD Control circuit in the C2 TIPM harness connector.

Does the test light illuminate brightly and flash on and off?

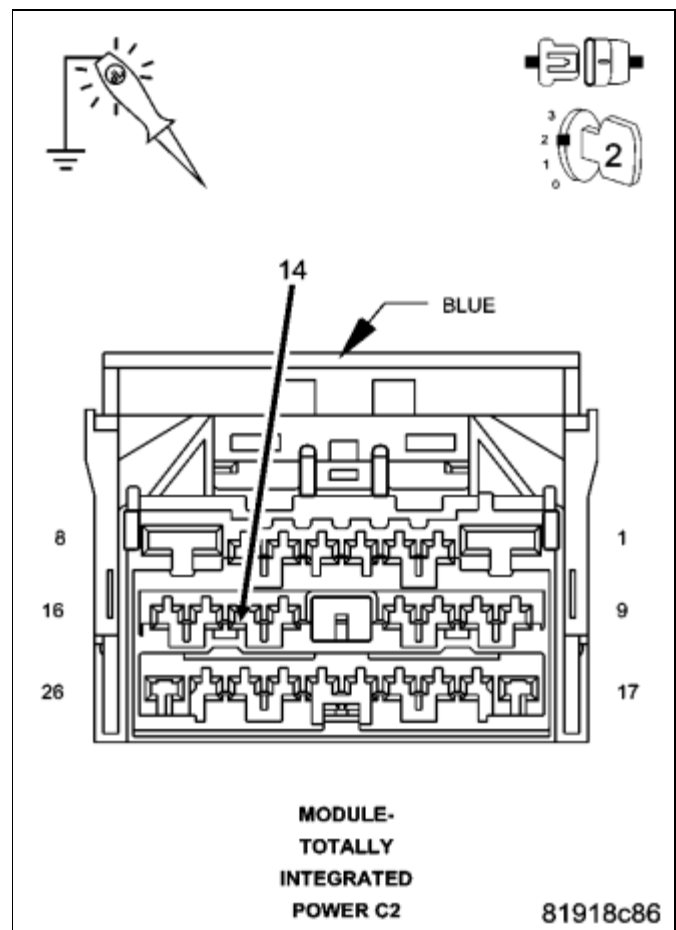
Yes

- **NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

If OK, replace the TIPM in accordance with the Service Information.

No

- Go To [6](#)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related TIPM and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the TIPM and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

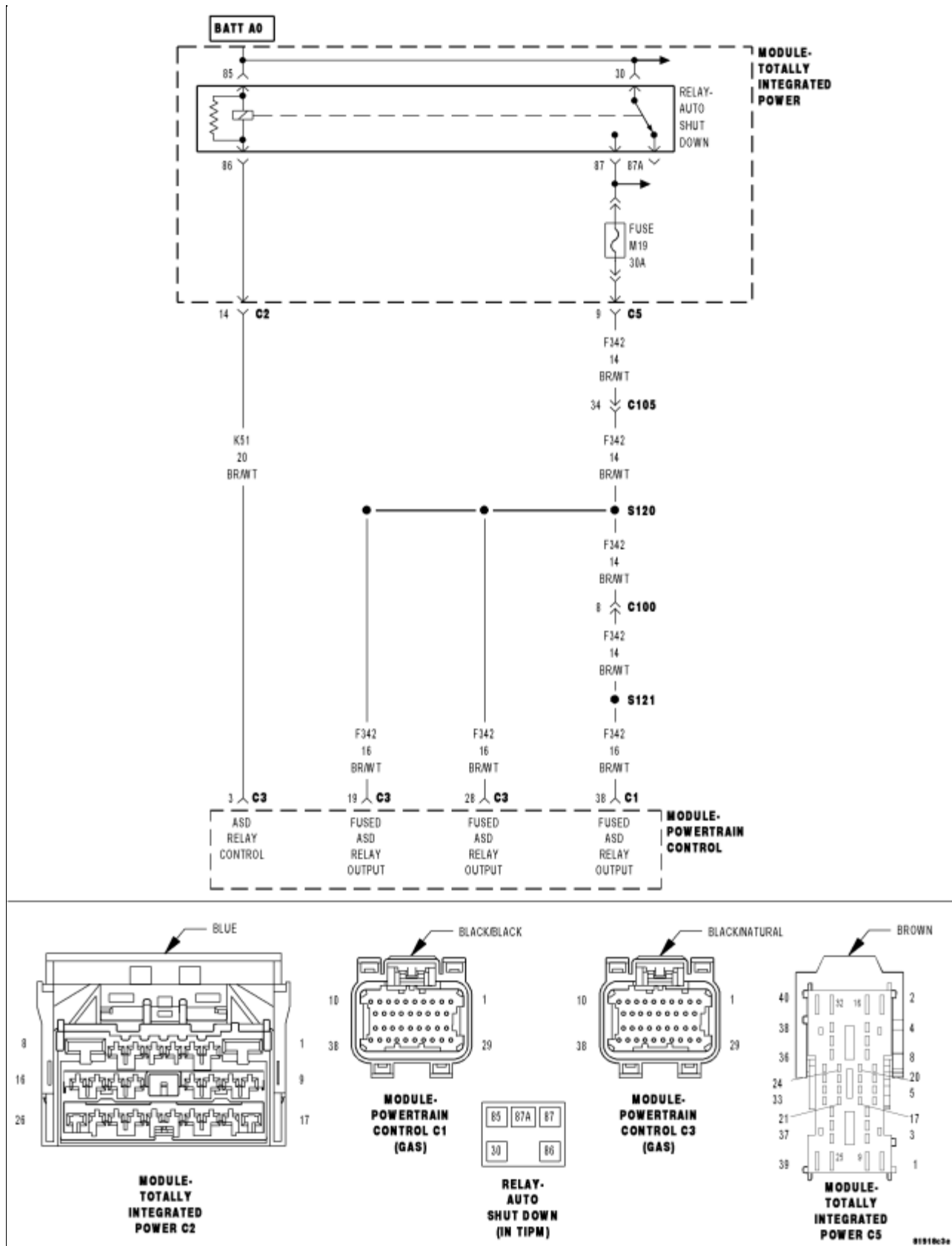
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0688-AUTO SHUTDOWN SENSE CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With ignition key on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

No voltage sensed at the PCM when the ASD is energized or voltage is sensed when the ASD is not energized. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD CONTROL OUTPUT CIRCUIT SHORTED TO VOLTAGE
(F342) ASD CONTROL OUTPUT CIRCUIT OPEN
(F342) ASD CONTROL OUTPUT CIRCUIT SHORTED TO GROUND
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VERIFY ASD DTC

NOTE: If any O2 SENSOR HEATER CIRCUIT HIGH DTCs set along with P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW, all of the O2 Sensor Heater Control circuits need to be checked for a short to battery voltage.

NOTE: If any of the following component DTC(s) have set along with P0688, diagnose them first before continuing. Ignition Coil(s) Fuel Injector(s) ASD Control ASD Control Output (TIPM DTC)

Turn the ignition on.
With a scan tool, select View DTCs.

Is the DTC currently Active?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. EXCESSIVE RESISTANCE IN THE (F342) ASD CONTROL OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the C1 PCM harness connector.
Disconnect the C5 TIPM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F342) ASD Control Output circuit from the C5 TIPM harness connector to the appropriate terminal of special tool #8815.

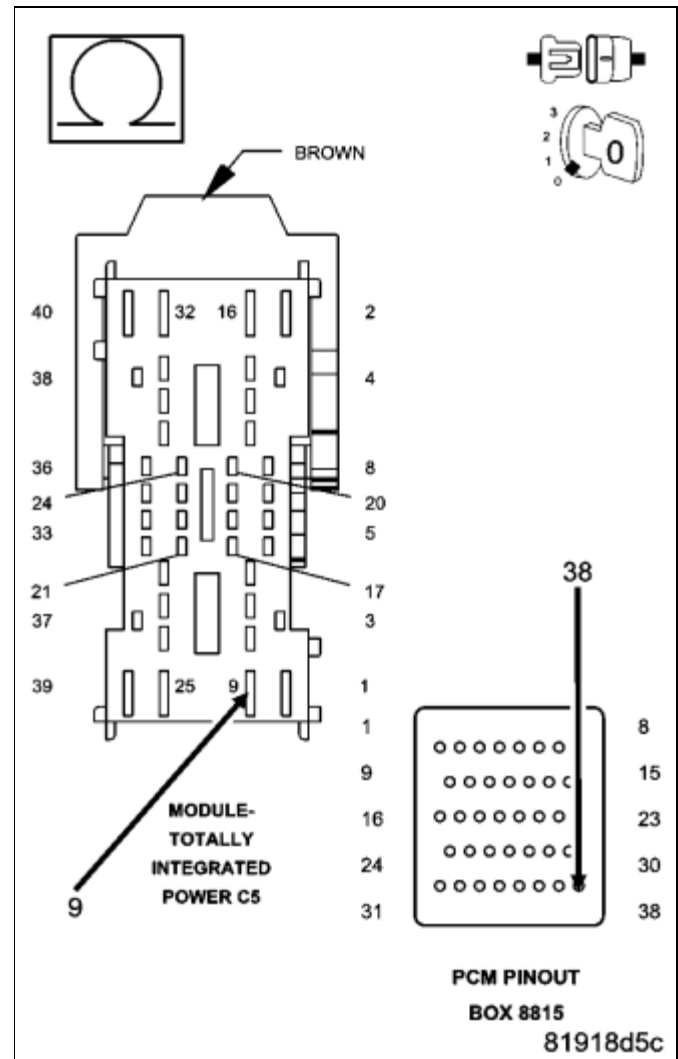
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (F342) ASD Control Output circuit. Inspect the related in-line connectors and splices.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. EXCESSIVE RESISTANCE IN THE (F342) ASD CONTROL OUTPUT CIRCUIT

Disconnect the C3 PCM harness connector.
Measure the resistance of the (F342) ASD Control Output circuit from the C5 TIPM harness connector to the appropriate terminals of special tool #8815.

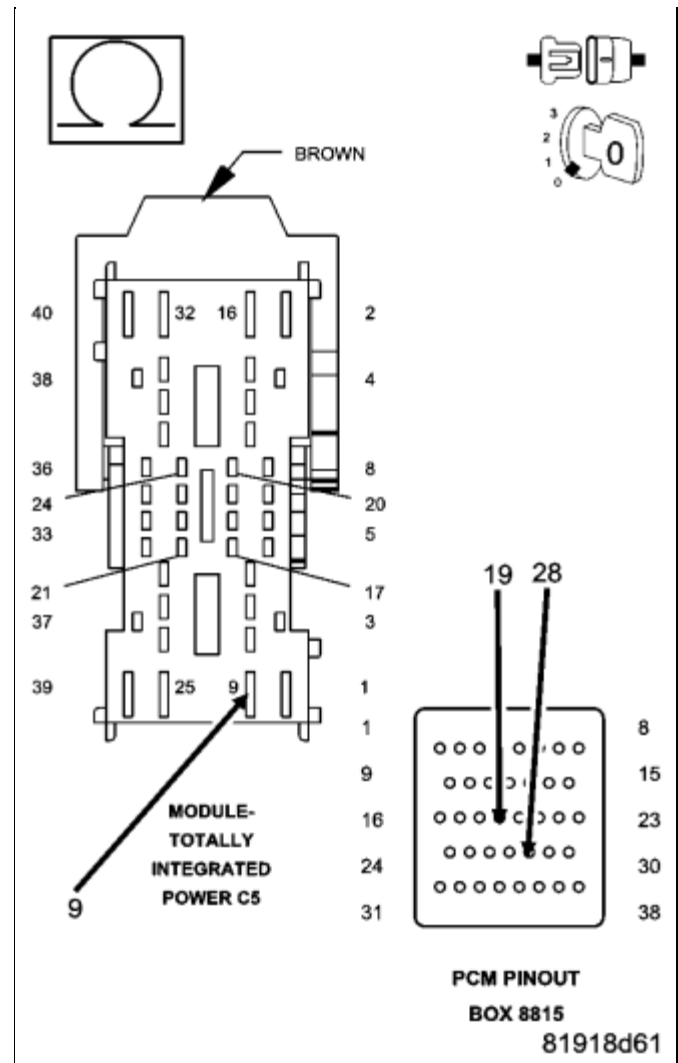
Is the resistance below 5.0 ohms at each terminal?

Yes

- Go To [6](#)

No

- Repair the open in the (F342) ASD Control Output circuits.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (F342) ASD CONTROL OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F342) ASD Control Output circuit at the C5 TIPM harness connector.

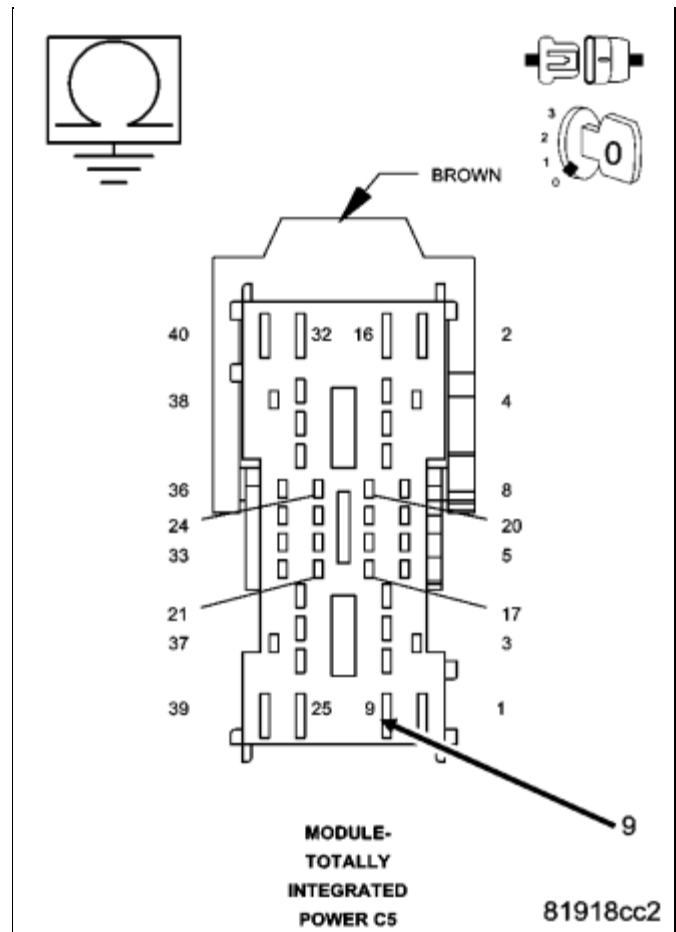
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F342) ASD Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (F342) ASD CONTROL OUTPUT CIRCUIT SHORTED TO VOLTAGE

Ignition on, engine not running.
Using a voltmeter measure the voltage on the (F342) ASD Control Output circuit in the C5 TIPM harness connector.

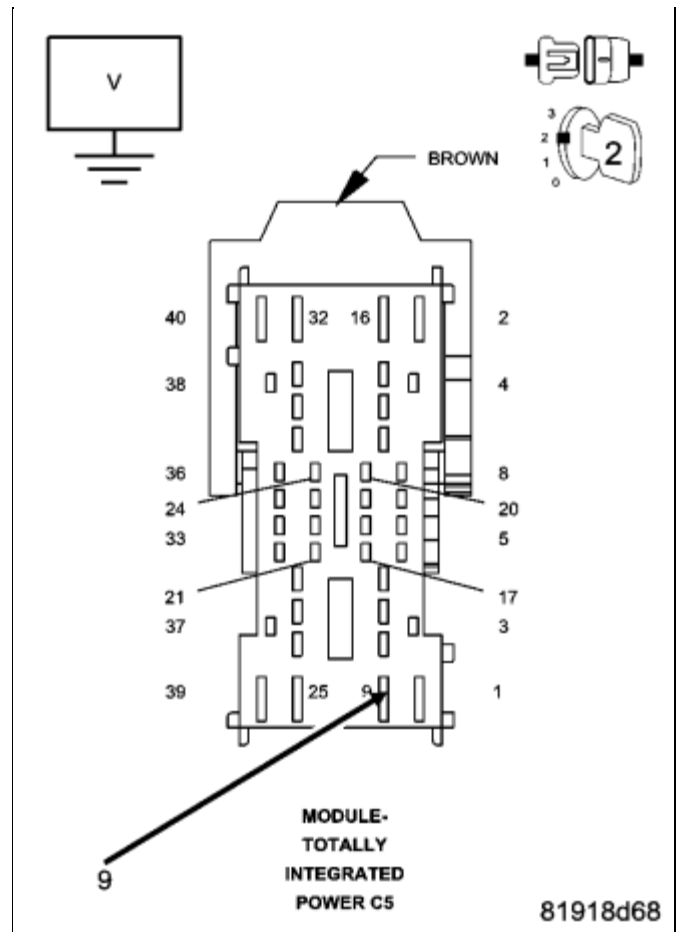
Is there any voltage present?

Yes

- Repair the short to voltage in the (F342) ASD Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Turn the ignition off.

Connect the C1 and C3 PCM harness connectors and the C5 TIPM harness connector.

Ignition on, engine not running.

Using the scan tool in the PCM, actuate the ASD.

With a 12-volt test light connected to ground, probe the (K51) ASD Control circuit at the C2 TIPM terminal connection.

Does the test light illuminate brightly and flash on an off during the actuation?

Yes

- **NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

If OK, replace the TIPM in accordance with the Service Information.

No

- Go To [Z](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related TIPM and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the TIPM and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

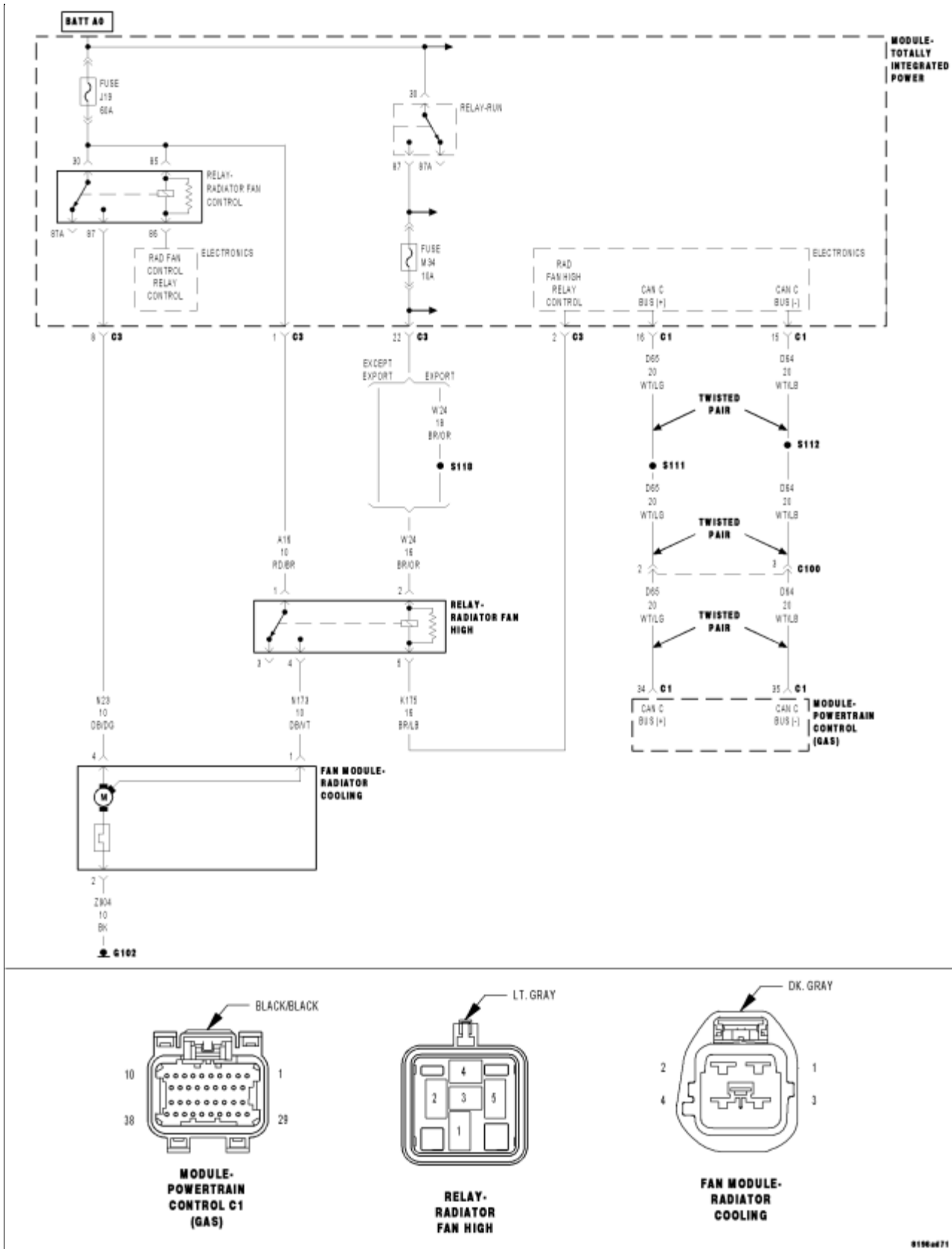
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0691-COOLING FAN 1 CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects an open in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. LOW SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the Low Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the Low Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the Low Speed Cooling Fan Relay.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Cooling Fan Module, TIPM, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Cooling Fan Module, TIPM, and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

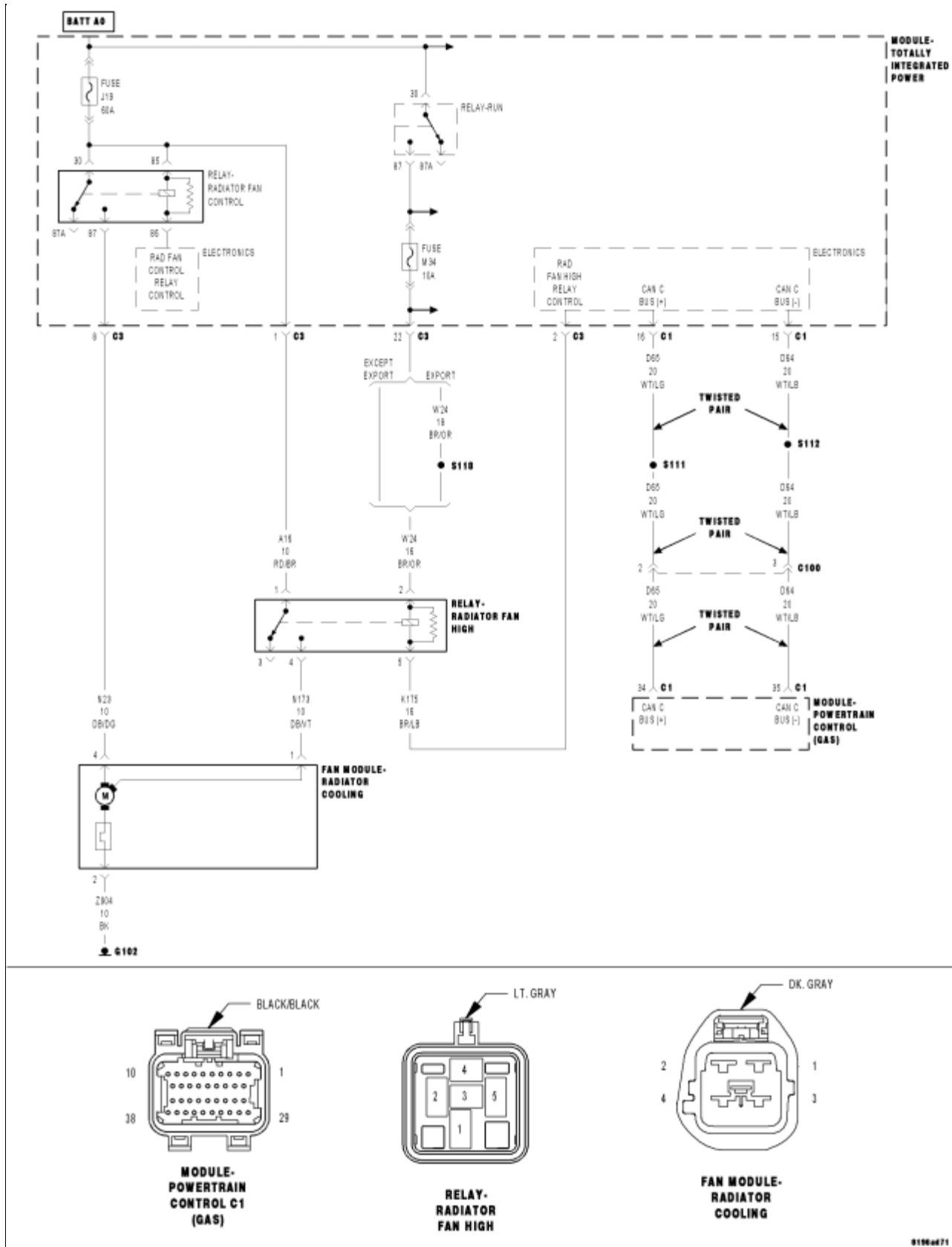
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P0692-COOLING FAN 1 CONTROL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects a shorted condition in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. LOW SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the Low Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the Low Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the Low Speed Cooling Fan Relay.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Cooling Fan Module, TIPM, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Cooling Fan Module, TIPM, and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

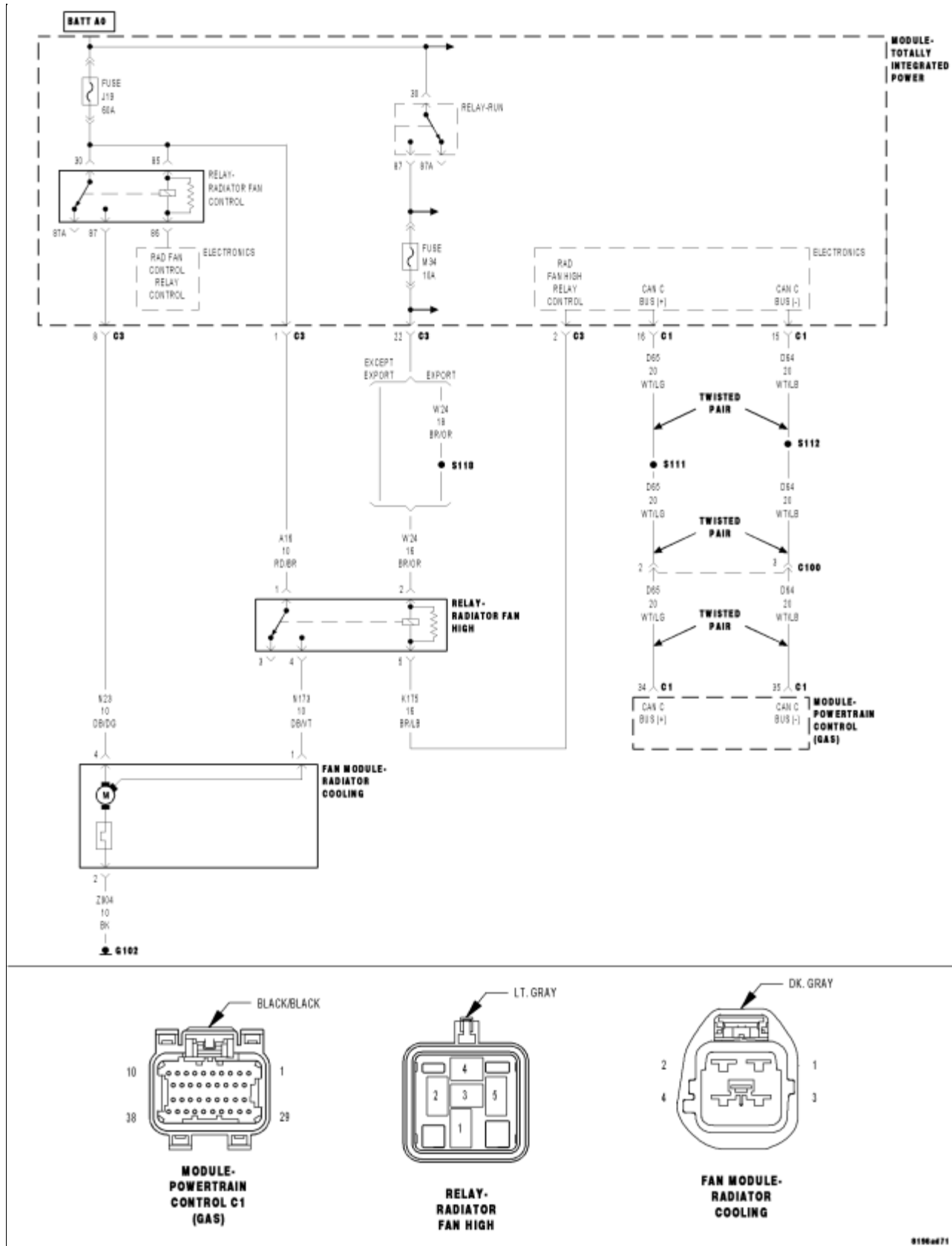
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P0693-COOLING FAN 2 CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects an open or short to ground in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO GROUND
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT OPEN
HIGH SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. HIGH SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the High Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the High Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the High Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the High Speed Cooling Fan Relay.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 TIPM harness connector.

Remove the High Speed Cooling Fan Relay.

Measure the resistance between ground and the (K175) High Speed Cooling Fan Relay Control circuit at the relay connection.

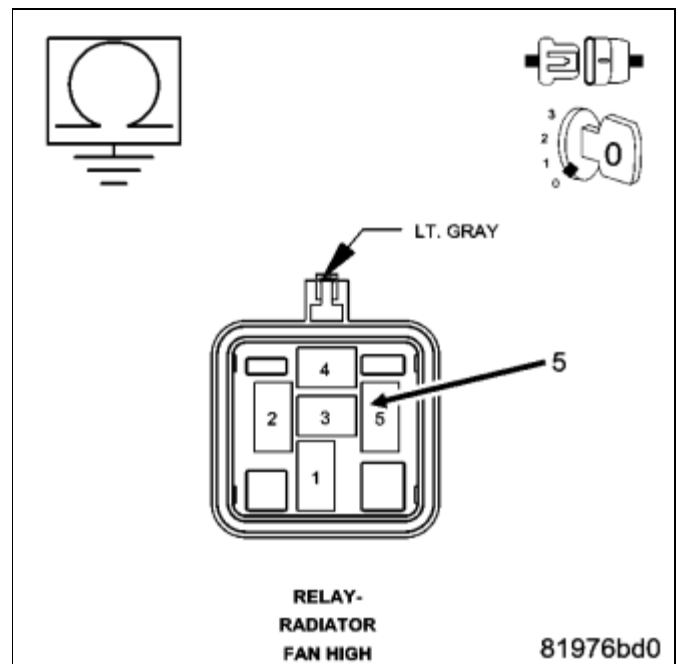
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (K175) High Speed Cooling Fan Relay Control circuit from the C3 TIPM harness connector to the Relay connection.

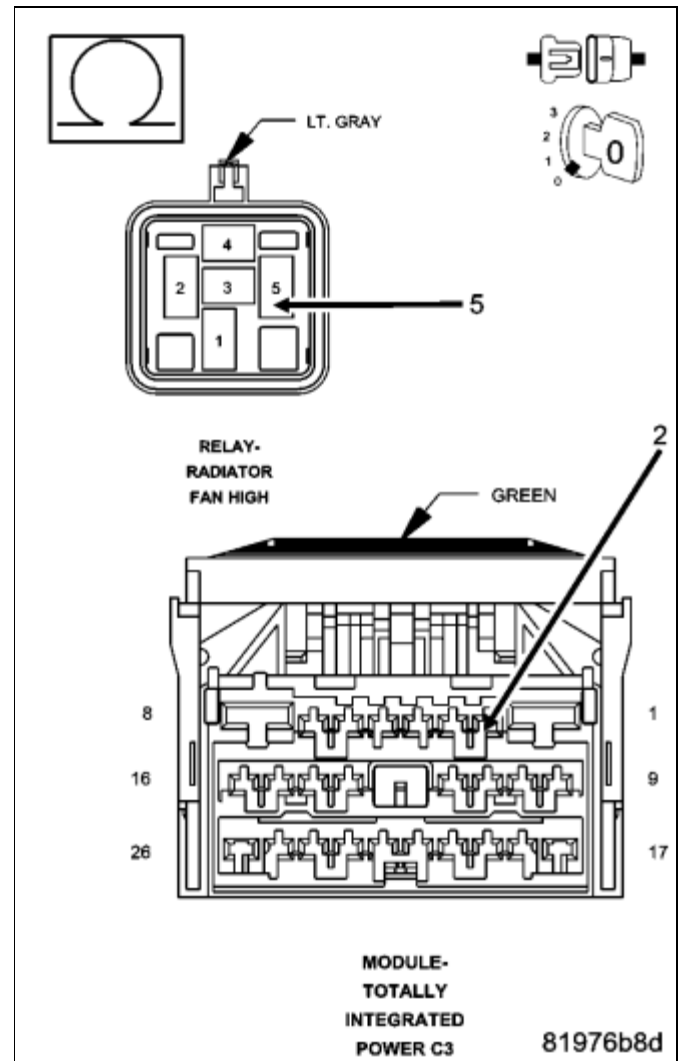
Is the resistance above 5.0 ohms?

Yes

- Repair the open or excessive resistance in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Cooling Fan Module, TIPM, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Cooling Fan Module, TIPM, and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

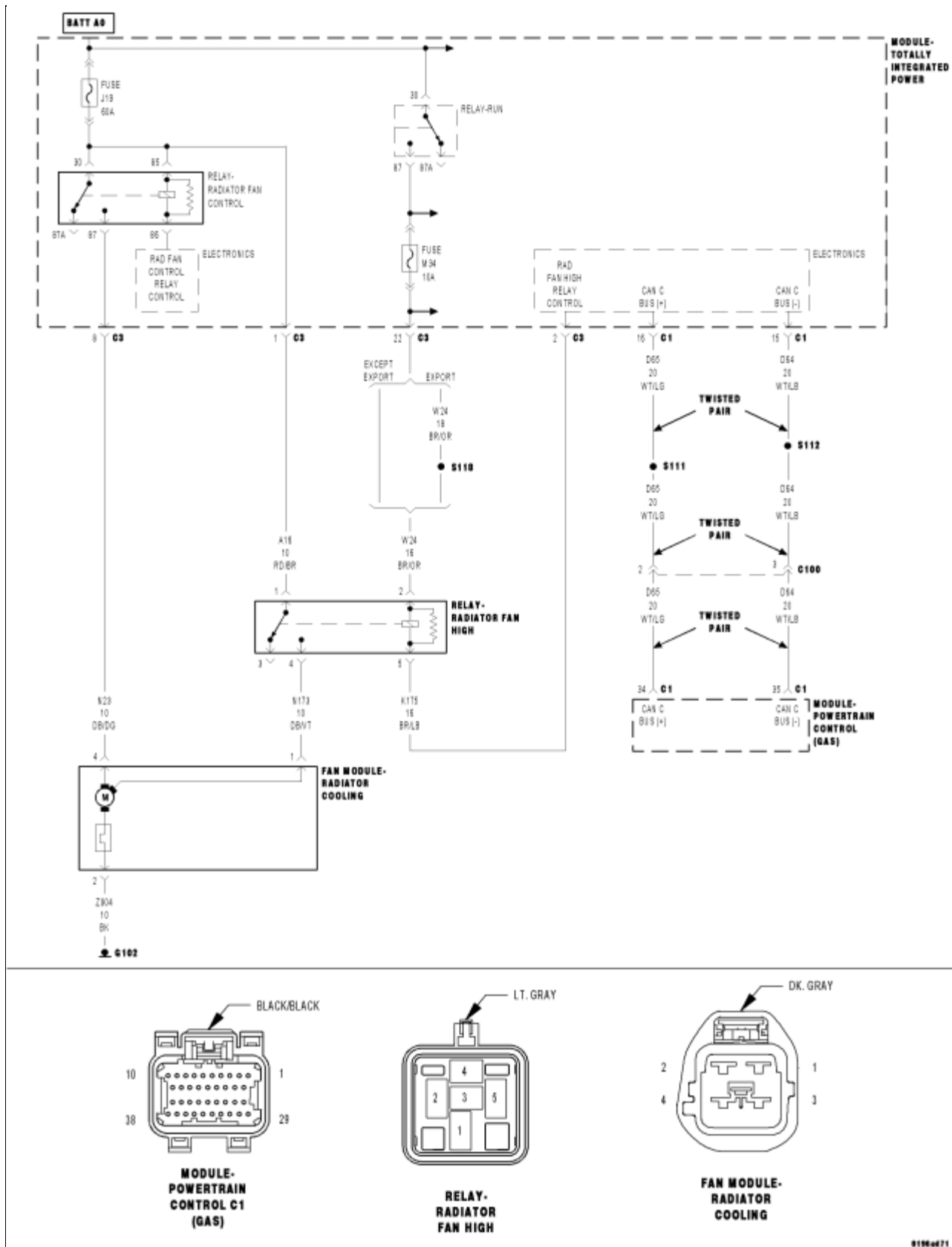
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.

- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P0694-COOLING FAN 2 CONTROL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The PCM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects a short to voltage in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
HIGH SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. HIGH SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the High Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit. Remove the High Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the High Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the High Speed Cooling Fan Relay.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C3 TIPM harness connector.

Remove the High Speed Cooling Fan Relay.

Ignition on, engine not running.

Measure the voltage on the (K175) High Speed Cooling Fan Relay Control circuit at the relay connection.

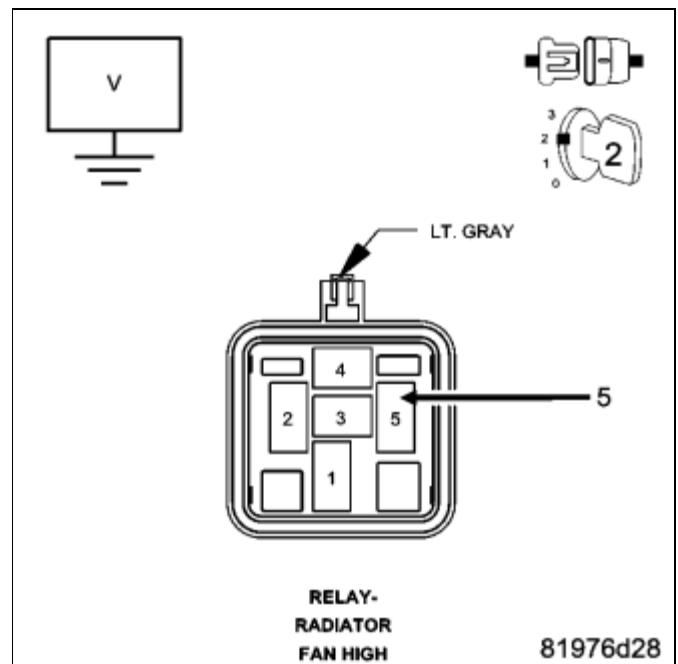
Is there any voltage present?

Yes

- Repair the short to voltage in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Cooling Fan Module, TIPM, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Cooling Fan Module, TIPM, and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P0700-TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and battery voltage greater than 10 volts.

◦ **Set Condition:**

An active DTC is stored in the TCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
DTC PRESENT IN THE TRANSMISSION CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC PRESENT IN EATX CONTROLLER

This is an informational DTC letting you know that a DTC(s) is stored in the Transmission Control Module. Erase this DTC from the PCM after all Transmission DTC(s) have been repaired.

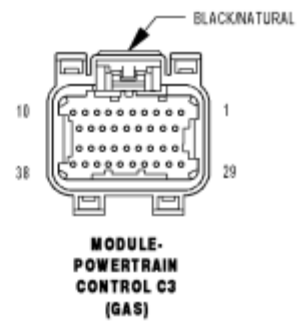
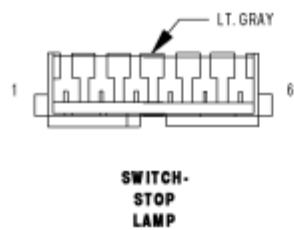
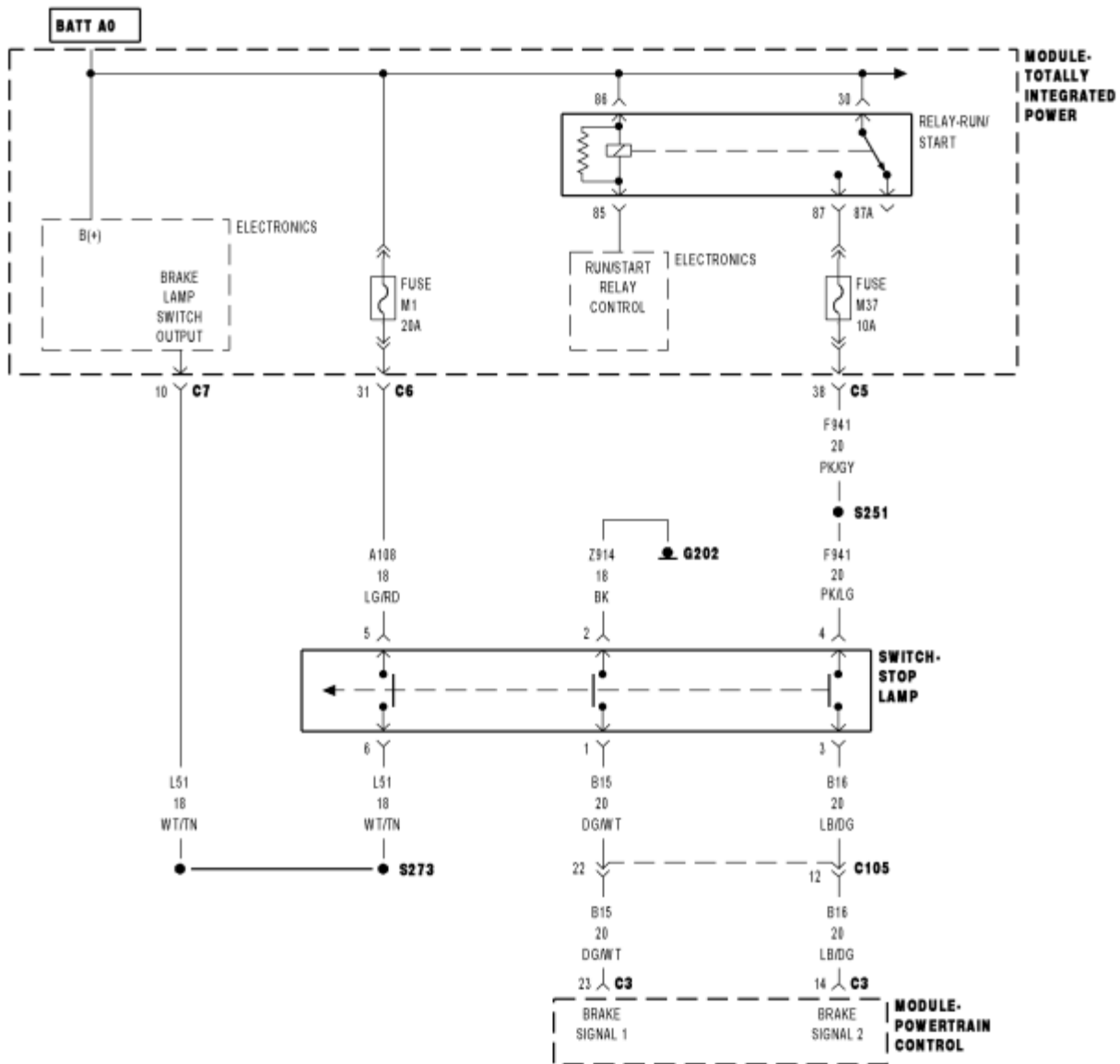
Using a scan tool, read the Transmission Controller DTC and refer to the Transmission Category and perform the appropriate symptom.

PCM Diagnostic Information complete.

Continue

- Test Complete.

P0703-BRAKE SWITCH 2 PERFORMANCE



81917095

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

- **Set Condition:**

When the PCM recognizes Brake Switch No.2 voltage is not equal to the applied value at the PCM when Brake Switch No.1 is applied. This could be a normal condition. If this condition is seen repeatedly by the PCM the fault is set. Cruise will not work for the rest of the key cycle.

Possible Causes
(F941) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(B16) BRAKE SIGNAL 2 CIRCUIT OPEN
(B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND
(B15) BRAKE SIGNAL 1 CIRCUIT OPEN
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.

NOTE: Make sure the Stop Lamp Switch is properly wired, such as (B15) Brake Signal 1 and (B16) Brake Signal 2 circuit are not switched at the harness connector.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F941) FUSED IGNITION SWITCH CIRCUIT

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

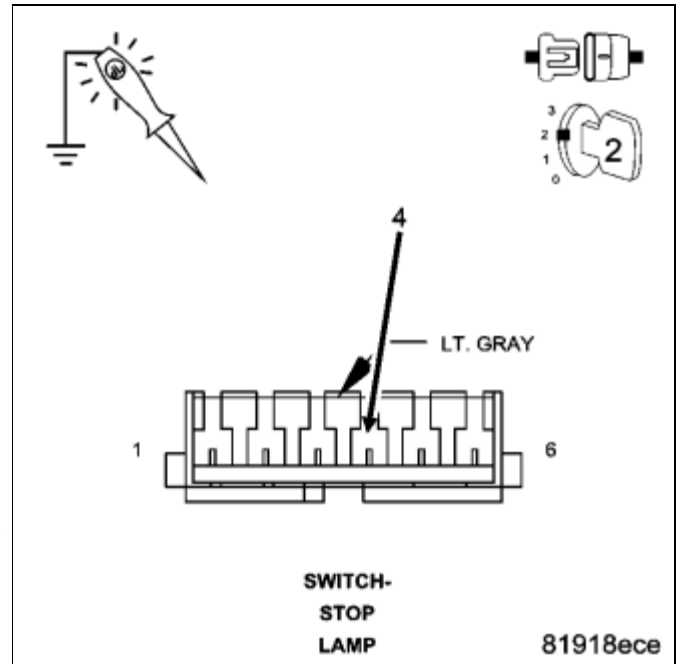
Using a 12-volt test light connected to ground, probe the (F941) Fused Ignition Switch Output circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?**Yes**

- Go To [3](#)

No

- Repair the open or short to ground in the (F941) Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

**3. STOP LAMP SWITCH**

Turn the ignition off.

Measure the resistance between the (F941) Fused Ignition Switch Output circuit terminal and the (B16) Brake Signal 2 circuit terminal in the Stop Lamp Switch.

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit for each circuit check?**Yes**

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors. If OK, replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. (B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.
Measure the voltage on the (B16) Brake Signal 2 circuit in the Stop Lamp Switch harness connector.
Ignition on, engine not running.

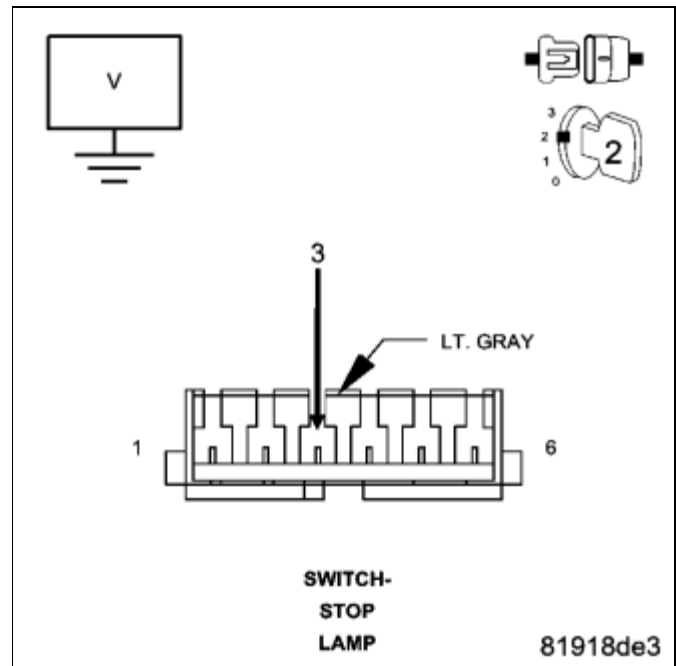
Is there any voltage present?

Yes

- Repair the short to voltage in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (B16) BRAKE SIGNAL 2 CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B16) Brake Signal 2 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

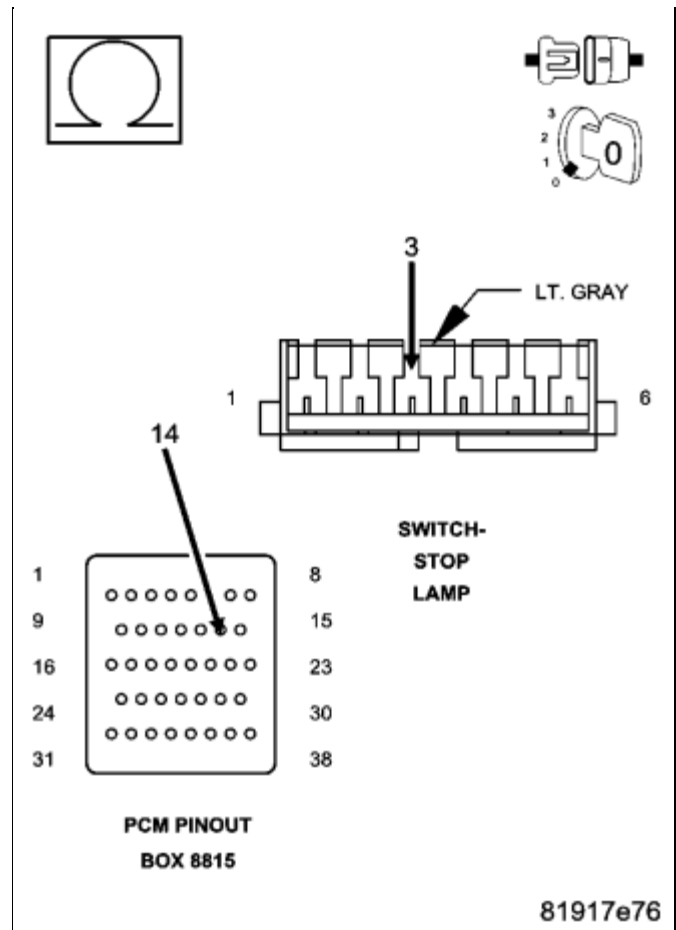
Yes

- Go To [6](#)

No

- Repair the open in the (B16) Brake Signal 2 circuit.

Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B16) Brake Signal 2 circuit in the Stop Lamp Switch harness connector.

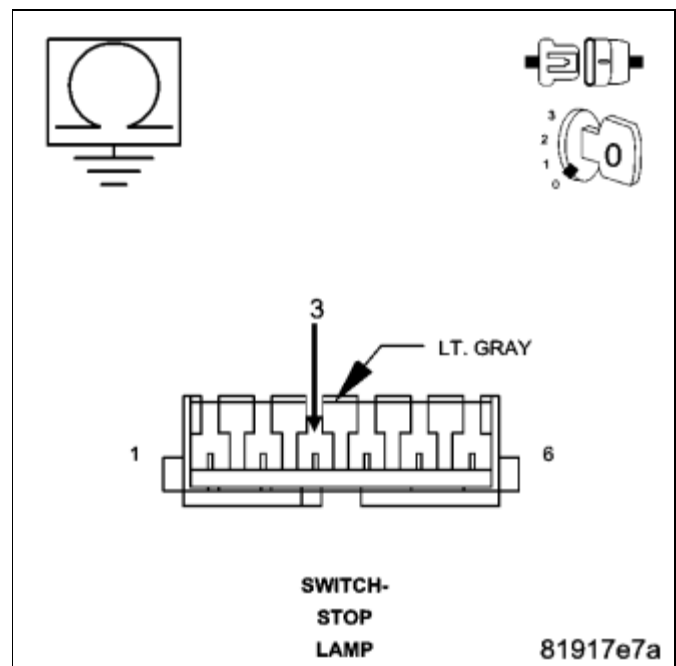
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. (B15) BRAKE SIGNAL 1 CIRCUIT OPEN

Measure the resistance of the (B15) Brake Signal 1 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

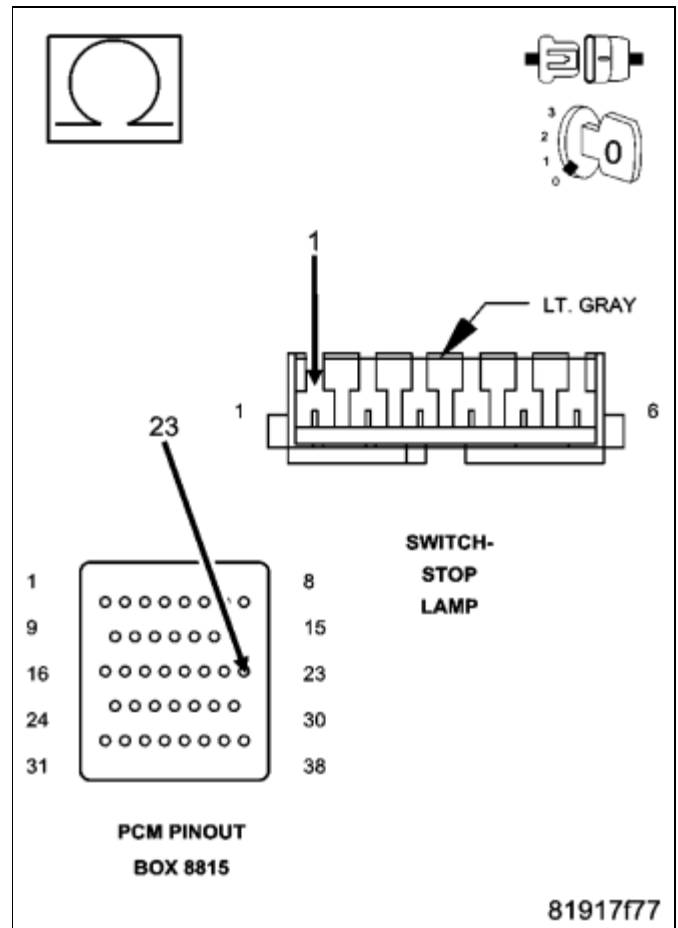
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

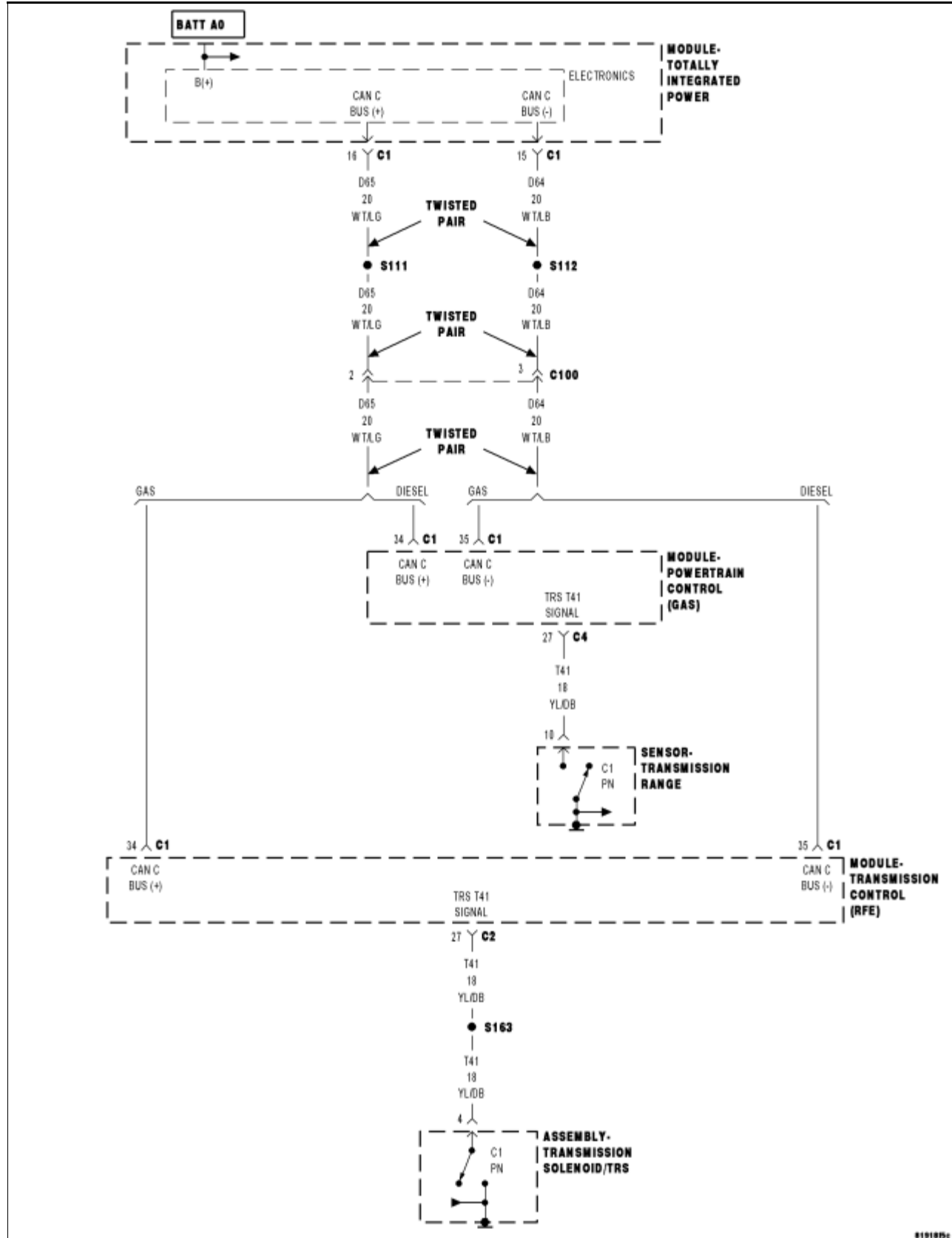
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P0850-PARK/NEUTRAL SWITCH PERFORMANCE



8101020

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Park Neutral switch rationality test is enabled only for vehicles equipped with a 4/5 speed automatic transmission. This diagnostic checks if the park/neutral switch is incorrectly stuck in the neutral position during driving conditions by comparing Vehicle Speed, Engine Speed, Throttle Position, and Pressure Ratio to the fail thresholds and by looking at the state of the Park/Neutral Switch. The stuck in drive condition is not explicitly checked as the starter relay does not energize and therefore render the vehicle inoperable.

- **When Monitored:**

Continuously with the transmission in Park, Neutral, or Drive and NOT in Limp-in mode.

- **Set Condition:**

This code will set if the PCM detects an irrational Park/Neutral switch state for at least one minute. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN
TRS (T41) SENSE (P/N SENSE) CIRCUIT SHORTED TO GROUND
TRANSMISSION RANGE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the TCM for DTCs, if P0706 is set in the TCM diagnose the TCM code before continuing.

Ignition on, engine not running.

While moving the gear selector through all gear positions (Park to 1 and back to Park).

Using a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN

Turn the ignition off.

Disconnect the C4 PCM harness connector.

Disconnect the Transmission Range Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the TRS (T41) Sense (P/N Sense) circuit from the TRS harness connector to the appropriate terminal of special tool #8815.

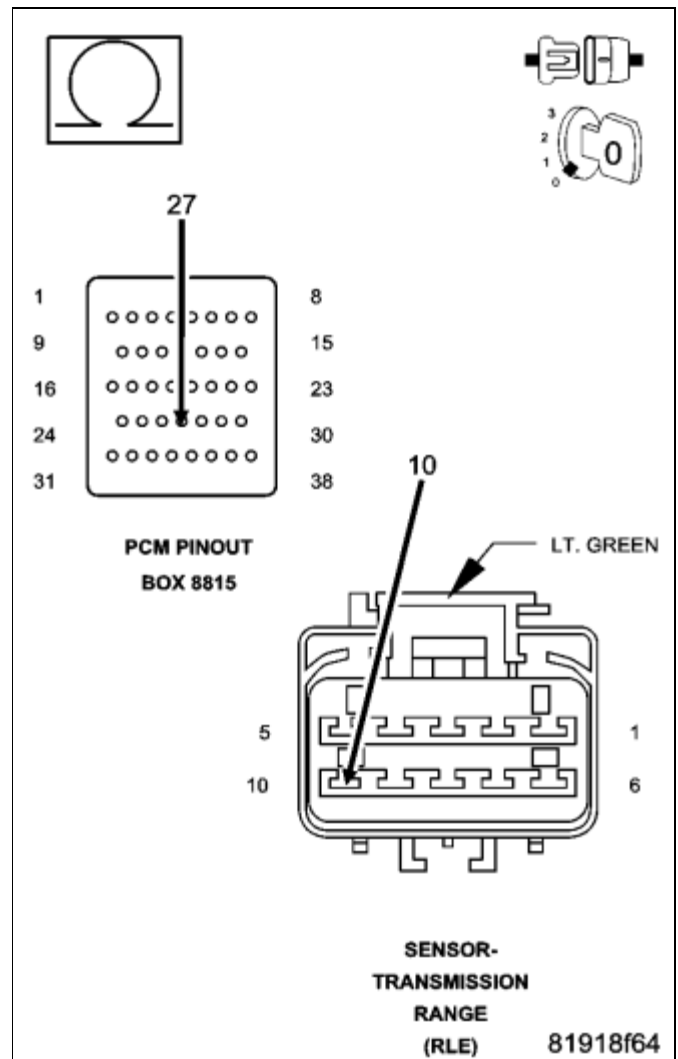
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the open in the TRS (T41) Sense (P/N Sense) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. TRS (T41) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the TRS (T41)

Sense (P/N Sense) circuit at the TRS harness connector.

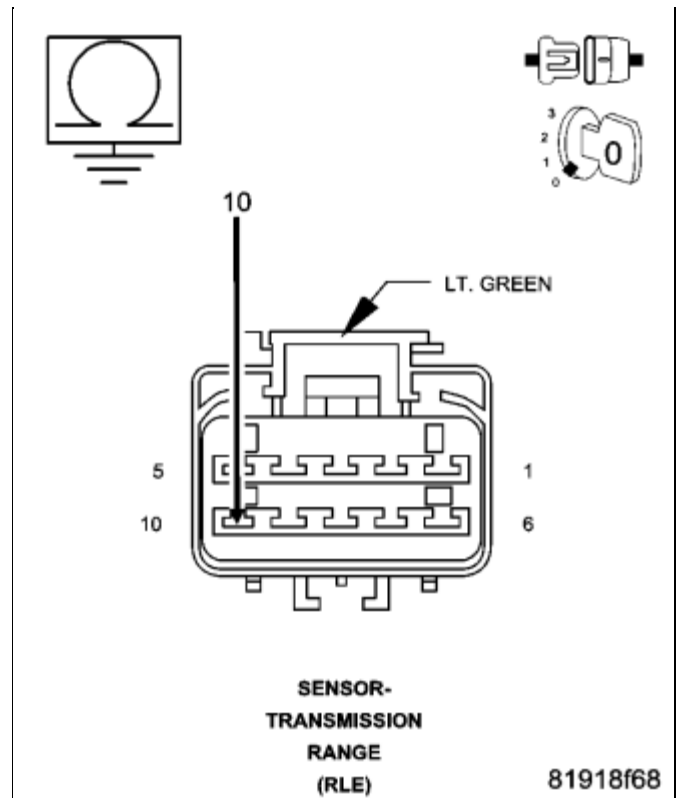
Is the resistance above 100k ohms?

Yes

- Go To [4](#)

No

- Repair the short to ground in the TRS (T41) Sense (P/N Sense) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. TRANSMISSION RANGE SENSOR

Measure the resistance between ground and the (T41) TRS Sense (P/N Sense) circuit while moving the gear selector through each gear in the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

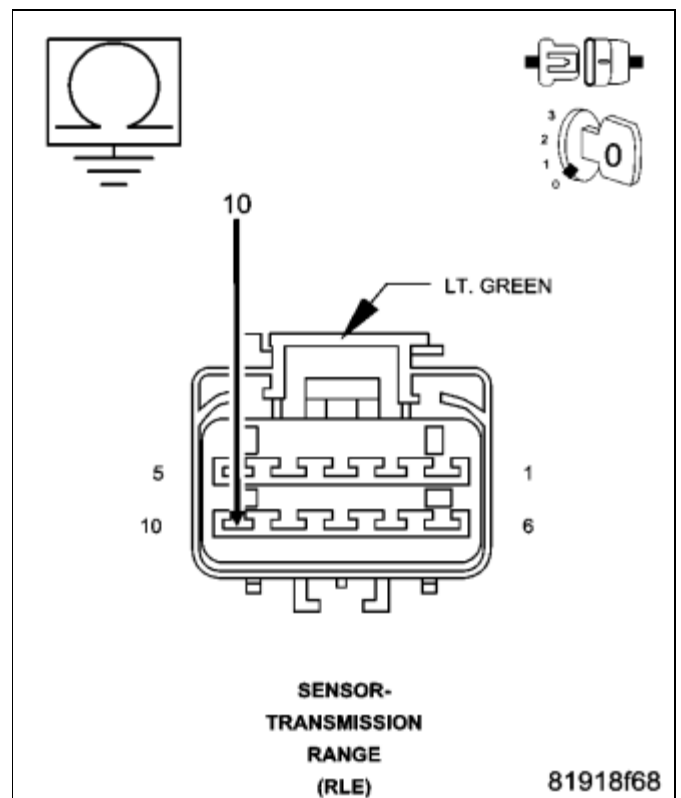
Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded)?

Yes

- Go To [5](#)

No

- Replace the Transmission Range Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Transmission Solenoid and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1115-GENERAL TEMPERATURE RATIONALITY

The General Temperature Rationality looks at the outputs of the three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If two sensors agree but not the third, the third sensor is declared as irrational. If all three sensors are irrational the General Temperature Sensor Rationality is failed.

- **When Monitored:**

Engine off time is greater than 480 minutes and the vehicle has been driven for one minute over 35 mph. Ambient temperature is greater than -64° C (-83° F).

- **Set Condition:**

Once the vehicle is soaked for a calibrated engine off time and then driven over calibrated speed and load conditions for some calibrated time, the PCM compares the ambient air, engine coolant, and intake air temperature sensor values. If the values of all the three sensors disagree with one another, a general temperature sensor irrationality is declared. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE SENSOR SIGNAL CIRCUIT
EXCESSIVE RESISTANCE IN THE SENSOR GROUND CIRCUIT
SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT
TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Turn the ignition off.

If possible, allow the vehicle to sit with the ignition off for more than 480 minutes in an environment where the

temperature is consistent and above -7° C (19.4° F).

Test drive the vehicle. The vehicle must exceed 48 km/h (30 mph) during the test drive. Do not cycle the ignition off when the test drive is completed.

With a scan tool, select View the DTCs.

NOTE: All ECT, Intake Air, and Ambient Air Temperature Sensor codes must be diagnosed and repaired before continuing.

NOTE: In cold weather, this DTC could be set by a high powered block heater and no repair would be required.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. TEMPERATURE SENSOR CIRCUIT

With a scan tool, read the ECT, Ambient Air Temp, and Intake Air Temp Sensor temp values.

Start the engine.

Allow the engine to reach normal operating temperature while monitoring the three Sensor temperature values.

Is the temperature for each of the Sensors increasing properly?

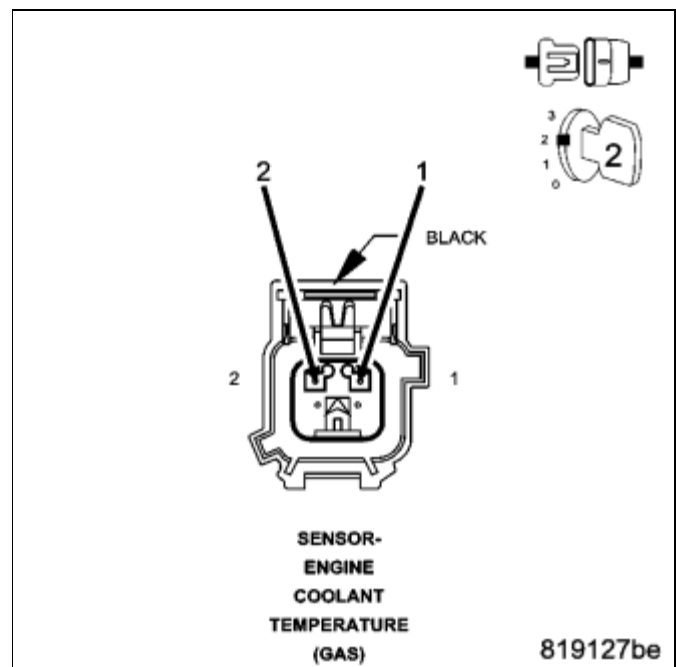
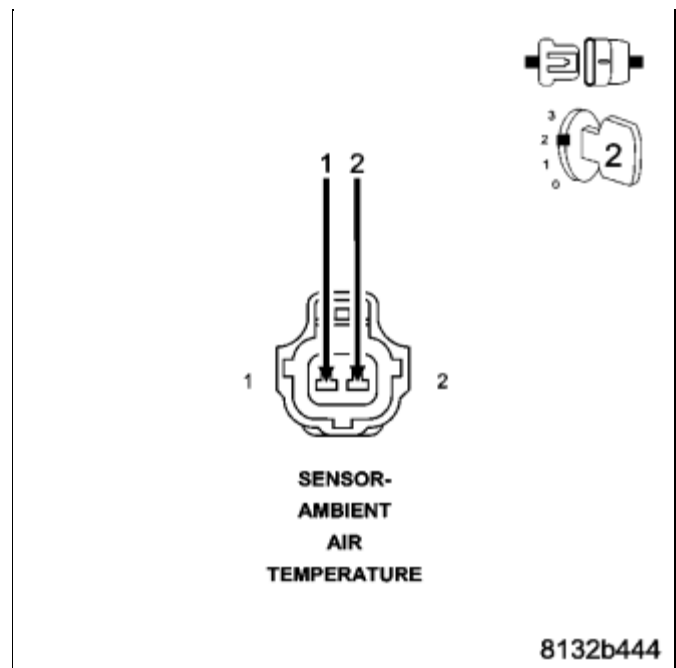
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [3](#)

3. TEMPERATURE SENSOR



Disconnect the suspected sensor.

Ignition on, engine not running.

With the scan tool, read the voltage of the suspected Sensor.

Connect a jumper wire between the Sensor Signal circuit and the Sensor ground circuit.

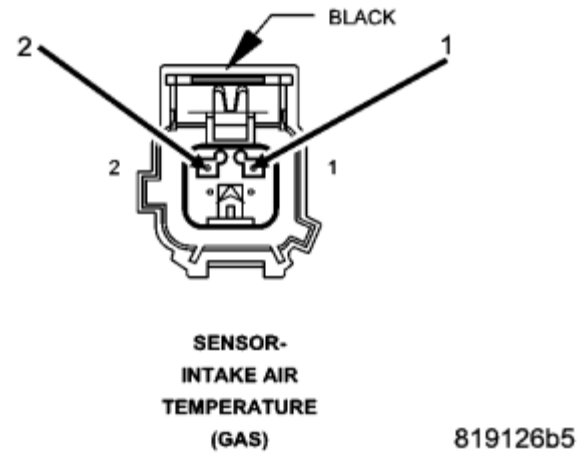
Did the voltage reading start at 4.8 to 5.0 volts and decrease to 0 volts when the jumper wire was installed?

Yes

- Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module

connectors. Replace the Sensor if no problems were found in the connectors.

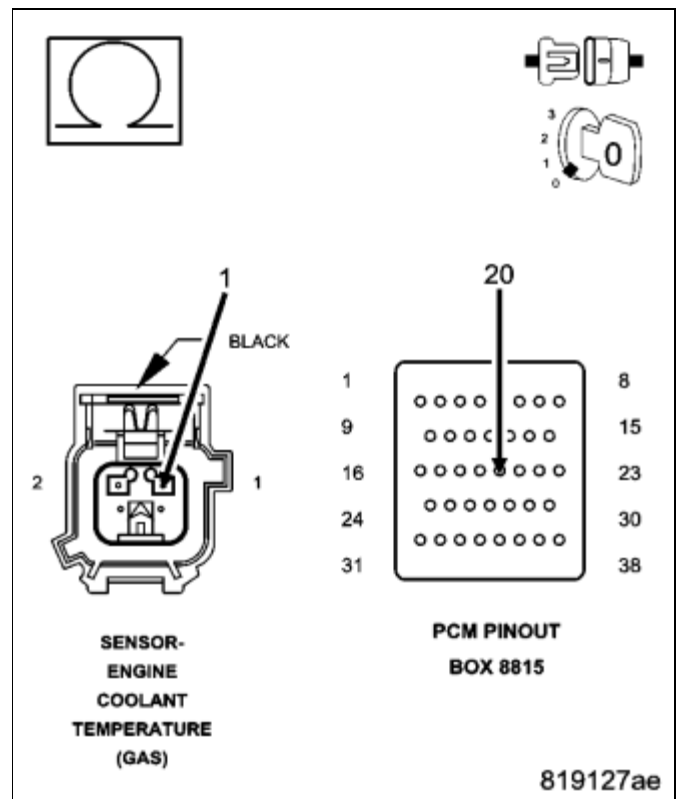
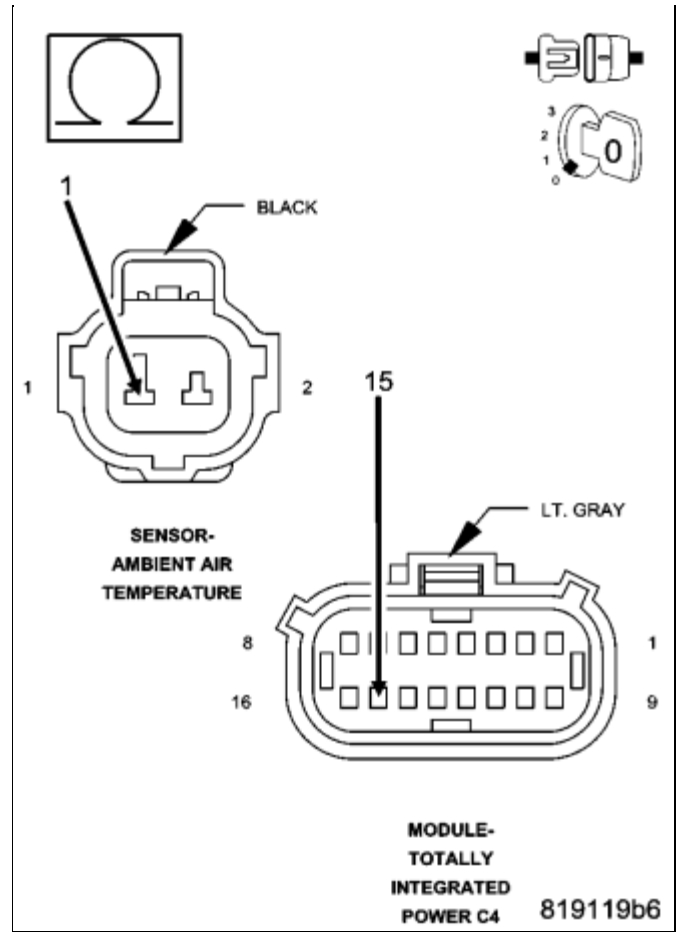
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [4](#)
- **NOTE: Remove the jumper wire before continuing.**

4. EXCESSIVE RESISTANCE IN THE TEMPERATURE SENSOR SIGNAL CIRCUIT



Turn the ignition off.

Disconnect the C2 PCM harness connector.
Disconnect the C4 TIPM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Sensor Signal circuit from the Sensor harness connector to the appropriate terminal of special tool #8815 for the ECT Sensor and IAT Sensor. Measure the resistance of the (G31) AAT Sensor Signal circuit from the Sensor harness connector to the C4 TIPM harness connector.

Is the resistance above 5.0 ohms.

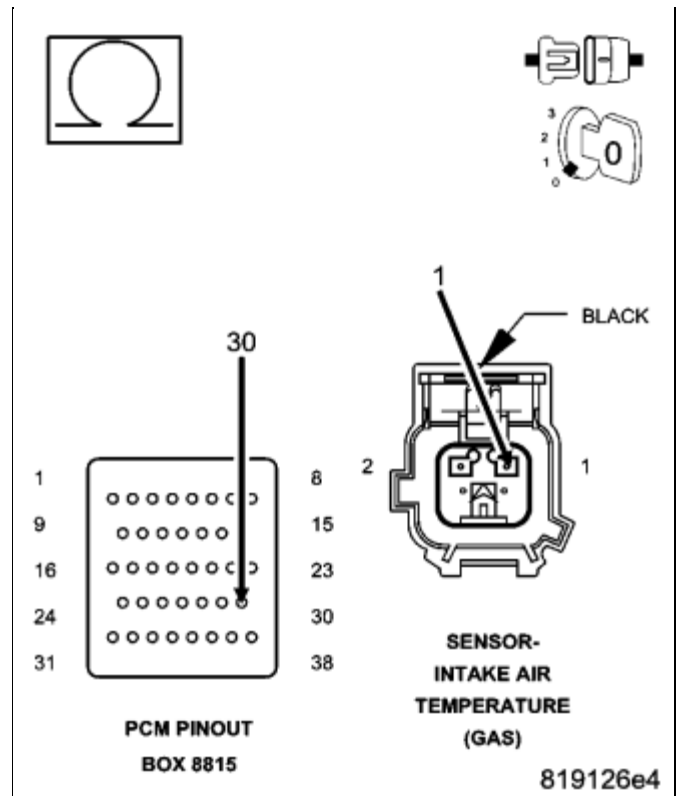
Yes

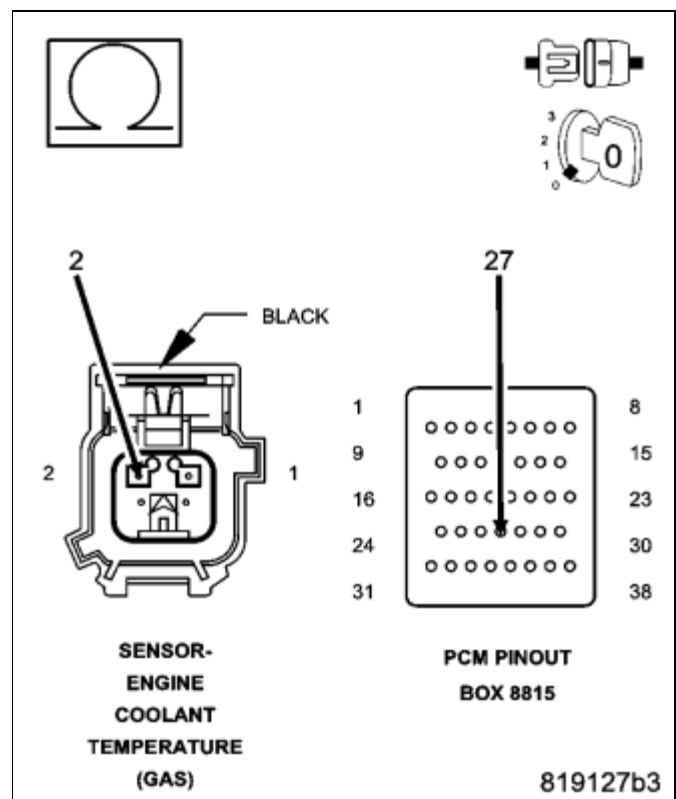
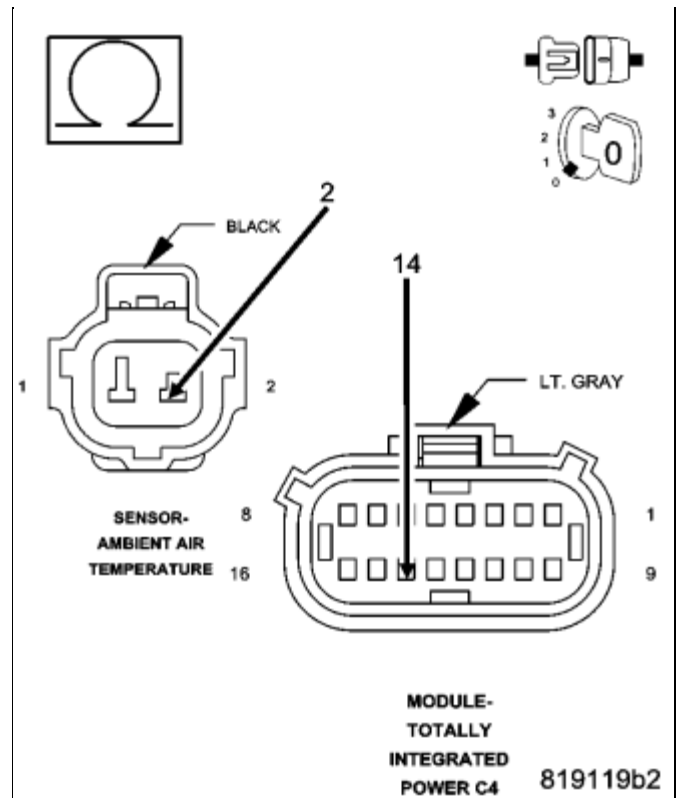
- Repair the excessive resistance in the Temperature Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. EXCESSIVE RESISTANCE IN THE SENSOR GROUND CIRCUIT





Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor and IAT Sensor to the appropriate terminal of special tool #8815.

Measure the resistance of the (G931) Sensor ground circuit from the AAT Sensor harness connector to the C4 TIPM

harness connector.

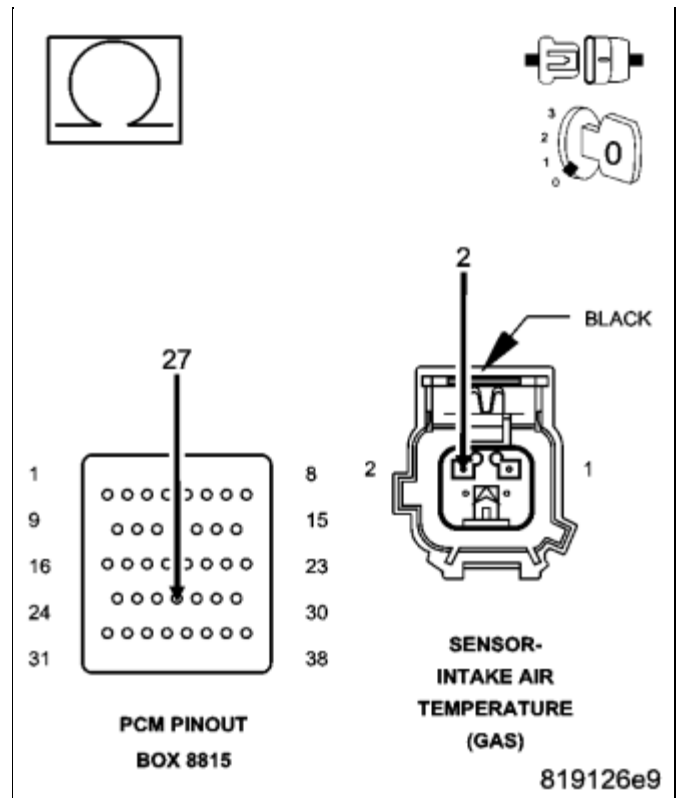
Is the resistance above 5.0 ohms.

Yes

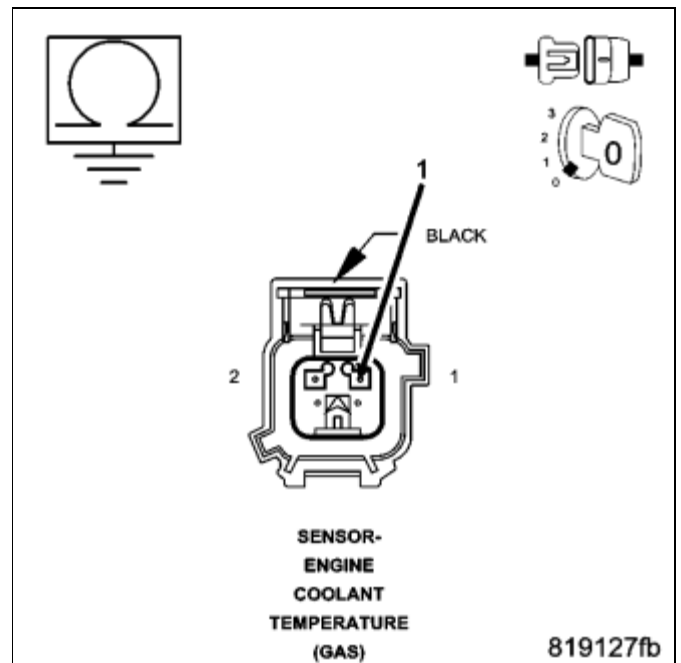
- Repair the excessive resistance in the Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

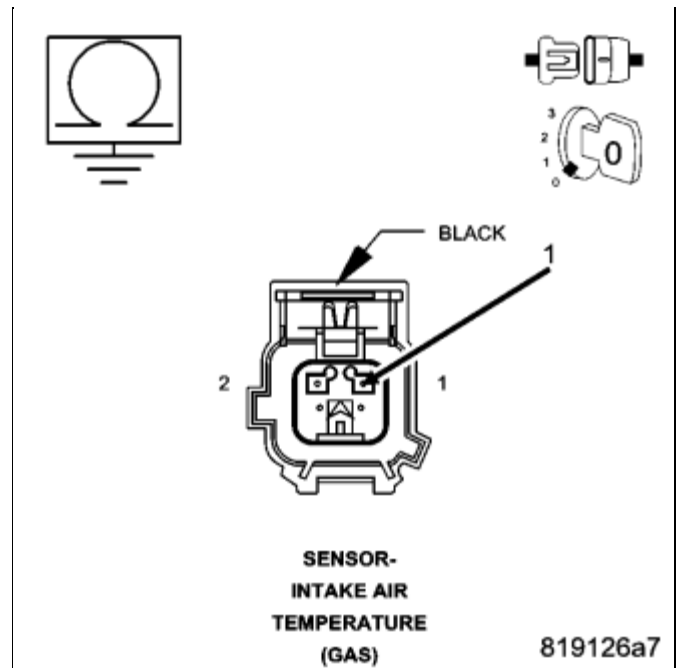
No

- Go To [6](#)



6. SENSOR SIGNAL CIRCUIT SHORTED TO GROUND





Measure the resistance between ground and the Sensor Signal circuit at the Sensor harness connector.

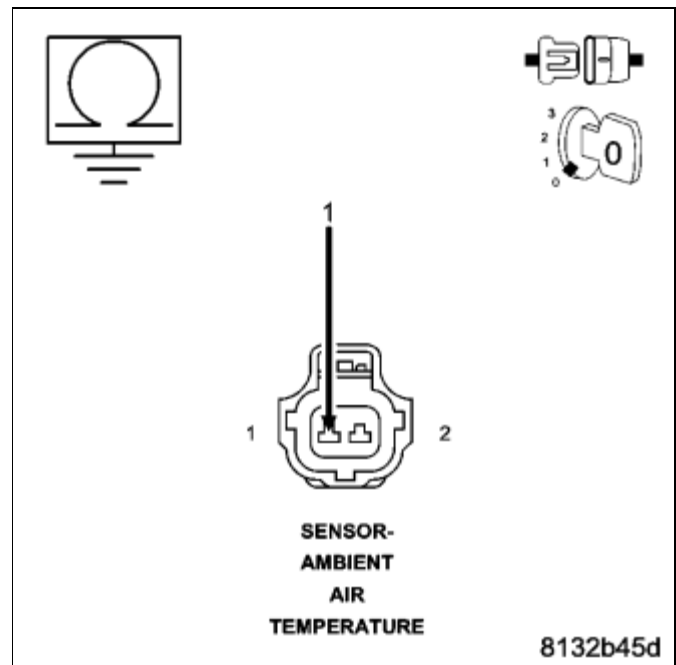
Is the resistance below 100 ohms?

Yes

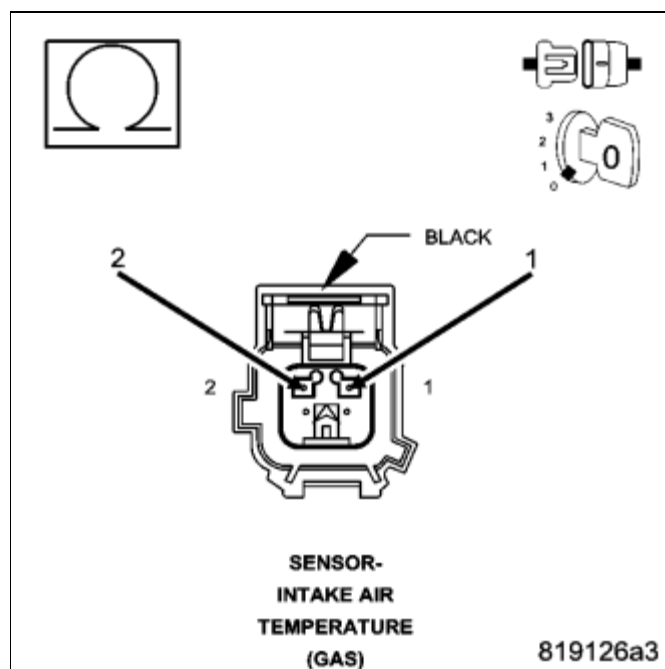
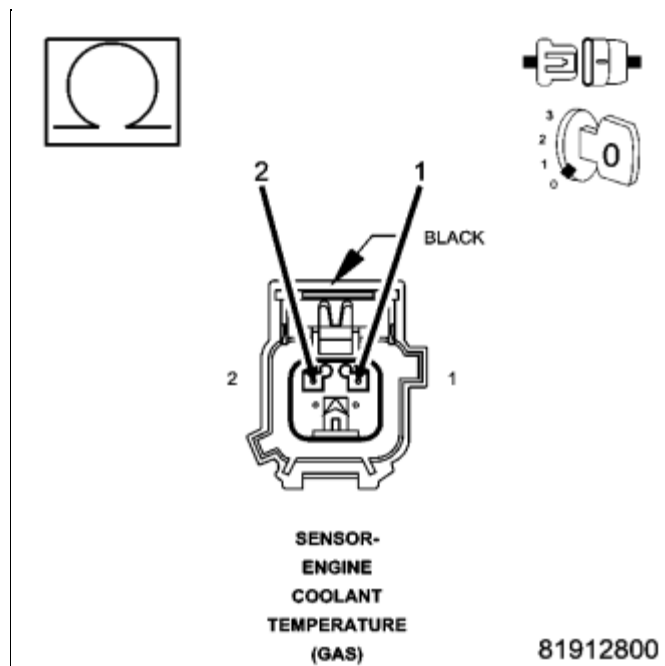
- Repair the short to ground in the Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [7](#)



7. SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT



Measure the resistance between ground and the Sensor Signal circuit at the Sensor harness connector.

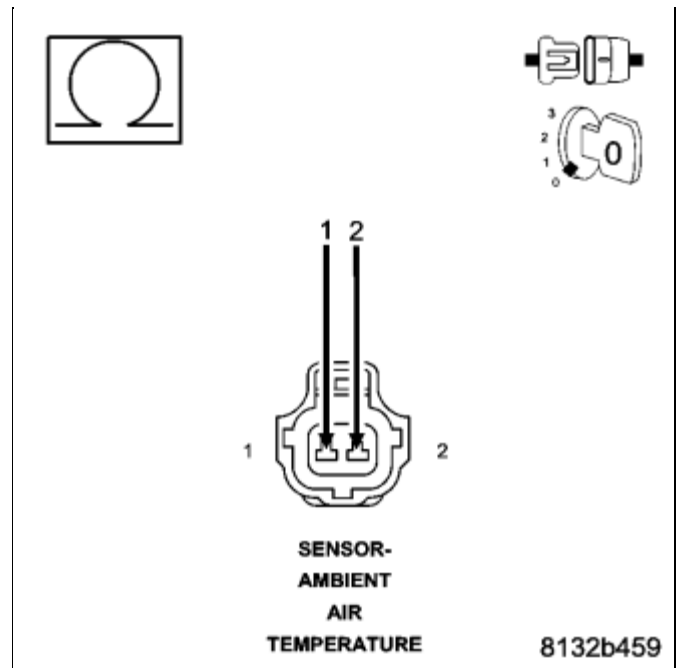
Is the resistance below 100 ohms?

Yes

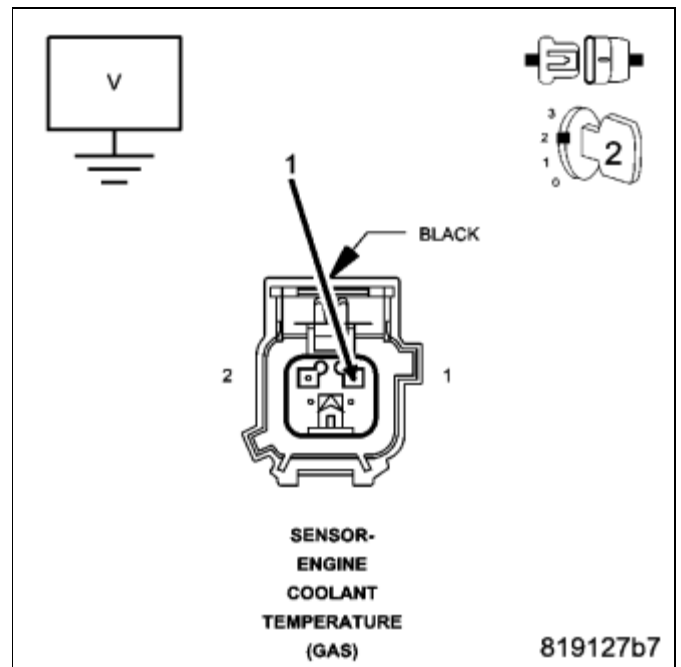
- Repair the short between the Sensor ground circuit and the Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

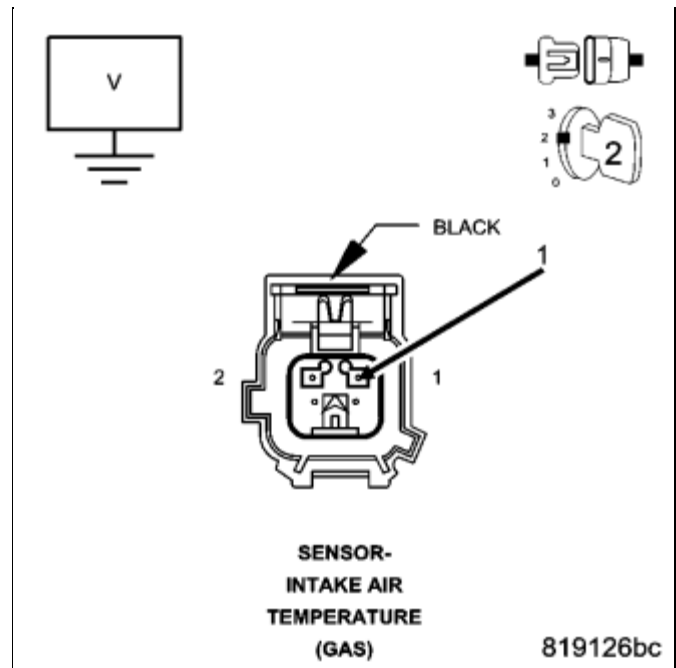
No

- Go To [8](#)



8. SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE





Turn the ignition on.
Measure the voltage on the Sensor Signal circuit at the Sensor harness connector.

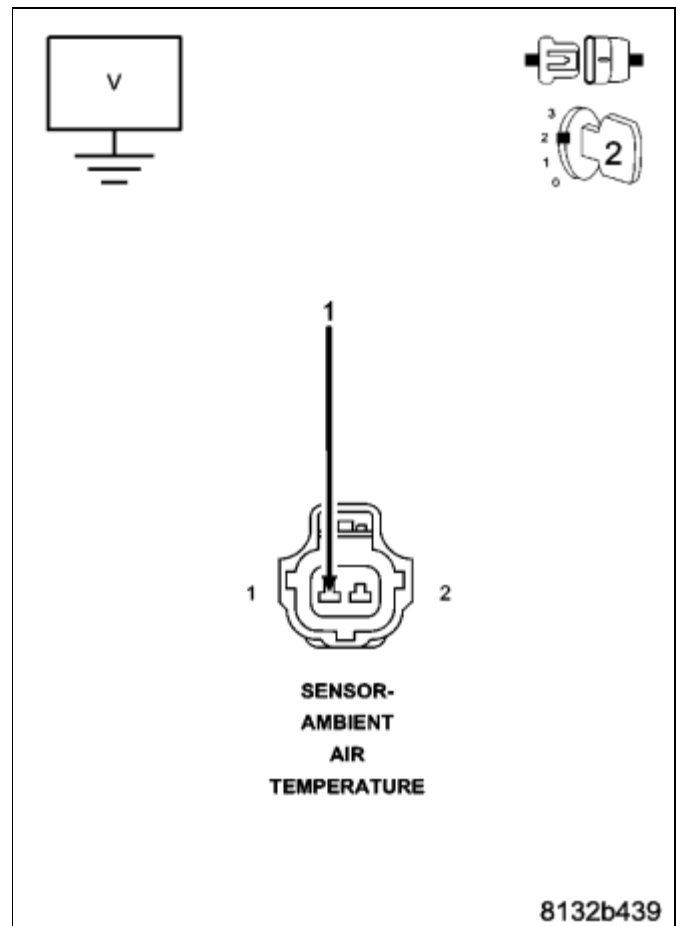
Is there any voltage present?

Yes

- Repair the short to voltage in the Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [9](#)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor and the Powertrain Control Module (PCM).
Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1128-CLOSED LOOP FUELING NOT ACHIEVED - BANK 1

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Engine running in closed loop mode.

- **Set Condition:**

Enable conditions are met and the O2 sensor has not been in closed loop control at least once on each of the two consecutive trips, the MIL illuminates and the DTC is set. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
1/1 O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL PROBLEM

FUEL FILTER/PRESSURE REGULATOR (HIGH)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

Below Specification

- Go To [12](#)
- **CAUTION: Stop All Actuations.**

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With a scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?

Yes

- Go To [4](#)

No

Go To [8](#)

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the 1/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1 inch of Hg on the Vacuum Gauge reading?

Yes

- Go To [6](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. If OK, replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. If OK, replace the Engine Coolant Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. ENGINE MECHANICAL PROBLEM

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)

8. 1/1 O2 SENSOR

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K41) Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire installed?

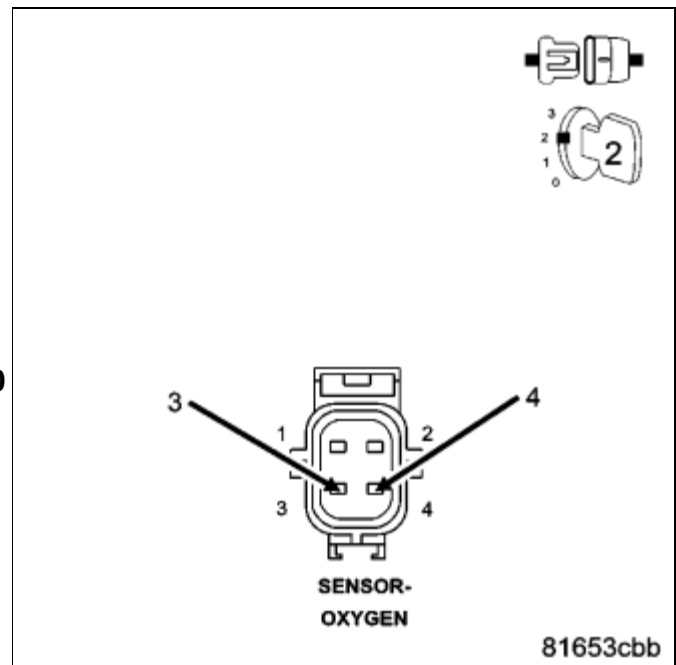
Yes

- Verify that there is good pin to terminal contact in the 1/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the 1/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

NOTE: Remove the jumper wire before continuing.

**9. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT**

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [10](#)

No

- Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

10. (K902) O2 RETURN UPSTREAM CIRCUIT

Disconnect the 1/1 O2 Sensor harness connector.
Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

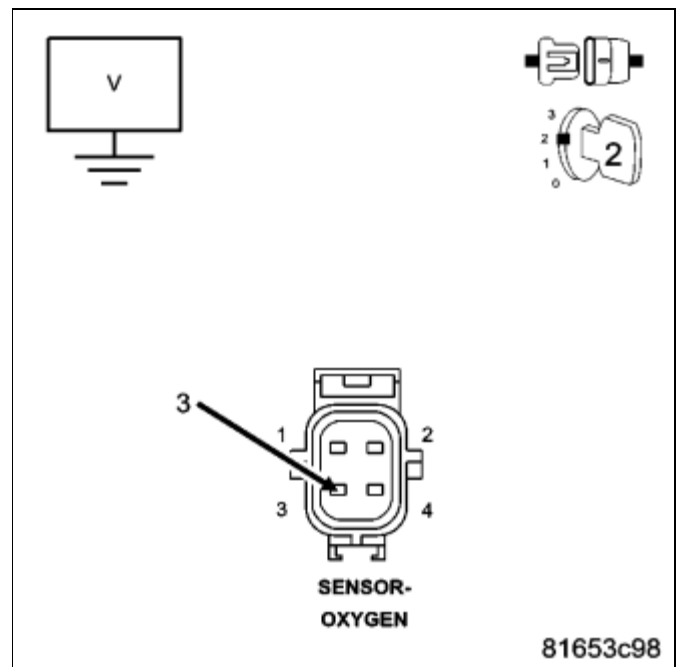
Is the voltage at 2.5 volts?

Yes

- Go To [11](#)

No

- Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor and the Powertrain Control Module (PCM).
Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.
Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.
Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.
Attach a fuel pressure test gauge to the T fitting on tool #6539.
Ignition on, engine not running.
With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)
- **CAUTION: Stop All Actuations.**

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or

servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.
Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [14](#)

14. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

- Verify that there is good pin to terminal contact in the Fuel Pump Module, Relay, and Powertrain Control Module connectors. If OK, replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1129-CLOSED LOOP FUELING NOT ACHIEVED - BANK 2

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Engine running in closed loop mode.

- **Set Condition:**

Enable conditions are met and the O2 sensor has not been in closed loop control at least once on each of the two consecutive trips, the MIL illuminates and the DTC is set. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE

O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
2/1 O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL PROBLEM
FUEL FILTER/PRESSURE REGULATOR (HIGH)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

- Go To [3](#)

Above Specification

- Replace the fuel filter/pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

Below Specification

- Go To [12](#)
- **CAUTION: Stop All Actuations.**

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes

- Go To [4](#)

No

- Go To [8](#)

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

NOTE: Perform the following test on all O2 Sensors.

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the 2/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1 inch of Hg on the Vacuum Gauge reading?

Yes

- Go To [6](#)

No

- Verify that there is good pin to terminal contact in the MAP Sensor and Powertrain Control Module connectors. If OK, replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82° C (180° F). The value should reach at least 82° C (180° F).

Did the ECT value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors. If OK, replace the Engine Coolant Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. ENGINE MECHANICAL PROBLEM

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral.

ENGINE VALVE TIMING - must be within specifications.

ENGINE COMPRESSION - must be within specifications.

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely.

TORQUE CONVERTER STALL SPEED - must be within specifications.

POWER BRAKE BOOSTER - no internal vacuum leaks.

FUEL - must be free of contamination.

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector.

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)

8. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/1 O2 Sensor harness connector.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read between 4.1 and 5.0 volts on the scan tool with the connector disconnected.

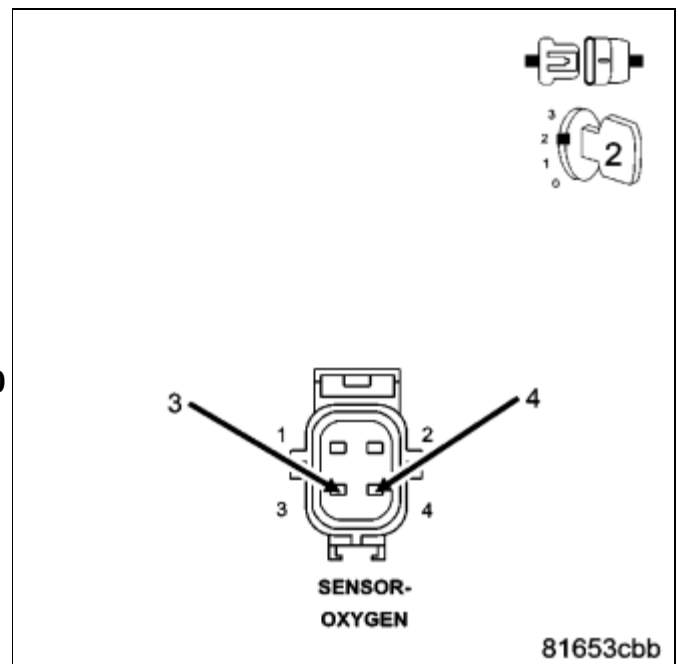
Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from between 4.1 and 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from between 4.1 and 5.0 volts to 2.5 volts when the jumper wire was installed?

Yes

- Verify that there is good pin to terminal contact in the 2/1 O2 Sensor and Powertrain Control Module connectors. If OK, replace the 2/1 O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [9](#)

NOTE: Remove the jumper wire before continuing.

9. O2 SENSOR SIGNAL CIRCUIT

With the scan tool, monitor all the O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage between 4.1 and 5.0 volts?

Yes

- Go To [10](#)

No

- Check all the O2 Signal circuits for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

10. (K902) O2 RETURN UPSTREAM CIRCUIT

Disconnect the 2/1 O2 Sensor harness connector.
Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

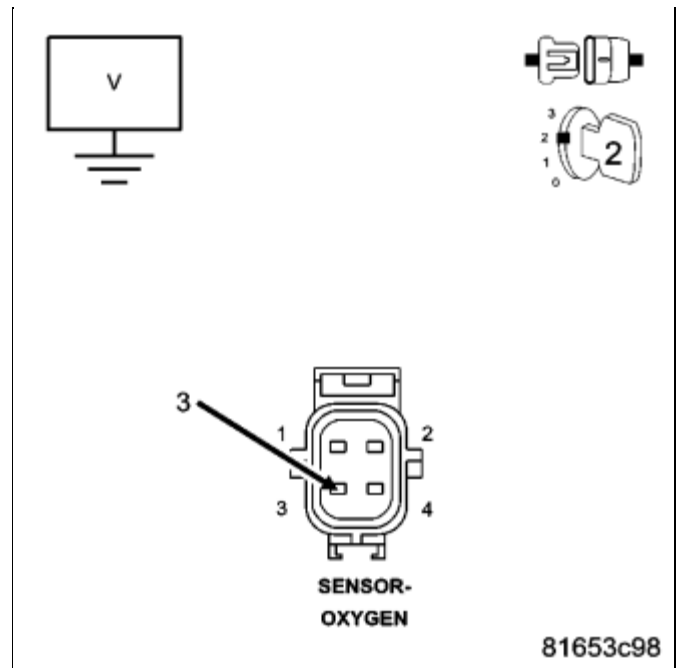
Is the voltage at 2.5 volts?

Yes

- Go To [11](#)

No

- Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.
Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Repair or replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)
- **CAUTION: Stop All Actuations.**

13. FUEL PUMP INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [14](#)

14. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

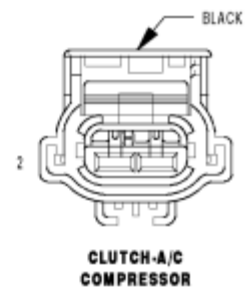
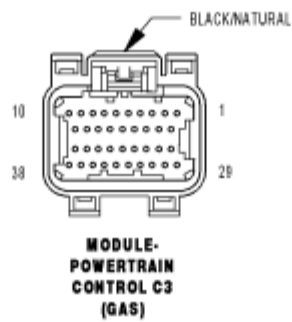
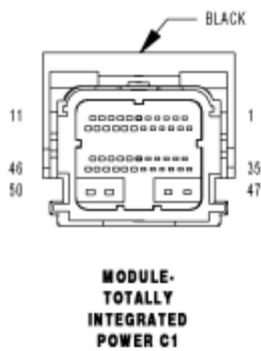
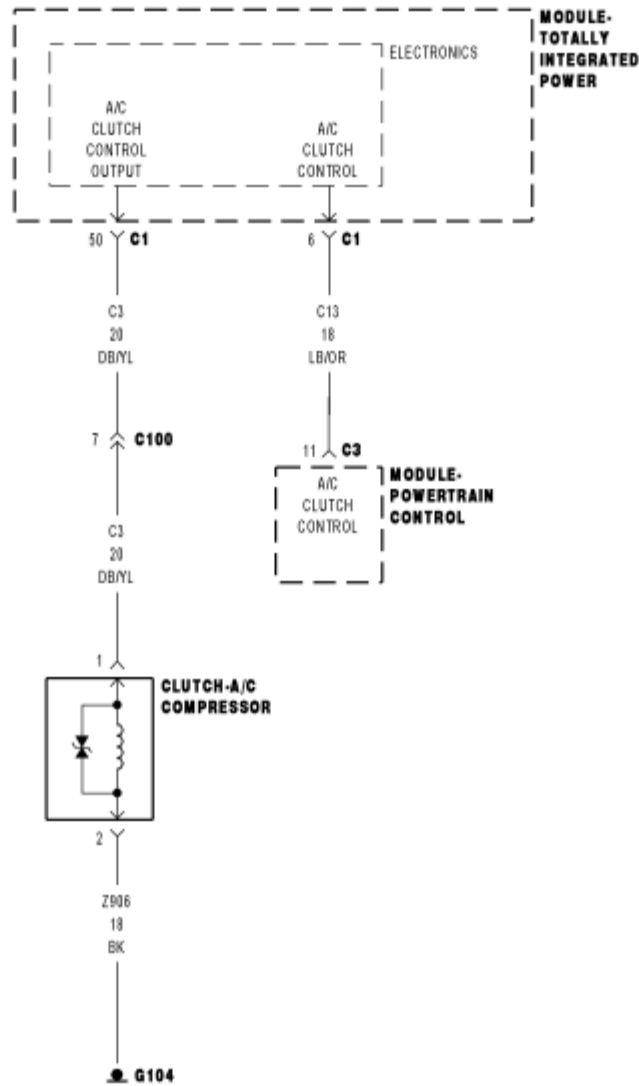
Repair

- Verify that there is good pin to terminal contact in the Fuel Pump Module, Relay, and Powertrain Control

Module connectors. If OK, replace the Fuel Pump Module.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1273-A/C CLUTCH CONTROL CIRCUIT 2 HIGH (TIPM)



818100cc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.

◦ **Set Condition:**

A shorted high condition has been detected in the A/C Clutch Control output circuit by the TIPM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT SHORTED TO VOLTAGE
EXCESSIVE RESISTANCE IN THE (Z906) A/C CLUTCH GROUND CIRCUIT
A/C COMPRESSOR CLUTCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C CLUTCH OPERATION

Ignition on, engine not running.

With a scan tool under the PCM Actuators, actuate the A/C Clutch.

Is the A/C Clutch actuating?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [2](#)

2. A/C CLUTCH CONTROL OPERATION FROM THE PCM

Turn the ignition off.
 Disconnect the C1 TIPM harness connector.
 Ignition on, engine not running.
 Using the scan tool under the PCM Actuators, actuate the A/C Clutch.
 With a 12-volt test light connected to ground, probe the (C13) A/C Clutch Control circuit in the C1 TIPM harness connector.

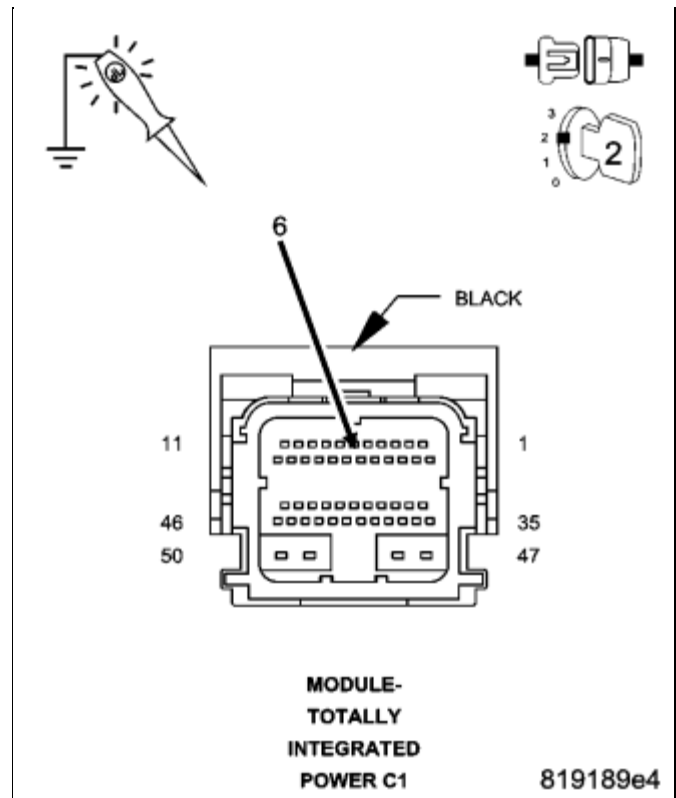
Does the test light illuminate brightly and flash on and off?

Yes

- Go To [3](#)

No

- Perform the Diagnostic Procedure for P0645-A/C CLUTCH CONTROL CIRCUIT. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)



3. (C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the A/C Compressor Clutch harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (C3) A/C Clutch Control Output circuit at the A/C Compressor Clutch harness connector.

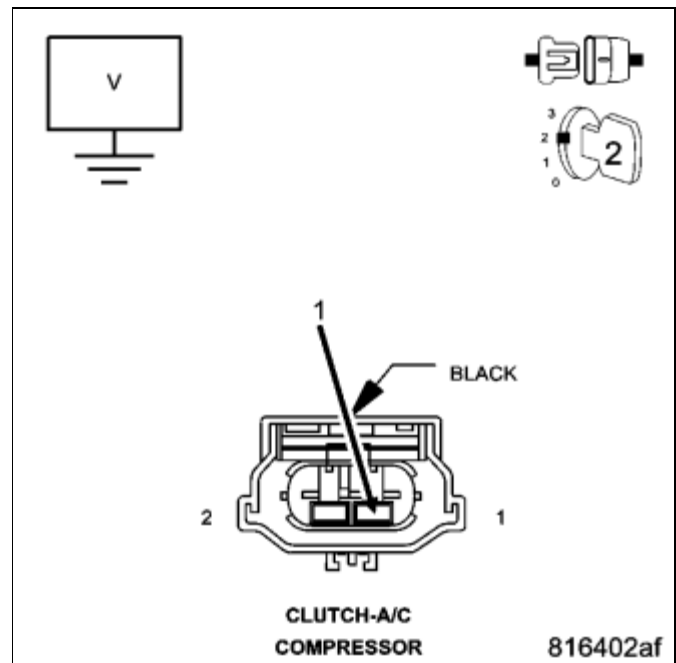
Is there any voltage present?

Yes

- Repair the short to voltage in the (C3) A/C Clutch Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. A/C CLUTCH GROUND CIRCUIT OPEN

Turn the ignition off.
 Connect the C1 TIPM harness connector.
 Using a 12-volt test light connected to 12-volts, probe the (Z906) A/C Clutch ground circuit at the A/C Compressor Clutch harness connector.

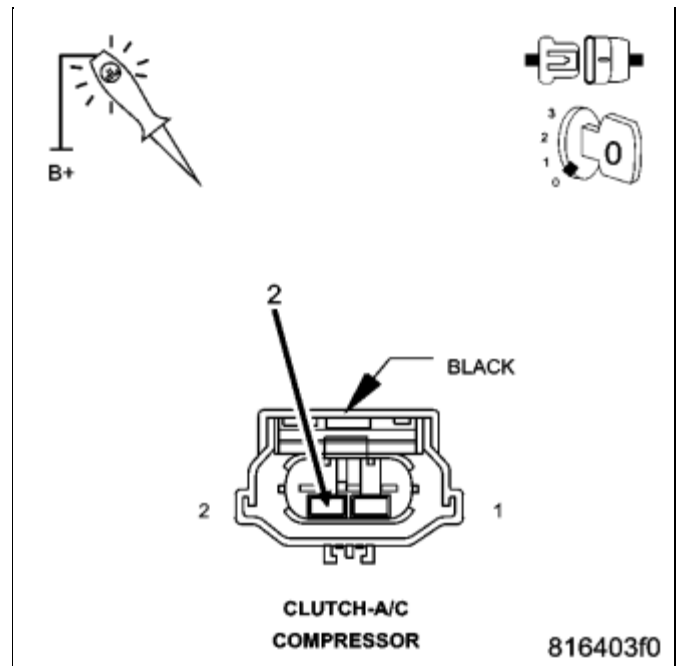
Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (Z906) A/C Clutch ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



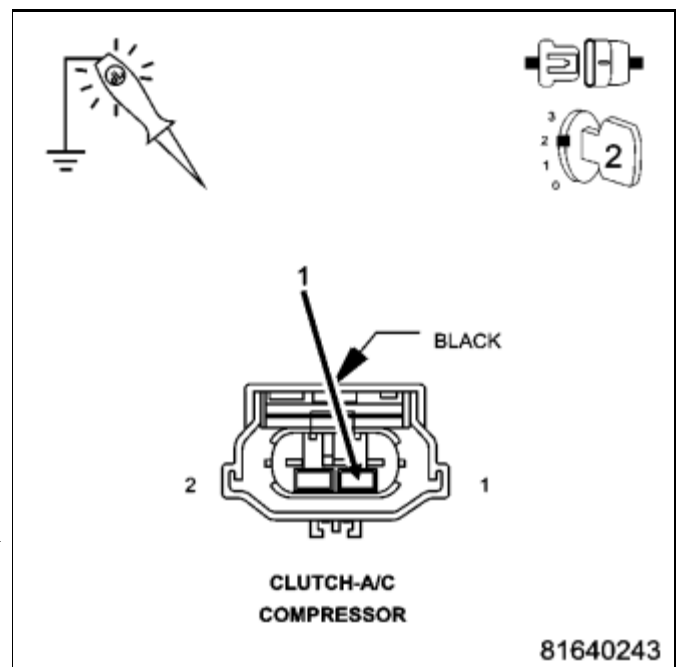
5. A/C COMPRESSOR CLUTCH

Ignition on, engine not running.
 Using the scan tool under the TIPM Actuators, actuate the A/C Clutch.
 With a 12-volt test light connected to ground, probe the (C3) A/C Clutch Control Output circuit at the A/C Compressor Clutch harness connector.

Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the A/C Clutch, TIPM, and Powertrain Control Module connectors. If OK, replace the A/C Compressor Clutch per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [6](#)

6. TOTALLY INTEGRATED POWER MODULE (TIPM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the A/C Clutch,

TIPM, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the A/C Clutch, TIPM, and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

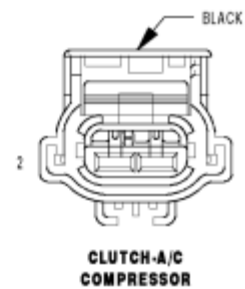
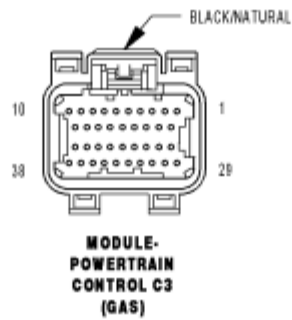
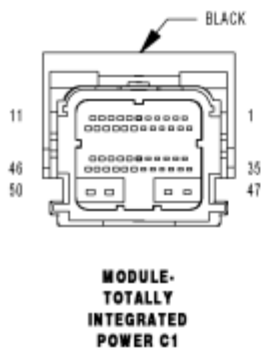
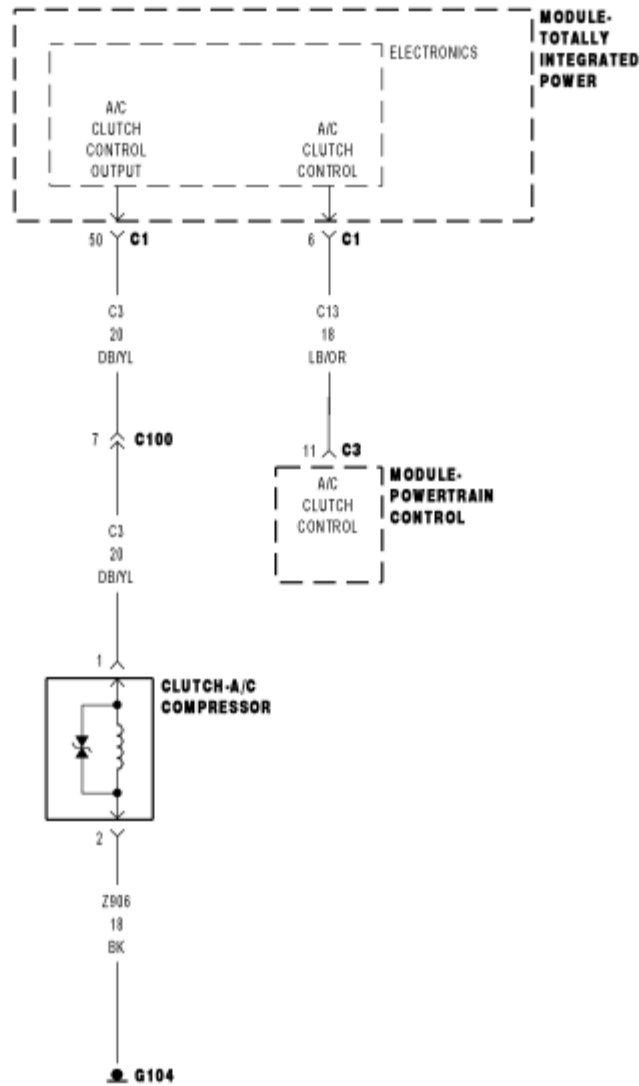
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

P1275-A/C CLUTCH CONTROL CIRCUIT 2 OVERCURRENT (TIPM)



818100cc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts. TIPM requesting A/C Clutch operation.

◦ **Set Condition:**

An overcurrent condition is detected in the A/C Clutch control output circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
TERMINAL DAMAGE OR CORROSION
A/C CLUTCH GROUND HIGH RESISTANCE
(C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT HIGH RESISTANCE
(C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT SHORTED TO GROUND
A/C COMPRESSOR CLUTCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C CLUTCH OPERATION

Ignition on, engine not running.

With a scan tool in the TIPM Actuators, actuate the A/C Clutch.

Is the A/C Clutch actuating?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [2](#)

2. VISUAL AND PHYSICAL CONNECTOR AND TERMINAL INSPECTION

Turn the ignition off.

Disconnect the C1 TIPM harness connector.

Disconnect the A/C Clutch harness connector.

Inspect the terminal and connector condition. Check for signs of corrosion build up or damage the would compromise the terminal to controller pin connector.

NOTE: Make sure that all in-line connectors are inspected for corrosion and/or damage.

Visually inspect the wiring harness. Look for any chafed, pierced, pinched or partially broken wires hidden in the wire insulation.

Were any of the above conditions found?

Yes

- Repair or replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT EXCESSIVE RESISTANCE

With a jumper wire, connect one end to the (C3) A/C Clutch Control Output circuit in the A/C Clutch harness connector and the other to a clean chassis ground.

Using a 12-volt test light connected to battery voltage, probe the (C3) A/C Clutch Control Output circuit in the C1 TIPM harness connector.

NOTE: The test light should be illuminated and bright. Compared the brightness to that of a direct connection to the battery.

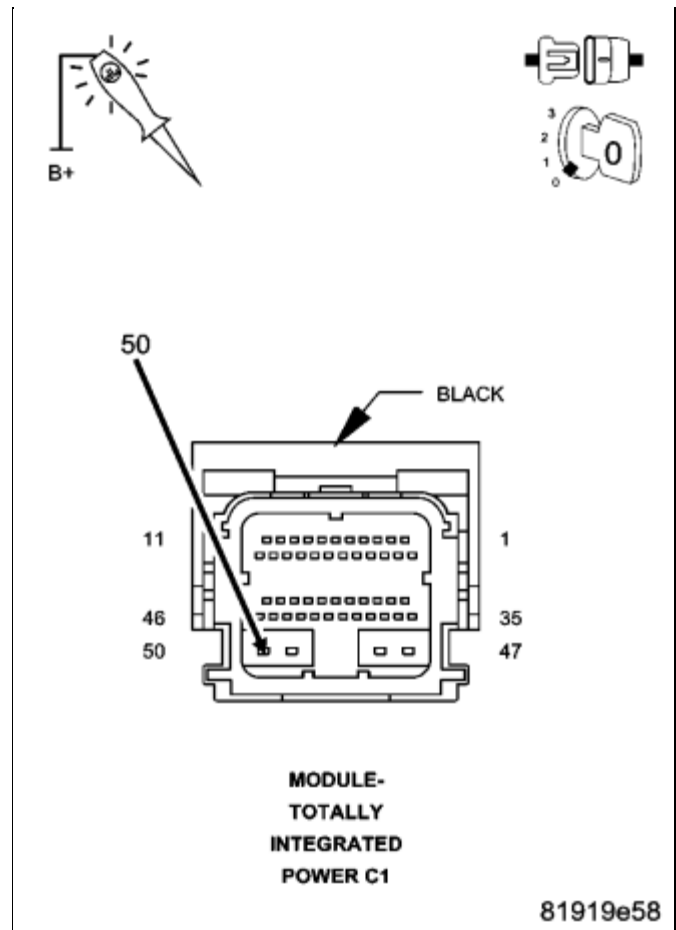
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (C3) A/C Clutch Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST.



(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. (C3) A/C CLUTCH CONTROL OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C3) A/C Clutch Control Output circuit at the A/C Clutch harness connector.

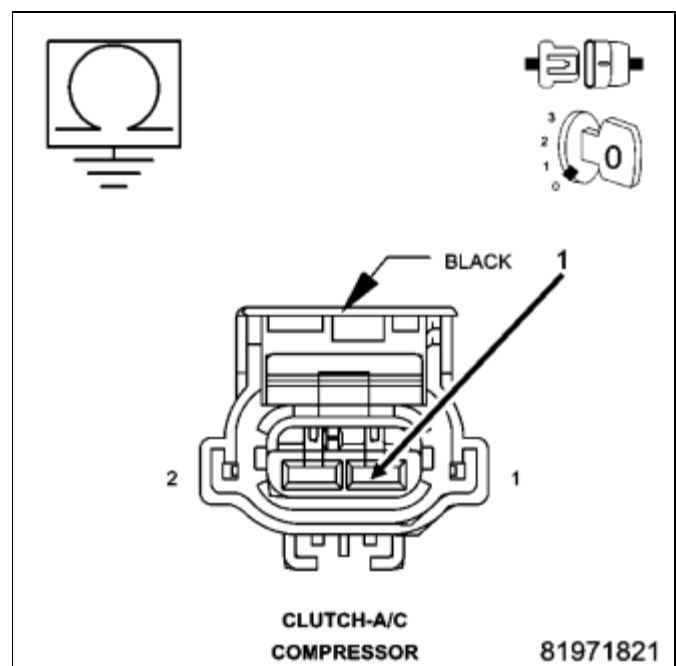
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (C3) A/C Clutch Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. A/C CLUTCH GROUND CIRCUIT

Using a 12-volt test light connected to battery voltage, probe the (Z906) A/C Clutch Ground circuit in the A/C Clutch harness connector.

NOTE: The test light should be illuminated and bright. Compared the brightness to that of a direct connection to the battery.

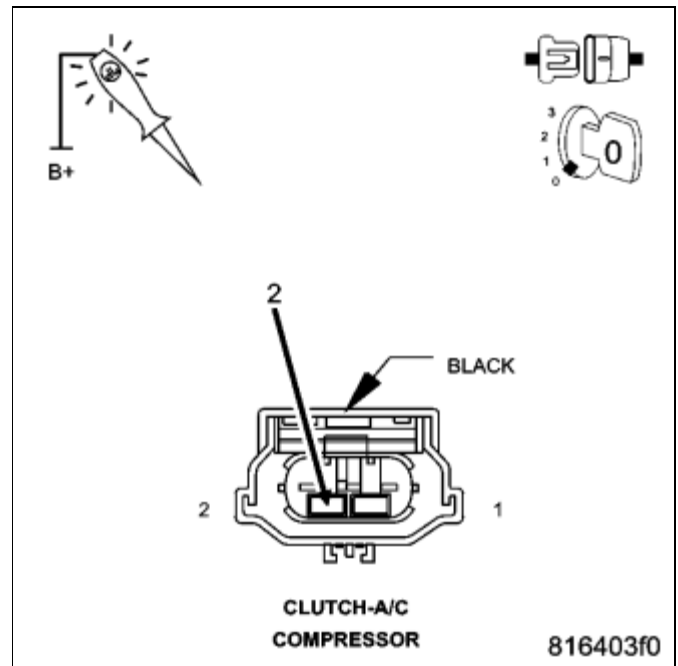
Does the test light illuminate brightly?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (Z906) A/C Clutch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. A/C CLUTCH CONTROL OUTPUT FROM TIPM

Reconnect the C1 TIPM harness connector.

Ignition on, engine not running.

With a scan tool in the TIPM Actuators, actuate the A/C Clutch.

Using the 12-volt test light connected to ground, probe the (C3) A/C Clutch Control Output circuit in the A/C Clutch harness connector.

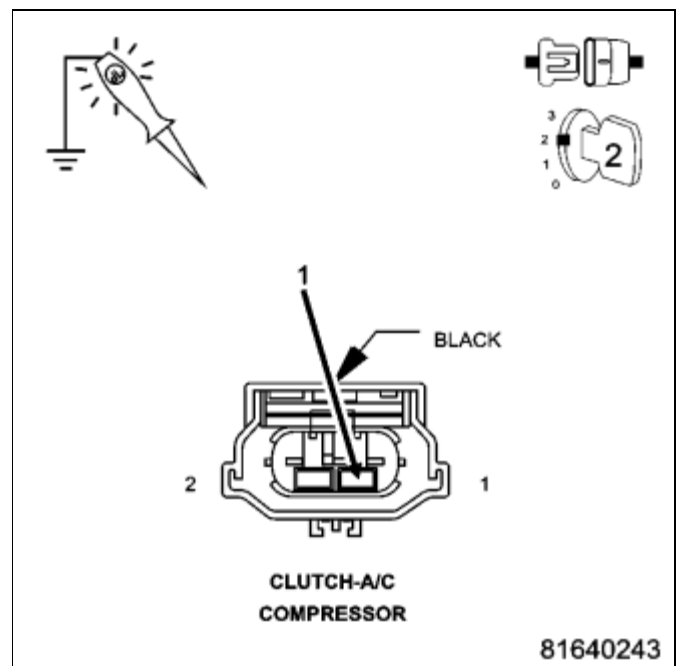
Does the test light illuminate brightly?

Yes

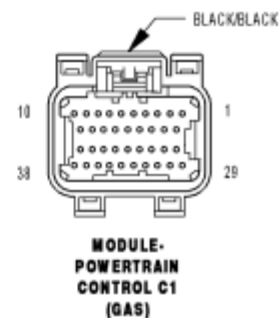
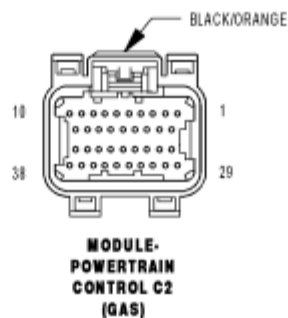
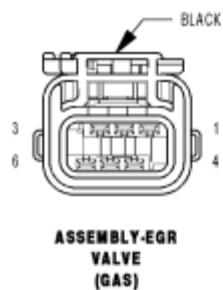
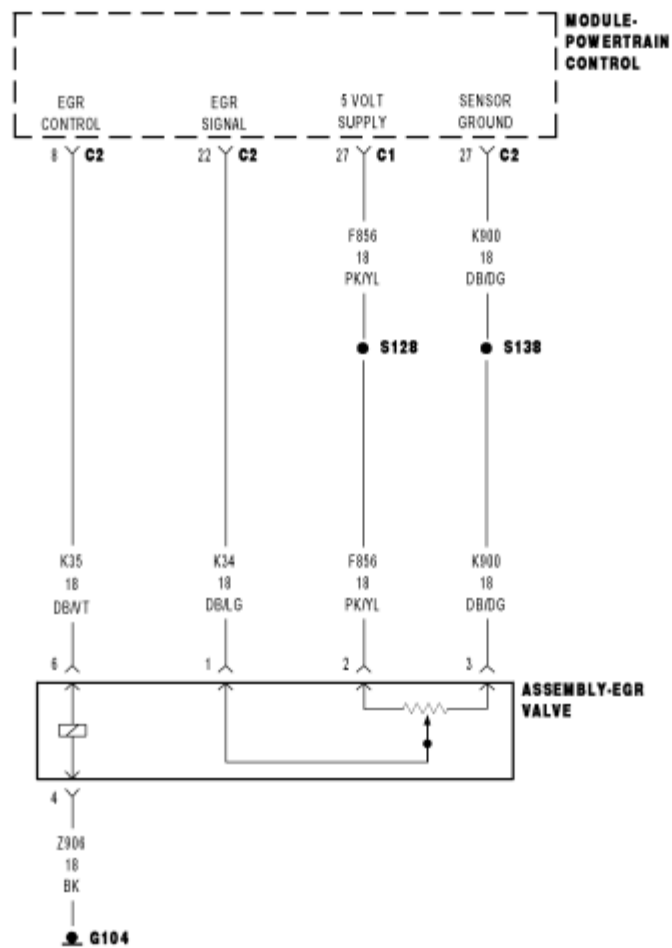
- Replace the A/C Clutch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the TIPM in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)



P01404-EGR POSITION SENSOR RATIONALITY CLOSED



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The EGR valve has a position sensor and the EGR position rationality is designed to make sure that the valve moves freely within its operating range. Closed valve position reference check verifies that the valve is within its allowable upper and lower limits. The EGR position rationality test looks for a sustained error relative to commanded valve position.

- **When Monitored:**

Engine running.

- **Set Condition:**

The EGR flow or valve movement is not what is expected. A rationality error has been detected for the EGR Open Position Performance. Two trip fault.

Possible Causes
EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
(K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(Z906) GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose and repair any EGR signal circuit high or low DTCs before continuing with this

procedure.

Turn the ignition on.

With the scan tool, select View DTCs. Record DTC and Freeze Frame information.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose fitting clothing. Failure to follow these instructions can result in personal or fatal injury.

WARNING: The normal operating temperature of the EGR system is very high. Never work around or attempt to service any part of the EGR system until it has cooled.

NOTE: Attempt to operate the vehicle under conditions similar to which the DTC was set.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

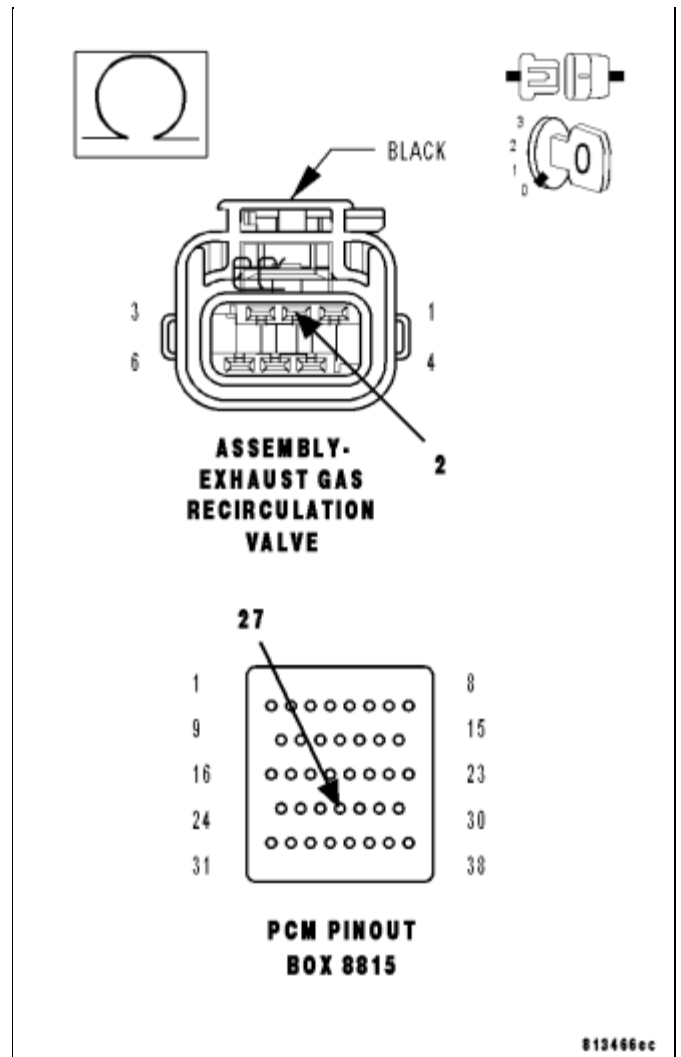
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

Measure the resistance of the (K35) EGR Solenoid Control circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

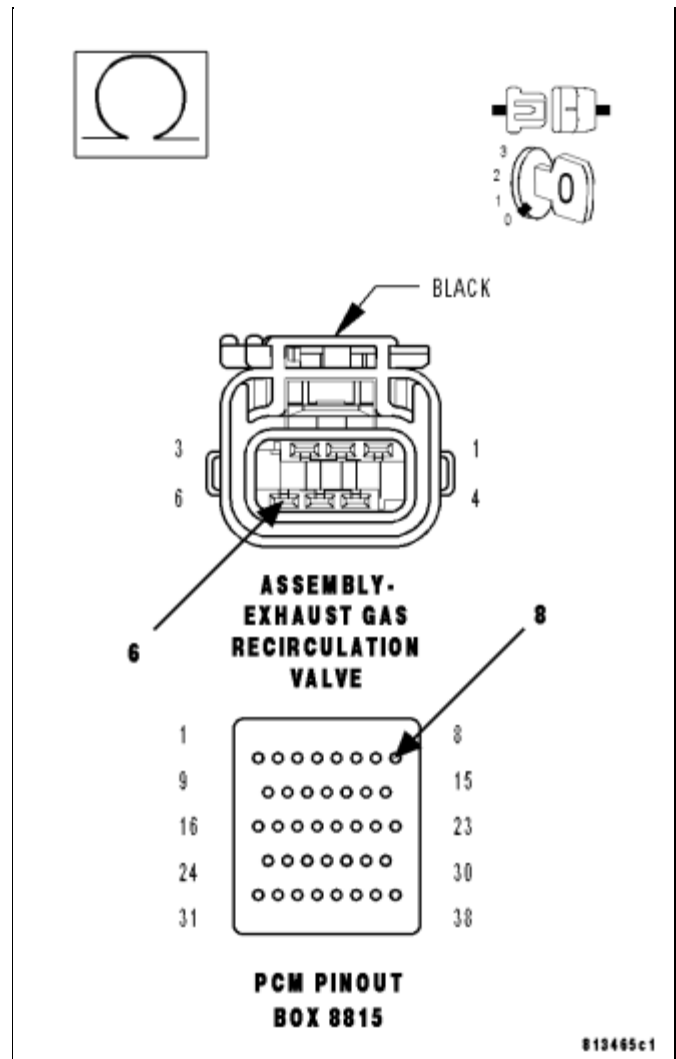
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K35) EGR Solenoid Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.

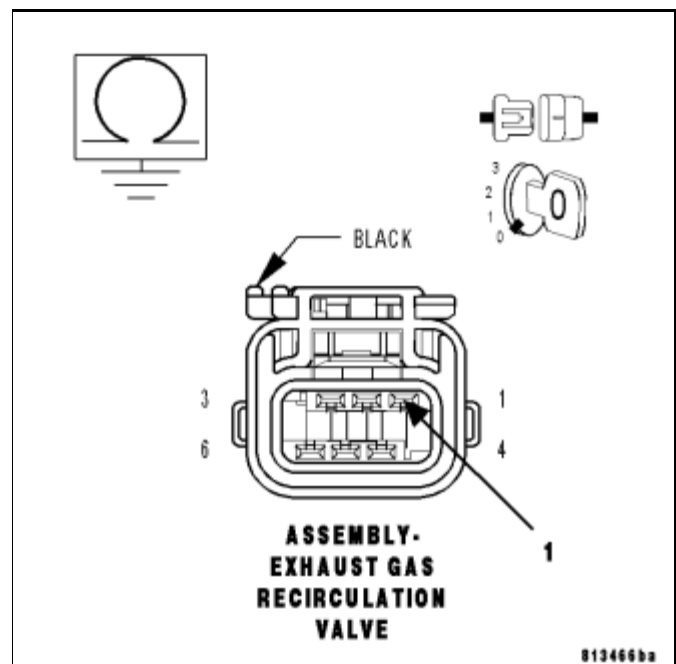
Is the resistance below 5.0 ohms?

Yes

- Repair the short to ground in the (K34) EGR Sensor Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the EGR Valve Assembly harness connector.

Using a 12 volt test light connected to the 12 volts, check the (Z906) Ground circuit in the EGR Valve Assembly harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

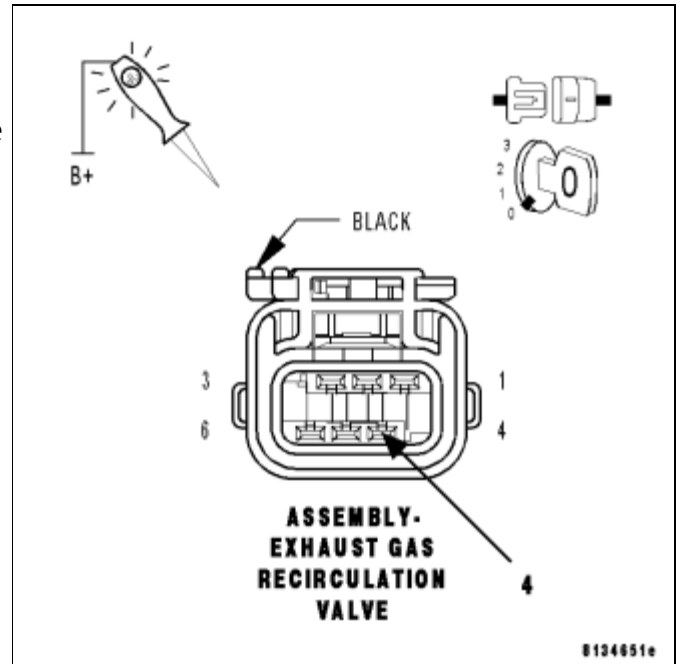
Is the test light illuminated and bright?

Yes

- Go to [6](#)

No

- Repair the excessive resistance in the (Z906) Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (K35) EGR CONTROL CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Connect the EGR Valve Assembly connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter, perform a voltage drop test by backprobing the (K35) EGR Control circuit at the EGR Valve Assembly harness connector and probing the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, perform the EGR System Test.
Select OPEN to open the EGR valve.

Monitor the circuit voltage on the voltmeter.

Is the voltage below 0.5 volts when the valve was opened during the system test?

Yes

- Go to [7](#)

No

- Repair the excessive resistance in the (K35) EGR Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. EGR SOLENOID ASSEMBLY

Connect the Powertrain Control Module (PCM) connector.

Turn the ignition on.

With the scan tool, actuate the EGR Valve Solenoid Duty Cycle.

Select the Duty Cycle reading of 79.9%

Using a 12 volt test light connected to ground, check the (K35) EGR Control circuit in the EGR Valve Assembly harness connector.

NOTE: If the DTC is active, the actuation test may not be allowed by the PCM. It may be necessary to clear the DTCs before starting the actuation.

NOTE: The voltage supplied to the solenoid circuit during the actuation may be less than battery voltage. The test light should be illuminated, but may not be as bright as a direct connection to the battery.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate accordingly during the actuation?

Yes

- Go To [8](#)

No

- Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors. If OK, replace the EGR Solenoid Assembly per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid Assembly and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Solenoid and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

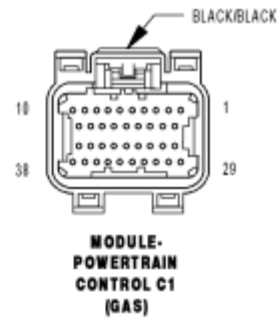
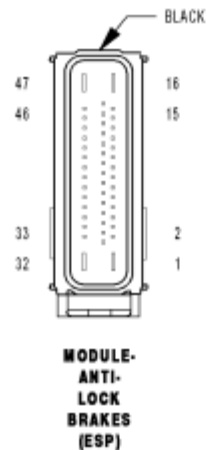
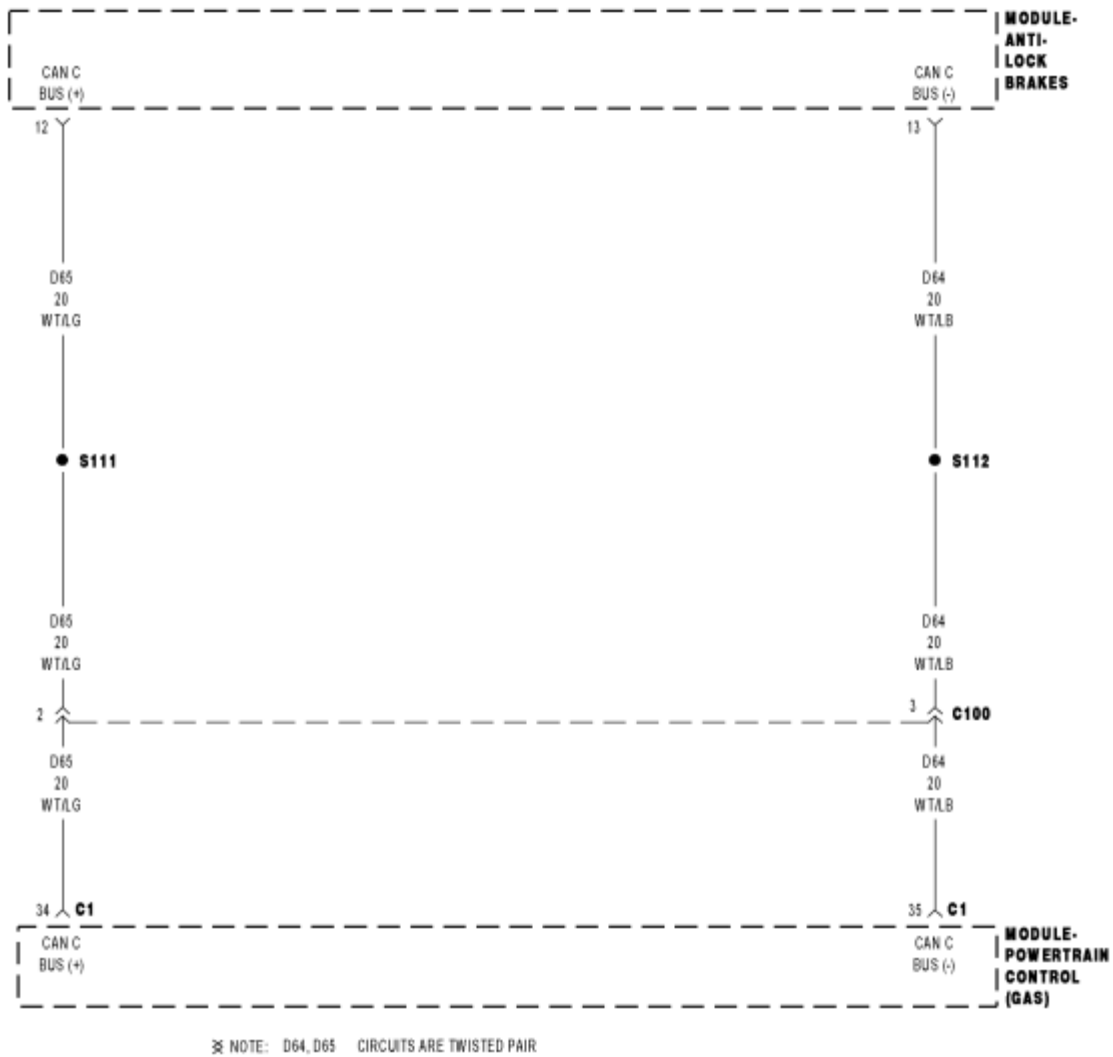
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and vehicle moving. Cruise is learned and customer is trying to use the Cruise.

- **Set Condition:**

The PCM recognizes rear wheel speed is greater than front wheel speed. One trip fault.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any Bus Communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

Start the engine.
Allow the engine to idle.

NOTE: It may be necessary to drive the vehicle for the fault to become Active.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the code sets during a front OR rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Wheel Speed Sensors, ABS Module, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Wheel Speed Sensor, ABS Module, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

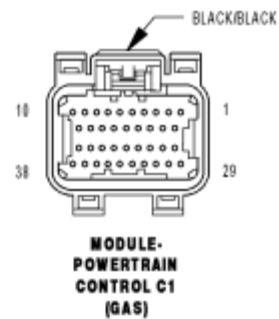
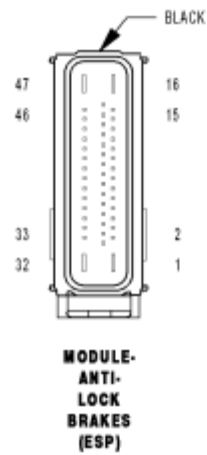
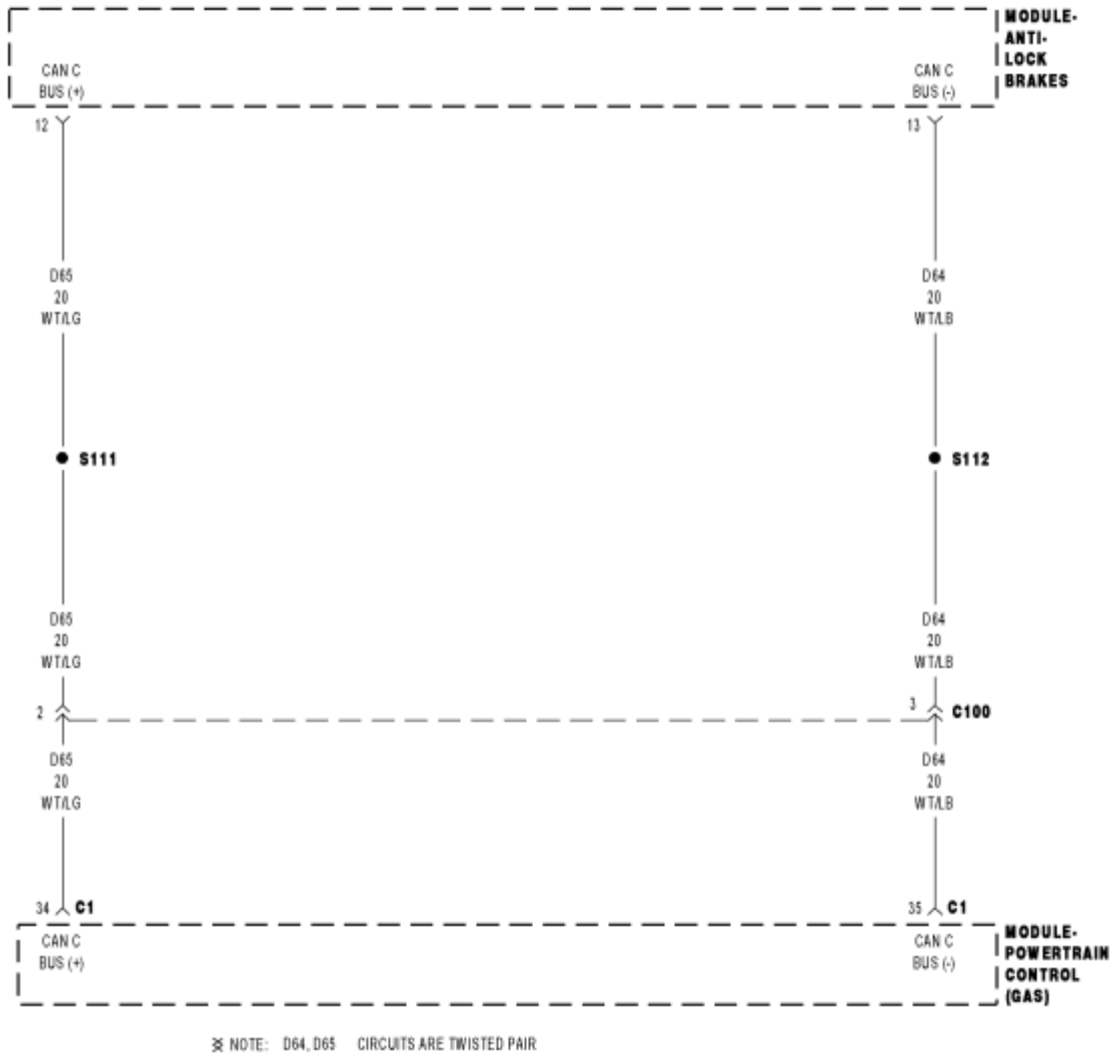
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS



8191759x

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on and vehicle moving. Brake pedal must not be applied.

- **Set Condition:**

The PCM recognizes front axle speed is greater than rear axle speed. One trip fault.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any Bus Communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

Start the engine.
Allow the engine to idle.

NOTE: It may be necessary to drive the vehicle for the fault to become Active.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.
Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the code sets during a front OR rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Wheel Speed Sensors, ABS Module, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Wheel Speed Sensor, ABS Module, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

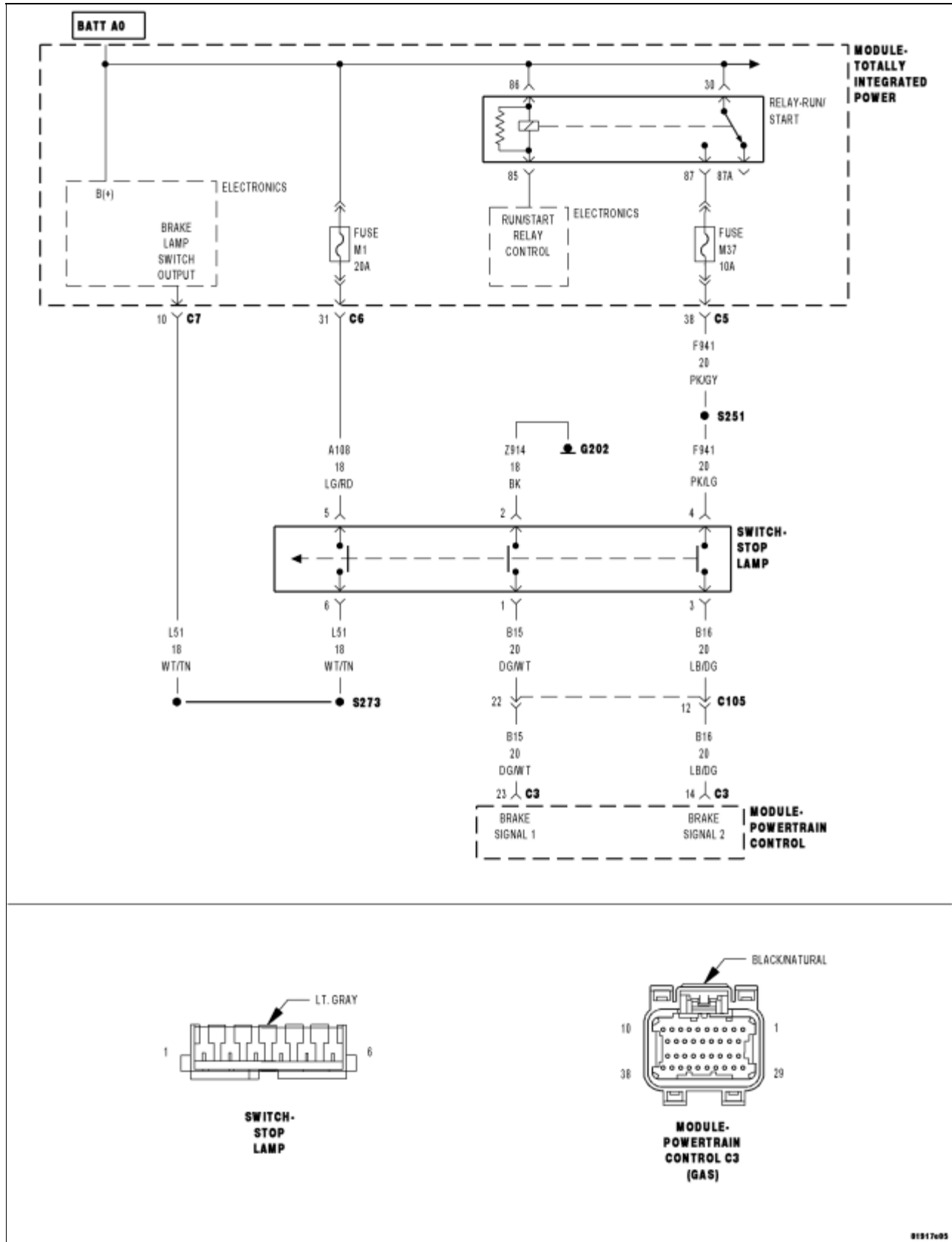
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1572-BRAKE PEDAL STUCK ON



- **When Monitored:**

Ignition on. In plant mode only.

- **Set Condition:**

PCM recognizes the Brake Pedal could not electrically indicate the applied (On) position with both switch inputs. One trip fault.

Possible Causes
(B15) BRAKE SIGNAL 1 CIRCUIT OPEN
(B16) BRAKE SIGNAL 2 CIRCUIT OPEN
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. STOP LAMP SWITCH OPERATION

NOTE: Check the related fuse and relay for proper operation before continuing.

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit when pressing and releasing the brake pedal switch?

Yes

- Go To [3](#)

No

- Replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. STOP LAMP SWITCH OPERATION

Measure the resistance between the (F941) Fused Ignition Switch terminal and the (B16) Brake Signal 2 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit when pressing and releasing the Stop Lamp switch?

Yes

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors. If OK, replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. (B15) BRAKE SIGNAL 1 CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors.
Probing the PCM harness connectors will damage the**

PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B15) Brake Signal 1 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

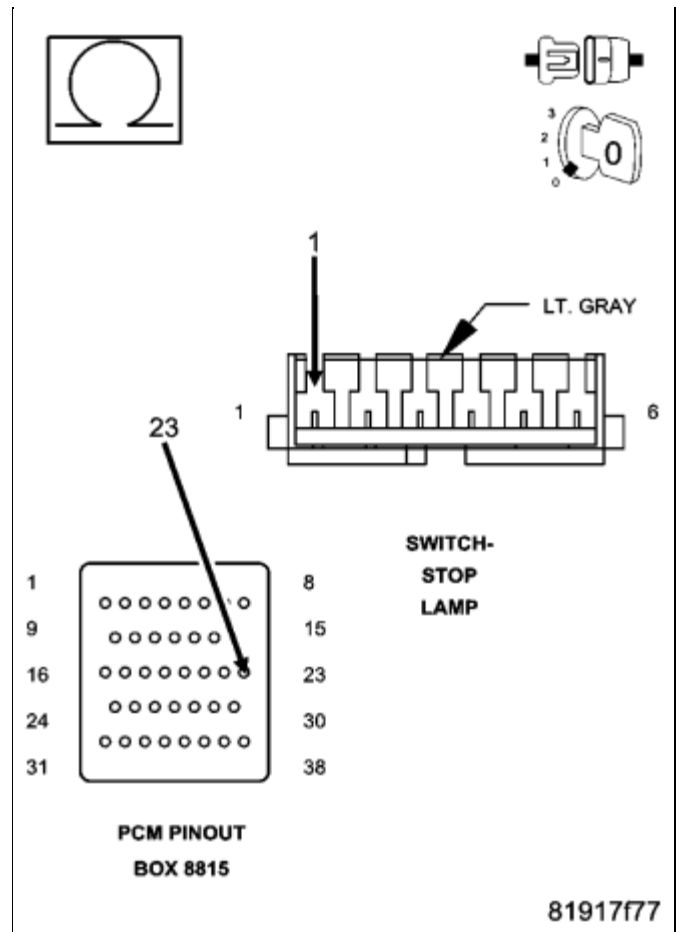
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (B16) BRAKE SIGNAL 2 CIRCUIT OPEN

Measure the resistance of the (B16) Brake Signal 2 circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

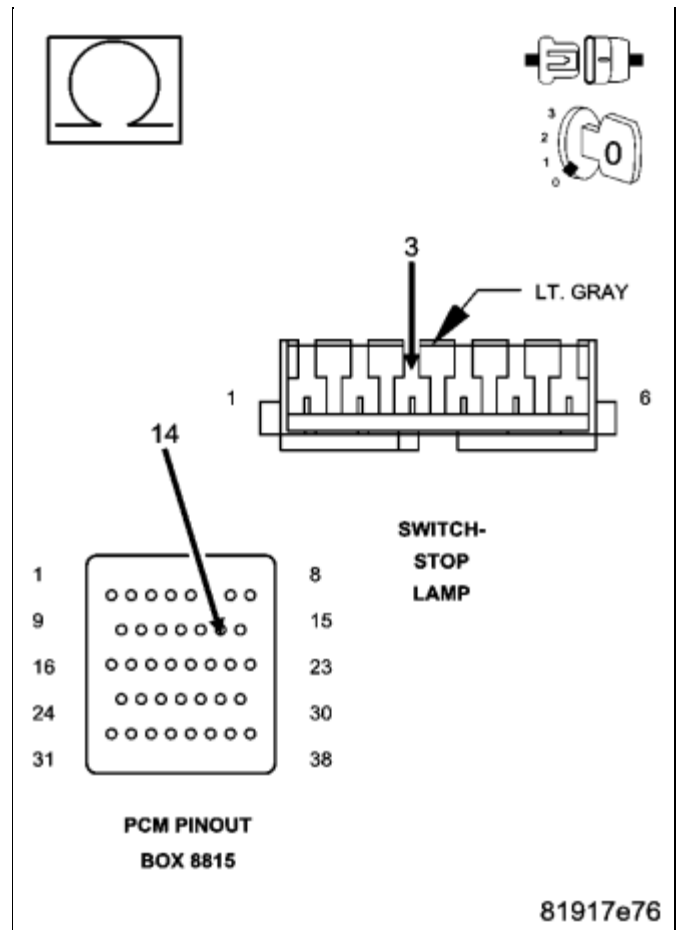
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

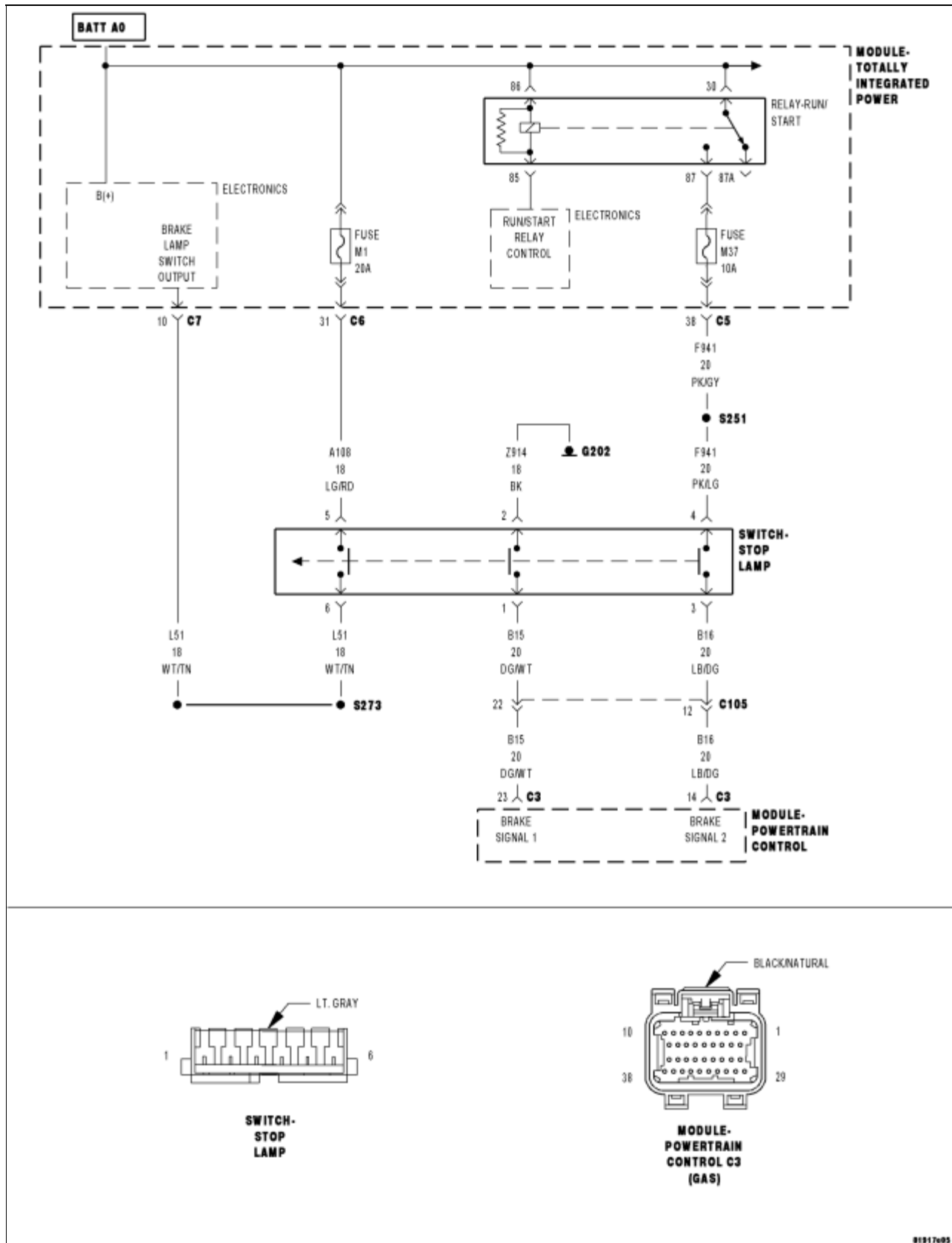
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1573-BRAKE PEDAL STUCK OFF



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on, In plant mode passed the Applied test.

- **Set Condition:**

PCM recognizes the Brake Pedal could not electronically indicate the released (Off) position with both switches. If P1572 sets, P1573 will also set. One trip fault.

Possible Causes
(B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(B15) BRAKE SIGNAL 1 CIRCUIT SHORTED TO GROUND
STOP LAMP SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. STOP LAMP SWITCH OPERATION

NOTE: Check the related fuse and relay for proper operation before continuing.

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connectors.

Measure the resistance between the (Z914) Ground circuit terminal and the (B15) Brake Signal 1 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit when pressing and releasing the brake switch?

Yes

- Go To [3](#)

No

- Replace the Stop Lamp Switch.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. STOP LAMP SWITCH OPERATION

Measure the resistance between the (F941) Fused Ignition Switch circuit terminal and the (B16) Brake Signal 2 circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit when pressing and releasing the Stop Lamp switch?

Yes

- Go To [4](#)

No

- Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors. Replace the Stop Lamp Switch if no problems were found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. (B16) BRAKE SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (B16) Brake Signal 2 circuit in the Stop Lamp Switch harness connector.

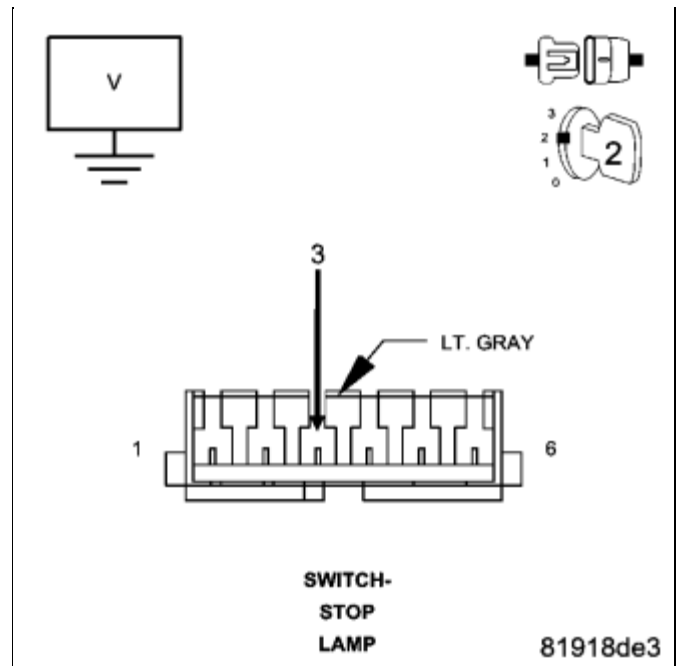
Is there any voltage present?

Yes

- Repair the short to voltage in the (B16) Brake Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (B15) BRAKE SIGNAL 1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (B15) Brake Signal 1 circuit in the Stop Lamp Switch harness connector.

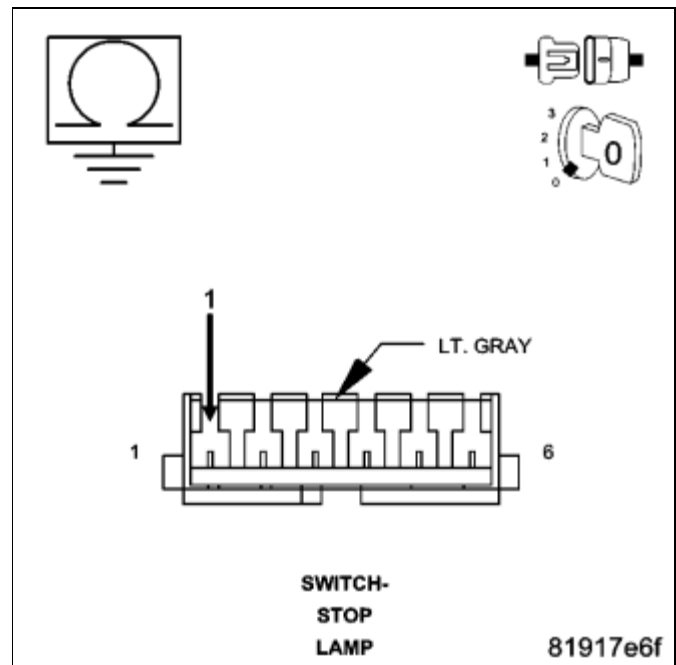
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (B15) Brake Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Stop Lamp Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

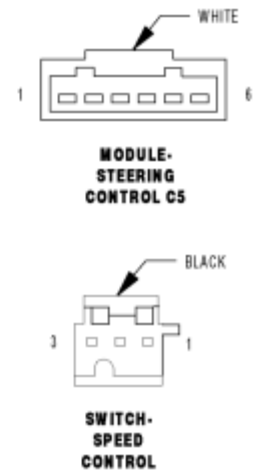
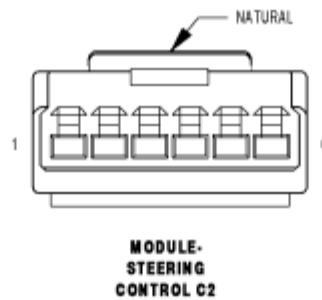
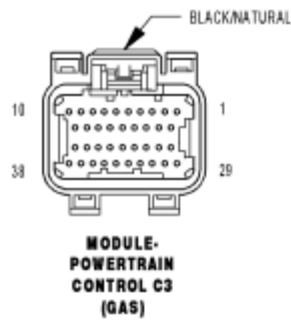
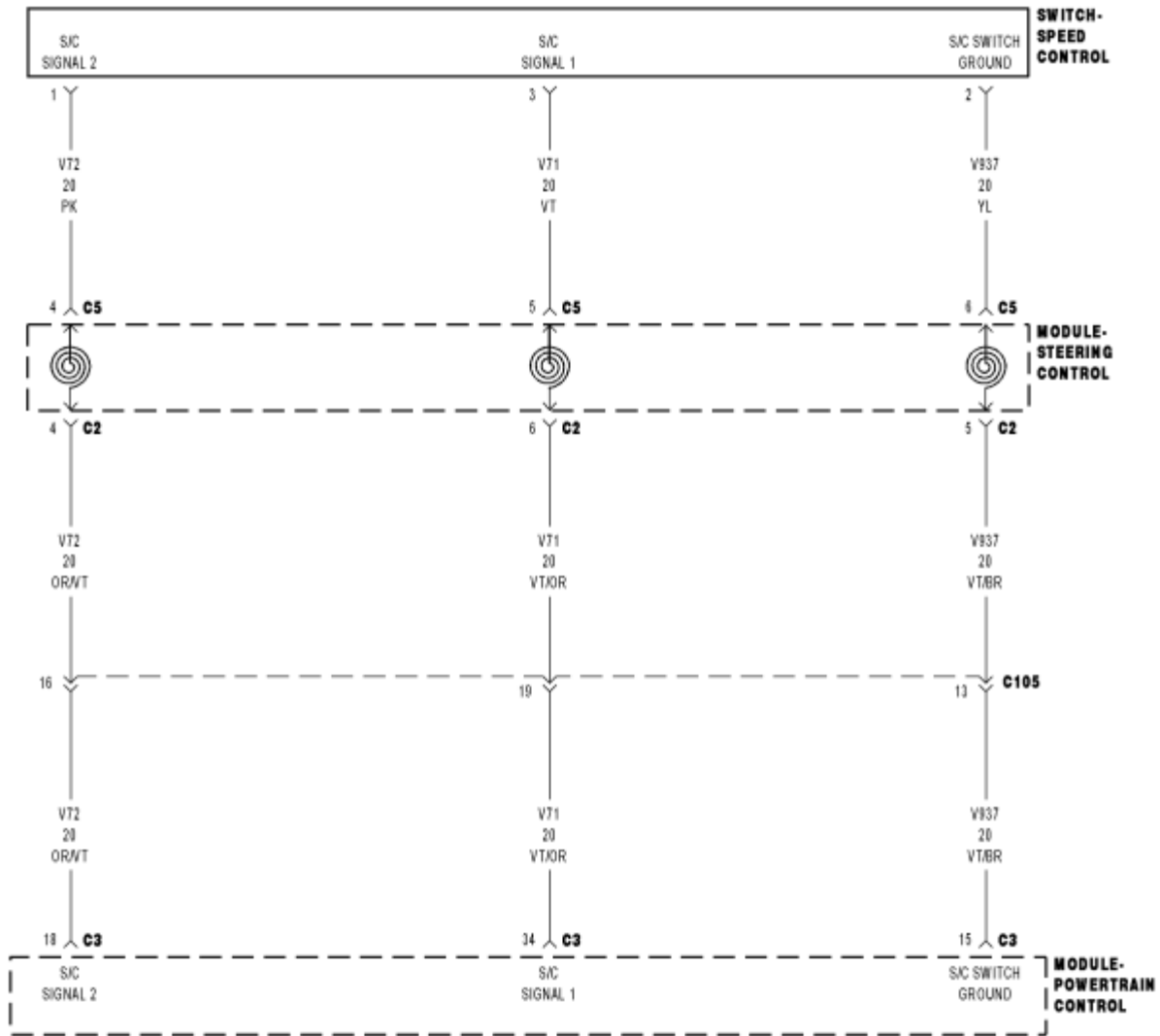
Were there any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1593-SPEED CONTROL SWITCH 1/2 STUCK



81c901a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

Cruise Switch inputs are not coherent with each other. Example: PCM is reading Switch No.1 as Accel and Switch No.2 as Coast at the same time. One trip fault.

Possible Causes
S/C SWITCH SIGNAL CIRCUITS SHORTED TO VOLTAGE
RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUITS
RESISTANCE IN THE (V937) S/C SWITCH GROUND CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT
(V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V72) S/C SIGNAL 2 CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO GROUND
SPEED CONTROL SWITCH
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: This DTC is a two trip fault. If the scan tool indicates a one trip failure, the possible cause may have been the customer pressing the switch in two positions simultaneously. Test drive the vehicle and activate the Speed Control system. If the DTC matures to an active fault a repair is necessary.

Ask the customer if it is possible that button was held in two positions at the same time before this DTC set. If this is the case, no repair is necessary.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switch from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V72) S/C Signal 2 and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V71) S/C Signal 1 and (V937) S/C Switch Ground circuit of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switch have the correct resistance value?

Yes

- Go To [3](#)

No

- Replace the Speed Control Switch that had the incorrect resistance value.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Disconnect the C3 PCM harness connector.
 Turn the ignition on.
 Measure the voltage on the (V71) S/C Signal 1 circuit at the Speed Control harness connector.

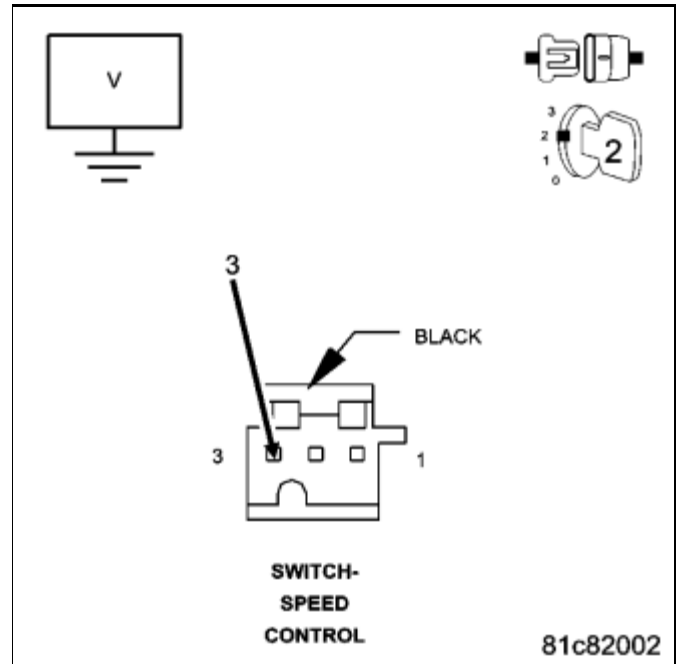
Is there any voltage present?

Yes

- Repair the short to voltage in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (V72) S/C Signal 2 circuit at the Speed Control harness connector.

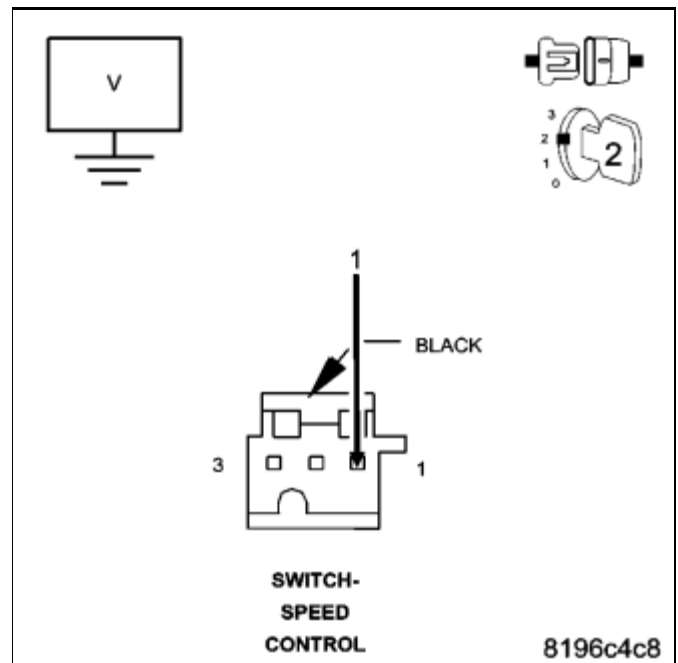
Is there any voltage present?

Yes

- Repair the short to voltage in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. S/C SIGNAL 1 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Measure the resistance of the (V71) S/C Signal 1 circuit from the Speed Control harness connector to the appropriate terminals of special tool #8815.

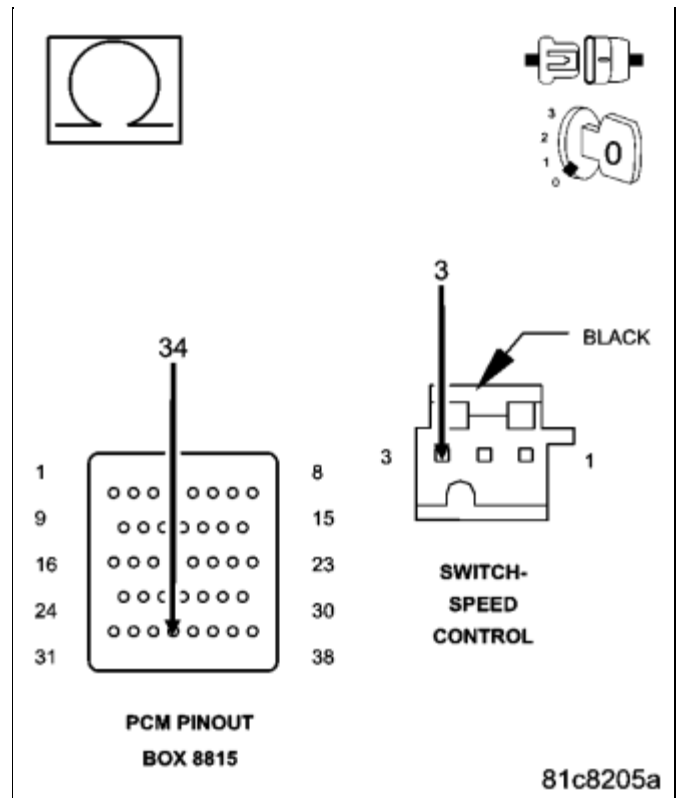
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (V71) Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (V72) S/C SIGNAL 2 CIRCUIT OPEN

Measure the resistance of the (V72) S/C Signal 2 circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

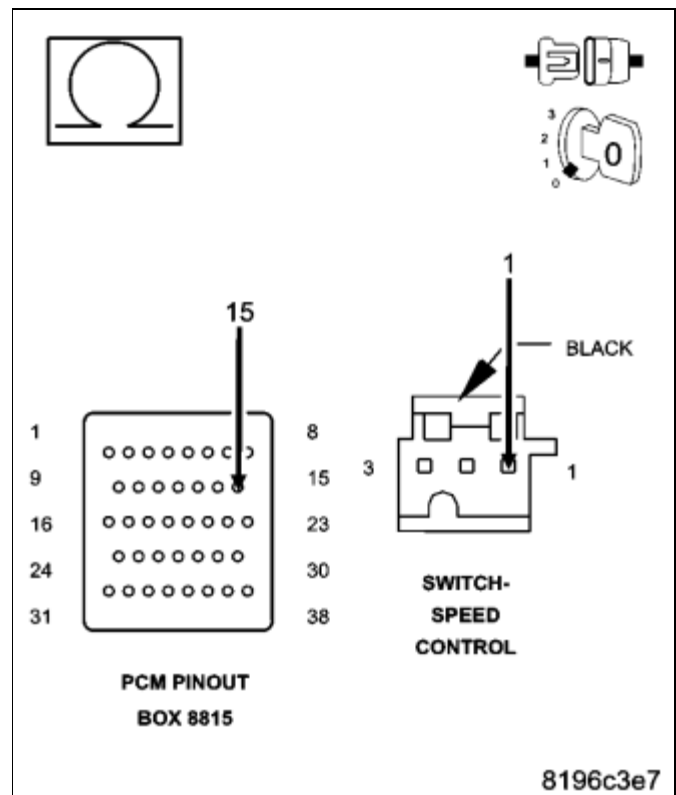
Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (V937) S/C SWITCH GROUND CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) S/C Switch Ground circuit at the Speed Control harness connector to the appropriate terminal of special tool #8815.

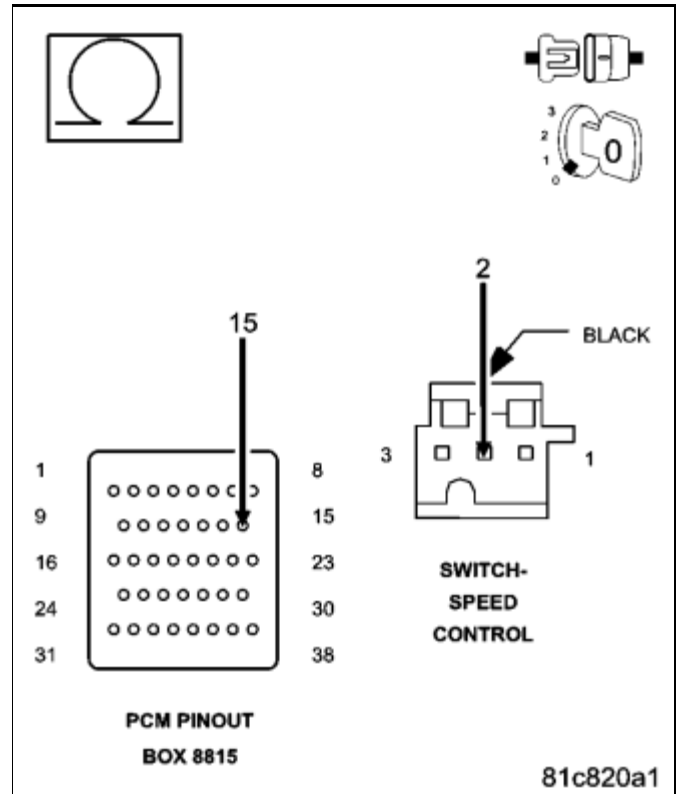
Is the resistance below 5.0 ohms for both measurements?

Yes

- Go To [8](#)

No

- Repair the excessive resistance in the (V937) S/C Switch Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



8. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Measure the resistance between the (V937) S/C Switch Ground circuit and both of the (V71) S/C Signal 1 circuit in the S/C Switch harness connector.

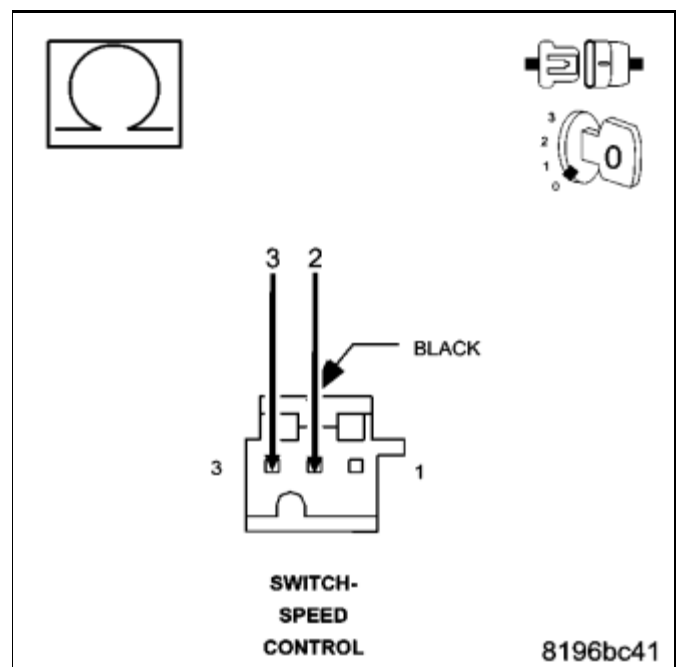
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V937) S/C Switch Ground circuit and the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO THE (V937) S/C SWITCH GROUND CIRCUIT

Measure the resistance between the (V937) S/C Switch Ground circuit and both of the (V72) S/C Signal 2 circuit in the S/C Switch harness connector.

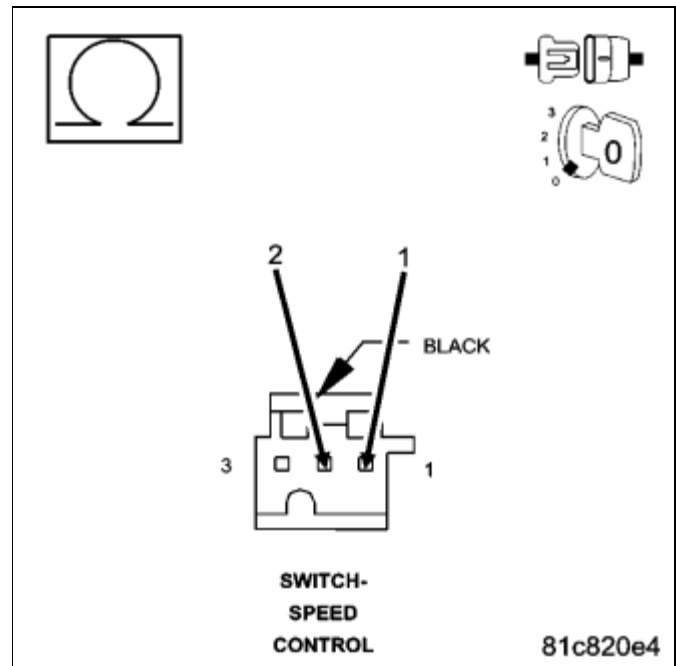
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (V937) S/C Switch Ground circuit and the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO THE (V72) S/C SIGNAL 2 CIRCUIT

Measure the resistance between the (V71) S/C Signal 1 circuit and the (V72) S/C Signal 2 circuit at the Speed Control harness connector.

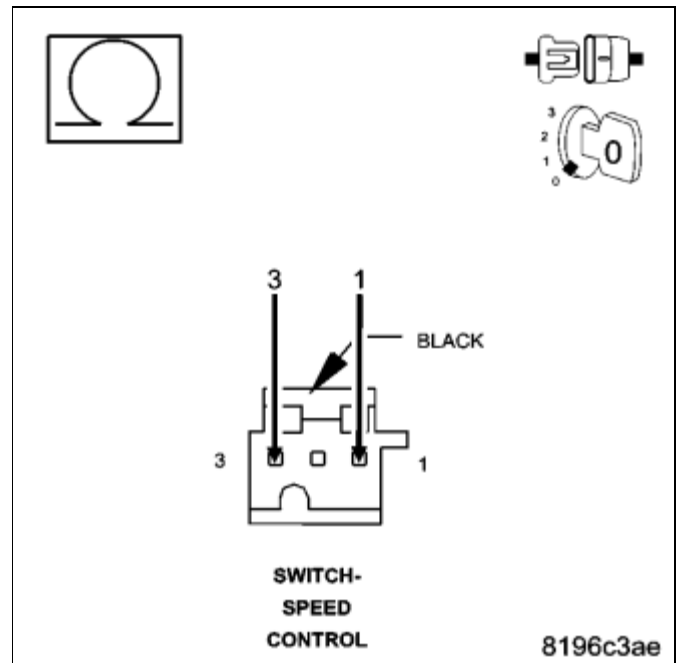
Is the resistance below 100 ohms for each circuit?

Yes

- Repair the short between the (V72) S/C Signal 2 circuit and the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)



11. (V71) S/C SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V71) S/C

Switch Signal 1 circuit at the S/C Switch harness connector.

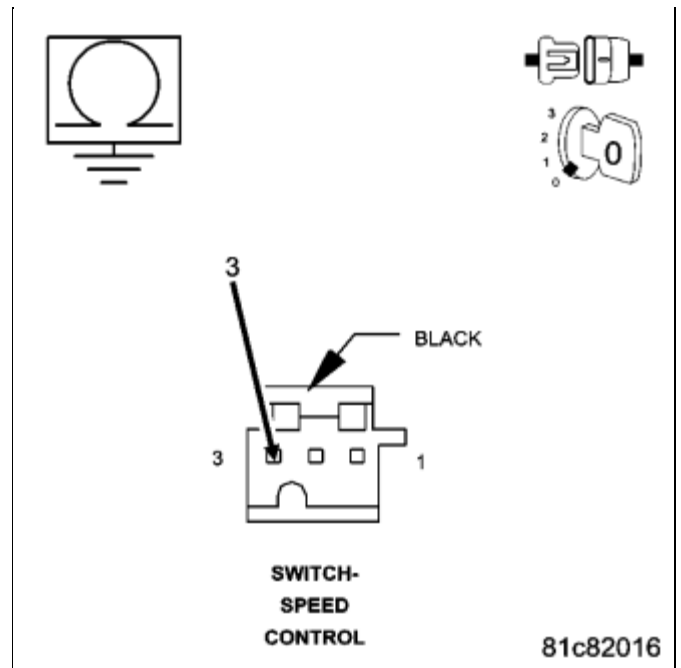
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V71) S/C Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [12](#)



12. (V72) S/C SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the ((V72) S/C Signal 2 at the S/C Switch harness connector.

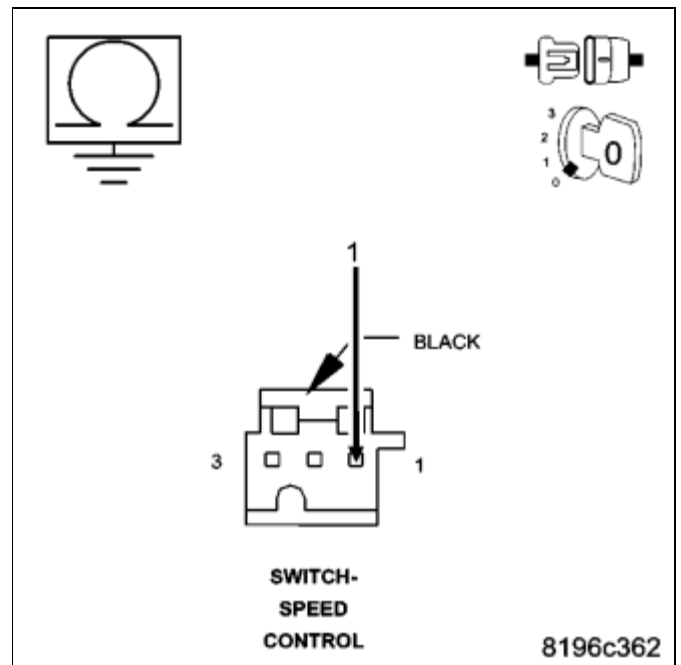
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (V72) S/C Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)



13. SPEED CONTROL SWITCH VOLTAGE VALUES

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Connect the C3 PCM harness connector and the S/C Switch harness connector.

Using a voltmeter check the voltage on the (V37) S/C Signal 1 circuit and the (V38) S/C Signal 2 circuit at the

appropriate terminals of the special tool #8815.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.

SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLTAGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes

- Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors. Replace the Speed Control Switch if no problems are found in the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [14](#)

14. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Speed Control Switch and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Switch and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1602-PCM NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on and battery voltage greater than 10 volts.

- **Set Condition:**

The PCM has not been programmed.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM PROGRAMMED

Ignition on, engine not running.

With a scan tool, erase DTCs.

With a scan tool program the PCM.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read DTCs.

Does the DTC reset?

Yes

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- The PCM has been successfully programmed. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P1607-PCM INTERNAL SHUTDOWN TIMER RATIONALITY TOO SLOW

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The PCM compares actual shutdown time to a calculated shutdown time value. The calculated shut down time value is based on the amount the ECT should drop after a completely warmed up engine is shut down for a minimum of 8 hours. If the difference between actual shutdown time and the calculated shut down time is greater than a maximum value, a one trip failure will set. The shutdown time is measured again after 1 hour of ignition off time following the next engine warm up cycle. The PCM compares the shutdown time to a calculated value. If the difference is greater than a maximum value, the MIL is illuminated and a DTC will set.

◦ **When Monitored:**

With the engine running after a cycle when a complete engine warm up was achieved, the difference between engine coolant temperature and ambient air temperature less than or equal to 10° C (50° F), and battery voltage greater than 10 volts.

◦ **Set Condition:**

This DTC sets if the engine coolant temp does not drop enough or drops too much during engine off time. This DTC may also set if the controller timer is inaccurate. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ENGINE COOLING CONDITIONS THAT MAY SET THIS DTC
ENGINE COOLANT LEVEL
PCM INTERNAL TIMER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ENGINE COOLANT INSPECTION

NOTE: This DTC will set if the engine cools quicker than is should compared to engine off times. If the customer washed a hot engine with the engine off, a One Trip Failure will set. If the vehicle is parked in a highly ventilated area or has a large fan blowing on it which might cause the engine to cool quicker than expected this DTC may set.

WARNING: Do not remove or loosen the radiator cap with the system hot and under pressure. Serious burns from coolant can occur.

Turn the ignition off.

Allow the engine to cool enough to allow the pressure in the coolant system to drop enough to safely remove the radiator cap.

Check the coolant level and condition.

Is the engine coolant level filled to the proper level?

Yes

- Go To [2](#)

No

- Add the appropriate type and amount of engine coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE.)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

2. POWERTRAIN CONTROL MODULE (PCM)

Turn the ignition on.

With the scan tool under PCM/NGC Data Display, locate the Ignition Off Time value.

While monitoring a stop watch, turn the Ignition off for 10 minutes, watch the stop watch for those 10 minutes, and then turn the Ignition on.

With the scan tool under Data Functions, check the Ignition Off Time value again.

Does the Ignition Time Off value on the scan tool match the actual time you had the Ignition off on the stop watch?

Yes

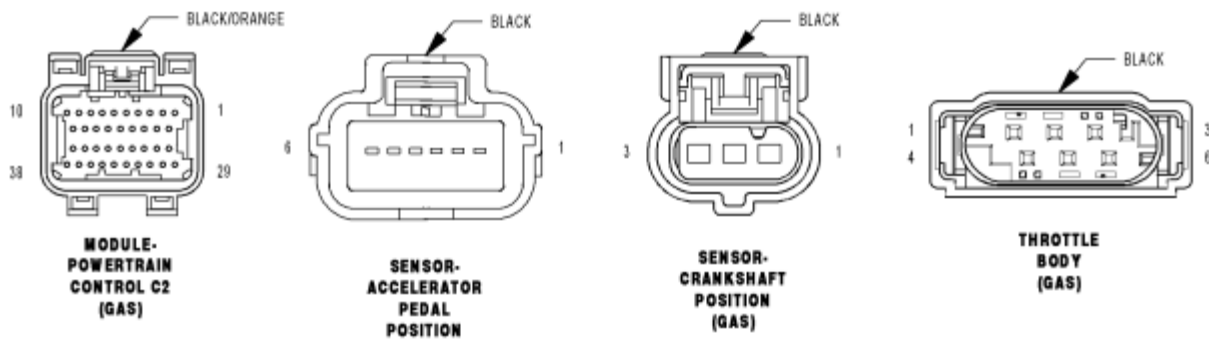
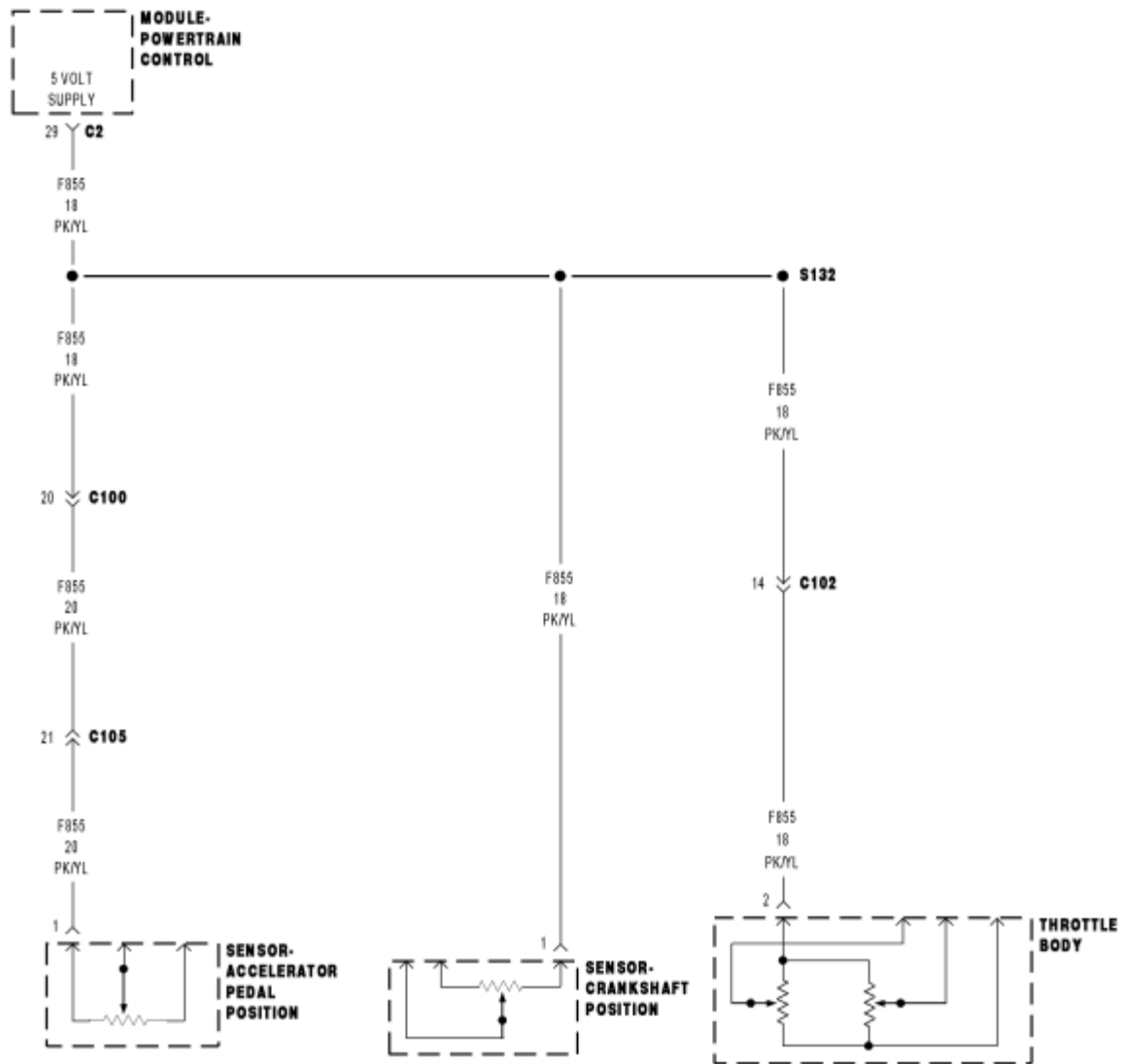
- The conditions that set the DTC are not active at this time. For further assistance refer to the

INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC



81810042

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

When the PCM recognizes the Primary 5-volt Supply circuit voltage is varying too much too quickly. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO GROUND
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO VOLTAGE
(F855) PRIMARY 5-VOLT SUPPLY CIRCUIT OPEN
5-VOLT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

NOTE: This code can be caused by the improper installation of after market accessories that may be causing excessive noise on the (F855) 5-volt Supply circuit.

Measure the resistance between ground and the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) Primary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

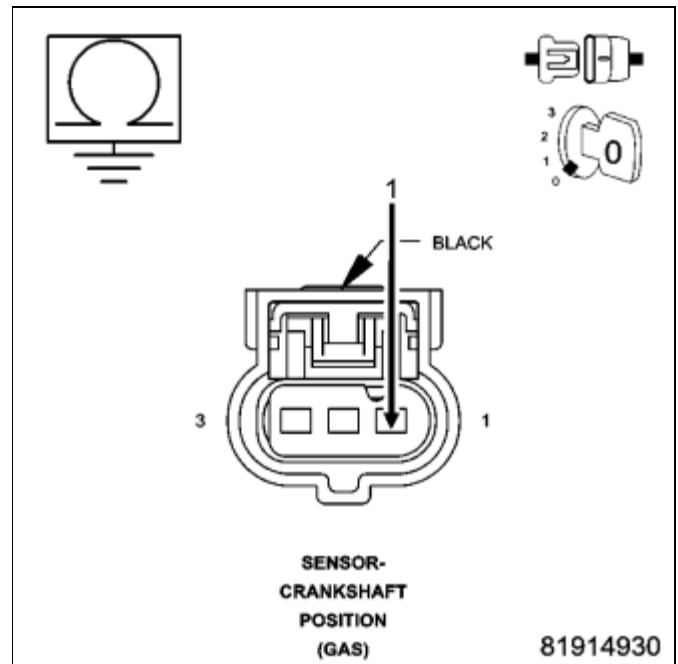
3. SENSOR SHORTED TO GROUND

Connect the C2 PCM harness connector and all the previously disconnected Sensors except for the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the Throttle Body harness connector.

NOTE: You must Turn the Ignition Off when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.



While monitoring the voltage, disconnect each Sensor harness connector that shares the (F855) Primary 5-volt Supply circuit, one at a time.

Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes

- Verify that there is good pin to terminal contact in the Related Sensor and the Powertrain Control Module connectors. If OK, replace the Sensor that causes the (F855) Primary 5-volt Supply circuit voltage to increase when disconnected.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. 5-VOLT SENSOR

Turn the ignition off.

Connect all the previously disconnected Sensors except for the CKP Sensor harness connector.

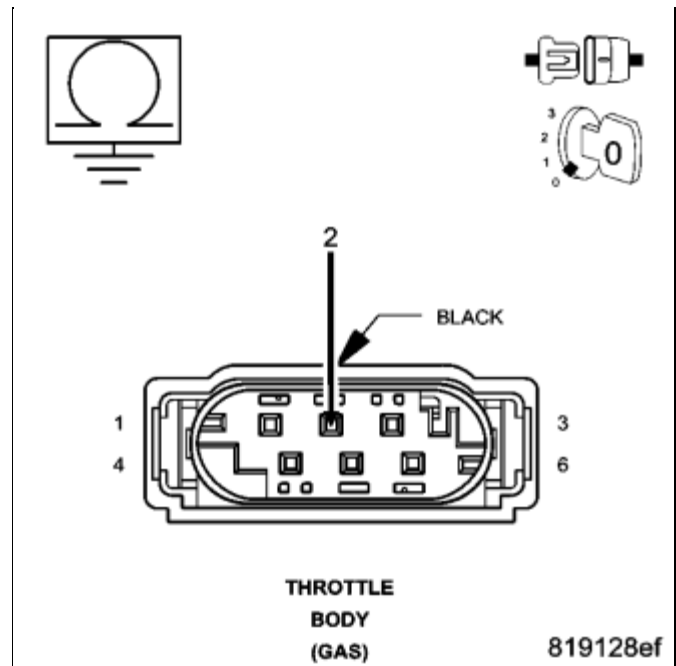
Ignition on, engine not running.

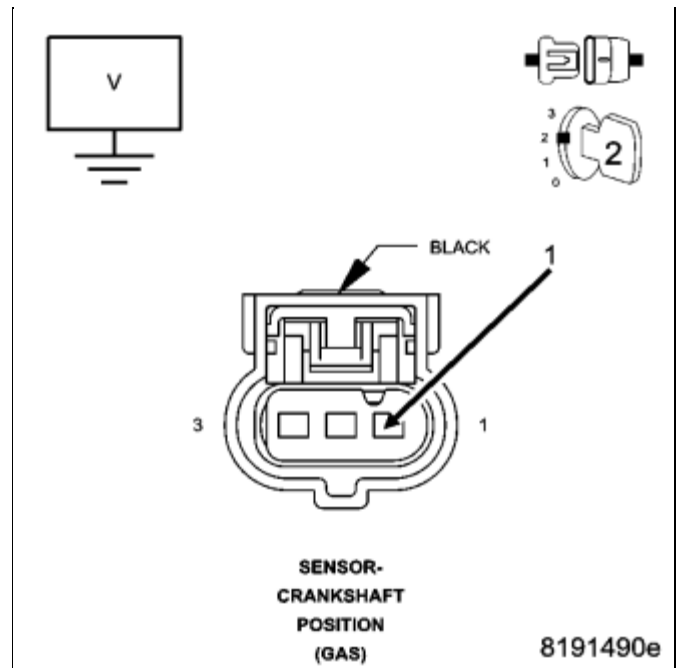
Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.

Is the voltage between 4.8 and 5.2 volts?

Yes

- Verify that there is good pin to terminal contact in the Related Sensor and the Powertrain Control Module connectors. If OK, replace the Crank Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)





No

- Go To [5](#)

5. (F855) PRIMARY 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.
 Ignition on, engine not running.
 Measure the voltage on the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

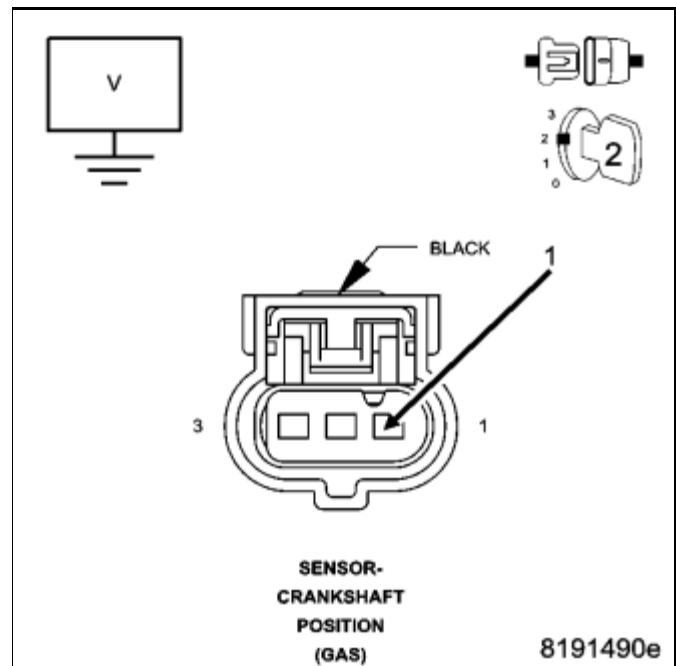
Is there any voltage present?

Yes

- Repair the short to voltage in the (F855) Primary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Reconnect all the sensors that were disconnected in the previous step except for the CKP Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (F855) Primary 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

It may be necessary to perform this test from every sensor that uses the (F855) Primary 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (F855) Primary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Related Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Related Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

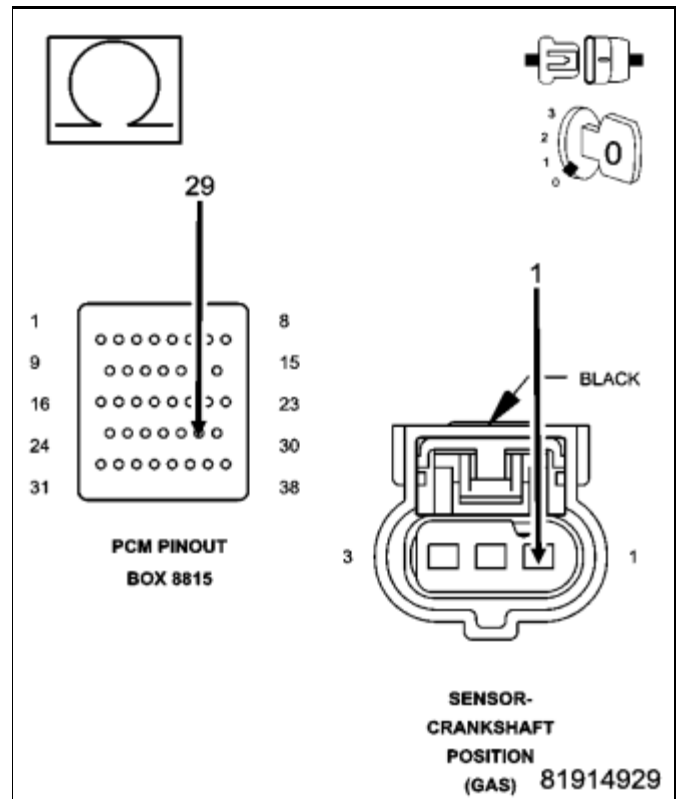
Were there any problems found?

Yes

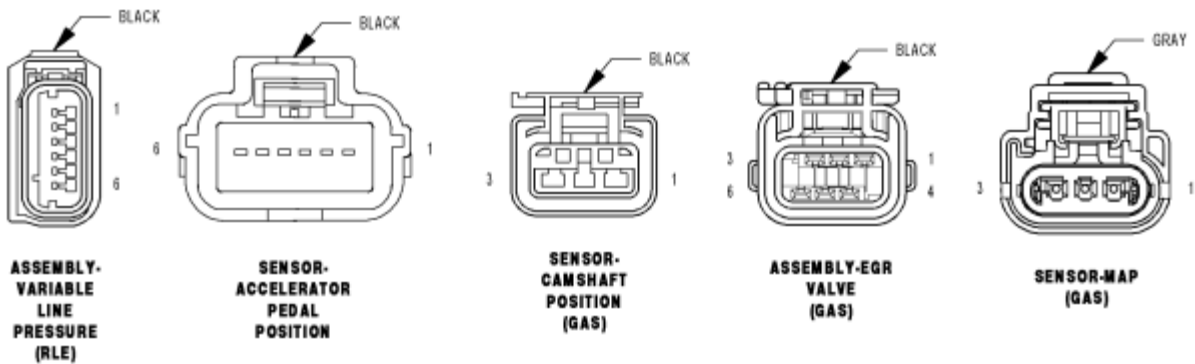
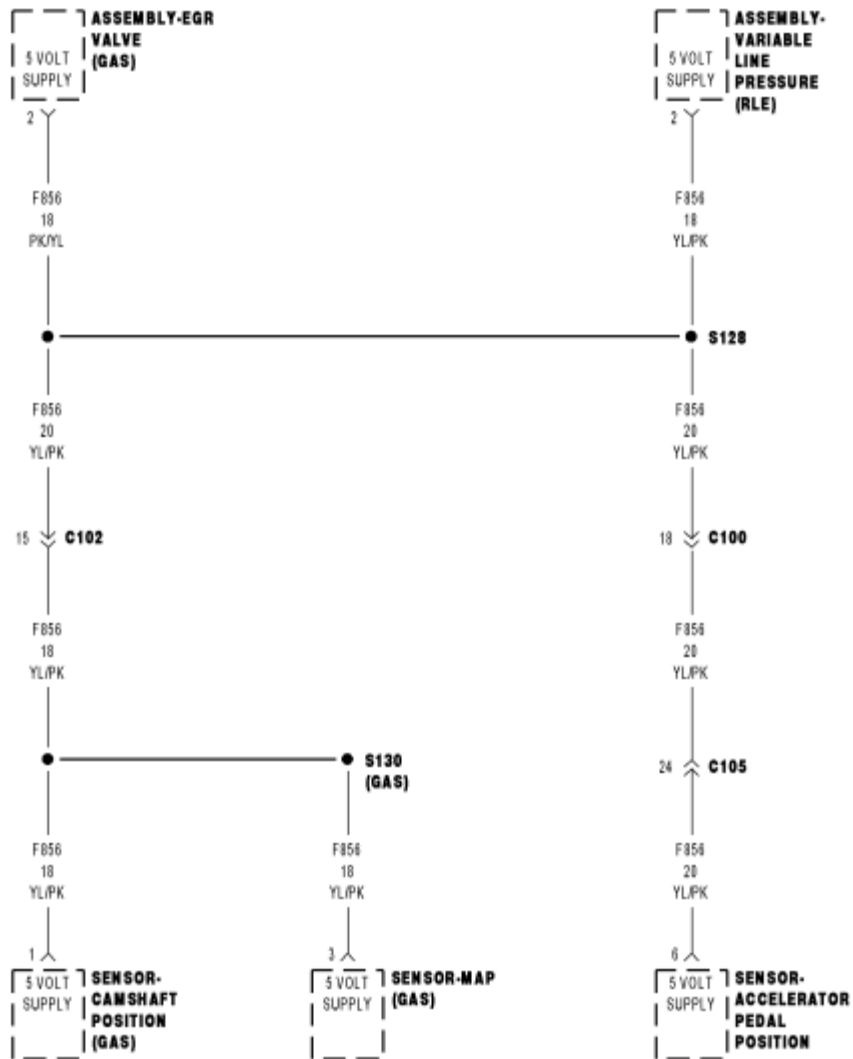
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC



81010311

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is varying too much too quickly. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT OPEN
5-VOLT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for any improperly installed aftermarket accessories before continuing with this test.

Start the engine and allow it to idle for at least 60 seconds.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

NOTE: This code can be caused by the improper installation of after market accessories that may be causing excessive noise on the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.

Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) Auxiliary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

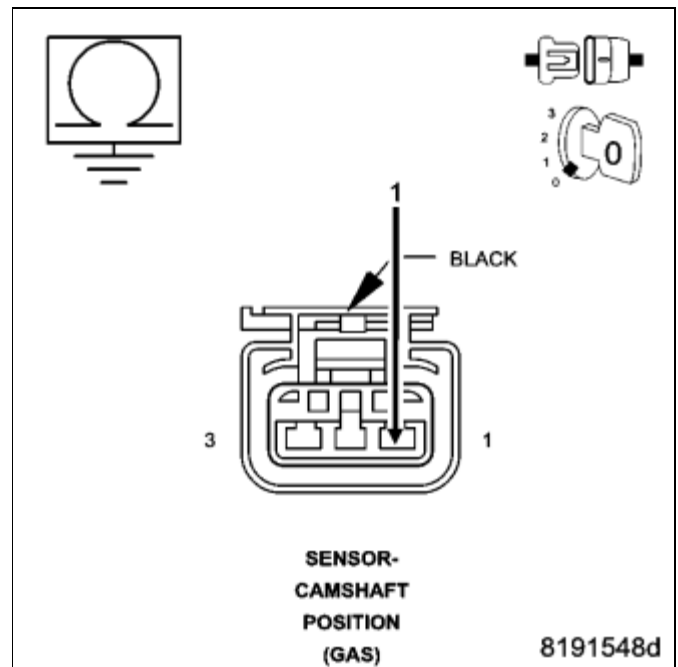
- Go To [3](#)

3. SENSOR SHORTED TO GROUND

Connect the C1 PCM harness connector and all the previously disconnected Sensors except for the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply



circuit in the CMP Sensor harness connector.

NOTE: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F856) Auxiliary 5-volt Supply circuit, one at a time.

Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes

- Verify that there is good pin to terminal contact in the Related Sensor and the Powertrain Control Module connectors. If OK, replace the Sensor that causes the (F856) Auxiliary 5-volt Supply circuit voltage to increase when disconnected.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. 5-VOLT SENSOR

Turn the ignition off.

Connect all the previously disconnected Sensors except for the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.

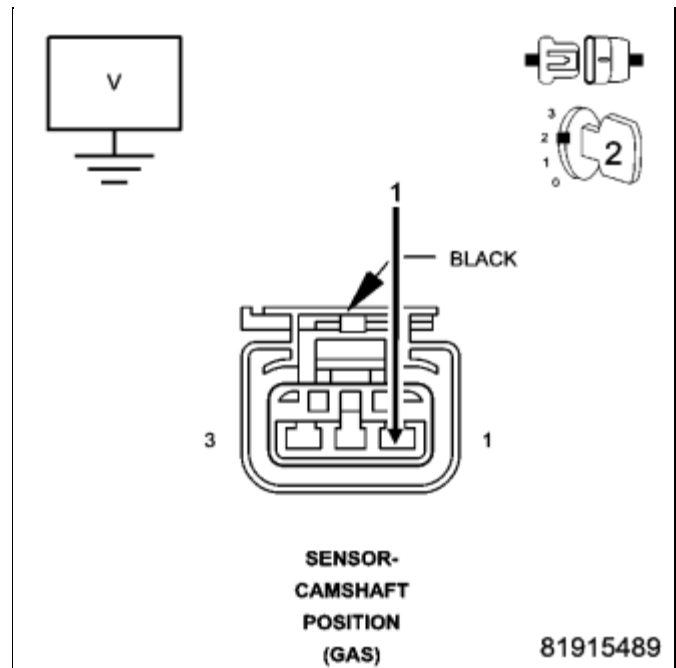
Is the voltage below 4.5 volts?

Yes

- Go To [5](#)

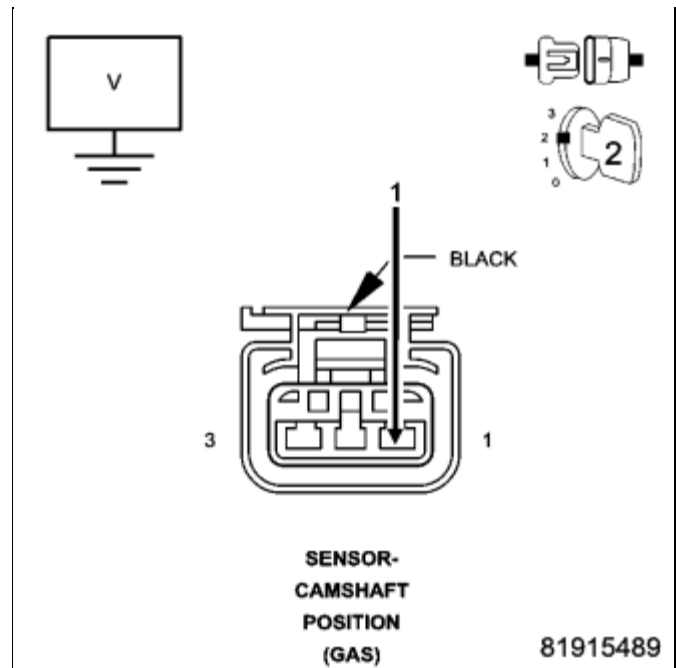
No

- Verify that there is good pin to terminal contact in the Camshaft Position Sensor and the Powertrain Control



Module connectors. If OK, replace the Cam Position Sensor.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C1 PCM harness connector.
 Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.
 Ignition on, engine not running.
 Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.

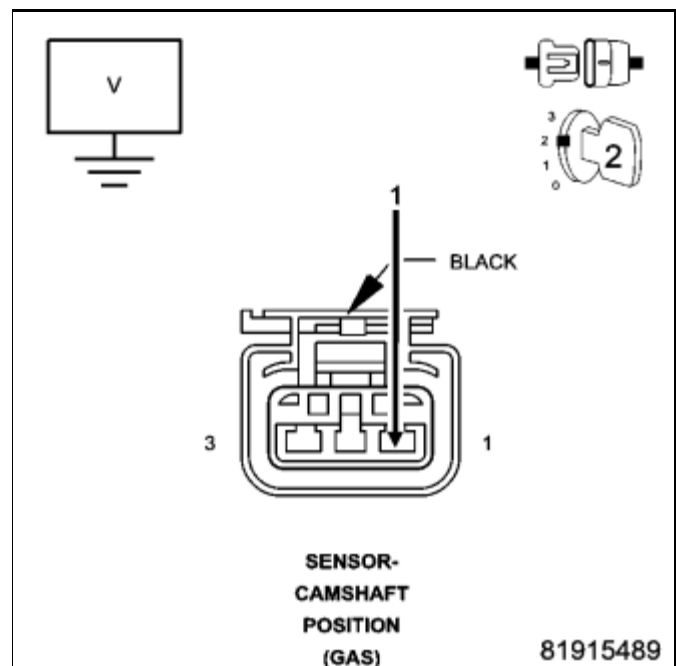
Is there any voltage present?

Yes

- Repair the short to voltage in the (F856) Auxiliary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Reconnect all the sensors that were disconnected in the previous step except the CMP Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (F856) Auxiliary 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

It may be necessary to perform this test from every sensor that uses the (F856) Auxiliary 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (F856) Auxiliary 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Related Sensors and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Related Sensor and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

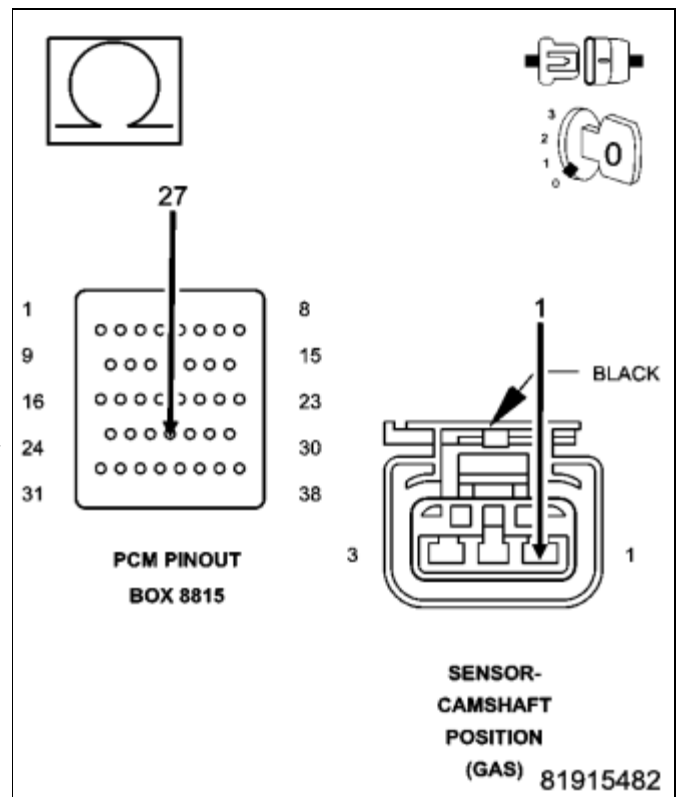
Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



P1696-EEPROM MEMORY WRITE DENIED/INVALID

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on.

- **Set Condition:**

An attempt to program/write to the internal EEPROM failed, Also checks at power down. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) SOFTWARE UPDATE
EXCESSIVE RESISTANCE IN THE PCM POWER OR GROUND CIRCUITS
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any other DTCs set in the PCM before proceeding with this test.

Turn the ignition on.

With the scan tool, Clear DTCs.

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle in order for this DTC to set.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go to [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. PCM ODOMETER MILEAGE NOT PROGRAMMED

Turn the ignition on.

With the scan tool, attempt to perform the Program PCM Odometer function.

With the scan tool, Clear DTCs.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [3](#)

No

- The SRI mileage has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. CHECKING THE PCM POWER AND GROUND CIRCUITS

Perform the diagnostic procedure for *CHECKING THE PCM POWER AND GROUND CIRCUITS.

Using the wiring diagram/schematic as a guide, inspect the Powertrain Control Module (PCM) wiring and connectors.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go to [4](#)

4. POWERTRAIN CONTROL MODULE (PCM)

Turn the ignition on.

With the scan tool, attempt to perform the Program PCM Odometer function.

With the scan tool, Clear DTCs.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- The SRI mileage has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P1697-EMR (SRI) MILEAGE NOT STORED

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously with the ignition on.

- **Set Condition:**

The PCM Odometer mileage has not been programmed into the PCM.

Possible Causes
PCM ODOMETER MILEAGE NOT PROGRAMMED
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM ODOMETER MILEAGE NOT PROGRAMMED

Turn the ignition on.

With the scan tool, attempt to perform the Program PCM Odometer function.

With the scan tool, clear DTCs.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Replace and program the Powertrain Control Module in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- The SRI mileage has been successfully programmed into the PCM. Test is complete.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

P1897-LEVEL 1 RPM BUS UNLOCK

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running.

◦ **Set Condition:**

When the PCM recognizes an internal failure to communicate with the FCM or the CMP and CKP Sensor count periods are too short. One trip fault. ETC light is flashing.

Possible Causes
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. POWERTRAIN CONTROL MODULE (PCM)

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2072-ELECTRONIC THROTTLE CONTROL SYSTEM - ICE BLOCKAGE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

The PCM recognizes the Throttle plate is stuck during extremely cold Ambient Temperature operation. The throttle plate goes through a de-icing procedure. If the throttle blade still doesn't move this fault sets. The MIL will not illuminate. The vehicle will be in Limp home condition, limiting rpm and vehicle speed.

Possible Causes
THROTTLE PLATE FROZEN

Diagnostic Test

1. THROTTLE BODY INSPECTION

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data.

NOTE: This DTC sets in extreme cold Ambient Temperatures with the throttle plate stuck by the time the vehicle gets to the dealership the condition may be corrected.

NOTE: P2110 will set with P2072. P2118 may also set and the customer will experience a Limp-in condition. If either of these two faults are set, it indicates that the ice blockage software has run and no repair is necessary.

NOTE: Diagnose any other DTCs that may also be set before continuing.

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Is the throttle blade still stuck because it is frozen?

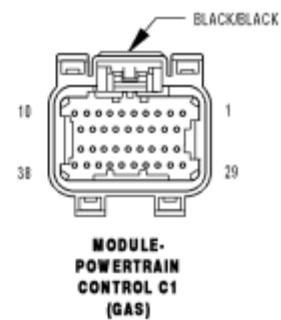
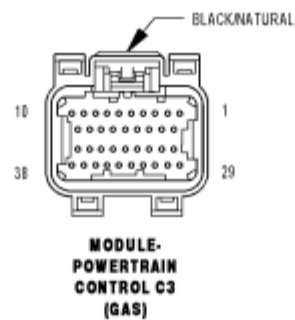
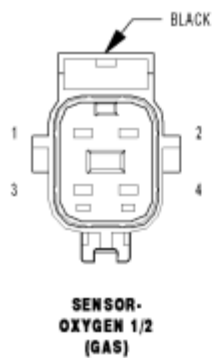
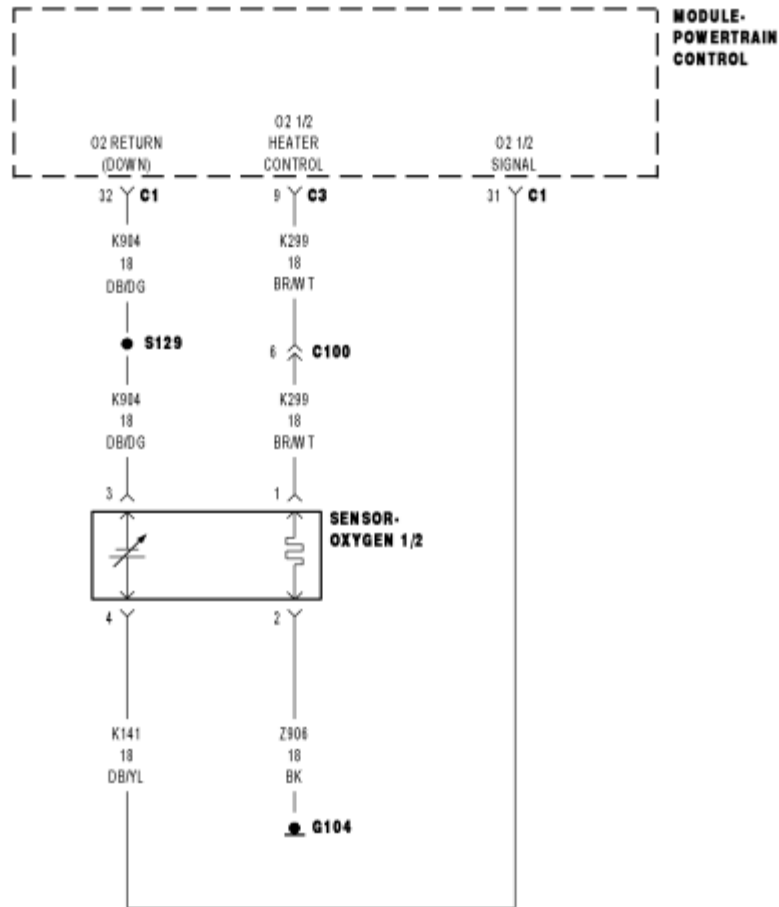
Yes

- Allow the Throttle Body to thaw naturally in a room temperature climate.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7° C (20° F) and altitude below 2590.8 m (8500 ft).

◦ **Set Condition:**

The conditions that cause this diagnostic to fail is when the upstream O2 sensor becomes biased from an exhaust leak, O2 sensor contamination, or some other extreme operating condition. The downstream O2 sensor is considered to be protected from extreme environments by the catalyst. The PCM monitors the downstream O2 sensor feedback control, called downstream fuel trim, to detect any shift in the upstream O2 sensor target voltage from nominal target voltage. The value of the downstream fuel trim is compared with the lean thresholds. Every time the value exceeds the calibrated threshold, a fail timer is incremented and mass flow through the exhaust is accumulated. If the fail timer and accumulated mass flow exceed the fail thresholds, the test fails and the diagnostic stops running for that trip. If the test fails on consecutive trips, a DTC is set.

Possible Causes
EXHAUST LEAK
FUEL DELIVERY SYSTEM
O2 SENSOR, WIRING, OR CONNECTORS
ENGINE MECHANICAL SYSTEM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

NOTE: A thorough exhaust leak test must be completed before removing an O2 Sensor or any other part from the exhaust system. Do not remove any parts before an exhaust leak check has been completed.

NOTE: An exhaust leak may cause downstream fuel adaptives to rail out, resulting in a false O2 Sensor failure

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CHECKING THE FUEL DELIVERY SYSTEM

Perform the diagnostic procedure for *CHECKING THE FUEL DELIVERY SYSTEM.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CHECKING THE OXYGEN SENSOR OPERATION

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors relative to the components tested in this procedure.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to the components tested in this procedure and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

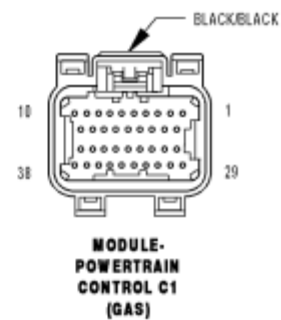
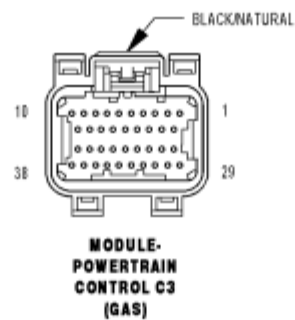
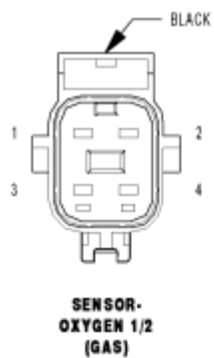
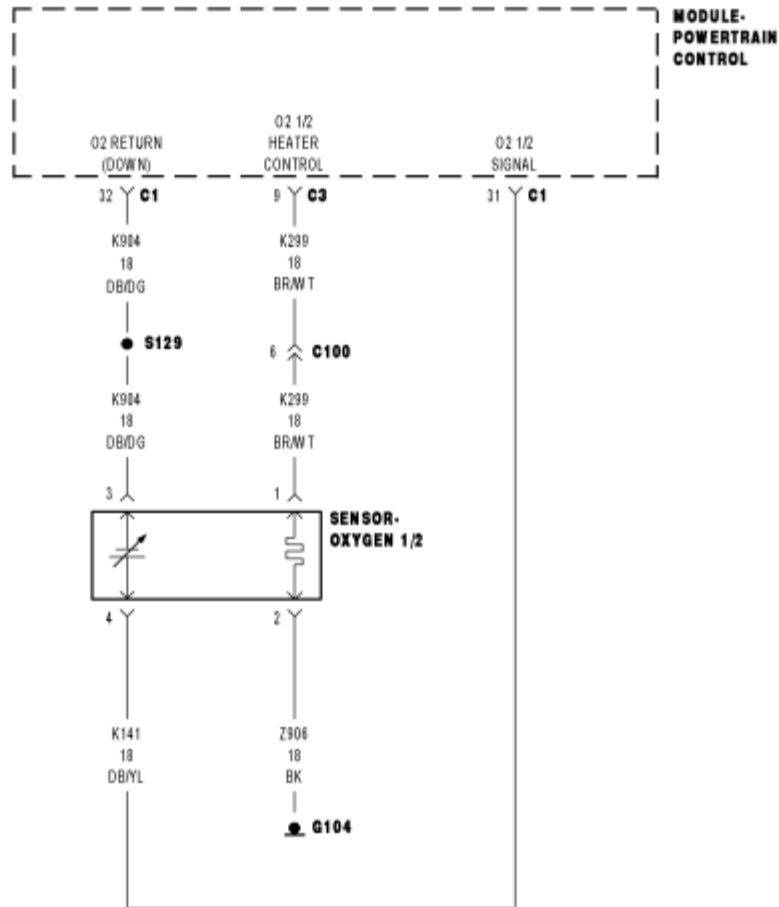
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the PCM in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7° C (20° F) and altitude below 2590.8 m (8500 ft).

◦ **Set Condition:**

The conditions that cause this diagnostic to fail is when the upstream O2 sensor becomes biased from an exhaust leak, O2 sensor contamination, or some other extreme operating condition. The downstream O2 sensor is considered to be protected from extreme environments by the catalyst. The PCM monitors the downstream O2 sensor feedback control, called downstream fuel trim, to detect any shift in the upstream O2 sensor target voltage from nominal target voltage. The value of the downstream fuel trim is compared with the rich thresholds. Every time the value exceeds the calibrated threshold, a fail timer is incremented and mass flow through the exhaust is accumulated. If the fail timer and accumulated mass flow exceed the fail thresholds, the test fails and the diagnostic stops running for that trip. If the test fails on consecutive trips, a DTC is set.

Possible Causes
EXHAUST LEAK
FUEL DELIVERY SYSTEM
O2 SENSOR, WIRING, OR CONNECTORS
ENGINE MECHANICAL SYSTEM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

NOTE: A thorough exhaust leak test must be completed before removing an O2 Sensor or any other part from the exhaust system. Do not remove any parts before an exhaust leak check has been completed.

NOTE: An exhaust leak may cause downstream fuel adaptives to rail out, resulting in a false O2 Sensor failure

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CHECKING THE FUEL DELIVERY SYSTEM

Perform the diagnostic procedure for *CHECKING THE FUEL DELIVERY SYSTEM.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CHECKING THE OXYGEN SENSOR OPERATION

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors relative to the components tested in this procedure.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to the components tested in this procedure and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

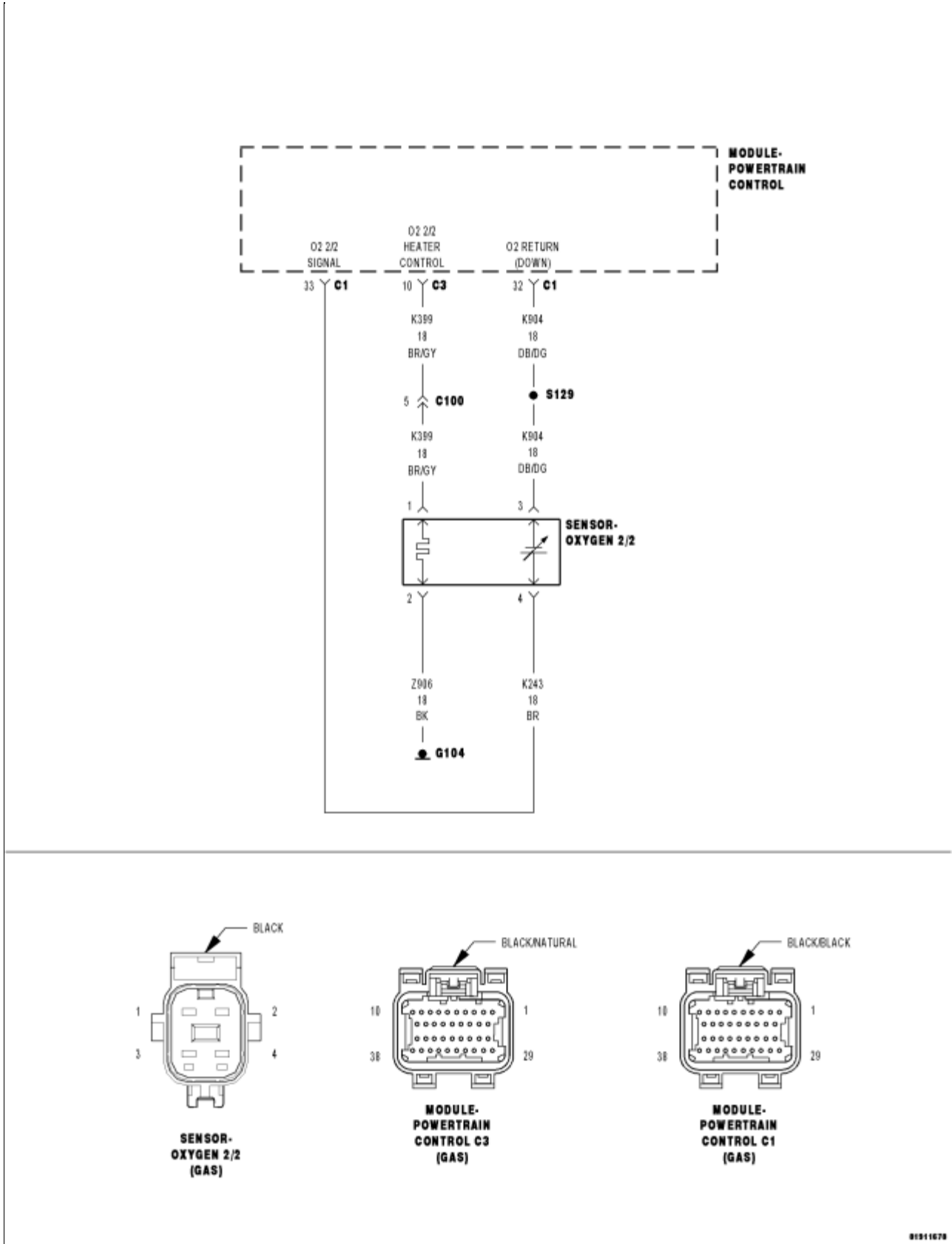
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the PCM in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN



With the engine running in closed loop mode, the ambient/battery temperature above -6.7° C (20° F) and altitude below 2590.8 m (8500 ft). Fuel level greater than 15%.

◦ **Set Condition:**

The conditions that cause this diagnostic to fail is when the upstream O2 sensor becomes biased from an exhaust leak, O2 sensor contamination, or some other extreme operating condition. The downstream O2 sensor is considered to be protected from extreme environments by the catalyst. The PCM monitors the downstream O2 sensor feedback control, called downstream fuel trim, to detect any shift in the upstream O2 sensor target voltage from nominal target voltage. The value of the downstream fuel trim is compared with the lean thresholds. Every time the value exceeds the calibrated threshold, a fail timer is incremented and mass flow through the exhaust is accumulated. If the fail timer and accumulated mass flow exceed the fail thresholds, the test fails and the diagnostic stops running for that trip. If the test fails on consecutive trips, a DTC is set.

Possible Causes
EXHAUST LEAK
FUEL DELIVERY SYSTEM
O2 SENSOR, WIRING, OR CONNECTORS
ENGINE MECHANICAL SYSTEM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

NOTE: A thorough exhaust leak test must be completed before removing an O2 Sensor or any other part from the exhaust system. Do not remove any parts before an exhaust leak check has been completed.

NOTE: An exhaust leak may cause downstream fuel adaptives to rail out, resulting in a false O2 Sensor failure

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CHECKING THE FUEL DELIVERY SYSTEM

Perform the diagnostic procedure for *CHECKING THE FUEL DELIVERY SYSTEM.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CHECKING THE OXYGEN SENSOR OPERATION

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors relative to the components tested in this procedure.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to the components tested in this procedure and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

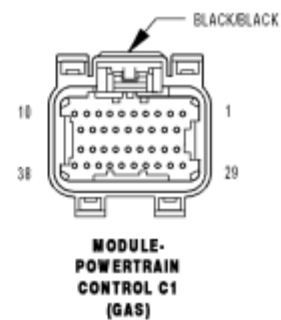
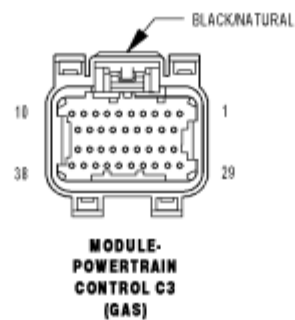
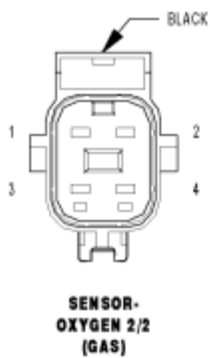
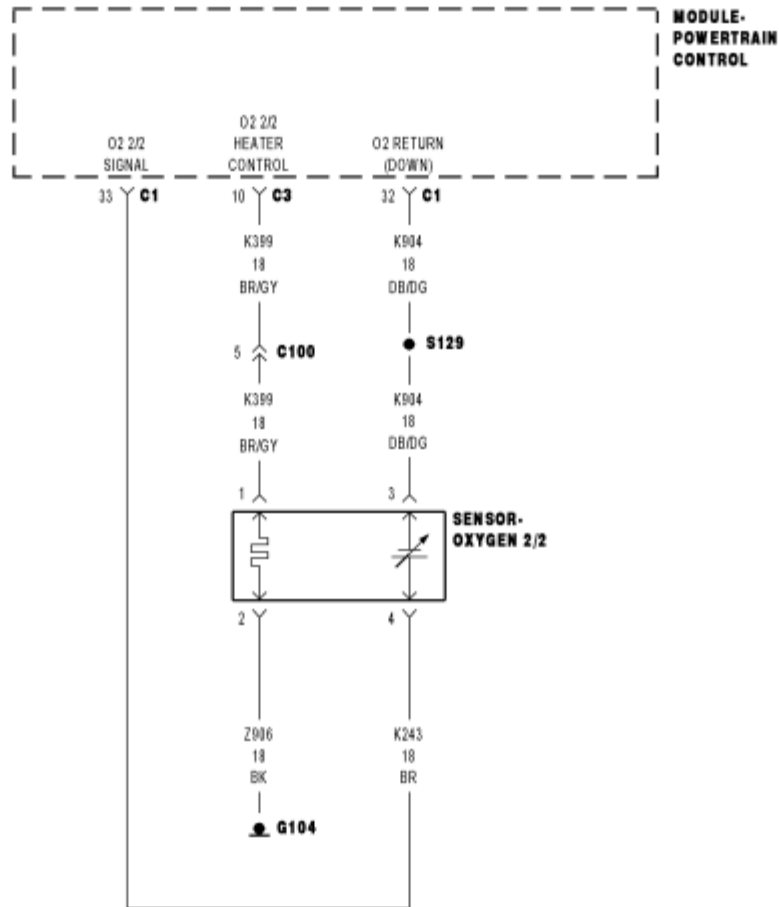
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the PCM in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH



0811678

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running in closed loop mode, the ambient/battery temperature above -6.7° C (20° F) and altitude below 2590.8 m (8500 ft).

◦ **Set Condition:**

The conditions that cause this diagnostic to fail is when the upstream O2 sensor becomes biased from an exhaust leak, O2 sensor contamination, or some other extreme operating condition. The downstream O2 sensor is considered to be protected from extreme environments by the catalyst. The PCM monitors the downstream O2 sensor feedback control, called downstream fuel trim, to detect any shift in the upstream O2 sensor target voltage from nominal target voltage. The value of the downstream fuel trim is compared with the lean thresholds. Every time the value exceeds the calibrated threshold, a fail timer is incremented and mass flow through the exhaust is accumulated. If the fail timer and accumulated mass flow exceed the fail thresholds, the test fails and the diagnostic stops running for that trip. If the test fails on consecutive trips, a DTC is set.

Possible Causes
EXHAUST LEAK
FUEL DELIVERY SYSTEM
O2 SENSOR, WIRING, OR CONNECTORS
ENGINE MECHANICAL SYSTEM
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active or Pending at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CHECKING THE EXHAUST SYSTEM FOR LEAKS

NOTE: A thorough exhaust leak test must be completed before removing an O2 Sensor or any other part from the exhaust system. Do not remove any parts before an exhaust leak check has been completed.

NOTE: An exhaust leak may cause downstream fuel adaptives to rail out, resulting in a false O2 Sensor failure

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the liquid/soapy water to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CHECKING THE FUEL DELIVERY SYSTEM

Perform the diagnostic procedure for *CHECKING THE FUEL DELIVERY SYSTEM.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CHECKING THE OXYGEN SENSOR OPERATION

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors relative to the components tested in this procedure.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to the components tested in this procedure and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

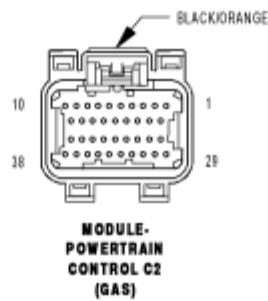
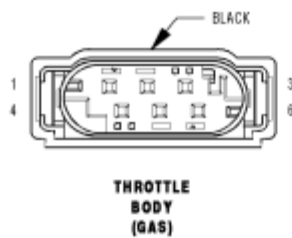
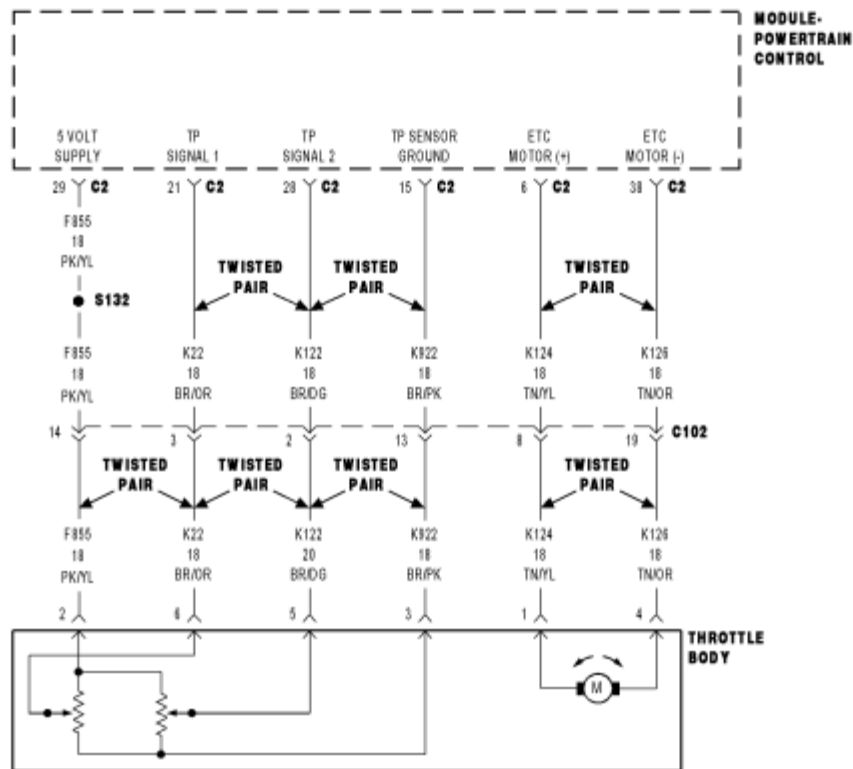
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the PCM in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT



8100000

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on and the ETC Motor is not in Limp Home mode.

- **Set Condition:**

When the PCM detects an internal error or a short between the ETC Motor - and ETC Motor + circuits in the ETC Motor Driver. One trip fault. ETC light is flashing.

Possible Causes
THROTTLE PLATE / BORE INSPECTION
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO THE (K126) ETC MOTOR (-) CIRCUIT
(K124) ETC MOTOR (+) CIRCUIT OPEN
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND
(K126) ETC MOTOR (-) CIRCUIT OPEN
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND
LOW BATTERY VOLTAGE
ETC MOTOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: If the P2100 is intermittent, it is possible that the controller is overheating in extreme hot temperatures, and this is considered a normal protection operation. No repair is necessary.

NOTE: Low battery voltage can also cause excessive current draw, in very hot and very cold ambient temperatures. Make sure the battery can pass a load test before continuing.

With a scan tool, select View DTCs.

View the Freeze Frame data and look closely at the temperatures at which this DTC set.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE PLATE INSPECTION

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Were any signs of foreign material or scoring of the throttle plate or bore found?

Yes

- Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors.
Probing the PCM harness connectors will damage the**

PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform the diagnostics.

Ignition on, engine not running.

Measure the voltage on the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

Is there any voltage present?

Yes

- Repair the short to voltage on the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.

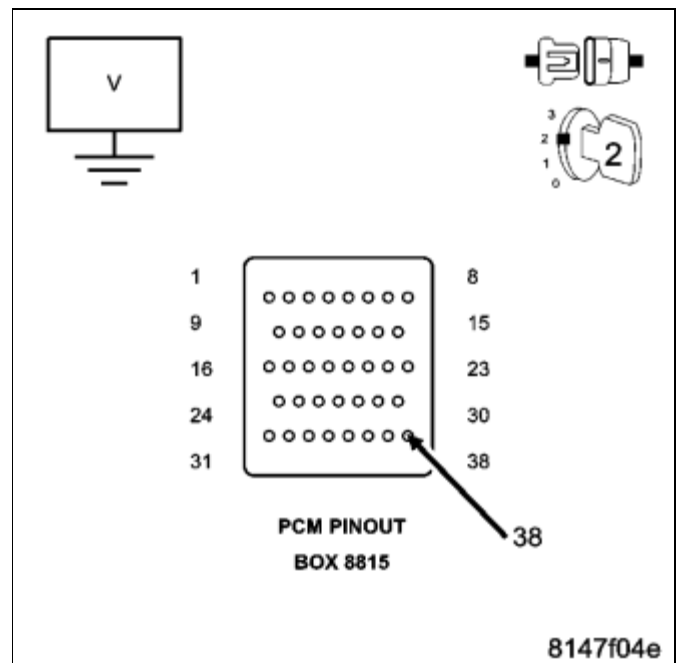
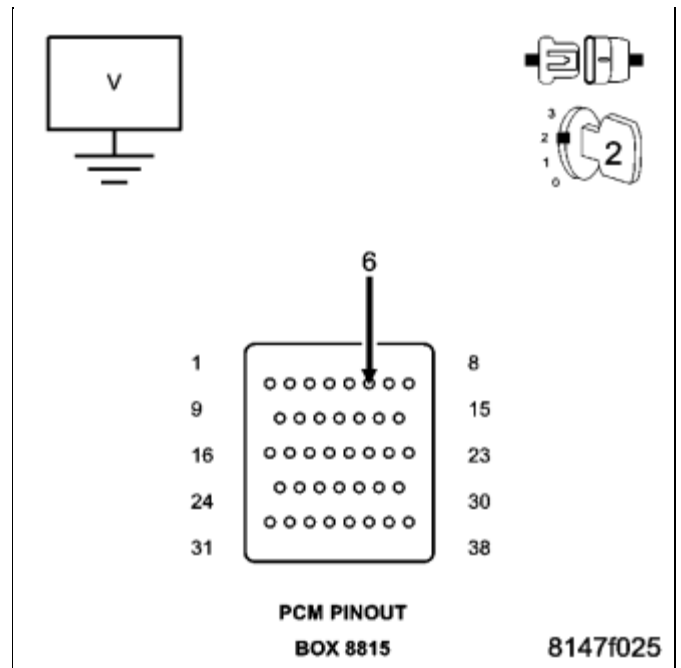
Is there any voltage present?

Yes

- Repair the short to voltage in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO THE (K126) ETC MOTOR (-) CIRCUIT

Turn the ignition off.

Measure the resistance between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit at the appropriate terminals of special tool #8815.

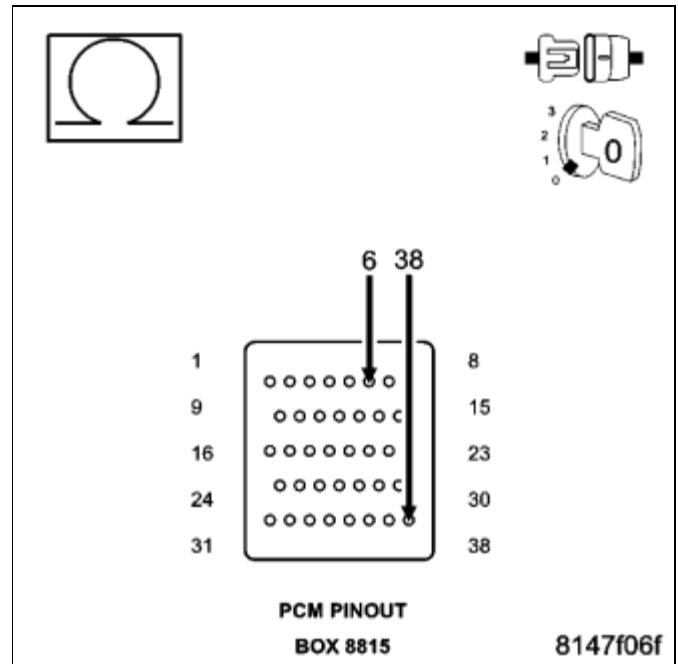
Is the resistance below 100 ohms?

Yes

- Repair the short to between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K124) ETC MOTOR (+) CIRCUIT OPEN

Measure the resistance of the (K124) ETC Motor (+) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

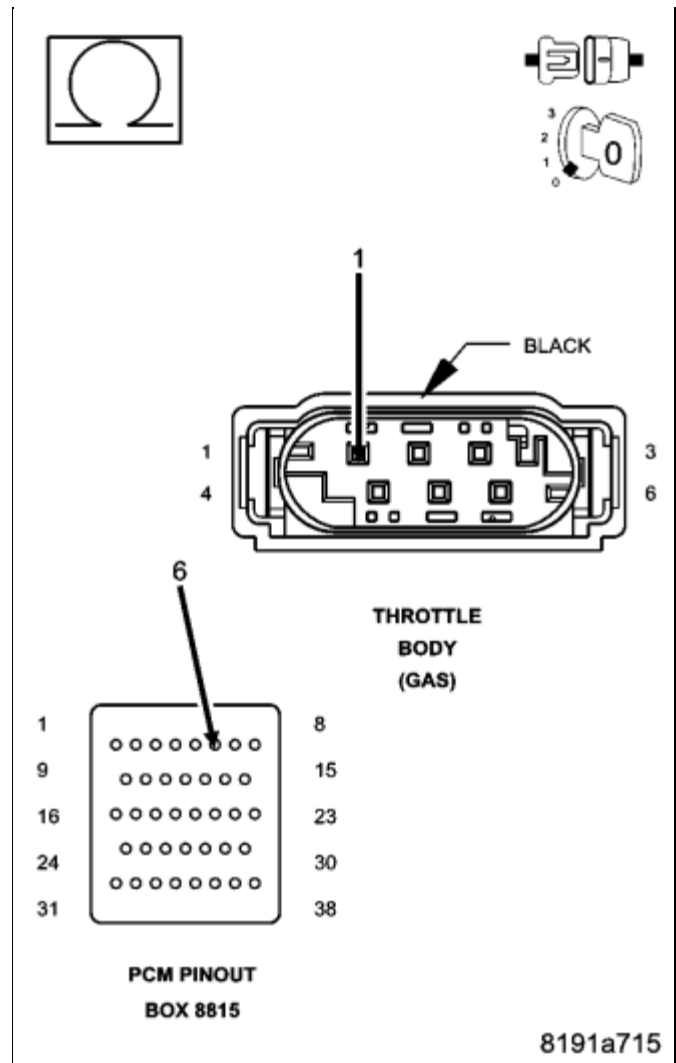
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K124) ETC Motor (+) circuit between the appropriate terminals of special tool #8815.

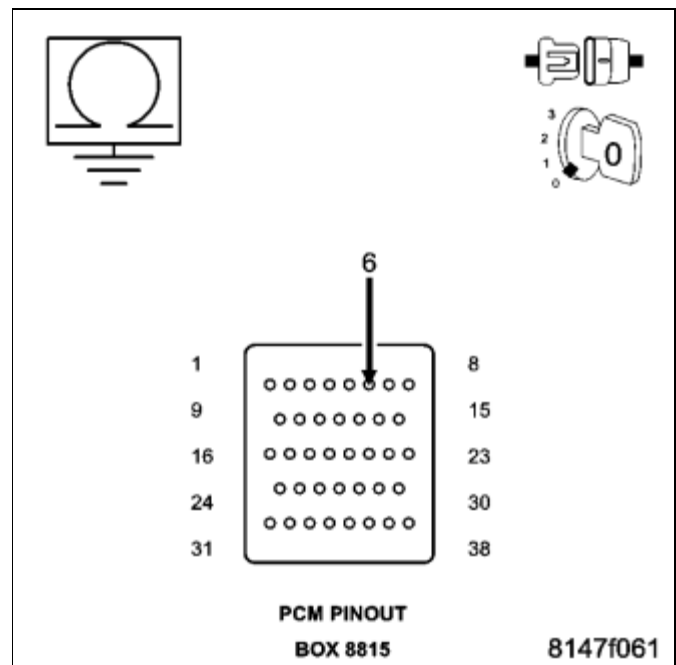
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K126) ETC MOTOR (-) CIRCUIT OPEN

Measure the resistance of the (K126) ETC Motor (-) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

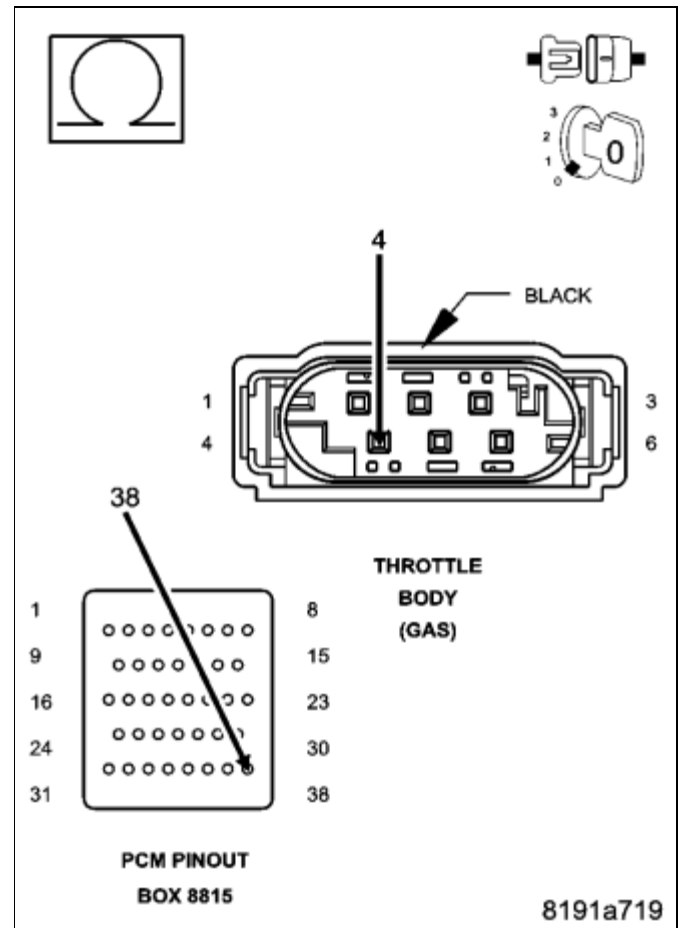
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K126) ETC Motor (-) circuit using the appropriate terminal of special tool #8815.

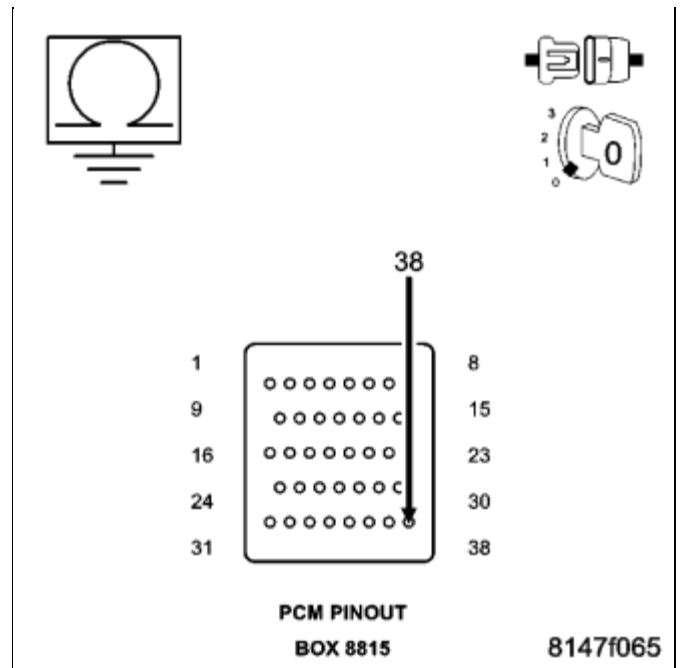
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.

Connect the Throttle Body harness connector.
Measure the resistance of the ETC Motor between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit at the appropriate terminals of special tool #8815.

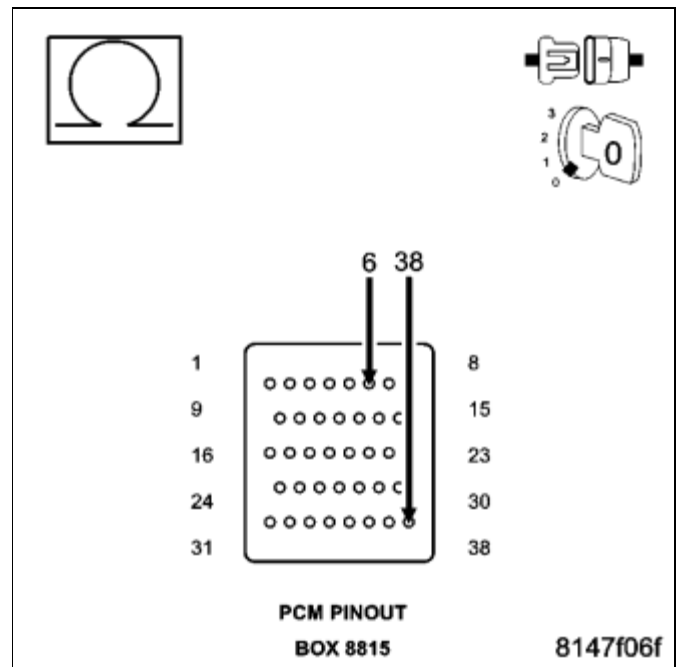
Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes

- Go To [11](#)

No

- Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

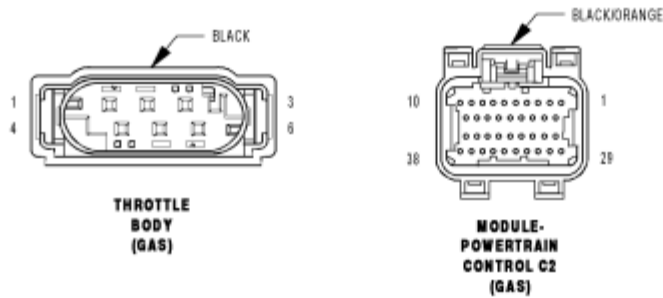
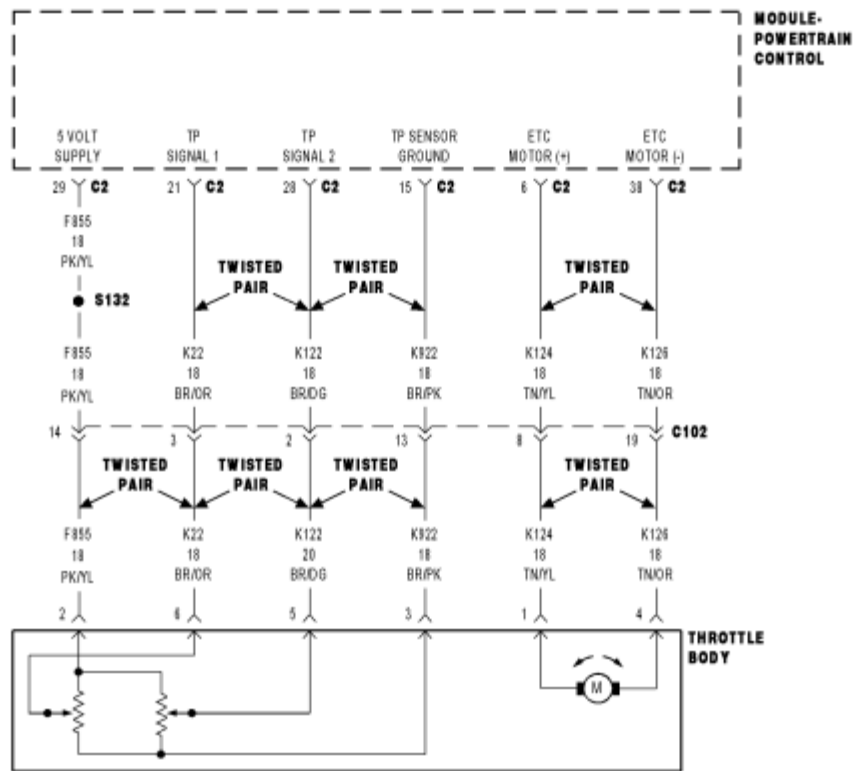
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2101-ELECTRONIC THROTTLE CONTROL MOTOR PERFORMANCE



81000000

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the vehicle running, ETC Motor not in Limp Home mode, and the TPS adaptation is complete.

- **Set Condition:**

The PCM recognizes too large of an error between the actual position of the Throttle Plate and the Set Point position. One trip fault and the code will set within 5 seconds. Three good trips to turn off the MIL ETC light is flashing.

Possible Causes
THROTTLE BODY ASSEMBLY
LOW BATTERY VOLTAGE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: Before continuing visually inspect the throttle blade and bore for any obstructions. Icing of the throttle body may have caused this code to set.

NOTE: Low battery voltage can also cause excessive current draw, in very hot and very cold ambient temperature. Make sure the battery can pass a load test before continuing.

NOTE: Diagnose any 5-Volt Supply, Battery, and TP Sensor DTCs before continuing.

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE POSITION WITHIN 2° DEGREES OF DESIRED THROTTLE POSITION

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, monitor the Actual Throttle Position and Desired Throttle Position.

Compare the Actual Throttle Position and the Set Point Throttle Position.

Is the Actual Throttle Position within 2° degrees of the Desired Throttle Position?

Yes

- Go To [3](#)

No

- Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. ETC OPERATION

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test.

NOTE: It may be necessary to use a mirror to see the throttle blade.

Observe the throttle blade.

NOTE: Make sure the motion of the throttle blade is smooth and that it opens and closes.

Did the ETC motor operate properly?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2107-ELECTRONIC THROTTLE CONTROL MODULE PROCESSOR

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

Internal PCM failure. Module will attempt to reset, so you will be able to hear the throttle relearning. If the condition is continuous, the vehicle may not be driveable. One trip fault. ETC light is flashing.

Possible Causes
POWERTRAIN CONTROL MODULE NEEDS TO BE REPROGRAMMED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. REPROGRAM THE POWERTRAIN CONTROL MODULE

Check for any related TSBs.

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

Test drive the vehicle for 10 miles on a flat road surface.

Does this DTC reset?

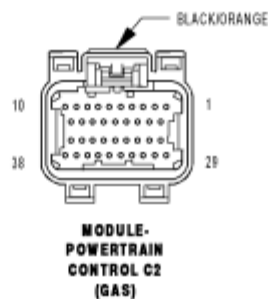
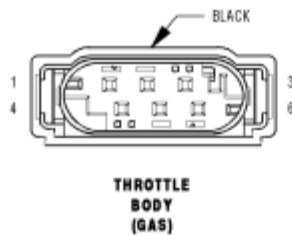
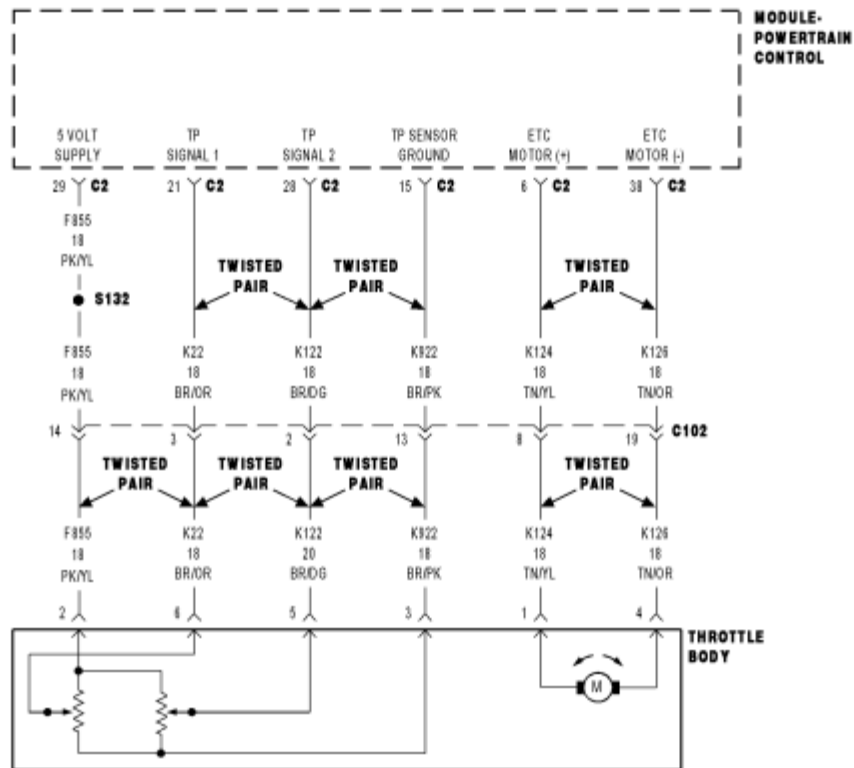
Yes

- Replace and reprogram the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

Test Complete.

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on and ETC motor is working.

- **Set Condition:**

When the PCM requests to limit engine speed if PWM is too high for 20.5 seconds and before P2118 sets. One trip fault and the code will set within 5 seconds. ETC light is illuminated.

Possible Causes
THROTTLE PLATE STUCK
(K124) ETC MOTOR (+) CIRCUIT OPEN
(K126) ETC MOTOR (-) CIRCUIT OPEN
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND
ETC MOTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: If P2072 is also set, this indicates that the cold weather ice blockage routine has run. No repair action is required.

Ignition on, engine not running.
With a scan tool, select View DTCs.

In the Freeze Frame data, look at the temperature at which the fault occurred. If it occurred in extreme cold temperatures, Icing of the throttle body may have caused this code to set.

NOTE: Diagnose any TP Sensor faults, 5-Volt Supply faults, and Battery Voltage High or Low DTCs before continuing.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (K124) ETC MOTOR (+) CIRCUIT OPEN

Turn the ignition off.
Disconnect the Throttle Body harness connector.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K124) ETC Motor (+) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

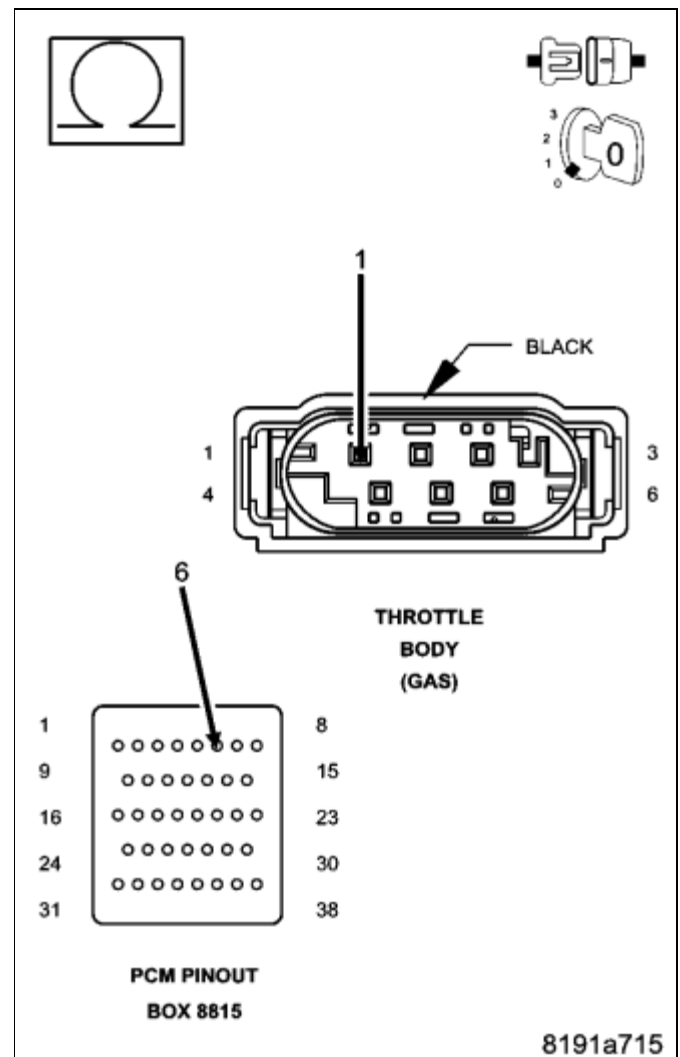
Is the resistance below 5.0 ohms?

Yes

- Go To [3](#)

No

- Repair the open in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. (K126) ETC MOTOR (-) CIRCUIT OPEN

Measure the resistance of the (K126) ETC Motor (-) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

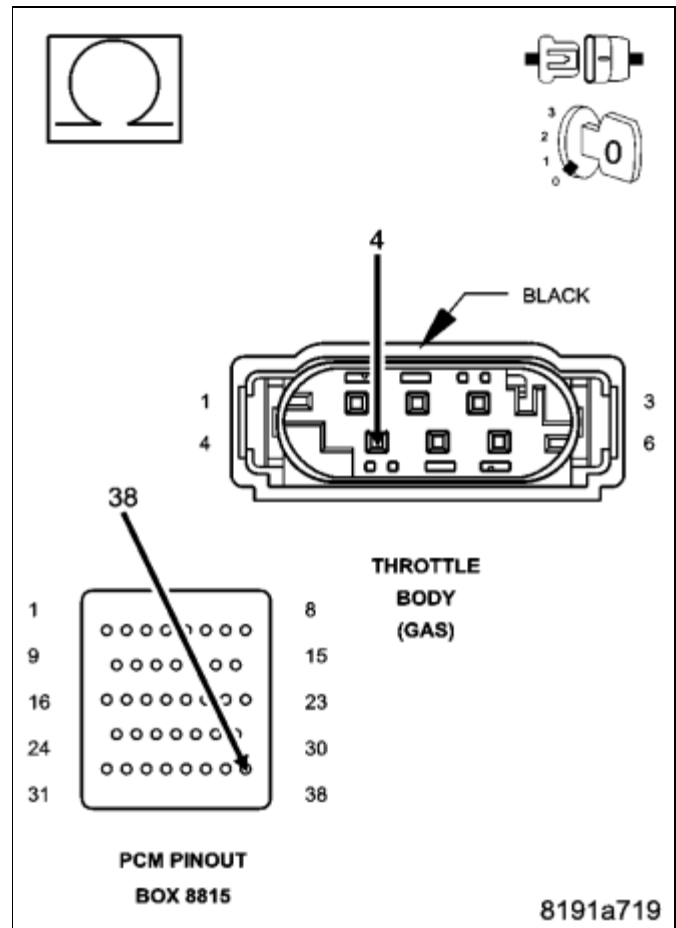
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

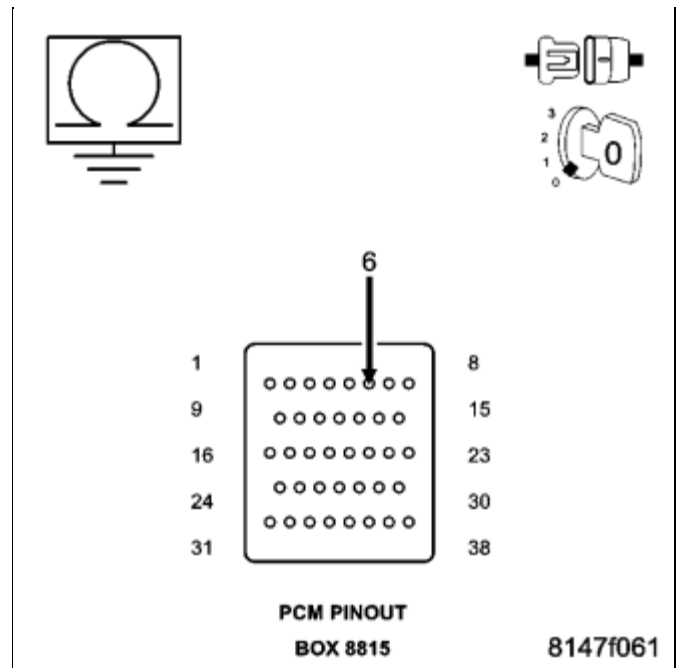
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.

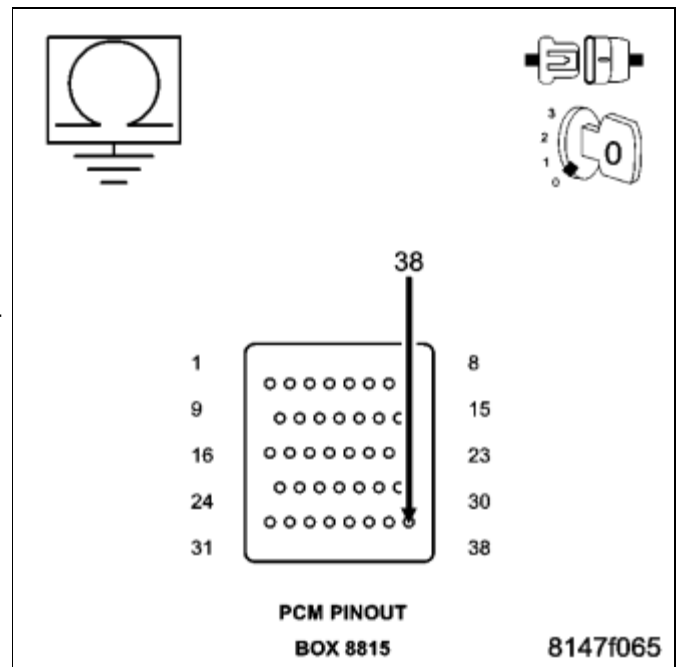
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.

Measure the resistance of the ETC Motor between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit at the appropriate terminals of special tool #8815.

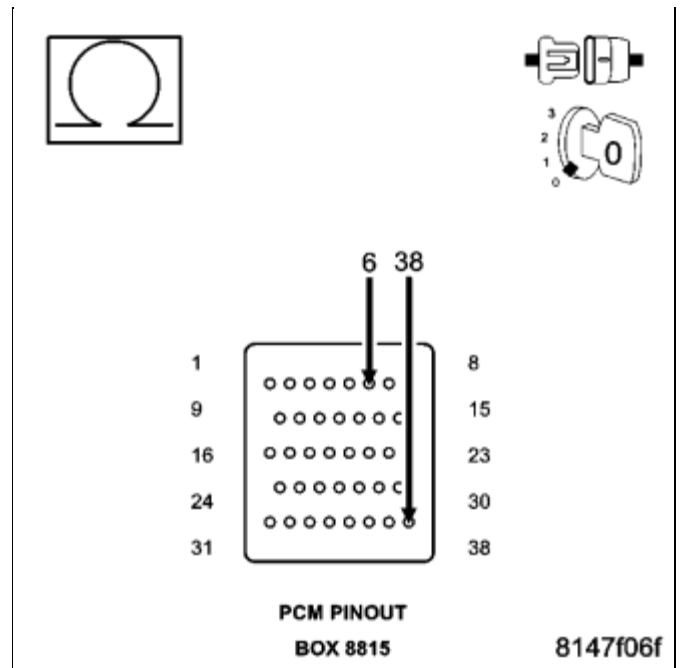
Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. THROTTLE PLATE STUCK

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) causing the Throttle to stick.

Using a scan tool, perform the ETC Throttle Follower Test.

You may need an assistant to watch the Throttle Plate move.

Does the Throttle Plate move during the test?

Yes

- Go To [8](#)

No

- Remove the debris if possible or replace the Throttle Body Assembly if signs of physical damage are present. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body

and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

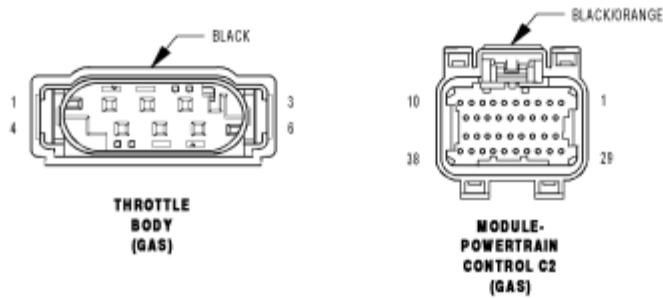
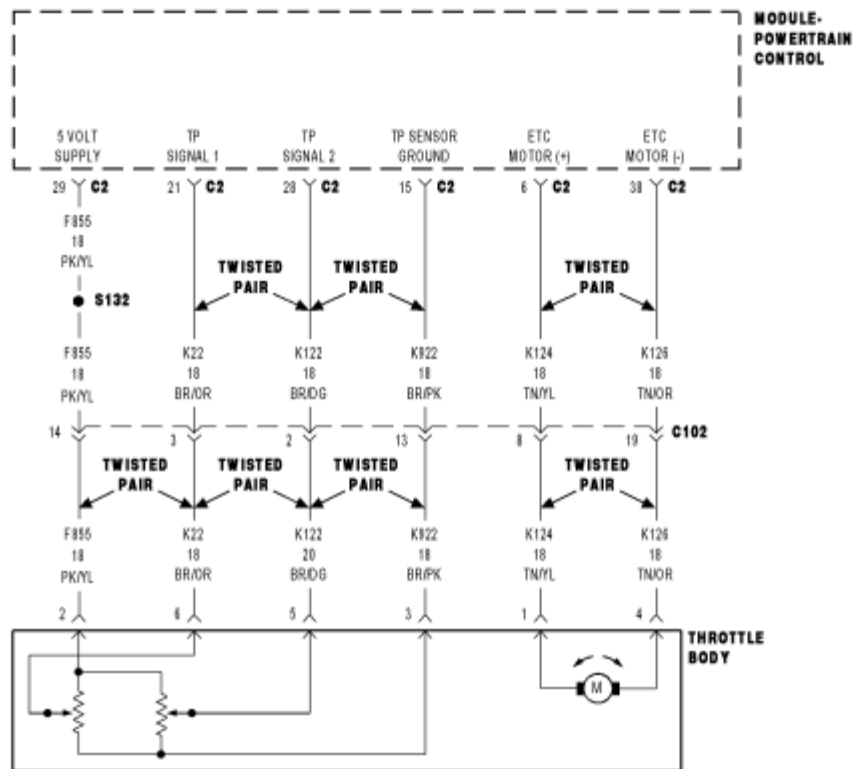
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE



81000000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and battery voltage greater than 10 volts.

◦ **Set Condition:**

Just after key on, the throttle is opened and closed to test the system. If the TP Sensor does not return to Limp Home Position at the end of this test, this DTC will set. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
THROTTLE PLATE STUCK ABOVE LIMP HOME POSITION
TP SENSOR NO.1 AND TP SENSOR NO.2 BOTH READ 2.5 VOLTS
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE
(K124) ETC MOTOR (+) CIRCUIT OPEN
(K126) ETC MOTOR (-) CIRCUIT OPEN
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Maximum engine speed could be reduced while this fault is active, it just depends where the throttle gets stuck.

Ignition on, engine not running.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

With a scan tool select View DTCs.

NOTE: Diagnose any TP Sensor or 5-Volt Supply DTCs before continuing.

Is the DTC Active at this time?**Yes**

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE PLATE STUCK OPEN

Turn the ignition off.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material causing the Throttle to remain open.

Using a scan tool, under System Tests, perform the ETC Throttle Follower Test.

Have an assistant watch the throttle plate to verify it moves during the test.

Does the Throttle Plate move?**Yes**

- Go To [3](#)

No

- Remove the debris if possible or replace the Throttle Body Assembly if signs of physical damage are present. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and perform the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. TP SENSOR NO.1 AND TP SENSOR NO.2 BOTH EQUAL 2.5 VOLTS

With a scan tool, perform the ETC Throttle Follower test while reading both TP Sensor voltage readings.

Are both TP Sensor readings stuck at 2.5 volts?**Yes**

- Check the TP Sensor Signal circuits for excessive resistance, being shorted to each other, or shorted to the Sensor Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Throttle Body harness connector.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform the diagnostics.

Ignition on, engine not running.
Measure the voltage on the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

Is there any voltage present?

Yes

- Repair the short to voltage on the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. (K124) ETC MOTOR (+) CIRCUIT OPEN

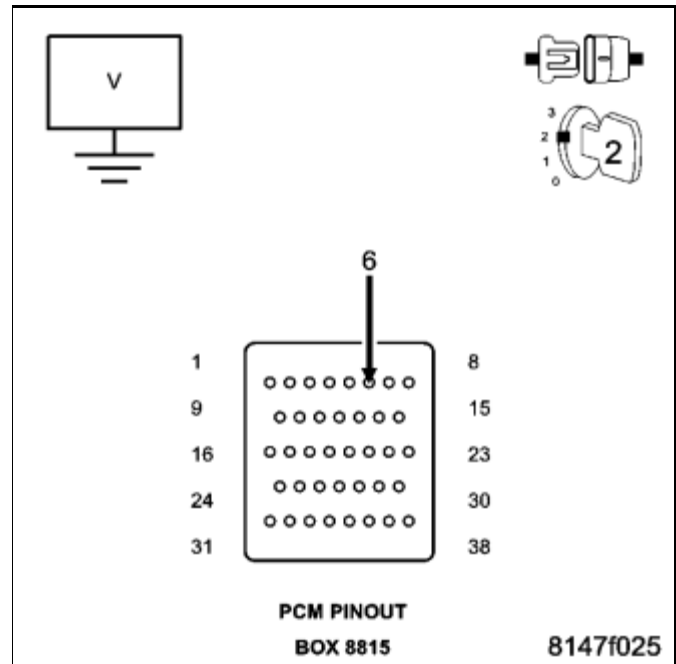
Turn the ignition off.
Measure the resistance of the (K124) ETC Motor (+) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

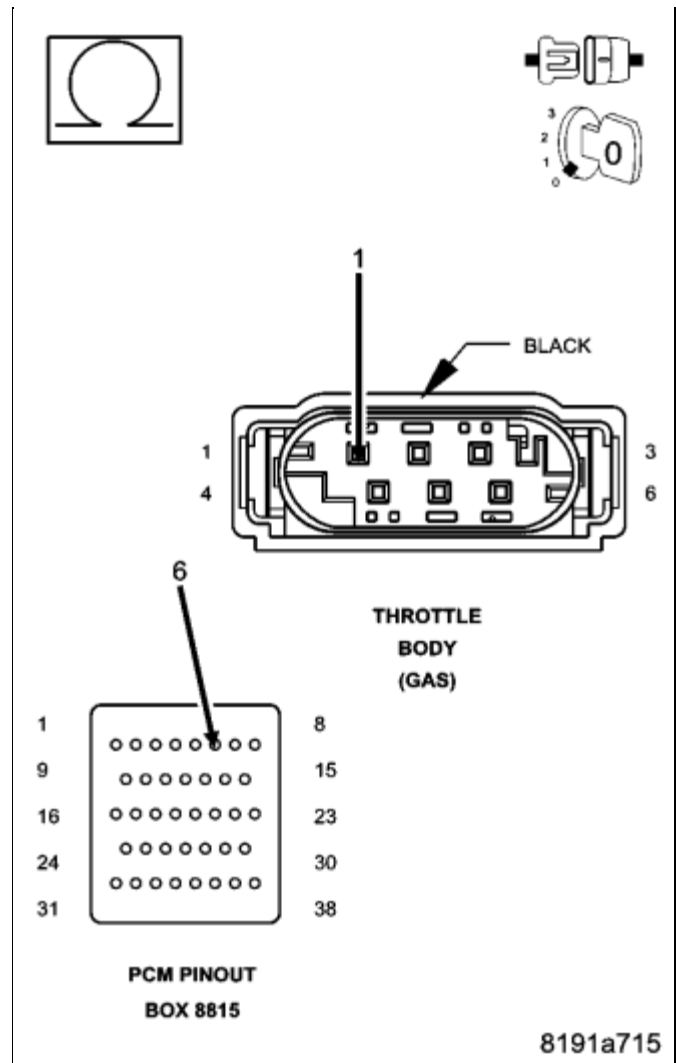
Yes

- Go To [6](#)

No



- Repair the open in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (K126) ETC MOTOR (-) CIRCUIT OPEN

Measure the resistance of the (K126) ETC Motor (-) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

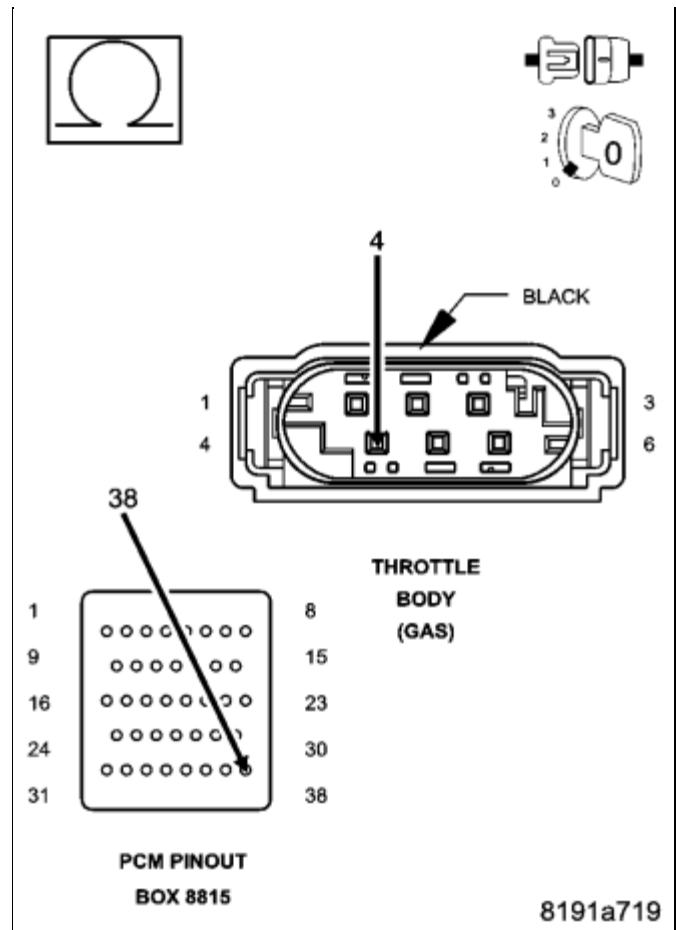
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

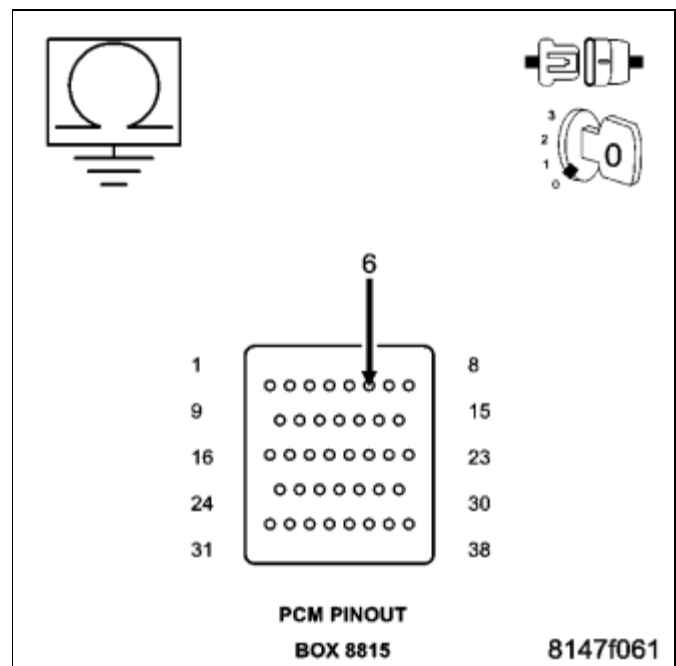
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.

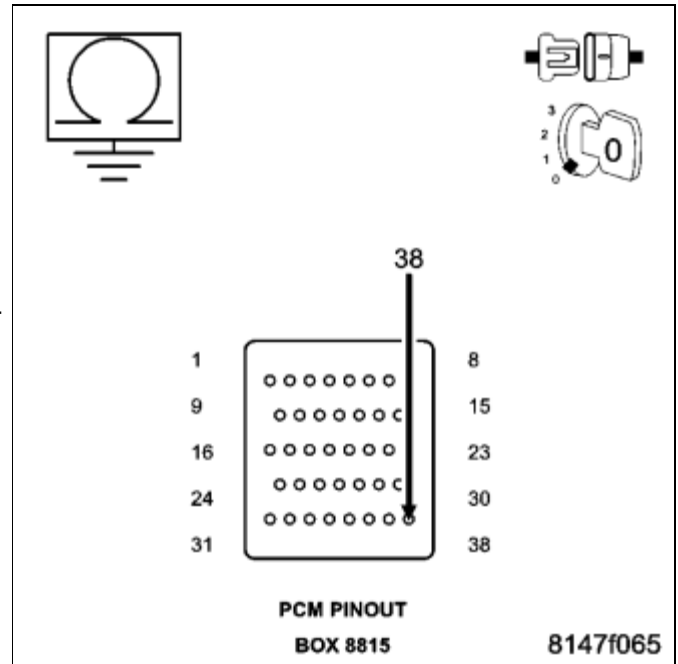
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

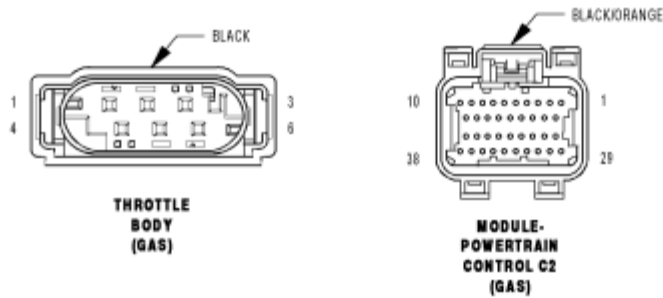
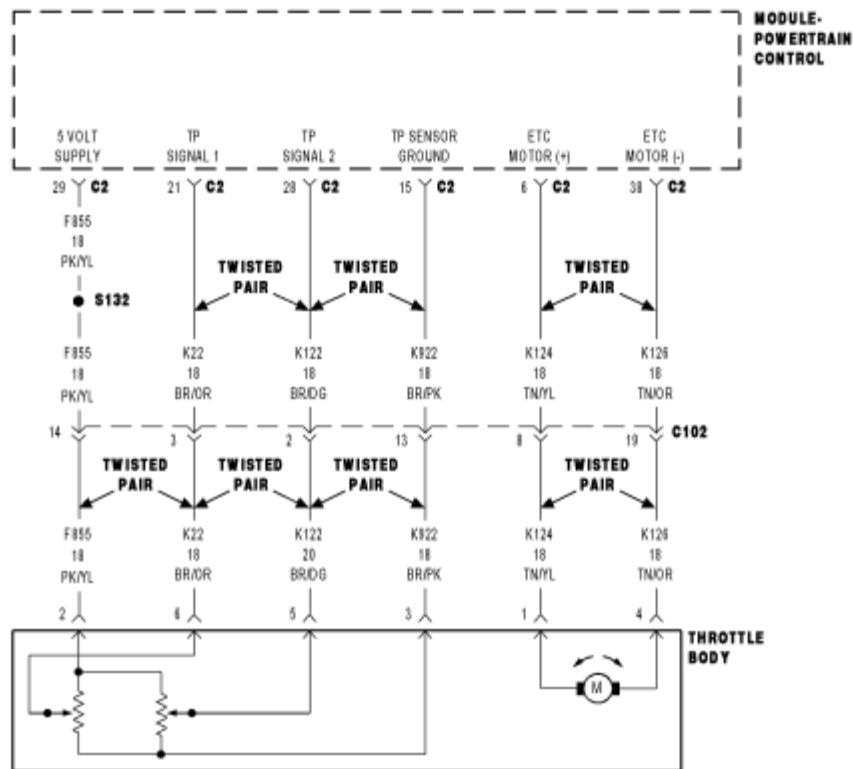
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN



81000000

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and battery voltage greater than 10 volts.

◦ **Set Condition:**

Just after key on, the throttle is opened and closed to test the system. If the TP Sensor does not return to Limp Home Position at the end of this test, this DTC will set. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
THROTTLE PLATE STUCK AT OR BELOW LIMP HOME POSITION
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE
(K124) ETC MOTOR (+) CIRCUIT OPEN
(K126) ETC MOTOR (-) CIRCUIT OPEN
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

With a scan tool, select View DTCs.

NOTE: Diagnose any TP Sensor, Battery Voltage, and 5-Volt Supply DTCs before continuing.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE PLATE STUCK OPEN

Turn the ignition off.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not open this DTC sets.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material causing the Throttle to remain open.

Using a scan tool, under System Tests, perform the ETC Throttle Follower Test.

Have an assistant watch the throttle plate to verify it moves during the test.

Does the Throttle Plate move?

Yes

- Go To [3](#)

No

- Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

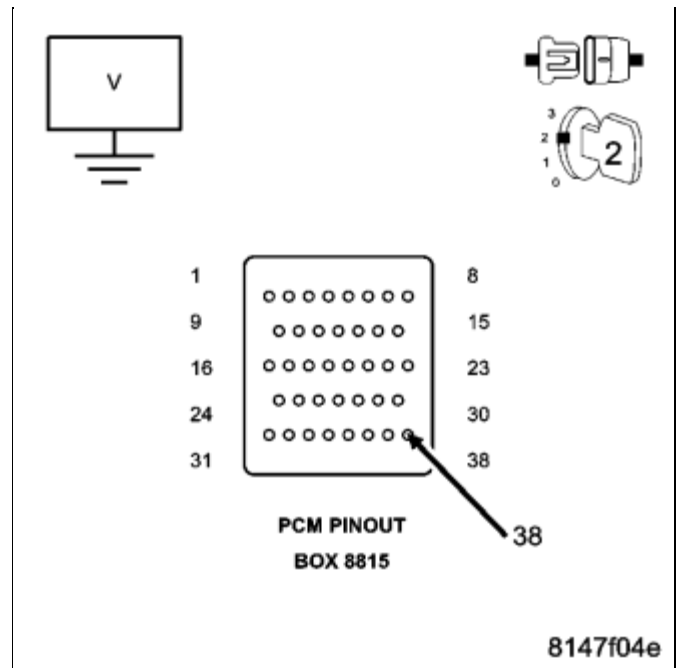
Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

Measure the voltage on the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.



Is there any voltage present?

Yes

- Repair the short to voltage on the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (K124) ETC MOTOR (+) CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (K124) ETC Motor (+) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

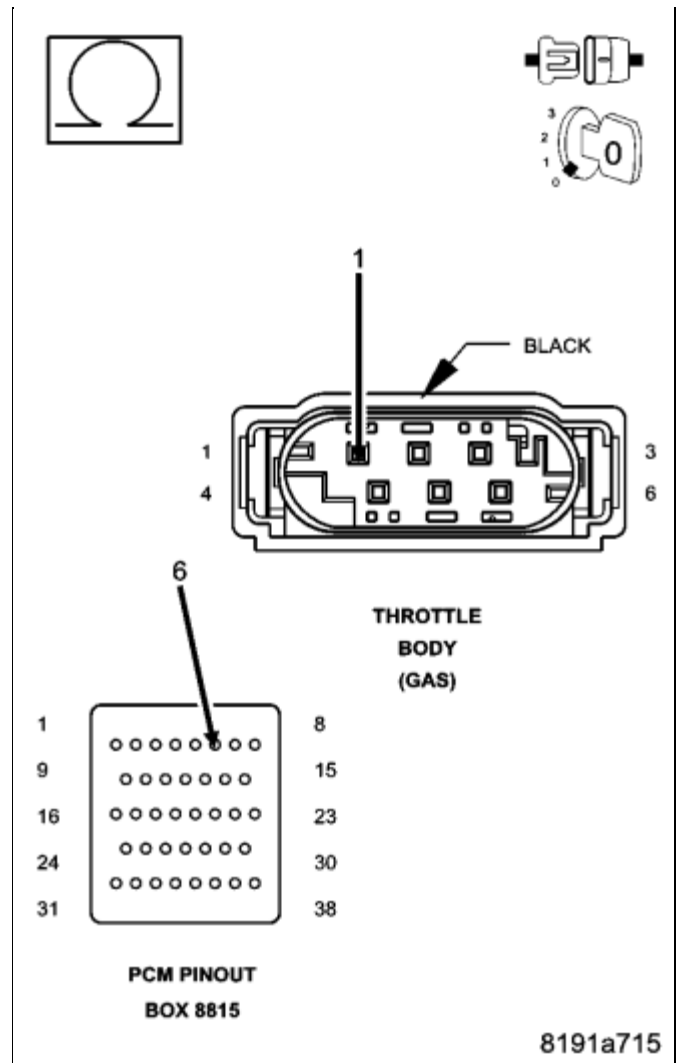
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (K126) ETC MOTOR (-) CIRCUIT OPEN

Measure the resistance of the (K126) ETC Motor (-) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

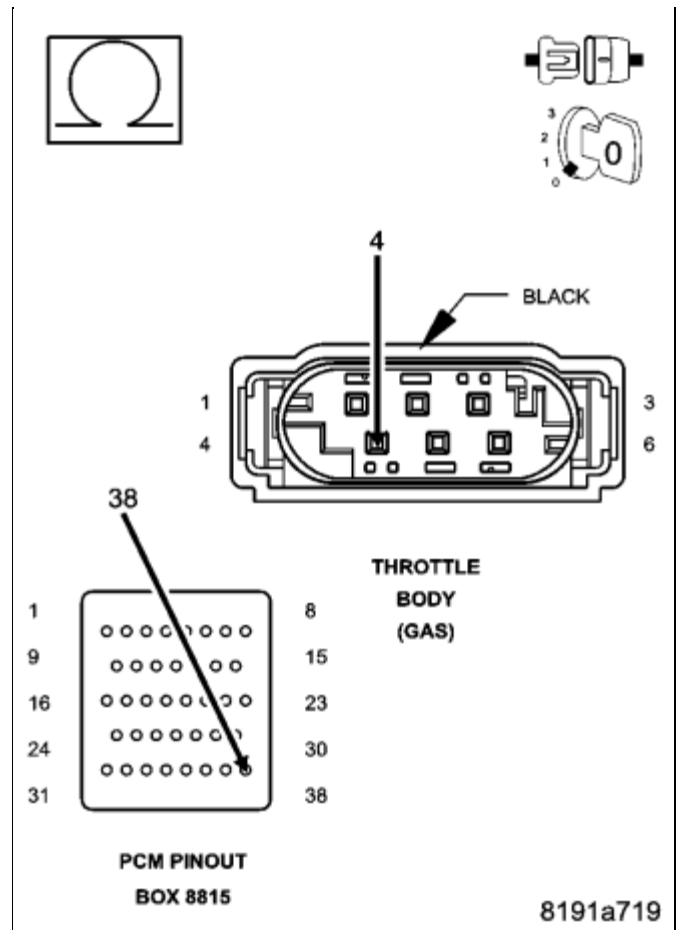
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

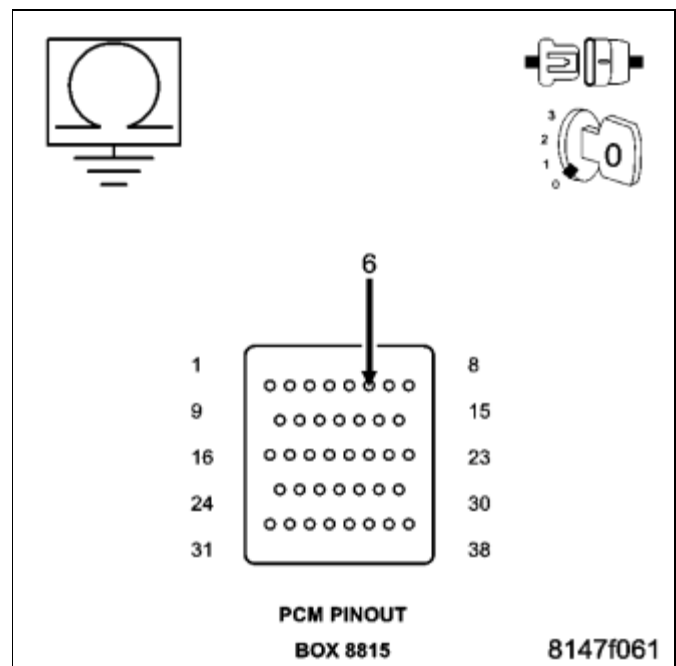
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [Z](#)



7. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.

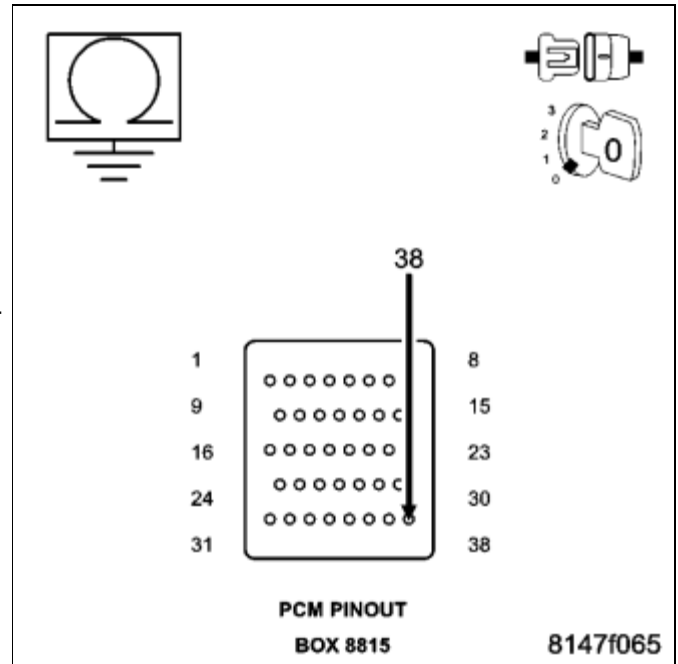
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2115-ACCELERATOR PEDAL POSITION SENSOR 1 MINIMUM STOP PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors. The test for P2115 is only enabled once test for P2166 has passed.

- **Set Condition:**

APPS No.1 has failed to achieve the required minimum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle. ETC light is illuminated.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool, select View DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, view DTCs.

NOTE: Diagnose any APPS out of Range and 5-Volt Supply DTCs before continuing.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

Start the engine.

Does the DTC return?

Yes

- Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P2116-ACCELERATOR PEDAL POSITION SENSOR 2 MINIMUM STOP PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors. The test for P2116 is only enabled once test for P2167 has passed.

◦ **Set Condition:**

APPS No.2 has failed to achieve the required minimum value during In Plant testing. One trip fault and the code will be stored within 5 seconds. Engine will only idle. ETC light is illuminated.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool, select View DTCs and record the related Freeze Frame data.

With a scan tool, erase DTCs.

Start the engine.

With a scan tool, view DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

Start the engine.

Does the DTC return?

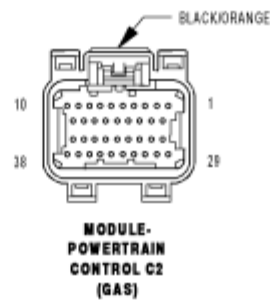
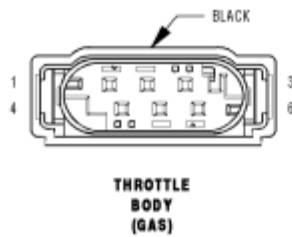
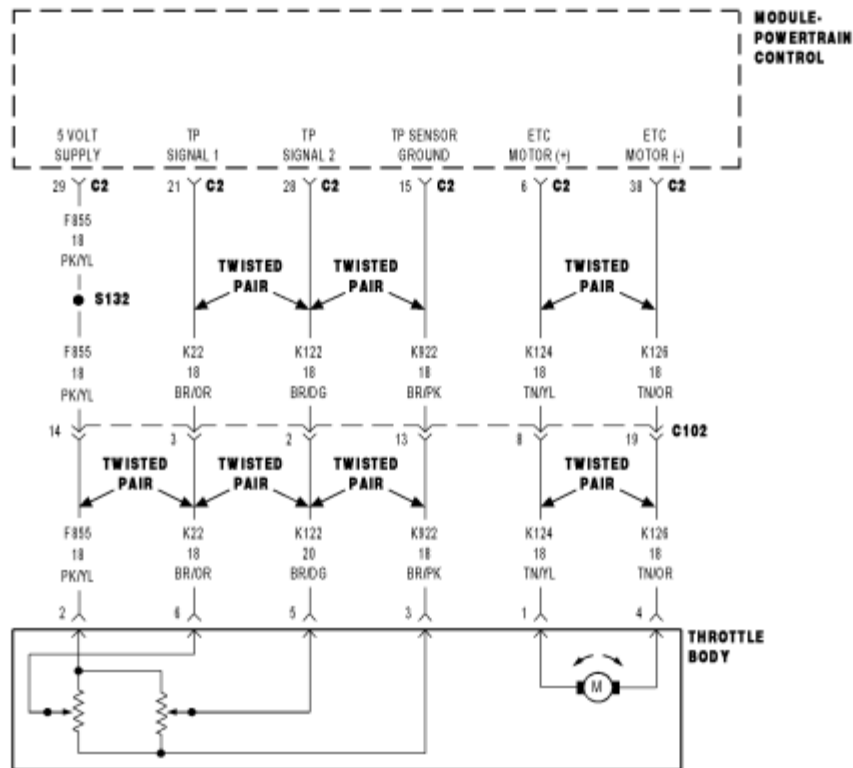
Yes

- Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT



810028a5

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and the ETC Motor is not in Limp Home mode.

Set Condition:

When the PCM detects an internal error or a short between the ETC Motor - and ETC Motor + circuits in the ETC Motor Driver. One trip fault. ETC light is flashing.

Possible Causes
THROTTLE PLATE / BORE INSPECTION
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO THE (K126) ETC MOTOR (-) CIRCUIT
(K124) ETC MOTOR (+) CIRCUIT OPEN
(K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND
(K126) ETC MOTOR (-) CIRCUIT OPEN
(K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND
ETC MOTOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test**1. ACTIVE DTC**

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

NOTE: If P2072 is also set, this indicates that the cold weather ice blockage routine has run. No repair action is necessary.

Ignition on, engine not running.

NOTE: If the P2118 is intermittent, it is possible that the controller is overheating in extreme hot temperatures, and this is considered a normal protection operation. No repair is necessary.

With a scan tool, select View DTCs.
Look closely at the temperatures at which this DTC set.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. THROTTLE PLATE INSPECTION

Turn the ignition off.
Remove the Air Cleaner Assembly from the Throttle Body.
Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Were any signs of foreign material or scoring of the throttle plate or bore found?

Yes

- Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Throttle Body harness connector.
Disconnect the C2 PCM harness connector.
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the voltage on the (K124) ETC Motor (+) circuit at the appropriate terminal of special tool #8815.

Is there any voltage present?

Yes

- Repair the short to voltage on the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K126) ETC Motor (-) circuit at the appropriate terminal of special tool #8815.

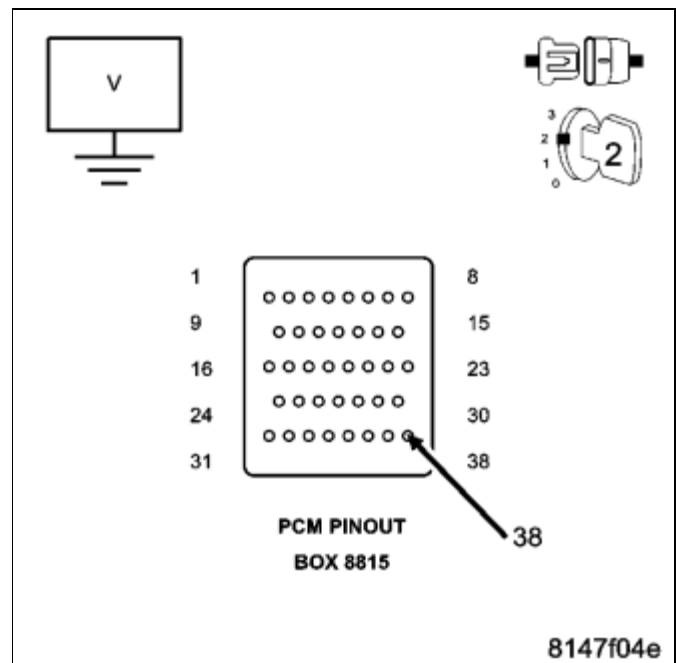
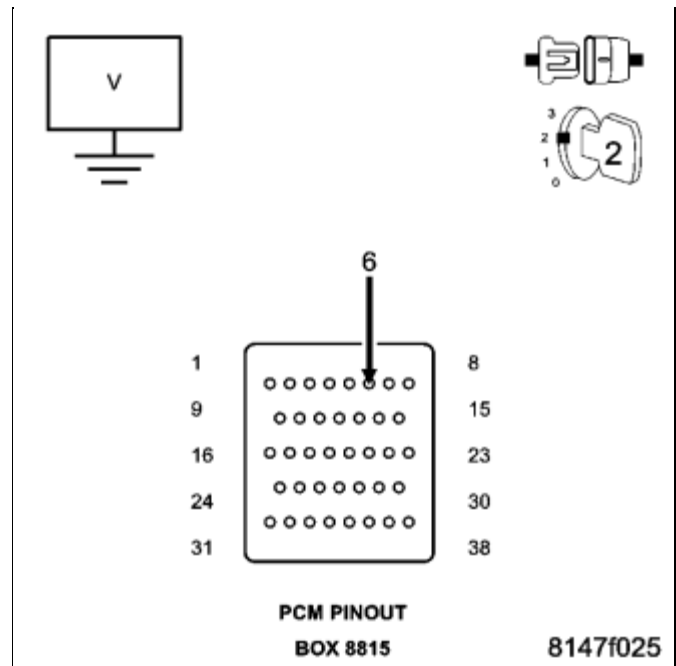
Is there any voltage present?

Yes

- Repair the short to voltage in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO THE (K126) ETC MOTOR (-) CIRCUIT

Turn the ignition off.

Measure the resistance between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit at the appropriate terminals of special tool #8815.

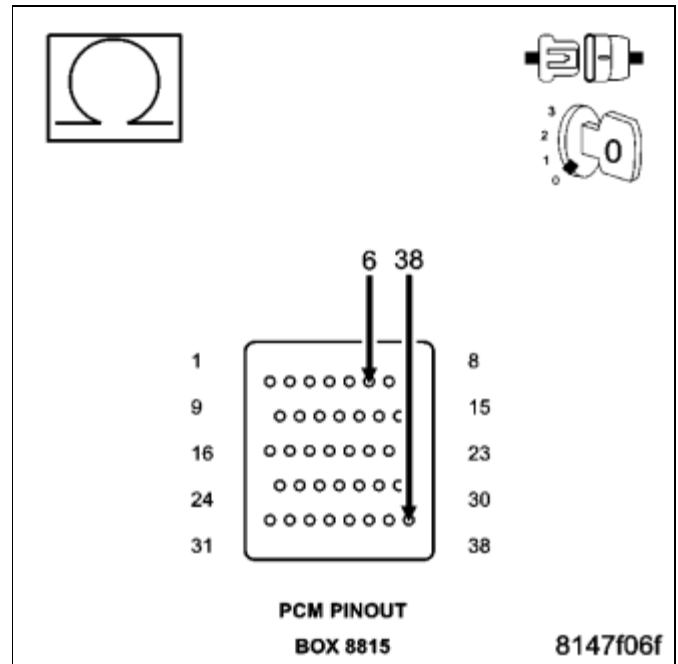
Is the resistance below 100 ohms?

Yes

- Repair the short to between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K124) ETC MOTOR (+) CIRCUIT OPEN

Measure the resistance of the (K124) ETC Motor (+) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

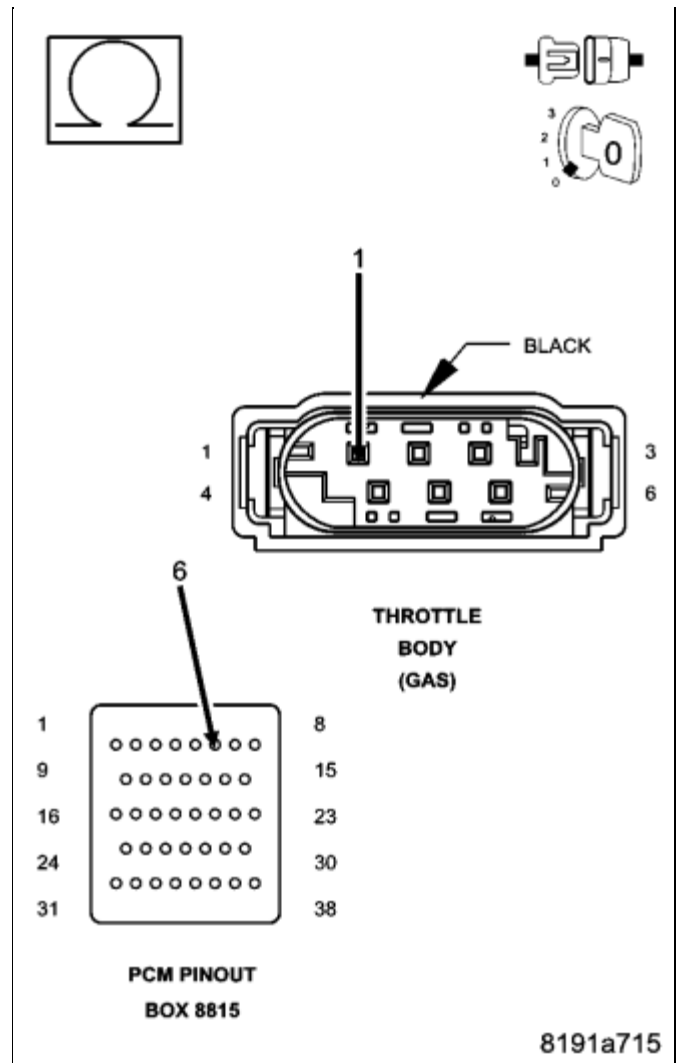
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K124) ETC MOTOR (+) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K124) ETC Motor (+) circuit between the appropriate terminals of special tool #8815.

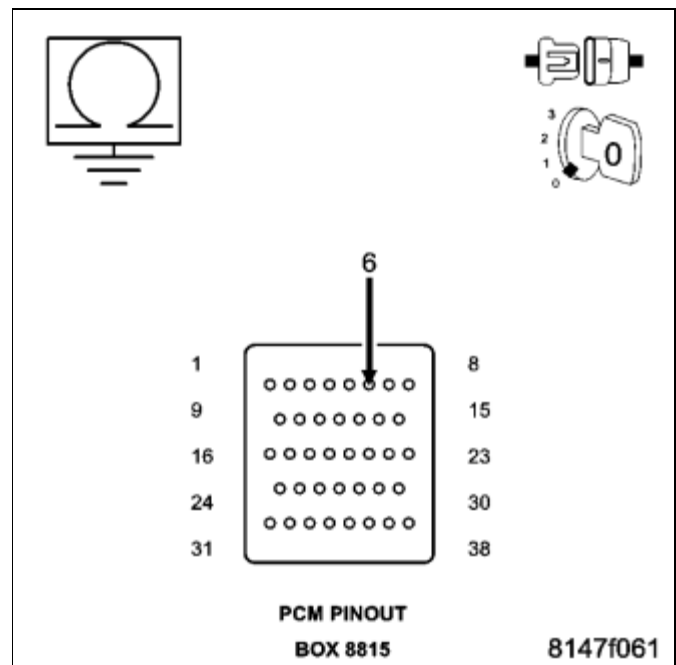
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K124) ETC Motor (+) circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K126) ETC MOTOR (-) CIRCUIT OPEN

Measure the resistance of the (K126) ETC Motor (-) circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

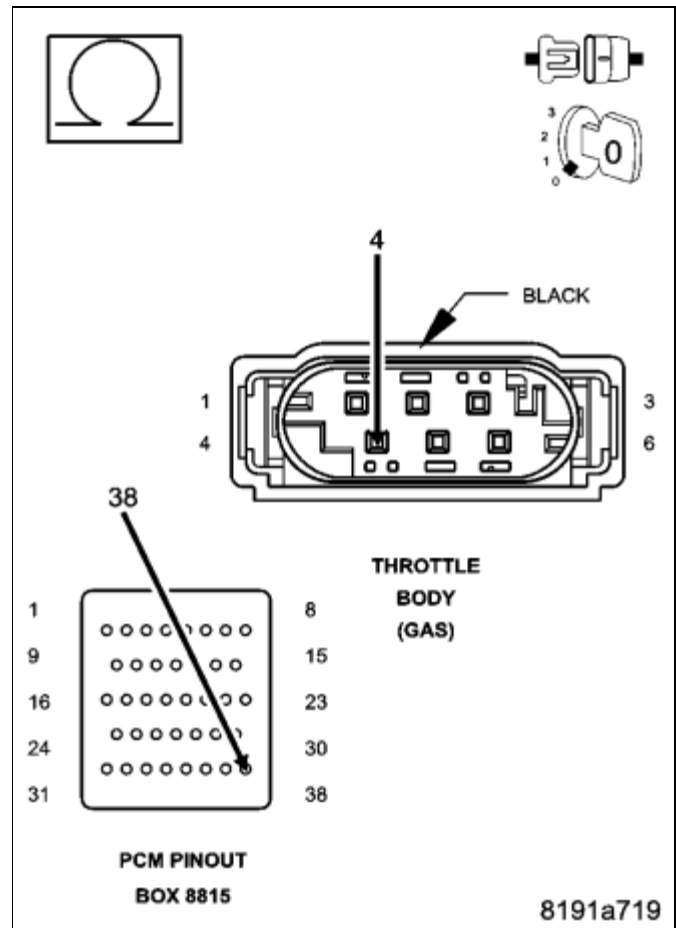
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. (K126) ETC MOTOR (-) CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K126) ETC Motor (-) circuit between the appropriate terminals of special tool #8815.

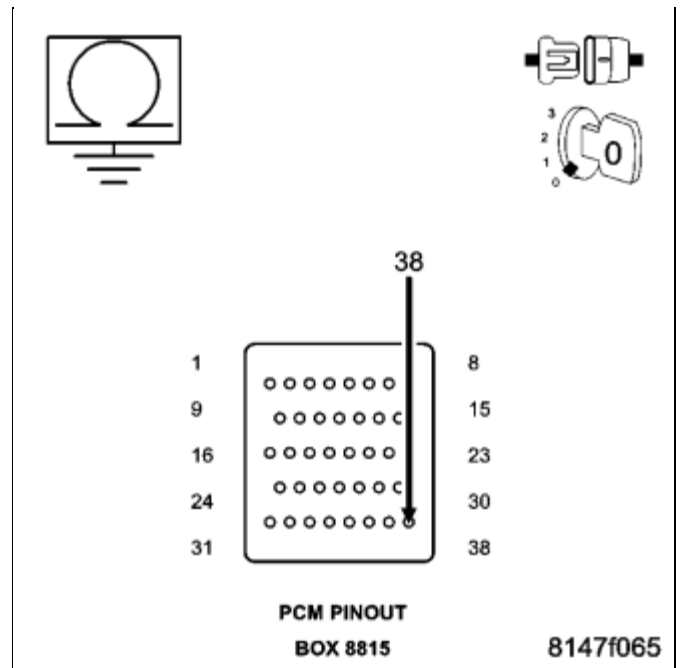
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K126) ETC Motor (-) circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.

Connect the Throttle Body harness connector.
Measure the resistance of the ETC Motor between the (K124) ETC Motor (+) circuit and the (K126) ETC Motor (-) circuit at the appropriate terminals of special tool #8815.

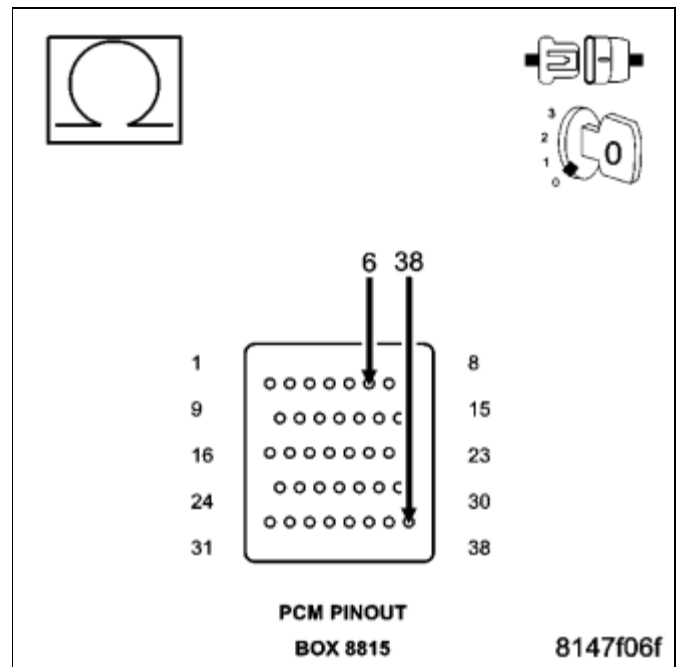
Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes

- Go To [11](#)

No

- Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

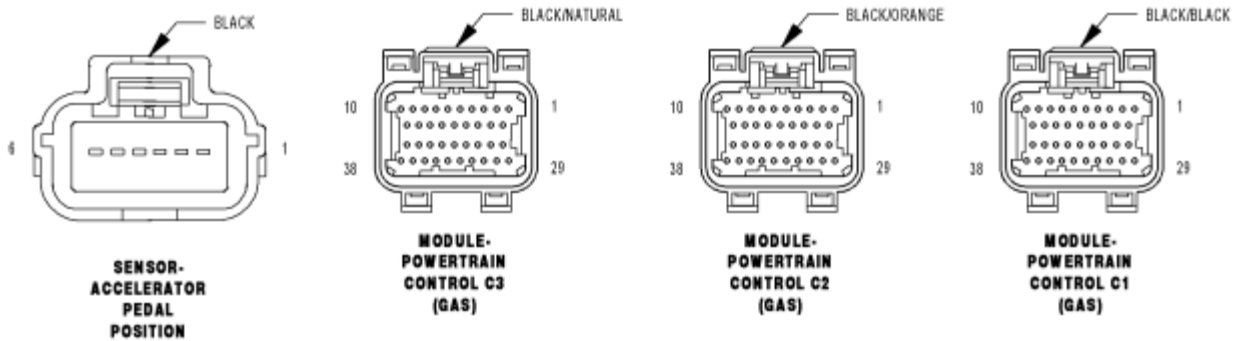
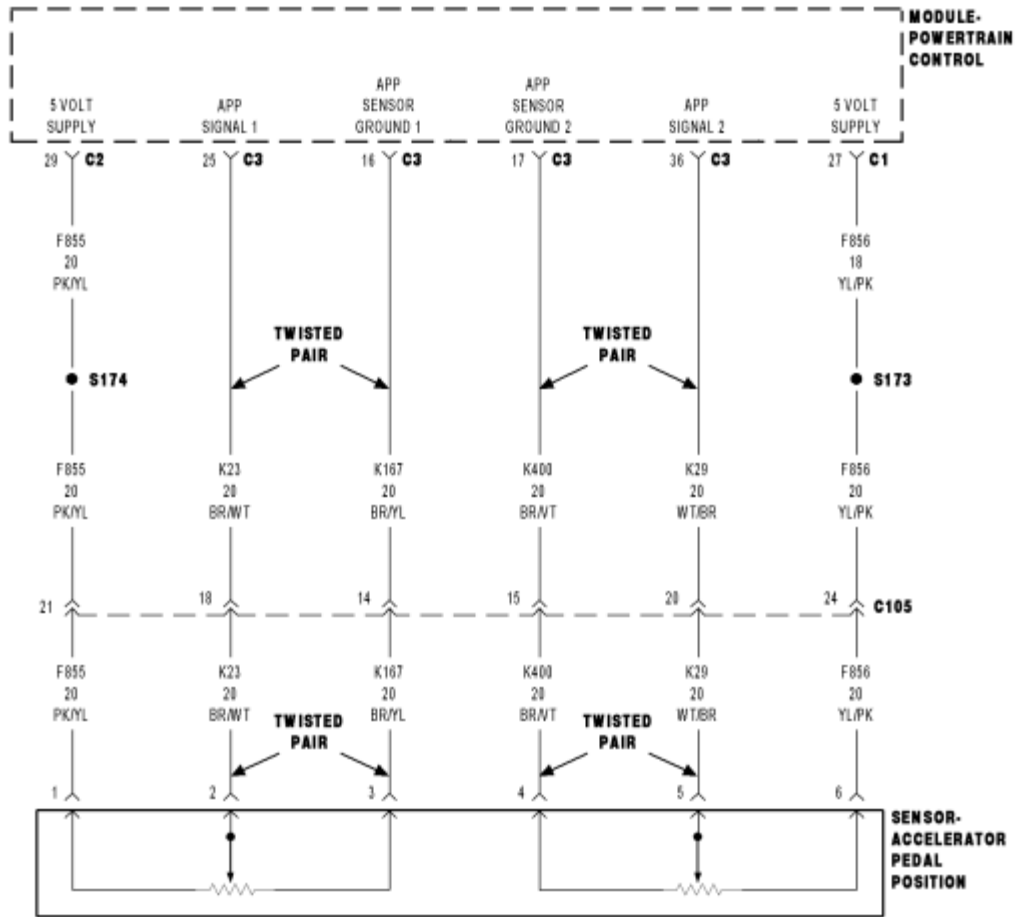
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW



01514288

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and no other APPS No.1 DTCs present.

◦ **Set Condition:**

When the APP Sensor No.1 voltage is too low. Engine will additionally idle if the brake pedal is pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K23) APP SIGNAL 1 CIRCUIT OPEN
(K23) APP SIGNAL 1 CIRCUIT SHORTED TO GROUND
(K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (K167) APP RETURN 1 CIRCUIT
(K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (K400) APP RETURN 2 CIRCUIT
APP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

NOTE: If you are viewing data recorder information or Freeze Frame data the APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the voltage close to zero with a normal sensor when using a data recorder/lab scope.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the APP Sensor harness connector.

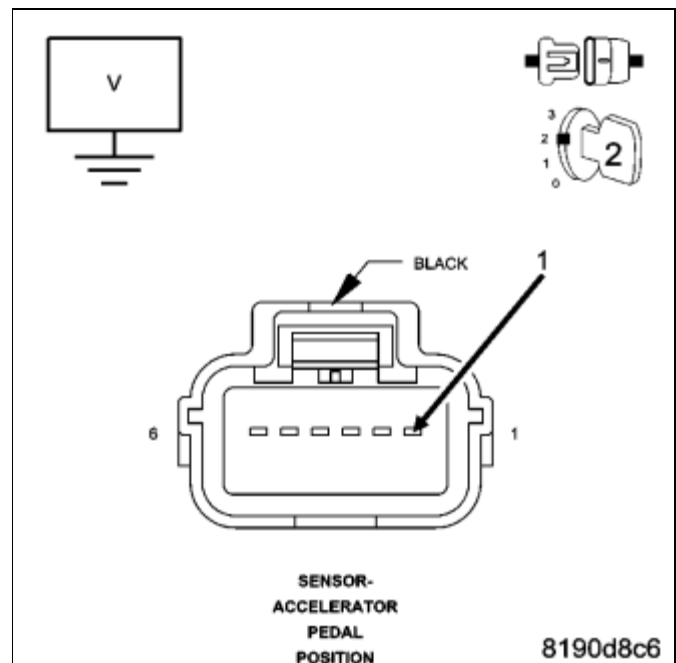
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [8](#)



3. (K23) APP SIGNAL 1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K23) APP Signal 1 circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

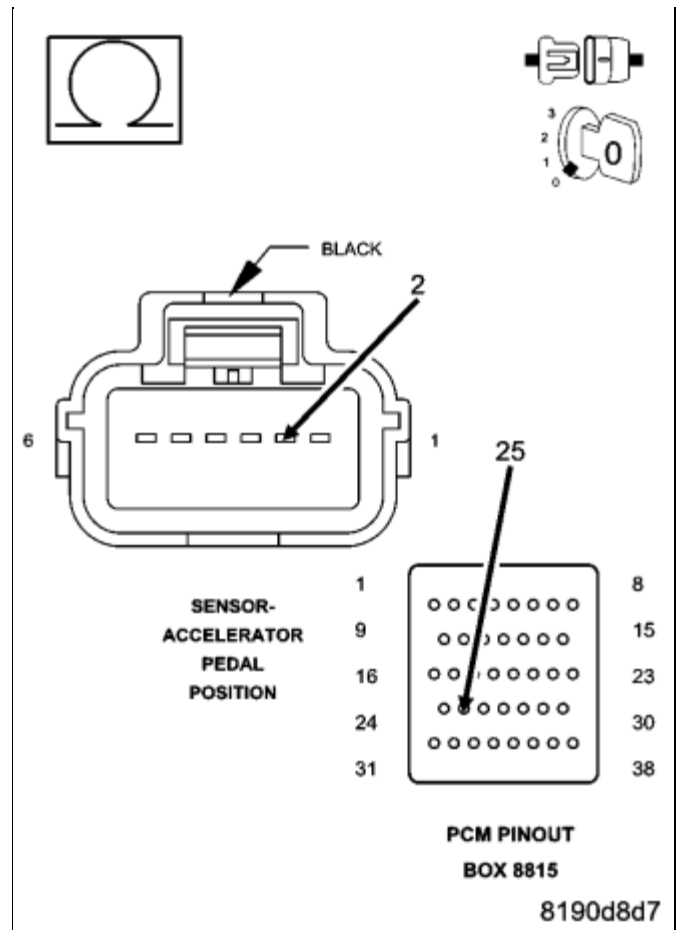
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K23) APP Signal 1 circuit in the APP Sensor harness connector.

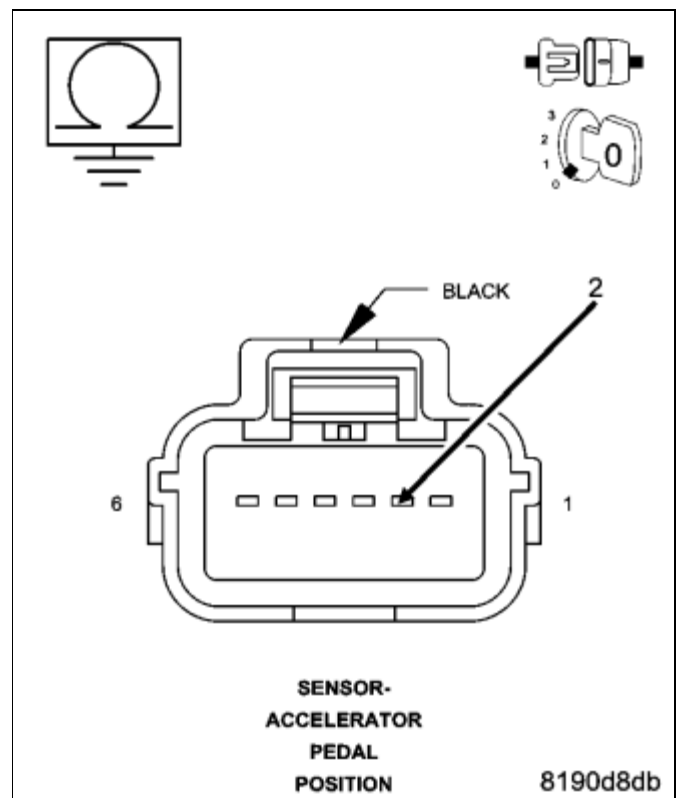
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (K167) APP RETURN 1 CIRCUIT

Measure the resistance between the (K23) APP Signal 1 circuit and the (K167) Return 1 circuit at the APP Sensor harness connector.

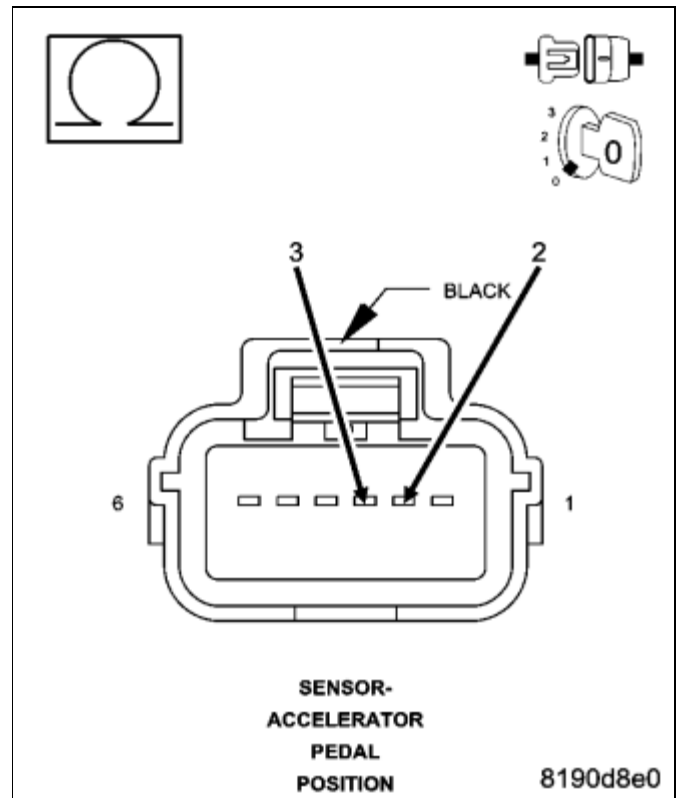
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K167) APP Return 1 circuit and the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (K400) APP RETURN 2 CIRCUIT

Measure the resistance between the (K23) APP Signal 1 circuit and the (K400) Return 2 circuit in the APP Sensor harness connector.

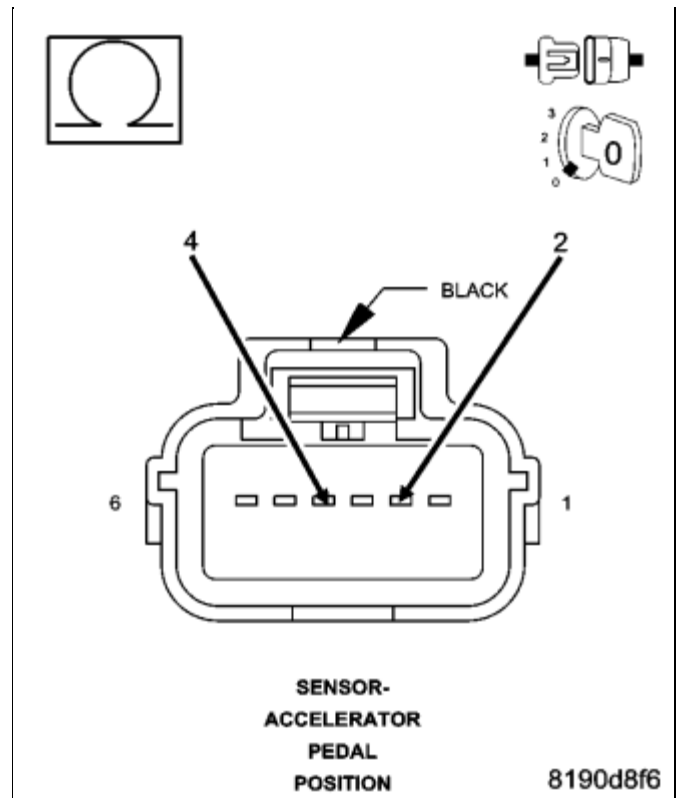
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K400) APP Return 2 circuit and the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. ACCELERATOR PEDAL POSITION SENSOR

Connect the PCM harness connectors.

Ignition on, engine not running.

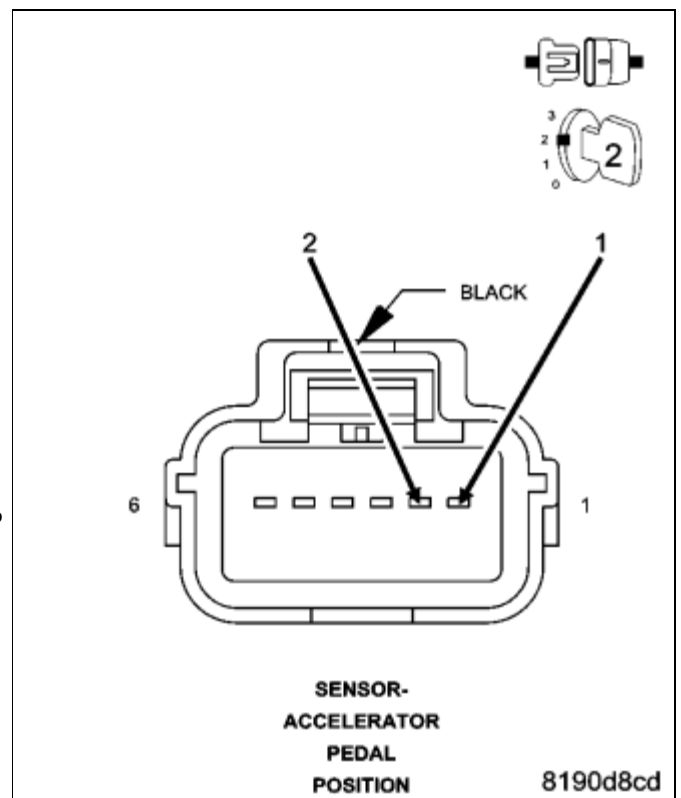
With a scan tool, monitor the APP Sensor No.1 voltage. Connect a jumper wire between the (F855) 5-volt Supply circuit and the (K23) APP Signal 1 circuit in the Sensor harness connector.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the jumper wire installed.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Go To [10](#)
- **NOTE: Remove the jumper wire before continuing.**

8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

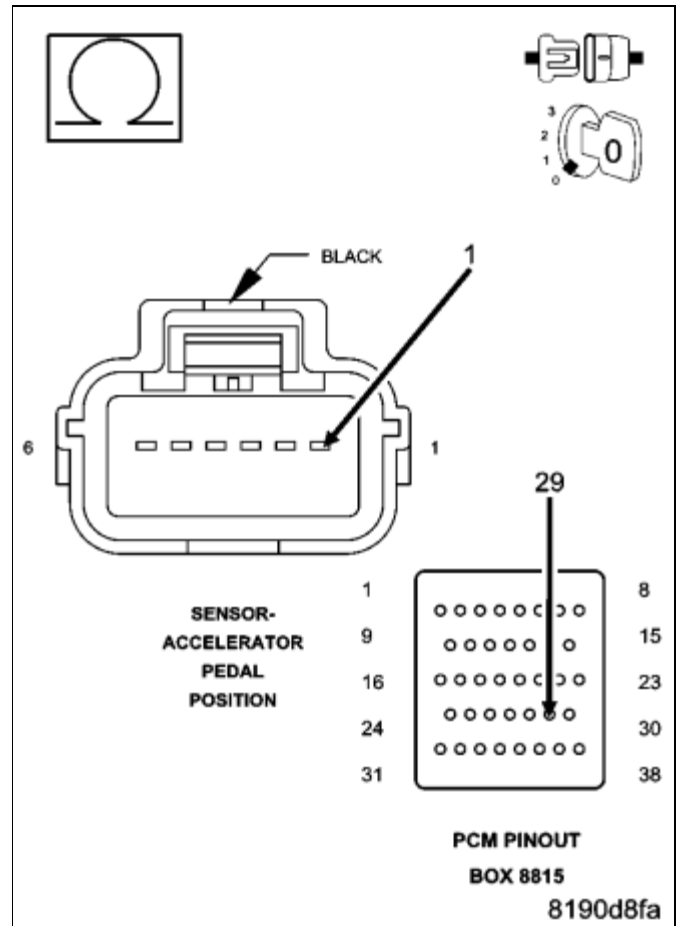
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.

Is the resistance below 100 ohms?

Yes

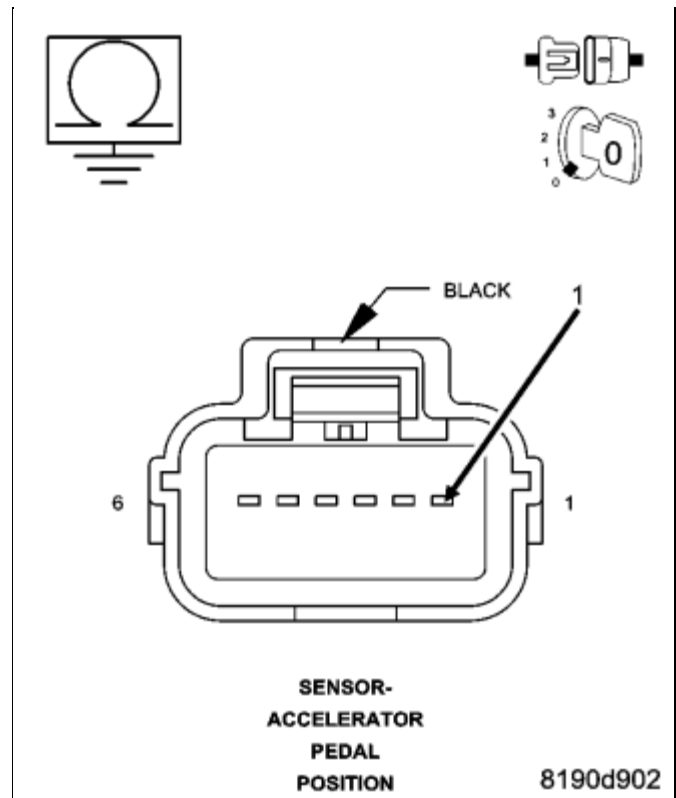
- Repair the short to ground in the (F855) 5-volt Supply

circuit.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

11. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor No.1 voltage.

Slowly press the Accelerator pedal down.

Does voltage start at approximately 0.45 of a volt and go above 4.6 volts with a smooth transition?

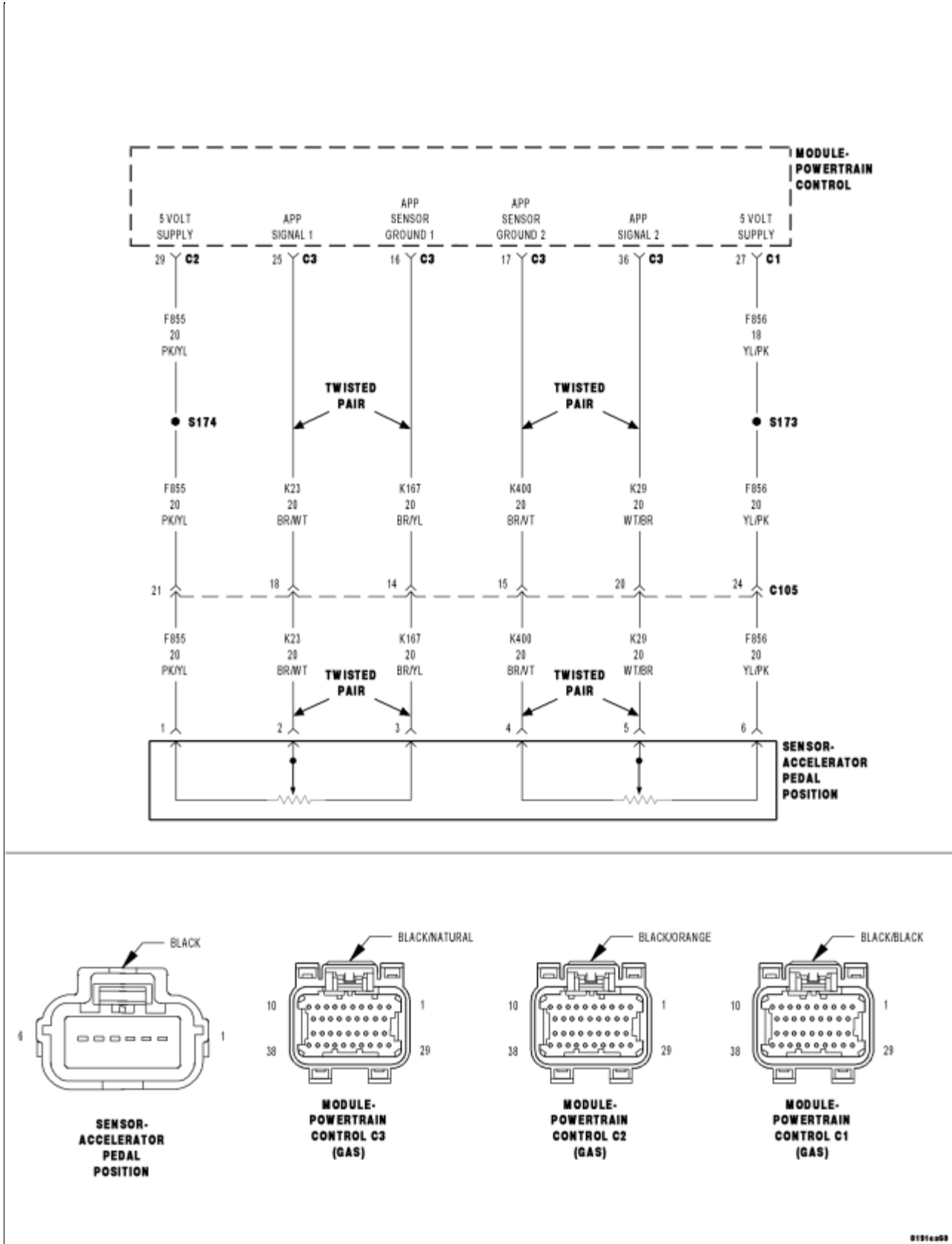
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH



With the ignition on and no other APPS No.1 DTCs present.

◦ **Set Condition:**

When APP Sensor No.1 voltage is too high. Engine will additionally idle if the brake pedal is pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(K23) APP SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE
(K23) APP SIGNAL 1 SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K23) APP SIGNAL 1 SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K167) APP RETURN 1 CIRCUIT OPEN
APP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

NOTE: If you are viewing data recorder information or Freeze Frame data the APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the

voltage close to zero with a normal sensor when using a data recorder/lab scope.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the PCM harness connectors.
 Disconnect the APP Sensor harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K23) APP Signal 1 circuit in the APP Sensor harness connector.

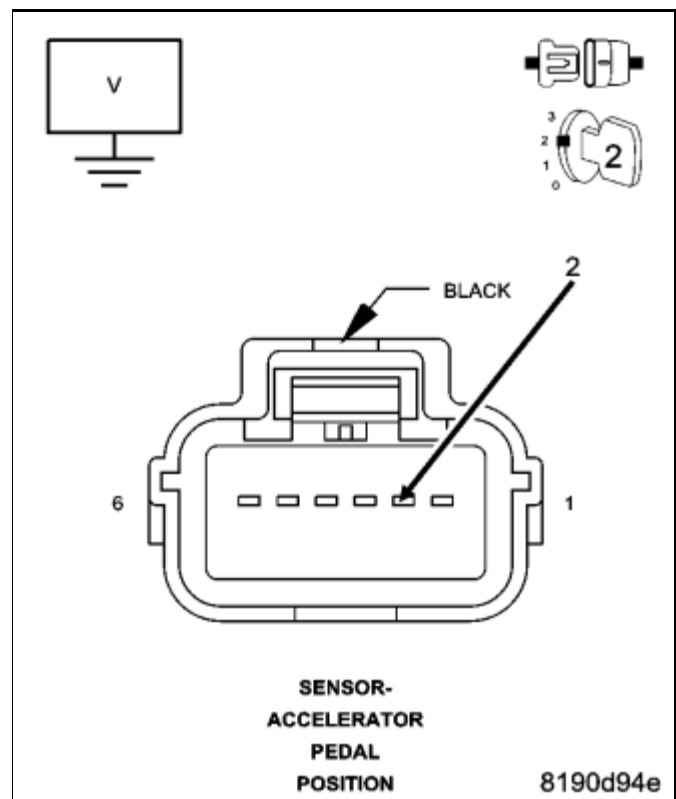
Is there any voltage present?

Yes

- Repair the short to voltage in the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
 Measure the resistance between the (K23) APP Signal 1 circuit and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.

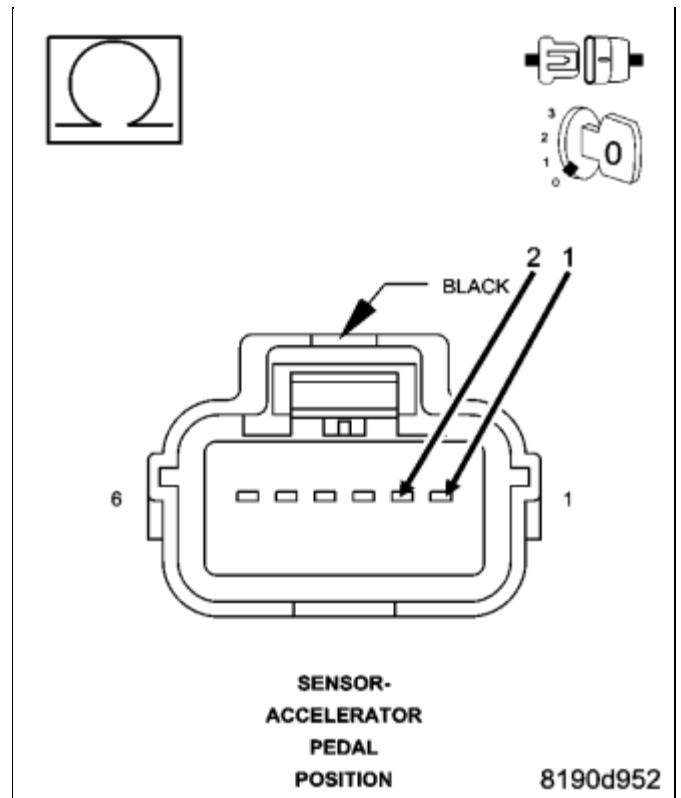
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K23) APP Signal 1 circuit and the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (K23) APP SIGNAL 1 CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K23) APP Signal 1 circuit and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

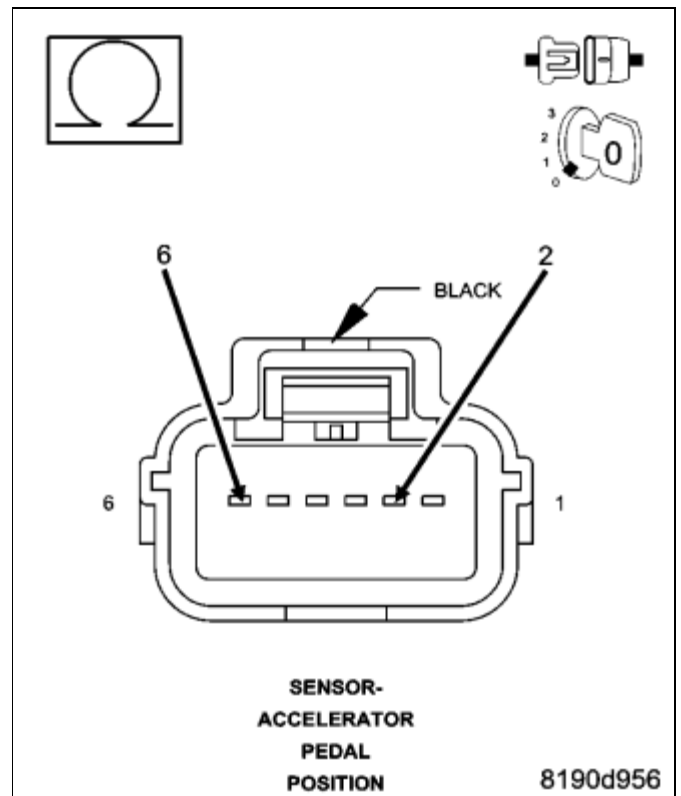
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K23) APP Signal 1 circuit and the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K167) APP RETURN 1 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K167) APP Return 1 circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

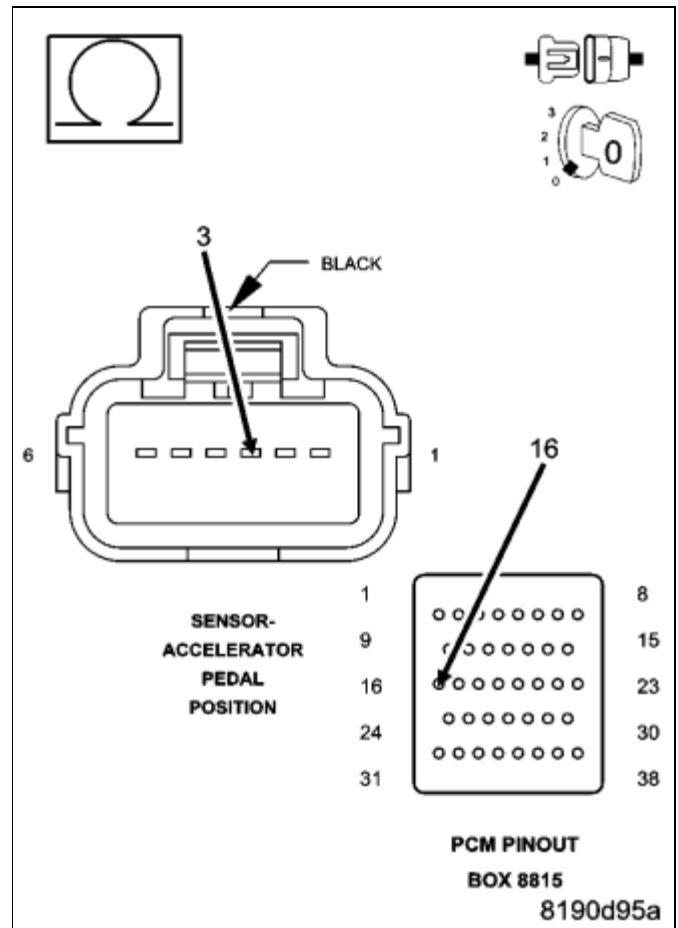
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K167) APP Return 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. ACCELERATOR PEDAL POSITION SENSOR

Connect the PCM harness connectors.
Ignition on, engine not running.
With a scan tool, monitor the APP Sensor 1 voltage.

Is the voltage above 0 volts?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. APP SENSOR NO.1 SWEEP

Ignition on, engine not running.

With a scan tool, monitor the Accelerator Pedal Position Sensor voltage.

Slowly press the Accelerator Pedal down.

Does voltage start at approximately 0.45 of a volt and go above 4.6 volts with a smooth transition?

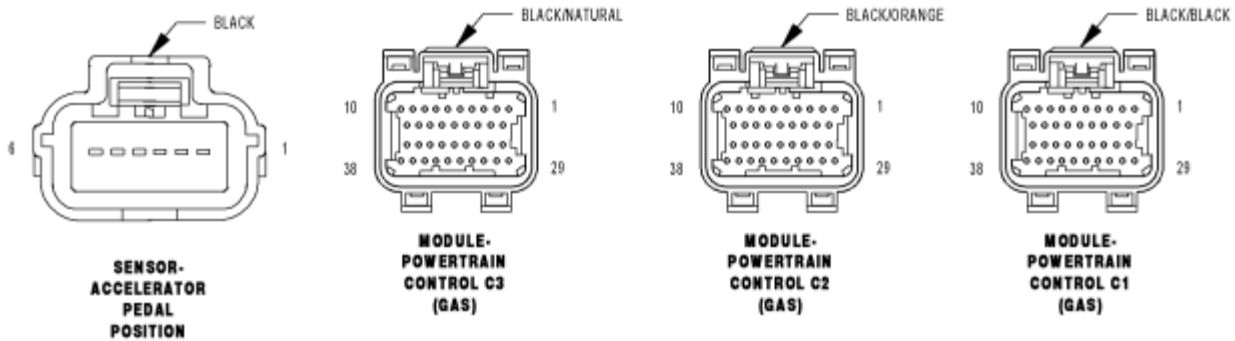
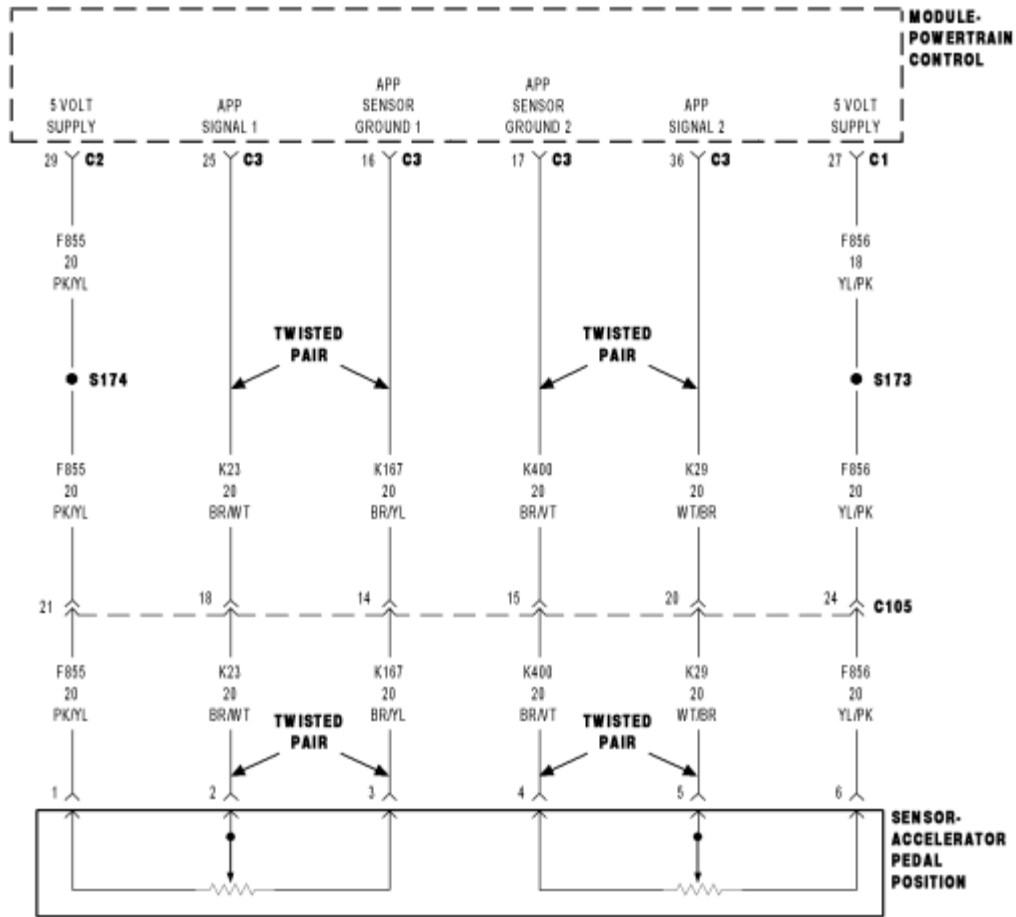
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW



01514288

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and no other APPS No.2 DTCs present.

◦ **Set Condition:**

When the APP Sensor No.2 voltage is too low. Engine will only idle if the Brake pedal is Pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K29) APP SIGNAL 2 CIRCUIT OPEN
(K29) APP SIGNAL 2 CIRCUIT SHORTED TO GROUND
(K29) APP SIGNAL 2 CIRCUIT SHORTED TO THE (K167) APP RETURN 1 CIRCUIT
(K29) APP SIGNAL 2 CIRCUIT SHORTED TO THE (K400) APP RETURN 2 CIRCUIT
APP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

NOTE: If you are viewing data recorder information or Freeze Frame data the APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the voltage close to zero with a normal sensor when using a data recorder/lab scope.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the APP Sensor harness connector.
Ignition on, engine not running.
Measure the voltage on the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

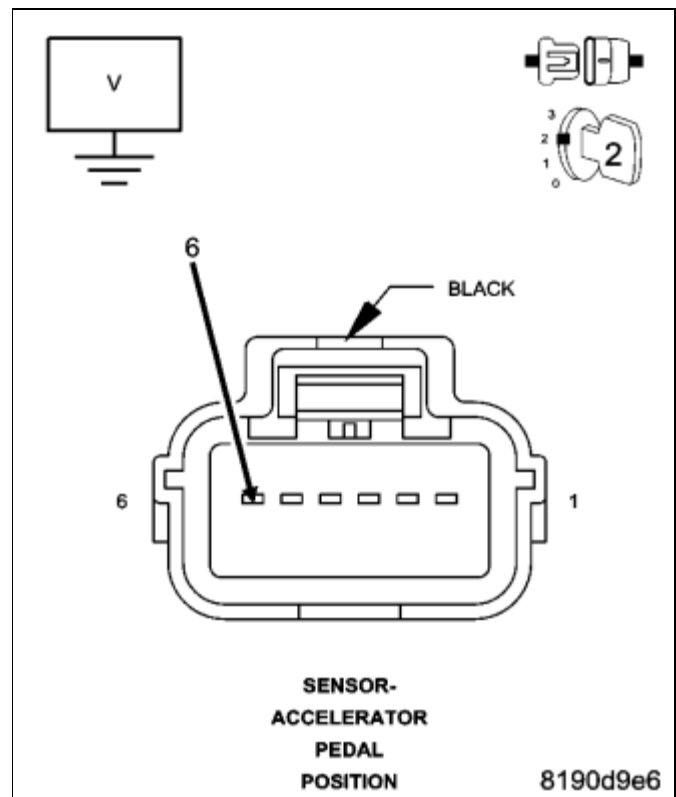
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [8](#)



3. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K29) APP Sensor No.2 Signal circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

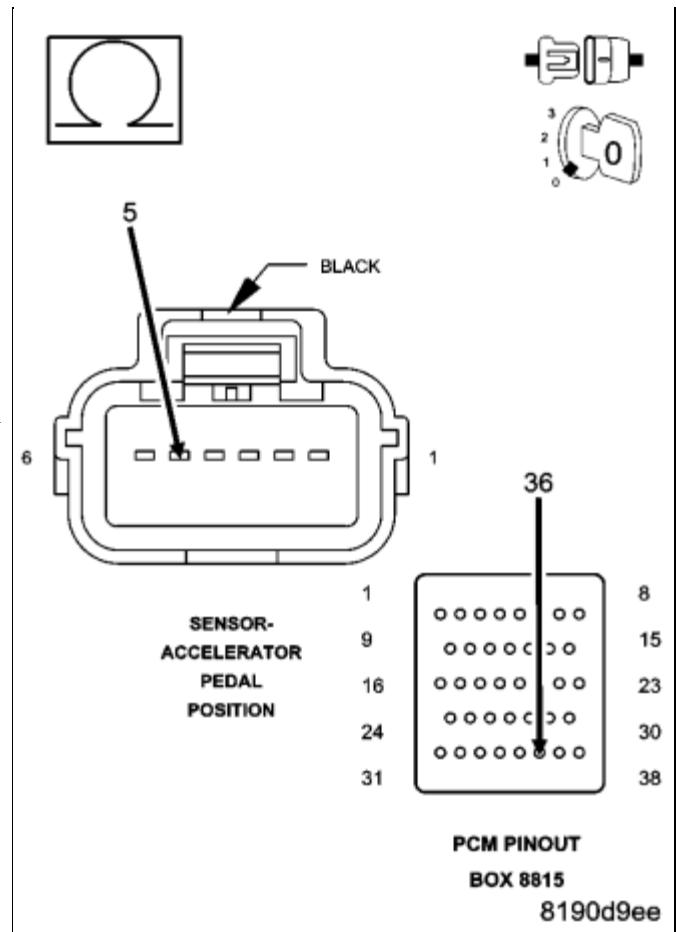
Is the resistance below 5.0 ohms?

Yes

- Go To [4](#)

No

- Repair the open in the (K29) APP Sensor No.2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K29) APP Sensor No.2 Signal circuit in the APP Sensor harness connector.

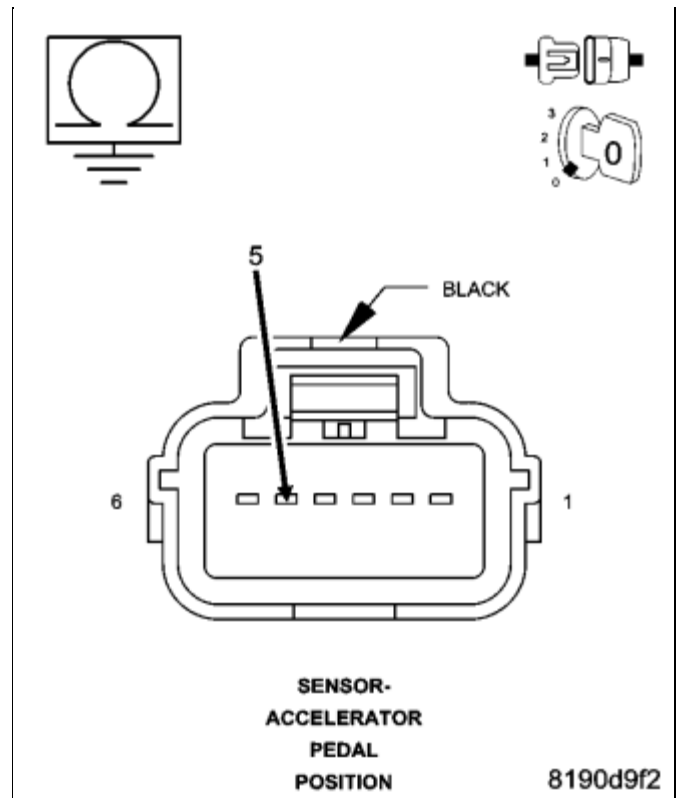
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K29) APP Sensor No.2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K400) APP SENSOR NO.2 RETURN CIRCUIT

Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (K400) Sensor No.2 Return circuit in the APP Sensor harness connector.

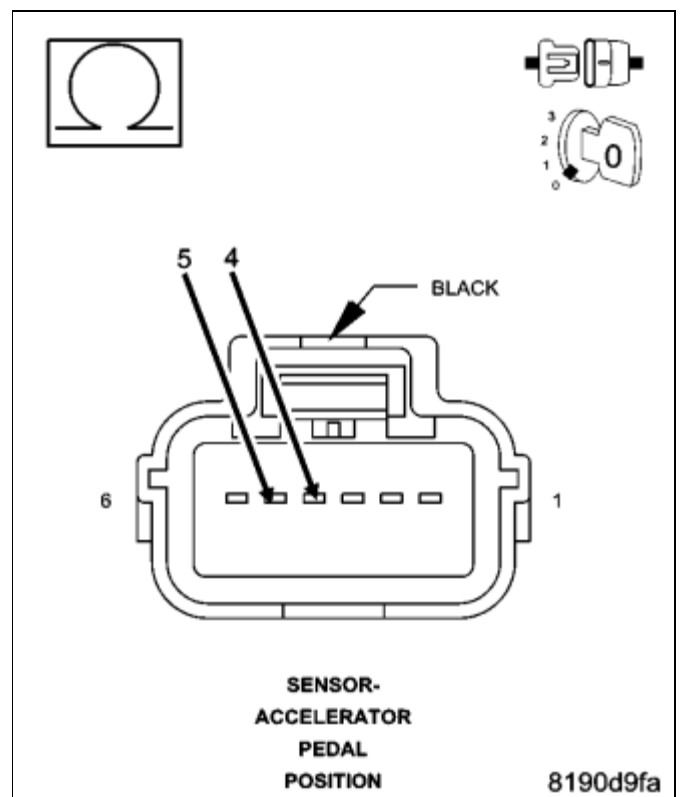
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K400) APP Sensor No.2 Return circuit and the (K29) APP Sensor No.2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K167) APP SENSOR NO.1

RETURN CIRCUIT

Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (K167) Sensor No.1 Return circuit in the APP Sensor harness connector.

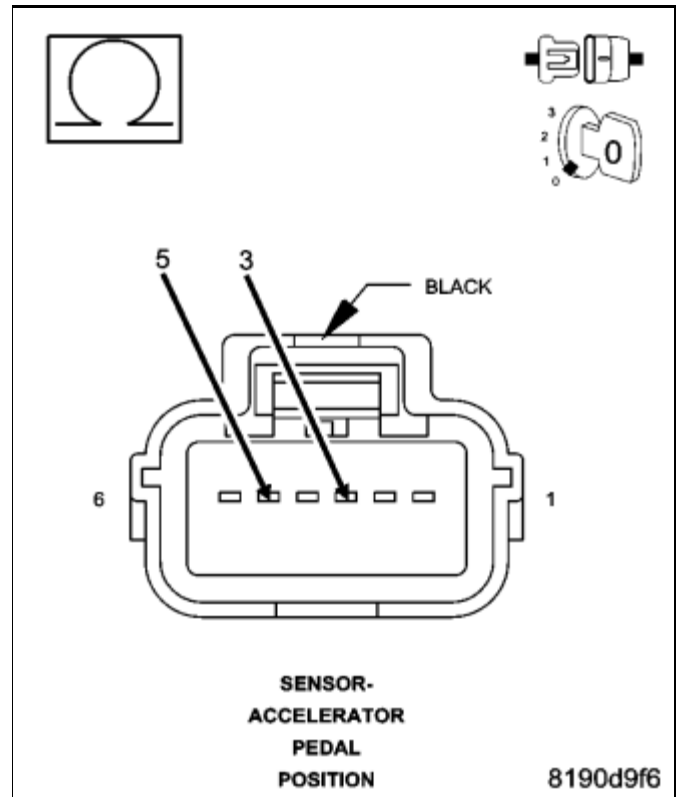
Is the resistance below 100 ohms?

Yes

- Repair the short between the (K167) APP Sensor No.1 Return circuit and the (K29) APP Sensor No.2 Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. ACCELERATOR PEDAL POSITION SENSOR

Connect the PCM harness connectors.

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor No.2 voltage.

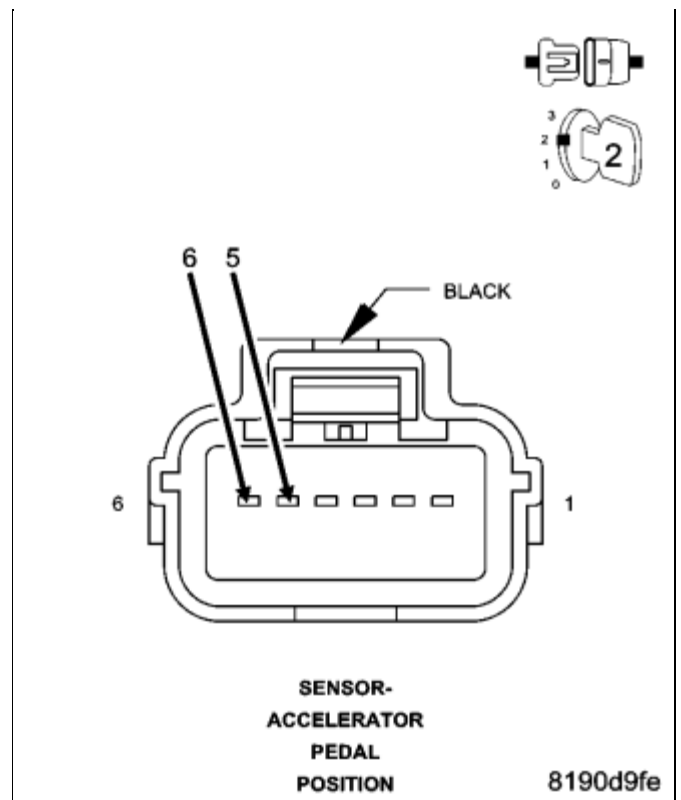
Connect a jumper wire between the (F856) 5-volt Supply circuit and the (K29) APP Sensor No.2 Signal circuit in the Sensor harness connector.

NOTE: The sensor voltage should be approximately 5.0 volts (plus or minus .1 volt) with the jumper wire installed.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service



Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)
- **NOTE: Remove the jumper wire before continuing.**

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

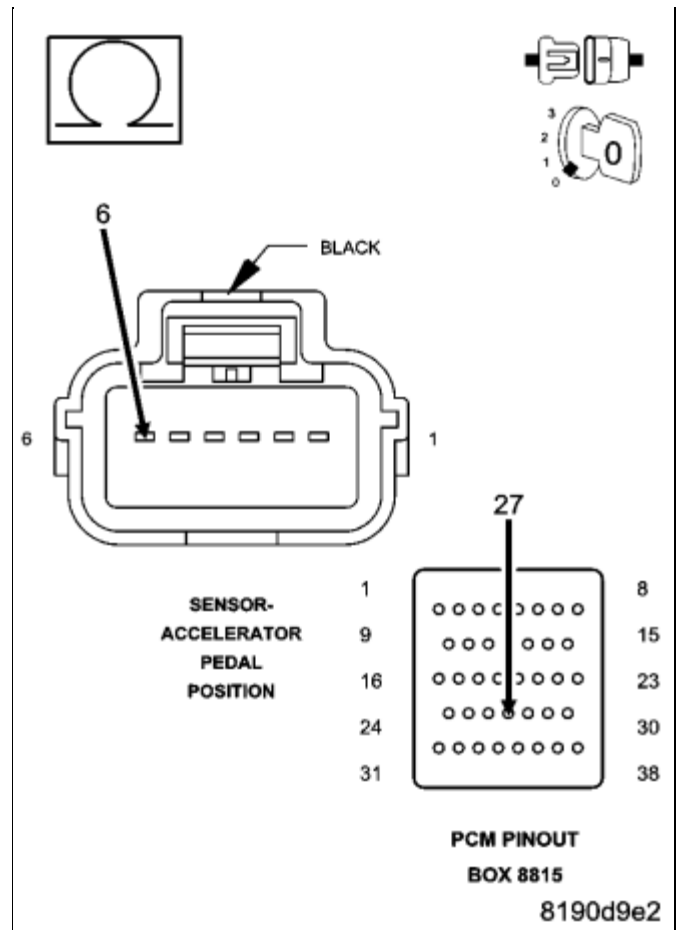
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the open in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

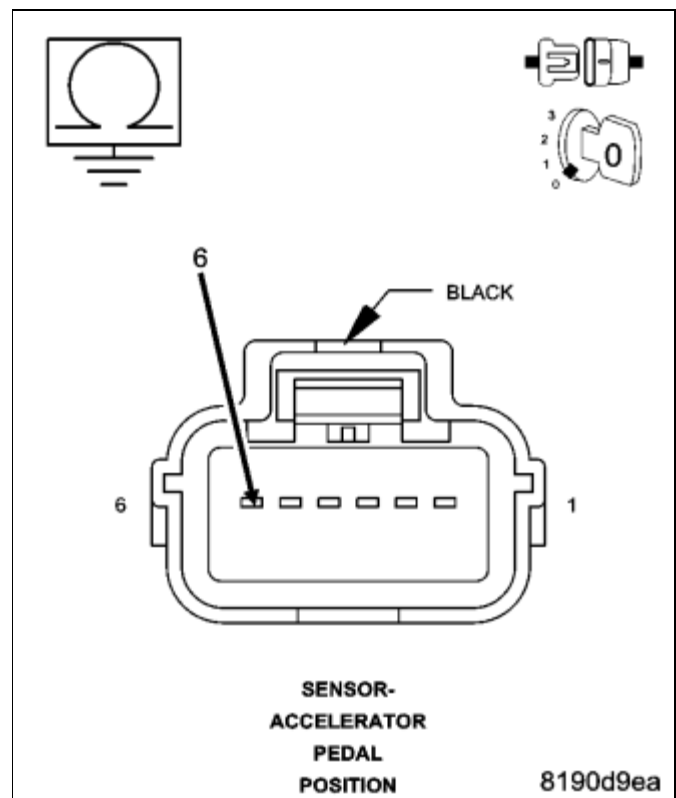
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

11. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor No.2 voltage.

Slowly press the Accelerator pedal down.

Does voltage start at approximately 0.22 of a volt and go above 2.31 volts with a smooth transition?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH

With the ignition on and no other APPS No.2 DTCs present.

◦ **Set Condition:**

When APP Sensor No.2 voltage is too high. Idle is additionally forced any time the brake is applied or failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(K29) APP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
(K29) APP SIGNAL 2 SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K29) APP SIGNAL 2 SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K400) APP RETURN 2 CIRCUIT OPEN
APP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

NOTE: If you are viewing data recorder information or Freeze Frame data the APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the voltage close to zero with a normal sensor when using a data recorder/lab scope.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [8](#)

2. (K29) APP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the PCM harness connectors.
 Disconnect the APP Sensor harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K29) APP Signal 2 circuit in the APP Sensor harness connector.

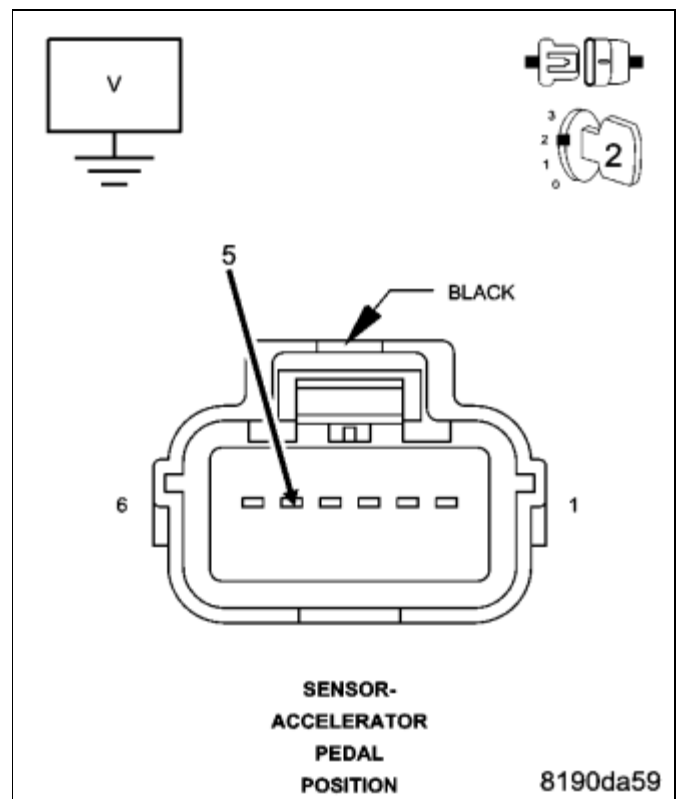
Is there any voltage present?

Yes

- Repair the short to voltage in the (K29) APP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. (K29) APP SIGNAL 2 CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Measure the resistance between the (K29) APP Signal 2 circuit and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

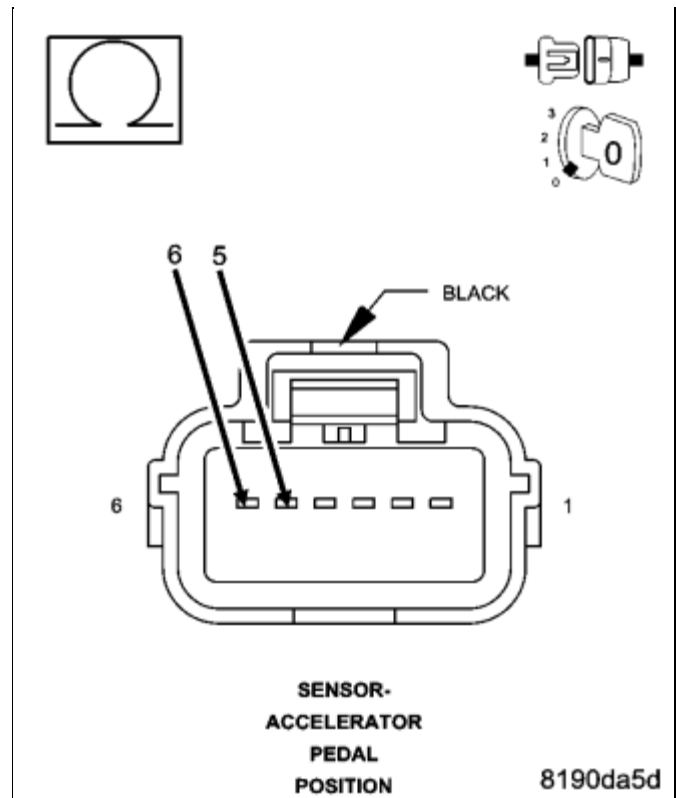
Is the resistance below 10 ohms?

Yes

- Repair the short between the (K29) APP Signal 2 circuit and the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (K29) APP SIGNAL 2 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K29) APP Signal 2 circuit and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.

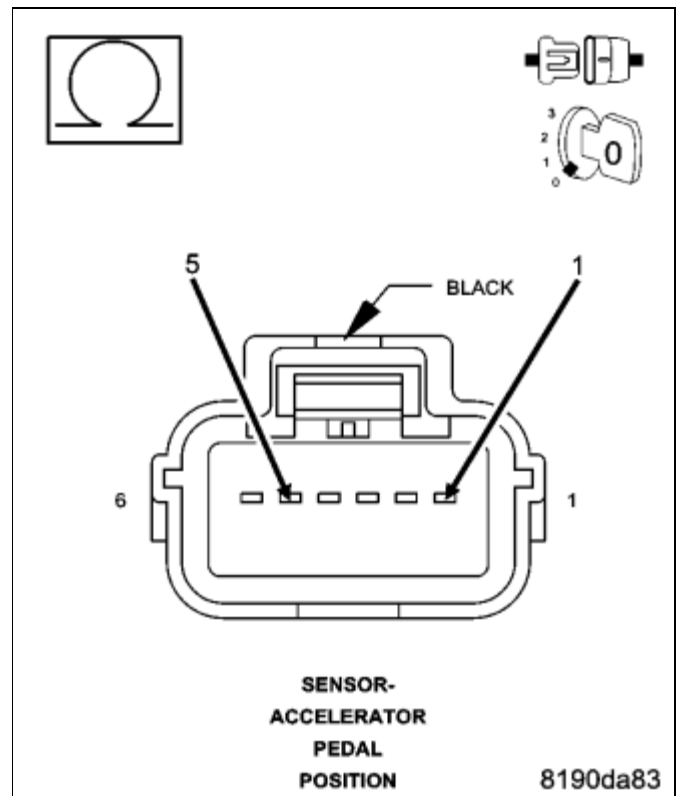
Is the resistance below 10 ohms?

Yes

- Repair the short between the (K29) APP S Signal 2 circuit and the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)



5. (K400) APP RETURN 2 CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K400) APP Return 2 circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

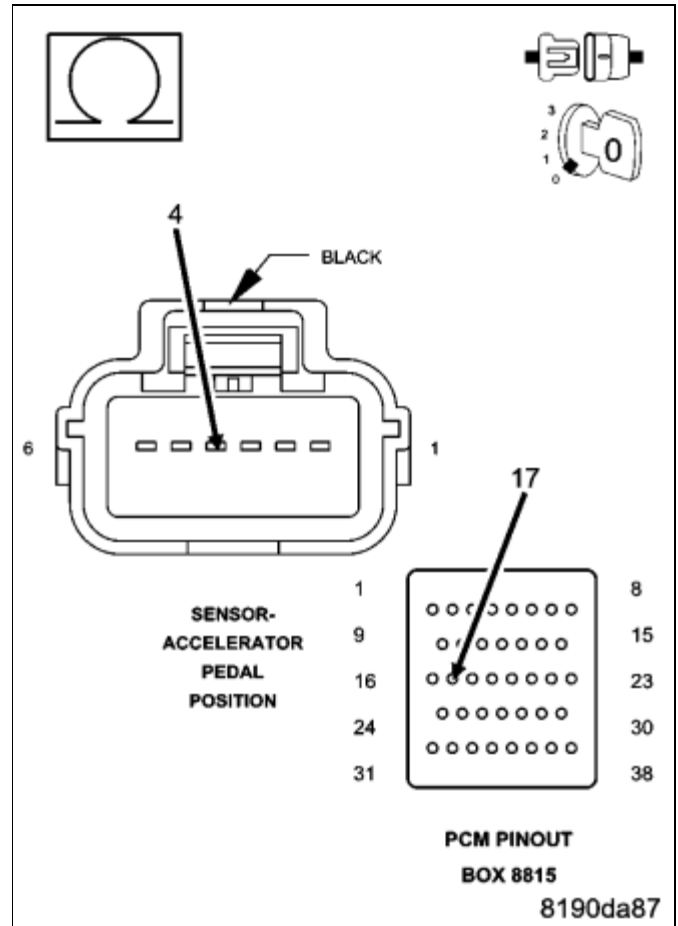
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K400) APP Return 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. ACCELERATOR PEDAL POSITION SENSOR

Connect the PCM harness connectors.
Ignition on, engine not running.
With a scan tool, monitor the APP Sensor 2 voltage.

Is the voltage above 0 volts?

Yes

- Go To [7](#)

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. APP SENSOR NO.2 SWEEP

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor 2 voltage.

Slowly press the Accelerator Pedal down.

Does voltage start at approximately 0.22 of a volt and go above 2.31 volts with a smooth transition?

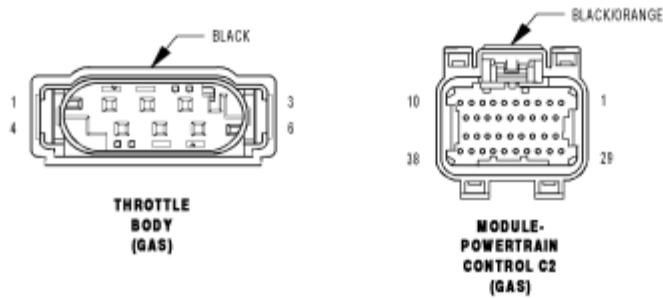
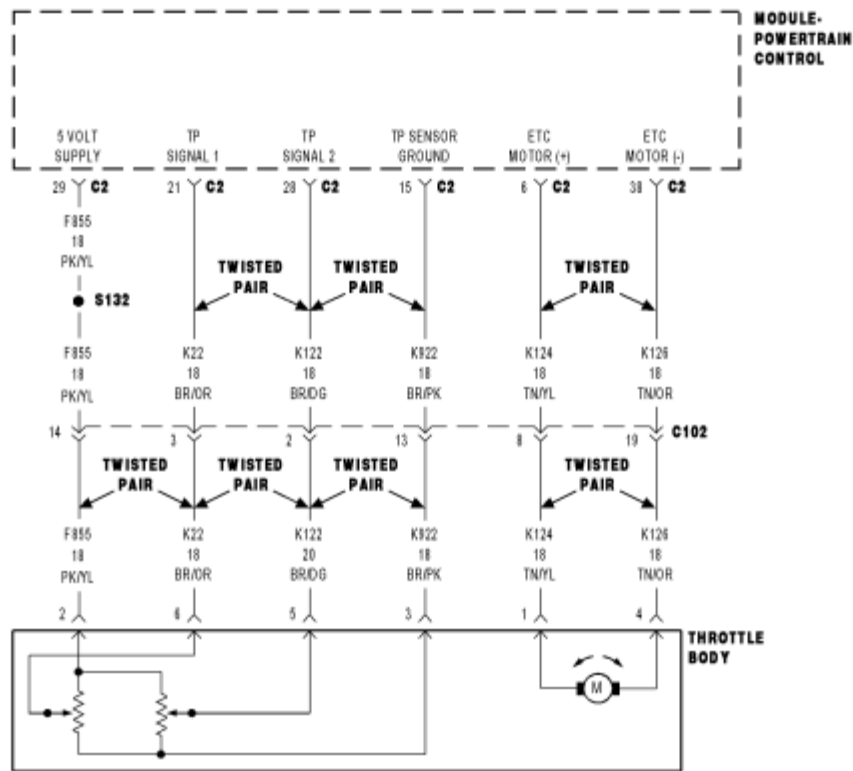
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION



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For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on and no other DTCs present for TP Sensor No.1 or No.2.

◦ **Set Condition:**

PCM recognizes TP Sensors No.1 and No.2 are not coherent. One trip fault and the code will set within 5 seconds. ETC light is illuminated.

Possible Causes
(K22) TP SIGNAL 1 SHORTED TO VOLTAGE
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE
RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT
RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND
(K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP SENSOR GROUND CIRCUIT
(K22) TP SIGNAL 1 CIRCUIT SHORTED TO THE (K122) TP SIGNAL 2 CIRCUIT
THROTTLE POSITION SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

Ignition on, engine not running.

NOTE: Inspect the engine for vacuum leaks.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Go To [14](#)

2. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Disconnect the Throttle Body harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (K22) TP Signal 1 circuit in the Throttle Body harness connector.

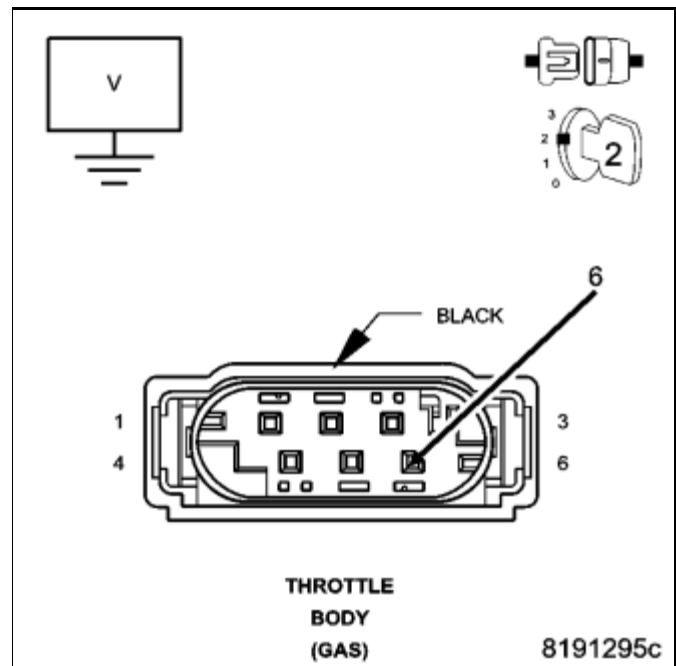
Is there any voltage present?

Yes

- Repair the short to voltage in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)



3. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO VOLTAGE

Measure the voltage on the (K122) TP Signal 2 circuit in the Throttle Body harness connector.

Is there any voltage present?

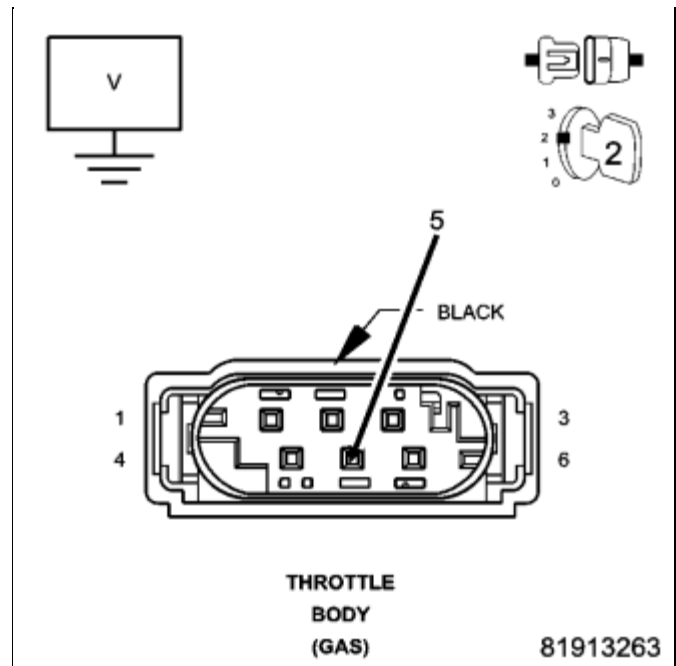
Yes

- Repair the short to voltage in the (K122) TP Signal 2 circuit.

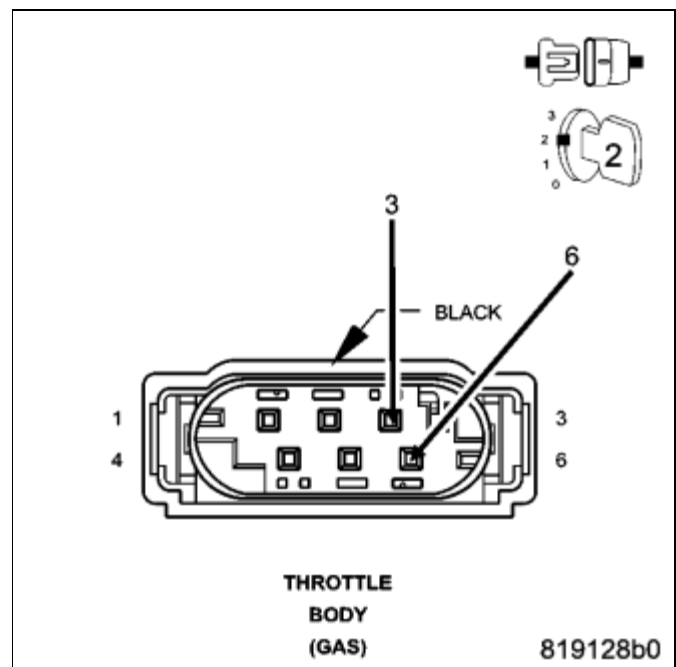
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. THROTTLE POSITION SENSOR



Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Signal 1 and Signal 2 voltage.

Connect a jumper wire between the (K922) Sensor Return circuit and the (K22) TP Signal 1 circuit.

TP Sensor No.1 voltage should change from approximately

4.5 volts to 0.5 of a volt?

For TP Sensor No.2, connect a jumper wire between (F855) 5-volt supply circuit and the (K122) TP Signal 2 circuit.

TP Sensor No.2 voltage should change from approximately 0 volts to 5.0 volts?

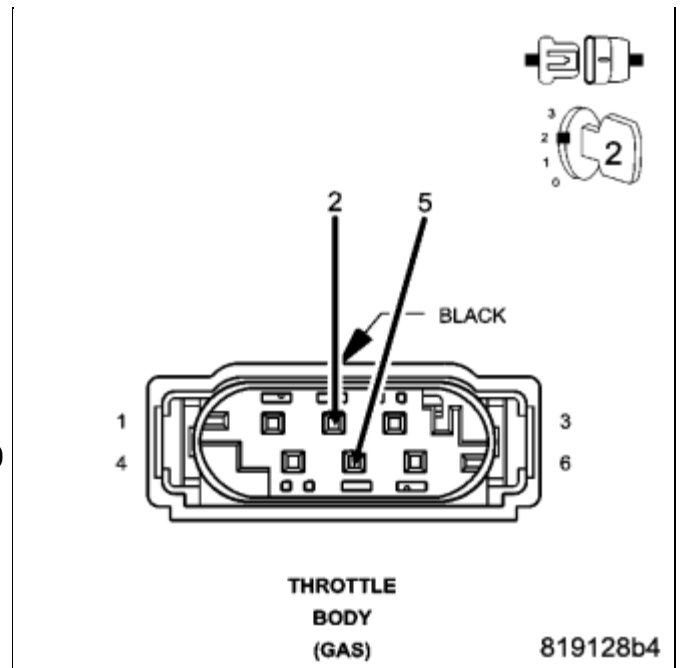
Is the voltage reading within the listed specification with the jumper wire installed?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body in accordance with Service Information. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)
- **NOTE: Remove the jumper wire before continuing.**



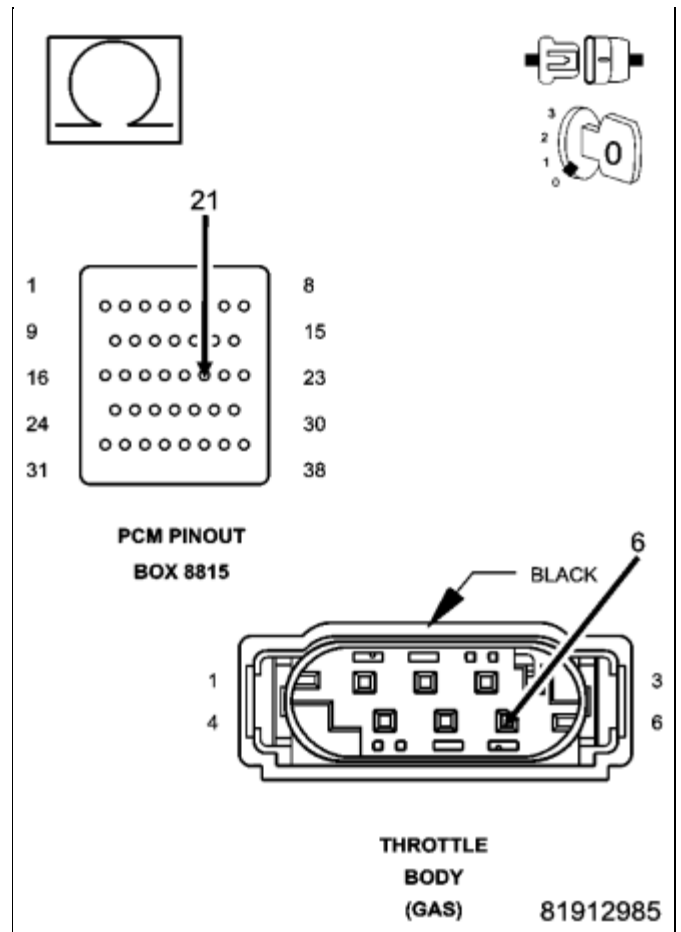
5. EXCESSIVE RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Signal 1 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. EXCESSIVE RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

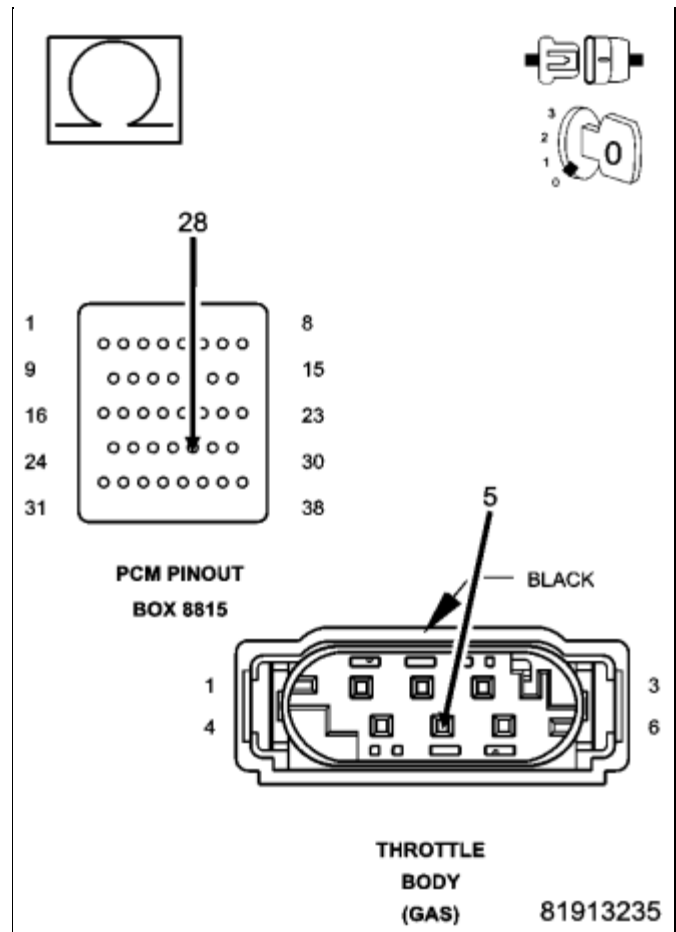
Is the resistance below 5.0 ohms for each circuit?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Signal 1 circuit at the Throttle Body harness connector.

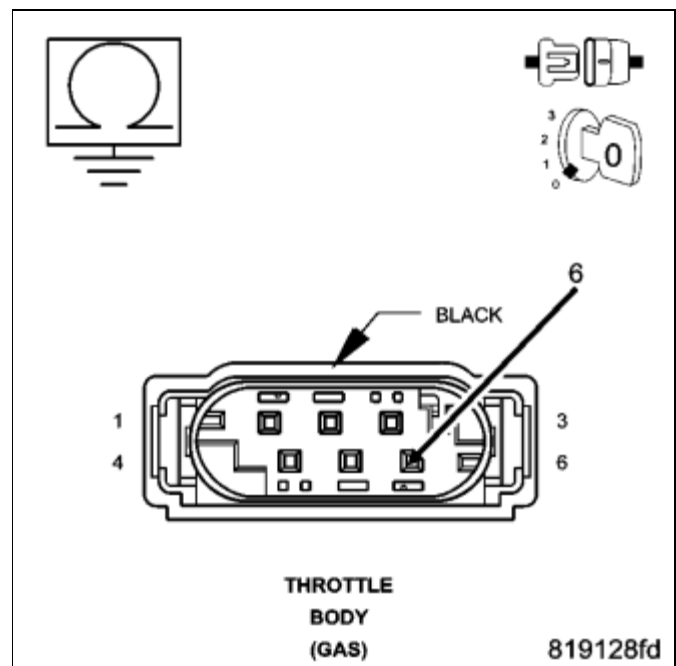
Is the resistance below 100 ohms for each circuit?

Yes

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

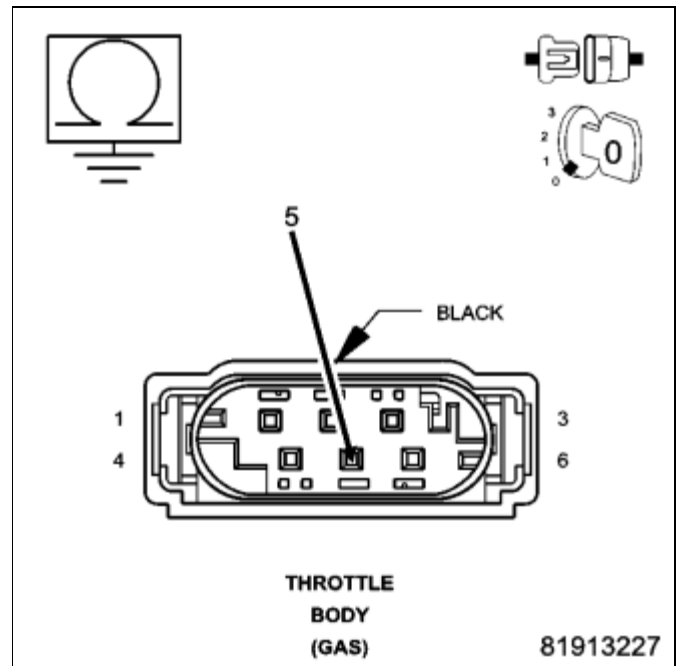
Is the resistance below 100 ohms for each circuit?

Yes

- Repair the short to ground in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

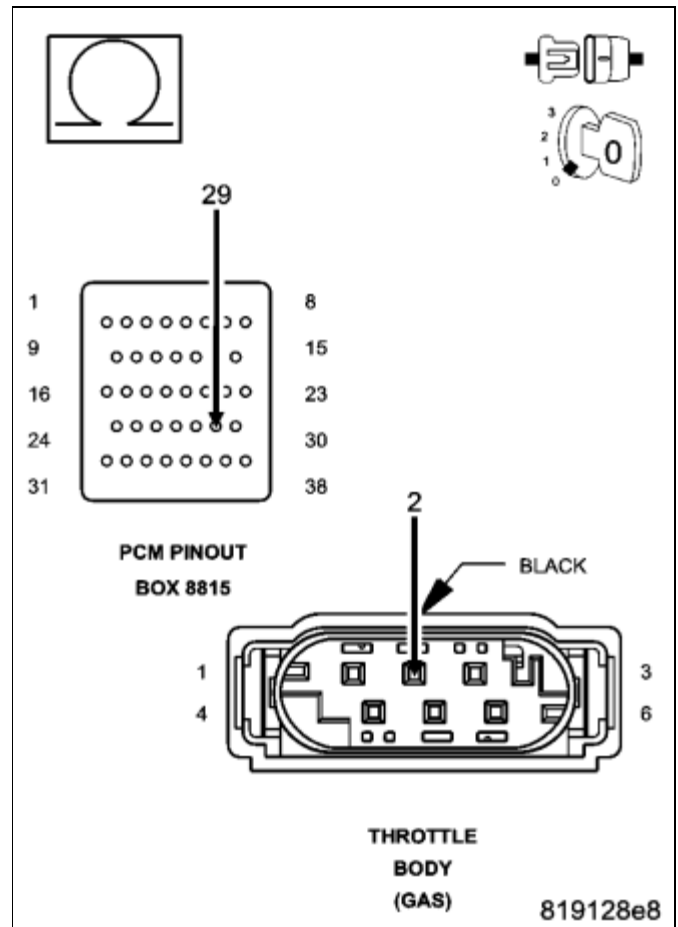
Is the resistance below 5.0 ohms?

Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



10. (F855) 5-VOLT SUPPLY SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.

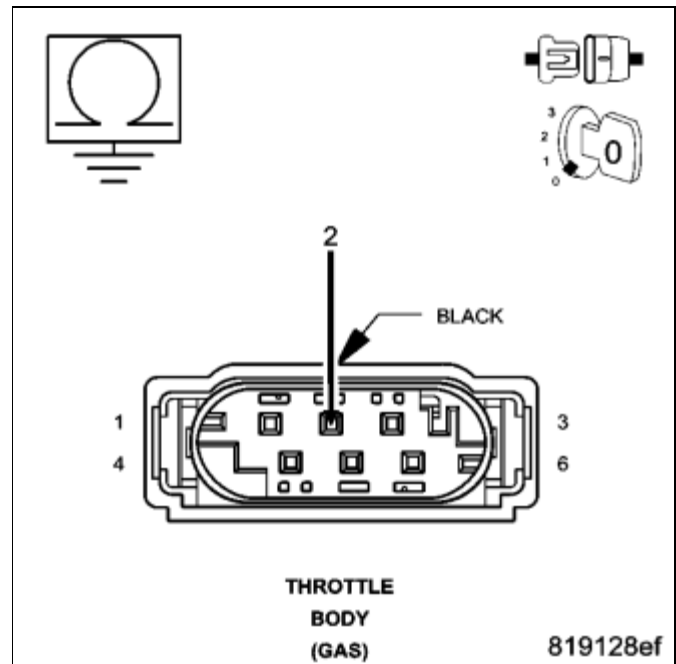
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)



11. EXCESSIVE RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

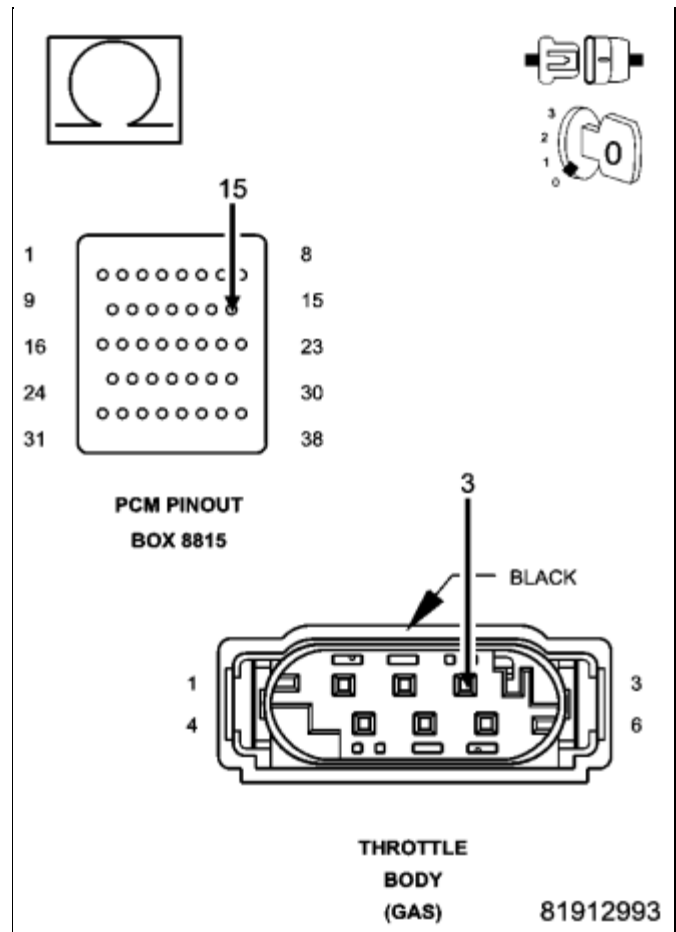
Is the resistance below 5.0 ohms?

Yes

- Go To [12](#)

No

- Repair the excessive resistance in the (K922) Sensor Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. (K22) TP SIGNAL 1 SHORTED TO (K122) TP SIGNAL 2

Measure the resistance between the (K22) TP Signal 1 circuit and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

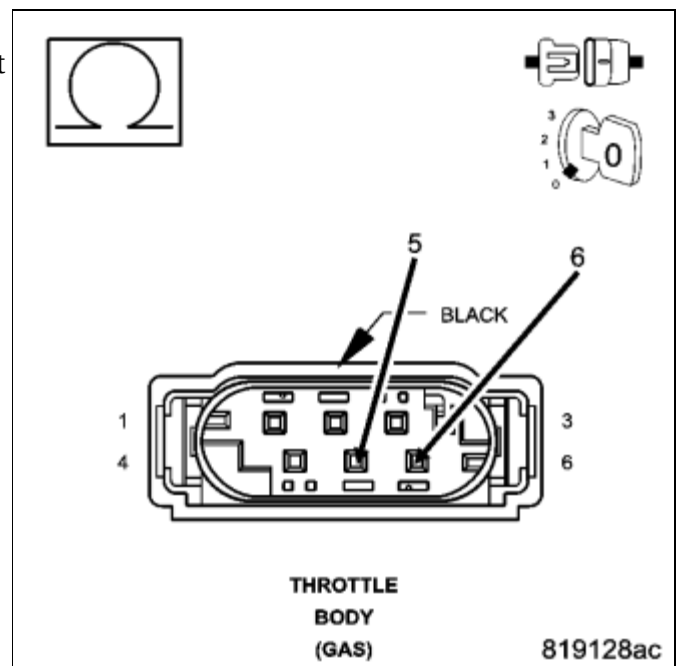
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K122) TP Signal 2 circuit and the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [13](#)



13. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Throttle Body and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

14. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test and monitor the TP Sensor No.1 or No.2 voltage.

Slowly press the throttle pedal down.

The voltage for TP Sensor No.1 should start at approximately 0.7 of a volt and increase to approximately 4.3 volts.

The voltage for TP Sensor No.2 should start at approximately 4.3 volts and decrease to approximately 0.7 of a volt.

Is the voltage within the range of the listed specification for the appropriate Sensor?

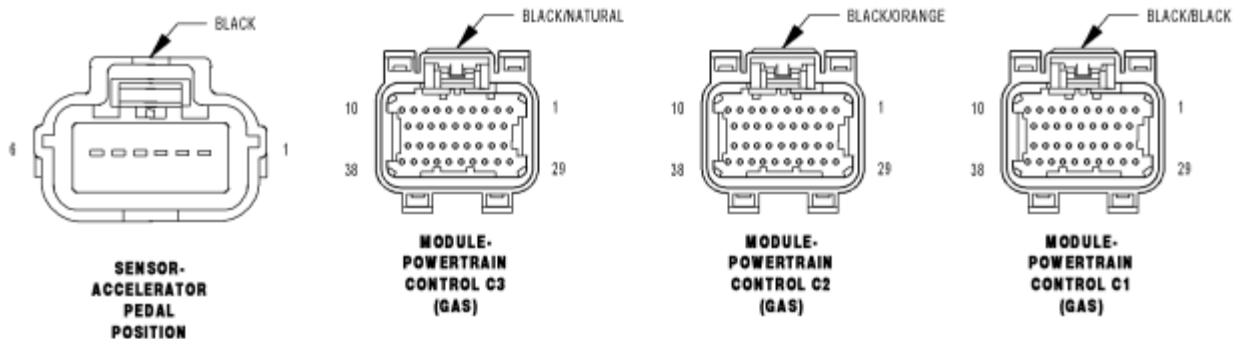
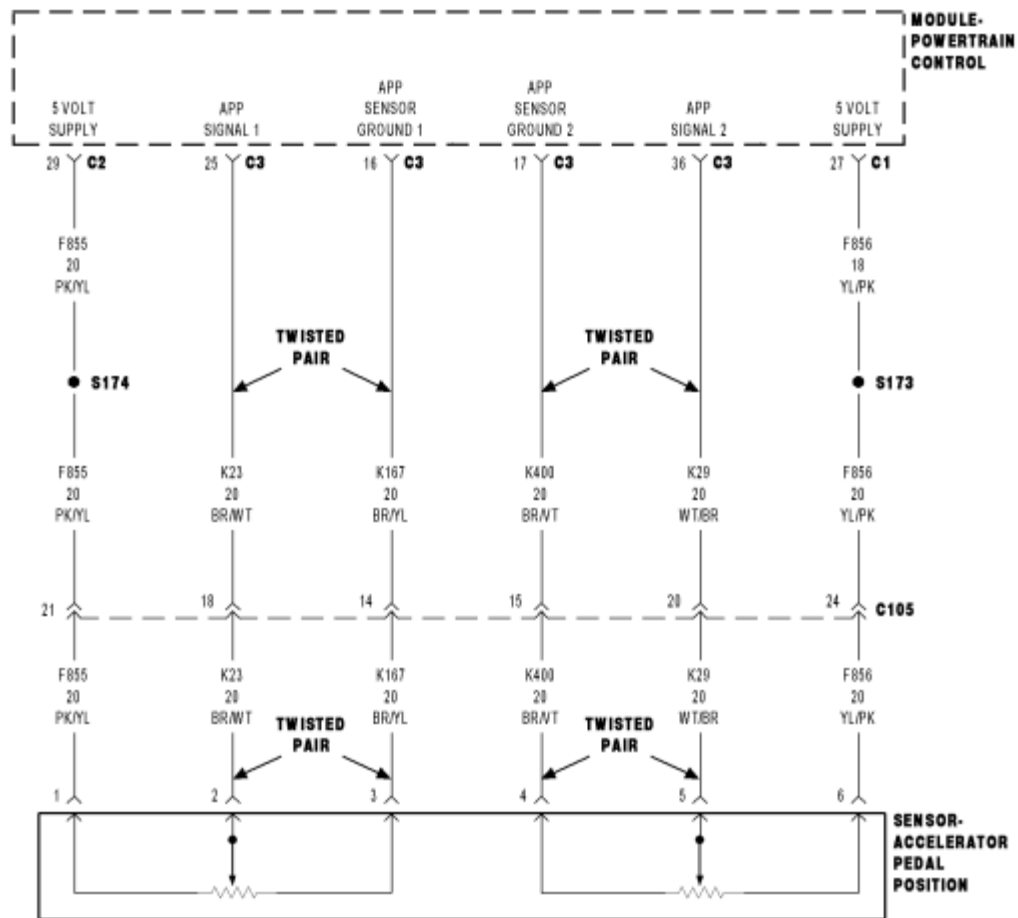
Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Verify that there is good pin to terminal contact in the Throttle Body and the Powertrain Control Module connectors. If OK, replace the Throttle Body in accordance with Service Information. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION



8151a08

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on and no APPS No.1 and APPS No.2 DTC present.

- **Set Condition:**

APPS values No.1 and No.2 are not coherent. Idle is additionally forced when the brake pedal is pressed or failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (K167) APP RETURN 1 CIRCUIT
EXCESSIVE RESISTANCE IN THE (K400) APP RETURN 2 CIRCUIT
EXCESSIVE RESISTANCE IN THE (K23) APP SIGNAL 1 CIRCUIT
EXCESSIVE RESISTANCE IN THE (K29) APP SIGNAL 2 CIRCUIT
APP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: When this DTC is Active the engine speed, torque, and vehicle speed are limited to a Limp in mode.

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: Diagnose and repair any system voltage or sensor supply voltage DTCs before continuing with this test.

NOTE: If you are viewing data recorder information or Freeze Frame data the APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the voltage close to zero with a normal sensor when using a data recorder/lab scope.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. EXCESSIVE RESISTANCE IN THE (K23) APP SIGNAL 1 CIRCUIT

Turn the ignition off.

Disconnect the C3 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 along with the #8815-1 to perform the diagnosis.

Using a voltmeter perform a voltage drop test. Backprobe the (K23) APP Signal 1 circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [3](#)

No

- Repair the excessive resistance in the (K23) APP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. EXCESSIVE RESISTANCE IN THE (K167) APP RETURN 1 CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K167) APP Return 1 circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [4](#)

No

- Repair the excessive resistance in the (K167) APP Return 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. EXCESSIVE RESISTANCE IN THE (K29) APP SIGNAL 2 CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K29) APP Signal 2 circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [5](#)

No

- Repair the excessive resistance in the (K29) APP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

5. EXCESSIVE RESISTANCE IN THE (K400) APP RETURN 2 CIRCUIT

Turn the ignition off.

Move the voltmeter leads to backprobe the (K400) APP Return 2 circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (K400) APP Return 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the Ignition off.

Remove special tool #8815 from the C3 PCM harness connector and Re-Connect the C3 PCM harness connector to the PCM.

Disconnect the C2 PCM harness connector to install special tool #8815 and #8815-1.

Using a voltmeter perform a voltage drop test. Backprobe the (F855) 5-volt Supply circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.

Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [7](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the Ignition off.

Remove special tool #8815 from the C2 PCM harness connector and Re-Connect the C2 PCM harness connector to the PCM.

Disconnect the C1 PCM harness connector to install special tool #8815 and #8815-1.

Using a voltmeter perform a voltage drop test. Backprobe the (F856) 5-volt Supply circuit at the APPS harness connector and probe the appropriate terminal of the special tool #8815. Make sure the voltmeter leads are connected so a positive polarity is displayed on the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine and allow it to reach normal operating temperature.
Monitor the voltmeter.

Is the voltage below 0.5 of a volt?

Yes

- Go To [8](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

8. CHECKING APPS NO.1 AND NO.2 WITH A LAB SCOPE

Ignition on, engine not running.

Set up a lab scope in a way that you can view two graphs simultaneously.

Backprobe (K23) APP Signal 1 circuit using Channel 1 at the APP Sensor harness connector.

Backprobe (K29) APP Signal 2 circuit using Channel 2 at the APP Sensor harness connector.

NOTE: The APP Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens

every 320 milliseconds and may not show up on the scan tool but may show up on a data recorder or lab scope. It is acceptable to see the voltage close to zero with a normal sensor when using a data recorder/lab scope.

Slowly press and release the Accelerator Pedal while monitoring the lab scope screen.

Does the scope pattern show any missing or erratic signals?

Yes

- Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors. If OK, replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

Go To [9](#)

9. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the APPS and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

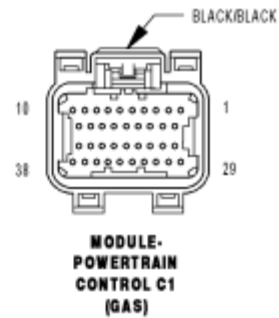
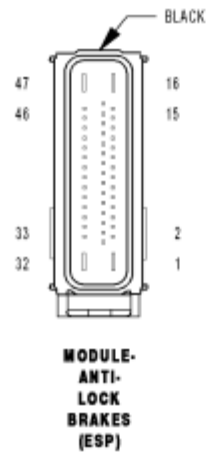
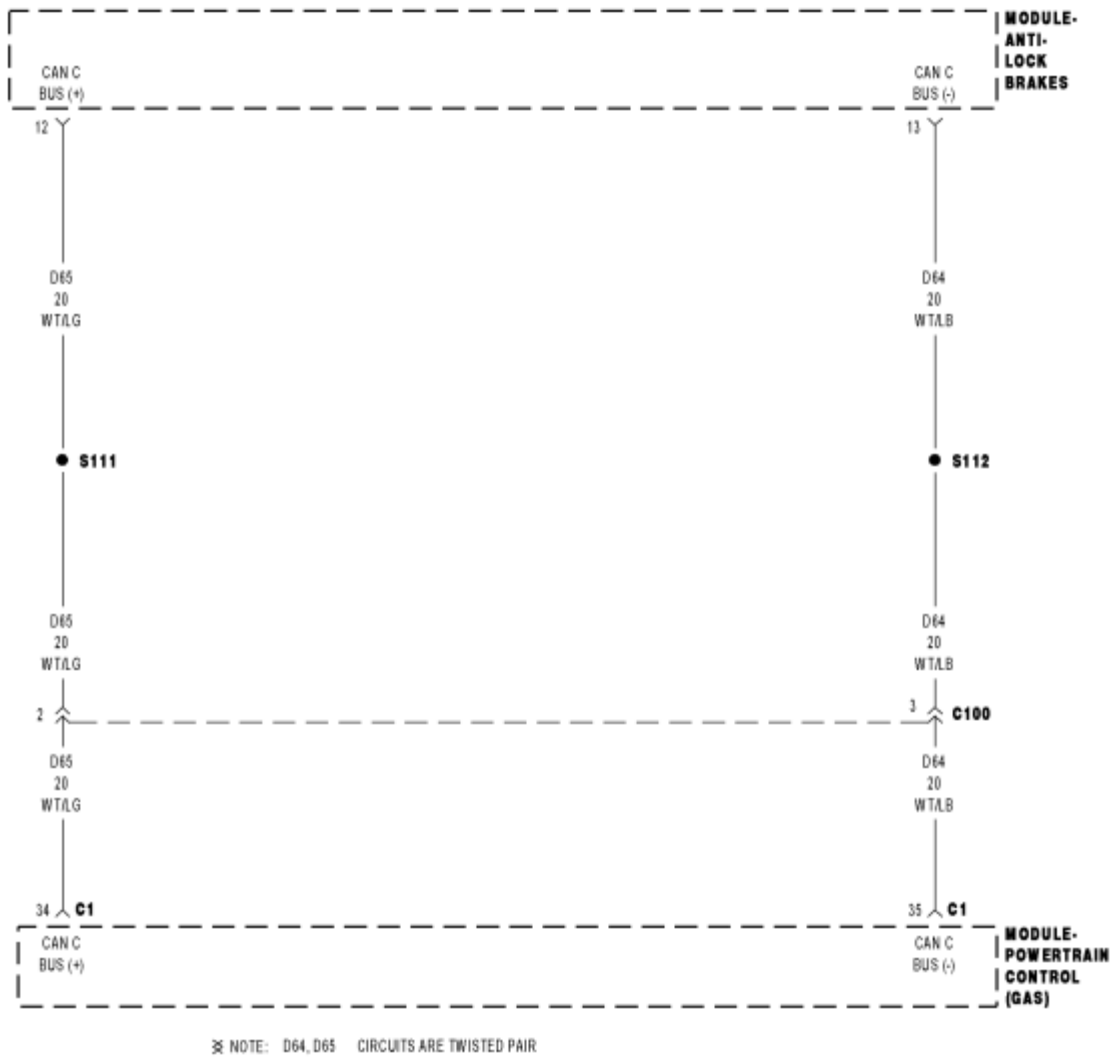
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2161-VEHICLE SPEED SENSOR 2 ERRATIC



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

PCM recognizes Vehicle speed input No.2 erratic or high. VSS No.2 is based on the average of the Front Wheel Speeds. One trip fault and the code will set within 5 seconds. No MIL and No ETC light. Cruise is disabled.

Possible Causes
ACTIVE BUS OR COMMUNICATION DTCS
TIRE CIRCUMFERENCE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the code sets during a front OR rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the ABS Module and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ABS Module and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2166-ACCELERATOR PEDAL POSITION SENSOR 1 MAXIMUM STOP PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors.

◦ **Set Condition:**

APPS No.1 has failed to achieve the required maximum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle. ETC light will illuminate.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool, select View DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, view DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.
Next, erase DTCs.
Start the engine.

Does the DTC return?

Yes

- Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P2167-ACCELERATOR PEDAL POSITION SENSOR 2 MAXIMUM STOP PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors.

◦ **Set Condition:**

APPS No.2 has failed to achieve the required maximum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle. ETC light will illuminate.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool, select View DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, view DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

Start the engine.

Does the DTC return?

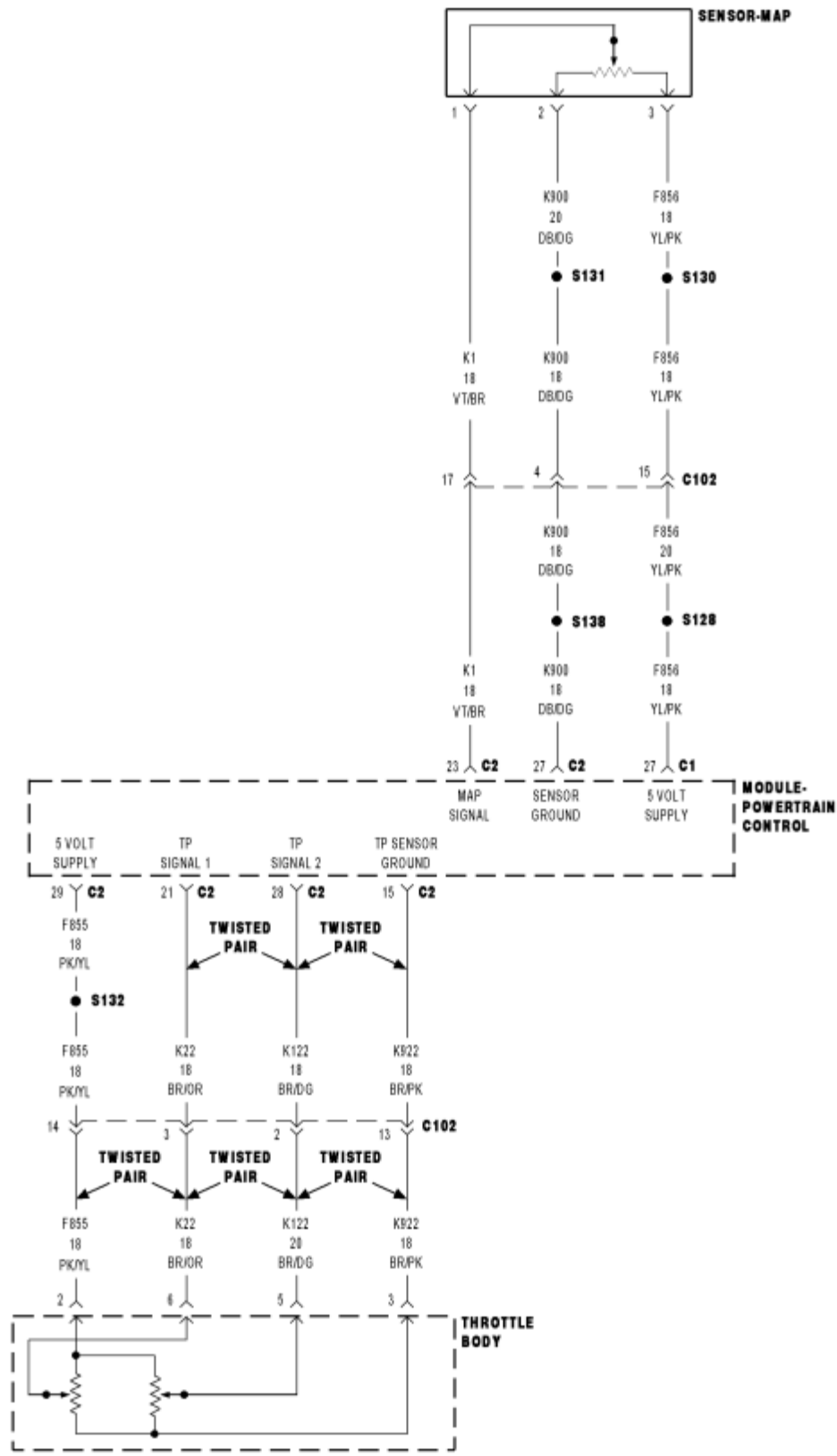
Yes

- Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION)



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and engine running with no MAP Sensor DTCs.

◦ **Set Condition:**

A large vacuum leak has been detected or both of the TP Sensors have failed based on their position being 2.5 volts and the calculated MAP value is less than the actual MAP minus an Offset value. One trip fault and the code will set within 5 seconds. ETC light will flash.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP RETURN CIRCUIT
MAP SENSOR
TP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a vacuum leak.

NOTE: This fault code could be present if any Cam/Crank DTCs are set. No repair is necessary for P2172 if any Cam or Crank Sensor faults are set.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Fuel System Lean or Rich, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to limit the maximum engine speed if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold and Throttle body for leaks and cracks.
Inspect the Power Brake Booster for any vacuum leaks.
Inspect the PCV system for proper operation or any vacuum leaks.
Inspect the MAP Sensor for proper installation.

Were any vacuum leaks found?

Yes

- Repair the vacuum leak as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes

- Go To [4](#)

No

- Go To [13](#)

4. TP SENSOR OPERATION

Ignition on, engine not running.
With a scan tool, perform the ETC Throttle Follower Test.
TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.
TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [5](#)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the Throttle Body harness connector.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

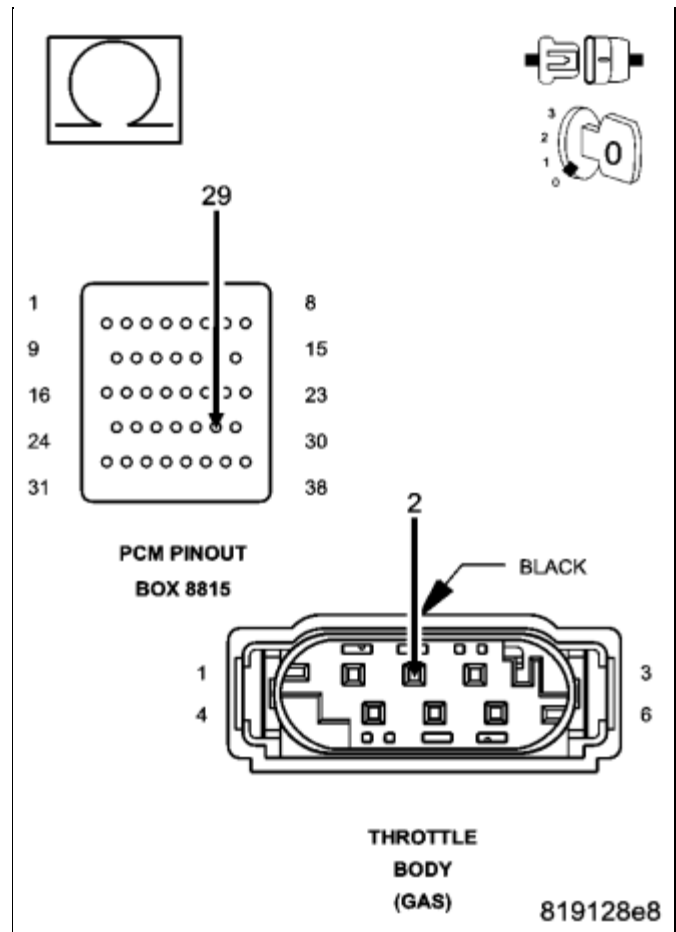
Is the resistance above 100 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit at the Throttle Body harness connector.

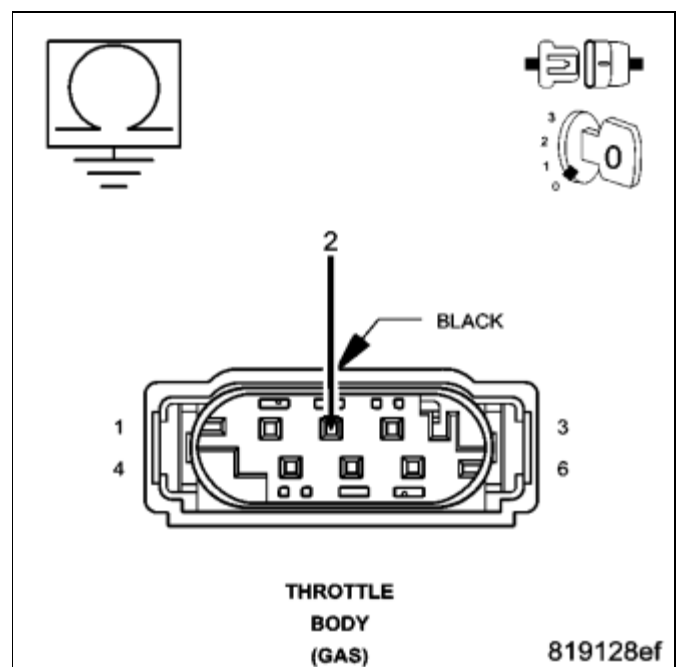
Is the resistance above 100 ohms?

Yes

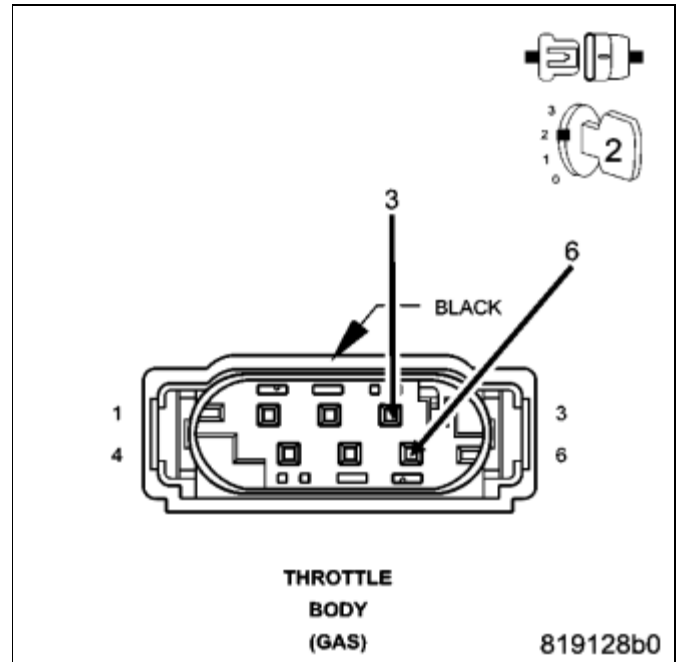
- Go To [7](#)

No

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7.



Connect the C2 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the TP Sensor voltage.
 Connect a jumper wire between the (K22) TP Signal 1 circuit and the (K922) TP Return circuit in the Throttle Body harness connector.
 TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.
 Connect a jumper wire between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.
 TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

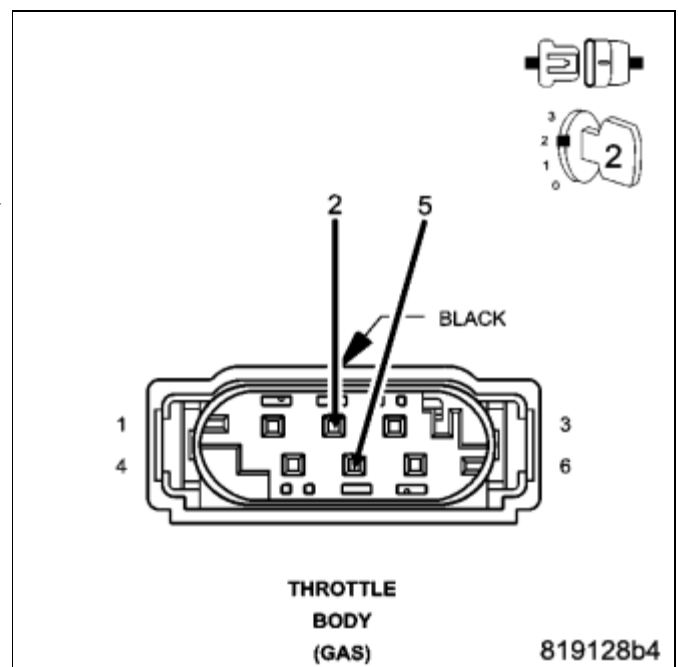
Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes

- Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K22) TP Signal 1 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

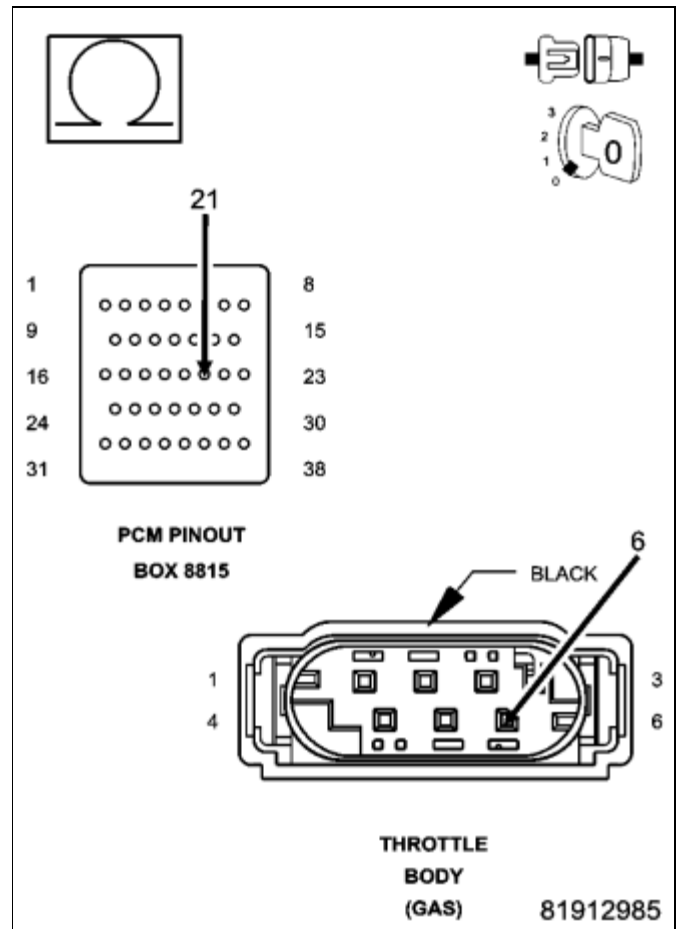
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

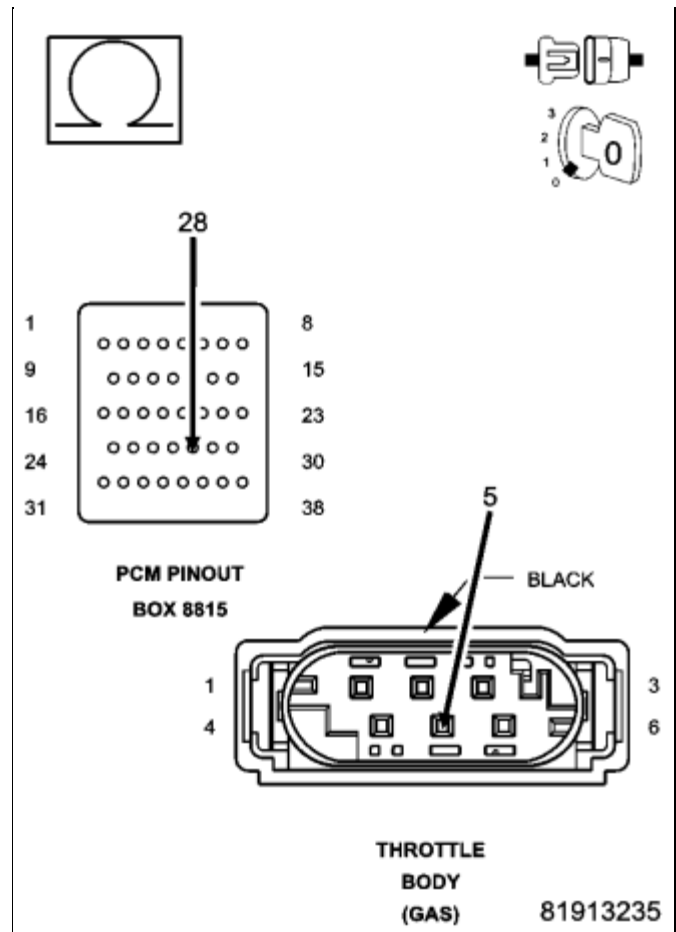
Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



10. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Signal 1 circuit at the Throttle Body harness connector.

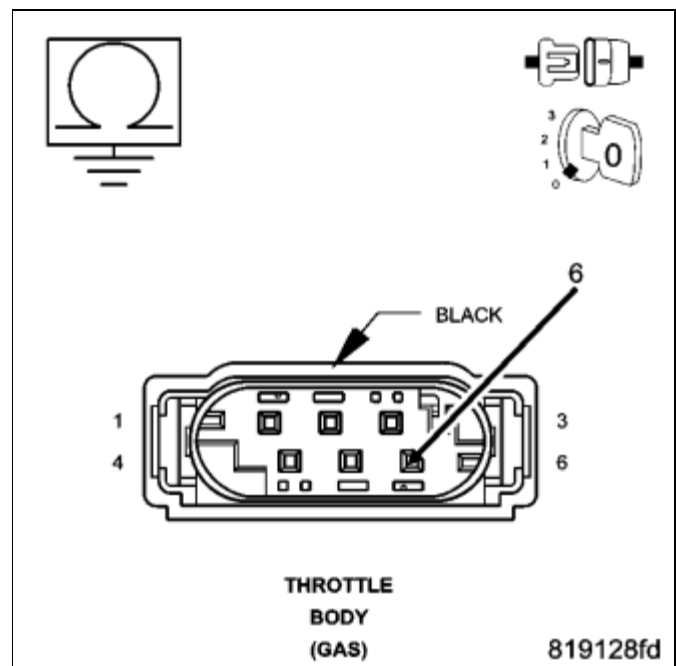
Is the resistance above 100 ohms?

Yes

- Go To [11](#)

No

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

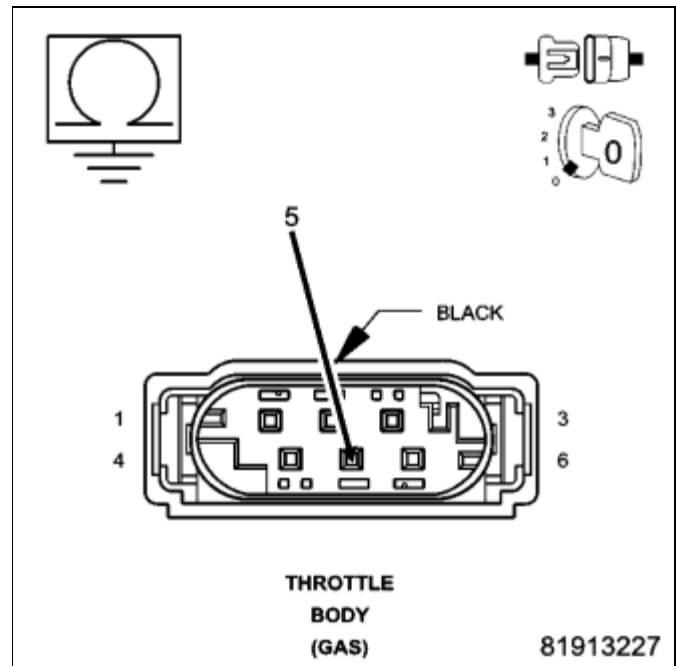
Is the resistance above 100 ohms?

Yes

- Go To [12](#)

No

- Repair the short to ground in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. RESISTANCE IN THE (K922) TP RETURN CIRCUIT

Measure the resistance of the (K922) TP Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

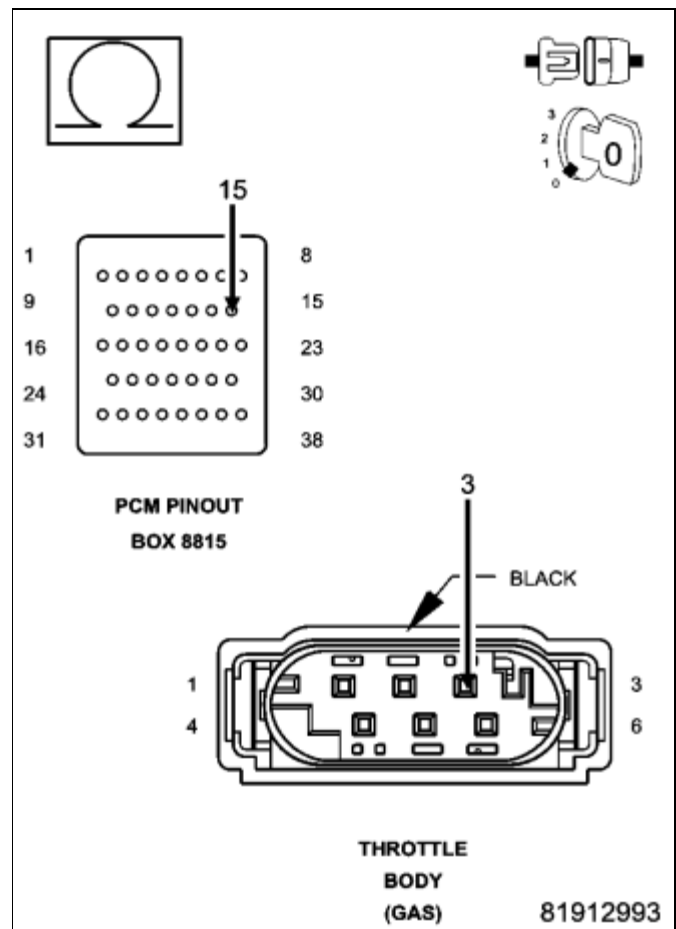
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K922) TP Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



13. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the MAP Sensor harness connector.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

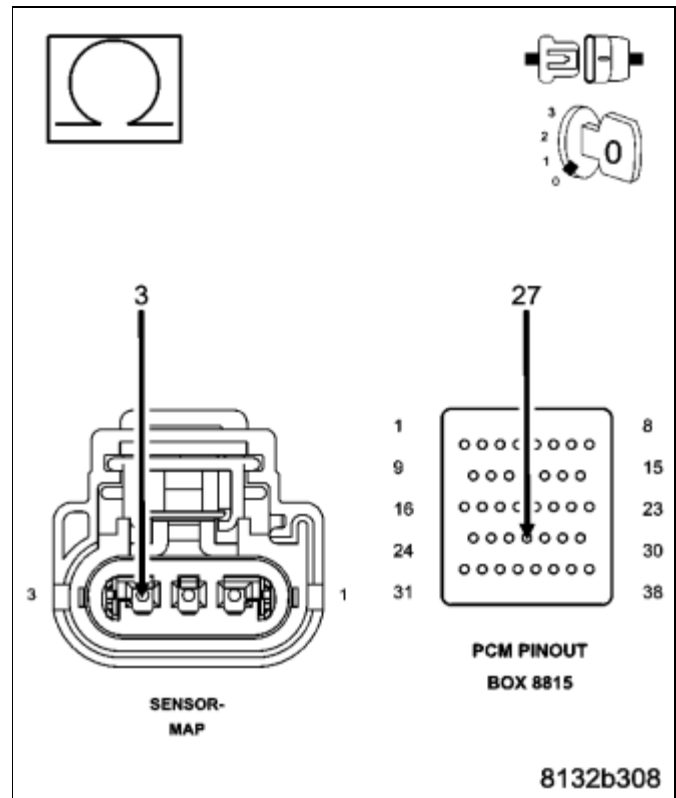
Is the resistance below 5.0 ohms?

Yes

- Go To [14](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



14. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

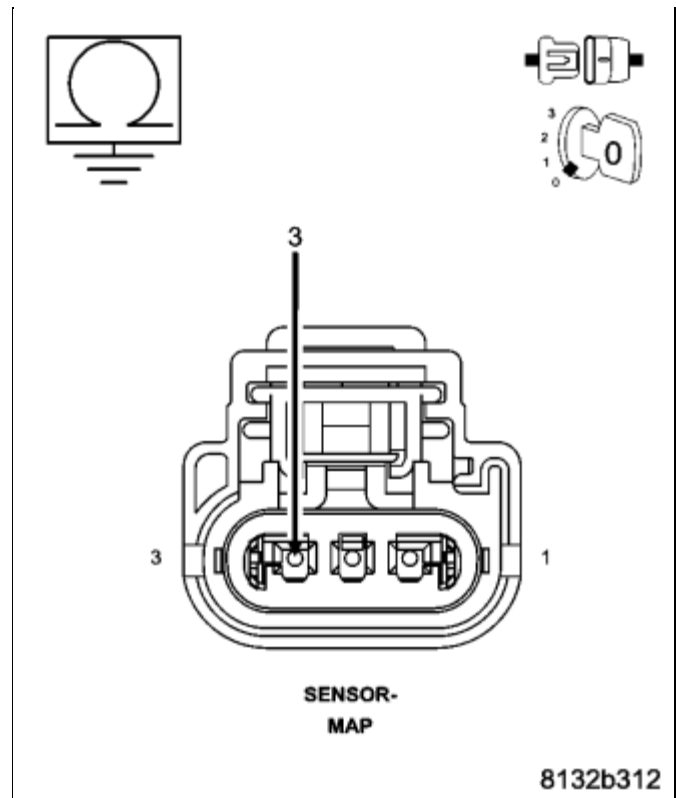
Is the resistance above 100k ohms?

Yes

- Go To [15](#)

No

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



15. MAP SENSOR

Connect the C1 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the MAP Sensor voltage.
 Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.
 Cycle the ignition switch from off to on.
 With a scan tool, monitor the MAP Sensor voltage.

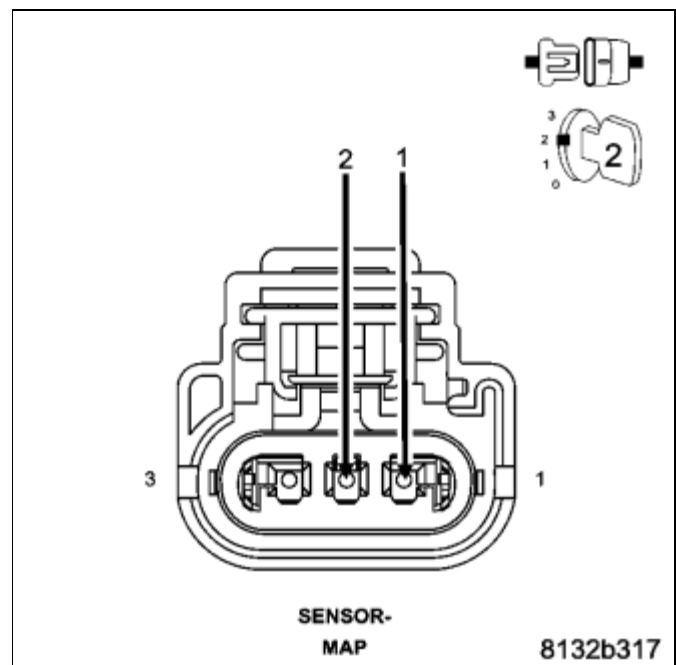
Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes

- Replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [16](#)
- **NOTE: Remove the jumper wire before continuing.**



16. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

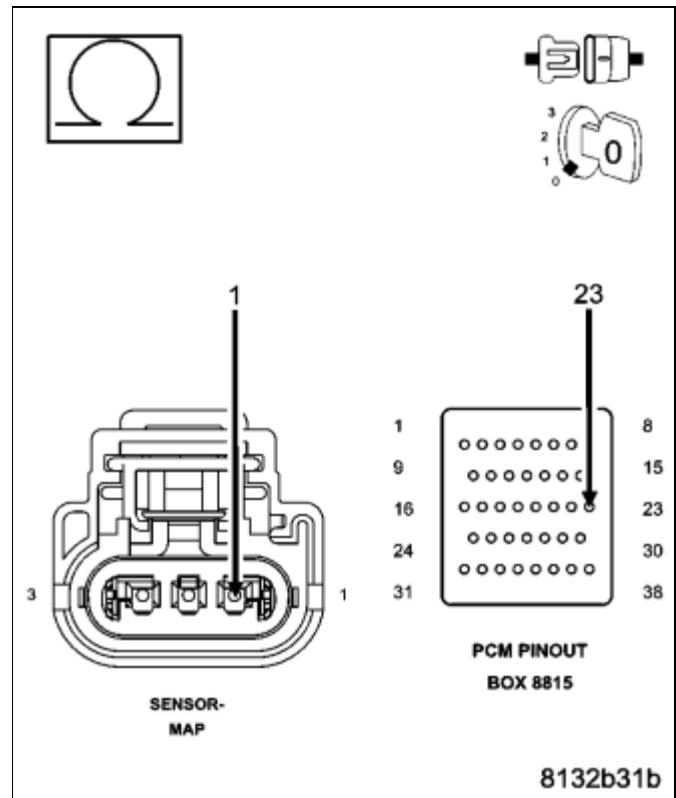
Is the resistance below 5.0 ohms?

Yes

- Go To [17](#)

No

- Repair the excessive resistance in the (K1) MAP Signal circuit
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



17. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

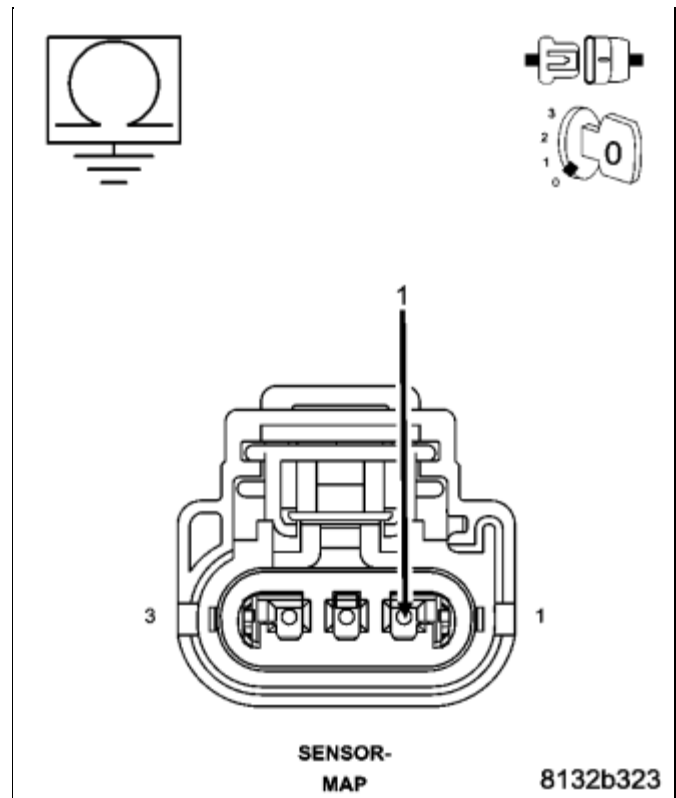
Is the resistance above 100k ohms?

Yes

- Go To [18](#)

No

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



18. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

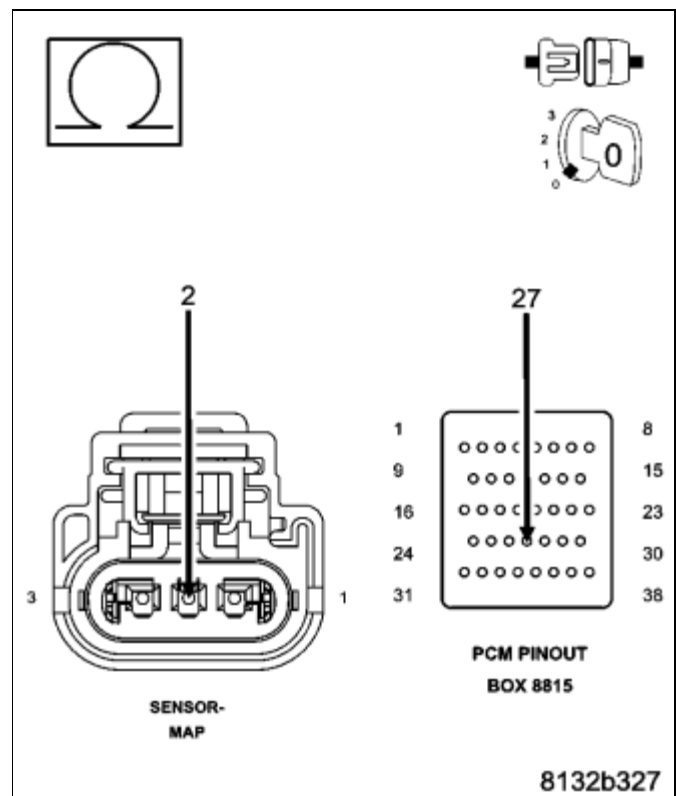
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



19. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor, Throttle Body, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor, Throttle Body, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

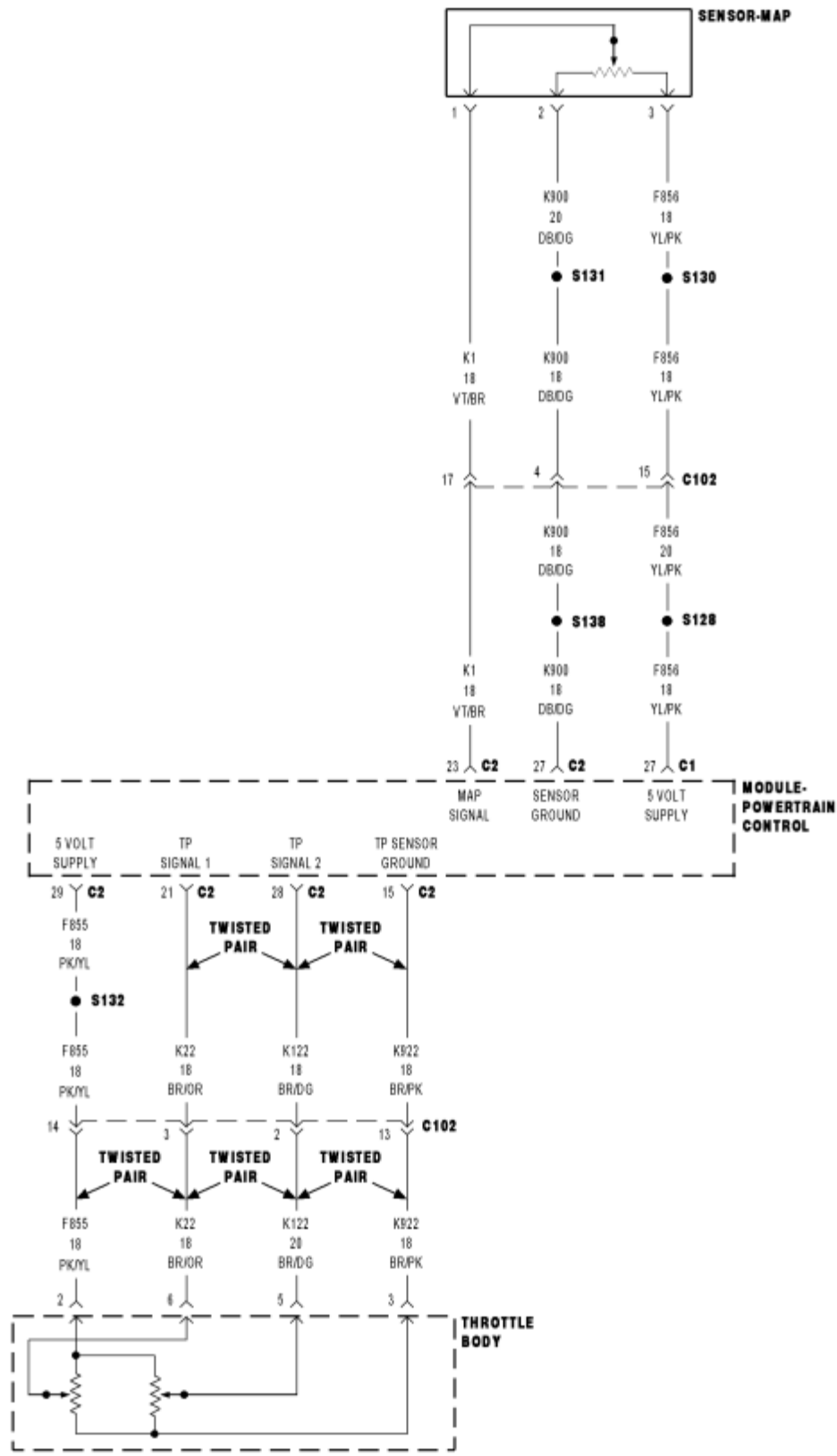
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION)



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and engine running with no MAP Sensor DTCs.

◦ **Set Condition:**

A large vacuum leak has been detected or both of the TP Sensors have failed based on their position being 2.5 volts and the calculated MAP value is less than the Gas Flow Adaptation value is too high. One trip fault the code will set within 5 seconds. ETC light will flash.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP RETURN CIRCUIT
MAP SENSOR
TP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a vacuum leak.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Oxygen Sensor, Fuel related, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to limit the maximum engine speed if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold and Throttle body for leaks and cracks.
Inspect the Power Brake Booster for any vacuum leaks.
Inspect the PCV system for proper operation or any vacuum leaks.
Inspect the MAP Sensor for proper installation.

Were any vacuum leaks found?

Yes

- Repair the vacuum leak as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes

- Go To [4](#)

No

- Go To [13](#)

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test.

TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.

TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [5](#)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

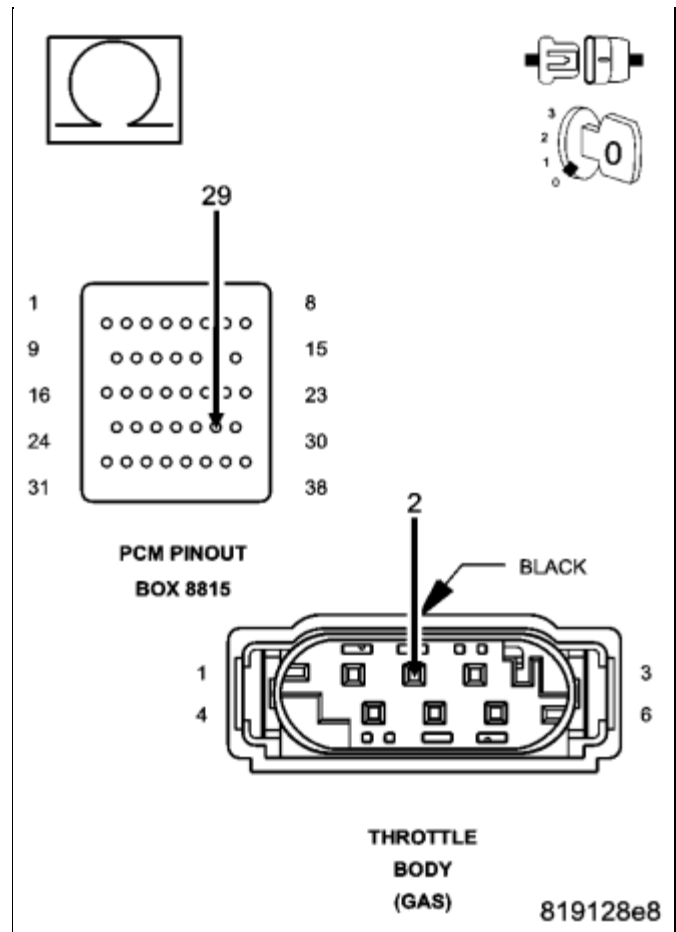
Is the resistance below 100 ohms?

Yes

- Go To [6](#)

No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit at the Throttle Body harness connector.

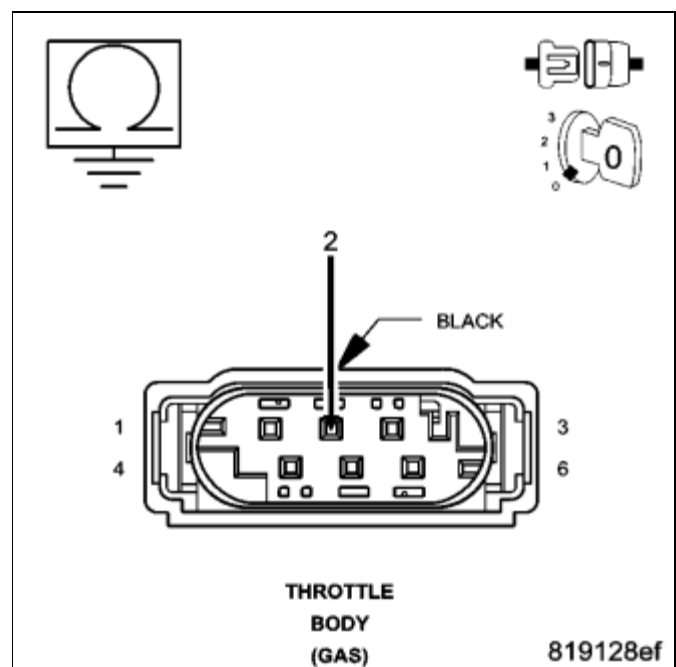
Is the resistance above 100 ohms?

Yes

- Go To [7](#)

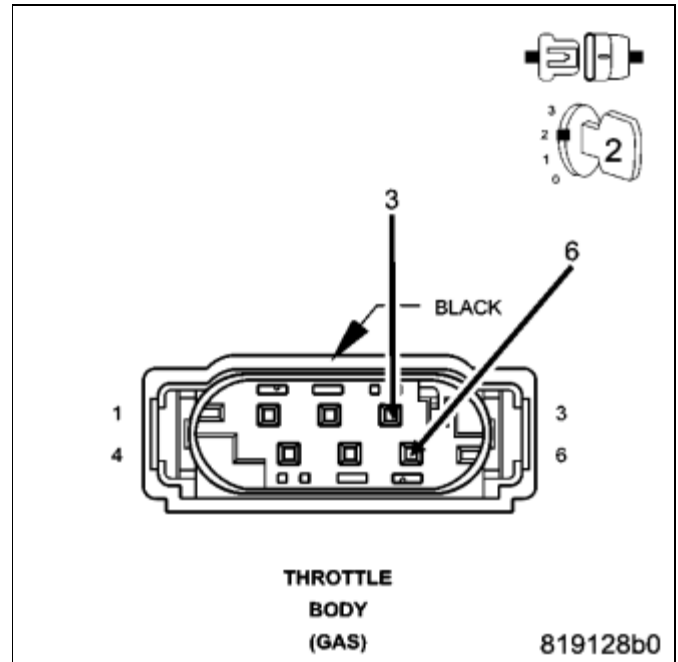
No

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



TP SENSOR

7.



Connect the C2 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the TP Sensor voltage.
 Connect a jumper wire between the (K22) TP Signal 1 circuit and the (K922) TP Return circuit in the Throttle Body harness connector.
 TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.
 Connect a jumper wire between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.
 TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

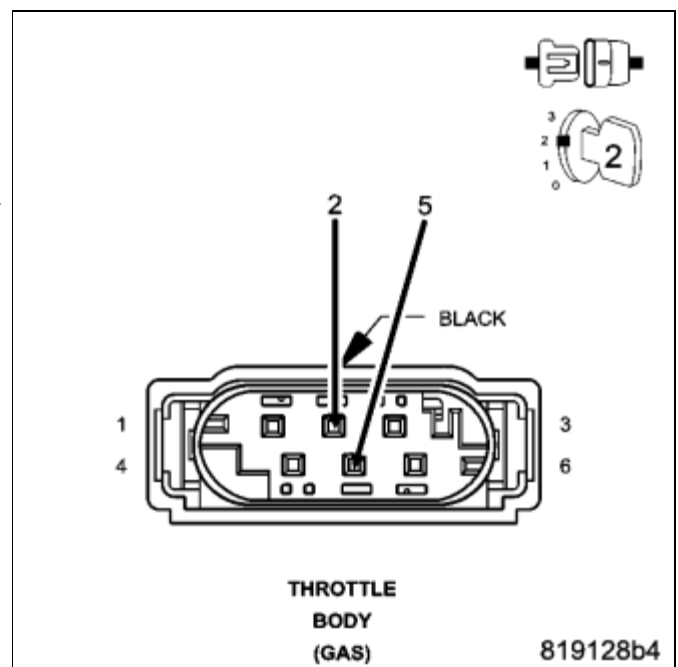
Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes

- Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K22) TP Signal 1 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

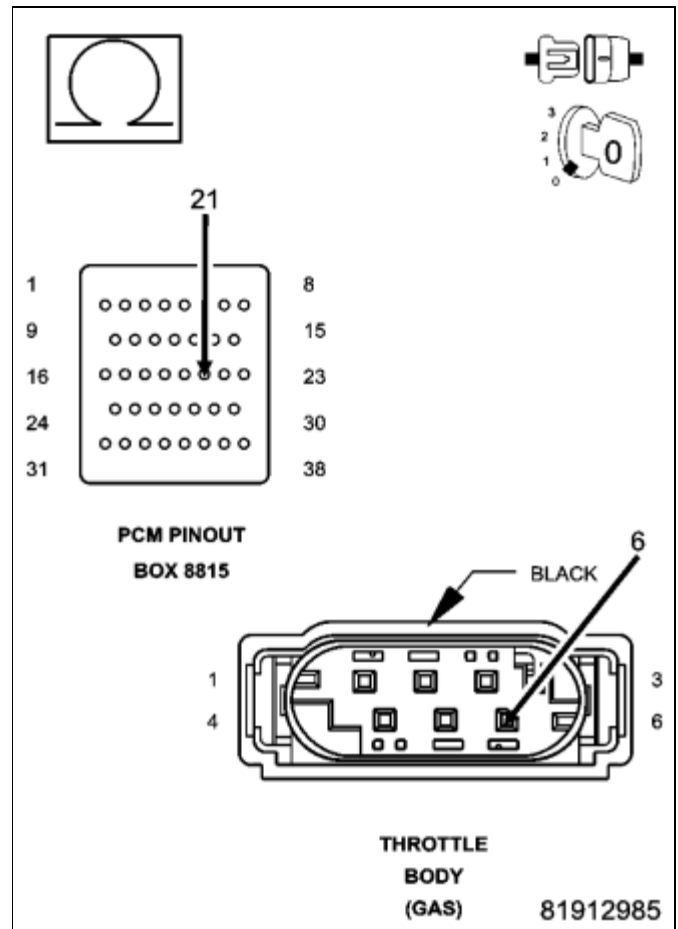
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

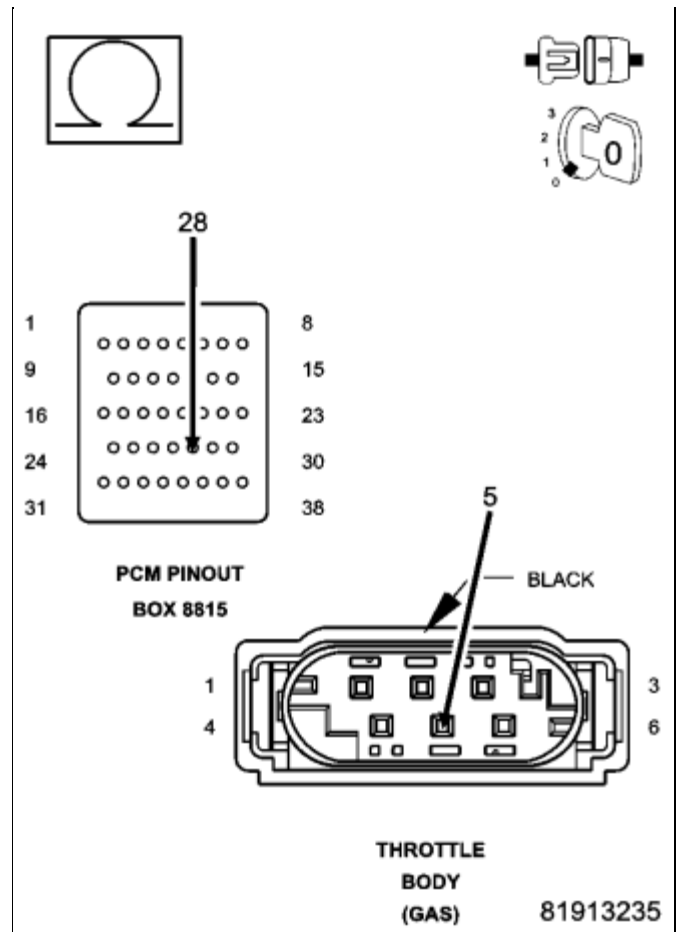
Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



10. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Signal 1 circuit at the Throttle Body harness connector.

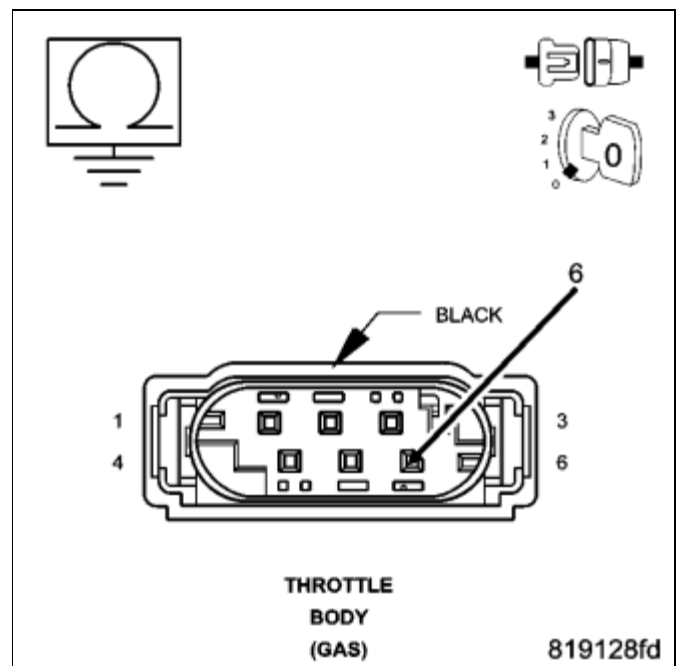
Is the resistance above 100k ohms?

Yes

- Go To [11](#)

No

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

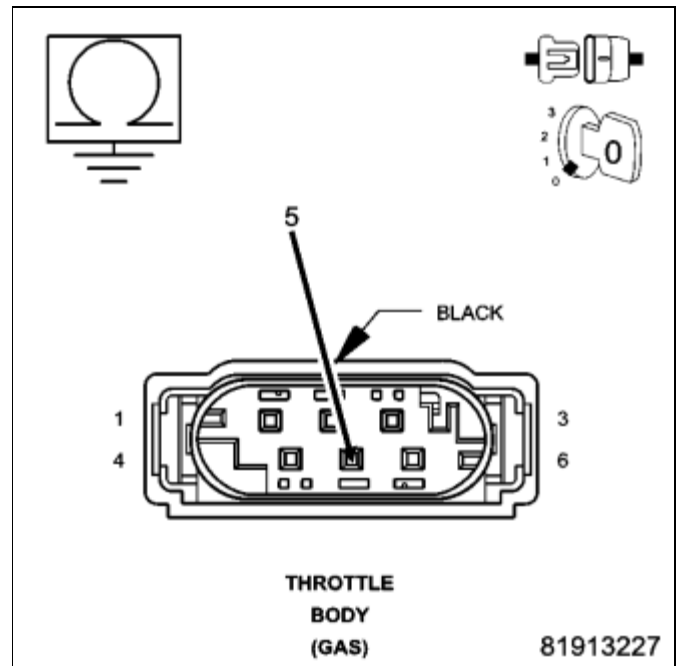
Is the resistance above 100k ohms?

Yes

- Go To [12](#)

No

- Repair the short to ground in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. RESISTANCE IN THE (K922) TP RETURN CIRCUIT

Measure the resistance of the (K922) TP Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

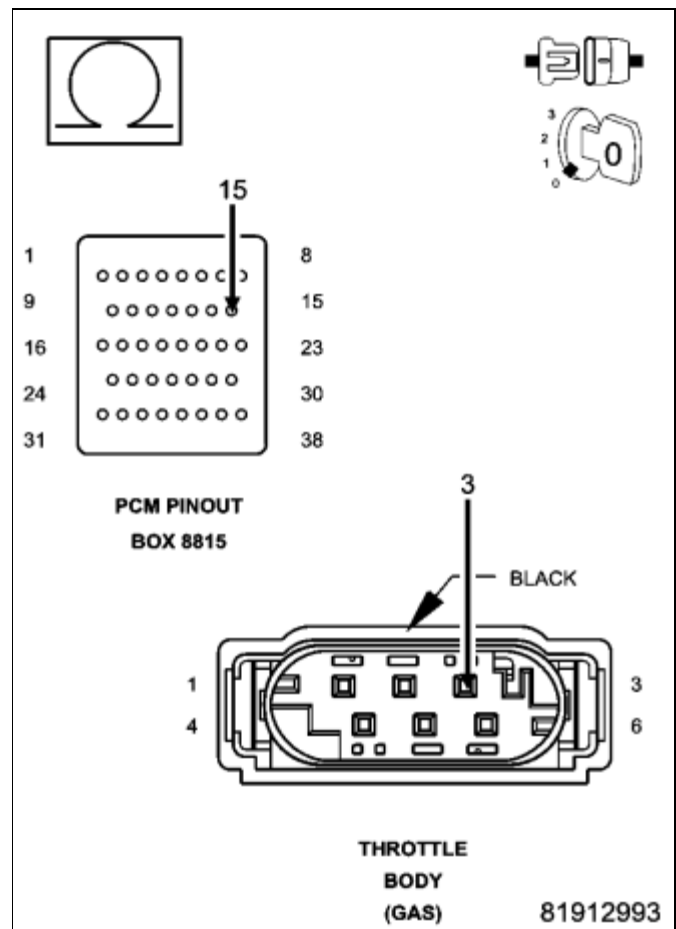
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K922) TP Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



13. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the MAP Sensor harness connector.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

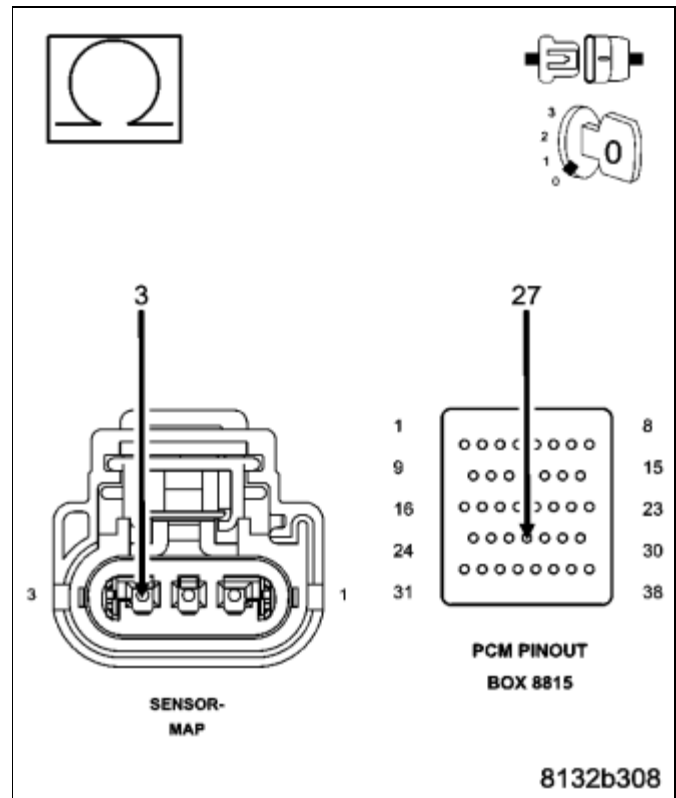
Is the resistance below 5.0 ohms?

Yes

- Go To [14](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



14. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

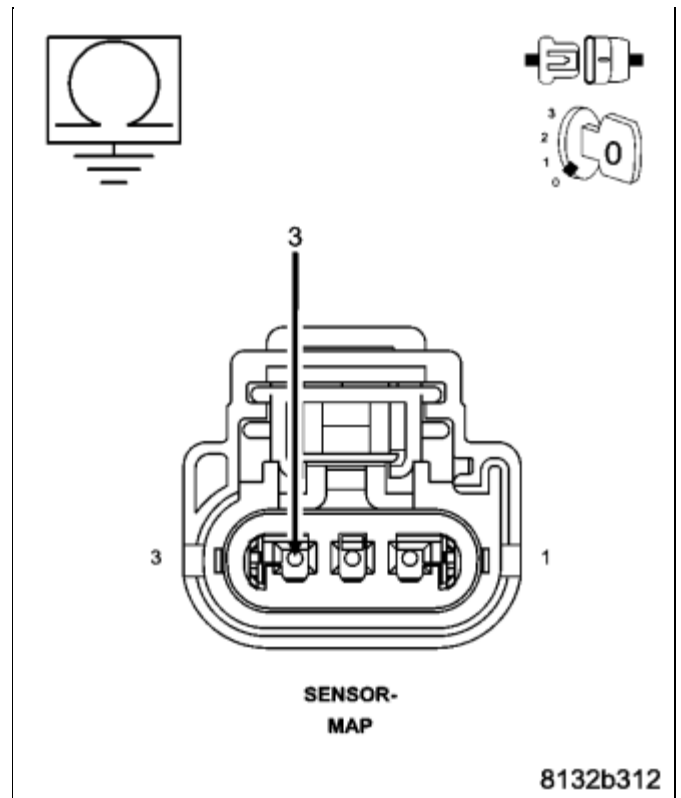
Is the resistance above 100k ohms?

Yes

- Go To [15](#)

No

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



15. MAP SENSOR

Connect the C1 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the MAP Sensor voltage.
 Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.
 Cycle the ignition switch from off to on.
 With a scan tool, monitor the MAP Sensor voltage.

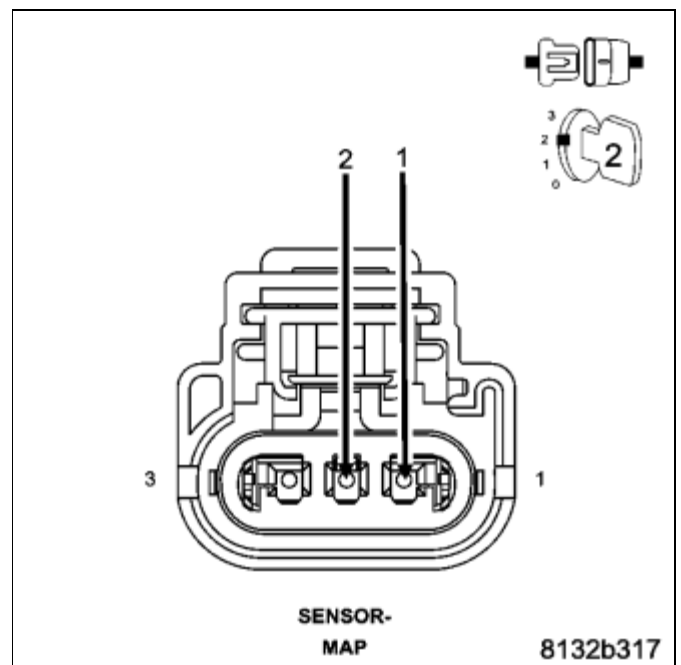
Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes

- Replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [16](#)
- **NOTE: Remove the jumper wire before continuing.**



16. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

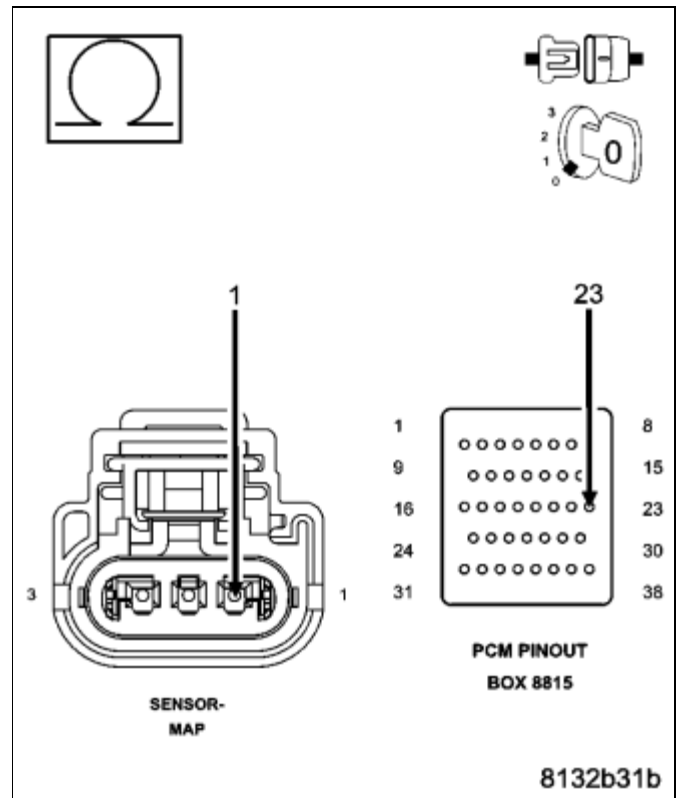
Is the resistance below 5.0 ohms?

Yes

- Go To [17](#)

No

- Repair the excessive resistance in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



17. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit at the MAP Sensor harness connector.

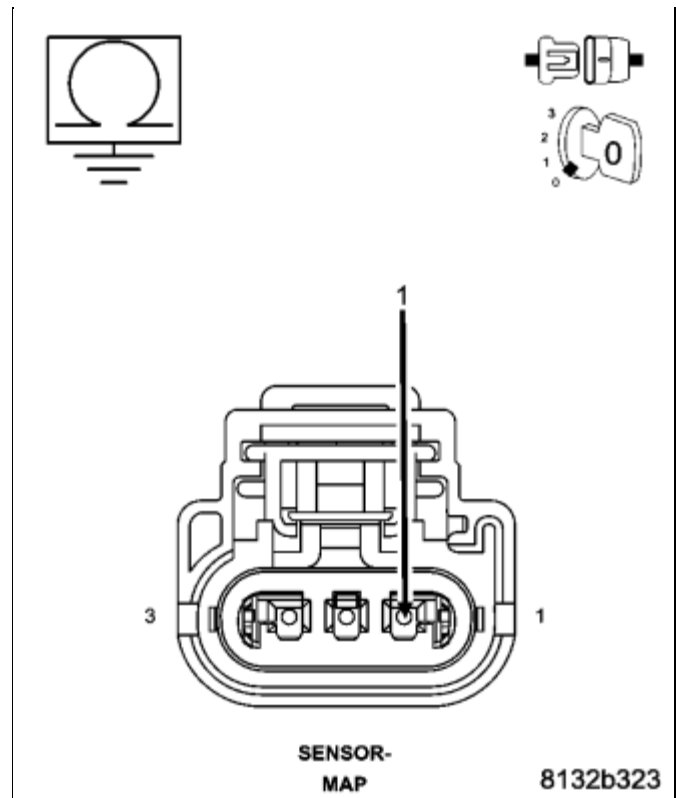
Is the resistance above 100k ohms?

Yes

- Go To [18](#)

No

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



18. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

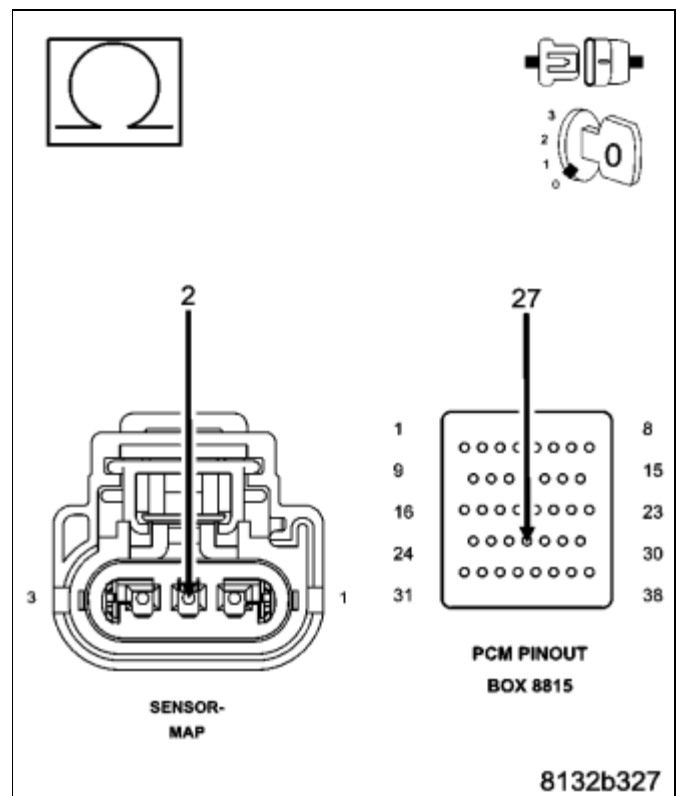
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



19. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor, Throttle Body, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor, Throttle Body, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

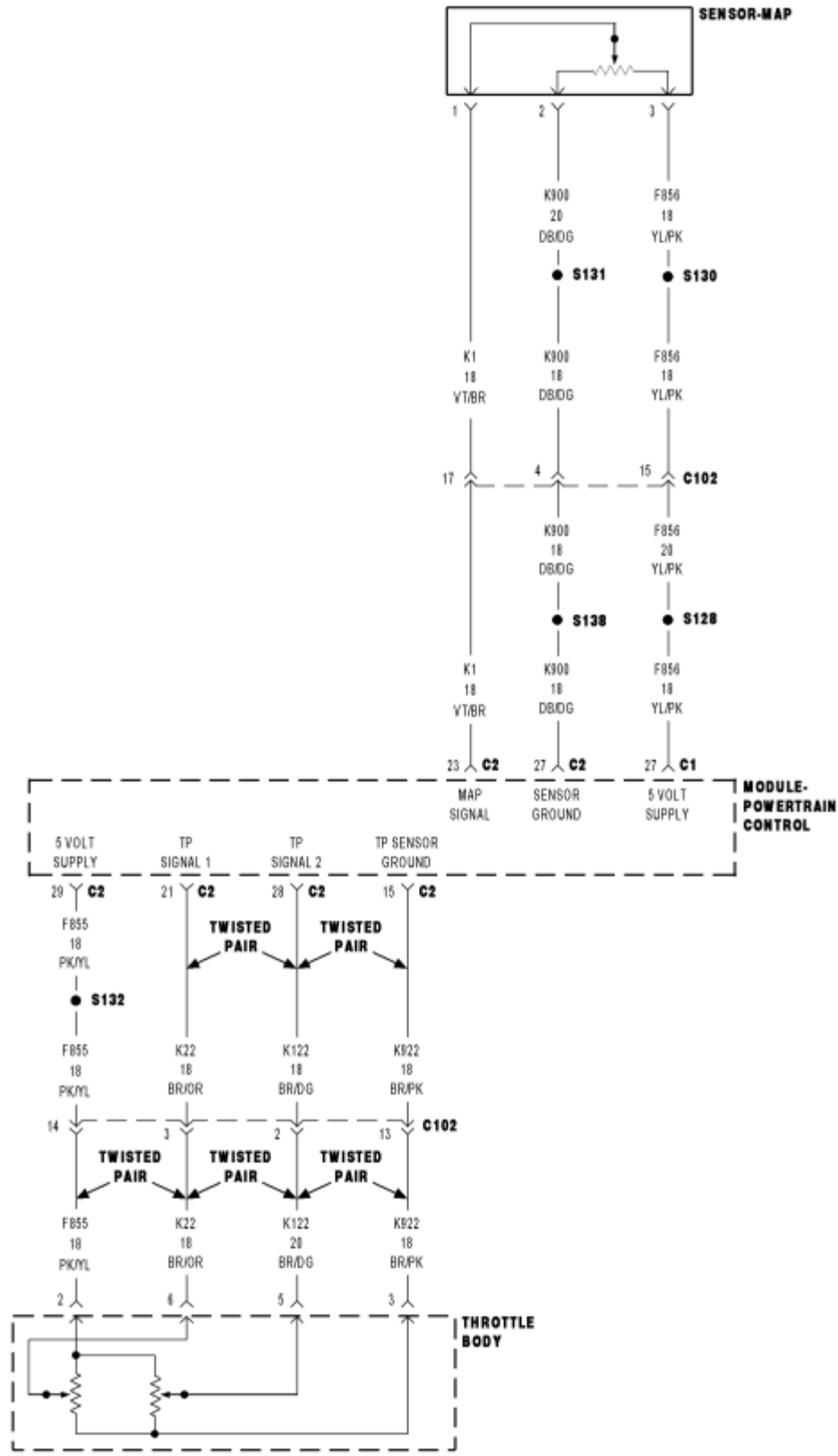
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

**P2174-LOW AIRFLOW/RESTRICTION DETECTED
(INSTANTANEOUS ACCUMULATION)**



8151ccc

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and engine running with no MAP Sensor DTCs.

◦ **Set Condition:**

PCM calculated MAP value is greater than actual MAP value plus an offset value. One trip fault. Three good trips to turn of the mil. MIL is on and the ETC light will flash.

Possible Causes
RESTRICTED AIR INLET SYSTEM
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP RETURN CIRCUIT
MAP SENSOR
TP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a plugged intake air system or dirty Throttle Body. Check for any TSBs before continuing.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Fuel System Lean or Rich, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Question the customer about weather conditions, as ICE build up on the blade can cause this fault when ambient is around -10 to +4°C (14 to 39.2°F) range.

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. RESTRICTED AIR INLET SYSTEM

Turn the ignition off.
Remove the Air Cleaner Assembly.
Remove the Air Filter.
Inspect the Throttle Body opening for signs of any foreign materials.
Check the intake tube / air cleaner for obstructions - include snow packing questions to customer.

Were any restrictions found?

Yes

- Repair the restriction as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes

- Go To [4](#)

No

- Go To [13](#)

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test.

TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.

TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [5](#)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

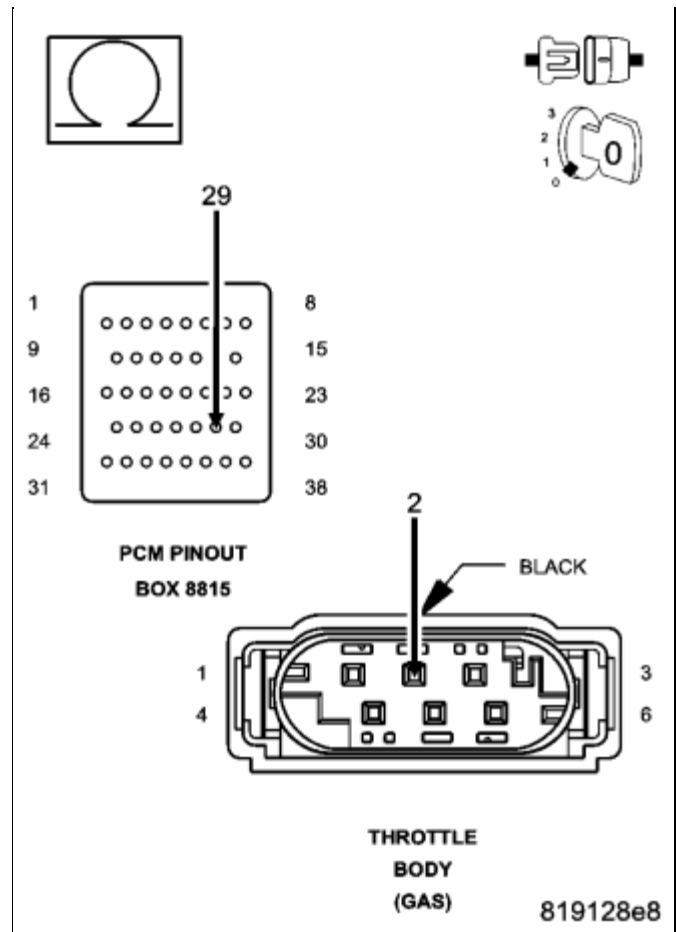
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 100 ohms?

Yes

- Go To [6](#)



No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit at the Throttle Body harness connector.

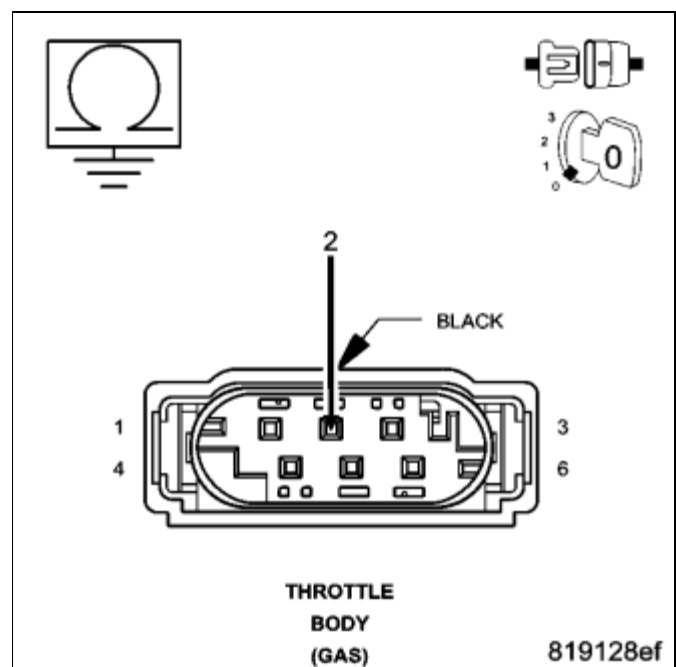
Is the resistance above 100k ohms?

Yes

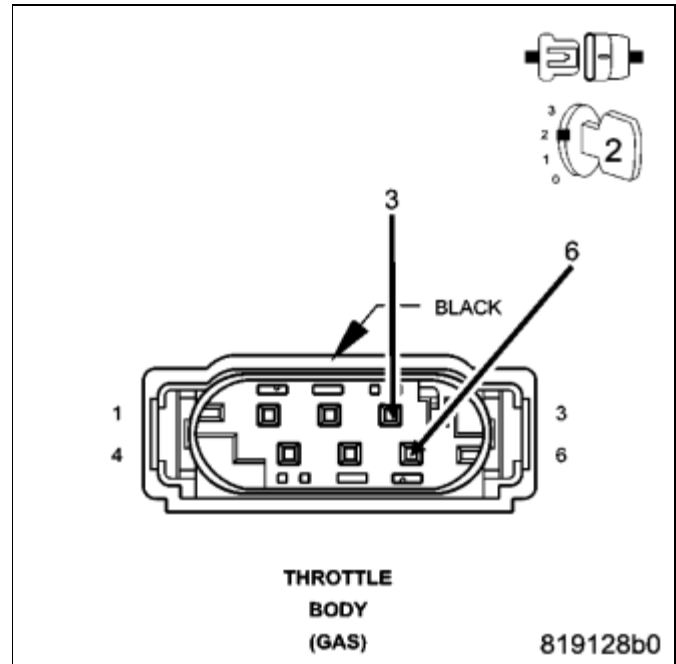
- Go To [7](#)

No

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7.



Connect the PCM harness connectors.
 Ignition on, engine not running.
 With a scan tool, monitor the TP Sensor voltage.
 Connect a jumper wire between the (K22) TP Signal 1 circuit and the (K922) TP Return circuit in the Throttle Body harness connector.
 TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.
 Connect a jumper wire between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.
 TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

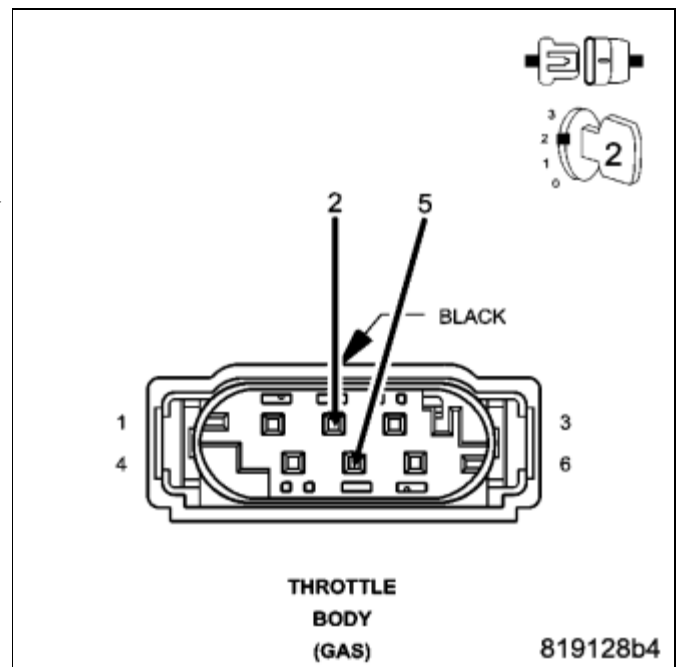
Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes

- Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K22) TP Signal 1 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

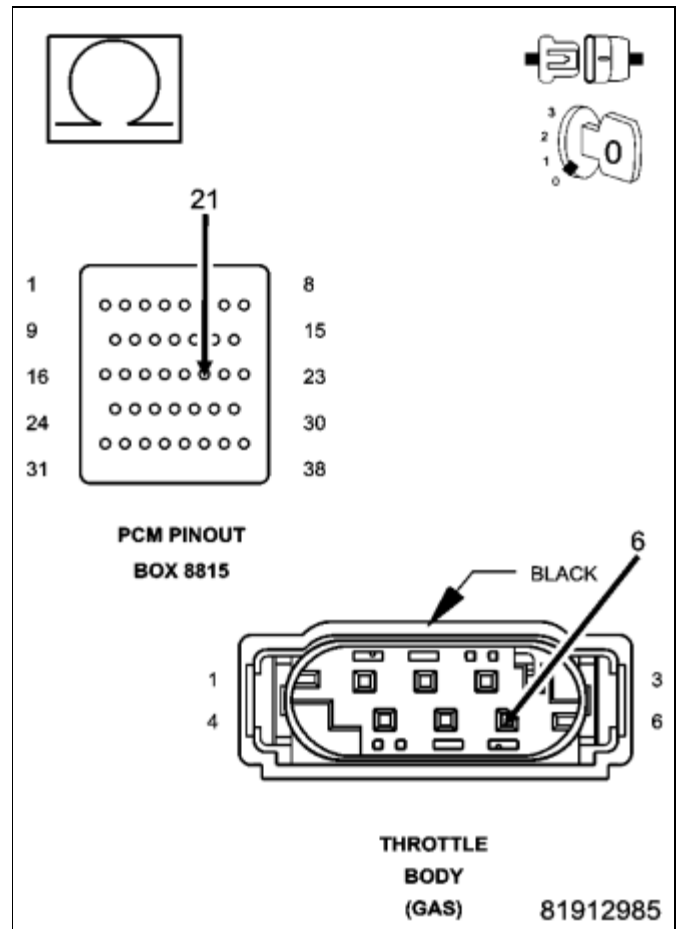
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

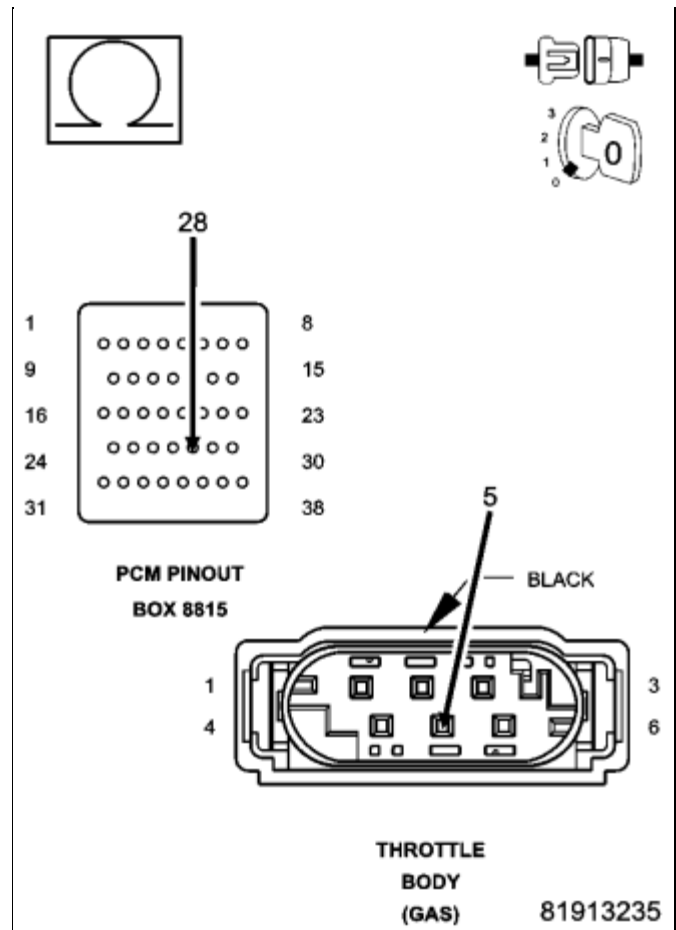
Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



10. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Signal 1 circuit at the Throttle Body harness connector.

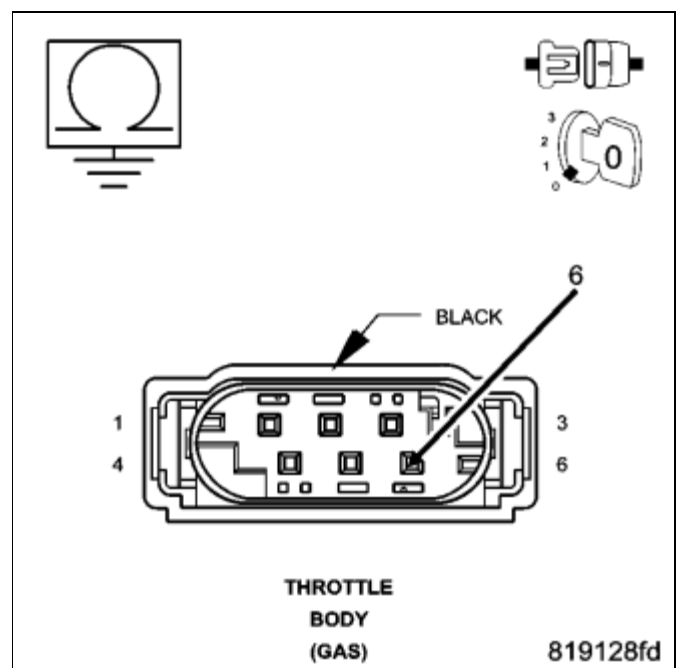
Is the resistance above 100k?

Yes

- Go To [11](#)

No

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal circuit at the Throttle Body harness connector.

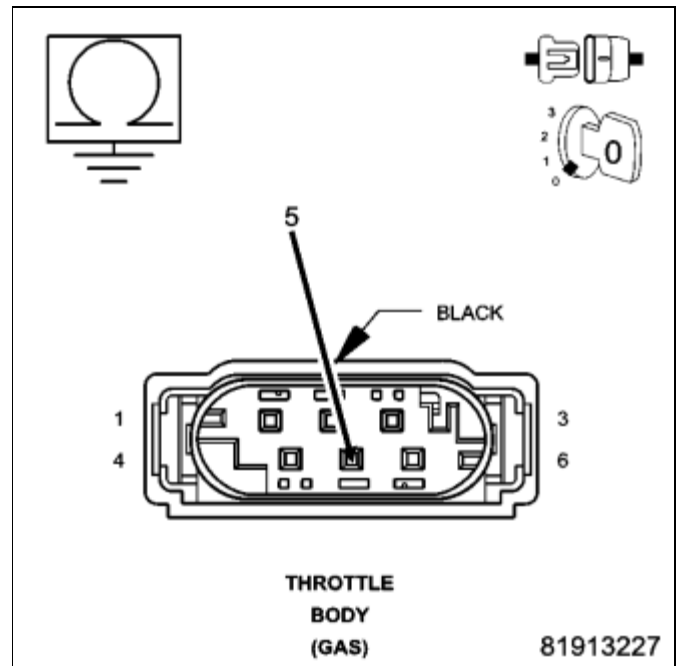
Is the resistance above 100k ohms?

Yes

- Go To [12](#)

No

- Repair the short to ground in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. RESISTANCE IN THE (K922) TP RETURN CIRCUIT

Measure the resistance of the (K922) TP Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

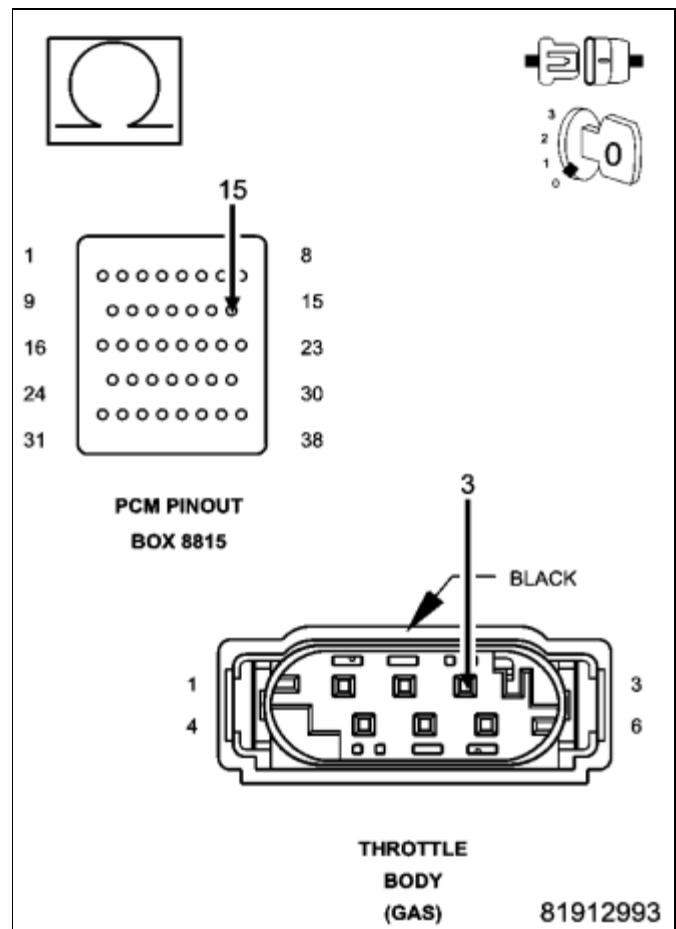
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K922) TP Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



13. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the MAP Sensor harness connector.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

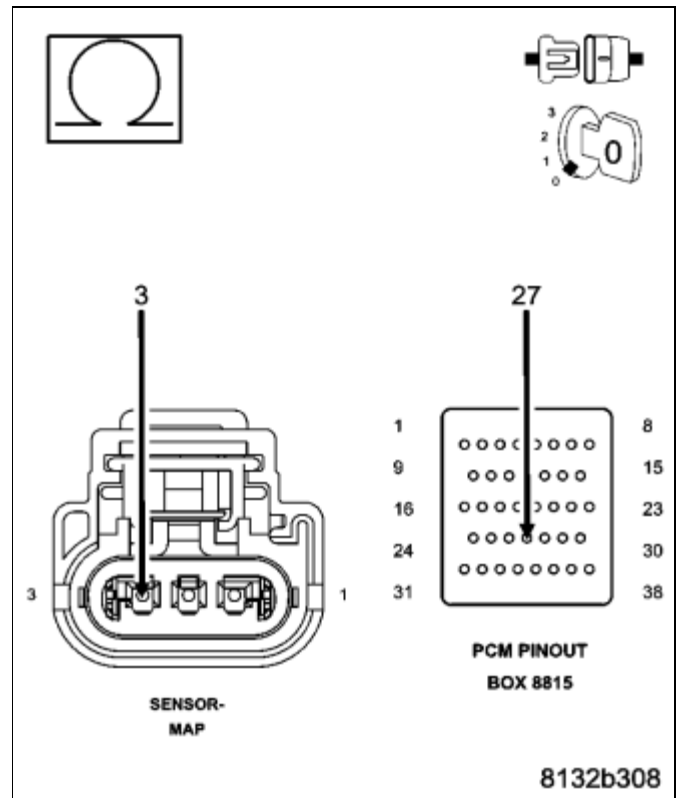
Is the resistance below 5.0 ohms?

Yes

- Go To [14](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



14. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

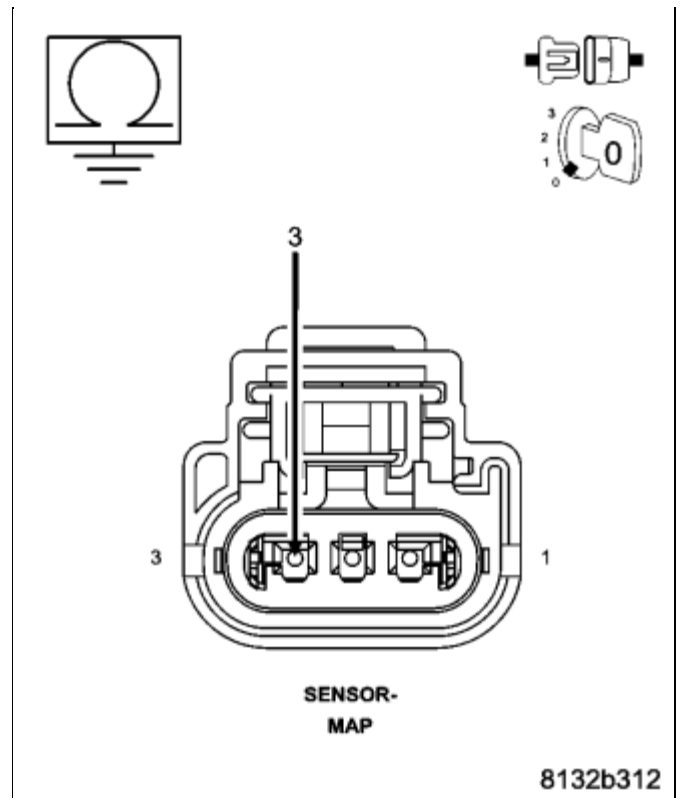
Is the resistance above 100k ohms?

Yes

- Go To [15](#)

No

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



15. MAP SENSOR

Connect the PCM harness connectors.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.

Cycle the ignition switch from off to on.

With a scan tool, monitor the MAP Sensor voltage.

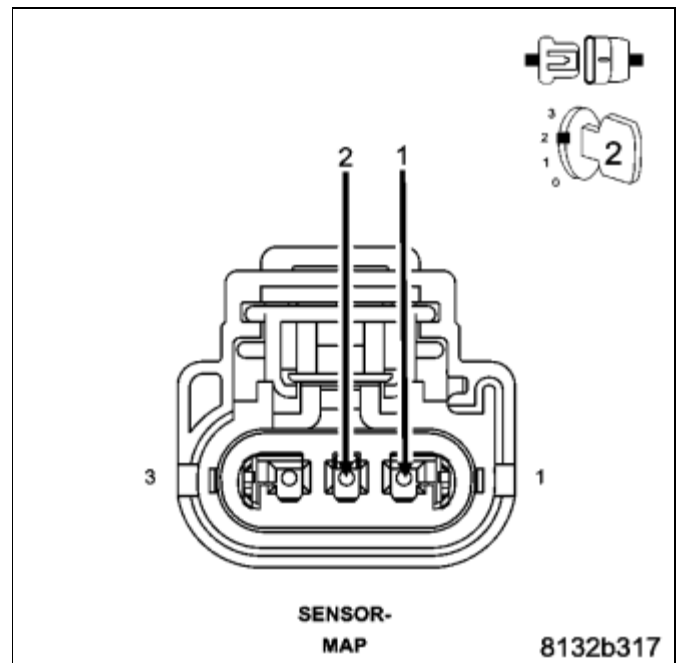
Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes

- Replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [16](#)
- **NOTE: Remove the jumper wire before continuing.**



16. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

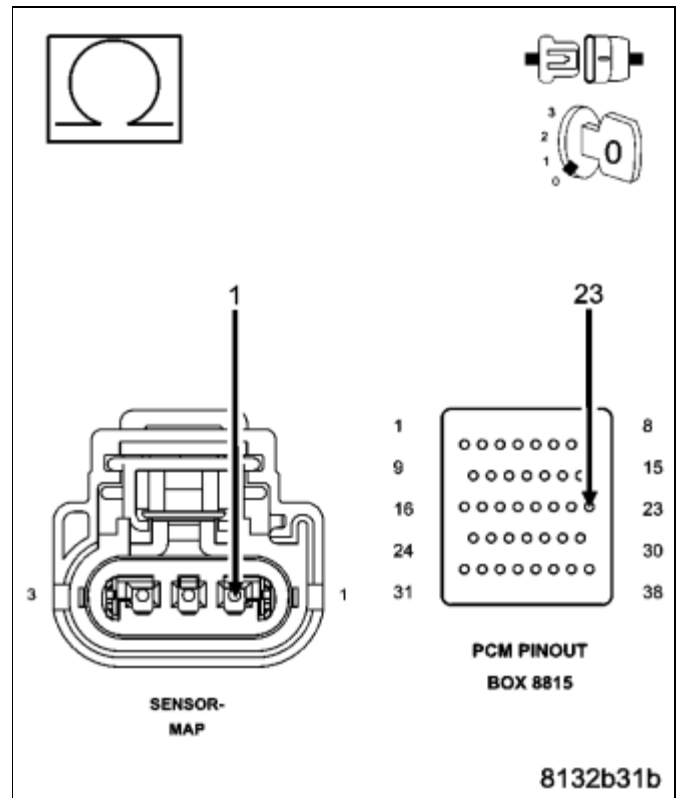
Is the resistance below 5.0 ohms?

Yes

- Go To [17](#)

No

- Repair the excessive resistance in the (K1) MAP Signal circuit
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



17. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

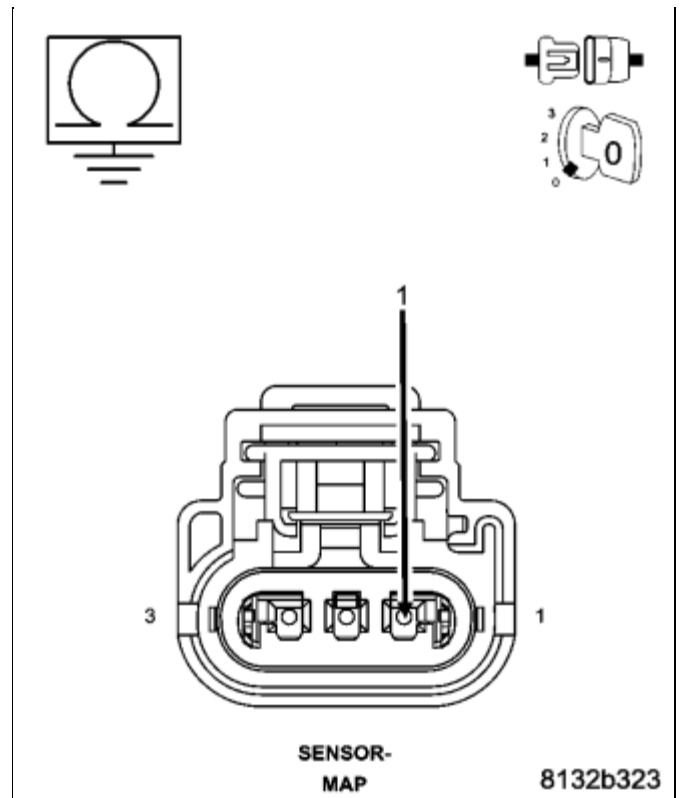
Is the resistance above 100k ohms?

Yes

- Go To [18](#)

No

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



18. RESISTANCE IN (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

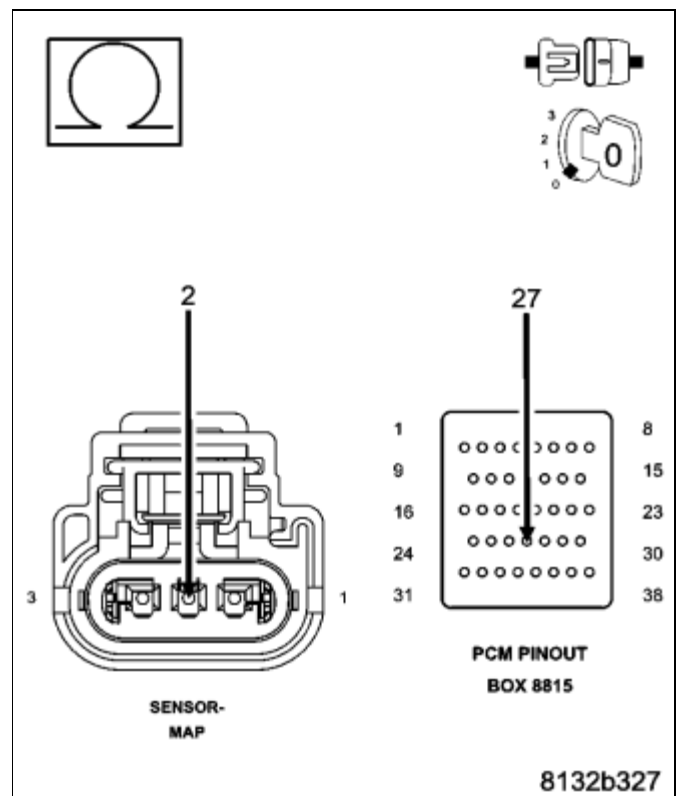
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



19. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor, Throttle Body, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor, Throttle Body, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

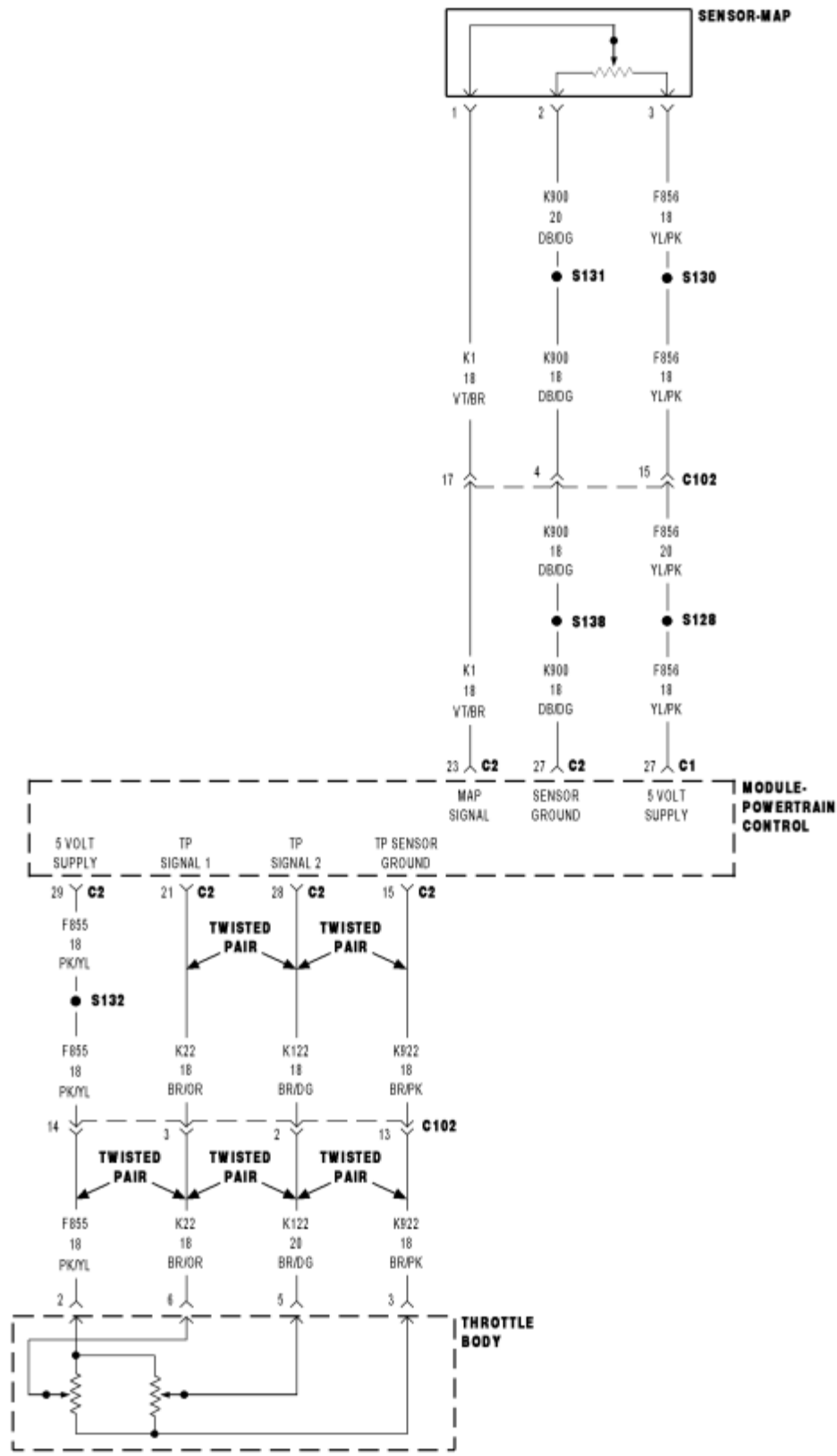
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION)



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on and engine running with no MAP Sensor DTCs.

◦ **Set Condition:**

PCM calculated MAP value is greater than actual MAP value plus an offset value. One trip fault and the code will set within 5 seconds. Three good trips to turn off the mil. MIL is on and the ETC light will flash.

Possible Causes
RESTRICTED AIR INLET SYSTEM
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP RETURN CIRCUIT
MAP SENSOR
TP SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a plugged intake air system or dirty Throttle Body. Check for any TSBs before continuing.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Oxygen Sensor, Fuel related or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Question the customer about weather conditions, as ICE build up on the blade can cause this fault when ambient is around -10 to +4°C (14 to 39.2°F) range.

Start the engine and allow it to reach normal operating temperature.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. RESTRICTED AIR INLET SYSTEM

Turn the ignition off.
Remove the Air Cleaner Assembly.
Remove the Air Filter.
Inspect the Throttle Body opening for signs of any foreign materials.
Check the intake tube / air cleaner for obstructions - include snow packing questions to customer.

Were any restrictions found?

Yes

- Repair the restriction as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes

- Go To [4](#)

No

- Go To [13](#)

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, perform the ETC Throttle Follower Test.

TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.

TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Go To [5](#)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

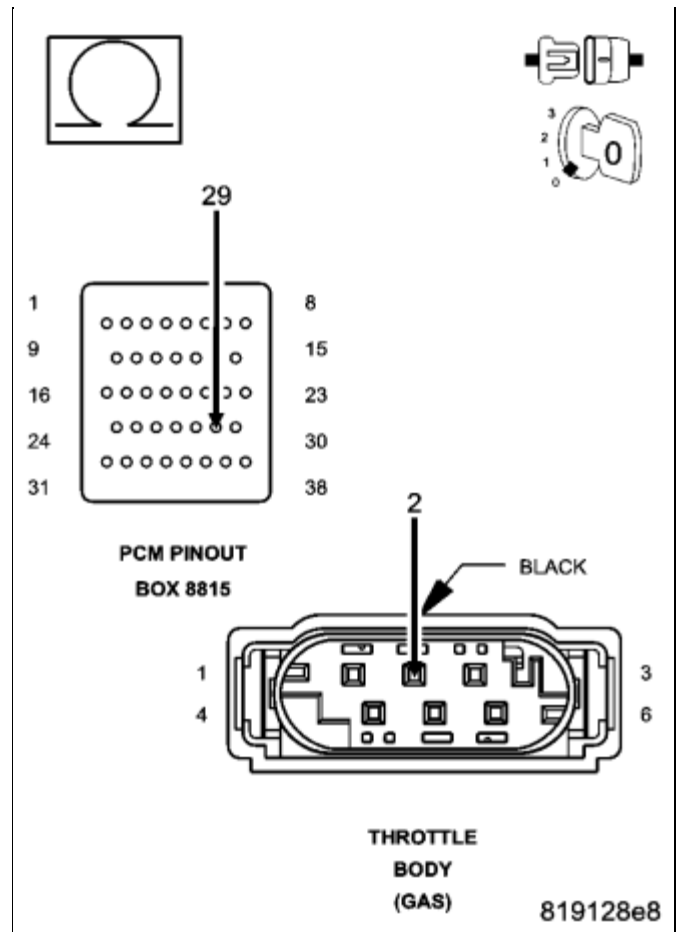
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 100 ohms?

Yes

- Go To [6](#)



No

- Repair the excessive resistance in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit at the Throttle Body harness connector.

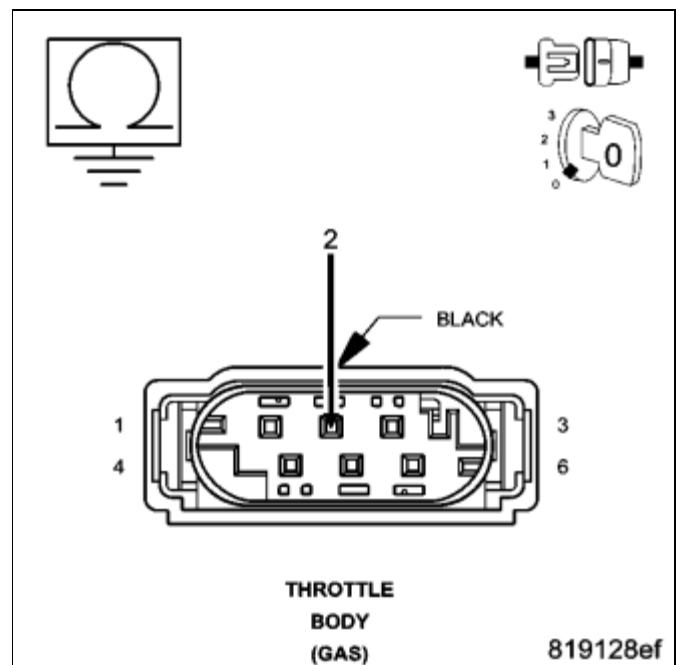
Is the resistance above 100k ohms?

Yes

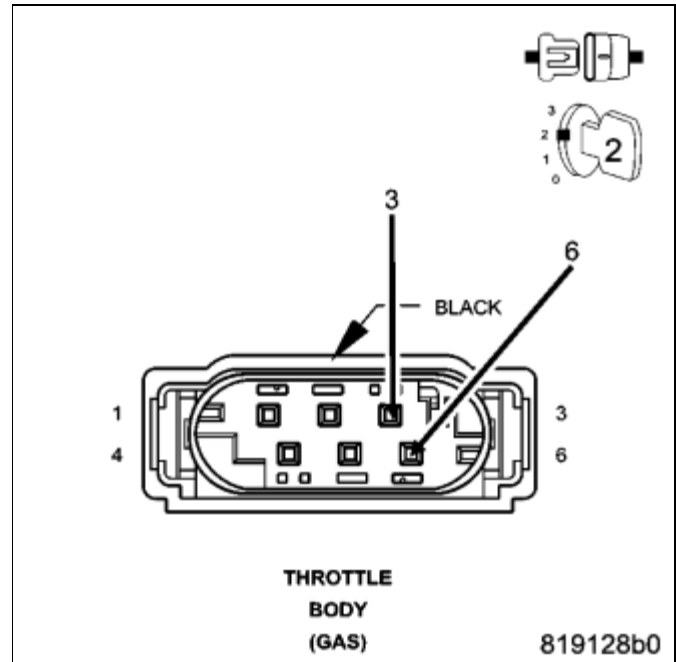
- Go To [7](#)

No

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7.



Connect the PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the TP Sensor voltage.
 Connect a jumper wire between the (K22) TP Signal 1 circuit and the (K922) TP Return circuit in the Throttle Body harness connector.
 TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.
 Connect a jumper wire between the (K122) TP Signal 2 circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.
 TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

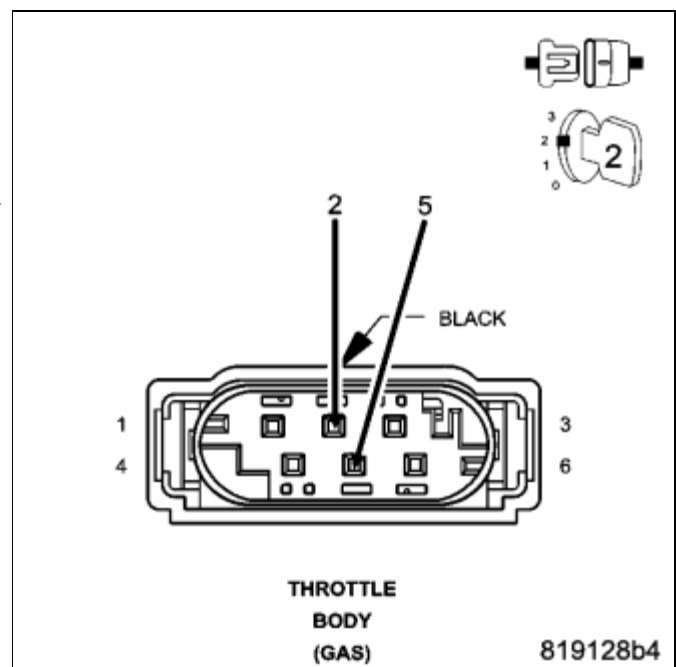
Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes

- Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)



8. RESISTANCE IN THE (K22) TP SIGNAL 1 CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K22) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

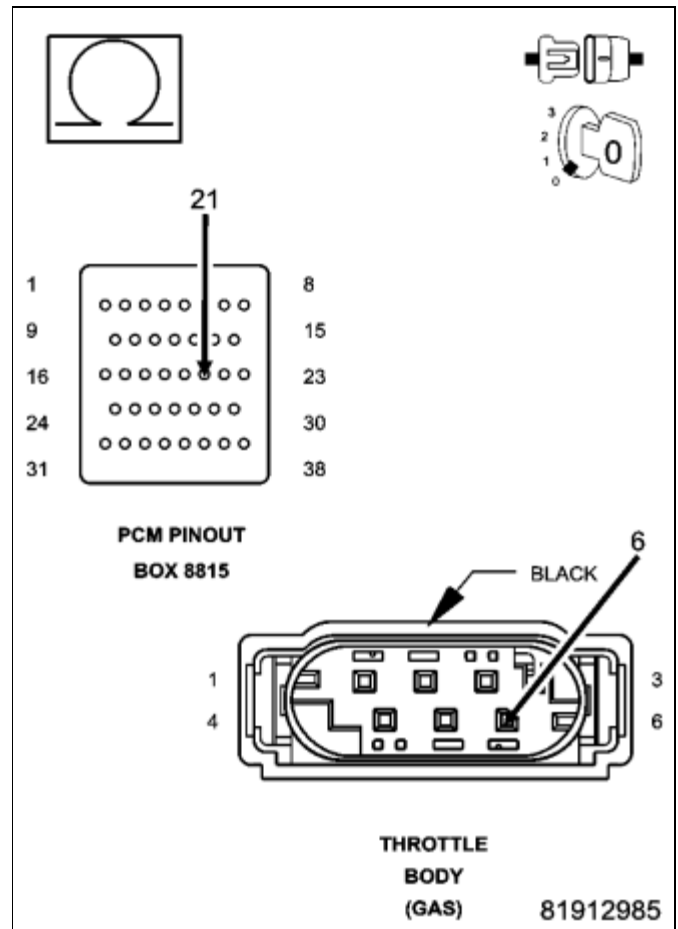
Is the resistance below 5.0 ohms?

Yes

- Go To [9](#)

No

- Repair the excessive resistance in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



9. RESISTANCE IN THE (K122) TP SIGNAL 2 CIRCUIT

Measure the resistance of the (K122) TP Signal 2 circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

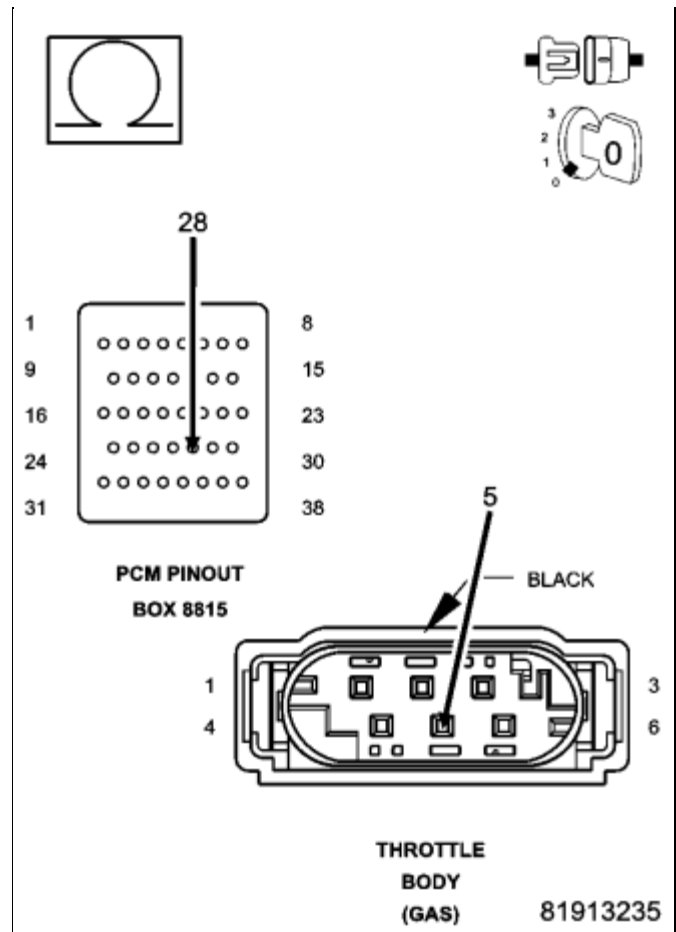
Yes

- Go To [10](#)

No

- Repair the excessive resistance in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



10. (K22) TP SIGNAL 1 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Signal 1 circuit at the Throttle Body harness connector.

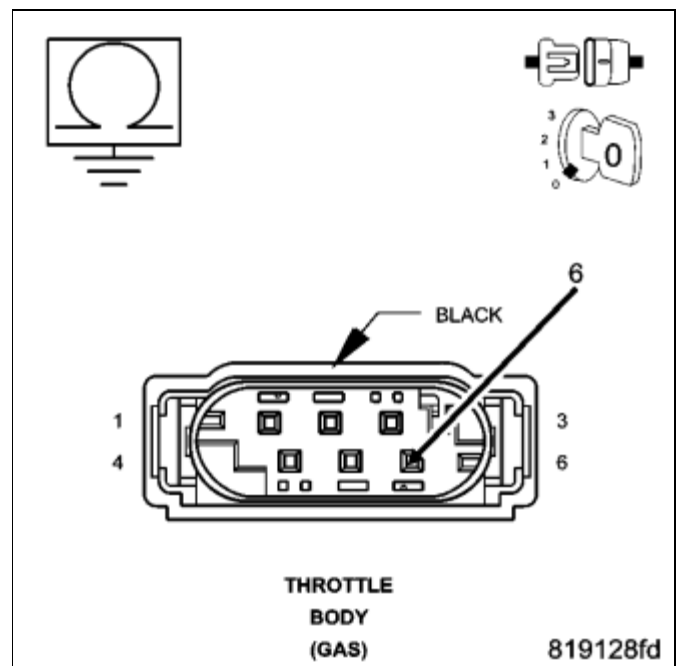
Is the resistance above 100k ohms?

Yes

- Go To [11](#)

No

- Repair the short to ground in the (K22) TP Signal 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



11. (K122) TP SIGNAL 2 CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Signal 2 circuit at the Throttle Body harness connector.

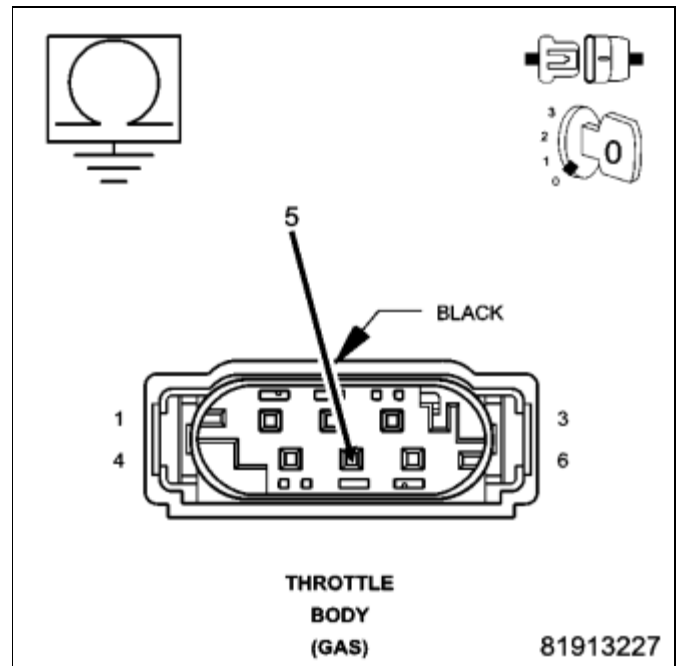
Is the resistance above 100k ohms?

Yes

- Go To [12](#)

No

- Repair the short to ground in the (K122) TP Signal 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



12. RESISTANCE IN THE (K922) TP RETURN CIRCUIT

Measure the resistance of the (K922) TP Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

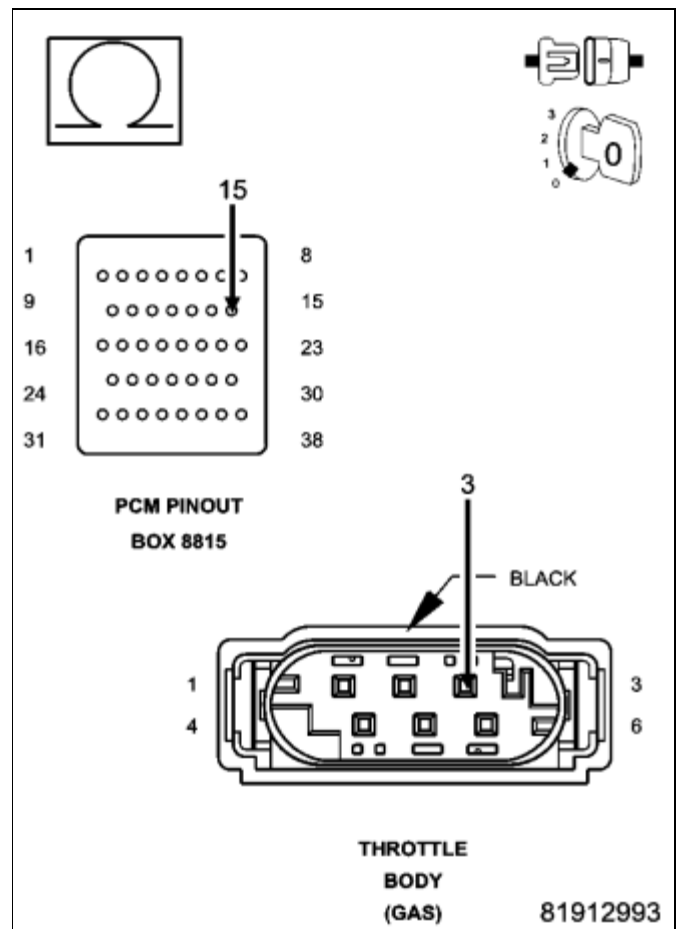
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K922) TP Return circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



13. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Disconnect the MAP Sensor harness connector.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

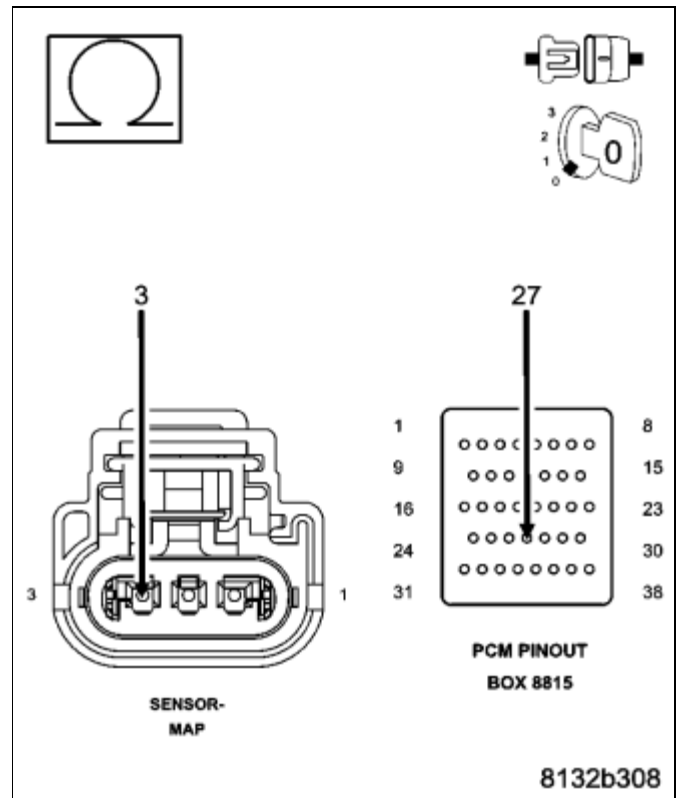
Is the resistance below 5.0 ohms?

Yes

- Go To [14](#)

No

- Repair the excessive resistance in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



14. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

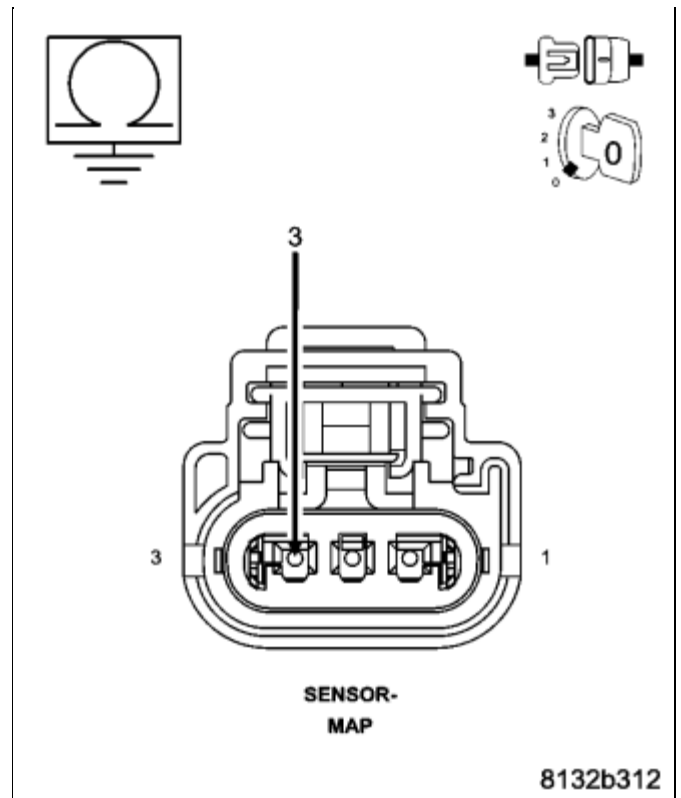
Is the resistance above 100k ohms?

Yes

- Go To [15](#)

No

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



15. MAP SENSOR

Connect the C1 PCM harness connector.
 Ignition on, engine not running.
 With a scan tool, monitor the MAP Sensor voltage.
 Connect a jumper wire between the (K1) MAP Signal circuit
 and the (K900) Sensor ground circuit.
 Cycle the ignition switch from off to on.
 With a scan tool, monitor the MAP Sensor voltage.

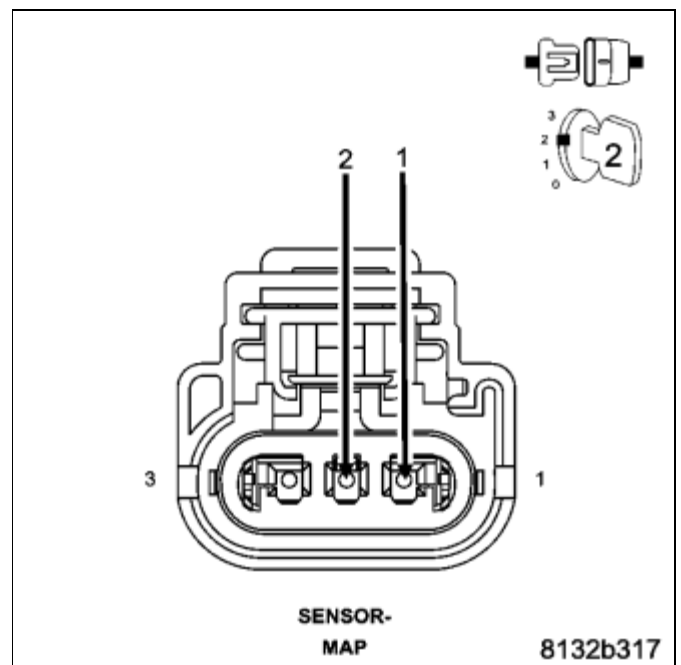
**Does the scan tool display MAP voltage from
 approximately 4.9 volts to below 0.5 volt with the jumper
 wire installed?**

Yes

- Replace the MAP Sensor.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [16](#)
- **NOTE: Remove the jumper wire before continuing.**



16. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.
 Disconnect the C2 PCM harness connector.
 Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

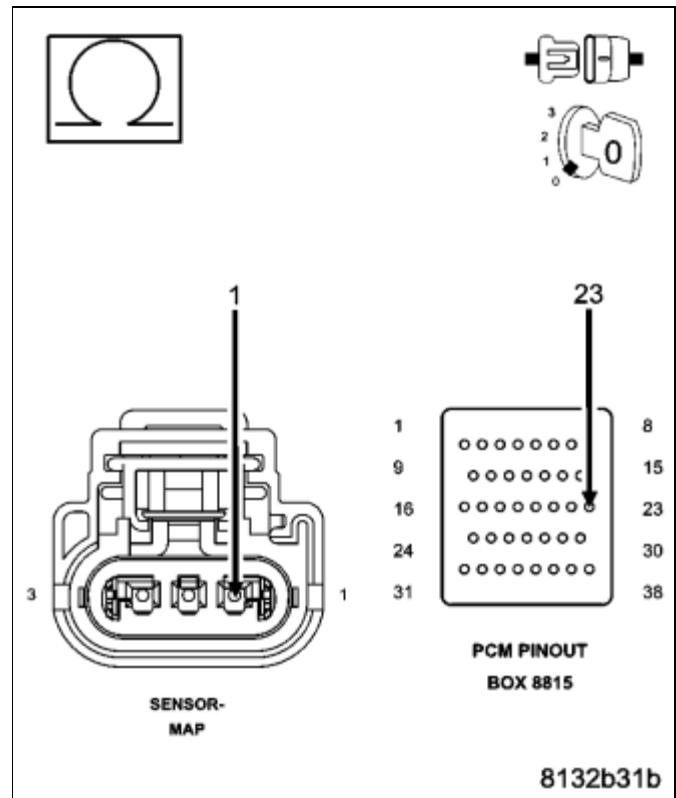
Is the resistance below 5.0 ohms?

Yes

- Go To [17](#)

No

- Repair the excessive resistance in the (K1) MAP Signal circuit
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



17. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

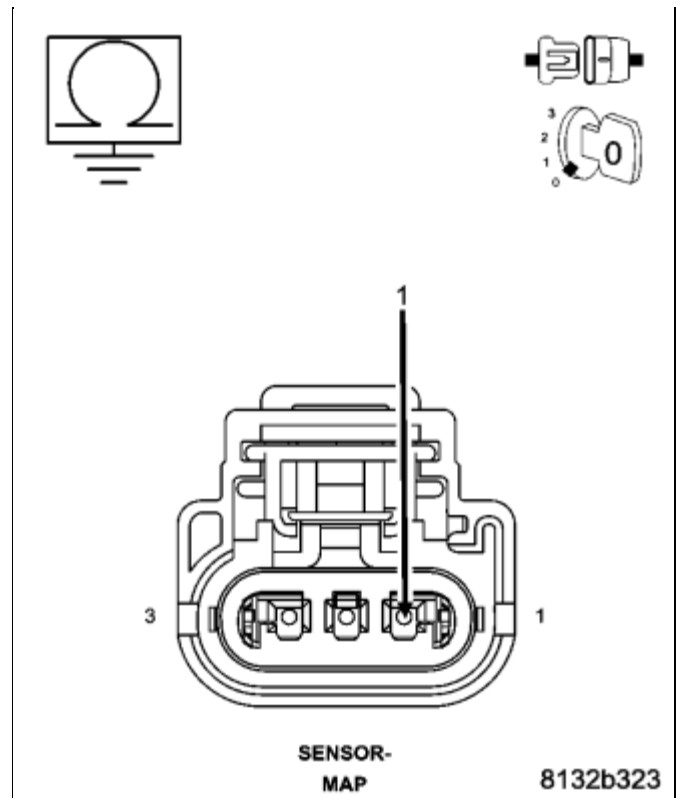
Is the resistance above 100k ohms?

Yes

- Go To [18](#)

No

- Repair the short to ground in the (K1) MAP Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



18. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

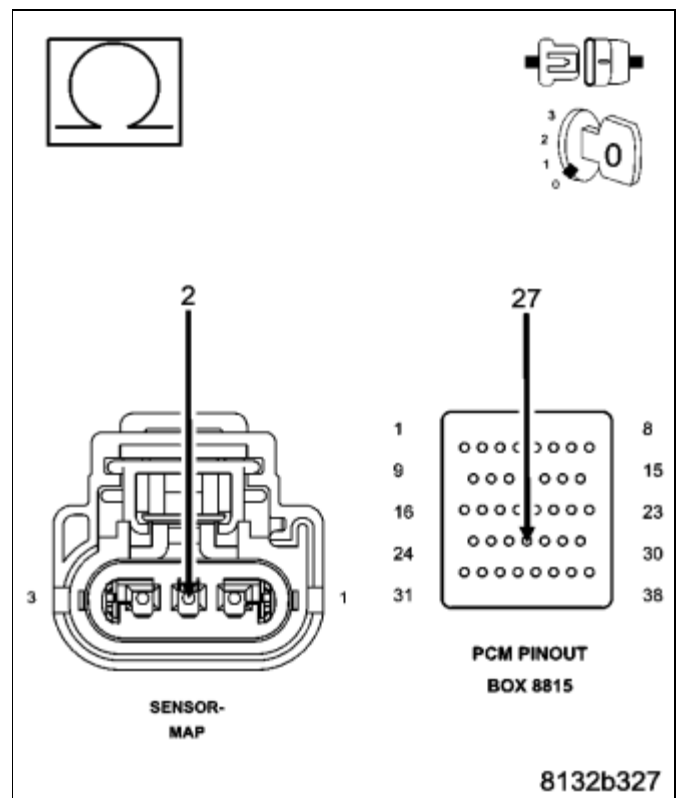
Is the resistance below 5.0 ohms?

Yes

- Go To [19](#)

No

- Repair the excessive resistance in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



19. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor, Throttle Body, and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the MAP Sensor, Throttle Body, and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

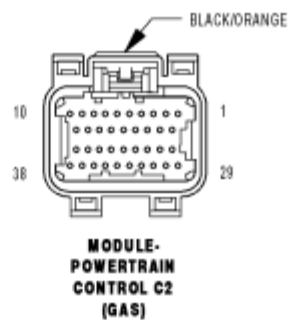
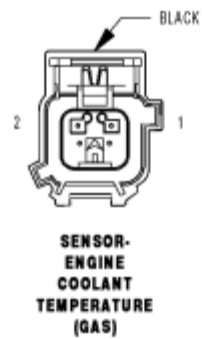
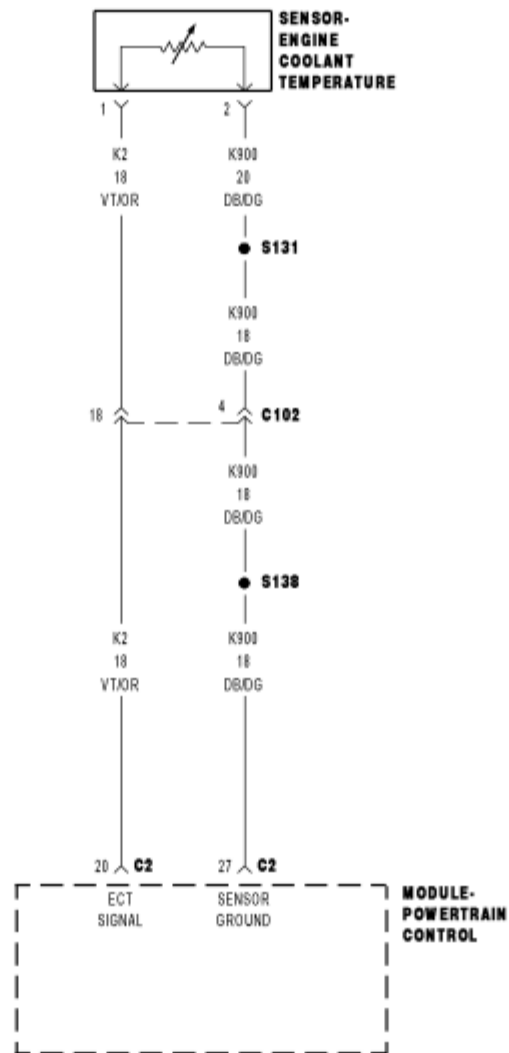
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2181-COOLING SYSTEM PERFORMANCE



010127aa

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on, Engine running, and no ECT DTCs present.

◦ **Set Condition:**

PCM recognizes that the ECT has failed its self coherence test. The coolant temp should only change at a certain rate, if this rate is too slow or too fast this fault will set. Two trip fault. Three good trips to clear MIL. The MIL and ETC light will illuminate.

Possible Causes
LOW COOLANT LEVEL
(K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
THERMOSTAT
ECT SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: If this code sets during extreme ambient temperatures, improper installation of a block heater could be the cause of this DTC.

With a scan tool, select View DTCs.

Diagnose all other ECT and Cooling System codes before continuing.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. LOW COOLANT LEVEL

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

NOTE: Need to make sure that no Cooling System DTCs are set or changes that would make the warm up much slower or much faster: broken water pump can set this, addition of aftermarket auxiliary cooler can set this DTC.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes

- Go To [3](#)

No

- Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. THERMOSTAT

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82° C (180° F) . Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg on the scan tool should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes

- Go To [4](#)

No

- Replace the thermostat.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. ECT SENSOR

Turn the ignition off.

Disconnect the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.

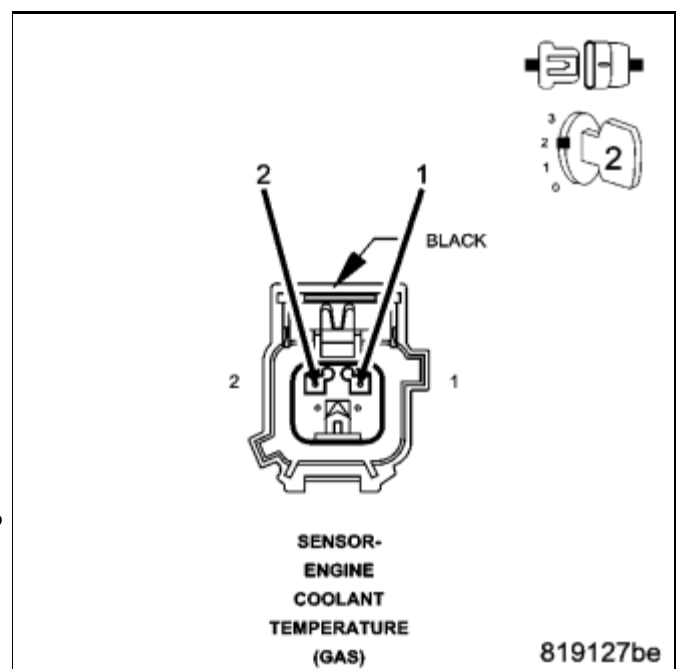
Connect a jumper between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

NOTE: The sensor voltage should be approximately 0.0 volts (plus or minus .1 volt) with the jumper wire in place.

Does the scan tool display the voltage as described above?

Yes

- Verify that there is good pin to terminal contact in the



ECT Sensor and Powertrain Control Module connectors. If OK, replace the ECT Sensor.

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. (K2) ECT SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

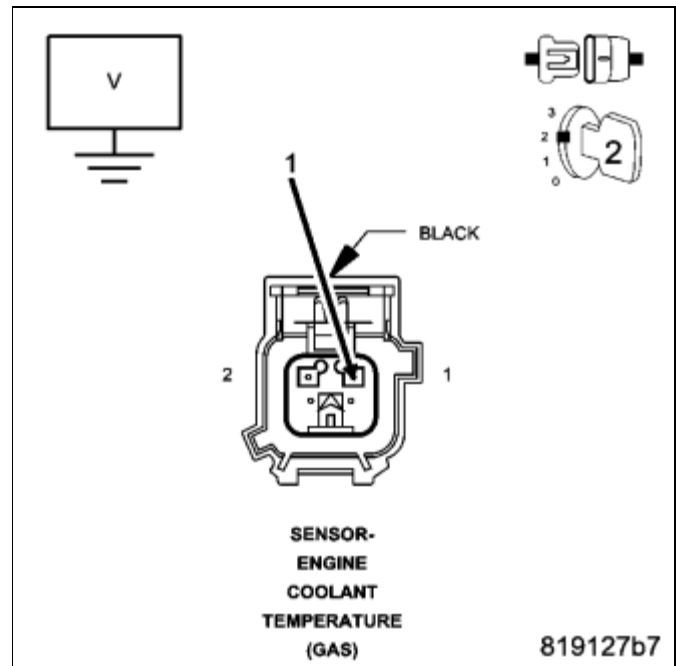
Is there any voltage present?

Yes

- Repair the short to voltage in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

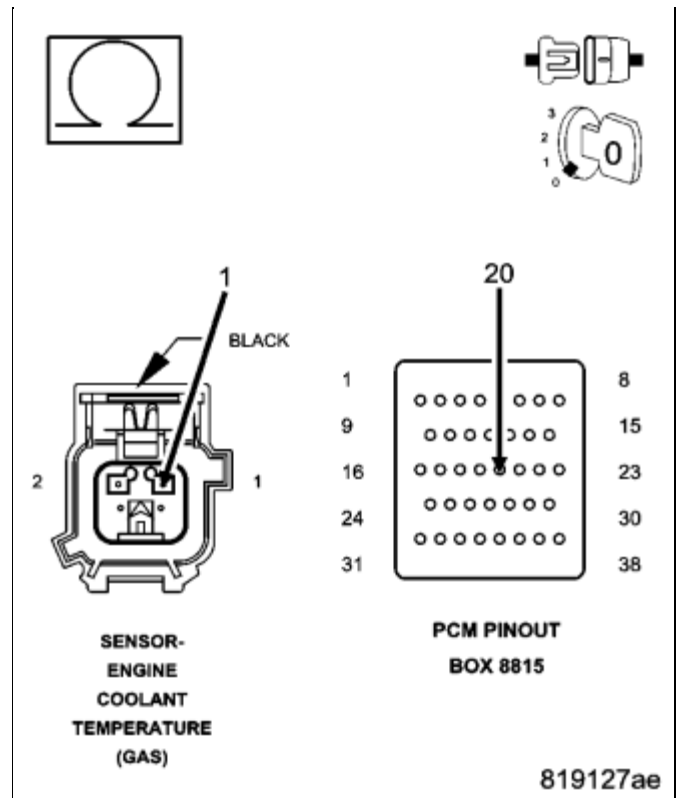
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

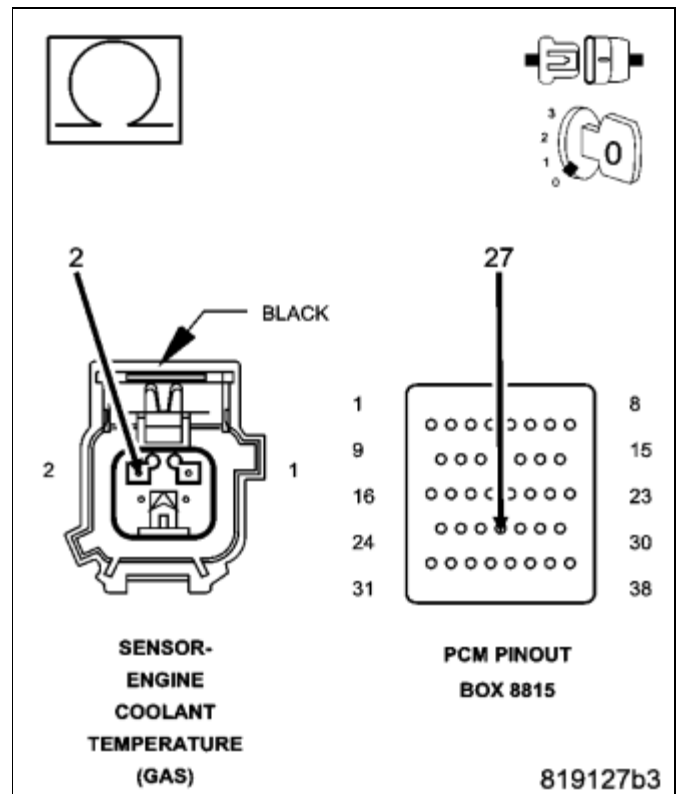
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (K900) Sensor ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



8. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

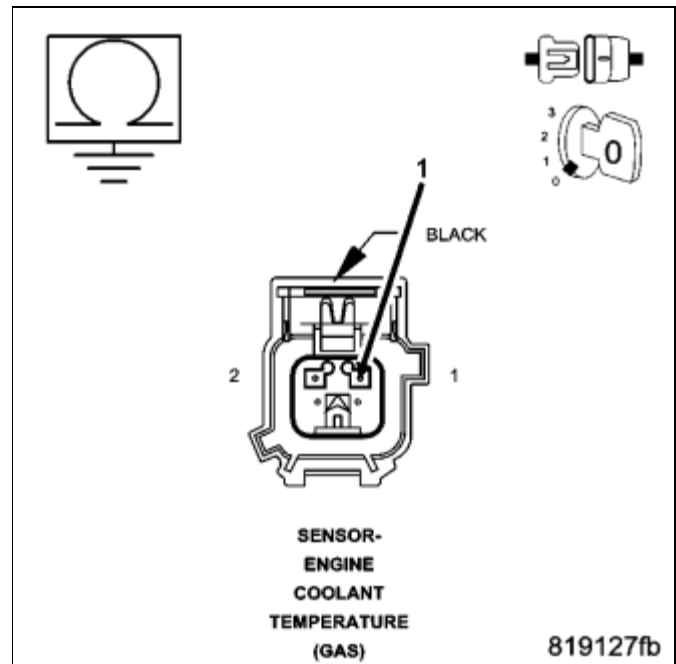
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

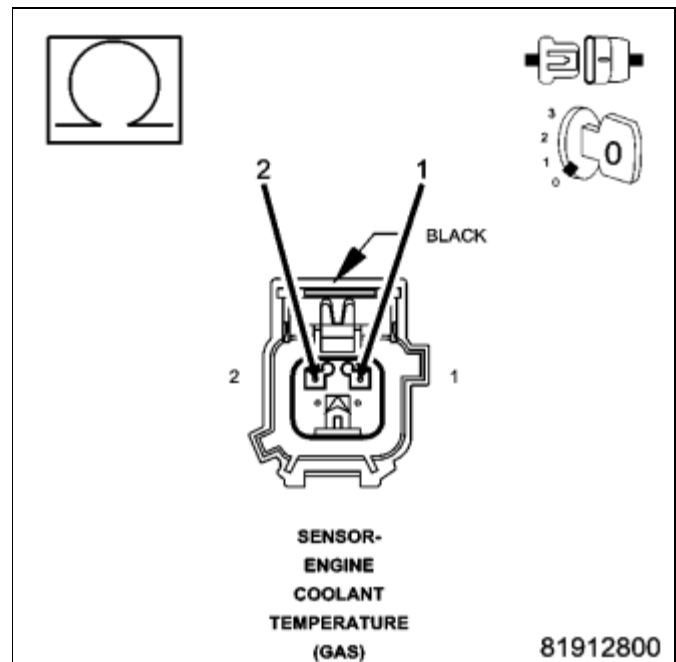
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K900) Sensor ground and the (K2) ECT Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



10. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the ECT Sensor and

the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the ECT Sensor and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

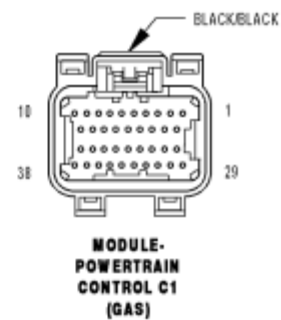
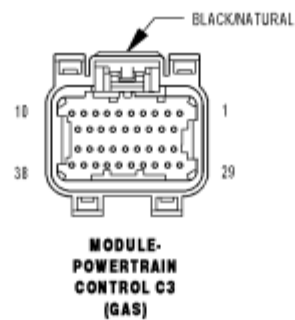
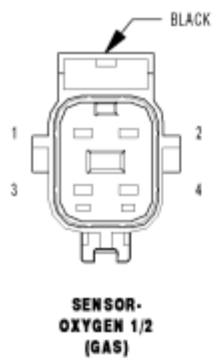
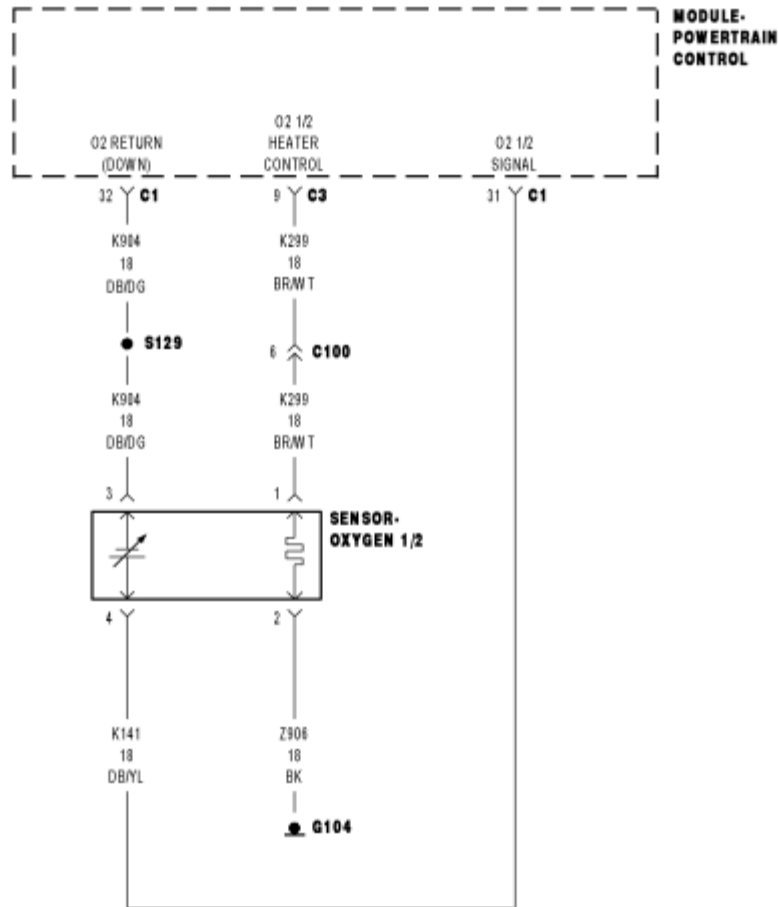
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2271-O2 SENSOR 1/2 SIGNAL STUCK RICH



81811440

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the engine running, vehicle speed above 96 kph (60 mph), throttle open for a minimum of 120 seconds, ECT greater than 70° C (158° F), catalytic converter temperature greater than 600° C (1112° F), and downstream oxygen sensor in a rich state. During a decel fuel shutoff event, the downstream oxygen sensor should switch from rich to lean within a specific time.

- **Set Condition:**

The PCM monitors the downstream O2 sensor. If the PCM does not detect a rich to lean switch within a specific time during a decel fuel shutoff event, the monitor will fail. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
OXYGEN SENSOR WIRING OR CONNECTORS
O2 SENSOR SIGNAL CIRCUIT
O2 SENSOR RETURN CIRCUIT
1/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC IS ACTIVE

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE OXYGEN SENSOR OPERATION

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 1/2 O2 Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

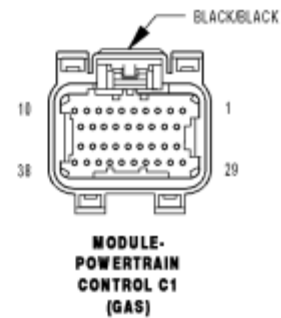
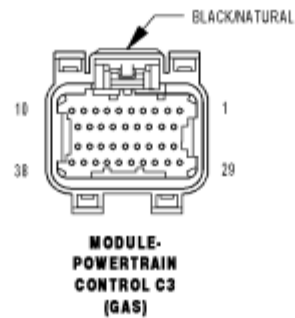
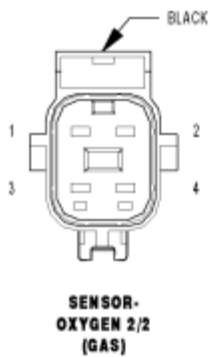
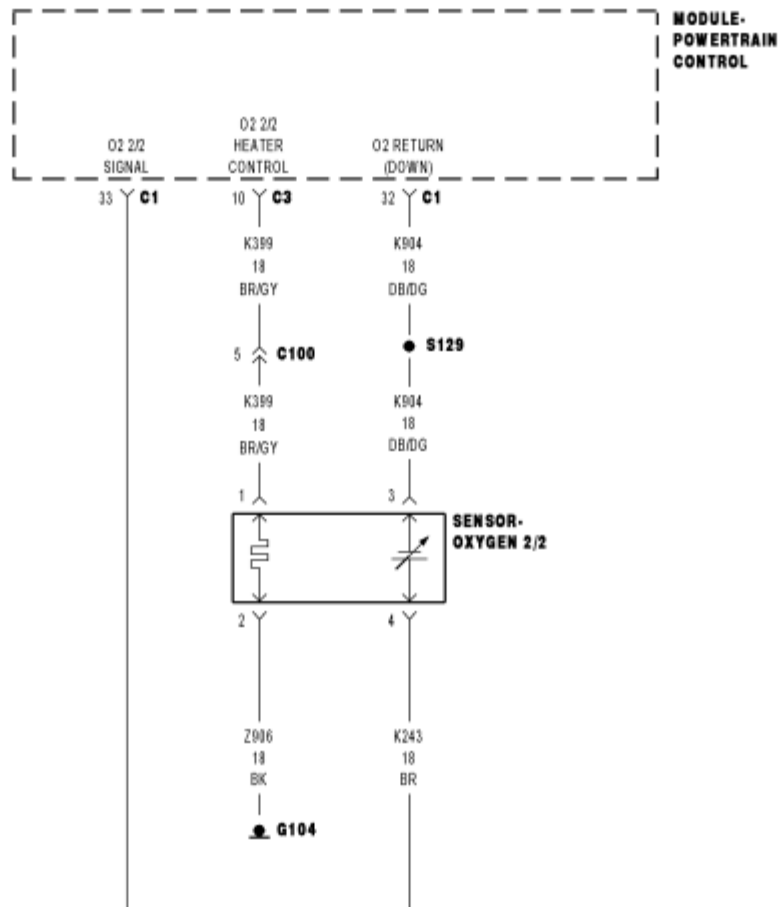
Were any problems found?**Yes**

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2273-O2 SENSOR 2/2 SIGNAL STUCK RICH



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the engine running, vehicle speed above 96 kph (60 mph), throttle open for a minimum of 120 seconds, ECT greater than 70 C (158 F), catalytic converter temperature greater than 600 C (1112 F), and downstream oxygen sensor in a rich state. During a decel fuel shutoff event, the downstream oxygen sensor should switch from rich to lean within a specific time.

- **Set Condition:**

The PCM monitors the downstream O2 sensor. If the PCM does not detect a rich to lean switch within a specific time during a decel fuel shutoff event, the monitor will fail. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
OXYGEN SENSOR WIRING OR CONNECTORS
O2 SENSOR SIGNAL CIRCUIT
O2 SENSOR RETURN CIRCUIT
2/2 O2 SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC IS ACTIVE

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

NOTE: It may be necessary to test drive the vehicle within the DTC monitoring conditions in order for this DTC to set.

With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

2. CHECKING THE OXYGEN SENSOR OPERATION

NOTE: Check for signs of contaminants that may have damaged the O2 Sensor, such as contaminated fuel, unapproved silicone, oil and coolant.

Perform the diagnostic procedure for *CHECKING THE OXYGEN SENSOR OPERATION.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the 2/2 O2 Sensor and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2299-BRAKE PEDAL POSITION/ACCELERATOR PEDAL POSITION INCOMPATIBLE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on. No Break or APPS faults present.

- **Set Condition:**

The PCM recognizes a brake application following the APPS showing a fixed pedal opening. Temporary or permanent. Internally the PCM will reduce throttle opening below driver demand. One trip fault and the code will be set within 5 seconds. ETC light will illuminate, the light will only stay illuminated while DTC is active.

Possible Causes
CUSTOMER PRESSING ACCELERATOR PEDAL, THEN PRESSING BRAKE PEDAL, AND CONTINUES HOLDING THEM DOWN SIMULTANEOUSLY
STOP LAMP SWITCH
APP SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC INFORMATION

NOTE: If a pedal assembly becomes mechanically stuck the voltage output will stay fixed, if this is also Followed by a long application of the brakes this code will set.

NOTE: When this code sets the pedal position in the PCM software will ramp to idle. If the Pedal voltage changes OR the brake pedal is released, the pedal position in the PCM software will ramp up to the pedal position and the ETC light will go out.

With a scan tool, read DTCs and record the related Freeze Frame data.

Diagnose all other Stop Lamp Switch and APP Sensor codes before continuing.

This code can be set by a driver who uses both feet while driving, one for the Accelerator Pedal and the other for the Brake Pedal.

NOTE: The most likely cause of this DTC is caused by the customer Brake Torquing the engine by pressing the Accelerator pedal and the pressing the Brake Pedal.

Ask the driver of the vehicle if these conditions apply to their driving habits.

Are the listed conditions part of the customers driving habits?

Yes

- Advise the customer of what caused the DTC. This is normal operation of a ETC equipped vehicle because of safety issues.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [2](#)

2. STOP LAMP SWITCH OPERATION

With a scan tool, read both Stop Lamp Switch statuses while pressing and releasing the Brake Pedal.

Does the scan tool display the Pressed and Released while pressing and releasing the Pedal?

Yes

- Go To [3](#)

No

- Check the Stop Lamp Switch for proper installation and check the related circuits for opens and shorts using the appropriate wiring diagram. If OK, replace the Stop Lamp Switch assembly.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor both APP Sensor voltage readings.

Slowly press the accelerator pedal from idle until it reaches the end stop near the floor.

APPS No.1 voltage should start at approximately 0.45 of a volt and increase to approximately 4.6 volts with a smooth transition.

APPS No.2 voltage should start at approximately 0.22 of a volt and increase to approximately 2.31 volts with a smooth transition.

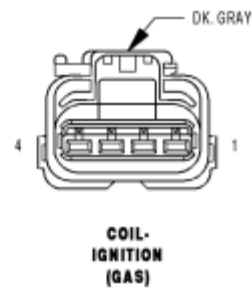
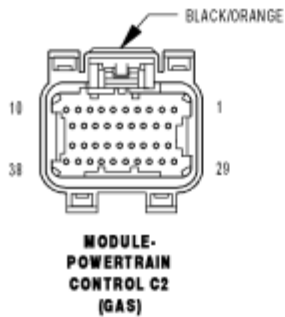
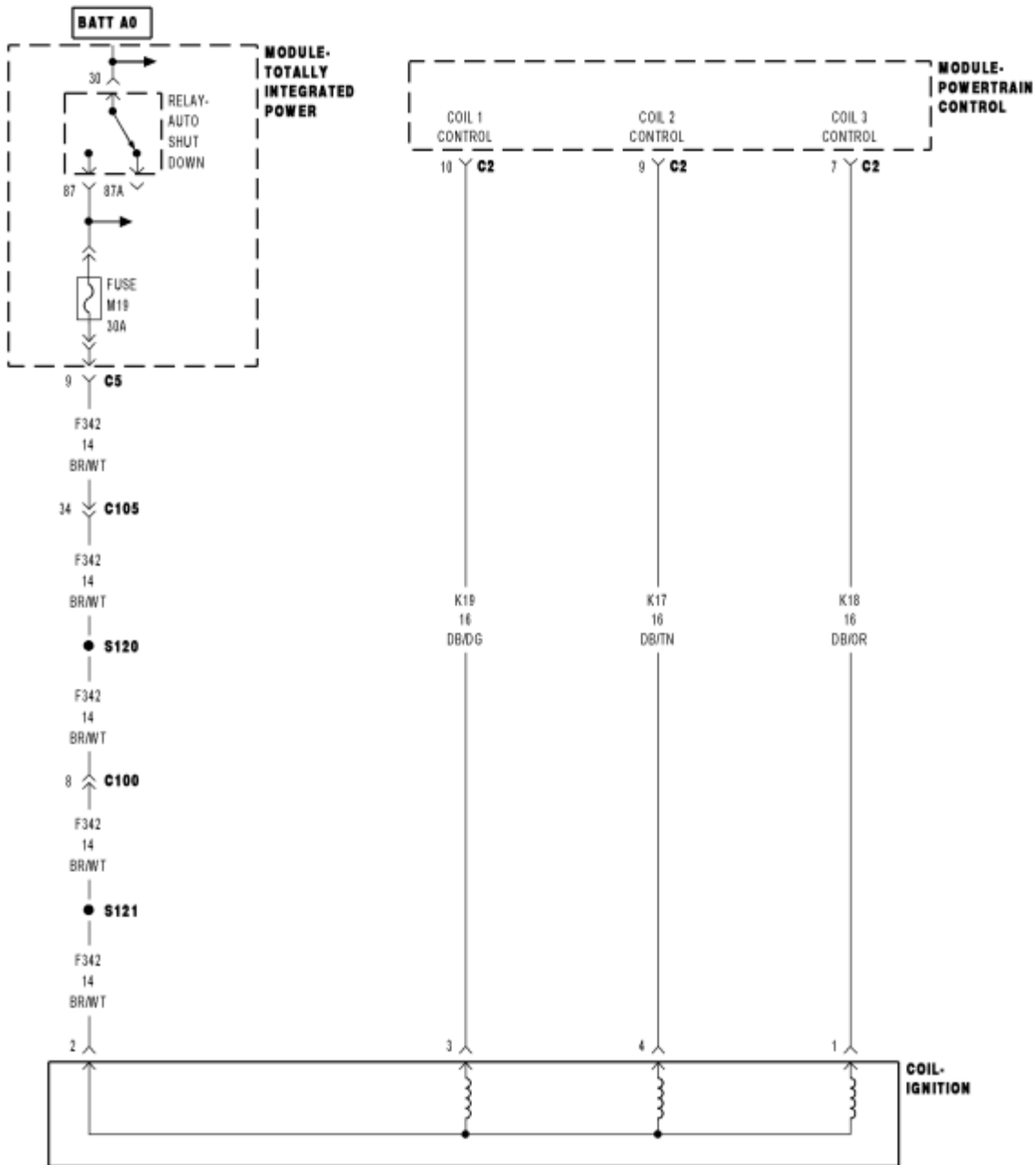
Does the voltage for the appropriate sensor follow the list specification?**Yes**

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

No

- Check the Signal and Return circuits for opens and shorts. If OK, Replace the APP Sensor Assembly per Service Information. After installation is complete, with a scan tool select the ETC RELEARN function to relearn the APPS values.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



81a2589c

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running and battery voltage greater than 10 volts.

◦ **Set Condition:**

If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K19) COIL CONTROL 1 CIRCUIT OPEN
(K19) COIL CONTROL 1 CIRCUIT SHORTED TO GROUND
COIL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any ASD related DTCs before continuing.

Start the engine.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. (F342) ASD OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (F342) ASD Output circuit in the Ignition Coil harness connector.

With a scan tool, actuate the ASD.

NOTE: Make sure the test light is probing the circuit before actuating the Coil or a DTC may set and not allow the actuation.

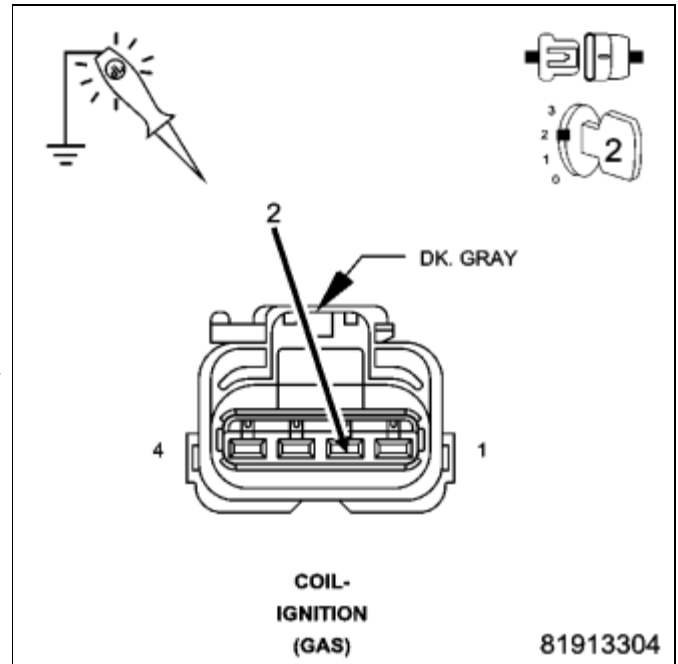
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the open or short to ground in the (F342) ASD Output circuit between the TIPM and Coil harness connector. Refer to the ASD diagnostic procedures for further assistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)
- **NOTE: Stop All Actuations.**



3. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Using a 12-volt test light connected to a 12-volt source, probe the (K19) Coil Control 1 circuit in the Coil harness connector.

Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.

- Replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

ON constantly.

- Go To [4](#)

OFF constantly.

- Go To [5](#)

4. (K19) COIL CONTROL 1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance between ground and the (K19) Coil Control 1 circuit in the Coil harness connector.

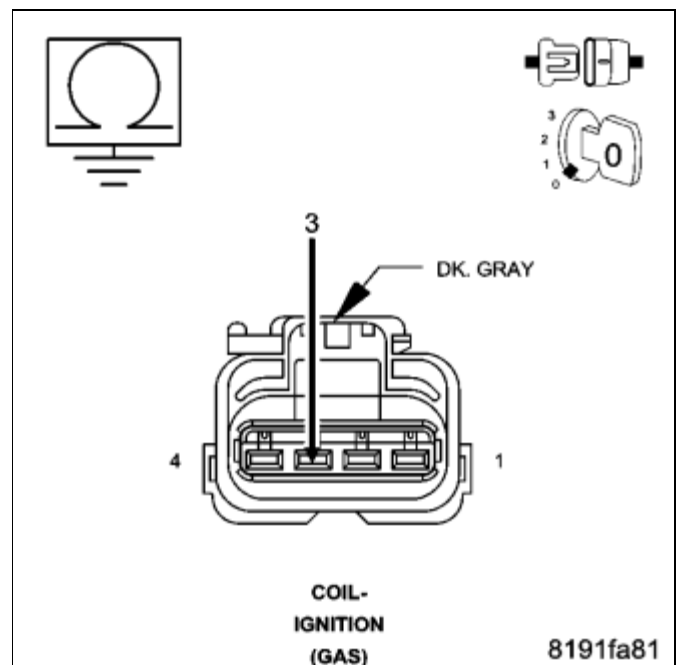
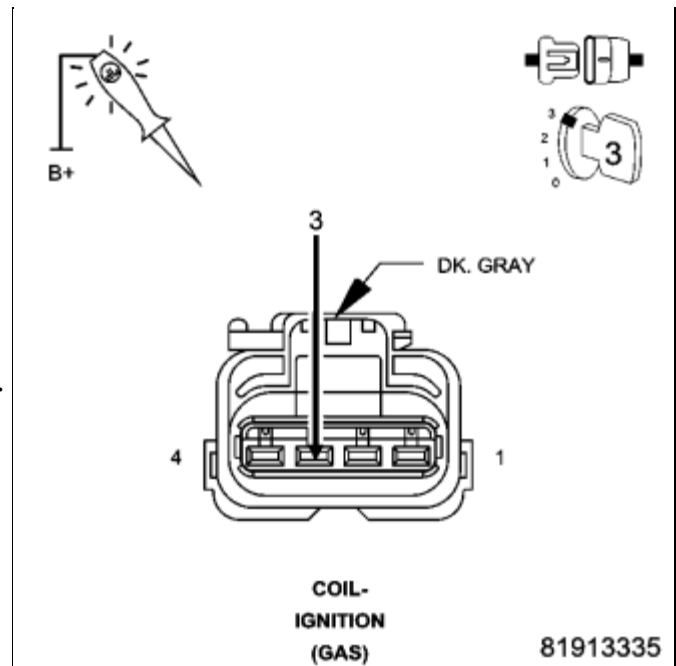
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K19) Coil Control 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



5. (K19) COIL CONTROL 1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K19) Coil Control 1 circuit from the Coil harness connector to the appropriate terminal of special tool #8815.

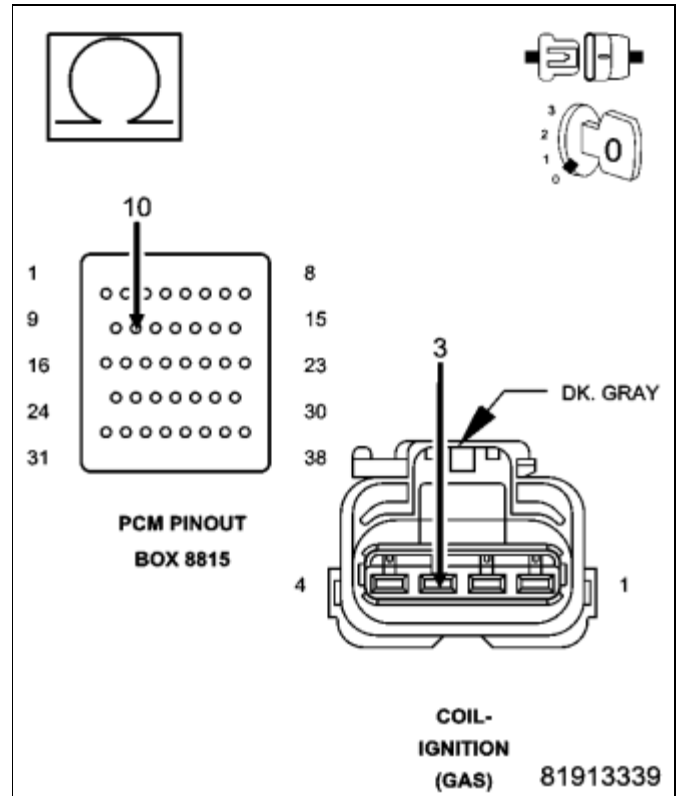
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K19) Coil Control 1 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Ignition Coil and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Ignition Coil and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

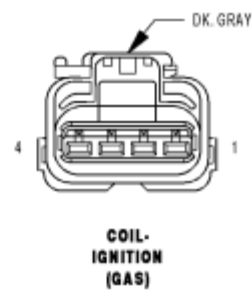
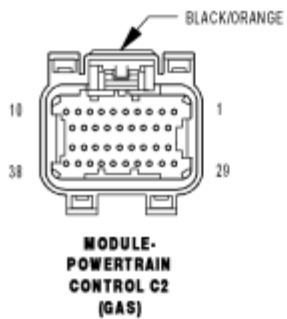
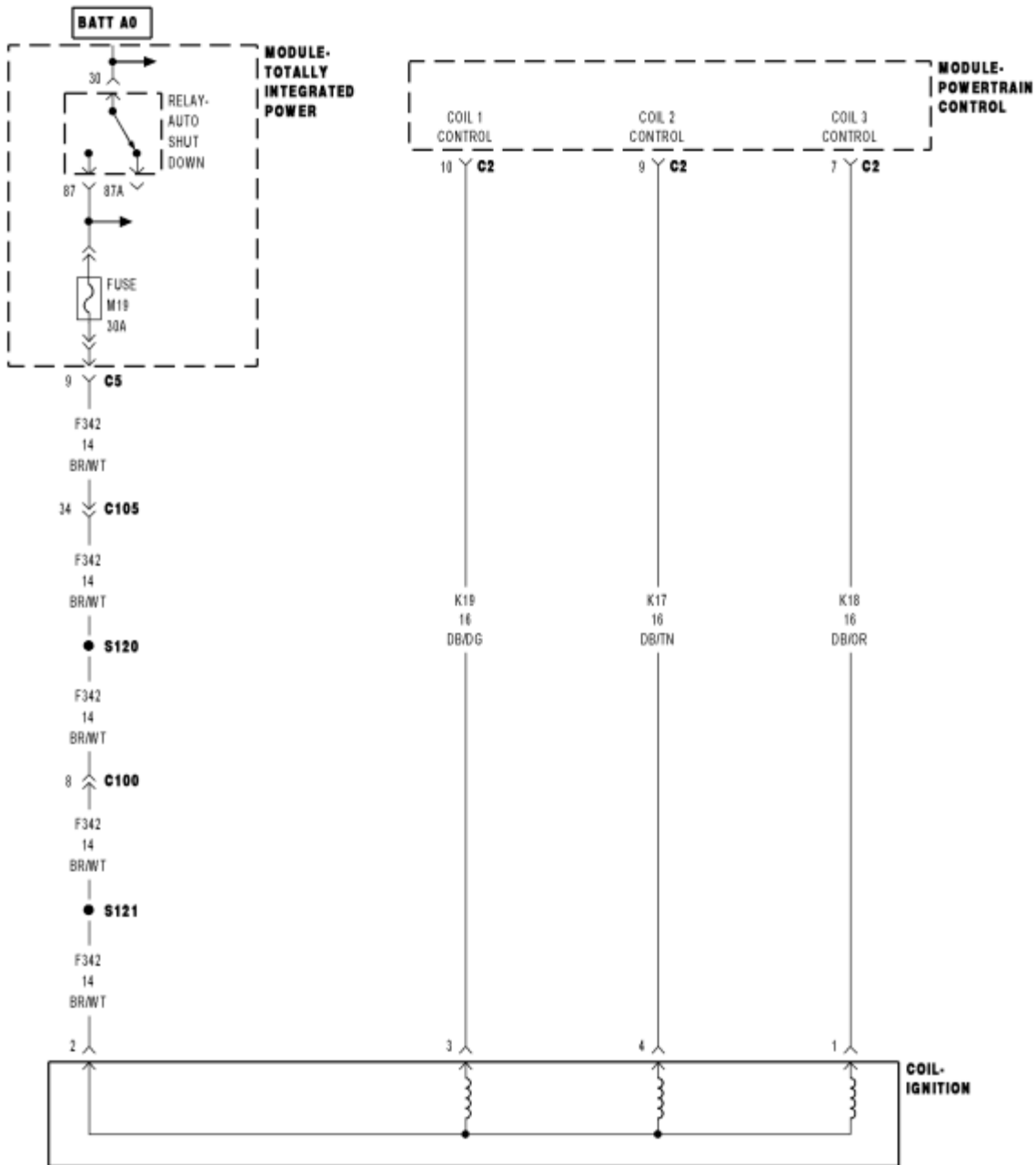
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

PROCEDURE.)

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



81a2589c

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine running and battery voltage greater than 10 volts.

◦ **Set Condition:**

If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K17) COIL CONTROL 2 CIRCUIT OPEN
(K17) COIL CONTROL 2 CIRCUIT SHORTED TO GROUND
COIL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any ASD related DTCs before continuing.

Start the engine.

With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS

AND TESTING.)

2. (F342) ASD OUTPUT CIRCUIT

Turn the ignition off.
 Disconnect the Ignition Coil harness connector.
 Ignition on, engine not running.
 Using a 12-volt test light connected to ground, probe the (F342) ASD Output circuit in the Ignition Coil harness connector.

NOTE: Make sure the test light is probing the circuit before actuating the Coil or a DTC may set and not allow the actuation.

With a scan tool, actuate the ASD.

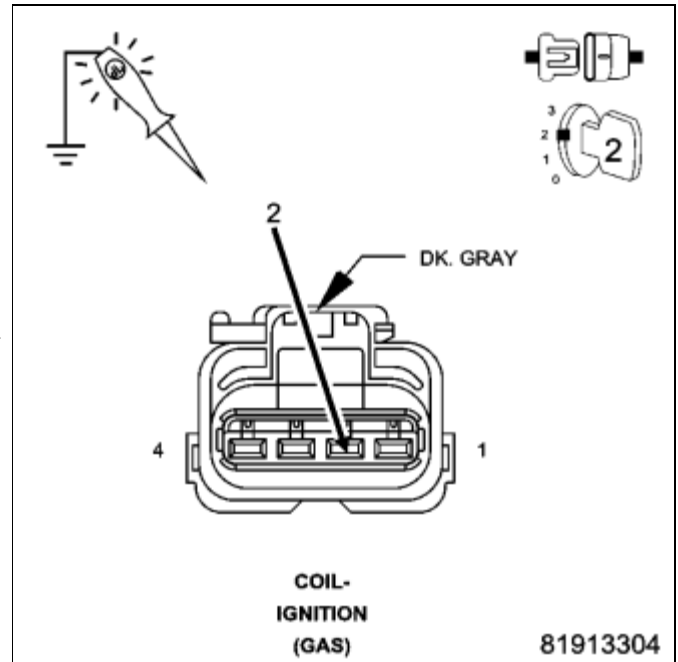
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the open or short to ground in the (F342) ASD Relay Output circuit between the TIPM and Coil harness connector. Refer to the ASD diagnostic procedures for further assistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)
- **NOTE: Stop All Actuations.**



3. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Using a 12-volt test light connected to a 12-volt source, probe the (K17) Coil Control 2 circuit.
 Crank the engine for 5 seconds while observing the test light.

What is the state of the test light during the actuation?

Brightly blinking.

- Replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

ON constantly.

- Go To [4](#)

OFF constantly.

- Go To [5](#)

4. (K17) COIL CONTROL 2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K17) Coil Control 2 circuit in the Coil harness connector.

Is the resistance below 100 ohms?

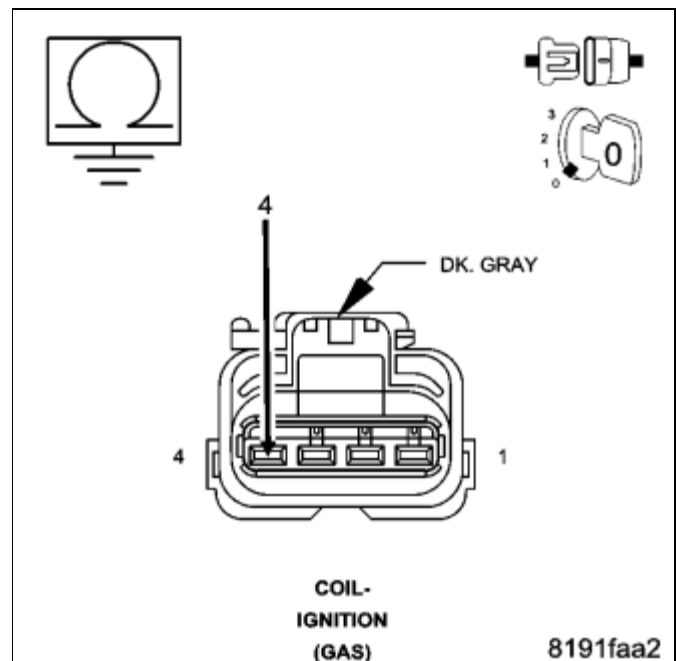
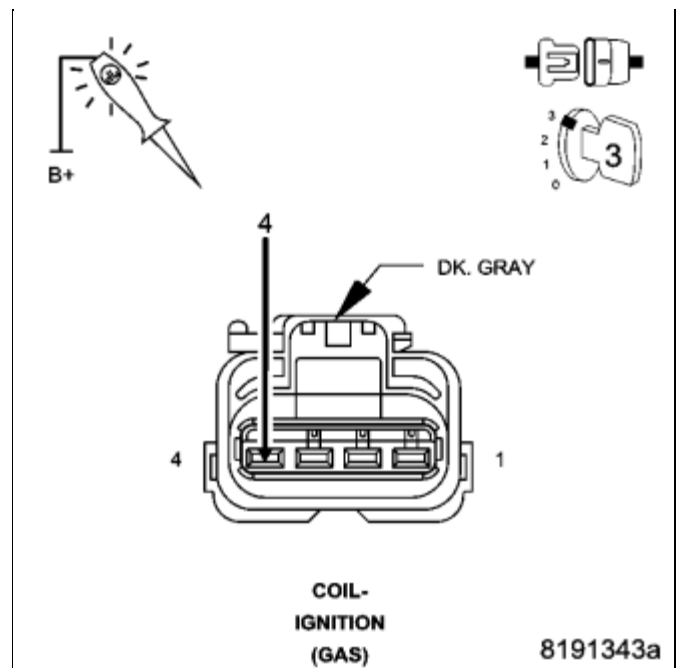
Yes

- Repair the short to ground in the (K17) Coil Control 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)

5. (K17) COIL CONTROL 2 CIRCUIT OPEN



Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K17) Coil Control 2 circuit from the Coil harness connector to the appropriate terminal of special tool #8815.

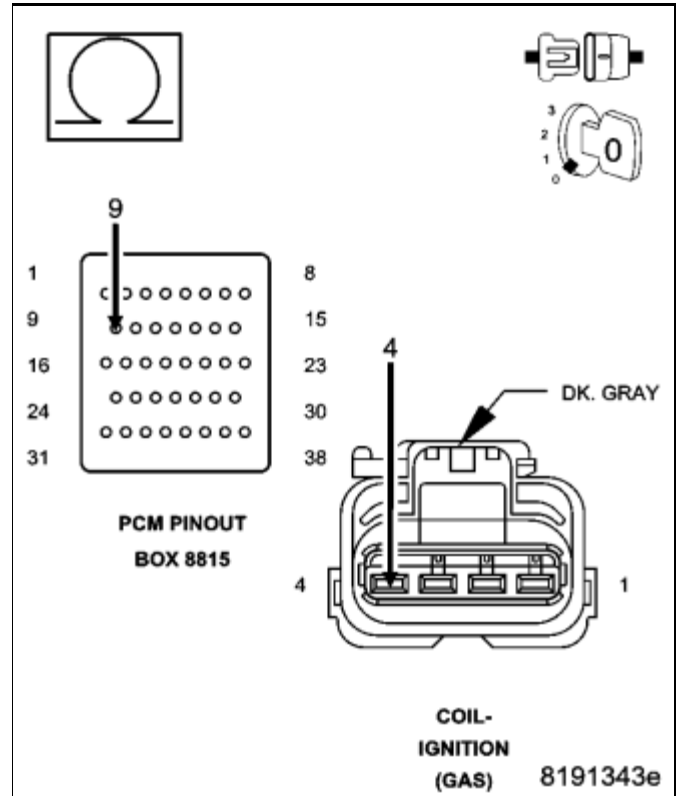
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K17) Coil Control 2 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Ignition Coil and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Ignition Coil and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

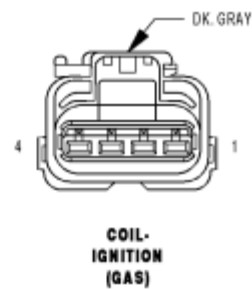
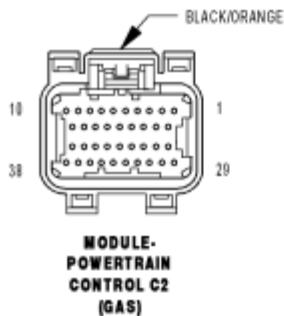
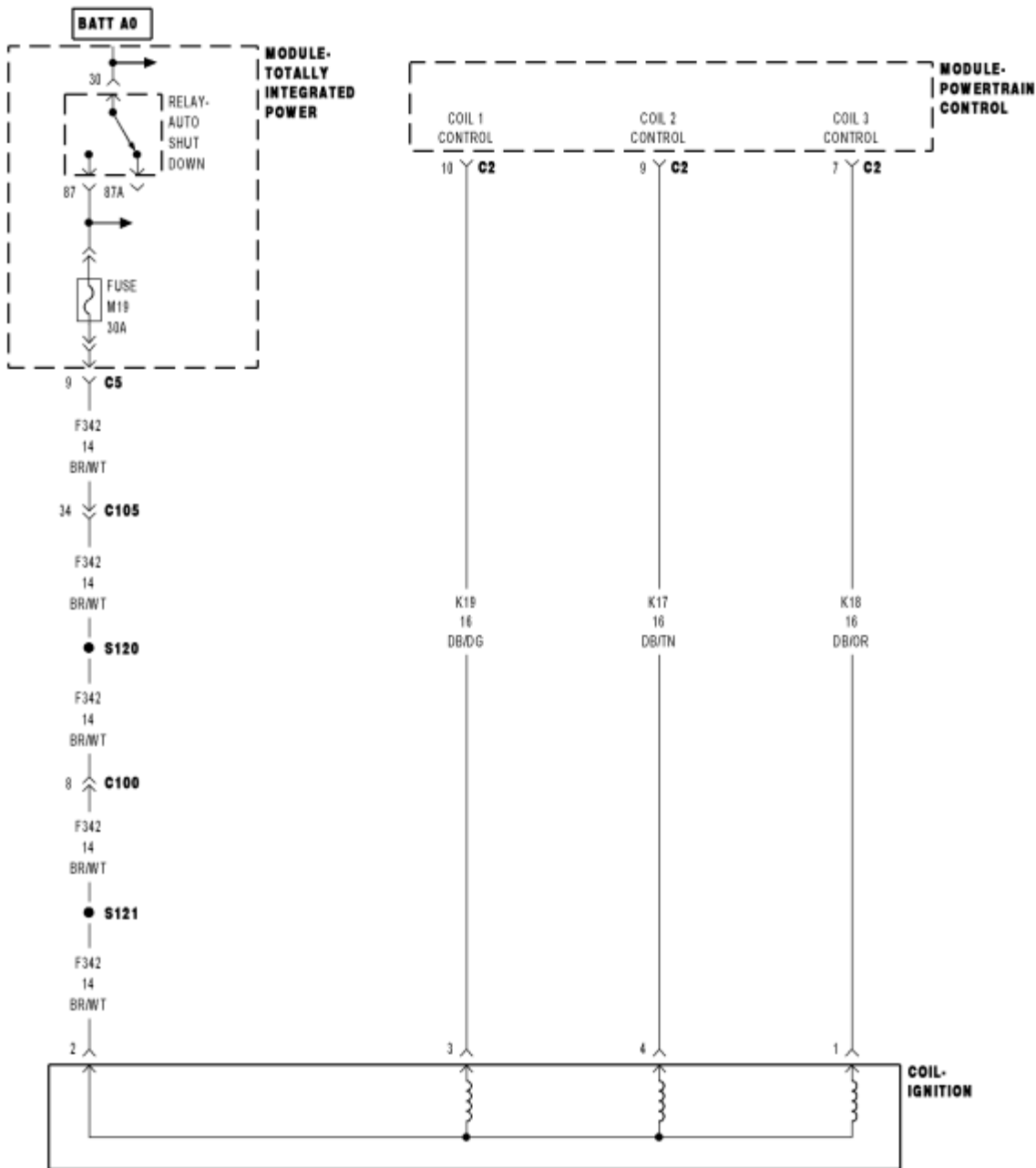
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



01-03-0000

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Engine running and battery voltage greater than 10 volts.

- **Set Condition:**

If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F342) ASD OUTPUT CIRCUIT
(K18) COIL CONTROL 3 CIRCUIT OPEN
(K18) COIL CONTROL 3 CIRCUIT SHORTED TO GROUND
COIL
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any ASD related DTCs before continuing.

Start the engine.
With a scan tool, select View DTCs.

NOTE: It may be necessary to drive the vehicle to meet the conditions to set this DTC, try to repeat the conditions in which the fault originally set by reviewing the Freeze Frame data.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (F342) ASD OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (F342) ASD Output circuit in the Ignition Coil harness connector.

With a scan tool, actuate the ASD.

NOTE: Make sure the test light is probing the circuit before actuating the Coil or a DTC may set and not allow the actuation.

Does the test light illuminate brightly?

Yes

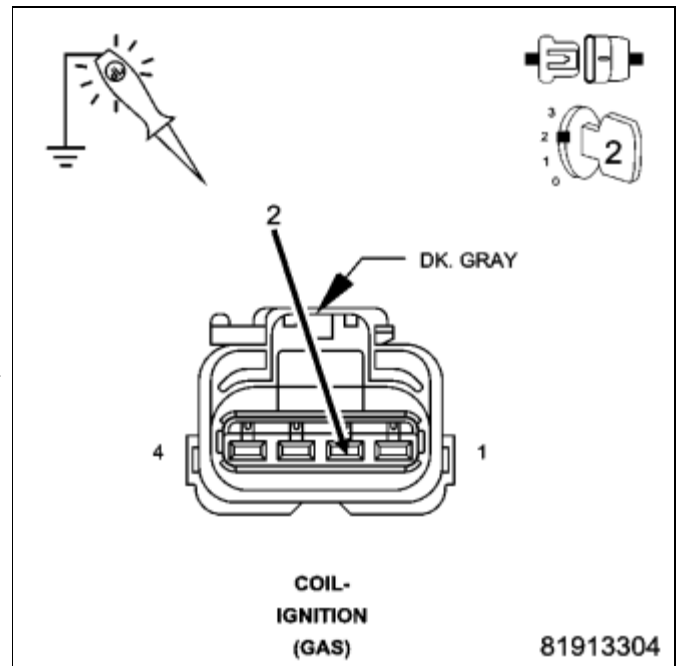
- Go To [3](#)

No

- Repair the open or short to ground in the (F342) ASD Output circuit between the TIPM and Coil harness connector. Refer to the ASD diagnostic procedures for further assistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)
- **NOTE: Stop All Actuations.**

3. IGNITION COIL

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal



injury or death.

Using a 12-volt test light connected to a 12-volt source, probe the (K18) Coil Control 3 circuit in the Ignition Coil harness connector.
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light during the actuation?

Brightly blinking.

- Replace the Ignition Coil.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

ON constantly.

- Go To [4](#)

OFF constantly.

- Go To [5](#)

4. (K18) COIL CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the C2 PCM harness connector.
Measure the resistance between ground and the (K18) Coil Control 3 circuit in the Coil harness connector.

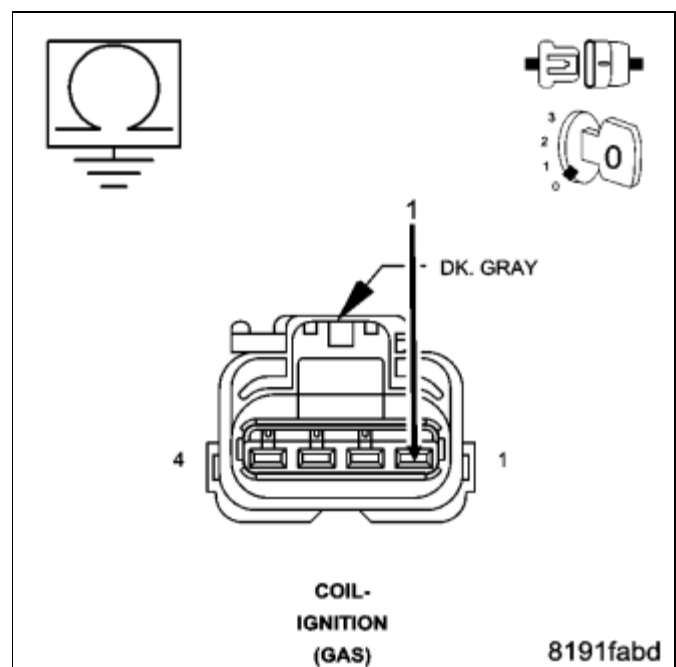
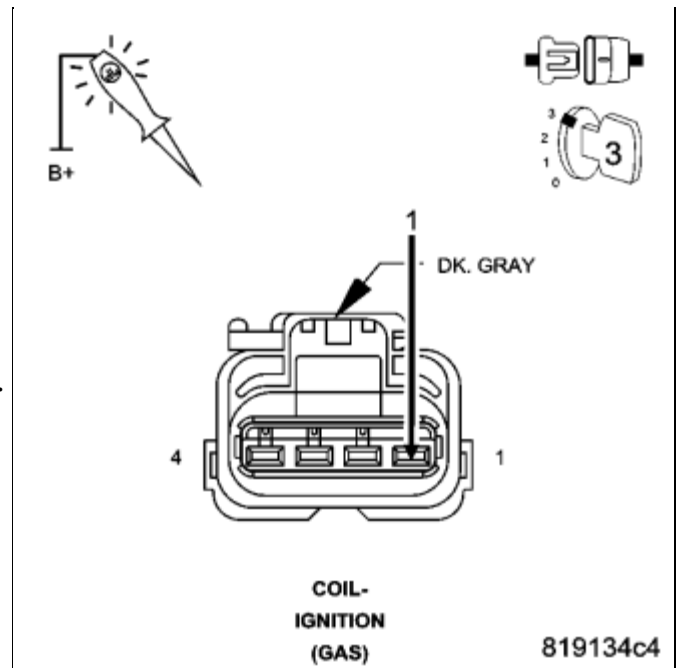
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K18) Coil Control 3 circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



5. (K18) COIL CONTROL 3 CIRCUIT OPEN

Turn the ignition off.
Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K18) Coil Control 3 circuit from the Coil harness connector to the appropriate terminal of special tool #8815.

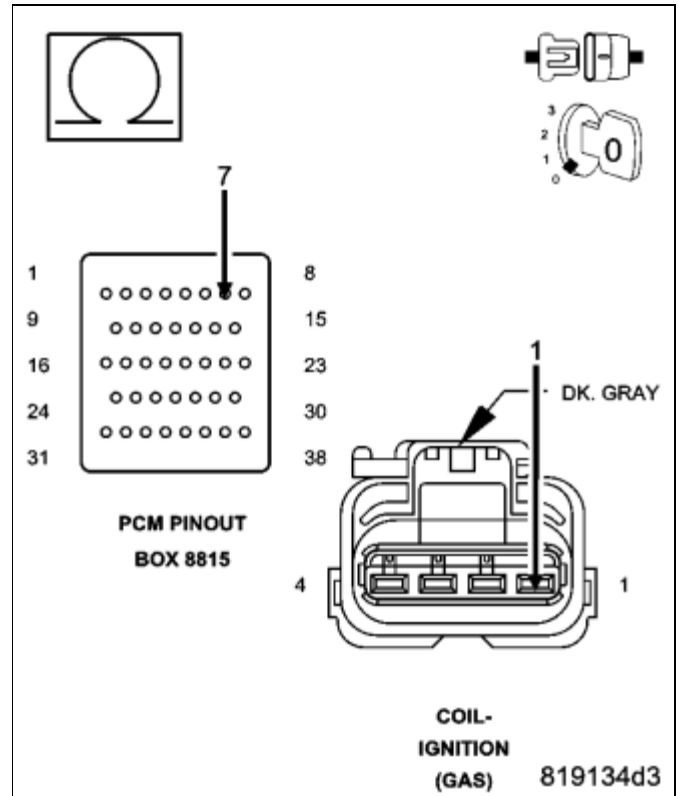
Is the resistance below 5.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (K18) Coil Control 3 circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Ignition Coil and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Ignition Coil and the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

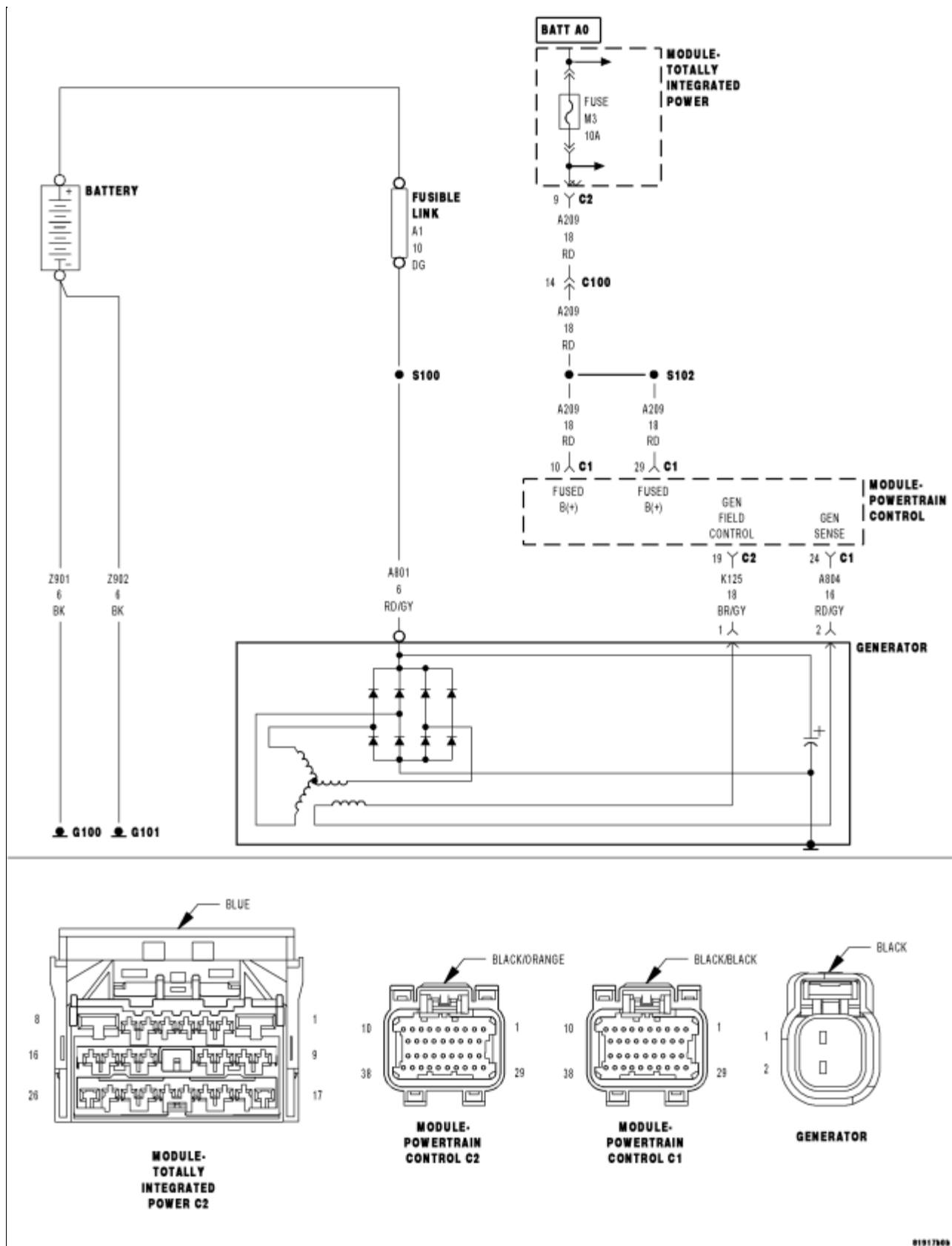
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

PROCEDURE.)

P2503-CHARGING SYSTEM OUTPUT LOW



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

The engine running. The engine RPM is high enough to assure sufficient generator current output to satisfy the electrical loads.

◦ **Set Condition:**

The battery sensed voltage is less than the target charging voltage, during engine operation, for a calibrated amount of time. One Trip Fault. Generator light will illuminate.

Possible Causes
LOOSE ACCESSORY DRIVE BELT
EXCESSIVE RESISTANCE IN THE (A801) BATTERY POSITIVE CIRCUIT
GENERATOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

NOTE: The battery must be fully charged.

NOTE: The Generator belt tension and condition must be checked before continuing.

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data.

With a scan tool, erase DTCs.

Start the engine.

Allow the idle to stabilize.

Ignition on, engine not running.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. FUSED B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Measure the voltage between the Generator B+ Output Terminal and the Battery+ Post.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes

- Repair the excessive resistance in the battery positive circuit between the Generator and Battery.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

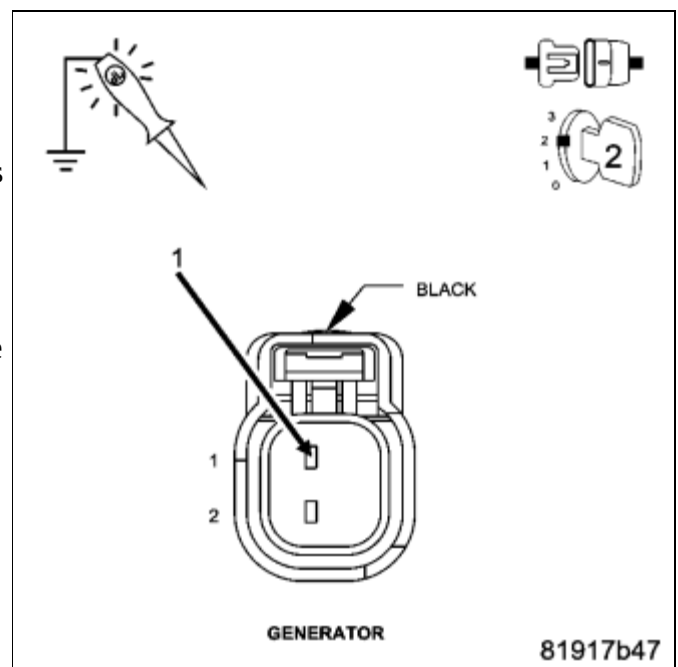
Using a 12-volt test light connected to ground, probe (K125) Generator Field Control circuit in the Generator Field harness connector.

Ignition on, engine not running.

With a scan tool, actuate the Generator Field Driver.

NOTE: The DTC needs to be cleared before actuating the Solenoid, if the DTC is not cleared, the Solenoid may not be allowed to actuate.

NOTE: The test light should be illuminated and bright proportional to the maximum duty cycle allowed by the scan tool. For example, if the scan tool allows 100% actuation, the brightness should be as bright as a direct



connection to the battery. If the scan tool allows a maximum 25% actuation, the brightness should be 25% as bright as a direct connection to the battery.

Does the test light illuminate accordingly during the actuation?

Yes

- Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors. Replace the Generator if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [4](#)

4. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

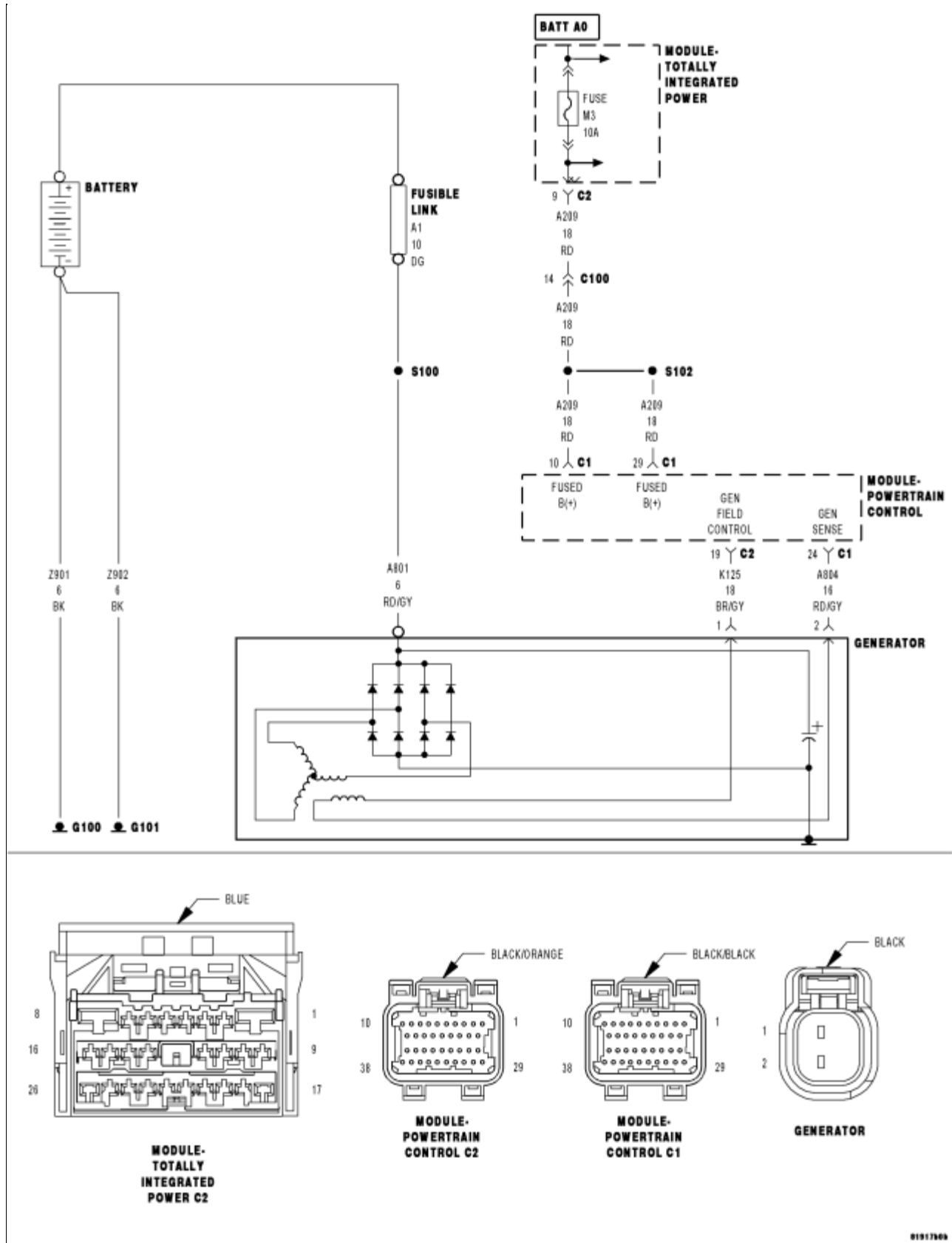
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2504-CHARGING SYSTEM OUTPUT HIGH



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

The engine running. The engine speed greater than 1157 RPM.

◦ **Set Condition:**

The alternator B+ voltage sense circuit voltage reading exceeds the direct Battery B+ sense circuit. The Generator output terminal is not connected to the Battery B+ post. One trip fault.

Possible Causes
EXCESSIVE RESISTANCE IN THE (A209) BATTERY FEED CIRCUIT
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.

NOTE: The battery must be fully charged.

NOTE: The Generator belt tension and condition must be checked before continuing.

Ignition on, engine not running.

With a scan tool, select View DTCs and record the related Freeze Frame data.

With the scan tool erase DTCs.

Start the engine.

Allow the idle to stabilize.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. (A801) BATTERY POSITIVE CIRCUIT VISUAL INSPECTION

Turn the ignition off.

Inspect the (A801) Battery Positive circuit at Generator Output post for corrosion and looseness.

Inspect the Battery + and – cables for corrosion and looseness.

Inspect the (A0) Battery Positive circuit at the C8 TIPM harness connector for corrosion and looseness.

Were any problems found?

Yes

- Repair and replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. EXCESSIVE RESISTANCE IN THE (A209) BATTERY FEED CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 and #8815-1 to perform diagnosis.

Disconnect the C1 PCM harness connector.

Perform a voltage drop test on the (A209) Battery Feed circuit from the appropriate terminals of special tool #8815-1 to the C2 TIPM harness.

Using a voltmeter probe the appropriate terminal of special tool #8815-1 with the Negative lead of the voltmeter and back probe the (A209) Battery Feed circuit at the C2 TIPM with the Positive lead of the voltmeter.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine

Monitor the voltmeter.

Is the voltage above 0.4 of a volt?

Yes

- Repair the excessive resistance in the (A209) Battery Positive circuit between the Generator and TIPM.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Generator and Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

P2610-PCM INTERNAL SHUTDOWN TIMER RATIONALITY TOO FAST

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The PCM compares actual shutdown time to a calculated shutdown time value. The calculated shut down time value is based on the amount of shutdown time necessary for the ECT to drop a specific amount after a completely warmed up engine is shut down. If the difference between actual shutdown time and the calculated shut down time is greater than a maximum value, a one trip failure will set. The shutdown time is measured again after 1 hour of ignition off time following the next engine warm up cycle. The PCM compares the shutdown time to a calculated value. If the difference is greater than a maximum value, the MIL is illuminated and a DTC will set.

◦ When Monitored:

With the engine running after a cycle when a complete engine warm up was achieved, the difference between engine coolant temperature and ambient air temperature greater than 10° C (50° F), after a minimum temperature drop of 10° C (50° F) during ignition off, and battery voltage greater than 10 volts.

◦ Set Condition:

The PCM detects that the engine coolant temperature drops a specified amount during the measured engine off time. Two trip fault. Three good trips to turn off the MIL.

Possible Causes

POWERTRAIN CONTROL MODULE (PCM) SOFTWARE UPDATE
EXCESSIVE RESISTANCE IN THE PCM POWER OR GROUND CIRCUITS
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose and repair any other DTCs set in the PCM before proceeding with this test.

Turn the ignition on.

With the scan tool, Clear DTCs in the Powertrain Control Module (PCM).

Start the engine and allow it to reach operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. PCM IGNITION CIRCUITS

Turn the ignition off.

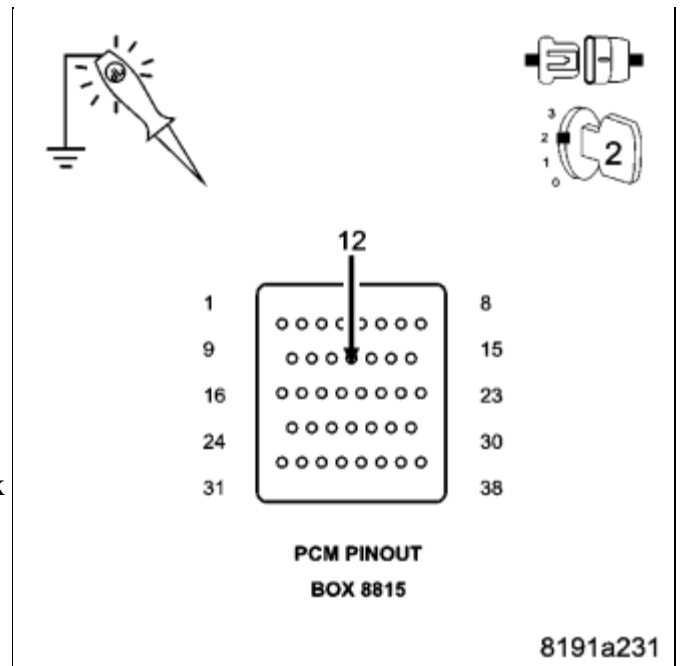
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground probe the (F1) Fused Ignition Switch circuit.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the open or excessive resistance in the (F1) Fused Ignition Switch circuit. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

3. POWERTRAIN CONTROL MODULE (PCM)

Verify that the PCM is operating at the latest software version available.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

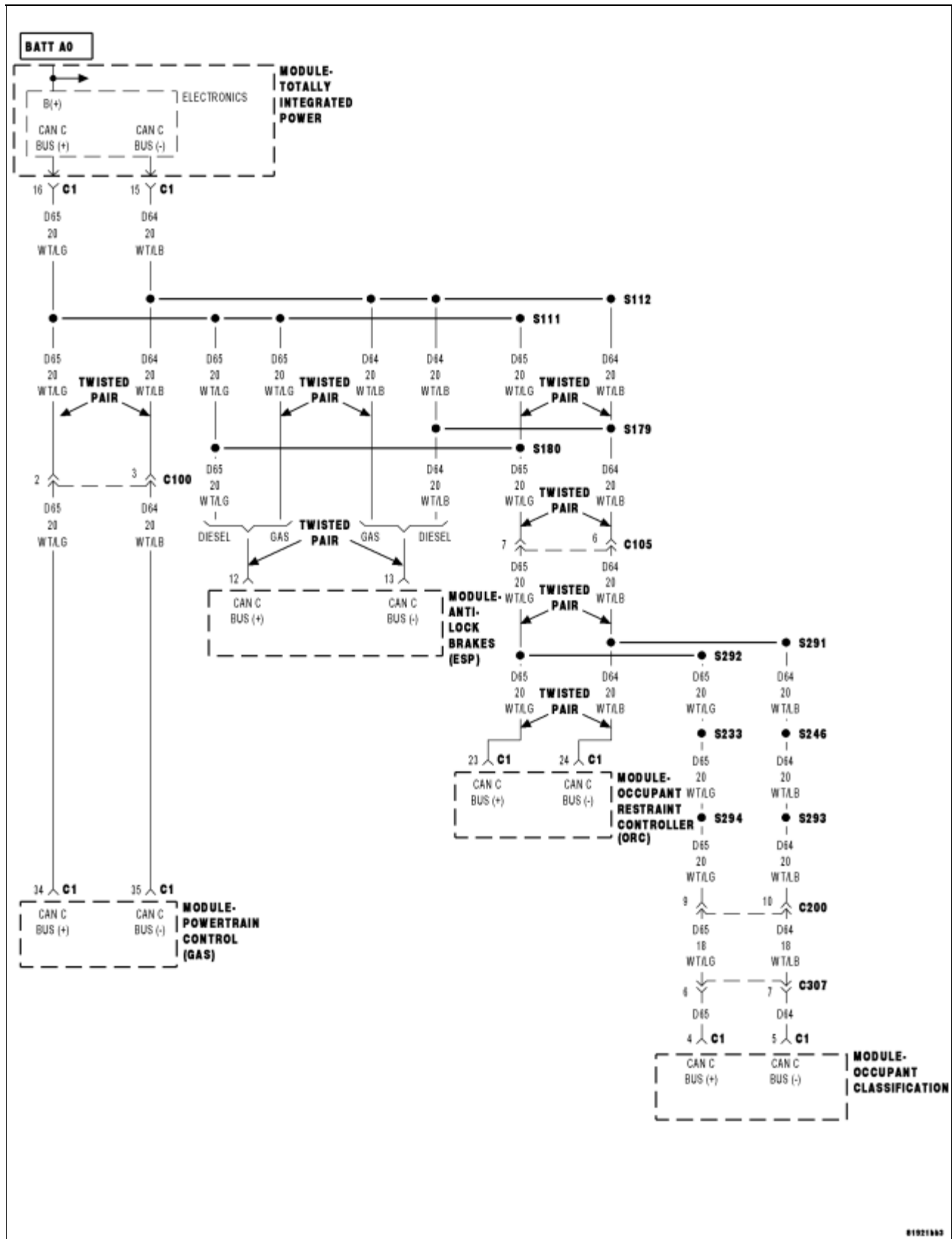
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U0001-CAN C BUS



For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM loses communication over the CAN C Bus circuit. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read TIPM DTCs.

Is the DTC Active at this time?

Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0101-LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM doesn't receive a Bus Message from the Transmission Control Module for 7 consecutive seconds. The circuit is continuously monitored. Two Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, View PCM DTCs.

Is the DTC Active at this time?

Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 10 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM doesn't receive an ABS message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
ABS MODULE
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View PCM DTCs.

Is the DTC Active at this time?

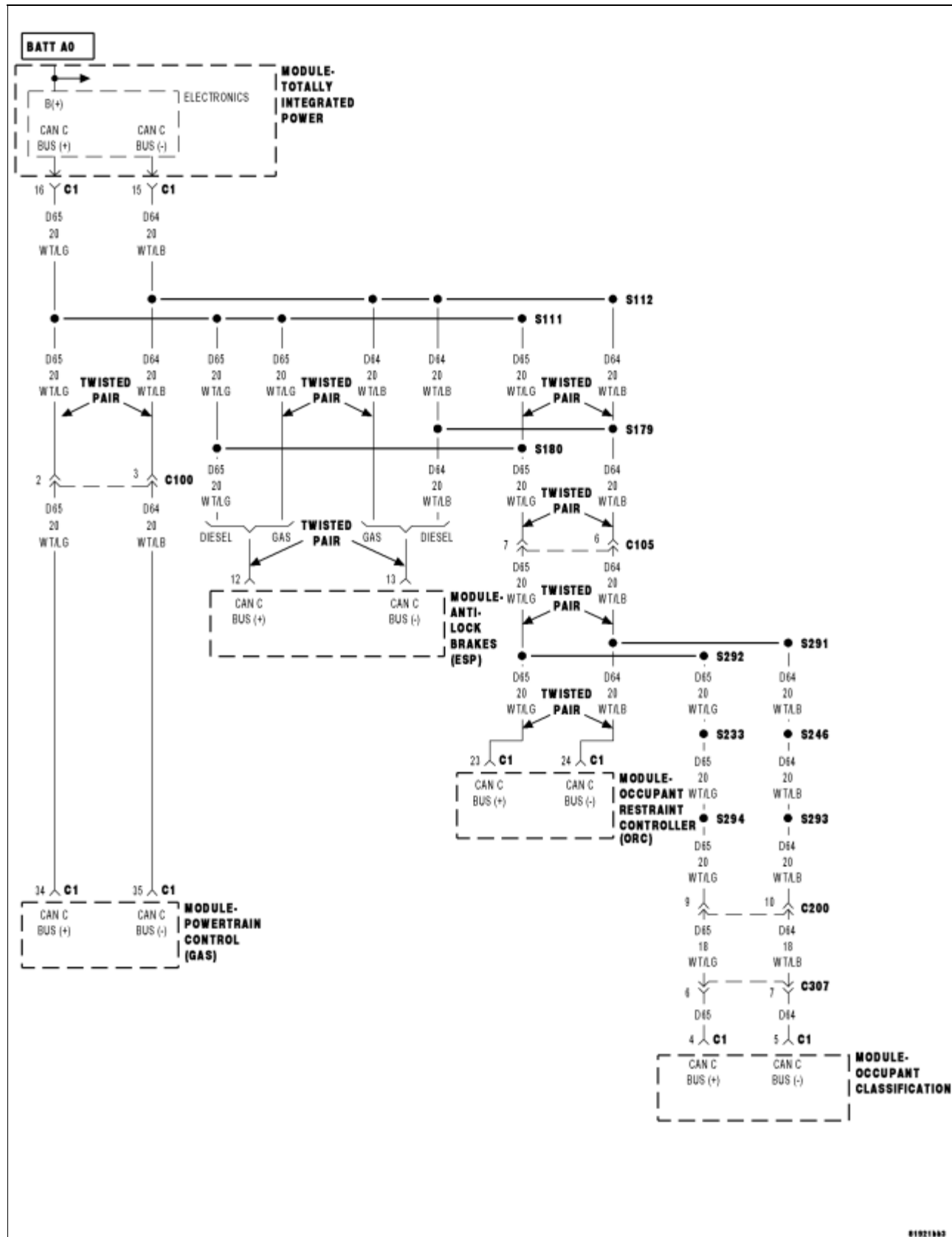
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts.

- **Set Condition:**

The PCM doesn't receive a TIPM message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View PCM DTCs.

Is the DTC Active at this time?

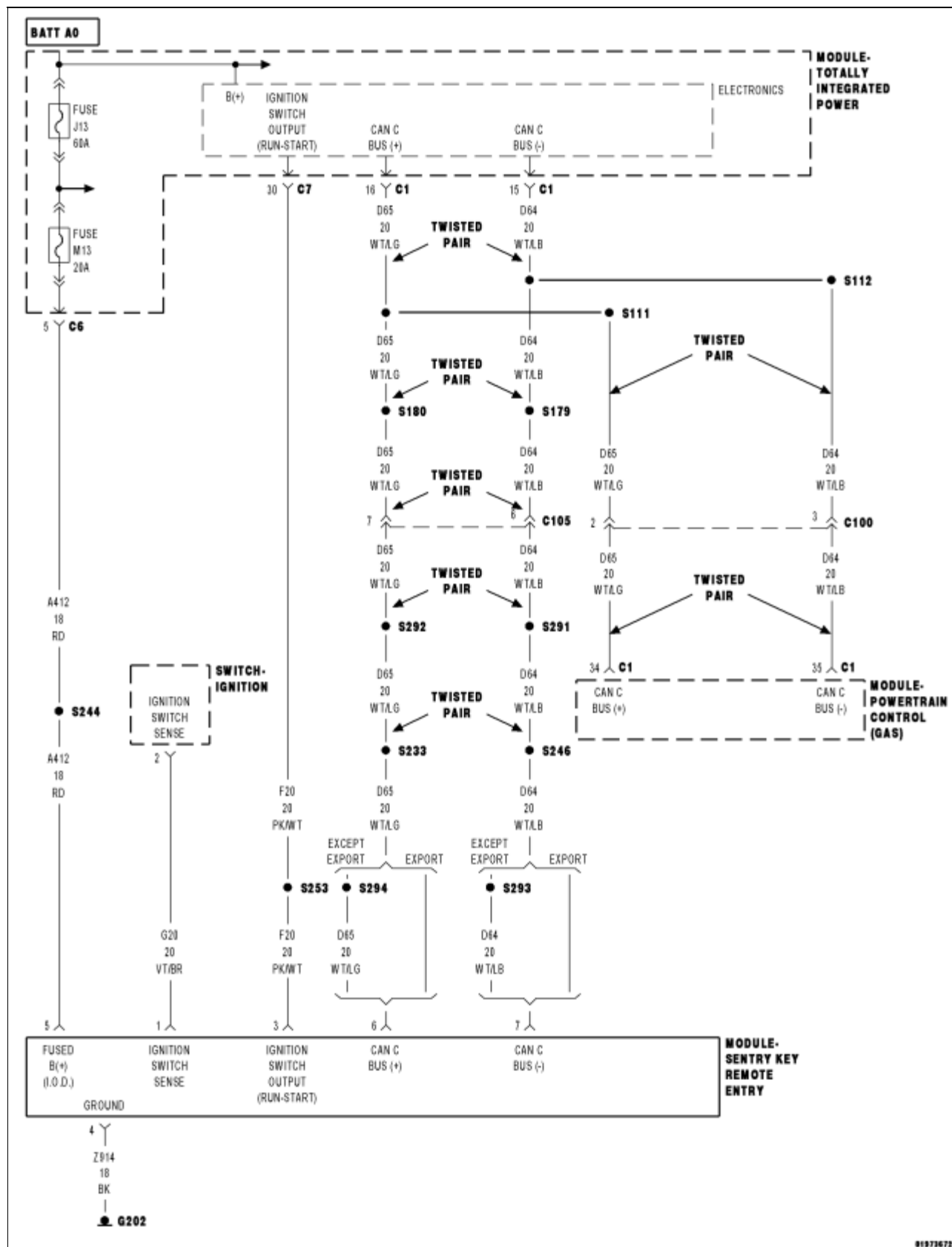
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY CONTROL MODULE (SKREEM-WCM)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM doesn't receive a SKREEM message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
NO POWER TO VEHICLE SECURITY CONTROL MODULE (SKREEM) — MODULE UNPLUGGED OR OPEN FUSE
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

NOTE: For vehicle communication problems, use the scan tool to refer to the Network Review Screen. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

NOTE: Check the IOD fuse before continuing. If the fuse is open, check the circuit for a short to ground.

Turn the ignition on.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for

diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U110A-LOST COMMUNICATION WITH SCM

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition run time is greater than 1 second. Battery voltage between 9 and 16 volts. Engine run time greater than 3 seconds.

- **Set Condition:**

The PCM doesn't receive a SKREEM message over the CAN C circuit for 7 consecutive seconds. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS OPEN OR SHORTED CONDITION
SCM
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, View PCM DTCs.

Is the DTC Active at this time?

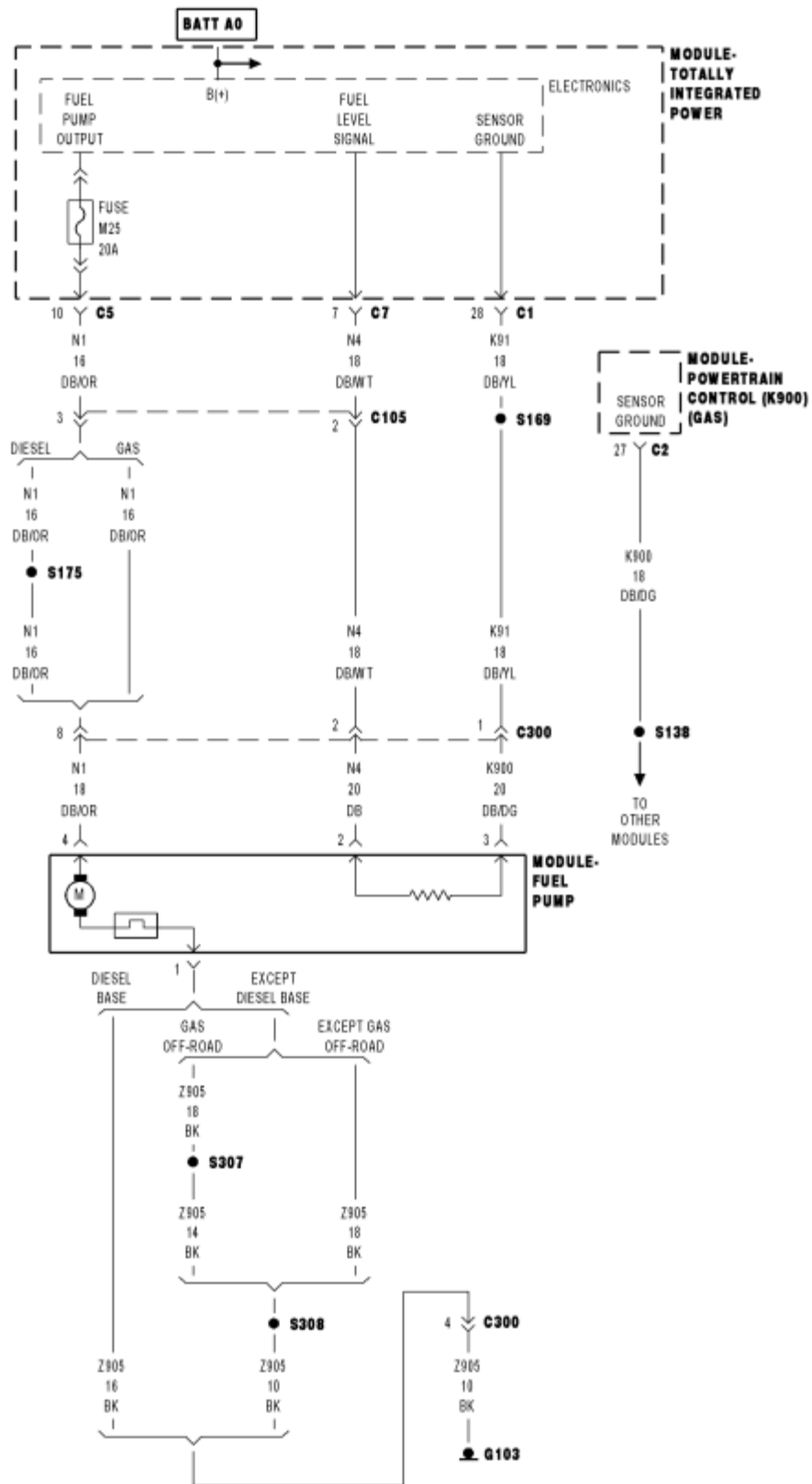
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

U110C-NO FUEL LEVEL BUS MESSAGE RECEIVED



01017141

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

When the PCM does not receive a fuel level signal from the TIPM over the CAN C circuit. The circuit is constantly monitored. One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) ALSO ACTIVE

With the scan tool, select View DTCs.

Is the U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) also set?

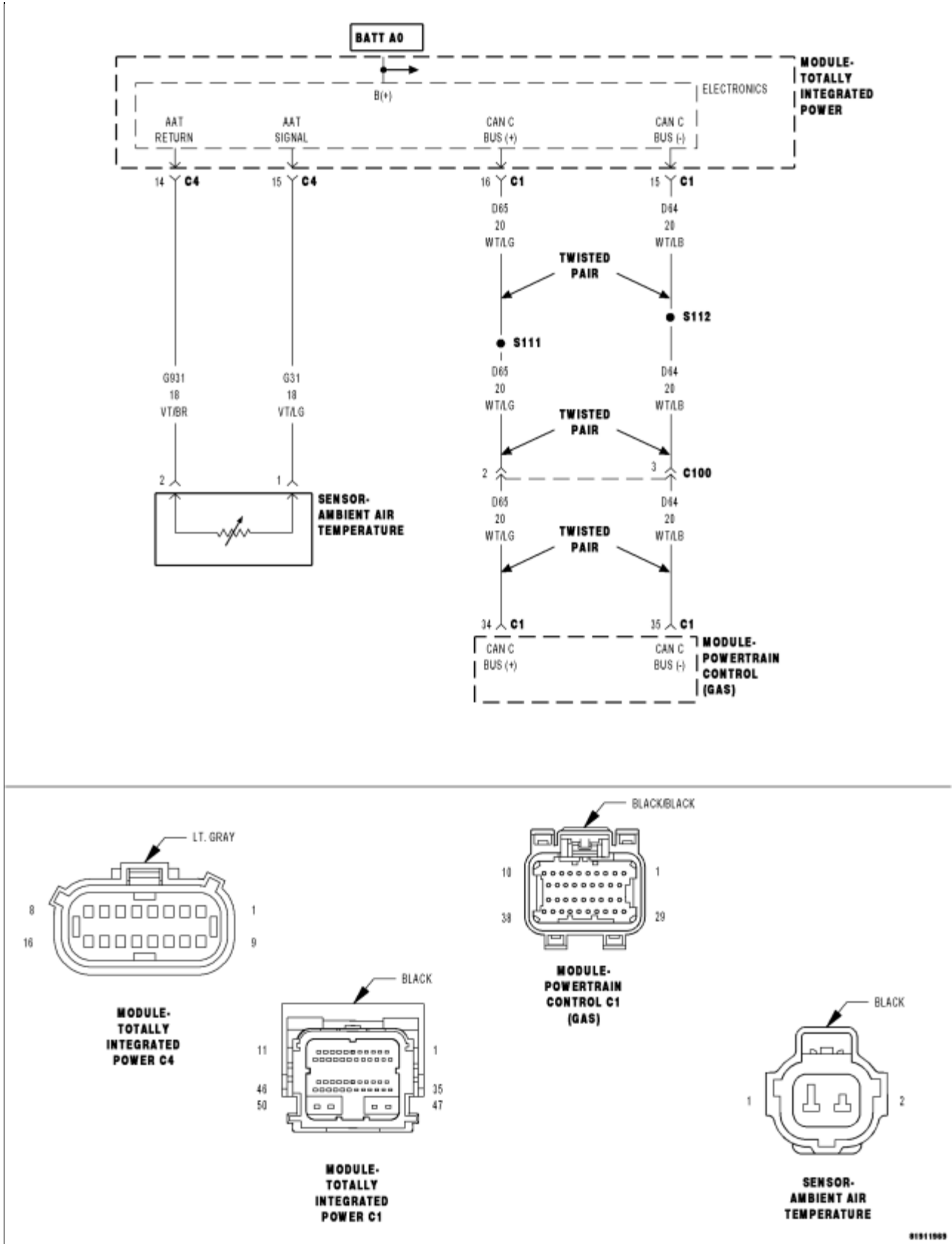
Yes

- Follow the diagnostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U110E-LOST AMBIENT TEMPERATURE MESSAGE



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on.

- **Set Condition:**

The PCM doesn't receive the ambient temperature signal over the CAN C bus from the TIPM. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ambient temperature sensor signal is a direct input to the TIPM. The TIPM sends the PCM the ambient temperature signal over the CAN C bus.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) ALSO ACTIVE

2.

With the scan tool, select View DTCs.

Is the U0141-NO BUS MESSAGE RECEIVED FROM THE FCM (TIPM) also set?

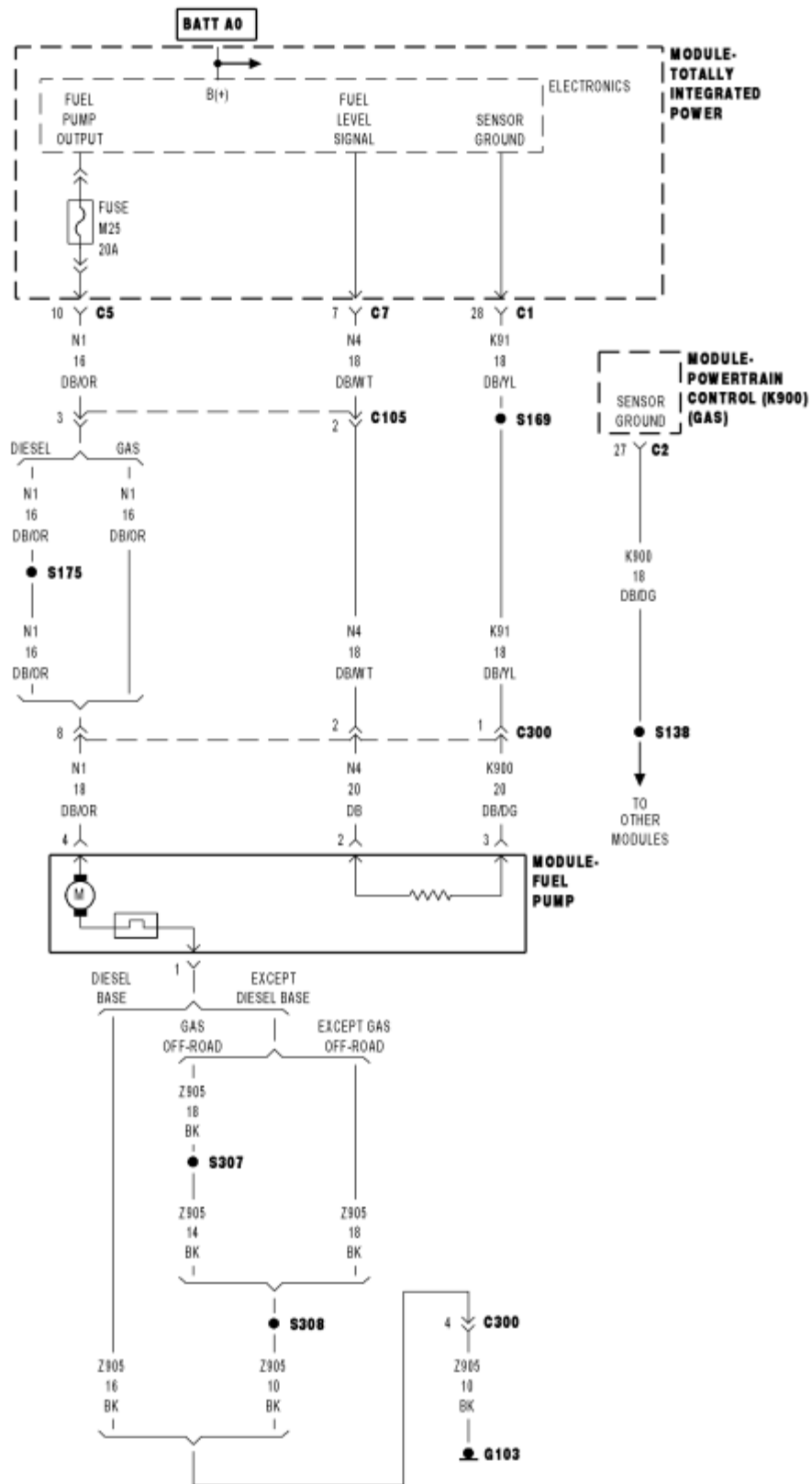
Yes

- Follow the diagnostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U110F-LOST FUEL VOLUME MESSAGE



00017141

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

When the PCM does not receive a fuel volume signal from the TIPM over the CAN C circuit. The circuit is constantly monitored. One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) ALSO ACTIVE

With the scan tool, select View DTCs.

Is the U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) also set?

Yes

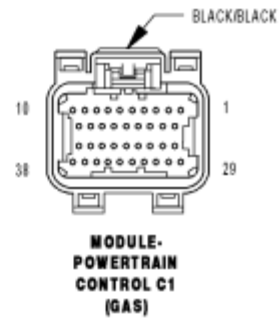
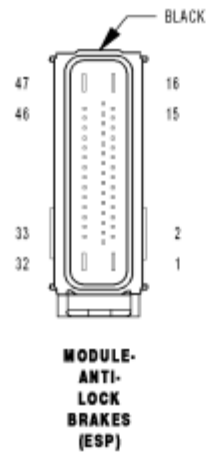
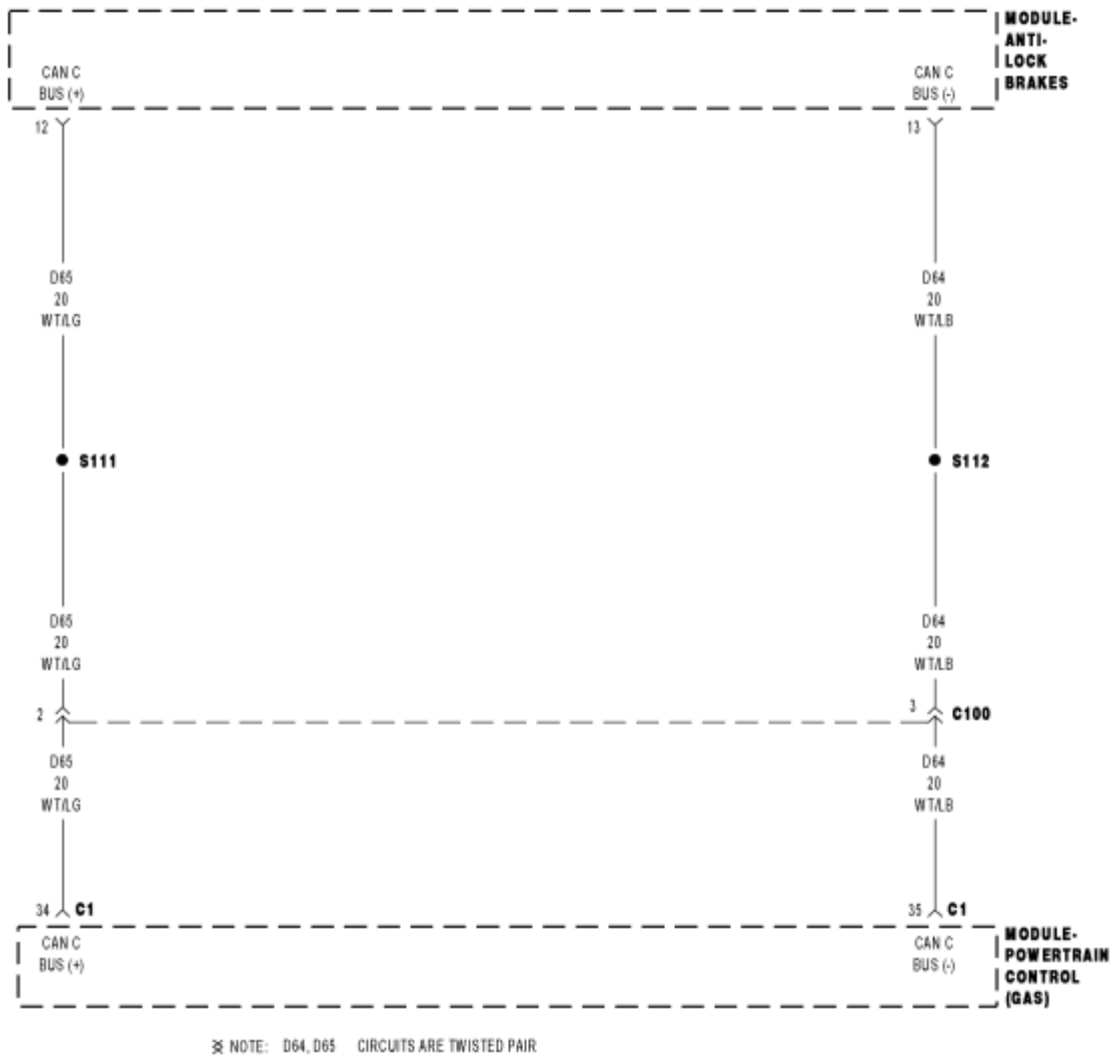
Follow the diagnostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM)

- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1110-LOST VEHICLE SPEED MESSAGE



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The PCM doesn't receive a vehicle speed signal from the Anti-lock brake Module over the CAN C bus.
One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
ANTI-LOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anti-lock Brake Module.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. U0121-LOST COMMUNICATION WITH ABS MODULE ALSO SET

With the scan tool continue reading DTCs.

Is the U0121-LOST COMMUNICATION WITH ABS MODULE also set?

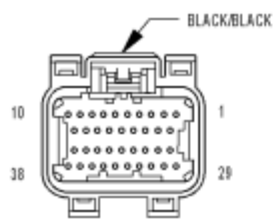
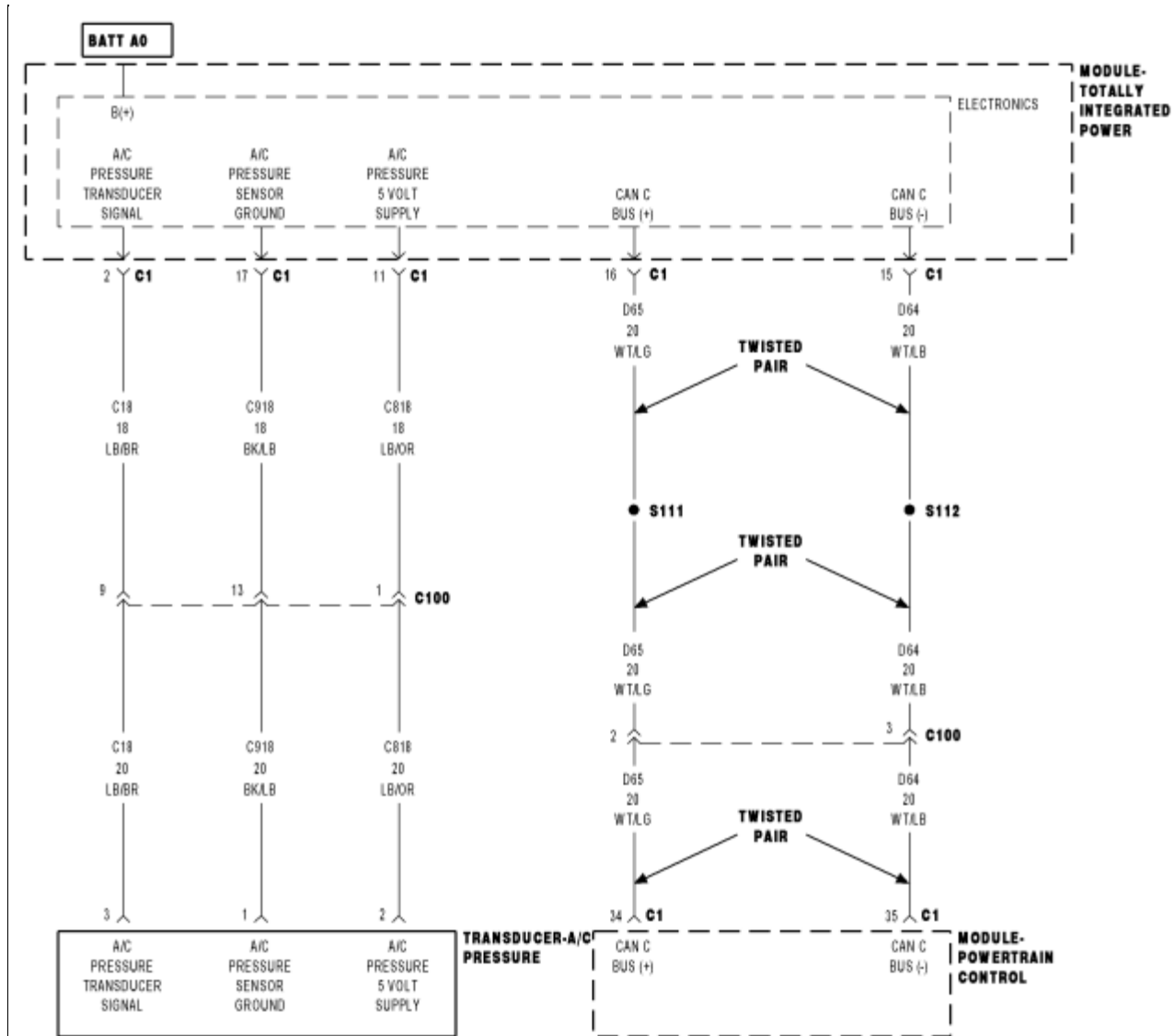
Yes

- Follow the diagnostics for U0121-LOST COMMUNICATION WITH ABS MODULE. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING.)

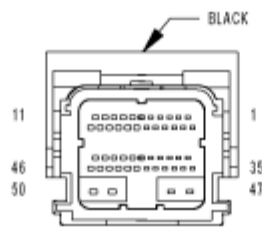
No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

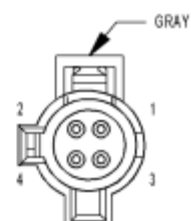
U1113-LOST A/C PRESSURE MESSAGE



**MODULE-
POWERTRAIN
CONTROL C1
(GAS)**



**MODULE-
TOTALLY
INTEGRATED
POWER C1**



**TRANSDUCER-A/C
PRESSURE**

01017401

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

- **Set Condition:**

The PCM doesn't receive the A/C Pressure signal over the CAN C bus from the TIPM. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The A/C Pressure Transducer signal is a direct input to the TIPM. The TIPM sends the PCM the A/C pressure signal over the CAN C bus.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM) ALSO ACTIVE

With the scan tool continue reading DTCs.

Is the U0141-NO BUS MESSAGE RECEIVED FROM THE TIPM also set?

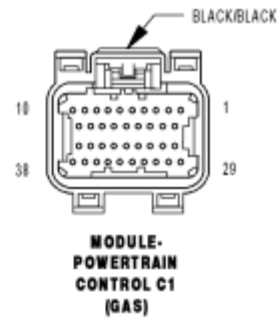
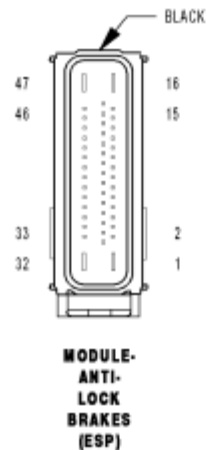
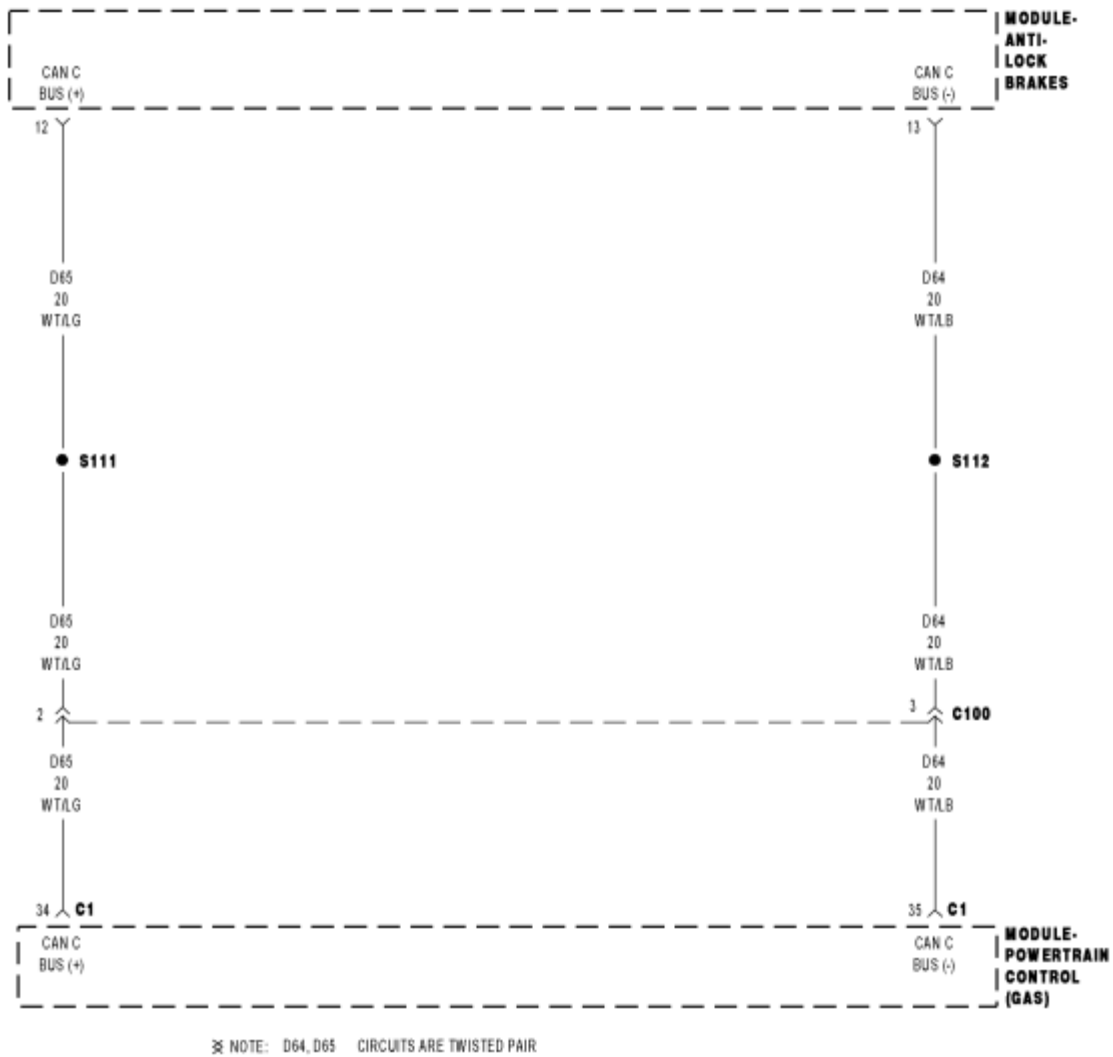
Yes

- Follow the diagnostics for U0141-LOST COMMUNICATION WITH FRONT CONTROL MODULE (TIPM). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1120-LOST WHEEL DISTANCE MESSAGE



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The PCM doesn't receive a vehicle speed signal from the Anti-lock brake Module over the CAN C bus.
One Trip fault.

Possible Causes
CAN C BUS CIRCUIT OPEN OR SHORTED
ANTI-LOCK BRAKE MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anti-lock Brake Module.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. U0121-LOST COMMUNICATION WITH ABS MODULE ALSO SET

With the scan tool continue reading DTCs.

Is the U0121-LOST COMMUNICATION WITH ABS MODULE also set?

Yes

- Follow the diagnostics for U0121-LOST COMMUNICATION WITH ABS MODULE. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1403-IMPLAUSIBLE FUEL LEVEL SIGNAL RECEIVED

Ignition on.

◦ **Set Condition:**

The fuel level message the PCM is receiving is implausible. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN CIRCUIT OPEN OR SHORTED
FUEL LEVEL SENSOR
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The Totally Integrated Power Module isn't receiving a fuel volume signal from the Fuel Level Sensor. The PCM received the Fuel Level signal from the TIPM over the CAN C Bus circuit. The signal the TIPM is sending over CAN C is implausible.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CAN C HARDWARE DTCS ALSO ACTIVE

With a scan tool check for DTCs in the TIPM.

Are any CAN C Hardware related DTCs active at this time?

Yes

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the appropriate diagnostic procedures.
- Perform BODY VERIFICATION TEST - VER 1.

No

- Go To [3](#)

3. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Ignition on, engine not running.

Using a fused jumper wire, jump the (K900) Sensor Ground circuit to the (N4) Fuel Level Sensor No.1 Signal circuit in the Fuel Pump Motor harness connector.

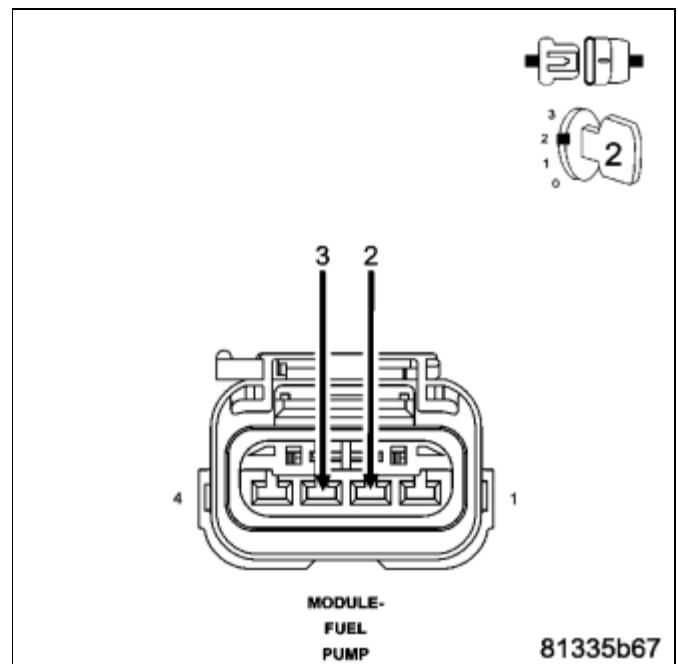
Did the Fuel gauge level change from empty to full?

Yes

- Replace the Fuel Level Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)



4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the C7 TIPM harness connector.
 Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C7 TIPM harness connector.

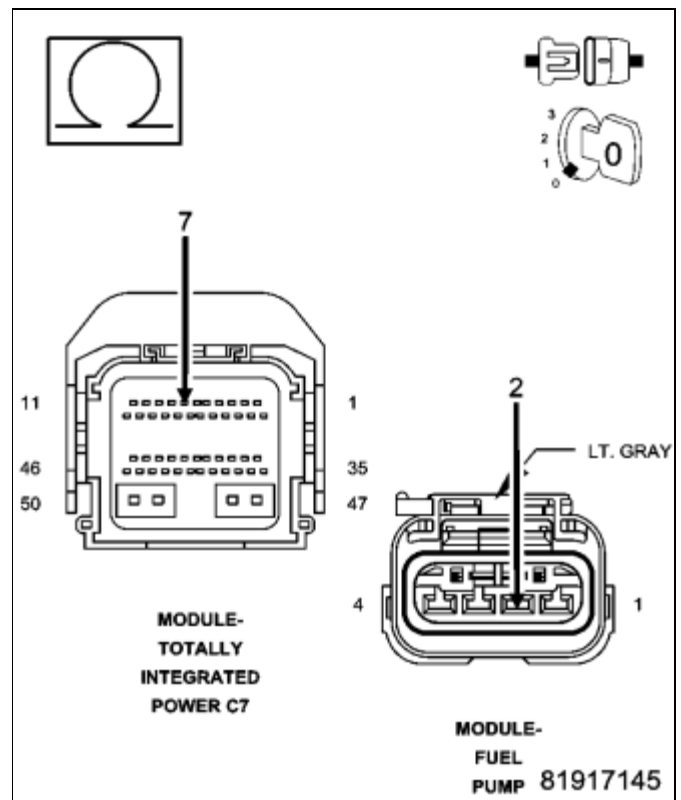
Is the resistance below 5.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



5. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector.

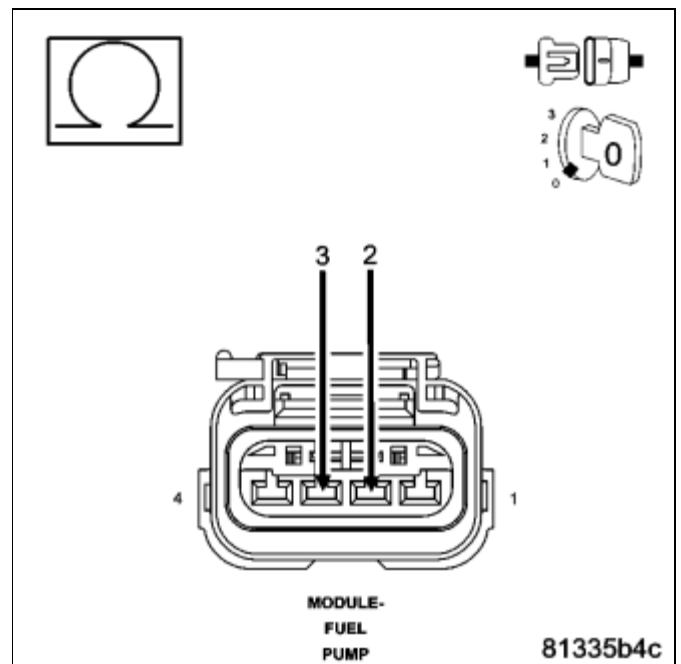
Is the resistance below 5.0 ohms?

Yes

- Repair the short between the (K900) Sensor Ground circuit and the (N4) Fuel Level Signal circuit.
- Perform the POWERTRAIN VERIFICATION TEST.
 (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [6](#)



6. (K900) SENSOR GROUND CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the TIPM harness connector.

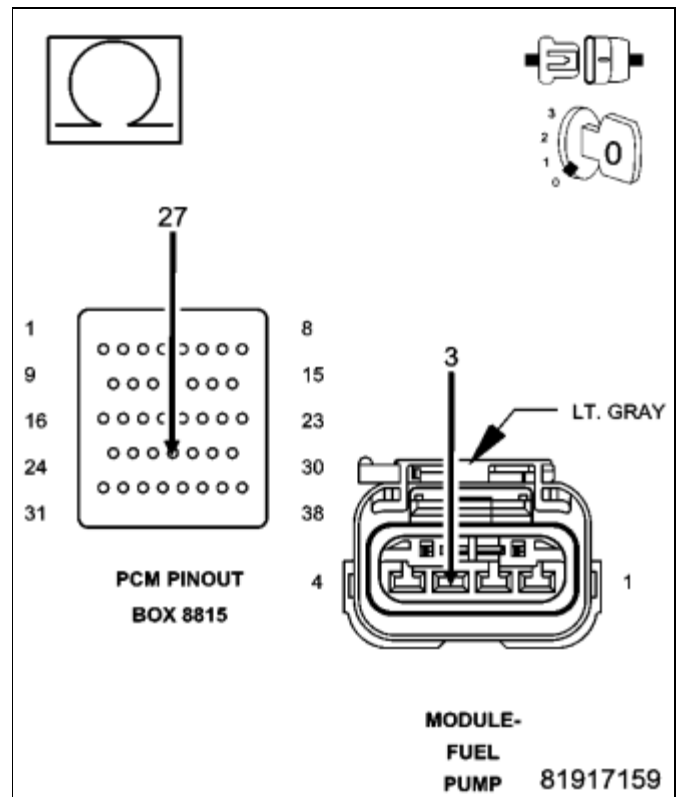
Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)

No

- Repair the open in the (K900) Sensor Ground circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connector at the Powertrain Control Module (PCM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Powertrain Control Module connectors.

Refer to any Technical Service Bulletins that may apply.

Were there any problems found?

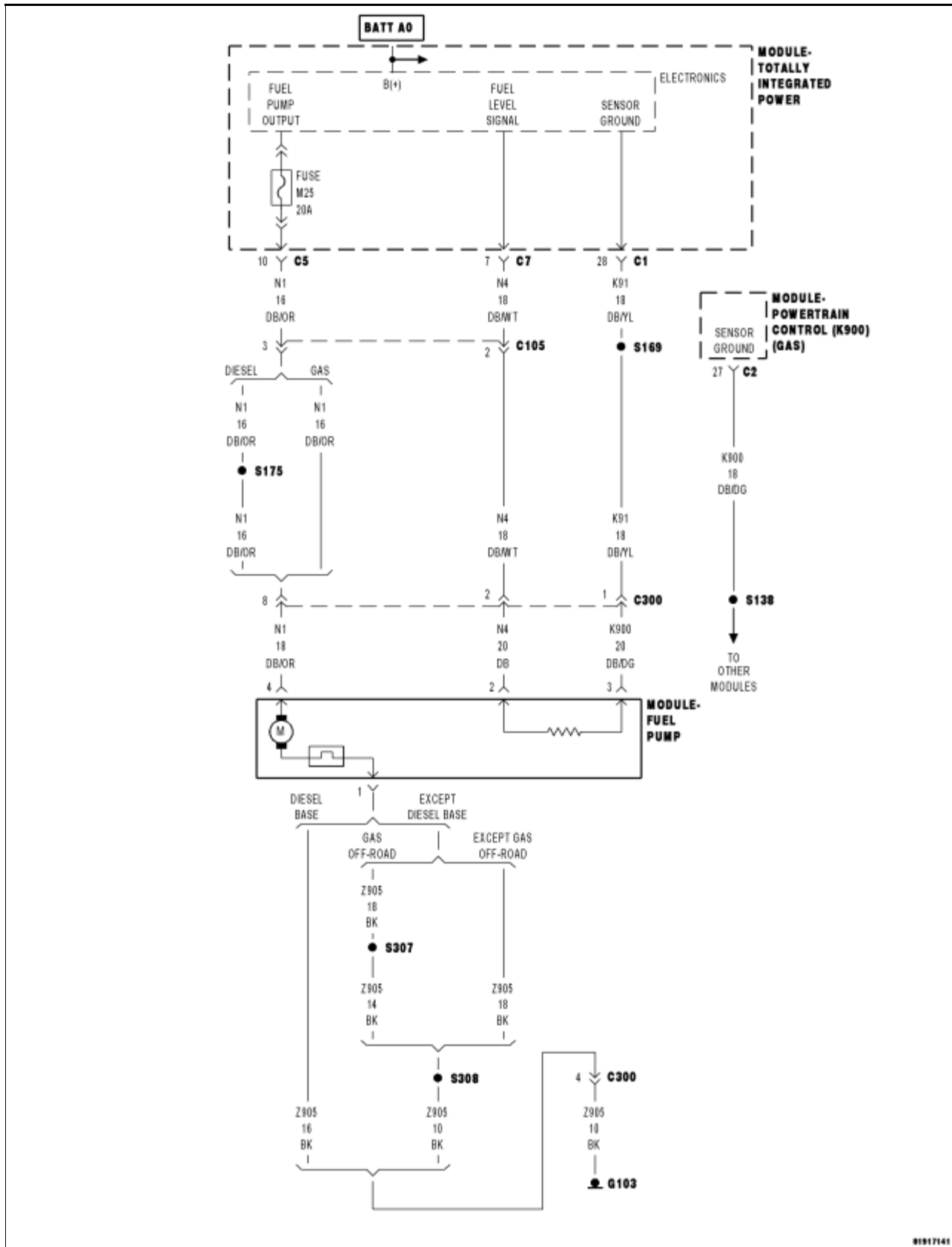
Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1411-IMPLAUSIBLE FUEL VOLUME SIGNAL RECEIVED



01017141

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The TIPM has to send the PCM a fuel volume signal over CAN C. The signal the TIPM sends over CAN C is implausible.

- **When Monitored:**

Ignition on.

- **Set Condition:**

The fuel volume message the PCM is receiving is implausible. The circuit is continuously monitored.

Possible Causes
CAN C OPEN OR SHORTED
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the DTC Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. CAN C BUS DTCS ALSO ACTIVE

With a scan tool check for DTCs in the TIPM.

Are any CAN C related DTCs Active at this time?

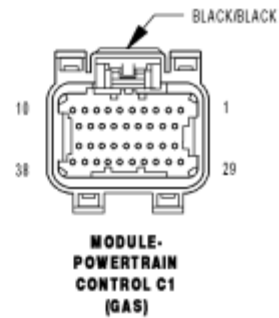
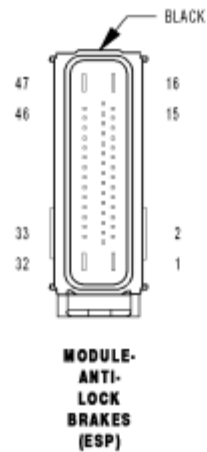
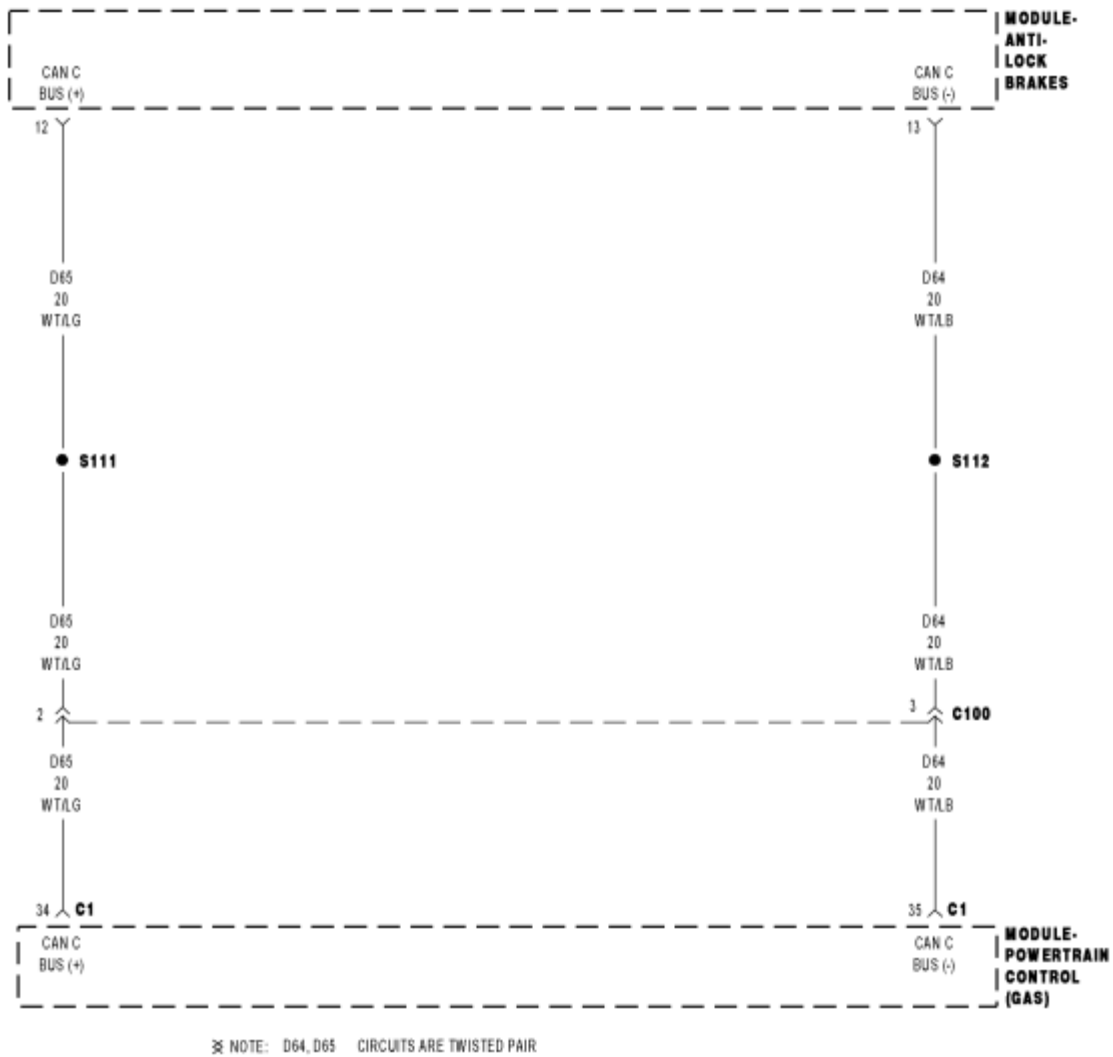
Yes

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the appropriate diagnostic procedures.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored. One Trip fault.

Possible Causes
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends vehicle speed information over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT IS ACTIVE

Continue reading DTCs.

Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT Active at this time?

Yes

- Refer to the Diagnostic Procedure for the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING.)

No

- Go To [3](#)

3. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes

- Go To [4](#)

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

4. ACTIVE DTCS IN THE TIPM

With the scan tool, select ECU View and select TIPM.
With the scan tool, read active DTCs.

Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT ACTIVE in the TIPM at this time?

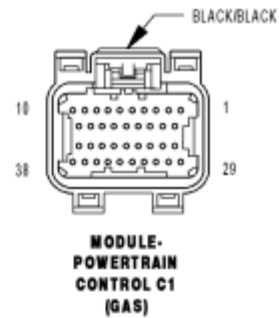
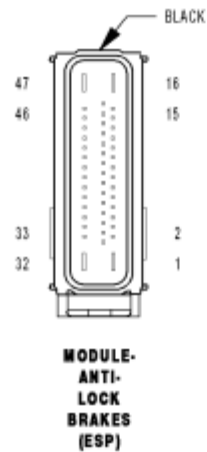
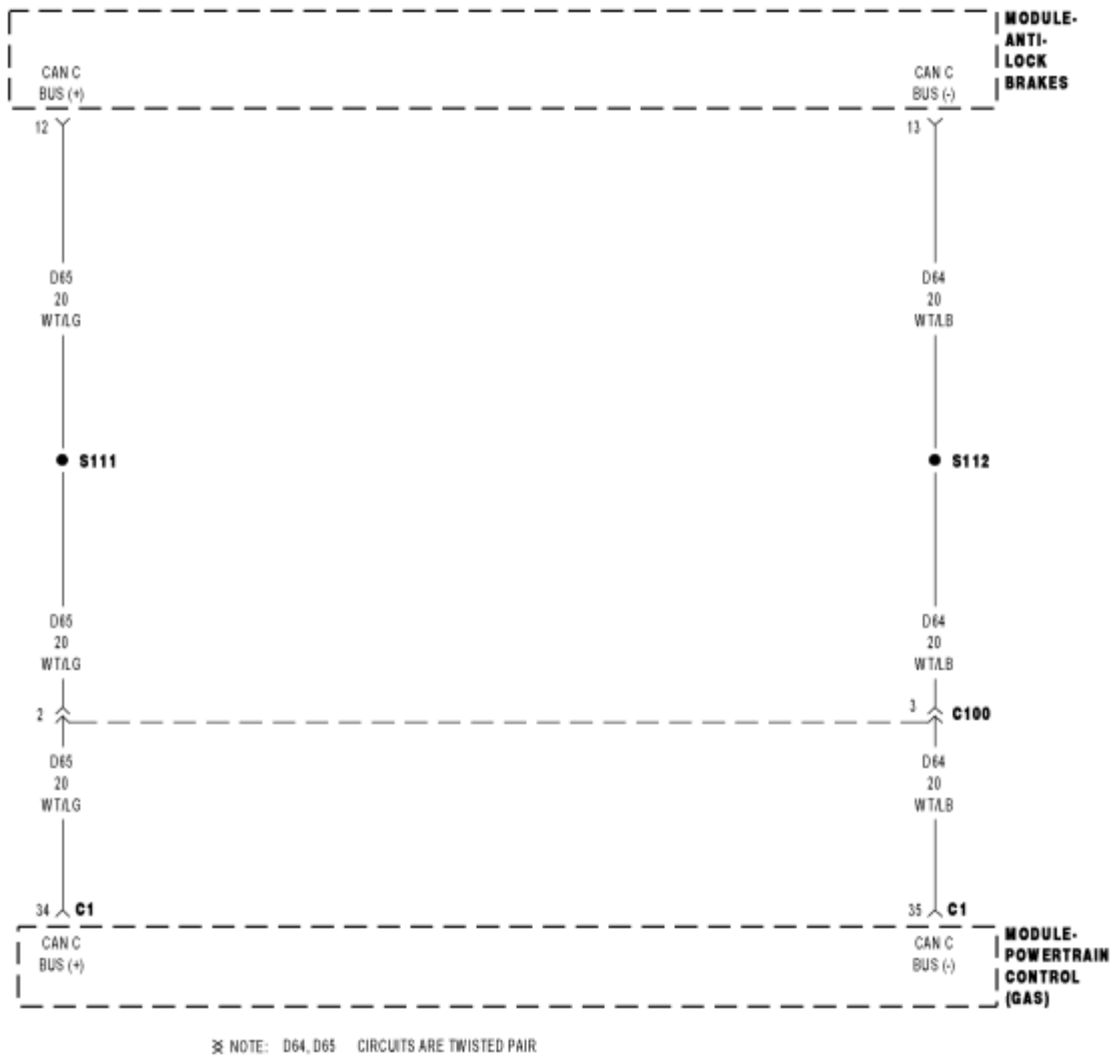
Yes

- Replace the ABS Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored. One Trip fault.

Possible Causes
VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes

- Go To [3](#)

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

Are any DTCs active or stored in the ABS Module?

Yes

- Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
- Perform ABS VERIFICATION TEST - VER 1

No

- Go to [4](#)

4. ACTIVE DTCS IN THE TIPM

With the scan tool, select ECU View and select TIPM.
With the scan tool, read active DTCs.

Are any Communication DTCs active in the TIPM relating to the ABS System?

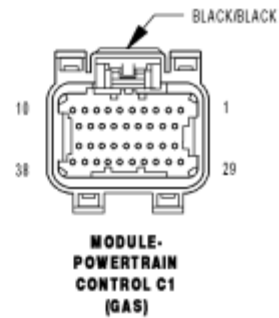
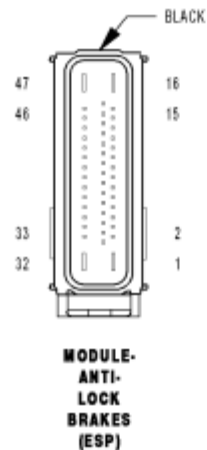
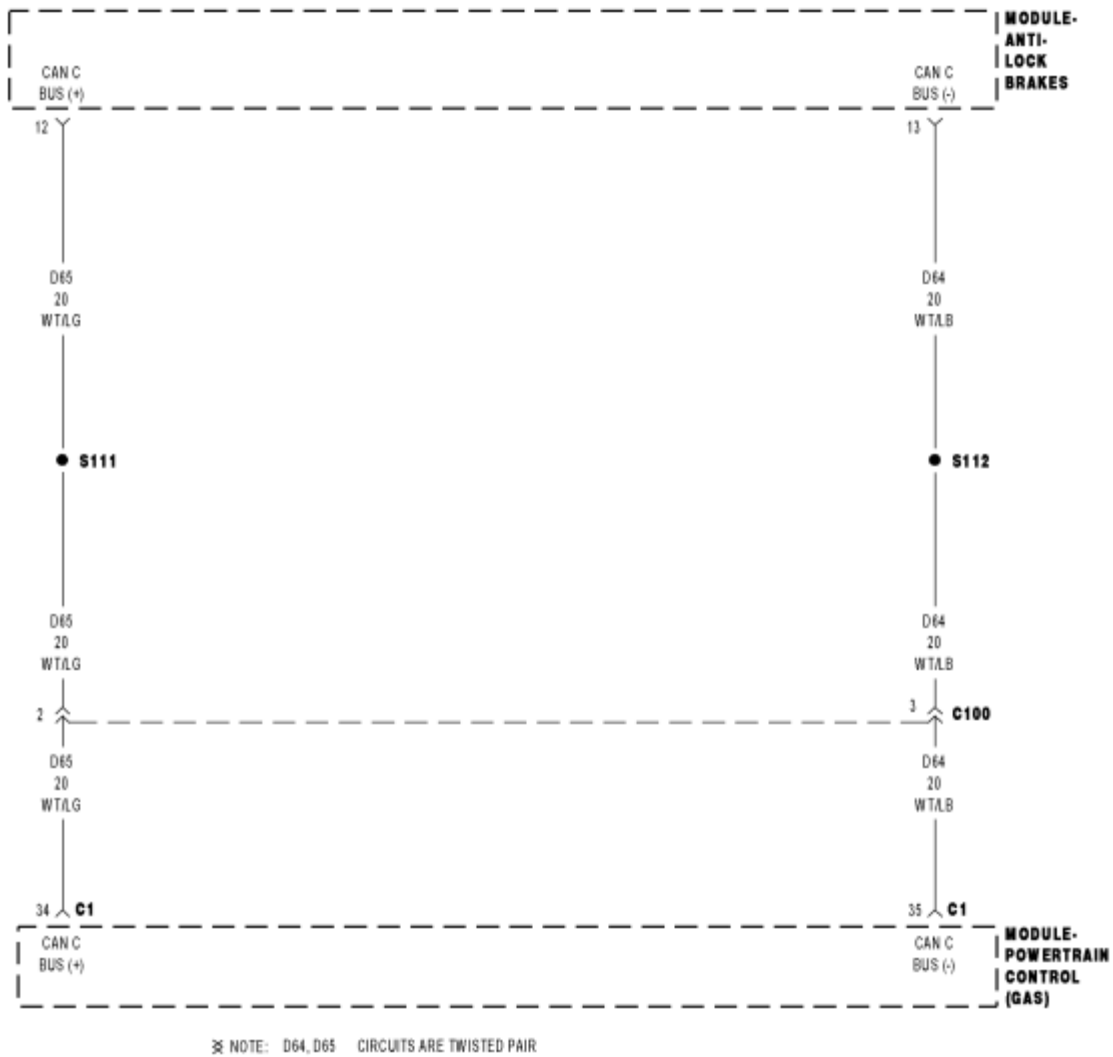
Yes

- Replace the ABS Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED



8181750a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on.

◦ **Set Condition:**

The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored. One Trip fault.

Possible Causes
VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE
CAN C BUS CIRCUIT SHORTED
CAN C BUS CIRCUIT OPEN
ABS MODULE
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, select View DTCs.

Is the U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED Active at this time?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.)

2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

Is the ABS Module active on the bus?

Yes

- Go To [3](#)

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

Are any DTCs active or stored in the ABS Module?

Yes

- Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
- Perform ABS VERIFICATION TEST - VER 1

No

- Go to [4](#)

4. ACTIVE DTCS IN THE TIPM

With the scan tool, select ECU View and select TIPM.
With the scan tool, read Active DTCs.

Are any Communication DTCs active in the TIPM relating to the ABS System?

Yes

- Replace the ABS Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

*CHECKING THE EXHAUST SYSTEM FOR LEAKS

1. CHECKING THE EXHAUST SYSTEM FOR LEAKS

Turn the ignition off.

Raise the vehicle in accordance with the Service Information.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time

Connect Exhaust Cone #8404-EC or #8404-EC to Air Pressure Regulator (with hose) #W-18-MIL-1146AS.

CAUTION: The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.

Attach shop air to the air pressure regulator.

Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)

Insert the exhaust cone into the vehicle tail pipe.

If the vehicle is equipped with dual exhaust. Use the #8404-ECT with equipped attached plug, plug one side of the dual exhaust pipe. Pressurize the other as described above.

Apply Mopar® Air Leak Detector PN# 05191804AA (or an equivalent leak finder liquid) to the following areas:

- All welded joints from the exhaust manifold to 152.4 mm (6 inches) behind the downstream O2 sensor
- O2 sensor seal points
- O2 sensor boss welds
- Flange/joint connection(s)
- Exhaust manifold to cylinder head connection(s)
- EGR solenoid gasket base and tube seal points (if equipped)

Watch for the Mopar® Air Leak Detector PN# 05191804AA (or the equivalent leak finder liquid) to bubble.

Use the following definitions to help determine if system or component repair/replacement is necessary:

Type 1 Leak is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear.

Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.

Type 2 Leak is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear.

Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater

O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

If a leak is found that matches the above definition, repair or replace the component as necessary. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

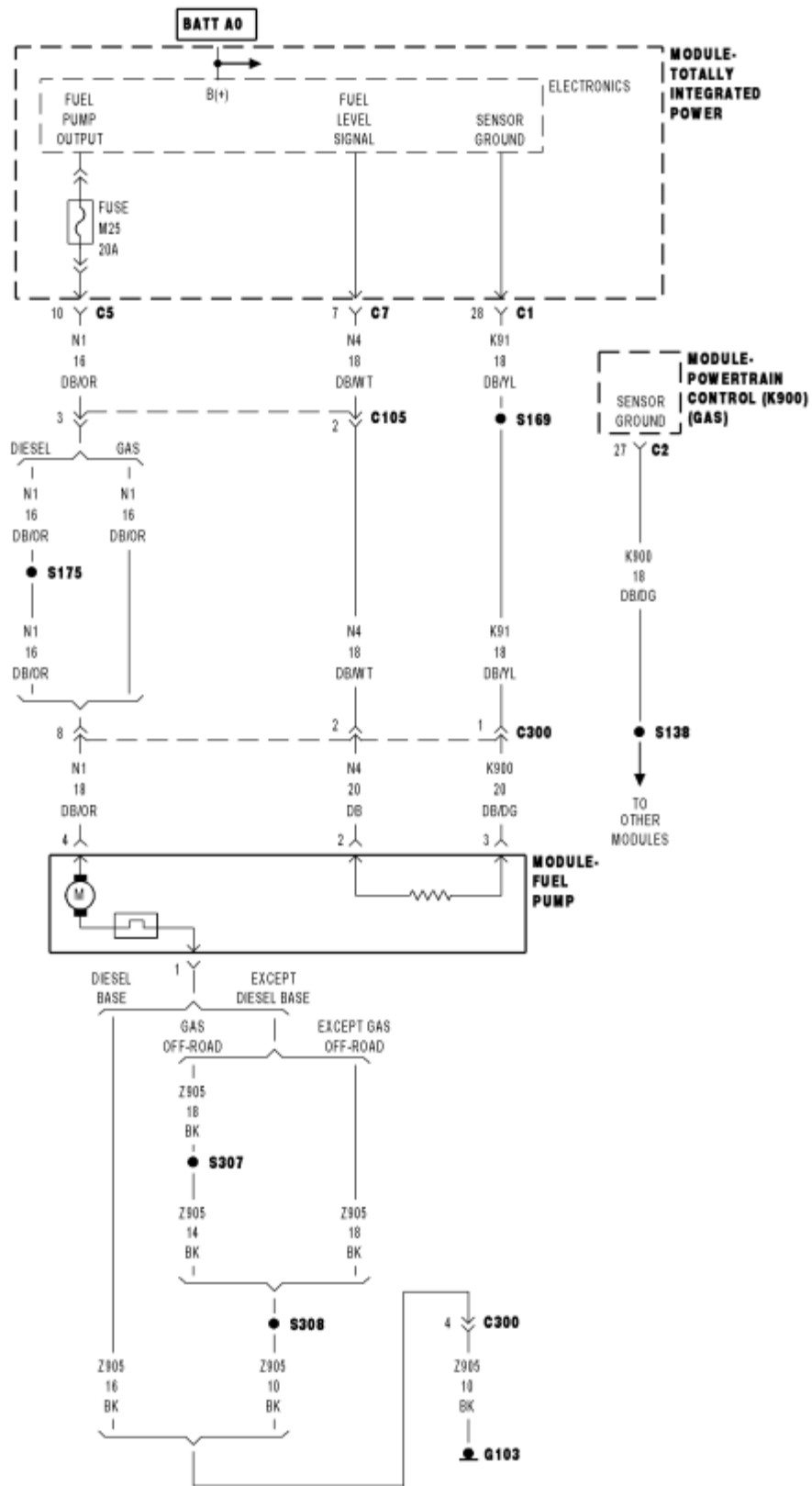
Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test complete.

***CHECKING THE FUEL DELIVERY SYSTEM**



00017141

For a complete wiring diagram **Refer to Section 8W.**

RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND
(K31) FUEL PUMP CONTROL CIRCUIT OPEN
(N1) FUSED FUEL PUMP OUTPUT OPEN
(N1) FUSED FUEL PUMP OUTPUT SHORTED TO GROUND
FUEL PUMP MODULE
TIPM
PCM

Diagnostic Test

1. FUEL PUMP OPERATION

Ignition on, engine not running.
With a scan tool, actuate the Fuel System test.

NOTE: It may be necessary to use a mechanics stethoscope in the next step.

Listen for fuel pump operation at the fuel tank.

Does the Fuel Pump operate?

Yes

- Go To [2](#)

No

- Go To [5](#)

CAUTION: Stop All Actuations.

2. FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Below Specification

- Go To [3](#)

Within Specification

- Test Complete.

Above Specification

- Replace the fuel filter/fuel pressure regulator.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

CAUTION: Stop All Actuations.

3. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16") or #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification now?**Yes**

- Repair/replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

CAUTION: Stop All Actuations.

4. CHECKING FUEL INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?**Yes**

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

5. FUEL PUMP CONTROL OPERATION FROM THE PCM

Stop the Fuel Pump actuation.

Turn the ignition off.

Disconnect the C1 TIPM harness connector.

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Ignition on, engine not running.

Using a 12-volt test light connected to B+ probe the (K31) Fuel Pump Control circuit in the C1 TIPM harness connector.

Using a scan tool actuate the Fuel Pump under the PCM actuations.

Does the test light illuminate brightly during the actuation?

Yes

- Go To [8](#)

No

- Go To [6](#)

6. (K31) FUEL PUMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

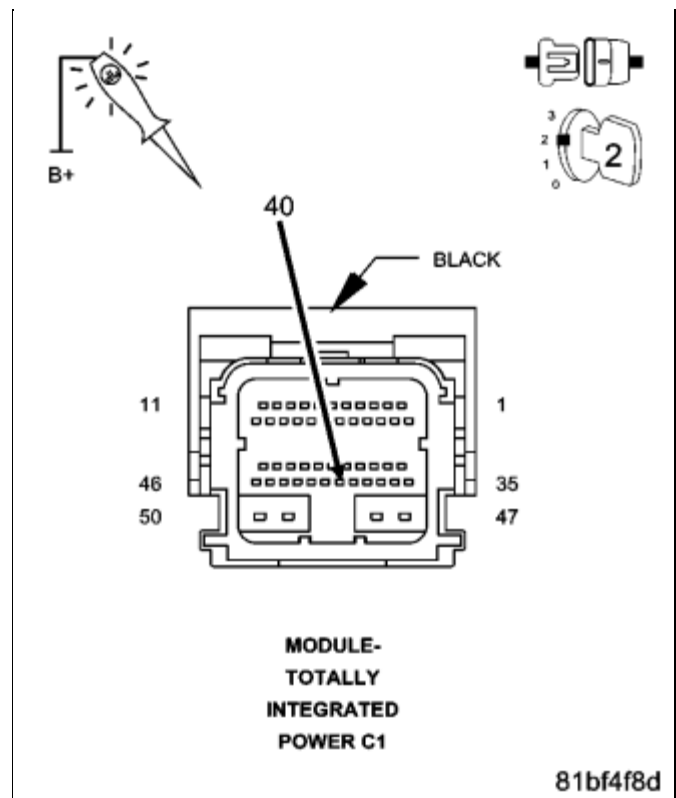
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

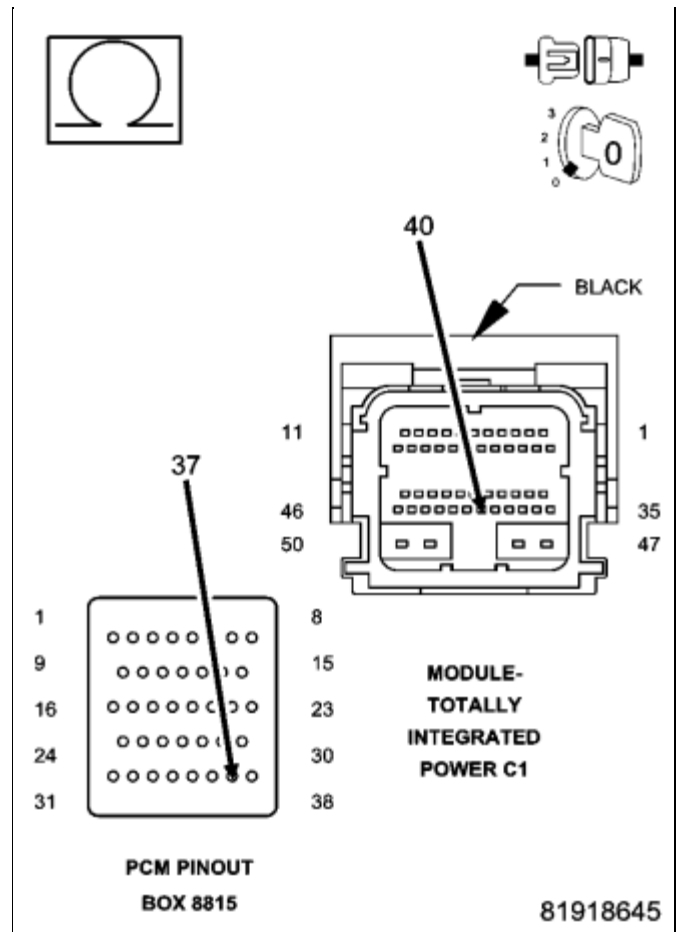
Measure the resistance of the (K31) Fuel Pump Control circuit from the C1 TIPM harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes

- Go To [7](#)





No

- Repair the open in the (K31) Fuel Pump Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Control circuit in the TIPM C1 harness connector.

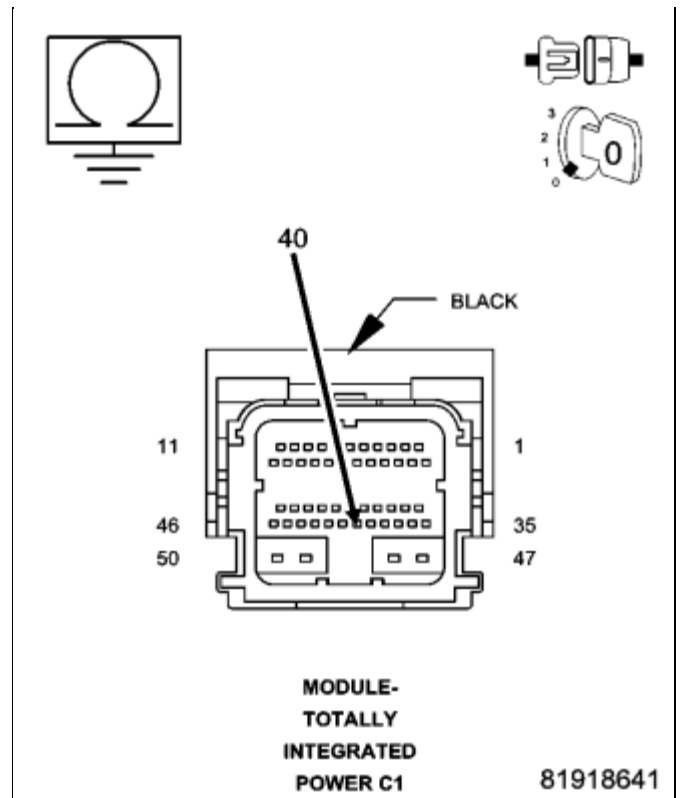
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K31) Fuel Pump Control circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [11](#)



8. (N1) FUEL PUMP OUTPUT CIRCUIT OPEN

Turn the ignition off.
 Disconnect the C5 TIPM harness connector.
 Disconnect the Fuel Pump Module harness connector.
 Measure the resistance of the (N1) Fused Fuel Pump Output circuit from the C5 TIPM harness connector and the Fuel Pump Module harness connector.

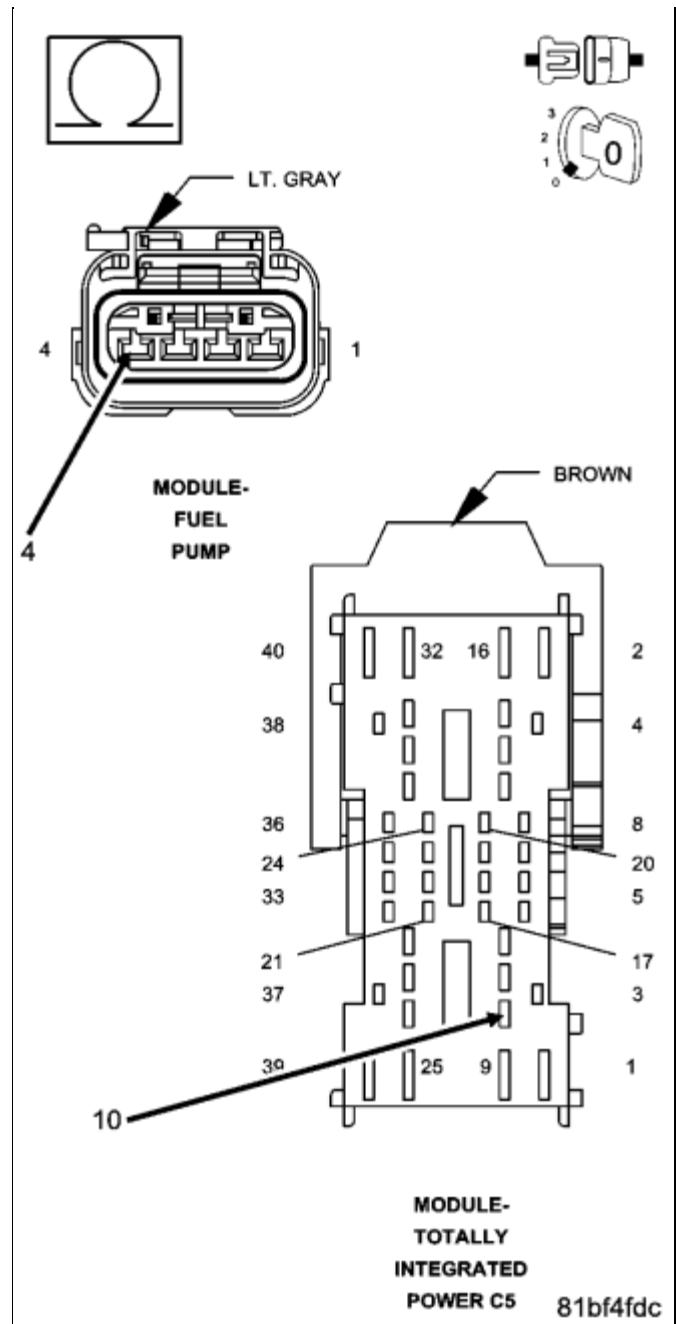
Is the resistance above 5.0 ohms?

Yes

- Repair the open in the (N1) Fused Fuel Pump Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. (N1) FUEL PUMP OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N1) Fused Fuel Pump Output circuit at the Fuel Pump Module harness connector.

Is the resistance below 100 ohms?

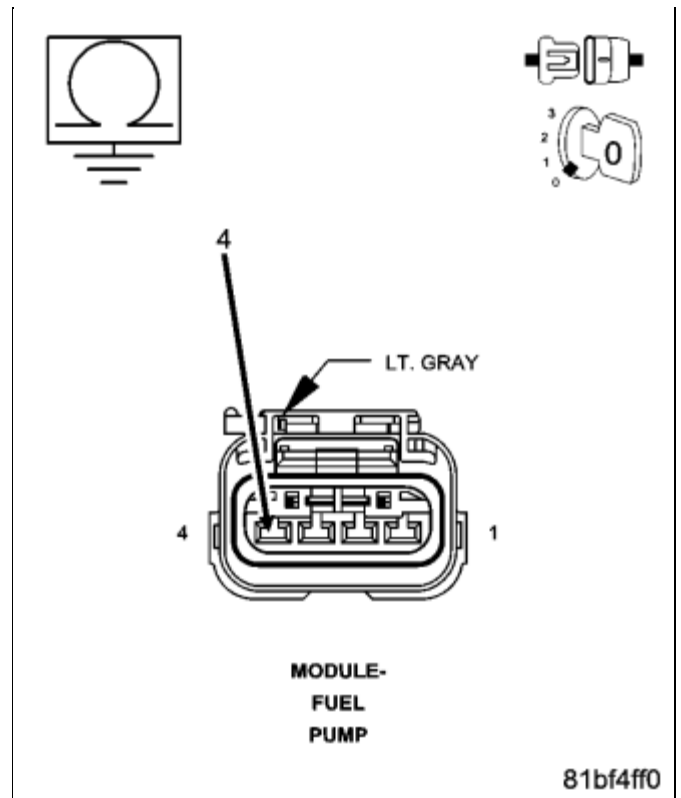
Yes

- Repair the short to ground in the (N1) Fused Fuel Pump Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST.

(Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [10](#)



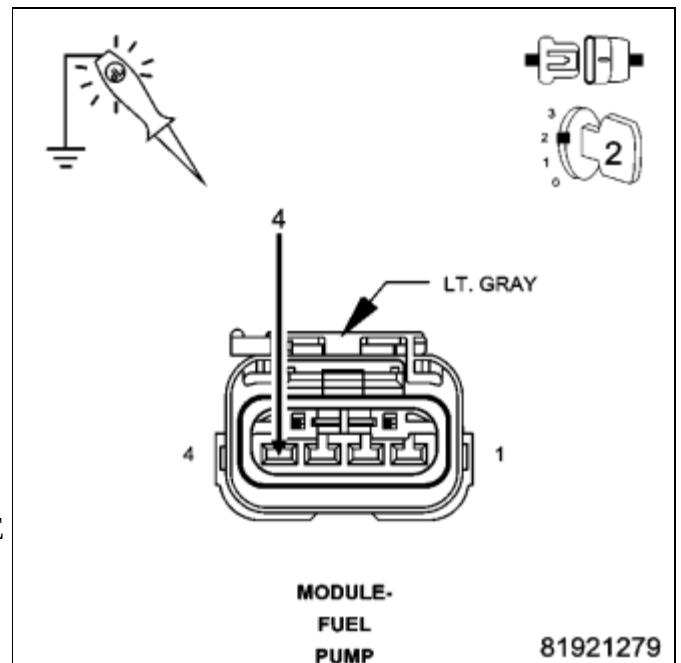
10. FUEL PUMP MODULE/TIPM

Connect the C3 PCM harness connector.
 Connect the C1 and C5 TIPM harness connectors.
 Turn the ignition on.
 Using a scan tool actuate the Fuel Pump Module.
 Using a 12-volt test light connected to ground, probe the (N1) Fused Fuel Pump Output circuit at the Fuel Pump Module harness connector.

Does the test light illuminate?

Yes

- Replace the Fuel Pump Module in accordance with the Service Information. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP MODULE - REMOVAL).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



No

- Replace the Totally Integrated Power Module in accordance with the Service Information. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

*CHECKING THE OXYGEN SENSOR OPERATION

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. OXYGEN SENSOR, WIRING, OR CONNECTORS

NOTE: Diagnose and repair any O2 sensor or rationality DTCs before proceeding with this test.

NOTE: When performing this procedure as part of another diagnostic process, it may be necessary to repeat this test for all of the oxygen sensors on the vehicle.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen sensor and the PCM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Turn the ignition on.

Monitor the scan tool data relative to the sensor and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test. If necessary, check each sensor circuit for high resistance or a shorted condition.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [2](#)

2. OXYGEN SENSOR VOLTAGE

Start the engine and allow it to reach normal operating temperature.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With a scan tool, monitor all O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all O2 sensors?

Yes

- Go to [3](#)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [4](#)

3. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Turn the ignition on.

With a scan tool, actuate the O2 Sensor heater.

With the scan tool, monitor O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes

- Go to [4](#)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD

PROCEDURE.)

No

- Test complete.

4. O2 SENSOR

Turn the ignition off.

NOTE: Check for contaminants that may cause improper O2 Sensor operation, such as contaminated fuel, unapproved silicone, or evidence of oil or coolant.

Disconnect the O2 Sensor harness connector.

Turn the ignition on.

With a scan tool, monitor the O2 Sensor voltage.

NOTE: The voltage should be approximately 5.0 volts with the connector disconnected.

Connect a jumper wire between the signal circuit and the return circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Is the O2 Sensor voltage displayed on the scan tool as described?

Yes

- Replace the O2 Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [5](#)

5. O2 SENSOR SIGNAL CIRCUIT

Using the wiring diagram/schematic as a guide, inspect the O2 Sensor Signal circuit and connectors between the O2 sensor and the PCM.

Check the O2 Sensor signal circuit for a short to ground, open circuit, short to voltage, or high resistance.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [6](#)

6. O2 SENSOR RETURN CIRCUIT

Using the wiring diagram/schematic as a guide, inspect the O2 Sensor Return circuit and connectors between the O2 sensor and the PCM.

Check the O2 Sensor return circuit for a short to ground, open circuit, short to voltage or high resistance.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go to [7](#)

7. POWERTRAIN CONTROL MODULE (PCM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the O2 sensor and the PCM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to the components tested in this procedure and wiggle test the wiring and connectors.

Look for the data to change or for a DTC to set during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

*CHECKING THE PCM POWER AND GROUND CIRCUITS

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. PCM WIRING OR CONNECTORS

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the wiring and each connector at the PCM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

No

- Go To [2](#)

2. CHECKING THE PCM GROUND CIRCUITS

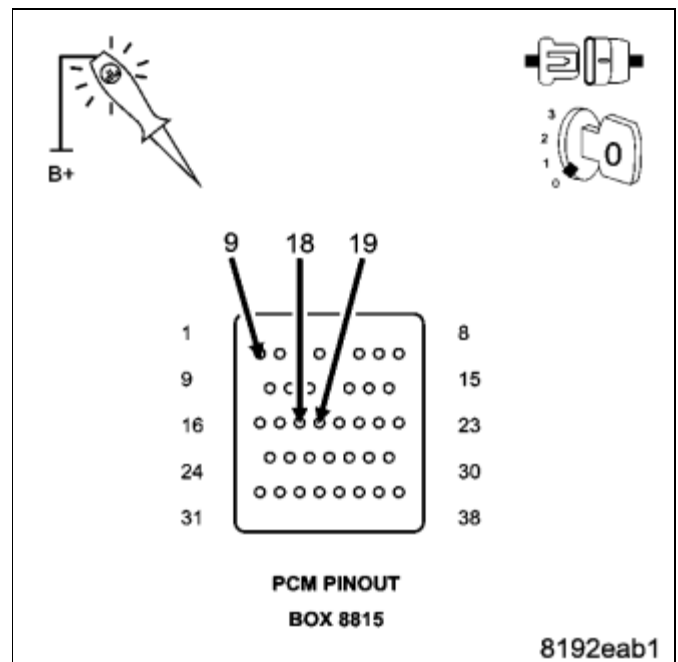
Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12 volt test light connected to 12 volts, check the PCM ground circuits.

Wiggle test each circuit during the test to check for an intermittent open in the circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated and bright?

Yes

- Go To [3](#).

No

- Repair the PCM ground circuit(s) for an open circuit or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

3. CHECKING THE PCM FUSED IGNITION CIRCUITS

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

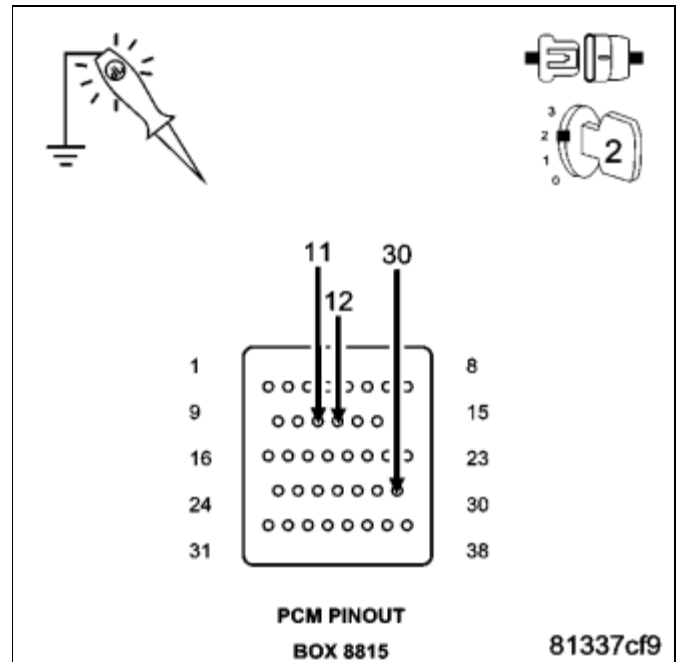
Turn the ignition on.

Using a 12 volt test light connected to ground, check the PCM Fused Ignition circuits.

Check each circuit with the ignition on, engine running position, and during cranking.

Wiggle test each circuit during the test to check for an intermittent open in the circuit.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated and bright?

Yes

- Go To [4](#).

No

- Repair the open or short to ground in the PCM Fused Ignition circuits.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

4. CHECKING THE PCM FUSED B+ CIRCUITS

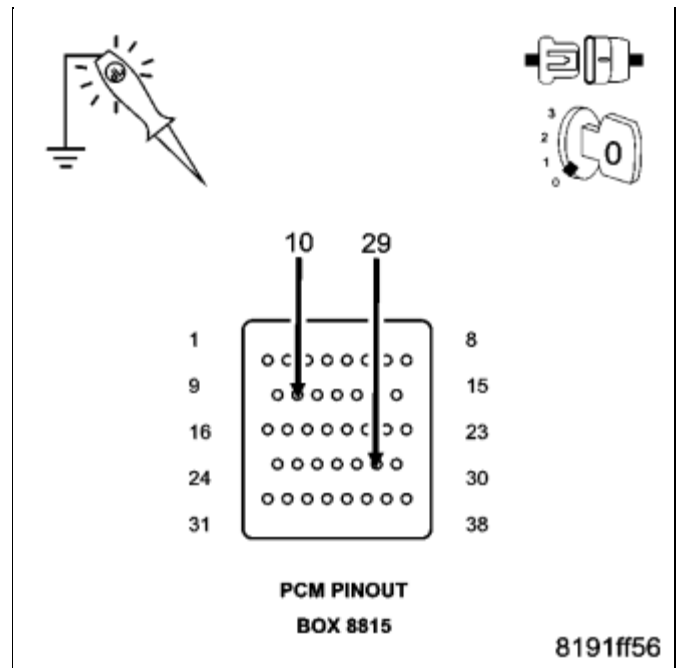
Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12 volt test light connected to Ground, check the PCM Fused B+ circuits.

Wiggle test each circuit during the test to check for an intermittent open in the circuit.

NOTE: The test light should be illuminated and bright with the ignition on and not illuminated with the ignition off. Compare the brightness to that of a direct connection to the battery.



Is the test light illuminated as described above?

Yes

- Test complete.

No

- Repair the open or short to ground in the PCM Fused B+ circuit(s) for as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

***ENGINE CRANKS BUT DOES NOT START**

For a complete wiring diagram **Refer to Section 8W.**

POWERTRAIN FUSES OPEN
CRANKSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR
ASD RELAY
(A209) FUSED B+ CIRCUIT OPEN OR SHORTED TO GROUND
(F342) FUSED ASD RELAY OUTPUT CIRCUIT OPEN
FUEL CONTAMINATION
ENGINE MECHANICAL
PCM

Diagnostic Test

1. NO START PRE-TEST

NOTE: Verify no codes are set in the Occupant Restraint Controller. If codes are present, they may be the cause of a No Start condition.

NOTE: The following list of items must be checked before continuing with any no start tests.

The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times. This will allow any DTCs to set that may have been erased due to a dead battery. Try to communicate with PCM using a scan tool. If communication between the scan tool and PCM is not allowed inspect fuses. If the PCM reports a No Response condition, refer to section 8 Electrical Electronic Control Module Electrical Diagnostics for the proper tests.

Make sure the PCM Power and Ground circuits are OK.

Read the PCM DTCs with the scan tool . If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Table of Contents for the related P-code that is reported by the PCM.

Make sure that the Bus is functional. Attempt to communicate with the Instrument Cluster and VTSS, If you are unable to establish communications refer to 8 Electrical Electronic Control Module Electrical Diagnostics for the proper Diagnostic procedures.

The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the scan tool and check for DTCs that may be stored in the Sentry Key Immobilizer Module (SKREEM). Repair the DTC(s) before continuing.

If no DTCs are found, using the scan tool, select Clear PCM (BATT Disconnect).

Crank the engine several times. Using the scan tool, View DTCs. If a DTC is present perform the DTC diagnostics before continuing.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [2](#)

2. OPEN FUSE

Check for any open fuses in the TIPM or Junction Block that may be related to the No Start condition.

Are any of the fuses open?

Yes

- Replace the open fuse and check the related circuit(s) for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CRANKSHAFT POSITION SENSOR

Turn the ignition off.

Disconnect the CKP Sensor.

Attempt to start the engine.

Does the engine start?

Yes

- Replace the Crankshaft Position Sensor in accordance with the Service Information. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/CRANKSHAFT POSITION SENSOR - REMOVAL.)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [4](#)

4. CAMSHAFT POSITION SENSOR

Turn the ignition off.
 Connect the CKP Sensor.
 Disconnect the CMP Sensor.
 Attempt to start the engine.

Does the engine start?

Yes

- Replace the Camshaft Position Sensor in accordance with the Service Information. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/CAMSHAFT POSITION SENSOR - REMOVAL.)
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. (A209) FUSED B+ CIRCUIT CHECK

Turn the ignition off.
 Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground probe the (A209) Fused B+ circuits.

Does the test light illuminate brightly?

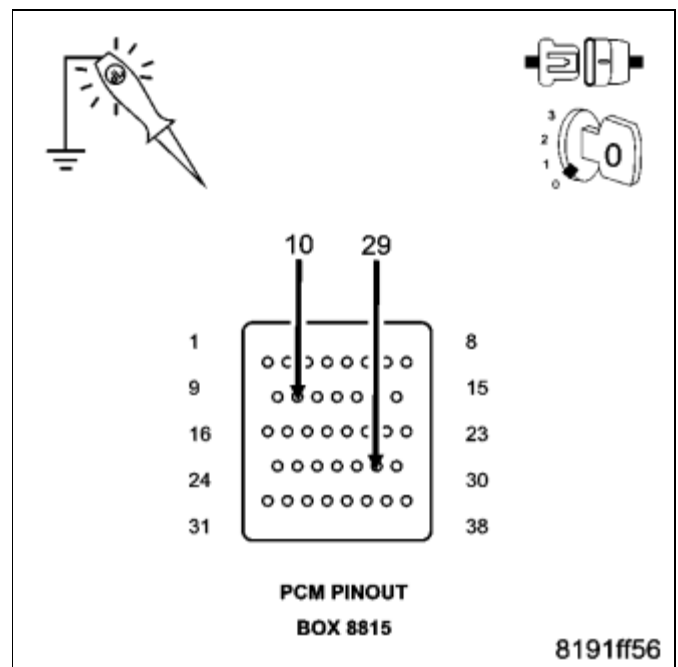
Yes

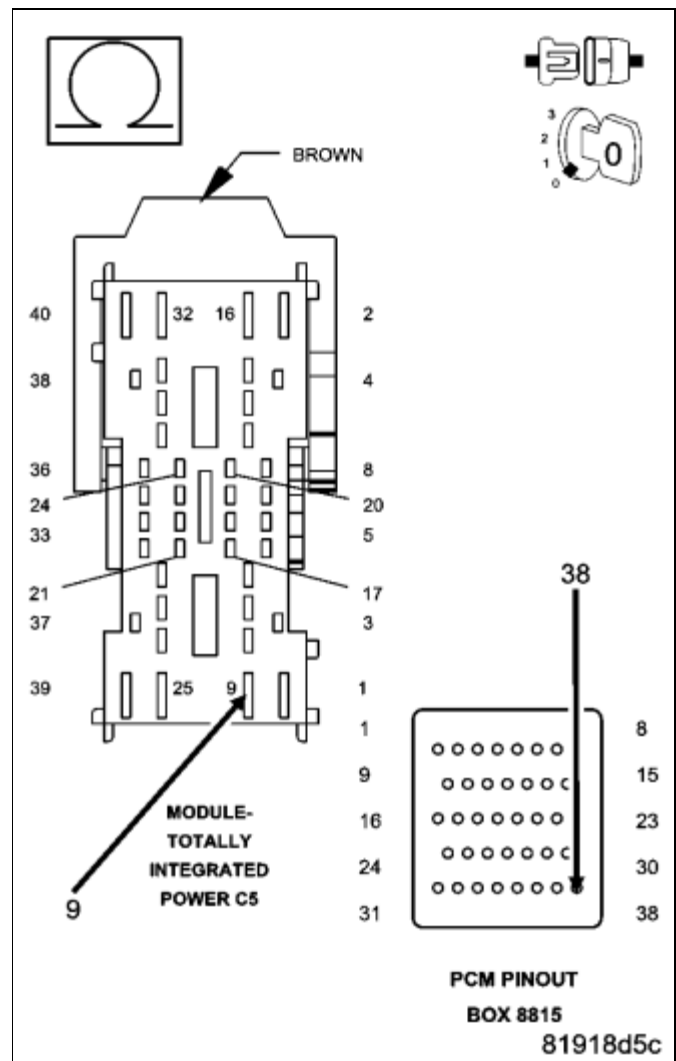
- Go To [6](#)

No

- Repair the open or short to ground in the (A209) Fused B+ circuit between the TIPM and PCM.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. (F342) FUSED ASD RELAY OUTPUT CIRCUIT OPEN





Disconnect the C5 TIPM harness connector
Disconnect the C3 PCM harness connector.

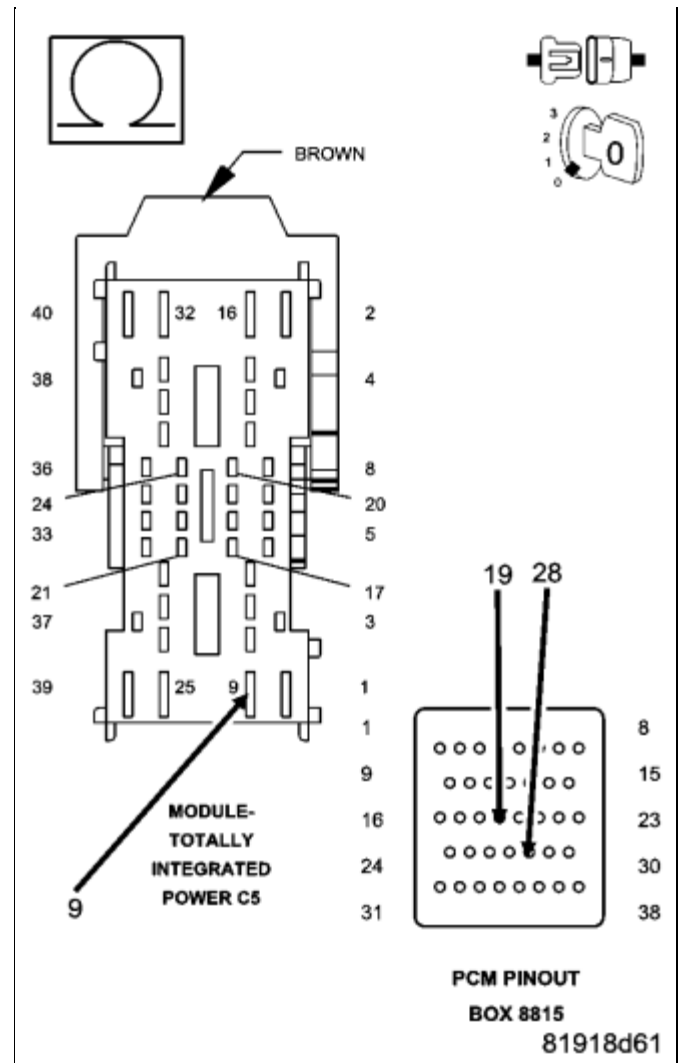
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F342) ASD Relay Output circuit from the C5 TIPM harness connector to the appropriate terminals of special tool #8815, Ignition coils, and the Fuel injectors.

Is the resistance below 5.0 ohms for each measurement?

Yes

- Go To [7](#)



No

- Repair the open in the (F342) Fused ASD Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

7. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking the Fuel Delivery System in the Driveability section of this manual.

Was the No Start condition solved after following the Checking the Fuel Delivery System diagnostic procedure?

Yes

- Test Complete.

No

- Go To [8](#)

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE VALVE TIMING - must be within specifications, check for broken timing components

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

***ETC INTERMITTENT NO CRANK CONDITION**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
ETC STARTER INHIBIT

Diagnostic Test

1. ETC STARTER INHIBIT

NOTE: This ETC equipped engine will try to relearn ETC position when the key is left in the on position for an extended period of time and will not allow the starter to crank during this procedure. This procedure can take up to 2.5 seconds.

To verify the cause of the no crank condition or delayed crank use the scan tool, and read the ETC Starter Inhibit mileage.

The controller will store the mileage at which the no start condition occurred because of the ETC testing procedure.

This is considered normal operation for a vehicle equipped with an Electronic Throttle Control System and no repairs are necessary.

Is a mileage stored under the ETC Starter Inhibit?

Yes

- Test Complete.

No

- Refer to the appropriate diagnostic procedure for further assistance if any other DTC's are set.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

*FUEL PRESSURE LEAK DOWN

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the fuel pressure drop?

Yes

- Replace Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [2](#)

2. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the fuel pressure drop?

Yes

- Replace the leaking fuel injectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Test Complete.

*HARD START FUEL SYSTEM

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
FUEL CONTAMINATION
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Below Specification

- Go To [2](#)

Within Specification

- Go To [4](#)

2. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Raise vehicle on hoist, and disconnect the fuel supply line at the fuel pump module.

Install special tool #6539 (5/16") #6631(3/8") fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes

- Visually and physically inspect the fuel supply lines between the fuel tank and the fuel rail. Repair/replace as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. CHECKING THE FUEL INLET STRAINER

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair/replace as necessary.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Turn the ignition off.

Install special tool #6539 (5/16") or #6631 (3/8") fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the fuel pressure drop?

Yes

- Replace Fuel Pump Module.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 kPa +/- 34 kPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 kPa (35 psi)

Does the fuel pressure drop?

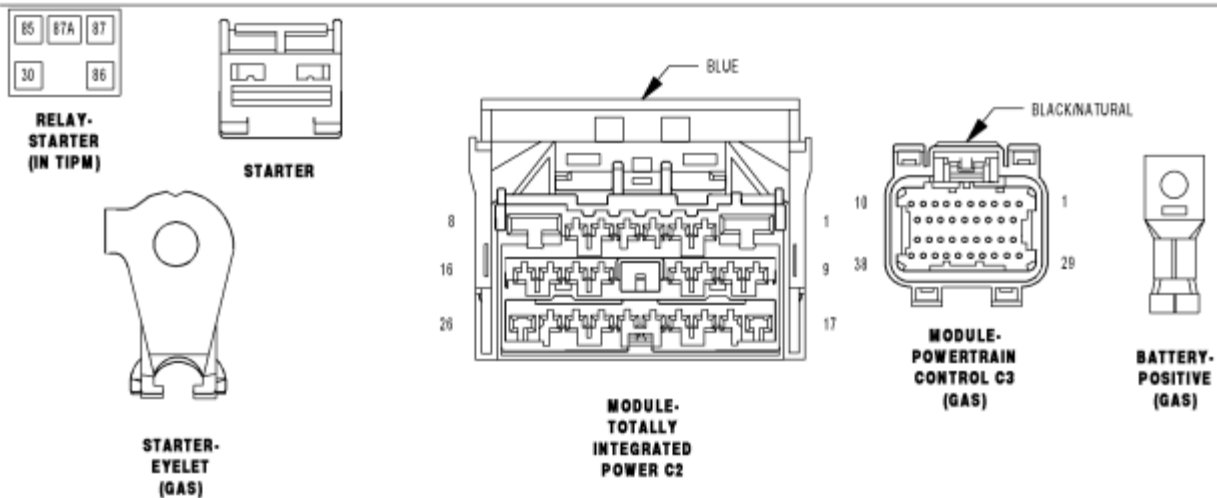
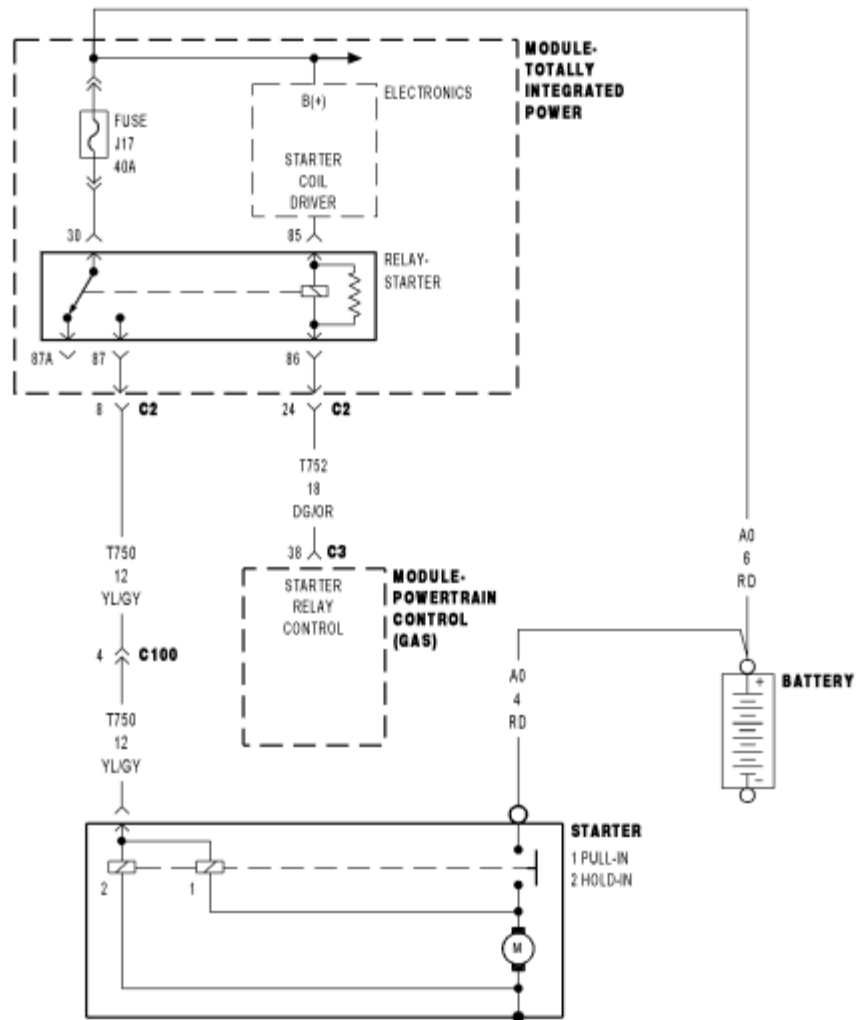
Yes

- Replace the leaking fuel injectors.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Check the fuel for contaminants.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

***NO CRANK CONDITION**



01020039

For a complete wiring diagram **Refer to Section 8W.**

MECHANICAL CONDITION
FUSED B+ CIRCUITS OPEN
BATTERY CIRCUIT RESISTANCE TOO HIGH
(T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(T752) STARTER RELAY CONTROL CIRCUIT OPEN
(T750) STARTER RELAY OUTPUT CIRCUIT SHORTED TO GROUND
(T750) STARTER RELAY OUTPUT CIRCUIT OPEN
TRANSMISSION RANGE SENSOR
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE (PCM)
STARTER

Diagnostic Test

1. MECHANICAL CONDITION

NOTE: Verify the battery is fully charged and capable of passing a load test before continuing.

WARNING: Make sure the battery is disconnected, then wait two minutes before proceeding. Failure to do so may result in personal injury or possible death.

Turn the engine over by hand to make sure the engine is not seized.

Is the engine able to turn over?

Yes

- Go To [2](#)

No

- Repair the mechanical condition preventing the starter motor from cranking.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

2. PCM FUSED B+ CIRCUITS

Turn the ignition off.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, probe the Fused B+ circuits at the appropriate terminals of special too #8815.

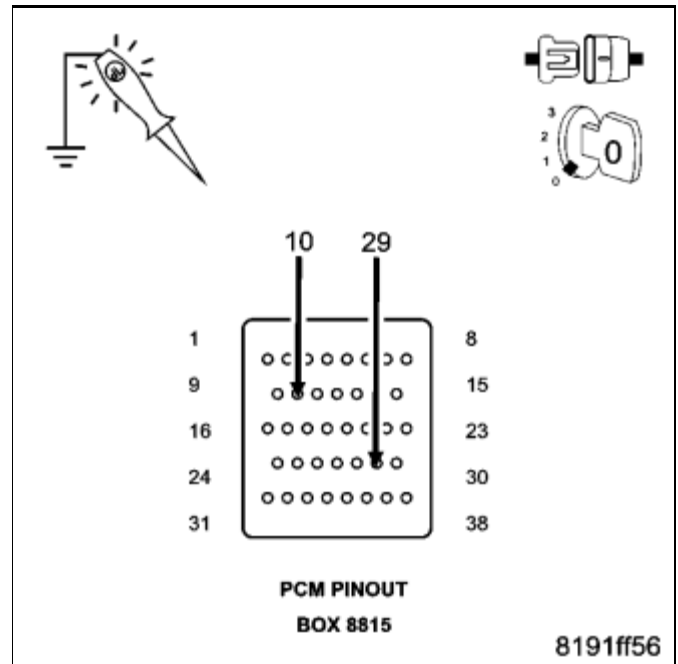
Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the open or short to ground in the PCM Fused B+ circuits.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

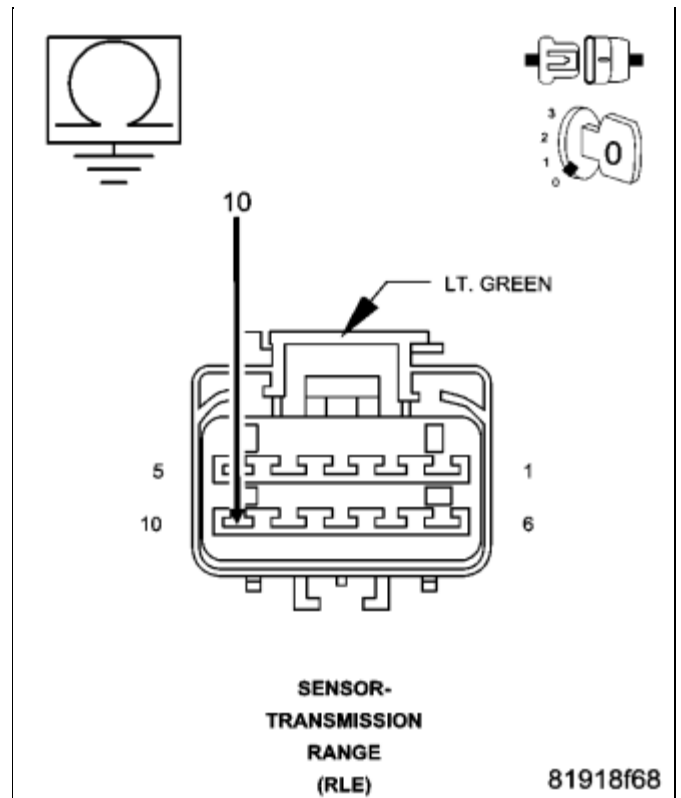


3. TRANSMISSION RANGE SENSOR

Turn the ignition off.
Disconnect the TRS harness connectors.
Move the Gear selector through all gear positions, from Park to 1st and back.
While moving the gear selector through each gear, measure the resistance between ground and the TRS (T41) Sense (P/N Sense) circuit at the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded) ?



Yes

- Go To [4](#)

No

- Replace the Transmission Range Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. EXCESSIVE RESISTANCE IN THE BATTERY CIRCUIT

Turn the ignition off.

Check the Battery Cables for excessive resistance using the service information procedure.

Did either Battery Cable have a voltage drop greater than 0.2 of a volt?

Yes

- Repair the excessive resistance in the Battery circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [5](#)

5. STARTER

CAUTION: The Parking Brake must be on and the Transmission must be in park for a vehicle equipped with an automatic transmission.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Turn ignition off.
Disconnect the Starter Solenoid harness connector.

NOTE: The Starter Solenoid harness connector must remain disconnected at this time.

Have an assistant turn the ignition key to the CRANK position.

Using a 12-volt test light connected ground, probe the (T750) Starter Relay Output circuit in the Starter Solenoid harness connector while the ignition key is in the CRANK position.

Does the test light illuminate brightly?

Yes

- Replace the Starter per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

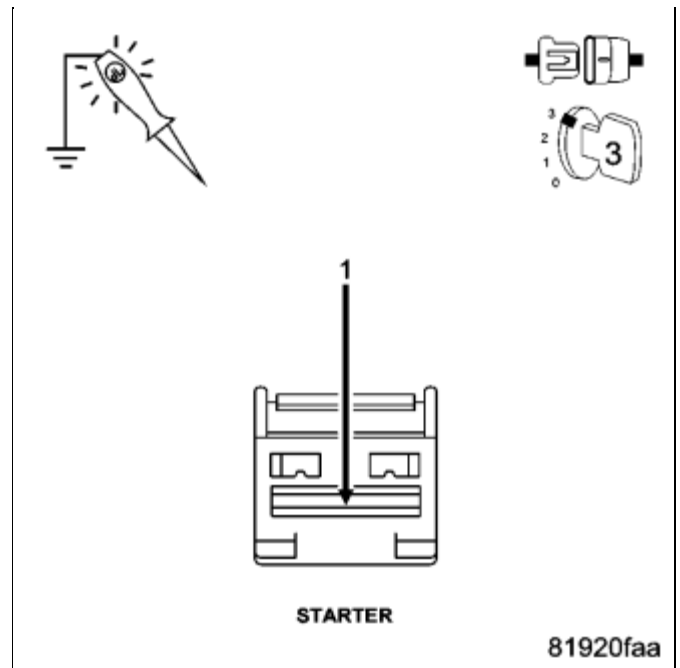
No

- Go To [6](#)

6. (T752) STARTER RELAY CONTROL CIRCUIT CHECK

Turn the ignition off.
Disconnect the C2 TIPM harness connector.
Use a 12-volt test light connected to ground and probe the (T752) Starter Relay Control circuit in the C2 TIPM harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.



Have an assistant turn the key to the CRANK position.

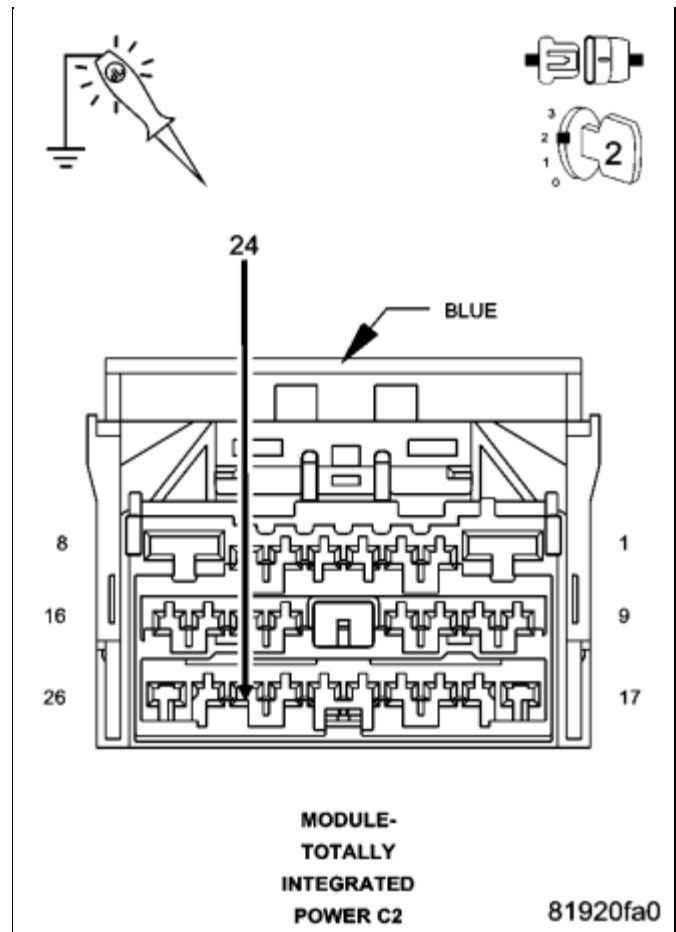
Does the test light illuminate brightly when the key is turned to the crank condition?

Yes

- Go To [7](#)

No

- Repair the excessive resistance or short to ground in the (T752) Starter Relay Control circuit between the PCM and TIPM.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



7. (T750) STARTER CONTROL OUTPUT CIRCUIT OPEN

Disconnect the Starter Solenoid connector.
Measure the resistance of the (T750) Starter Control Output circuit between the Starter Solenoid harness connector and the C2 TIPM harness connector.

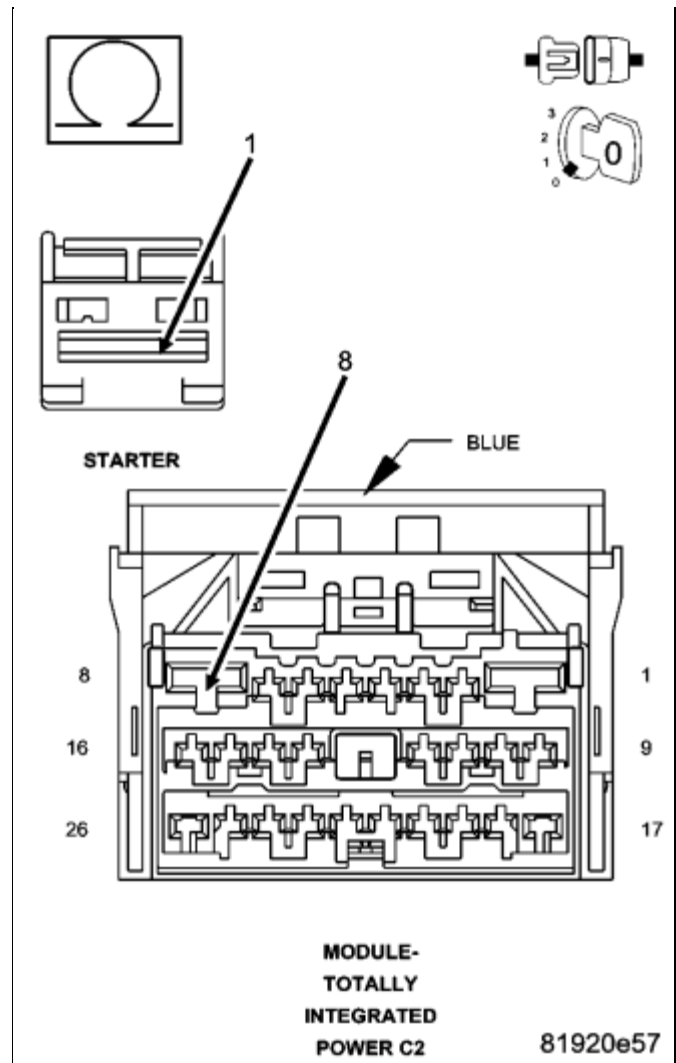
Is the resistance below 5.0 ohms?

Yes

- Go To [8](#)

No

- Repair the open in the (T750) Starter Control Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



8. (T750) STARTER RELAY OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (T750) Starter Relay Output circuit in the Starter Solenoid harness connector.

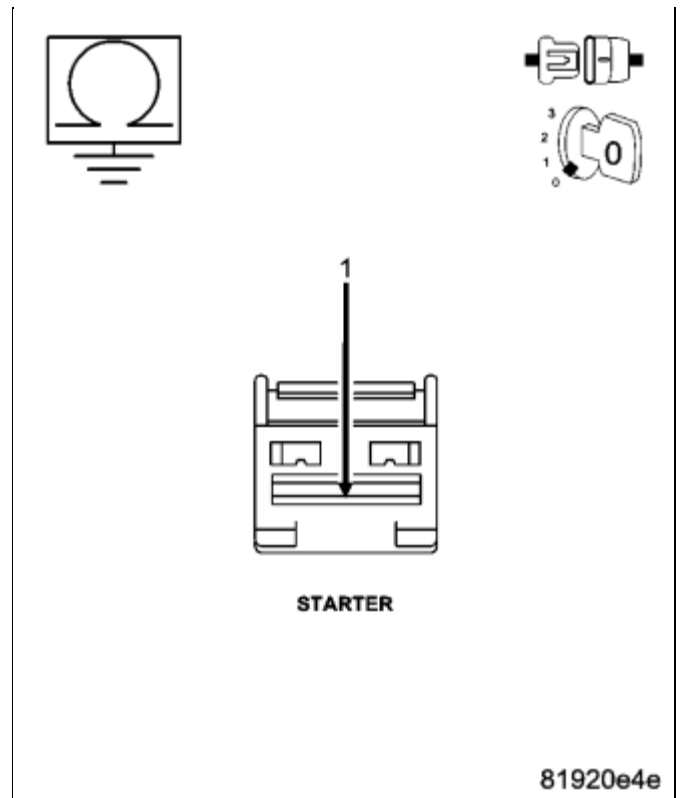
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (T750) Starter Relay Output circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)



9. TOTALLY INTEGRATED POWER MODULE (TIPM)

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors.
Pay particular attention to all Power and Ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Totally Integrated Power Module in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE.)

*NO RESPONSE WITH A NO START CONDITION

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes

(A209) PCM FUSED B+ CIRCUIT
PCM NO RESPONSE
(F1) PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
(Z903) PCM GROUND CIRCUITS
CRANKSHAFT POSITION SENSOR
(F855) 5-VOLT SENSOR OPEN/SHORTED
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
PCM

Diagnostic Test

1. (A209) PCM FUSED B+ CIRCUIT

NOTE: The scan tool and cable must be operating properly for the results of this test to be valid.

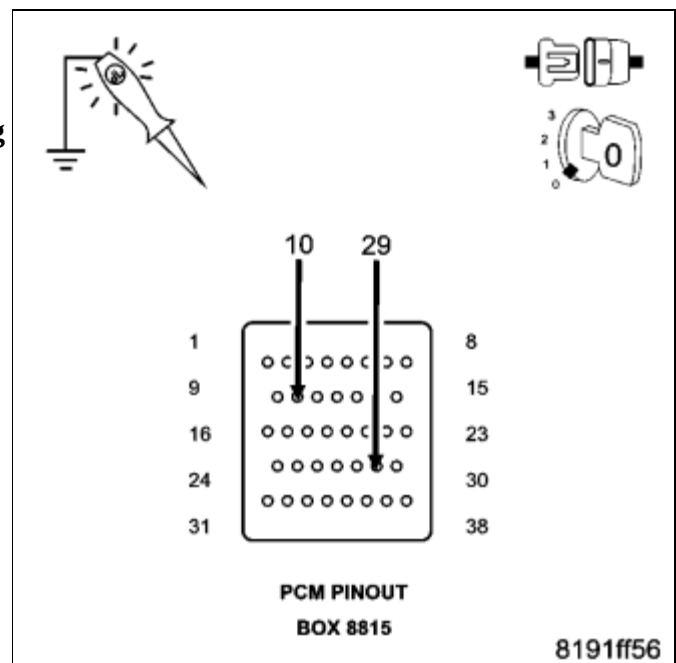
NOTE: Make sure the ignition switch was on while trying to communicate with the PCM.

Turn the ignition off.
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground probe the appropriate terminal of special tool #8815.

Does the test light illuminate brightly?



Yes

- Go To [2](#)

No

- Repair the open or short to ground in the (A209) Fused B+ circuit. Inspect and replace fuses as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

2. (F1) PCM FUSED IGNITION SWITCH CIRCUIT

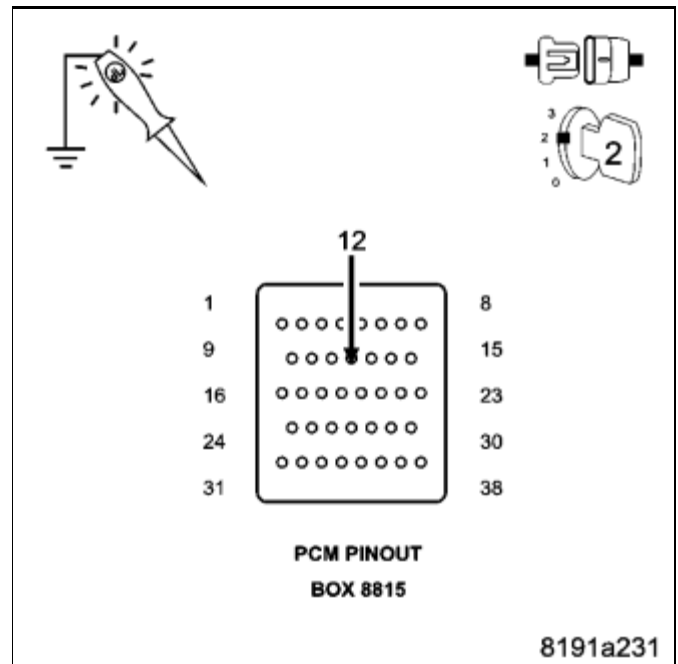
Using a 12-volt test light connected to ground, probe the (F1) PCM Fused Ignition Switch Output circuit in the appropriate terminals of special tool #8815.

Does the test light illuminate brightly?**Yes**

- Go To [3](#)

No

- Repair the (F1) Ignition Switch Output circuit. Inspect and replace fuses as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



3. (Z903) PCM GROUND CIRCUITS

Using a 12-volt test light connected to battery voltage, probe the (Z903) PCM ground circuits in the appropriate terminals of special tool #8815.

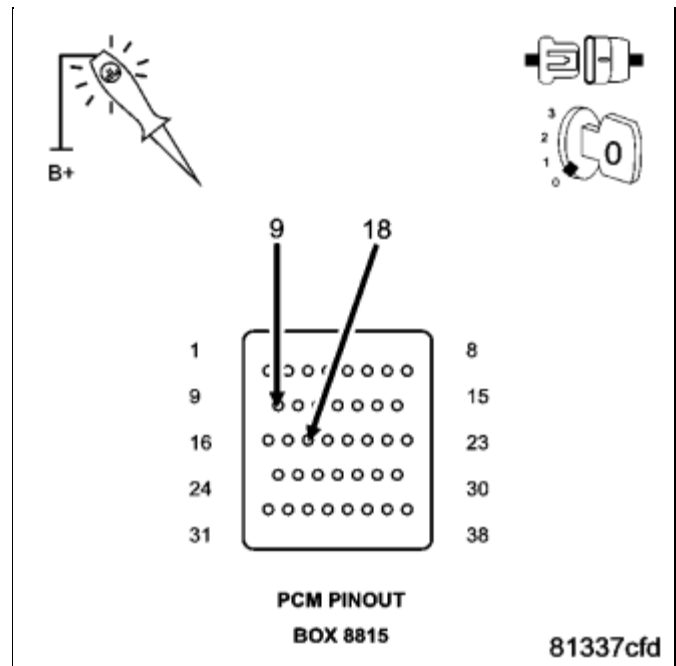
Does the test light illuminate brightly?**Yes**

- Go To [4](#)

No

- Repair the (Z903) PCM ground circuits.

- Perform the POWERTRAIN VERIFICATION TEST.
(Refer to 9 - ENGINE - STANDARD PROCEDURE.)



4. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Connect the C2 PCM harness connector.
Disconnect the Crankshaft Position Sensor harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit.

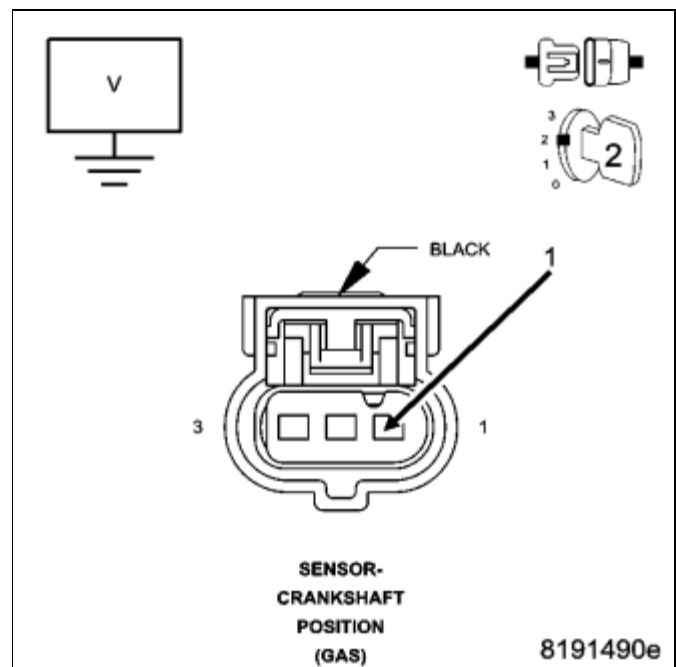
Is the voltage between 4.5 and 5.2 volts?

Yes

- Go To [5](#)

No

- Go To [6](#)



5. CKP SENSOR

Turn the ignition off.
Disconnect the Throttle Body harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit in

the Throttle Body harness connector.

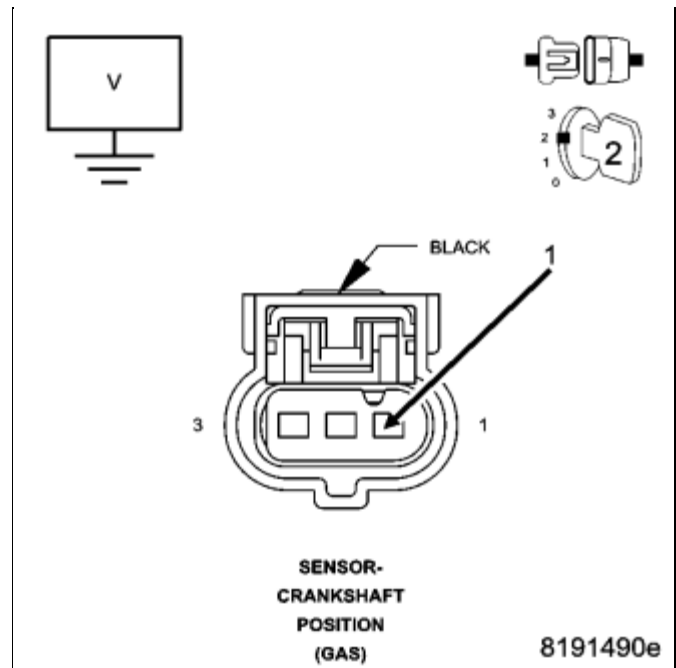
Is the voltage between 4.5 and 5.2 volts?

Yes

- If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace the Crankshaft Position Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)



6. (F855) 5-VOLT SENSOR OPEN/SHORTED

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit.

Disconnect all the sensors that use the (F855) 5-volt Supply circuit.

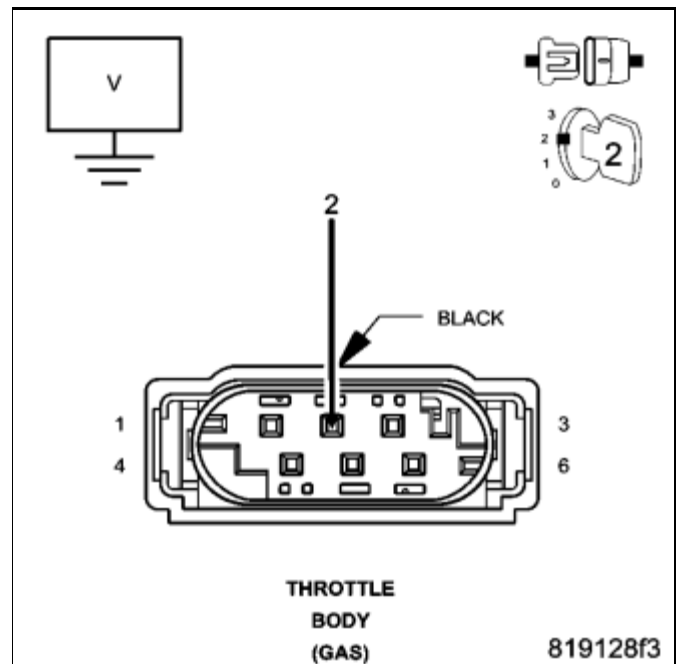
Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors.

Yes

- Replace the sensor that is pulling down the (F855) 5-volt supply.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)



7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect PCM harness connectors.

Disconnect all the sensors that share the (F855) 5-volt Supply circuit.

Measure the resistance between ground and the (F855) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F855) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [8](#)

8. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Disconnect all the sensors that share the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (F856) 5-volt Supply circuit.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [9](#)

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Replace and program the Powertrain Control Module per Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

***START AND STALL CONDITION**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
CURRENT PCM DTCS
CURRENT SKIM DTCS
THROTTLE POSITION SENSOR SWEEP
TP SENSOR 1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
ECT SENSOR
OTHER POSSIBLE CAUSES FOR START AND STALL CONDITION
FUEL CONTAMINATION

Diagnostic Test**1. CHECKING DTCS**

Ignition on, engine not running.
With a scan tool, select View DTCS.

Are any DTCS present?**Yes**

- Refer to the appropriate Diagnostic Procedure.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [2](#)

2. CHECKING SKREEM DTCS

NOTE: If you are unable to communicate with the SKIM/SKREEM, refer to the VEHICLE THEFT AND SECURITY ELECTRICAL DIAGNOSTICS in Section 8 and perform the appropriate diagnostics.

With the scan tool, read the SKIM codes.

Are there any SKREEM DTCS?

Yes

- Refer to the Sentry Key Vehicle Theft Security Electrical Diagnostics in Section 8.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [3](#)

3. TP SENSOR SWEEP

Ignition on, engine not running.

With the scan tool read TP Sensor voltage.

On vehicles equipped with an electronic throttle body, use a scan tool to perform the ETC Throttle Follower test and monitor both TP Sensor voltage readings.

Was the voltage change smooth?

Yes

- Go To [4](#)

No

- Replace the Throttle Body Assembly on an ETC throttle body.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

4. TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED

With the scan tool, read Throttle Position Sensor No.1 voltage.

Throttle must be against its stop.

Is the voltage 0.92 or less with the Throttle closed?

Yes

- Go To [5](#)

No

- Check for a binding throttle condition. If OK, replace the Throttle Position Sensor or the Throttle Body Assembly for ETC vehicles.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

5. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soaked).

NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.

Ignition on, engine not running.
With the scan tool, read the ECT value.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)?

Yes

- Go To [6](#)

No

- Replace the Engine Coolant Temperature Sensor.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

6. OTHER POSSIBLE CAUSES OF START AND STALL CONDITION

The following additional items should be checked as a possible cause for a start and stall condition. Refer to any Technical Service Bulletins (TSBs) that may apply to the symptom.

The exhaust system must be free of any restrictions.

The engine compression must be within specifications.

The engine valve timing must be within specifications.

The engine must be free from vacuum leaks.

The throttle body must be free of carbon buildup and dirt.

Do any of the above conditions exist?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

No

- Go To [7](#)

7. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.
Follow the diagnostics for Checking Fuel Delivery in this manual.

Was the No Start condition solved after following the above diagnostic test?

Yes

- Test Complete.

No

- Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE.)

STANDARD PROCEDURE

PCM/ECM REPROGRAMMING - GAS

MODULE REPROGRAMING

Replacement PCM's will require programming utilizing the StarSCAN® or equivalent. The PCM will not operate the engine until it is programmed. A Diagnostic Trouble Code (DTC) will be set - "not programmed".

CAUTION: Extreme care must be taken when programming a calibration into a generic PCM. Do not randomly select a calibration. Once a calibration is selected and programmed, the controller cannot be reprogrammed to a different calibration. The module can only be reprogrammed to a more recent version of that calibration.

SPECIAL TOOLS/EQUIPMENT OR EQUIVALENT REQUIRED:

NPN	Battery Charger
-----	-----------------

CH9401	StarSCAN® Tool
CH9404	StarSCAN® Vehicle Cable
CH9409	StarSCAN® Documentation Kit
CH9410	StarSCAN® Ethernet Cable, 12 ft.
CH9412	StarSCAN® Software Update Device Kit
	TechCONNECT PC or equivalent
	StarSCAN® Software Update CD

****REPAIR PROCEDURE - USING THE INTERNET TO RETRIEVE THE FLASH FILE:**

NOTE: The StarSCAN® or equivalent diagnostic scan tool fully supports Internet connectivity. However, in order to take advantage of this feature you must first configure the StarSCAN® or equivalent for your dealership's network. For instruction on setting up your StarSCAN® or equivalent for the dealer's network; refer to the StarSCAN® or equivalent Quick Start Networking Guide available on DealerCONNECT > Service > StarSCAN® or equivalent and StarMOBILE Tools >Online Documentation or at www.dcctools.com website under the download center.

NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9410 StarSCAN® or equivalent ethernet cable to the StarSCAN® or equivalent and the dealer's network drop.
3. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent and the vehicle.
4. Power ON the StarSCAN® or equivalent.
5. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the "Home" screen:
 - a. Select "ECU View"
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select "More Options"
 - d. Select "ECU Flash"
 - e. Record the part number at the top of the "Flash PCM" screen for later reference.
6. Replace the PCM with the appropriate Generic PCM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Powertrain Control Module, Removal.
7. Program the PCM as follows:
 - a. Using the StarSCAN® or equivalent at the "Home" screen, Select "ECU View"
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select "More Options"
 - d. Select "ECU Flash"

- e. Select “Browse for New File”. Follow the on screen instructions.
- f. Highlight the appropriate calibration based on the part number recorded in Step 5.
- g. Select “Download to Scantool”.
- h. Select “Close” after the download is complete, then select “Back”.
- i. Highlight the listed calibration.
- j. Select “Update Controller”. Follow on screen instructions.
- k. When the update is complete, select “OK”.
- l. Verify the part number at the top of the “Flash PCM” screen has updated to the new part number.
- 8. Is this a GPEC Module?
 - a. Yes >> go to [STEP 9](#).
 - b. No >> go to [STEP 12](#).
- 9. Do not start the engine prior to completing the following steps (a. and b.)
 - a. Turn the ignition switch to the OFF position for no less than 15 seconds.
 - b. Turn the ignition to the RUN position (DO NOT CRANK THE ENGINE) for no less than 20 seconds.
- 10. Is this vehicle equipped with a CVT?
 - a. Yes >> go to [STEP 11](#).
 - b. No >> go to [STEP 17](#).
- 11. The TCM must be reprogrammed as follows:
 - a. Using the StarSCAN® or equivalent at the “Home” screen, Select “ECU View”
 - b. Touch the screen to highlight the TCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Record the part number at the top of the “Flash TCM” screen for later reference.
 - f. Select “Browse for New File”. Follow the on screen instructions.

NOTE: If the part number recorded in step “11e” is the same as the new p/n shown on the “Flash File List” screen no further action is required. Cancel the TCM reprogram procedure. Continue to step [STEP 17](#).

- g. Highlight the appropriate calibration.
- h. Select “Download to Scantool”.
- i. Select “Close” after the download is complete, then select “Back”.
- j. Highlight the listed calibration.
- k. Select “Update Controller”. Follow on screen instructions.
- l. When the update is complete, select “OK”.
- m. Verify the part number at the top of the “Flash TCM” screen has updated to the new part number.
- n. Continue to step [STEP 15](#)
- 12. Is “WCM - Wireless Control Module” displayed in the “ECU Overview” screen list of modules?
 - a. Yes >> go to [STEP 13](#).
 - b. No >> go to [STEP 14](#).
- 13. Program the PCM to the Wireless Control Module (WCM).
 - a. Highlight the WCM.
 - b. Select “Misc. Function”.
 - c. Highlight “PCM Replaced”.
 - d. Select “Start”
 - e. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.
 - f. When complete proceed to [STEP 15](#).
- 14. Program the VIN into the PCM.
 - a. Scroll through the list of controllers and highlight the PCM.
 - b. Select “Misc. Function”.
 - c. Highlight “Check PCM VIN”.
 - d. Select “Start”

- e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.
 - f. Unplug the scan tool from the Data Link Connector.
 - g. At the “Vehicle Disconnected” screen, press “OK”.
 - h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.
15. Is the vehicle equipped ETC?
- a. Yes >> go to [STEP 17](#).
 - b. No >> go to [STEP 16](#).
16. Using the StarSCAN® or equivalent at the “Home” screen:
- a. Select ECU View
 - b. Scroll through the list of controllers and highlight the PCM.
 - c. Select Misc. Function.
 - d. Highlight “Learn ETC”.
 - e. Select “Start”
 - f. Follow the on screen instructions. Select Next after each step . Select Finish after completing the last step.

NOTE: Due to the PCM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKREEM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. From the Home screen select System View. Then select All DTCs. Press Clear All Stored DTCs if there are any DTCs shown on the list.

NOTE: The following step is required by law when reprogramming a PCM and/or TCM.

17. Type the necessary information on the Authorized Modification Label p/n 04275086AB and attach near the VECI label .

DaimlerChrysler AUTHORIZED MODIFICATIONS THESE MODIFICATIONS HAVE BEEN APPROVED AS APPROPRIATE, BY SRV AND CSRV.

THE FOLLOWING MODIFICATIONS HAVE BEEN MADE:

1

CHANGE AUTHORITY 2 DEALER CODE 3 DATE 4

80F34528

REPAIR PROCEDURE USING SOFTWARE UPDATE CD TO RETRIEVE THE FLASH FILE:

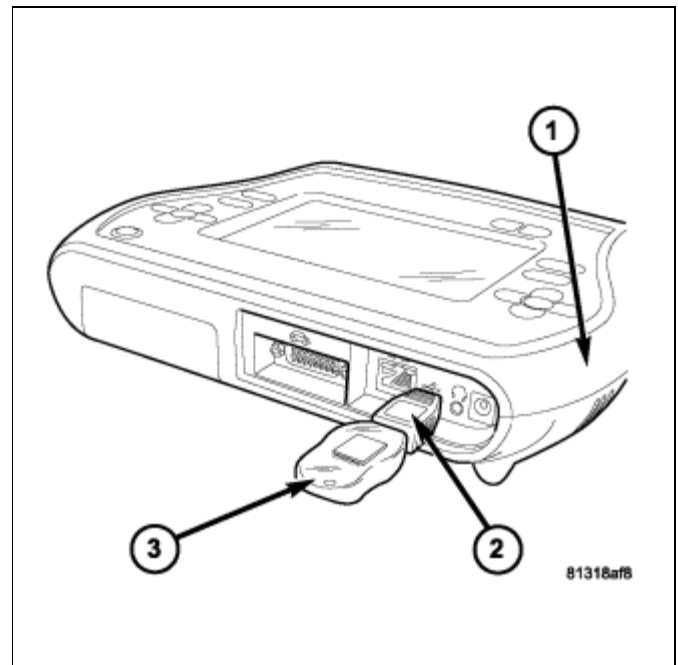
NOTE: If this flash process is interrupted/aborted, the flash should be restarted.

NOTE: For detailed information on the operation of the StarSCAN® or equivalent, refer to the Quick Reference documentation provided in the StarSCAN® or equivalent documentation kit. In addition, more recent information may also be available at the www.dcctools.com website. Look under Training Aids and also under Download Center > Frequently Asked Questions for more help.

1. Open the hood, install a battery charger and verify that the charging rate provides approximately 13.5 volts. Set the battery charger timer to maintain the charging voltage for the duration of the flash process.
2. Connect the CH9404 StarSCAN® or equivalent vehicle cable to the StarSCAN® or equivalent and the vehicle.

3. Power ON the StarSCAN® or equivalent.
4. Retrieve the old ECU part number. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “ECU View”
 - b. Touch the screen to highlight the PCM in the list of modules.
 - c. Select “More Options”
 - d. Select “ECU Flash”
 - e. Record the part number at the top of the “Flash PCM” screen for later reference.
5. Replace the PCM with the appropriate Generic PCM. Refer to the detailed service information available in TechCONNECT, under: Service Info, 8-Electrical, Electronic Control Module, Powertrain Control Module, Removal.
6. Insert the StarSCAN® or equivalent Software Update CD into the TechCONNECT or equivalent PC. The StarSCAN® or equivalent Software Update CD will start automatically. Select “Download Flash Updates”.
7. At the “**Select a method for looking up controller flash updates.**” screen:
 - a. Select “Enter part number”. Enter the “Part Number” recorded in [STEP 4](#) when prompted to do so.
 - b. Using the mouse highlight the appropriate “Calibration”. Select “Next”.
 - c. Follow the on screen instructions.
 - d. When completed, proceed to [STEP 8](#).
8. With the StarSCAN® or equivalent powered OFF, connect the USB Key and Gender Changer to the StarSCAN® or equivalent USB port .

9. Connect the StarSCAN® or equivalent to the vehicle (if not already connected).
10. Power ON the StarSCAN® or equivalent.
11. Download the flash file from the USB key to the StarSCAN® or equivalent. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “Flash Download”, then select “Retrieve files from the USB storage device”
 - b. Highlight the appropriate calibration. Select “Download to Scan Tool”
 - c. When the download is complete, select “Close” and “Back”.
12. Reprogram the ECU. Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “ECU View”.
 - b. Select More Options”.
 - c. Select “ECU Flash”.
 - d. Highlight the appropriate calibration.
 - e. Select “Update Controller”. Follow the on screen instructions.
 - f. When the update is complete, select “OK”.
 - g. Verify the part number at the top of the “Flash PCM” screen has updated to the new part number.
13. Is “WCM - Wireless Control Module” displayed in the “ECU Overview” screen list of modules?
 - a. Yes >> go to [STEP 14](#).
 - b. No >> go to [STEP 15](#).
14. Program the PCM to the Wireless Control Module (WCM). Using the StarSCAN® or equivalent at the “Home” screen:
 - a. Select “ECU View”
 - b. Scroll through the list of controllers and highlight the WCM.
 - c. Select “Misc. Function”.
 - d. Highlight “PCM Replaced”.
 - e. Select “Start”
 - f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.



g. When complete proceed to [STEP 16](#).

15. Program the VIN into the PCM.

a. Scroll through the list of controllers and highlight the PCM.

b. Select “Misc. Function”.

c. Highlight “Check PCM VIN”.

d. Select “Start”

e. Follow the on screen instructions. Select “Next” after each step . When the window appears with 17 boxes, select “Show Keyboard”. Place the cursor to the right of the last box and then backspace to delete the boxes from the window. Enter the VIN. Select “Finish” after completing the last step.

f. Unplug the scan tool from the Data Link Connector.

g. At the “Vehicle Disconnected” screen, press “OK”.

h. Connect the scan tool to the Data Link Connector and verify that the VIN is visible at the top of the “Home” screen.

16. Is the vehicle equipped with a 3.7L or 4.7L engine?

a. Yes >> go to [STEP 18](#).

b. No >> go to [STEP 17](#).

17. Using the StarSCAN® or equivalent at the “Home” screen:

a. Select “ECU View”

b. Scroll through the list of controllers and highlight the PCM.

c. Select “Misc. Function”.

d. Highlight “Learn ETC”.

e. Select “Start”

f. Follow the on screen instructions. Select “Next” after each step . Select “Finish” after completing the last step.

NOTE: Due to the PCM programming procedure, a DTC may be set in other modules (TCM, BCM, MIC, SKIM, etc.) within the vehicle, if so equipped. Some DTC's may cause the MIL to illuminate. Check all modules using “ECU View” from the Home screen, record the DTC's, and erase these DTC's prior to returning the vehicle to the customer. Erase any DTC's in the PCM only after all other modules have had their DTC's erased.

NOTE: The following step is required by law.

18. Type the necessary information on the “Authorized Modification Label” p/n 04275086AB and attach near the VECI label . **

POWERTRAIN VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SELECTING THE PROPER VERIFICATION TEST

The following verification test are for different repairs . Select the appropriate Verification test for the repair that has been completed.

Speed Control repair

- Go To [2](#)

Charging System repair

- Go To [3](#)

NVLD System repair

- Go To [4](#)

All other repairs

- Go To [5](#)

2. POWERTRAIN VERIFICATION TEST 1

NOTE: 1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all engine components are properly installed and connected.
6. Connect the scan tool to the data link connector and erase all codes.
7. Turn the speed control ON (if equipped, cruise light will be on).
8. Depress and release the SET Switch when the vehicle speed is greater than 56 km/h (35 mph). The speed control should engage and hold the selected speed.
9. Press and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 3 km/h (2 mph).
10. Press and hold the COAST switch. The vehicle speed should decrease.
11. Using caution, press and release the brake pedal. The speed control should disengage.
12. Bring the vehicle speed back up to 56 km/h (35 mph).
13. Press the RESUME/ACCEL switch. The speed control should resume the previously set speed.
14. Hold down the SET switch. The vehicle should decelerate.

15. Make sure vehicle speed is greater than 56 km/h (35 mph) and release the SET Switch. The vehicle should adjust and set a new vehicle speed.
16. Press and release the CANCEL switch. The speed control should disengage.
17. Bring the vehicle speed back up above 56 km/h (35 mph) and engage speed control.
18. Turn the Speed Control Off. (Cruise light will be off). The speed control should disengage.

NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.

19. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as "lift foot set"), the vehicle may accelerate and exceed the desired set speed by up to 8 km/h (5 mph).
20. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.
21. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.
22. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.
23. If the "lift foot sets" are continually used, a speed control overshoot/undershoot condition will develop.
24. To "unlearn" the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).
25. Then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.
26. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

Yes

- Repair is complete.

No

- Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

3. POWERTRAIN VERIFICATION TEST 2

1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly has been replaced use a scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using

the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all components related to the repair are properly installed and connected.
6. With the scan tool, clear DTCs.
7. Perform generator output test. Refer to the appropriate service information as necessary.
8. Start the engine and set engine speed to 2000 RPM for at least thirty seconds.
9. Cycle the ignition key off and on.
10. With the scan tool, read the DTCs.

Are any DTCs or symptoms remaining?

Yes

- Check for any Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

No

- Repair is complete.

4. POWERTRAIN VERIFICATION TEST 3

1. Install the Miller Tool #8404 Evaporative Emission Leak Detector (EELD) according to the instructions in the previous DTC table.
2. Set the smoke/air control switch to AIR.
3. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).
4. Press the remote smoke/air start button.
5. Position the red flag on the air flow meter so it is aligned with the indicator ball.
6. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size of leak indicated by the DTC set in the PCM.
7. Install the service port adapter #8404-14 on the vehicle's service port.
8. Connect the Air supply hose from the EELD to the vehicle.
9. Press the remote button to activate AIR flow.

NOTE: 10. Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

11. Compare the flow meter indicator ball reading to the red flag.
12. ABOVE the red flag indicates a leak present.
13. BELOW the red flag indicates a sealed system.

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

14. If the indicator ball shows a leak present, perform the smoke test indicated in the previous test and identify the leak and repair. Perform this verification test when the repair is complete.

Did the indicator ball indicate the a leak is present?

Yes

- Repeat the DTC test to identify the leak and repair.

No

- Repair is complete.

5. POWERTRAIN VERIFICATION TEST 4

NOTE: 1. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 2. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 3. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

NOTE: 4. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 5. When replacing an O2 Sensor, the PCM RAM memory must be cleared, either by disconnecting the PCM C1 connector or momentarily disconnecting the Battery negative terminal.

6. The NGC learns the characteristics of each O2 heater element and these old values should be cleared when installing a new O2 sensor. The customer may experience driveability issues if this is not performed.
7. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
8. Connect the scan tool to the data link connector.
9. Make sure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.
10. If the Catalyst was replaced, with the scan tool go to the Miscellaneous Menu Option "Catalyst Replaced" and press enter.
11. If a Comprehensive Component DTC was repaired, perform steps 12 - 14. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.
12. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.
13. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).
14. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Engine Electrical

Diagnostic List.

15. If the conditions cannot be duplicated, erase all DTCs with the Scan tool.

16. If another DTC has set, return to the Engine Electrical Diagnostic List and follow the path specified for that DTC.

Did the OBDII Monitor run successfully and has the Good Trip Counter changed to one or more?

Yes

- Repair is complete.

No

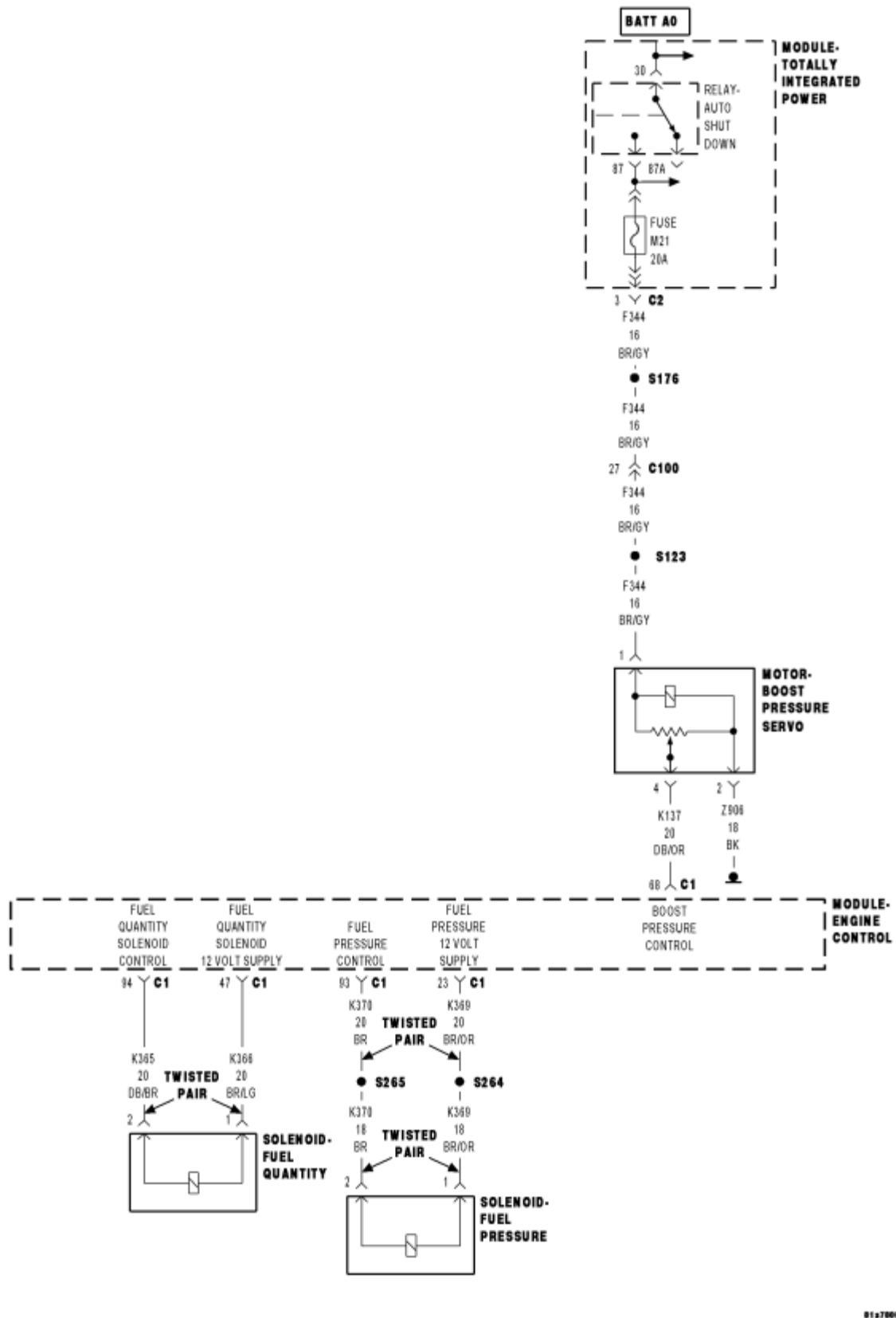
- Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

ENGINE ELECTRICAL DIAGNOSTICS - DIESEL

ENGINE ELECTRICAL DIAGNOSTICS - DIESEL

DIAGNOSIS AND TESTING

P0001 - FUEL QUANTITY CONTROL CIRCUIT/OPEN



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Fuel Quantity Solenoid (FQS) is a solenoid operated valve designed to regulate fuel volume to the fuel injection pump. The FQS valve is positioned in the inlet side of the fuel injection pump assembly. The solenoid receives 12-volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel injection pump inlet passage is open allowing full fuel flow to the pump chamber. When the ECM grounds the FQS control signal the solenoid valve closes the fuel inlet passage, preventing fuel from entering the pump chamber.

- **When Monitored:**

With the ignition on and the ECM command of the Fuel Quantity Solenoid off.

- **Set Condition:**

The ECM does not detect voltage on the (K365) Fuel Quantity Solenoid Control circuit for 0.2 seconds.

Possible Causes
INTERMITTENT DTC
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO (K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
FUEL QUANTITY SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
 With the scan tool, Clear DTCs in the Engine Control Module (ECM).
 With the scan tool, actuate the Fuel Quantity Solenoid at 100%.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Fuel Quantity Solenoid harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage of the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

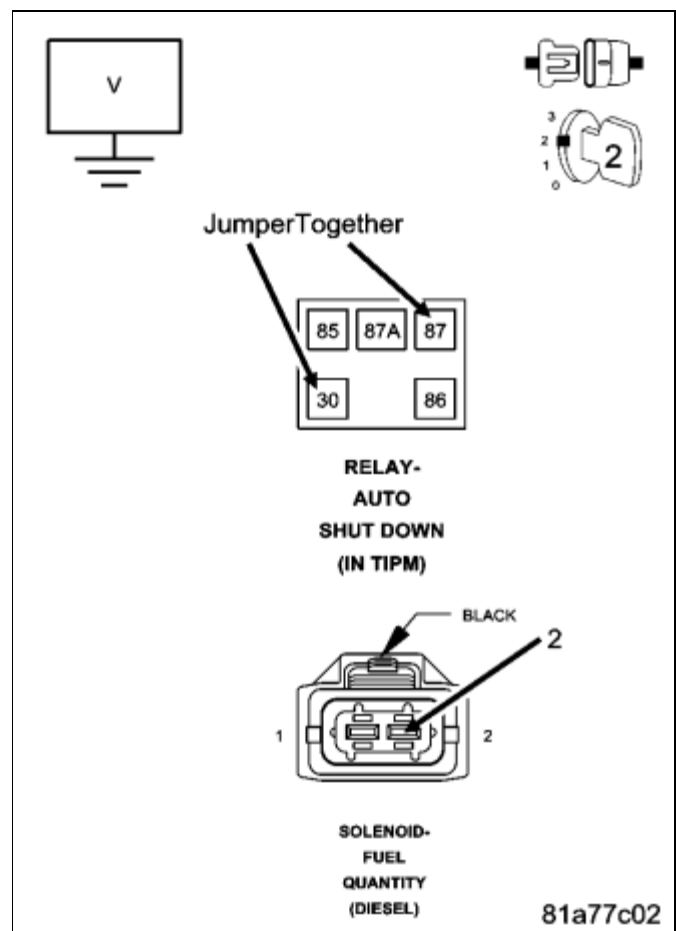
Is there any voltage present?

Yes

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

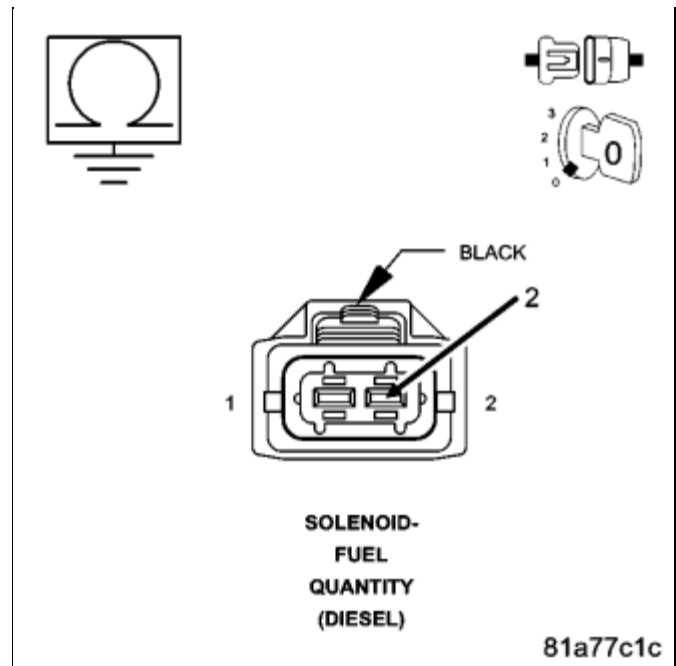
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO (K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT

Measure the resistance between the (K365) Fuel Quantity Solenoid Control circuit and the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit in the Fuel Quantity Solenoid harness connector.

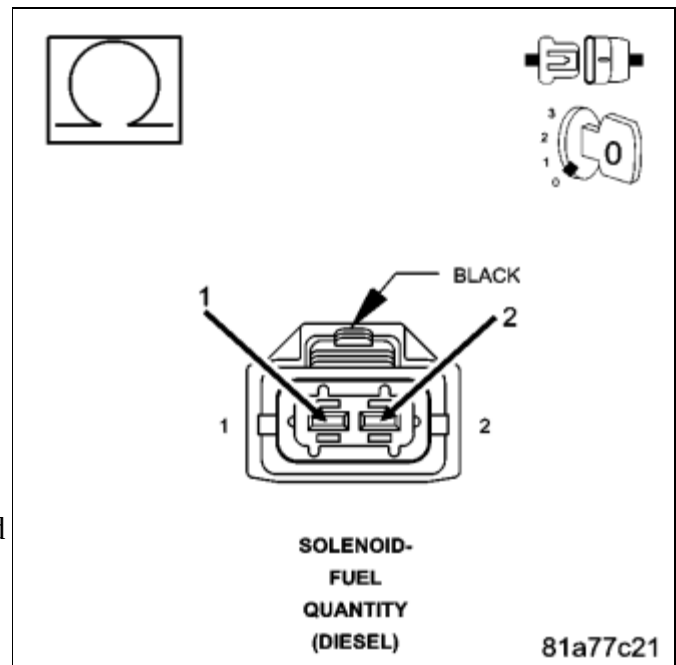
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K365) Fuel Quantity Solenoid Control circuit between the Fuel Quantity Solenoid harness

connector and the Engine Control Module (ECM) harness connector.

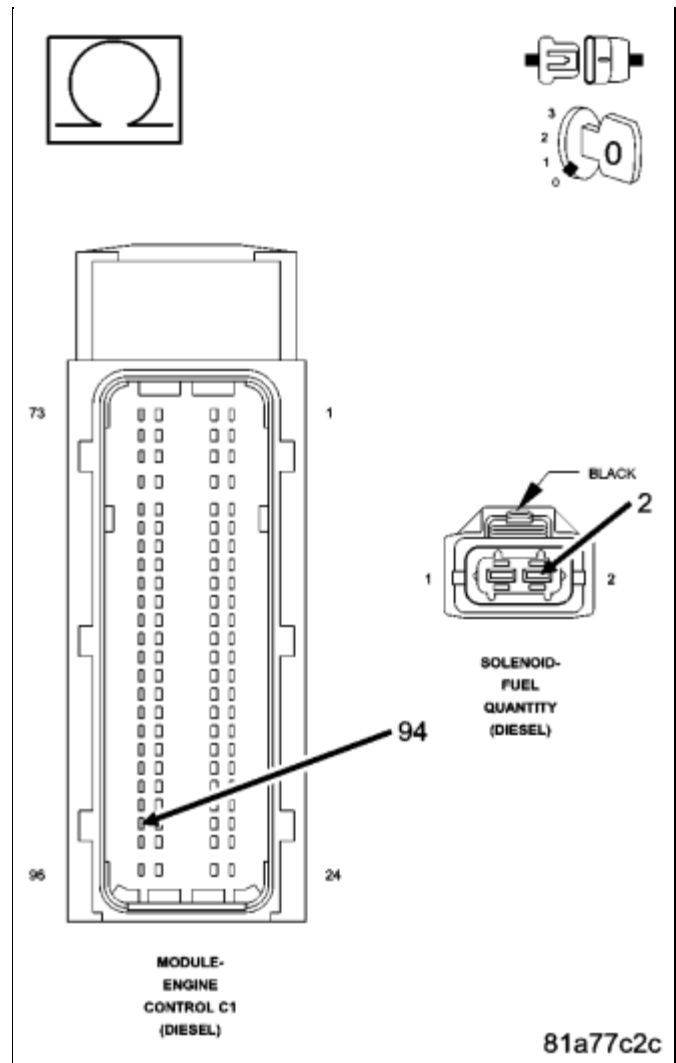
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit between the Fuel Quantity Solenoid harness connector and the Engine Control Module (ECM) harness connector.

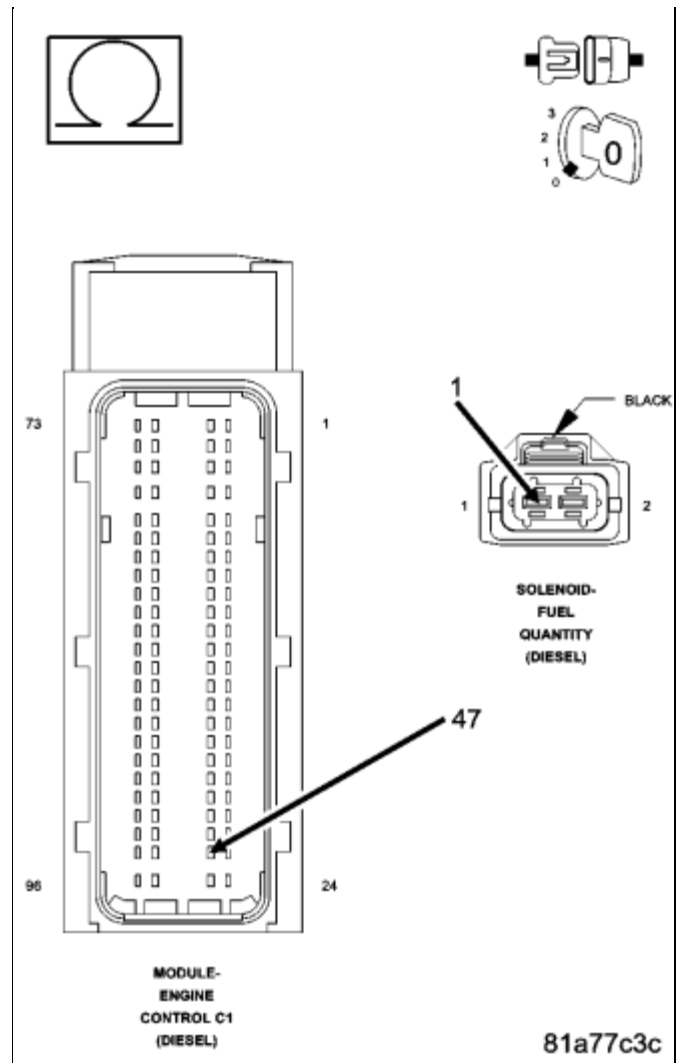
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. FUEL QUANTITY SOLENOID

Connect the Engine Control Module (ECM) harness connector.

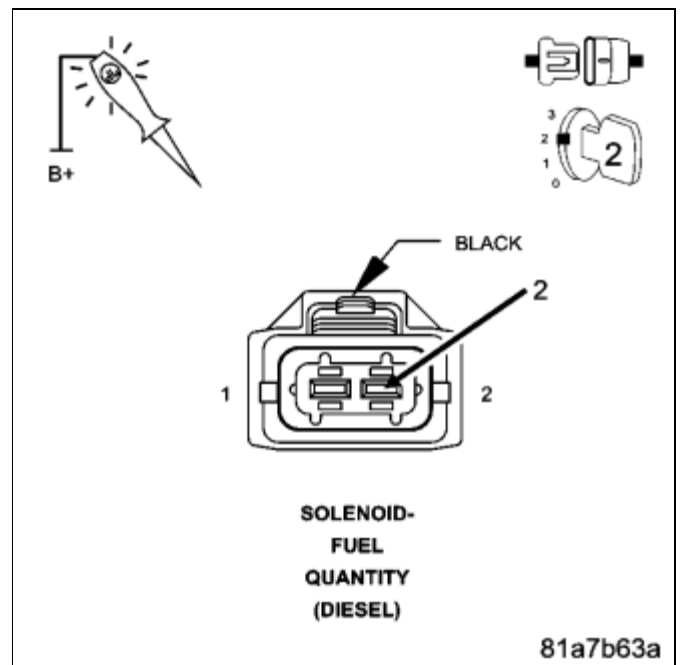
Turn the ignition on.

With the scan tool, actuate the Fuel Quantity Solenoid (CP3 Metering Pump) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

Is the test light illuminated and bright with the actuation at 100%?

Yes

- Replace the Fuel Quantity Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [8](#)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Quantity Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0003 - FUEL QUANTITY CONTROL CIRCUIT LOW

The Fuel Quantity Solenoid (FQS) is a solenoid operated valve designed to regulate fuel volume to the fuel injection pump. The FQS valve is positioned in the inlet side of the fuel injection pump assembly. The solenoid receives 12-volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel injection pump inlet passage is open allowing full fuel flow to the pump chamber. When the ECM grounds the FQS control signal the solenoid valve closes the fuel inlet passage, preventing fuel from entering the pump chamber.

- **When Monitored:**

With the ignition on and the ECM command of the Fuel Quantity Solenoid off.

- **Set Condition:**

The ECM detects that the (K365) Fuel Quantity Solenoid Control circuit voltage is shorted to ground for 0.2 seconds.

Possible Causes
INTERMITTENT DTC
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
FUEL QUANTITY SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Quantity Solenoid at 100%.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Fuel Quantity Solenoid harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

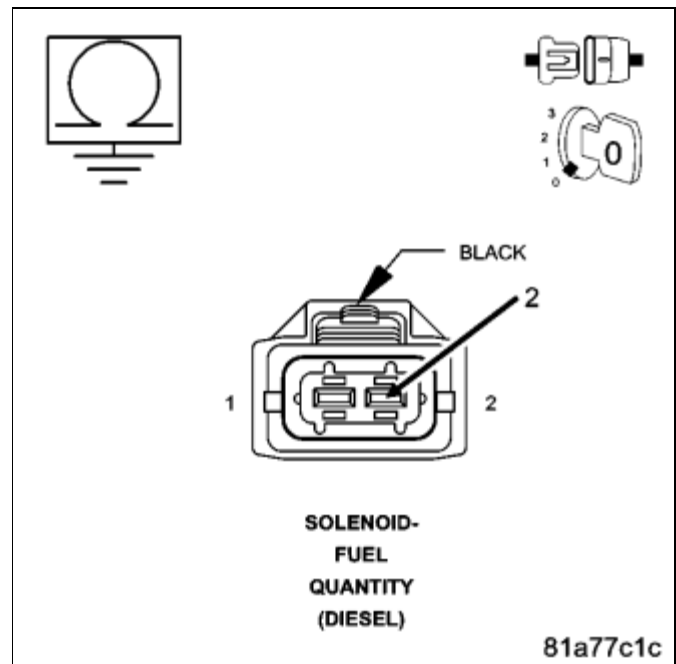
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K365) Fuel Quantity Solenoid Control circuit between the Fuel Quantity Solenoid harness connector and the Engine Control Module (ECM) harness connector.

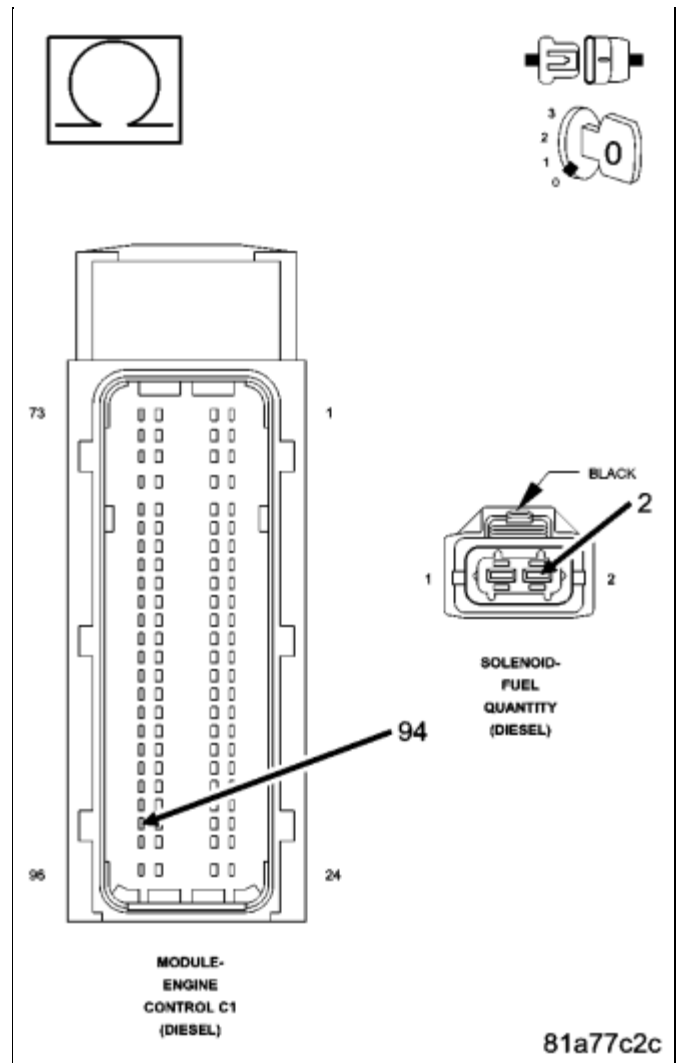
Is the resistance below 10.0 ohms?

Yes

- Go to [4](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit between the Fuel Quantity Solenoid harness connector and the Engine Control Module (ECM) harness connector.

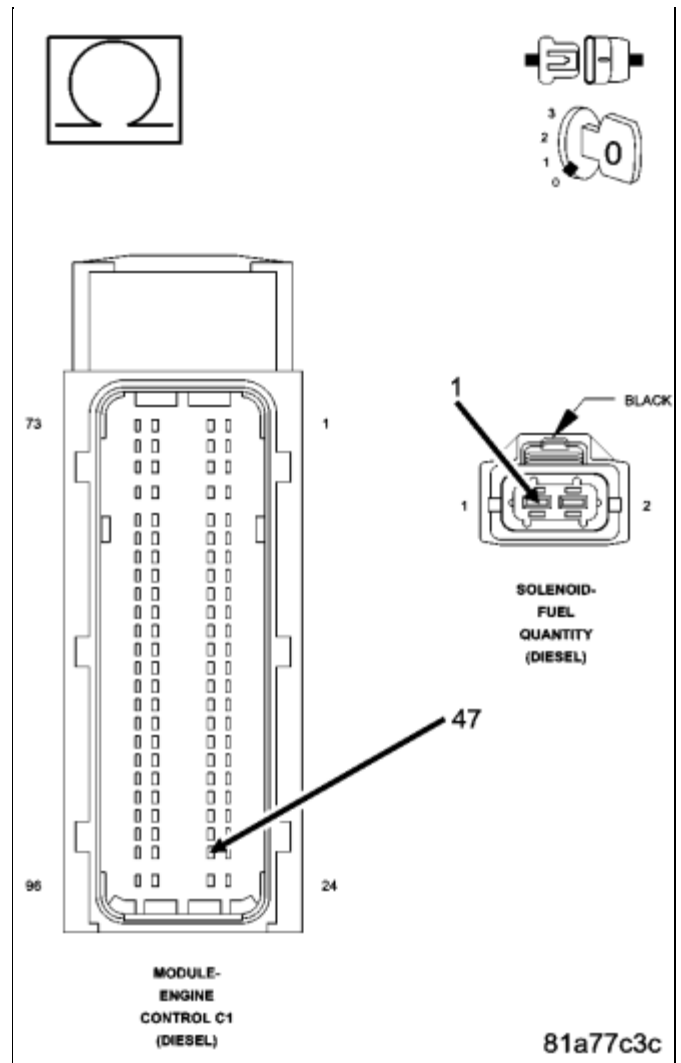
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 in the ASD Relay harness connector.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in ECM harness connector C2 cavities 1, 3 and 5.

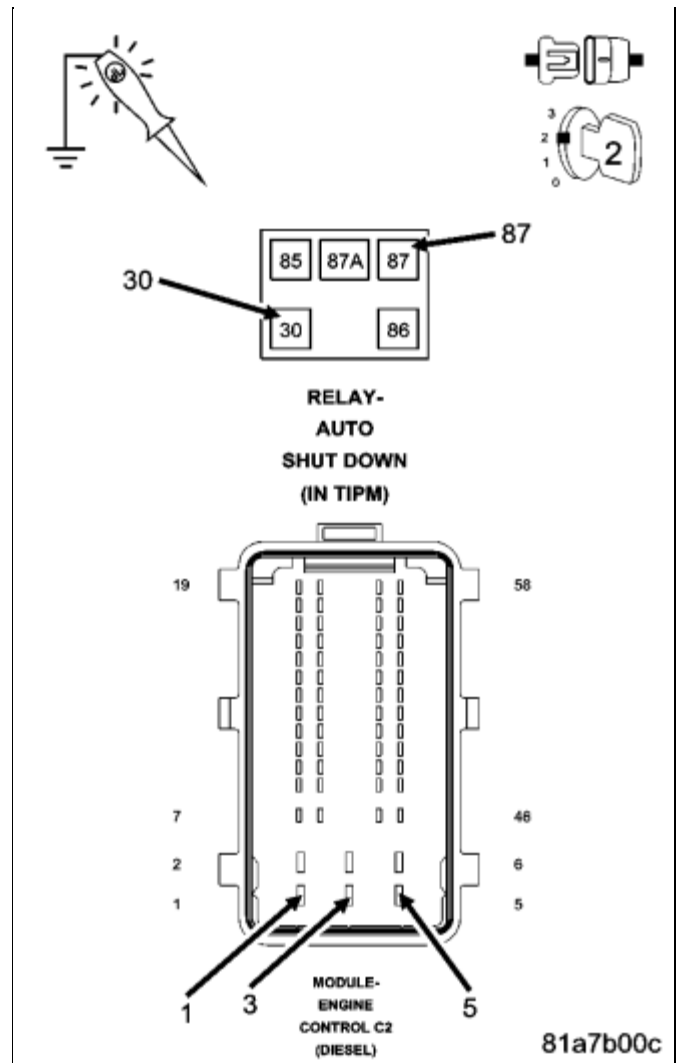
Did the test light illuminate for each circuit?

Yes

- Go To [6](#)

No

- Repair the ASD Relay Output circuit(s) for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. FUEL QUANTITY SOLENOID

Connect the Engine Control Module (ECM) harness connector.

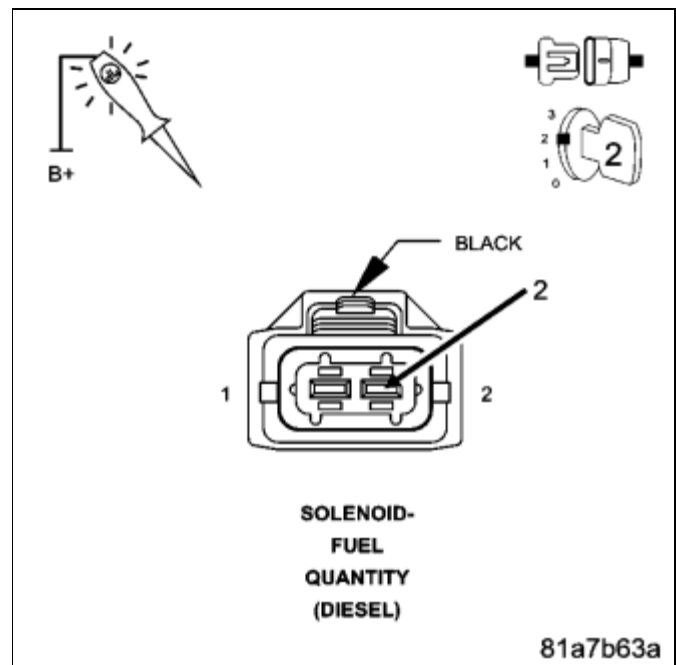
Turn the ignition on.

With the scan tool, actuate the Fuel Quantity Solenoid (CP3 Metering Pump) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

With the scan tool, actuate the Fuel Quantity Solenoid (CP3 Metering Pump) to 0%.

Using a 12 volt test light connected to 12 volts, check the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

NOTE: The test light should not be illuminated.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.

Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?

Yes

- Replace the Fuel Quantity Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [Z](#)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Quantity Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

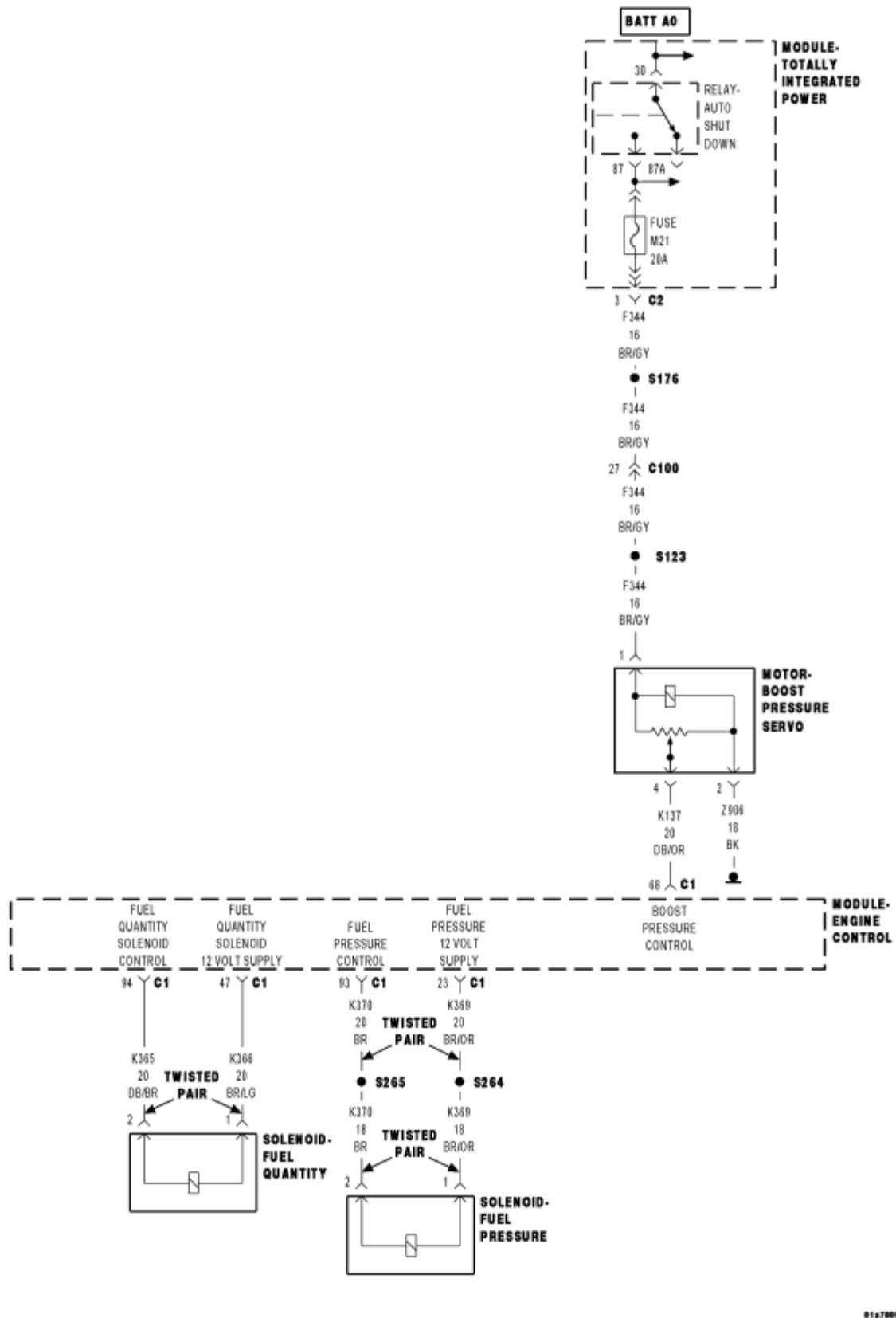
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0004 - FUEL QUANTITY CONTROL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Fuel Quantity Solenoid (FQS) is a solenoid operated valve designed to regulate fuel volume to the fuel injection pump. The FQS valve is positioned in the inlet side of the fuel injection pump assembly. The solenoid receives 12-volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel injection pump inlet passage is open allowing full fuel flow to the pump chamber. When the ECM grounds the FQS control signal the solenoid valve closes the fuel inlet passage, preventing fuel from entering the pump chamber.

- **When Monitored:**

With the ignition on and the ECM command of the Fuel Quantity Solenoid on.

- **Set Condition:**

The ECM detects excessive current on the (K365) Fuel Quantity Solenoid Control circuit for 0.2 second.

Possible Causes
INTERMITTENT DTC
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL QUANTITY SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Quantity Solenoid at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

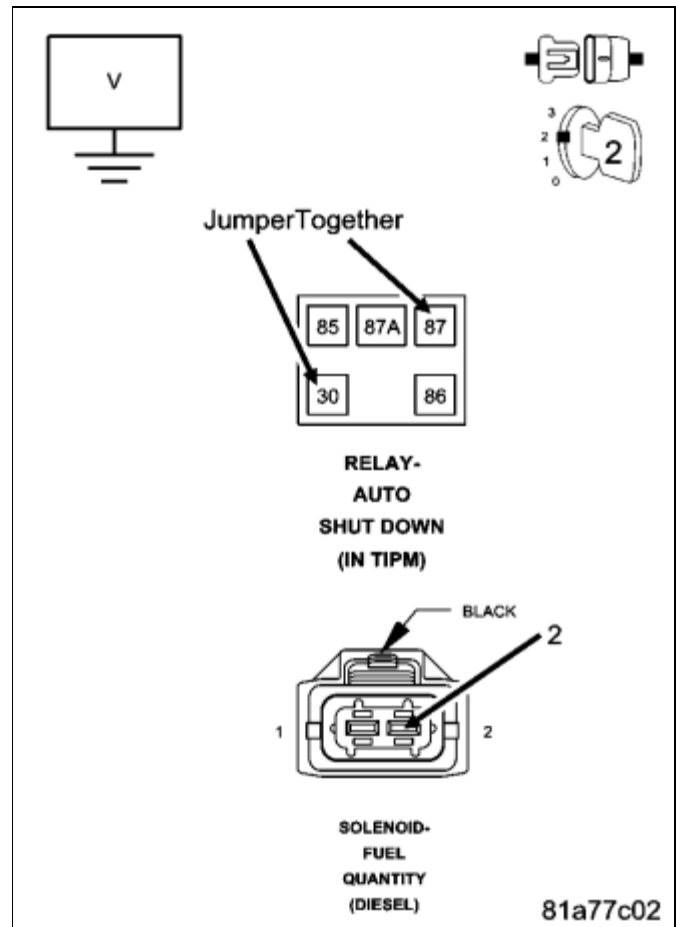
Is there any voltage present?

Yes

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K365) FUEL QUANTITY SOLENOID CONTROL CIRCUIT SHORTED TO (K366) FUEL QUANTITY SOLENOID 12 VOLT SUPPLY CIRCUIT

Turn the ignition off.

Remove the jumper wire and install the ASD Relay
Measure the resistance between the (K365) Fuel Quantity Solenoid Control circuit and the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit in the Fuel Quantity Solenoid harness connector.

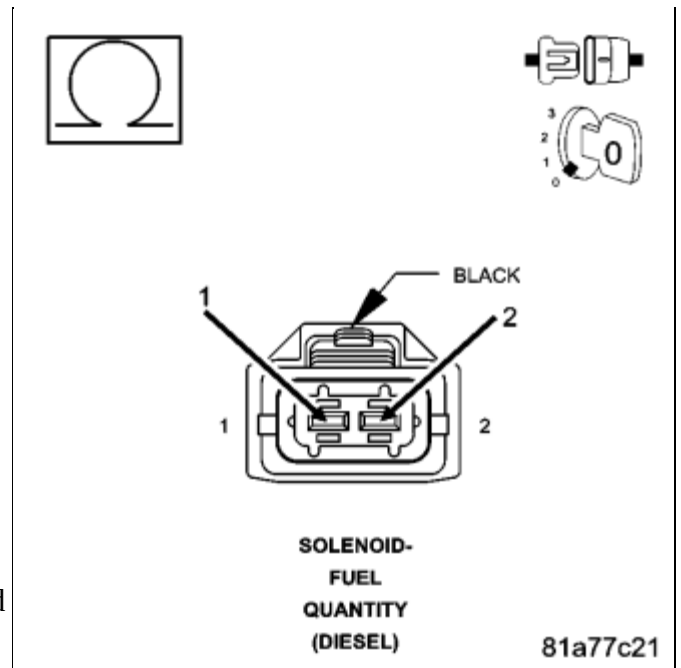
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for a short to the (K366) Fuel Quantity Solenoid 12 Volt Supply circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K365) FUEL QUANTITY SOLENOID CONTROL OPEN OR HIGH RESISTANCE

Measure the resistance of the (K365) Fuel Quantity Solenoid Control circuit between the Fuel Quantity Solenoid harness connector and the Engine Control Module (ECM) harness connector.

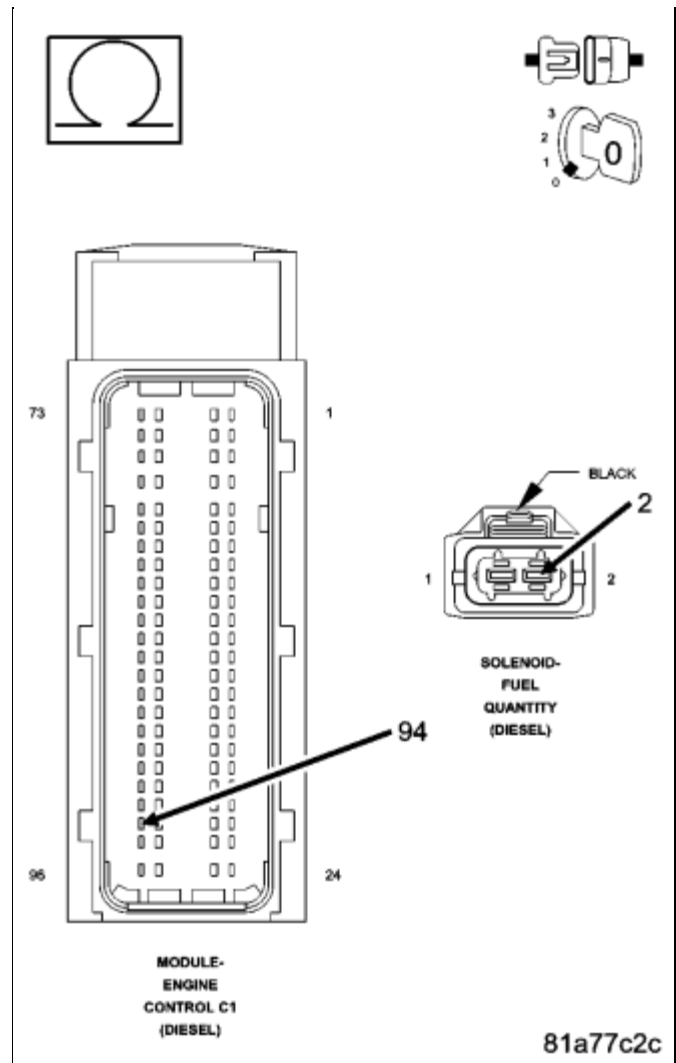
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K365) Fuel Quantity Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. FUEL QUANTITY SOLENOID

Connect the Engine Control Module (ECM) harness connector.

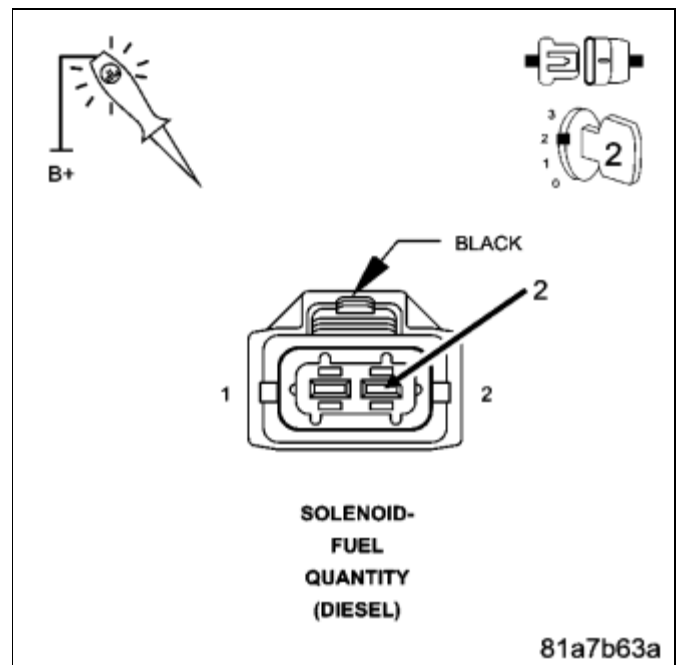
Turn the ignition on.

With the scan tool, actuate the Fuel Quantity Solenoid (CP3 Metering Pump) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K365) Fuel Quantity Solenoid Control circuit in the Fuel Quantity Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

Is the test light illuminated and bright with the actuation at 100%?

Yes

- Replace the Fuel Quantity Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Quantity Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

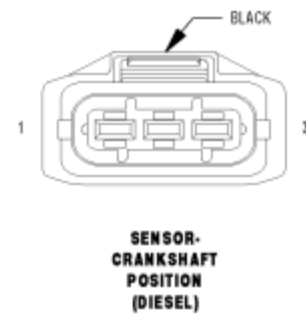
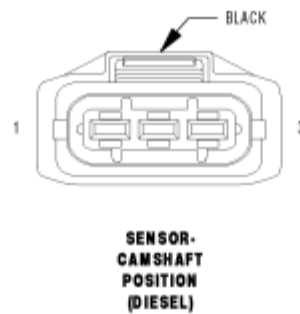
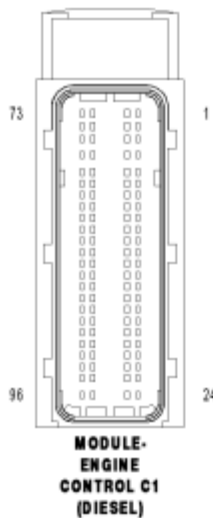
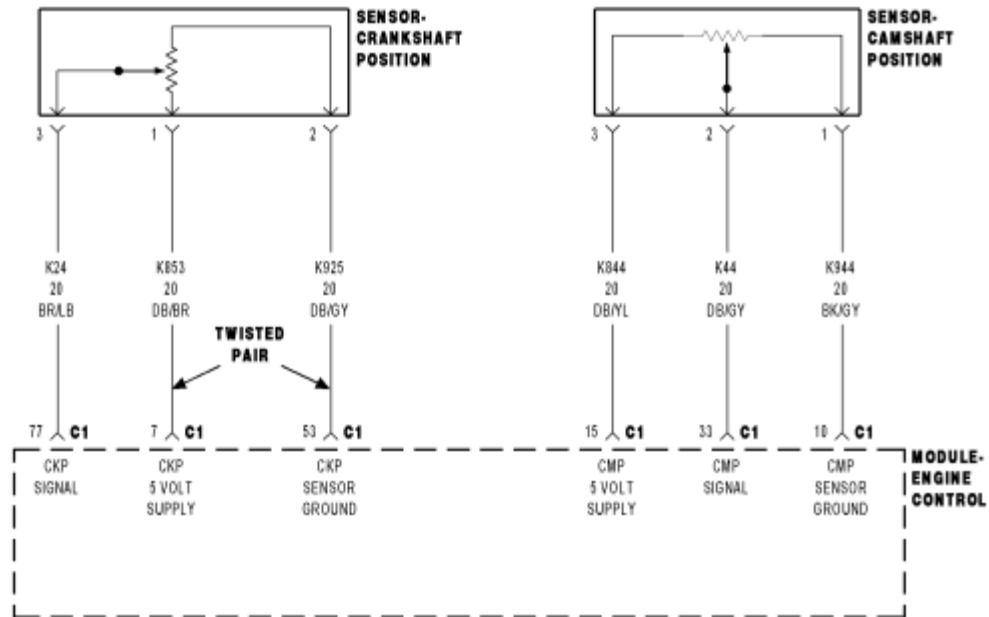
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0016—CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT



01a94782

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Engine cranking and Engine running

◦ **Set Condition:**

Engine Control Module detects an error when the camshaft position is out of phase with the crankshaft position.

Possible Causes
(K44) ERRATIC CAM POSITION SENSOR 1 SIGNAL
CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
(K24) ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR MAGNETIC RING
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR
TIMING GEAR MISALIGNMENT/INCORRECT VALVE TIMING

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool clear the DTC(s).

Start the engine and run until operating temp is reached.

If the DTC does not reset it may be necessary to test drive the vehicle.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

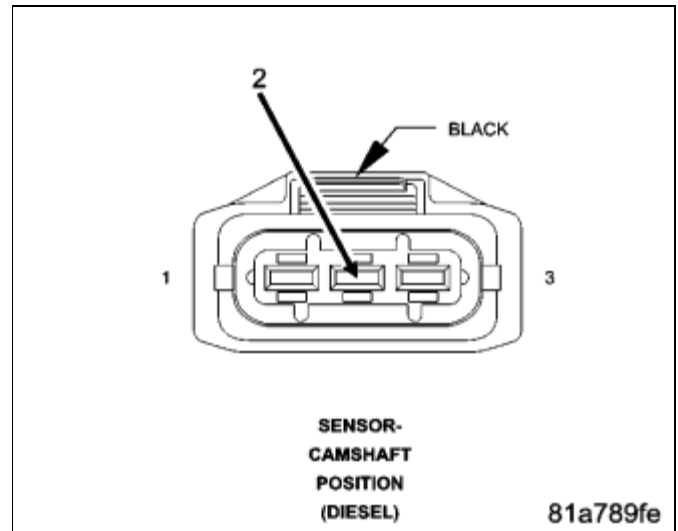
2. CHECKING THE (K44) CMP SIGNAL WITH A LAB SCOPE

With a lab scope, backprobe the (K44) CMP Signal circuit at the CMP Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.
Observe the lab scope screen.

NOTE: The CMP Sensor is a hall-effect type sensor that produces a 5-volt digital (square wave) signal.



Are there any irregular or missing signals?

Yes

- Go To [3](#)

No

- Go To [6](#)

3. CMP WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification. Refer to any TSBs that may apply.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. TONE WHEEL/PULSE RING INSPECTION

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes

- Repair or replace the Tone Wheel/Pulse Ring as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

- Replace the Camshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ERRATIC CMP SIGNAL

Turn the ignition off.

Remove the lab scope probe.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

With scan tool, erase DTCs.

Start the engine.

Gently tap on and wiggle the Cam Position Sensor.

Ignition on, engine not running.

Inspect the Sensor connector and harness connector, and inspect the ECM connector and harness connector for

loose, bent, corroded, or pushed out pins/terminals.
Inspect the related wire harness and the splices in the CMP circuit.

Did this DTC set again?

Yes

- Repair the wiring/connector concerns as needed or replace the Camshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECKING THE (K24) CKP SIGNAL WITH A LAB SCOPE

Turn the ignition off.

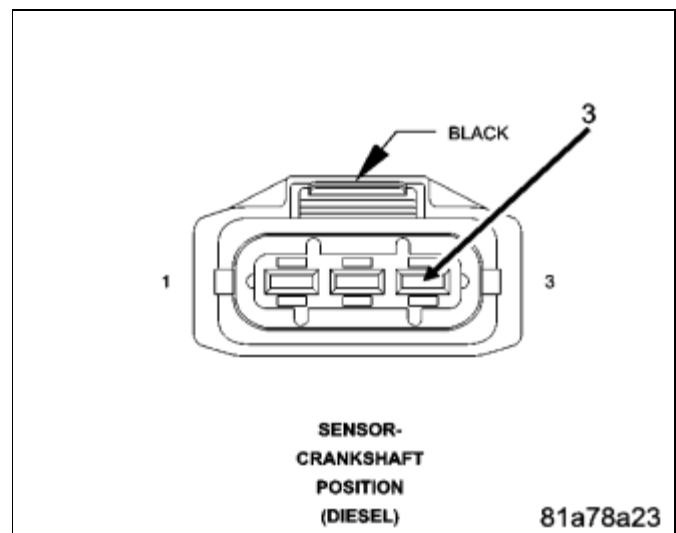
With a lab scope, backprobe the (K24) CKP Signal circuit at the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Observe the lab scope screen.

NOTE: The CKP Sensor is a hall-effect type sensor that produces a 5-volt digital (square wave) signal.



Are there any irregular or missing signals?

Yes

- Go To [8](#)

No

- Go To [10](#)

8. CKP WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification. Refer to any TSBs that may apply.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. MAGNETIC RING INSPECTION

Remove the Crankshaft Position Sensor.
Inspect the Magnetic Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes

- Repair or replace the CKP Magnetic Ring as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Crankshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ERRATIC CKP SIGNAL

NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Gently tap on and wiggle the Crank Position Sensor.

Turn the ignition off.

Inspect the Sensor connector and harness connector, and inspect the ECM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

Inspect the related wire harness and the splices in the CKP circuits.

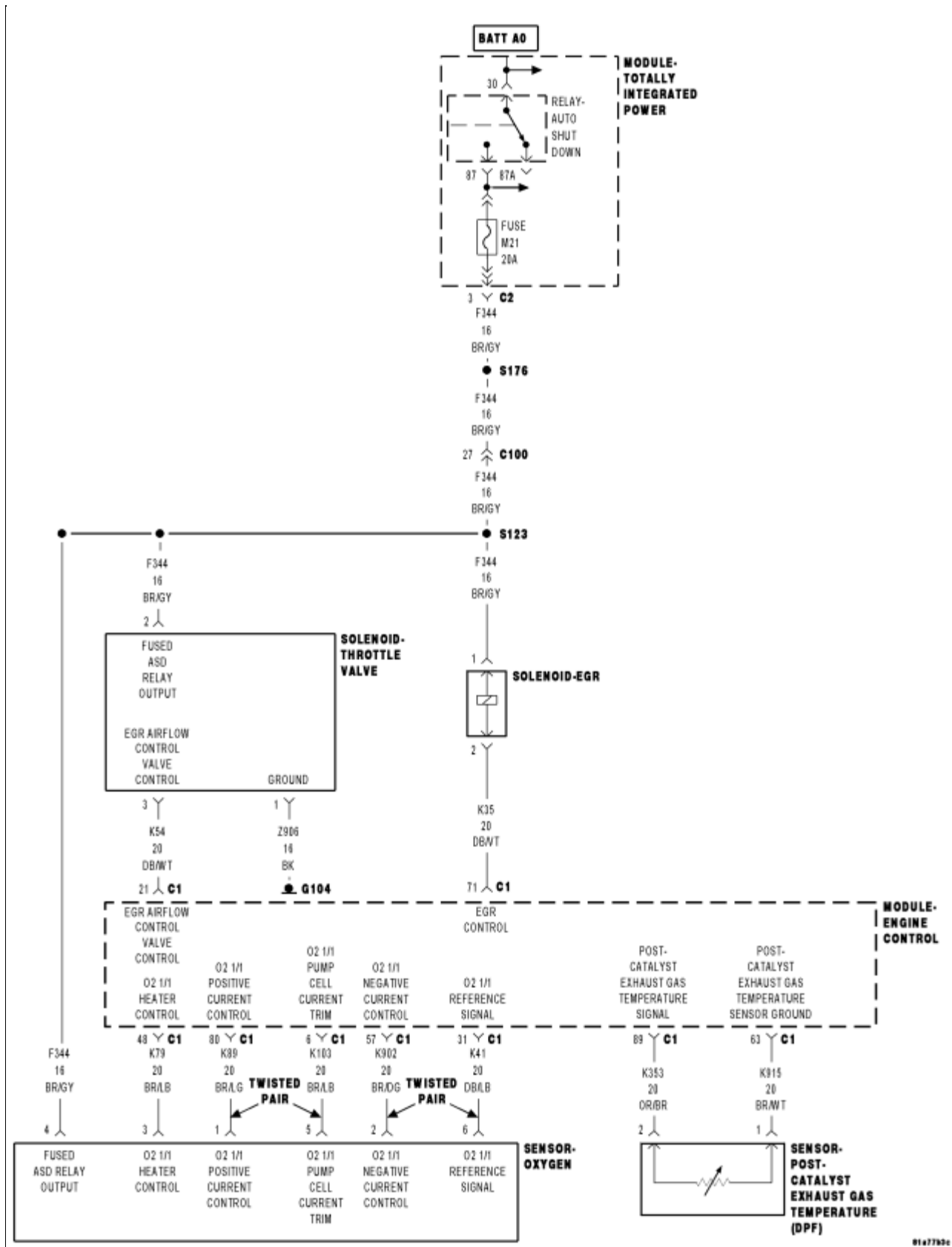
Were any problems found?**Yes**

- Repair the wiring/connector concerns as needed or replace the Crankshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

P0030 - O2 SENSOR 1/1 HEATER CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Oxygen Sensor Heater command on.

- **Set Condition:**

The ECM detects an implausible voltage on the (K79) O2 1/1 Heater Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

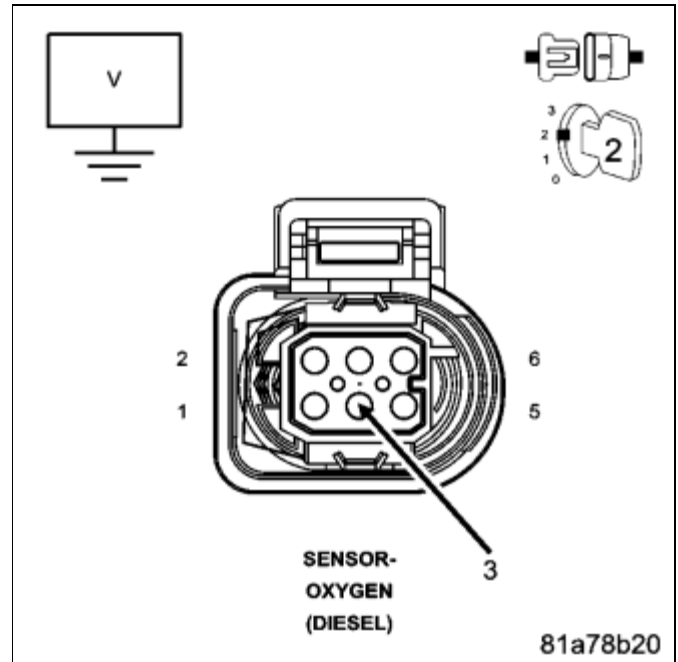
Is there any voltage present?

Yes

- Repair the (K79) O2 1/1 Heater Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay
 Measure the resistance between ground and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

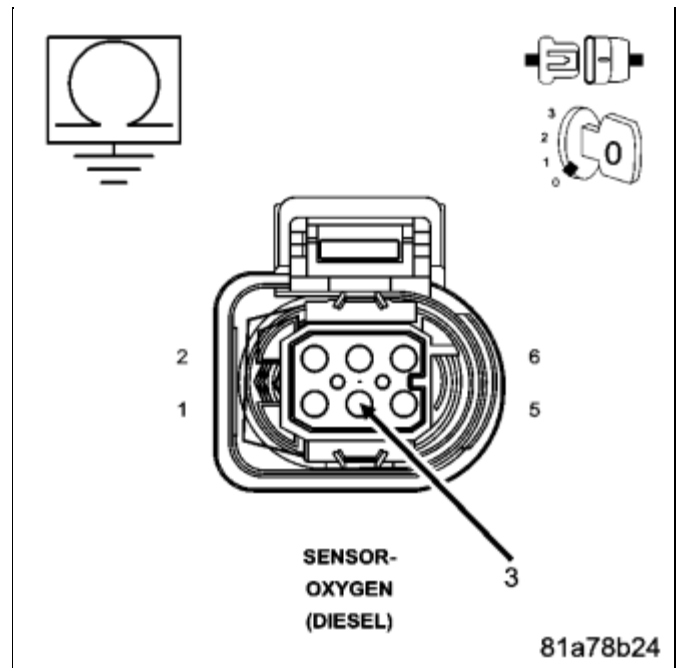
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K79) O2 1/1 Heater Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

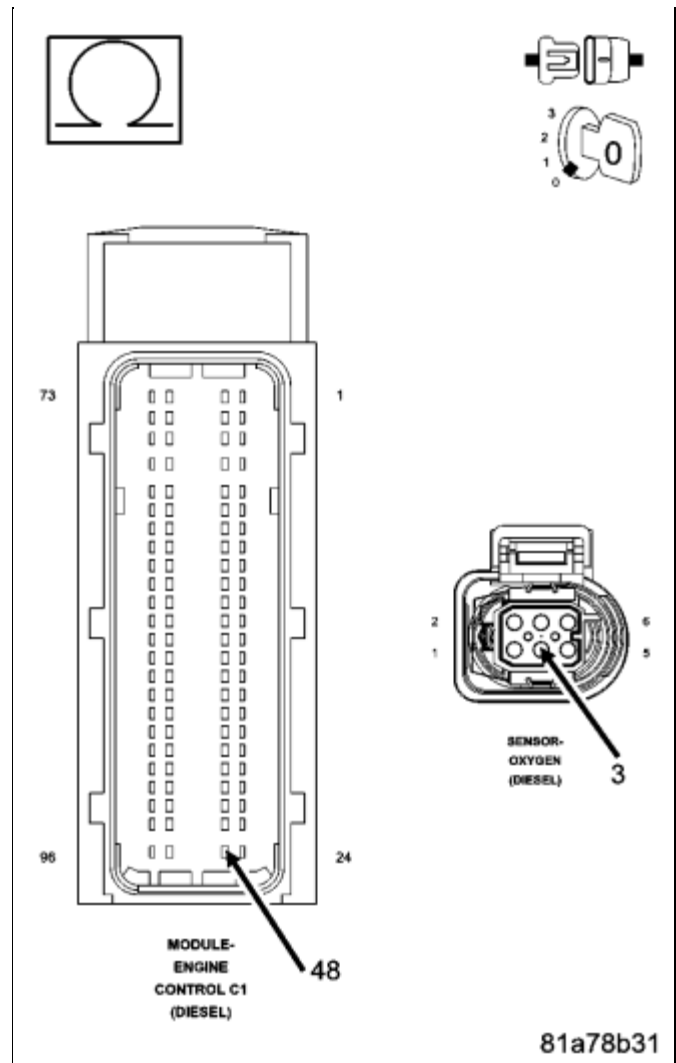
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

Measure the resistance of the (F344) Fused ASD Relay Output circuit between the Oxygen Sensor harness connector and the ASD Relay connector.

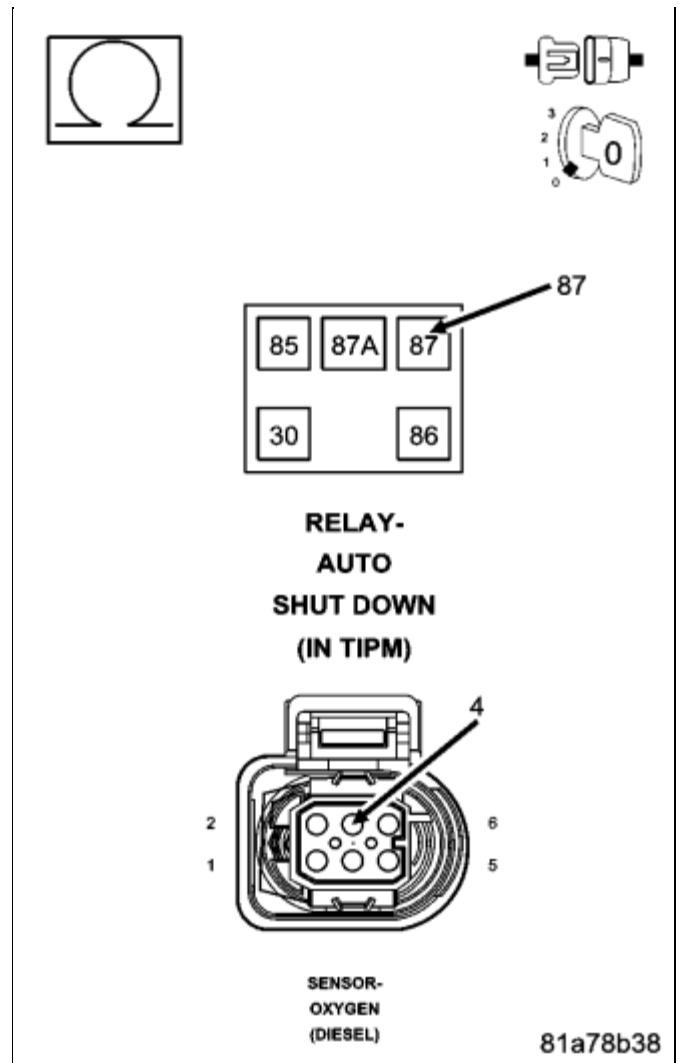
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Turn the ignition on.

With the scan tool, Clear DTCs.

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [7](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

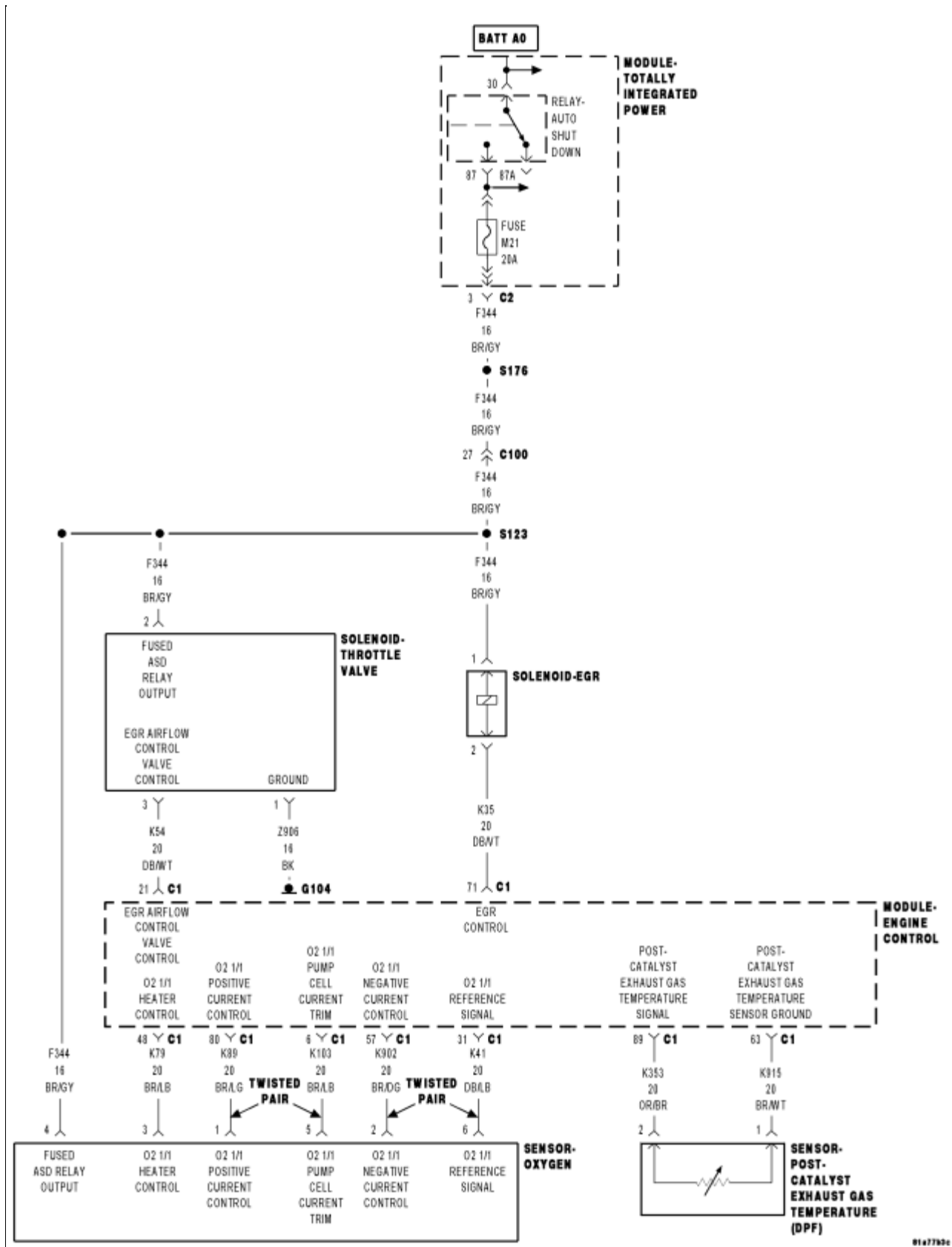
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0031 - O2 SENSOR 1/1 HEATER CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Oxygen Sensor Heater command on.

- **Set Condition:**

The ECM detects that the (K79) O2 1/1 Heater Control circuit is shorted to ground for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.
 With the scan tool, Clear DTCs in the Engine Control Module (ECM).
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

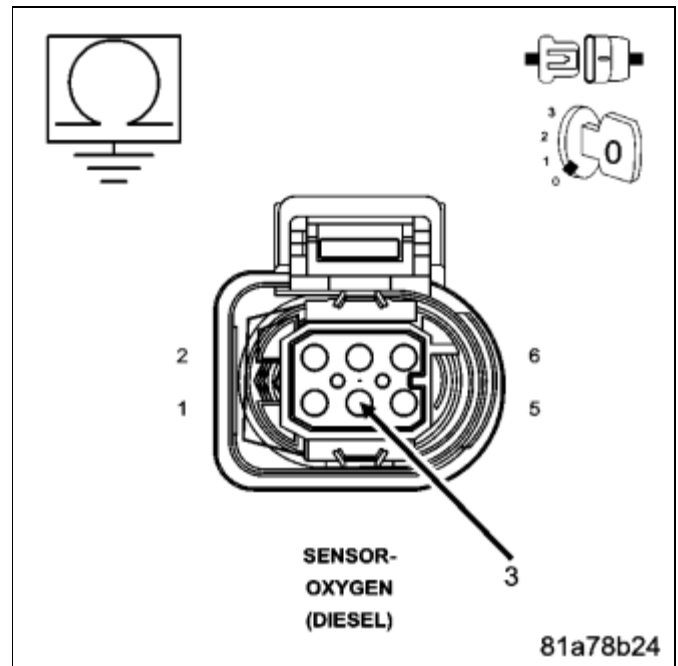
Is the resistance below 1000 ohms?

Yes

- Repair the (K79) O2 1/1 Heater Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K79) O2 1/1 Heater Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

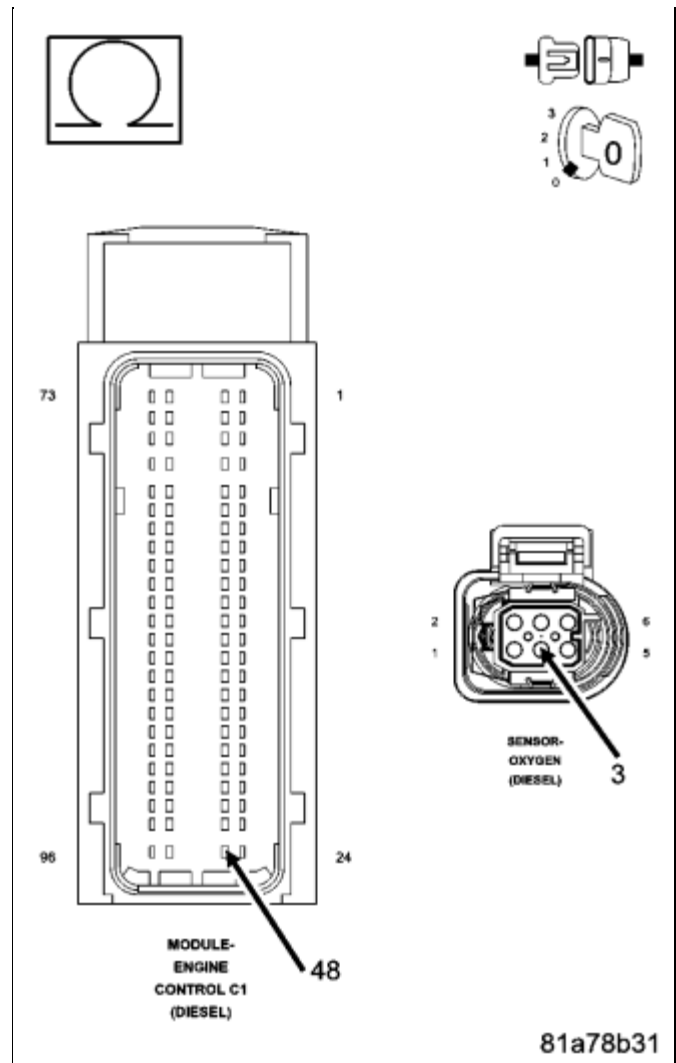
Is the resistance below 10.0 ohms?

Yes

- Go to [4](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [5](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

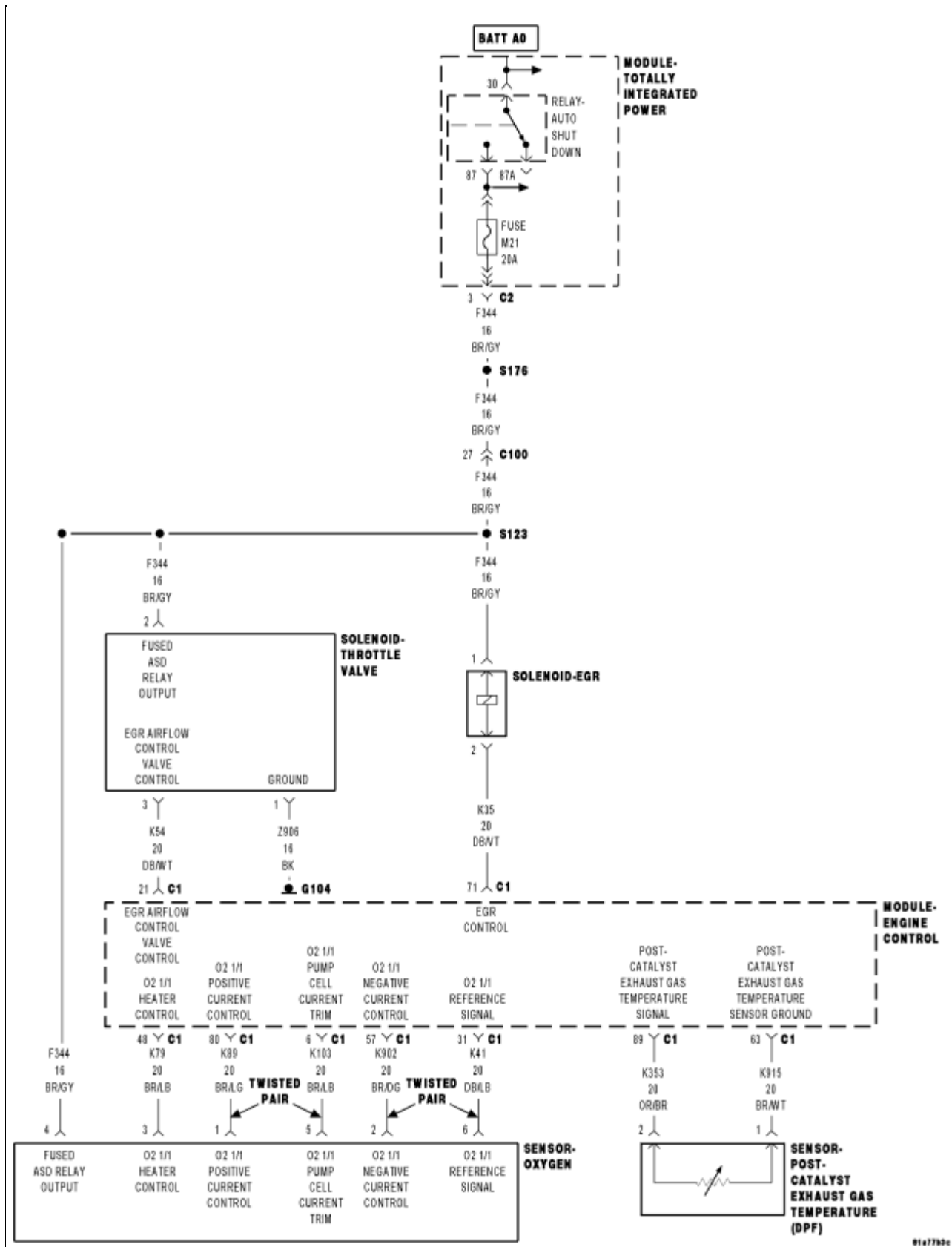
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0032 - O2 SENSOR 1/1 HEATER CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Oxygen Sensor Heater command on.

◦ **Set Condition:**

The ECM detects that the (K79) O2 1/1 Heater Control circuit is shorted to voltage for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT
(K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

Is there any voltage present?

Yes

- Repair the (K79) O2 1/1 Heater Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay
 Measure the resistance between the (K79) O2 1/1 Heater Control circuit and the (F344) Fused ASD Relay Output circuit in the Oxygen Sensor harness connector.

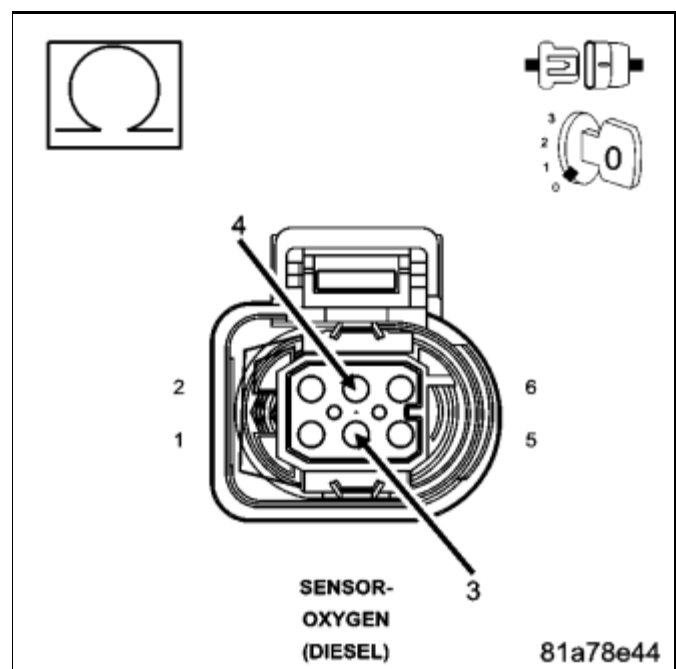
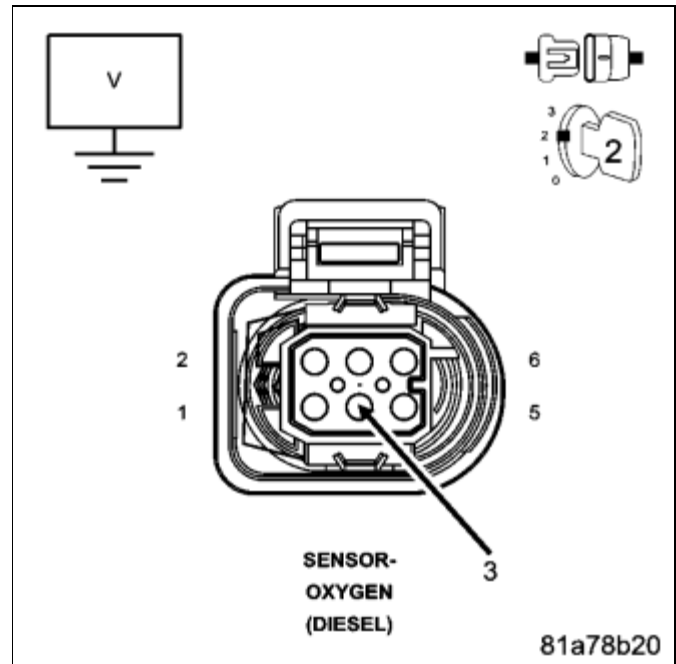
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for a short to the (F344) Fused ASD Relay Output circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K79) O2 1/1 Heater Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

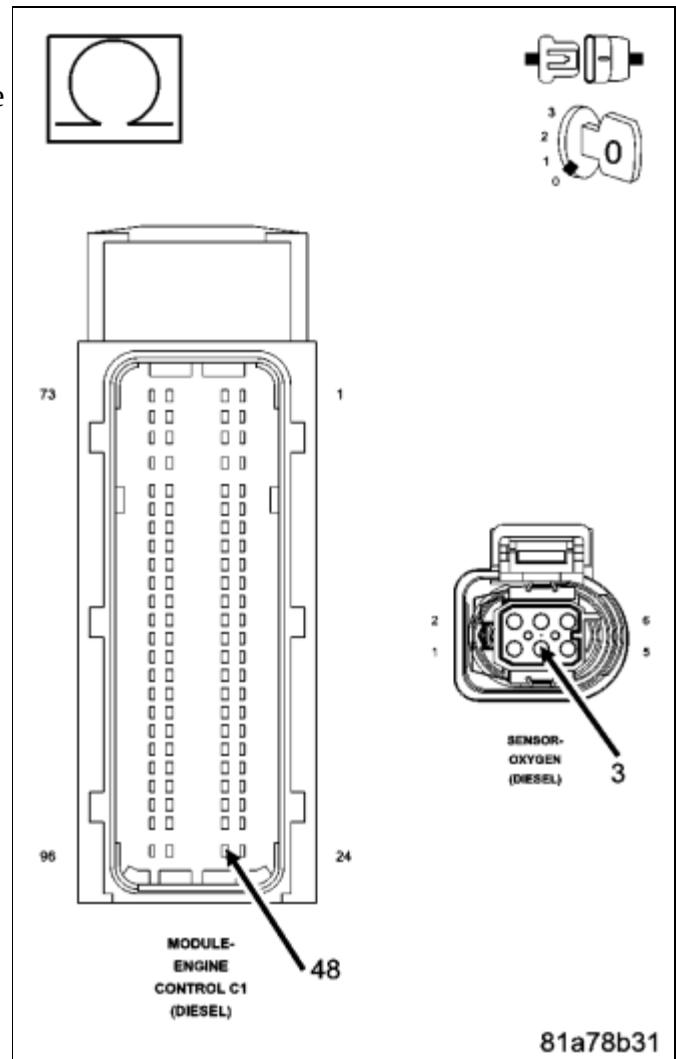
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

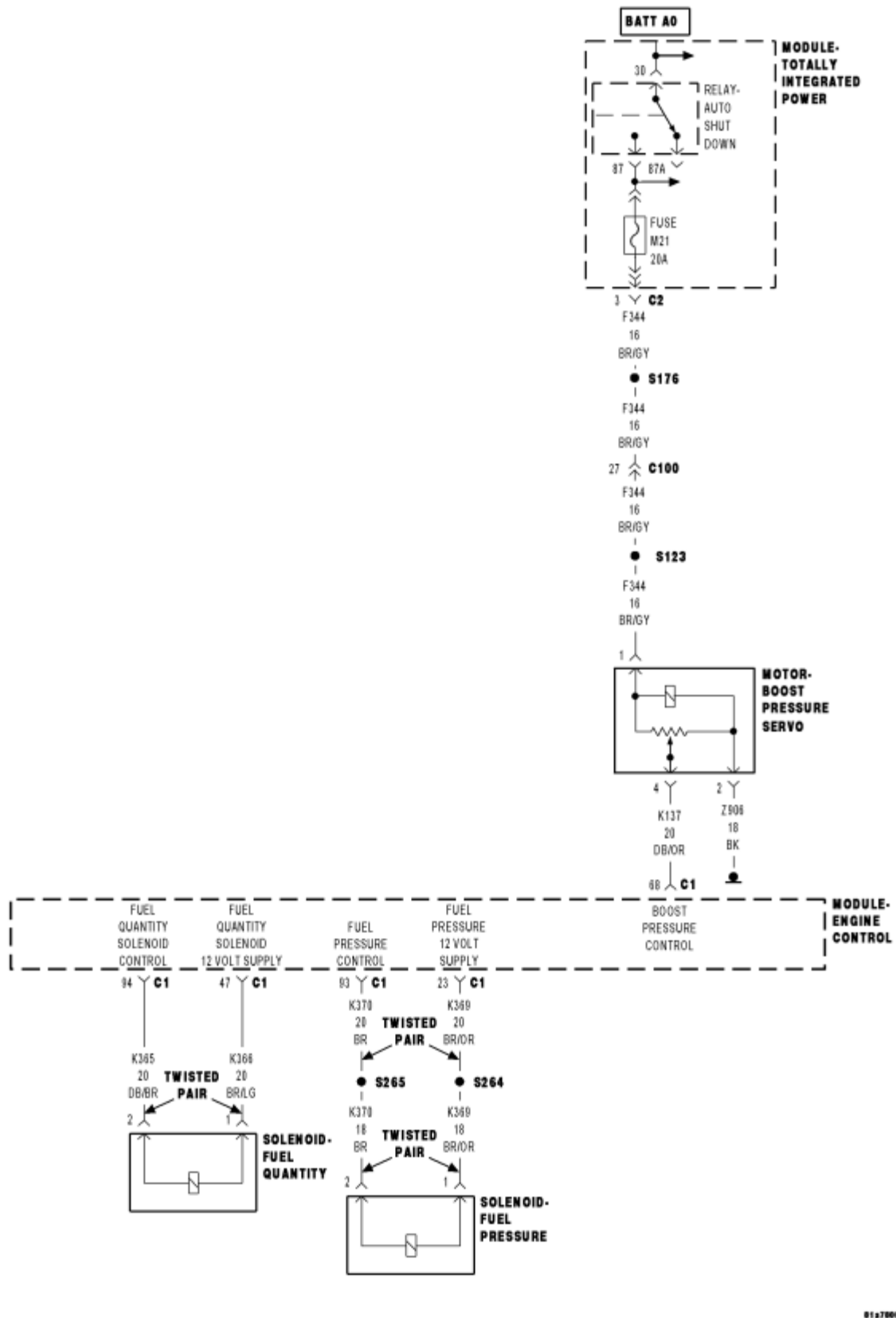
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0045 - TURBOCHARGER BOOST CONTROL CIRCUIT/OPEN



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Boost Pressure Servo Motor is a electrically operated DC motor designed to regulate the boost pressure output of the turbocharger. The BPSM is mounted to the side of the turbocharger assembly. The BPSM receives 12-volt power, ground and a duty-cycle ground signal from the ECM.

- **When Monitored:**

With the ignition on and the Boost Pressure Servo Motor command off.

- **Set Condition:**

The ECM detects that the (K137) Boost Pressure Servo Motor Control circuit is open for 0.5 second.

Possible Causes
INTERMITTENT DTC
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO GROUND
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SERVO MOTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Boost Pressure Servo Motor at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Boost Pressure Servo Motor harness connector.

Turn the ignition on.

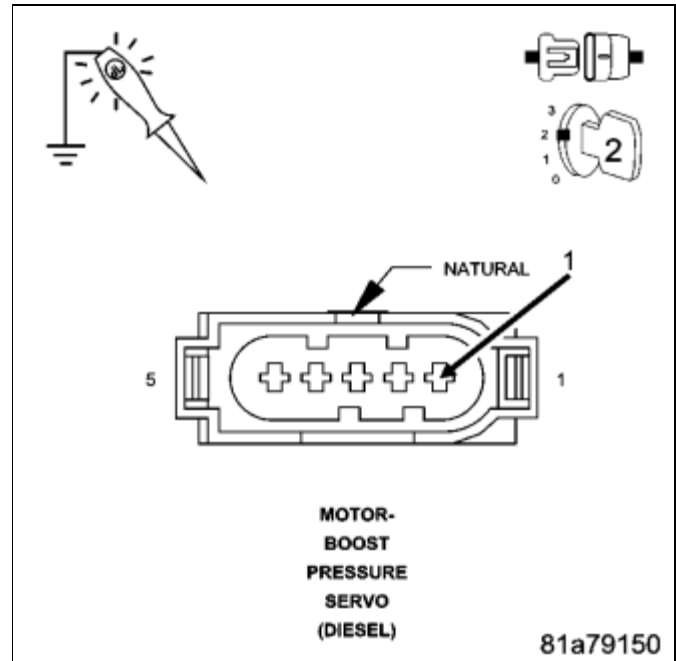
Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go to [3](#)



No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

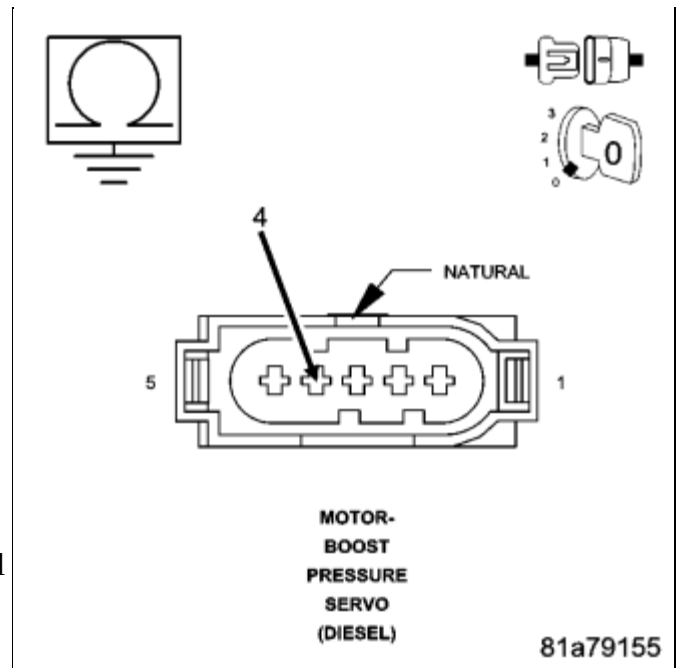
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K137) Boost Pressure Servo Motor Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K137) Boost Pressure Servo Motor Control circuit between the Boost Pressure Servo Motor harness connector and the Engine Control Module (ECM) harness connector.

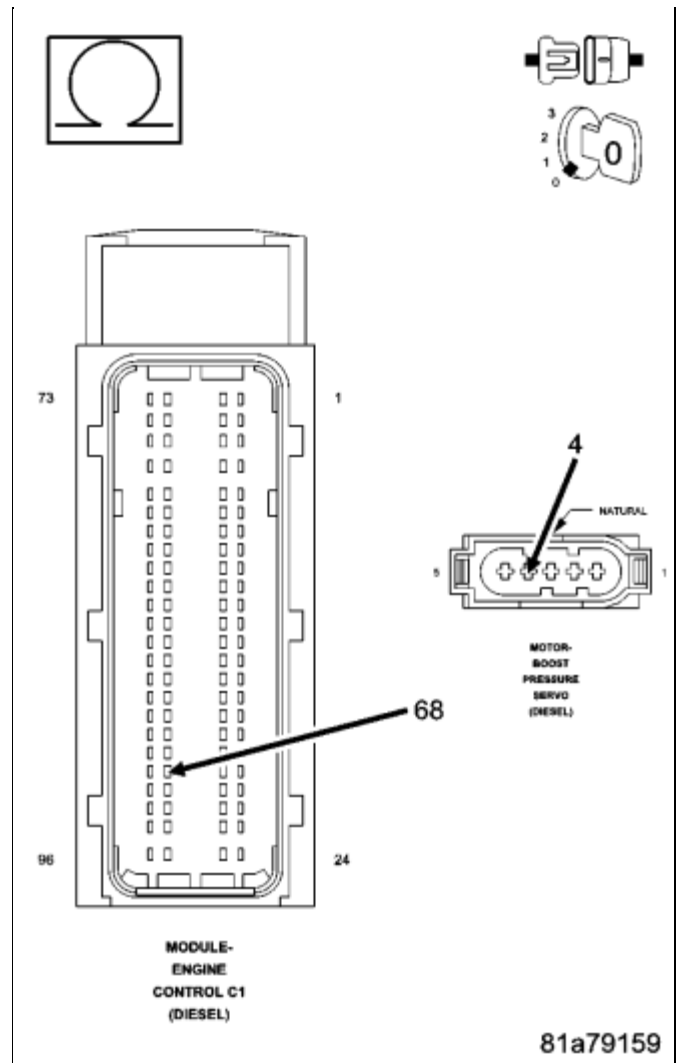
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K137) Boost Pressure Servo Motor Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. BOOST PRESSURE SERVO MOTOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

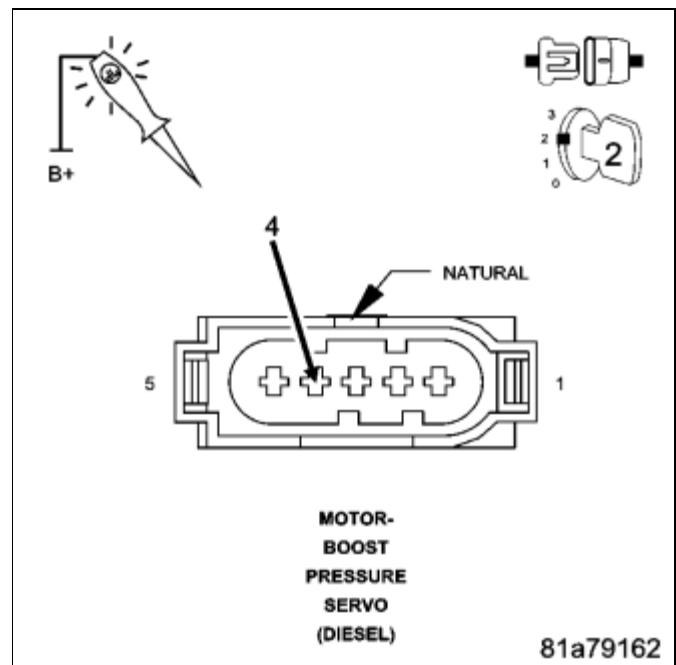
Turn the ignition on.

With the scan tool, actuate the Boost Pressure Servo Motor (Boost Pressure Actuator) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller



for 30 seconds. Be certain the actuation is active when checking the circuit.

With the scan tool, actuate the Boost Pressure Servo Motor (Boost Pressure Actuator) to 0%. Using a 12 volt test light connected to 12 volts, check the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should not be illuminated.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.

Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?

Yes

- Replace the Boost Pressure Servo Motor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Servo Motor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

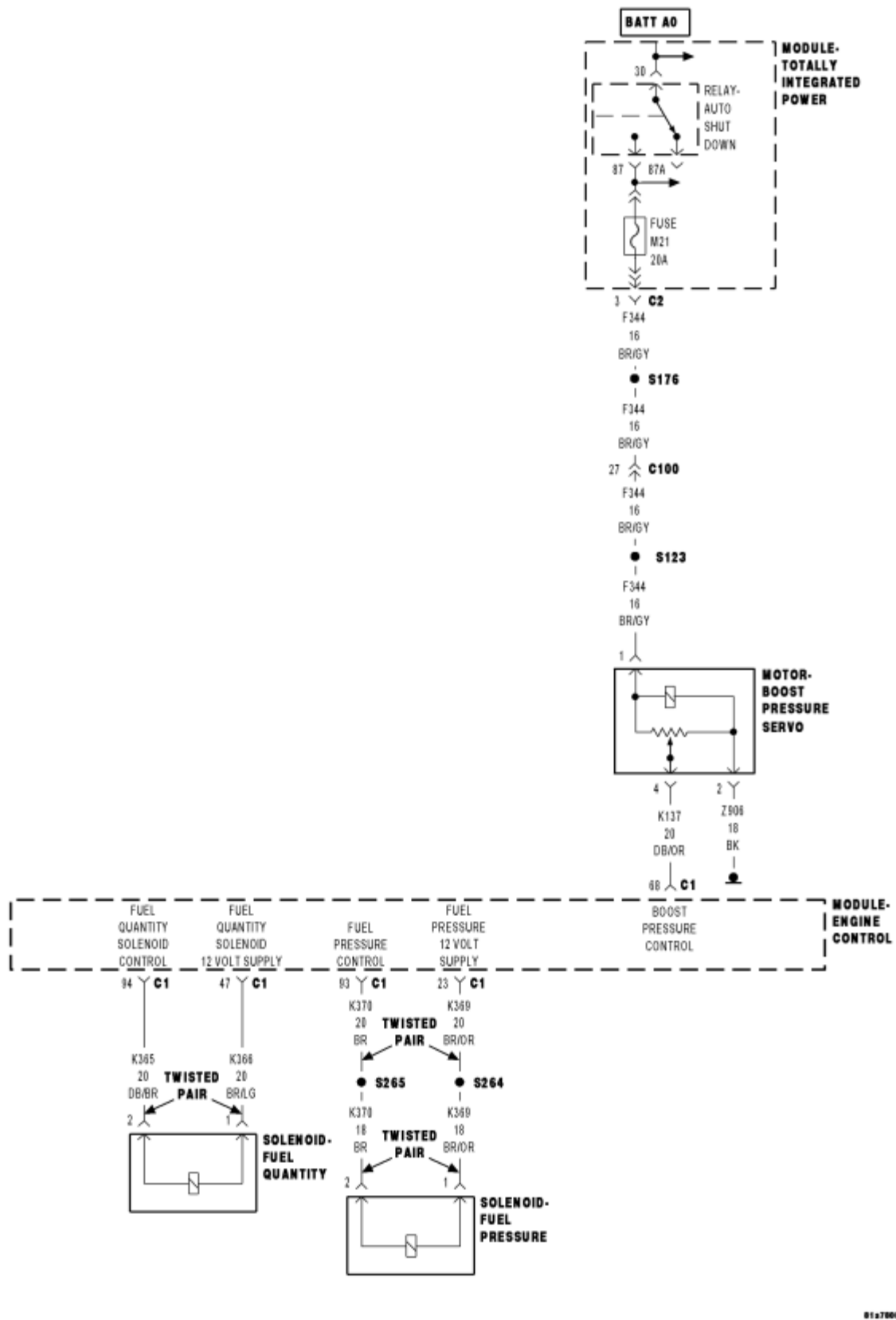
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0046 - TURBOCHARGER BOOST CONTROL CIRCUIT/EXCESSIVE CURRENT



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Boost Pressure Servo Motor is a electrically operated DC motor designed to regulate the boost pressure output of the turbocharger. The BPSM is mounted to the side of the turbocharger assembly. The BPSM receives 12-volt power, ground and a duty-cycle ground signal from the ECM.

- **When Monitored:**

With the ignition on and the Boost Pressure Servo Motor command off.

- **Set Condition:**

The Boost Pressure Servo Motor reports an internal error to the ECM.

Possible Causes
INTERMITTENT DTC
TURBOCHARGER MECHANICAL PROBLEM
(Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SERVO MOTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Boost Pressure Servo Motor harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

Go to [2](#)

No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. (Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Using a 12 volt test light connected to 12 volts, check the (Z906) Ground circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go to [3](#)

No

- Repair the (Z906) Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. TURBOCHARGER MECHANICAL PROBLEM

Ensure the ignition is off.

Inspect the Turbocharger and Boost Pressure Servo Motor linkage for damage, debris and other problems that could effect Turbocharger vane movement.

Were any problems found?

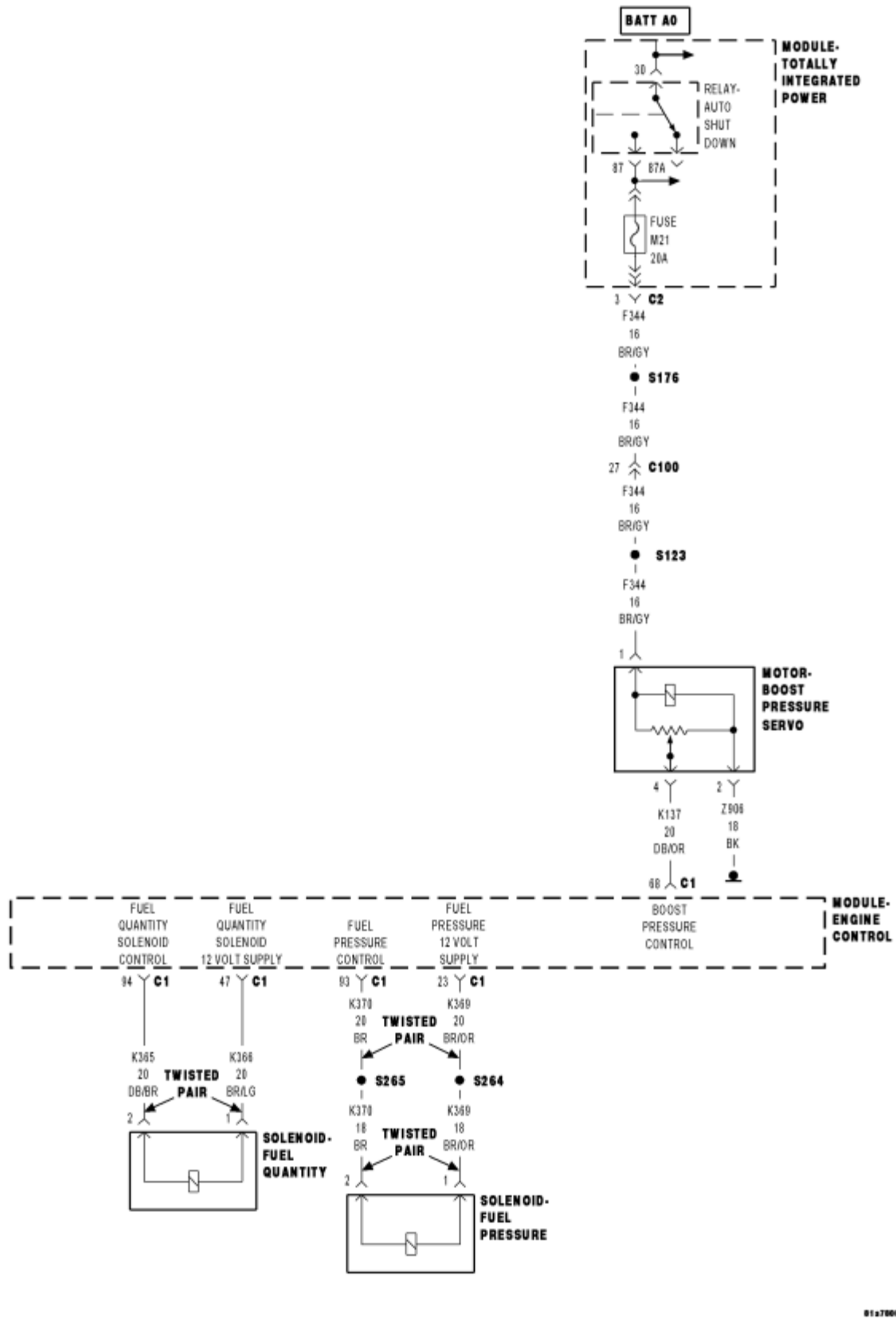
Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Boost Pressure Servo Motor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0047 - TURBOCHARGER BOOST CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Boost Pressure Servo Motor command off.

◦ **Set Condition:**

The ECM detects that the (K137) Boost Pressure Servo Motor Control circuit is shorted to ground for 0.5 second.

Possible Causes
INTERMITTENT DTC
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO GROUND
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SERVO MOTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Boost Pressure Servo Motor at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Boost Pressure Servo Motor harness connector.

Turn the ignition on.

Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

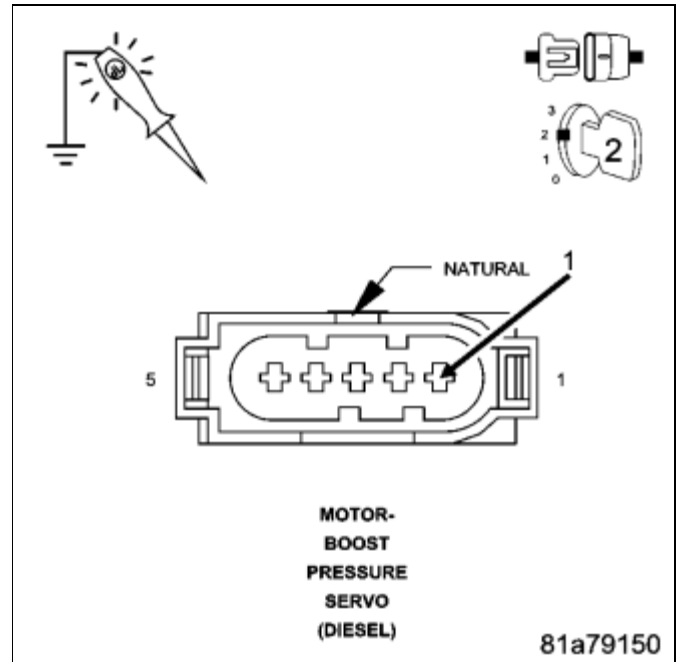
Is the test light illuminated and bright?

Yes

- Go to [3](#)

No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

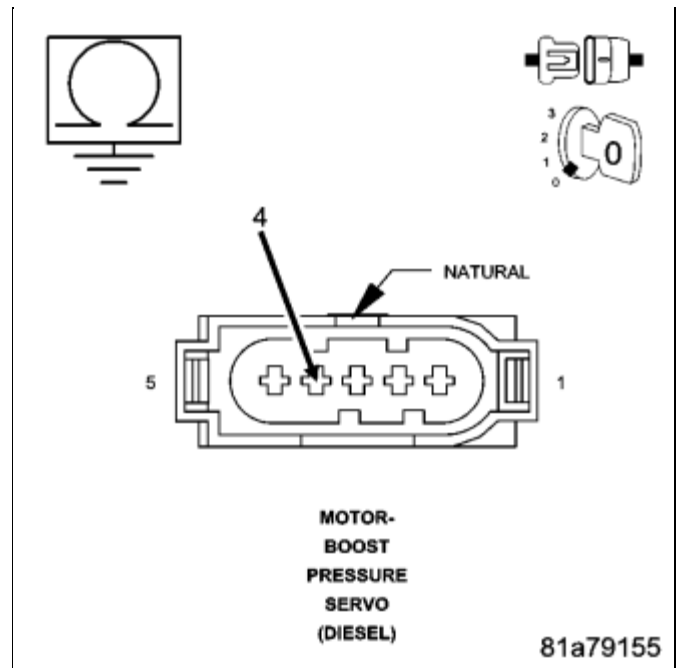
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K137) Boost Pressure Servo Motor Control circuit for a short to ground.



- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K137) Boost Pressure Servo Motor Control circuit between the Boost Pressure Servo Motor harness connector and the Engine Control Module (ECM) harness connector.

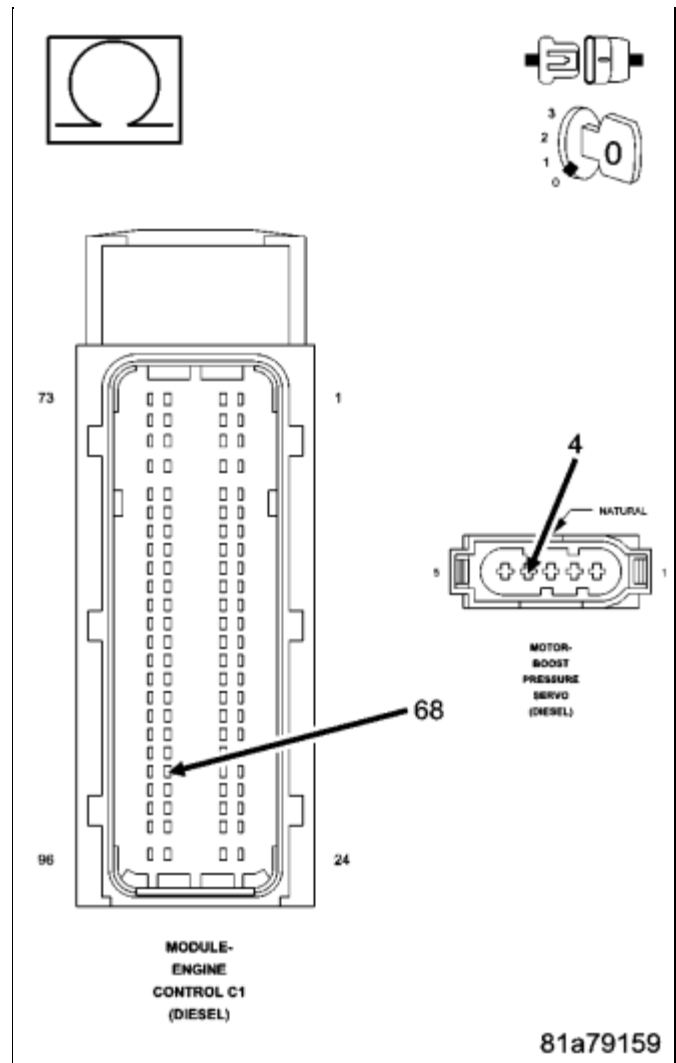
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K137) Boost Pressure Servo Motor Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. BOOST PRESSURE SERVO MOTOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

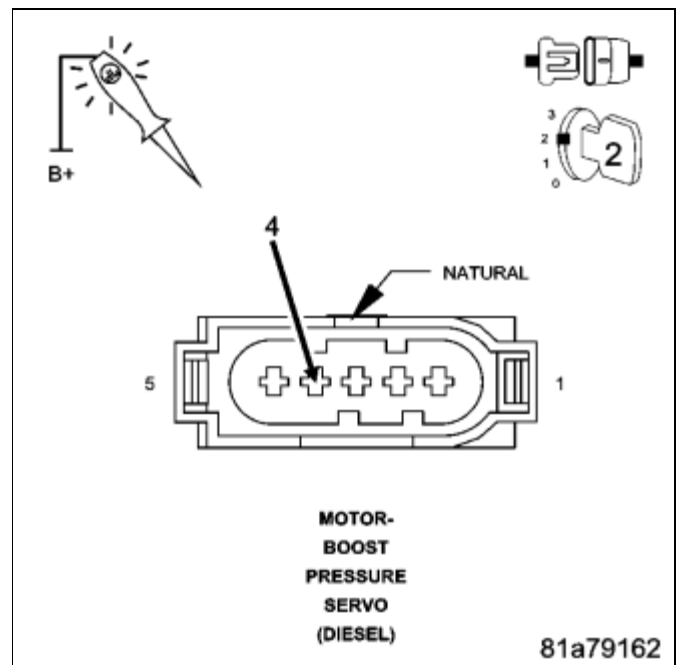
Turn the ignition on.

With the scan tool, actuate the Boost Pressure Servo Motor (Boost Pressure Actuator) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller



for 30 seconds. Be certain the actuation is active when checking the circuit.

With the scan tool, actuate the Boost Pressure Servo Motor (Boost Pressure Actuator) to 0%. Using a 12 volt test light connected to 12 volts, check the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should not be illuminated.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.

Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?

Yes

- Replace the Boost Pressure Servo Motor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Servo Motor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

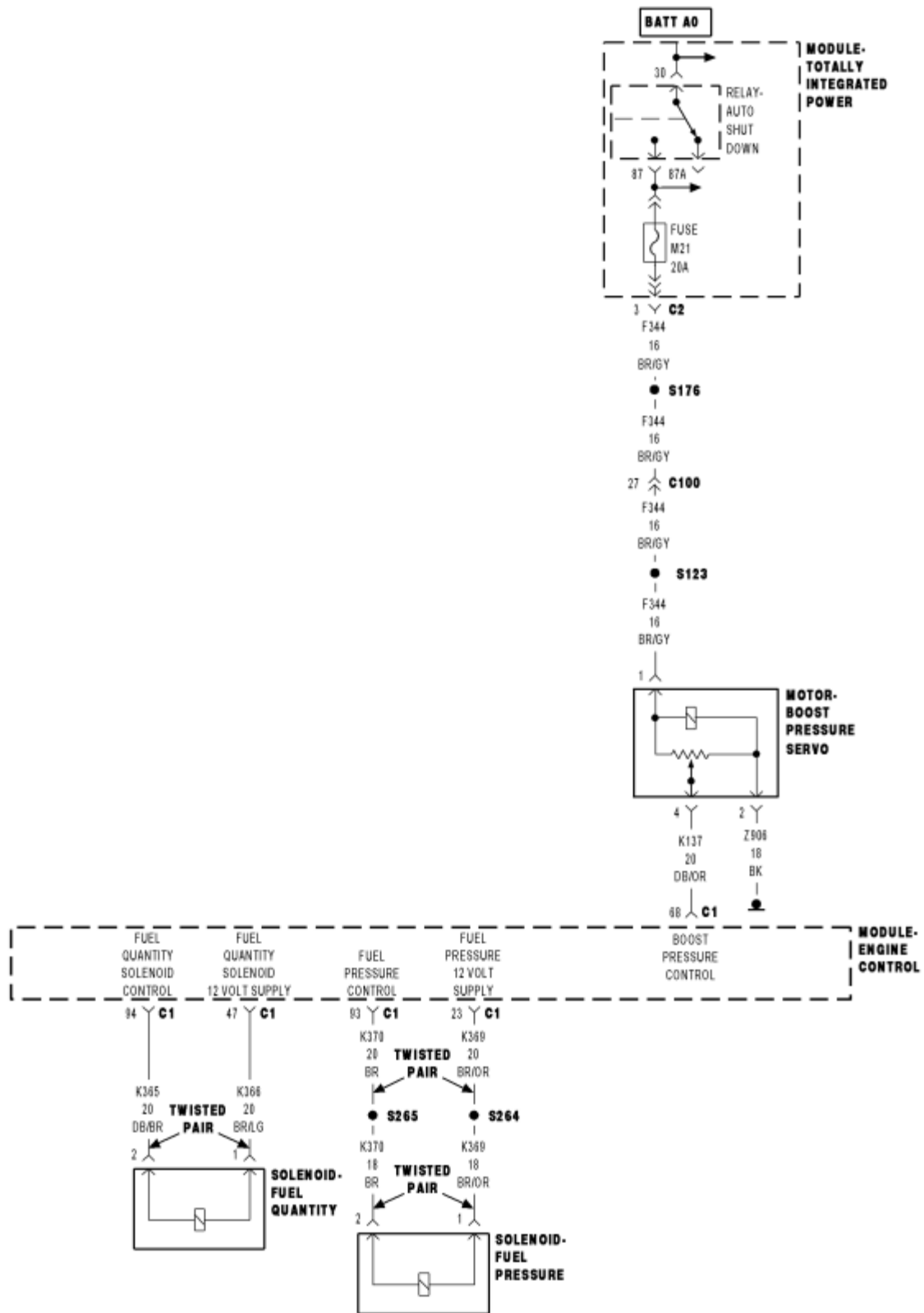
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0048 - TURBOCHARGER BOOST CONTROL CIRCUIT HIGH



81a78009

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Boost Pressure Servo Motor command on.

◦ **Set Condition:**

The ECM detects that the (K137) Boost Pressure Servo Motor Control circuit is shorted to voltage for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
(K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SERVO MOTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Boost Pressure Servo Motor at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K137) BOOST PRESSURE SERVO MOTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Boost Pressure Servo Motor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

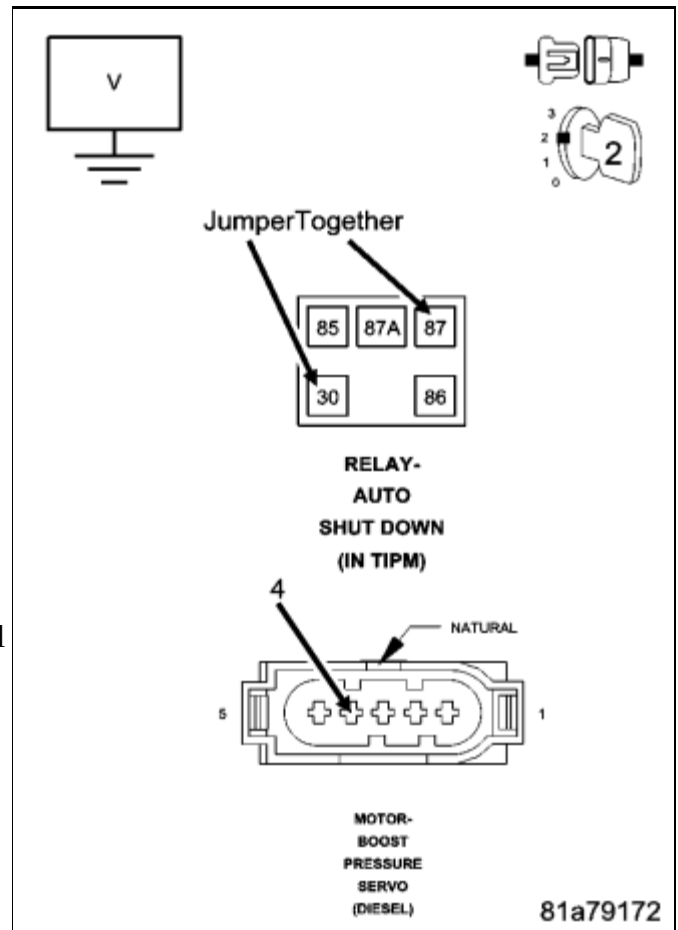
Is there any voltage present?

Yes

- Repair the (K137) Boost Pressure Servo Motor Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K137) BOOST PRESSURE SERVO MOTOR CONTROL OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay
 Measure the resistance of the (K137) Boost Pressure Servo Motor Control circuit between the Boost Pressure Servo Motor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

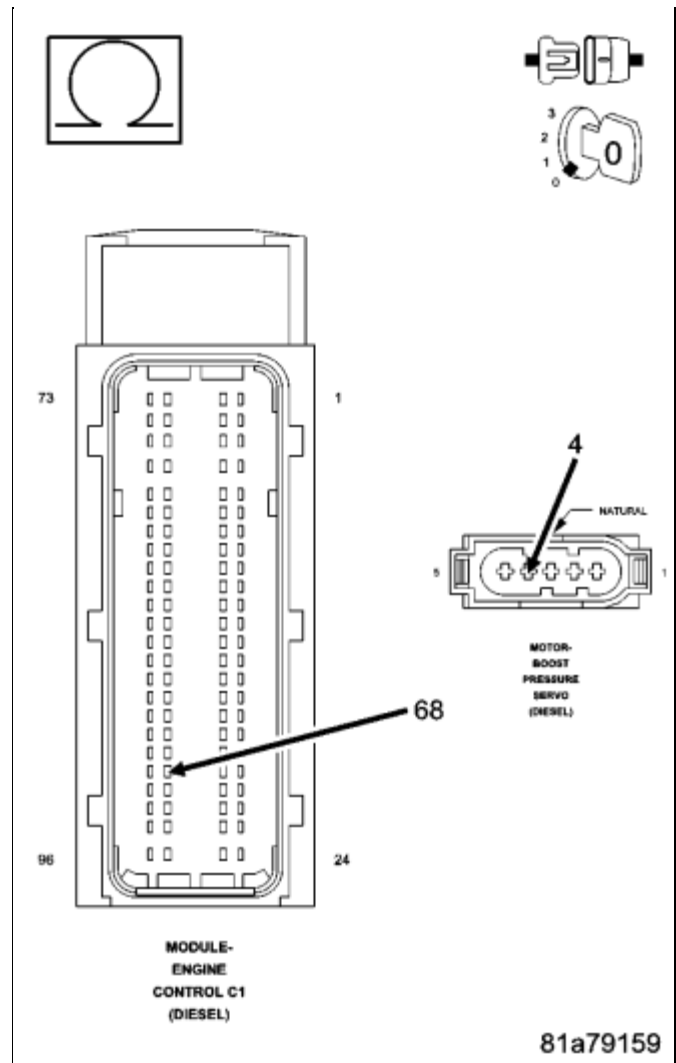
Yes

- Go to [4](#)

No

- Repair the (K137) Boost Pressure Servo Motor Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



4. BOOST PRESSURE SERVO MOTOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

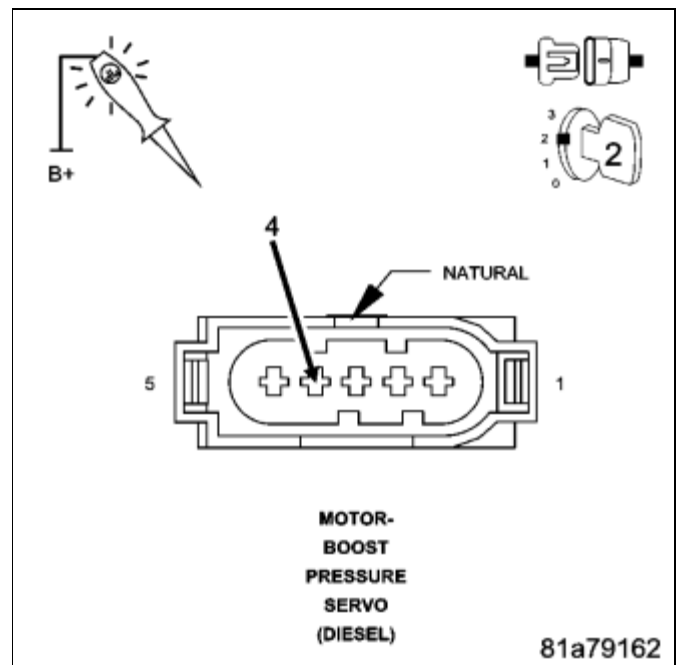
Turn the ignition on.

With the scan tool, actuate the Boost Pressure Servo Motor (Boost Pressure Actuator) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K137) Boost Pressure Servo Motor Control circuit in the Boost Pressure Servo Motor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller



for 30 seconds. Be certain the actuation is active when checking the circuit.

Is the test light illuminated and bright with the actuation at 100%?

Yes

- Replace the Boost Pressure Servo Motor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Servo Motor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

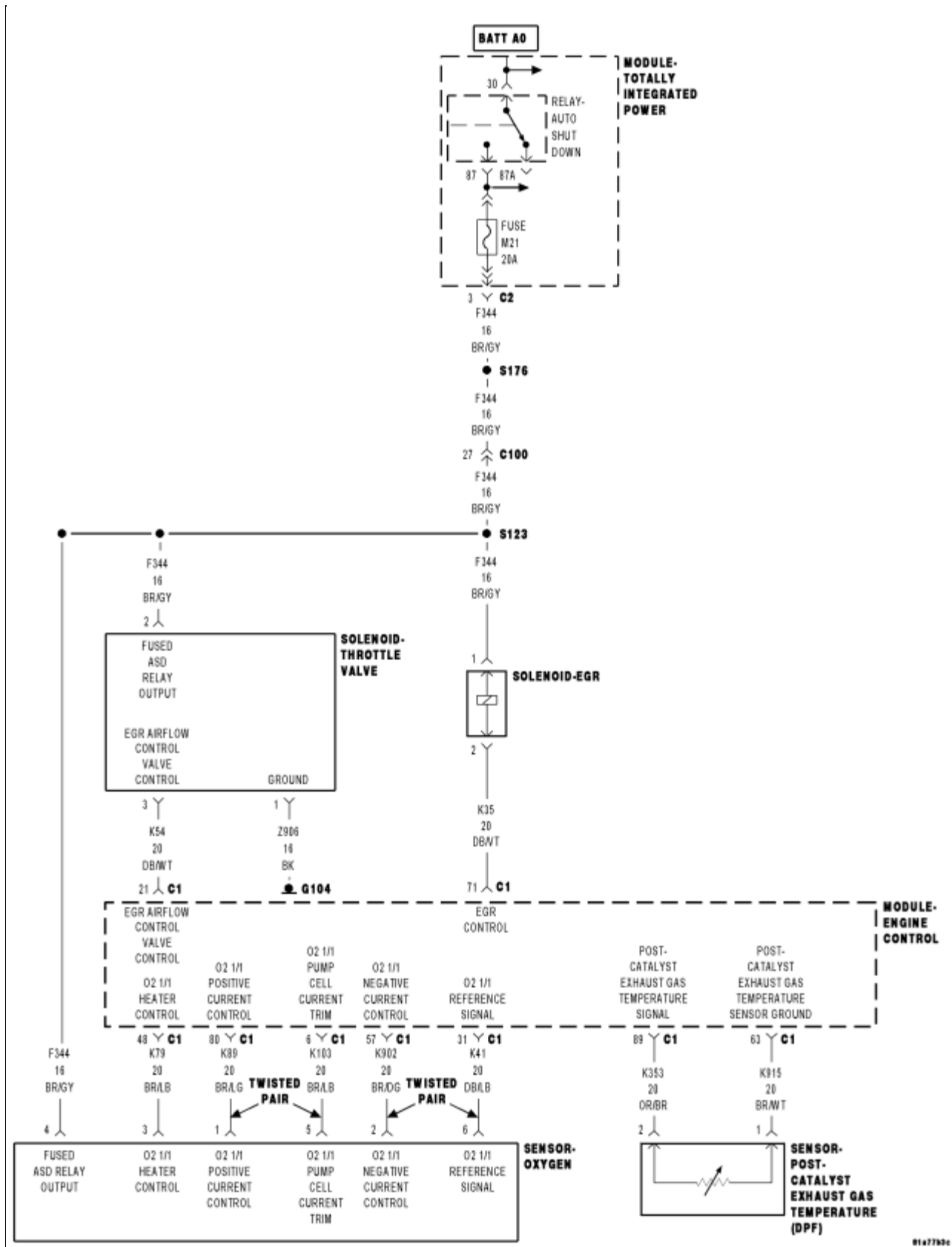
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0053-O2 SENSOR 1/1 HEATER RESISTANCE



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Oxygen Sensor Heater command on.

- **Set Condition:**

The ECM detects an implausible voltage on the (K79) O2 1/1 Heater Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Oxygen Sensor Heater.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage of the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

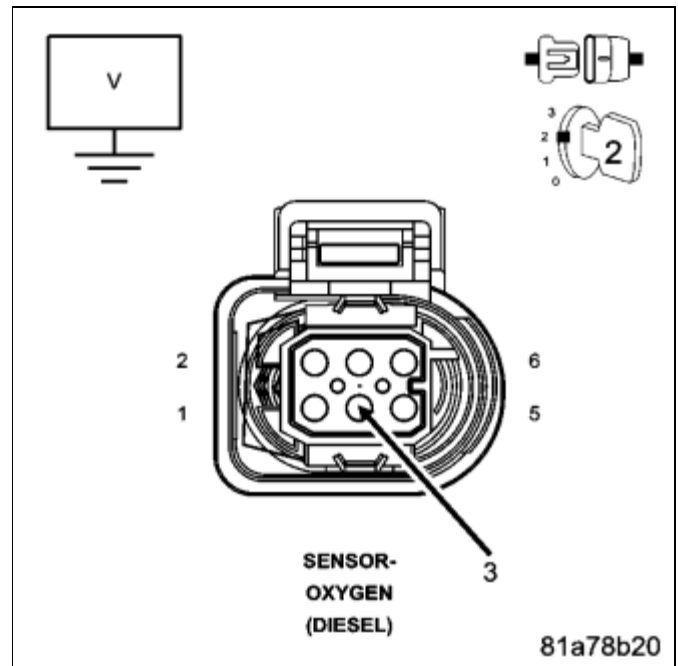
Is there any voltage present?

Yes

- Repair the (K79) O2 1/1 Heater Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Measure the resistance between ground and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

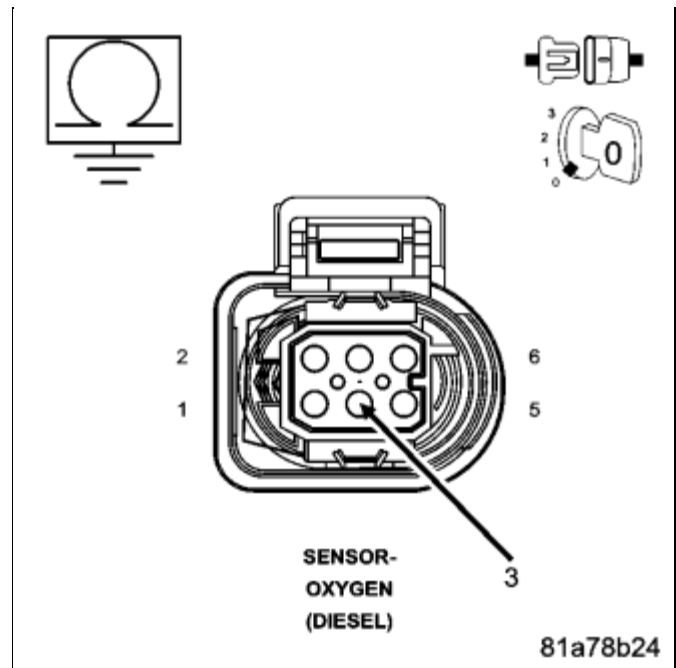
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K79) O2 1/1 Heater Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

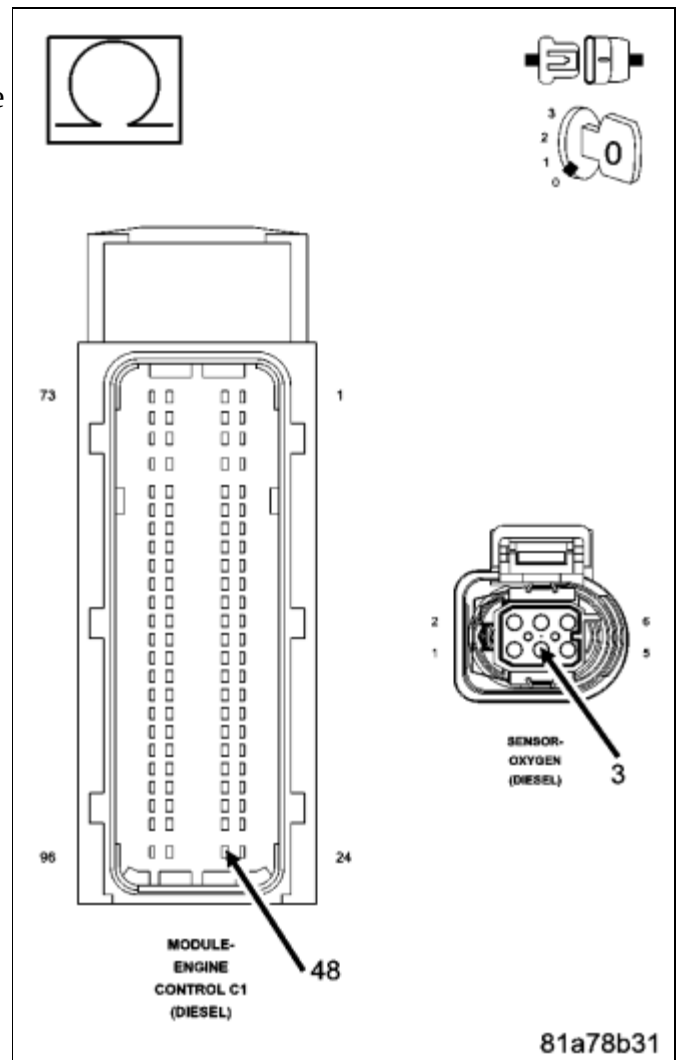
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (F344) Fused ASD Relay Output 2 circuit between the Oxygen Sensor harness connector and the ASD Relay connector.

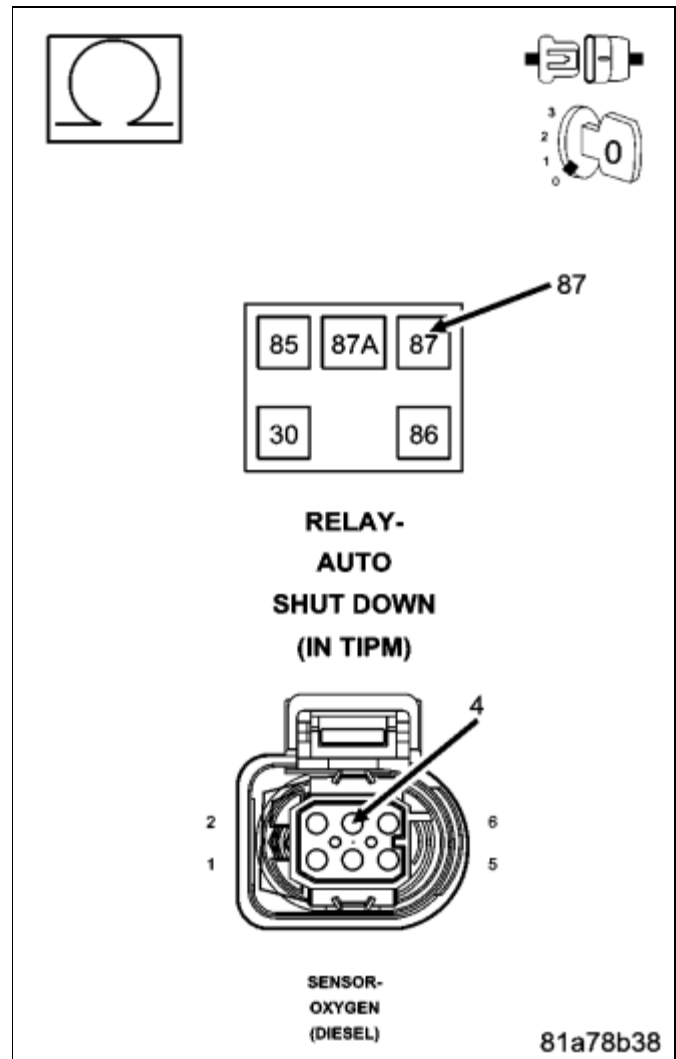
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (F344) Fused ASD Relay Output 2 circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [7](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0069–MANIFOLD PRESSURE/BAROMETRIC PRESSURE CORRELATION

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Barometric/Atmospheric Pressure Sensor is calculated from the Inlet Pressure Sensor Signal. The ECM compares the signal of the Inlet Pressure Sensor to the signal of the Boost Pressure Sensor during key on, engine off and during after-run mode to determine the plausibility of these sensors.

- **When Monitored:**

With the ignition on and at engine idle. There are no Sensor Reference Voltage DTC's. There are no other Boost Pressure related DTC's. There are no Inlet Pressure Sensor DTC's.

- **Set Condition:**

The difference between the Boost Pressure Sensor Signal and the Inlet Pressure Sensor Signal is greater than 100 hpa (1.45 psi) for 4.0 seconds.

Possible Causes

BOOST PRESSURE SENSOR RELATED WIRING & CONNECTORS
BOOST PRESSURE SENSOR
INLET PRESSURE SENSOR RELATED WIRING & CONNECTORS
INLET PRESSURE SENSOR
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CHECK FOR ACTIVE DTCS IN THE ECM

NOTE: Verify and note actual Atmospheric/Barometric pressure.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Turn the ignition on.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure.

2. ECM

With the scan tool, view the ECM Data and read the Atmospheric Pressure.

Compare ECM Atmospheric Pressure reading to the actual atmospheric pressure.

Does the scan tool display Atmospheric Pressure that is within 100 hpa (1.45 psi.) of actual atmospheric pressure?

Yes

- Go To [3](#)

No

- Check the wiring connectors between the Inlet Pressure Sensor and the ECM for high resistance, poor terminal contact, corrosion or other problems. If Inlet Pressure Sensor wiring and connectors check out good, replace the Inlet Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. BOOST PRESSURE SENSOR WIRING INSPECTION

Turn the ignition off.

Using the wiring schematics as a guide, inspect the wiring and connectors associated with the Boost Pressure Sensor circuits between the Boost Pressure Sensor and the ECM.

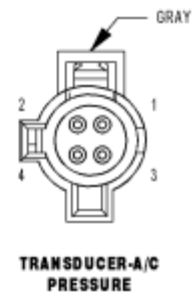
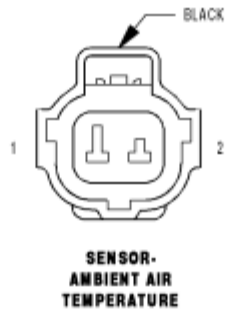
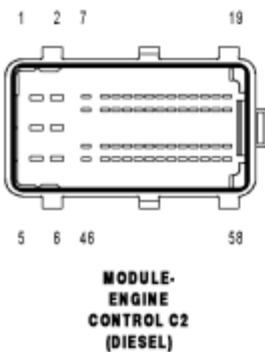
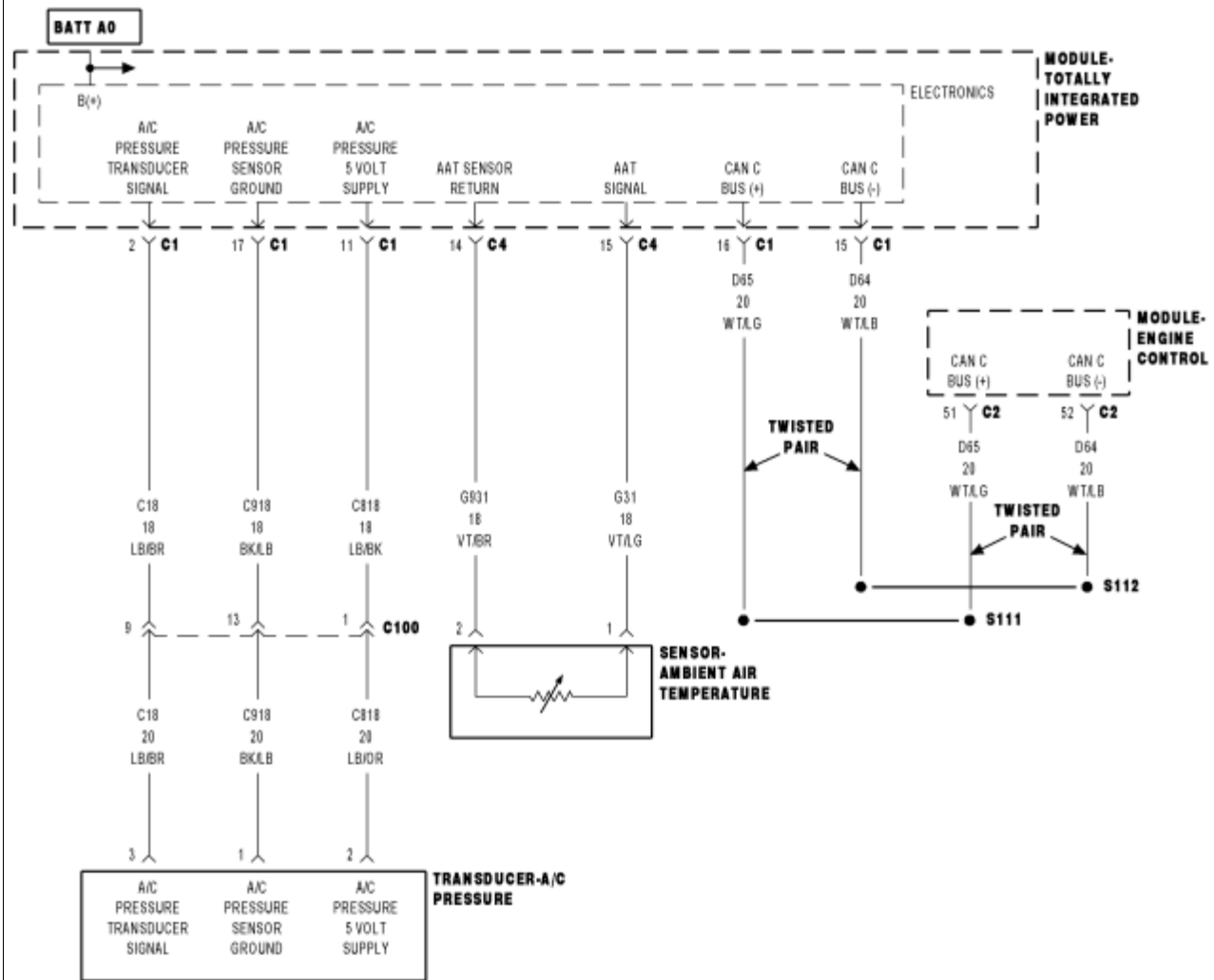
Were any problems found?**Yes**

- Repair or replace wiring/connectors as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Boost Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0070 - AMBIENT AIR TEMPERATURE SENSOR STUCK



01a783aa

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Ambient Air Temperature Sensor is a two wire sensor that is hard wired to the TIPM. The TIPM supplies a 5 volt sensor signal and sensor ground to the sensor. The sensor internal resistance changes in response to changes in ambient temperature. The TIPM provides the ECM with ambient temperature over the CAN Bus network.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Ambient Air Temperature Sensor signal over CAN Bus from the TIPM is implausible.

Possible Causes
INTERMITTENT DTC
TOTALLY INTEGRATED POWER MODULE
AMBIENT TEMPERATURE SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. DTC IS ACTIVE

NOTE: The Ambient Air Temperature Sensor is hardwired to the TIPM.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

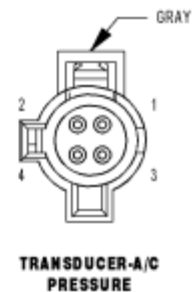
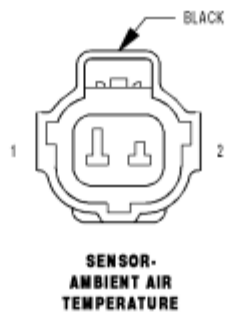
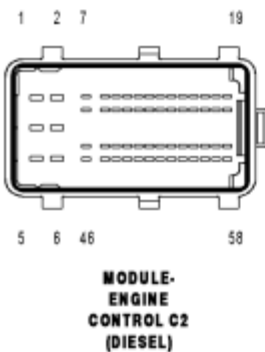
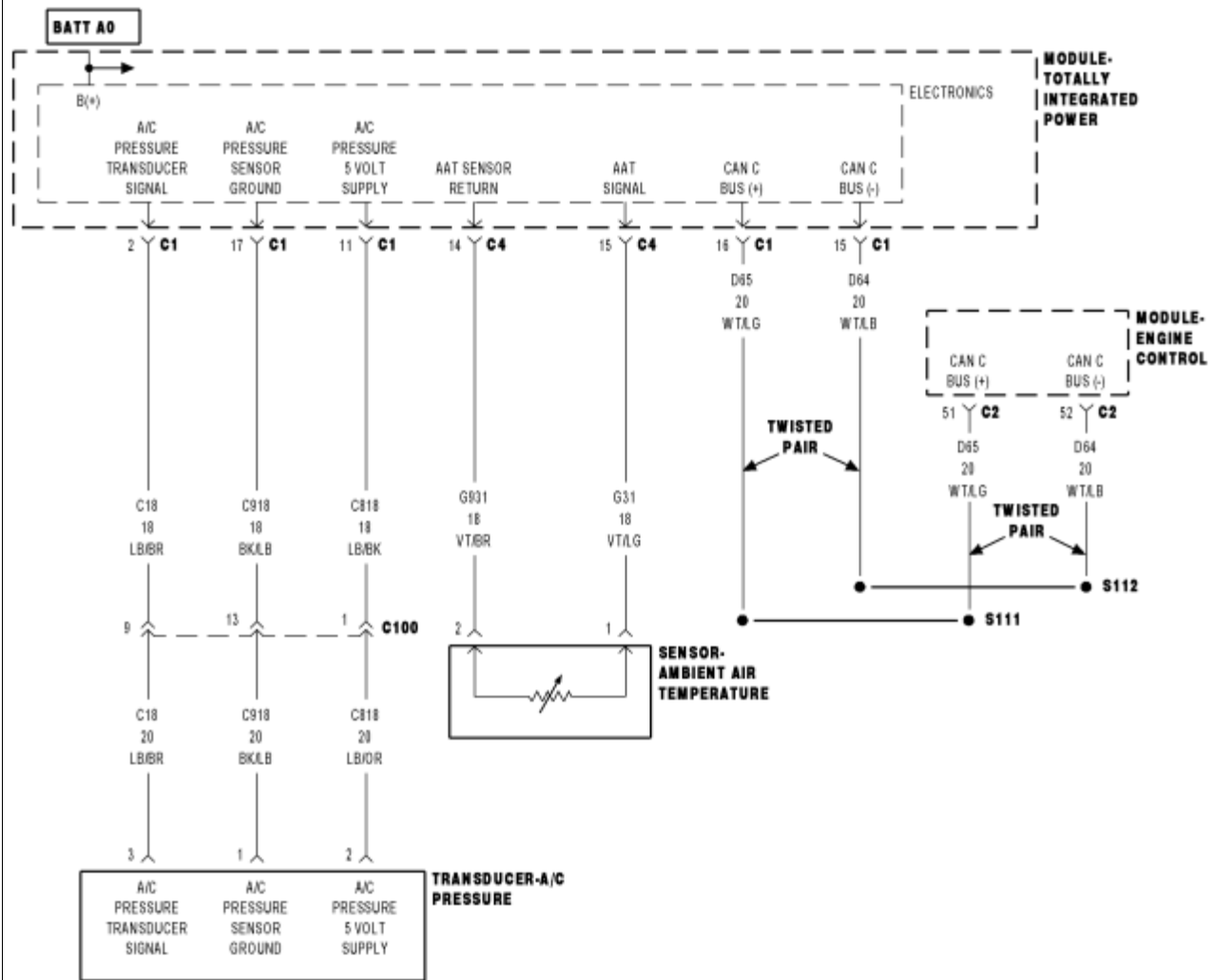
Yes

- Refer to the Service Information to diagnose problem with Ambient Air Temperature Sensor or associated wiring and connectors.

No

- Test Complete.

**P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW
(TIPM)**



01a783a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The Ambient Air Temperature (AAT) sensor circuit voltage at the TIPM is less than 0.078 of a volt for more than 2.8 seconds. One Trip Fault. Three good trips to clear the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) AAT RETURN
AAT SENSOR
TIPM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the AAT voltage.

Is the voltage below 0.078 of a volt?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. AAT SENSOR

Turn the ignition off.
Disconnect the AAT harness connector.

Ignition on, engine not running.
With a scan tool, read AAT voltage.

Is the voltage above 1.0 volt?

Yes

- Replace the AAT Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (G931) AAT RETURN CIRCUIT

Turn the ignition off.
Disconnect the C4 TIPM harness connector.
Measure the resistance between the (G931) AAT Return circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

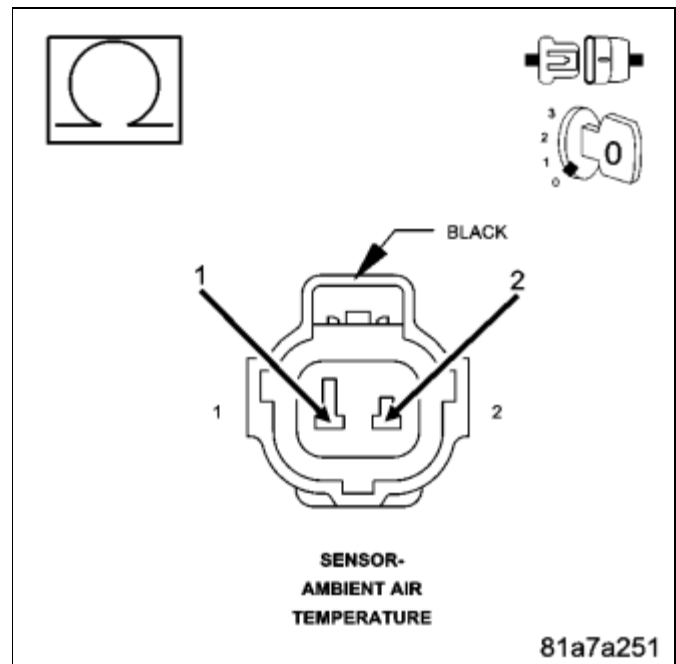
Is the resistance below 1000 ohms?

Yes

- Repair the short to between the (G931) AAT Return circuit and the (G31) AAT Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (G31) AAT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 1000 ohms?

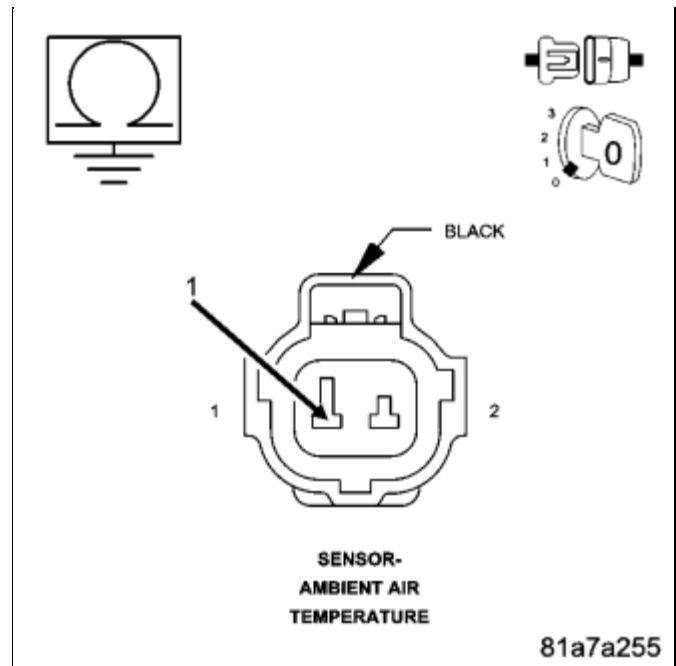
Yes

- Repair the short to ground in the (G31) AAT Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. TIPM

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

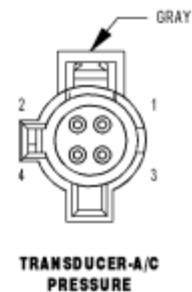
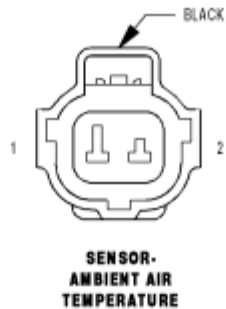
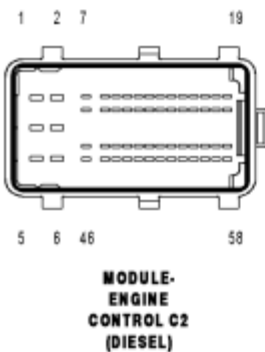
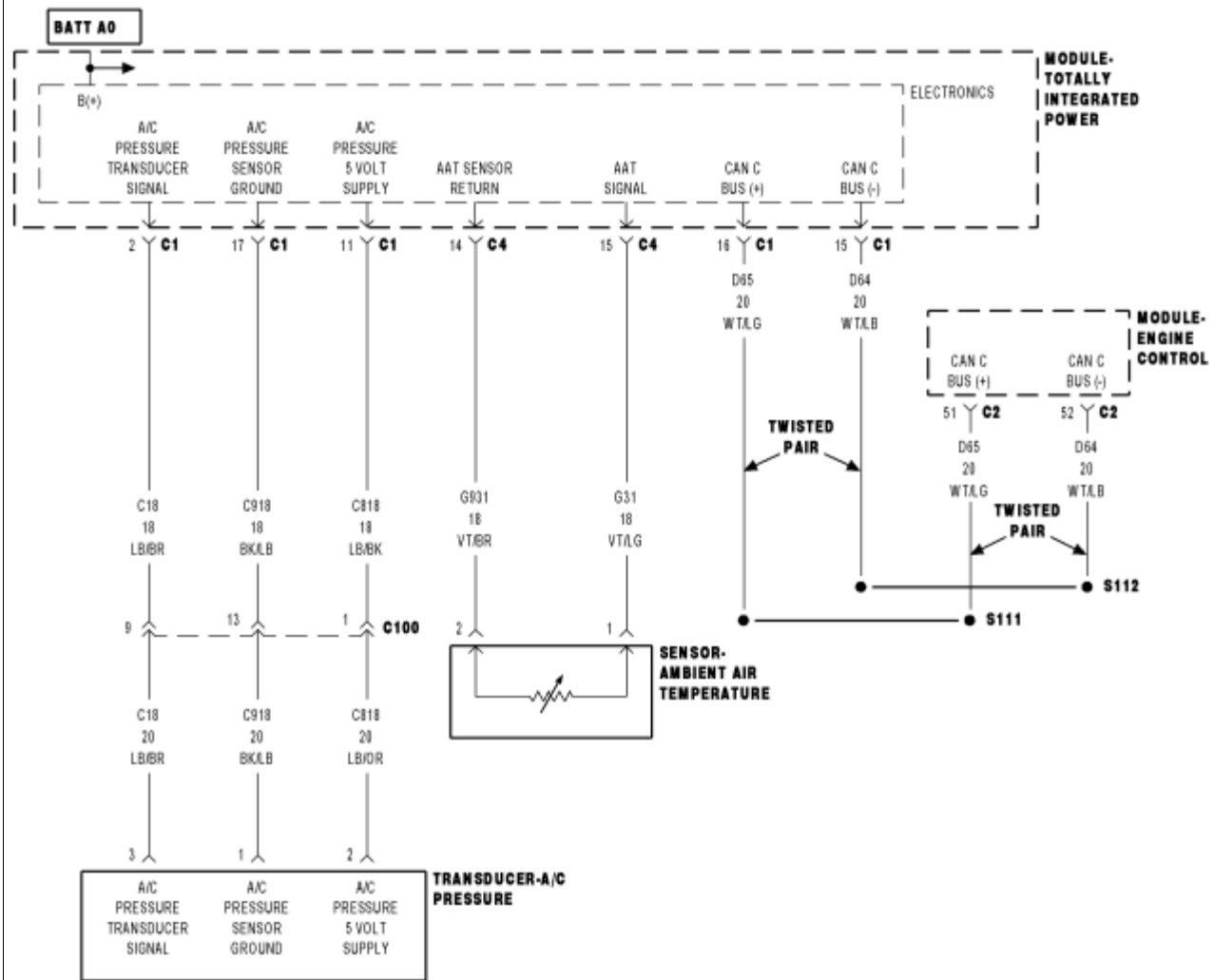
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Totally Integrated Power Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0073-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (TIPM)



01a783a

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10.4 volts.

◦ **Set Condition:**

The Ambient Air Temperature (AAT) sensor circuit voltage at the TIPM is greater than 4.98 volts for more than 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(G931) AAT RETURN CIRCUIT OPEN
AAT SENSOR
TIPM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.
With a scan tool, read the AAT voltage.

Is the voltage above 4.98 volts?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. AAT SENSOR

Turn the ignition off.
 Disconnect the AAT harness connector.
 Connect a jumper wire between the (G31) AAT Signal circuit and the (G931) AAT Return circuit in the AAT harness connector.
 Ignition on, engine not running.
 With a scan tool, read AAT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

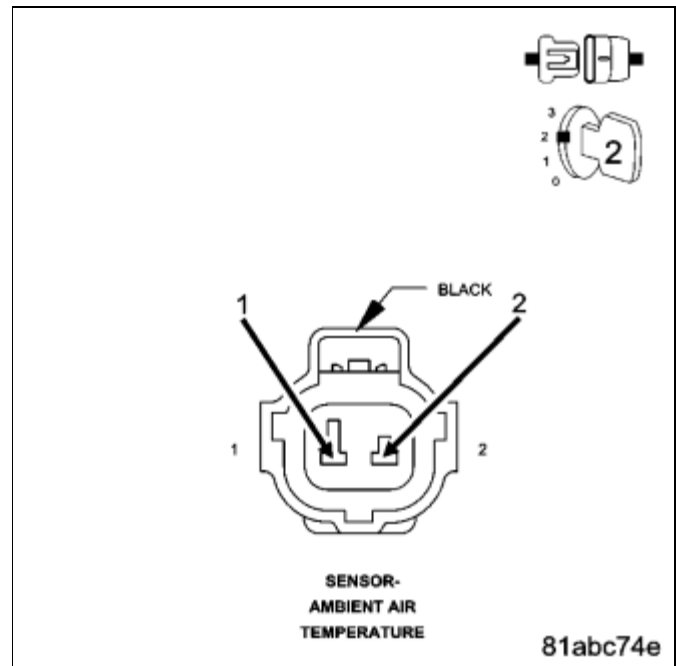
Yes

- Replace the AAT Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

NOTE: Remove the jumper wire before continuing.



3. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.
 Disconnect the C4 TIPM harness connector.
 Ignition on, engine not running.
 Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

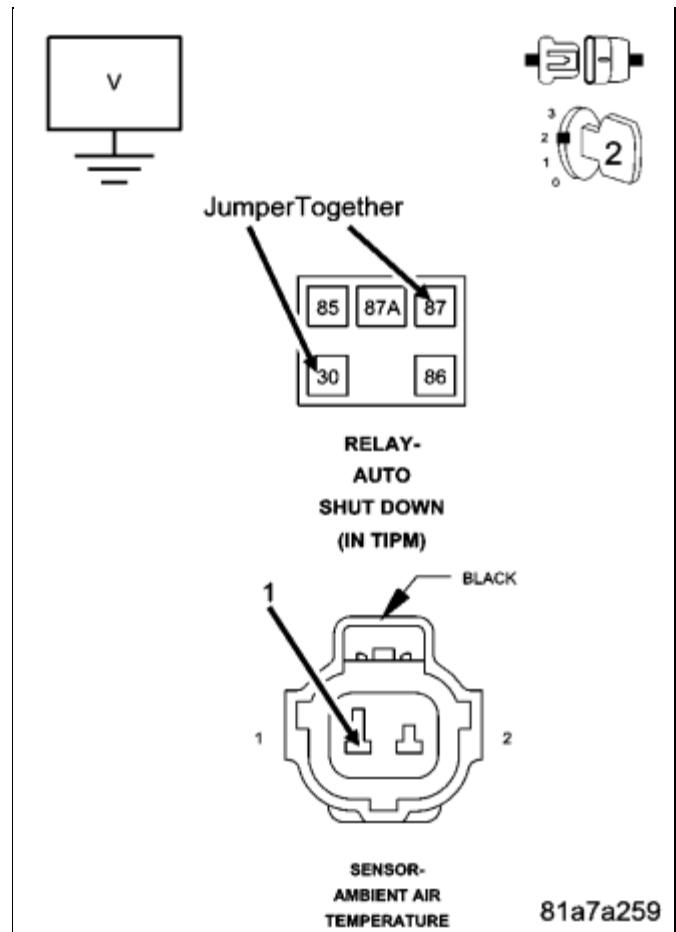
Is voltage present?

Yes

- Repair the short to battery voltage in the (G31) AAT Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (G31) AAT Signal circuit between the AAT Sensor harness connector and C4 TIPM harness connector.

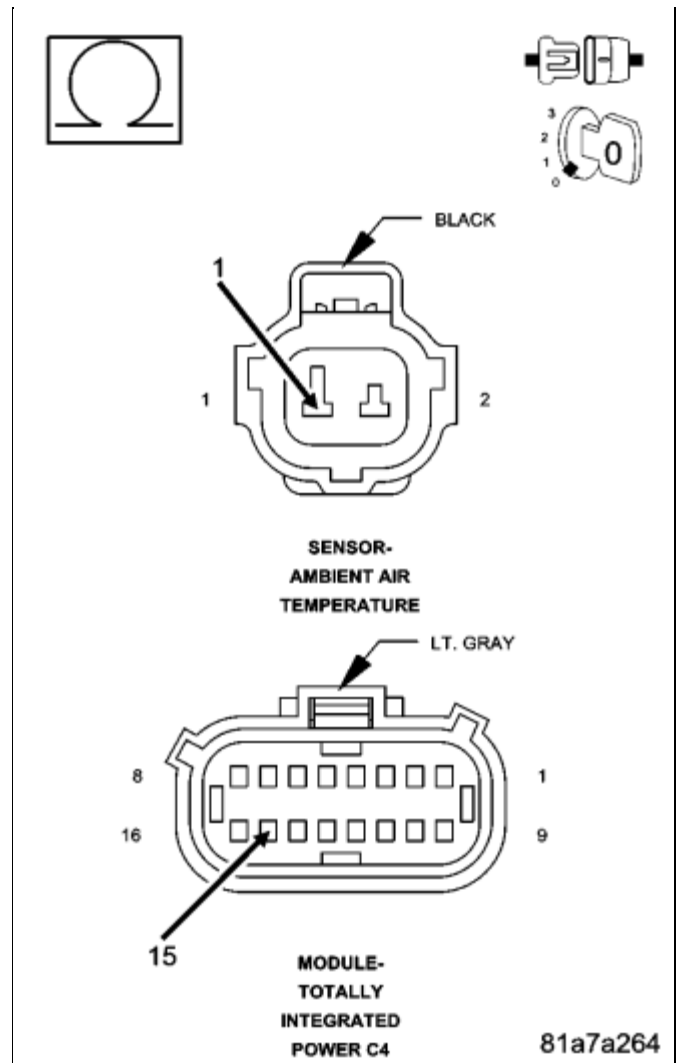
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the open in the (G31) AAT Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (G931) AAT RETURN CIRCUIT OPEN

Measure the resistance of the (G931) AAT Return circuit between the AAT Sensor harness connector and the C4 TIPM harness connector.

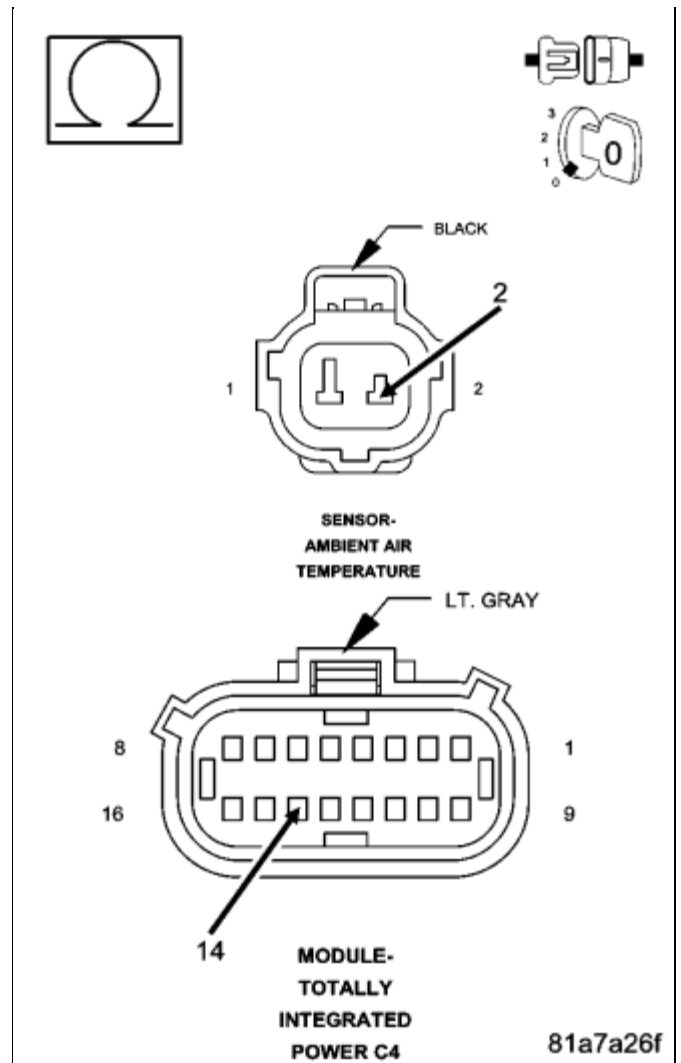
Is the resistance below 10.0 ohms?

Yes

- Go To [6](#)

No

- Repair the open in the (G931) AAT Return circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. TIPM

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

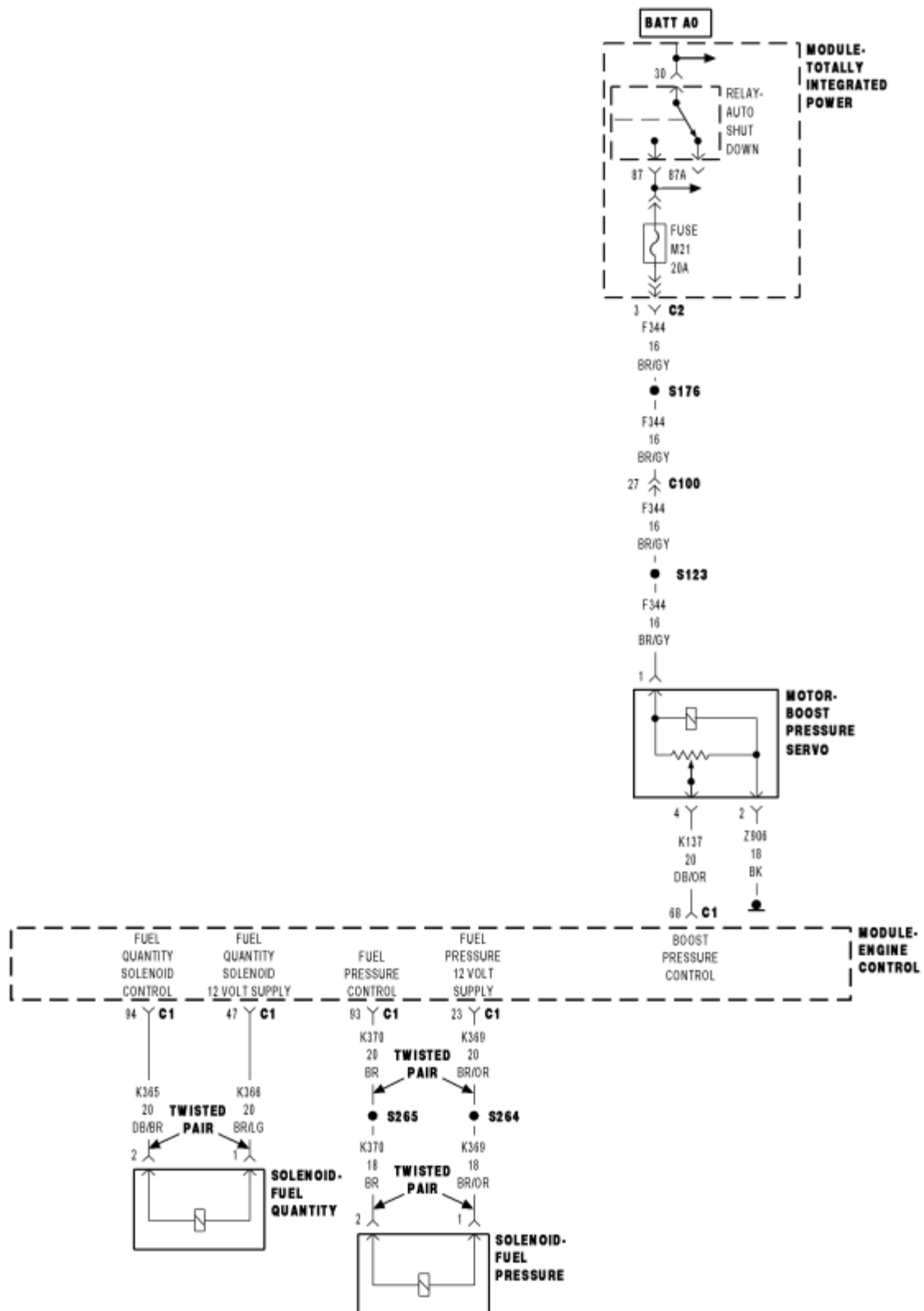
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Totally Integrated Power Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0087-FUEL RAIL PRESSURE TOO LOW



For a complete wiring diagram Refer to Section 8W

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM determines that the fuel rail pressure is too low for a given engine speed and load.

Possible Causes
AIR IN FUEL SYSTEM
FUEL DELIVERY SYSTEM
FUEL PRESSURE SENSOR
FUEL INJECTOR(S)
FUEL PRESSURE SOLENOID
FUEL PUMP
FUEL SYSTEM CONTAMINATION
FUEL SYSTEM LEAK
INTERMITTENT DTC

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECKING FOR OTHER ECM DTCS

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Turn the ignition on.

With the scan tool, read the ECM DTCs.

Are there any other DTCs present?

Yes

- Refer to symptom list for problems related to the DTC other than this DTC.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CURRENT DTC

NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. FUEL SYSTEM LEAK

Turn the ignition off.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the entire fuel system for leakage.

Is there any evidence of leakage?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL SYSTEM CONTAMINATION

NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the fuel system for contamination.

Is the fuel contaminated?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL PRESSURE SENSOR CALIBRATION

Turn the ignition on.

With the scan tool, read the Fuel Pressure Sensor volts.

Does the scan tool display between 0.45 and 0.60 volts for the Fuel Pressure Sensor?

Yes

- Go To [6](#)

No

- Check the Fuel Pressure Sensor wiring and connectors for corrosion or poor terminal contact that could cause high resistance. Repair as necessary. If wiring and connectors are o.k., replace the Fuel Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ATTEMPT TO START ENGINE

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

Does the engine start and idle?

Yes

- Go To [7](#)

No

- Go To [12](#)

7. CHECKING FOR AIR IN FUEL SYSTEM

With the scan tool in Sensors, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.

Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?

Yes

- Refer to the Service Information to purge air from the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. FUEL PRESSURE SOLENOID

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure.

NOTE: A sticking Fuel Pressure Solenoid is indicated by the Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.

Does the Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure Setpoint?

Yes

- Replace the Fuel Pressure Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [10](#)

10. FUEL INJECTOR(S)

NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.

Does the engine exhibit the symptoms described in the above note?

Yes

- Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [11](#)

11. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the ECM display this DTC?

Yes

- Replace the Fuel Pump in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

12. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

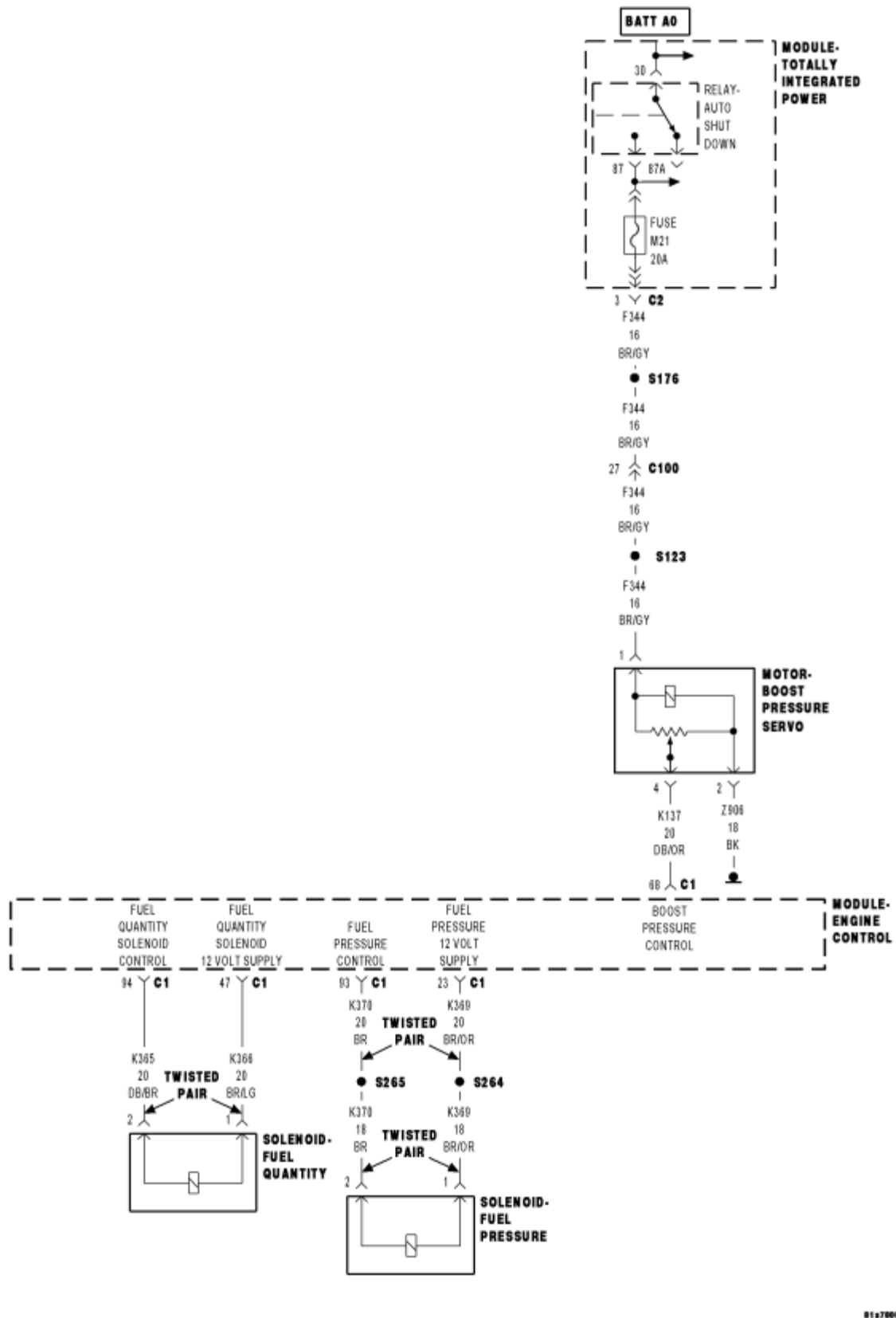
Does the ECM display this DTC?**Yes**

- Replace the Fuel Pump in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0088-FUEL RAIL PRESSURE TOO HIGH



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM determines that the fuel rail pressure is too high for a given engine speed and load.

Possible Causes
AIR IN FUEL SYSTEM
FUEL DELIVERY SYSTEM
FUEL PRESSURE SENSOR
FUEL INJECTOR(S)
FUEL PRESSURE SOLENOID
FUEL PUMP
FUEL SYSTEM CONTAMINATION
FUEL SYSTEM LEAK
INTERMITTENT DTC

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECKING FOR OTHER ECM DTCS

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING

WHEN SERVICING FUEL SYSTEM.

Turn the ignition on.

With the scan tool, read the ECM DTCs.

Are there any other DTCs present?

Yes

- Refer to symptom list for problems related to the DTC other than this DTC.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CURRENT DTC

NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. FUEL SYSTEM LEAK

Turn the ignition off.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE

FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the entire fuel system for leakage.

Is there any evidence of leakage?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL SYSTEM CONTAMINATION

NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the fuel system for contamination.

Is the fuel contaminated?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

Go To [5](#)

5. FUEL PRESSURE SENSOR CALIBRATION

Turn the ignition on.

With the scan tool, read the Fuel Pressure Sensor volts.

Does the scan tool display between 0.45 and 0.60 volts for the Fuel Pressure Sensor?

Yes

- Go To [6](#)

No

- Check the Fuel Pressure Sensor wiring and connectors for corrosion or poor terminal contact that could cause high resistance. Repair as necessary. If wiring and connectors are o.k., replace the Fuel Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ATTEMPT TO START ENGINE

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

Does the engine start and idle?

Yes

- Go To [7](#)

No

- Go To [12](#)

7. CHECKING FOR AIR IN FUEL SYSTEM

With the scan tool in Sensors, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.

Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?

Yes

- Refer to the Service Information to purge air from the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. FUEL PRESSURE SOLENOID

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure.

NOTE: A sticking Fuel Pressure Solenoid is indicated by the Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.

Does the Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure Setpoint?

Yes

- Replace the Fuel Pressure Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [10](#)

10. FUEL INJECTOR(S)

NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.

Does the engine exhibit the symptoms described in the above note?

Yes

- Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [11](#)

11. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the ECM display this DTC?

Yes

- Replace the Fuel Pump in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

12. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the ECM display this DTC?

Yes

- Go To [14](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

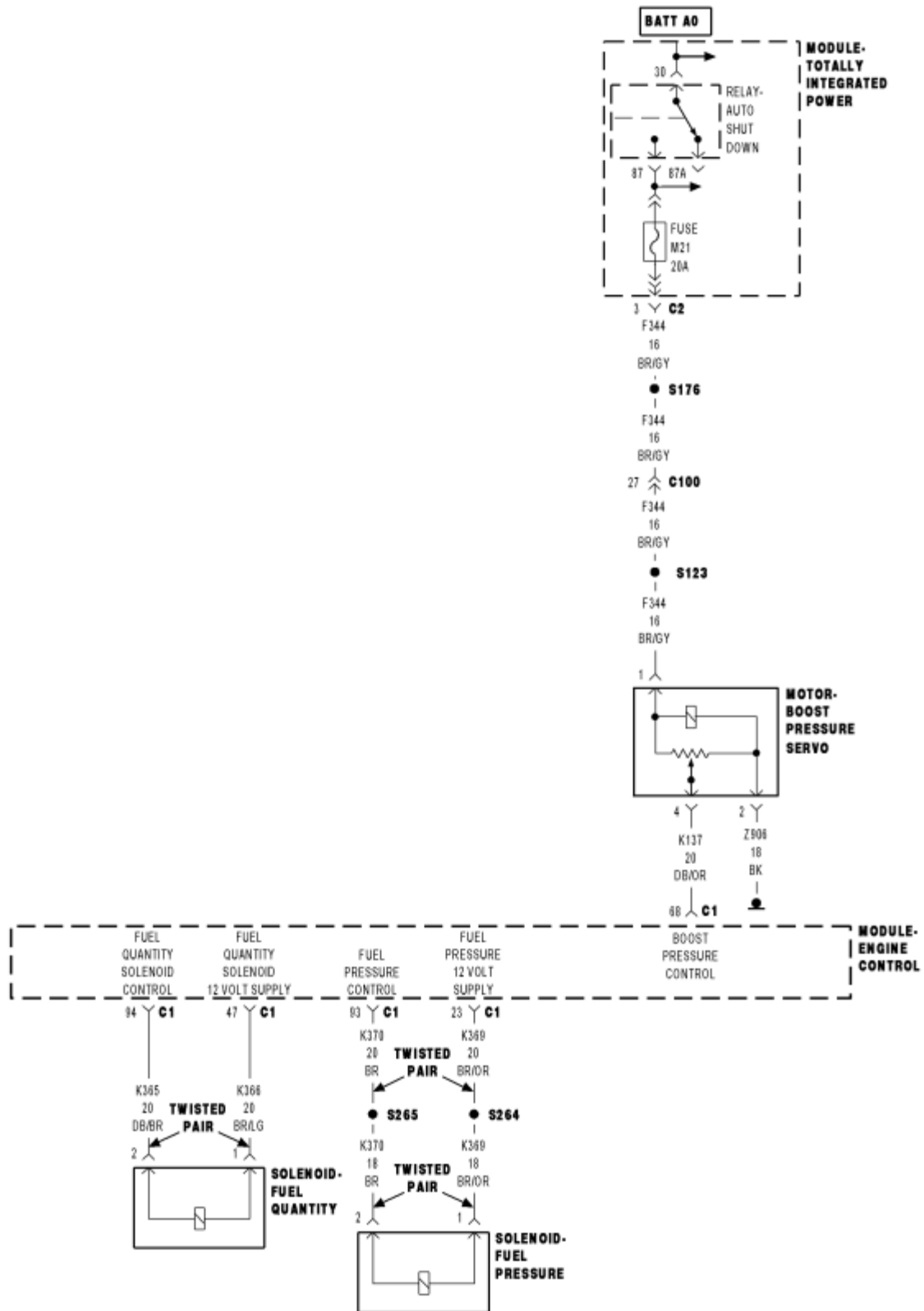
Yes

- Replace the Fuel Pump in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0090 - FUEL PRESSURE 1 CONTROL CIRCUIT/OPEN



81a78003

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Fuel Pressure Solenoid (FPS) is a solenoid operated valve designed to regulate fuel pressure in the fuel rail. The FPS valve is positioned in-line with the outlet passage of the high pressure fuel rail. The solenoid receives 12 volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel rail outlet passage opens allowing fuel pressure in the rail to escape into the return circuit to the fuel tank. When the ECM grounds the FPS control signal, the solenoid valve closes allowing fuel pressure to build in the rail.

- **When Monitored:**

With the ignition on and the Fuel Pressure Solenoid command off.

- **Set Condition:**

The ECM detects that the (K370) Fuel Pressure Solenoid Control circuit is open for 0.28 second.

Possible Causes
INTERMITTENT DTC
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
FUEL PRESSURE SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pressure Solenoid at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

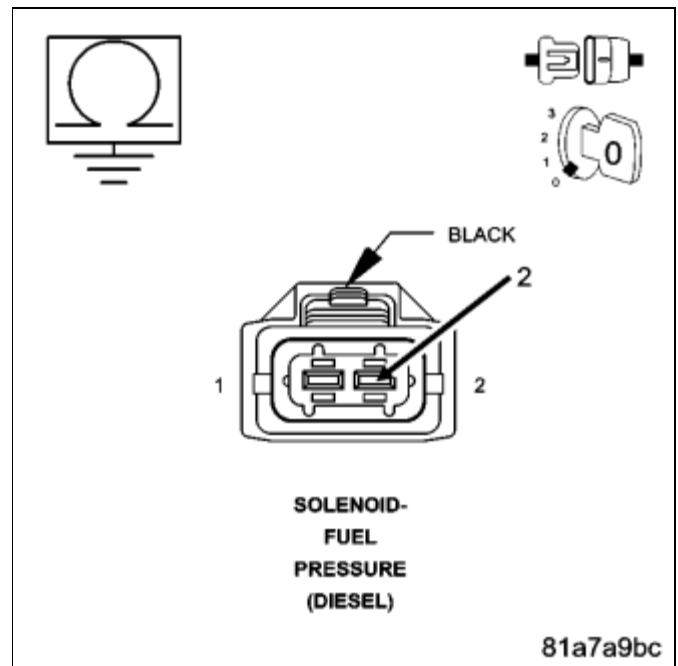
Measure the resistance between ground and the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

Is the resistance above 1000 ohms?**Yes**

- Go to [3](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**3. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE**

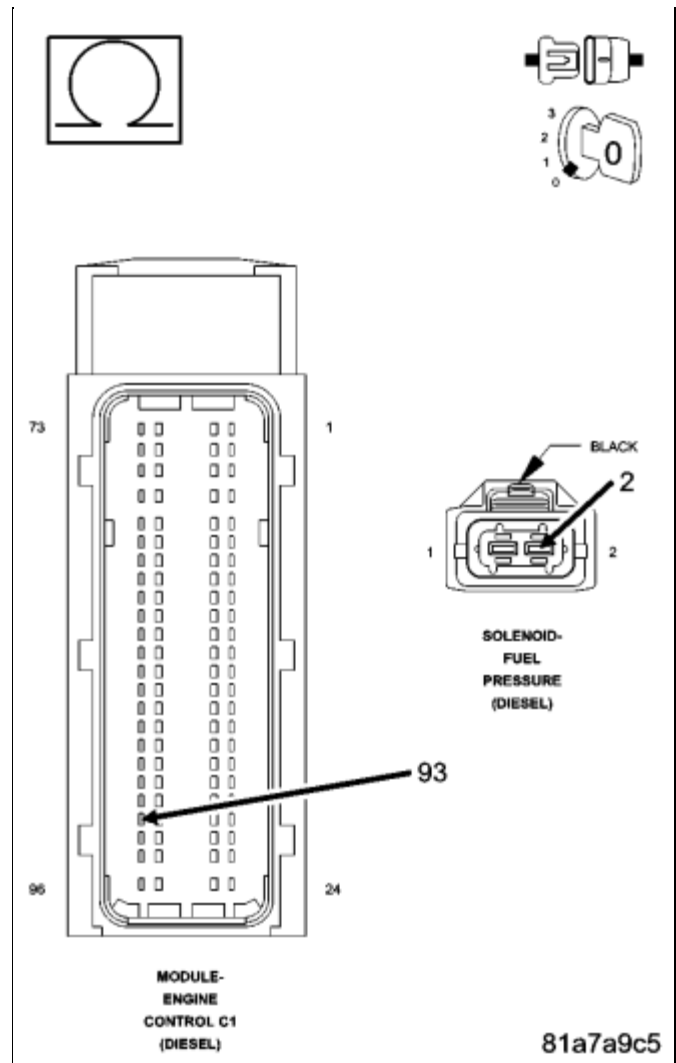
Measure the resistance of the (K370) Fuel Pressure Solenoid Control circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?**Yes**

- Go to [4](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K369) Fuel Pressure Solenoid 12 Volt Supply circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.

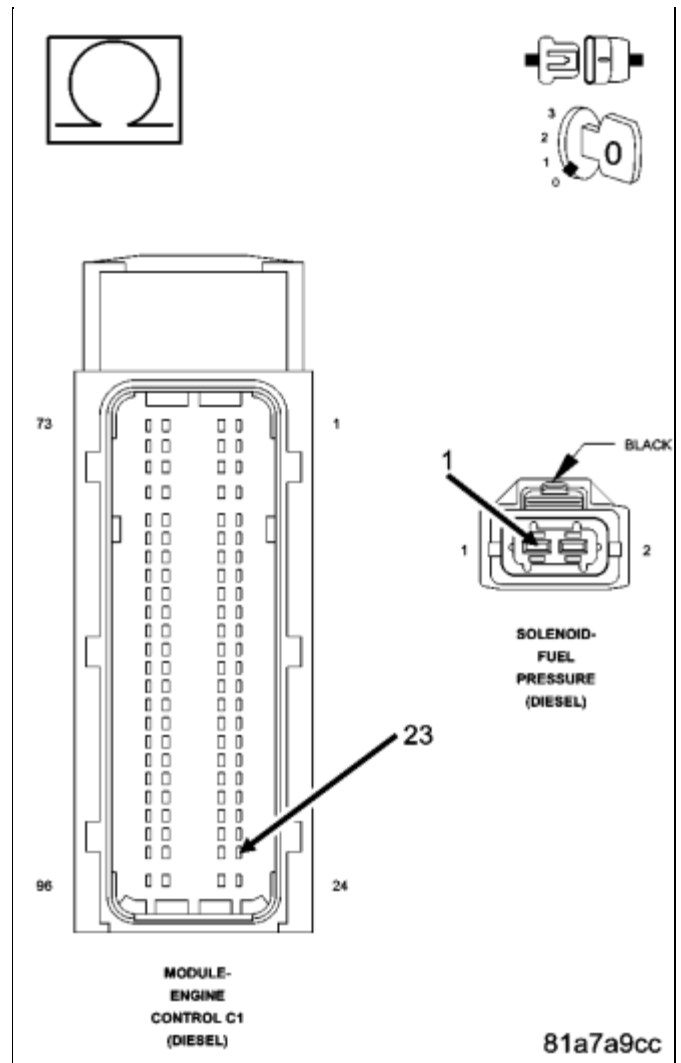
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K369) Fuel Pressure Solenoid 12 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. FUEL PRESSURE SOLENOID

Connect the Engine Control Module (ECM) harness connector.

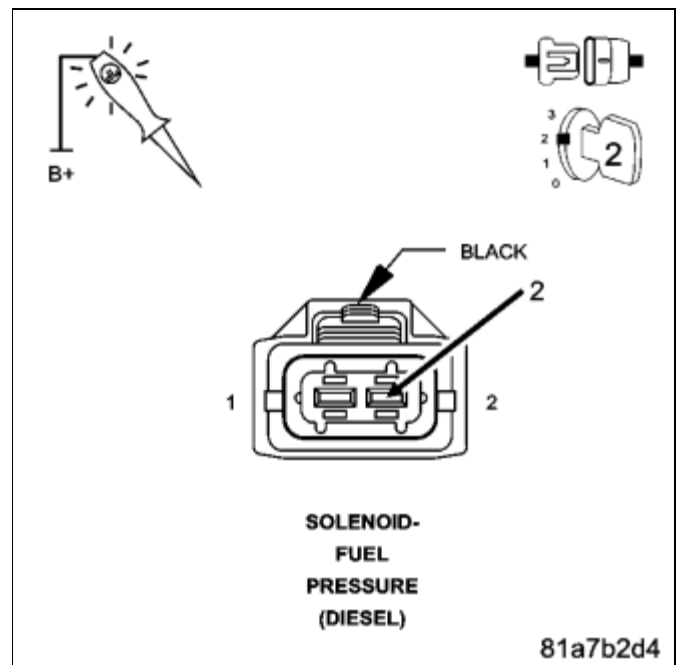
Turn the ignition on.

With the scan tool, actuate the Fuel Pressure Solenoid (Rail Pressure Actuator) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

Is the test light illuminated and bright with the actuation at 100%?

Yes

- Replace the Fuel Pressure Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

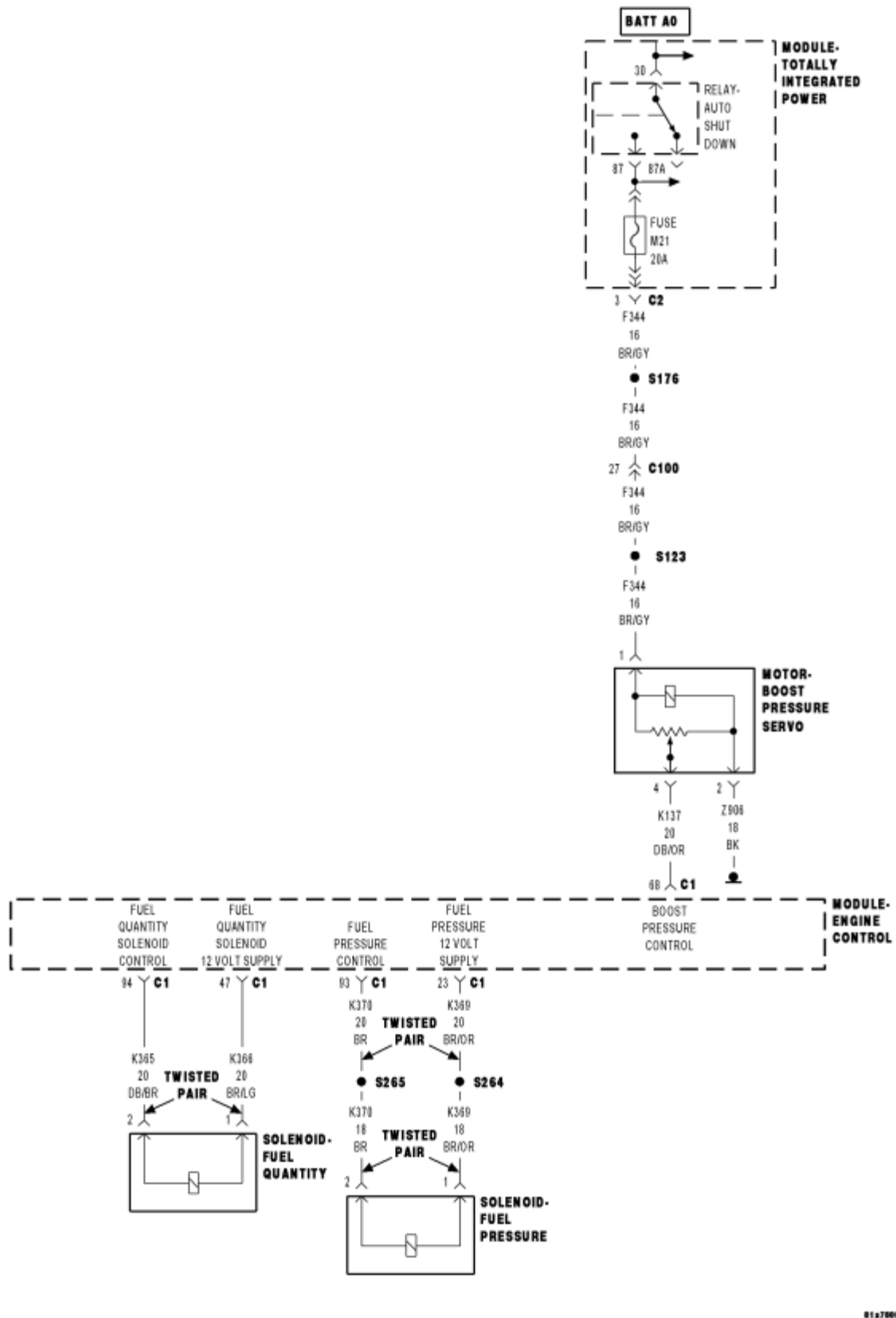
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0091 - FUEL PRESSURE 1 CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Fuel Pressure Solenoid (FPS) is a solenoid operated valve designed to regulate fuel pressure in the fuel rail. The FPS valve is positioned in the in-line with the outlet passage of the high pressure fuel rail. The solenoid receives 12 volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel rail outlet passage opens allowing fuel pressure in the rail to escape into the return circuit to the fuel tank. When the ECM grounds the FPS control signal, the solenoid valve closes allowing fuel pressure to build in the rail.

- **When Monitored:**

With the ignition on and the Fuel Pressure Solenoid command off.

- **Set Condition:**

The ECM detects that the (K370) Fuel Pressure Solenoid Control circuit is shorted to ground for 0.22 second.

Possible Causes
INTERMITTENT DTC
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
FUEL PRESSURE SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pressure Solenoid at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

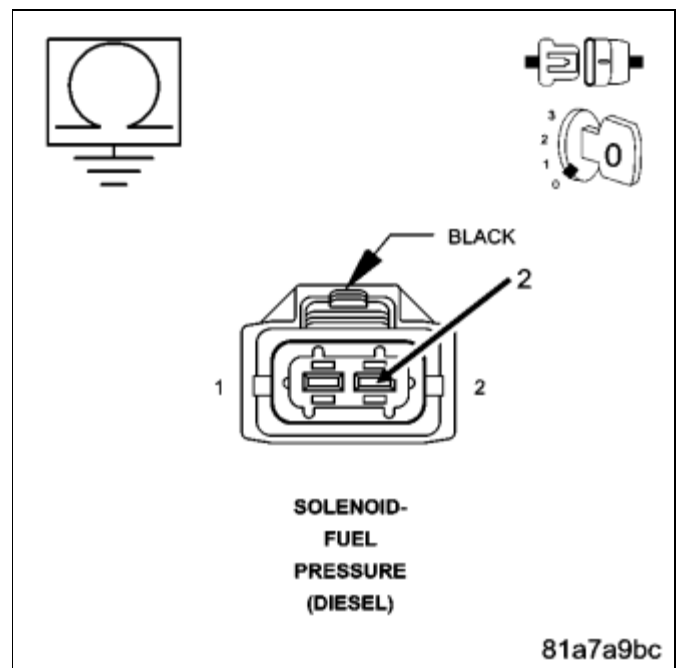
Measure the resistance between ground and the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

Is the resistance above 1000 ohms?**Yes**

- Go to [3](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**3. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE**

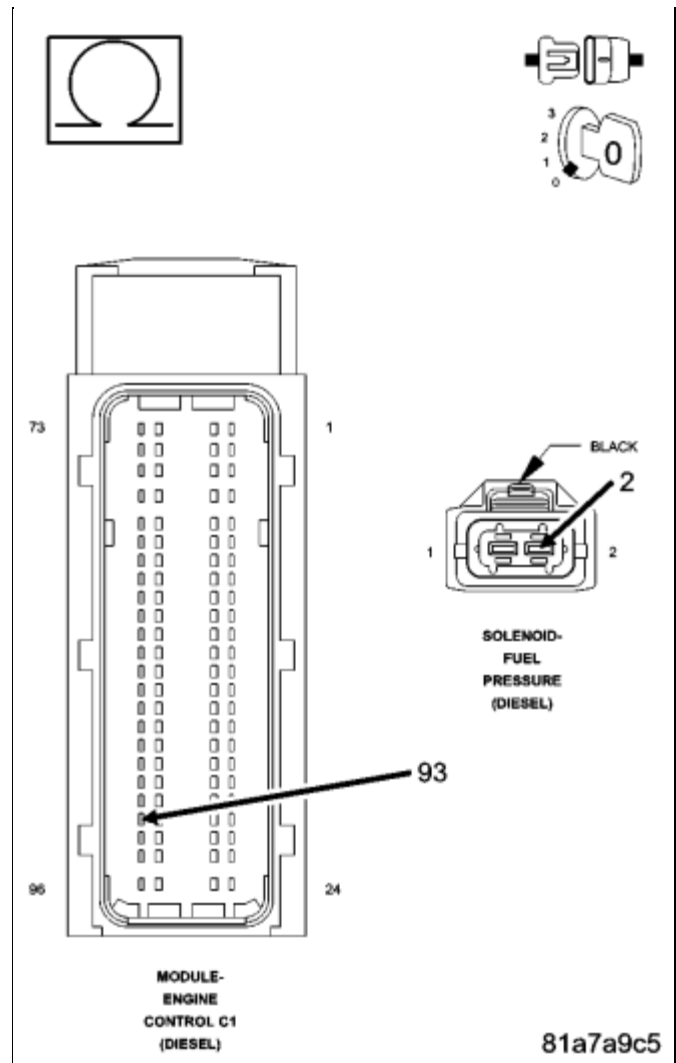
Measure the resistance of the (K370) Fuel Pressure Solenoid Control circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?**Yes**

- Go to [4](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K369) Fuel Pressure Solenoid 12 Volt Supply circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.

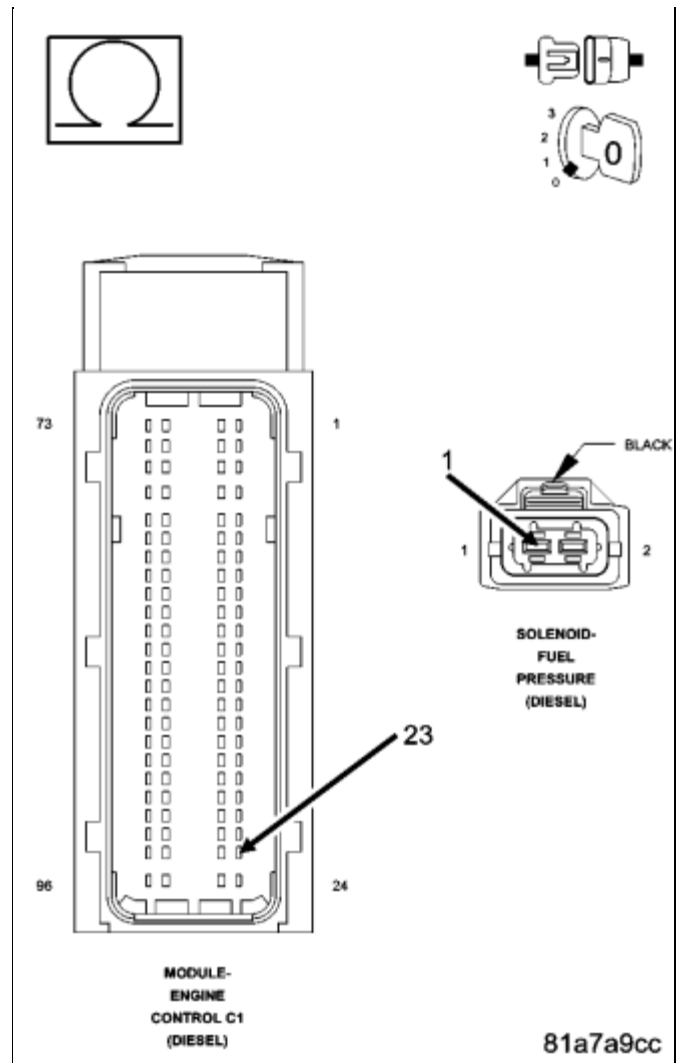
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K369) Fuel Pressure Solenoid 12 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 in the ASD Relay connector.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in ECM harness connector C2 cavities 1, 3 and 5.

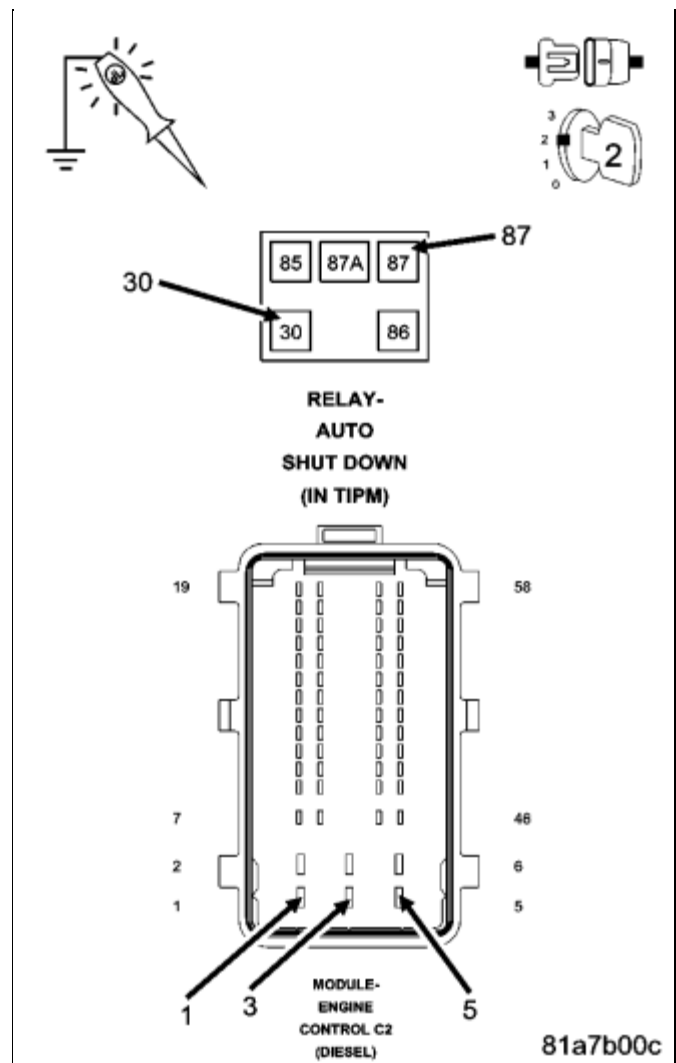
Did the test light illuminate for each circuit?

Yes

- Go To [6](#)

No

- Repair the ASD Relay Output circuit(s) for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. FUEL PRESSURE SOLENOID

Connect the Engine Control Module (ECM) harness connector.

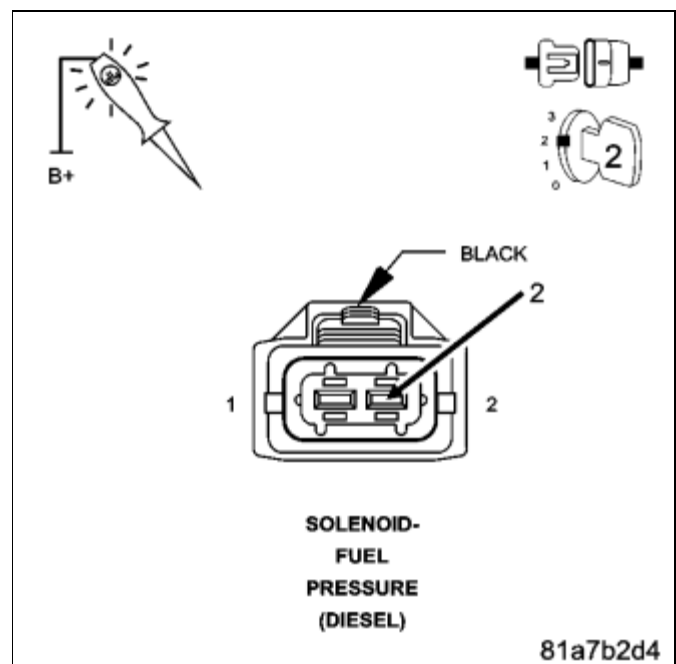
Turn the ignition on.

With the scan tool, actuate the Fuel Pressure Solenoid to 100%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

With the scan tool, actuate the Fuel Pressure Solenoid to 0%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

NOTE: The test light should not be illuminated.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.

Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?

Yes

- Replace the Fuel Pressure Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [Z](#)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0092 - FUEL PRESSURE 1 CONTROL CIRCUIT HIGH

The Fuel Pressure Solenoid (FPS) is a solenoid operated valve designed to regulate fuel pressure in the fuel rail. The FPS valve is positioned in-line with the outlet passage of the high pressure fuel rail. The solenoid receives 12 volt power and a duty-cycle ground signal from the ECM. When the solenoid is not actuated (no ground signal from the ECM), the fuel rail outlet passage opens allowing fuel pressure in the rail to escape into the return circuit to the fuel tank. When the ECM grounds the FPS control signal, the solenoid valve closes allowing fuel pressure to build in the rail.

- **When Monitored:**

With the ignition on and the Fuel Pressure Solenoid command on.

- **Set Condition:**

The ECM detects excessive current on the (K370) Fuel Pressure Solenoid Control circuit for 0.28 second.

Possible Causes
INTERMITTENT DTC
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO THE (K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT
(K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL PRESSURE SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pressure Solenoid at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.

Disconnect the Engine Control Module (ECM) connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

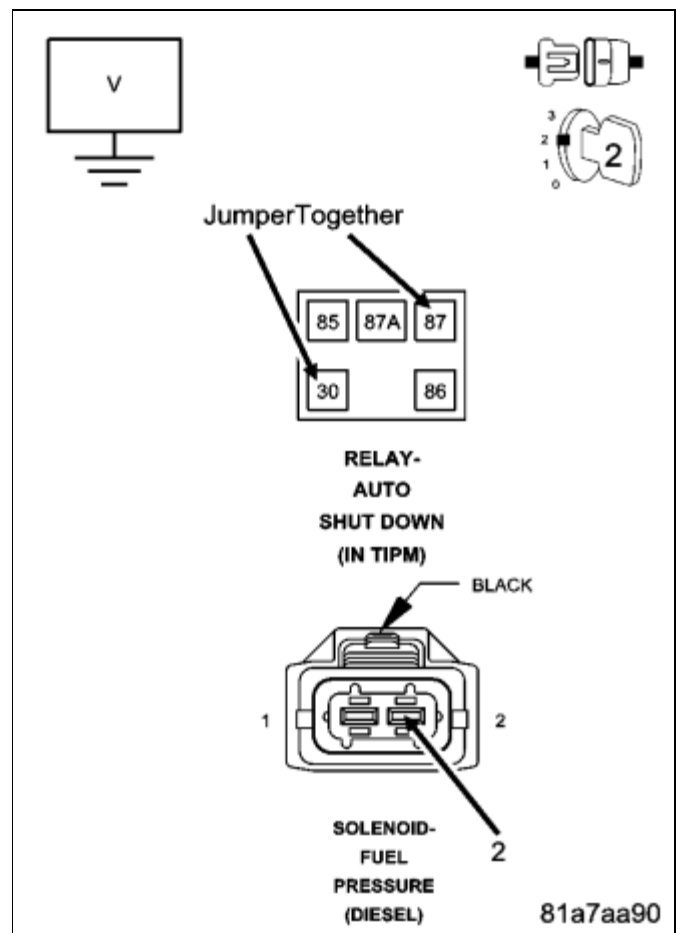
Measure the voltage of the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

Is there any voltage present?**Yes**

- Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

**3. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO THE (K369) FUEL PRESSURE SOLENOID 12 VOLT SUPPLY CIRCUIT**

Turn the ignition off.

Remove the jumper wire and install the ASD Relay

Measure the resistance between the (K370) Fuel Pressure

Solenoid Control circuit and the (K369) Fuel Pressure Solenoid 12 Volt Supply in the Fuel Pressure Solenoid harness connector.

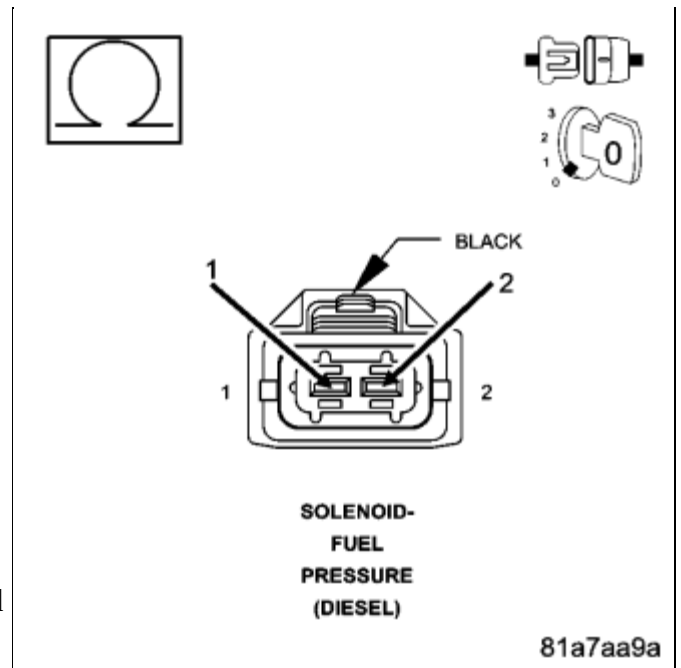
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to the (K369) Fuel Pressure Solenoid 12 Volt Supply circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K370) Fuel Pressure Solenoid Control circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.

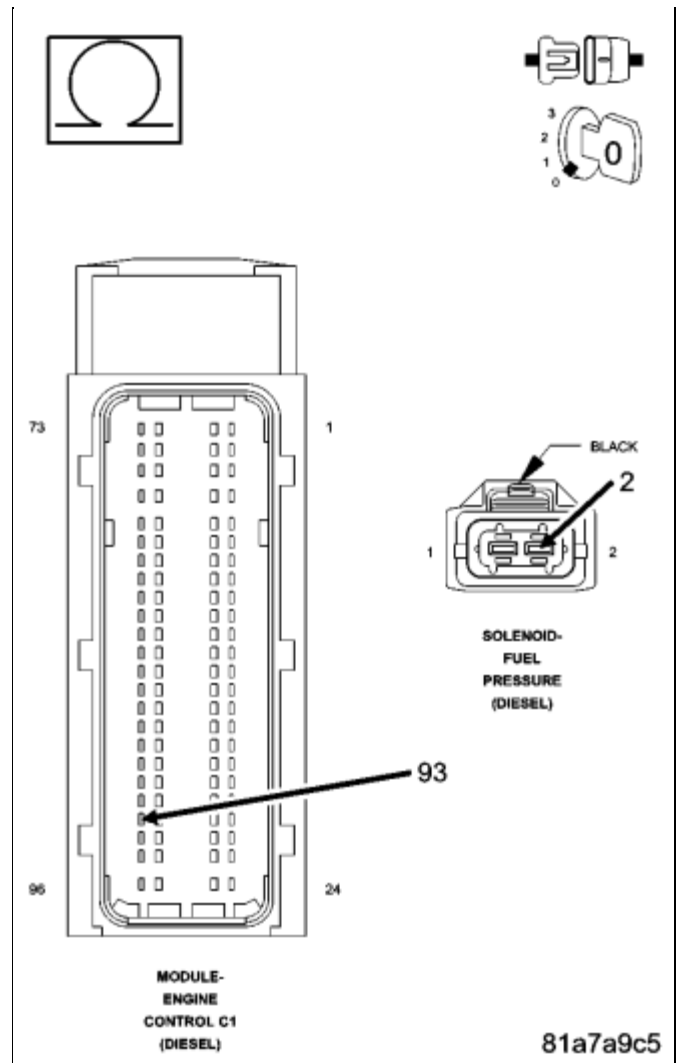
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K370) Fuel Pressure Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. FUEL PRESSURE SOLENOID

Connect the Engine Control Module (ECM) harness connector.

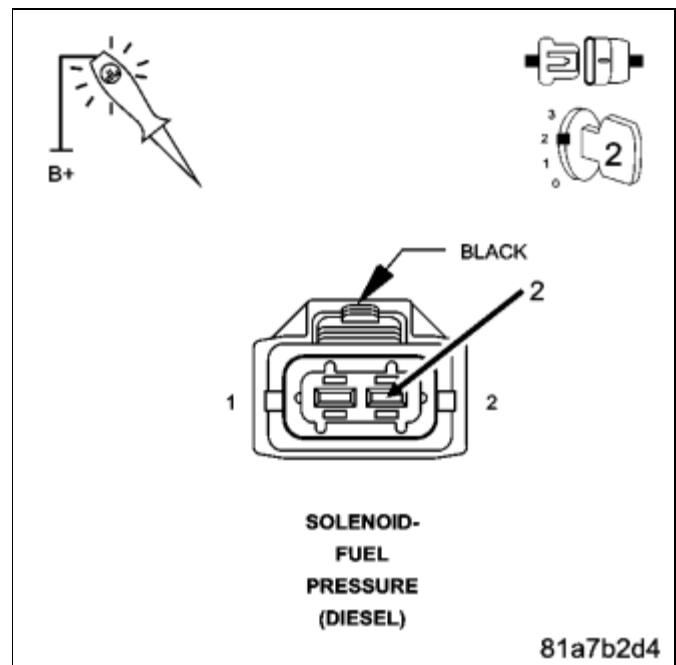
Turn the ignition on.

With the scan tool, actuate the Fuel Pressure Solenoid (Rail Pressure Actuator) to 100%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when



checking the circuit.

Is the test light illuminated and bright with the actuation at 100%?

Yes

- Replace the Fuel Pressure Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

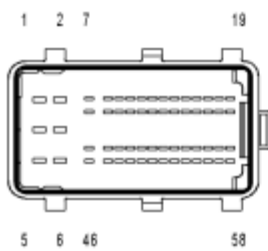
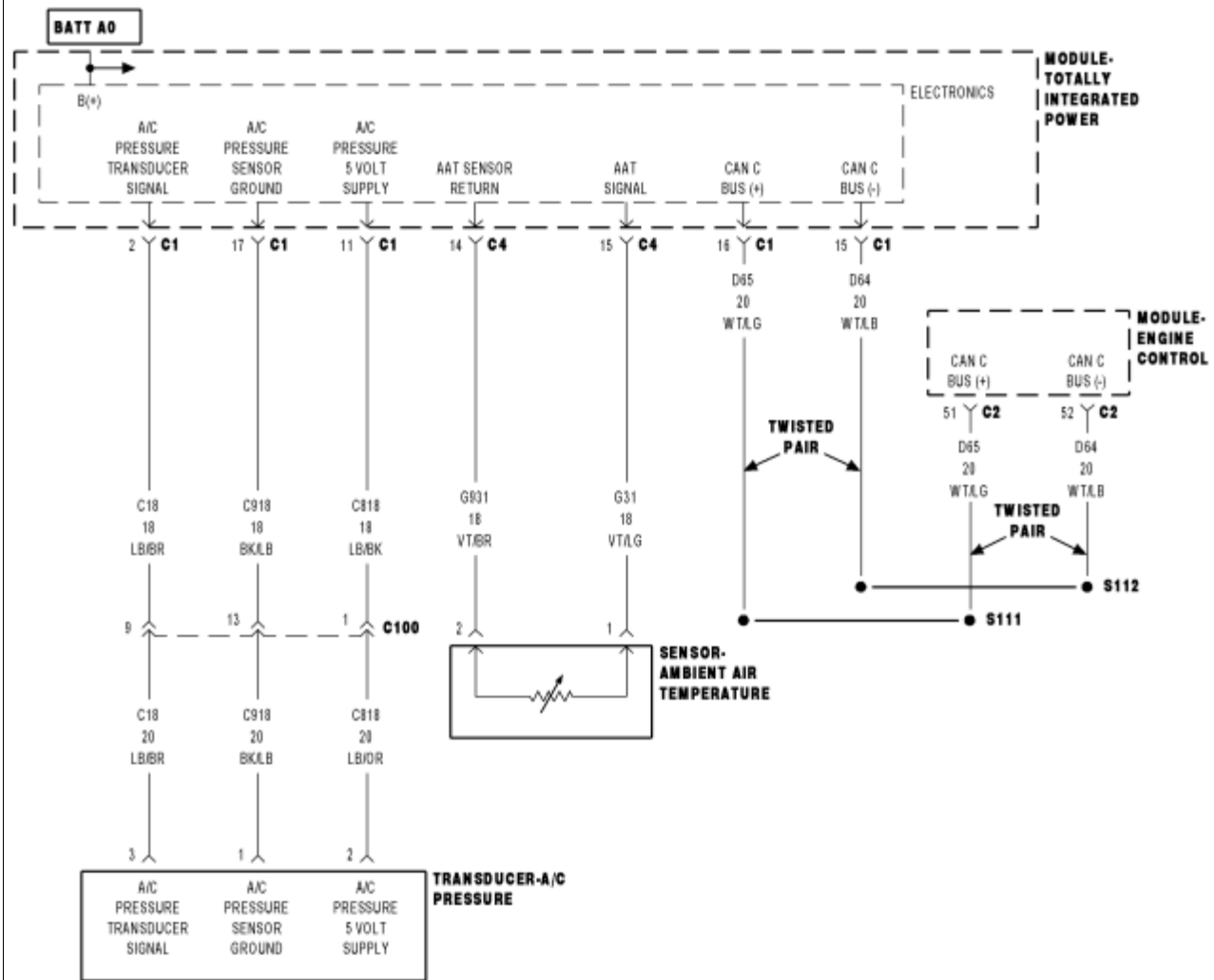
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

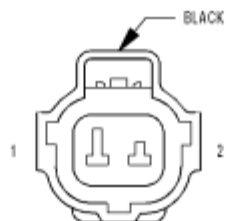
No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

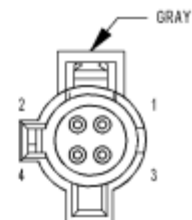
P009A-INTAKE AIR TEMP/AMBIENT AIR TEMP CORRELATION



**MODULE-
ENGINE
CONTROL C2
(DIESEL)**



**SENSOR-
AMBIENT AIR
TEMPERATURE**



**TRANSDUCER-A/C
PRESSURE**

01a783a

For a complete wiring diagram **Refer to Section 8W**

AAT SENSOR - COLD
AAT SENSOR - HOT
CHECKING CONNECTORS
IAT SENSOR - COLD
IAT SENSOR - HOT
INTERMITTENT CONDITION

Diagnostic Test

1. CHECKING CONNECTORS

Turn the ignition off.

Disconnect the IAT and AAT Sensor harness connectors.

Inspect both connectors for poor terminal contact, corrosion, damage or other problems.

Is there any evidence of connector problems?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [2](#)

2. IAT SENSOR - COLD

NOTE: Allow the engine to completely cool to ambient temperature.

Reconnect all connectors.

Turn the ignition on.

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Intake Air Temperature and compare it to the engine coolant temperature reading.

Are the readings within 7°C (13°F) of each other?

Yes

- Go To [3](#)

No

- Check the wiring and connectors associated with the IAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Intake Air Temperature Sensor.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

3. AAT SENSOR - COLD

NOTE: Allow the engine to completely cool to ambient temperature.

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Ambient Air Temperature and compare it to the engine coolant temperature reading.

Are the readings within 7°C (13°F) of each other?

Yes

- Go To [4](#)

No

- Check the wiring and connectors associated with the AAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Ambient Air Temperature Sensor.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

4. IAT SENSOR - HOT

Start the engine and bring the engine to operating temperature (thermostat open).

Turn the engine off and wait 10 minutes to allow the engine temperature to stabilize.

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Intake Air Temperature.

Are the readings within 7°C (13°F) of each other?

Yes

- Go To [5](#)

No

- Check the wiring and connectors associated with the IAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Intake Air Temperature Sensor.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

5. AAT SENSOR - HOT

Start the engine and bring the engine to operating temperature (thermostat open).
With the scan tool, read the Ambient Air Temperature.

Is the Ambient Temperature Sensor reading correct outside temperature?

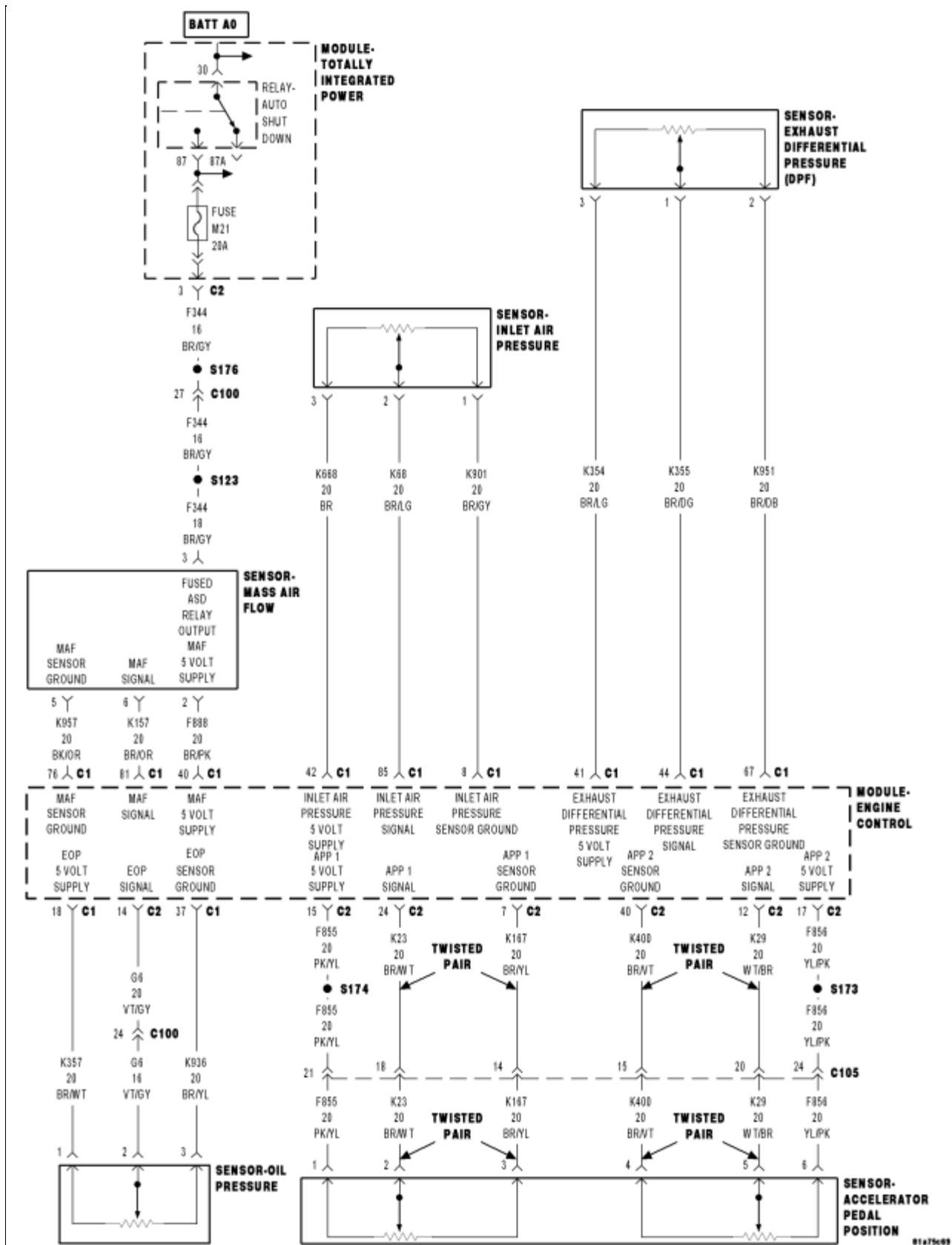
Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Check the wiring and connectors associated with the AAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Ambient Air Temperature Sensor.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

P0100-MASS AIR FLOW SENSOR



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects that the (K157) Mass Air Flow Sensor Signal circuit is not within a valid range.

Possible Causes
INTERMITTENT DTC
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT
MASS AIR FLOW SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Mass Air Flow Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K157) Mass Air Flow Sensor Signal circuit in the Mass Air Flow Sensor harness connector.

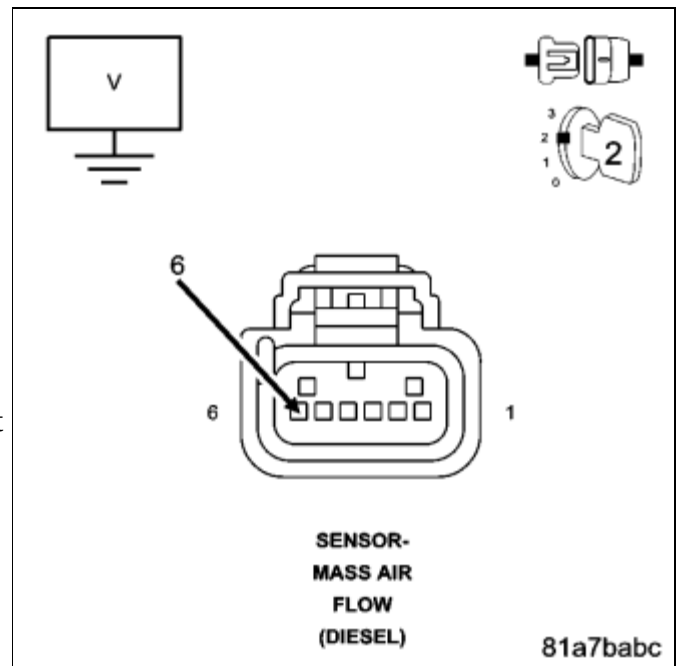
Is there any voltage present?

Yes

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor harness connector.

Is there any voltage present?

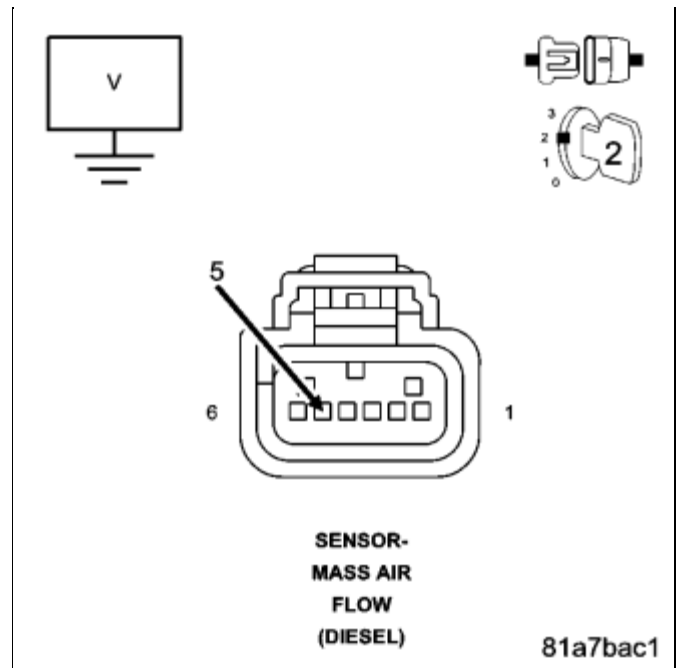
Yes

- Repair the (K957) Mass Air Flow Sensor Ground circuit for a short to voltage.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit in the Mass Air Flow Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

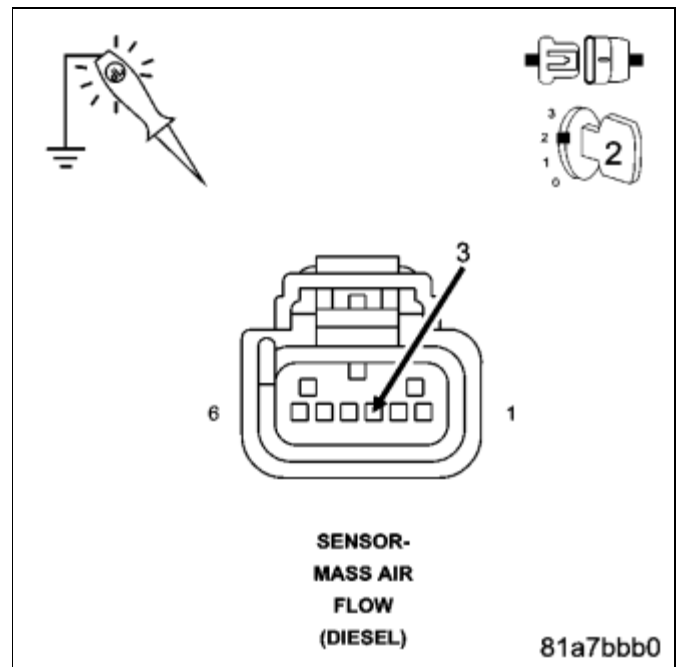
Is the test light illuminated and bright?

Yes

- Go to [5](#)

No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Disconnect the ECM harness connector.
 Measure the resistance of the (K157) Mass Air Flow Sensor Signal circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

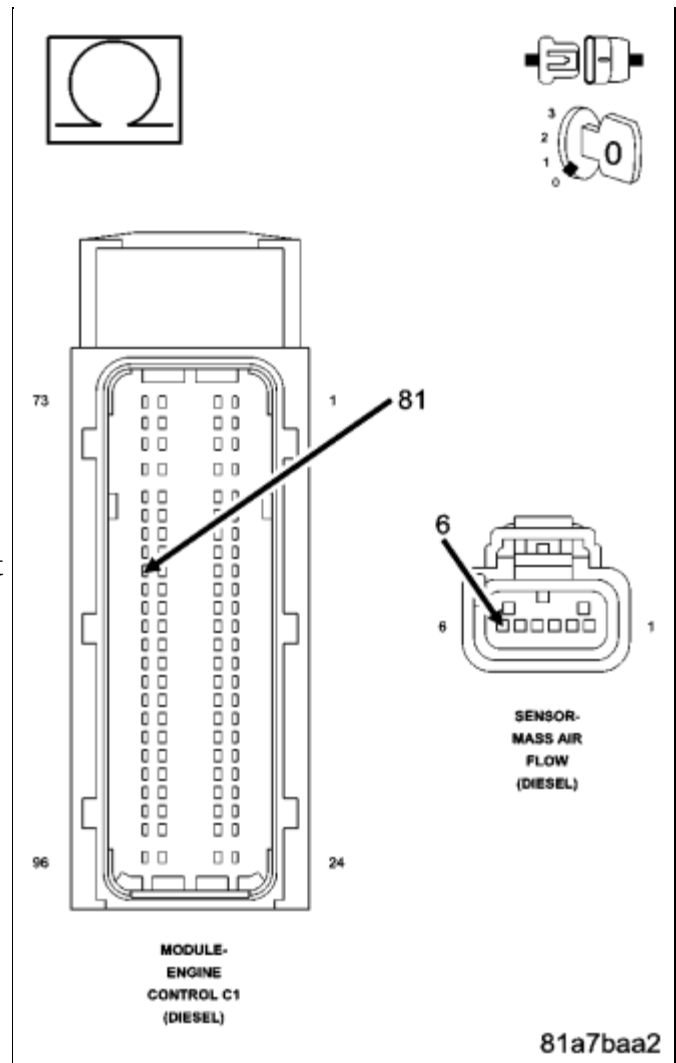
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K957) Mass Air Flow Sensor Ground circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

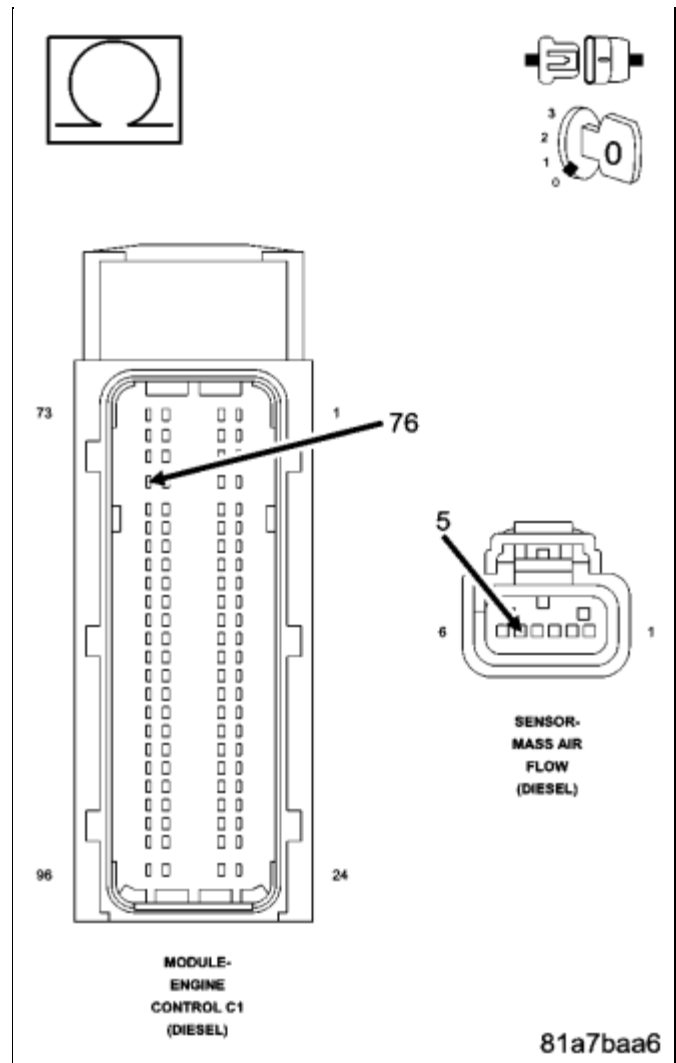
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K957) Mass Air Flow Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K157) Mass Air Flow Sensor Signal circuit in the Mass Air Flow Sensor harness connector.

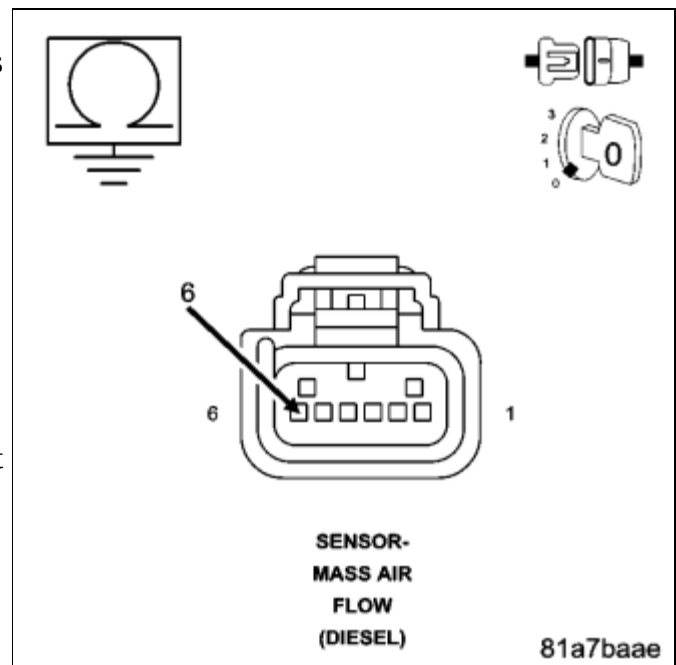
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT

Measure the resistance between the (K157) Mass Air Flow Sensor Signal circuit and the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor connector.

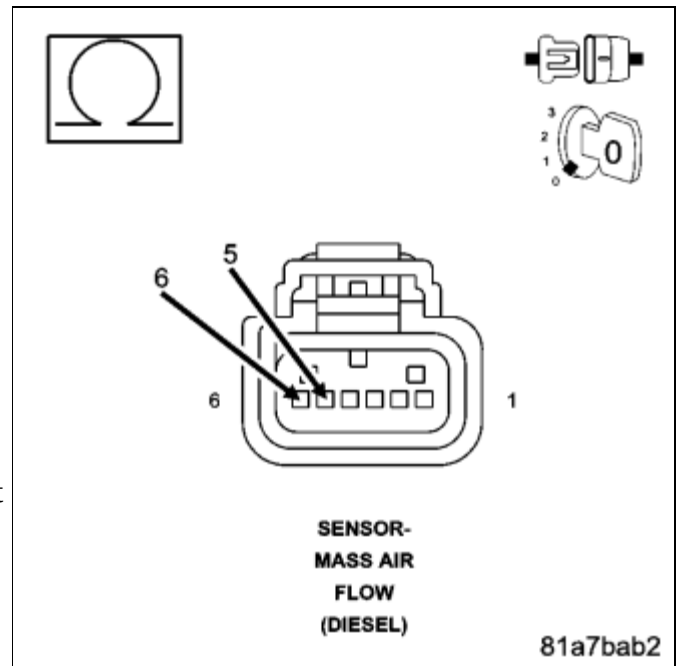
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to the (K957) Mass Air Flow Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. MASS AIR FLOW SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Mass Air Flow Sensor in accordance with the Service Information.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [10](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Mass Air Flow Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0101-MASS AIR FLOW SENSOR PERFORMANCE

With the ignition on.

◦ **Set Condition:**

The ECM detects that the (K157) Mass Air Flow Sensor Signal circuit is not within a valid range.

Possible Causes
INTERMITTENT DTC
INTAKE/EXHAUST SYSTEM PROBLEMS
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT
MASS AIR FLOW SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).
Start the engine and allow it to reach normal operating temperature.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK THE INTAKE SYSTEM HOSES/TUBES

NOTE: Damaged, restricted or poorly connected intake and turbocharger related tubes can cause this DTC to set.

Turn the ignition off.
Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections.
Inspect the Charge Air Cooler hoses/tubes and connections.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Mass Air Flow Sensor harness connector.
Turn the ignition on.
Measure the voltage of the (K157) Mass Air Flow Sensor
Signal circuit in the Mass Air Flow Sensor harness
connector.

Is there any voltage present?

Yes

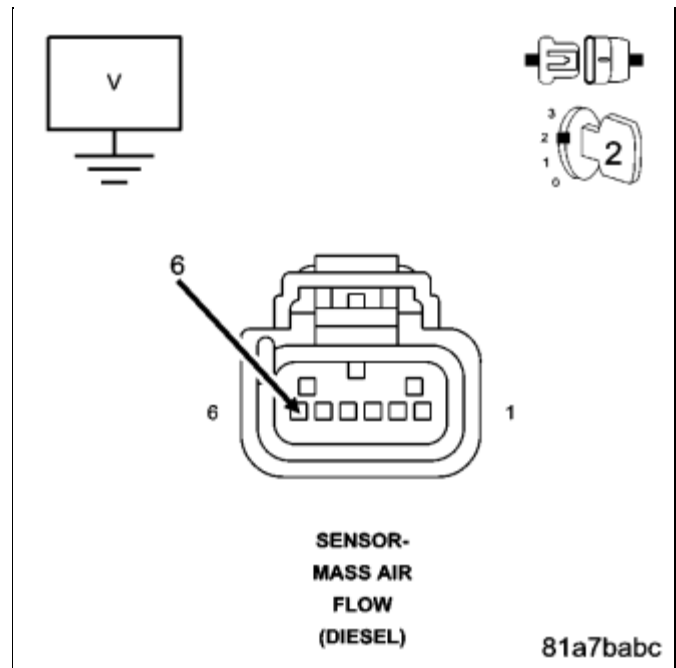
- Repair the (K157) Mass Air Flow Sensor Signal circuit

for a short to voltage.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor harness connector.

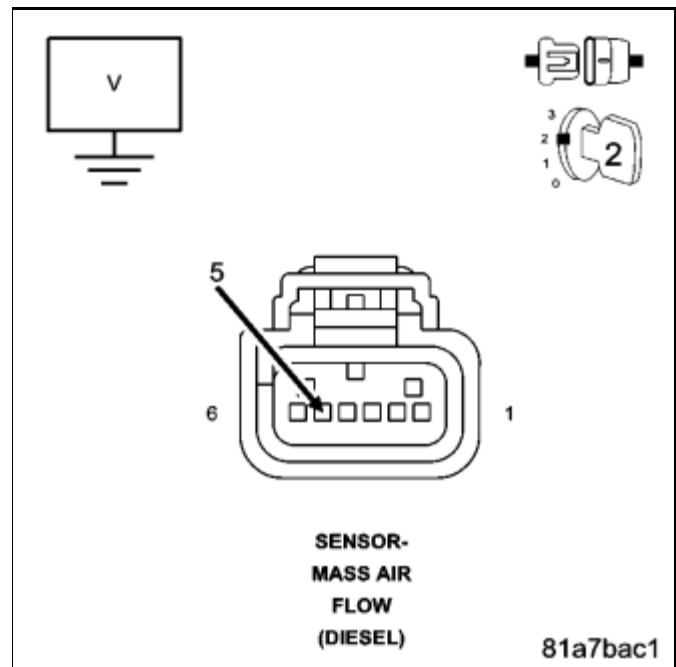
Is there any voltage present?

Yes

- Repair the (K957) Mass Air Flow Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit in the Mass Air

Flow Sensor harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

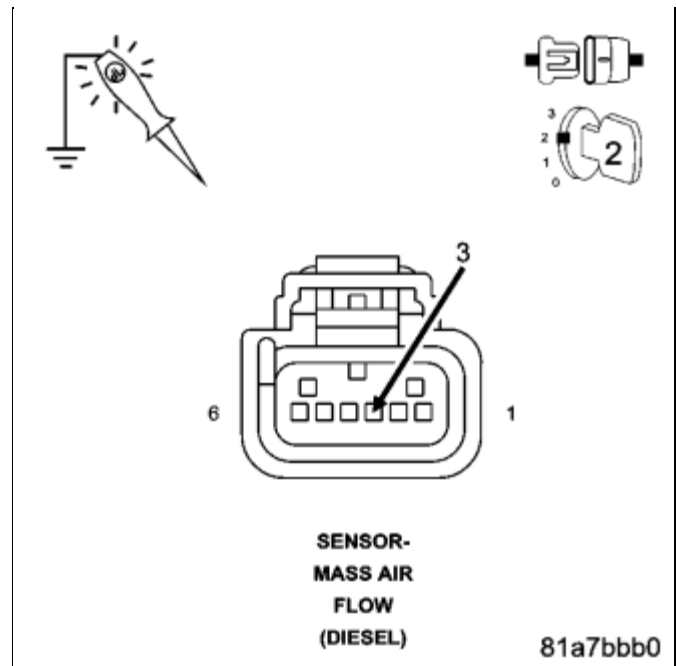
Is the test light illuminated and bright?

Yes

- Go to [6](#)

No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Mass Air Flow Sensor harness connector. Measure the resistance of the (K157) Mass Air Flow Sensor Signal circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

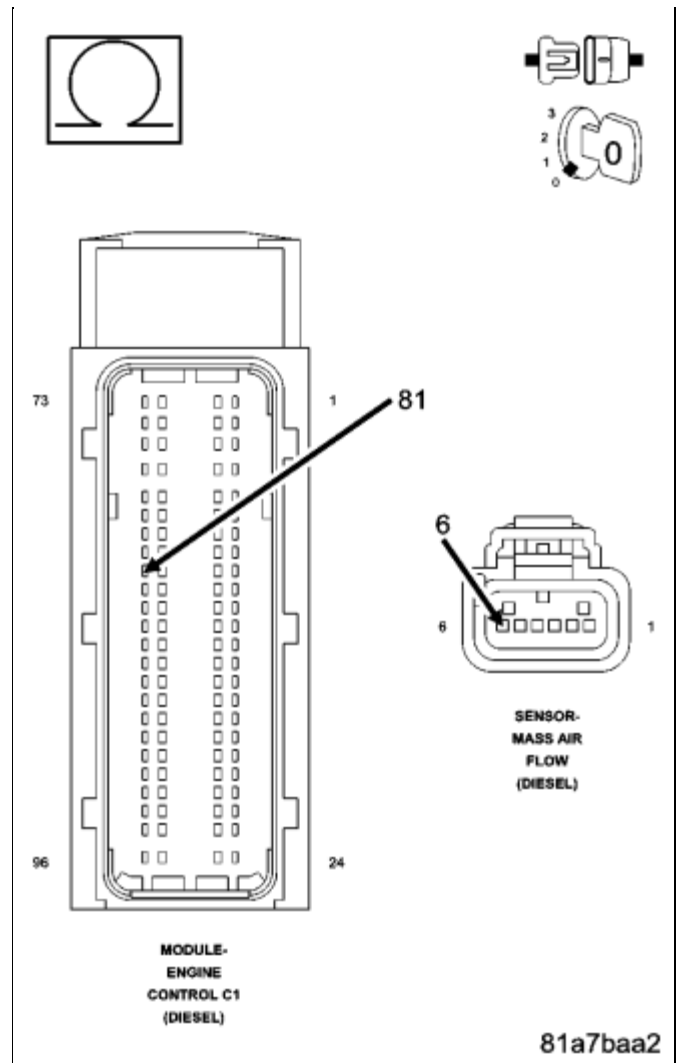
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K957) Mass Air Flow Sensor Ground circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

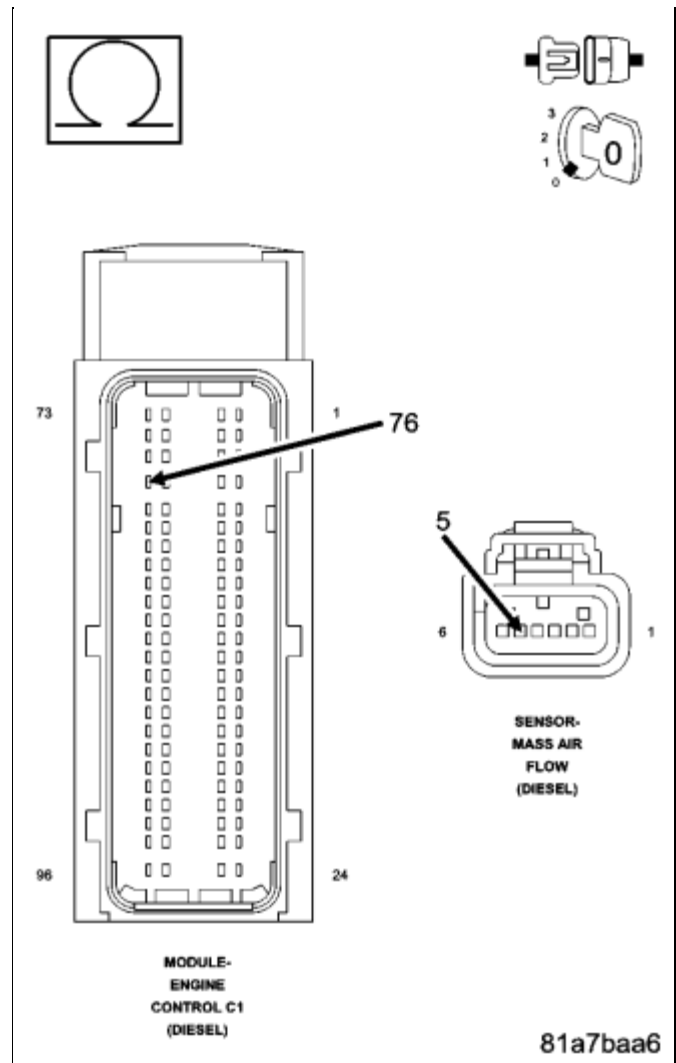
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K957) Mass Air Flow Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K157) Mass Air Flow Sensor Signal circuit in the Mass Air Flow Sensor harness connector.

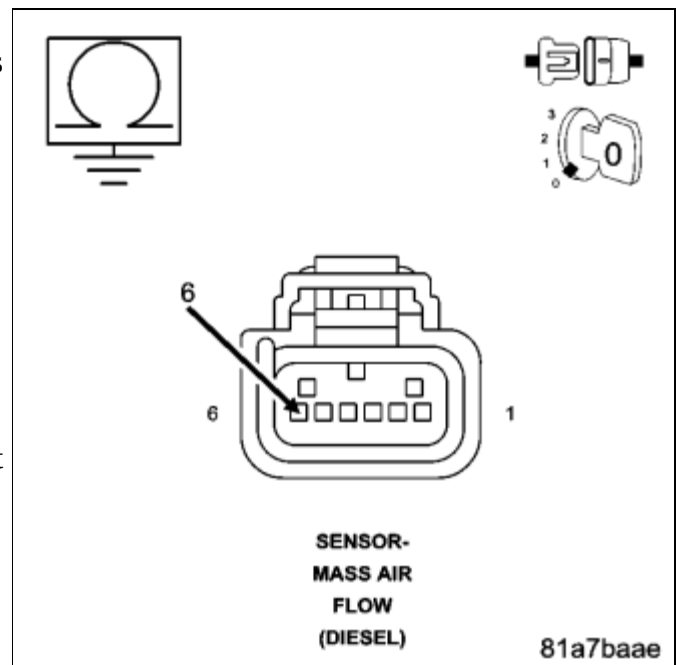
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT

Measure the resistance between the (K157) Mass Air Flow Sensor Signal circuit and the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor connector.

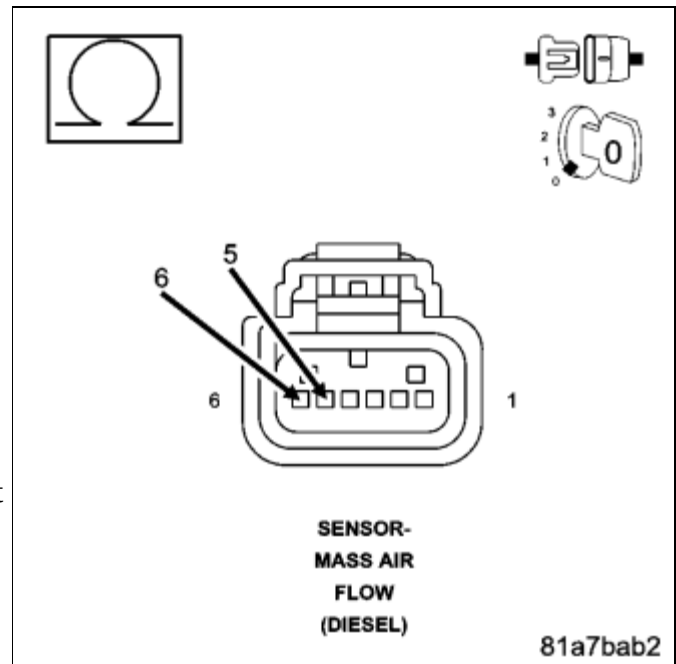
Is the resistance above 1000 ohms?

Yes

- Go to [10](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to the (K957) Mass Air Flow Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. MASS AIR FLOW SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Mass Air Flow Sensor in accordance with the Service Information.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [11](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Mass Air Flow Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

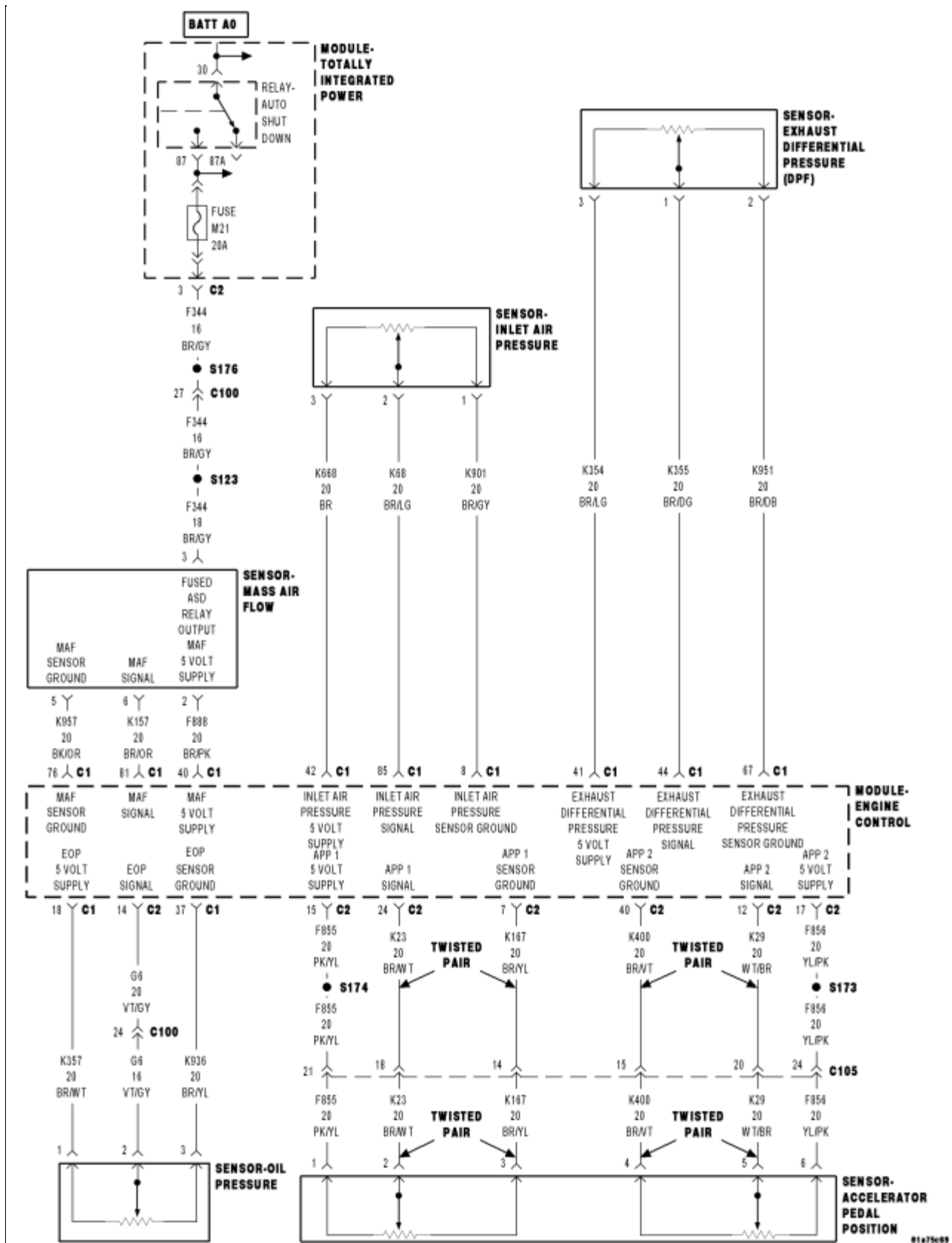
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0102-MASS AIR FLOW SENSOR CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

No reference Voltage DTC's present. With the engine running and engine speed below 5100 rpm..

◦ **Set Condition:**

The (K157) Mass Air Flow Sensor Signal is below the valid operating range for 0.5 second.

Possible Causes
INTERMITTENT DTC
INTAKE/EXHAUST SYSTEM PROBLEMS
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(F888) MASS AIR FLOW SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT
MASS AIR FLOW SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure.

2. CHECK FOR INTAKE AND EXHAUST SYSTEM RESTRICTIONS

Turn the ignition off.

Inspect the exhaust system for damaged components that could cause exhaust flow blockage.

Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections for damage, air leaks or blockage.

Inspect the Charge Air Cooler hoses/tubes and connections.

Inspect the air filter for excessive dirt, soiling or other problems that may cause restricted air flow.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go to [3](#)

3. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Mass Air Flow Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K157) Mass Air Flow Sensor Signal circuit between the Mass Air Flow Sensor connector and the Engine Control Module (ECM) harness connector.

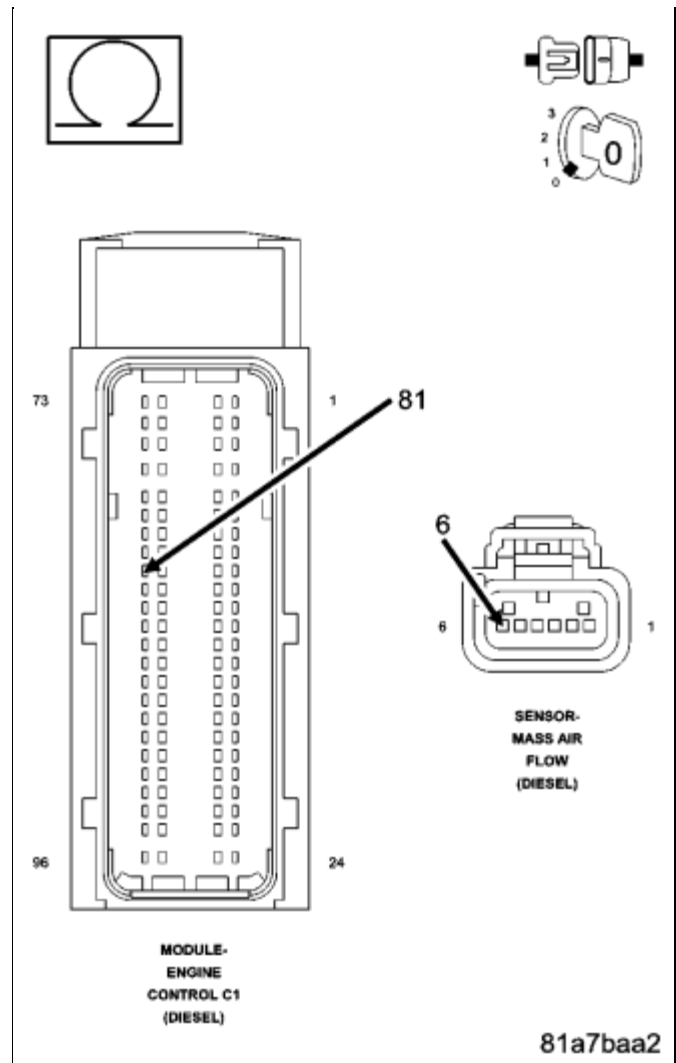
Is the resistance below 10.0 ohms?**Yes**

- Go to [4](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit

- for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K957) Mass Air Flow Sensor Ground circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

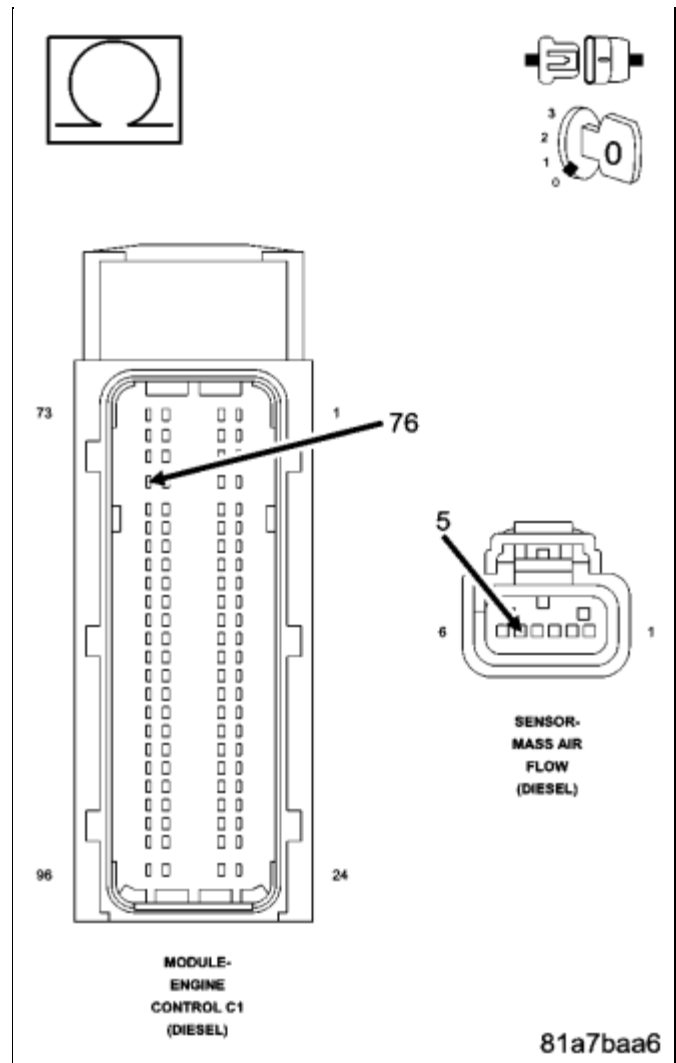
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K957) Mass Air Flow Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (F888) MASS AIR FLOW SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (F888) Mass Air Flow Sensor 5 Volt Supply circuit between the Mass Air Flow Sensor harness connector and the Engine Control Module (ECM) harness connector.

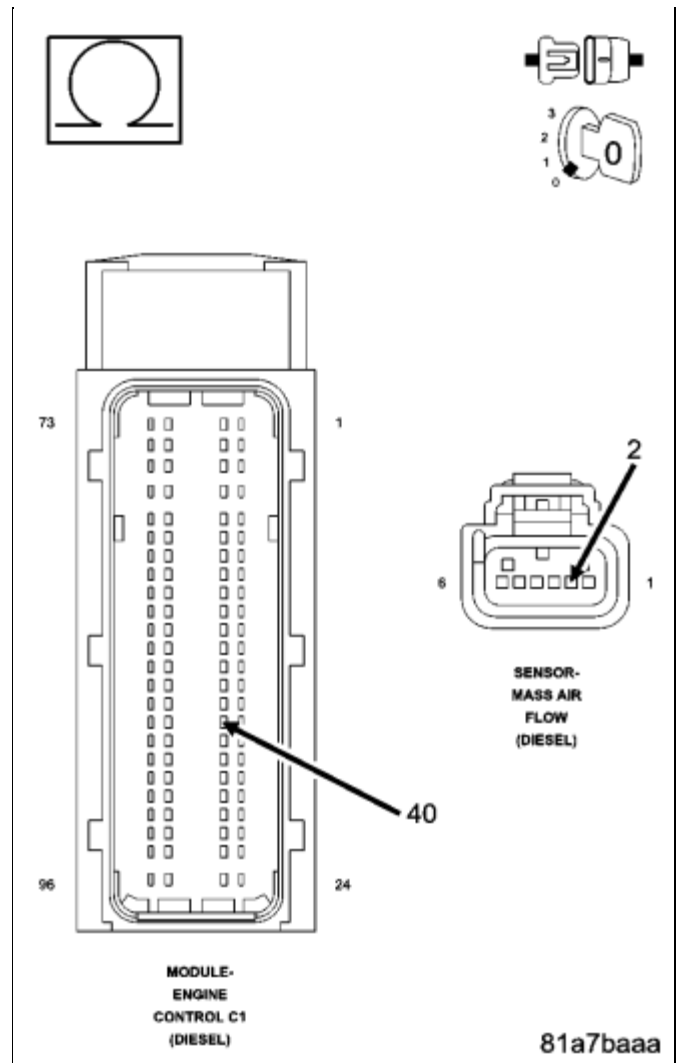
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (F888) Mass Air Flow Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K157) Mass Air Flow Sensor Signal circuit in the Mass Air Flow Sensor harness connector.

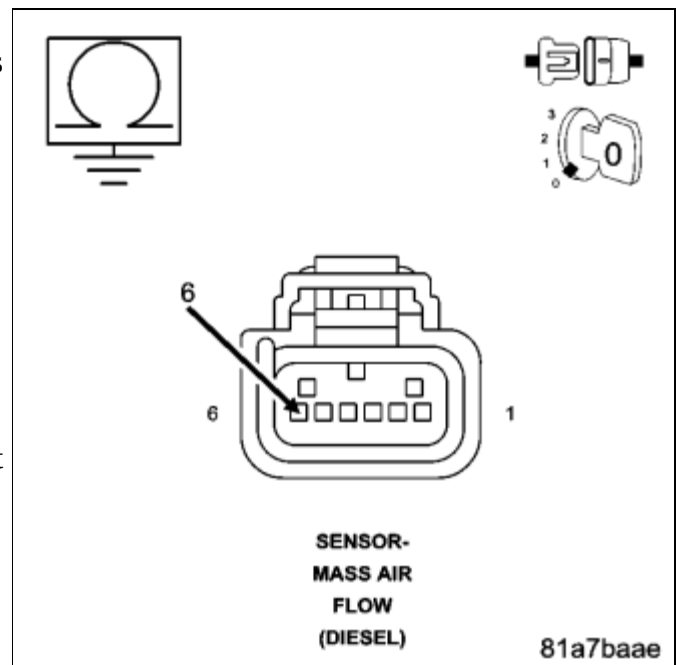
Is the resistance above 1000 ohms?

Yes

- Go to [Z](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO THE (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT

Measure the resistance between the (K157) Mass Air Flow Sensor Signal circuit and the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor connector.

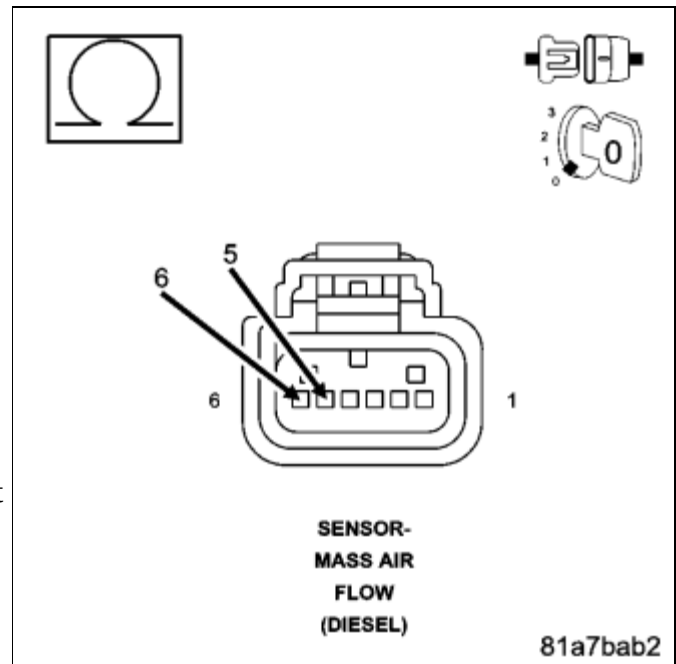
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to the (K957) Mass Air Flow Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. MASS AIR FLOW SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Mass Air Flow Sensor in accordance with the Service Information.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [9](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Mass Air Flow Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0103-MASS AIR FLOW SENSOR CIRCUIT HIGH

No reference Voltage DTC's present. With the engine running and engine speed below 5100 rpm..

◦ **Set Condition:**

The (K157) Mass Air Flow Sensor Signal is above the valid operating range for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
MASS AIR FLOW SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure.

2. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Mass Air Flow Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K157) Mass Air Flow Sensor Signal circuit in the Mass Air Flow Sensor harness connector.

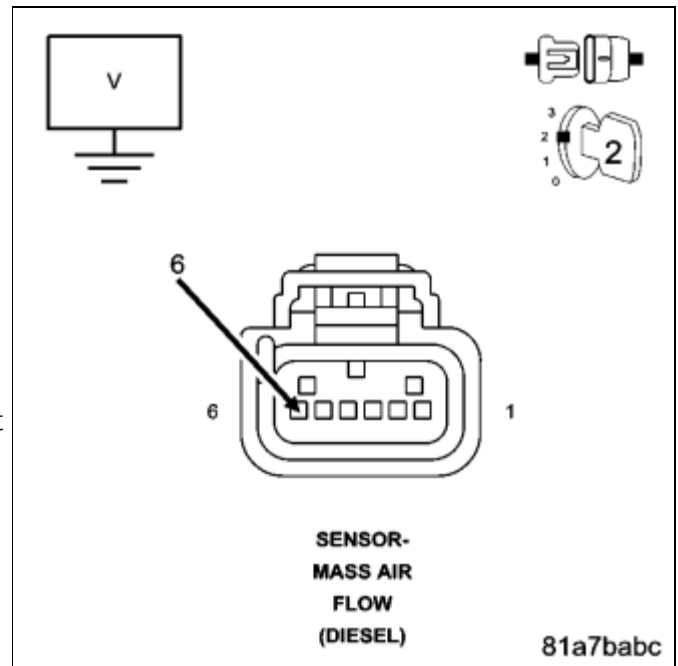
Is there any voltage present?

Yes

- Repair the (K157) Mass Air Flow Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K957) Mass Air Flow Sensor Ground circuit in the Mass Air Flow Sensor harness connector.

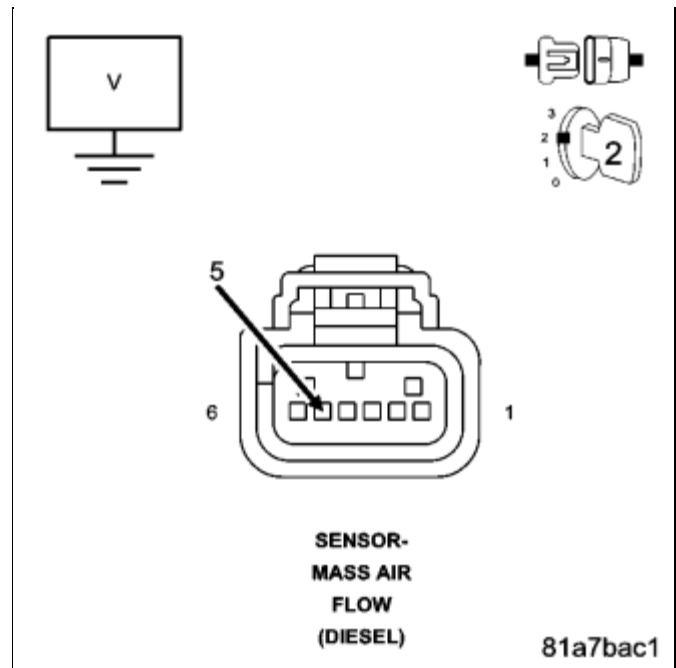
Is there any voltage present?

Yes

- Repair the (K957) Mass Air Flow Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K157) MASS AIR FLOW SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K157) Mass Air Flow Sensor Signal circuit between the Mass Air Flow Sensor connector and the Engine Control Module (ECM) harness connector.

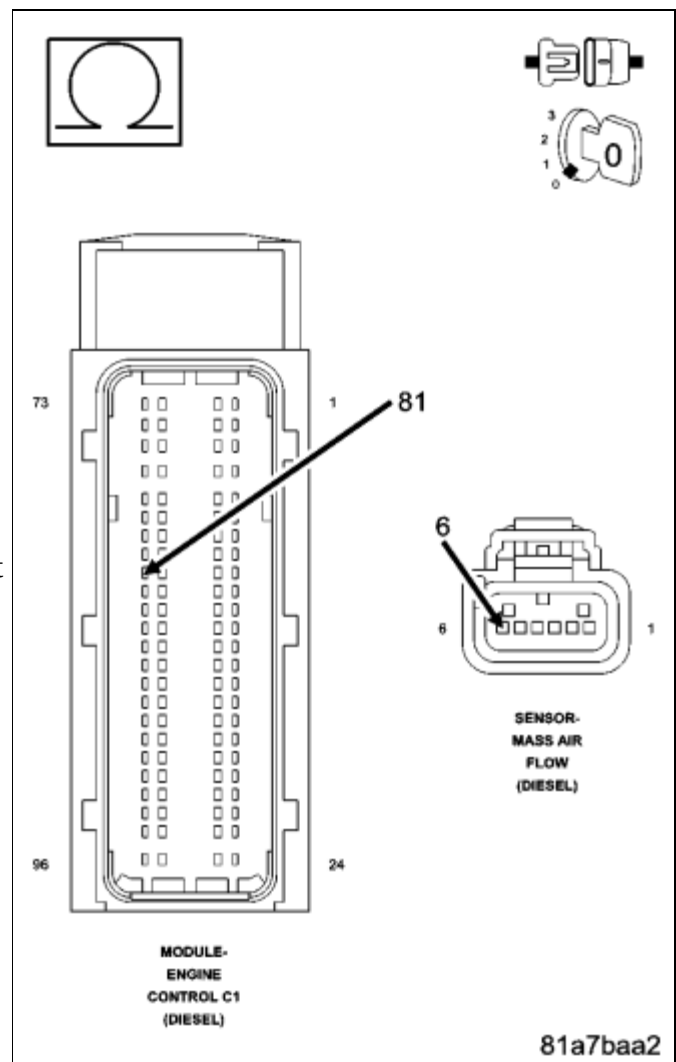
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K157) Mass Air Flow Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K957) MASS AIR FLOW SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K957) Mass Air Flow Sensor Ground circuit between the Mass Air Flow Sensor connector and the Engine Control Module (ECM) harness connector.

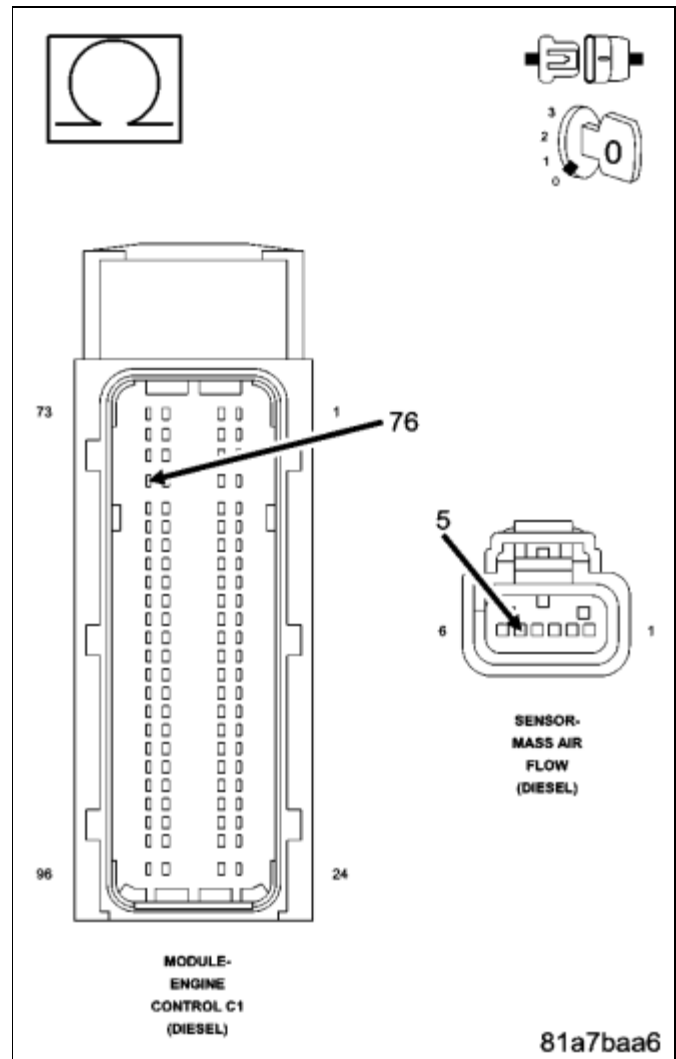
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K957) Mass Air Flow Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. MASS AIR FLOW SENSOR

Connect the Engine Control Module (ECM) harness connector.

Replace the Mass Air Flow Sensor in accordance with the Service Information.

Turn the ignition on.

With the scan tool, Clear DTCs.

Start the engine and allow it to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [7](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Mass Air Flow Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

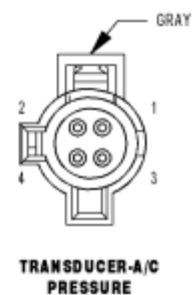
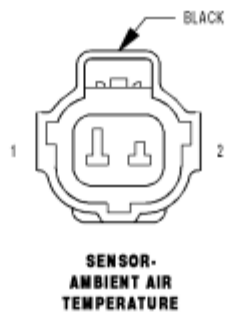
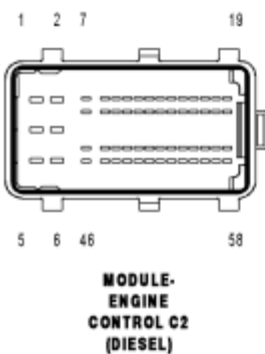
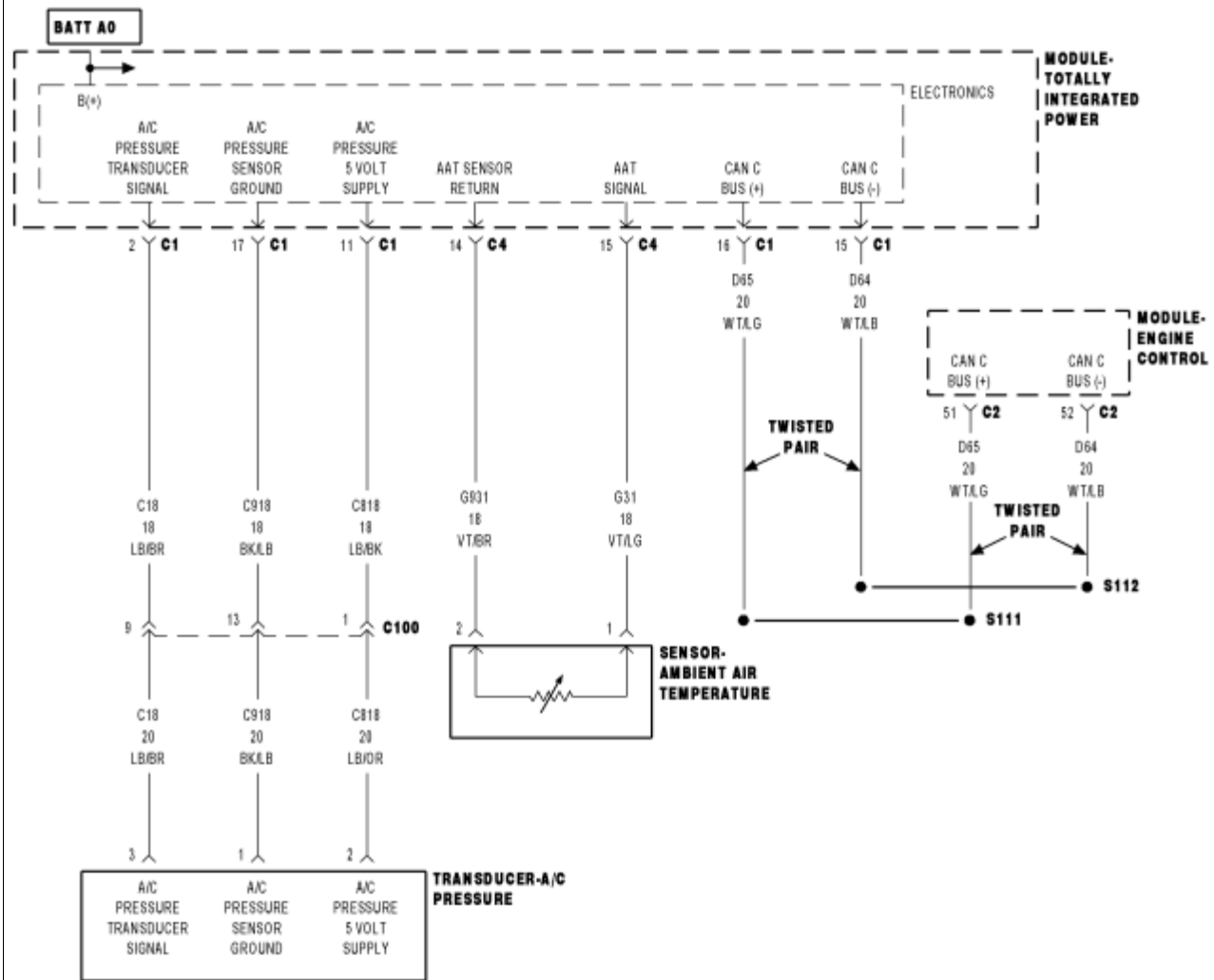
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW



01a783aa

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The (K48) Intake Air Temperature Sensor Signal circuit voltage is below 0.25 volt for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) INTAKE AIR TEMPERATURE SENSOR GROUND
(K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Boost Pressure/Intake Air Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K48) Intake Air Temperature Sensor Signal circuit in the Boost Pressure/Intake Air Temperature Sensor harness connector.

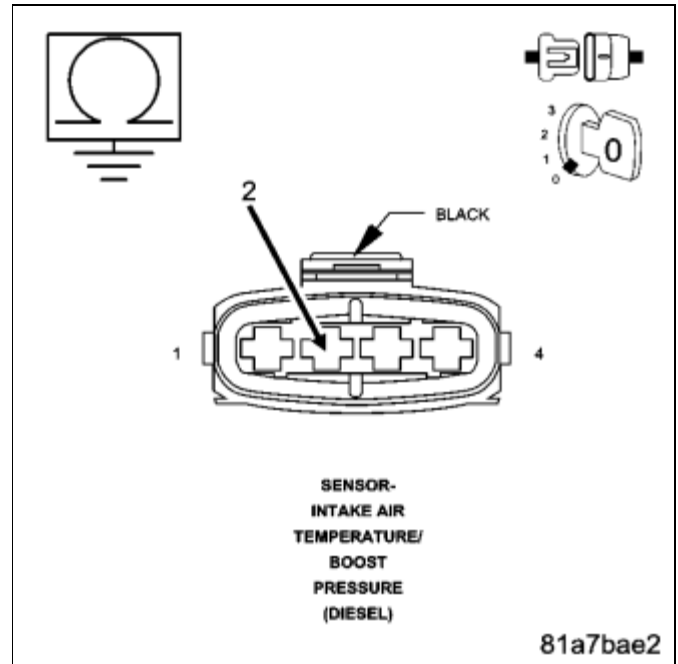
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K48) Intake Air Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K48) Intake Air Temperature Sensor Signal circuit and the (K656) Intake Air Temperature Sensor Ground circuit in the Boost Pressure/Intake Air Temperature Sensor harness connector.

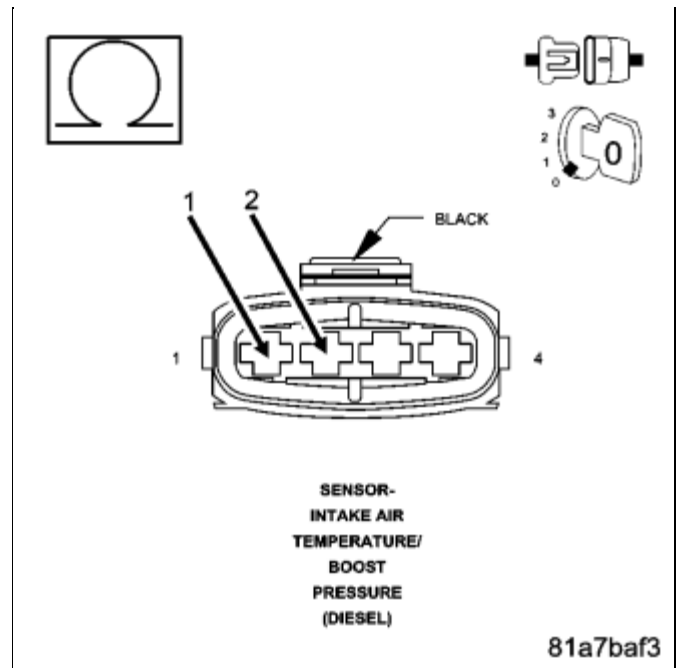
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K48) Intake Air Temperature Sensor Signal circuit for a short to the (K656) Intake Air Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE

Measure the resistance of the (K48) Intake Air Temperature Sensor Signal circuit between the Boost Pressure/Intake Air Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

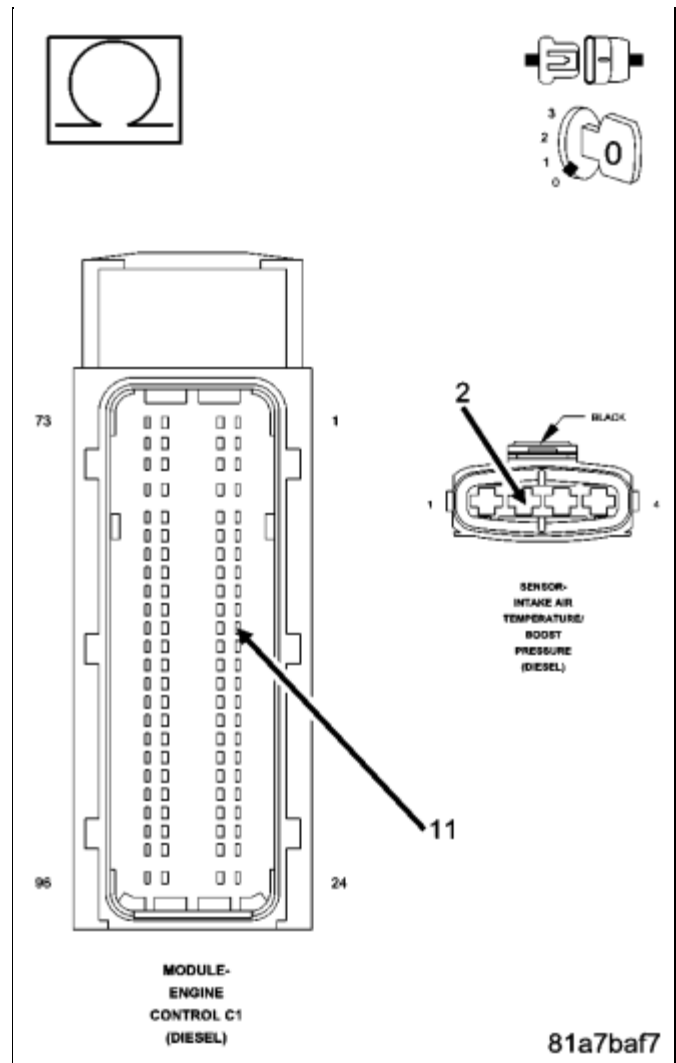
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K48) Intake Air Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

Turn the ignition off.
 Connect the Engine Control Module (ECM) connector.
 Turn the ignition on.
 With the scan tool, clear DTCs.
 With the scan tool, select View DTCs.

NOTE: The scan tool should display an Intake Air Temperature Sensor high voltage or open circuit DTC with the Boost Pressure/Intake Air Temperature Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Boost Pressure/Intake Air Temperature Sensor in accordance with the service information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Intake Air Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

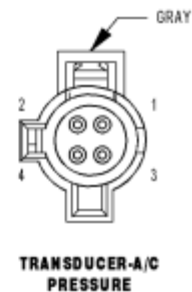
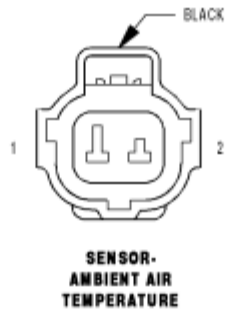
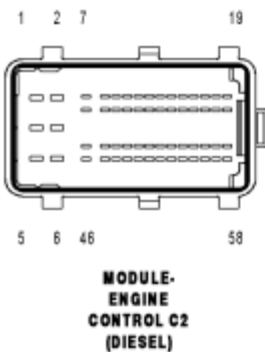
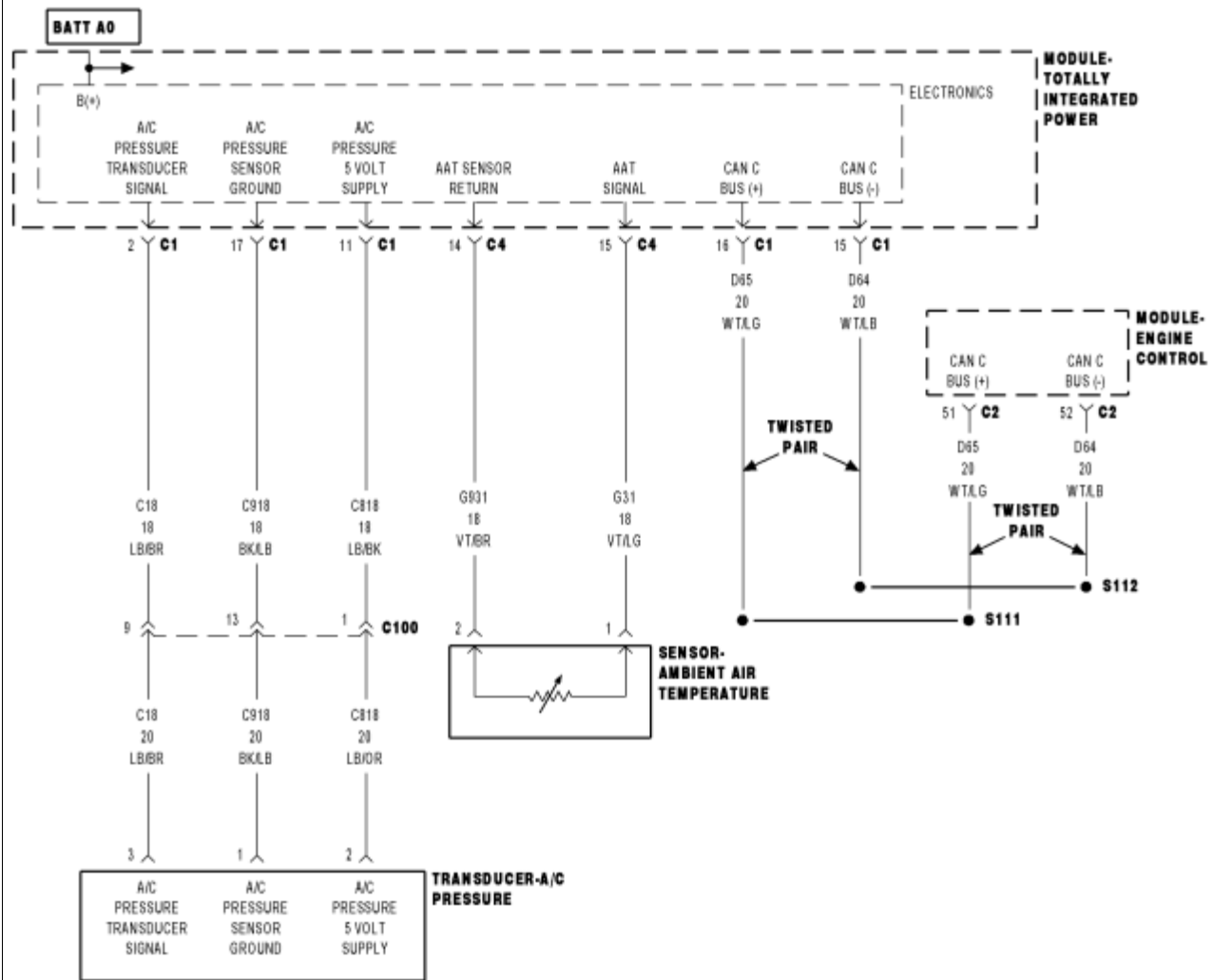
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH



01a783a

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K48) Intake Air Temperature Sensor Signal circuit voltage is above 4.96 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K656) INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K656) INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Boost Pressure/Intake Air Temperature Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K48) Intake Air Temperature Sensor Signal circuit in the Boost Pressure/Intake Air Temperature Sensor harness connector.

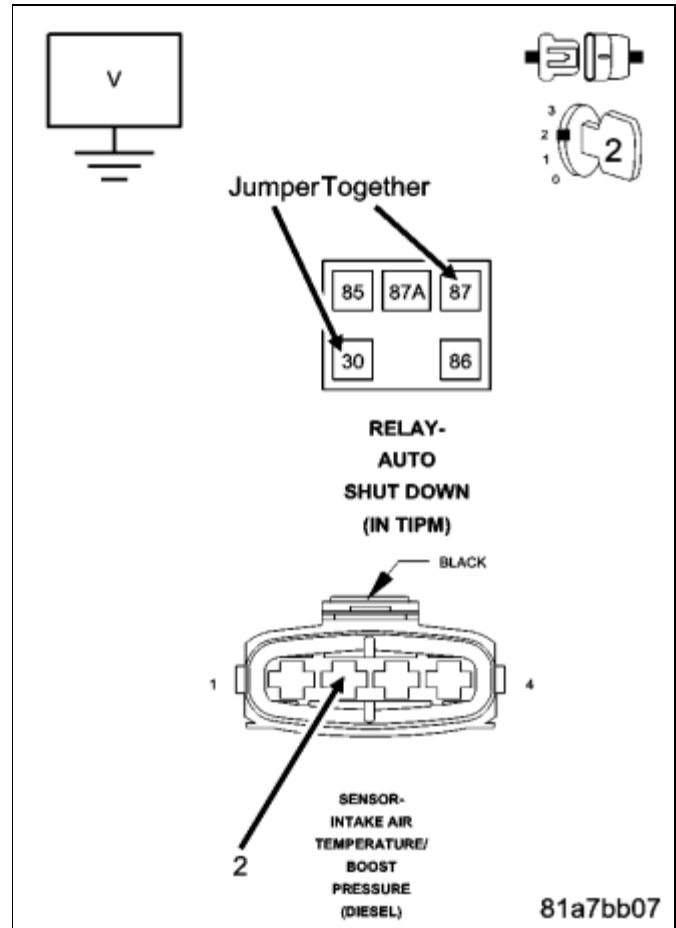
Is there any voltage present?

Yes

- Repair the (K48) Intake Air Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K656) INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K656) Intake Air Temperature Sensor Ground circuit in the Boost Pressure/Intake Air Temperature Sensor harness connector.

Is there any voltage present?

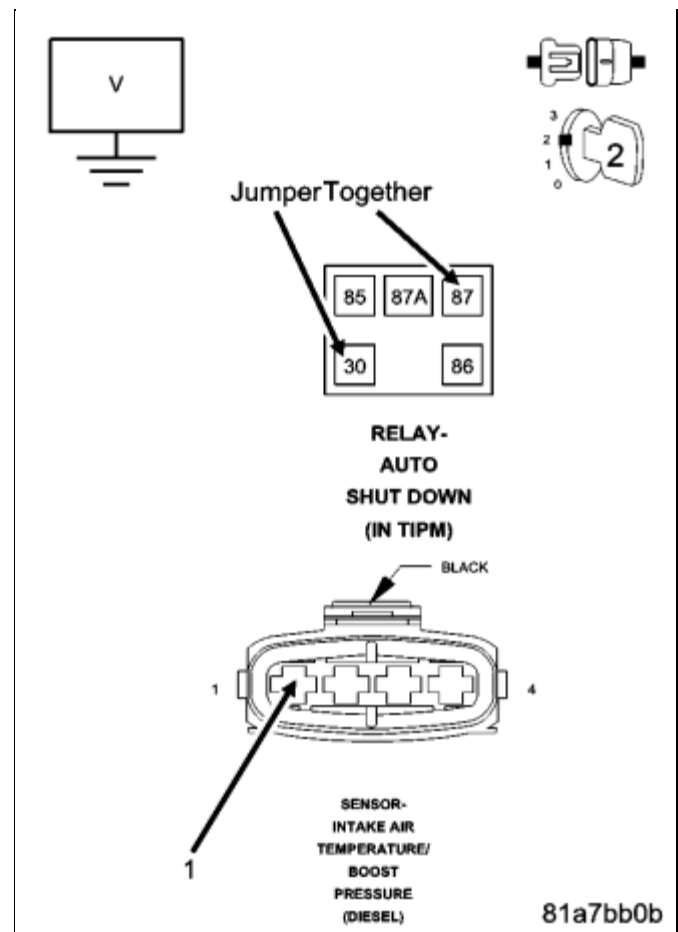
Yes

- Repair the (K656) Intake Air Temperature Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

- ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay..

Connect the Engine Control Module (ECM) harness connector.

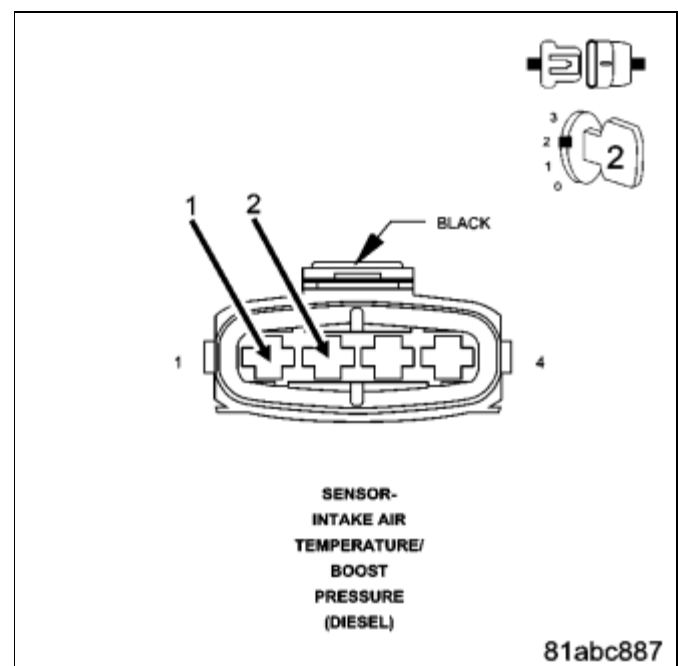
Connect a jumper wire between the (K656) Intake Air Temperature Sensor Ground circuit and the (K48) Intake Air Temperature Sensor Signal circuit in the Boost Pressure/Intake Air Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Intake Air Temperature Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Boost Pressure/Intake Air Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. (K48) INTAKE AIR TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K48) Intake Air Temperature Sensor Signal circuit between the Boost Pressure/Intake Air Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

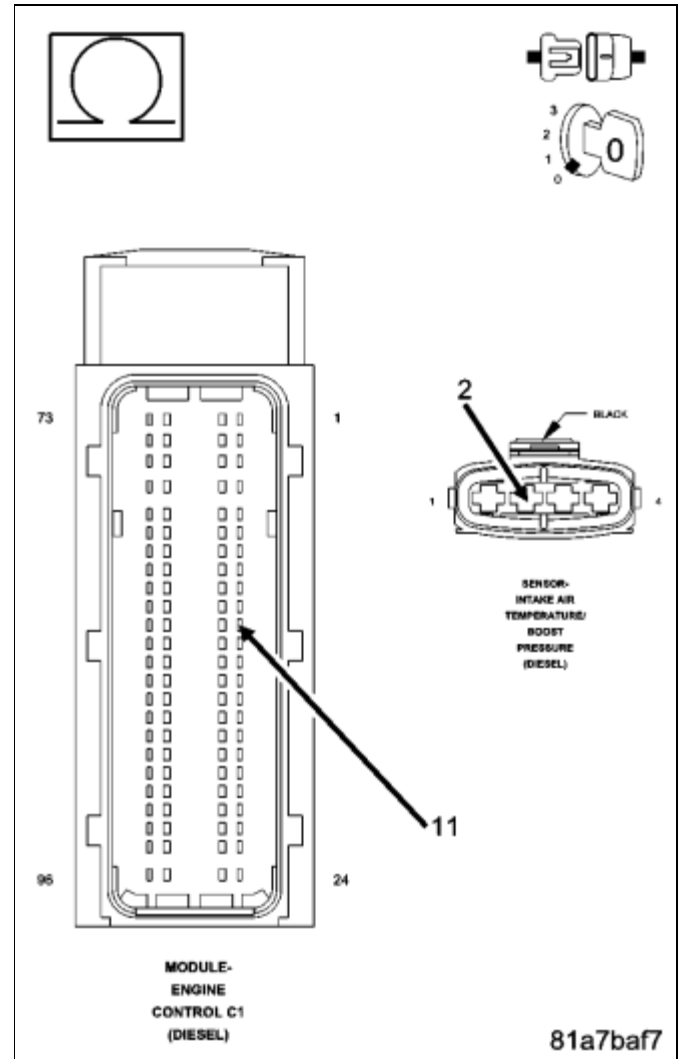
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K48) Intake Air Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K656) INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K656) Intake Air Temperature Sensor Ground circuit between the Boost Pressure/Intake Air Temperature Sensor harness connector and the Engine

Control Module (ECM) harness connector.

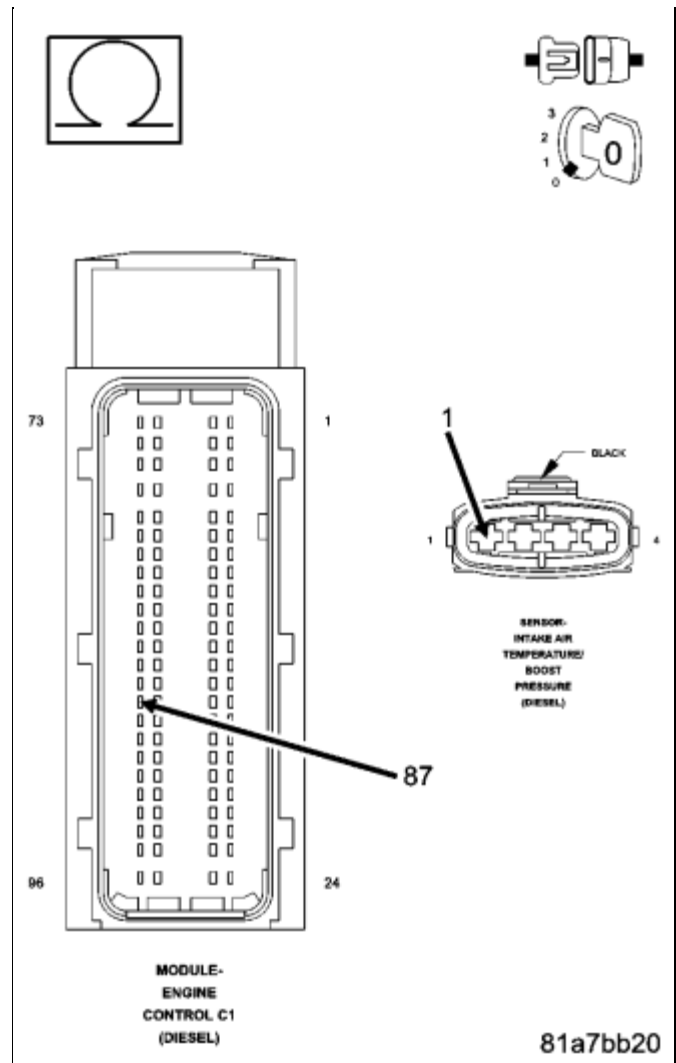
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K656) Intake Air Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Intake Air Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

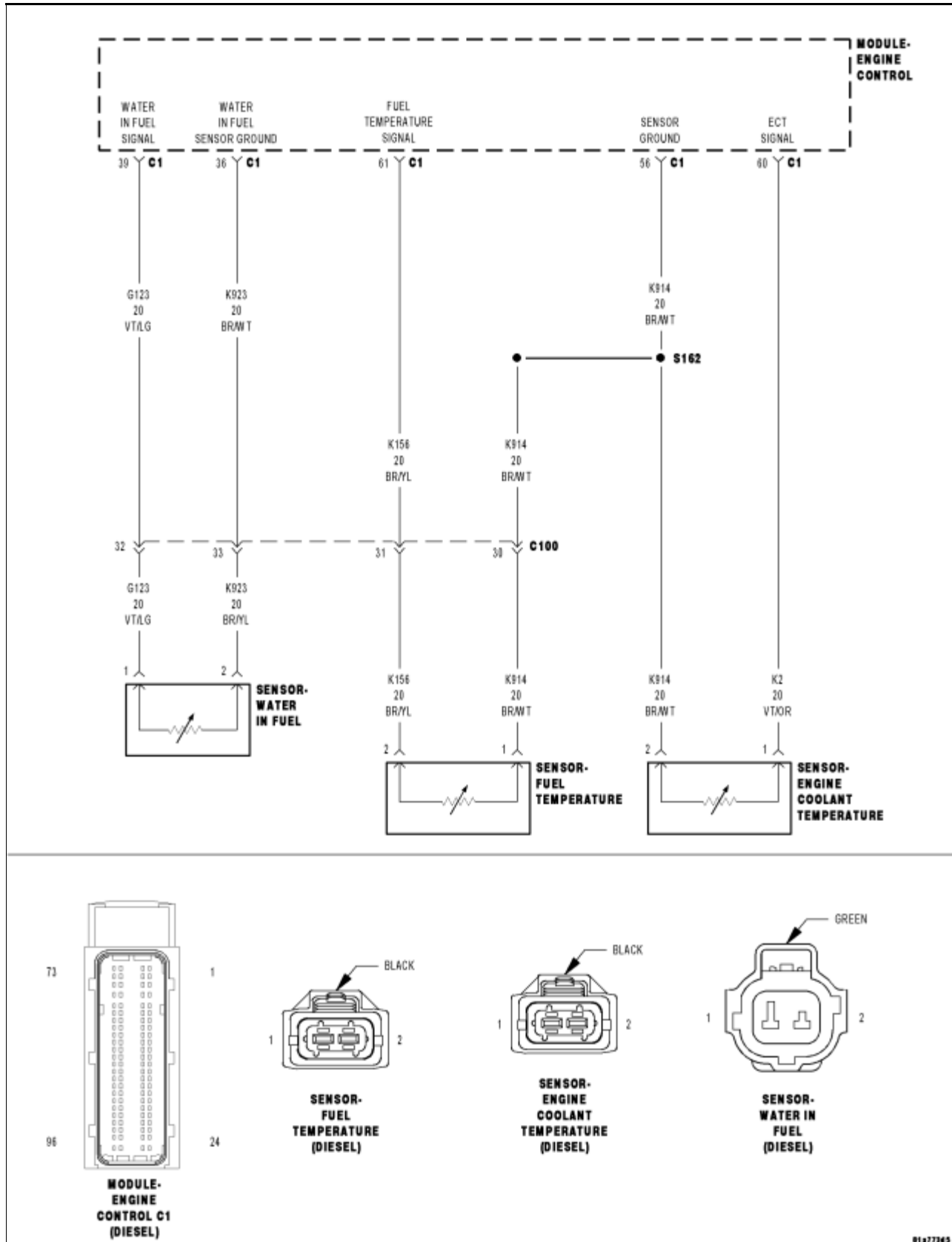
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0115-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K2) Engine Coolant Temperature Sensor Signal is defective.

Possible Causes
INTERMITTENT DTC
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ENGINE COOLANT TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Coolant Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

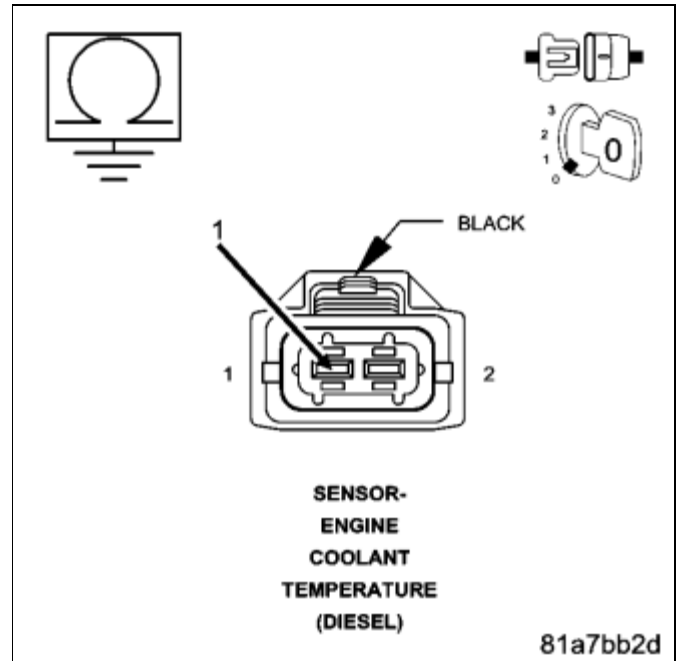
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) Engine Coolant Temperature Sensor Signal circuit and the (K914) Engine Coolant Temperature Sensor Ground circuit in the Engine Coolant Temperature Sensor harness connector.

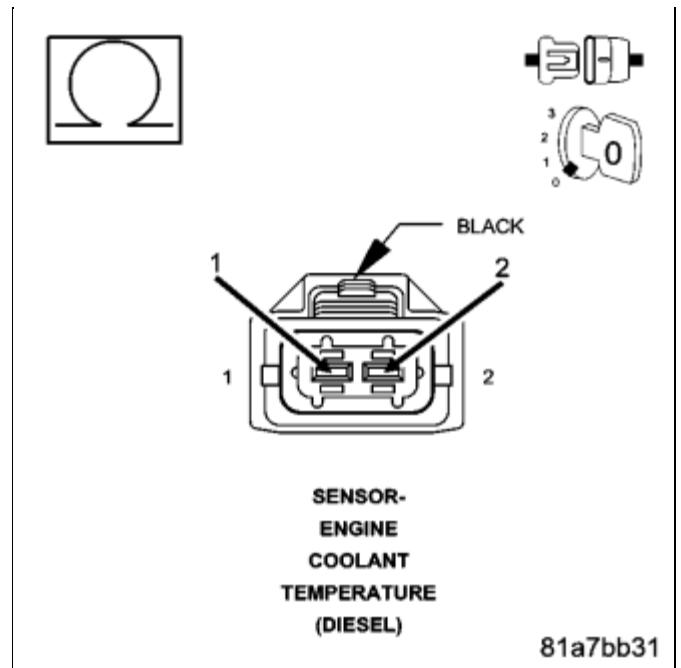
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to the (K914) Engine Coolant Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Measure the resistance of the (K2) Engine Coolant Temperature Sensor Signal circuit between the Engine Coolant Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

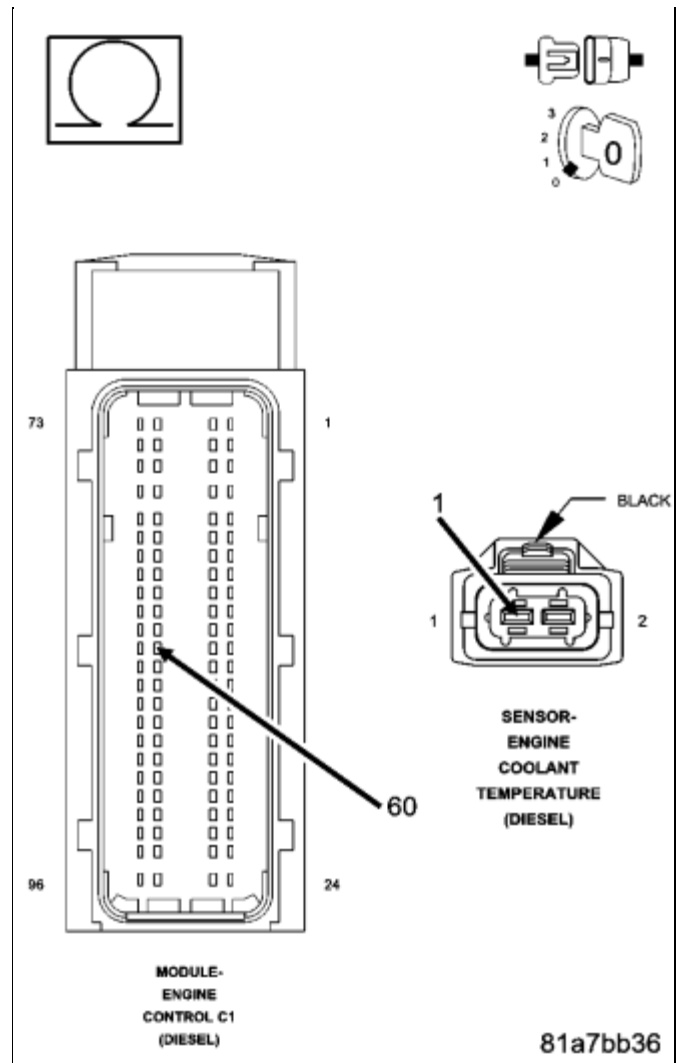
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ENGINE COOLANT TEMPERATURE SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 With the scan tool, select View DTCs.

NOTE: The scan tool should display an Engine Coolant Temperature Sensor high voltage or open circuit DTC with the connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Engine Coolant Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Engine Coolant Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

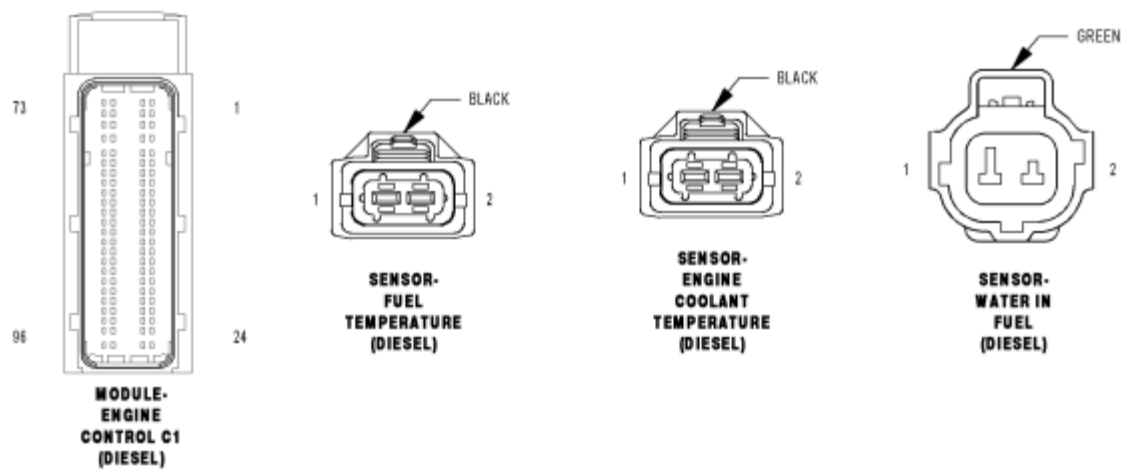
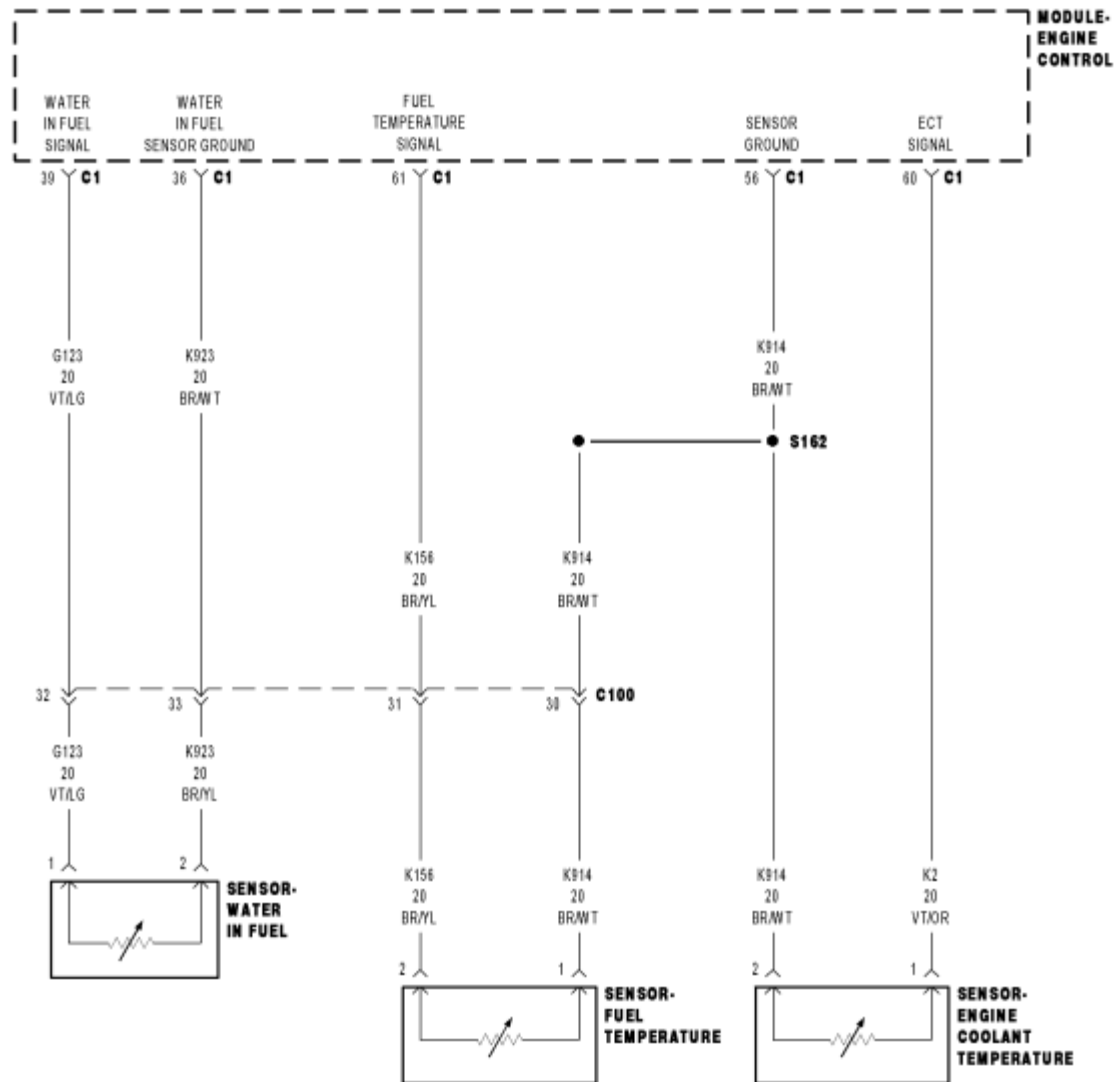
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0116-ENGINE COOLANT TEMPERATURE SENSOR PERFORMANCE



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The Engine Control Module (ECM) detects an implausible voltage on the (K2) Engine Coolant Temperature Sensor Signal circuit.

Possible Causes
INTERMITTENT DTC
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ENGINE COOLANT TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Engine Coolant Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

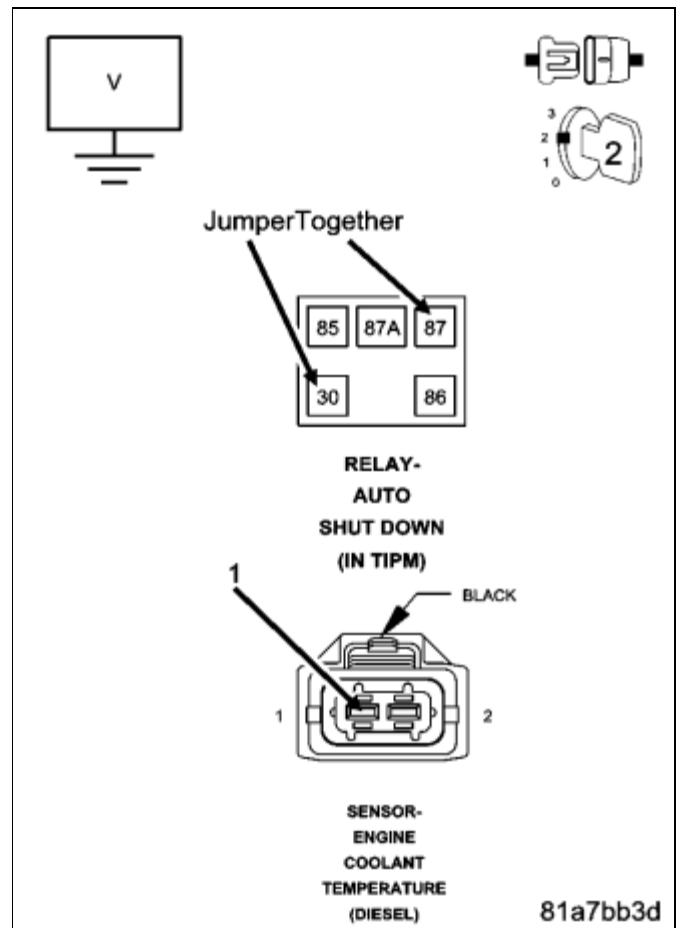
Is there any voltage present?

Yes

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K914) Engine Coolant Temperature Sensor Ground circuit in the Engine Coolant

Temperature Sensor harness connector.

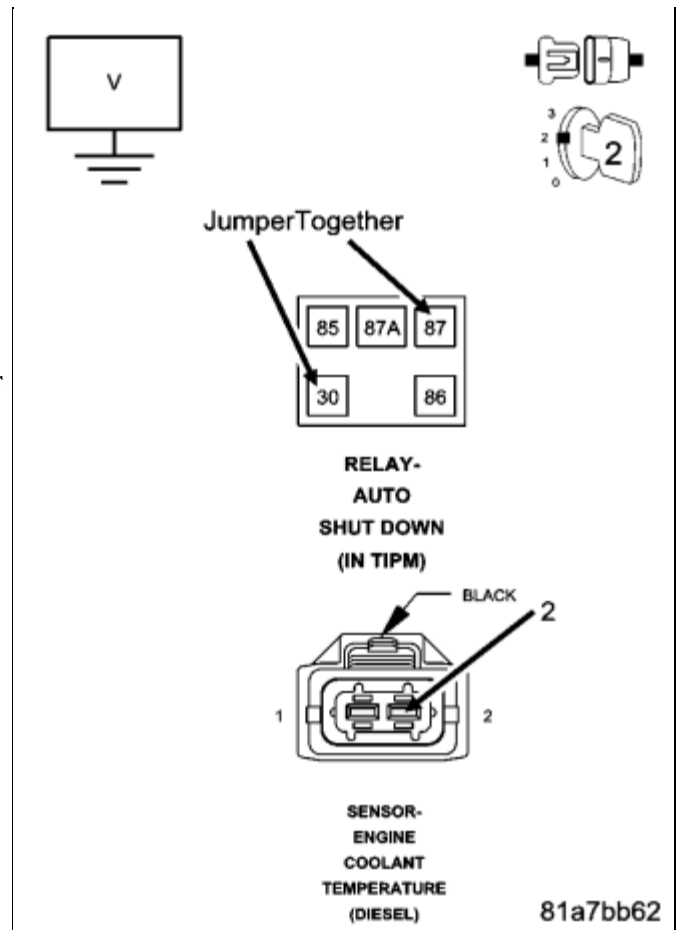
Is there any voltage present?

Yes

- Repair the (K914) Engine Coolant Temperature Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.. Measure the resistance between ground and the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

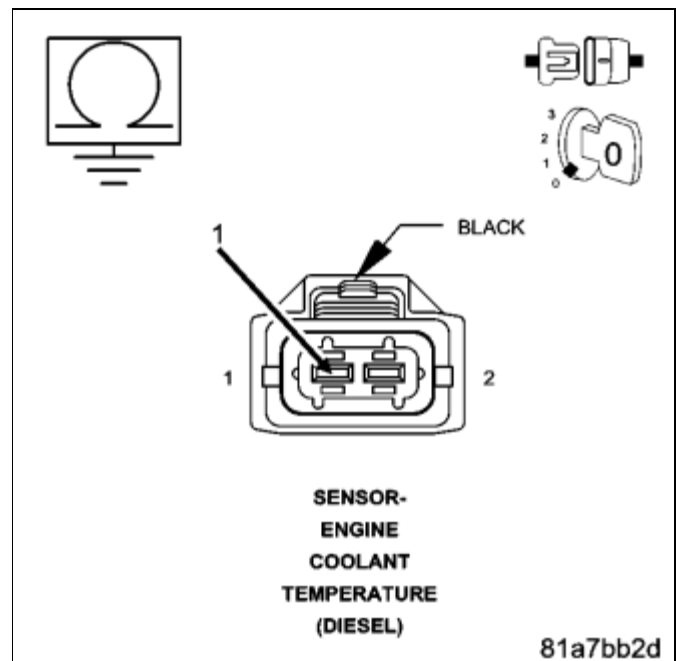
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914)

ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) Engine Coolant Temperature Sensor Signal circuit and the (K914) Engine Coolant Temperature Sensor Ground circuit in the Engine Coolant Temperature Sensor harness connector.

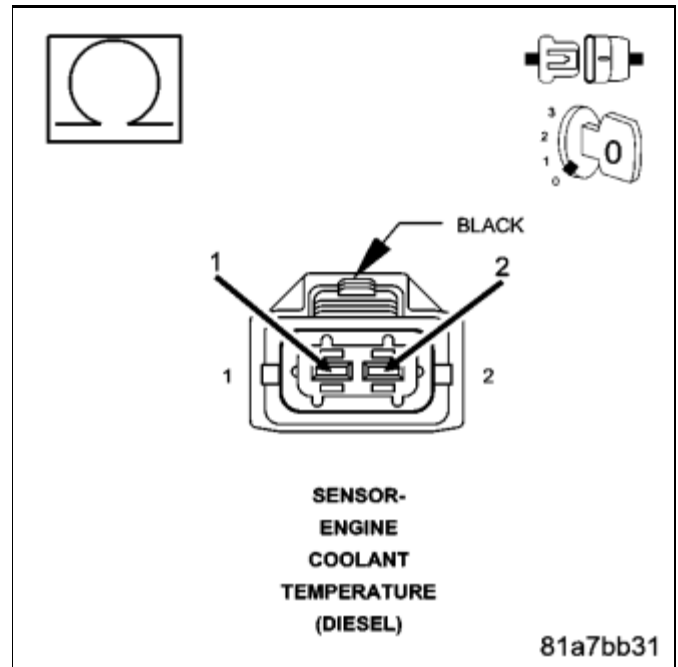
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to the (K914) Engine Coolant Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K2) Engine Coolant Temperature Sensor Signal circuit between the Engine Coolant Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

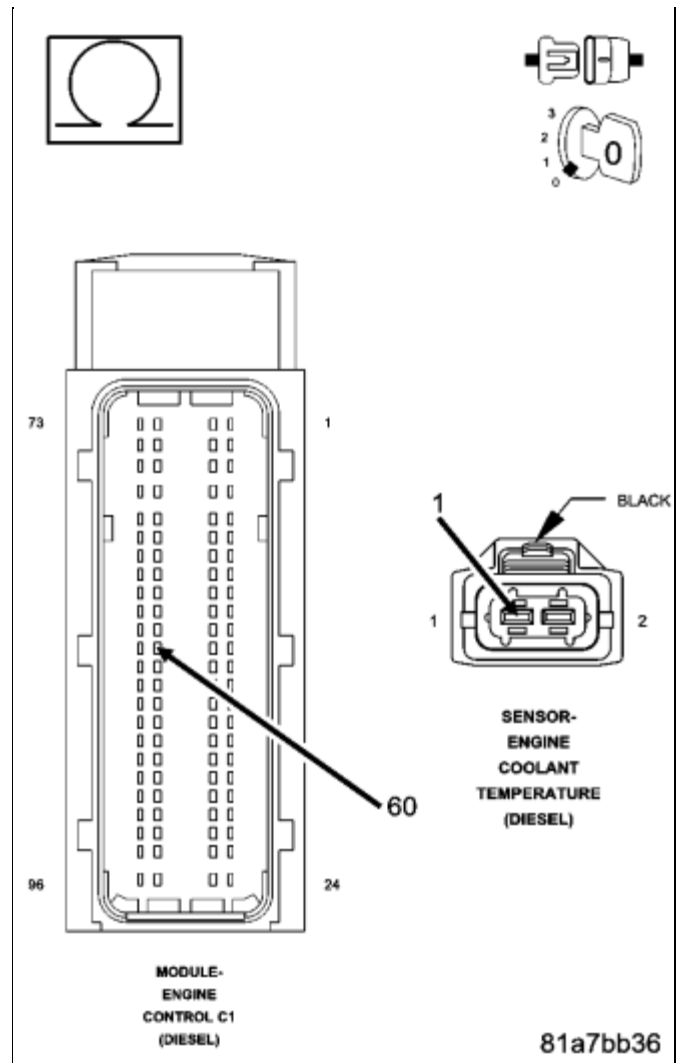
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K914) Engine Coolant Temperature Sensor Ground circuit between the Engine Coolant Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

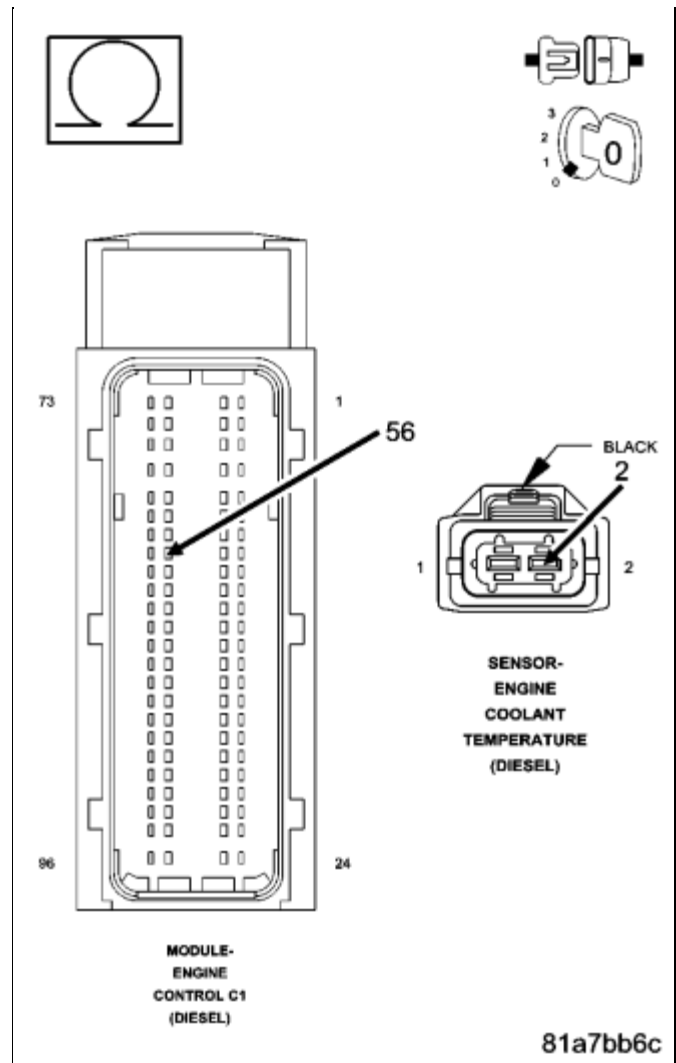
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K914) Engine Coolant Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE COOLANT TEMPERATURE SENSOR

Connect the Engine Control Module (ECM) harness connector.

Connect a jumper wire between the (K914) Engine Coolant Temperature Sensor Ground circuit and the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

Turn the ignition on.

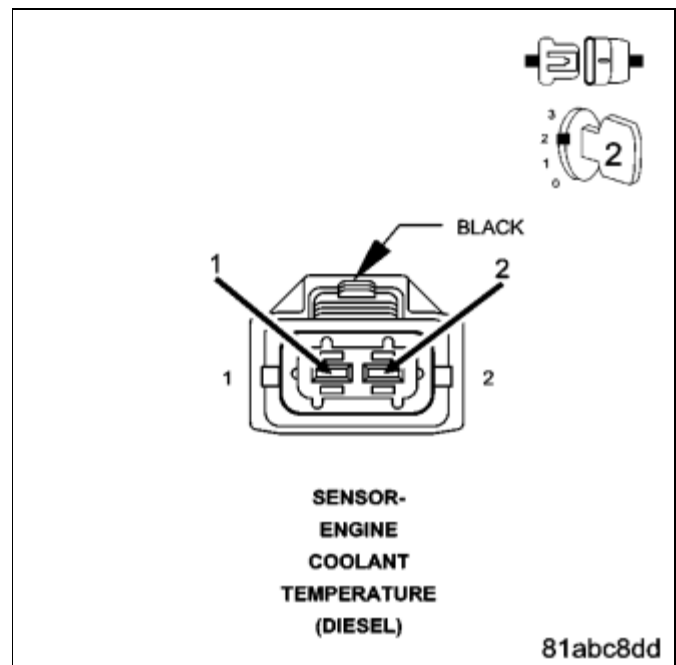
With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Engine Coolant Temperature Sensor low voltage or short to ground DTC with the jumper wire in place.

Turn the ignition off.

Remove the jumper wire.



Turn the ignition on.
With the scan tool, Clear DTCs.
With the scan tool, select View DTCs.

NOTE: The scan tool should display an Engine Coolant Temperature Sensor high voltage or open circuit DTC with the Engine Coolant Temperature Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Engine Coolant Temperature Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Engine Coolant Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

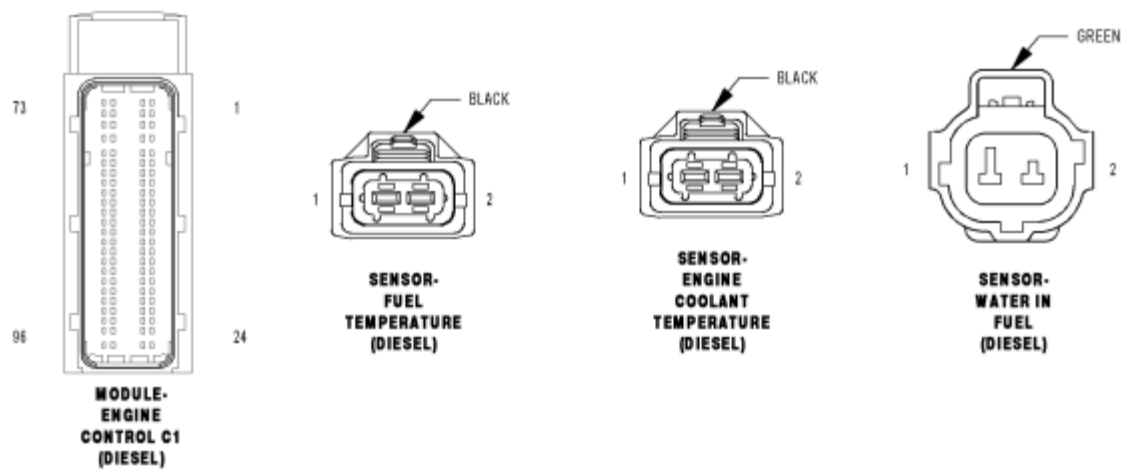
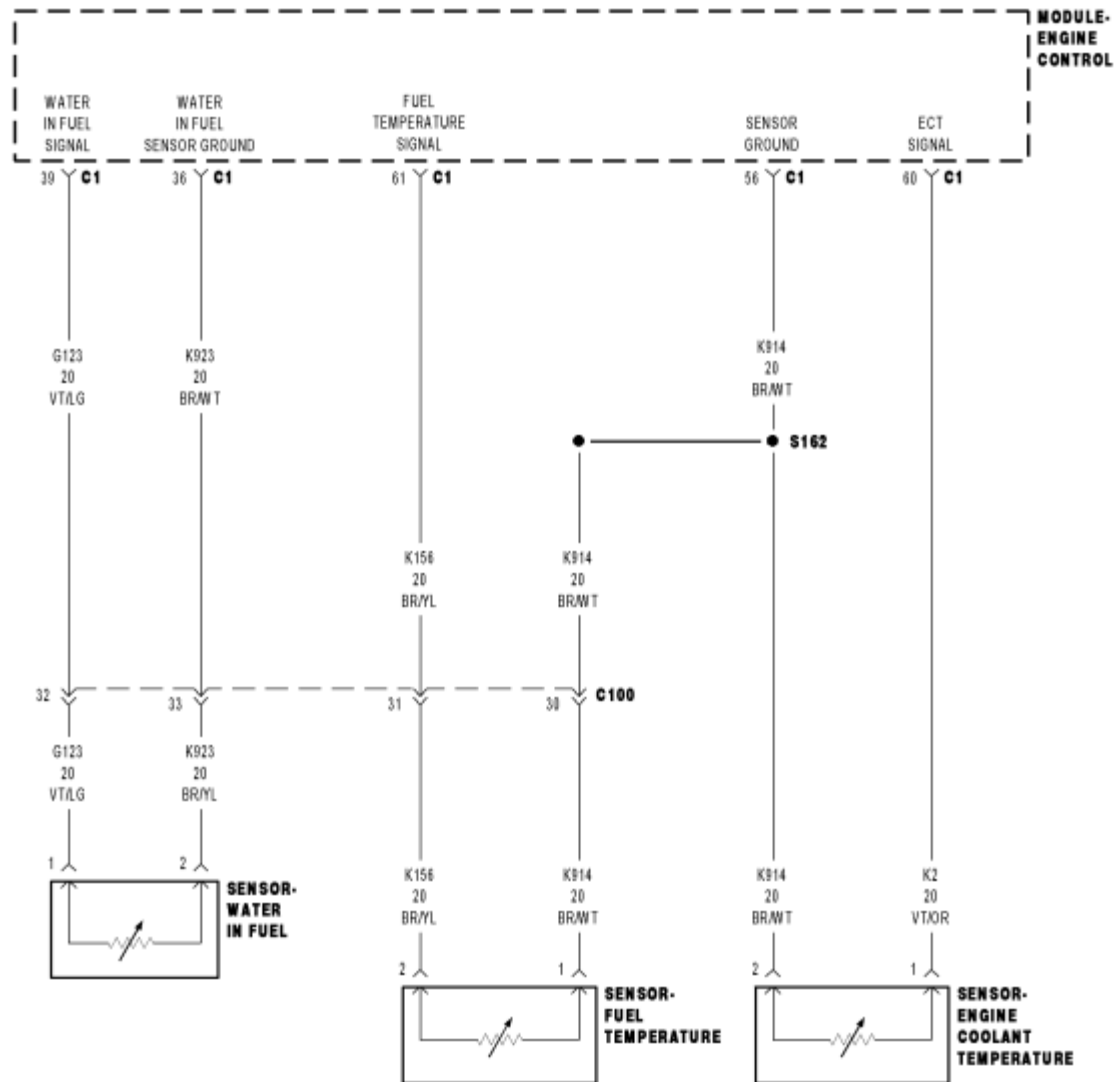
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K2) Engine Coolant Temperature Sensor Signal circuit voltage is below 0.13 volt for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ENGINE COOLANT TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Coolant Temperature Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

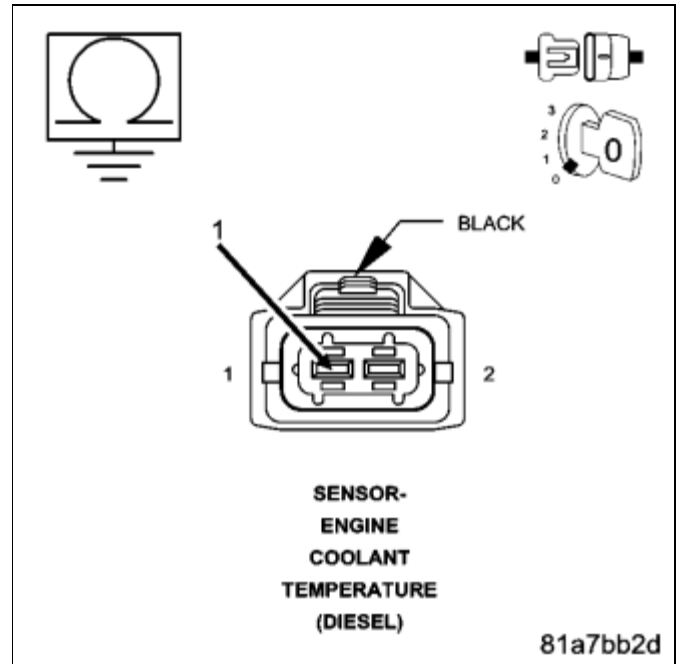
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) Engine Coolant Temperature Sensor Signal circuit and the (K914) Engine Coolant Temperature Sensor Ground circuit in the Engine Coolant Temperature Sensor harness connector.

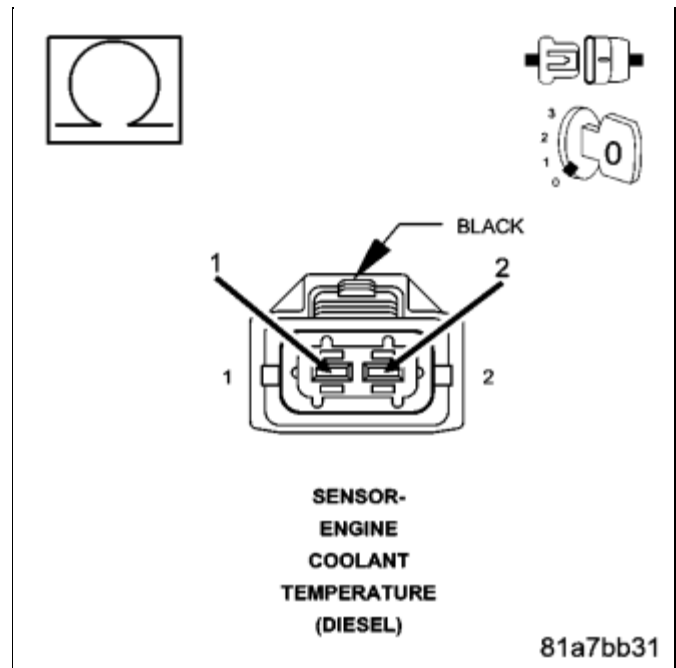
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to the (K914) Engine Coolant Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Measure the resistance of the (K2) Engine Coolant Temperature Sensor Signal circuit between the Engine Coolant Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

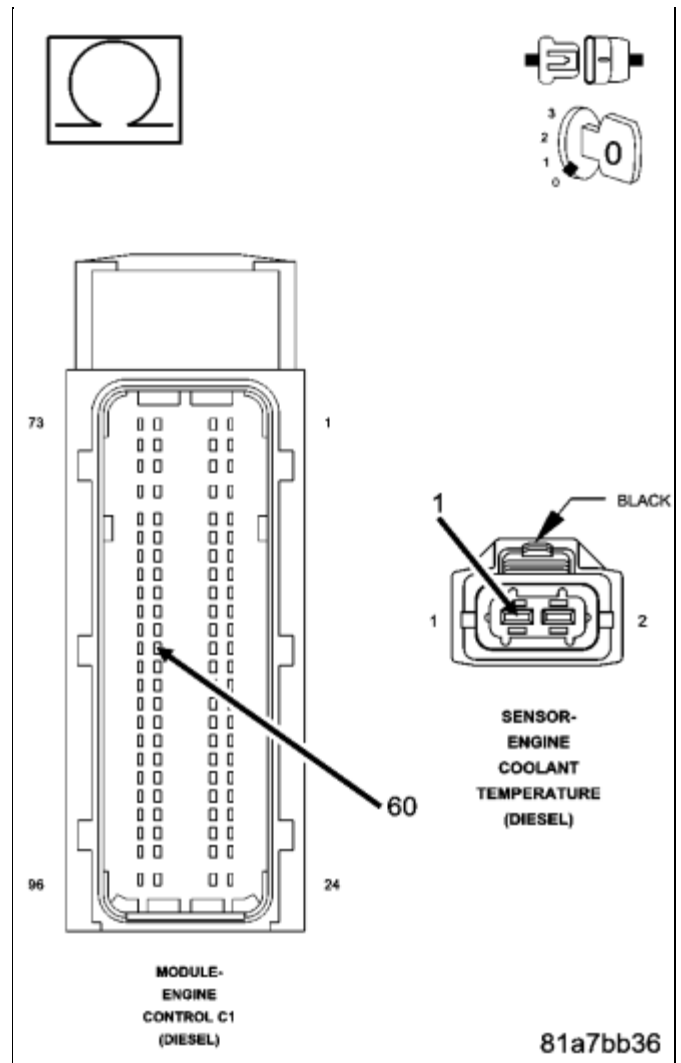
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ENGINE COOLANT TEMPERATURE SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 With the scan tool, select View DTCs.

NOTE: The scan tool should display an Engine Coolant Temperature Sensor high voltage or open circuit DTC with the connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Engine Coolant Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Engine Coolant Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

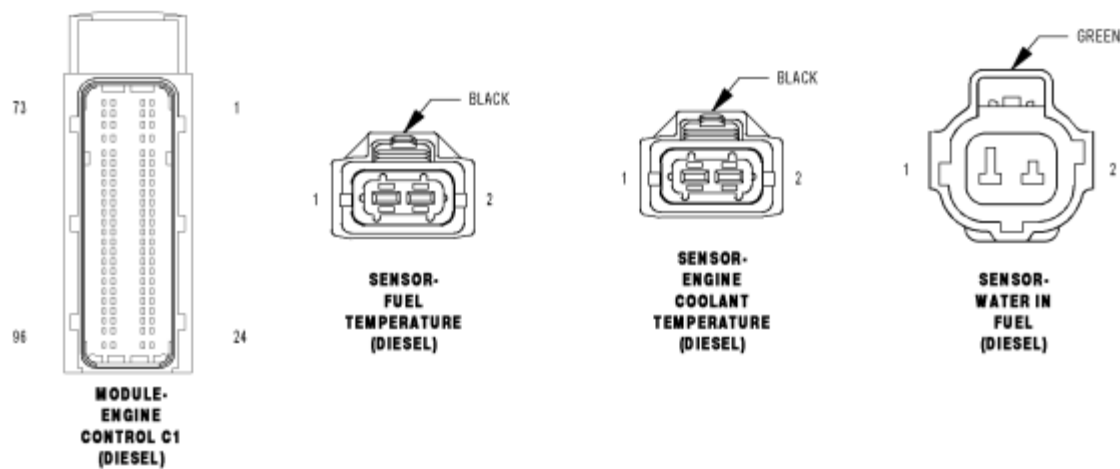
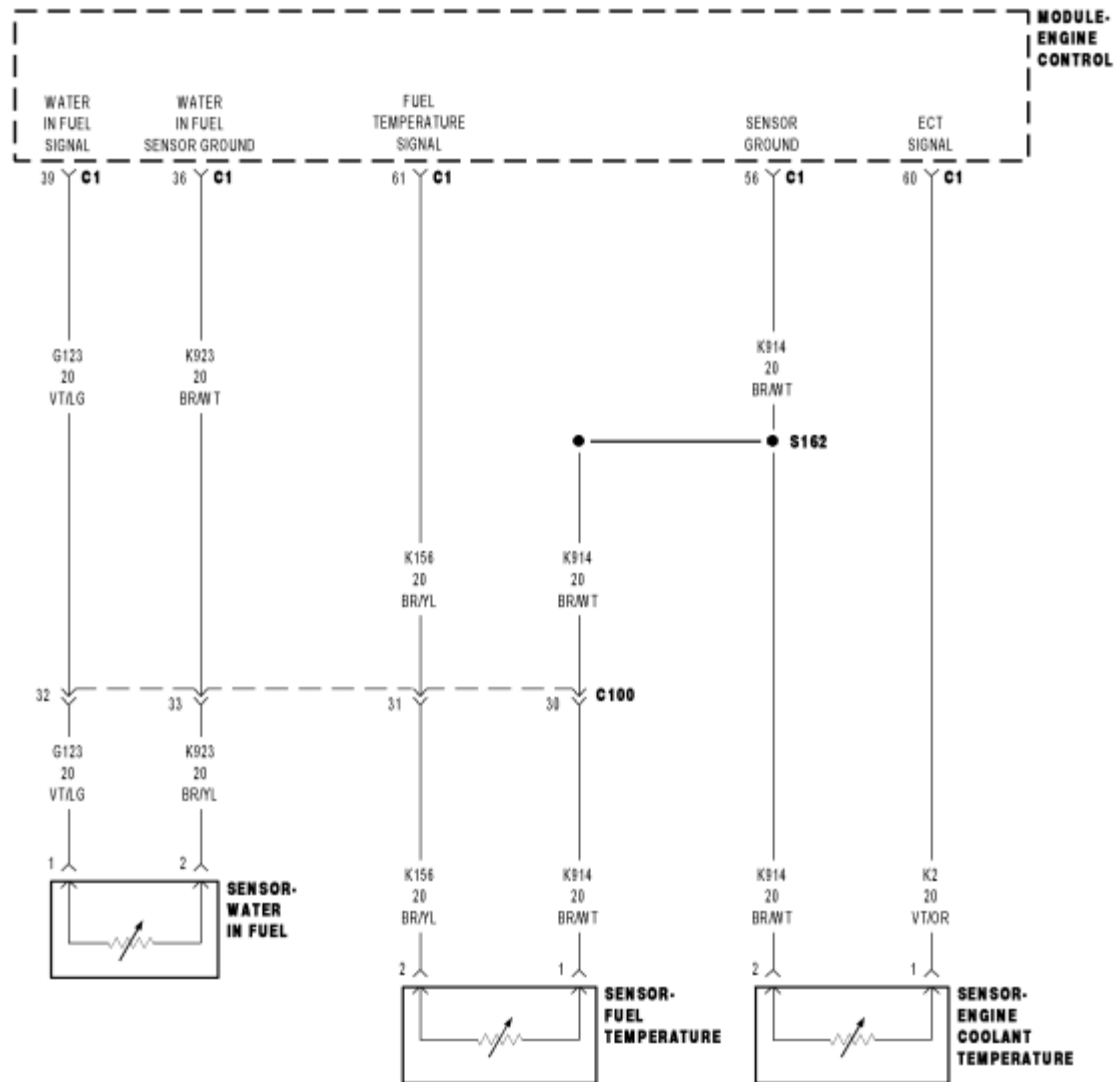
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH



01a77365

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The (K2) Engine Coolant Temperature Sensor Signal circuit voltage is above 4.93 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ENGINE COOLANT TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Engine Coolant Temperature Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

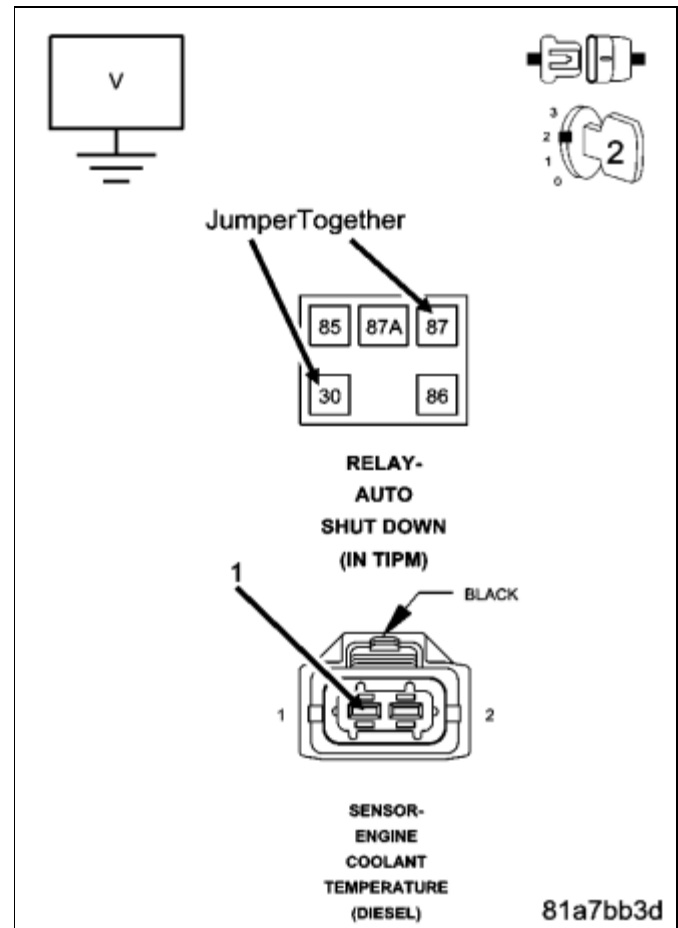
Is there any voltage present?

Yes

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K914) Engine Coolant Temperature Sensor Ground circuit in the Engine Coolant Temperature Sensor harness connector.

Is there any voltage present?

Yes

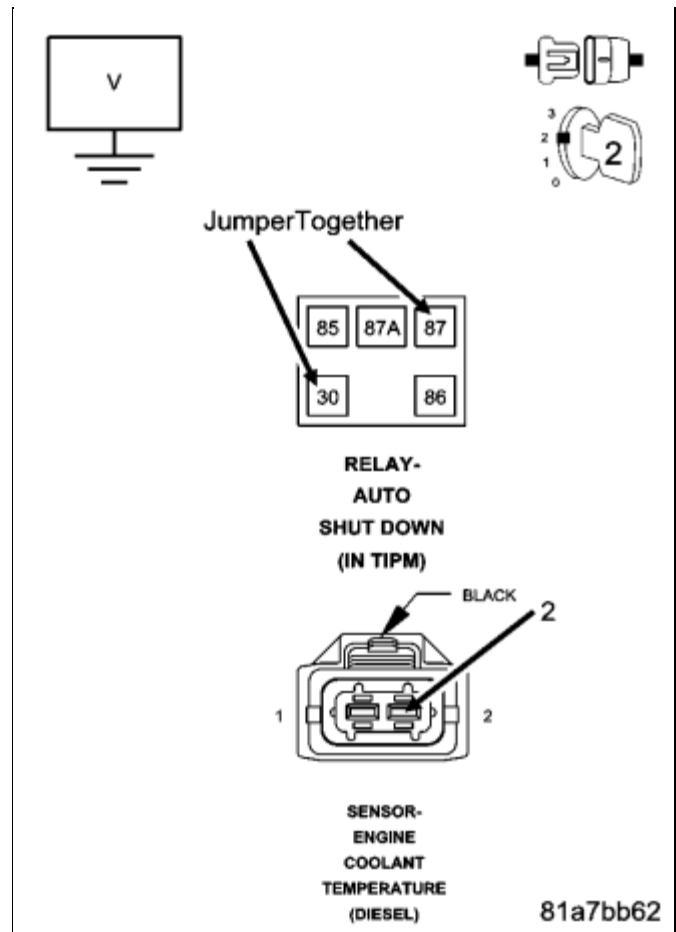
- Repair the (K914) Engine Coolant Temperature Sensor

Ground circuit for a short to voltage.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. ENGINE COOLANT TEMPERATURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay..

Connect the Engine Control Module (ECM) harness connector.

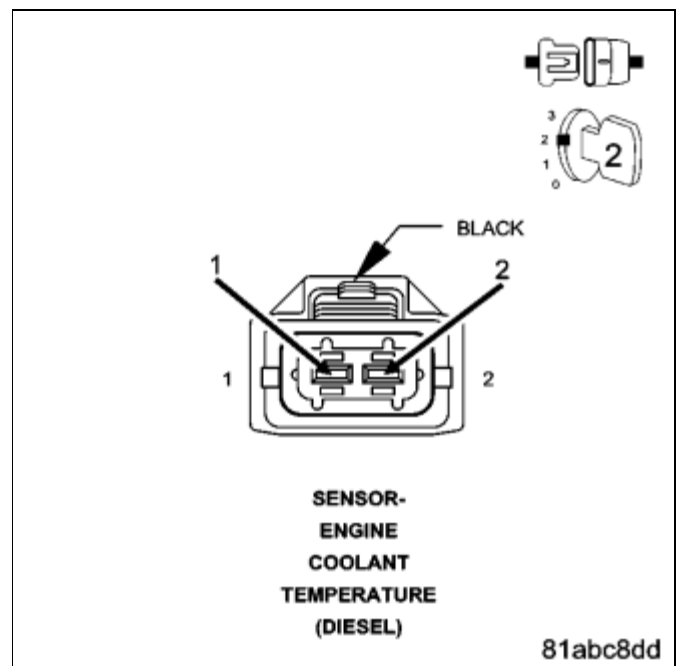
Connect a jumper wire between the (K914) Engine Coolant Temperature Sensor Ground circuit and the (K2) Engine Coolant Temperature Sensor Signal circuit in the Engine Coolant Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Engine Coolant Temperature Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Engine Coolant Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. (K2) ENGINE COOLANT TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K2) Engine Coolant Temperature Sensor Signal circuit between the Engine Coolant Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

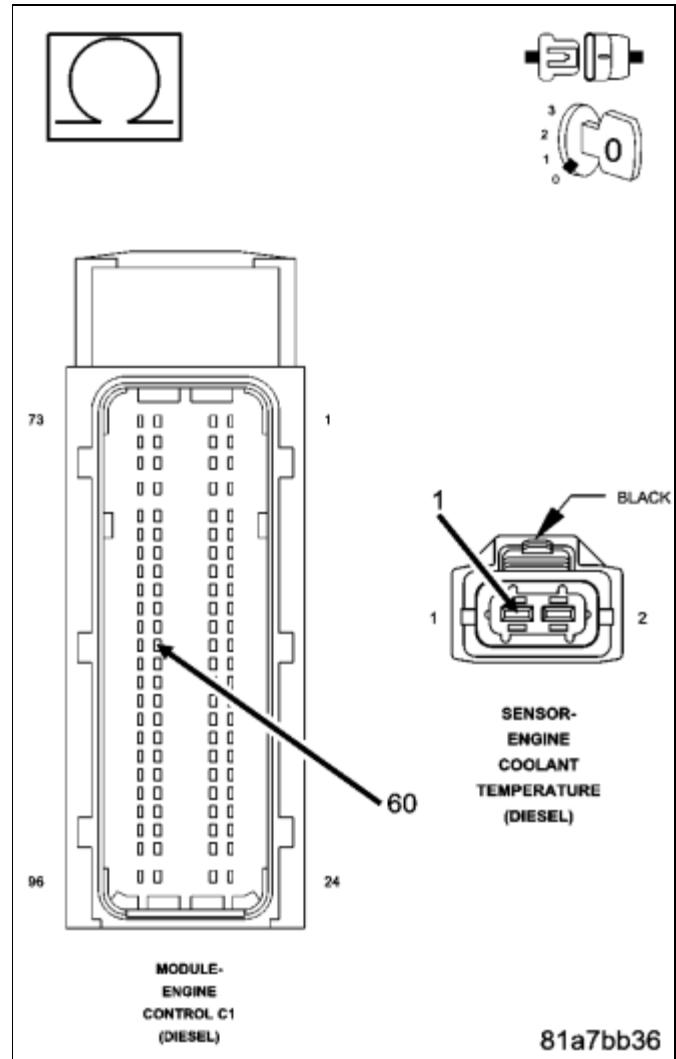
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K2) Engine Coolant Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K914) ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K914) Engine Coolant Temperature Sensor Ground circuit between the Engine Coolant Temperature Sensor harness connector and the

Engine Control Module (ECM) harness connector.

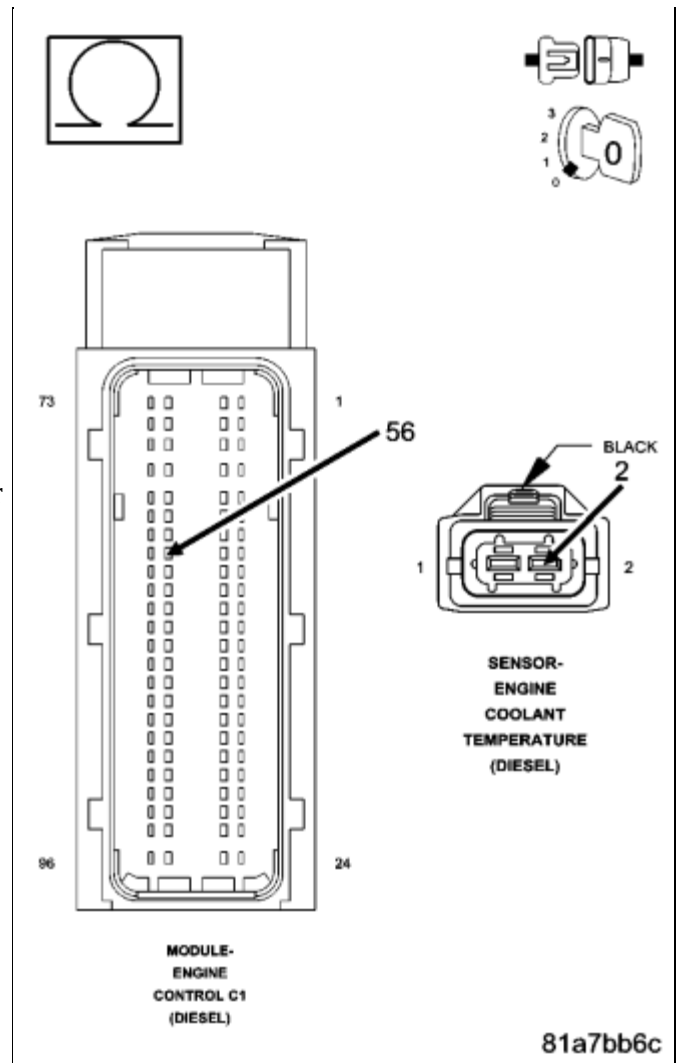
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K914) Engine Coolant Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Engine Coolant Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

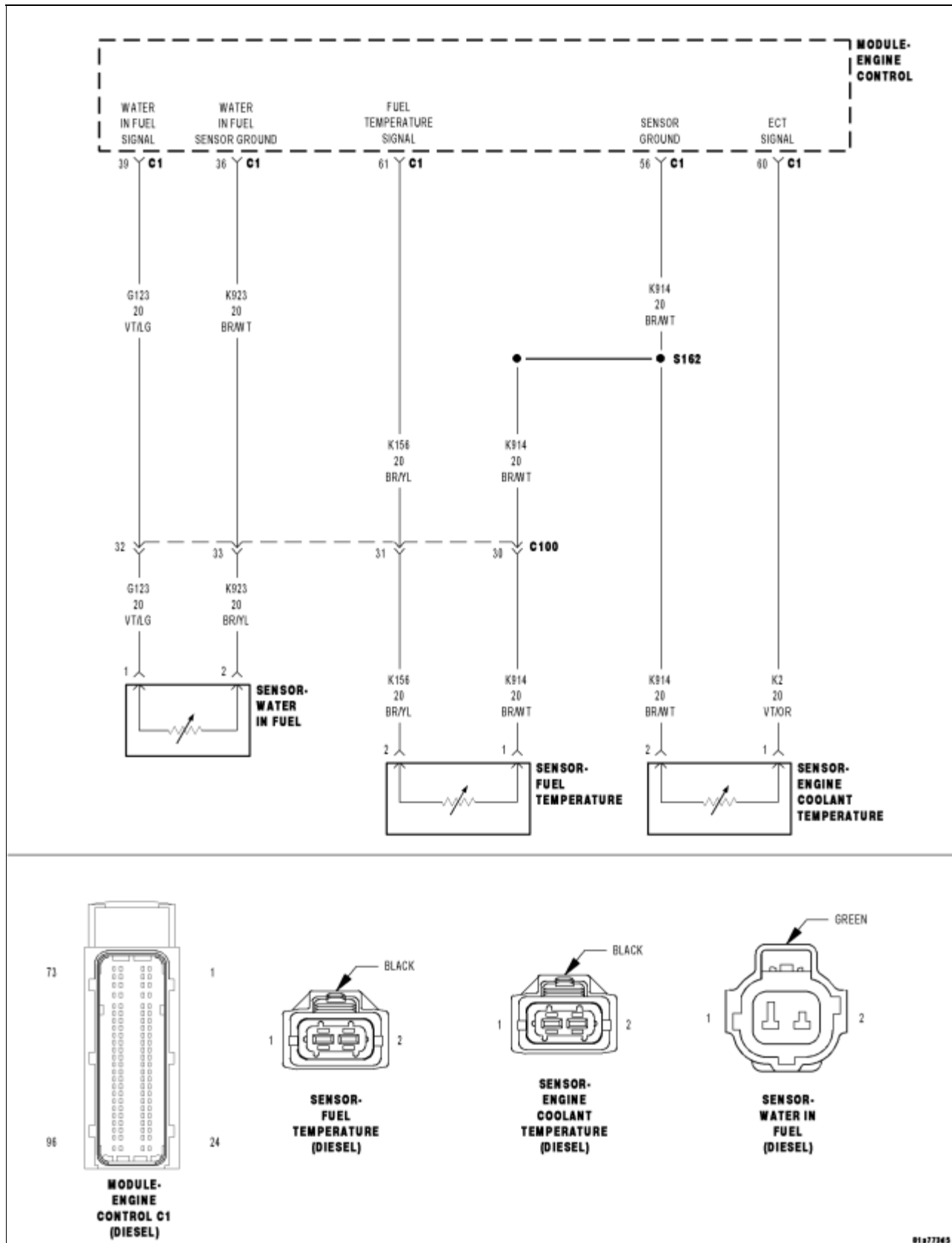
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0128-ENGINE COOLANT TEMP SENSOR ENGINE IS COLD TOO LONG



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running and engine temperature is below 34°C.

- **Set Condition:**

Engine temperature does not increase enough during a calibrated amount of time.

Possible Causes
ENGINE COLD TOO LONG

Diagnostic Test

1. CHECK COOLING SYSTEM PERFORMANCE

NOTE: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may cause this DTC to set.

Verify that the coolant level is correct.

Start the engine.

With the scan tool, set the engine RPM to 1500 and allow the engine to warm up for 10-15 minutes.

With the scan tool, monitor the Engine Coolant Temperature value during the warm up cycle. Make sure the transition of temperature change is smooth.

Did the engine temperature reach a minimum of 80° C (176° F)?

Yes

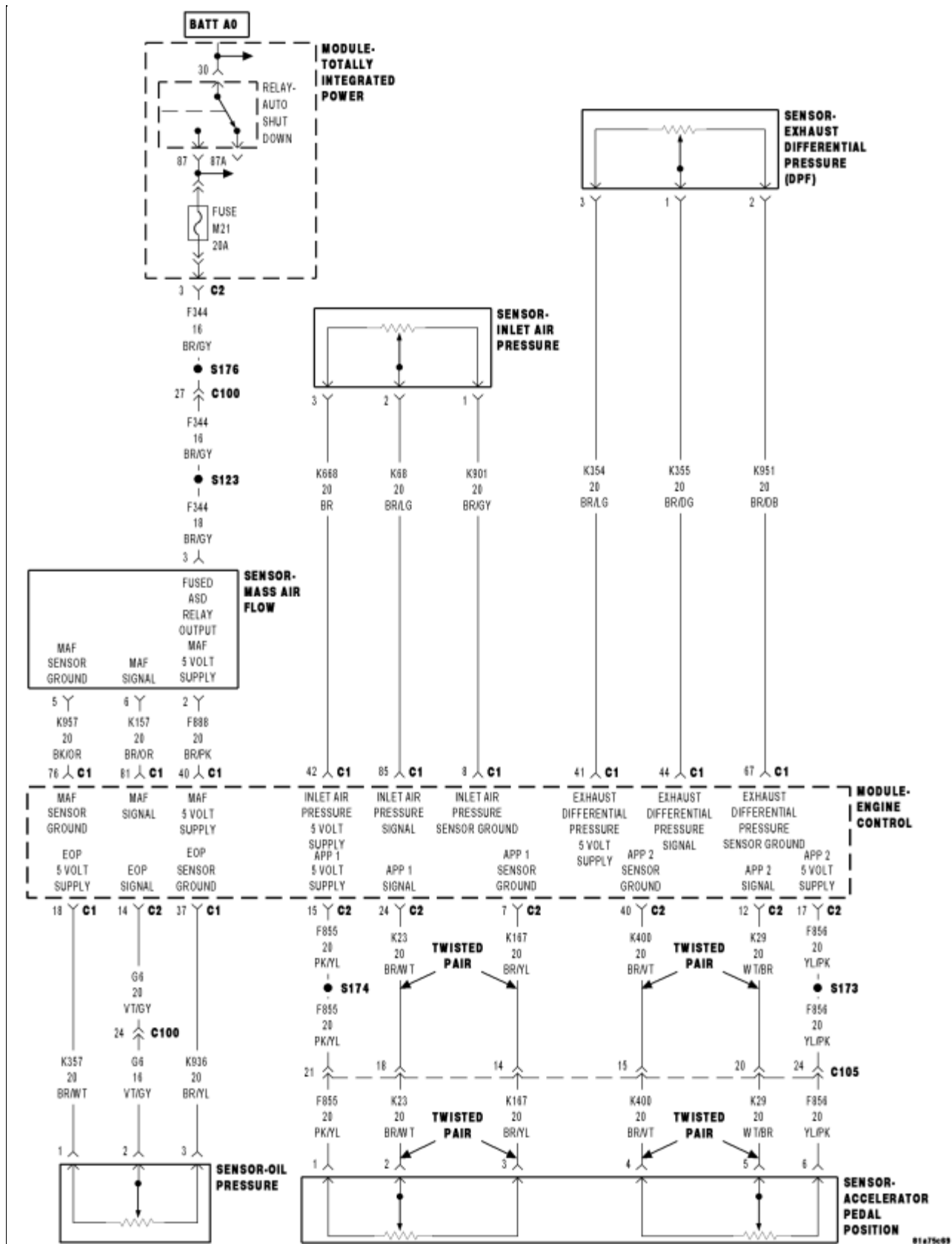
- Test Complete.

No

- Refer to the Service Information for cooling system performance diagnosis. The most probable cause is a Thermostat problem. Also, refer to any related TSBs. If there are no cooling system problems replace the Engine Coolant Temperature Sensor.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P012C-TURBO INLET AIR PRESSURE SENSOR CIRCUIT LOW



With the ignition on.

- **Set Condition:**

The (K68) Inlet Air Pressure Sensor Signal circuit voltage is below 0.35 volt for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K901) INLET AIR PRESSURE SENSOR GROUND
(K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K901) INLET AIR PRESSURE SENSOR GROUND
(K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
INLET AIR PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.
Disconnect the Inlet Air Pressure Sensor harness connector.
Turn the ignition on.
Measure the voltage of the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit in the Inlet Air Pressure Sensor harness connector.

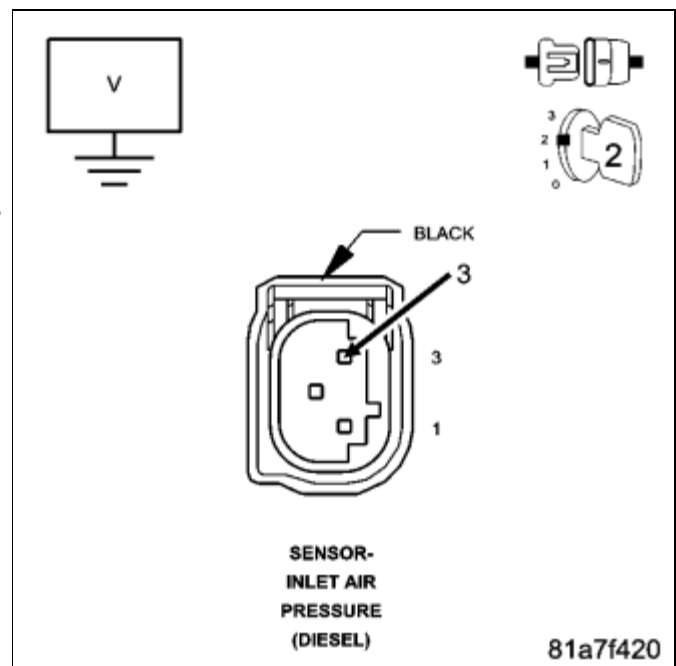
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition on.
Disconnect the Engine Control Module (ECM) harness connector.
Measure the resistance between ground and the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit in the Inlet Air Pressure Sensor harness connector.

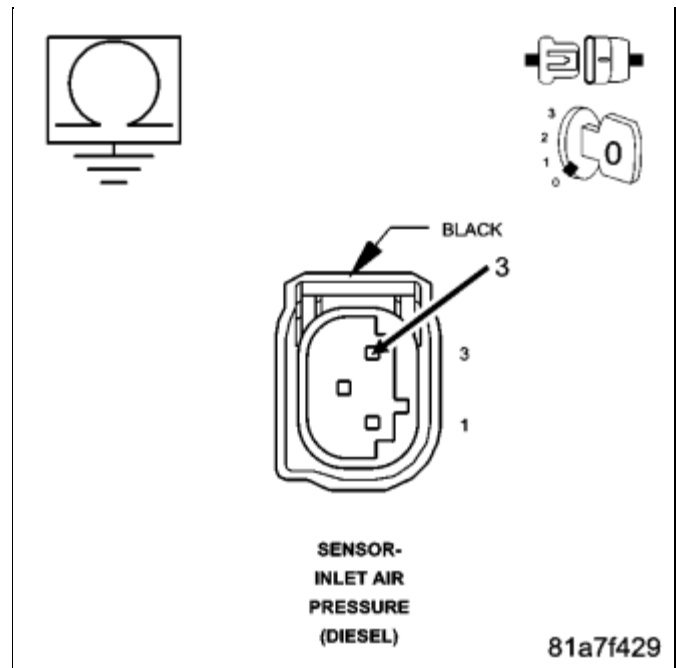
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit and the (K901) Inlet Air Pressure Sensor Ground circuit in the Inlet Air Pressure Sensor harness connector.

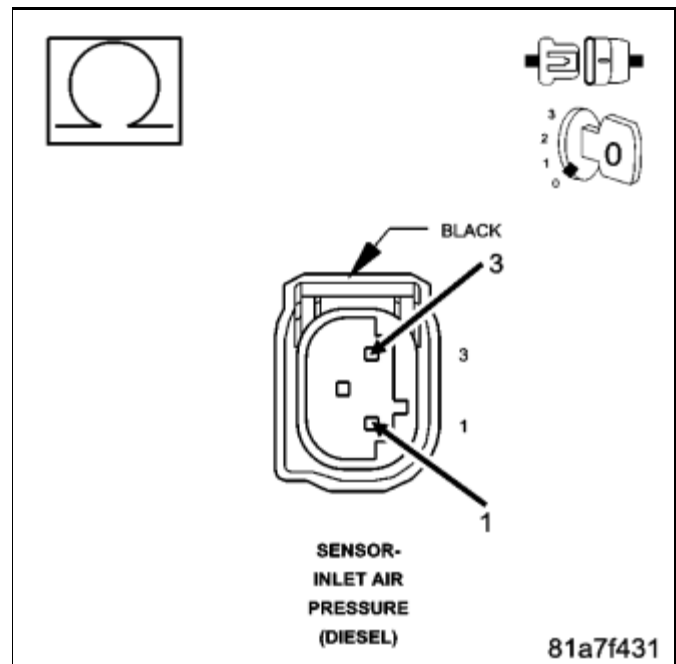
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit for a short to the (K901) Inlet Air Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit between the Inlet Air Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

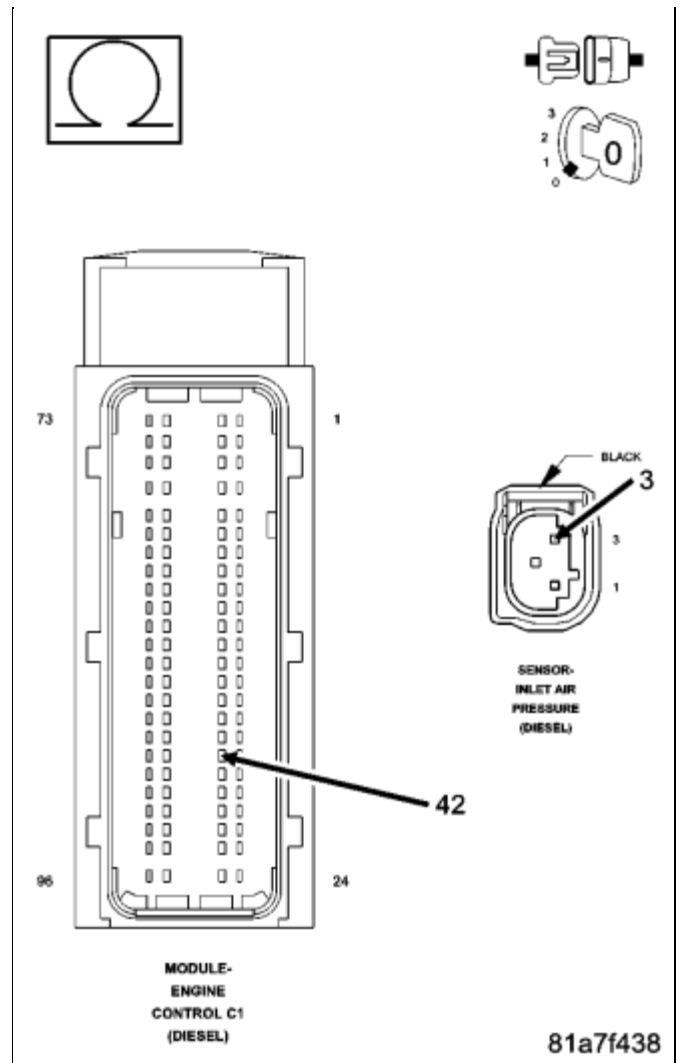
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. INLET AIR PRESSURE SENSOR

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Inlet Air Pressure Sensor high voltage or open DTC with the Inlet Air Pressure Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Inlet Air Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [7](#)

7. (K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K68) Inlet Air Pressure Sensor Signal circuit in the Inlet Air Pressure Sensor harness connector.

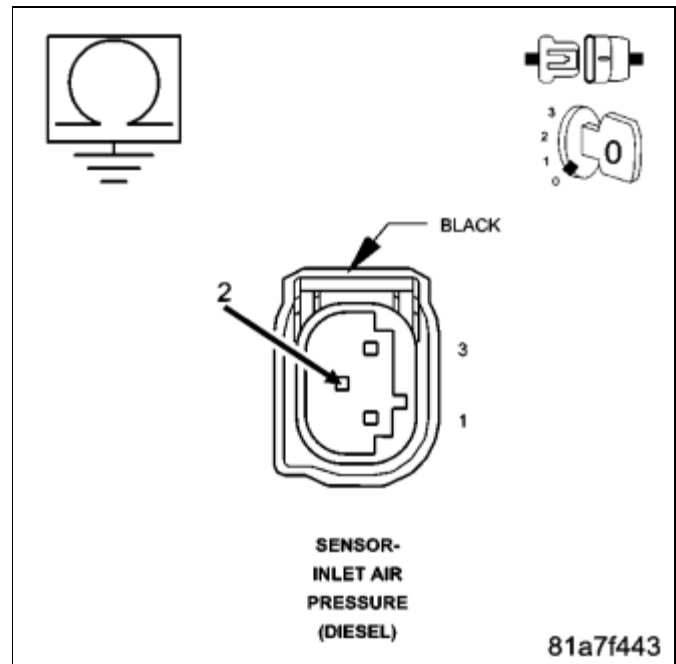
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K68) Inlet Air Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K68) Inlet Air Pressure Sensor Signal circuit and the (K901) Inlet Air Pressure Sensor Ground circuit in the Inlet Air Pressure Sensor harness connector.

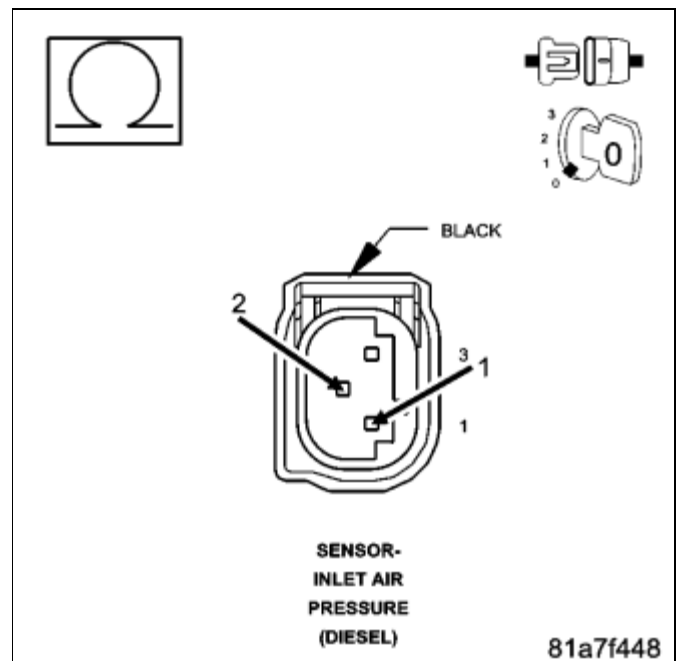
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K68) Inlet Air Pressure Sensor Signal circuit for a short to the (K901) Inlet Air Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K68) Inlet Air Pressure Sensor Signal circuit between the Inlet Air Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

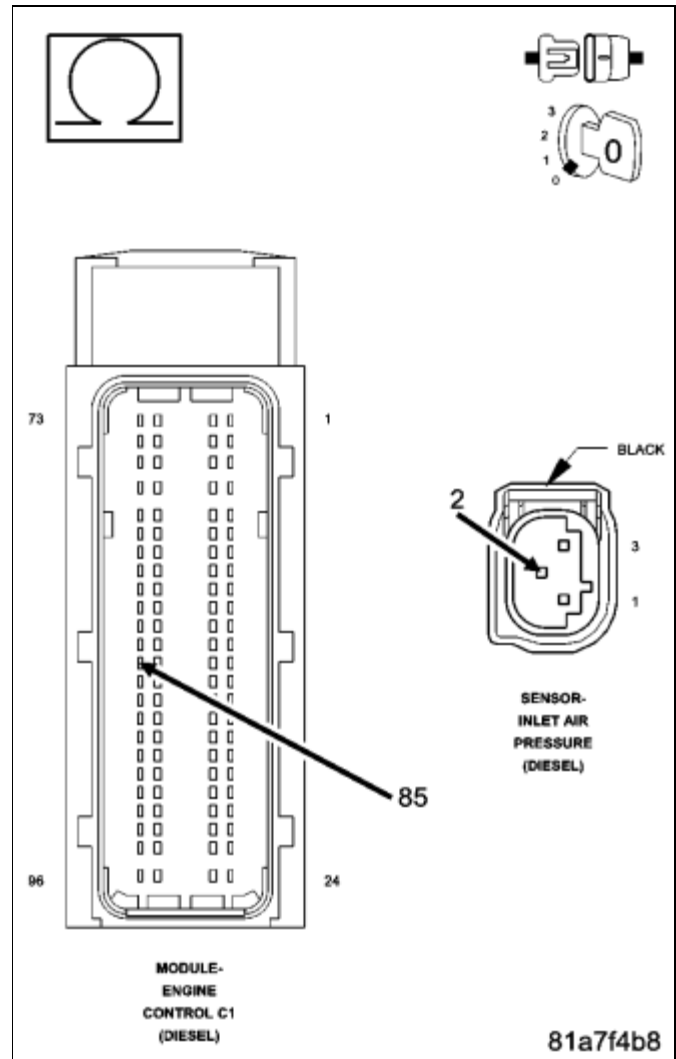
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K68) Inlet Air Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Inlet Air Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

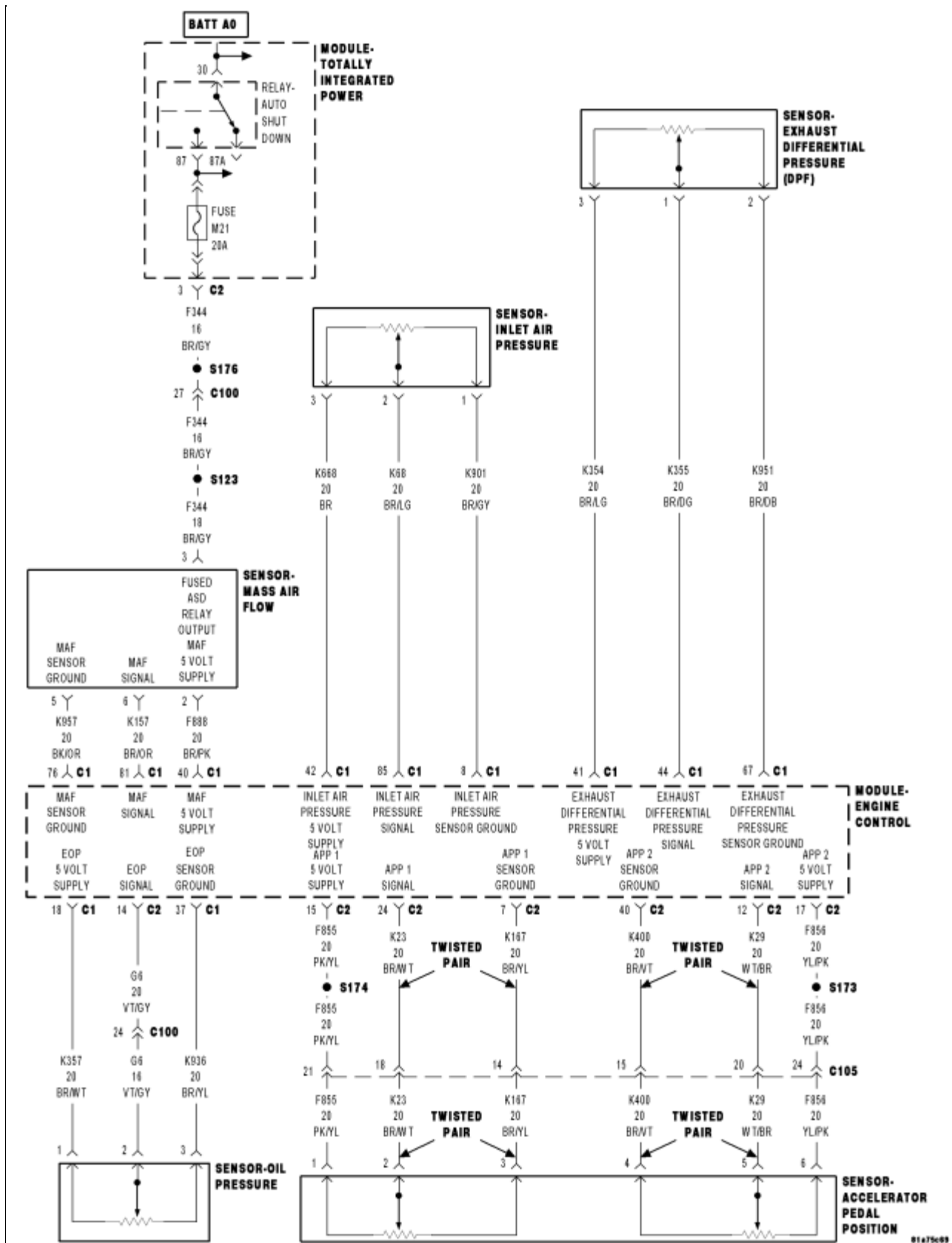
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P012D-TURBO INLET AIR PRESSURE SENSOR CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K68) Inlet Air Pressure Sensor Signal circuit voltage is above 4.76 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
INLET AIR PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Inlet Air Pressure Sensor harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

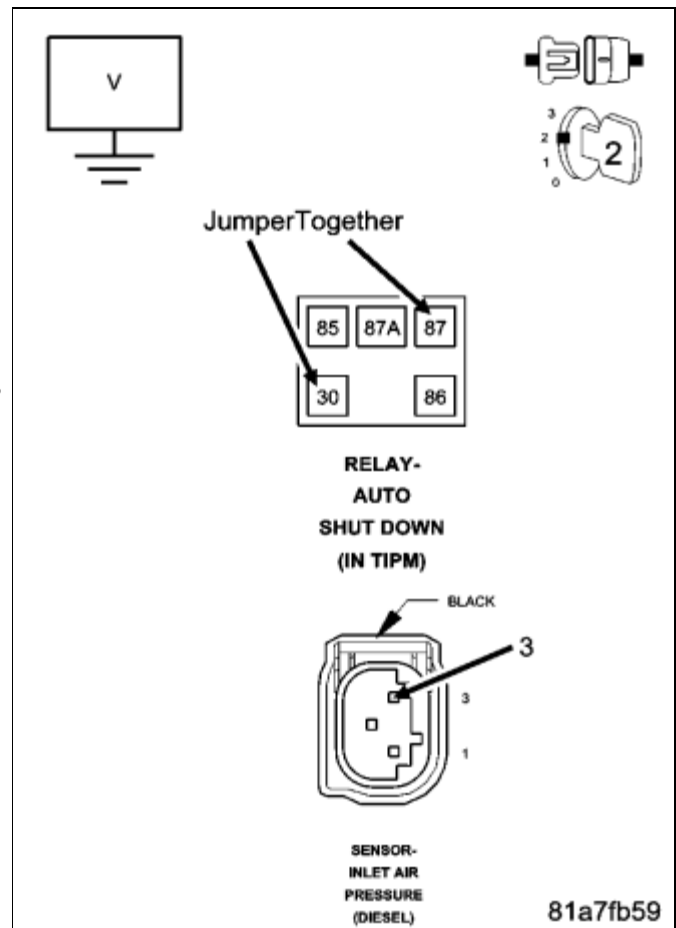
Measure the voltage of the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit in the Inlet Air Pressure Sensor harness connector.

Is there any voltage present?**Yes**

- Repair the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

**3. (K68) INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE**

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K68) Inlet Air Pressure Sensor Signal circuit in the Inlet Air Pressure Sensor harness connector.

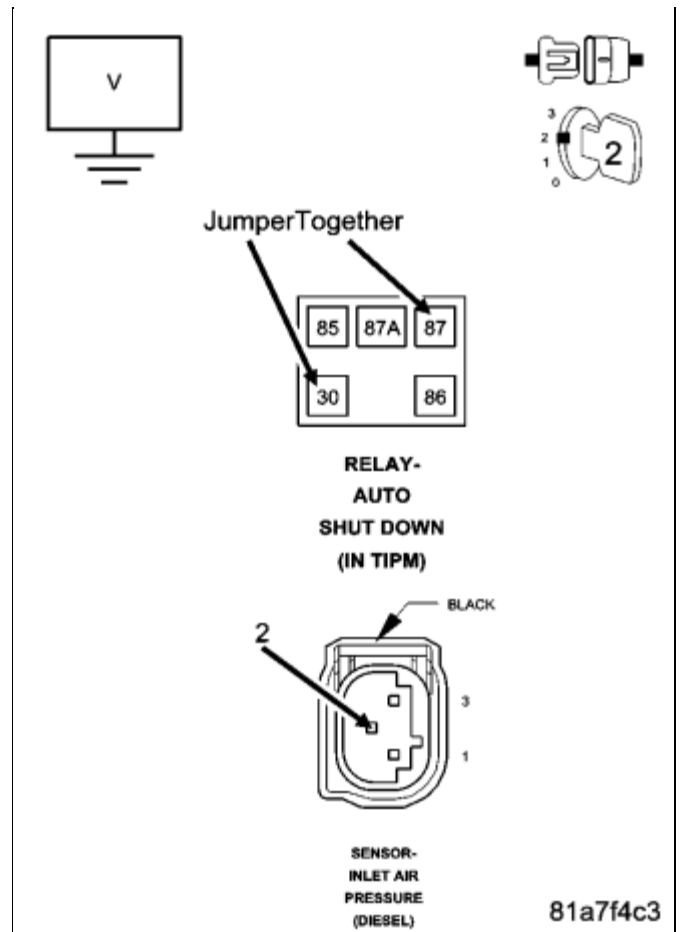
Is there any voltage present?

Yes

- Repair the (K68) Inlet Air Pressure Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K901) Inlet Air Pressure Sensor Ground circuit in the Inlet Air Pressure Sensor harness connector.

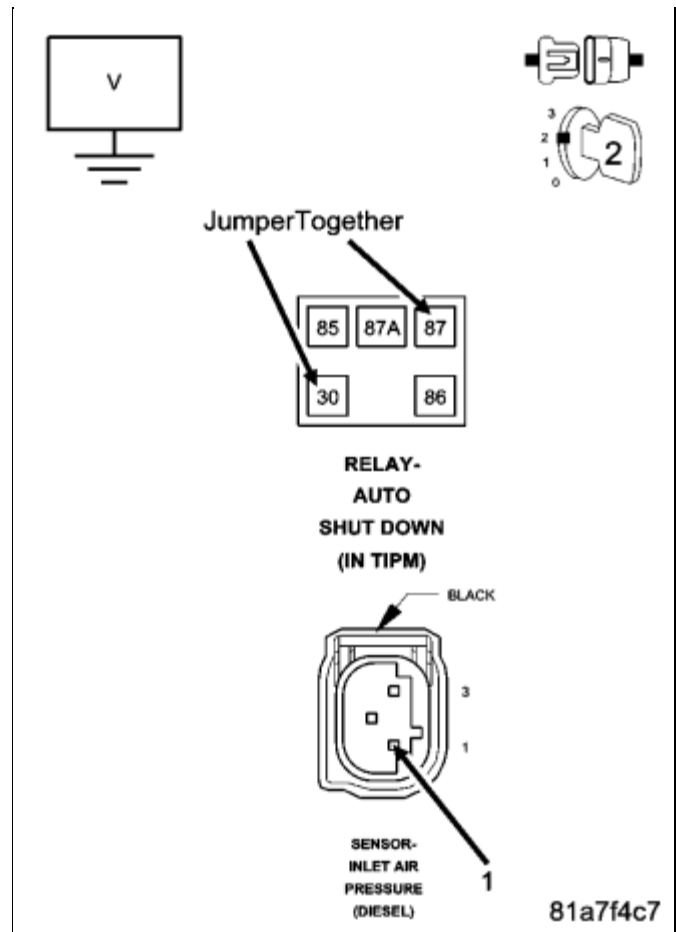
Is there any voltage present?

Yes

- Repair the (K901) Inlet Air Pressure Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. INLET AIR PRESSURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay. Connect the Engine Control Module (ECM) harness connector.

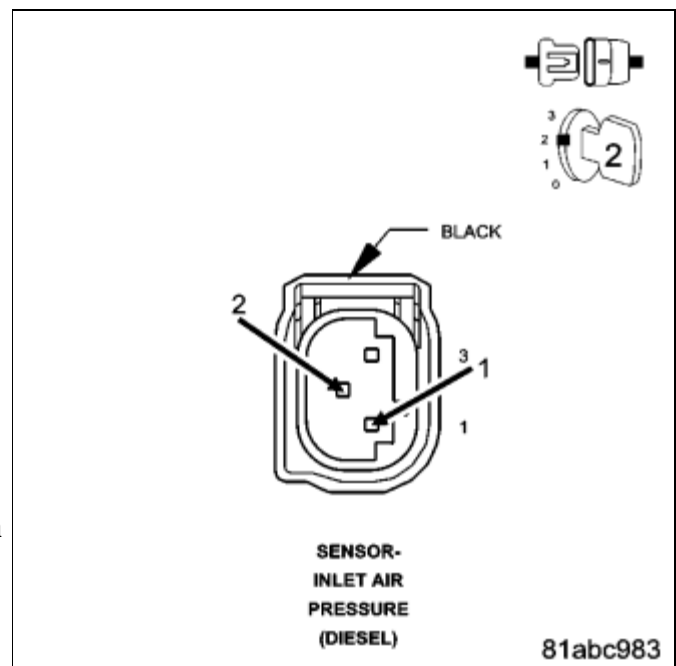
Connect a jumper wire between the (K901) Inlet Air Pressure Sensor Ground circuit and the (K68) Inlet Air Pressure Sensor Signal circuit in the Inlet Air Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Inlet Air Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Inlet Air Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. (K68) INLET AIR PRESSURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K68) Inlet Air Pressure Sensor Signal between the Inlet Air Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

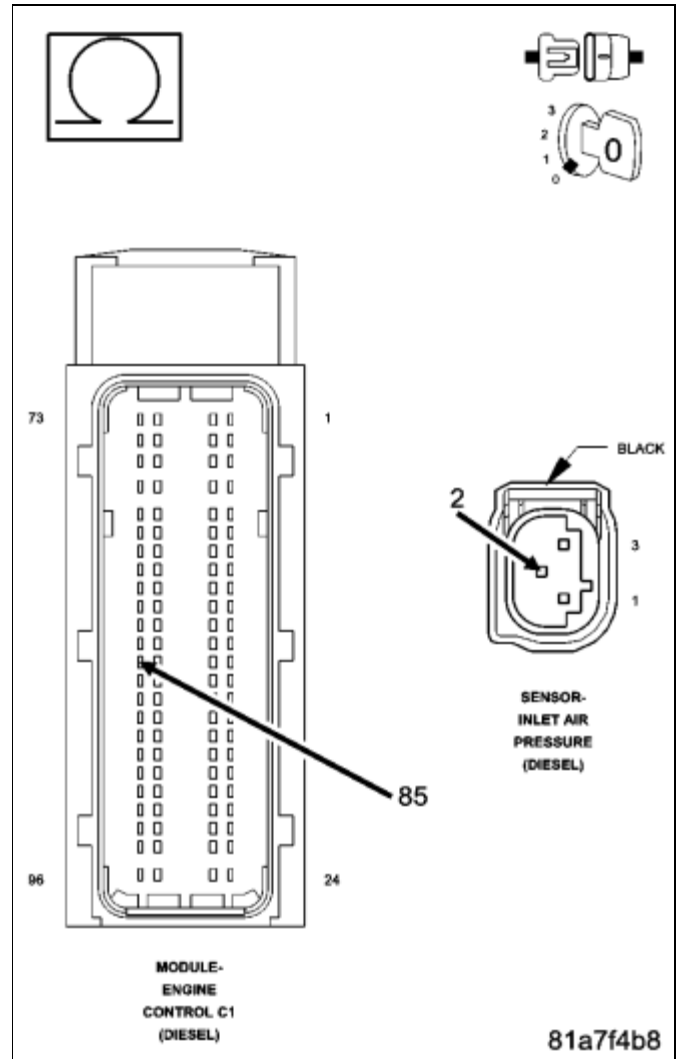
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K68) Inlet Air Pressure Sensor Signal for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K901) INLET AIR PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K901) Inlet Air Pressure Sensor Ground circuit between the Inlet Air Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

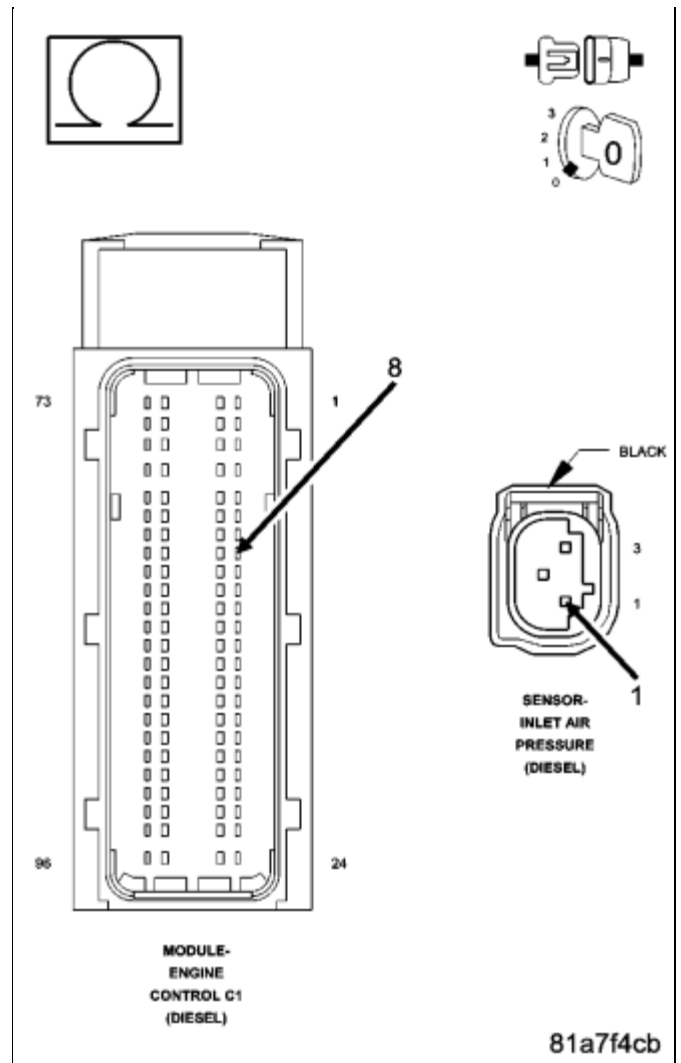
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K901) Inlet Air Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Inlet Air Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

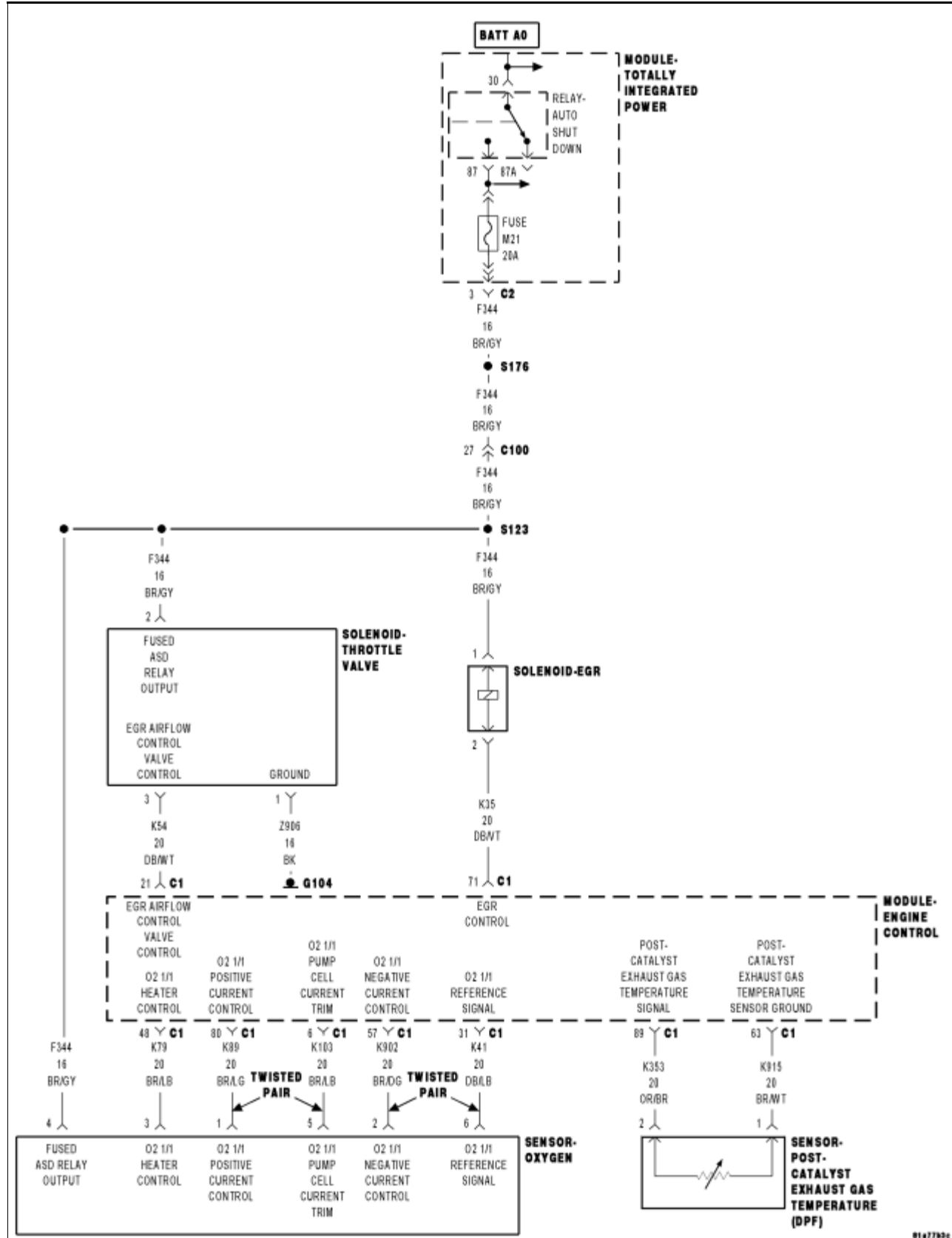
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0130-O2 SENSOR 1/1 CIRCUIT OPEN



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

- **Set Condition:**

The ECM detects an open on the (K902) O2 1/1 Negative Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

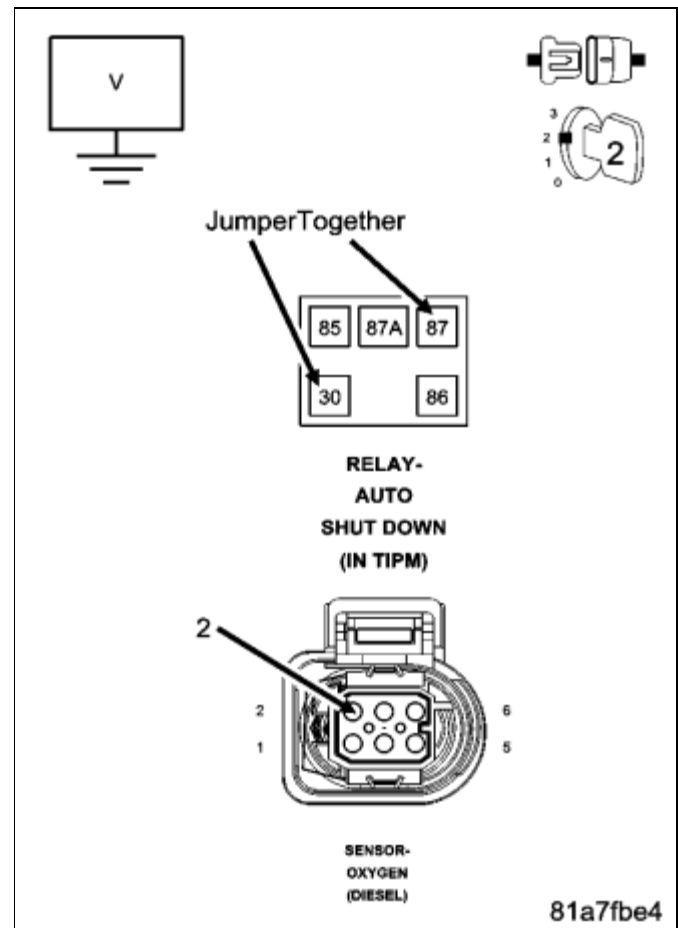
Is there any voltage present?

Yes

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay..
 Measure the resistance between the (K902) O2 1/1 Negative Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

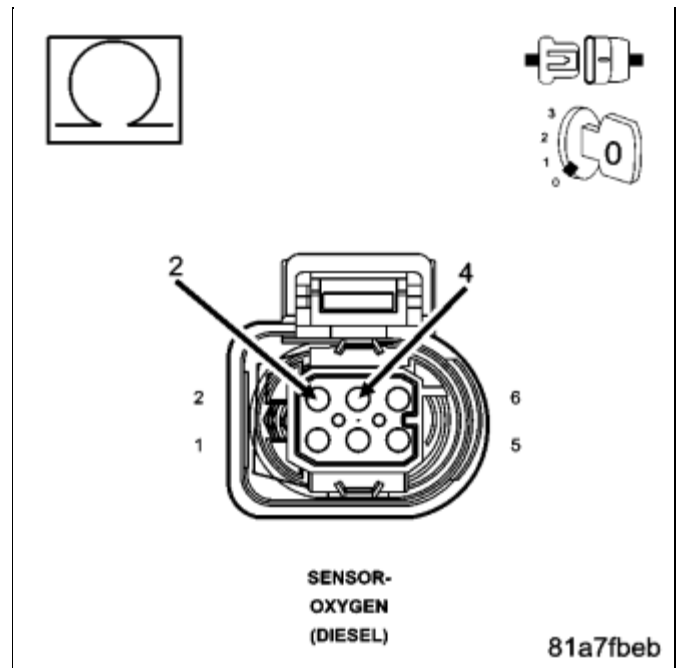
Is the resistance above 10.0 ohms?

Yes

- Go to [4](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K902) O2 1/1 Negative Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

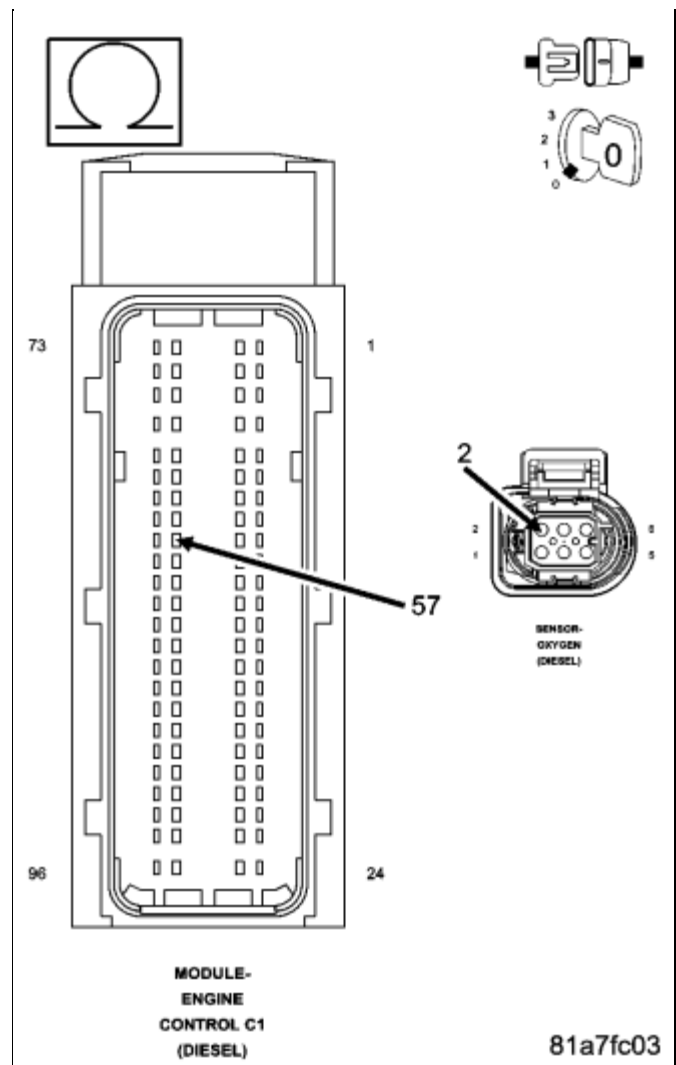
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

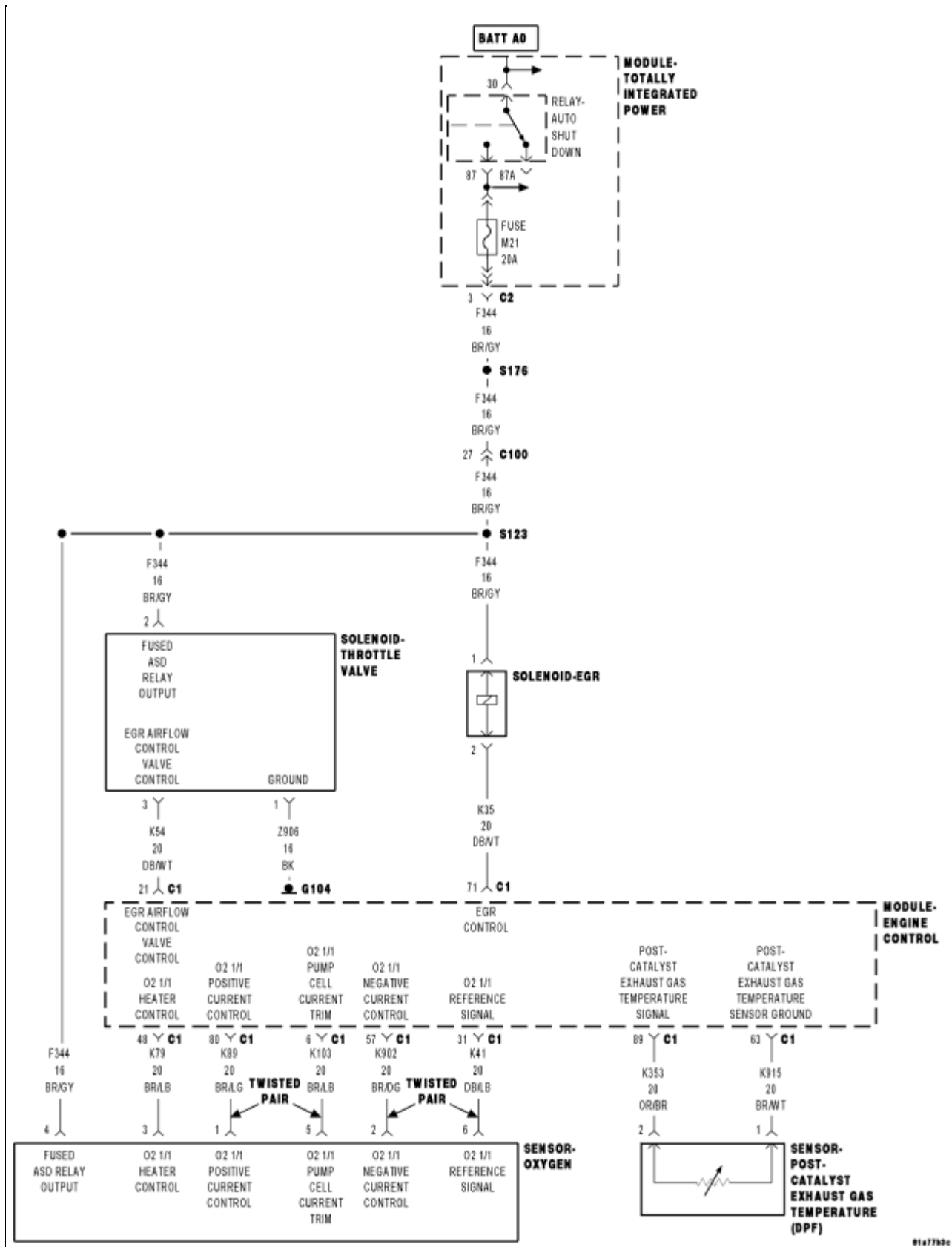
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0131-O2 SENSOR 1/1 CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to ground on the (K902) O2 1/1 Negative Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

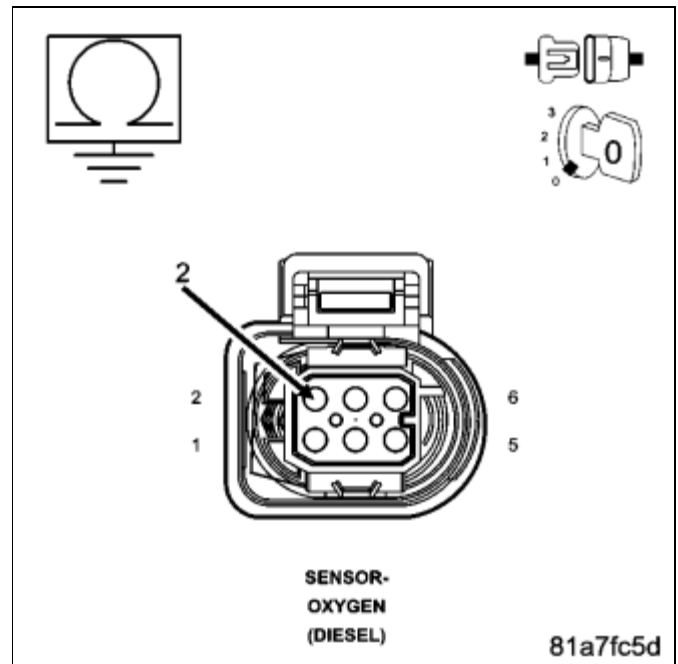
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K902) O2 1/1 Negative Current Control circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

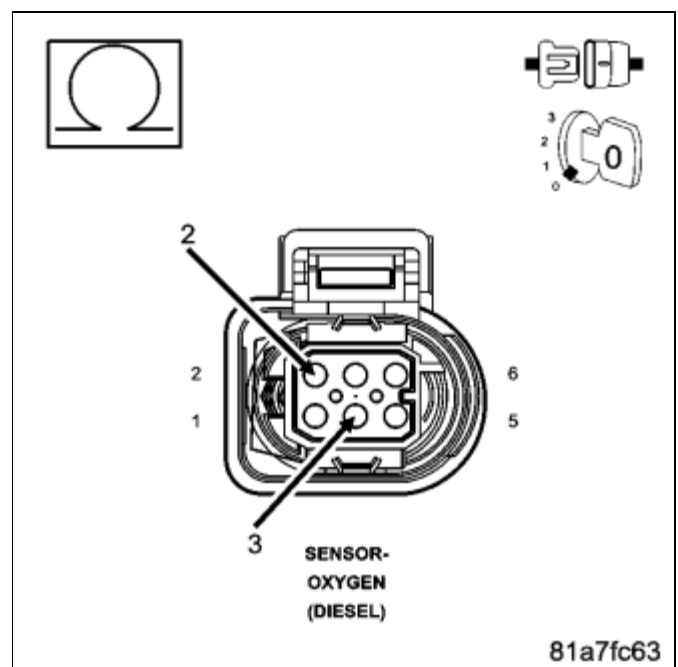
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K902) O2 1/1 Negative Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

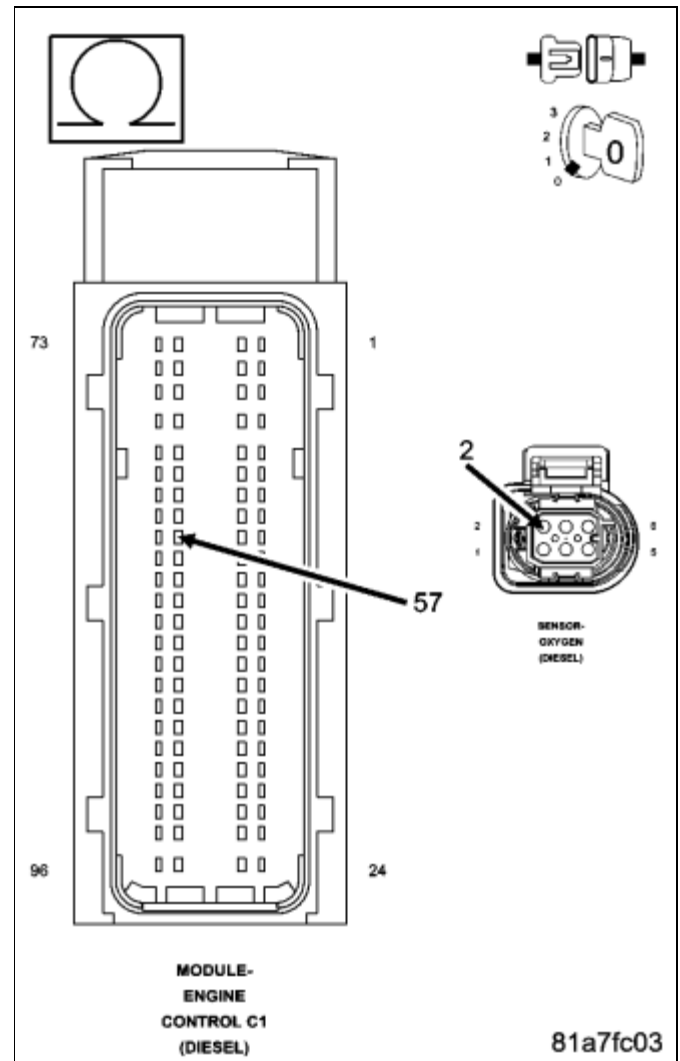
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

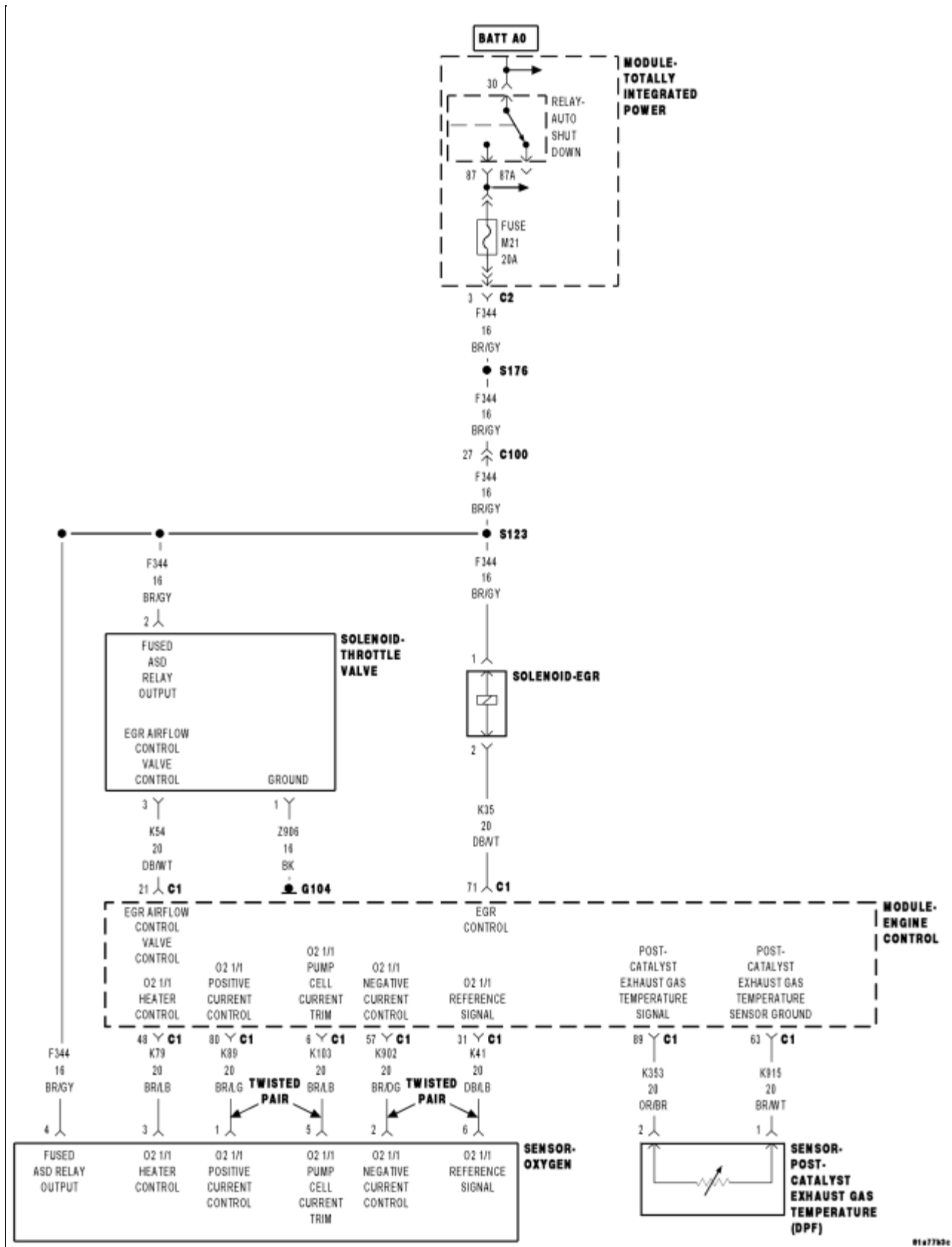
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT HIGH



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to voltage on the (K902) O2 1/1 Negative Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

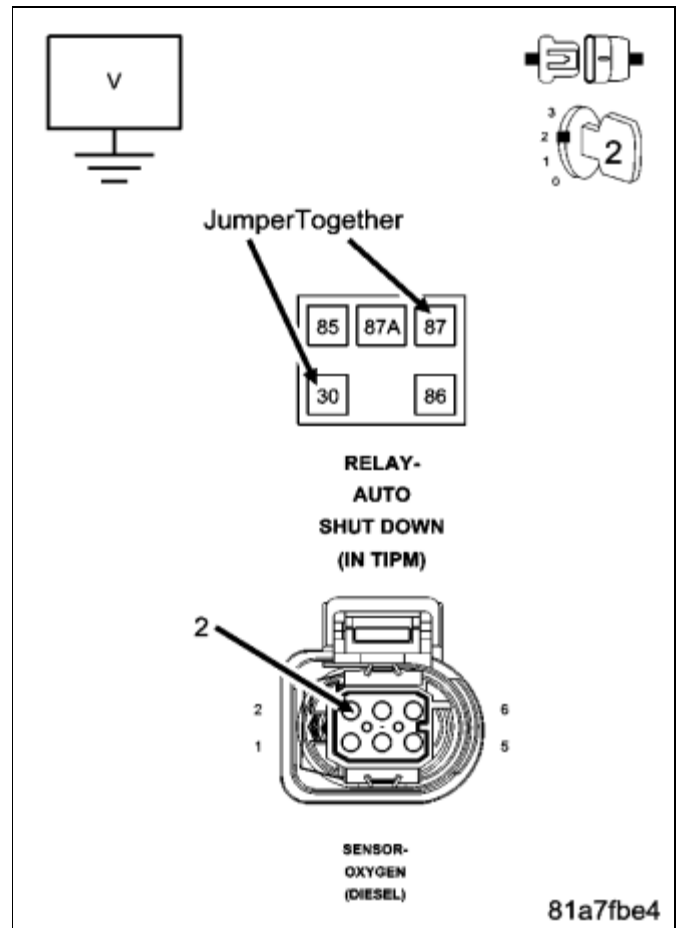
Is there any voltage present?

Yes

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay..
 Measure the resistance between the (K902) O2 1/1 Negative Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

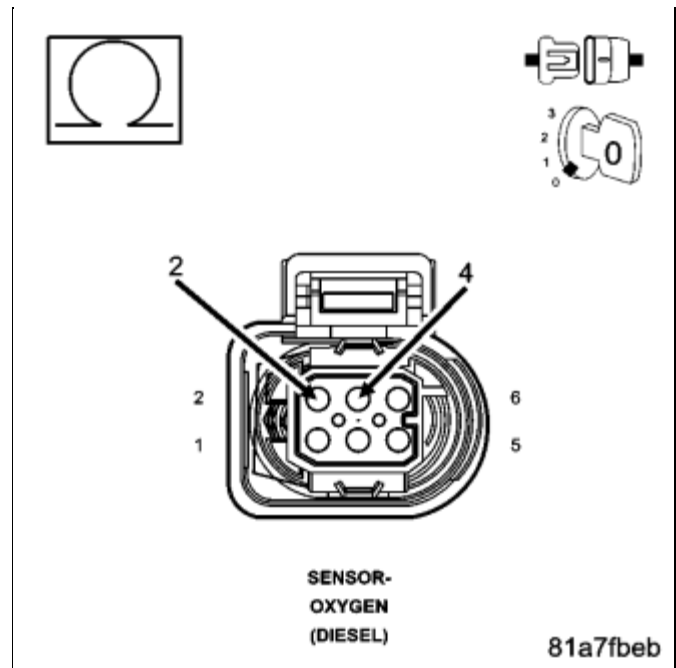
- Go to [4](#)

No

- Repair the (K902) O2 1/1 Negative Current Control

circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K902) O2 1/1 Negative Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

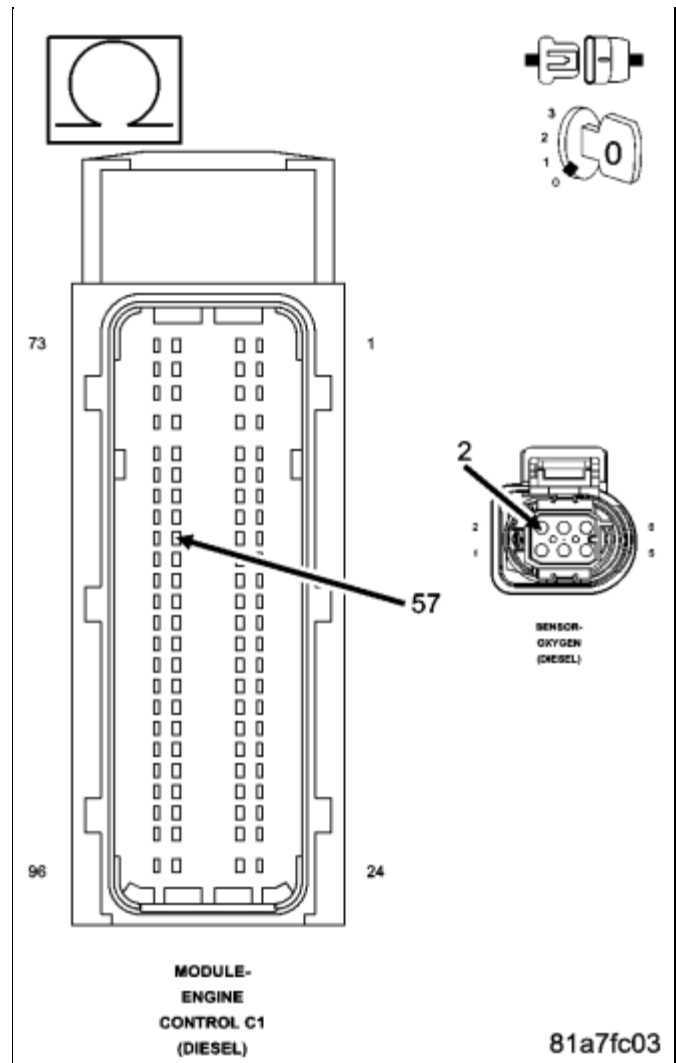
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

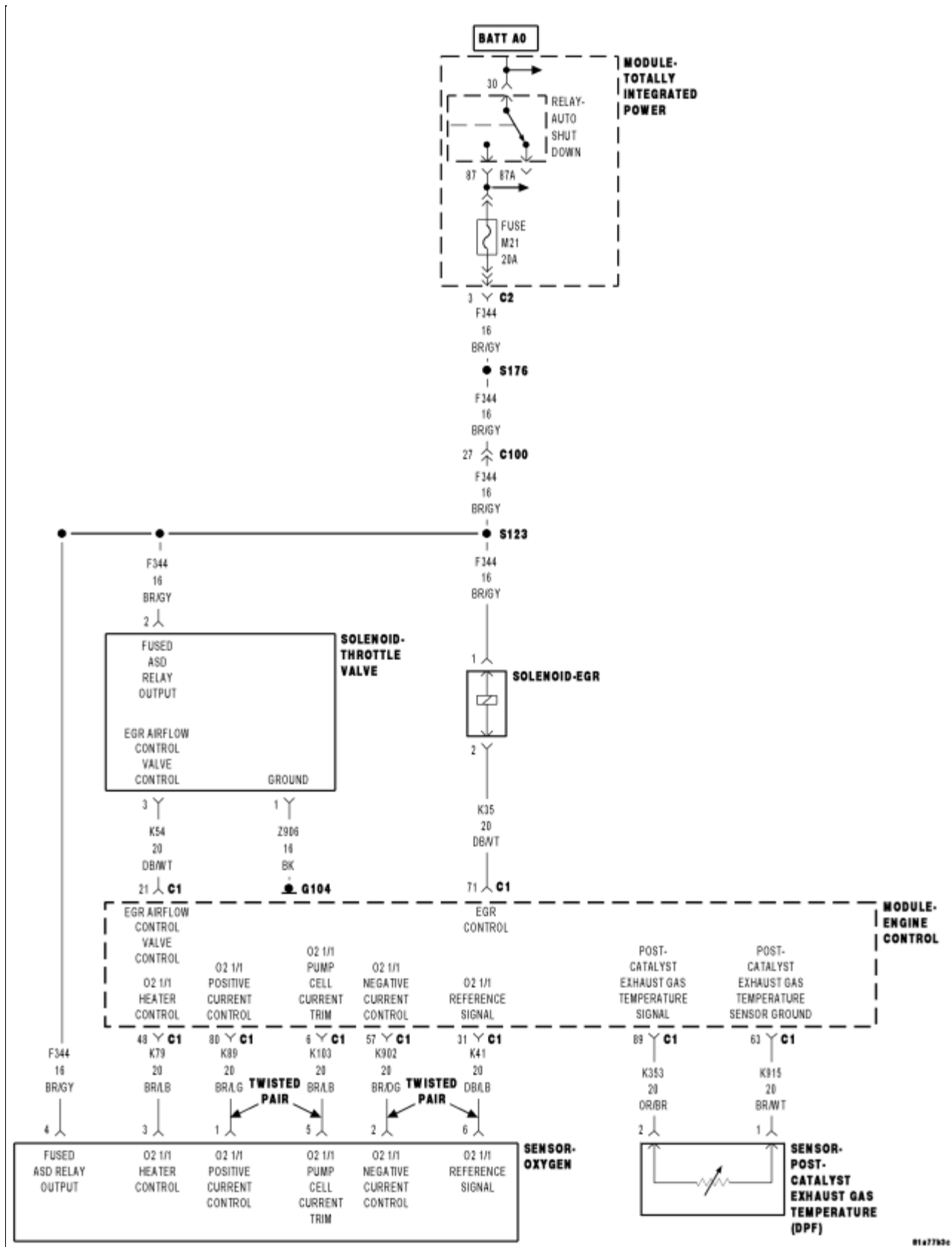
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the Oxygen Sensor Heater command on.

- **Set Condition:**

The ECM detects an implausible voltage on the (K79) O2 1/1 Heater Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE
(K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Oxygen Sensor Heater.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

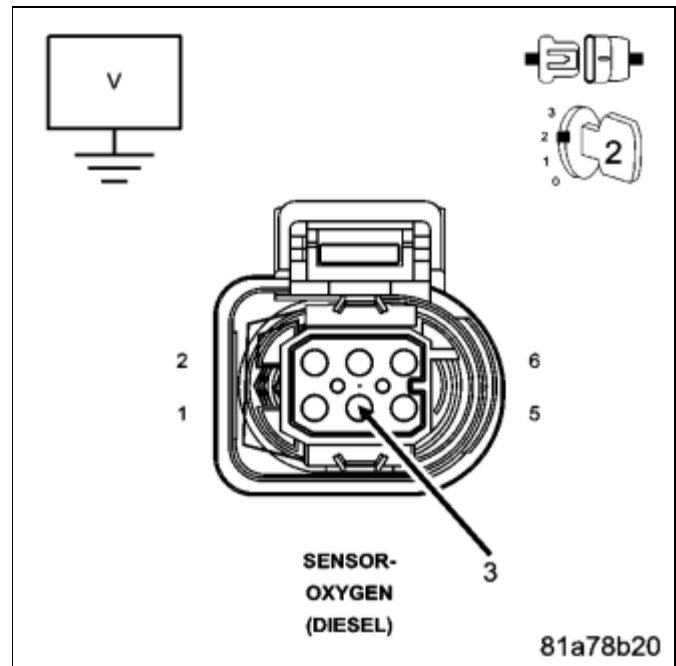
Is there any voltage present?

Yes

- Repair the (K79) O2 1/1 Heater Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K79) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay..
 Measure the resistance between ground and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

Is the resistance above 1000 ohms?

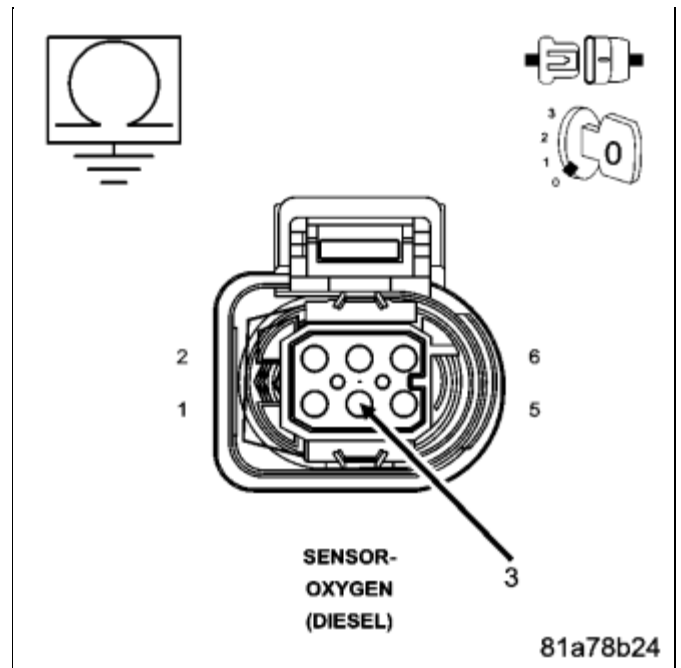
Yes

- Go to [4](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



4. (K79) O2 1/1 HEATER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K79) O2 1/1 Heater Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

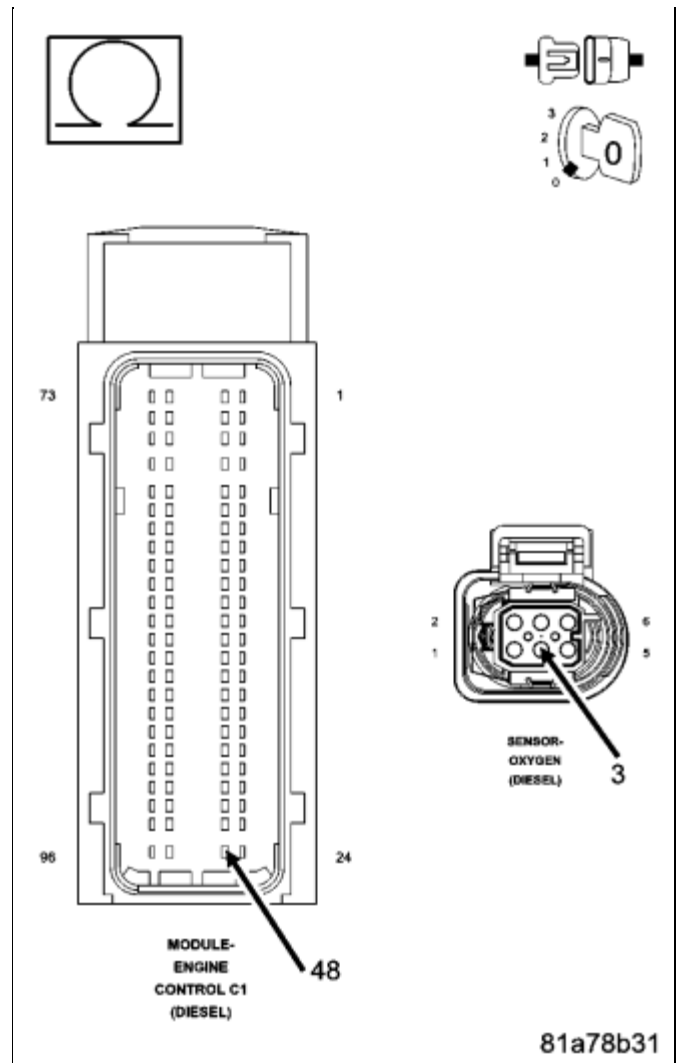
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K79) O2 1/1 Heater Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (F344) Fused ASD Relay Output 2 circuit between the Oxygen Sensor harness connector and the ASD Relay connector.

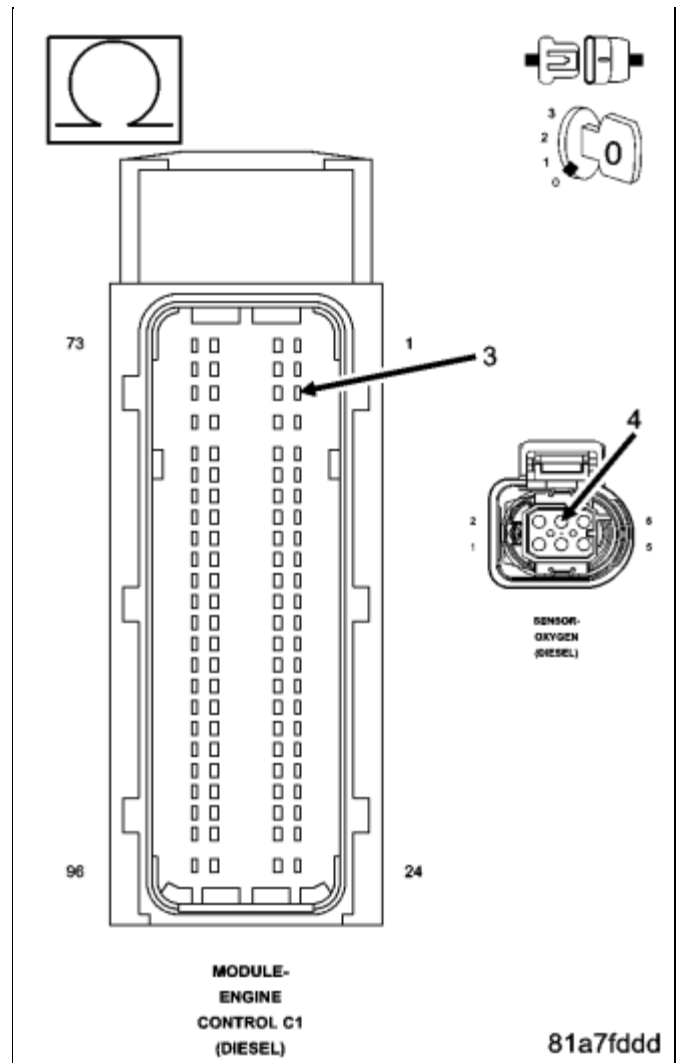
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (F344) Fused ASD Relay Output 2 circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. OXYGEN SENSOR

Connect the Engine Control Module (ECM) harness connector.
 Replace the Oxygen Sensor in accordance with the Service Information.
 Start the engine.
 Allow the engine to reach normal operating temperature.
 Monitor the scan tool for at least two minutes.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [Z](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

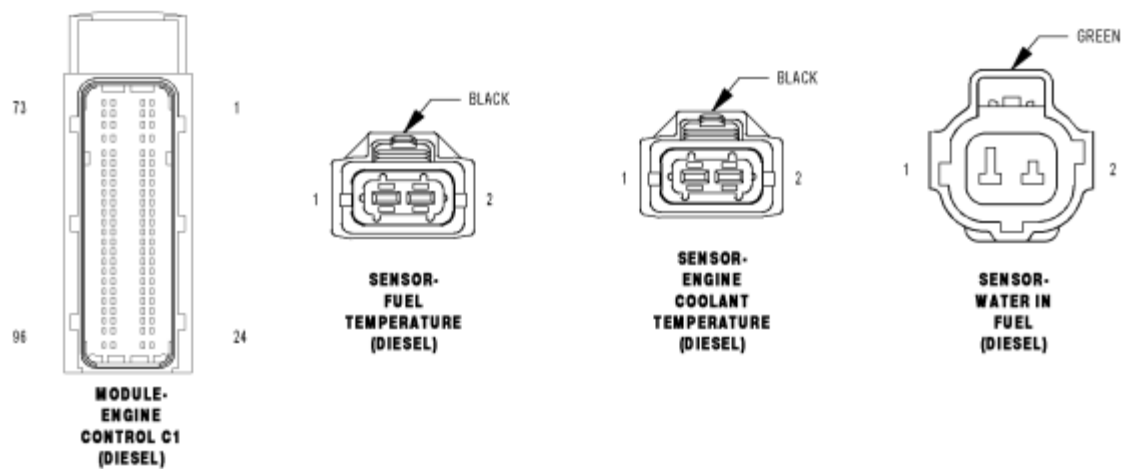
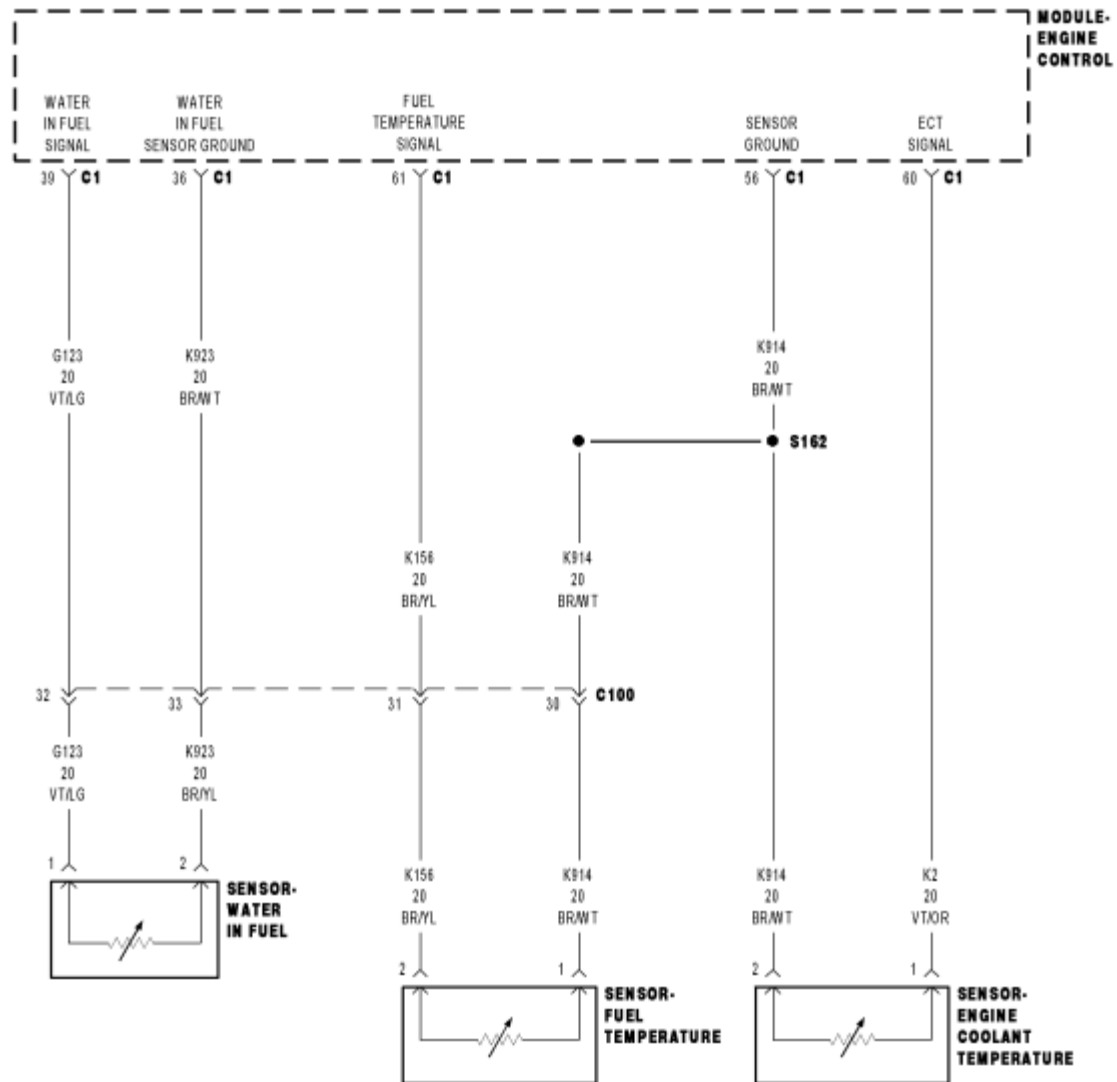
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0182-FUEL TEMPERATURE SENSOR CIRCUIT LOW



01a77365

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K156) Fuel Temperature Sensor Signal circuit voltage is below 0.13 volt for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914) FUEL TEMPERATURE SENSOR GROUND
(K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Fuel Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Fuel Temperature Sensor high voltage or open circuit DTC with the Fuel Temperature Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Fuel Temperature Sensor in accordance with the service information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. (K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K156) Fuel Temperature Sensor Signal circuit in the Fuel Temperature Sensor harness connector.

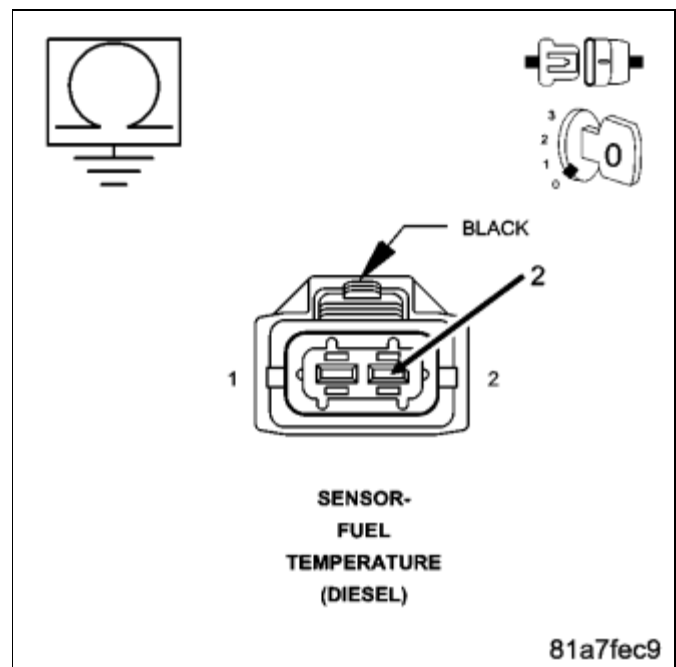
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K156) Fuel Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K914) FUEL

TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K156) Fuel Temperature Sensor Signal circuit and the (K914) Fuel Temperature Sensor Ground circuit in the Fuel Temperature Sensor harness connector.

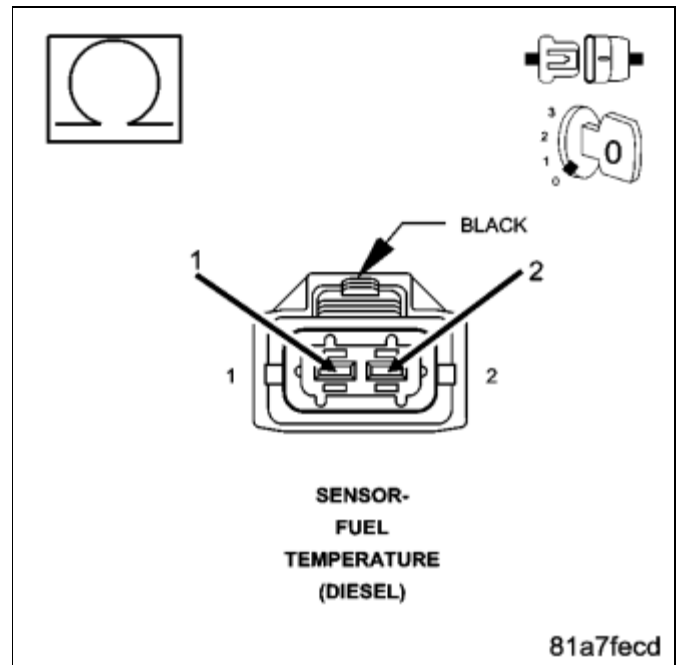
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K156) Fuel Temperature Sensor Signal circuit for a short to the (K914) Fuel Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE

Measure the resistance of the (K156) Fuel Temperature Sensor Signal circuit between the Fuel Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

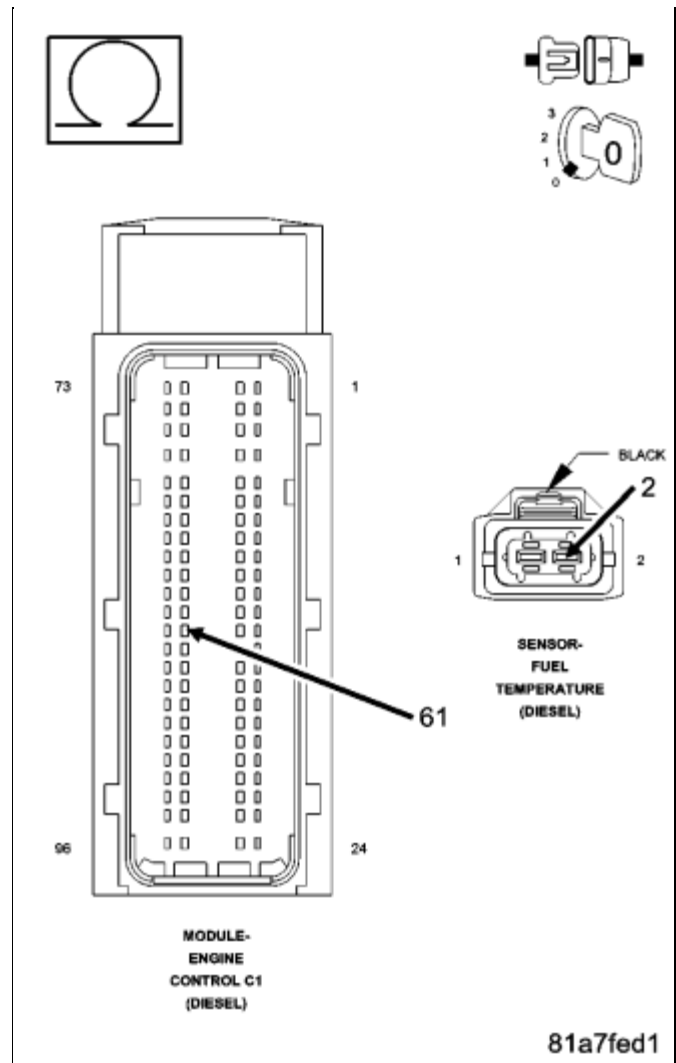
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K156) Fuel Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

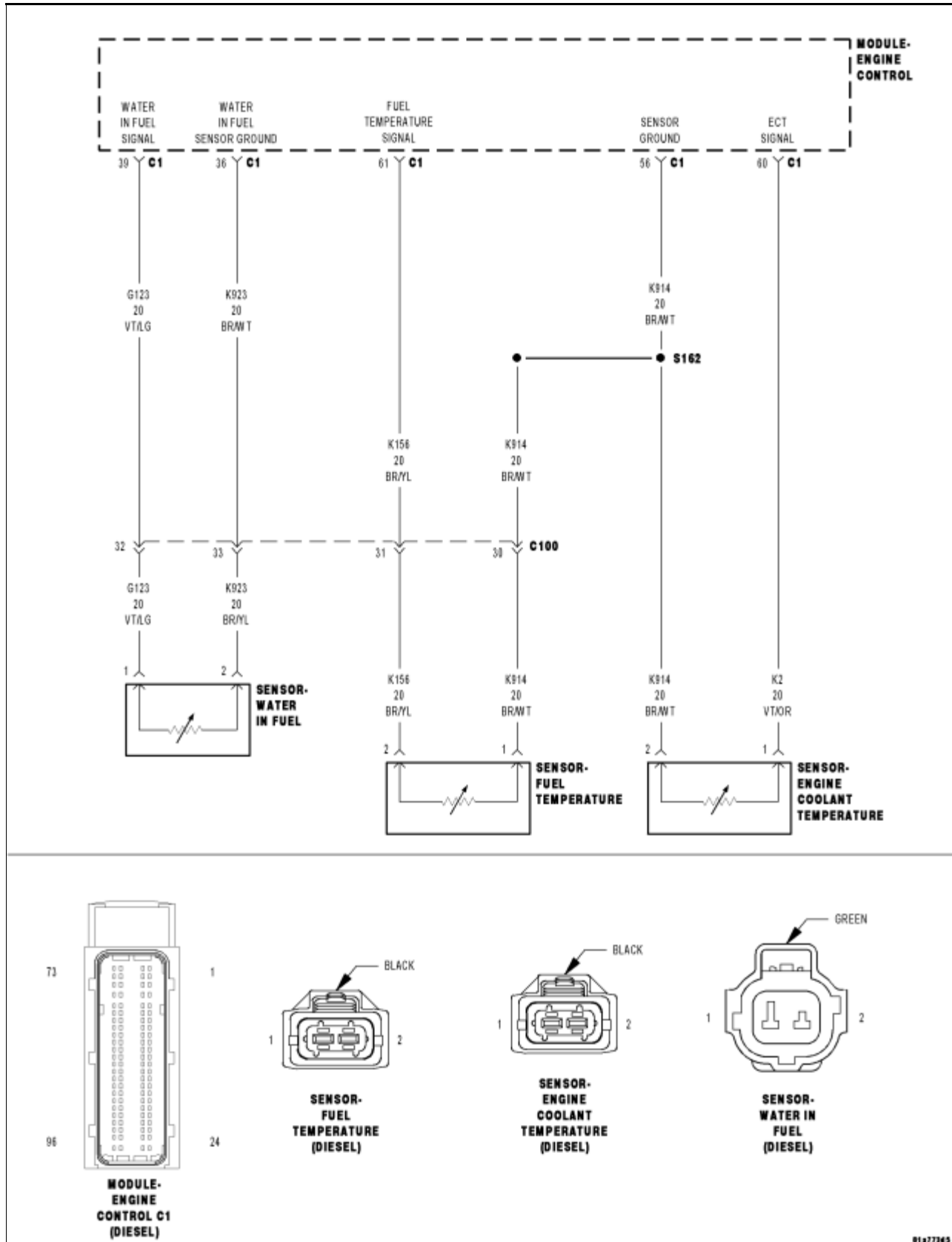
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0183-FUEL TEMPERATURE SENSOR CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K156) Fuel Temperature Sensor Signal circuit voltage is above 4.93 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K914) FUEL TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K914) FUEL TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
FUEL TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K156) FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

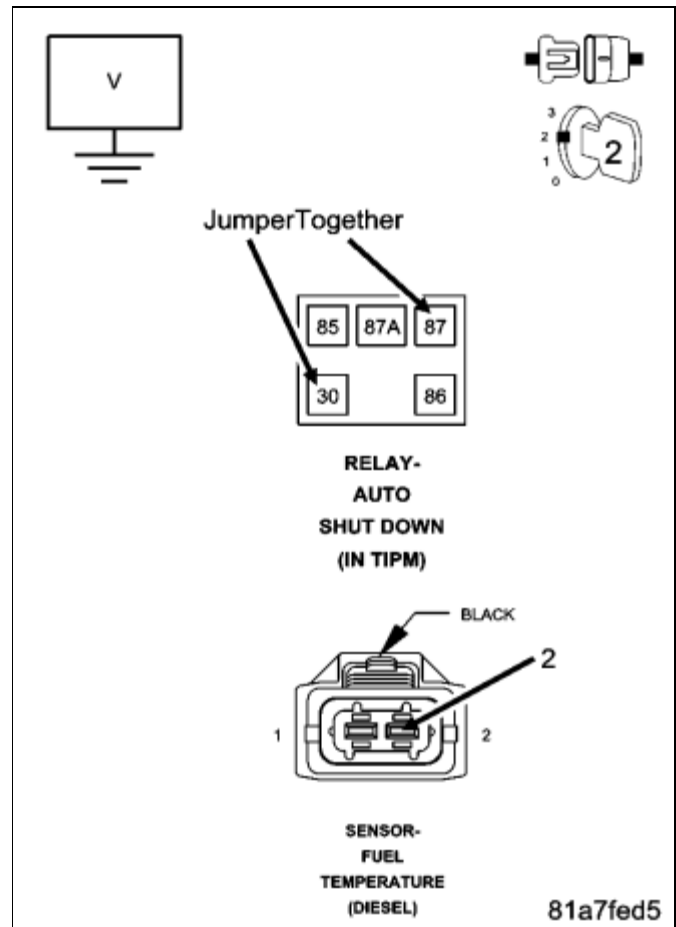
Turn the ignition off.
 Disconnect the Fuel Temperature Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K156) Fuel Temperature Sensor Signal circuit in the Fuel Temperature Sensor harness connector.

Is there any voltage present?**Yes**

- Repair the (K156) Fuel Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K914) FUEL TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K914) Fuel Temperature Sensor Ground circuit in the Fuel Temperature Sensor harness connector.

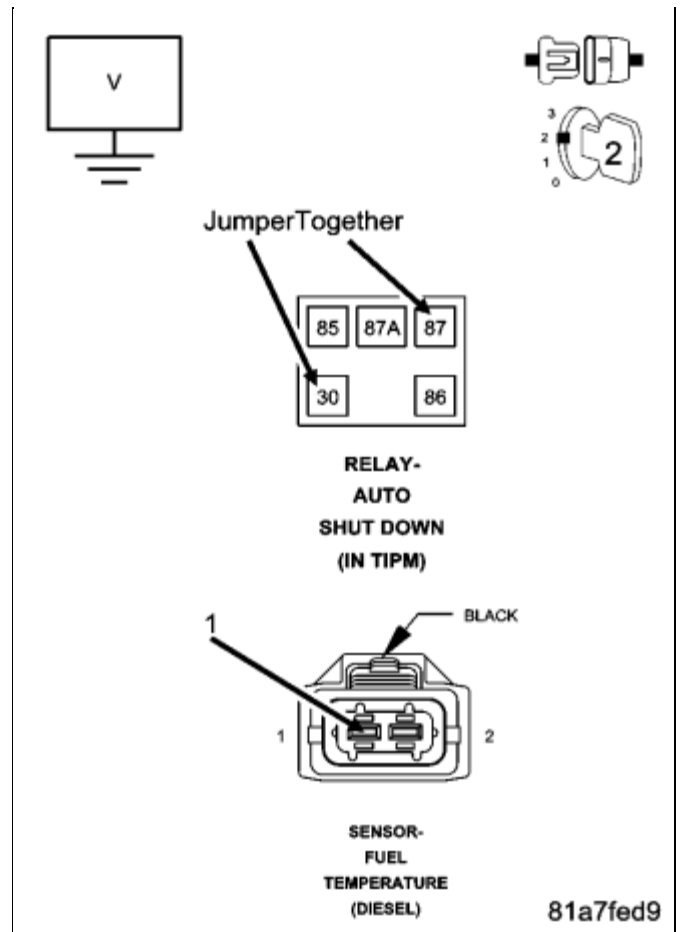
Is there any voltage present?

Yes

- Repair the (K914) Fuel Temperature Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. FUEL TEMPERATURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay..
Connect the Engine Control Module (ECM) harness connector.

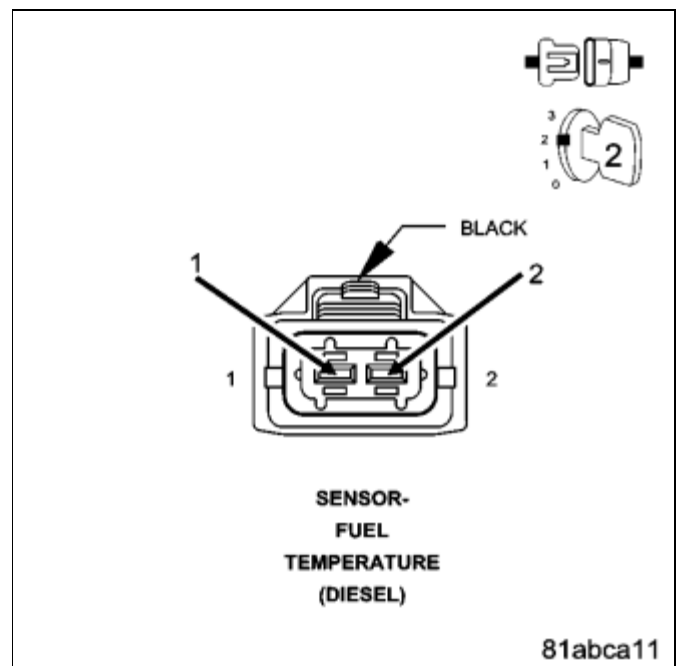
Connect a jumper wire between the (K914) Fuel Temperature Sensor Ground circuit and the (K156) Fuel Temperature Sensor Signal circuit in the Fuel Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Fuel Temperature Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Fuel Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. (K156) FUEL TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K156) Fuel Temperature Sensor Signal circuit between the Fuel Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

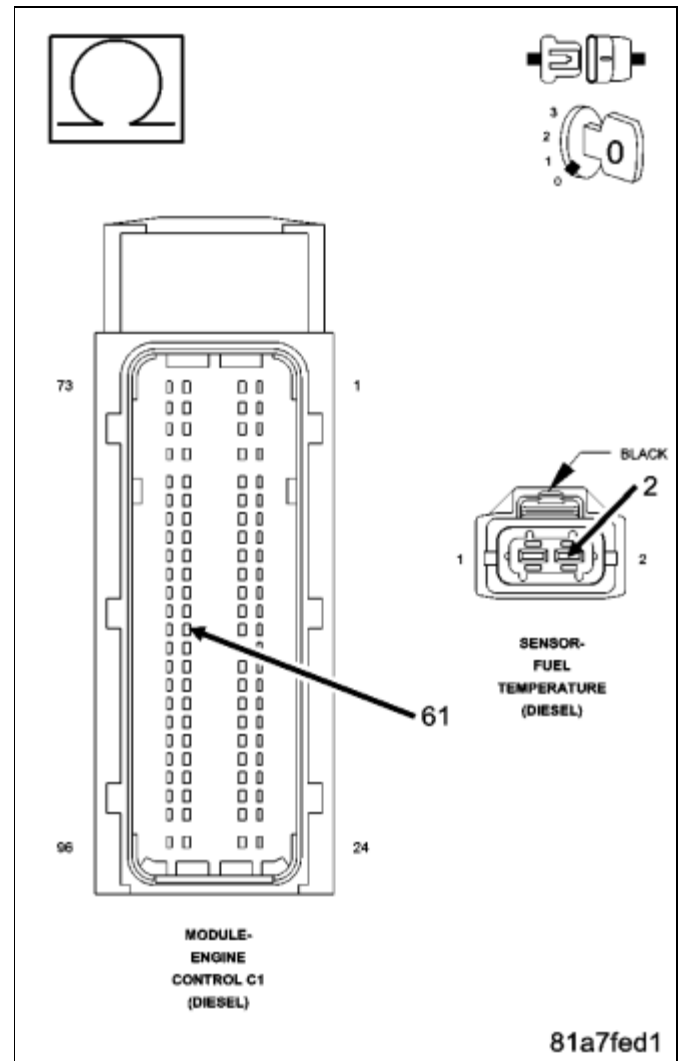
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K156) Fuel Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K914) FUEL TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K914) Fuel Temperature Sensor Ground circuit between the Fuel Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

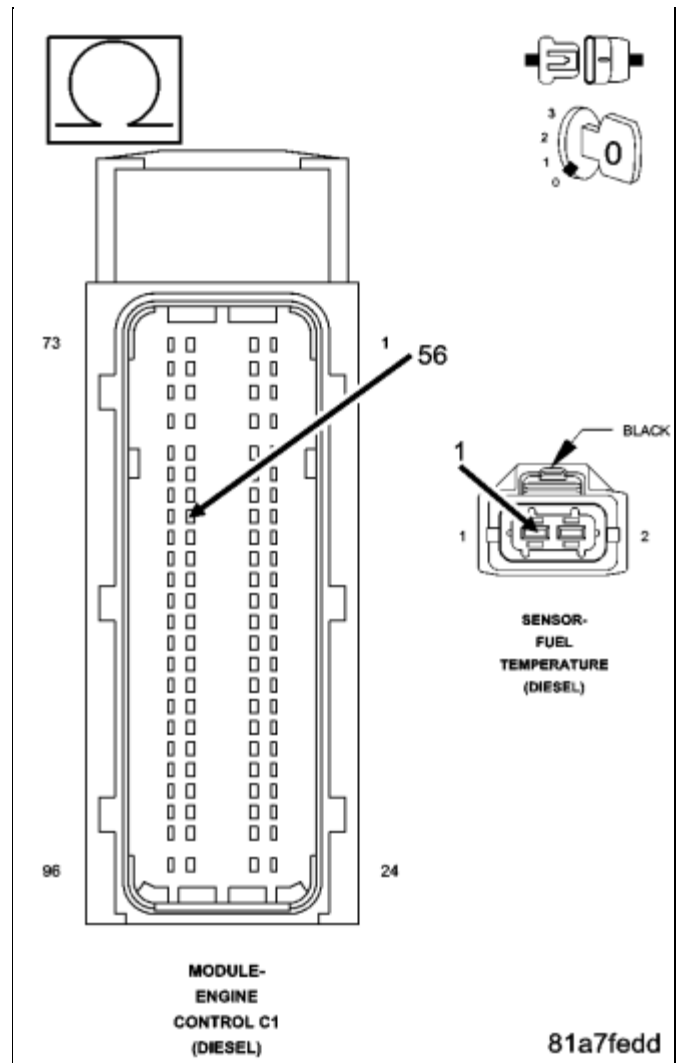
Is the resistance below 10.0 ohms?

Yes

- Go to [Z](#)

No

- Repair the (K914) Fuel Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

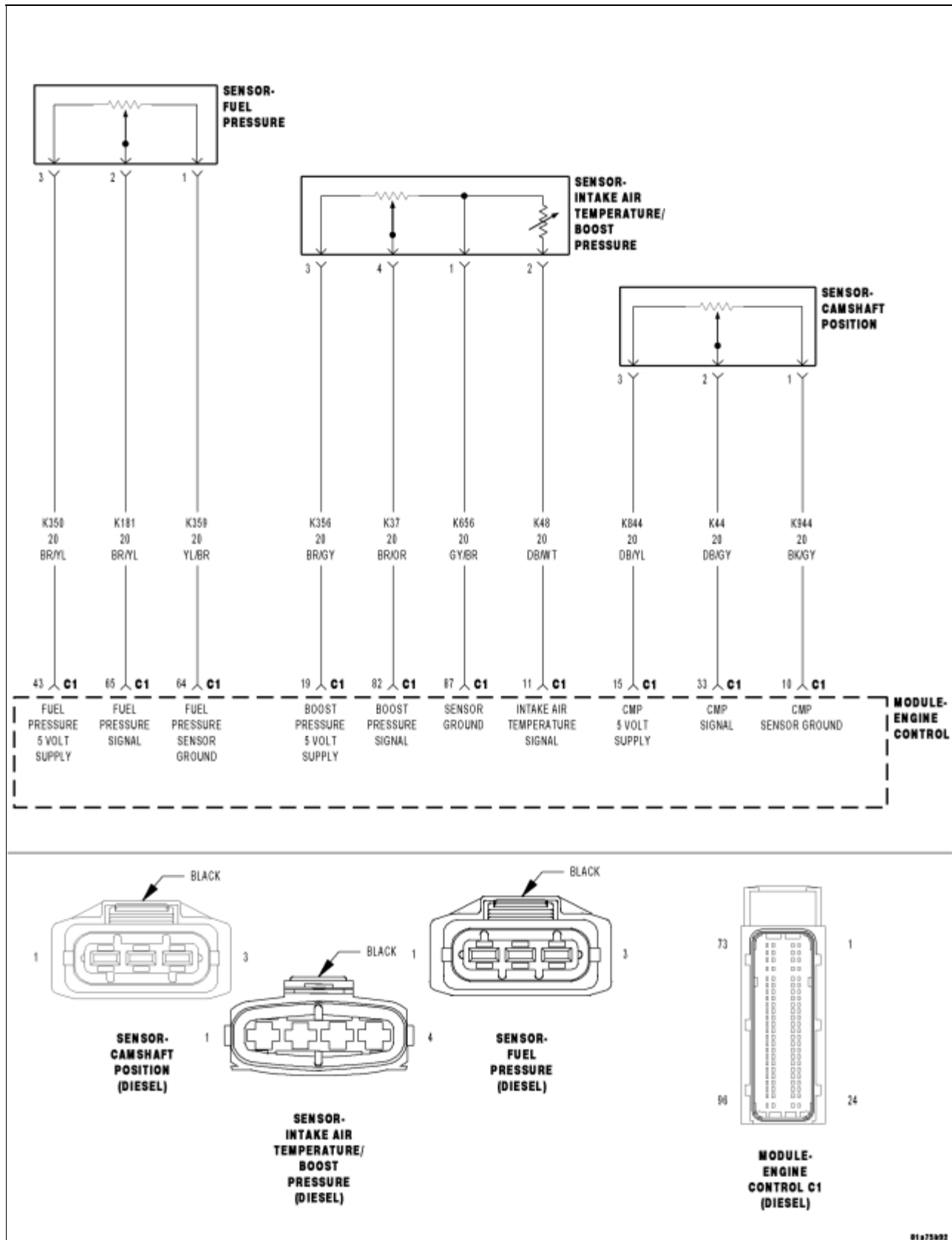
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0191 FUEL RAIL PRESSURE SENSOR CIRCUIT PERFORMANCE



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

At ignition shut off during Afterrun.

- **Set Condition:**

The Fuel Pressure Sensor signal is below 0.298 volt for 1.0 second.

Possible Causes
FUEL PRESSURE SENSOR
INTERMITTENT CONDITION

Diagnostic Test

1. FUEL PRESSURE SENSOR

NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Fuel Pressure Sensor. Inspect the Fuel Pressure Sensor harness connector and associated wiring for signs of poor terminal contact.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

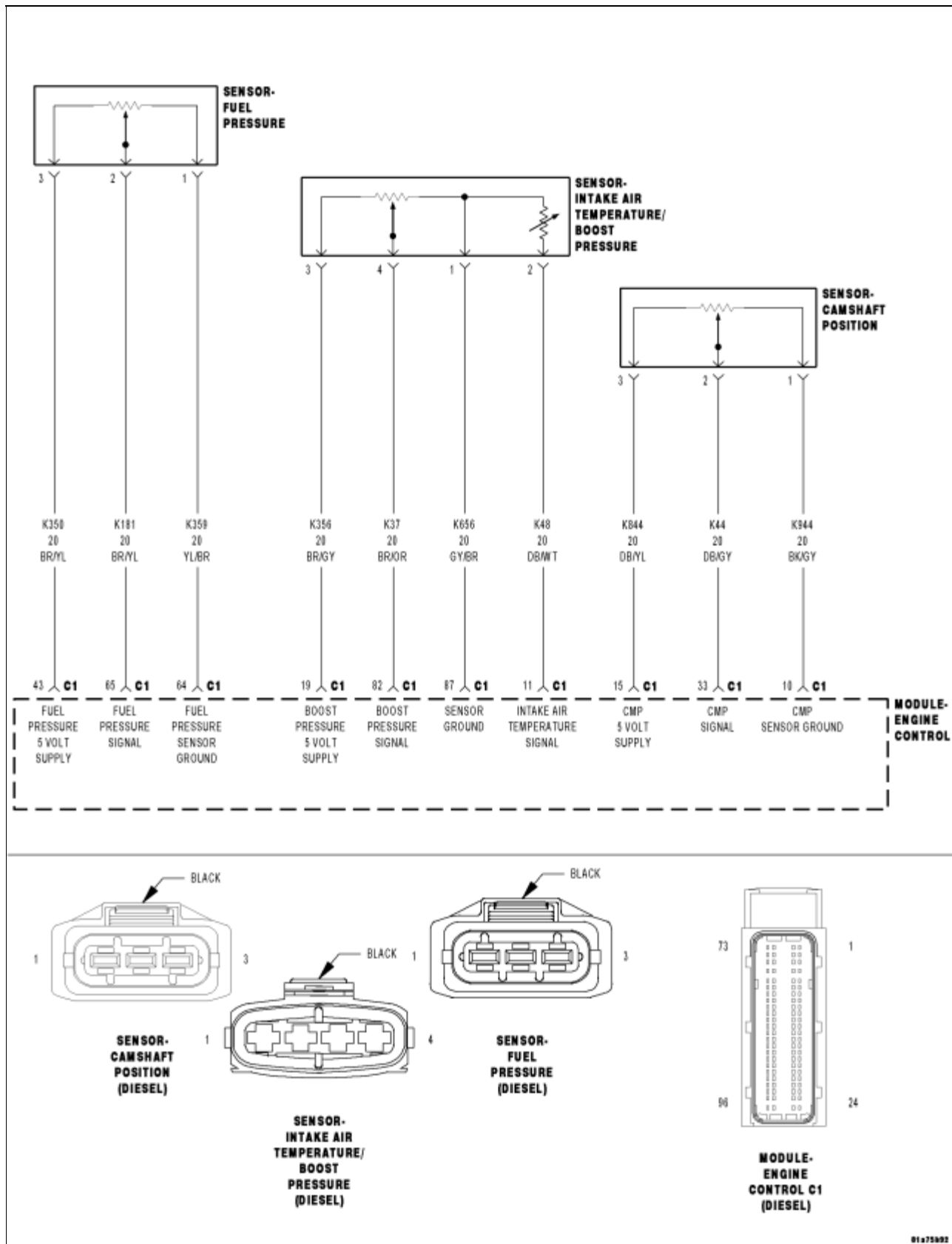
Yes

- Replace the Fuel Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0192-FUEL RAIL PRESSURE SENSOR LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K181) Fuel Pressure Sensor Signal circuit voltage is below 0.25 volt for 0.14 second.

Possible Causes
INTERMITTENT DTC
(K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K359) FUEL PRESSURE SENSOR GROUND
(K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K359) FUEL PRESSURE SENSOR GROUND
(K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K350) Fuel Pressure Sensor 5 Volt Supply circuit in the Fuel Pressure Sensor harness connector.

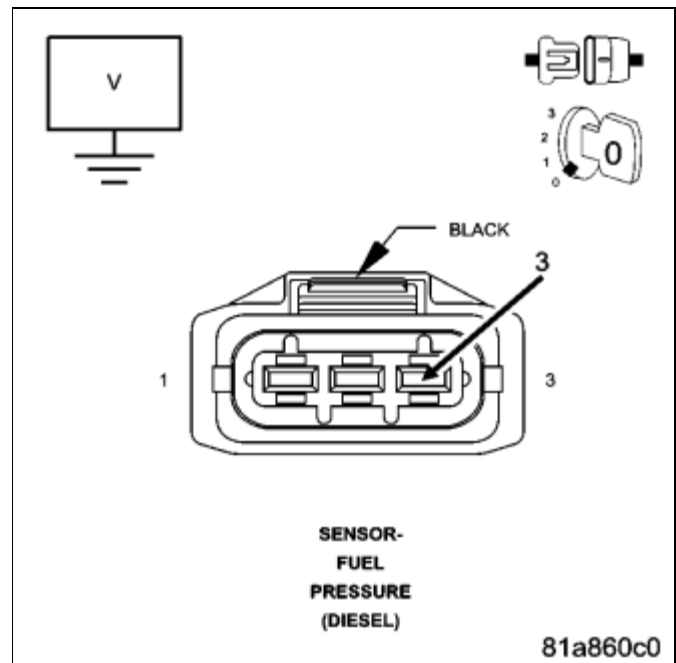
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K350) Fuel Pressure Sensor 5 Volt Supply circuit in the Fuel Pressure

Sensor harness connector.

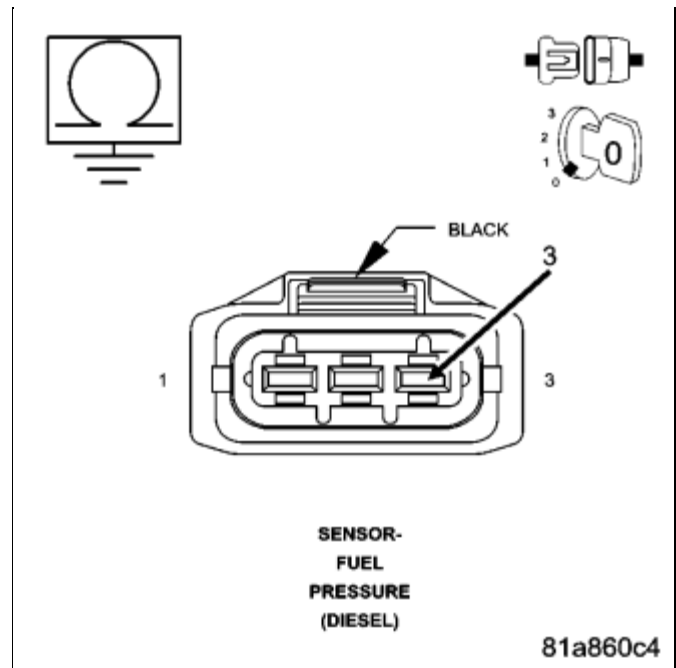
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K350) Fuel Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K359) FUEL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K350) Fuel Pressure Sensor 5 Volt Supply circuit and the (K359) Fuel Pressure Sensor Ground circuit in the Fuel Pressure Sensor harness connector.

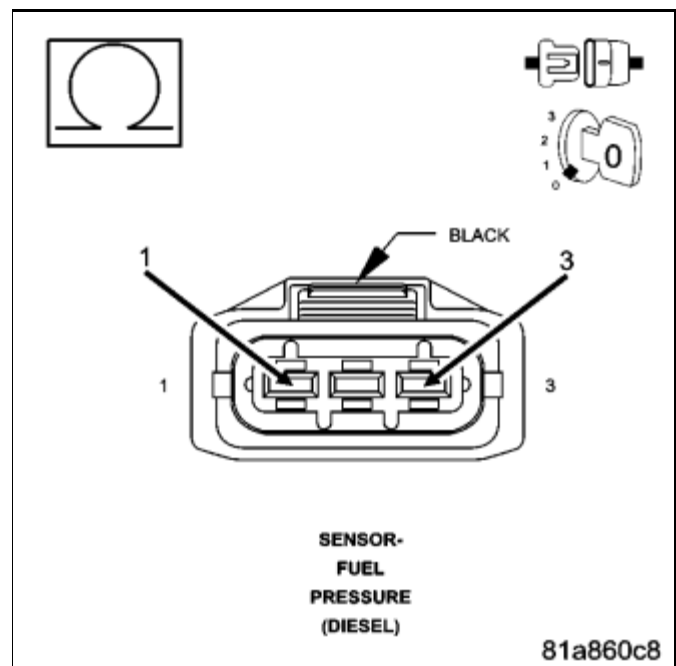
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K350) Fuel Pressure Sensor 5 Volt Supply circuit for a short to the (K359) Fuel Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K350) Fuel Pressure Sensor 5 Volt Supply circuit between the Fuel Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

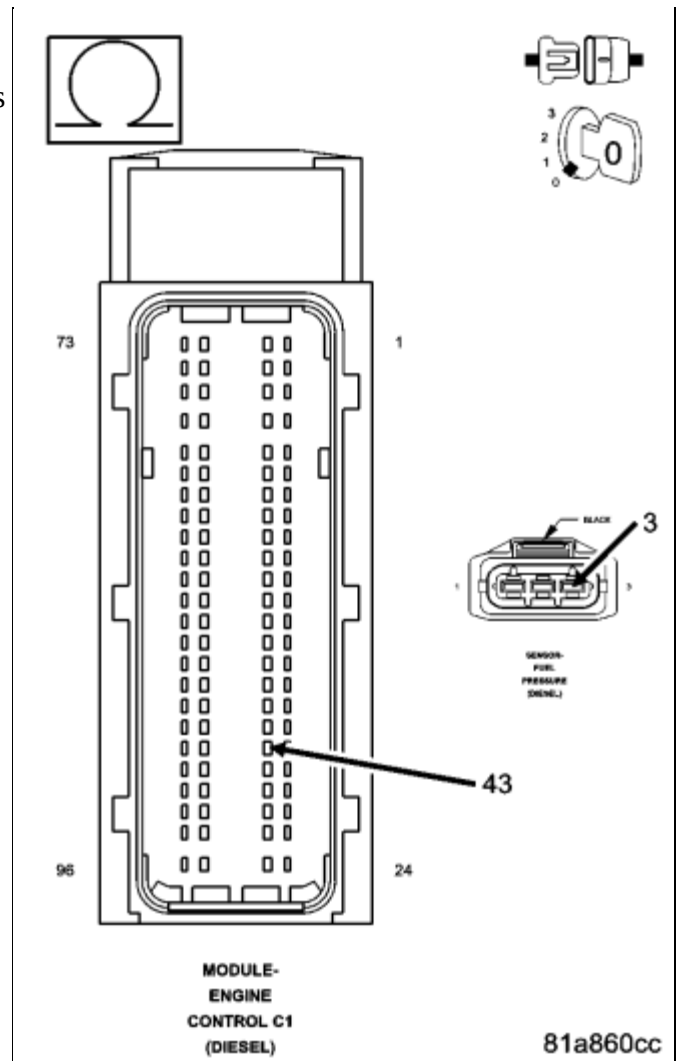
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K350) Fuel Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. FUEL PRESSURE SENSOR

With the scan tool, Clear DTCs.
With the scan tool, select View DTCs.

NOTE: The scan tool should display a Fuel Pressure Sensor high voltage or open DTC with the Fuel Pressure Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Fuel Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [7](#)

7. (K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K181) Fuel Pressure Sensor Signal circuit in the Fuel Pressure Sensor harness connector.

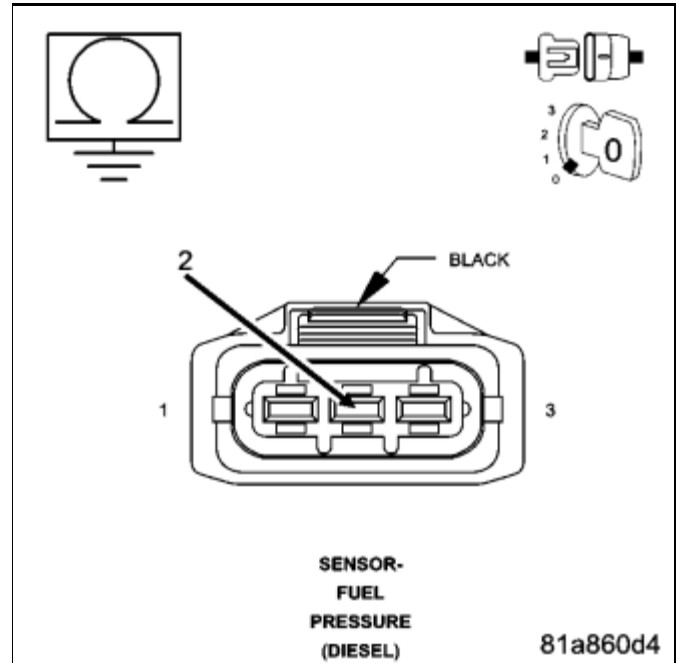
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K181) Fuel Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K359) FUEL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K181) Fuel Pressure Sensor Signal circuit and the (K359) Fuel Pressure Sensor Ground circuit in the Fuel Pressure Sensor harness connector.

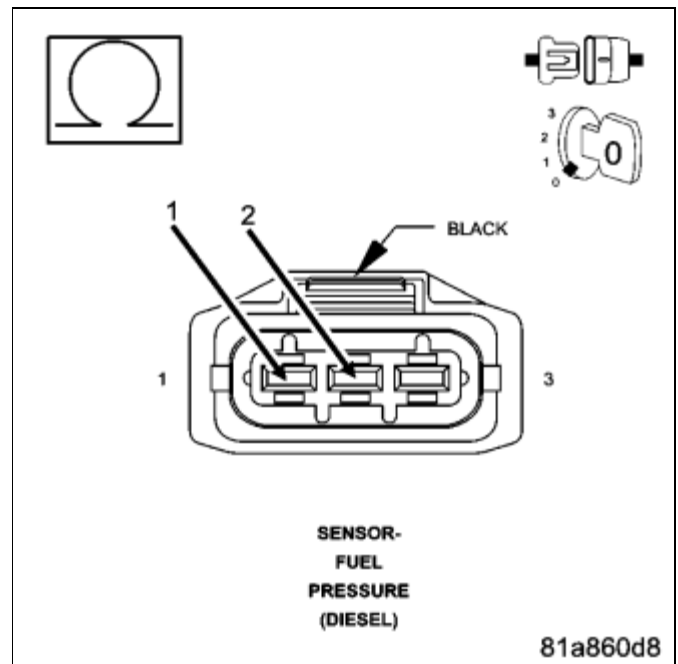
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K181) Fuel Pressure Sensor Signal circuit for a short to the (K359) Fuel Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K181) Fuel Pressure Sensor Signal circuit between the Fuel Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

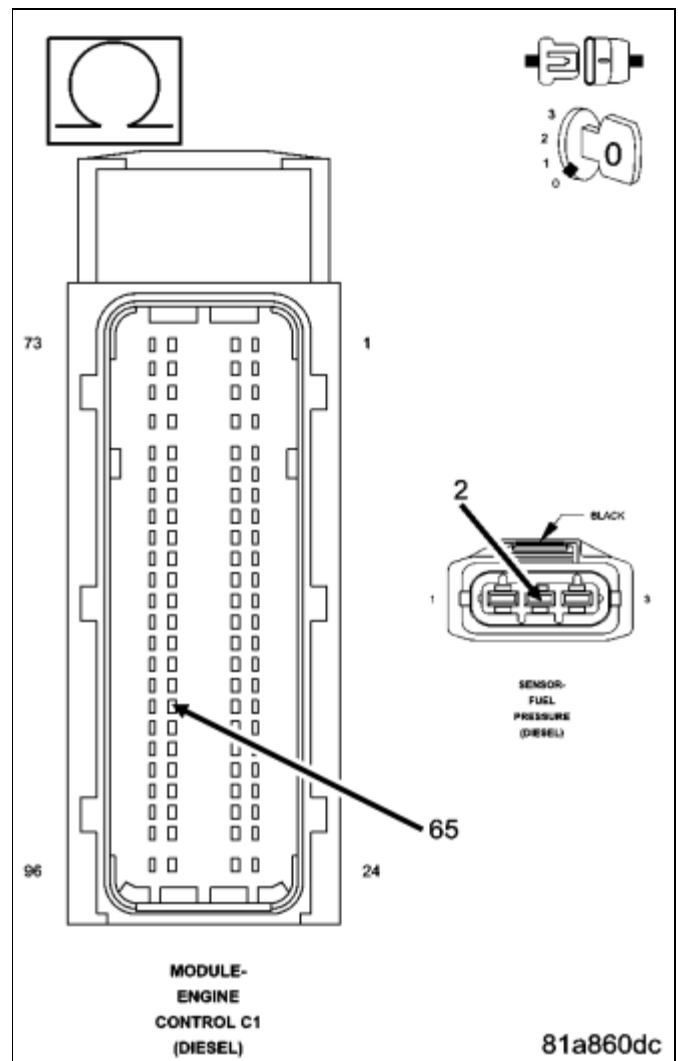
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K181) Fuel Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

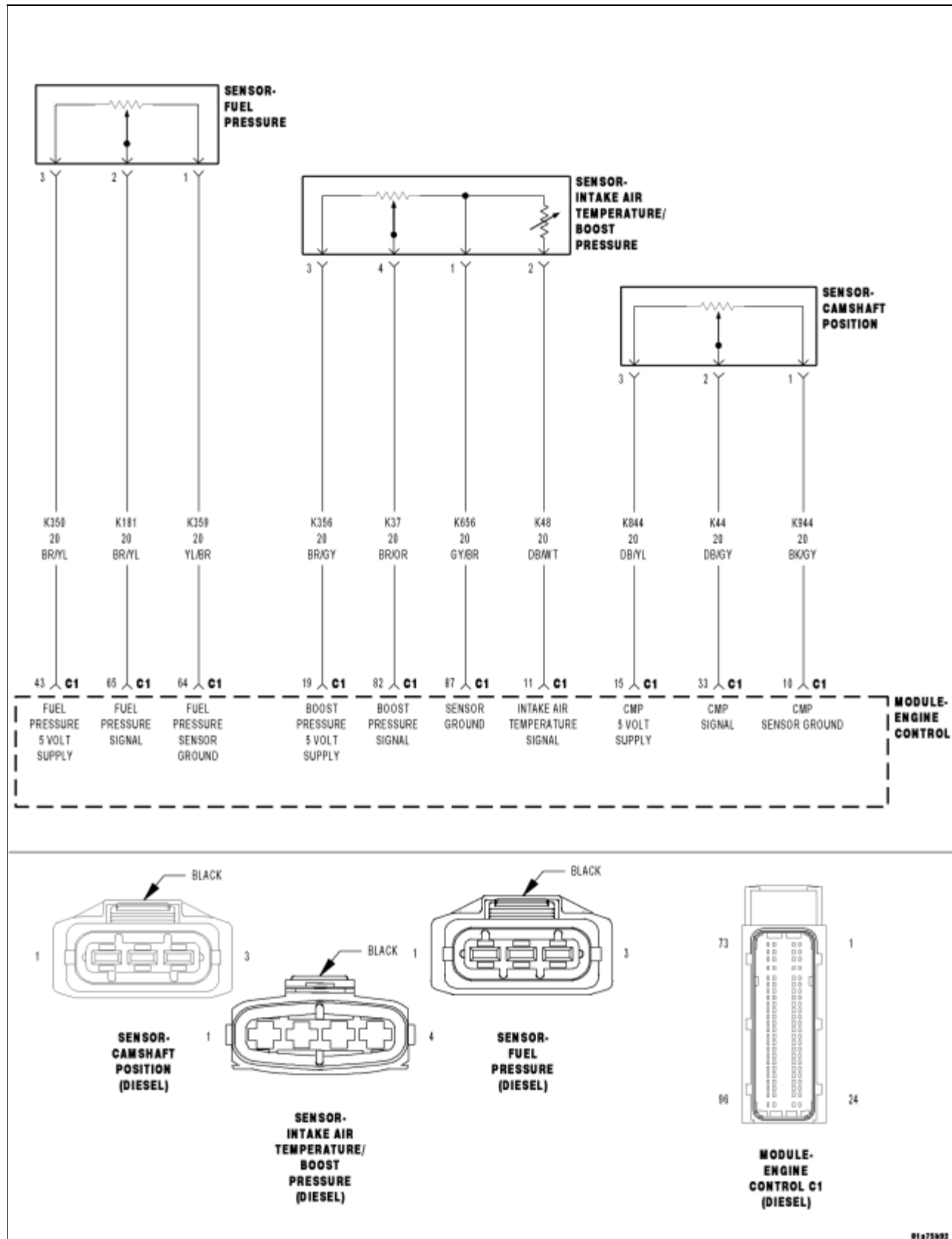
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0193-FUEL RAIL PRESSURE SENSOR HIGH



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K181) Fuel Pressure Sensor Signal circuit voltage is above 4.75 volts for 0.14 second.

Possible Causes
INTERMITTENT DTC
(K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K359) FUEL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K359) FUEL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
FUEL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time. Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K350) FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K350) Fuel Pressure Sensor 5 Volt Supply circuit in the Fuel Pressure Sensor harness connector.

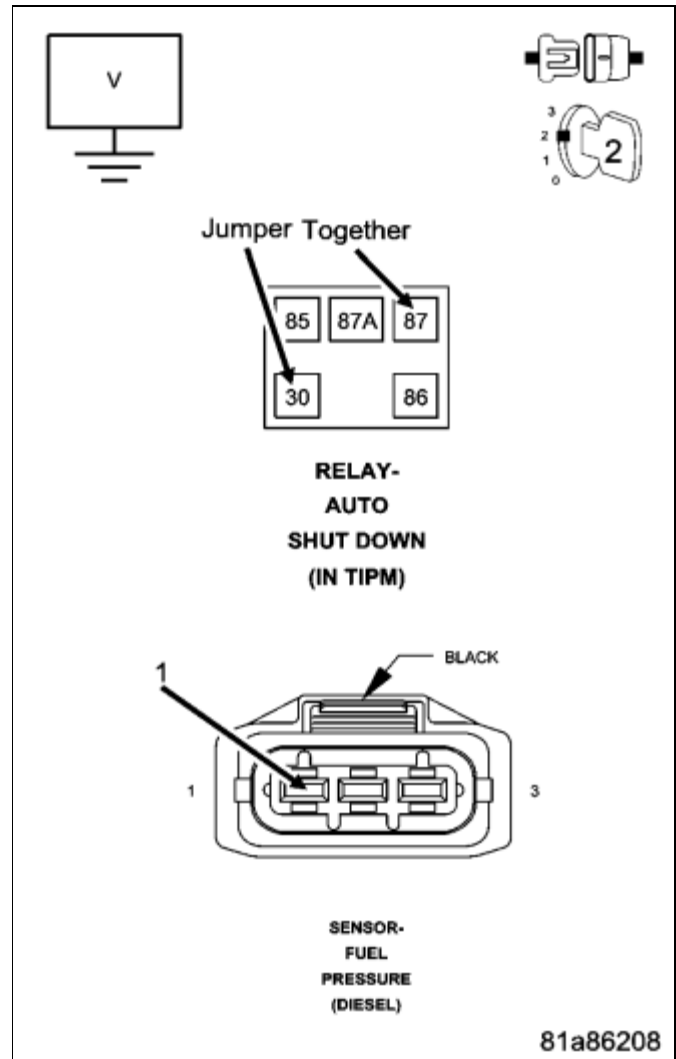
Is there any voltage present?

Yes

- Repair the (K350) Fuel Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K181) FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K181) Fuel Pressure Sensor Signal circuit in the Fuel Pressure Sensor harness connector.

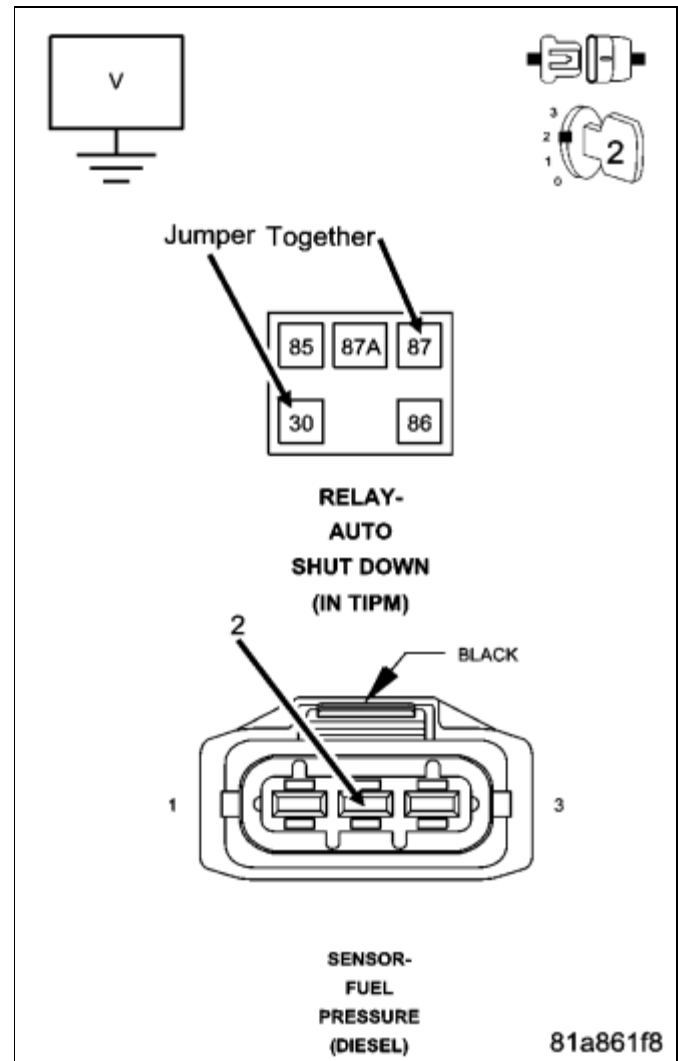
Is there any voltage present?

Yes

- Repair the (K181) Fuel Pressure Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K359) FUEL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K359) Fuel Pressure Sensor Ground circuit in the Fuel Pressure Sensor harness connector.

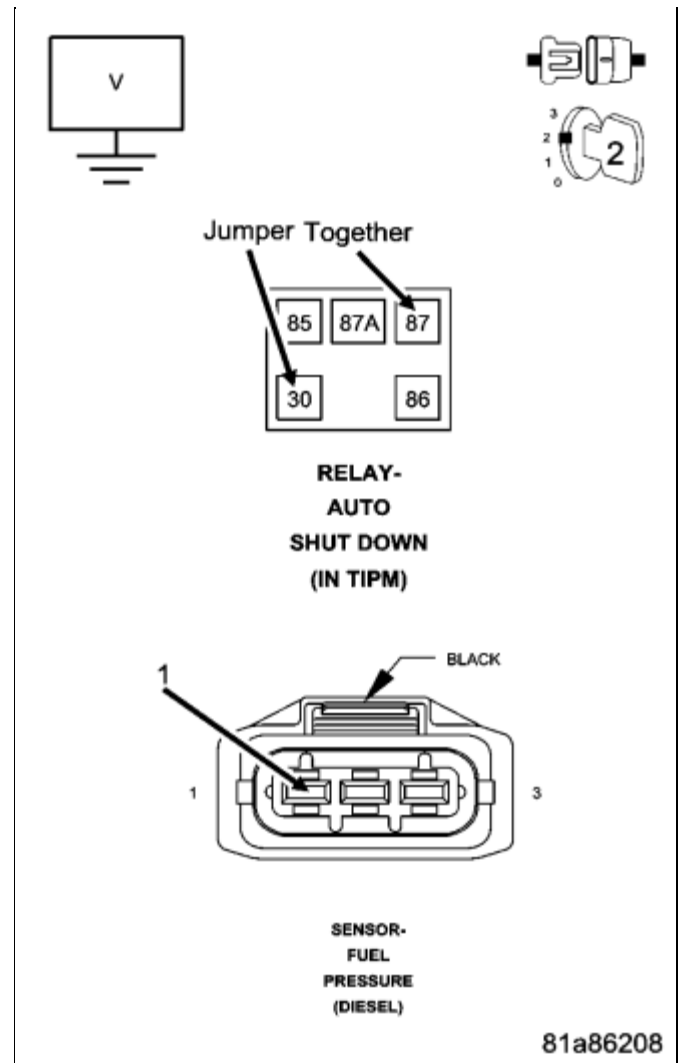
Is there any voltage present?

Yes

- Repair the (K359) Fuel Pressure Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. FUEL PRESSURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay. Connect the Engine Control Module (ECM) harness connector.

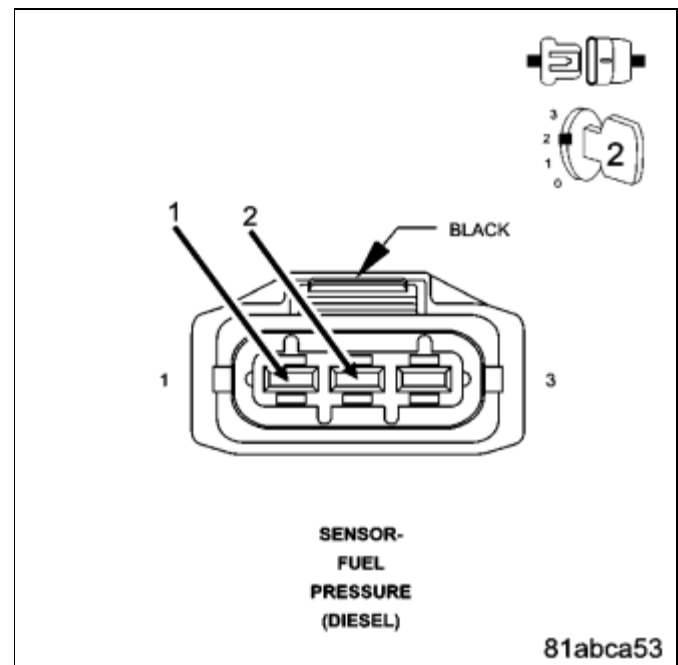
Connect a jumper wire between the (K359) Fuel Pressure Sensor Ground circuit and the (K181) Fuel Pressure Sensor Signal circuit in the Fuel Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Fuel Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Fuel Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. (K181) FUEL PRESSURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) connector. Measure the resistance of the (K181) Fuel Pressure Sensor Signal between the Fuel Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

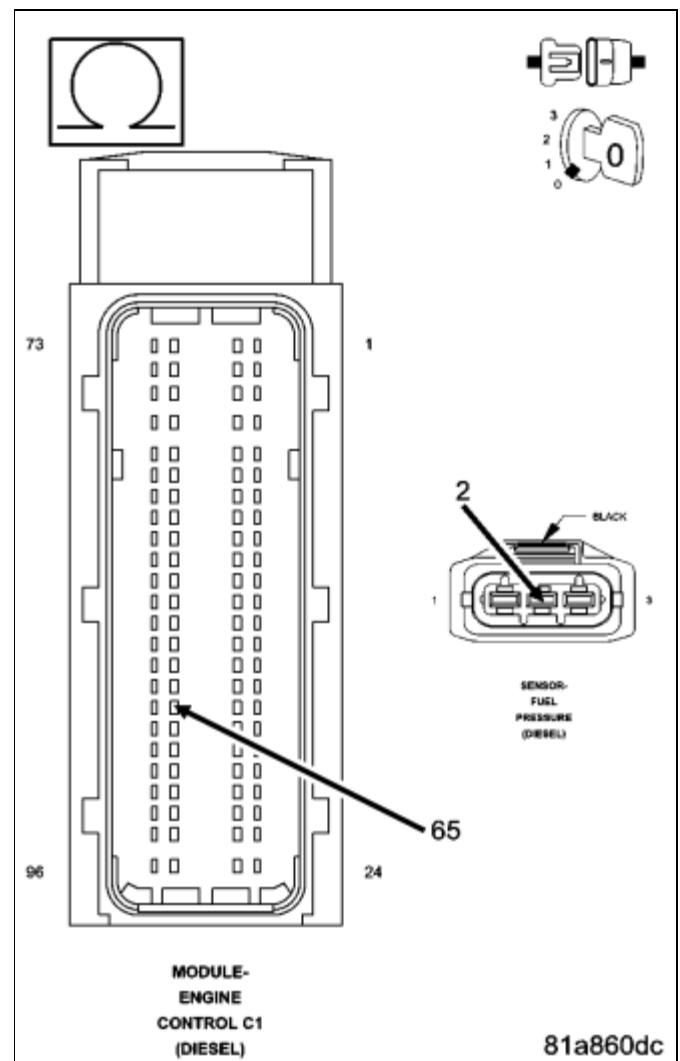
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K181) Fuel Pressure Sensor Signal for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K359) FUEL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K359) Fuel Pressure Sensor Ground circuit between the Fuel Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

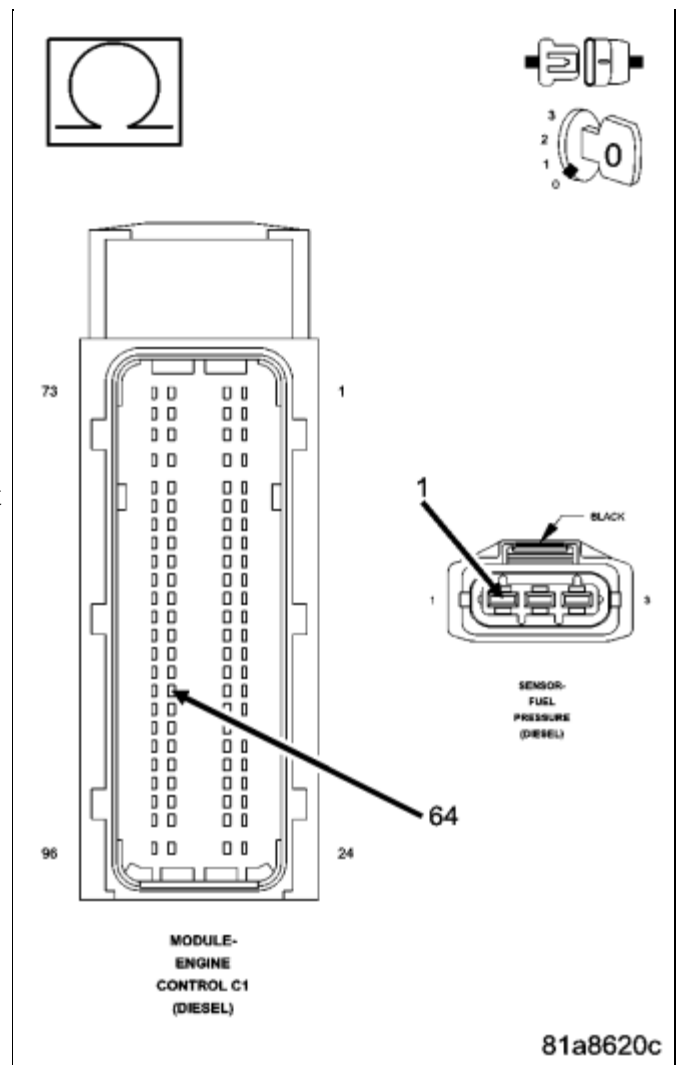
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K359) Fuel Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

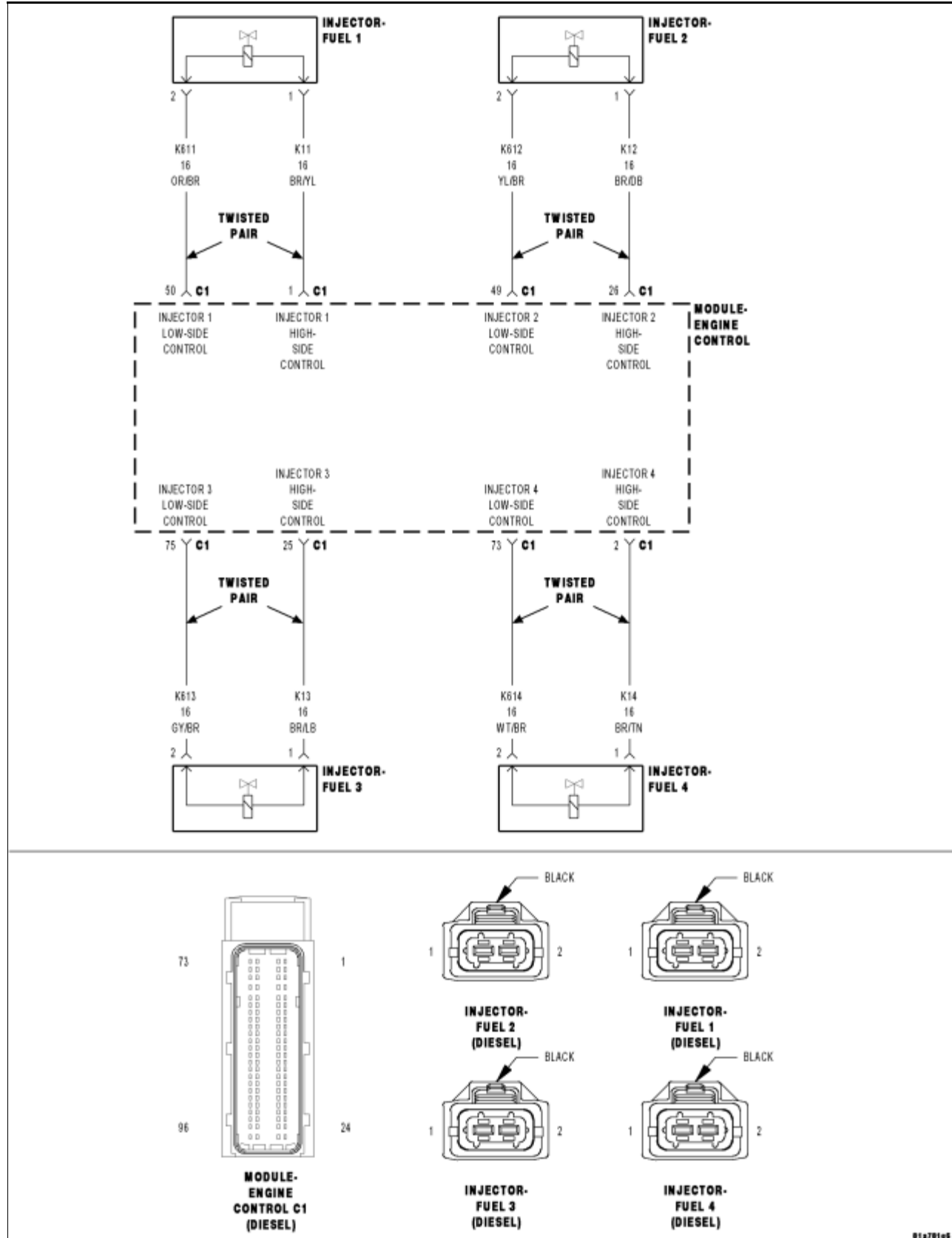
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT / OPEN



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects an open or shorted Fuel Injector 1 control circuit.

Possible Causes
INTERMITTENT DTC
(K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT
(K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR NO. 1
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.
 With the scan tool, Clear DTCs in the Engine Control Module (ECM).
 Attempt to start the engine and test drive the vehicle.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Fuel Injector No. 1 harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K11) Fuel Injector No. 1 High-Side Control circuit in the Fuel Injector No. 1 harness connector.

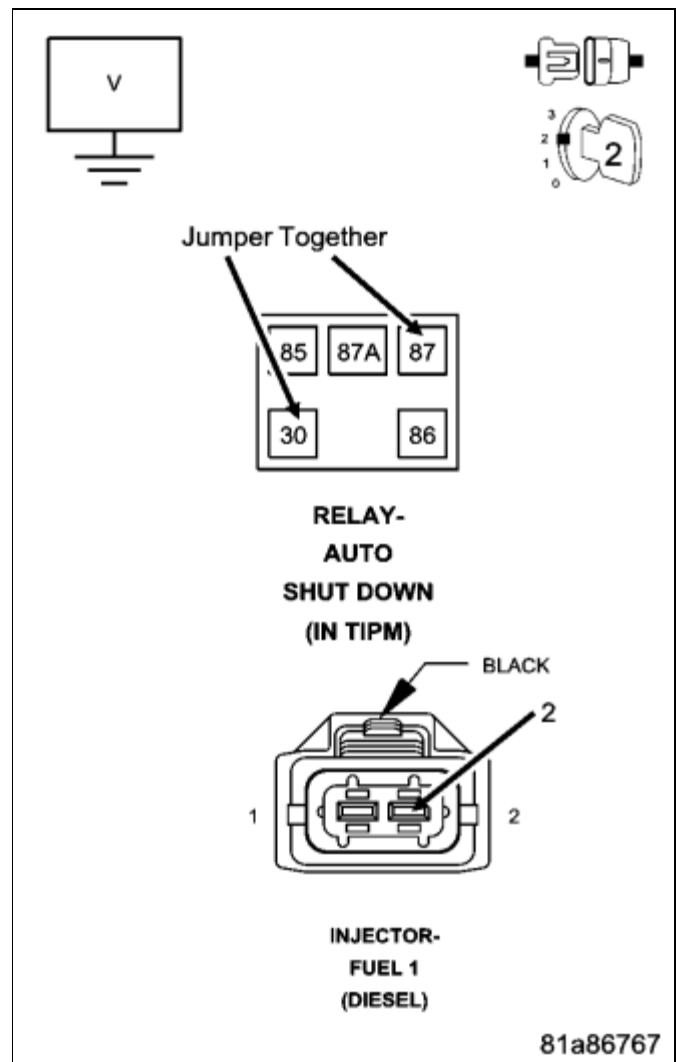
Is there any voltage present?

Yes

- Repair the (K11) Fuel Injector No. 1 High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K611) Fuel Injector No. 1 Low-Side Control circuit.

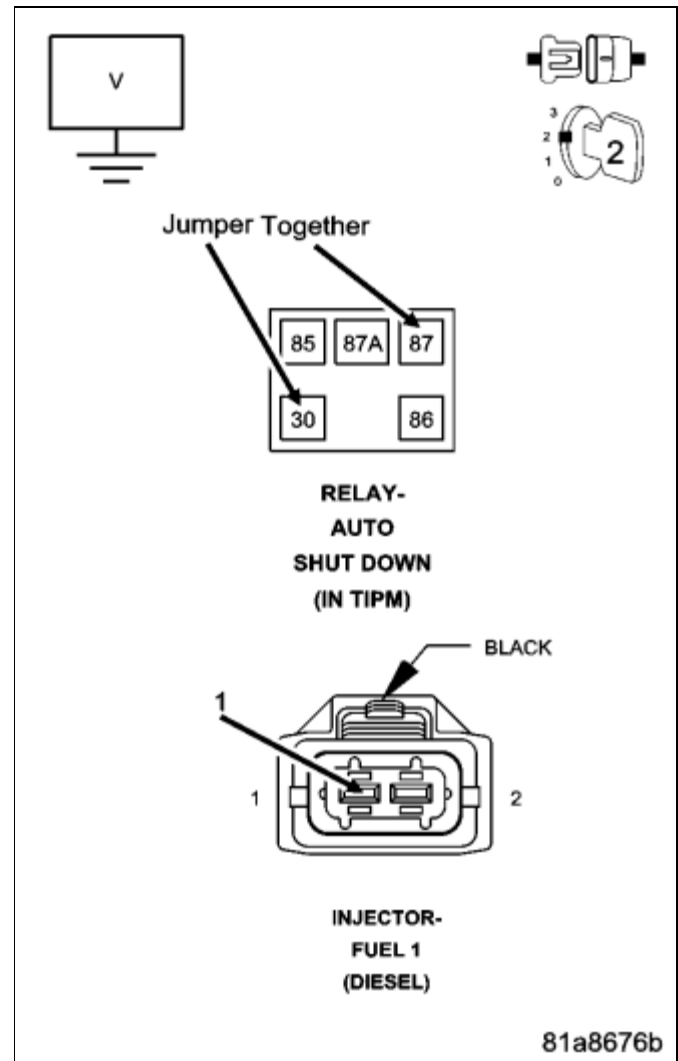
Is there any voltage present?

Yes

- Repair the (K611) Fuel Injector No. 1 Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay..

Measure the resistance between ground and the (K11) Fuel Injector No. 1 High-Side Control circuit in the Fuel Injector No. 1 harness connector.

Is the resistance above 1000 ohms?

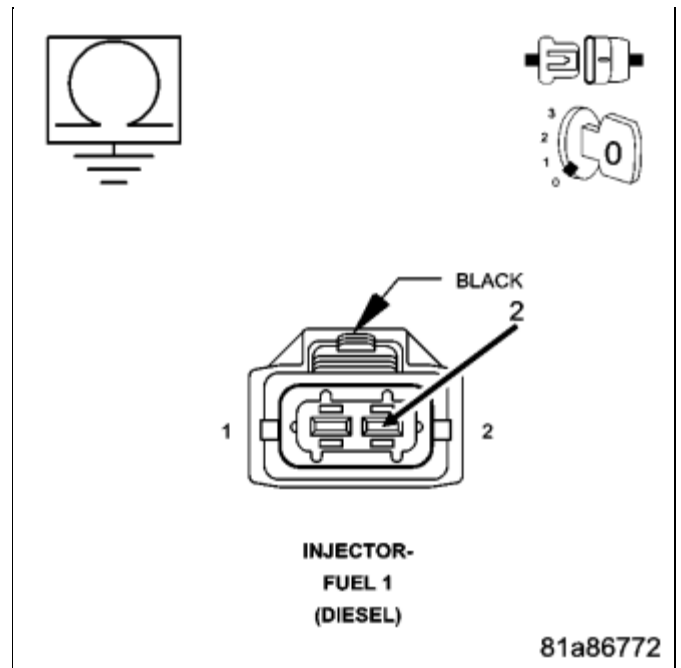
Yes

- Go to [5](#)

No

- Repair the (K11) Fuel Injector No. 1 High-Side

- Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K611) Fuel Injector No. 1 Low-Side Control circuit in the Fuel Injector No. 1 harness connector.

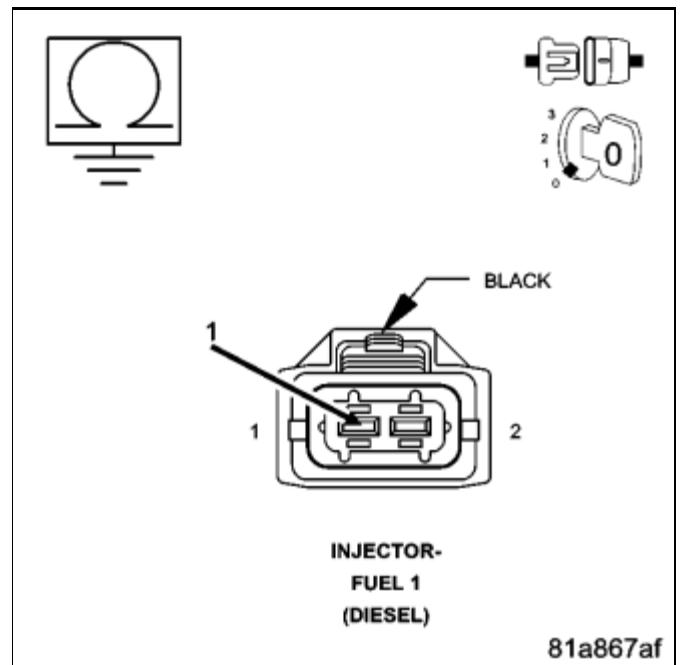
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K611) Fuel Injector No. 1 Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the (K11) Fuel Injector No. 1 High-Side Control circuit and the (K611) Fuel Injector No.

1 Low-Side Control circuit in the Fuel Injector No. 1 harness connector.

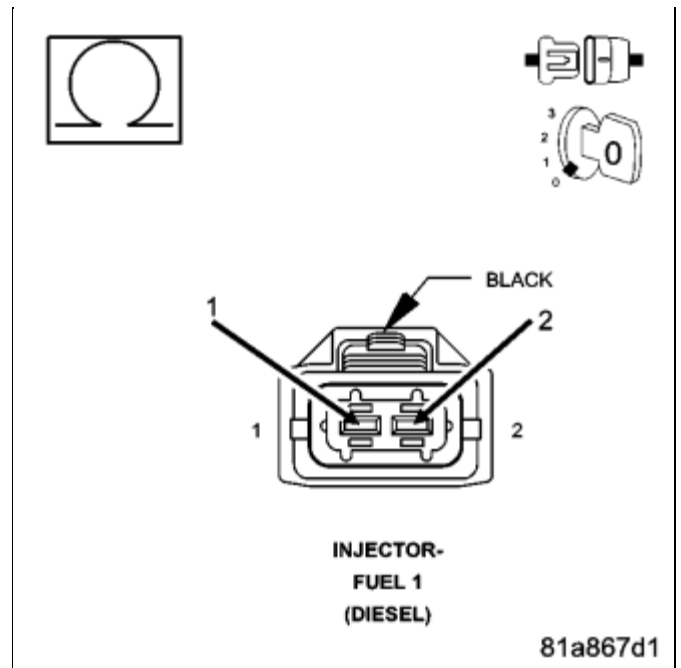
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (K11) Fuel Injector No. 1 High-Side Control circuit for a short to the (K611) Fuel Injector No. 1 Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K11) FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K11) Fuel Injector No. 1 High-Side Control circuit between the Fuel Injector No. 1 harness connector and the Engine Control Module (ECM) harness connector.

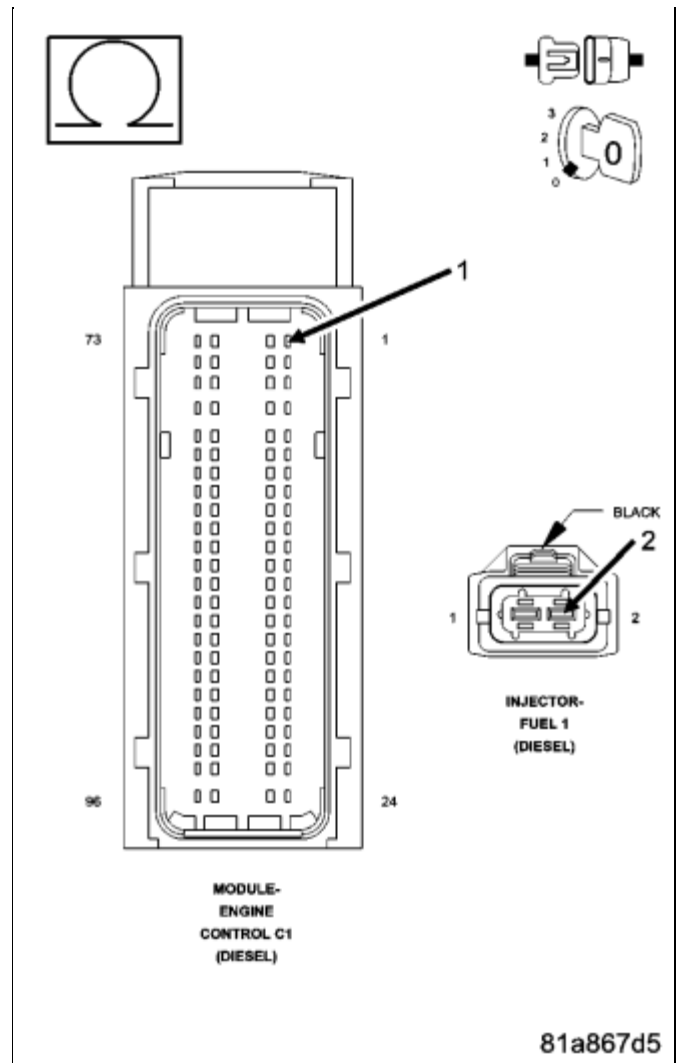
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K11) Fuel Injector No. 1 High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K611) FUEL INJECTOR NO. 1 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K611) Fuel Injector No. 1 Low-Side Control circuit between the Fuel Injector No. 1 harness connector and the Engine Control Module (ECM) harness connector.

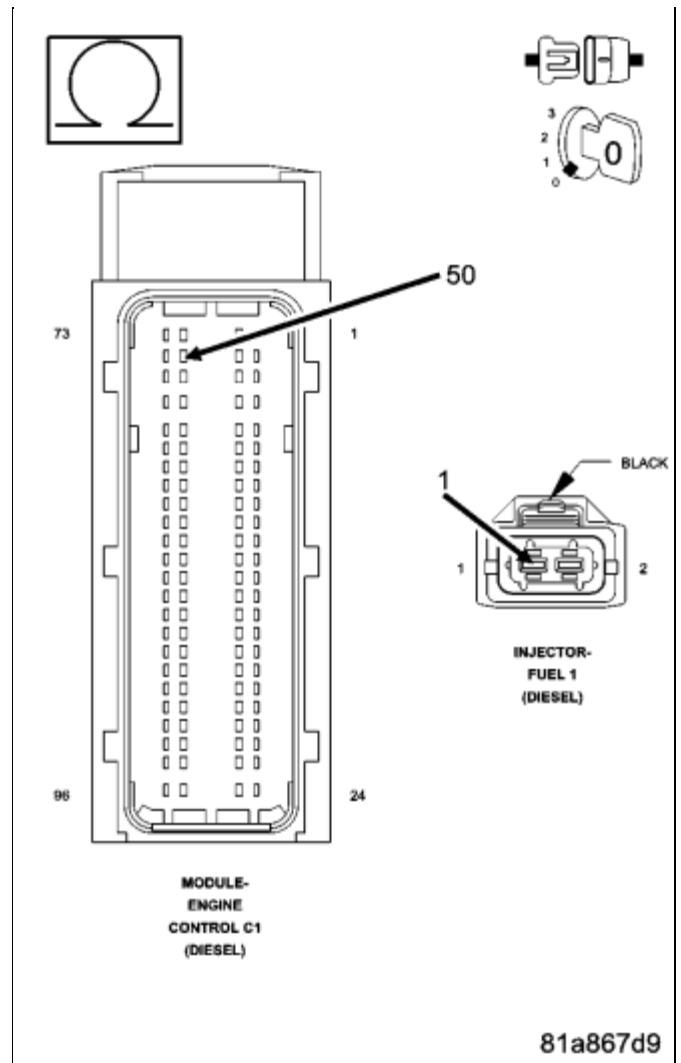
Is the resistance below 10.0 ohms?

Yes

- Go to [9](#)

No

- Repair the (K611) Fuel Injector No. 1 Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. FUEL INJECTOR NO. 1

Measure the resistance between the terminals of Fuel Injector No. 1.

Is the resistance between 150k and 210k ohms?

Yes

- Go to [10](#)

No

- Replace the Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector No. 1 and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test. Refer to any Technical Service Bulletins that may apply.

Were any problems found?

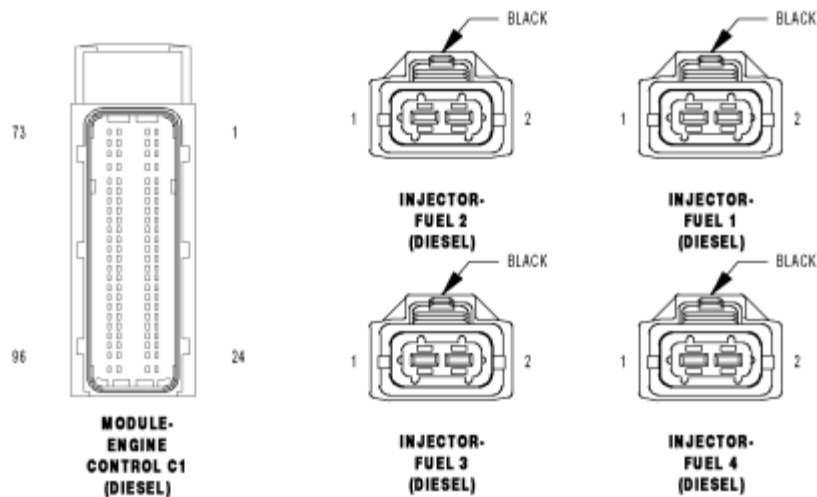
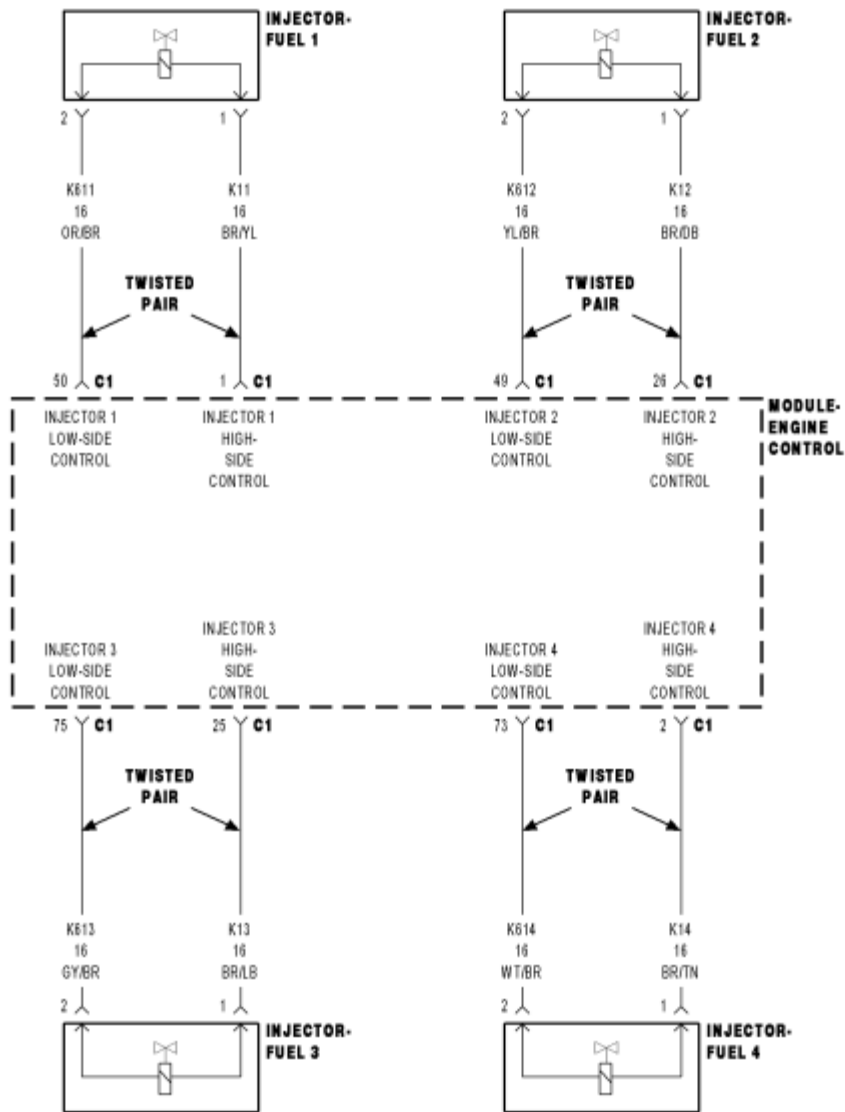
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0202-FUEL INJECTOR 2 CIRCUIT / OPEN



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects an open or shorted Fuel Injector 2 control circuit.

Possible Causes
INTERMITTENT DTC
(K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT
(K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR NO. 2
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Injector No. 2 harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

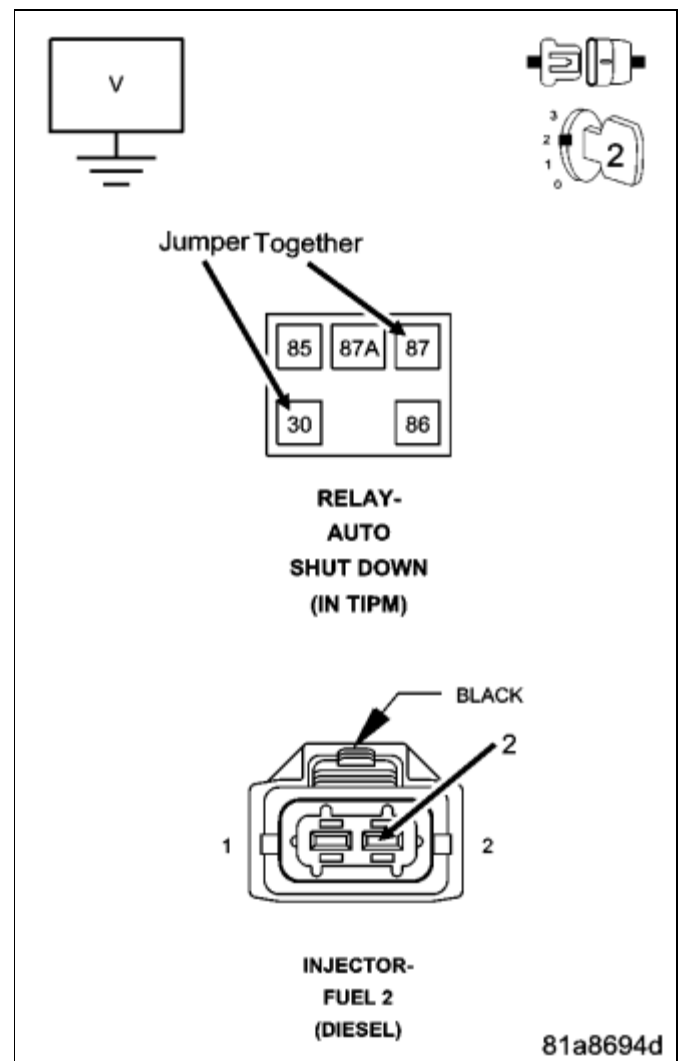
Measure the voltage of the (K12) Fuel Injector No. 2 High-Side Control circuit in the Fuel Injector No. 2 harness connector.

Is there any voltage present?**Yes**

- Repair the (K12) Fuel Injector No. 2 High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

**3. (K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE**

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K612) Fuel Injector No. 2 Low-Side Control circuit.

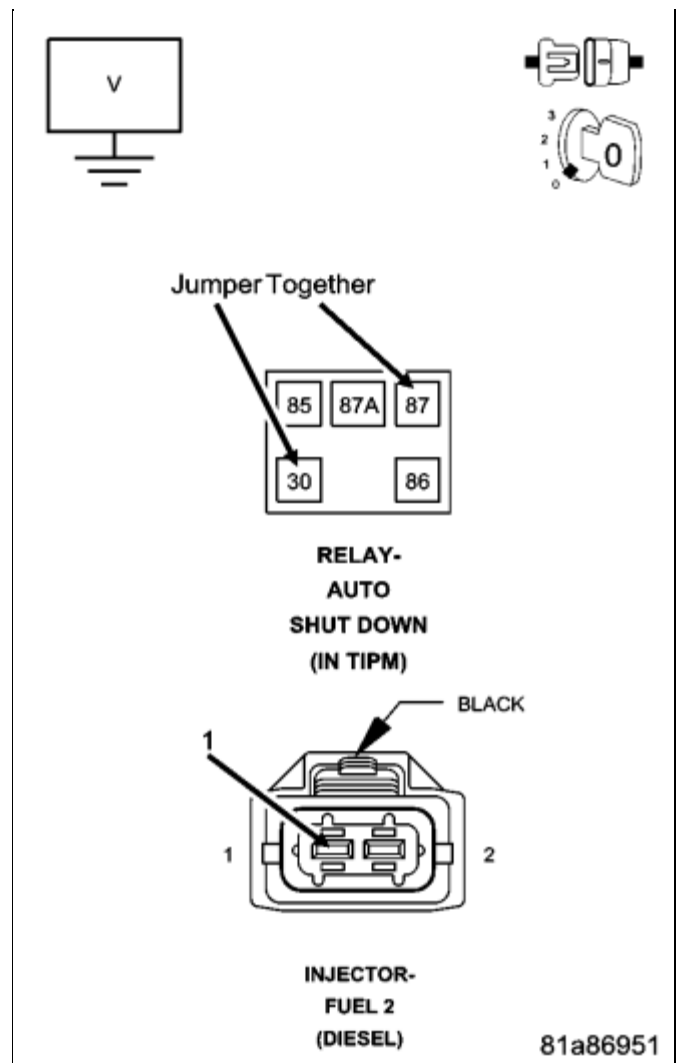
Is there any voltage present?

Yes

- Repair the (K612) Fuel Injector No. 2 Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Remove the jumper wire and install the ASD Relay..
Measure the resistance between ground and the (K12) Fuel Injector No. 2 High-Side Control circuit in the Fuel Injector No. 2 harness connector.

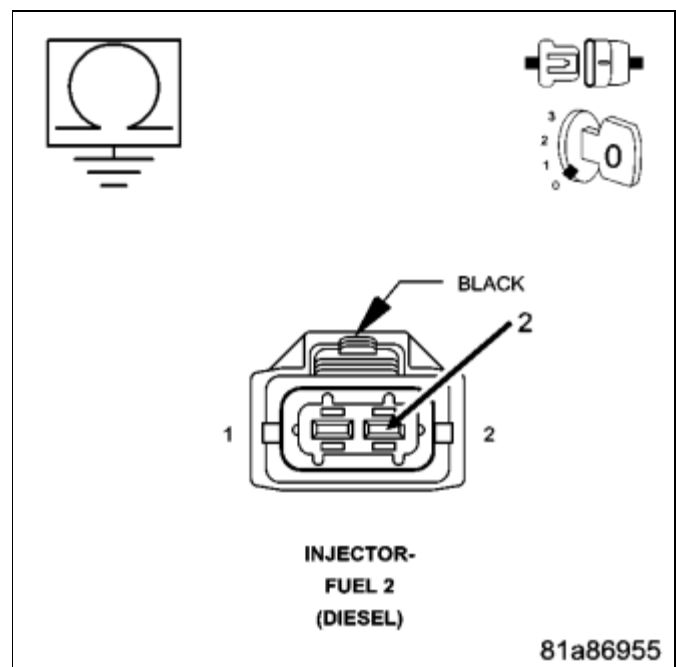
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K12) Fuel Injector No. 2 High-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K612) Fuel Injector No. 2 Low-Side Control circuit in the Fuel Injector No. 2 harness connector.

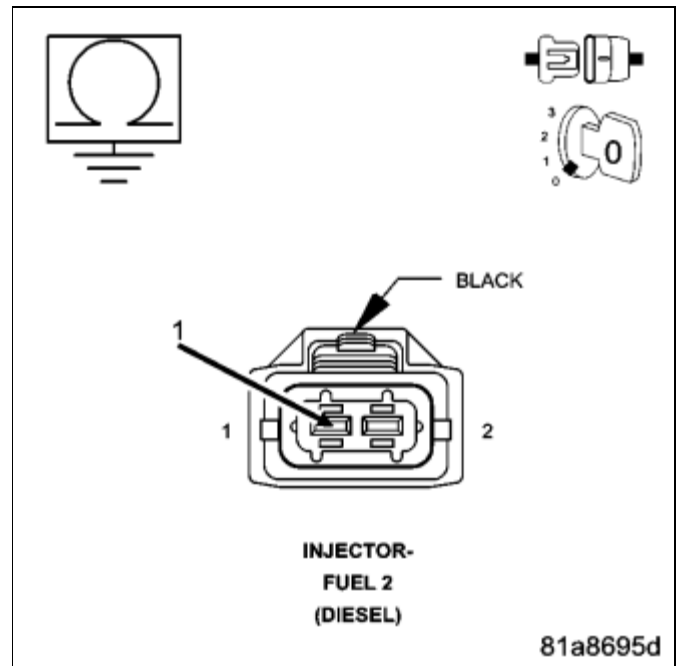
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K612) Fuel Injector No. 2 Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the (K12) Fuel Injector No. 2 High-Side Control circuit and the (K612) Fuel Injector No. 2 Low-Side Control circuit in the Fuel Injector No. 2 harness connector.

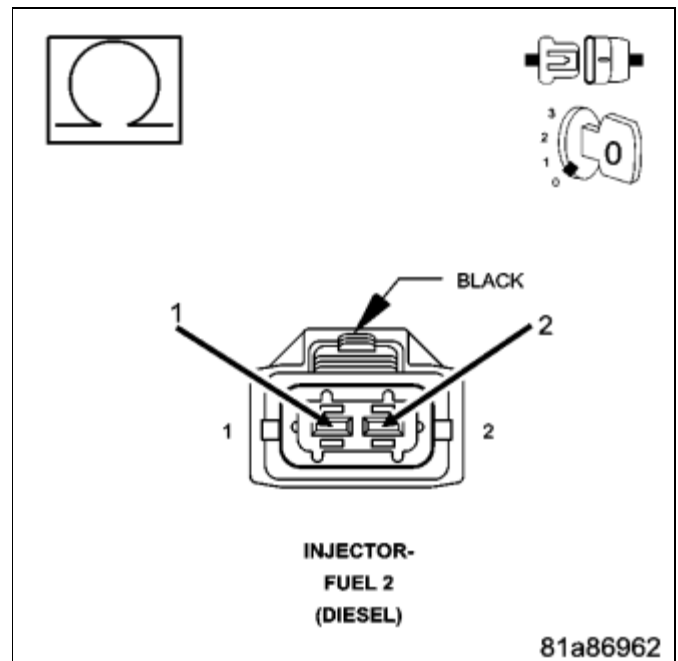
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (K12) Fuel Injector No. 2 High-Side Control circuit for a short to the (K612) Fuel Injector No. 2 Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K12) FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K12) Fuel Injector No. 2 High-Side Control circuit between the Fuel Injector No. 2 harness connector and the Engine Control Module (ECM) harness connector.

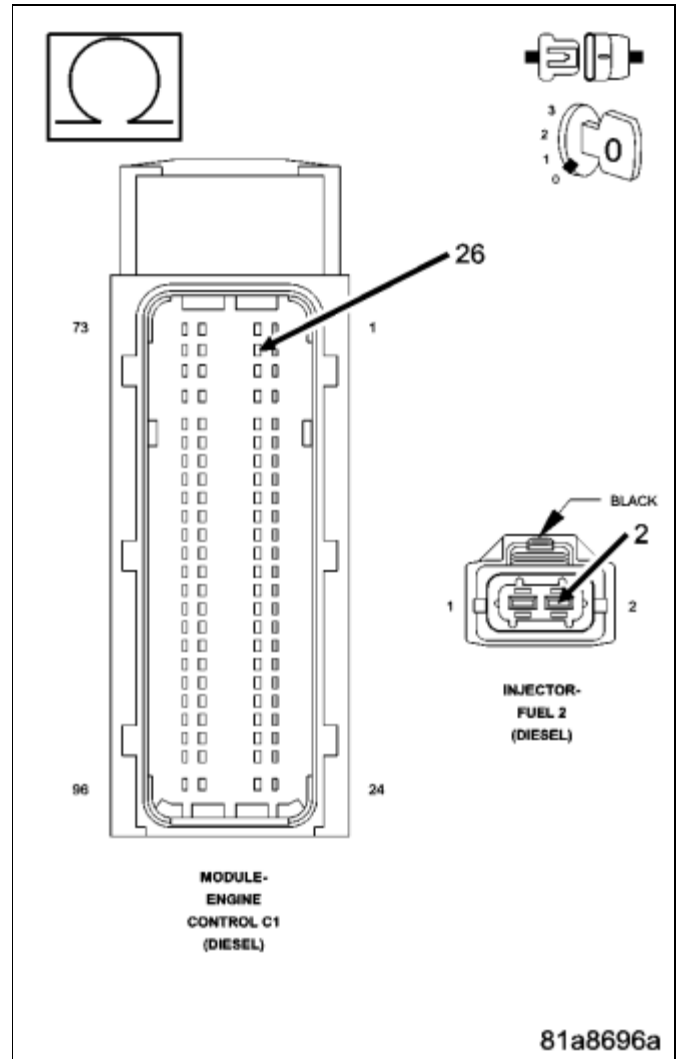
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K12) Fuel Injector No. 2 High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K612) FUEL INJECTOR NO. 2 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K612) Fuel Injector No. 2 Low-Side Control circuit between the Fuel Injector No. 2 harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

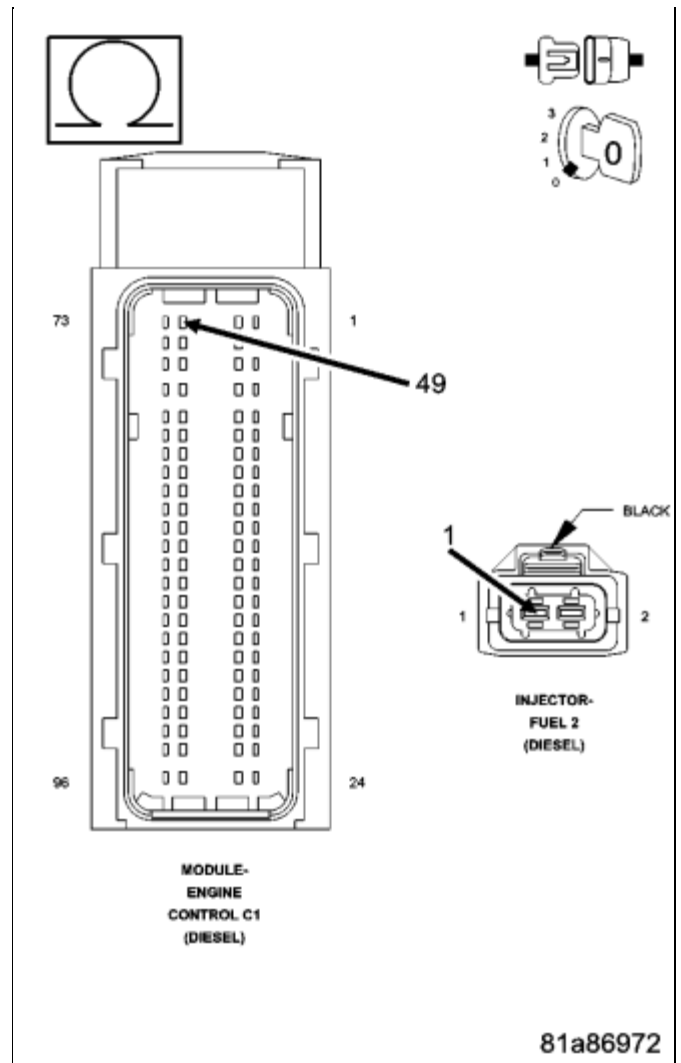
- Go to [9](#)

No

- Repair the (K612) Fuel Injector No. 2 Low-Side

Control circuit for an open circuit or high resistance.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. FUEL INJECTOR NO. 2

Measure the resistance between the terminals of Fuel Injector No. 2.

Is the resistance between 150k and 210k ohms?

Yes

- Go to [10](#)

No

- Replace the Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector No. 2 and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test. Refer to any Technical Service Bulletins that may apply.

Were any problems found?

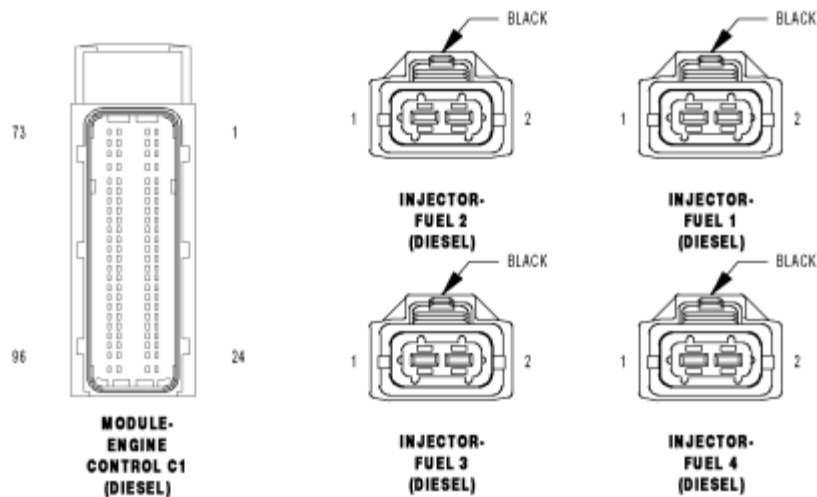
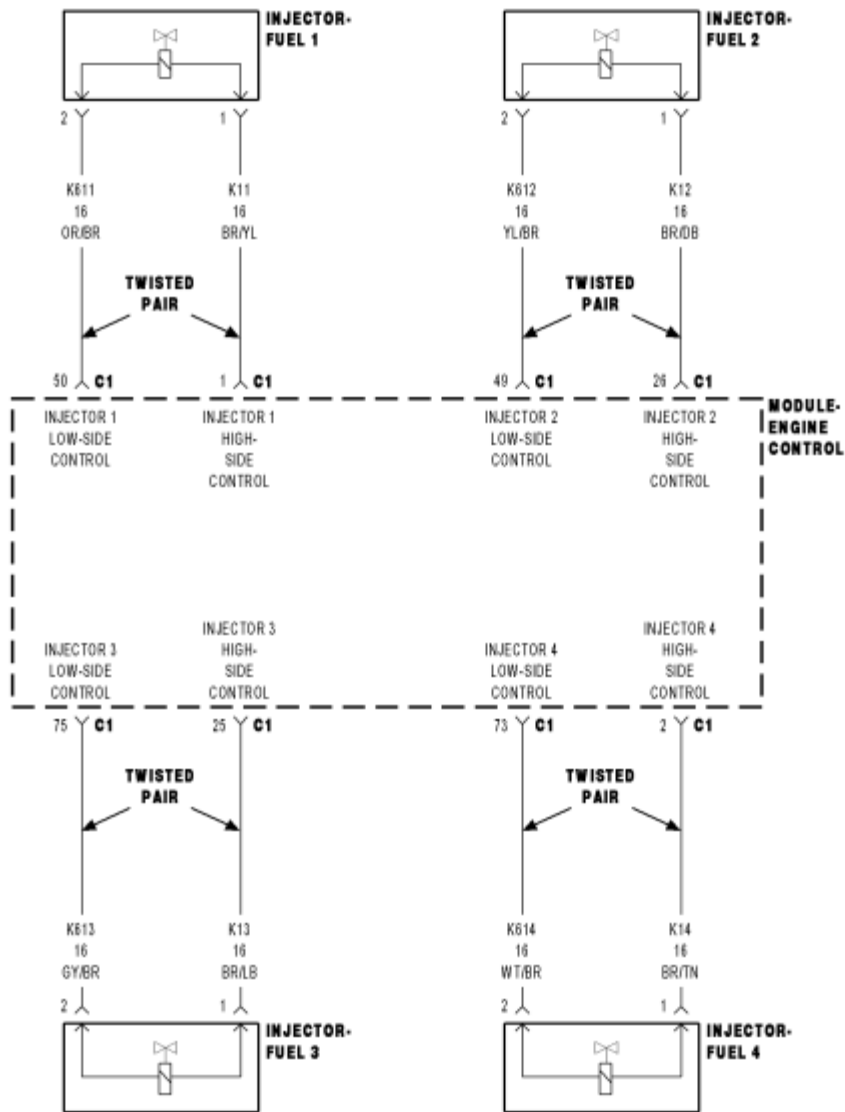
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0203-FUEL INJECTOR 3 CIRCUIT / OPEN



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects an open or shorted Fuel Injector 3 control circuit.

POSSIBLE CAUSES
INTERMITTENT DTC
(K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT
(K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR NO. 3
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

DIAGNOSTIC TEST

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select view DTCs.

Is the status active for this DTC?**YES**

- GO TO [2](#)

NO

- Refer to the *checking for an intermittent DTC diagnostic procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Injector No. 3 harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD relay connector.

Turn the ignition on.

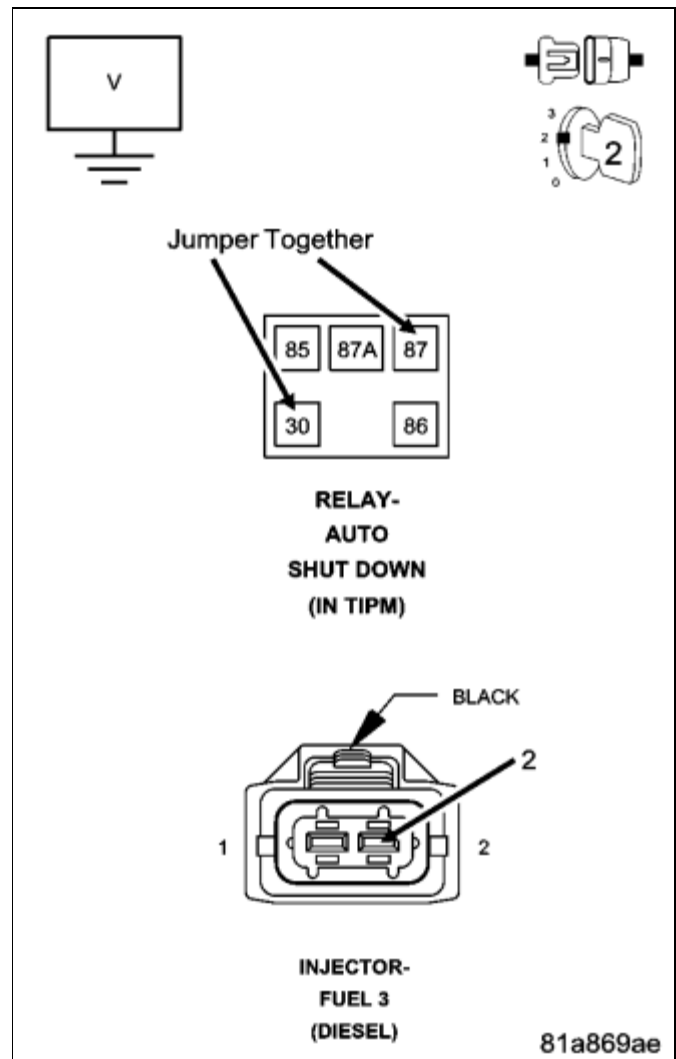
Measure the voltage of the (K13) Fuel Injector No. 3 High-Side Control circuit in the Fuel Injector No. 3 harness connector.

Is there any voltage present?**Yes**

- Repair the (K13) Fuel Injector No. 3 High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K613) Fuel Injector No. 3 Low-Side Control circuit in the Fuel Injector No. 3 harness connector.

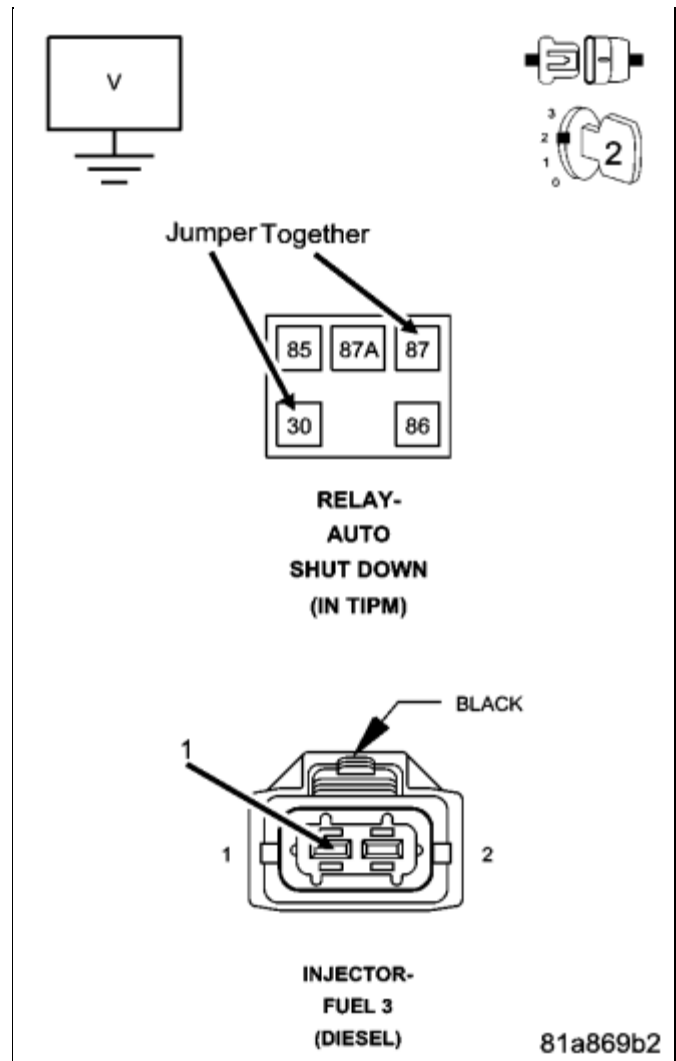
Is there any voltage present?

Yes

- Repair the (K613) Fuel Injector No. 3 Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Remove the jumper wire and install the ASD Relay..
Measure the resistance between ground and the (K13) Fuel Injector No. 3 High-Side Control circuit in the Fuel Injector No. 3 harness connector.

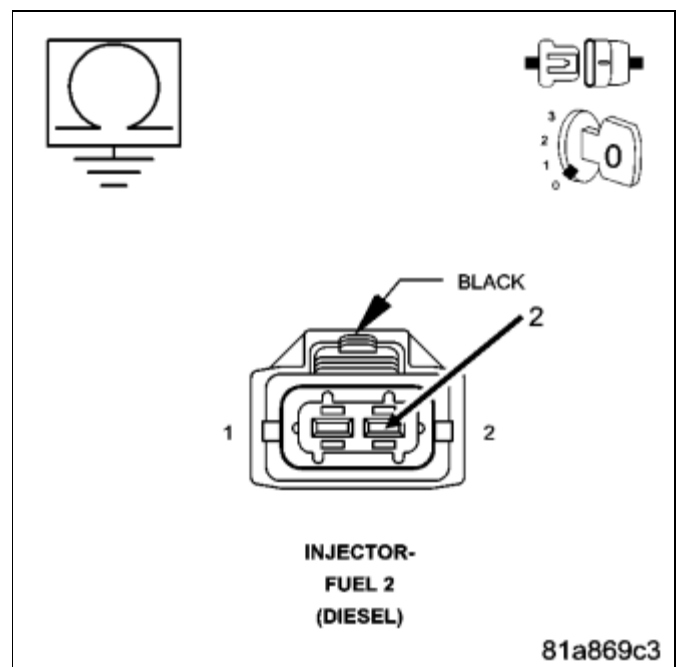
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K13) Fuel Injector No. 3 High-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K613) Fuel Injector No. 3 Low-Side Control circuit in the Fuel Injector No. 3 harness connector.

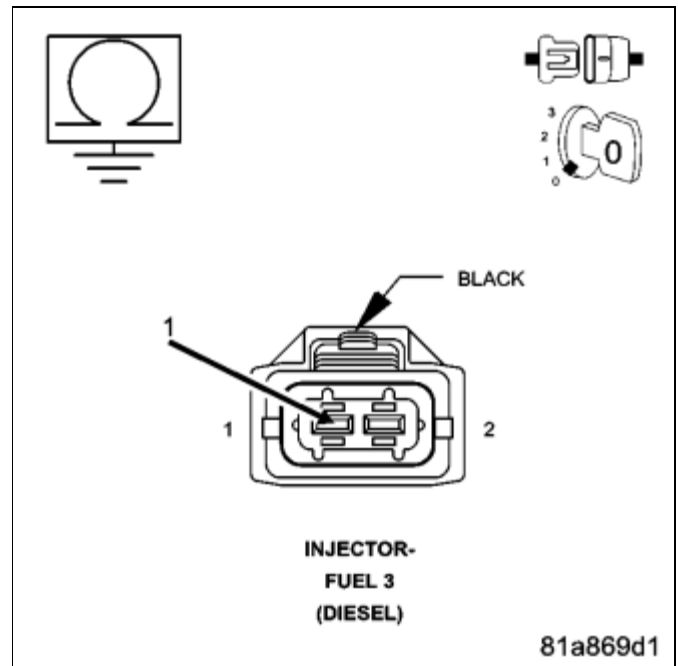
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K613) Fuel Injector No. 3 Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the (K13) Fuel Injector No. 3 High-Side Control circuit and the (K613) Fuel Injector No. 3 Low-Side Control circuit in the Fuel Injector No. 3 harness connector.

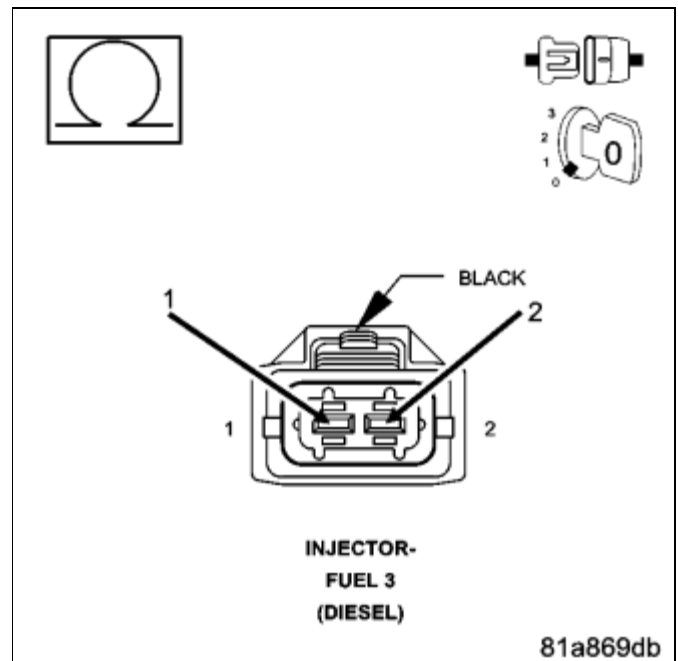
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (K13) Fuel Injector No. 3 High-Side Control circuit for a short to the (K613) Fuel Injector No. 3 Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K13) FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K13) Fuel Injector No. 3 High-Side Control circuit between the Fuel Injector No. 3 harness connector and the Engine Control Module (ECM) harness connector.

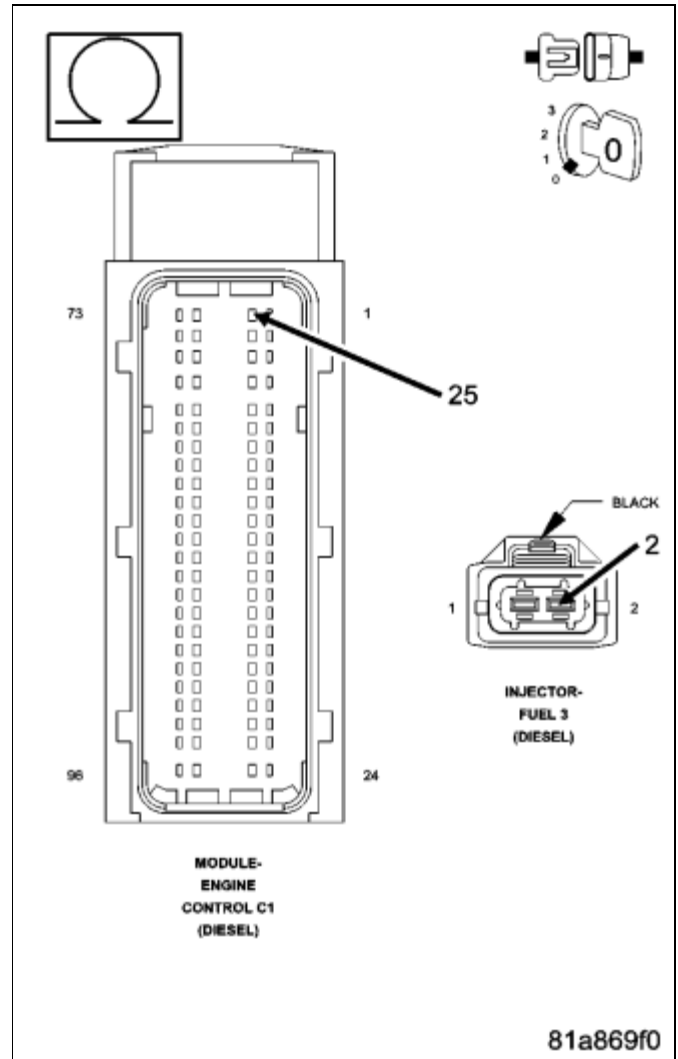
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K13) Fuel Injector No. 3 High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K613) FUEL INJECTOR NO. 3 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K613) Fuel Injector No. 3 Low-Side Control circuit between the Fuel Injector No. 3 harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

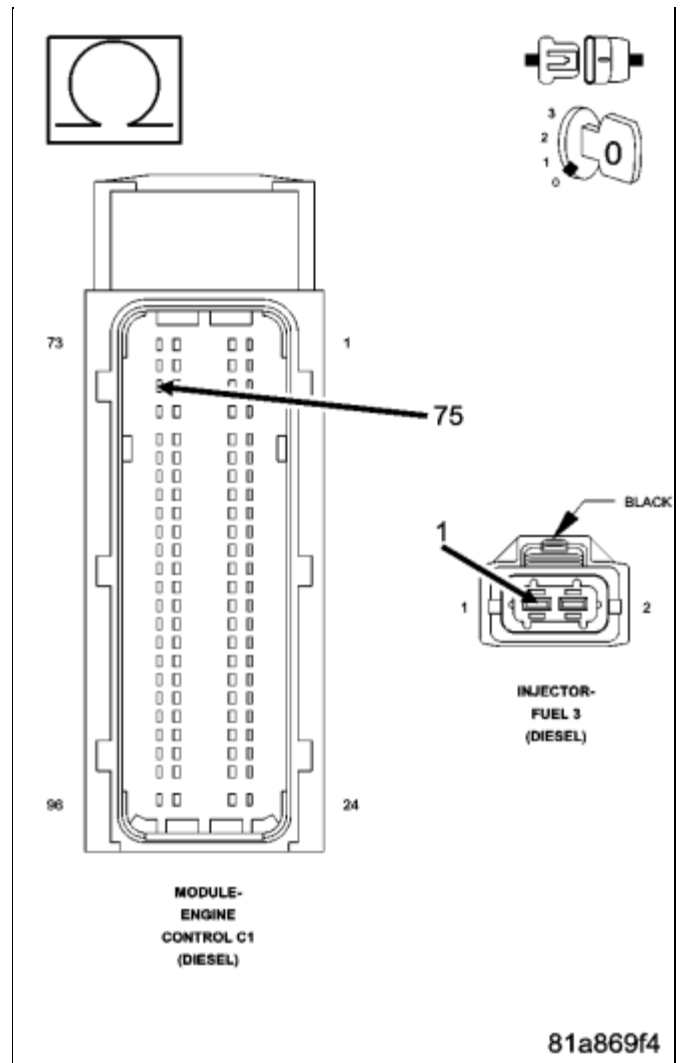
- Go to [9](#)

No

- Repair the (K613) Fuel Injector No. 3 Low-Side

Control circuit for an open circuit or high resistance.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. FUEL INJECTOR NO. 3

Measure the resistance between the terminals of Fuel Injector No. 3.

Is the resistance between 150k and 210k ohms?

Yes

- Go to [10](#)

No

- Replace the fuel injector in accordance with the service information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector No. 3 and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test. Refer to any technical service bulletins that may apply.

Were any problems found?

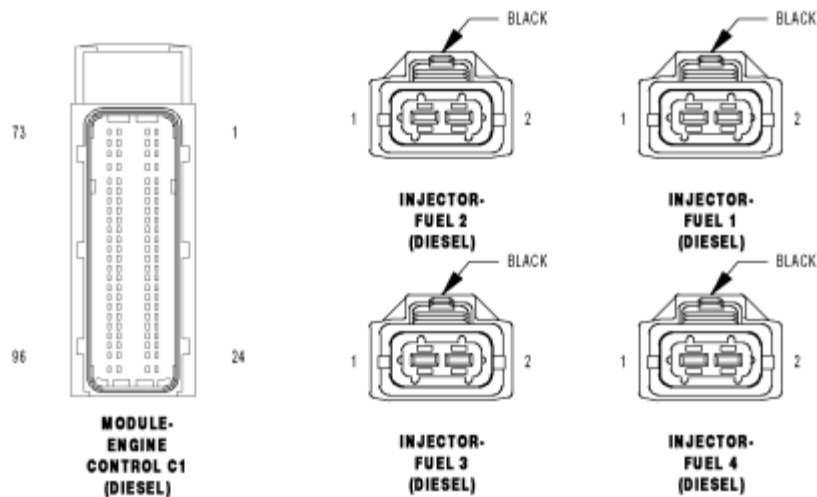
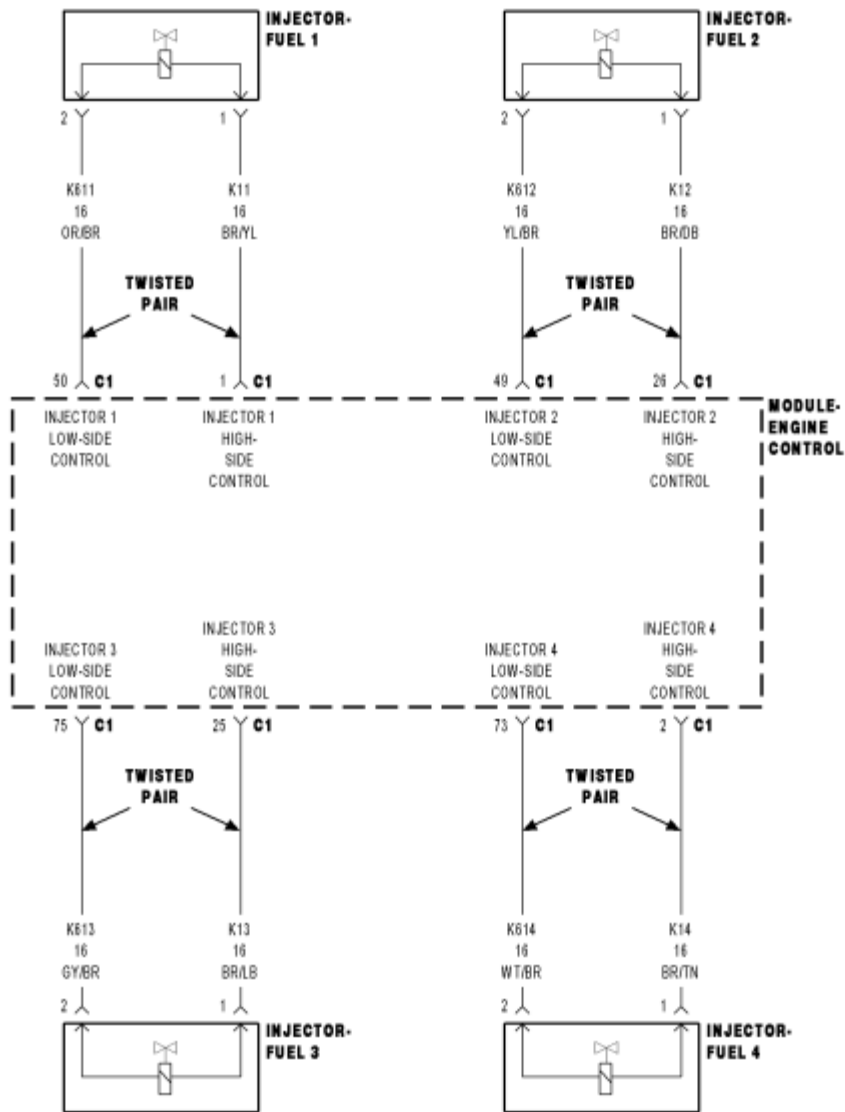
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the service information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0204-FUEL INJECTOR 4 CIRCUIT / OPEN



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects an open or shorted Fuel Injector 4 control circuit.

Possible Causes
INTERMITTENT DTC
(K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
(K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
(K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT
(K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR NO. 4
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Injector No. 4 harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

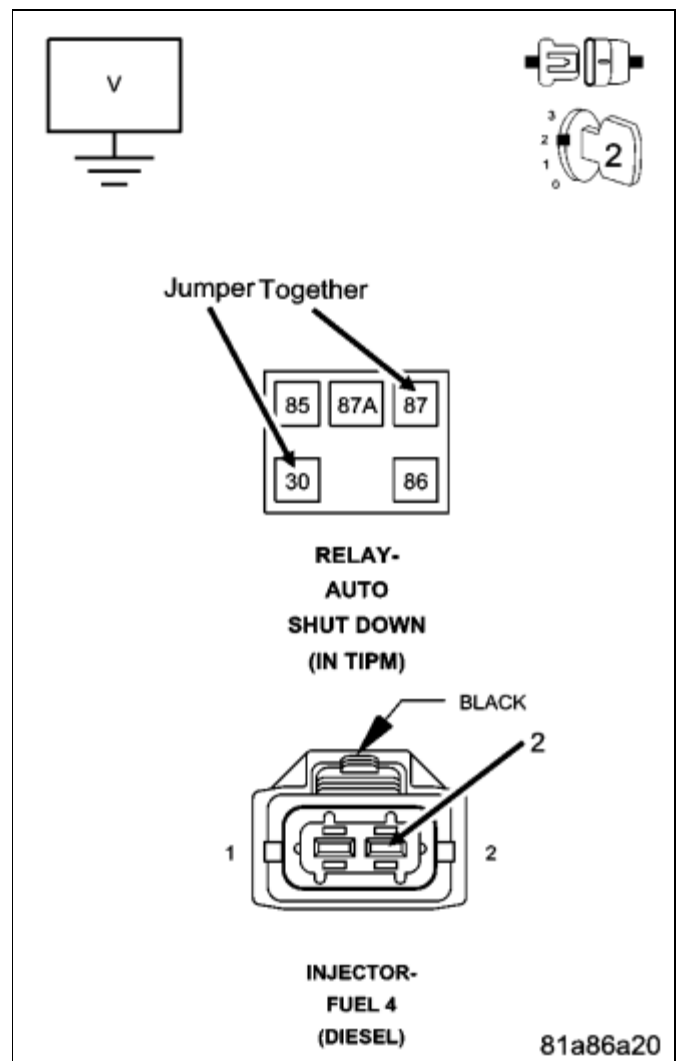
Measure the voltage of the (K14) Fuel Injector No. 4 High-Side Control circuit in the Fuel Injector No. 4 harness connector.

Is there any voltage present?**Yes**

- Repair the (K14) Fuel Injector No. 4 High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

**3. (K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE**

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K614) Fuel Injector No. 4 Low-Side Control circuit in the Fuel Injector No. 4 harness connector.

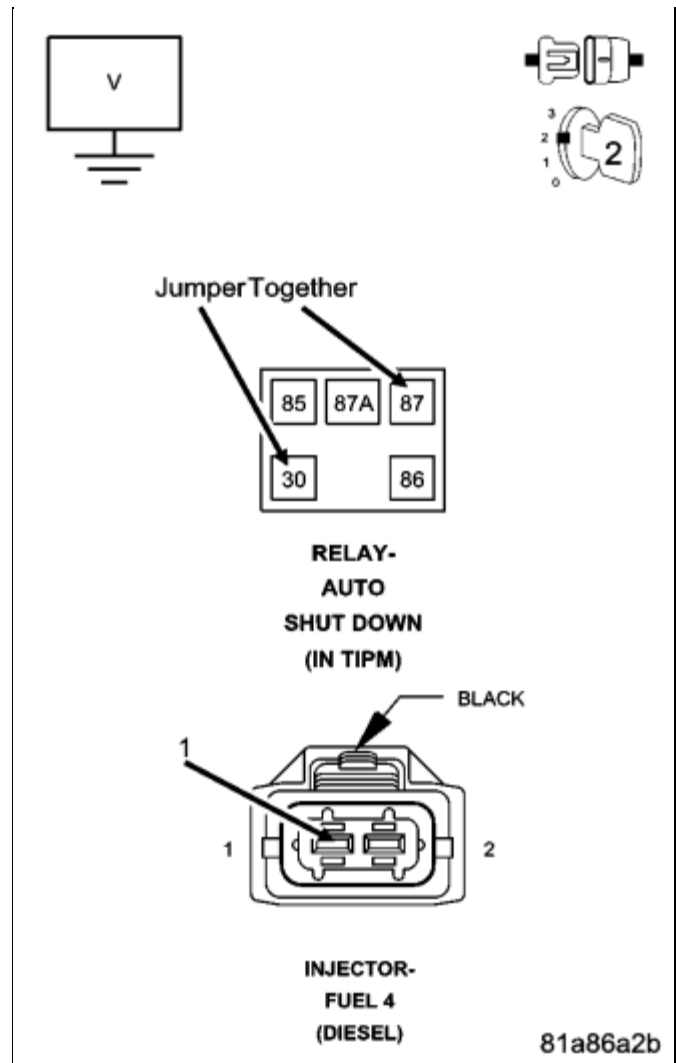
Is there any voltage present?

Yes

- Repair the (K614) Fuel Injector No. 4 Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Remove the jumper wire and install the ASD Relay..
Measure the resistance between ground and the (K14) Fuel Injector No. 4 High-Side Control circuit in the Fuel Injector No. 4 harness connector.

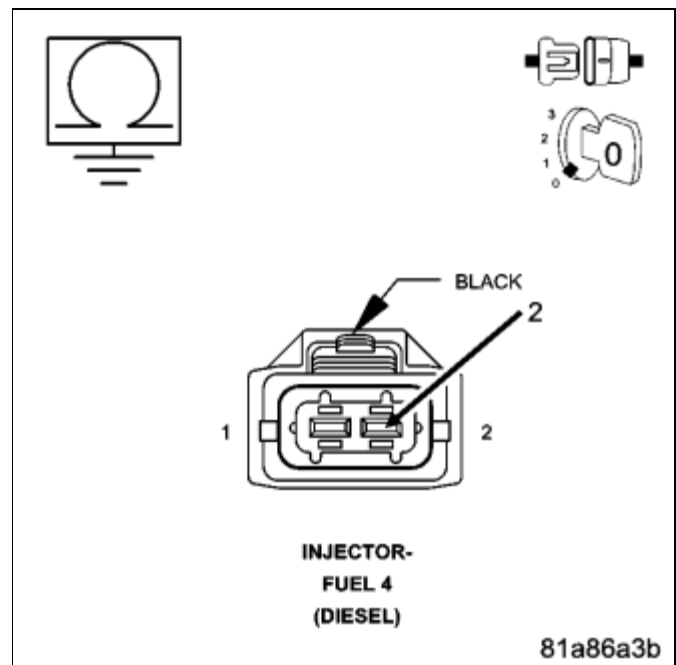
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K14) Fuel Injector No. 4 High-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K614) Fuel Injector No. 4 Low-Side Control circuit in the Fuel Injector No. 4 harness connector.

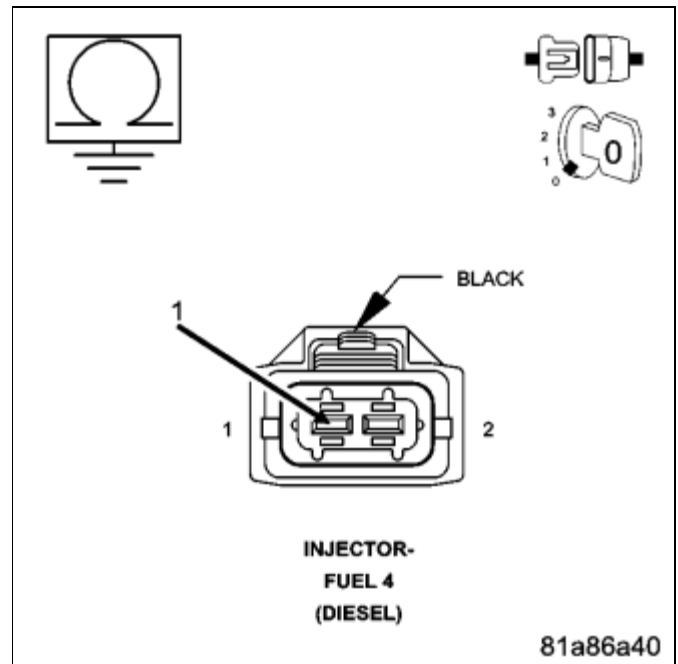
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K614) Fuel Injector No. 4 Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT SHORTED TO (K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the (K14) Fuel Injector No. 4 High-Side Control circuit and the (K614) Fuel Injector No. 4 Low-Side Control circuit in the Fuel Injector No. 4 harness connector.

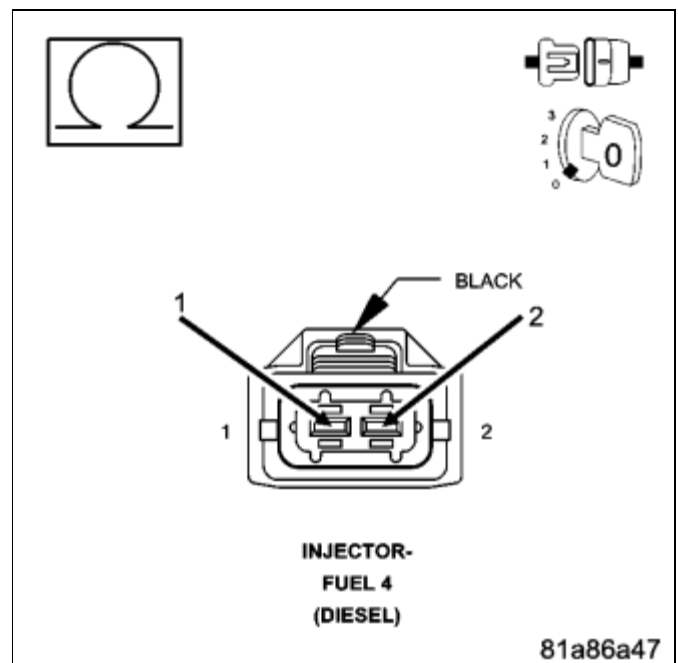
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (K14) Fuel Injector No. 4 High-Side Control circuit for a short to the (K614) Fuel Injector No. 4 Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K14) FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K14) Fuel Injector No. 4 High-Side Control circuit between the Fuel Injector No. 4 harness connector and the Engine Control Module (ECM) harness connector.

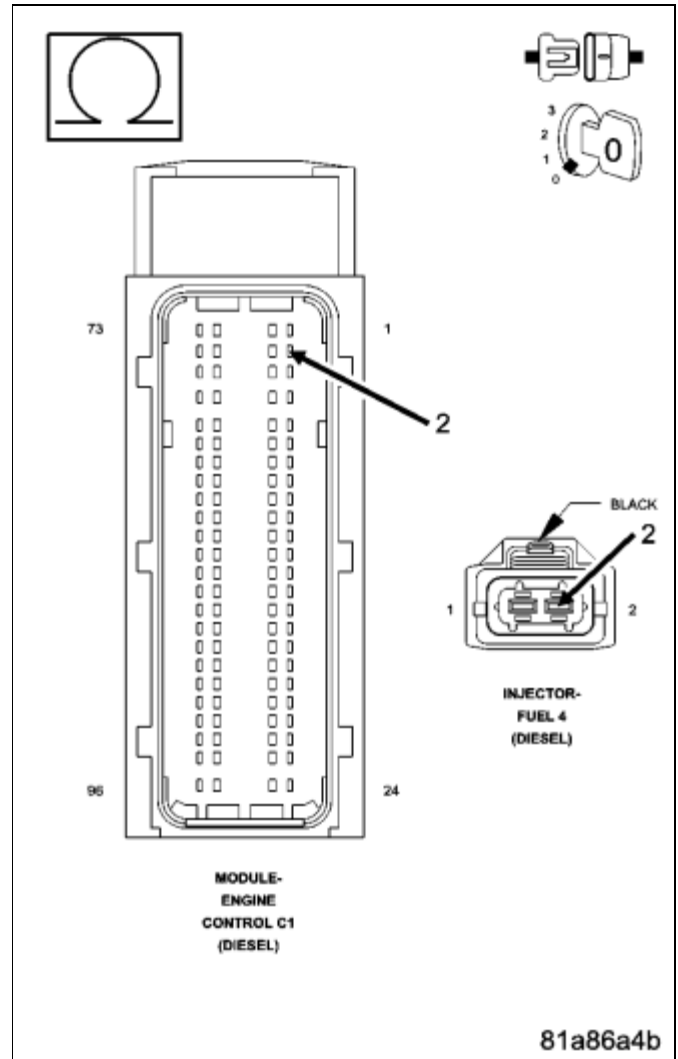
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K14) Fuel Injector No. 4 High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K614) FUEL INJECTOR NO. 4 LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K614) Fuel Injector No. 4 Low-Side Control circuit between the Fuel Injector No. 4 harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

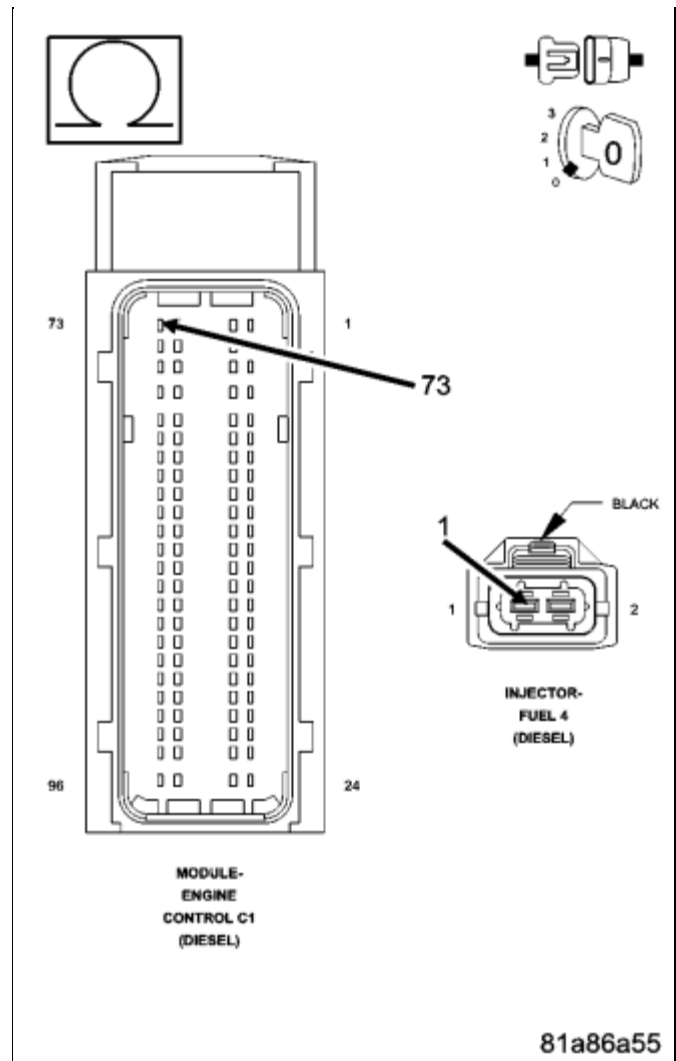
- Go to [9](#)

No

- Repair the (K614) Fuel Injector No. 4 Low-Side

Control circuit for an open circuit or high resistance.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. FUEL INJECTOR NO. 4

Measure the resistance between the terminals of Fuel Injector No. 4.

Is the resistance between 150k and 210k ohms?

Yes

- Go to [10](#)

No

- Replace the Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector No. 4 and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test. Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0219-ENGINE OVERSPEED CONDITION

For a complete wiring diagram **Refer to Section 8W**

◦ When Monitored:

With the engine running.

◦ Set Condition:

The CKP Sensor indicates engine speed is at or above 4800 rpm. NOTE: Engine damage is possible when the engine speed exceeds 4800 rpm.

Possible Causes
INTERMITTENT DTC
CRANKSHAFT POSITION SENSOR WIRING AND CONNECTORS
CRANKSHAFT POSITION SENSOR
DRIVER ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition off.

Check the CKP Sensor wiring between the ECM and CKP harness connectors for poor terminal contact, corrosion or other problems that may cause erratic CKP Sensor signals.

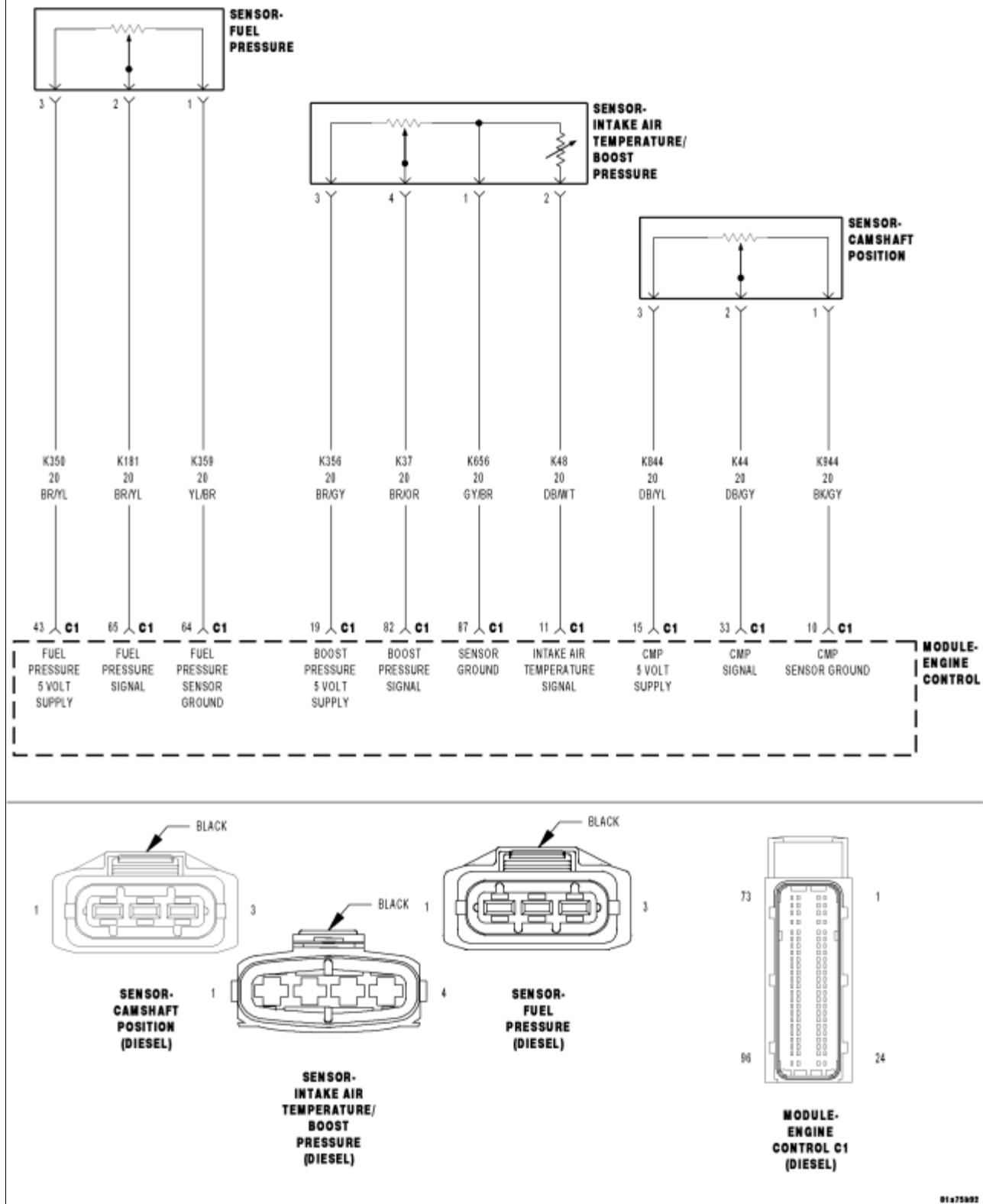
Check the CKP Sensor for damage and proper mounting.

View repair.

No

- Repair or replace as necessary. Refer to the Service Information to check for engine mechanical problems that may have occurred due to excessive engine speed. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0234-TURBOCHARGER OVERBOOST CONDITION



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running and the ECM attempting to govern turbocharger boost pressure.

◦ **Set Condition:**

The Boost Pressure Sensor indicates actual turbocharger boost is greater than the ECM setpoint for engine boost for 0.71 second.

Possible Causes
INTERMITTENT DTC
CLOGGED AIR FILTER
INTAKE/EXHAUST RESTRICTION
INTAKE AIR LEAK
BOOST PRESSURE SERVO MOTOR
TURBOCHARGER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK THE AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

Were any of these problems found?

Yes

- Replace the Air Filter element
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. AIR RESTRICTION

NOTE: Inspect all air intake, crankcase vent, charge air cooler and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

Inspect the intake system, exhaust system and related tubes and connections.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK FOR INTAKE SYSTEM AIR LEAKS

Remove the Crankcase Vent Heater.

Remove the Mass Air Flow Sensor from the turbocharger inlet tube.

Seal off and/or plug the turbocharger inlet tube where the MAF sensor was removed.

Connect smoke machine 84-04 to the Crankcase Vent Heater port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. REPLACE THE BOOST PRESSURE SERVO MOTOR

Replace the Boost Pressure Servo Motor in accordance with the Service Information.

NOTE: Ensure the Boost Pressure Servo Motor and ECM harness connectors are connected.

Test drive the vehicle.

With the scan tool, select View DTCs.

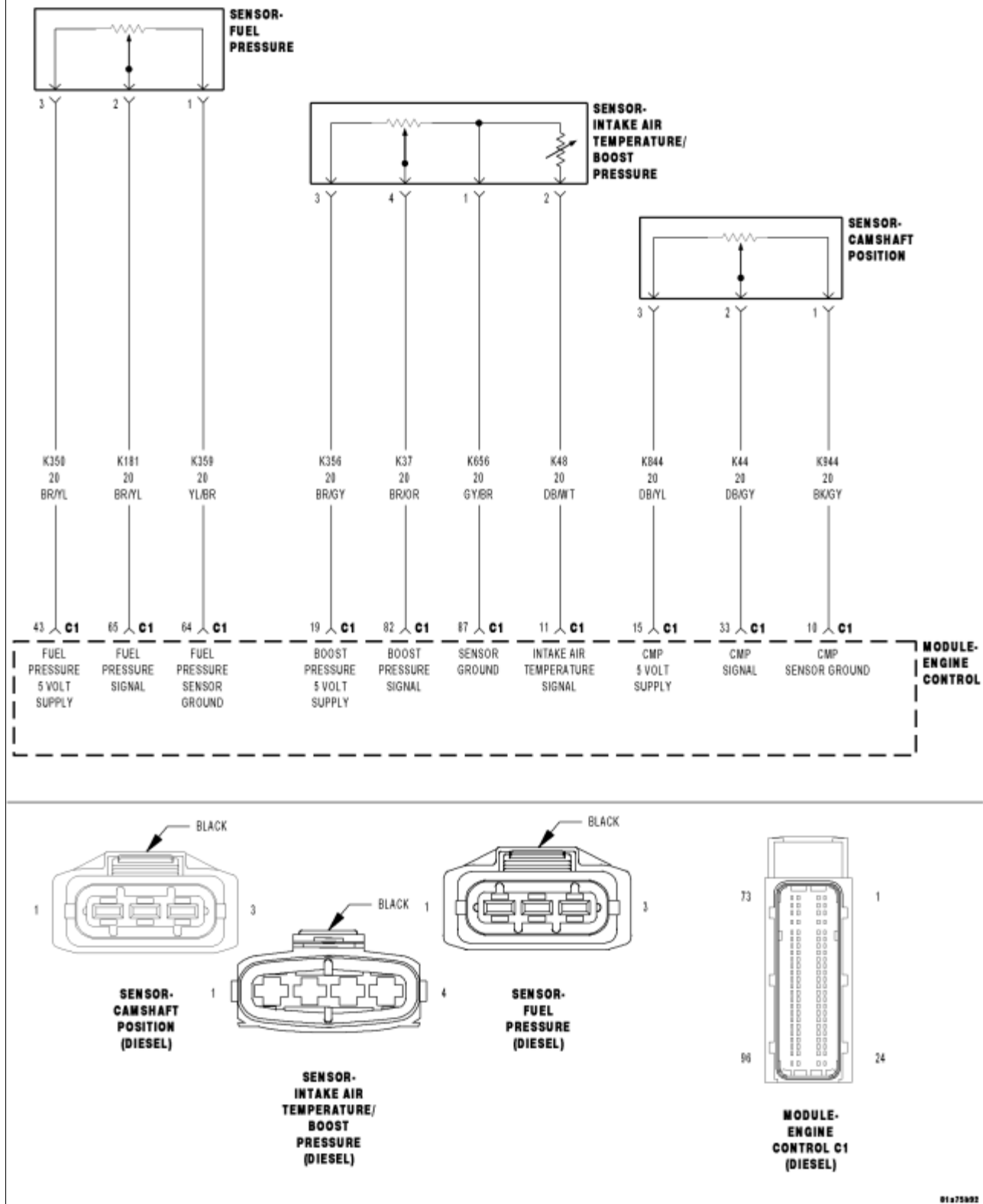
Is the status Active for this DTC?**Yes**

- Replace the Turbocharger assembly in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0235-TURBO BOOST PRESSURE SENSOR CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K37) Boost Pressure Sensor Signal is defective.

Possible Causes
INTERMITTENT DTC
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.
 Disconnect the Boost Pressure Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (K356) Boost Pressure Sensor 5 Volt Supply circuit in the Boost Pressure Sensor harness connector.

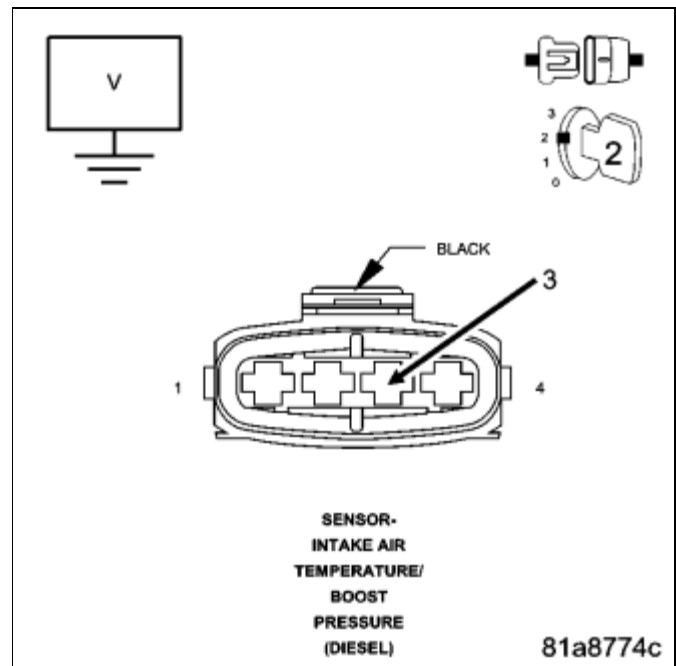
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connectors.
 Measure the resistance between ground and the (K356) Boost Pressure Sensor 5 Volt Supply circuit in the Boost Pressure Sensor harness connector.

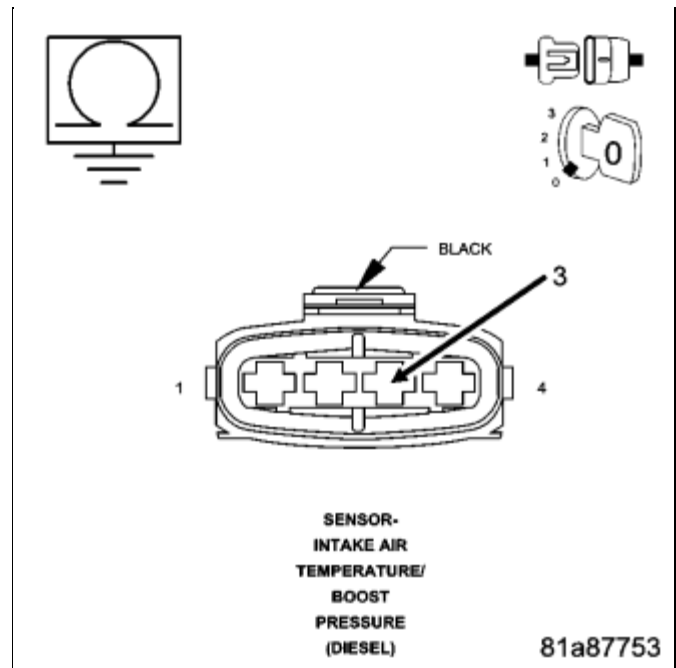
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K356) Boost Pressure Sensor 5 Volt Supply circuit and the (K656) Boost Pressure Sensor Ground circuit in the Boost Pressure Sensor harness connector.

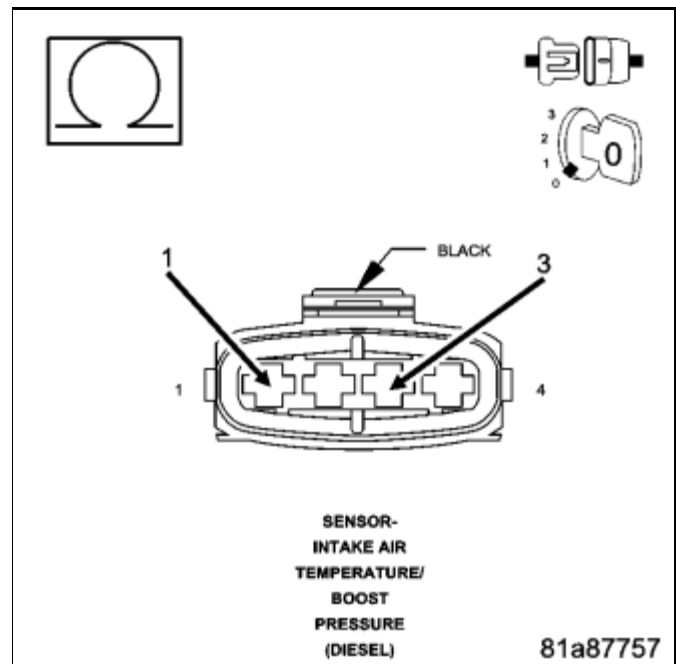
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to the (K656) Boost Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K356) Boost Pressure Sensor 5 Volt Supply circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

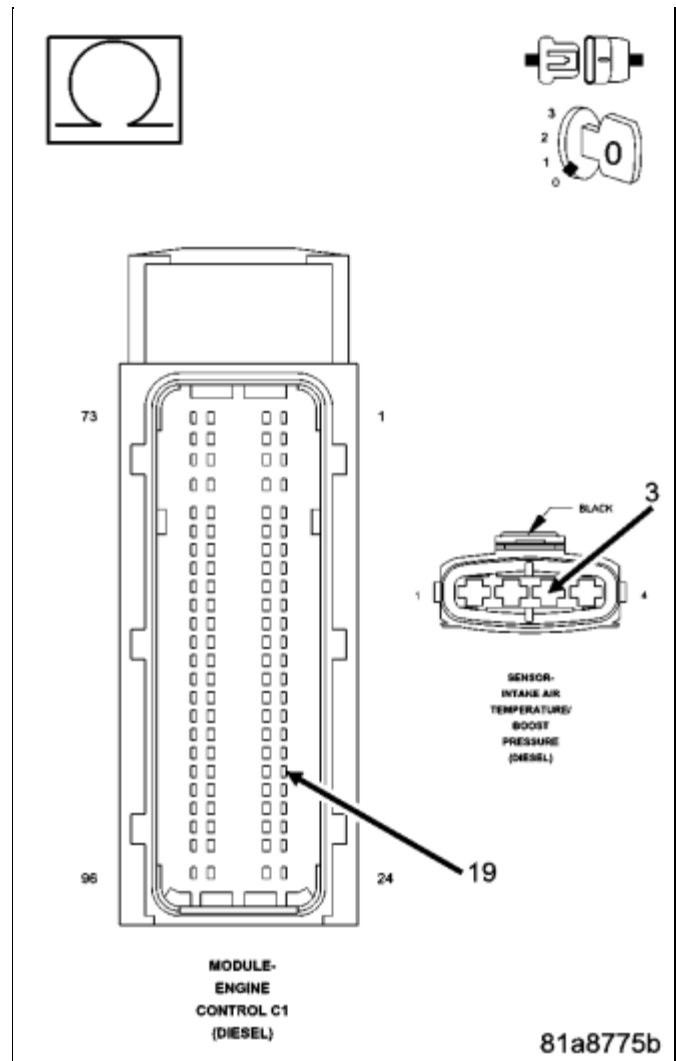
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. BOOST PRESSURE SENSOR

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Boost Pressure Sensor high voltage or open DTC with the Boost Pressure Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Boost Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [7](#)

7. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K37) Boost Pressure Sensor Signal circuit in the Boost Pressure Sensor harness connector.

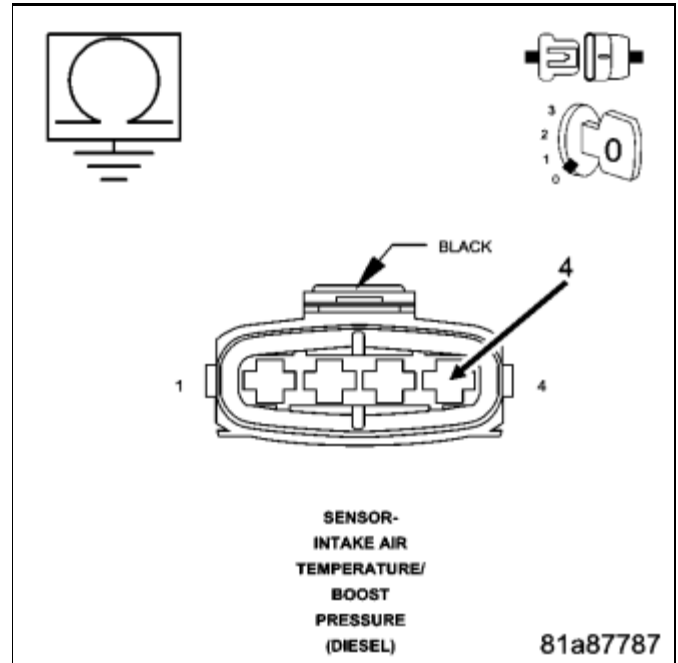
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K37) Boost Pressure Sensor Signal circuit and the (K656) Boost Pressure Sensor Ground circuit in the Boost Pressure Sensor harness connector.

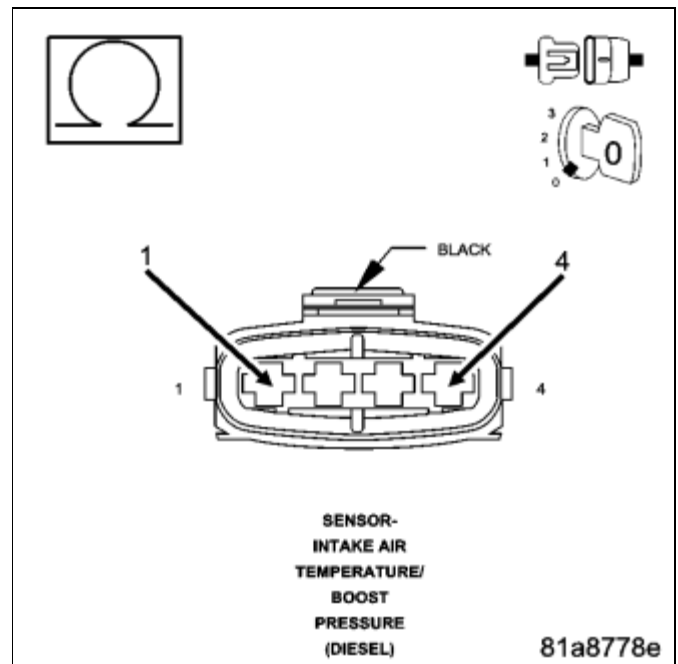
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for a short to the (K656) Boost Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K37) Boost Pressure Sensor Signal circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

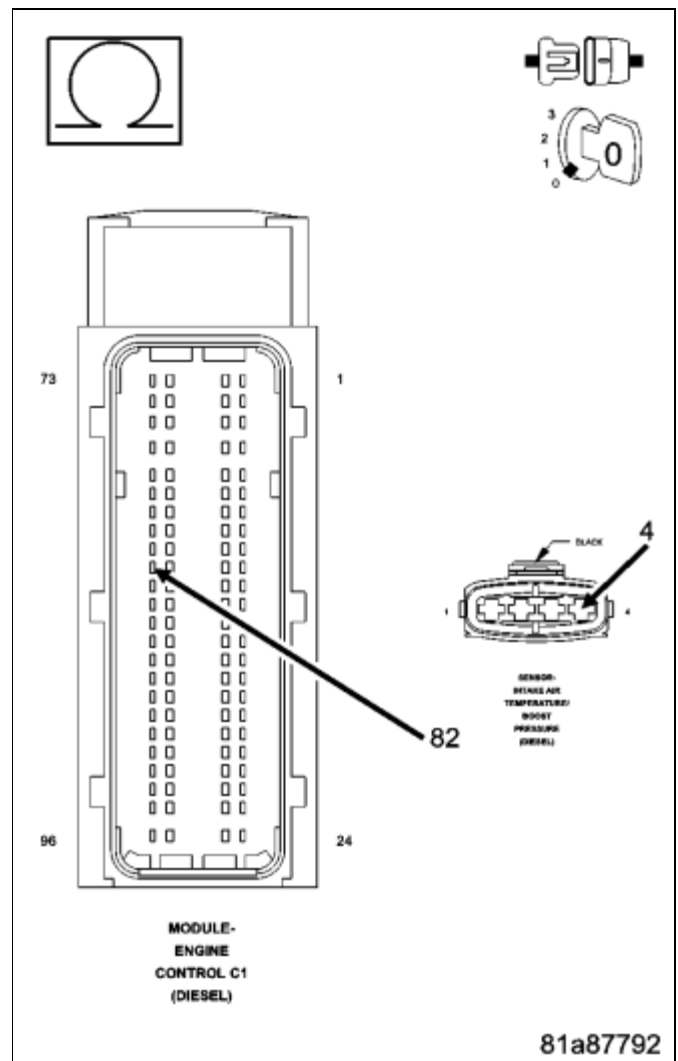
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

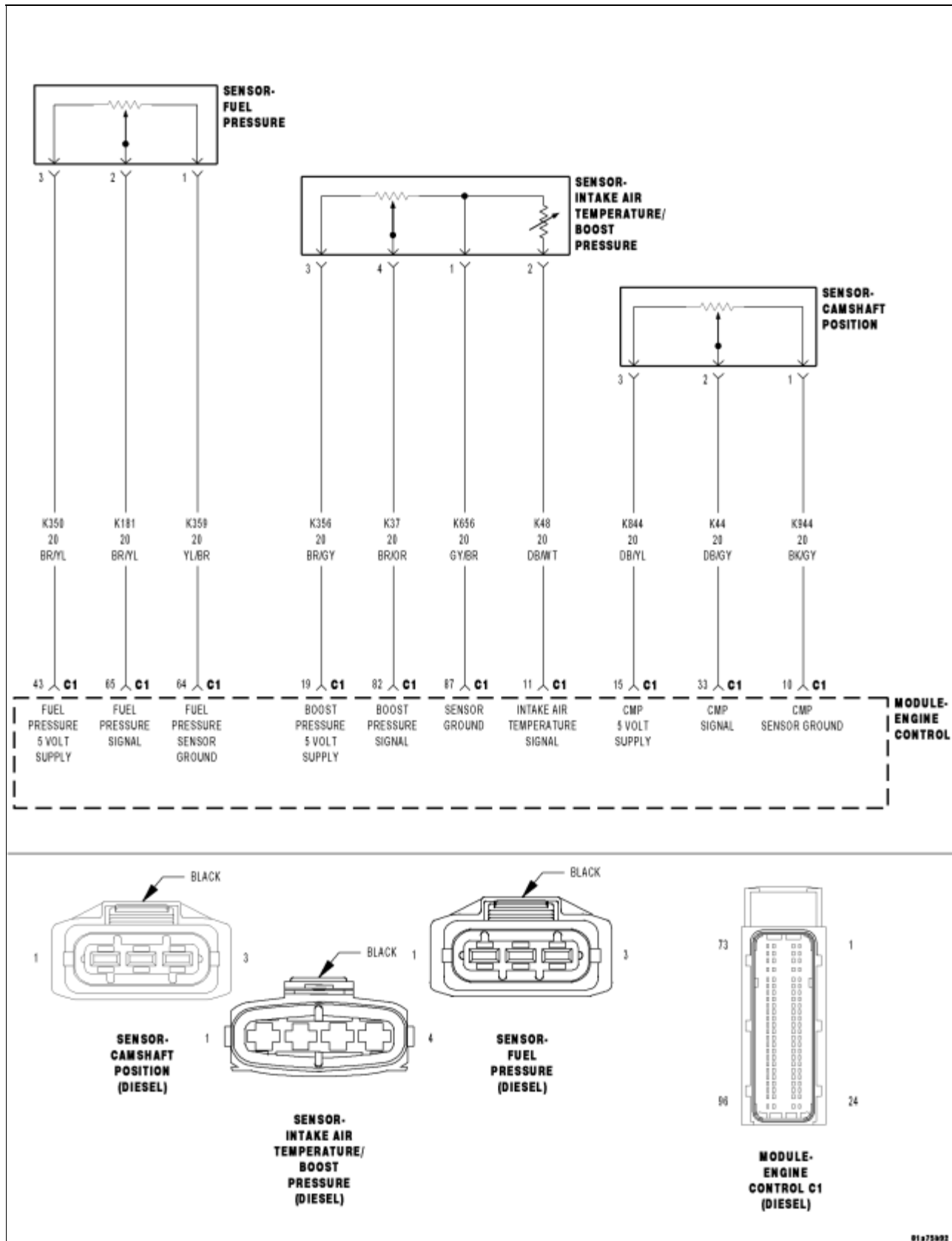
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0237-TURBO BOOST PRESSURE SENSOR CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K37) Boost Pressure Sensor Signal circuit voltage is below 0.29 volt for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K356) Boost Pressure Sensor 5 Volt Supply circuit in the Boost Pressure Sensor harness connector.

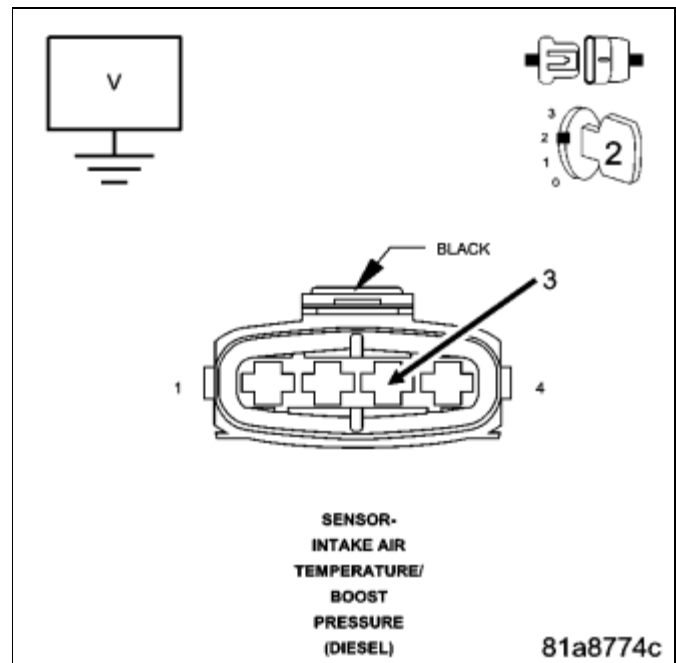
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connectors.

Measure the resistance between ground and the (K356) Boost Pressure Sensor 5 Volt Supply circuit in the Boost

Pressure Sensor harness connector.

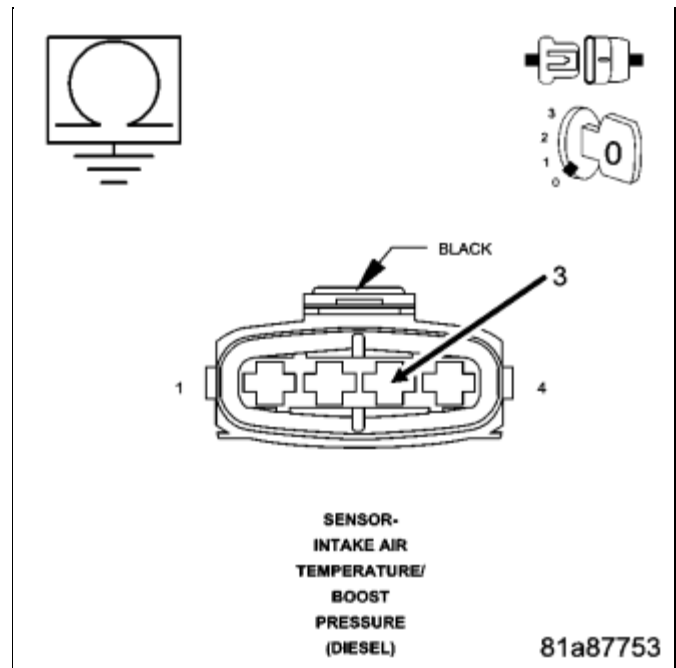
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K356) Boost Pressure Sensor 5 Volt Supply circuit and the (K656) Boost Pressure Sensor Ground circuit in the Boost Pressure Sensor harness connector.

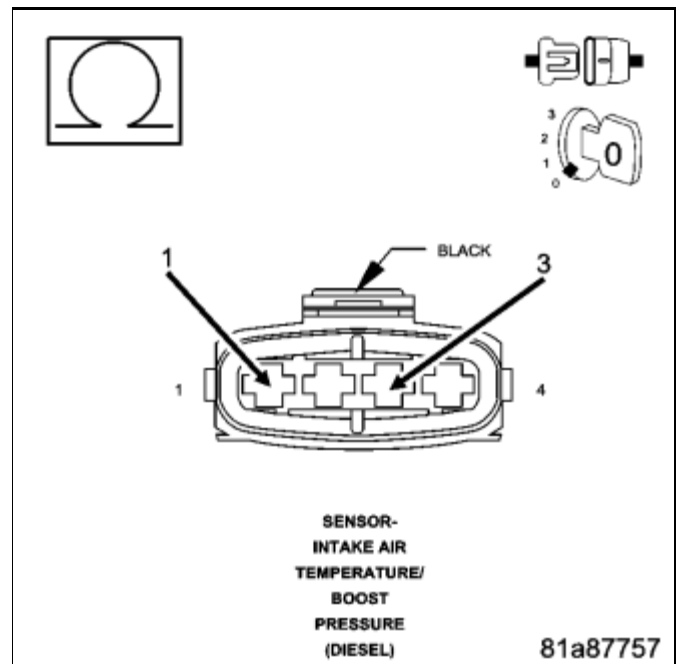
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to the (K656) Boost Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K356) Boost Pressure Sensor 5 Volt Supply circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

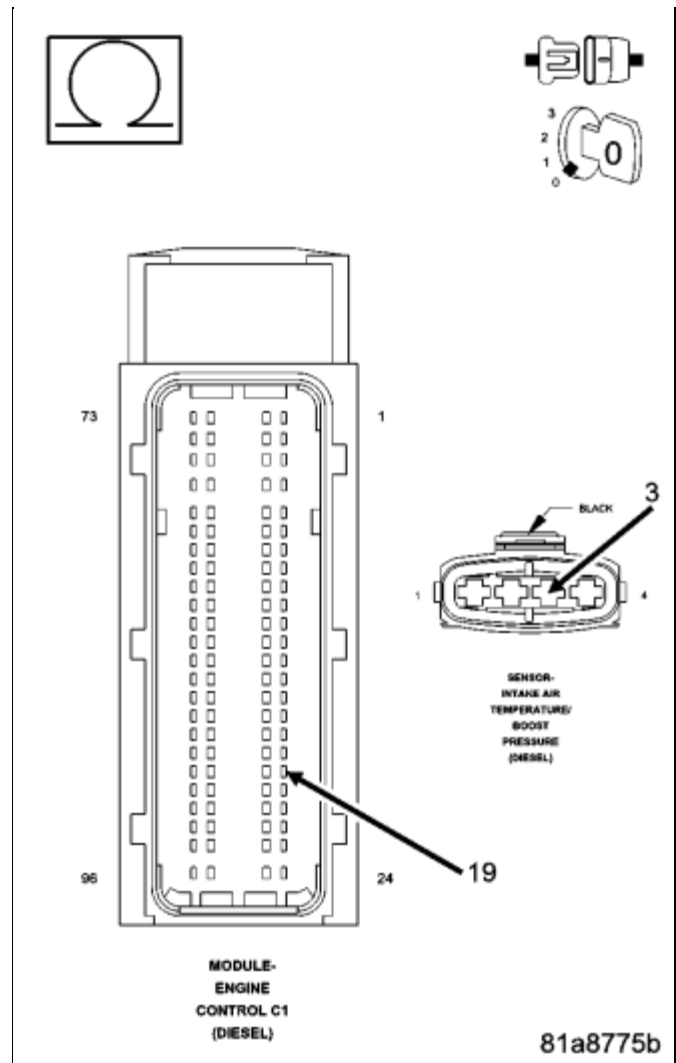
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. BOOST PRESSURE SENSOR

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Boost Pressure Sensor high voltage or open DTC with the Boost Pressure Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Boost Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [7](#)

7. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K37) Boost Pressure Sensor Signal circuit in the Boost Pressure Sensor harness connector.

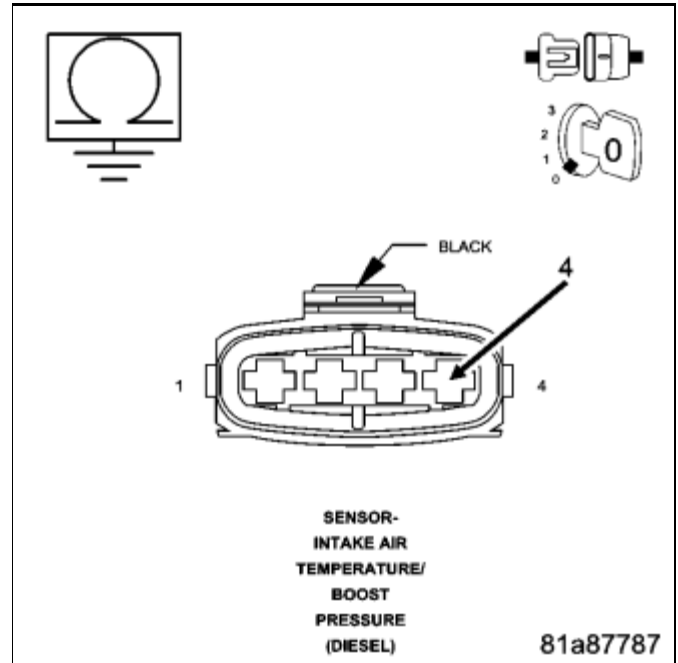
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K37) Boost Pressure Sensor Signal circuit and the (K656) Boost Pressure Sensor Ground circuit in the Boost Pressure Sensor harness connector.

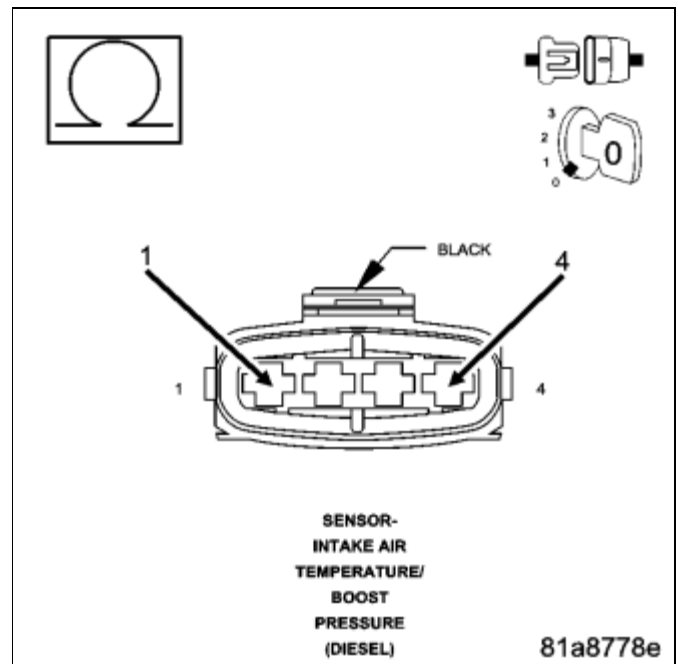
Is the resistance above 1000 ohms?

Yes

- Go to [9](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for a short to the (K656) Boost Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K37) Boost Pressure Sensor Signal circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

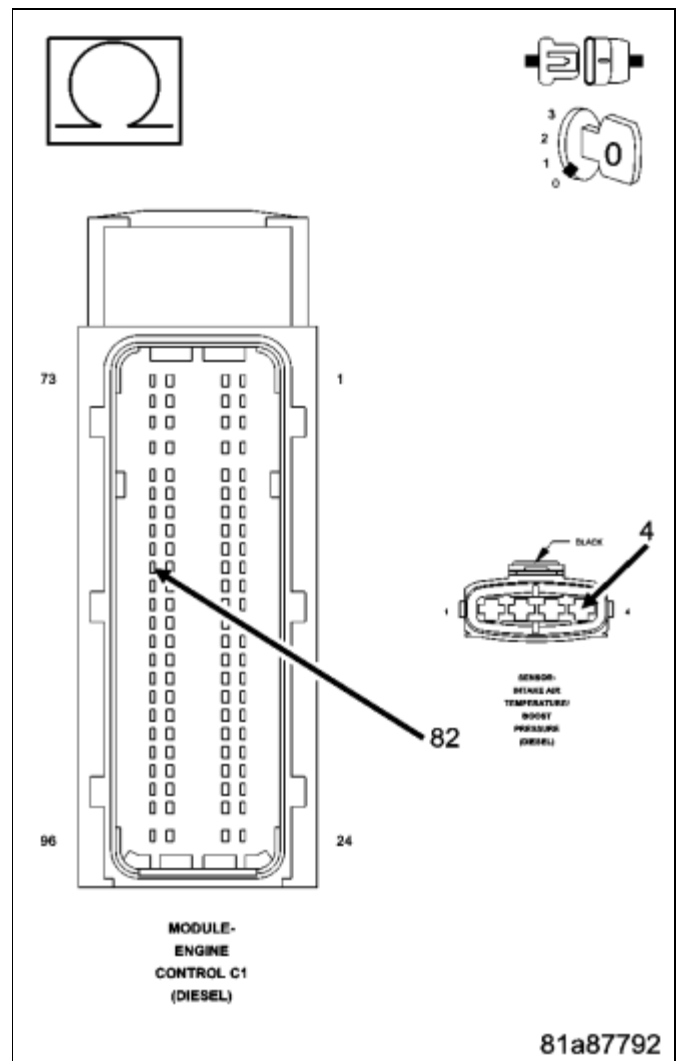
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K37) Boost Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

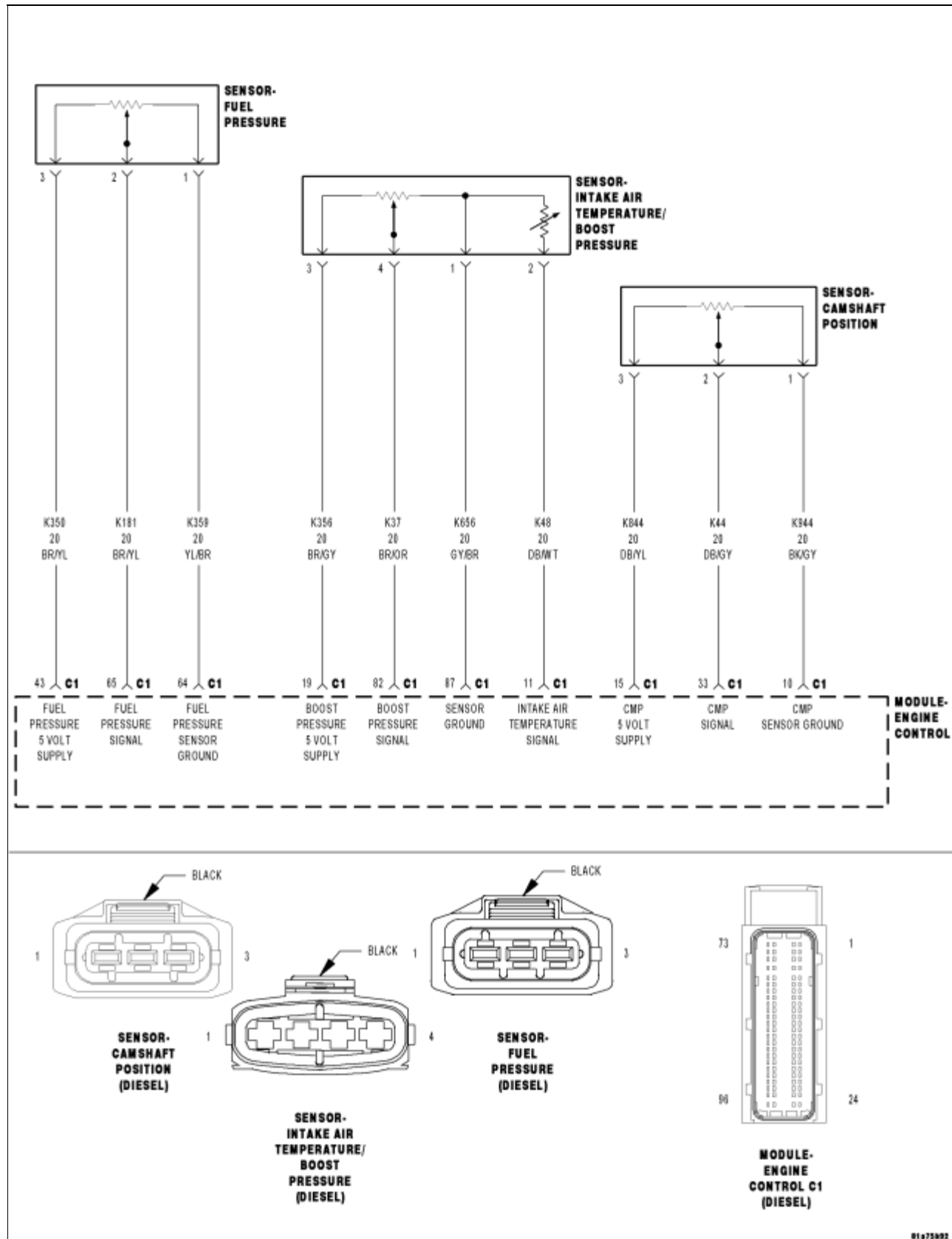
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0238-TURBO BOOST PRESSURE SENSOR CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K37) Boost Pressure Sensor Signal circuit voltage is above 4.70 volts for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K656) BOOST PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K656) BOOST PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
BOOST PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time. Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K356) BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.
Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K356) Boost Pressure Sensor 5 Volt Supply circuit in the Boost Pressure Sensor harness connector.

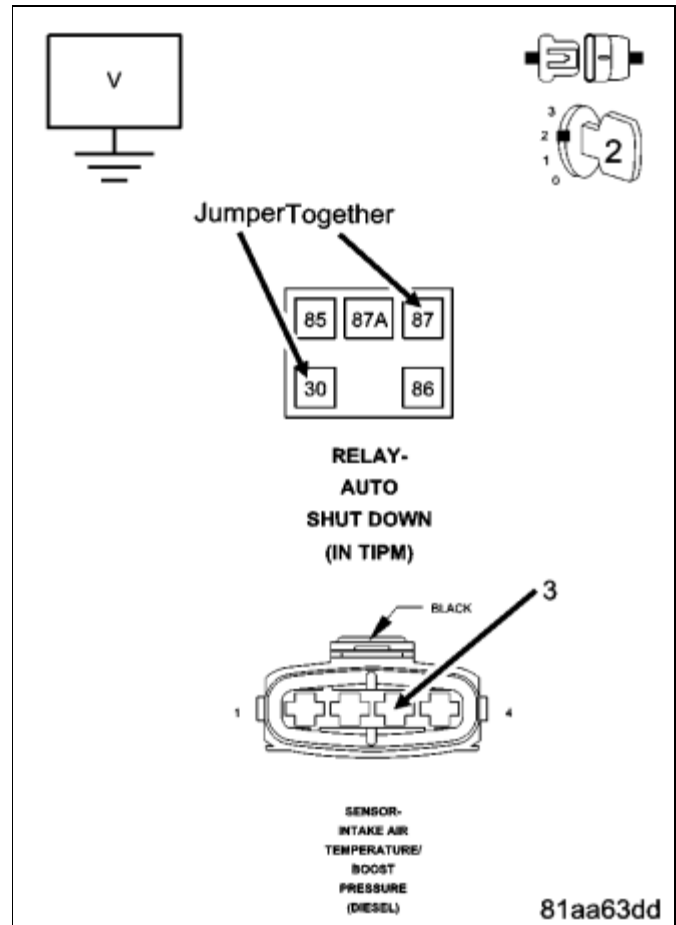
Is there any voltage present?

Yes

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K37) Boost Pressure Sensor Signal circuit in the Boost Pressure Sensor harness connector.

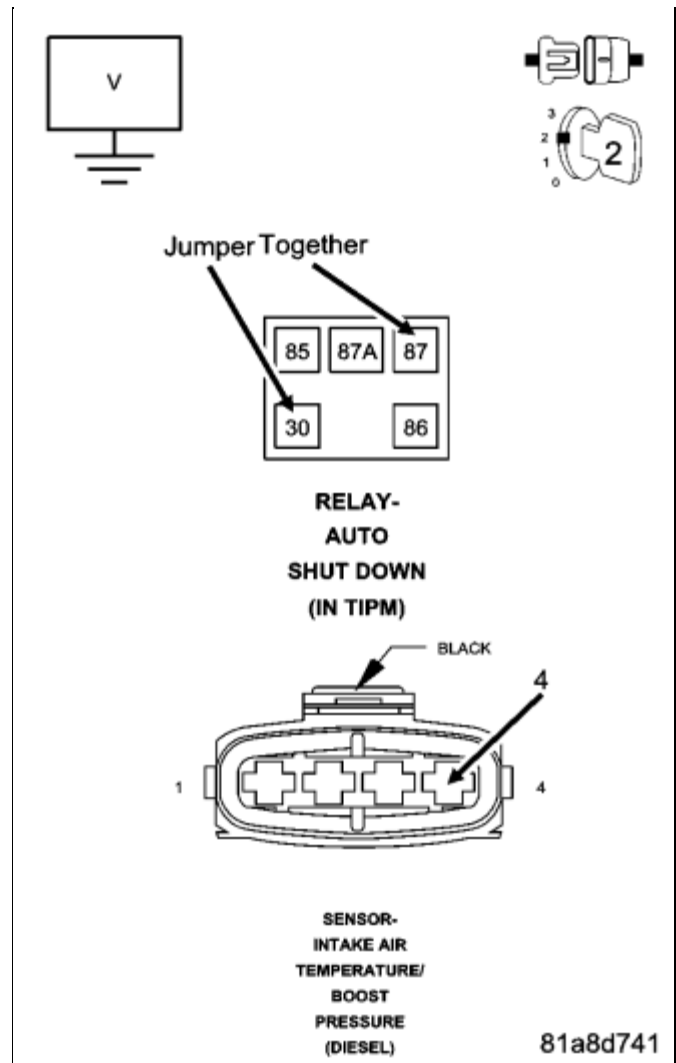
Is there any voltage present?

Yes

- Repair the (K37) Boost Pressure Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K656) Boost Pressure Sensor Ground circuit in the Boost Pressure Sensor harness connector.

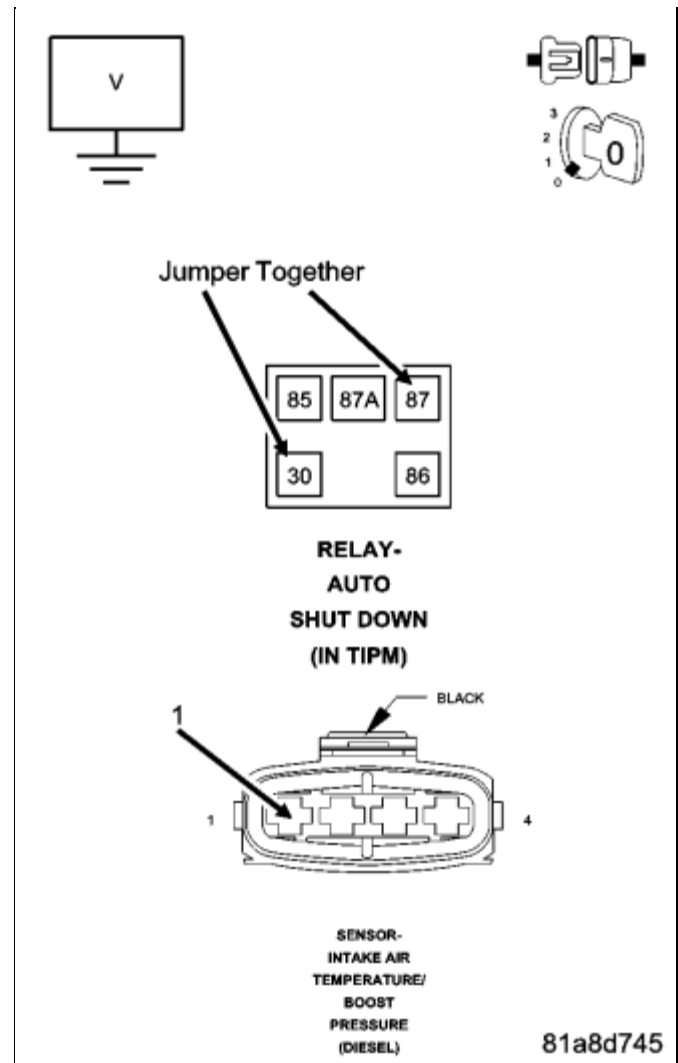
Is there any voltage present?

Yes

- Repair the (K656) Boost Pressure Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. BOOST PRESSURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.
Connect the Engine Control Module (ECM) harness connector.

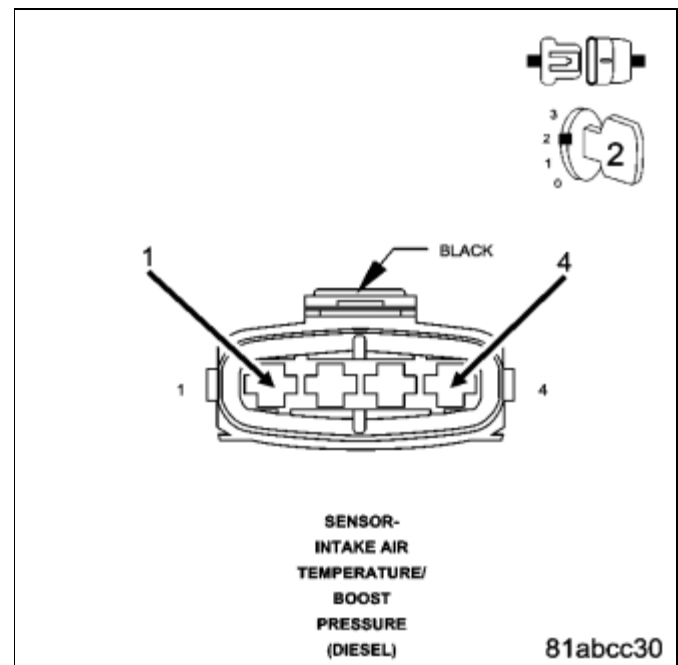
Connect a jumper wire between the (K656) Boost Pressure Sensor Ground circuit and the (K37) Boost Pressure Sensor Signal circuit in the Boost Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Boost Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Boost Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. (K37) BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K37) Boost Pressure Sensor Signal circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

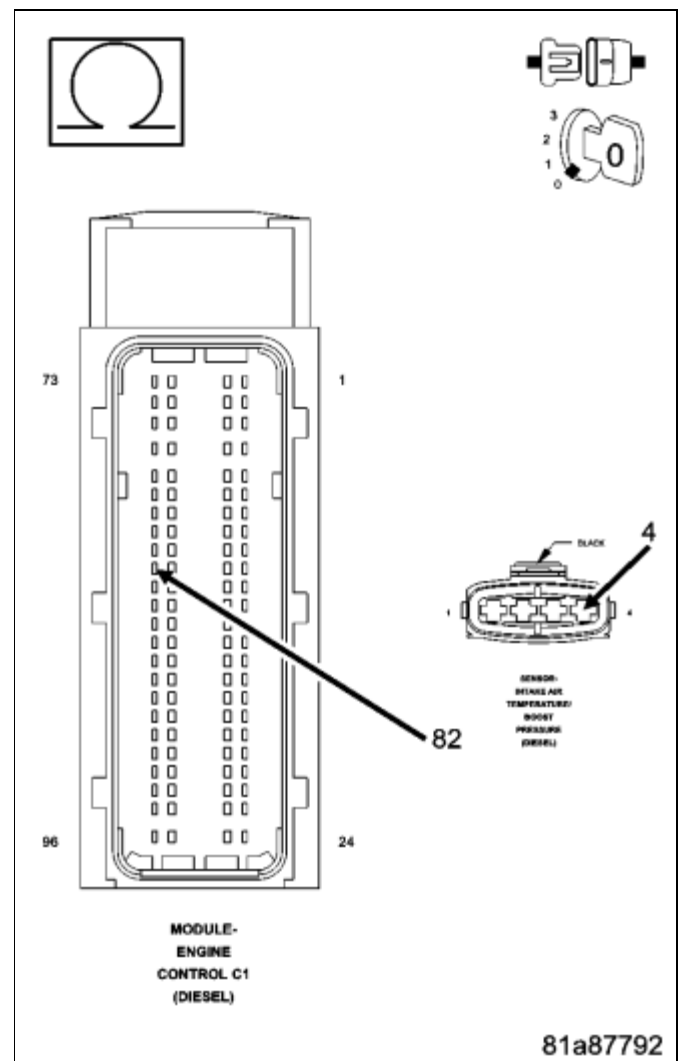
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K37) Boost Pressure Sensor Signal for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K656) BOOST PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K656) Boost Pressure Sensor Ground circuit between the Boost Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

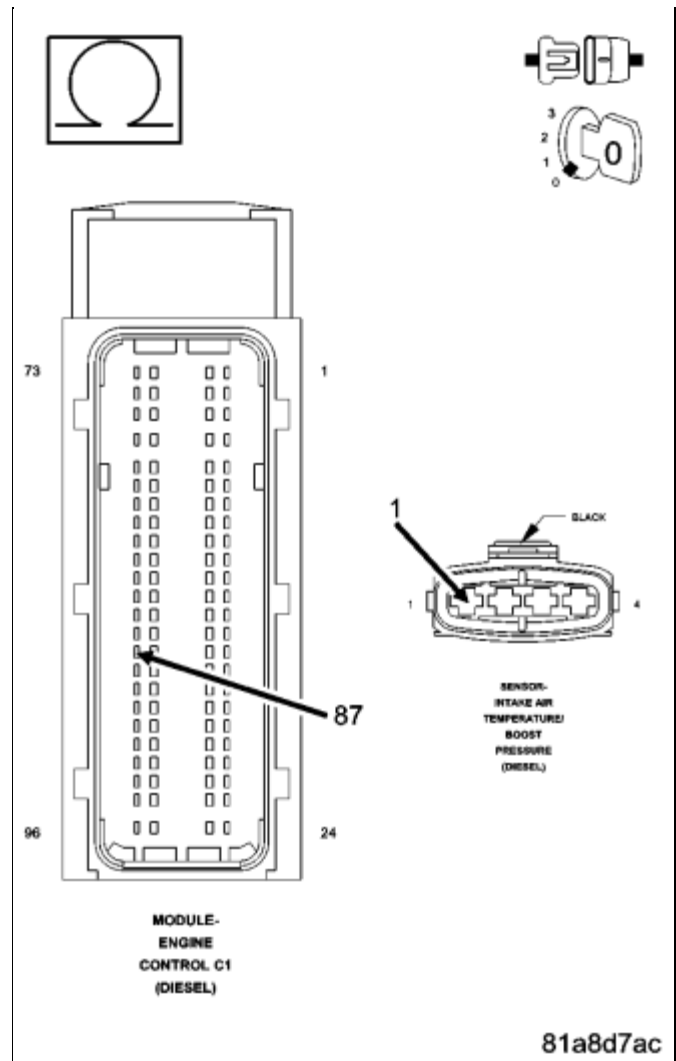
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K656) Boost Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors the Boost Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

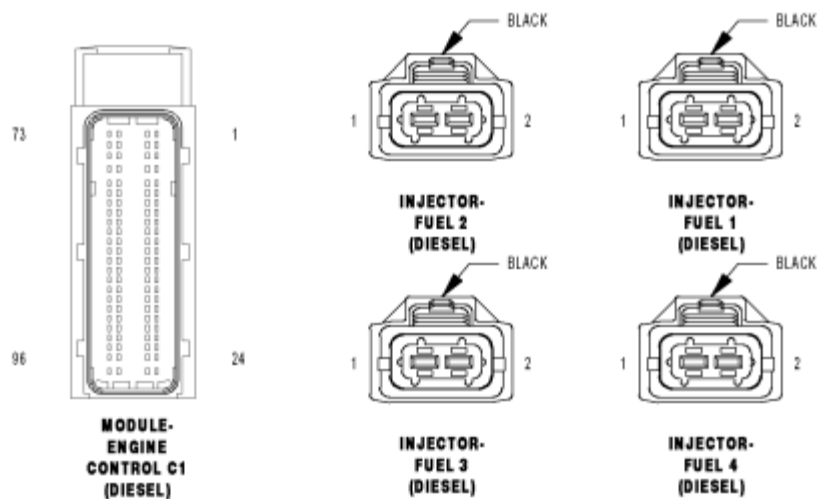
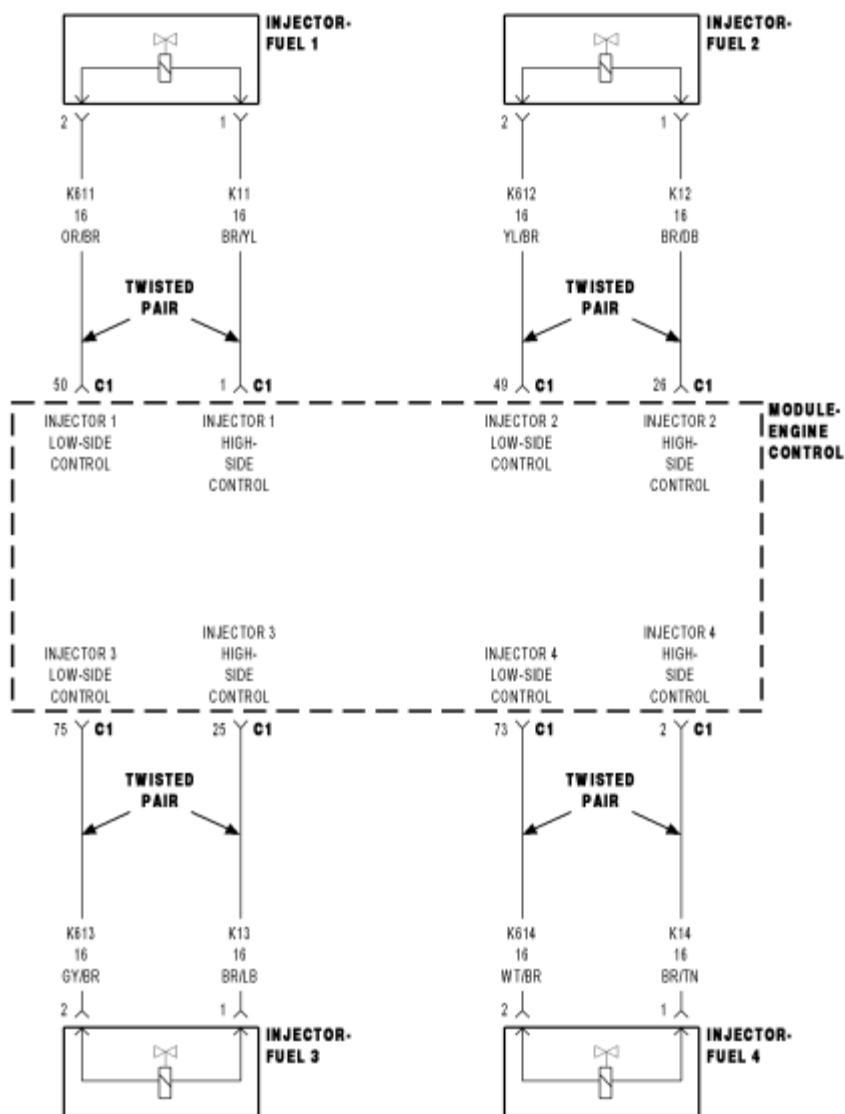
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0261-FUEL INJECTOR 1 CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.
 With the scan tool, erase the ECM DTCs.
 Attempt to start the engine and test drive the vehicle.
 With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect all of the Cylinder Fuel Injector harness connectors.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage of each Fuel Injector High-Side Control circuit.
 Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185k ohms (+/- 10%)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 1.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.

Turn the ignition on.

With the scan tool, clear all ECM DTC's.

Disconnect the Cylinder 1 Fuel Injector harness connector.

With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

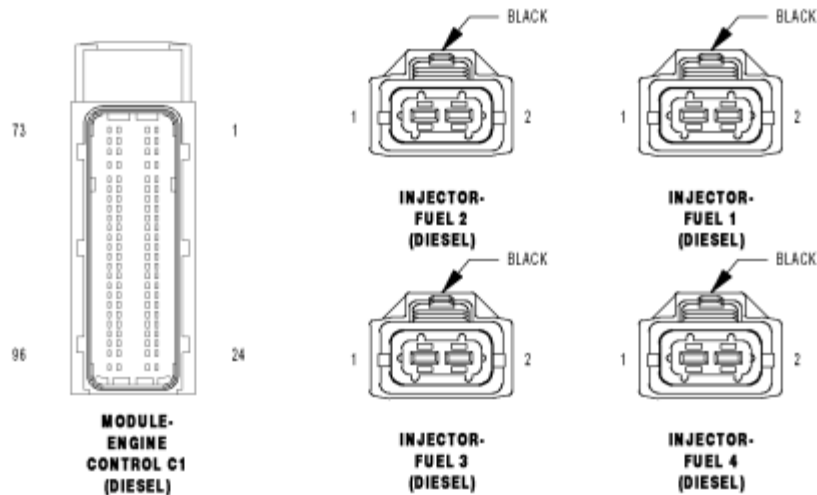
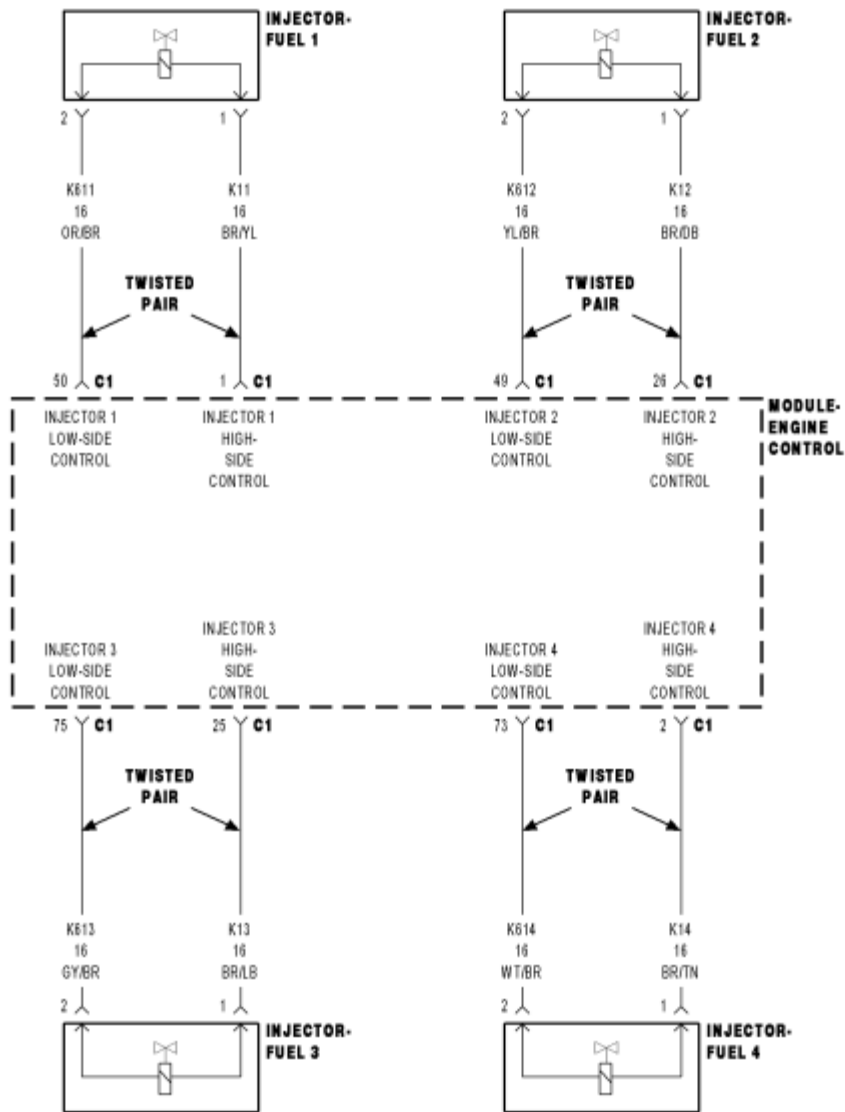
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0262-FUEL INJECTOR 1 CIRCUIT HIGH



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185k ohms (+/- 10%).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 1.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

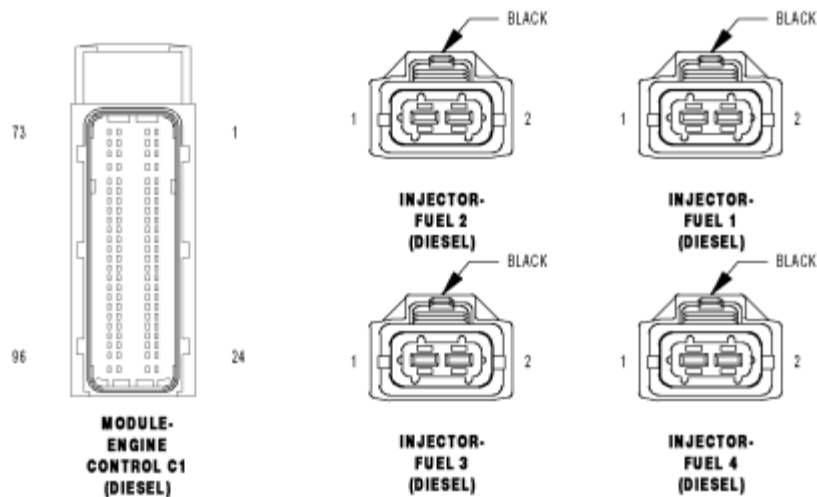
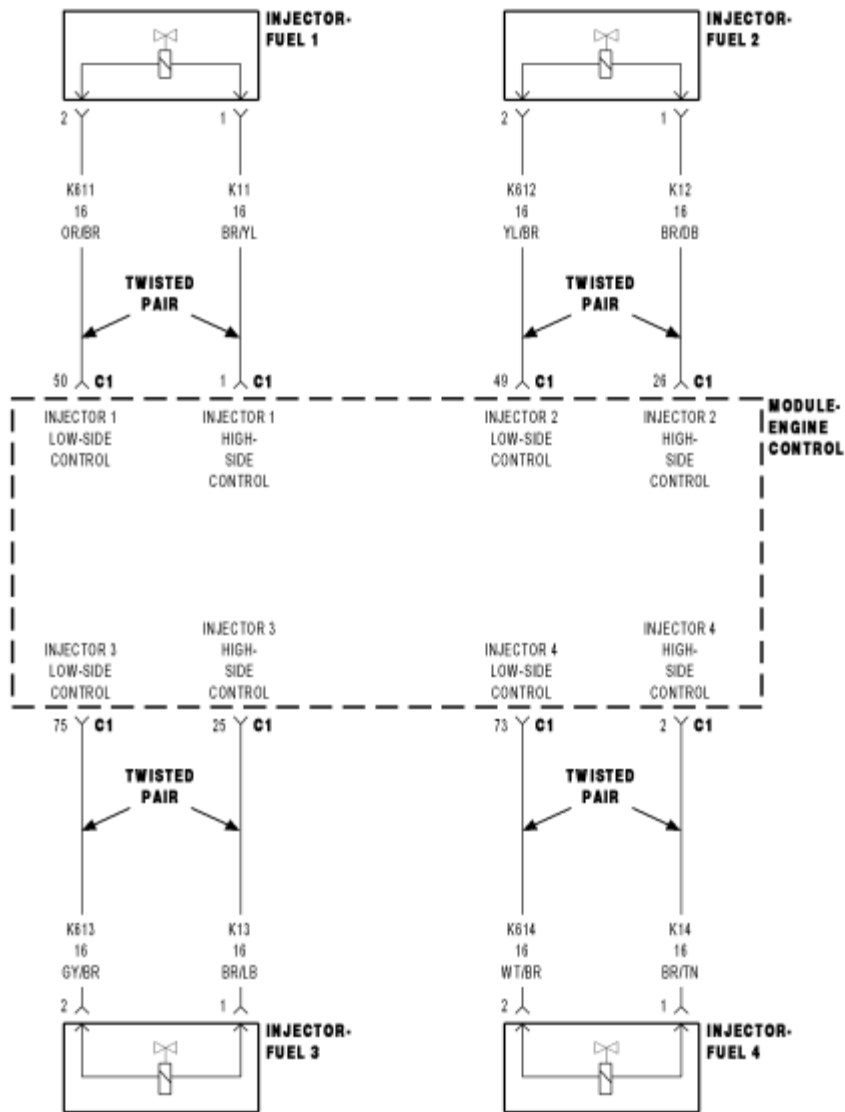
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0263-CYLINDER 1 CONTRIBUTION/BALANCE



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) is unable to stabilize fuel quantity in cylinder 1.

Possible Causes
ENGINE COMPRESSION
FUEL INJECTOR QUANTITY
FUEL SUPPLY CONTAMINATION
INJECTOR LEAKAGE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, erase ECM DTCs.
 Test drive the vehicle and attempt to duplicate the problem.
 With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

Is the fuel contaminated?

Yes

- Refer to the Service Information to remove and replace fuel throughout the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECKING THE SUPPLY SIDE FUEL DELIVERY SYSTEM

Refer to the symptom Checking the Fuel Supply System and test for proper Fuel pressure from the fuel tank to the high pressure Fuel Injection Pump.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, air in fuel system, failed fuel sending unit, contaminated fuel.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. ENGINE COMPRESSION

Ignition on, engine off.

Refer to the Service Information and perform the Cylinder Compression Test.

Is the cylinder compression within specification for all cylinders?

Yes

Go To [5](#)

No

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect each Fuel Injector harness connector.

Measure the resistance of each of the Fuel Injector Control circuits between the Fuel Injector and ECM harness connectors.

Is the resistance below 10.0 ohms for each measurement?

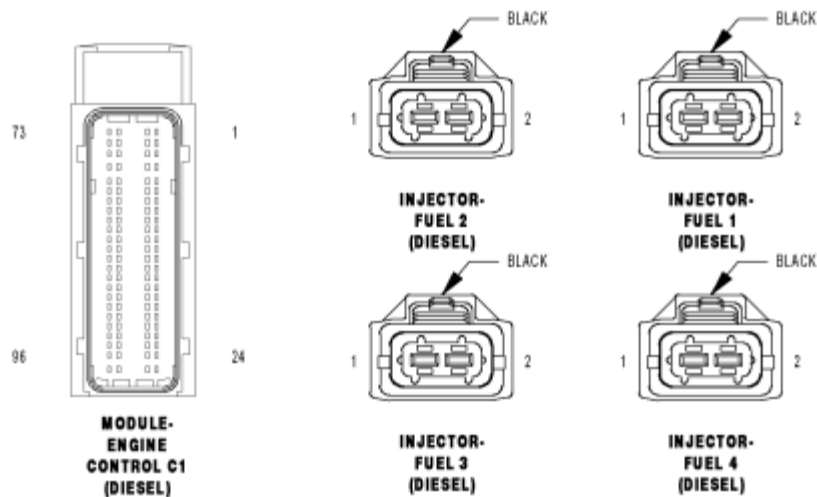
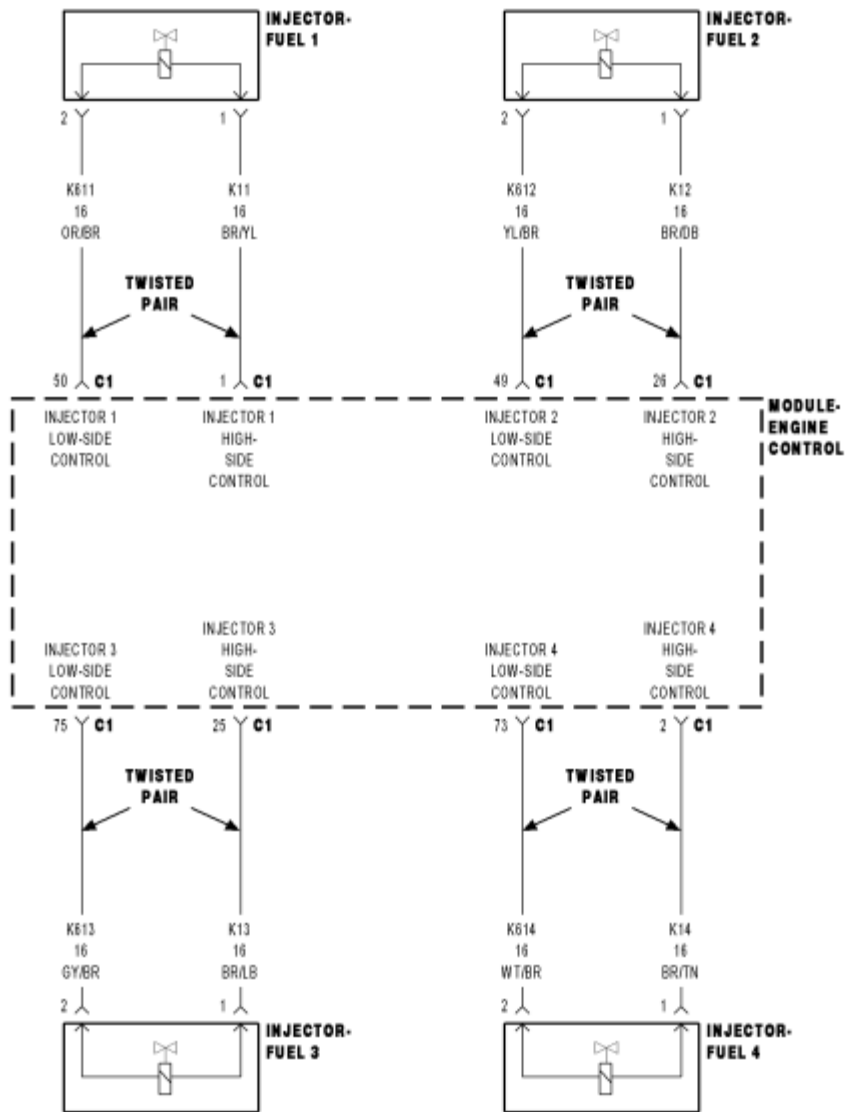
Yes

- Check the intake system for air leaks that could affect this cylinder. If found, repair intake system leak as necessary. If o.k. replace the Fuel Injector.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the Fuel Injector circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0264-FUEL INJECTOR 2 CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 2.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

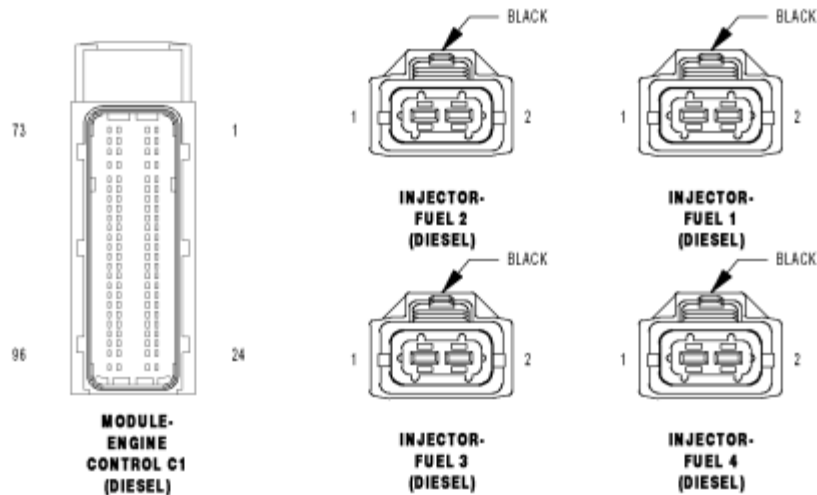
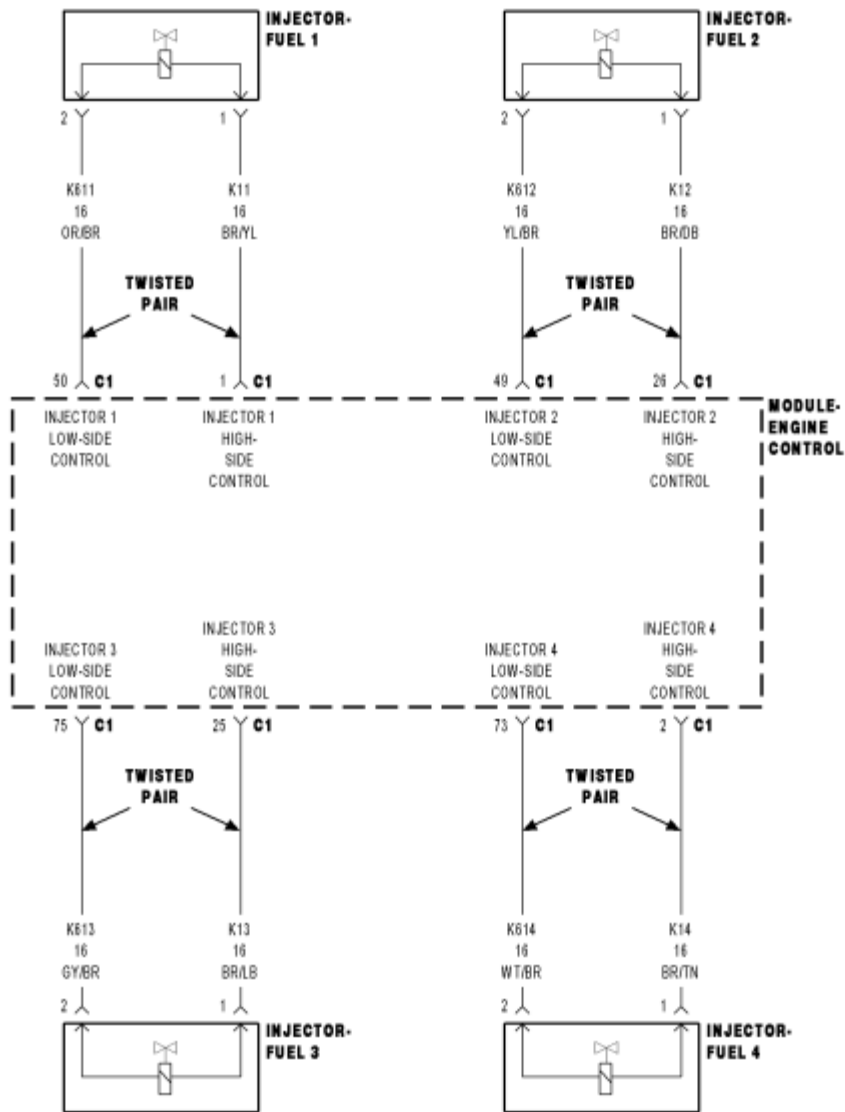
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0265-FUEL INJECTOR 2 CIRCUIT HIGH



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 2.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

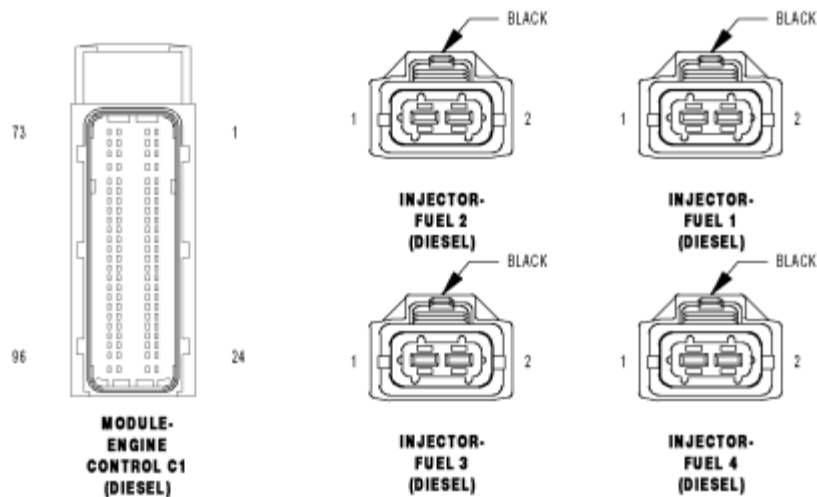
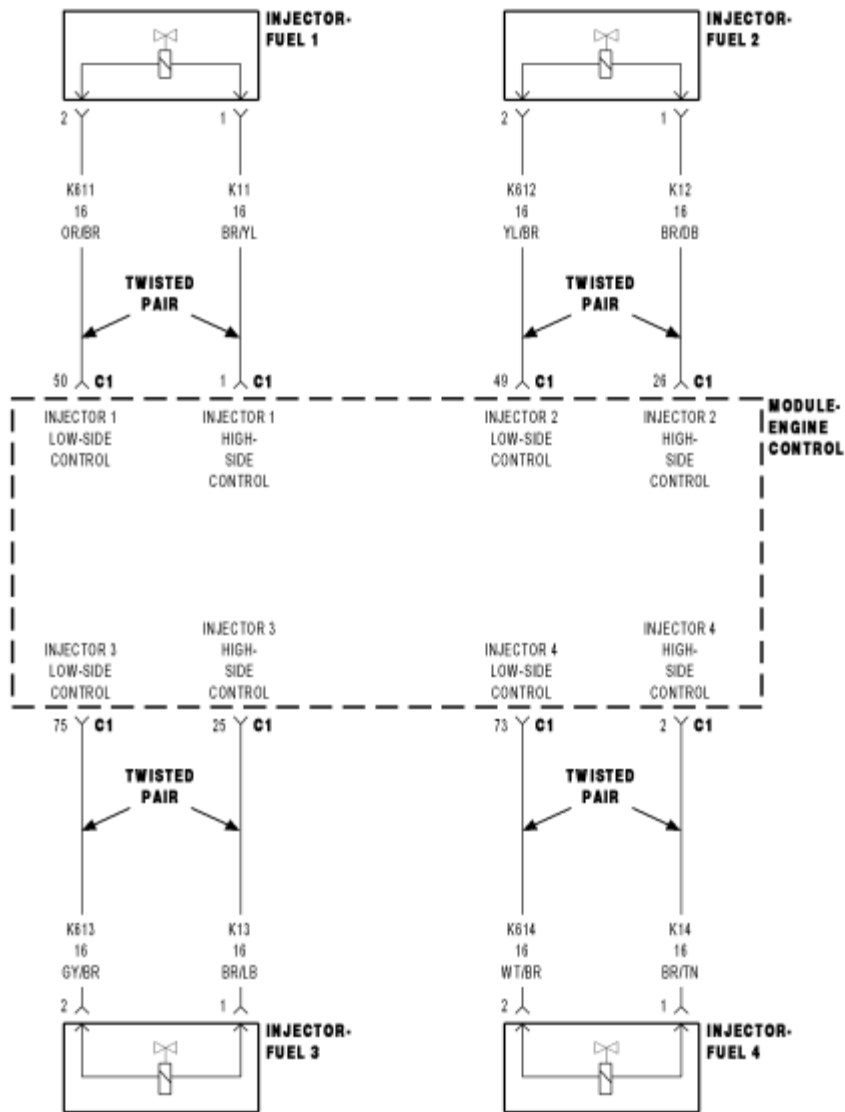
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0266-CYLINDER 2 CONTRIBUTION/BALANCE



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) is unable to stabilize fuel quantity in cylinder 2.

Possible Causes
ENGINE COMPRESSION
FUEL INJECTOR QUANTITY
FUEL SUPPLY CONTAMINATION
INJECTOR LEAKAGE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, erase ECM DTCs.
 Test drive the vehicle and attempt to duplicate the problem.
 With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

Is the fuel contaminated?

Yes

- Refer to the Service Information to remove and replace fuel throughout the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECKING THE SUPPLY SIDE FUEL DELIVERY SYSTEM

Refer to the symptom Checking the Fuel Supply System and test for proper Fuel pressure from the fuel tank to the high pressure Fuel Injection Pump.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, air in fuel system, failed fuel sending unit, contaminated fuel.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. ENGINE COMPRESSION

Ignition on, engine off.

Refer to the Service Information and perform the Cylinder Compression Test.

Is the cylinder compression within specification for all cylinders?

Yes

Go To [5](#)

No

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect each Fuel Injector harness connector.

Measure the resistance of each of the Fuel Injector Control circuits between the Fuel Injector and ECM harness connectors.

Is the resistance below 10.0 ohms for each measurement?

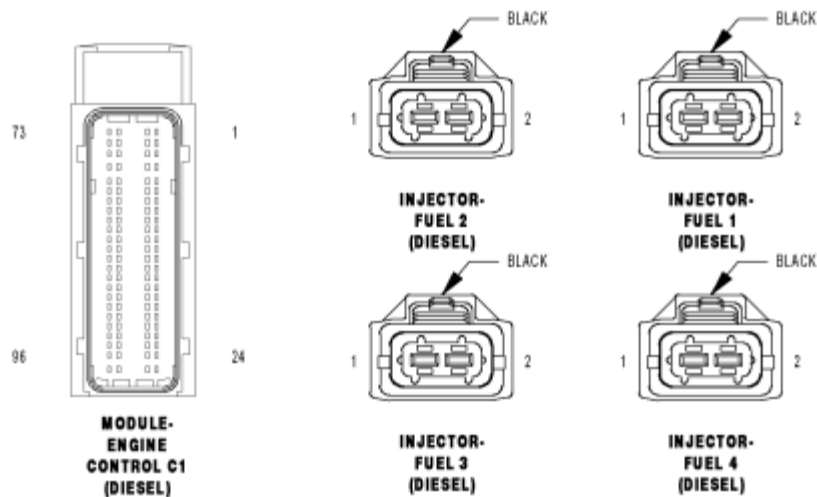
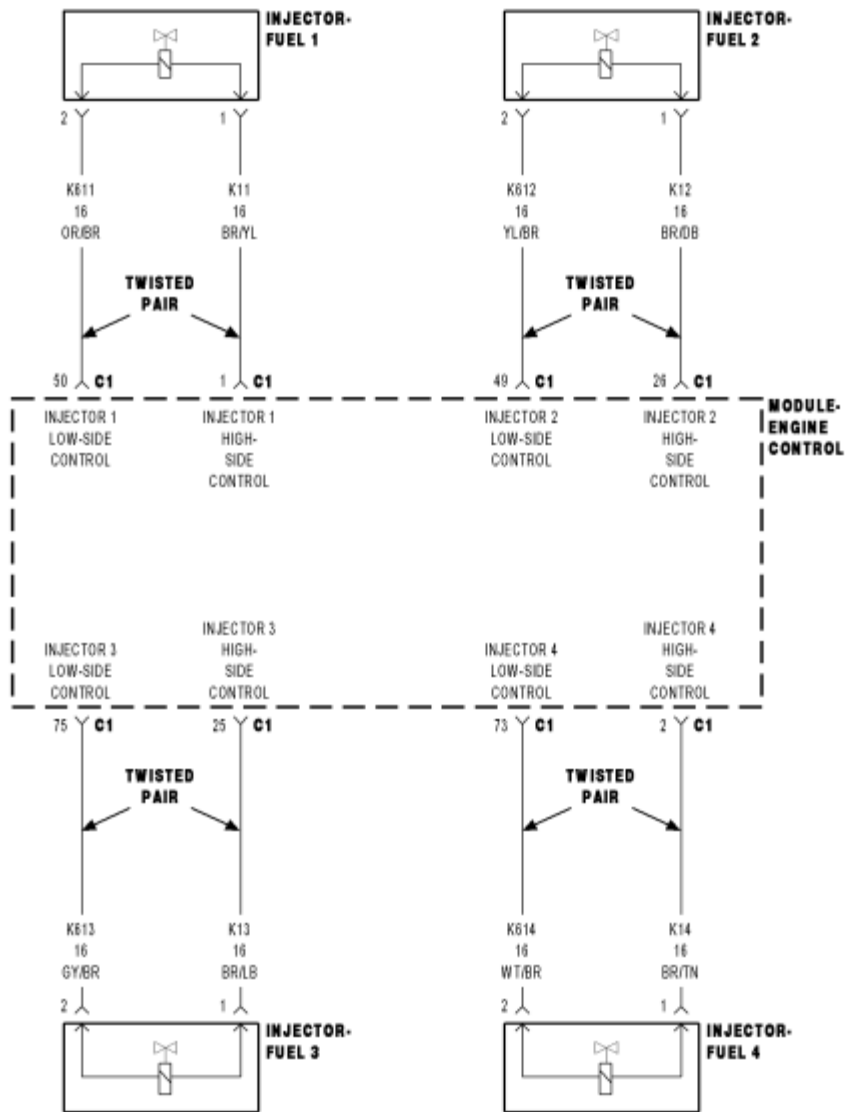
Yes

- Check the intake system for air leaks that could affect this cylinder. If found, repair intake system leak as necessary. If o.k. replace the Fuel Injector.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the Fuel Injector circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0267-FUEL INJECTOR 3 CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185k ohms (+/- 10%).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 3.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

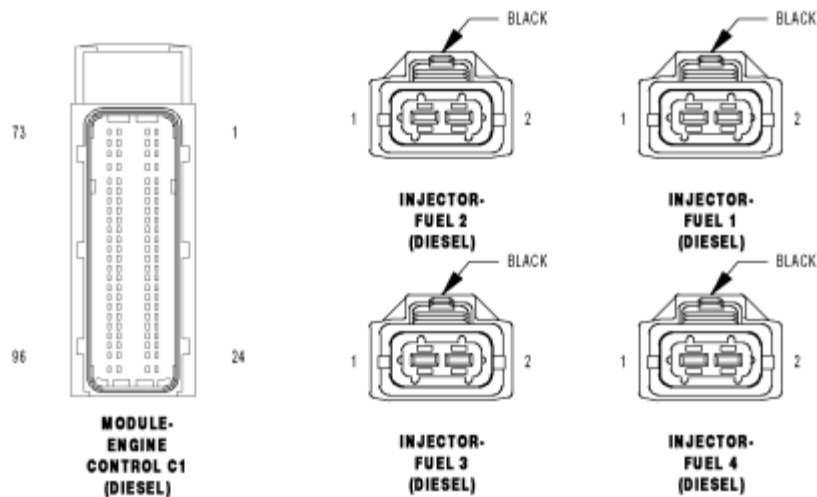
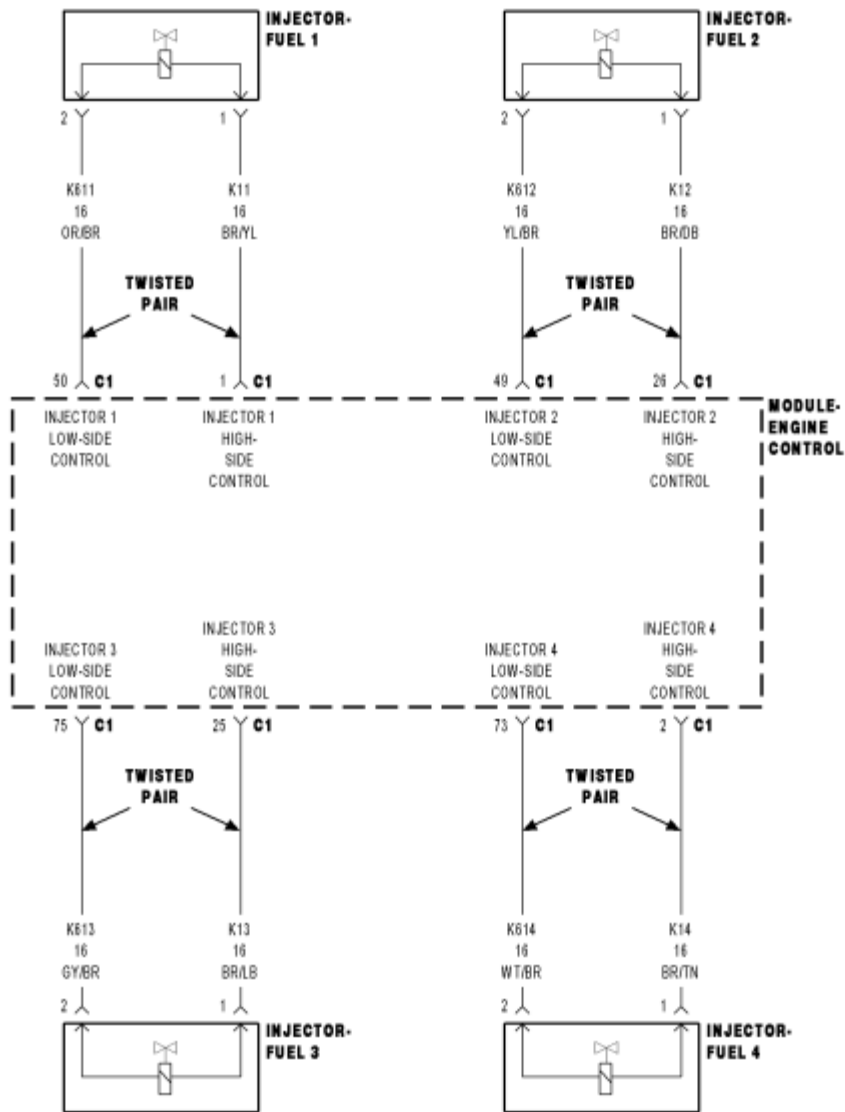
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0268-FUEL INJECTOR 3 CIRCUIT HIGH



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185K ohms (+/- 10%).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 3.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

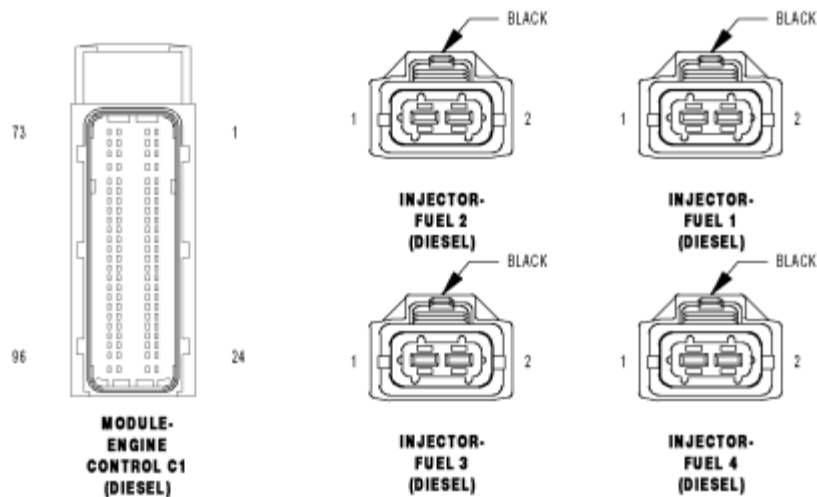
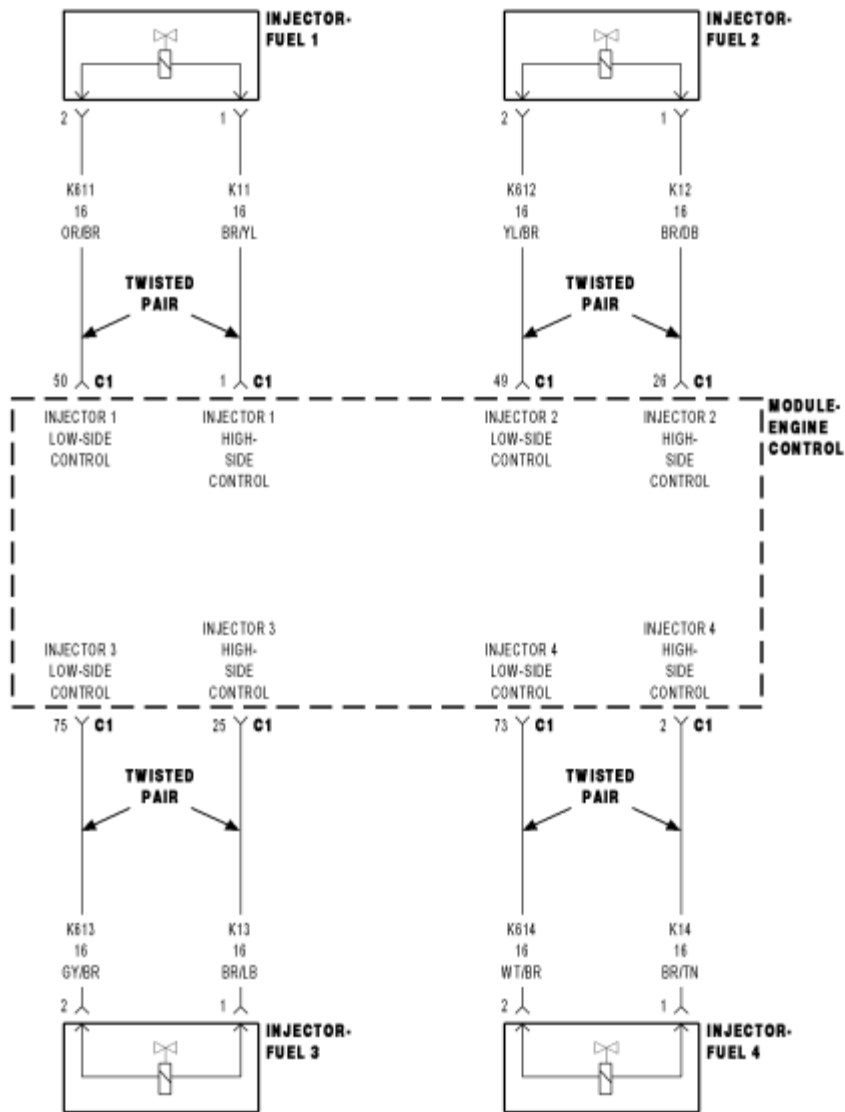
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0269-CYLINDER 3 CONTRIBUTION/BALANCE



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) is unable to stabilize fuel quantity in cylinder 3.

Possible Causes
ENGINE COMPRESSION
FUEL INJECTOR QUANTITY
FUEL SUPPLY CONTAMINATION
INJECTOR LEAKAGE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, erase ECM DTCs.
 Test drive the vehicle and attempt to duplicate the problem.
 With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

Is the fuel contaminated?

Yes

- Refer to the Service Information to remove and replace fuel throughout the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECKING THE SUPPLY SIDE FUEL DELIVERY SYSTEM

Refer to the symptom Checking the Fuel Supply System and test for proper Fuel pressure from the fuel tank to the high pressure Fuel Injection Pump.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, air in fuel system, failed fuel sending unit, contaminated fuel.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. ENGINE COMPRESSION

Ignition on, engine off.

Refer to the Service Information and perform the Cylinder Compression Test.

Is the cylinder compression within specification for all cylinders?

Yes

Go To [5](#)

No

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect each Fuel Injector harness connector.

Measure the resistance of each of the Fuel Injector Control circuits between the Fuel Injector and ECM harness connectors.

Is the resistance below 10.0 ohms for each measurement?

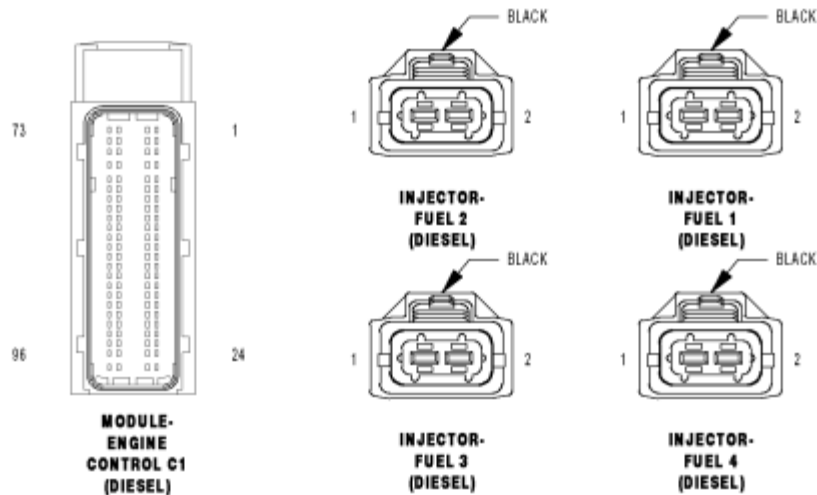
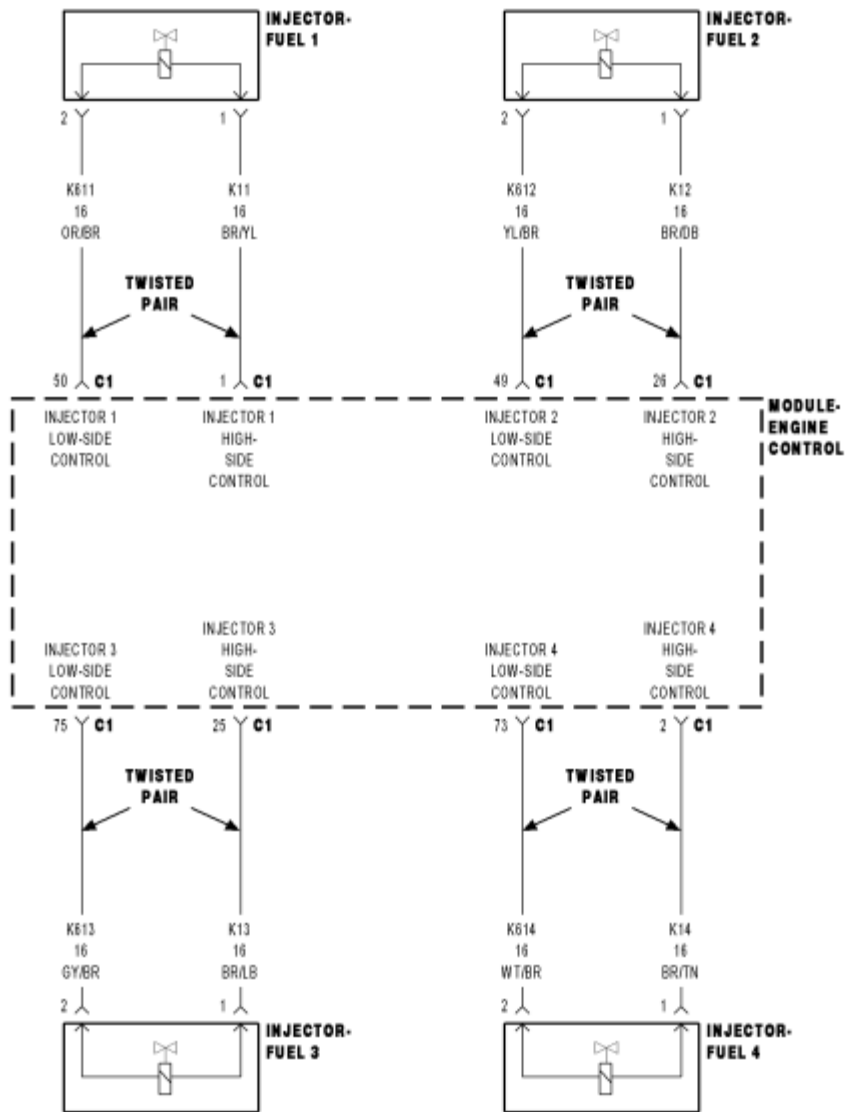
Yes

- Check the intake system for air leaks that could affect this cylinder. If found, repair intake system leak as necessary. If o.k. replace the Fuel Injector.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the Fuel Injector circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0270-FUEL INJECTOR 4 CIRCUIT LOW



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185K ohms (+/- 10%).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 4.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

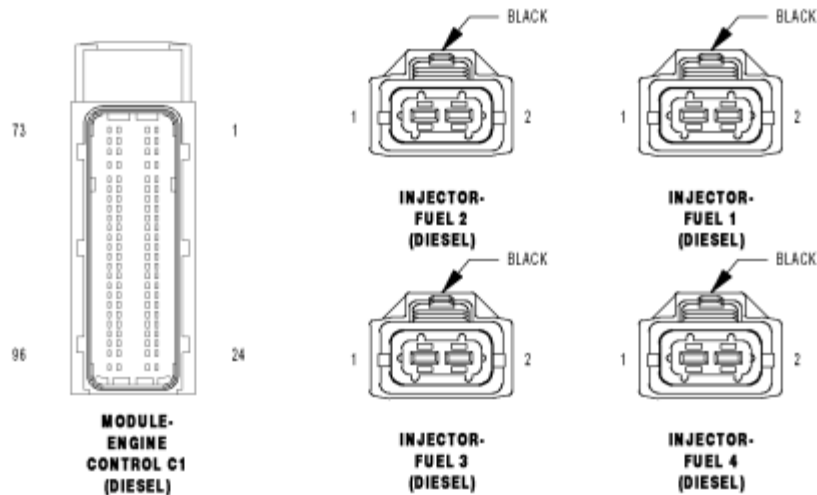
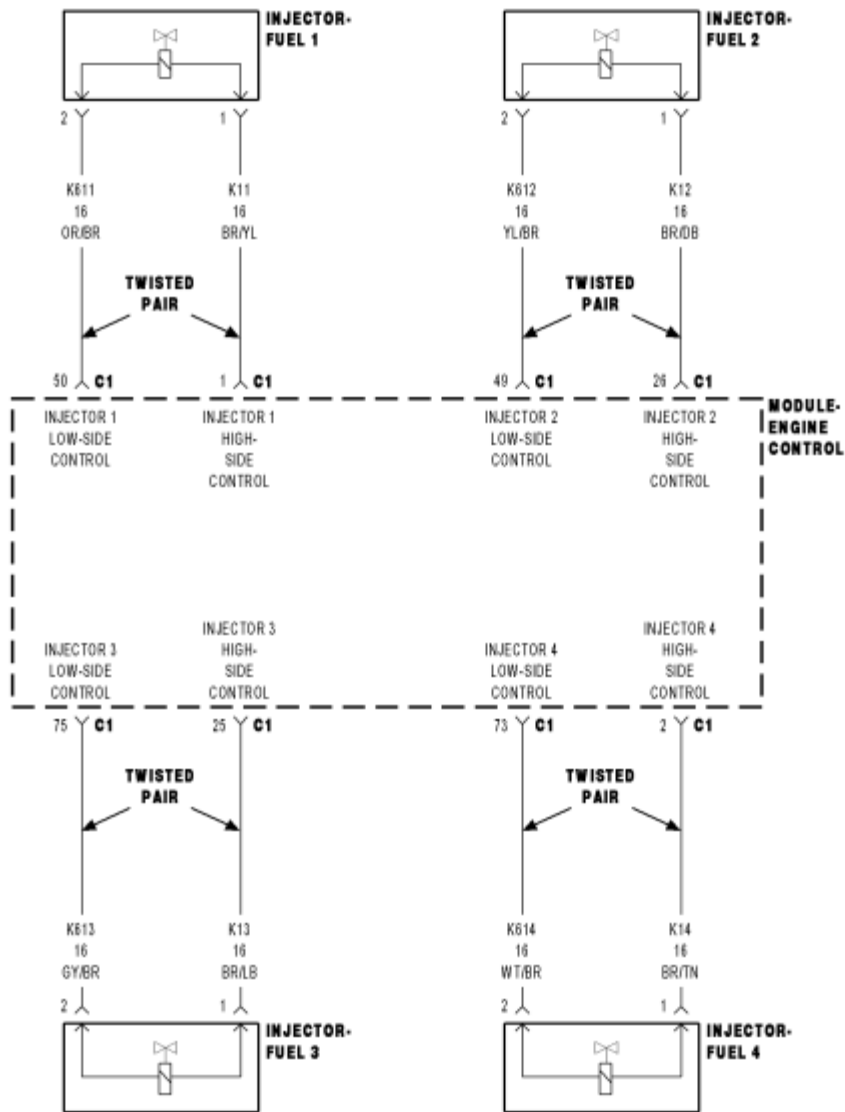
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0271-FUEL INJECTOR 4 CIRCUIT HIGH



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For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the engine cranking or running.

- **Set Condition:**

The ECM detects a fault on a Fuel Injector Control circuit.

Possible Causes
ENGINE CONTROL MODULE
INTERMITTENT CONDITION
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR CIRCUITS SHORTED TOGETHER
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (REFER TO 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is the voltage above 1.0 volt for any of the measurements?

Yes

- Repair the appropriate Fuel Injector Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [7](#)

No

- Repair the appropriate Fuel Injector Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR INTERNAL SHORT TO GROUND

Measure the resistance between either terminal of each Fuel Injector and ground.

Is the resistance above 500k ohms for each measurement?

Yes

- Go to [8](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure above 500k ohms to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. CHECK CYLINDER FUEL INJECTOR RESISTANCE

Measure the resistance of each Fuel Injector (measure across both terminals of the injector).

Is the resistance between 150k and 210k ohms?

Yes

- Go To [9](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Fuel Injector that did not measure 185k ohms (+/- 10%).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. MULTIPLE CYLINDER FUEL INJECTOR DTC'S

Were there multiple Cylinder Fuel Injector DTC's set in the ECM?

Yes

- Go to [10](#)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Cylinder Fuel Injector 4.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. CYLINDER FUEL INJECTOR

Reconnect all harness connectors.
Turn the ignition on.

With the scan tool, clear all ECM DTC's.
Disconnect the Cylinder 1 Fuel Injector harness connector.
With the scan tool, read the ECM DTC's.

NOTE: The continuing setting of multiple DTC's indicates that the disconnected injector is not the cause of these faults.

NOTE: If multiple DTC's did not reset after disconnecting a single injector, replace the injector that was disconnected. In this case the lack of multiple DTC's setting indicates that the disconnected injector is the cause of these faults.

Choose the correct result below.

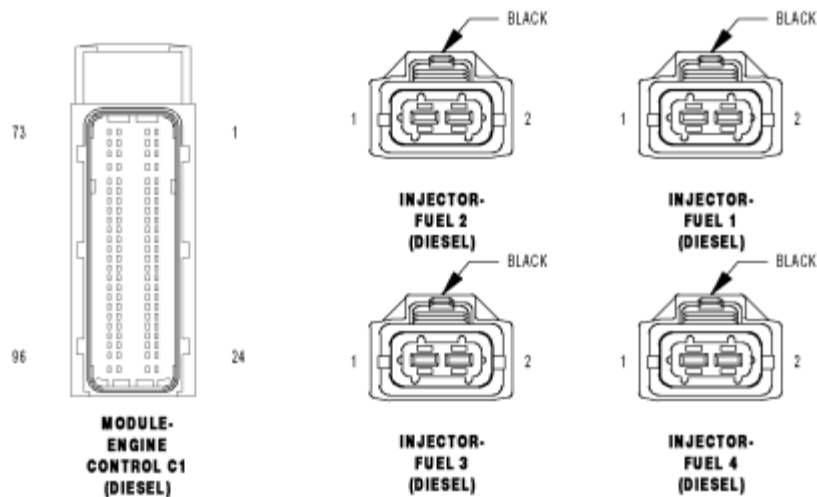
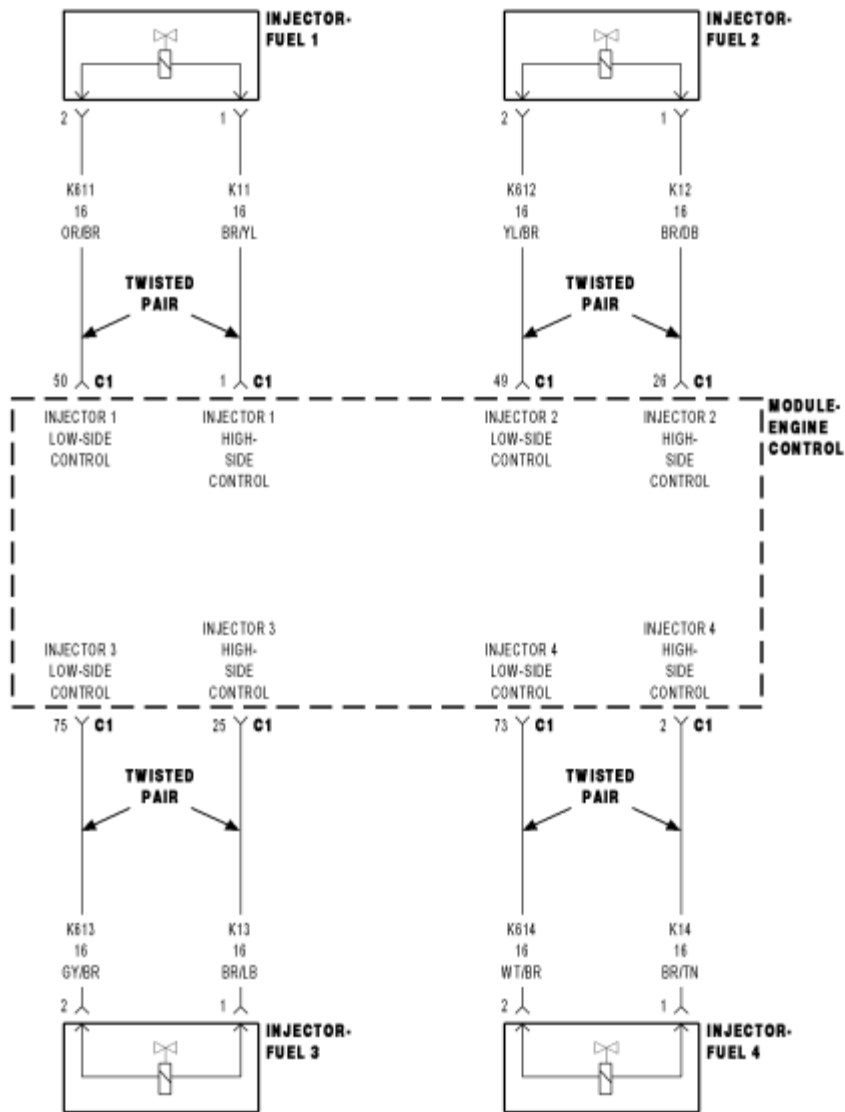
The ECM set multiple Cylinder Injector DTC's.

- Reconnect the disconnected Injector harness connector and repeat test by disconnecting another injector until multiple DTC's are not set.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

The ECM set only a DTC for the disconnected Cylinder Injector

- Replace the Cylinder Fuel Injector that was disconnected.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0272-CYLINDER 4 CONTRIBUTION/BALANCE



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For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) is unable to stabilize fuel quantity in cylinder 4.

Possible Causes
ENGINE COMPRESSION
FUEL INJECTOR QUANTITY
FUEL SUPPLY CONTAMINATION
INJECTOR LEAKAGE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, erase ECM DTCs.
 Test drive the vehicle and attempt to duplicate the problem.
 With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

Is the fuel contaminated?

Yes

- Refer to the Service Information to remove and replace fuel throughout the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECKING THE SUPPLY SIDE FUEL DELIVERY SYSTEM

Refer to the symptom Checking the Fuel Supply System and test for proper Fuel pressure from the fuel tank to the high pressure Fuel Injection Pump.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, air in fuel system, failed fuel sending unit, contaminated fuel.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. ENGINE COMPRESSION

Ignition on, engine off.

Refer to the Service Information and perform the Cylinder Compression Test.

Is the cylinder compression within specification for all cylinders?

Yes

Go To [5](#)

No

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR CIRCUIT RESISTANCE

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect each Fuel Injector harness connector.

Measure the resistance of each of the Fuel Injector Control circuits between the Fuel Injector and ECM harness connectors.

Is the resistance below 10.0 ohms for each measurement?

Yes

- Check the intake system for air leaks that could affect this cylinder. If found, repair intake system leak as necessary. If o.k. replace the Fuel Injector.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the Fuel Injector circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0299-TURBOCHARGER UNDERBOOST CONDITION

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running and the ECM attempting to govern turbocharger boost pressure.

◦ **Set Condition:**

The Boost Pressure Sensor indicates actual turbocharger boost is less than the ECM setpoint for engine boost for 0.83 second.

Possible Causes
INTERMITTENT DTC
CLOGGED AIR FILTER
INTAKE AIR RESTRICTION
INTAKE AIR LEAK

BOOST PRESSURE SERVO MOTOR
TURBOCHARGER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle.

With the scan tool, select View DTCs.

NOTE: If there are any EGR related DTC's, repair the EGR DTC's before continuing with this test.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK THE AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

Were any of these problems found?

Yes

- Replace the Air Filter element
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK FOR INTAKE SYSTEM RESTRICTIONS

NOTE: Damaged, restricted or poorly connected intake and turbocharger related tubes can cause this DTC to set.

Turn the ignition off.

Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections.

Inspect the Charge Air Cooler hoses/tubes and connections.

Inspect the EGR Air Flow Control Valve to ensure the valve is not stuck in the closed position.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. CHECK FOR INTAKE SYSTEM AIR LEAKS

Remove the Crankcase Vent Heater.

Remove the Mass Air Flow Sensor from the turbocharger inlet tube.

Seal off and/or plug the turbocharger inlet tube where the MAF sensor was removed.

Connect smoke machine 84-04 to the Crankcase Vent Heater port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. REPLACE THE BOOST PRESSURE SERVO MOTOR

Replace the Boost Pressure Servo Motor in accordance with the Service Information.

NOTE: Ensure the Boost Pressure Servo Motor and ECM harness connectors are connected.

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

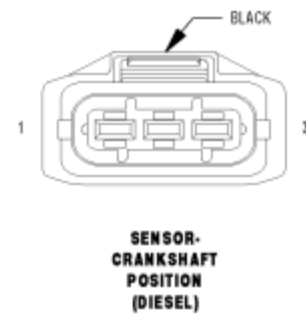
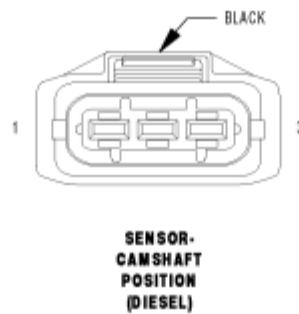
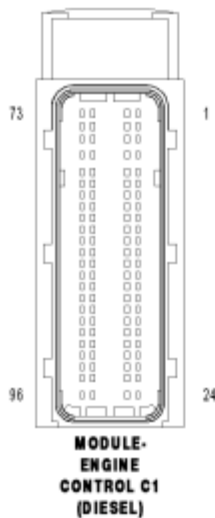
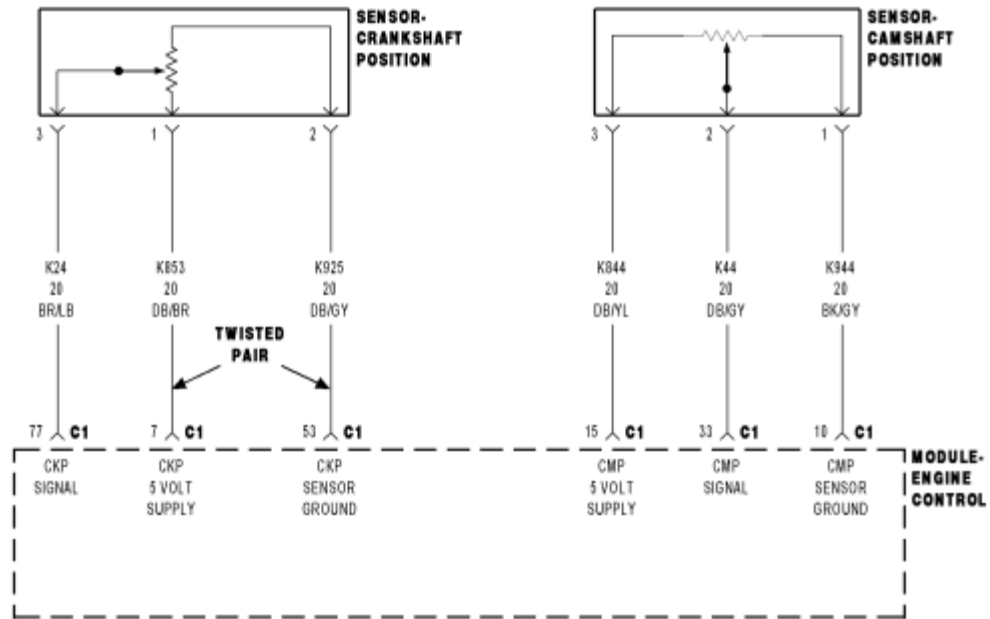
Yes

- Replace the Turbocharger assembly in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT



01a94782

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Crankshaft Position (CKP) Sensor is a hall effect type sensor. The sensor produces a 5-volt digital signal (square wave). The ECM provides a 5-volt supply, 5-volt sensor signal and ground to the CKP Sensor. The sensor is positioned opposite a magnetic ring at the rear of the crankshaft. The magnetic ring contains internal magnetic strips (electric teeth) that act on the hall-effect switch causing the digital switching of the sensor signal from high (5-volts) to low (0 volts).

- **When Monitored:**

With the engine cranking or running

- **Set Condition:**

The Engine Control Module (ECM) does not receive a signal from the Crankshaft Position Sensor when the Camshaft Position Sensor indicates engine rpm.

Possible Causes
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN
(K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CHECKING (K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT
DAMAGED CKP SENSOR OR CRANKSHAFT
ECM
(K925) CKP SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
(K24) CKP SENSOR SIGNAL CIRCUIT OPEN
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
CRANKSHAFT POSITION SENSOR
(K925) CKP SENSOR GROUND CIRCUIT OPEN
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE -

DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. CHECKING (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the Crankshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K24) CKP Sensor Signal circuit at the CKP Sensor harness connector.

Select the appropriate voltage reading.

Voltage is above 5.4 volts.

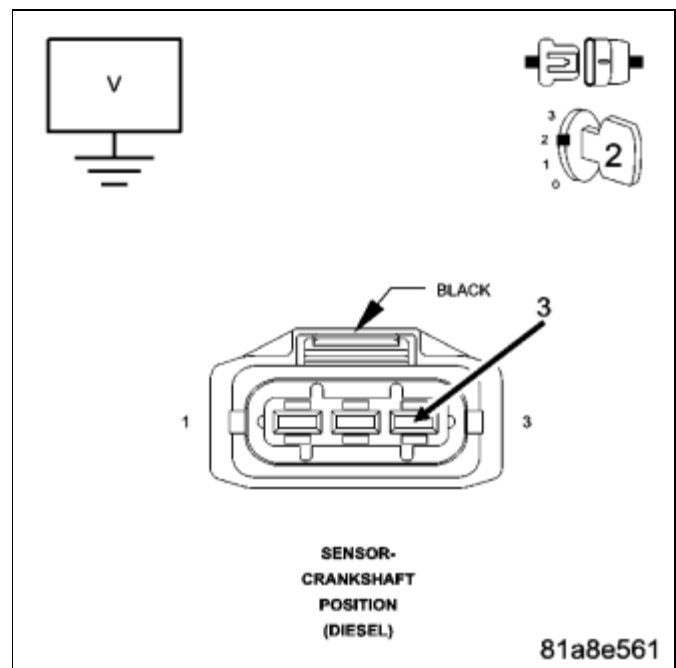
- Go To [4](#)

Voltage is between 4.7 and 5.4 volts.

- Go To [5](#)

Voltage is below 4.7 volts.

- Go To [12](#)



4. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (K24) CKP Sensor Signal circuit at the CKP Sensor harness connector.

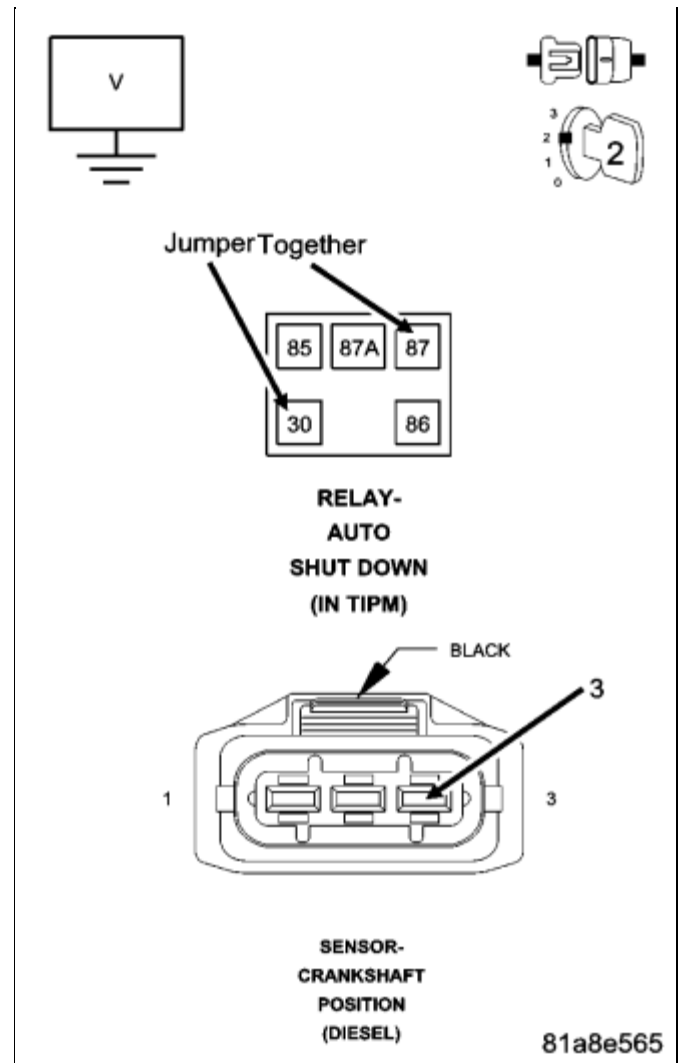
Is the voltage below 1.0 volt?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K24) Crankshaft Position Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. CHECKING (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT

Measure the voltage of the (K853) CKP Sensor 5-Volt Supply circuit at the CKP Sensor harness connector.

Select the appropriate voltage reading.

Voltage is above 5.4 volts.

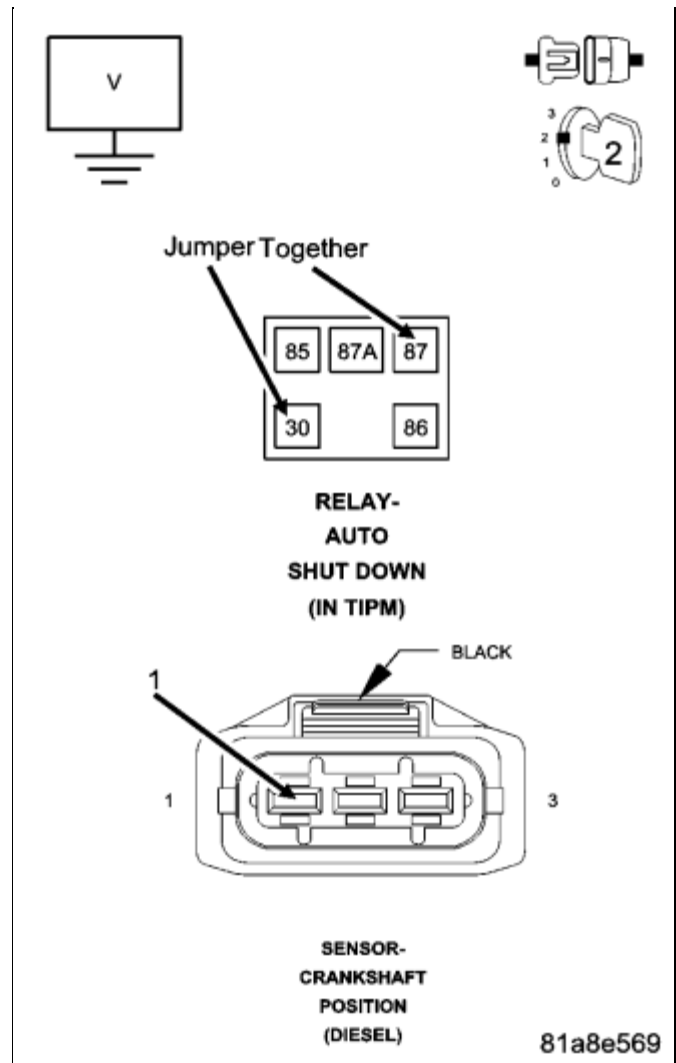
- Repair the (K853) CKP 5-Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Voltage is between 4.7 and 5.4 volts.

- Go To [6](#)

Voltage is below 4.7 volts.

- Go To [9](#)



6. (K925) CRANKSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECT Sensor harness connector.
 Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.
 Connect the other end of the jumper wire to the (K925) CKP Sensor Ground circuit in the Crankshaft Position Sensor harness connector.
 Turn the ignition on.
 With the scan tool in Engine, Sensors, read the Engine Coolant Temp volts.

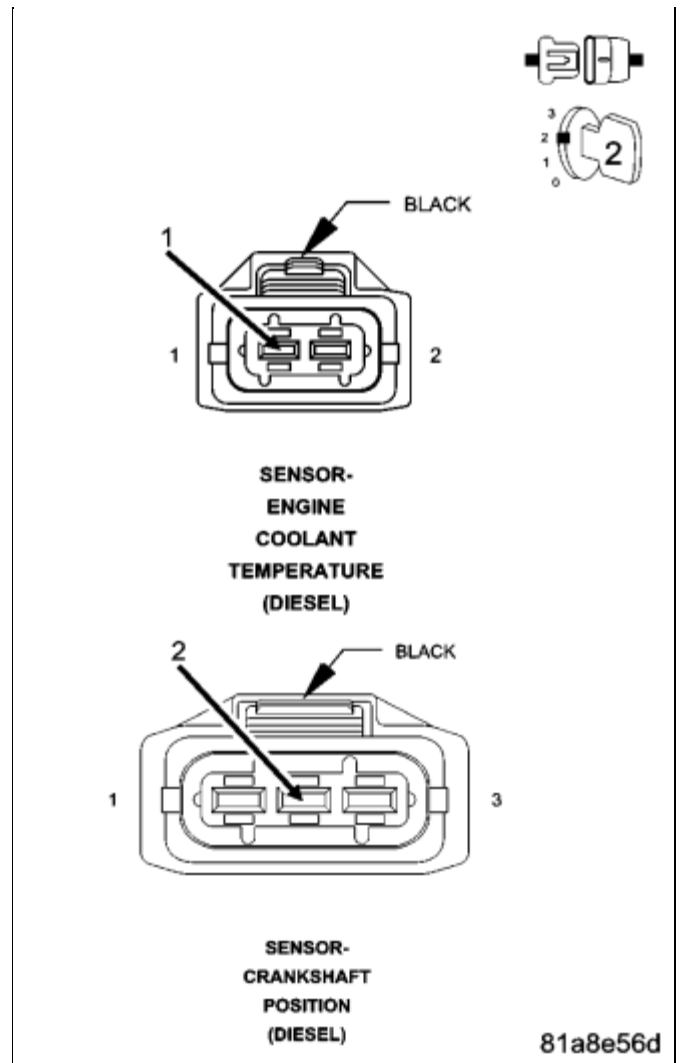
Is the voltage below 0.5 volt?

Yes

- Go To [8](#)

No

- Go To [7](#)



7. (K925) CRANKSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K925) CKP Sensor Ground circuit between the CKP Sensor harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

Yes

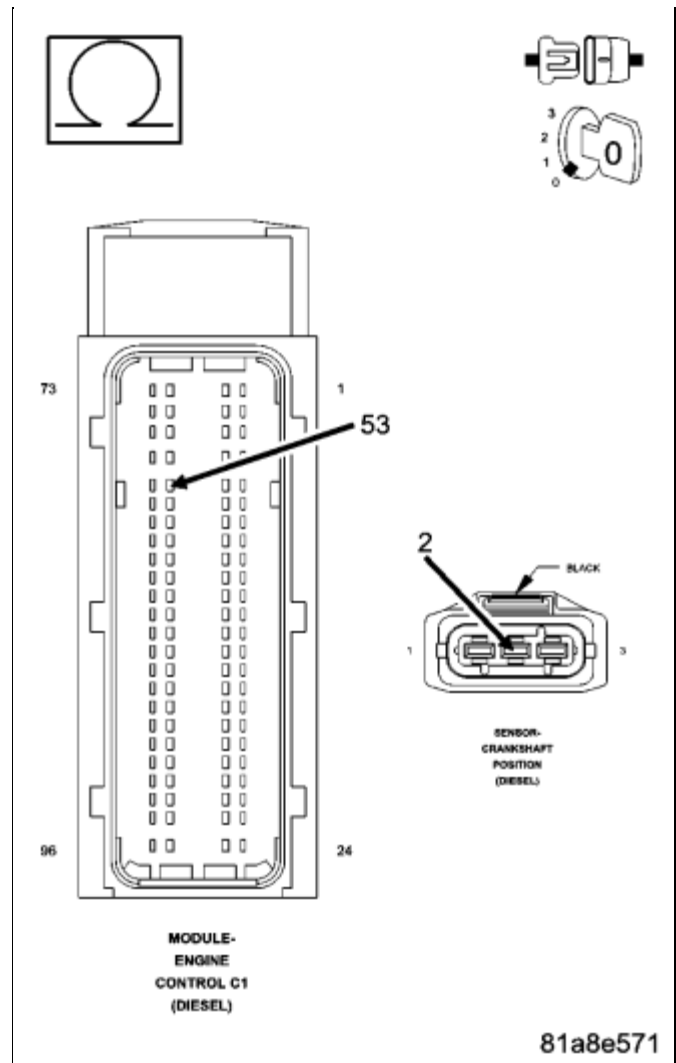
- Replace and program the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K925) CKP Sensor Ground circuit for an

open.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. DAMAGED CRANKSHAFT POSITION SENSOR OR CRANKSHAFT

Turn the ignition off.

Remove the CKP Sensor.

Inspect the CKP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the Crankshaft magnetic ring for conditions such as damage, or debris.

Is there any evidence of these conditions?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Crankshaft Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K853) CKP Sensor 5-Volt Supply circuit between the ECM harness connector and the CKP Sensor harness connector.

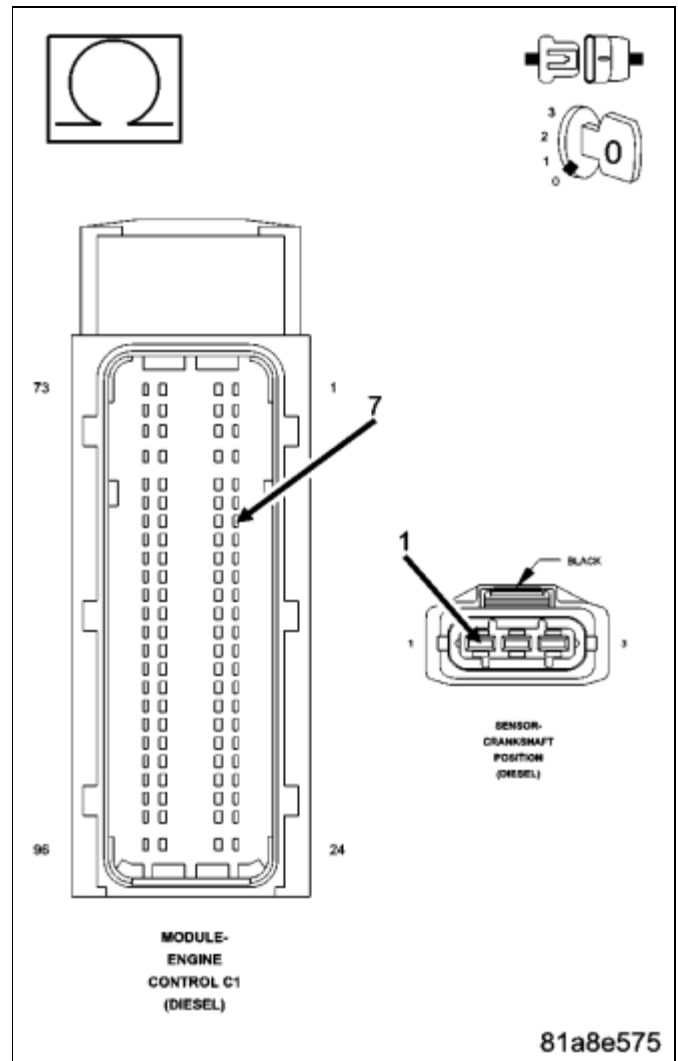
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K853) CKP Sensor 5-Volt Supply circuit at the CKP Sensor harness connector.

Is the resistance above 1000 ohms?

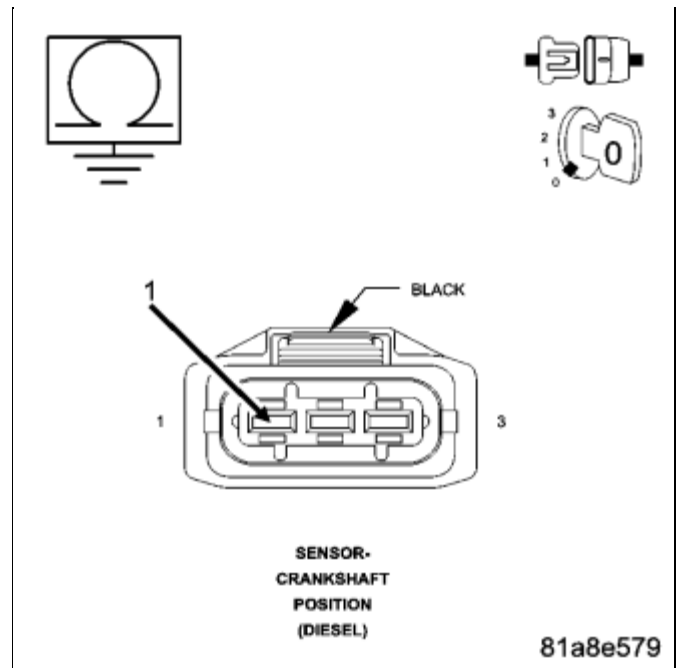
Yes

- Go To [11](#)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



11. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Measure the resistance between the (K853) CKP Sensor 5-Volt Supply circuit and the (K925) CKP Sensor Ground circuit at the CKP Sensor harness connector.

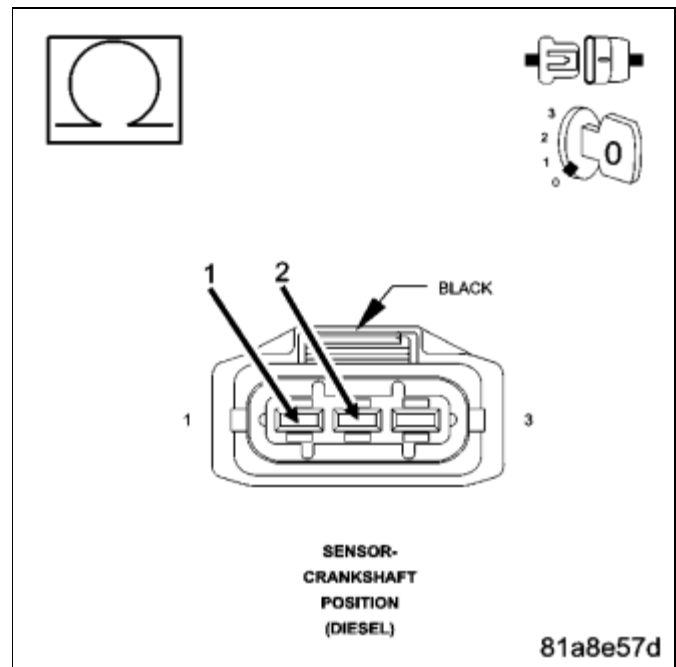
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit and (K925) CKP Sensor Ground circuits for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT OPEN

Disconnect the ECM harness connectors.
Measure the resistance of the (K24) CKP Sensor Signal circuit between the ECM harness connector and the CKP Sensor harness connector.

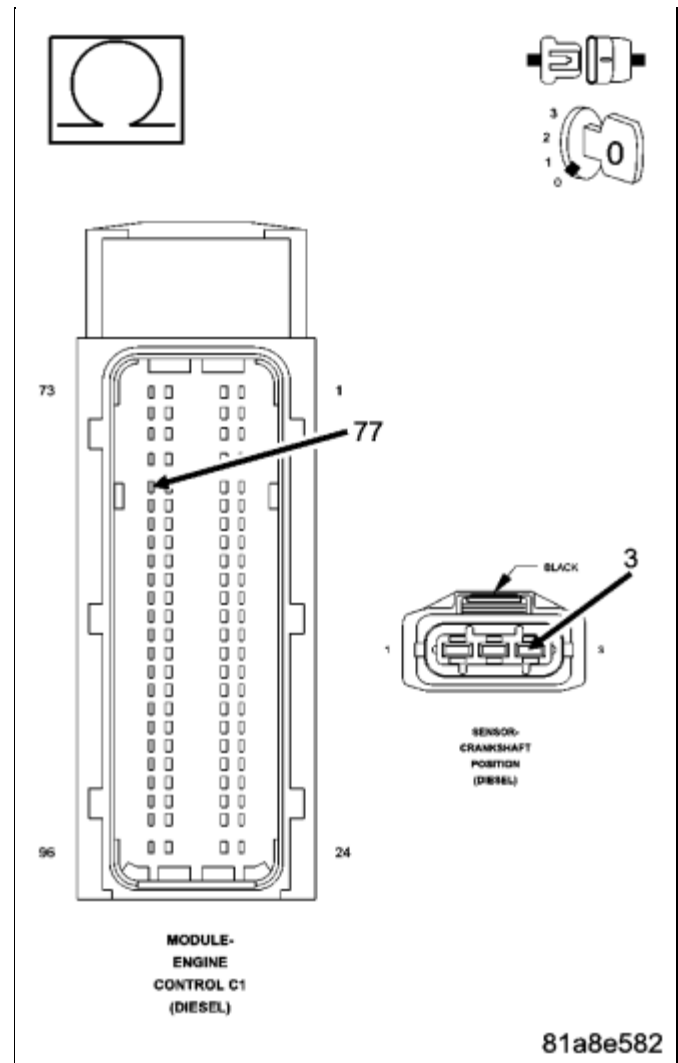
Is the resistance below 10.0 ohms?

Yes

- Go To [13](#)

No

- Repair the (K24) CKP Sensor Signal circuit for an open
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Sensor Signal circuit at the CKP Sensor harness connector.

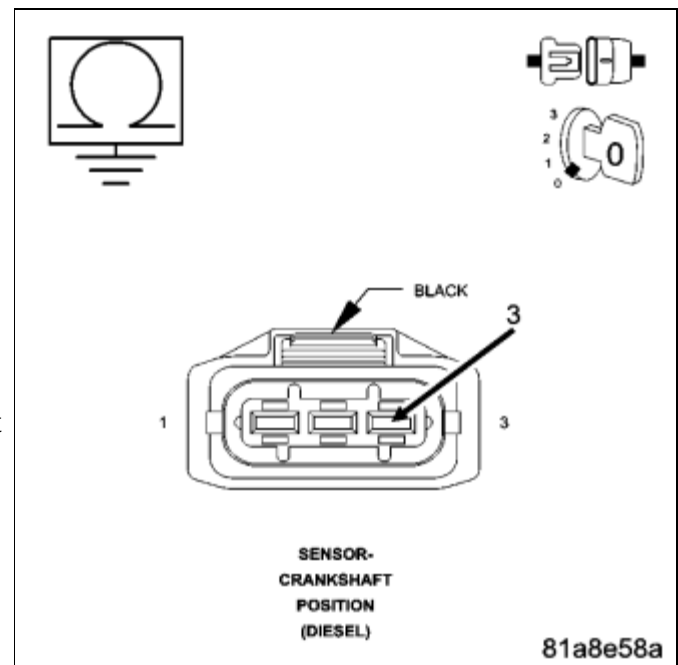
Is the resistance above 1000 ohms?

Yes

- Go To [14](#)

No

- Repair the (K24) CKP Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



14. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Measure the resistance between the (K24) CKP Sensor Signal circuit and the (K925) CKP Sensor Ground circuit at the CKP Sensor harness connector.

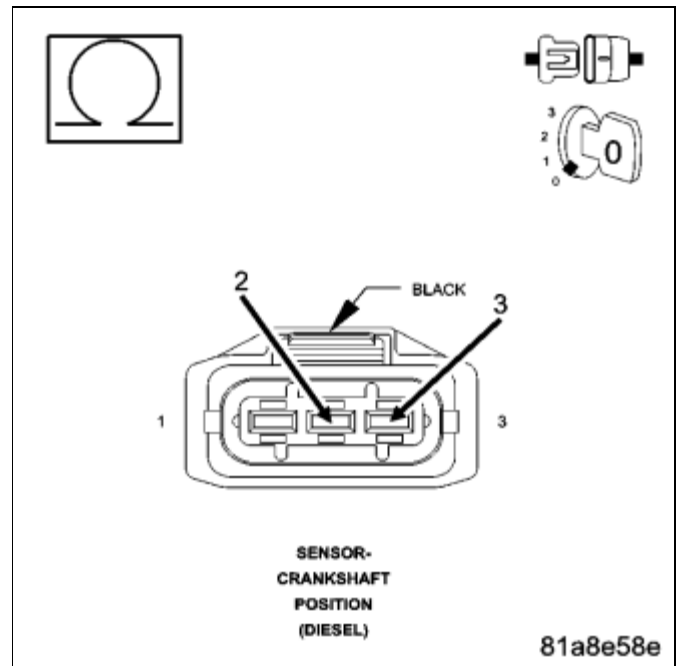
Is the resistance above 1000 ohms?

Yes

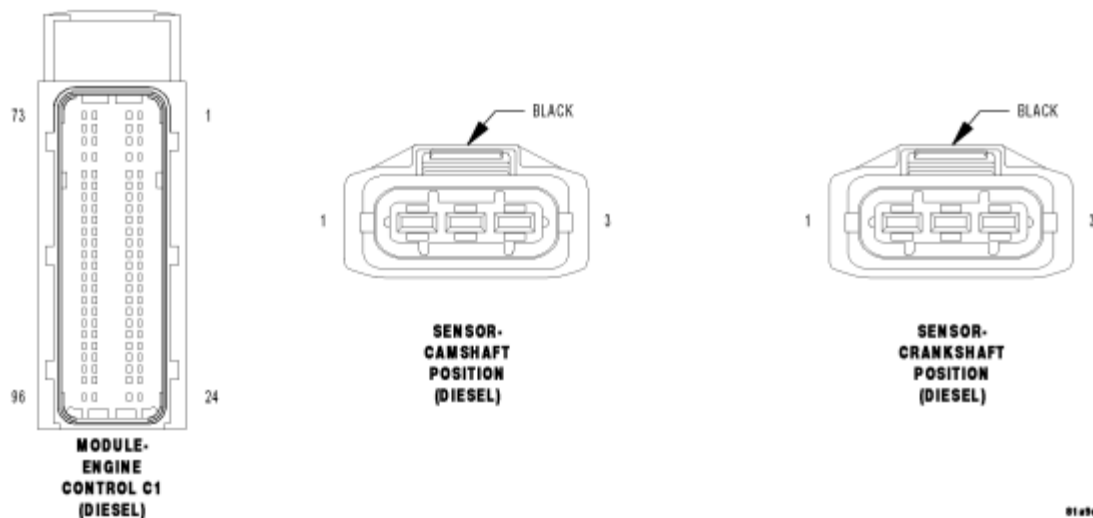
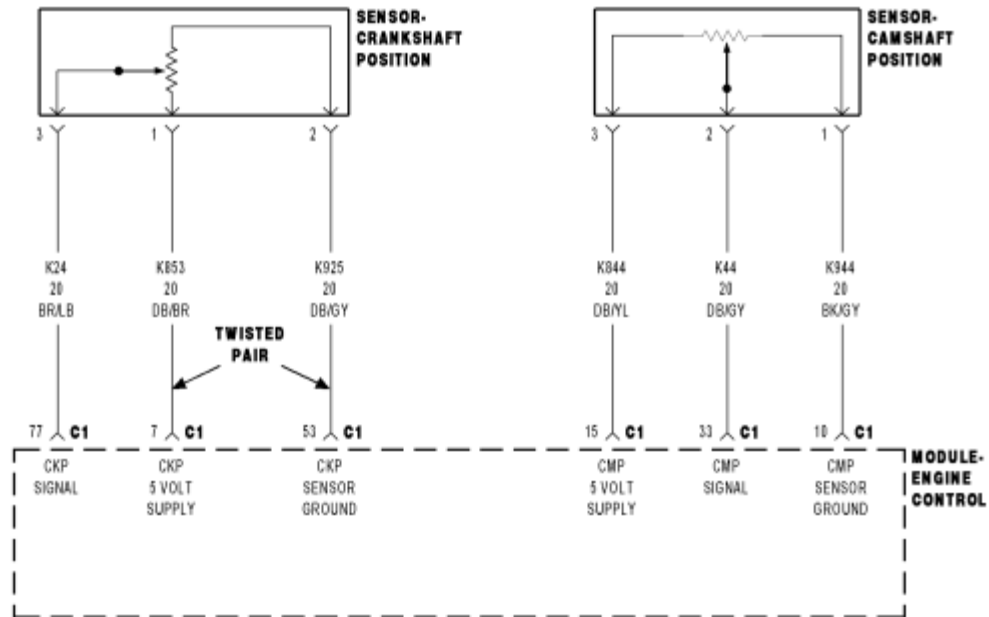
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K24) CKP Sensor Signal circuit and the (K925) CKP Sensor Ground circuit for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0336-CRANKSHAFT POSITION SENSOR PERFORMANCE



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Crankshaft Position (CKP) Sensor is a hall effect type sensor. The sensor produces a 5-volt digital signal (square wave). The ECM provides a 5-volt supply, 5-volt sensor signal and ground to the CKP Sensor. The sensor is positioned opposite a magnetic ring at the rear of the crankshaft. The magnetic ring contains internal magnetic strips (electric teeth) that act on the hall-effect switch causing the digital switching of the sensor signal from high (5-volts) to low (0 volts).

- **When Monitored:**

With the engine cranking or running

- **Set Condition:**

The Engine Control Module (ECM) does not receive a signal from the Crankshaft Position Sensor when the Camshaft Position Sensor indicates engine rpm.

Possible Causes
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN
(K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CHECKING (K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT
DAMAGED CKP SENSOR OR CRANKSHAFT
ECM
(K925) CKP SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
(K24) CKP SENSOR SIGNAL CIRCUIT OPEN
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
CRANKSHAFT POSITION SENSOR
(K925) CKP SENSOR GROUND CIRCUIT OPEN
(K853) CKP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE -

DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. CHECKING (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the Crankshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K24) CKP Sensor Signal circuit at the CKP Sensor harness connector.

Select the appropriate voltage reading.

Voltage is above 5.4 volts.

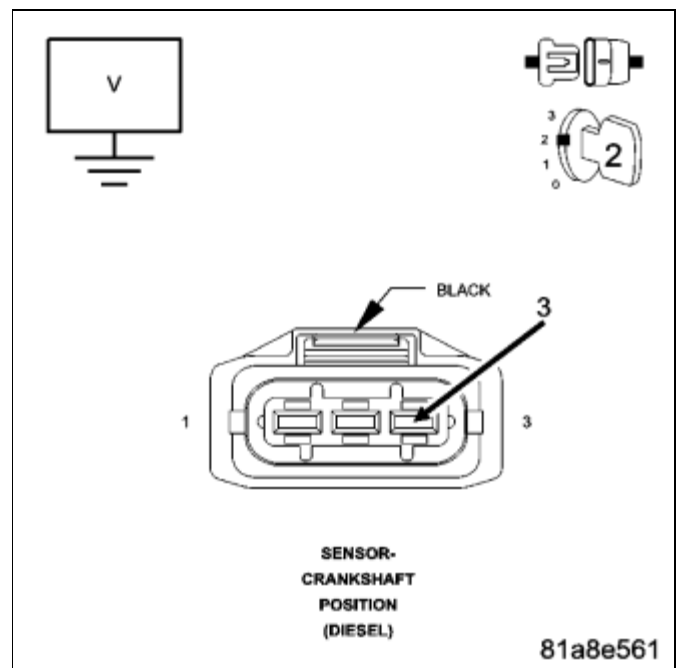
- Go To [4](#)

Voltage is between 4.7 and 5.4 volts.

- Go To [5](#)

Voltage is below 4.7 volts.

- Go To [12](#)



4. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (K24) CKP Position Sensor Signal circuit at the CKP Sensor harness connector.

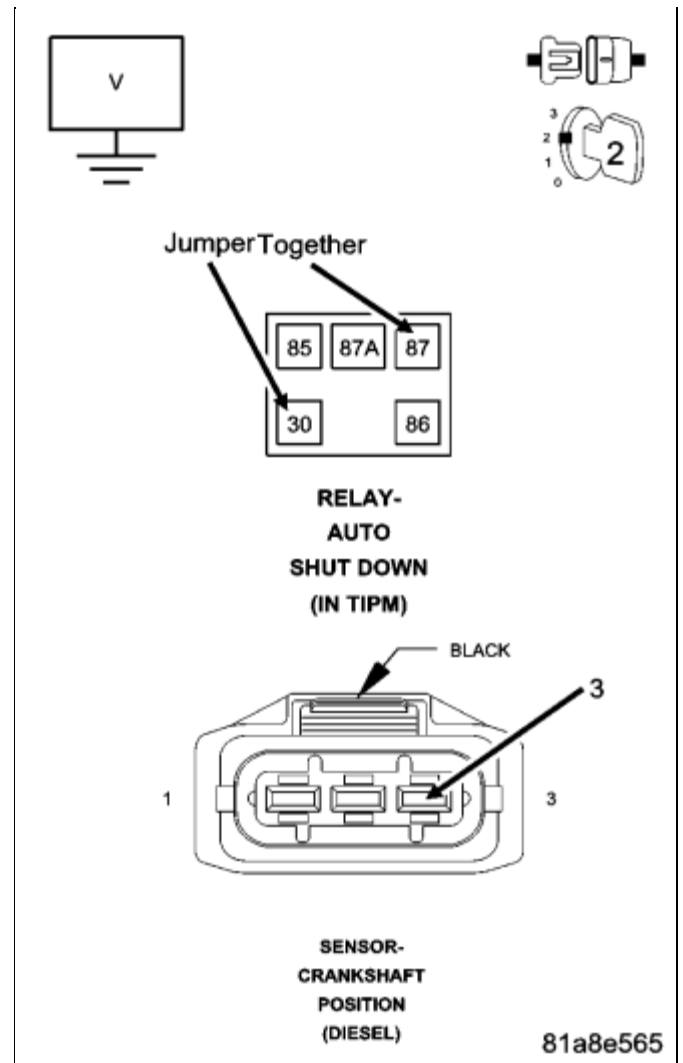
Is the voltage below 1.0 volt?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K24) Crankshaft Position Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. CHECKING (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT

Measure the voltage of the (K853) CKP Sensor 5-Volt Supply circuit at the CKP Sensor harness connector.

Select the appropriate voltage reading.

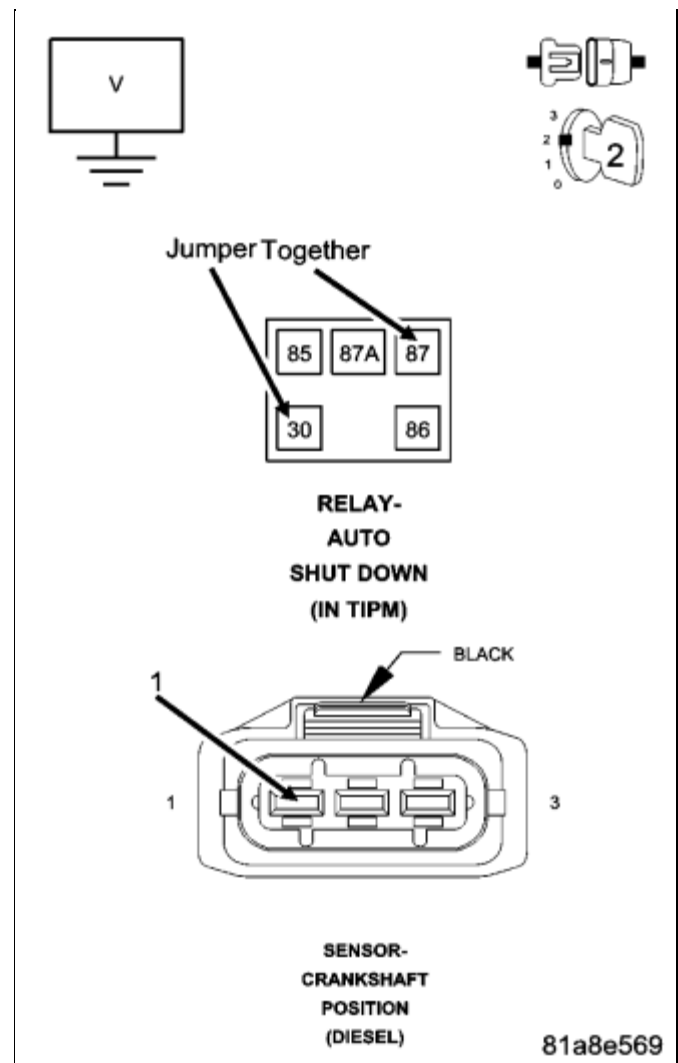
Voltage is above 5.4 volts.

- Repair the (K853) CKP 5-Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Voltage is between 4.7 and 5.4 volts.

- Go To [6](#)

Voltage is below 4.7 volts.



- Go To [9](#)

6. (K925) CRANKSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Disconnect the ECT Sensor harness connector.
 Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.
 Connect the other end of the jumper wire to the (K925) CKP Sensor Ground circuit in the Crankshaft Position Sensor harness connector.
 With the scan tool in Engine, Sensors, read the Engine Coolant Temp volts.

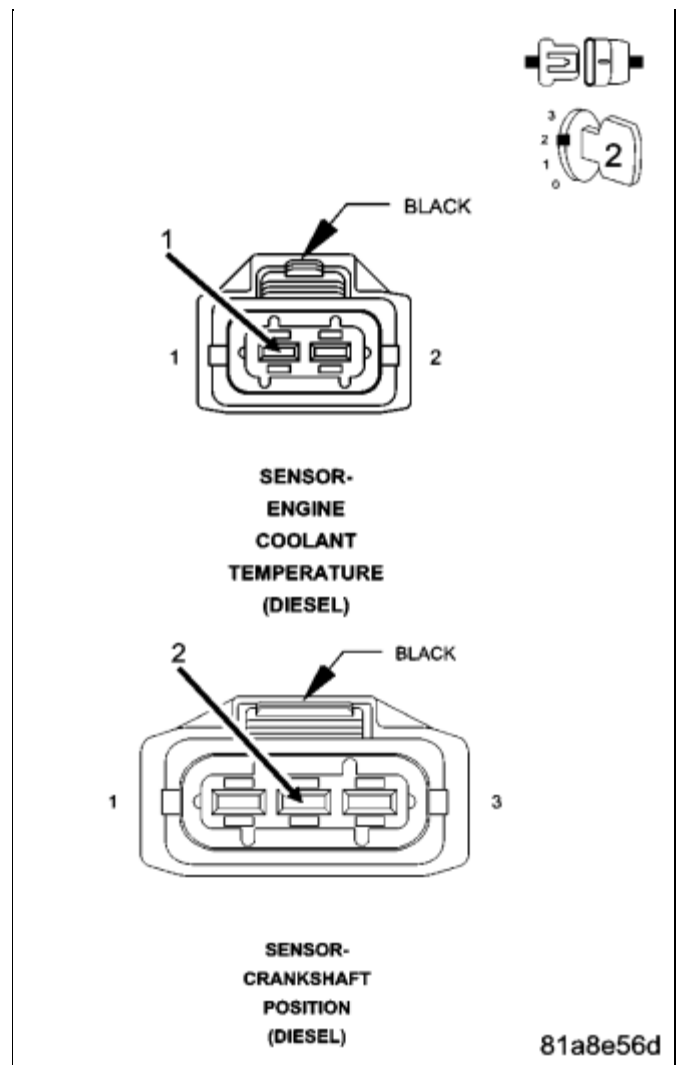
Is the voltage below 0.5 volt?

Yes

- Go To [8](#)

No

- Go To [7](#)



7. (K925) CRANKSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K925) CKP Sensor Ground circuit between the CKP Sensor harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

Yes

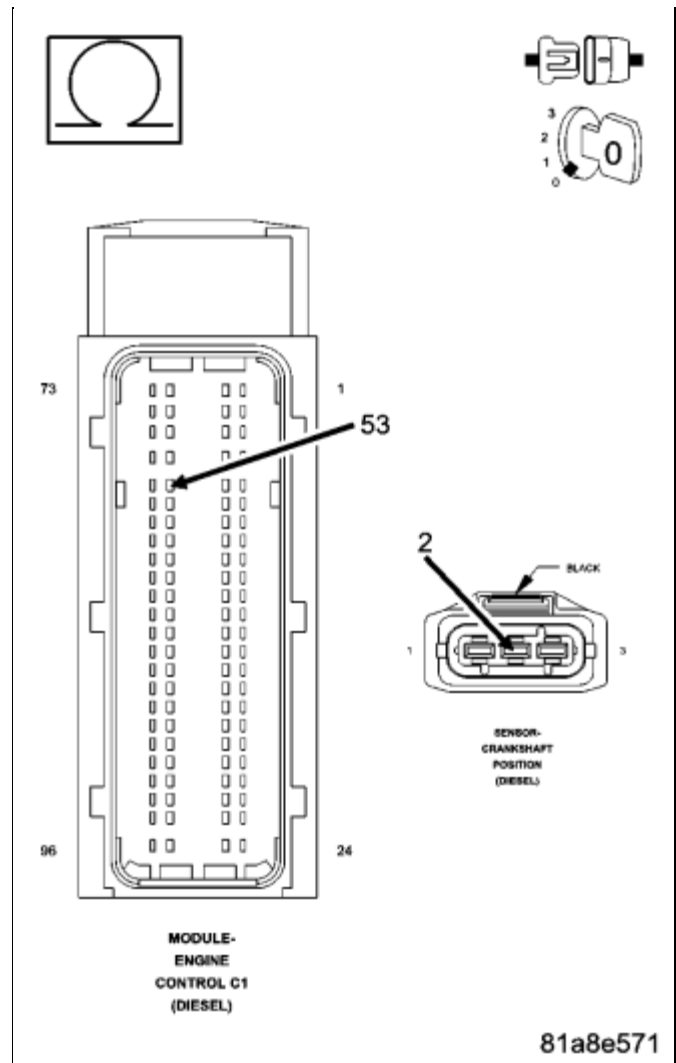
- Replace and program the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K925) CKP Sensor Ground circuit for an

open.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. DAMAGED CRANKSHAFT POSITION SENSOR OR CRANKSHAFT

Turn the ignition off.

Remove the CKP Sensor.

Inspect the CKP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the Crankshaft magnetic ring for conditions such as damage, or debris.

Is there any evidence of these conditions?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Crankshaft Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K853) CKP Sensor 5-Volt Supply circuit between the ECM harness connector and the CKP Sensor harness connector.

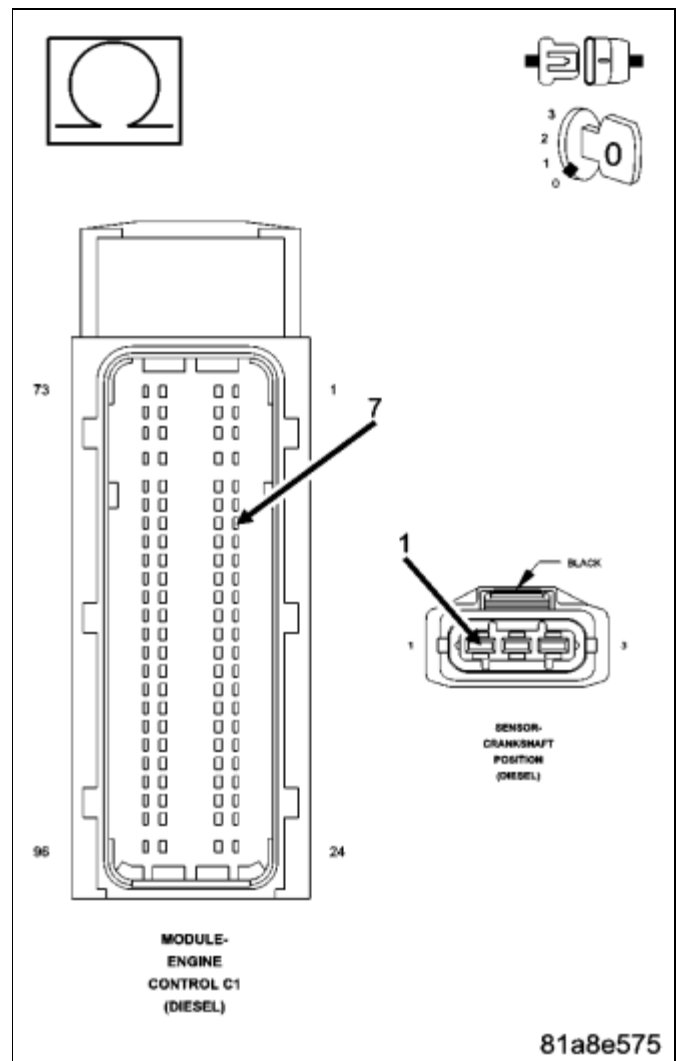
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K853) CKP Sensor 5-Volt Supply circuit at the CKP Sensor harness connector.

Is the resistance above 1000 ohms?

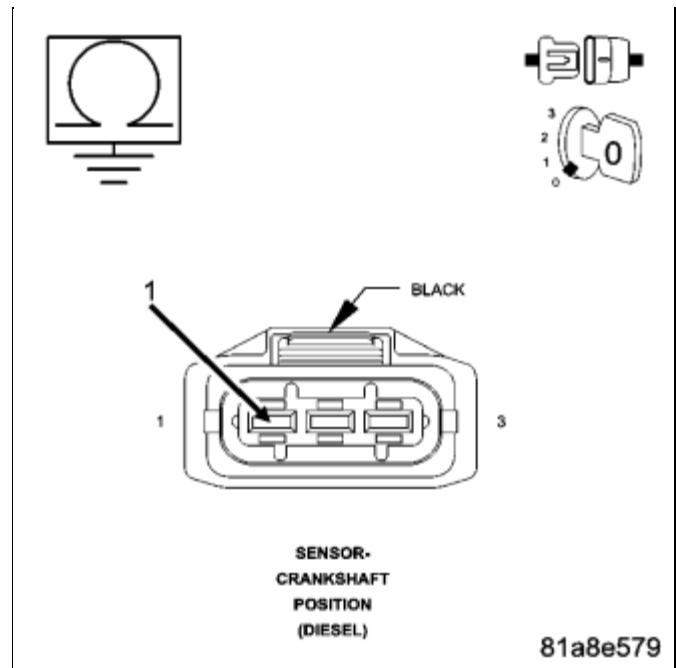
Yes

- Go To [11](#)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



11. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Measure the resistance between the (K853) CKP Sensor 5-Volt Supply circuit and the (K925) CKP Sensor Ground circuit at the CKP Sensor harness connector.

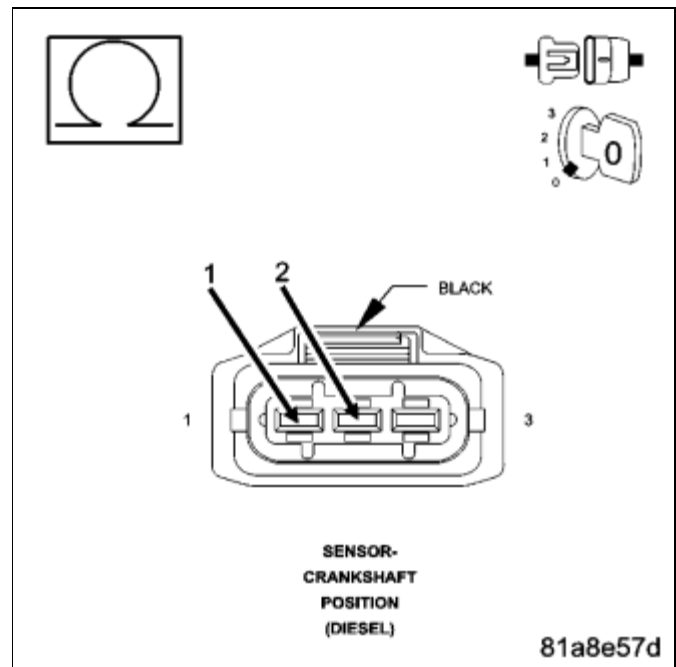
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K853) CKP Sensor 5-Volt Supply circuit and (K925) CKP Sensor Ground circuits for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K24) CKP Sensor Signal circuit between the ECM harness connector and the CKP Sensor harness connector.

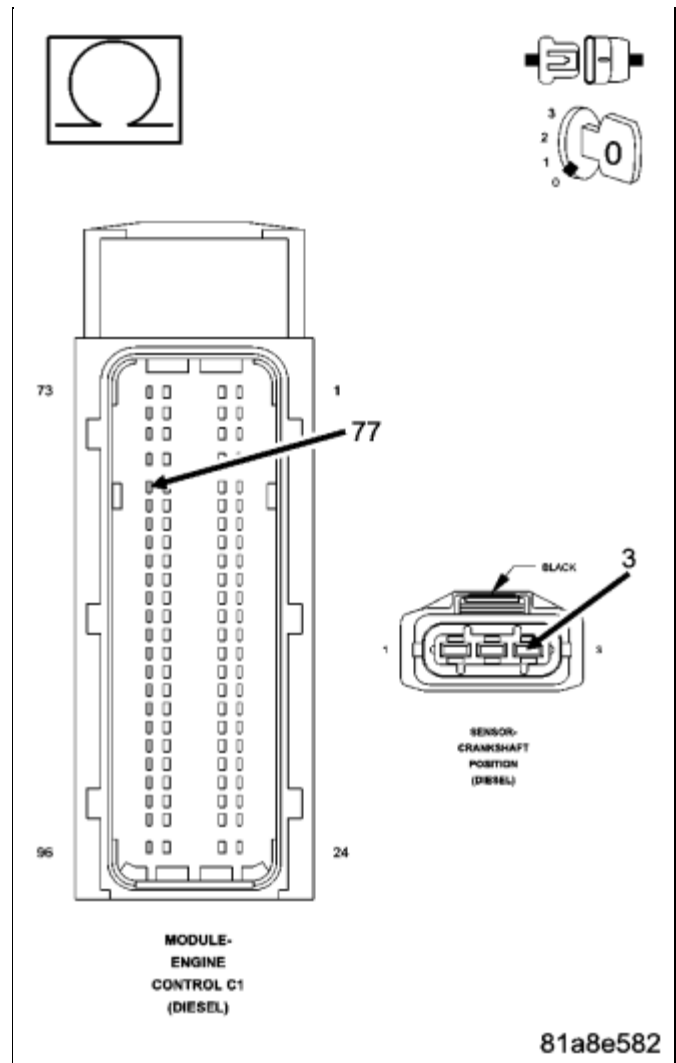
Is the resistance below 10.0 ohms?

Yes

- Go To [13](#)

No

- Repair the (K24) CKP Sensor Signal circuit for an open
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Sensor Signal circuit at the CKP Sensor harness connector.

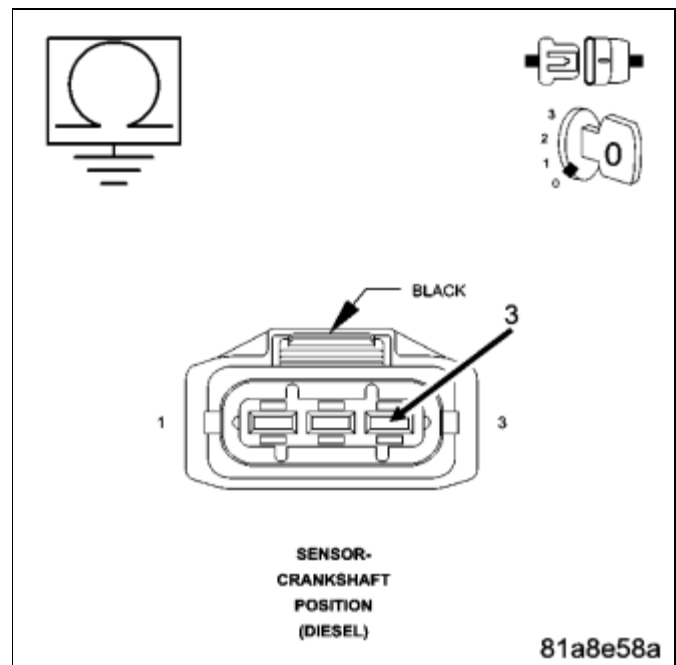
Is the resistance above 1000 ohms?

Yes

- Go To [14](#)

No

- Repair the (K24) CKP Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



14. (K24) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K925) CKP SENSOR GROUND CIRCUIT

Measure the resistance between the (K24) CKP Sensor Signal circuit and the (K925) CKP Sensor Ground circuit at the CKP Sensor harness connector.

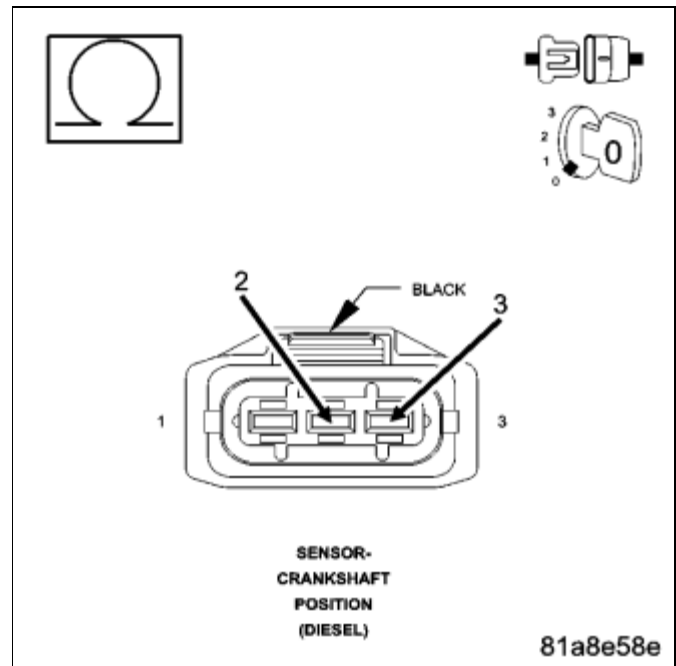
Is the resistance above 1000 ohms?

Yes

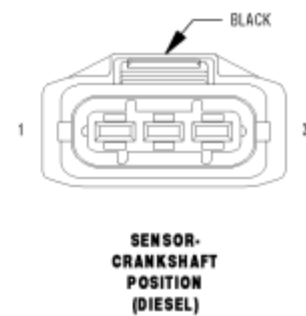
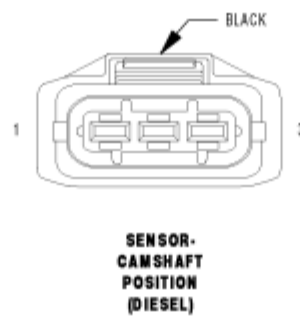
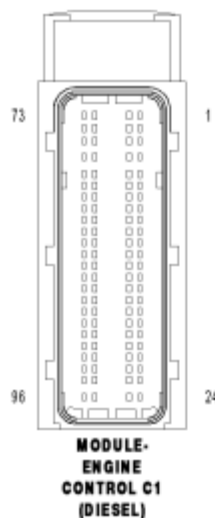
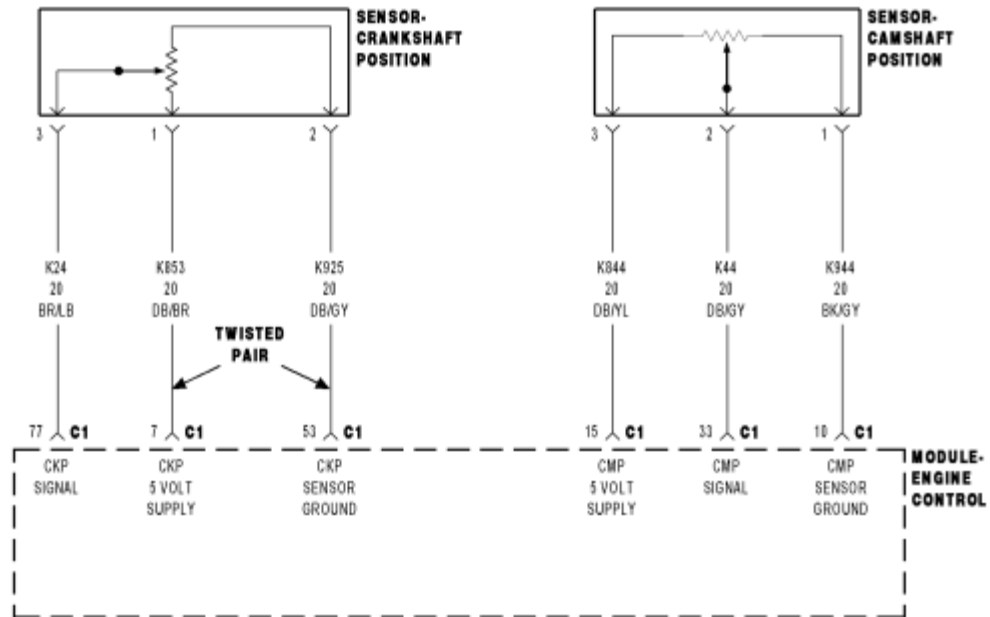
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K24) CKP Sensor Signal circuit and the (K925) CKP Sensor Ground circuit for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0340-CAMSHAFT POSITION SENSOR CIRCUIT



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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Camshaft Position (CMP) Sensor is a hall effect type sensor. The sensor produces a 5-volt digital signal (square wave). The ECM provides a 5-volt supply, 5-volt sensor signal and ground to the CMP Sensor. The sensor is positioned opposite a toothed eccentric on the camshaft. As the camshaft rotates, the teeth on the eccentric pass closely to the CMP sensor triggering the hall-effect switch causing the digital switching of the sensor signal from high (5-volts) to low (0 volts).

- **When Monitored:**

With the engine speed above 50 rpm.

- **Set Condition:**

The Engine Control Module (ECM) does not receive a signal from the Camshaft Position Sensor when the Crankshaft Position Sensor indicates engine rpm.

Possible Causes
(K844) CMP 5-VOLT SUPPLY CIRCUIT OPEN
(K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CHECKING (K844) CMP 5-VOLT SUPPLY CIRCUIT
DAMAGED CMP SENSOR OR CAMSHAFT
ECM
(K944) CMP SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
(K44) CMP SENSOR SIGNAL CIRCUIT OPEN
(K844) CMP 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
CAMSHAFT POSITION SENSOR
(K844) CMP 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) CMP SENSOR GROUND CIRCUIT
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) CMP SENSOR GROUND CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. CHECKING (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the Camshaft Position Sensor harness connector.
Turn the ignition on.
Measure the voltage of the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector.

Select the appropriate voltage reading.

Voltage is above 5.4 volts.

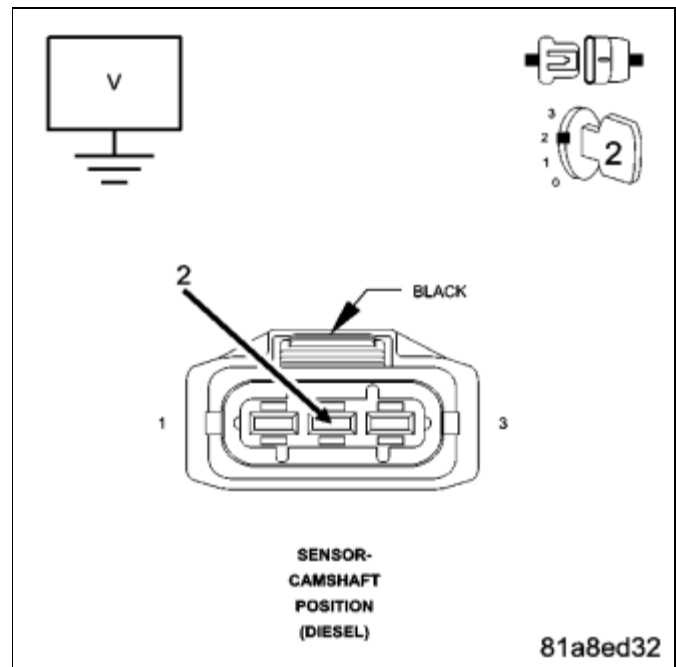
- Go To [4](#)

Voltage is between 4.7 and 5.4 volts.

- Go To [5](#)

Voltage is below 4.7 volts.

- Go To [12](#)



4. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.
Disconnect the ECM harness connectors.
Remove the ASD Relay.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of the (K44) CMP Position Sensor Signal circuit at the CMP Sensor harness connector.

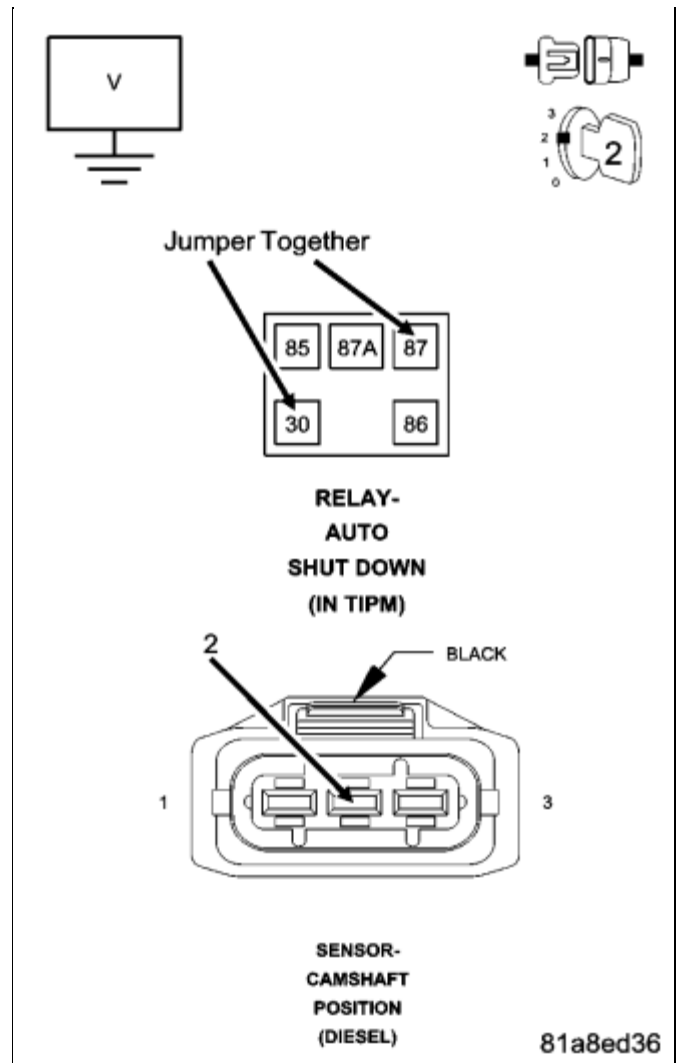
Is the voltage below 1.0 volt?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K44) Camshaft Position Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. CHECKING (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT

Measure the voltage of the (K844) CMP Sensor 5-Volt Supply circuit at the CMP Sensor harness connector.

Select the appropriate voltage reading.

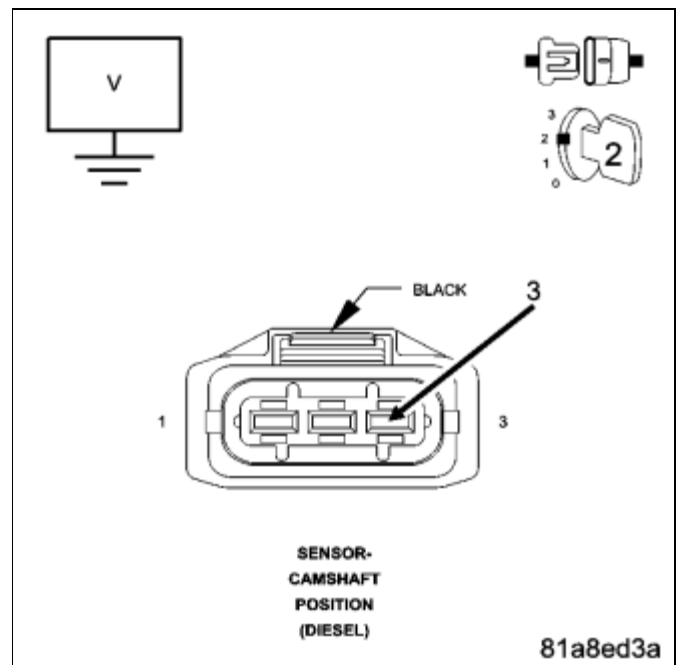
Voltage is above 5.4 volts.

- Repair the (K844) CMP 5-Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Voltage is between 4.7 and 5.4 volts.

- Go To [6](#)

Voltage is below 4.7 volts.



- Go To [9](#)

6. (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition on.

Disconnect the ECT Sensor harness connector.

Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.

Connect the other end of the jumper wire to the (K944) CMP Sensor Ground circuit in the Camshaft Position Sensor harness connector.

With the scan tool in Engine, Sensors, read the Engine Coolant Temp volts.

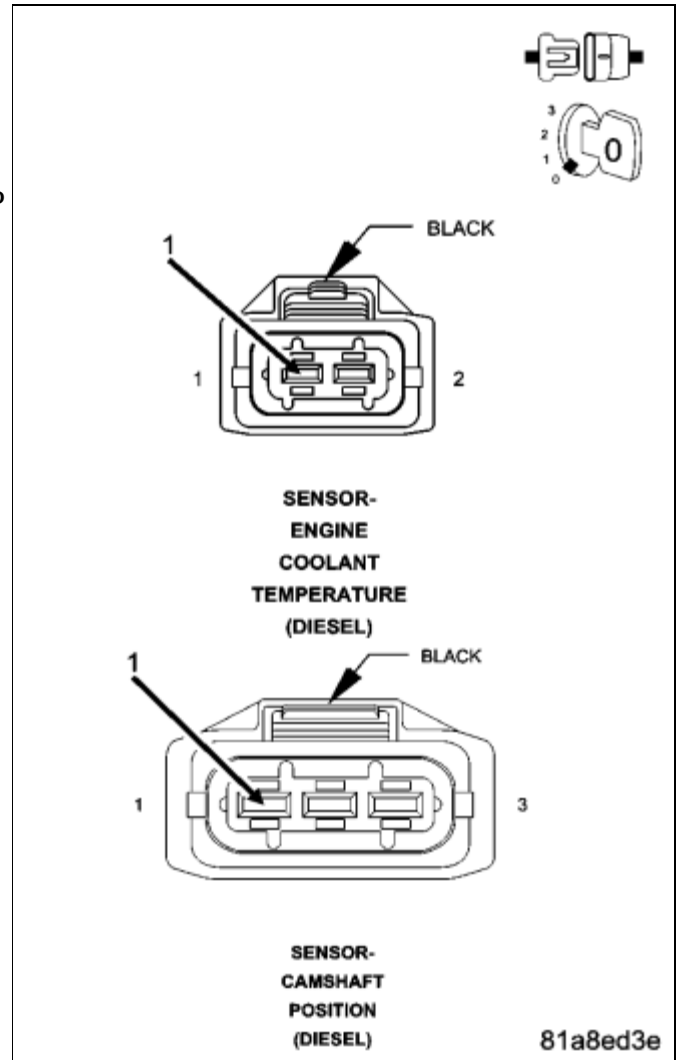
Is the voltage below 0.5 volt?

Yes

- Go To [8](#)

No

- Go To [7](#)



7. (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance of the (K944) CMP Sensor Ground circuit between the CMP Sensor harness connector and the ECM harness connector.

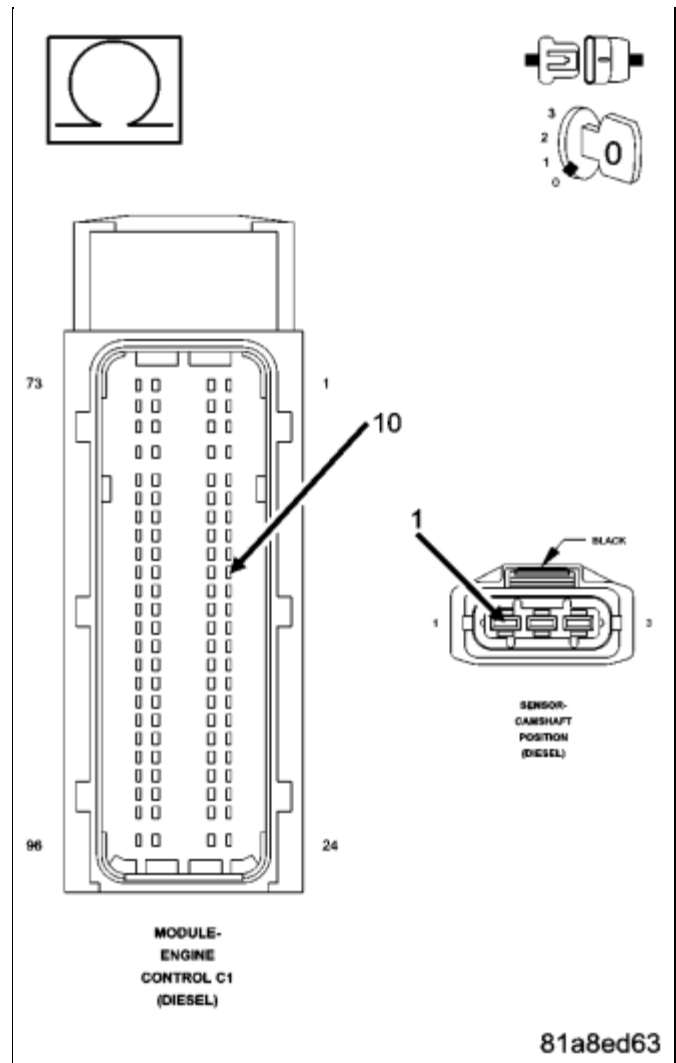
Is the resistance below 10.0 ohms?

Yes

- Replace and program the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K944) CMP Sensor Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. DAMAGED CAMSHAFT POSITION SENSOR OR CAMSHAFT

Turn the ignition off.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

Is there any evidence of these conditions?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Camshaft Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K844) CMP 5-Volt Supply circuit between the ECM harness connector and the CMP Sensor harness connector.

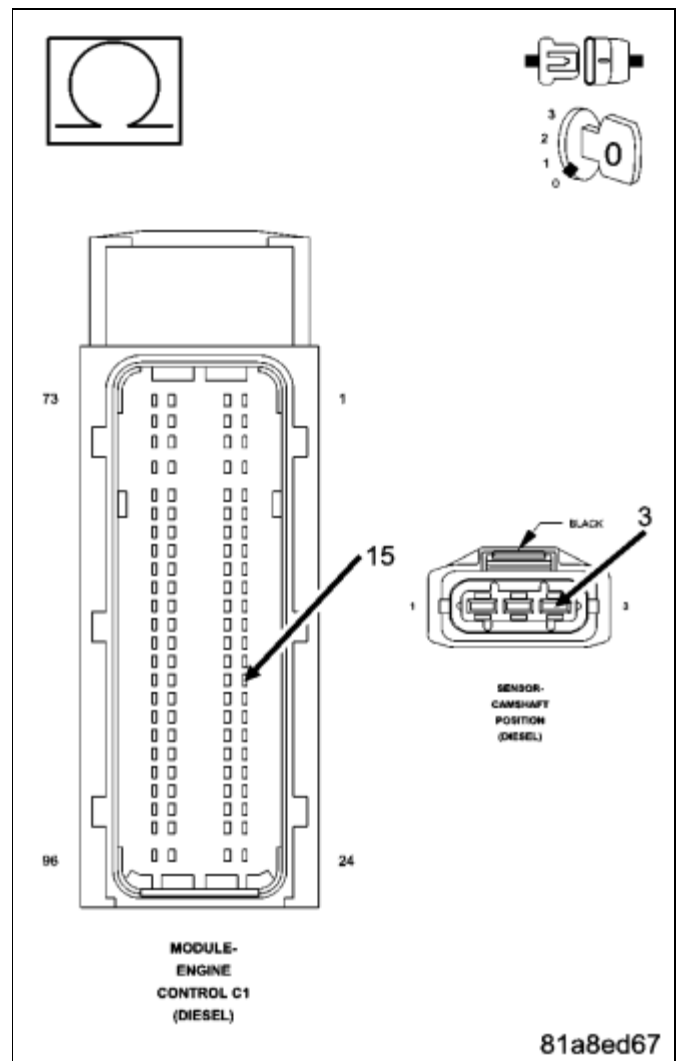
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (K844) CMP 5-Volt Supply circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K844) CMP Sensor 5-Volt Supply circuit at the CMP Sensor harness connector.

Is the resistance above 1000 ohms?

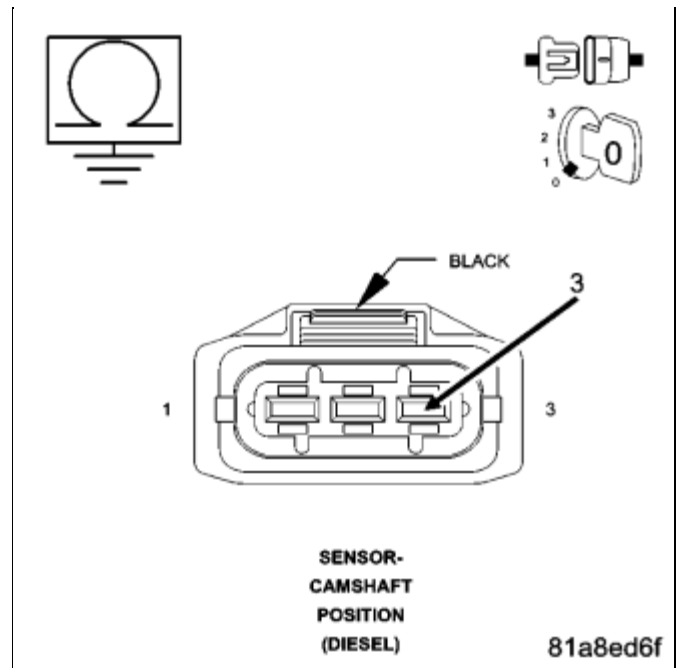
Yes

- Go To [11](#)

No

- Repair the (K844) CMP Sensor 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



11. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) CMP SENSOR GROUND CIRCUIT

Measure the resistance between the (K844) CMP Sensor 5-Volt Supply circuit and the (K944) CMP Sensor Ground circuit at the CMP Sensor harness connector.

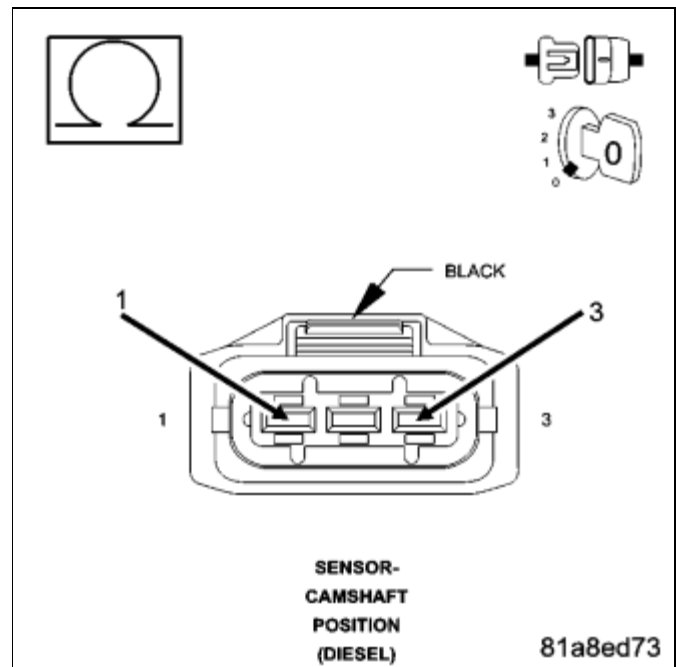
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K844) CMP Sensor 5-Volt Supply circuit and (K944) CMP Sensor Ground circuits for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K44) CMP Sensor Signal circuit between the ECM harness connector and the CMP Sensor harness connector.

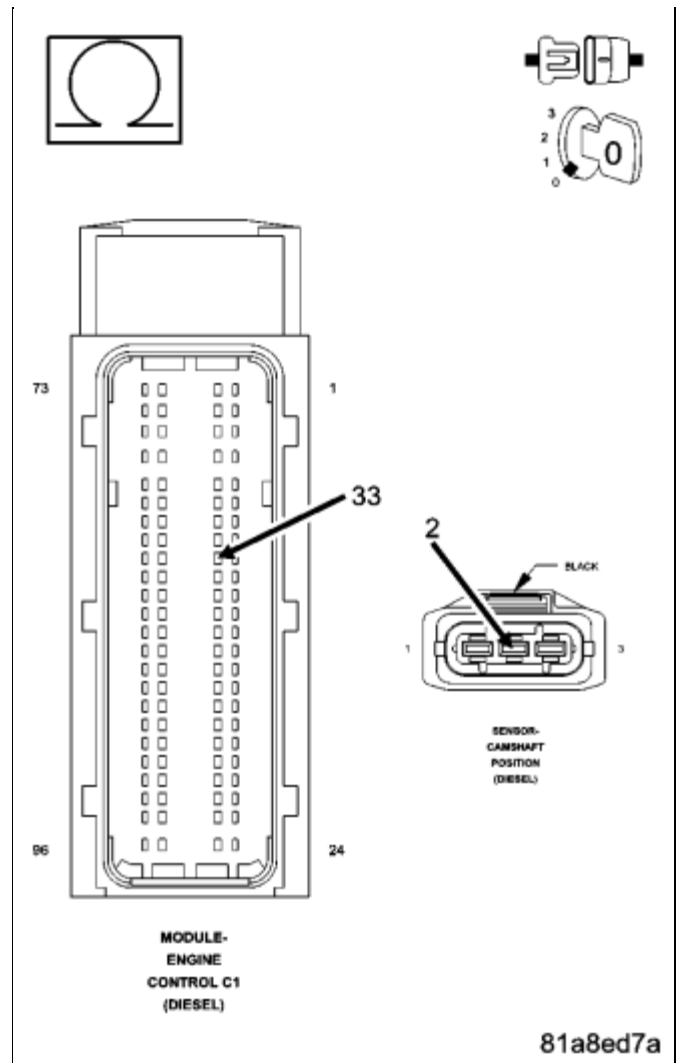
Is the resistance below 10.0 ohms?

Yes

- Go To [13](#)

No

- Repair the (K44) CMP Sensor Signal circuit for an open
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector.

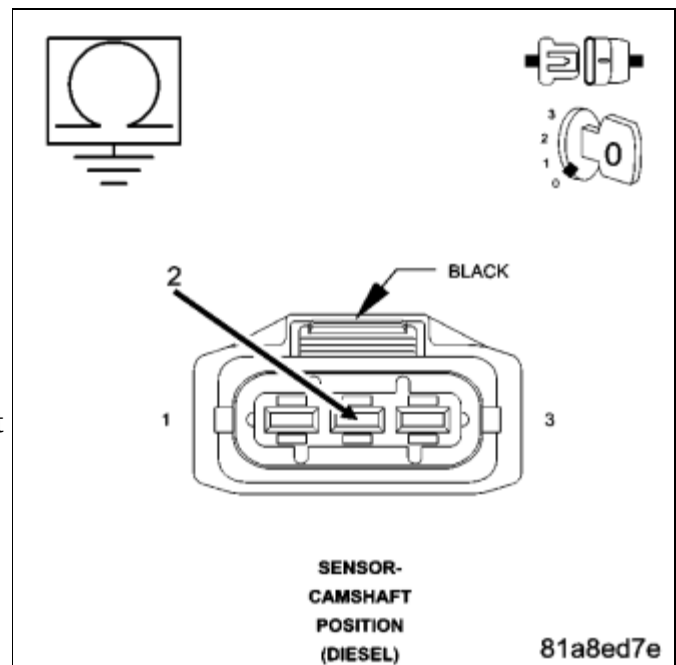
Is the resistance above 1000 ohms?

Yes

- Go To [14](#)

No

- Repair the (K44) CMP Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



14. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT

Measure the resistance between the (K44) CMP Sensor Signal circuit and the (K944) CMP Sensor Ground circuit at the CMP Sensor harness connector.

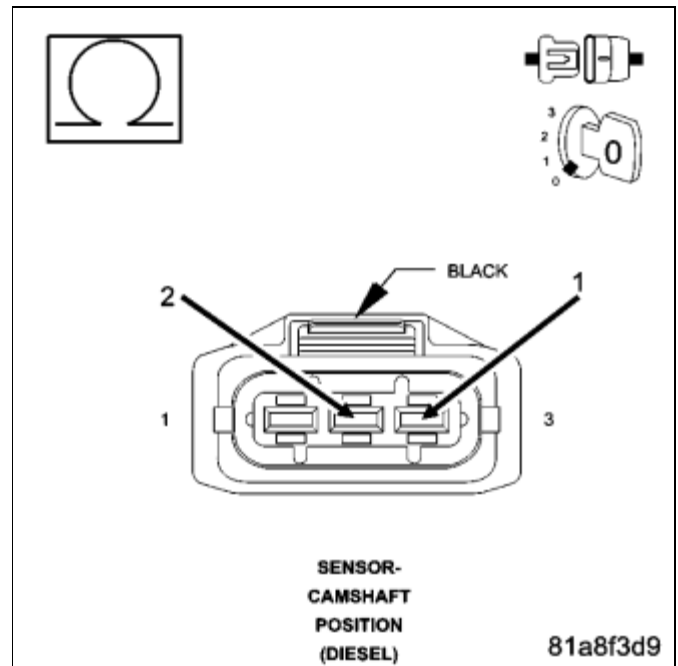
Is the resistance above 1000 ohms?

Yes

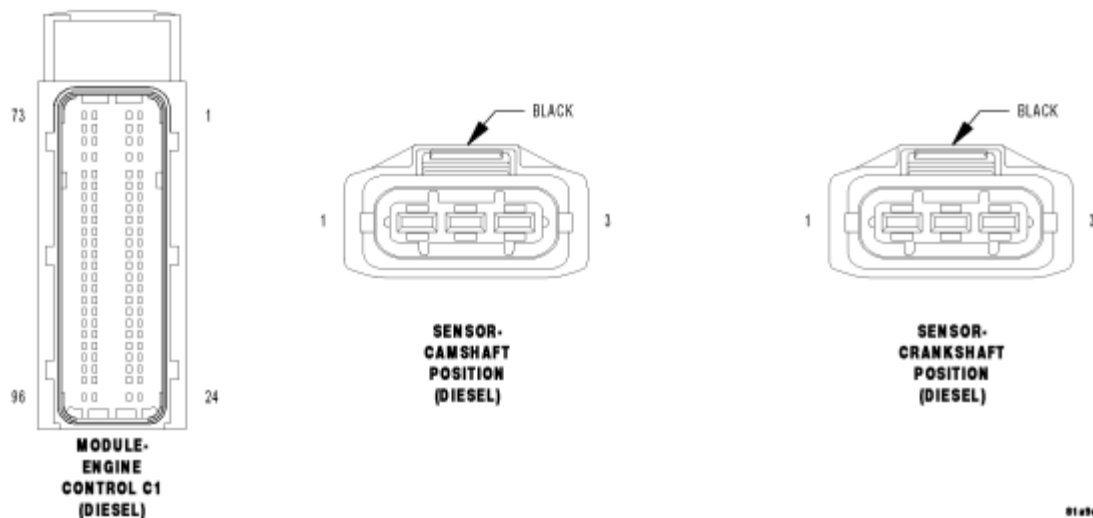
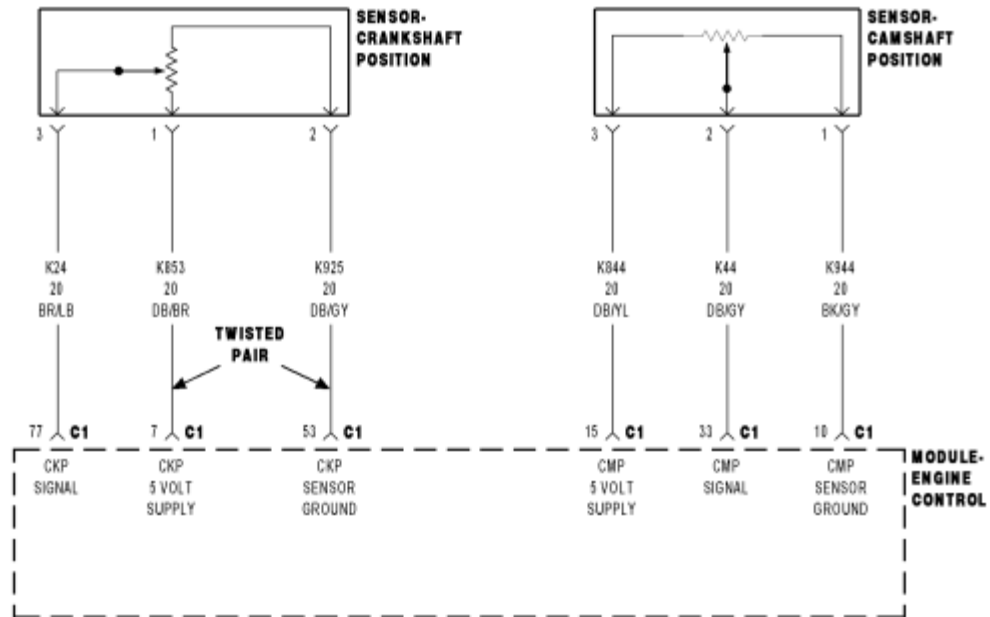
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K44) CMP Sensor Signal circuit and the (K944) CMP Sensor Ground circuit for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0341-CAMSHAFT POSITION SENSOR PERFORMANCE



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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Camshaft Position (CMP) Sensor is a hall effect type sensor. The sensor produces a 5-volt digital signal (square wave). The ECM provides a 5-volt supply, 5-volt sensor signal and ground to the CMP Sensor. The sensor is positioned opposite a toothed eccentric on the camshaft. As the camshaft rotates, the teeth on the eccentric pass closely to the CMP sensor triggering the hall-effect switch causing the digital switching of the sensor signal from high (5-volts) to low (0 volts).

- **When Monitored:**

With the engine speed above 50 rpm.

- **Set Condition:**

The Engine Control Module (ECM) does not receive a signal from the Camshaft Position Sensor when the Crankshaft Position Sensor indicates engine rpm.

Possible Causes
(K844) CMP 5-VOLT SUPPLY CIRCUIT OPEN
(K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
CHECKING (K844) CMP 5-VOLT SUPPLY CIRCUIT
DAMAGED CMP SENSOR OR CAMSHAFT
ECM
(K944) CMP SENSOR GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
(K44) CMP SENSOR SIGNAL CIRCUIT OPEN
(K844) CMP 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
CAMSHAFT POSITION SENSOR
(K844) CMP 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) CMP SENSOR GROUND CIRCUIT
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) CMP SENSOR GROUND CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VERIFY ACTIVE DTC

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. CHECKING (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT

Turn the ignition off.
 Disconnect the Camshaft Position Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector.

Select the appropriate voltage reading.

Voltage is above 5.4 volts.

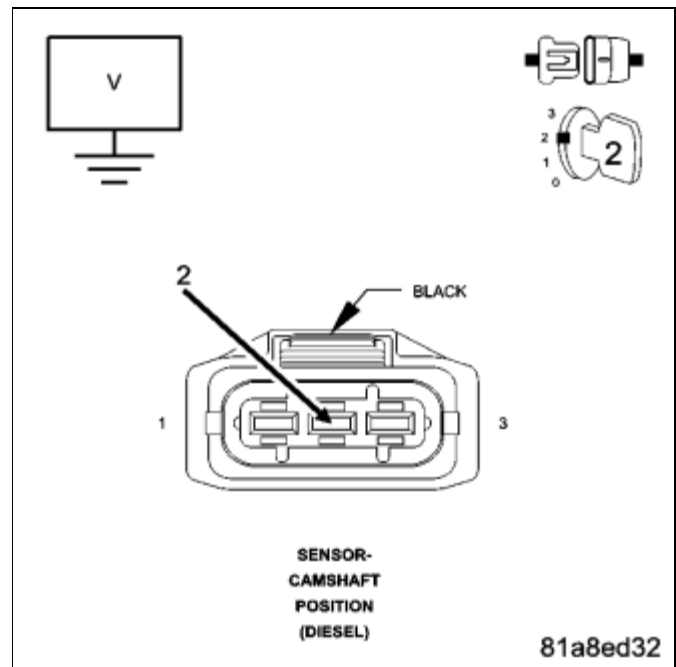
- Go To [4](#)

Voltage is between 4.7 and 5.4 volts.

- Go To [5](#)

Voltage is below 4.7 volts.

- Go To [12](#)



4. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage of the (K44) CMP Position Sensor Signal circuit at the CMP Sensor harness connector.

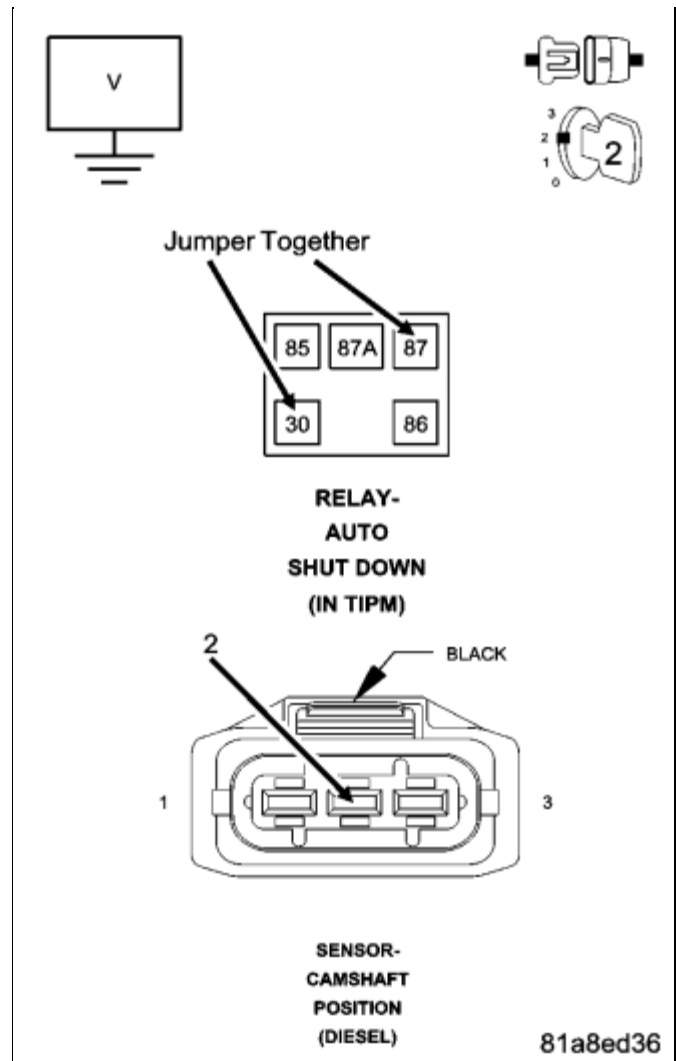
Is the voltage below 1.0 volt?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K44) Camshaft Position Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. CHECKING (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT

Measure the voltage of the (K844) CMP Sensor 5-Volt Supply circuit at the CMP Sensor harness connector.

Select the appropriate voltage reading.

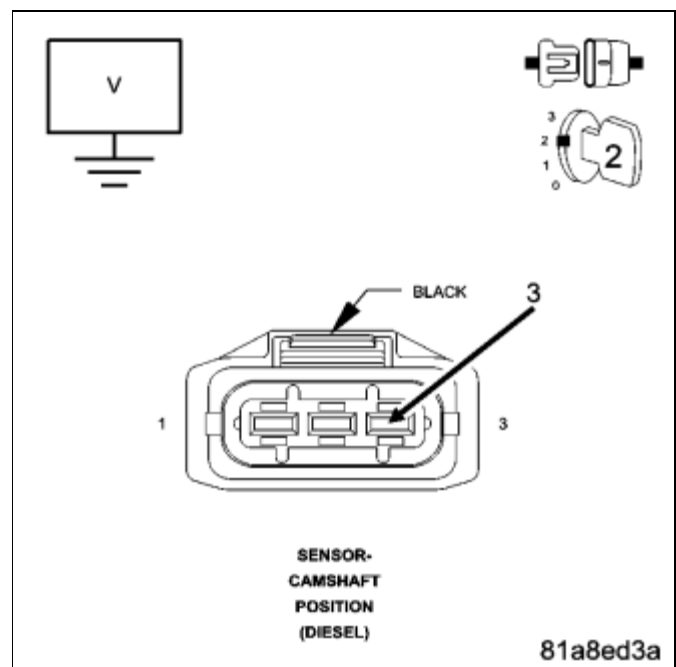
Voltage is above 5.4 volts.

- Repair the (K844) CMP 5-Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Voltage is between 4.7 and 5.4 volts.

- Go To [6](#)

Voltage is below 4.7 volts.



- Go To [9](#)

6. (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECT Sensor harness connector.
 Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.
 Connect the other end of the jumper wire to the (K944) CMP Sensor Ground circuit in the Camshaft Position Sensor harness connector.
 Turn the ignition on.
 With the scan tool in Engine, Sensors, read the Engine Coolant Temp volts.

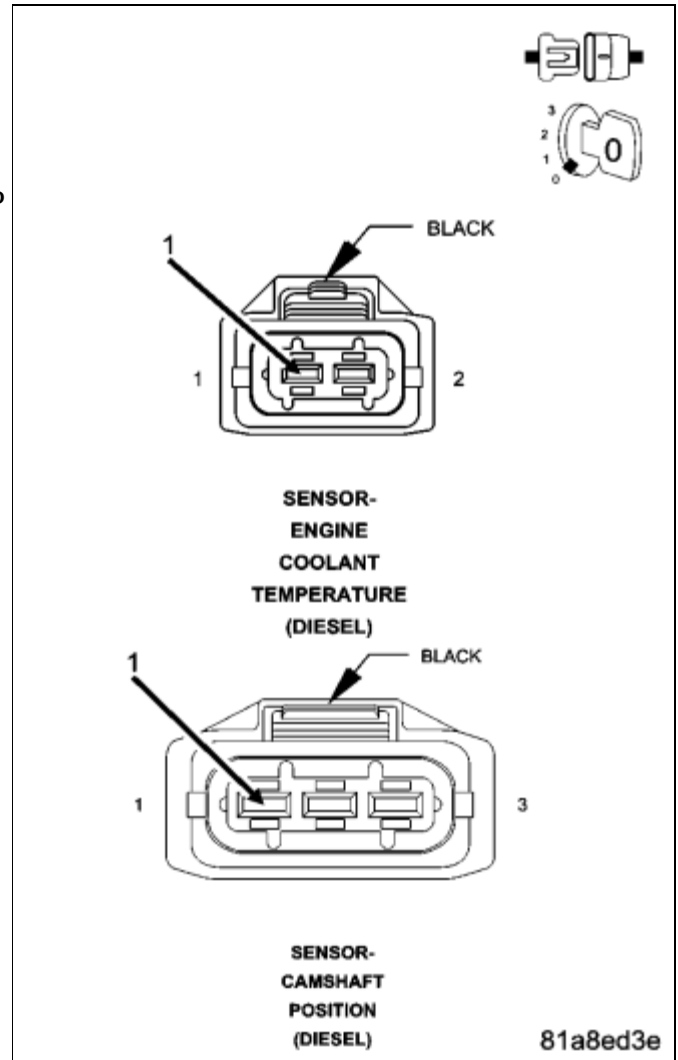
Is the voltage below 0.5 volt?

Yes

- Go To [8](#)

No

- Go To [7](#)



7. (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K944) CMP Sensor Ground circuit between the CMP Sensor harness connector and the ECM harness connector.

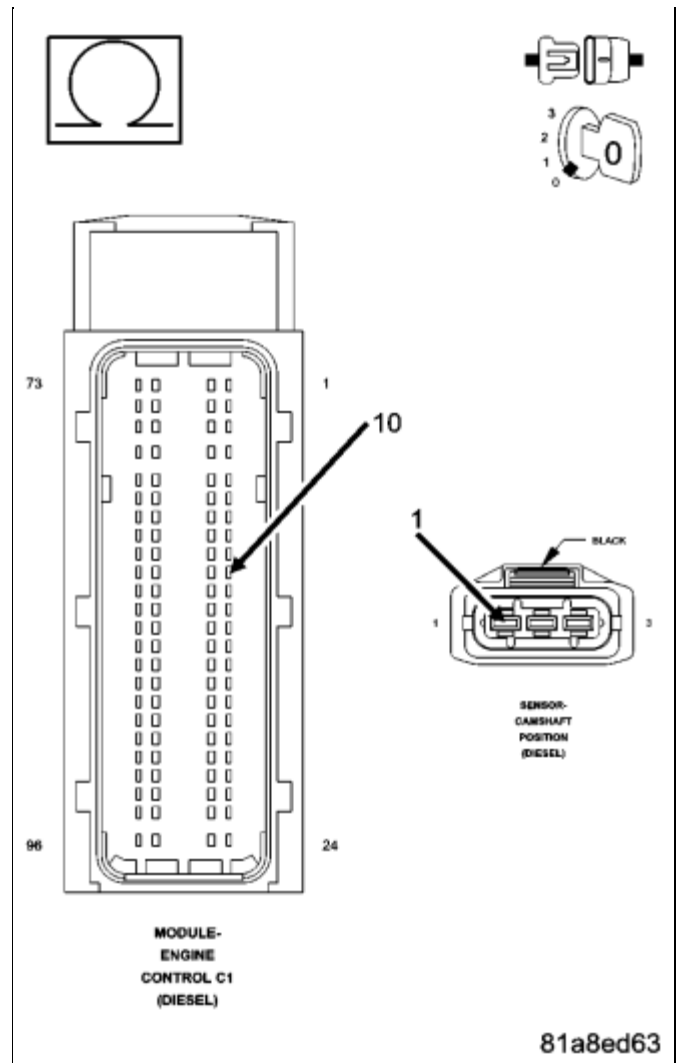
Is the resistance below 10.0 ohms?

Yes

- Replace and program the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K944) CMP Sensor Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. DAMAGED CAMSHAFT POSITION SENSOR OR CAMSHAFT

Turn the ignition off.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

Is there any evidence of these conditions?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Replace the Camshaft Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K844) CMP 5-Volt Supply circuit between the ECM harness connector and the CMP Sensor harness connector.

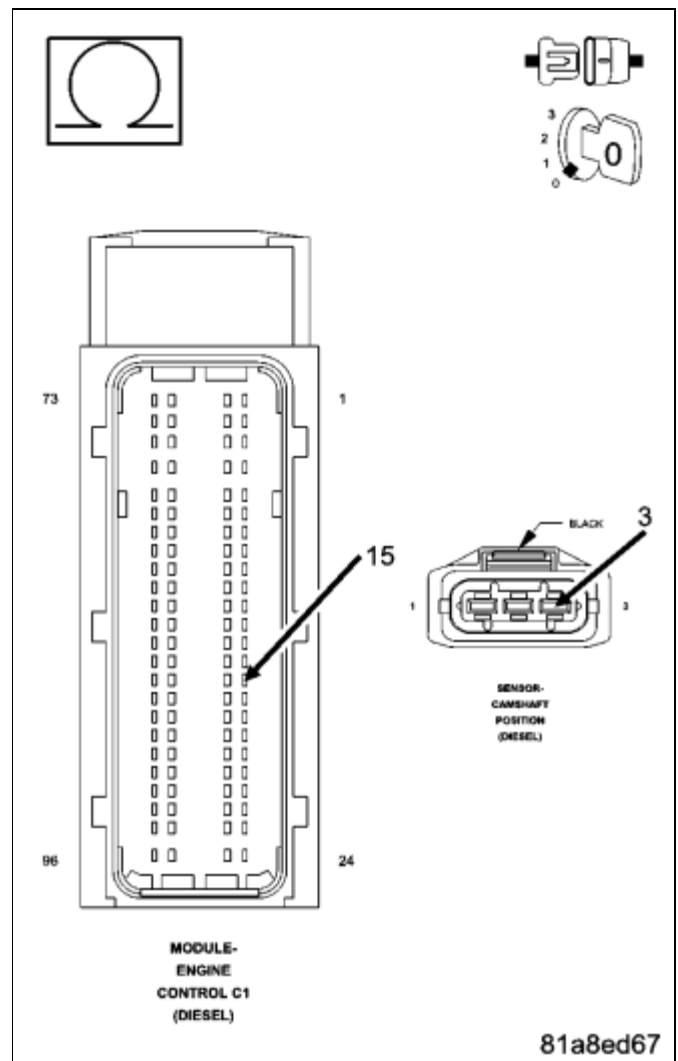
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (K844) CMP 5-Volt Supply circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K844) CMP Sensor 5-Volt Supply circuit at the CMP Sensor harness connector.

Is the resistance above 1000 ohms?

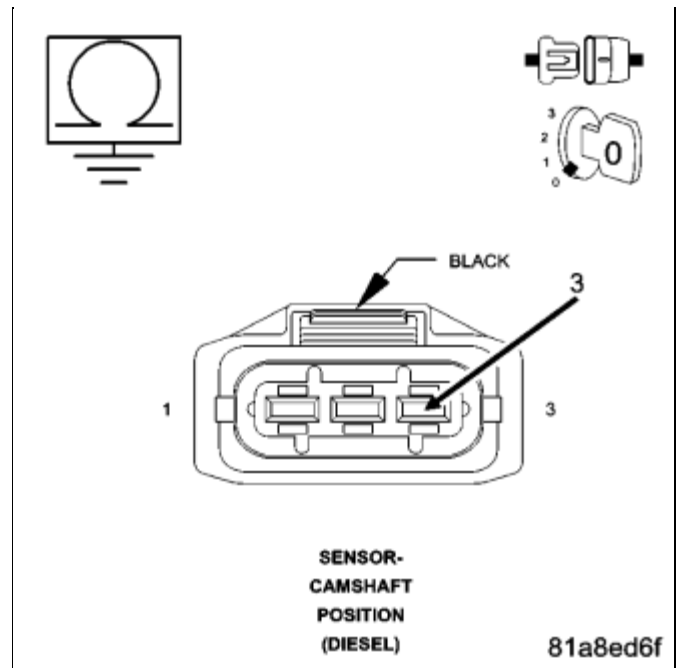
Yes

- Go To [11](#)

No

- Repair the (K844) CMP Sensor 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



11. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT

Measure the resistance between the (K844) CMP Sensor 5-Volt Supply circuit and the (K944) CMP Sensor Ground circuit at the CMP Sensor harness connector.

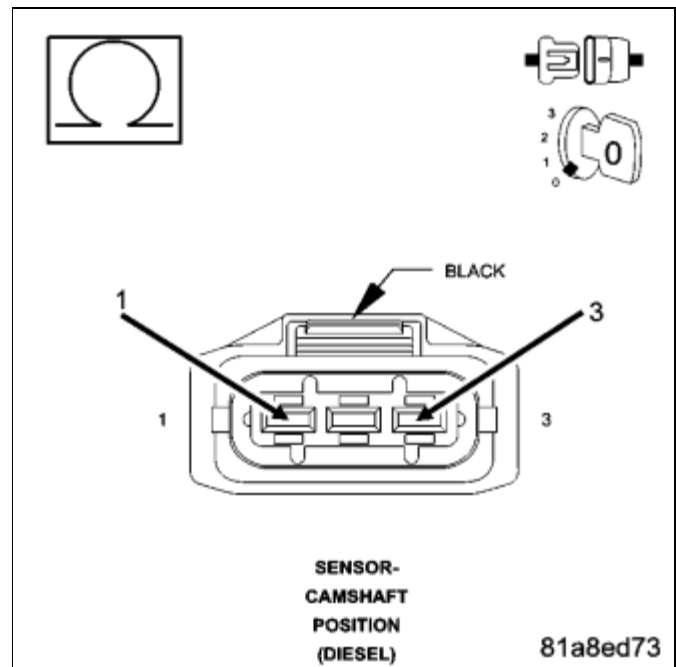
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K844) CMP Sensor 5-Volt Supply Circuit and (K944) CMP Sensor Ground circuits for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (K44) CMP Sensor Signal circuit between the ECM harness connector and the CMP Sensor harness connector.

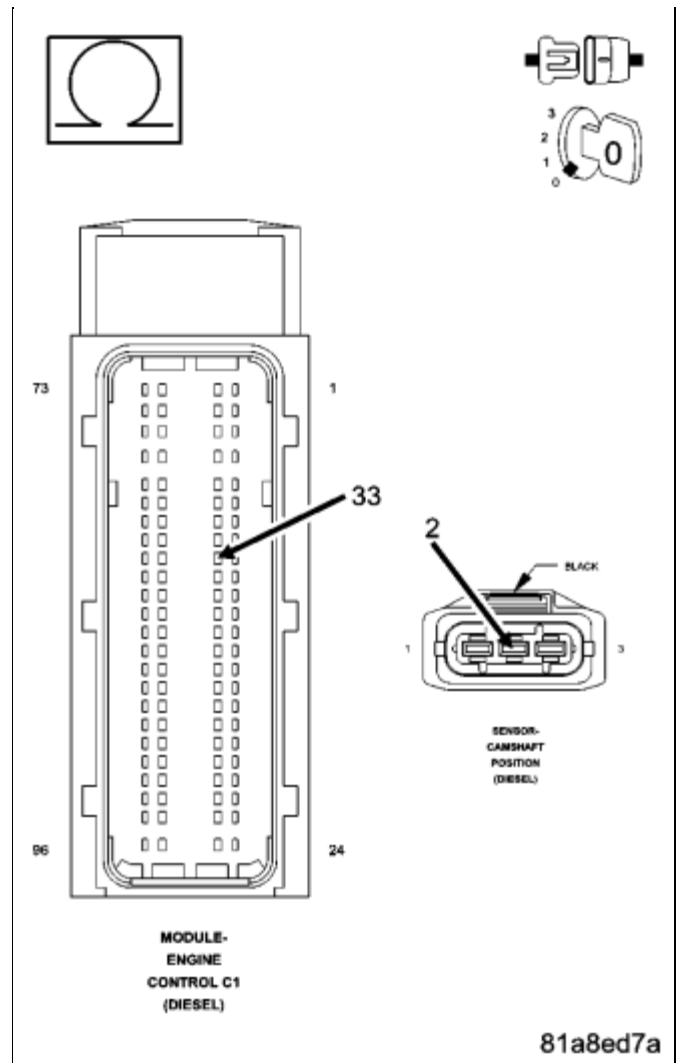
Is the resistance below 10.0 ohms?

Yes

- Go To [13](#)

No

- Repair the (K44) CMP Sensor Signal circuit for an open
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector.

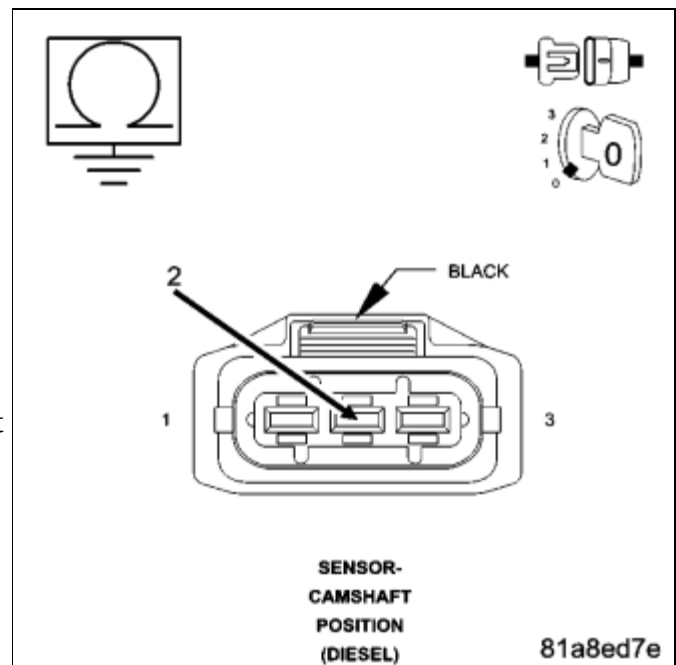
Is the resistance above 1000 ohms?

Yes

- Go To [14](#)

No

- Repair the (K44) CMP Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



14. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) CAMSHAFT POSITION SENSOR GROUND CIRCUIT

Measure the resistance between the (K44) CMP Sensor Signal circuit and the (K944) CMP Sensor Ground circuit at the CMP Sensor harness connector.

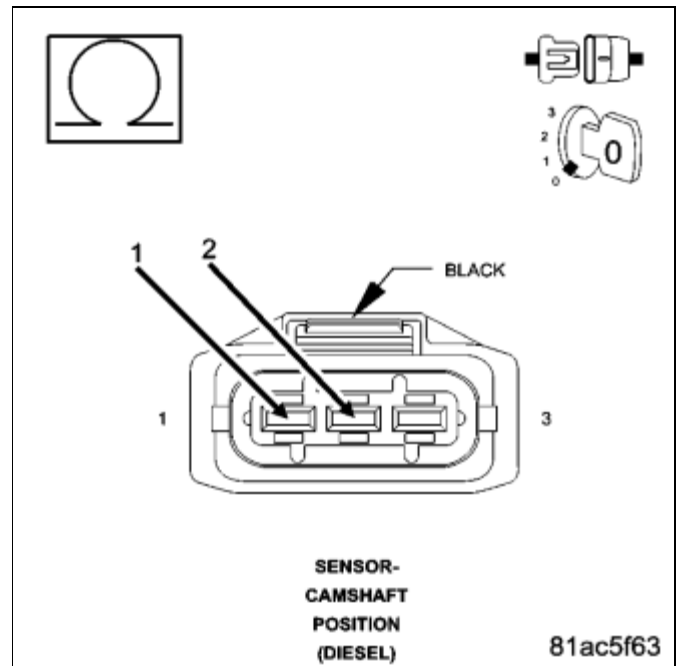
Is the resistance above 1000 ohms?

Yes

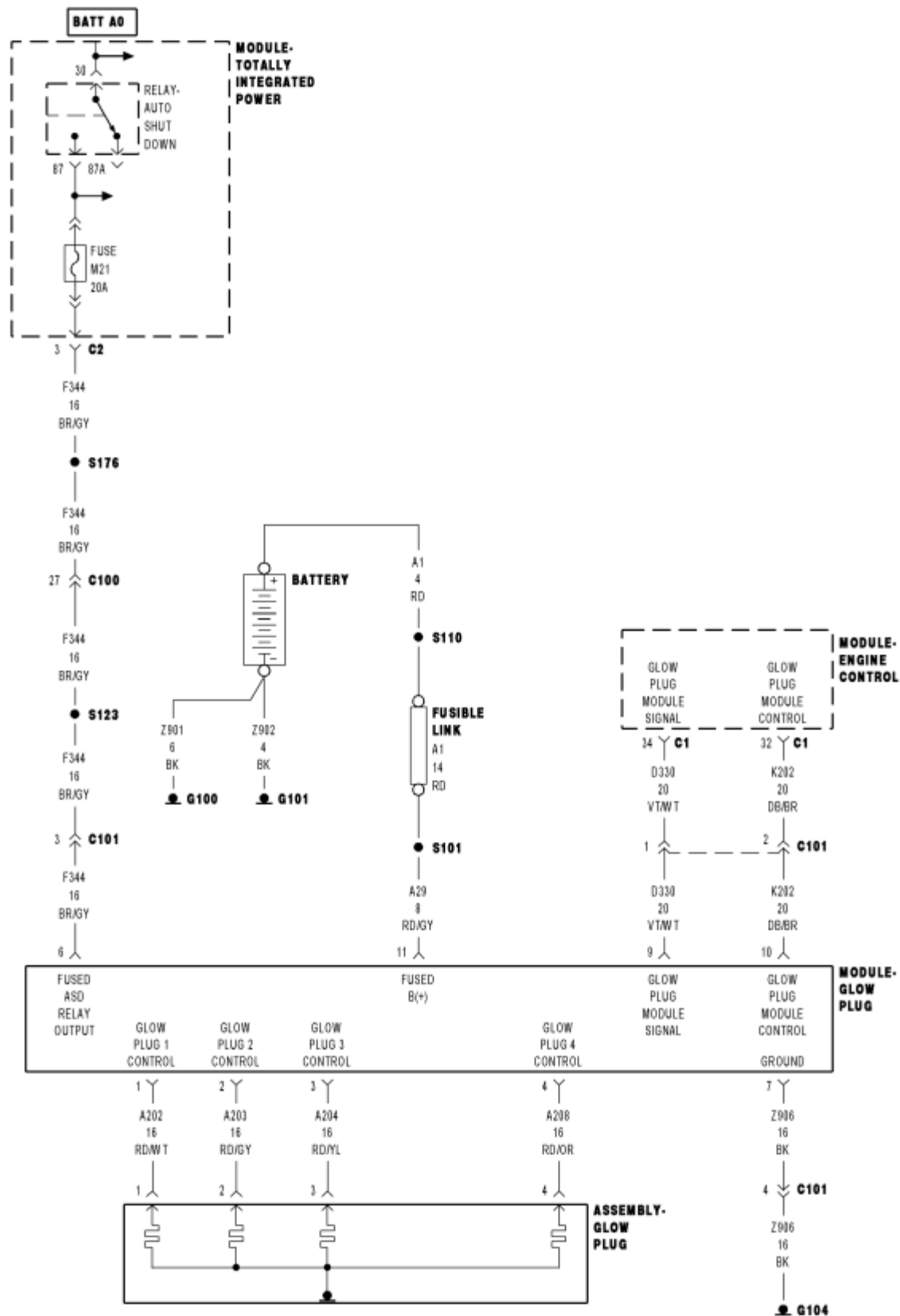
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K44) CMP Sensor Signal circuit and the (K944) CMP Sensor Ground circuit for a short together.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0383-GLOW PLUG CONTROL MODULE CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The ECM detects an open or short to ground on the (K202) Glow Plug Module Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND
(K202) GLOW PLUG MODULE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
GLOW PLUG MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Glow Plugs.

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Glow Plug Module harness connector.
 Disconnect the Engine Control Module (ECM) harness connectors.
 Measure the resistance between ground and the (K202) Glow Plug Module Control circuit in the Glow Plug Module harness connector.

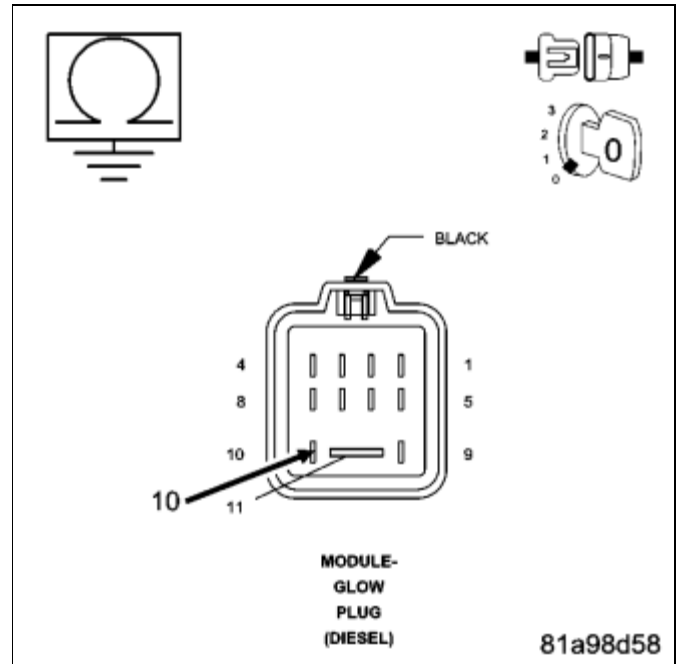
Is the resistance below 1000 ohms?

Yes

- Repair the (K202) Glow Plug Module Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K202) GLOW PLUG MODULE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K202) Glow Plug Module Control circuit between the Glow Plug Module harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

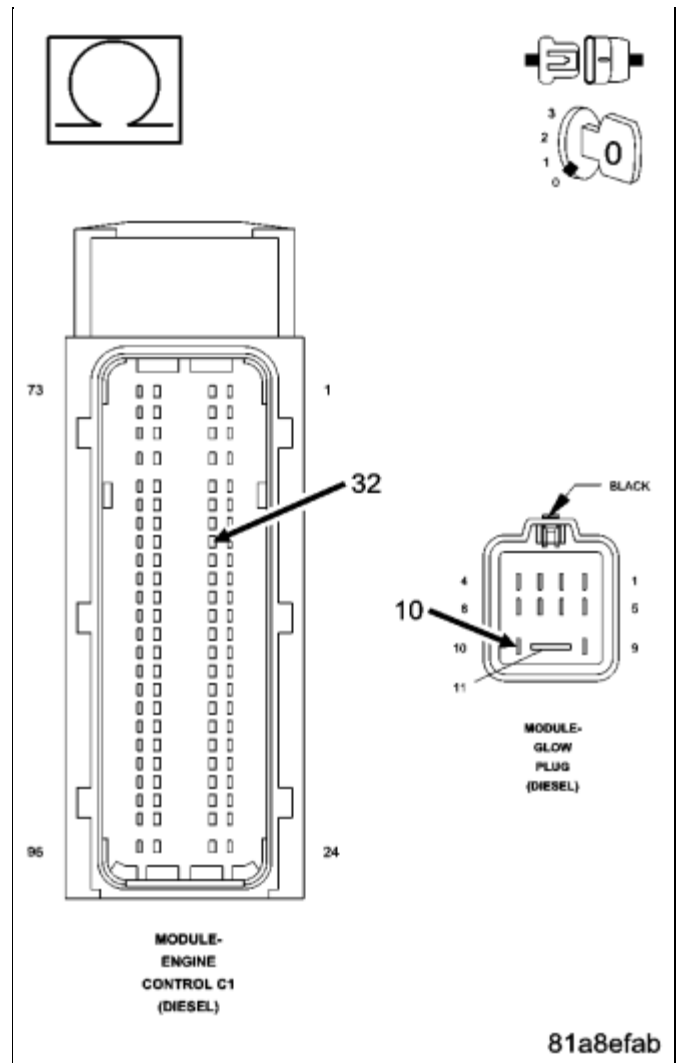
Yes

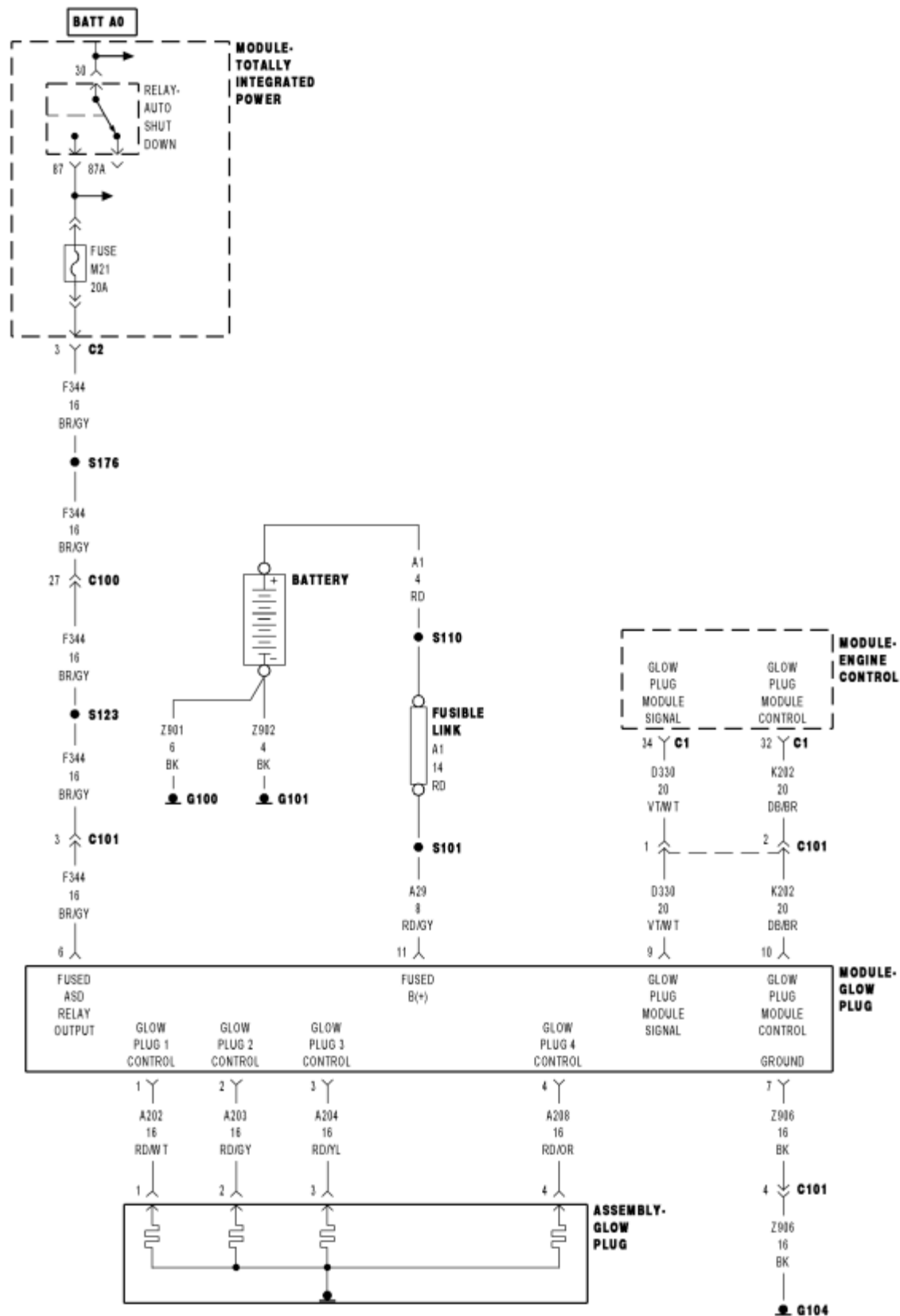
- Replace the Glow Plug Control Module.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K202) Glow Plug Module Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0384-GLOW PLUG CONTROL MODULE CONTROL CIRCUIT HIGH





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For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to voltage on the (K202) Glow Plug Module Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Glow Plugs.

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

(K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE

2.

Turn the ignition off.
 Disconnect the Glow Plug Module harness connector.
 Disconnect the Engine Control Module (ECM) harness connectors.
 Turn the ignition on.
 Measure the voltage of the (K202) Glow Plug Module Control circuit.

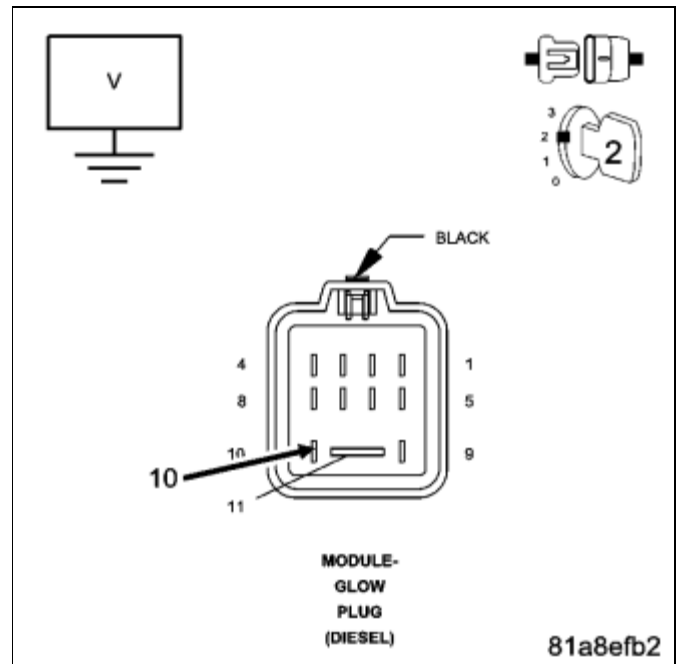
Is the voltage below 0.5 volt?

Yes

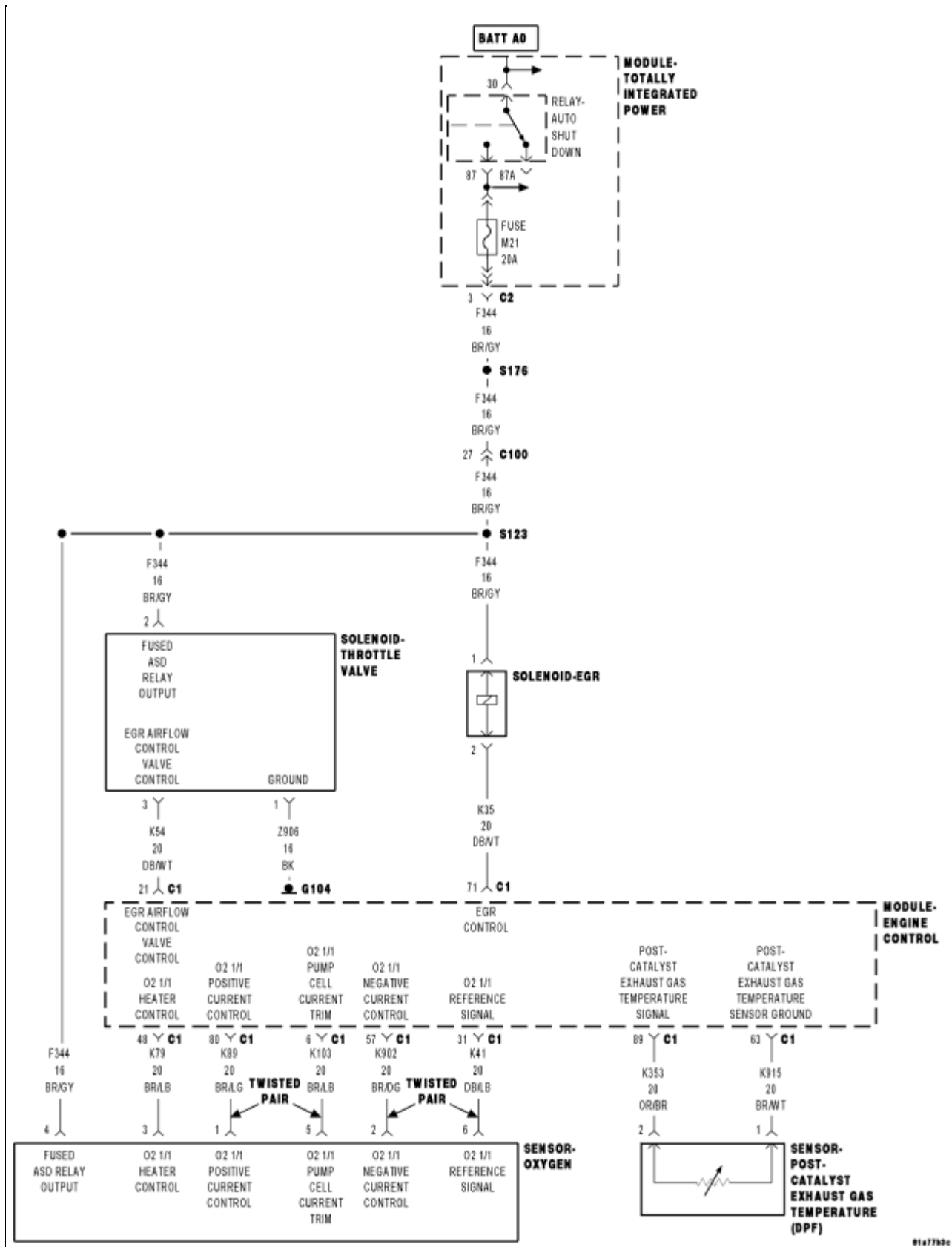
- Replace the Glow Plug Control Module.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K202) Glow Plug Module Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0401-EGR SOLENOID CIRCUIT NEGATIVE DEVIATION



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects EGR flow is less than the requested flow.

Possible Causes
AIR FILTER
AIR RESTRICTION
CHECKING FOR AIR LEAKS
CHECKING THE EGR AIR FLOW CONTROL VALVE
CHECKING THE EGR COOLER AND TUBES
EGR VALVE
INTERMITTENT CONDITION

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

NOTE: If there are any Mass Air Flow DTC's, diagnose the MAF DTC's before continuing EGR diagnostics.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

Were any of these problems found?**Yes**

- Replace the Air Filter element.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. AIR RESTRICTION

NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

Inspect the intake system, exhaust system and related tubes and connections.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECKING FOR AIR LEAKS

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECKING EGR AIR FLOW CONTROL VALVE (EGR AFCV)

Disconnect the air tube at the inlet port of the EGR Air Flow Control Valve.

Turn the ignition on.

Use a mirror to observe the motion of the EGR Air Flow Control Valve in the following step.

NOTE: The EGR AFCV should be normally open (allowing full air flow) then close during actuation.

With the scan tool, actuate the “Throttle Valve” while observing the EGR Air Flow Control Valve.

Does the EGR AFCV close completely when actuated?

Yes

- Go To [6](#)

No

- Replace the EGR Air Flow Control Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. CHECKING EGR COOLER AND TUBES

Turn the ignition off.

Gain access to and inspect the EGR Cooler and both tubes that connect to the EGR Cooler. Check tubes and cooler for damage, leaks, excessive carbon build up and other problems that could restrict or prevent proper exhaust gas flow.

NOTE: Compressed air (at low pressure) can be applied to the lower port of the EGR Cooler. When applying compressed air check for air to flow through cooler and out the upper port. Always wear safety glasses when working with compressed air.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECKING THE EGR VACUUM SUPPLY

Refer to the symptom Checking The EGR Vacuum Supply to check for proper EGR vacuum supply and EGR Solenoid operation.

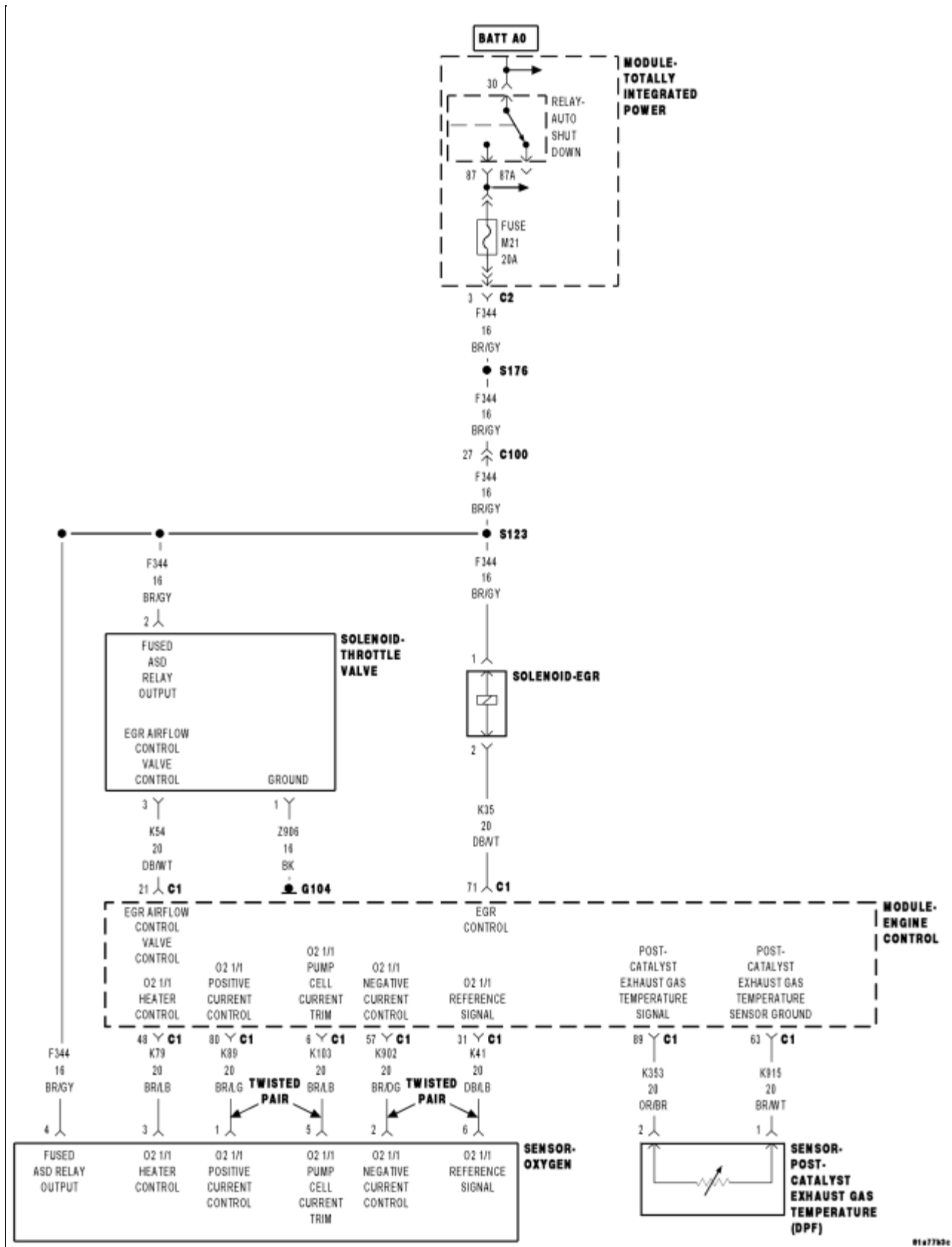
Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the EGR Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0402-EGR SOLENOID CIRCUIT POSITIVE DEVIATION



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects EGR flow is more than the requested flow.

Possible Causes
AIR FILTER
AIR RESTRICTION
CHECKING FOR AIR LEAKS
CHECKING THE EGR AIR FLOW CONTROL VALVE
CHECKING THE EGR COOLER AND TUBES
EGR VALVE
INTERMITTENT CONDITION

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

NOTE: If there are any Mass Air Flow DTC's, diagnose the MAF DTC's before continuing EGR diagnostics.

Did this DTC set again?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

Were any of these problems found?**Yes**

- Replace the Air Filter element.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. AIR RESTRICTION

NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause this DTC to set.

Inspect the intake system, exhaust system and related tubes and connections.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECKING FOR AIR LEAKS

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECKING EGR AIR FLOW CONTROL VALVE (EGR AFCV)

Disconnect the air tube at the inlet port of the EGR Air Flow Control Valve.

Turn the ignition on.

Use a mirror to observe the motion of the EGR Air Flow Control Valve in the following step.

NOTE: The EGR AFCV should be normally open (allowing full air flow) then close during actuation.

With the scan tool, actuate the “Throttle Valve” while observing the EGR Air Flow Control Valve.

Does the EGR AFCV close completely when actuated?

Yes

- Go To [6](#)

No

- Replace the EGR Air Flow Control Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. CHECKING EGR COOLER AND TUBES

Turn the ignition off.

Gain access to and inspect the EGR Cooler and both tubes that connect to the EGR Cooler. Check tubes and cooler for damage, leaks, excessive carbon build up and other problems that could restrict or prevent proper exhaust gas flow.

NOTE: Compressed air (at low pressure) can be applied to the lower port of the EGR Cooler. When applying compressed air check for air to flow through cooler and out the upper port. Always wear safety glasses when working with compressed air.

Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECKING THE EGR VACUUM SUPPLY

Refer to the symptom Checking The EGR Vacuum Supply to check for proper EGR vacuum supply and EGR Solenoid operation.

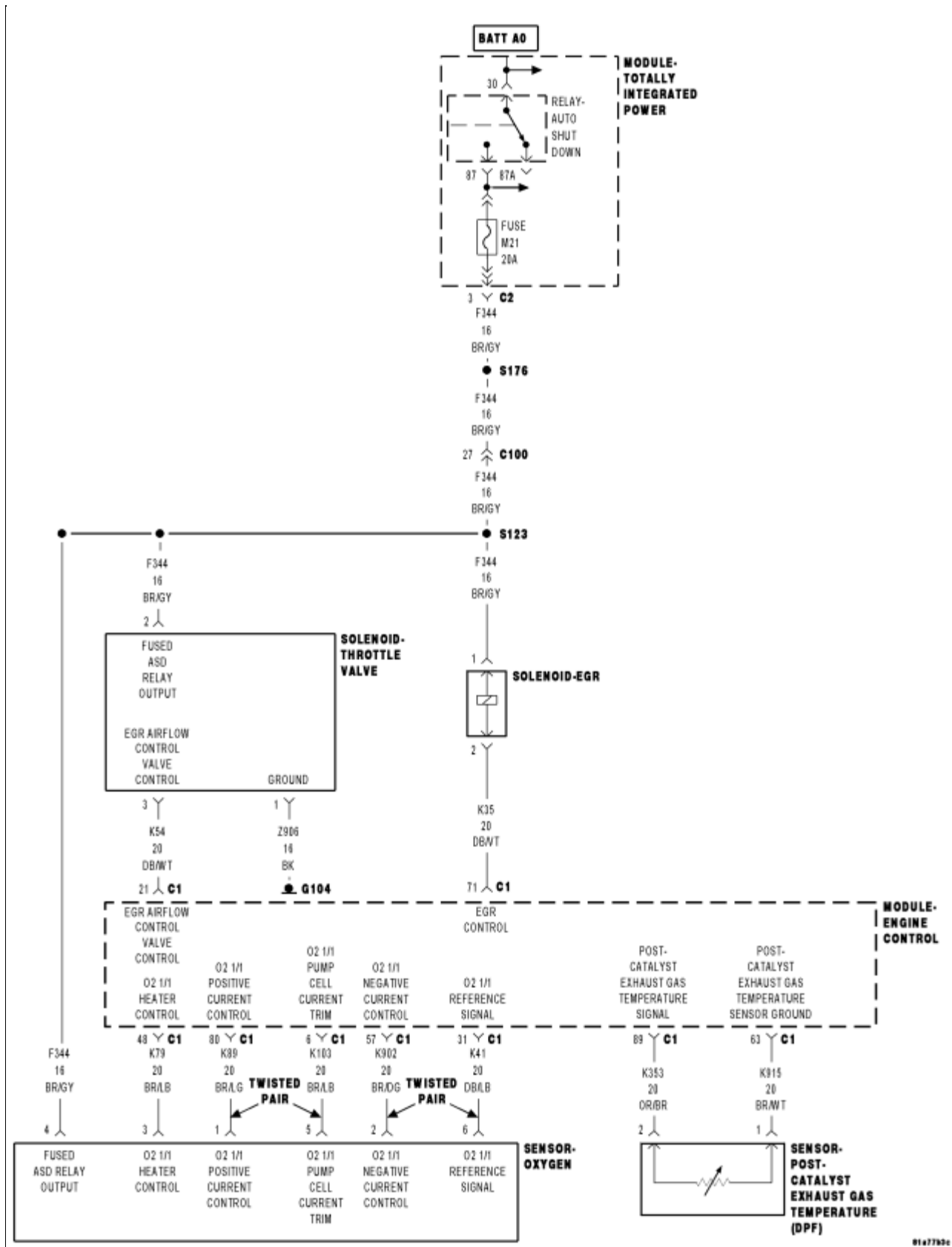
Were any problems found?**Yes**

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the EGR Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0403-EGR SOLENOID CIRCUIT OPEN



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The EGR Solenoid is a two-wire electrically operated vacuum solenoid used to control the vacuum supply to the EGR Solenoid. The Solenoid receives 12 volts from the ECM/ASD relay and a pulse-width modulated ground signal from the ECM. The solenoid contains 2 vacuum ports. Vacuum from the vacuum pump system is supplied to one of the ports. The other port is connected to the EGR Solenoid. With the solenoid de-energized (off) the vacuum supply is blocked within the solenoid, prohibiting vacuum from reaching the EGR Solenoid. When the ECM energizes (grounds) the solenoid, the vacuum supply is applied to the EGR Solenoid causing the EGR Solenoid to open.

- **When Monitored:**

With the ignition on and the EGR Solenoid command off.

- **Set Condition:**

The ECM detects an open on the (K35) EGR Solenoid Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
(F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
EGR SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Exhaust Gas Recirc Positioner.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

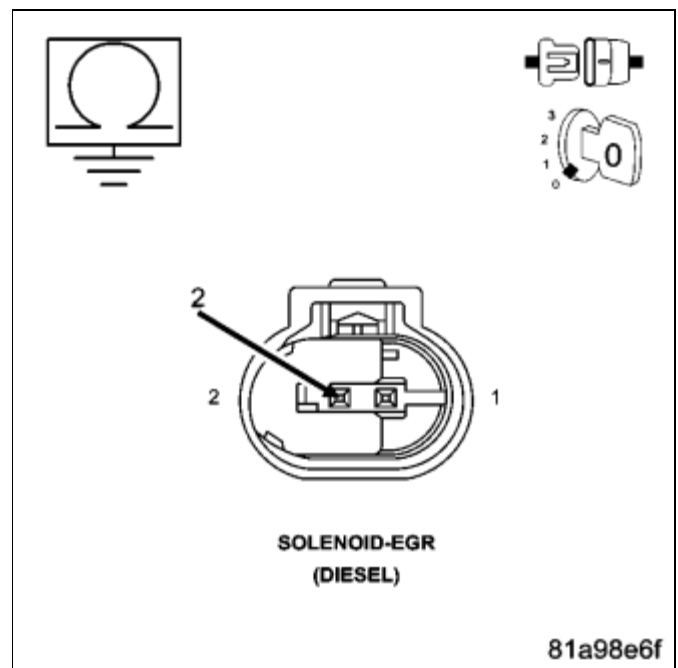
Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

Is the resistance above 1000 ohms?**Yes**

- Go to [3](#)

No

- Repair the (K35) EGR Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**3. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE**

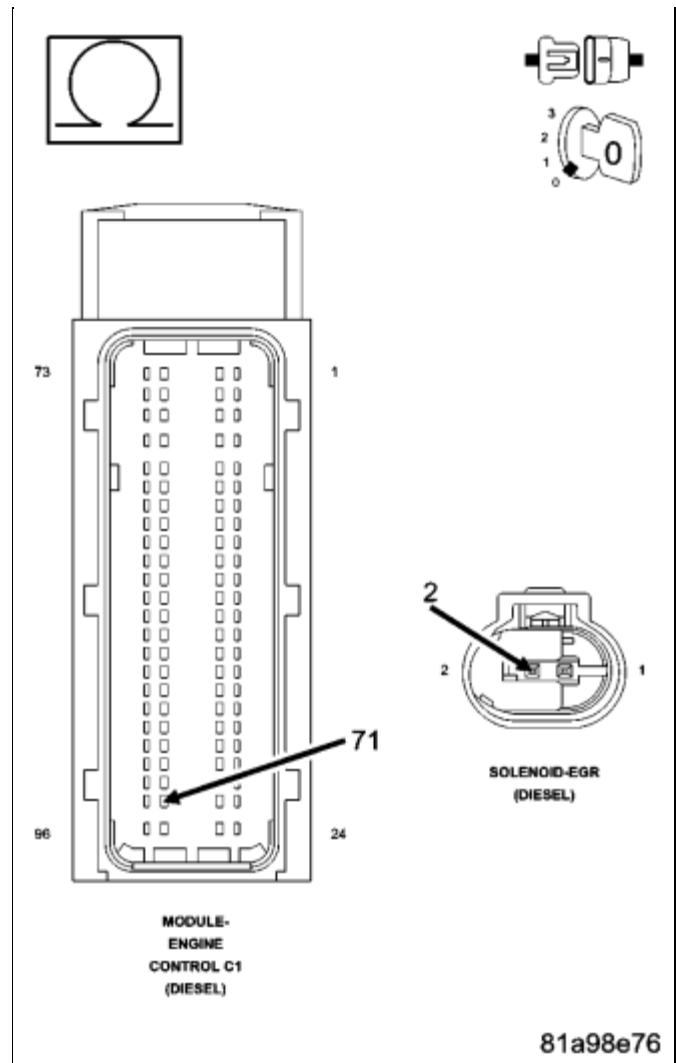
Measure the resistance of the (K35) EGR Solenoid Control circuit between the EGR Solenoid harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?**Yes**

- Go to [4](#)

No

- Repair the (K35) EGR Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (F344) FUSED ASD RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE

Connect the Engine Control Module (ECM) connector.
Turn the ignition on.

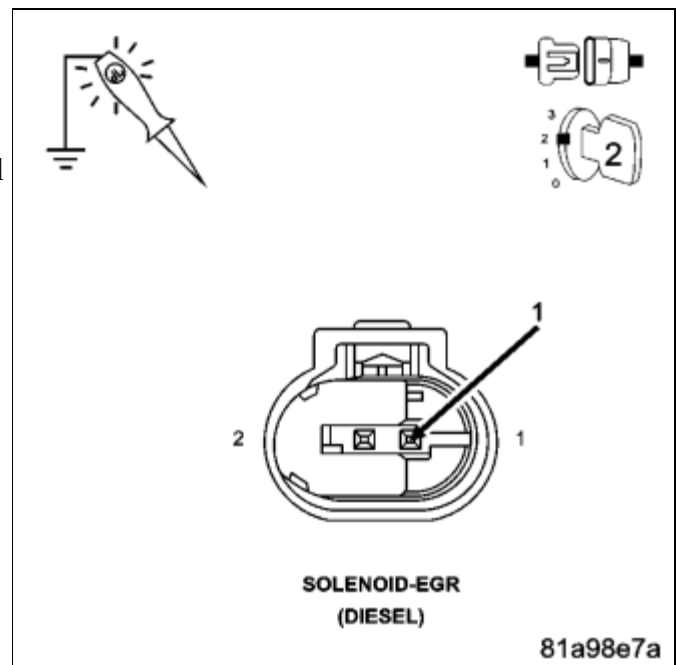
Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output circuit at the EGR Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go to [5](#)



No

- Repair the (F344) Fused ASD Relay Output circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

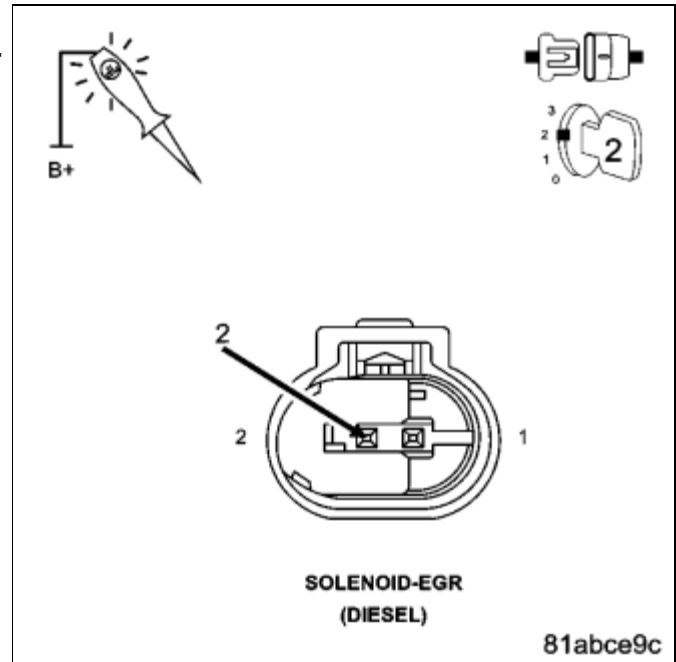
5. EGR SOLENOID

With the scan tool, actuate the Exhaust Gas Recirc Positioner to 100%.

Using a 12 volt test light connected to 12 volts, check the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.



Is the test light illuminated and bright?

Yes

- Replace the EGR Solenoid in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the EGR Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

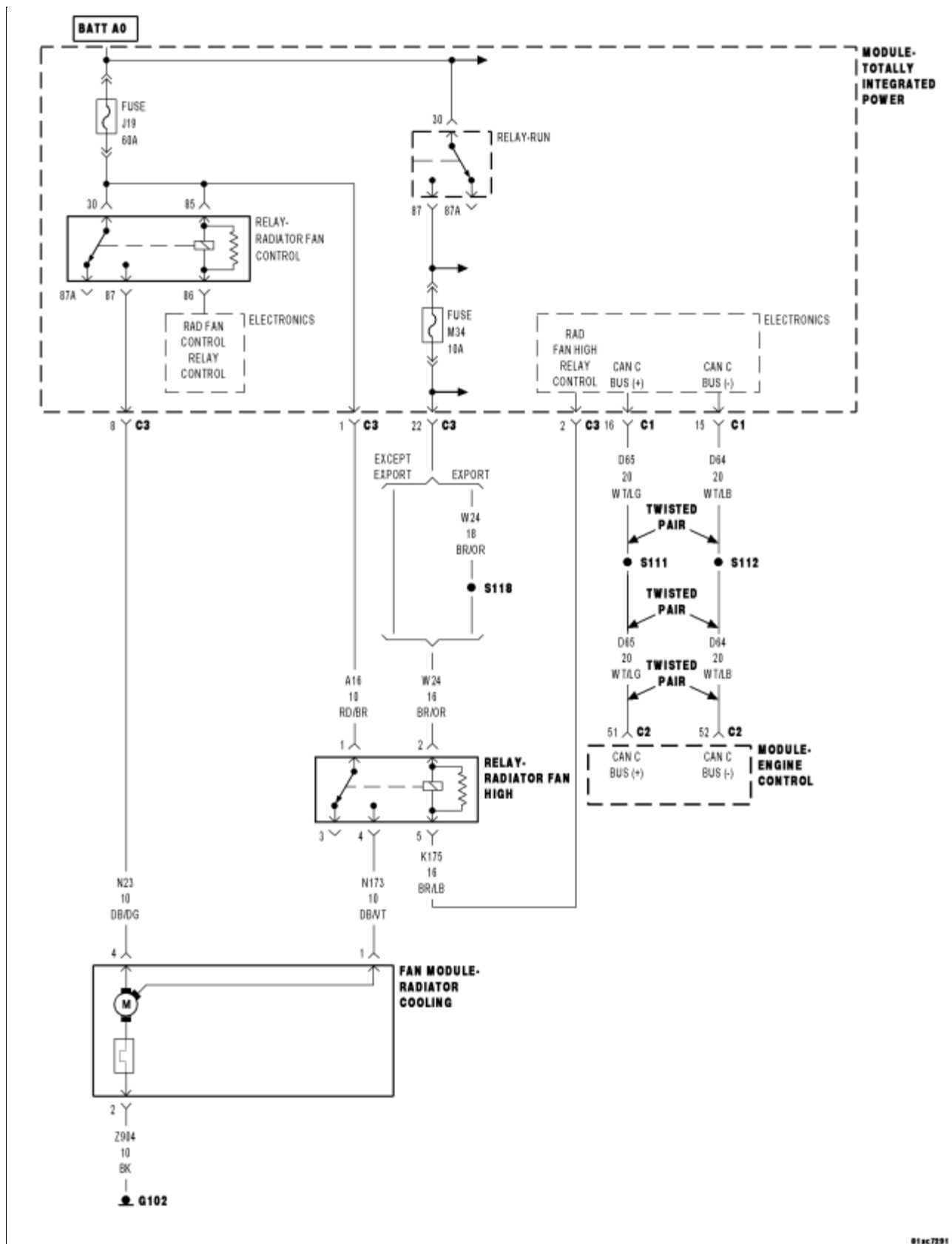
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0480-COOLING FAN 1 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating.

Possible Causes
CAN C BUS FAILURE
ENGINE COOLANT TEMP SENSOR DTCS SET
COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Cooling Fan.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. CAN C or ECT DTCS CURRENTLY ACTIVE

Are any CAN C or ECT DTCs Active at this time?

Yes

- Refer to the appropriate diagnostics for the ECT Sensor or CAN C Bus DTC.

No

- Go To [3](#)

3. COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM

Are any Cooling Fan Control Circuit DTCs set in the TIPM?**Yes**

- Diagnose the appropriate Cooling Fan Control Circuit DTC in the TIPM

No

- Go To [4](#)

4. ECM

NOTE: Before continuing, check the ECM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

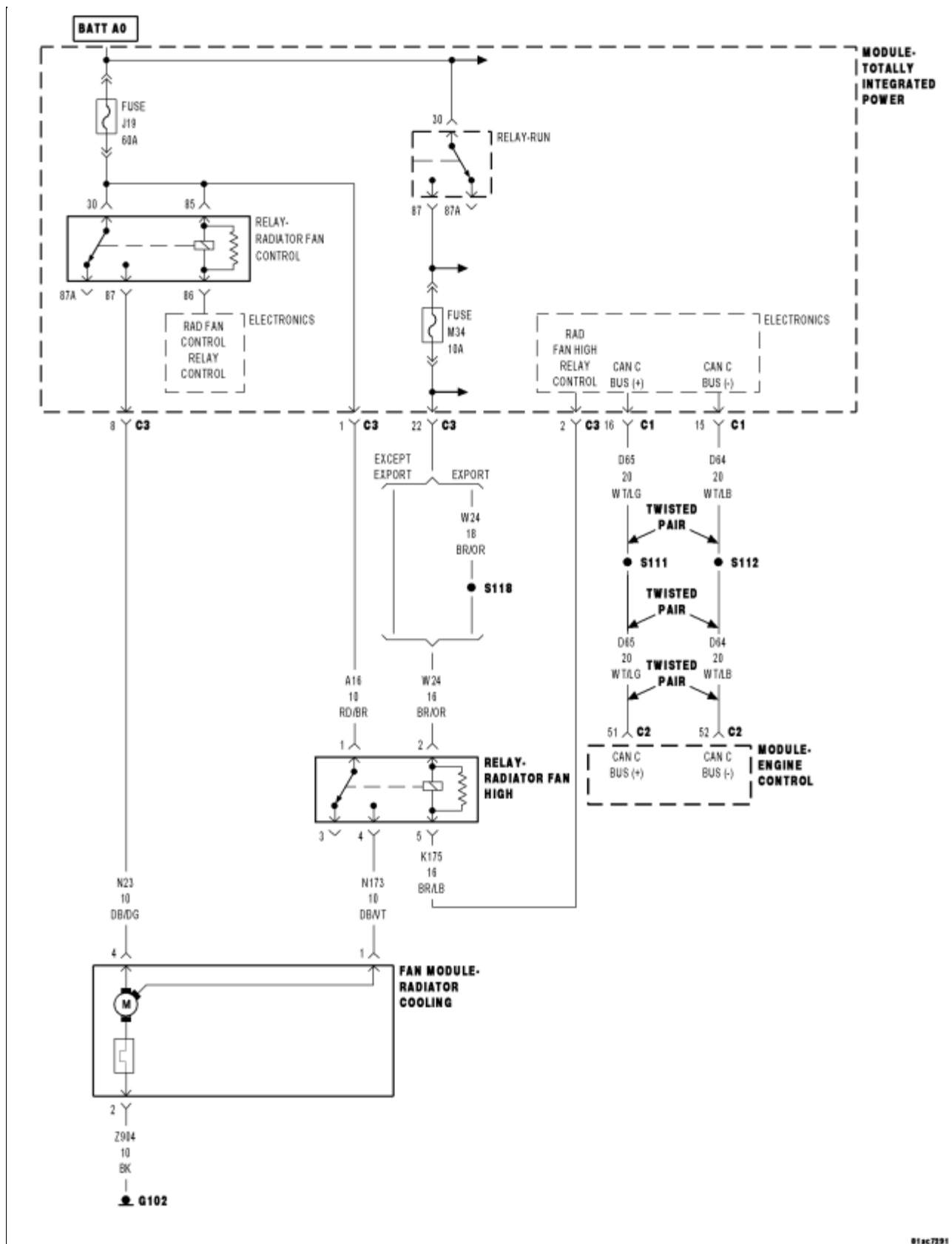
Were there any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0481-COOLING FAN 2 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating.

Possible Causes
CAN C BUS FAILURE
ENGINE COOLANT TEMP SENSOR DTCS SET
COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Cooling Fan High Speed Relay.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CAN C or ECT DTCS CURRENTLY ACTIVE

Are any CAN C or ECT DTCs Active at this time?

Yes

- Refer to the appropriate diagnostics for the ECT Sensor or CAN C Bus DTC.

No

- Go To [3](#)

3. COOLING FAN CONTROL CIRCUIT DTCS SET IN THE TIPM

Are any Cooling Fan Control Circuit DTCs set in the TIPM?**Yes**

- Diagnose the appropriate Cooling Fan Control Circuit DTC in the TIPM

No

- Go To [4](#)

4. ECM

NOTE: Before continuing, check the ECM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

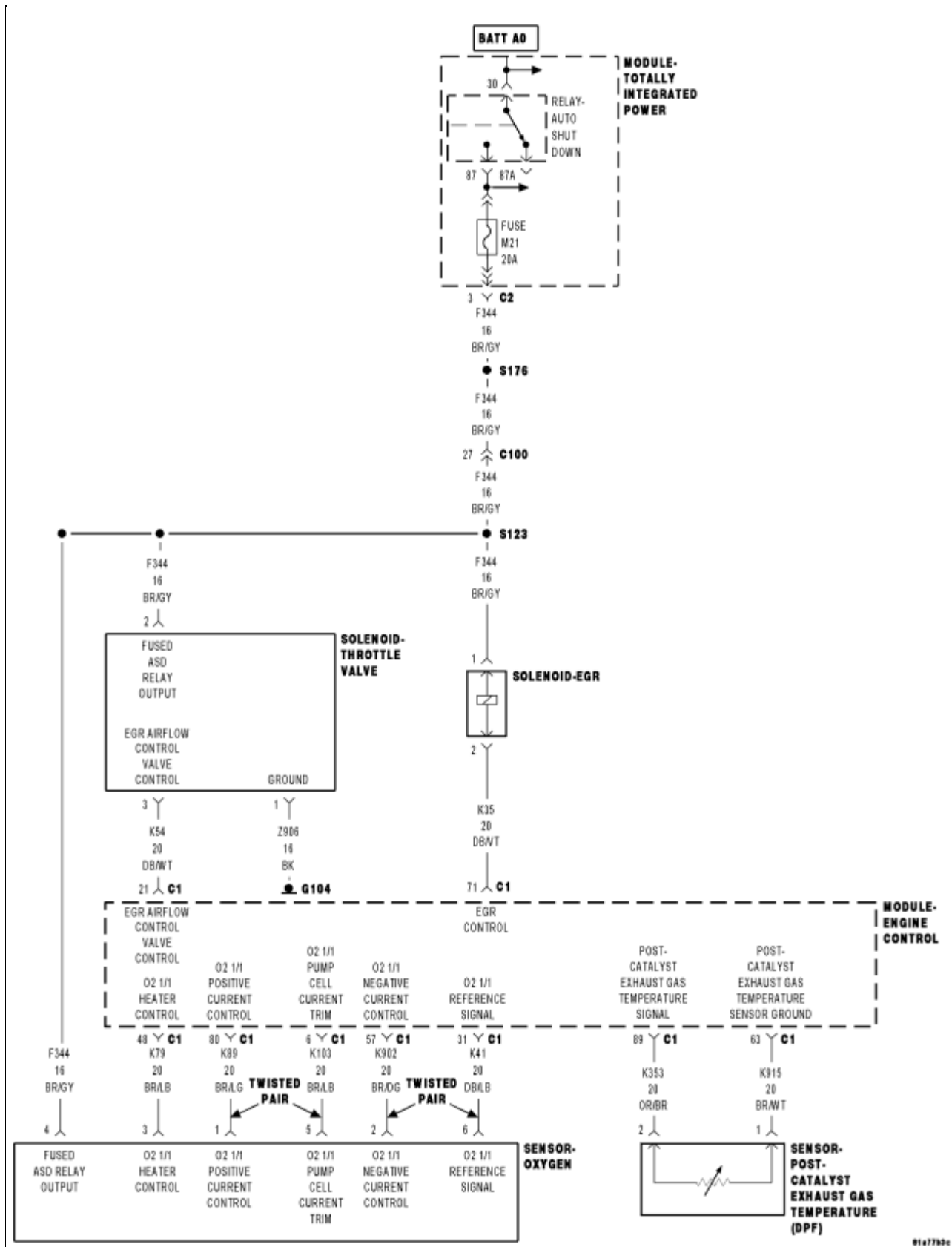
Were there any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0489-EGR CONTROL CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The EGR Solenoid is a two-wire electrically operated vacuum solenoid used to control the vacuum supply to the EGR Valve. The Solenoid receives 12 volts from the ECM/ASD relay and a pulse-width modulated ground signal from the ECM. The solenoid contains 2 vacuum ports. Vacuum from the vacuum pump system is supplied to one of the ports. The other port is connected to the EGR Valve. With the solenoid de-energized (off) the vacuum supply is blocked within the solenoid, prohibiting vacuum from reaching the EGR Valve. When the ECM energizes (grounds) the solenoid, the vacuum supply is applied to the EGR Valve causing the EGR Valve to open.

- **When Monitored:**

With the ignition on and the EGR Solenoid command off.

- **Set Condition:**

The ECM detects a short to ground on the (K35) EGR Solenoid Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
EGR SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the EGR Solenoid at 100%.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

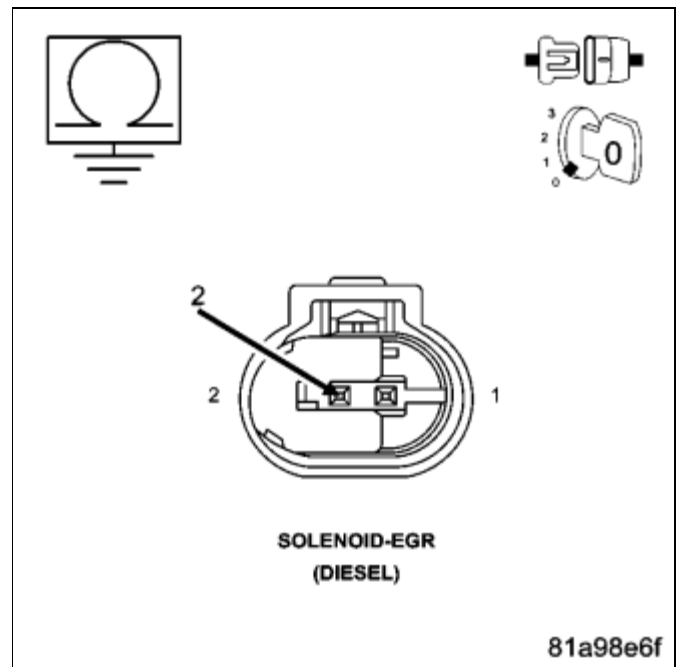
Is the resistance below 1000 ohms?

Yes

- Repair the (K35) EGR Solenoid Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K35) EGR Solenoid Control circuit between the EGR Solenoid harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

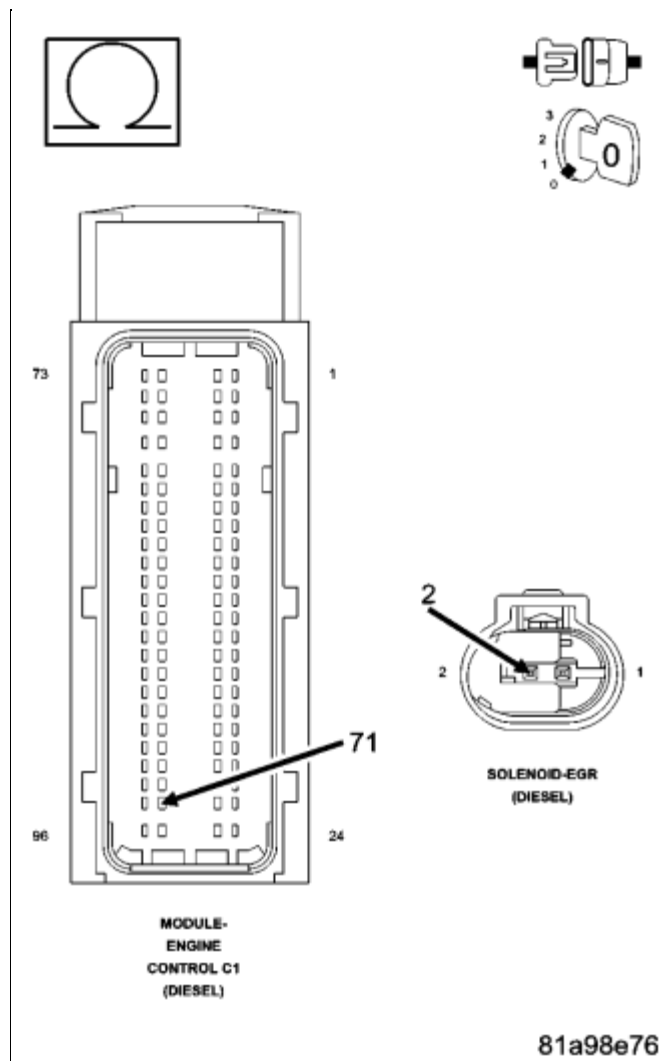
Yes

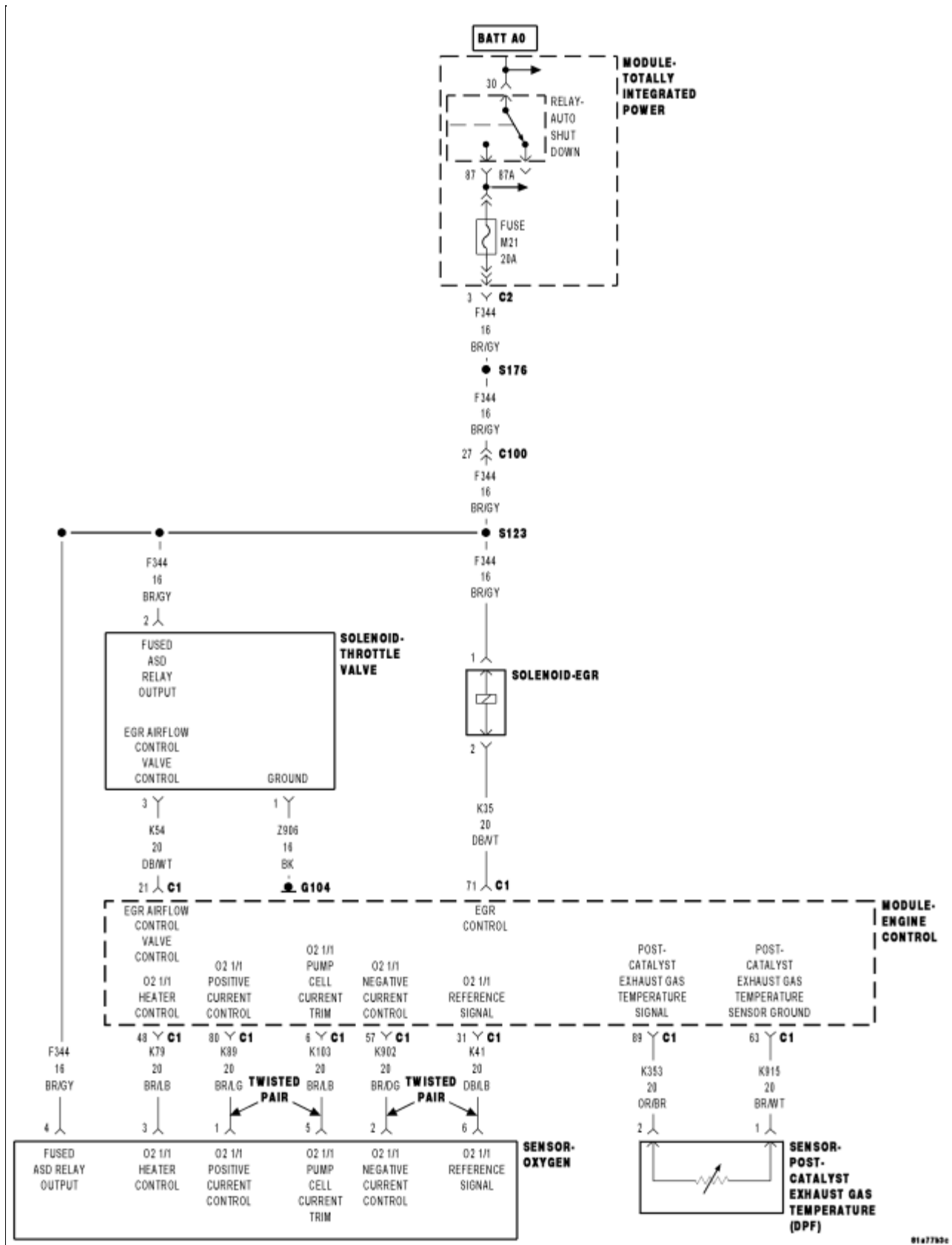
- Replace the EGR Solenoid.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K35) EGR Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0490-EGR CONTROL CIRCUIT HIGH





For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The EGR Solenoid is a two-wire electrically operated vacuum solenoid used to control the vacuum supply to the EGR Valve. The Solenoid receives 12 volts from the ECM/ASD relay and a pulse-width modulated ground signal from the ECM. The solenoid contains 2 vacuum ports. Vacuum from the vacuum pump system is supplied to one of the ports. The other port is connected to the EGR Valve. With the solenoid de-energized (off) the vacuum supply is blocked within the solenoid, prohibiting vacuum from reaching the EGR Valve. When the ECM energizes (grounds) the solenoid, the vacuum supply is applied to the EGR Valve causing the EGR Valve to open.

- **When Monitored:**

With the ignition on and the EGR Solenoid command on.

- **Set Condition:**

The ECM detects excessive current on the (K35) EGR Solenoid Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
EGR SOLENOID
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the EGR Solenoid at 100%.

Monitor the scan tool for at least two minutes.

Start the engine.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the Engine Control Module harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

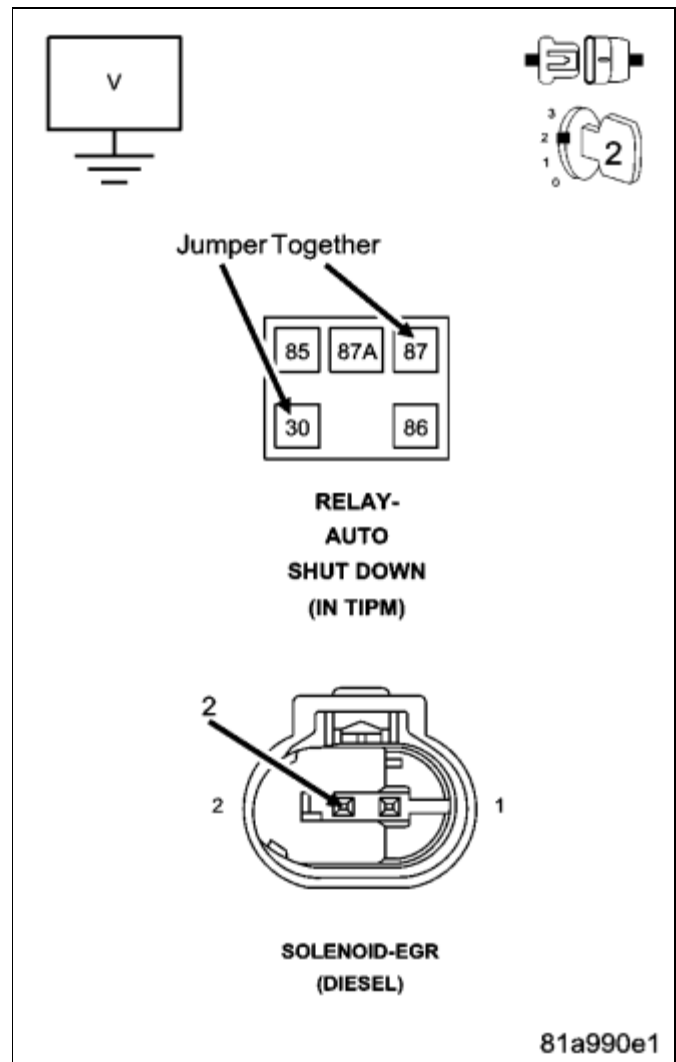
Is there any voltage present?

Yes

- Repair the (K35) EGR Solenoid Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Turn the ignition off.

Measure the resistance between the (K35) EGR Solenoid Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the EGR Solenoid harness connector.

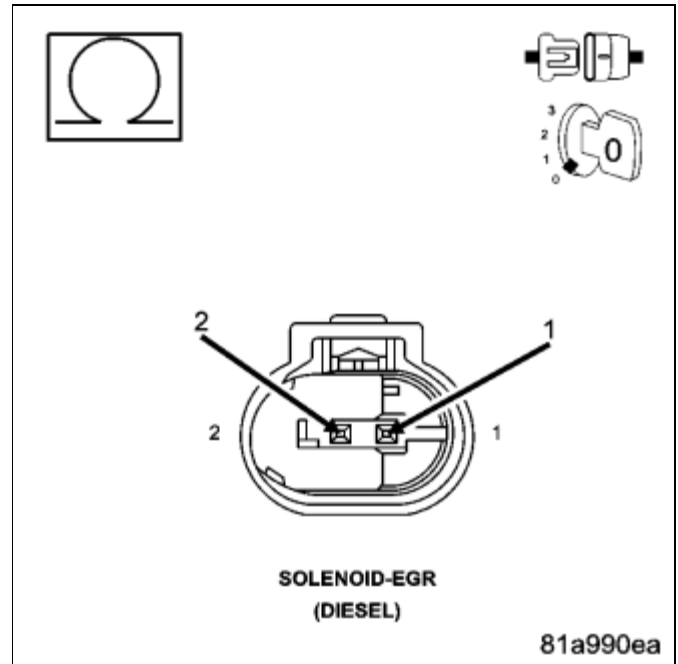
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K35) EGR Solenoid Control circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K35) EGR Solenoid Control circuit between the EGR Solenoid harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

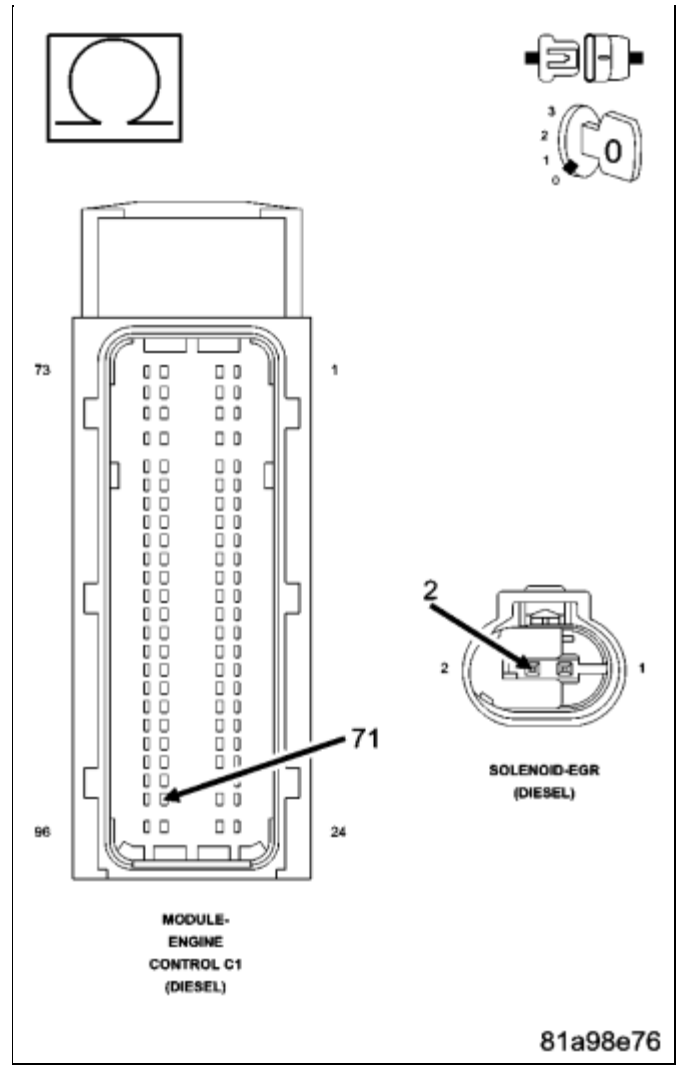
Yes

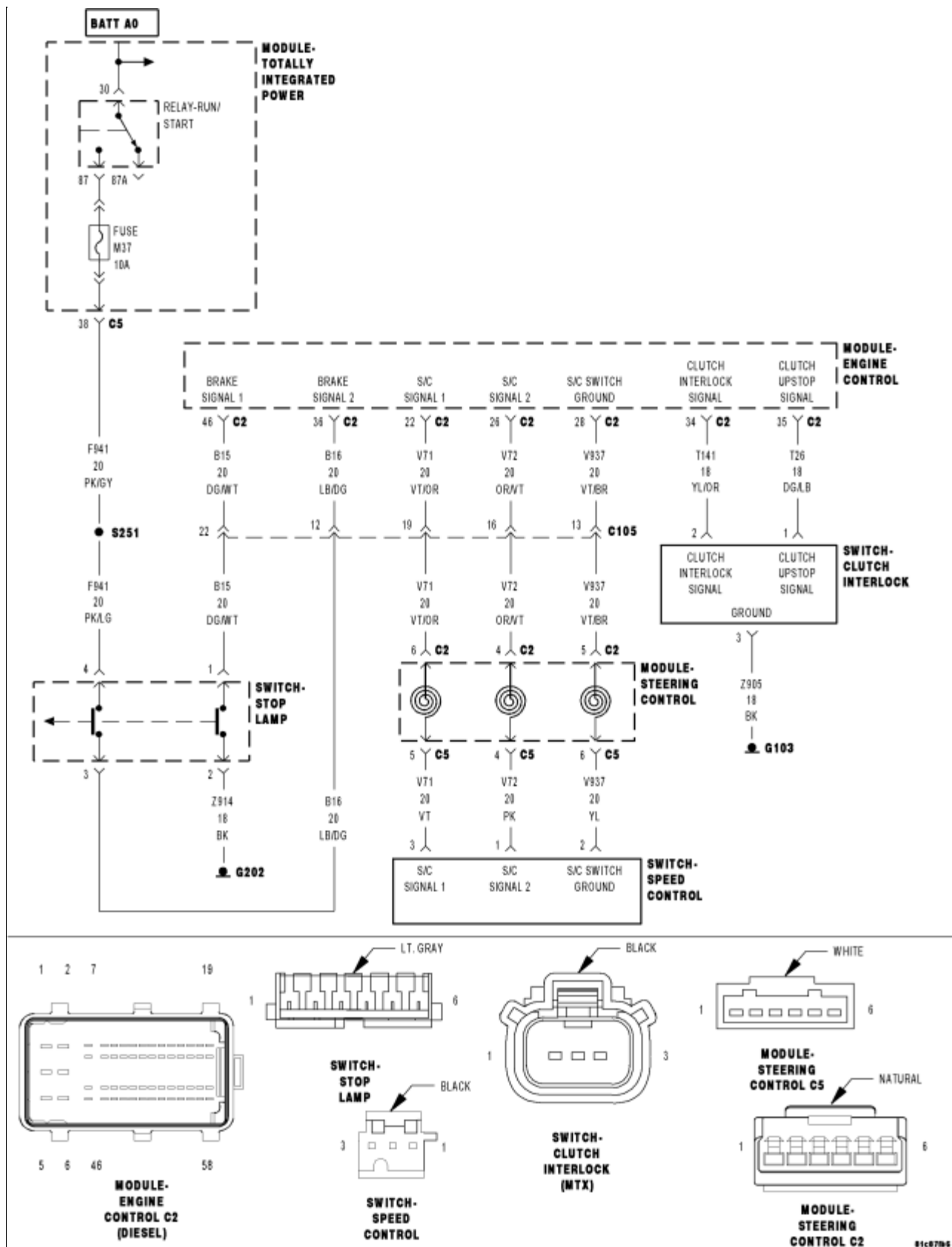
- Replace the EGR Solenoid.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K35) EGR Solenoid Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0504-BRAKE SWITCH A/B CORRELATION





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on. VSS indicates increasing and decreasing vehicle speed. APP Sensor indicates increasing and decreasing acceleration demand.

- **Set Condition:**

The ECM determines that the brakes have been applied without the receiving an input from the Primary Brake Switch Signal and Secondary Brake Switches.

Possible Causes
INTERMITTENT CONDITION
(Z914) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
(F941) IGNITION SWITCH START/RUN CIRCUIT
(B15) BRAKE SWITCH 1 SIGNAL CIRCUIT SHORTED TO GROUND
(B15) BRAKE SWITCH 1 SIGNAL CIRCUIT OPEN
(B16) BRAKE SWITCH 2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B16) BRAKE SWITCH 2 SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK THE BRAKE SWITCH 2 STATUS

Turn the ignition on.

While observing the BRAKE SWITCH 2 status on the scan tool display, press and release the brake pedal several times.

Does the scan tool display BRAKE SWITCH 2: PRESSED and NOT PRESSED for the appropriate pedal position?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. CHECK THE BRAKE SWITCH 1 STATUS

While observing the BRAKE SWITCH 1 status on the scan tool display, press and release the brake pedal several times.

Does the scan tool display BRAKE SWITCH 1: PRESSED and NOT PRESSED for the appropriate pedal position

Yes

- Go To [3](#)

No

- Go To [4](#)

3. INTERMITTENT CONDITION

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

4. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.
 Disconnect the Stop Lamp Switch harness connector.
 Turn the ignition on.
 Measure the voltage between the (B15) Brake Switch 1 Signal circuit and ground.

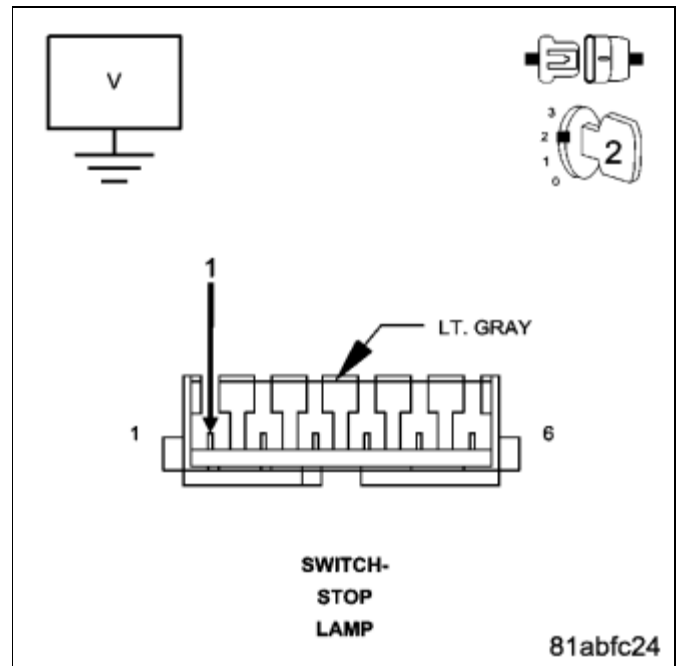
Is the voltage above 9.0 volts?

Yes

- Go To [5](#)

No

- Go To [8](#)



5. STOP LAMP SWITCH - SIGNAL 1 CKT OPEN

While monitoring the BRAKE SWITCH 1 status with the scan tool, connect a jumper wire between (Z914) Ground and the Brake Switch 1 Signal circuit.

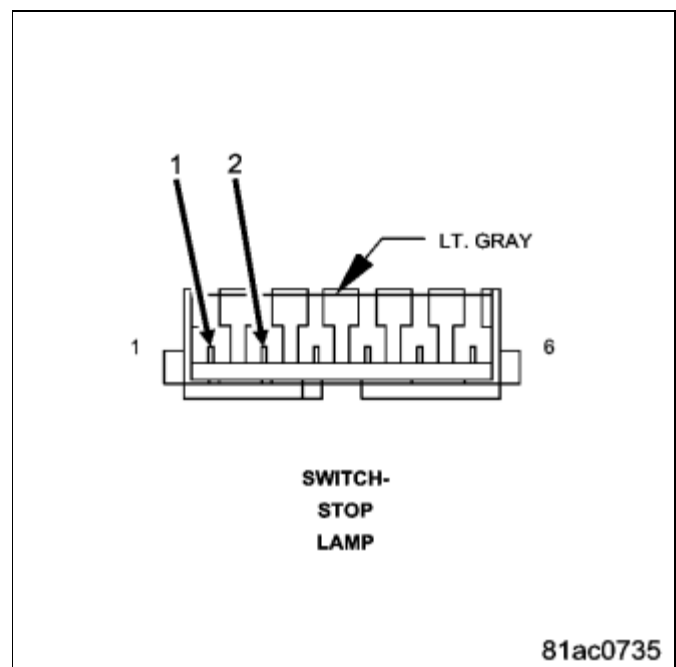
Does the scan tool display change from PRESSED to NOT PRESSED?

Yes

- Adjust or replace the Brake Lamp Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (Z914) GROUND CIRCUIT OPEN

Turn the ignition off.
Measure the resistance between ground and the (Z914) Ground circuit.

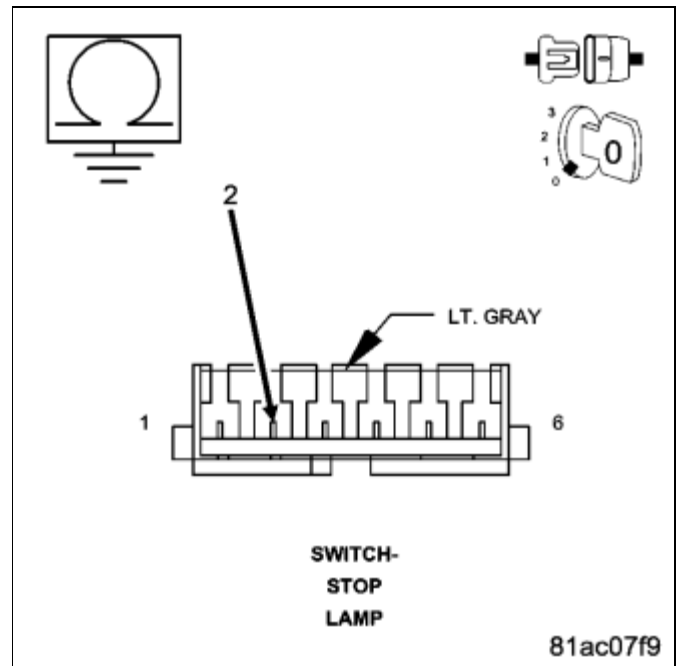
Is the resistance below 10.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (Z914) Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. ENGINE CONTROL MODULE - INTERNAL

If there are no possible causes remaining, view repair.

Repair

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the (B15) Brake Switch 1 Signal circuit.

Is the resistance above 1000 ohms?

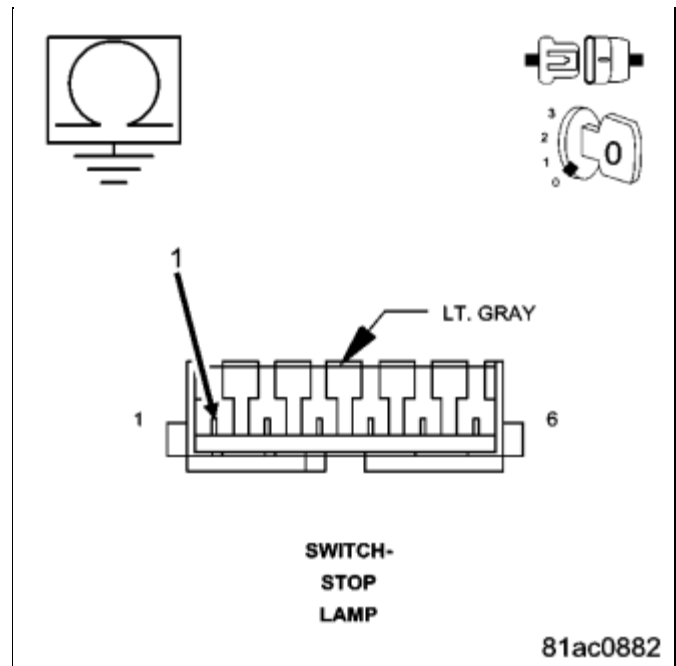
Yes

- Go To [9](#)

No

- Repair the (B15) Brake Switch 1 Signal circuit for a short to ground.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT OPEN

Measure the resistance of the (B15) Brake Switch 1 Signal circuit between the Stop Lamp Switch harness connector and the ECM harness connector.

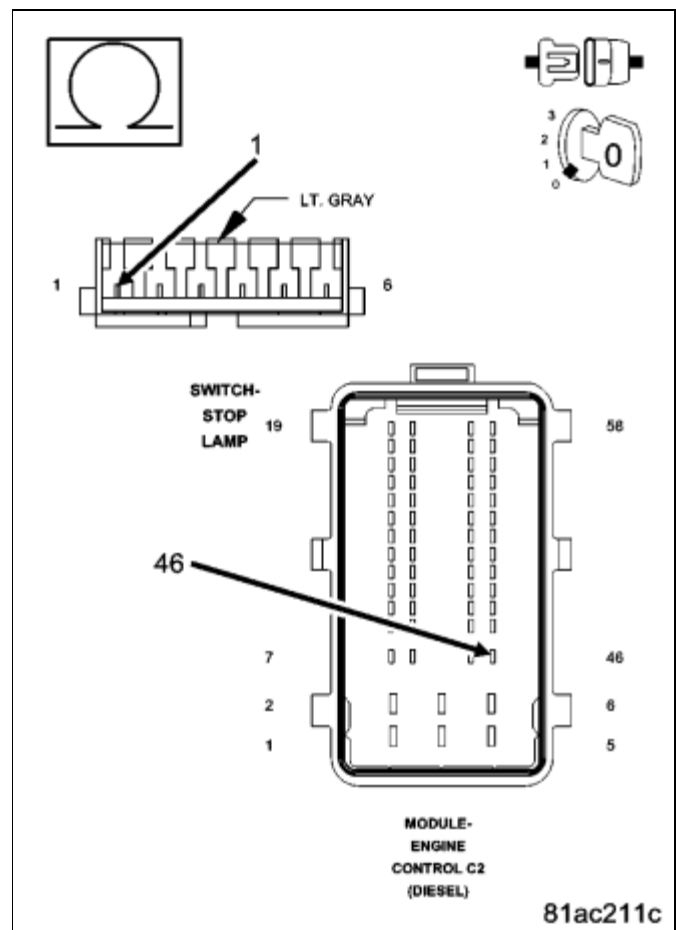
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (B15) Brake Switch 1 Signal circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE - BRAKE SWITCH 1 SIGNAL

If there are no possible causes remaining, view repair.

Repair

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. (F941) IGNITION SWITCH START/RUN CIRCUIT OPEN

Turn the ignition off.
Disconnect the Stop Lamp Switch harness connector.
Turn the ignition on.
Using a 12-volt test light connected to ground, check the (F941) Ignition Switch Start/Run circuit.

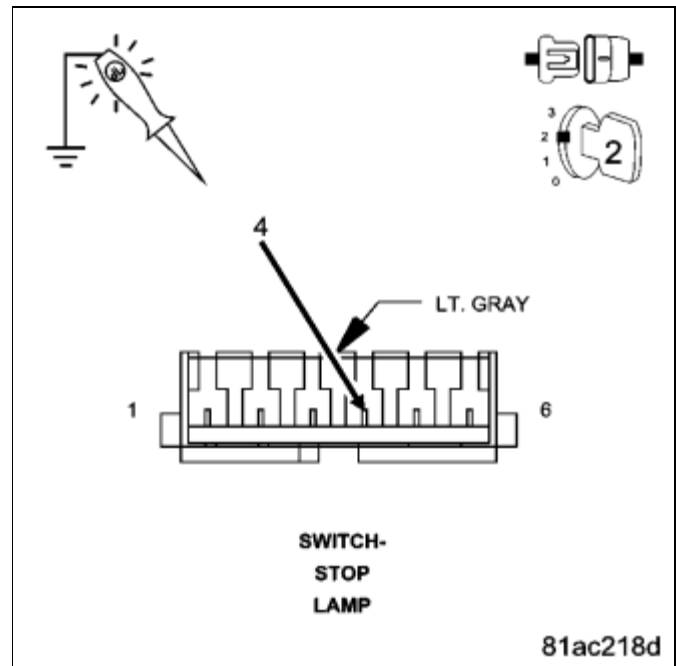
Does the test light illuminate brightly?

Yes

- Go To [12](#)

No

- Repair the (F941) Ignition Switch Start/Run circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



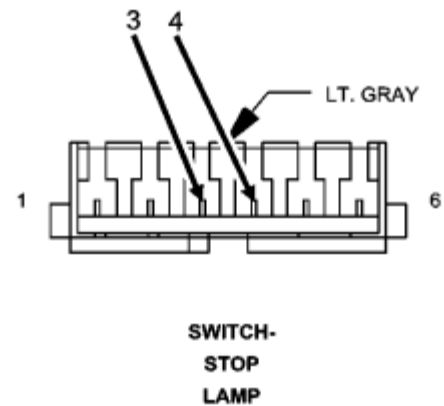
12. STOP LAMP SWITCH - BRAKE SWITCH 2 SIGNAL OPEN

While monitoring the BRAKE SWITCH 2 status with the scan tool, connect a jumper wire between the Brake Switch 2 Signal circuit and the (F941) Ignition Switch Start/Run circuit.

Does the scan tool display change from PRESSED to NOT PRESSED?

Yes

- Adjust or replace the Brake Lamp Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



81ac2546

No

- Go To [13](#)

13. (B16) BRAKE SWITCH 2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage between the (B16) Brake Switch 2 Signal circuit and ground.

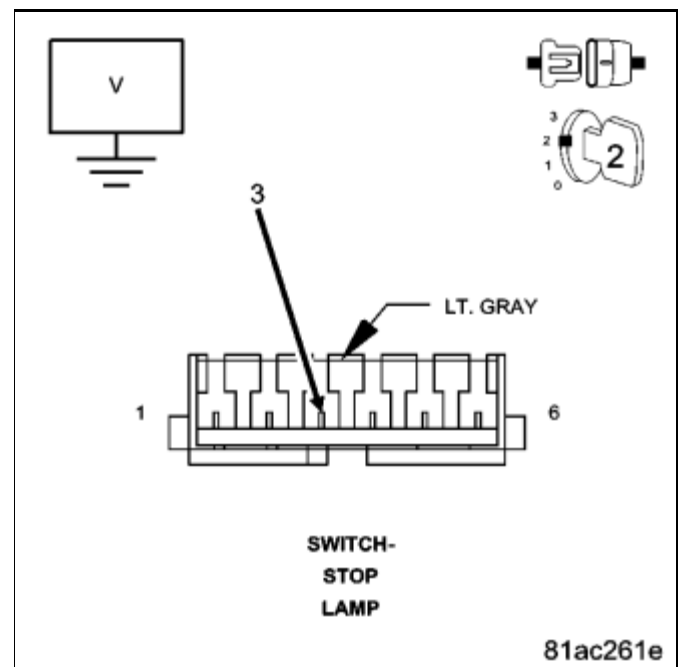
Is the voltage above 1.0 volt?

Yes

- Repair the (B16) Brake Switch 2 Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [14](#)



81ac261e

14. (B16) BRAKE SWITCH 2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (B16) Brake Switch 2 Signal circuit between the Stop Lamp Switch harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (B16) Brake Switch 2 Signal circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0513-INVALID SKIM KEY

For a complete wiring diagram **Refer to Section 8W**

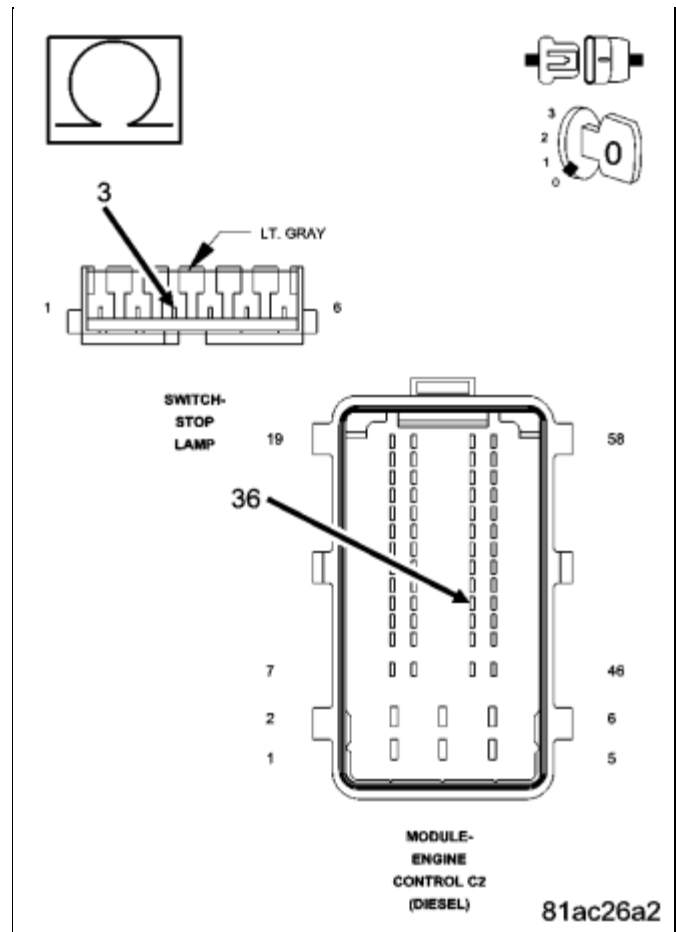
◦ When Monitored:

With the ignition on.

◦ Set Condition:

The ECM receives and invalid SKIM Key message from the SKREEM.

Possible Causes
INTERMITTENT DTC
INCORRECT VIN PROGRAMMED IN THE ECM/PCM
UNPROGRAMMED IGNITION KEYS
SKREEM
ENGINE CONTROL MODULE (ECM)



Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR SKREEM COMMUNICATION AND DTCs

Ignition on, engine not running.

With the scan tool, check for proper communication and active DTCs in the SKREEM.

Are any SKREEM communication problems or DTCs present?

Yes

- Refer to the symptom list for problems related to SKREEM Communication and DTCs before continuing.

No

- Go To [2](#)

2. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, clear all ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between key cycles.

With the scan tool, select View DTCs in the ECM.

Is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Refer to *CHECKING FOR INTERMITTENT DTC in the symptom list. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. REPROGRAM IGNITION KEYS AND RETEST

Turn the ignition on.

With the scan tool, clear all ignition keys out of SKREEM memory.

With the scan tool, reprogram all ignition keys to the SKREEM.

Turn the ignition on and off several times pausing 10 seconds between key cycles.

With the scan tool, select View DTCs in the ECM.

Is the status Active for this DTC?

Yes

- Go to [4](#)

No

- Test complete.

4. REPLACE THE SKREEM AND RETEST

Replace and program the SKREEM in accordance with the Service Information.

Turn the ignition on.

With the scan tool, clear all ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between key cycles.

With the scan tool, select View DTCs in the ECM.

Is the status Active for this DTC?

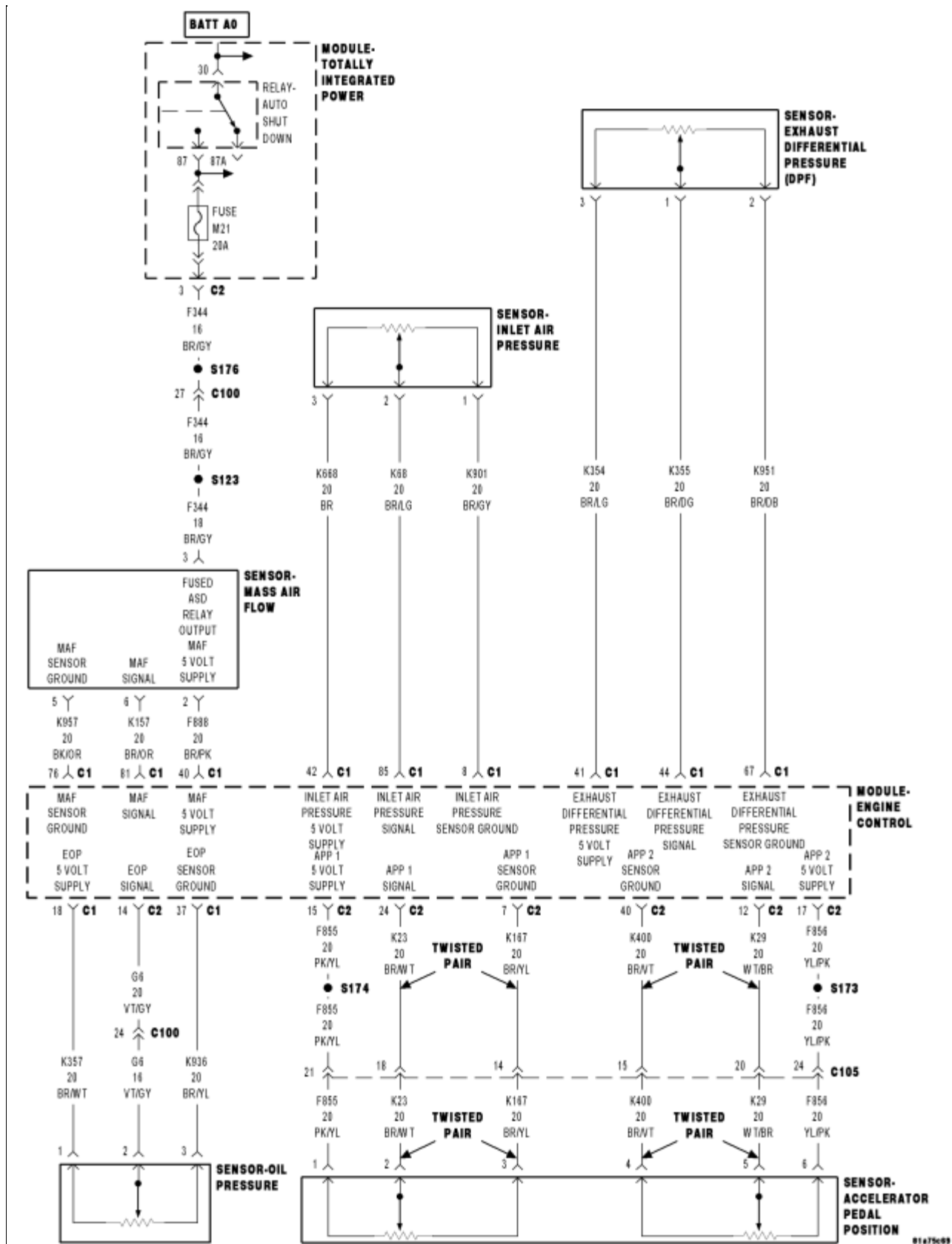
Yes

- Replace and program the Engine Control Module in accordance the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test complete.

P0522-ENGINE OIL PRESSURE SENSOR CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

At engine start-up.

- **Set Condition:**

The ECM detects that the (G6) Oil Pressure Sensor Signal circuit is below 0.25 volt for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K936) OIL PRESSURE SENSOR GROUND CIRCUIT
(G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K936) OIL PRESSURE SENSOR GROUND CIRCUIT
(K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
OIL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.
 Disconnect the Oil Pressure Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (K357) Oil Pressure Sensor 5 Volt Supply circuit in the Oil Pressure Sensor harness connector.

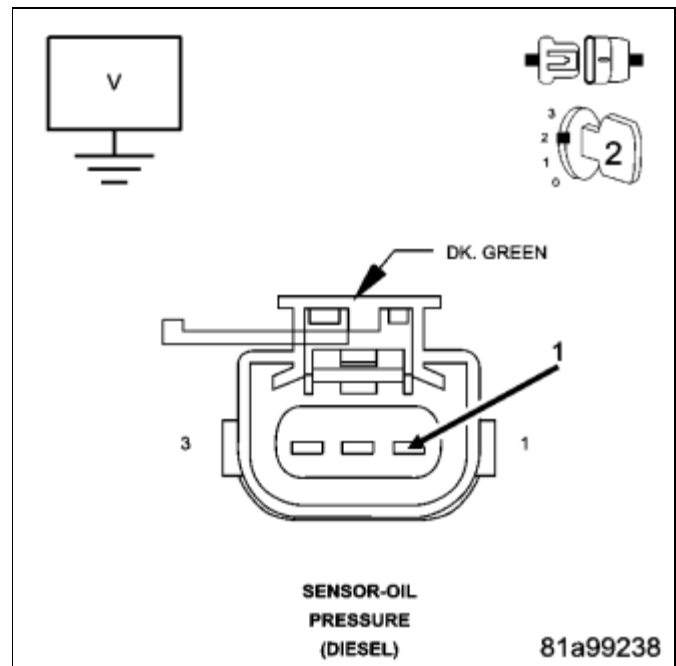
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K357) Oil Pressure Sensor 5 Volt Supply circuit in the Oil Pressure Sensor harness connector.

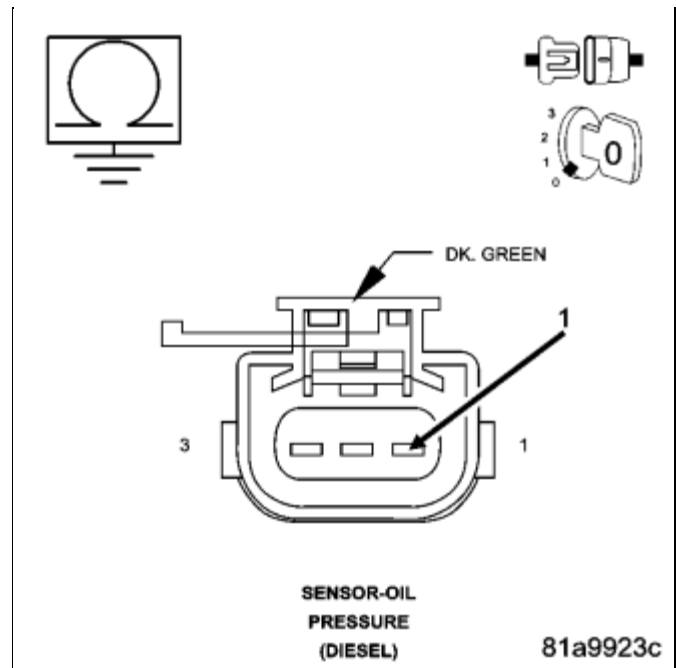
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K357) Oil Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K936) OIL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K357) Oil Pressure Sensor 5 Volt Supply circuit and the (K936) Oil Pressure Sensor Ground circuit in the Oil Pressure Sensor harness connector.

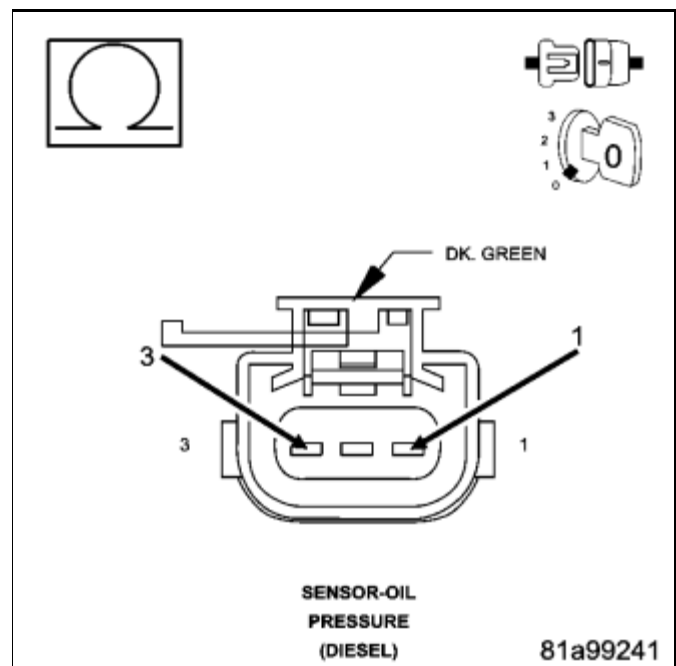
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K357) Oil Pressure Sensor 5 Volt Supply circuit for a short to the (K936) Oil Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K357) Oil Pressure Sensor 5 Volt Supply circuit between the Oil Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

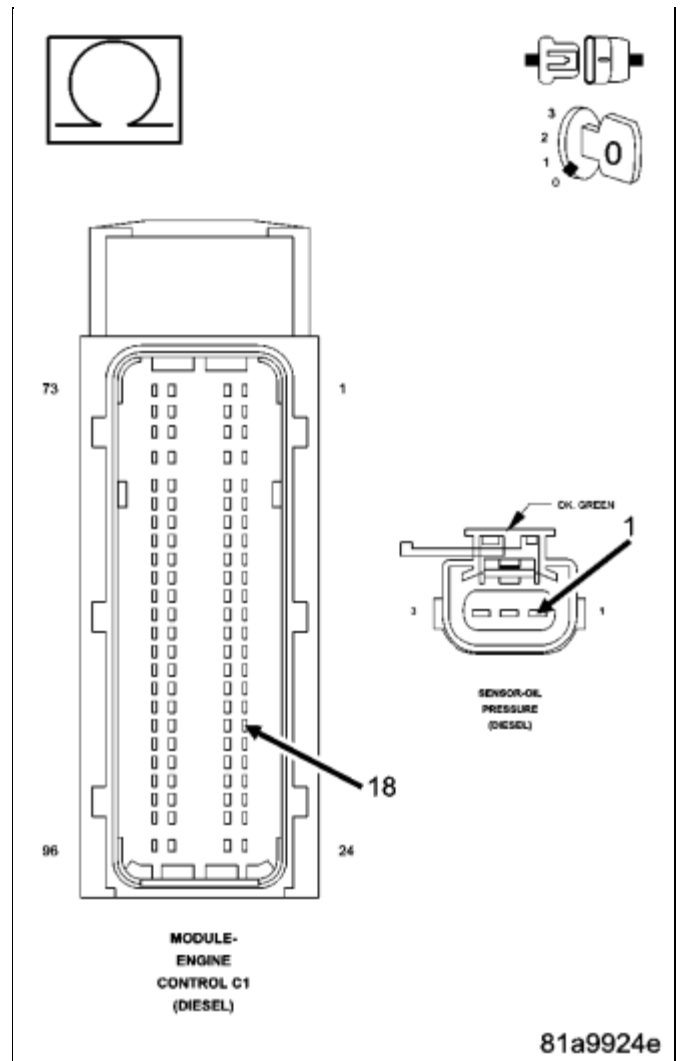
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K357) Oil Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (G6) Oil Pressure Sensor Signal circuit in the Oil Pressure Sensor harness connector.

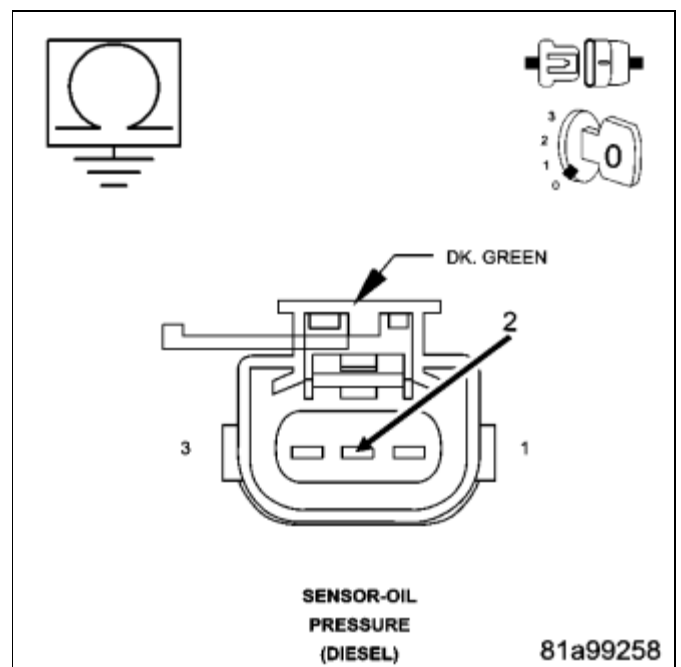
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (G6) Oil Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9



- ENGINE - STANDARD PROCEDURE)

7. (G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K936) OIL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (G6) Oil Pressure Sensor Signal circuit and the (K936) Oil Pressure Sensor Ground circuit in the Oil Pressure Sensor harness connector.

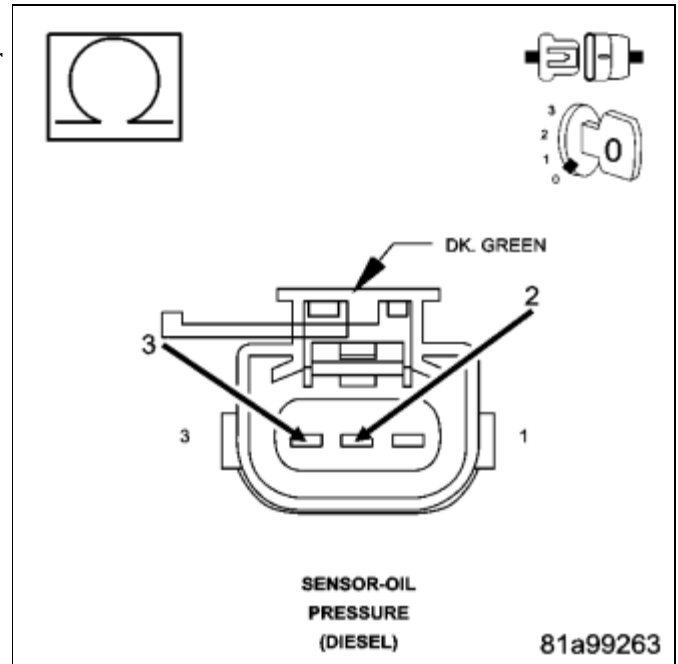
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (G6) Oil Pressure Sensor Signal circuit for a short to the (K936) Oil Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (G6) Oil Pressure Sensor Signal circuit between the Oil Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

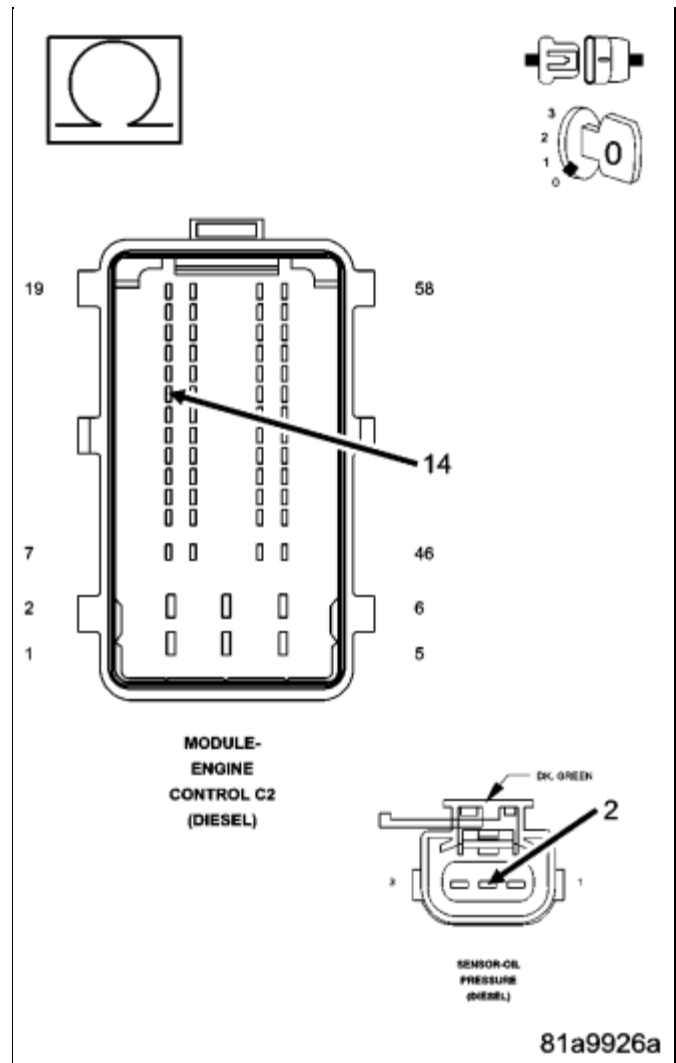
Is the resistance below 10.0 ohms?

Yes

- Go to [9](#)

No

- Repair the (G6) Oil Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. OIL PRESSURE SENSOR

Connect the Engine Control Module (ECM) harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Oil Pressure Sensor high voltage or open DTC with the Oil Pressure Sensor connector disconnected.

Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Oil Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [10](#)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oil Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

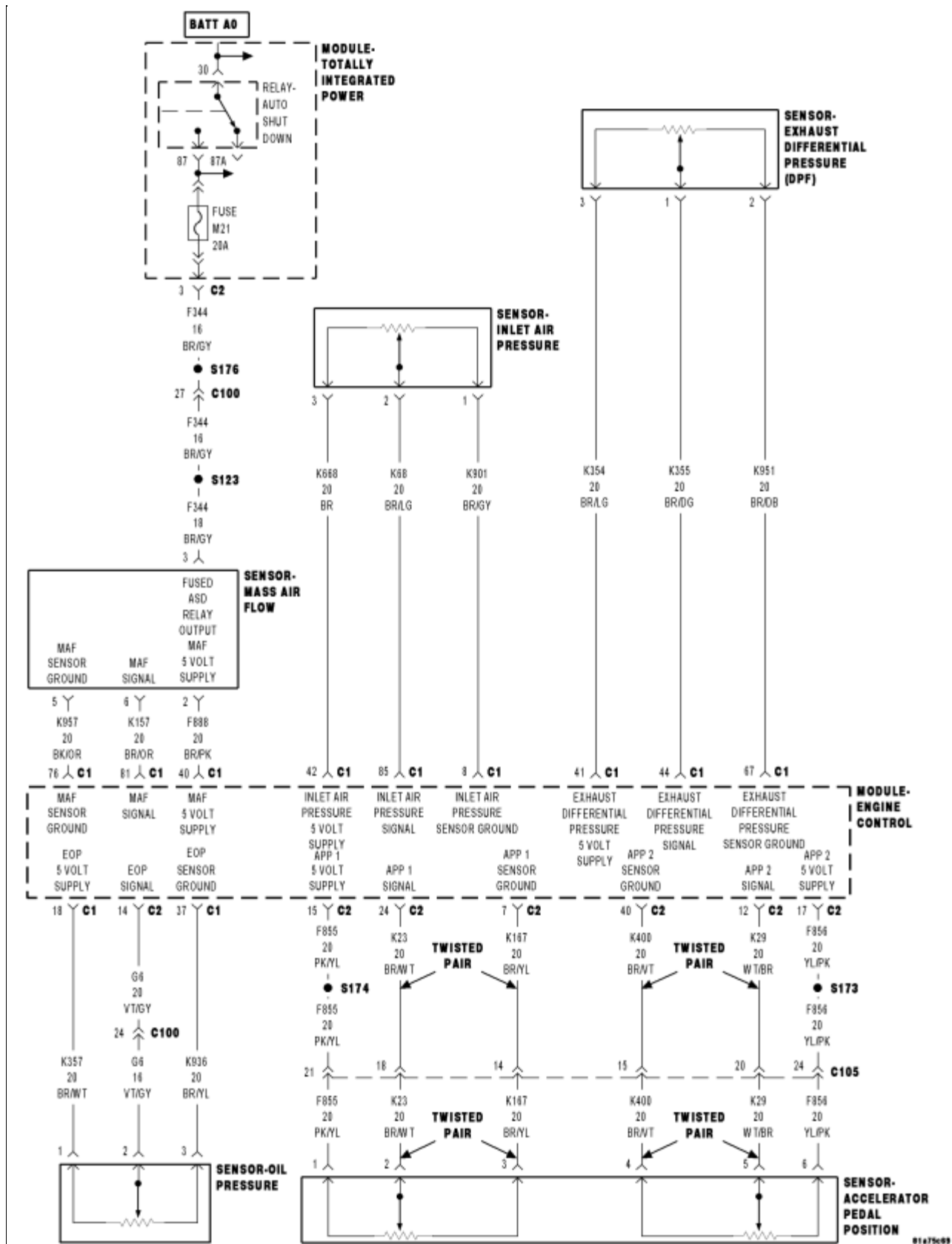
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0523-ENGINE OIL PRESSURE SENSOR CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

At engine start-up.

- **Set Condition:**

The ECM detects that the (G6) Oil Pressure Sensor Signal circuit is above 4.6 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K936) OIL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K936) OIL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
OIL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K357) OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

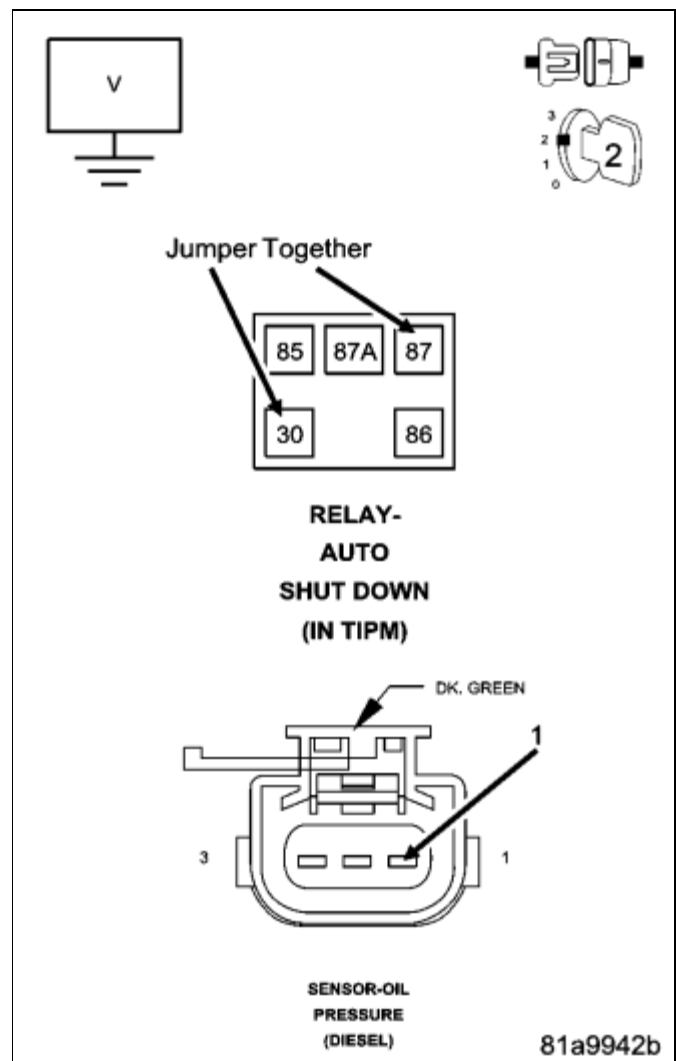
Measure the voltage of the (K357) Oil Pressure Sensor 5 Volt Supply circuit in the Oil Pressure Sensor harness connector.

Is there any voltage present?**Yes**

- Repair the (K357) Oil Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

**3. (G6) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE**

NOTE: The jumper wire should still be in place.

Measure the voltage of the (G6) Oil Pressure Sensor Signal circuit in the Oil Pressure Sensor harness connector.

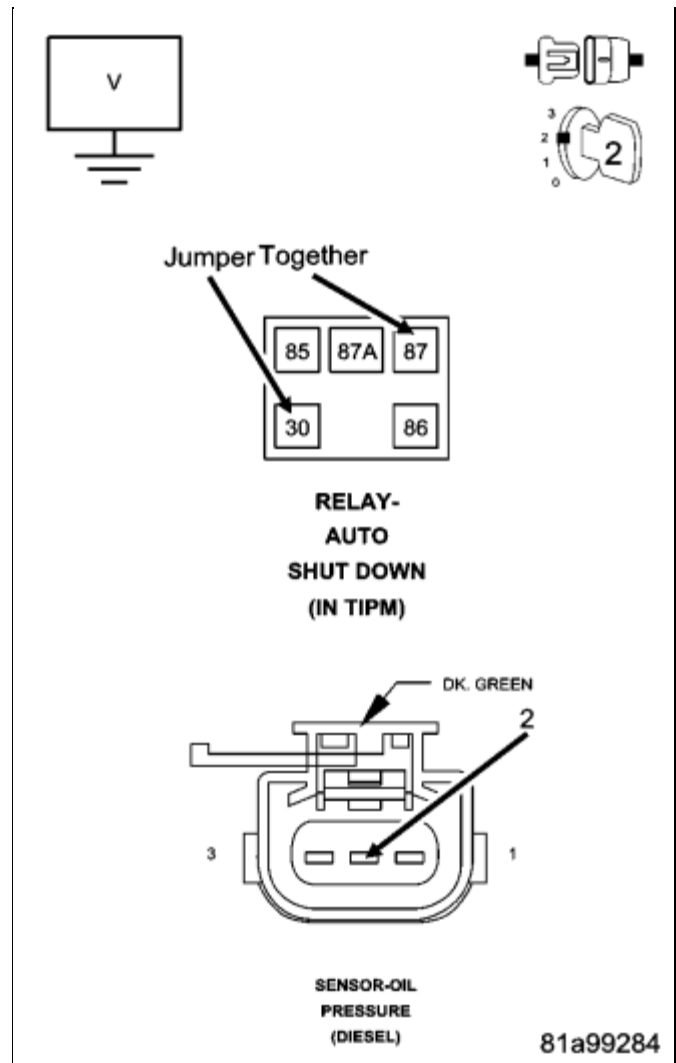
Is there any voltage present?

Yes

- Repair the (G6) Oil Pressure Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K936) OIL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K936) Oil Pressure Sensor Ground circuit in the Oil Pressure Sensor harness connector.

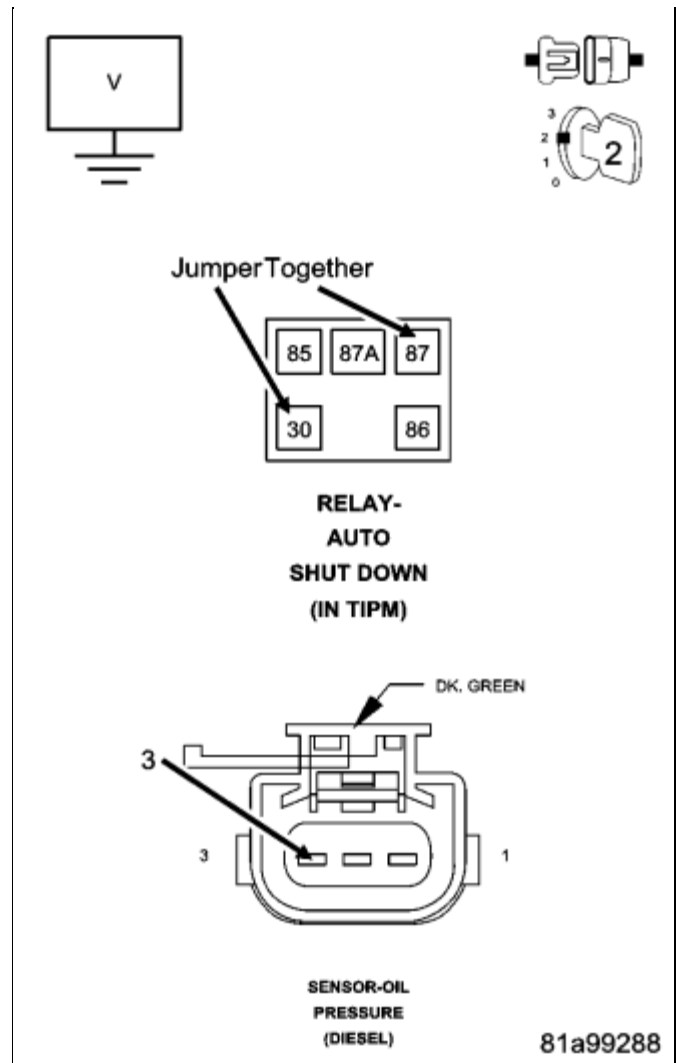
Is there any voltage present?

Yes

- Repair the (K936) Oil Pressure Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. OIL PRESSURE SENSOR

Turn the ignition off.

Remove the jumper wire and install the ASD Relay. Connect the Engine Control Module (ECM) harness connector.

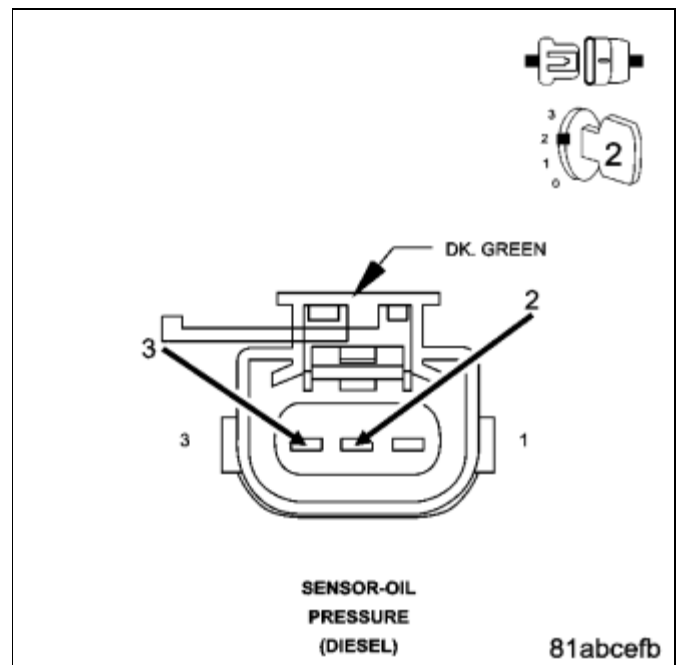
Connect a jumper wire between the (K936) Oil Pressure Sensor Ground circuit and the (G6) Oil Pressure Sensor Signal circuit in the Oil Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Oil Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Oil Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. (G6) OIL PRESSURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (G6) Oil Pressure Sensor Signal between the Oil Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

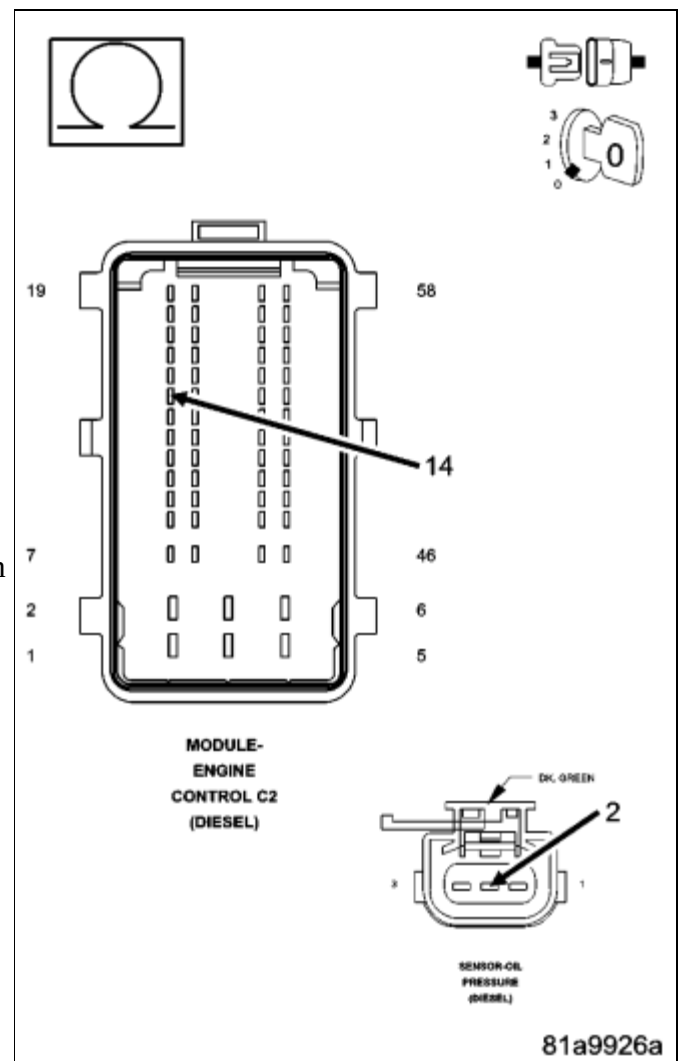
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (G6) Oil Pressure Sensor Signal for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K936) OIL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K936) Oil Pressure Sensor Ground circuit between the Oil Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

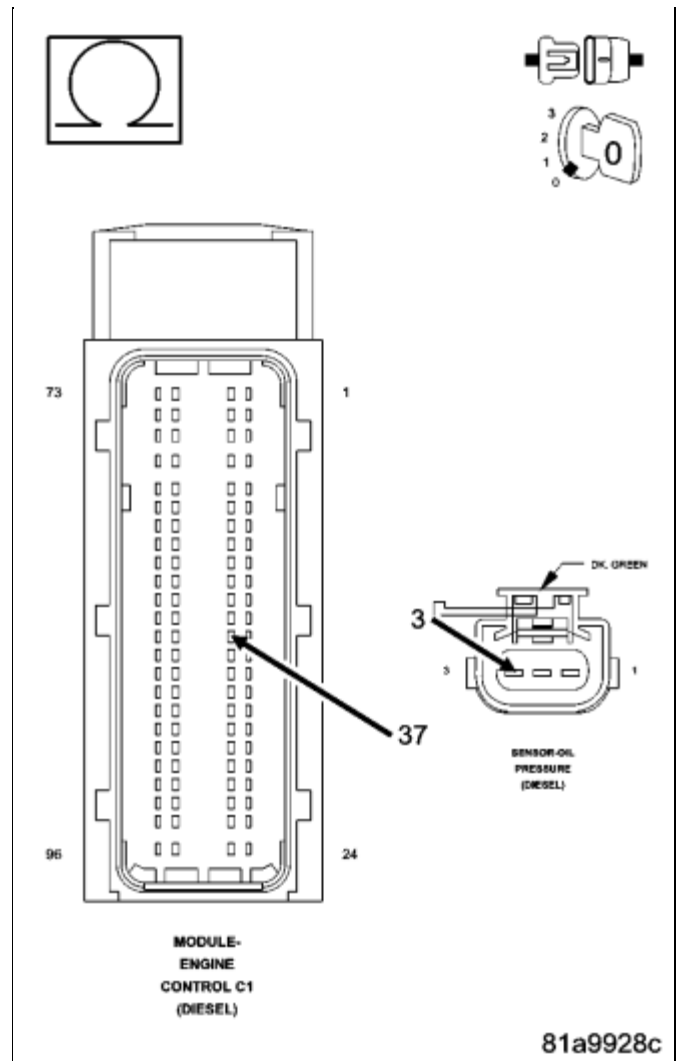
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K936) Oil Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oil Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

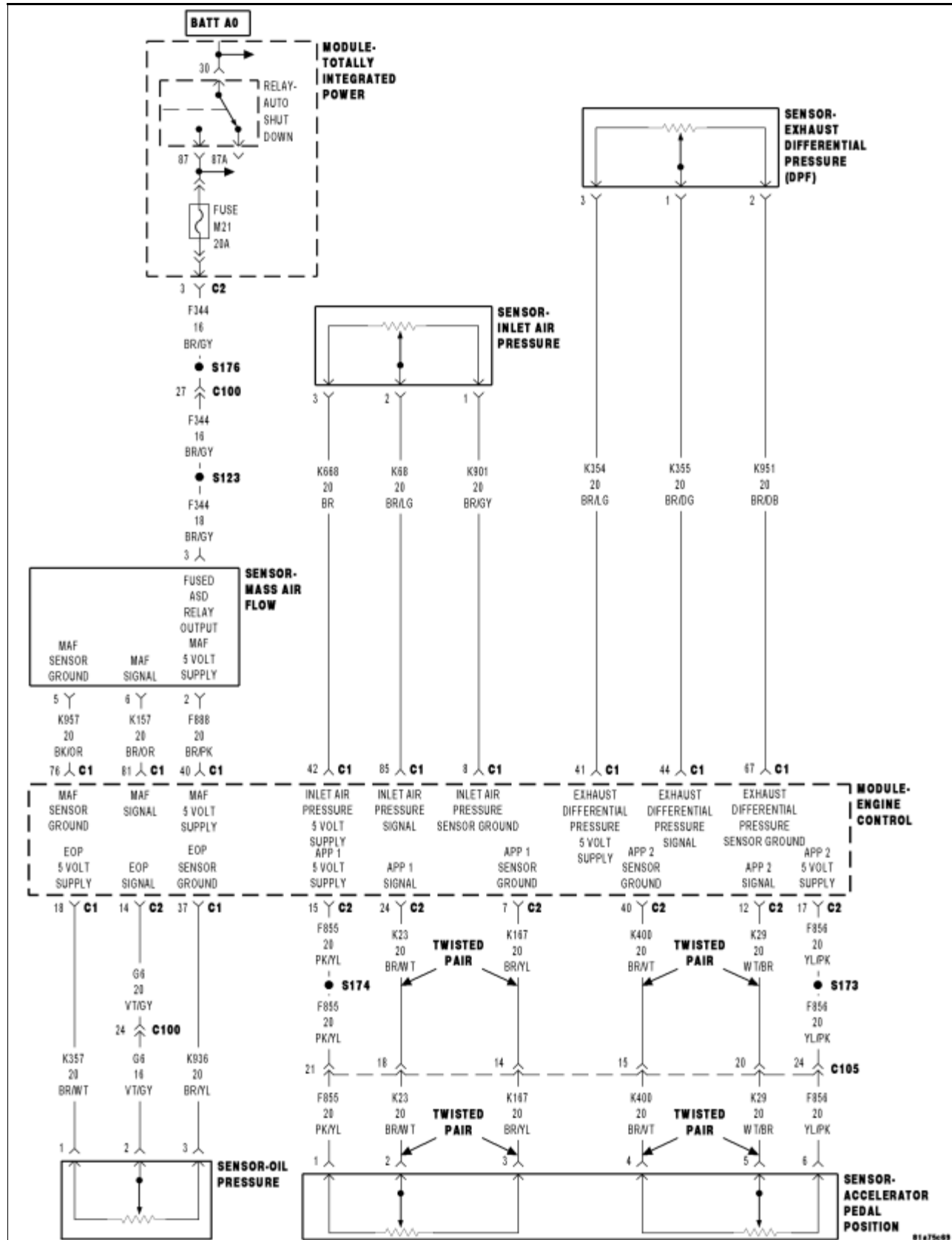
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0524- ENGINE OIL PRESSURE IS TOO LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The Oil Pressure Sensor indicates low oil pressure for 5 seconds.

Possible Causes
MECHANICAL PROBLEM
OIL PRESSURE SENSOR FAILURE
OIL PRESSURE SENSOR CIRCUIT(S) OPEN OR HIGH RESISTANCE
INTERMITTENT CONDITION

Diagnostic Test

1. CHECKING FOR CURRENT DTC

NOTE: Perform Pre-diagnostic test before continuing

NOTE: Ensure the engine oil level is at the specified level and the engine oil filter is the specified filter for this specific engine application.

NOTE: If there are Engine Oil Pressure Sensor circuit High/Low DTC's, repair the circuit High/Low DTC's before continuing with this test.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure.

2. MECHANICAL PROBLEM

Refer to the Service Information and perform the Engine Oil Pressure Test.

Is the oil pressure within specification?

Yes

- Go To [3](#)

No

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CHECKING OP SENSOR CIRCUITS

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the each of the Oil Pressure Sensor circuits (3) between the Oil Pressure Sensor and the ECM harness connectors.

Is the resistance below 10.0 ohms for each of the measurements?

Yes

- Replace the Oil Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the Oil Pressure Sensor circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0562-ECM VOLTAGE TOO LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects battery voltage of 10.5 volts or less for 20 seconds.

Possible Causes
CHECKING ECM POWER AND GROUNDS
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.

Test drive the vehicle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Go To [3](#)

2. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

Were any problem found with the ECM powers and grounds?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. INTERMITTENT CONDITION

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set.

Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

P0563-ECM VOLTAGE TOO HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running and vehicle speed above 30 km/h.

- **Set Condition:**

The ECM detects battery voltage of 15.0 volts or greater for 5.0 seconds

Possible Causes
CHECKING ECM POWER AND GROUNDS
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.
With the scan tool, erase ECM DTCs.

NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.

Test drive the vehicle.
Turn the ignition on.
With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Go To [3](#)

2. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

Were any problem found with the ECM powers and grounds?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. INTERMITTENT CONDITION

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set.

Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

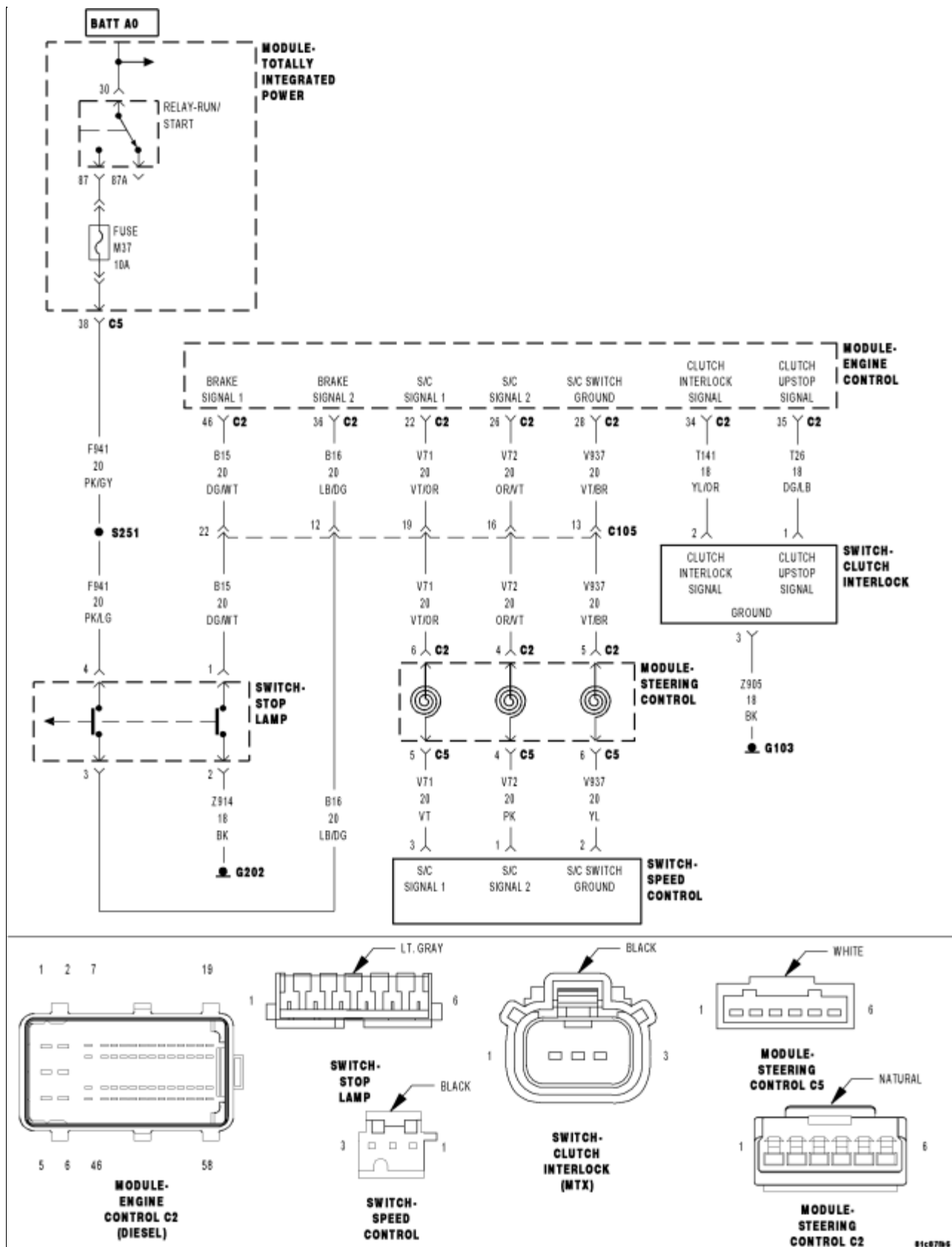
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

P0573-BRAKE SWITCH STUCK OFF



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on. VSS indicates increasing and decreasing vehicle speed. APP Sensor indicates increasing and decreasing acceleration demand.

- **Set Condition:**

The ECM determines that the brakes have been applied without the receiving an input from the Primary Brake Switch Signal and Secondary Brake Switches.

Possible Causes
INTERMITTENT CONDITION
(Z914) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
(F941) IGNITION SWITCH START/RUN CIRCUIT
(B15) BRAKE SWITCH 1 SIGNAL CIRCUIT SHORTED TO GROUND
(B15) BRAKE SWITCH 1 SIGNAL CIRCUIT OPEN
(B16) BRAKE SWITCH 2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B16) BRAKE SWITCH 2 SIGNAL CIRCUIT OPEN
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK THE BRAKE SWITCH 2 STATUS

Turn the ignition on.

While observing the BRAKE SWITCH 2 status on the scan tool display, press and release the brake pedal several times.

Does the scan tool display BRAKE SWITCH 2: PRESSED and NOT PRESSED for the appropriate pedal position?

Yes

- Go To [2](#)

No

- Go To [11](#)

2. CHECK THE BRAKE SWITCH 1 STATUS

While observing the BRAKE SWITCH 1 status on the scan tool display, press and release the brake pedal several times.

Does the scan tool display BRAKE SWITCH 1: PRESSED and NOT PRESSED for the appropriate pedal position

Yes

- Go To [3](#)

No

- Go To [4](#)

3. INTERMITTENT CONDITION

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set. Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

4. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.
 Disconnect the Stop Lamp Switch harness connector.
 Turn the ignition on.
 Measure the voltage between the (B15) Brake Switch 1 Signal circuit and ground.

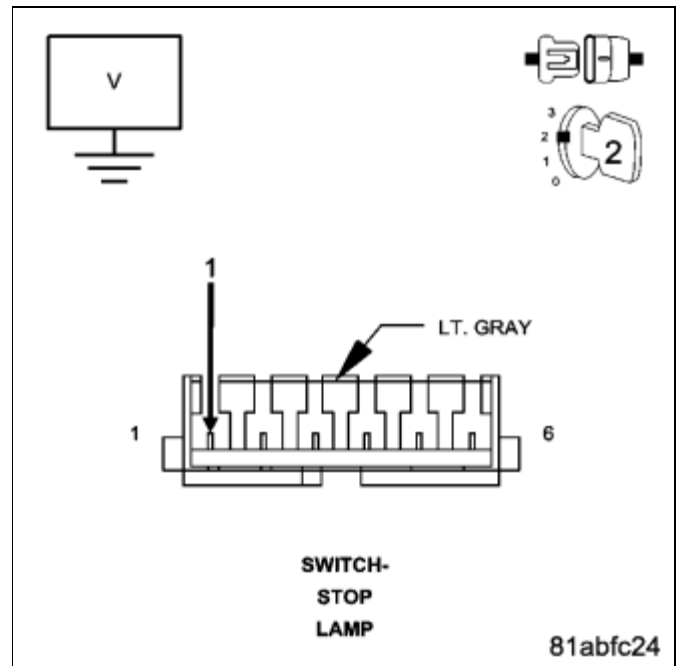
Is the voltage above 9.0 volts?

Yes

- Go To [5](#)

No

- Go To [8](#)



5. STOP LAMP SWITCH - SIGNAL 1 CKT OPEN

While monitoring the BRAKE SWITCH 1 status with the scan tool, connect a jumper wire between (Z914) Ground and (B15) Brake Switch 1 Signal circuit.

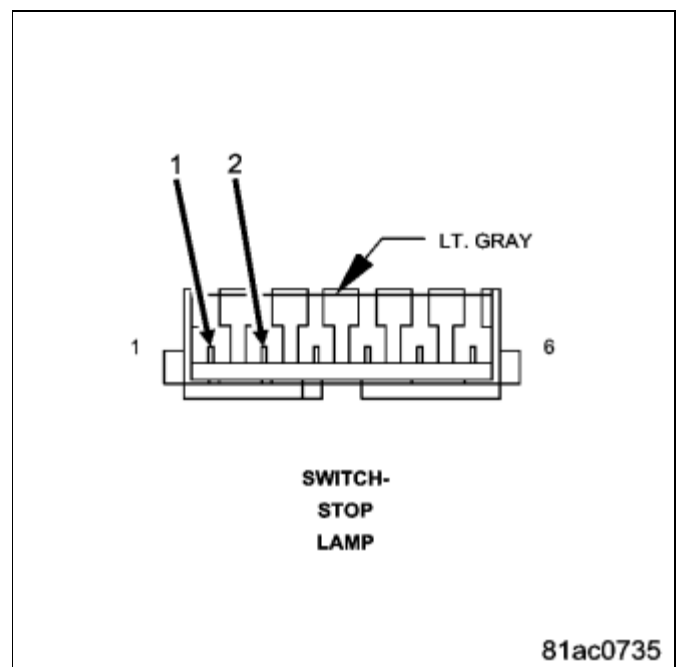
Does the scan tool display change from PRESSED to NOT PRESSED?

Yes

- Adjust or replace the Brake Lamp Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (Z914) GROUND CIRCUIT OPEN

Turn the ignition off.
Measure the resistance between ground and the (Z914) Ground circuit.

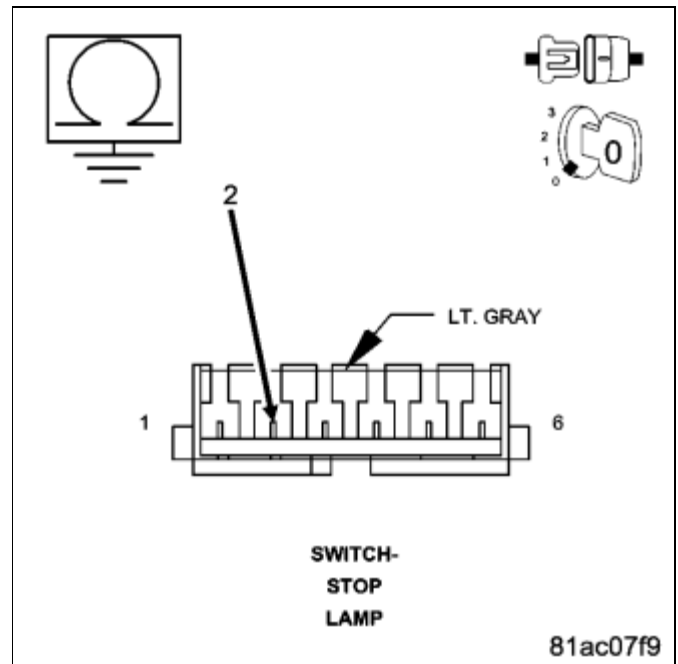
Is the resistance below 10.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (Z914) Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. ENGINE CONTROL MODULE - INTERNAL

If there are no possible causes remaining, view repair.

Repair

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the (B15) Brake Switch 1 Signal circuit.

Is the resistance above 1000 ohms?

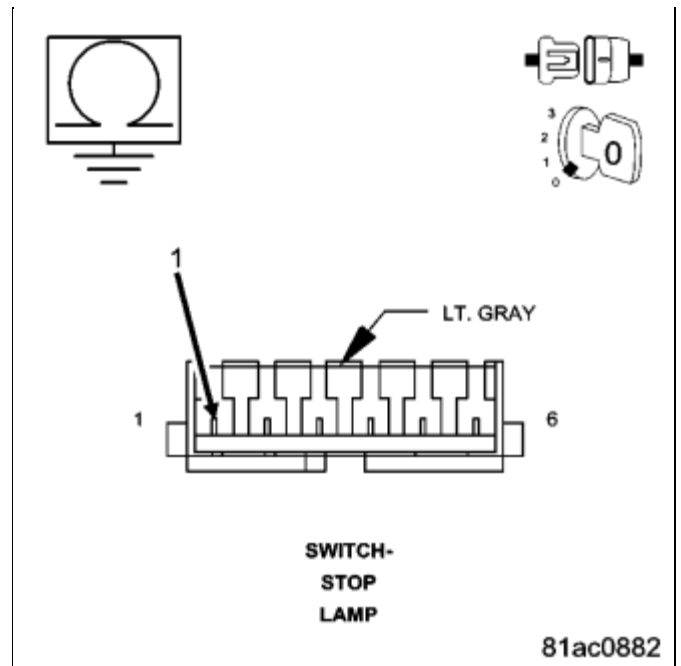
Yes

- Go To [9](#)

No

- Repair the (B15) Brake Switch 1 Signal circuit for a short to ground.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (B15) BRAKE SWITCH 1 SIGNAL CIRCUIT OPEN

Measure the resistance of the (B15) Brake Switch 1 Signal circuit between the Stop Lamp Switch harness connector and the ECM harness connector.

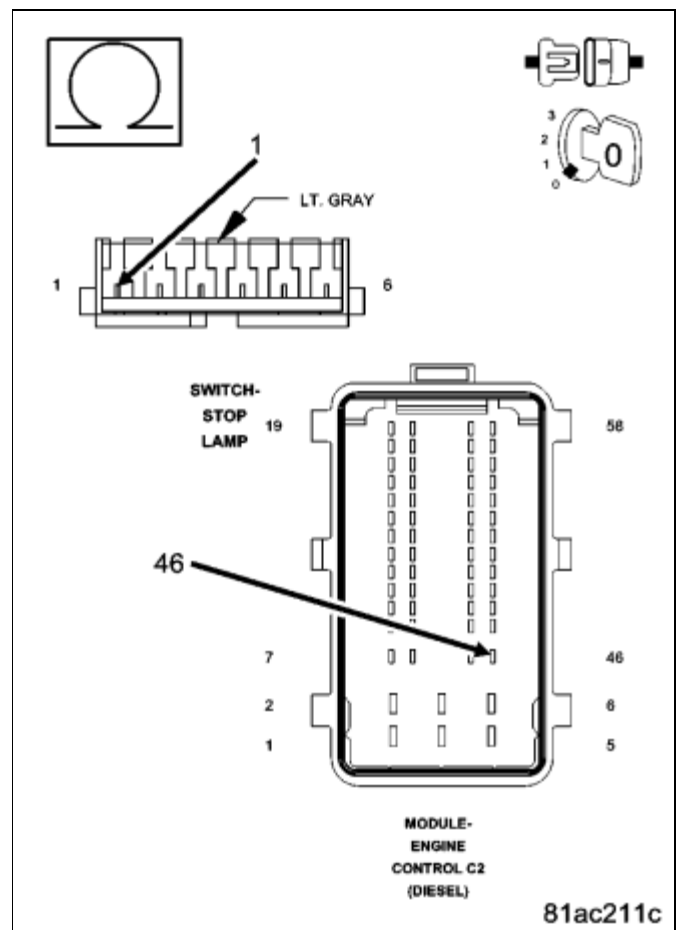
Is the resistance below 10.0 ohms?

Yes

- Go To [10](#)

No

- Repair the (B15) Brake Switch 1 Signal circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. ENGINE CONTROL MODULE - BRAKE SWITCH 1 SIGNAL

If there are no possible causes remaining, view repair.

Repair

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. (F941) IGNITION SWITCH START/RUN CIRCUIT OPEN

Turn the ignition off.
Disconnect the Stop Lamp Switch harness connector.
Turn the ignition on.
Using a 12-volt test light connected to ground, check the (F941) Ignition Switch Start/Run circuit.

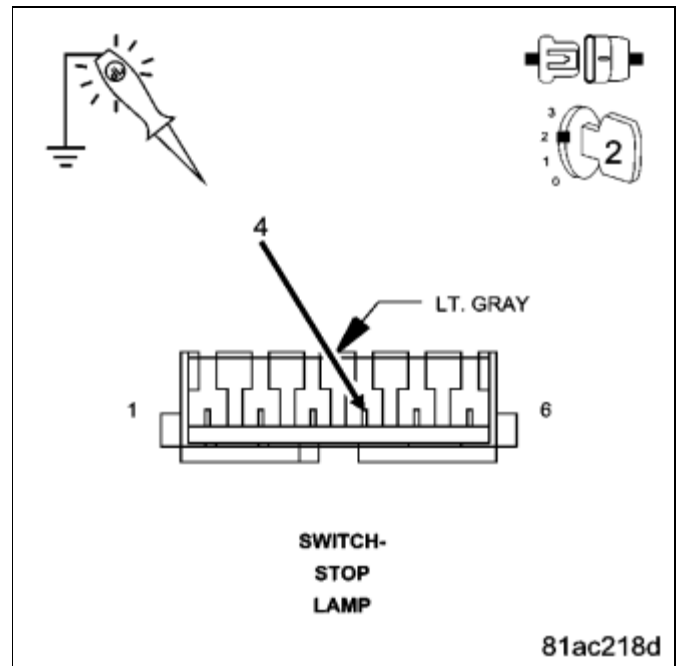
Does the test light illuminate brightly?

Yes

- Go To [12](#)

No

- Repair the (F941) Ignition Switch Start/Run circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



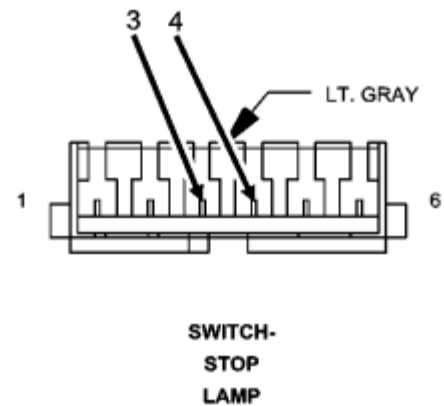
12. STOP LAMP SWITCH - BRAKE SWITCH 2 SIGNAL OPEN

While monitoring the BRAKE SWITCH 2 status with the scan tool, connect a jumper wire between the Brake Switch 2 Signal circuit and the (F941) Ignition Switch Start/Run circuit.

Does the scan tool display change from PRESSED to NOT PRESSED?

Yes

- Adjust or replace the Brake Lamp Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



81ac2546

No

- Go To [13](#)

13. (B16) BRAKE SWITCH 2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage between the (B16) Brake Switch 2 Signal circuit and ground.

Is the voltage above 1.0 volt?

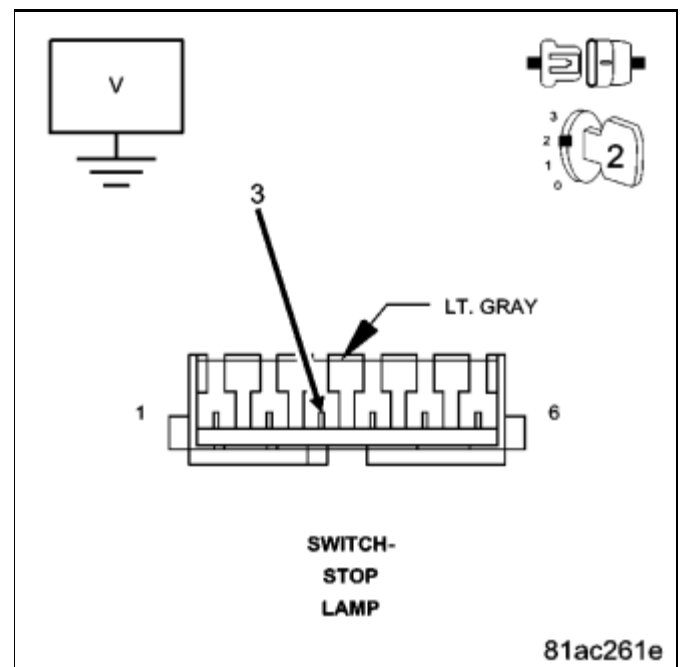
Yes

- Repair the (B16) Brake Switch 2 Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [14](#)

14. (B16) BRAKE SWITCH 2 SIGNAL CIRCUIT OPEN



81ac261e

Turn the ignition off.

Measure the resistance of the (B16) Brake Switch 2 Signal circuit between the Stop Lamp Switch harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

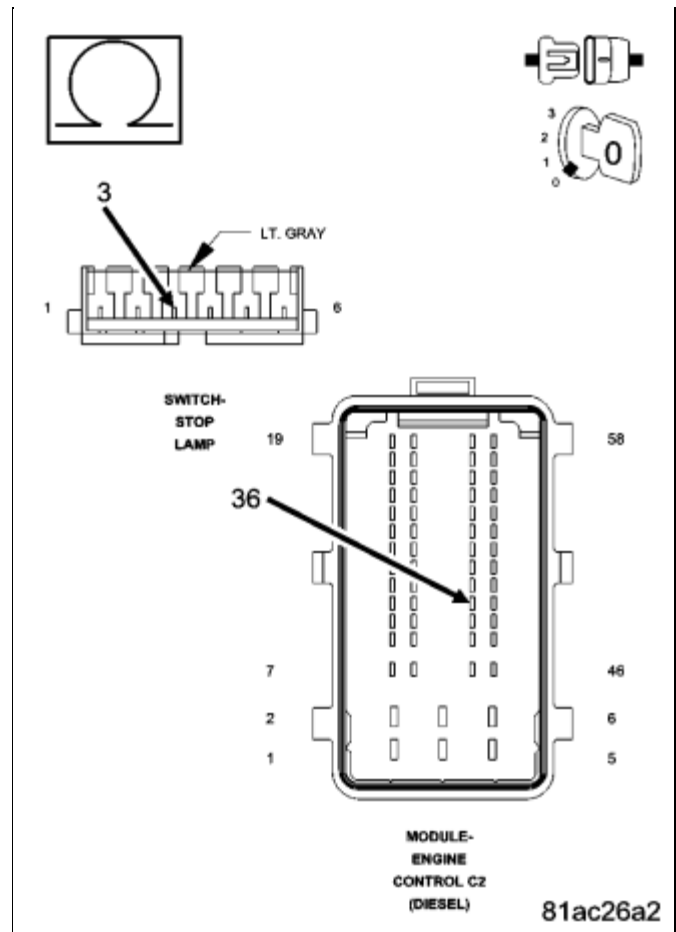
Yes

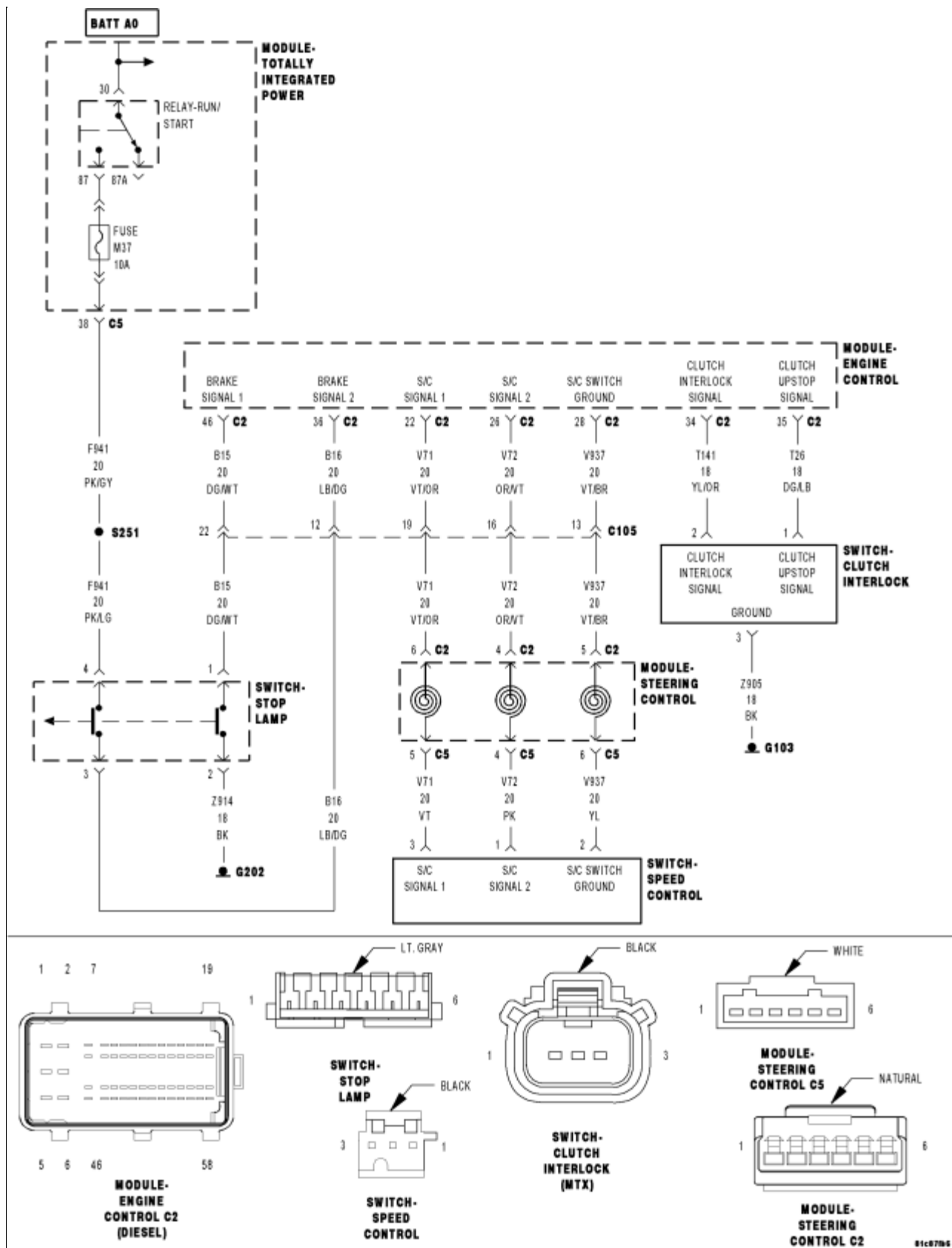
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (B16) Brake Switch 2 Signal circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0578-S/C SWITCH #1 SIGNAL CIRCUIT STUCK SWITCH





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

(V71) S/C Signal #1 indicates that a switch is pressed for more than 1 minute.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V71) S/C SIGNAL #1 CIRCUIT OPEN
(V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND
(V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

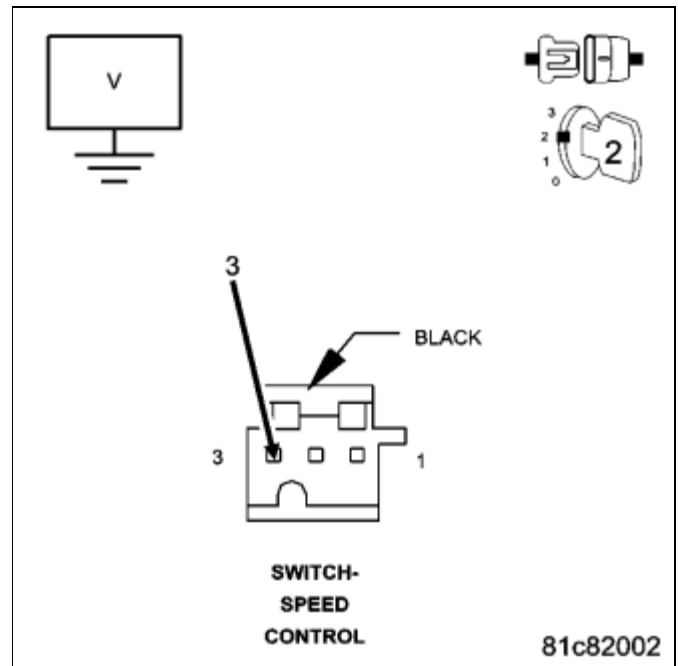
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

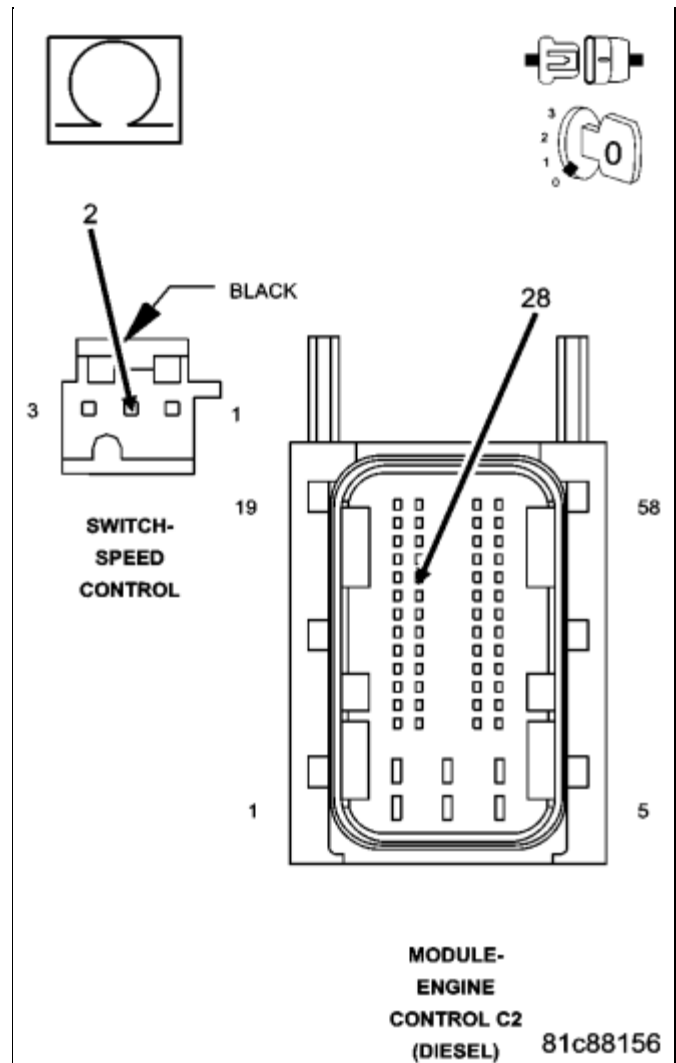
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

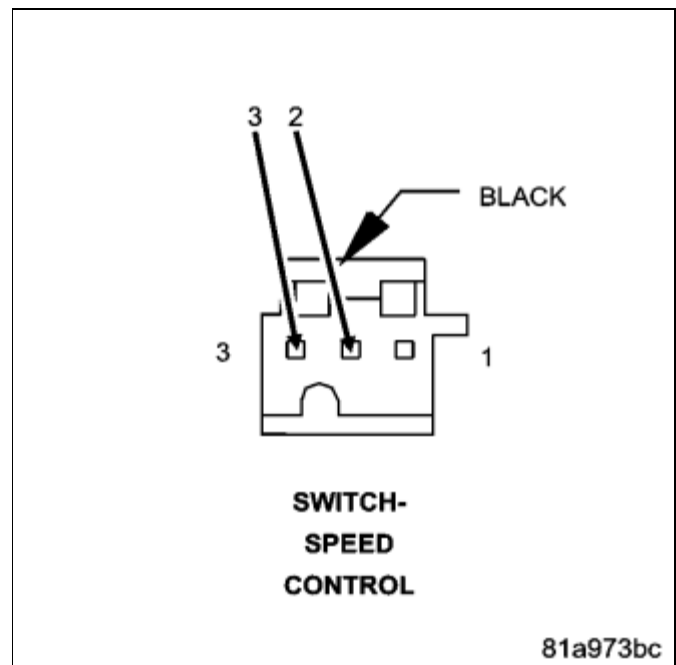
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V71) S/C Signal #1 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V71) S/C SIGNAL #1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V71) S/C Signal #1 circuit between the S/C Switch harness connector and the ECM harness connector.

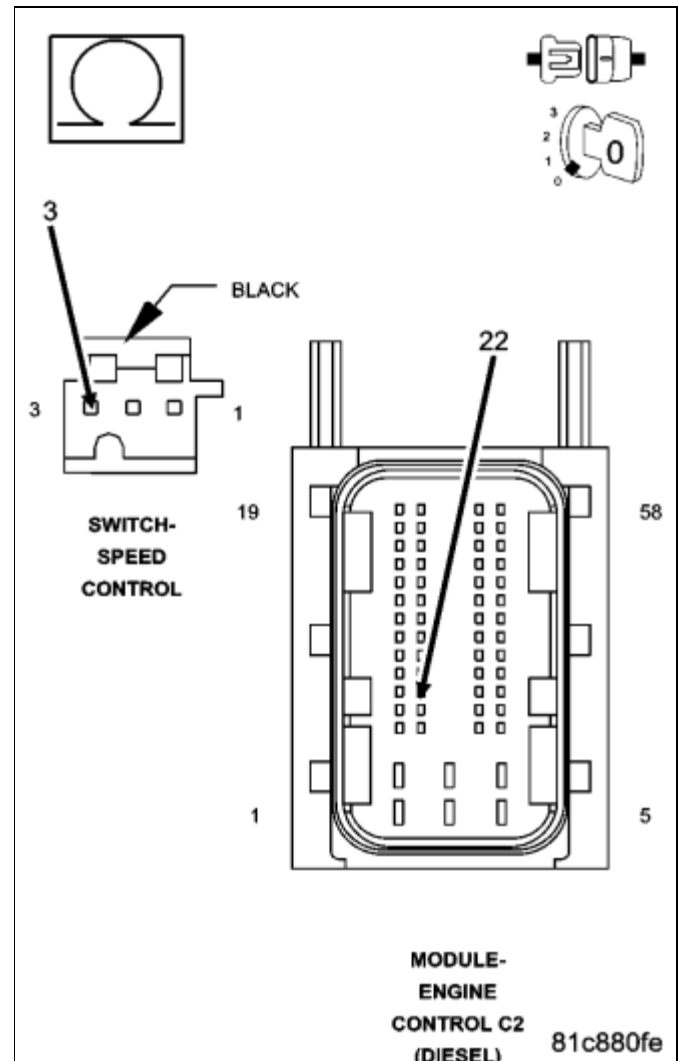
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V71) S/C Signal #1 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the resistance above 1000 ohms?

Yes

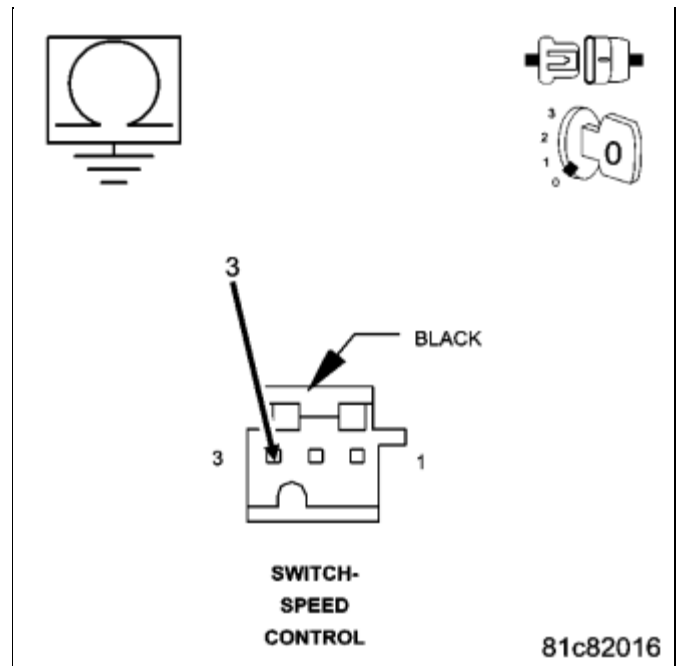
- Replace and program the Engine Control Module in

accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V71) S/C Signal #1 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

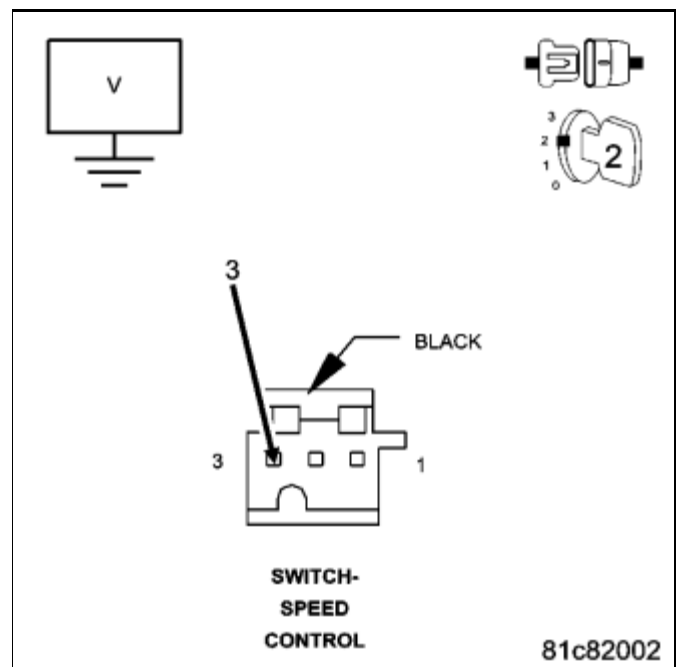
Turn the ignition on.

Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

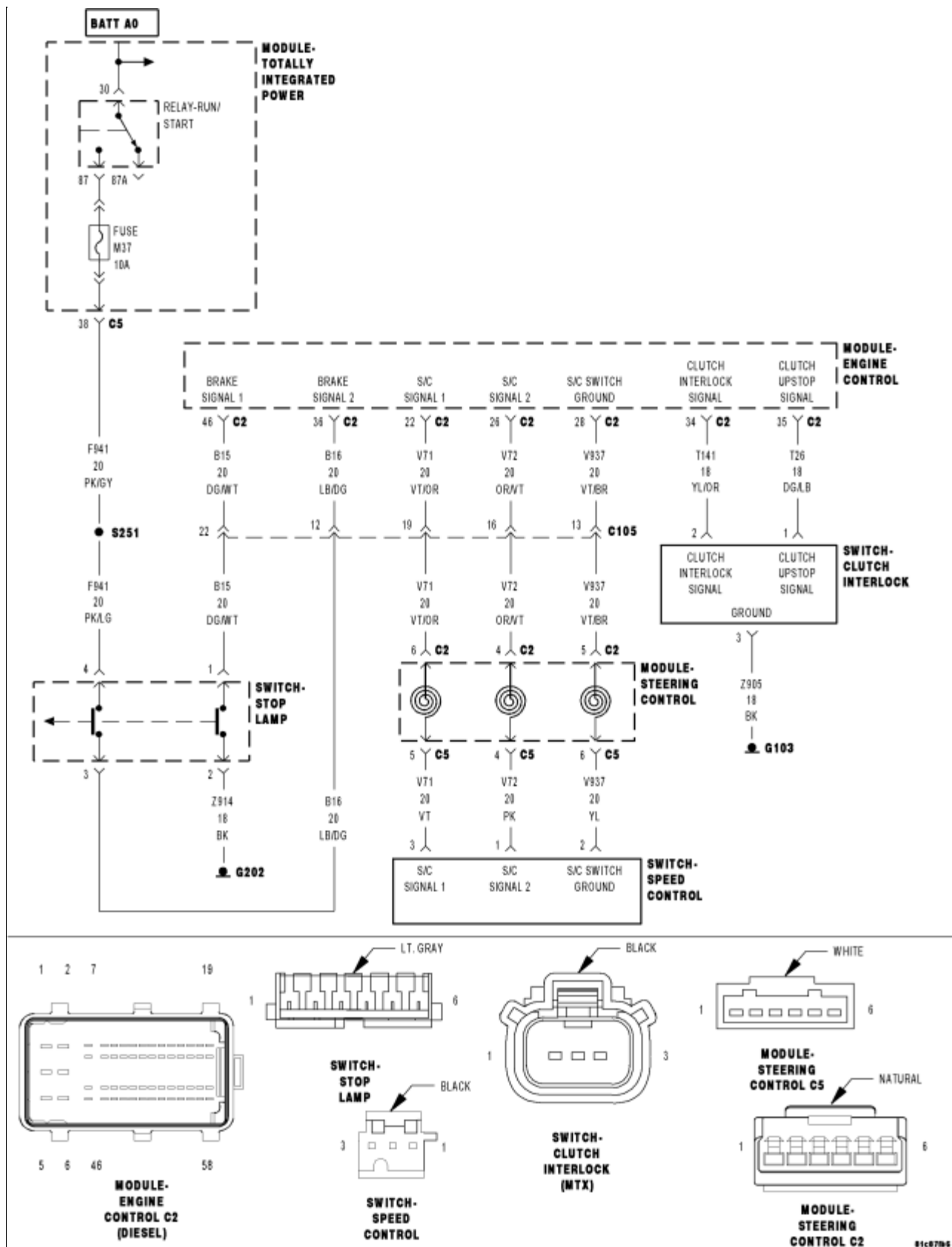
- Repair the (V71) S/C Signal #1 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0579-S/C SWITCH #1 SIGNAL CIRCUIT PLAUSIBILITY



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition switch on and no other S/C Switch DTC's present.

◦ **Set Condition:**

The S/C Signal #1 voltage is not within a valid switch signal range.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V71) S/C SIGNAL #1 CIRCUIT OPEN
(V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND
(V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

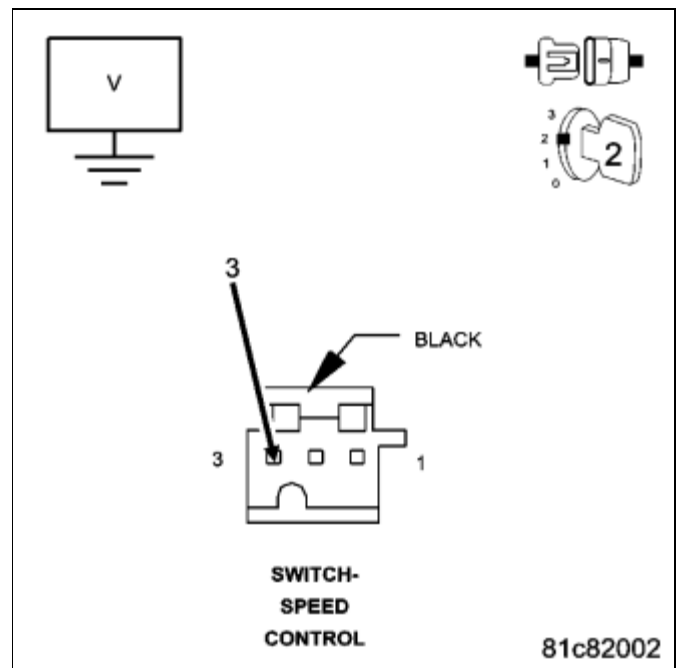
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

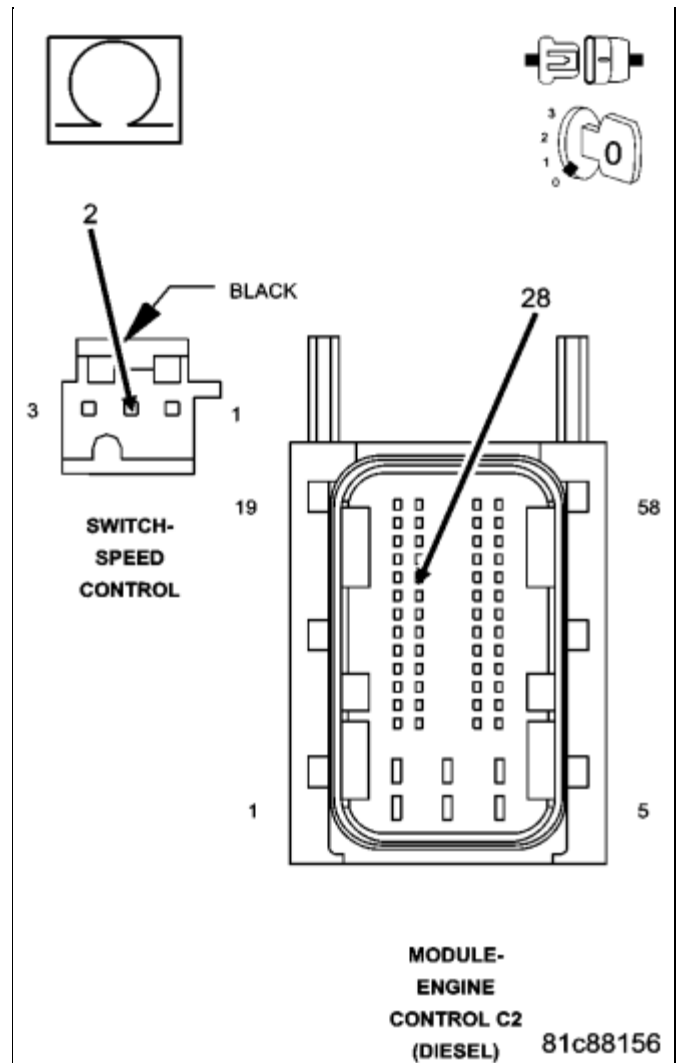
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

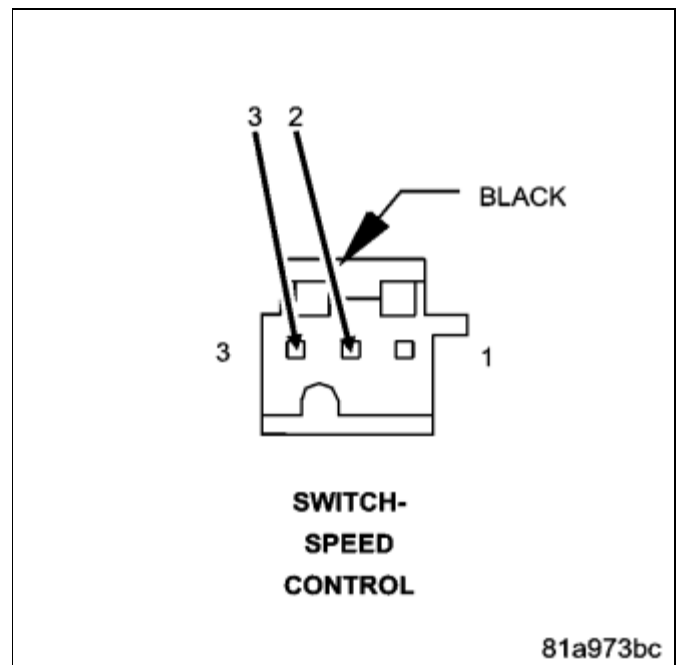
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V71) S/C Signal #1 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V71) S/C SIGNAL #1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V71) S/C Signal #1 circuit between the S/C Switch harness connector and the ECM harness connector.

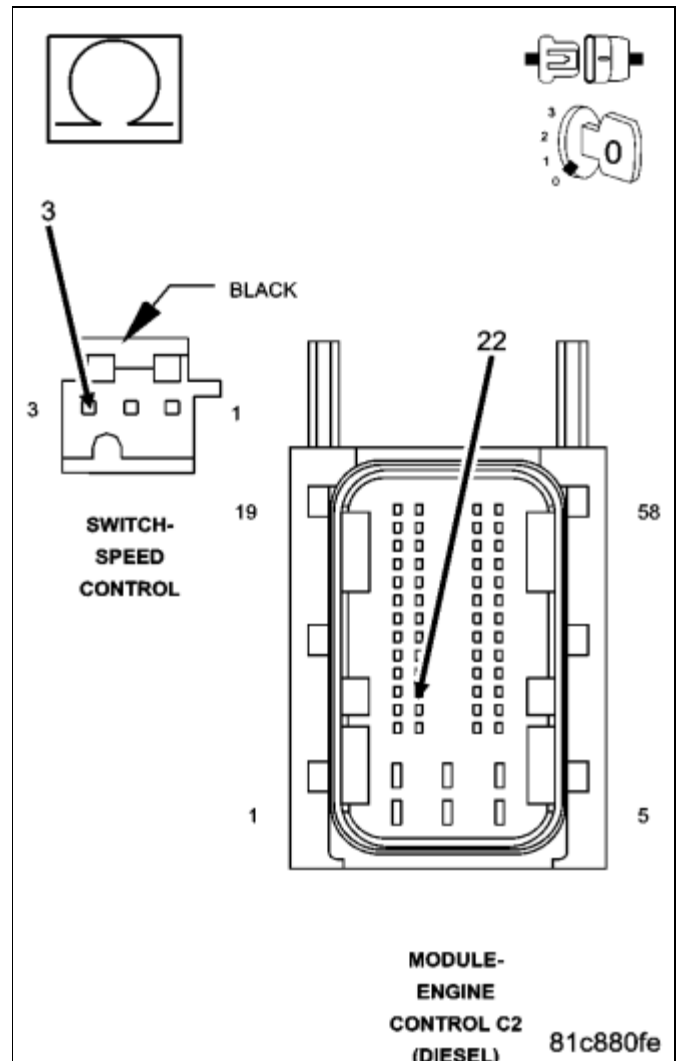
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V71) S/C Signal #1 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the resistance above 1000 ohms?

Yes

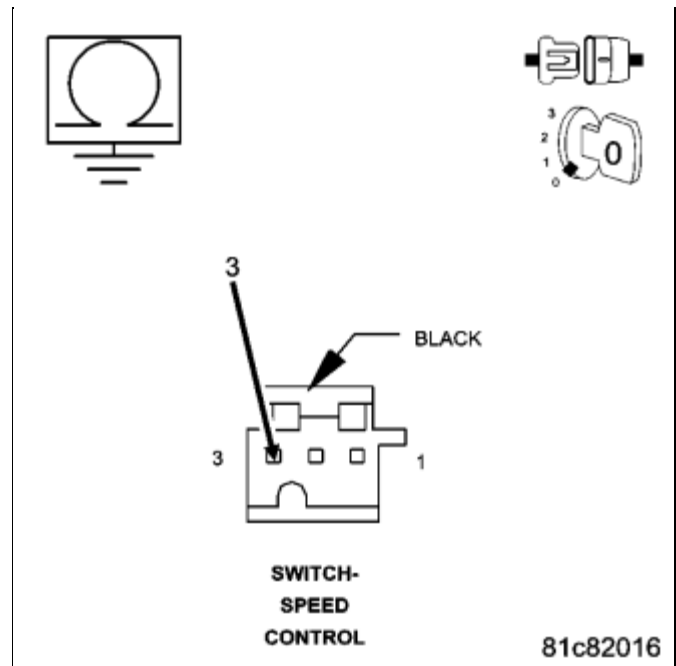
- Replace and program the Engine Control Module in

accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V71) S/C Signal #1 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

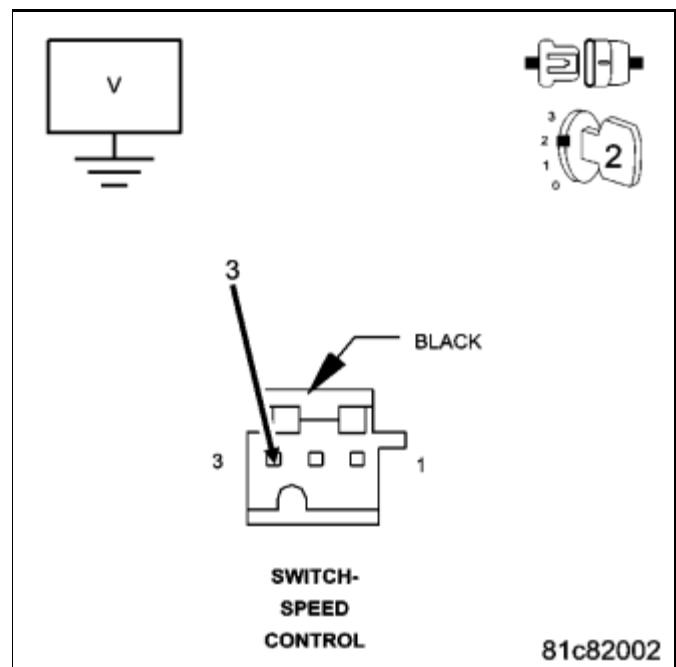
Turn the ignition on.

Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

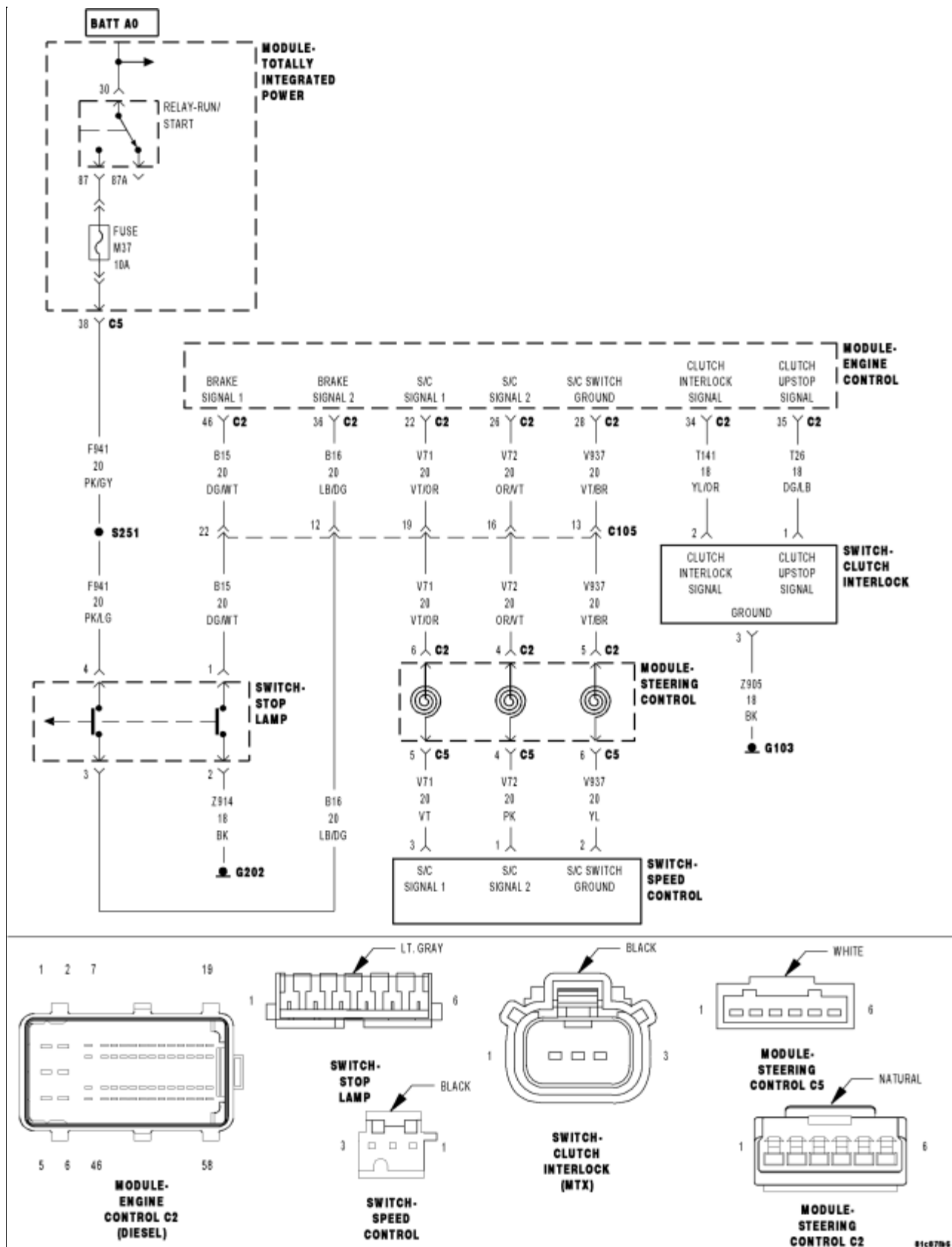
- Repair the (V71) S/C Signal #1 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-S/C SWITCH #1 SIGNAL CIRCUIT VOLTAGE TOO HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The S/C Switch Signal #1 is above 4.90 volts for 0.35 second.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V71) S/C SIGNAL #1 CIRCUIT OPEN
(V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND
(V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

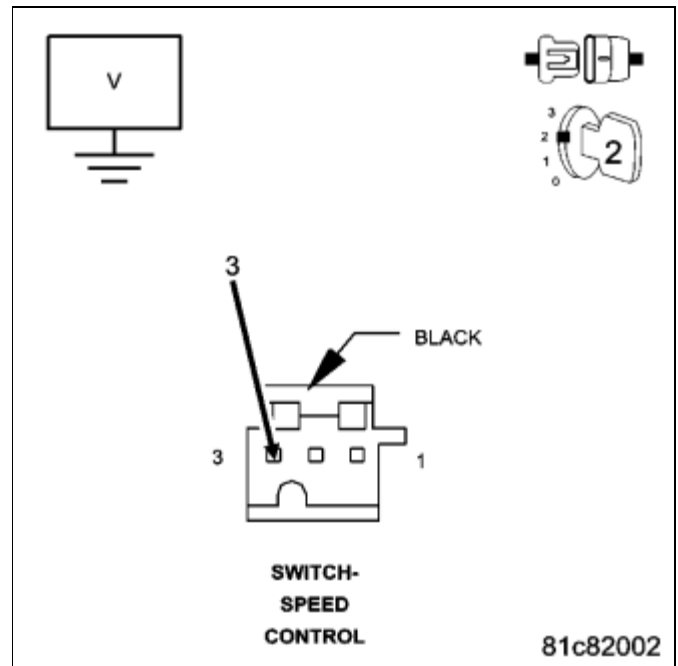
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

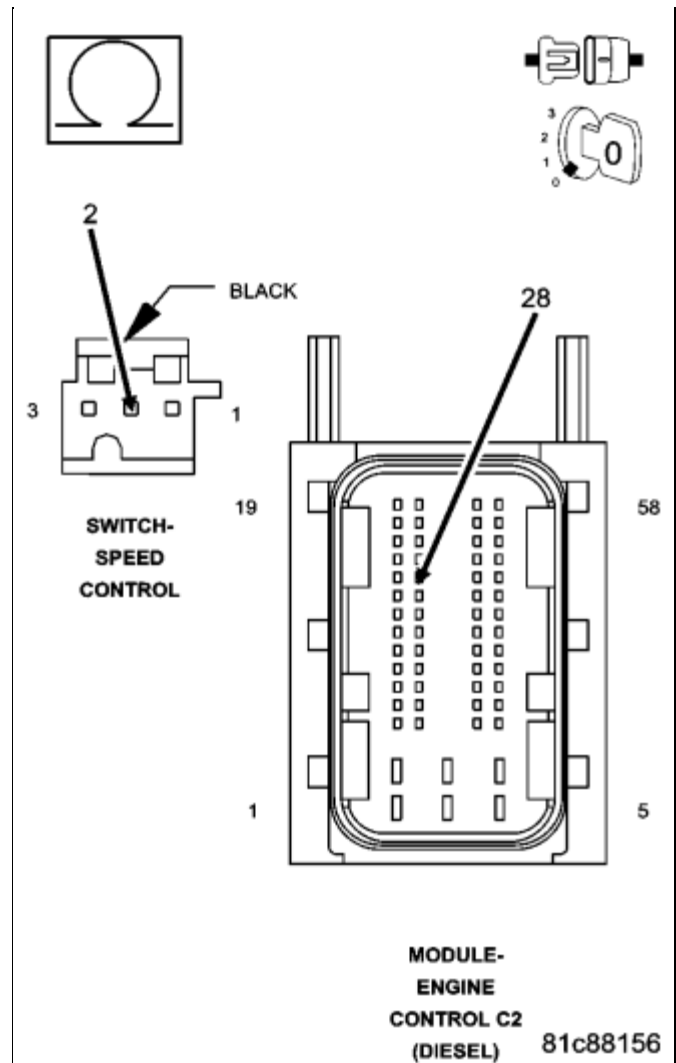
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

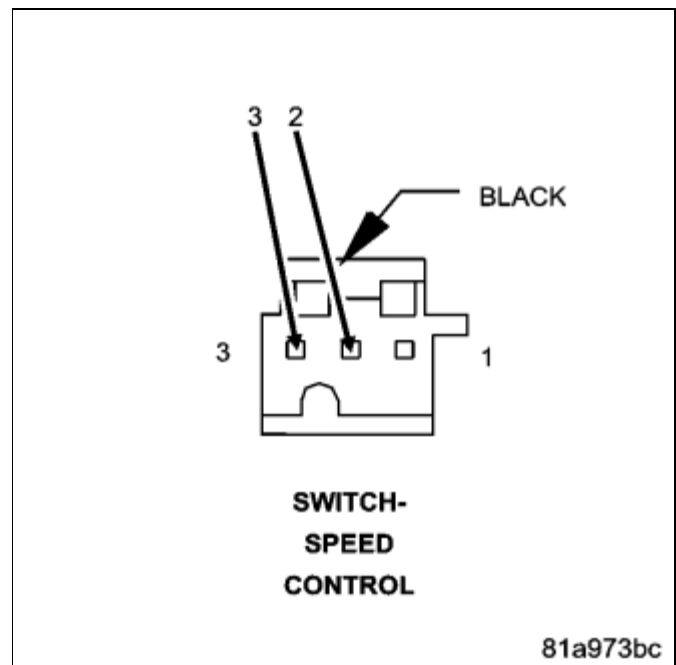
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V71) S/C Signal #1 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V71) S/C SIGNAL #1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V71) S/C Signal #1 circuit between the S/C Switch harness connector and the ECM harness connector.

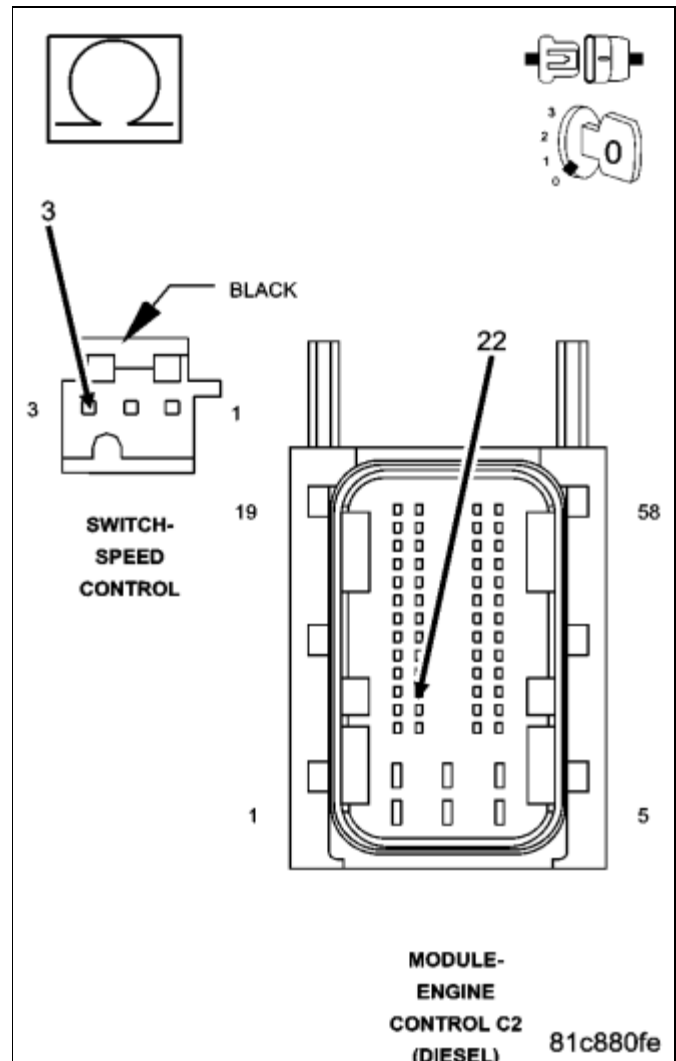
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V71) S/C Signal #1 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the resistance above 1000 ohms?

Yes

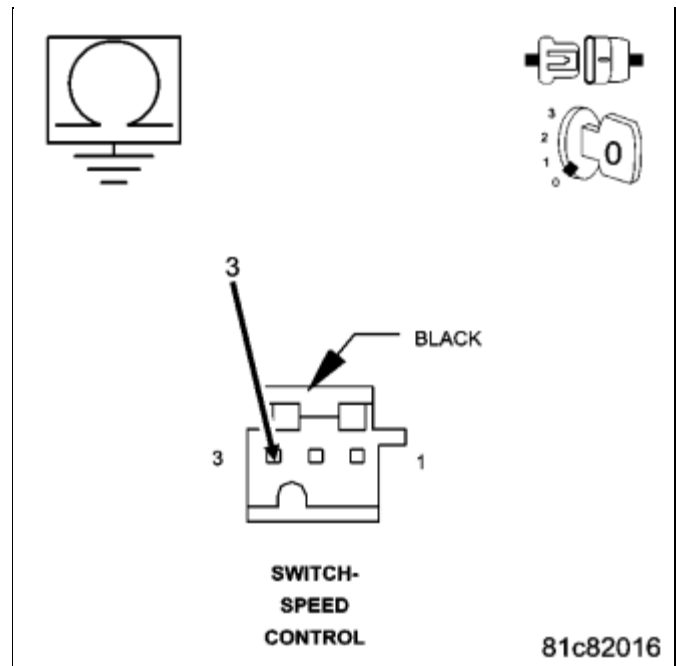
- Replace and program the Engine Control Module in

accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V71) S/C Signal #1 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

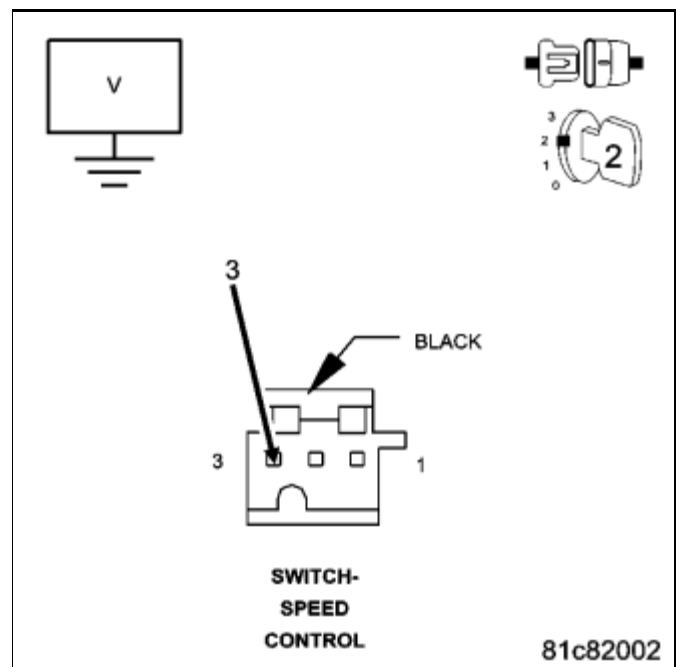
Turn the ignition on.

Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

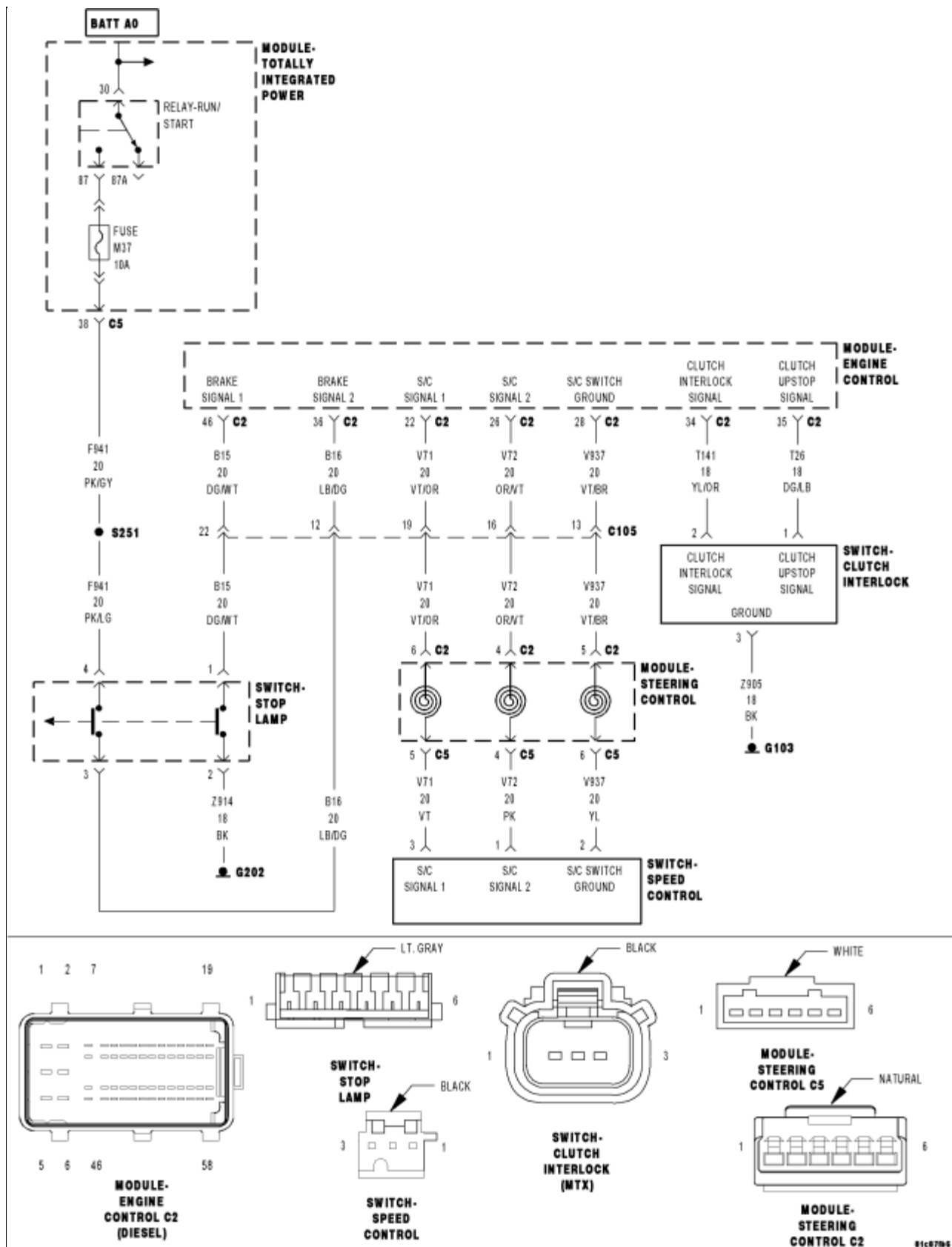
- Repair the (V71) S/C Signal #1 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0580-S/C SWITCH #1 SIGNAL CIRCUIT VOLTAGE TOO LOW



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The S/C Switch Signal #1 is below 0.60 volt for 0.35 second.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V71) S/C SIGNAL #1 CIRCUIT OPEN
(V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND
(V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

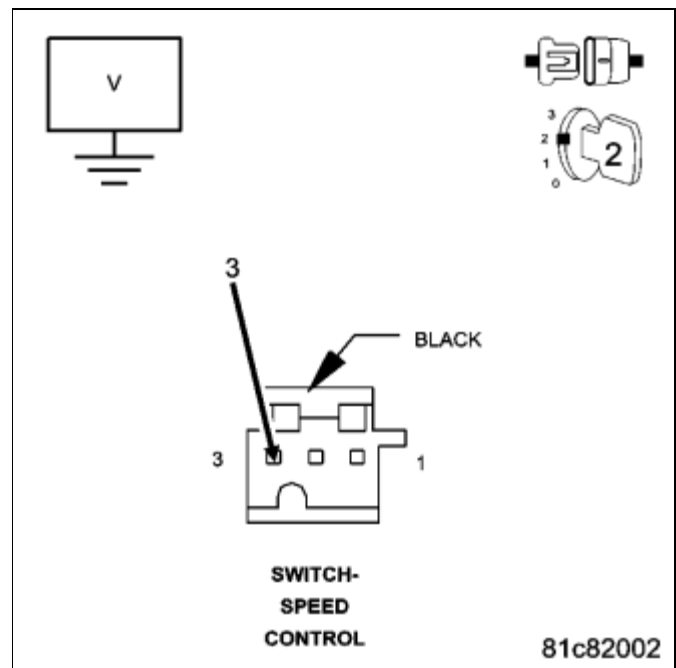
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

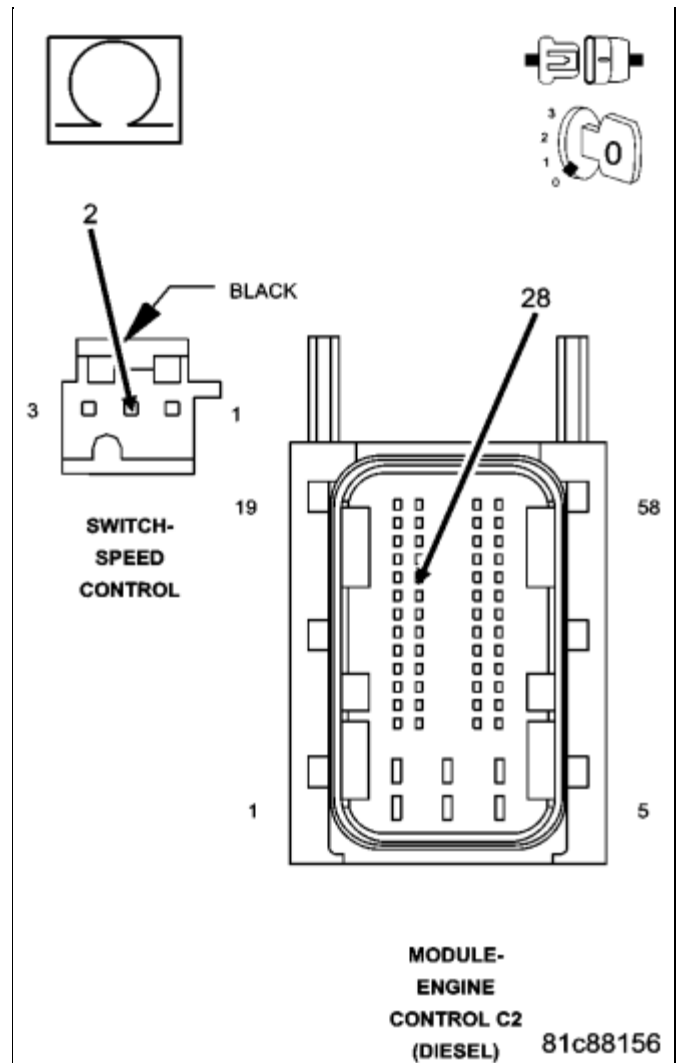
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

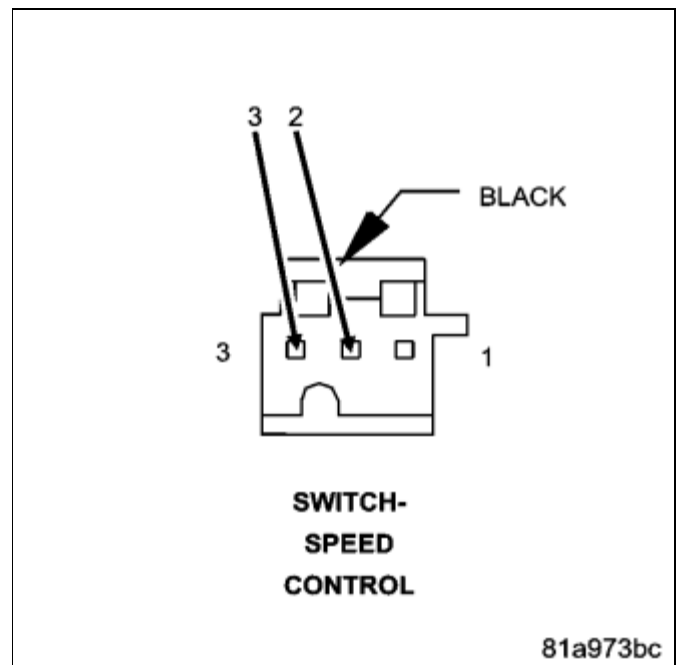
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V71) S/C Signal #1 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V71) S/C SIGNAL #1 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V71) S/C Signal #1 circuit between the S/C Switch harness connector and the ECM harness connector.

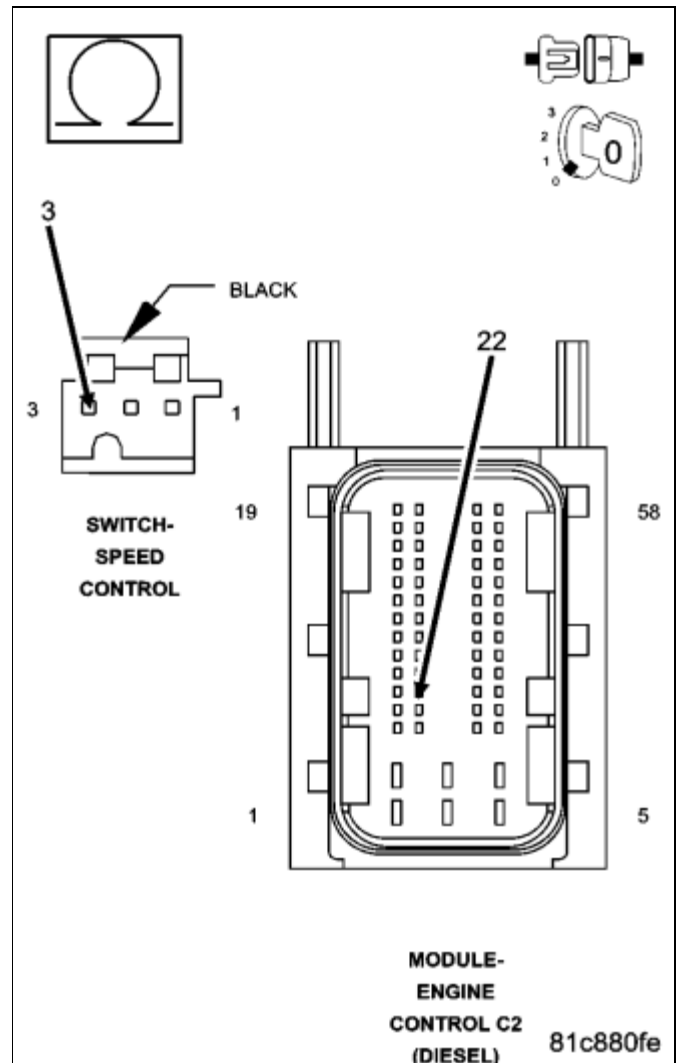
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V71) S/C Signal #1 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V71) S/C SIGNAL #1 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the resistance above 1000 ohms?

Yes

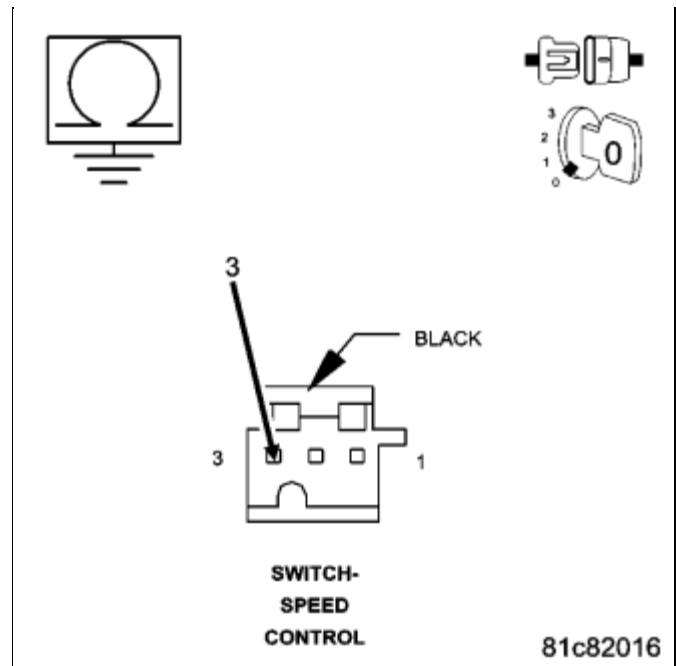
- Replace and program the Engine Control Module in

accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V71) S/C Signal #1 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V71) S/C SIGNAL #1 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

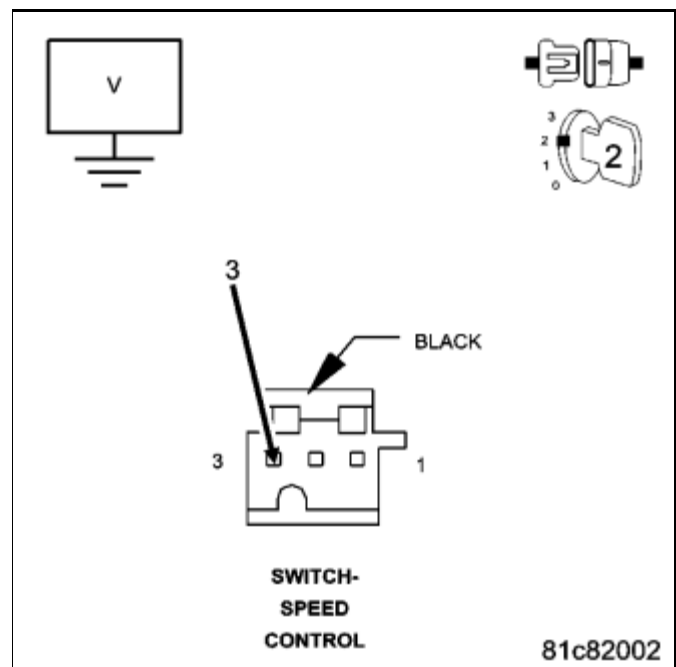
Turn the ignition on.

Measure the voltage of the (V71) S/C Signal #1 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

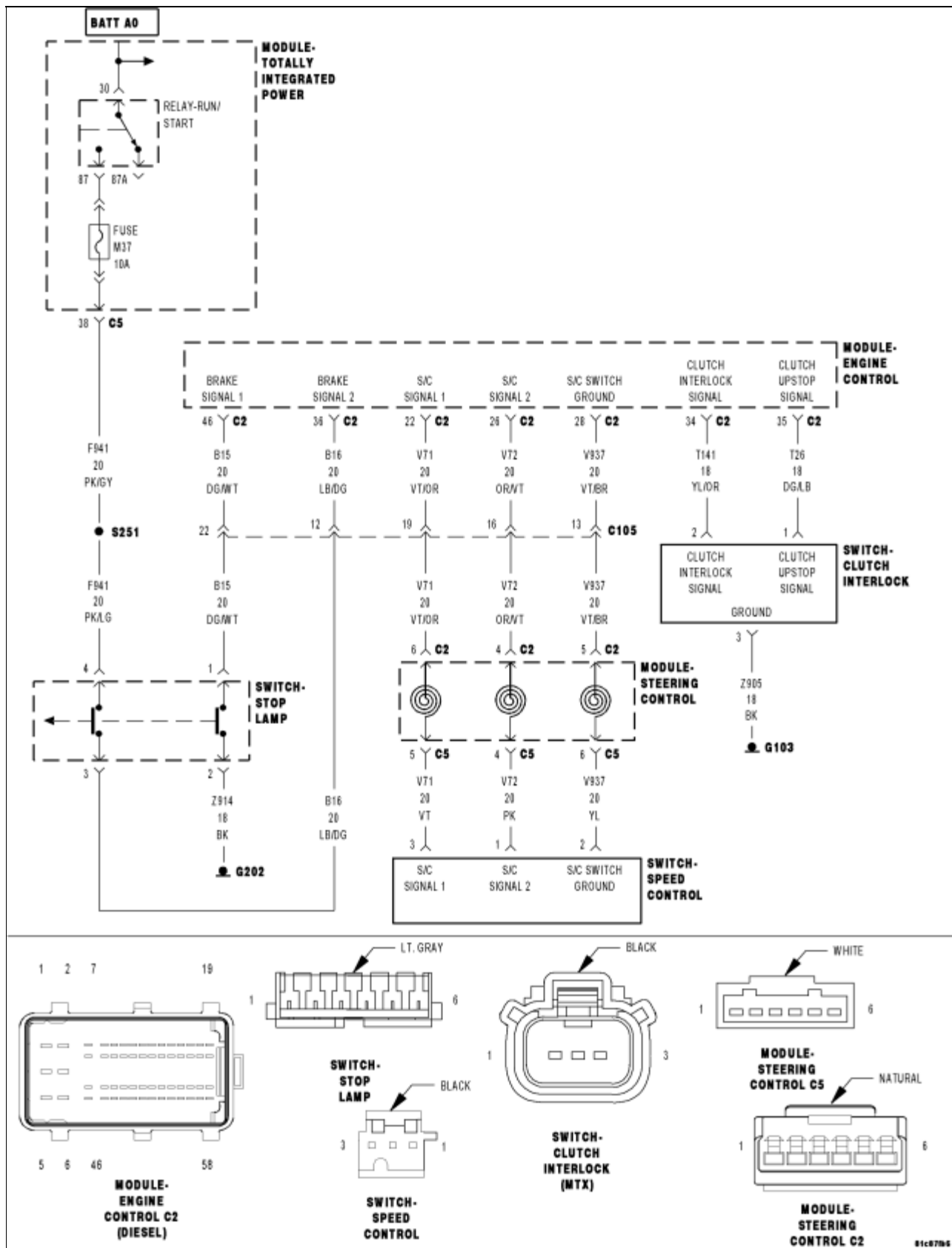
- Repair the (V71) S/C Signal #1 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0585-S/C SWITCH PLAUSIBILITY BETWEEN SWITCH #1 AND #2



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a discrepancy between S/C Signal #1 and S/C Signal #2 for 5.0 seconds.

Possible Causes
INTERMITTENT CONDITION
(V71) S/C SIGNAL #1 CIRCUIT OPEN
(V72) S/C SIGNAL #2 CIRCUIT OPEN
(V937) S/C SWITCH GROUND OPEN
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and activate the Speed Control.

At some point during the test drive, press each of the S/C Switch buttons.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. S/C SIGNALS OPEN

Turn the ignition off.

Disconnect the S/C Switch harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the (V71) S/C Signal #1 circuit and the (V72) S/C Signal #2 circuit between the S/C Switch harness connector and the ECM harness connector.

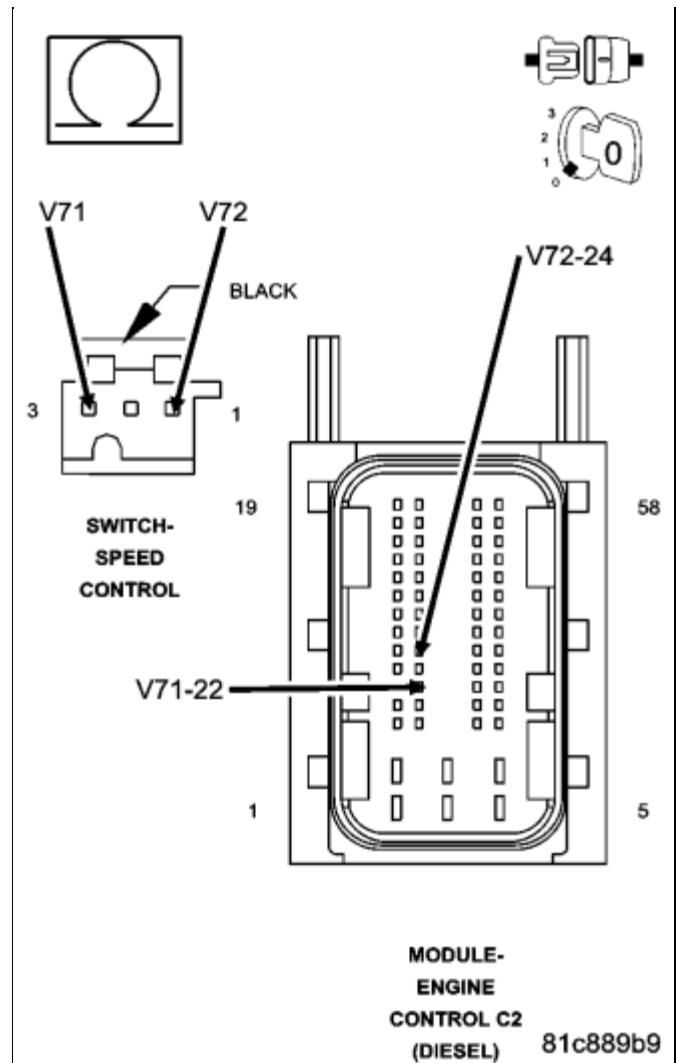
Is the resistance below 10.0 ohms for each measurement?

Yes

- Go To [3](#)

No

- Repair the S/C Signal circuit(s) for high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (V937) S/C SWITCH GROUND OPEN

Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

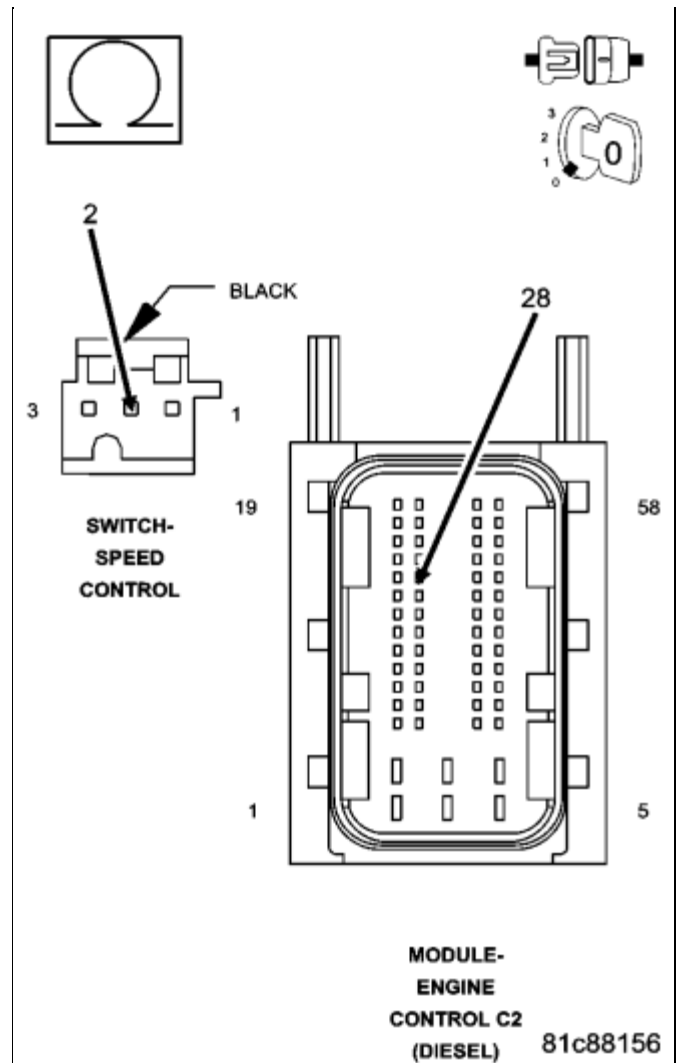
Is the resistance below 10.0 ohms?

Yes

- Go To [4](#)

No

- Repair the S/C Switch Ground circuit for high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. SPEED CONTROL SWITCH

Replace the S/C Switch.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and activate the Speed Control.

At some point during the test drive, press each of the S/C Switch buttons.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

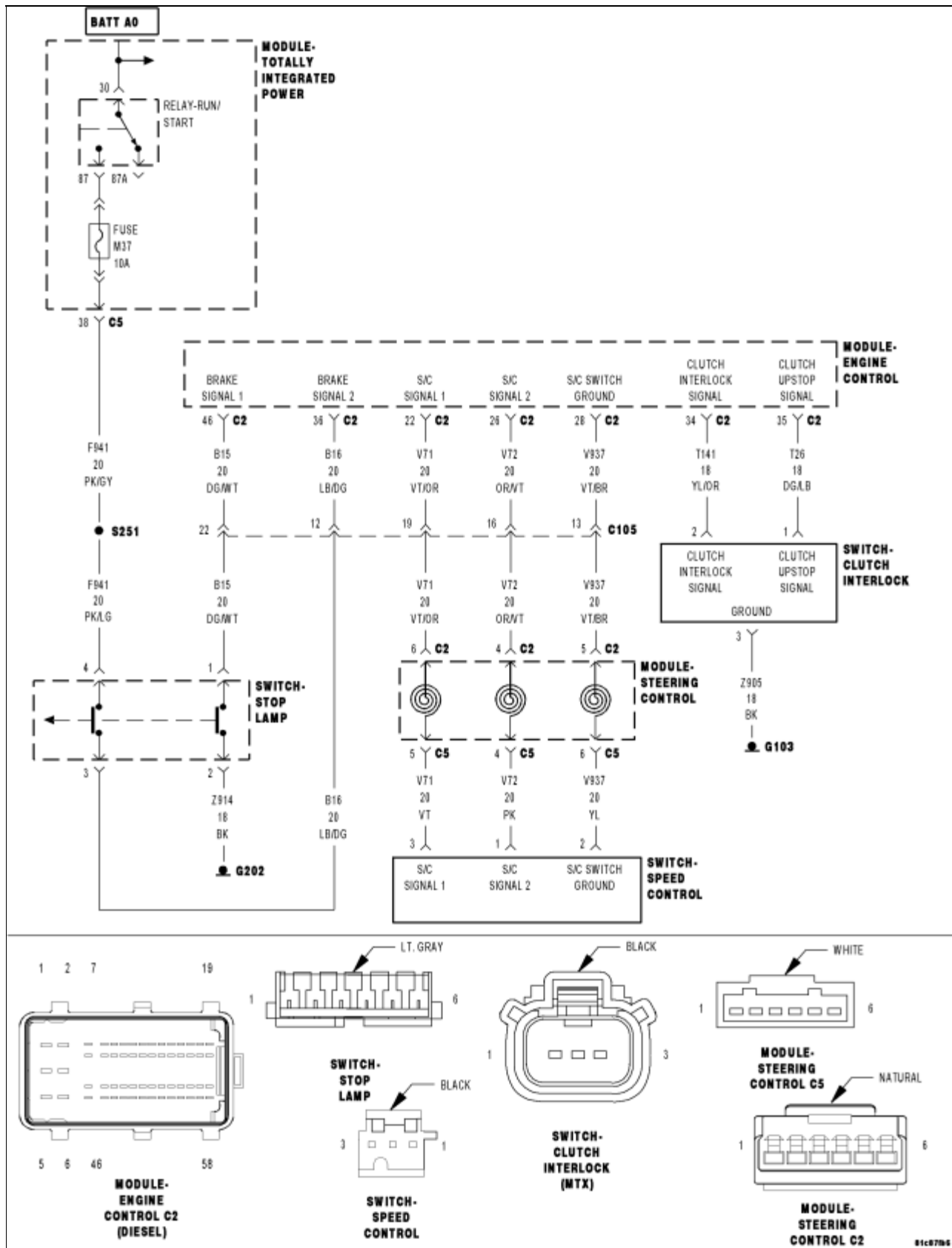
Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- The repair is complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0590-S/C SWITCH #2 SIGNAL CIRCUIT STUCK SWITCH



For a complete wiring diagram Refer to Section 8W

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The S/C Switch Signal #2 indicates that a switch is pressed for more than 1 minute.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V72) S/C SIGNAL #2 CIRCUIT OPEN
(V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND
(V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

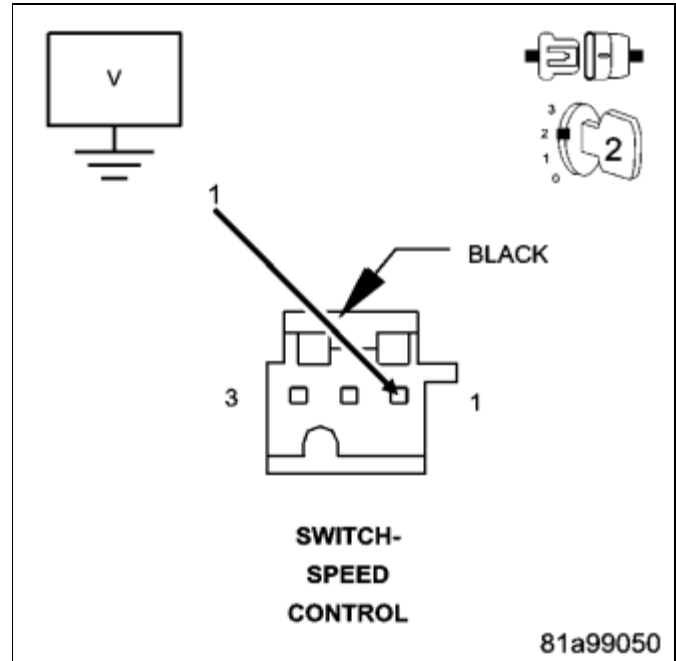
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
Disconnect the S/C Switch harness connector.
Turn the ignition on.
Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

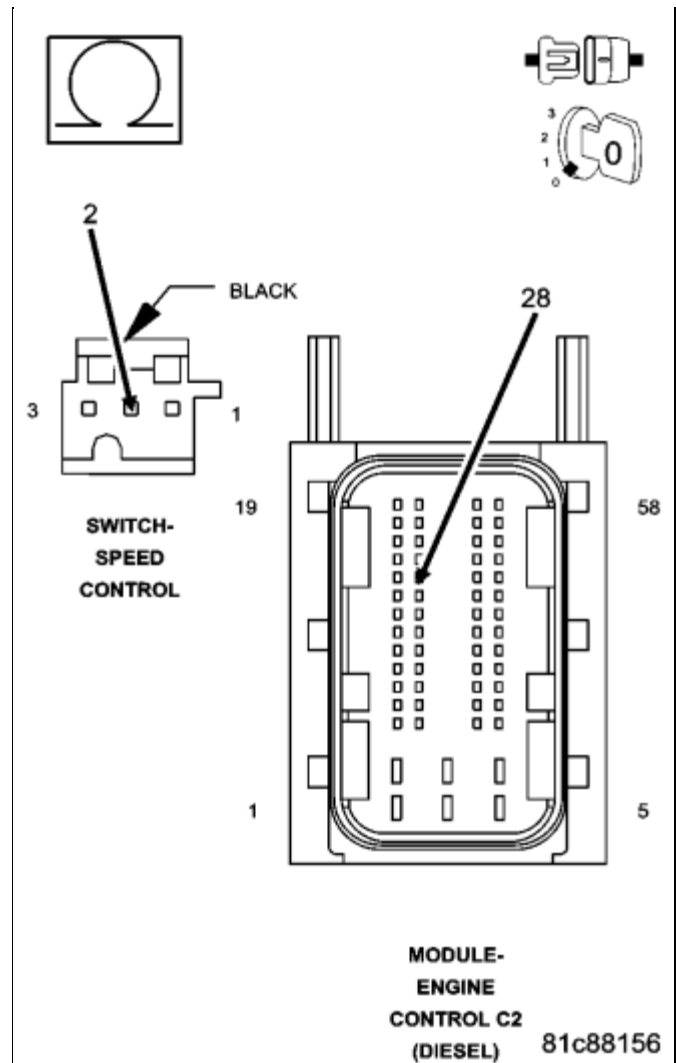
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

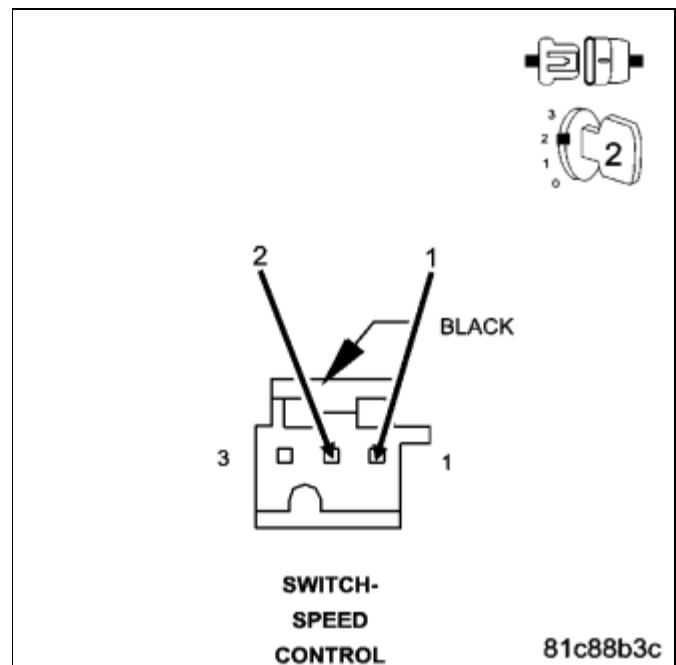
Reconnect the S/C Switch harness connector.
Turn the ignition on.
With the scan tool, read the S/C Switch Voltage.
While monitoring the scan tool, connect a jumper wire between the (V72) S/C Signal #2 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V72) S/C SIGNAL #2 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V72) S/C Signal #2 circuit between the S/C Switch harness connector and the ECM harness connector.

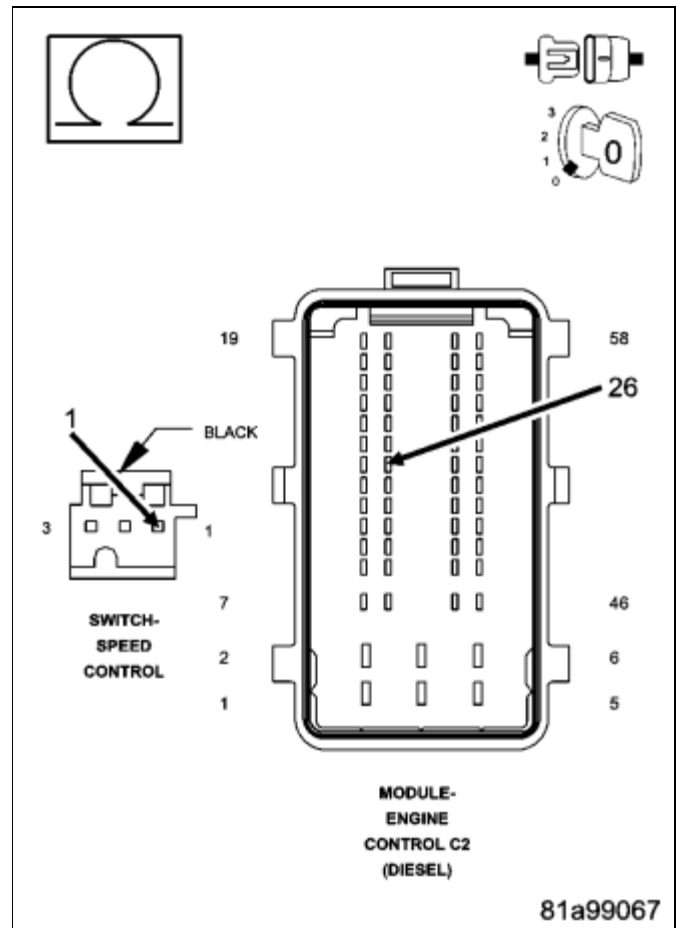
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V72) S/C Signal #2 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

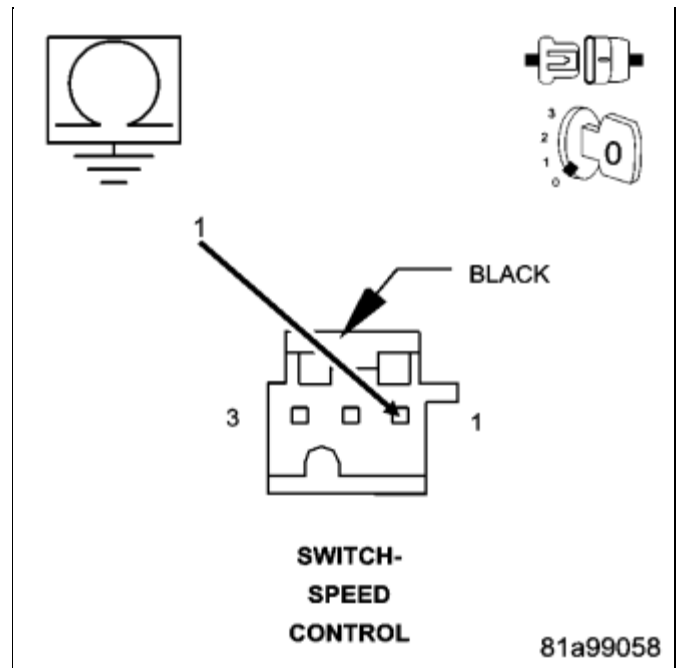
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V72) S/C Signal #2 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

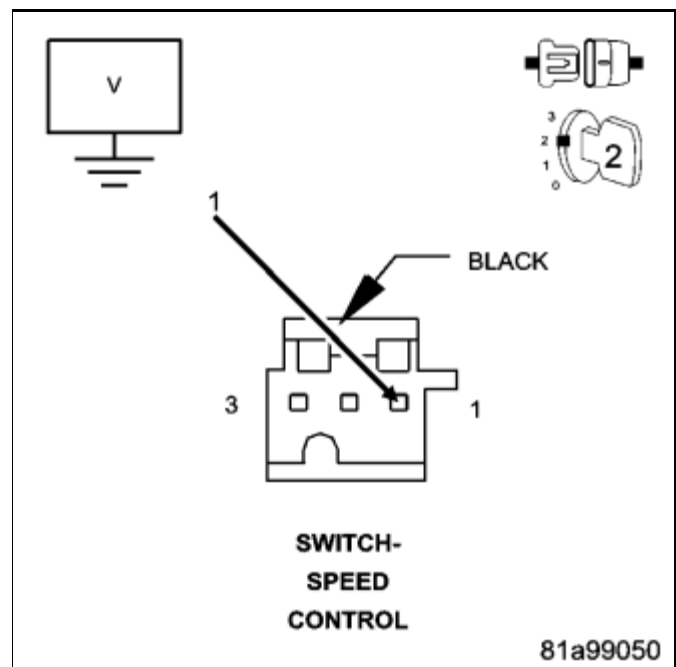
Turn the ignition on.

Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

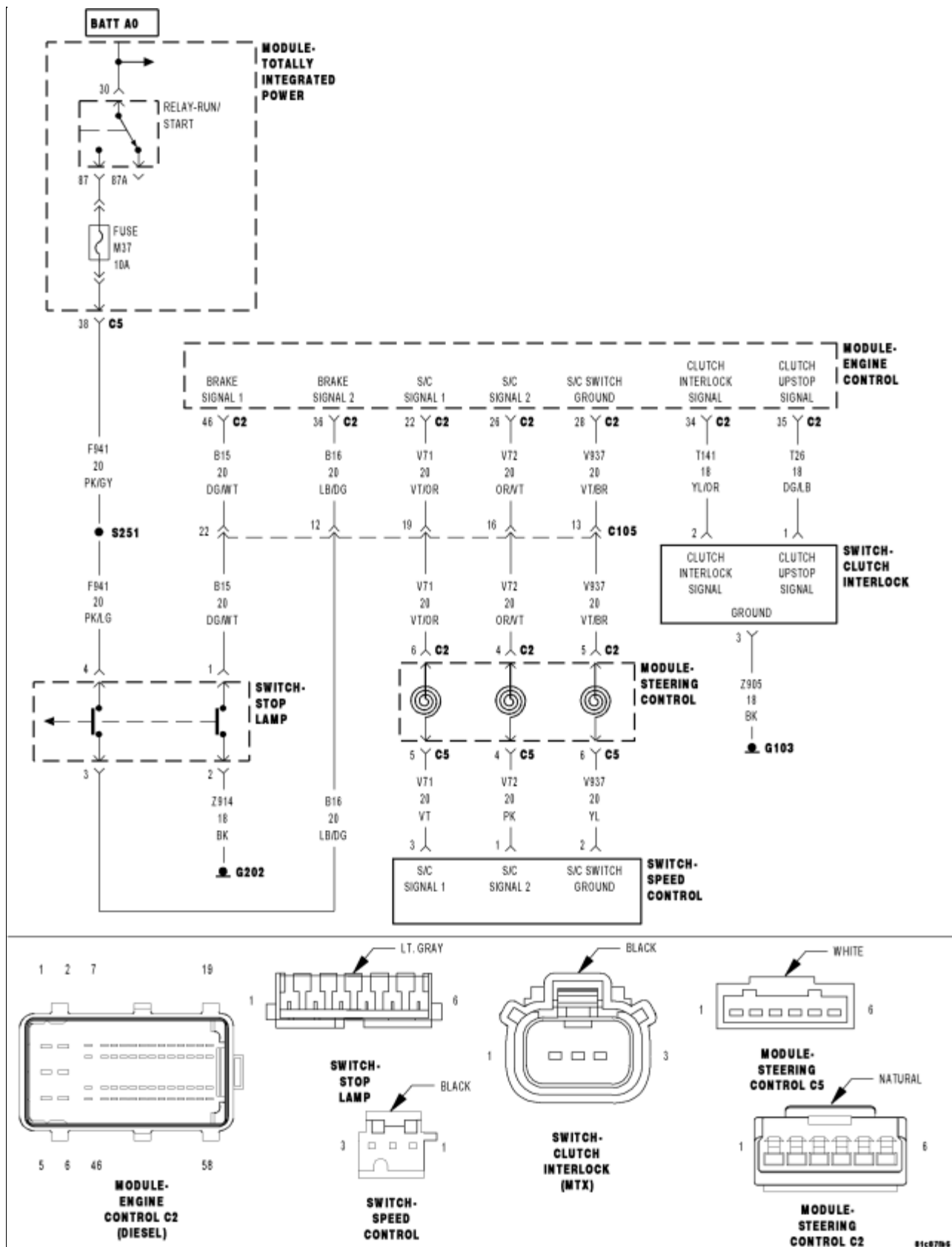
- Repair the (V72) S/C Signal #2 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0591-S/C SWITCH #2 SIGNAL CIRCUIT PLAUSIBILITY



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition switch on and no other S/C Switch DTC's present.

◦ **Set Condition:**

The S/C Switch Signal #2 voltage is not within a valid switch signal range.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V72) S/C SIGNAL #2 CIRCUIT OPEN
(V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND
(V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Diagnostic Test

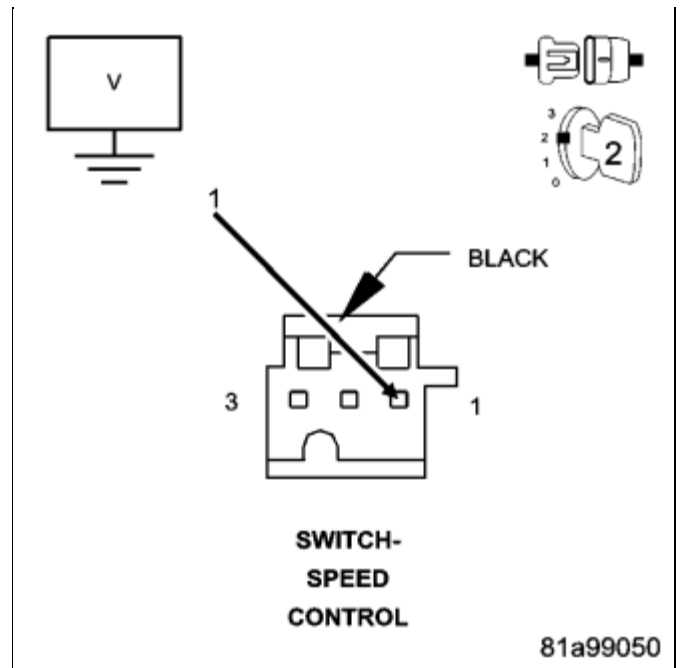
1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.



Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

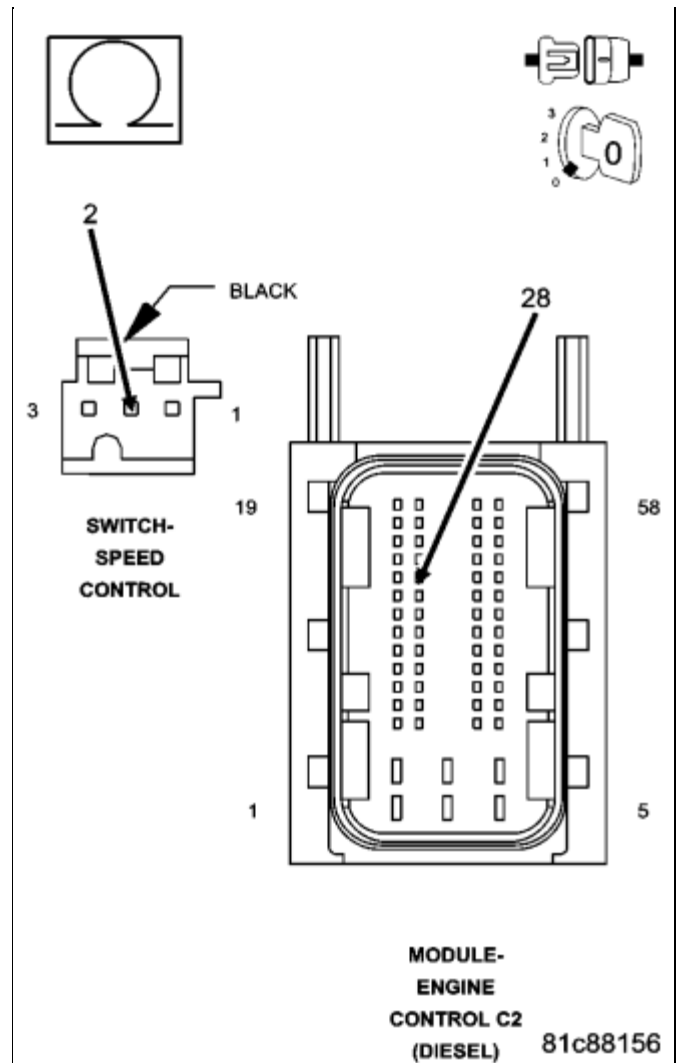
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

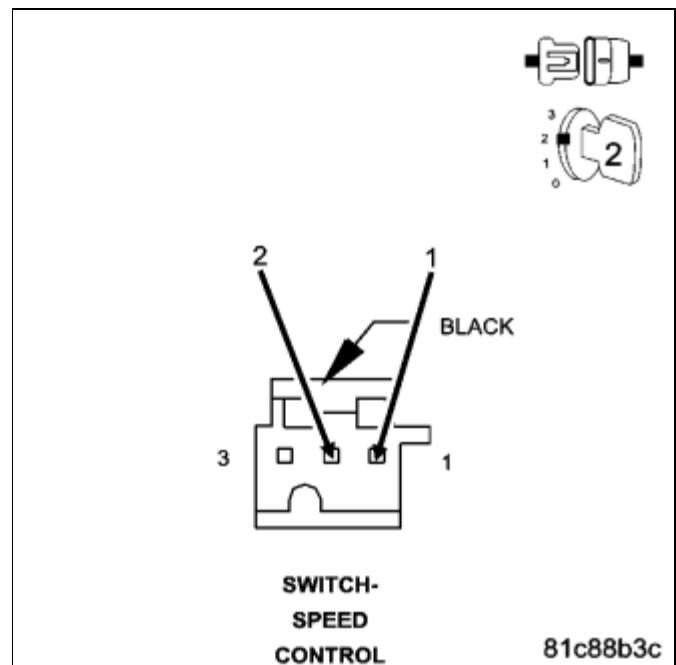
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V72) S/C Signal #2 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V72) S/C SIGNAL #2 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V72) S/C Signal #2 circuit between the S/C Switch harness connector and the ECM harness connector.

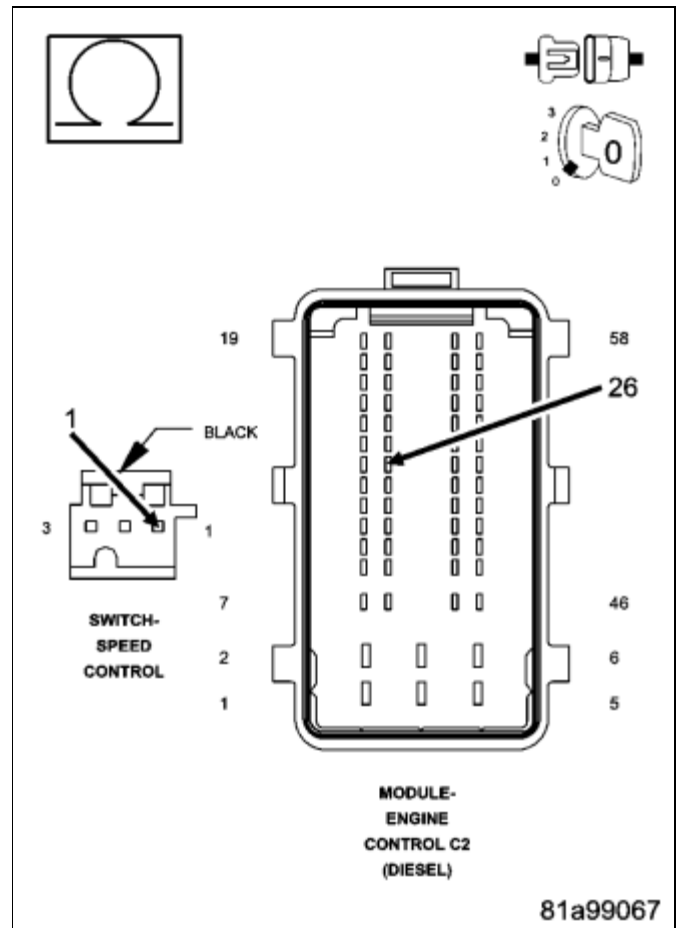
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V72) S/C Signal #2 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

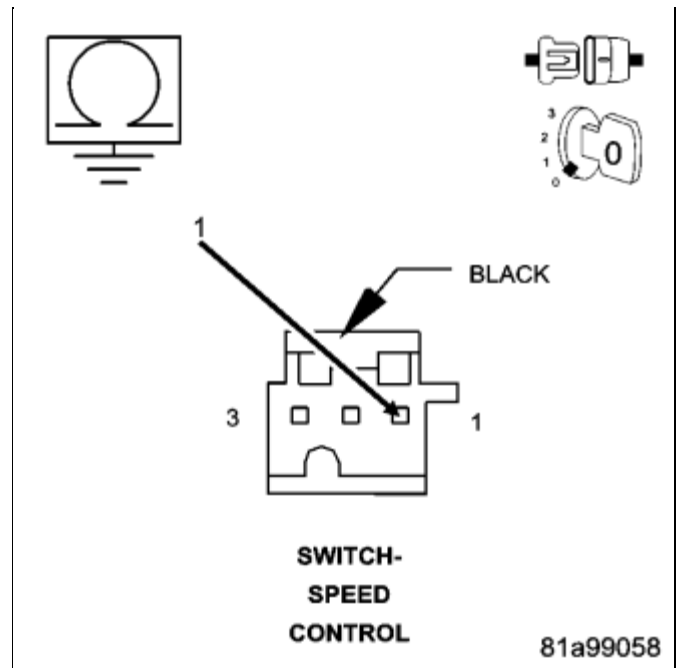
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V72) S/C Signal #2 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

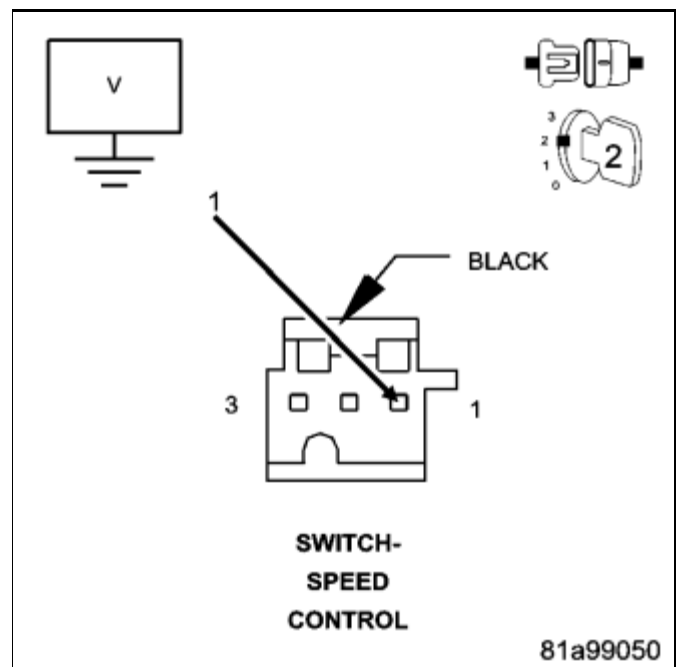
Turn the ignition on.

Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

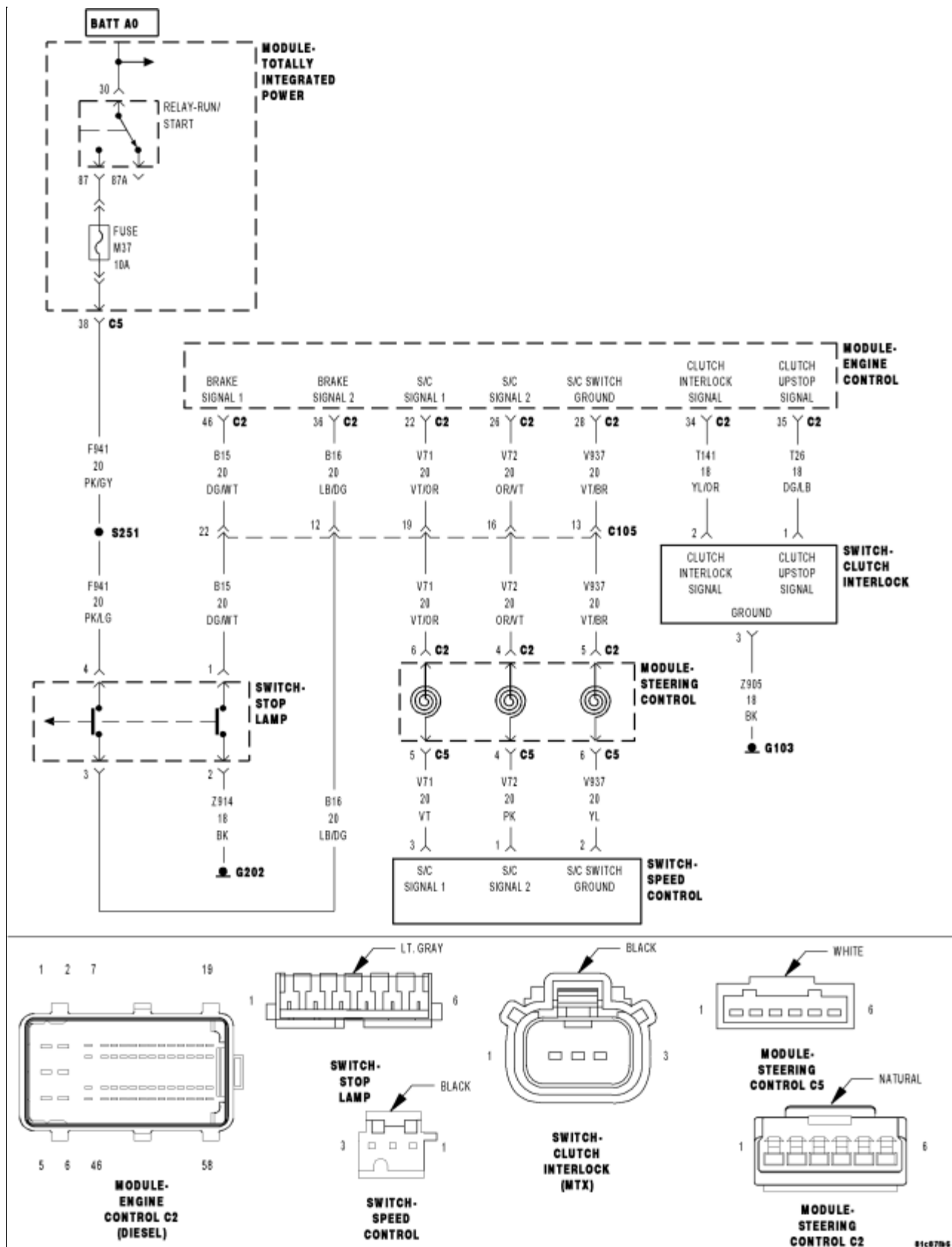
- Repair the (V72) S/C Signal #2 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0592-S/C SWITCH #2 SIGNAL CIRCUIT VOLTAGE TOO LOW



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The S/C Switch Signal #2 is below 0.60 volt for 0.35 second.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V72) S/C SIGNAL #2 CIRCUIT OPEN
(V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND
(V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Diagnostic Test

1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

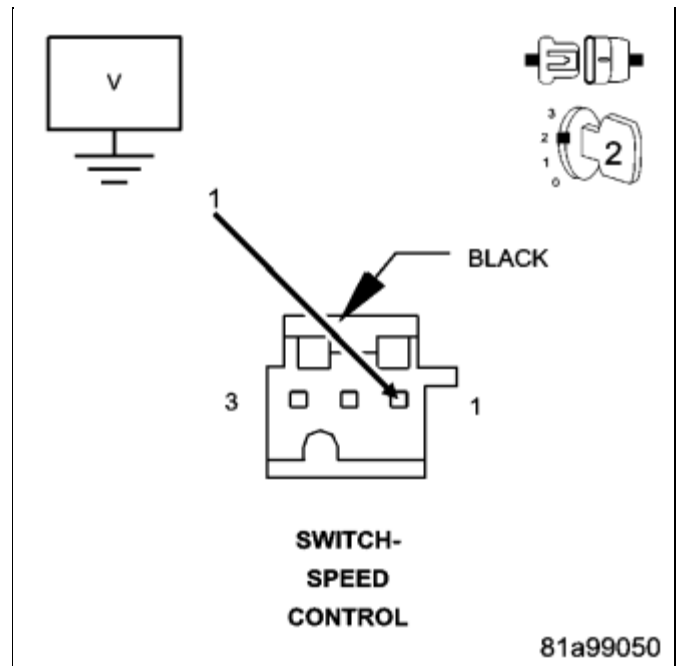
Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

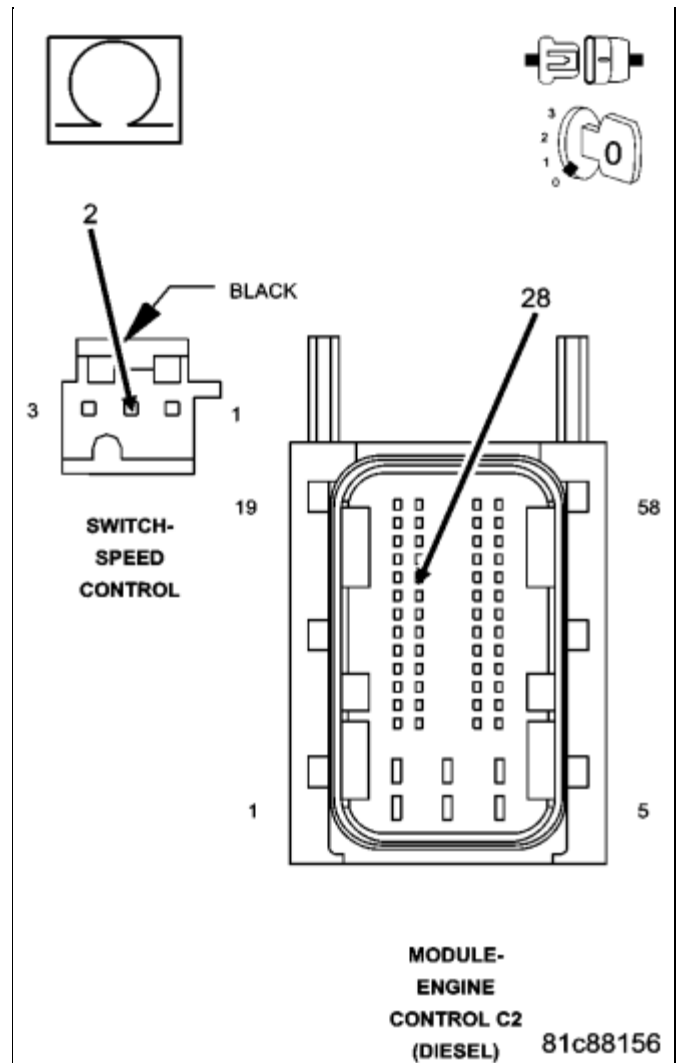
Yes

- Go To [3](#)

No



- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

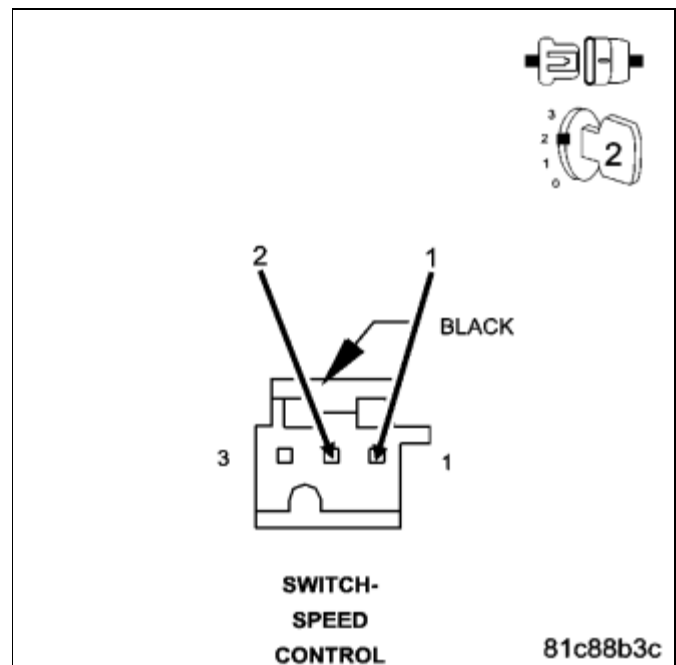
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V72) S/C Signal #2 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V72) S/C SIGNAL #2 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V72) S/C Signal #2 circuit between the S/C Switch harness connector and the ECM harness connector.

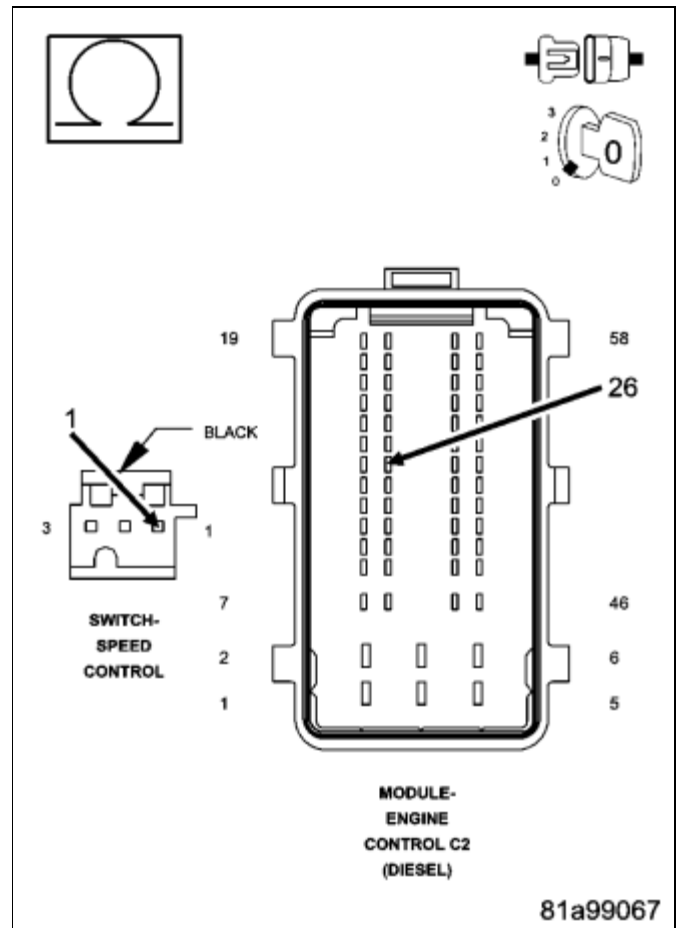
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V72) S/C Signal #2 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

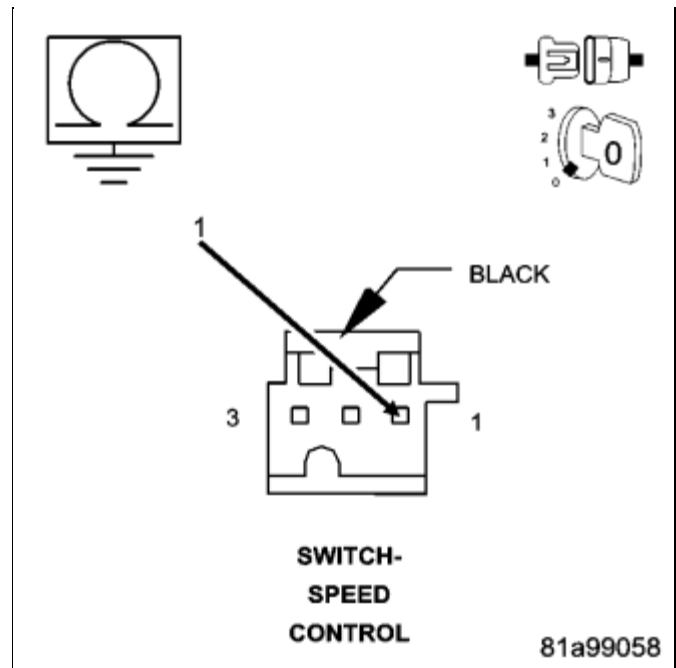
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V72) S/C Signal #2 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

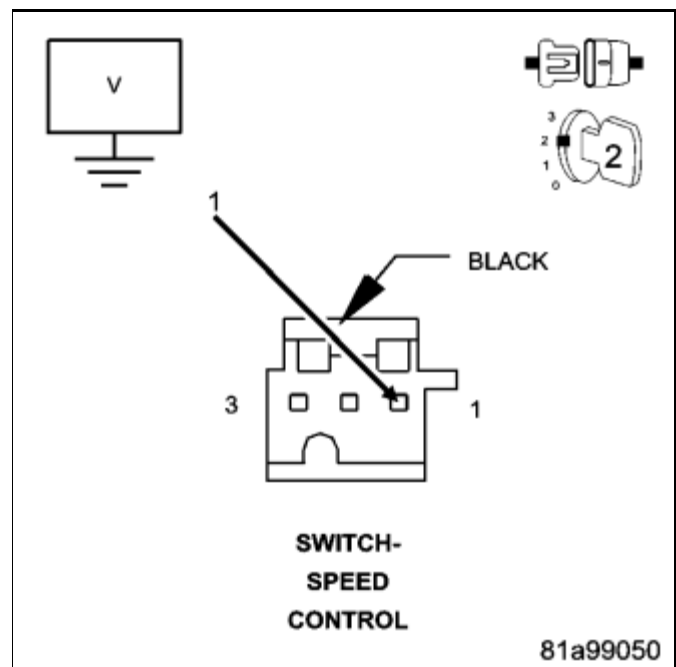
Turn the ignition on.

Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

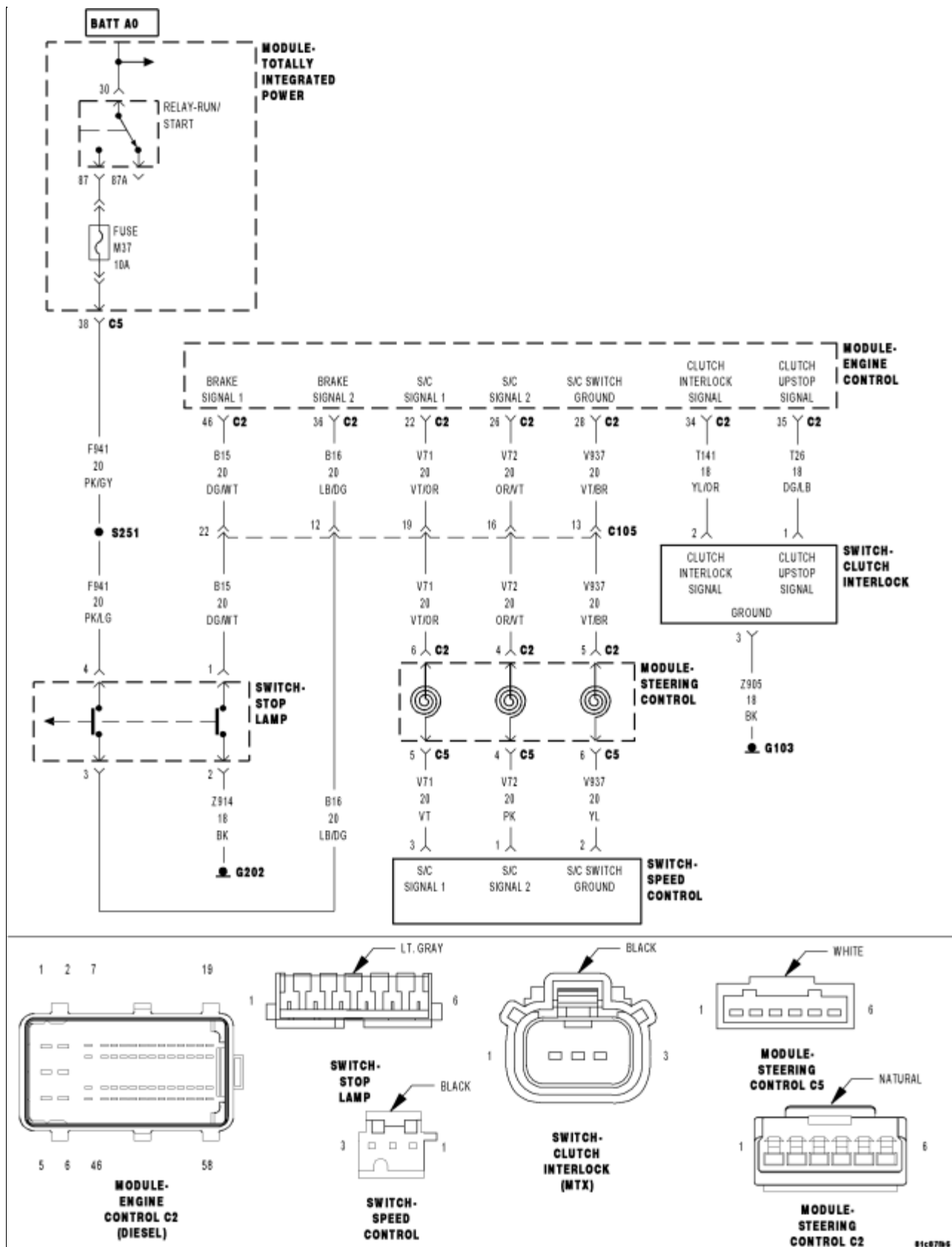
- Repair the (V72) S/C Signal #2 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0593-S/C SWITCH #2 SIGNAL CIRCUIT VOLTAGE TOO HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The S/C Switch Signal #2 is above 4.80 volts for 0.35 second.

Possible Causes
(V937) S/C SWITCH GROUND OPEN
(V72) S/C SIGNAL #2 CIRCUIT OPEN
(V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND
(V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE
SPEED CONTROL SWITCH
ENGINE CONTROL MODULE

Diagnostic Test

1. VERIFY S/C SIGNAL CIRCUIT VOLTAGE

KEY	SIGNAL 1		SIGNAL 2	
	LO LIMIT	HI LIMIT	LO LIMIT	HI LIMIT
RELEASED	4.49	4.56	4.49	4.56
ON-OFF	0.85	1.00	3.67	3.75
SET	3.29	3.39	1.30	1.45
RESUME-ACCEL	3.98	4.05	2.17	2.29
CANCEL	1.72	1.82	2.98	3.08

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition off.
 Disconnect the S/C Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Select the appropriate voltage reading.

4.5 to 5.5 volts.

- Go To [2](#)

Below 4.5 volts.

- Go To [4](#)

Above 5.5 volts.

- Go To [6](#)

2. (V937) S/C SWITCH GROUND OPEN

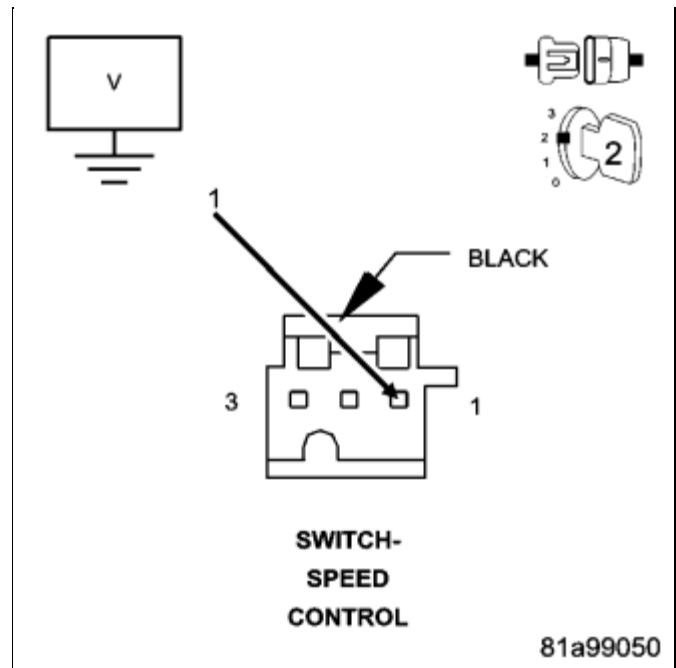
Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance of the (V937) S/C Switch Ground circuit between the S/C Switch harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

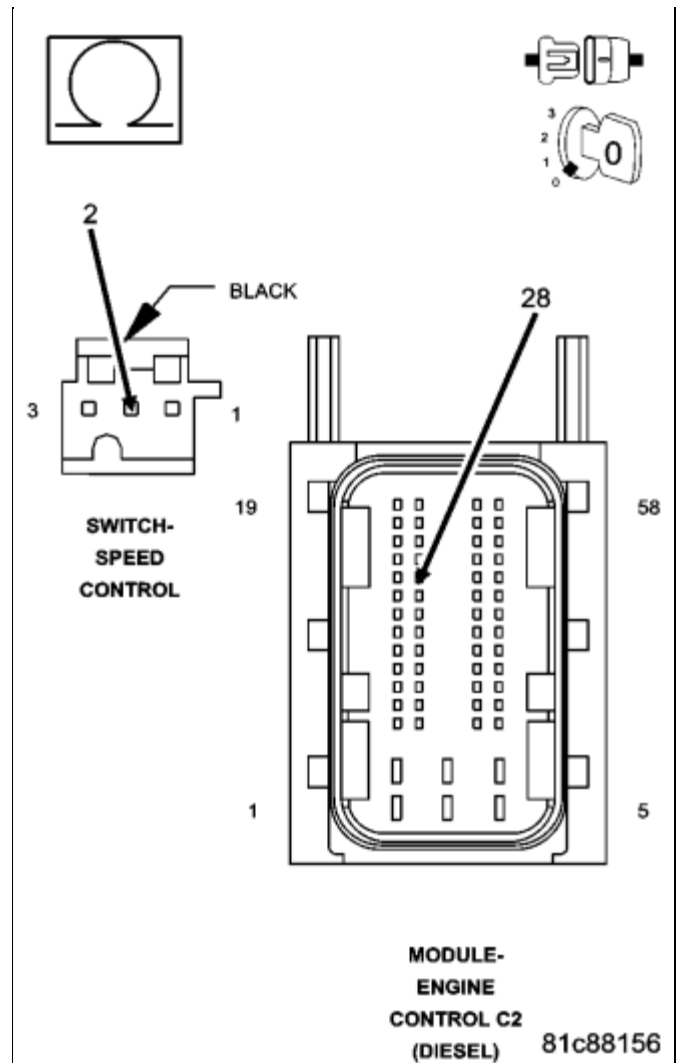
Yes

- Go To [3](#)

No



- Repair the (V937) S/C Switch Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ECM - SENSOR GROUND OPEN

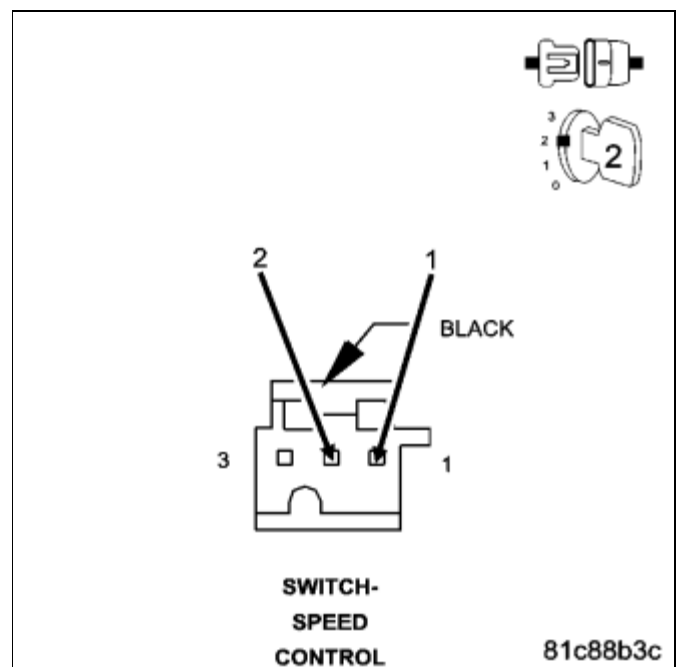
Reconnect the S/C Switch harness connector.
 Turn the ignition on.
 With the scan tool, read the S/C Switch Voltage.
 While monitoring the scan tool, connect a jumper wire between the (V72) S/C Signal #2 circuit and the (V937) S/C Switch Ground circuit in the S/C Switch harness connector.

Does the scan tool display below 0.1 volt with the jumper wire connected?

Yes

- Replace the Speed Control Switch.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No



- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V72) S/C SIGNAL #2 CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Measure the resistance between of the (V72) S/C Signal #2 circuit between the S/C Switch harness connector and the ECM harness connector.

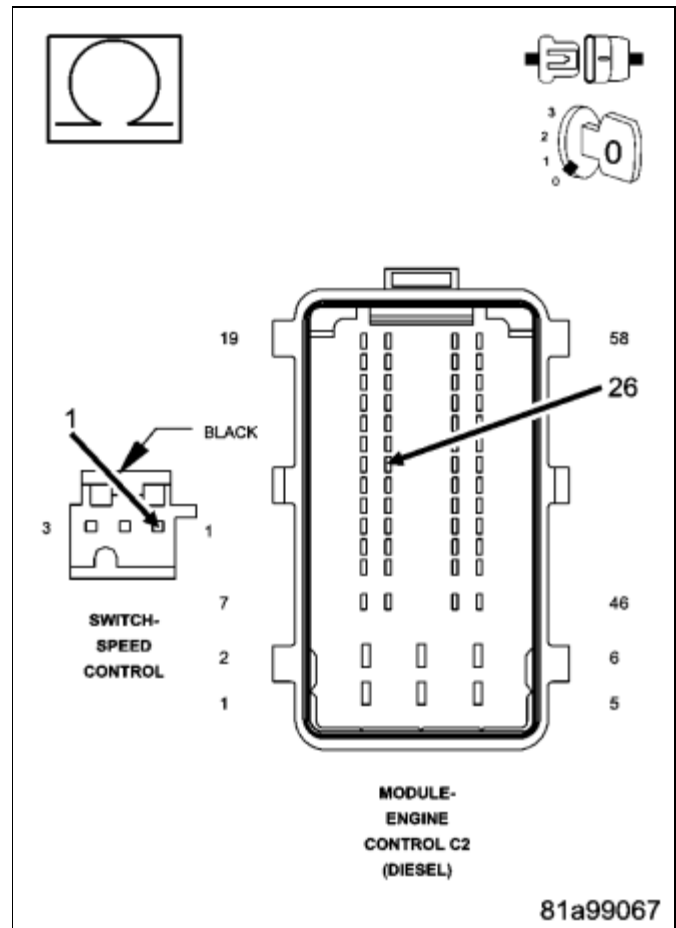
Is the resistance below 10.0 ohms?

Yes

- Go To [5](#)

No

- Repair the (V72) S/C Signal #2 circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (V72) S/C SIGNAL #2 CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

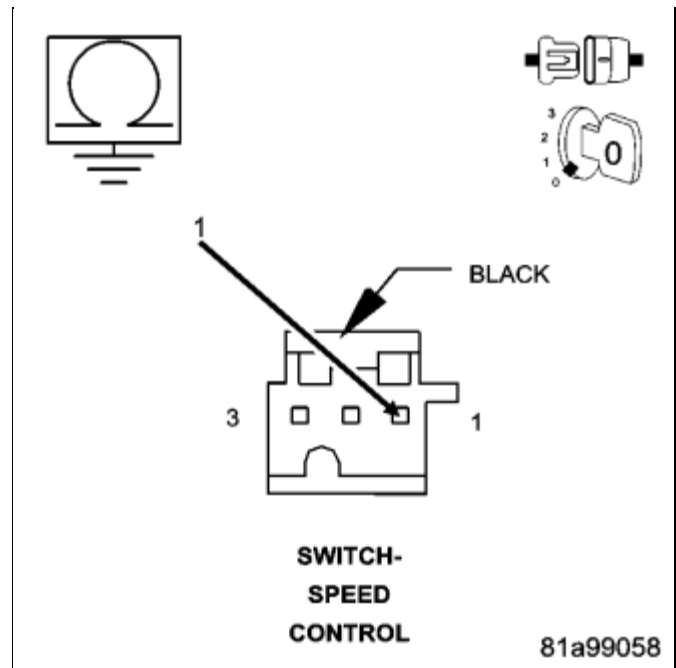
Is the resistance above 1000 ohms?

Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (V72) S/C Signal #2 circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V72) S/C SIGNAL #2 CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

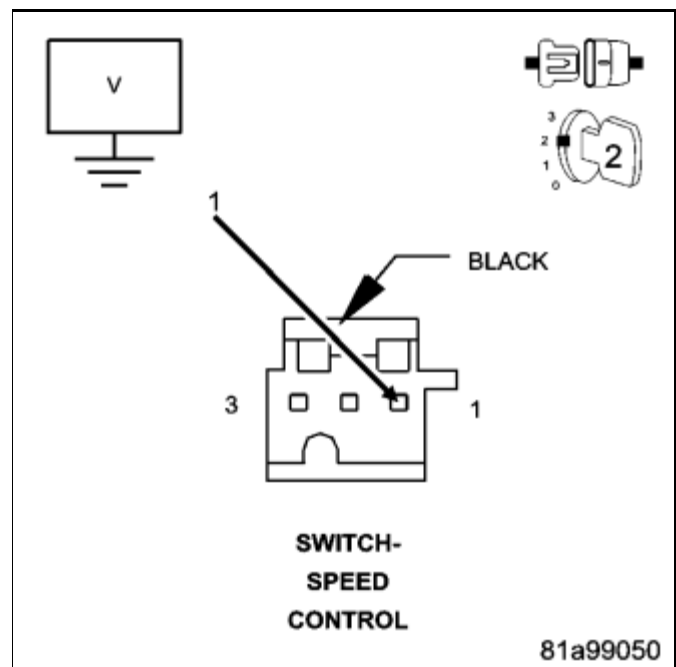
Turn the ignition on.

Measure the voltage of the (V72) S/C Signal #2 circuit at the S/C Switch harness connector.

Is the voltage above 1.0 volt?

Yes

- Repair the (V72) S/C Signal #2 circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0606-ECU INTERNAL FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) detects an internal failure.

Possible Causes
INTERMITTENT DTC
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, select View DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the Engine Control Module (ECM) wiring and

connectors.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Check for proper ECM power supply from the ignition switch and the ASD relay. Check the ECM for proper ground supply.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0610-ECU VEHICLE OPTIONS MISMATCH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

There is a transmission coding error in the Engine Control Module (ECM).

Possible Causes
INTERMITTENT DTC
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, select View DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK FOR PROPER SOFTWARE AND VARIANT CODING

Use the scan tool and update the variant coding.

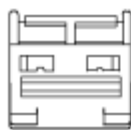
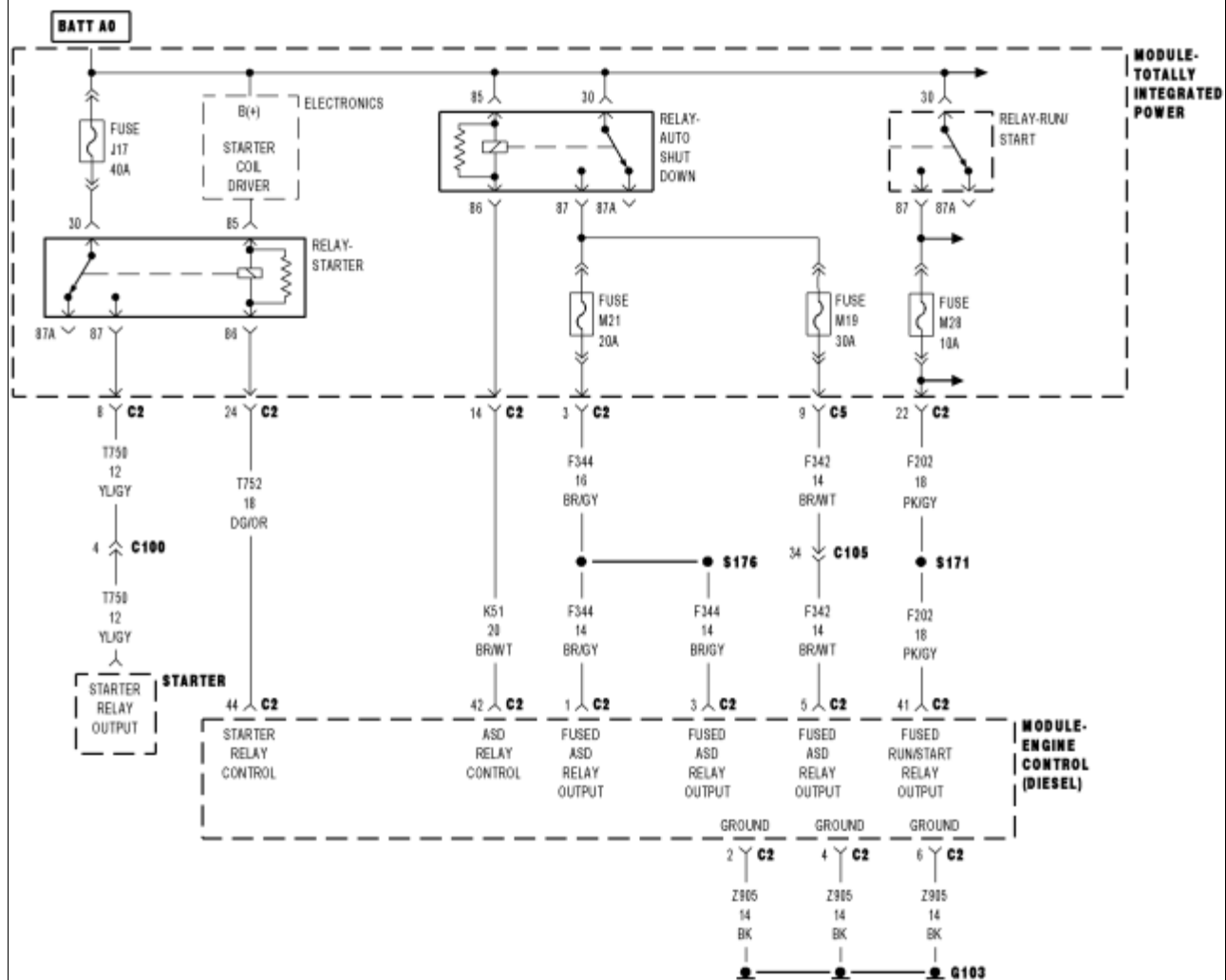
Use the scan tool and check for the proper software level in the ECM.

View Repair.

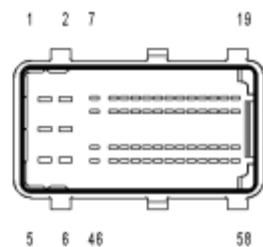
Test Complete

- Test Complete
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0615-STARTER CONTROL CIRCUIT OPEN



STARTER



MODULE-ENGINE CONTROL C2 (DIESEL)

81a798a8

For a complete wiring diagram Refer to Section 8W

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Starter Relay Control circuit. When the ignition switch is turned to the Start/Crank position, the ECM grounds this signal to indicate a request for Starter Motor operation.

- **When Monitored:**

With the ignition on and the Starter command off.

- **Set Condition:**

The ECM does not detect voltage on the (T752) Engine Starter Relay Control circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(T752) STARTER RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine several times.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the TIPM C2 harness connector.
 Disconnect the Engine Control Module (ECM) harness connectors.
 Measure the resistance between ground and the (T752) Starter Relay Control circuit in the TIPM C2 harness connector.

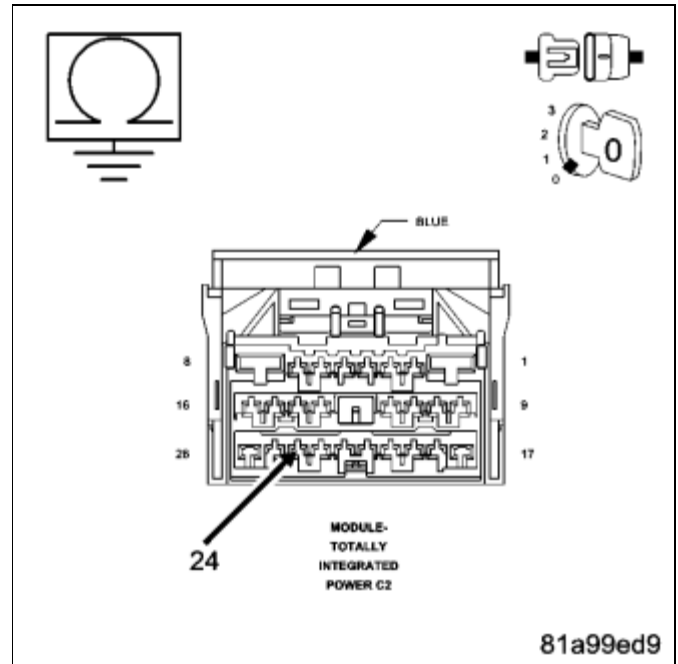
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (T752) Starter Relay Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (T752) STARTER RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (T752) Starter Relay Control circuit between the TIPM C2 harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

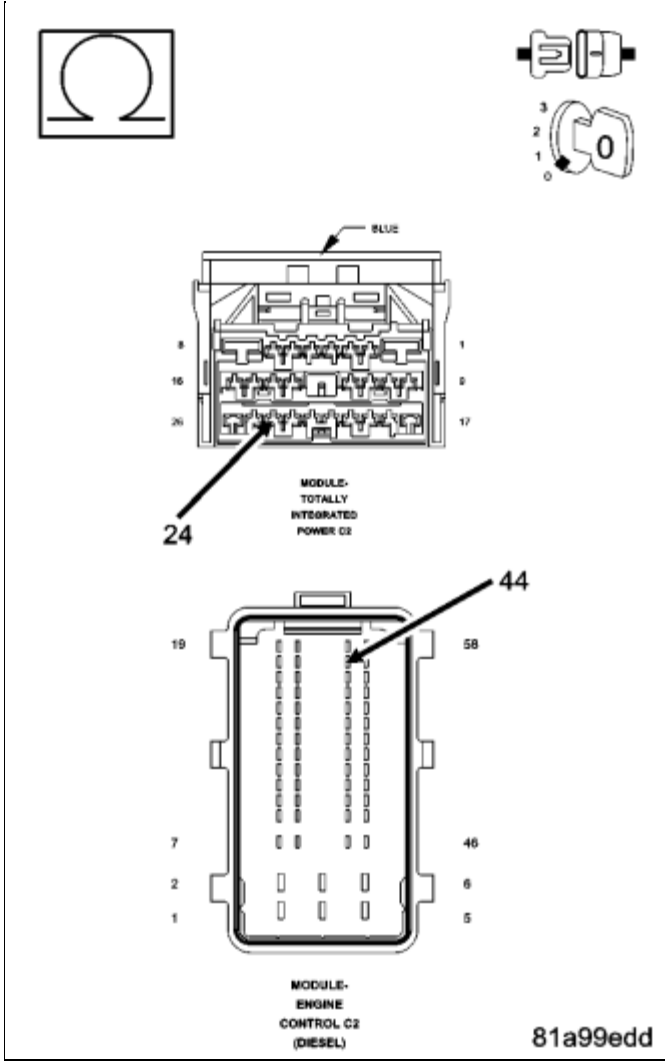
Yes

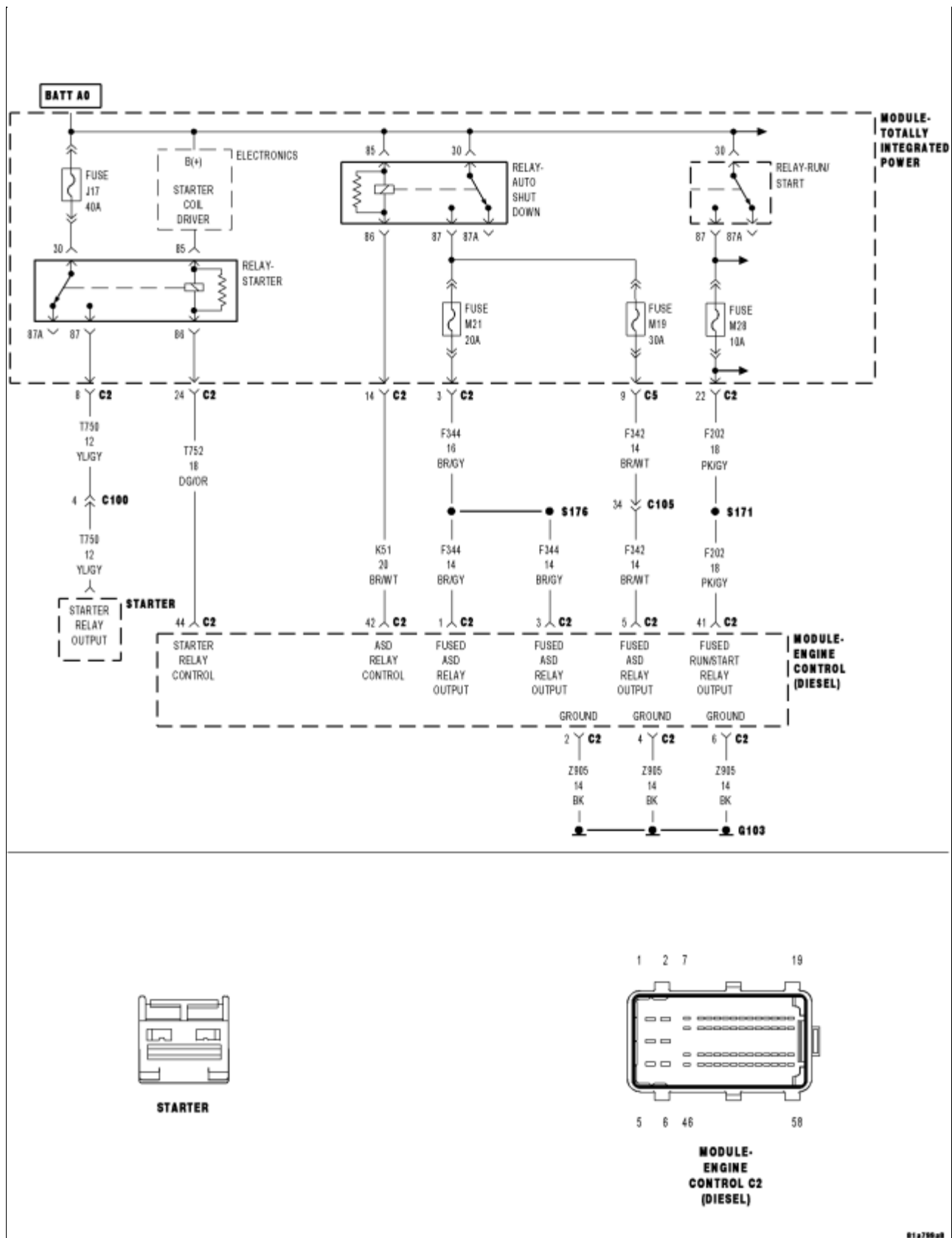
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (T752) Starter Relay Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**P0616-STARTER CONTROL
CIRCUIT LOW**





For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Starter Relay Control circuit. When the ignition switch is turned to the Start/Crank position, the ECM grounds this signal to indicate a request for Starter Motor operation.

- **When Monitored:**

With the ignition on and the Starter command off.

- **Set Condition:**

The ECM detects a short to ground on the (T752) Engine Starter Relay Control circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(T752) STARTER RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine several times.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the TIPM C2 harness connector.
 Disconnect the Engine Control Module (ECM) harness connectors.
 Measure the resistance between ground and the (T752) Starter Relay Control circuit in the TIPM harness connector.

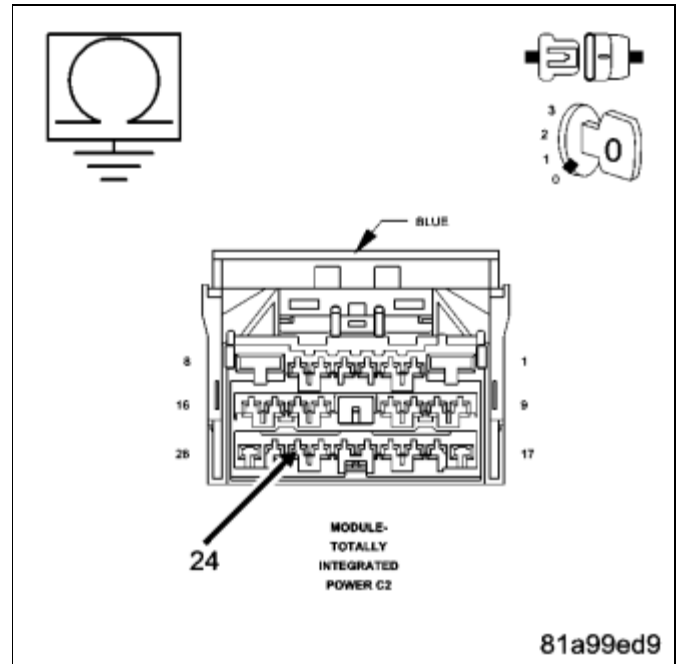
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (T752) Starter Relay Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (T752) STARTER RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (T752) Starter Relay Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

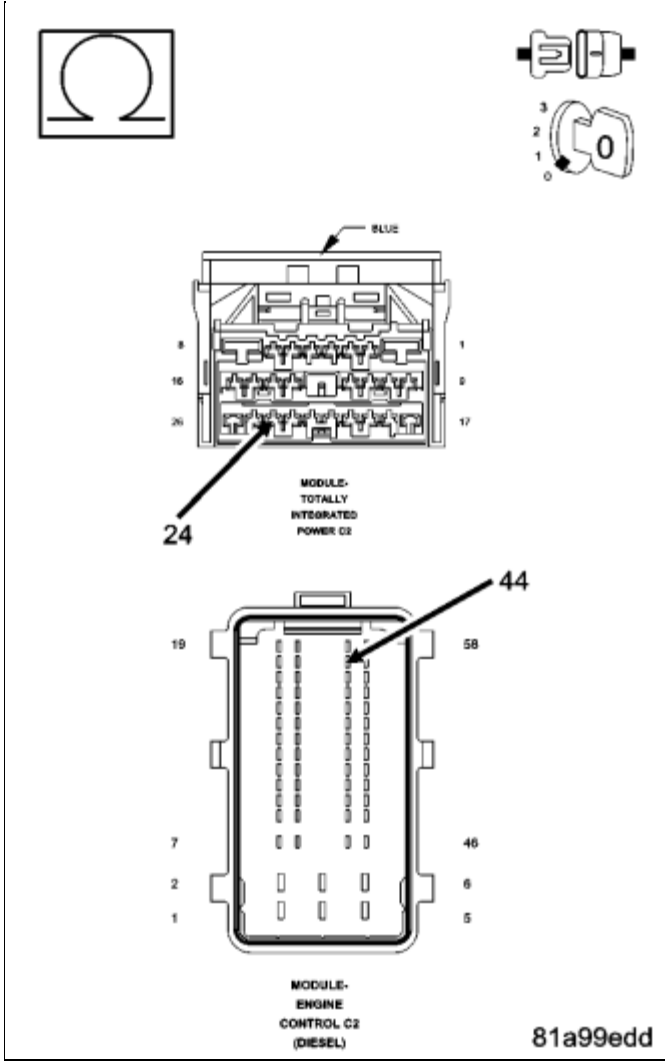
Yes

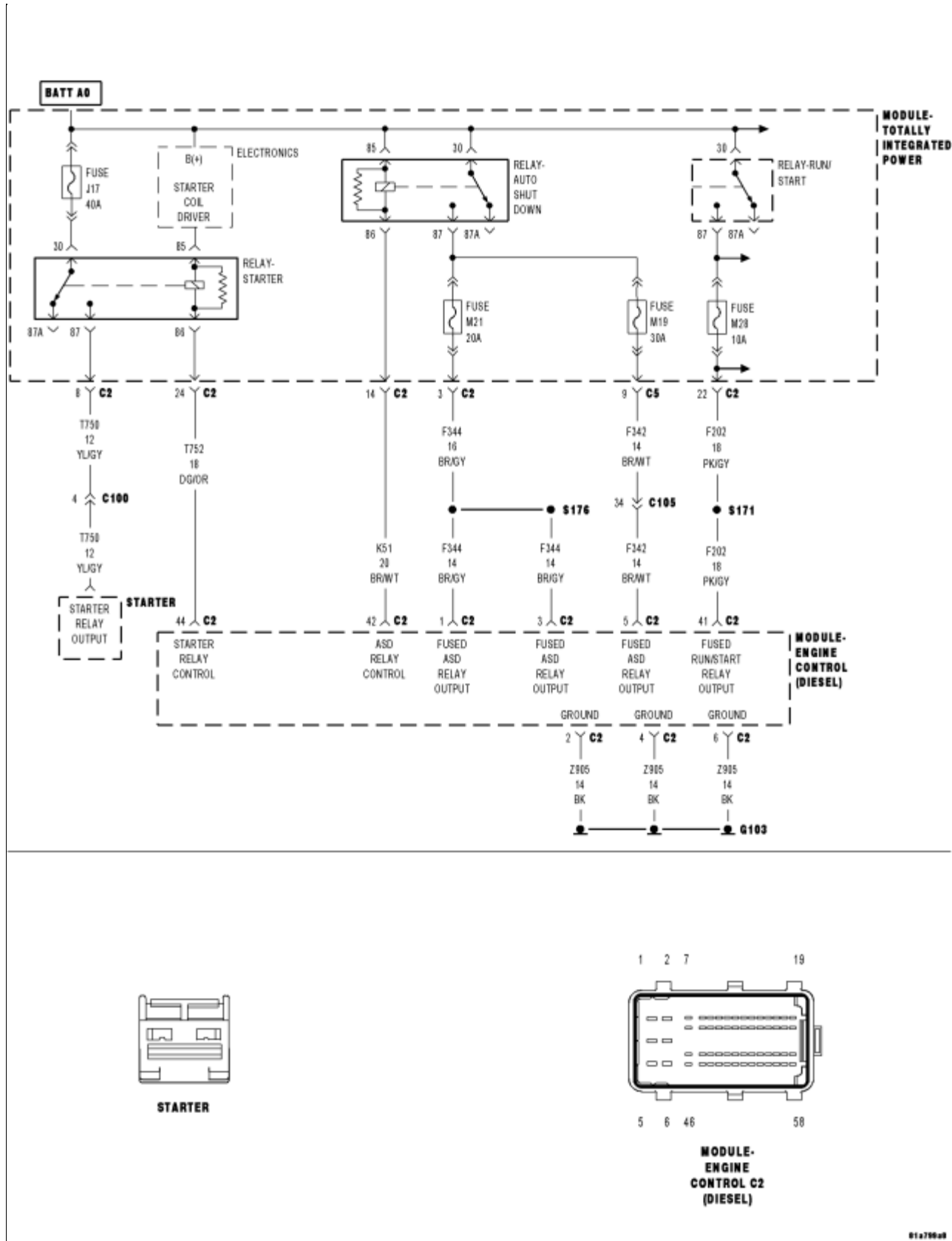
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (T752) Starter Relay Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**P0617-STARTER CONTROL
CIRCUIT HIGH**





For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Starter Relay Control circuit. When the ignition switch is turned to the Start/Crank position, the ECM grounds this signal to indicate a request for Starter Motor operation.

- **When Monitored:**

With the ignition on and the Starter command on.

- **Set Condition:**

The ECM detects a short circuit on the (T752) Engine Starter Relay Control circuit for at 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
(T752) STARTER RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine several times.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the TIPM C2 harness connector.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (T752) Starter Relay Control circuit in the TIPM harness connector.

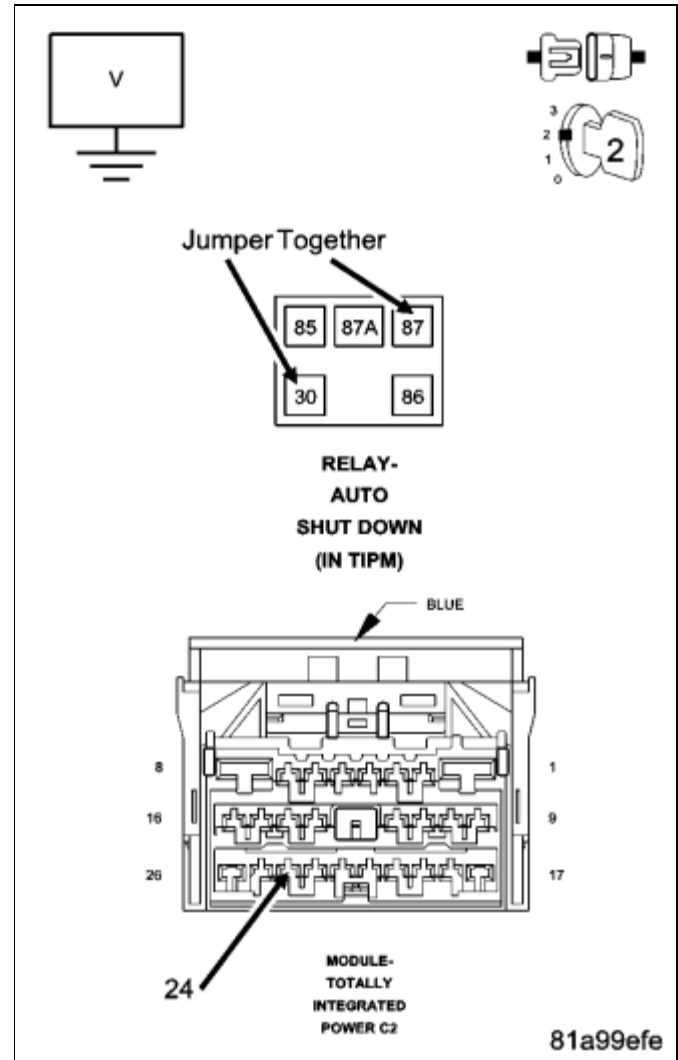
Is there any voltage present?

Yes

- Repair the (T752) Starter Relay Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (T752) STARTER CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance of the (T752) Starter Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

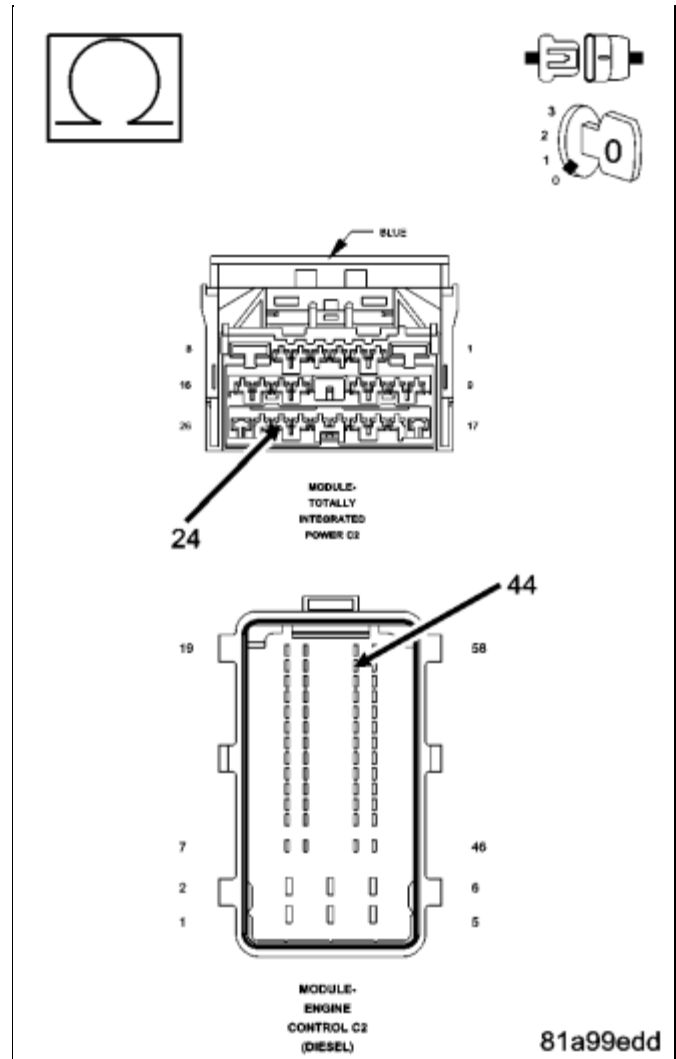
Yes

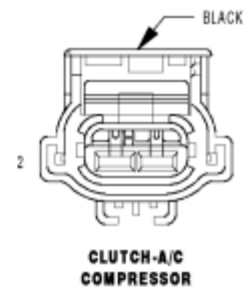
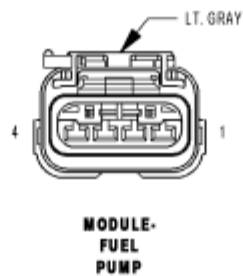
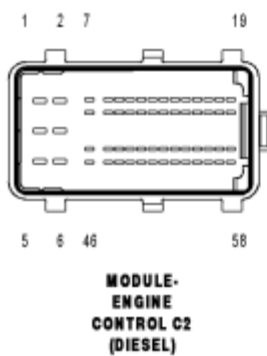
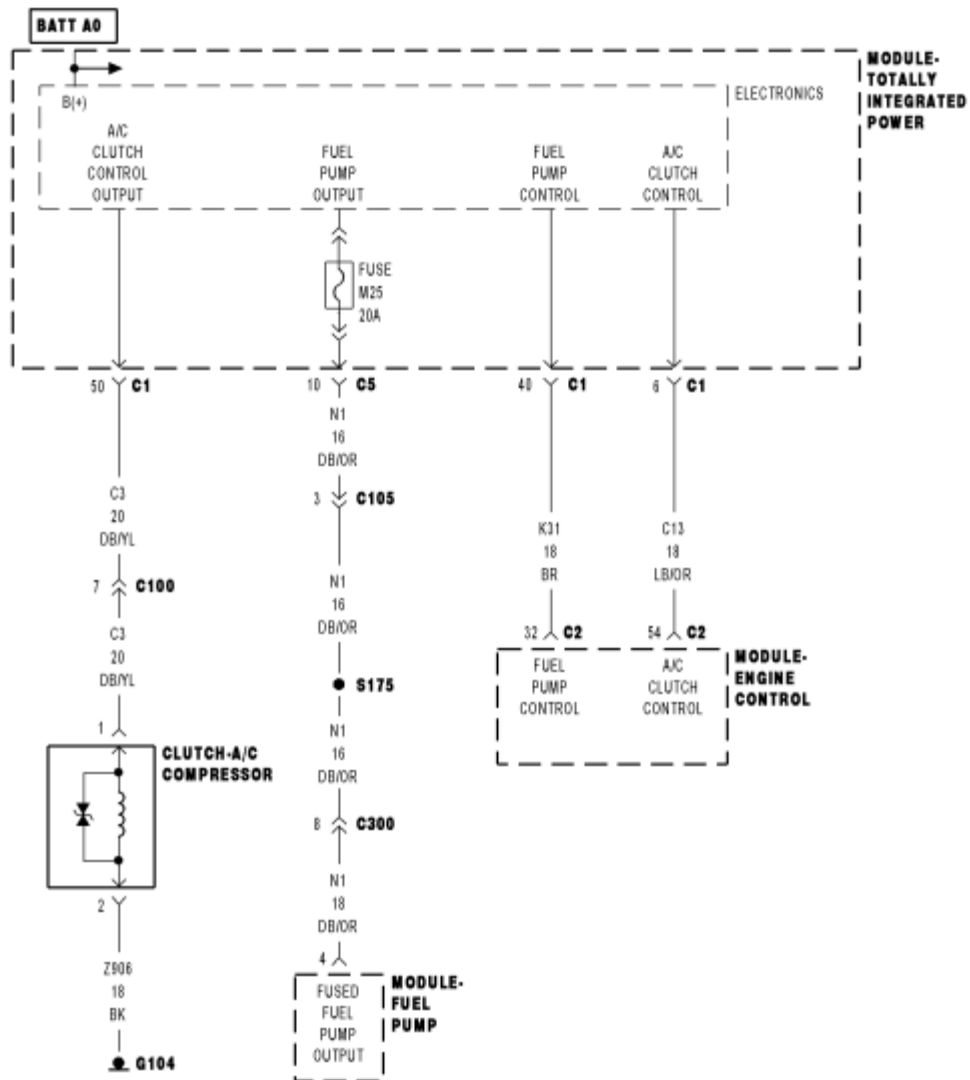
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (T752) Starter Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP CONTROL CIRCUIT OPEN





01a75673

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Fuel Pump Relay Control circuit. The ECM grounds this signal to indicate a request for Fuel Pump operation.

- **When Monitored:**

With the ignition on and the Fuel Pump command off.

- **Set Condition:**

The ECM does not detect voltage on the (K31) Fuel Pump Control circuit for 0.50 second.

Possible Causes
INTERMITTENT DTC
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND
(K31) FUEL PUMP CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pump.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Disconnect the Engine Control Module (ECM) harness connectors.

Measure the resistance between ground and the (K31) Fuel Pump Control circuit in the TIPM harness connector.

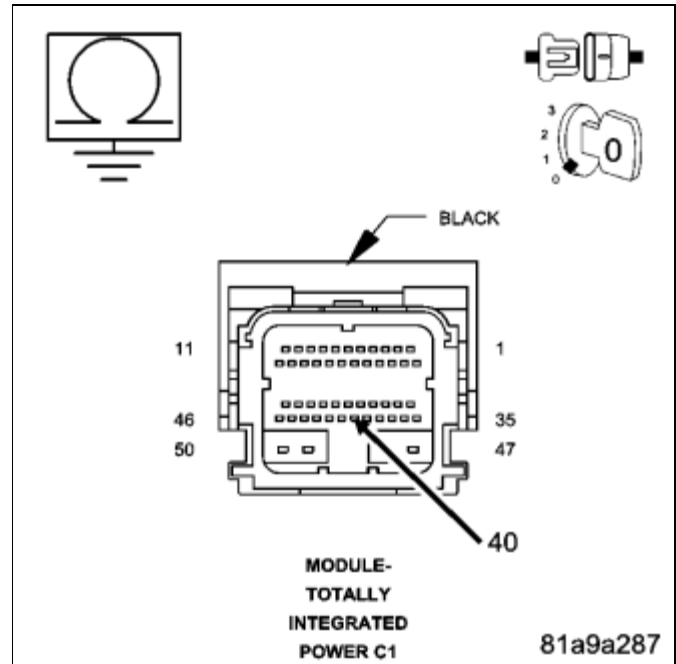
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K31) Fuel Pump Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K31) FUEL PUMP CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K31) Fuel Pump Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

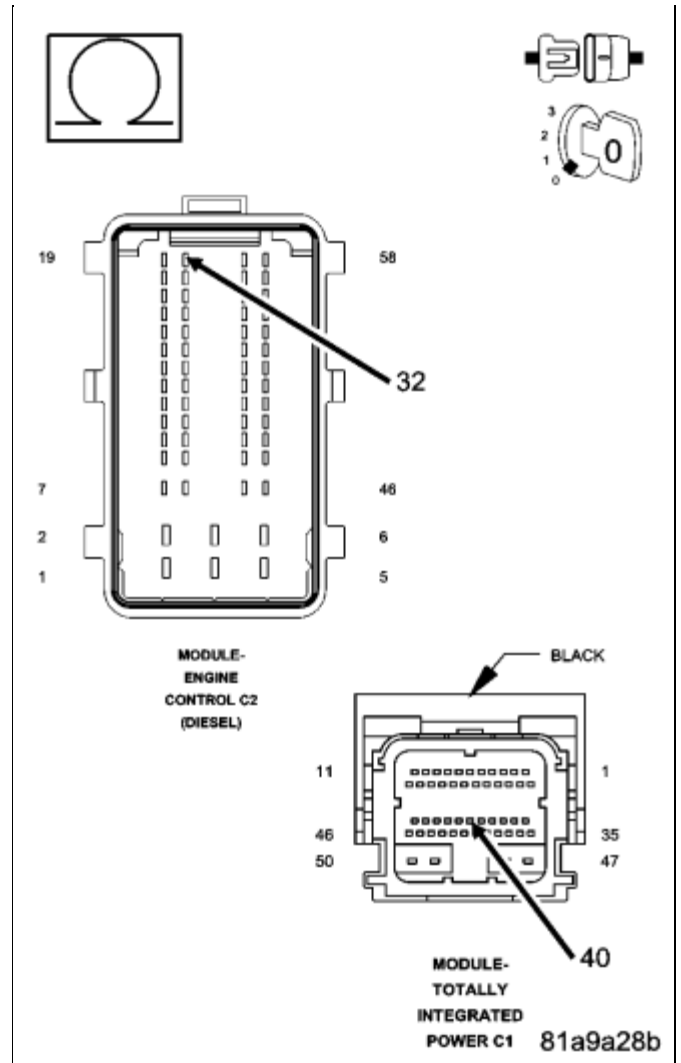
Yes

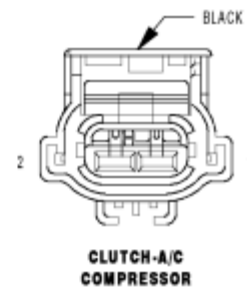
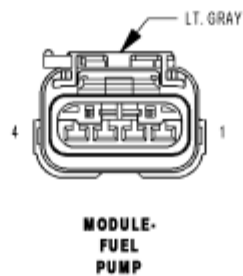
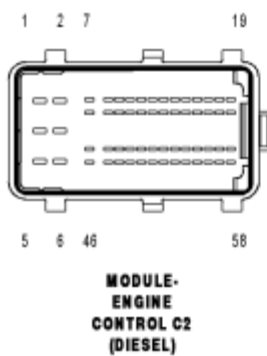
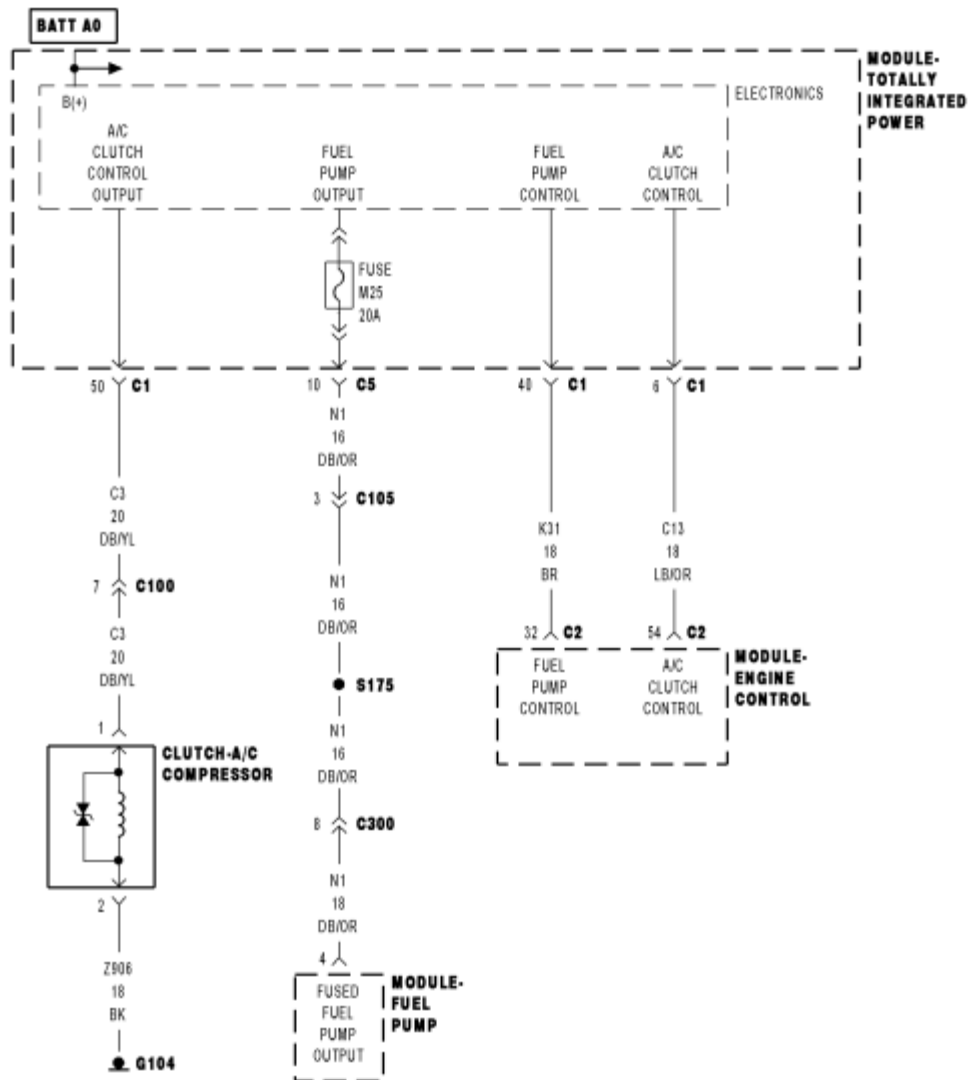
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K31) Fuel Pump Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0628-FUEL PUMP CONTROL CIRCUIT LOW





01a75673

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Fuel Pump Relay Control circuit. The ECM grounds this signal to indicate a request for Fuel Pump operation.

- **When Monitored:**

With the ignition on and the Fuel Pump command off.

- **Set Condition:**

The ECM detects a short to ground on the (K31) Fuel Pump Control circuit for 0.50 second.

Possible Causes
INTERMITTENT DTC
(K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND
(K31) FUEL PUMP CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pump.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Disconnect the Engine Control Module (ECM) harness connectors.

Measure the resistance between ground and the (K31) Fuel Pump Control circuit in the TIPM harness connector.

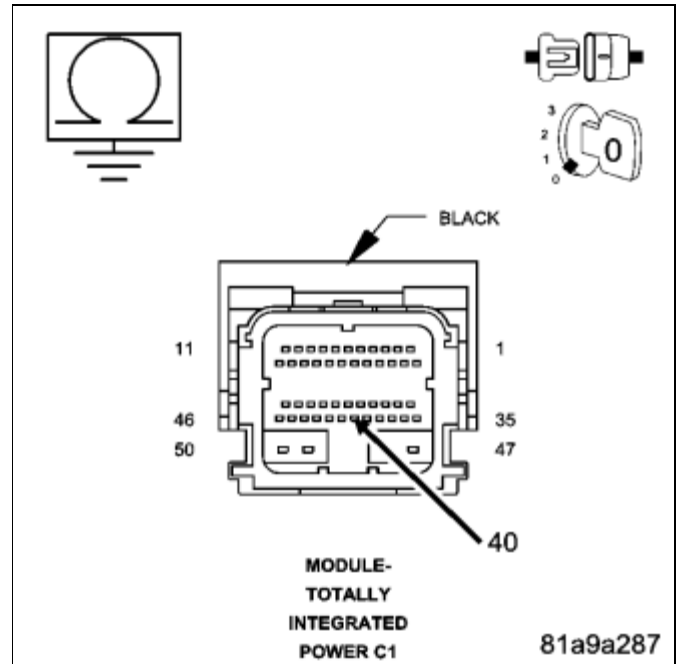
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K31) Fuel Pump Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K31) FUEL PUMP CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K31) Fuel Pump Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

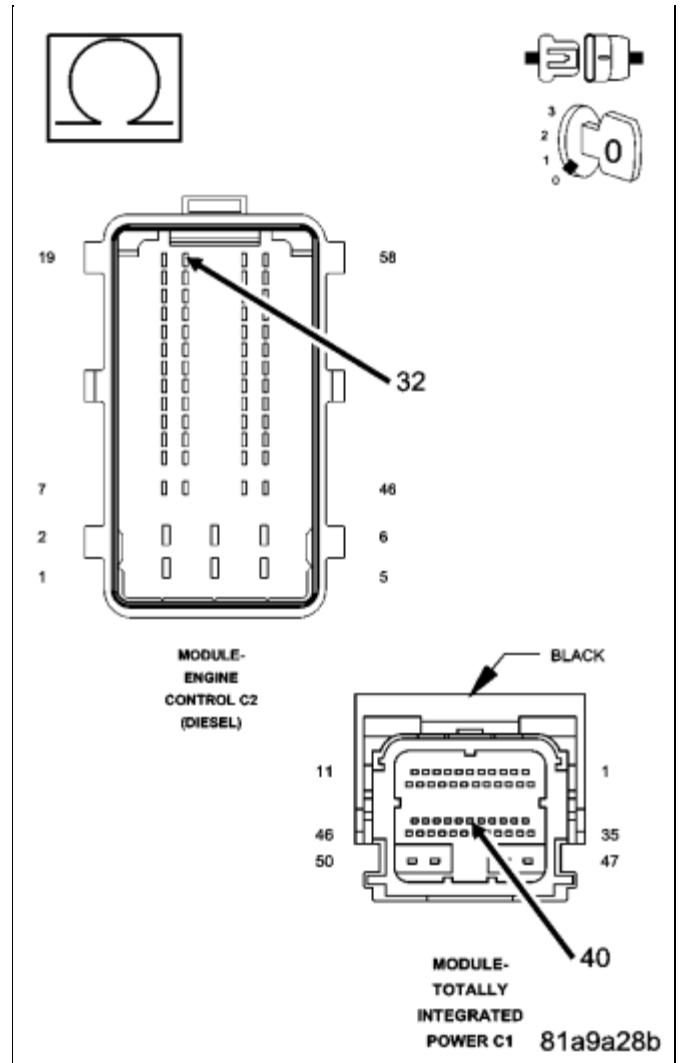
Yes

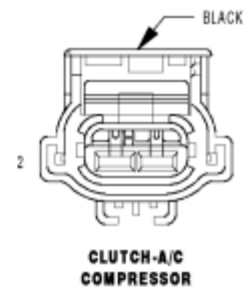
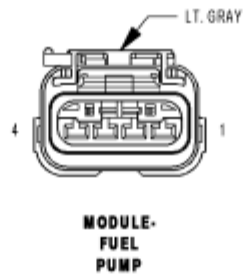
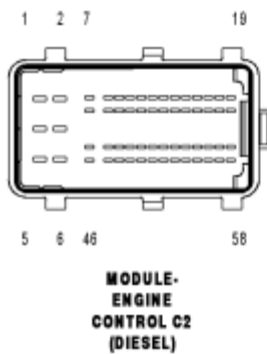
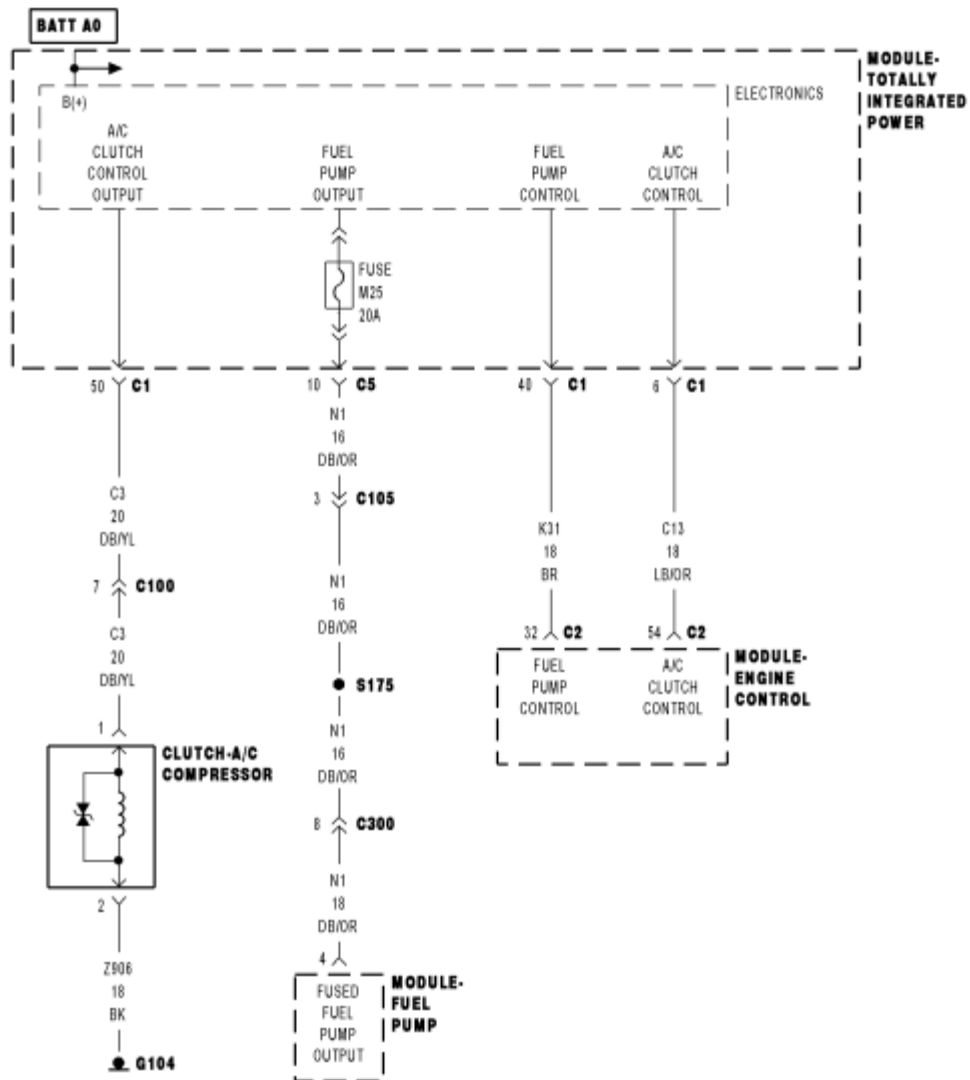
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K31) Fuel Pump Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0629-FUEL PUMP CONTROL CIRCUIT HIGH





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For a complete wiring diagram Refer to Section 8W

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the Fuel Pump Relay Control circuit. The ECM grounds this signal to indicate a request for Fuel Pump operation.

- **When Monitored:**

With the ignition on and the Fuel Pump Relay command on.

- **Set Condition:**

The ECM detects a short circuit on the (K31) Fuel Pump Relay Control circuit for 0.50 second.

Possible Causes
INTERMITTENT DTC
(K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
(K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the TIPM C1 harness connector.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K31) Fuel Pump Control circuit in the TIPM harness connector.

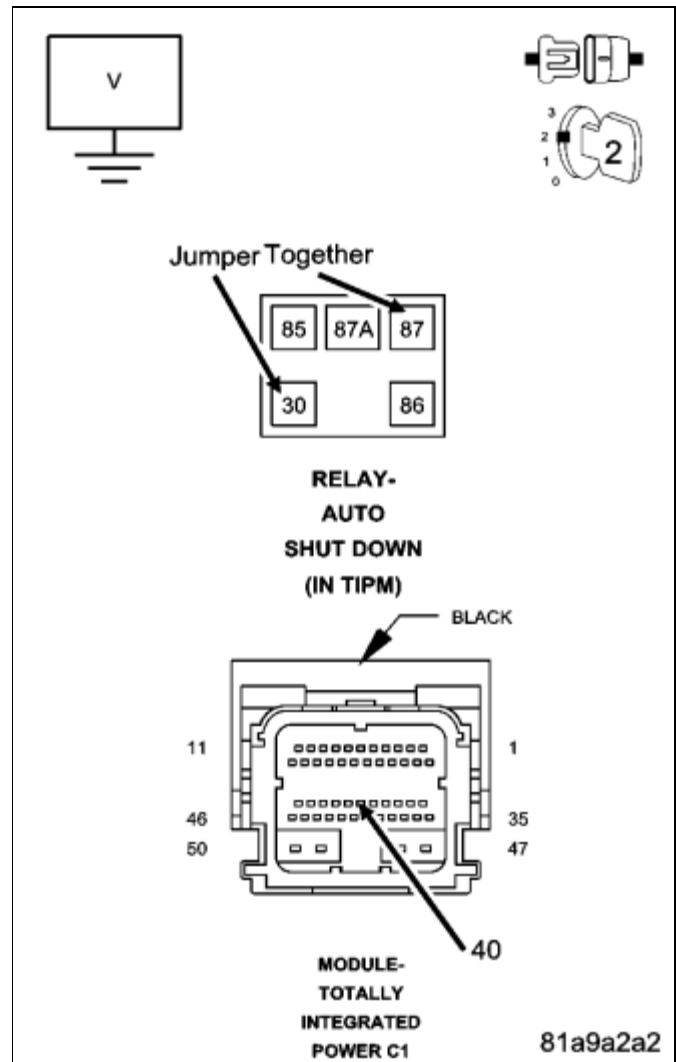
Is there any voltage present?

Yes

- Repair the (K31) Fuel Pump Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K31) FUEL PUMP CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance of the (K31) Fuel Pump Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

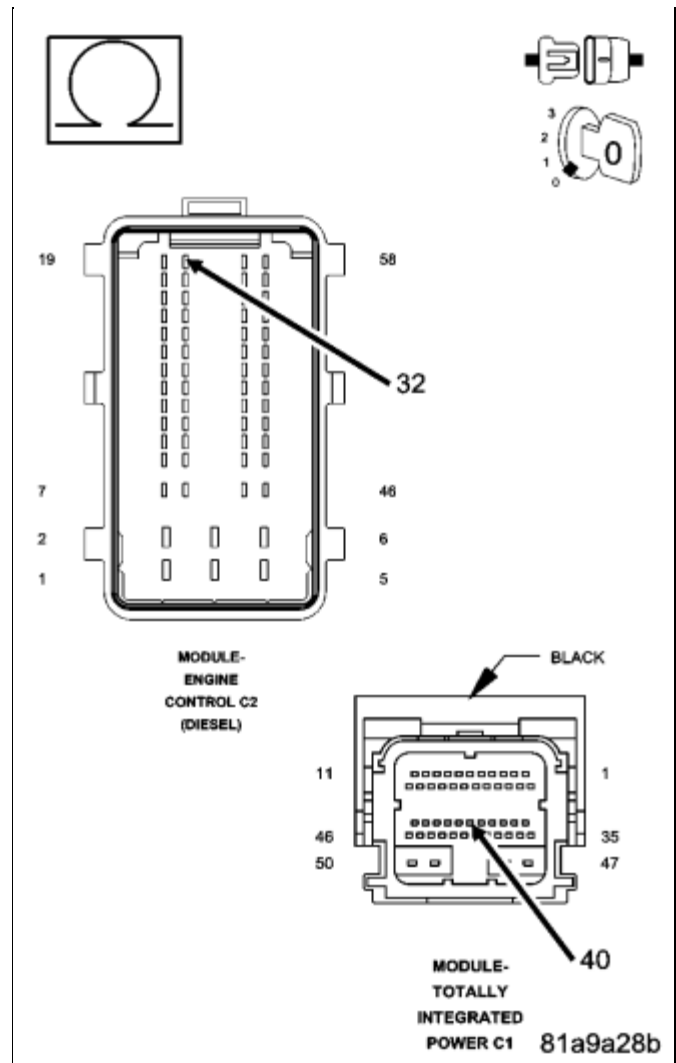
Yes

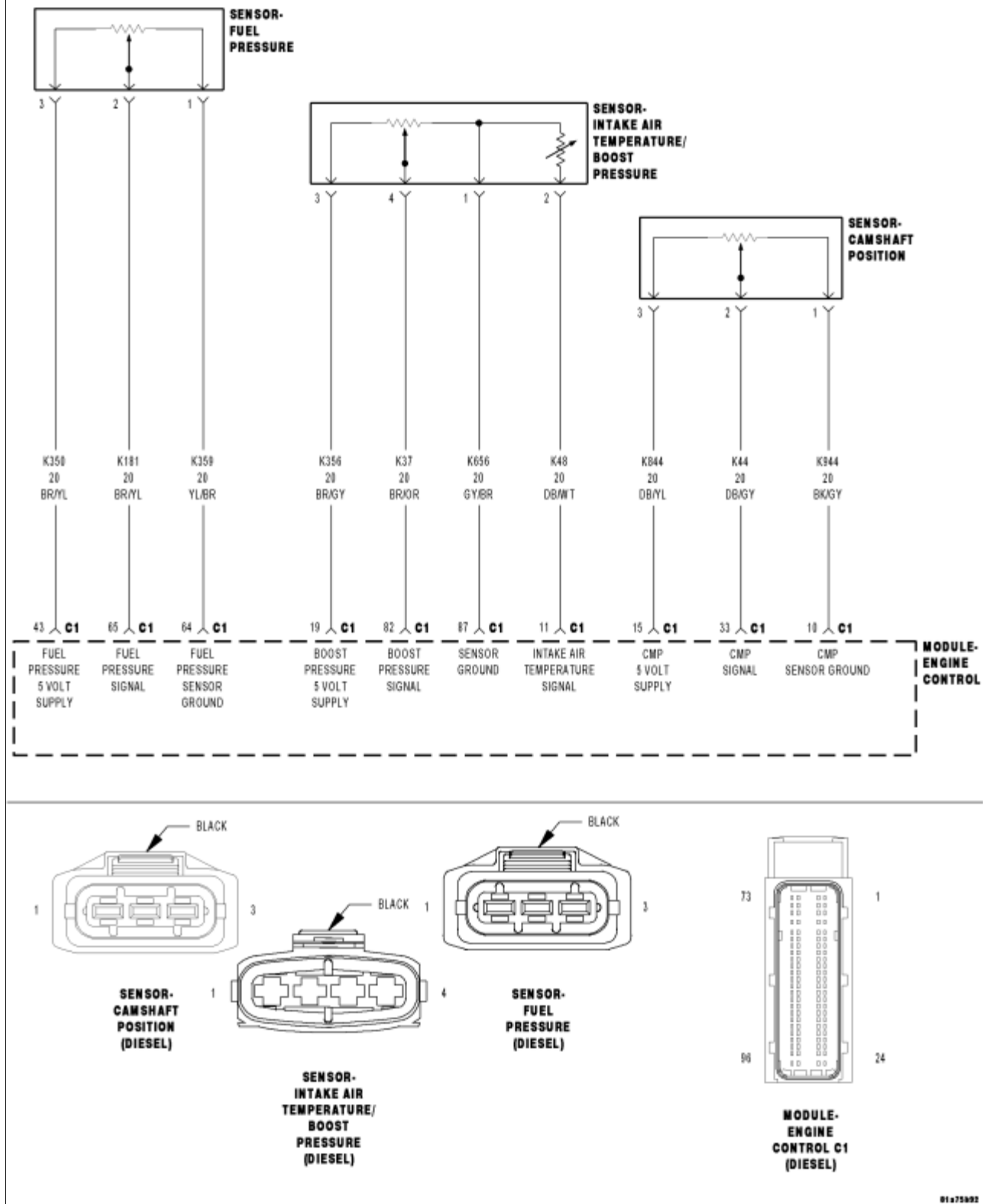
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K31) Fuel Pump Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW





For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects low voltage on the Sensor Supply 1 circuit for 0.10 seconds.

Possible Causes
INTERMITTENT DTC
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
BOOST PRESSURE SENSOR
FUEL PRESSURE SENSOR
CAMSHAFT POSITION SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 1 provides 5 volts to the Camshaft Position Sensor, Boost Pressure Sensor and the Fuel Pressure Sensor.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

With the scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CAMSHAFT POSITION SENSOR

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K844) Camshaft Position Sensor 5 Volt Supply circuit at the CMP Sensor harness connector.

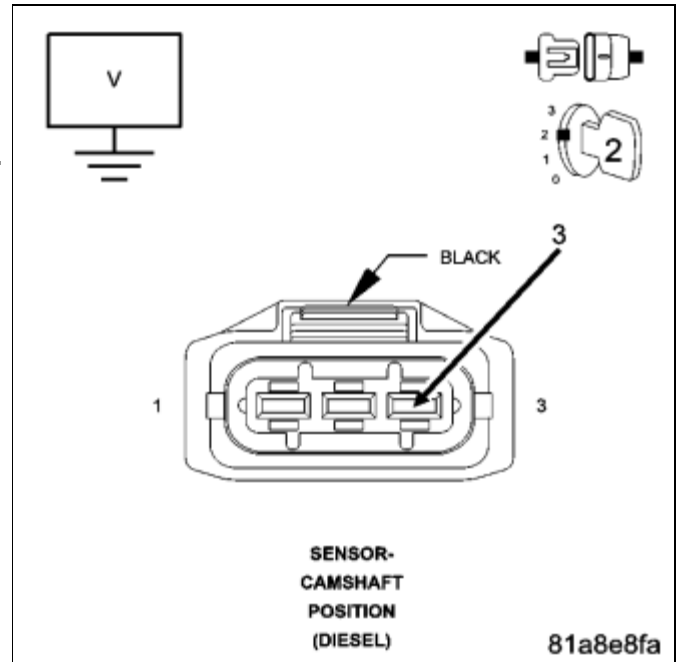
Is the voltage above 4.6 volts?

Yes

- Replace the Camshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)



3. BOOST PRESSURE SENSOR

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K356) Boost Pressure Sensor 5 Volt Supply circuit at the Boost Pressure Sensor harness connector.

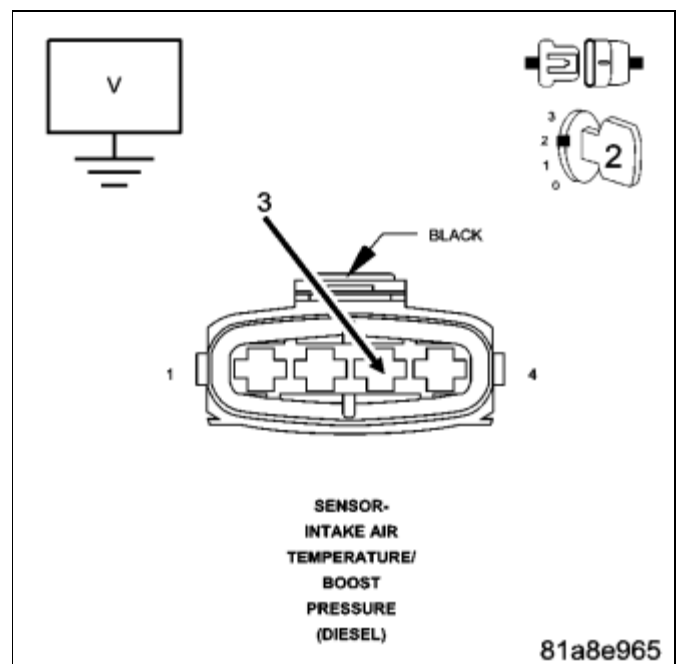
Is the voltage above 4.6 volts?

Yes

- Replace the Boost Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. FUEL PRESSURE SENSOR

Turn the ignition off.
 Disconnect the Fuel Pressure Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (K350) Fuel Pressure Sensor 5 Volt Supply circuit at the Fuel Pressure Sensor harness connector.

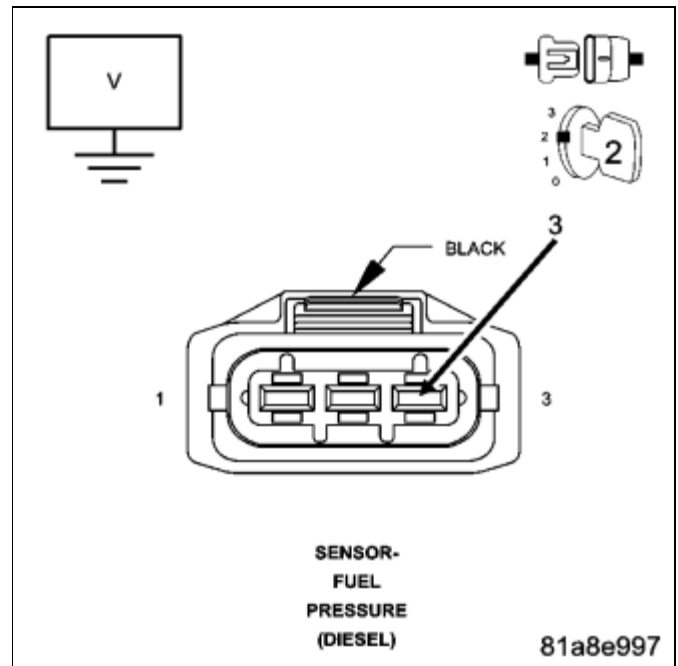
Is the voltage above 4.6 volts?

Yes

- Replace the Fuel Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance between ground and the (K356) Boost Pressure Sensor 5 Volt Supply circuit at the Boost Pressure Sensor harness connector.
 Measure the resistance between ground and the (K844) Camshaft Position Sensor 5 Volt Supply circuit at the CMP Sensor harness connector.
 Measure the resistance between ground and the (K350) Fuel Pressure Sensor 5 Volt Supply circuit at the Fuel Pressure Sensor harness connector.

Is the resistance above 1000 ohms for each circuit?

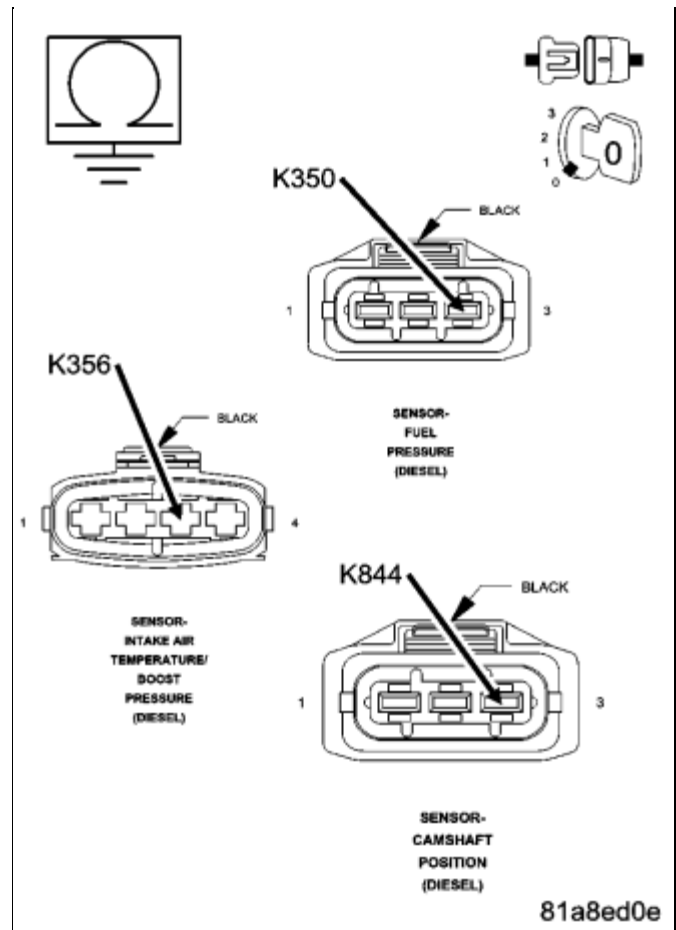
Yes

- Go To [6](#)

No

- Repair the 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



6. ENGINE CONTROL MODULE (ECM)

Inspect the (K844) Camshaft Position Sensor 5 Volt Supply circuit between the CMP harness connector and the ECM harness connector.

Inspect the (F855) Boost Pressure Sensor 5 Volt Supply circuit between the Boost Pressure Sensor harness connector and the ECM harness connector

Inspect the (F855) Fuel Pressure Sensor 5 Volt Supply circuit between the Fuel Pressure Sensor harness connector and the ECM harness connector

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

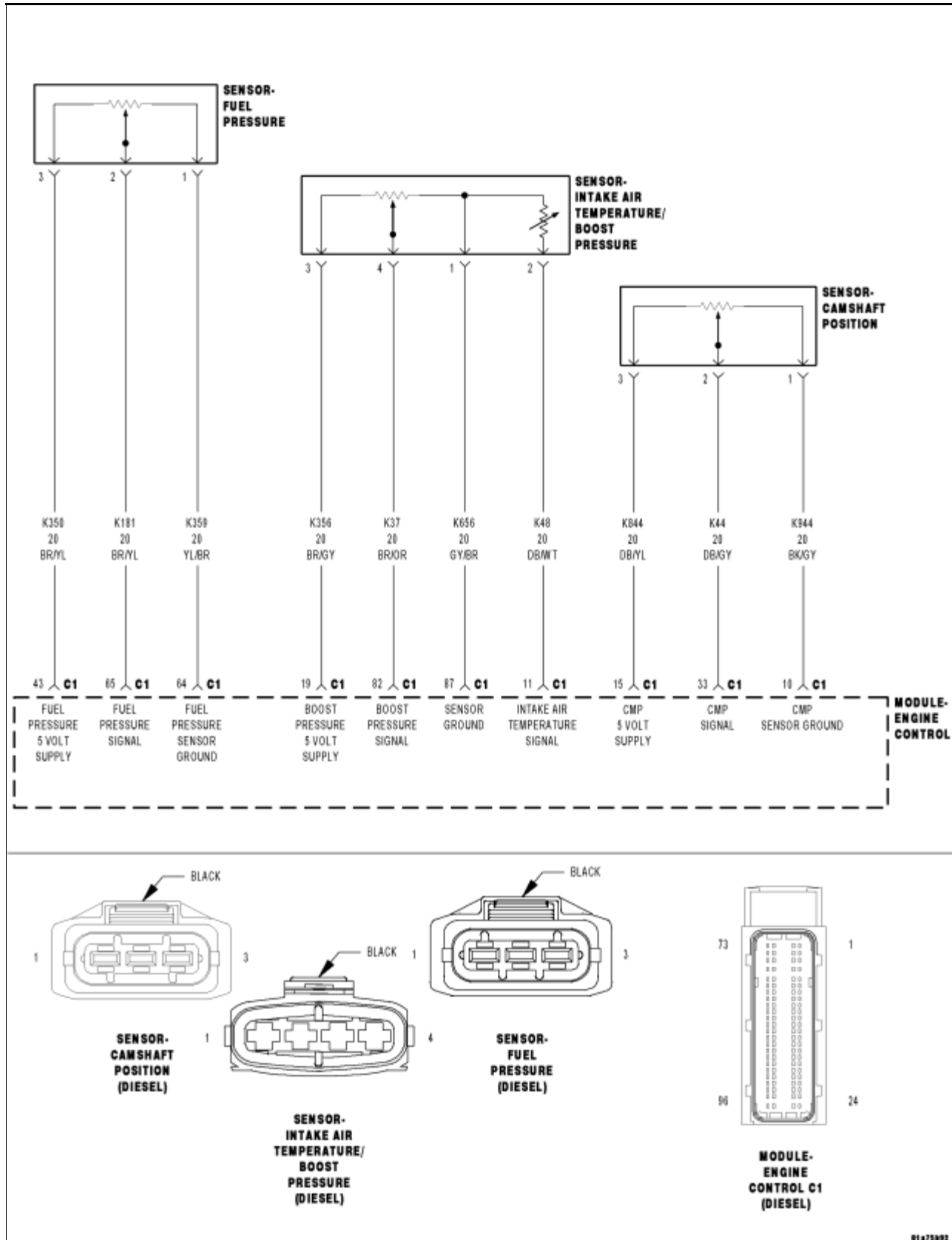
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0643-SENSOR REFERENCE VOLTAGE 1 CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to voltage on the Sensor Supply 1 circuit for 0.10 seconds.

Possible Causes
INTERMITTENT DTC
(K356) BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K350) FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 1 provides 5 volts to the Camshaft Position Sensor, Boost Pressure Sensor and the Fuel Pressure Sensor.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.
 With the scan tool, erase ECM DTCs.
 Turn the ignition off for 10 seconds.
 Turn the ignition on.
 With the scan tool, View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K356) BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

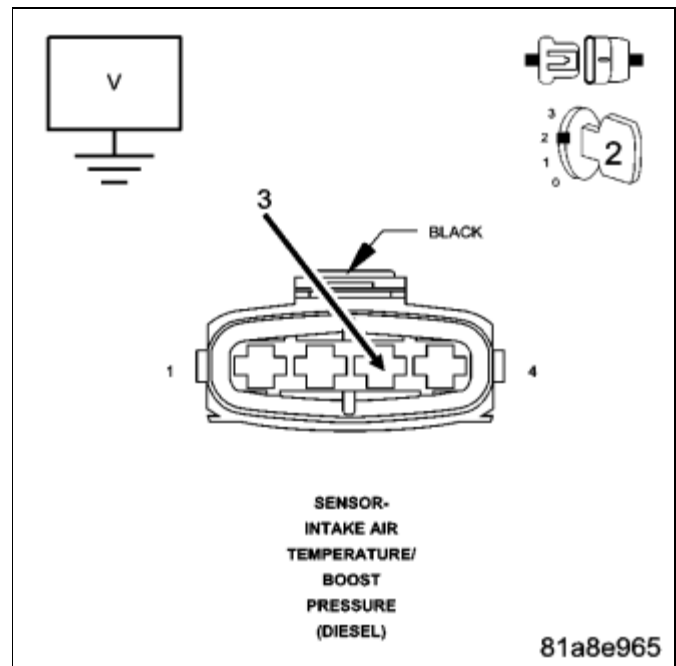
Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the (K356) Boost Pressure Sensor 5 Volt Supply circuit at the Boost Pressure Sensor harness connector.

**Is the voltage below 1.0 volt?****Yes**

- Go To [3](#)

No

- Repair the (K356) Boost Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (K844) CAMSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.

Measure the voltage on the (K844) Camshaft Position Sensor 5 Volt Supply circuit at the CMP Sensor harness connector.

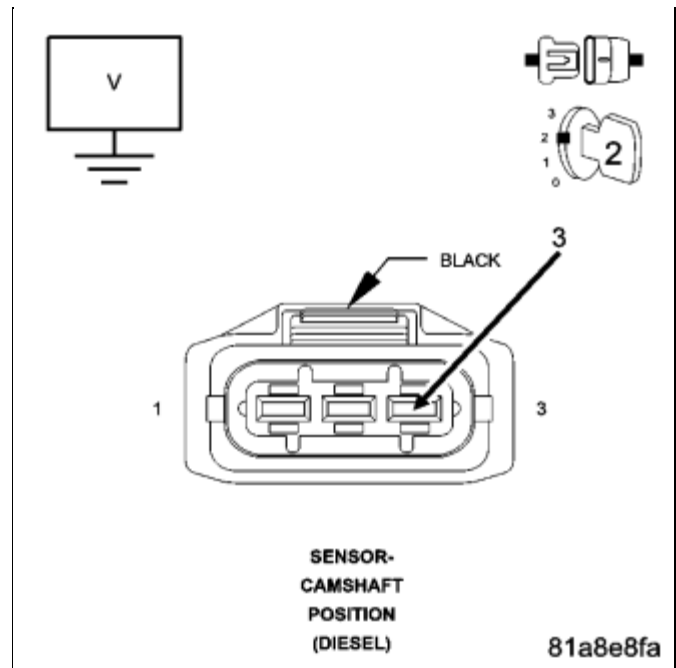
Is the voltage below 1.0 volt?

Yes

- Go To [4](#)

No

- Repair the (K844) Camshaft Position Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K350) FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.

Measure the voltage on the (K350) Fuel Pressure Sensor 5 Volt Supply circuit at the Fuel Pressure Sensor harness connector.

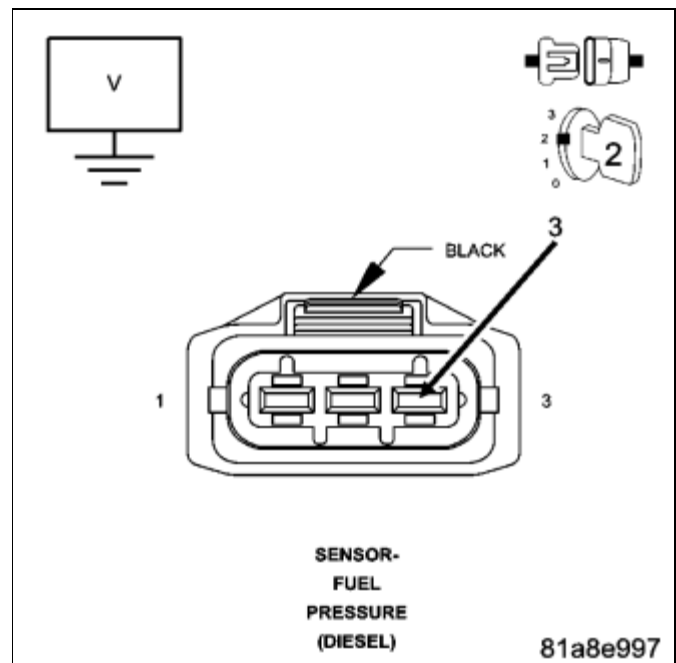
Is the voltage below 1.0 volt?

Yes

- Go To [5](#)

No

- Repair the (K350) Fuel Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ENGINE CONTROL MODULE (ECM)

Turn the ignition off.

Remove the jumper wire and install the ASD relay.

Inspect the (K356) Boost Pressure Sensor 5 Volt Supply circuit between the Boost Pressure Sensor harness connector and the ECM harness connector.

Inspect the (K844) Camshaft Position Sensor 5 Volt Supply circuit between the CMP harness connector and the ECM harness connector.

Inspect the (K350) Fuel Pressure Sensor 5 Volt Supply circuit between the Fuel Pressure Sensor harness connector and the ECM harness connector

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH CONTROL CONTROL CIRCUIT OPEN

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the A/C Compressor Clutch Control circuit. The ECM grounds this signal to indicate a request for A/C Compressor Clutch operation.

- **When Monitored:**

With the ignition on and the A/C Clutch command off.

- **Set Condition:**

The ECM does not detect voltage on the (C13) A/C Clutch Control circuit for 0.50 second.

Possible Causes
INTERMITTENT DTC
(C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND
(C13) A/C CLUTCH CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the A/C Clutch.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Disconnect the Engine Control Module (ECM) harness connectors.

Measure the resistance between ground and the (C13) A/C Clutch Control circuit in the TIPM harness connector.

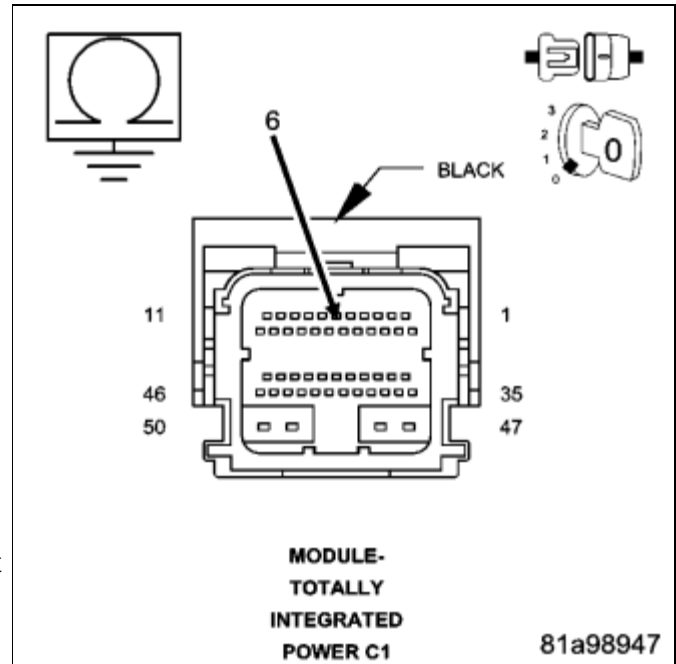
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (C13) A/C Clutch Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (C13) A/C CLUTCH CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (C13) A/C Clutch Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

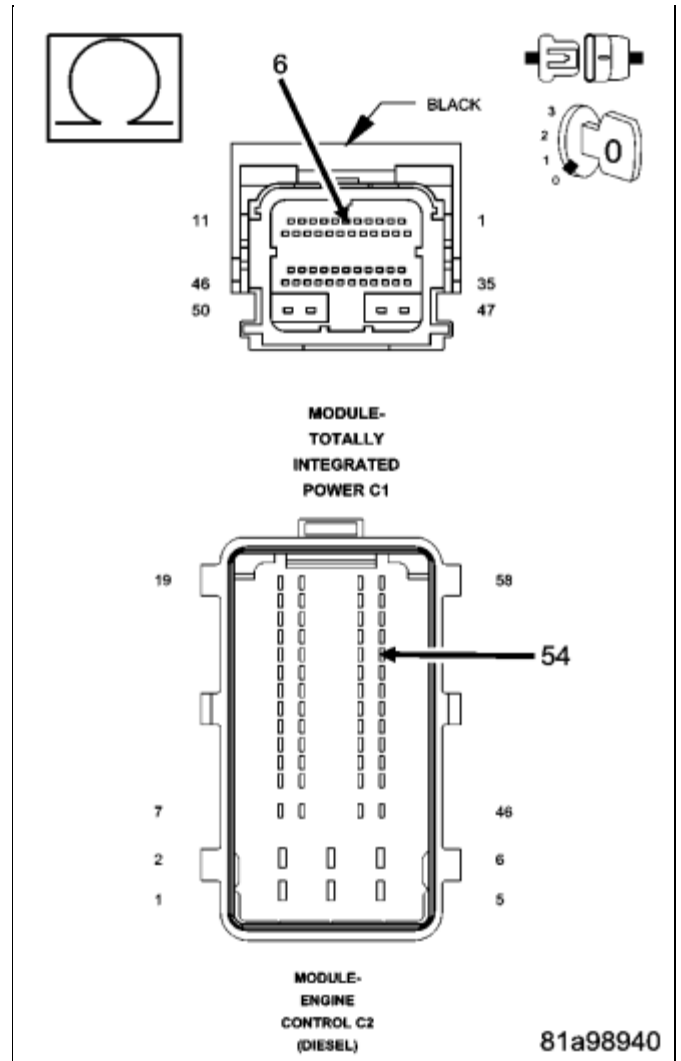
Yes

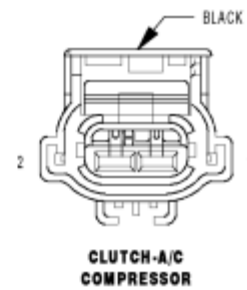
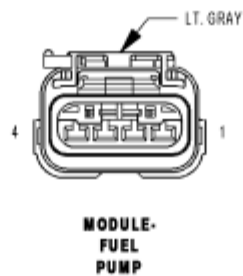
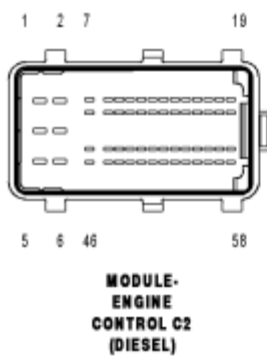
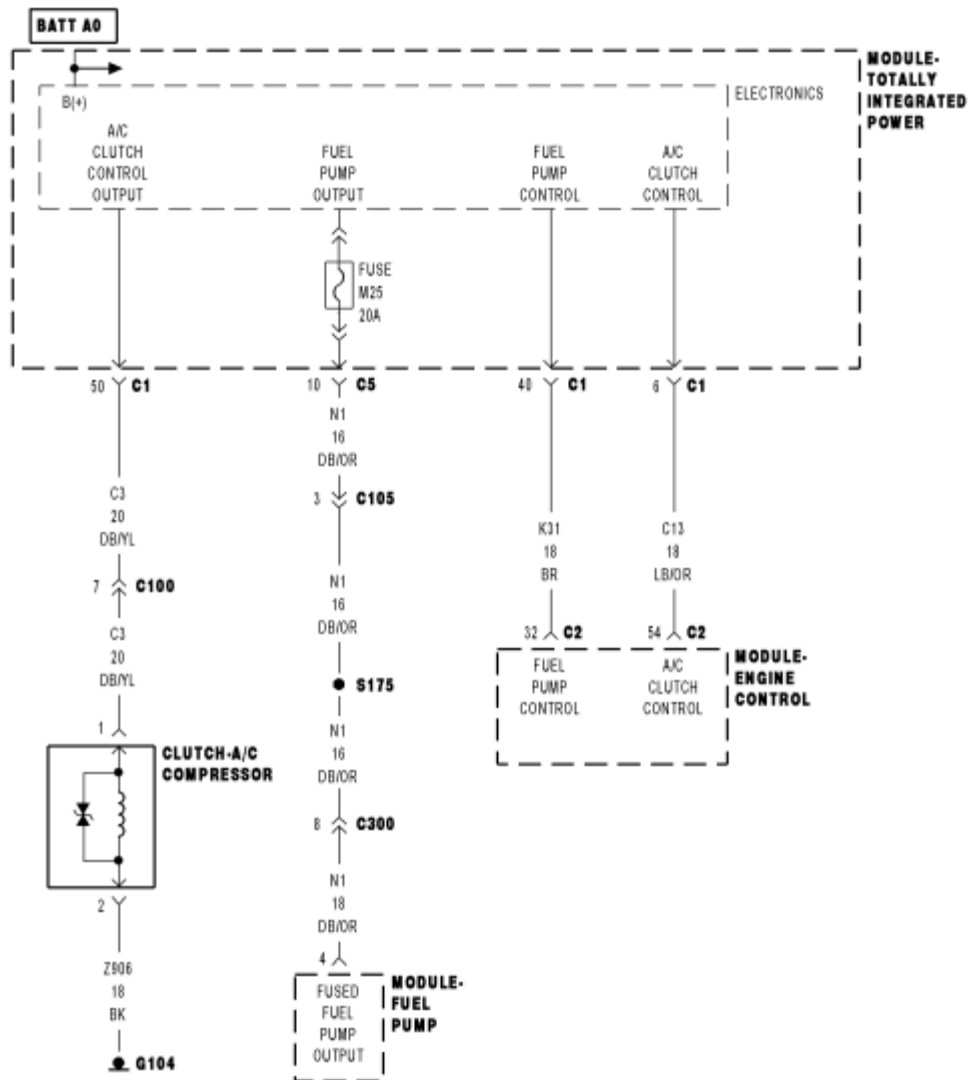
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (C13) A/C Clutch Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0646-A/C CLUTCH CONTROL CIRCUIT LOW





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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the A/C Compressor Clutch Control circuit. The ECM grounds this signal to indicate a request for A/C Compressor Clutch operation.

- **When Monitored:**

With the ignition on and the A/C Clutch command off.

- **Set Condition:**

The ECM detects a short to ground on the (C13) A/C Clutch Control circuit for 0.50 seconds.

Possible Causes
INTERMITTENT DTC
(C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND
(C13) A/C CLUTCH CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the A/C Clutch.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the TIPM C1 harness connector.

Disconnect the Engine Control Module (ECM) harness connectors.

Measure the resistance between ground and the (C13) A/C Clutch Control circuit in the TIPM harness connector.

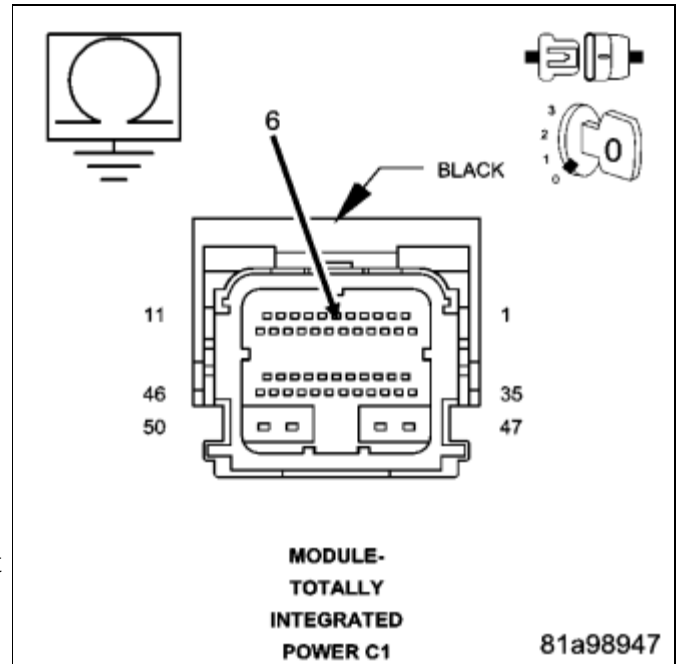
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (C13) A/C Clutch Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (C13) A/C CLUTCH CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (C13) A/C Clutch Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

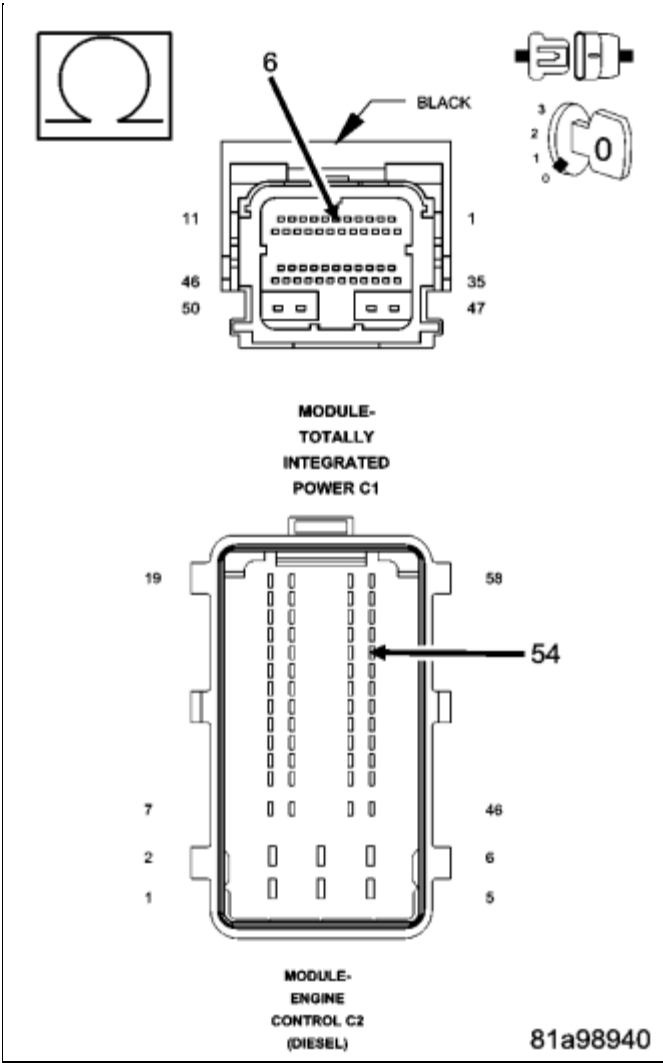
Yes

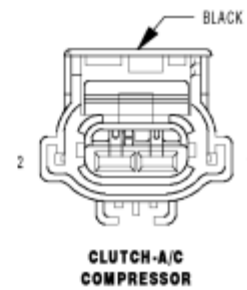
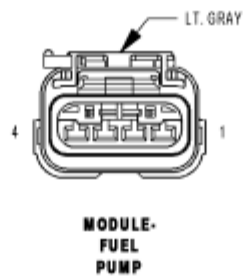
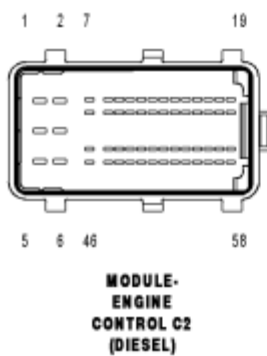
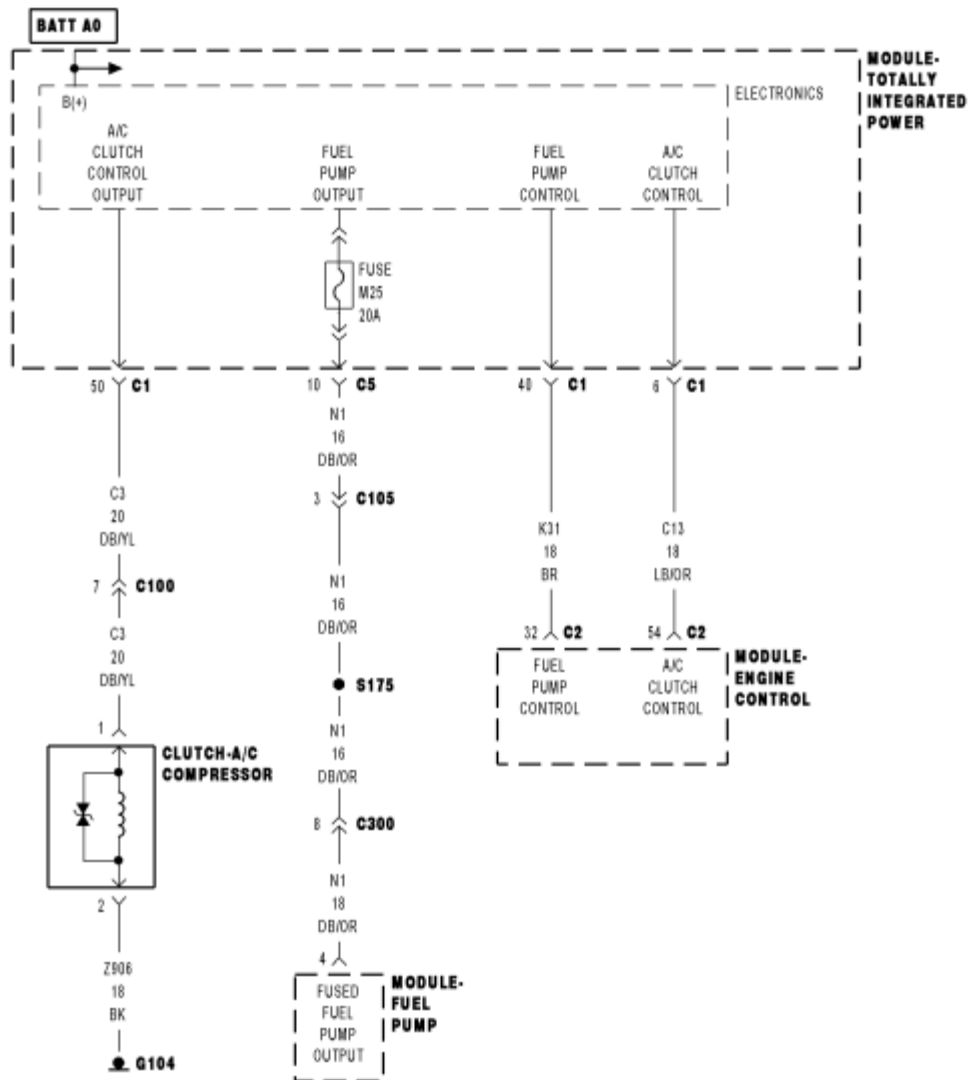
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (C13) A/C Clutch Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**P0647-A/C CLUTCH CONTROL
CIRCUIT HIGH**





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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is on, the Totally Integrated Power Module (TIPM) sends a 12 volt signal to the ECM on the A/C Compressor Clutch Control circuit. The ECM grounds this signal to indicate a request for A/C Compressor Clutch operation.

- **When Monitored:**

With the ignition on and the A/C Clutch Relay command on.

- **Set Condition:**

The ECM detects a short circuit on the (C13) A/C Clutch Relay Control circuit for 0.50 second.

Possible Causes
INTERMITTENT DTC
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Start and idle the engine.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to turn the A/C system on.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (C13) A/C CLUTCH CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the TIPM C1 harness connector.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (C13) A/C Clutch Control circuit in the TIPM harness connector.

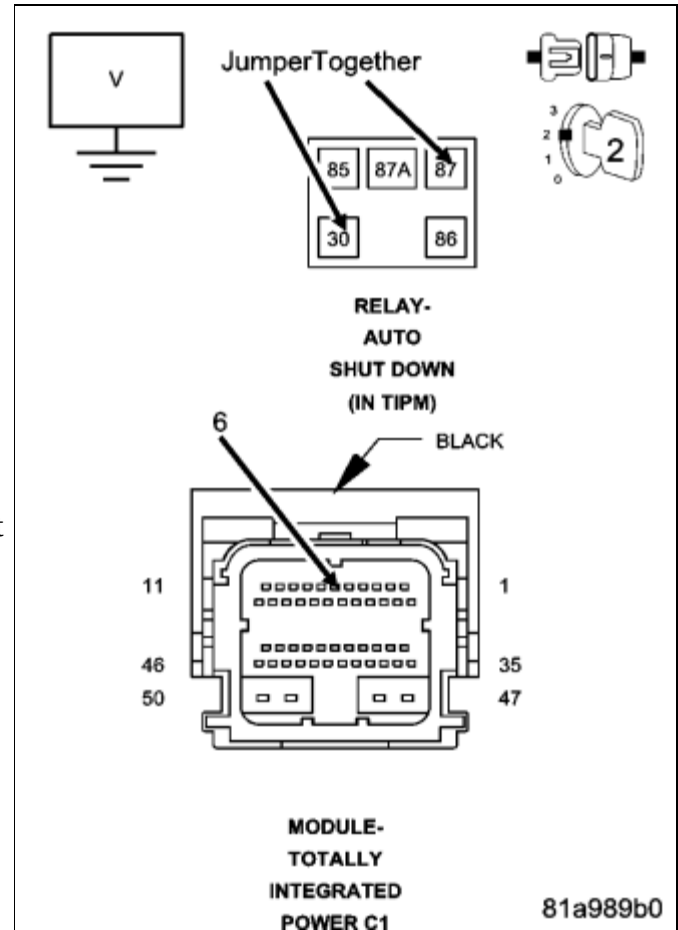
Is there any voltage present?

Yes

- Repair the (C13) A/C Clutch Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (C13) A/C CLUTCH CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance of the (C13) A/C Clutch Control circuit between the TIPM harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms?

Yes

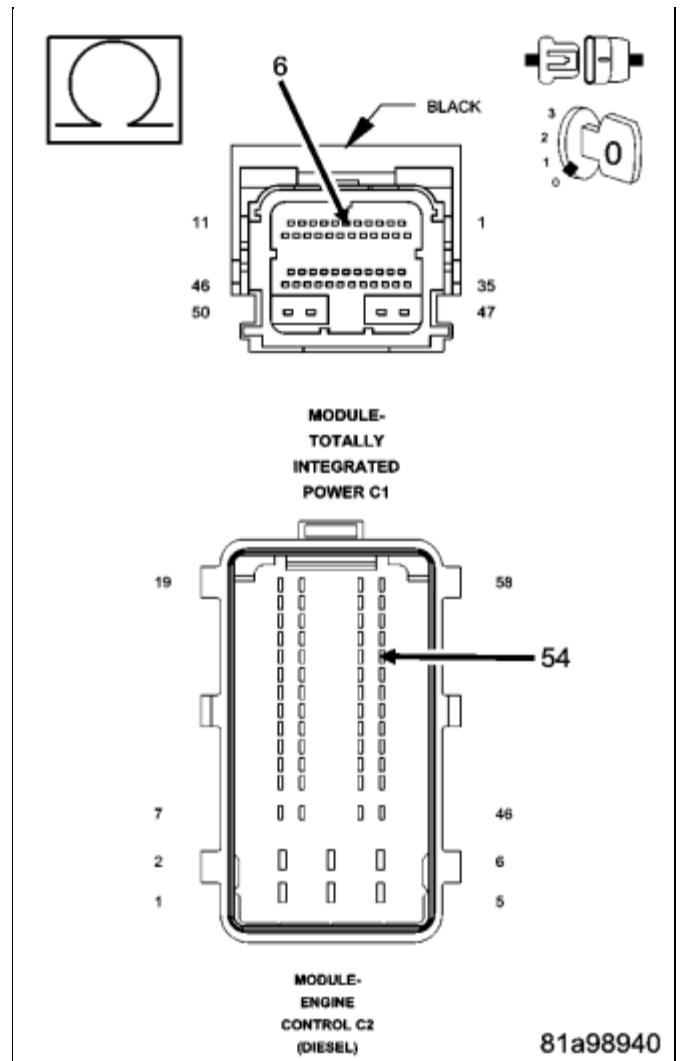
- Replace and program the TIPM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)

No

- Repair the (C13) A/C Clutch Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0652-SENSOR REFERENCE VOLTAGE 2 TOO LOW



With the ignition on.

- **Set Condition:**

The ECM detects low voltage on the Sensor Supply 2 circuit for 0.10 seconds

Possible Causes
INTERMITTENT DTC
ACCELERATOR PEDAL POSITION SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
INLET AIR PRESSURE SENSOR
OIL PRESSURE SENSOR
MASS AIR FLOW SENSOR
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources and one 8–Volt source. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 2 provides 5 volts to the Inlet Pressure Sensor, Exhaust Differential Pressure Sensor, Engine Oil Pressure Sensor, and the Accelerator Pedal Position Sensor 2 and 8 volts to the Mass Air Flow Sensor.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit at the APP Sensor harness connector.

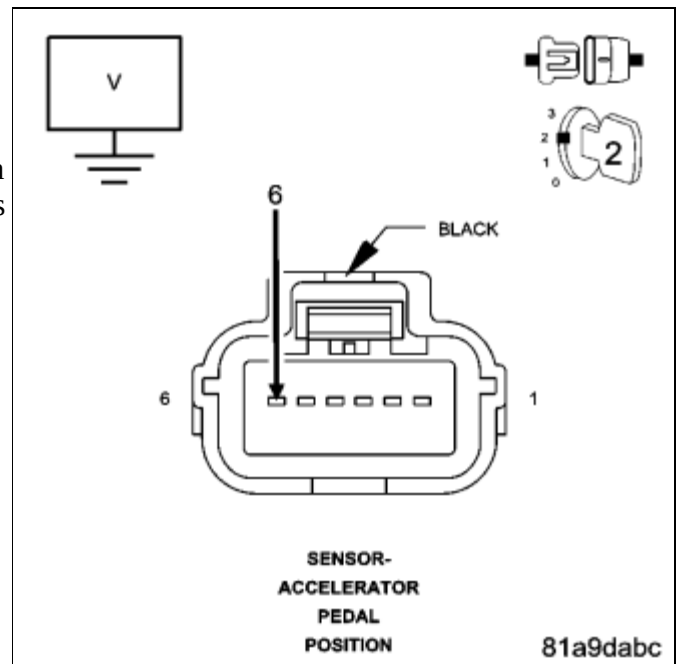
Is the voltage above 4.6 volts?

Yes

- Replace the Accelerator Pedal Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)



3. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit.

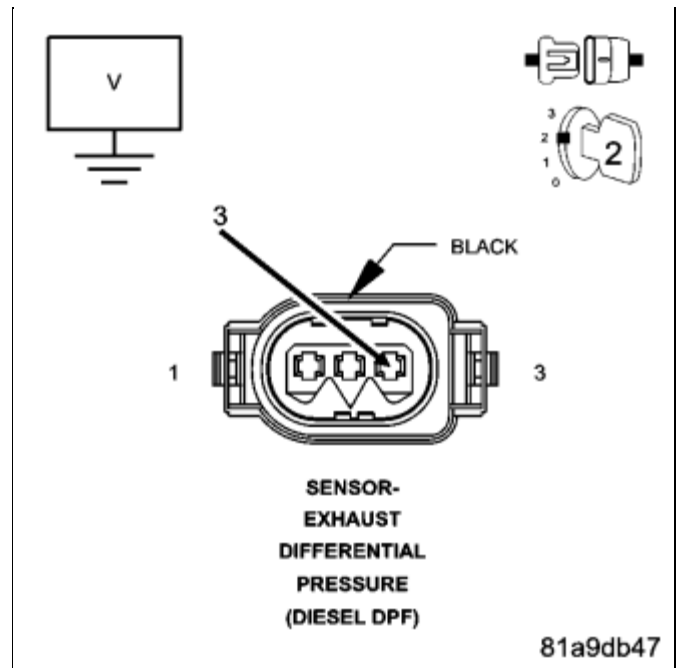
Is the voltage above 4.6 volts?

Yes

- Replace the Exhaust Differential Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. INLET AIR PRESSURE SENSOR

Turn the ignition off.
 Disconnect the Inlet Air Pressure Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit.

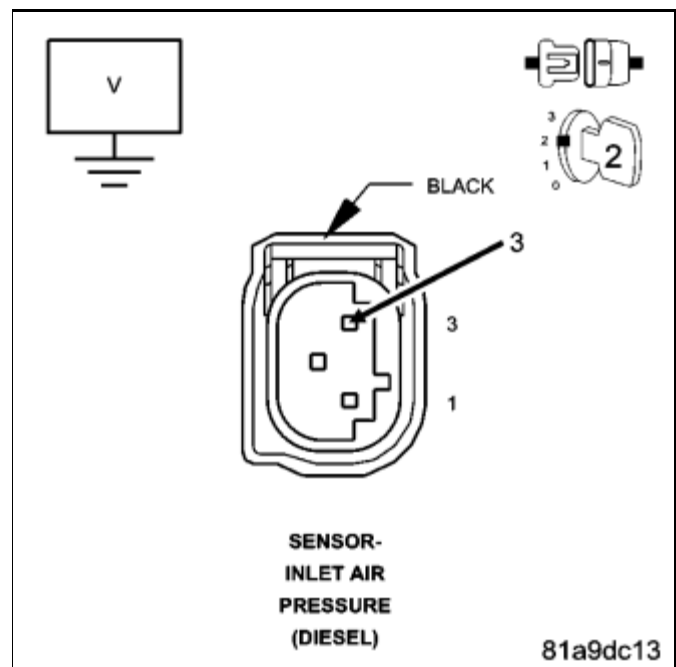
Is the voltage above 4.6 volts?

Yes

- Replace the Inlet Air Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. ENGINE OIL PRESSURE SENSOR

Turn the ignition off.
 Disconnect the Engine Oil Pressure Sensor harness connector.

Turn the ignition on.
 Measure the voltage of the (K357) Engine Oil Pressure
 Sensor 5 Volt Supply circuit.

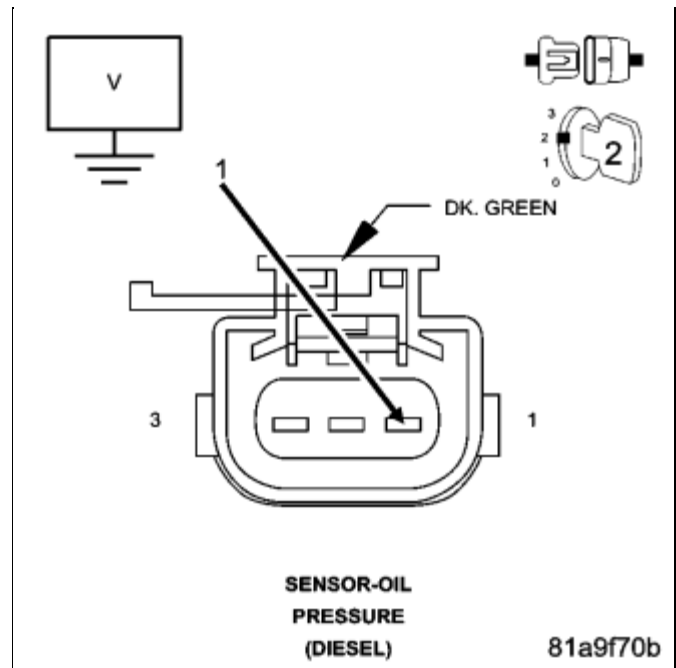
Is the voltage above 4.6 volts?

Yes

- Replace the Engine Oil Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9
 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. MASS AIR FLOW SENSOR

Turn the ignition off.
 Disconnect the MAF Sensor harness connector.
 Turn the ignition on.
 Measure the voltage of the (F888) MAF Sensor 5 Volt
 Supply circuit.

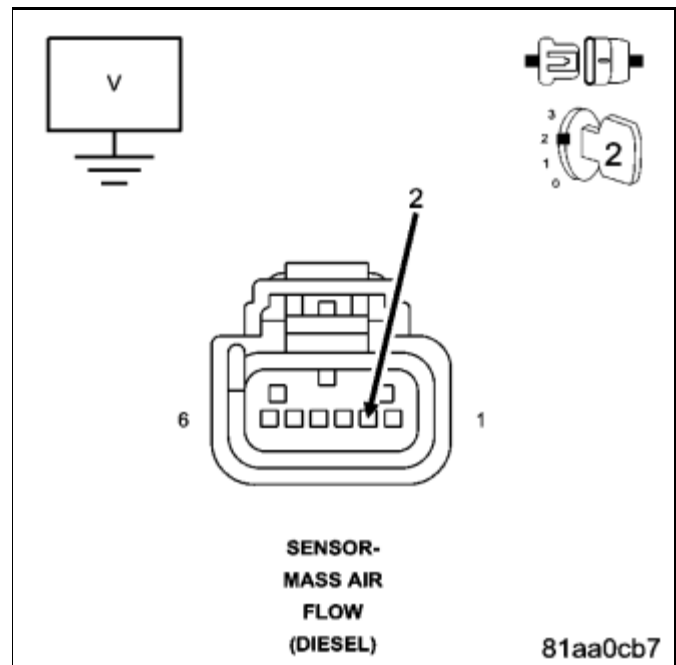
Is the voltage above 4.6 volts?

Yes

- Replace the MAF Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9
 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)



7. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Measure the resistance between ground and the (F856)

Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit.

Measure the resistance between ground and the (K354)

Exhaust Differential Pressure Sensor 5 Volt Supply circuit.

Measure the resistance between ground and the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit.

Measure the resistance between ground and the (K357)

Engine Oil Pressure Sensor 5 Volt Supply circuit.

Measure the resistance between ground and the (F888) MAF Sensor 8 Volt Supply circuit.

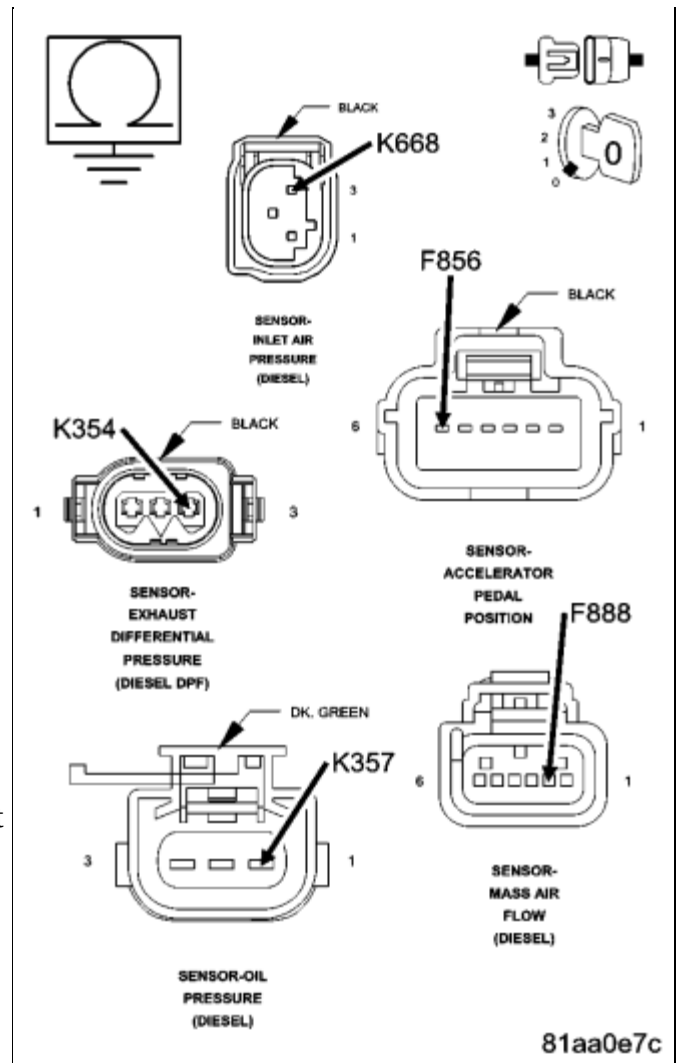
Is the resistance above 1000 ohms for each circuit?

Yes

- Go To [8](#)

No

- Repair the appropriate 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Turn the ignition off.

Inspect the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit between the Accelerator Pedal Position Sensor and the ECM.

Inspect the (K354) Exhaust Gas Pressure Sensor 5 Volt Supply circuit between the Exhaust Differential Pressure Sensor and the ECM.

Inspect the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit between the Inlet Air Pressure Sensor and the ECM.

Inspect the (K357) Oil Pressure Sensor 5 Volt Supply circuit between the Engine Oil Pressure Sensor and the ECM.

Inspect the (F888) MAF Sensor 8 Volt Supply circuit between the MAF Sensor and the ECM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

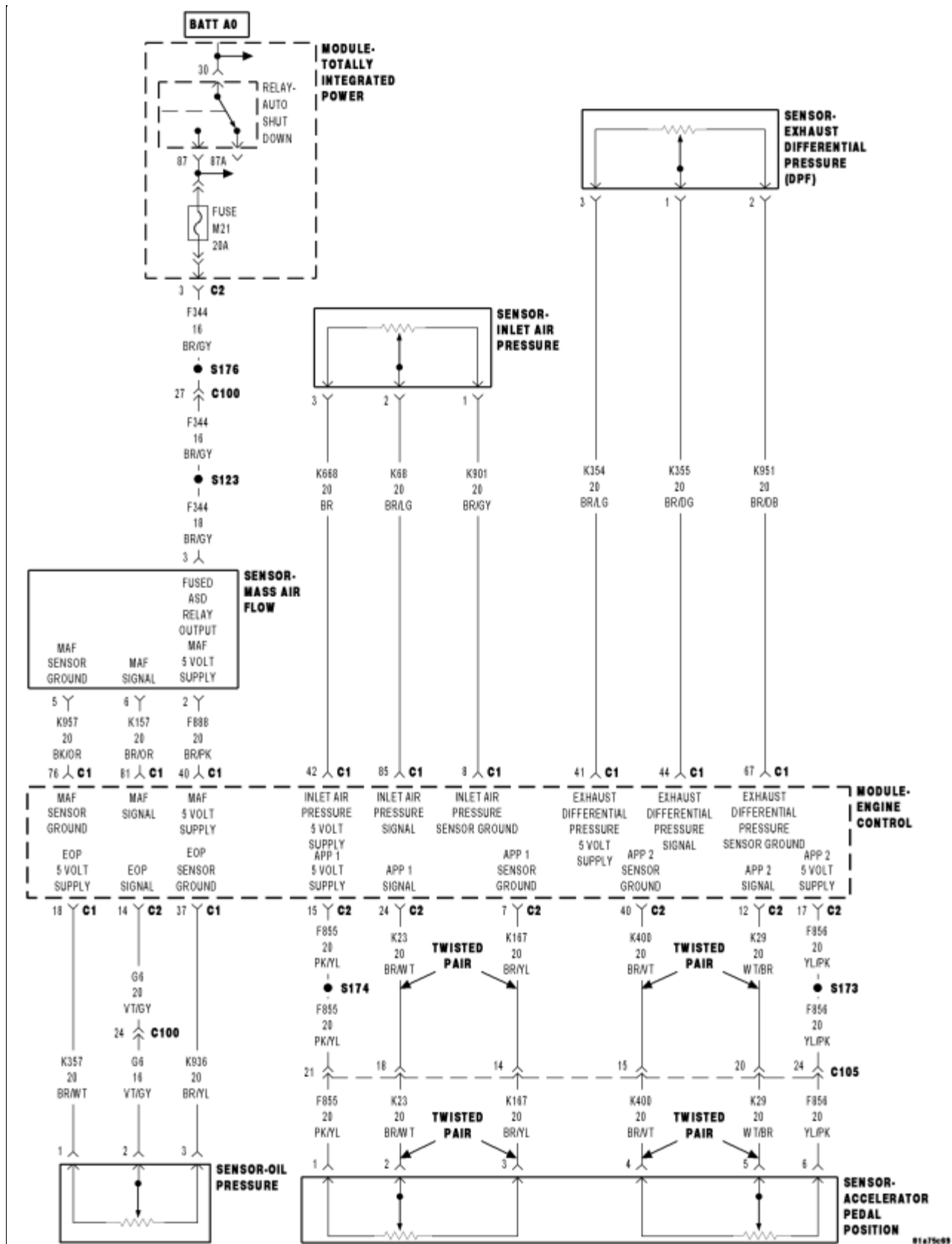
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0653-SENSOR REFERENCE VOLTAGE 2 TOO HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to voltage on the Sensor Supply 2 circuit for 0.10 seconds.

Possible Causes
INTERMITTENT CONDITION
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K357) ENGINE OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(F888) MASS AIR FLOW SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 2 provides 5 volts to the Inlet Pressure Sensor, Exhaust Differential Pressure Sensor, Engine Oil Pressure Sensor, Mass Air Flow Sensor, and the Accelerator Pedal Position Sensor 2.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

With the scan tool, select View DTCs.

Is the status Active for this DTC?**Yes**

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Accelerator Pedal Position Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

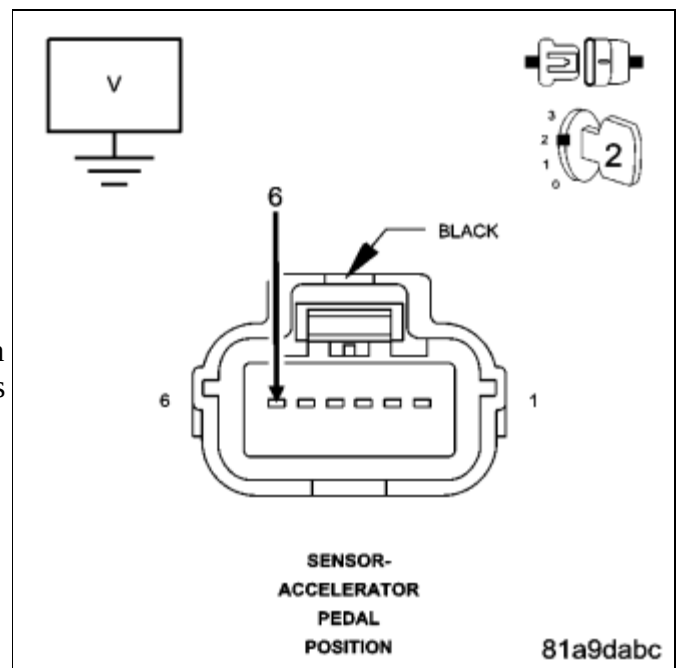
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit at the APP Sensor harness connector.

Is there any voltage present?**Yes**

- Repair the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No**

- Go To [3](#)

3. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.

Measure the voltage of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit at the Exhaust Differential Pressure Sensor harness connector.

Is there any voltage present?

Yes

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. (K668) INLET AIR PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Inlet Air Pressure Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.

Measure the voltage of the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit at the Inlet Air Pressure harness connector.

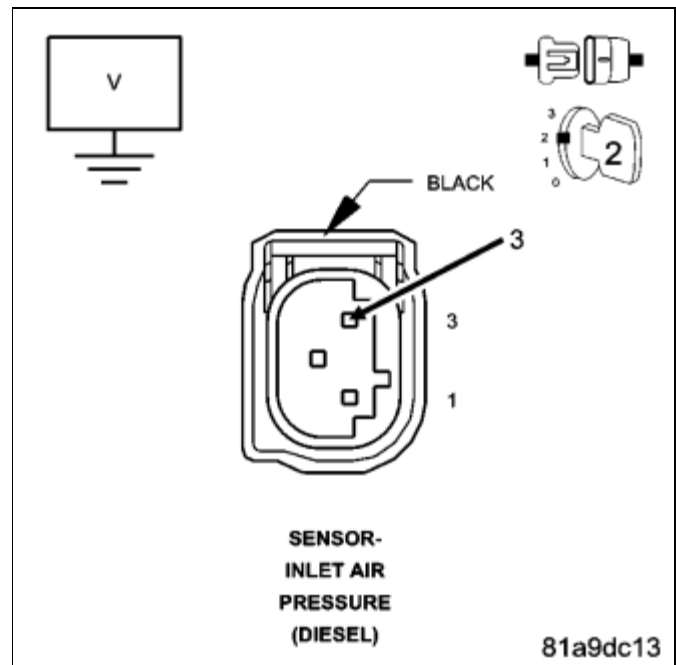
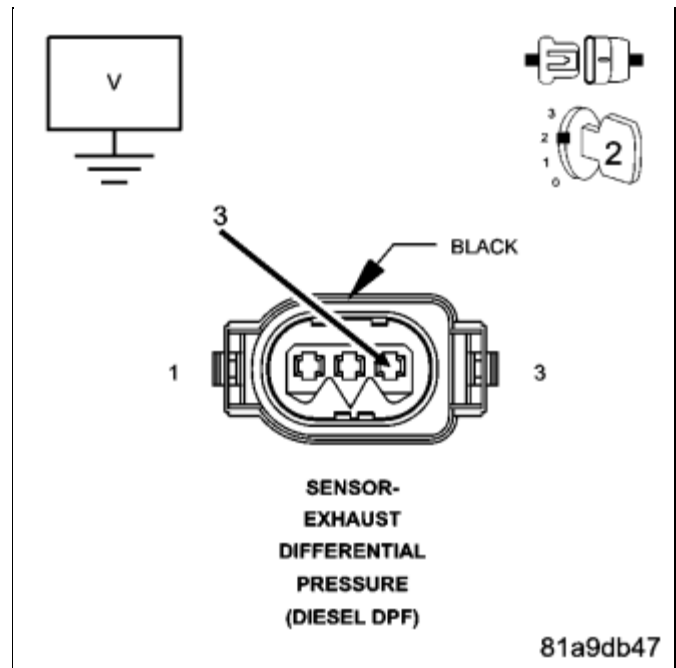
Is there any voltage present?

Yes

- Repair the Inlet Air Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (K357) ENGINE OIL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Engine Oil Pressure Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.
Measure the voltage of the (K357) Engine Oil Pressure Sensor 5 Volt Supply circuit at the Oil Pressure Sensor harness connector.

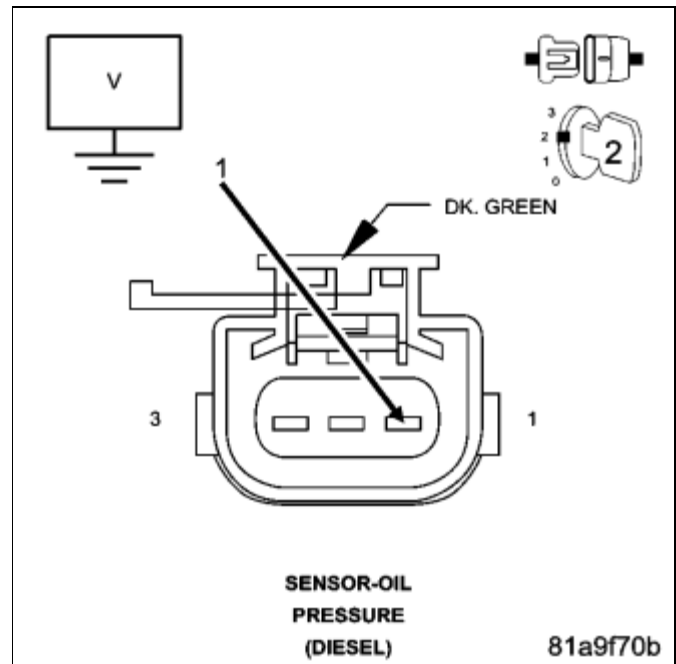
Is there any voltage present?

Yes

- Repair the Engine Oil Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (F888) MASS AIR FLOW SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the MAF Sensor harness connector.

NOTE: The jumper wire should still be in place.

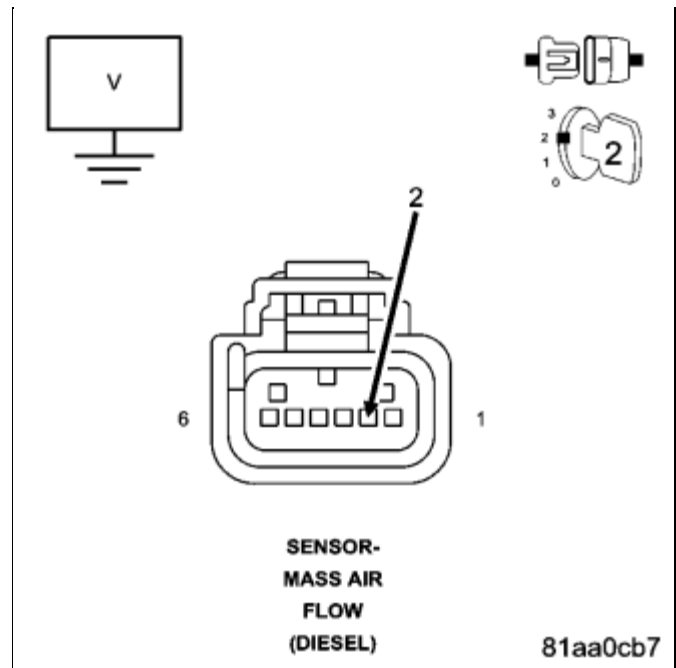
Turn the ignition on.
Measure the voltage of the (F888) MAF Sensor 5 Volt Supply circuit at the MAF Sensor harness connector.

Is there any voltage present?

Yes

- Replace the MAF Sensor 5 Volt Supply circuit for a

- short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Go To [Z](#)

7. ENGINE CONTROL MODULE (ECM)

Turn the ignition off.

Inspect the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit between the Accelerator Pedal Position Sensor and the ECM.

Inspect the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit between the Exhaust Differential Pressure Sensor and the ECM.

Inspect the (K668) Inlet Air Pressure Sensor 5 Volt Supply circuit between the Inlet Air Pressure Sensor and the ECM.

Inspect the (K357) Engine Oil Pressure Sensor 5 Volt Supply circuit between the Engine Oil Pressure Sensor and the ECM.

Inspect the (F888) MAF Sensor 5 Volt Supply circuit between the MAF Sensor and the ECM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P065A- GENERATOR PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects that the Generator output is not within specifications.

Possible Causes
GENERATOR BELT
GENERATOR BELT TENSIONER
GENERATOR B+ CIRCUIT OPEN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR OTHER DTC'S

Turn the ignition on.

With the scan tool, check the ECM for LIN Bus or System Voltage related DTC's.

Are there any LIN Bus or System Voltage related DTCs?

Yes

- Repair other DTCs before continuing.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)
-

2. GENERATOR B+ CIRCUIT

Turn the ignition off.

Using a test light connected to ground, probe the B+ circuit at the generator.

Does the test light illuminate brightly?

Continue

- Go To [3](#)

No

- Repair the Generator B+ circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CHECK GENERATOR DRIVE BELT

Visually inspect the generator drive belt for glazing, cracks and other problems.

Inspect the generator drive belt and tensioner for proper tension.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)
-

4. TEST DRIVE THE VEHICLE

Turn the ignition on.

With the scan tool, erase DTC's.

Test drive the vehicle.

With the scan tool, read DTC's.

Does the scan tool display this DTC?

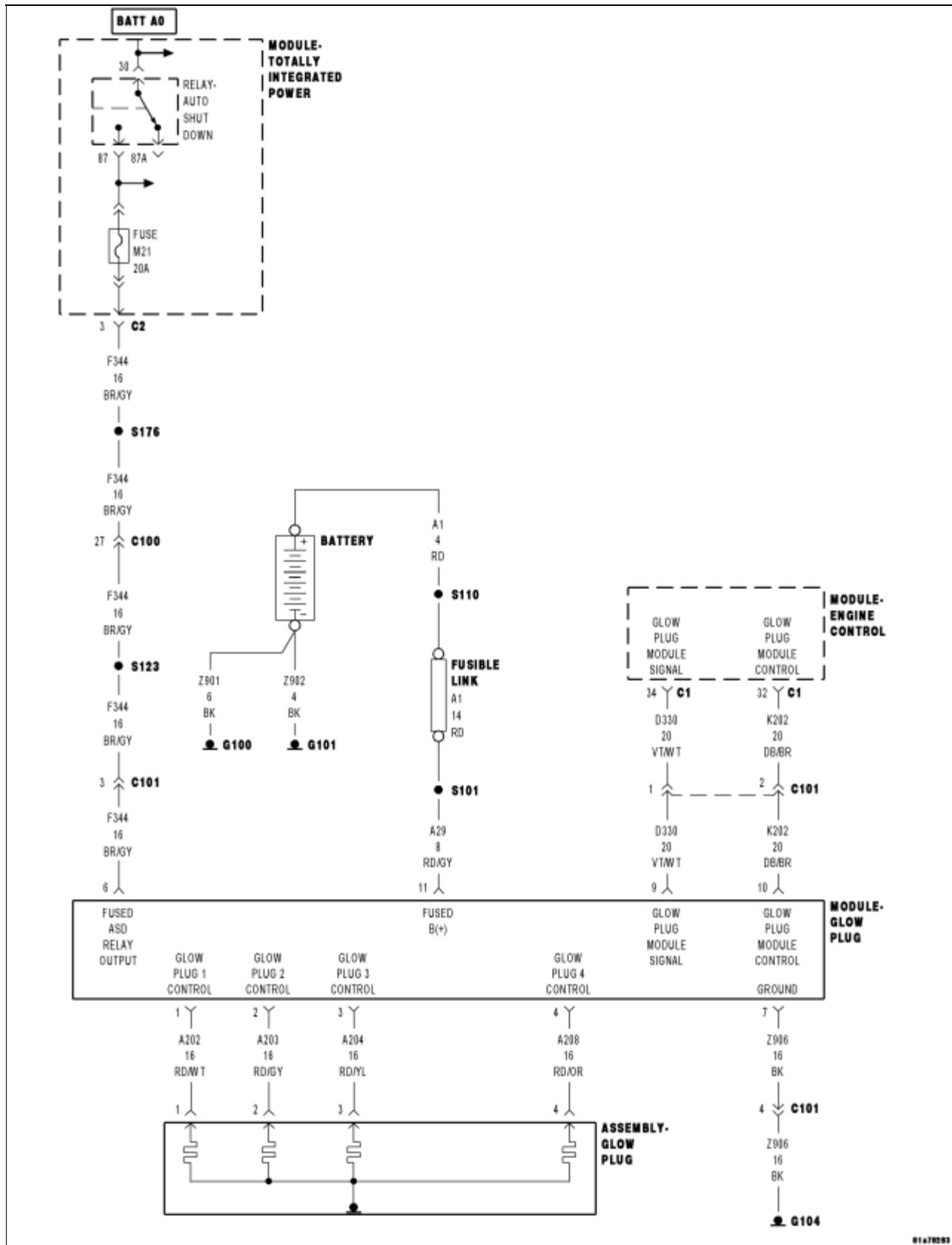
Yes

- Replace the Generator.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P066A-CYLINDER 1 GLOW PLUG CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command off.

- **Set Condition:**

The ECM detects an open or shorted to ground on the Cylinder 1 Glow Plug circuit.

Possible Causes
INTERMITTENT DTC
(A202) GLOW PLUG 1 CONTROL CIRCUIT OPEN
(A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO GROUND
(A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 1
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A202) GLOW PLUG 1 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 1 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A202) Glow Plug 1 Control circuit between the Glow Plug 1 harness connector and the Glow Plug Module harness connector.

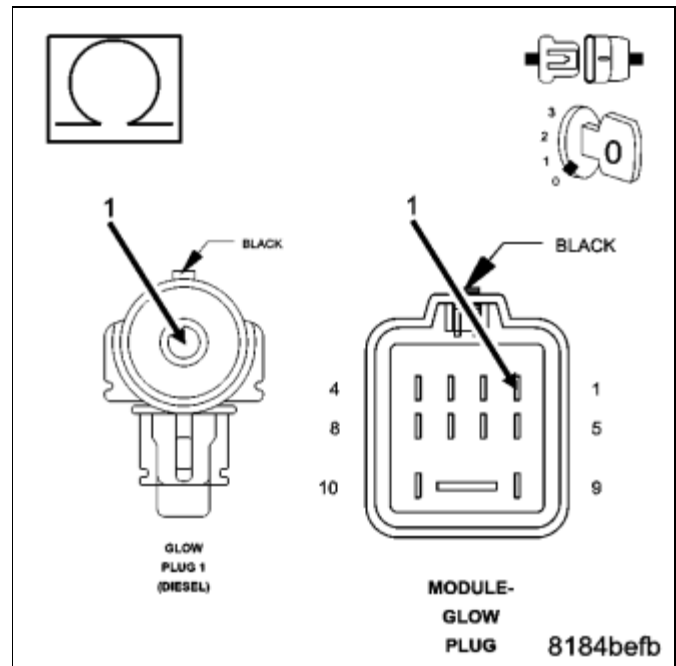
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A202) Glow Plug 1 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A202) Glow Plug 1 Control circuit at the Glow Plug 1 harness connector.

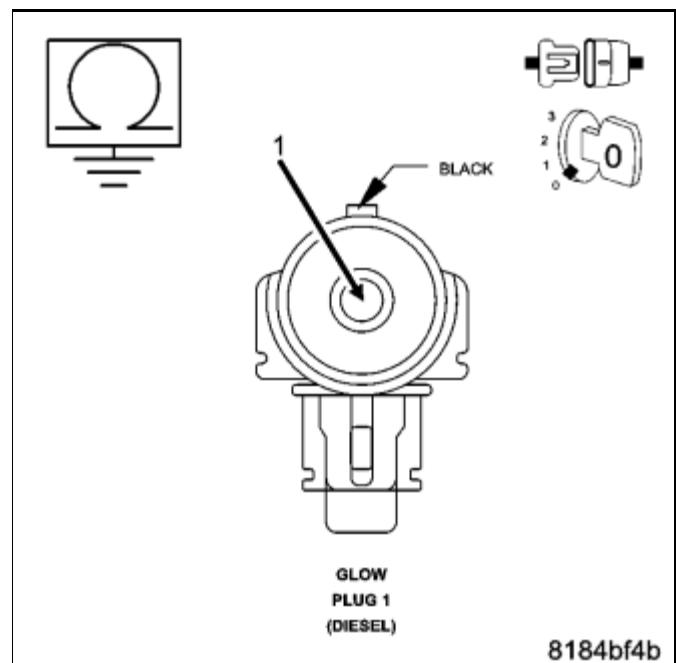
Is the resistance below 1000 ohms?

Yes

- Repair the (A202) Glow Plug 1 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A202) Glow Plug 1 Control circuit at the Glow Plug 1 harness connector.

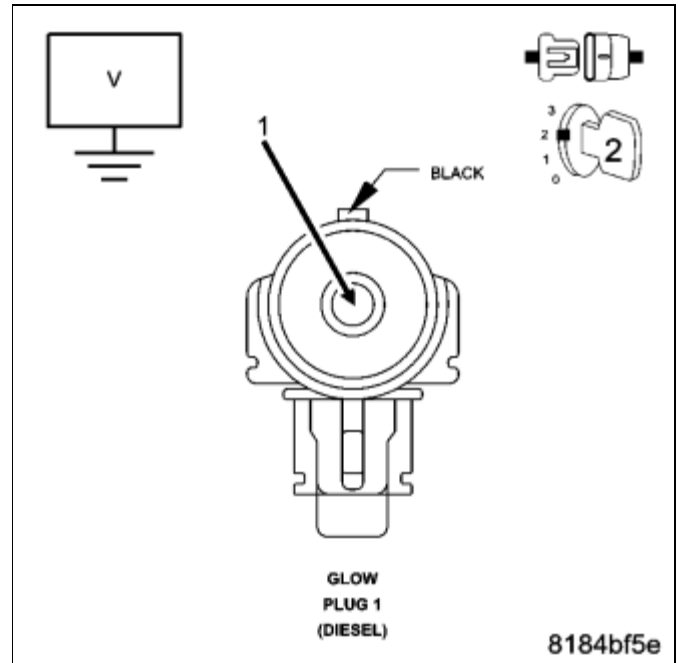
Is there voltage present on the (A202) Glow Plug 1 Control circuit?

Yes

- Repair the (A202) Glow Plug 1 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 1

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 1.
Turn the ignition on.
With the scan tool, erase ECM DTC's.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTC's.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

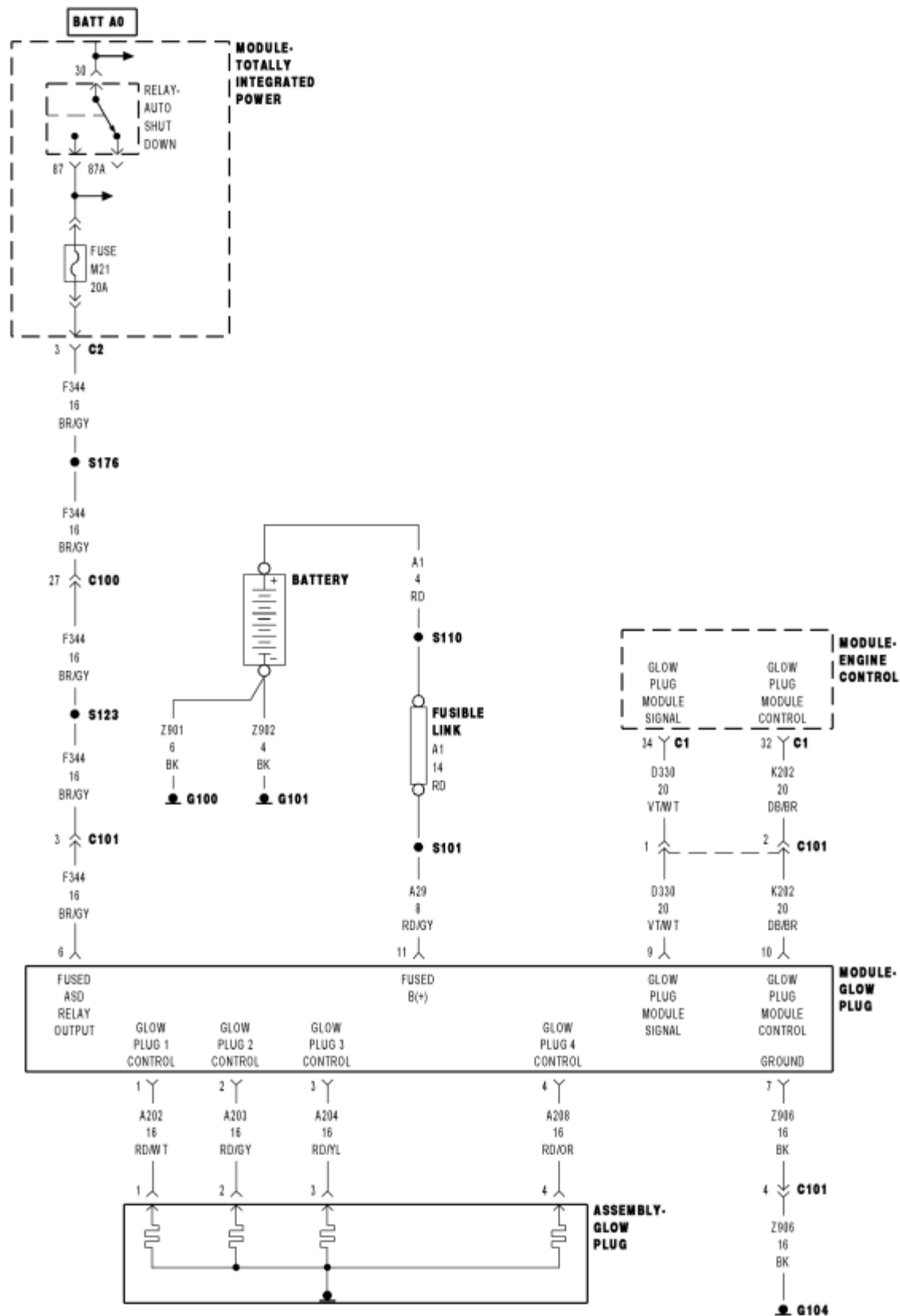
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P066C-CYLINDER 2 GLOW PLUG CIRCUIT LOW



81a70293

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command off.

- **Set Condition:**

The ECM detects an open or shorted to ground on the Cylinder 2 Glow Plug circuit.

Possible Causes
INTERMITTENT DTC
(A203) GLOW PLUG 2 CONTROL CIRCUIT OPEN
(A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO GROUND
(A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 2
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A203) GLOW PLUG 2 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 2 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A203) Glow Plug 2 Control circuit between the Glow Plug 2 harness connector and the Glow Plug Module harness connector.

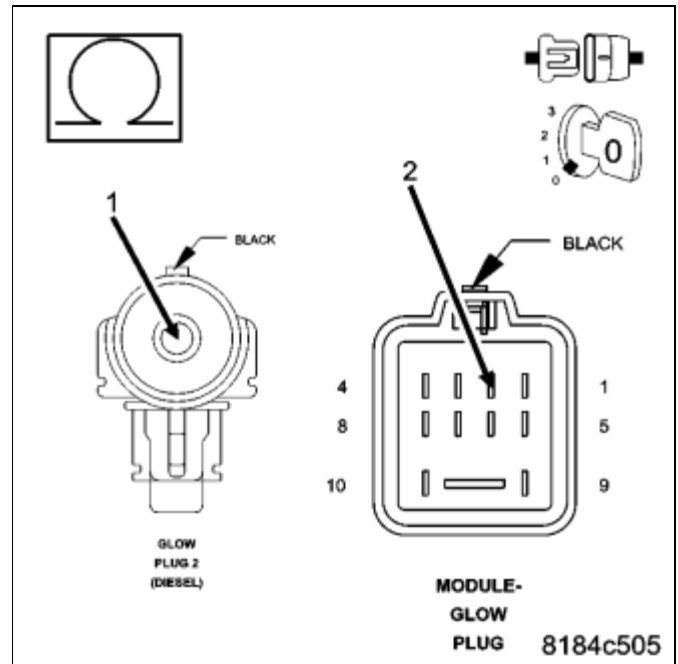
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A203) Glow Plug 2 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A203) Glow Plug 2 Control circuit at the Glow Plug 2 harness connector.

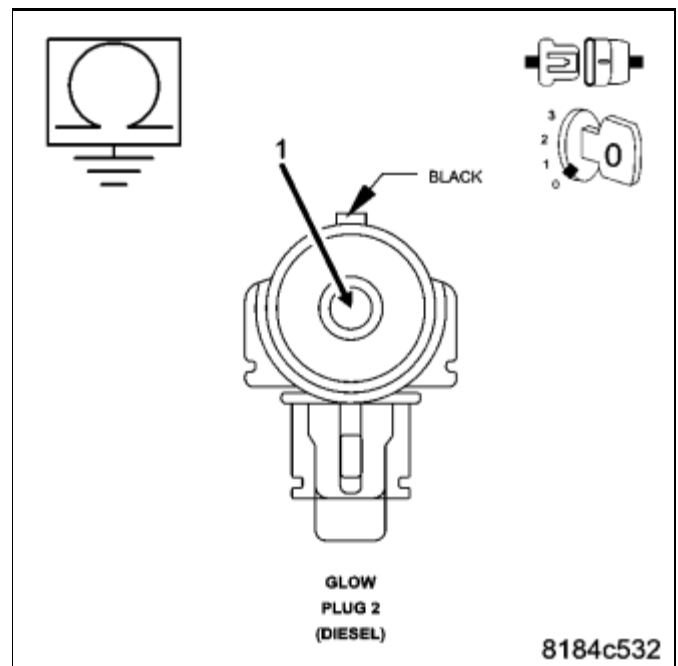
Is the resistance below 1000 ohms?

Yes

- Repair the (A203) Glow Plug 2 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A203) Glow Plug 2 Control circuit at the Glow Plug 2 harness connector.

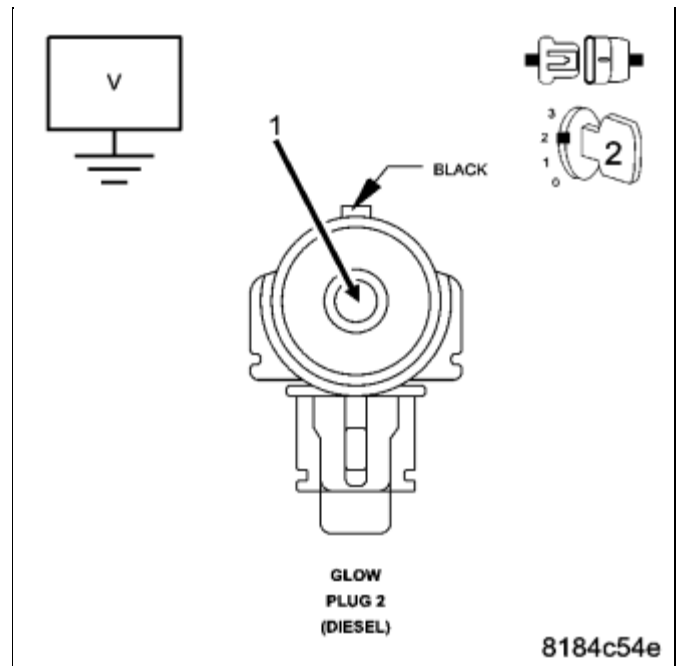
Is there voltage present on the (A203) Glow Plug 2 Control circuit?

Yes

- Repair the (A203) Glow Plug 2 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 2

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 2.
Turn the ignition on.
With the scan tool, erase ECM DTC's.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTC's.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

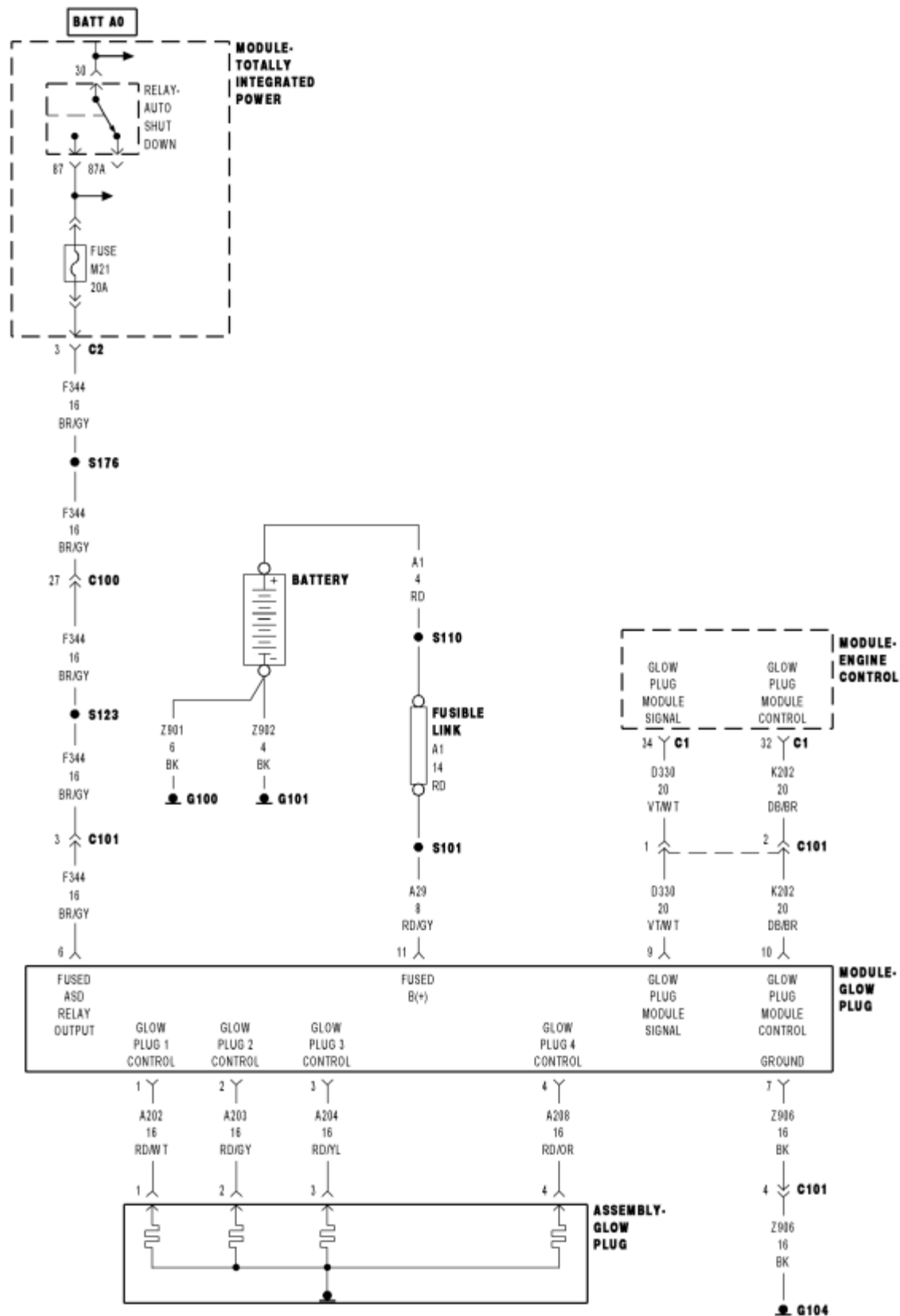
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P066E-CYLINDER 3 GLOW PLUG CIRCUIT LOW



81a70293

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command off.

- **Set Condition:**

The ECM detects an open or shorted to ground on the Cylinder 3 Glow Plug circuit.

Possible Causes
INTERMITTENT DTC
(A204) GLOW PLUG 3 CONTROL CIRCUIT OPEN
(A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO GROUND
(A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 3
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A204) GLOW PLUG 3 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 3 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A204) Glow Plug 3 Control circuit between the Glow Plug 3 harness connector and the Glow Plug Module harness connector.

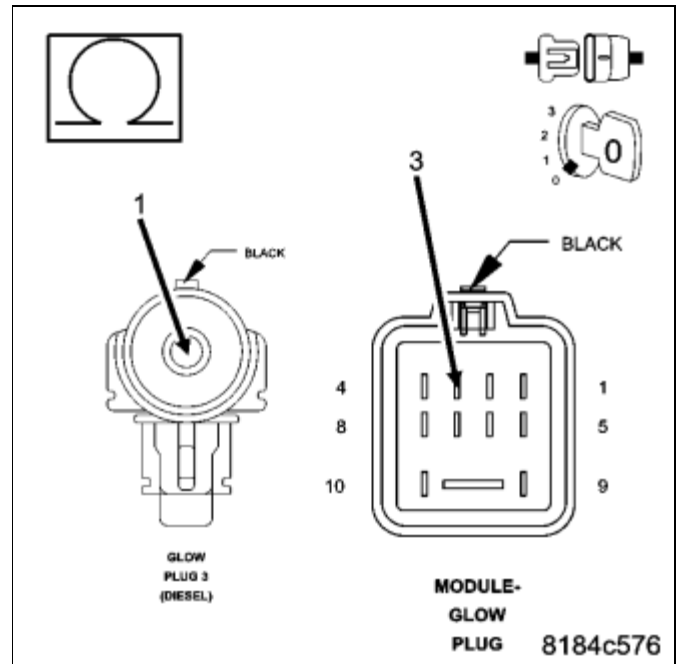
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A204) Glow Plug 3 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A204) Glow Plug 3 Control circuit at the Glow Plug 3 harness connector.

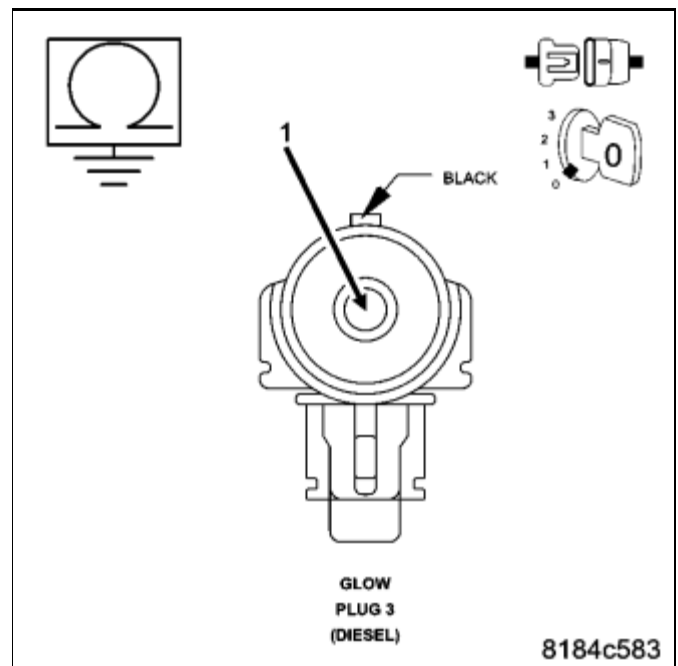
Is the resistance below 1000 ohms?

Yes

- Repair the (A204) Glow Plug 3 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A204) Glow Plug 3 Control circuit at the Glow Plug 3 harness connector.

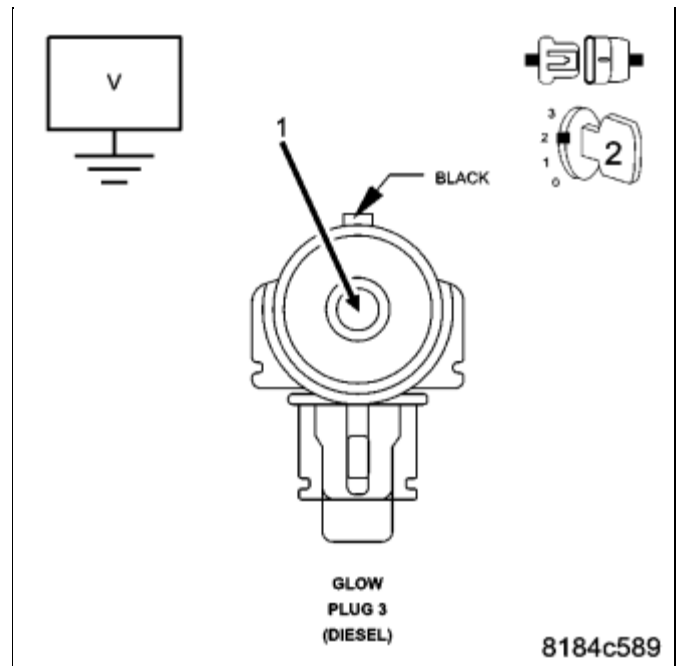
Is there voltage present on the (A204) Glow Plug 3 Control circuit?

Yes

- Repair the (A204) Glow Plug 3 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 3

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 3.
Turn the ignition on.
With the scan tool, erase ECM DTC's.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTC's.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

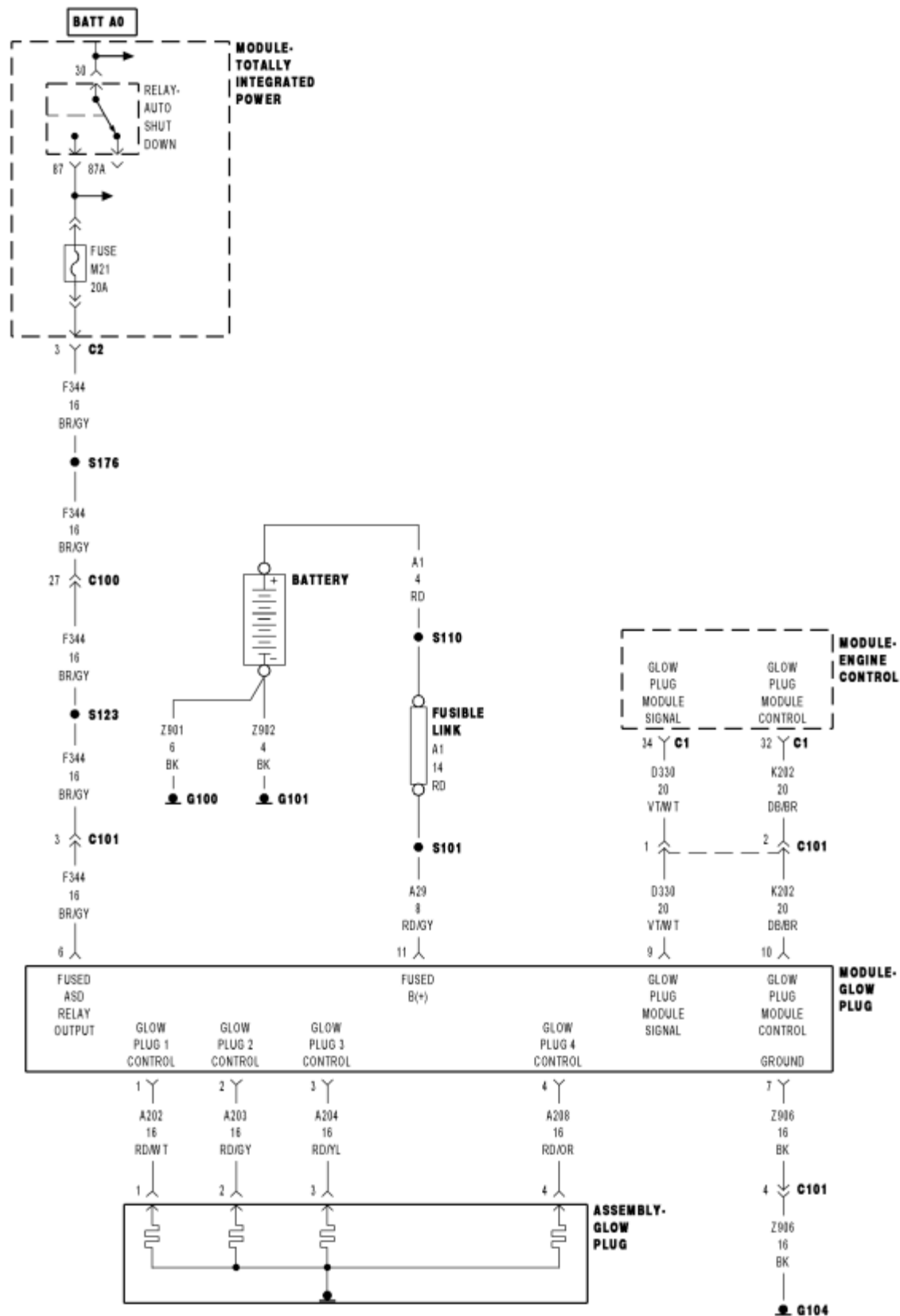
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**P0670-GLOW PLUG CONTROL MODULE CONTROL CIRCUIT
OPEN**



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects an open on the (K202) Glow Plug Module Control circuit for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND
(K202) GLOW PLUG MODULE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Glow Plugs.

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

(K202) GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

2.

Turn the ignition off.
 Disconnect the Glow Plug Module harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (K202) Glow Plug Module Control circuit in the Glow Plug Module harness connector.

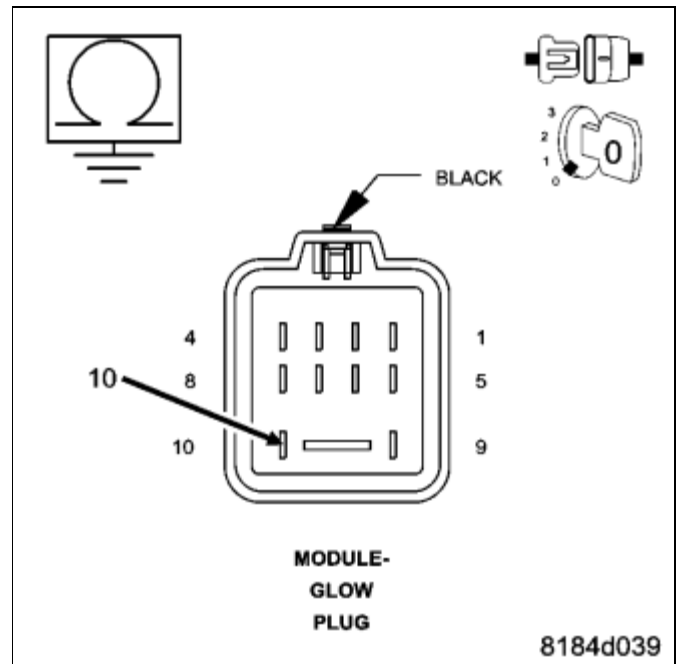
Is the resistance below 1000 ohms?

Yes

- Repair the (K202) Glow Plug Module Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K202) GLOW PLUG MODULE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K202) Glow Plug Module Control circuit between the Glow Plug Module harness connector and the Engine Control Module (ECM) harness connector.

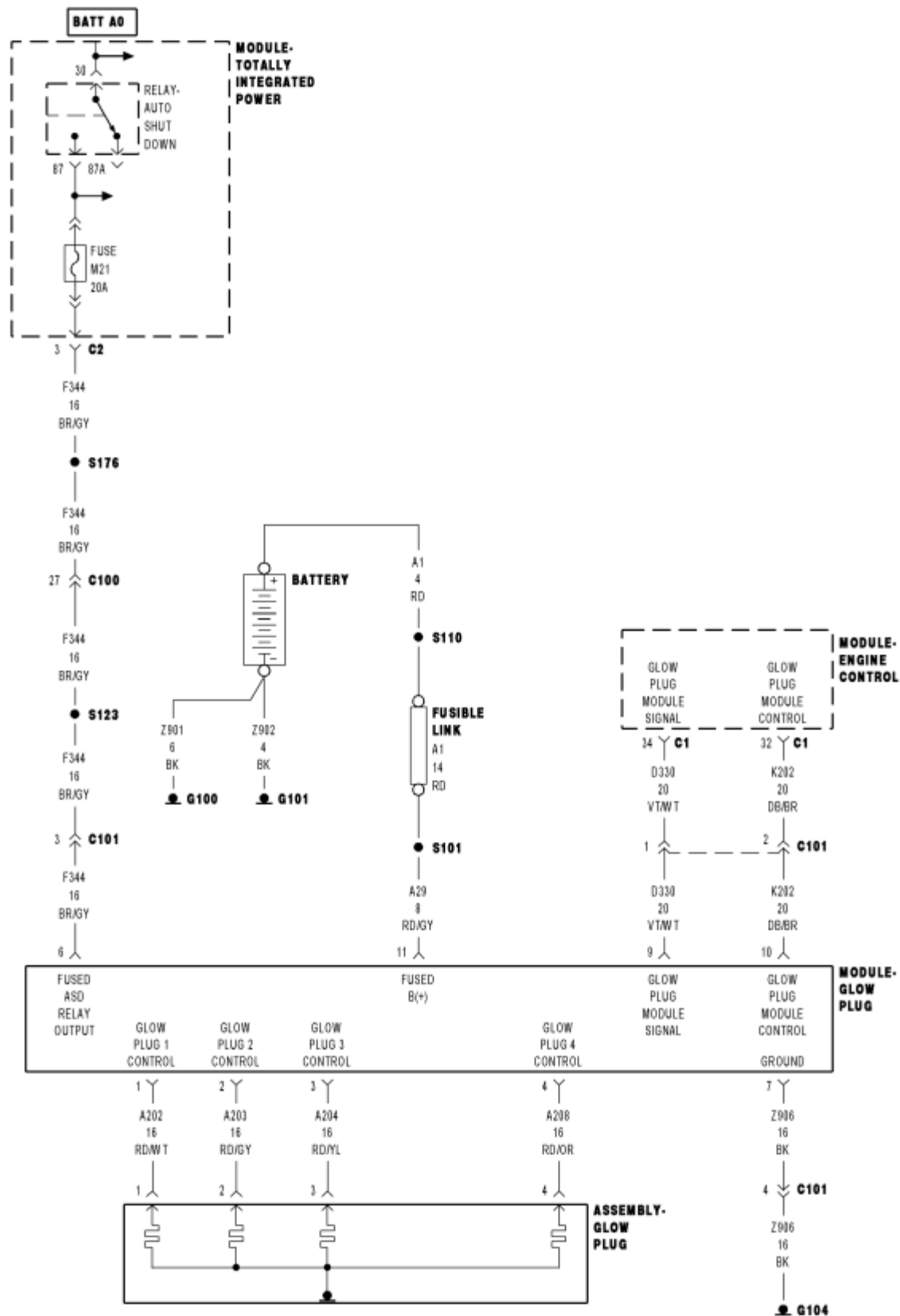
Is the resistance below 10.0 ohms?

Yes

- Replace the Glow Plug Control Module.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K202) Glow Plug Module Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command on.

- **Set Condition:**

The ECM detects an open or short on the Cylinder 1 Glow Plug circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(A202) GLOW PLUG 1 CONTROL CIRCUIT OPEN
(A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO GROUND
(A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 1
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A202) GLOW PLUG 1 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 1 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A202) Glow Plug 1 Control circuit between the Glow Plug 1 harness connector and the Glow Plug Module harness connector.

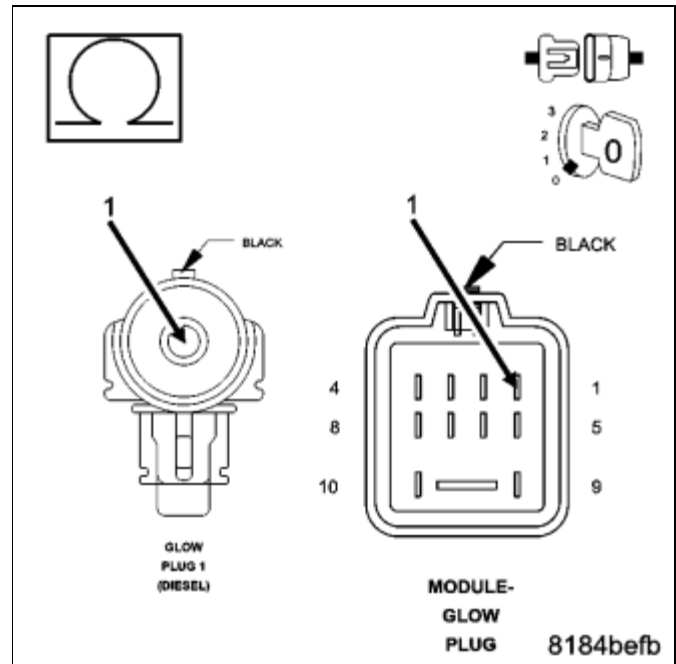
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A202) Glow Plug 1 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A202) Glow Plug 1 Control circuit at the Glow Plug 1 harness connector.

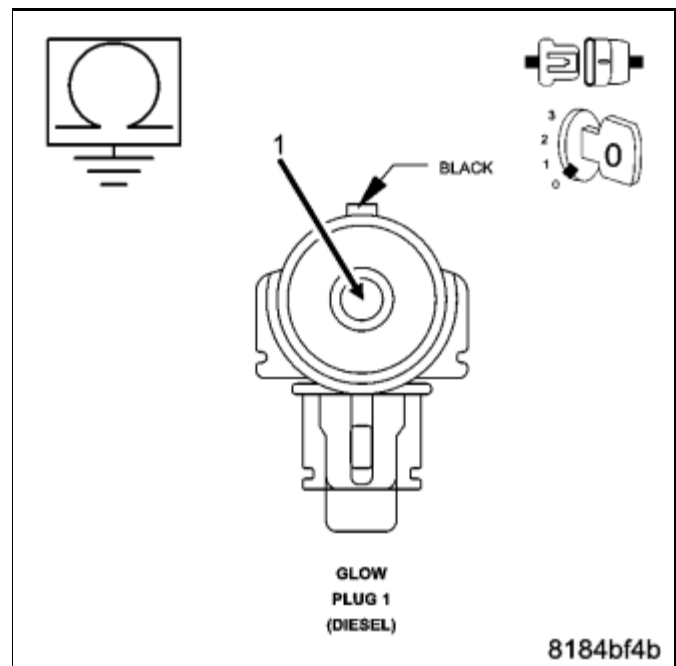
Is the resistance below 1000 ohms?

Yes

- Repair the (A202) Glow Plug 1 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A202) GLOW PLUG 1 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (A202) Glow Plug 1 Control circuit at the Glow Plug 1 harness connector.

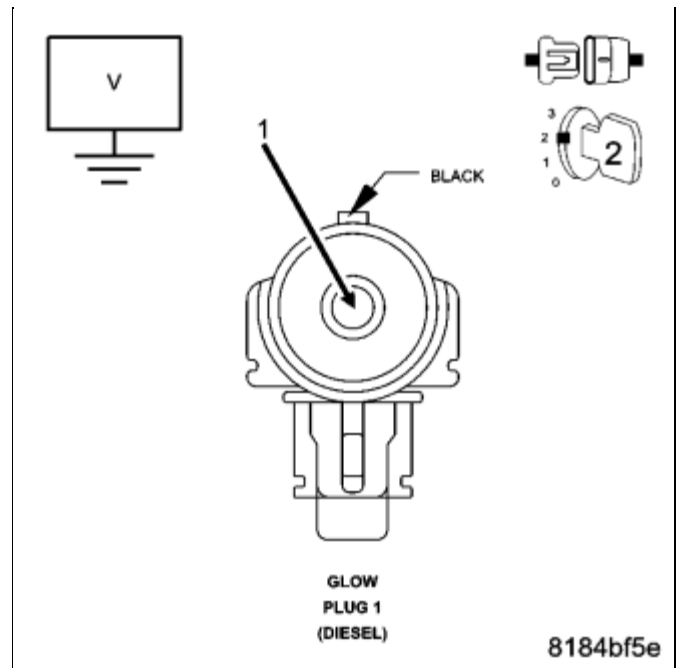
Is there voltage present on the (A202) Glow Plug 1 Control circuit?

Yes

- Repair the (A202) Glow Plug 1 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 1

Turn the ignition off.

Refer to the Service Information and replace the Glow Plug 1.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.

With the scan tool, read ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

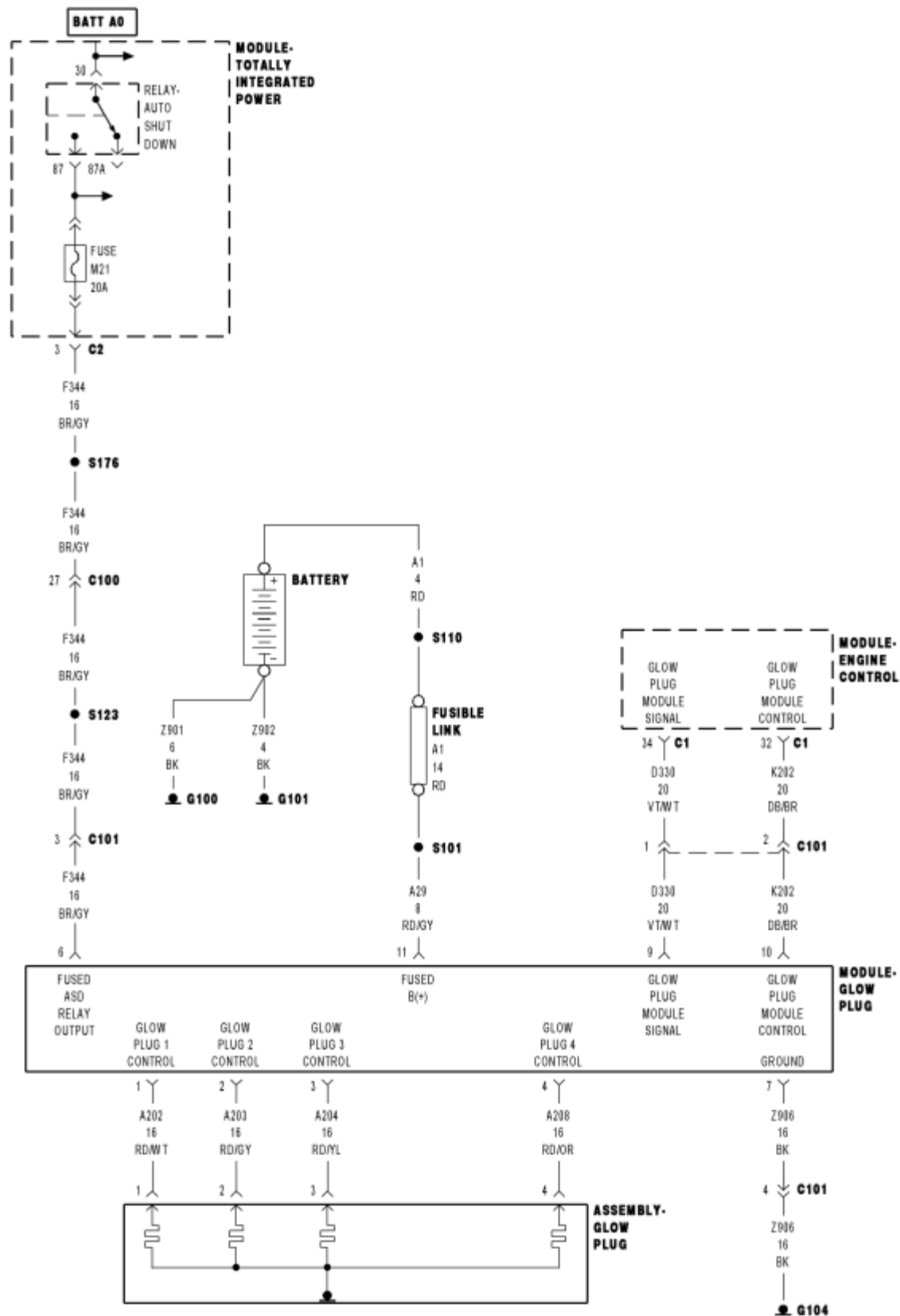
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0672-CYLINDER 2 GLOW PLUG CIRCUIT



81a70293

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command on.

- **Set Condition:**

The ECM detects an open or short on the Cylinder 2 Glow Plug circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(A203) GLOW PLUG 2 CONTROL CIRCUIT OPEN
(A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO GROUND
(A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 2
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A203) GLOW PLUG 2 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 2 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A203) Glow Plug 2 Control circuit between the Glow Plug 2 harness connector and the Glow Plug Module harness connector.

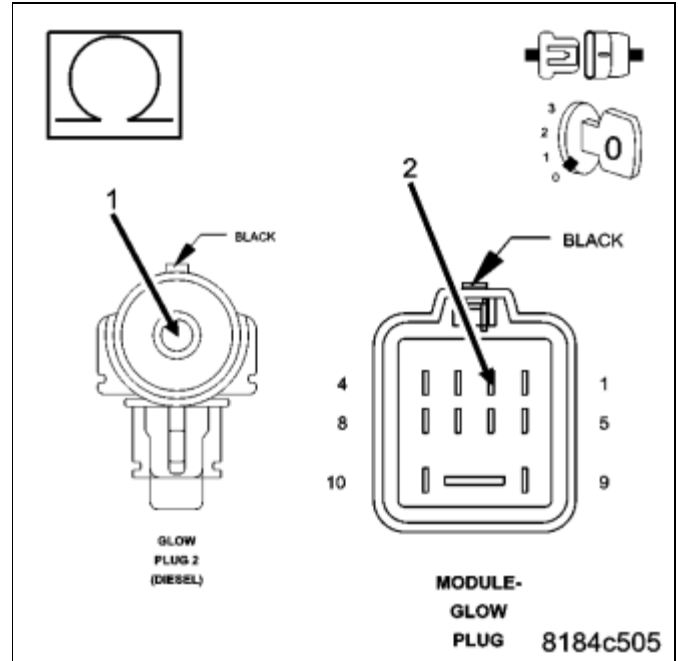
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A203) Glow Plug 2 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A203) Glow Plug 2 Control circuit at the Glow Plug 2 harness connector.

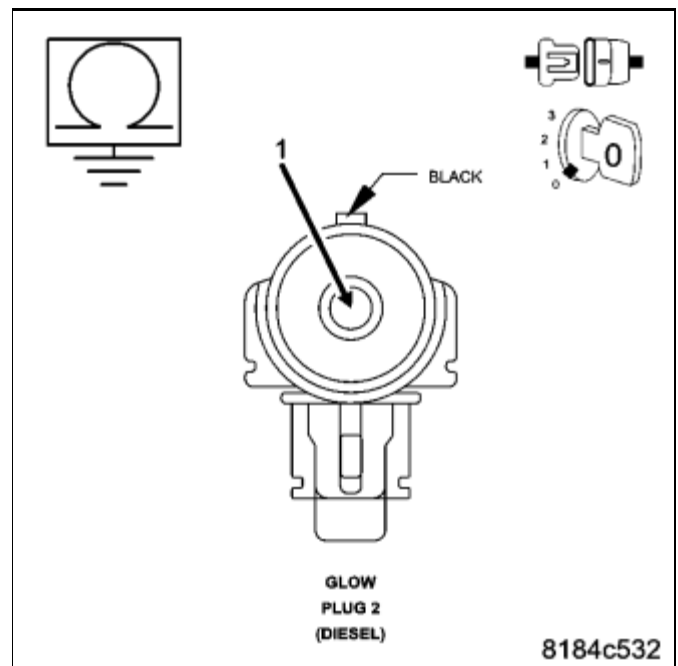
Is the resistance below 1000 ohms?

Yes

- Repair the (A203) Glow Plug 2 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A203) GLOW PLUG 2 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A203) Glow Plug 2 Control circuit at the Glow Plug 2 harness connector.

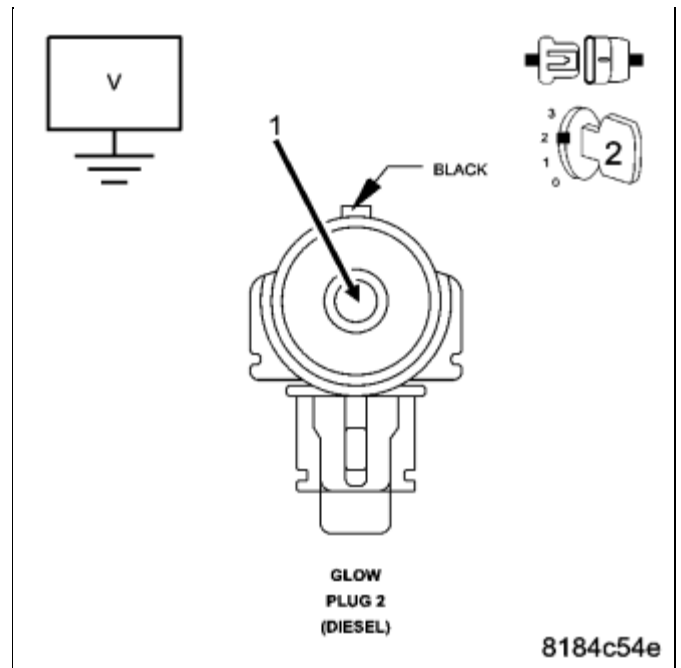
Is there voltage present on the (A203) Glow Plug 2 Control circuit?

Yes

- Repair the (A203) Glow Plug 2 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 2

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 2.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

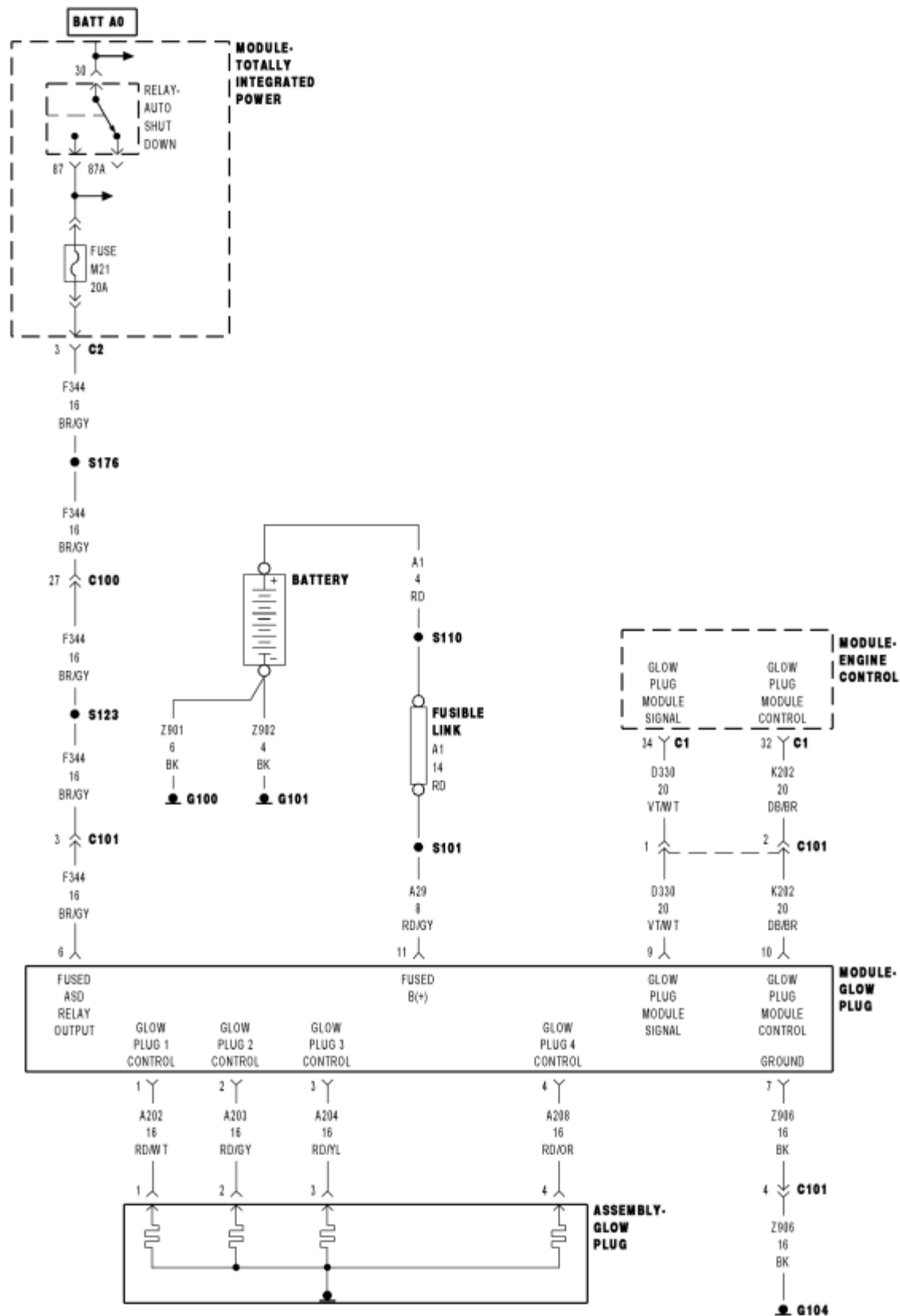
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0673-CYLINDER 3 GLOW PLUG CIRCUIT



81a70293

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command on.

- **Set Condition:**

The ECM detects an open or short on the Cylinder 3 Glow Plug circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(A204) GLOW PLUG 3 CONTROL CIRCUIT OPEN
(A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO GROUND
(A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 3
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A204) GLOW PLUG 3 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 3 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A204) Glow Plug 3 Control circuit between the Glow Plug 3 harness connector and the Glow Plug Module harness connector.

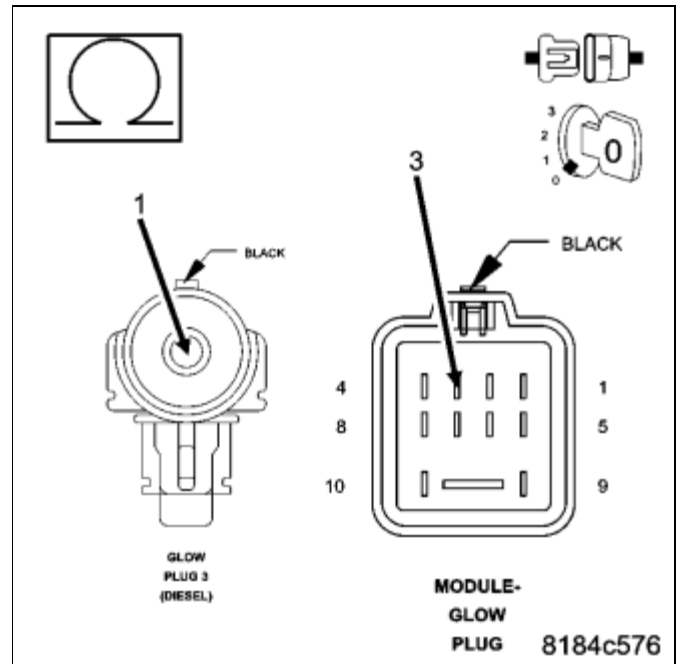
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A204) Glow Plug 3 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A204) Glow Plug 3 Control circuit at the Glow Plug 3 harness connector.

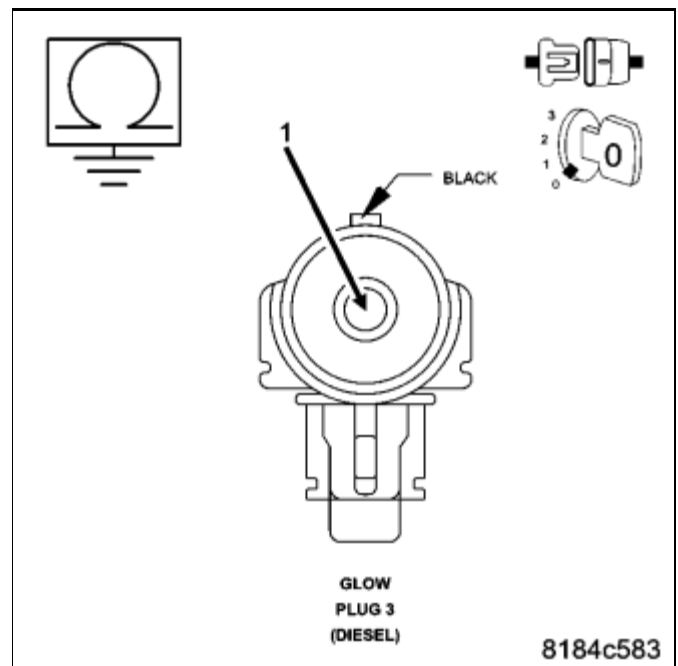
Is the resistance below 1000 ohms?

Yes

- Repair the (A204) Glow Plug 3 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A204) GLOW PLUG 3 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A204) Glow Plug 3 Control circuit at the Glow Plug 3 harness connector.

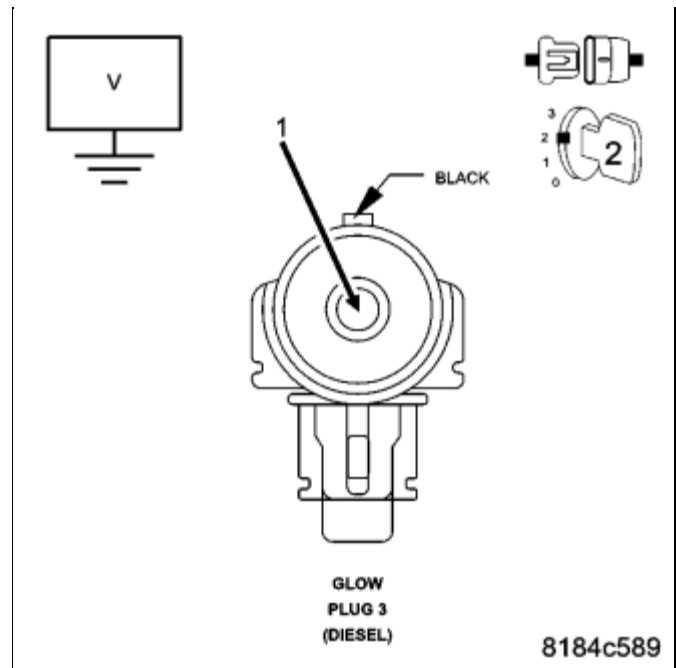
Is there voltage present on the (A204) Glow Plug 3 Control circuit?

Yes

- Repair the (A204) Glow Plug 3 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 3

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 3.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

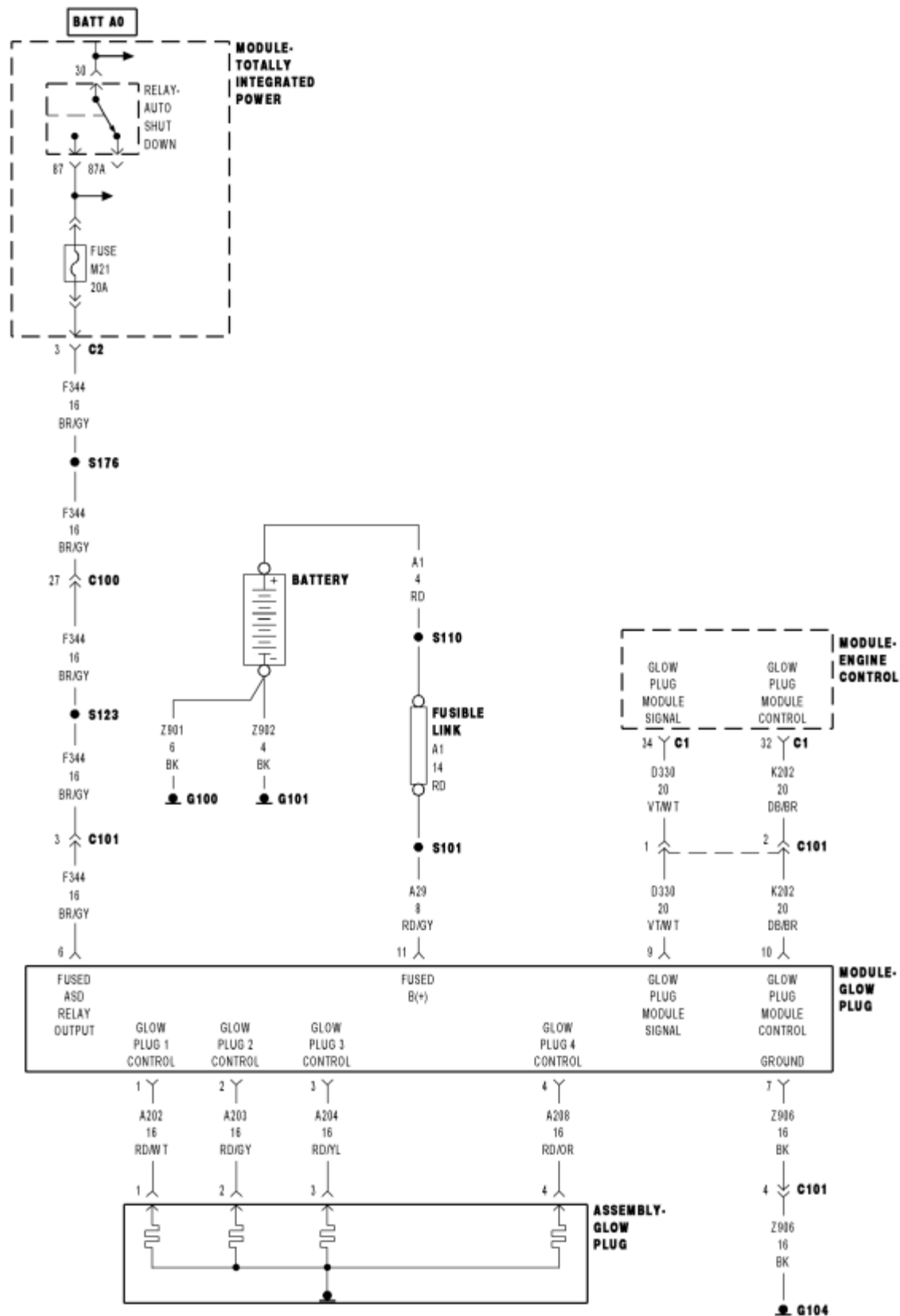
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0674-CYLINDER 4 GLOW PLUG CIRCUIT



81a70293

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command on.

- **Set Condition:**

The ECM detects an open or short on the Cylinder 4 Glow Plug circuit for 0.5 seconds.

Possible Causes
INTERMITTENT DTC
(A208) GLOW PLUG 4 CONTROL CIRCUIT OPEN
(A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO GROUND
(A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 4
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A208) GLOW PLUG 4 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect Glow Plug 4 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A208) Glow Plug Control circuit between the Glow Plug 4 harness connector and the Glow Plug Module harness connector.

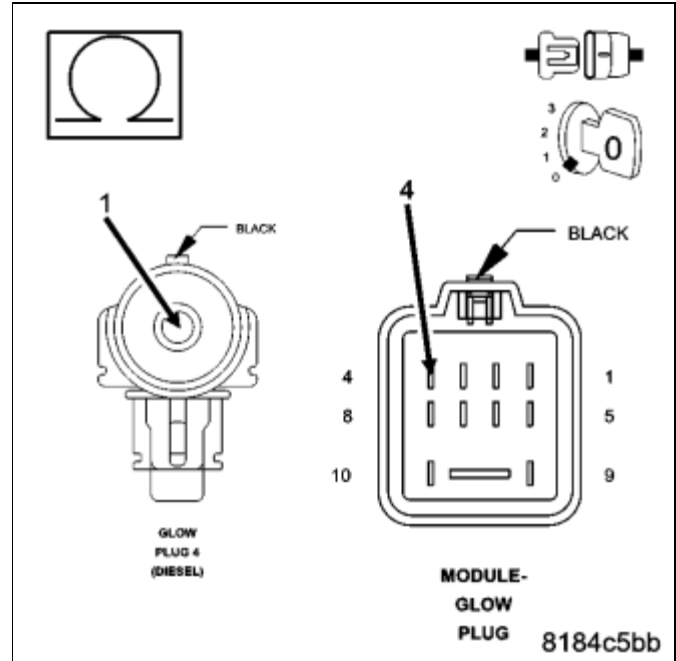
Is the resistance below 10.0 ohms for each circuit?

Yes

- Go To [3](#)

No

- Repair the (A208) Glow Plug 4 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A208) Glow Plug Control circuit at the Glow Plug 4 harness connector.

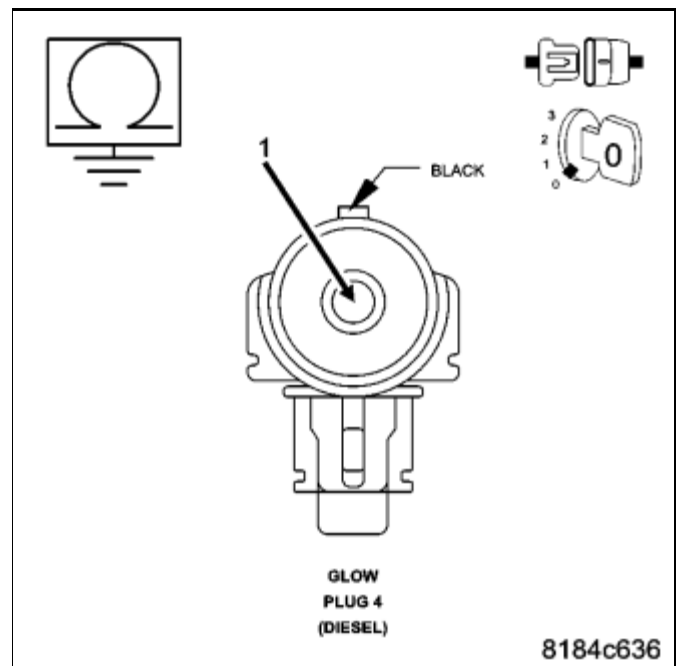
Is the resistance below 1000 ohms for any of the measurements?

Yes

- Repair the (A208) Glow Plug 4 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A208) Glow Plug 4 Control circuit at the Glow Plug 4 harness connector.

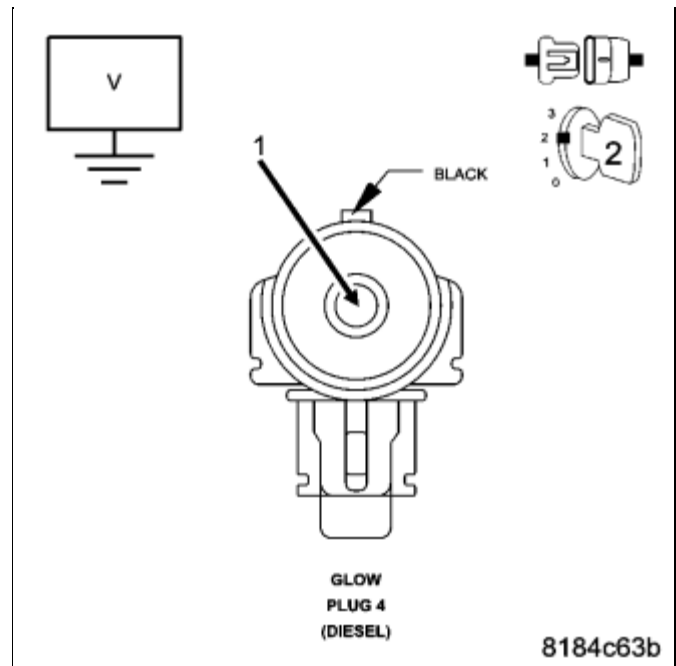
Is there voltage present on any of the Glow Plug Control circuits?

Yes

- Repair the (A208) Glow Plug 4 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG

Turn the ignition off.
Connect each Glow Plug connector.
Connect the Glow Plug Module connector.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

Did each Glow Plug pass the test?

Yes

- Go to [6](#)

No

- Replace the appropriate Glow Plug in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

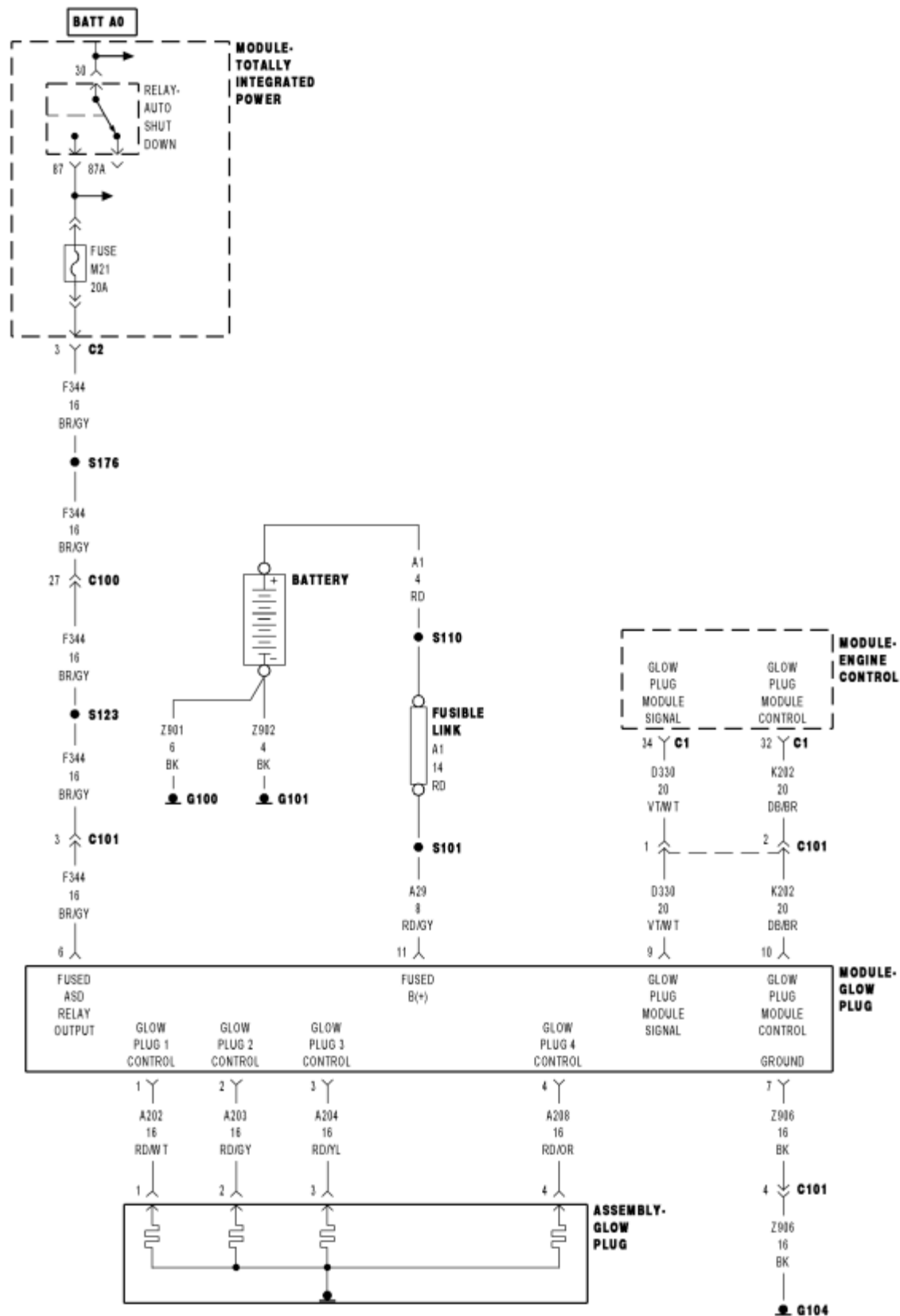
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P067A-CYLINDER 4 GLOW PLUG CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on and the Glow Plug Module Glow Plug command off.

- **Set Condition:**

The ECM detects an open or shorted to ground on the Cylinder 4 Glow Plug circuit.

Possible Causes
INTERMITTENT DTC
(A208) GLOW PLUG 4 CONTROL CIRCUIT OPEN
(A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO GROUND
(A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO VOLTAGE
GLOW PLUG 4
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTC's.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (A208) GLOW PLUG 4 CONTROL CIRCUIT OPEN

Turn the ignition off.
 Disconnect the Glow Plug 4 harness connector.
 Disconnect the Glow Plug Module harness connector.
 Measure the resistance of the (A208) Glow Plug 4 Control circuit between the Glow Plug 4 harness connector and the Glow Plug Module harness connector.

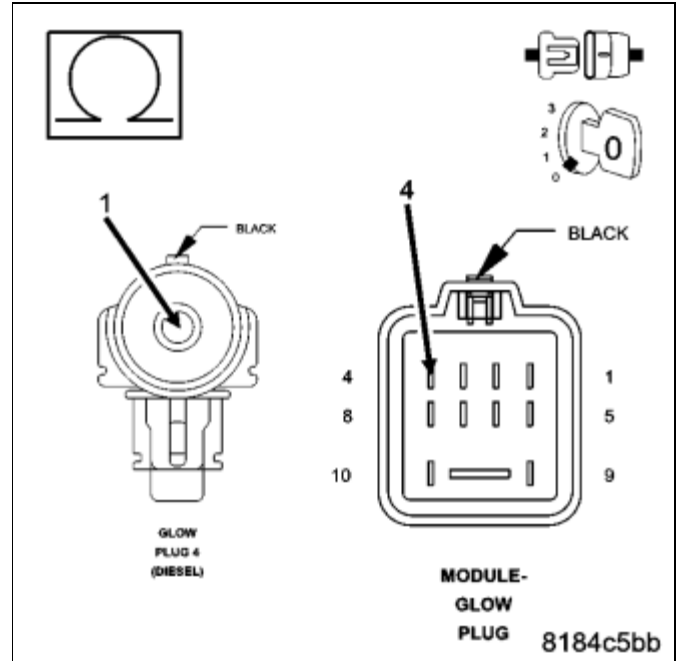
Is the resistance below 10.0 ohms?

Yes

- Go To [3](#)

No

- Repair the (A208) Glow Plug 4 Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (A208) Glow Plug 4 Control circuit at the Glow Plug 4 harness connector.

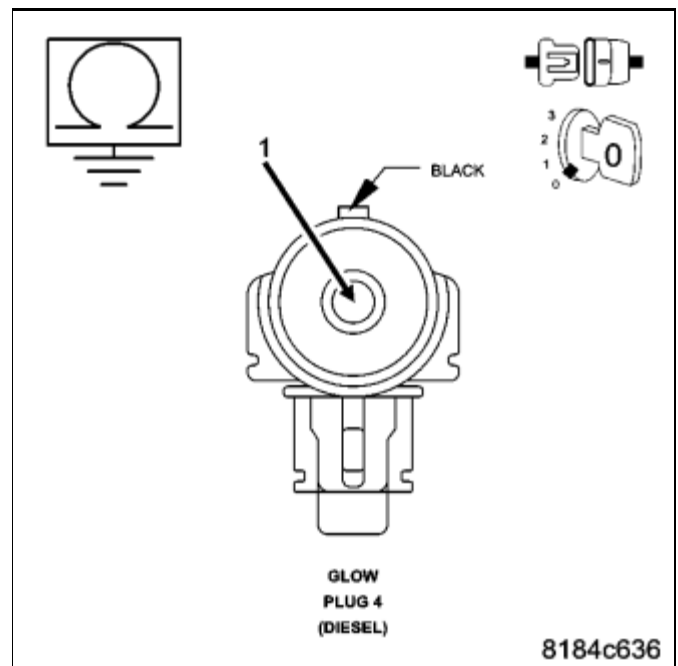
Is the resistance below 1000 ohms?

Yes

- Repair the (A208) Glow Plug 4 Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (A208) GLOW PLUG 4 CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the (A208) Glow Plug 4 Control circuit at the Glow Plug 4 harness connector.

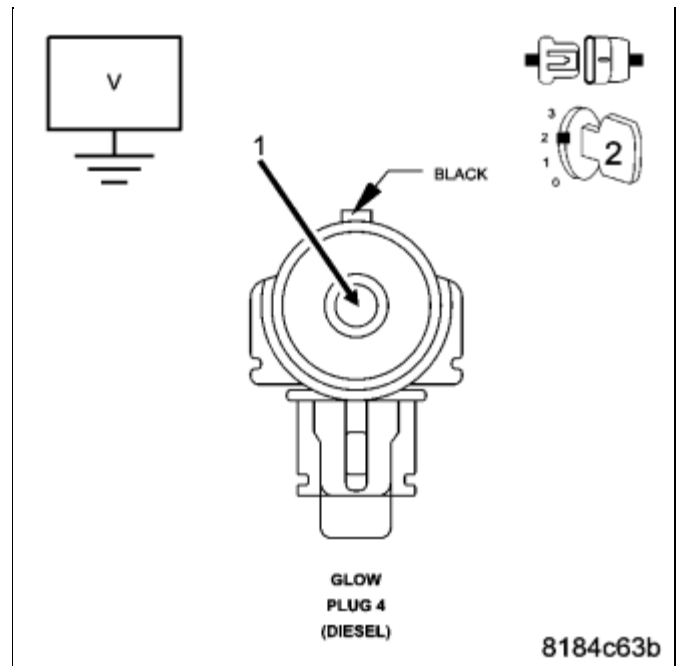
Is there voltage present on the (A208) Glow Plug 4 Control circuit?

Yes

- Repair the (A208) Glow Plug 4 Control circuit for a short to voltage
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. GLOW PLUG 4

Turn the ignition off.
Refer to the Service Information and replace the Glow Plug 4.
Turn the ignition on.
With the scan tool, erase ECM DTC's.
Perform several ignition key cycles leaving the ignition on for at least 10 seconds per cycle.
With the scan tool, read ECM DTC's.

Does the scan tool display this DTC?

Yes

- Go to [6](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plugs and the Glow Plug Module.
Look for any chafed, pierced, pinched, or partially broken wires.
Look for broken, bent, pushed out or corroded terminals.
Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

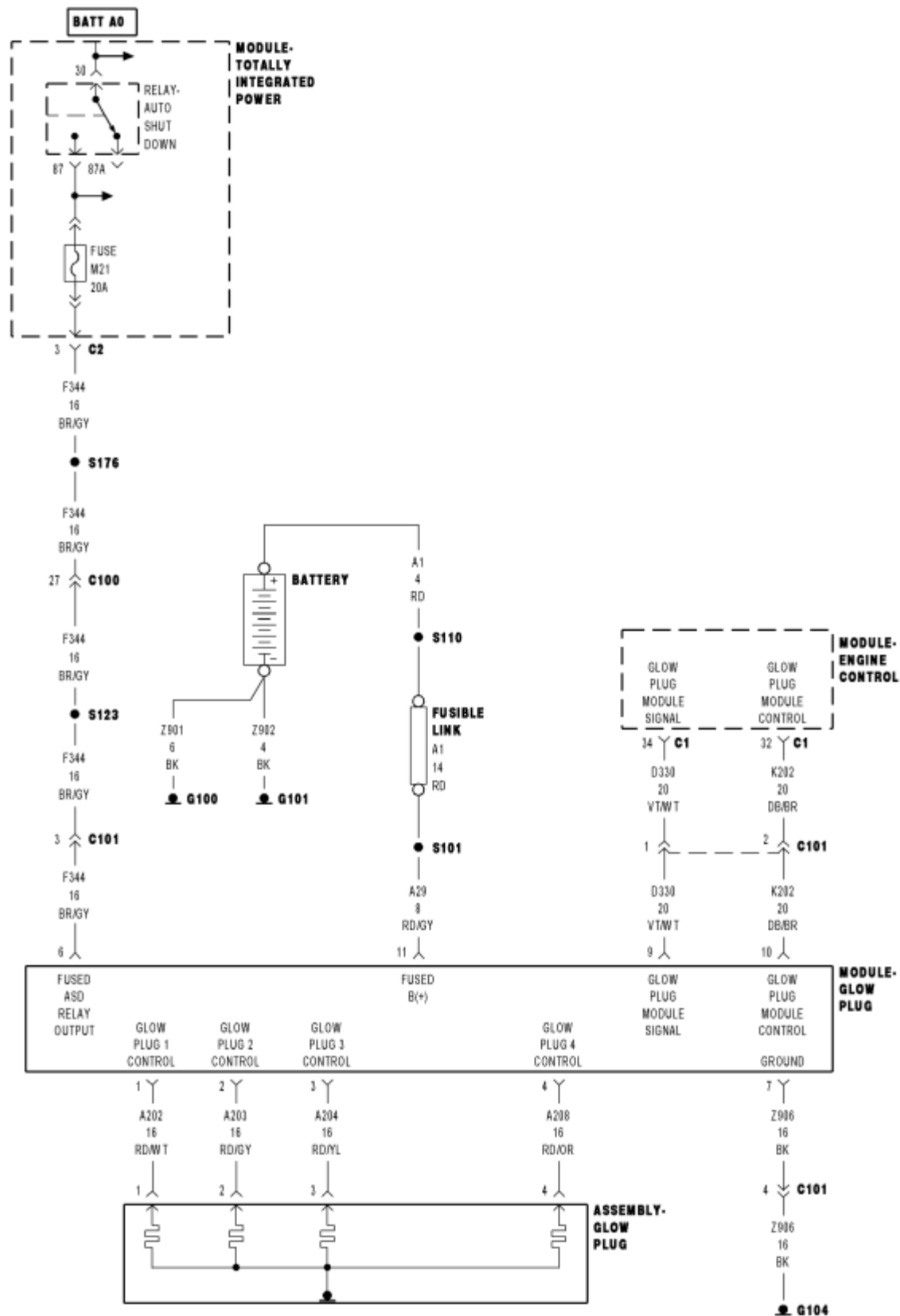
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0683-GLOW PLUG MODULE SIGNAL CIRCUIT MALFUNCTION



81a70293

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a malfunction on the (D330) Glow Plug Module Signal or (K202) Glow Plug Module Control circuit.

Possible Causes
ENGINE CONTROL MODULE
GLOW PLUG MODULE
(D330)/(K202) GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT OPEN
(D330)/(K202) GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO GROUND
(D330)/(K202) GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO VOLTAGE
INTERMITTENT CONDITION

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (D330)/(K202) GLOW PLUG MODULE SIG/CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the (D330) Glow Plug Module Signal circuit between the Glow Plug Module harness and the ECM harness connector.

Measure the resistance of the (K202) Glow Plug Module Control circuit between the Glow Plug Module harness and the ECM harness connector.

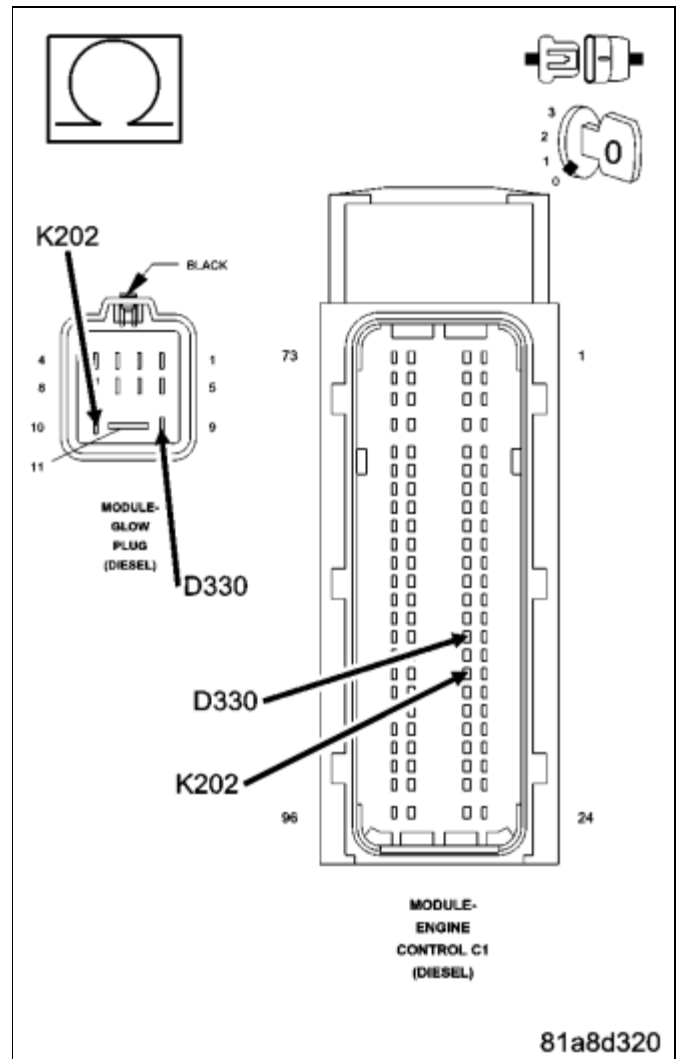
Is the resistance below 10.0 ohms for both measurements?

Yes

- Go To [3](#)

No

- Repair the Glow Plug Module circuit(s) that measured above 10.0 ohms for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (D330)/(K202) GLOW PLUG MODULE SIG/CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (D330) Glow Plug Module Signal circuit at the Glow Plug Module harness connector.

Measure the resistance between ground and the (K202) Glow Plug Module Control circuit at the Glow Plug Module harness connector.

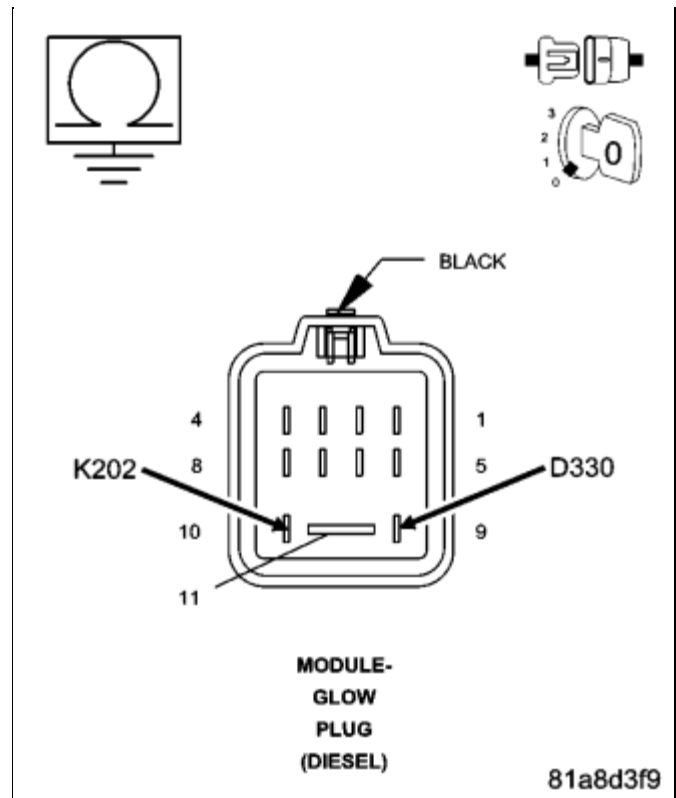
Is the resistance above 1000 ohms for both measurements?

Yes

- Go To [4](#)

No

- Repair the Glow Plug Module circuit(s) that measured below 1000 ohms for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (D330)/(K202) GLOW PLUG MODULE SIG/CONTROL CIRCUIT SHORTED TO VOLTAGE

Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage of the (D330) Glow Plug Module Signal circuit at the Glow Plug Module harness connector.
 Measure the voltage of the (K202) Glow Plug Module Control circuit at the Glow Plug Module harness connector.

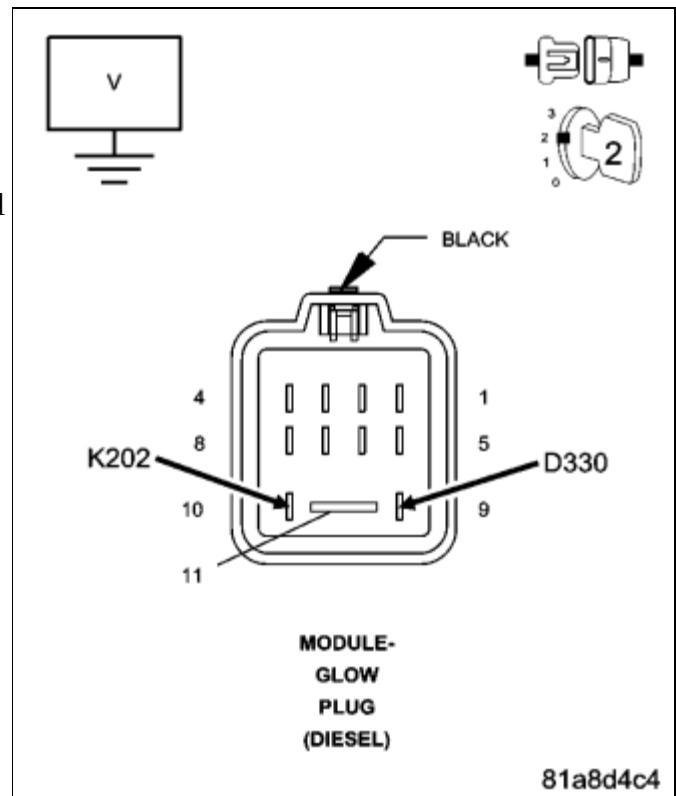
Is the voltage below 1.0 volt for both measurements?

Yes

- Go To [5](#)

No

- Repair the Glow Plug Module circuit(s) that measured above 1.0 volt for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. GLOW PLUG CONTROL MODULE

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Replace the Glow Plug Module in accordance with the Service Information.

Reconnect all connectors.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

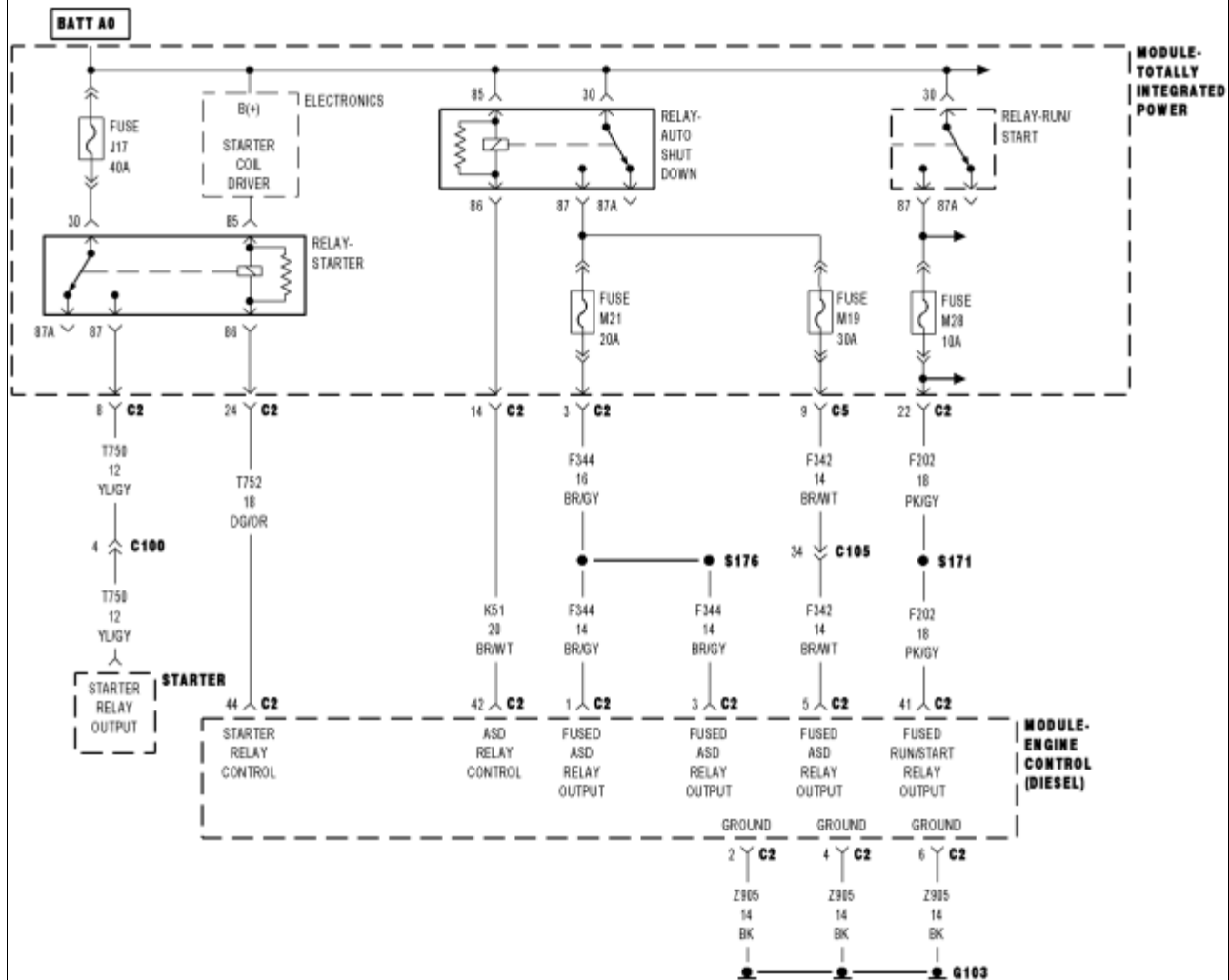
Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

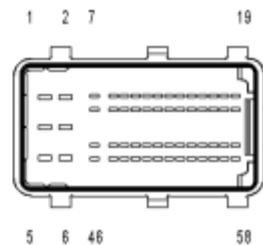
No

- Test Complete.

P068A-ECM RELAY OFF TOO EARLY



STARTER



MODULE-ENGINE CONTROL C2 (DIESEL)

81a798a8

For a complete wiring diagram Refer to Section 8W

Theory of Operation

When the ignition switch is turned off (ignition power removed from ECM) the ECM continues to drive the ECM/ASD relay on for approximately 20–40 seconds. This period of time is the After-Run Mode of operation. During After-Run the ECM performs several internal and external checks. When After-Run is complete, the ECM switches off the ECM/ASD relay driver and powers off the engine system.

- **When Monitored:**

When the ignition is turned off, during after-run mode of operation.

- **Set Condition:**

The internal ECM timer determines that the ASD Relay has shut off before the AFTER-RUN mode of operation has been completed.

Possible Causes
CHECK FOR OTHER DTCS
INTERMITTENT CONDITION
SUBSTITUTE ASD RELAY
(K51) ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY
ECM POWER AND GROUND CIRCUITS
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR OTHER DTCS

Turn the ignition on.

With the scan tool, check for additional DTCS.

Are other DTCS present?

Yes

- Refer to the Symptom List for diagnosis of the other DTCS before continuing.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CLEAR CODE AND CHECK IF THE DTC RESETS

With the scan tool, erase ECM DTCs.

Perform several ignition key cycles, pausing for at least 40 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. ASD RELAY

Turn the ignition off.

Install a known good relay in place of the ASD Relay.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition key cycles, pausing for at least 40 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [4](#)

No

- Replace the ASD Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K51) ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY

Turn the ignition off.
 Remove the ASD Relay from the TIPM.
 Disconnect the ECM harness connectors.
 Measure the resistance of the ASD Relay Control circuit while wiggling the wiring harness and connectors between the ECM and the TIPM.

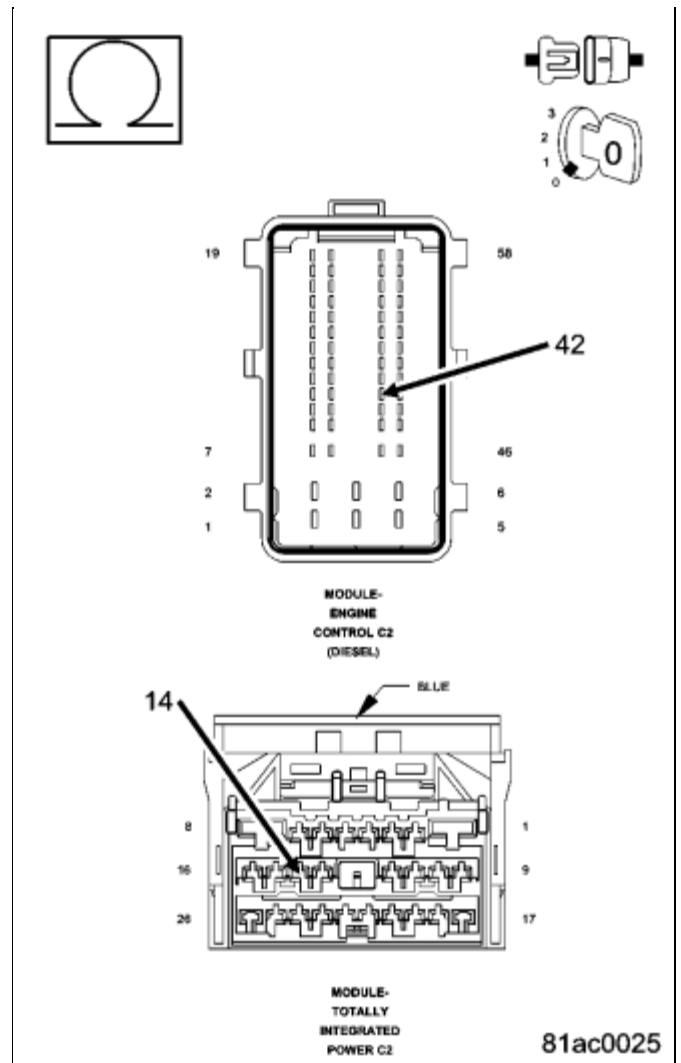
Was the resistance above 10.0 ohms at any time while wiggling the wiring harness and connectors?

Yes

- Repair the ASD Relay Control circuit for an intermittent open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. CHECK THE ECM POWER AND GROUND CIRCUITS

Turn the ignition off.
 Install the ASD relay.
 Refer to symptom CHECKING THE ECM POWER AND GROUNDS and verify proper Ignition, Battery and Ground circuits at the ECM.

Were any problem found with the ECM Ignition, Battery or Ground circuits?

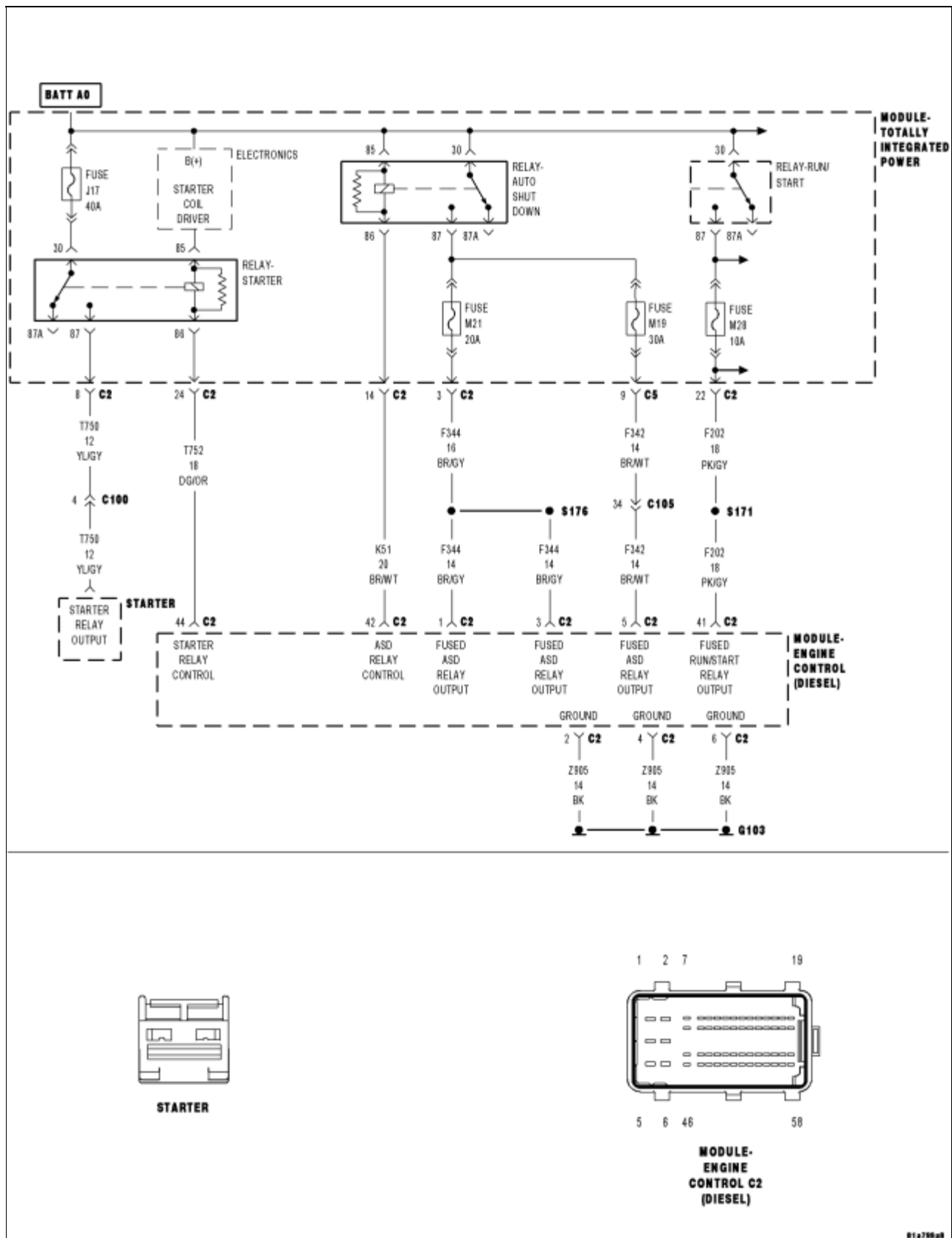
Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P068B-ECM RELAY OFF TOO LATE



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When the ignition switch is turned off (ignition power removed from ECM) the ECM continues to drive the ECM/ASD relay on for approximately 20–40 seconds. This period of time is the After-Run Mode of operation. During After-Run the ECM performs several internal and external checks. When After-Run is complete, the ECM switches off the ECM/ASD relay driver and powers off the engine system.

- **When Monitored:**

When the ignition is turned off, during AFTER-RUN mode of operation.

- **Set Condition:**

The internal ECM timer determines that the ASD Relay remained on for 2.0 seconds once AFTER-RUN mode of operation has been completed.

Possible Causes
CHECK FOR OTHER DTCS
INTERMITTENT CONDITION
SUBSTITUTE ASD RELAY
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND INTERMITTENTLY
ASD RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR OTHER DTCS

Turn the ignition on.
With the scan tool, check for additional DTCS.

Are other DTCS present?

Yes

- Refer to the Symptom List for diagnosis of the other DTCs before continuing.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CLEAR CODE AND CHECK IF THE DTC RESETS

Perform several ignition key cycles, pausing for at least 40 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [3](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. ASD RELAY

Turn the ignition off.

Install a known good relay in place of the ASD Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Perform several ignition key cycles, pausing for at least 40 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

Did this DTC set again?

Yes

- Go To [4](#)

No

- Replace the ASD Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND INTERMITTENTLY

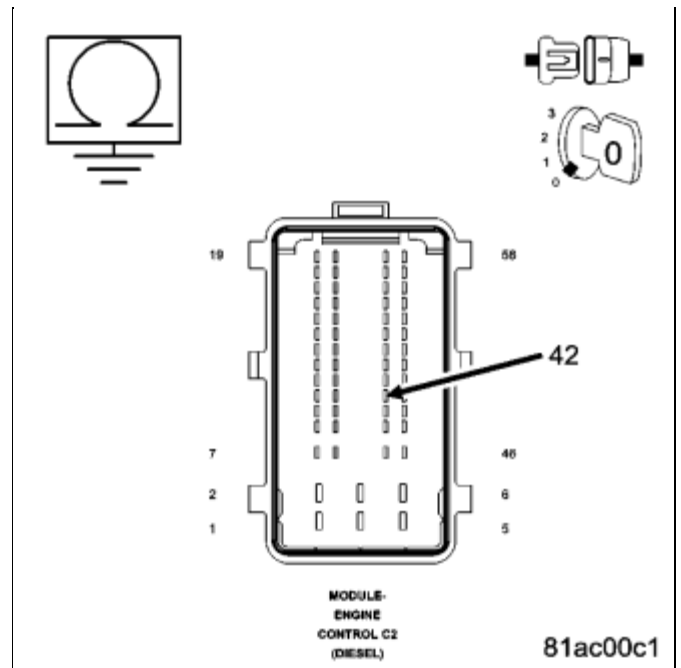
Was the resistance below 1000 ohms at any time while wiggling the wiring harness and connectors?

Yes

- Repair the (K51) ASD Relay Control circuit for an intermittent short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. ASD RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE

Turn the ignition on.
Measure the voltage of the ASD Relay Output circuit.

Is the voltage below 1.00 volt?

Yes

- Go To [6](#)

No

- Repair the ASD Relay Output circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. CHECK THE ECM POWER AND GROUND CIRCUITS

Turn the ignition off.
Install the ASD relay.
Refer to symptom **CHECKING THE ECM POWER AND GROUNDS** and verify proper Ignition, Battery and Ground circuits at the ECM.

Were any problem found with the ECM Ignition, Battery or Ground circuits?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0691-COOLING FAN 1 CONTROL CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects an open in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay, RAD FAN 1.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. LOW SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the Low Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the Low Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the Low Speed Cooling Fan Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. TOTALLY INTEGRATED POWER MODULE

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors.
Pay particular attention to all Power and Ground circuits.

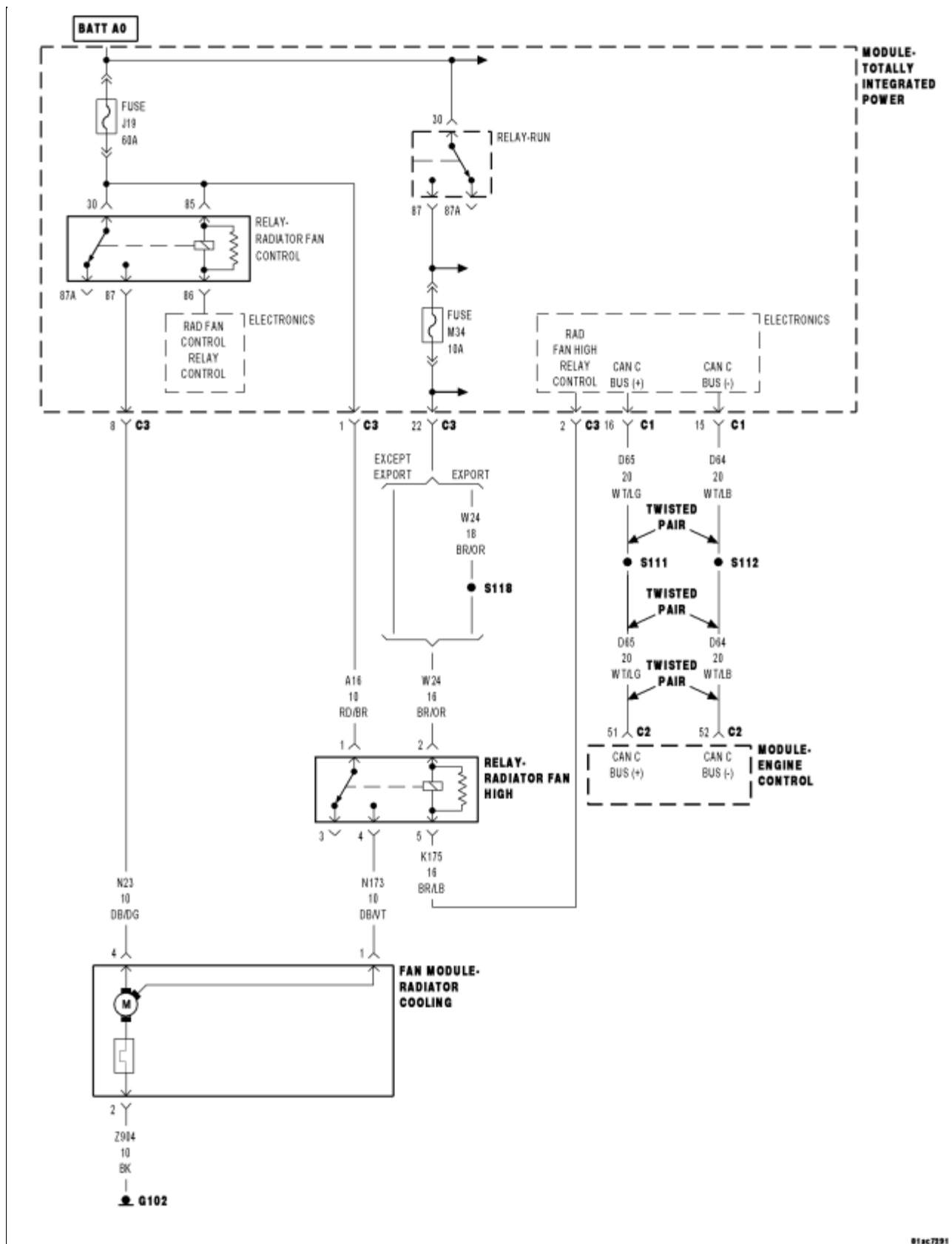
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0692-COOLING FAN 1 CONTROL CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects a shorted condition in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay RAD FAN 1.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. LOW SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the Low Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the Low Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the Low Speed Cooling Fan Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. TOTALLY INTEGRATED POWER MODULE

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors.
Pay particular attention to all Power and Ground circuits.

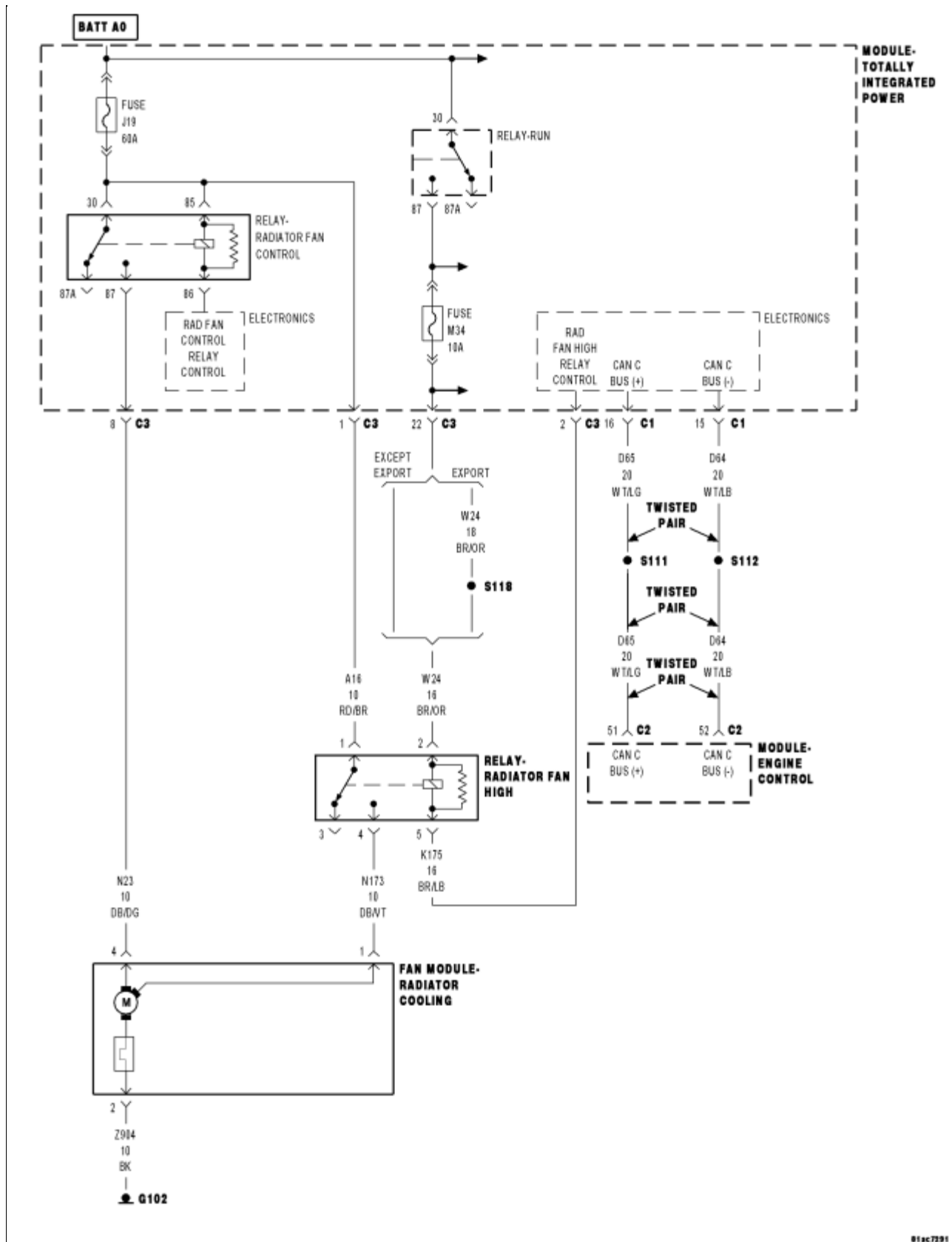
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0693-COOLING FAN 2 CONTROL CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects an open or short to ground in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO GROUND
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT OPEN
HIGH SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the High Speed Cooling Fan Relay RAD FAN 2.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. HIGH SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the High Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit.

Remove the High Speed Cooling Fan Relay and substitute it with a known good Relay.
 Ignition on, engine not running.
 With a scan tool, actuate the High Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the High Speed Cooling Fan Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.
 Disconnect the C3 TIPM harness connector.
 Remove the High Speed Cooling Fan Relay.
 Measure the resistance between ground and the (K175) High Speed Cooling Fan Relay Control circuit at the relay connection.

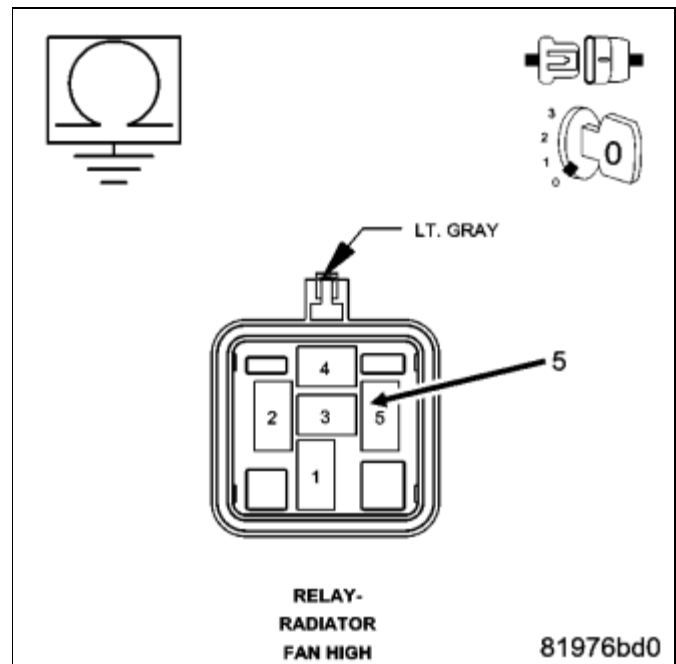
Is the resistance below 100 ohms?

Yes

- Repair the short to ground in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (K175) High Speed Cooling Fan Relay Control circuit from the C3 TIPM harness connector to the Relay connection.

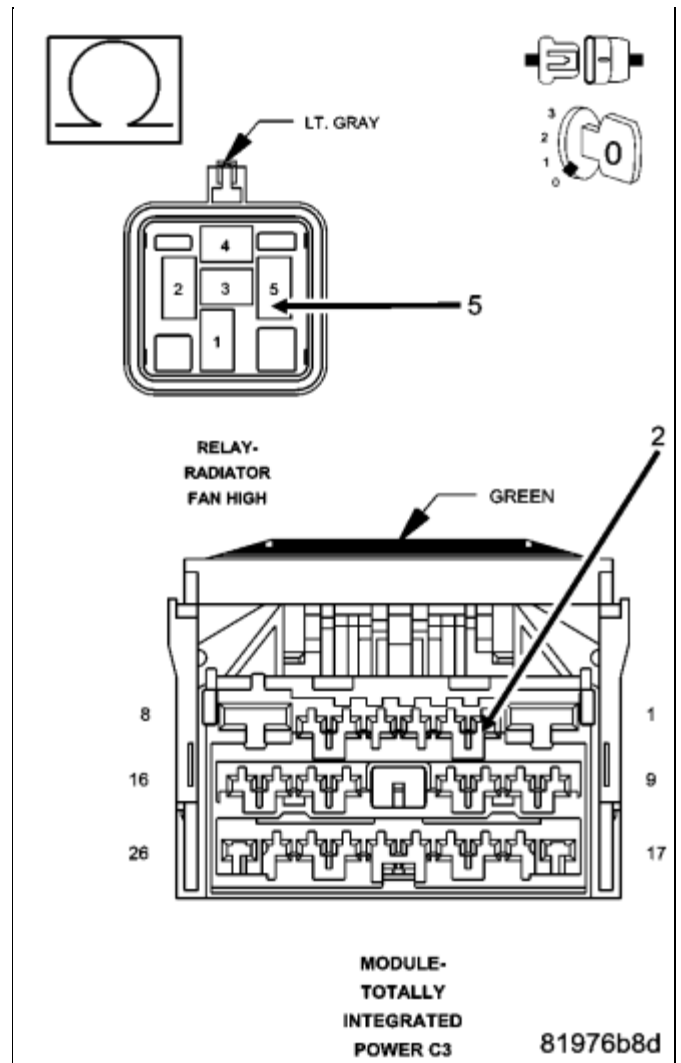
Is the resistance above 5.0 ohms?

Yes

- Repair the open or excessive resistance in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. TOTALLY INTEGRATED POWER MODULE

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0694-COOLING FAN 2 CONTROL CIRCUIT HIGH

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

The ECM is requesting the TIPM to turn on the Cooling Fan On and it is not operating. The TIPM detects a short to voltage in the Relay Coil Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
HIGH SPEED COOLING FAN RELAY
TOTALLY INTEGRATED POWER MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the High Speed Cooling Fan Relay RAD FAN 2.

Is the Cooling Fan operating?

Yes

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. HIGH SPEED COOLING FAN RELAY

Turn the ignition off.

Verify the High Speed Cooling Fan Relay is installed properly and that the terminals are making a tight fit. Remove the High Speed Cooling Fan Relay and substitute it with a known good Relay.

Ignition on, engine not running.
With a scan tool, actuate the High Speed Cooling Fan Relay.

Is the Cooling Fan operating?

Yes

- Replace the High Speed Cooling Fan Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (K175) HIGH SPEED COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the C3 TIPM harness connector.
Remove the High Speed Cooling Fan Relay.
Ignition on, engine not running.
Measure the voltage on the (K175) High Speed Cooling Fan Relay Control circuit at the relay connection.

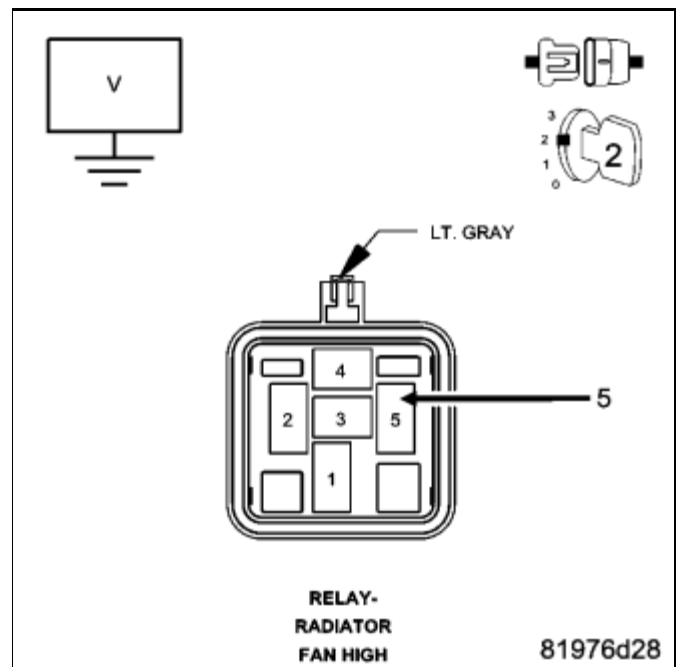
Is there any voltage present?

Yes

- Repair the short to voltage in the (K175) High Speed Cooling Fan Relay Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. TOTALLY INTEGRATED POWER MODULE

NOTE: Before continuing, check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors.
Pay particular attention to all Power and Ground circuits.

Were any problems found?

Yes

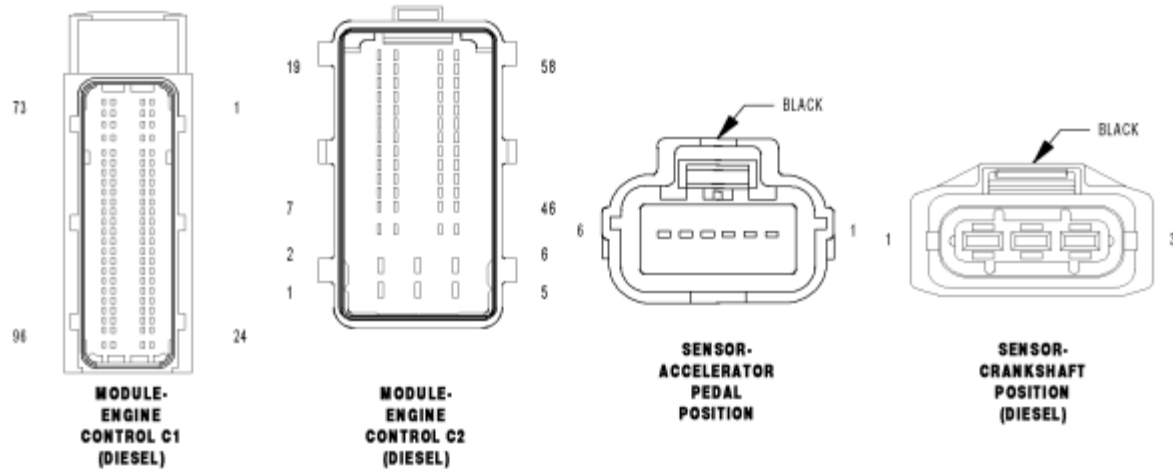
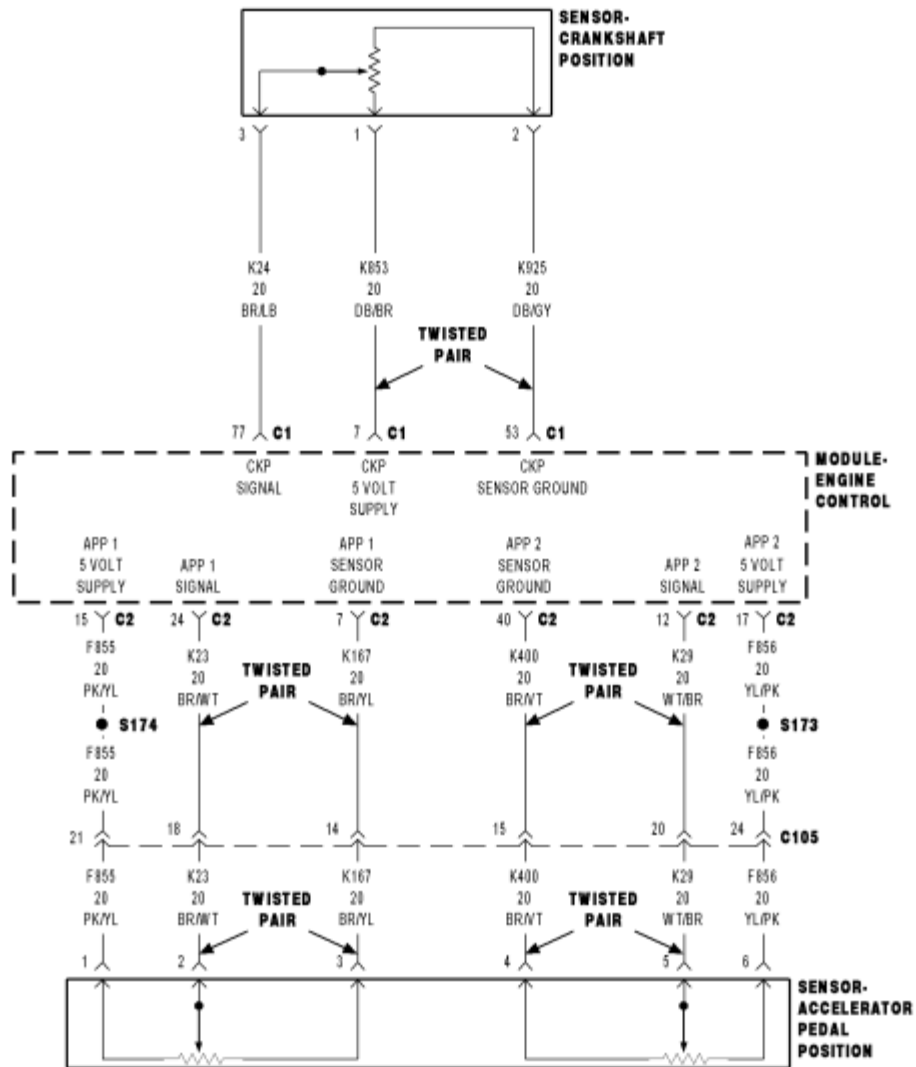
- Repair as necessary.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0698-SENSOR REFERENCE VOLTAGE 3 CIRCUIT LOW



81a754a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a low voltage on the Sensor Supply 3 circuit for 0.10 seconds

Possible Causes
INTERMITTENT DTC
CRANKSHAFT POSITION SENSOR
ACCELERATOR PEDAL POSITION SENSOR
5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ENGINE CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 2 provides 5 volts to the Crankshaft Position Sensor and the Accelerator Pedal Position Sensor 1.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

With the scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CRANKSHAFT POSITION SENSOR SHORTED TO GROUND

Turn the ignition off.

Disconnect the Crankshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K853) Crankshaft Position Sensor 5 Volt Supply circuit at the Crankshaft Position Sensor harness connector.

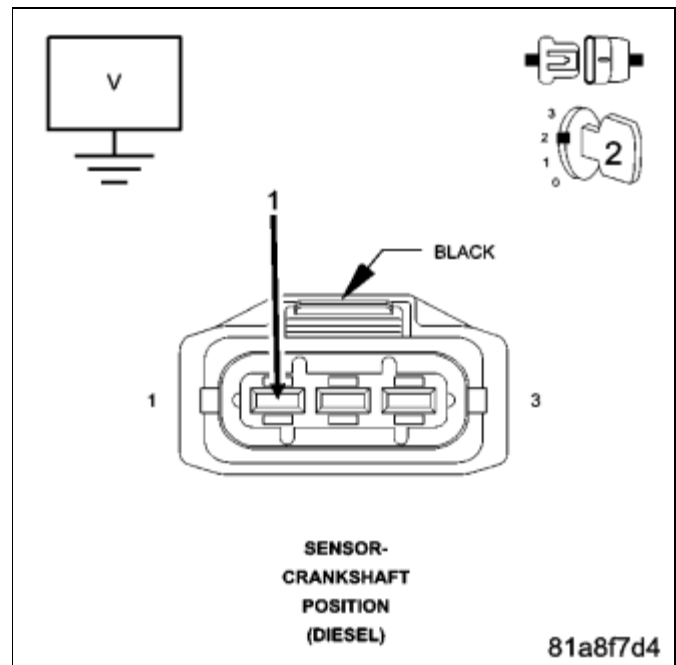
Is the voltage above 4.6 volts?

Yes

- Replace the Crankshaft Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)



3. ACCELERATOR PEDAL POSITION SENSOR 1 SHORTED TO GROUND

Turn the ignition off.

Disconnect the Accelerator Pedal Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K855) Accelerator Pedal Position Sensor 1 5 Volt Supply circuit at the Accelerator Pedal Position Sensor harness connector.

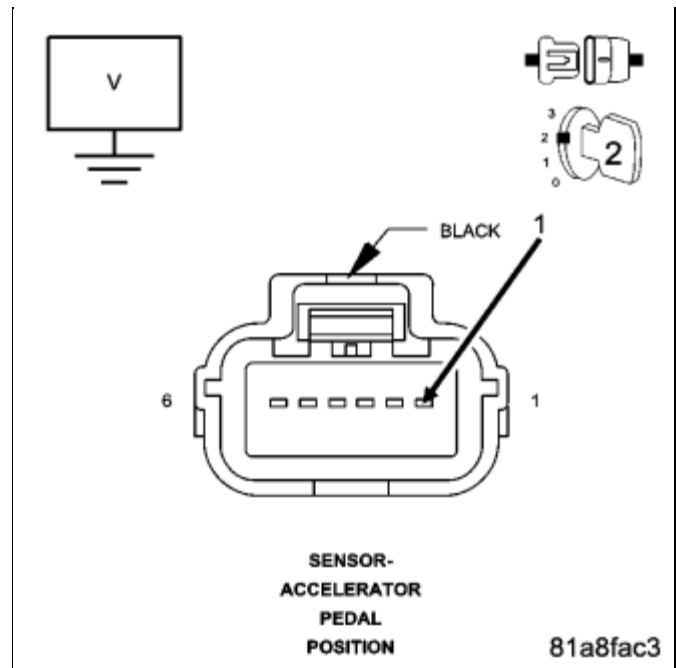
Is the voltage above 4.6 volts?

Yes

- Replace the Accelerator Pedal Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the (K853) Crankshaft Position Sensor 5 Volt Supply circuit at the Crankshaft Position Sensor harness connector.

Measure the resistance between ground and the (F855) Accelerator Pedal Position Sensor 1 5 Volt Supply circuit at the Accelerator Pedal Position Sensor harness connector.

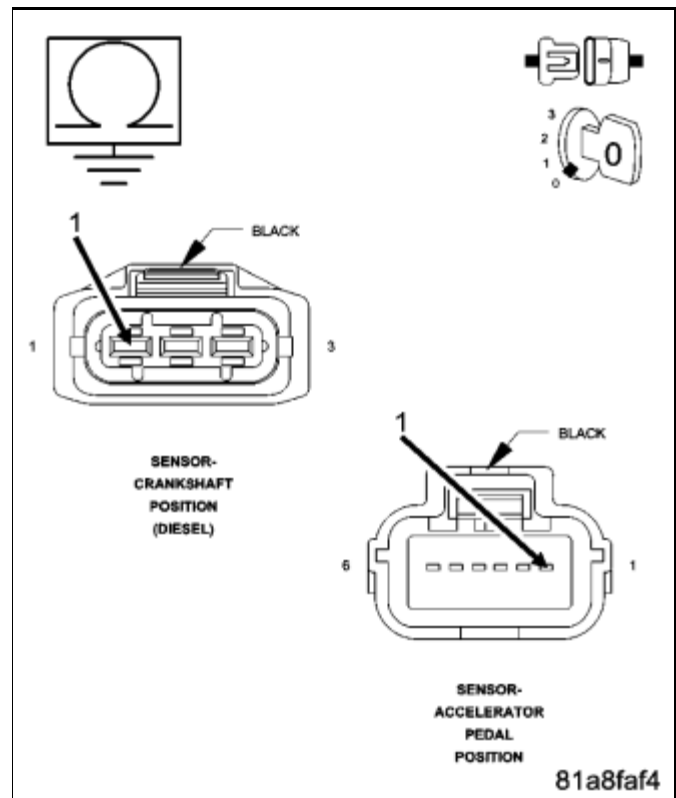
Is the resistance above 1000 ohms for each circuit?

Yes

- Go To [5](#)

No

- Repair the 5-Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ENGINE CONTROL MODULE (ECM)

Turn the ignition off.

Inspect the (K853) Crankshaft Position Sensor 5 Volt Supply circuit between the Crankshaft Position Sensor harness connector and the ECM harness connector.

Inspect the (F855) Accelerator Pedal Position Sensor 1 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the ECM harness connector.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

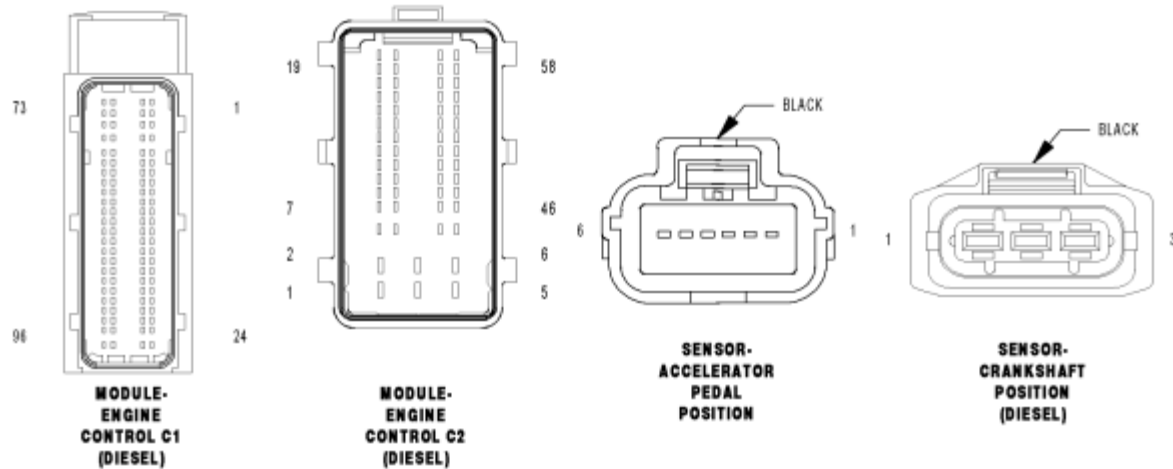
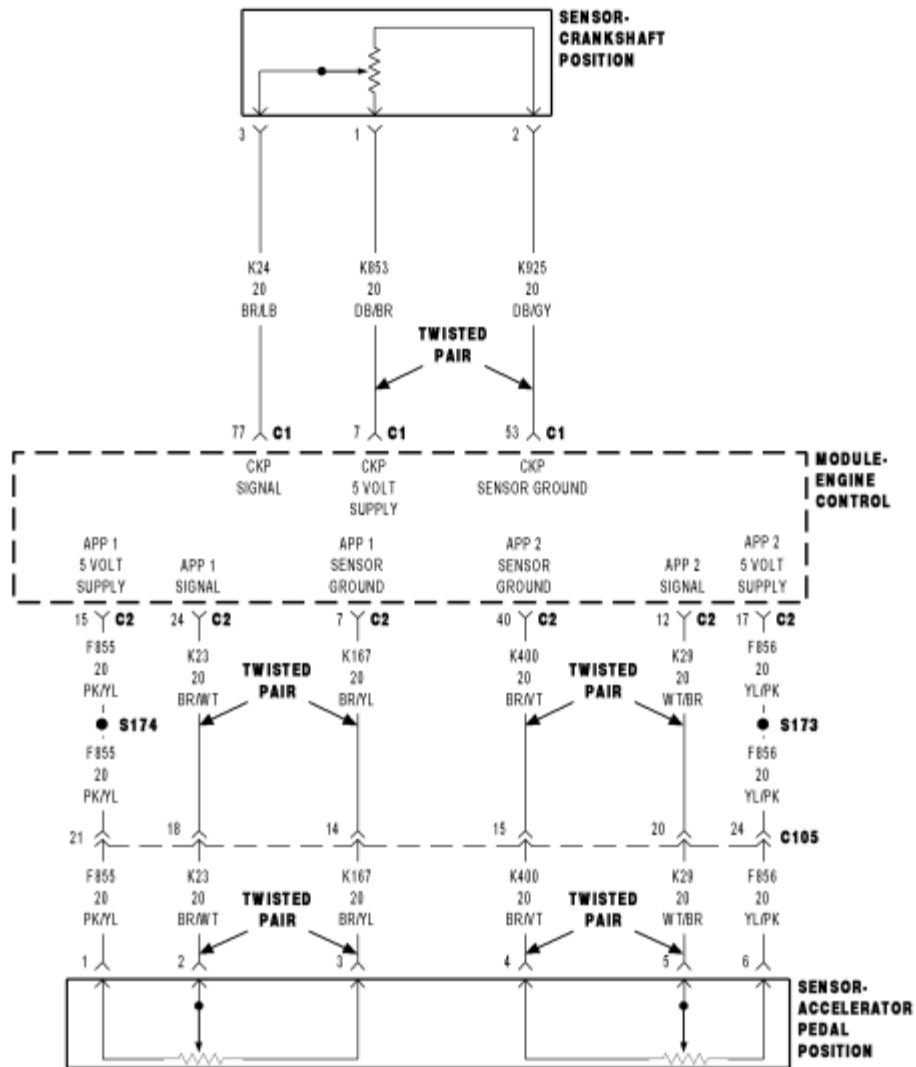
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0699-SENSOR REFERENCE VOLTAGE 3 TOO HIGH



81a754a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to voltage on the Sensor Supply 3 circuit for 0.10 seconds.

Possible Causes
INTERMITTENT DTC
(F855) ACCELERATOR PEDAL POSITION SENSOR 1 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K853) CRANKSHAFT POSITION SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Theory of Operation

The ECM contains 3 internal 5–Volt Sensor Supply sources. Each 5–Volt Supply source is split into parallel circuits to provide 5 volts to multiple sensors. Sensor Supply 2 provides 5 volts to the Crankshaft Position Sensor and the Accelerator Pedal Position Sensor 1.

Diagnostic Test

1. CHECK FOR ACTIVE DTC

Turn the ignition on.
 With the scan tool, erase ECM DTCs.
 Turn the ignition off for 10 seconds.
 Turn the ignition on.
 With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F855) ACCELERATOR PEDAL POSITION SENSOR 1 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Accelerator Pedal Position Sensor harness connector.
 Disconnect the ECM harness connectors.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
 Turn the ignition on.
 Measure the voltage on the (F855) Accelerator Pedal Position Sensor 1 5-Volt Supply circuit at the Accelerator Pedal Position Sensor harness connector.

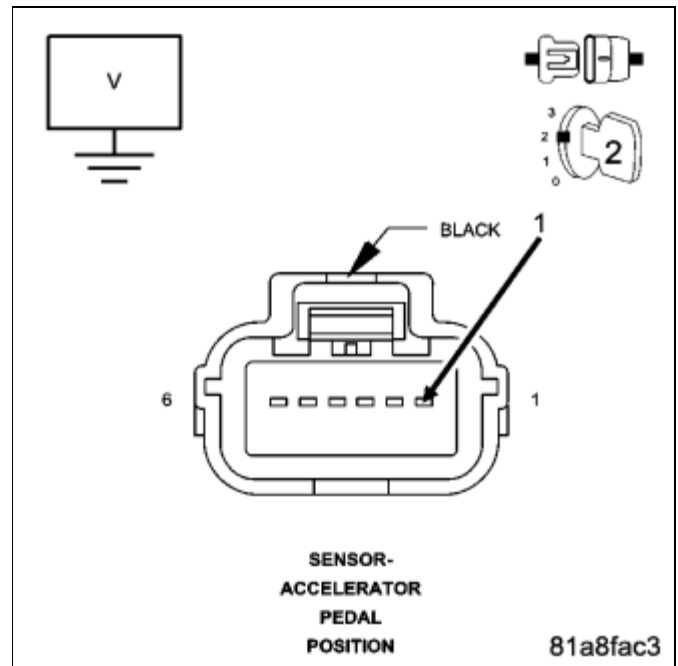
Is the voltage below 1.0 volt?

Yes

- Go To [3](#)

No

- Repair the (F855) Accelerator Pedal Position Sensor 1 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



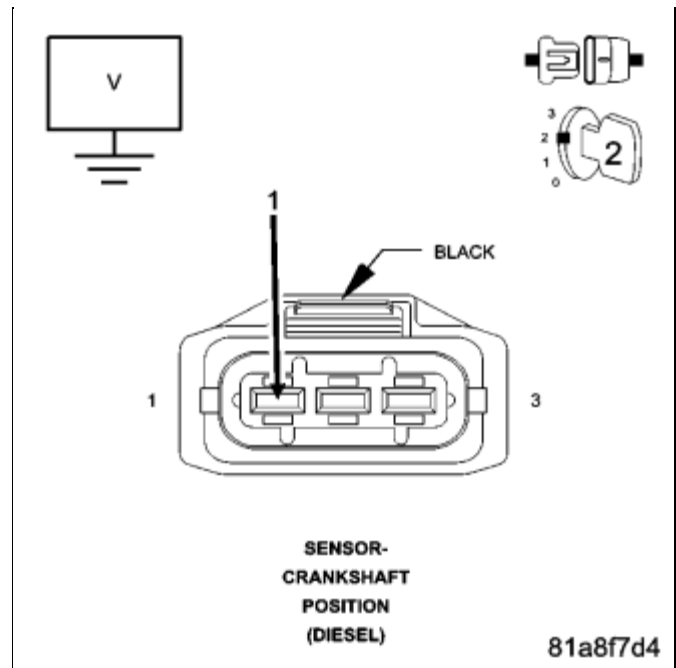
3. (K853) CRANKSHAFT POSITION SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Crankshaft Position Sensor harness connector.

NOTE: The jumper wire should still be in place.

Turn the ignition on.
 Measure the voltage of the (K853) Crankshaft Position Sensor 5 Volt Supply circuit at the CKP Sensor harness connector.

Is the voltage below 1.0 volt?



Yes

- Go To [4](#)

No

- Repair the (K853) Crankshaft Position Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ENGINE CONTROL MODULE (ECM)

Turn the ignition off.

Remove the jumper wire and install the ASD relay.

Inspect the (K853) Crankshaft Position Sensor 5 Volt Supply circuit between the Crankshaft Position Sensor and the ECM.

Inspect the (F855) Accelerator Pedal Position Sensor 1 5 Volt Supply circuit between the Accelerator Pedal Position Sensor and the ECM.

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

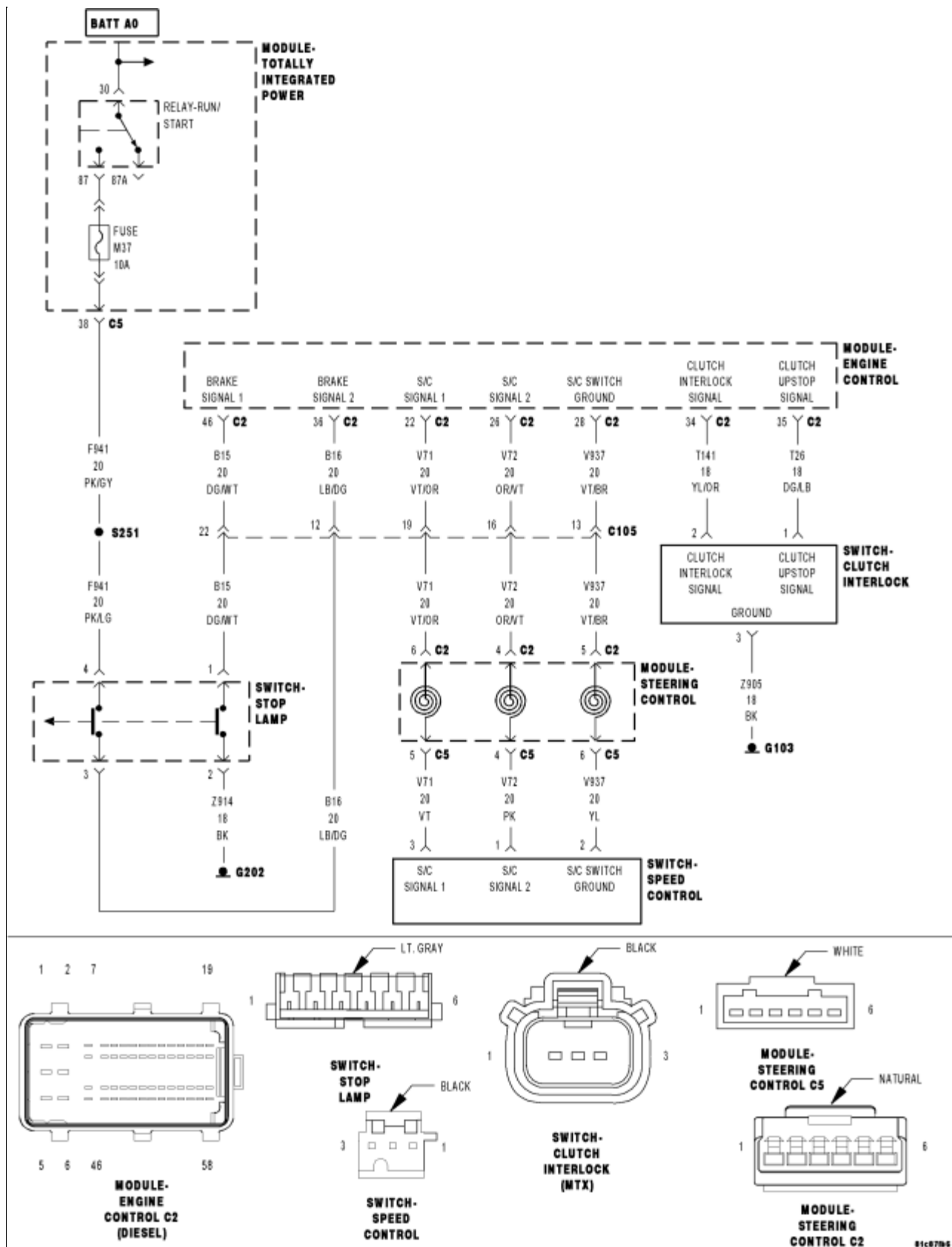
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0830-CLUTCH PEDAL SWITCH CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

While driving the vehicle and shifting gears.

◦ **Set Condition:**

The Engine Control Module (ECM) does not detect changes in the (T141) Clutch Interlock Switch Signal circuit voltage while CAN messages from the Transmission Control Module indicate transmission gear changes.

Possible Causes
INTERMITTENT DTC
(T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE
(T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(Z905) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
CLUTCH INTERLOCK SWITCH
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Press and release the clutch pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

2. (T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.
 Disconnect the Clutch Interlock Switch harness connector.
 Turn the ignition on.
 Measure the voltage of the (T141) Clutch Interlock Switch Signal circuit in the Clutch Interlock Switch harness connector.

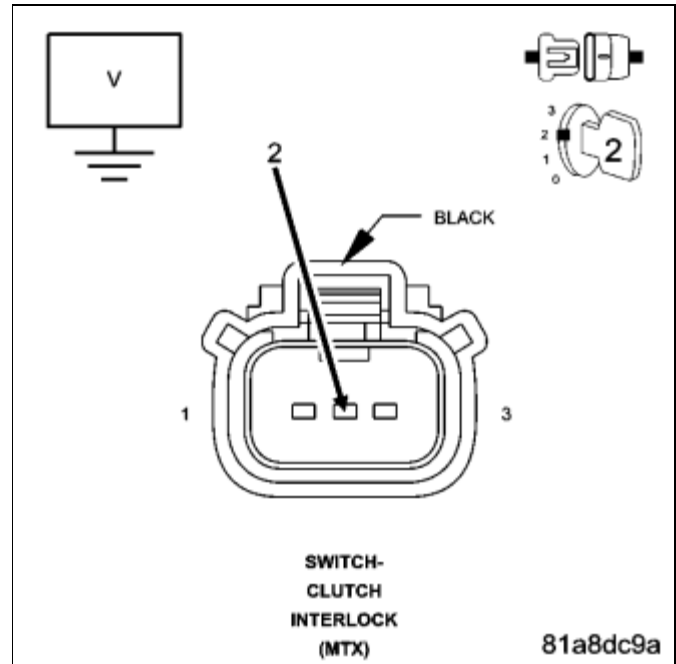
Is the voltage above 10.0 volts?

Yes

- Go to [3](#)

No

- Go to [5](#)



3. (Z905) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12 volt test light connected to 12 volts, check the (Z905) Ground circuit in the Clutch Interlock Switch harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

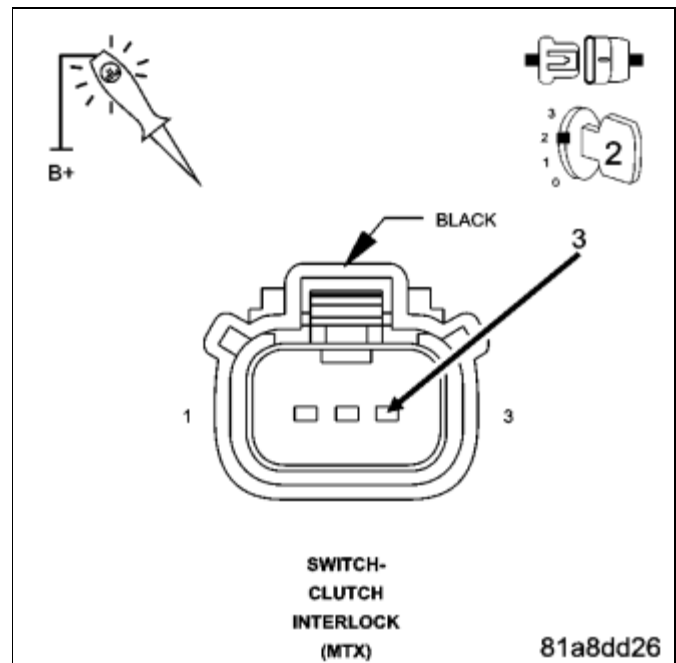
Is the test light illuminated and bright?

Yes

- Go to [4](#)

No

- Repair the (Z905) Ground for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. CLUTCH INTERLOCK SWITCH

Turn the ignition off.

Connect a jumper wire between the (Z905) Ground circuit and the (T141) Clutch Interlock Switch Signal circuit in the Clutch Interlock Switch harness connector.

Turn the ignition on.

With the scan tool, monitor the Clutch Interlock status.

NOTE: The scan tool should display the Clutch Interlock status as pressed with the jumper wire in place and not pressed with the jumper wire removed.

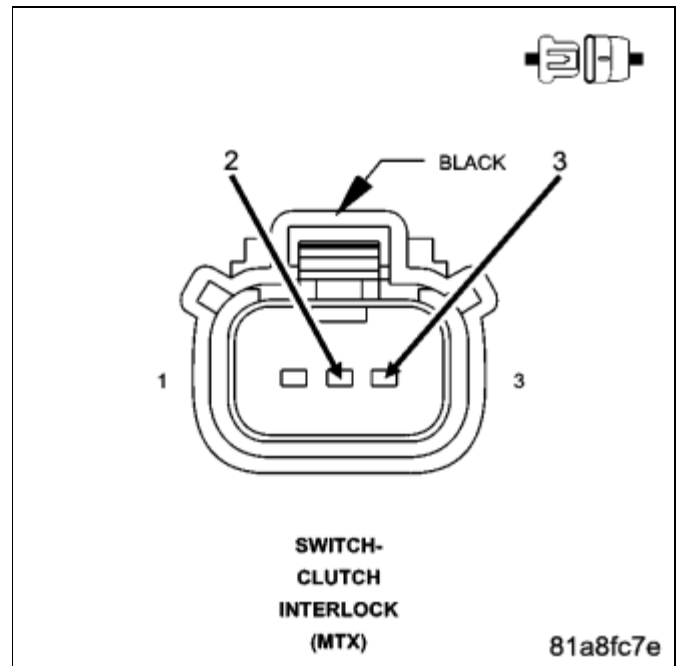
Does the scan tool display the status as described above?

Yes

- Replace the Clutch Interlock Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [8](#)



5. (T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (T141) Clutch Interlock Switch Signal circuit in the Clutch Interlock Switch harness connector.

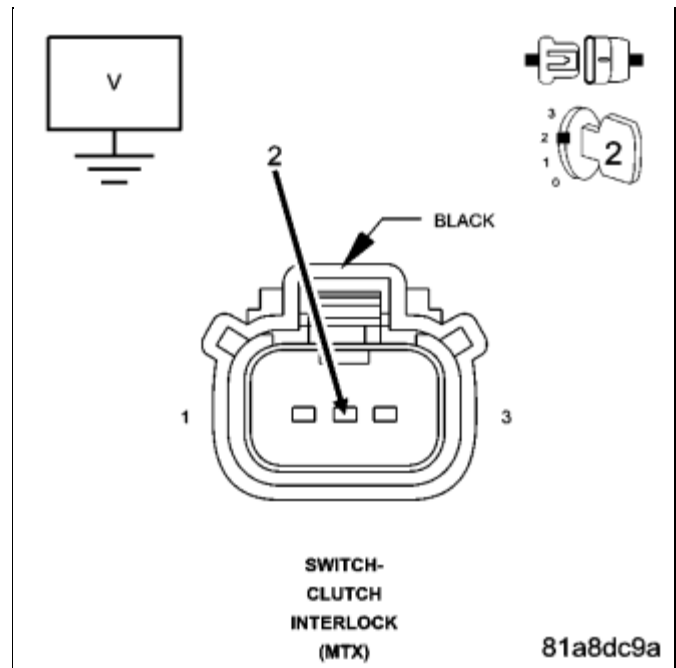
Is there any voltage present?

Yes

- Repair the (T141) Clutch Interlock Switch Signal

circuit for a short to voltage.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. (T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (T141) Clutch Interlock Switch Signal circuit in the Clutch Interlock Switch harness connector.

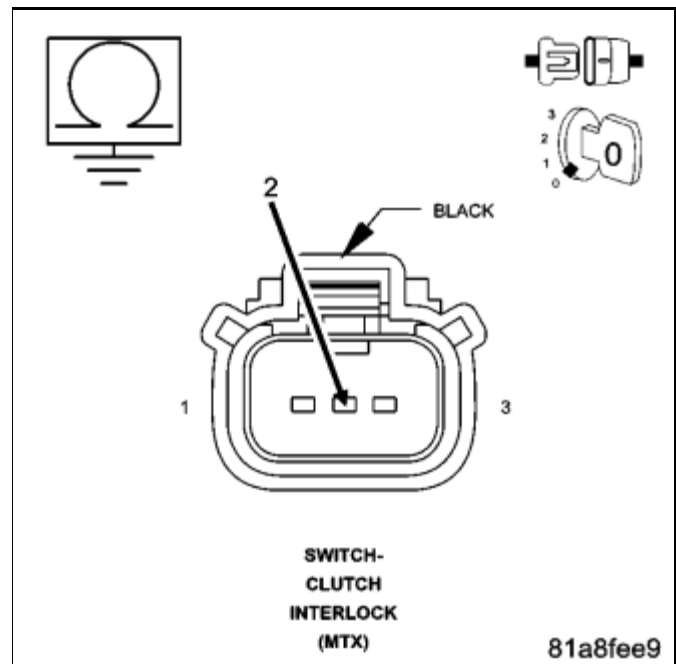
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (T141) Clutch Interlock Switch Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (T141) CLUTCH INTERLOCK SWITCH SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (T141) Clutch Interlock Switch Signal circuit between the Clutch Interlock Switch harness connector and the Engine Control Module (ECM) harness connector.

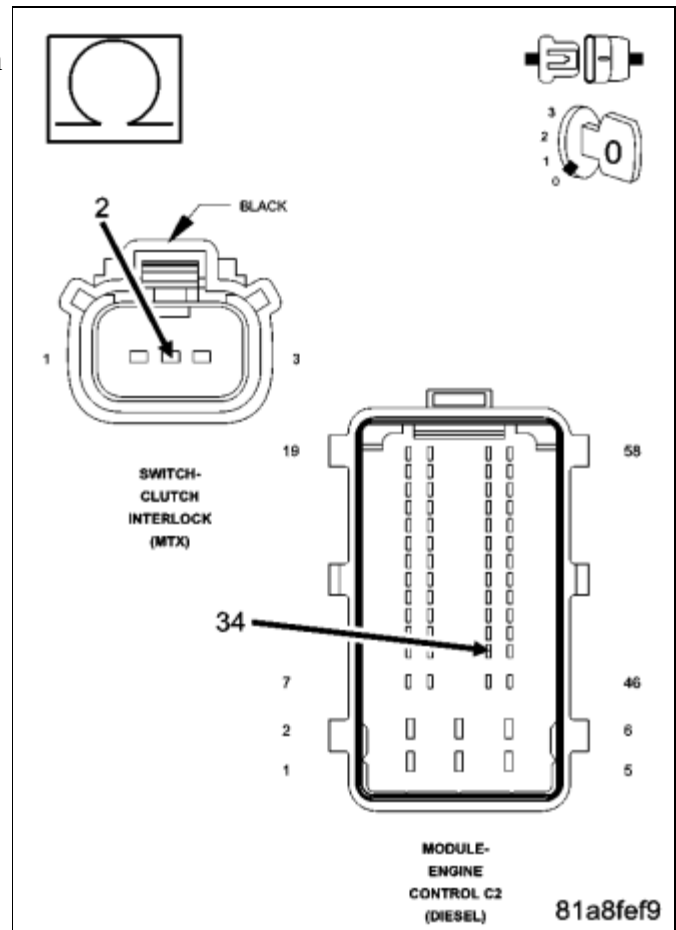
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (T141) Clutch Interlock Switch Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Clutch Interlock Switch and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

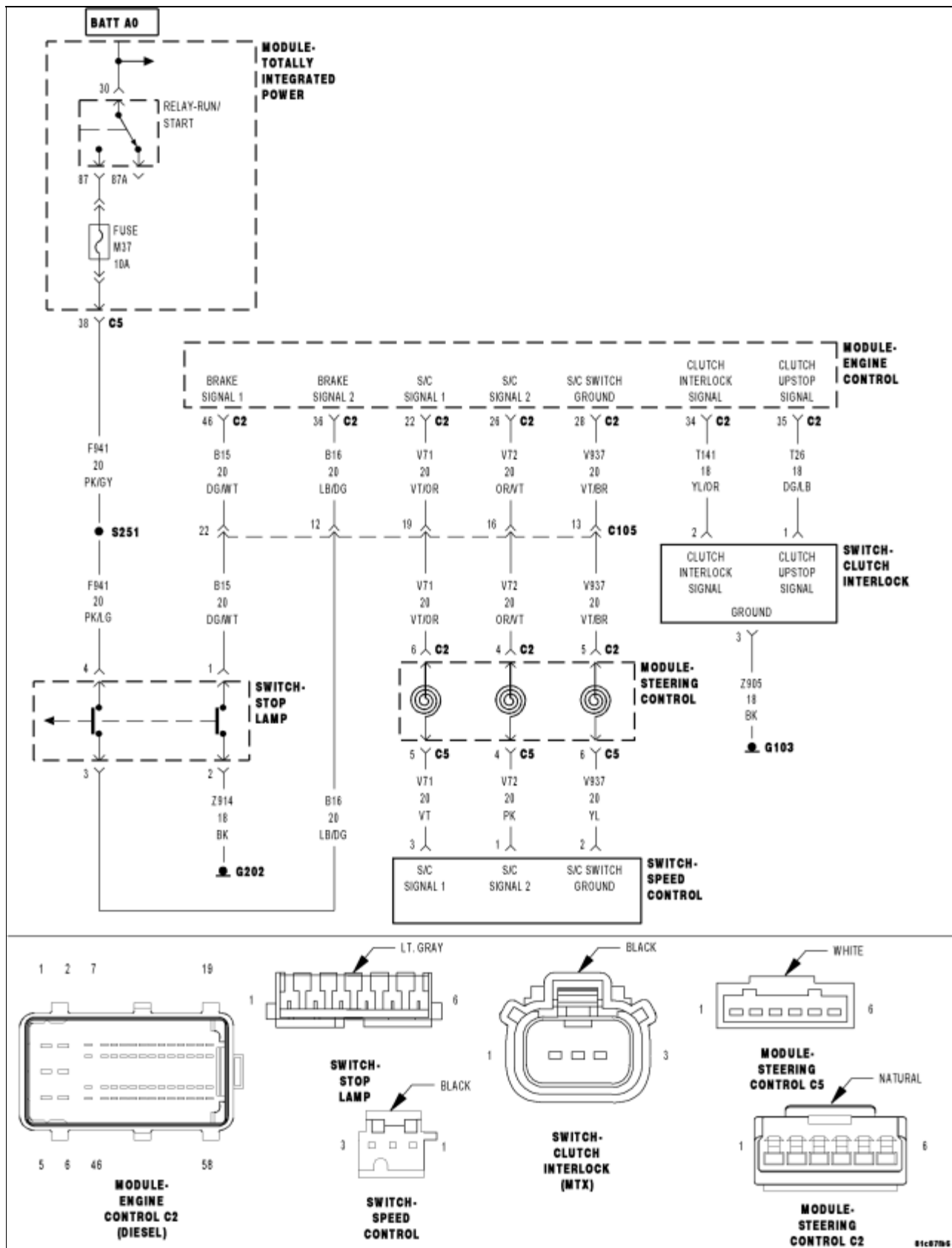
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0833-CLUTCH UPSTOP SWITCH PERFORMANCE



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Engine Control Module (ECM) detects that the (T26) Clutch Upstop Switch Signal circuit signal is implausible.

Possible Causes
INTERMITTENT DTC
(T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE
(T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(Z905) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
CLUTCH INTERLOCK SWITCH
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Press and release the clutch pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.
Disconnect the Clutch Interlock Switch harness connector.
Turn the ignition on.
Measure the voltage of the (T26) Clutch Upstop Switch Signal circuit in the Clutch Interlock Switch harness connector.

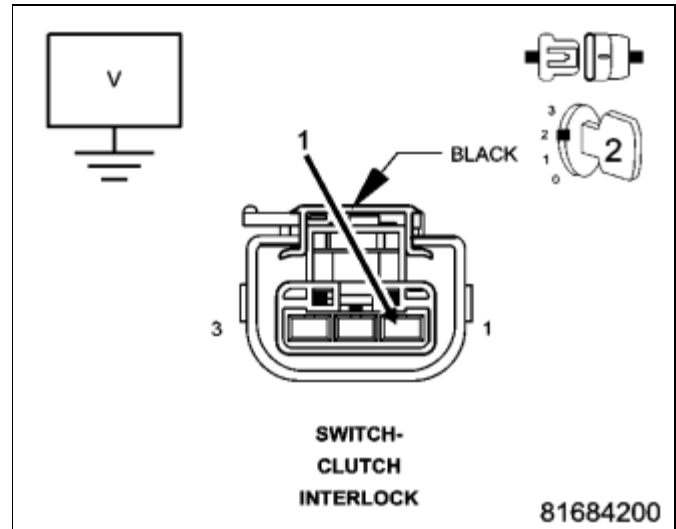
Is the voltage above 10.0 volts?

Yes

- Go to [3](#)

No

- Go to [5](#)



3. (Z905) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12 volt test light connected to 12 volts, check the (Z905) Ground circuit between the Clutch Interlock Switch harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

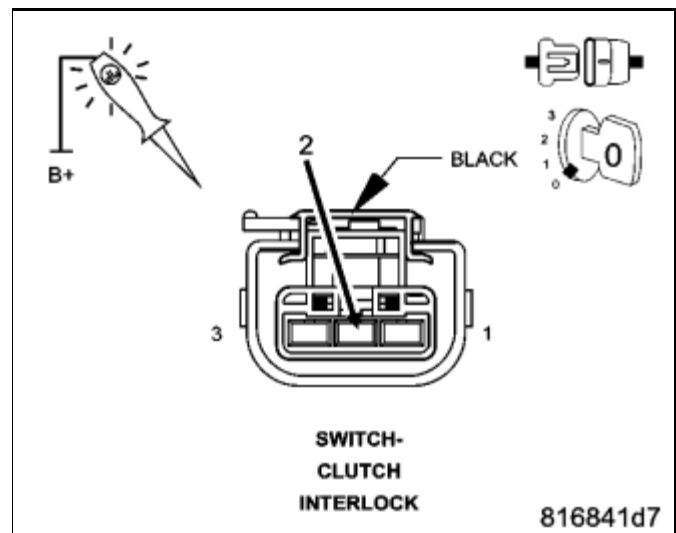
Is the test light illuminated and bright?

Yes

- Go to [4](#)

No

- Repair the (Z905) Ground for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. CLUTCH INTERLOCK SWITCH

Turn the ignition off.

Connect a jumper wire between the (Z905) Ground circuit and the (T26) Clutch Upstop Switch Signal circuit in the Clutch Interlock Switch harness connector.

Turn the ignition on.

With the scan tool, monitor the Clutch Upstop status.

NOTE: The scan tool should display the Clutch Interlock status as not pressed with the jumper wire in place and pressed with the jumper wire removed.

Does the scan tool display the status as described above?

Yes

- Replace the Clutch Interlock Switch in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [8](#)

5. (T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (T26) Clutch Upstop Switch Signal circuit in the Clutch Interlock Switch harness connector.

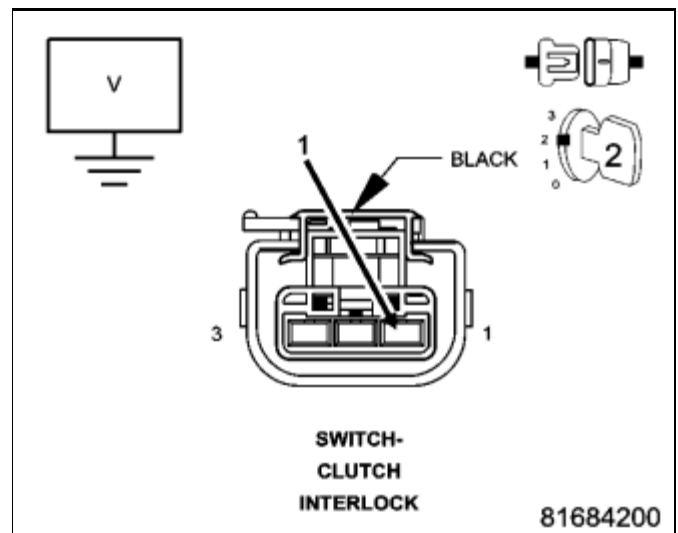
Is there any voltage present?

Yes

- Repair the (T26) Clutch Upstop Switch Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)



6. (T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (T26) Clutch Upstop Switch Signal circuit in the Clutch Interlock Switch harness connector.

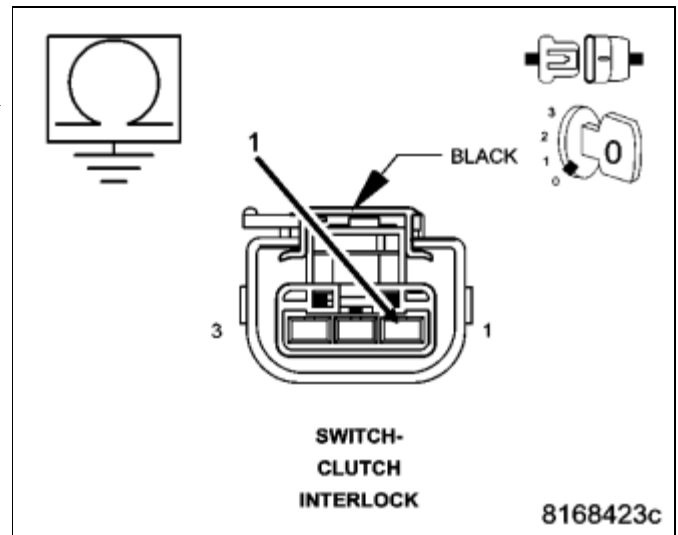
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (T26) Clutch Upstop Switch Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (T26) CLUTCH UPSTOP SWITCH SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (T26) Clutch Upstop Switch Signal circuit between the Clutch Interlock Switch harness connector and the Engine Control Module (ECM) harness connector.

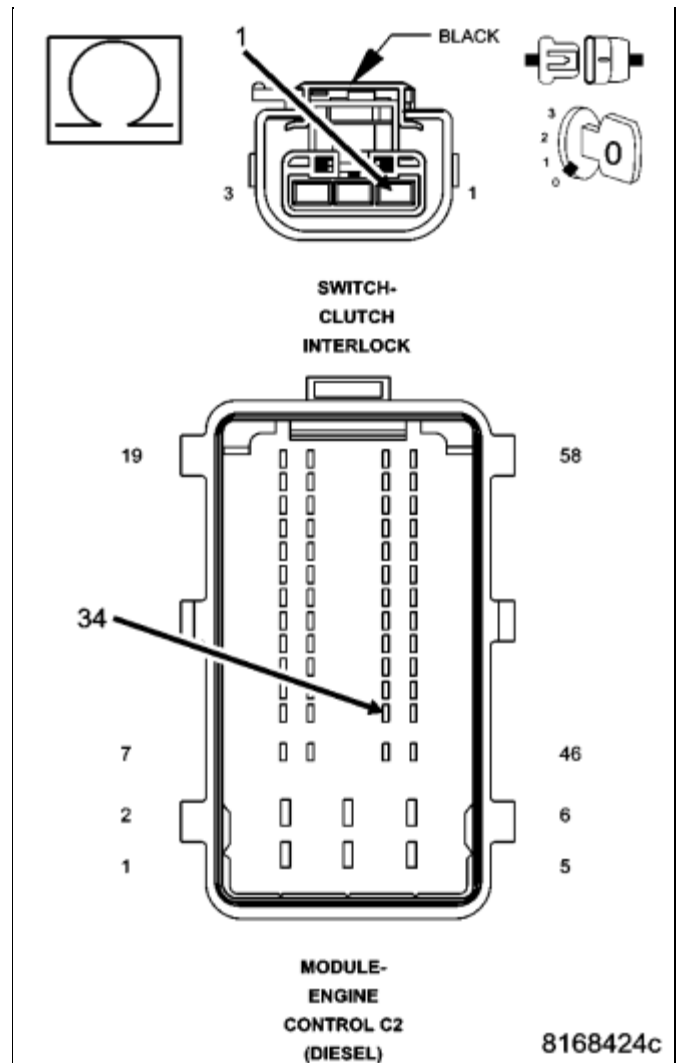
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (T26) Clutch Upstop Switch Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Clutch Interlock Switch and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1001-IGNITION KEY OFF TIMER PERFORMANCE - TOO FAST

For a complete wiring diagram **Refer to Section 8W**

Possible Causes
BODY CONTROL MODULE
BODY CONTROL MODULE POWER AND GROUNDS
CHECKING FOR OTHER DTCS
CHECKING THE ECT OPERATION
IGNITION SWITCH
INTERMITTENT CONDITION

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition on key cycles turning the ignition off for 10 seconds between cycles.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

Turn the ignition on.

Does the scan tool display all FCM and BCM DTC's.

NOTE: Any ECM communication related DTC's in the FCM or BCM must be diagnosed and corrected before continuing to diagnose this DTC.

Are there any ECM communication related DTC's in the FCM or BCM?

Yes

- Refer to the Symptom List and repair communication DTC's before continuing.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [3](#)

3. CHECKING THE ECT OPERATION

Refer to symptom Checking the ECT Sensor and verify proper ECT Sensor operation.

Is the ECT Sensor operating correctly?

Yes

- Go To [4](#)

No

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

4. IGNITION SWITCH

Refer to the Wiring Information and verify proper ignition switch operation. Turn the ignition key to each position and verifying correct voltage output by back probing the corresponding ignition switch harness connector cavity.

Is the Ignition Switch functioning properly?

Yes

- Go To [5](#)

No

- Repair or replace Ignition Switch, wiring or connectors as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

5. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.
Verify that the BCM is active on the bus.

Is the BCM active on the bus?**Yes**

- The condition that caused the code to set is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

P1002-IGNITION KEY OFF TIMER PERFORMANCE - TOO SLOW

For a complete wiring diagram **Refer to Section 8W**

Possible Causes
BODY CONTROL MODULE
BODY CONTROL MODULE POWER AND GROUNDS
CHECKING FOR OTHER DTCS
CHECKING THE ECT OPERATION
IGNITION SWITCH
INTERMITTENT CONDITION

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition on key cycles turning the ignition off for 10 seconds between cycles.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

Turn the ignition on.

Does the scan tool display all FCM and BCM DTC's.

NOTE: Any ECM communication related DTC's in the FCM or BCM must be diagnosed and corrected before continuing to diagnose this DTC.

Are there any ECM communication related DTC's in the FCM or BCM?

Yes

- Refer to the Symptom List and repair communication DTC's before continuing.

- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go To [3](#)

3. CHECKING THE ECT OPERATION

Refer to symptom Checking the ECT Sensor and verify proper ECT Sensor operation.

Is the ECT Sensor operating correctly?

Yes

- Go To [4](#)

No

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

4. IGNITION SWITCH

Refer to the Wiring Information and verify proper ignition switch operation. Turn the ignition key to each position and verifying correct voltage output at each ignition switch harness connector cavity.

Is the Ignition Switch functioning properly?

Yes

- Go To [5](#)

No

- Repair or replace Ignition Switch, wiring or connectors as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

5. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.
Verify that the BCM is active on the bus.

Is the BCM active on the bus?

Yes

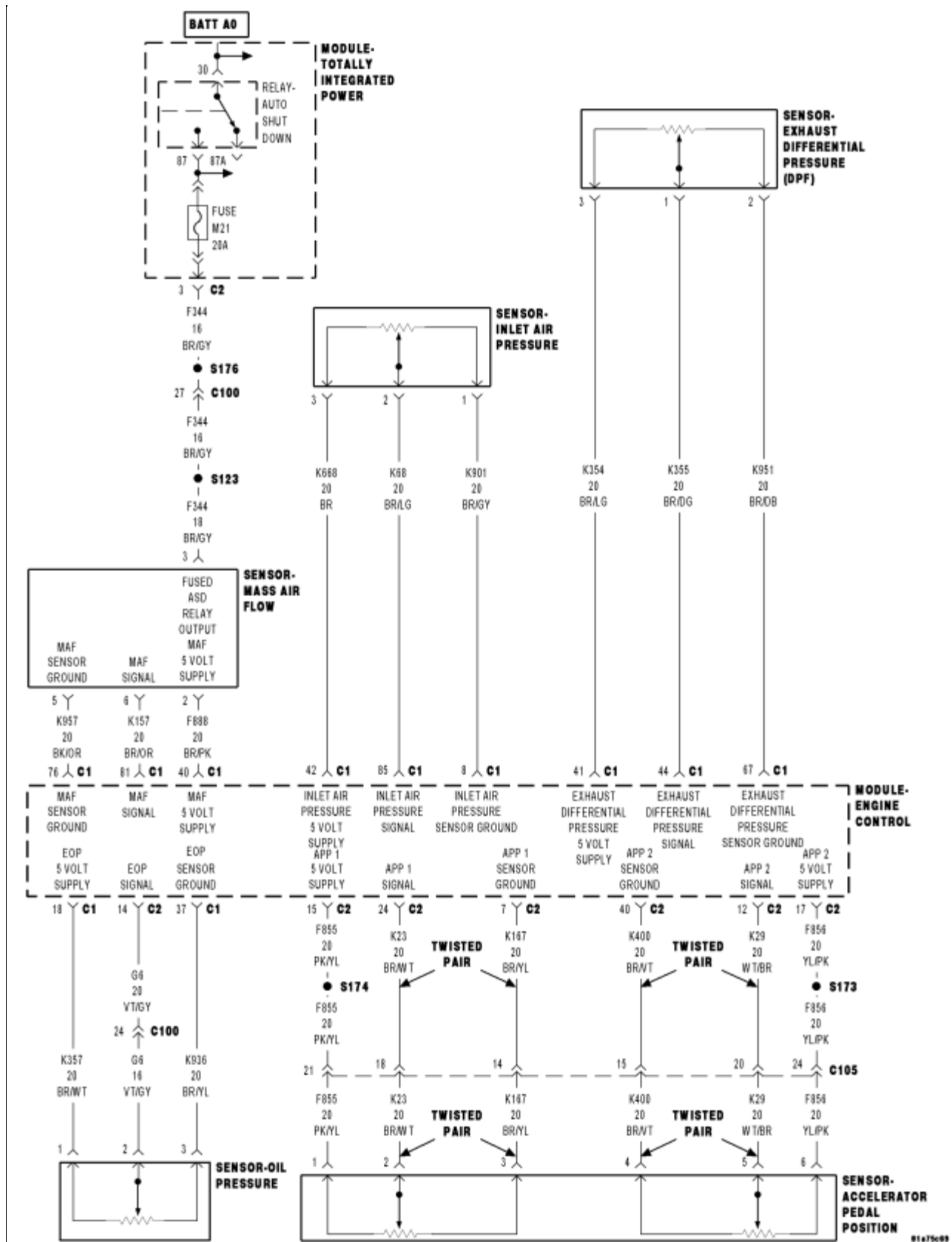
- The condition that caused the code to set is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC

CONTROL MODULES - STANDARD PROCEDURE).

No

- (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

P1453–DIFFERENTIAL PRESSURE SENSOR HOSE BLOCKED



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects differential pressure that are lower than expected for certain engine operating conditions for 2.0 seconds.

Possible Causes
DAMAGED EXHAUST SYSTEM
LEAKING EXHAUST SYSTEM
HIGH RESISTANCE IN EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUITS
HOSE/TUBE CONNECTIONS TO THE EXHAUST DIFFERENTIAL PRESSURE SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
DIESEL PARTICULATE FILTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VISUAL INSPECTION

Turn the ignition off.

Visually inspect the Exhaust Differential Pressure Sensor for physical damage, proper electrical connection and proper mechanical connection. Ensure any tubes and/or hoses connected to the sensor are in good working condition and properly connected at all ends.

Visually inspect the entire exhaust system for bent, crushed or otherwise damaged tubes which may cause an

exhaust system restriction.

Inspect the exhaust system for exhaust leaks.

Were any problems found?

Yes

- Repair or replace as necessary.

No

- Go To [2](#)

2. CHECKING THE DIFFERENTIAL PRESSURE SENSOR HOSES

Turn the ignition off.

Disconnect both Differential Pressure Sensor Hoses at the Differential Pressure Sensor.

Apply Low Pressure shop air to each of the disconnected hose ends.

NOTE: The applied air pressure at each hose should flow through the hoses into the DPF Filter.

Does the applied air pressure flow through both hoses into the DPF Filter.

Yes

- Go To [3](#)

No

- Repair or replace blocked hoses or DPF Filter connection tubes. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. EXHAUST DIFFERENTIAL SENSOR CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of each Exhaust Differential Pressure Sensor circuit between the Exhaust Differential Pressure Sensor harness connector and the ECM harness connector.

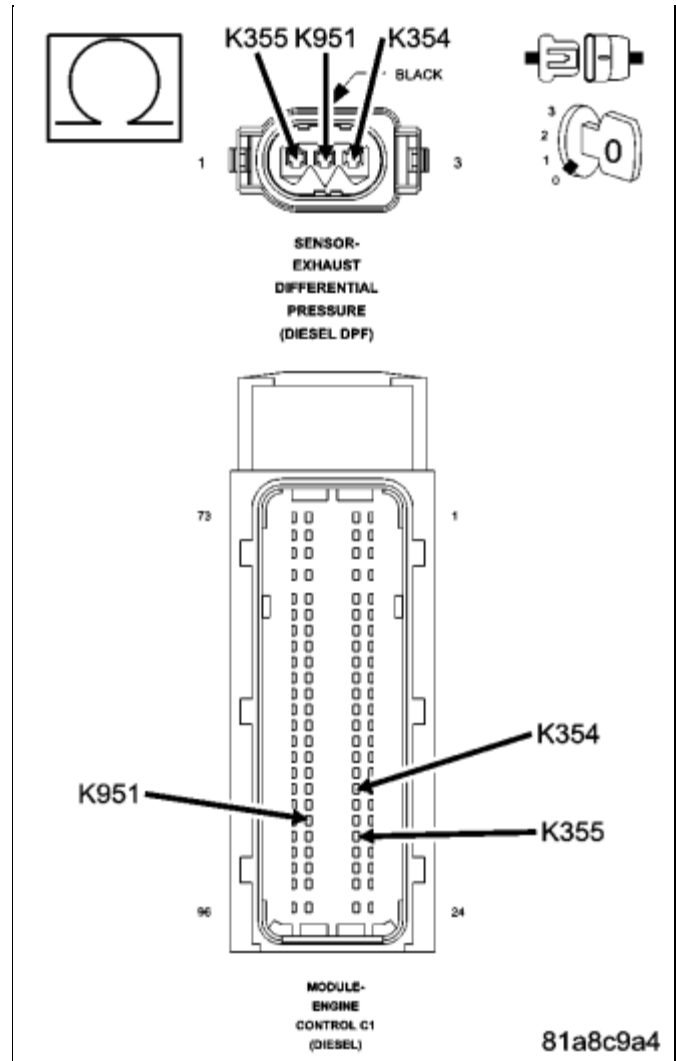
Is the resistance below 10.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the circuit(s) that measured above 10.0 ohms for high resistance. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)



4. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.

Replace the Exhaust Differential Pressure Sensor.

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

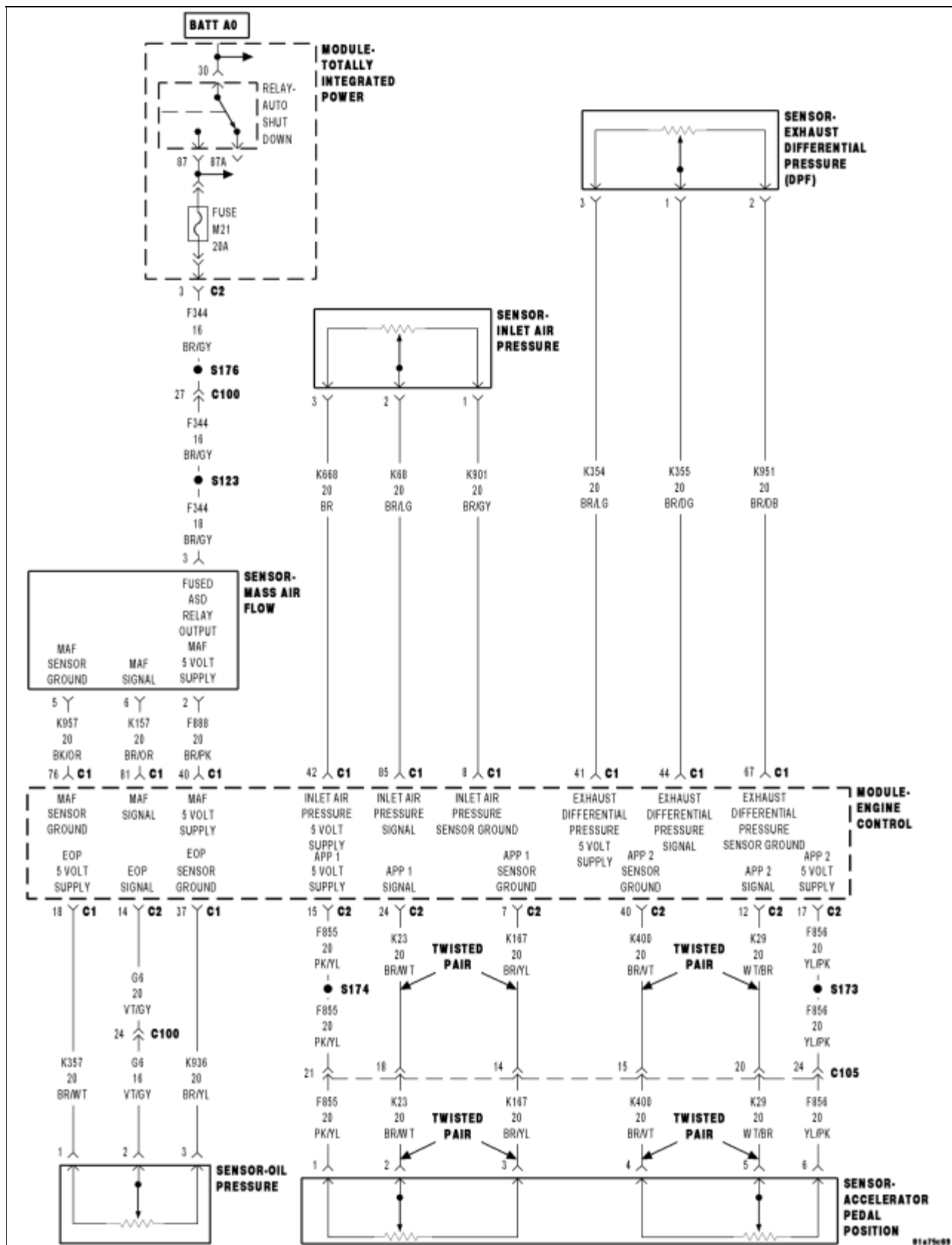
Yes

- Replace the Diesel Particulate Filter.

No

- Test Complete.

P1454-DIFFERENTIAL PRESSURE SENSOR FLOW TOO HIGH



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash accumulates in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter. The ECM monitors the sensor to determine when to perform a particulate filter regeneration procedure which is designed to clear “burn-off” the ash collected in the filter.

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects incorrect exhaust flow through the particulate filter during certain engine operating conditions.

Possible Causes
DAMAGED EXHAUST SYSTEM
LEAKING EXHAUST SYSTEM
HIGH RESISTANCE IN EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUITS
HOSE/TUBE CONNECTIONS TO THE EXHAUST DIFFERENTIAL PRESSURE SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
DIESEL PARTICULATE FILTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VISUAL INSPECTION

Turn the ignition off.

Visually inspect the Exhaust Differential Pressure Sensor for physical damage, proper electrical connection and proper mechanical connection. Ensure any tubes and/or hoses connected to the sensor are in good working

condition and properly connected at all ends.

Visually inspect the entire exhaust system for bent, crushed or otherwise damaged tubes which may cause an exhaust system restriction.

Inspect the exhaust system for exhaust leaks.

Were any problems found?

Yes

- Repair or replace as necessary.

No

- Go To [2](#)

2. PARTICULATE FILTER REGENERATION

Start and idle the engine.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, perform the Diesel Particulate Filter Regeneration procedure.

After this procedure is complete, turn the ignition off for 60 seconds.

Test drive the vehicle.

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

Yes

- Go To [3](#)

No

- Test complete.

3. EXHAUST DIFFERENTIAL SENSOR CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of each Exhaust Differential Pressure Sensor circuit between the Exhaust Differential Pressure Sensor harness connector and the ECM harness connector.

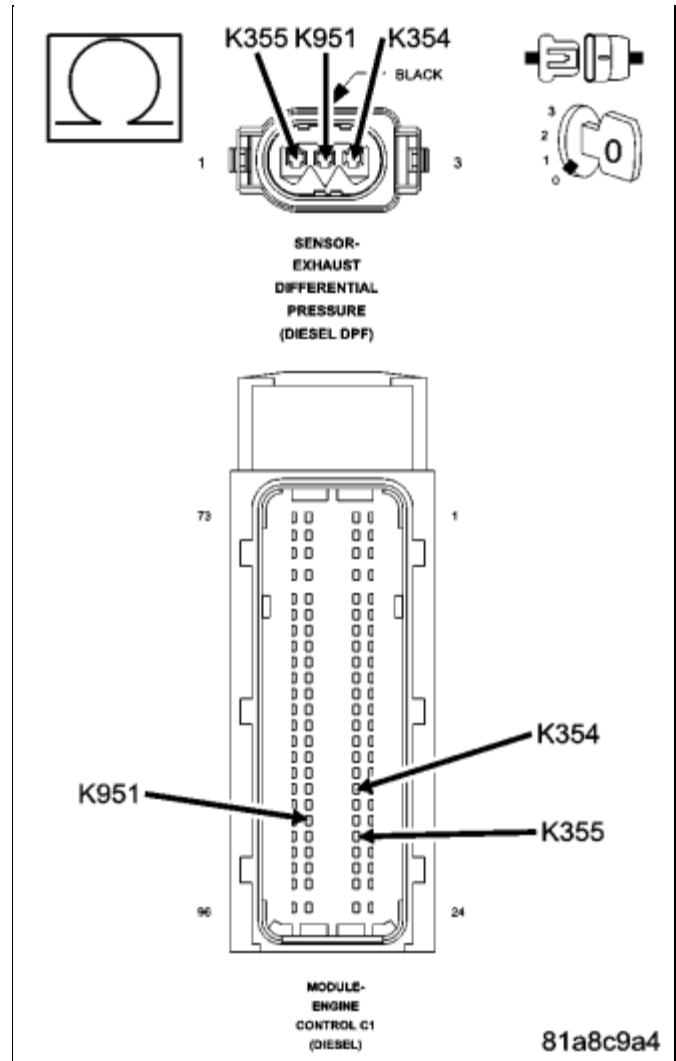
Is the resistance below 10.0 ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the circuit(s) that measured above 10.0 ohms for high resistance. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)



4. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.

Replace the Exhaust Differential Pressure Sensor.

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

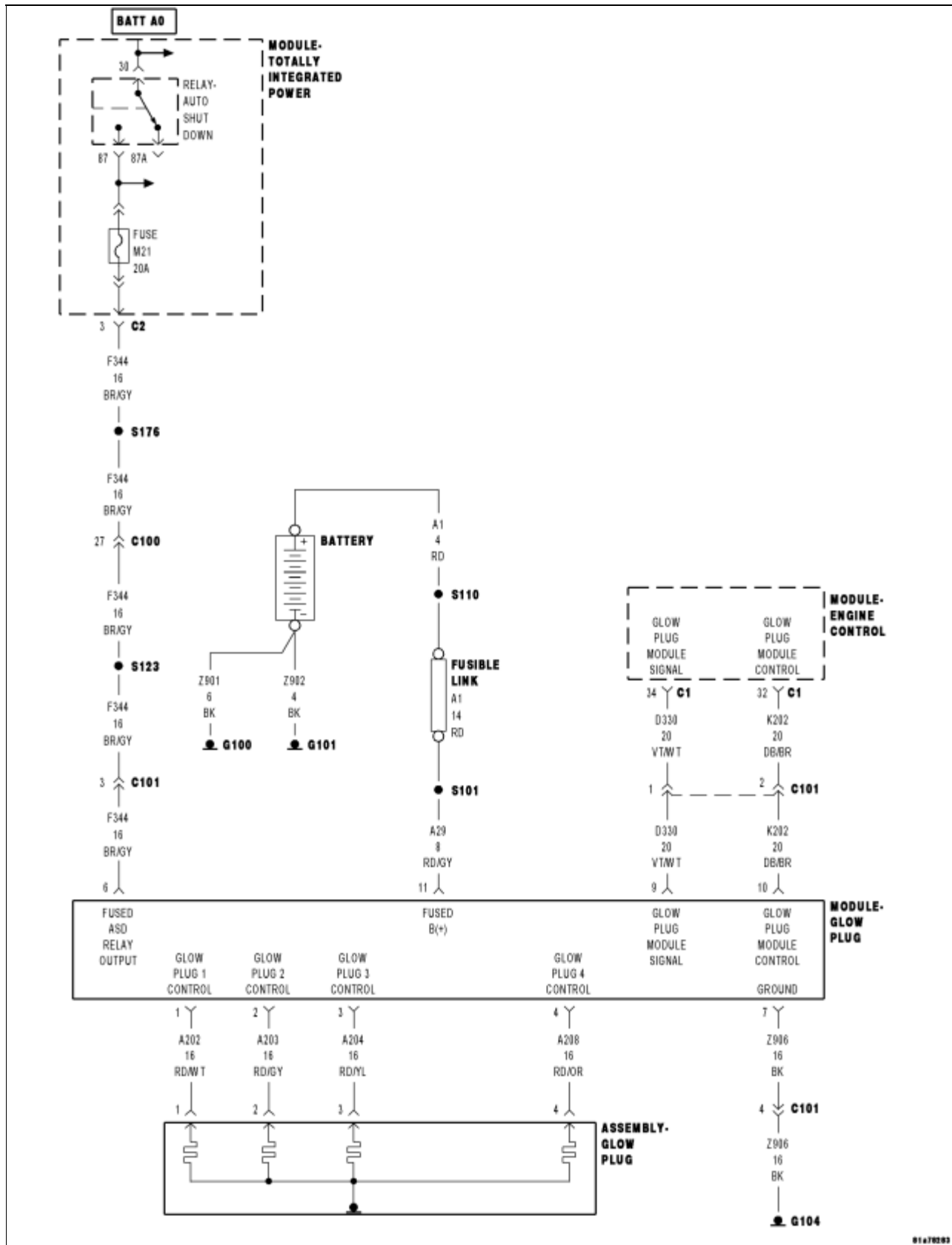
Yes

- Replace the Diesel Particulate Filter.

No

- Test Complete.

P1648-GLOW PLUG MODULE INTERNAL



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The Glow Plug Control Module reports an internal fault to the ECM.

Possible Causes
INTERMITTENT DTC
GLOW PLUG MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs.

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. GLOW PLUG MODULE

Using the wiring diagram/schematic as a guide, inspect the Glow Plug Module wiring and connectors. Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

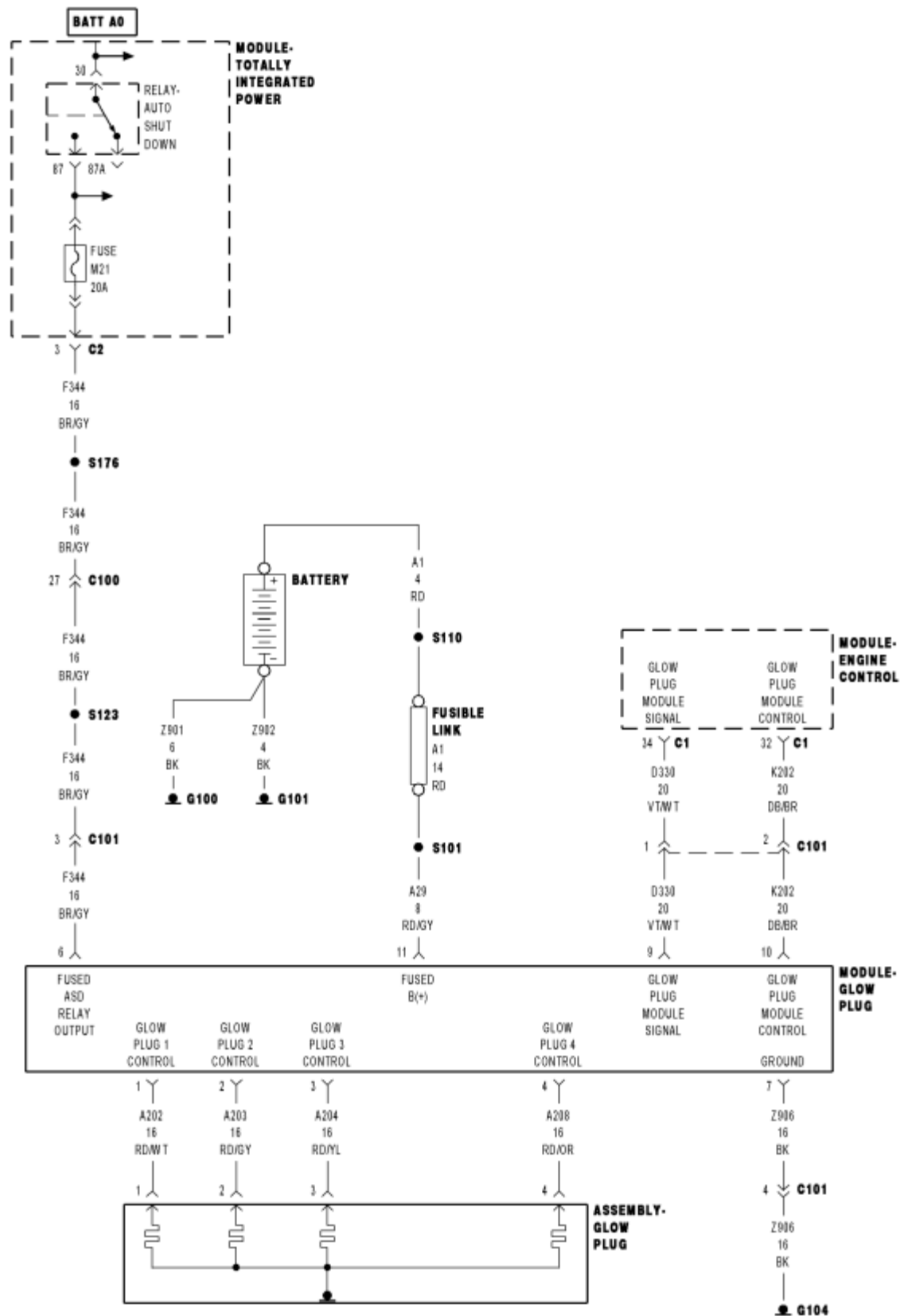
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Glow Plug Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1649-GLOW PLUG MODULE POWER SUPPLY CIRCUIT



81a70293

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the Glow Plugs commanded on.

- **Set Condition:**

The Glow Plug Control Module reports a power supply circuit fault to the ECM.

Possible Causes
INTERMITTENT DTC
(F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE
(A29) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
(Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
GLOW PLUG MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: Diagnose and repair any system voltage or ASD Relay DTCs before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Glow Plugs.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Disconnect the Glow Plug Module harness connector.
 Turn the ignition on.
 Using a 12 volt test light connected to ground, check the (F344) Fused ASD Relay Output 2 circuit in the Glow Plug Module harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

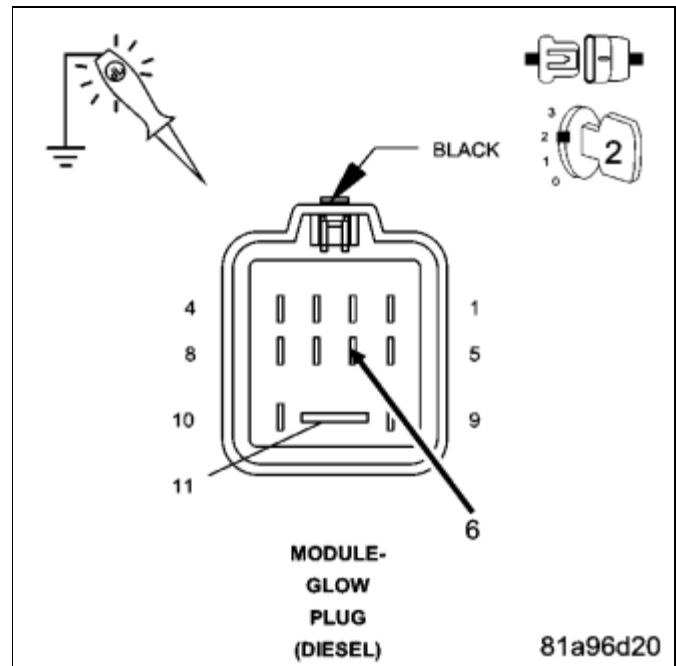
Is the test light illuminated and bright?

Yes

- Go to [3](#)

No

- Repair the (F344) Fused ASD Relay Output 2 circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (Z906) GROUND CIRCUIT OPEN OR HIGH RESISTANCE

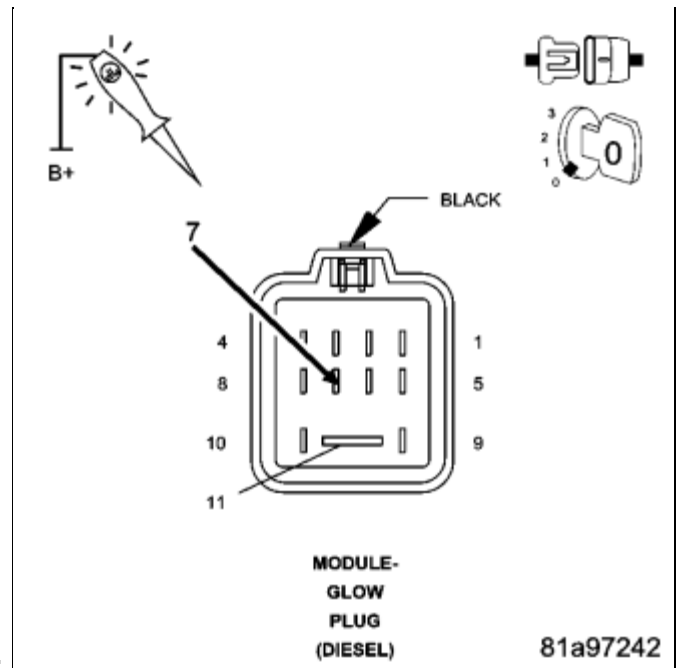
Turn the ignition off.
 Using a 12 volt test light connected to B+, check the (Z906) Ground circuit in the Glow Plug Module harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go to [4](#)



No

- Repair the (Z906) Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (A29) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE

Using a 12 volt test light connected to ground, check the (A29) Fused B+ circuit in the Glow Plug Module harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

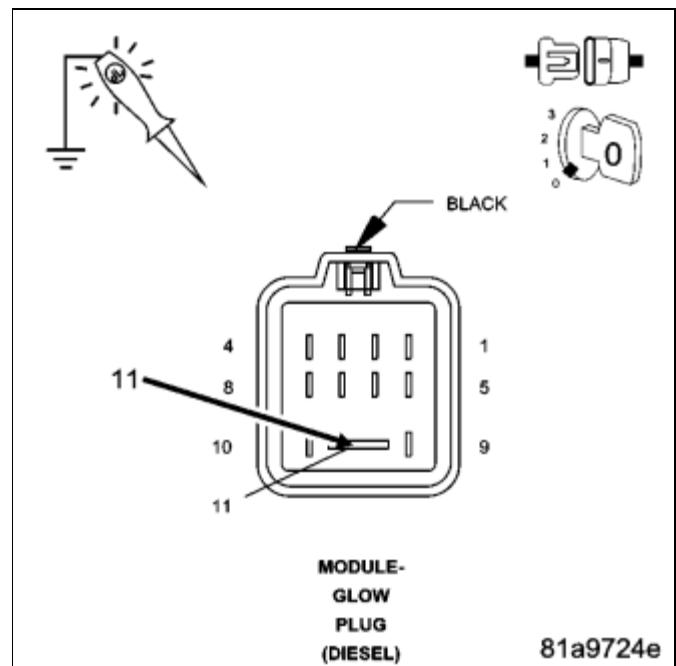
Is the test light illuminated and bright?

Yes

- Go to [5](#)

No

- Repair the (A29) Fused B+ circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. GLOW PLUG MODULE

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, actuate the Glow Plugs.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plug Module and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1685-SKIM SYSTEM

With the ignition on.

- **Set Condition:**

A communication error occurs between the ECM and SKREEM.

Possible Causes
INTERMITTENT DTC
INCORRECT VIN PROGRAMMING
SKREEM
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR SKREEM COMMUNICATION AND DTCs

Ignition on, engine not running.

With the scan tool, check for proper communication and active DTCs in the SKREEM.

Are any SKREEM communication problems or DTCs present?

Yes

- Refer to the symptom list for problems related to SKREEM Communication and DTCs before continuing.

No

- Go To [2](#)

2. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, clear all ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between key cycles.

With the scan tool, select View DTCs in the ECM.

Is the status Active for this DTC?**Yes**

- Go to [3](#)

No

- Refer to *CHECKING FOR INTERMITTENT DTC in the symptom list. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

3. REPLACE THE SKREEM AND RETEST

Replace and program the SKREEM in accordance with the Service Information.

Turn the ignition on.

With the scan tool, clear all ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between key cycles.

With the scan tool, select View DTCs in the ECM.

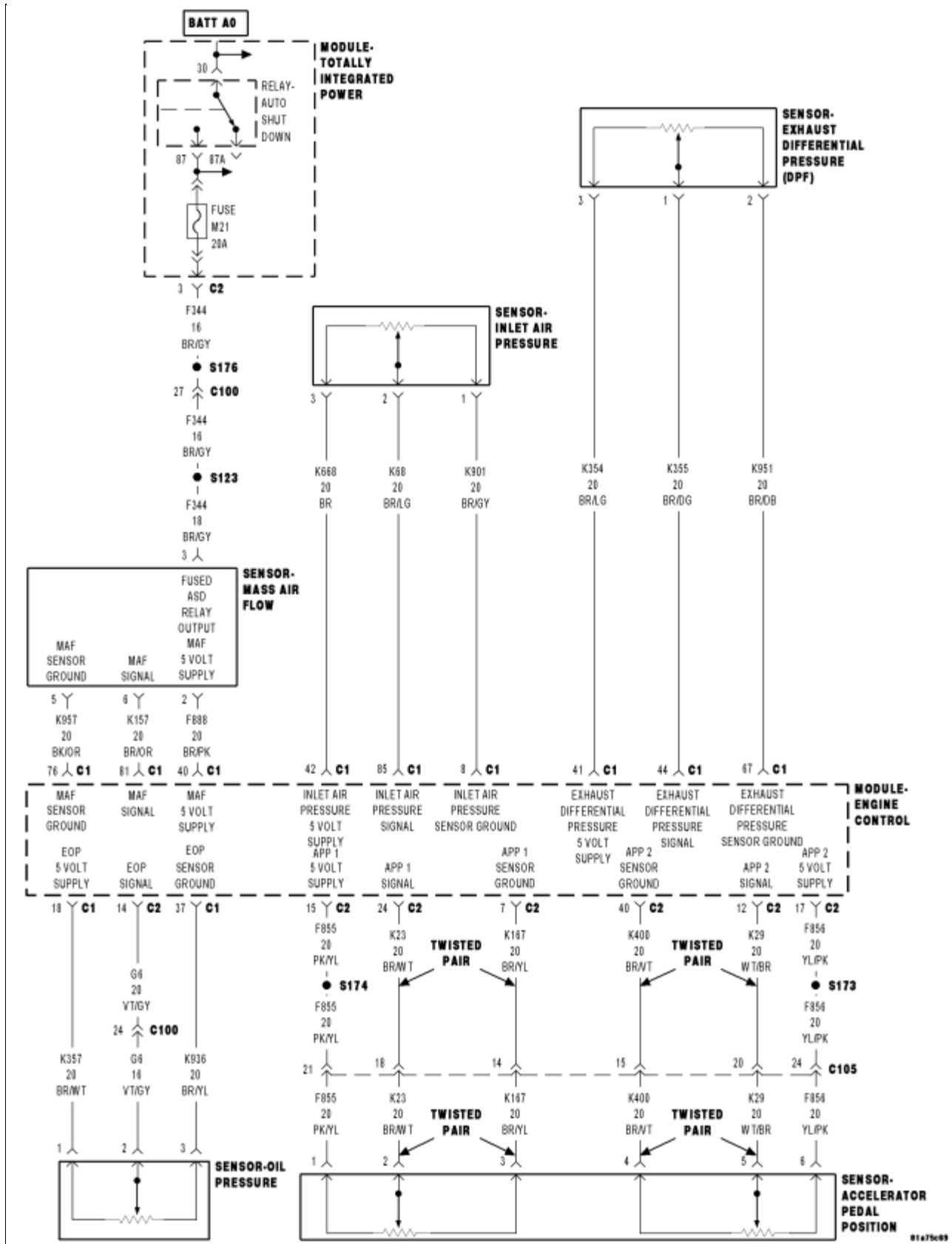
Is the status Active for this DTC?**Yes**

- Replace and program the Engine Control Module in accordance the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test complete.

P2002–DIESEL PARTICULATE FILTER EFFICIENCY BELOW THRESHOLD



The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects incorrect exhaust flow through the particulate filter during certain engine operating conditions.

Possible Causes
DAMAGED EXHAUST SYSTEM
LEAKING EXHAUST SYSTEM
HIGH RESISTANCE IN EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUITS
HOSE/TUBE CONNECTIONS TO THE EXHAUST DIFFERENTIAL PRESSURE SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
DIESEL PARTICULATE FILTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECKING FOR OTHER DTC'S

NOTE: This DTC can be set when vehicle is driven only on short trips where exhaust and engine temperatures do not reach operating temperature for 30 minutes or more.

Turn the ignition on.

With the scan tool, read the ECM DTC's.

Are there other DTC's set in the ECM?

Yes

- Repair other DTC's before continuing with this test.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

Diagnostic Test

2. VISUAL INSPECTION

Turn the ignition off.

Visually inspect the Exhaust Differential Pressure Sensor for physical damage, proper electrical connection and proper mechanical connection. Ensure any tubes and/or hoses connected to the sensor are in good working condition and properly connected at all ends.

Visually inspect the entire exhaust system for bent, crushed or otherwise damaged tubes which may cause an exhaust system restriction.

Inspect the exhaust system for exhaust leaks.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. PARTICULATE FILTER REGENERATION

Start and idle the engine.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, perform the Diesel Particulate Filter Regeneration procedure.

After this procedure is complete, turn the ignition off for 60 seconds.

Test drive the vehicle.

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

Yes

- Go To [4](#)

No

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of each Exhaust Differential Pressure Sensor circuit between the Exhaust Differential Pressure Sensor harness connector and the ECM harness connector.

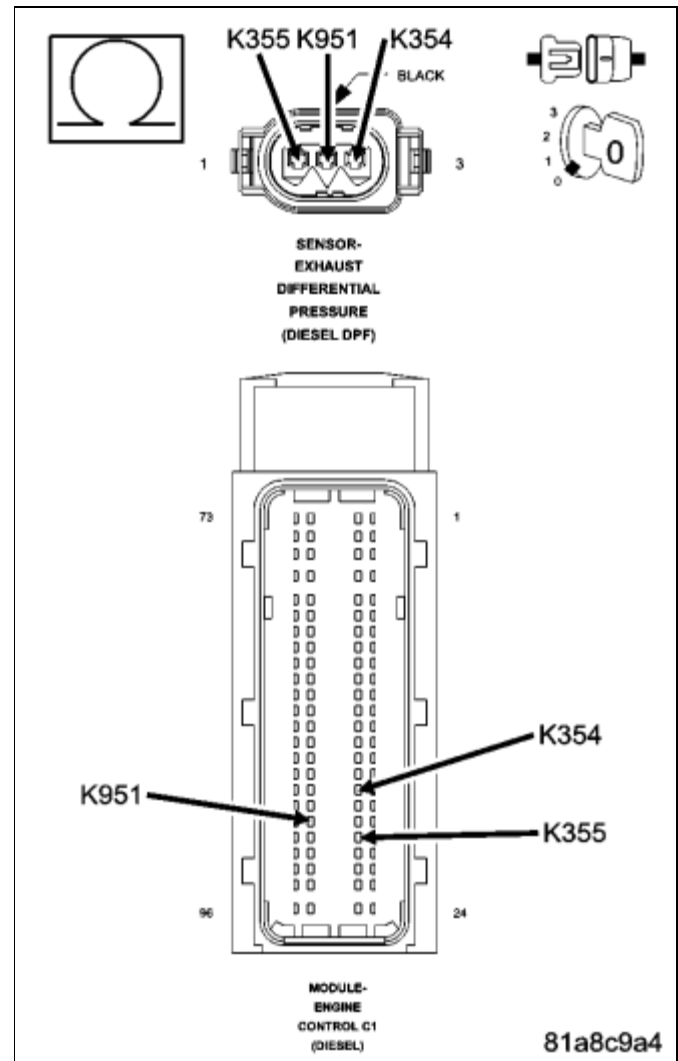
Is the resistance below 10.0 ohms for each circuit?

Yes

- Go To [5](#)

No

- Repair the circuit(s) that measured above 10.0 ohms for high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Replace the Exhaust Differential Pressure Sensor.

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

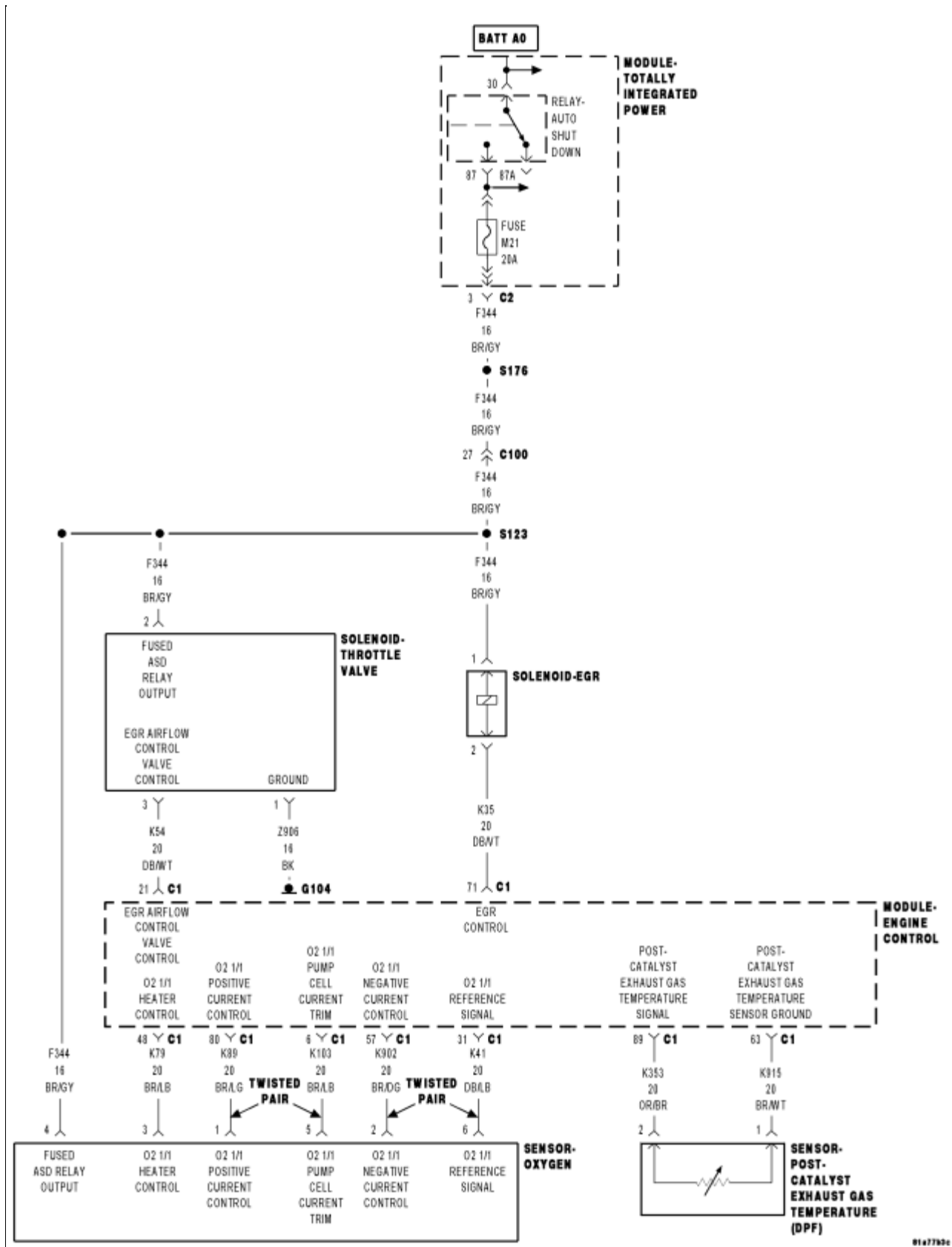
Yes

- Replace the Diesel Particulate Filter.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2032-EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW - BANK 1 SENSOR 2



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects that the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit is shorted to ground.

Possible Causes
INTERMITTENT DTC
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
POST-CATALYST EXHAUST TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Post-Catalyst Exhaust Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

3. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit and the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

4. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE

Measure the resistance of the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit between the Post-Catalyst Exhaust Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

5. POST-CATALYST EXHAUST TEMPERATURE SENSOR

Connect the Engine Control Module (ECM) connector.

Turn the ignition on.

With the scan tool, clear DTCs.

With the scan tool, select View DTCs.

Monitor the scan tool for at least two minutes.

NOTE: The scan tool should display a Post-Catalyst Exhaust Temperature Sensor high voltage or open circuit DTC with the Post-Catalyst Exhaust Temperature Sensor connector disconnected.

Does the scan tool display the DTC as described above?

Yes

- Replace the Post-Catalyst Exhaust Temperature Sensor in accordance with the service information.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Post-Catalyst Exhaust Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

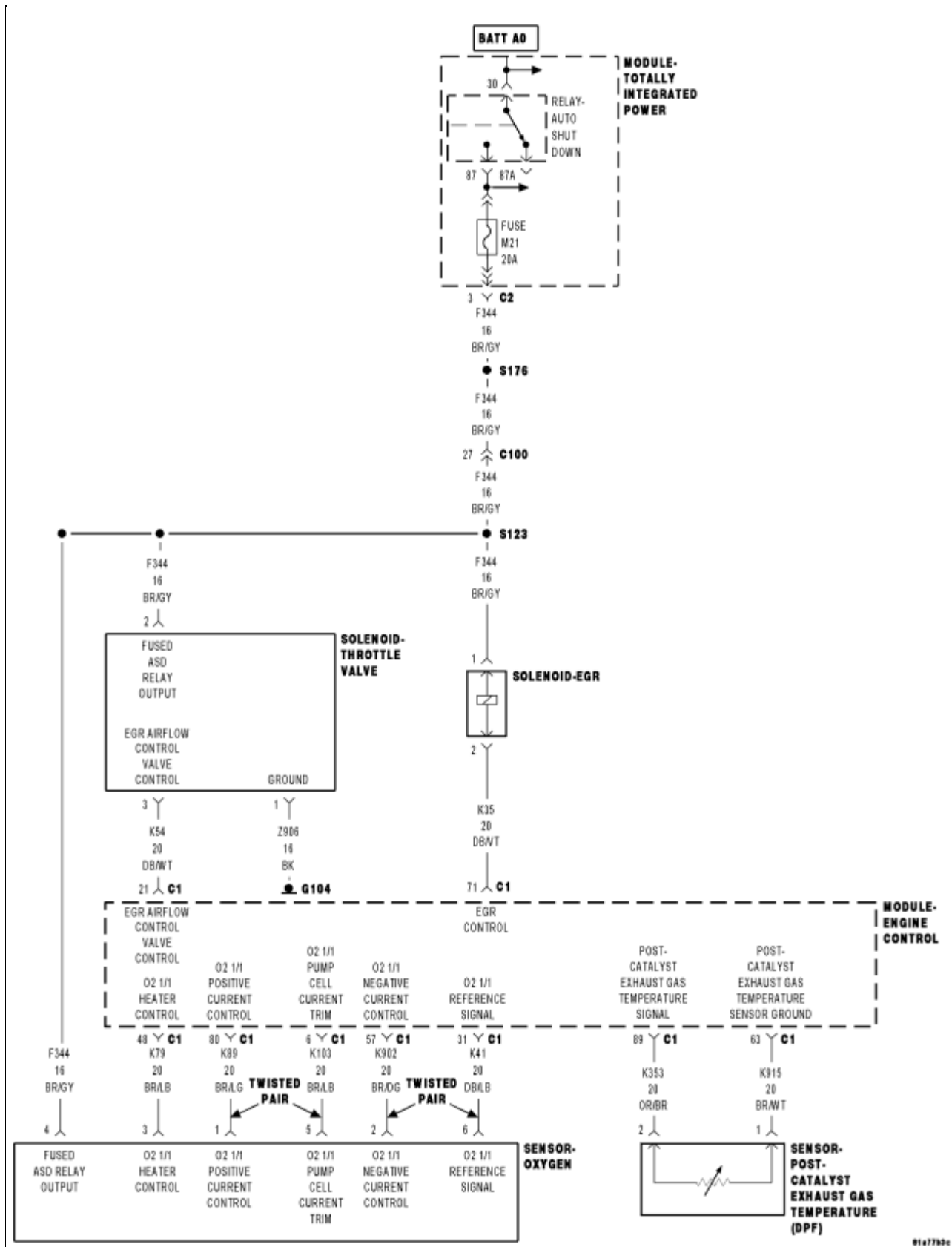
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

P2033-EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH - BANK 1 SENSOR 2



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The Post-Catalyst Exhaust Temperature Sensor Signal is above 1000°C.

Possible Causes
INTERMITTENT DTC
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
POST-CATALYST EXHAUST TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Post-Catalyst Exhaust Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

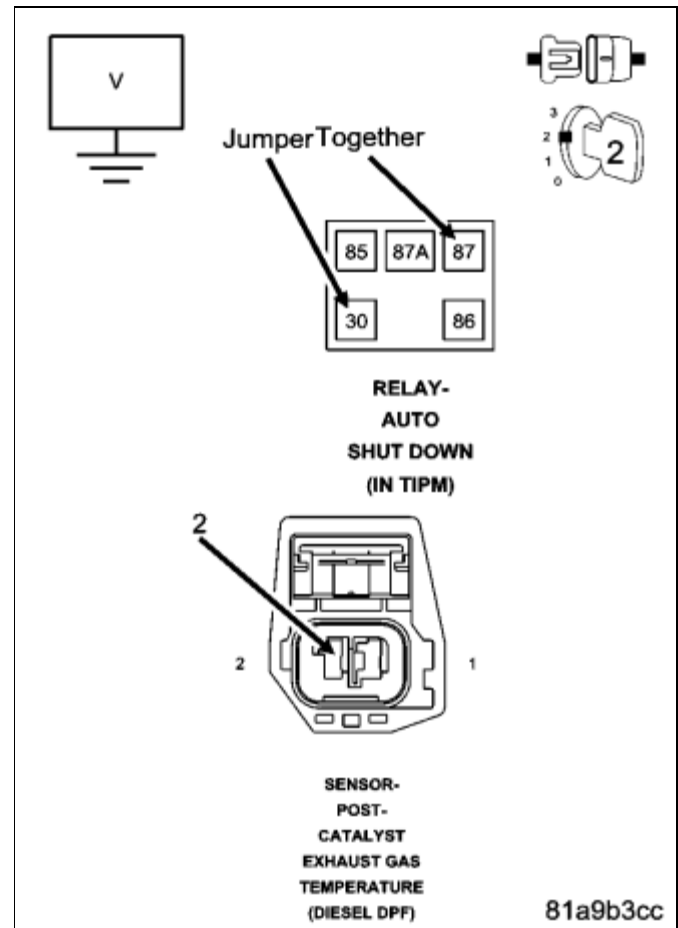
Is there any voltage present?

Yes

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Is there any voltage present?

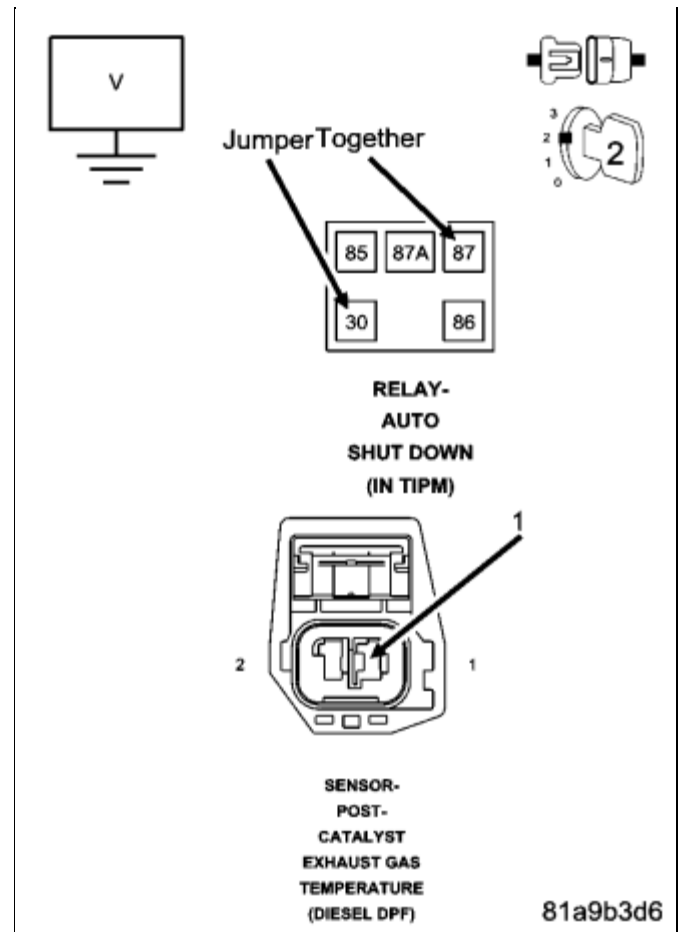
Yes

- Repair the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL OPEN OR HIGH RESISTANCE

Turn the ignition off.

Measure the resistance of the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit between the Post-Catalyst Exhaust Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

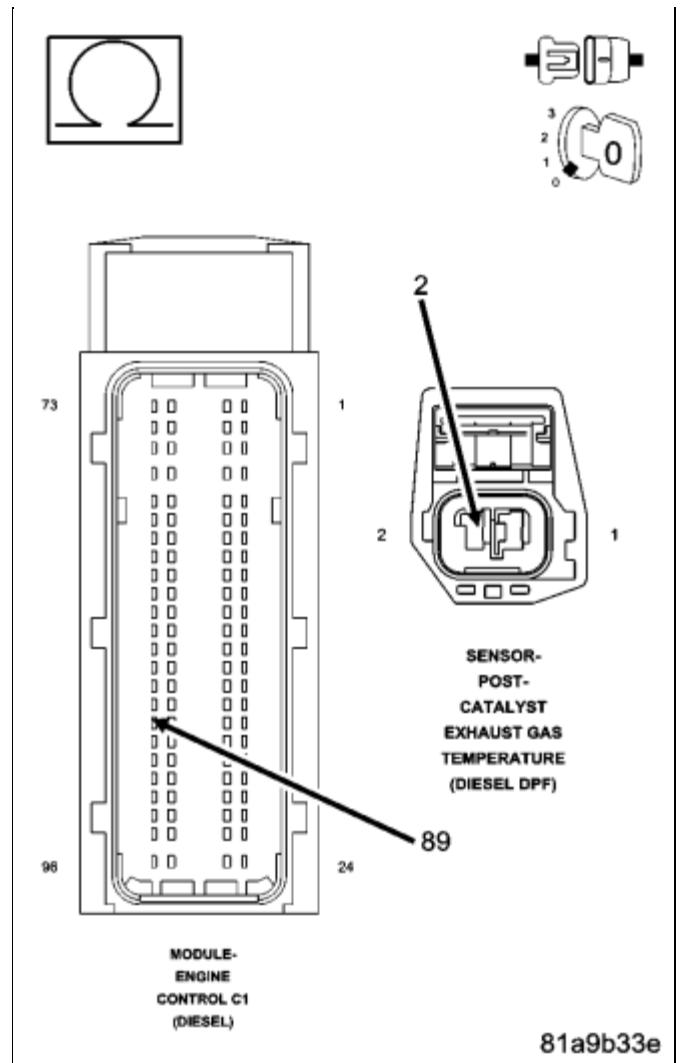
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit between the Post-Catalyst Exhaust Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

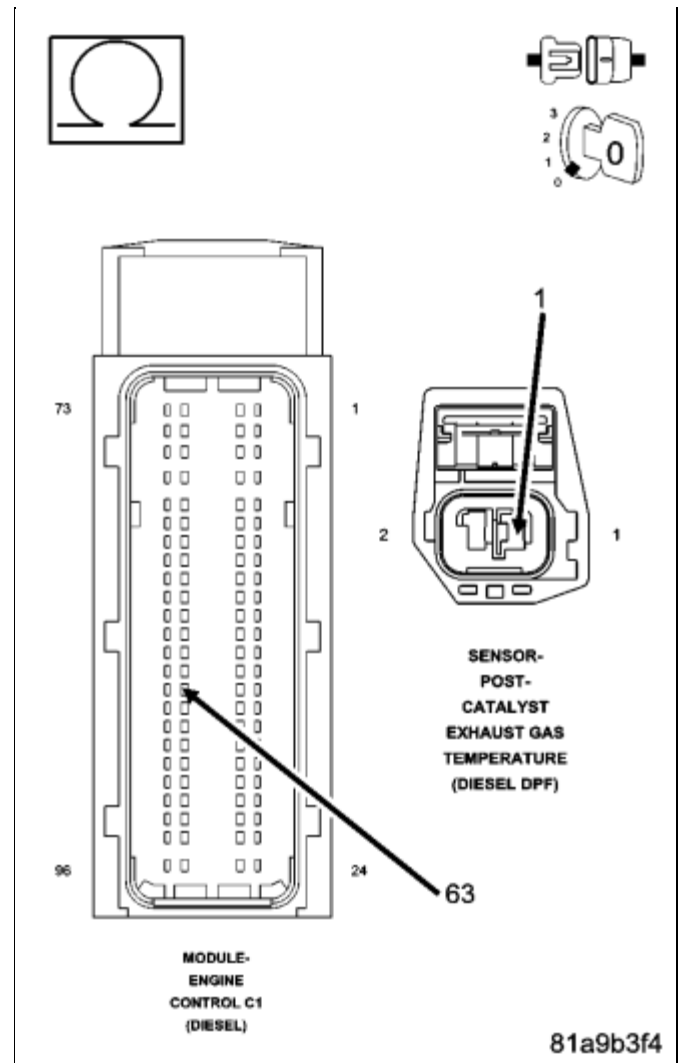
Yes

- Go to [6](#)

No

- Repair the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)



6. POST-CATALYST EXHAUST TEMPERATURE SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Remove the jumper wire from between cavity 30 and cavity 87 of the ASD Relay Connector.

Install the ASD Relay.

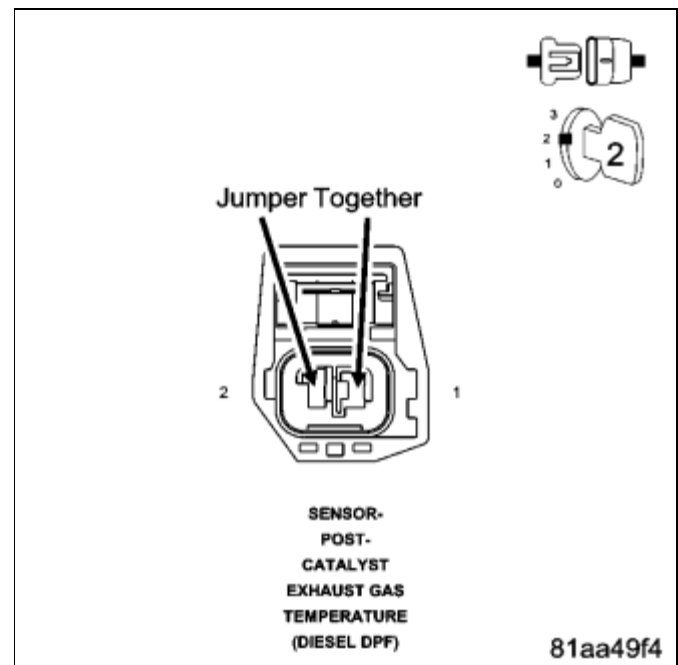
Connect a jumper wire between the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit and the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Post-Catalyst Exhaust Temperature Sensor low voltage or short to



ground DTC with the jumper wire in place.

Does the scan tool display the DTC as described above?

Yes

- Replace the Post-Catalyst Exhaust Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [7](#)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Post-Catalyst Exhaust Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

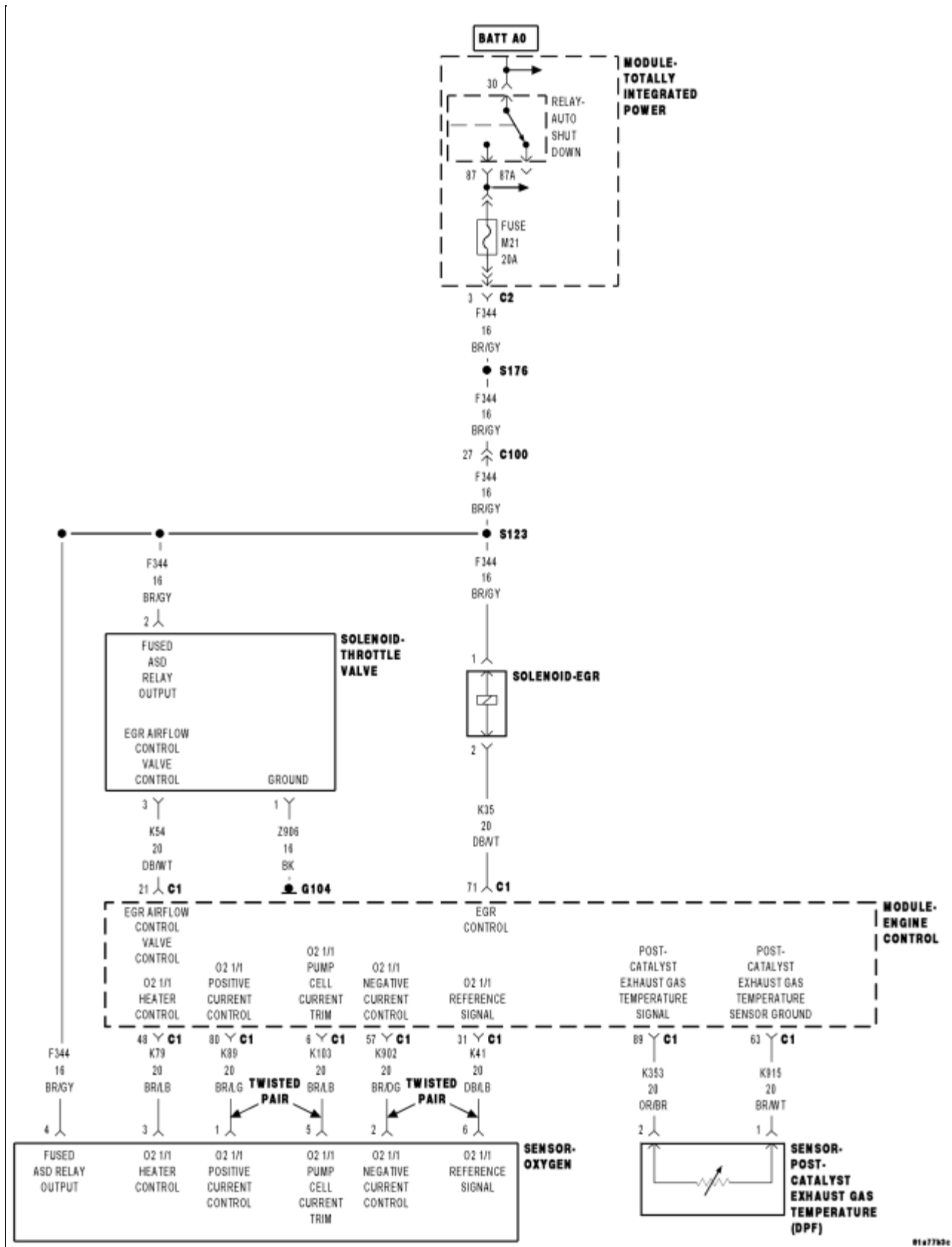
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2084-EXHAUST GAS TEMPERATURE SENSOR CIRCUIT PERFORMANCE - BANK 1 SENSOR 2



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The Engine Control Module (ECM) detects that the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit voltage is implausible.

Possible Causes
INTERMITTENT DTC
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND
(K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
POST-CATALYST EXHAUST TEMPERATURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Post-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Post-Catalyst Exhaust Temperature Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

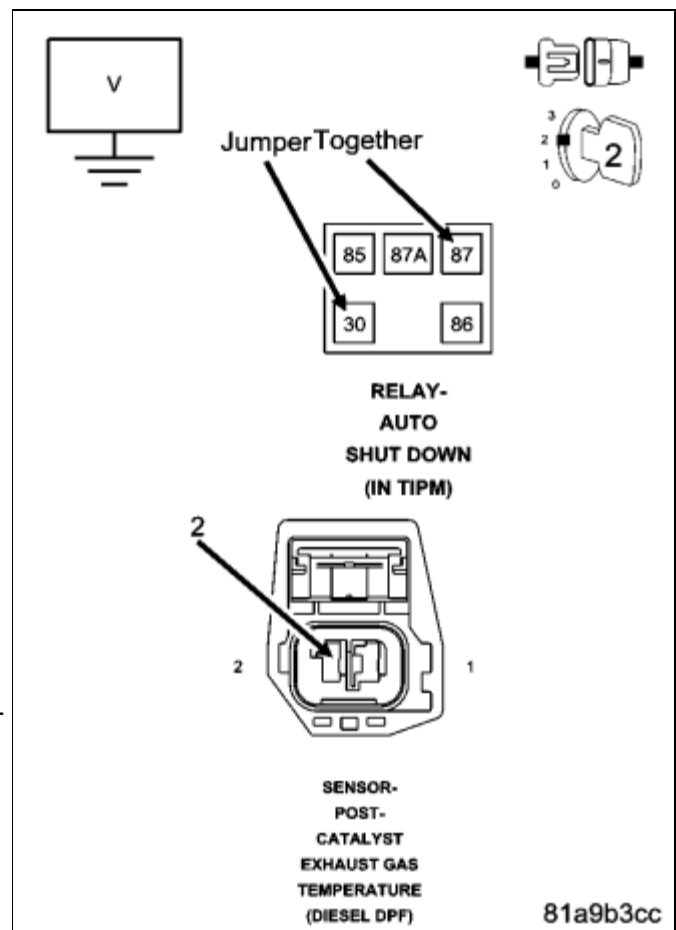
Is there any voltage present?

Yes

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go to [3](#)



3. (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit in the Post-Catalyst

Exhaust Temperature Sensor harness connector.

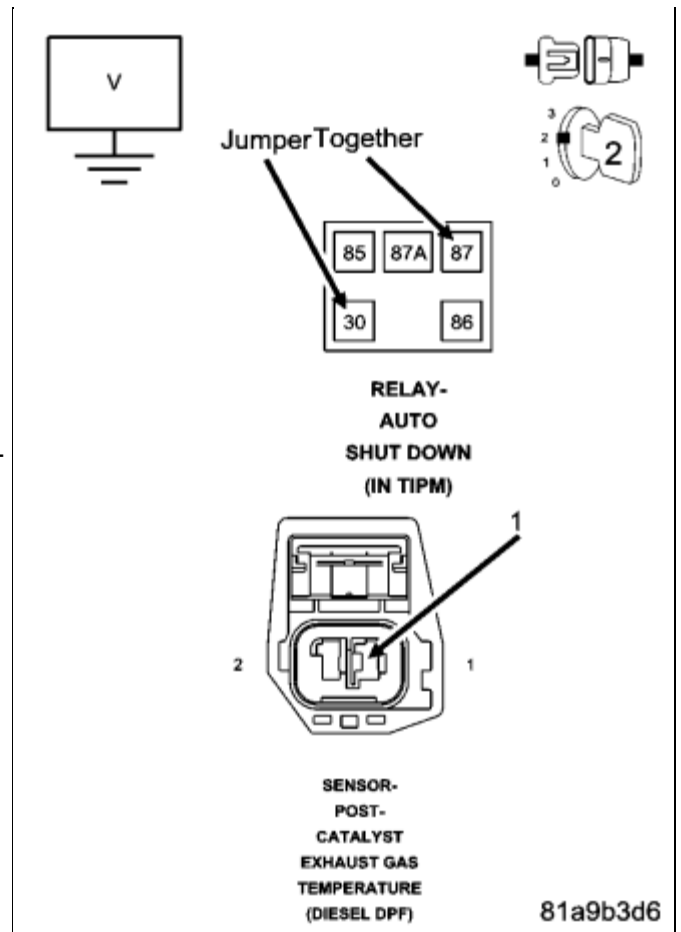
Is there any voltage present?

Yes

- Repair the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go to [4](#)



4. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD relay.

Measure the resistance between ground and the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

5. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit and the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit in the Post-Catalyst Exhaust Temperature

Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for a short to the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

6. (K353) POST-CATALYST EXHAUST TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit between the Post-Catalyst Exhaust Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

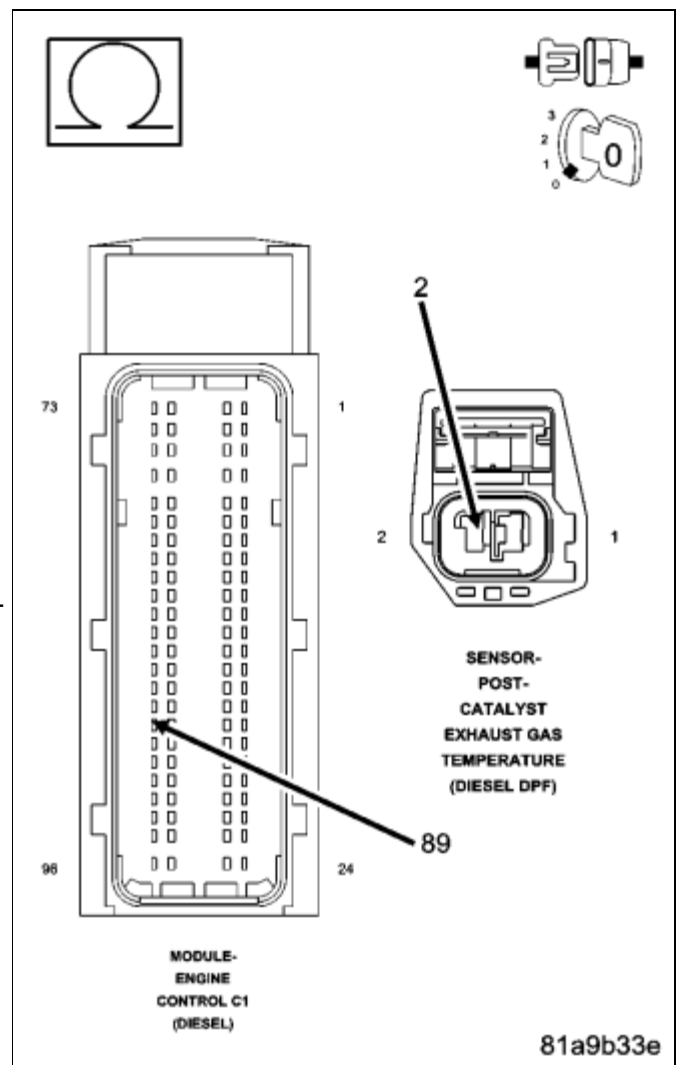
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



7. (K915) POST-CATALYST EXHAUST TEMPERATURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit between the Post-Catalyst Exhaust Temperature Sensor harness connector and the Engine Control Module (ECM) harness connector.

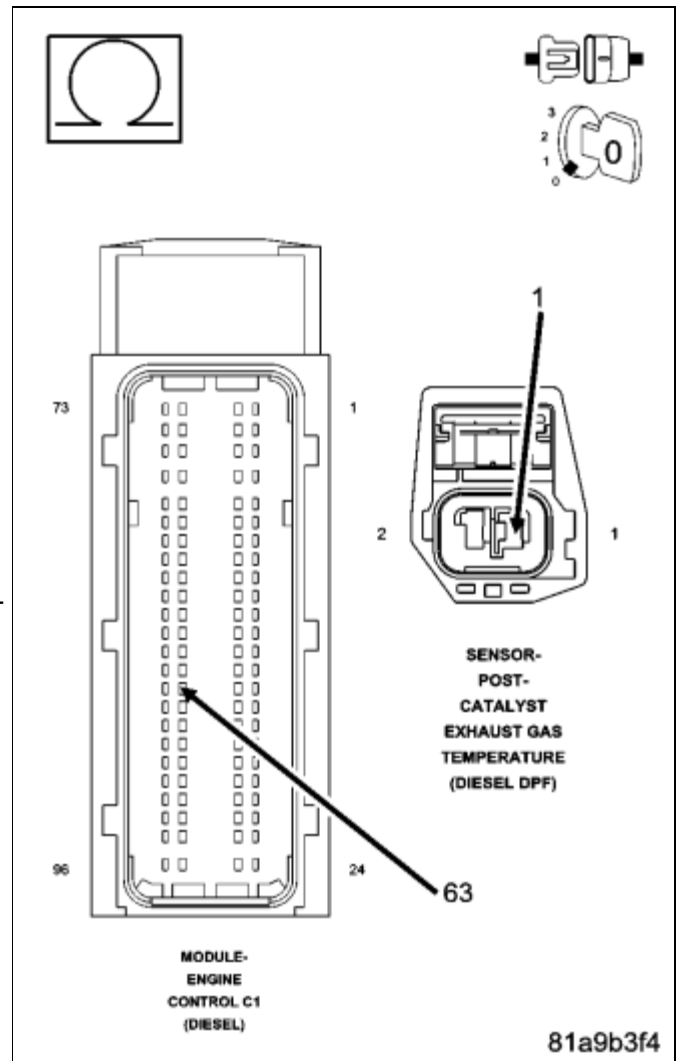
Is the resistance below 10.0 ohms?

Yes

- Go to [8](#)

No

- Repair the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



8. POST-CATALYST EXHAUST TEMPERATURE SENSOR

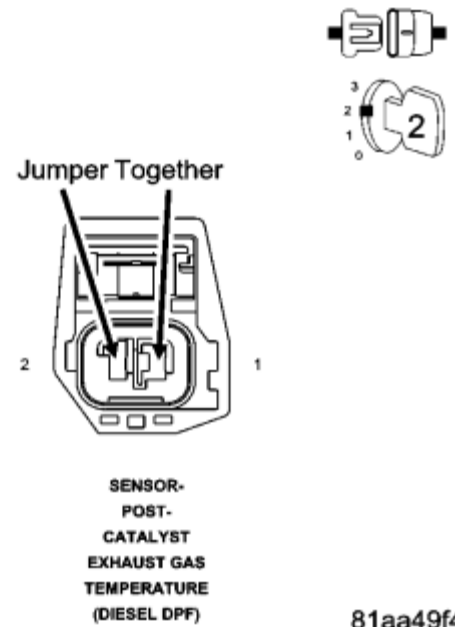
Connect the Engine Control Module (ECM) connector.
Connect a jumper wire between the (K915) Post-Catalyst Exhaust Temperature Sensor Ground circuit and the (K353) Post-Catalyst Exhaust Temperature Sensor Signal circuit in the Post-Catalyst Exhaust Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display a Post-Catalyst Exhaust Temperature Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC as described above?

Yes

- Replace the Post-Catalyst Exhaust Temperature Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Go to [9](#)

9. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Post-Catalyst Exhaust Temperature Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

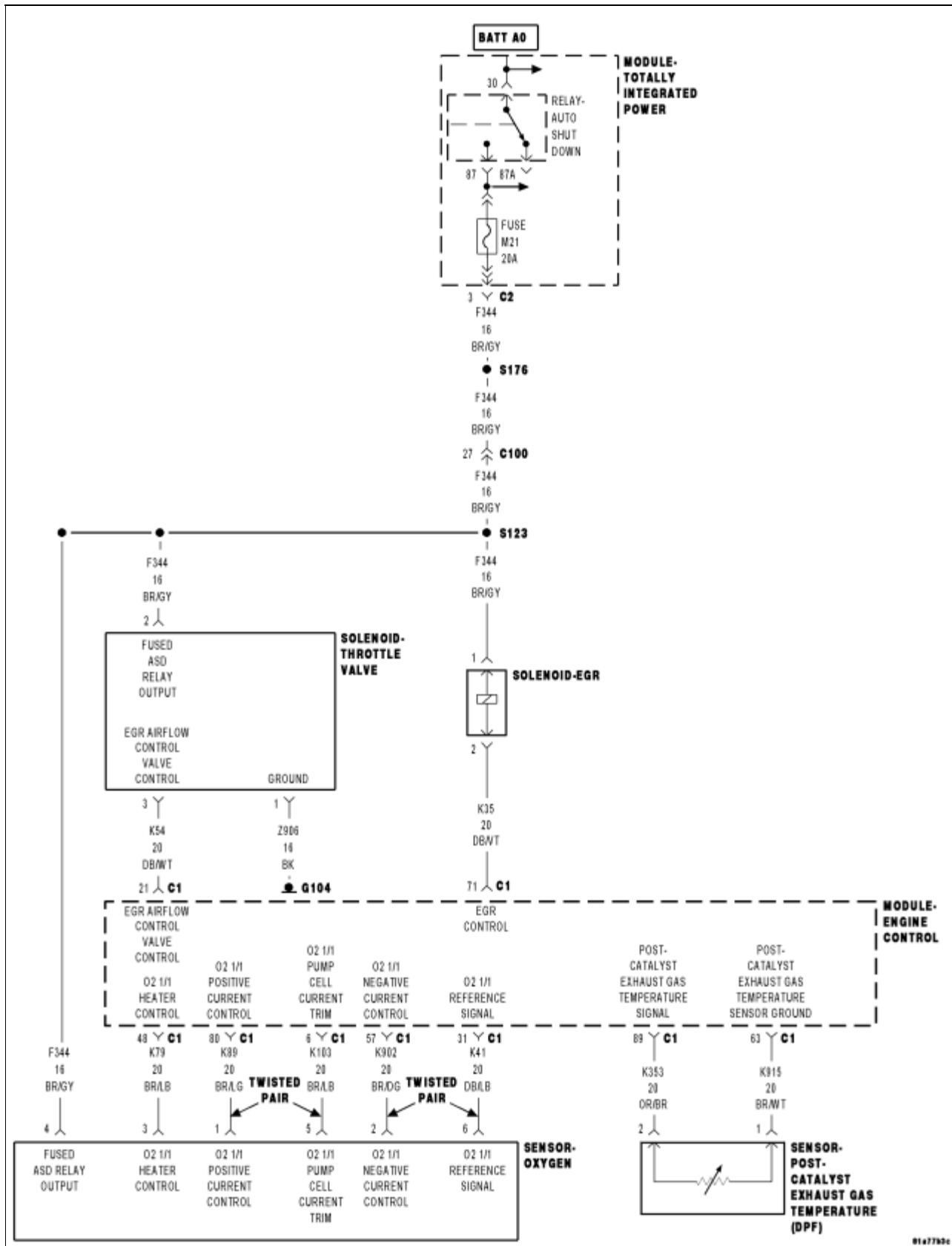
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

P2100-EGR AIR FLOW CONTROL VALVE CIRCUIT OPEN



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The EGR Air Flow Control Valve is a two-wire electrically operated throttle valve motor used to assist the EGR system function by creating a vacuum in the intake system to draw exhaust gas into the intake manifold. The Solenoid receives 12 volts from the ECM/ASD relay and a pulse-width modulated ground signal from the ECM. With the solenoid de-energized (off) the throttle valve is in the open (full flow) position. When the ECM energizes (grounds) the throttle motor, the throttle valve closes creating a low pressure (vacuum) in the intake system. This low pressure effect helps draw exhaust gases from the EGR Valve into the intake system.

- **When Monitored:**

With the ignition on and the ECM EGR Air Flow Control Valve command off.

- **Set Condition:**

The ECM detects an open EGR Air Flow Control Valve Control circuit for 0.5 second.

Possible Causes
INTERMITTENT CONDITION
(K344) ASD RELAY OUTPUT CIRCUIT OPEN
(K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT SHORTED TO GROUND
(K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT OPEN
EGR AIR FLOW CONTROL VALVE
ENGINE CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions

may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ECM power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. (K344) ECM RELAY OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (K344) ECM Relay Output circuit at the EGR Air Flow Control Valve harness connector.

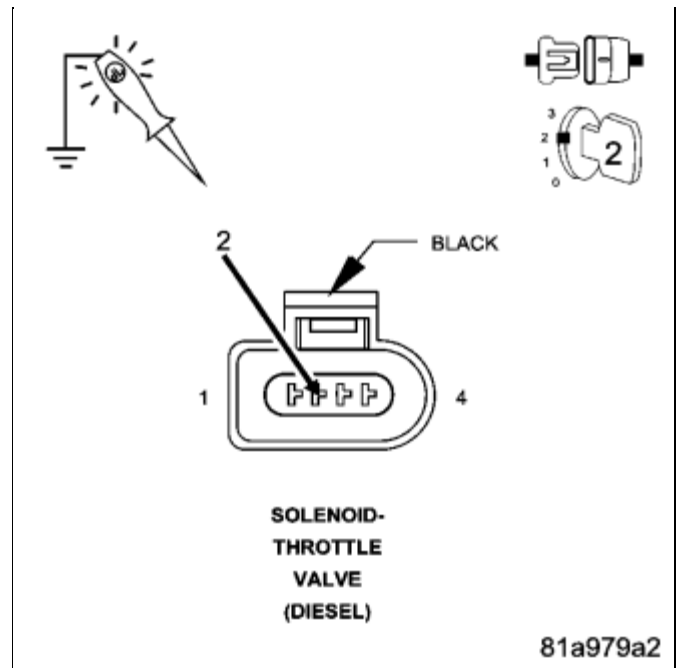
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (K344) ECM Relay Output circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the (K54) EGR Air Flow Control Valve Control circuit at the EGR Air Flow Control Valve harness connector.

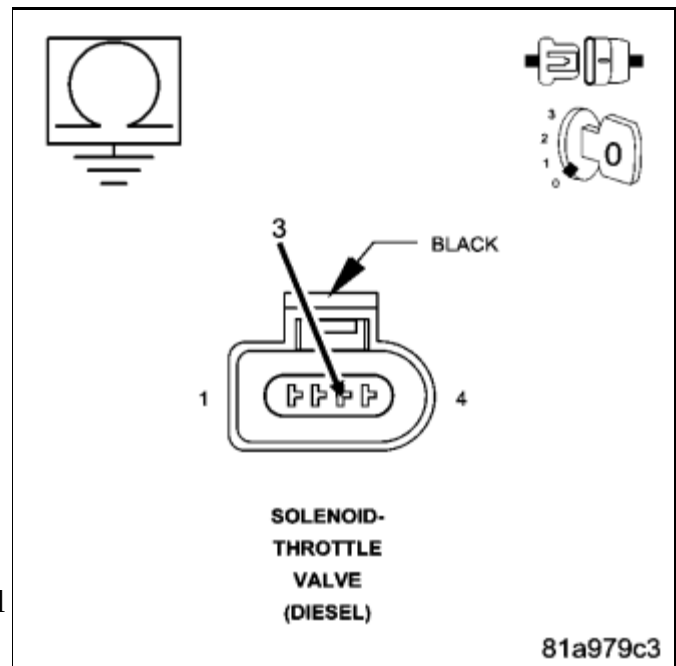
Is the resistance above 1000 ohms?

Yes

- Go To [5](#)

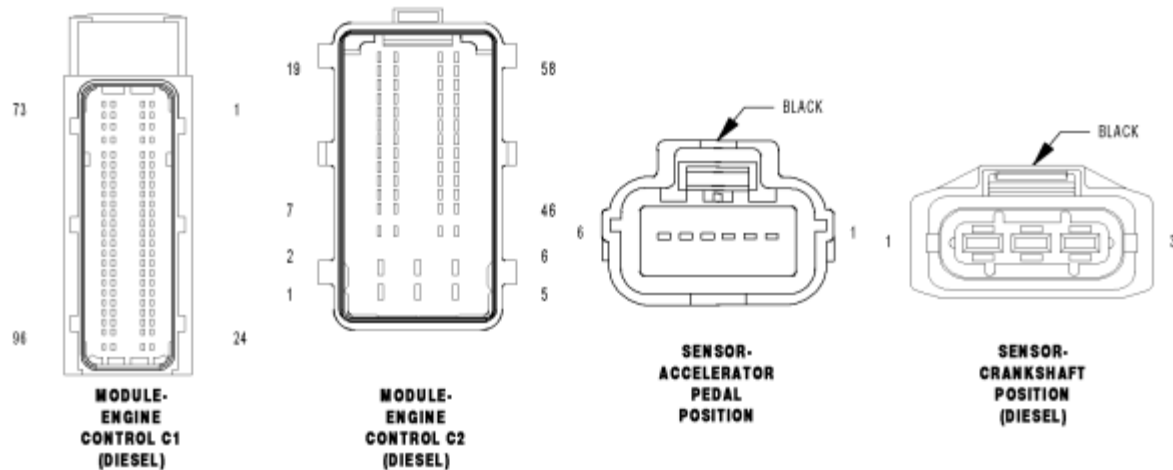
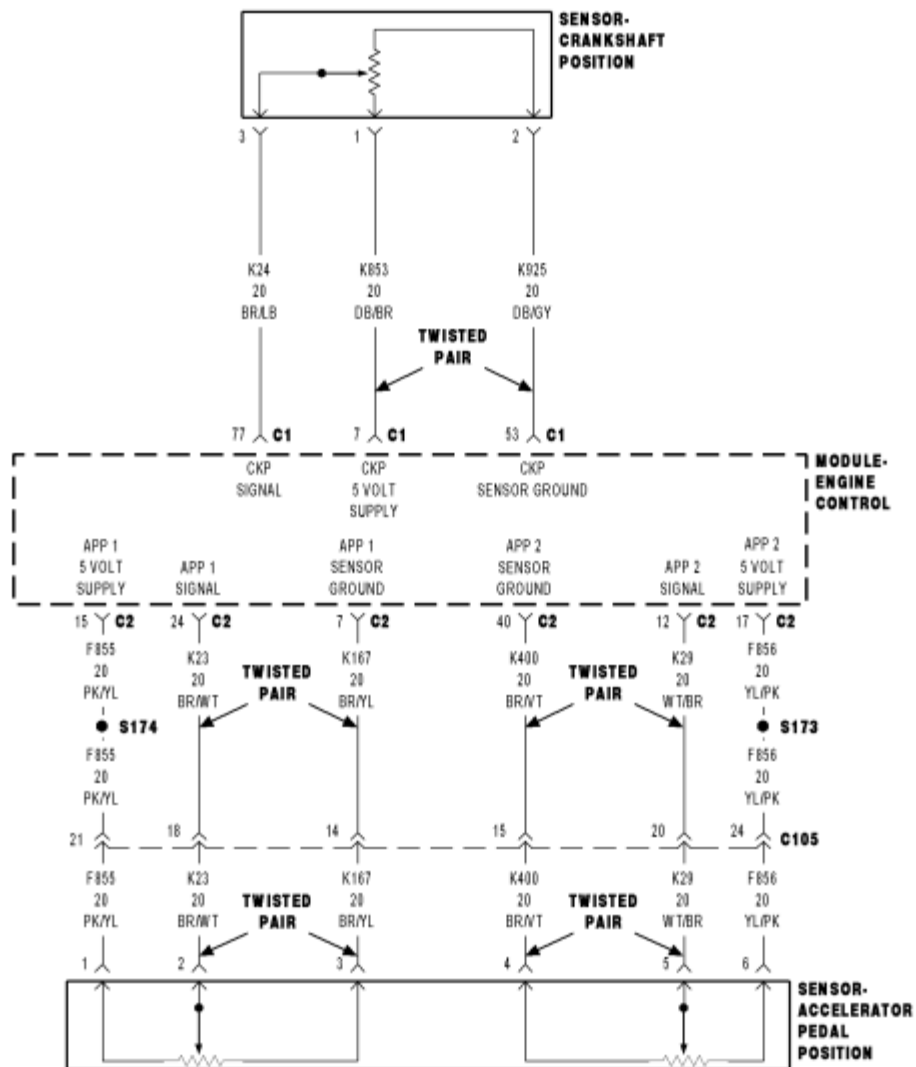
No

- Repair the (K54) EGR Air Flow Control Valve Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT OPEN

LOW



81a754a8

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Accelerator Pedal Position Sensor contains two independent three wire inductive sensors. Each sensor provides independent pedal position signals to the ECM. The raw voltage signal from APP #1 sensor is 2 times the raw voltage signal from APP #2. Although the raw voltage signals differ, the scan tool converts and displays these voltages as matching percentages of pedal travel.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The APP Sensor #1 Signal circuit is below 0.2 volt for 0.3 second.

Possible Causes
INTERMITTENT DTC
(F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO GROUND
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO THE (K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO THE (K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT
ACCELERATOR PEDAL POSITION SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the

Engine Control Module (ECM) harness connector.

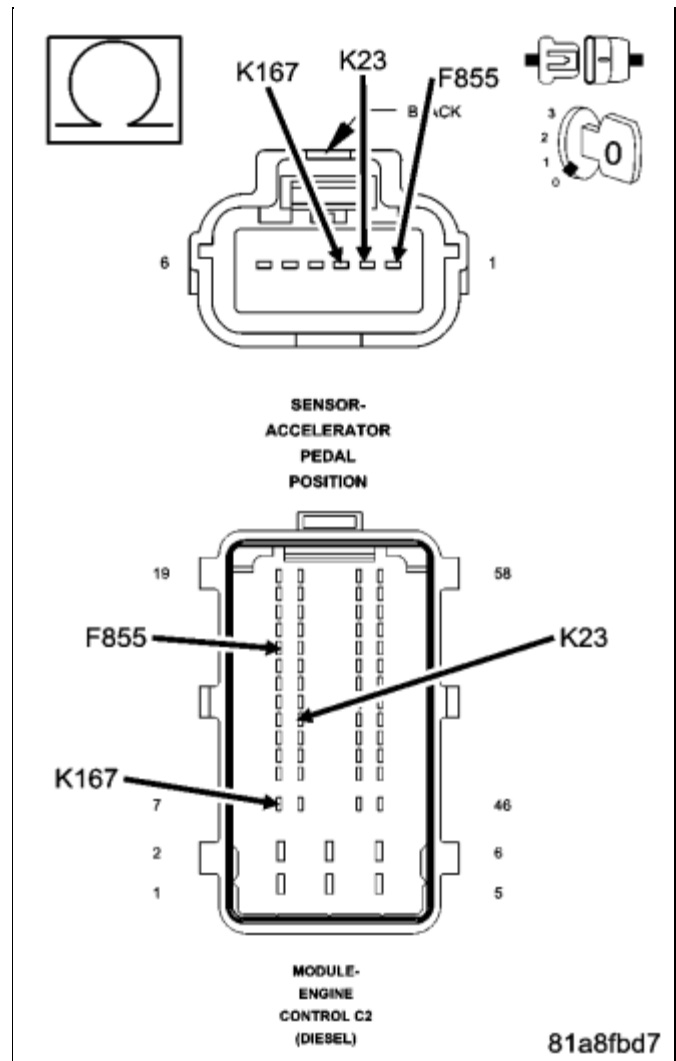
Is the resistance below 10.0 ohms for each of the circuits?

Yes

- Go to [3](#)

No

- Repair the appropriate circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

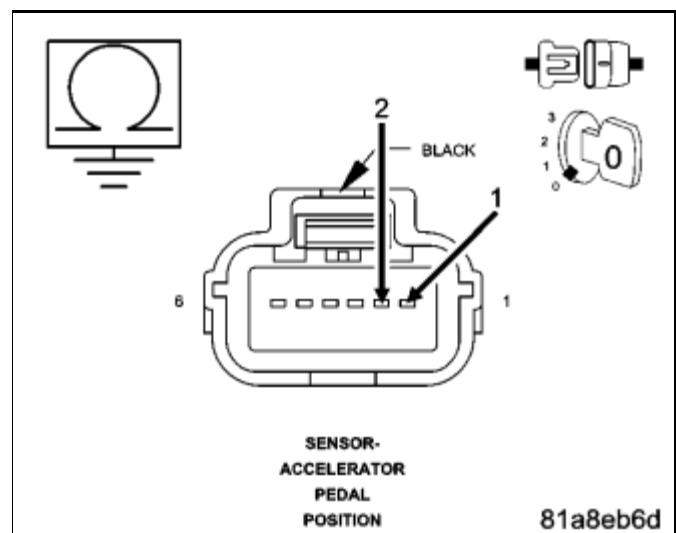
Measure the resistance between ground and the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

Is the resistance between ground and both of the circuits above 1000 ohms?

Yes

- Go to [4](#)

No



- Repair the appropriate circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Measure the resistance between the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit and the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the resistance between the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit and the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

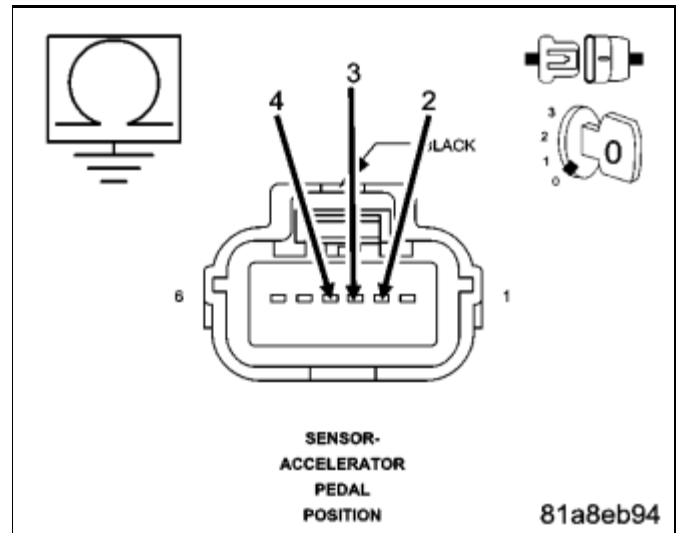
Is the resistance between ground and both of the circuits above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the appropriate circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ACCELERATOR PEDAL POSITION SENSOR

Connect the Engine Control Module (ECM) harness connector.

Connect a jumper wire between the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit and the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

Turn the ignition on.

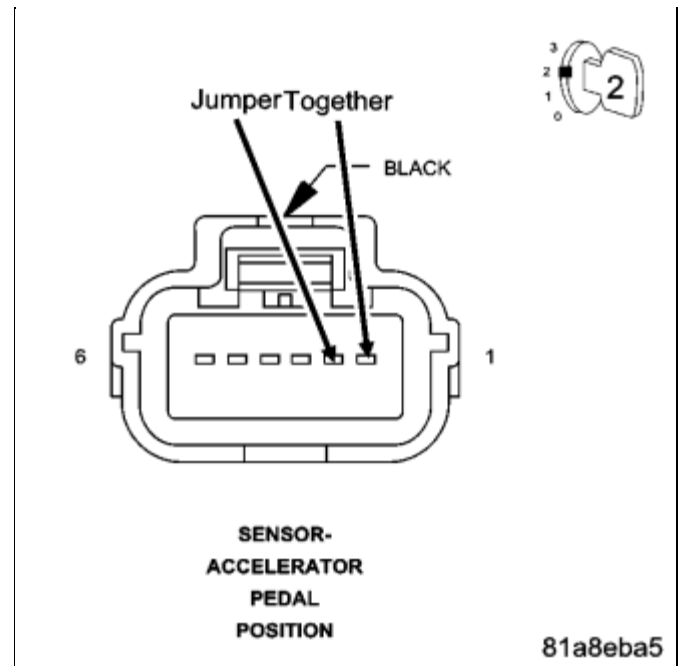
With the scan tool, Clear DTCs.

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Accelerator Pedal Position Sensor No. 1 high voltage or open DTC with the

Accelerator Pedal Position Sensor connector disconnected.



Does the scan tool display the DTC as described above?

Yes

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

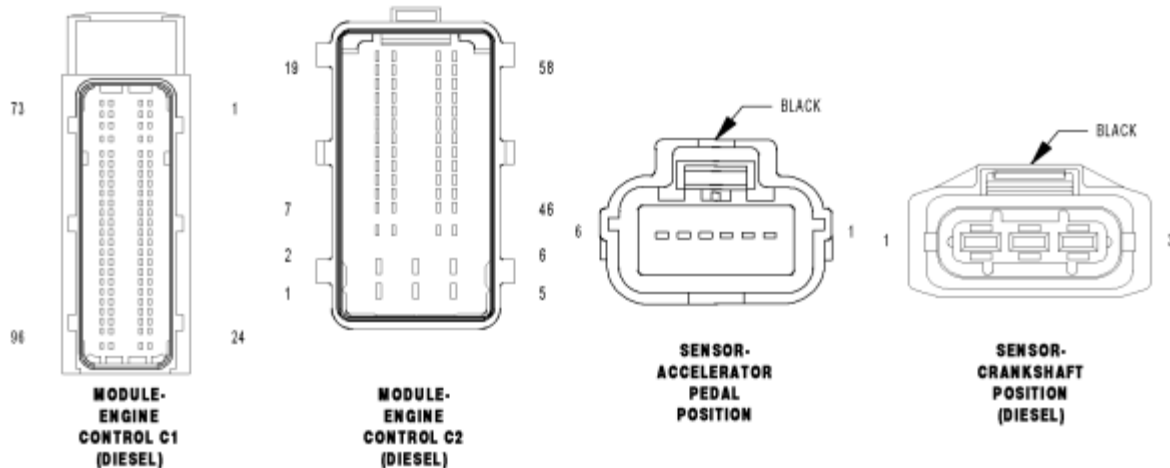
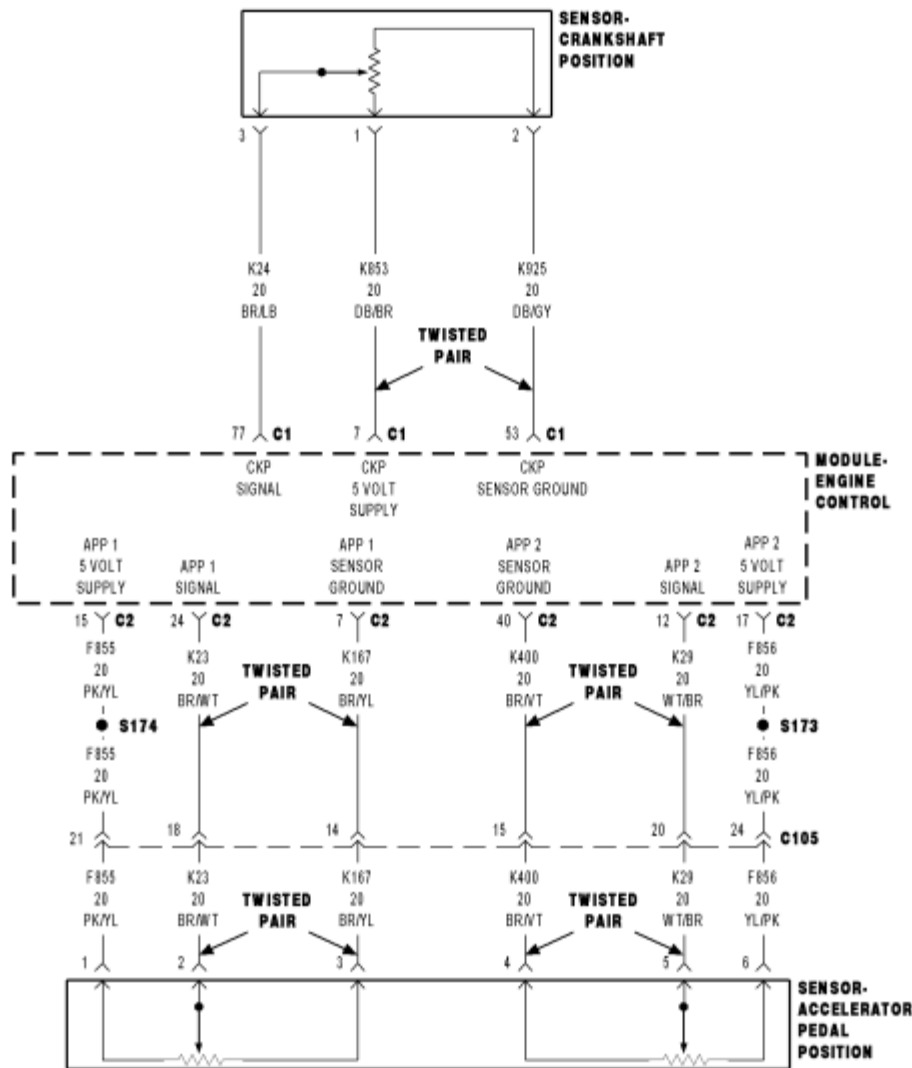
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH



81a754a8

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Accelerator Pedal Position Sensor contains two independent three wire inductive sensors. Each sensor provides independent pedal position signals to the ECM. The raw voltage signal from APP 1 sensor is 2 times the raw voltage signal from APP 2. Although the raw voltage signals differ, the scan tool converts and displays these voltages as matching percentages of pedal travel.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The APP Sensor 1 signal circuit is above 4.8 volts for 0.3 second.

Possible Causes
INTERMITTENT DTC
(F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO THE (F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT OR (F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT
(F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ACCELERATOR PEDAL POSITION SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Accelerator Pedal Position Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the voltage of the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit in the Accelerator Pedal Position

Sensor harness connector.

Measure the voltage of the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

Is there voltage present on any of the circuits?

Yes

- Repair the appropriate circuit that has voltage present for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. (K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT SHORTED TO THE 5 VOLT SUPPLY CIRCUIT

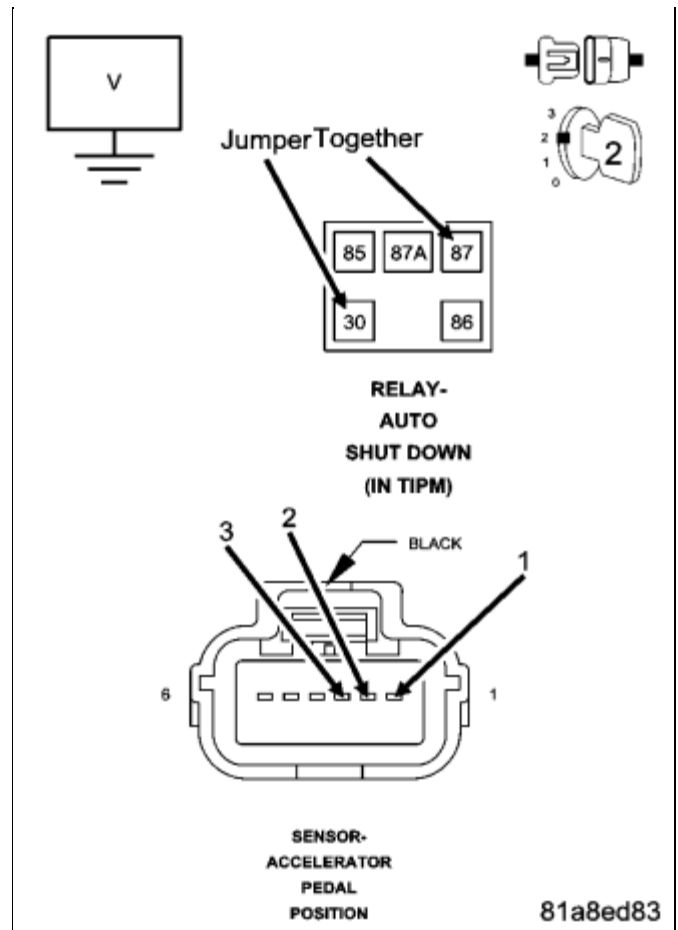
Turn the ignition off.

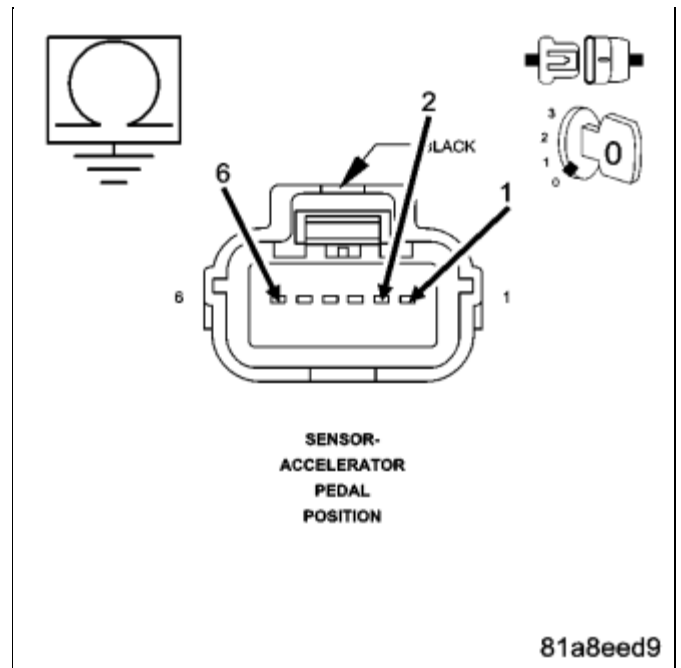
Remove the jumper wire and install the ASD Relay.

Measure the resistance between the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit and the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the resistance between the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit and the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

Is the resistance above 10.0 ohms for both of the circuits?





Yes

- Go to [4](#)

No

- Repair the shorted (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each of the circuits?

Yes

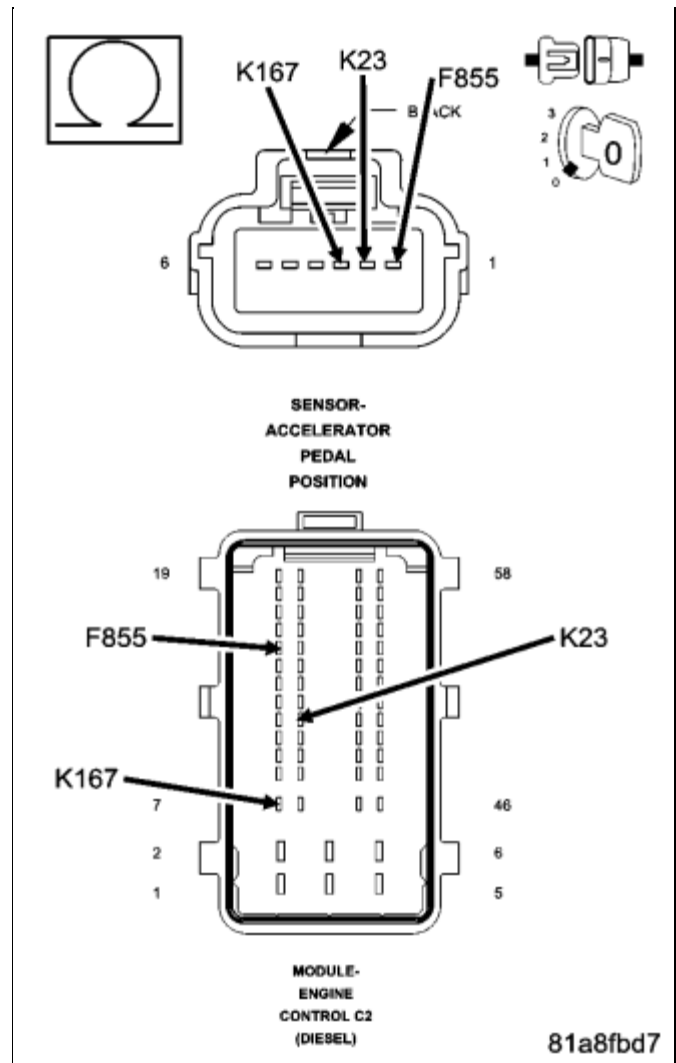
- Go to [5](#)

No

- Repair the appropriate circuit for an open circuit or

high resistance.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ACCELERATOR PEDAL POSITION SENSOR

Connect the Engine Control Module (ECM) harness connector.

Connect a jumper wire between the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit and the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

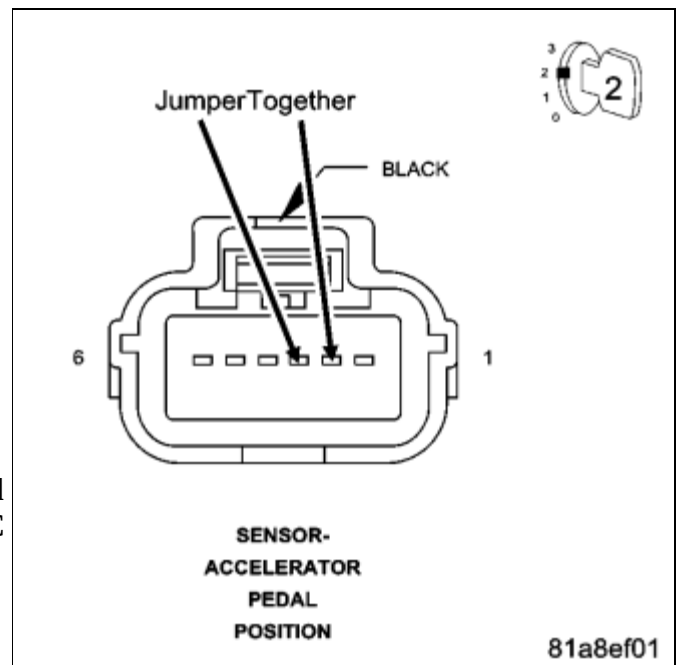
Turn the ignition on.

With the scan tool, Clear DTCs.

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Accelerator Pedal Position Sensor No. 1 low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC as described above?

Yes

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

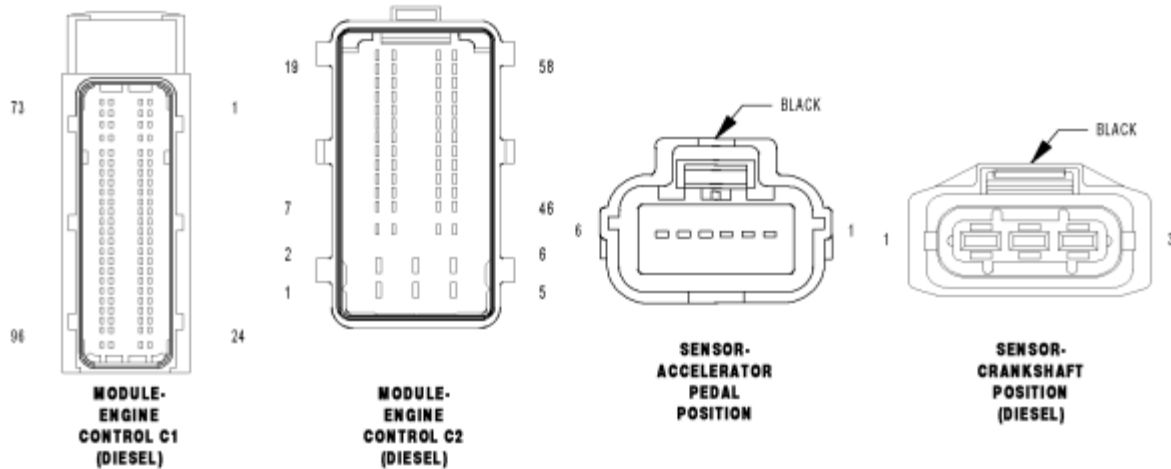
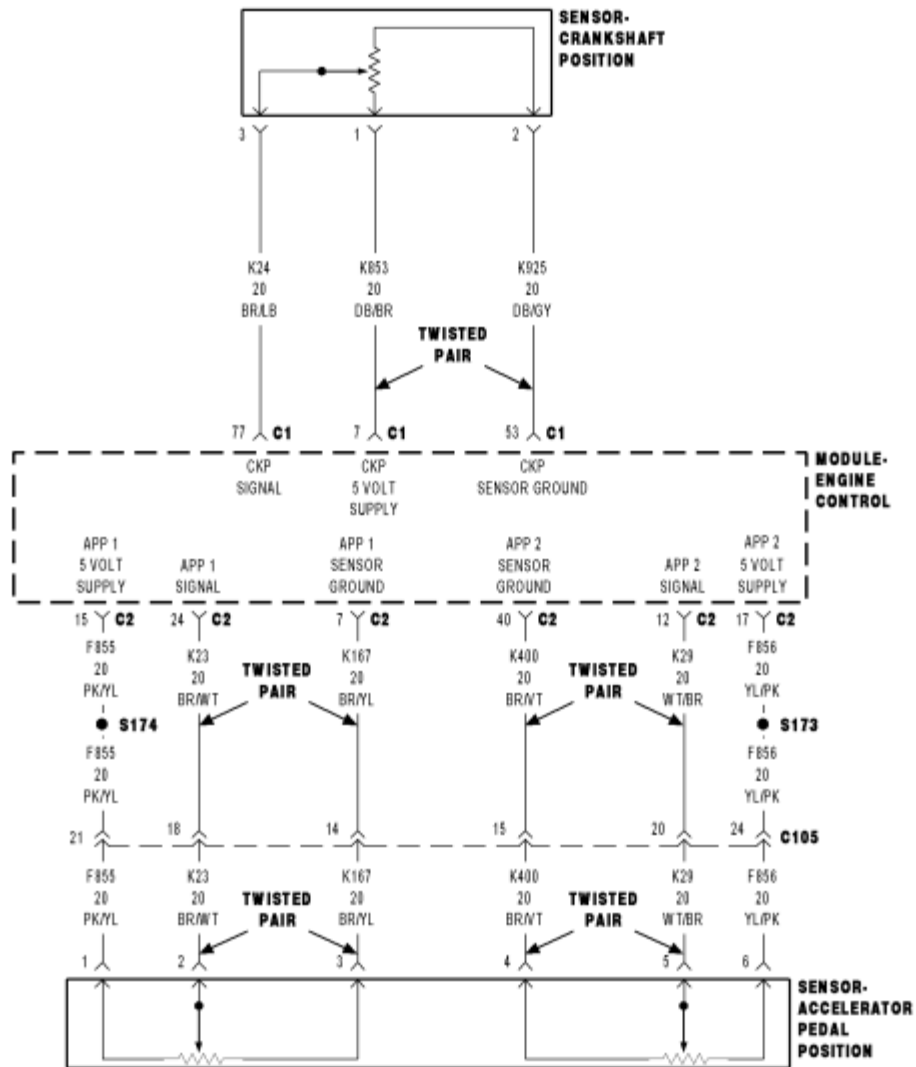
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW



81a754a6

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Accelerator Pedal Position Sensor contains two independent three wire inductive sensors. Each sensor provides independent pedal position signals to the ECM. The raw voltage signal from APP 1 sensor is 2 times the raw voltage signal from APP 2. Although the raw voltage signals differ, the scan tool converts and displays these voltages as matching percentages of pedal travel.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The APP Sensor #2 Signal circuit is below 0.097 volt for 0.3 second.

Possible Causes
INTERMITTENT DTC
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO GROUND
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO THE (K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO THE (K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT
ACCELERATOR PEDAL POSITION SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

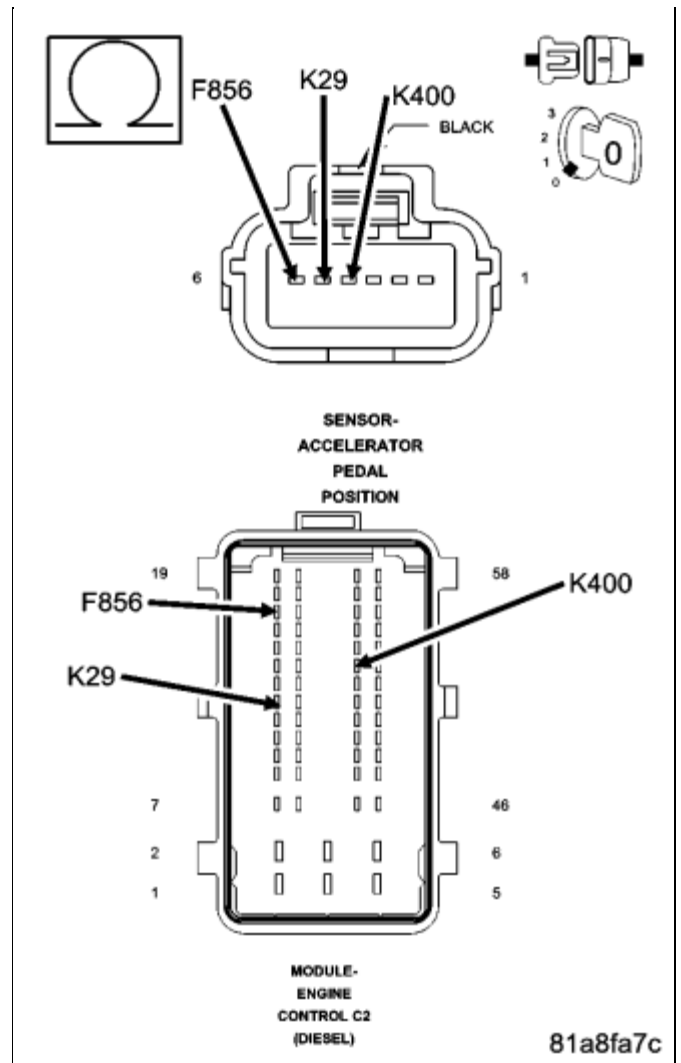
Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each of the circuits?



Yes

- Go to [3](#)

No

- Repair the appropriate circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

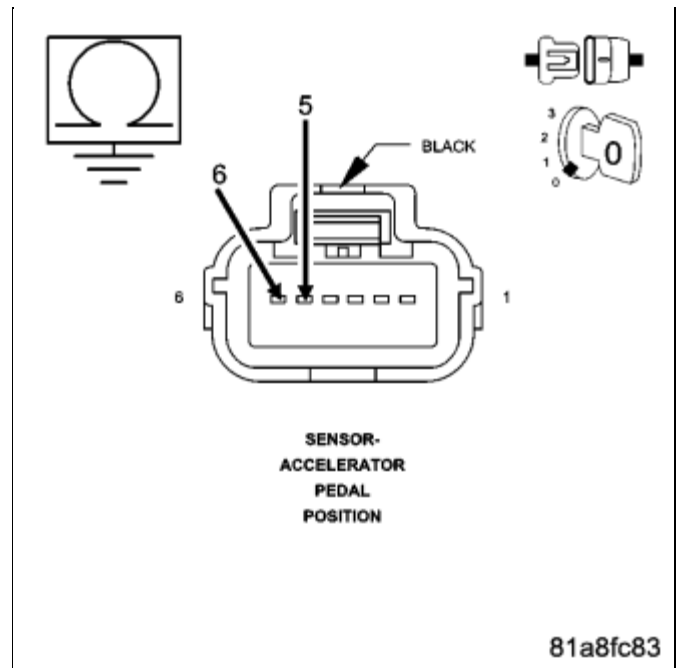
Measure the resistance between ground and the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

Is the resistance between ground and both of the circuits above 1000 ohms?

Yes

- Go to [4](#)

No



- Repair the appropriate circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Measure the resistance between the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit and the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the resistance between the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit and the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

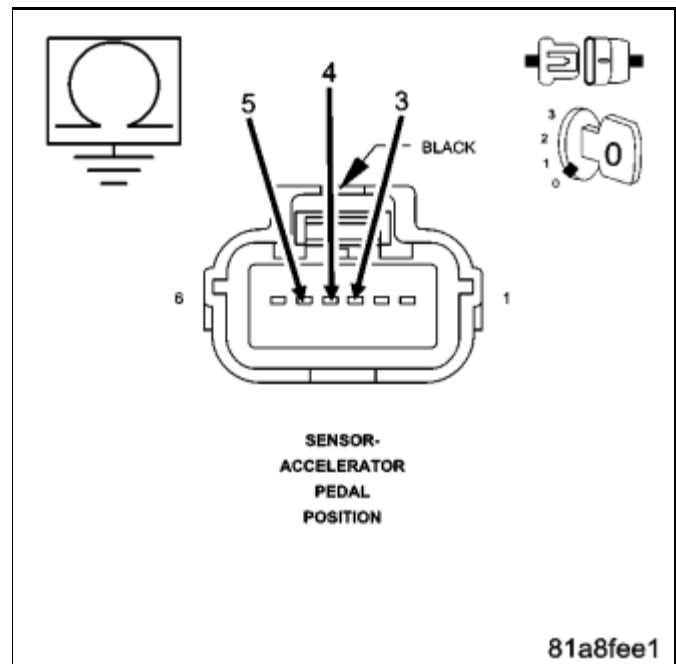
Is the resistance between ground and both of the circuits above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the appropriate circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. ACCELERATOR PEDAL POSITION SENSOR

Connect the Engine Control Module (ECM) harness connector.

Connect a jumper wire between the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit and the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

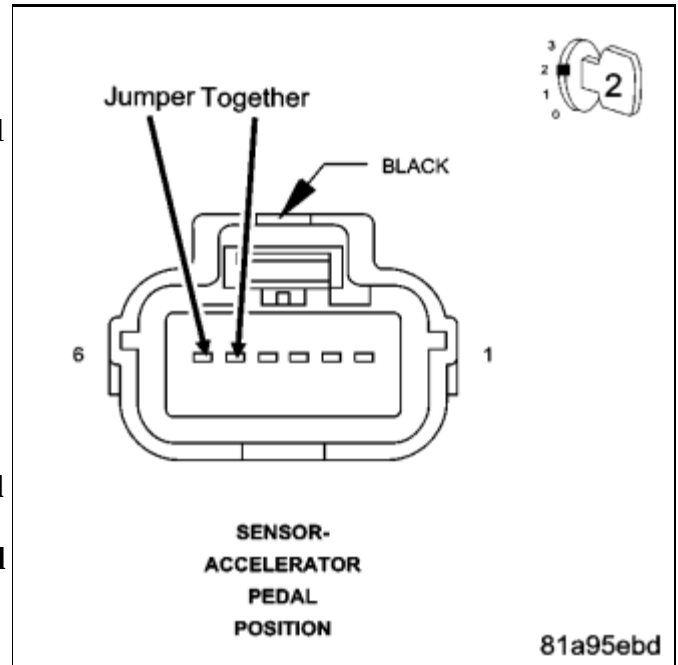
Turn the ignition on.

With the scan tool, Clear DTCs.

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Accelerator Pedal Position Sensor No. 2 high voltage or open DTC with the Accelerator Pedal Position Sensor connector disconnected and the jumper wire in place.



Does the scan tool display the DTC as described above?

Yes

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

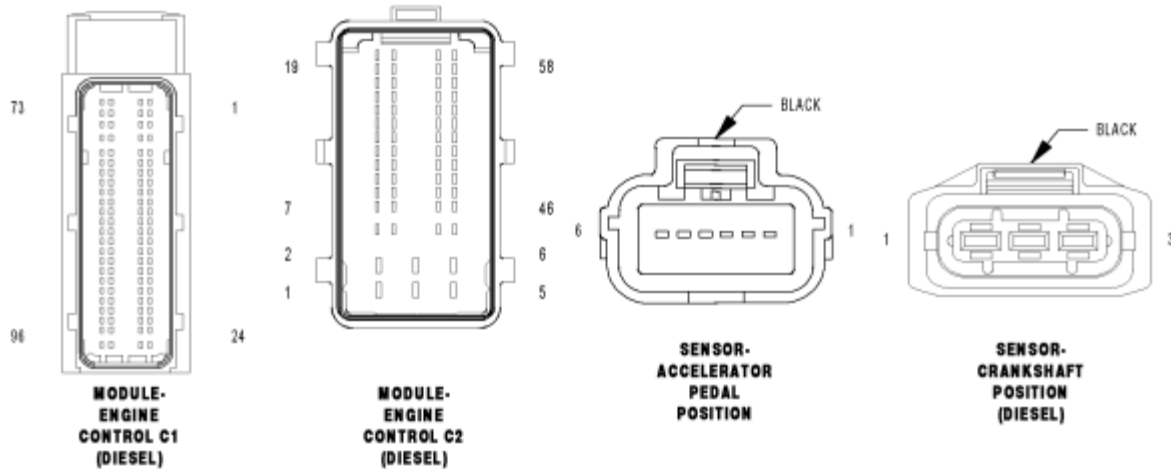
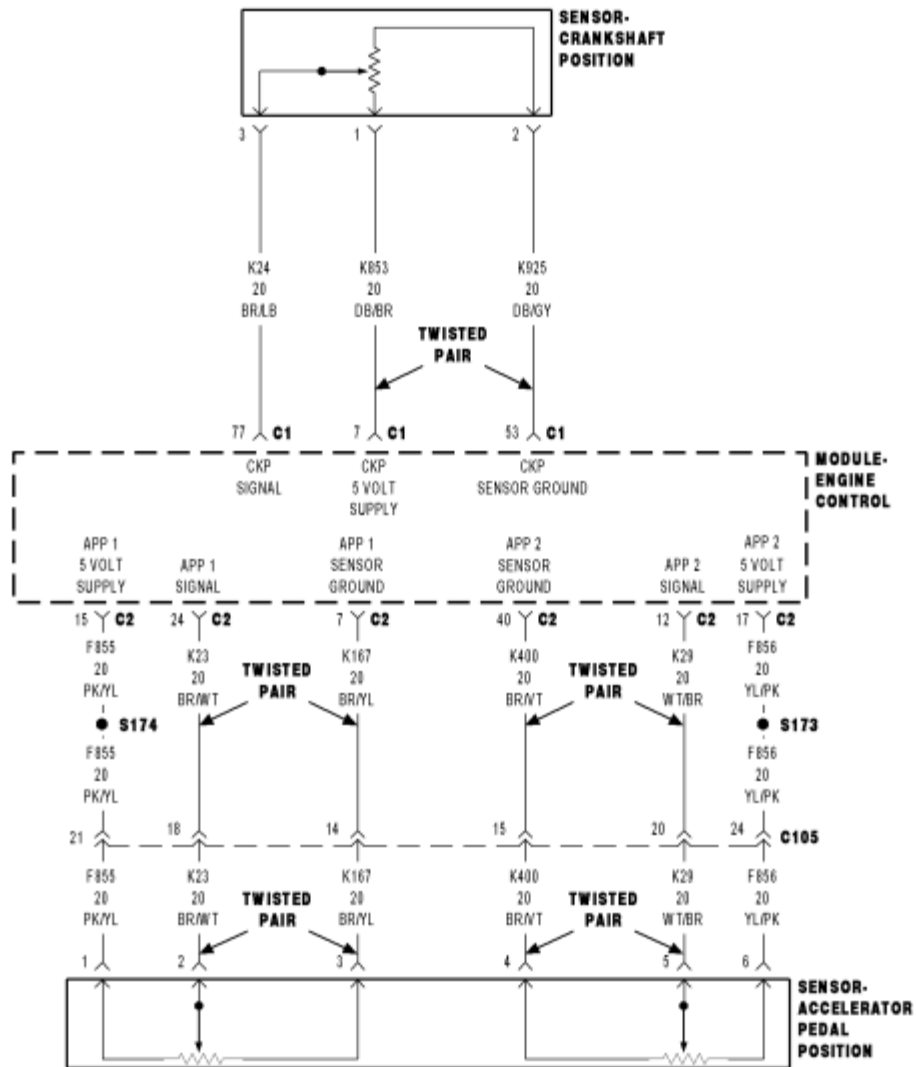
- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH



81a754a6

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Accelerator Pedal Position Sensor contains two independent three wire inductive sensors. Each sensor provides independent pedal position signals to the ECM. The raw voltage signal from APP 1 sensor is 2 times the raw voltage signal from APP 2. Although the raw voltage signals differ, the scan tool converts and displays these voltages as matching percentages of pedal travel.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The APP Sensor #2 signal circuit is above 2.5 volt for 0.3 second.

Possible Causes
INTERMITTENT DTC
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO THE (F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT OR (F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ACCELERATOR PEDAL POSITION SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT SHORTED TO VOLTAGE

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

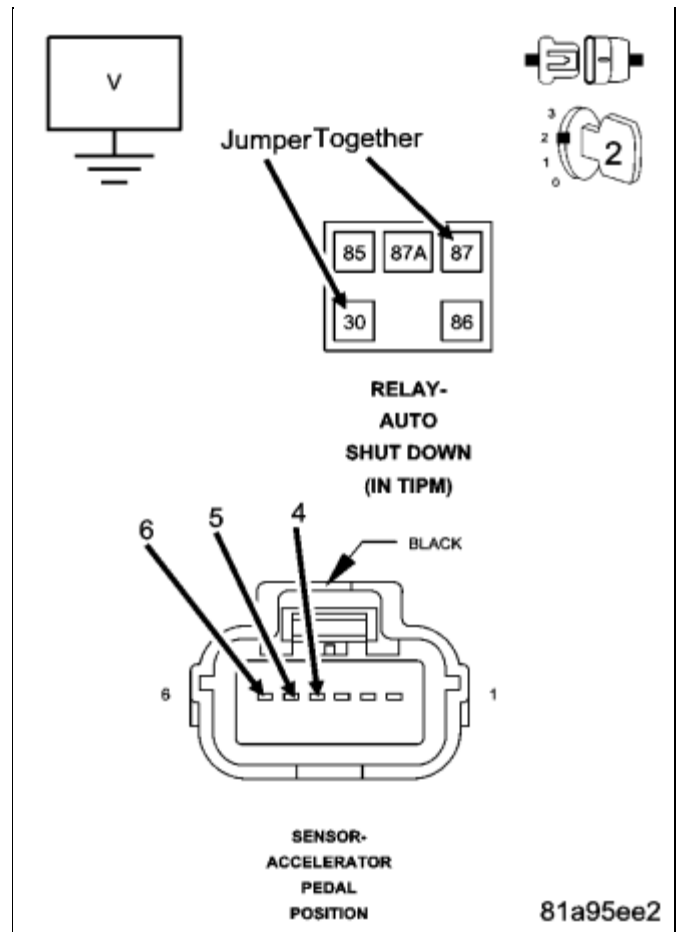
Measure the voltage of the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the voltage of the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit in the Accelerator Pedal Position Sensor harness connector.

Is there voltage present on any of the circuits?

Yes

- Repair the appropriate circuit that has voltage present



for a short to voltage.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. (K29) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT SHORTED TO THE 5 VOLT SUPPLY CIRCUIT

Turn the ignition off.

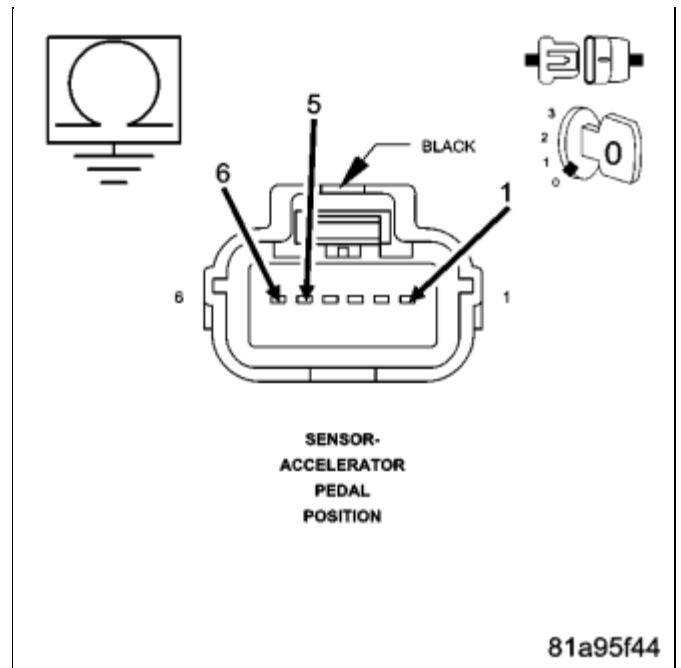
Remove the jumper wire and install the ASD Relay.

Measure the resistance between the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit and the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

Measure the resistance between the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit and the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit in the Accelerator Pedal Position Sensor harness connector.

Is the resistance above 1000 ohms for both of the circuits?

Yes



- Go to [4](#)

No

- Repair the shorted (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

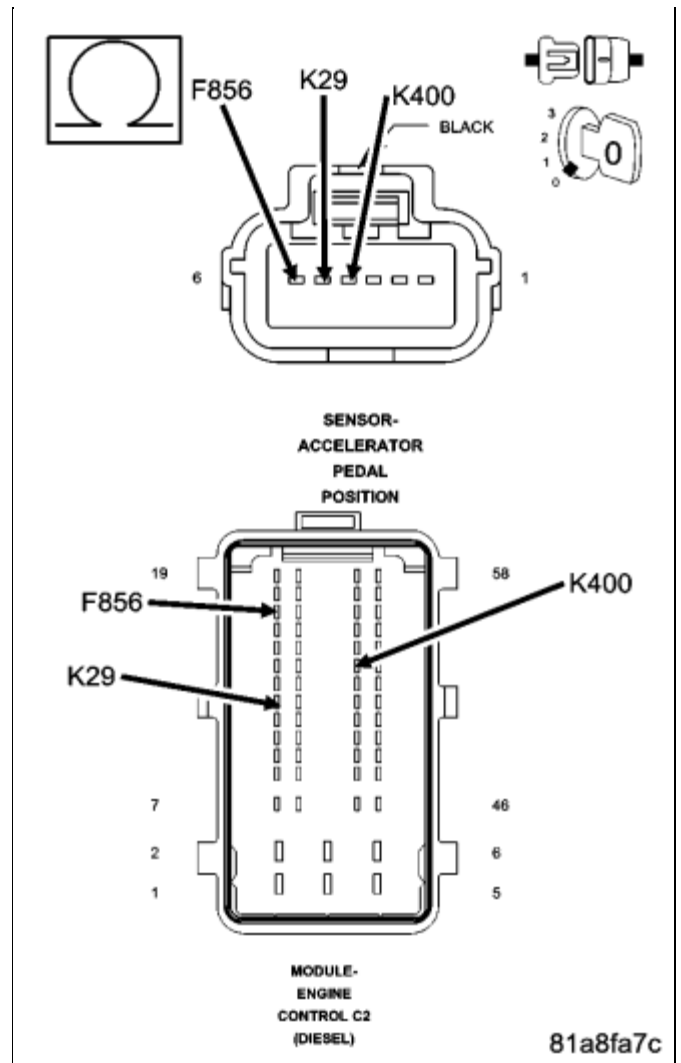
Is the resistance below 10.0 ohms for each of the circuits?

Yes

- Go to [5](#)

No

- Repair the appropriate circuit for an open circuit or



high resistance.

- o Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. ACCELERATOR PEDAL POSITION SENSOR

Connect the Engine Control Module (ECM) harness connector.

Connect a jumper wire between the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit and the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit in the Accelerator Pedal Position Sensor harness connector.

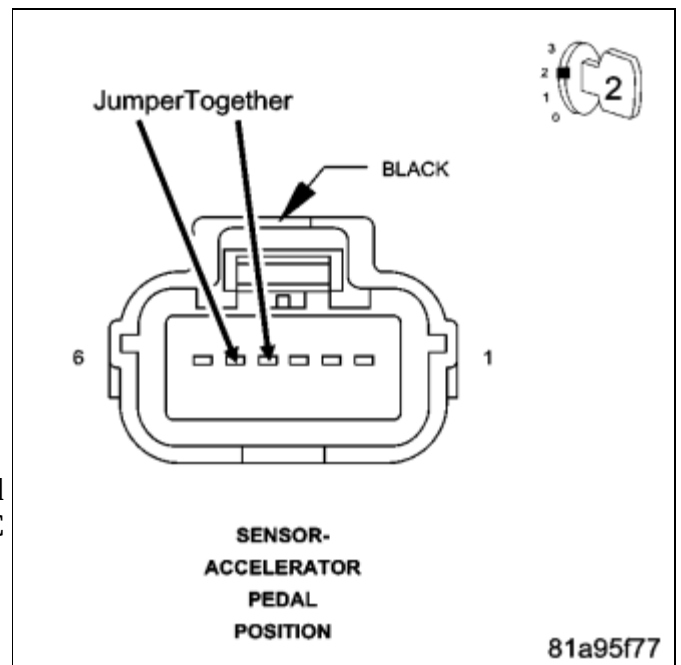
Turn the ignition on.

With the scan tool, Clear DTCs.

Fully depress and release the Accelerator Pedal several times.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Accelerator Pedal Position Sensor No. 2 low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC as described above?**Yes**

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Accelerator Pedal Position Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

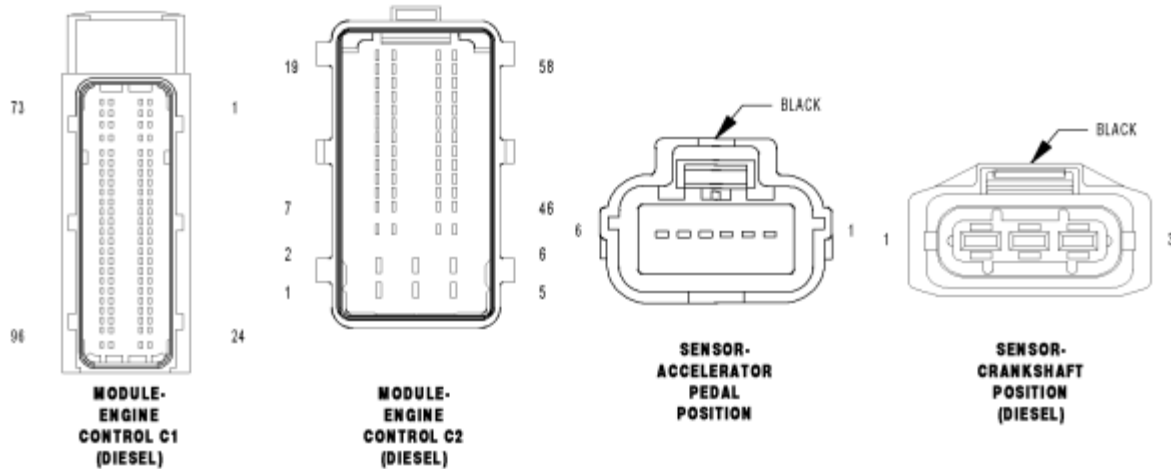
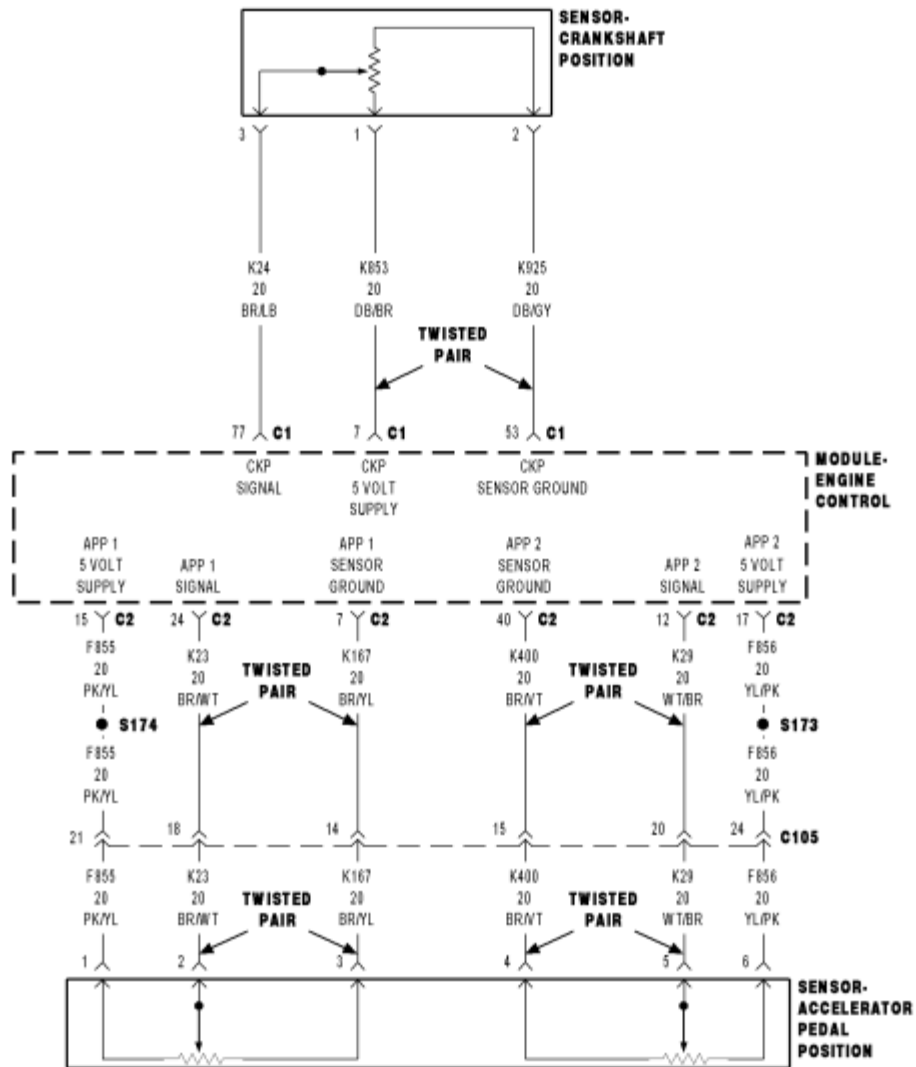
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2138-ACCELERATOR PEDAL POSITION SENSOR 1 / 2 CORRELATION



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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Accelerator Pedal Position Sensor contains two independent three wire inductive sensors. Each sensor provides independent pedal position signals to the ECM. The raw voltage signal from APP 1 sensor is 2 times the raw voltage signal from APP 2. Although the raw voltage signals differ, the scan tool converts and displays these voltages as matching percentages of pedal travel.

- **When Monitored:**

With the ignition on. No other APP DTC's set. No Sensor Reference Voltage DTC's set.

- **Set Condition:**

APP Sensor 1 and APP Sensor 2 signals do not agree for 0.4 second.

Possible Causes
INTERMITTENT DTC
(F855) ACCELERATOR PEDAL POSITION SENSOR NO. 1 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K23) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K167) ACCELERATOR PEDAL POSITION SENSOR NO. 1 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(F856) ACCELERATOR PEDAL POSITION SENSOR NO. 2 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K12) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K400) ACCELERATOR PEDAL POSITION SENSOR NO. 2 SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
ACCELERATOR PEDAL POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor reference or supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ACCELERATOR PEDAL POSITION SENSOR CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connector.

Measure the resistance of the (F855) Accelerator Pedal Position Sensor No. 1 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

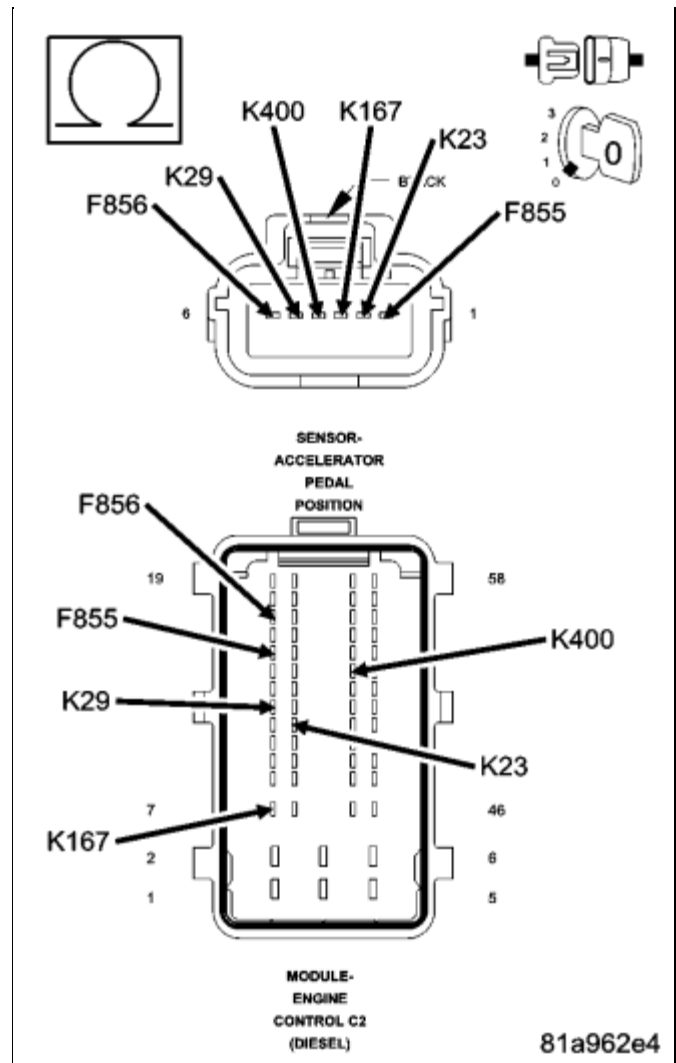
Measure the resistance of the (K23) Accelerator Pedal Position Sensor No. 1 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K167) Accelerator Pedal Position Sensor No. 1 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (F856) Accelerator Pedal Position Sensor No. 2 5 Volt Supply circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K29) Accelerator Pedal Position Sensor No. 2 Signal circuit between the Accelerator Pedal Position Sensor harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (K400) Accelerator Pedal Position Sensor No. 2 Sensor Ground circuit between the Accelerator Pedal Position Sensor harness connector and the



Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each of the circuits?

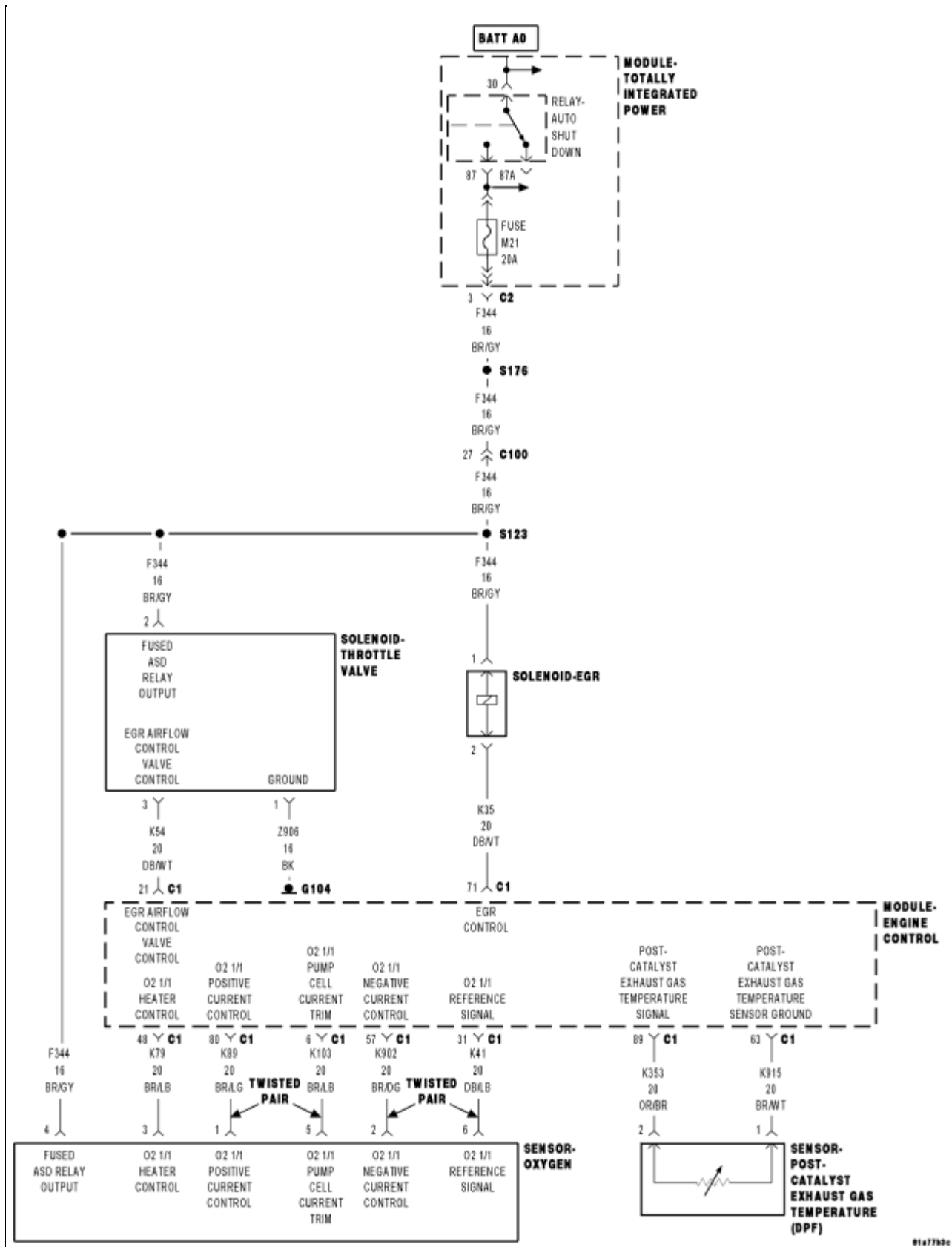
Yes

- Replace the Accelerator Pedal Position Sensor.

No

- Repair the circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2141-EGR AIR FLOW CONTROL VALVE CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The EGR Air Flow Control Valve is a three-wire electrically operated throttle valve motor used to assist the EGR system function by creating a vacuum in the intake system to draw exhaust gas into the intake manifold. The Solenoid receives 12 volts from the ECM/ASD relay, ground and a pulse-width modulated ground signal from the ECM. With the solenoid de-energized (off) the throttle valve is in the open (full flow) position. When the ECM energizes (grounds) the throttle motor, the throttle valve closes creating a low pressure (vacuum) in the intake system. This low pressure effect helps draw exhaust gases from the EGR Valve into the intake system.

- **When Monitored:**

With the ignition on and the ECM EGR Air Flow Control Valve command off.

- **Set Condition:**

The ECM detects a short ground on the EGR Air Flow Control Valve Control circuit for 0.5 second.

Possible Causes
INTERMITTENT CONDITION
(F344) ASD RELAY OUTPUT CIRCUIT OPEN
(K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT SHORTED TO GROUND
(K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT OPEN
(Z906) GROUND CIRCUIT OPEN
EGR AIR FLOW CONTROL VALVE
ENGINE CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

NOTE: An open ECM power supply to the ECM will cause multiple DTC's including this DTC to set.

NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.

If the ECM power and ground circuits are functioning properly continue with this test.

Yes

- Go To [3](#)

3. (Z906) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Using a 12-volt test light connected to 12 volts, check the (Z906) Ground circuit at the EGR Air Flow Control Valve harness connector.

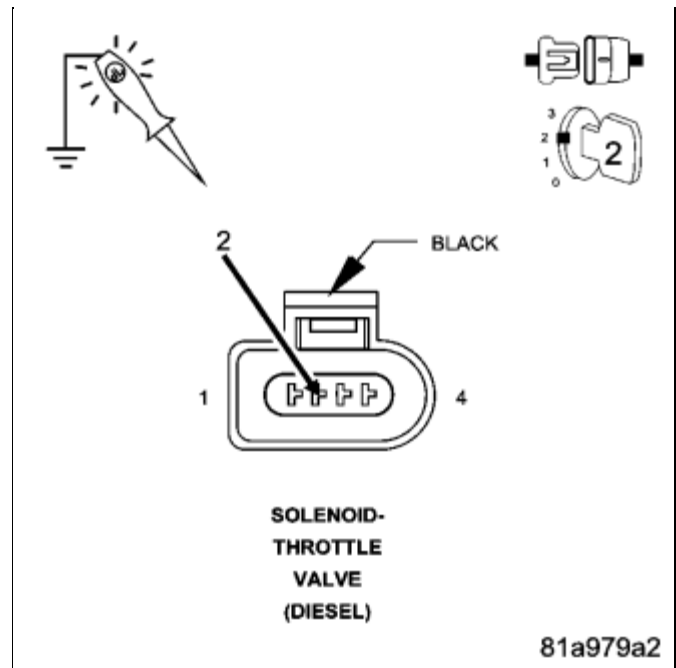
Does the test light illuminate brightly?

Yes

- Go To [4](#)

No

- Repair the (Z906) Ground circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**4. (F344) ASD RELAY OUTPUT CKT OPEN**

Turn the ignition on.

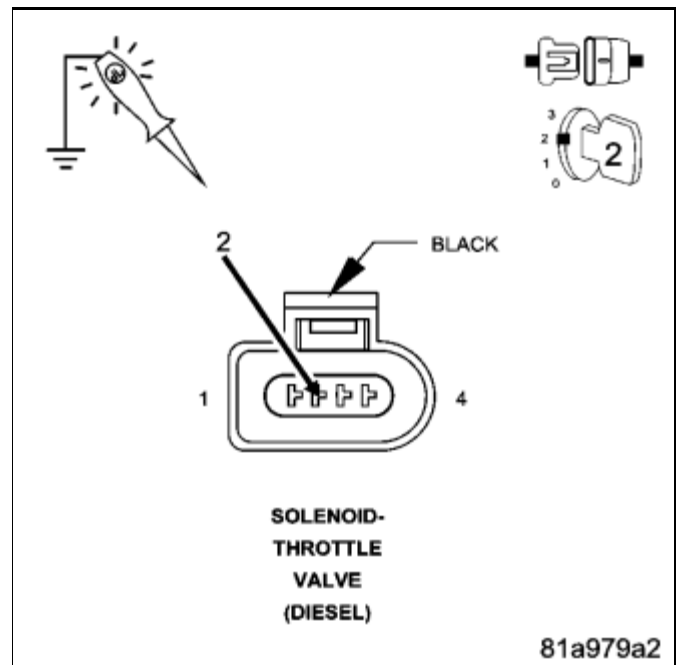
Using a 12-volt test light connected to ground, check the (F344) ASD Relay Output circuit at the EGR Air Flow Control Valve harness connector.

Does the test light illuminate brightly?**Yes**

- Go To [5](#)

No

- Repair the (F344) ASD Relay Output circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**5. (K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT SHORTED TO GROUND**

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the (K54) EGR

Air Flow Control Valve Control circuit at the EGR Air Flow Control Valve harness connector.

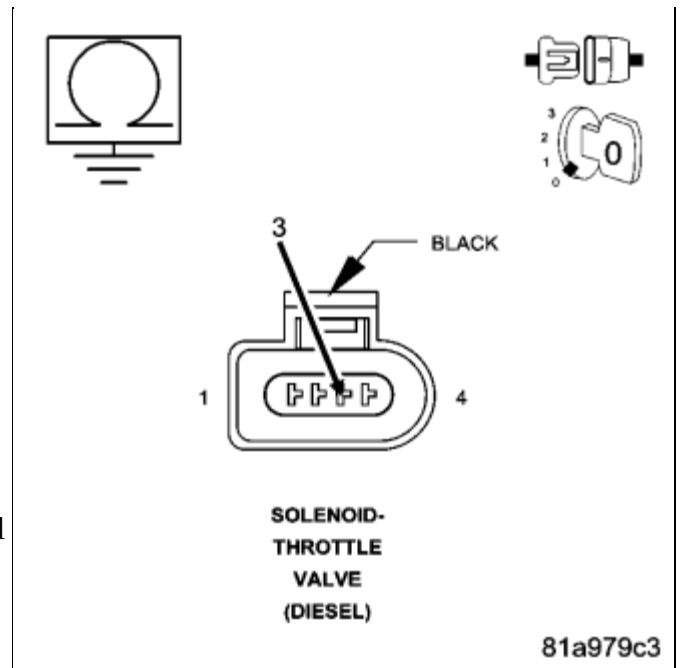
Is the resistance above 1000 ohms?

Yes

- Go To [6](#)

No

- Repair the (K54) EGR Air Flow Control Valve Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K54) EGR AIR FLOW CONTROL VALVE CONTROL CIRCUIT OPEN

Measure the resistance of the (K54) EGR Air Flow Control Valve Control circuit between the EGR Air Flow Control Valve harness connector and the ECM C1 harness connector.

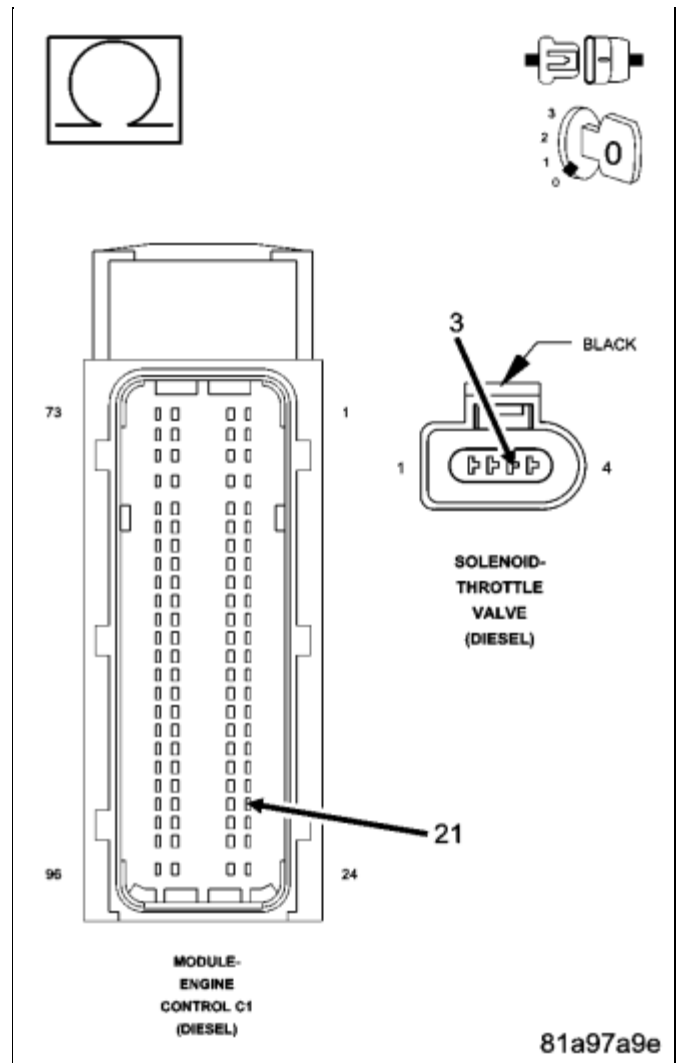
Is the resistance below 10.0 ohms?

Yes

- Go To [7](#)

No

- Repair the (K54) EGR Air Flow Control Valve Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. EGR AIR FLOW CONTROL VALVE

Install a substitute EGR Air Flow Control Valve in place of the vehicle's EGR Air Flow Control Valve.

NOTE: Ensure the ECM and EGR Air Flow Control Valve harness connectors are connected.

Turn the ignition on.

With the scan tool, check for this DTC to set again.

Did this DTC set again?

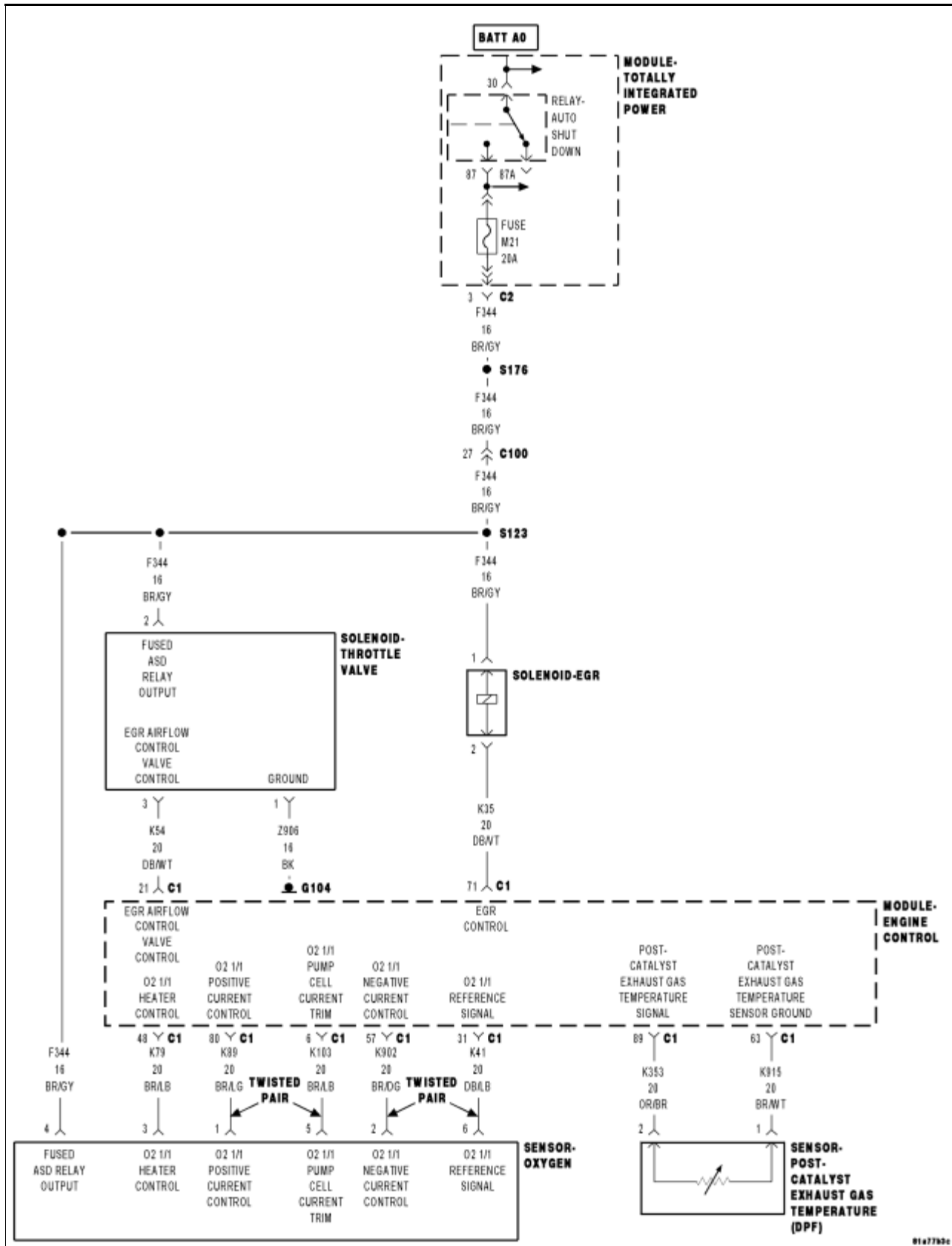
Yes

- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the EGR Air Flow Control Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2142-EGR AIR FLOW CONTROL VALVE CIRCUIT HIGH



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The EGR Air Flow Control Valve is a three-wire electrically operated throttle valve motor used to assist the EGR system function by creating a vacuum in the intake system to draw exhaust gas into the intake manifold. The Solenoid receives 12 volts from the ECM/ASD relay, ground and a pulse-width modulated ground signal from the ECM. With the solenoid de-energized (off) the throttle valve is in the open (full flow) position. When the ECM energizes (grounds) the throttle motor, the throttle valve closes creating a low pressure (vacuum) effect in the intake system. This low pressure effect helps draw exhaust gases from the EGR Valve into the intake system.

- **When Monitored:**

With the ignition on and the ECM EGR Air Flow Control Valve command on.

- **Set Condition:**

The ECM detects excessive current on the EGR Air Flow Control Valve Control circuit for 0.5 second.

Possible Causes
INTERMITTENT CONDITION
EGR AIR FLOW CONTROL VALVE
(K54) EGR AIR FLOW CONTROL VALVE CONTROL SHORTED TO VOLTAGE
ENGINE CONTROL MODULE

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.
With the scan tool, erase ECM DTCs.
Test drive the vehicle and monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. EGR AIR FLOW CONTROL VALVE

Turn the ignition off.
Disconnect the EGR Air Flow Control Valve harness connector.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Monitor the scan tool for ECM DTCs.

Does the scan tool display P2141?

Yes

- Replace the EGR Air Flow Control Valve.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (K54) EGR AIR FLOW CONTROL VALVE CONTROL SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the EGR Air Flow Control Valve harness connector.
Disconnect the ECM harness connectors.
Remove the ASD Relay from the TIPM.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of the (K54) EGR Air Flow Control Valve Control circuit at the EGR Air Flow Control Valve harness connector.

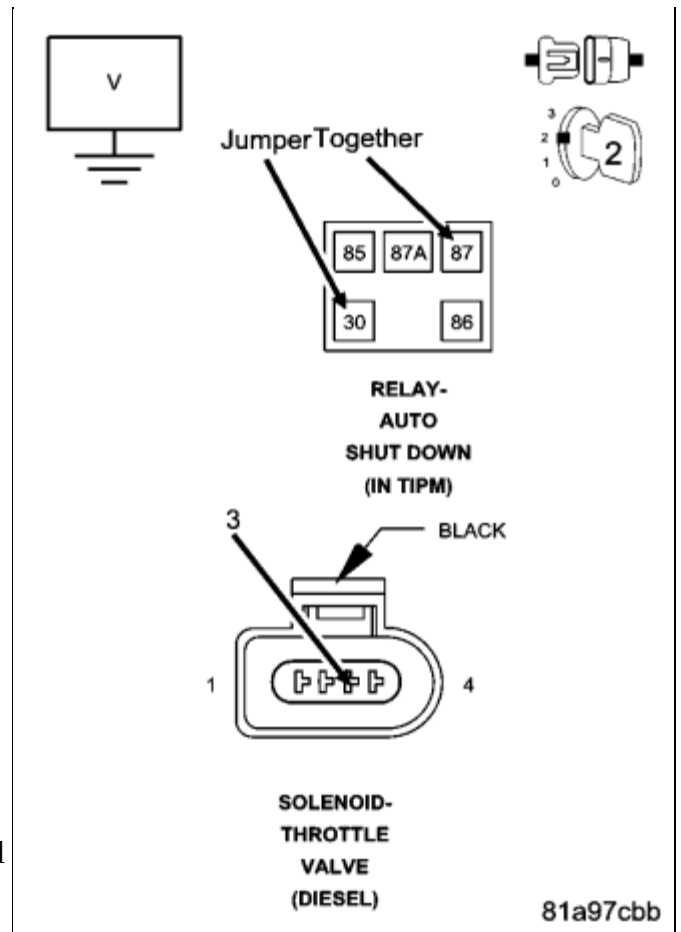
Is the voltage below 0.5 volt?

Yes

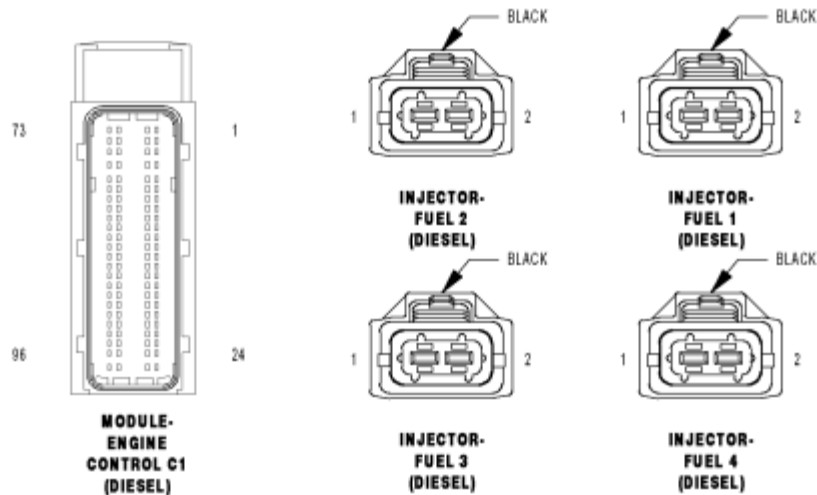
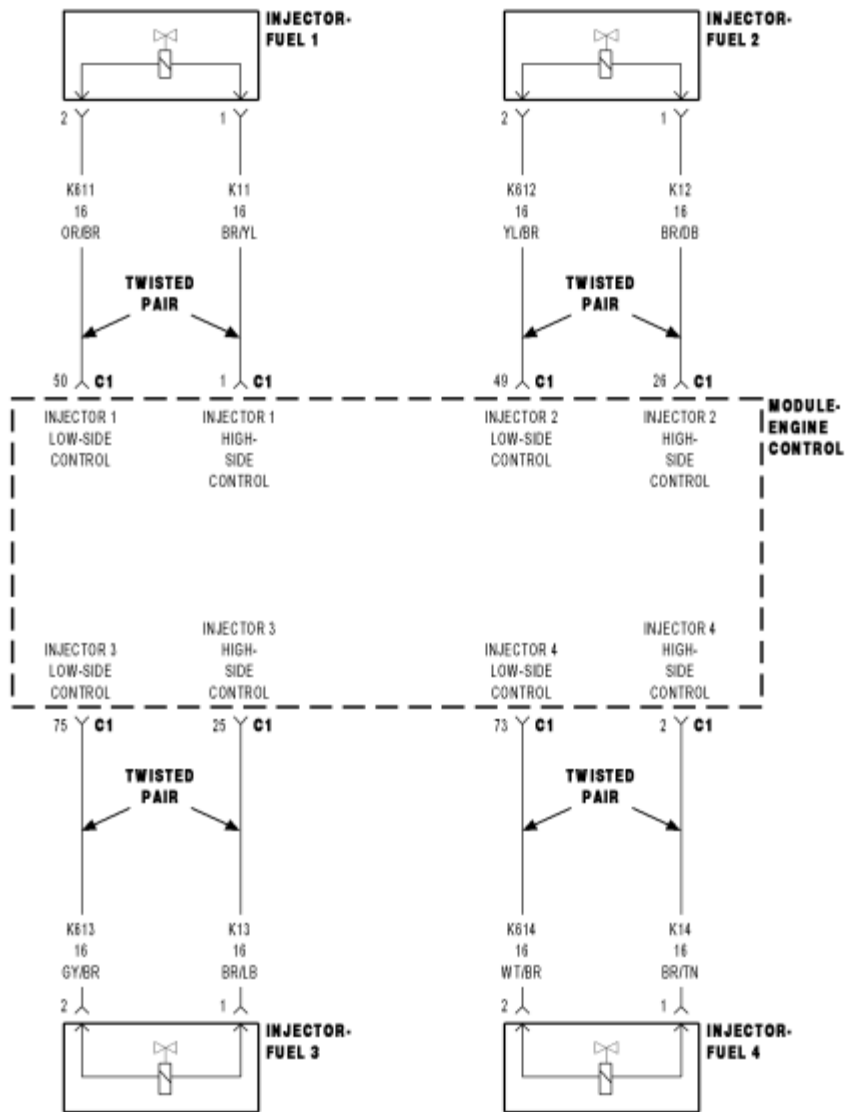
- Replace and program the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (K54) EGR Air Flow Control Valve Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2146-FUEL INJECTOR GROUP 1 SUPPLY VOLTAGE CIRCUIT OPEN



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

◦ **Set Condition:**

The ECM detects an open circuit error on a fuel injector high-side control circuit.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [3](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [4](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [5](#)

No

- Replace the Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

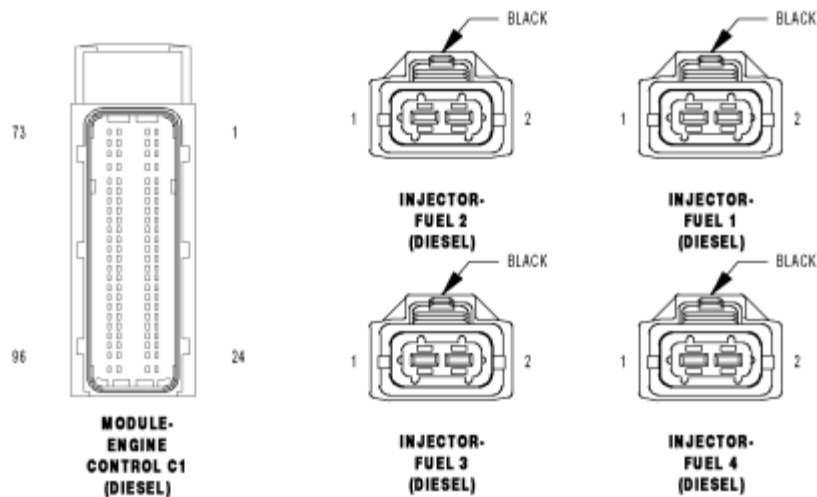
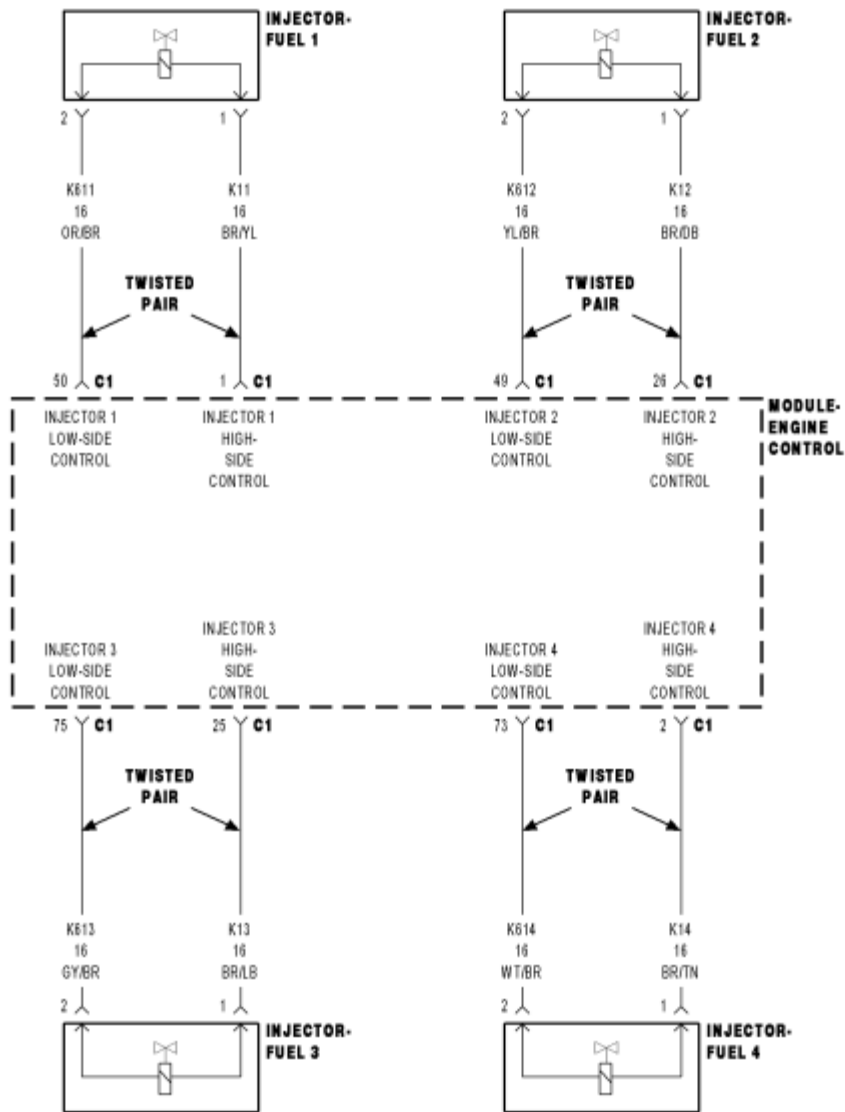
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2147-FUEL INJECTOR GROUP 1 SUPPLY VOLTAGE CIRCUIT LOW



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects a short to ground error on the injector high-side control circuit.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the Fuel Injector High-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms for each circuit?

Yes

- Go to [3](#)

No

- Repair the Fuel Injector High-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the Fuel Injector Low-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms for each circuit?

Yes

- Go to [4](#)

No

- Repair the Fuel Injector Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the Fuel Injector High-Side Control circuit and the Fuel Injector Low-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms between the circuits in each connector?

Yes

- Go to [5](#)

No

- Repair the Fuel Injector High-Side Control circuit for a short to the Fuel Injector Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [6](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [8](#)

No

- Replace Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between each Fuel Injector and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

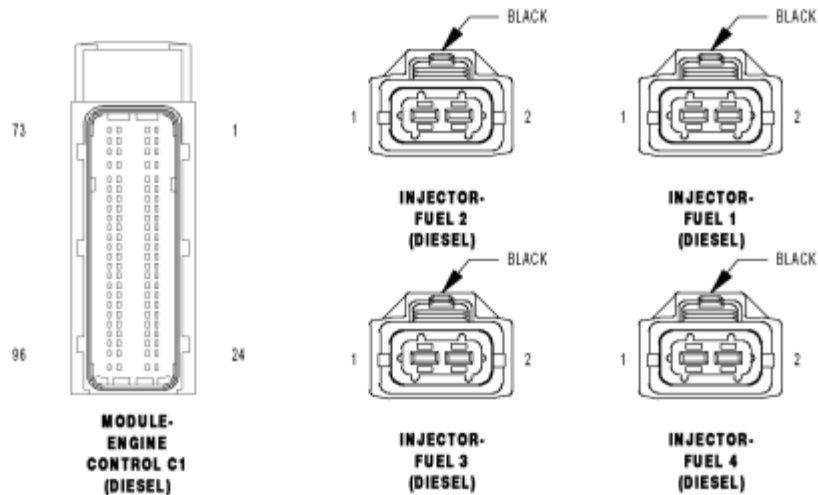
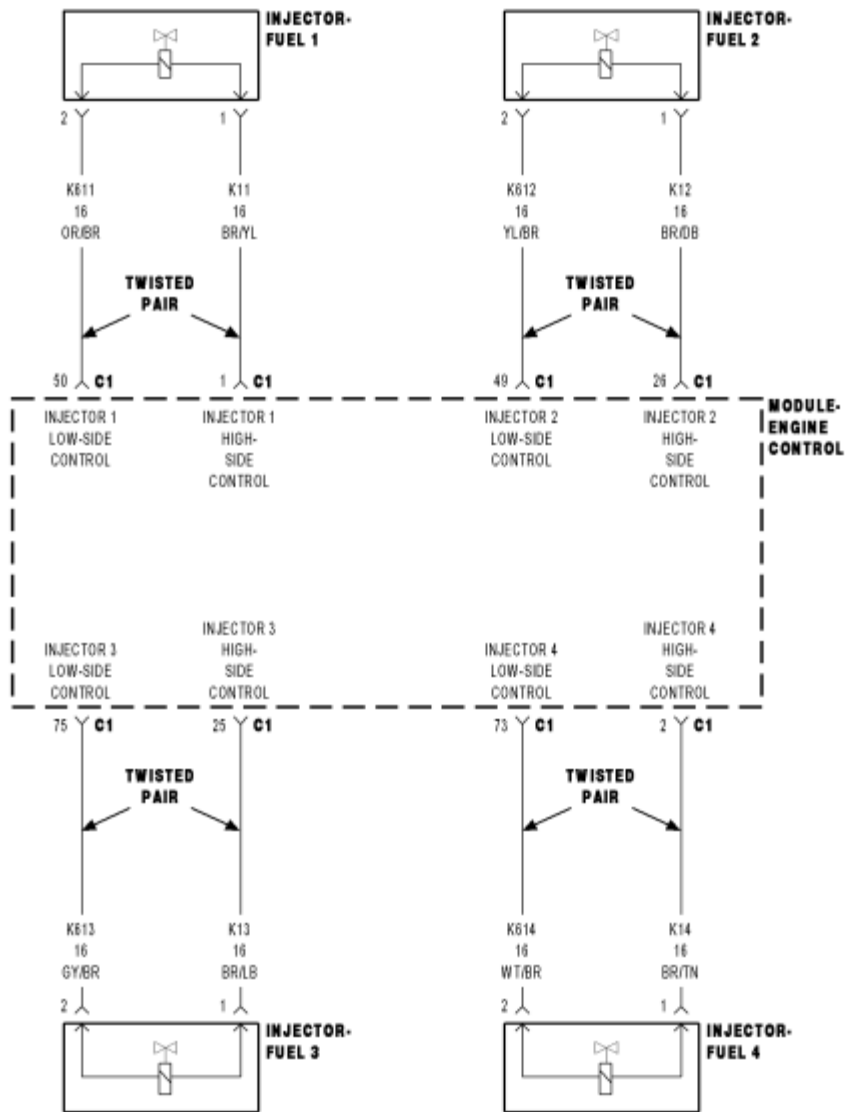
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2148-FUEL INJECTOR GROUP 1 SUPPLY VOLTAGE CIRCUIT HIGH



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects a short to voltage error on one of the injector high-side control circuits.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit in the Fuel Injector harness connector.

Is there voltage present on any of the circuits?

Yes

- Repair the Fuel Injector High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is there voltage present on any of the circuits?

Yes

- Repair the Fuel Injector Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for all circuits?

Yes

- Go to [5](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for all circuits?

Yes

- Go to [6](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [7](#)

No

- Replace Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injectors and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

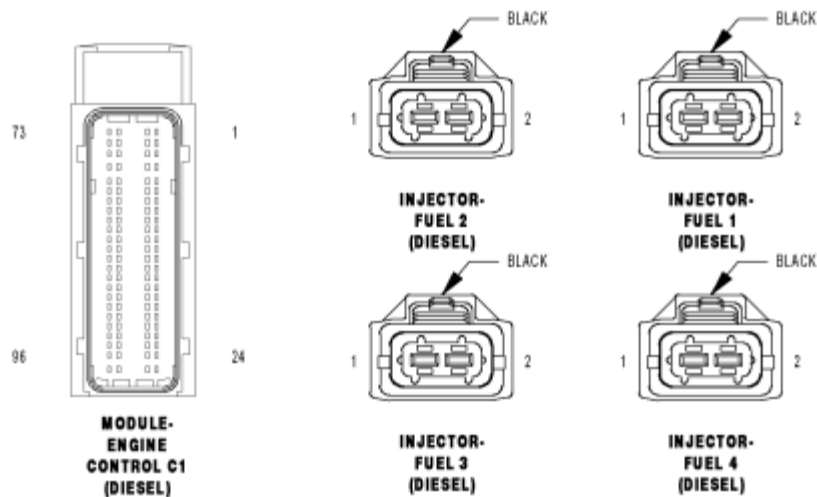
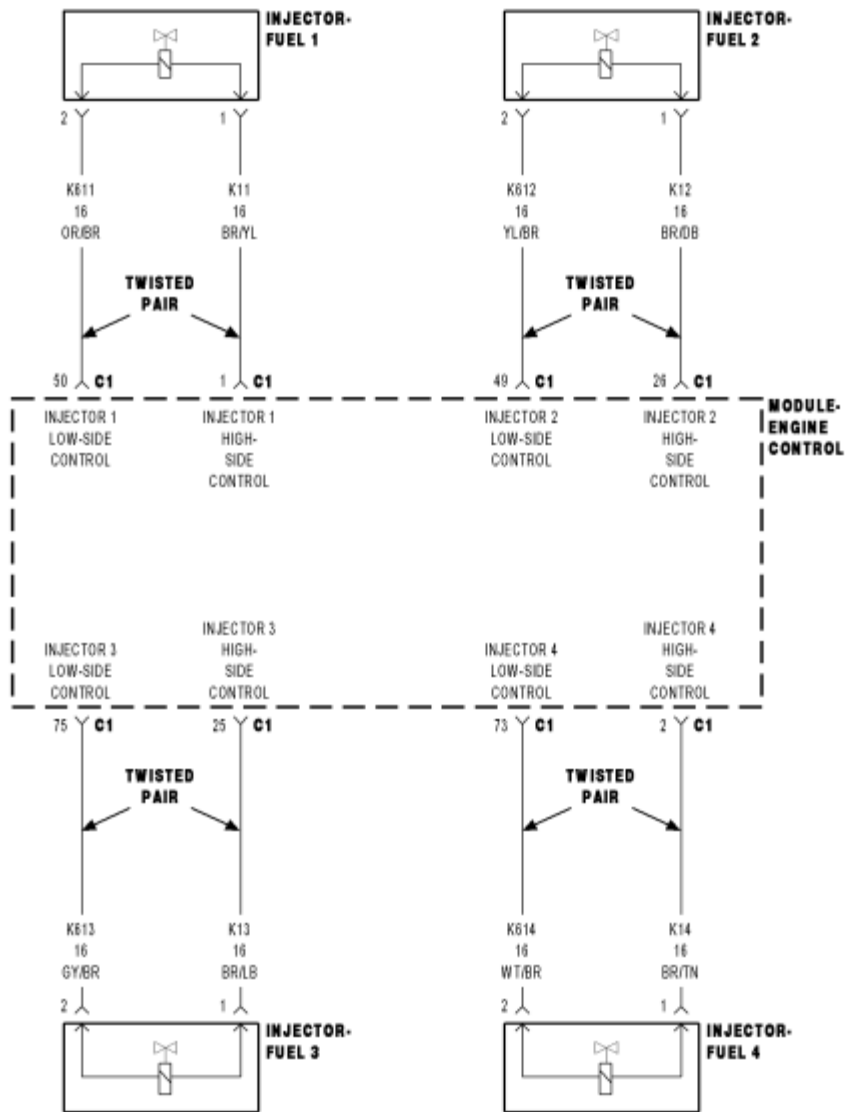
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2149-FUEL INJECTOR GROUP 2 SUPPLY VOLTAGE CIRCUIT OPEN



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

◦ **Set Condition:**

The ECM detects an open circuit error on a fuel injector high-side control circuit.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [3](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [4](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [5](#)

No

- Replace the Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injector and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

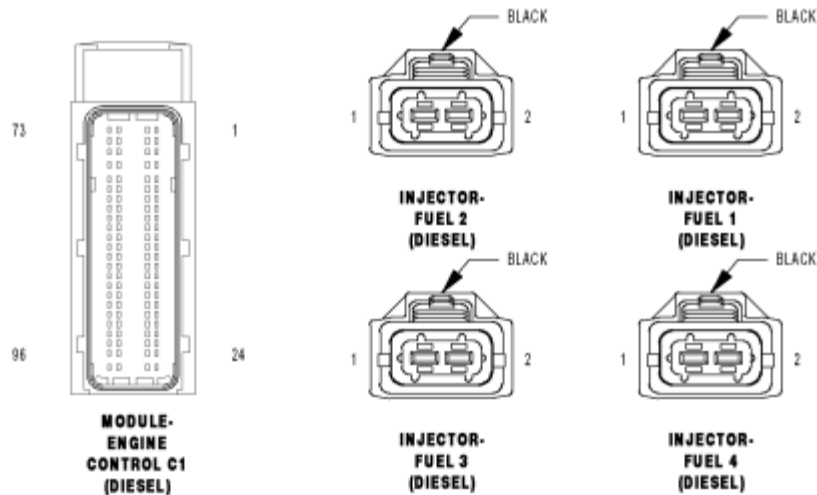
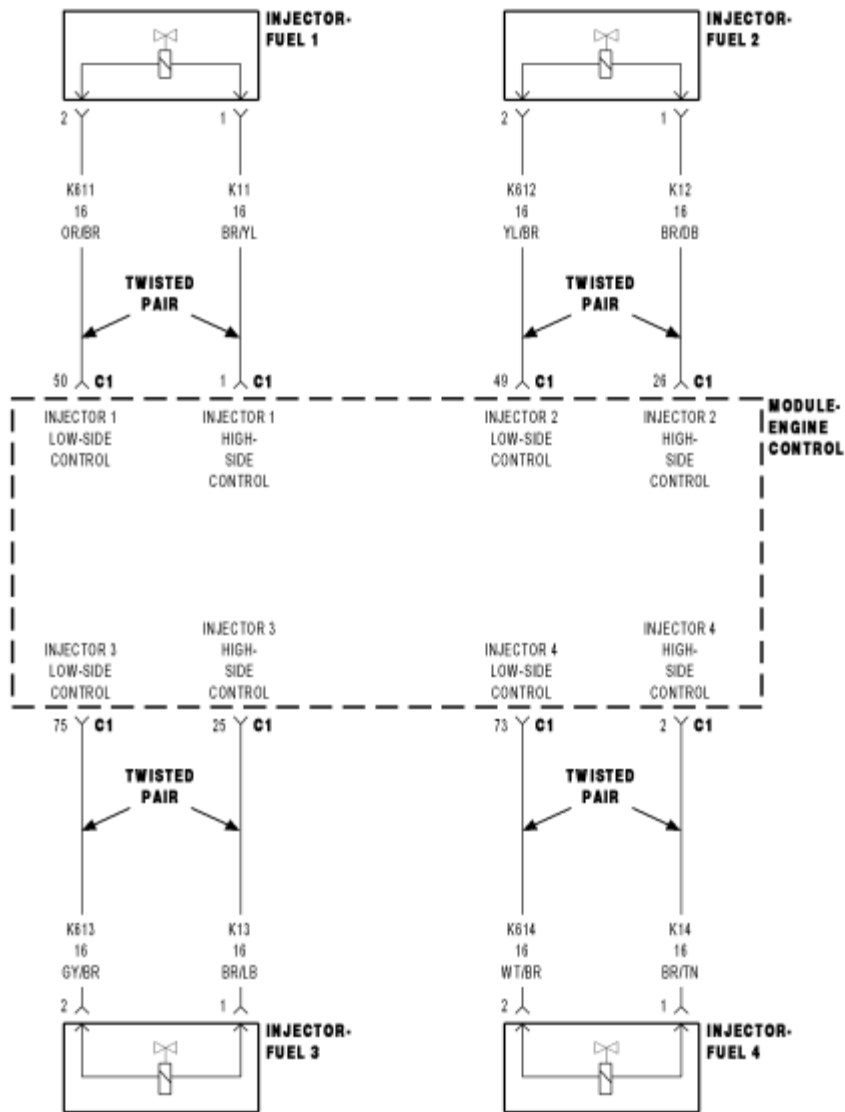
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2150-FUEL INJECTOR GROUP 2 SUPPLY VOLTAGE CIRCUIT LOW



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects a short to ground error on the injector high-side control circuit.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the Fuel Injector High-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms for each circuit?

Yes

- Go to [3](#)

No

- Repair the Fuel Injector High-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the Fuel Injector Low-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms for each circuit?

Yes

- Go to [4](#)

No

- Repair the Fuel Injector Low-Side Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT

Measure the resistance between the Fuel Injector High-Side Control circuit and the Fuel Injector Low-Side Control circuit in each Fuel Injector harness connector.

Is the resistance above 1000 ohms between the circuits in each connector?

Yes

- Go to [5](#)

No

- Repair the Fuel Injector High-Side Control circuit for a short to the Fuel Injector Low-Side Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for each circuit?

Yes

- Go to [6](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [8](#)

No

- Replace Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between each Fuel Injector and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

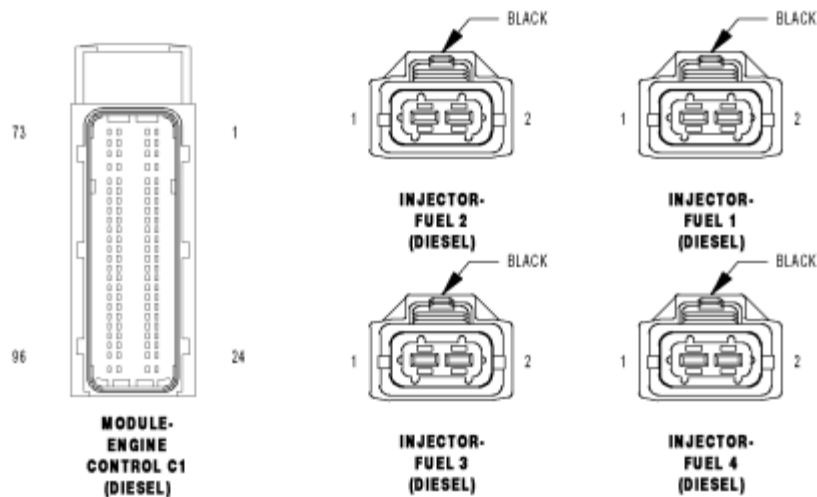
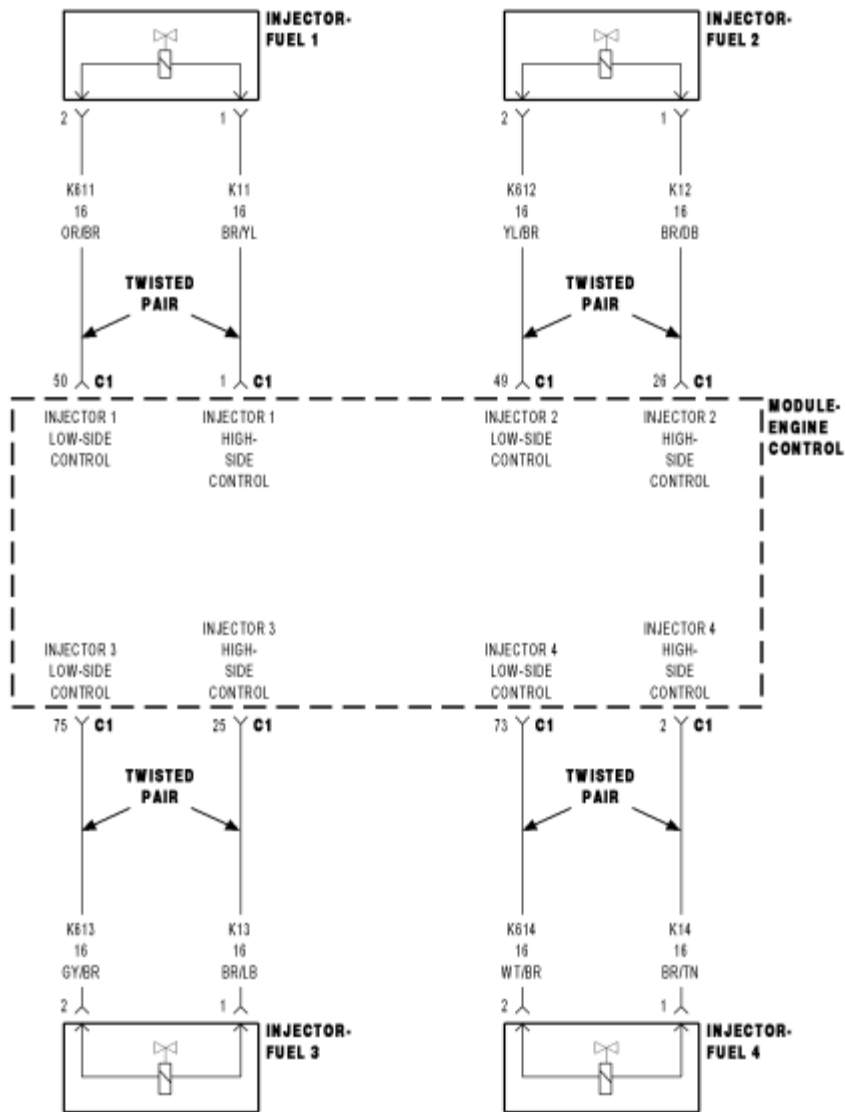
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2151-FUEL INJECTOR GROUP 2 SUPPLY VOLTAGE CIRCUIT HIGH



81a781a6

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects a short to voltage error on one of the injector high-side control circuits.

Possible Causes
INTERMITTENT DTC
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
FUEL INJECTOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC can set as a result of a fault in any of the injector circuits. Be sure to check all injector circuits before replacing an injector and all injectors before replacing a module.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Attempt to start the engine and test drive the vehicle.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect each Fuel Injector harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay in the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit in the Fuel Injector harness connector.

Is there voltage present on any of the circuits?

Yes

- Repair the Fuel Injector High-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

Is there voltage present on any of the circuits?

Yes

- Repair the Fuel Injector Low-Side Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. FUEL INJECTOR HIGH-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance of each Fuel Injector High-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for all circuits?

Yes

- Go to [5](#)

No

- Repair the Fuel Injector High-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of each Fuel Injector Low-Side Control circuit between the Fuel Injector harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms for all circuits?

Yes

- Go to [6](#)

No

- Repair the Fuel Injector Low-Side Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL INJECTOR

Measure the resistance between the terminals of each Fuel Injector.

Is the resistance between 150k and 210k ohms for each injector?

Yes

- Go to [7](#)

No

- Replace Fuel Injector in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Injectors and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

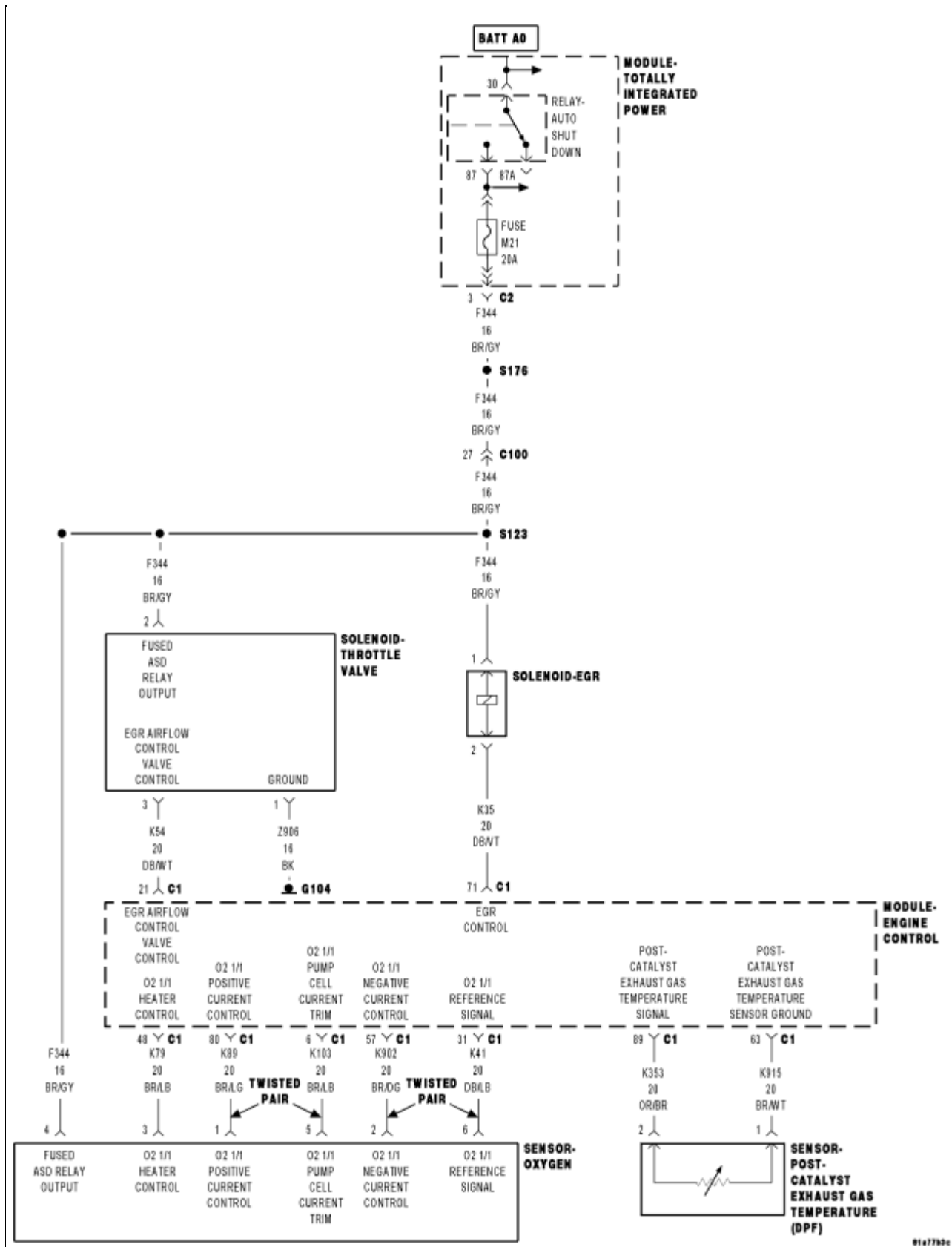
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2231-O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO HEATER CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The ECM detects a short between the (K902) O2 1/1 Negative Current Control circuit and the (K79) O2 1/1 Heater Control circuit.

Possible Causes
INTERMITTENT DTC
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL 2 CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor connector.
 Disconnect the Engine Control Module (ECM) connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

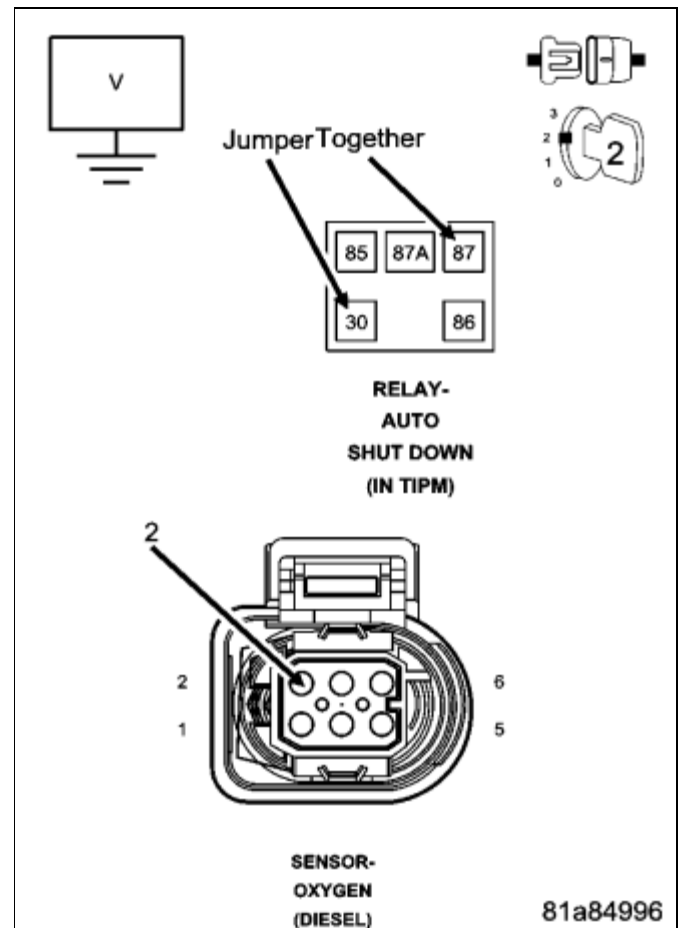
Is there any voltage present?

Yes

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance between ground and the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

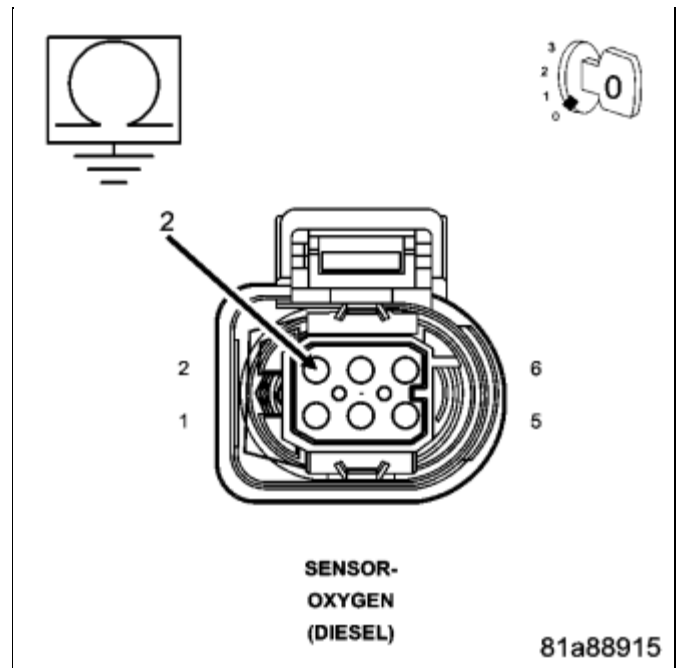
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Measure the resistance between the (K902) O2 1/1 Negative Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

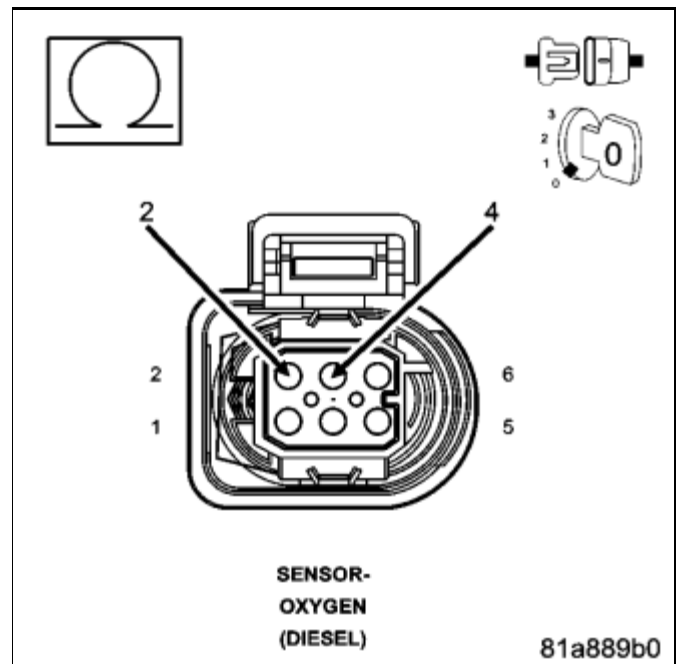
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K902) O2 1/1 Negative

Current Control circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

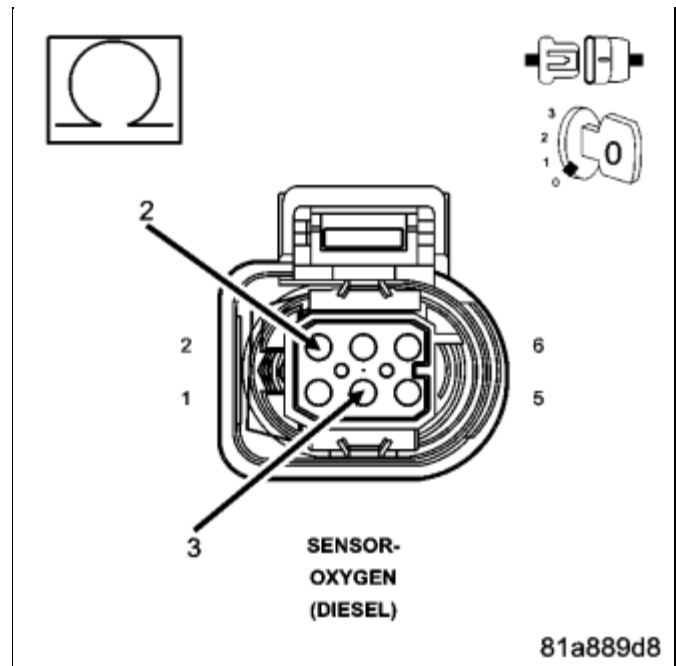
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K902) O2 1/1 Negative Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

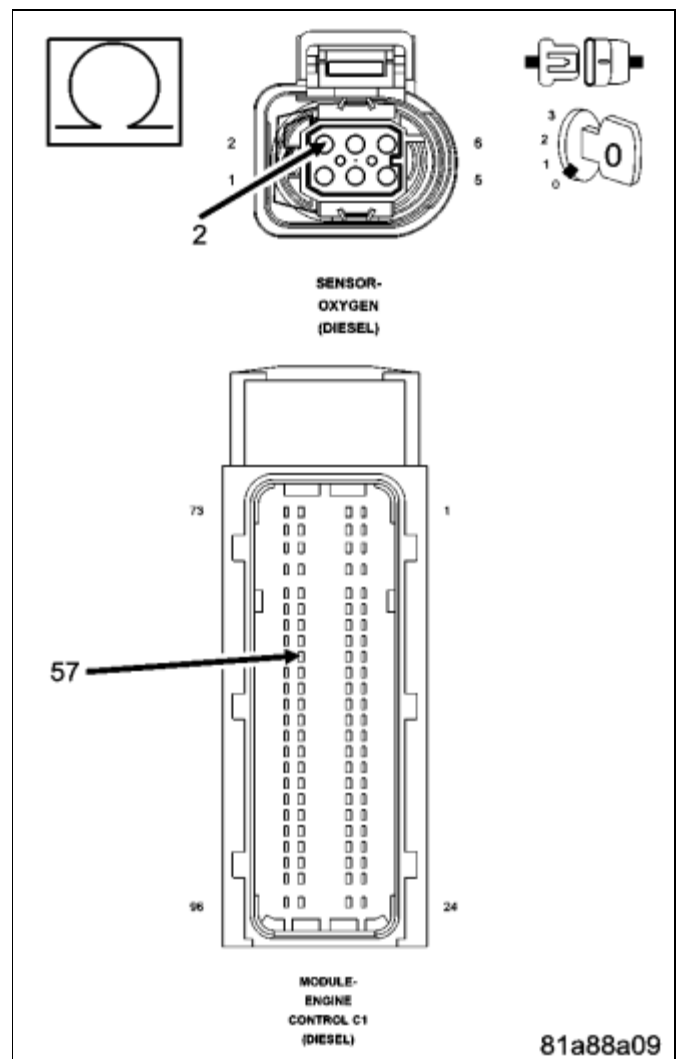
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [8](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

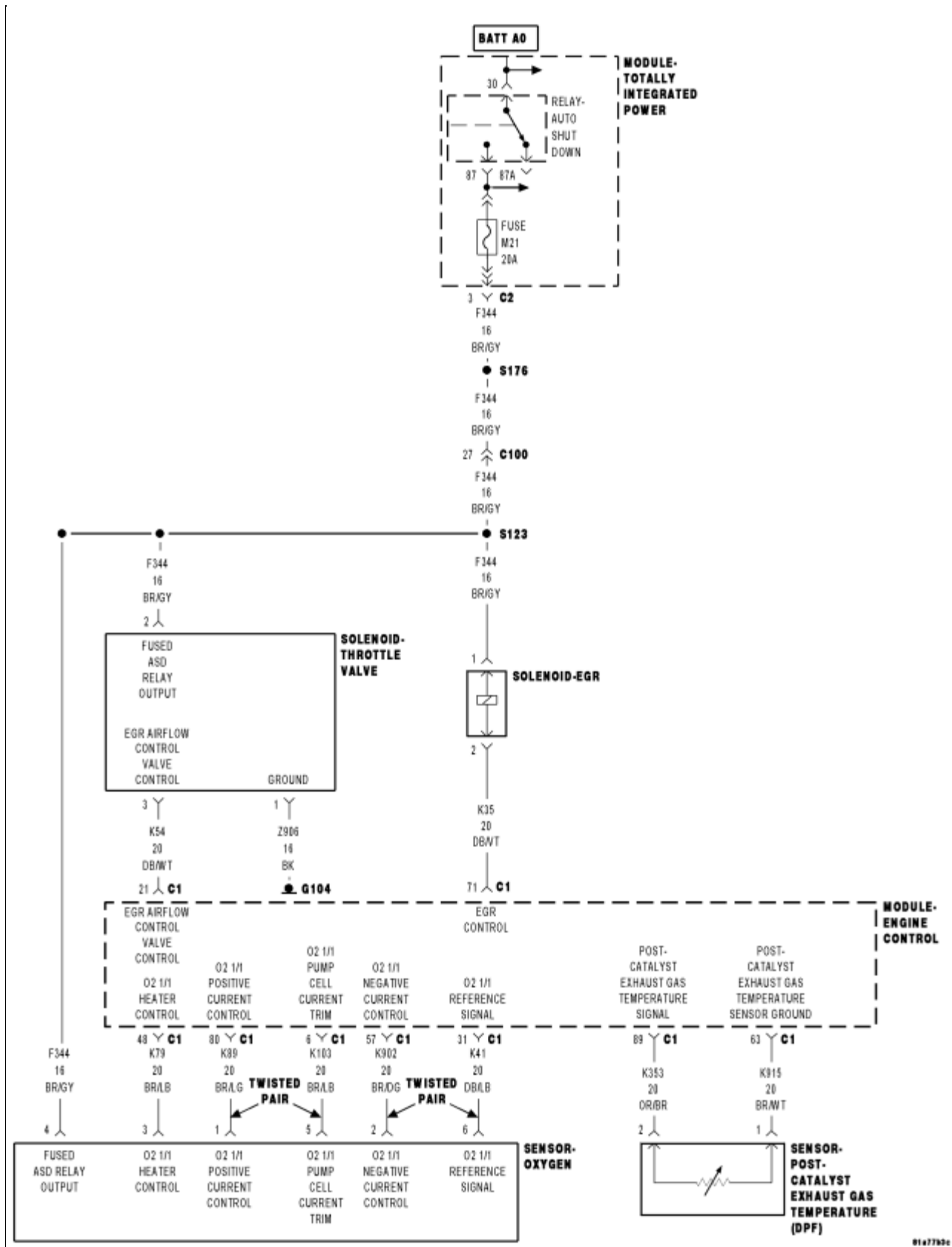
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2237-O2 SENSOR 1/1 PUMP CELL CURRENT CIRCUIT OPEN



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects an open on the (K89) O2 1/1 Positive Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K89) O2 1/1 Positive Current Control circuit in the Oxygen Sensor harness connector.

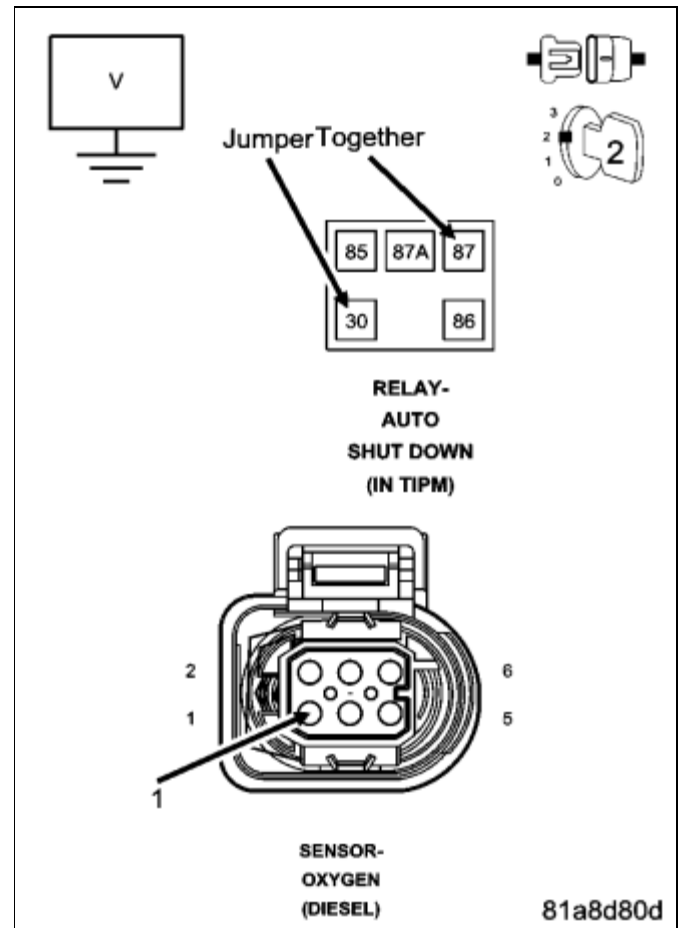
Is there any voltage present?

Yes

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and the (K89) O2 1/1 Positive Current Control circuit in the Oxygen Sensor harness connector.

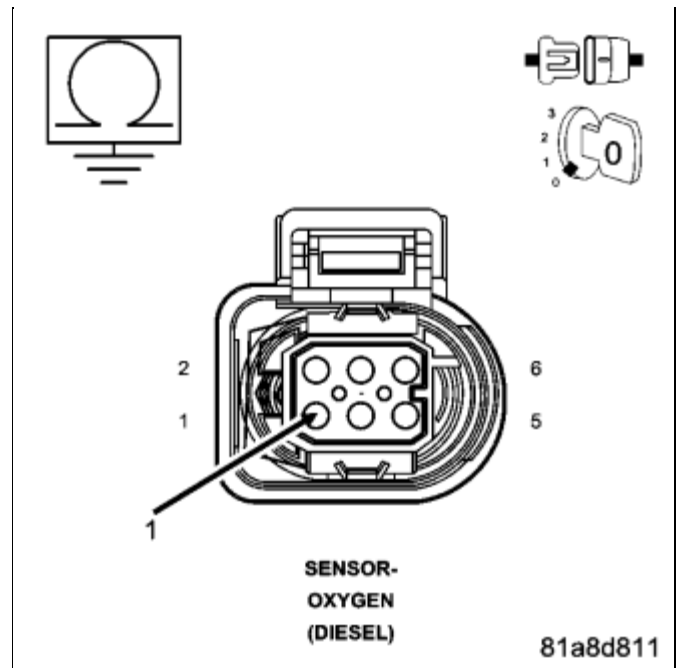
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Measure the resistance between the (K89) O2 1/1 Positive Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

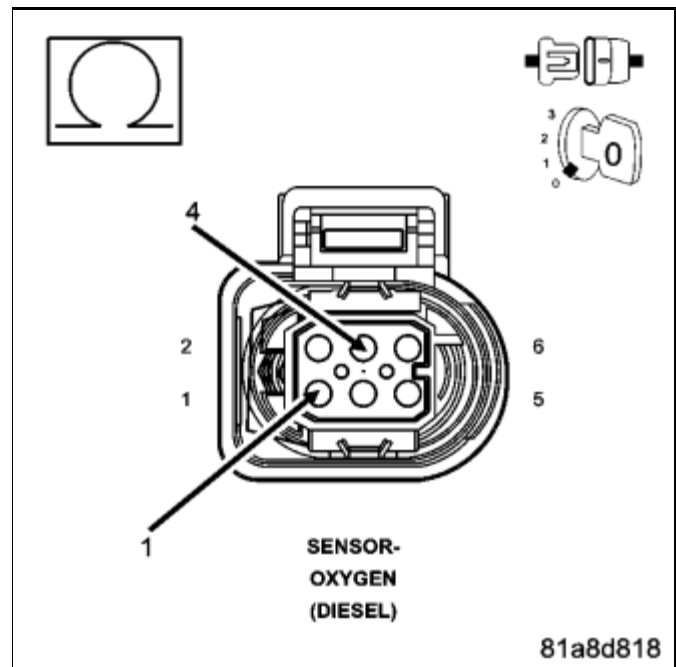
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K89) O2 1/1 Positive

Current Control circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

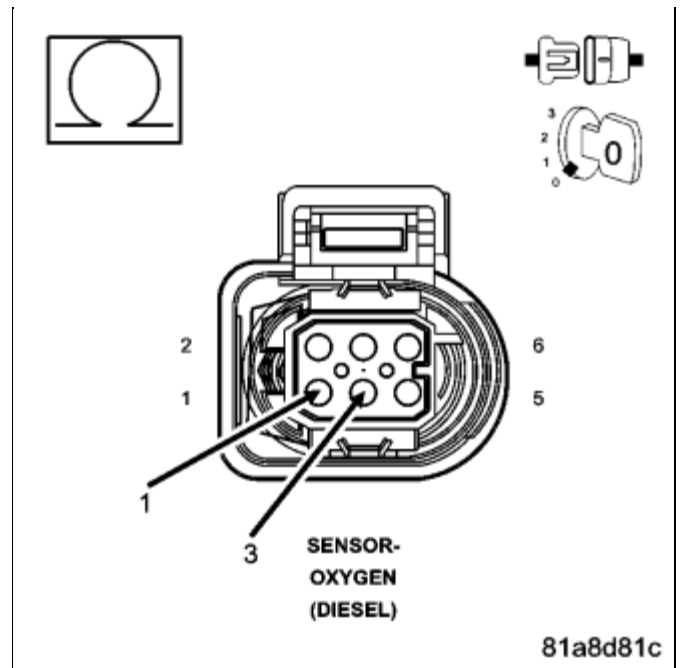
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K89) O2 1/1 Positive Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

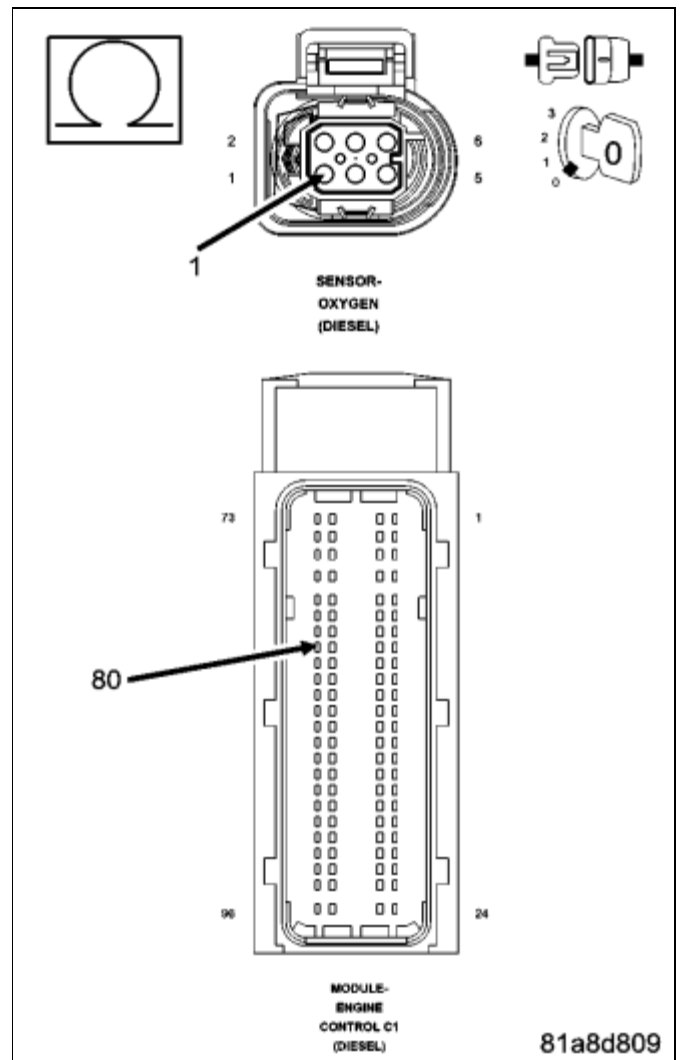
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [8](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

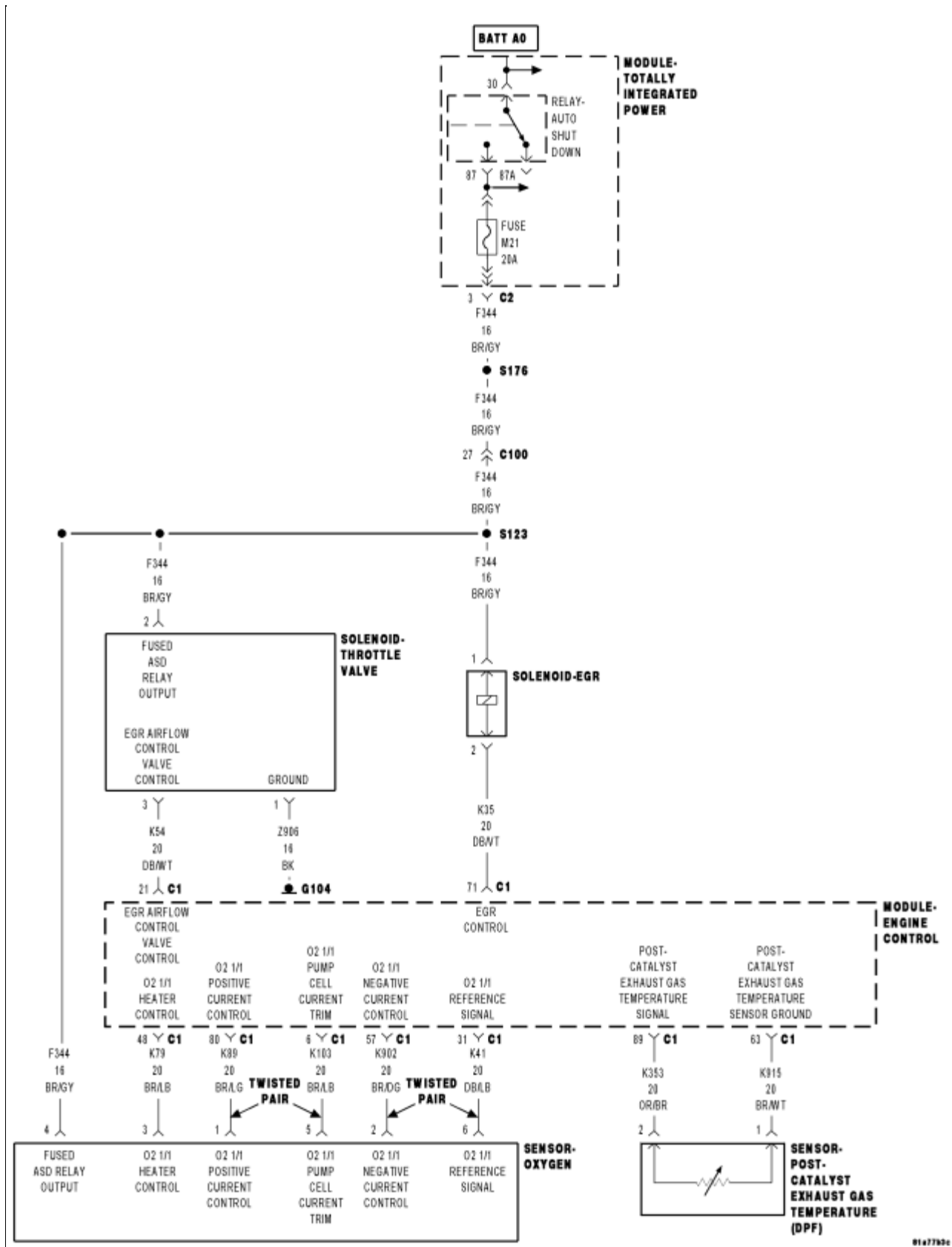
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2238-O2 SENSOR 1/1 PUMP CELL CURRENT CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to ground on the (K89) O2 1/1 Positive Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Oxygen Sensor connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K89) O2 1/1 Positive Current Control circuit in the Oxygen Sensor harness connector.

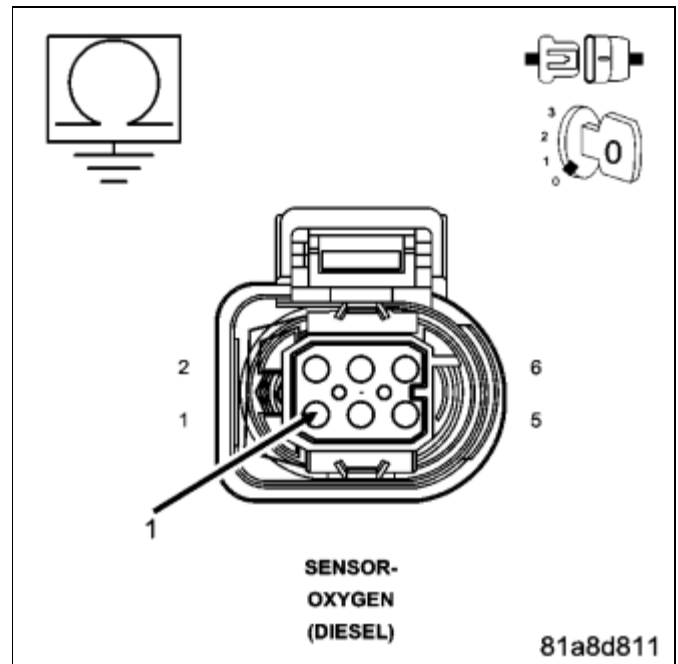
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K89) O2 1/1 Positive Current Control circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

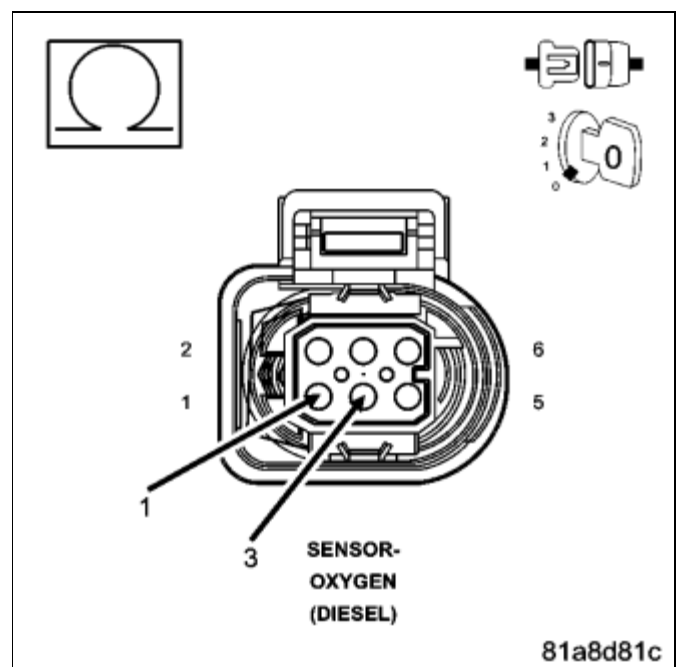
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K89) O2 1/1 Positive Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

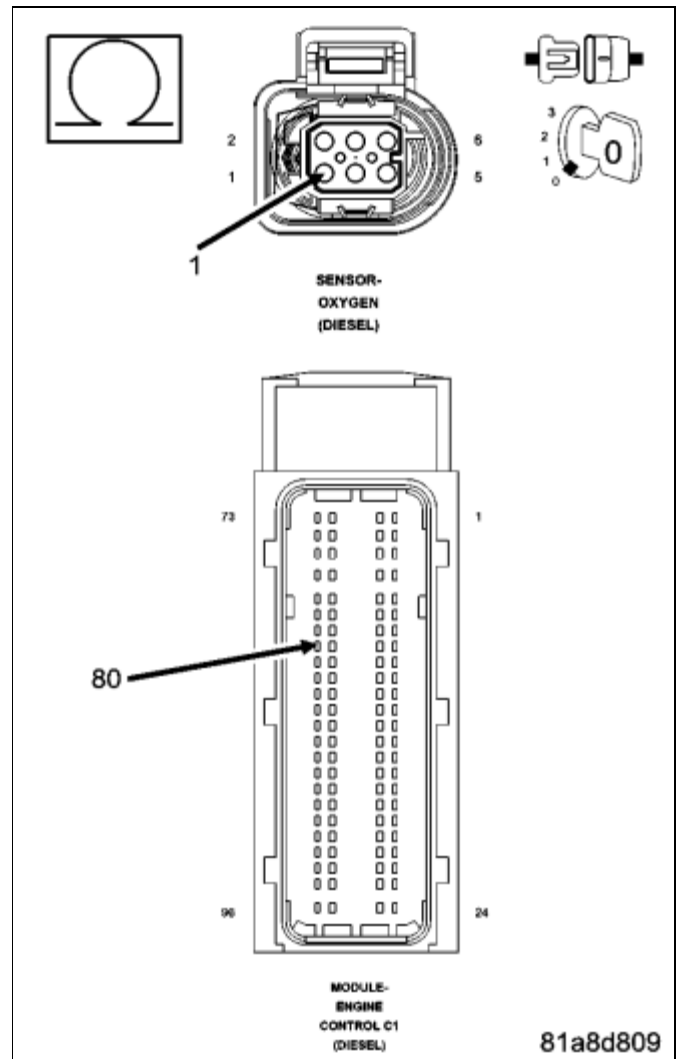
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

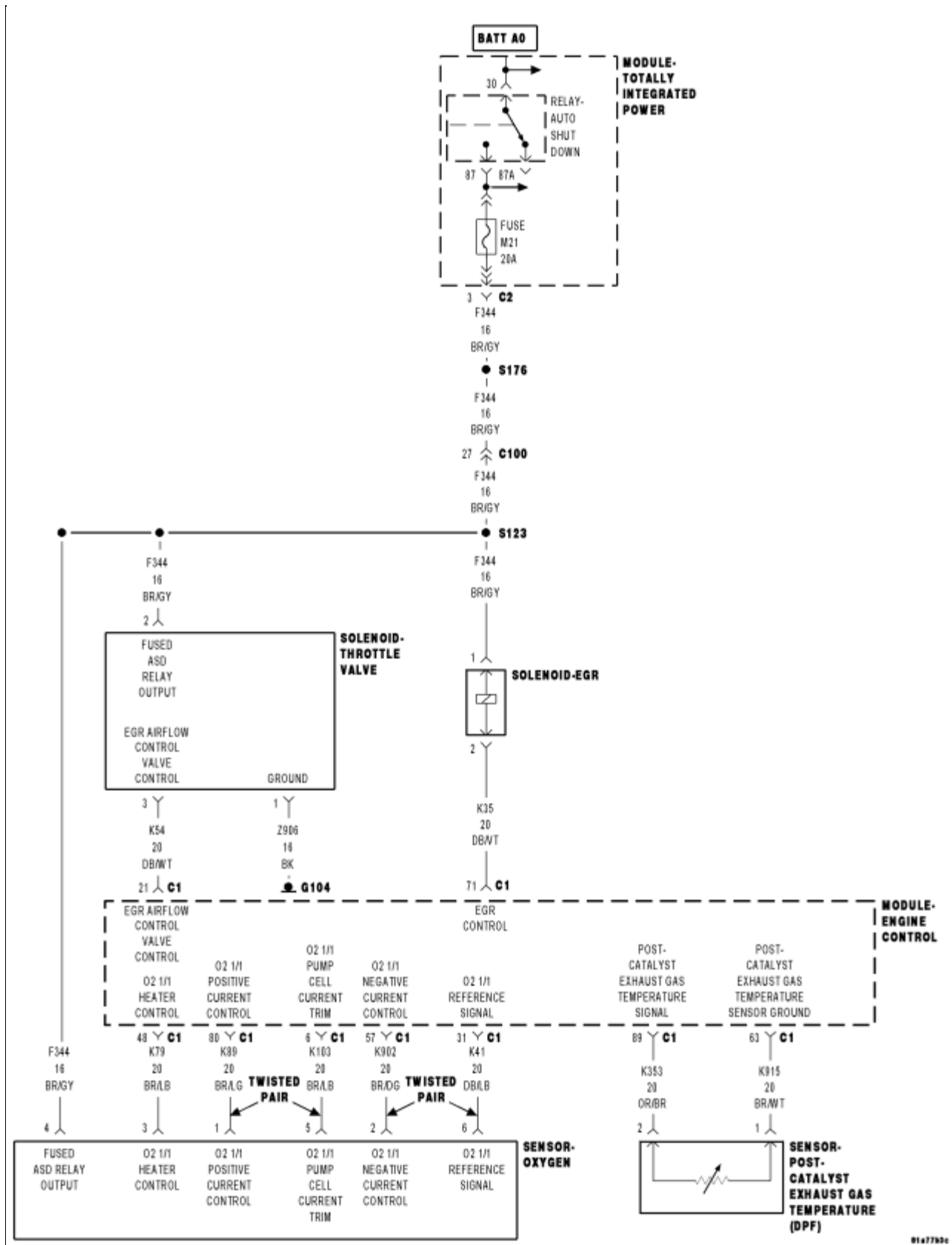
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2239-O2 SENSOR 1/1 PUMP CELL CURRENT CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to voltage on the (K89) O2 1/1 Positive Current Control circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K89) O2 1/1 Positive Current Control circuit in the Oxygen Sensor harness connector.

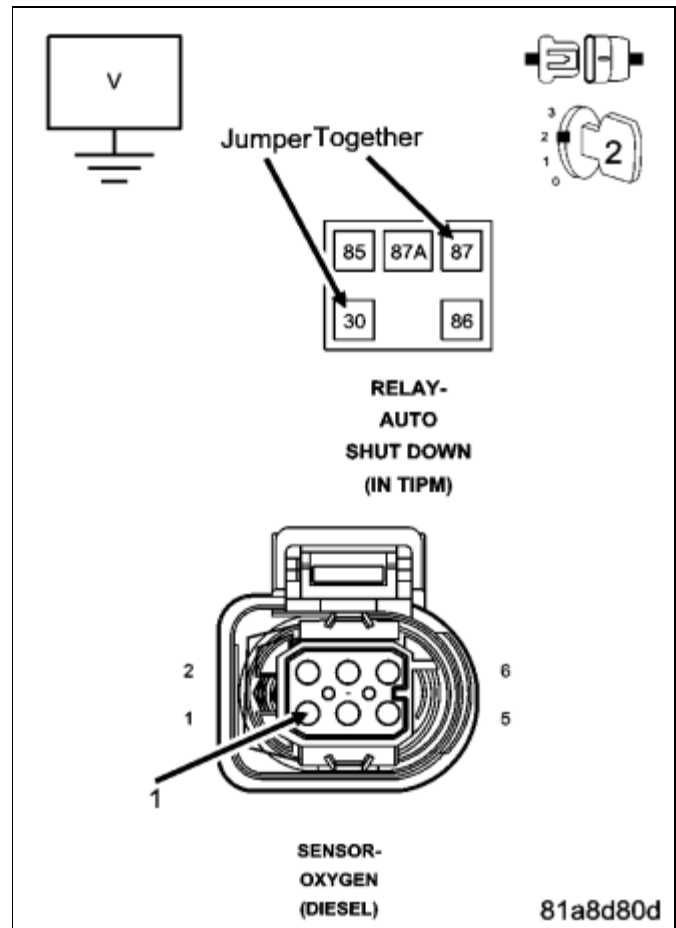
Is there any voltage present?

Yes

- Repair the (K89) O2 1/1 Positive Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance between the (K89) O2 1/1 Positive Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

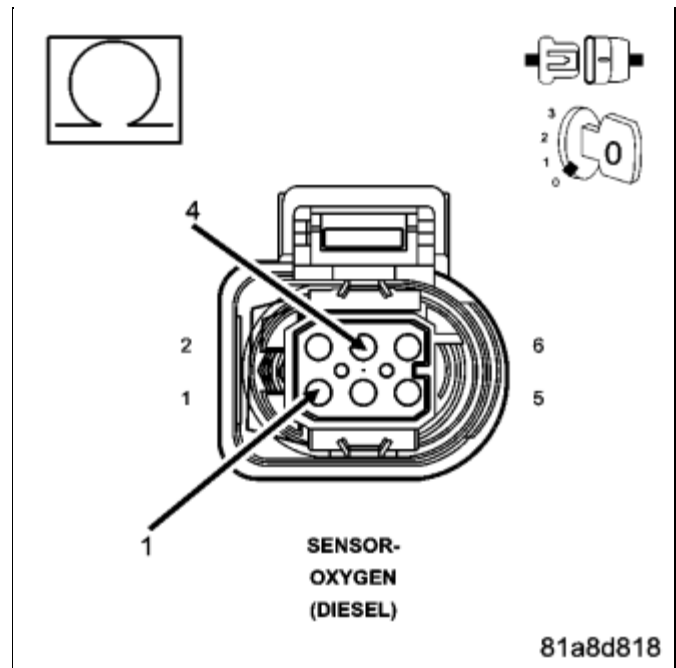
- Go to [4](#)

No

- Repair the (K89) O2 1/1 Positive Current Control

circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K89) O2 1/1 POSITIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K89) O2 1/1 Positive Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

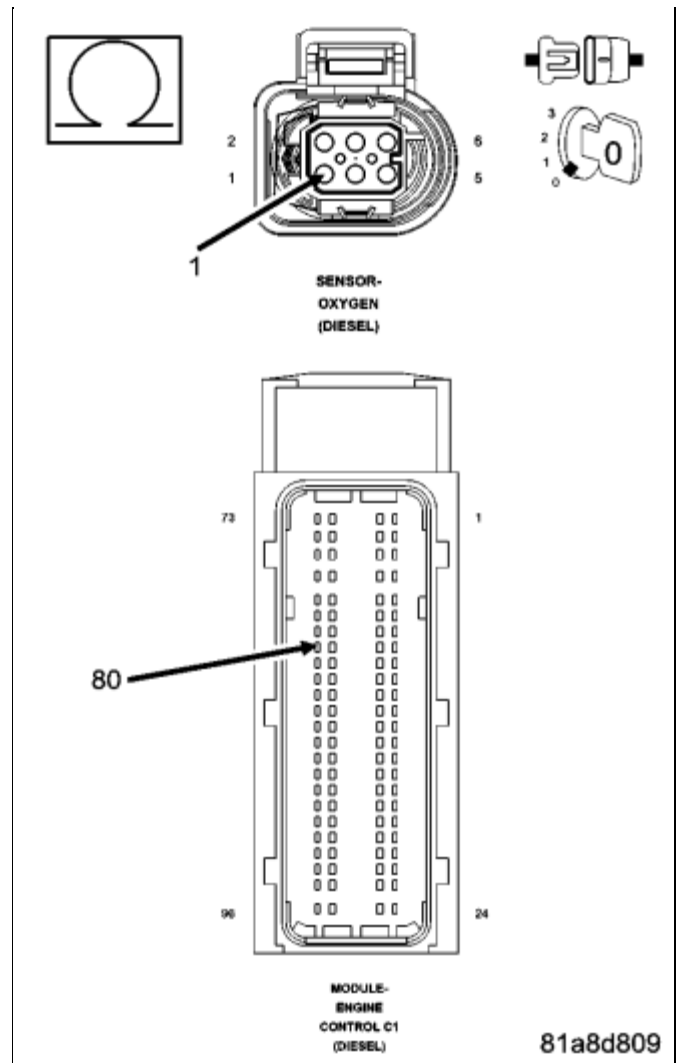
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K89) O2 1/1 Positive Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

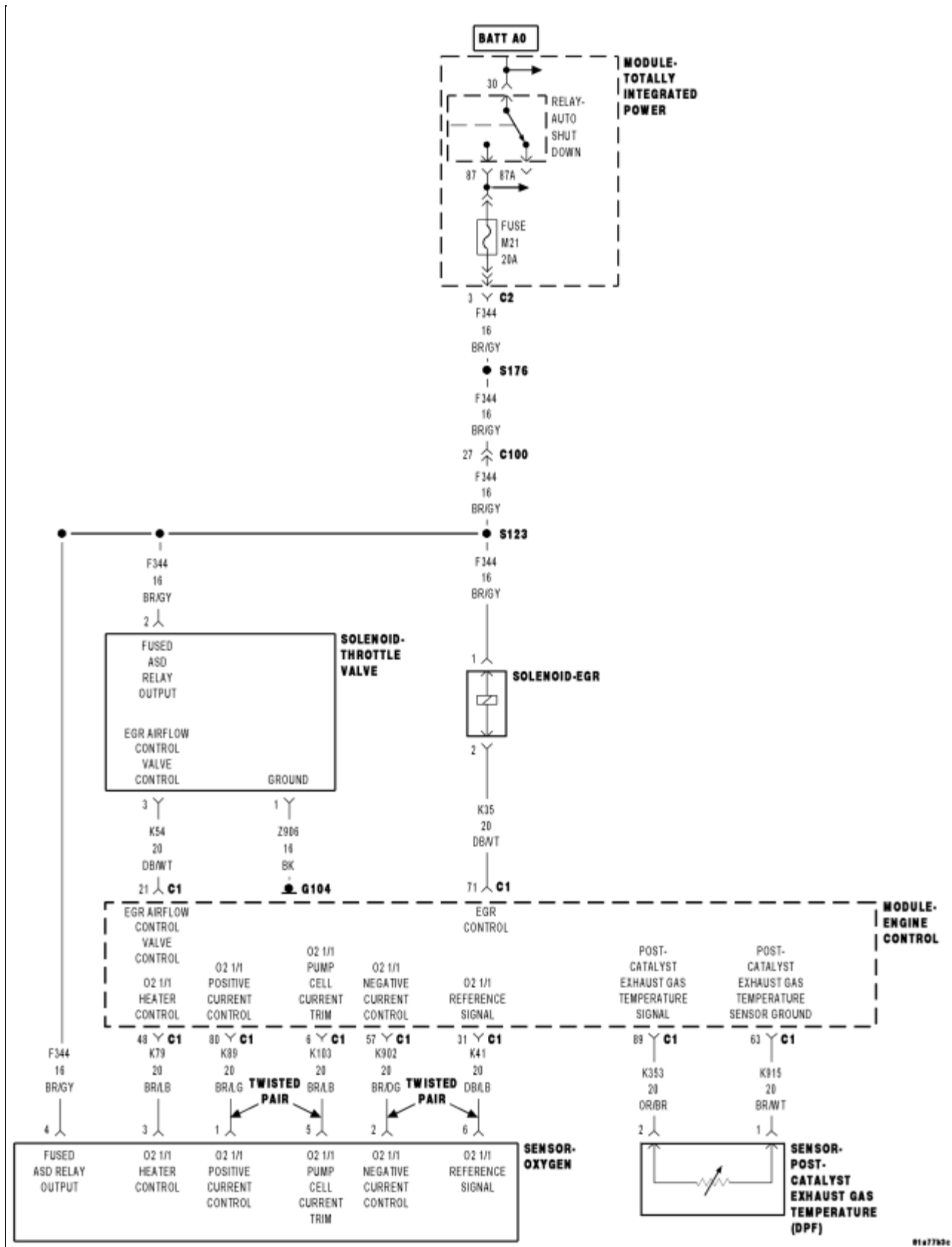
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2243-O2 SENSOR 1/1 REFERENCE VOLTAGE CIRCUIT OPEN



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects an open on the (K41) O2 1/1 Reference Signal circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K41) O2 1/1 Reference Signal circuit in the Oxygen Sensor harness connector.

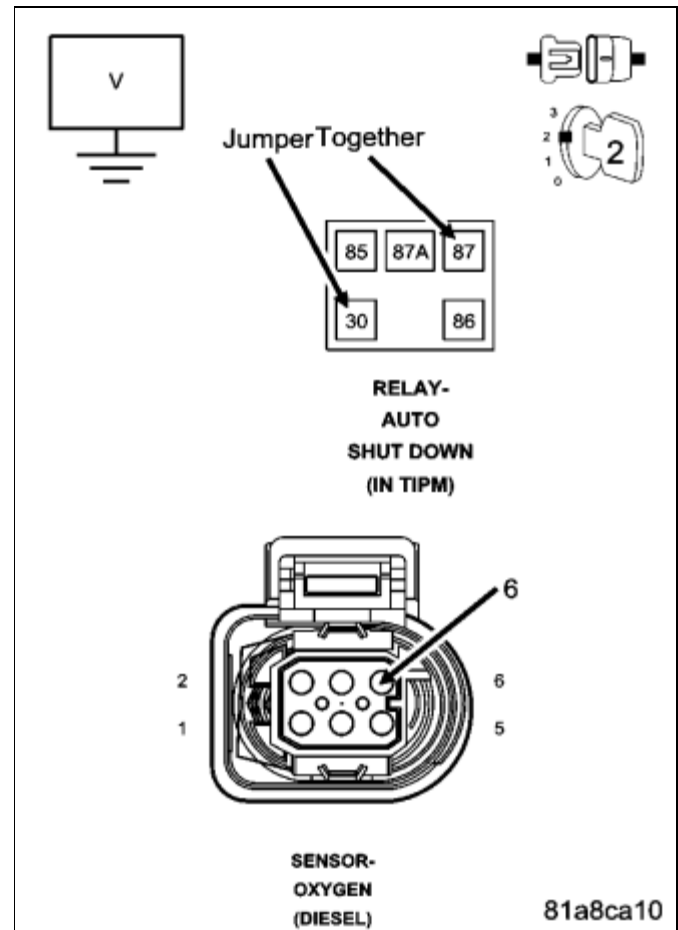
Is there any voltage present?

Yes

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.

Measure the resistance between ground and the (K41) O2 1/1 Reference Signal circuit in the Oxygen Sensor harness connector.

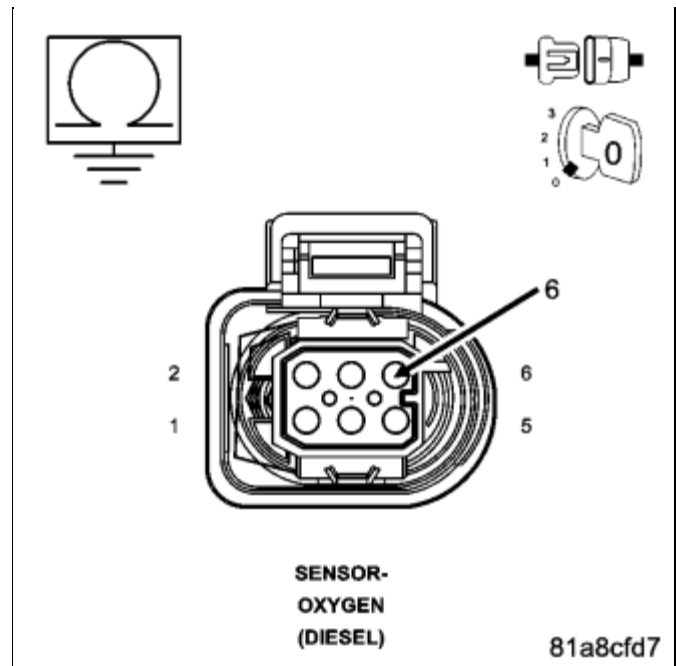
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Measure the resistance between the (K41) O2 1/1 Reference Signal circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

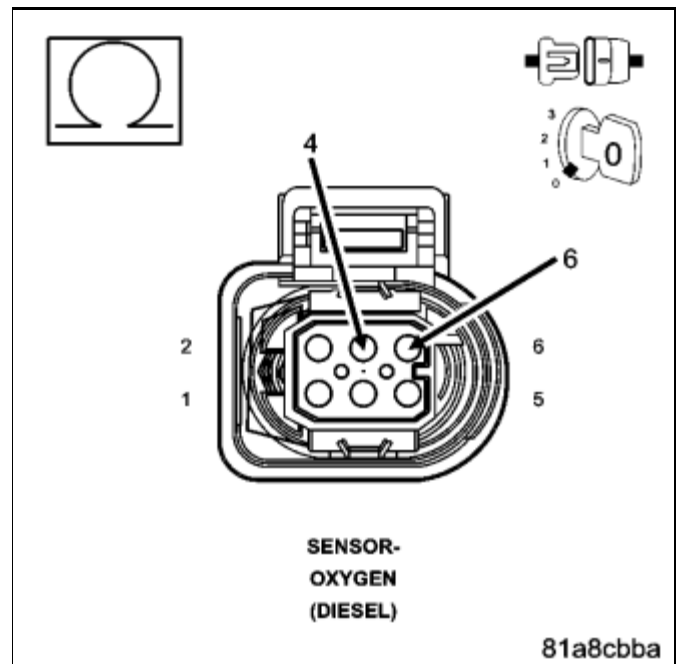
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K41) O2 1/1 Reference

Signal circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

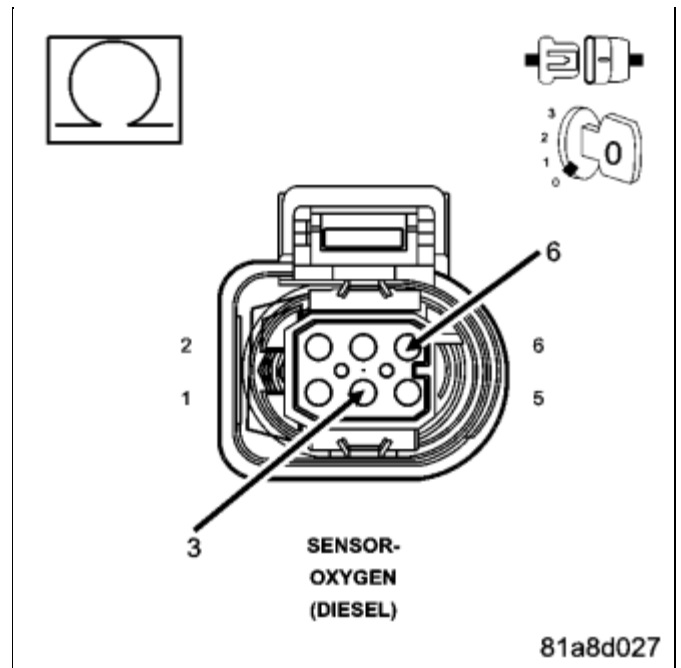
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K41) O2 1/1 Reference Signal circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

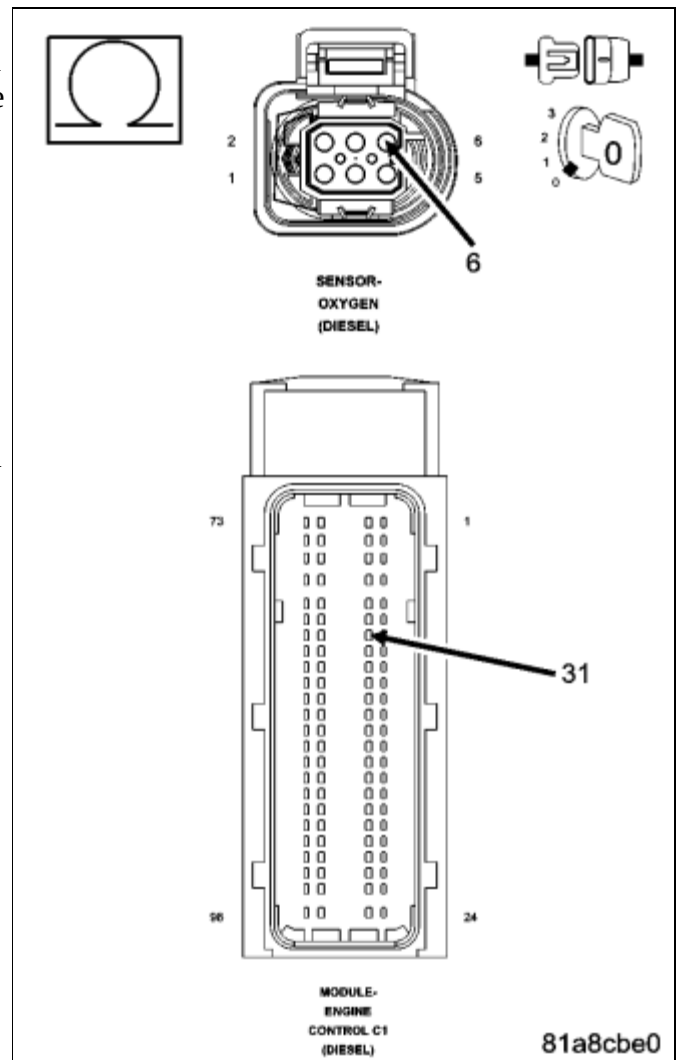
Is the resistance below 10.0 ohms?

Yes

- Go to [Z](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [8](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

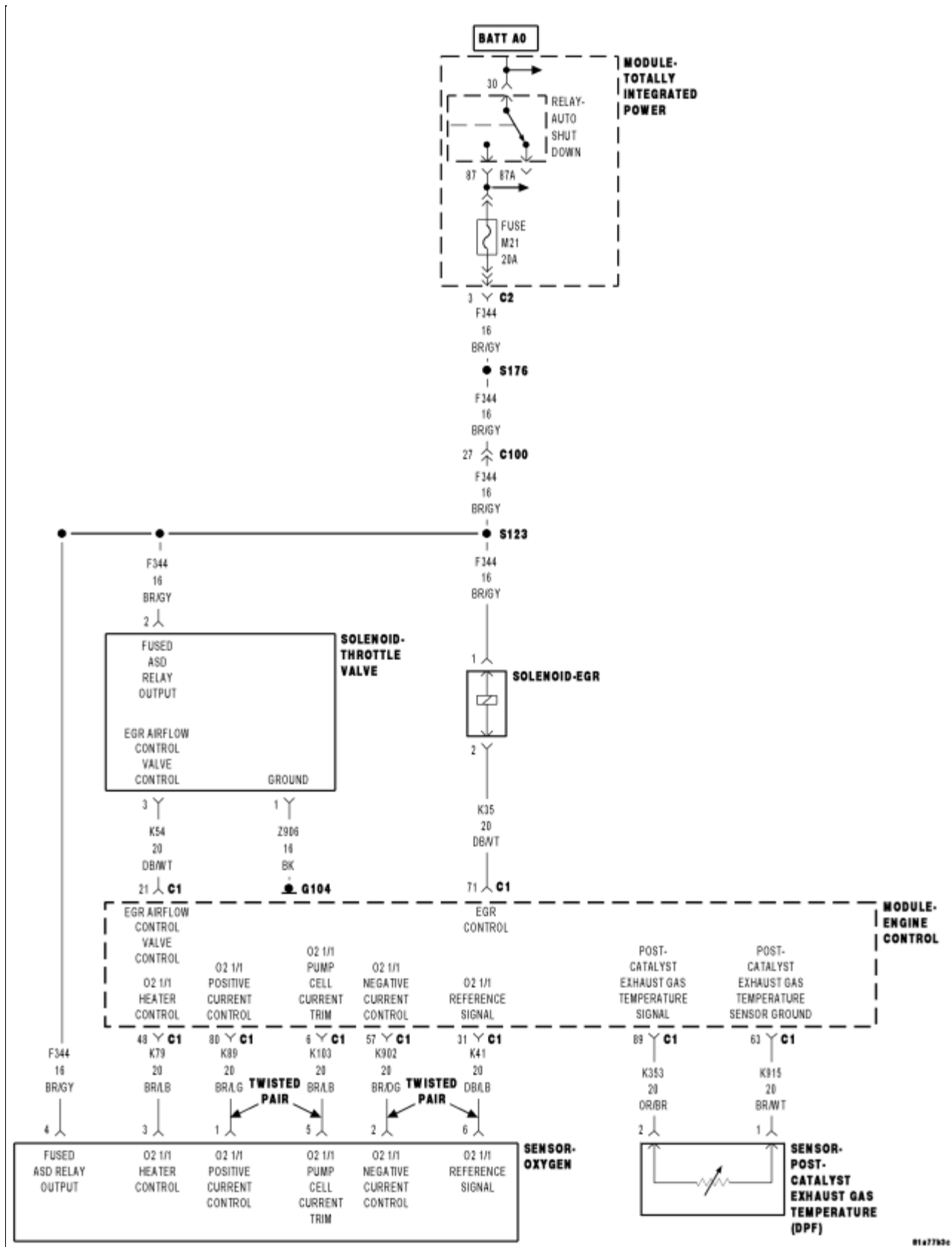
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2245-O2 SENSOR 1/1 REFERENCE VOLTAGE CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to ground on the (K41) O2 1/1 Reference Signal circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K41) O2 1/1 Reference Signal circuit in the Oxygen Sensor harness connector.

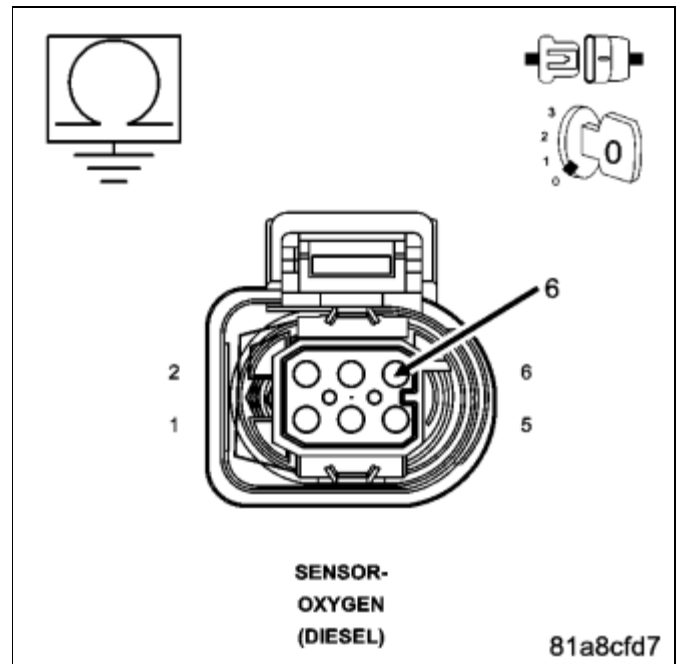
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K41) O2 1/1 Reference Signal circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

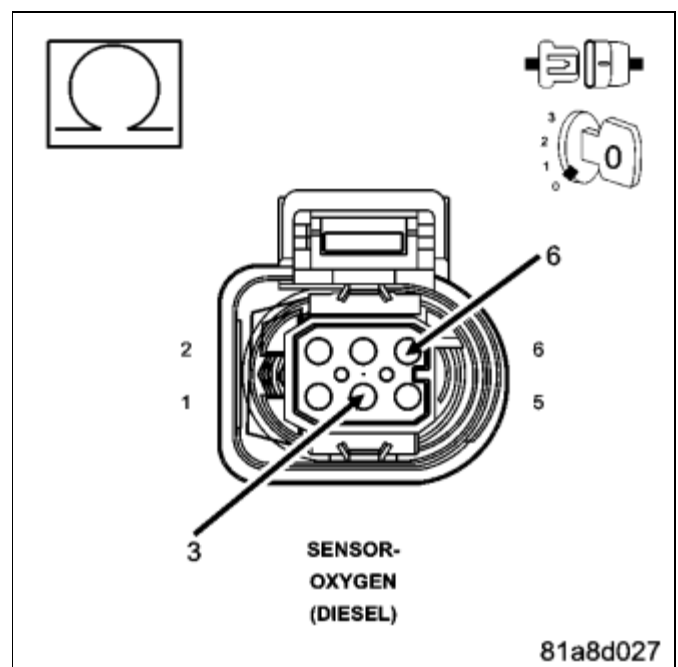
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K41) O2 1/1 Reference Signal circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

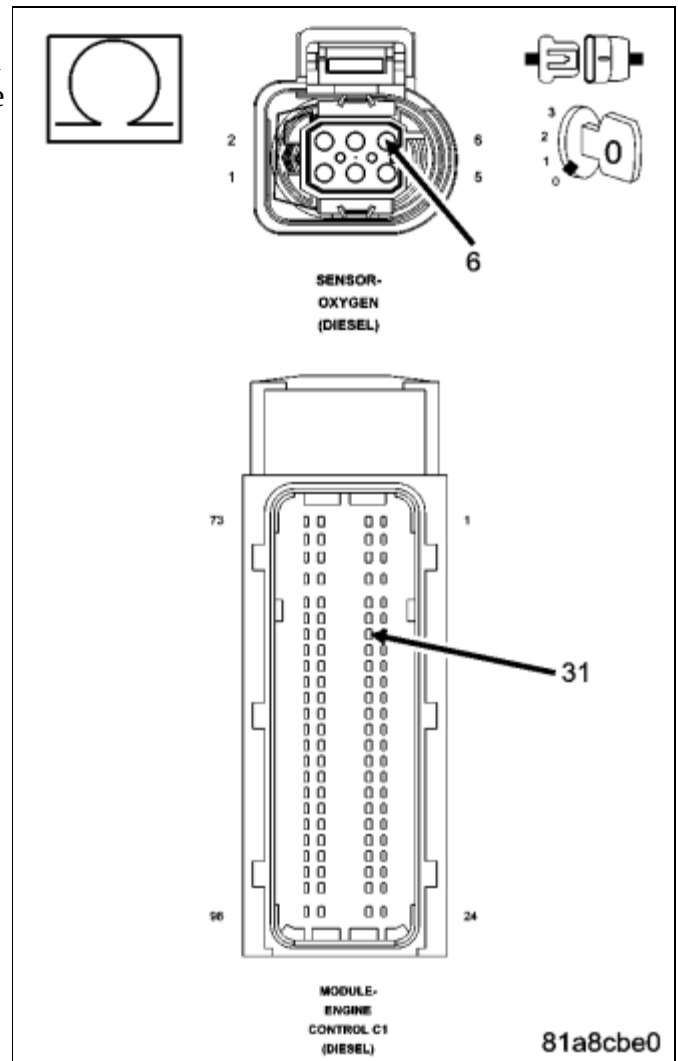
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

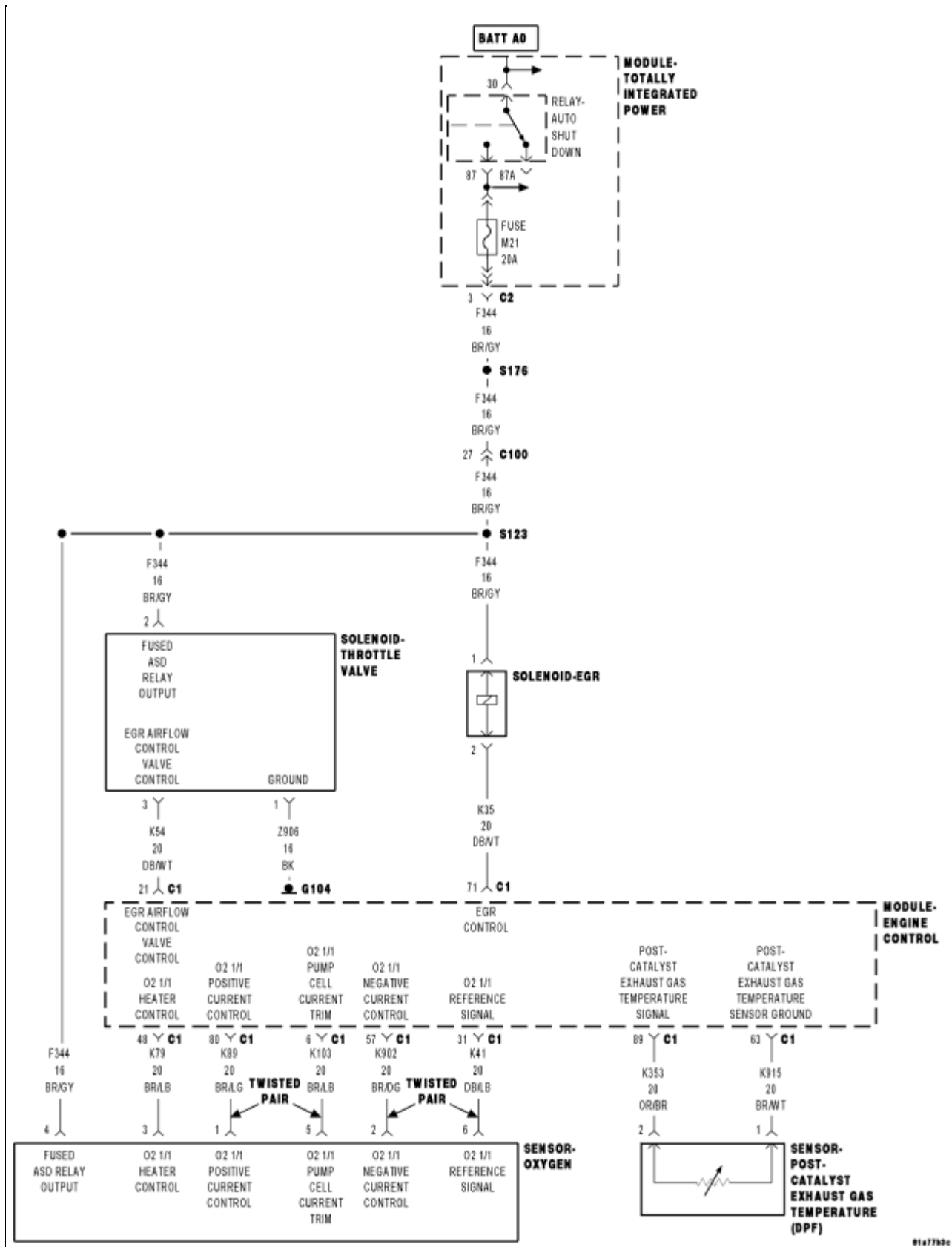
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2246-O2 SENSOR 1/1 REFERENCE VOLTAGE CIRCUIT HIGH



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on and the O2 1/1 Sensor at operating temperature.

◦ **Set Condition:**

The ECM detects a short to voltage on the (K41) O2 1/1 Reference Signal circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT
(K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K41) O2 1/1 Reference Signal circuit in the Oxygen Sensor harness connector.

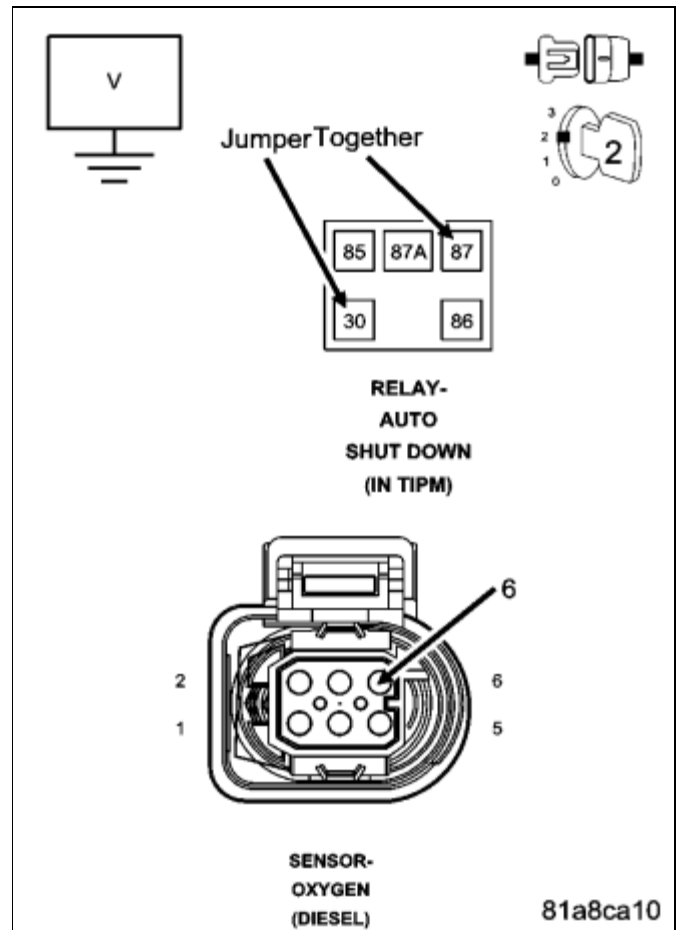
Is there any voltage present?

Yes

- Repair the (K41) O2 1/1 Reference Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance between the (K41) O2 1/1 Reference Signal circuit and the (F344) Fused ASD Relay Output circuit in the Oxygen Sensor harness connector.

Is the resistance above 1000 ohms?

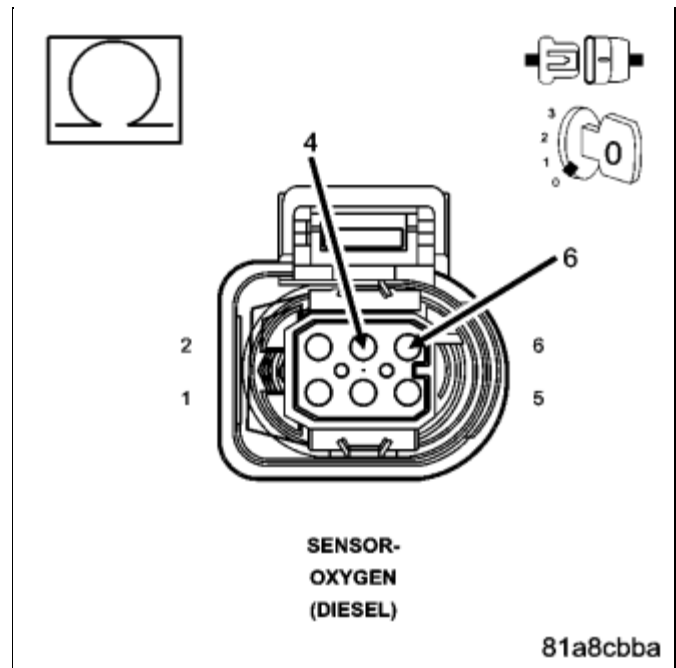
Yes

- Go to [4](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for a

- short to the (F344) Fused ASD Relay Output circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K41) O2 1/1 REFERENCE SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K41) O2 1/1 Reference Signal circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

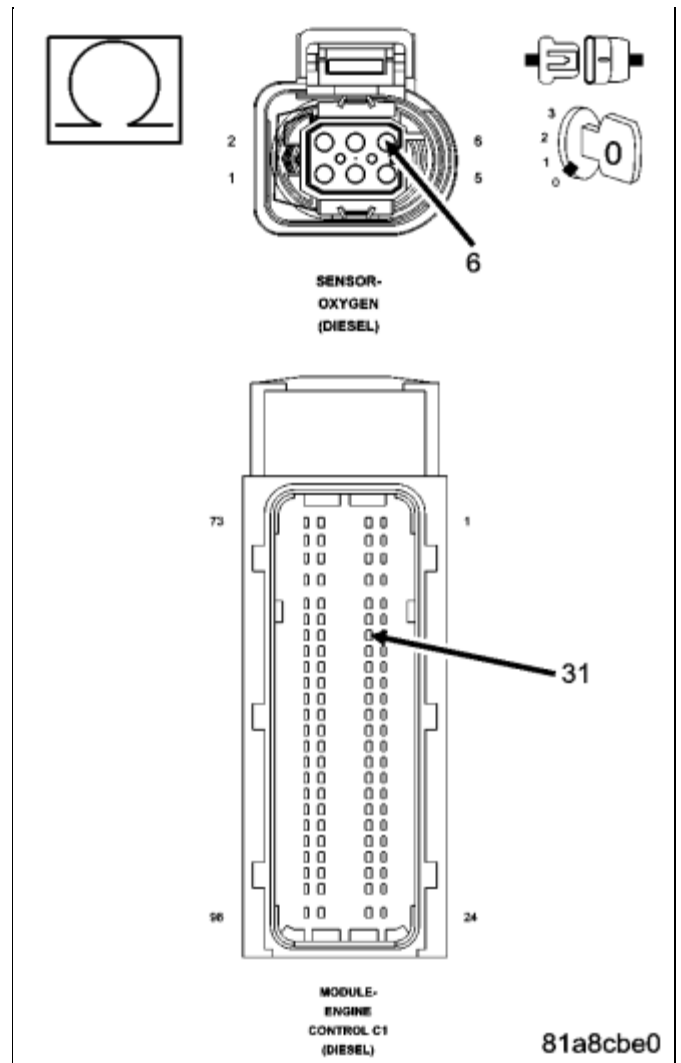
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K41) O2 1/1 Reference Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2280 - AIR FILTER RESTRICTION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the engine running. The ECM compares mass airflow volume/engine rpm to atmospheric pressure.

- **Set Condition:**

The ECM detects a 50% or more drop in airflow through the air filter for 5 minutes.

Possible Causes
INTERMITTENT DTC
CLOGGED AIR FILTER
INTAKE AIR RESTRICTION
INTAKE AIR LEAK

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK THE AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

Were any of these problems found?

Yes

- Replace the Air Filter element

No

- Go to [2](#)

2. CHECK FOR INTAKE SYSTEM RESTRICTIONS

NOTE: Damaged, restricted or poorly connected intake and turbocharger related tubes can cause this DTC to set.

Turn the ignition off.

Inspect all air intake and turbocharger related hoses/tubes and connections for leaks, restrictions and damage..

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go to [3](#)

3. CHECK FOR INTAKE SYSTEM AIR LEAKS

Turn the ignition off.

Remove the Crankcase Vent Heater.

Remove the Mass Air Flow Sensor from the turbocharger inlet tube.

Seal off and/or plug the turbocharger inlet tube where the MAF sensor was removed.

Connect smoke machine 84-04 to the Crankcase Vent Heater port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Test Complete.

P2299- BRAKE PEDAL POSITION/ACCELERATOR PEDAL POSITION INCOMPATIBLE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the engine running (engine speed above 710 rpm). No other APP or Brake Signal DTC's. Vehicle speed above 3 km/h.

- **Set Condition:**

The ECM detects a brake signal input (brakes applied) and Accelerator Pedal Position input is above 3% at the same time for 15.0 seconds.

Possible Causes
ACCELERATOR PEDAL POSITION SENSOR
ACCELERATOR PEDAL OBSTRUCTION
BRAKE SWITCH ADJUSTMENT
BRAKE SWITCH
INTERMITTENT WIRING/CONNECTOR PROBLEM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: This DTC may be set if the vehicle operator is “riding” the brake pedal (driving with both feet).

With the scan tool, clear all ECM DTCs.
Test drive the vehicle performing several stop-and-go operations.
With the scan tool, view active ECM DTCs.

Does the scan tool display this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK BRAKE SWITCH OPERATION

NOTE: This DTC may be set if the Brake Switch is not properly adjusted. Check Brake Switch adjustment before continuing.

Turn the ignition on.
With the scan tool, read the Primary and Secondary Brake Switch Input.

Are the Primary and Secondary Brake Switch inputs operating properly?

Yes

- Go To [3](#)

No

- Refer to the Service Information Wiring to diagnose Brake Switch and/or Brake Switch wiring problem.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CHECK ACCELERATOR PEDAL MOVEMENT

Turn the ignition off.
Check the Accelerator Pedal for obstructions or other problem that could restrict pedal travel, cause binding or prohibit the pedal from traveling to the complete rest position.

Were any of these problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK ACCELERATOR PEDAL POSITION SENSOR INPUT

Turn the ignition on.

NOTE: The Accelerator Pedal must be at the complete rest position for this test. Ensure the pedal is at rest and free from any obstruction.

With the scan tool, read the APP #1 and APP #2 percentages.

Does the scan tool display below 2% for APP #1 and APP #2 percentages?

Yes

- Go To [5](#)

No

- Replace the Accelerator Pedal Position Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. INTERMITTENT APP SENSOR/BRAKE SWITCH

Turn the ignition on.

With the scan tool, read the APP #1 and APP #2 percentages

Fully depress and release the Accelerator Pedal several times.

With the scan tool, read the Primary and Secondary Brake Switch inputs.

Fully depress and release the Brake Pedal several times.

Were any problems found with the inputs during pedal actuation for the Brakes or Accelerator?

Yes

- Repair or replace as necessary.

No

- Using the wiring diagrams check the connectors and wiring associated with the Accelerator Pedal Sensor and Brake Switch for damage, corrosion or other problems that could cause an intermittent DTC.

P242F–DIESEL PARTICULATE FILTER RESTRICTION — ASH ACCUMULATION

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the engine running.

- **Set Condition:**

The Differential Pressure Sensor signal indicates partial clogging of the particulate filter due to the accumulation of ash or other debris.

Possible Causes
DAMAGED EXHAUST SYSTEM
LEAKING EXHAUST SYSTEM
HIGH RESISTANCE IN EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUITS
HOSE/TUBE CONNECTIONS TO THE EXHAUST DIFFERENTIAL PRESSURE SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
DIESEL PARTICULATE FILTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECKING FOR OTHER DTC'S

NOTE: This DTC can be set when vehicle is driven only on short trips where exhaust and engine temperatures do not reach operating temperature for 30 minutes or more.

Turn the ignition on.

With the scan tool, read the ECM DTC's.

Are there other DTC's set in the ECM?

Yes

- Repair other DTC's before continuing with this test.
- Perform ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. VISUAL INSPECTION

Turn the ignition off.

Visually inspect the Exhaust Differential Pressure Sensor for physical damage, proper electrical connection and proper mechanical connection. Ensure any tubes and/or hoses connected to the sensor are in good working condition and properly connected at all ends.

Visually inspect the entire exhaust system for bent, crushed or otherwise damaged tubes which may cause an exhaust system restriction.

Inspect the exhaust system for exhaust leaks.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. PARTICULATE FILTER REGENERATION

Start and idle the engine.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, perform the Diesel Particulate Filter Regeneration procedure.

After this procedure is complete, turn the ignition off for 60 seconds.

Test drive the vehicle.

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

Yes

- Go To [4](#)

No

Test complete.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of each Exhaust Differential Pressure Sensor circuit between the Exhaust Differential Pressure Sensor harness connector and the ECM harness connector.

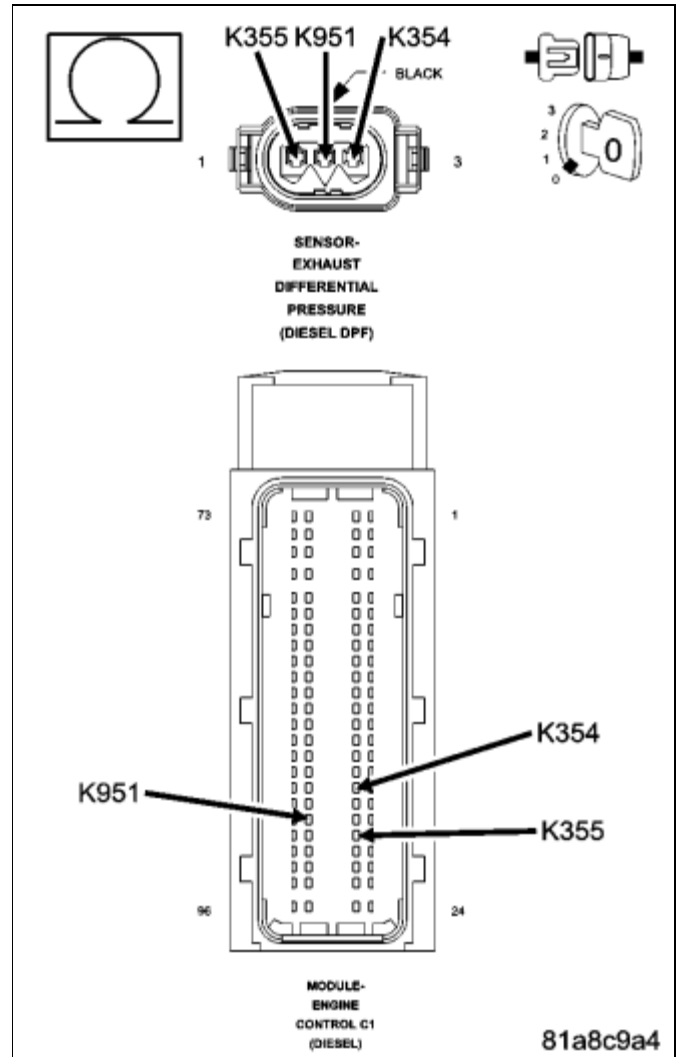
Is the resistance below 10.0 ohms for each circuit?

Yes

- Go To [5](#)

No

- Repair the circuit(s) that measured above 10.0 ohms for high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Replace the Exhaust Differential Pressure Sensor.

Turn the ignition on.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Test drive the vehicle

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

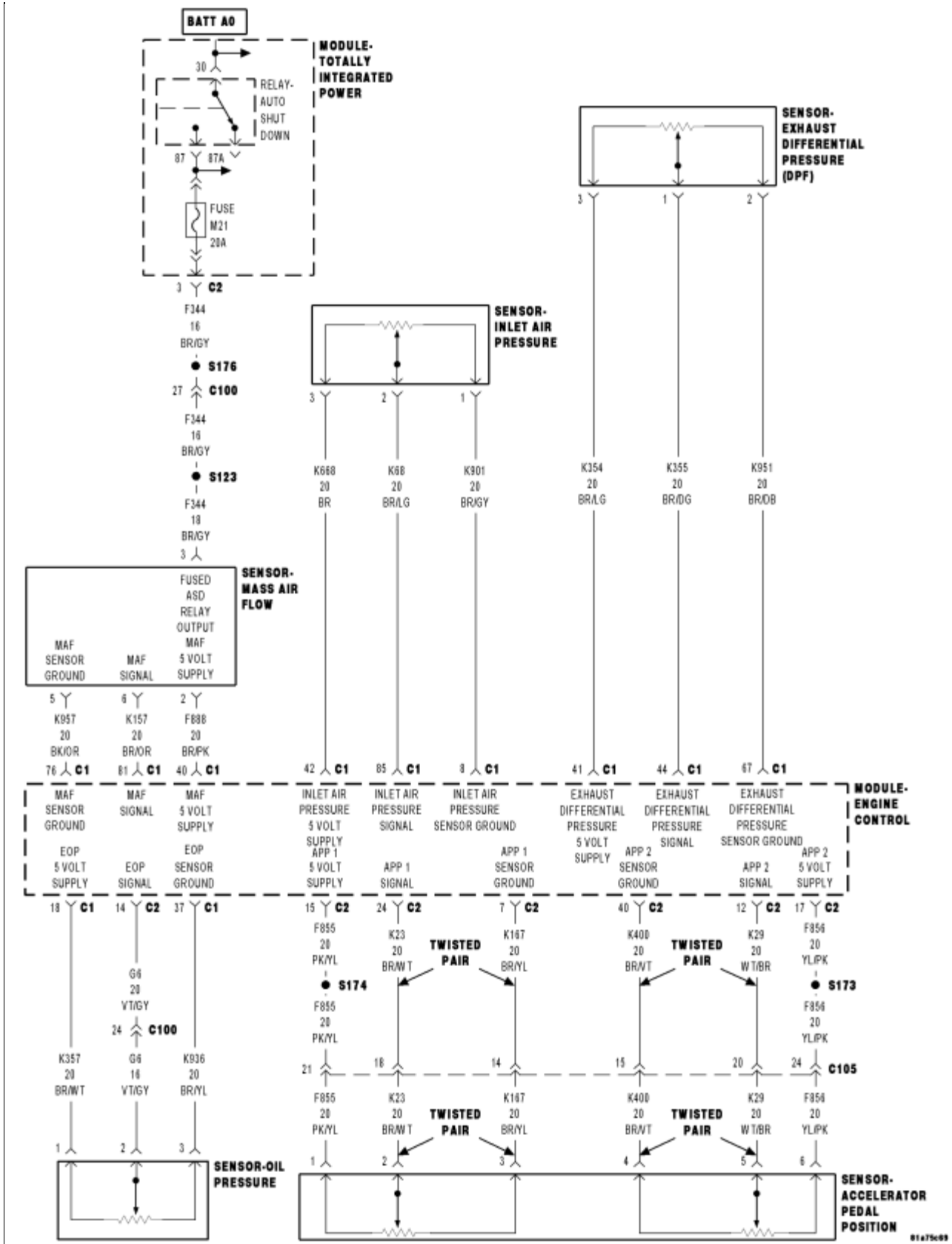
Yes

- Replace the Diesel Particulate Filter.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P244B—DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE TOO HIGH



The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the engine running.

- **Set Condition:**

The ECM detects pressure at the particulate filter above 950 hpa for 10.0 seconds.

Possible Causes
DAMAGED EXHAUST SYSTEM
LEAKING EXHAUST SYSTEM
HIGH RESISTANCE IN EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUITS
HOSE/TUBE CONNECTIONS TO THE EXHAUST DIFFERENTIAL PRESSURE SENSOR
EXHAUST DIFFERENTIAL PRESSURE SENSOR
DIESEL PARTICULATE FILTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHECKING FOR OTHER DTC'S

NOTE: This DTC indicates that the soot level in the Diesel Particulate Filter is too high. This occurs normally on high mileage vehicles. However, if there is an EGR system problem, turbocharger problem or oil consumption problem with the engine, this DTC can occur on a low mileage vehicle

Turn the ignition on.

With the scan tool, read the ECM DTC's.

Are there other DTC's set in the ECM?

Yes

- Repair other DTC's before continuing with this test.
- Perform ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. VISUAL INSPECTION

Turn the ignition off.

Visually inspect the Exhaust Differential Pressure Sensor for physical damage, proper electrical connection and proper mechanical connection. Ensure any tubes and/or hoses connected to the sensor are in good working condition, clear of any restrictions and properly connected at all ends.

Visually inspect the entire exhaust system for bent, crushed or otherwise damaged tubes which may cause an exhaust system restriction.

Inspect the exhaust system for exhaust leaks.

Were any problems found?

Yes

- Repair or replace as necessary.

No

- Go To [3](#)

3. PARTICULATE FILTER REGENERATION

Start and idle the engine.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, perform the Diesel Particulate Filter Regeneration procedure.

After this procedure is complete, turn the ignition off for 60 seconds.

Test drive the vehicle.

With the scan tool, Read DTCs in the Engine Control Module (ECM).

Is the status Active for this DTC?

Yes

- Go To [4](#)

No

- Test complete.

4. EXHAUST DIFFERENTIAL PRESSURE SENSOR CIRCUIT HIGH RESISTANCE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of each Exhaust Differential Pressure Sensor circuit between the Exhaust Differential Pressure Sensor harness connector and the ECM harness connector.

Is the resistance below 10.0 ohms for each circuit?

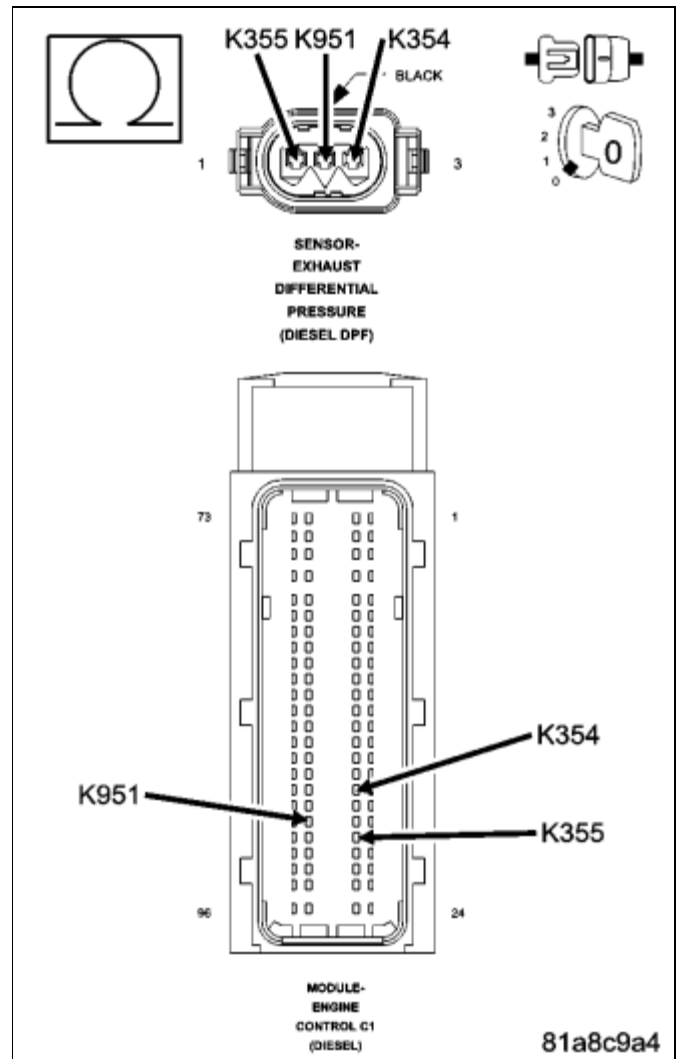
Yes

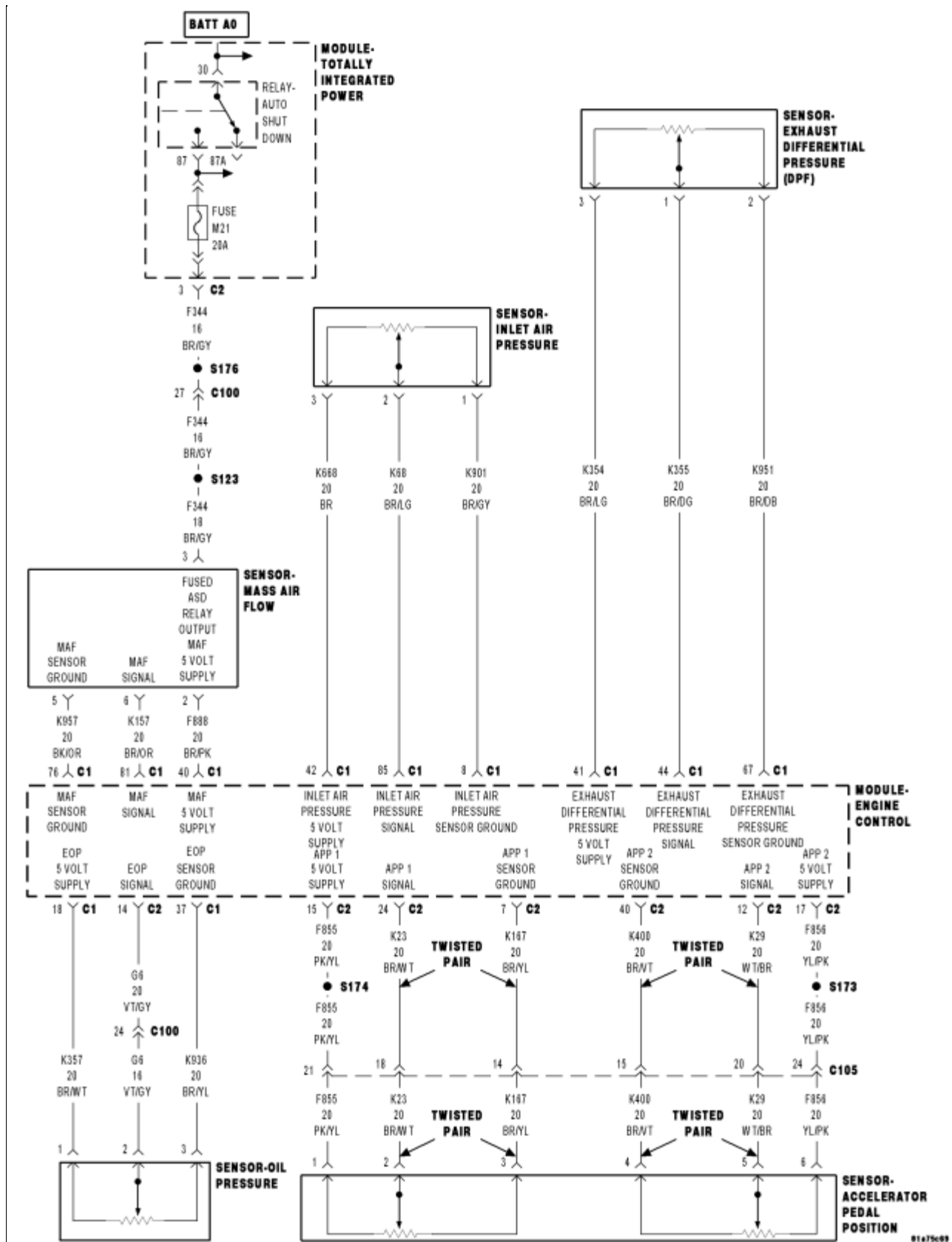
- Replace the Diesel Particulate Filter. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Repair the circuit(s) that measured above 10.0 ohms for high resistance. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P2453-DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR CIRCUIT PERFORMANCE





For a complete wiring diagram Refer to Section 8W

Theory of Operation

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

At the beginning of engine crank.

- **Set Condition:**

The Differential Pressure Sensor Signal is below negative 40 hpa or above positive 40 hpa.

Possible Causes
INTERMITTENT DTC
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
EXHAUST DIFFERENTIAL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit in the Exhaust Differential Pressure Sensor harness connector.

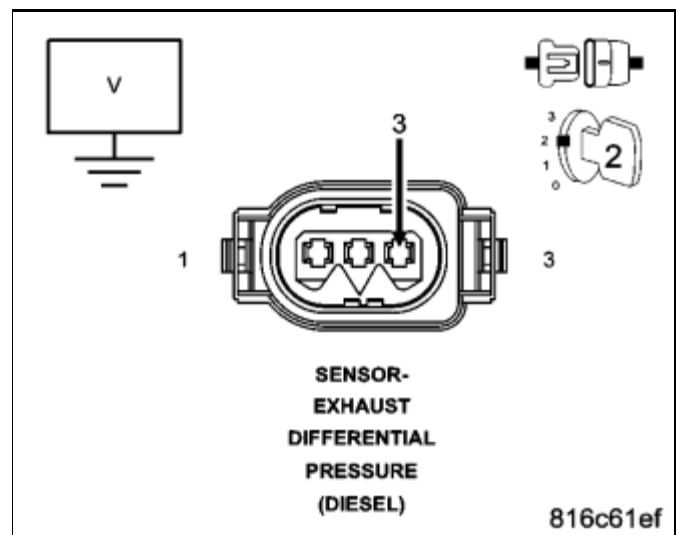
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit in the Exhaust Differential Pressure Sensor harness connector.

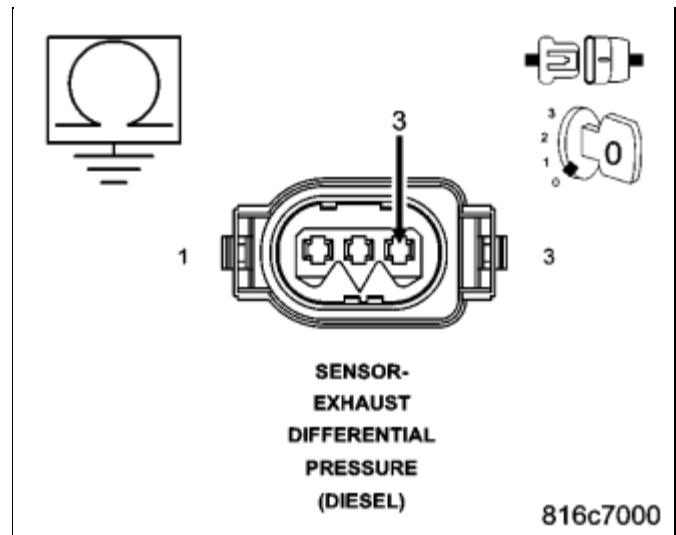
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit and the (K951) Exhaust Differential Pressure Sensor Ground circuit in the Exhaust Differential Pressure Sensor harness connector.

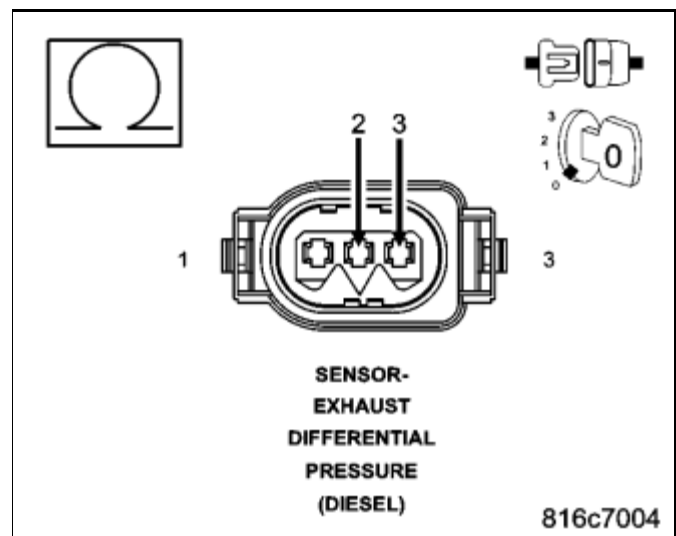
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to the (K951) Exhaust Differential Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit between the Exhaust

Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

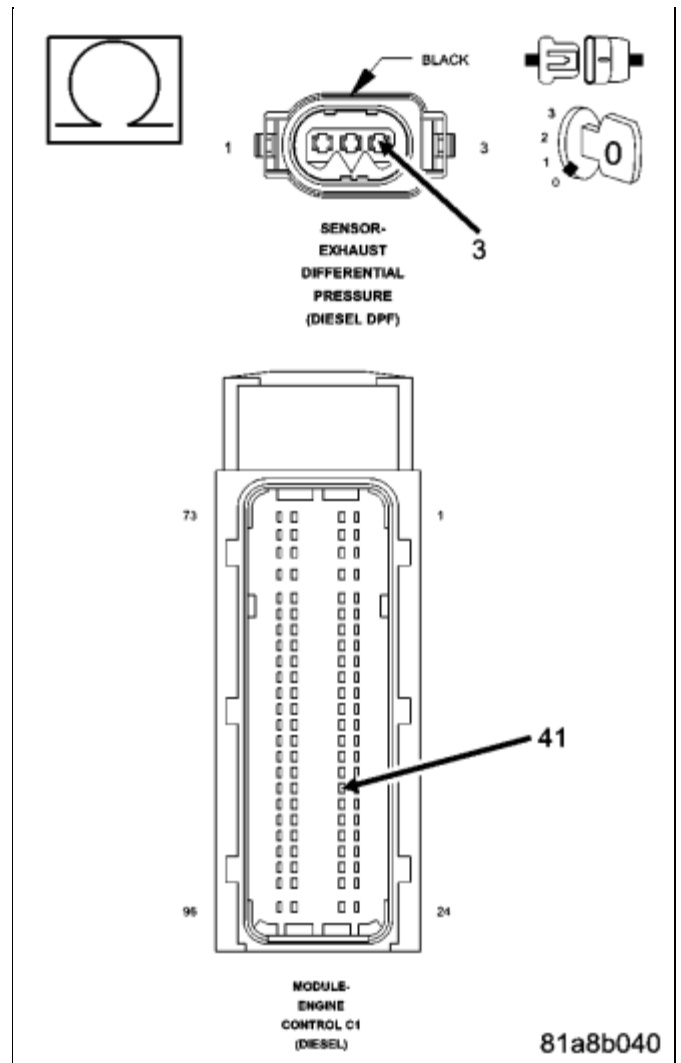
Is the resistance below 10.0 ohms?

Yes

- Go to [9](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
Disconnect the Engine Control Module (ECM) connector.
Measure the resistance of the (K355) Exhaust Differential Pressure Sensor Signal circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

Yes

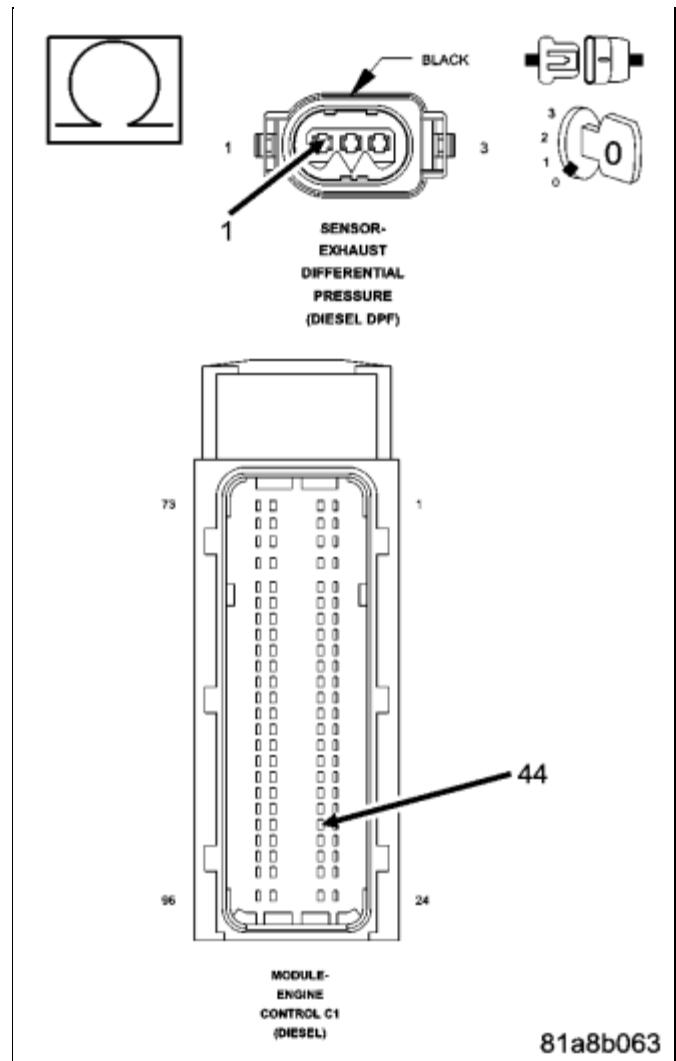
- Go to [7](#)

No

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for an open circuit or high

resistance.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K951) Exhaust Differential Pressure Sensor Ground circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10.0 ohms?

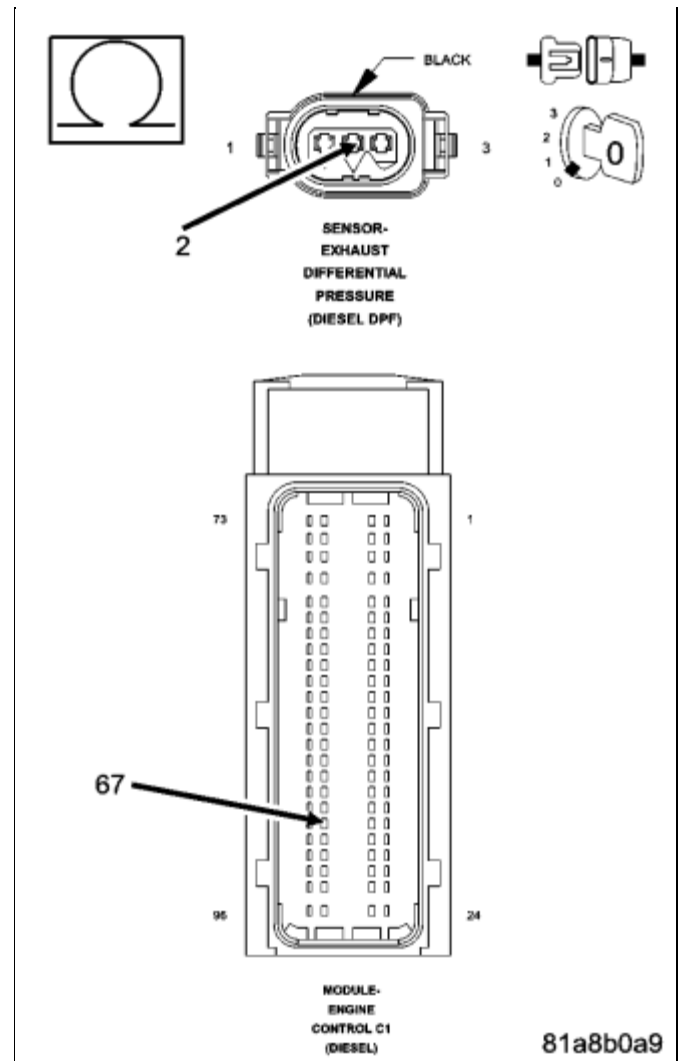
Yes

- Go to [8](#)

No

- Repair the (K951) Exhaust Differential Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

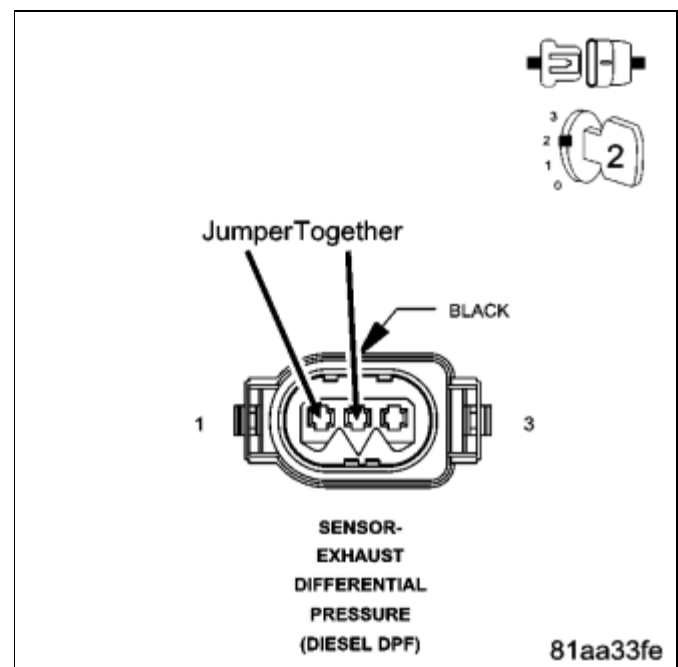
- ENGINE - STANDARD PROCEDURE)



8. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.
 Connect the Engine Control Module (ECM) harness connector.
 Connect a jumper between the (K355) Exhaust Differential Pressure Sensor Signal circuit and the (K951) Exhaust Differential Pressure Sensor Ground circuit in the Exhaust Differential Pressure Sensor harness connector.
 Turn the ignition on.
 With the scan tool, Clear DTCs.
 With the scan tool, select View DTCs.

NOTE: The scan tool should display an Exhaust Differential Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC(s) as described above?

Yes

- Replace the Exhaust Differential Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Exhaust Differential Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

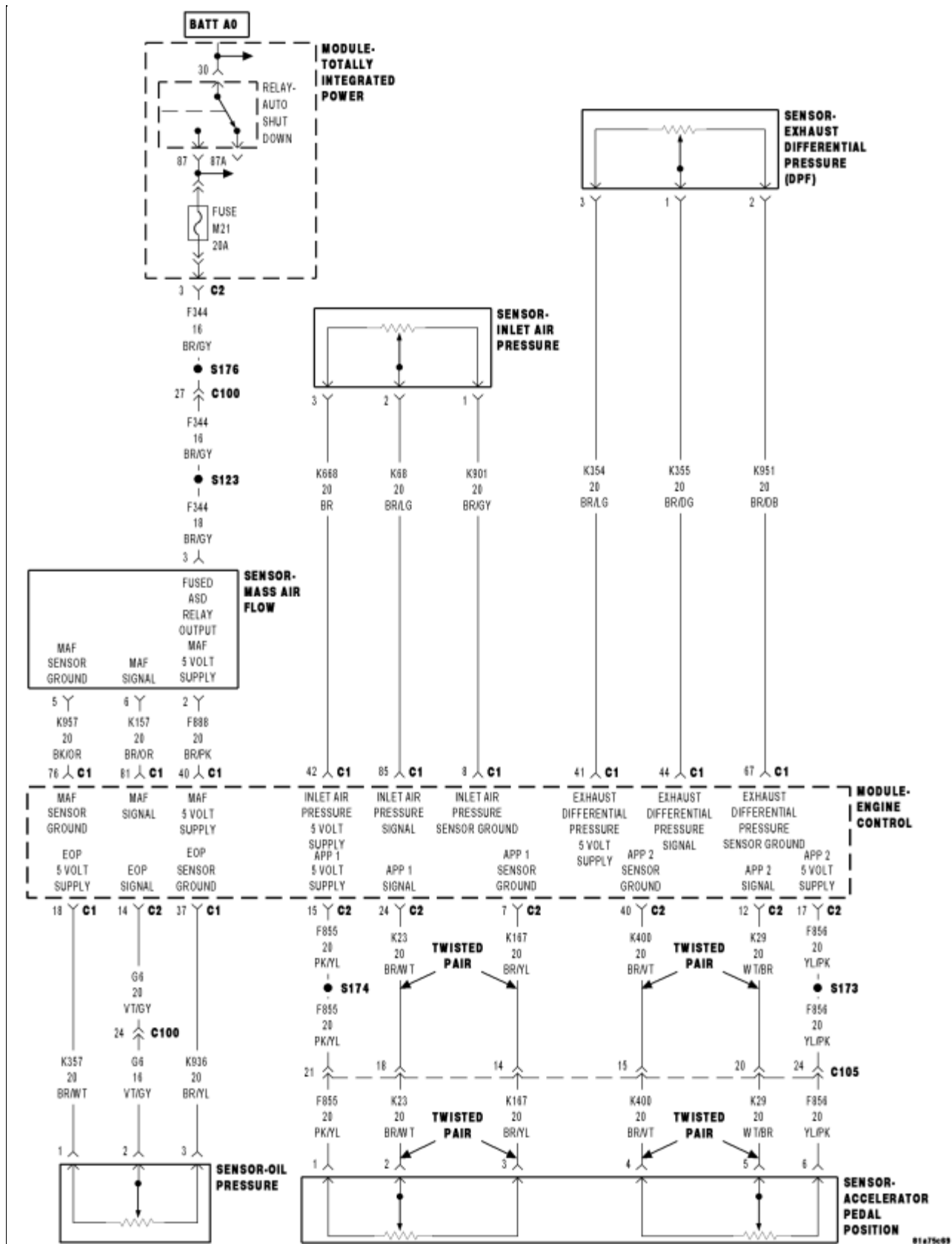
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2454-DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K355) Exhaust Differential Pressure Sensor signal is below 0.15 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
EXHAUST DIFFERENTIAL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit in the Exhaust Differential Pressure Sensor harness connector.

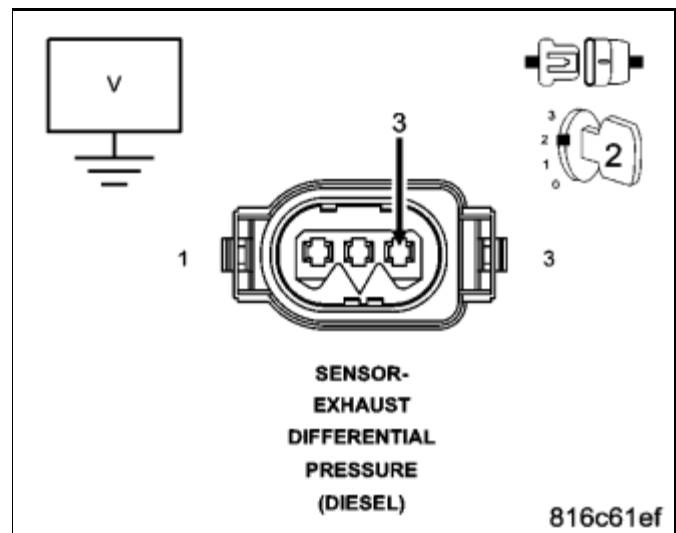
Is the voltage above 4.5 volts?

Yes

- Go to [6](#)

No

- Go to [3](#)



3. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit in the Exhaust Differential Pressure Sensor harness connector.

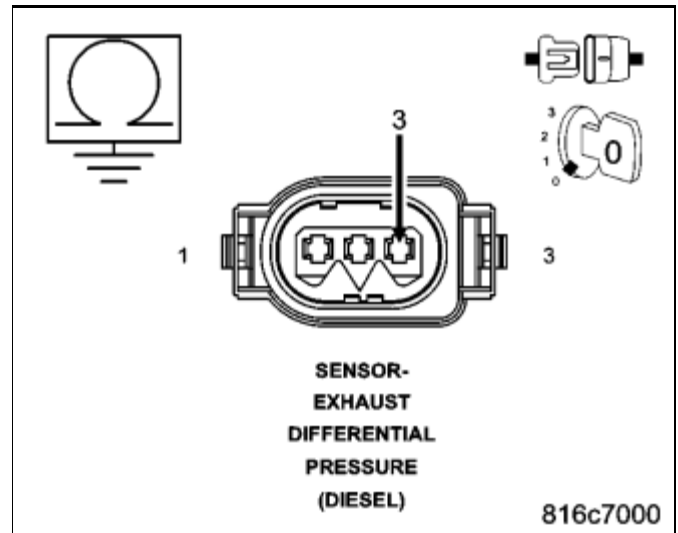
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit and the (K951) Exhaust Differential Pressure Sensor Ground circuit in the Exhaust Differential Pressure Sensor harness connector.

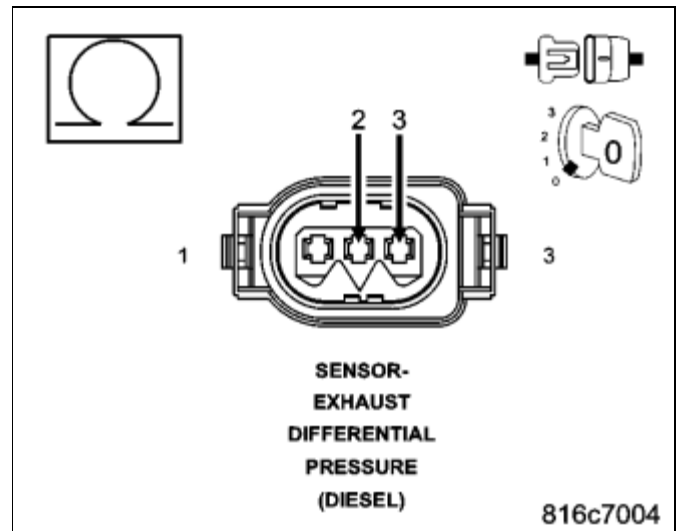
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to the (K951) Exhaust Differential Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K354) Exhaust Differential

Pressure Sensor 5 Volt Supply circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

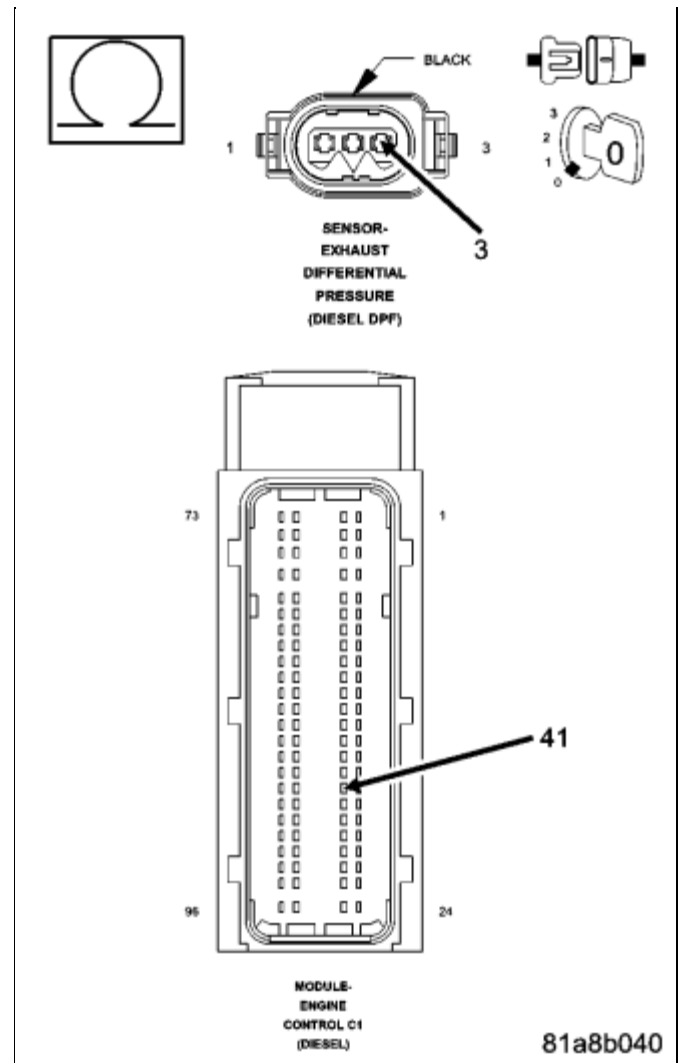
Is the resistance below 10.0 ohms?

Yes

- Go to [10](#)

No

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Engine Control Module (ECM) connector.
Measure the resistance between ground and the (K355) Exhaust Differential Pressure Sensor Signal circuit in the Exhaust Differential Pressure Sensor harness connector.

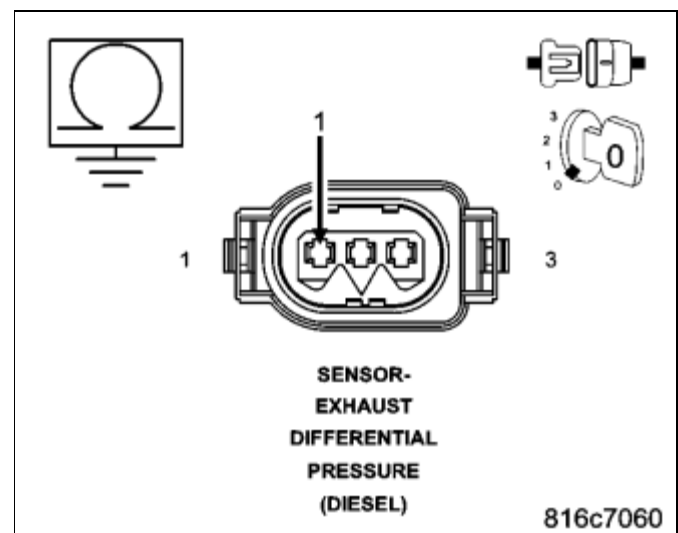
Is the resistance above 1000 ohms?

Yes

- Go to [7](#)

No

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance between the (K355) Exhaust Differential Pressure Sensor Signal circuit and the (K951) Exhaust Differential Pressure Sensor Ground circuit in the Exhaust Differential Pressure Sensor harness connector.

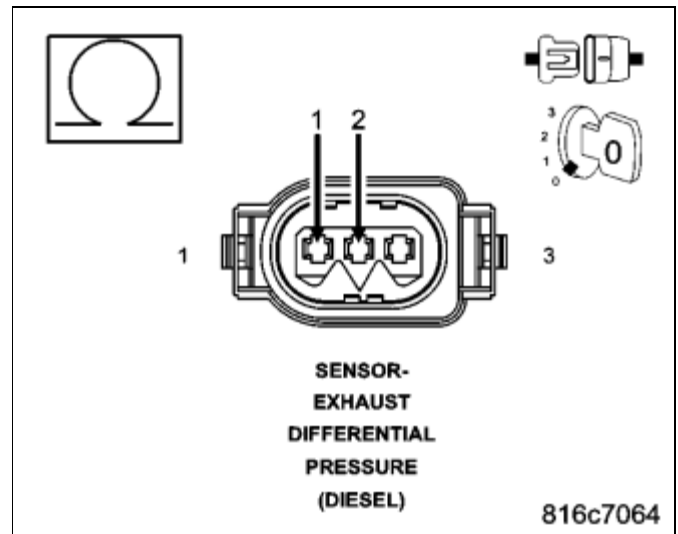
Is the resistance above 1000 ohms?

Yes

- Go to [8](#)

No

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for a short to the (K951) Exhaust Differential Pressure Sensor Ground circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K355) Exhaust Differential Pressure Sensor Signal circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

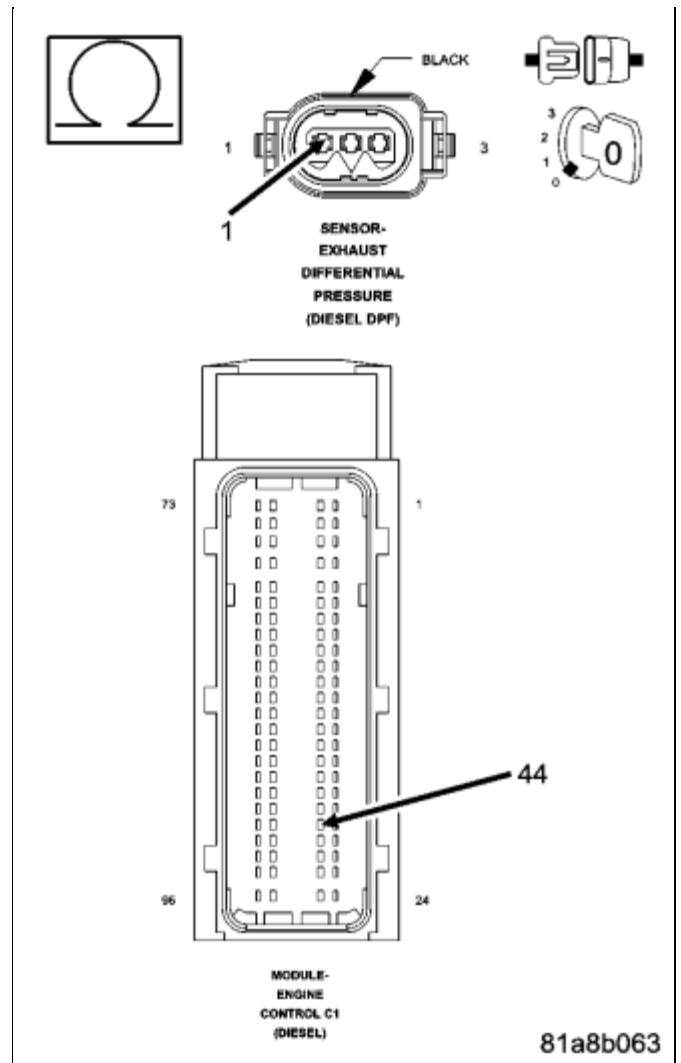
Is the resistance below 10.0 ohms?

Yes

- Go to [9](#)

No

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

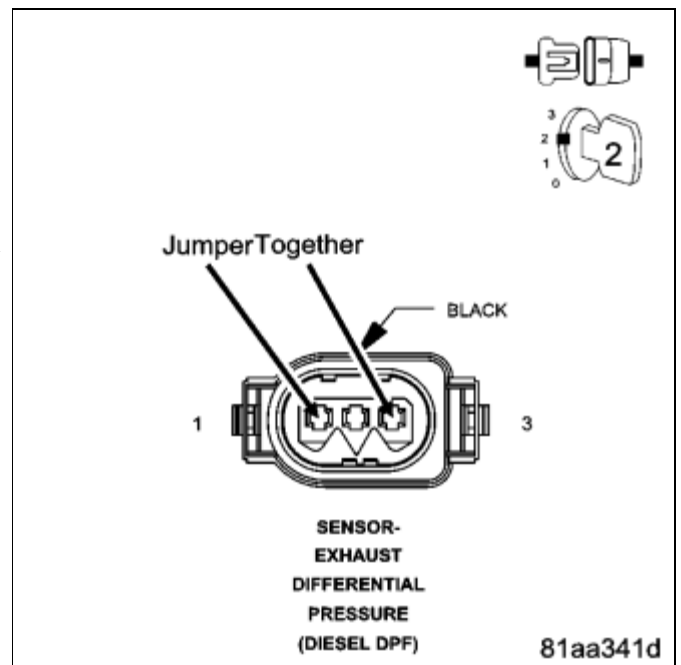
Connect a jumper wire between the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit and the (K355) Exhaust Differential Pressure Sensor Signal circuit in the Exhaust Differential Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Exhaust Differential Pressure Sensor high voltage or open DTC with the Exhaust Differential Pressure Sensor harness connector disconnected and the jumper wire in place.



Does the scan tool display the DTC as described above?**Yes**

- Replace the Exhaust Differential Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [10](#)

10. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Exhaust Differential Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

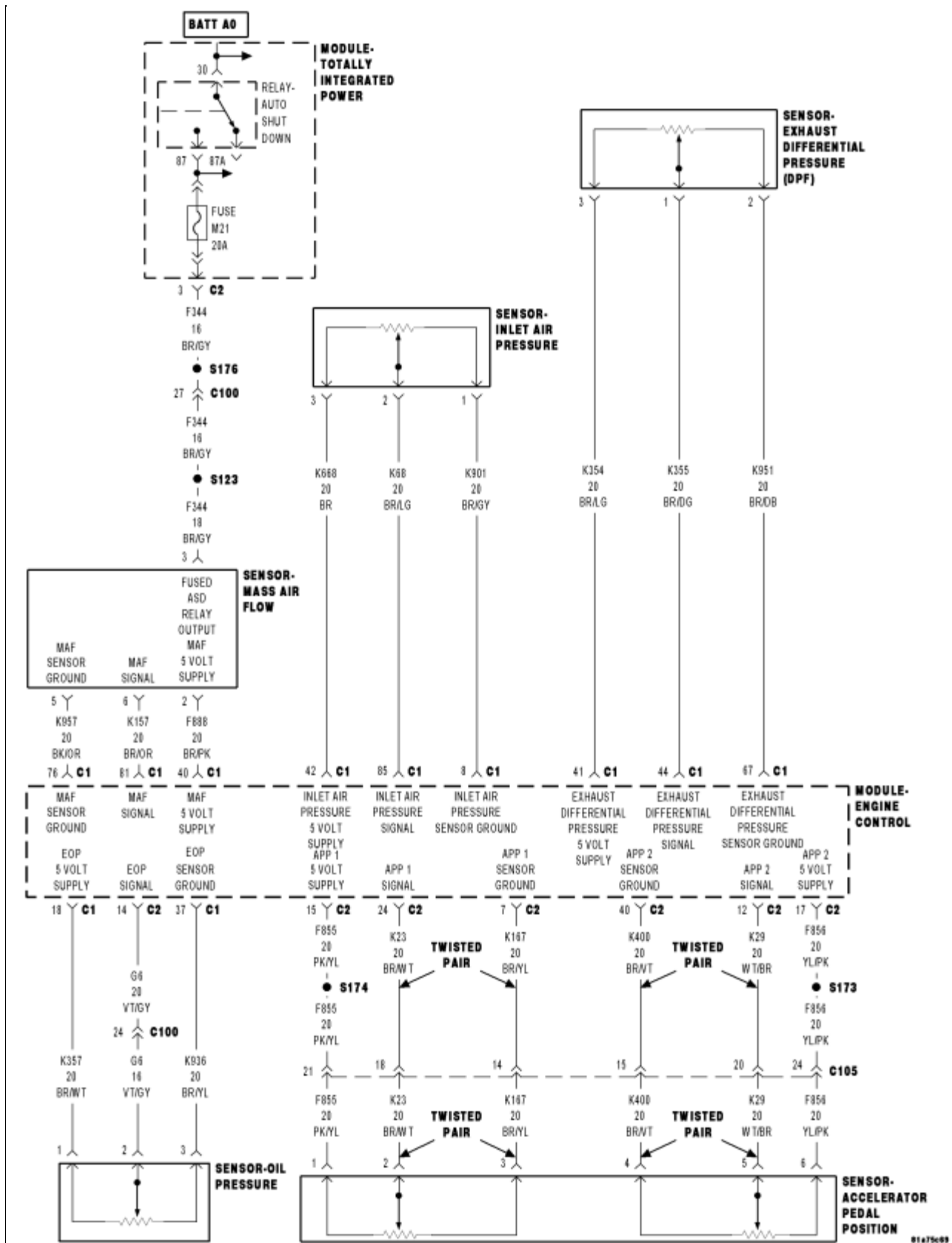
Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2455-DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR CIRCUIT HIGH



For a complete wiring diagram Refer to Section 8W

Theory of Operation

The Diesel particulate filter is an inline canister filter located in the exhaust system between the engine and the muffler. This filter captures and stores ash particles created by the diesel combustion process. This filter is monitored by the ECM with a Differential Pressure Sensor. This sensor measures the difference in exhaust system pressure before and after the particulate filter through tube connections directly to the exhaust pipe. As ash and soot accumulate in the filter, the exhaust pressure at the inlet side of the filter increases as compared to the pressure at the outlet side of the filter.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The (K355) Exhaust Differential Pressure Sensor signal is above 4.59 volts for 0.5 second.

Possible Causes
INTERMITTENT DTC
(K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE
(K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE
(K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE
EXHAUST DIFFERENTIAL PRESSURE SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: If any Sensor Reference or Sensor Supply voltage DTCs are present, perform the applicable diagnostic procedure before continuing with this test.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K354) EXHAUST DIFFERENTIAL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Exhaust Differential Pressure Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit in the Exhaust Differential Pressure Sensor harness connector.

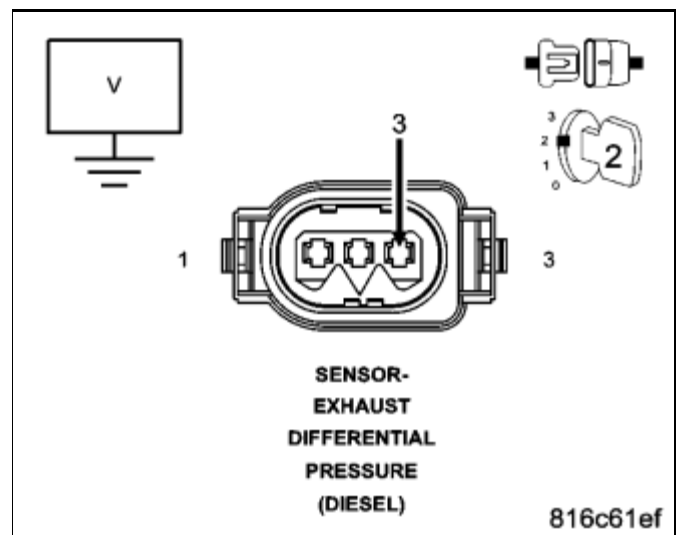
Is there any voltage present?

Yes

- Repair the (K354) Exhaust Differential Pressure Sensor 5 Volt Supply circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K355) Exhaust Differential Pressure Sensor Signal circuit in the Exhaust Differential Pressure Sensor harness connector.

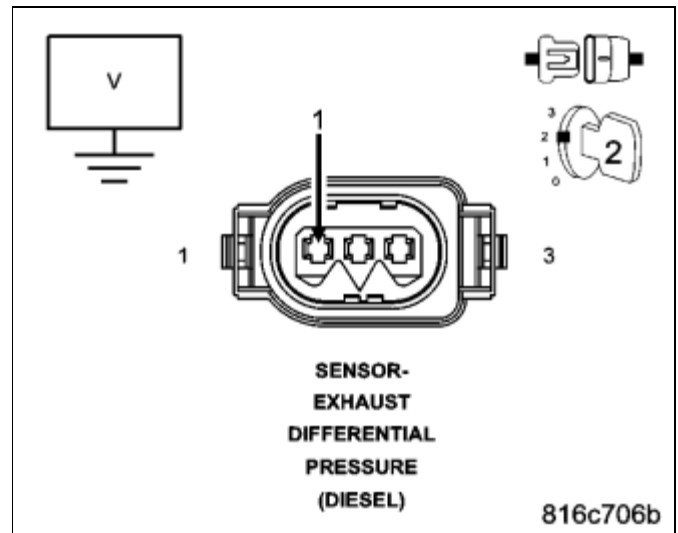
Is there any voltage present?

Yes

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)



4. (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

NOTE: The jumper wire should still be in place.

Measure the voltage of the (K951) Exhaust Differential Pressure Sensor Ground circuit in the Exhaust Differential Pressure Sensor harness connector.

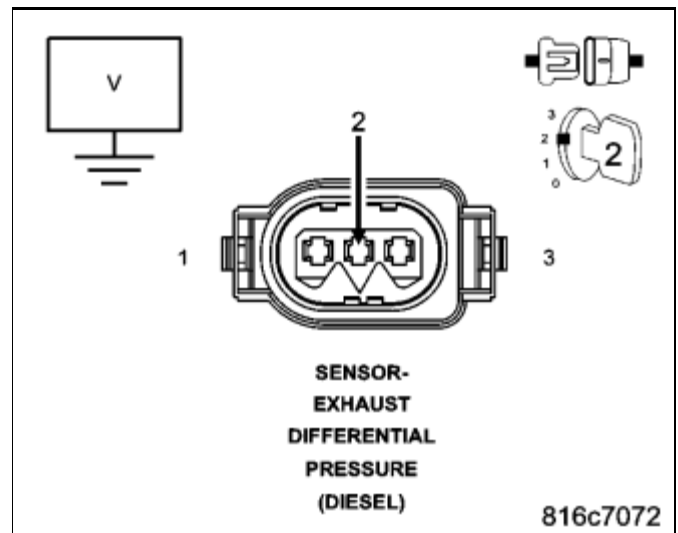
Is there any voltage present?

Yes

- Repair the (K951) Exhaust Differential Pressure Sensor Ground circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. (K355) EXHAUST DIFFERENTIAL PRESSURE SENSOR SIGNAL CIRCUIT OPEN OR HIGH

RESISTANCE

Turn the ignition off.

Remove the jumper wire and install the ASD Relay.
Measure the resistance of the (K355) Exhaust Differential Pressure Sensor Signal circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

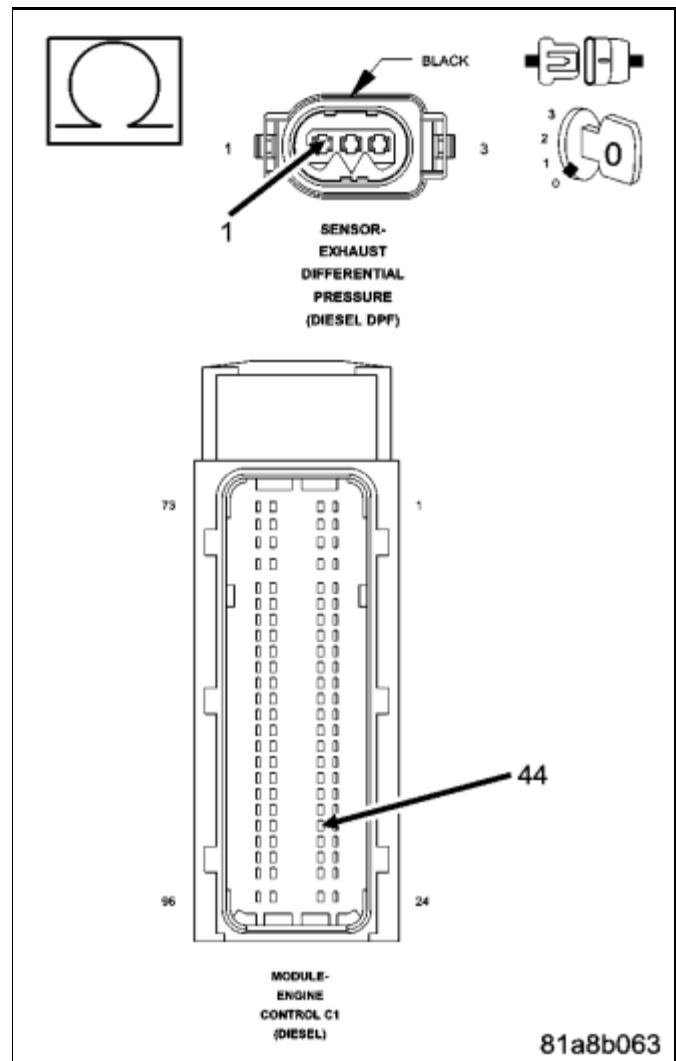
Is the resistance below 10.0 ohms?

Yes

- Go to [6](#)

No

- Repair the (K355) Exhaust Differential Pressure Sensor Signal circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K951) EXHAUST DIFFERENTIAL PRESSURE SENSOR GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K951) Exhaust Differential Pressure Sensor Ground circuit between the Exhaust Differential Pressure Sensor harness connector and the Engine Control Module (ECM) harness connector.

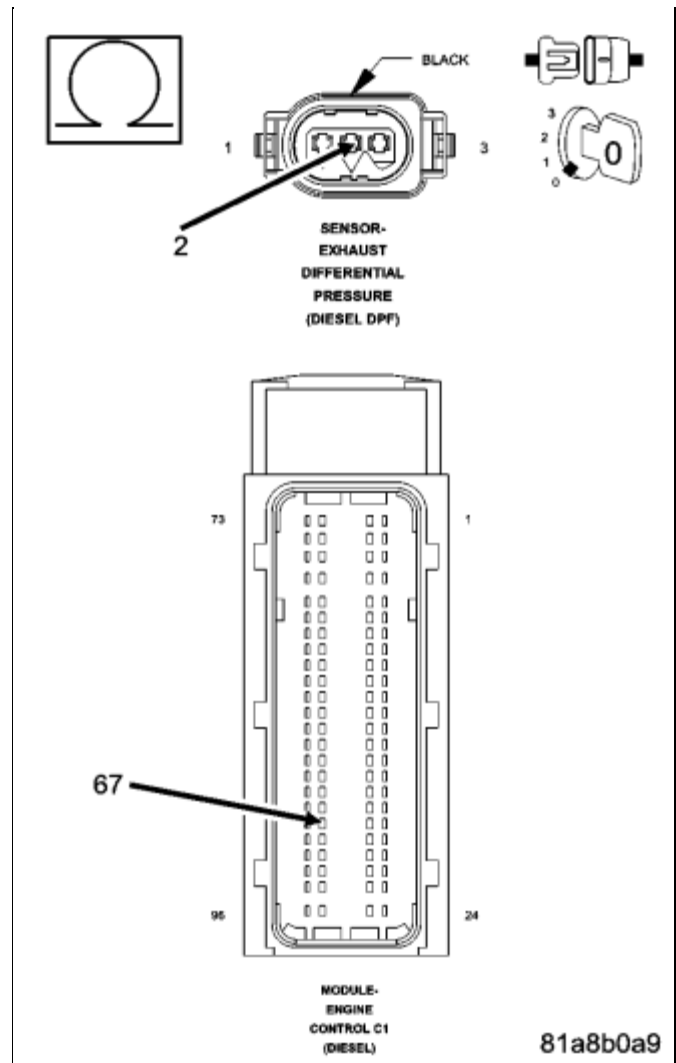
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K951) Exhaust Differential Pressure Sensor Ground circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. EXHAUST DIFFERENTIAL PRESSURE SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

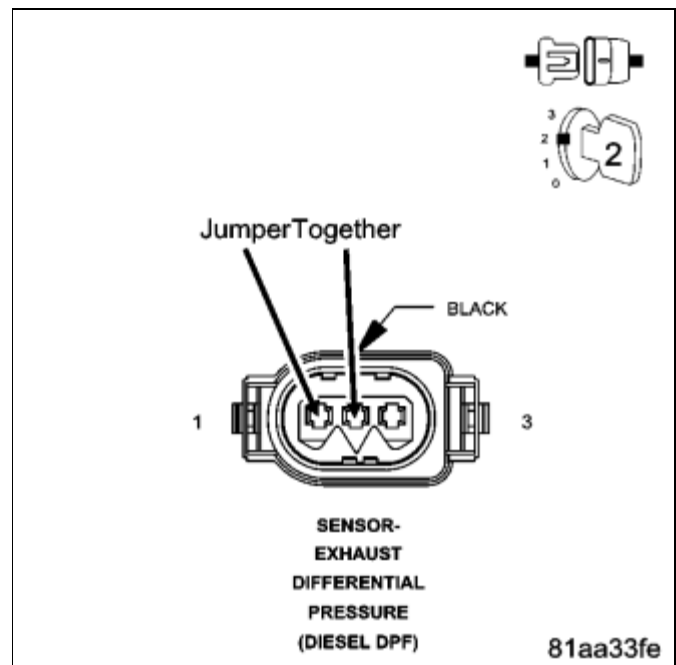
Connect a jumper wire between the (K951) Exhaust Differential Pressure Sensor Ground circuit and the (K355) Exhaust Differential Pressure Sensor Signal circuit in the Exhaust Differential Pressure Sensor harness connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, select View DTCs.

NOTE: The scan tool should display an Exhaust Differential Pressure Sensor low voltage or short to ground DTC with the jumper wire in place.



Does the scan tool display the DTC as described above?

Yes

- Replace the Exhaust Differential Pressure Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [8](#)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Exhaust Differential Pressure Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P250F-ENGINE OIL LEVEL TOO LOW

For a complete wiring diagram **Refer to Section 8W**

◦ When Monitored:

With the ignition on.

◦ Set Condition:

The engine oil change counter indicates that the engine is overdue for an oil change. The DPF regeneration is disabled to prevent further oil delusion.

Possible Causes
ENGINE OIL CHANGE COUNTER LEVEL TOO LOW

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition off.
Refer to the Service Information and change the engine oil.
With the scan tool, reset the engine oil change counter.

View repair.

Test Complete

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P252F-ENGINE OIL LEVEL TOO HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The engine oil change counter indicates that the engine is overdue for an oil change. The DPF regeneration is disabled to prevent further oil delusion.

Possible Causes
ENGINE OIL CHANGE COUNTER LEVEL TOO HIGH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition off.

Refer to the Service Information and change the engine oil.

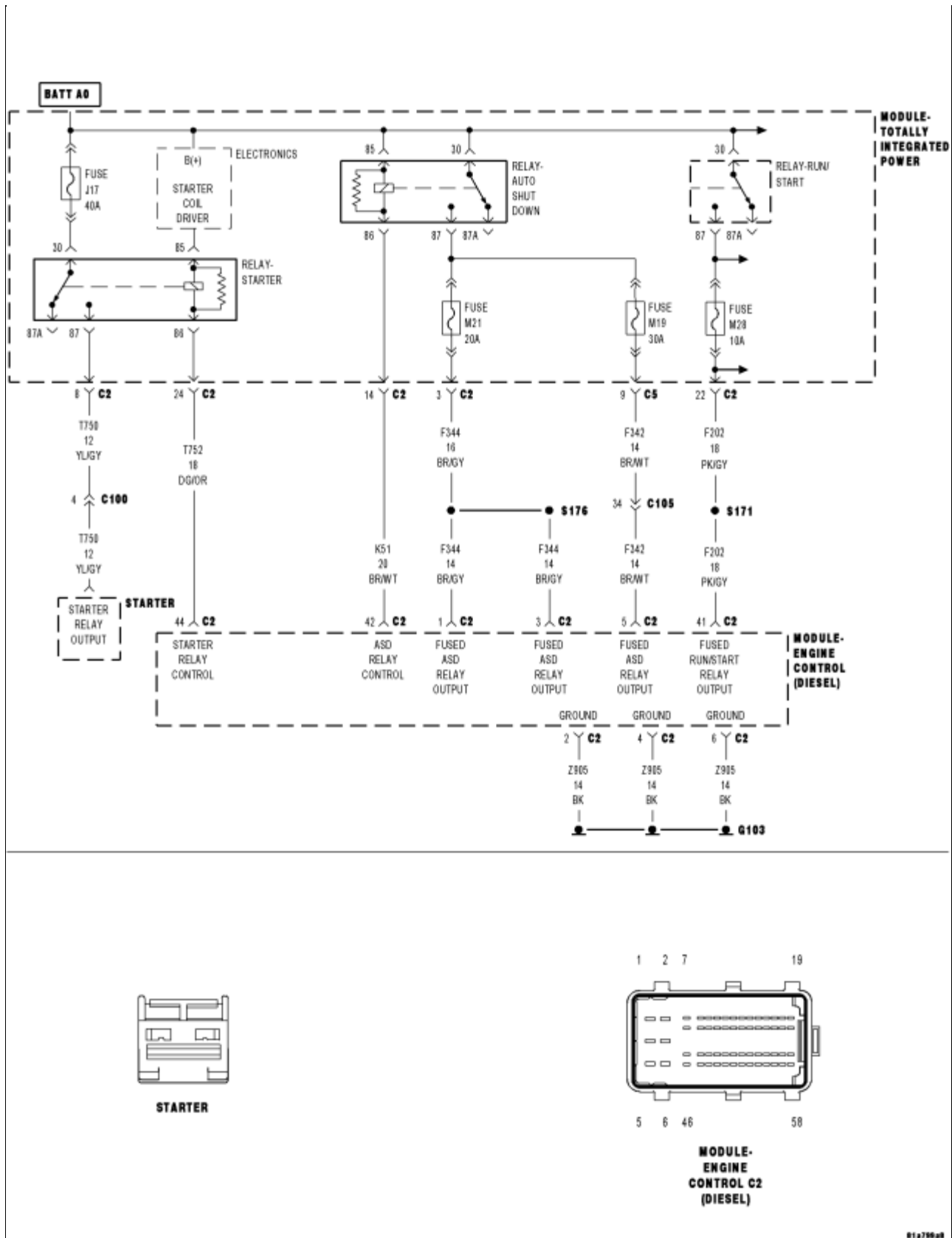
With the scan tool, reset the engine oil change counter.

View repair.

Test Complete

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2533-IGNITION SWITCH RUN/START POSITION CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

CHECK THE ECM POWER AND GROUNDS
ENGINE CONTROL MODULE

Diagnostic Test

1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECK POWER AND GROUNDS

Refer to symptom Checking the ECM Power and Grounds.

Are the ECM Power and Ground circuits o.k.?

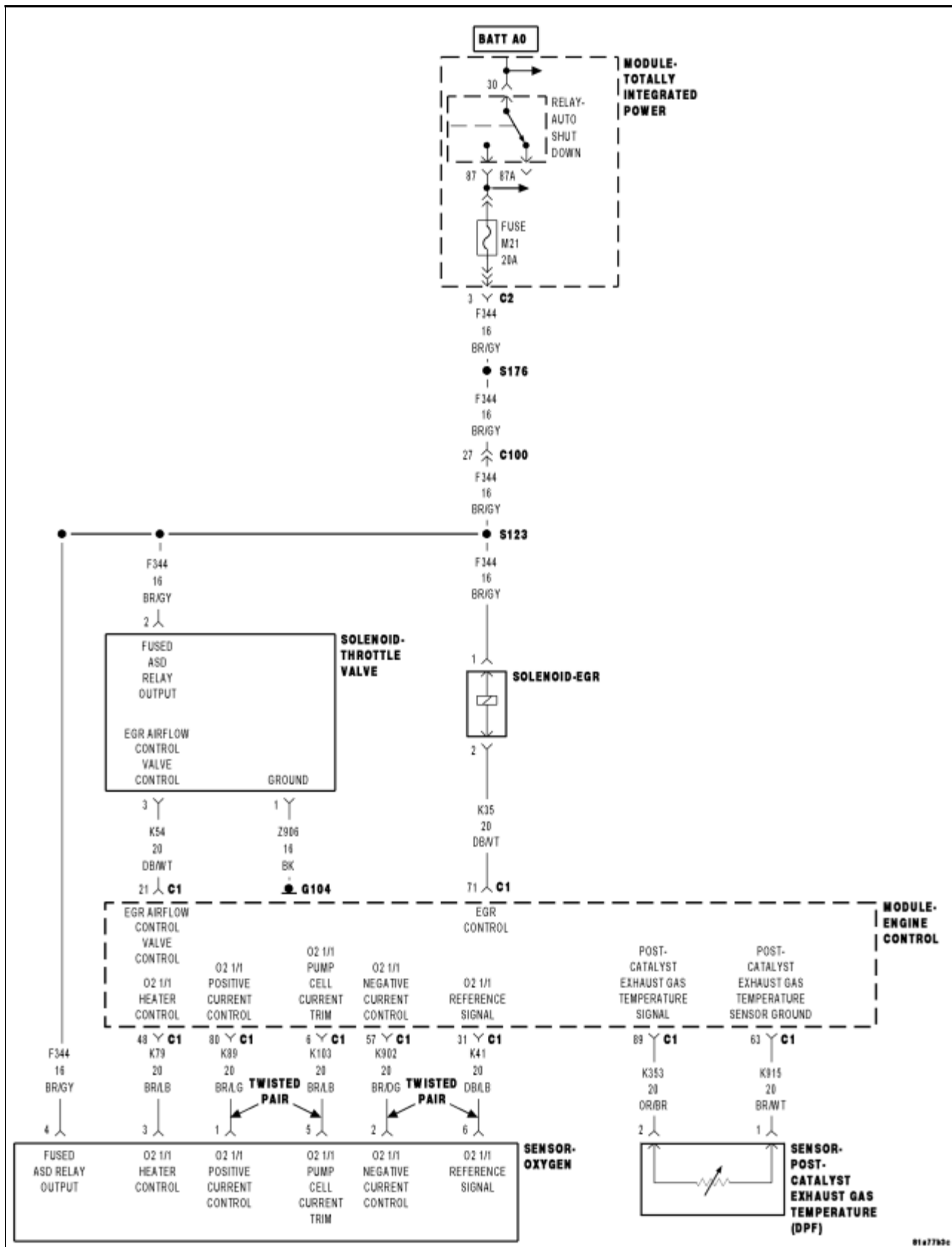
Yes

- Replace the ECM in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2627-O2 SENSOR 1/1 PUMP CELL CURRENT TRIM CIRCUIT LOW



For a complete wiring diagram Refer to Section 8W

- **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to ground on the (K103) O2 1/1 Pump Cell Current Trim circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO GROUND
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Oxygen Sensor harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance between ground and the (K103) O2 1/1 Pump Cell Current Trim circuit in the Oxygen Sensor harness connector.

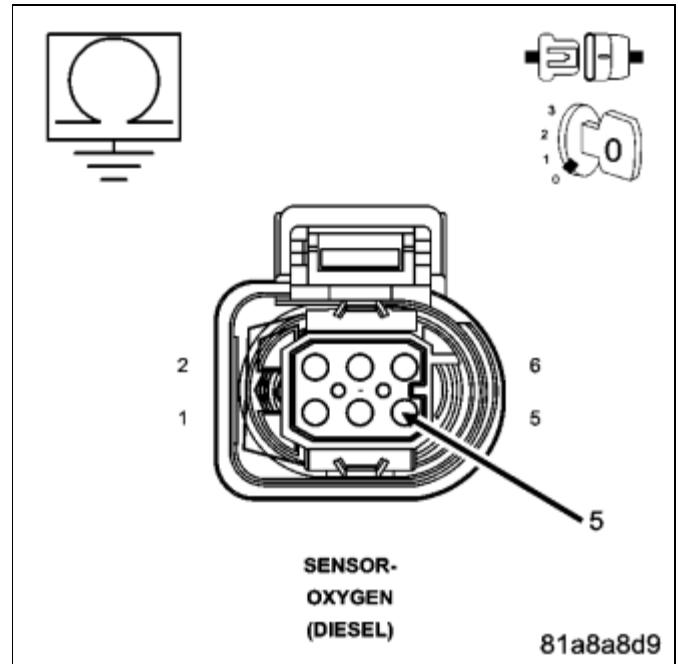
Is the resistance above 1000 ohms?

Yes

- Go to [3](#)

No

- Repair the (K103) O2 1/1 Pump Cell Current Trim circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K103) O2 1/1 Pump Cell Current Trim circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

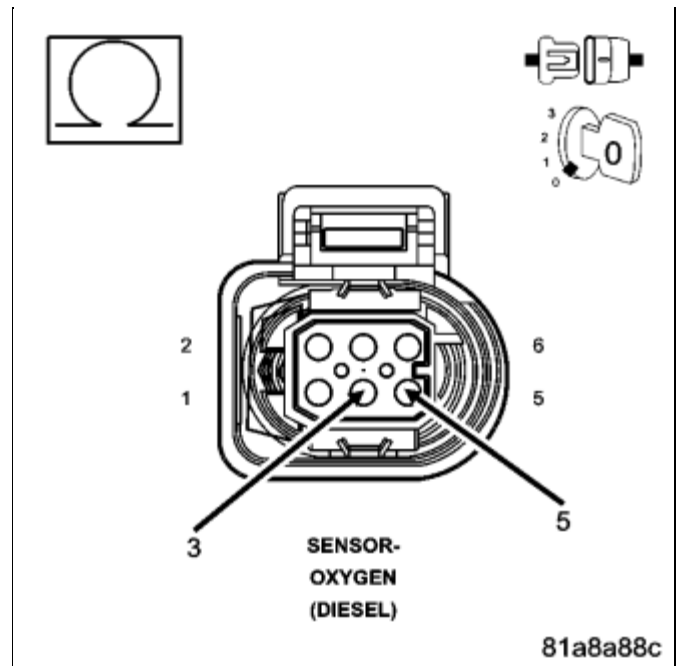
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K103) O2 1/1 Pump Cell Current Trim circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K103) O2 1/1 Pump Cell Current Trim circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

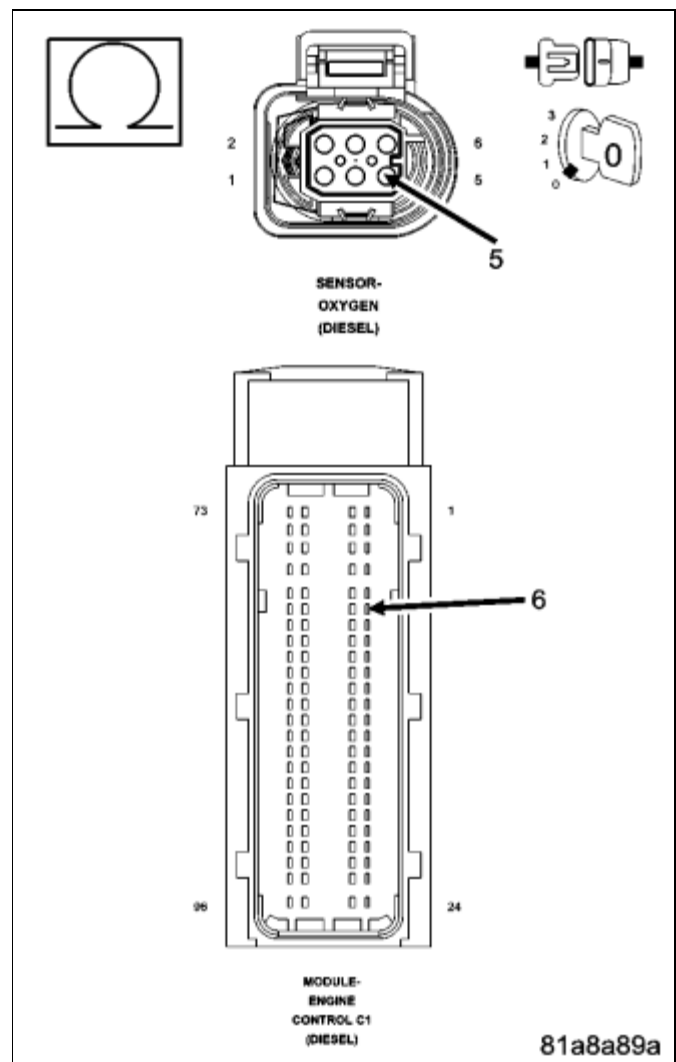
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K103) O2 1/1 Pump Cell Current Trim circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

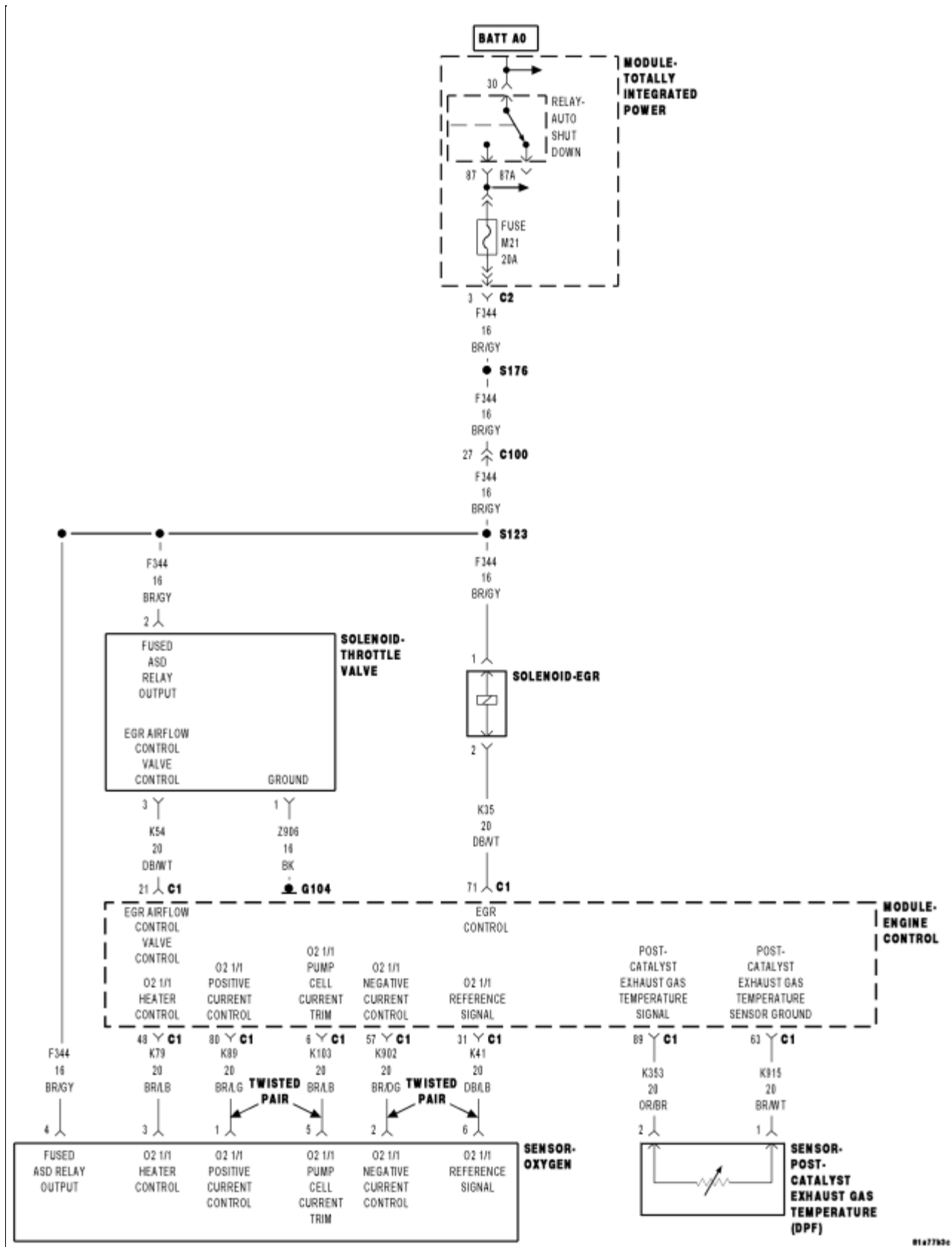
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2628-O2 SENSOR 1/1 PUMP CELL CURRENT TRIM CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM detects a short to voltage on the (K103) O2 1/1 Pump Cell Current Trim circuit for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO VOLTAGE
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO THE (K79) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K103) O2 1/1 Pump Cell Current Trim circuit in the Oxygen Sensor harness connector.

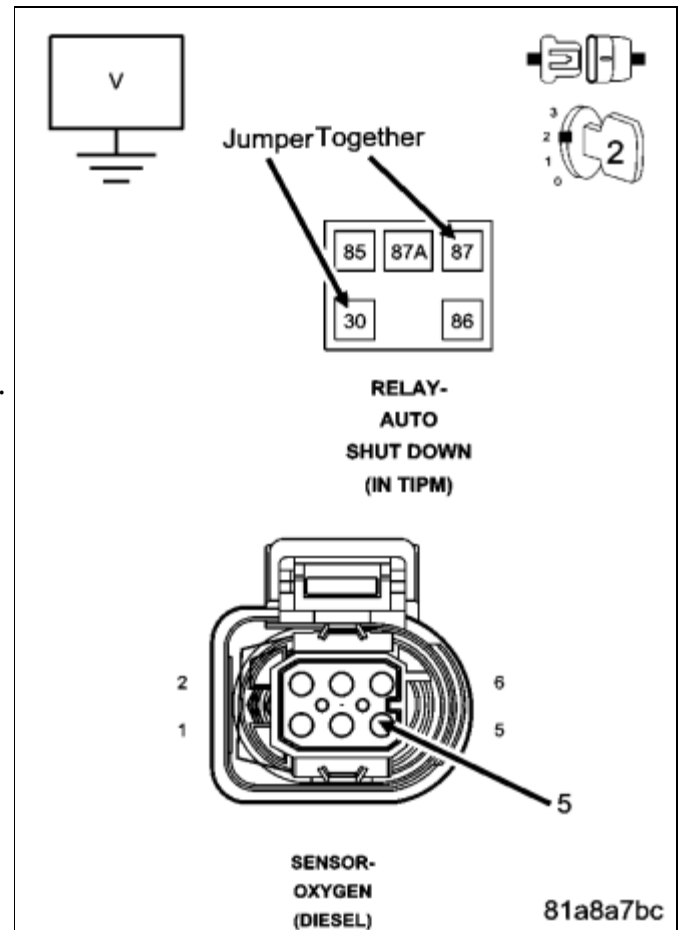
Is there any voltage present?

Yes

- Repair the (K103) O2 1/1 Pump Cell Current Trim circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT SHORTED TO THE (K79) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance between the (K103) O2 1/1 Pump Cell Current Trim circuit and the (K79) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

Is the resistance above 1000 ohms?

Yes

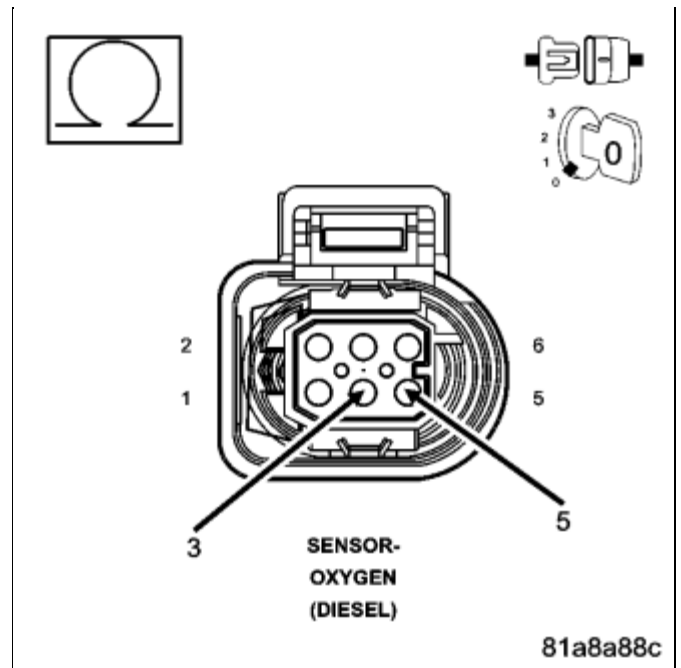
- Go to [4](#)

No

- Repair the (K103) O2 1/1 Pump Cell Current Trim

circuit for a short to the (K79) Fused ASD Relay Output 2 circuit.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K103) O2 1/1 PUMP CELL CURRENT TRIM CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K103) O2 1/1 Pump Cell Current Trim circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

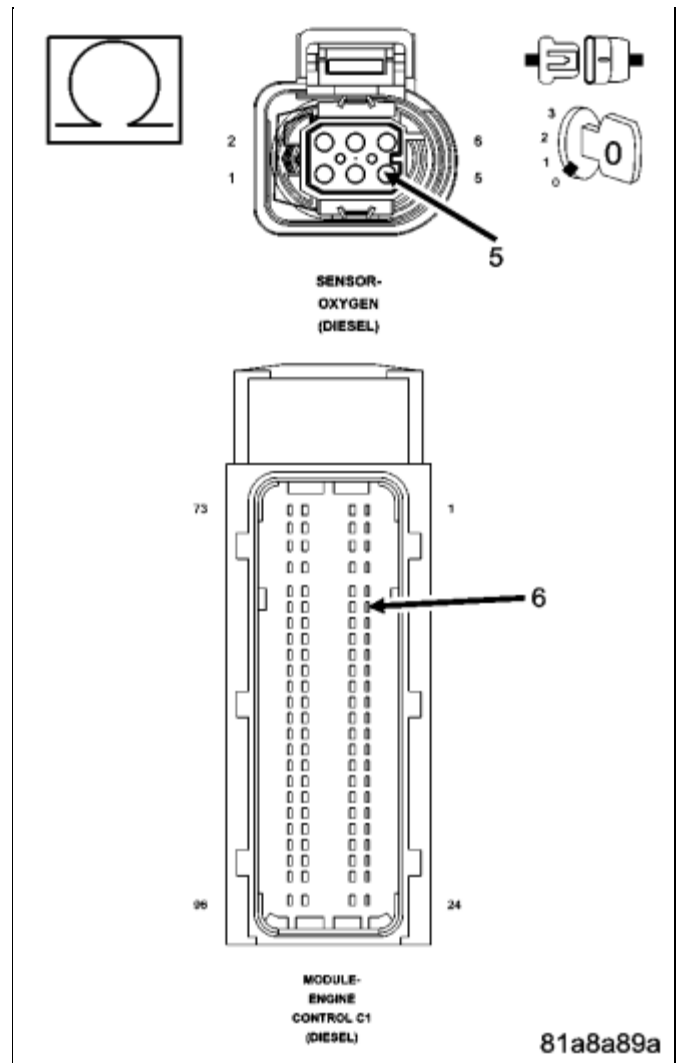
Is the resistance below 10.0 ohms?

Yes

- Go to [5](#)

No

- Repair the (K103) O2 1/1 Pump Cell Current Trim circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

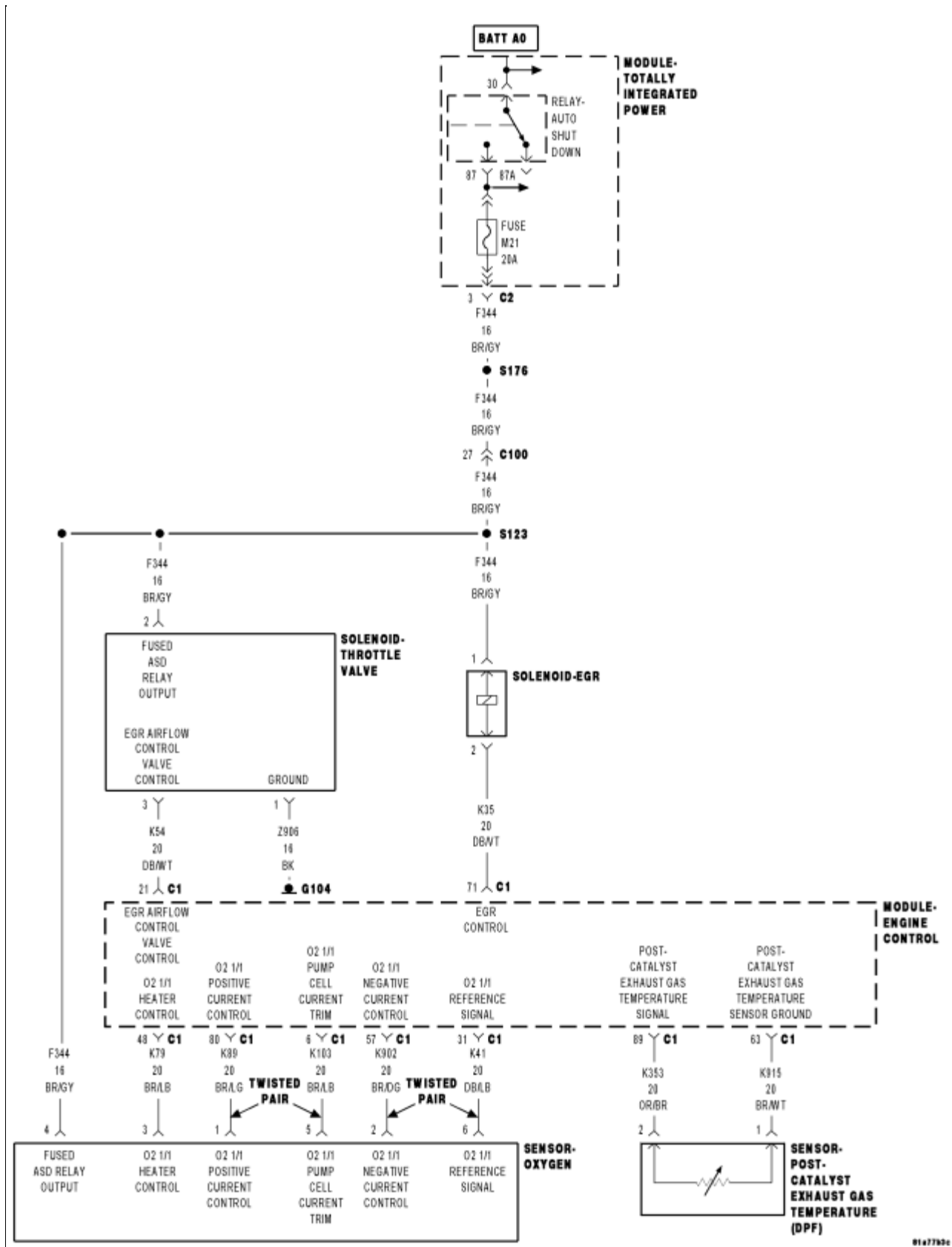
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2A00-O2 SENSOR 1/1 CIRCUIT PERFORMANCE



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on.

◦ **Set Condition:**

The ECM detects an open or implausible voltage on the (K902) O2 1/1 Negative Current Control for 2.0 seconds.

Possible Causes
INTERMITTENT DTC
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT
(K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE
OXYGEN SENSOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
 Disconnect the Oxygen Sensor harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Remove the ASD Relay from the TIPM.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

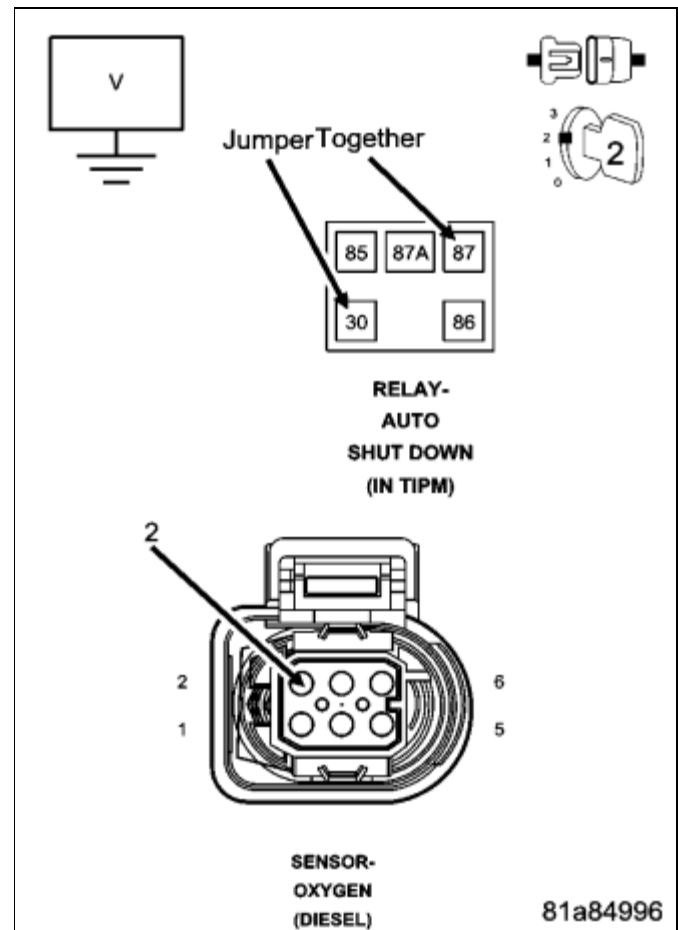
Is there any voltage present?

Yes

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [3](#)



3. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Remove the jumper wire and install the ASD Relay.
 Measure the resistance between ground and the (K902) O2 1/1 Negative Current Control circuit in the Oxygen Sensor harness connector.

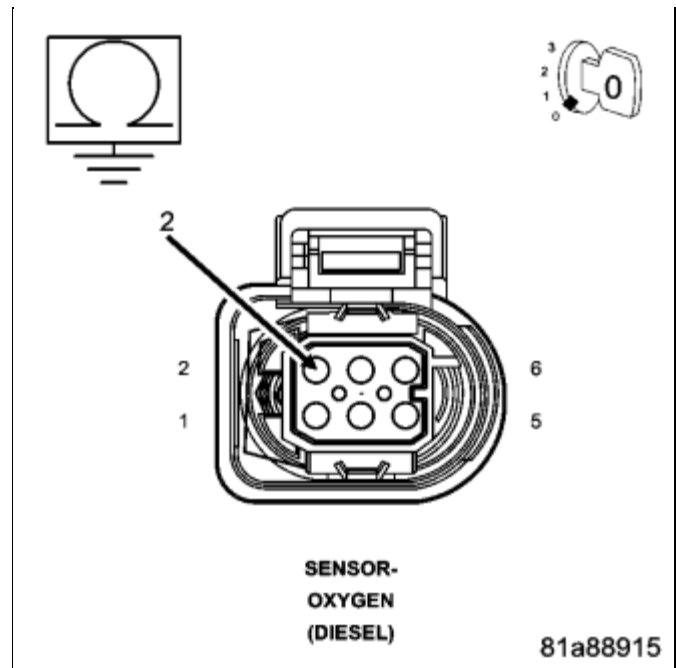
Is the resistance above 1000 ohms?

Yes

- Go to [4](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (F344) FUSED ASD RELAY OUTPUT 2 CIRCUIT

Measure the resistance between the (K902) O2 1/1 Negative Current Control circuit and the (F344) Fused ASD Relay Output 2 circuit in the Oxygen Sensor harness connector.

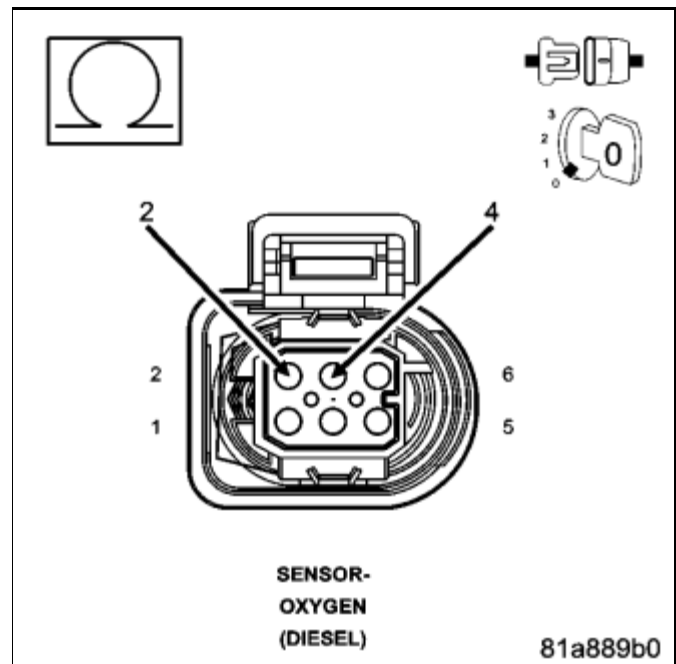
Is the resistance above 1000 ohms?

Yes

- Go to [5](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (F344) Fused ASD Relay Output 2 circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT SHORTED TO THE (K79) O2 1/1 HEATER CONTROL CIRCUIT

Measure the resistance between the (K902) O2 1/1 Negative

Current Control circuit and the (K79) O2 1/1 Heater Control circuit in the Oxygen Sensor harness connector.

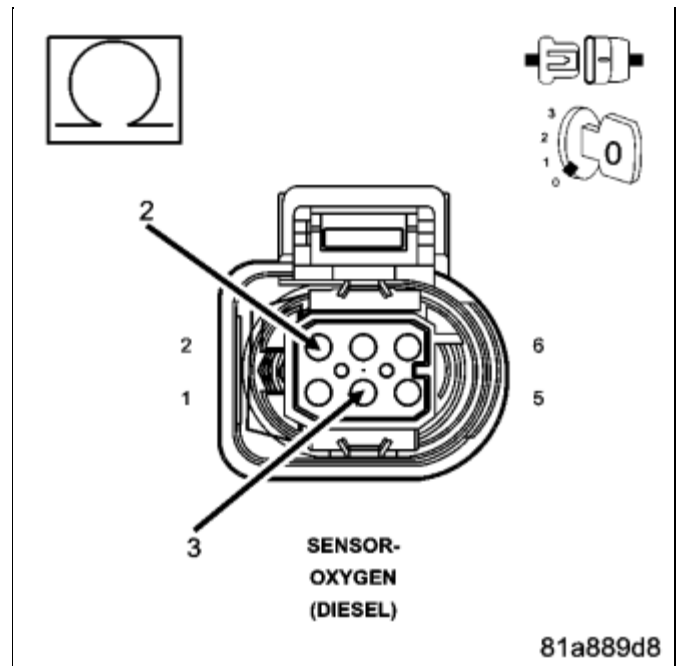
Is the resistance above 1000 ohms?

Yes

- Go to [6](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for a short to the (K79) O2 1/1 Heater Control circuit.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K902) O2 1/1 NEGATIVE CURRENT CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K902) O2 1/1 Negative Current Control circuit between the Oxygen Sensor harness connector and the Engine Control Module (ECM) harness connector.

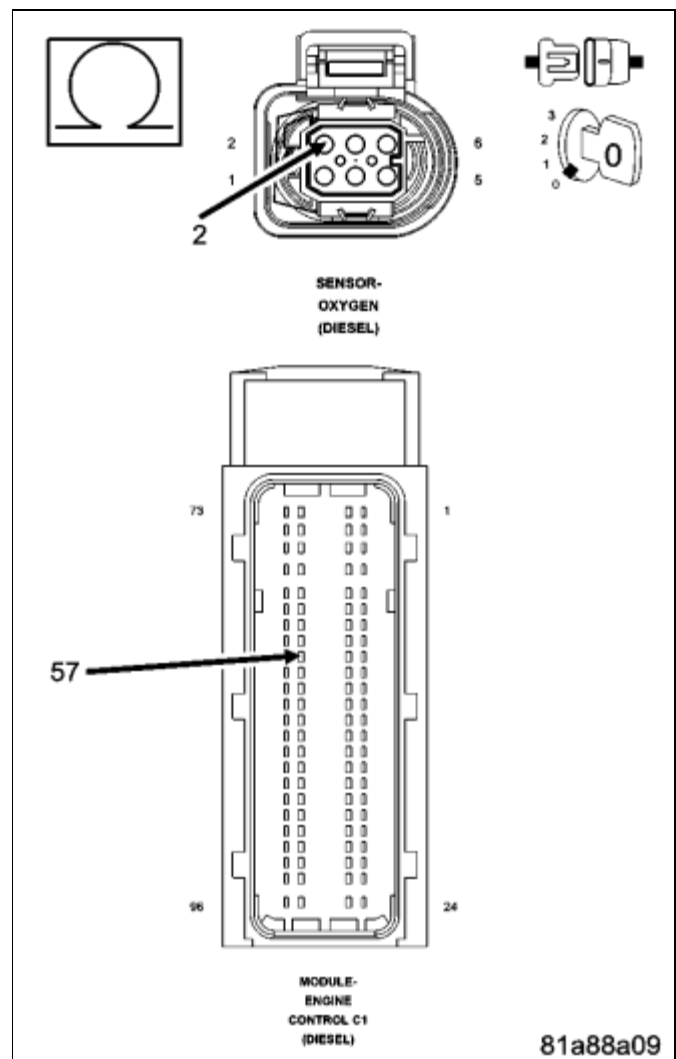
Is the resistance below 10.0 ohms?

Yes

- Go to [7](#)

No

- Repair the (K902) O2 1/1 Negative Current Control circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. OXYGEN SENSOR

Turn the ignition off.

Connect the Engine Control Module (ECM) harness connector.

Replace the Oxygen Sensor in accordance with the Service Information.

Start the engine.

Allow the engine to reach normal operating temperature.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go to [8](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Oxygen Sensor and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

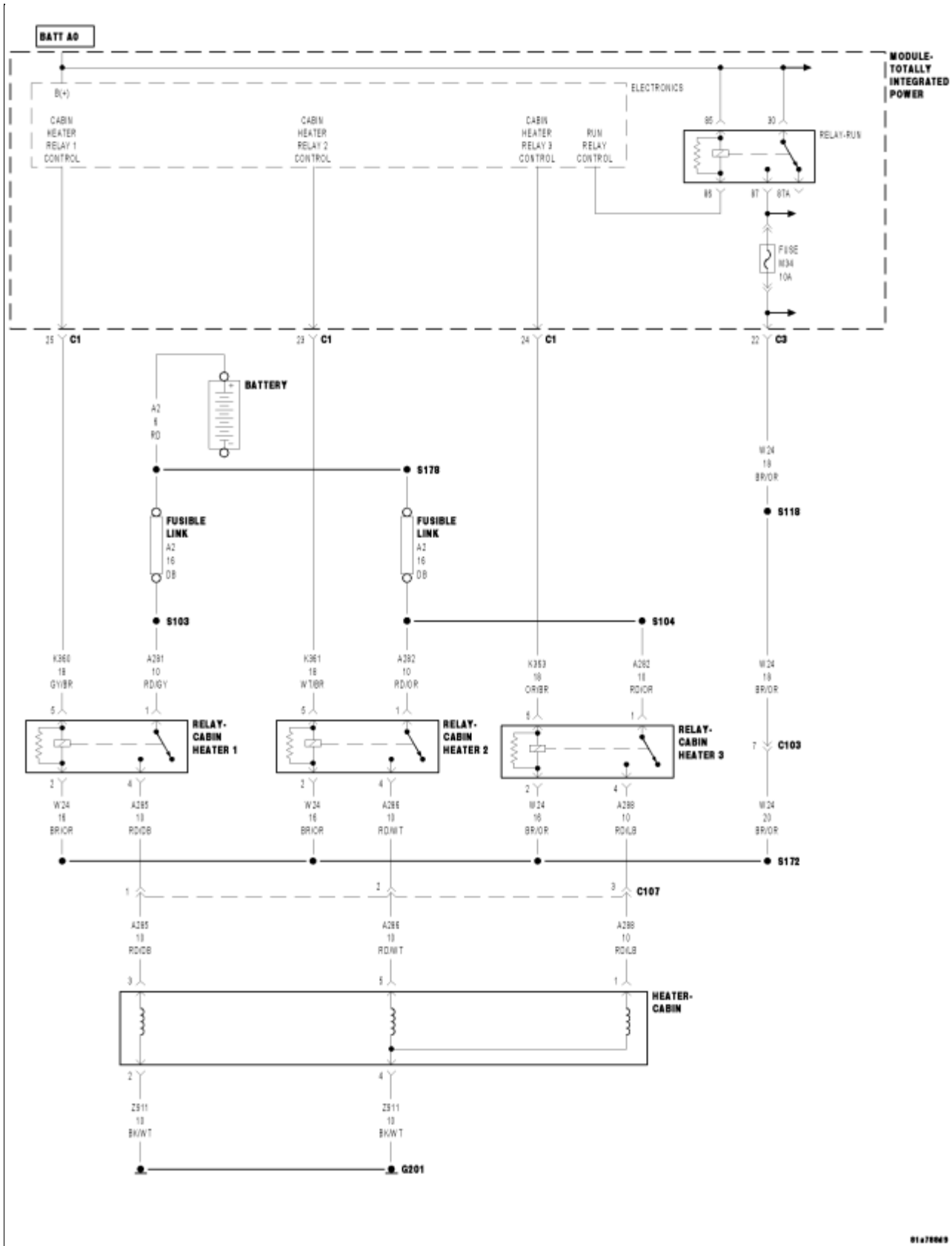
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

B10B3 - CABIN HEATER 1 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

A Cabin Heater (PTC) #1 error message has been received over the CAN bus from the Totally Integrated Power Module (TIPM).

Possible Causes
INTERMITTENT DTC
DTC SET IN TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC will set if the Engine Control Module (ECM) receives a message from the Totally Integrated Power Module indicating that a PTC Heater Relay DTC is present.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the PTC Heater Relay 1.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ENGINE CONTROL MODULE (ECM)

With the scan tool, select View DTCs in the Totally Integrated Power Module.

Is there a stored or active PTC Heater Relay DTC present in the Totally Integrated Power Module?

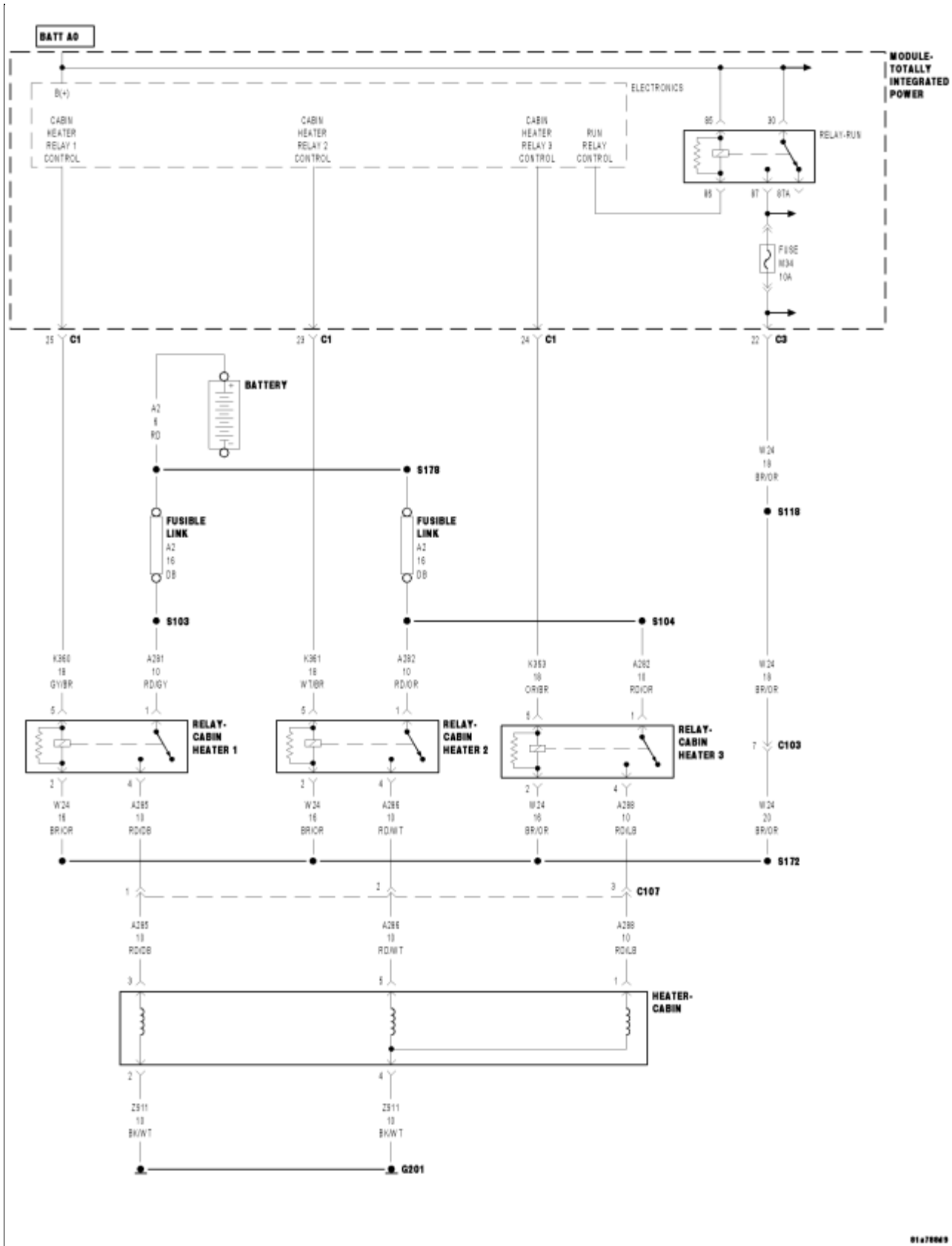
Yes

- Refer to 24 - HVAC — ELECTRICAL DIAGNOSTICS for diagnostic procedures and for further possible causes.

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

B10B7 - CABIN HEATER 2 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

A Cabin Heater (PTC) #2 error message has been received over the CAN bus from the Totally Integrated Power Module (TIPM).

Possible Causes
INTERMITTENT DTC
DTC SET IN TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC will set if the Engine Control Module (ECM) receives a message from the Totally Integrated Power Module indicating that a PTC Heater Relay DTC is present.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the PTC Heater Relay 2.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ENGINE CONTROL MODULE (ECM)

With the scan tool, select View DTCs in the Totally Integrated Power Module.

Is there a stored or active PTC Heater Relay DTC present in the Totally Integrated Power Module?

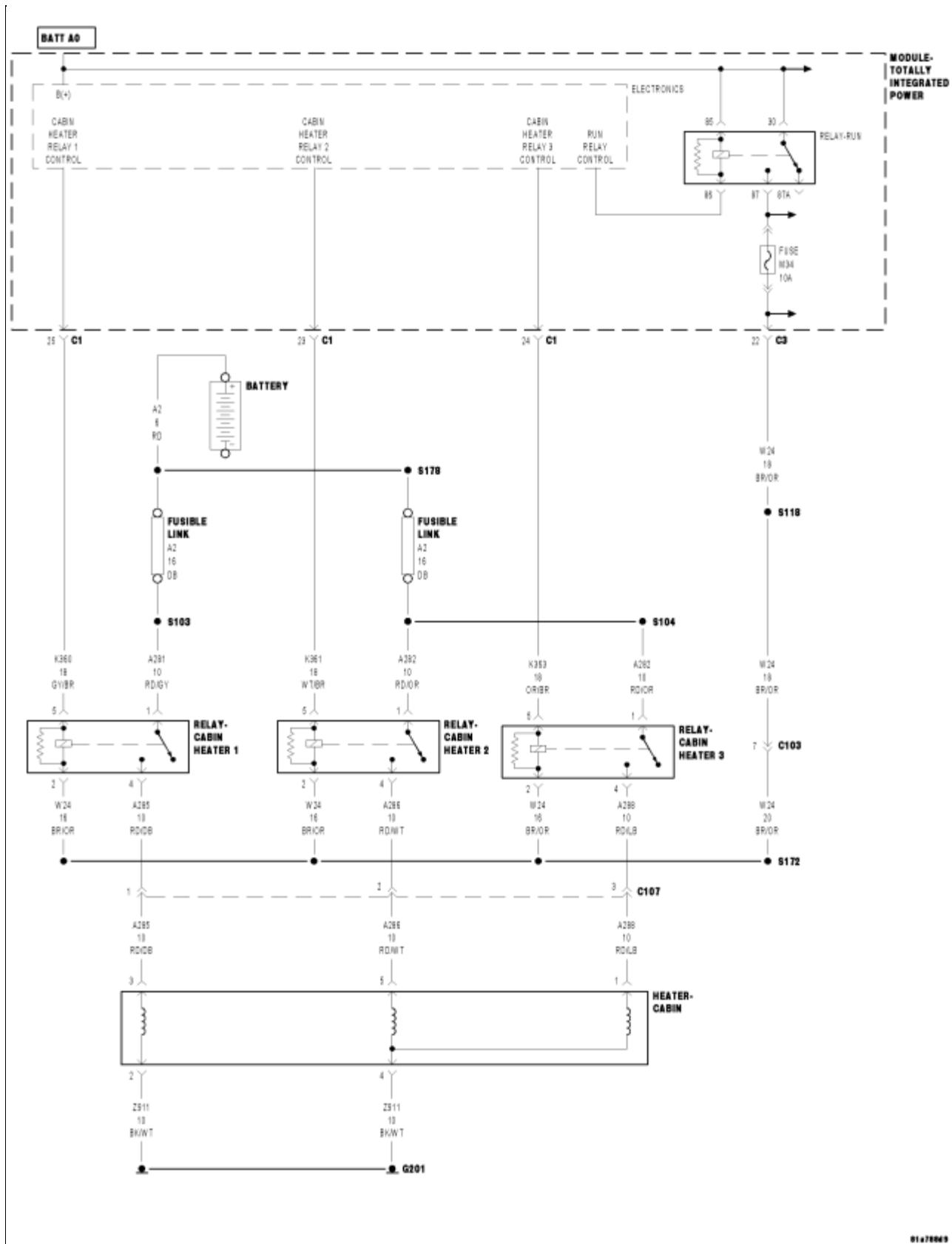
Yes

- Refer to 24 - HVAC — ELECTRICAL DIAGNOSTICS for diagnostic procedures and for further possible causes.

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

B1137 - CABIN HEATER 3 CONTROL CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

A Cabin Heater (PTC) #3 error message has been received over the CAN bus from the Totally Integrated Power Module.

Possible Causes
INTERMITTENT DTC
DTC SET IN TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

NOTE: This DTC will set if the Engine Control Module (ECM) receives a message from the Totally Integrated Power Module indicating that a PTC Heater Relay DTC is present.

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the PTC Heater Relay 3.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. ENGINE CONTROL MODULE (ECM)

With the scan tool, select View DTCs in the Totally Integrated Power Module.

Is there a stored or active PTC Heater Relay DTC present in the Totally Integrated Power Module?

Yes

- Refer to 24 - HVAC — ELECTRICAL DIAGNOSTICS for diagnostic procedures and for further possible causes.

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

B1C32- AIRBAG DEPLOYMENT DETECTED

◦ When Monitored:

With the ignition on.

◦ Set Condition:

The ACM sends a CAN Bus message to the ECM indicating that the airbags have been deployed.

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding.

Diagnostic Test

1. DTC EXPLANATION

NOTE: This DTC indicates that the vehicle has been in an accident and the airbag module has deployed the airbags.

View Repair.

Yes

Test Complete.

U0002–CAN C BUS OFF PERFORMANCE

INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

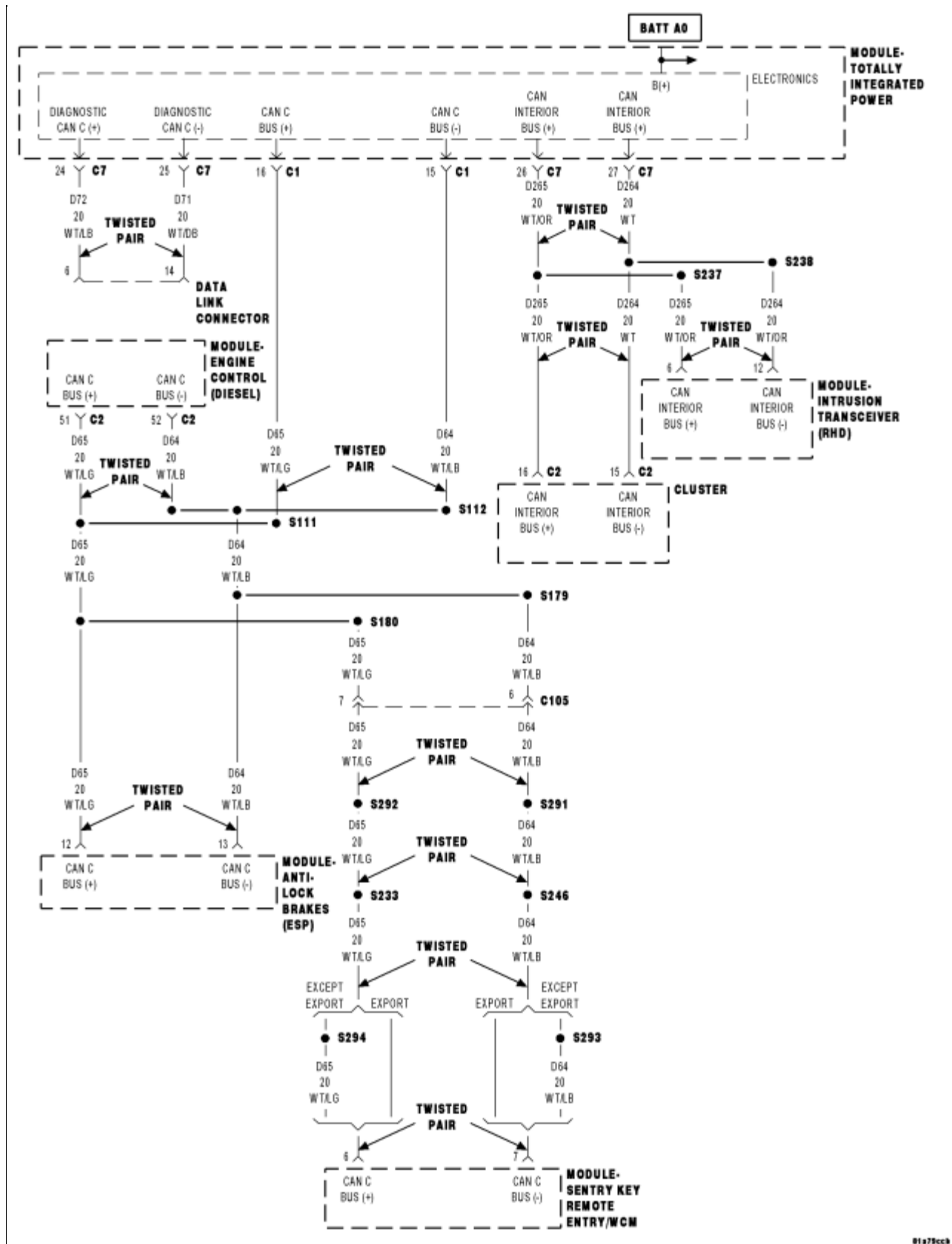
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

U0101-LOST COMMUNICATION WITH TRANSMISSION CONTROL MODULE



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

With the ignition on.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Transmission Control Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
TRANSMISSION CONTROL MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

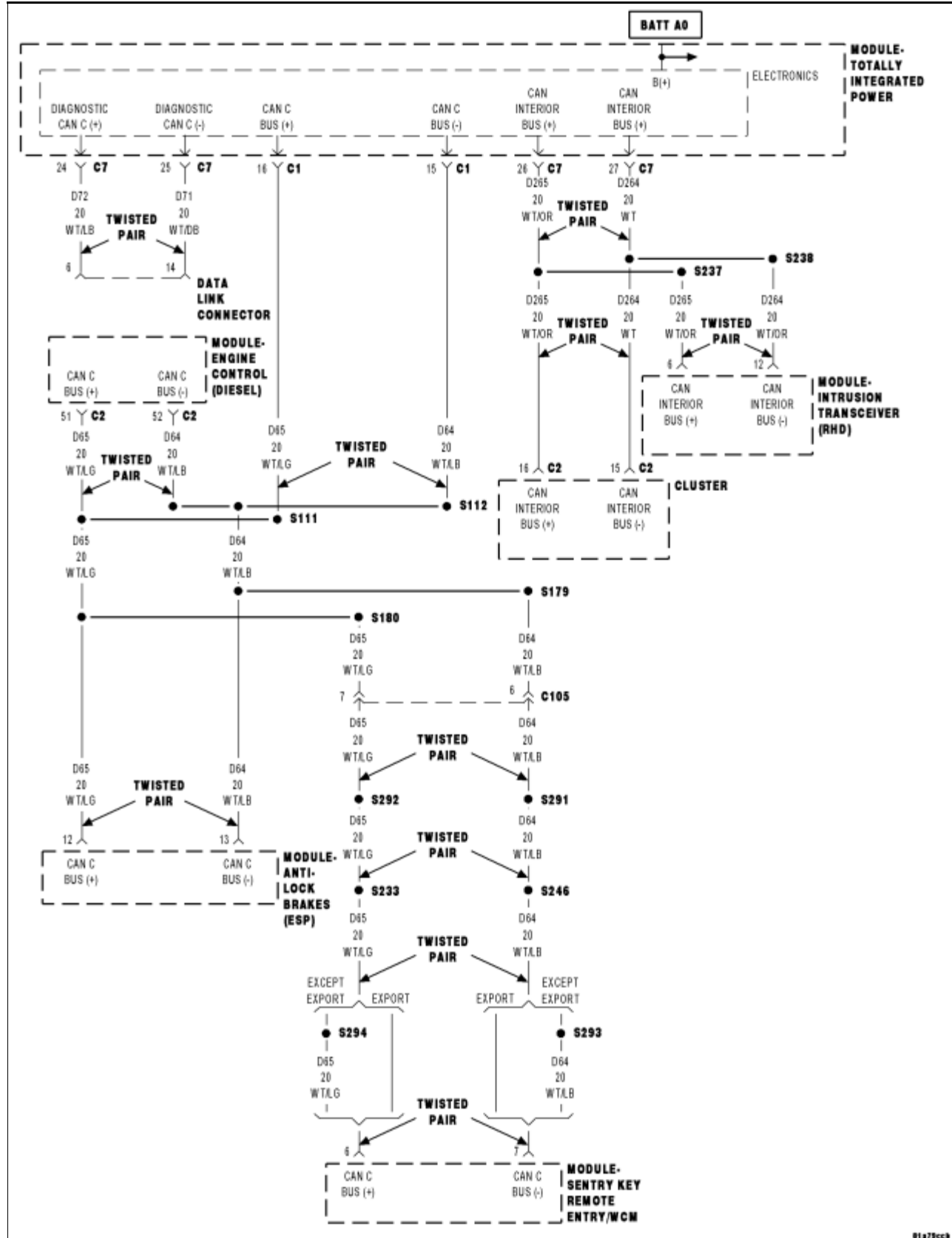
- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

U0103-LOST COMMUNICATION WITH ELECTRIC GEAR SHIFT

MODULE



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Electric Gear Shift Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
ELECTRIC GEAR SHIFT MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

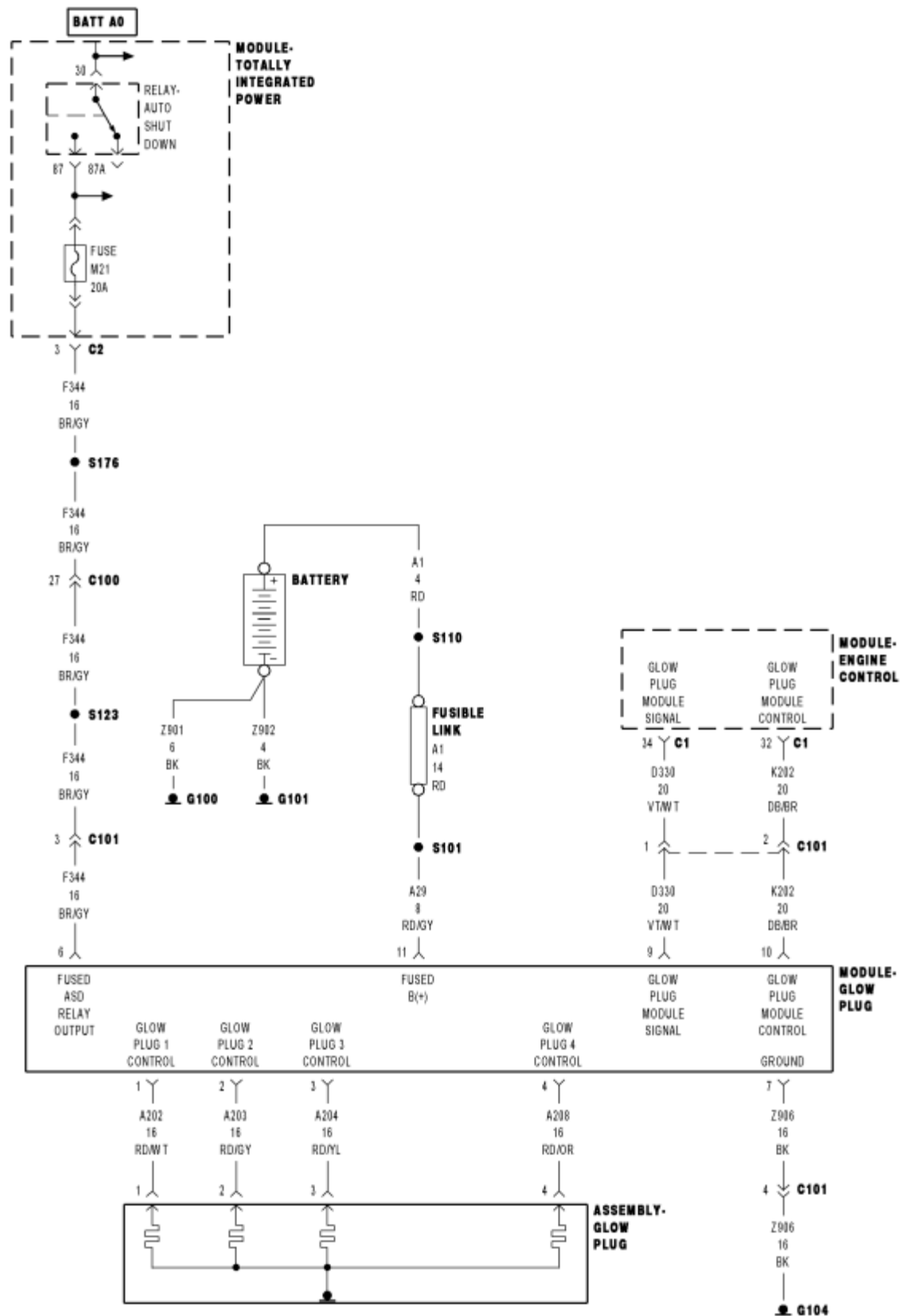
- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

U0106-LOST COMMUNICATION WITH GLOW PLUG CONTROL MODULE



81a70293

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM isn't receiving a LIN bus message from the Glow Plug Control Module.

Possible Causes
INTERMITTENT DTC
(D509) LIN BUS CIRCUIT OPEN OR HIGH RESISTANCE
GLOW PLUG CONTROL MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.

With a scan tool, View DTCs.

Record all DTC information.

NOTE: If DTC U1008 LIN 1 BUS is active in addition to this DTC, perform the diagnostic procedure for that DTC before continuing with this test.

NOTE: If DTC U1132 GENERATOR COMMUNICATION is active or stored in addition to this DTC, proceed with this diagnostic procedure.

With a scan tool, Clear DTCs.

Start the engine and allow it to reach normal operating temperature.

Monitor the scan tool for at least 2 minutes.

With a scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. U1132 GENERATOR COMMUNICATION DTC IS PRESENT

With a scan tool, View DTCs.

Is DTC U1132 GENERATOR COMMUNICATION Active in addition to this DTC?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. (D509) LIN BUS CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Generator harness connector.

Disconnect the Glow Plug Module harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (D509) LIN Bus circuit between the Generator harness connector and the Engine Control Module (ECM) harness connector.

Measure the resistance of the (D509) LIN Bus circuit between the Glow Plug Module harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10 ohms for both measurements?

Yes

- Go To [6](#)

No

- Repair the (D509) LIN Bus for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (D509) LIN BUS CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Glow Plug Module harness connector.

Disconnect the Engine Control Module (ECM) harness connector.

Measure the resistance of the (D509) LIN Bus circuit between the Generator harness connector and the Engine Control Module (ECM) harness connector.

Is the resistance below 10 ohms?

Yes

- Go To [5](#)

No

- Repair the (D509) LIN Bus for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. GLOW PLUG CONTROL MODULE

Ignition off, engine not running.

Connect the Engine Control Module (ECM) harness connector.

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With a scan tool, Clear DTCs.

Start the engine and allow it to reach normal operating temperature.

Monitor the scan tool for at least 2 minutes.

With a scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go to [6](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Generator and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?

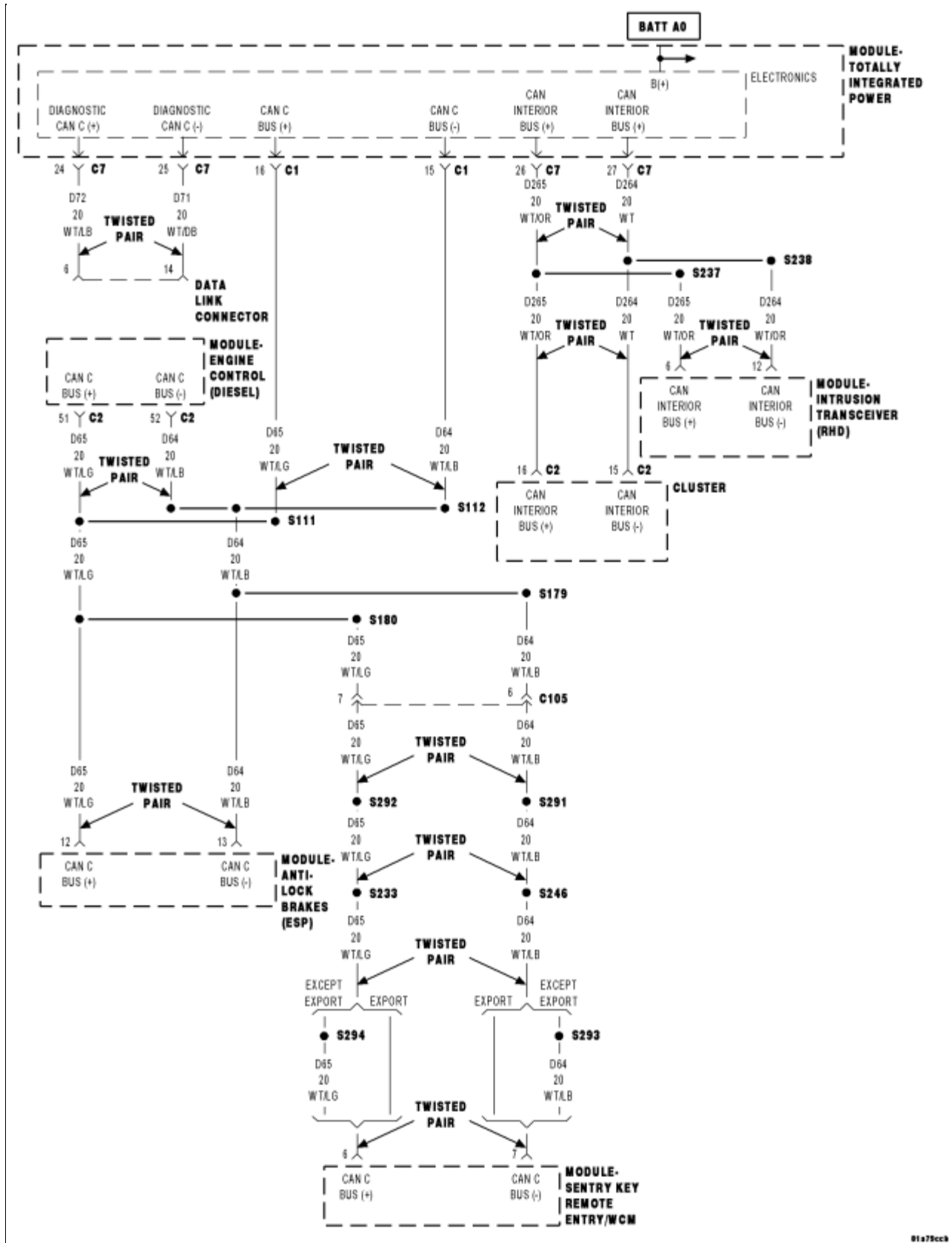
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE



01a79cc9

For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Anti-lock Brake Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
ANTI-LOCK BRAKE MODULE
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

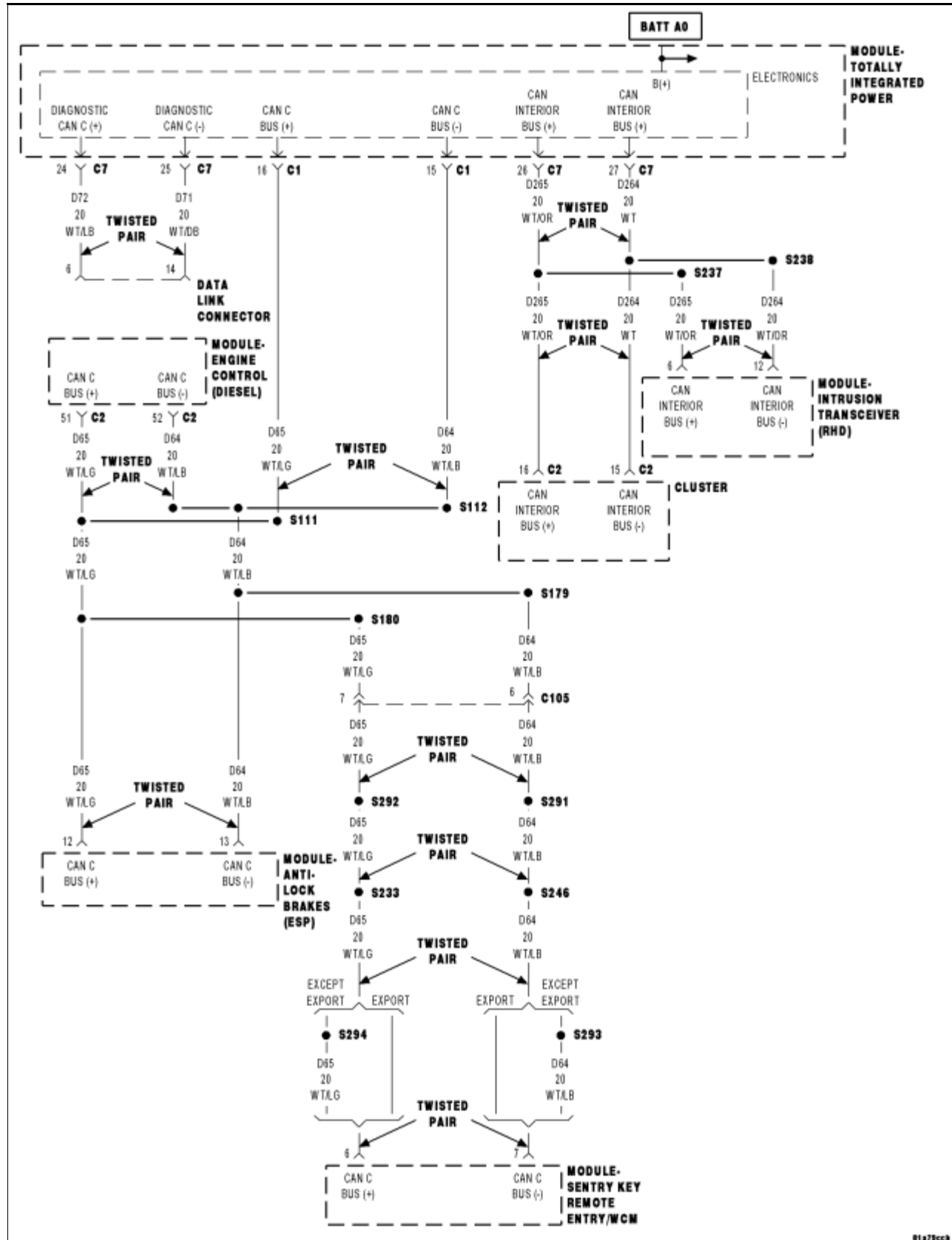
- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

U0141-LOST COMMUNICATION WITH TOTALLY

INTEGRATED POWER MODULE



81a78cck

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Totally Integrated Power Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

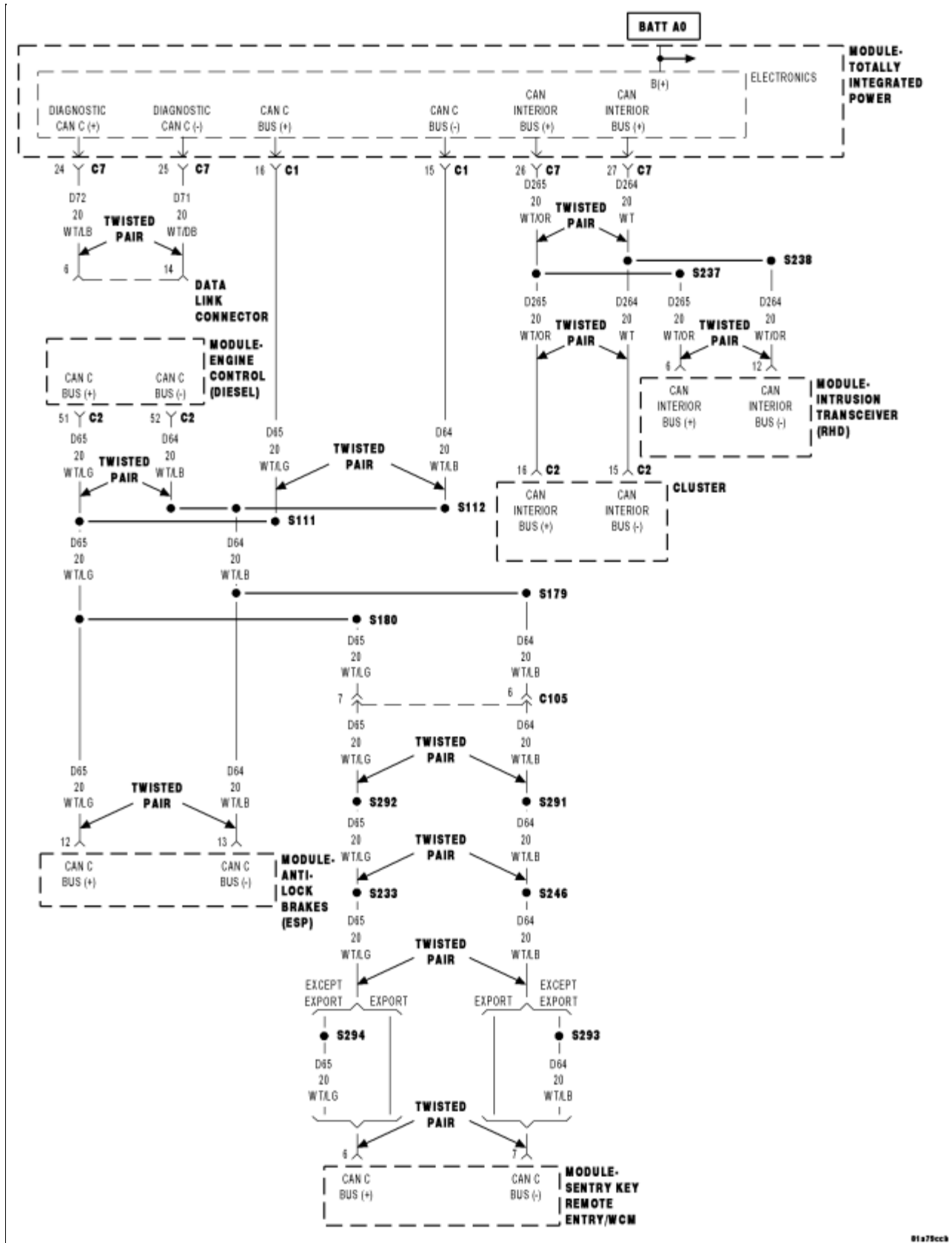
- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

U0168-LOST COMMUNICATION WITH VEHICLE SECURITY MODULE (SKREEM/WCM)



For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the SKREEM/WCM.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
TOTALLY INTEGRATED POWER MODULE (TIPM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

U0402-IMPLAUSIBLE DATA RECEIVED FROM TCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An error message has been received over the bus from the Transmission Control Module (TCM).

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
TRANSMISSION CONTROL MODULE (TCM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. TCM COMMUNICATION RELATED DTC'S IN OTHER MODULES

With a scan tool check for TCM communication related DTCs in other modules on the CAN Bus.

Are there any TCM communication related DTCs in other modules on the CAN Bus at this time?

Yes

- Replace and program the Transmission Control Module (TCM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0407-IMPLAUSIBLE DATA RECEIVED FROM GLOW PLUG CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An error message has been received over the bus from the Glow Plug Control Module (GPCM).

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
GLOW PLUG CONTROL MODULE (GPCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Replace and program the Glow Plug Control Module (GPCM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0415-IMPLAUSIBLE DATA RECEIVED FROM ABS

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An error message has been received over the bus from the Anti-lock Brake Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
ANTI-LOCK BRAKE MODULE (CAB)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. ABS COMMUNICATION RELATED DTC'S IN OTHER MODULES

With a scan tool check for ABS communication related DTCs in other modules on the CAN Bus.

Are there any ABS communication related DTCs in other modules on the CAN Bus at this time?

Yes

- Replace and program the Anti-Lock Brake Control Module (CAB) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0429-IMPLAUSIBLE DATA RECEIVED FROM SCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An error message has been received over the bus from the Steering Control Module (SCM).

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
STEERING CONTROL MODULE (SCM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. SCM COMMUNICATION RELATED DTC'S IN OTHER MODULES

With a scan tool check for SCM communication related DTCs in other modules on the CAN Bus.

Are there any SCM communication related DTCs in other modules on the CAN Bus at this time?

Yes

- Replace and program the Steering Control Module (SCM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0452-INVALID DATA RECEIVED RESTRAINTS CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An error message has been received over the bus from the Airbag Control Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
AIRBAG CONTROL MODULE (ACM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. ACM COMMUNICATION RELATED DTC'S IN OTHER MODULES

With a scan tool check for ACM communication related DTCs in other modules on the CAN Bus.

Are there any ACM communication related DTCs in other modules on the CAN Bus at this time?

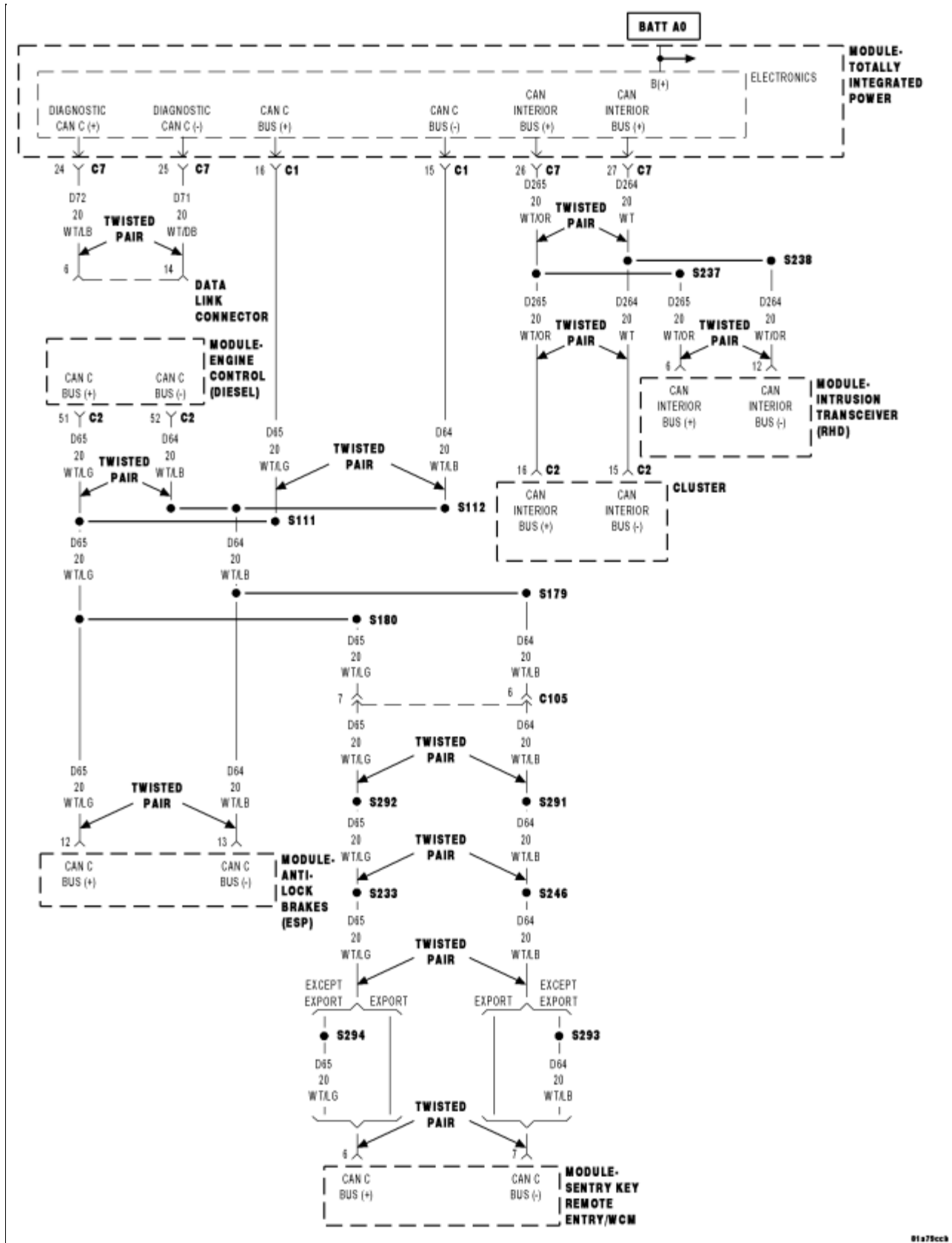
Yes

- Replace and program the Airbag Control Module (ACM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1004-CAN C BUS TRANSMIT PERFORMANCE



01a79cc9

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the system is active and there are no ECM system voltage DTCs present.

- **Set Condition:**

The ECM is reporting an error condition when attempting to transmit a CAN bus message.

Possible Causes
INTERMITTENT DTC
CAN BUS ERROR CONDITION
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. COMMUNICATION DTCS PRESENT

With a scan tool check for any other communication DTCs present in other modules on the CAN C bus.

Are there any CAN C bus DTCs active at this time?

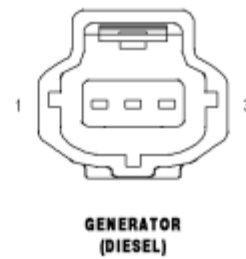
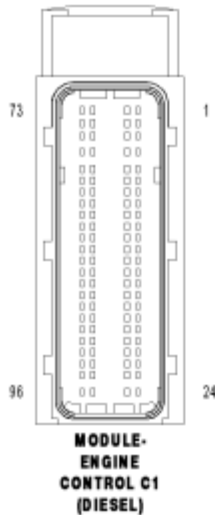
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for additional vehicle communication diagnostic procedures.

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1008-LIN 1 BUS



01aa210a

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM is receiving a LIN bus error message.

Possible Causes
INTERMITTENT DTC
(D509) LIN BUS CIRCUIT SHORTED TO GROUND
(D509) LIN BUS CIRCUIT SHORTED TO VOLTAGE
GENERATOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.

With a scan tool, View DTCs.

Record all DTC information.

With a scan tool, Clear DTCs.

Start the engine and allow it to reach normal operating temperature.

Monitor the scan tool for at least 2 minutes.

With a scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

GENERATOR

2.

Turn the ignition off.
 Disconnect the Generator harness connector.
 Turn the ignition on.
 With a scan tool, Clear DTCs.
 With a scan tool, View DTCs.
 Monitor the scan tool for at least 2 minutes.

NOTE: If the Generator LIN bus circuit is shorted internally, the LIN Bus DTC will not set with the Generator disconnected. If the LIN bus is shorted to voltage or ground, this DTC will remain Active.

Is the status Active for this DTC?

Yes

- Go To [3](#)

No

- Replace the Generator in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (D509) LIN BUS CIRCUIT SHORTED TO GROUND

Turn the ignition off.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance between ground and the (D509) LIN Bus circuit in the Generator harness connector.

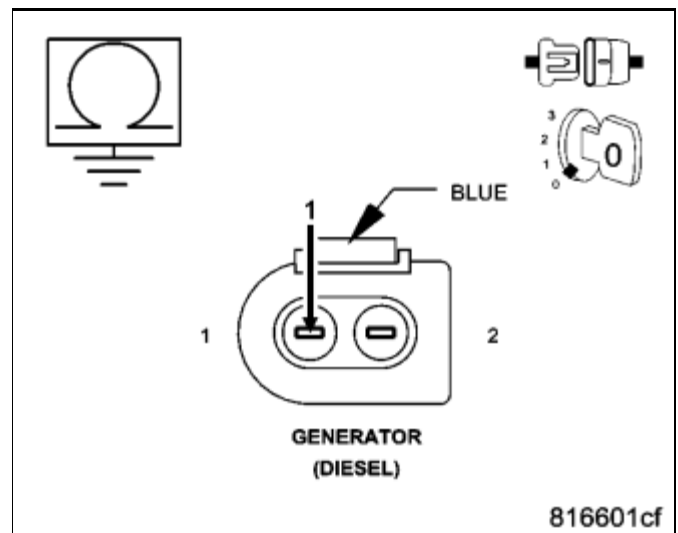
Is the resistance above 1000 ohms?

Yes

- Go To [4](#)

No

- Repair the (D509) LIN Bus for a short to ground.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



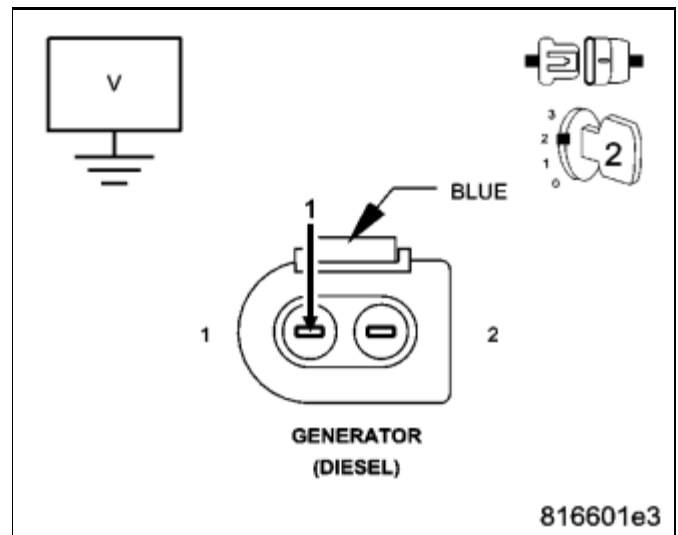
4. (D509) LIN BUS CIRCUIT SHORTED TO VOLTAGE

Remove the ASD Relay.
 Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.
 Turn the ignition on.
 Measure the voltage of the (D509) LIN Bus circuit in the Generator harness connector.

Is there any voltage present?

Yes

- Repair the (D509) LIN Bus circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



No

- Go To [5](#)

5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plug Module and the Engine Control Module (ECM).
 Look for any chafed, pierced, pinched, or partially broken wires.
 Look for broken, bent, pushed out or corroded terminals.
 Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.
 Look for the data to change or for the DTC to reset during the wiggle test.
 Refer to any Technical Service Bulletins that may apply.

Were any problems found?

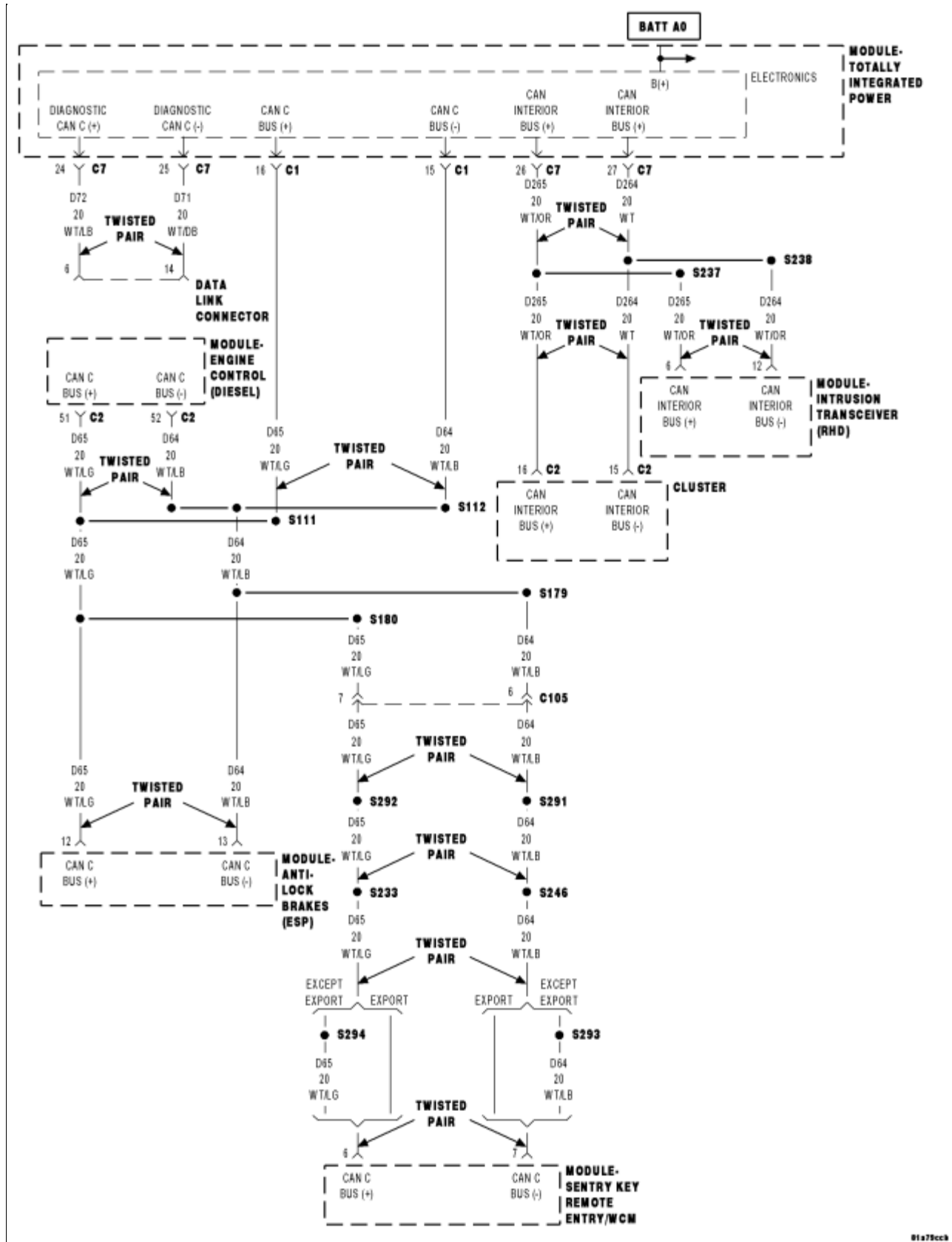
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U110A-LOST COMMUNICATION WITH SCM - CAN-C



01a79cc9

For a complete wiring diagram Refer to Section 8W

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Steering Control Module (SCM).

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
STEERING CONTROL MODULE (SCM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

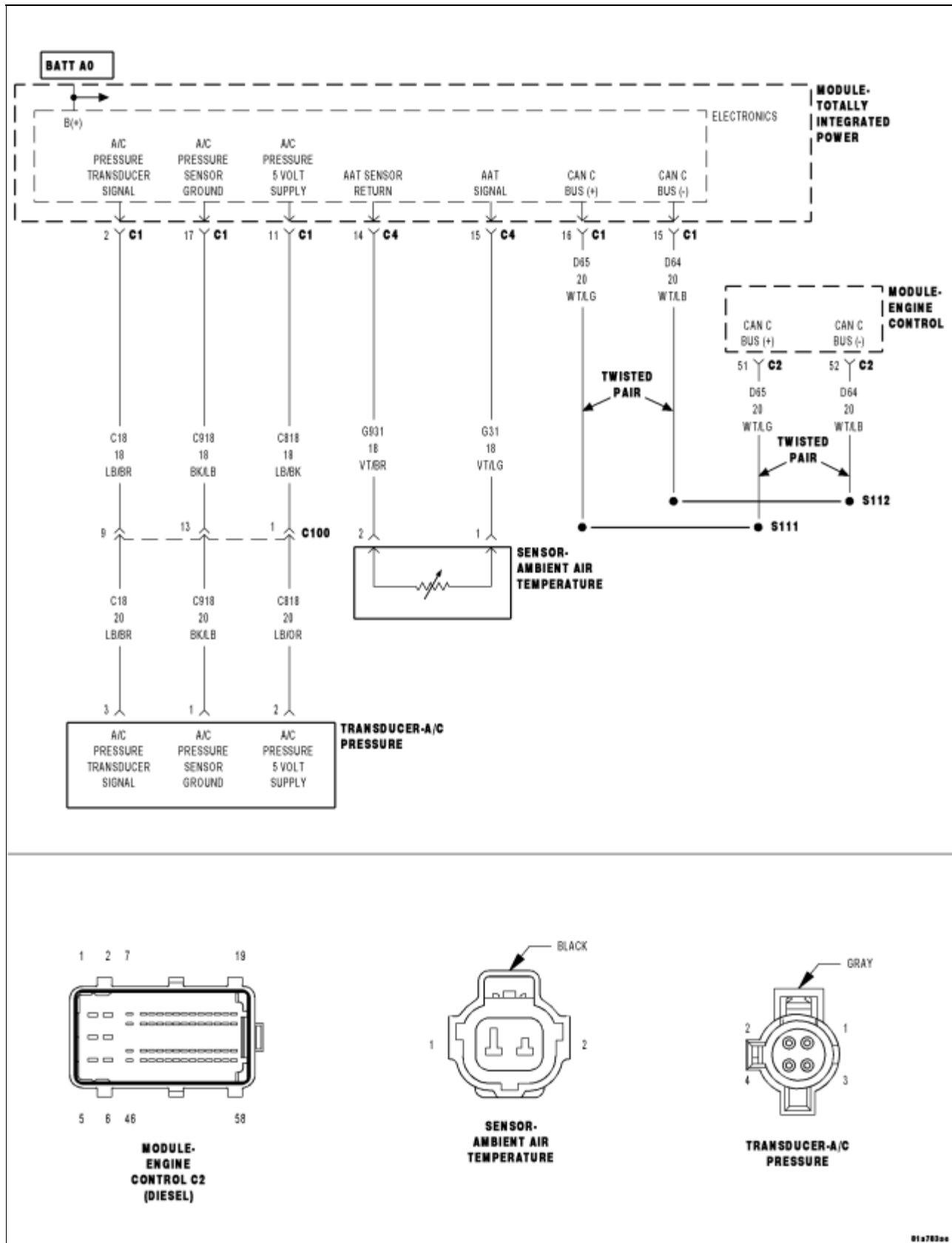
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

U110E-LOST AMBIENT TEMPERATURE MESSAGE



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM doesn't receive a Bus Message from the Front Control Module.

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
FRONT CONTROL MODULE (FCM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

Monitor the scan tool for at least two minutes.

Cycle the ignition key off and on several times, leaving the ignition on for at least 10 seconds at a time.

Start the engine.

Allow the engine to reach normal operating temperature.

With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

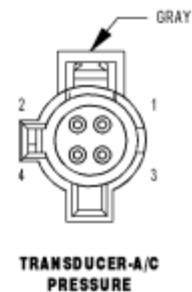
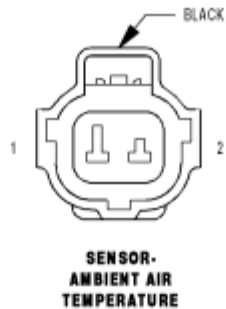
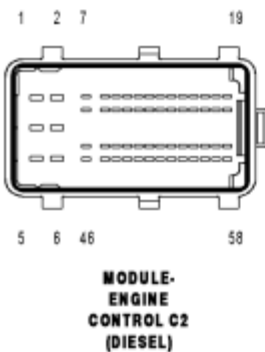
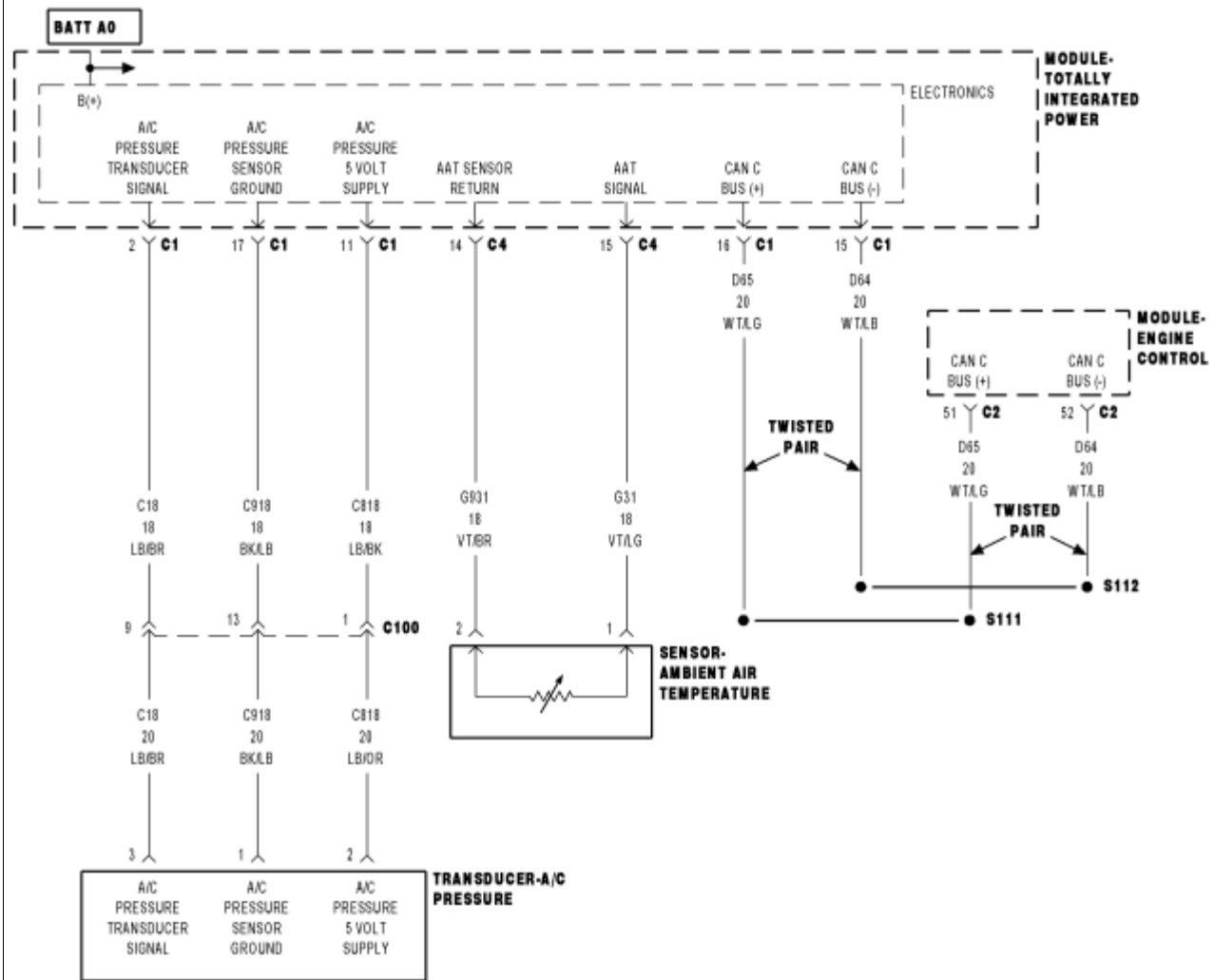
- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes related to FCM/TIPM Communication Errors. If there are no other communication errors present, replace and program the ECM in accordance with the Service Information.

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE

- DIAGNOSIS AND TESTING)

U1113-LOST AC PRESSURE MESSAGE



01a783a

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

An invalid message has been received over the bus from the Front Control Module (FCM).

Possible Causes
INTERMITTENT DTC
CAN BUS OPEN OR SHORTED CONDITION
FRONT CONTROL MODULE (FCM)
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose all CAN B and C communication DTCs before continuing.

Ignition on, engine not running.
With a scan tool, view DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. COMMUNICATION DTCS PRESENT IN THE TOTALLY INTEGRATED POWER MODULE (TIPM)

With a scan tool check for DTCs in the TIPM.

Are there any CAN bus DTCs active in the TIPM at this time?

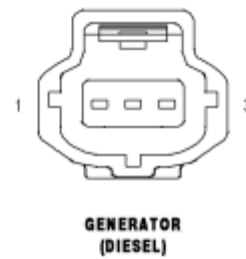
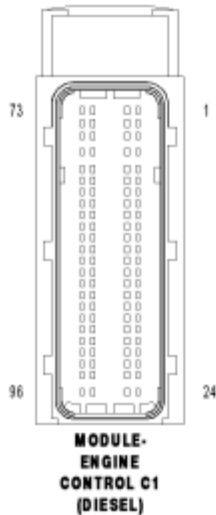
Yes

- Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for additional vehicle communication diagnostic procedures.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1132-GENERATOR COMMUNICATION



01aa210a

For a complete wiring diagram **Refer to Section 8W**

◦ **When Monitored:**

Continuously while the system is active.

- **Set Condition:**

The ECM isn't receiving a LIN bus message from the Generator.

Possible Causes
INTERMITTENT DTC
(D509) LIN BUS CIRCUIT OPEN OR HIGH RESISTANCE
GENERATOR
ENGINE CONTROL MODULE (ECM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC IS ACTIVE

Turn the ignition on.
 With a scan tool, View DTCs.
 Record all DTC information.

NOTE: If DTC U1008 LIN 1 BUS is active in addition to this DTC, perform the diagnostic procedure for that DTC before continuing with this test.

With a scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 Monitor the scan tool for at least 2 minutes.
 With a scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (D509) LIN BUS CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.
 Disconnect the Generator harness connector.
 Disconnect the Engine Control Module (ECM) harness connector.
 Measure the resistance of the (D509) LIN Bus circuit between the Generator harness connector and the Engine Control Module (ECM) harness connector.

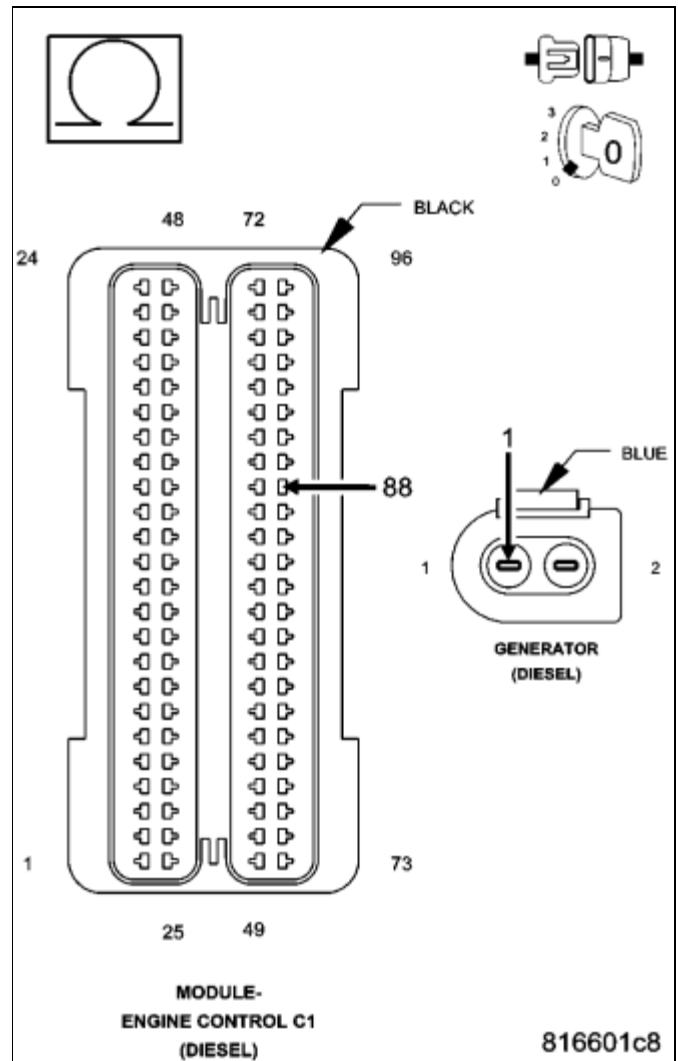
Is the resistance below 10.0 ohms for both measurements?

Yes

- Go To [3](#)

No

- Repair the (D509) LIN Bus circuit for an open circuit or high resistance.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. GENERATOR

Ignition off, engine not running.
 Connect the Engine Control Module (ECM) harness connector.
 Replace the Generator in accordance with the Service Information.
 Turn the ignition on.
 With a scan tool, Clear DTCs.
 Start the engine and allow it to reach normal operating temperature.
 Monitor the scan tool for at least 2 minutes.
 With a scan tool, View DTCs.

Is the status Active for this DTC?

Yes

- Go to [4](#)

No

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Glow Plug Module and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins that may apply.

Were any problems found?**Yes**

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace the Engine Control Module (ECM) in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U1421-IMPLAUSIBLE IGNITION KEY OFF TIME RECEIVED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

At ignition on.

- **Set Condition:**

The ECM detects a problem when comparing the current ECT Sensor input to the ECT Sensor input at the last ECM power down and the amount of time that has elapsed based on an internal timer in the TIPM.

Possible Causes
INTERMITTENT CONDITION
IGNITION SWITCH
TIPM POWERS AND GROUNDS
TOTALLY INTEGRATED POWER MODULE (TIPM)

ENGINE COOLANT TEMPERATURE SENSOR

Diagnostic Test

1. CHECK FOR ACTIVE DTC

NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.

NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

Did this DTC set again?

Yes

- Go To [2](#)

No

- Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. CHECKING FOR OTHER DTCS

With the scan tool, read other TIPM DTCs.

NOTE: Any ECM communication related DTC's in the TIPM must be diagnosed and corrected before continuing to diagnose this DTC.

Are there any ECM communication related DTC's in the TIPM?

Yes

- Refer to the Symptom List and repair communication DTC's before continuing.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECKING THE ECT SENSOR

Refer to the symptom Checking the ECT Sensor and verify proper ECT Sensor operation.

Is the ECT Sensor operating correctly?**Yes**

- Go To [4](#)

No

- Repair the (K344) ASD Relay Output circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. IGNITION SWITCH

Refer to the Wiring Information and verify proper Ignition Switch operation.

Turn the ignition key to each position and verify correct voltage output at each ignition switch harness connector cavity.

Is the Ignition Switch operating properly?**Yes**

- Go To [5](#)

No

- Repair or replace Ignition Switch, wiring or connectors as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. TIPM POWER AND GROUND CIRCUITS

Refer to the Wiring Information and verify proper battery supply, ignition switch supply and grounds at the TIPM harness connectors.

Are the TIPM power and grounds functioning properly?**Yes**

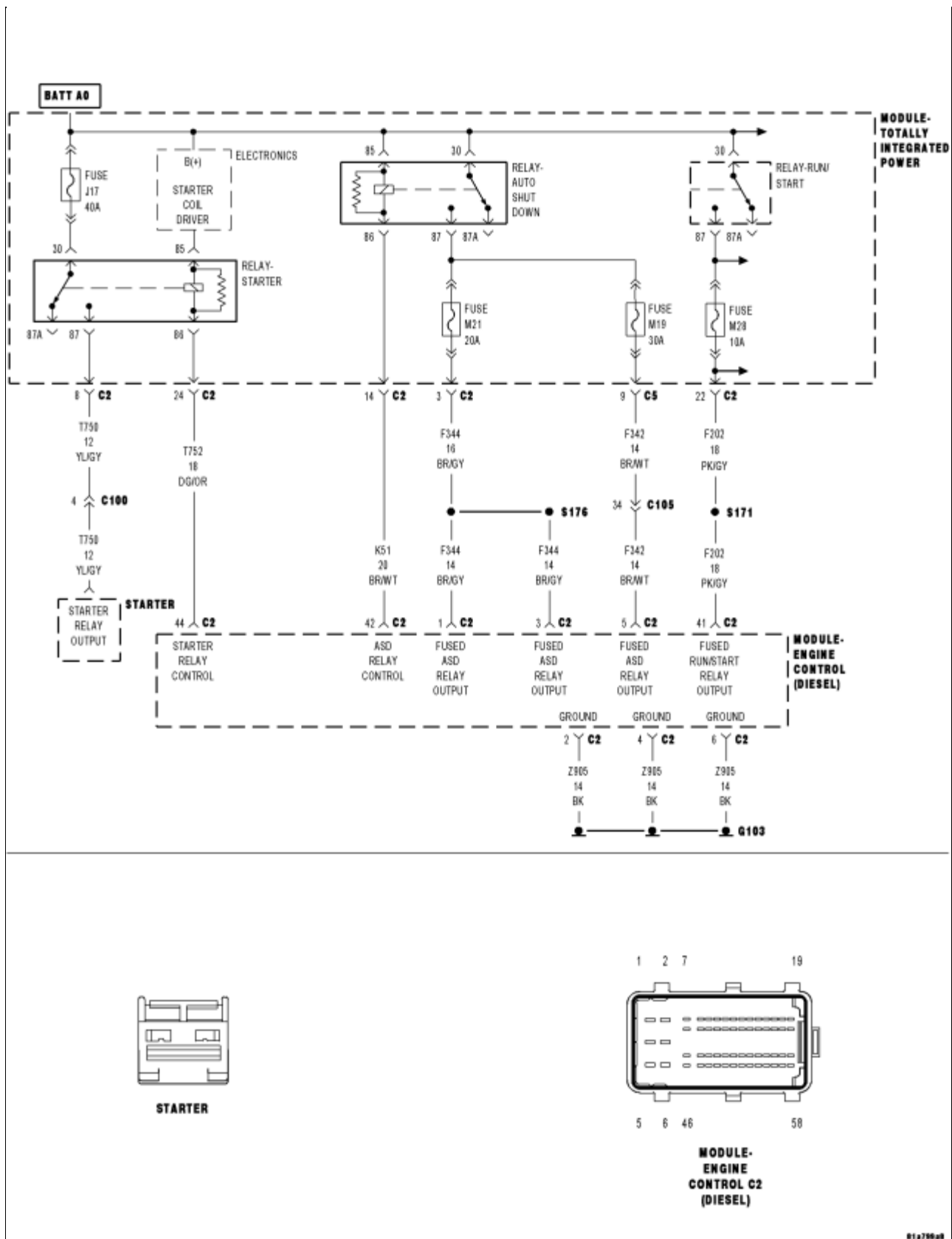
- Replace the Totally Integrated Power Module in accordance with the Service Information.

- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair power/ground circuit(s) as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***ENGINE CRANKS BUT WILL NOT START**



For a complete wiring diagram **Refer to Section 8W**

INTAKE SYSTEM RESTRICTION
ECM CODES PRESENT
ECT SENSOR
FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT SHORTED TO VOLTAGE
ENGINE CONTROL MODULE
ENGINE DRIVE BELT
FUEL PRESSURE SENSOR
FUEL SUPPLY CONTAMINATION
SUPPLY SIDE FUEL SYSTEM PRESSURE
FUEL SYSTEM RESTRICTION
GLOW PLUGS
SKREEM CODES PRESENT

Diagnostic Test

1. ECM CODES PRESENT

NOTE: The ECM must have proper power and ground connections for the following tests to be valid. Refer to Checking the ECM Power and Grounds in the symptom list.

Turn the ignition on.
With the scan tool, read the ECM DTCs.

Does the scan tool display any ECM DTCs?

Yes

- Refer to symptom list for problems related to ECM DTC.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. SKREEM CODES PRESENT

With the scan tool, read the SKREEM DTCs.

Does the scan tool display any SKREEM DTCs?

Yes

- Refer to symptom list for problems related to SKREEM DTC.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK FOR INTAKE SYSTEM RESTRICTIONS

Turn the ignition off.

Ensure vehicle has adequate fuel supply in fuel tank.

Inspect all air intake and turbocharger related hoses/tubes and connections.

Inspect the air filter for excessive dirt, soiling or other problems that may cause restricted air flow.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. ECT SENSOR

Using a temperature probe, check the vehicle temperature near the ECT Sensor.

Turn the ignition on.

With the scan tool in Sensors, read the ECT Sensor temperature.

Compare the temperature probe reading with the scan tool reading.

Are the two readings within 10°C of each other?

Yes

- Go To [5](#)

No

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. GLOW PLUGS

NOTE: Prior to performing this test, be sure to check the Glow Plug operation. Refer to CHECKING GLOW PLUG OPERATION for the related symptom(s).

Refer to the Service Information and check the Glow Plugs for proper operation.

Are the Glow Plugs operating properly?

Yes

- Go To [6](#)

No

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL SYSTEM RESTRICTION

Inspect the fuel system lines for restrictions, leaks or other problems.

NOTE: Refer to the Service Information to ensure that the fuel system is properly primed. A non-primed system or excessive air in the supply system will cause a no-start condition.

Is there any evidence of problems?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. FUEL CONTAMINATION

Inspect the fuel supply for contamination.

Is the fuel contaminated?

Yes

- Refer to the Service Information to remove and replace fuel throughout the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. SUPPLY SIDE FUEL SYSTEM PRESSURE

Refer to and perform the Checking the Low Pressure Fuel Delivery System Test in this section.

Is the fuel pressure within specification?

Yes

- Go To [9](#)

No

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. FUEL PRESSURE SENSOR

Turn the ignition on, engine off.

With the scan tool, read the Fuel Pressure Sensor volts.

Is the Fuel Pressure Sensor voltage 0.45 and 0.60 volt?

Yes

- Go To [10](#)

No

- Refer to the Service Information Wiring to check Fuel Pressure Sensor circuits. If no problems are found, replace the Fuel Pressure Sensor.

10. CHECK FUEL PRESSURE AT ENGINE CRANKING

With the scan tool, read the Fuel Pressure Sensor signal while cranking the engine.

Does the Fuel Pressure Sensor signal increase to above 4300 psi (300 bar) within a few seconds after engine cranking begins?

Yes

- Go To [11](#)

No

- Go To [13](#)

11. FUEL INJECTOR LOW-SIDE CONTROL CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the each Fuel Injector harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector Low-Side Control circuit in the Fuel Injector harness connectors.

Is there any voltage present?

Yes

- Repair the Fuel Injector Low-Side Control circuit(s) for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [12](#)

12. ENGINE DRIVE BELT

Refer to the Service Information to ensure the Engine Drive Belt is installed correctly and the camshaft and crankshaft gears are timed correctly.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Replace and program the Engine Control Module in accordance with the Service Information.

13. FUEL PRESSURE SOLENOID

Turn the ignition off.

Refer to the Service Information and replace the Fuel Pressure Solenoid.

Turn the ignition on.

With the scan tool, erase the ECM DTC's.

Attempt to start the vehicle.

Does the vehicle start and run?

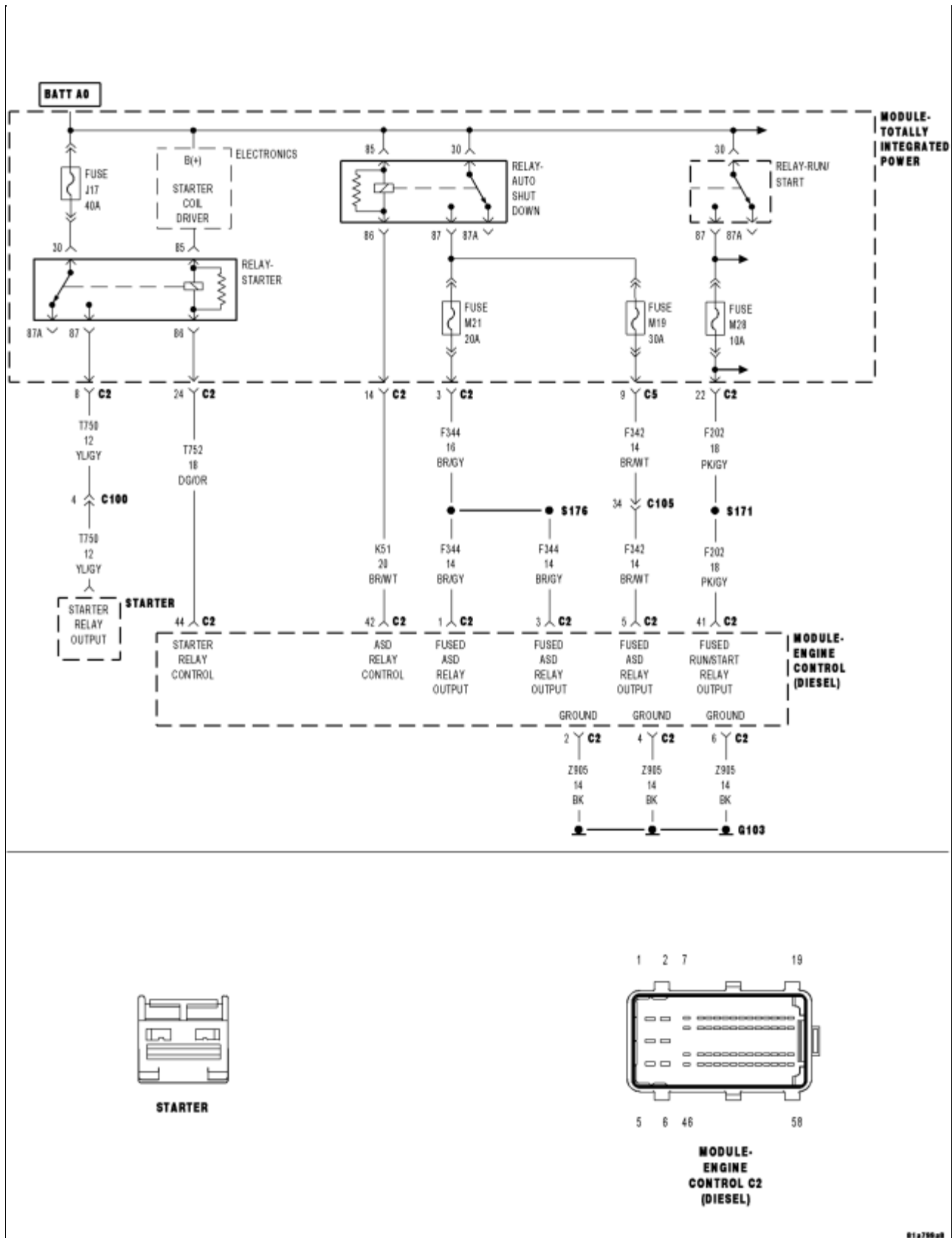
Yes

- Repair is complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Refer to the Service Information and replace the Fuel Injection Pump assembly.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***ENGINE WILL NOT CRANK**



For a complete wiring diagram **Refer to Section 8W**

BATTERY CABLE HIGH RESISTANCE
BATTERY CABLES
ECM
MECHANICAL PROBLEM
OPEN FUSED BATTERY (+) CIRCUIT
STARTER COIL DRIVER (INTERNAL TIPM)
SKREEM CODES PRESENT
STARTER MOTOR
STARTER RELAY
(T752) STARTER RELAY CONTROL CIRCUIT OPEN
(T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE
(T750) STARTER RELAY OUTPUT CIRCUIT OPEN

Diagnostic Test

1. BATTERY CABLES

NOTE: The battery must be fully charged before diagnosing a no crank condition.

Turn the ignition off.

Inspect the battery cables for corrosion, looseness or other problems.

Is there evidence of problems?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. BATTERY CABLE HIGH RESISTANCE

Using the Service Information, check the battery cables for high resistance.

Did either battery cable have a voltage drop greater than 0.2 volts?

Yes

- Replace the battery cable(s).
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. SKREEM CODES PRESENT

Turn the ignition on.

With the scan tool, read the SKREEM DTCs.

Does the scan tool display any SKREEM DTCs?

Yes

- Refer to symptom list for problems related to SKREEM.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. TIPM CAN BUS CODES PRESENT

With the scan tool, read the TIPM DTCs.

NOTE: If there are CAN BUS related problems the TIPM will not supply power to the Starter Relay coil.

Does the scan tool display any CAN Bus related DTCs in the TIPM?

Yes

- Refer to symptom list for problems related to CAN Bus communication.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

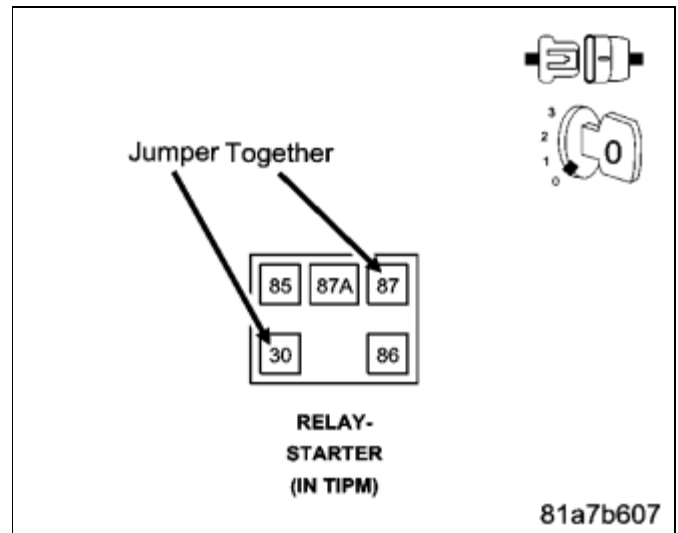
- Go To [5](#)

5. CHECKING STARTER OPERATION

Turn the ignition off.
Remove the Starter Relay from the TIPM.

WARNING: THE TRANSMISSION MUST BE IN NEUTRAL AND THE PARK BRAKE MUST BE SET FOR THIS TEST.

WARNING: THE ENGINE MAY CRANK IN THE NEXT STEP. WHEN THE ENGINE IS CRANKING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.



Momentarily jumper Starter Relay connector cavities 30 and 87 in the TIPM connector.

Did the engine crank?

Yes

- Go To [6](#)

No

- Go To [11](#)

6. STARTER RELAY

Install a known good relay in place of the Starter Relay.
Attempt to start the engine.

Does the engine crank?

Yes

- Replace the Starter Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

Were any problem found with the ECM powers and grounds?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. STARTER COIL DRIVE CIRCUIT (INTERNAL TIPM)

Turn the ignition off.

Remove the Starter Relay from the TIPM.

Using a 12-volt test light connected to ground, check the Starter Coil Driver circuit in the Starter Relay connector while turning the ignition switch to the START position.

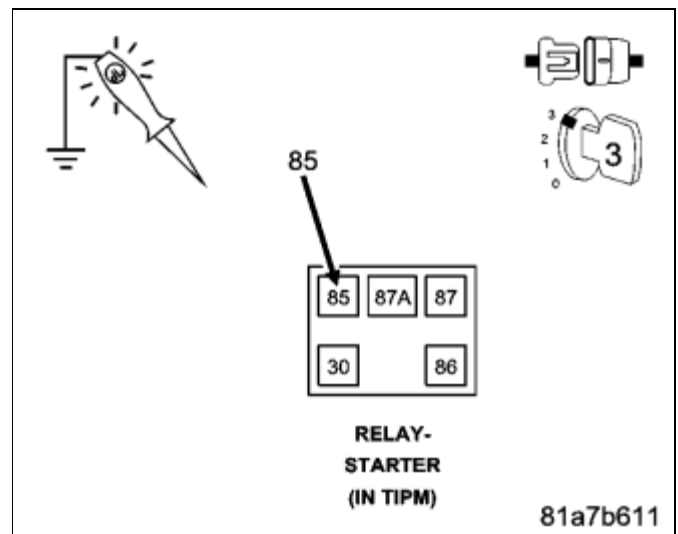
Does the test light illuminate with the ignition switch in the START position?

Yes

- Go To [9](#)

No

- Check the TIPM ignition supply circuits and fuses. If TIPM fuses and ignition supply circuits are ok, replace the TIPM.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. (T752) STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the TIPM.

Using a jumper wire, connect ASD Relay connector cavities 30 and 87 in the TIPM.

Turn the ignition on.
Measure the voltage of the (T752) Starter Relay Control circuit.

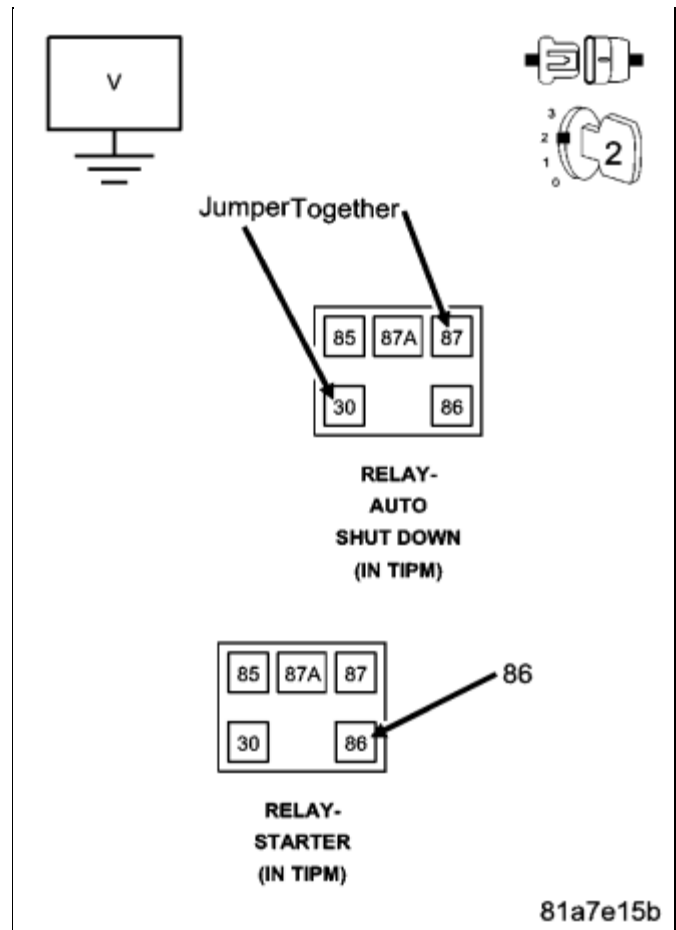
Is the voltage above 1.0 volt?

Yes

- Repair the (T752) Starter Relay Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [10](#)



10. (T752) STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.
Remove the jumper wire and install the ASD Relay.
Measure the resistance of the (T752) Starter Relay Control circuit between the ECM harness connector and the Starter Relay connector in the TIPM.

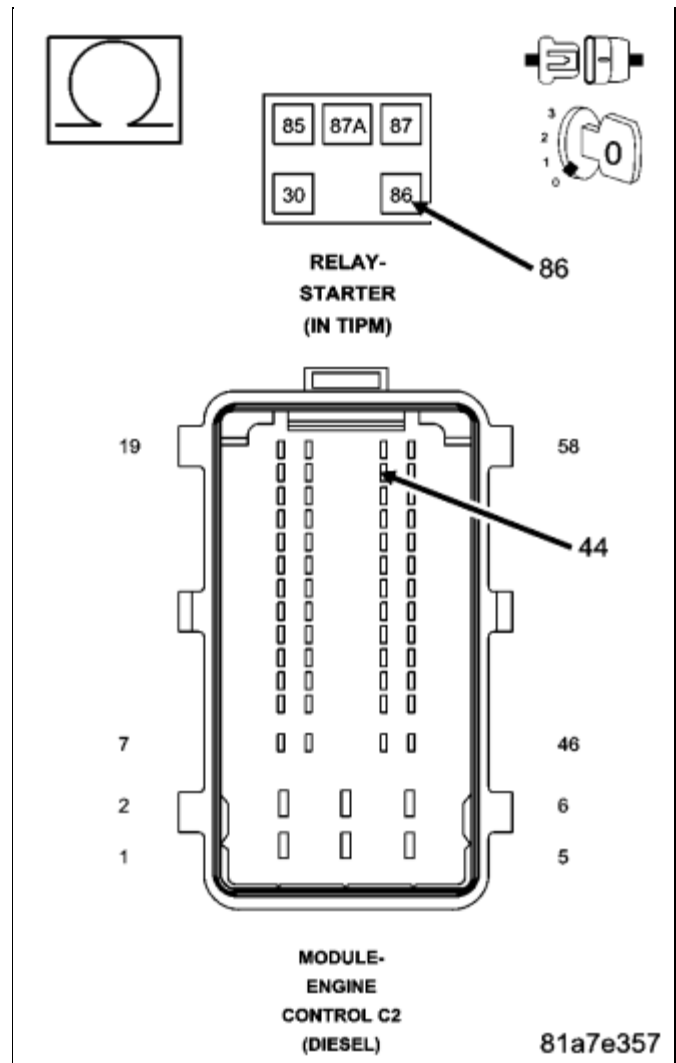
Is the resistance below 10.0 ohms?

Yes

- Replace the Engine Control Module in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (T752) Starter Relay Control circuit for an open.



11. FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, check the Fused B(+) circuit in the Starter Relay connector in the TIPM.

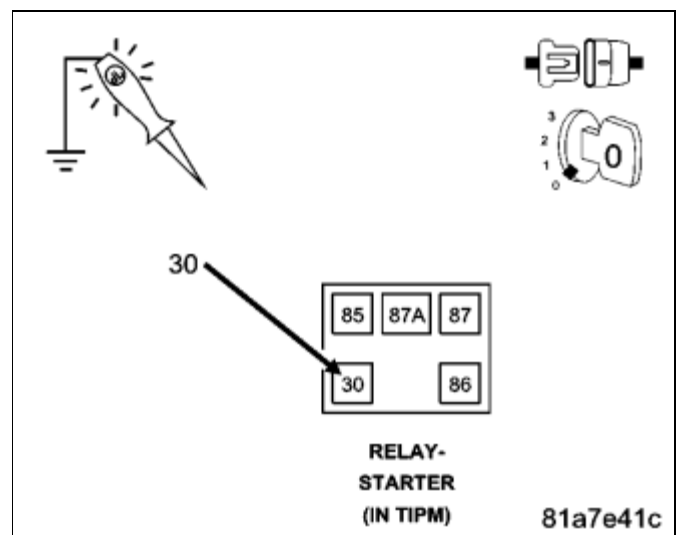
Is the test light on?

Yes

- Go To [12](#)

No

- Repair the Fused B(+) circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (T750) STARTER RELAY OUTPUT CIRCUIT OPEN

Disconnect the (T750) Starter Relay Output wire from the Starter Solenoid.

Connect the (T750) Starter Relay Output wire (at the Starter) to ground.

Using a 12-volt test light connected to 12-volts, check the (T750) Starter Relay Output circuit at the Starter Relay connector in the TIPM.

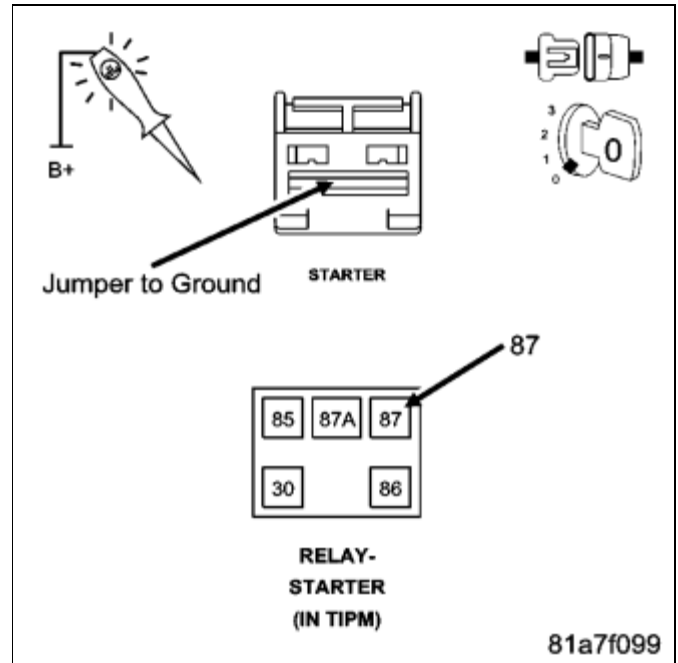
Does the test light illuminate brightly?

Yes

- Go To [13](#)

No

- Repair the (T750) Starter Relay Output circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. MECHANICAL PROBLEM

Turn the ignition off.

Attempt to manually rotate the crankshaft 360°.

Is the crankshaft able to rotate 360°?

Yes

- Replace the Starter Motor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the engine mechanical problem.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*LACK OF ENGINE POWER

For a complete wiring diagram **Refer to Section 8W**

Possible Causes
AIR IN FUEL SYSTEM

INJECTOR QUANTITY ADJUSTMENT
INTAKE/EXHAUST SYSTEM RESTRICTION
EGR SYSTEM PROBLEM
LOW ENGINE COMPRESSION
INTAKE AIR SYSTEM LEAK
FUEL DELIVERY SYSTEM RESTRICTION
ENGINE DRIVE BELT/CHAIN
FUEL INJECTOR(S)
FUEL PRESSURE SOLENOID
FUEL INJECTION PUMP
FUEL SYSTEM CONTAMINATION
FUEL SYSTEM LEAK
TURBOCHARGER

Diagnostic Test

1. CHECKING FOR ECM DTCS

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Turn the ignition on.

With the scan tool, read the ECM DTCs.

Are there any DTCs present?

Yes

- Refer to symptom list for problems related to this DTC.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. FUEL SYSTEM LEAK

Turn the ignition off.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the entire fuel system for leakage.

Is there any evidence of leakage?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. FUEL SYSTEM CONTAMINATION

NOTE: Mixing any other fuels such as gasoline or kerosine can cause this symptom to occur.

Turn the ignition off.

WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME

PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.

WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

Inspect the fuel system for contamination.

Is the fuel contaminated?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECKING BOOST PRESSURE

Turn the ignition on.

NOTE: This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings.

With the scan tool in Sensors, read and compare the Boost Pressure (PSI) with the Boost Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, and cruise.

NOTE: The Boost Pressure reading should directionally follow (trail) the Boost Pressure Desired/Setpoint reading.

Does the Boost Pressure reading follow the Boost Pressure Desired/Setpoint reading?

Yes

- Go To [5](#)

No

- Go To [13](#)

5. CHECKING FUEL PRESSURE

Turn the ignition on.

NOTE: This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings.

With the scan tool in Sensors, read and compare the Fuel Pressure (PSI) with the Fuel Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, cruise and deceleration.

NOTE: The Fuel Pressure reading should directionally follow (trail) the Fuel Pressure Desired/Setpoint reading.

Does the Fuel Pressure reading directionally follow the Fuel Pressure Desired/Setpoint reading?

Yes

- Go To [6](#)

No

- Go To [10](#)

6. INJECTOR QUANTITY ADJUSTMENT

NOTE: Each Fuel Injector is labeled with a code. This code determines the injector quantity adjustment. Each Injector code must be programmed into the ECM using the scan tool.

Turn the ignition off.

Refer to the Service Information to locate each fuel injector label and check for the correct code for each fuel injector in the ECM.

Are all of the injector codes correct?

Yes

- Go To [7](#)

No

- Using the scan tool, program the correct Fuel Injector code into the ECM.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. ENGINE COMPRESSION

Start and idle the engine.

With the scan tool, perform the Cylinder Compression Test.

Does the Cylinder Compression Test indicate low compression in any of the cylinders?

Yes

- Using the Service Information, repair the engine as necessary to regain proper cylinder compression.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. FUEL INJECTOR

NOTE: An injector that sticks open can cause this symptom. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.

Start and idle the engine.

With the scan tool, perform the Cylinder Fuel Quantity Correction Test.

NOTE: A problem injector will be indicated by a significant change in correction quantity as compared to the rest of the injectors.

Are any of the injectors displaying a significant amount of injection quantity correction?

Yes

- Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. ENGINE DRIVE BELT/CHAIN

Refer to the Service Information to ensure the Engine Drive Belt/Chain is installed correctly and the camshaft and crankshaft gears are timed correctly.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

10. CHECKING THE SUPPLY SIDE FUEL DELIVERY SYSTEM

Refer to the Checking the Low Pressure Fuel Delivery System Test and test for proper Fuel pressure and volume from the fuel tank to the high pressure Fuel Injection Pump.

NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, air in fuel system, failed fuel sending unit, contaminated fuel.

Were there any problems with the Fuel Delivery System?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [11](#)

11. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool in Sensors, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi (7.0 bar) above and/or below the Fuel Pressure Setpoint.

Does Actual Fuel Pressure oscillate more than 100 psi (7.0 bar) above and/or below the Fuel Pressure Setpoint?

Yes

- Refer to the Service Information to purge air from the fuel system.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [12](#)

12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Test drive the vehicle.

Does the vehicle still exhibit a lack of power?

Yes

- Refer to the Service Information and replace the Fuel Injection Pump assembly.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

13. CHECK FOR INTAKE AND EXHAUST SYSTEM RESTRICTIONS

Turn the ignition off.

Inspect the exhaust system for damaged components that could cause exhaust flow blockage.

Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections for damage, air leaks or blockage.

Inspect the Charge Air Cooler hoses/tubes and connections.

Inspect the air filter for excessive dirt, soiling or other problems that may cause restricted air flow.

Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [14](#)

14. CHECKING FOR AIR LEAKS

NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a poor performance/lack of power symptom.

Turn the ignition off.

Remove the Crankcase Vent Heater.

Remove the Mass Air Flow Sensor from the turbocharger inlet tube.

Seal off and/or plug the turbocharger inlet tube where the MAF sensor was removed.

Connect smoke machine 84-04 to the Crankcase Vent Heater port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

Is there evidence of smoke leakage?

Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go To [15](#)

15. EGR SYSTEM

Refer to the symptom list and perform the CHECKING THE EGR SYSTEM test.

Were any problems found during the EGR System test?

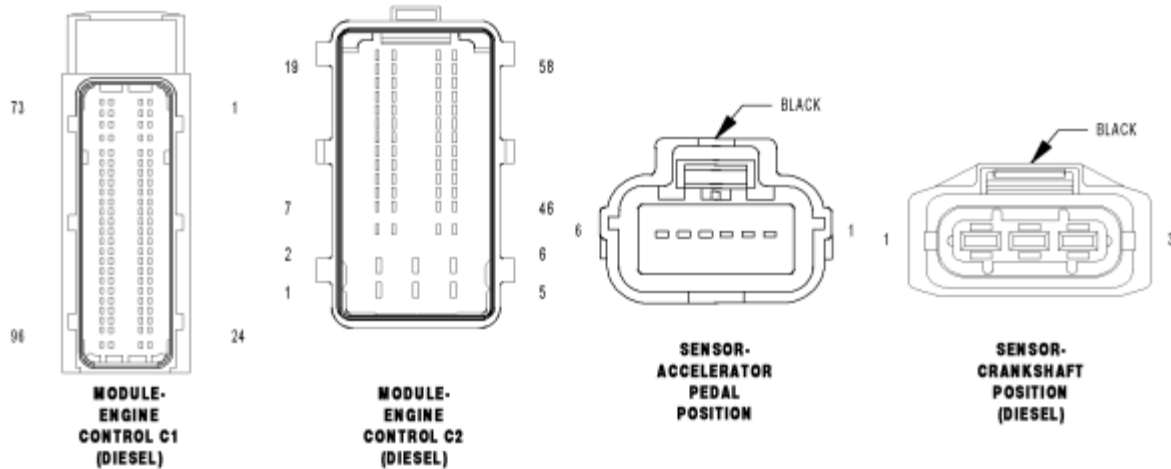
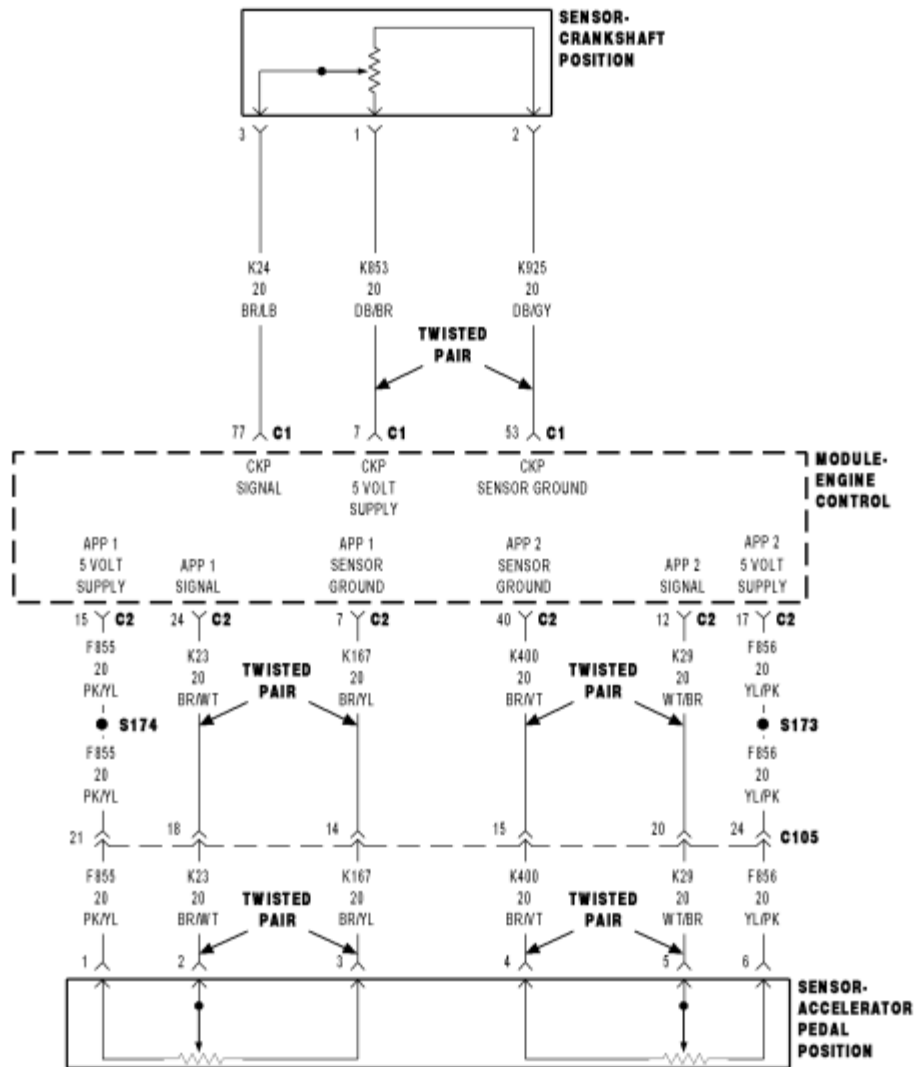
Yes

- Repair or replace as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Check for proper linkage connection between the Boost Pressure Servo Motor and the Turbocharge assembly. Repair or replace as necessary. If o.k., refer to the Service Information and replace the Turbocharger assembly.

***CHECKING THE ACCELERATOR PEDAL POSITION SENSOR CALIBRATION**



81a754a6

For a complete wiring diagram **Refer to Section 8W**

APP SENSOR 1
APP SENSOR 2

Diagnostic Test

1. APP SENSOR IDLE VOLTAGE

NOTE: If there are any Accelerator Pedal Position Sensor DTC's active in the ECM, diagnose DTC's before continuing this test.

NOTE: The APP Sensor is a device that contains two separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.

NOTE: The APP Sensor 1 signal should always be double the voltage of the APP Sensor 2 signal.

NOTE: Ensure the accelerator pedal is free from any restriction or binding before continuing.

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 Volts with the accelerator pedal in the at rest position.

Does the scan tool display between 0.20 and 0.61 volt for sensor 1 and 0.10 and 0.30 volt for sensor 2?

Yes

- Go To [2](#)

No

- Check the APP Sensor circuits for proper resistance. If no problems are found, replace the APP Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. APP SENSOR 1

While back probing, measure the voltage of the APP Sensor 1 Signal circuit at the ECM. Monitor the voltmeter while slowly pressing the accelerator pedal completely down.

NOTE: APP signals are displayed in voltage and percentage on the scan tool. Although APP 1 voltage is double APP 2 voltage, the percentage display of APP 1 and APP 2 should be within 2.5% of each other during all phases of accelerator pedal travel.

Did the voltage increase smoothly with pedal travel?

Yes

- Go To [3](#)

No

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. APP SENSOR 2

While back probing, measure the voltage of the APP Sensor 2 Signal circuit at the ECM. Monitor the voltmeter while slowly pressing the accelerator pedal completely down.

NOTE: APP signals are displayed in voltage and percentage on the scan tool. Although APP 1 voltage is double APP 2 voltage, the percentage display of APP 1 and APP 2 should be equal during all phases of accelerator pedal travel.

Did the voltage increase smoothly with pedal travel?

Yes

- Go To [4](#)

No

- Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. APP SENSOR WIDE OPEN THROTTLE VOLTAGE

Fully depress the accelerator pedal.
With the scan tool, read the voltage for APP Sensor 1 and APP Sensor 2.

Does the scan tool display between 4.30 and 4.80 volts for sensor 1 and 2.15 and 2.40 volts for sensor 2?

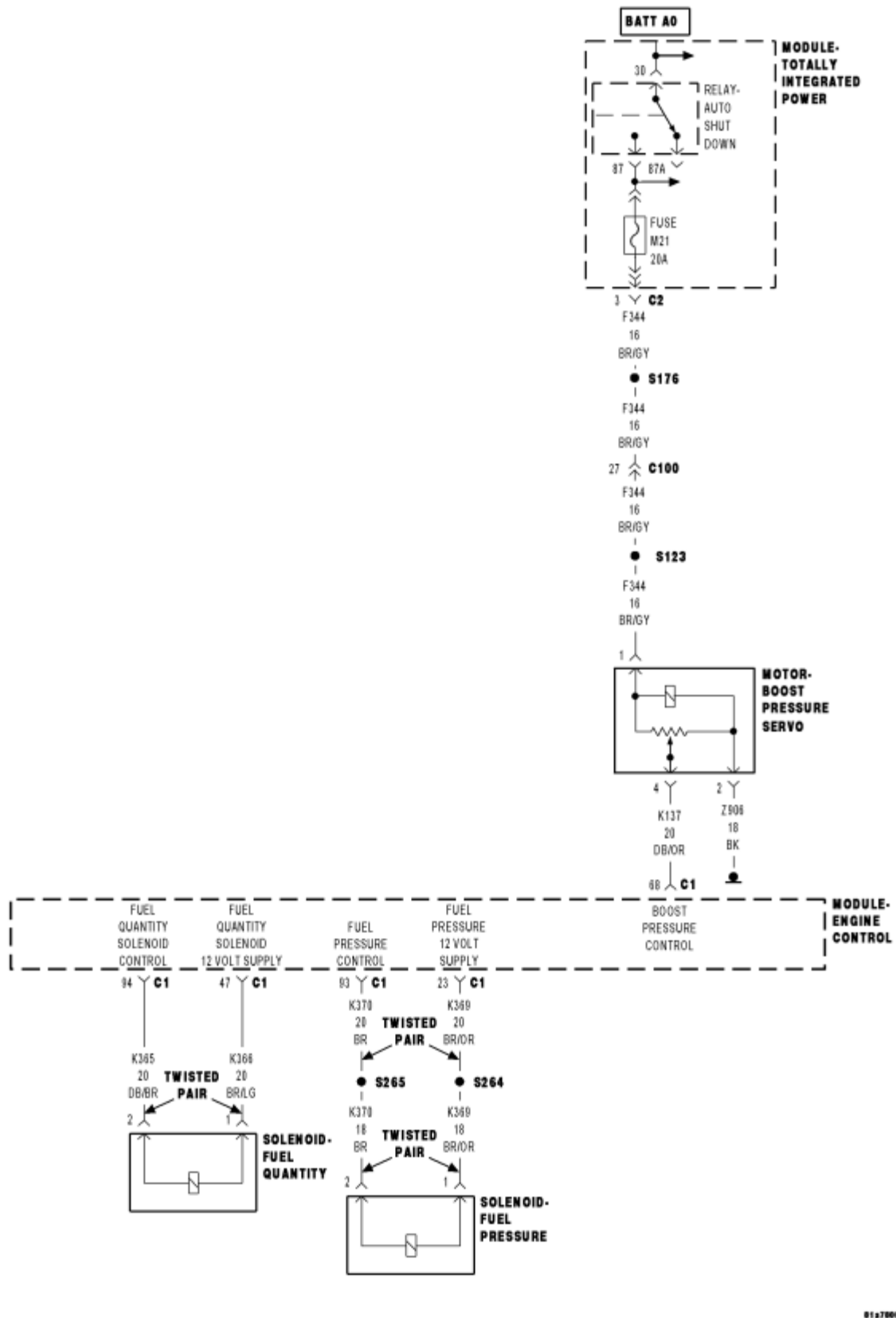
Yes

- Test Complete.

No

- Check the APP Sensor circuits for proper resistance. If o.k., replace the APP Sensor in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE BOOST PRESSURE SENSOR CALIBRATION**



For a complete wiring diagram **Refer to Section 8W**

TURBOCHARGER BOOST PRESSURE SENSOR CALIBRATION
--

Diagnostic Test

1. BOOST PRESSURE SENSOR CALIBRATION

Turn the ignition on.

With the scan tool, read the Boost Pressure Voltage and Boost Pressure hpa.

NOTE: The Boost Pressure hpa and Intake/Inlet Air Pressure hpa readings should both match closely to the Atmospheric Pressure hpa reading. These readings will change depending on altitude.

Is the Boost Pressure Voltage between 1.12 and 1.36 volt?

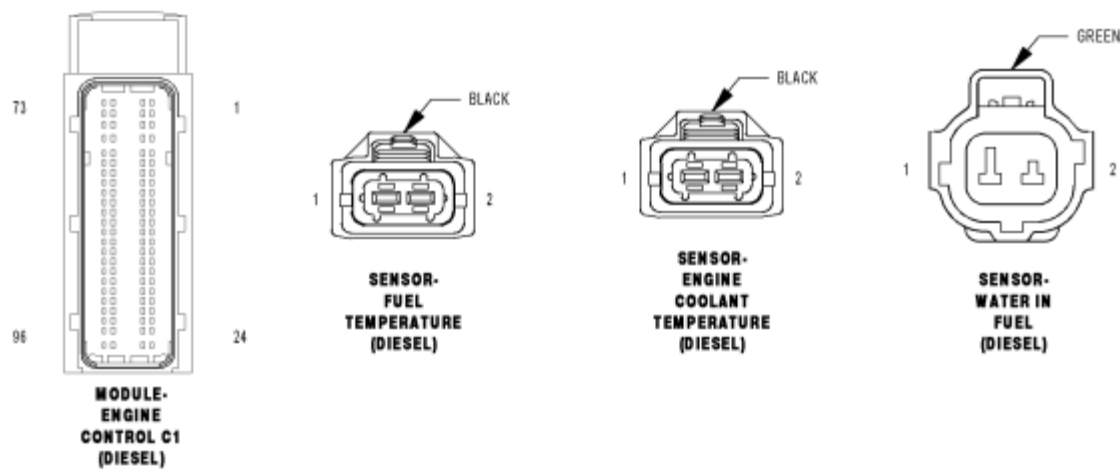
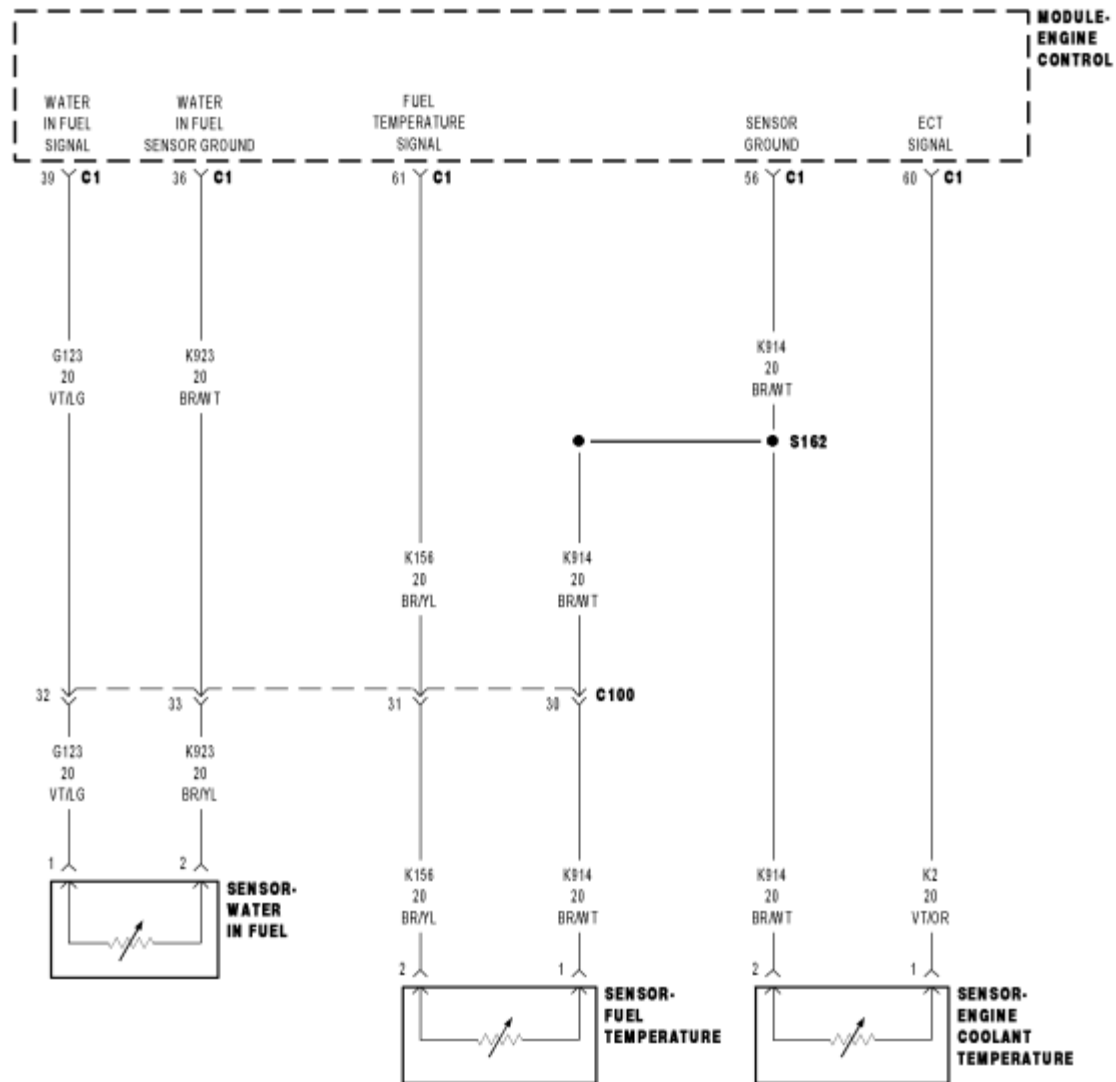
Yes

- Test Complete.

No

- Replace the Turbocharger Boost Pressure Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE ENGINE COOLANT TEMPERATURE SENSOR CALIBRATION**



01a77365

For a complete wiring diagram **Refer to Section 8W**

Possible Causes

ECT SENSOR - COLD
ECT SENSOR - HOT

Diagnostic Test

1. ECT SENSOR - COLD

NOTE: The thermostat must be operating correctly for this test to be valid.

With the scan tool in Sensors, read and note the engine coolant temperature.
Using a temperature probe, measure the engine block temperature near the ECT Sensor.

NOTE: The engine temperature should be below 50°C (120°F).

Are the readings within 7°C (13°F) of each other?

Yes

- Go To [2](#)

No

- Check the wiring and connectors associated with the ECT Sensor for corrosion, damage or other problems. Repair as necessary. If no problems are found, replace the Engine Coolant Temperature Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. ECT SENSOR - HOT

NOTE: The thermostat must be operating correctly for this test to be valid.

Start the engine and bring the engine to operating temperature (thermostat open).
Turn the engine off and wait 10 minutes to allow the engine temperature to stabilize.
Using a temperature probe, measure the engine block temperature near the ECT Sensor.
With the scan tool, select Engine, then Sensors and read the engine coolant temperature.

Are the readings within 7°C (13°F) of each other?

Yes

- Test Complete.

No

- Check the wiring and connectors associated with the ECT Sensor for corrosion, damage or other problems. Repair as necessary. If no problems are found, replace the Engine Coolant Temperature Sensor.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE EGR SYSTEM**

For a complete wiring diagram **Refer to Section 8W**

Possible Causes
VACUUM SUPPLY TO EGR SOLENOID
EGR SOLENOID
EGR VALVE

Diagnostic Test**1. VACUUM SUPPLY TO EGR SOLENOID**

Turn the ignition off.

Disconnect the vacuum supply hose to the EGR Solenoid.

Connect a vacuum gauge to the disconnected vacuum supply hose to the EGR Solenoid.

Start and idle the engine.

Observe the vacuum gauge reading.

Does the vacuum gauge display vacuum above 24 inches of mercury?

Yes

- Go To [2](#)

No

- Check vacuum pump and vacuum supply system for problems related to low vacuum.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. VACUUM SUPPLY TO EGR VALVE

NOTE: The engine must be at operating temperature for this test.

Turn the ignition off.

Reconnect the vacuum supply hose to the EGR Solenoid.

Disconnect the vacuum hose at the EGR Valve.

Connect a vacuum gauge to the disconnected vacuum hose at the EGR Valve.

Start and idle the engine.

Observe the vacuum gauge reading for at least 10 minutes beginning at engine start up.

Does the vacuum gauge display vacuum above 14 inches of mercury for approximately 10 minutes from engine start up then drop to 0?

Yes

- Go To [3](#)

No

- Check the vacuum hose between the EGR Solenoid and the EGR Valve for crack, kinks cuts, or other damage that may prevent proper vacuum operation. If the hose is functioning properly, replace the EGR Solenoid.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. EGR VALVE

Turn the ignition off.

Reconnect the vacuum hose at the EGR Valve.

Disconnect both vacuum hoses at the EGR Solenoid.

Using a vacuum tee connector, connect both disconnected hose ends at the EGR Solenoid.

NOTE: This test will apply continual vacuum to the EGR Valve. If the EGR Valve is functioning properly, a dramatic loss of engine power will occur when attempting to accelerate and/or load the engine.

Test drive the vehicle.

Does the vehicle exhibit a noticeable loss of power on acceleration?

Yes

- Test Complete.

No

- Replace the EGR Valve in accordance with the Service Information.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE ENGINE MECHANICAL SYSTEMS**

For a complete wiring diagram **Refer to Section 8W**

Possible Causes
CHECKING ENGINE MECHANICAL SYSTEMS

Diagnostic Test

1. CHECKING ENGINE MECHANICAL

NOTE: The following items should be checked as a possible cause of a Driveability or No-Start problem.

WARNING: Do not attempt to remove or separate high pressure fuel line. Attempting to do so could result in severe bodily injury or death.

Engine Valve Timing - must be within specification

Engine Compression - must be within specifications

Camshaft Lobes - check for abnormal wear

Camshaft Position Sensor - check the camshaft position sensor tooth for debris and deterioration

Crankshaft Position Sensor - check the crankshaft magnetic strip for debris and deterioration

Engine Exhaust System - must be free of any restriction

Engine Drive Belt and Sprockets - must be properly positioned

Vacuum System - must operate properly and be free of any vacuum leaks

Fuel - must have adequate supply and must be free of contamination (ie. debris, water and gasoline)

Fuel Injectors - must not be plugged or restricted

Fuel Lift Pump - must operate properly (where applicable)

Fuel Injection Pump - must be producing the correct output volume and pressure

Inspect the Fuel Lines, Fuel Filter and Fuel Pressure Relief Valve for signs of restriction and leaks

NOTE: Check for any Technical Service Bulletins that may relate to the problem.

Are there any problems evident?

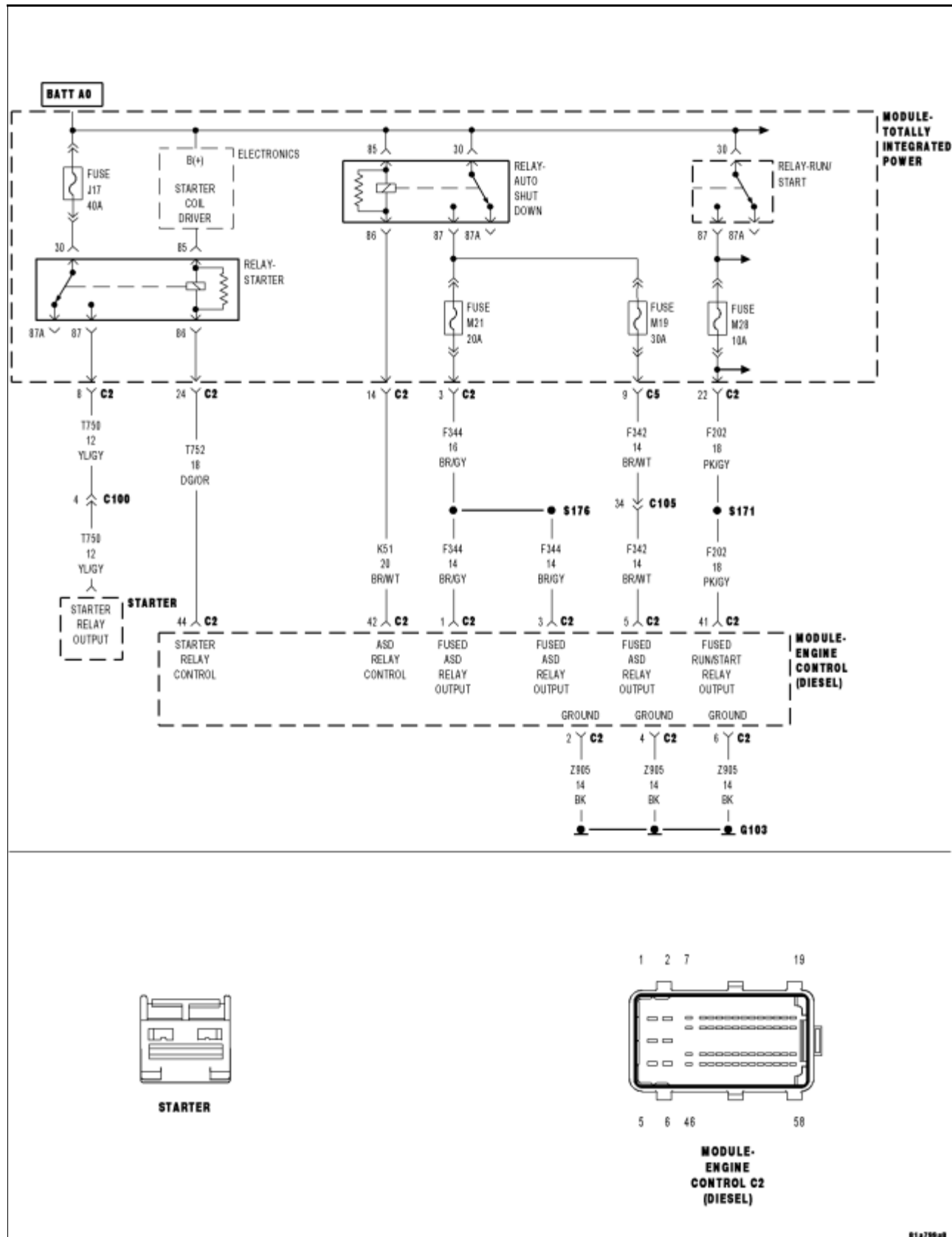
Yes

- Repair as necessary.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.

*CHECKING THE ECM POWER AND GROUND CIRCUITS



Possible Causes
(K51) ASD RELAY CONTROL CIRCUIT OPEN
(F344) ASD RELAY OUTPUT CIRCUIT(S) OPEN
CHECKING THE ASD RELAY SYSTEM
(Z905) ECM GROUND CIRCUIT(S) OPEN
FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN
(F202) FUSED IGNITION SWITCH (START/RUN) OUTPUT CIRCUIT OPEN
SUBSTITUTE ASD RELAY
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Diagnostic Test

1. ECM GROUND CIRCUIT(S) OPEN

Turn the ignition off.
 Disconnect the ECM harness connectors.
 Using a 12-volt test light connected to 12-volts, check each of the ECM ground circuits in ECM harness connector C2 cavities 2, 4 and 6.

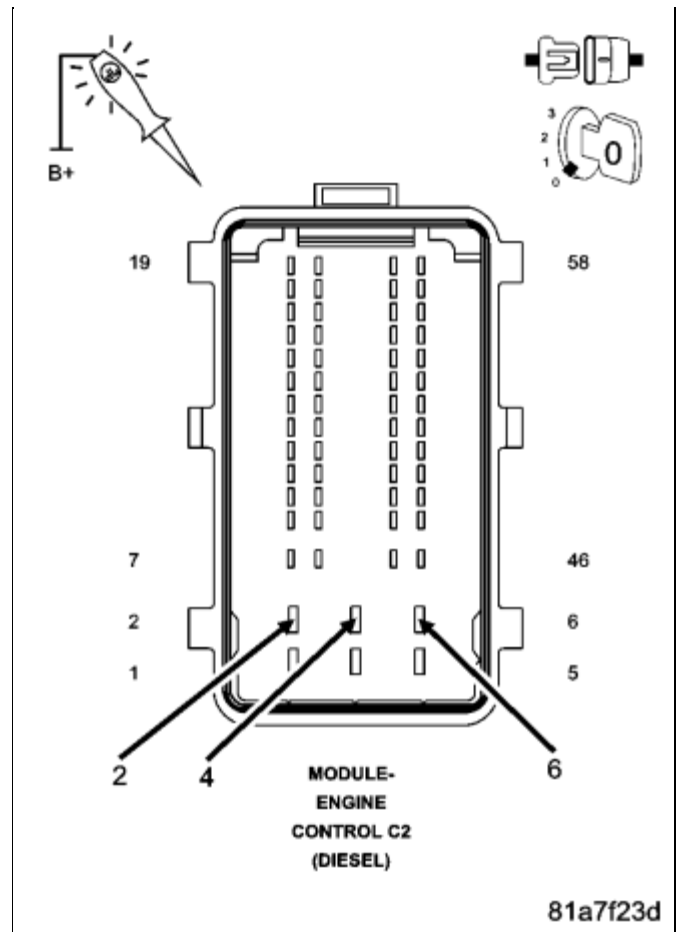
Did the test light illuminate for each cavity?

Yes

- Go To [2](#)

No

- Repair the ECM Ground circuit(s) for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



2. (F202) FUSED IGNITION SWITCH START/RUN OUTPUT CIRCUIT OPEN

Turn the ignition to the Start position.

Using a 12-volt test light connected to ground, check the (F202) Fused Ignition Switch Start/Run Output circuit in ECM harness connector C2 cavity 41.

Turn the ignition to the Run position.

Using a 12-volt test light connected to ground, check the (F202) Fused Ignition Switch Start/Run Output circuit in ECM harness connector C2 cavity 41.

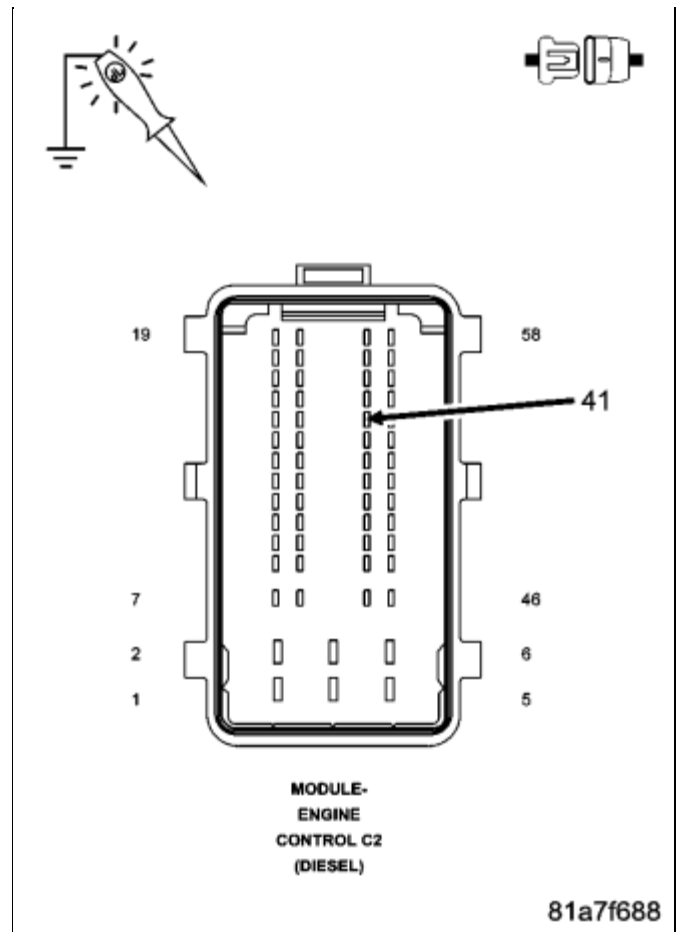
Is the test light on for both ignition switch positions?

Yes

- Go To [3](#)

No

- Repair the (F202) Fused Ignition Switch Start/Run Output circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. CHECKING THE ASD RELAY SYSTEM

Turn the ignition off.

Connect a jumper wire between ground and the (K51) ASD Relay Control circuit in ECM C2 harness connector cavity 42.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F344) Fused ASD Relay Output circuits at the ECM C2 harness connector cavities 1, 3 and 5.

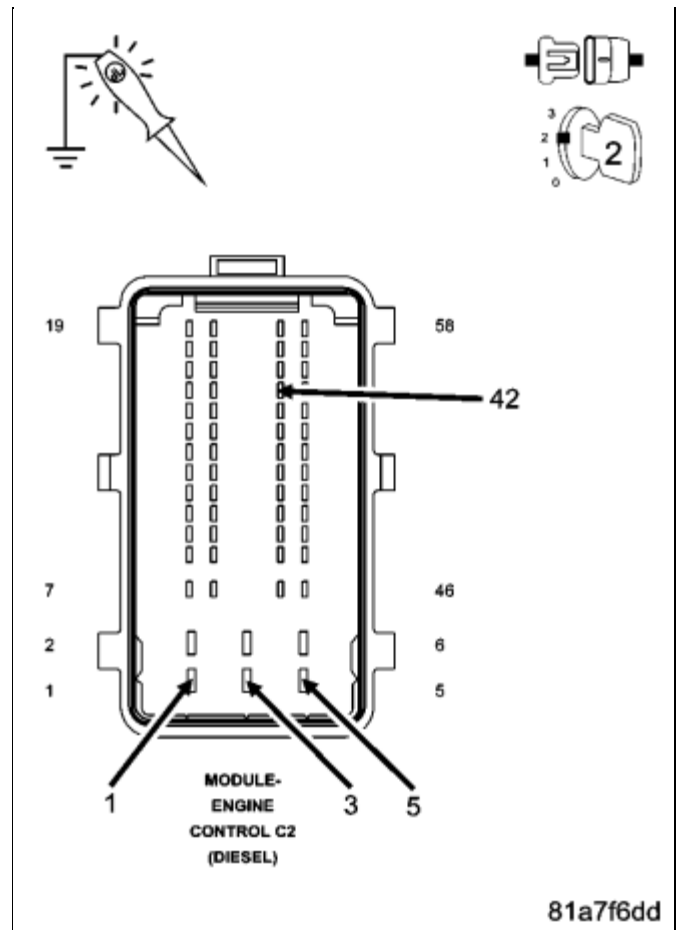
Does the test light illuminate brightly for each circuit?

Yes

- Test Complete.

No

- Go To [4](#)



4. FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN

Turn the ignition off.
Remove the ASD Relay from the TIPM.
Using a 12-volt test light connected to ground, check both Fused ASD Relay Battery Supply circuits in ASD Relay connector.

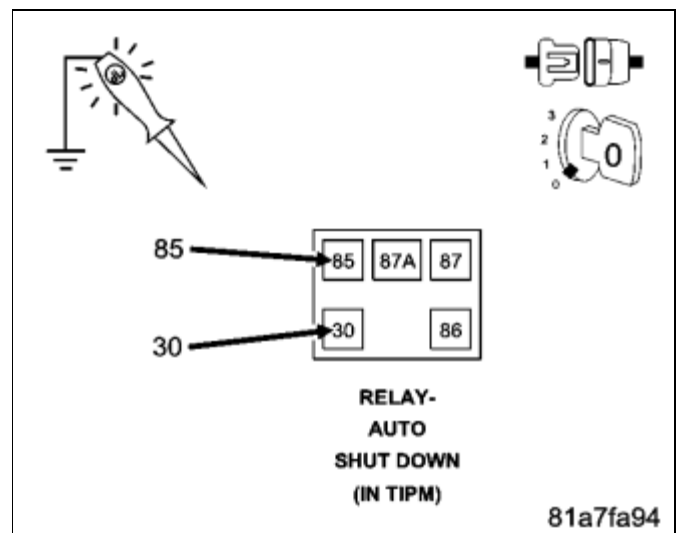
Is the test light on?

Yes

- Go To [5](#)

No

- Repair the Fused ASD Relay Battery Supply circuit(s) for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (F344) ASD RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire between cavity 30 and cavity 87 in the ASD Relay connector.

Using a 12-volt test light connected to ground, check the (F344) ASD Relay Output circuit in ECM harness connector C2 cavities 1, 3 and 5.

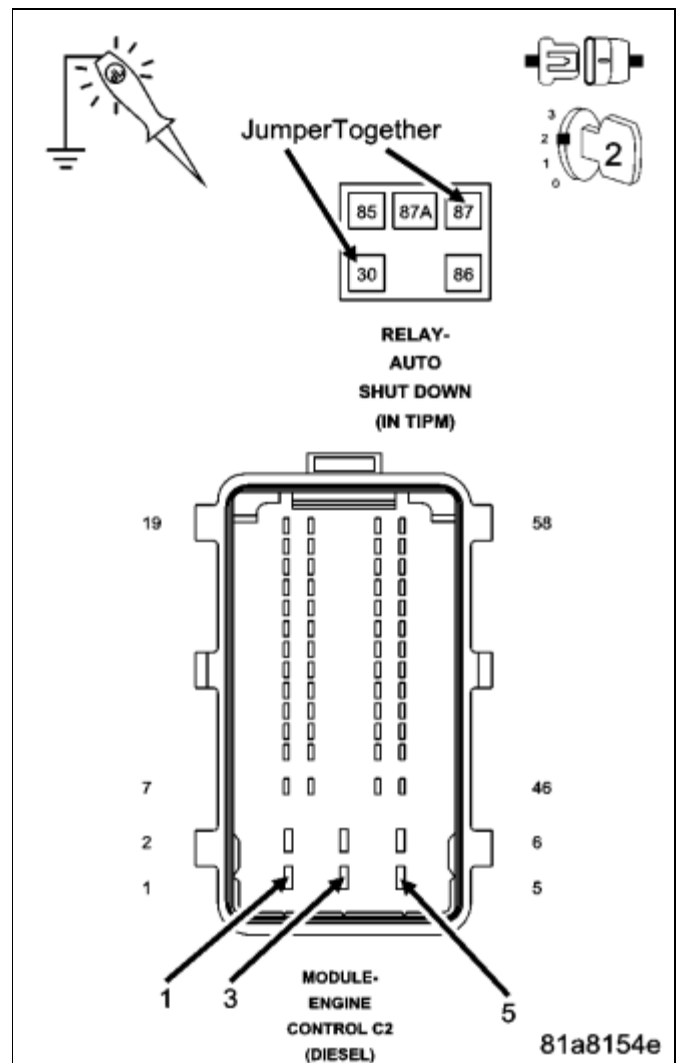
Did the test light illuminate for each circuit?

Yes

- Go To [6](#)

No

- Repair the (F344) ASD Relay Output circuit(s) for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. ASD RELAY

Turn the ignition off.

Install a known good relay in place of the ASD Relay.

Connect a jumper wire between ground and the (K51) ASD Relay Control circuit in ECM C2 harness connector cavity 42.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F344) Fused ASD Relay Output circuits at the ECM C2 harness connector cavities 1, 3 and 5.

Did the test light illuminate brightly for each circuit?

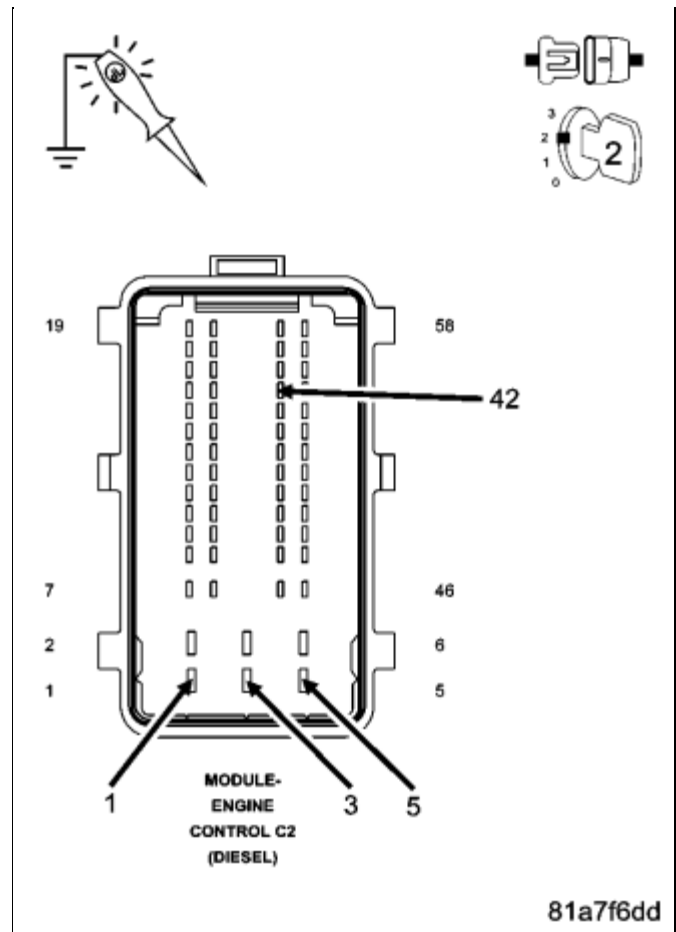
Yes

- Replace the ASD Relay.
- Perform the ECM Verification Test Ver. 1. (Refer to 9

- ENGINE - STANDARD PROCEDURE)

No

- Go To [Z](#)



7. (K51) ASD RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.
Remove the ASD Relay from the TIPM.
Measure the resistance of the (K51) ASD Relay Control circuit between the TIPM connector and the ECM harness connector.

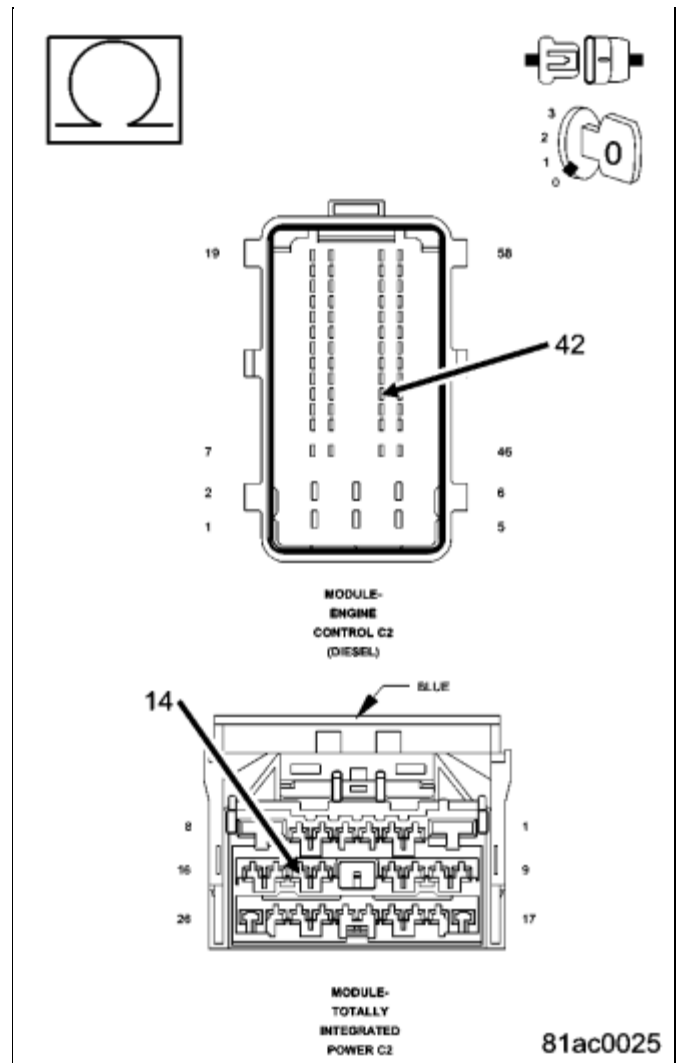
Is the resistance below 10.0 ohms?

Yes

- Go To [8](#)

No

- Repair the (K51) ASD Relay Control circuit for an open.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K51) ASD RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the TIPM.
Turn the ignition on.
Measure the voltage on the (K51) ASD Relay Control circuit.

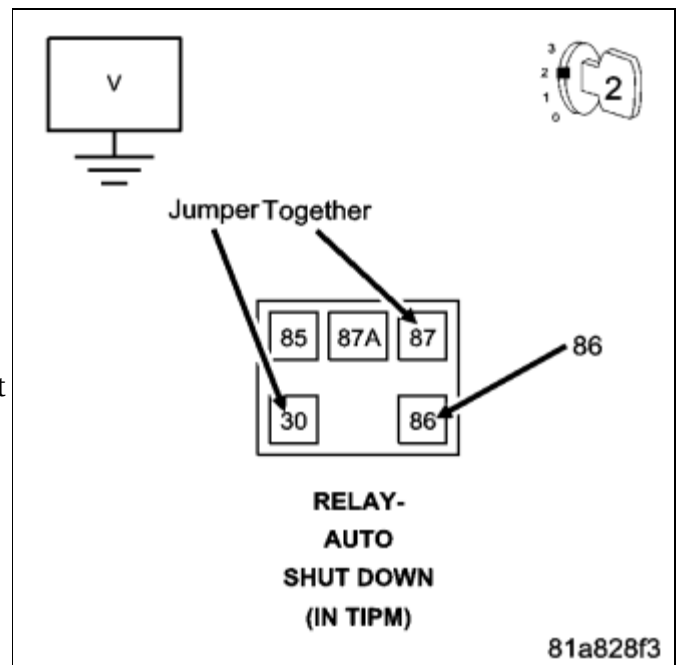
Is the voltage above 1.0 volt?

Yes

- Repair the (K51) ASD Relay Control circuit for a short to voltage.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Test Complete.



*CHECKING THE FUEL SUPPLY SYSTEM

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. CHECKING THE FUEL PUMP CIRCUITS

Turn the ignition on.

NOTE: Diagnose and repair any fuel pump control circuit or relay DTCs before continuing with this test.

Disconnect the Fuel Pump Module harness connector.

Connect a test light between the (N1) Fuel Pump Control Output circuit and the (Z905) Ground circuit at the Fuel Pump Module harness connector (body side).

With a scan tool, actuate the fuel pump control to ON (100%).

CAUTION: Stop all actuation tests before continuing.

Does the test light illuminate brightly?

Yes

- Go to [2](#)

No

- Go to [8](#)

2. CHECKING THE FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system Line, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Disconnect the Low Pressure Fuel Supply Line from the inlet port of the Fuel Injection Pump.

Install a fuel pressure gauge in the disconnected Low Pressure Fuel Supply Line.

Turn the ignition on.

With the scan tool, actuate the fuel pump relay control. Observe the fuel pressure gauge.

NOTE: The fuel pressure specification is between 4.5 and 6.0 bar (65 and 87 psi.).

CAUTION: Stop all actuation tests before continuing.

Select the conclusion that best matches the result of the test:

Fuel pressure is within the stated specification

- Go to [6](#)

Fuel pressure is below the stated specification

- Go to [3](#)

Fuel pressure is above the stated specification

- Replace the Fuel Filter/Water Separator.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. RESTRICTED LOW PRESSURE FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure, even with the engine off. Before testing or servicing any fuel system Line, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Reconnect the Low Pressure Fuel Supply Line from the inlet port of the Fuel Injection Pump
Disconnect the Low Pressure Fuel Supply Line from the inlet port of the Fuel Filter/Water Separator.
Install a fuel pressure gauge in the disconnected Low Pressure Fuel Supply Line.
Turn the ignition on.

With the scan tool, actuate the fuel pump relay control. Observe the fuel pressure gauge.

NOTE: The fuel pressure specification is between 4.5 and 6.0 bar (65 and 87 psi.).

CAUTION: Stop all actuation tests before proceeding.

Is the fuel pressure within specification?

Yes

- Replace the Fuel Filter/Water Separator.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. RESTRICTED INJECTOR BACK FLOW LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure, even with the engine off. Before testing or servicing any fuel system Line, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Disconnect the Injector Back Flow Pressure Fuel Line from the Low Pressure Fuel Supply Line.

NOTE: The Injector Back Flow Pressure Fuel Line is connected to the Low Pressure Fuel Supply Line approximately six inches away from the Fuel Filter/Water Separator.

Install a cap to block the port where the Injector Back Flow Pressure Fuel Line was connected.

Install a fuel pressure gauge in the disconnected Low Pressure Fuel Supply Line.

Turn the ignition on.

With the scan tool, actuate the fuel pump relay control. Observe the fuel pressure gauge.

NOTE: The fuel pressure specification is between 4.5 and 6.0 bar (65 and 87 psi.).

CAUTION: Stop all actuation tests before proceeding.

Is the fuel pressure within specification?

Yes

- Go to [6](#)

No

- Go to [5](#)

5. FUEL PUMP MODULE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system Line, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Reconnect the Low Pressure Fuel Supply Line from the inlet port of the Fuel Filter/Water Separator.

Reconnect the Injector Back Flow Pressure Fuel Line.

Disconnect the Low Pressure Fuel Supply Line from the outlet port of the Fuel Module on top of the Fuel Tank.

Install a fuel pressure gauge in the outlet port of the Fuel Pump Module.

Turn the ignition on.

With the scan tool, actuate the fuel pump relay control. Observe the fuel pressure gauge.

NOTE: The fuel pressure specification is between 4.5 and 6.0 bar (65 and 87 psi.).

CAUTION: Stop all actuation tests before proceeding.

Is the fuel pressure within specification?

Yes

- Replace the Fuel Pump Module.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. FUEL PRESSURE SOLENOID BACK FLOW RETURN LINE

Turn the ignition off.

Disconnect the Back Flow Return Line at the Fuel Pressure Solenoid.

Disconnect the Back Flow Return Line at the Fuel Pump Module on top of the Fuel Tank

Apply air pressure to the Solenoid end of the Back Flow Return Line.

Is air movement evident at the Fuel Pump Module end of the Back Flow Return Line?

Yes

- Test Complete

No

- Go to [7](#)

7. HIGH PRESSURE PUMP BACK FLOW RETURN LINE

Turn the ignition off.

Reconnect the Back Flow Return Line at the Fuel Pressure Solenoid.

Disconnect the Back Flow Return Line at the High Pressure Fuel Pump.

Apply air pressure to the High Pressure Pump end of the Back Flow Return Line.

Is air movement evident at the Fuel Pump Module end of the Back Flow Return Line?

Yes

- Test Complete

No

- Repair the Back Flow Return Line for kinks or broken line.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. (Z905) FUEL PUMP GROUND CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Using a 12 volt test light connected to 12 volts, check the (Z905) Fuel Pump Motor Ground circuit at the Fuel Pump Module harness connector.

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Go to [9](#)

No

- Repair the (Z905) Fuel Pump Ground circuit for an open circuit or high resistance.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (N1) FUEL PUMP CONTROL OUTPUT CIRCUIT CHECK

Using a 12 volt test light connected to 12 volts, check the (N1) Fuel Pump Motor Ground circuit at the Fuel Pump Module harness connector.

Turn the ignition on.

With a scan tool, actuate the fuel pump control to ON (100%).

NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.

Is the test light illuminated and bright?

Yes

- Replace the Fuel Pump Module in accordance with the Service information.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Repair the (N1) Fuel Pump Control Output circuit for an open, short to ground or short to voltage. If the Fuel Pump Control Output circuit is o.k., replace the Totally Integrated Power Module.
- Perform the PCM Verification Test. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*INTERMITTENT DTC

For a complete wiring diagram **Refer to Section 8W**

Diagnostic Test

1. INTERMITTENT DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

The conditions necessary to set this DTC are not present at this time.

Review the scan tool environmental data. If possible, try to duplicate the conditions under which the DTC set.

If applicable, actuate the component with the scan tool.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change, the actuation to be interrupted, or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected component and the ECM.

Inspect and clean all ECM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a schematic and inspect any common ground or supply circuits.

For intermittent Misfire DTCs check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to the component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

Were any problems found during the above inspections?

Yes

- Perform the necessary repairs.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No

- Test Complete.

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. NO RESPONSE

NOTE: For vehicle communication problems, use the scan tool to refer to the Network Review Screen. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red.

Does the scan tool display a Vehicle Network problem or NO RESPONSE condition?

Yes

- Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No

- Go To [2](#)

2. NO START

Does the vehicle have a NO START condition?

Yes

- Check the vehicle for any DTC(s), including Vehicle Theft Security related DTC(s), that may cause a no-start condition.
- If no DTC(s) are present that relate to a no-start condition, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No

- Go To [3](#)

3. VEHICLE REPAIR HISTORY AND TSB(s)

Check the vehicle repair history for repairs that may relate to the current condition.
 Inspect the vehicle for aftermarket accessories that may have been installed incorrectly.
 Check for any TSB(s) related to the condition or DTC(s).
 If a TSB applies, follow the procedure outlined in the TSB.

Select the appropriate response for the condition that applies:

Performing a TSB procedure repaired the condition.

- Test Complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

A DTC is present, no TSB applies, or the TSB didn't repair the condition.

- Go To [4](#)

No DTC(s) or conditions are present.

- Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

4. VEHICLE INSPECTION

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

Based on the diagnostic condition that applies, review the following list and perform any tests that relate to the condition:

If multiple DTCs are set in the ECM, review the wiring schematics for problems in any shared supply or ground circuits. Refer to the diagnostic procedure for Checking the ECM Power and Ground Circuits.

Inspect the air intake system and turbocharger related tubes for damage, restriction, or poor connection.

Inspect the exhaust system and related tubes for damage, restriction, or poor connection.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause an air flow restriction.

If the ECM detects and stores a DTC, the ECM also stores the environmental conditions under which the DTC was set.

Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, Clear the stored DTC(s).

Attempt to duplicate the environmental conditions under which the DTC was set.

Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the vehicle conditions under which the DTC conditions will be monitored. Operate the vehicle under those conditions.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the component and the module.

If the DTC(s) are fuel or air related, check the fuel level and quality.

Were any repairs made that corrected the DTC or condition?

Yes

- Test complete.
- Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No

- Refer to the diagnostic test procedure related to the DTC.

STANDARD PROCEDURE

ECM VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. SELECT THE PROPER VERIFICATION TEST

Select the verification test for the repair that has been completed:

Speed Control repair

- Go To [2](#)

Charging System repair

- Go To [3](#)

No Start repair

- Go To [4](#)

Diesel Particulate Filter repair

- Go To [5](#)

Differential Pressure Sensor repair

- Go To [6](#)

DTC and all other repairs

- Go To [7](#)

2. SPEED CONTROL VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. With the scan tool, erase all diagnostic trouble codes (DTCs).
3. Road test the vehicle at a speed above 60 km/h (35 MPH).
4. Turn the speed control ON/OFF switch on.
5. Depress and release the SET switch. If the speed control does not engage, the repair is not complete, continue with step 12.
6. Quickly depress and release the RESUME/ACCEL switch. If the vehicle speed does not increase by 3 km/h (2 MPH), the repair is not complete, continue with step 12.
7. Using caution, depress and release the brake pedal. If the speed control does not disengage, the repair is not complete, continue with step 12.
8. With the vehicle speed at least 60 km/h (35 MPH), depress the RESUME/ACCEL switch. If the speed control does not resume at the previously set speed, the repair is not complete, continue with step 12.

9. Hold down the COAST switch. If the vehicle does not decelerate, the repair is not complete, continue with step 12.
10. While still holding down the COAST switch, ensure the vehicle speed is at least 60 km/h (35 MPH) and release the COAST switch. If the vehicle does not adjust and set a new vehicle speed, the repair is not complete, continue with step 12.
11. With the speed control engaged, depress the ON/OFF switch. If the speed control does not disengage, the repair is not complete, continue with step 12.
12. If the vehicle did not successfully perform all of the previous steps, check for Technical Service Bulletins (TSBs) that pertain to this speed control problem and then, if necessary, return to the Symptom List.
13. If the vehicle successfully performed all of the previous steps, the speed control system is now functioning as designed. The repair is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

3. CHARGING SYSTEM VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. With the scan tool, erase all diagnostic trouble codes (DTCs).
3. Start the engine.
4. Raise the engine speed to 2000 RPM for at least 30 seconds.
5. Allow the engine to idle.
6. Turn the ignition off for 20 seconds.
7. Turn the ignition on.
8. With the scan tool, read ECM DTCs.
9. If this DTC has set again, or another DTC has set, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
10. If the charging system is functioning correctly and there are no DTCs, the repair is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

4. NO START VERIFICATION TEST

NOTE: IMPORTANT! If the Engine Control Module or Sentry Key Immobilizer Module has been

replaced, ensure the programming procedure for the module has been performed in accordance with the Service Information.

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. Inspect the engine oil for contamination. If it is contaminated, change the oil and filter.
3. With the scan tool, erase all diagnostic trouble codes (DTCs).
4. Turn the ignition off for at least 10 seconds.
5. Attempt to start the engine.
6. If the engine is unable to start, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
7. If the engine starts and continues to run, the repair is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

5. DIESEL PARTICULATE FILTER VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. This procedure should be performed after the Diesel Particulate Filter has been replaced
3. With the scan tool, erase all diagnostic trouble codes (DTCs).
4. With the scan tool, perform the Diesel Particulate Filter Replacement procedure located in the Engine Misc. Function section.
5. Attempt to start the vehicle.
6. If the engine is unable to start, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
7. If the engine starts and continues to run, the repair is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

6. DIFFERENTIAL PRESSURE SENSOR VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

2. This procedure should be performed after the Differential Pressure Sensor has been replaced
3. With the scan tool, erase all diagnostic trouble codes (DTCs).
4. With the scan tool, perform the Differential Pressure Sensor Replacement procedure located in the Engine Misc. Function section.
5. Attempt to start the vehicle.
6. If the engine is unable to start, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
7. If the engine starts and continues to run, the repair is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

7. ROAD TEST VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. If this verification procedure is being performed after a non-DTC test, perform steps 3 and 4. If not, proceed to step 5.
3. Check to see if the initial symptom still exists. If there are no trouble codes and the symptom no longer exists, the repair was successful and testing is now complete.
4. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins (TSBs) and return to the Symptom List if necessary.
5. For previously read DTCs that have not been dealt with, return to the Symptom List and follow the diagnostic path for that DTC; otherwise, continue.
6. If the Engine Control Module (ECM) has been replaced, continue with step 9.
7. With the scan tool, erase all diagnostic trouble codes (DTCs), then disconnect the scan tool.
8. Turn the ignition off for at least 10 seconds.
9. If equipped with a Transfer Case Position Switch, perform step 10, otherwise, continue with step 11.
10. With the ignition switch on, place the Transfer Case Shift Lever in each gear position, stopping for 15 seconds in each position.
11. Road test the vehicle. For some of the road test, go at least 64 km/h (40 MPH). If this test is for an A/C Relay Control Circuit, drive the vehicle for at least 5 minutes with the A/C on.
12. At some point, stop the vehicle and turn the engine off for at least 10 seconds, then restart the engine and continue.
13. Upon completion of the road test, turn the engine off and check for DTCs with the scan tool.
14. If the repaired DTC has set again, the repair is not complete. Check for any pertinent Technical Service Bulletins (TSBs) and return to the Symptom List. If there are no DTCs, the repair was successful and is now complete.

Are any DTCs or symptoms remaining?

Yes

- Repair is not complete, refer to the appropriate diagnostic procedure.

No

- Repair is complete.

ENGINE 3.8L

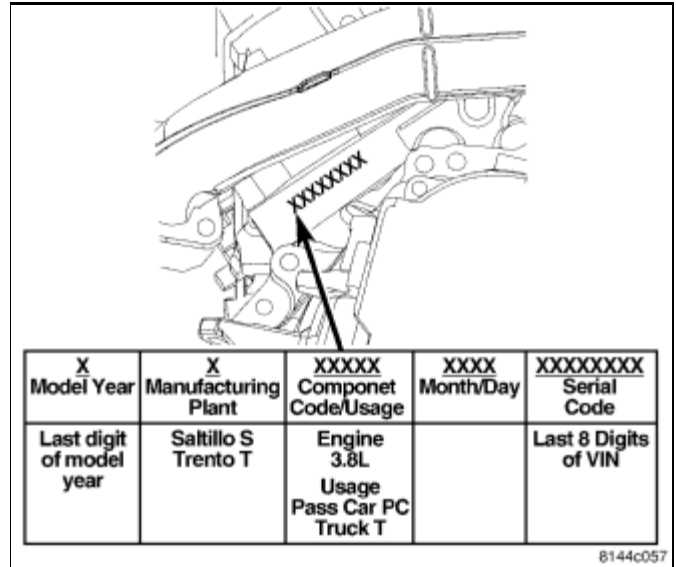
ENGINE 3.8L

DESCRIPTION

The 3.8 Liter (231 cu. in.) engine is 60° V-6 engines with cast iron cylinder blocks and aluminum cylinder heads. The engine uses a single, block mounted camshaft, roller lifters with pushrods to actuate the valves and either cracked cap, or standard cap, forged connecting rods. The engine does not have provisions for a free wheeling valve train.

The firing order is 1-2-3-4-5-6. The left cylinder bank is numbered 2, 4, and 6. The right cylinder bank is numbered 1, 3, and 5.

The engine identification number is located on the rear of the cylinder block just below the cylinder head.



DIAGNOSIS AND TESTING

INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Engine Mechanical and the Engine Performance diagnostic charts, for possible causes and corrections of malfunctions (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - PERFORMANCE).

For fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Hydraulic Lash Adjuster Noise Diagnosis

Engine Oil Leak Inspection

PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - DIAGNOSIS AND TESTING)
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.
	3. Faulty starter.	3. Test starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING)
	4. Faulty coil(s) or control unit.	4. Test and replace as needed. (Refer to Appropriate Diagnostic Information)
	5. Incorrect spark plug gap.	5. Set gap. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS)
	6. Contamination in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump.	7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information)
	8. Incorrect engine timing.	8. Check for a skipped timing belt/chain.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low.	1. Test minimum air flow. (Refer to Appropriate Diagnostic Information)
	2. Incorrect fuel mixture.	2. (Refer to Appropriate Diagnostic Information)
	3. Intake manifold leakage.	3. Inspect intake manifold, manifold gasket, and vacuum hoses.
	4. Faulty ignition coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs.	1. Clean plugs and set gap.
	2. Contamination in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Incorrect valve timing.	4. Correct valve timing.
	5. Leaking cylinder head	5. Replace cylinder head gasket.

	gasket.	
	6. Low compression.	6. Test compression of each cylinder.
	7. Burned, warped, or pitted valves.	7. Replace valves.
	8. Plugged or restricted exhaust system.	8. Perform exhaust restriction test. (Refer to 11 - EXHAUST SYSTEM - DIAGNOSIS AND TESTING) Install new parts, as necessary.
	9. Faulty ignition coil(s).	9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs.	1. Clean spark plugs and set gap.
	2. Contamination in Fuel System.	2. Clean fuel system and replace fuel filter.
	3. Burned, warped, or pitted valves.	3. Replace valves.
	4. Faulty ignition coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap.	1. Clean spark plugs and set gap.
	2. Faulty ignition coil(s).	2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	3. Dirty fuel injector(s).	3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Contamination in fuel system.	4. Clean system and replace fuel filter.

MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check and correct engine oil level.
	2. Thin or diluted oil.	2. Change oil to correct viscosity.
	3. Thick oil	3. (a) Change engine oil and filter.
		(b) Run engine to operating temperature.
		(c) Change engine oil and filter again.
	4. Low oil pressure.	4. Check and correct engine oil pressure problem.

	5. Dirt in hydraulic lifters/lash adjusters.	5. Replace hydraulic lifters/lash adjusters.	
	6. Worn rocker arms.	6. Inspect oil supply to rocker arms.	
	7. Worn hydraulic lifters/lash adjusters.	7. Replace hydraulic lifters/lash adjusters.	
	8. Worn valve guides.	8. Replace cylinder head assembly.	
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.	
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.	
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.	
	3. Thin or diluted oil.	3. Change oil to correct viscosity.	
	4. Thick oil	4. (a) Change engine oil and filter.	
		(b) Run engine to operating temperature.	
		(c) Change engine oil and filter again.	
	5. Excessive bearing clearance.	5. Measure bearings for correct clearance. Repair as necessary.	
	6. Connecting rod journal out-of-round.	6. Replace crankshaft or grind surface.	
	7. Misaligned connecting rods.	7. Replace bent connecting rods.	
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.	
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.	
	3. Thin or diluted oil.	3. Change oil to correct viscosity.	
	4. Thick oil	4. (a) Change engine oil and filter.	
		(b) Run engine to operating temperature.	
		(c) Change engine oil and filter again.	
	5. Excessive bearing clearance.	5. Measure bearings for correct clearance. Repair as necessary.	
	6. Excessive end play.	6. Check thrust bearing for wear on flanges.	

	7. Crankshaft journal out-of-round or worn.	7. Replace crankshaft or grind journals.
	8. Loose flywheel or torque converter.	8. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check engine oil level.
	2. Faulty oil pressure sensor/switch.	2. Replace oil pressure sensor/switch.
	3. Low oil pressure.	3. Check oil pressure sensor/switch and main bearing oil clearance.
	4. Clogged oil filter.	4. Install new oil filter.
	5. Worn parts in oil pump.	5. Replace worn parts or pump.
	6. Thin or diluted oil.	6. Change oil to correct viscosity.
	7. Oil pump relief valve stuck.	7. Remove valve and inspect, clean, or replace.
	8. Oil pump suction tube loose.	8. Remove oil pan and install new tube or clean, if necessary.
	9. Oil pump cover warped or cracked.	9. Install new oil pump.
	10. Excessive bearing clearance.	10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets.	1. Replace gasket(s).
	2. Loose fastener, broken or porous metal part.	2. Tighten, repair or replace the part.
	3. Misaligned or deteriorated cup or threaded plug.	3. Replace as necessary.
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction.	1. Check system and repair as necessary. (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS/PCV VALVE - DIAGNOSIS AND TESTING)
	2. Worn, scuffed or broken rings.	2. Hone cylinder bores. Install new rings.
	3. Carbon in oil ring slots.	3. Install new rings.

4. Rings fitted too tightly in grooves.	4. Remove rings and check grooves. If groove is not proper width, replace piston.
5. Worn valve guide(s).	5. Replace cylinder head assembly.
6. Valve stem seal(s) worn or damaged.	6. Replace seal(s).

ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil level indicator to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.
5. **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:
 - Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the outlet on the cover.
 - Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve outlet on the cover.
 - Attach an air hose with pressure gauge and regulator to the oil level indicator tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
 - If the leakage occurs at the crankshaft rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.
 7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

NOTE: If oil leakage is observed at the oil level indicator tube to block location; remove the tube, clean and reseal using Mopar® Stud & Bearing Mount (press fit tube applications only), and for O-ring style tubes, remove tube and replace the O-ring seal.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.
 - a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
 - b. Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.
7. After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Check engine oil level and add oil if necessary.
2. Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.
3. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
4. Remove the Auto Shutdown (ASD) relay from the PDC.
5. Be sure throttle blade is fully open during the compression check.
6. Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0–500 psi (Blue) pressure transducer (Special Tool CH7059) with cable adaptors to the DRBIII®. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).
7. Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.
8. Repeat the previous step for all remaining cylinders.
9. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
10. If one or more cylinders have abnormally low compression pressures, repeat the compression test.

11. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the pressure cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

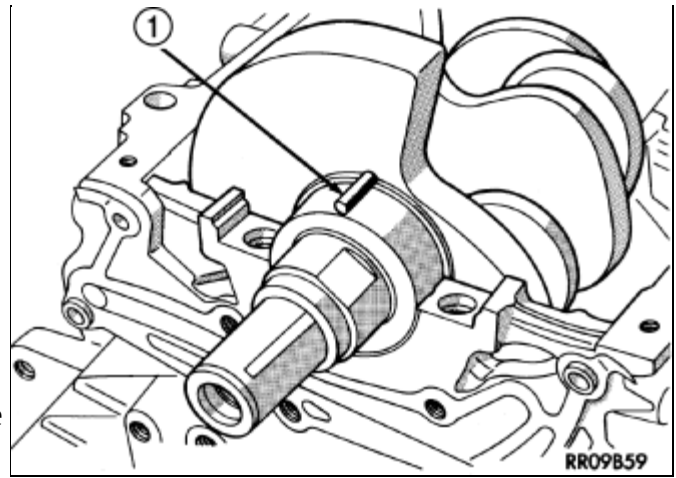
FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

STANDARD PROCEDURE

MEASURING BEARING CLEARANCE USING PLASTIGAGE

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

1. Remove oil film from surface to be checked. Plastigage is soluble in oil.
2. Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap/bed plate bolts of the bearing being checked to the proper specifications.



3. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Compare the clearance measurements to specifications found in the engine specifications table (Refer to 9 - ENGINE - SPECIFICATIONS). **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

4. Install the proper crankshaft bearings to achieve the specified bearing clearances.

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® BED PLATE SEALANT is a unique (green-in-color) anaerobic type gasket material that is

specially made to seal the area between the bed plate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

MOPAR® GASKET SEALANT is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

SEALER APPLICATION

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

ENGINE GASKET SURFACE PREPARATION

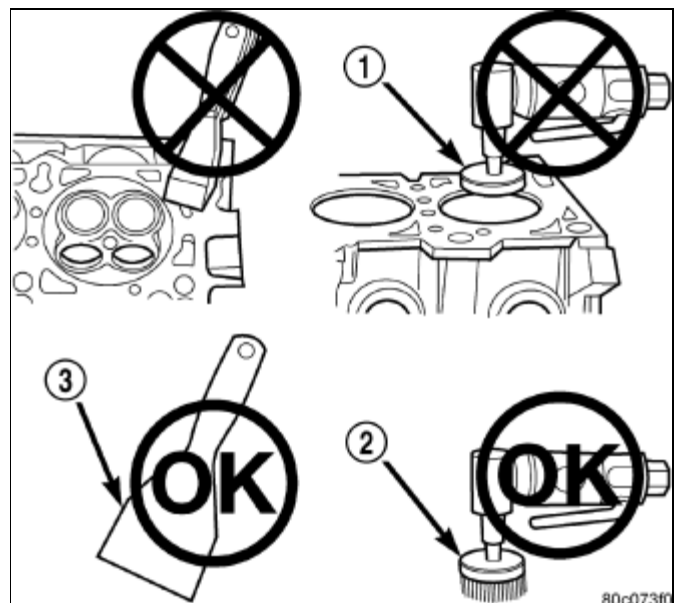
To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:



- Solvent or a commercially available gasket remover
- Plastic or wood scraper
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow)

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.

1. Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.
2. Remove negative battery cable.
3. Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.
4. With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.
5. Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).
6. Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)
7. Repair engine or components as necessary to prevent this problem from re-occurring.

CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

8. Install new spark plugs.
9. Drain engine oil and remove oil filter.
10. Install a new oil filter.
11. Fill engine with specified amount of approved oil.
12. Connect negative battery cable.
13. Start engine and check for any leaks.

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (excluding spark plug and camshaft bearing cap attaching threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original center line.

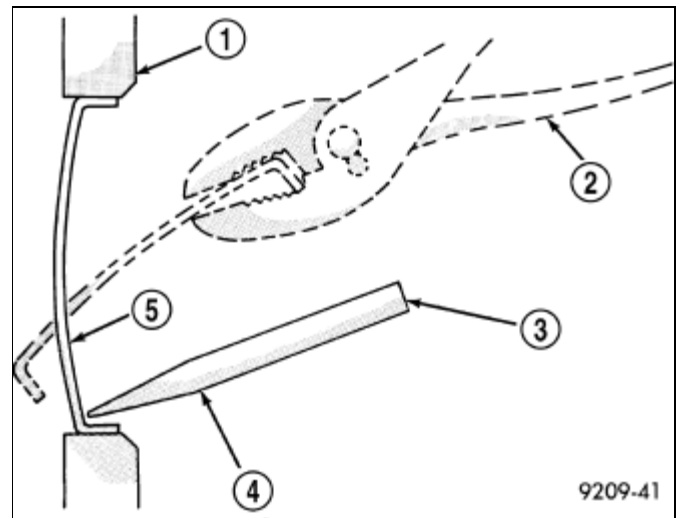
Heli-Coil tools and inserts are readily available from automotive parts jobbers.

ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug .

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

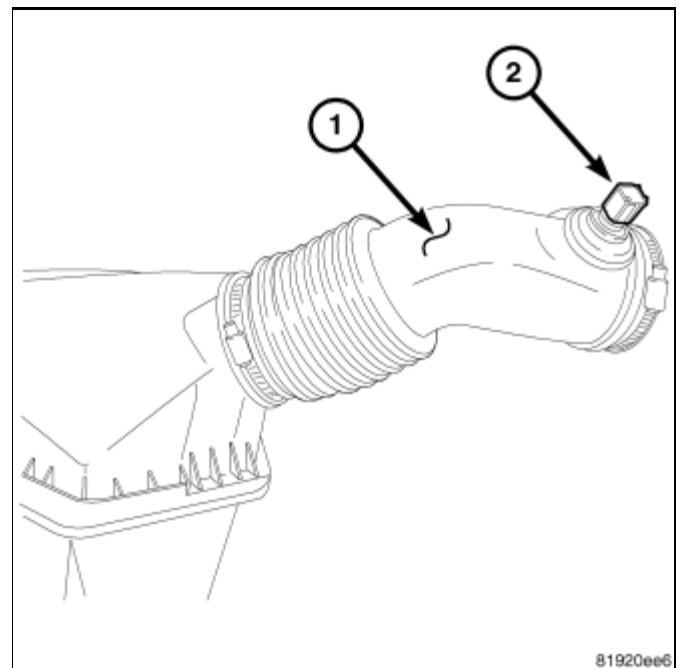
Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.



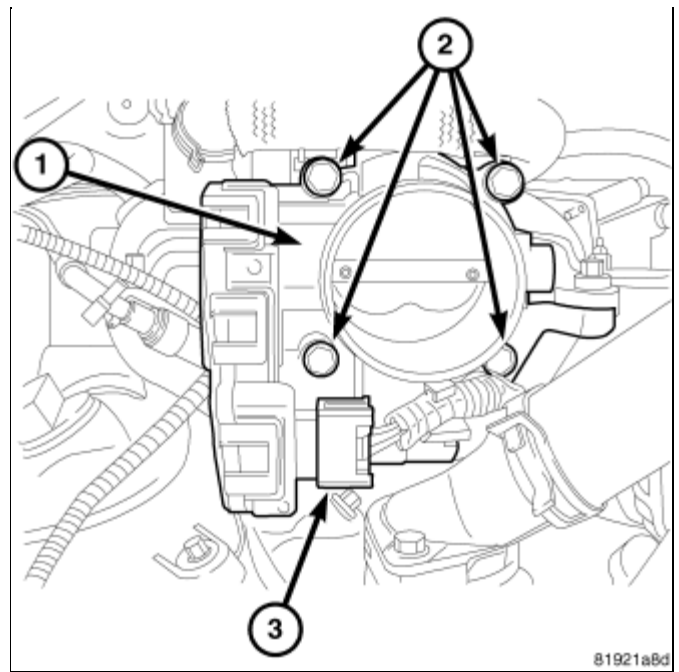
It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately. .

REMOVAL

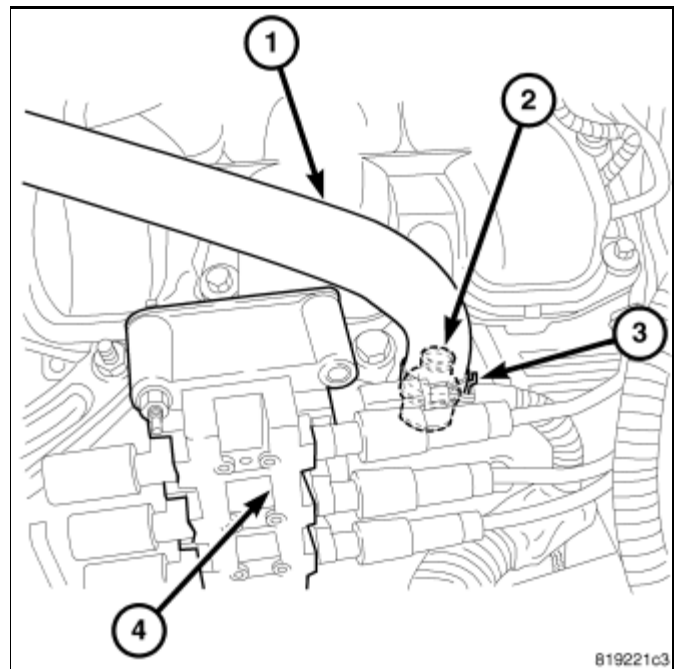
1. Perform fuel pressure release procedure. (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
2. Disconnect negative battery cable.
3. Disconnect the Inlet Air Temp Sensor (IAT) (2), and remove air cleaner hose (1) and housing.

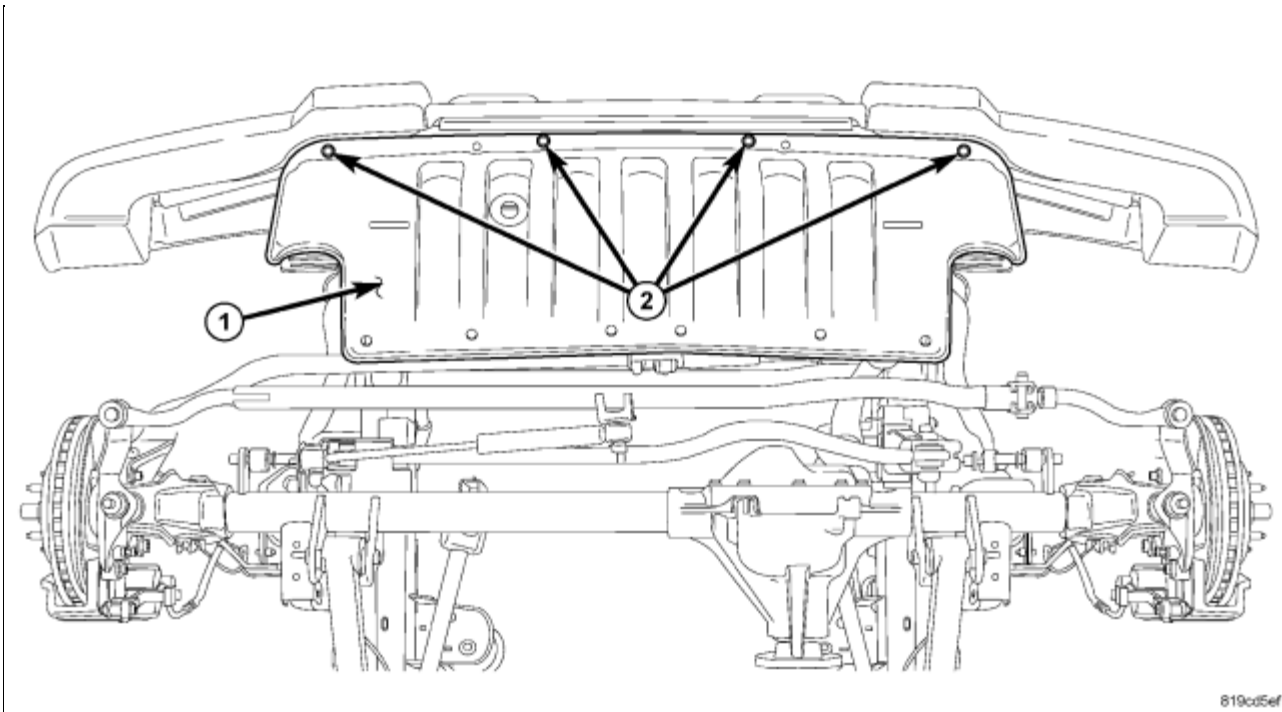


4. Evacuate and recover the air conditioning.
5. Disconnect the throttle control connectors (3) from the throttle body.



6. Disconnect the PCV hose (1) at the left cylinder head cover.

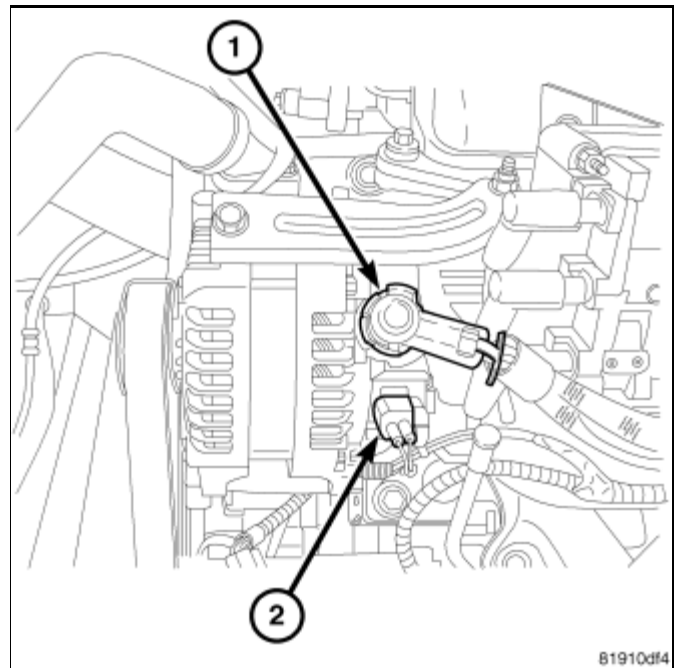




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7. Remove the front splash shield (1).
8. Drain the cooling system.
9. Disconnect the upper radiator hose from the thermostat housing and the lower radiator hose from the radiator.
10. Disconnect the heater hoses and coolant reservoir hose.

11. Disconnect the generator electrical connectors (1,2).

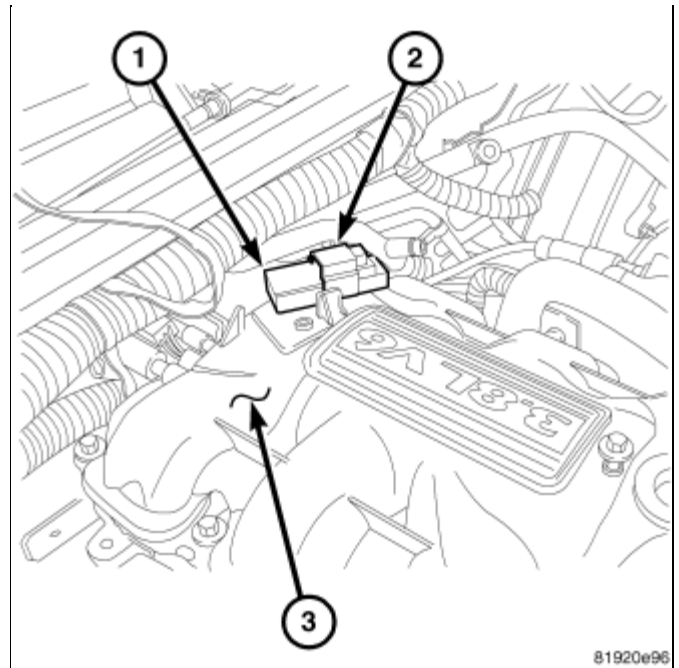


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12. Disconnect the throttle position (TP), idle air control (IAC) motor, oxygen (HO2), cam position (CMP), manifold absolute pressure (MAP) (2) and the two engine wiring

harness connectors. Free the harness from the cover studs and set harness aside.

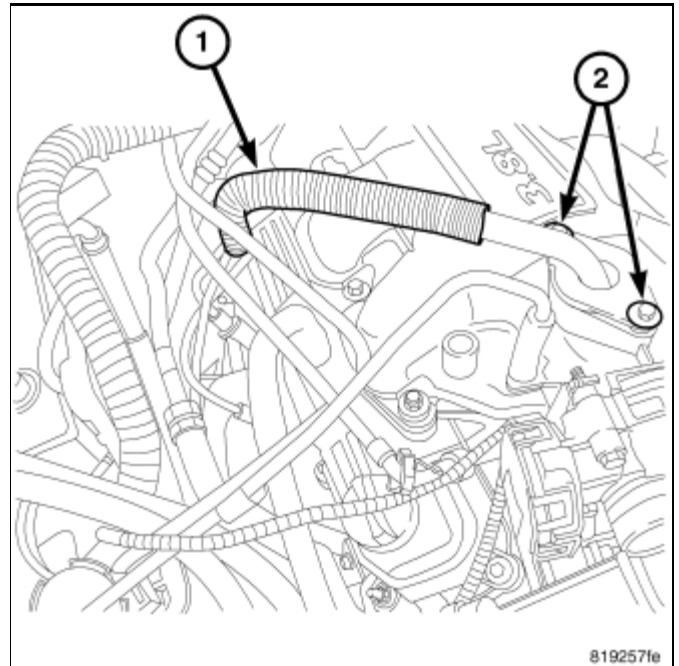
13. Disconnect the purge solenoid harness connector.



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14. Disconnect the EVAP hose from the throttle body.

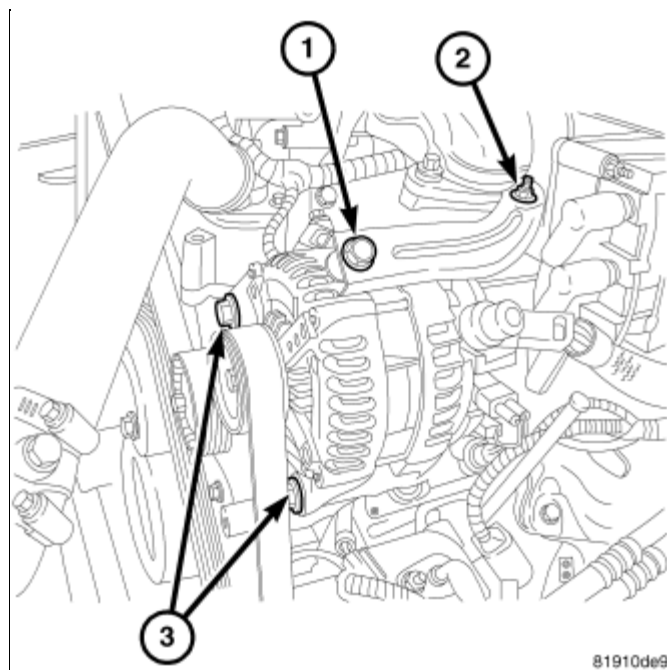
15. Remove the EGR tube (1) (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - REMOVAL).



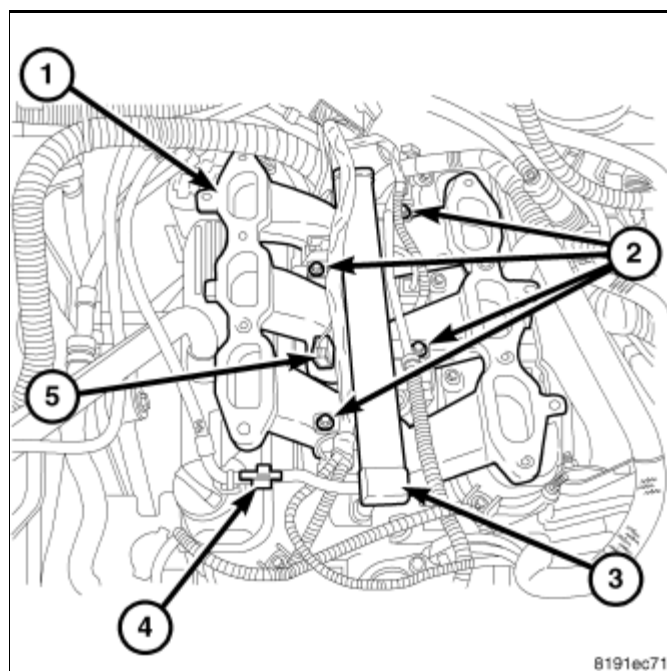
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16. Remove the drive belts.

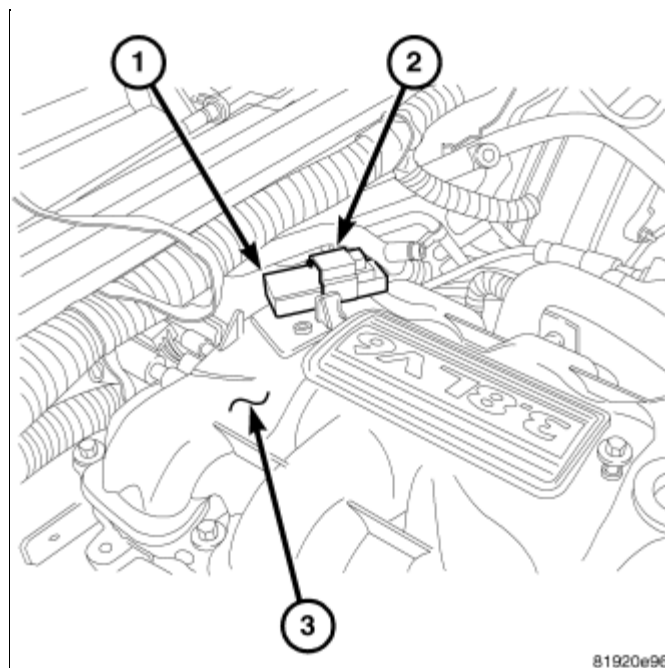
17. Remove the generator (3).



18. Disconnect the fuel line from fuel rail (4).
19. Remove engine wiring harness retainer from left cylinder head cover and oil level indicator tube.

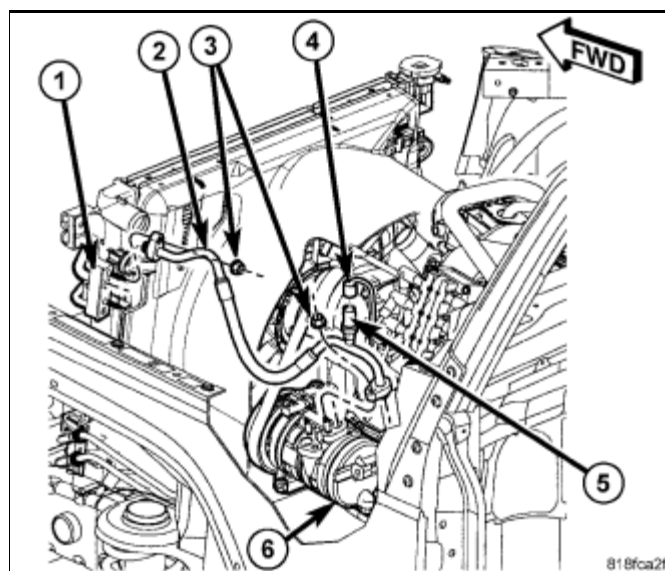


20. Disconnect the knock sensor wiring harness connector.
21. Remove the upper intake manifold (3).



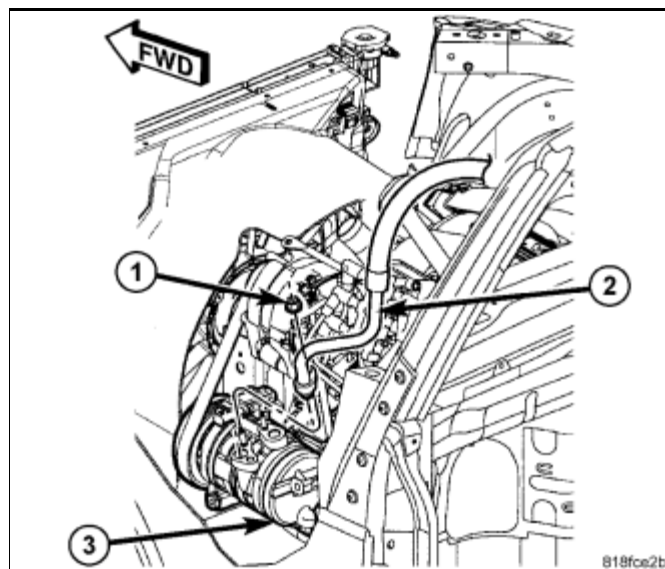
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22. Disconnect the A/C electrical connector.
23. Disconnect the A/C discharge line (2) from the compressor. Cover and seal all openings of hoses and compressor.



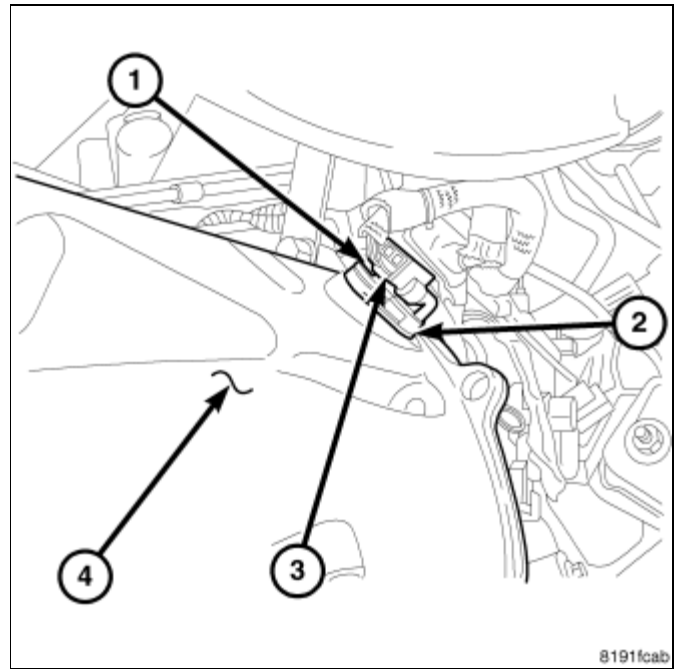
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24. Disconnect the A/C suction line (2) from the compressor. Cover and seal all openings of hoses and compressor.

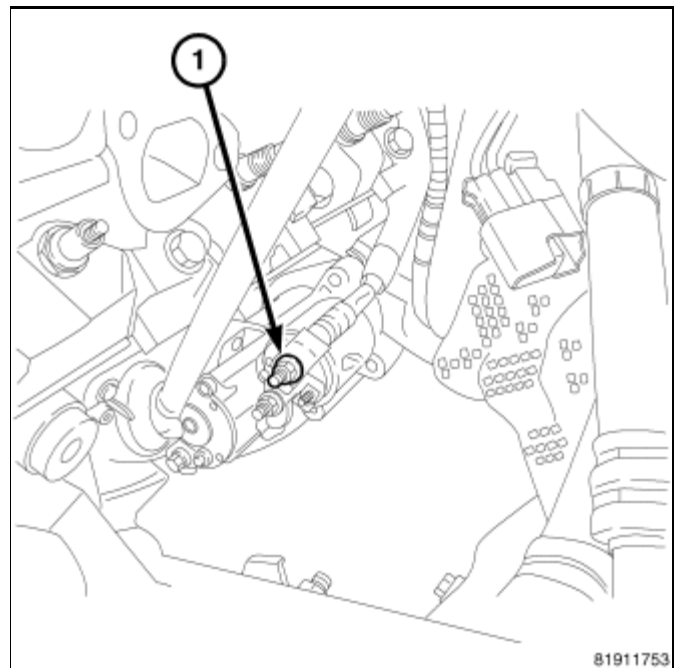


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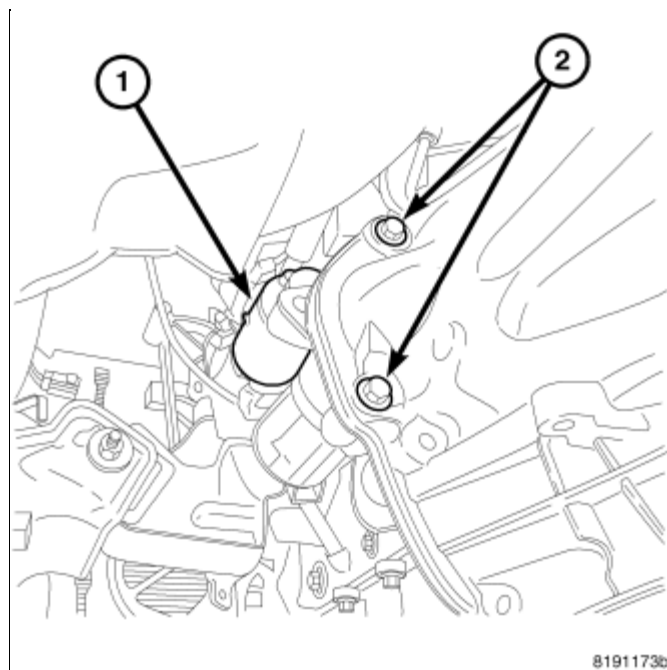
- 25. Disconnect the oil pressure sending unit (OPS).
- 26. Disconnect the coolant hose at the engine oil cooler.
- 27. Remove the crankshaft sensor (2), (CKP).



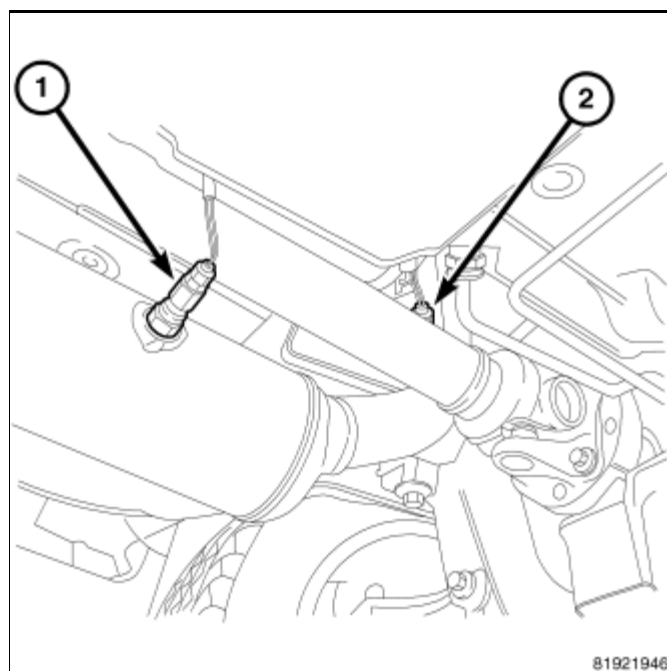
- 28. Disconnect the in block heater (if equipped).
- 29. Disconnect the starter wiring (1) and remove starter.



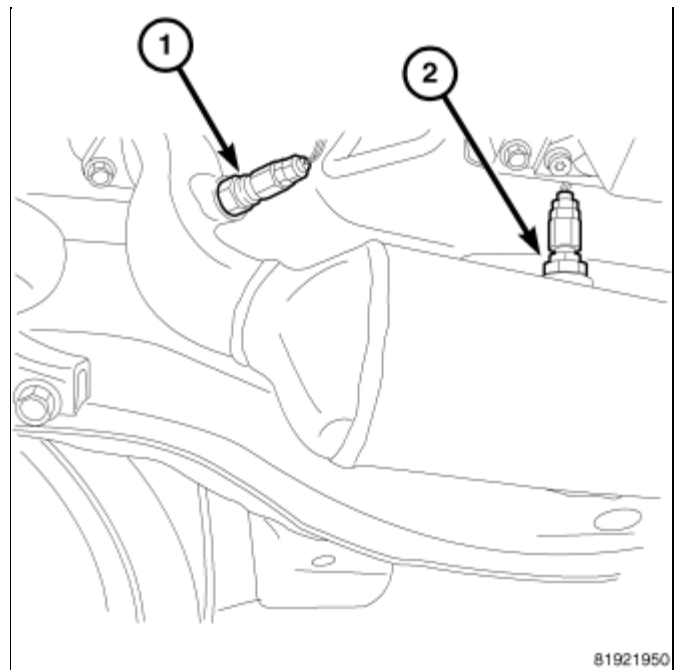
- 30. Remove the starter (1).
- 31. Remove the flex plate inspection cover. (If equipped).
- 32. Rotate the engine at the crankshaft pulley bolt and remove the torque converter bolts. (If equipped).



33. Disconnect the left side oxygen sensors (1,2).



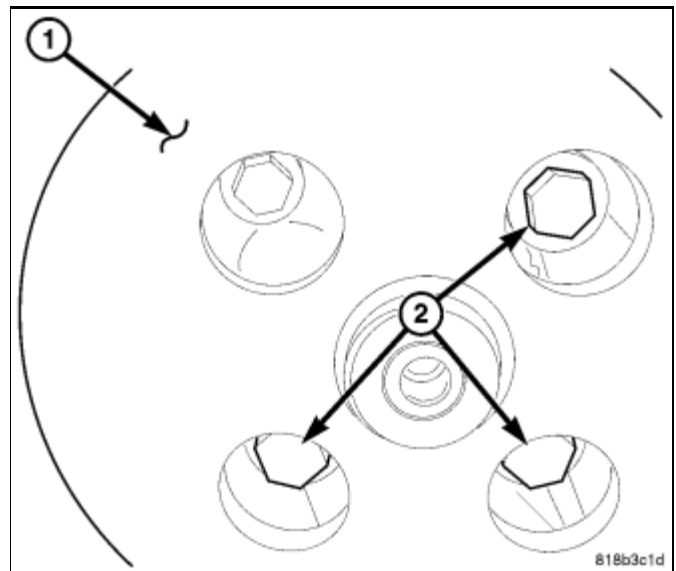
- 34. Disconnect the right side oxygen sensors (1,2).
- 35. Disconnect the exhaust pipes from the manifolds.
- 36. Remove the left and right exhaust manifolds.



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37. Remove the power steering pump mounting bolts (2) and pump, with hoses attached.

38. Remove the engine mount thru bolts.



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39. Remove the structural cover mounting bolts (1,2), and cover. (If equipped).

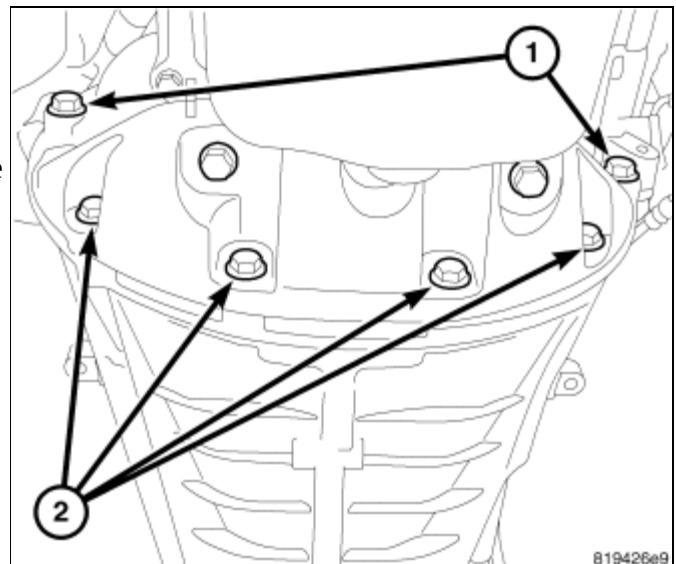
40. Support the transmission using a suitable jack.

41. Connect engine lifting chain to engine, and lift the engine using a suitable hoist.

42. Lift the engine using a suitable hoist.

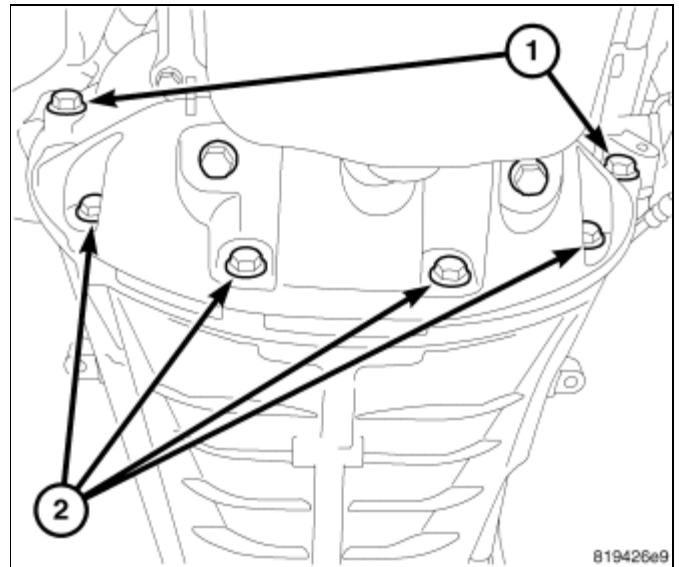
43. Separate the transmission from the engine.

INSTALLATION - ENGINE ASSEMBLY

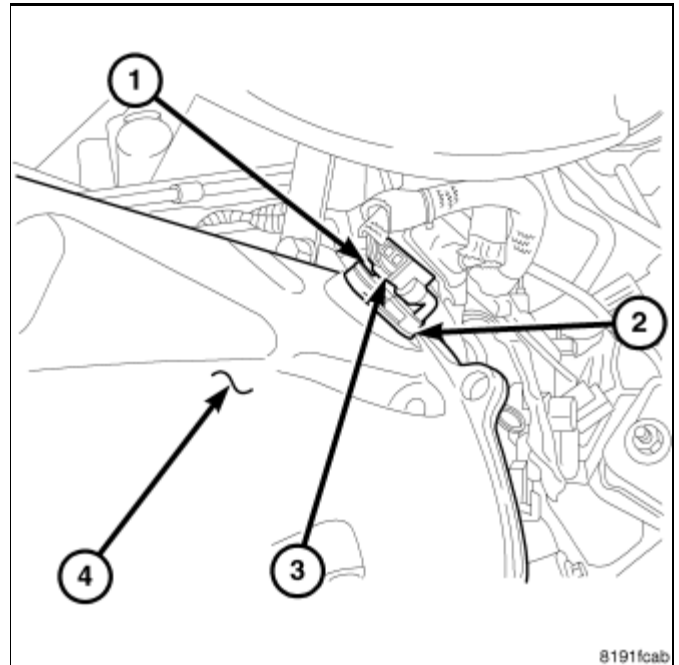


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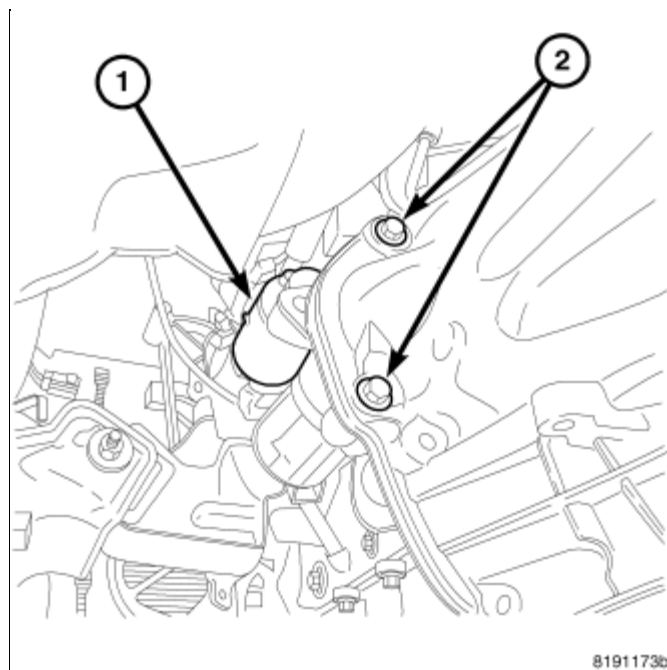
1. Position the engine in the vehicle.
2. Install the transmission bellhousing to engine mounting bolts (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - INSTALLATION) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION).
3. Tighten the engine mount thru bolts (Refer to 9 - ENGINE/ENGINE MOUNTING/FRONT MOUNT - INSTALLATION).
4. Install the torque converter bolts. (If equipped) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION).
5. Install the structural cover (1) (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).



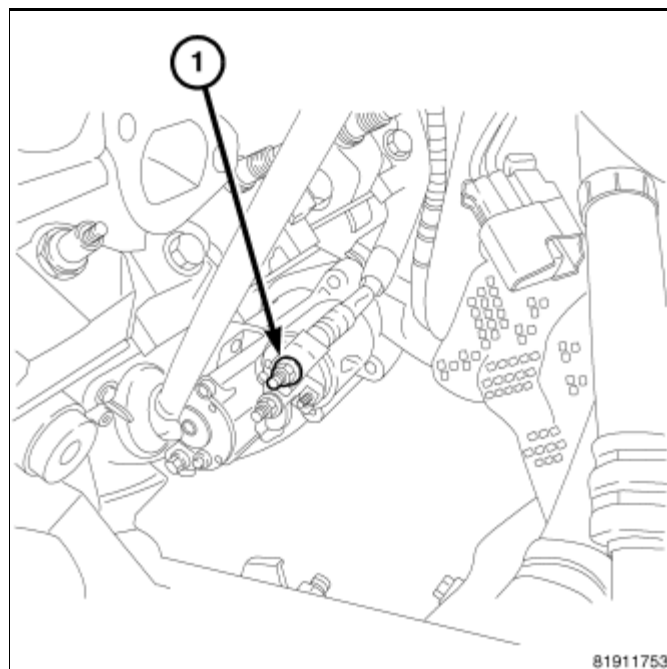
6. Install the crank position sensor (2) (CKP).



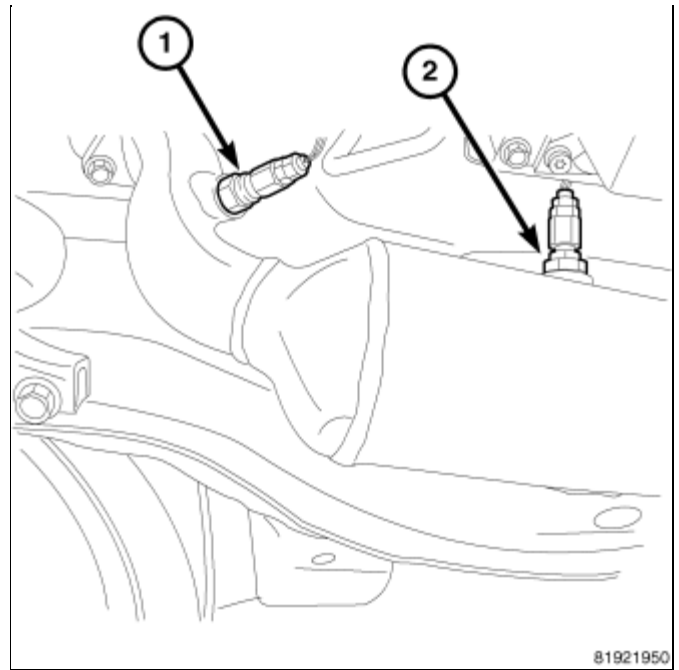
7. Install the starter (1) (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).



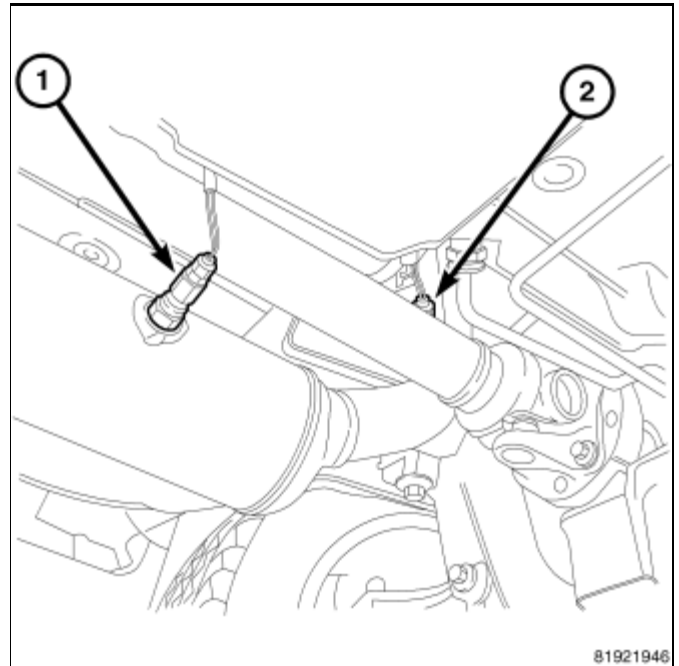
8. Install the flex plate inspection cover. (If equipped).
9. Connect the starter wiring (1) (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).



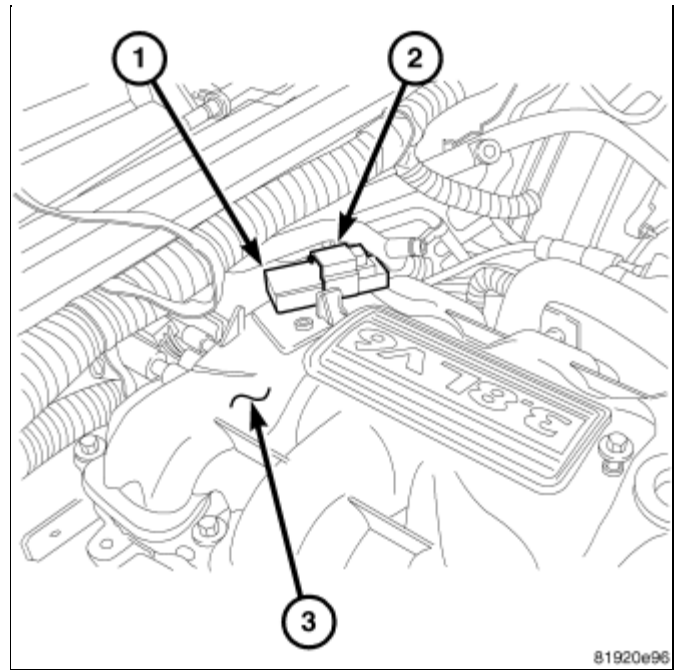
10. Connect the knock sensor electrical connector.
11. Install the left and right exhaust manifolds.
12. Connect the exhaust system and connect the right side O2 sensors (1,2).



13. Connect the left side O2 sensors (1,2).
14. Connect the in block heater (if equipped).
15. Connect the coolant hose at the engine oil cooler.



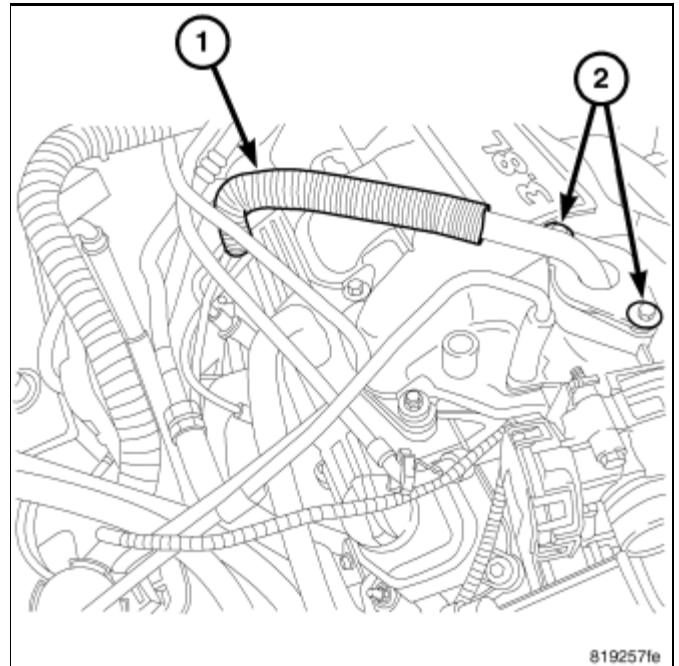
16. Connect the oil pressure sending unit (OPS) wiring harness connector.
17. Install the upper intake manifold (3) (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).



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18. Install the EGR tube (1) (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - INSTALLATION).

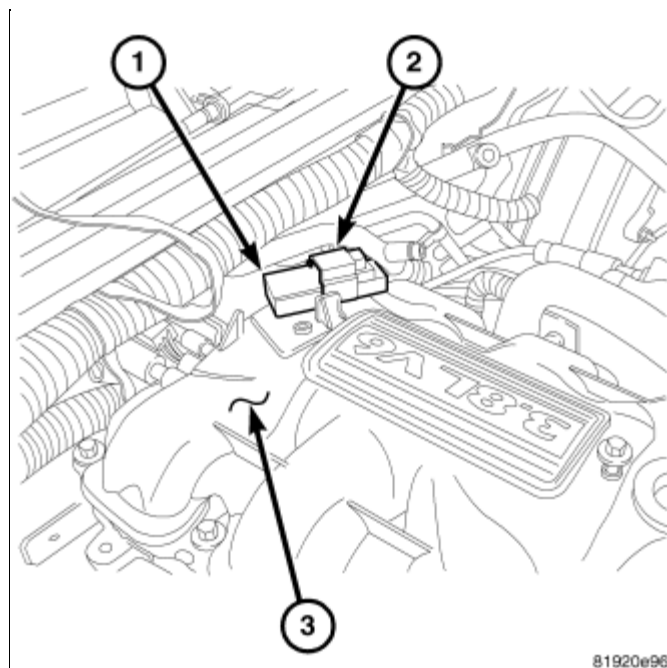
19. Connect the engine vacuum harnesses.



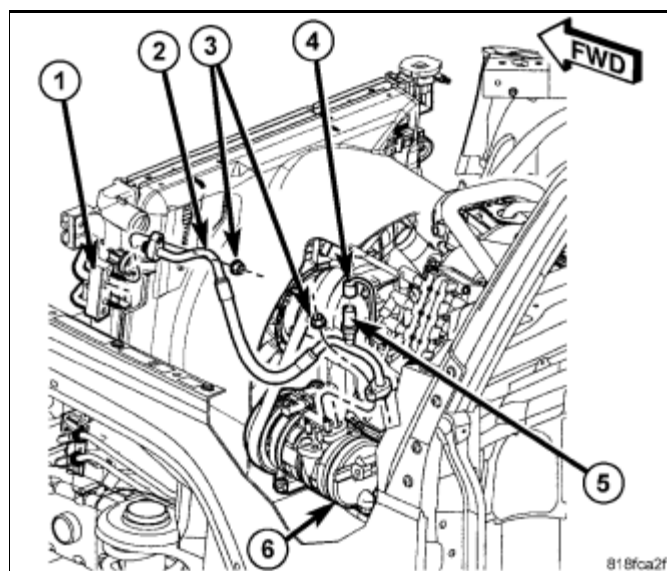
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20. Route the engine harness to the left cylinder head and attach the purge solenoid.

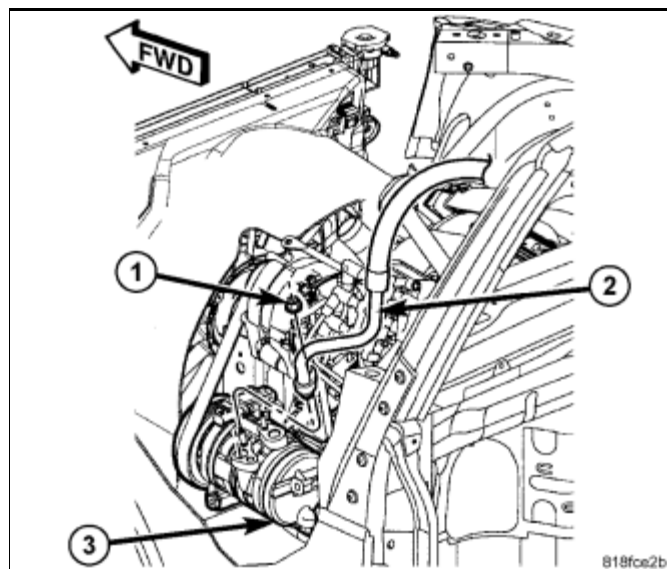
21. Connect the throttle position (TP), idle air control (IAC) motor, oxygen (H02), cam position (CMP), manifold absolute pressure (MAP) (2), and the engine wiring harness connectors.



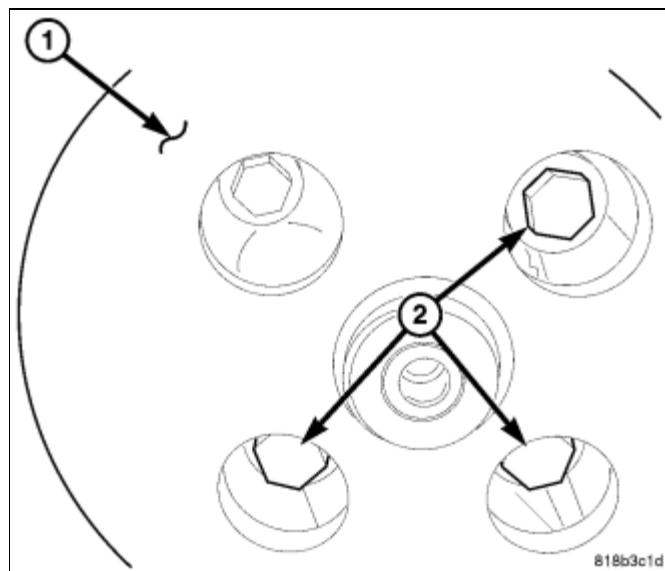
22. Connect the A/C discharge line (2) at the compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).



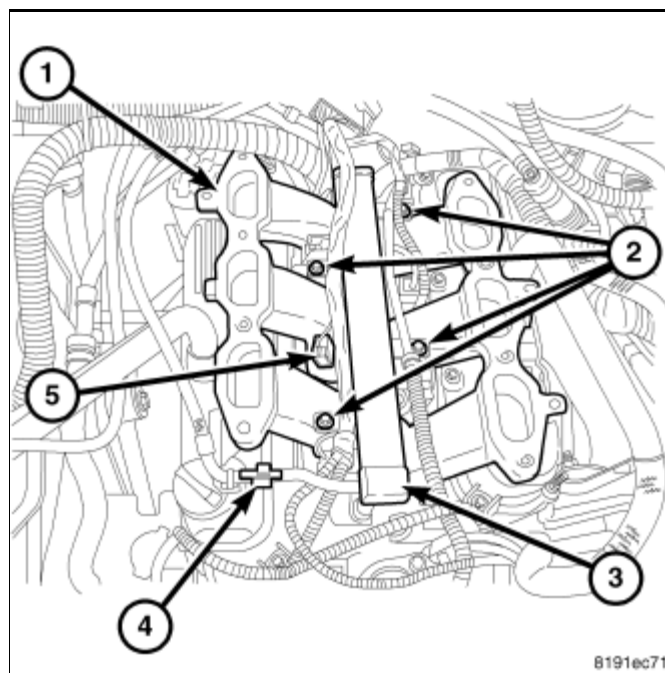
23. Connect the A/C suction line (2) at the compressor and compressor electrical connector (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).



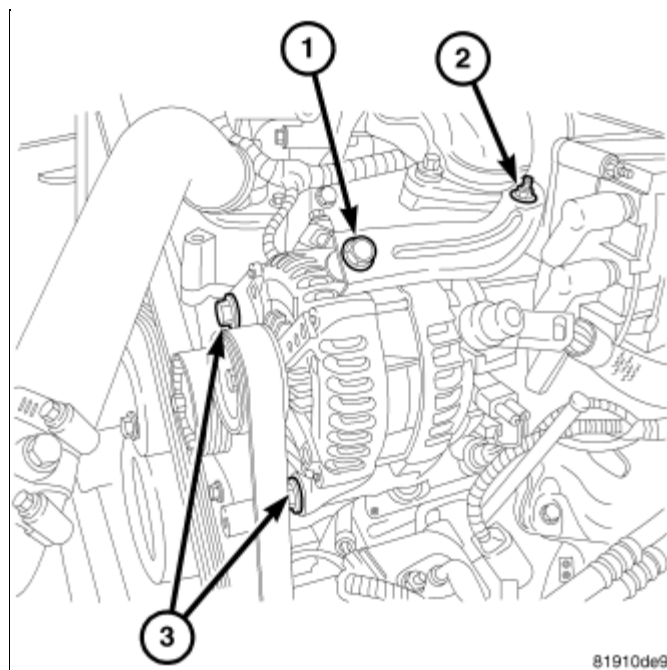
24. Install the power steering pump (1) (Refer to 19 - STEERING/PUMP - INSTALLATION).



25. Connect the fuel line (4) to the fuel rail.

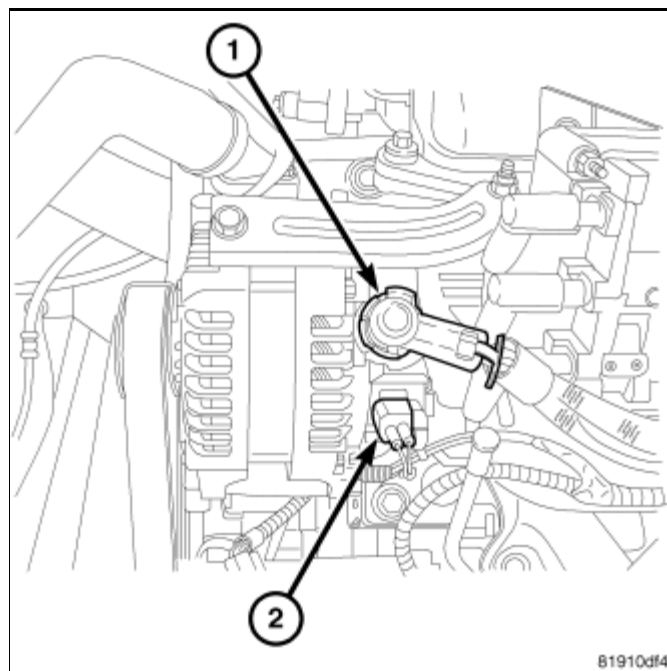


26. Install the generator (3) (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).



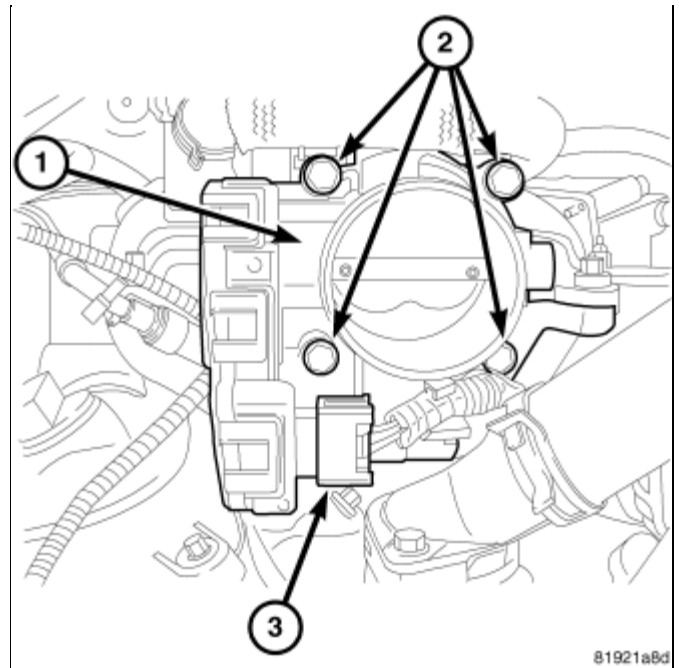
27. Reconnect the generator wiring. (1,2) (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

28. Install the drive belt.

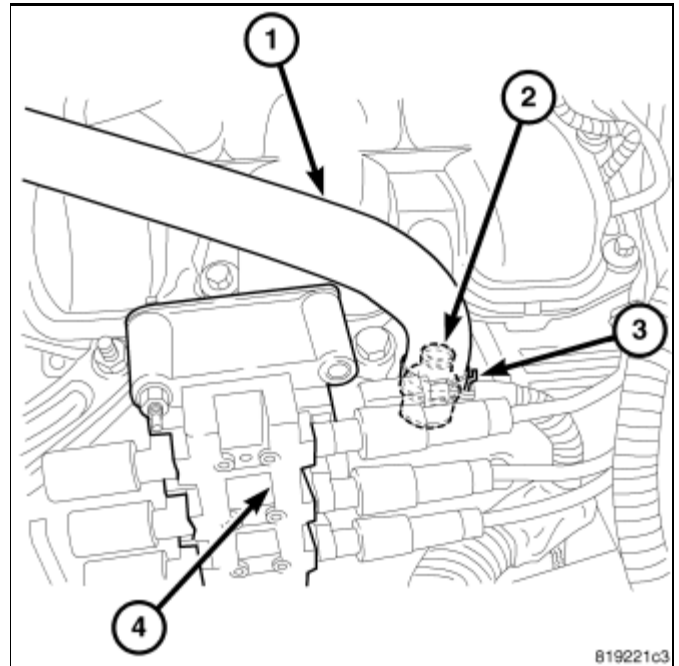


29. Connect the radiator, coolant reservoir and heater hoses.

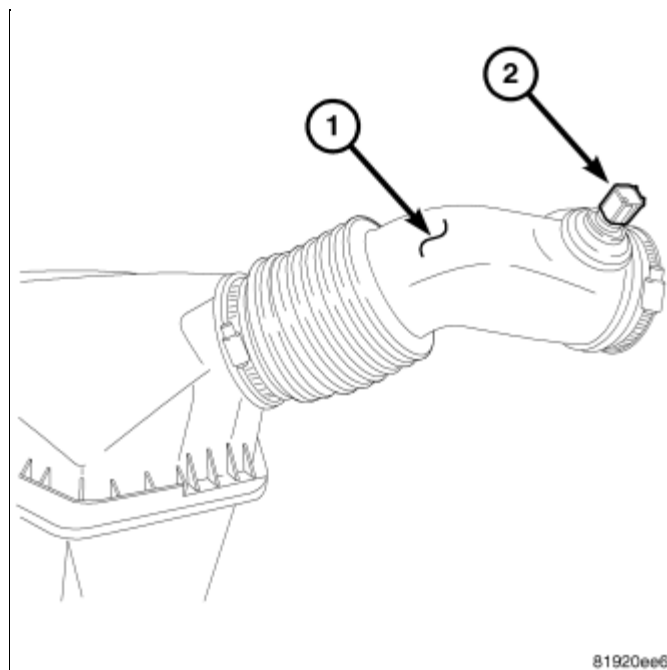
30. Connect the throttle wiring harness (ETC) (3).



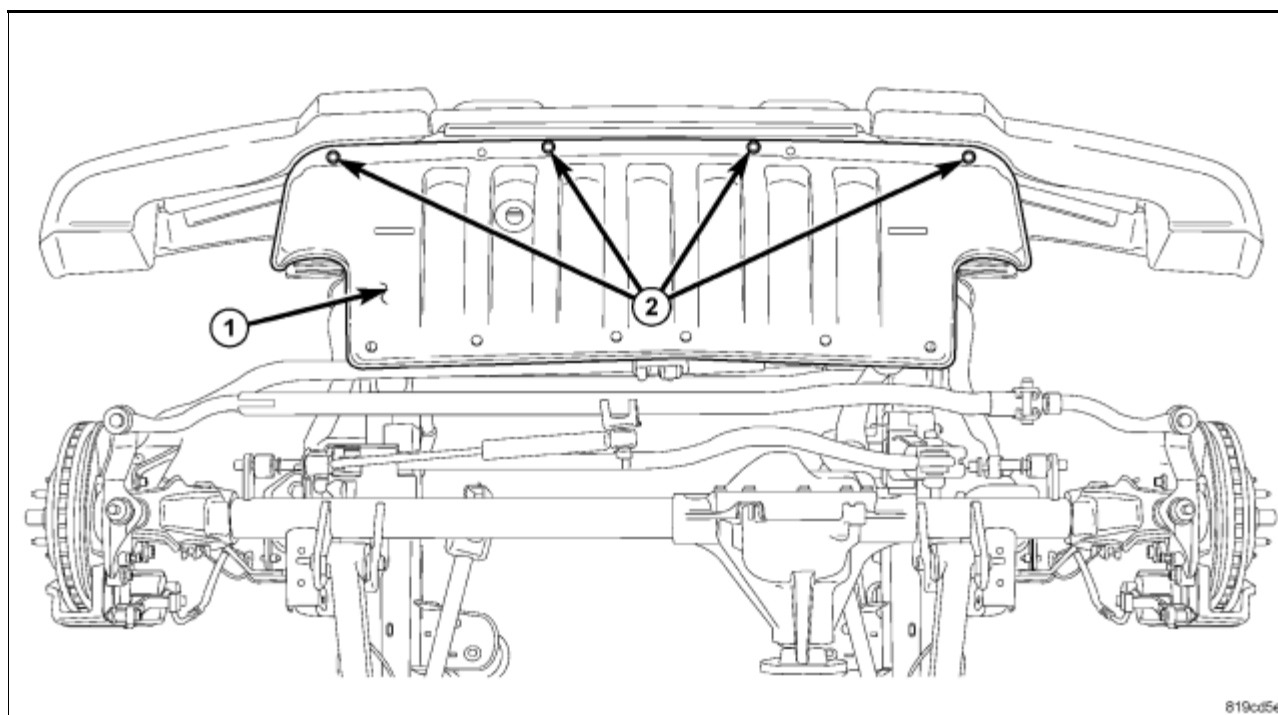
31. Install the PCV hose (1).
32. Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



33. Install the air cleaner housing, inlet hose (1) and inlet air temp sensor (IAT) (2) (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - INSTALLATION).
34. Evacuate and recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
35. Install new oil filter. Fill engine crankcase with proper oil to correct level (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).



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36. Install the front splash shield (1).
37. Connect negative cable to battery.
38. Start engine and run until operating temperature is reached.

SPECIFICATIONS

3.8L ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Engine Type	60° V-6 Engine	
Number of Cylinders	6	
Displacement 3.8L	3.8 Liters	231 cu. in.
Bore 3.8L	96.0 mm	3.779 cu.in.
Stroke	87 mm	3.425 in.
Compression Ratio 3.8L	-	9.6:1
Firing Order	-	1-2-3-4-5-6
Compression Pressure-Minimum	689.5 kPa	100 psi.
Cylinder Compression (Max. Difference Between Cylinders)	-	25%

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Bore Diameter (Standard) 3.8L	95.993-96.007 mm	3.7792-3.780 in.
Out of Round (Service Limits)	0.076 mm	0.003 in.
Taper (Service Limits)	0.051 mm	0.002 in.
Lifter Bore Diameter (early)	22.980-23.010 mm	0.905-0.906 in.
Lifter Bore Diameter (Late)	21.42-21.45 mm	0.843-0.844 in.
Deck Surface Flatness (Max.)	0.1 mm	0.004 in.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	57.985-58.005 mm	2.2829-2.2837 in.
Main Bearing Journal Diameter	63.987-64.013 mm	2.5192-2.5202 in.
Journal Out-of-Round (Max.)	0.005 mm	0.0002 in.
Journal Taper (Max.)	0.003 mm	0.0001 in.
End Play	0.09-0.24 mm	0.0036-0.0095 in.
Wear Limit	0.381 mm	0.015 in.
Main Bearing Diametrical Clearance 1-2-3-4	0.011-0.055 mm	0.0005-0.0022 in.
Wear Limit	0.076 mm	0.003 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.019-0.067 mm.	0.0007-0.0026 in.
Wear Limit	0.074 mm	0.003 in.
Side Clearance	0.135-0.405 mm	0.005-0.016 in.
Wear Limit	0.45 mm	0.017 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Diameter 3.8L-Measured 33.01 mm (1.30 in) From Piston Top	95.968-95.998 mm.	3.778-3.779 in.
Clearance in Bore @ Size Location (New)	-0.005-0.039 mm	-0.0002-0.0015 in.
Weight 3.8L	426 ± 5 grams	15.03 ± 0.1764 oz.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	Press Fit in Rod (Serviced as a Assembly)	
Clearance in Piston @ 21C (70°F)	0.006-0.019 mm	0.0002-0.0007 in.
Clearance in Connecting Rod	Interference Fit	
Diameter	22.87-22.88 mm	0.9007-0.9009 in.
Length 3.8L	71.25-71.75 mm	2.805-2.824 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring End Gap		
Top Compression Ring	0.20-0.36 mm	0.008-0.014 in.
Second Compression Ring	0.30-0.55 mm	0.012-0.022 in.
Oil Control (Steel Rails)	0.25-0.76 mm	0.010-0.030 in.
Wear Limit-Compression Rings	0.75 mm	0.030 in.
Wear Limit-Oil Control Steel Rails	1.88 mm	0.074 in.
Ring Side Clearance		
Top Compression Ring 3.8L	0.030-0.069 mm	0.0012-0.0027 in.
Second Compression Ring 3.8L	0.041-0.085 mm	0.0016-0.0033 in.
Oil Ring (Steel Ring)	0.015-0.225 mm	0.0006-0.0089 in.
Side Clearance Wear Limit- Top Ring	0.10 mm	0.004 in.

Side Clearance Wear Limit-2nd Ring	0.13 mm	0.005
Radial Wall Wear Limit Oil Ring Pack	0.038 mm	0.0015
Ring Width-Top Compression Ring 3.8L	1.175-1.190 mm	0.0462-0.0468
Ring Width-2nd Compression Ring 3.8L	1.47-1.49 mm	0.0579-0.0587 in.
Ring Width-Oil Ring (Steel Rails) 3.8L	0.435-0.490 mm	0.017-0.019

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter		
#1	50.724-50.775 mm	1.997-1.999 in.
#2	50.317-50.368 mm	1.9809-1.9829 in.
#3	49.936-49.987 mm	1.9659-1.9679 in.
#4	49.530-49.581 mm	1.9499-1.9520 in.
Bearing Clearance-Diametrical	0.025-0.101 mm	0.001-0.004 in.
Bearing Clearance (Max.Allowable)	0.127 mm	0.005 in.
End Play	0.254-0.508 mm	0.010-0.020 in.
Camshaft Bearing Diameter		
#1	50.800-50.825	1.9999-2.0009 in.
#2	50.393-50.419 mm	1.9839-1.9849 in.
#3	50.013-50.038 mm	1.9690-1.9699 in.
#4	49.606-49.632 mm	1.9529-1.954 in.
Exhaust Valve Timing		
Closes-3.8L (ATDC)	-	18°
Opens-3.8L (BBDC)	-	46°

Duration-3.8L	-	244°
Intake Valve Timing		
Closes-3.8L (ABDC)	-	63°
Opens-3.8L (ATDC)	-	1°
Duration-3.8L	-	242°
Valve Overlap-3.8L	-	17°

HYDRAULIC LIFTER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	Hydraulic Roller	
Outside Diameter (early)	22.949-22.962 mm	0.903-0.904 in.
Outside Diameter (Late)	21.387-21.405 mm	0.842-0.843 in.
Clearance in Block (early)	0.020-0.061 mm	0.0007-0.0024 in.
Clearance in Block (Late)	0.015-0.063 mm	0.0006-0.0025 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	0.65-0.75 mm	0.0026-0.0030 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard

Face Angle-Intake	-	45-45.5°
Face Angle-Exhaust	-	45-45.5°
Head Diameter-Intake	47.87-48.13 mm	1.88-1.89 in.
Head Diameter-Exhaust	35.37-35.63 mm	1.39-1.40 in.
Valve Lift (Zero Lash)-Intake and Exhaust-3.8L	11.0 mm	0.433 in.
Valve Length-Intake	125.84-126.6 mm	4.95-4.98 in.
Valve Length-Exhaust	127.20-127.96	5.00-5.04 in.
Valve Stem to Tip Height (valve tip to spring seat washer)-Intake	48.1-49.7 mm	1.89-1.95 in.
Valve Stem to Tip Height (valve tip to spring seat washer)-Exhaust	48.53-50.09 mm	1.91-1.97 in.

VALVE SEAT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Angle	-	44.5-45°
Run Out (Service Limits)	0.0762 mm	0.003 in.
Width-Intake and Exhaust	1.50-2.00 mm	0.057-0.078 in.

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Guide Bore Diameter (Std.)	6.975-7.00 mm	0.274-0.275 in.

VALVE MARGIN

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DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	0.825-0.973 mm	0.032-0.038 in.
Exhaust	1.565-1.713 mm	0.061-0.067 in.

VALVE STEM DIAMETER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake (Standard)	6.935-6.953 mm	0.2718-0.2725 in.
Exhaust (Standard)	6.906-6.924 mm	0.2718-0.2725 in.

VALVE STEM TO GUIDE CLEARANCE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	0.025-0.065 mm	0.001-0.0025 in.
Exhaust	0.059-0.094 mm	0.002-0.0037 in.
Max Allowable-Intake (Rocking Method)	0.247 mm	0.010 in.
Max Allowable-Exhaust (Rocking Method)	0.414 mm	0.016 in.

PUSH RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Length	135.438 mm	5.33 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length-Type A	51.1 mm	2.02 in.
Wire Diameter Type A	4.20-4.28 mm	0.15-0.19 in.
Number of Coils Type A	7.0	
Spring Tension (Valve Closed) Type A	376.4-424.4 N @ 41.9 mm	84.6-95.4 lbs. @ 1.65 in.
Spring Tension (Valve Open) Type A	884.9-983.3 N @ 30.4 mm	199.0-221.0 lbs. @ 1.22 in.
Installed Height	41.1-42.7 mm	1.61-1.68 in

LUBRICATION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed* (Minimum with engine at operating temperature)	34.47 kPa	5 psi
At 3000 RPM	205-551 kPa	30-80 psi
Oil Filter By-Pass Valve Setting	62-103 kPa	9-15 psi
Oil Pressure Switch Actuating Pressure	14-28 Kpa	2-4 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.		

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over rotors-Inner and Outer	0.10 mm	0.004 in.

Cover Out-Of-Flat (Max.)	0.025 mm	0.001 in.
Inner Rotor Thickness	7.64 mm	0.301 in.
Outer Rotor Thickness (Min)	7.64 mm	0.301 in.
Outer Rotor Clearance (Max)	0.039 mm	0.015 in.
Outer Rotor Diameter (Min)	79.95 mm	3.148 in.
Tip Clearance Between Rotors (Max)	0.20 mm	0.008 in.

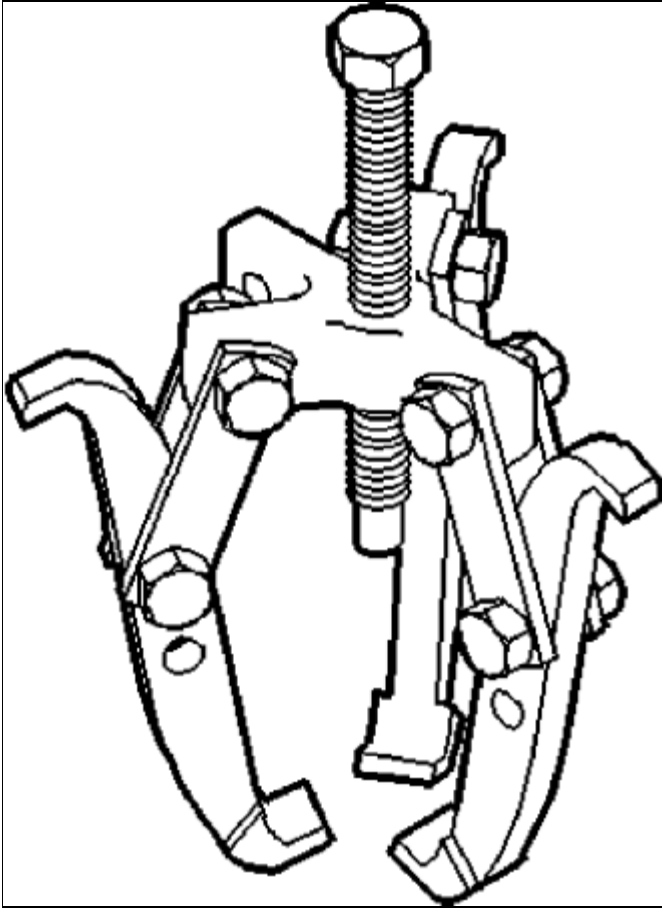
SPECIFICATIONS - TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket—Bolt	54	40	—
Camshaft Thrust Plate—Bolts	12	—	105
Forged Connecting Rod Cap-Nuts	54 +j turn	40 +j turn	—
Cracked Connecting Rod Cap-Bolts	(Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION)		
Crankshaft Main Bearing Cap-Bolts	41 +j turn	30 +j turn	—
Crankshaft Main Bearing Cap Cross Bolts (3.8L)	61	45	—
Crankshaft Oil Seal Retainer Rear-Bolts	12	—	105
Crankshaft Damper-Bolt	54	40	—
Cylinder Block Drain Plugs	20	15	—
Cylinder Head-Bolts	(Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION)		
Cylinder Head Cover-Bolts	12	—	105
Flex Plate to Crankshaft	88	65	—
Engine Mounting	(Refer to 9 - ENGINE/ENGINE MOUNTING)		
Exhaust Manifold-Bolts	23	—	200
Intake Manifold - Lower-Bolts	23	—	200

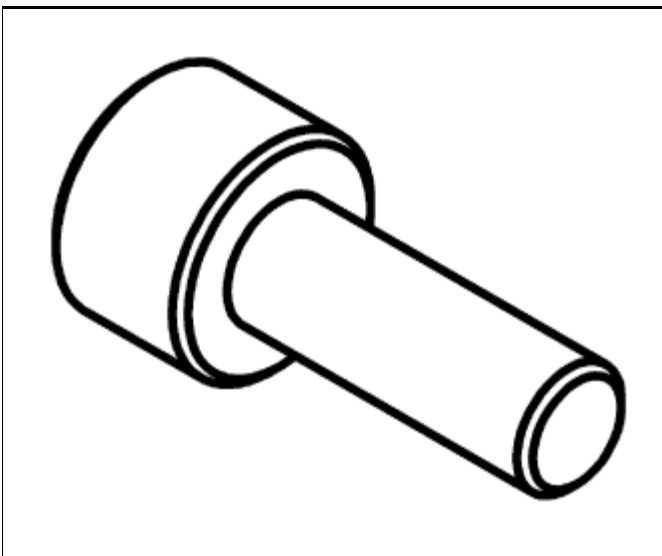
Intake Manifold - Lower Gasket Retainer-Bolts	12	—	105
Intake Manifold Upper-Bolts	12	—	105
Lifter Yoke Retainer-Bolts	12	—	105
Oil Filter Attaching Fitting	54	40	—
Oil Cooler Attaching Fitting	27	20	—
Oil Filter	20	15	—
Oil Filter Adapter-Bolts	28	—	250
Oil Gallery Plug	27	20	—
Oil Pan—Bolts	12	—	105
Oil Pan Drain-Plug	27	20	—
Oil Pressure Switch	23	—	200
Oil Pump Cover Plate-Screws	12	—	105
Oil Pump Pick-up Tube-Bolt	28	—	250
Oil Dipstick Housing-Bolts	48	35	—
Rocker Arm Shaft-Bolts	23	—	200
Spark Plug	16	12	—
Thermostat Housing	12	—	105
Timing Chain Case Cover			
—M8 Bolt	27	20	—
—M10 Bolt	54	40	—
Water Pump-Bolts	12	—	105
Water Pump Pulley-Bolts	28	—	250

SPECIAL TOOLS

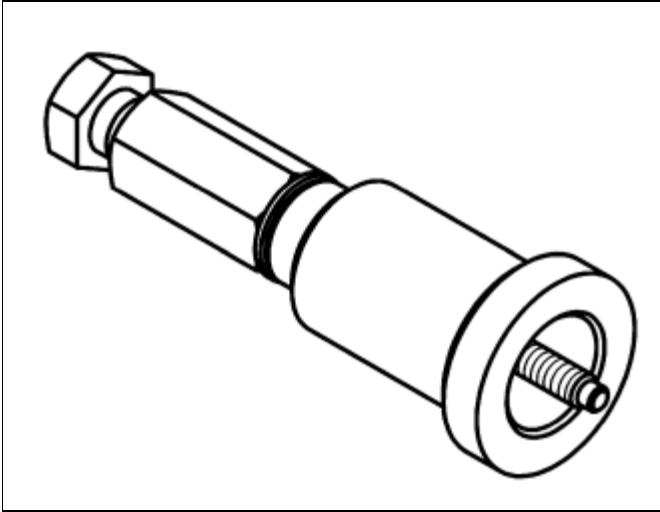
3.8L ENGINE



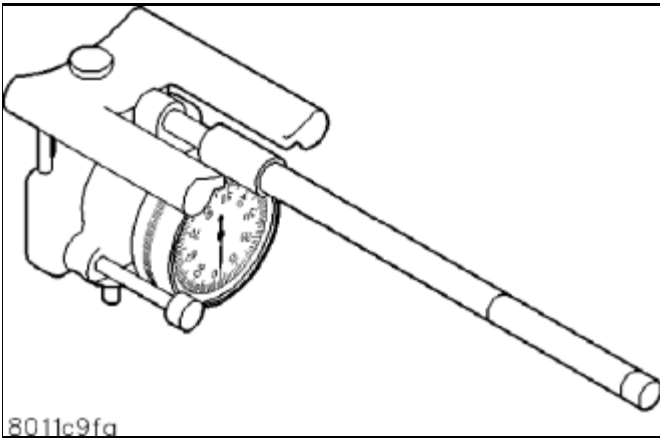
PULLER 1023



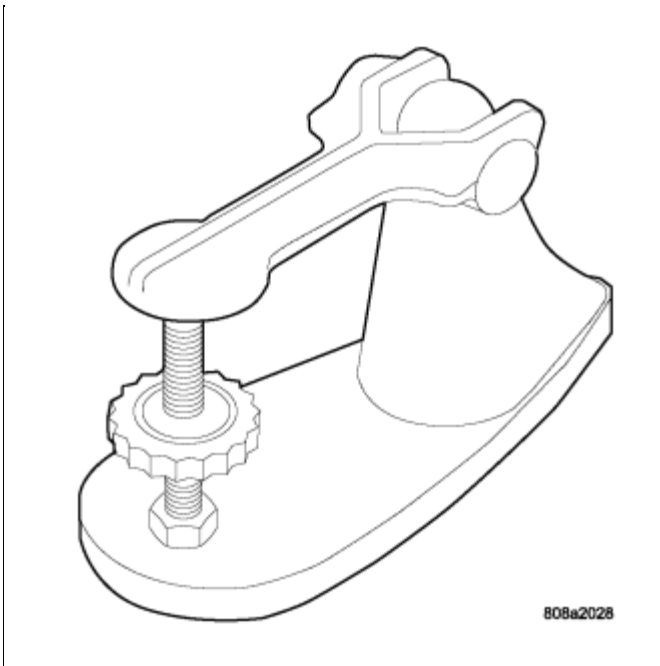
INSERT 8450



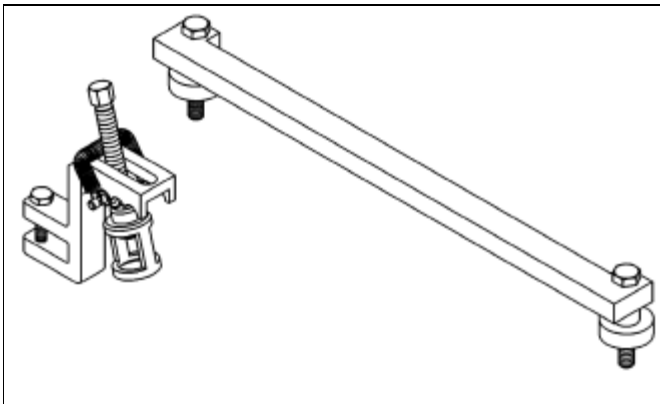
Crankshaft Damper/Sprocket Installer 8452



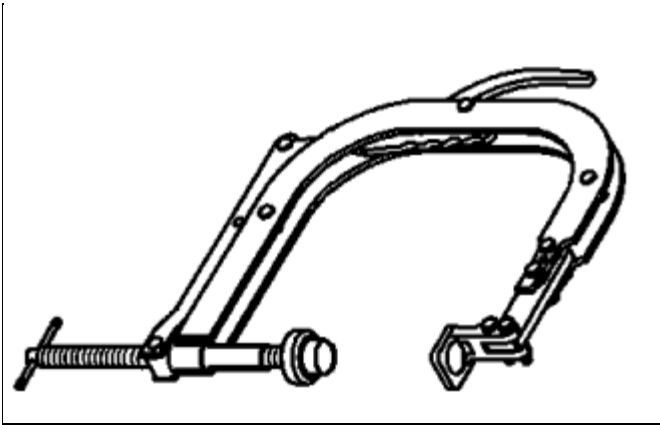
INDICATOR CYLINDER BORE C-119



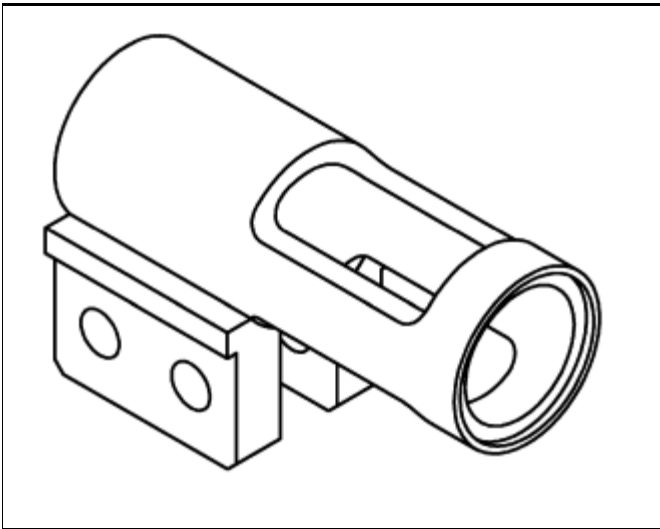
Valve Spring Tester C-647



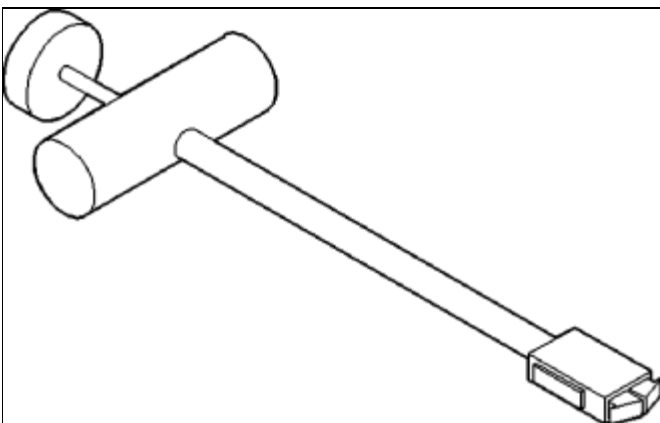
COMPRESSOR, VALVE SPRING 8453



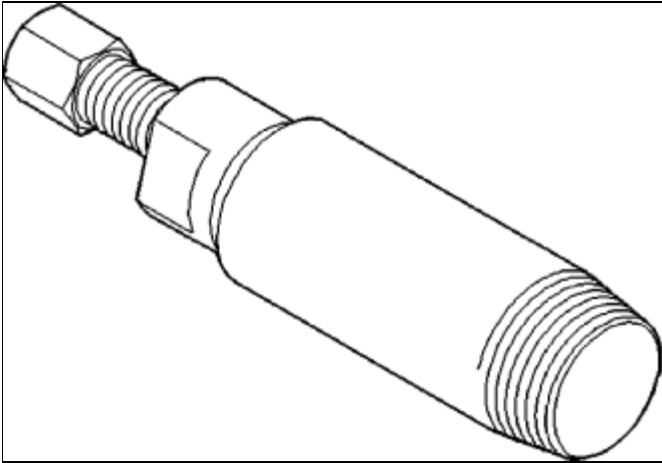
Valve Spring Compressor C-3422-D



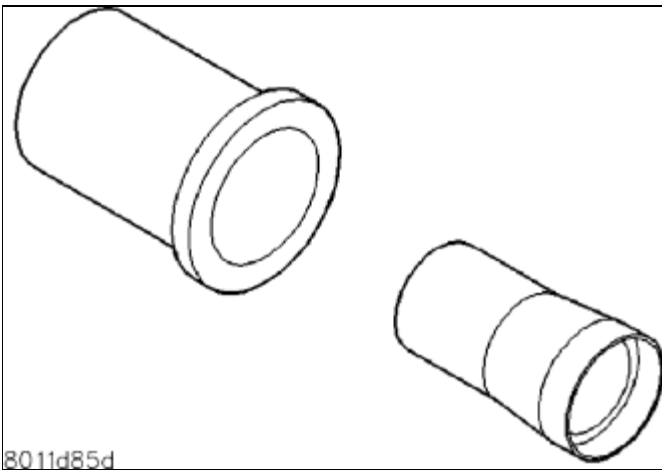
ADAPTER, VALVE SPRING 8464



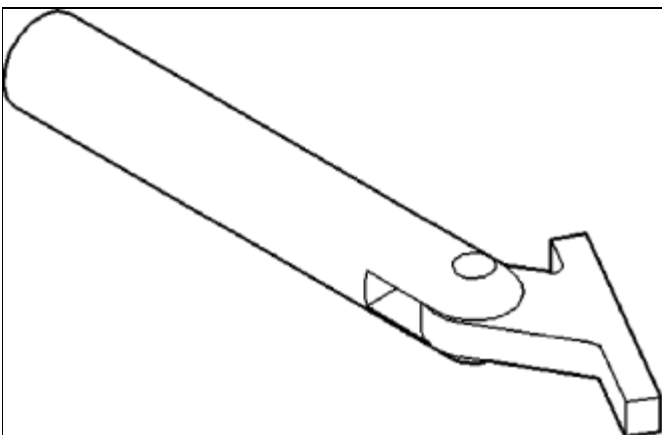
Valve Tappet

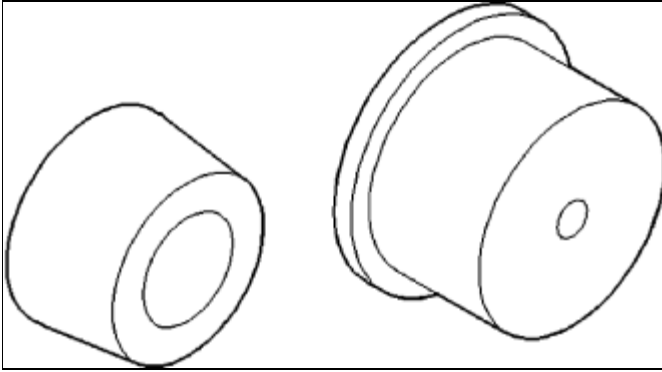
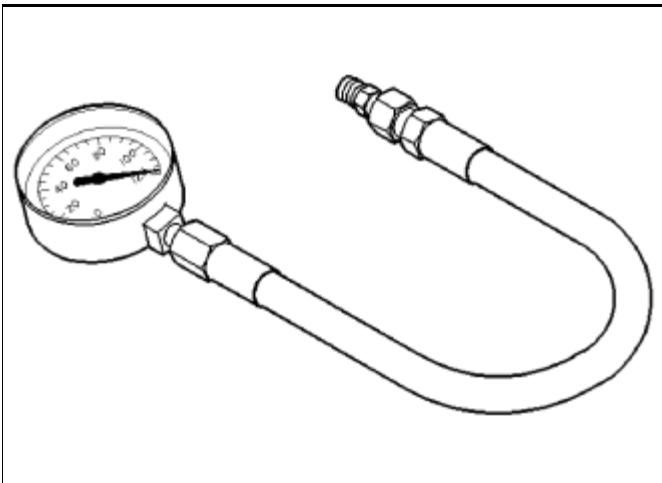


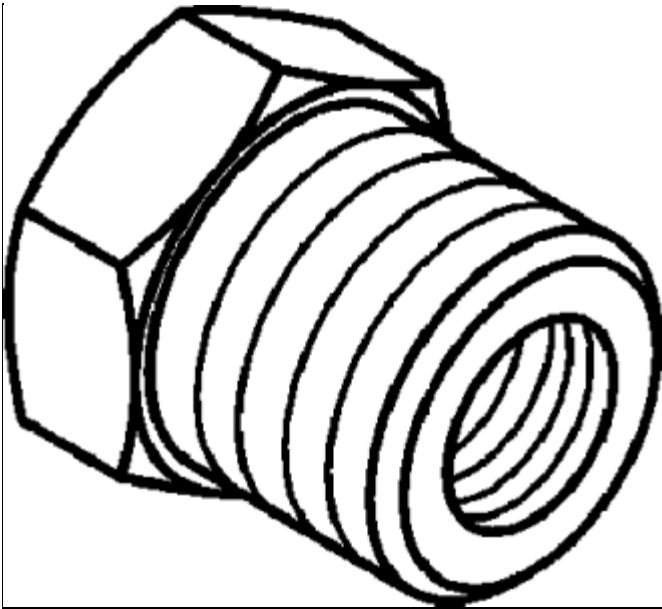
Front Crankshaft Seal Remover 6341A



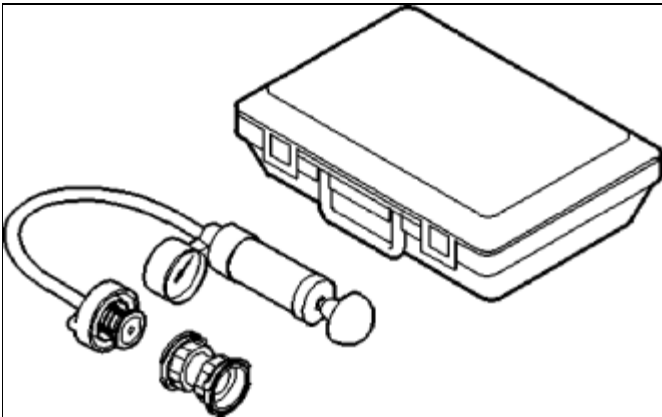
Seal Installer C-4992



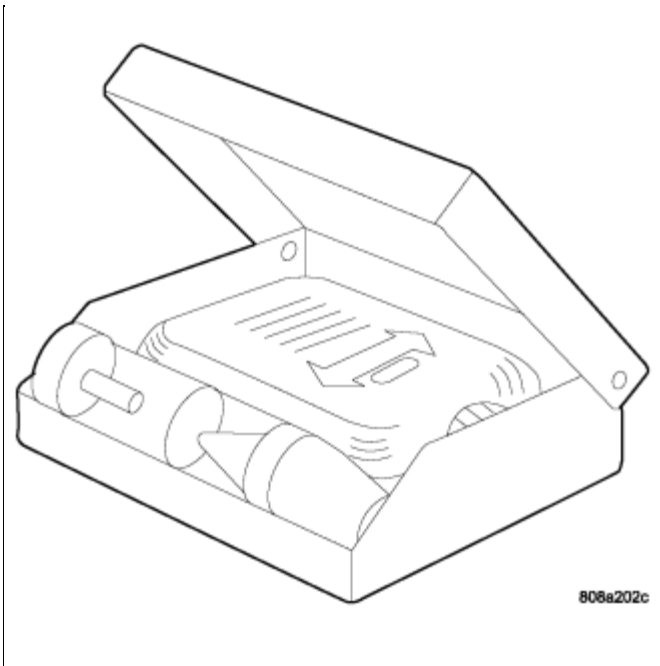
Crankshaft Main Bearing Remover C-3059**Rear Crankshaft Oil Seal Installer 6926****Oil Pressure Gauge C-3292**



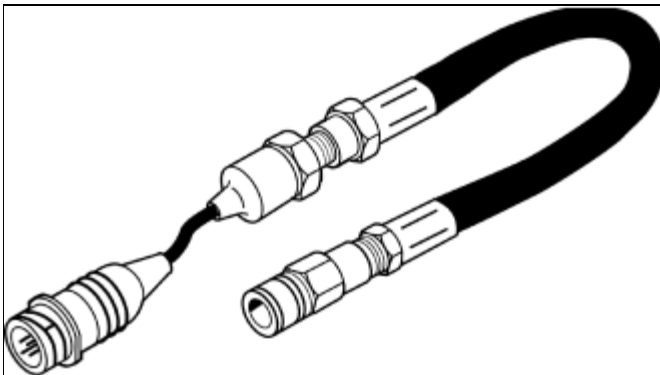
Adaptor 8406



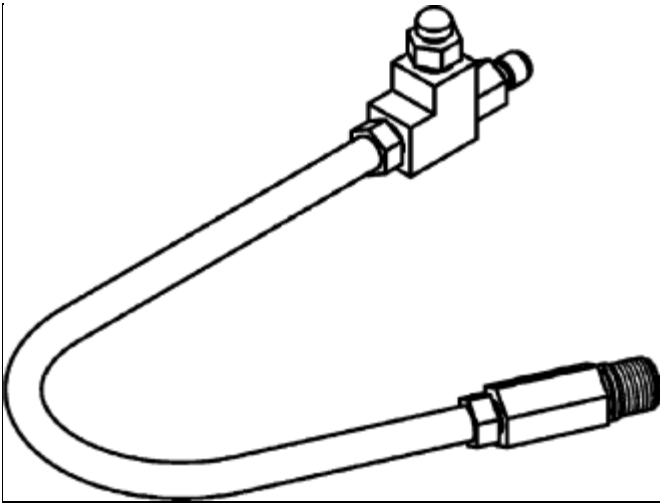
Pressure Tester Kit 7700



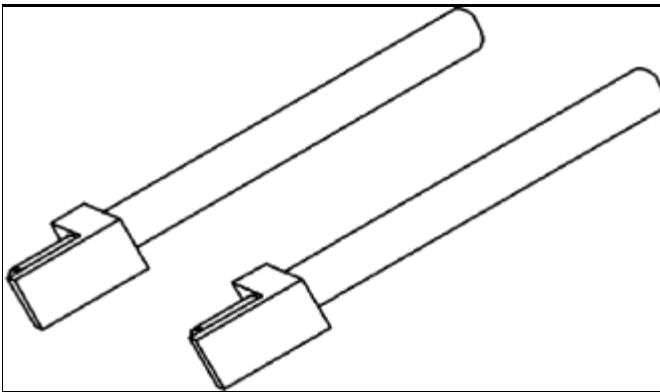
BLOC-CHEK KIT C-3685



Pressure Transducer CH7059



Cylinder Compression Pressure Adaptor 8116



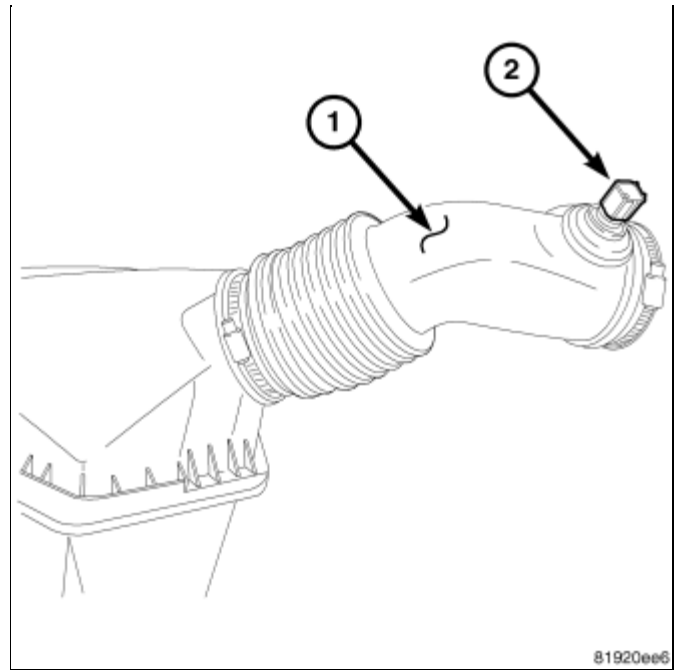
Connecting Rod Guides 8189

ELEMENT-AIR CLEANER

REMOVAL

1. Disconnect the IAT sensor (2).
2. Disconnect the CCV hose.
3. Separate the air inlet tube from the throttle body.
4. Remove the air cleaner cover bolts.
5. Lift cover and pull toward the engine and remove cover tabs from air cleaner housing.
6. Lift cover and remove the filter.

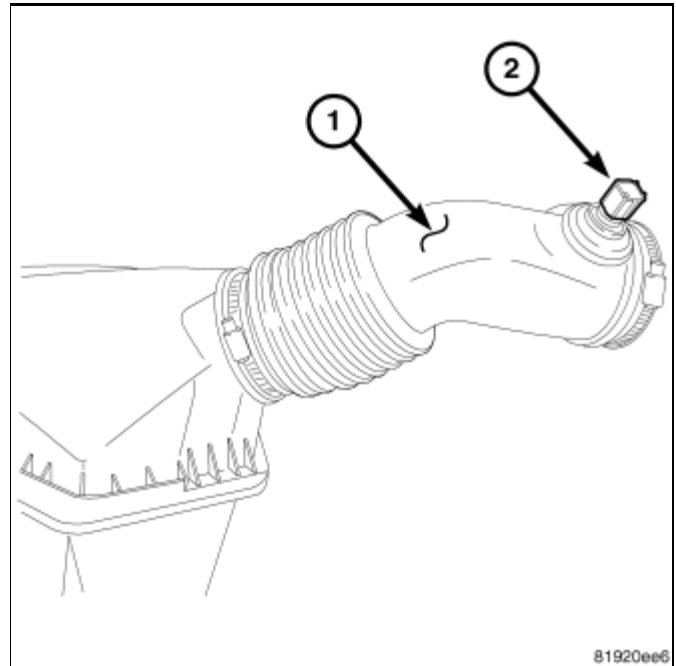
INSTALLATION



1. Install the air filter element into air box.
2. Move cover so that the tabs insert into the air cleaner housing.
3. Position the cover down over the element and lower housing and tighten the fasteners.
4. Connect the air inlet tube to the throttle body and tighten the clamp.
5. Connect the IAT sensor (2).
6. Connect the CCV hose.

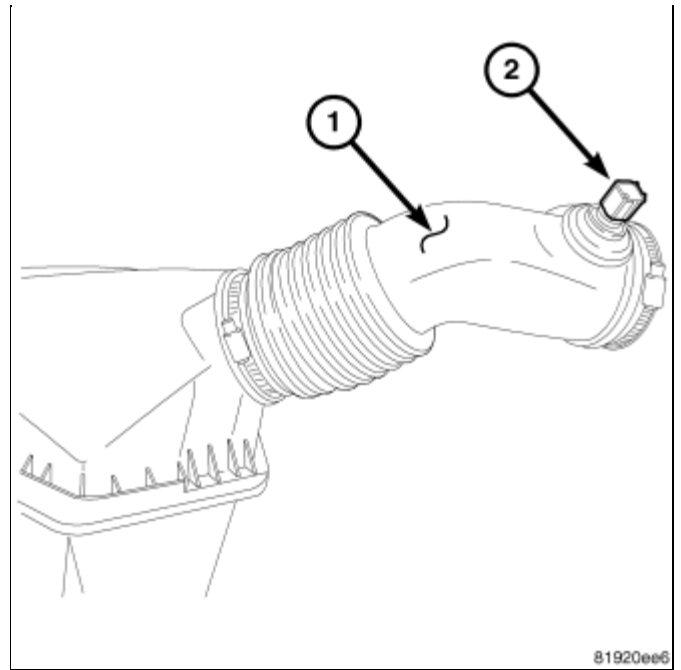
HOUSING-AIR CLEANER

REMOVAL



1. Disconnect the negative battery cable.
2. Disconnect the inlet air temperature sensor (2).
3. Disconnect the CCV hose from the air cleaner cover.
4. Remove the air inlet tube to throttle body.
5. Remove the bolt for air cleaner housing at upper radiator cross member.
6. Pull air box up and off over the single locating pin.
7. Remove air box from vehicle.

INSTALLATION

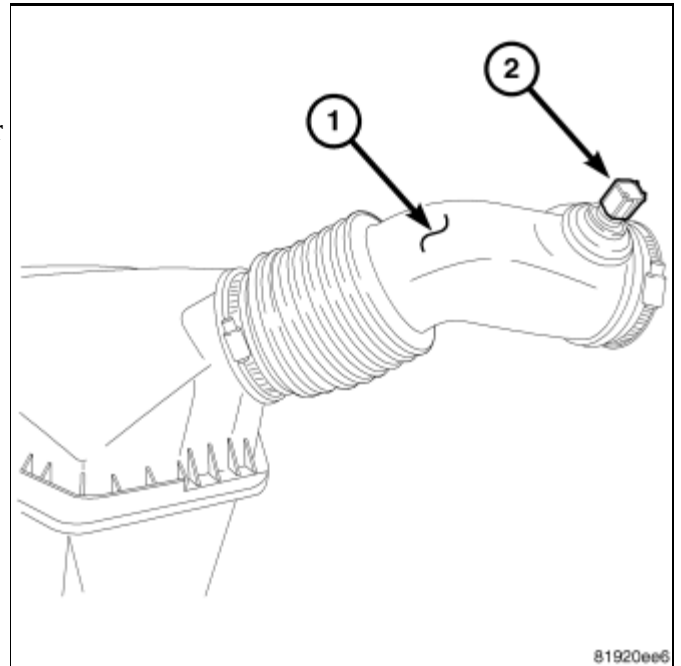


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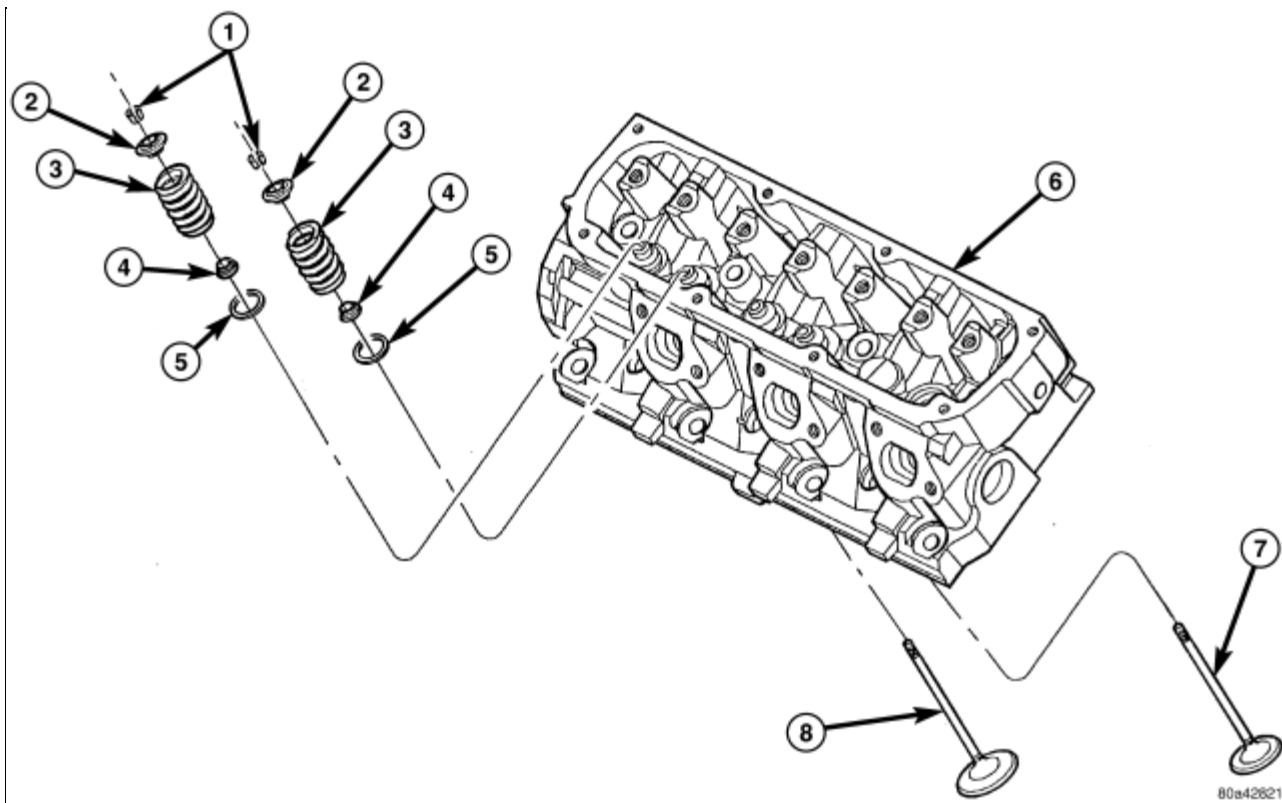
1. Install air cleaner housing into vehicle and onto the locating pin.
2. Install bolt to hold air cleaner housing to the upper radiator cross member.
3. Install the air inlet tube to the throttle body and tighten clamp.
4. Connect the IAT sensor (2).
5. Connect the CCV hose to the air cleaner cover.
6. Connect the negative battery cable.

CYLINDER HEAD

DESCRIPTION



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The aluminum cylinder heads (6) are designed to create high flow combustion chambers to improve performance, while minimizing the change to the burn rate in the chamber. The cylinder head incorporates the combustion chamber. Two valves (7,8) per-cylinder are used with inserted valve seats (5) and guides. A multi-layer steel (MLS) type gasket is used between the cylinder head and engine block.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

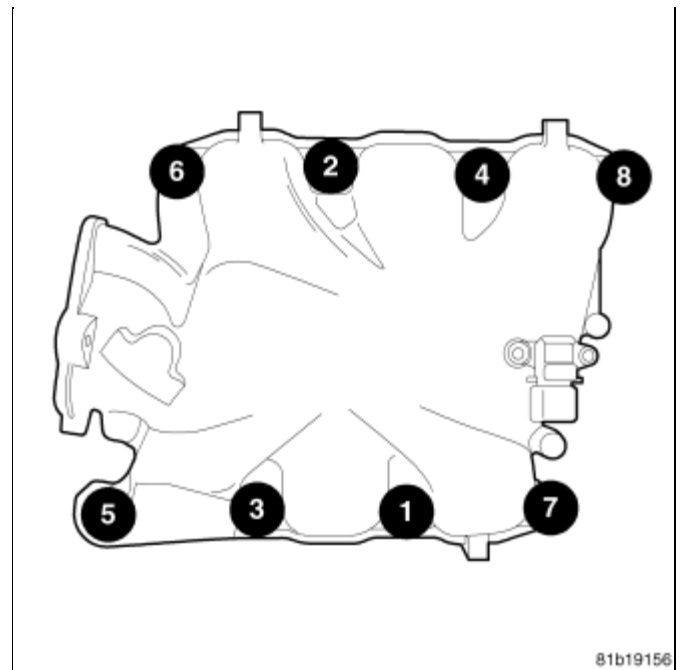
Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

1. Drain the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
2. Disconnect negative cable from battery.
3. Remove upper and lower intake manifolds.

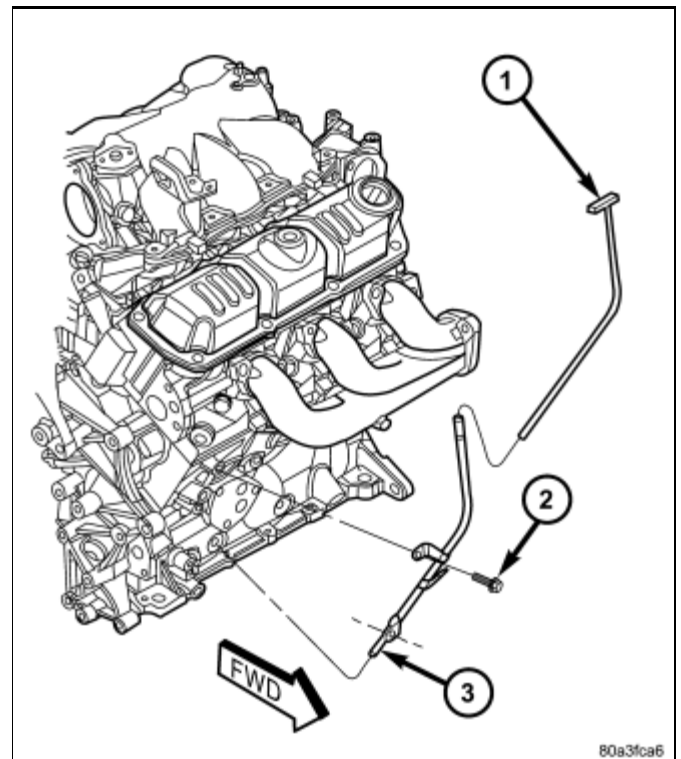
WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE

PERSONAL INJURY, HANDLE WITH CARE.



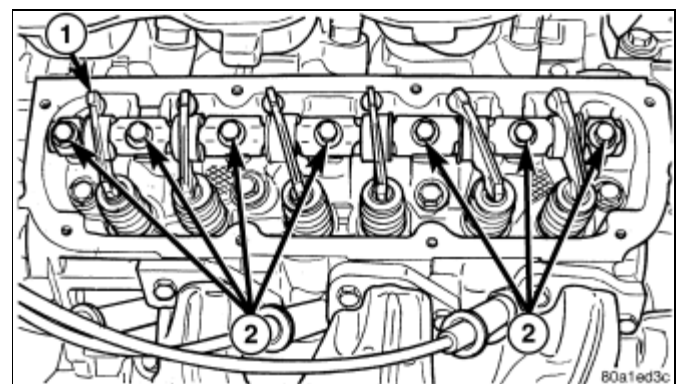
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4. Remove the cylinder head covers. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)
5. Remove the spark plugs from cylinder head.
6. Remove the oil level indicator and tube.



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7. Remove exhaust manifold(s). (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - REMOVAL)
8. Remove rocker arm and shaft assemblies (2). (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL) Remove push rods and **mark positions to ensure installation in original locations.**

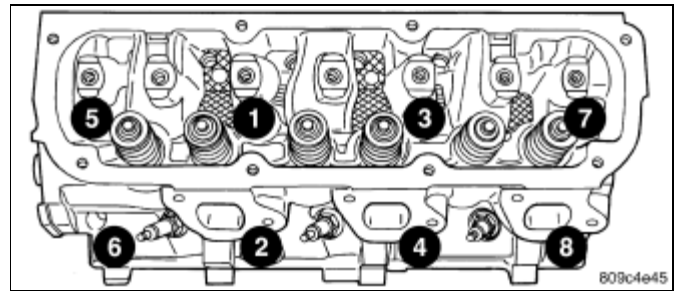


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9. Remove the eight head bolts from each cylinder head and remove cylinder heads.

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.



NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Remove all gasket material from cylinder head and block (Refer to 9 - ENGINE - STANDARD PROCEDURE). Be careful not to gouge or scratch the aluminum head sealing surface.

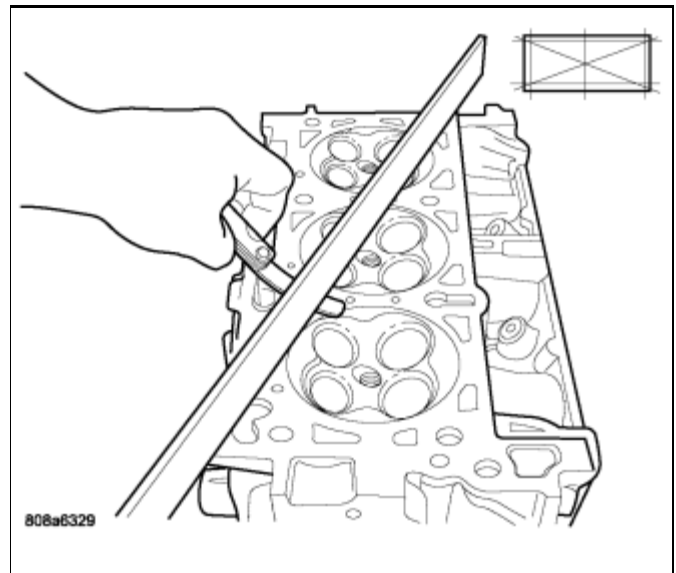
Clean all engine oil passages.

INSPECTION

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages.
3. Check cylinder head for flatness .
4. Cylinder head must be flat within:
 - Standard dimension = less than 0.05 mm (0.002 inch.)
 - Service Limit = 0.2 mm (0.008 inch.)
 - Grinding Limit = Maximum of 0.2 mm (0.008 inch.) is permitted.

CAUTION: 0.20 mm (0.008 in.) MAX is a combined total dimension of the stock removal limit from cylinder head and block top surface (Deck) together.

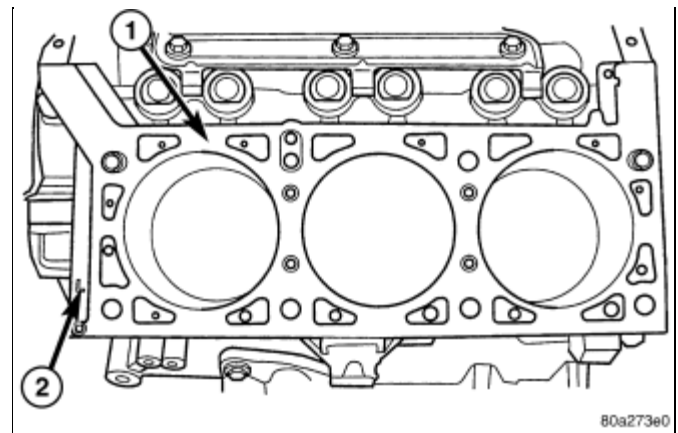
INSTALLATION



1. Clean all sealing surfaces of engine block and cylinder heads. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

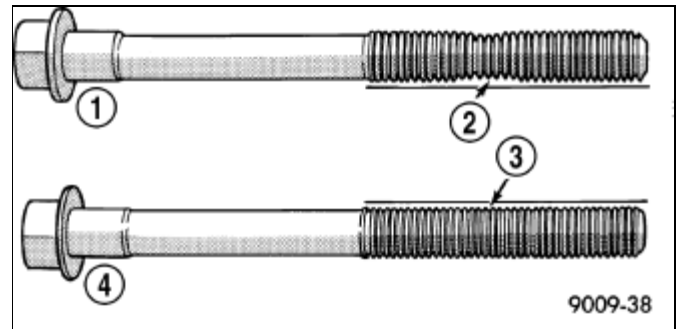
2. Position new gasket(s) on engine block . The left bank gasket is identified with the “L” stamped in the exposed area of the gasket located at front of engine (shown in). The right bank gasket is identified with a “R” stamped in the exposed area of the gasket also, but is located at the rear of the

engine.



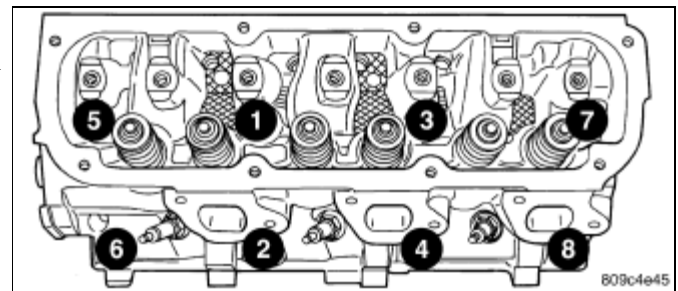
3. The cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts must be replaced .

4. Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt should be replaced.



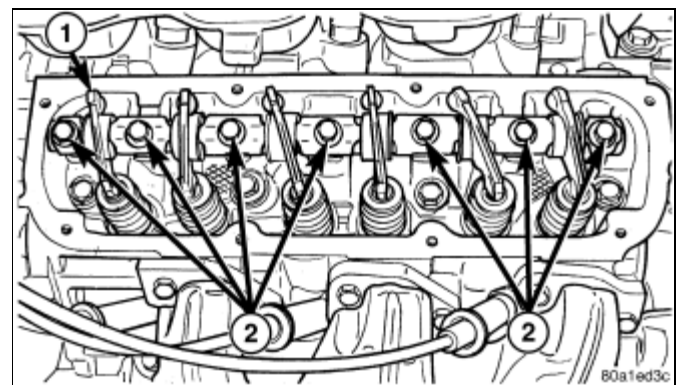
5. Tighten the cylinder head bolts 1–8 in the sequence shown in . Using the 4 step torque turn method, tighten according to the following values:

- Step 1: Bolts 1 – 8 to 61 N·m (45 ft. lbs.)
- Step 2: Bolts 1 – 8 to 88 N·m (65 ft. lbs.)
- Step 3: Bolts 1 – 8 (again) to 88 N·m (65 ft. lbs.)
- Step 4: Bolts 1 – 8 turn an additional 1/4 Turn. **(Do not use a torque wrench for this step.)**



NOTE: Bolt torque after 1/4 turn should be over 122 N·m (90 ft. lbs.). If not, replace the bolt.

6. Inspect and replace worn or bent push rods.
7. Install the push rods.
8. Install the rocker arm and shaft assemblies (2). (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION)
9. Install the cylinder head covers. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



10. Install the exhaust manifolds. (Refer to 9 -

ENGINE/MANIFOLDS/EXHAUST MANIFOLD - INSTALLATION)

11. Install new O-ring on oil level indicator tube. Install oil level indicator tube assembly .

12. Install upper and lower intake manifolds. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION)

13. Fill the cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

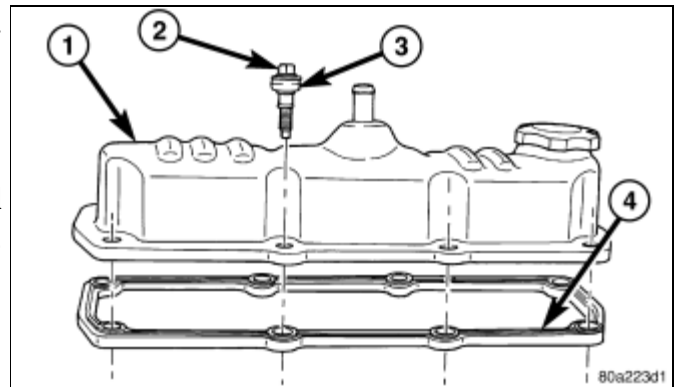
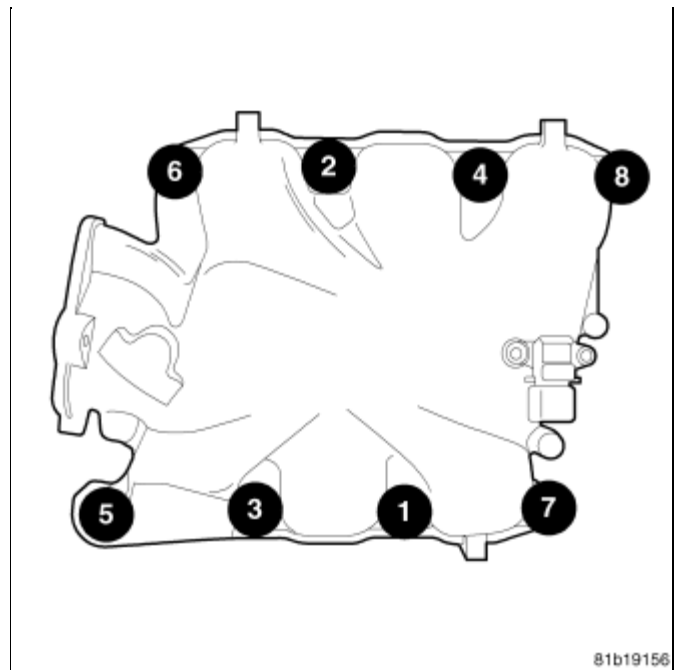
14. Connect negative cable to battery.

COVER(S)-CYLINDER HEAD

DESCRIPTION

The cylinder head covers (1) are made of composite material. The covers are sealed with steel reinforced silicon rubber gaskets. The cylinder head cover uses rubber isolators at each fastener location.

NOTE: Due to the tight packaging near the cylinder head covers, which makes spill clean-up difficult, a spill during an engine oil change may be misinterpreted as an oil leak. When investigating an oil leak in the location of the cylinder head covers and intake manifold, follow the procedure found in Oil Leak Diagnosis for determining the source of a leak.

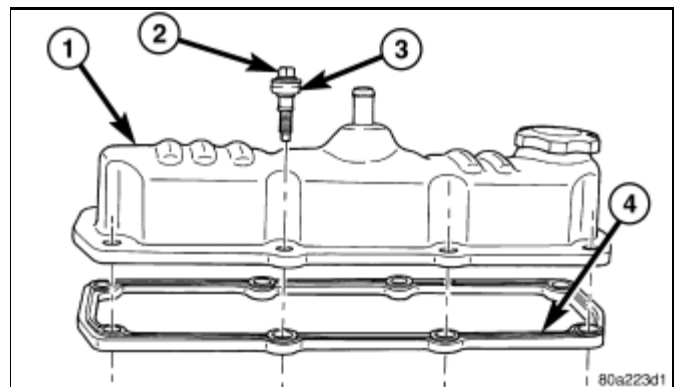


COVER-CYLINDER HEAD- RIGHT

REMOVAL

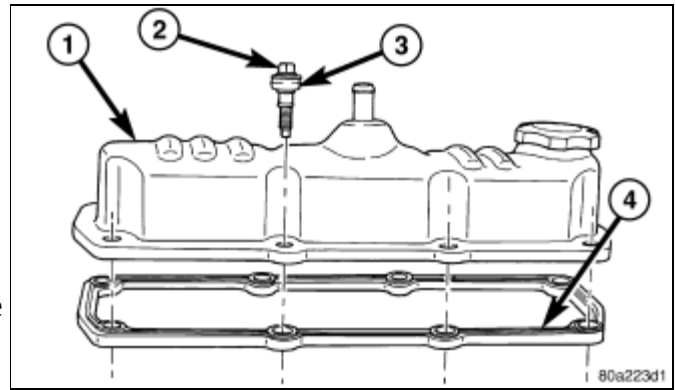
1. Disconnect negative cable from battery.
2. Disconnect spark plug wires from plugs.
3. Disconnect CCV hose from cylinder head cover.
4. Remove cylinder head cover bolts.
5. Remove cylinder head cover (1) and gasket (4).

INSTALLATION



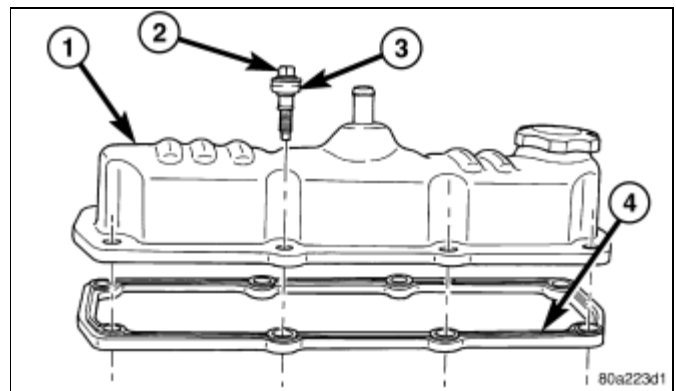
1. Clean cylinder head and cylinder head cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.
2. Inspect seal on the cover bolt for wear or damage. Replace bolt assembly (2) as necessary.
3. Inspect the PCV hose for damage. replace as necessary.

NOTE: The cylinder head cover bolts (2) contain a torque limiter sleeve and a seal . The seal and torque sleeve is replaced with the bolt.



4. Assemble gasket to cylinder cover by inserting the bolt assemblies through each bolt hole on the cover and gasket (4).

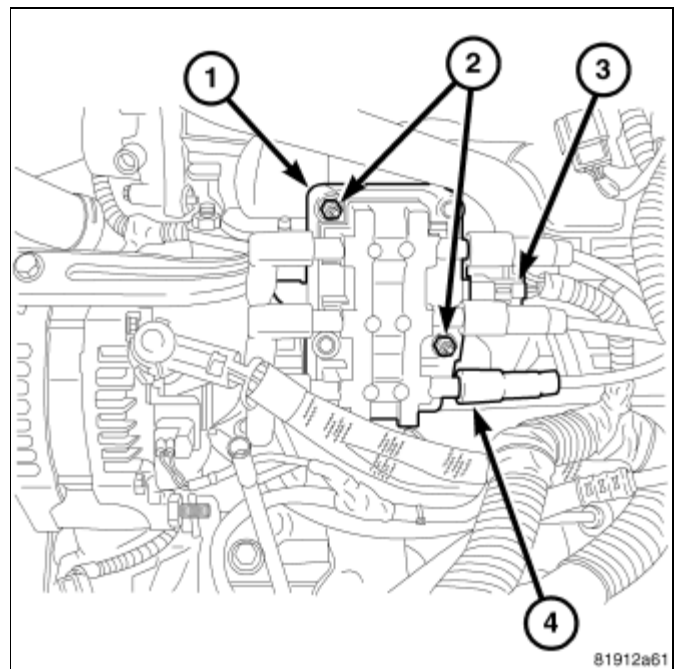
5. Install cylinder head cover and bolts (2).
6. Tighten cylinder head cover bolts to 12 N·m (105 in. lbs.).
7. Connect CCV hose to cylinder head cover.
8. Connect spark plug wires to spark plugs.
9. Connect negative cable to battery.



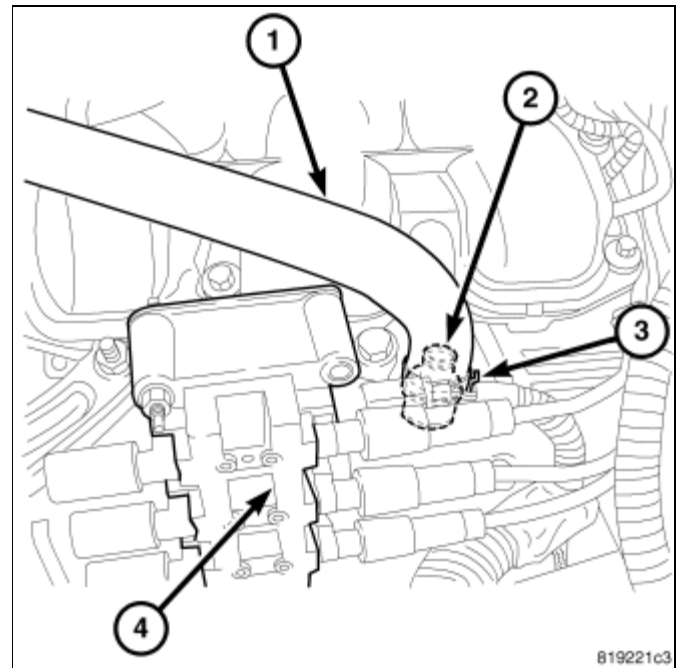
COVER-CYLINDER HEAD-LEFT

REMOVAL

1. Remove the ignition coil pack (1).
2. Disconnect spark plug wires from spark plugs.



3. Disconnect PCV hose (1) from cylinder head cover.

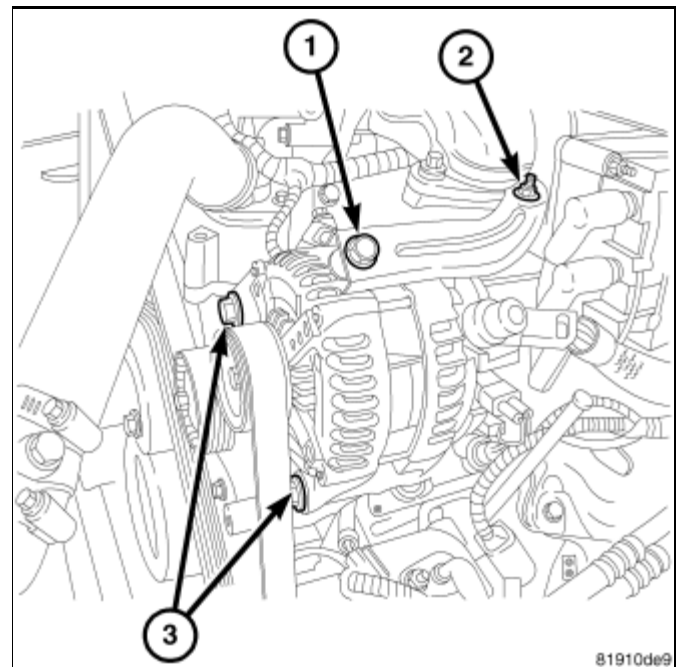


4. Remove the generator support bracket (1,2).

5. Remove cylinder head cover bolts.

6. Remove cylinder head cover and gasket.

INSTALLATION



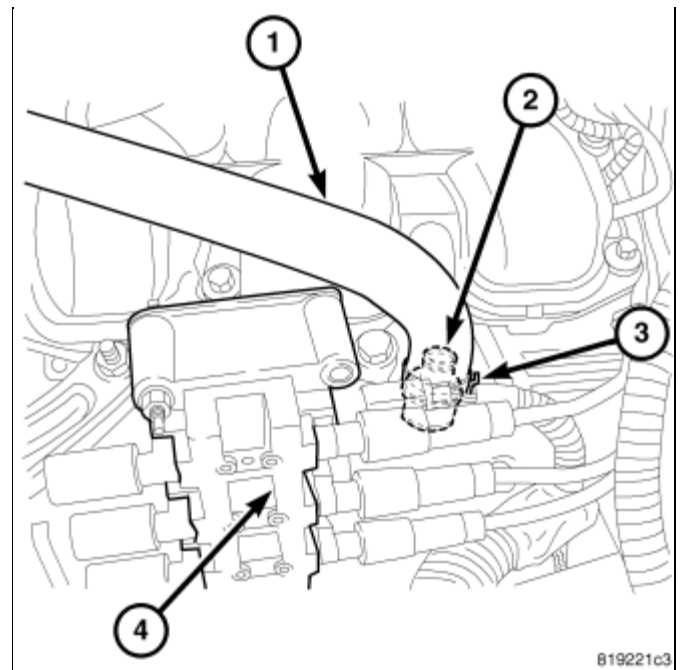
1. Clean cylinder head and cylinder head cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.

2. Assemble gasket to cylinder cover by inserting the fasteners through each bolt hole on cover and gasket.

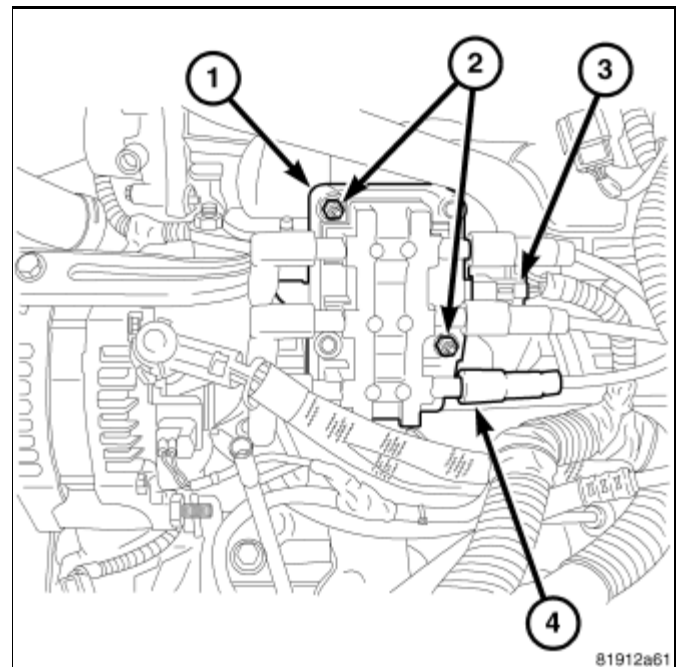
3. Install the cylinder head cover and bolts.

4. Tighten cylinder head cover bolts to 12 N·m (105 in. lbs.).

5. Connect PCV hose (1).



6. Install the ignition coil pack (1) and plug wires.



7. Install the generator support bracket (1,2).

8. Connect spark plug wires to spark plugs.

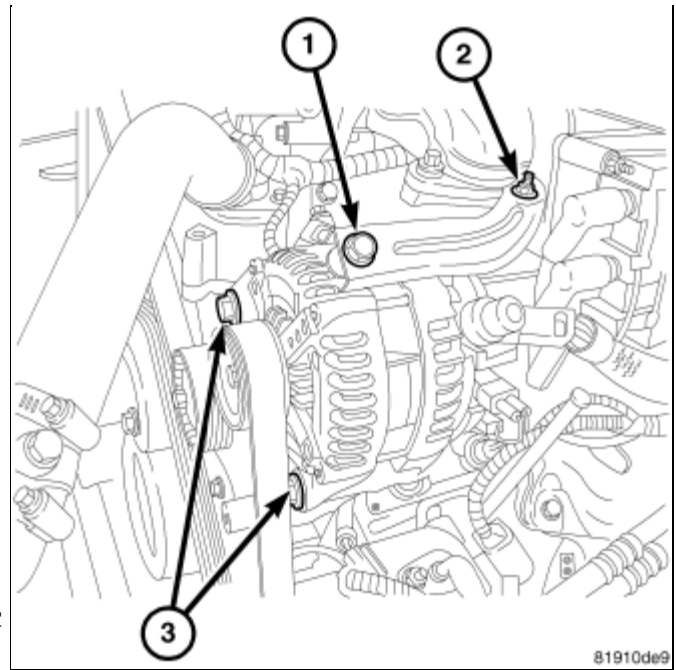
VALVES & SEATS- INTAKE/EXHAUST

DESCRIPTION

The valves have chrome plated valve stems with four-bead lock grooves. The valve stem seals are made of Viton rubber.

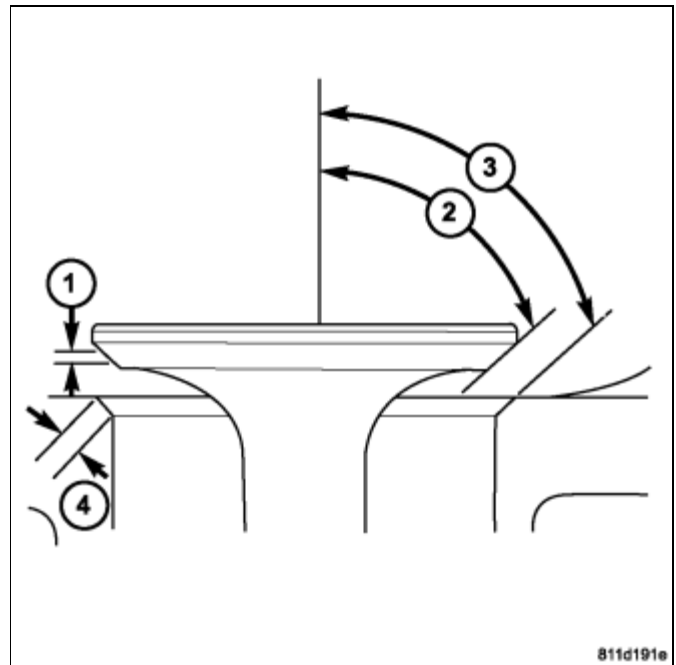
OPERATION

The two valves per cylinder are opened using roller hydraulic lifters, push rods, and rocker arms.



STANDARD PROCEDURE - REFACING VALVES AND VALVE SEATS

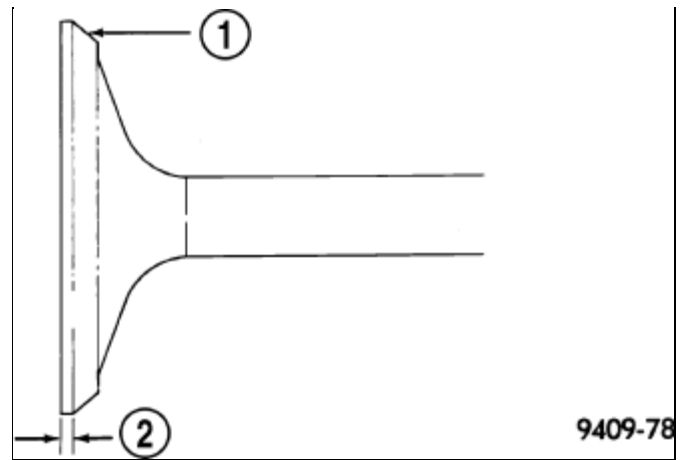
The intake and exhaust valves and seats are machined to specific angles .



VALVES

1. Inspect the remaining margin after the valves are refaced .

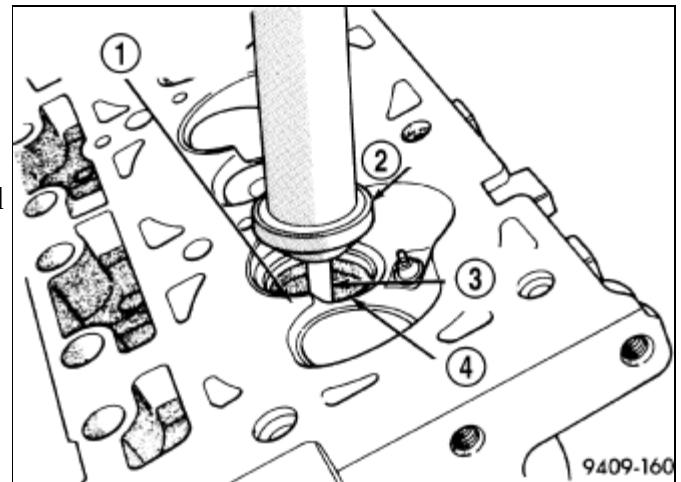
(Refer to 9 - ENGINE - SPECIFICATIONS)



VALVE SEATS

CAUTION: Remove metal from valve seat only. Do not remove material from cylinder head .

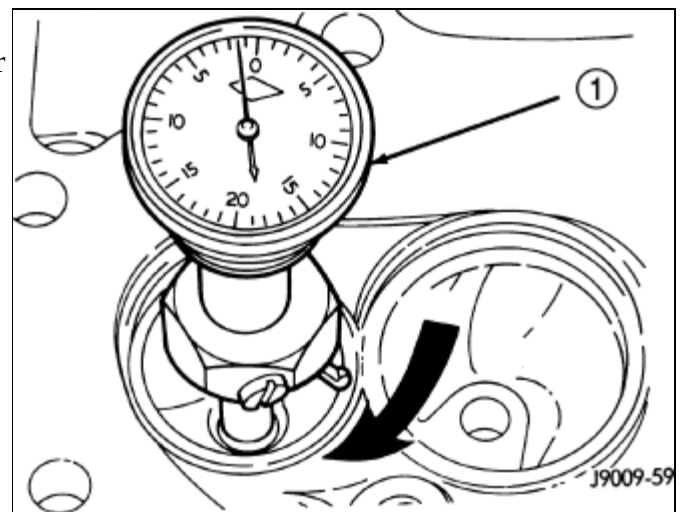
1. When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.



2. Measure the concentricity of valve seat using dial indicator . Total runout should not exceed 0.051 mm (0.002 in.) total indicator reading.

3. Inspect the valve seat using Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, lower valve seat with a 15 degree stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

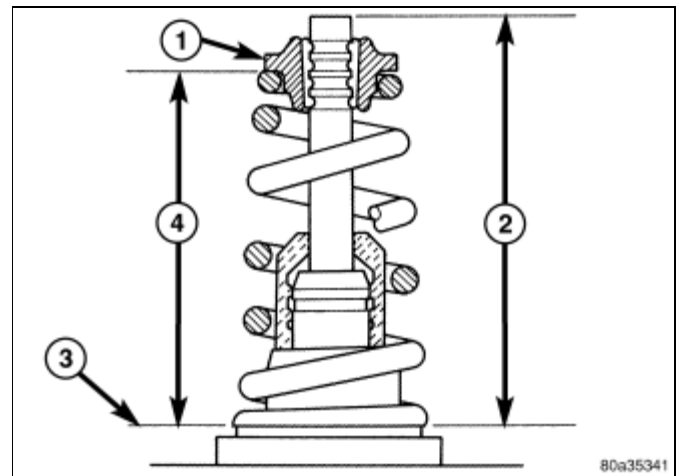
NOTE: Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise cylinder head must be replaced.



4. When seat is properly positioned the width of intake and exhaust seats should be 1.50–2.00 mm (0.059–0.078 in.) .

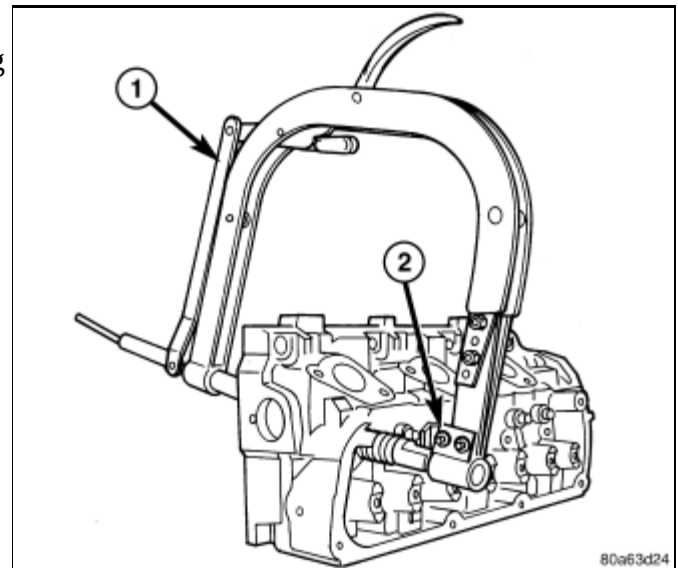
5. After grinding the valve seats or faces, install the valve in cylinder head and check valve installed height by measuring from valve tip to spring seat . Remove valve from cylinder head and grind valve tip until within specifications. Check valve tip for scoring. The tip chamfer should be reground (if necessary) to prevent seal damage when the valve is installed.

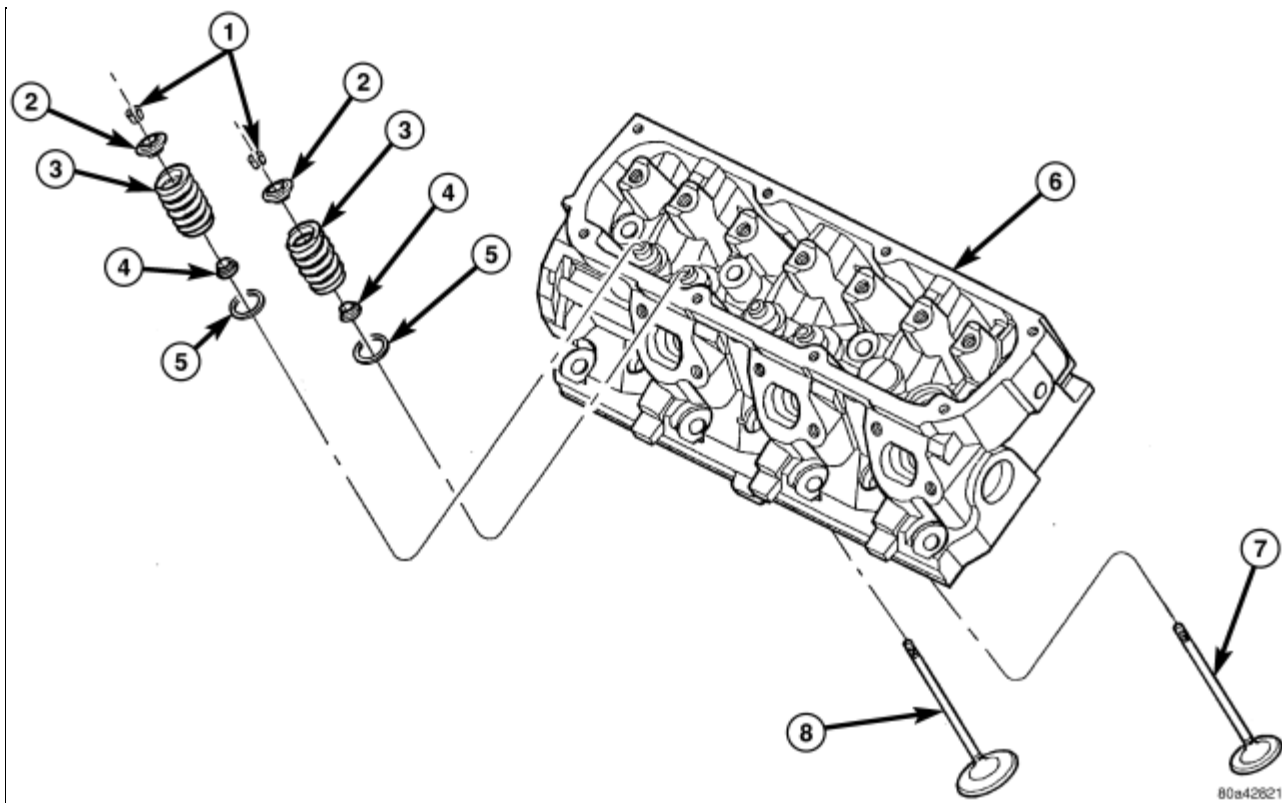
6. Check the valve spring installed height after refacing the valve and seat . **If valves and/or seats are reground, measure the installed height of springs , make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than specifications, install a 0.794 mm (0.0312 in.) spacer in head counterbore to bring spring height back within specifications.**



REMOVAL

1. With cylinder head removed, compress valve springs using Valve Spring Compressor Tool C-3422-D with adapter 8464 .





2. Remove valve retaining locks .
3. Slowly release valve spring compressor. Remove valve spring retainer, valve spring, and valve stem seal.
4. Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides**. Identify valves to insure installation in original location.

CLEANING

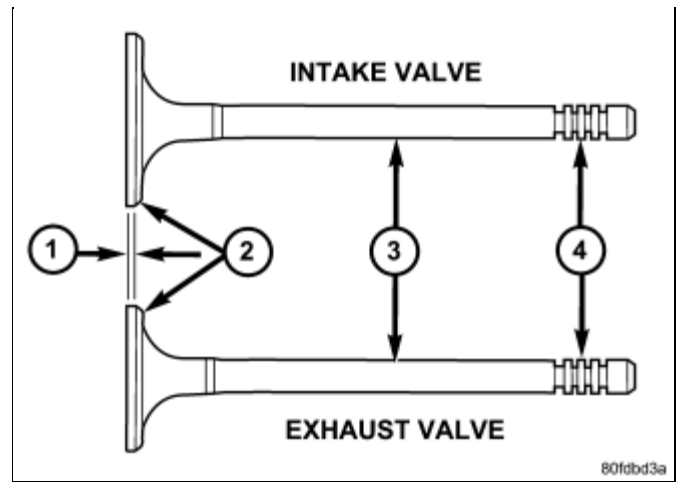
1. Clean all valves thoroughly and discard burned, warped and cracked valves.

INSPECTION

VALVES

1. Clean and inspect valves thoroughly. Replace burned, warped and cracked valves.
2. Measure valve stems for wear . For valve specifications, (Refer to 9 - ENGINE - SPECIFICATIONS).

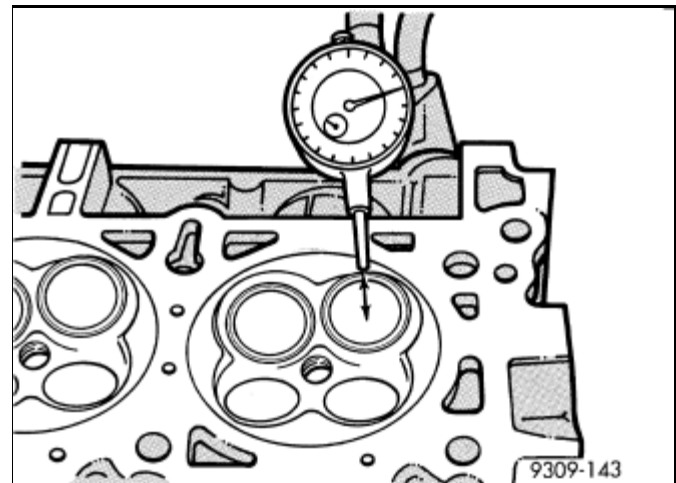
NOTE: Valve stems are chrome plated and should not be polished .



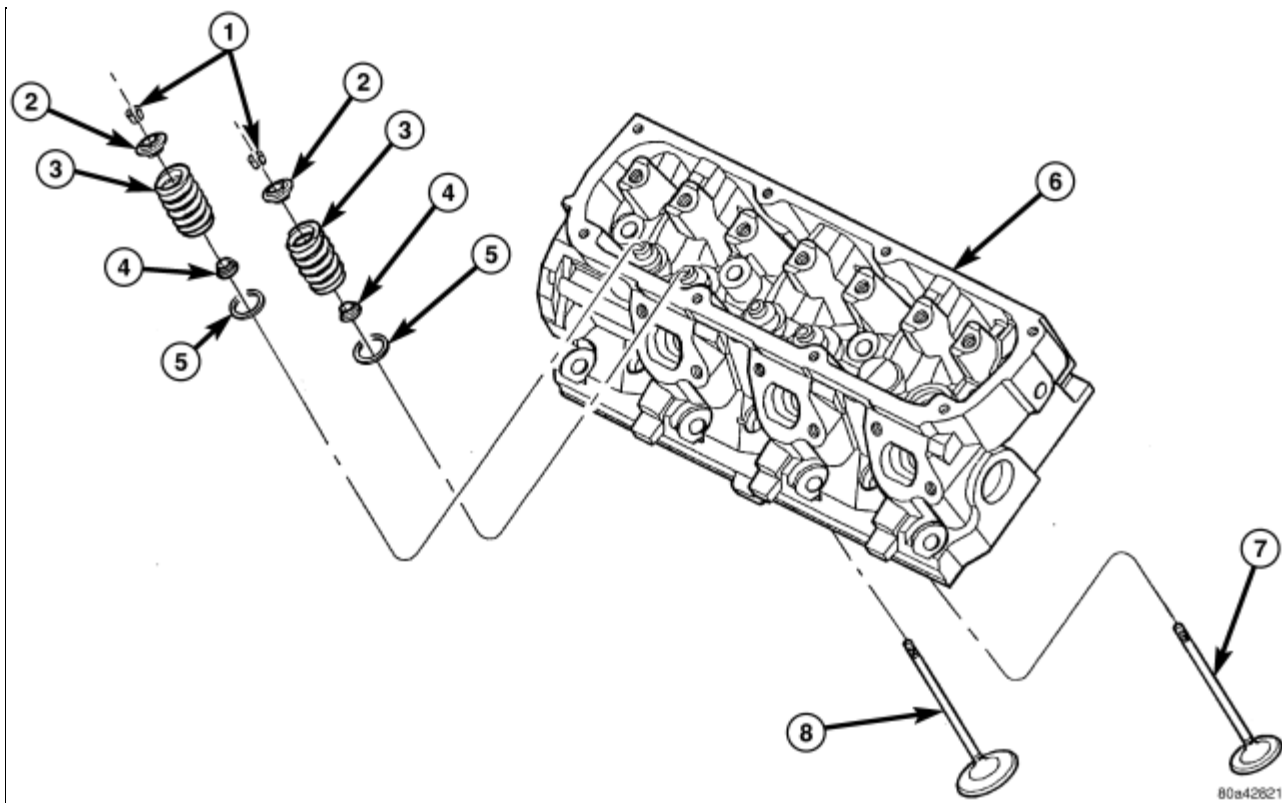
VALVE GUIDES

1. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
2. Measure valve stem-to-guide clearance as follows:
3. Install valve into cylinder head so it is 15 mm (0.590 inch.) off the valve seat. A small piece of hose may be used to hold valve in place.
4. Attach dial indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured .
5. Move valve to and from the indicator. For clearance specifications, (Refer to 9 - ENGINE - SPECIFICATIONS).

NOTE: Replace cylinder head if stem-to-guide clearance exceeds specifications, or if guide is loose in cylinder head.



INSTALLATION

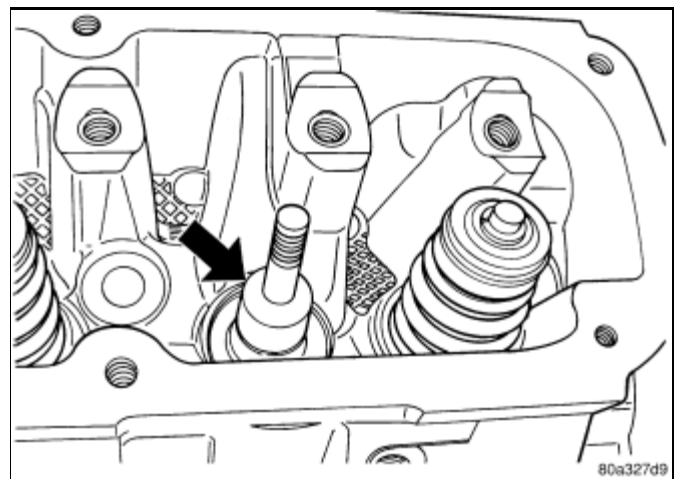


1. Coat valve stems with clean engine oil and insert them in cylinder head .
2. Install valve spring seat on head .

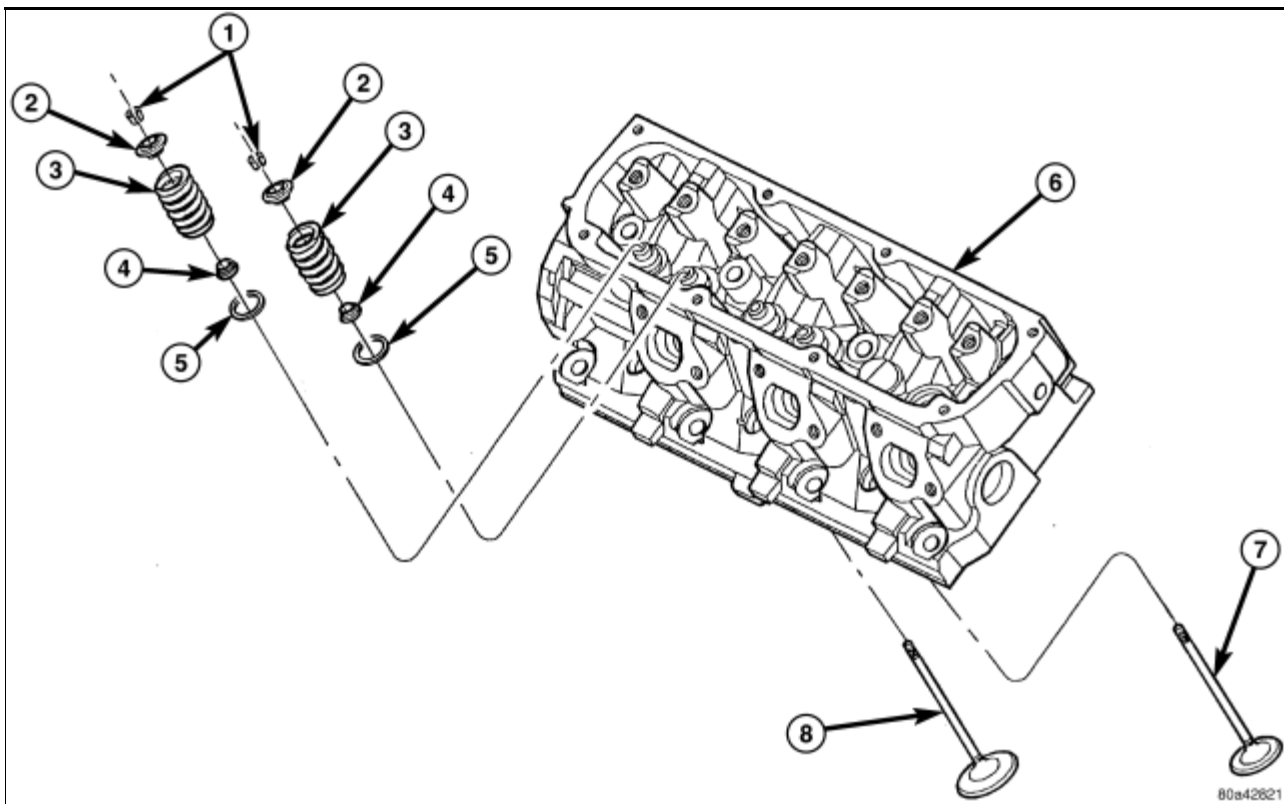
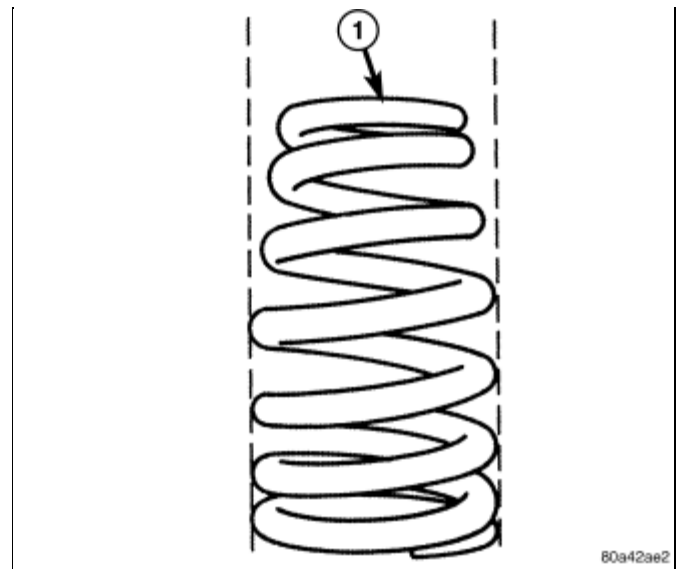
3. Install new seals on all valve stems and over valve guides
Install valve springs and valve retainers
4. Install the valve springs. (Refer to 9 -
ENGINE/CYLINDER HEAD/VALVE SPRINGS -
INSTALLATION)

SPRINGS-VALVE

DESCRIPTION



There are two interchangeable, floating (spring rotates during operation), valve spring designs. Type A may be identified by the counterclockwise (spring spirals down and to the left) appearance, And Type B may be identified by the clockwise (spring spirals down and to the right) appearance. Both of the valve springs are a bee-hive shaped design but have different specifications.



The springs are seated on a steel washer on the cylinder head with retainers and locks retaining the springs . The springs are installed with the smaller diameter against spring retainer .

OPERATION

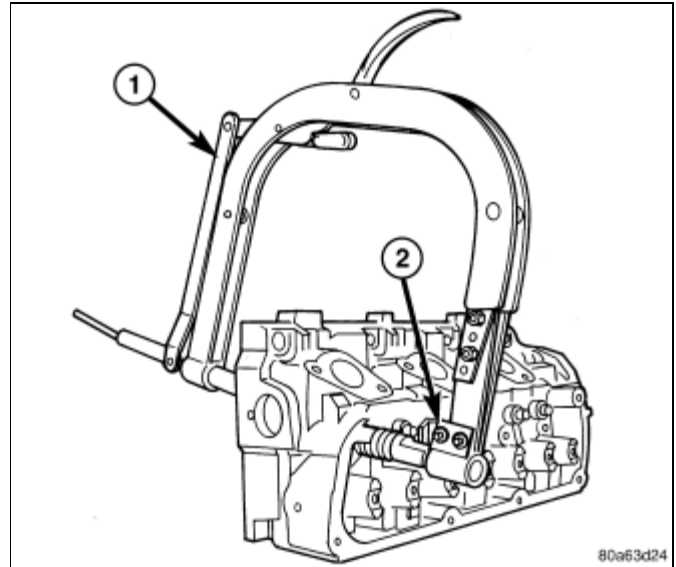
The valve spring returns the valve against its seat for a positive seal of the combustion chamber.

REMOVAL

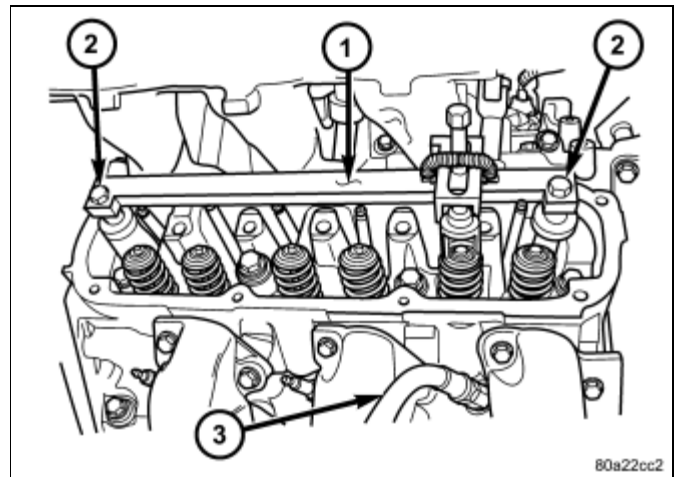
REMOVAL - CYLINDER HEAD OFF

1. With the cylinder head on a bench, position Special Tool C-3422-D with 8464 Adapter on the valve and spring retainer .
2. Compress the spring only enough to remove the valve retainer locks.
3. Slowly release the spring tension and remove the valve spring and retainer.
4. For removal of the valve stem seal (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - REMOVAL).

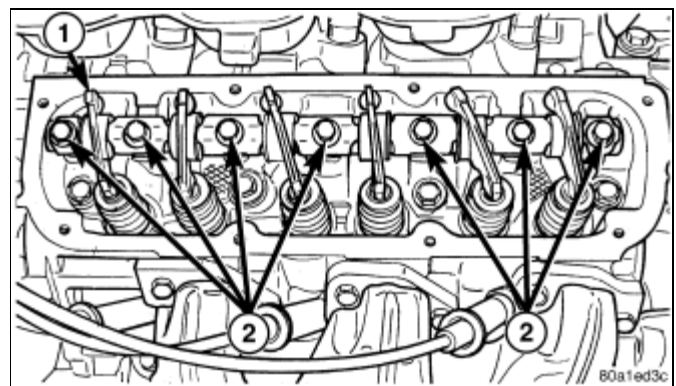
REMOVAL-IN VEHICLE



1. Disconnect negative cable from battery.
2. Remove spark plug wires and all spark plugs.
3. Remove cylinder head cover(s). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



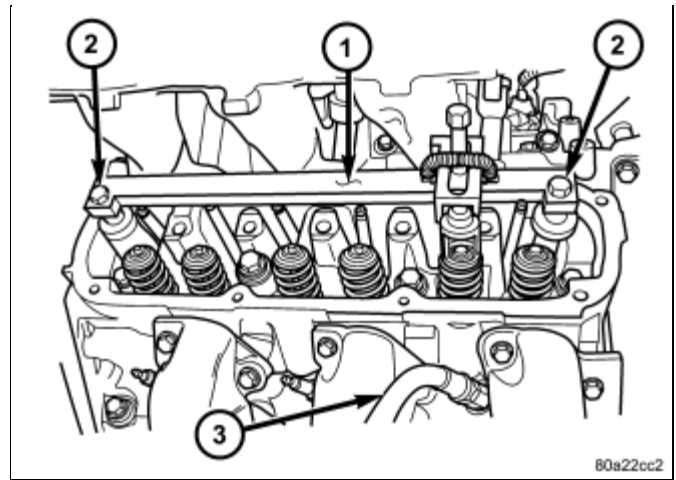
4. Remove rocker arms and shaft (1). (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL)
5. Rotate engine until the piston in the cylinder bore requiring spring removal is at TDC.



6. Install Special Tool 8453 (1) to the cylinder head. Tighten the attaching bolts to 23 N·m (200 in. lbs.).
7. Install a spark plug adapter (3) in the spark plug hole. Connect air hose that can supply 620.5–689 kPa (90–100 psi)

of air pressure to adapter. This is to hold valves in place while servicing components.

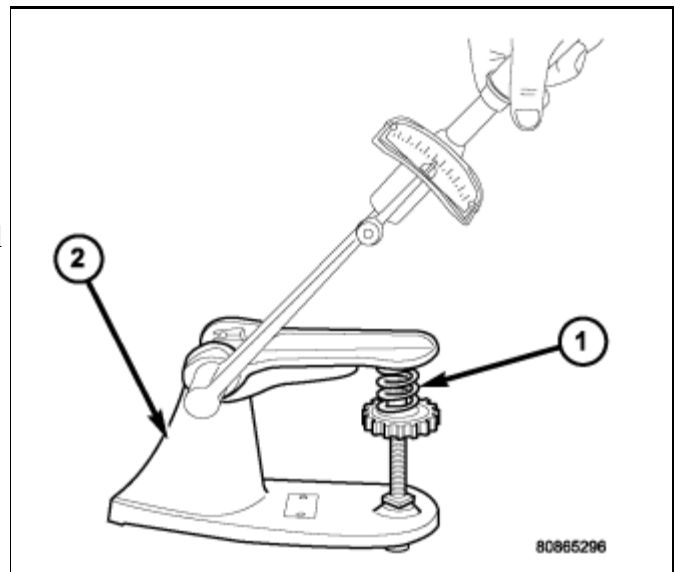
8. Locate the forcing screw and spring retainer adapter assembly over the spring requiring removal.
9. Slowly turn the forcing screw clockwise (compressing the valve spring) until the valve keepers can be removed.
10. Turn forcing screw counterclockwise to relieve spring tension. Remove retainer and valve spring.
11. Repeat procedure for each cylinder requiring valve spring removal.



INSPECTION

NOTE: There are two different types of valve springs used that are interchangeable, but have different specifications (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - DESCRIPTION).

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. **As an example;** the compression length of a spring to be tested is 38.00 mm (1.496 in.). Turn the table of Tool C-647 until surface is in line with the 38.00 mm (1.496 in.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Engine Specifications to obtain specified height and allowable tensions (Refer to 9 - ENGINE - SPECIFICATIONS). Replace any springs that do not meet specifications.

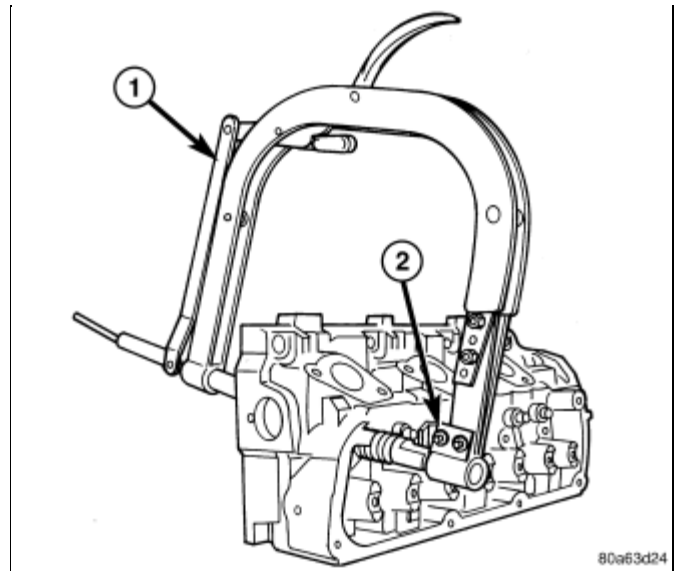


INSTALLATION

INSTALLATION - CYLINDER HEAD OFF

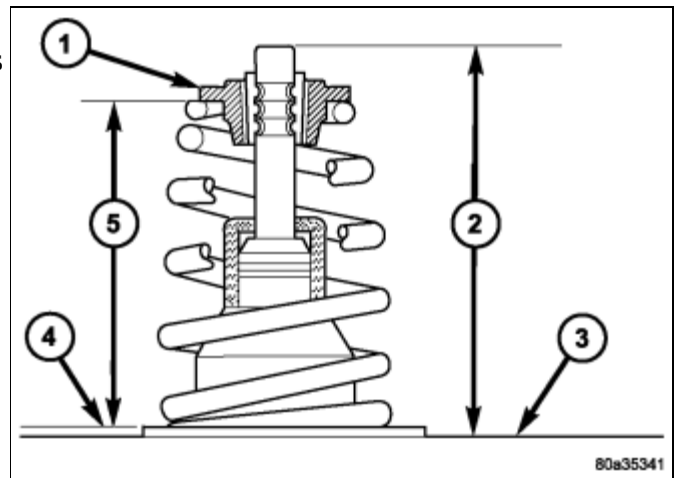
1. If removed, install a new valve stem seal (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - INSTALLATION).
2. Position valve spring and retainer on spring seat.

3. Using Special Tool C-3422-D with 8464 Adapter , compress the spring only enough to install the valve retainer locks. Install valve retainer locks.



4. Slowly release the spring tension. Ensure the retainer locks are seated properly .

INSTALLATION- IN VEHICLE

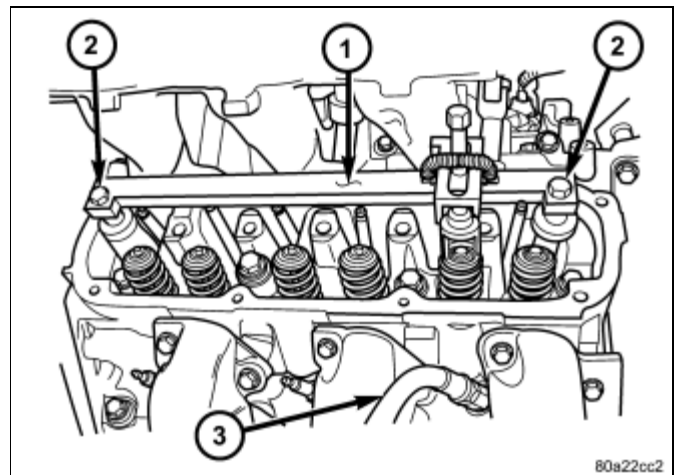


1. The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

CAUTION: Do not pinch seal between retainer and top of valve guide.

2. Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-2-3-4-5-6. **Make sure piston in cylinder is at TDC on the valve spring that is being covered.**

3. Remove spark plug adapter tool (3).



4. Install rocker arms and shaft assembly (1).
5. Install cylinder head covers.

6. Install spark plugs and connect wires.
7. Connect negative cable to battery.

ARMS-ROCKER

DESCRIPTION

DESCRIPTION

The rocker arms are installed on the rocker arm shaft. The rocker arms and shaft assembly is attached to the cylinder head with seven billeted bolts and retainers. The rocker arms are made of stamped steel.

DESCRIPTION - PUSH ROD

The pushrods are made of steel and are a hollow design. The pushrods are positioned between the hydraulic lifter and the rocker arm.

OPERATION

OPERATION

The rocker arm pivots are on the rocker shaft. Rocker arms are used to translate up and down motions provided by the camshaft, hydraulic roller lifter, and pushrod on one end, into a down and up motions on the valve stem on the opposing end.

OPERATION - PUSH ROD

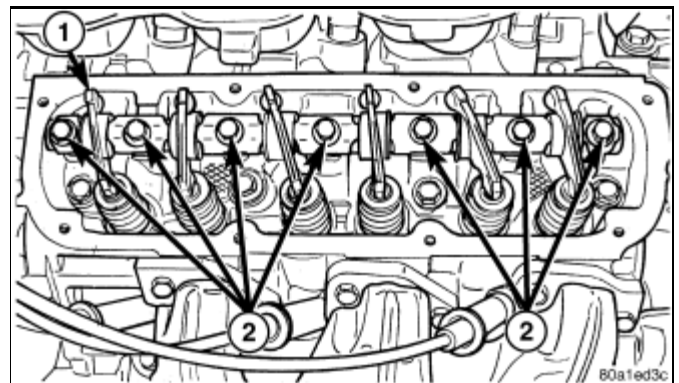
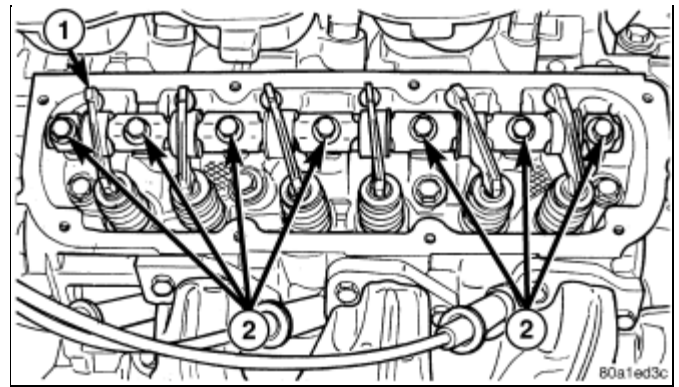
The pushrod is a solid link between the hydraulic roller lifter and the rocker arm. Also, the pushrod supplies engine oil from the hydraulic lifter to the rocker arm.

REMOVAL

1. Remove the cylinder head cover(s). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

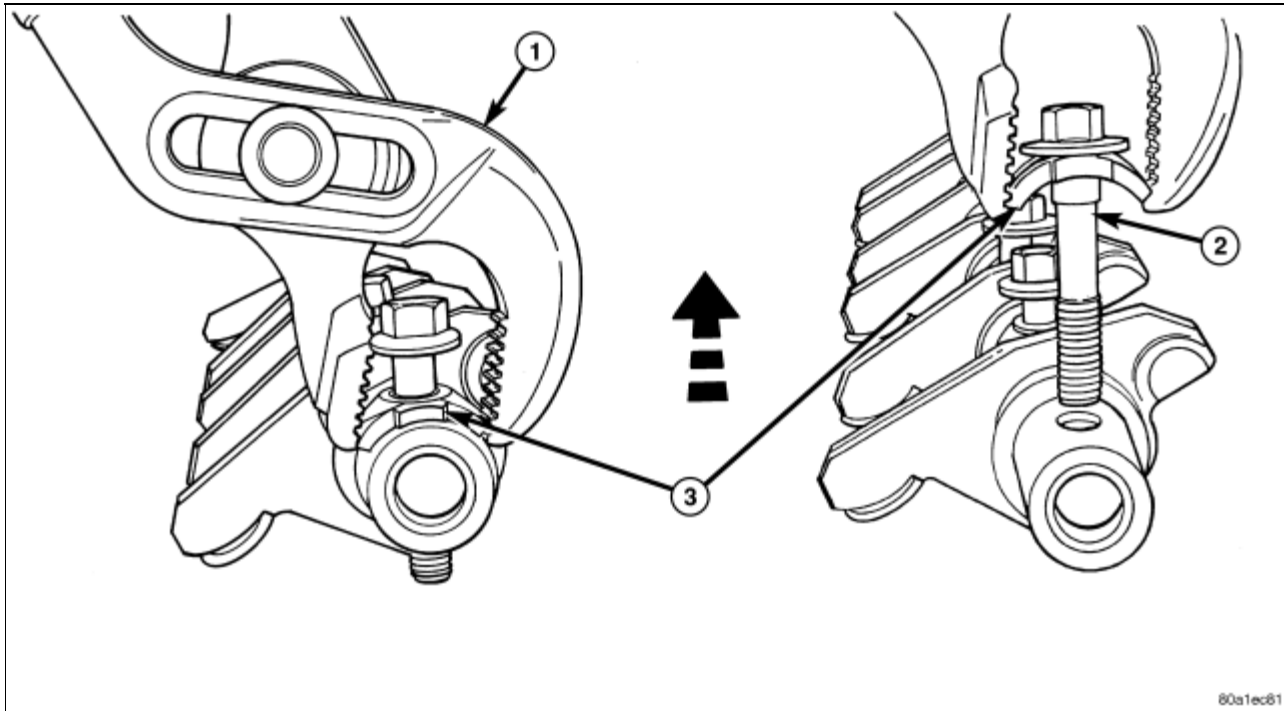
NOTE: Rocker arm shaft bolts are captured to the shaft.

2. Loosen the rocker shaft bolts , rotating one turn each, until all valve spring pressure is relieved.
3. Remove the rocker arms and shaft assembly .



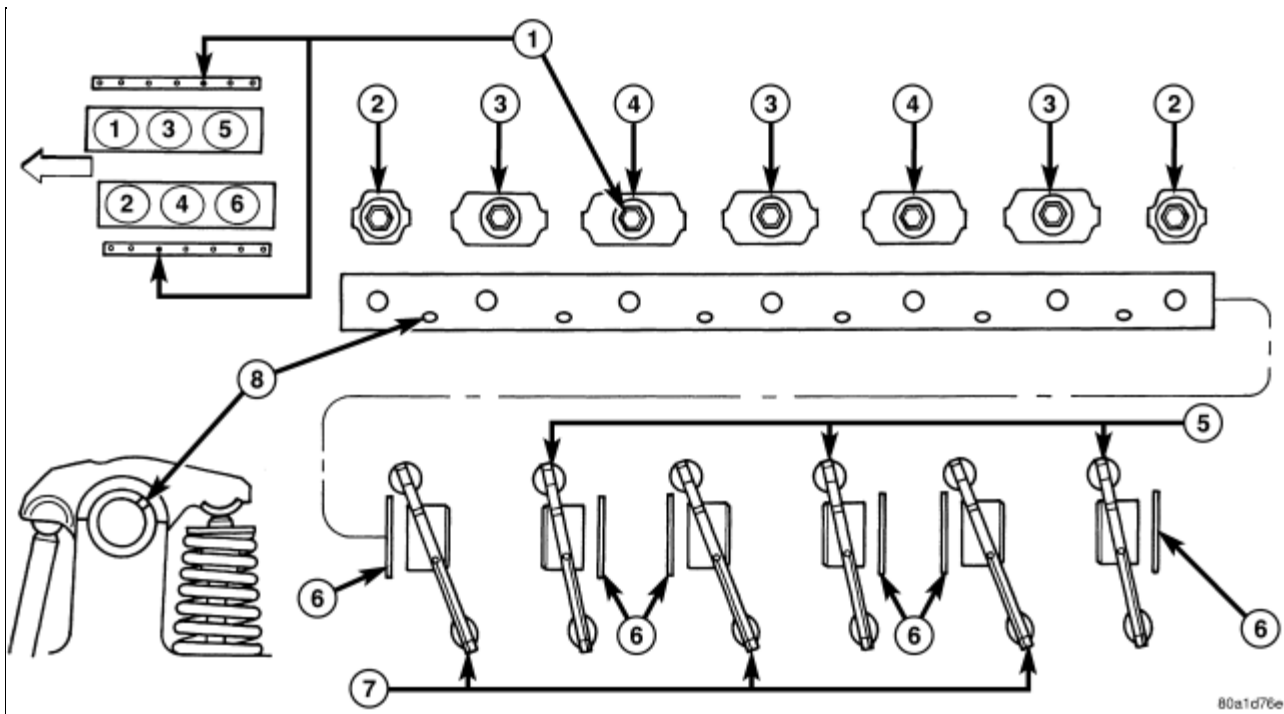
4. For rocker arm disassembly procedures, (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - DISASSEMBLY).

DISASSEMBLY



CAUTION: Do not attempt to drive the billeted bolt from the rocker shaft. This can damage the rocker arm retainer and bolt assembly.

1. Remove the rocker arm retainer and bolt by performing the following procedure:
 - a. Using adjustable pliers, grip the edges of the retainer .
 - b. Apply an upward force with a slight rocking motion until the retainer disengages from shaft .



2. Remove rocker arms . Identify the component locations for reassembly in original locations.

ASSEMBLY

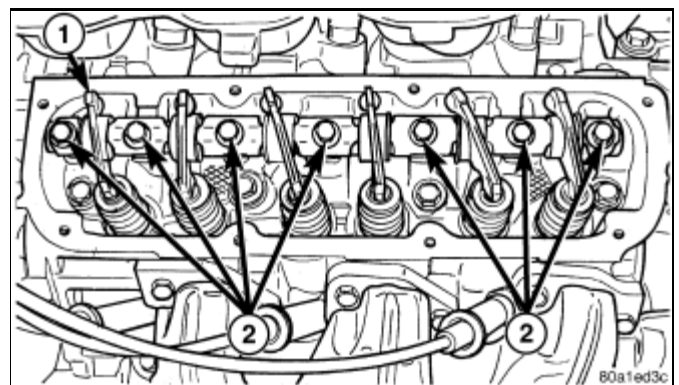
1. Install rocker arms on the shaft. Install in the original positions if re-used. **Ensure** the rocker shaft, all the retainers and washers are properly positioned and installed in the correct locations.
2. Install rocker arms and shaft to the cylinder head. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION)

INSTALLATION

CAUTION: Ensure the longer shaft retaining bolt is installed in the proper location on the rocker shaft. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - ASSEMBLY)

1. Position the rocker arm and shaft assemblies on the pedestal mounts.

CAUTION: Ensure all pushrods are properly located on the lifter and the rocker arm socket.



2. Align each rocker arm socket with each pushrod end.

CAUTION: The rocker arm shaft should be tightened down slowly, starting with the center bolts. Allow 20 minutes lifter bleed down time after installation of the rocker shafts before engine operation.

3. Slowly tighten rocker shaft bolts evenly until shaft is seated. Tighten bolts to 23 N·m (200 in. lbs.) .
4. Install the cylinder head cover(s). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION.)

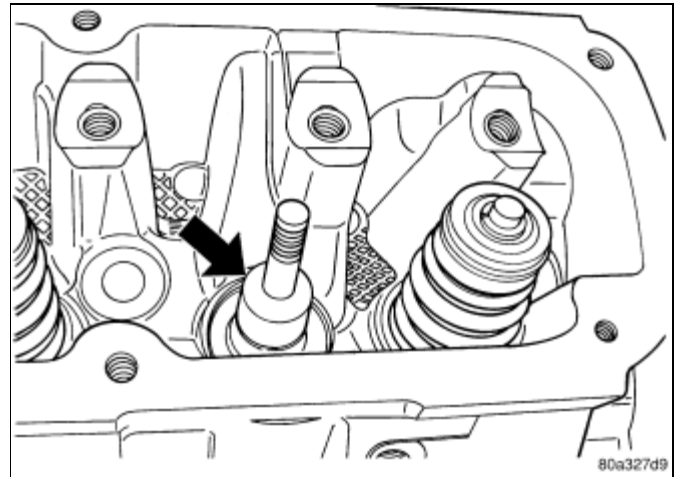
SEALS-VALVE STEM

DESCRIPTION

The valve stem seals are made of Viton rubber. The seals are positioned over the valve stem and seated on the valve guide .

REMOVAL

1. Remove the valve springs. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - REMOVAL)
2. Remove the valve stem seal.



INSTALLATION

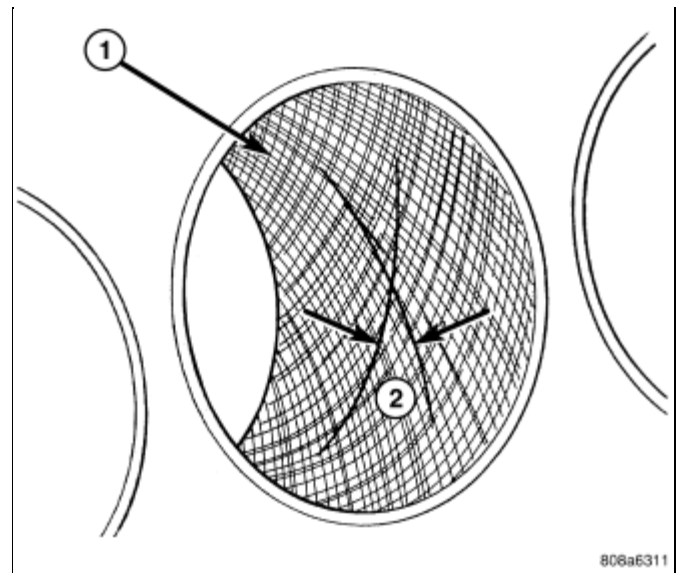
1. Install the valve stem seal squarely over the valve guide, using the valve stem as a guide. Do not force the seal against top of the valve guide.
2. Install the valve spring. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - INSTALLATION)

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron and is a deep skirt design.

STANDARD PROCEDURE - CYLINDER BORE HONING



1 - CROSS-HATCH PATTERN
2 - 40°–60°

1. Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.
2. Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20–60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.** Inspect cylinder walls after each 20 strokes.
3. Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 40–60 degrees (2), the cross hatch angle is most satisfactory for proper seating of rings.
4. A controlled hone motor speed between 200–300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 40–60 degree angle. Faster up and down strokes increase the cross-hatch angle.
5. After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION

ENGINE BLOCK

1. Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.
2. If new core plugs are to be installed, (Refer to 9 - ENGINE - STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS).
3. Examine block and cylinder bores for cracks or fractures.
4. Check block deck surfaces for flatness. Deck surface must be within service limit of 0.1 mm (0.004 in.).

CYLINDER BORE

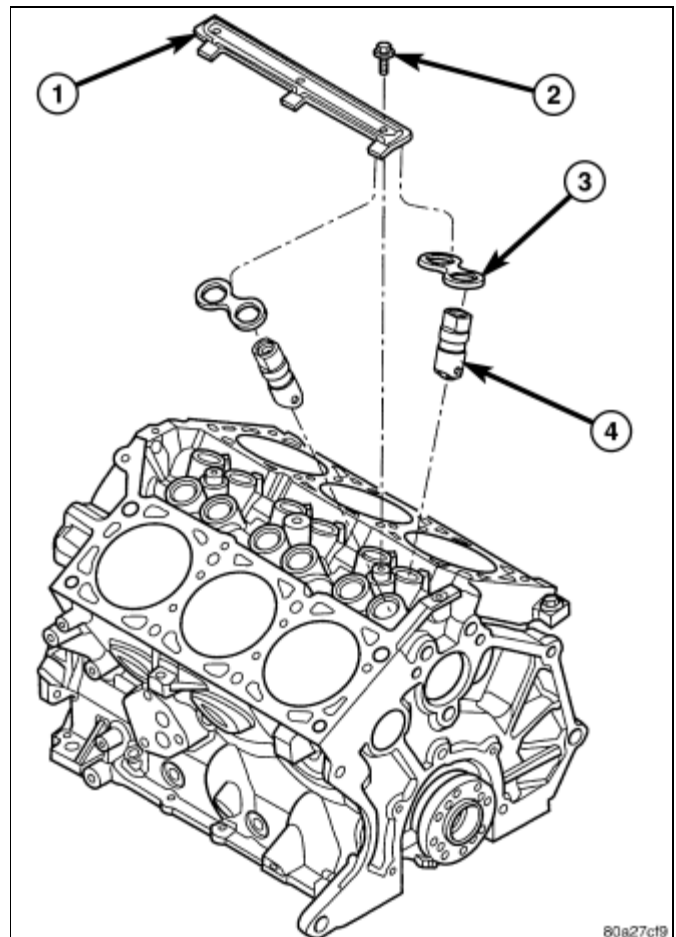
NOTE: The cylinder bores should be measured at normal room temperature, 21°C (70°F).

The cylinder walls should be checked for out-of-round and taper with Tool C119 or equivalent (Refer to 9 - ENGINE - SPECIFICATIONS). If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B . Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore. (Refer to 9 - ENGINE - SPECIFICATIONS).

TAPPETS-HYDRAULIC-(CAM IN BLOCK)

DESCRIPTION



1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

The hydraulic lifters are a roller type design and are positioned in the cylinder block with the lubrication whole facing upward. The lifters are aligned and retained by a yoke (3) and a retainer (1).

Lifter alignment is maintained by machined flats on lifter body. Lifters are fitted in pairs into six aligning yokes. The aligning yokes (3) are secured by a yoke retainer (1).

DIAGNOSIS AND TESTING - HYDRAULIC LIFTERS

HYDRAULIC LIFTERS DIAGNOSIS - PRELIMINARY STEP

Before disassembling any part of the engine to correct lifter noise, check the engine oil pressure. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)

Check engine oil level. The oil level in the pan should never be above the MAX mark on dipstick, or below the MIN mark. Either of these two conditions could cause noisy lifters.

OIL LEVEL TOO HIGH

If oil level is above the MAX mark on dipstick, it is possible for the connecting rods to dip into the oil while engine is running and create foaming. Foam in oil pan would be fed to the hydraulic lifters by the oil pump causing them to become soft and allow valves to seat noisily.

OIL LEVEL TOO LOW

Low oil level may allow pump to take in air which when fed to the lifters it causes them to become soft and allows valves to seat noisily. Any leaks on intake side of pump, through which air can be drawn, will create the same lifter noise. Check the lubrication system from the intake strainer to the oil pump cover, including the relief valve retainer cap. When lifter noise is due to aeration, it may be intermittent or constant, and usually more than one lifter will be noisy. When oil level and leaks have been corrected, the engine should be operated at fast idle to allow all of the air inside of the lifters to be bled out.

VALVE TRAIN NOISE

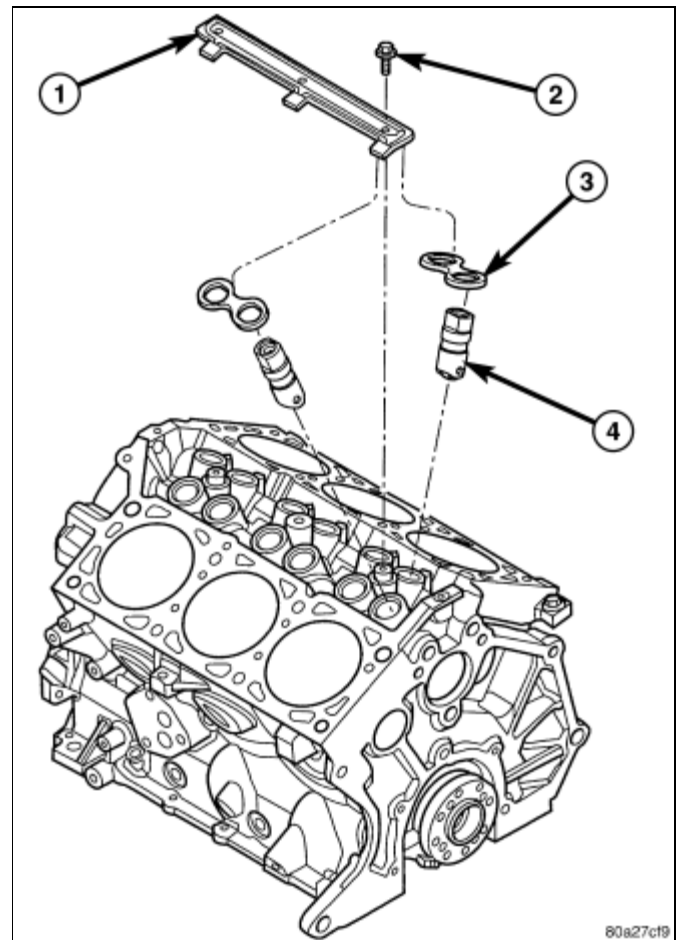
To determine source of valve train noise, operate engine at idle with cylinder head covers removed and listen for

source of the noise.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy lifters. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

Valve lifter noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger which will necessitate replacing the lifter, or by the plunger partially sticking in the lifter body cylinder. A heavy click is caused either by a lifter check valve not seating, or by foreign particles becoming wedged between the plunger and the lifter body causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, lifter assembly should be removed for inspection.

REMOVAL



1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

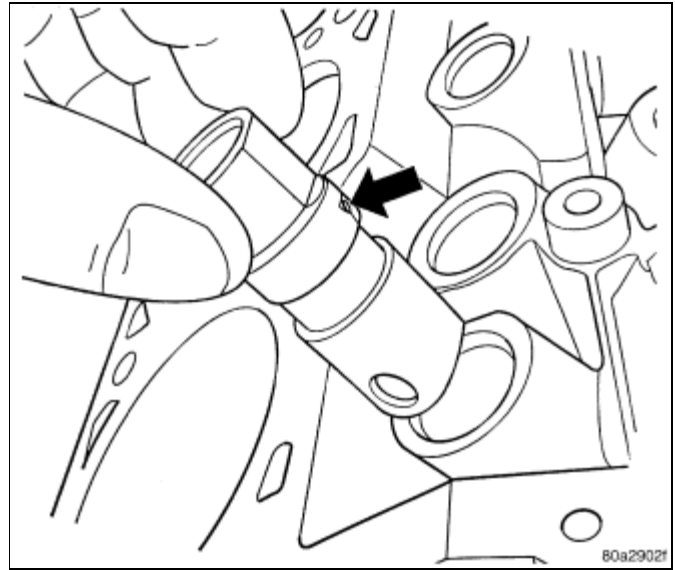
1. Remove the cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL)
2. Remove the yoke retainer (1) and aligning yokes (3).
3. Remove the hydraulic lifters. If necessary use Special Tool C-4129, or equivalent to remove lifters from bores. If lifters are to be reused, identify each lifter to ensure installation in original location.

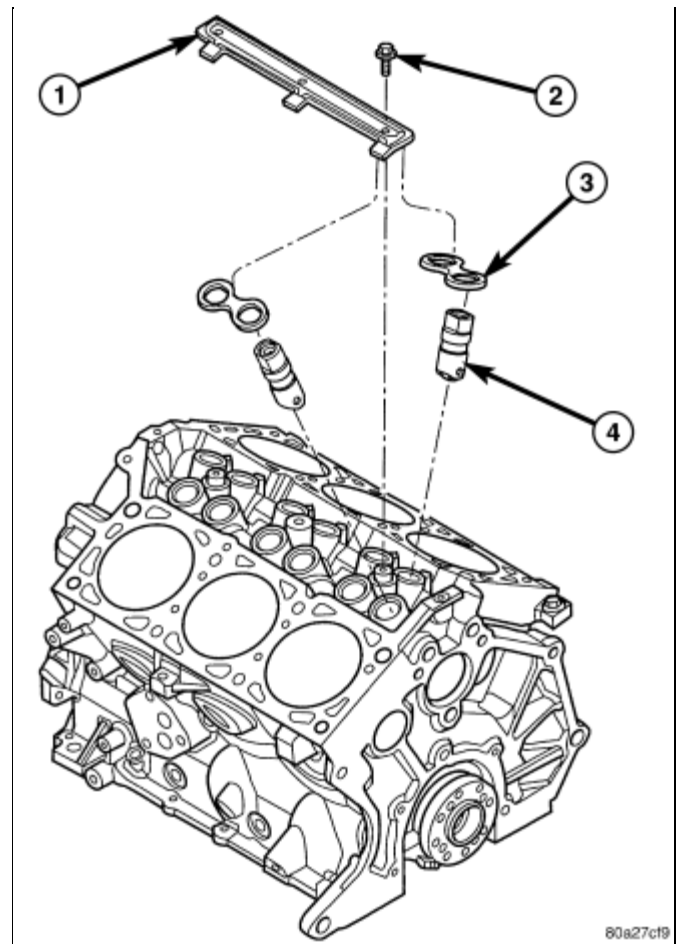
INSTALLATION

1. Lubricate the lifters with engine oil.

NOTE: Position the lifter in bore with the lubrication hole facing upward.

2. Install the hydraulic lifters with the lubrication hole facing upward towards middle of block. Install lifters in original positions, if reused.





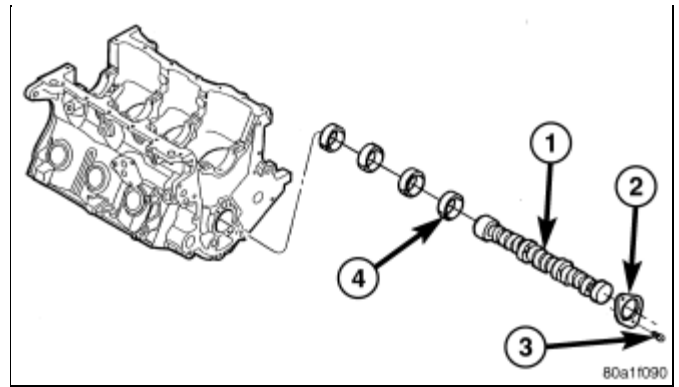
1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

3. Install lifter aligning yokes (3).
4. Install yoke retainer (1) and torque screws (2) to 12 N·m (105 in. lbs.).
5. Install the cylinder heads. (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION)
6. Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic lifters have filled with oil and have become quiet.

CAMSHAFT & BEARINGS (IN BLOCK)

DESCRIPTION



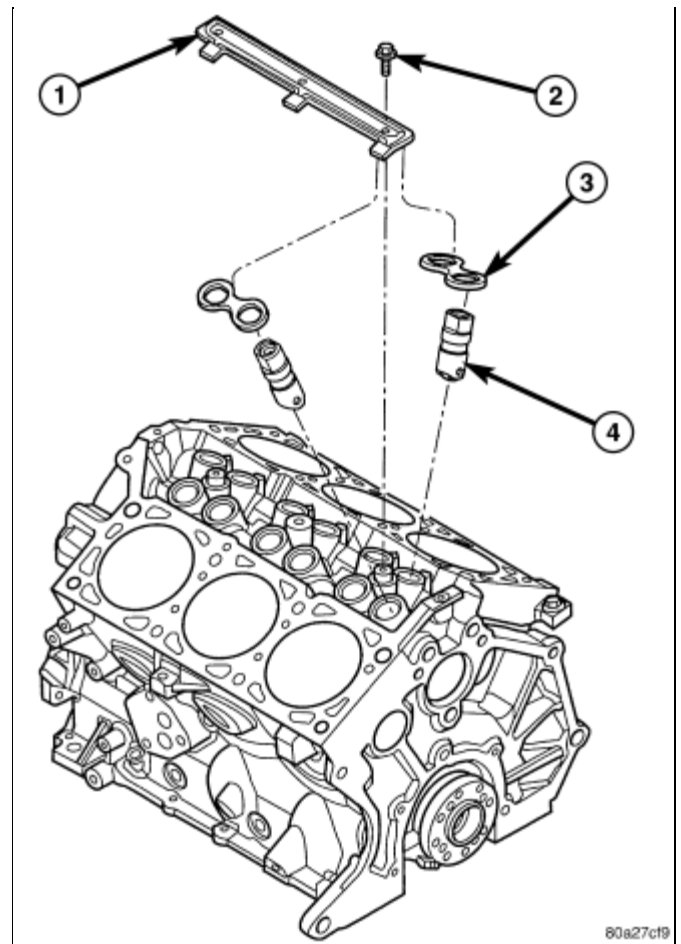
1 - CAMSHAFT
2 - THRUST PLATE
3 - BOLT
4 - CAMSHAFT BEARINGS (SERVICED WITH BLOCK)

The nodular iron camshaft (1) is mounted in the engine block and supported with four steel backed aluminum bearings (4). A thrust plate (2), located in front of the first bearing, is bolted to the block and controls the camshaft end play.

OPERATION

The camshaft is driven by the crankshaft through a timing chain and sprockets. The camshaft has precisely machined (egg-shaped) lobes to provide accurate valve timing and duration.

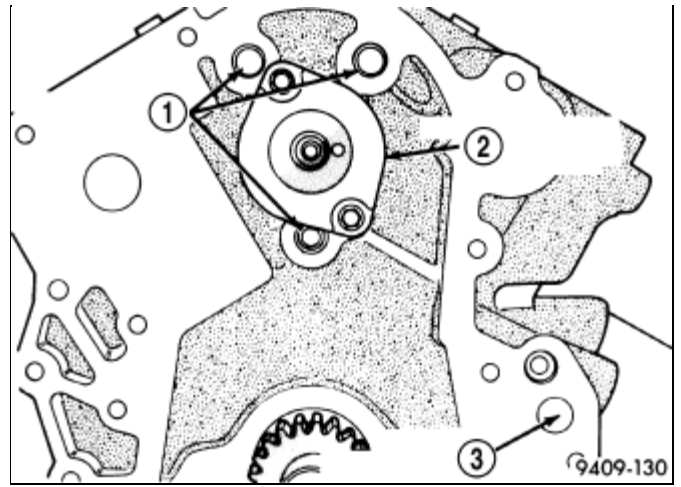
REMOVAL



HYDRAULIC LIFTERS

1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

1. Remove the radiator and cooling fans from the vehicle.
2. Remove the cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. Remove the timing chain and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the yoke retainer (1).
5. Remove the hydraulic lifters (4) (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - REMOVAL). Identify each tappet for reinstallation in original location.



1 - OIL GALLERY CUP PLUGS
2 - CAMSHAFT THRUST PLATE
3 - OIL FEED GALLERY FROM PUMP

6. Remove camshaft thrust plate (2).

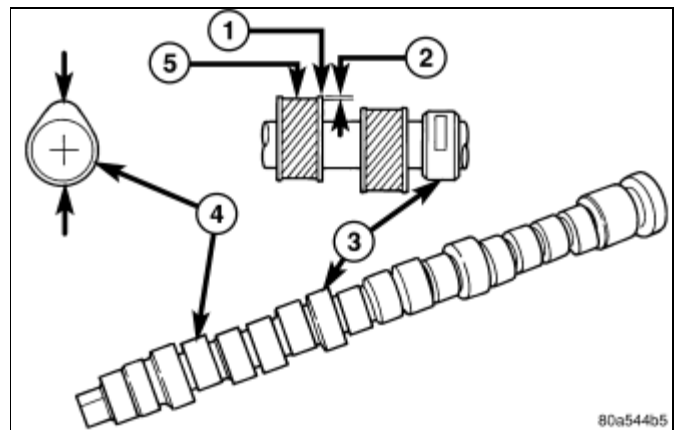
NOTE: Slowly remove the camshaft from the engine taking precautions not to damage the camshaft bearings.

7. Install a long bolt into front of camshaft to facilitate removal of the camshaft.

8. Carefully remove the camshaft,

NOTE: The camshaft bearings are serviced with the engine block.

INSPECTION



1 - UNWORN AREA
2 - ACTUAL WEAR

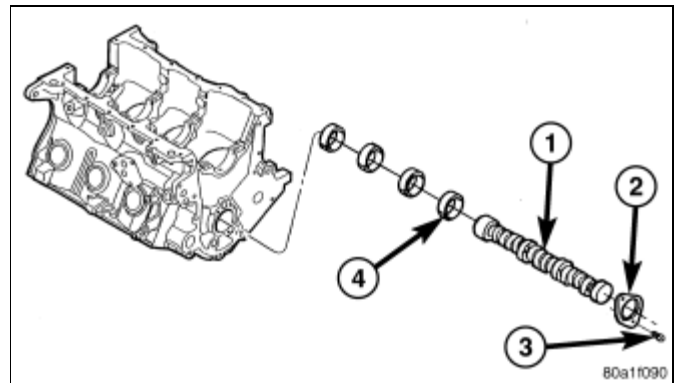
3 - BEARING JOURNAL
4 - LOBE
5 - WEAR ZONE

1. Check the cam lobes (4) and bearing surfaces (3) for abnormal wear and damage. Replace camshaft as required.

NOTE: If camshaft is replaced due to lobe wear or damage, always replace the lifters.

2. Measure the lobe (2) actual wear (unworn area - wear zone = actual wear) and replace camshaft if out of limit. Standard value is 0.0254 mm (0.001 in.), wear **limit** is 0.254 mm (0.010 in.).

INSTALLATION

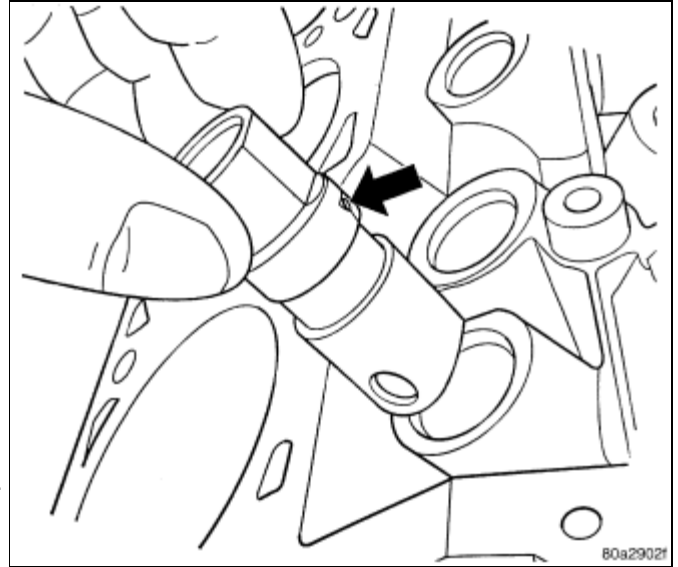


1 - CAMSHAFT
2 - THRUST PLATE
3 - BOLT
4 - CAMSHAFT BEARINGS (SERVICED WITH BLOCK)

1. Lubricate camshaft lobes (1) and camshaft bearing journals (4) with engine oil.
2. Install a long bolt into the camshaft to assist in the installation of the camshaft.
3. Carefully install the camshaft (1) in engine block.
4. Install camshaft thrust plate (2) and bolts (3). Tighten to 12 N·m (105 in. lbs.) torque.
5. Measure camshaft end play. (Refer to 9 - ENGINE - SPECIFICATIONS) If not within specifications, replace thrust plate.
6. Install the timing chain and sprockets. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

NOTE: When camshaft is replaced, all of the hydraulic lifters must be replaced.

7. Install the hydraulic lifters with lubrication hole in the upward position (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - INSTALLATION).
8. Install the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)
9. Install the cylinder heads. (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION)
10. Install the cylinder head covers. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)
11. Install the lower and upper intake manifolds. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION)
12. Install the radiator and cooling fan.



ROD-CONNECTING-PISTON

DESCRIPTION

CAUTION: DO NOT STAMP the connecting rods during identification. The use of a scribe or a paint mark is acceptable.

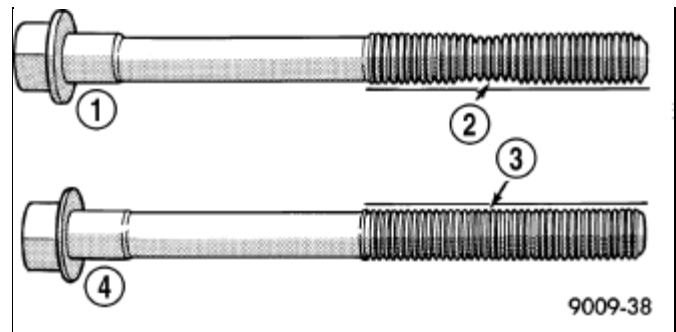
NOTE: The 3.8L may have any combination of forged or cracked cap connecting rods. The cracked cap design is easily identified by the connecting rod cap bolts rather than the traditional forged connecting rod cap nuts. The cracked cap design also has a different tightening procedure and specification. The connecting rod caps must be paint marked or scribed to identify the accompanying connecting rod. All connecting rod caps ARE NOT interchangeable between connecting rods.

The pistons are made of cast aluminum alloy and are a strutless, short skirt design. The connecting rods have either the standard forged caps or forged cracked cap design. Both the cracked cap and forged cap connecting rod designs are interchangeable and may be found in any combination when mounted to the crankshaft. The difference between the two different rod caps, aside from design, is the tightening procedure and specification. The piston rings consist of two compression rings and a three piece oil ring. Piston pins connect the piston to the forged steel connecting rods. The piston pins are a press fit into the connecting rod small bore. The piston, pin and connecting rod are serviced as an assembly.

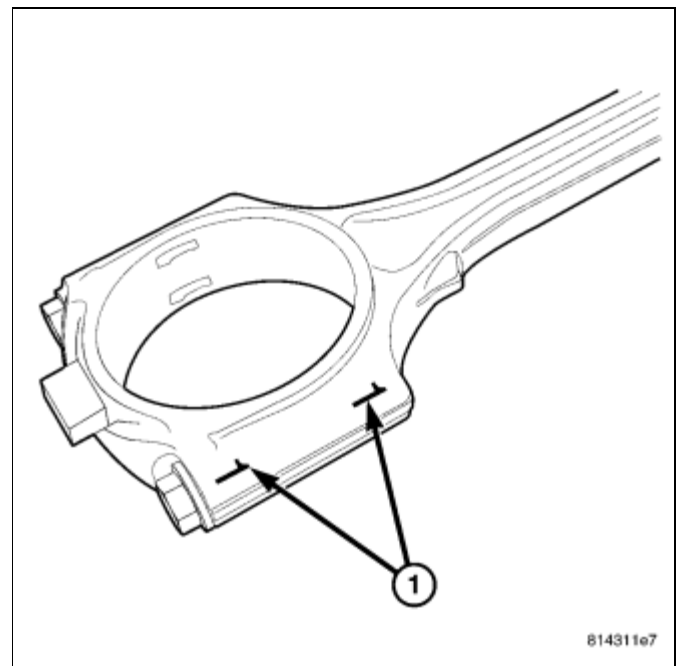
STANDARD PROCEDURE

FITTING CONNECTING RODS

1 - STRETCHED BOLT
2 - THREADS ARE NOT STRAIGHT ON LINE
3 - THREADS ARE STRAIGHT ON LINE
4 - UNSTRETCHED BOLT



NOTE: The connecting rod cap bolts (4) should be examined before reuse. Bolt stretch can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale (2) the bolt (1) must be replaced.



1 - PAINT MARK OR SCRIBE

The bearing caps are not interchangeable or reversible, and should be marked (1) at removal to ensure correct reassembly. Cracked bearing caps stay with the cracked rod. The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod. For connecting rod bearing fitting (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE). Fit all connecting rods on one bank until complete.

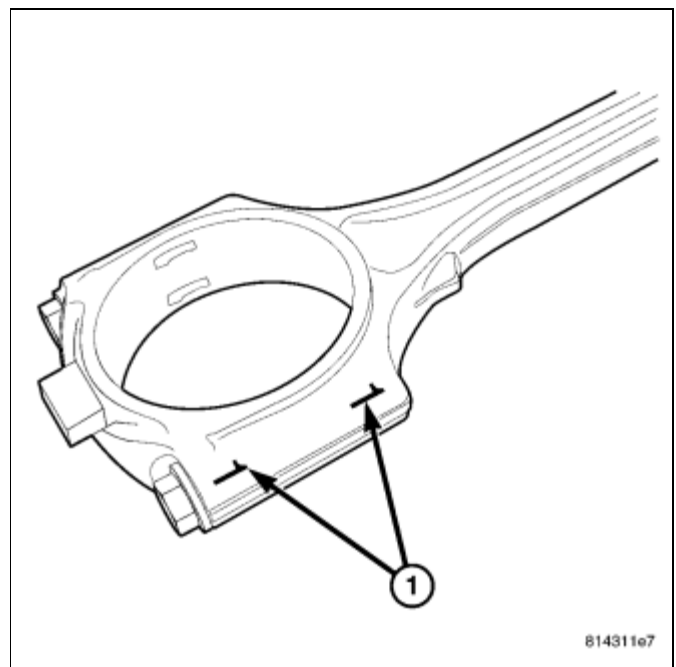
1. Before installing the bolts, the threads should be oiled with engine oil.
2. Install bolts finger tight then alternately torque each bolt to assemble the cap properly.
3. Tighten the cracked cap bolts to 28 N·m PLUS 90 degrees (20 ft.lbs.) plus 90 degrees.
4. Using a feeler gauge, check connecting rod side clearance. Refer to Engine Specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

FITTING PISTONS

NOTE: Pistons and connecting rods are machined to tight weight tolerances and need not be sorted in any way.

The piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line. Refer to Engine Specifications (Refer to 9 - ENGINE - SPECIFICATIONS). **Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).**

REMOVAL

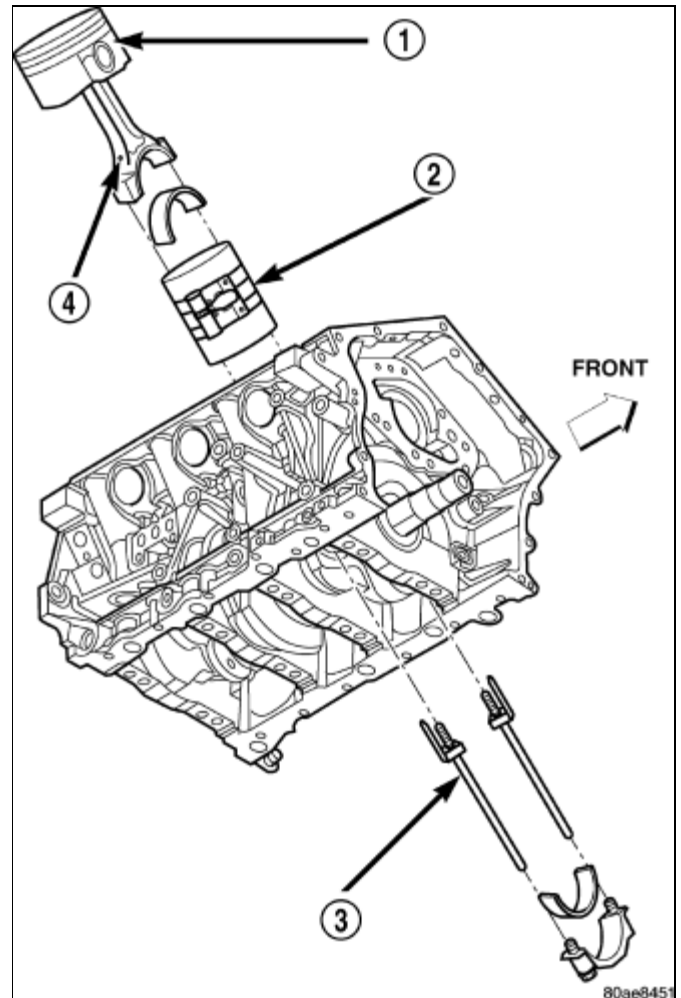


1 - PAINT MARK OR SCRIBE

NOTE: Refer to the connecting rod Description before beginning repair. (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - DESCRIPTION).

1. Disconnect negative cable from battery.
2. Remove the cylinder heads. (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL)
3. Remove the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

4. Remove the top ridge of cylinder bores with a reliable ridge reamer, if necessary, before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connecting rod is centered in cylinder bore.**
5. Inspect connecting rods and connecting rod caps for cylinder identification (1). Identify them (1), if necessary.



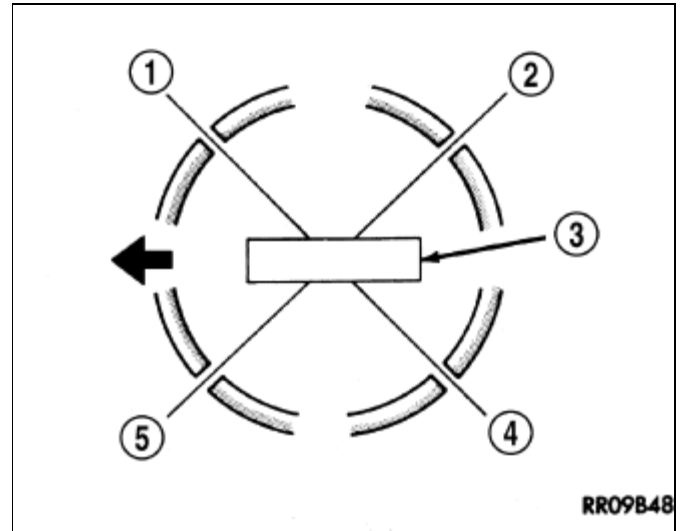
1 - "F" TOWARD FRONT OF ENGINE
2 - RING COMPRESSOR
3 - SPECIAL TOOL 8189
4 - OIL SQUIRT HOLE

6. Remove connecting rod cap. Install connecting rod bolt protectors special tool #8189 (3) on connecting rod to guide cracked connecting rod (4).
7. Remove each piston (1) and connecting rod assembly (4) out of the cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

8. After removal, install bearing cap on the mating rod.

INSTALLATION

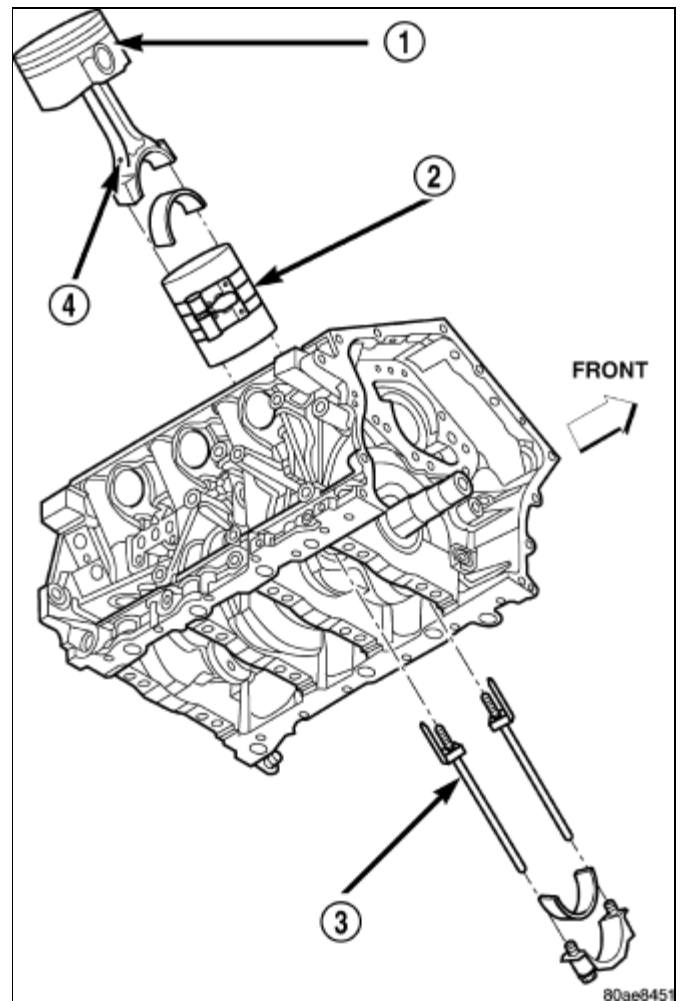
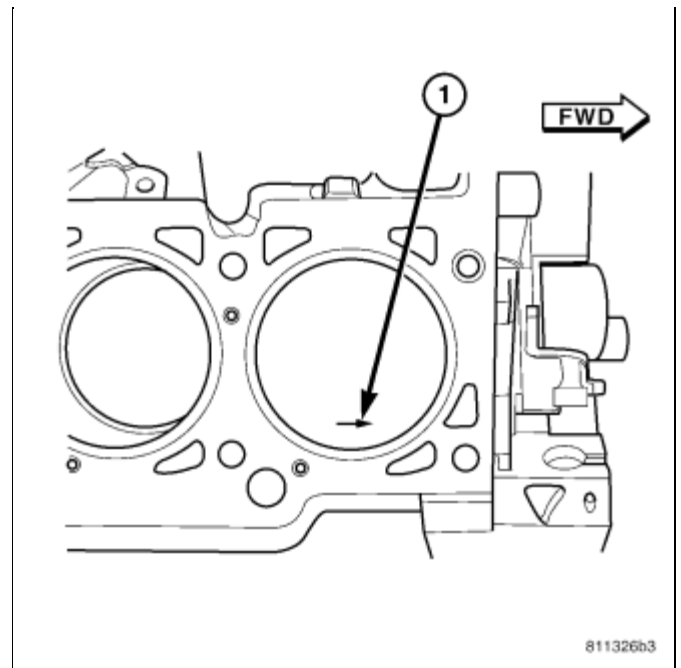


1 - SIDE RAIL UPPER
2 - NO. 1 RING GAP
3 - PISTON PIN
4 - SIDE RAIL LOWER
5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

NOTE: Refer to the connecting rod Description before beginning repair. (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - DESCRIPTION).

1. Before installing pistons and connecting rod assemblies into the bore, ensure that compression ring gaps (2,5) are staggered so that neither is in line with oil ring rail gap (1,4).

2. Before installing pistons and connecting rod assemblies into the bore, ensure that the arrow (1) on top of the piston is facing the front of the engine, if equipped.



1 - "F" TOWARD FRONT OF ENGINE

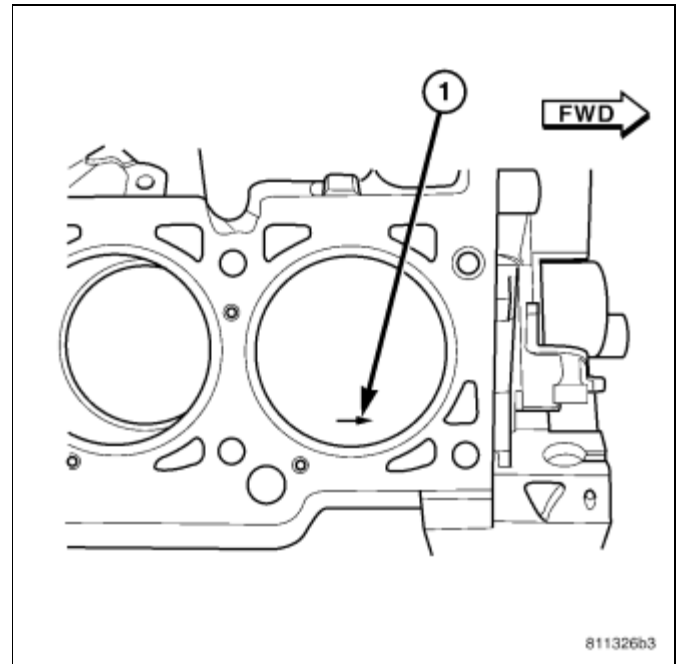
2 - RING COMPRESSOR

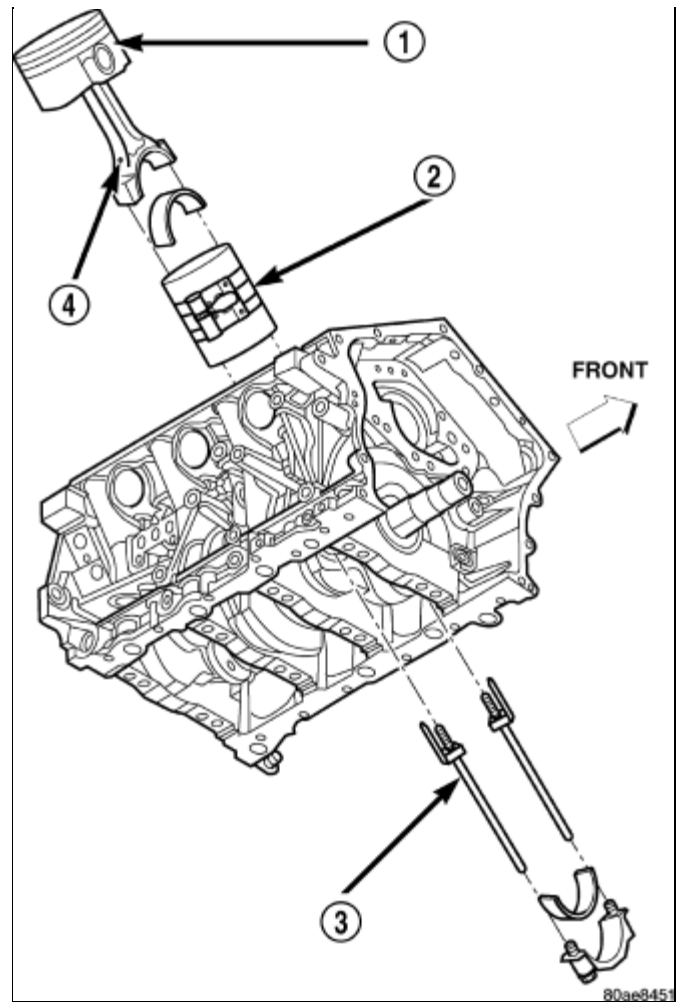
3 - SPECIAL TOOL 8189

4 - OIL SQUIRT HOLE

3. Lubricate the piston (1) and rings with clean engine oil. Position a ring compressor (2) over the piston and rings, and tighten the compressor (2). **Be sure position of rings does not change during this operation.**
4. Position upper bearing onto connecting rod. Lubricate bearing with oil.
5. Install connecting rod protectors special tool #8189 (3) on the connecting rod,

6. The pistons are marked with an arrow (1) on top of the piston. Install piston with this mark positioned to front of engine on both cylinder banks. The connecting rod oil squirt hole faces the major thrust (right) side of the engine block.





1 - "F" TOWARD FRONT OF ENGINE
2 - RING COMPRESSOR
3 - SPECIAL TOOL 8189
4 - OIL SQUIRT HOLE

7. Rotate crankshaft until the connecting rod journal is located in the center of the cylinder bore. Insert connecting rod and piston into cylinder bore by tapping down on the piston (1) using a hammer handle. At the same time, guide connecting rod (4) into position on connecting rod journal.
8. Install lower bearing shell and the appropriate connecting rod cap.
9. Install connecting rod bolts and tighten to 7 N·m (5 ft. lbs) initially. Tighten the bolts an additional 21 N·m (15 ft. lbs.) and then turn each bolt 90° to final clamping load.
10. Repeat procedure for each piston and connecting rod installation.
11. Install the cylinder heads. (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION)
12. Install the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)
13. Fill engine crankcase with proper oil to correct level.
14. Connect negative cable to battery.

BEARINGS-CONNECTING ROD

STANDARD PROCEDURE - MEASURING CONNECTING ROD BEARING CLEARANCE

The bearing caps are not interchangeable and should be marked at removal to ensure correct assembly. The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod. Fit all rods on one bank until complete. Connecting rod bearings are available in the standard size and the following undersizes: 0.025 mm (0.001 in.) and 0.250 mm (0.010 in.).

CAUTION: Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.

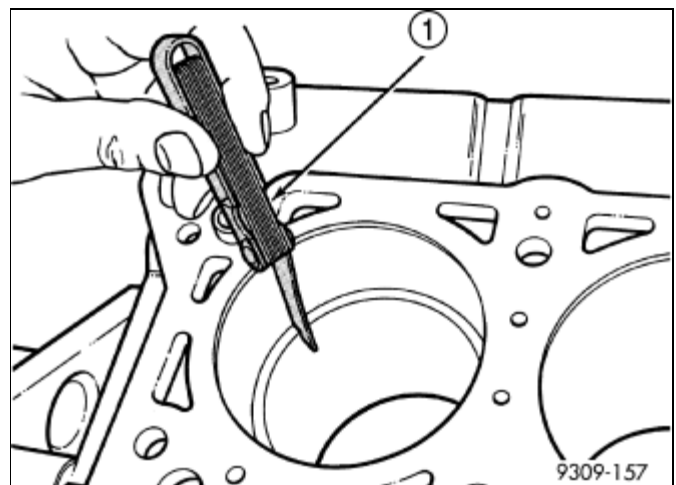
Measure connecting rod journal for taper and out-of-round.

The connecting rod bearing clearances can be determined by use of Plastigage or the equivalent. The following is the recommended procedure for the use of Plastigage:

1. Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.
2. Remove oil film from surface to be checked. Plastigage is soluble in oil.
3. Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from the oil hole. In addition, suspect areas can be checked by placing Plastigage in that area.
4. Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**
5. Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package. Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications (Refer to 9 - ENGINE - SPECIFICATIONS) . **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds wear limit specification, replace the bearing.**

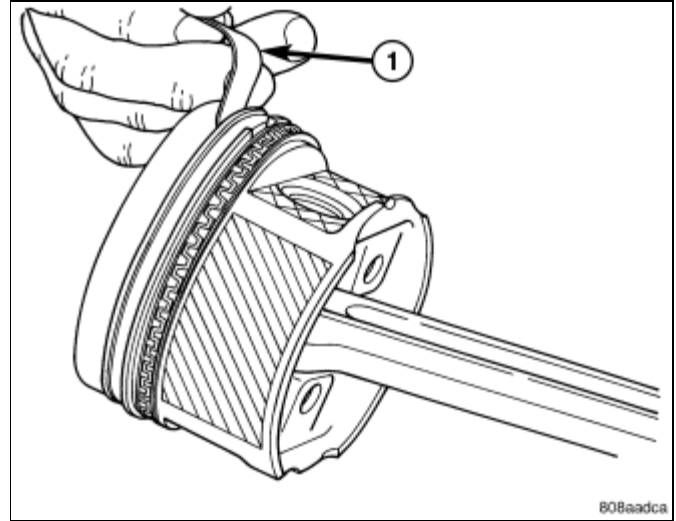
RINGS-PISTON

STANDARD PROCEDURE - PISTON RING FITTING



1 - FEELER GAUGE

1. Wipe cylinder bore clean. Insert the ring and push down with piston to ensure squareness in bore to approximately 12 mm (0.50 in.) from top of cylinder bore. Check ring gap with a feeler gauge (1). For clearance specification (Refer to 9 - ENGINE - SPECIFICATIONS).



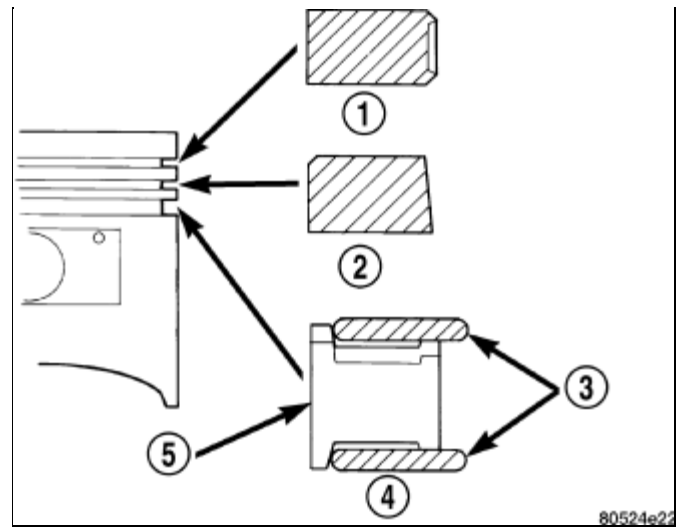
1 - FEELER GAUGE

2. Check piston ring to groove side clearance (1). For clearance specification (Refer to 9 - ENGINE - SPECIFICATIONS)

REMOVAL

1. Remove piston and connecting rod. (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL)
2. Remove No. 1 and No.2 piston rings from piston using a ring expander tool.
3. Remove upper oil ring side rail.
4. Remove lower oil ring side rail.
5. Remove oil ring expander.

INSTALLATION

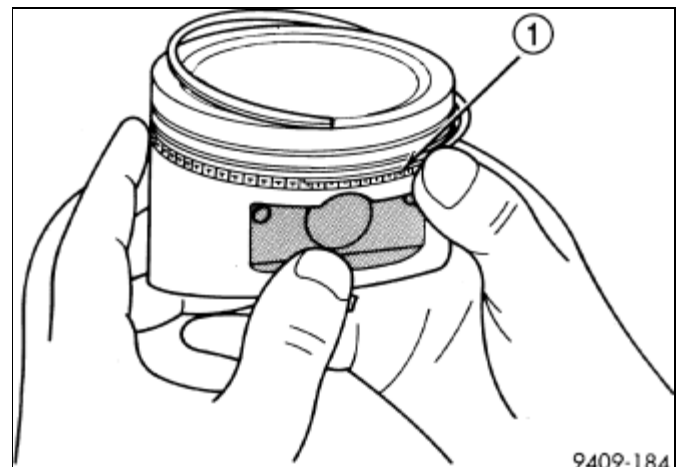


1 - NO. 1 PISTON RING
2 - NO. 2 PISTON RING
3 - SIDE RAIL
4 - OIL RING
5 - SPACER EXPANDER

1. Install rings with manufacturers I.D. mark (if present) facing up, to the top of the piston.

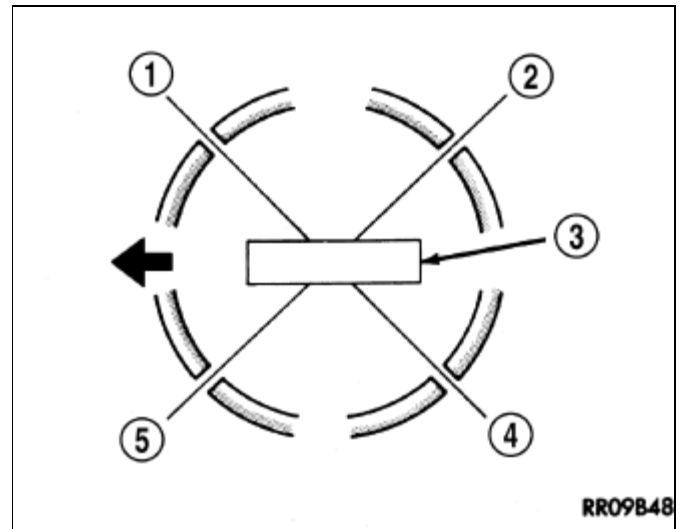
CAUTION: Install piston rings in the following order:

- Oil ring expander (5).
- Lower oil ring side rail (4).
- Upper oil ring side rail.
- No. 2 Intermediate piston ring (2).
- No. 1 Upper piston ring (1).



1 - SIDE RAIL END

2. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander.**
3. Install lower side rail first and then the upper (1) side rail.
4. Install No. 2 piston ring and then No. 1 piston ring.



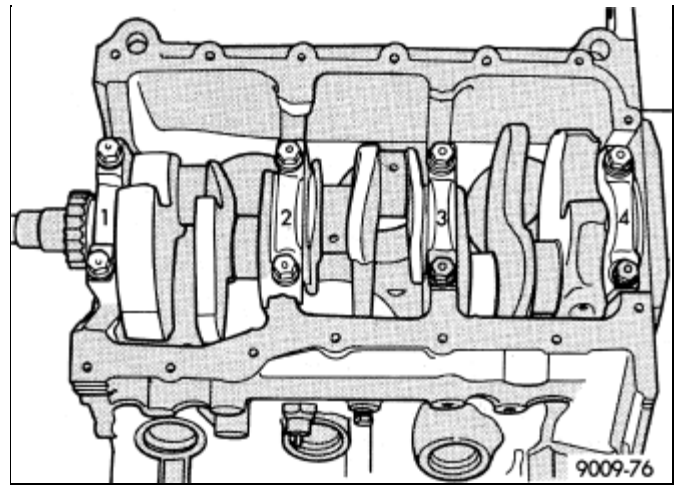
1 - SIDE RAIL UPPER
2 - NO. 1 RING GAP
3 - PISTON PIN
4 - SIDE RAIL LOWER
5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

5. Position piston ring end gaps.
6. Position oil ring expander gap (5) at least 45° from the side rail gaps (1,4) but **not** on the piston pin (3) center or on the thrust direction. Staggering ring gap is important for oil control.

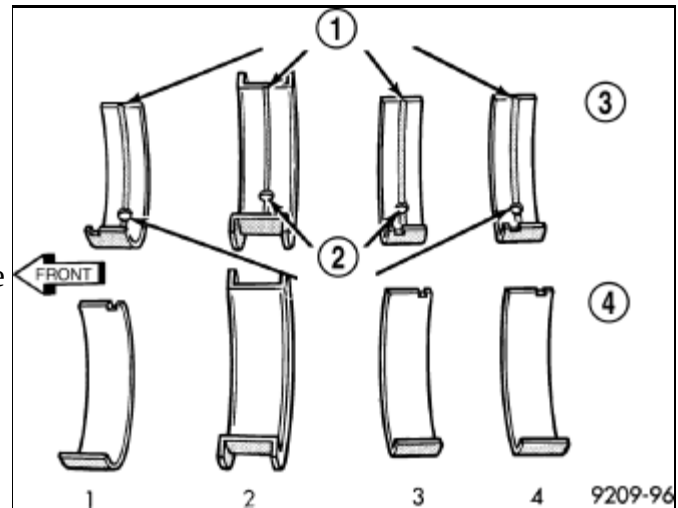
BEARINGS-CRANKSHAFT MAIN

STANDARD PROCEDURE - MAIN BEARING FITTING

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of 1, 3 and 4 are interchangeable. Upper main bearing halves of 1, 3 and 4 are interchangeable.



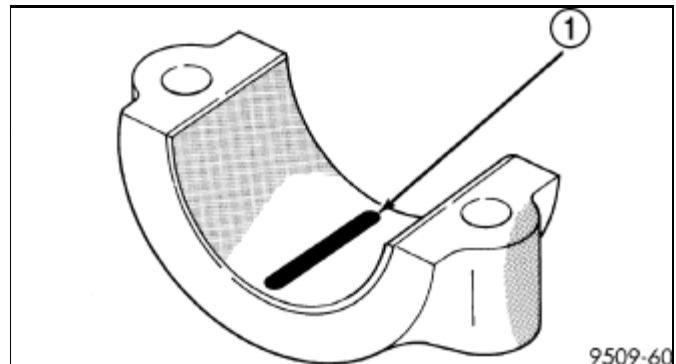
Upper and lower main bearing, position 2 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine. All bearing cap bolts removed during service procedures are to be cleaned and lubricated with engine oil before installation. Bearing shells are available in standard and the following undersizes: 0.025 mm (0.001 in.) and 0.254 mm (0.010 in). Never install an undersize bearing that will reduce clearance below specifications.



CRANKSHAFT BEARING OIL CLEARANCE

Inspect the crankshaft bearing journals.

Engine crankshaft bearing clearances can be determined by use of Plastigage (1) or the equivalent. The following is the recommended procedures for the use of Plastigage with the engine in the vehicle or engine on a repair stand.



PLASTIGAGE METHOD—ENGINE IN-VEHICLE

NOTE: The total clearance of the main bearings can only be determined with the engine in the vehicle by removing the weight of the crankshaft. This can be accomplished by either of two following methods:

1. Preferred method:

- Shim the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 in.) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tightening bolts to 14–20 N·m (10–15 ft. lbs.).
 - When checking #1 main bearing shim #2 main bearing.
 - When checking #2 main bearing shim #1 & #3 main bearing.
 - When checking #3 main bearing shim #2 & #4 main bearing.
 - When checking #4 main bearing shim #3 main bearing.

NOTE: Remove all shims before reassembling engine.

2. Alternative Method:

- Support the weight of the crankshaft with a jack under the counterweight adjacent to the bearing being checked.

3. Remove oil film from surface to be checked. Plastigage is soluble in oil.

4. Place a piece of Plastigage (1) across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

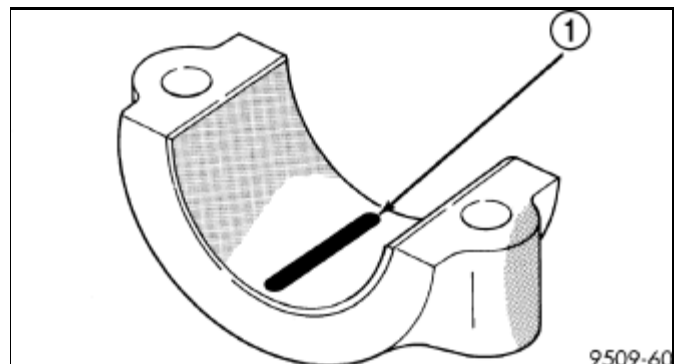
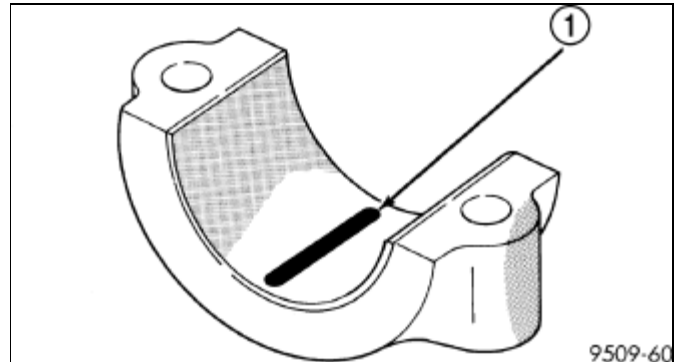
5. Remove the bearing cap and compare the width of the flattened Plastigage (1) with the scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. (Refer to 9 - ENGINE - SPECIFICATIONS) **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

PLASTIGAGE METHOD—ENGINE OUT-OF-VEHICLE

1. With engine in the inverted position (crankshaft up) and mounted on a repair stand, remove main journal cap.
2. Remove oil from journal and bearing shell.
3. Cut Plastigage (1) to same length as width of the bearing and place it in parallel with the journal axis (1).
4. Carefully install the main bearing cap and tighten the bolts to specified torque (Refer to 9 - ENGINE - SPECIFICATIONS).

CAUTION: Do not rotate crankshaft or the Plastigage

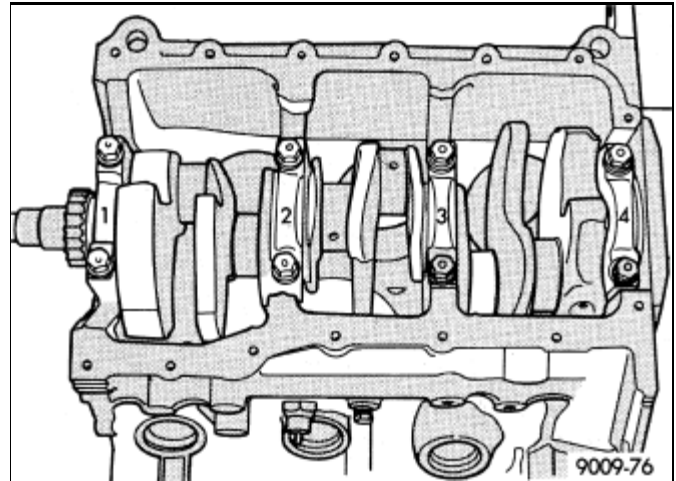


will be smeared.

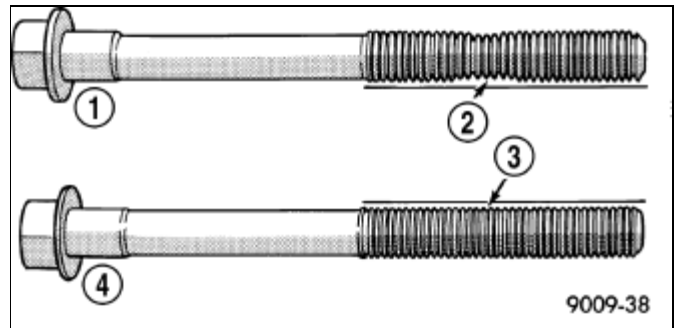
5. Carefully remove the bearing cap and measure the width of the Plastigage (1) at the widest part using the scale on the Plastigage package. Refer to Engine Specifications for proper clearances (Refer to 9 - ENGINE - SPECIFICATIONS). If the clearance exceeds the specified limits, replace the main bearing(s) with the appropriate size, and if necessary, have the crankshaft machined to next undersize.

REMOVAL - CRANKSHAFT MAIN BEARINGS

1. Remove the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
2. Identify main bearing caps before removal.
3. Remove bearing caps one at a time. Remove upper half of bearing by inserting Special Main Bearing Tool C-3059 into the oil hole of crankshaft.
4. Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.



INSTALLATION - CRANKSHAFT MAIN BEARINGS



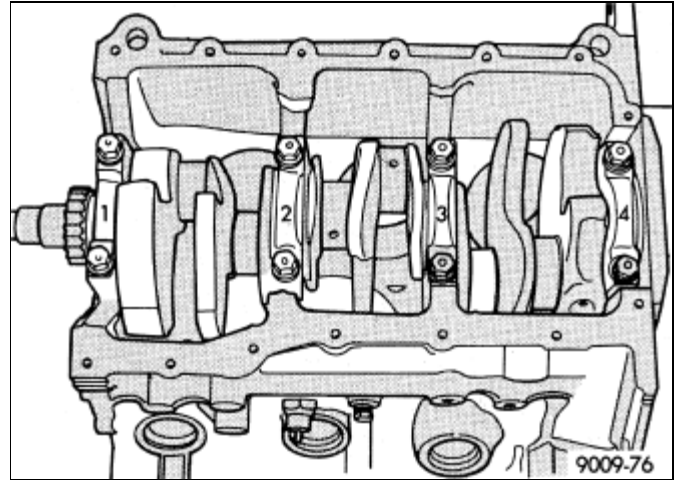
1 - STRETCHED BOLT
2 - THREADS ARE NOT STRAIGHT ON LINE
3 - THREADS ARE STRAIGHT ON LINE
4 - UNSTRETCHED BOLT

NOTE: One main bearing should be selectively fitted while all other main bearing caps are properly tightened.

1. For main bearing fitting procedure, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE)
2. Start bearing in place, and insert Main Bearing Tool C-3059 into oil hole of crankshaft.
3. Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059.
4. Inspect main cap bolts (4) for stretching. Replace bolts that are stretched.

NOTE: The main cap bolts (4) should be examined before reuse. Bolt stretch can be checked by holding a scale or straight edge against the threads (2). If all the threads do not contact the scale (2) the bolt must be replaced.

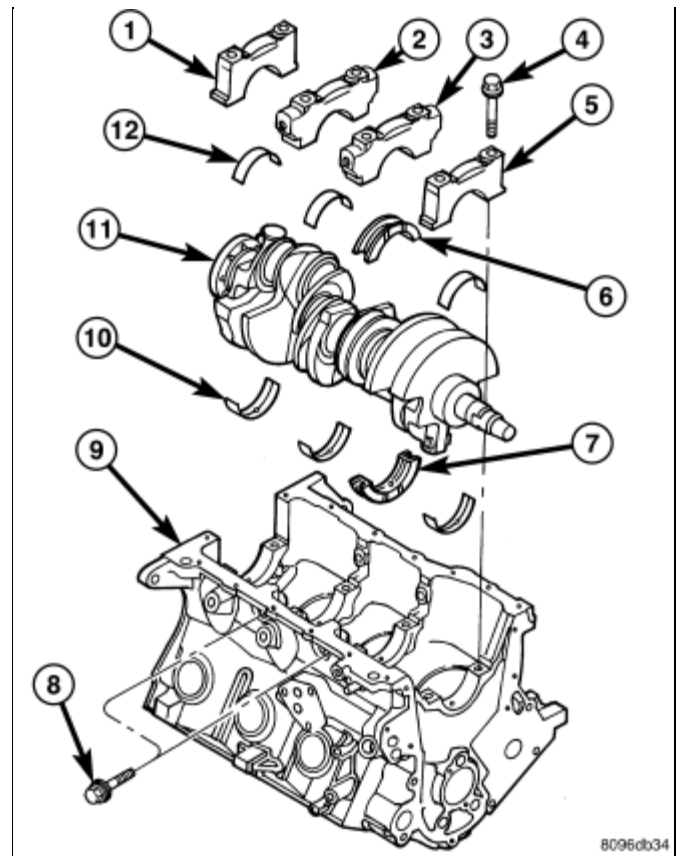
5. Install each main cap and tighten bolts finger tight.
6. Tighten number 1, 3 and 4 main cap bolts to 41 N·m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn).
7. Rotate the crankshaft until the number 6 piston is at TDC.
8. To ensure correct thrust bearing alignment the following procedure must be done:
 - Move crankshaft all the way to the rear of its travel.
 - Then, move crankshaft all the way to the front of its travel.
 - Wedge an appropriate tool between the rear of the cylinder block and rear crankshaft counterweight. This will hold the crankshaft in it's most forward position.
 - Tighten the #2 Thrust Bearing cap bolts to 41 N·m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn). Remove the holding tool.



9. Install oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)
10. Fill engine crankcase with proper oil to correct level.

CRANKSHAFT

DESCRIPTION - 3.8L



1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

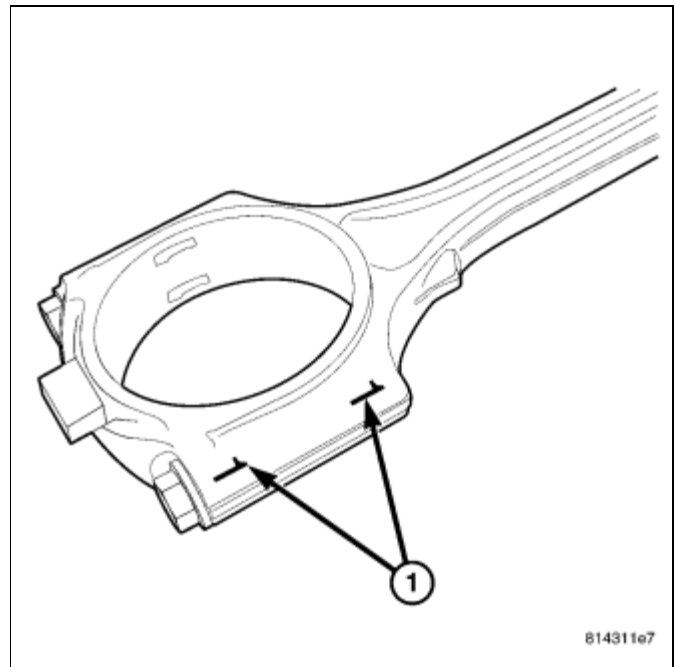
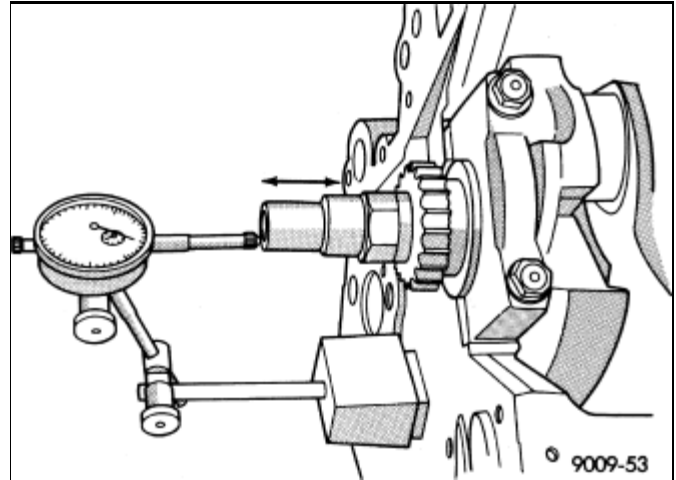
The nodular iron crankshaft is supported by four main bearings, with number two position (3) providing thrust bearing location. Each main bearing cap has two vertical retaining bolts. The two center main caps have horizontal bolts (8) to add increased rigidity to the lower engine block. Crankshaft end sealing is provided by

front and rear rubber seals.

STANDARD PROCEDURE - MEASURING CRANKSHAFT END PLAY

1. Mount a dial indicator to front of engine with the locating probe on nose of crankshaft.
2. Move crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move crankshaft all the way to the front and read the dial indicator. (Refer to 9 - ENGINE - SPECIFICATIONS) for end play specification.

REMOVAL



1 - PAINT MARK OR SCRIBE

1. Remove the engine assembly (Refer to 9 - ENGINE - REMOVAL).
2. Mount engine on an engine stand.
3. Remove the oil filter.
4. Remove the oil pan and oil pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
5. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - REMOVAL).
6. Remove timing chain and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND

SPROCKETS - REMOVAL).

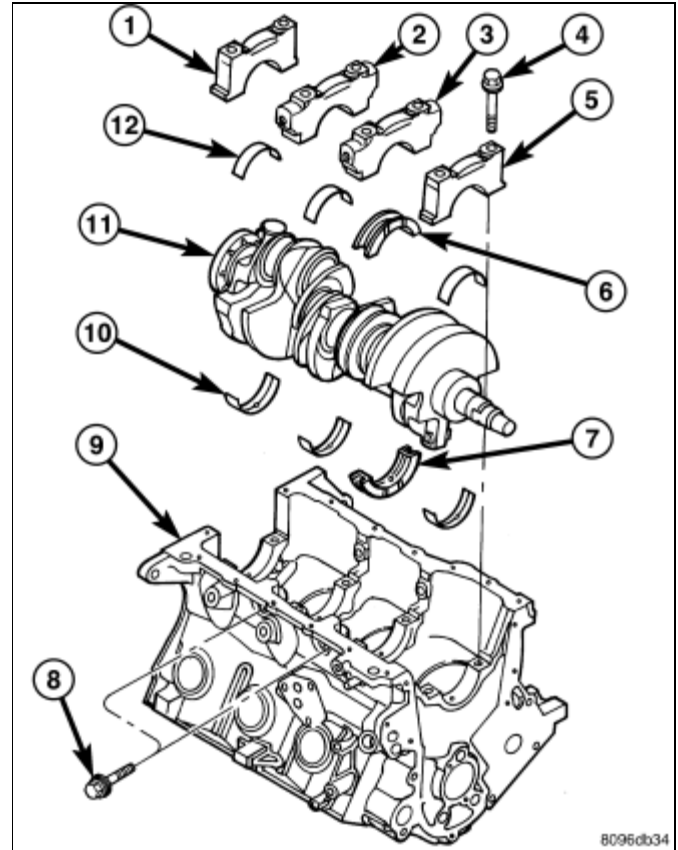
7. Remove crankshaft rear oil seal and retainer (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINER - REMOVAL).

8. Rotate the crankshaft until connecting rod cap is accessible.

9. Paint mark or scribe the connecting rod cap position (1).

10. Remove connecting rod bearing cap. Use care to prevent damage to the crankshaft bearing surfaces.

11. Repeat removal procedure for each connecting rod cap.



1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER

11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

12. Remove and discard the main bearing cross bolts and washers (8).

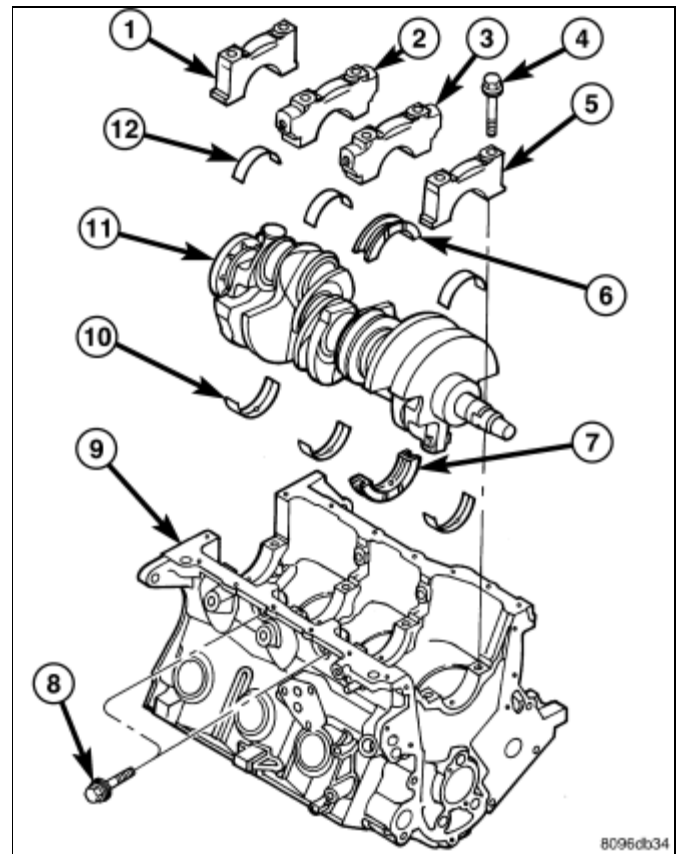
NOTE: Install new cross bolt and washer assembly (8) upon reassembly.

13. Remove the main bearing cap bolts (4).

14. Remove the main bearing caps (1,2,3,5).

15. Remove the crankshaft (11) from engine block.

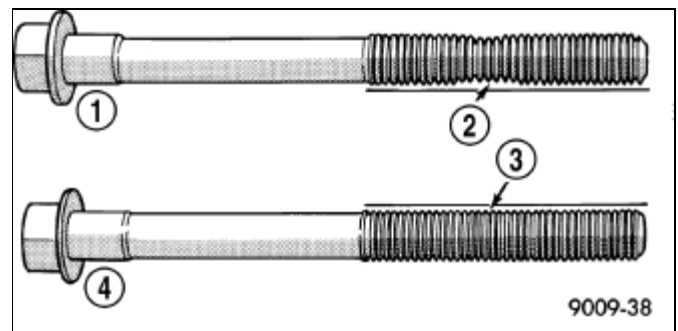
INSTALLATION



1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1

6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

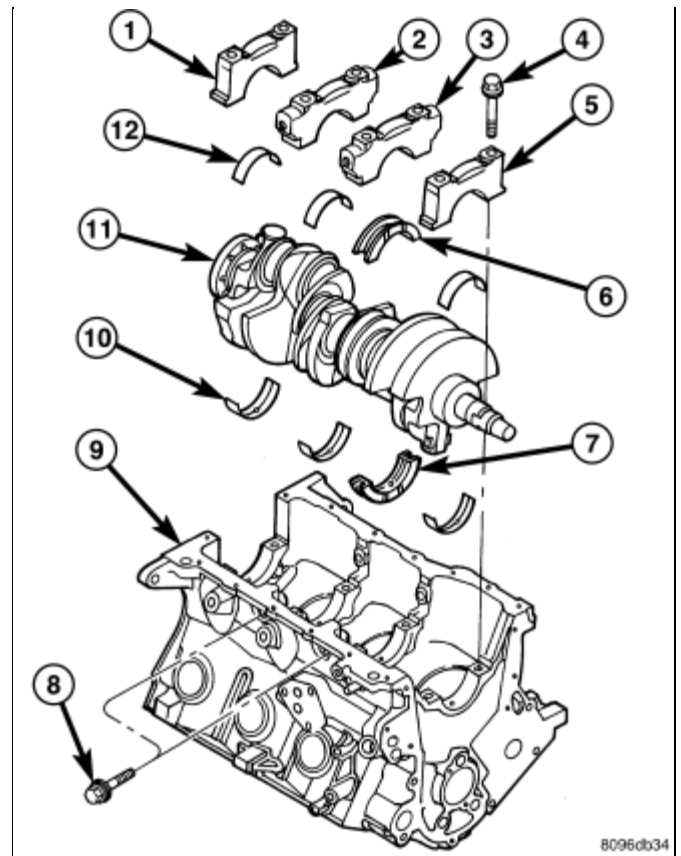
1. Lubricate with engine oil and install the crankshaft main bearing halves in the engine block.
2. Position the crankshaft (11) in engine block.
3. Perform main bearing fitting procedure (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE).



1 - STRETCHED BOLT
2 - THREADS ARE NOT STRAIGHT ON LINE
3 - THREADS ARE STRAIGHT ON LINE
4 - UNSTRETCHED BOLT

4. Inspect main cap bolts for stretching (2). Replace bolts that are stretched.

NOTE: The main cap bolts should be examined before reuse. Bolt stretch can be checked by holding a scale or straight edge (2) against the threads. If all the threads (3) do not contact the scale (2) the bolt must be replaced.



1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

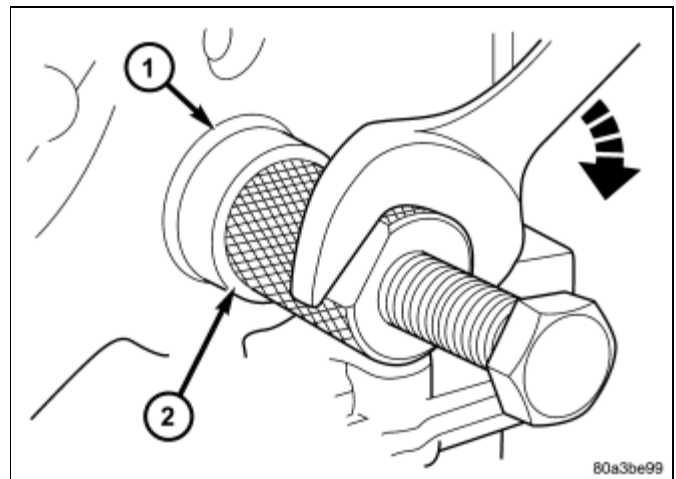
5. Install the main bearing caps (1,2,3,5) and bolts. Tighten bolts to 41 N·m (30 ft. lbs.) plus j turn.

NOTE: Install new cross bolt and washer assembly upon reassembly.

6. Install and tighten the NEW cross bolts and washer assemblies (8) to 61 N·m (45 ft. lbs.).
7. Position and install the connecting rod and bearing caps on the crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE).
8. Install the crankshaft rear oil seal (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINER - INSTALLATION)
9. Install the crankshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - INSTALLATION).
10. Install the timing chain and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - INSTALLATION).
11. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - INSTALLATION).
12. Install the oil pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
13. Install the engine assembly (Refer to 9 - ENGINE - INSTALLATION).

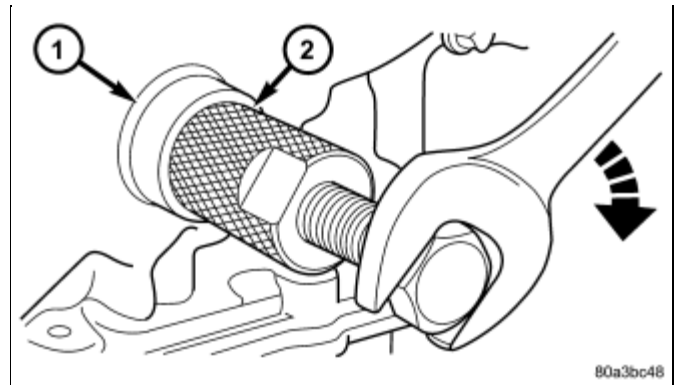
OIL SEAL-CRANKSHAFT-FRONT

REMOVAL



1 - SEAL
2 - SPECIAL TOOL 6341A

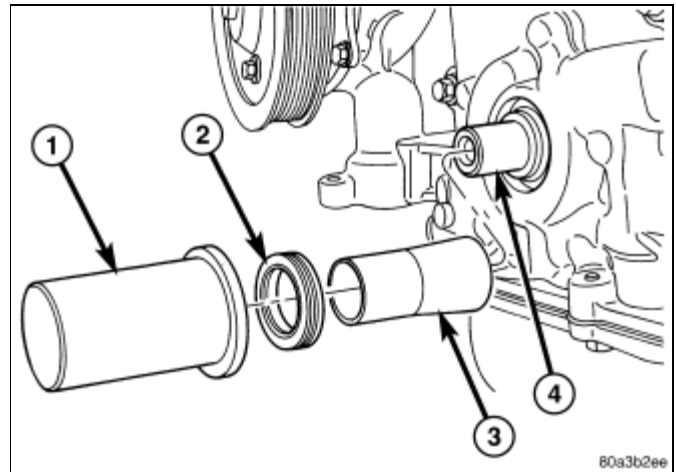
1. Disconnect negative cable from battery.
2. Remove accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)
3. Remove crankshaft damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)
4. Position Special Tool 6341A (2) on crankshaft nose. Carefully screw the tool into the seal (1) until it engages firmly. Be careful not to damage that crankshaft seal surface of cover



1 - SEAL
2 - SPECIAL TOOL 6341A

5. Remove oil seal (1) by turning the forcing screw until the seal disengages from the cover.

INSTALLATION



1 - SPECIAL TOOL C-4992-1
2 - SEAL
3 - SPECIAL TOOL C-4992-2
4 - CRANKSHAFT

1. Position Special Tool C-4992-2 Guide (3) , on the crankshaft nose.
2. Position new seal (2) over the guide with the seal spring in the direction of the engine front cover.
3. Install seal using Special Tool C-4992-1 (1) until seal is flush with cover.
4. Install crankshaft damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

5. Install accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)
6. Lower vehicle and connect negative cable to battery.

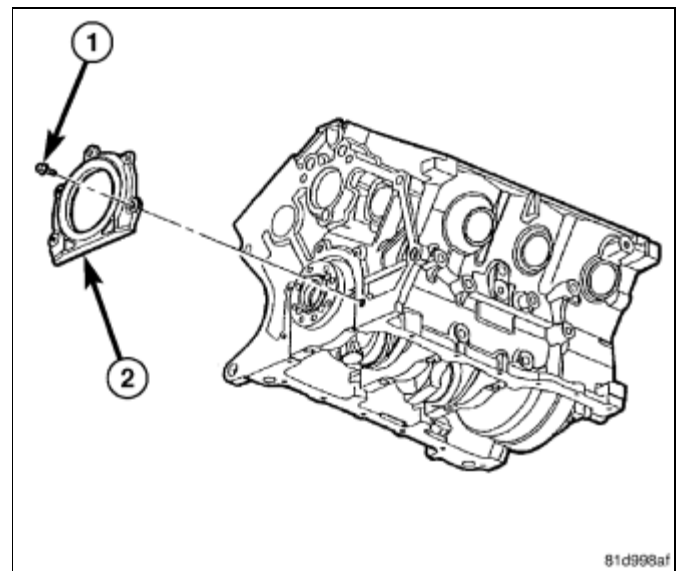
RETAINER-OIL SEAL-CRANK REAR

REMOVAL

NOTE: Any time the rear crank oil seal has been removed from the engine block, a new seal assembly must be installed. Do not re-use a real crank oil seal assembly once it has been removed.

1. Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL) or (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL).
2. Remove the flex plate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL) or for vehicles equipped with a manual transmission, the flywheel (Refer to 6 - CLUTCH/FLYWHEEL - REMOVAL).

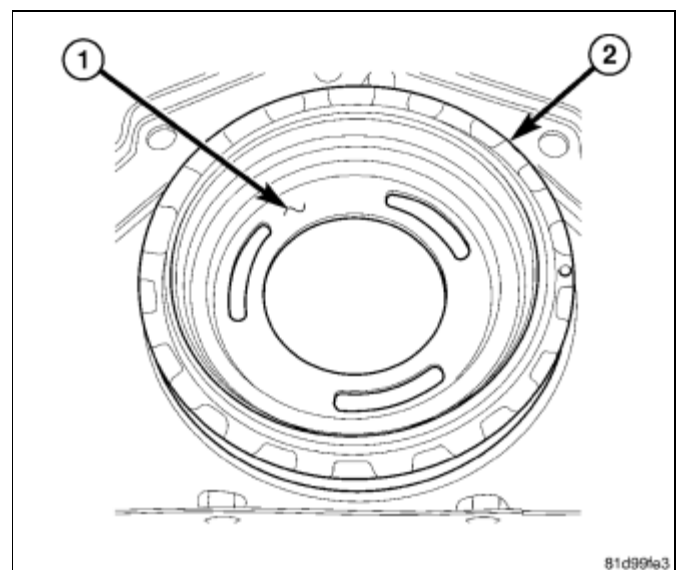
3. Remove oil seal retainer bolts (1).
4. Remove oil seal retainer (2).
5. Clean engine block and retainer of oil and gasket material. Make sure surfaces are clean and free of oil.



INSTALLATION

CAUTION: Before installing a new rear oil seal assembly, ensure that the plastic installation sleeve (1) is present in the seal assembly. The new seal cannot be properly installed without the plastic installation sleeve, and if the seal assembly is installed without it, oil leakage will result.

1. Remove any original sealer, oil, or debris from the rear oil seal retainer assembly mounting area.
2. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II in the lower corners of the rear crankshaft oil seal retainer mounting surface, where the seal retainer meets the oil pan (the T-Joint).
3. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II around the inside edge of the rear crankshaft oil seal retainer assembly recess in the engine block.



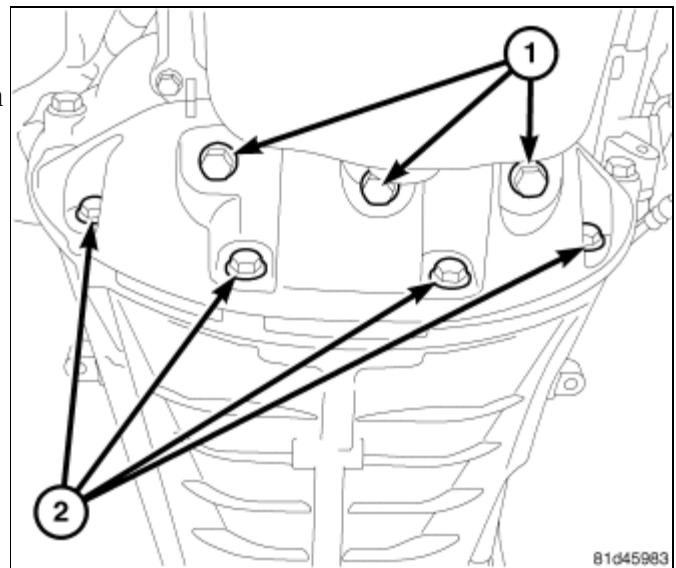
4. Place the rear crankshaft oil seal assembly over the rear crankshaft flange. Do not press seal assembly over the rear crankshaft flange at this time.
5. Using both hands, one on each side of the rear crankshaft flange, press the rear crankshaft oil seal over the rear crankshaft flange.
6. Ensure that the extruded dowels in the rear crankshaft oil seal are seated in the locating holes in the rear of the engine block.
7. Install the five rear crankshaft oil seal fasteners. Do not tighten at this time.
8. Remove and discard the plastic installation sleeve.
9. Tighten the five rear crankshaft oil seal fasteners to 11.8 Nm (105 in-lbs).
10. Install the flex plate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION) or flywheel (Refer to 6 - CLUTCH/FLYWHEEL - INSTALLATION).
11. Install the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION) or (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - INSTALLATION).

COVER-STRUCTURAL

REMOVAL

1. Raise vehicle on hoist.
2. Remove the bolts retaining structural cover to transmission (1,2).
3. Remove the bolts retaining structural cover to engine.
4. Remove the structural cover.

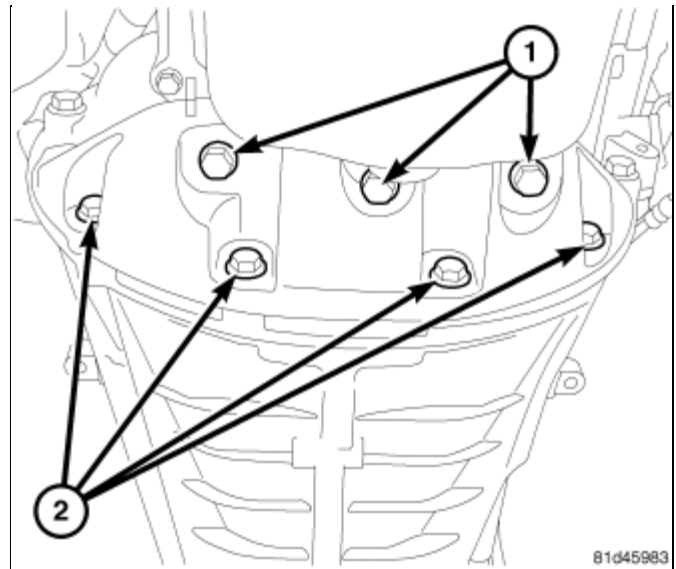
INSTALLATION



CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover or the oil pan.

1. Position the structural cover in the vehicle.
2. Install the bolts retaining the cover-to-oil pan (1). DO NOT tighten the bolts at this time.
3. Install the cover-to-transmission bolts (2). Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause



damage to the cover.

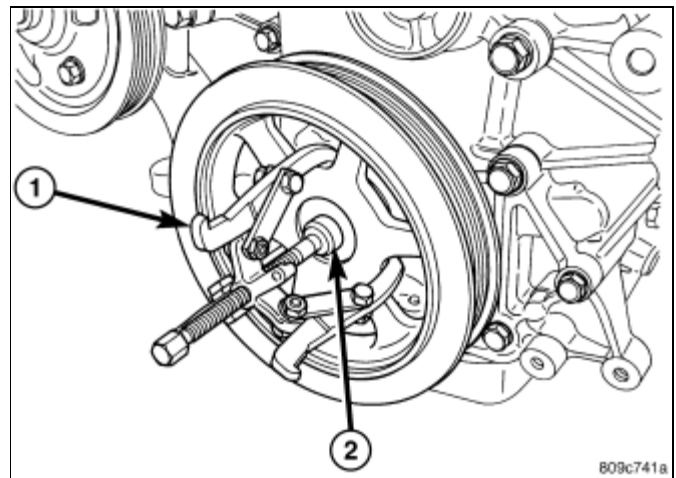
4. Tighten the two cover-to-transmission bolts to less than 25 lb. in. The cover must be flush to the transmission bellhousing machined surface.

5. Starting with the cover-to-oil pan bolts (1), tighten bolts to 54 N·m (40 ft. lbs.).

6. Tighten the cover-to-transmission bolts to 54 N·m (40 ft. lbs.).

DAMPER-VIBRATION

REMOVAL



1 - SPECIAL TOOL 8450 - INSERT

2 - SPECIAL TOOL 1026 - 3 JAW PULLER

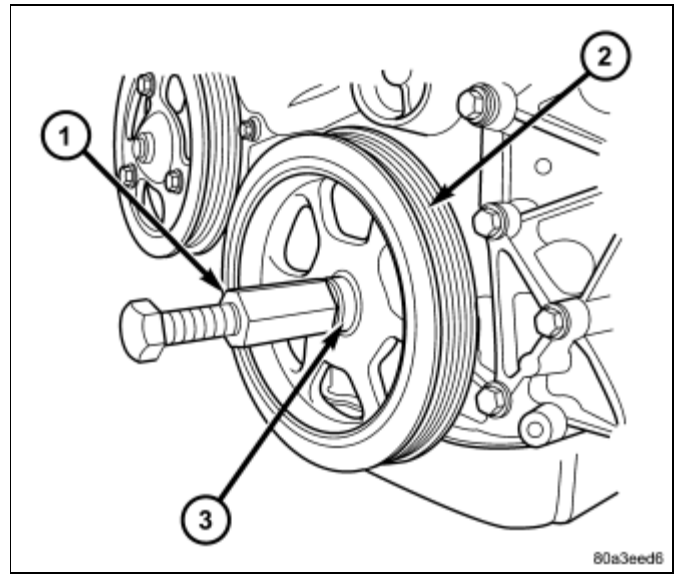
1. Disconnect negative cable from battery.

2. Raise vehicle on hoist.

3. Remove the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

4. Remove vibration damper bolt.
5. Insert Special Tool 8450 (2) into crankshaft nose.
6. Position 3-jaw puller Special Tool 1026 (2) on damper. Turn puller forcing screw until damper releases from crankshaft.
7. Remove the crankshaft vibration damper.

INSTALLATION



1 - FORCING SCREW / NUT FROM SPECIAL TOOL 8452
--

2 - VIBRATION DAMPER

3 - THRUST BEARING / WASHER

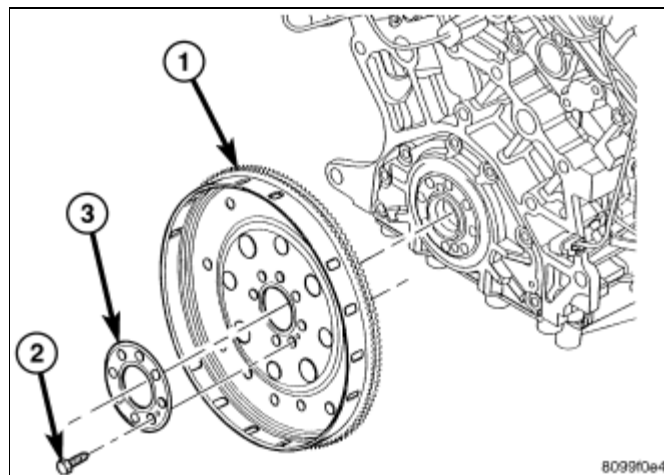
1. Install crankshaft vibration damper using the forcing screw, nut, and thrust bearing/washer (3) from Special Tool 8452 (1).

NOTE: To minimize friction and prolong tool life, lubricate the threads on the forcing screw of Special Tool 8452.

2. Position vibration damper on crankshaft.
3. Screw Special Tool 8452 (1) into crankshaft until the bolt seats. Turn the nut to install damper until it seats fully.
4. Remove Special Tool 8452.
5. Install vibration damper bolt. Torque bolt to 54 N·m (40 ft. lbs.).
6. Install the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)
7. Connect negative cable to battery.

FLEXPLATE

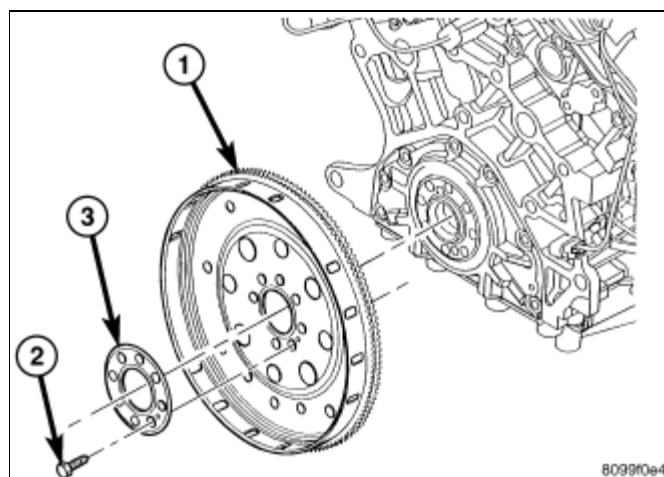
REMOVAL



1 - FLEX PLATE
2 - BOLT (QTY. 8)
3 - BACKING PLATE

1. Remove the transmission.
2. Remove flex plate attaching bolts.
3. Remove the flex plate (1).

INSTALLATION



1 - FLEX PLATE
2 - BOLT (QTY. 8)

3 - BACKING PLATE

1. Position flex plate (1) with backing plate on the crankshaft.
2. Apply Mopar® Lock & Seal Adhesive to the flex plate bolts.
3. Install flex plate bolts. Tighten bolts to 95 N·m (70 ft. lbs.).
4. Install the transmission.

MOUNT-FRONT

REMOVAL

1. Disconnect the negative cable from the battery.
2. Remove the engine oil filter.
3. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
4. Remove the cylinder block-to-insulator mount bolts and the nut from the engine insulator mount through bolt.
5. Using the jack, raise the engine high enough to remove the engine insulator mount thru bolt and the insulator mount.

INSTALLATION

1. Position the insulator mount and install the insulator mount through bolt.
2. Lower the engine until the cylinder block-to-insulator mount bolts can be installed.
3. Remove the jack and block of wood.
4. Torque the cylinder block-to-insulator mount bolts to 61 N·m (45 ft. lbs.).
5. Install and torque the through bolt retaining nut to 61 N·m (45 ft. lbs.).

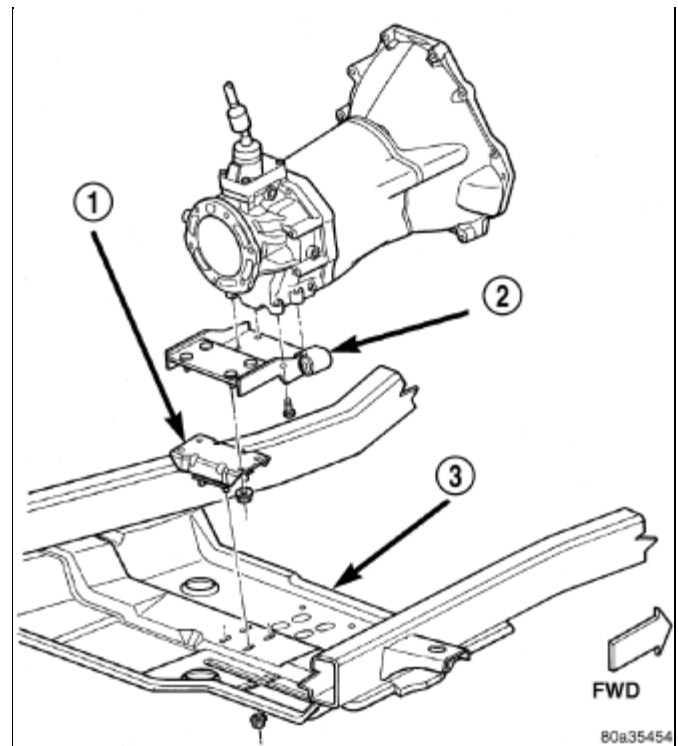
MOUNT-REAR

REMOVAL

MANUAL TRANSMISSIONS

1. Disconnect negative cable from battery.
2. Raise the vehicle and support the transmission.
3. Remove the nuts holding the support cushion to the skid plate.
4. Remove nuts holding support cushion to transmission support bracket.
5. Remove the support cushion (2) .

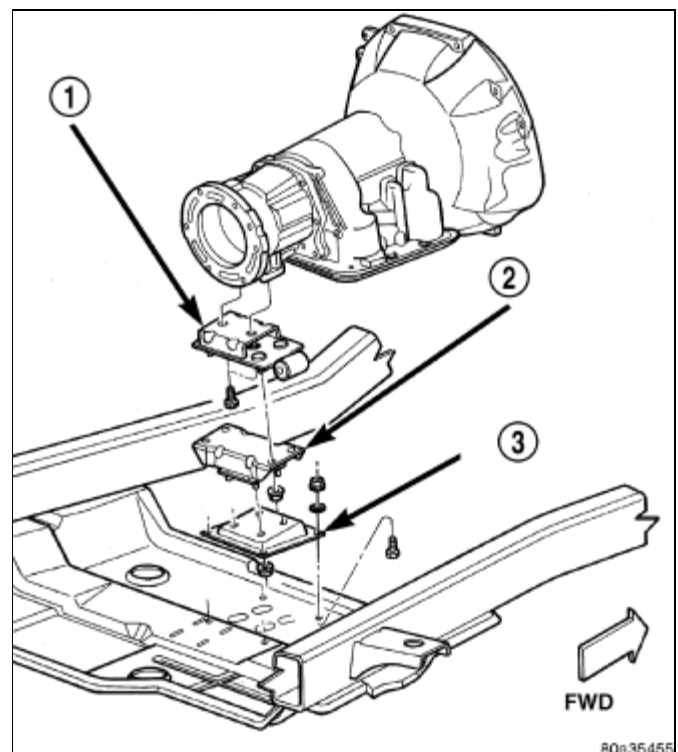
6. Remove bolts holding transmission support bracket to transmission.
7. Remove the transmission support bracket.



AUTOMATIC TRANSMISSIONS

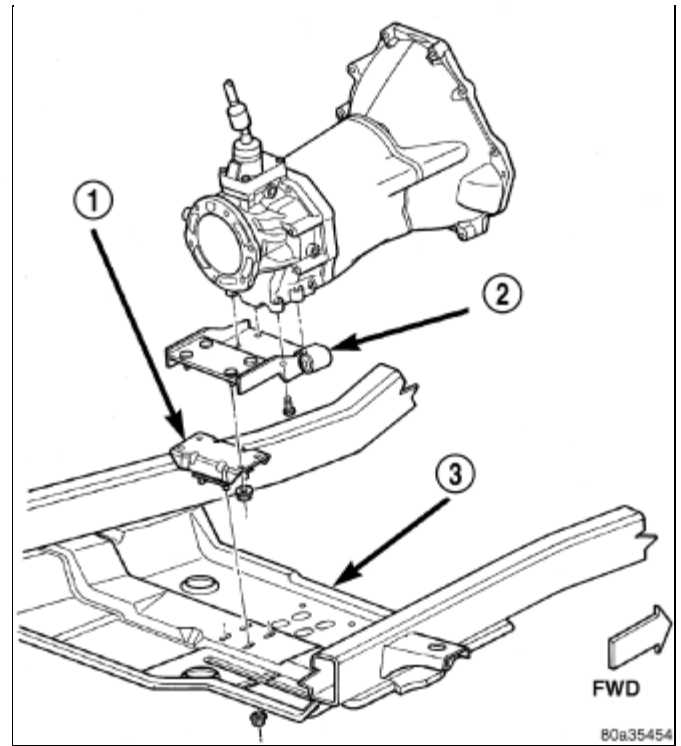
1. Disconnect negative cable from battery.
2. Raise the vehicle and support the transmission.
3. Remove the nuts holding the support cushion to the skid plate.
4. Remove nuts holding support cushion to transmission support bracket. Remove the support cushion (2) .
5. Remove the bolts holding the transmission support bracket to transmission.
6. Remove the transmission support bracket.

INSTALLATION



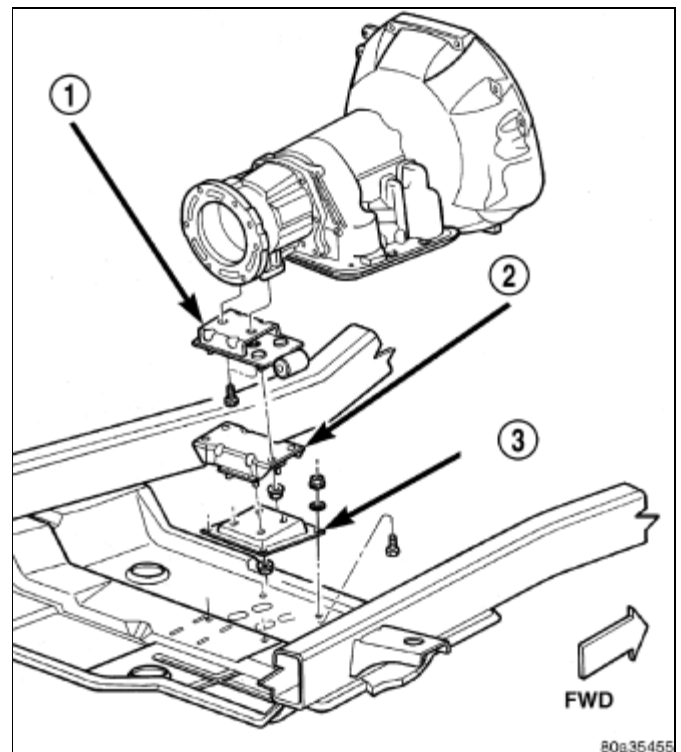
MANUAL TRANSMISSION

1. Position the skid plate to the studs of the support cushion and install the nuts. Tighten the nuts to 28 N·m (21 ft. lbs.) torque.
2. Install the skid plate bolts to the sill and tighten to 75 N·m (55 ft. lbs.) torque.
3. Remove the transmission support.
4. Lower the vehicle.
5. Connect negative cable to battery.
6. Position the transmission mount bracket to the transmission and install the bolts.
7. Tighten the bolts to 54 N·m (40 ft. lbs.) torque.
8. Position the support cushion (2) to the transmission mount bracket and install nuts.



AUTOMATIC TRANSMISSION

1. Position the skid plate to the studs of the support cushion and install the nuts. Tighten the nuts to 28 N·m (21 ft. lbs.) torque.
2. Install the skid plate bolts to the sill and tighten to 75 N·m (55 ft. lbs.) torque.
3. Remove the transmission support.
4. Lower the vehicle.
5. Connect negative cable to battery.
6. Position the transmission mount bracket to the transmission and install the bolts. Tighten the bolts to 54 N·m (40 ft. lbs.) torque.
7. Position the support cushion (2) to the transmission mount bracket and install nuts. Tighten the nuts to 41 N·m (30 ft. lbs.) torque.
8. If the support cushion bracket was removed from the skid plate, position the bracket on the skid plate and install the nuts and bolts. Tighten the nuts to 28 N·m (21 ft. lbs.) torque.

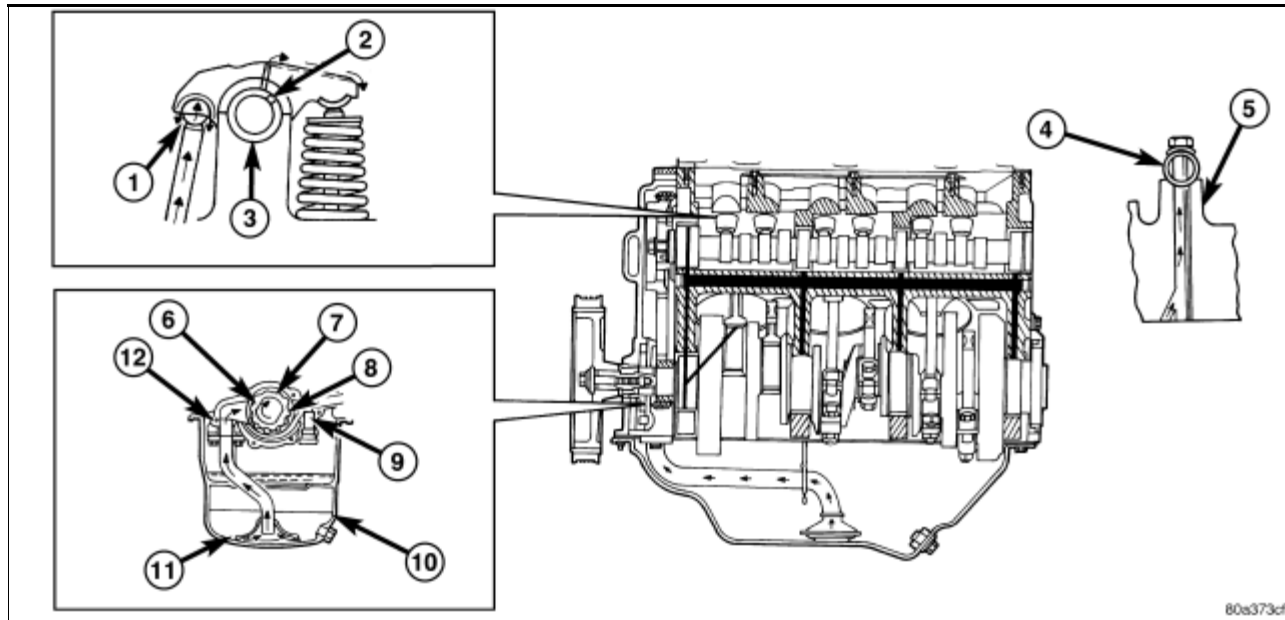


LUBRICATION

DESCRIPTION

The lubrication system is a full flow filtration pressure feed type. The oil pump is mounted in the timing chain cover and is driven by the crankshaft

OPERATION



Oil from the oil pan is pumped by a internal gear type oil pump directly coupled to the crankshaft. The pressure is regulated by a relief valve located in the timing chain cover. The oil is pumped through an oil filter and feeds a main oil gallery. This oil gallery feeds oil under pressure to the main and rod bearings, camshaft bearings. Passages in the cylinder block feed oil to the hydraulic lifters and rocker shaft brackets which feeds the rocker arm pivots .

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE

1. Disconnect and remove oil pressure switch (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL).
2. Install Special Tools C-3292 Gauge with 8406 Adaptor. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).
3. Start engine and record oil pressure. Refer to Oil Pressure in Engine Specifications for the correct pressure (Refer to 9 - ENGINE - SPECIFICATIONS).

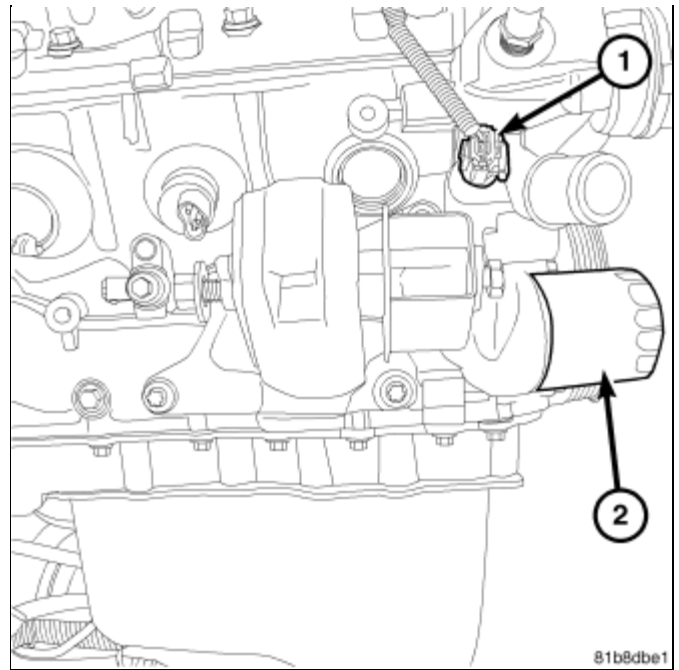
OIL

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE OIL AND FILTER CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.



Run engine until achieving normal operating temperature.

1. Open hood, remove oil fill cap.
2. Place a suitable drain pan under crankcase drain.
3. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
4. Remove oil filter (2).
5. Install and tighten drain plug in crankcase.
6. Install new oil filter (2).
7. Lower vehicle and fill crankcase with specified type and amount of engine oil.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

STANDARD PROCEDURE - ENGINE OIL LEVEL CHECK

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Add engine oil only when the level is at or below the ADD mark on the indicator.

FILTER-OIL

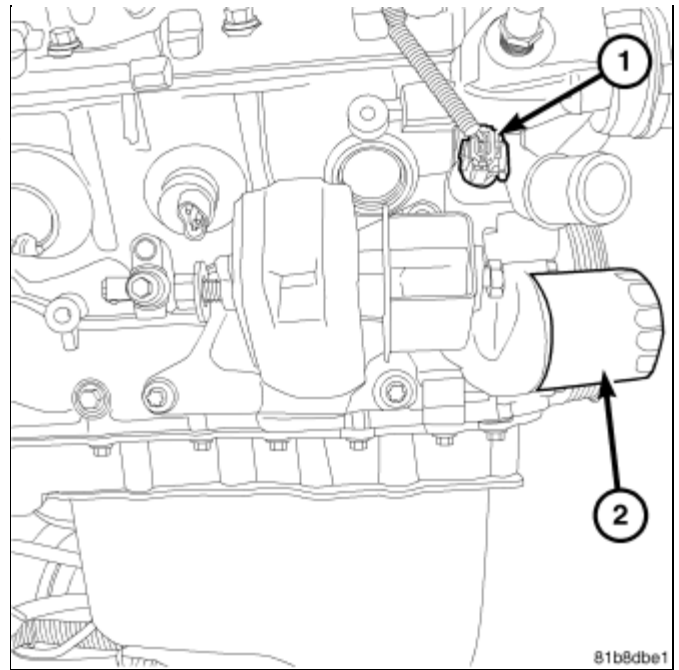
REMOVAL

CAUTION: When servicing the oil filter avoid deforming

the filter can be installed by installing the remove/install tool band strap against the can-to-base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

1. Using suitable oil filter wrench, turn filter (2) counterclockwise to remove from oil filter adapter. Properly discard used oil filter.

INSTALLATION

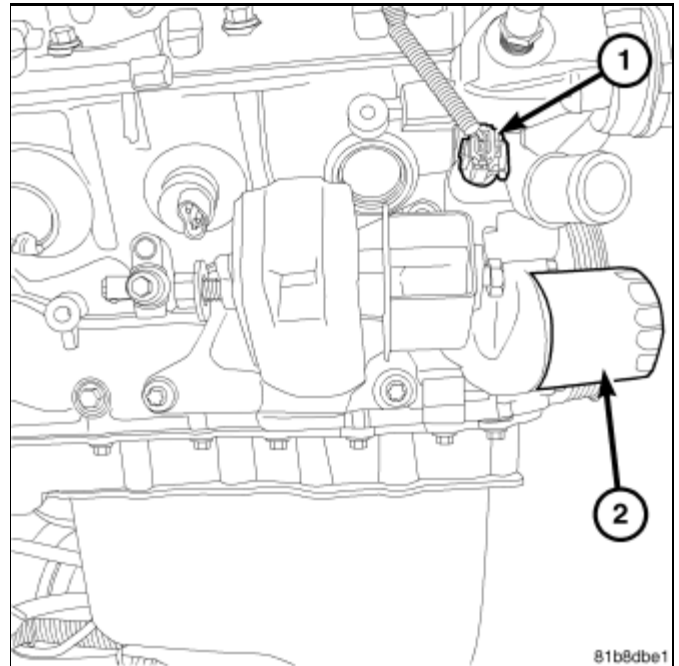


1. Wipe oil filter adapter base clean and inspect gasket contact surface.
2. Lubricate gasket of new filter with clean engine oil.
3. Install new filter (2) until gasket contacts base. Tighten filter 1 turn or 20 N·m (15 ft. lbs.). Use filter wrench if necessary.
4. Start engine and check for leaks.

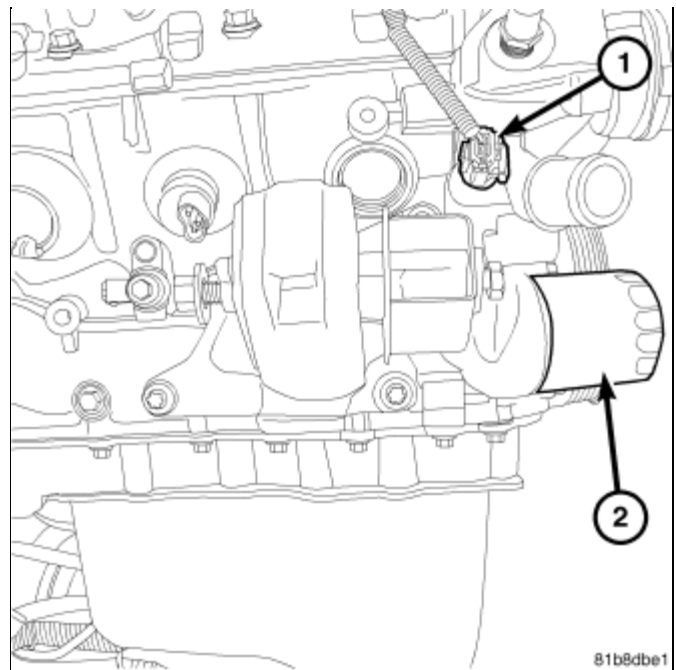
PAN-OIL

REMOVAL

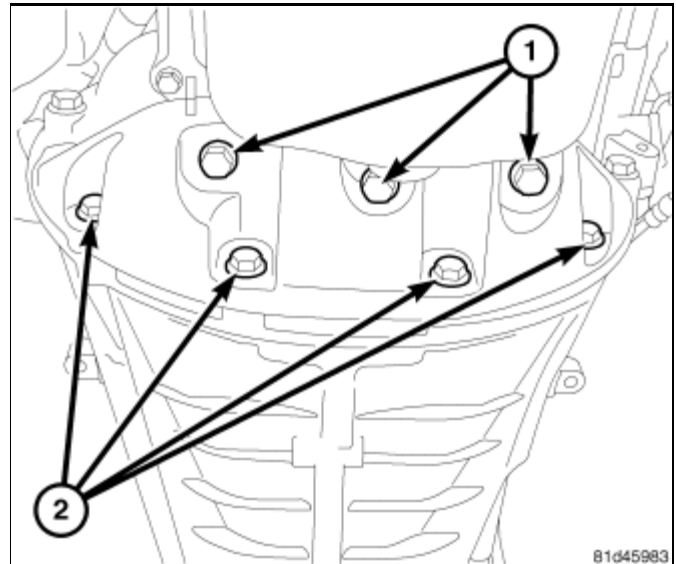
1. Disconnect negative cable from battery and remove engine oil level indicator tube.
2. Remove engine oil level indicator tube.



3. Raise vehicle on hoist and drain engine oil, and remove the oil filter (2).



4. Remove the structural cover fasteners (1,2) and structural cover. (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL)



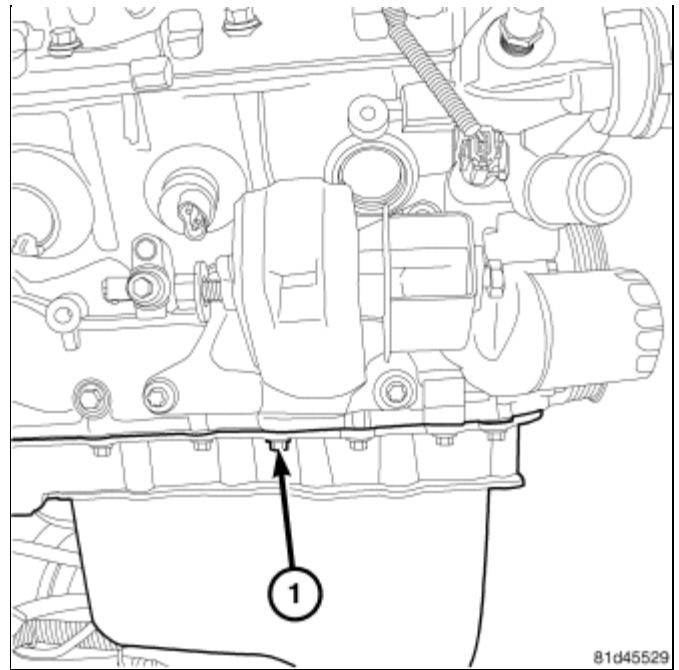
NOTE: Do not remove the lower oil pan bolts. Only remove the upper oil pan-to-engine block bolts (1).

5. Remove the oil pan fasteners (1), oil pan and gasket.

CLEANING

1. Clean oil pan with solvent and wipe dry with a clean cloth.
2. Clean all gasket material from mounting surfaces of pan and block.
3. Clean oil screen and pick-up tube in clean solvent.

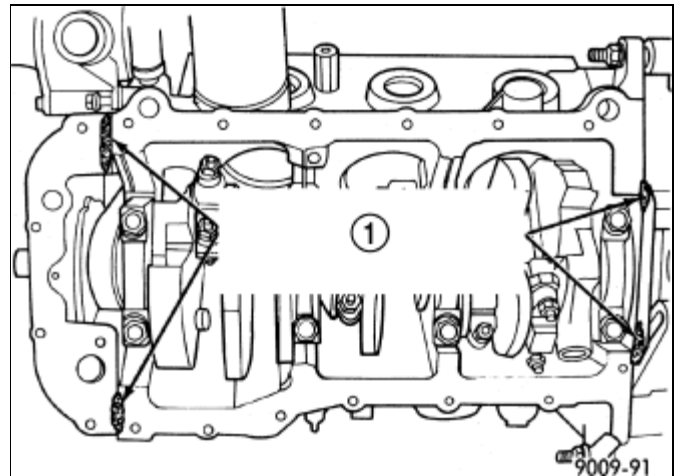
INSPECTION



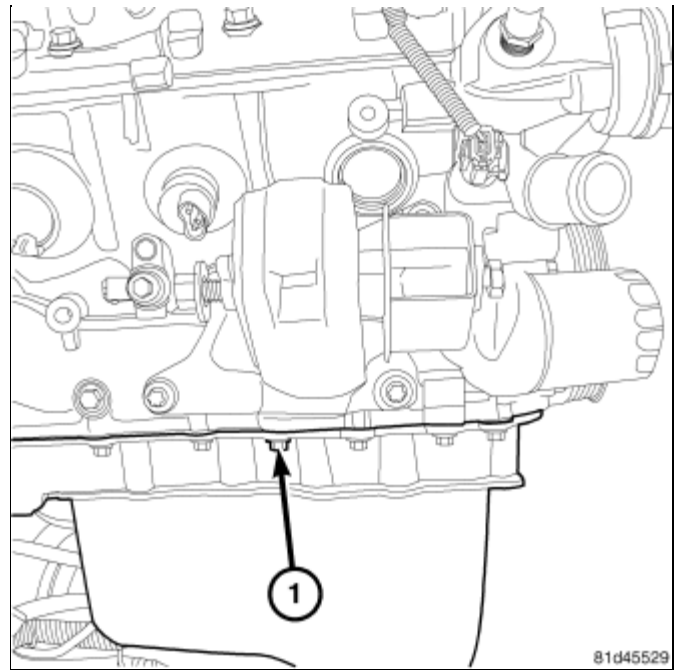
1. Inspect oil drain plug and plug hole for stripped or damaged threads and repair as necessary. Install a new drain plug gasket. Tighten to 27 N·m (20 ft. lbs.).
2. Inspect oil pan mounting flange for bends or distortion. Straighten flange if necessary.
3. Inspect condition of oil screen and pick-up tube, clean or replace as necessary.

INSTALLATION

1. Thoroughly clean sealing surfaces of any oil, dirt, or original sealer, and apply a 1/8 inch bead (1) of Mopar® Engine RTV GEN II at the parting line of the chain case cover (1) and the rear seal retainer (1).
2. Position a new pan gasket on oil pan.

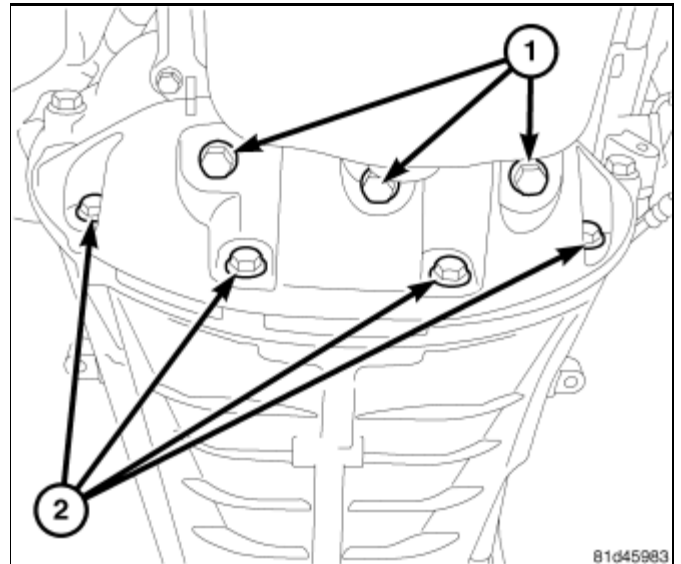


3. Install oil pan and tighten fasteners (1) to 12 N·m (105 in. lbs.).



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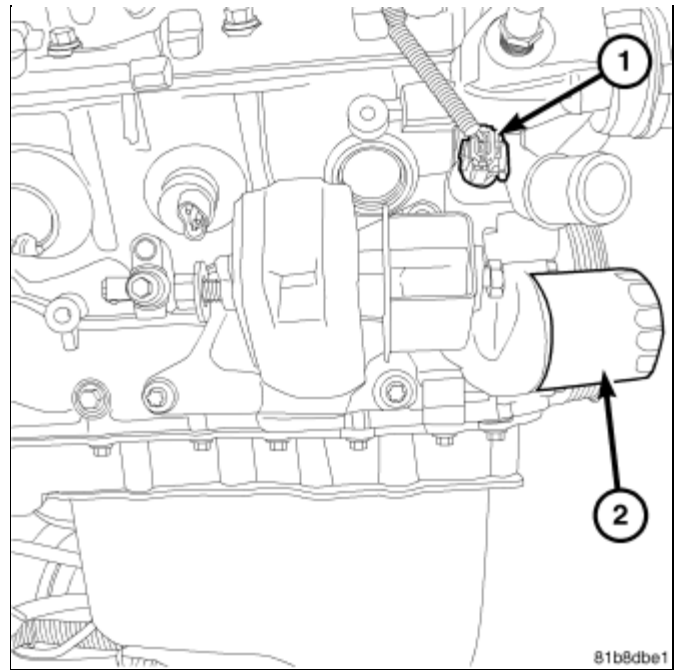
4. Install the structural cover and tighten fasteners (1,2)
(Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL
COVER - INSTALLATION).
5. Lower vehicle and install oil level indicator.



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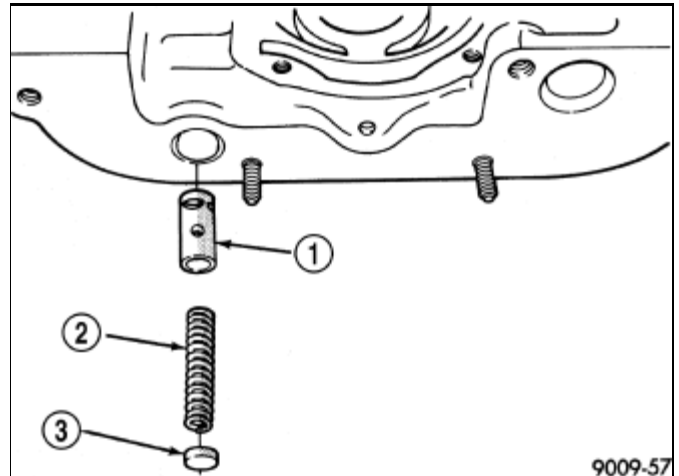
6. Install new oil filter (2).
7. Fill crankcase with oil to proper level.
8. Connect negative cable to battery.

RELIEF VALVE-OIL PRESSURE REMOVAL



1. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Drill a 3.175 mm (1/8 in.) hole in the center of the retainer cap . Insert a self-threading sheet metal screw into the cap.
3. Using suitable pliers, remove cap and discard.
4. Remove spring and relief valve .

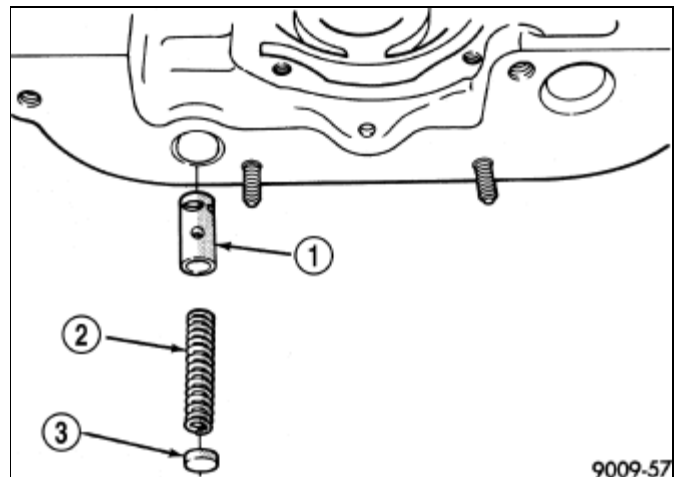
INSTALLATION



1. Clean relief valve, spring and bore.

NOTE: Lubricate relief valve with clean engine oil before installing.

2. Install relief valve (1) and spring (2) into housing.
3. Install new retainer cap until flush with sealing surface.
4. Install oil pan.
5. Fill crankcase with proper oil to correct level.



SWITCH-OIL PRESSURE

DESCRIPTION

The engine oil pressure switch is located on the timing cover, in front of the engine. The normally closed switch

provides an input through a single wire to the low pressure indicator light on the instrument cluster.

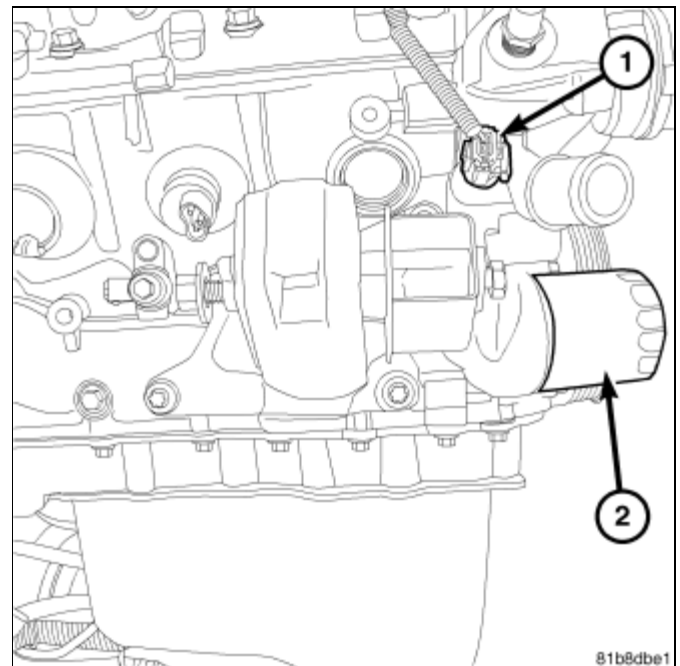
OPERATION

The oil pressure switch provides a ground for the instrument cluster low oil pressure indicator light. The switch receives oil pressure input from the engine main oil gallery. When engine oil pressure is greater than 27.5 Kpa (4 psi), the switch contacts open, providing an open circuit to the low pressure indicator light. For wiring circuits and diagnostic information, (Refer to Appropriate Wiring/Diagnostic Information).

REMOVAL

1. Raise vehicle on hoist.
2. Disconnect electrical connector from switch.
3. Remove oil pressure switch (1).

INSTALLATION



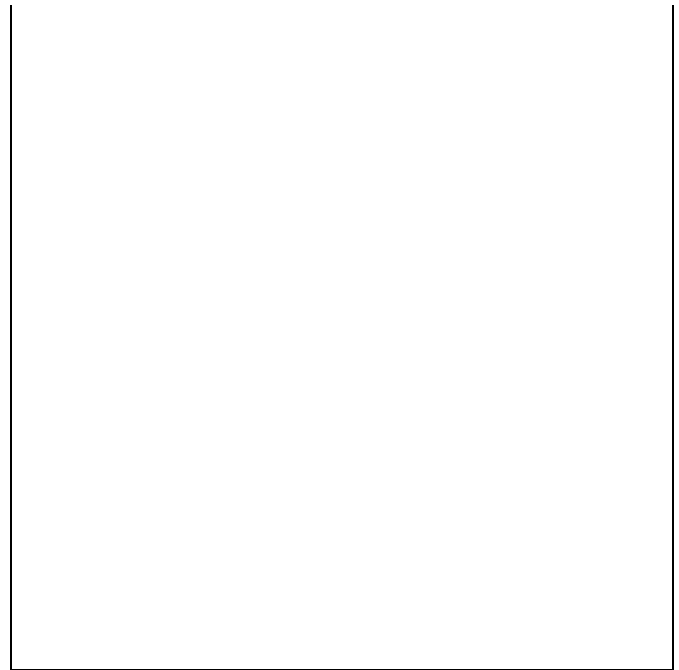
1. Install oil pressure switch (1). Torque oil pressure switch to 23 N·m (200 in. lbs.).
2. Connect electrical connector to switch.
3. Lower the vehicle.
4. Start engine and check for leaks.
5. Check engine oil level. Adjust as necessary.

PUMP-OIL

DESCRIPTION

The oil pump is located in the timing chain cover. It is driven by the crankshaft.

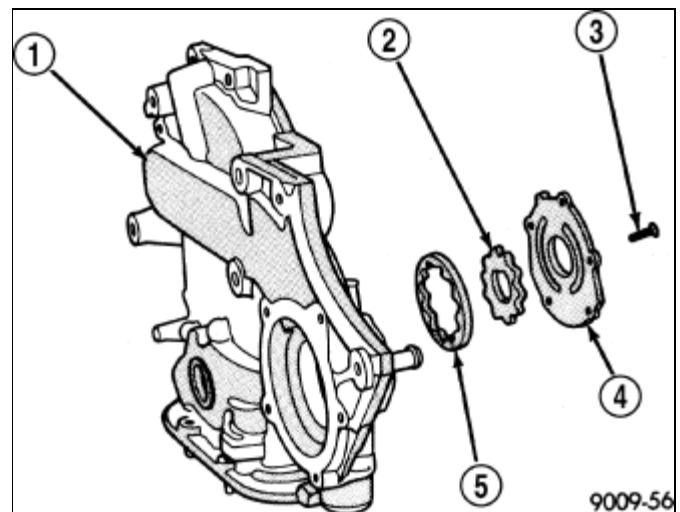
REMOVAL



The oil pump (1) is contained within the timing chain cover housing.

1. Remove oil pan.
2. Remove the timing chain cover.
3. Disassemble oil pump from timing chain cover.
4. Clean and Inspect oil pump components.

DISASSEMBLY

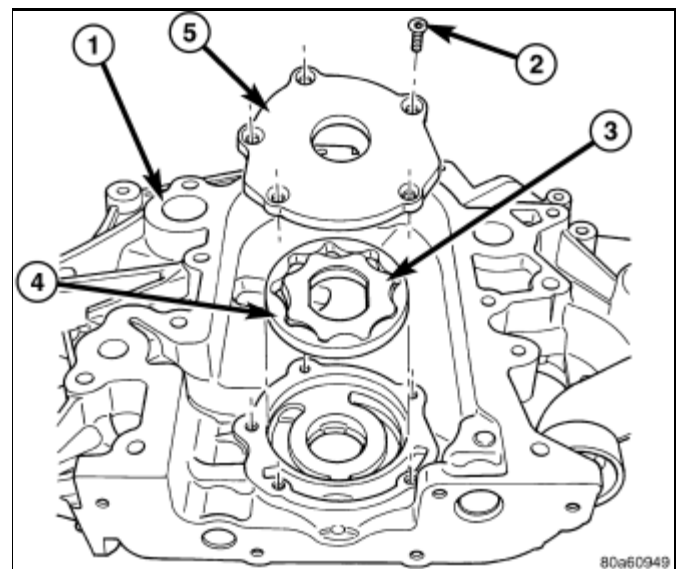


1. Remove oil pump cover screws (2), and lift off cover (5).
2. Remove oil pump rotors (3,4).
3. Clean and inspect oil pump components.

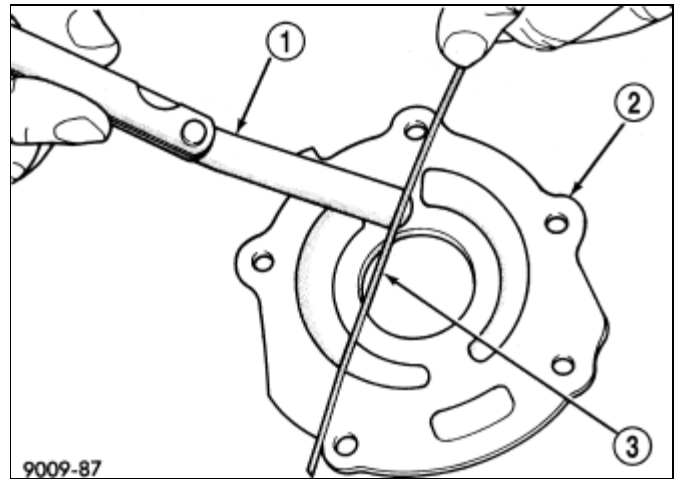
CLEANING

1. Clean all parts thoroughly in a suitable solvent.

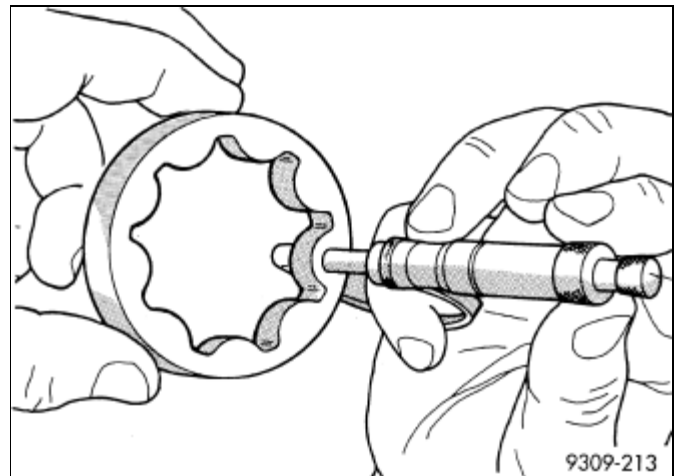
INSPECTION



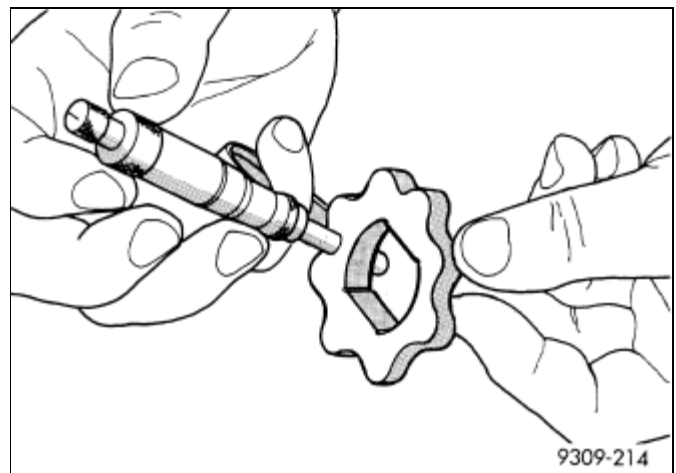
1. Inspect mating surface of the chain case cover. Surface should be smooth. Replace cover if scratched or grooved.
2. Lay a straightedge across the pump cover surface . If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.



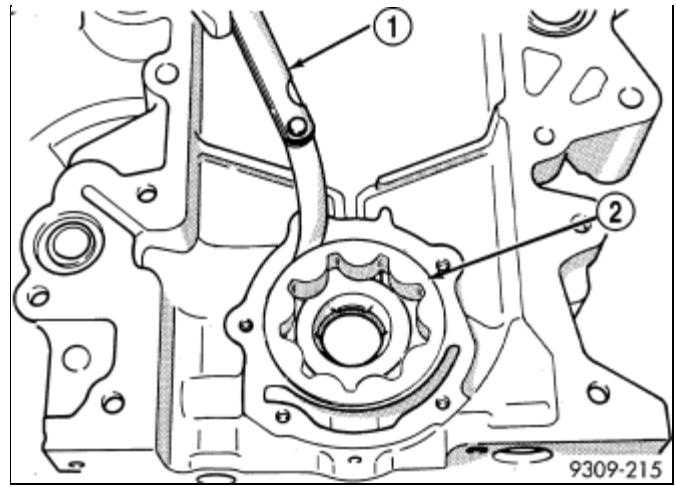
3. Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 in.) or less , or if the diameter is 79.95 mm (3.148 in.) or less, replace outer rotor.



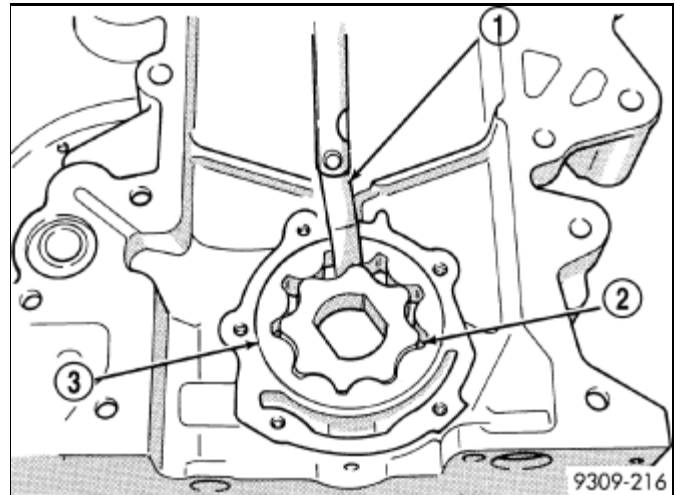
4. If inner rotor thickness measures 7.64 mm (0.301 in.) or less, replace inner rotor .



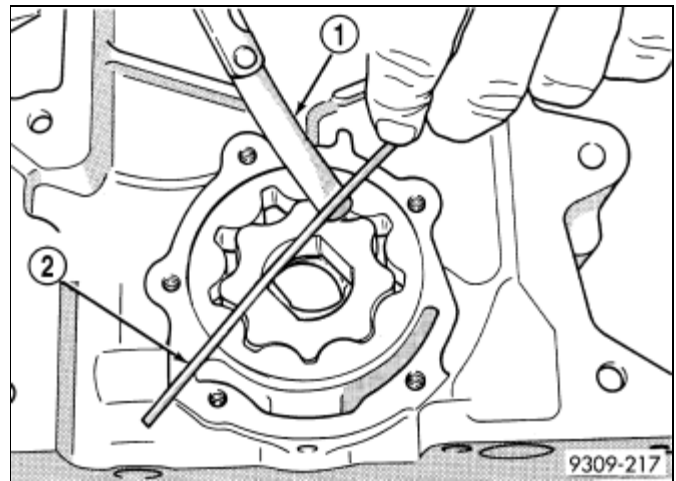
5. Install outer rotor into chain case cover. Press rotor to one side with fingers and measure clearance between rotor and chain case cover . If measurement is 0.39 mm (0.015 in.) or more, replace chain case cover, only if outer rotor is in specification.



6. Install inner rotor into chain case cover. If clearance between inner and outer rotors is 0.203 mm (0.008 in.) or more, replace both rotors.



7. Place a straightedge across the face of the chain case cover, between bolt holes. If a feeler gauge of 0.10 mm (0.004 in.) or more can be inserted between rotors and the straightedge, replace pump assembly . **ONLY** if rotors are in specs.



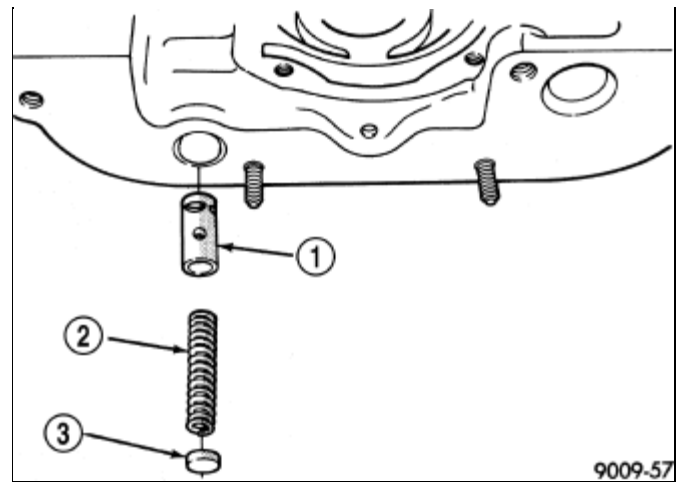
8. Remove oil pressure relief valve. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE RELIEF VALVE - REMOVAL)

9. Inspect oil pressure relief valve and bore. Inspect for scoring, pitting and free valve operation in bore . Small marks may be removed with 400-grit wet or dry sandpaper.

10. The relief valve spring has a free length of approximately

49.5 mm (1.95 inches) it should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 inches). Replace spring that fails to meet specifications.

11. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.



ASSEMBLY

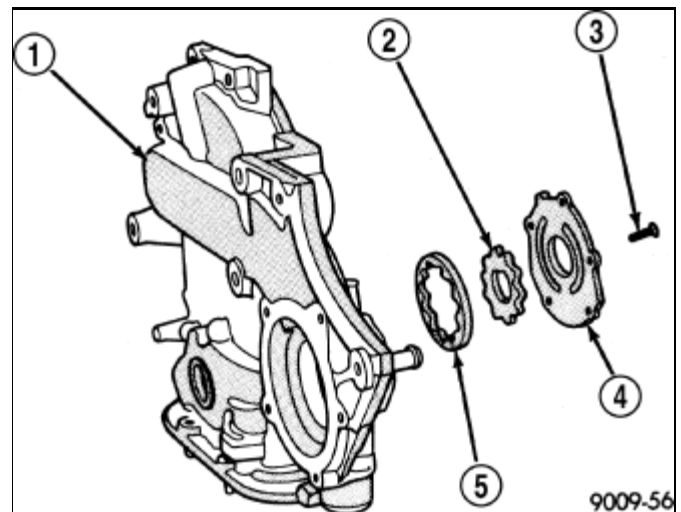
1. Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**
2. Prime oil pump before installation by filling rotor cavity with engine oil.
3. Install cover and tighten screws to 12 N·m (105 in. lbs.).
4. If removed, install the oil pressure relief valve. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE RELIEF VALVE - INSTALLATION).

INSTALLATION

1. Install oil pump assembly (2,4,5).
2. Install timing chain cover.

MANIFOLD-INTAKE

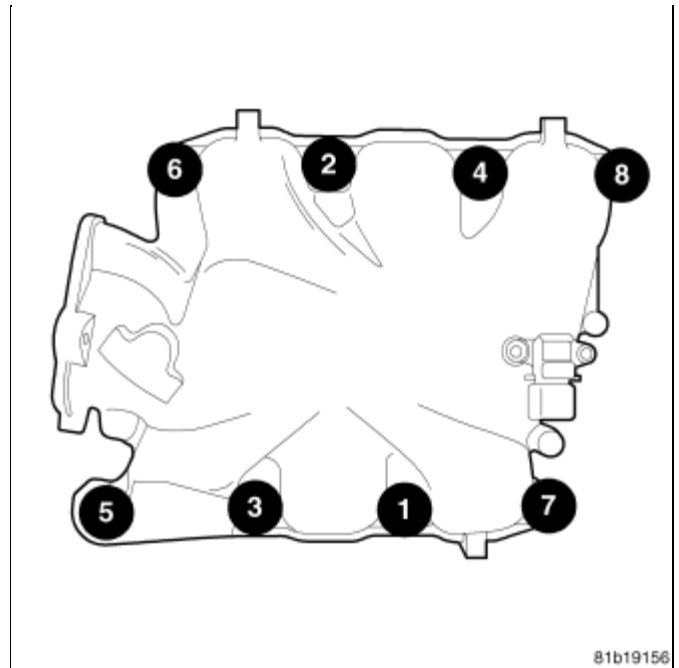
DESCRIPTION



The intake system is made up of an upper and lower intake manifold. The upper intake manifold is made of a composite material for the 3.8L engine. The lower intake manifold also provides coolant crossover between cylinder heads and houses the coolant thermostat.

The intake manifold utilizes a compact design with very low restriction and outstanding flow balance. This design allows the engine to perform with a wide torque curve while increasing higher rpm horsepower.

If, for some reason, the molded-in vacuum ports break, the composite manifold can be salvaged. The vacuum ports are designed to break at the shoulder, if overloaded. Additional material in the shoulder area provides sufficient stock to repair. Also, if the special screws that attach the MAP sensor, power steering reservoir, and the EGR tube become stripped, an oversized screw is available to repair the stripped-out condition.



DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

1. Start the engine.
2. Spray a small stream of water (Spray Bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

MANIFOLD-INTAKE

STANDARD PROCEDURE

STANDARD PROCEDURE - MANIFOLD STRIPPED THREAD REPAIR

The composite upper intake manifold thread bosses, if stripped out, can be repaired by utilizing a repair screw available through Mopar® parts. Repair screws are available for the following manifold attached components:

- MAP sensor
- Power steering reservoir
- EGR tube
- Throttle cable bracket

The repair screws require a unique tightening torque specification from the original screw. Refer to the following

chart for specification.

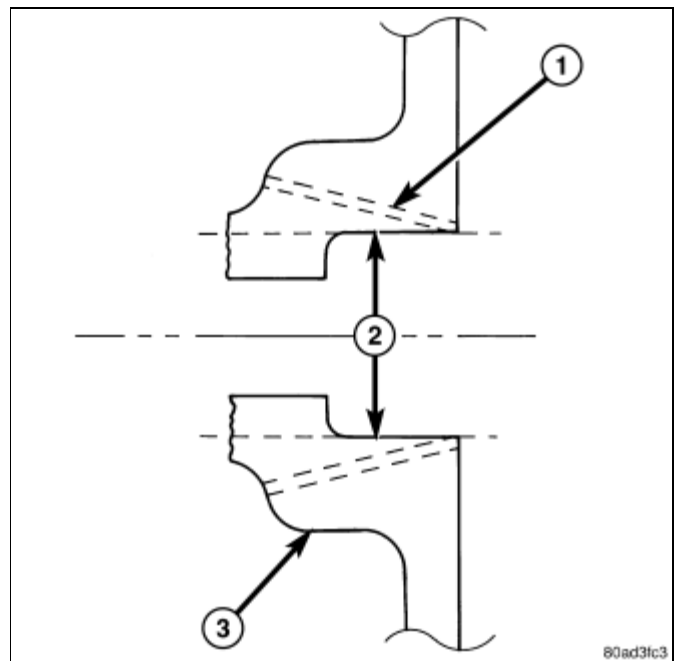
DESCRIPTION	TORQUE*
STRIP-OUT REPAIR SCREWS ONLY	
MAP Sensor Repair Screw	4 N·m (35 in. lbs.)
Power Steering Reservoir Repair Screw	9 N·m (80 in. lbs.)
EGR Tube Attaching Repair Screw	9 N·m (80 in. lbs.)
Throttle Cable Bracket Repair Screw	9 N·m (80 in. lbs.)
*Install Slowly Using Hand Tools Only	

STANDARD PROCEDURE - INTAKE MANIFOLD VACUUM PORT REPAIR

NOTE: While performing this procedure, avoid getting the manifold material residue into the plenum chamber.

The composite intake manifold vacuum ports can be repaired. Although, if the manifold plenum chamber is damaged or cracked, the manifold must be replaced.

To repair a broken or damaged vacuum port on the composite intake manifold, perform the following procedure:



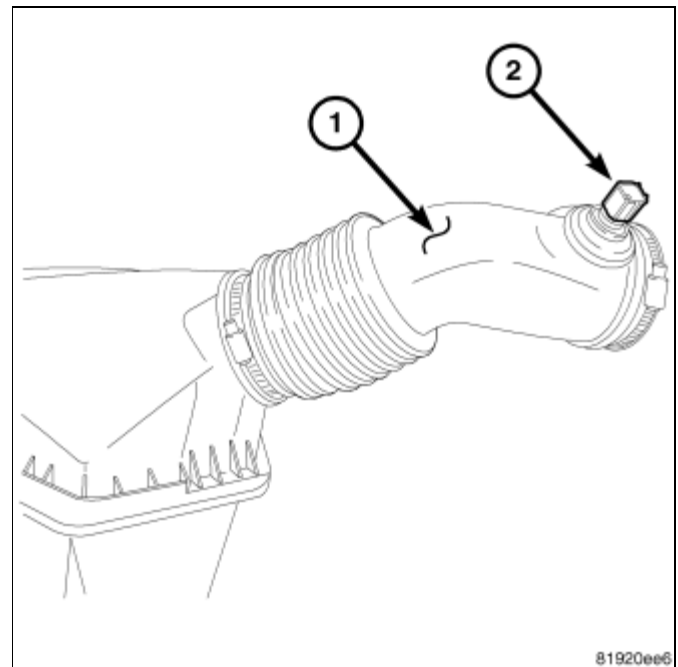
PARTS REQUIRED	TOOLS REQUIRED
· Brass Port – 1/4" O.D. x 1/8" pipe thread (LDP/Speed Control Port)	· Pipe Tap – 1/8" - 18 NPT
	· Drill Bit – 11/32"
	· File/Sandpaper

· Brass Port – 1/2" O.D. x 1/4" pipe thread (Brake Booster Port)	· Pipe Tap – 1/4" - 18 NPT
	· Drill Bit – 7/16"
	· File/Sandpaper

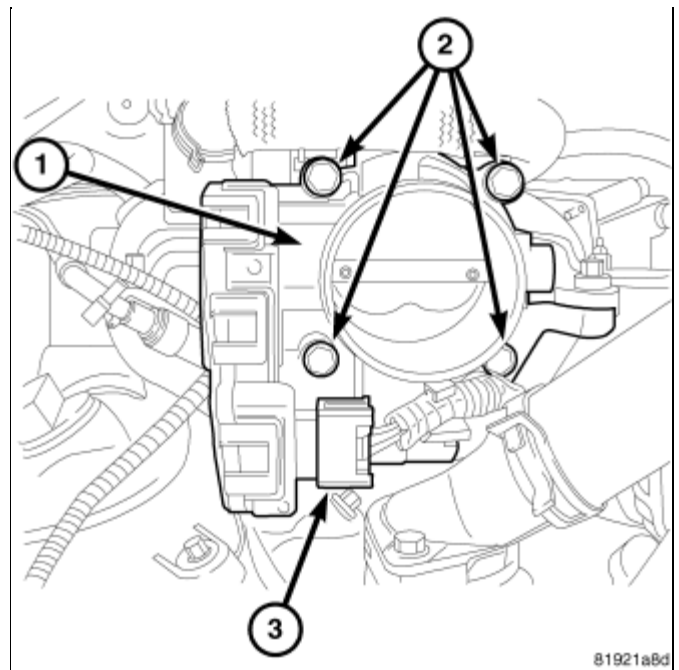
1. File or sand the remaining port back until a flat surface is obtained (plane normal to port axis).
2. Drill out the port base using a 7/16" (brake booster port) or 11/32" (LDP/speed control port) drill bit.
3. Using a 1/4"–18 NPT (brake booster port) or 1/8"–18 NPT (LDP/speed control port) pipe tap, cut internal threads. Use caution to start tap in a axis same as original port.
4. Apply Mopar® Thread Sealant to threads of repair port (s).
5. Install repair port (s). Do not over torque repair port (s).

REMOVAL - UPPER INTAKE MANIFOLD

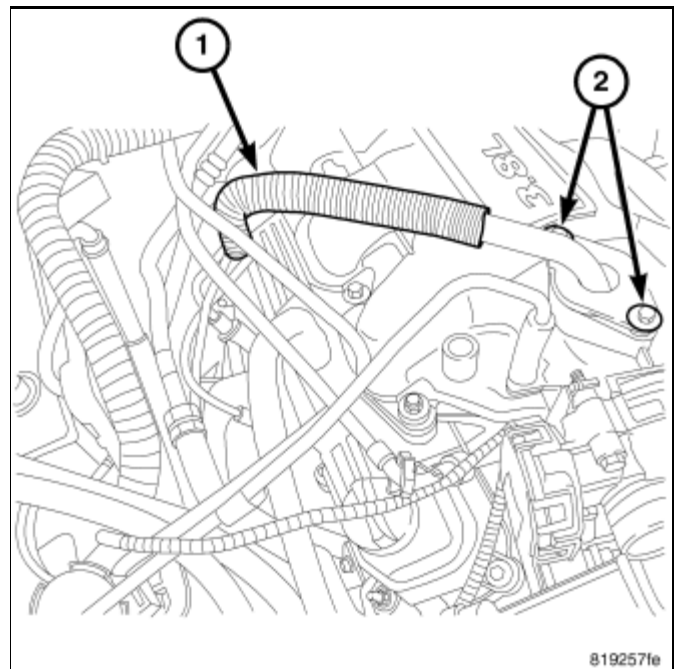
1. Disconnect battery negative cable.
2. Disconnect inlet air temperature (IAT) sensor electrical connector (2).
3. Remove air inlet resonator to throttle body hose assembly (1).



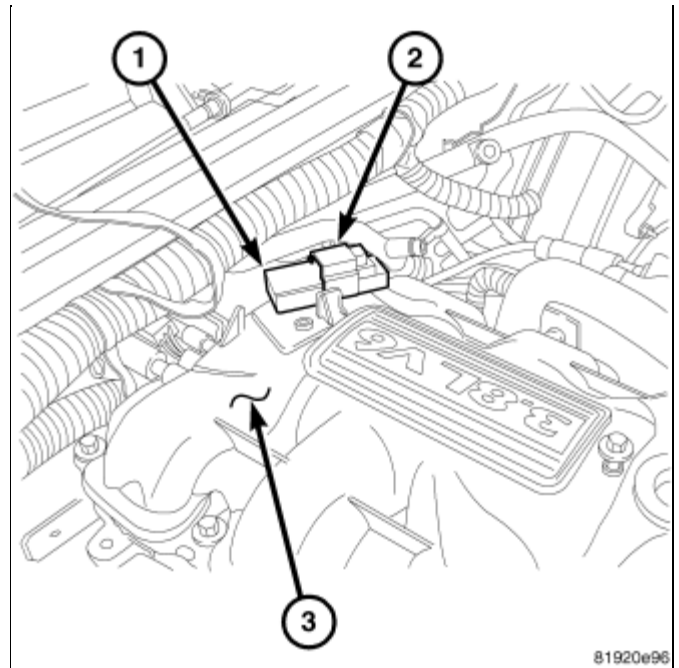
4. Disconnect the throttle connectors (ETC) (3) from the throttle body.
5. Disconnect the EVAP hose at the throttle.



6. Remove the EGR tube (1).
7. Disconnect the idle air control (IAC) motor and throttle position sensor (TPS) wiring.

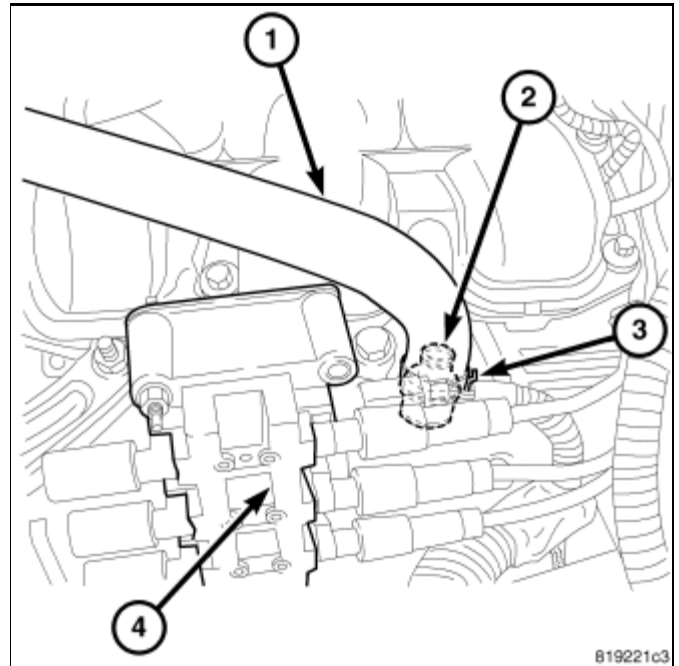


8. Disconnect the manifold absolute pressure (MAP) sensor electrical connector (2).



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9. Disconnect the PCV hose (1).



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10. Remove intake manifold bolts and remove the manifold.

11. Cover the lower intake manifold with a suitable cover while the upper manifold is removed.

12. Clean and inspect the upper intake manifold.

CLEANING

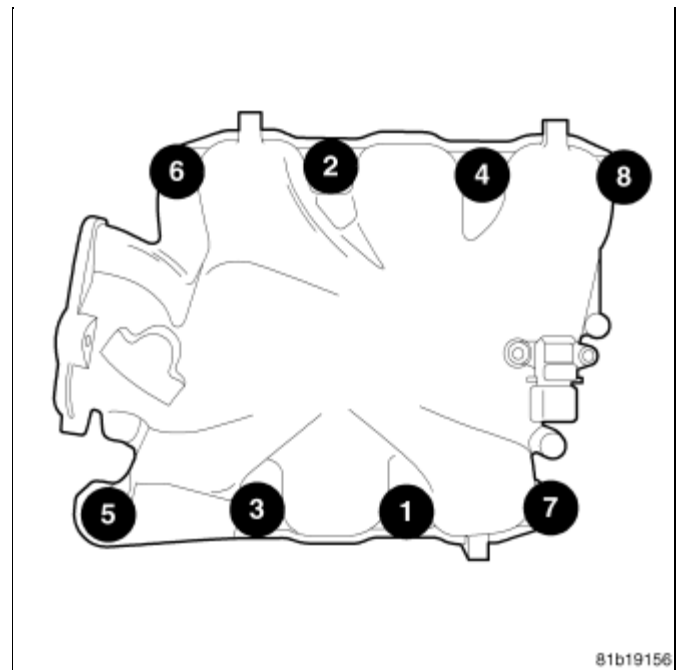
1. Discard gasket(s).

2. Clean all sealing surfaces.

INSPECTION

Check manifold for:

- Damage and cracks.
- Mounting surface distortion by using a straightedge and thickness gauge.

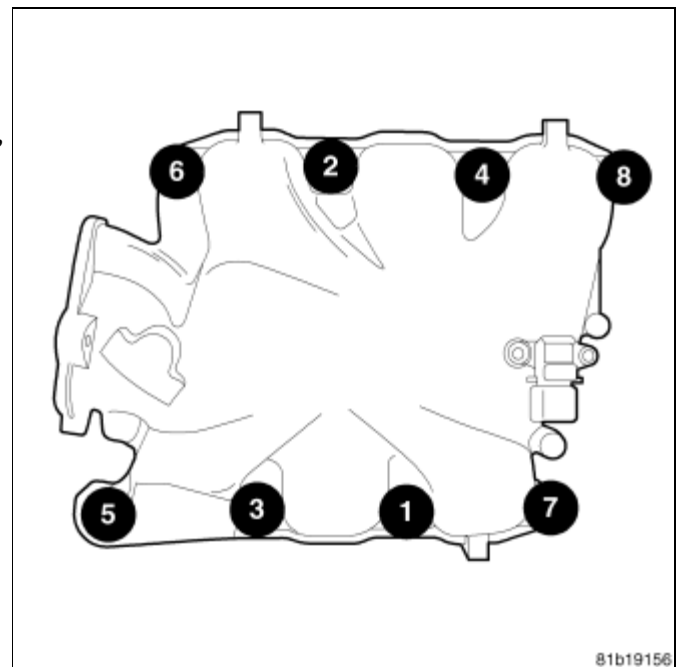


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INSTALLATION - UPPER INTAKE MANIFOLD

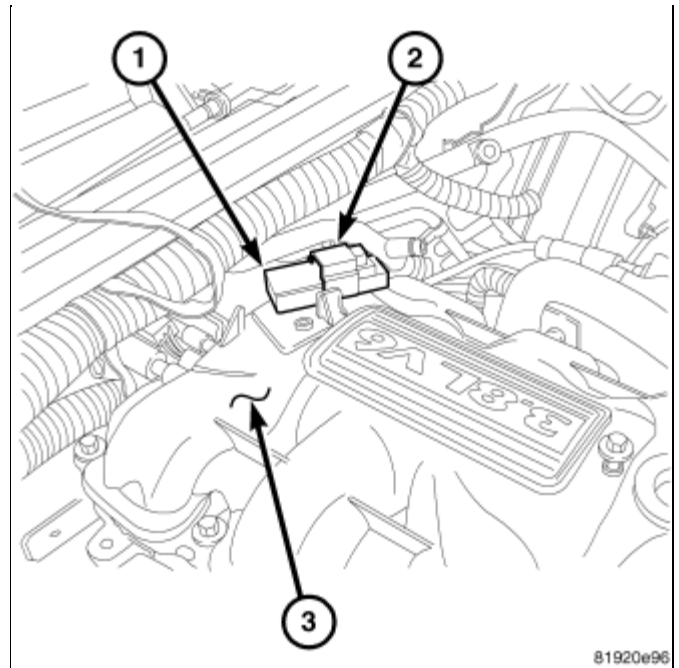
1. Remove covering on lower intake manifold and clean surfaces.
2. Inspect manifold gasket condition. Gaskets can be re-used, if not damaged. Position new gasket in seal channel and press lightly in-place. Repeat procedure for each gasket position.
3. Position upper manifold on lower manifold.
4. Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to each upper intake manifold bolt. Install and tighten bolts to 12 N·m (105 in. lbs.) using torque sequence.

CAUTION: The special screws used for the composite manifold attached components must be installed slowly using hand tools only. This requirement is to prevent the melting of material that causes stripped threads. If threads become stripped, an oversize repair screw is available.



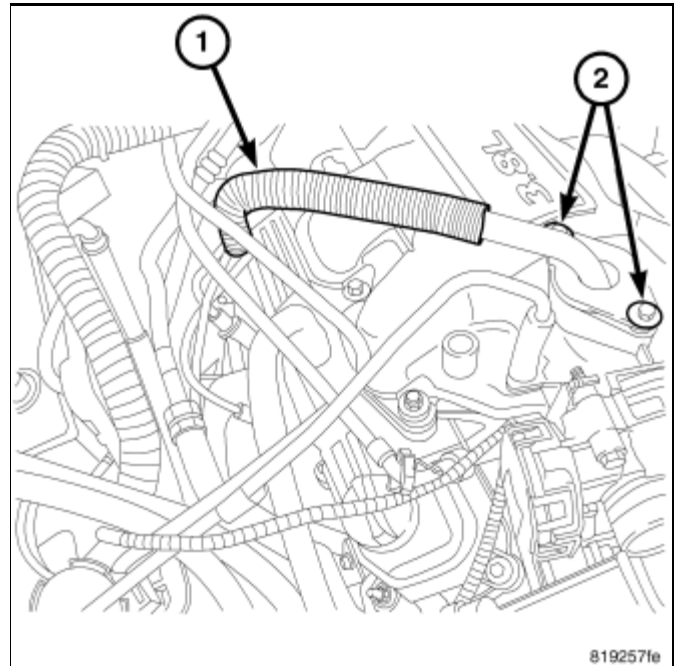
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5. Install the MAP sensor (1), and torque fasteners to 1.7 N·m (15 in. lbs.).
6. Connect the MAP sensor electrical connector (2).



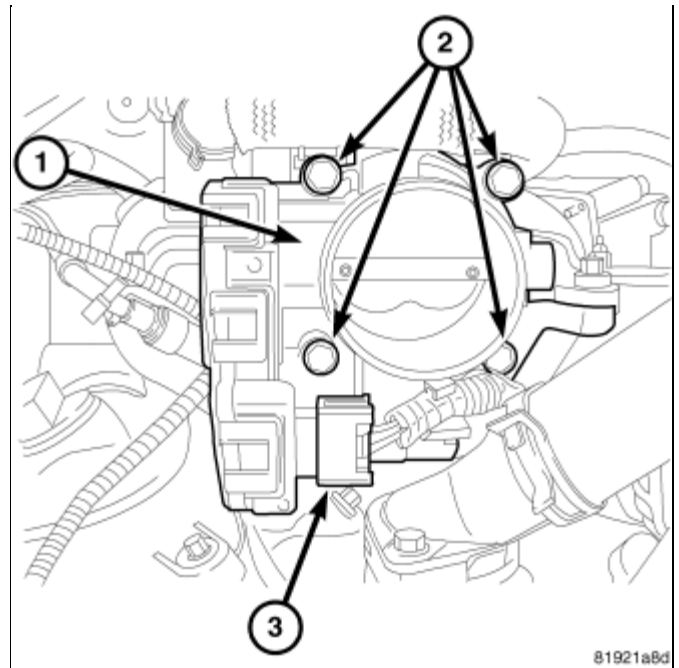
CAUTION: The special screws used for attaching the EGR tube to the manifold must be installed slowly using hand tools only. This requirement is to prevent the melting of material that causes stripped threads. If threads become stripped, an oversize repair screw is available.

7. Install the EGR tube (1).

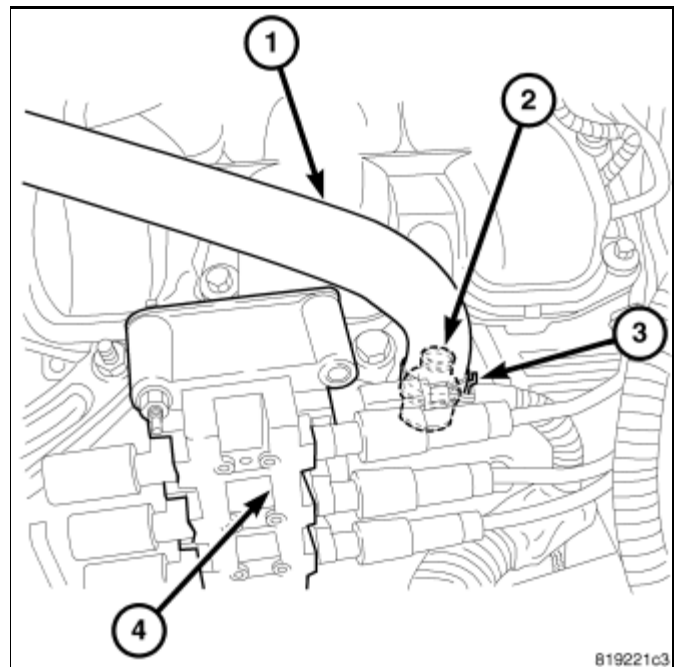


8. Connect the throttle (ETC) (3) connector to throttle body

9. Connect the EVAP hose to the throttle body.



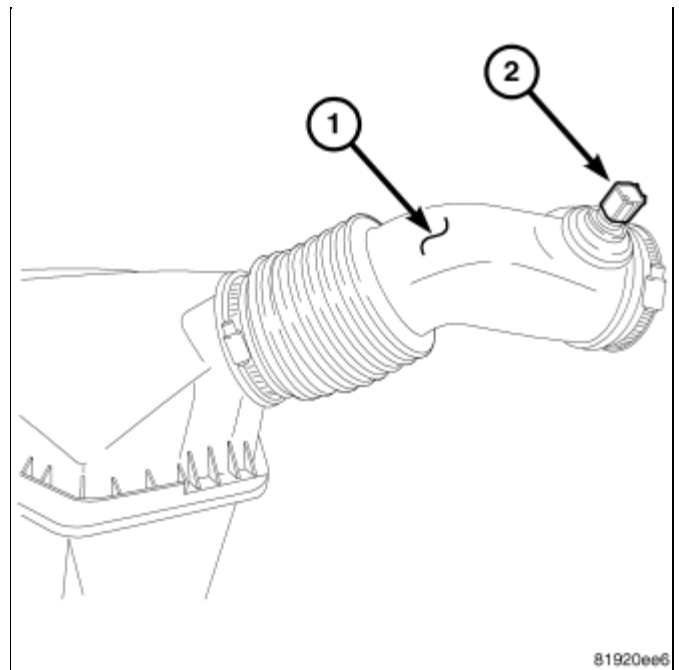
10. Connect the wiring connectors to the throttle position sensor (TPS) and idle air control (IAC) motor.
11. Connect the PCV hose (1).



12. Install air cleaner and air inlet hose assembly (1).
13. Connect the inlet air temperature (IAT) sensor electrical connector (2).
14. Connect battery negative cable.

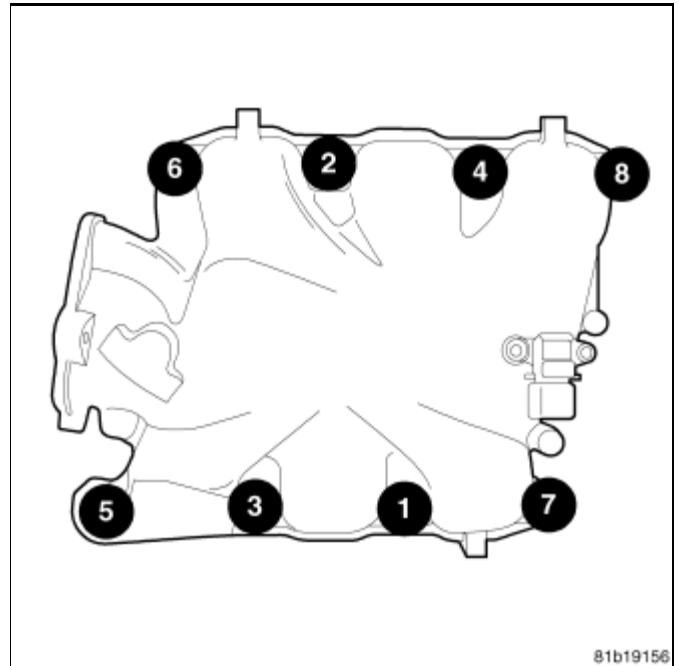
INTAKE MANIFOLD - LOWER

REMOVAL - LOWER INTAKE MANIFOLD



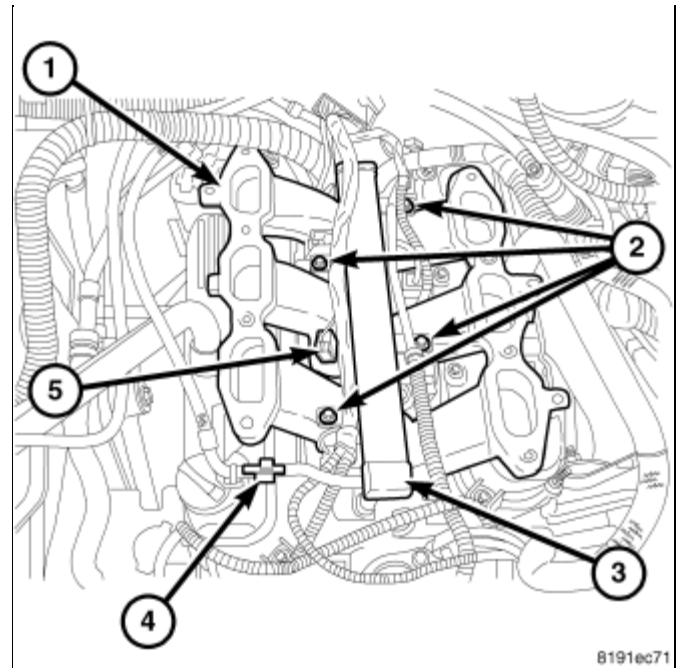
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1. Perform fuel system pressure release procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
2. Drain the cooling system.
3. Remove the upper intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).



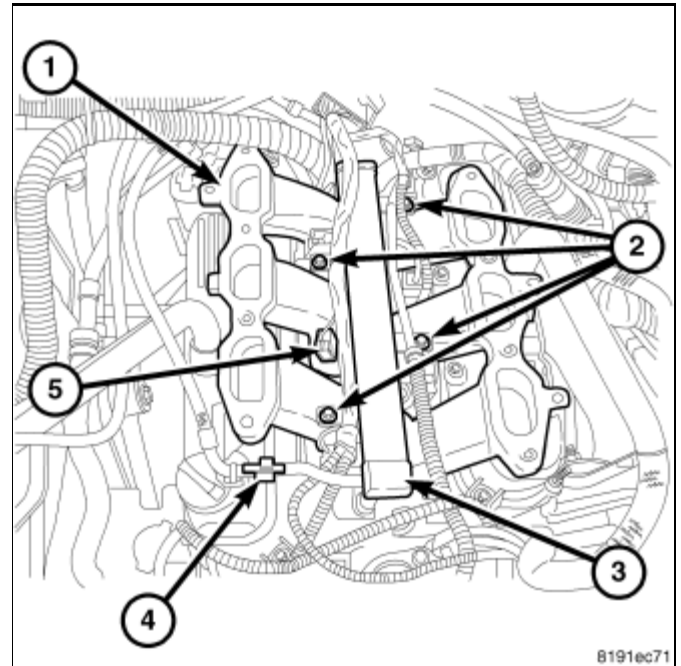
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4. Remove the fuel line (4) (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
5. Remove ignition coil and bracket.
6. Disconnect heater supply hose and engine coolant temperature sensor.



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7. Disconnect the fuel injector wire harness.
8. Remove the fuel injectors and rail assembly (3) (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).
9. Remove radiator upper hose.

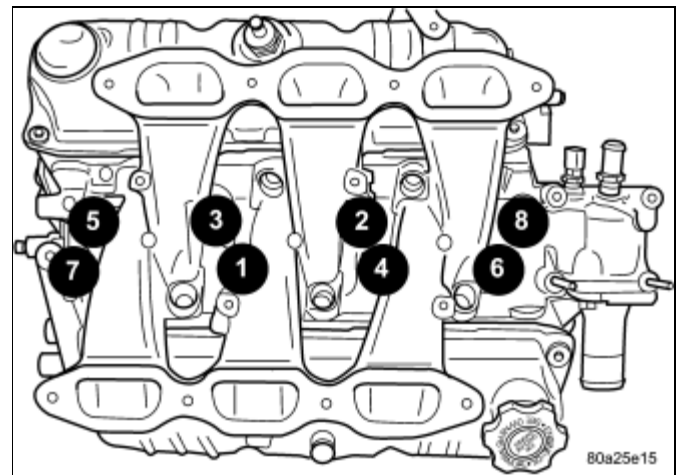


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10. Remove the intake manifold bolts.
11. Remove lower intake manifold.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

12. Remove intake manifold seal retainers screws. Remove intake manifold gasket.



80a25e15

CLEANING

1. Discard gasket(s).
2. Clean all sealing surfaces.

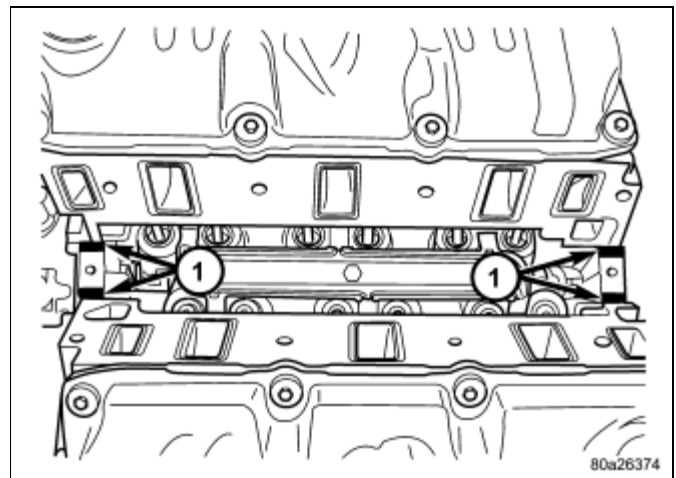
INSPECTION

Check for:

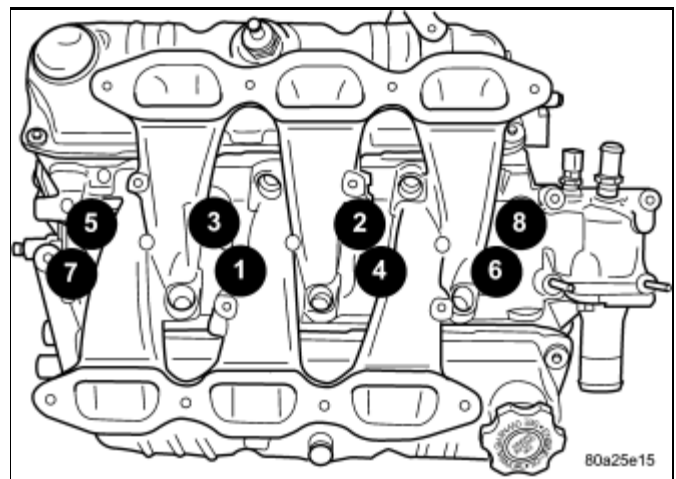
- Damage and cracks of each section.
- Clogged water passages in end cross-overs (if equipped).
- Check for cylinder head mounting surface distortion using a straightedge and thickness gauge. (Refer to 9 - ENGINE/CYLINDER HEAD - INSPECTION)

INSTALLATION - LOWER INTAKE MANIFOLD

1. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II onto each of the **four** manifold to cylinder head gasket corners (1).
2. Carefully install the new intake manifold gasket. Tighten end seal retainer screws to 12 N·m (105 in. lbs.).



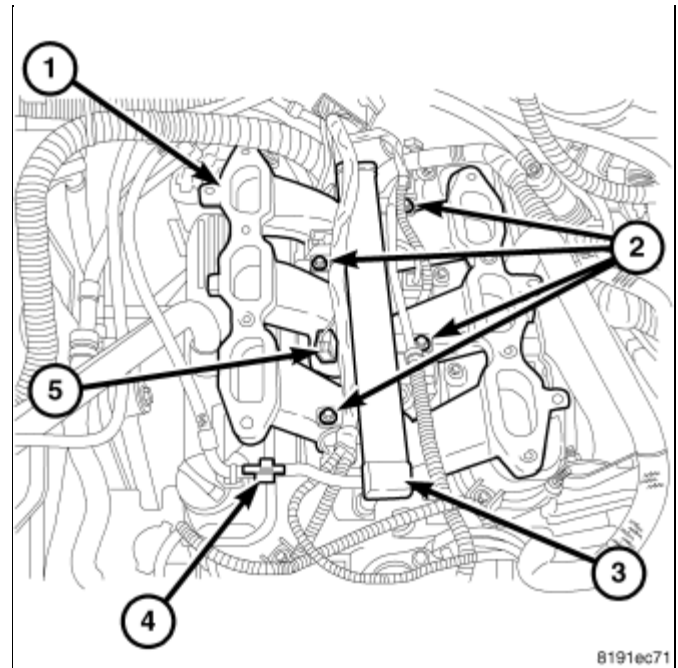
3. Install lower intake manifold. Install the bolts and torque to 1 N·m (10 in. lbs.). Then torque bolts to 22 N·m (200 in. lbs.) in sequence shown. Then torque again to 22 N·m (200 in. lbs.). After intake manifold is in place, **inspect to make sure seals are in place.**



4. Install the fuel injectors and rail assembly (3) (Refer to 14

- FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).

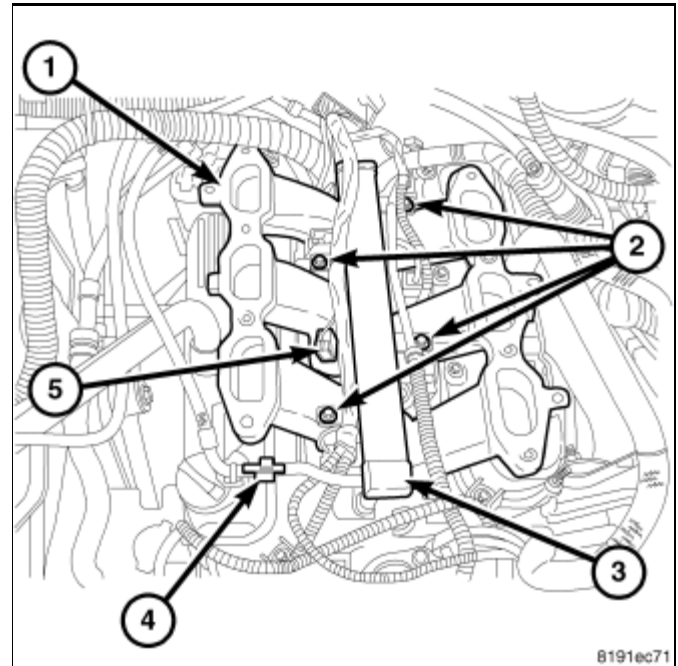
5. Connect fuel injector electrical harness.



6. Connect the engine coolant temperature sensor.

7. Connect the heater supply and radiator upper hoses to manifold.

8. Connect the fuel line (4) (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).



9. Install the upper intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

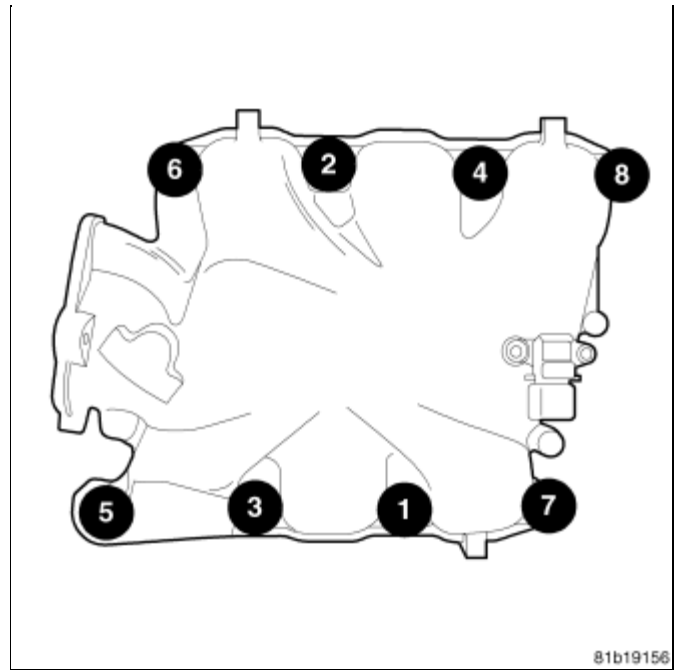
10. Connect negative battery cable.

11. Fill the cooling system.

12. Connect the negative battery cable.

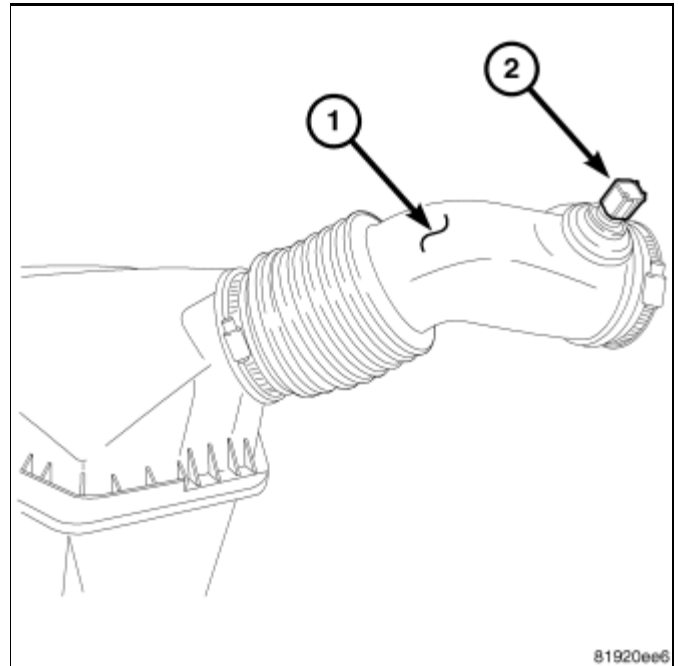
MANIFOLD-EXHAUST-RIGHT

REMOVAL



81b19156

1. Disconnect battery negative cable.
2. Separate the exhaust pipe at the exhaust manifold.
3. Remove the air cleaner hose (1) and housing.



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4. Disconnect the TPS, IAC and purge vacuum hose from the throttle body.
5. Disconnect the spark plug wires at the spark plugs.
6. Disconnect the oxygen sensors (1,2).
7. Remove bolts attaching exhaust manifold to cylinder head and remove manifold.
8. Inspect and clean manifold.

CLEANING

1. Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

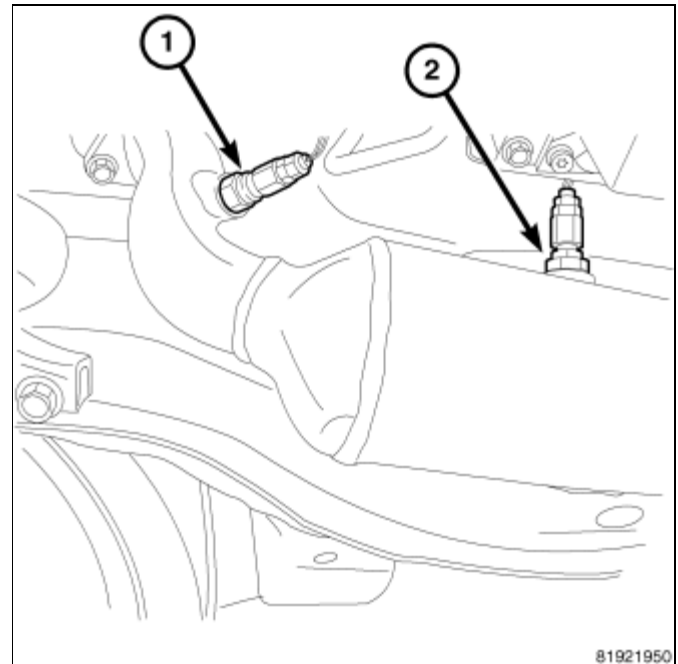
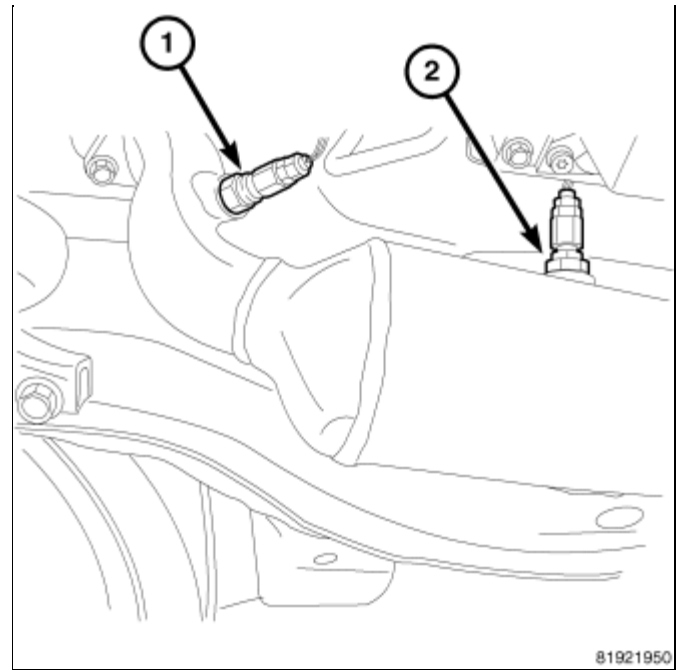
INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

Manifold surface flatness limits should not exceed 1.0 mm (0.039 in.).

INSTALLATION

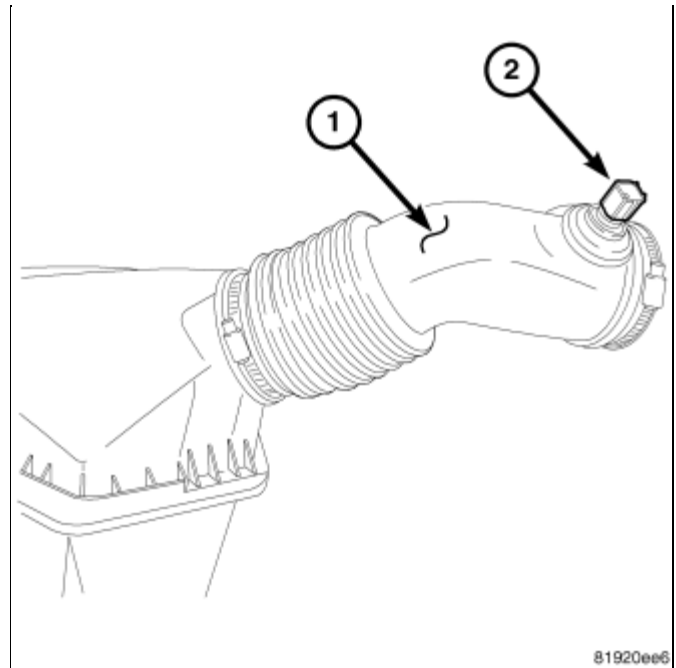
1. Position exhaust manifold on cylinder head and install bolts to center runner (cylinder # 3) and initial tighten to 2.8 N·m (25 in. lbs.).
2. Install the remaining manifold attaching bolts. Tighten all bolts to 23 N·m (200 in. lbs.).
3. Connect the oxygen sensors (1,2).
4. Connect the spark plug wires to the spark plugs.



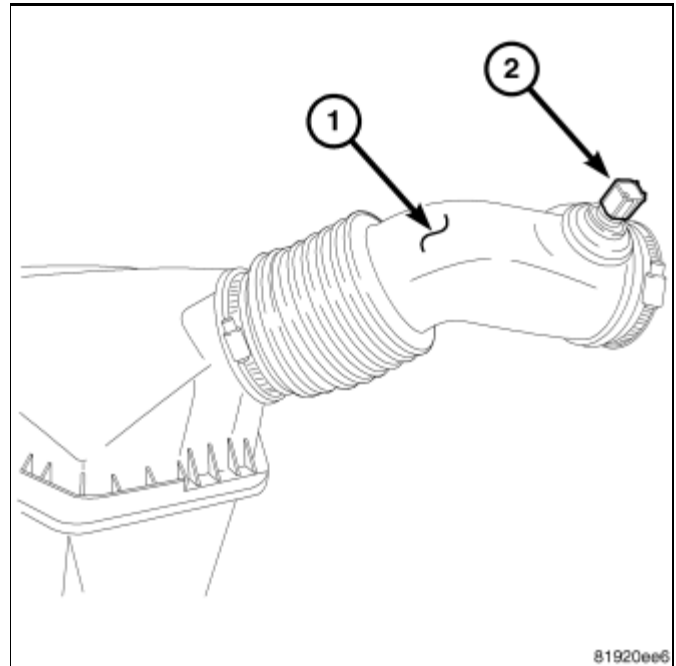
5. Connect the IAC, TPS and the EVAP hose to the throttle body.

6. Attach exhaust pipe to exhaust manifold.
7. Install the air cleaner housing and hose (1).
8. Connect battery negative cable.

MANIFOLD-EXHAUST-LEFT REMOVAL



1. Disconnect battery negative cable.
2. Remove the fresh air hose (1).
3. Disconnect left cylinder bank spark plug wires.



4. Remove heat shield attaching bolts.
5. Remove bolts attaching exhaust to manifold.
6. Disconnect the left side oxygen sensors (1,2).
7. Remove bolts attaching exhaust manifold to cylinder head.
8. Remove the exhaust manifold.

CLEANING

1. Discard gasket (if equipped) and clean all surfaces of

manifold and cylinder head.

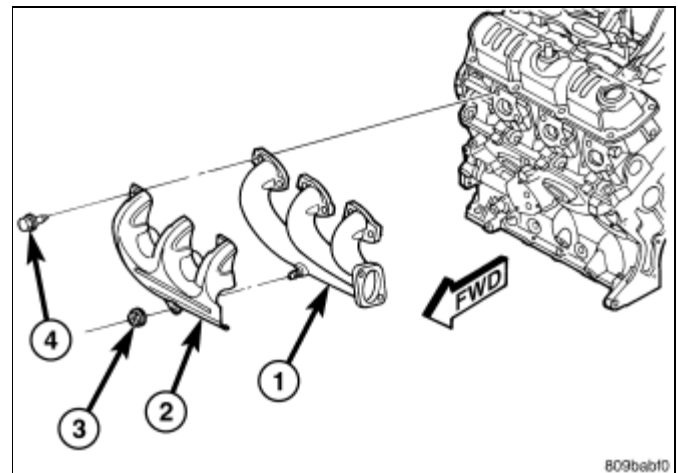
INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

Manifold surface flatness limits should not exceed 1.0 mm (0.039 in.).

INSTALLATION

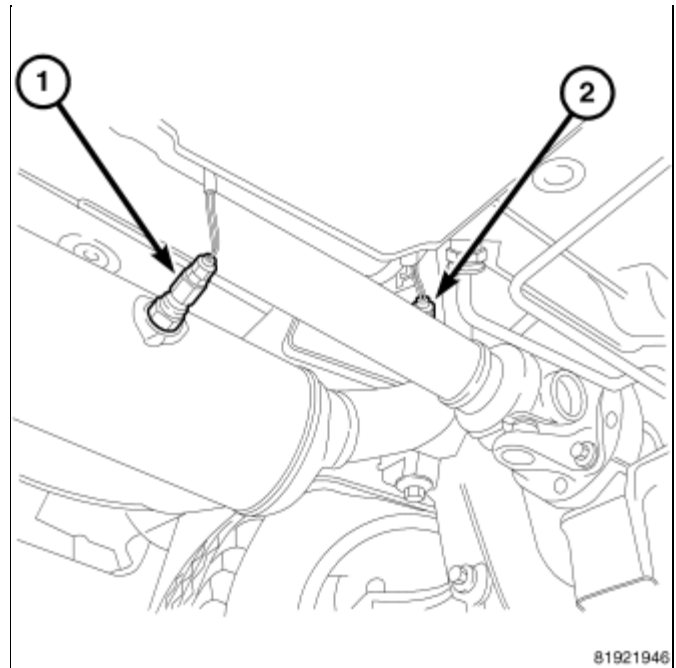
1. Position exhaust manifold (1) on cylinder head. Install bolts to center runner (cylinder #4) and initial tighten to 2.8 N·m (25 in. lbs.).
2. Position heat shield (2) on manifold.
3. Install the remaining manifold attaching bolts. Tighten all bolts to 23 N·m (200 in. lbs.).
4. Install and tighten heat shield attaching nut (3) to 12 N·m (105 in. lbs.).



5. Attach exhaust pipe to exhaust manifold and tighten bolts to 41 N·m (30 ft. lbs.).
6. Connect the left side oxygen sensors (1,2).
7. Connect battery negative cable.

VALVE TIMING

STANDARD PROCEDURE



STANDARD PROCEDURE - VALVE TIMING VERIFICATION

1. Remove front cylinder head cover and all 6 spark plugs.
2. Rotate engine until the #2 piston is at TDC of the compression stroke.
3. Install a degree wheel on the crankshaft pulley.
4. With proper adaptor, install a dial indicator into #2 spark plug hole. Using the indicator find TDC on the compression stroke.
5. Position the degree wheel to zero.
6. Remove dial indicator from spark plug hole.
7. Place a 5.08 mm (0.200 in.) spacer between the valve stem tip of #2 intake valve and rocker arm pad. Allow tappet to bleed down to give a solid tappet effect.
8. Install a dial indicator so plunger contacts the #2 intake valve spring retainer as nearly perpendicular as possible. Zero the indicator.
9. Rotate the engine clockwise until the intake valve has lifted .254 mm (0.010 in.).

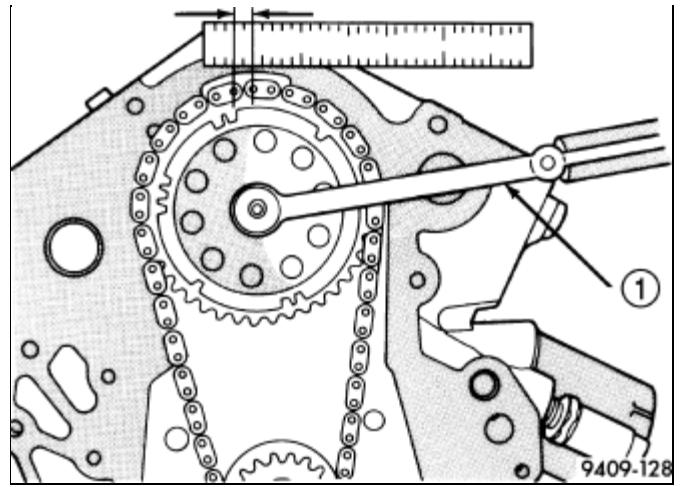
CAUTION: Do not turn crankshaft any further clockwise as intake valve might bottom and result in serious damage.

10. Degree wheel should read 6 degrees BTDC to 6 degrees ATDC.

STANDARD PROCEDURE - MEASURING TIMING CHAIN WEAR

1. Position a scale next to timing chain so that any movement of chain may be measured.
2. Position a torque wrench and socket on the camshaft sprocket attaching bolt. Apply force in the direction of crankshaft rotation to take up slack to the following torque:
 - 41 N·m (30 ft. lb.) with cylinder heads installed
 - 20 N·m (15 ft. lb.) with cylinder heads removed

NOTE: With torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block crankshaft to prevent rotation.

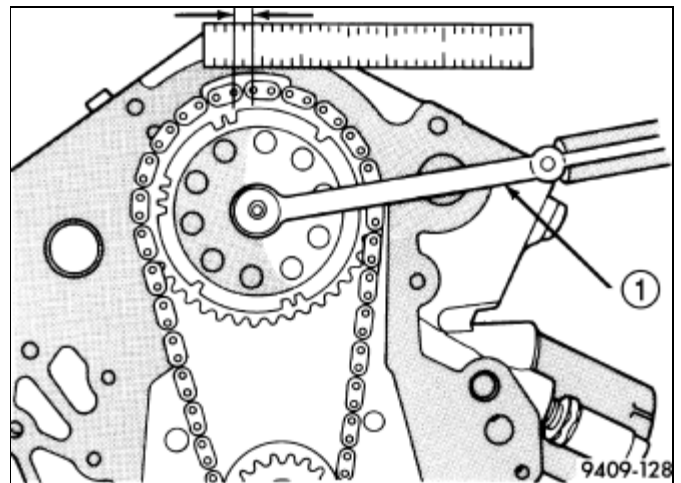


3. Holding a measuring scale along edge of chain links.
 4. Apply force in the reverse direction to the following torque:

- 41 N·m (30 ft. lb.) with cylinder heads installed
- 20 N·m (15 ft. lb.) with cylinder heads removed

5. Measure amount of sprocket/chain movement.

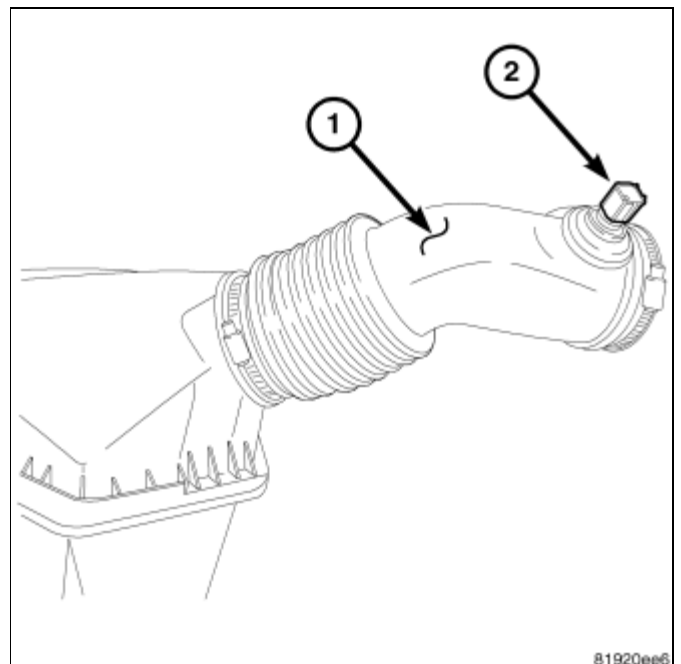
6. Install a new timing chain and sprockets if movement exceeds 3.175 mm (1/8 in.).



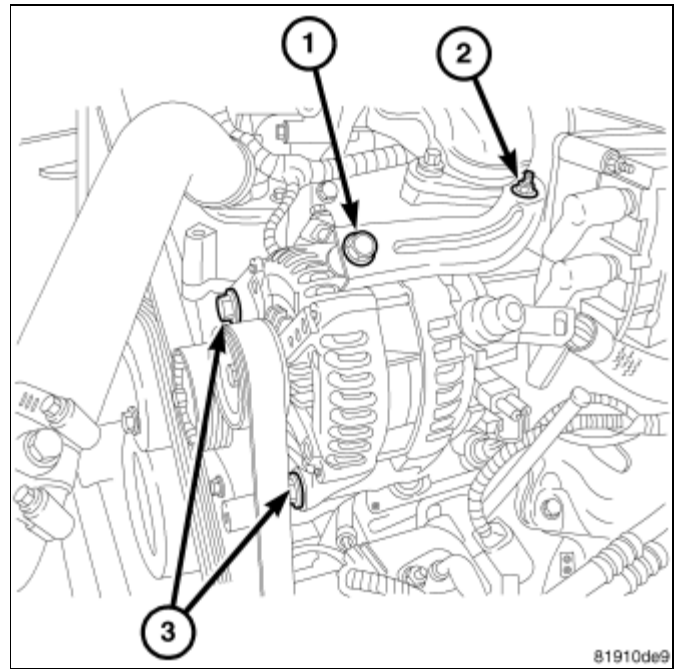
COVER-TIMING CHAIN

REMOVAL

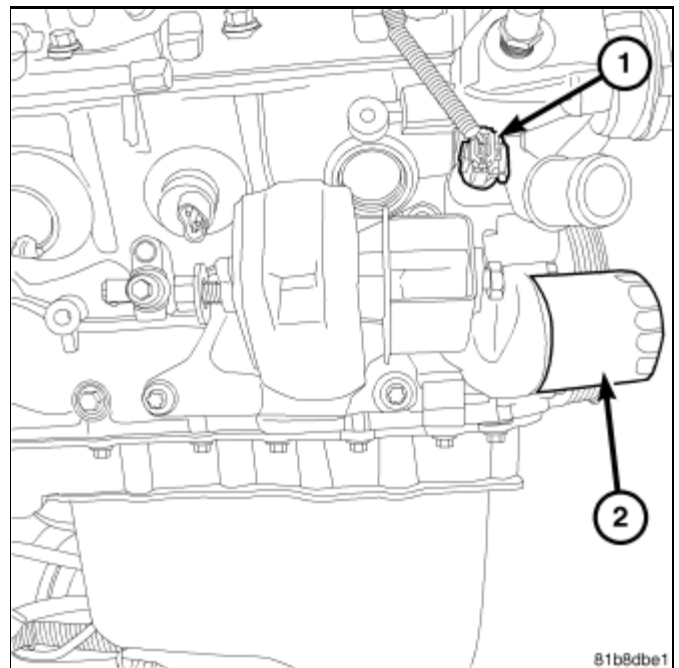
1. Perform the fuel pressure relief procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
2. Disconnect negative cable from battery.
3. Drain cooling system.
4. Remove the air cleaner hose (1) and housing assembly.



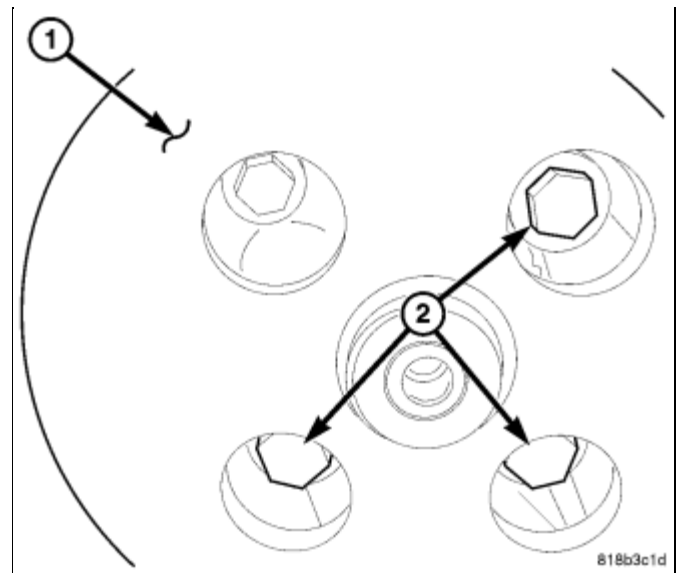
5. Remove the accessory drive belt and belt tensioner.
6. Remove the generator (3).
7. Remove the oil level indicator tube.
8. Drain engine oil.



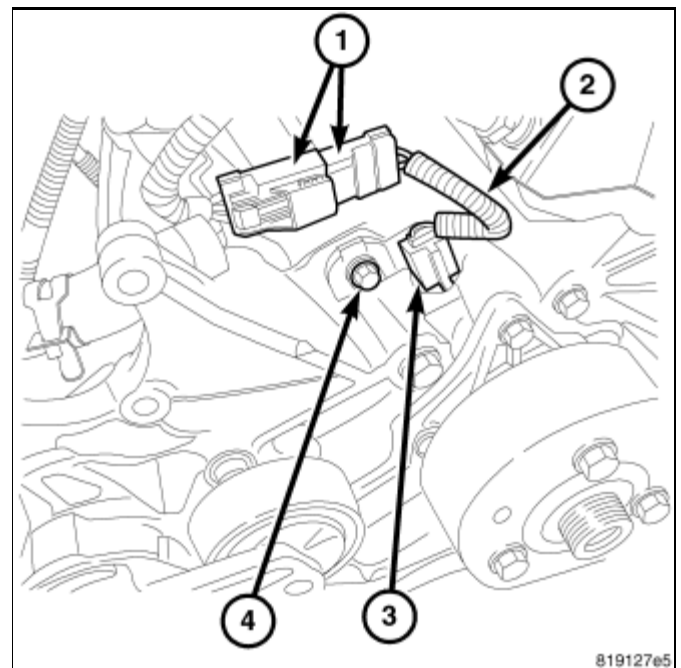
9. Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
10. Remove the oil filter (2).
11. Disconnect the oil pressure switch (1).

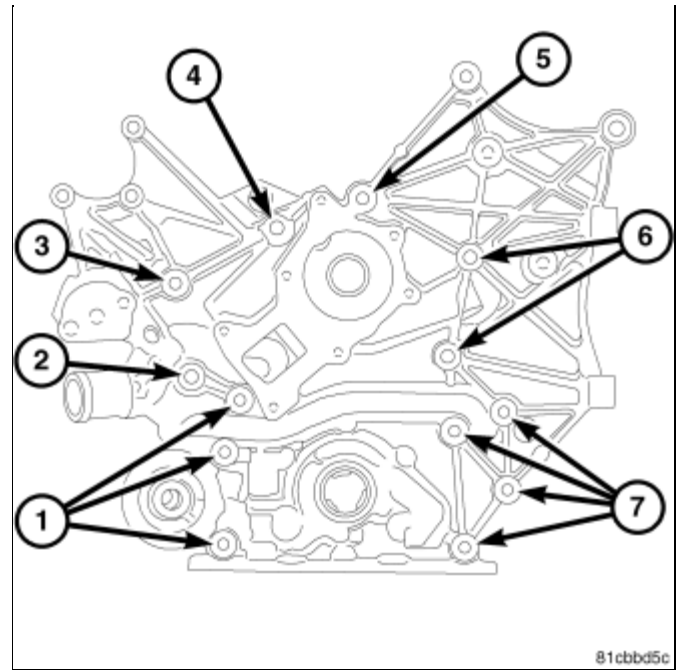


12. Remove power steering pump fasteners (2) and set pump (1) aside.
13. Disconnect the lower radiator hose.
14. Separate the air conditioning compressor from the engine and set aside.



15. Remove crankshaft vibration damper using special tool #8454 and insert #8450. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)
16. Remove camshaft position sensor (CMP) (4) from timing chain cover (Refer to 8 - ELECTRICAL/IGNITION CONTROL/CAMSHAFT POSITION SENSOR - REMOVAL).

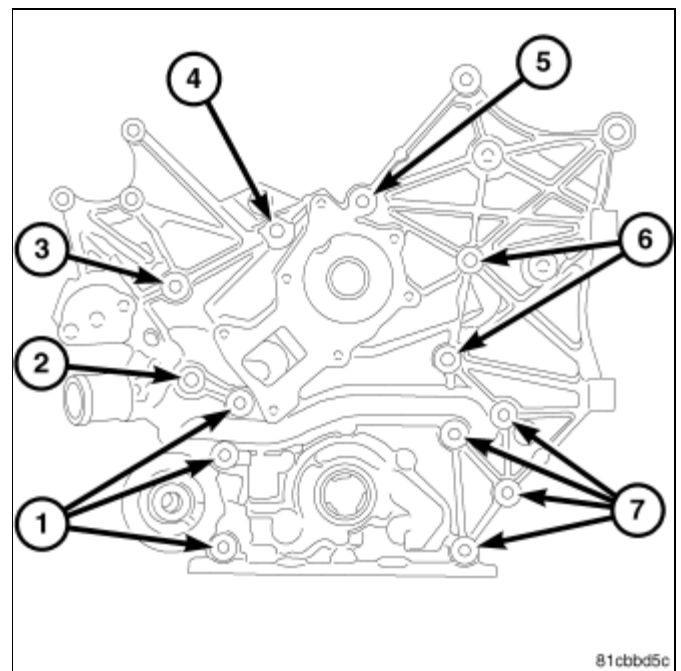




1,7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

17. Remove the timing chain cover fasteners (1–7) and remove timing chain cover.

INSTALLATION



1,7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
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2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

CAUTION: Crankshaft oil seal must be removed to insure correct oil pump engagement.

1. Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.

NOTE: DO NOT USE SEALER ON COVER GASKET

2. Position new gasket on timing cover. Adhere new gasket to chain case cover, making sure that the lower edge of the gasket is 0.5 mm (0.020 in.) beyond the lower edge of the cover.

3. Rotate crankshaft so that the oil pump drive flats are in the vertical position.

4. Position oil pump inner rotor so the mating flats are in the same position as the crankshaft drive flats.

CAUTION: Make sure the oil pump is engaged on the crankshaft correctly or severe damage may result.

5. Install timing cover.

NOTE: Torque the M10 bolts (2,4,6,) first, then the M8 (1,3,5,7).

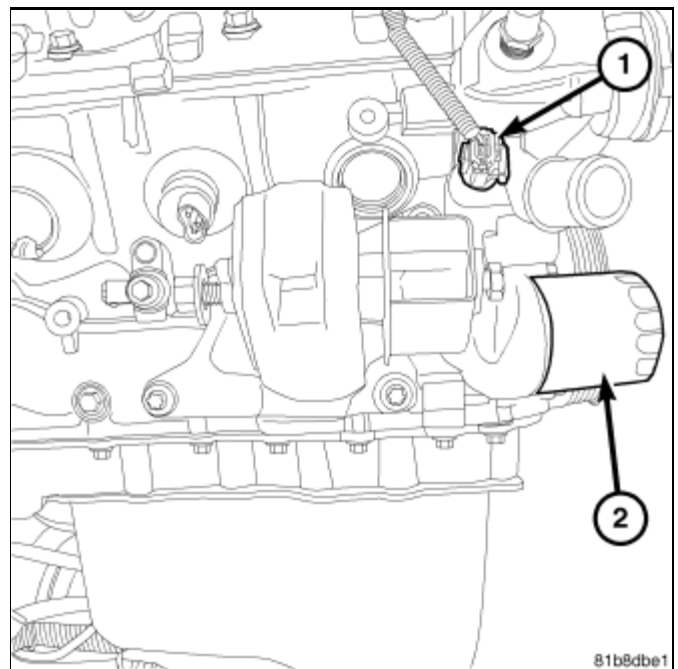
6. Install timing chain cover bolts. Tighten the M10 bolts (2,4,6) to 54 N·m (40 ft. lbs.) and M8 bolts (1,3,5,7) to 28 N·m (21 ft. lbs.).

7. Install the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

8. Install crankshaft front oil seal. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION)

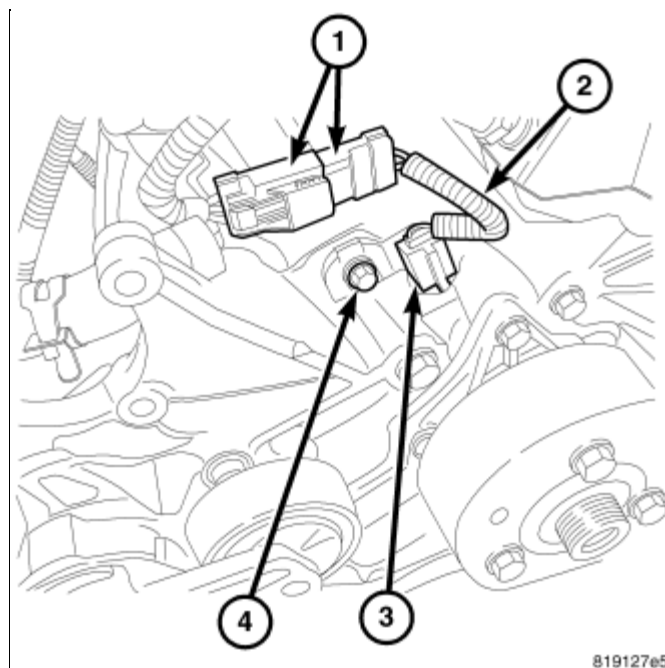
9. Install crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

10. Install a new oil filter (2) and connect the oil pressure switch (1).



11. Connect the coolant hoses.

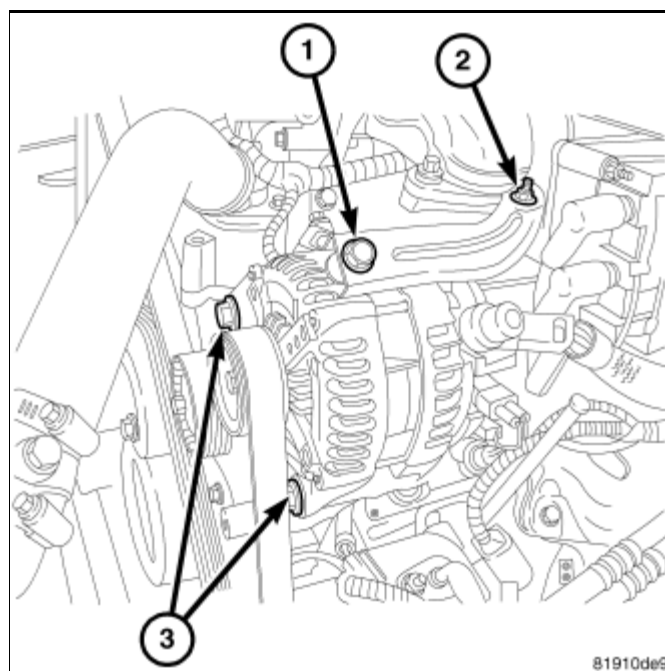
12. Install camshaft position sensor (CMP).



13. Install A/C compressor.

14. Install the oil level indicator tube.

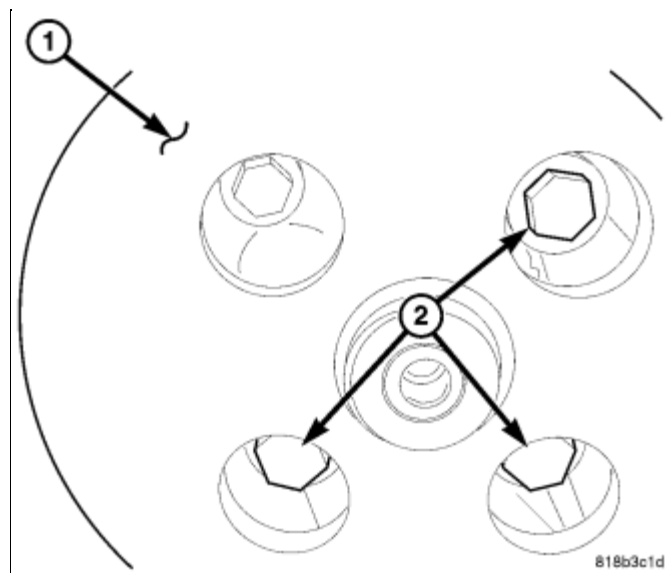
15. Install the generator (3).



16. Install the power steering pump (1).

17. Install the accessory drive belt and idler pulley.

18. Fill crankcase with engine oil to proper level.



19. Install the Air cleaner housing and hose (1).

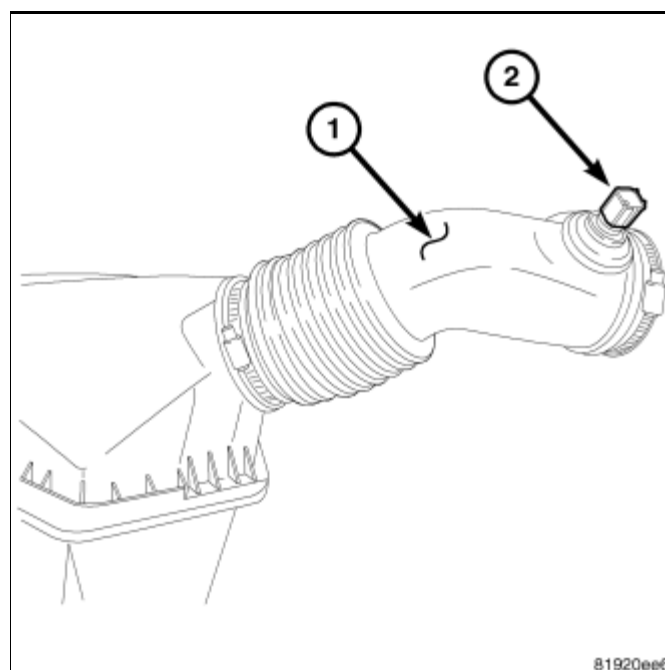
20. Fill cooling system.

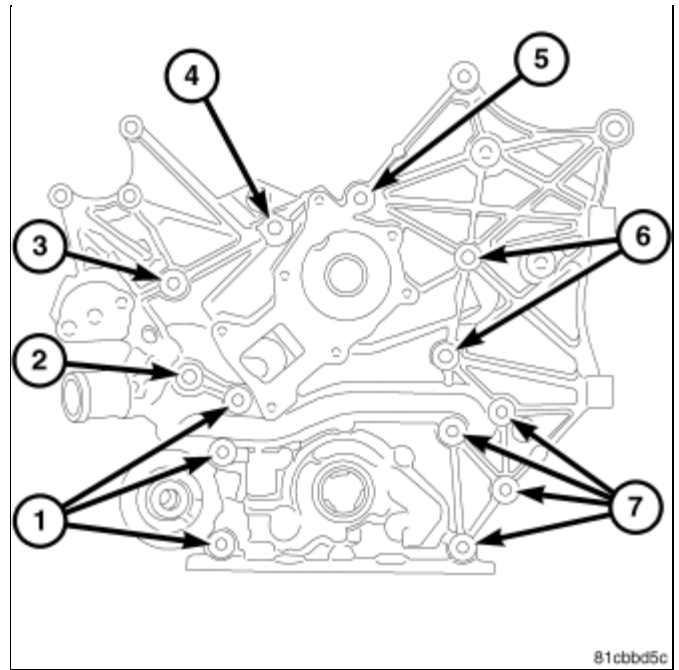
21. Connect negative cable to battery.

CHAIN & SPROCKETS-TIMING

REMOVAL

REMOVAL - TIMING CHAIN AND CAMSHAFT SPROCKET



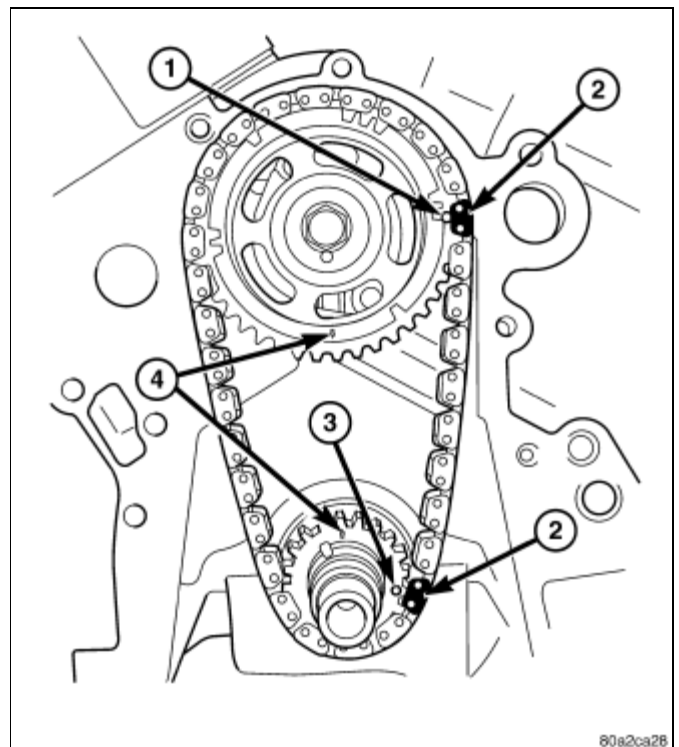


1,7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

1. Disconnect negative cable from battery.
 2. Remove the timing chain cover bolts (1–7), and timing cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

3. Rotate engine by turning crankshaft until the timing marks are aligned as shown (4).
 4. Remove camshaft sprocket attaching bolt.
 5. Remove the timing chain with camshaft sprocket.
 6. Remove the crankshaft sprocket.

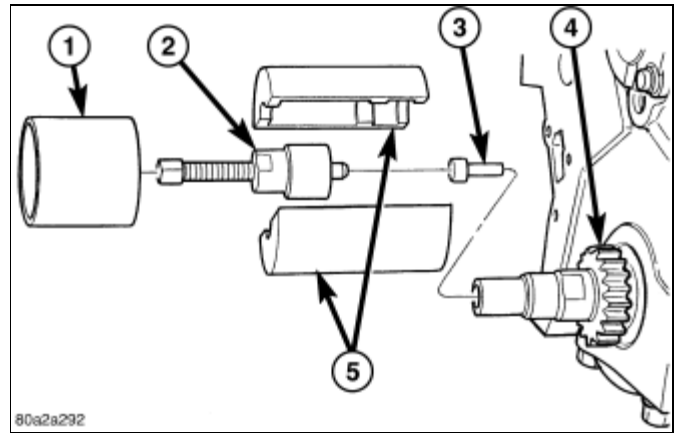
REMOVAL - CRANKSHAFT SPROCKET



1. Remove the timing chain.
2. Using Special Tools 8539 (5), 5048-6 (1), and 5048-1, remove the crankshaft sprocket while holding the crankshaft from turning. Be careful not to damage the crankshaft surfaces.

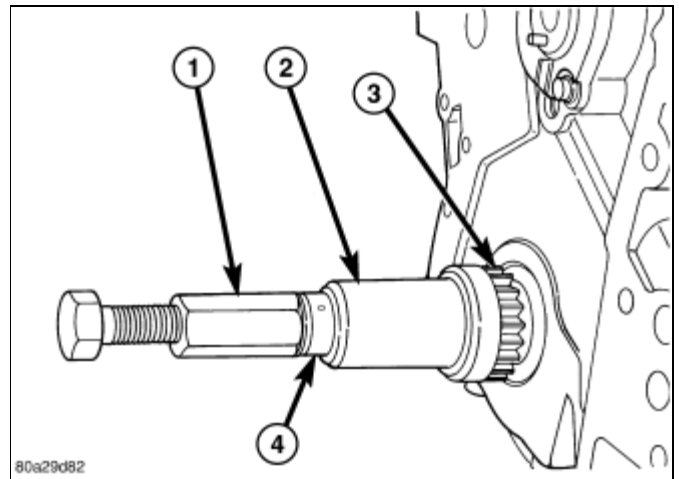
INSTALLATION

INSTALLATION - CRANKSHAFT SPROCKET



1. Position the sprocket on the crankshaft (timing mark out) with the timing slot aligned with the timing pin.
2. Install sprocket using Special Tool 8452 (1,2). Install sprocket until it is fully seats on the crankshaft.
3. Install the timing chain and camshaft sprocket.

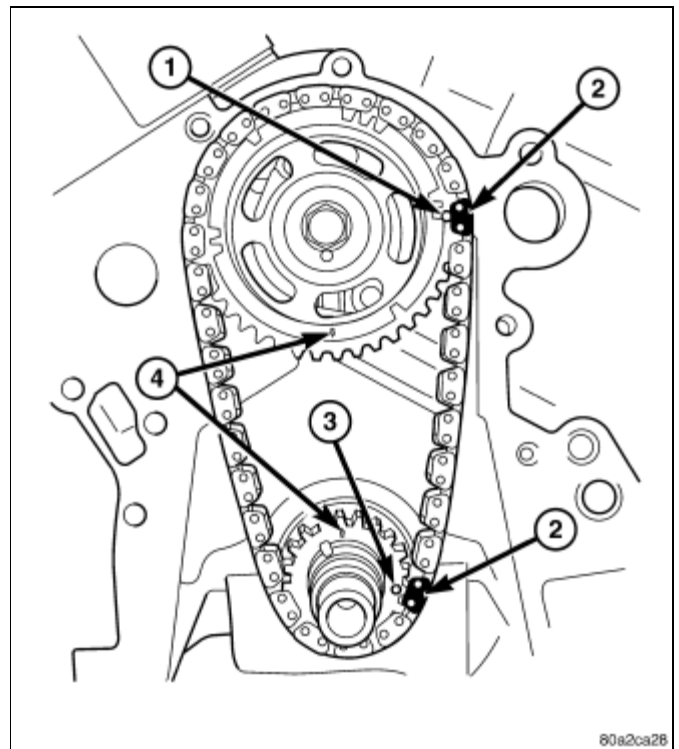
INSTALLATION - TIMING CHAIN AND CAMSHAFT SPROCKET

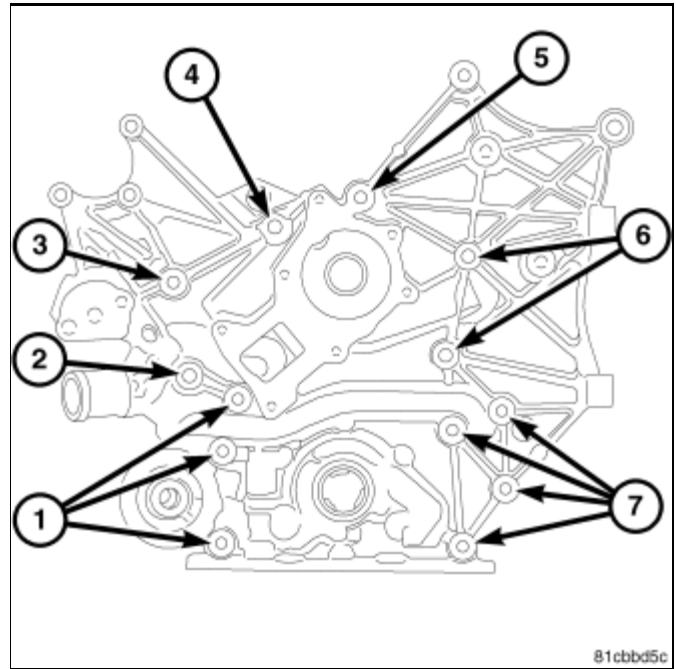


1. Rotate crankshaft so the timing arrow is to the 12 o'clock position (4).

NOTE: Lubricate timing chain and sprockets with clean engine oil before installation.

2. While holding camshaft sprocket and chain in hand, place timing chain around the sprocket, aligning the plated link (2) with the dot on the sprocket. Position the timing arrow to the 6 o'clock position .
3. Place timing chain around crankshaft sprocket with the plated link (2) lined up with the dot on the sprocket. Install camshaft sprocket into position.
4. Use a straight edge to check alignment of timing marks.
5. Install camshaft sprocket bolt and washer. Tighten bolt to 54 N·m (40 ft. lbs.).
6. Rotate crankshaft 2 revolutions and check timing mark alignment. If timing marks do not line up, remove camshaft sprocket and realign.





1,7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

7. Install the timing chain cover, and bolts (1–7). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

8. Connect negative cable to battery.

ENGINE - 2.8L DIESEL - SERVICE INFORMATION

ENGINE - 2.8L DIESEL - SERVICE INFORMATION

DESCRIPTION

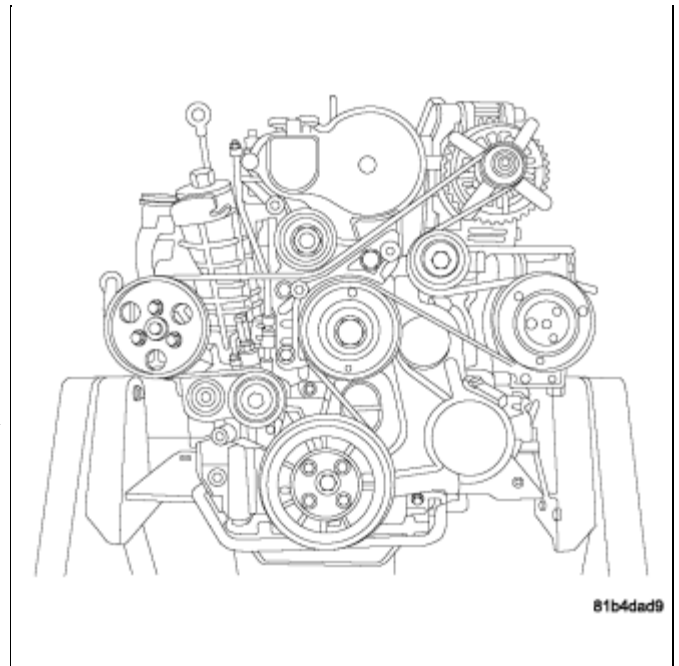
2.8L COMMON RAIL DIESEL ENGINE

The 2.8L (2776cc) four-cylinder “common rail” direct injection engine is an in-line overhead valve design. The engine utilize a cast iron cylinder block. The engine has a one piece aluminum cylinder head with four valves per cylinder and dual overhead cam shafts. The 2.8L is turbocharged, intercooled and also equipped with a EGR cooler.

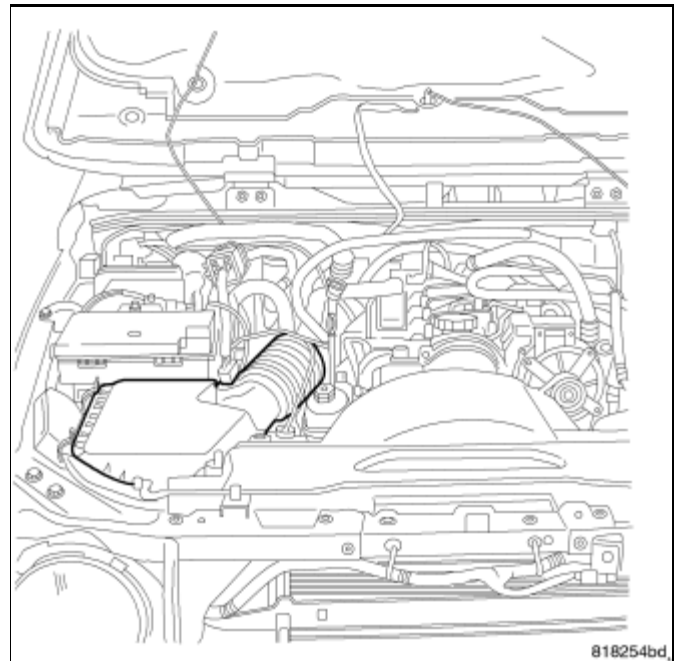
The identification stamp for the 2.8L is located on the left side of the engine block, above the starter. The engine code label is located on the front timing cover and is the same as the engine I.D. and serial number. There is also a fuel system label on the front timing cover used for fuel system identification during ECM programming.

REMOVAL

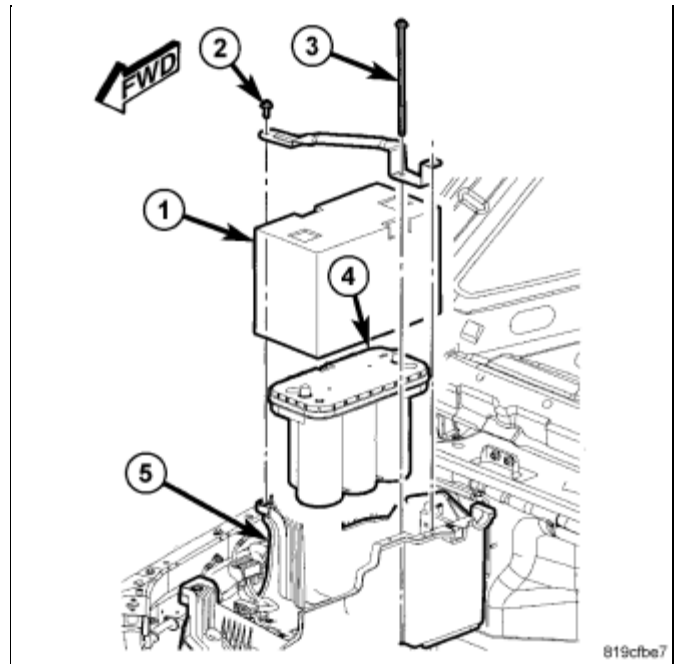
ENGINE - 2.8L DIESEL



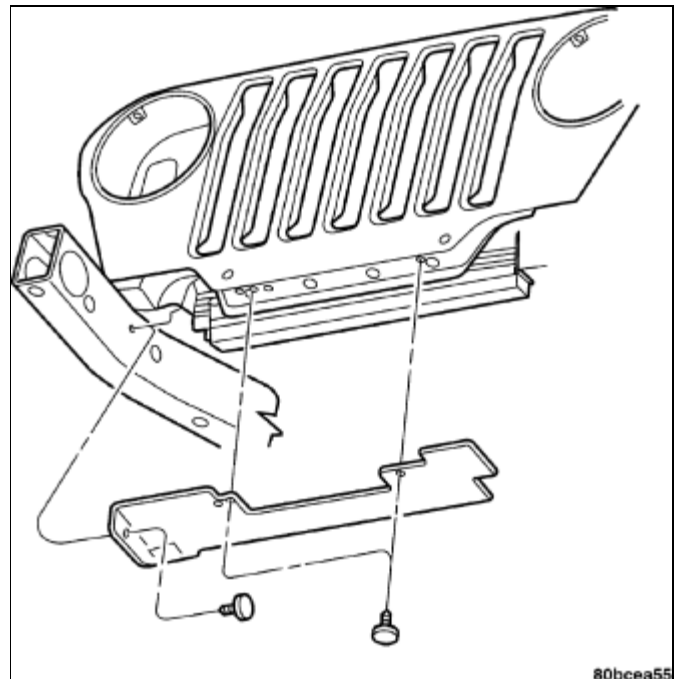
1. Remove the intake air box.
2. Remove the turbocharger air inlet.



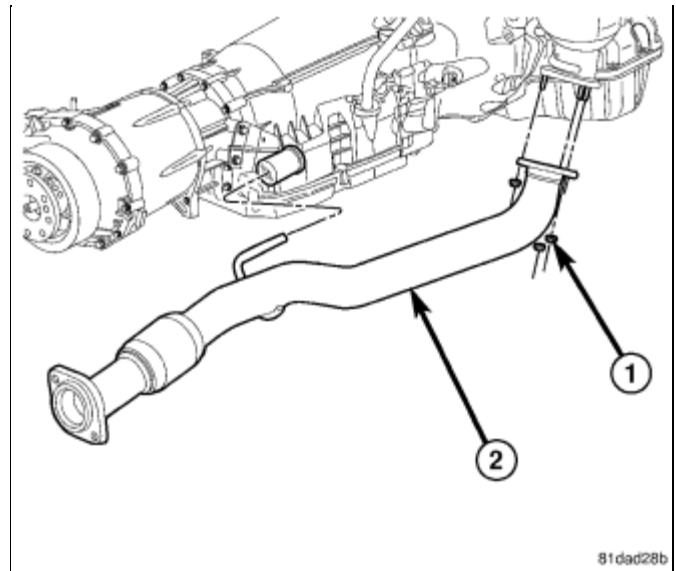
3. Disconnect the battery cables. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
4. Remove the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL)



5. Remove the front lower splash shield.
6. Drain the coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
7. Drain the engine oil.
8. Evacuate the A/C system.
9. Remove the lower air deflector from the radiator.



10. Remove the retainers (1) Disconnect the exhaust system (2) from the catalytic converter. (Refer to 11 - EXHAUST SYSTEM/CATALYTIC CONVERTER - REMOVAL)
11. Disconnect the oxygen sensors.
12. Remove the catalytic converter to engine bolts.

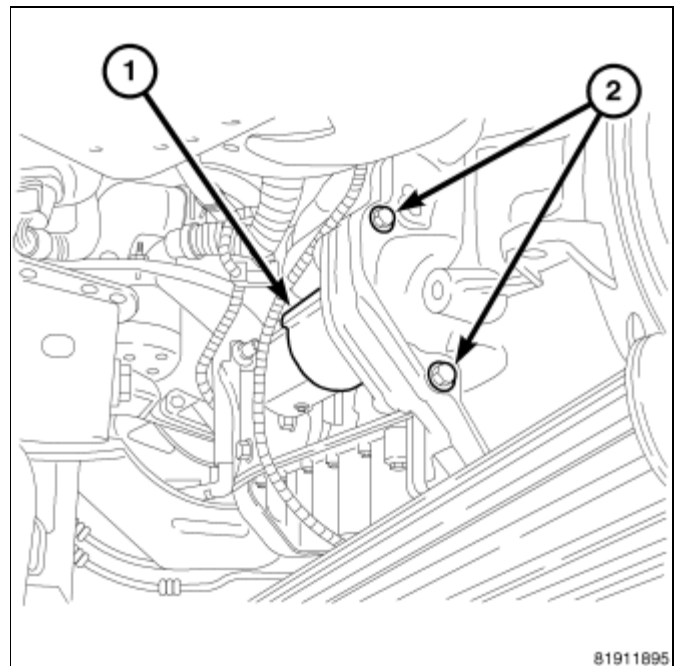


13. Remove the starter. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)

14. Remove the front tires. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE)

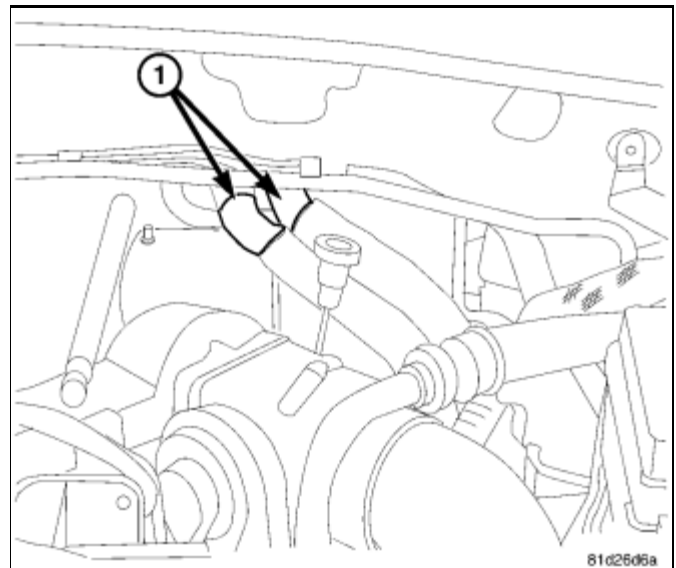
15. Remove the right front inner fender well. (Refer to 23 - BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - REMOVAL)

16. Remove the left front inner fender well. (Refer to 23 - BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - REMOVAL)

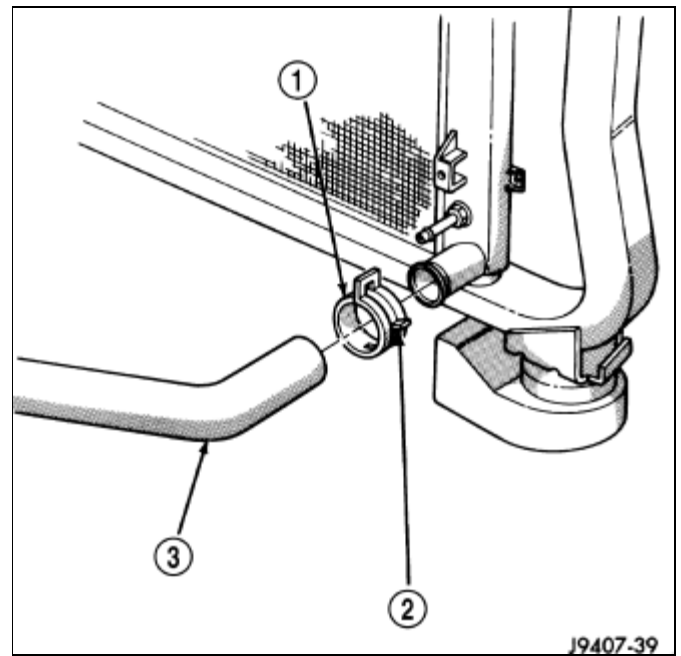


17. Disconnect the coolant hoses (1) from the heater core connection at the bulkhead.

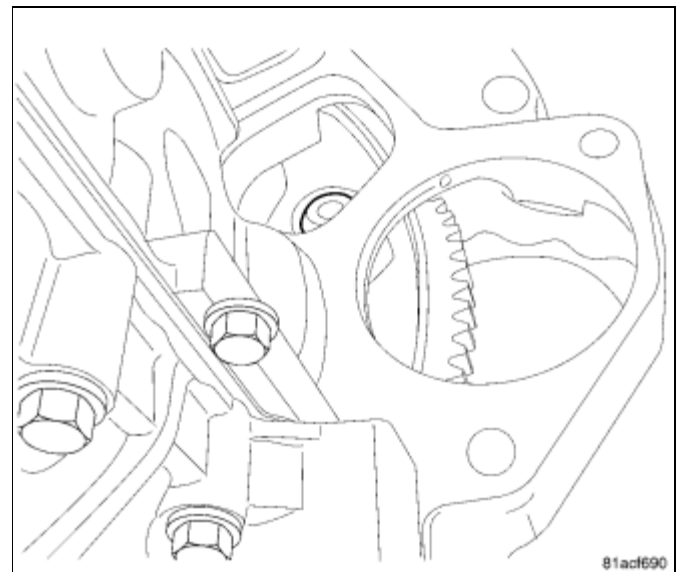
18. Remove the coolant recovery container hose. (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL)



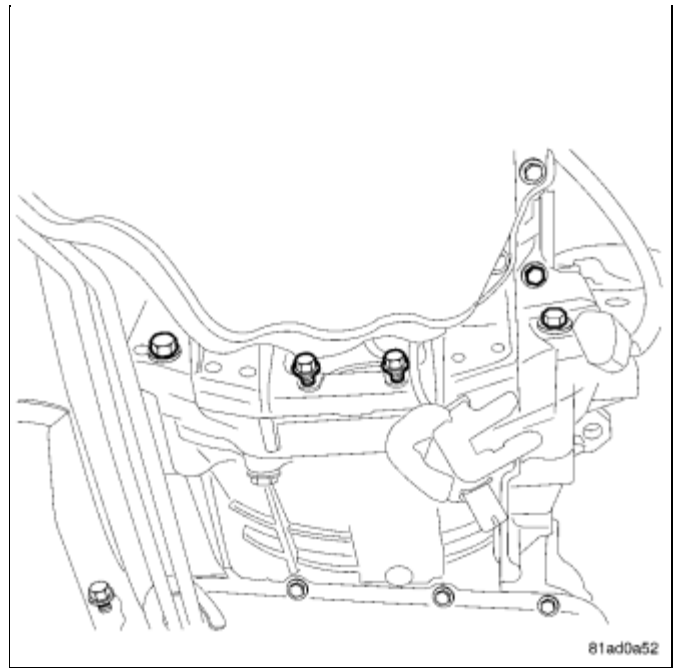
- 19. Remove the cooling module.
- 20. Remove the fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)



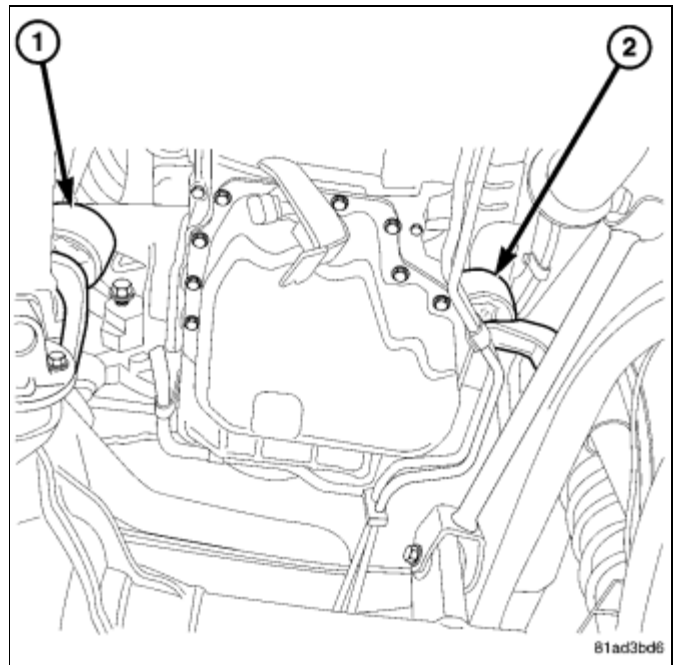
- 21. Remove the torque converter to flex plate bolts.



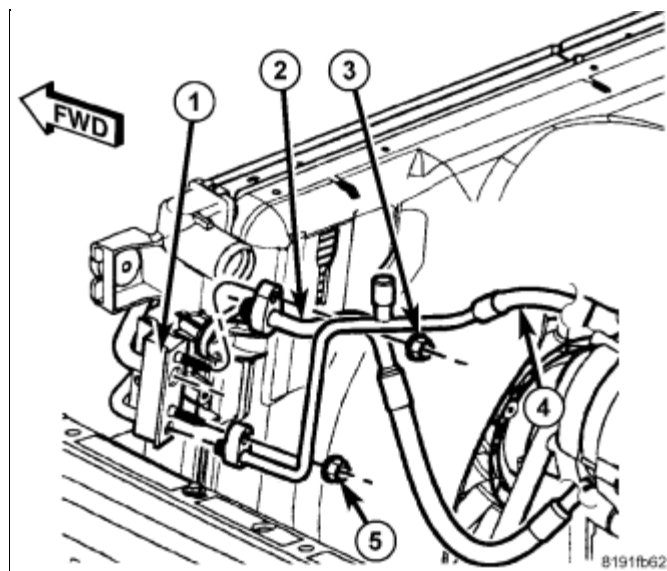
- 22. Remove the bell housing bolts.
- 23. Remove the transmission line bracket at the oil pan.



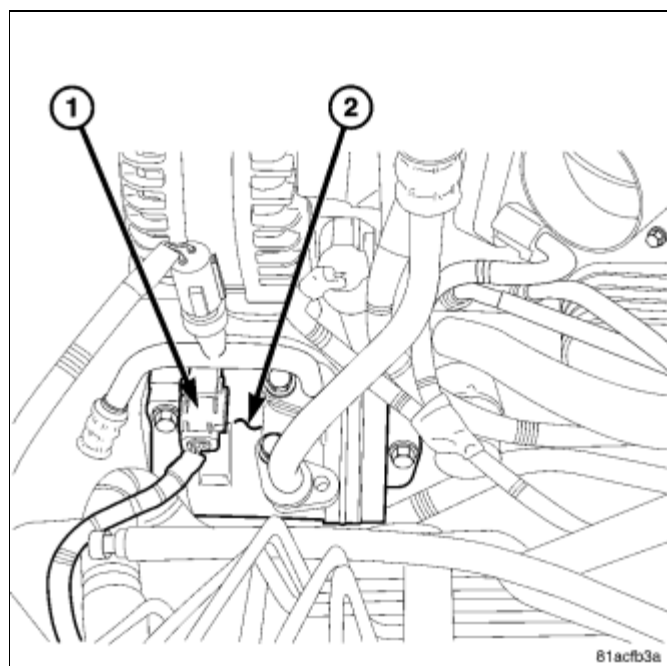
- 24. Remove the bolt from the left engine mount.
- 25. Remove the bolt from the right engine mount.



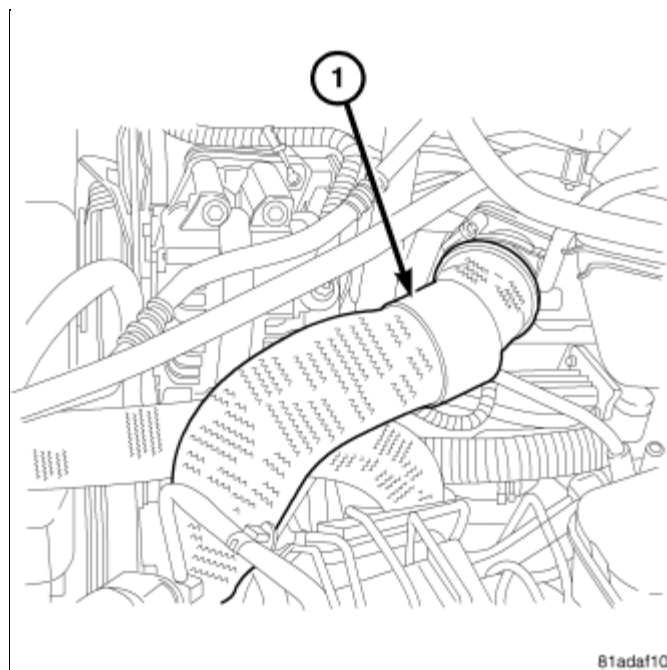
- 26. Remove the A/C lines at the condenser.



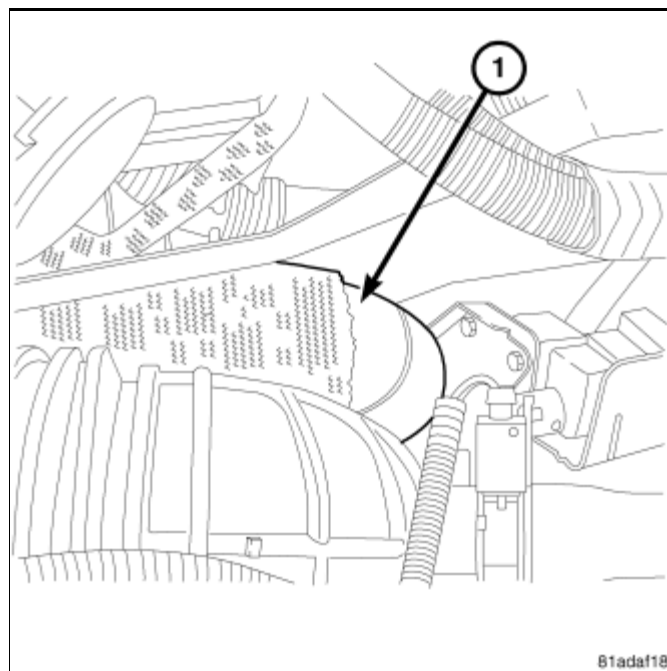
27. Remove the A/C suction line at the compressor.
28. Remove the A/C discharge line at the compressor.
29. Disconnect the A/C compressor connector.
30. Remove the A/C compressor.



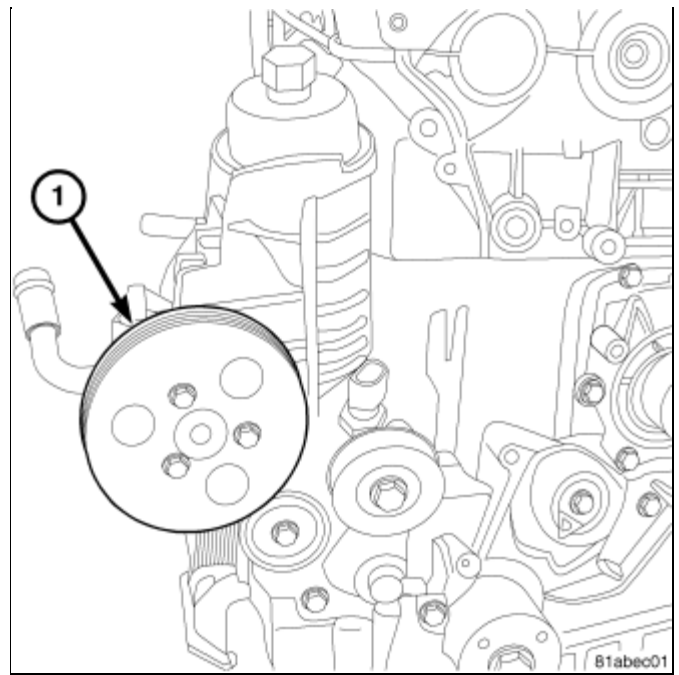
31. Remove the left side charge air cooler hose.



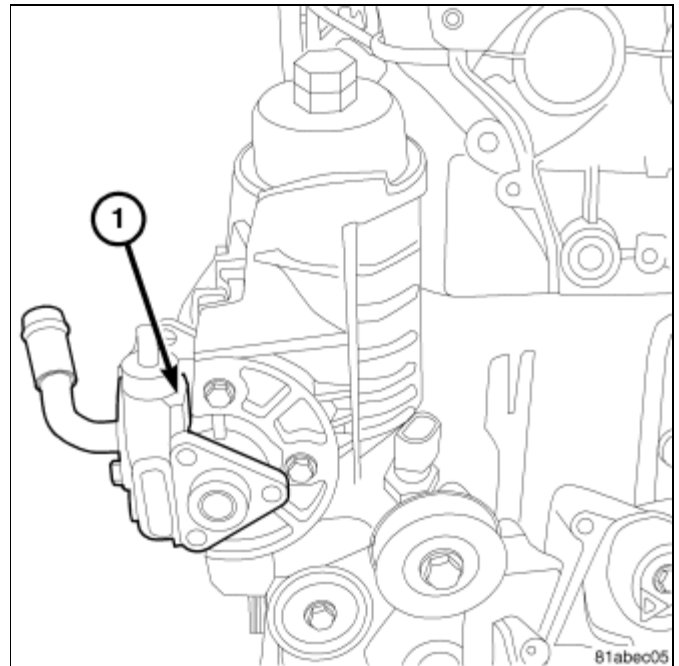
- 32. Remove the right side charge air cooler hose.
- 33. Remove the transmission cooler lines at the transmission cooler.
- 34. Remove the EGR vacuum control solenoid.



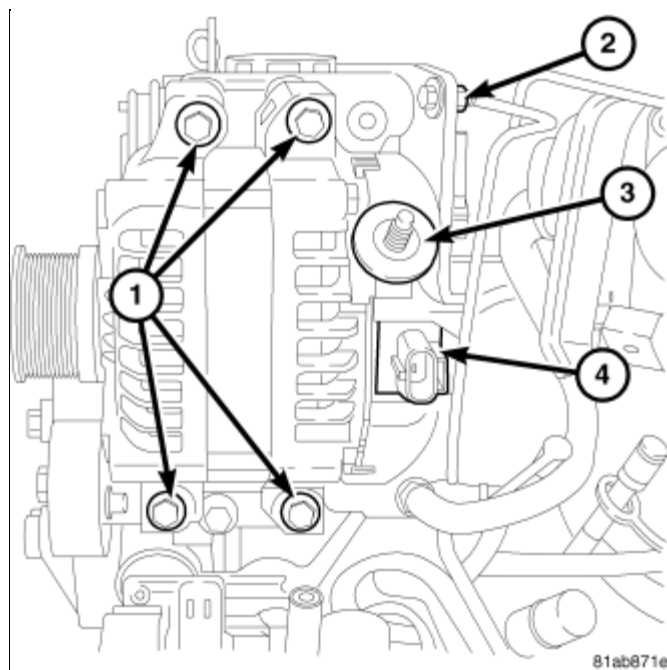
- 35. Remove the power steering pump pulley (1).



36. Remove the power steering pump (1) and position aside.

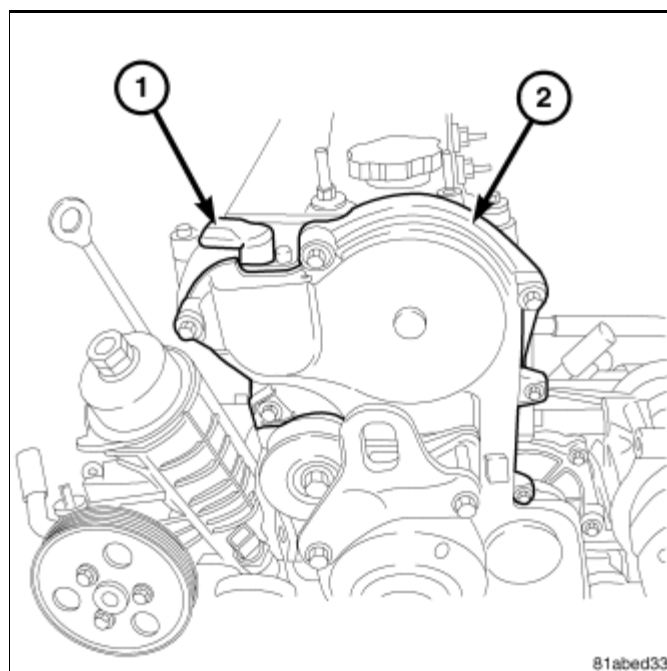


- 37. Remove the generator.
- 38. Disconnect the oil pressure sender connector.
- 39. Disconnect the EGR solenoid connector.

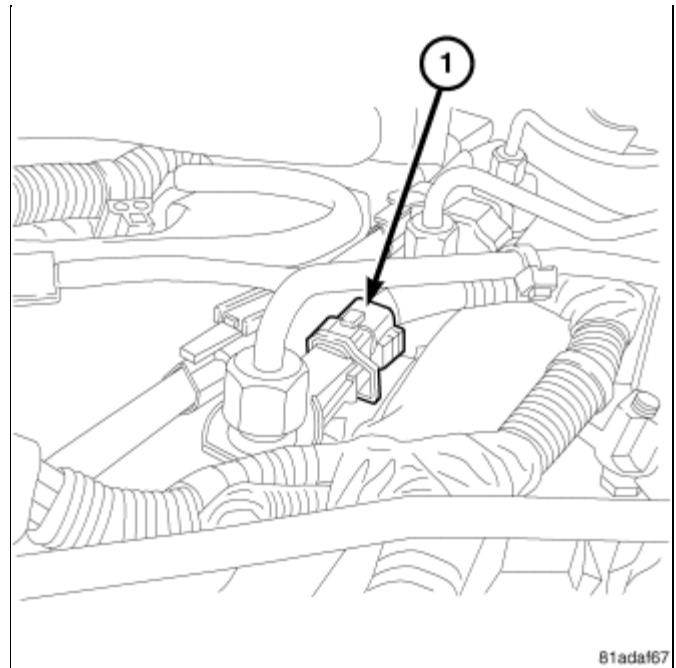


40. Disconnect the engine harness connector from the camshaft position sensor (1).

41. Disconnect the boost pressure solenoid harness connector.



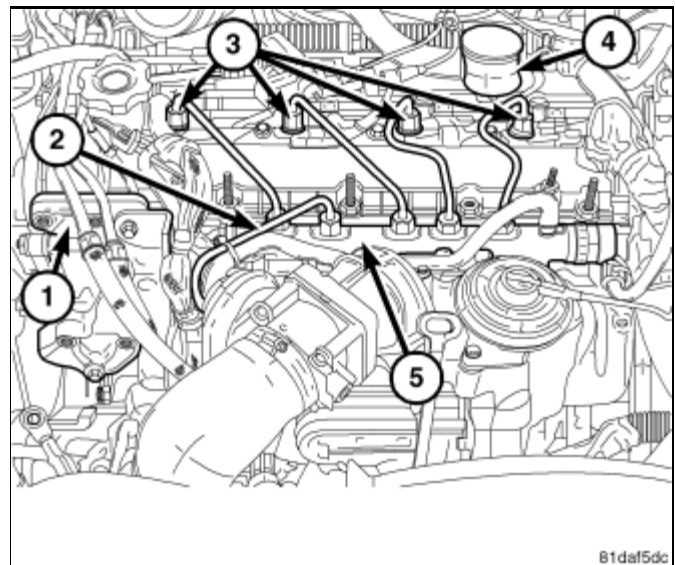
42. Disconnect the fuel injector connectors.



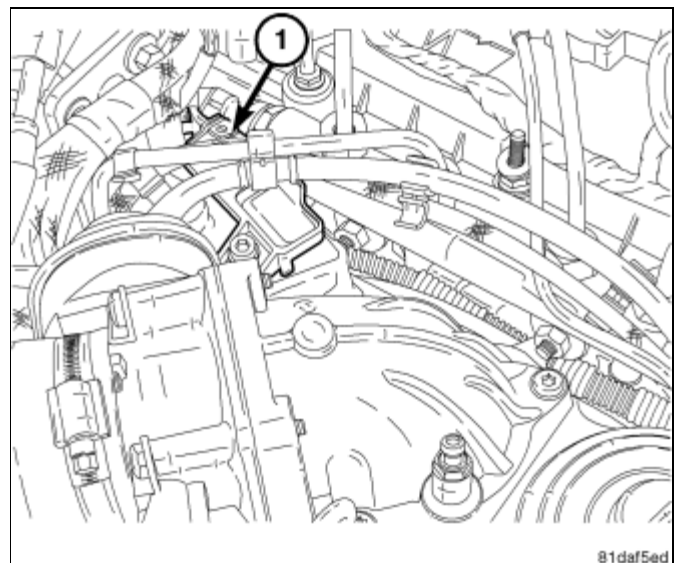
- 43. Disconnect the fuel pressure sensor harness connector.
- 44. Disconnect the fuel pressure regulator harness connector.
- 45. Remove the high pressure feed fuel line bracket.
- 46. Remove the high pressure fuel feed line (2).

NOTE: Any time the high pressure fuel line(s) are removed, the fuel line must be replaced.

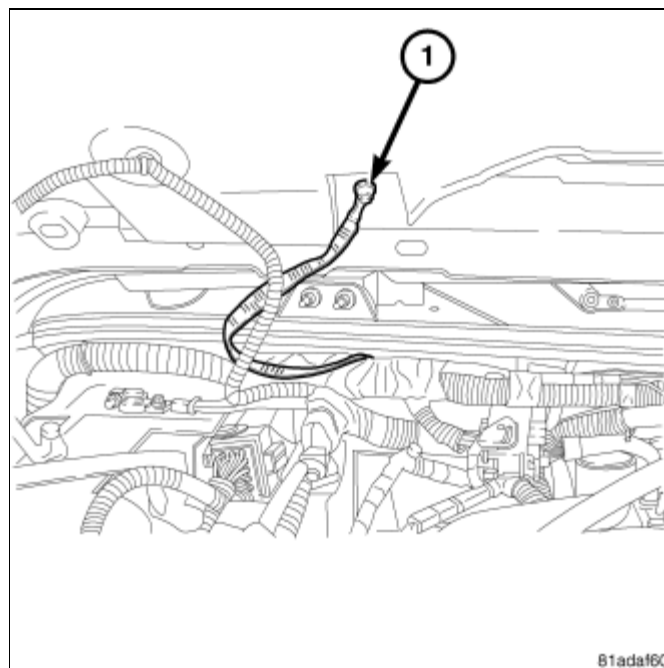
- 47. Disconnect the EGR airflow control valve solenoid harness connector.



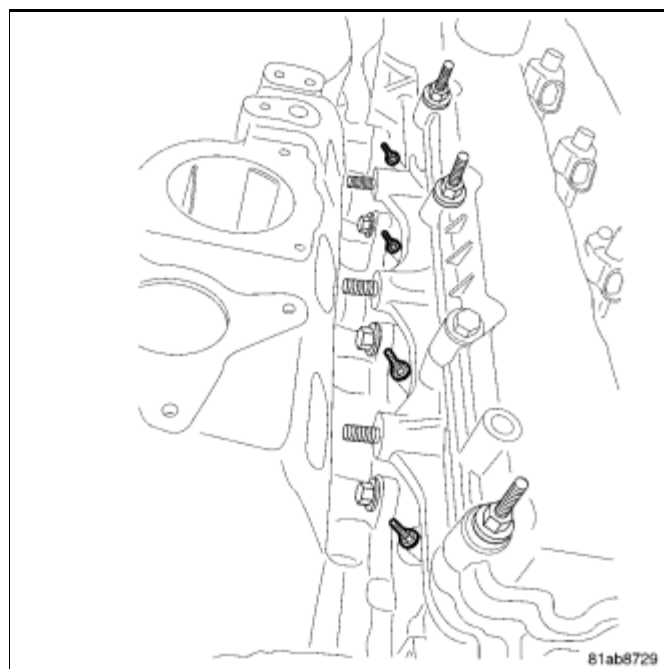
- 48. Disconnect the IAT/BPS harness connector (1).



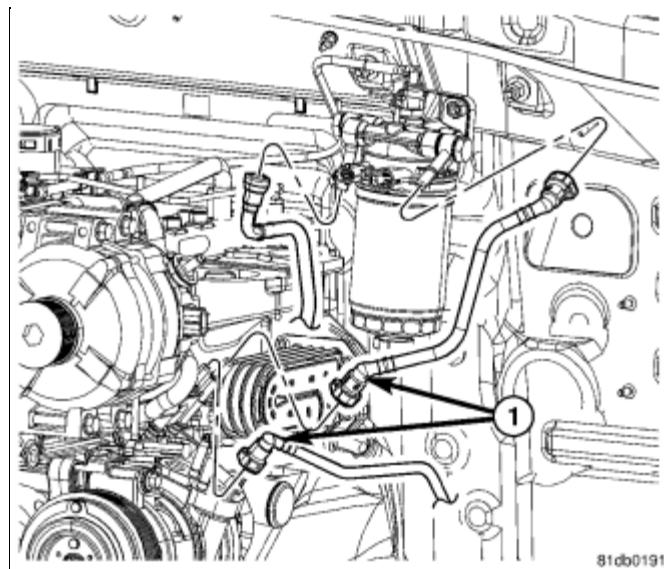
- 49. Disconnect the ground strap between the cowl and hood.
- 50. Position the engine wiring harness aside.



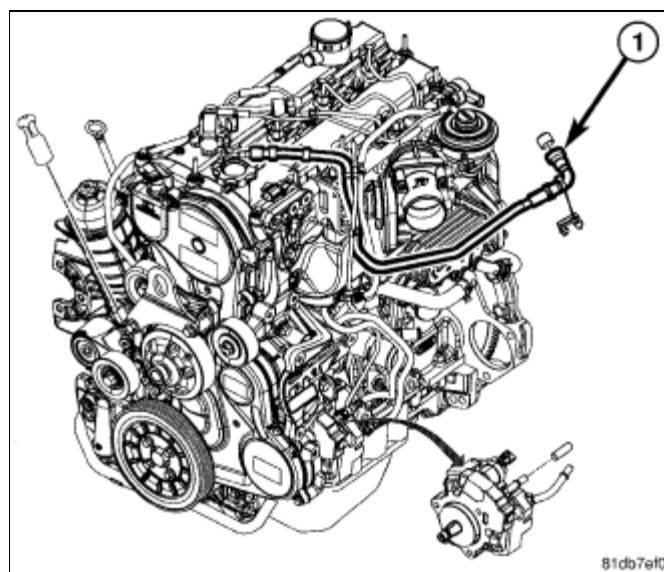
- 51. Disconnect the glow plug harness connectors.
- 52. Remove the vacuum tube.
- 53. Remove the vacuum tube from the EGR valve.



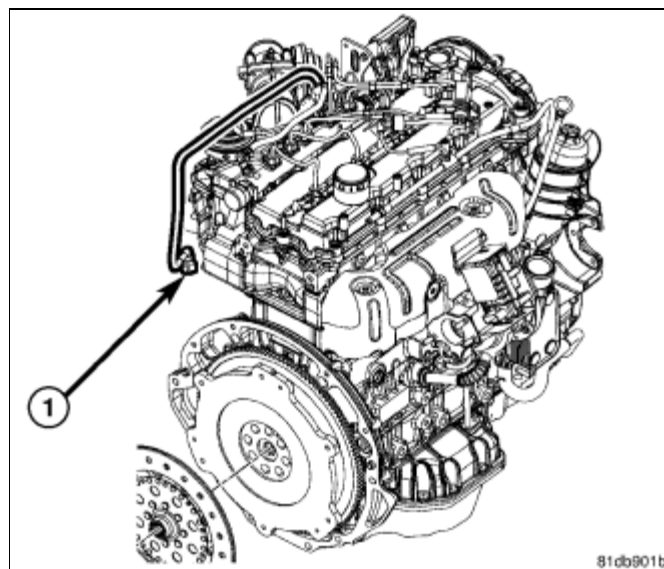
- 54. Disconnect the fuel lines (1).



55. Disconnect the fuel rail fuel return line (1).



56. Disconnect the fuel pump fuel return line (1).
 57. Remove the transmission vent hose retainer.

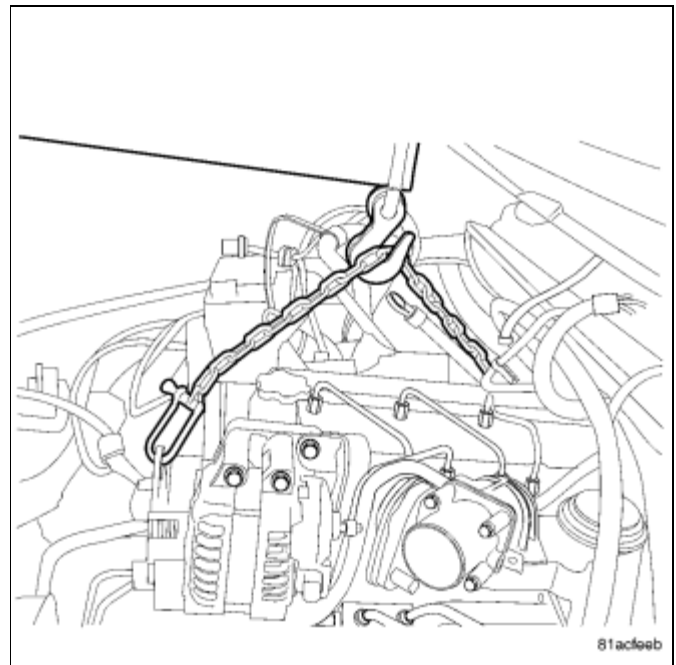
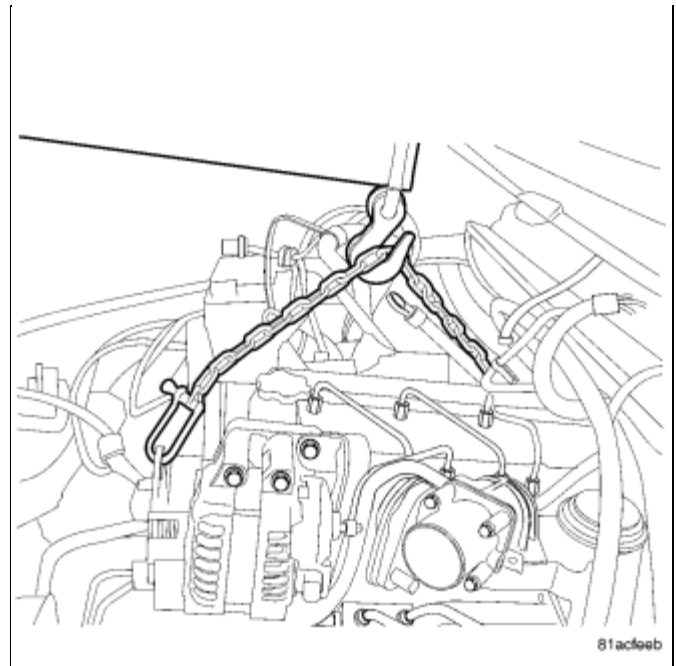


58. Install the engine lift, and support the weight of the engine.
59. Remove the engine mount through bolts.
60. Remove the engine.

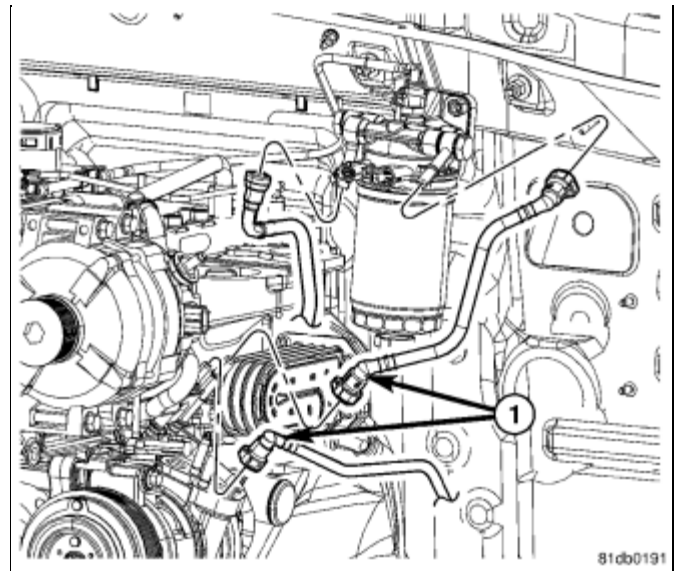
INSTALLATION

ENGINE - 2.8L DIESEL

1. Install the engine.
2. Install the engine mount through bolts.
3. Remove the engine lift.
4. Install the fuel return lines.
5. Install the transmission vent hose retainer.

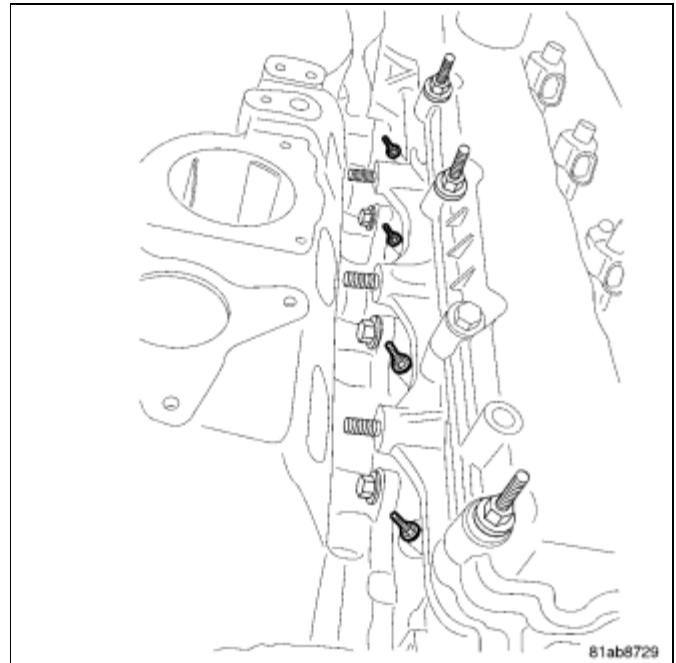


6. Install the fuel lines (1).

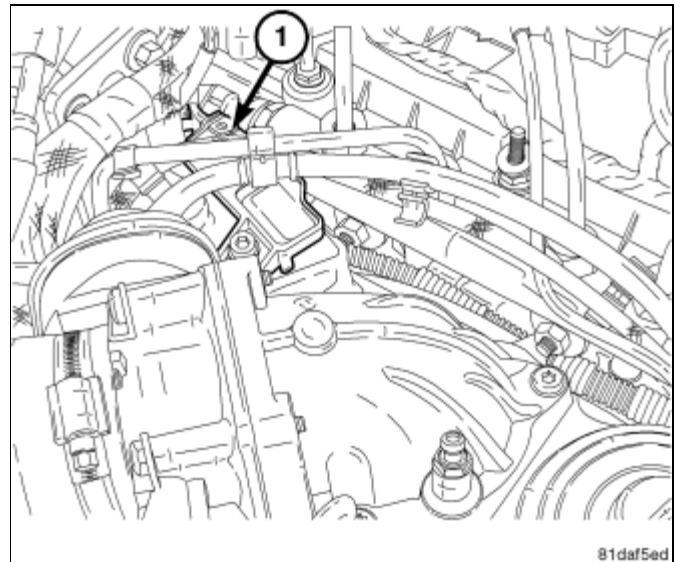


CAUTION: The glow plugs operate on a 4.4-volt system. The glow plugs **DO NOT** tolerate any over voltage. Full battery voltage will destroy the glow plug immediately. **DO NOT** test the glow plugs with a 12V source as damage will occur to the glow plug.

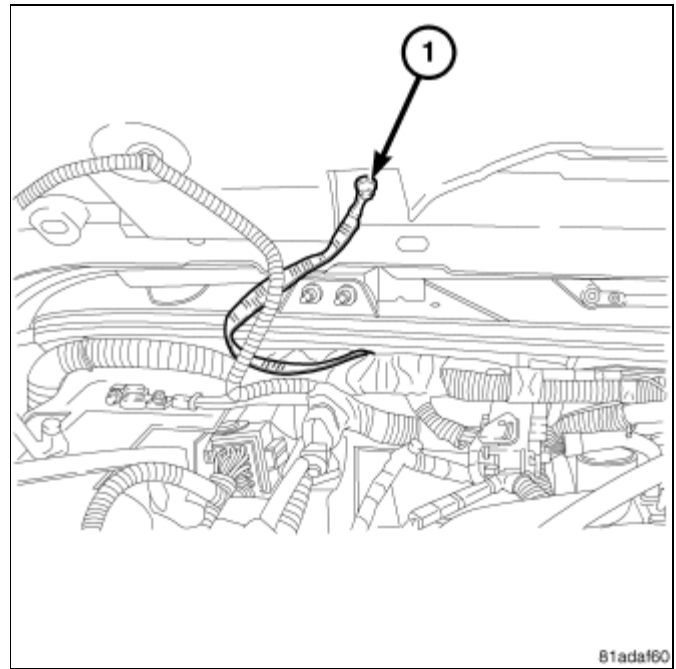
7. Install the glow plugs. Torque each glow plug to 14 Nm (10 lbs. ft.).
8. Connect the glow plug harness connectors.
9. Install the vacuum tube. Torque the nuts to 11 Nm (97 lbs. in.).
10. Install the vacuum line to the EGR valve.



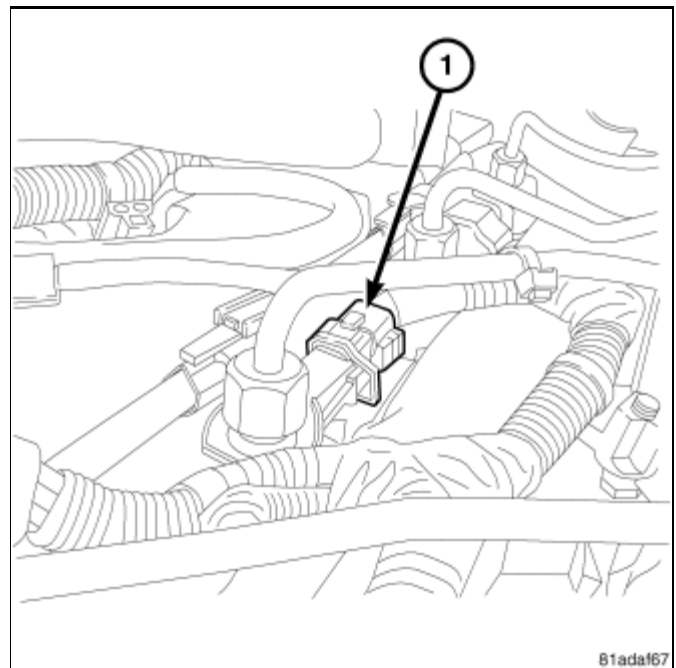
11. Connect the IAT/BPS harness connector (1).



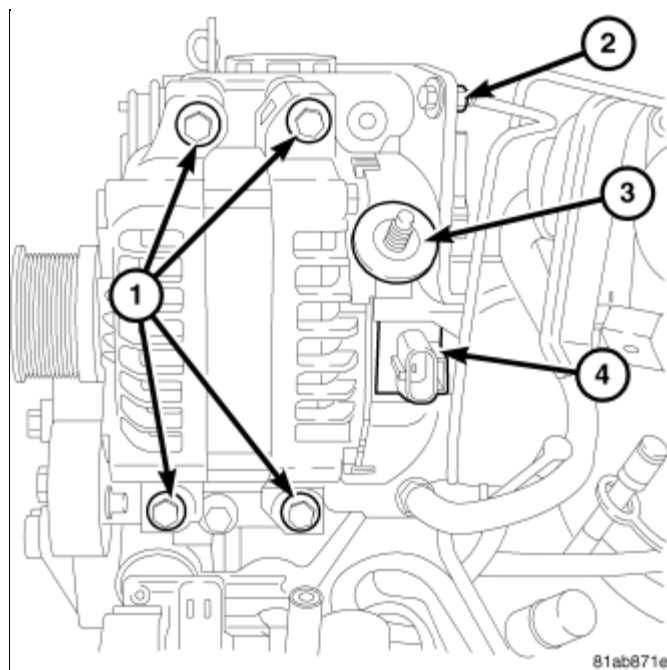
12. Connect the ground strap between the cowl and hood.
13. Position the engine wiring harness.



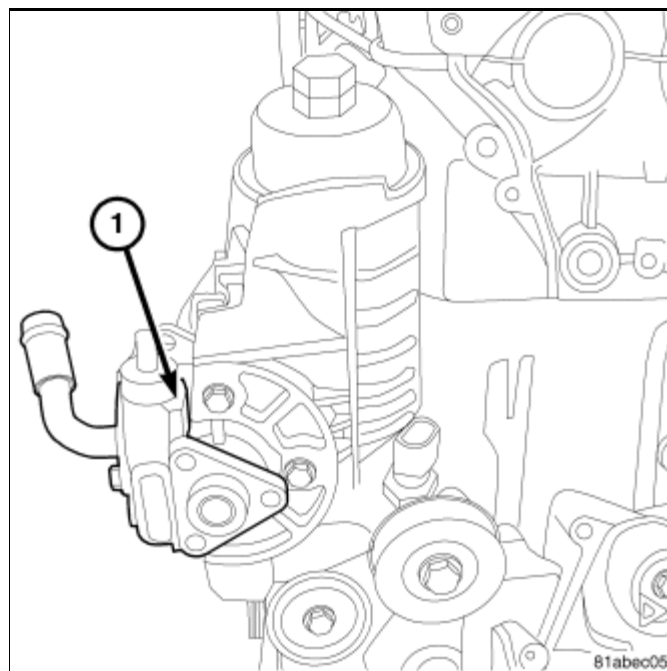
14. Connect the fuel injector connectors.
15. Connect the fuel pressure connector.
16. Connect the fuel regulator connector.
17. Connect the throttle control solenoid connector.



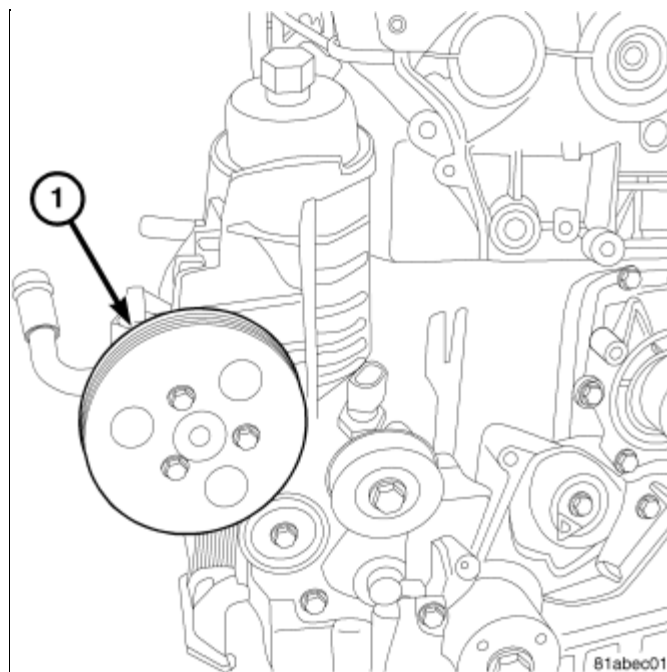
18. Install the generator. Torque the generator bolts to 33 Nm (24 lbs. ft.).
19. Connect the oil pressure sender connector.
20. Connect the EGR solenoid connector.
21. Connect the camshaft position sensor connector.
22. Connect the turbocharger actuator connector.



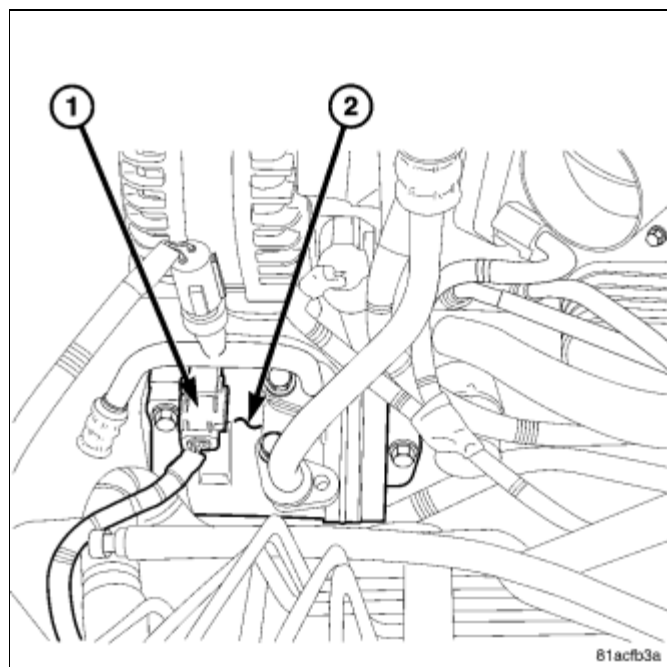
23. Install the power steering pump. Torque the bolts to 33 Nm (24 lbs. ft).



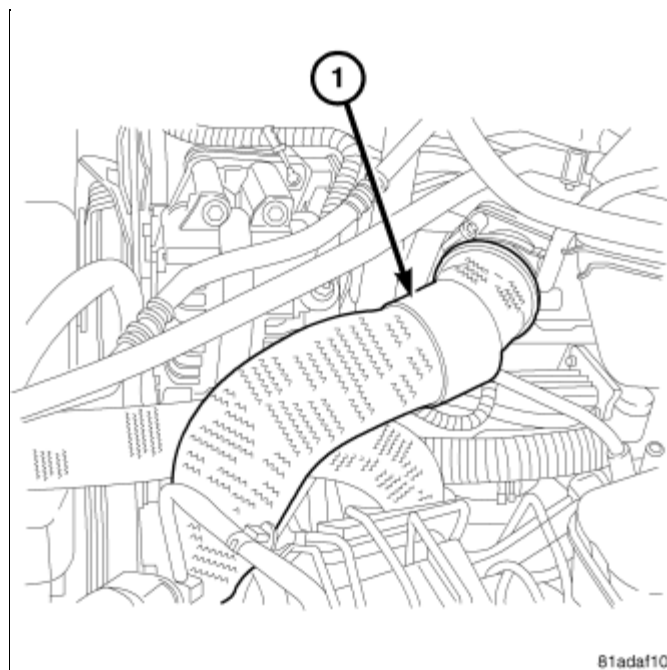
24. Install the power steering pump pulley. Torque the pulley bolts to 33 Nm (24 lbs ft.).



25. Install the A/C compressor. Torque the bolts to 32 Nm (23 lbs. ft).
26. Install the A/C suction line at the compressor.
27. Install the A/C discharge line at the compressor.
28. Connect the A/C compressor connector.

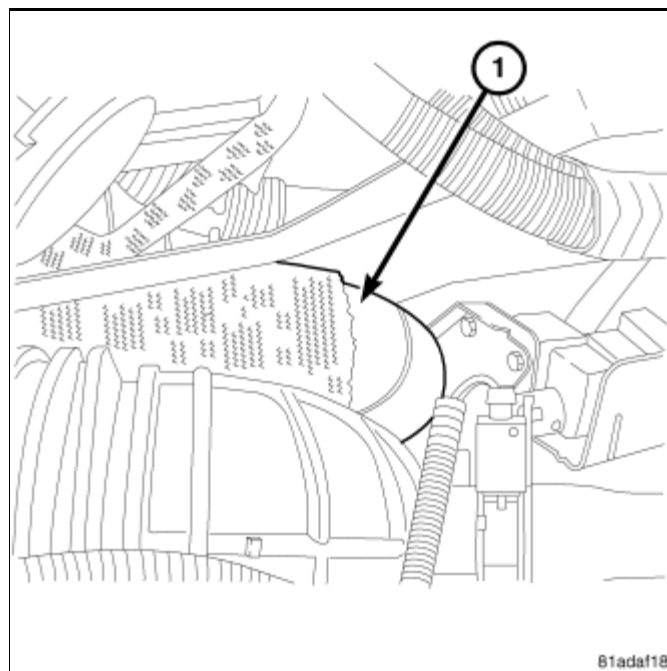


29. Install the left side charge air cooler hose.



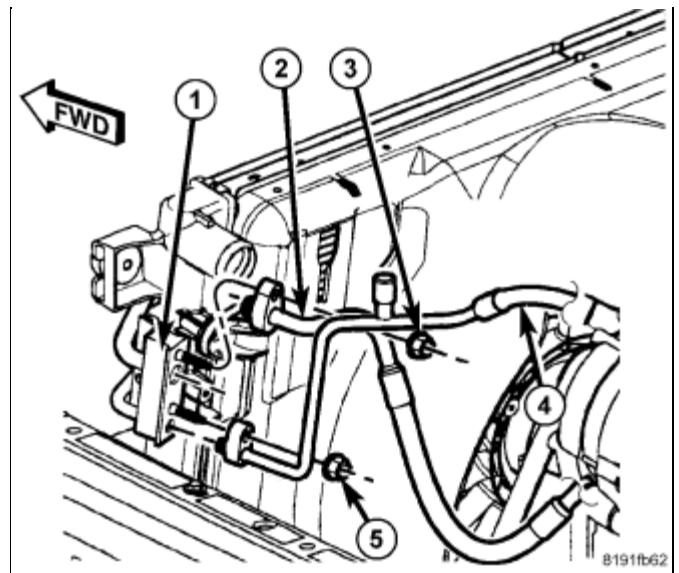
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- 30. Install the right side charge air cooler hose.
- 31. Install the transmission cooler lines at the transmission cooler.
- 32. Install the EGR vacuum control solenoid.

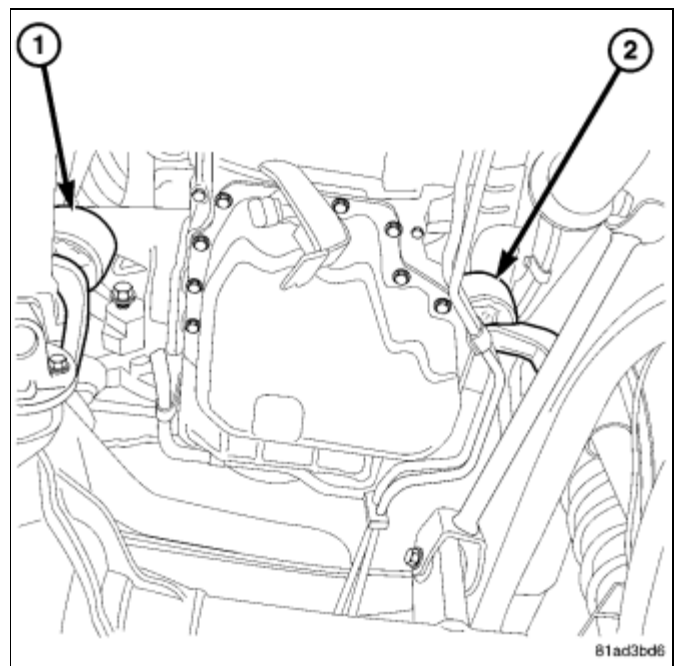


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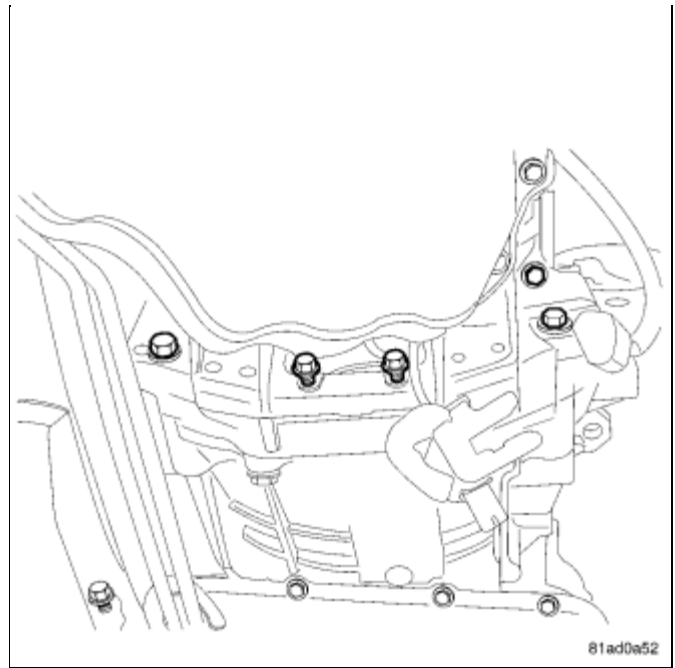
- 33. Install the A/C lines at the condenser.



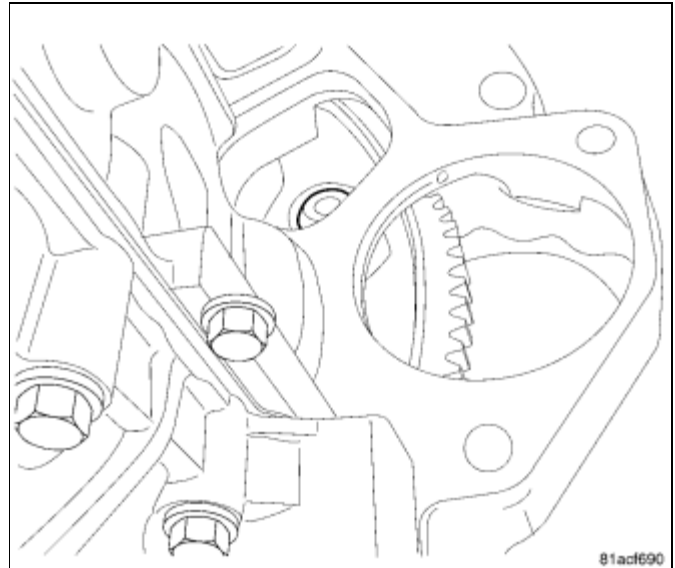
- 34. Install the bolt to the left engine mount.
- 35. Install the bolt to the right engine mount.



- 36. Install the bell housing bolts.
- 37. Install the transmission line bracket at the oil pan.

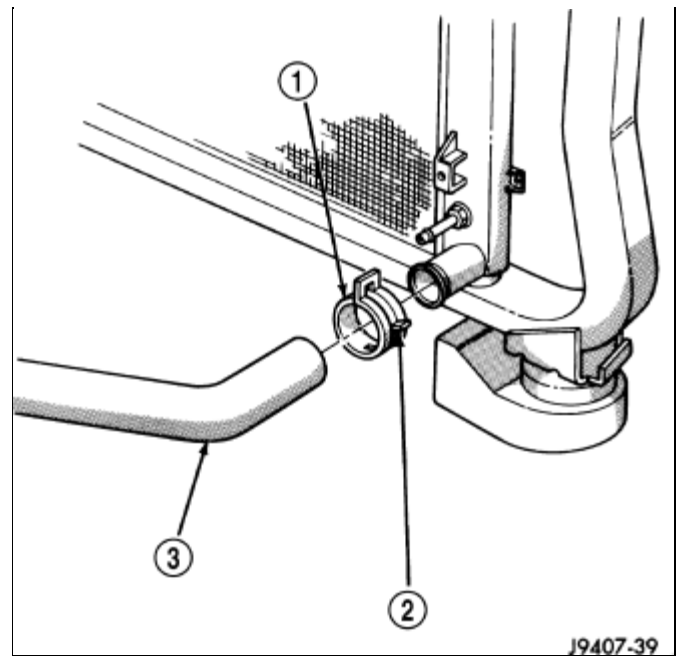


38. Install the torque converter to flex plate bolts.

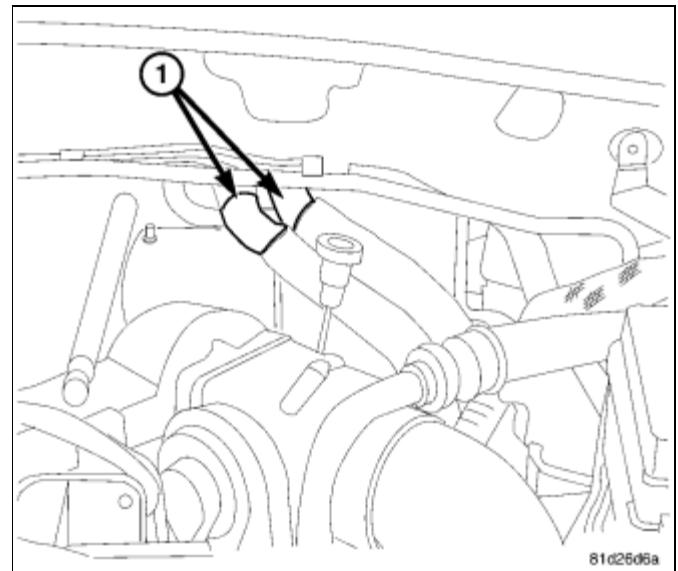


39. Install the cooling module.

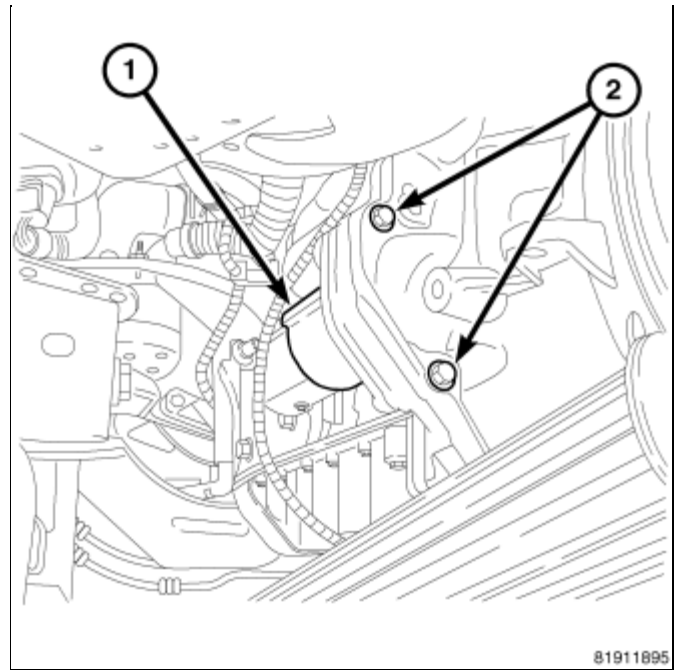
40. Install the fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)



- 41. Install the coolant hoses (1) to the heater core.
- 42. Install the coolant recovery container hose. (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL)

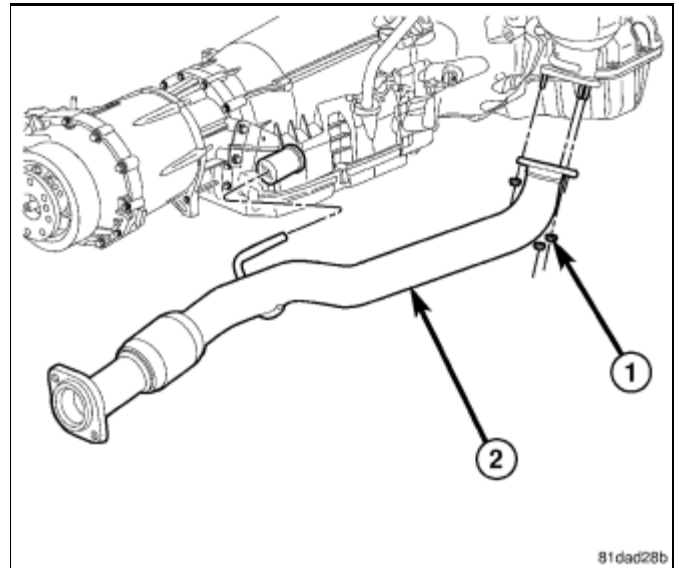


- 43. Install the starter. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)
- 44. Install the left front inner fender well. (Refer to 23 - BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - REMOVAL)
- 45. Install the right front inner fender well. (Refer to 23 - BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - REMOVAL)
- 46. Install the front tires. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE)



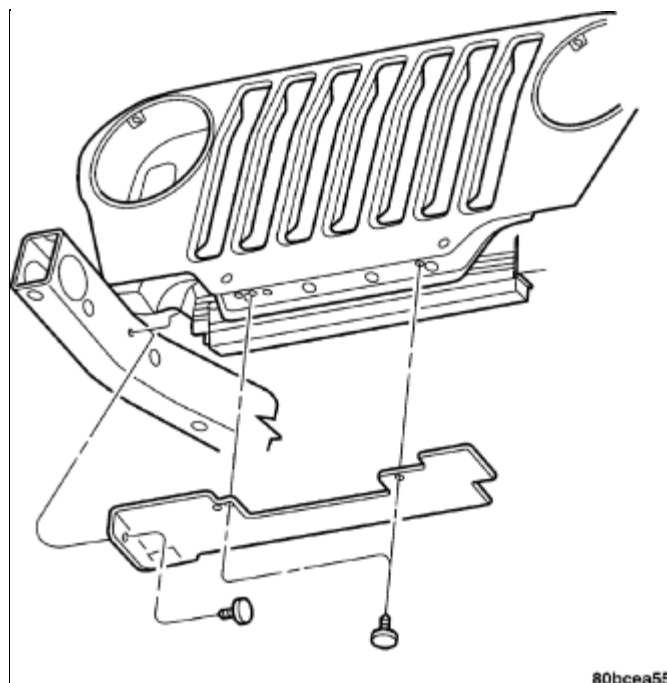
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- 47. Connect the exhaust system (2) to the catalytic converter.
(Refer to 11 - EXHAUST SYSTEM/CATALYTIC CONVERTER - REMOVAL)
- 48. Connect the oxygen sensors.
- 49. Install the catalytic converter to engine bolts.



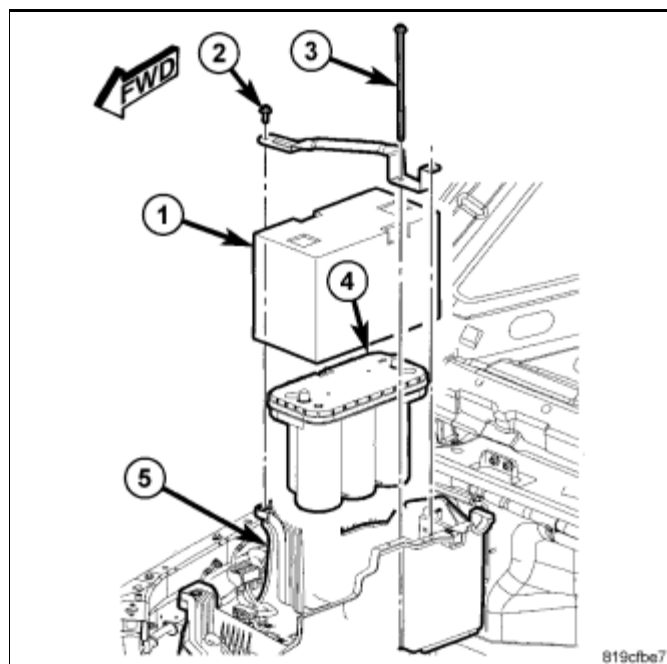
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- 50. Install the front lower splash shield.
- 51. Fill the coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
- 52. Fill the engine oil.
- 53. Charge the A/C system.
- 54. Install the lower air deflector from the radiator.



55. Install the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL)

56. Connect the battery cables. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)

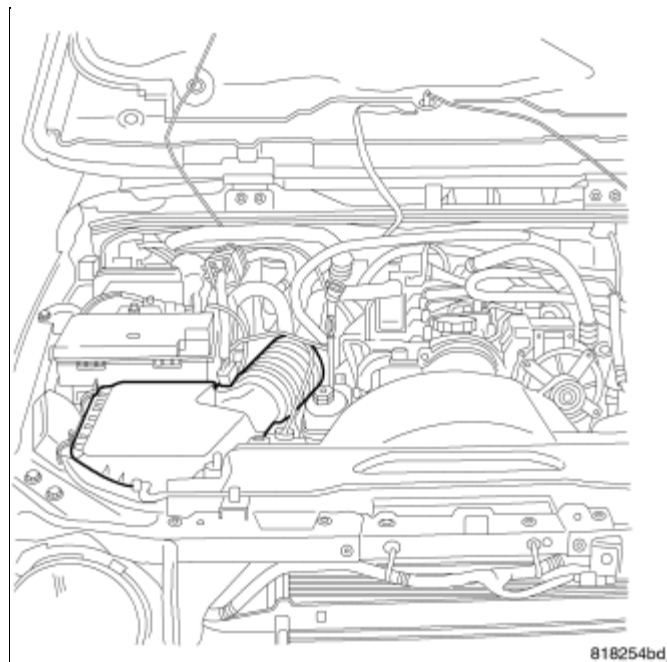


57. Install the turbocharger air inlet.

58. Install the intake air box.

SPECIFICATIONS

ENGINE INFORMATION



818254bd

2.8L Engine Specifications

Engine	2.8L JK/KA
Engine Type	2.8L — 16 Valves
Displacement	2777 cc
Bore	94.00
Stroke	100.05
Power (VGT)	130 kW (177CV)@3800 RPM
Torque (ATX)	400 Nm @ 2000 RPM
Torque (MTX)	410 Nm @ 2000 RPM
Cylinders	4 In line
Injection Order	1-3-4-2
Compression Ratio	17.0:1
Maximum compression pressure variation between two cylinders.	5 bar (72.5 psi)
Vacuum at idle	680 mm/HG (27.5 In/HG)
Idle Speed (ATX)	760 +/- 50 RPM
Idle Speed (MTX)	875 +/- 50 RPM

Maximum RPM in Gear	4500 RPM
Maximum RPM in neutral	ATX 2800 MTX 3500
Belt tension	Automatic Belt Tensioner
Thermostat opening	80°C +/- 2°C
Generator Rating	Denso 12V-180A
Emissions Level	EU4
Block configuration/Material	Open/Cast Iron
Cylinder Head	Dual Overhead Cam
Timing System	Belt
Fuel System	CP3.2+ 1,600 bar Fuel Pump, Piezo Injectors
Fuel Supply	Electric Fuel Pump In the Fuel Tank
Electronic Control Unit	EDC 16
Timing System	Belt Driven DOHC Overhead Camshaft
Air Intake	Dry Filter With turbocharger and Charge Air Cooler
Fuel System	Direct Fuel Injection Common Rail System
Emission devices	Cooled EGR (pneumatic) Electric Intake Throttle Fast Metallic Glow plugs
Combustion Cycle	4 Stroke
Cylinder Compression Difference Between Cylinders	10 bar (145 psi)
Cooling System	Water Cooling
Turbocharging:	Single VGT with REA
Intake Ports	Aluminum heads with traditional dual side intake and exhaust ports. One intake port is helical and the other has a directed entry.
Crankshaft	8 Counterweights with an incorporated balance shaft gear.
Camshafts	2 overhead camshafts with axial front bearings and identical camshaft caps, finger followers, and hydraulic lifters.
Intake & Exhaust Valves	Flat with fire deck face.

Intake Manifold	Aluminum, with Cast-in EGR passages, intake mixer, vacuum actuated EGR valve, electric intake throttle and a U-type EGR cooler
Lubrication	Pressure Lubricated By Rotary Pump
Minimum Oil Pressure (warm)	0.7 BAR at idle / 2.5 BAR at 3800 rpm
Engine Rotation	Clockwise Viewed From Front Cover

2.8L Engine Specifications	
Cylinder Head	
Cylinder head height	135.5 mm (5.334 in.)
Cylinder head flatness deformation tolerance	0.075 mm (0.003 in.)
Cylinder head gasket thickness	
0 Hole	1.10 mm (0.043 in)
1 Hole	1.20 mm (0.047 in)
2 Holes	1.30 mm (0.051 in)
Intake Manifold	
Intake manifold flatness deformation tolerance	0.075 mm (0.003 in.)
Exhaust Manifold	
Exhaust manifold flatness deformation tolerance	0.075 mm (0.003 in.)
Tappets	
Hydraulic tappet outside diameters	11.994 mm +/- 0.06 mm (0.472 in +/- 0.002)
Valves	
Intake valve face angle	45°30'
Exhaust valve face angle	45°30'
Intake Valve Head Diameter	32 mm (1.25 in.)
Exhaust Valve Head Diameter	29.4 mm (1.15 in.)

Intake Valve Stem Diameter	5.97 mm (0.235 in.)
Exhaust Valve Stem Diameter	5.96 mm (0.235 in.)
Intake Valve Guide Stem Clearance	
Min	0.030 mm (0.0012 in.)
Max	0.060 mm (0.0024 in.)
Exhaust Valve Guide Stem Clearance	
Min	0.040 mm (0.0016 in.)
Max	0.070 mm (0.0028 in.)
Valve Springs	
Free Length	50.8 mm (2 in.)
Closed Valve	38 mm (1.49 in.)
Opened Valve	29 mm (1.14 in.)
Camshafts	
Camshaft End Play	
Max	0.350 mm (0.013 in.)
Min	0.150 mm (0.006 in.)
Outer Journal Diameter (at crankshaft)	25.95 mm +/- 0.01 mm (1.021 mm +/- .0004 in)
Inner Journal Diameter (at cylinder head)	26.00 mm + 0.015 mm (1.027 mm .0006 in)
Crankshaft Journal Clearance.	
Max	0.075 mm (0.003 in.)
Min	0.030 mm (0.0012 in)
Connecting Rods	
Connecting Rod Diameter (Small End)	32 mm (1.26 in.)
Connecting Rod Diameter (Large End)	57.563 mm (2.266 in.)
Piston Pin	
Diameter	32 mm (1.26 in.)

Length	70.7 mm - 71.00 mm (2.78 in — 2.79 in.)
Crankshaft	
End Play	0.1 mm — 0.33 mm (0.004 in. — 0.013 in.)
Bearing Selection (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE)\	
Engine Block	
Cylinder Bore Internal Diameter	94 mm (3.700 in.)
Cylinder Bore Out-Of-Round	0.007 mm (0.0003 in.)
Oversized Piston	+0.40 mm (+0.015 in.)
Fuel System	
Injection Pressure	CRS 3.0 — 1600 Bar
High Pressure Pump	CP3.2+
ECU	EDC16CP31
Injectors	Piezo CRI 3.0
Glow Plugs	
Make/Type	Bosch / GLP2
Voltage	4.4V
Lubrication System	
Oil Pump Outer Rotor End Play	
Min	0.01 (0.0004 in.)
Max	0.09 (0.0036 in.)
Oil Pump Inner Rotor End Play	
Max	0.01 mm (0.0004 in.)
Min	0.09 mm (0.0036 in.)
Oil Pump Outer Rotor to Body Diameter Clearance	
Max	0.130 mm (0.052 in.)

Min	0.230 mm (0.0091 in)
Oil Pressure Relief Valve	
Opening Pressure	5 Bar
Oil Pressure Valve Spring Free Length	46.8 mm (1.84 in)
Minimum Oil Pressure (Warm)	
at Idle	0.7 Bar
at 3800 RPM	2.5 Bar
Cooling System	
Thermostat Opening Temperature	80°C (176°F)
Engine Oil	
Specification (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION)	
Coolant	
Specification (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION)	

Cylinder Head Gasket Selection		
	Millimeters	Inches
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.300 — 0.399	0.0119 — 0.0158
CYLINDER HEAD GASKET THICKNESS	1.10	0.0434
PISTON CLEARANCE	0.700–0.800	0.0276 —0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.400 — 0.499	0.0158 — 0.0197
CYLINDER HEAD GASKET THICKNESS	1.20	0.0473
PISTON CLEARANCE	0.701–0.800	0.0276 —0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.500 — 0.600	0.0197 — 0.0237
CYLINDER HEAD GASKET THICKNESS	1.30	0.0512

PISTON CLEARANCE	0.701–0.800	0.0276 —0.0315
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TORQUE

ENGINE BLOCK

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Lower Oil Pan	15	12	133
Upper Oil Pan (m6 bolt)	15	12	133
Upper Oil Pan (m8 bolt)	32	23	283
Oil Pickup Tube	15	12	133
Oil Drain Plug	54	40	478
Balance Shaft	33	23	283
Main Bearing Caps	(Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSTALLATION)		
Connecting Rod Caps	(Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION)		
Dipstick Tube (sump)	11	8	97
Dipstick Tube (block)	33	24	292
Oil Cooler Coolant Line	33	24	292
Transmission adapter bolts (hex head)	68.5	50	606
Transmission adapter bolts (Allen Head)	69	51	610
Oil Jet	11	8	97
Engine Mount Bolts	54	40	477
Oil Filter Cap	25	18.4	221
Oil Pressure Sensor	14	10	124
Air Temp/Pressure sensor	12	9	106

Fuel Quantity Solenoid	11	8	97
Fuel Rail Sensor	35	26	309

CYLINDER HEAD

DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Cylinder Head Bolt	(Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION)		
Cylinder Head Cover	11	8	97
Vacuum Tube	11	8	97
Fuel Rail	24	18	18
Fuel Injector lines at the injector	28	20	247
Fuel injector lines at the fuel rail	24	18	212
High Pressure Fuel Feed Line at the Fuel Rail	20	15	177
High Pressure Fuel Feed Line at the High Pressure Pump	28	20	247
High Pressure Fuel Line Bracket bolt	15	11	133
Fuel injector	33	24	292
Glow Plugs	14	10	124
EGR Throttle Assembly	11	8	97
Exhaust Manifold	36	27	318
Camshaft Sprocket	64	47	566
Camshaft Cap	11	8	97
Front Camshaft Journal	11	8	97
Intake Manifold	25	19	221

FRONT ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Outer Front Cover (upper)	11	8	97
Outer Front Cover (lower)	11	8	97
Inner Front Cover	11	8	97
Front Cover	33	24	292
Crankshaft Sprocket	100 + 120 degrees	74+ 120 degrees	885+ 120 degrees
Crankshaft Pulley	32	23	283
Front Engine Lifting Bracket	45	33	398
Accessory Drive Idler Pulley	45	33	398
Accessory Belt Tensioner	45	33	398
CMP sensor	11	8	97
Water Pump	32	23	283
Timing Belt Tensioner	28	21	247
TVA Valve	13	10	115
Fuel Rail Sensor	35	26	310
Fuel Quantity Solenoid	11	8	97

REAR ENGINE

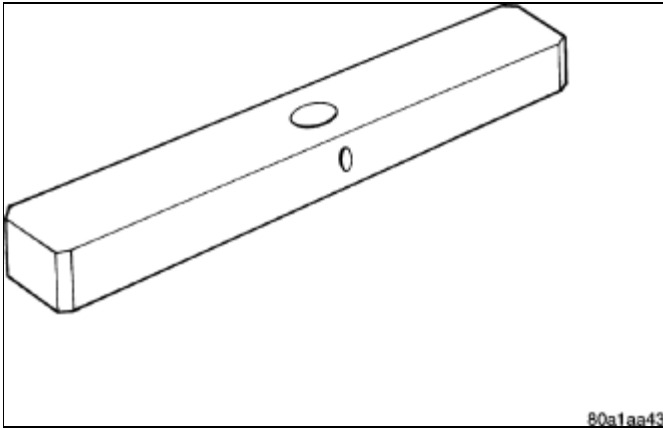
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Rear Cover	15	10	133
Rear Lifting Bracket	45	33	398
Crankshaft Sensor	11	8	97
CKP Cover Plate	15	11	133
Trans Adapter Plate (allen bolts)	79	58	699

Trans Adapter Plate (hex bolt)	45	33	398
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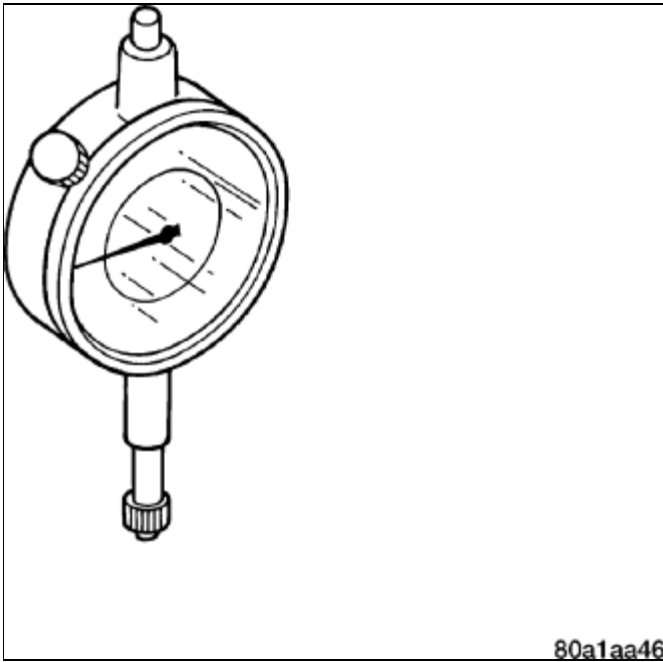
ACCESSORY DRIVE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump Pulley	33	24	283
Power Steering Pump	33	24	283
Generator	33	24	283
Generator Bracket	45	33	398
A/C Compressor	32	23	283
A/C Compressor Bracket	45	33	33
Turbocharger	32	23	283
Turbocharger Oil Feed Line at the Turbocharger	24	18	212
Turbocharger Oil Feed Line at the Engine Block	32	23	283
Turbocharger Oil Return Line	15	11	133
Turbocharger Brace	32	23	283
Turbocharger Adapter (oil feed line to engine block connection)	54	40	478
EGR Valve	15	11	133
EGR Cooler	15	11	133
High Pressure Fuel Pump	24	18	212
High Pressure Fuel Pump Sprocket.	88	65	779
Oil Cooler Housing	32	23	283
Oil Cooler Feed Line	11	8	97

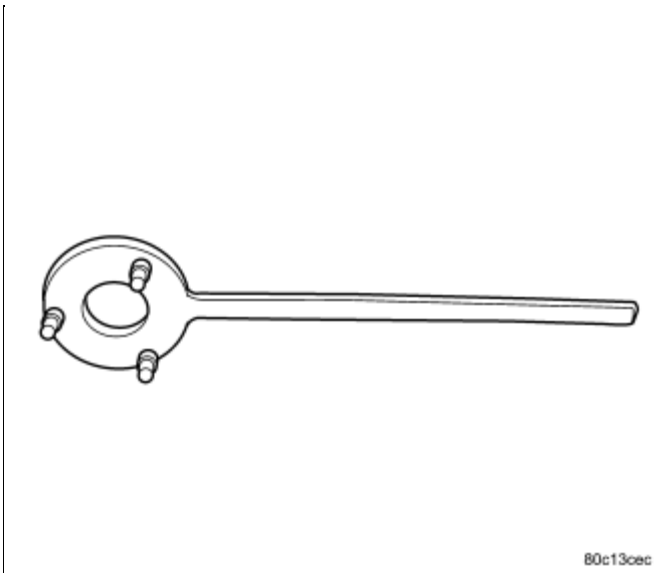
SPECIAL TOOLS



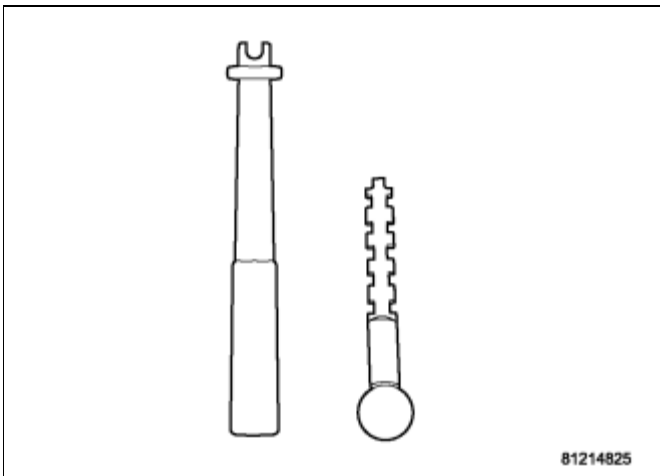
VM.1010 CYLINDER LINER PROTRUSION TOOL



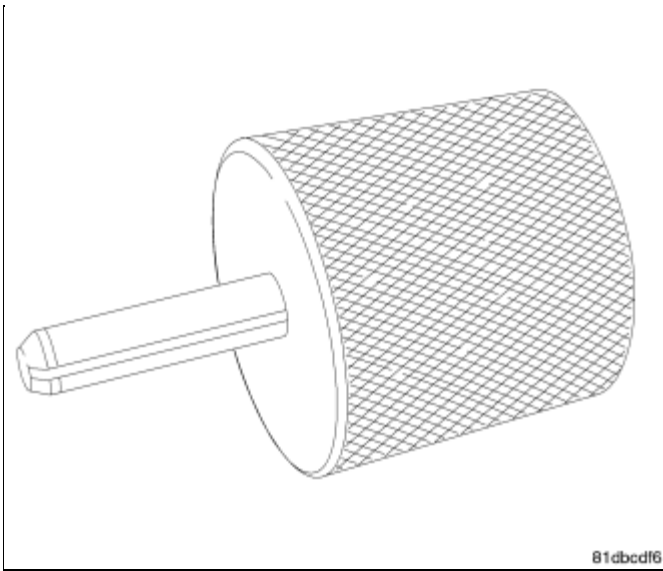
VM.1013 DIAL INDICATOR



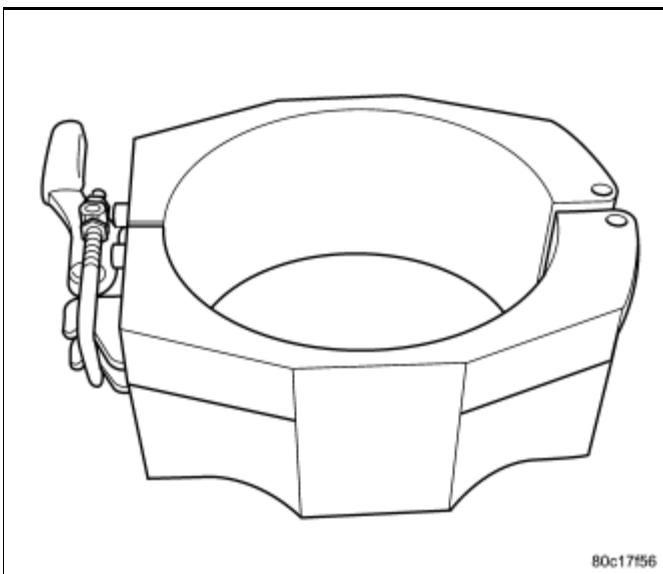
VM.1055 HIGH PRESSURE INJECTION PUMP GEAR HOLDER



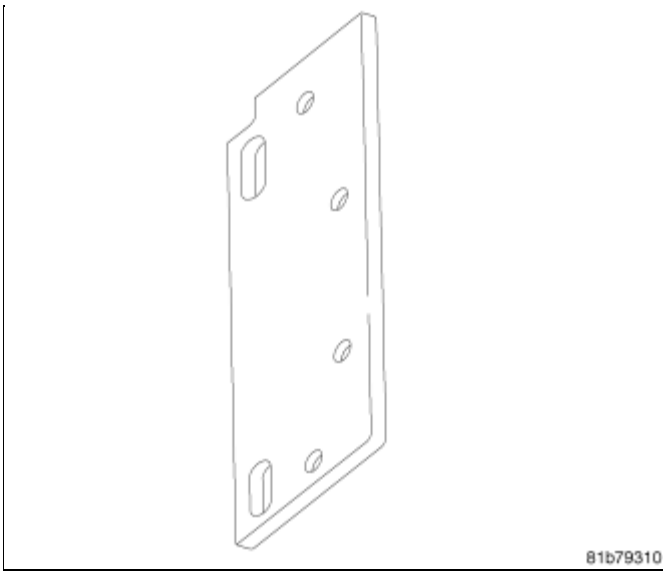
VM.1058 CAMSHAFT OIL SEAL REMOVER



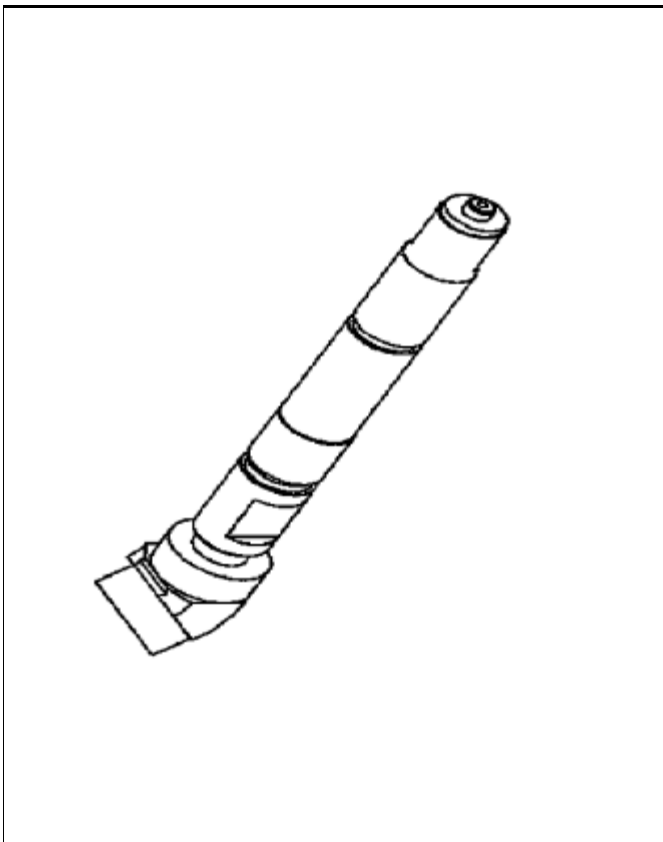
VM.10012 BALANCE SHAFT LOCK PIN



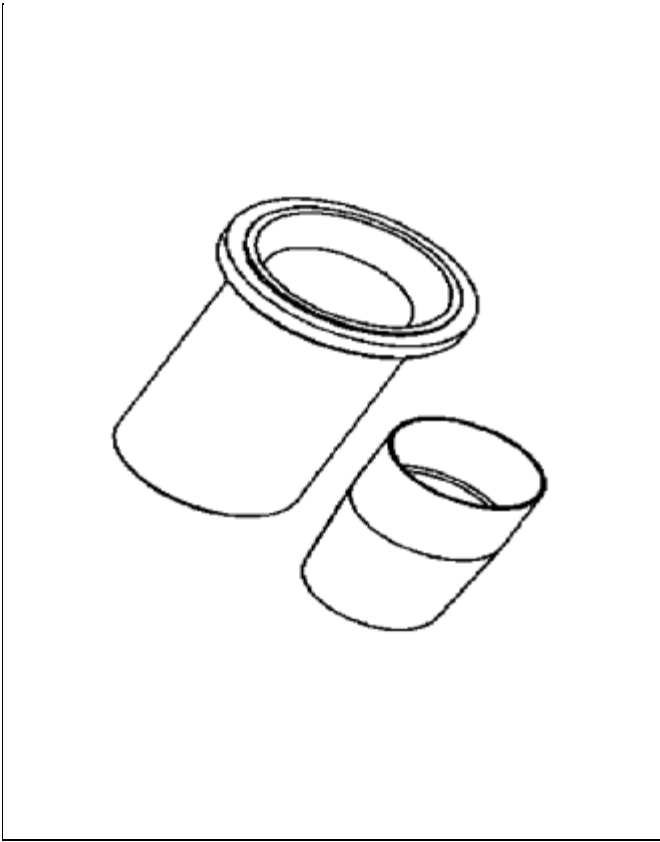
VM.1082 2.8L PISTON INSTALLER



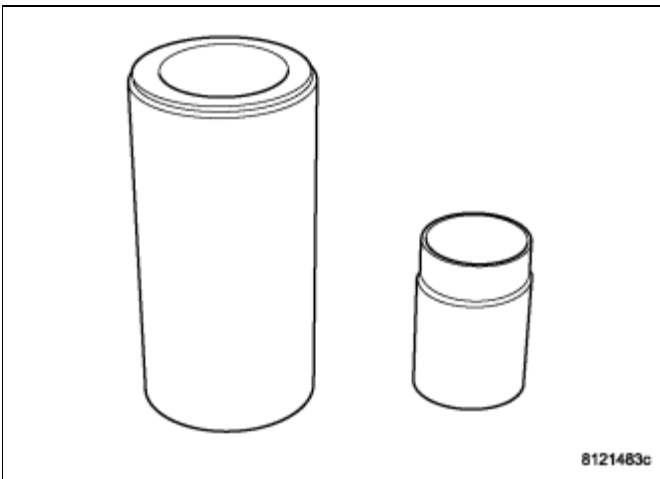
9990 FRONT AND REAR SEAL TOOL



10010 COMPRESSION TEST ADAPTER



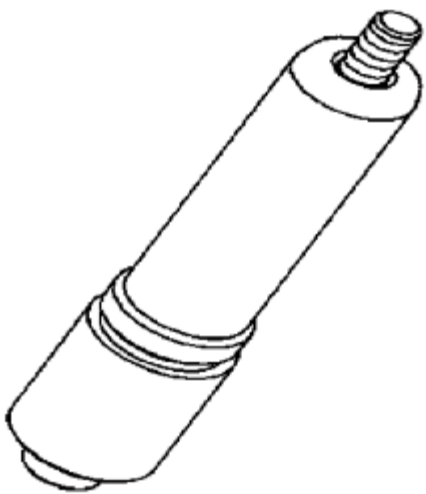
9937 SEAL INSTALLER

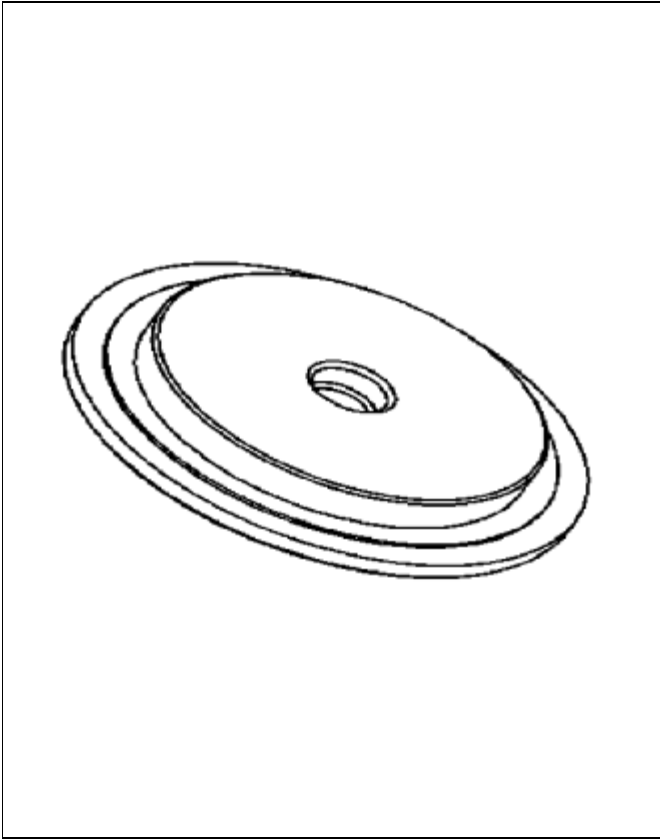


1057 SEAL INSTALLER

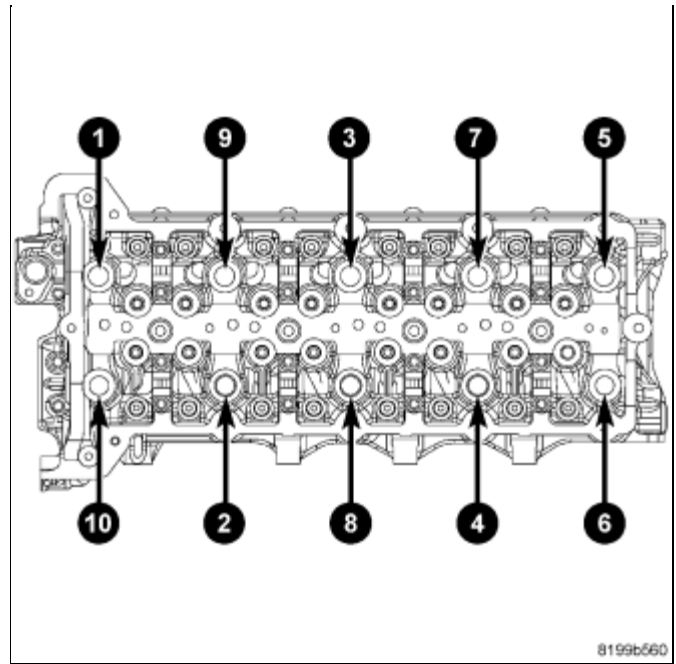


9991CAMSHAFT TIMING TOOL



9992 CRANKSHAFT LOCKING TOOL**9993 CRANKSHAFT SEAL INSTALLER****CYLINDER HEAD****DESCRIPTION**

The 2.8L aluminum, overhead valve cylinder head is torqued in a cross pattern. The cylinder head itself is not resurfacable.

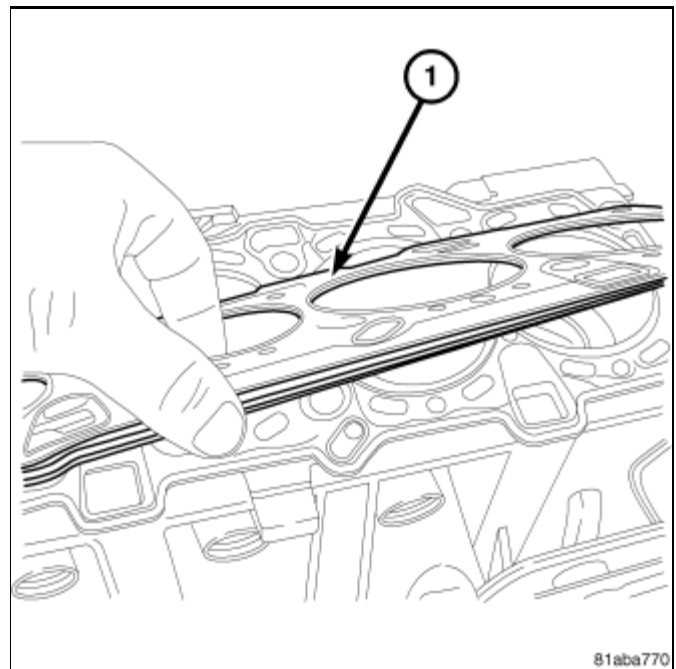


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1. The cylinder head uses a selectable Multi-layered Steel gasket that is available in three sizes.

STANDARD PROCEDURE

VALVE SEALS - IN VEHICLE

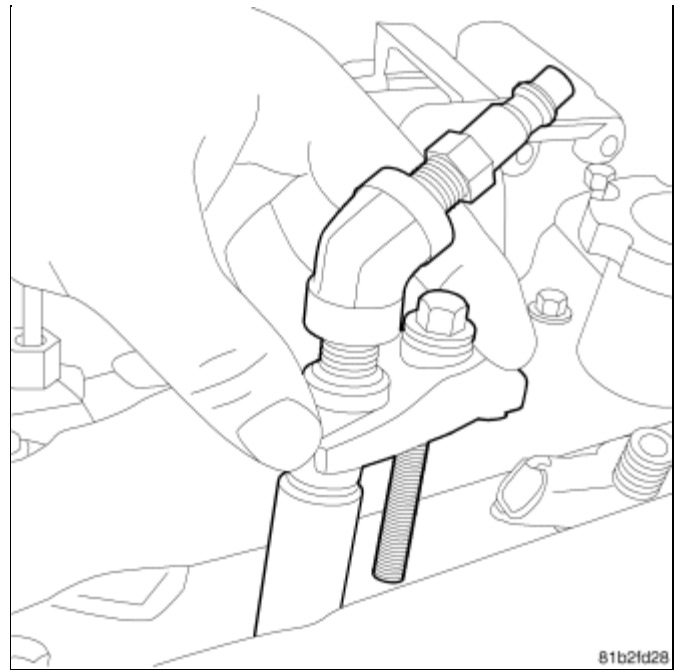


81aba770

1. Disconnect the negative battery cable.
2. Remove the intake manifold/cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

NOTE: Rocker arms and lifters must be kept in order of removal and stored in the up right position.

3. Position the rocker arms aside. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).



4. Install special tool VM.1072A, compression tester adaptor into the injector hole and retain with an injector hold down (2) bolt .

5. Prepare special tool MD998772A (1) for usage by inverting the tool to cylinder head holding screws so that the thread size matches the cylinder head.

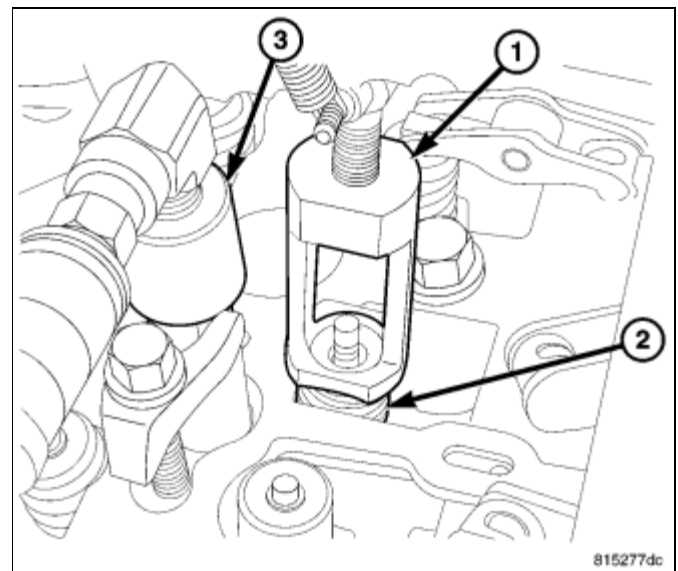
6. Install special tool MD998772A (1) onto cylinder head and using adaptor MD998772A-15 (2), place the adaptor over the valve spring.

7. Connect a regulated air supply (3) to VM.1072A (4), and pressurize the cylinder.

8. Place shop towels around the working area of the cylinder head to prevent valve locks from accidentally entering the engine.

9. Using adaptor MD998772A-15 (1), collapse the valve spring (2) and remove the locks .

10. Remove the valve spring (2) assembly.

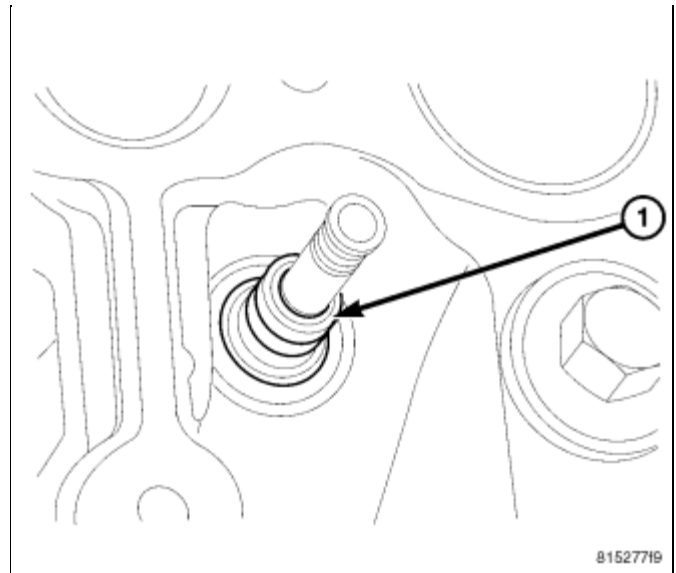


11. Remove the valve seal.

12. Repeat this procedure for all cylinders.

VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.



DISASSEMBLY

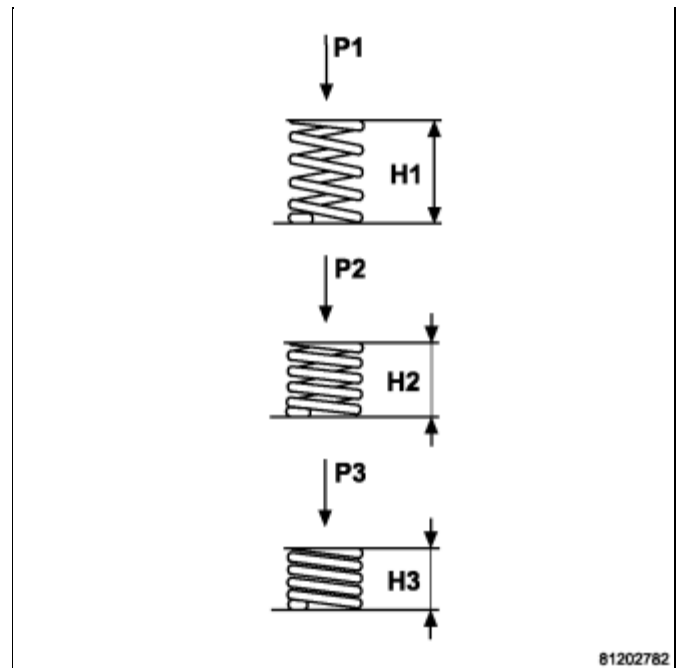
1. Remove the engine cylinder head from the cylinder block (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
2. Use Valve Spring Compressor Tool and compress each valve spring.
3. Remove the valve locks, retainers, and springs.
4. Use a smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.
5. Remove the valves, and place them in a rack in the same order as removed.

VALVE CLEANING

1. Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.
2. Clean all residue and gasket material from the engine cylinder head machined gasket surface.

INSPECTION

1. Inspect for cracks in the combustion chambers and valve ports.
2. Inspect for cracks on the exhaust seat.
3. Inspect for cracks in the gasket surface at each coolant passage.
4. Inspect valves for burned, cracked or warped heads.
5. Inspect for scuffed or bent valve stems.
6. Replace valves displaying any damage.
7. Check valve spring height .

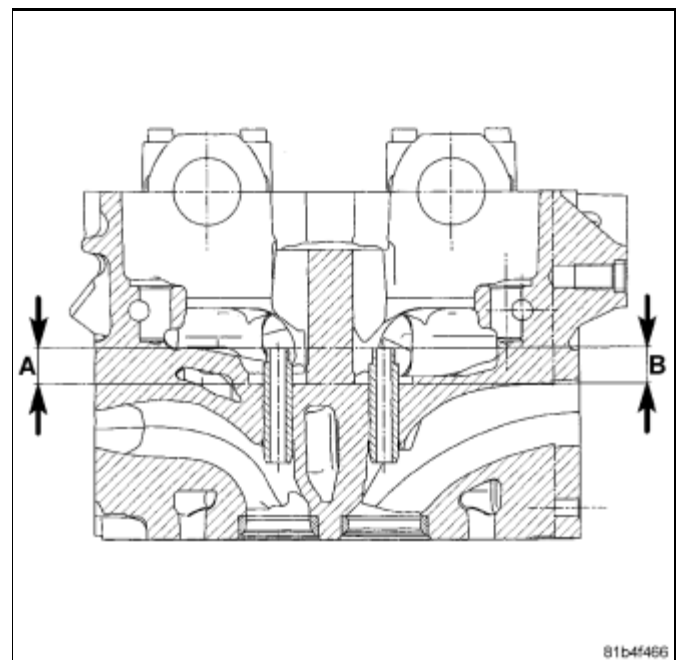


VALVE SEAT REFACING

1. Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.
2. Use tapered stones to obtain the specified seat width when required.

VALVE GUIDES

1. Valve Guides height requirement.
2. Measurement A and B: 13.50 mm - 14.00 mm. (0.570 in — 0.590 in)

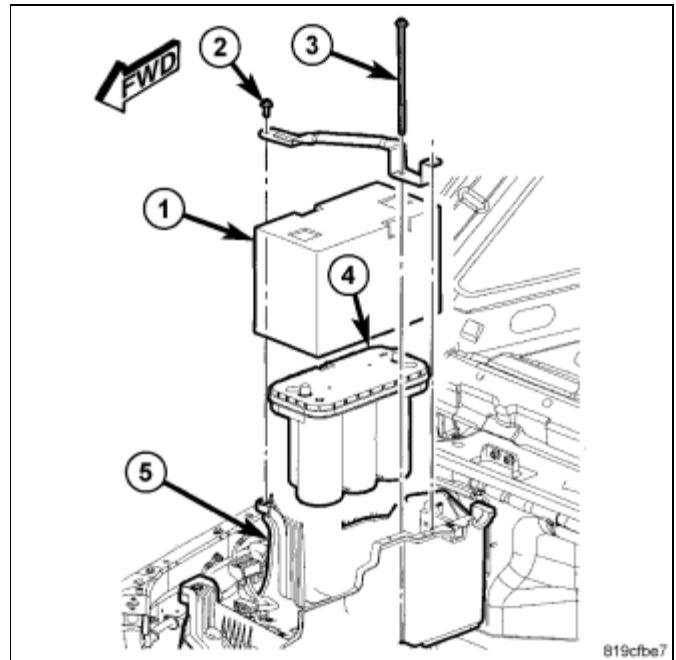


VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

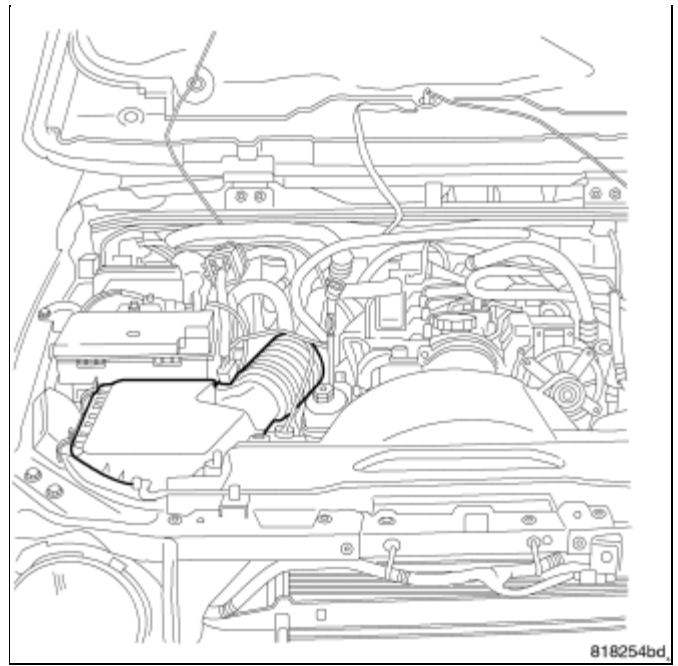
1. Measure and record internal diameter of valve guides. Valve guide internal diameter is 6.0 to 6.012 mm (0.2362 to 0.2366 in.).
2. Measure valve stems and record diameters. Intake valve stem diameter 5.952 to 5.97 mm (0.2343 to 0.2350 in). Exhaust valve stem diameter 5.942 to 5.96 mm (0.2339 to 0.2346 in).
3. Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is 0.03 to 0.06 mm (.0011 to .0023 in). Clearance of exhaust valve stem in valve guide is 0.04 to 0.07 mm (.0015 to .0027 in).
4. If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

REMOVAL

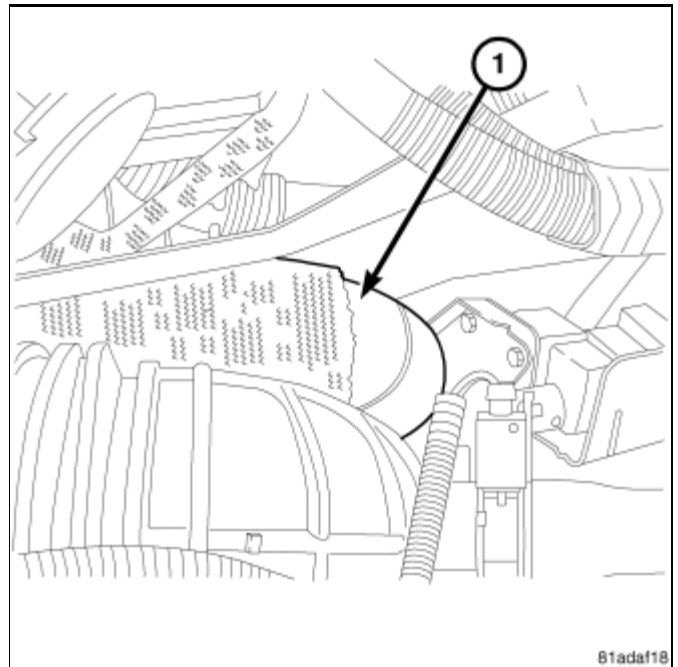
1. Disconnect the battery.
2. Remove the battery.



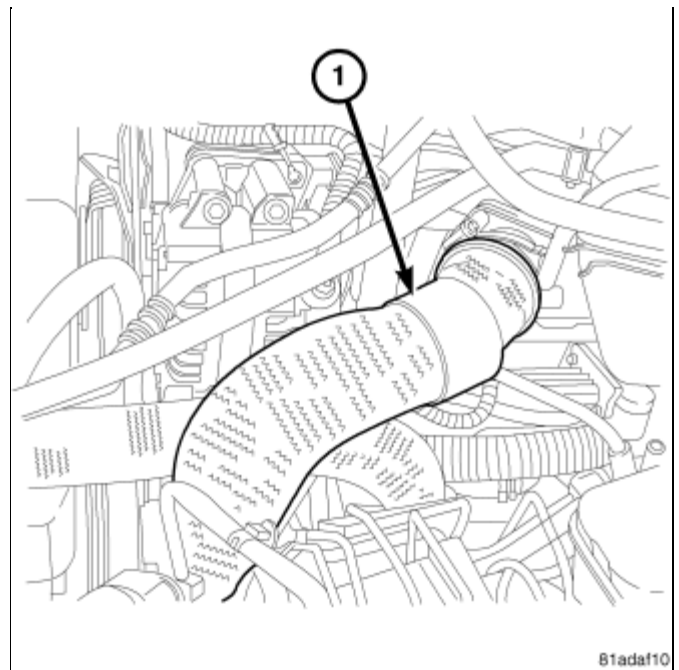
3. Remove the accessory drive belt.
4. Remove the intake air housing.
5. Drain the cooling system.



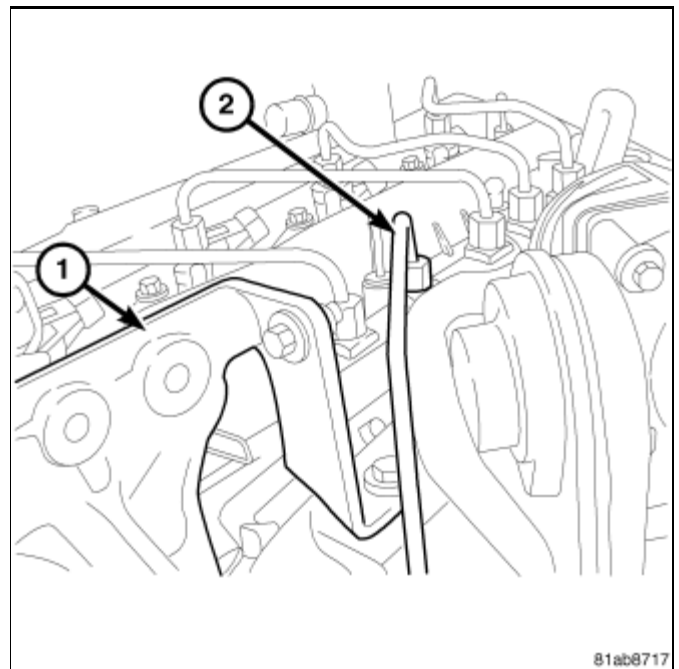
6. Remove the charge air cooler outlet hose.



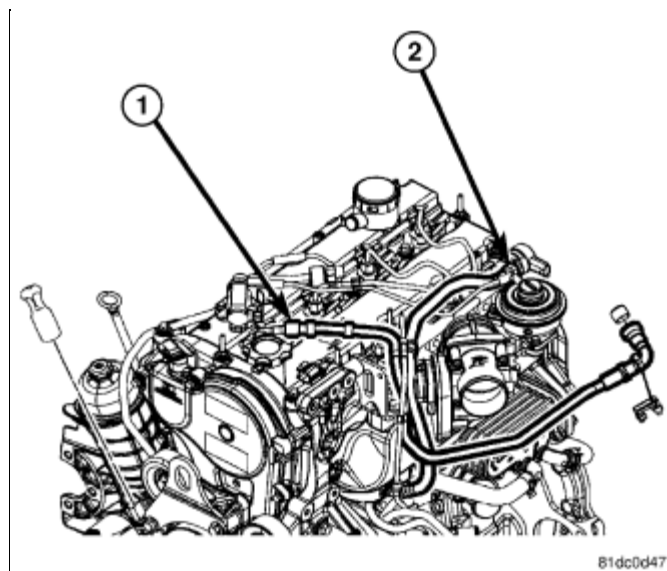
7. Remove the charge air cooler inlet hose.



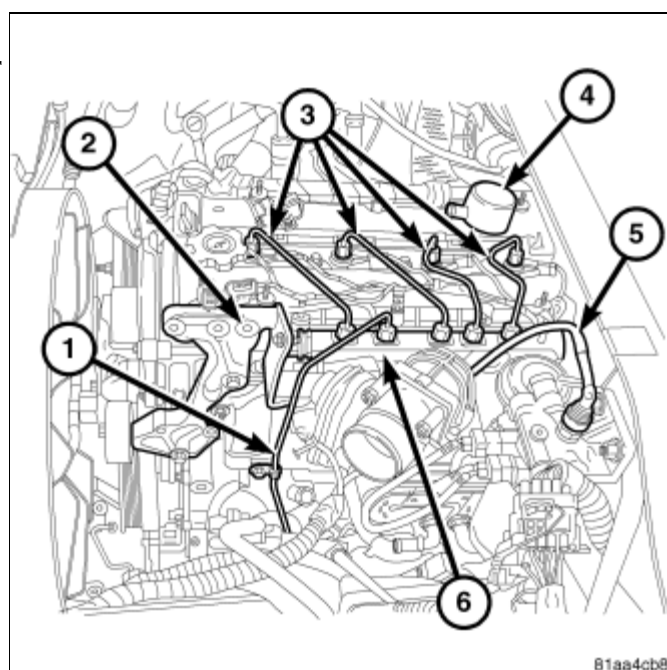
8. Remove the high pressure fuel feed line (2).
9. Remove the generator brace bolt (1).



10. Disconnect the fuel return lines (1) and (2).

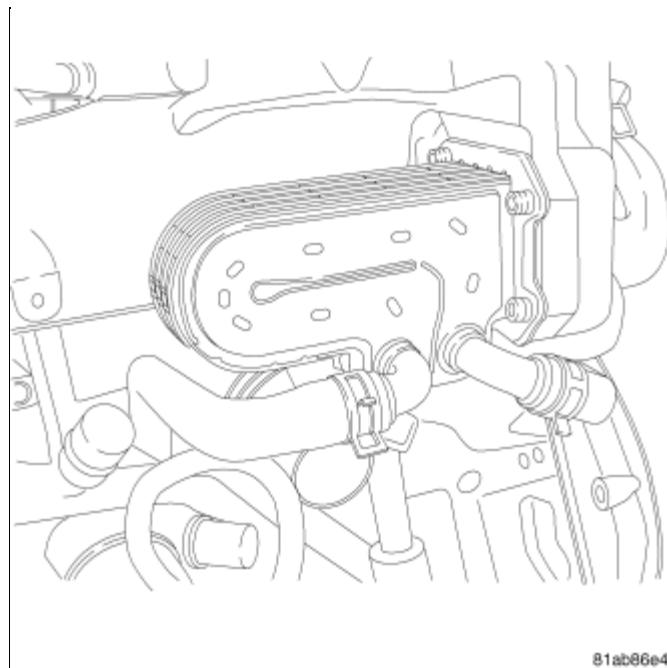


11. Disconnect the crankcase vent hose from the oil separator (4).

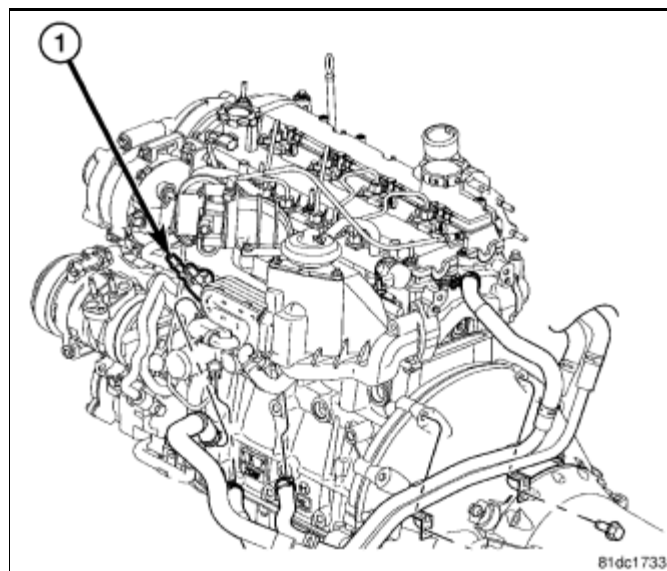


12. Remove the EGR cooler.

13. Remove the EGR cooler coolant lines.

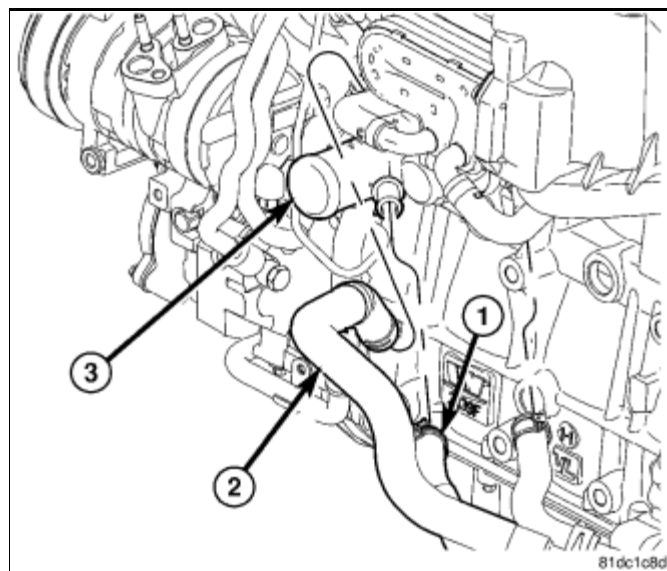


14. Remove the fuel block (1).

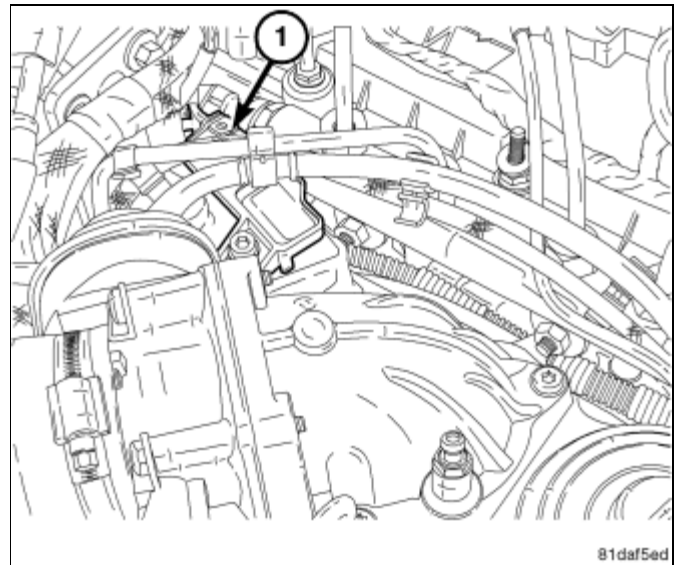


15. Disconnect the heater coolant lines (1) and (2) from the thermostat housing (3).

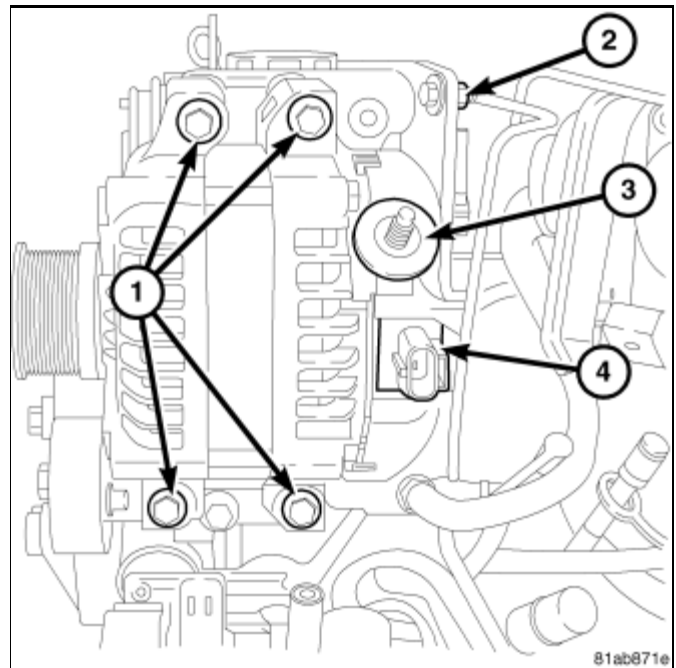
16. Remove the thermostat housing (3).



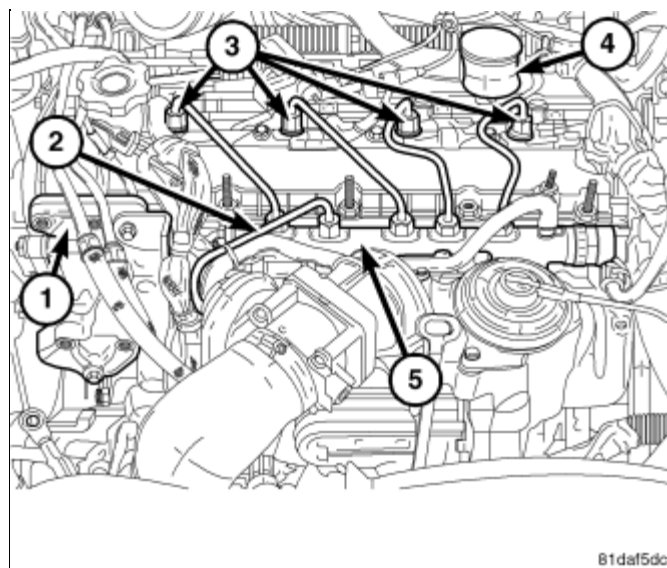
17. Disconnect the IAT/BPS sensor harness connector (1).
18. Remove the IAT/BPS sensor.
19. Remove the generator brace bolt (2).
20. Remove the EGR Airflow Control valve.



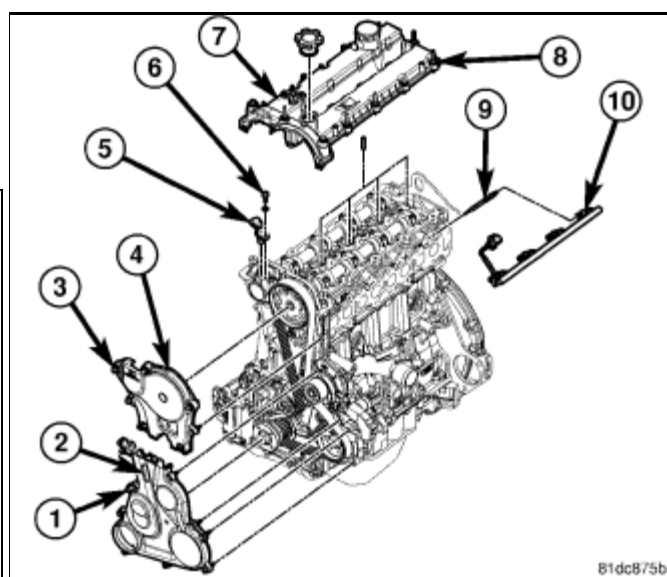
21. Remove the generator support bracket (2).
22. Remove the generator.
23. Disconnect the generator harness connectors (4).
24. Disconnect the battery positive cable from the generator output (3).



25. Disconnect the high pressure fuel line (2).
26. Remove the injector fuel lines (3) from the injectors and the fuel rail.
27. Disconnect the fuel rail solenoid harness connector.
28. Disconnect the fuel rail pressure sensor harness connector.
29. Remove the fuel rail (5).

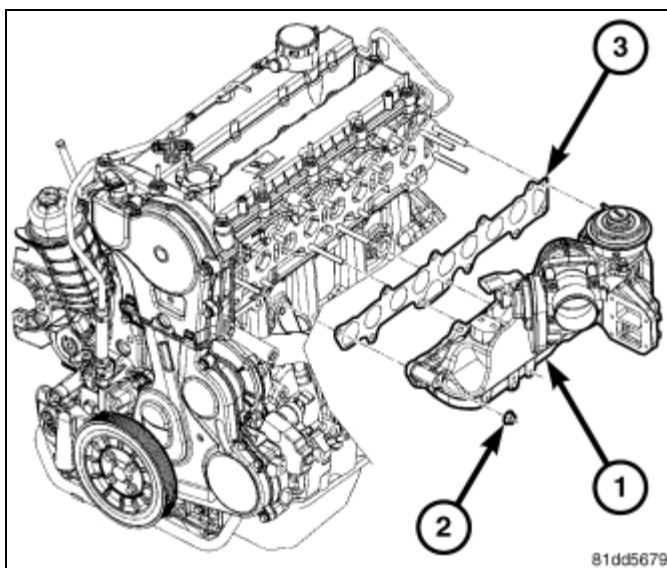


30. Disconnect and position aside the glow plug harness (10).

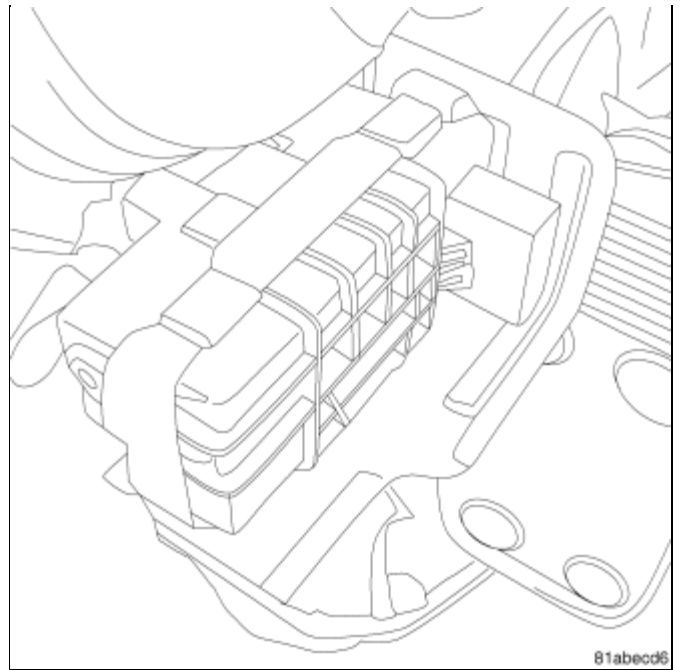


31. Remove the intake manifold fasteners (2).

32. Remove the intake manifold (1) and the gasket (3).

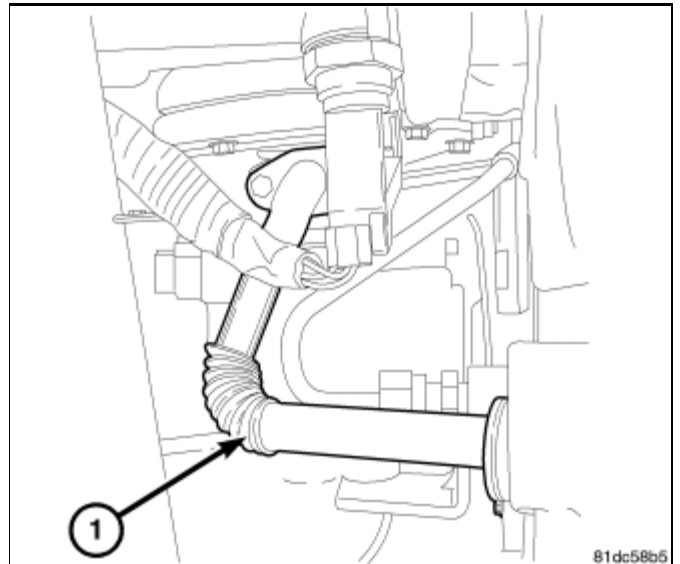


33. Disconnect the boost pressure solenoid harness connector.



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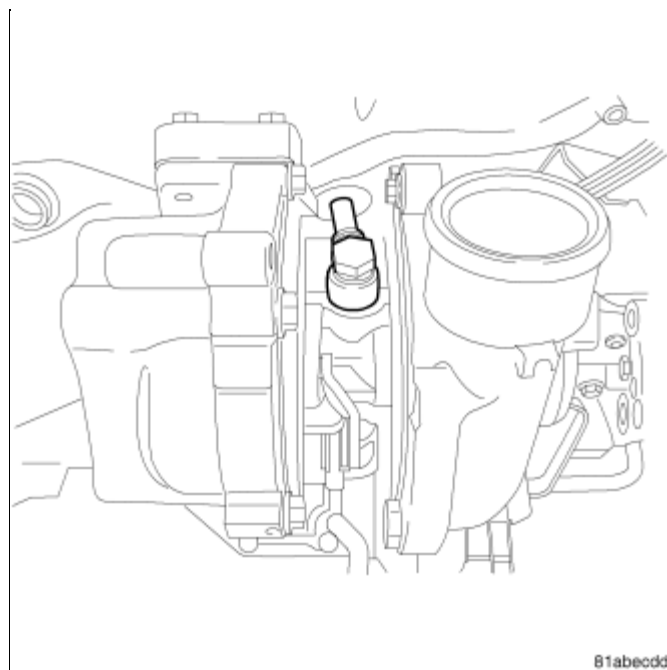
34. Remove the turbocharger oil return line (1).



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35. Remove the turbocharger nuts.

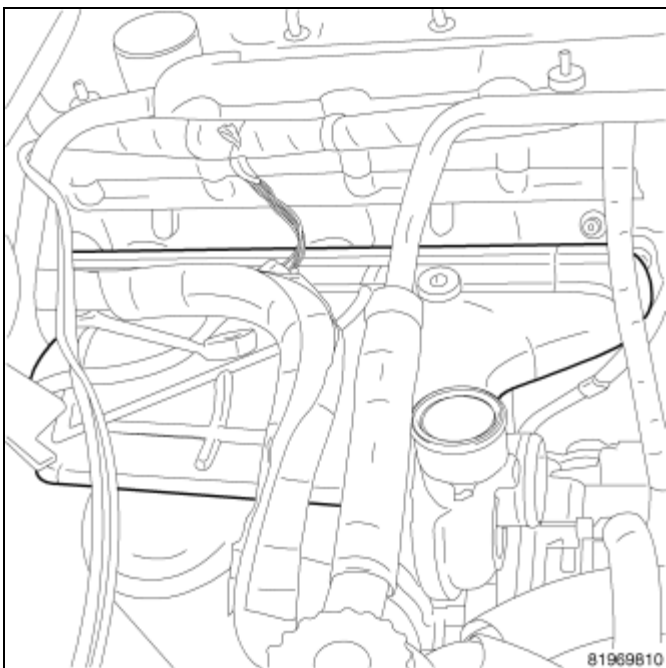
36. Remove the turbocharger oil feed line.



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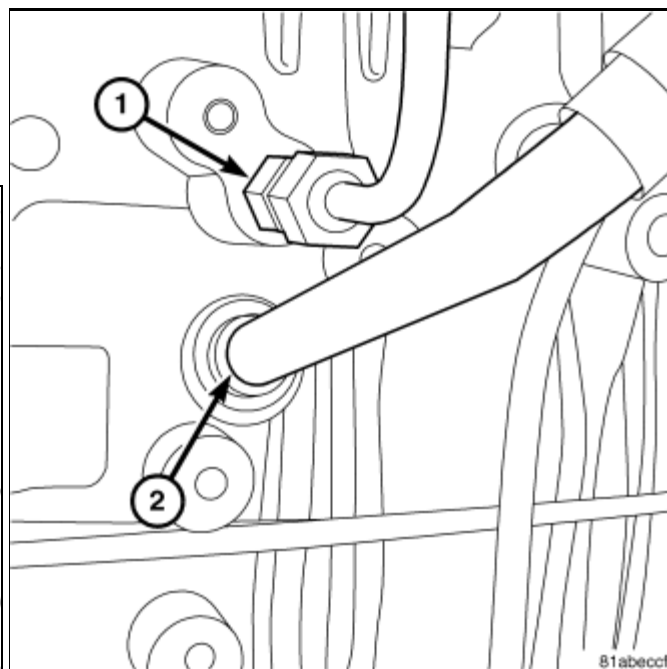
37. Remove the turbocharger oil lines from the engine block.

38.
Remove
the
exhaust
manifold.



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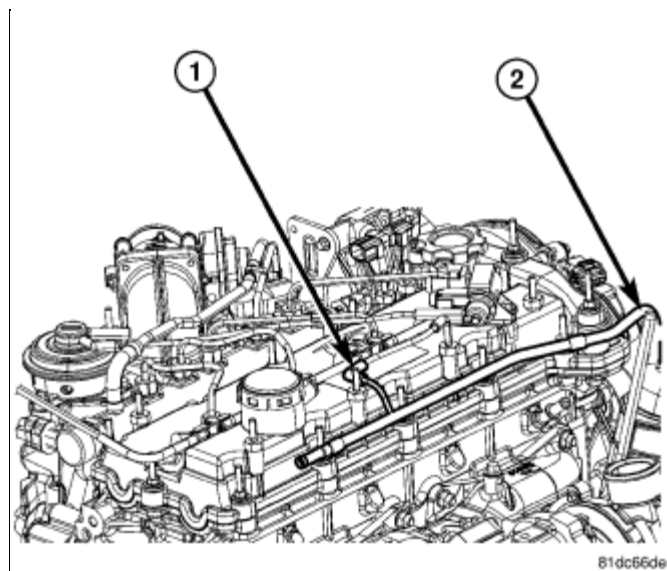
39.



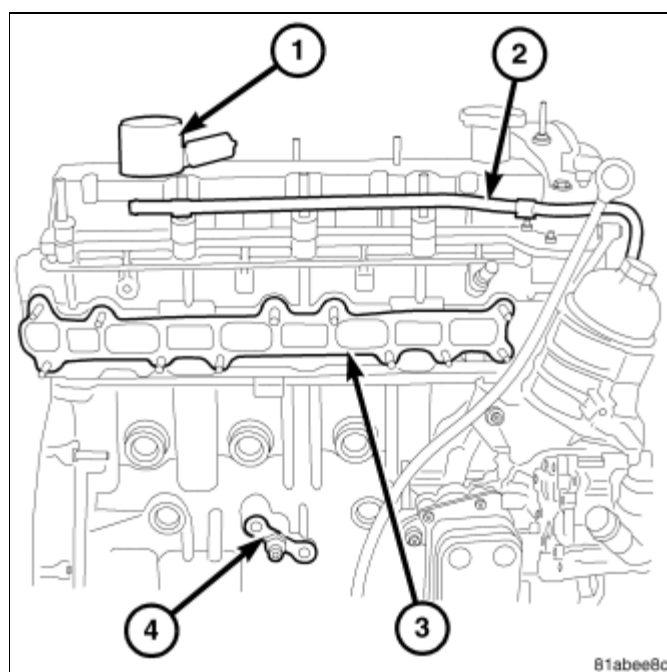
81abeccf

Disconnect the vacuum line (2) from the vacuum pump.

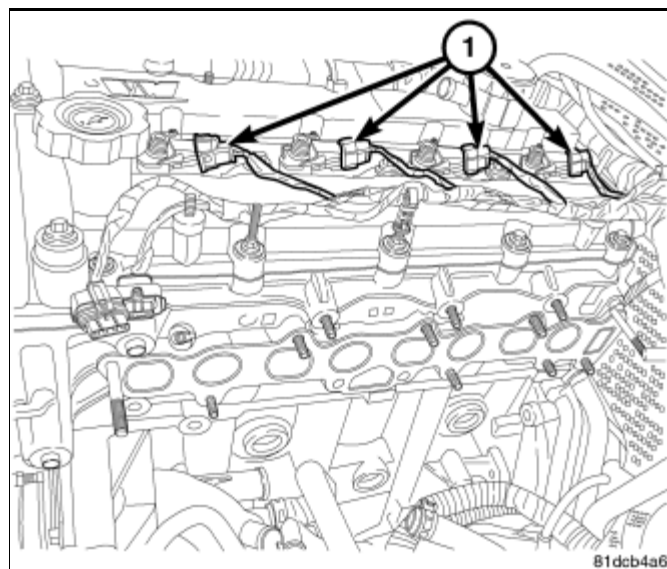
40. Disconnect the vacuum line (1).



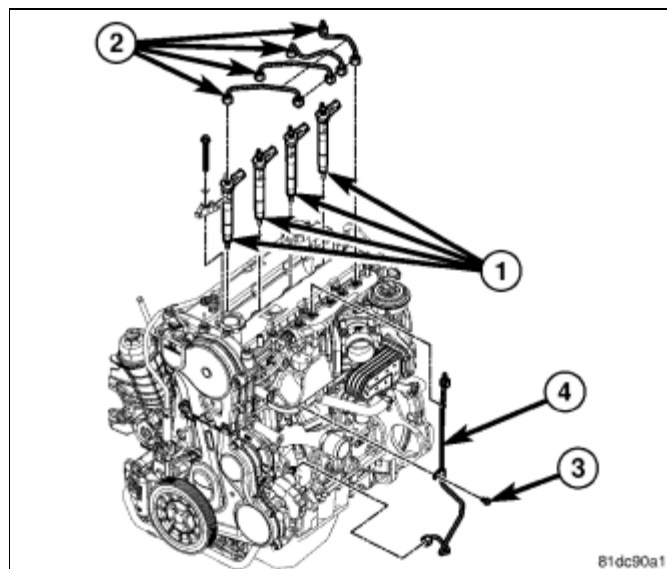
41. Remove the exhaust manifold gasket (3).



42. Disconnect the fuel injector harness connectors (1) from the fuel injectors.

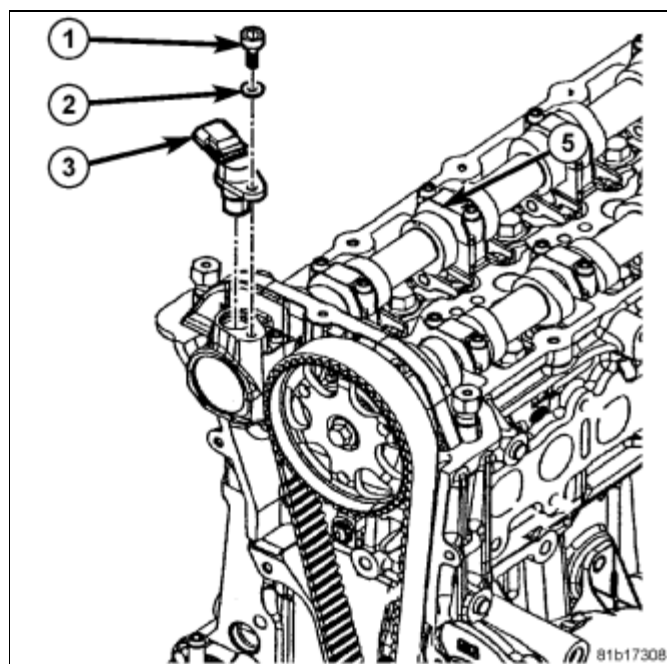


43. Remove the fuel injectors (1).



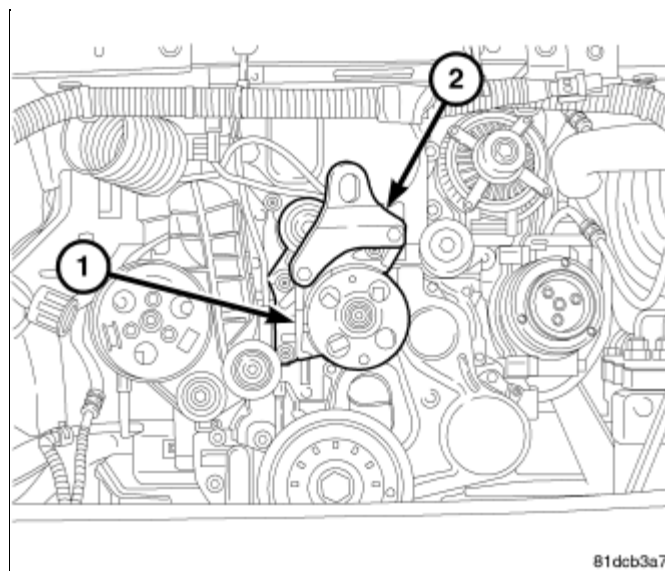
44. Disconnect the Camshaft Position Sensor (CMP) harness connector.

45. Remove the camshaft position sensor (3).



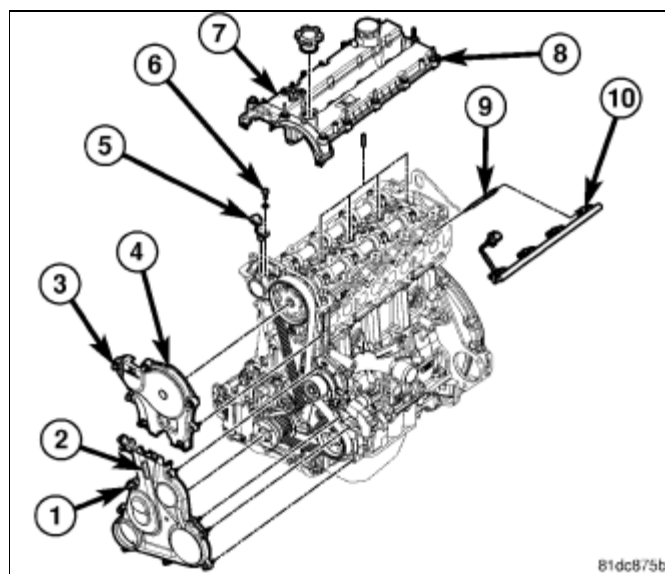
46. Remove the front engine lifting bracket (2).

47. Remove the idler pulley and cooling fan pulley bracket assembly (1).



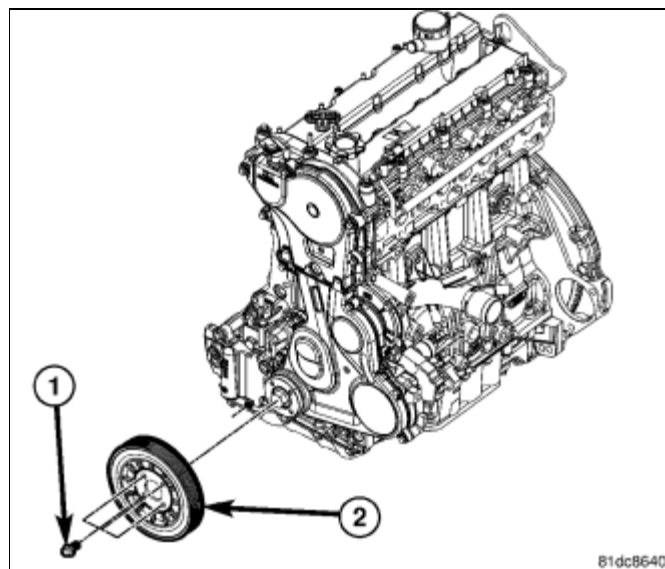
48. Remove the five bolts (3) and the upper front timing belt cover (4).

49. Remove the twelve fasteners (8) and the cylinder head cover (7).

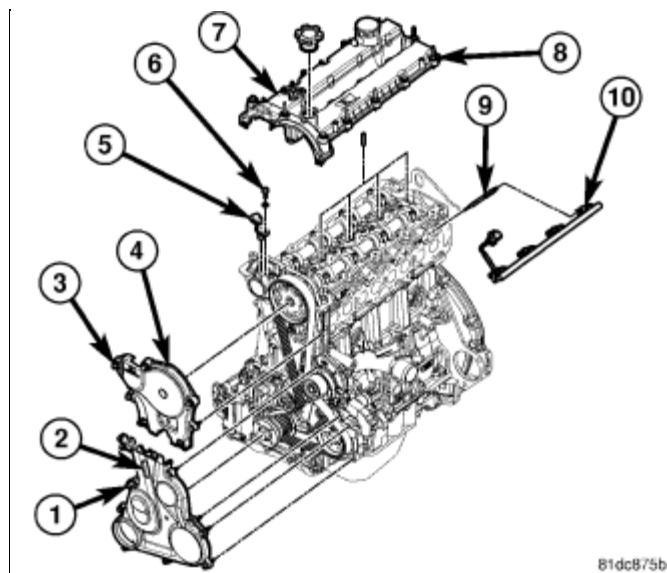


NOTE: The crankshaft sprocket bolt is a L.H. thread.

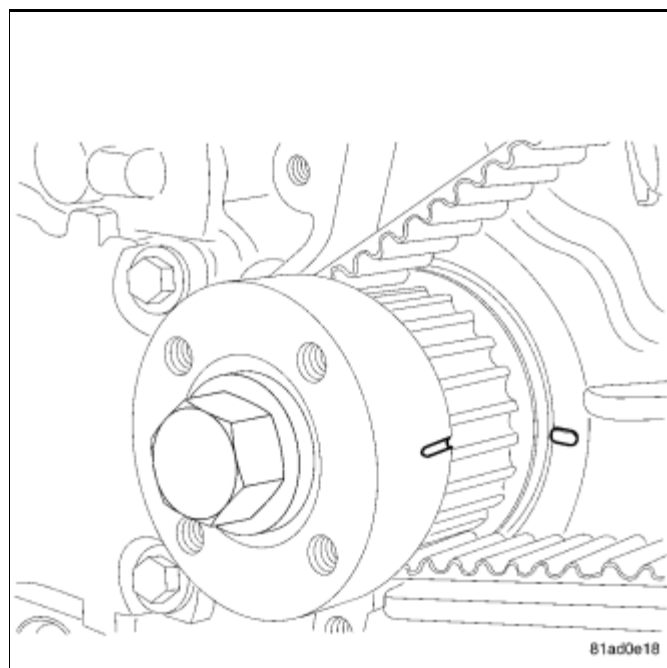
50. Remove the crankshaft damper bolts (1), and the crankshaft damper (2).



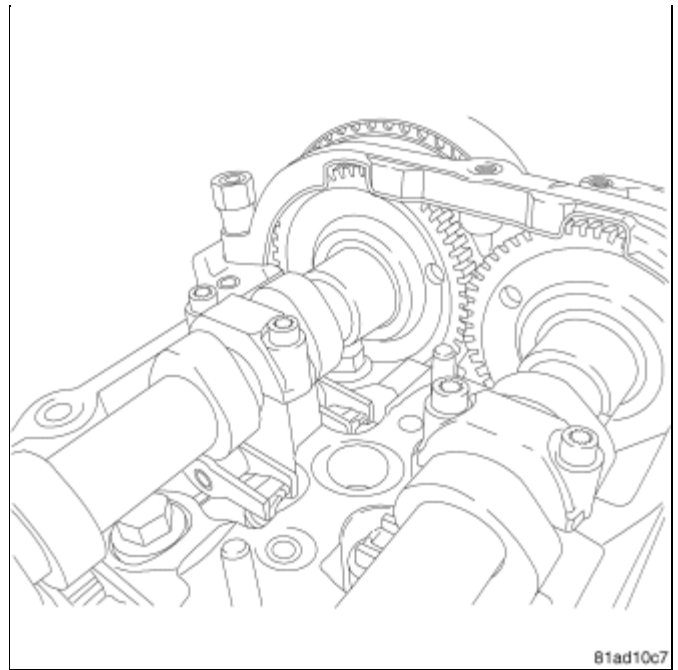
51. Remove the nine fasteners (1), and lower front cover (2).



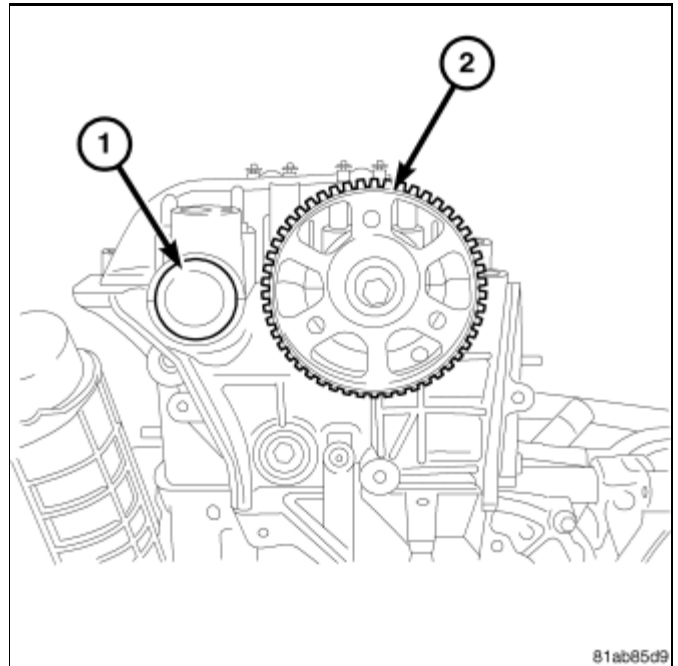
52. Rotate the engine by hand until the crankshaft 90° ATDC marks are aligned.



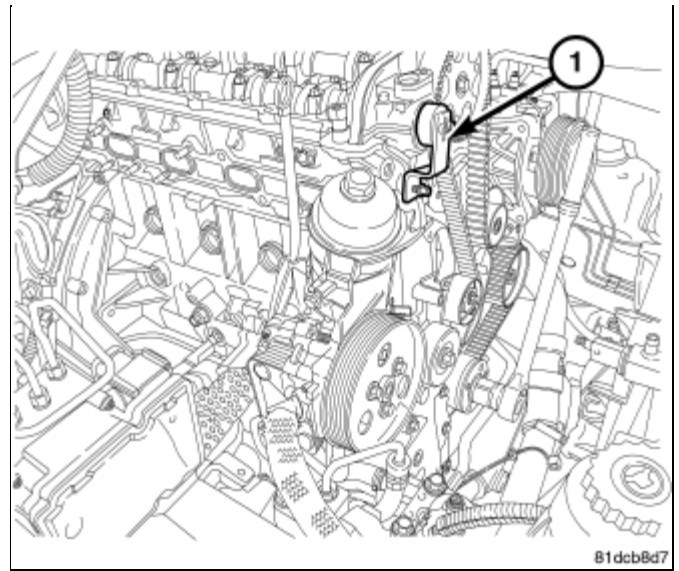
53. Verify the camshaft timing alignment holes on the camshaft gears are aligned horizontally.



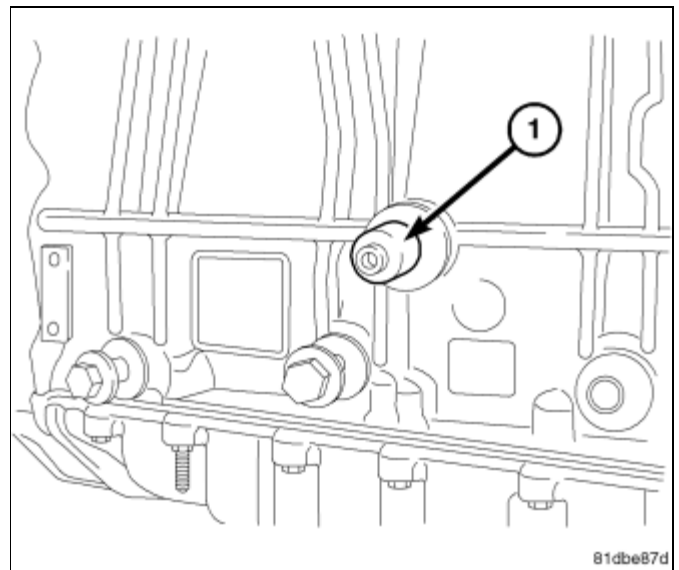
54. Remove the exhaust camshaft cap (1).



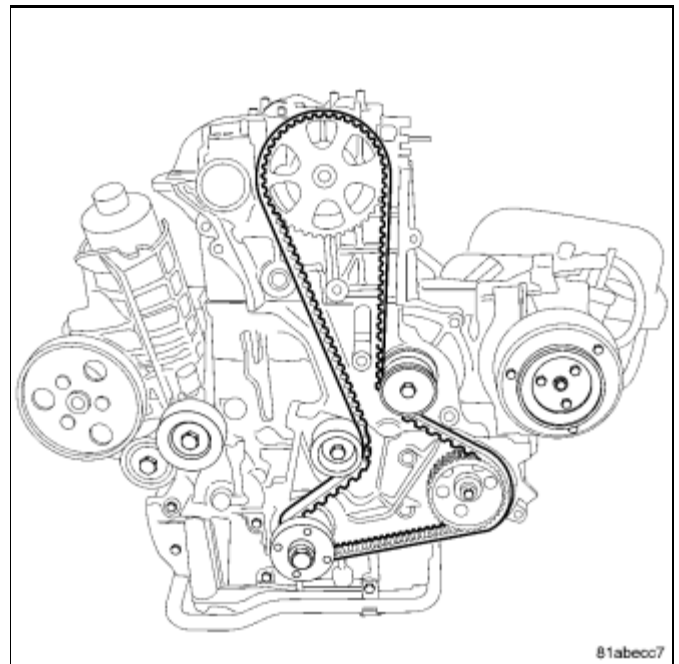
55. Install the camshaft locking tool VM 9991 (1).



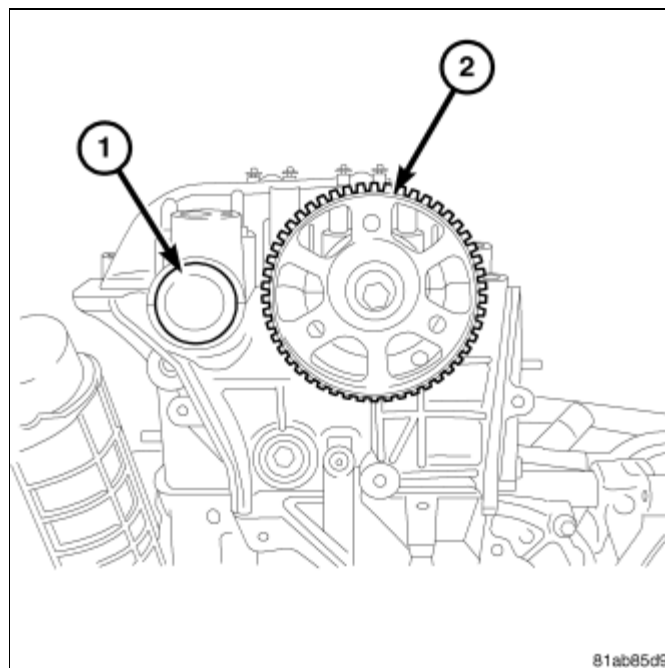
56. Install the crankshaft locking tool VM 9992 (1).



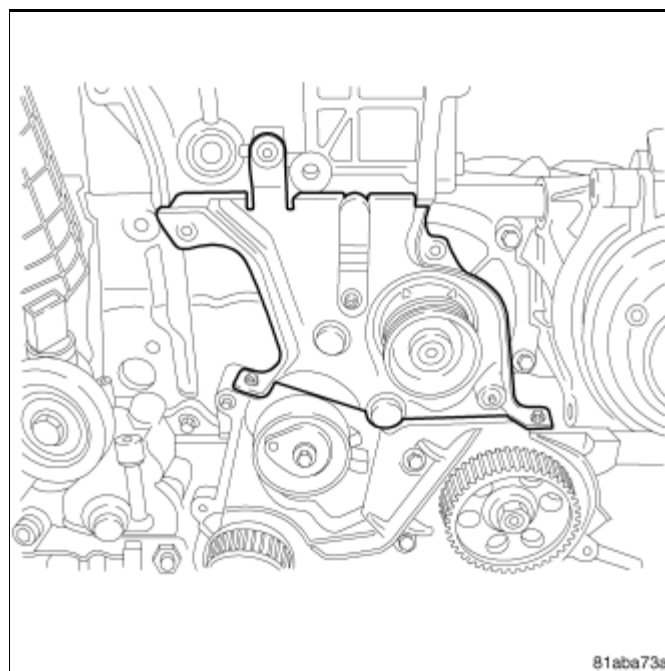
57. Remove the timing belt.



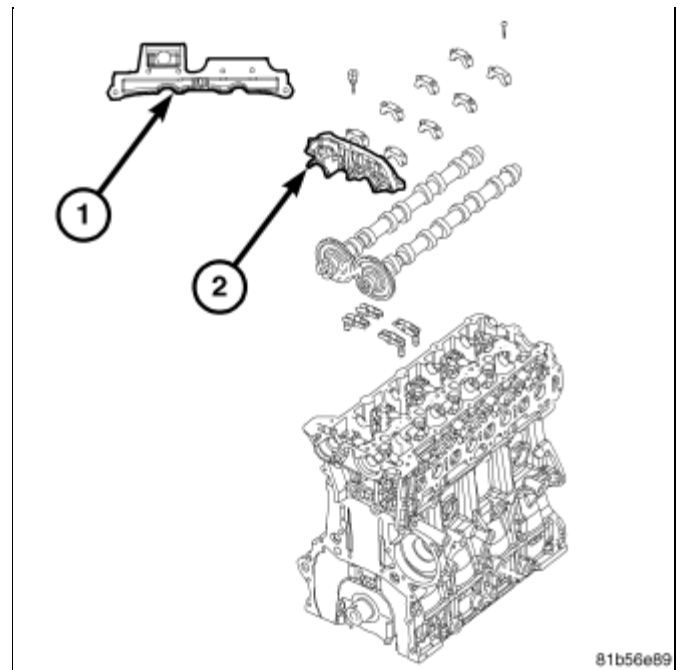
58. Remove the intake camshaft sprocket (2) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



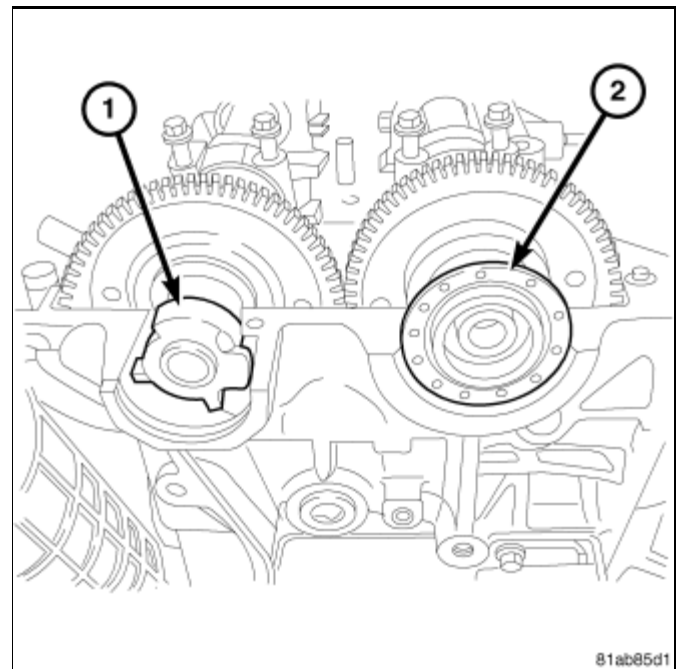
59. Remove the inner timing belt cover.



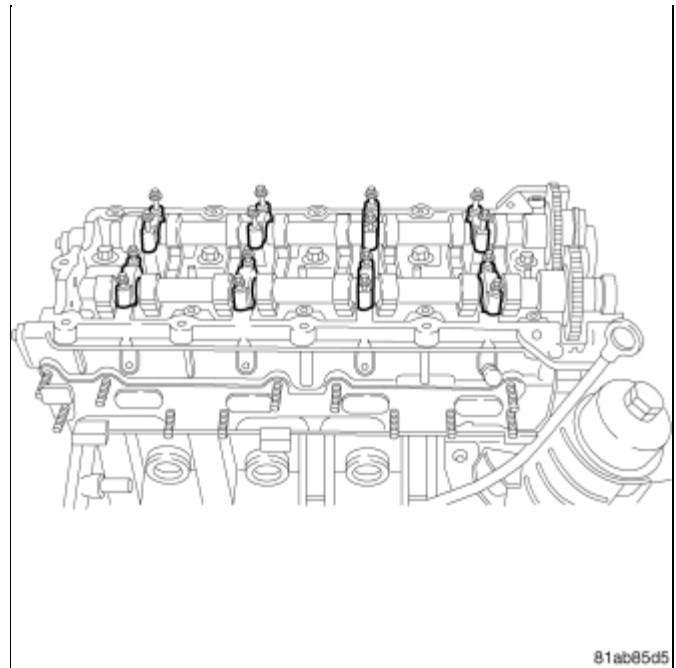
60. Remove the front camshaft journal (2).



61. Remove the intake camshaft oil seal (2).



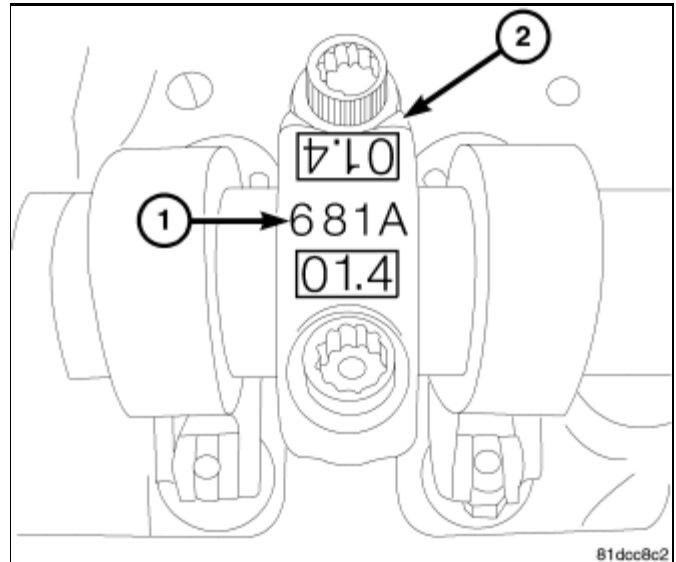
62. Using a circular pattern, loosen the camshaft cap bolts.



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NOTE: Observe the position marks on the cylinder head and camshaft cap. Always replace the camshaft cap to its original location. The illustration is an example of the camshaft markings.

63. Remove the camshaft caps (2).



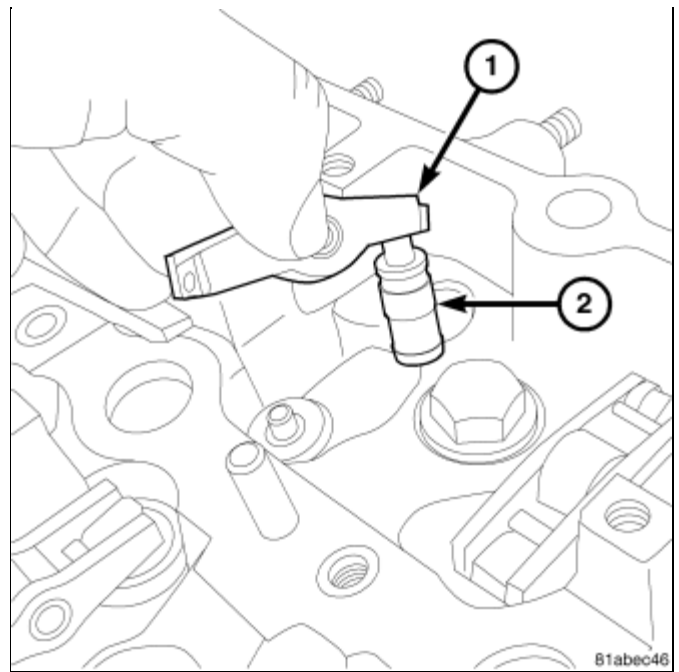
81dec8c2

NOTE: Observe the position of the rocker arms and lifters. Always return the rocker arms and lifters to their original location.

64. Remove the rocker arms (1) and hydraulic lifters (2).

65. Remove the cylinder head.

CLEANING

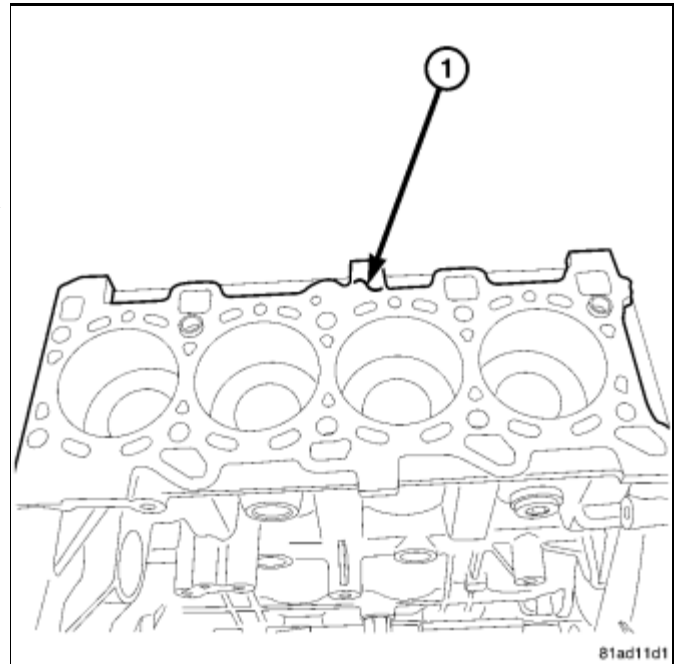


Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

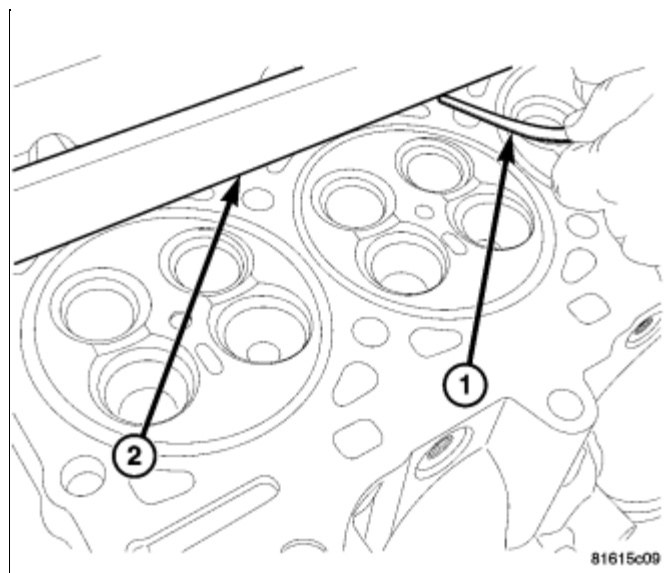
Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION



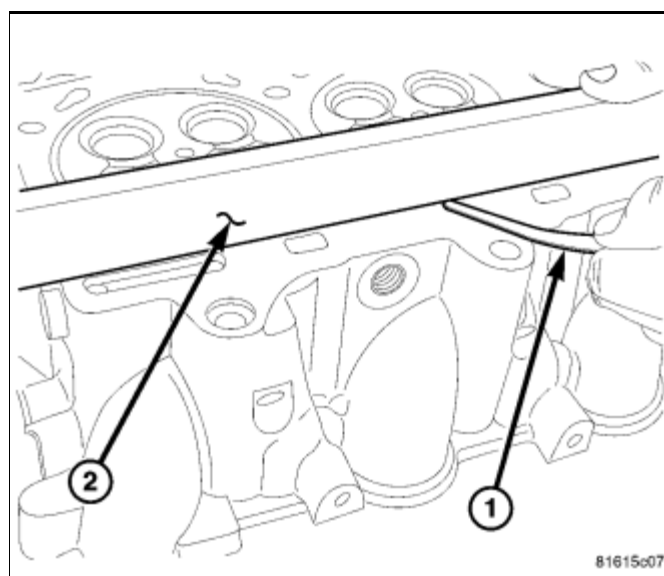
CAUTION: The cylinder head surface and straight edge must be absolutely clean before the flatness measurement is taken. DO NOT check flatness across the combustion chamber area or on the marks left by the gasket stopper.

Use a cleaned straight edge (2) and feeler (1) gauge to check the flatness. Lie the straight edge (2) parallel across the cooling ports. Measure before each combustion chamber toward the outer edge of the cylinder head, above and below each combustion chamber, between each combustion chamber, top and bottom, on the cylinder head and block mating surfaces. The **maximum** allowed warpage is 0.075mm (0.003 in.).

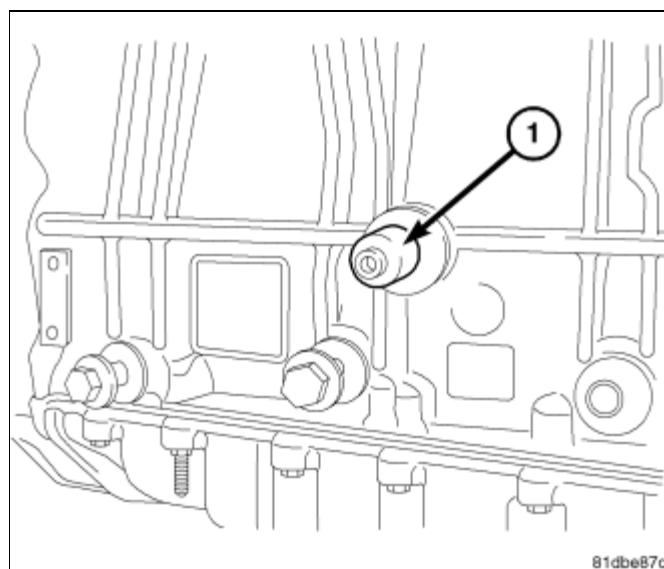


The minimum cylinder head thickness is 135.5 mm (5.33 in.).

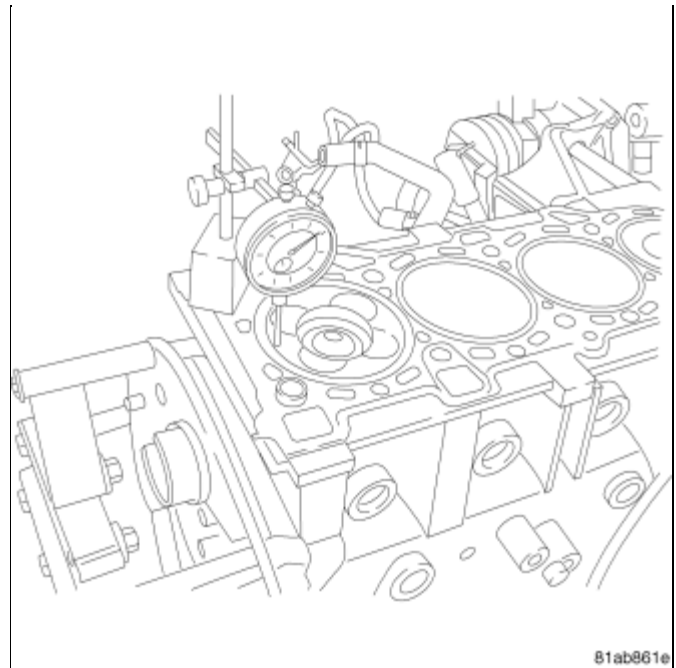
INSTALLATION



1. Remove the crankshaft locking tool.



2. Set the number one piston to top dead center (TDC).



81ab861e

3. Zero the dial indicator on the top of the piston at location shown (1).

4. Use the dial indicator to measure the height of the piston at top dead center.

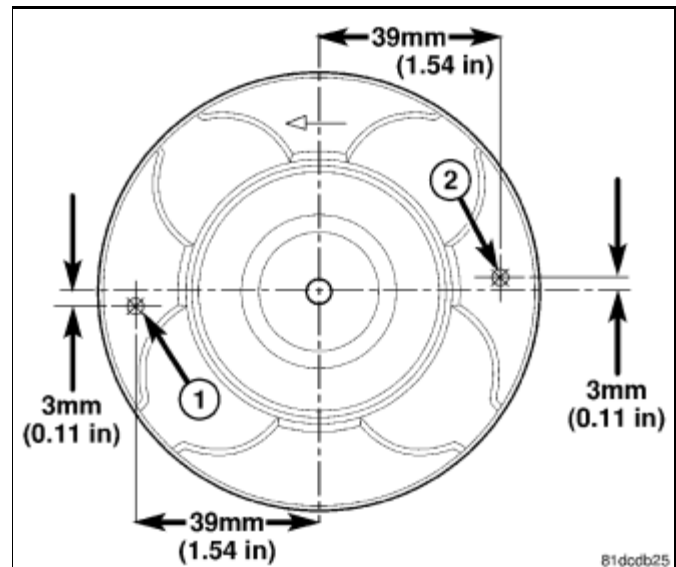
5. Zero the dial indicator on the top of the piston at location shown (2).

6. Use the dial indicator to measure the height of the piston at top dead center.

7. Repeat the procedure for each cylinder.

8. Average the 4 piston protrusion readings to determine the required gasket thickness.

9. Select the appropriate cylinder head gasket from the cylinder head gasket chart.



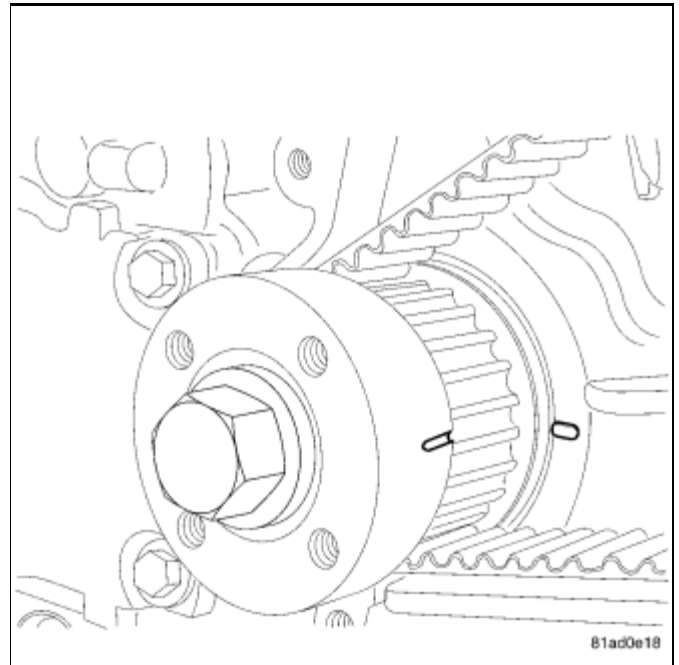
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Cylinder Head Gasket Selection

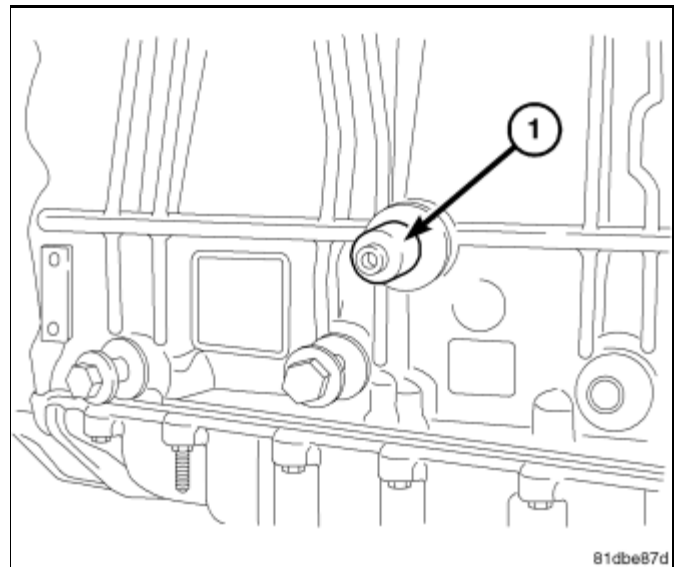
	Millimeters	Inches
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.300 - 0.399	0.0119 - 0.0158
CYLINDER HEAD GASKET THICKNESS	1.10	0.0434
PISTON CLEARANCE	0.701 - 0.800	0.0276 - 0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.400 - 0.499	0.0158 - 0.0197
CYLINDER HEAD GASKET THICKNESS	1.20	0.0473
PISTON CLEARANCE	0.701 - 0.800	0.0276 - 0.0315

DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.500 - 0.600	0.0197 - 0.0237
CYLINDER HEAD GASKET THICKNESS	1.30	0.0512
PISTON CLEARANCE	0.700 - 0.800	0.0276 - 0.0315

10. Return piston #1 to 90° ATDC, and align the crankshaft timing marks.

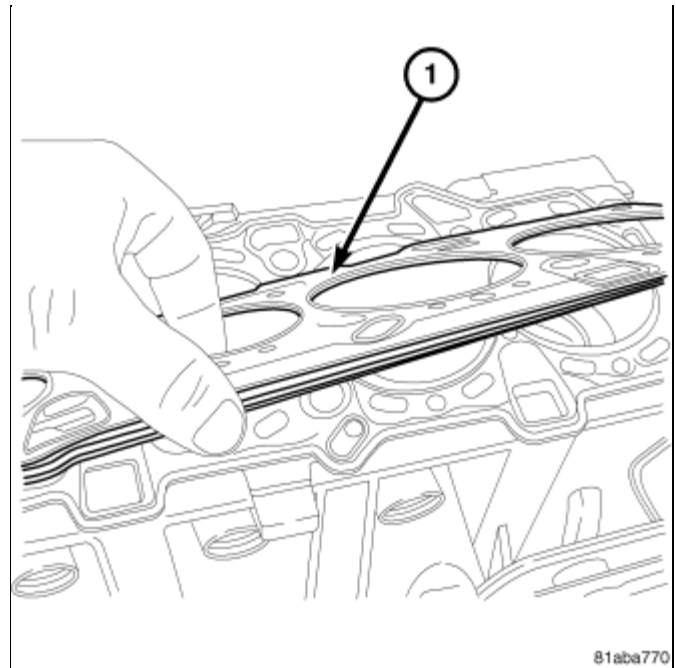


11. Reinstall the crankshaft locking tool (1).

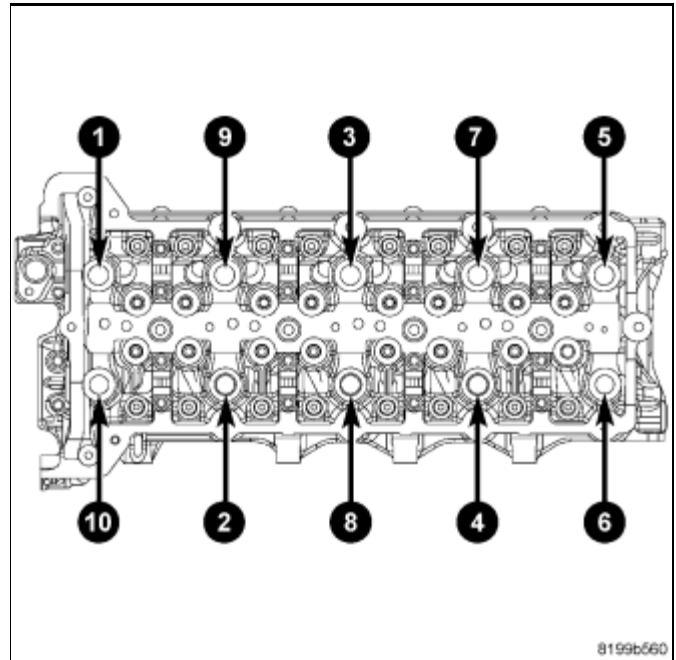


12. Install the head gasket (1).
 13. Install the cylinder head.

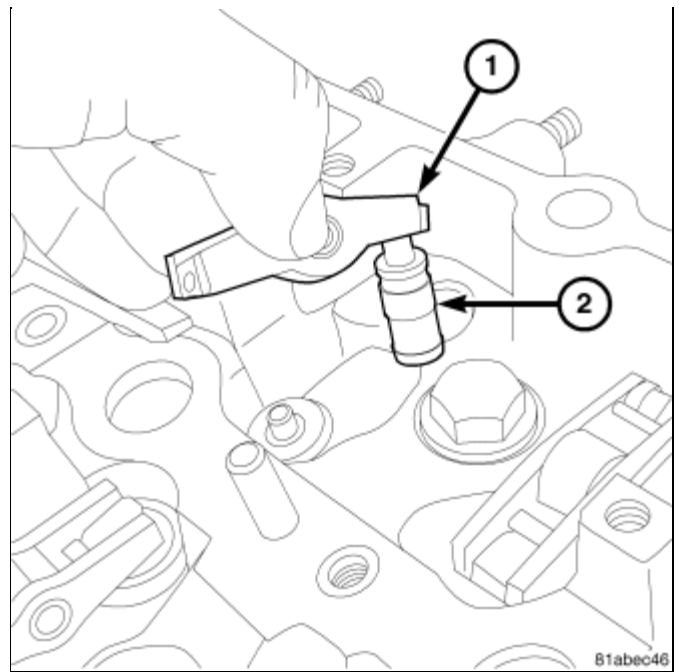
NOTE: Always use new cylinder head bolts whenever the existing bolts have been removed.



14. Install the cylinder head bolts in the illustrated pattern. Torque the bolts to 30 Nm (22 lbs. ft.).
15. Repeat the pattern, turning the bolts an additional 85°. Repeat the pattern twice more, turning 85° each time for a total of 255°.

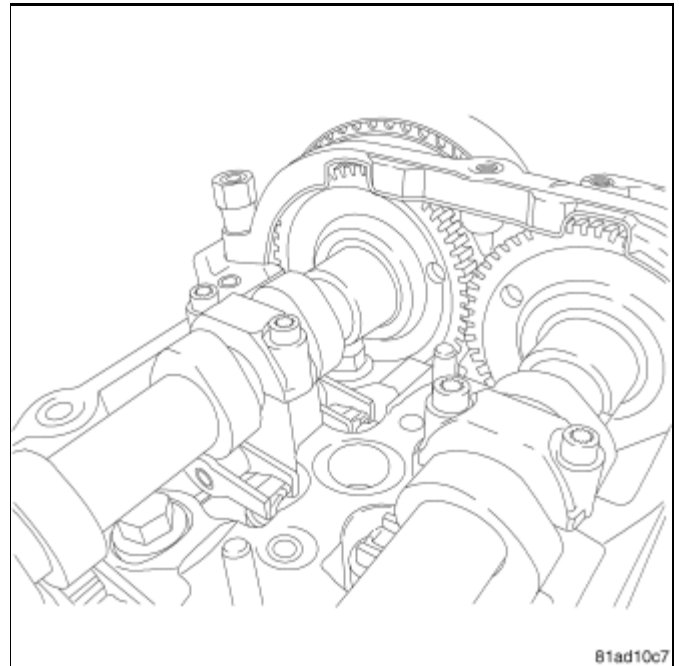


16. Install the rocker arms (1) and hydraulic lifters (2). Make sure to return the lifters and arms to their original position.

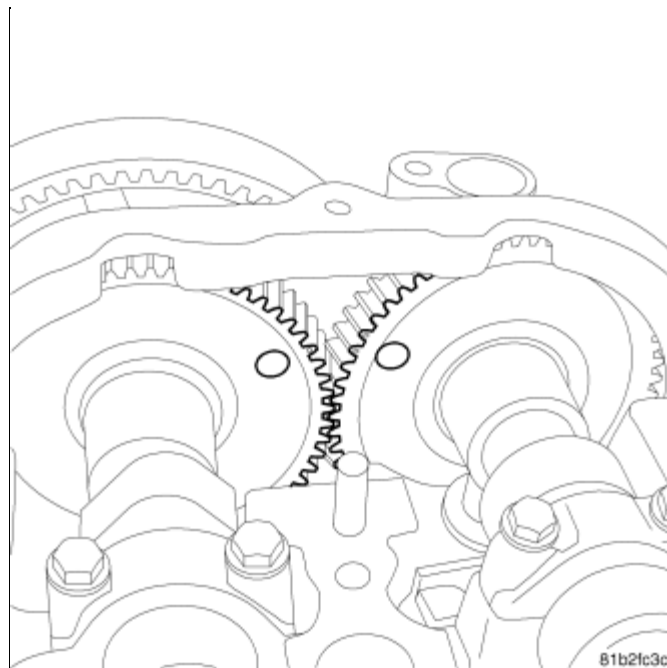


17. Set the camshafts in place.
18. Make sure that the timing dimples on the back of the camshaft gears are lined up horizontally.

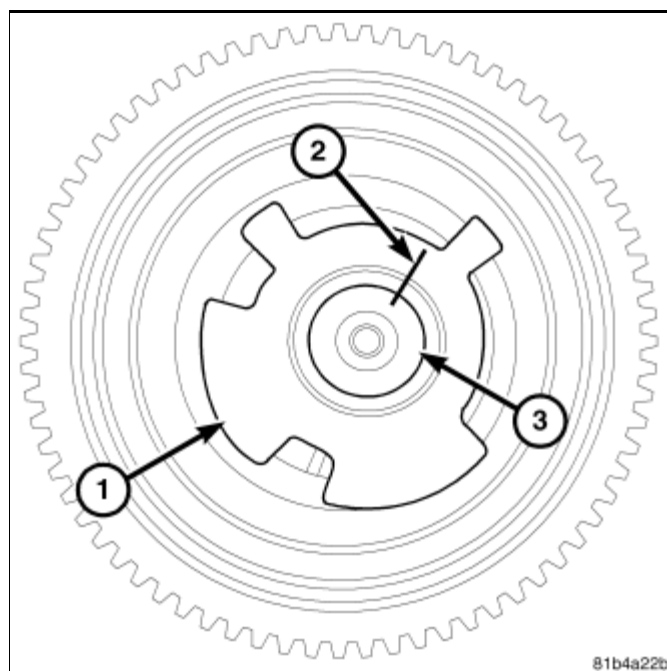
NOTE: The engine is not in time with the camshaft dots facing each other. The camshafts are set so that the dots face each other and then rotated until the camshaft locking tool can be bolted to the cylinder head. The camshaft locking tool properly positions the camshafts at 90° ATDC. The dots on the camshafts are used during assembly to quickly orient the camshafts so that the camshaft locking tool can be installed.



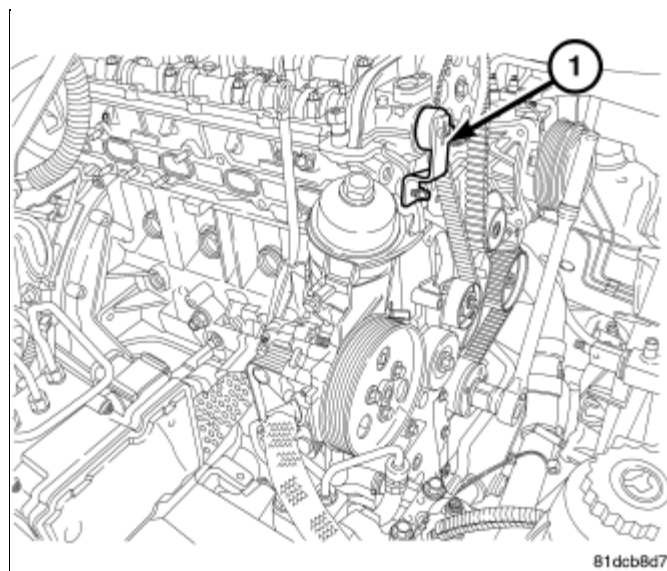
19. Turn the camshafts so that the 90° ATDC camshaft tool can be correctly installed.



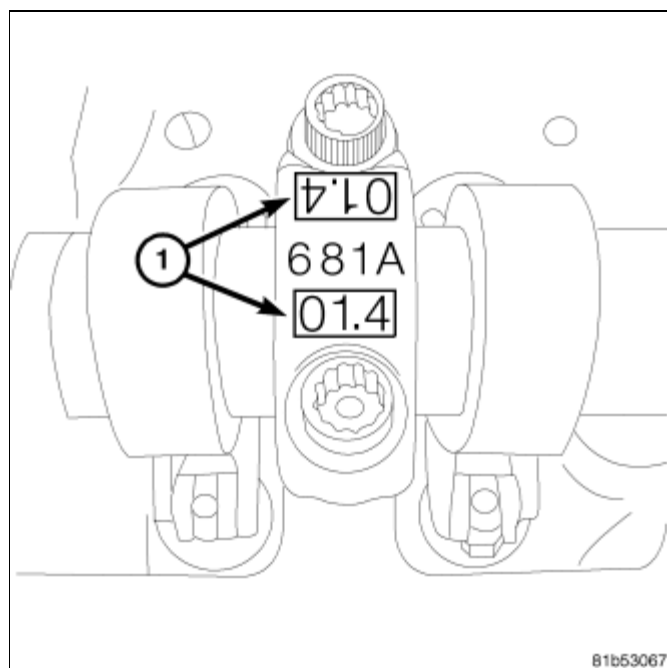
20. Make a mark (2) across the CMP reluctor wheel (1) and the exhaust camshaft (3). This mark will be used to verify that the CMP reluctor wheel did not rotate on the camshaft during assembly.



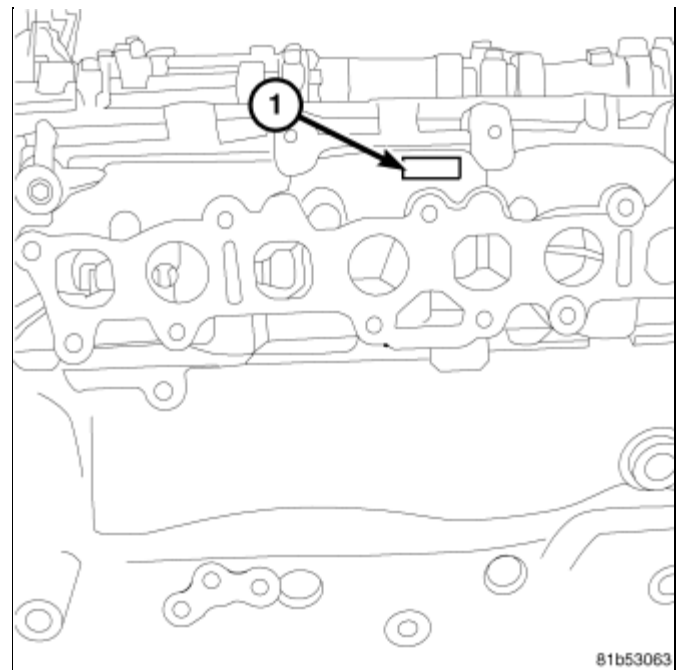
21. Install the camshaft locking tool (1).



22. The camshaft caps have several markings. The die identification number (1) is used during manufacturing, and is not necessary for assembly.

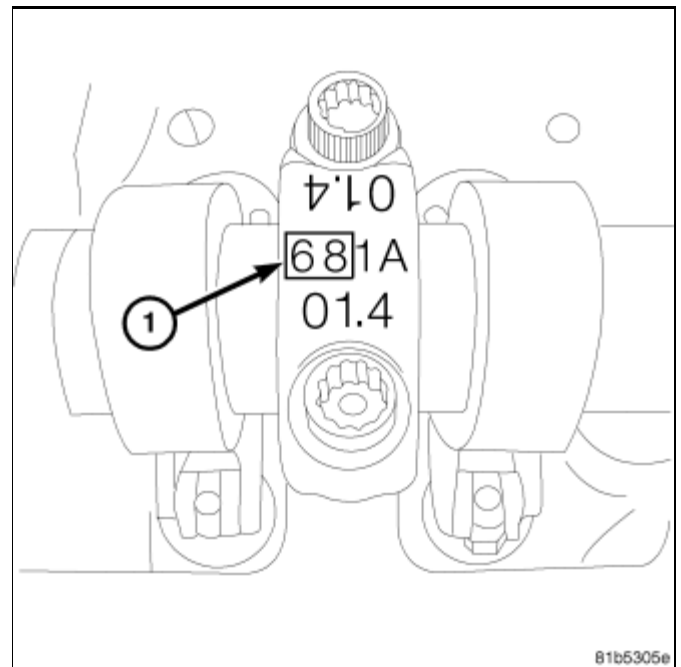


23. The progressive part number (1) is printed on the intake side of the cylinder head. The last 2 digits are the same as the number on the camshaft caps.



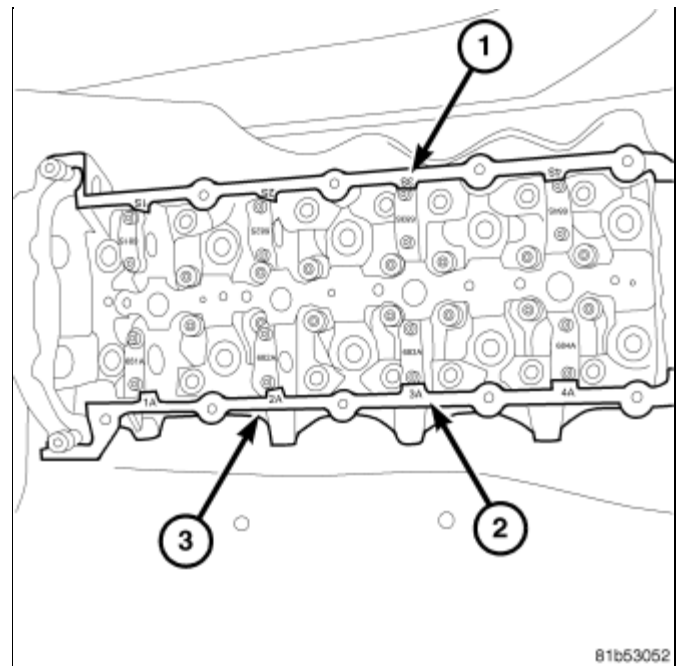
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24. The last two digits of the progressive part number (1) are printed on the camshaft caps and will match the last two digits of the number on the side of the cylinder head and front camshaft cap. These numbers are stamped after the machining process and match the camshaft caps to the cylinder head.



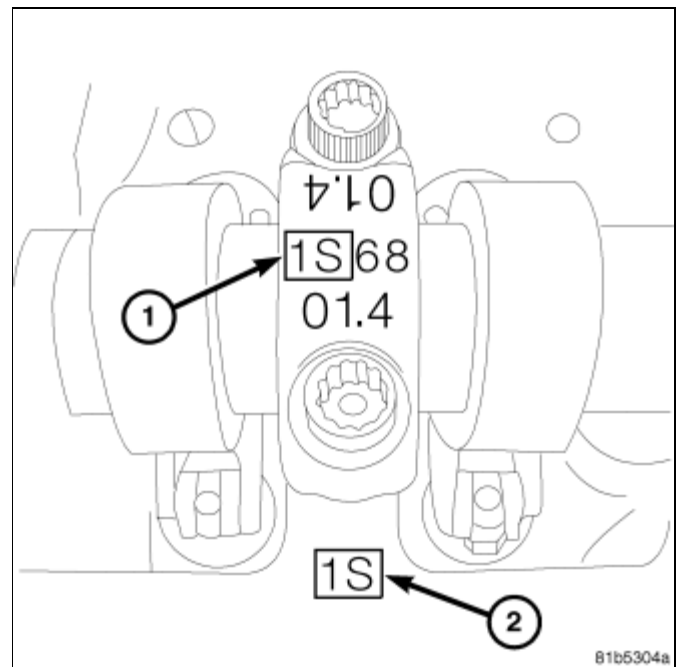
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25. The camshaft cap locations are marked on the cylinder head near each camshaft cap. The exhaust side (1) are marked with a number and the letter "S". The intake side (2) is marked with a number and the letter "A".



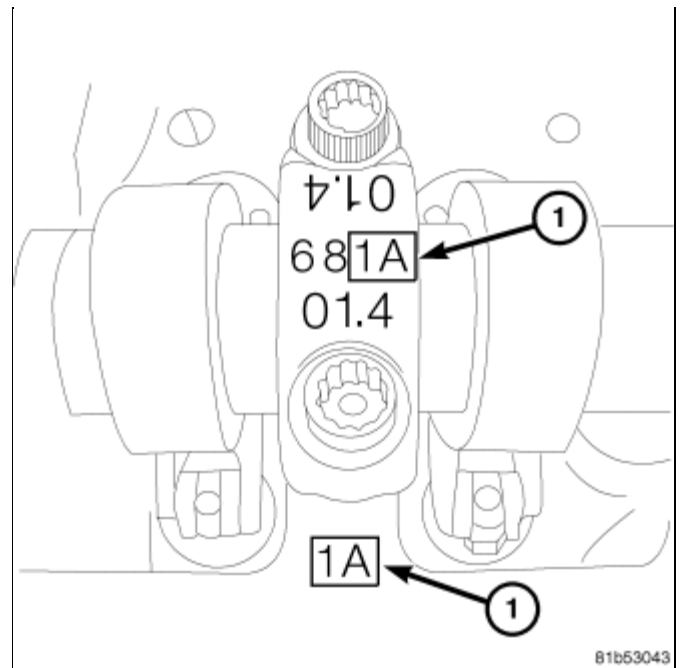
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26. The camshaft cap must be aligned with the mark (1) aligned in the same direction as the cylinder head mark (2). In the illustration, the camshaft cap is the first cylinder (indicated by the 1) on the exhaust side of the cylinder head (indicated by the S).

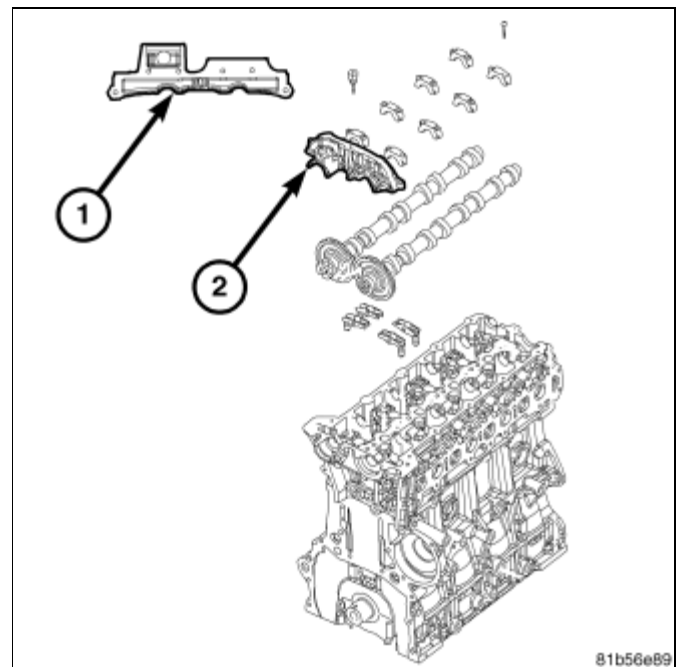


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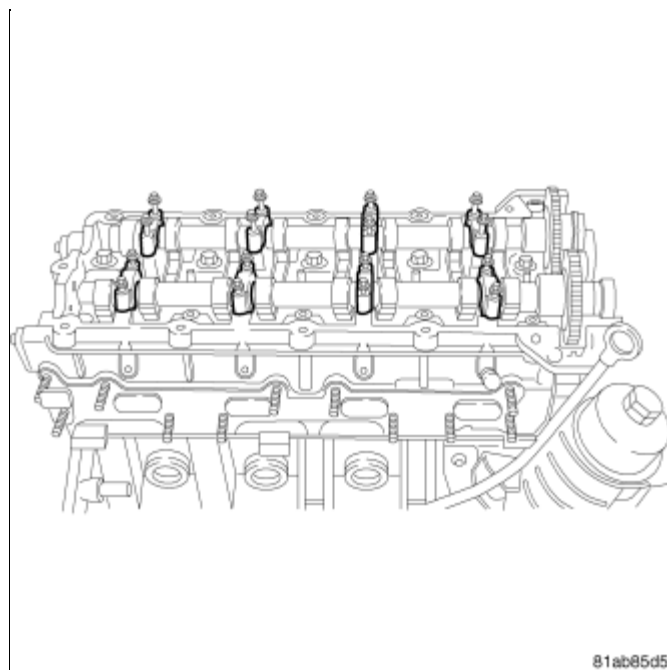
27. The first cylinder on the intake side is marked with the code 1A. Each camshaft cap location is marked in this manner on both the camshaft cap and cylinder head. It is critical that all of the camshaft caps are returned to their correct locations.



28. Apply a thin bead of Loctite 510 to the front camshaft cap (2) in the location shown (1).



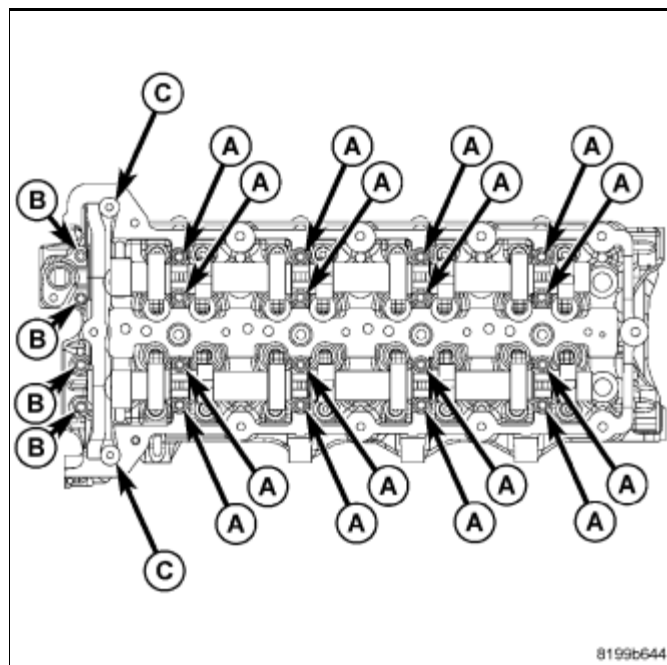
29. Loosely install the camshaft bolts finger tight.



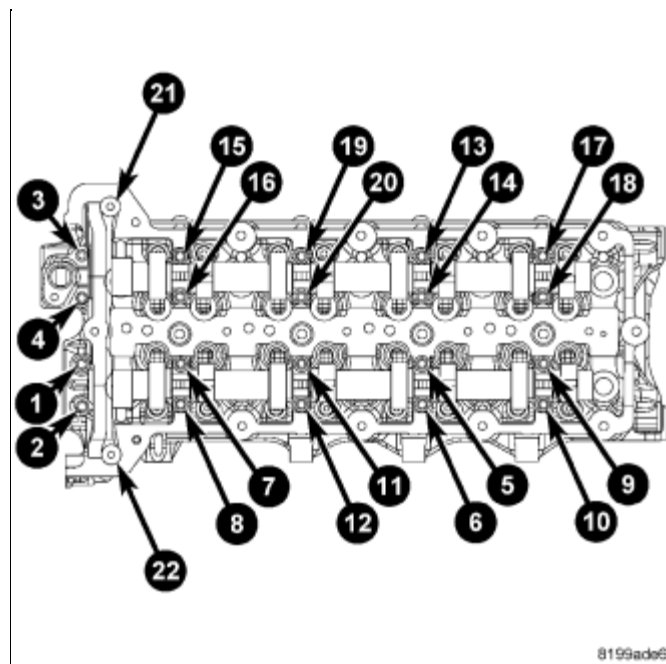
NOTE: When the camshaft caps are removed, always replace the camshaft cap bolts.

30. The camshaft bolts have 3 different bolt sizes.

- Bolts A are M6 35
- Bolts B are M6 45
- Bolts C are M6 stud bolts.

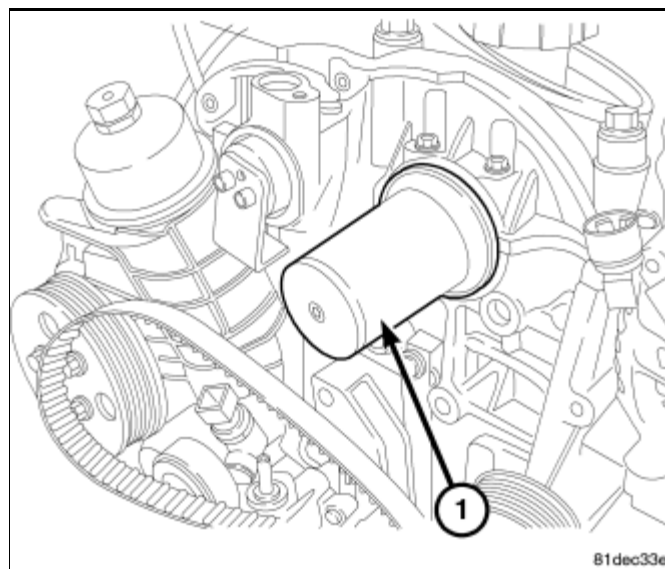


31. Following the illustrated pattern, torque the camshaft cap bolts to 11 Nm (98 lbs. in.).



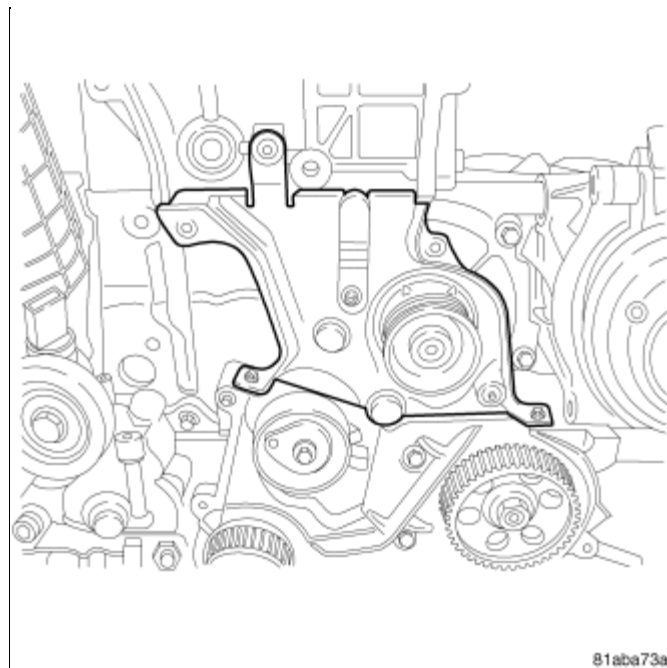
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32. Use the 9937-1 Seal Installer (1) to install the intake camshaft oil seal.



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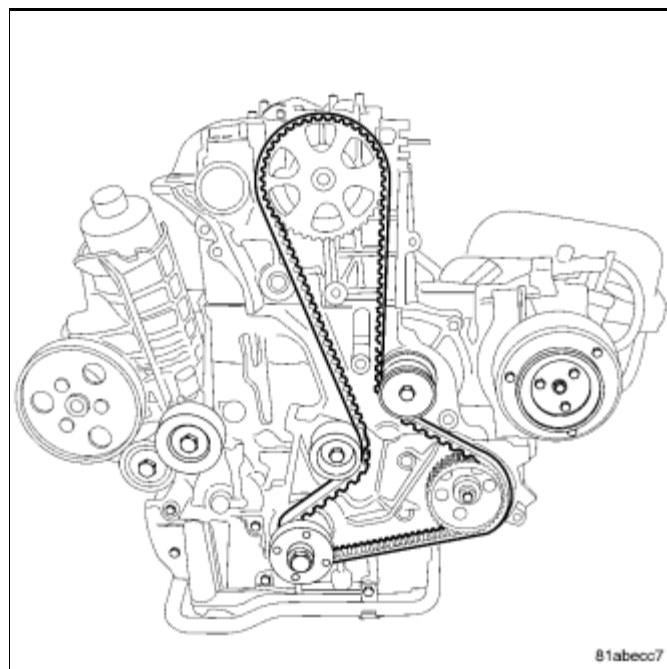
33. Install the inner front cover. Torque the bolts to 11 Nm (97 lbs. in.).



81aba73a

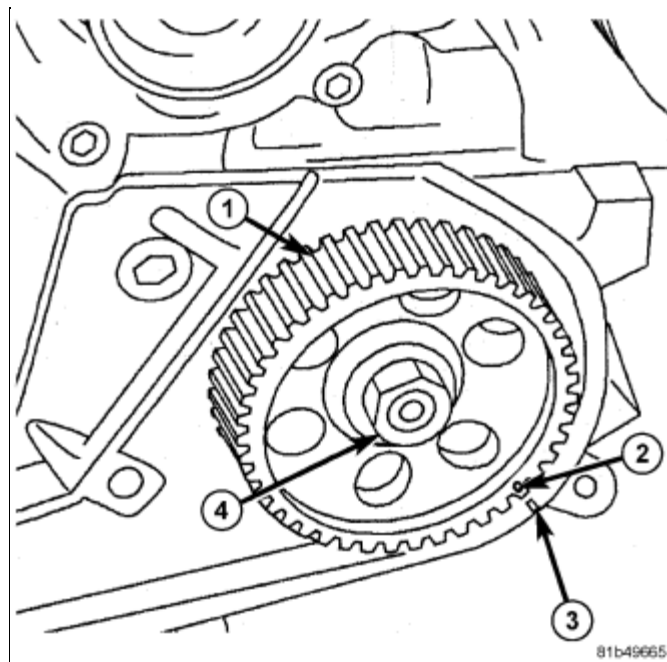
NOTE: The crankshaft sprocket bolt is a L.H. thread.

34. Install the crankshaft sprocket. Torque the bolt to 100 Nm (74 lbs. ft.) and then an additional 120 degrees.

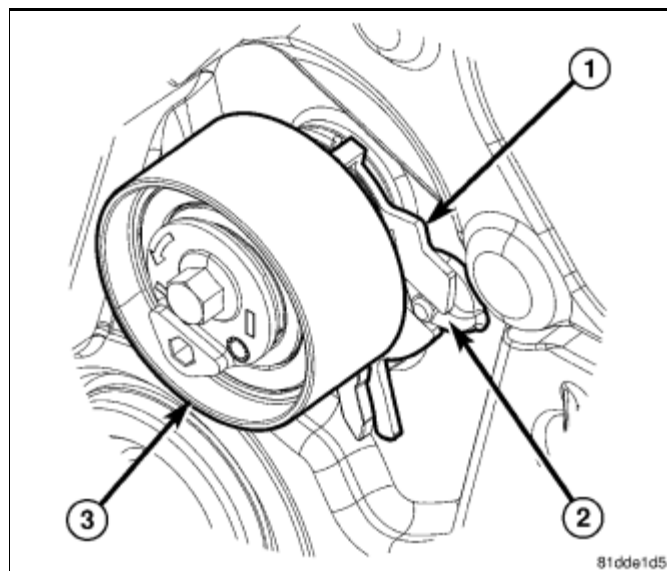


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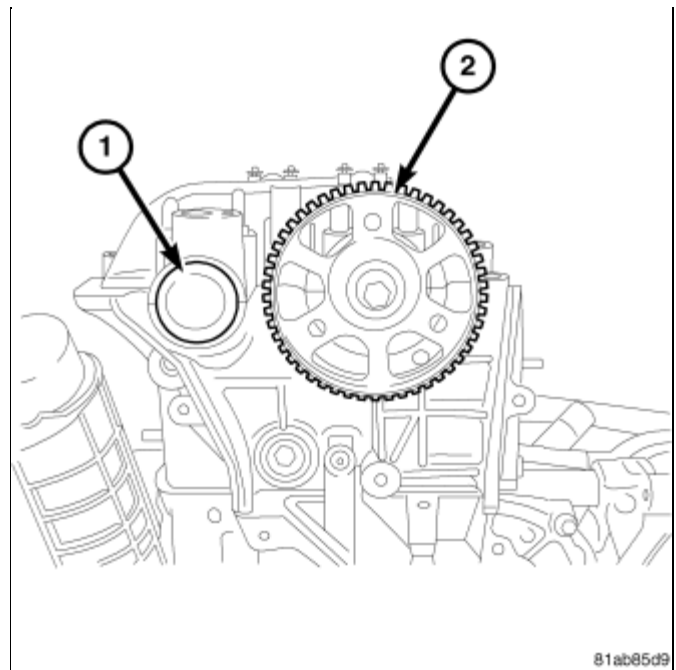
35. Align the high pressure fuel pump sprocket timing mark (2) with the timing mark (3) on the block.



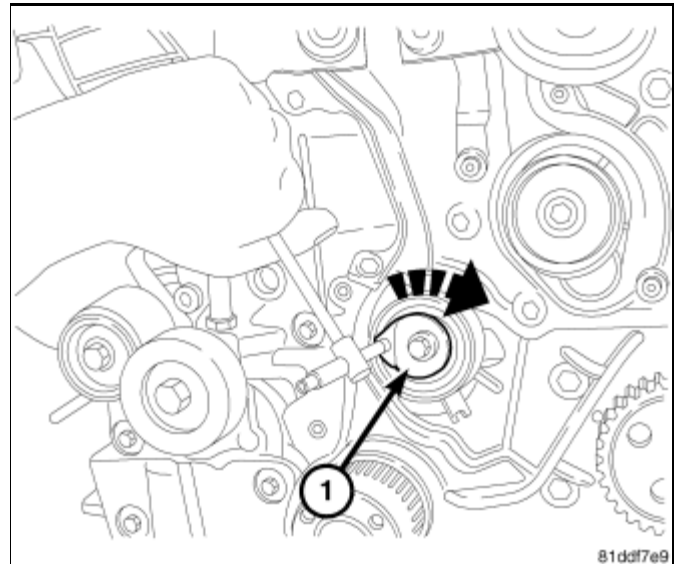
36. Install the timing belt tensioner (3). Do not tighten at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.



37. Install the camshaft sprocket (2). Do not tighten the bolt at this time.

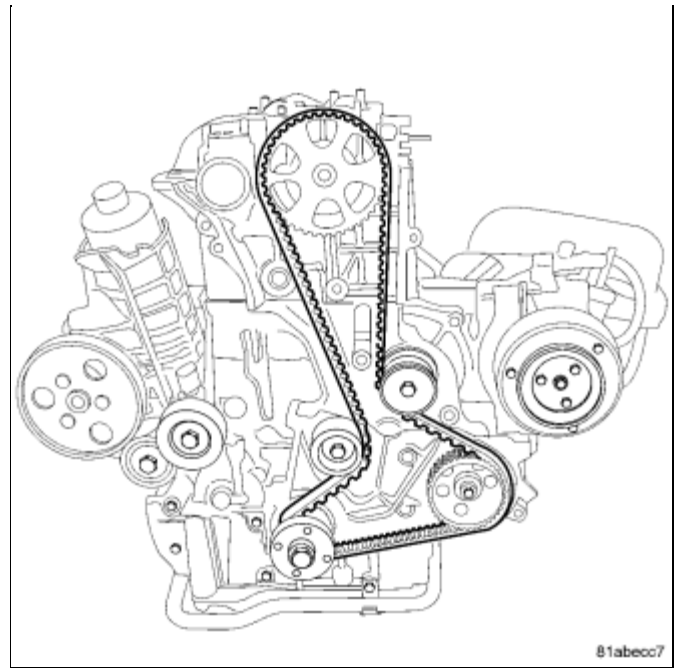


38. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed.



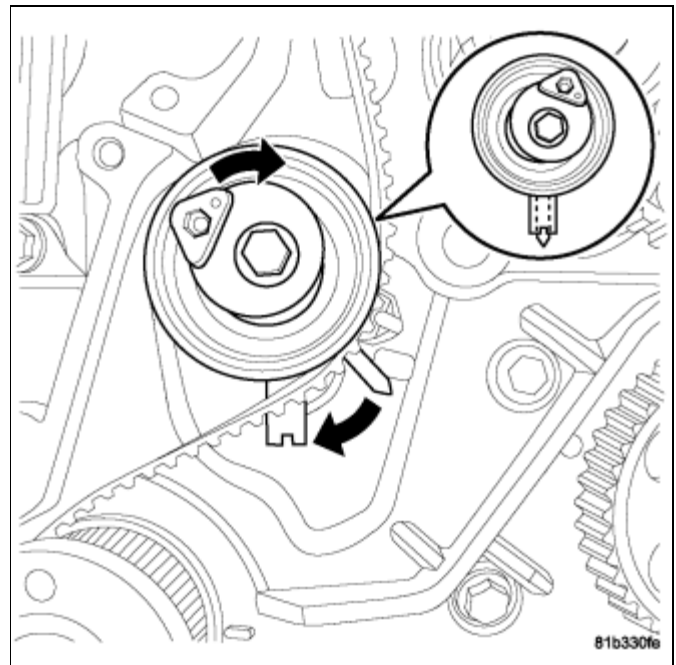
NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

39. Install timing belt.



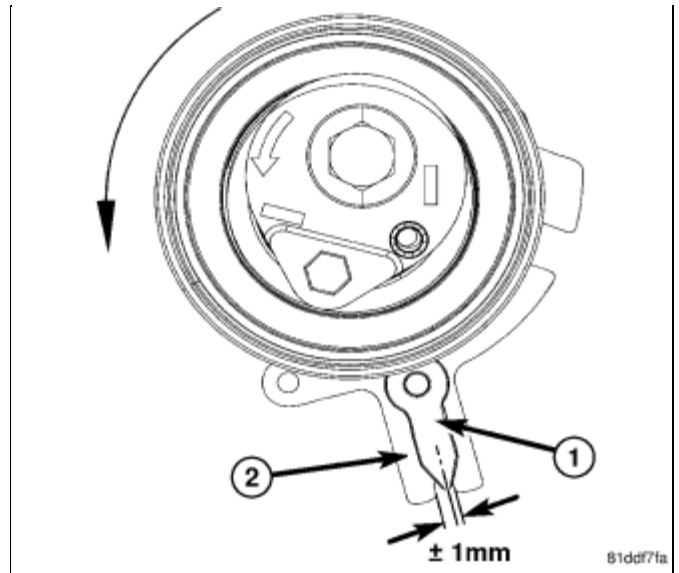
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40. Adjust timing belt tensioner by lining up the arrow and the notch as illustrated.

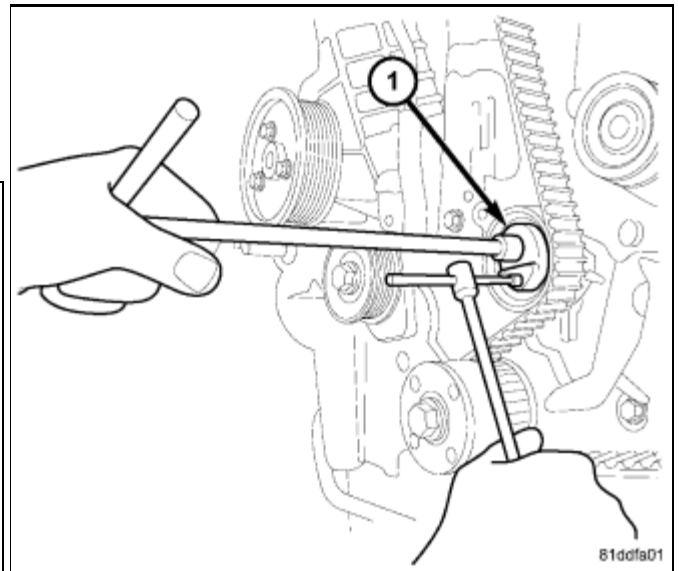


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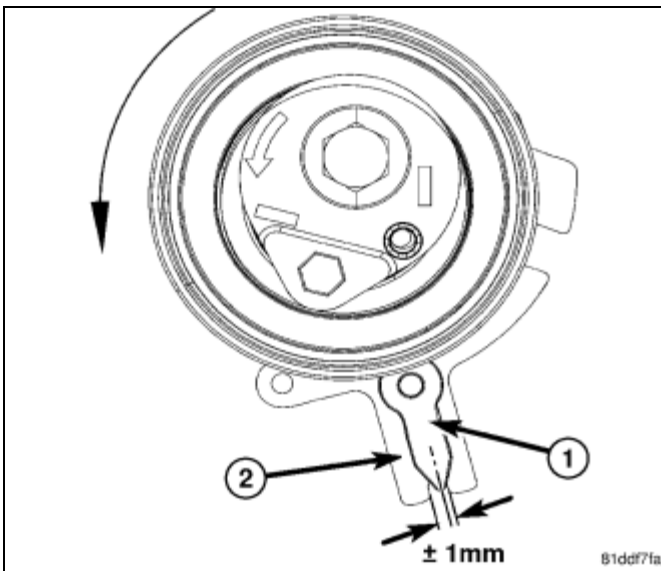
41. Verify the tensioner load indicator (1) is centered in the tensioner load gage (2).



42. Tighten the timing belt tensioner bolt to 28 Nm (21 lb ft).

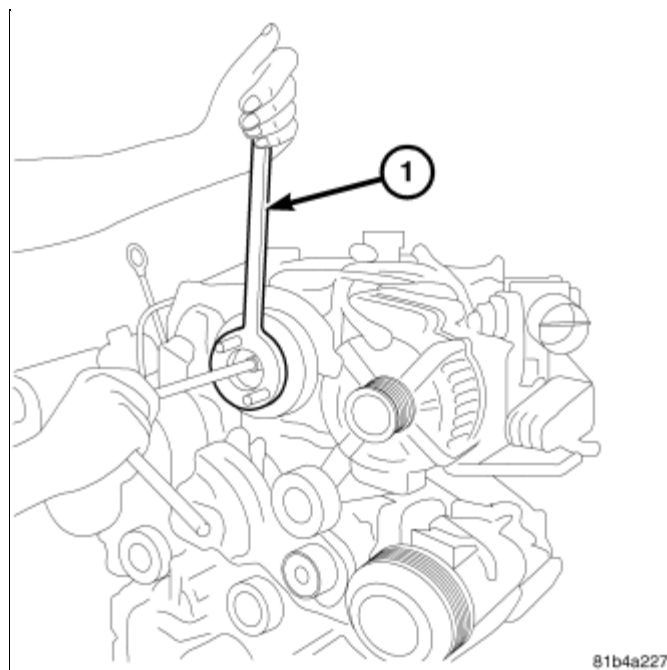


43. Verify the tensioner load indicator (1) is still centered in the tensioner load gage (2). If the indicator is not centered

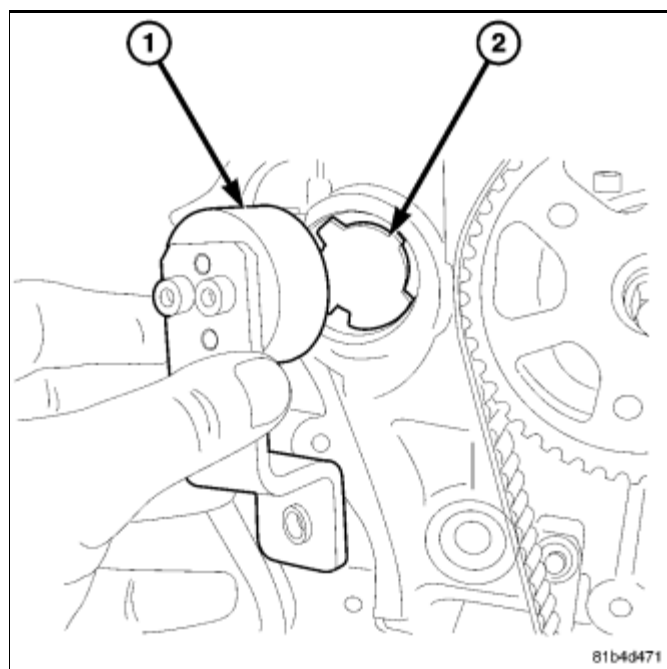


in the gage as shown, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

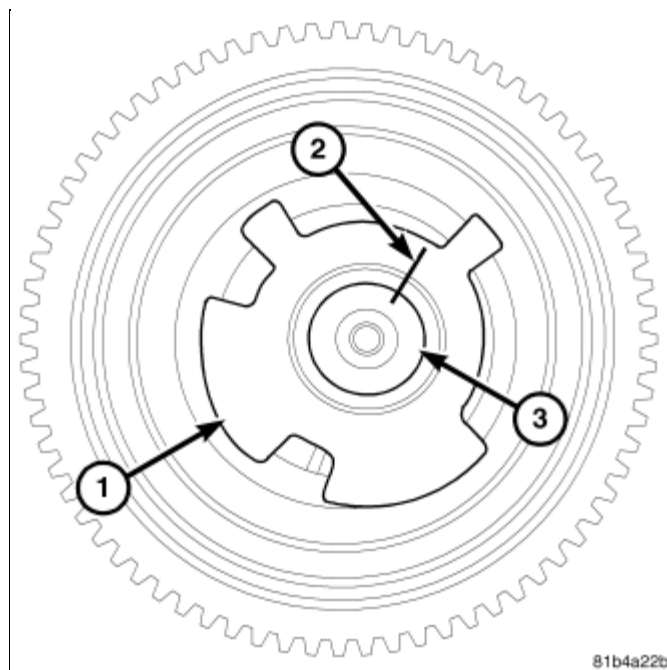
44. Use VM 1055 Gear Holder (1) to hold the camshaft sprocket while torquing. Torque the intake camshaft sprocket bolt to 64 Nm (47 lbs. ft.)



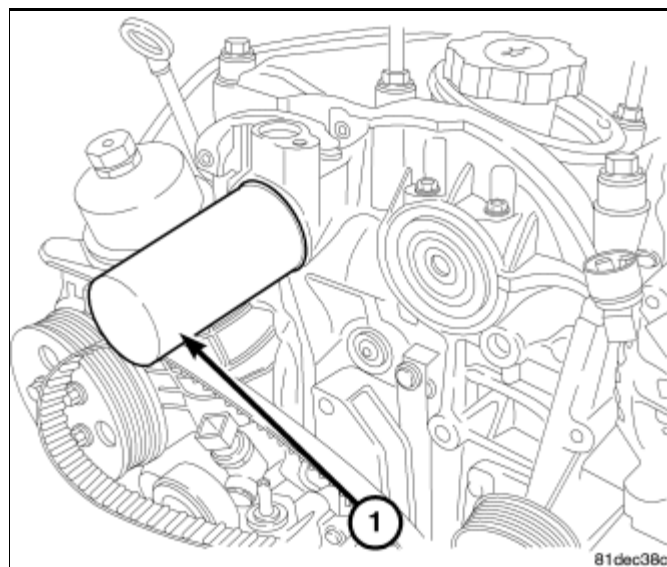
45. Remove the camshaft locking tool (1).



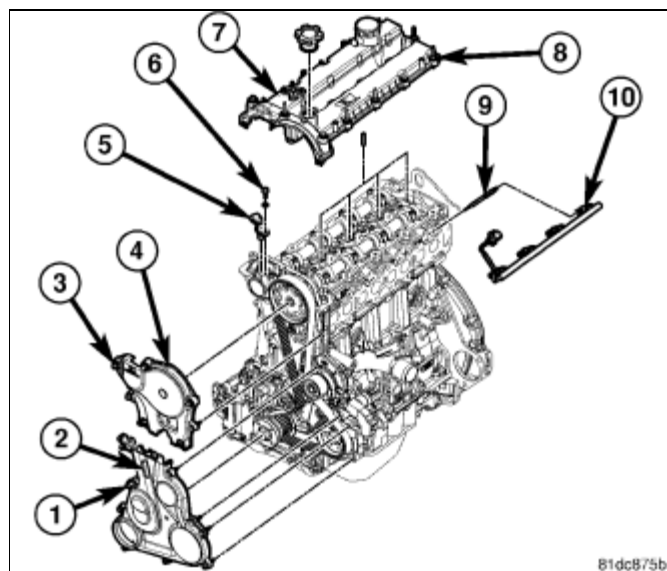
46. Verify that the reluctor wheel (1) has not moved on the camshaft. If the witness marks are not aligned, the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, and the exhaust camshaft must be replaced.



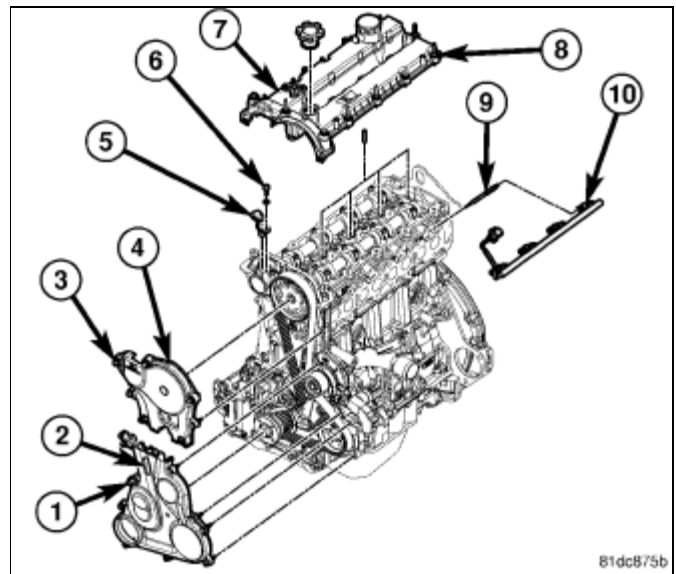
47. Use VM 1057 Seal Installer (1) to install the exhaust camshaft cap.



48. Install the lower front cover (2). torque the bolts to 11 Nm (97 lbs. in.).

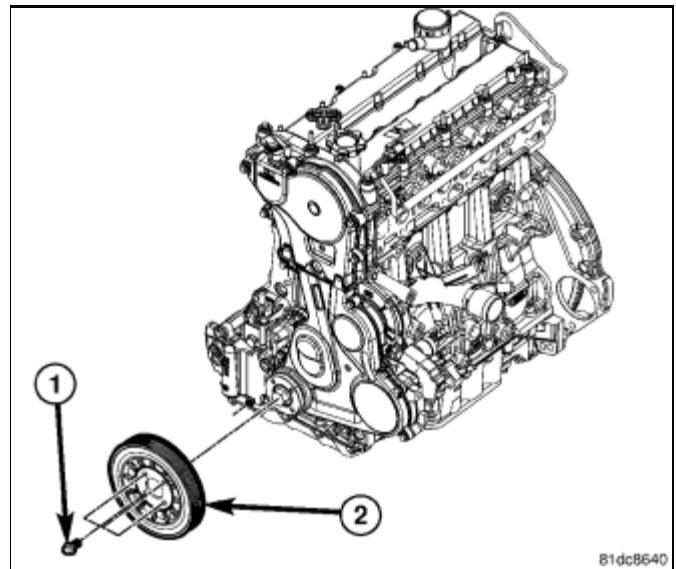


49. Install the upper front cover (3). torque the bolts to 11 nm (97 lbs. in.).



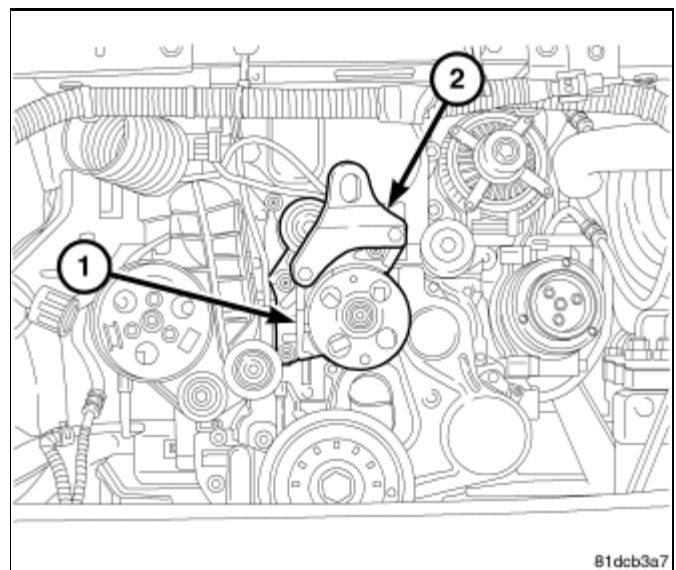
NOTE: The crankshaft sprocket bolt is a L.H. thread.

50. Install the crankshaft damper (2). Torque the bolts (1) to 32 Nm (23 lbs. ft.).

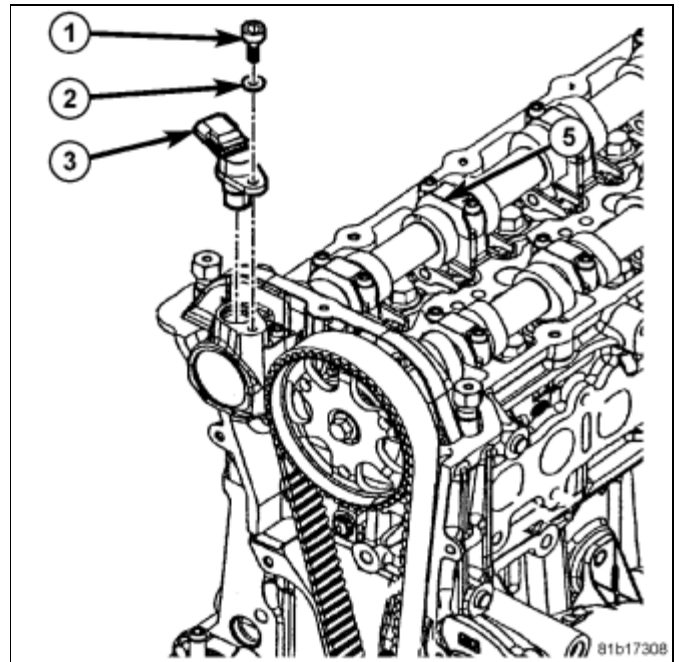


51. Install the idler pulley bracket (1) and torque the bolts to 45 Nm (33 lbs. ft.).

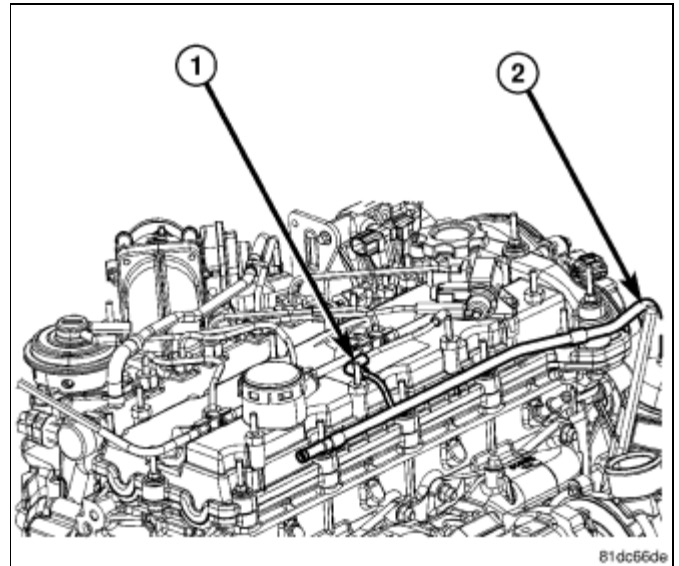
52. Install the front engine lifting bracket (2) and torque the bolts to 45 Nm (33 lbs. ft.).



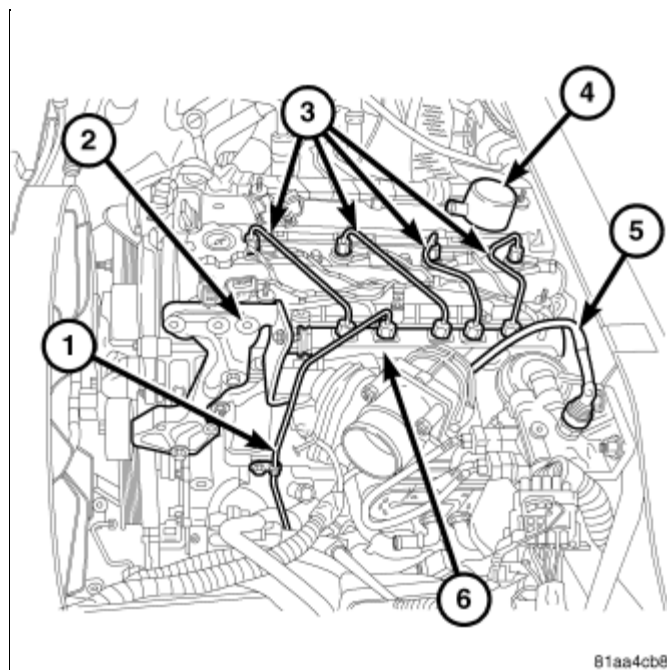
53. Install the cam position sensor (3). Torque the cam position sensor bolt (1) to 11 Nm (97 lbs. in.).
54. Connect the cam position sensor harness connector.



55. Install the vacuum supply line (2) to the vacuum pump.
56. Install the vacuum line (1) to the fitting on the cylinder head cover.

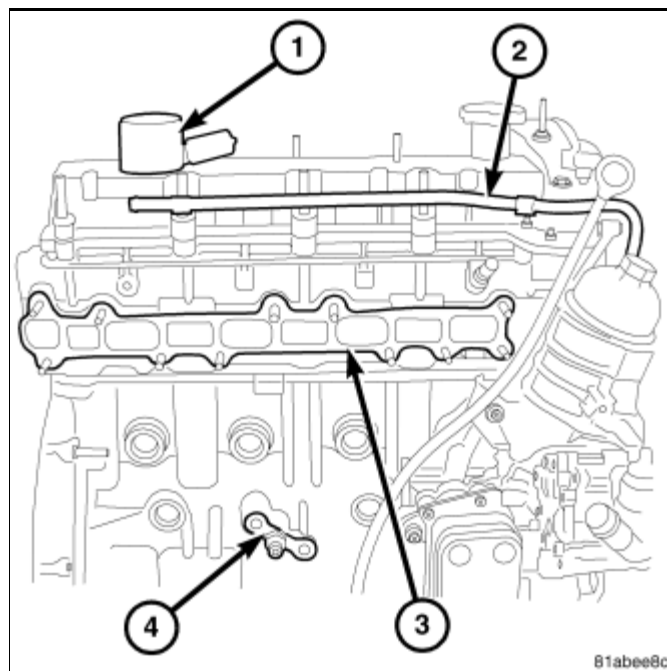


57. Reconnect the crankcase vent hose to the oil separator (4).



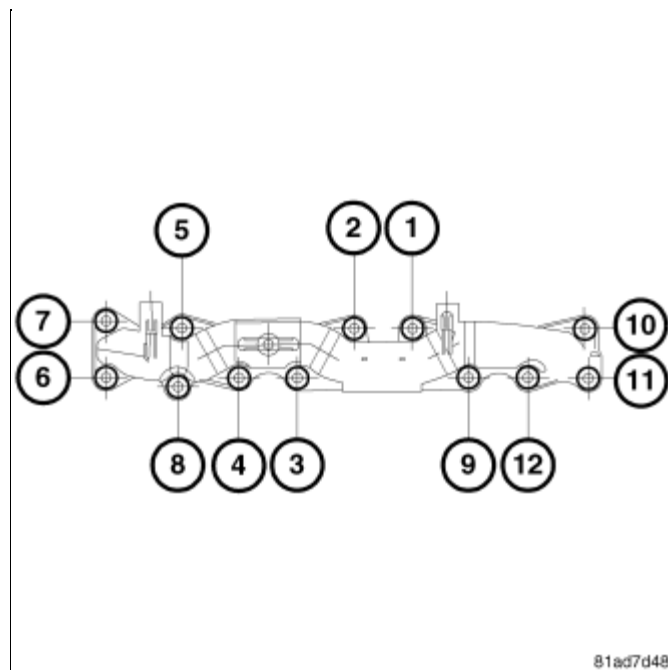
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58. Install the exhaust manifold gasket (3).



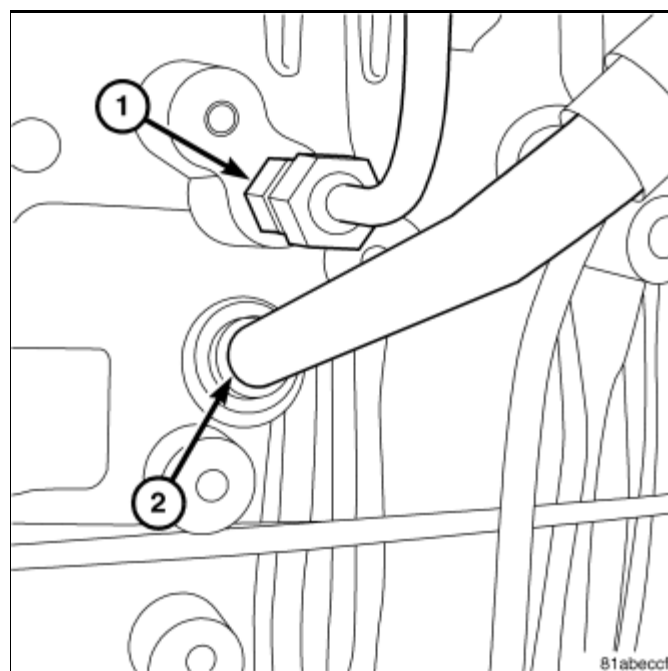
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59. Install the exhaust manifold using the torque sequence shown. Torque the bolts to 35 nm (29 lbs. ft.)
 60. Repeat the tightening procedure.



81ad7d48

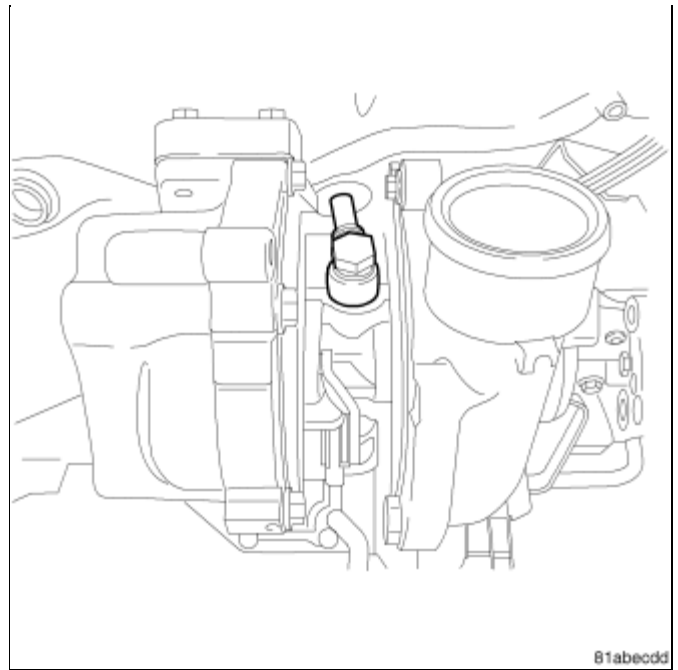
61. Install the turbocharger oil lines to the engine block. Torque the bolt to 32 Nm (23 lbs. ft.).



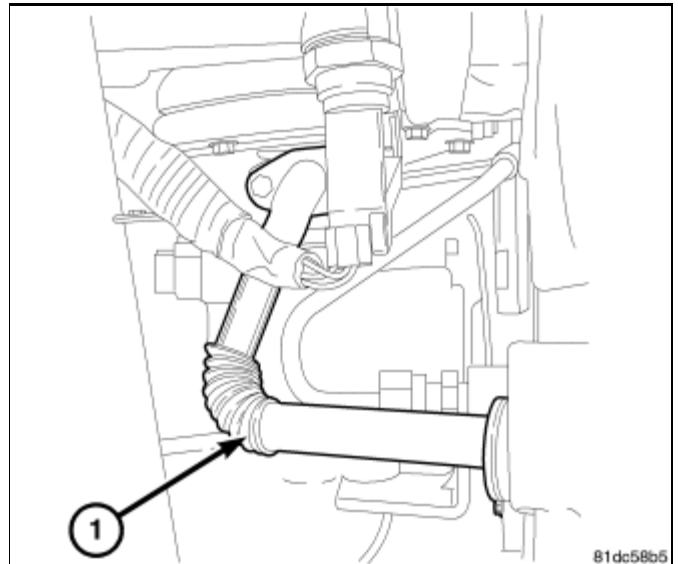
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62. Install the turbocharger nuts and torque to 32 Nm (23 lbs. ft.).

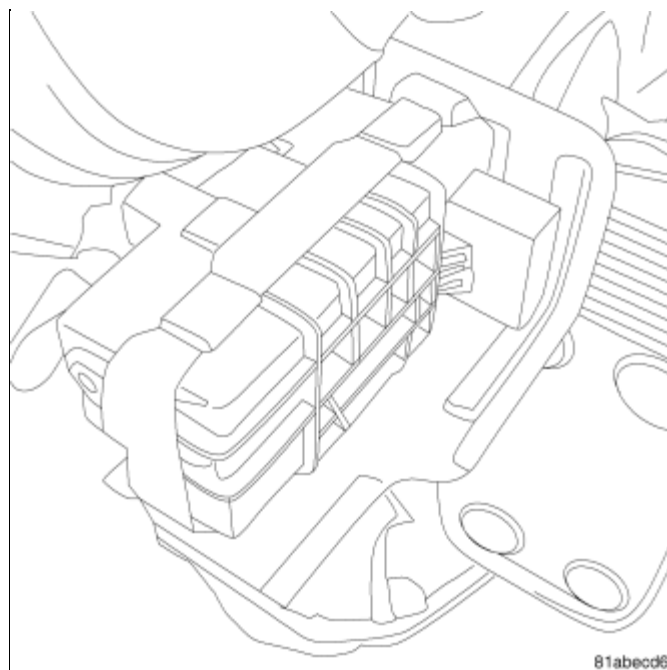
63. Install the turbocharger oil feed line. Torque the oil feed line bolt to 24 Nm (18 lbs. ft.).



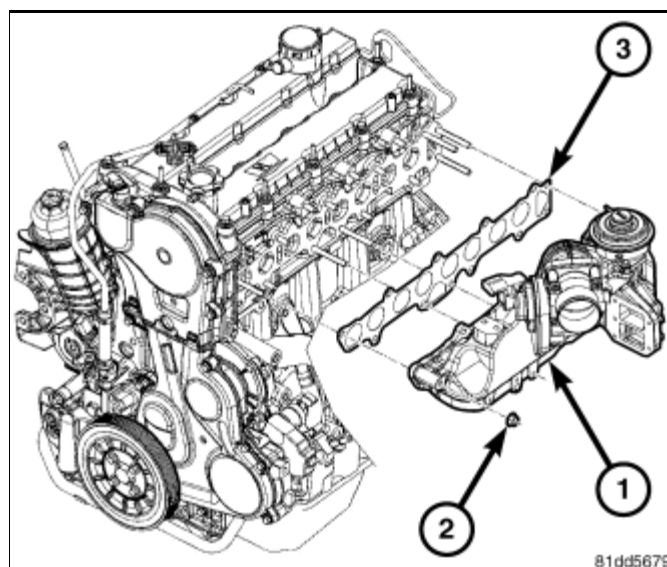
64. Install the turbocharger oil return line. Torque the oil return line bolts to 15 Nm (133 lbs. in.).



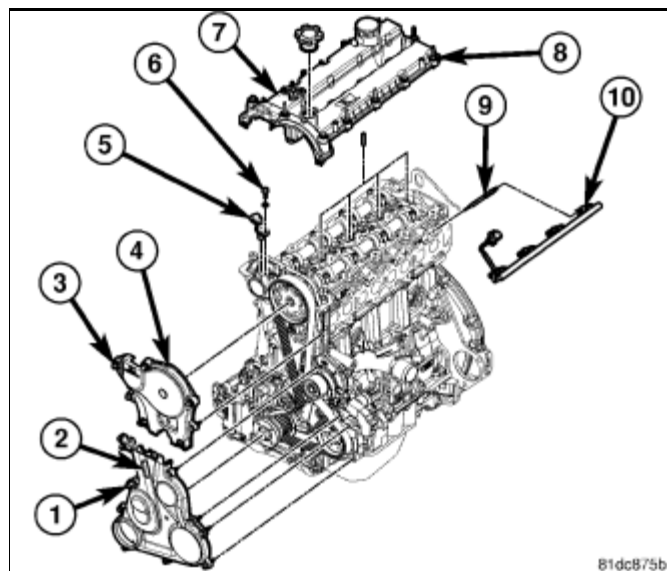
65. Connect the boost pressure solenoid harness connector.



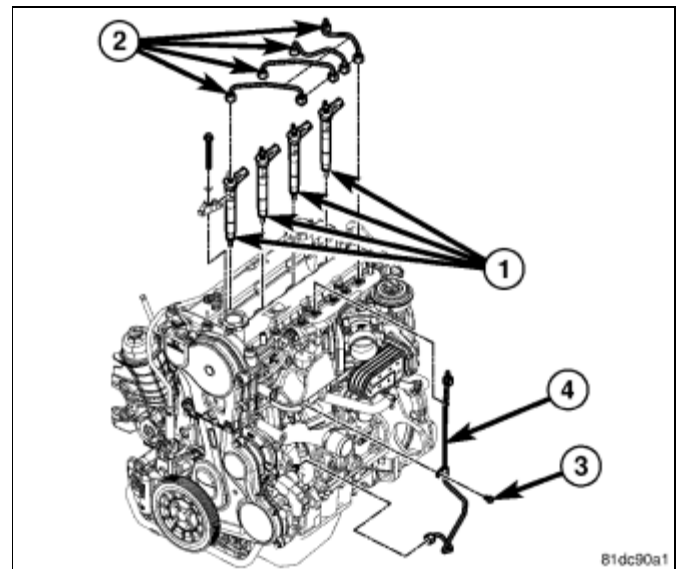
66. Install the intake manifold gasket (3).
67. Install the intake manifold (2).
68. Install the intake manifold fasteners (2). Torque the intake manifold bolts to 25 Nm (19 lbs. ft.).
69. Repeat the tightening procedure.



70. Reposition the glow plug harness (10), and reconnect the glow plug harness connectors.



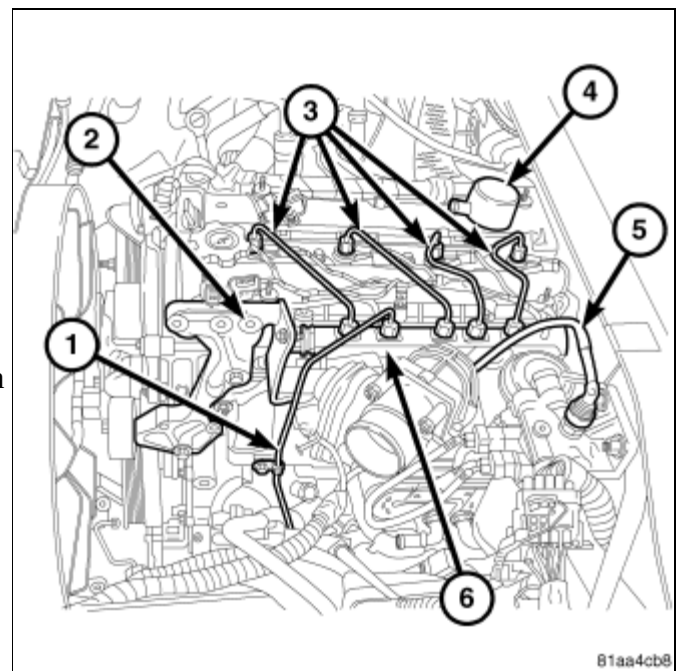
71. Install injectors and injector retainer claw and washer.
72. Install the injector clamp bolts. Do not tighten at this time.



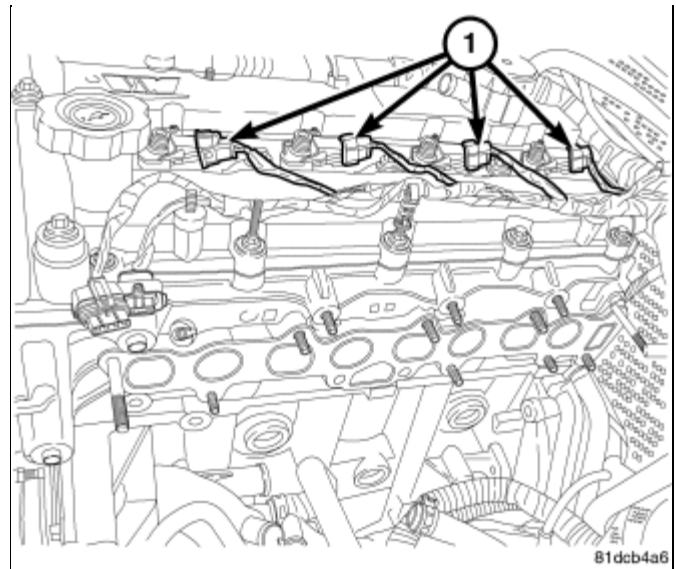
73. Install the fuel rail (6). Do not tighten fuel rail retainers at this time.

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed.

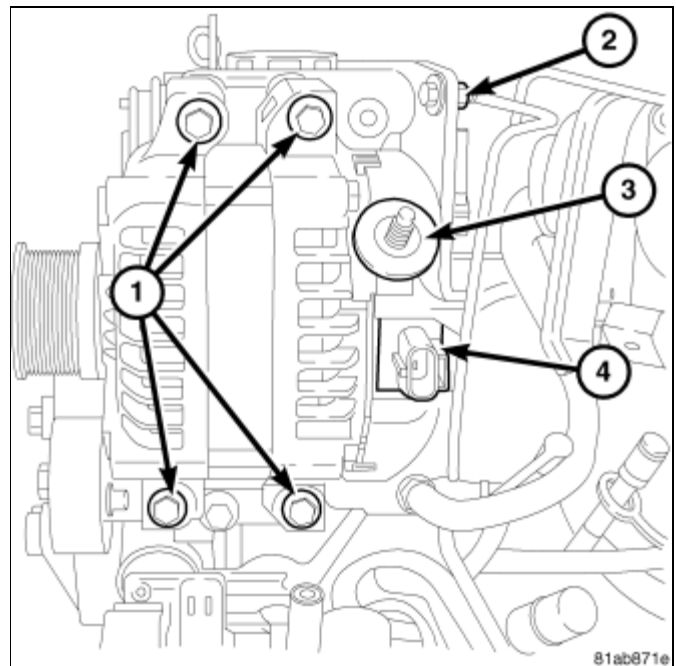
74. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.
75. Loosely install the high pressure fuel feed line to the high pressure pump and the fuel rail.
76. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).
77. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).
78. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).
79. Torque the fuel lines to at the fuel rail to 20 Nm (14.75 Ft lbs).
80. Torque the high pressure line at the fuel pump to 28 Nm (20 ft lbs).
81. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



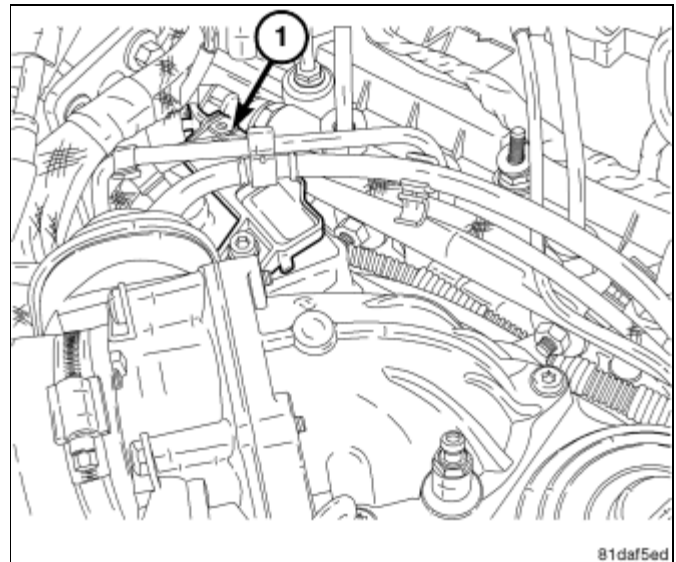
82. Connect the fuel injector harness connectors (1).
83. Connect the fuel pressure solenoid harness connector.
84. Connect the fuel rail pressure sensor harness connector.



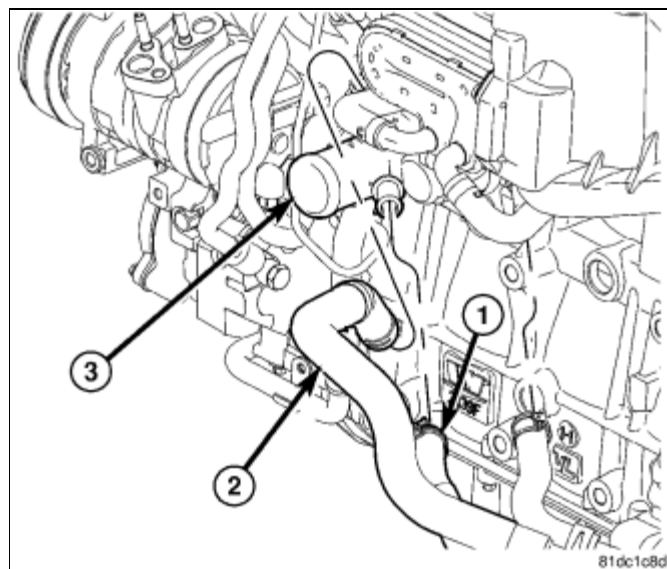
- 85. Install the generator bracket. Torque the bolts to 45 Nm (33 lbs. ft.).
- 86. Install the generator. Torque the bolts to 33 Nm (24 lbs. ft.).
- 87. Connect the generator connectors (4).
- 88. Connect the generator feed wire (3).



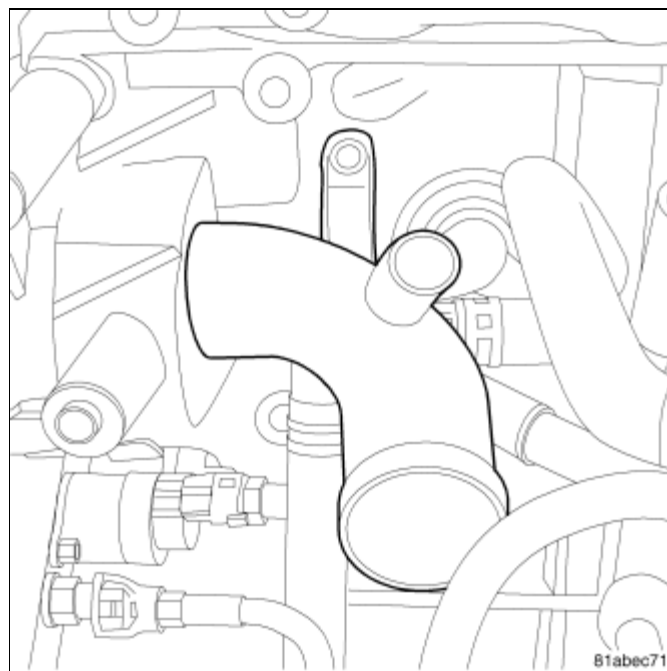
- 89. Install the intake air pressure and temperature sensor (1).
- 90. Connect the intake air pressure and temperature sensor harness connector (1).
- 91. Install the generator brace bolt (2).
- 92. Install the EGR airflow valve assembly.



93. Install the thermostat housing (3).

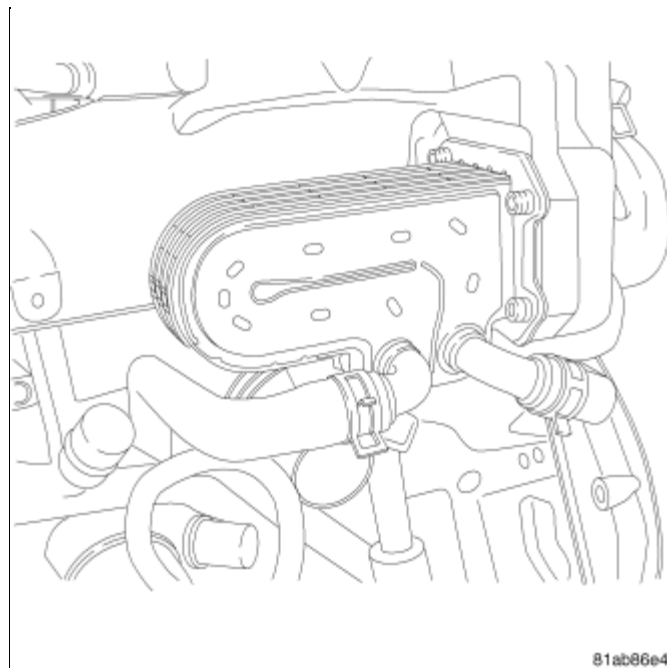


94. Connect the coolant lines from the thermostat housing.

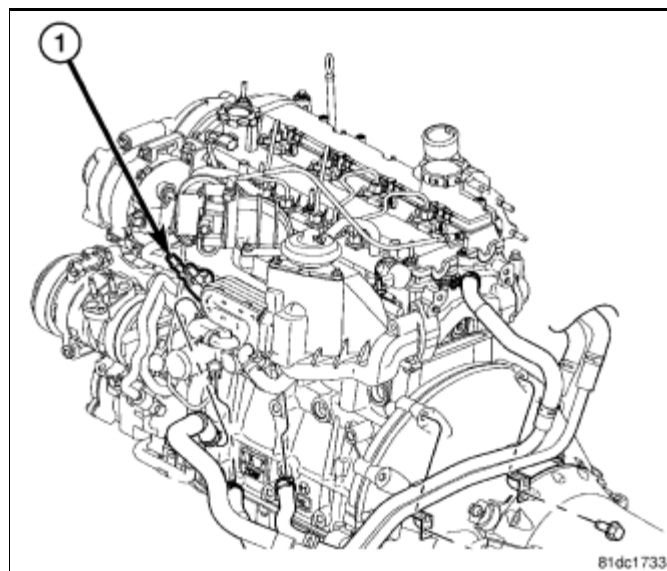


95. Install the EGR cooler. Torque the bolts to 15 Nm (132 lbs. in.)

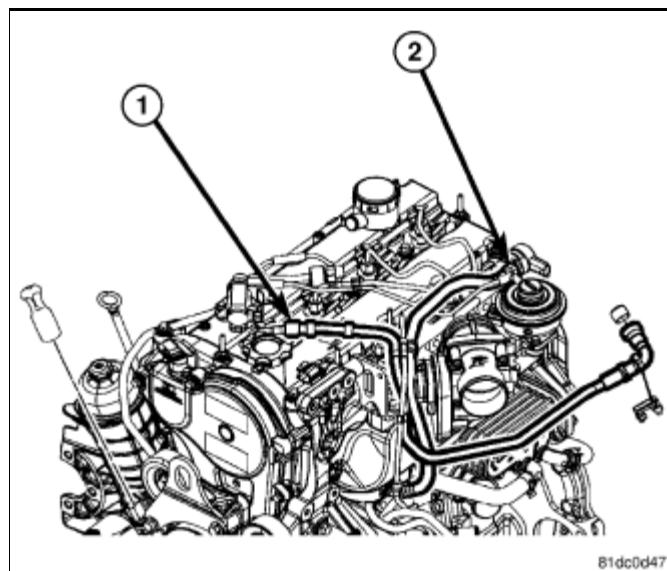
96. Install the EGR cooler coolant lines.



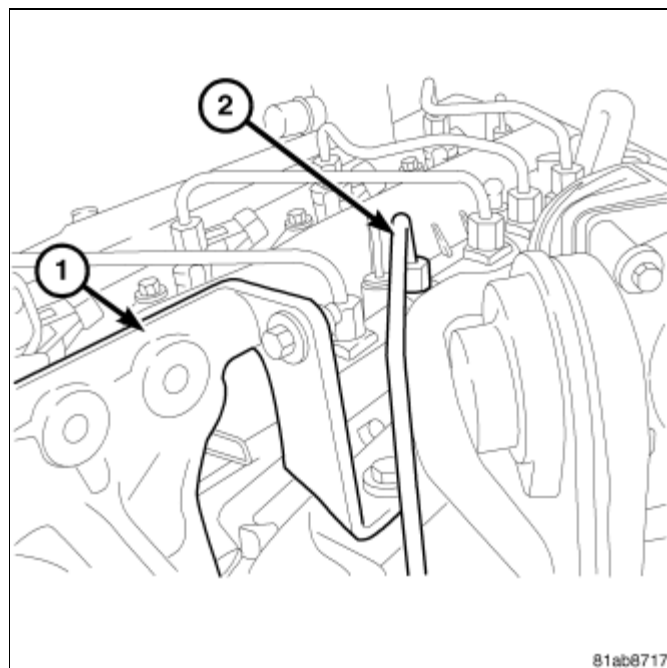
97. Install the fuel block (1).



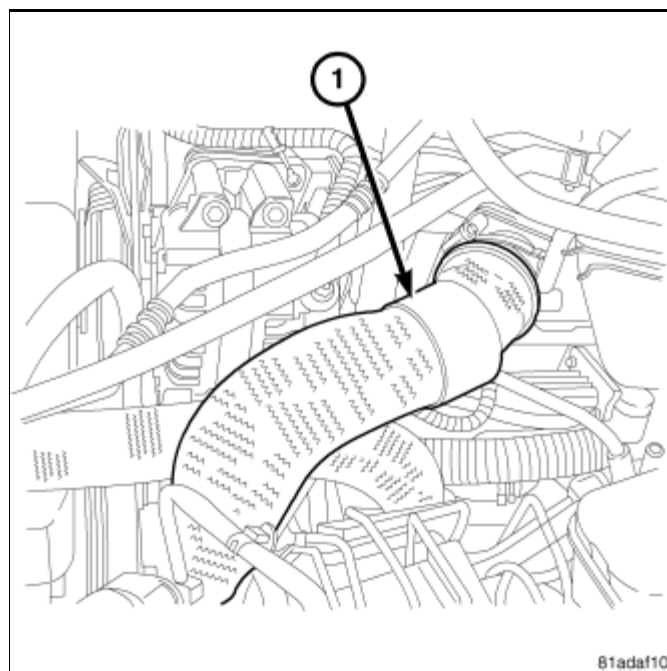
98. Connect the fuel return lines (1) and (2).



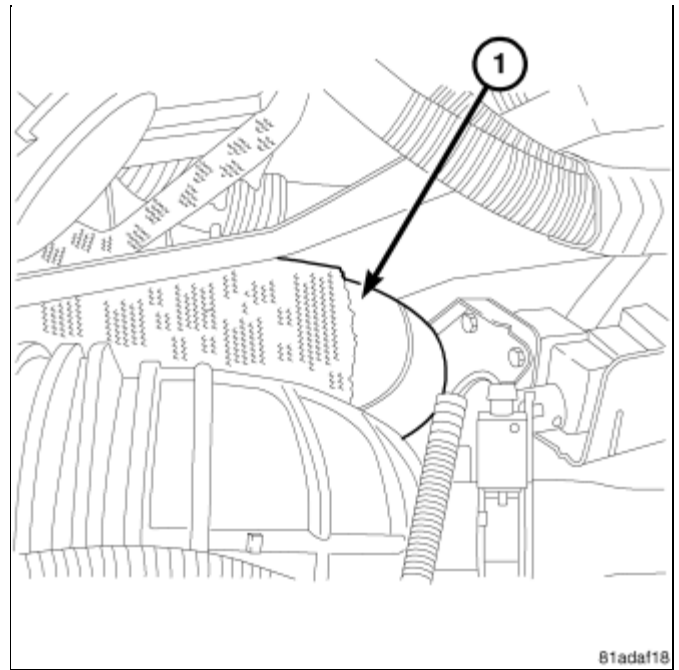
99. Install the support bracket bolt to the generator bracket (1).



100. Install the charge air cooler inlet hose.



101. Install the charge air cooler outlet hose.



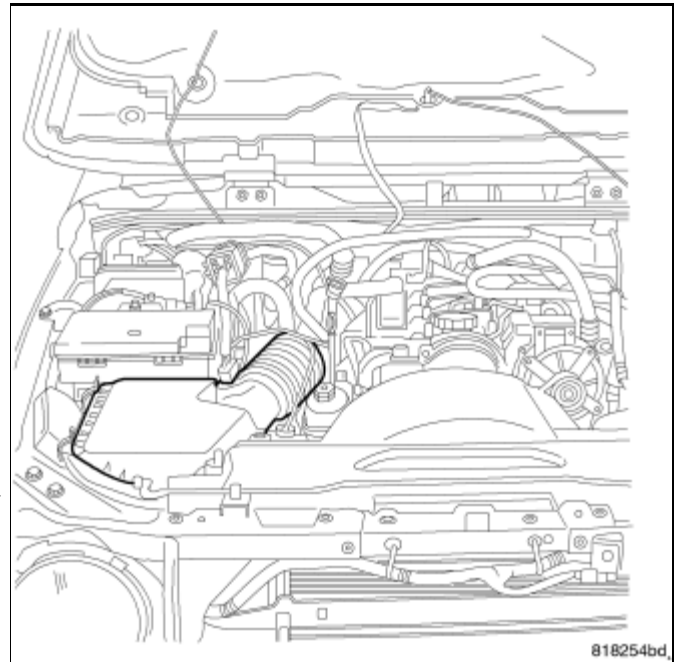
81adaf18

- 102. Install the accessory drive belt.
- 103. Install the intake air housing.
- 104. Fill the cooling system.
- 105. Connect the battery.

SEAL(S)-CAMSHAFT OIL

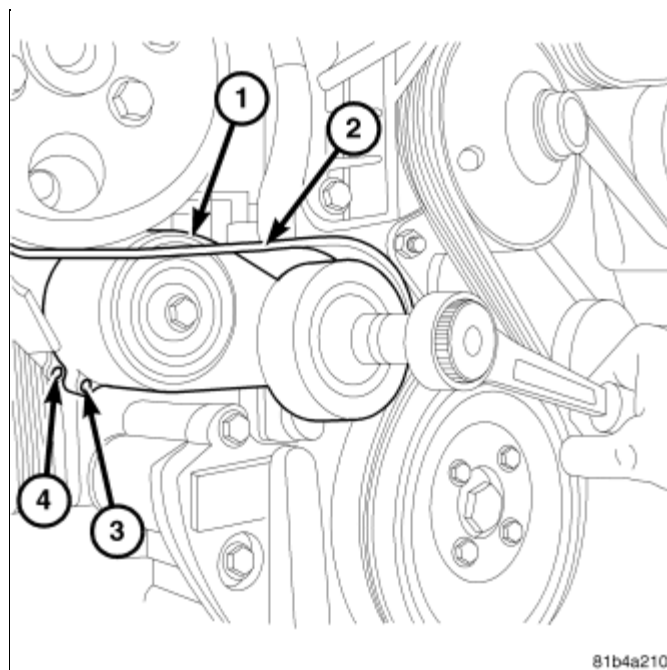
REMOVAL

- 1. Disconnect negative battery cable.
- 2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL) .

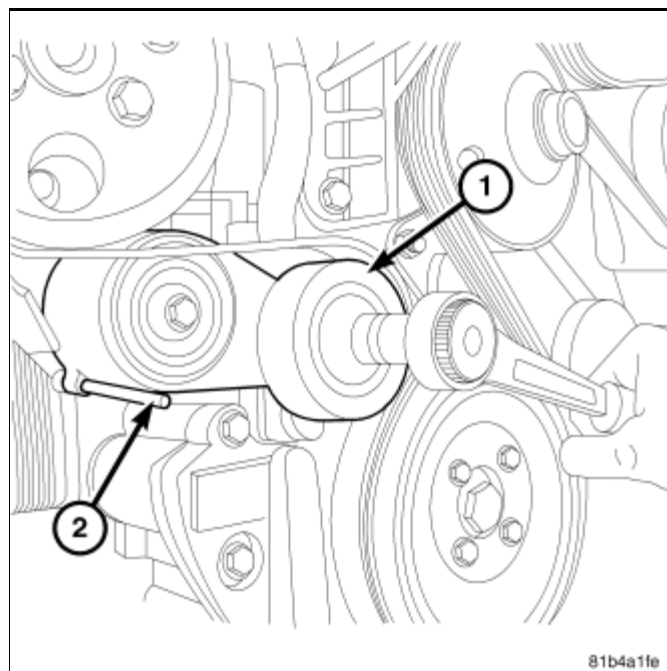


818254bd

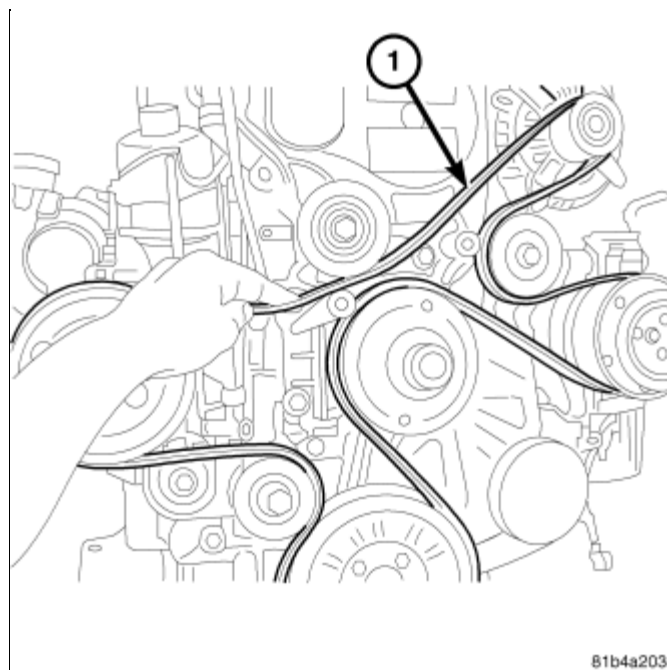
- 3. Loosen the accessory drive belt tension by rotating the accessory drive belt tensioner until holes 3 and 4 are lined up.



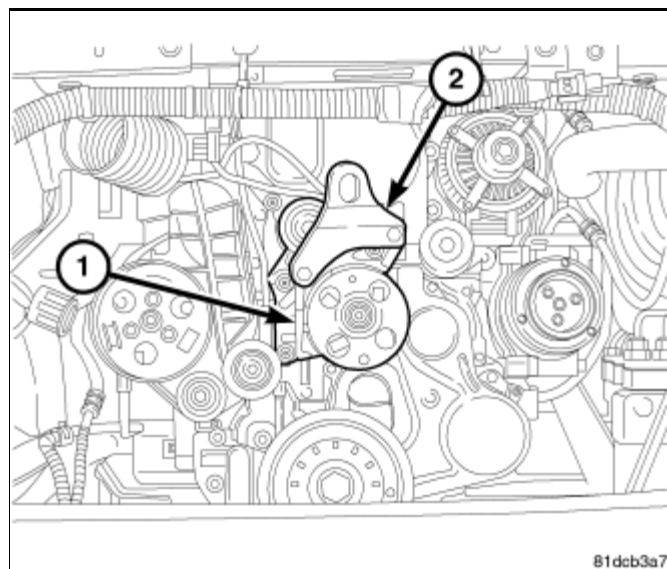
4. When the holes in the accessory drive belt tensioner are aligned, use a drift to lock the tensioner in place.



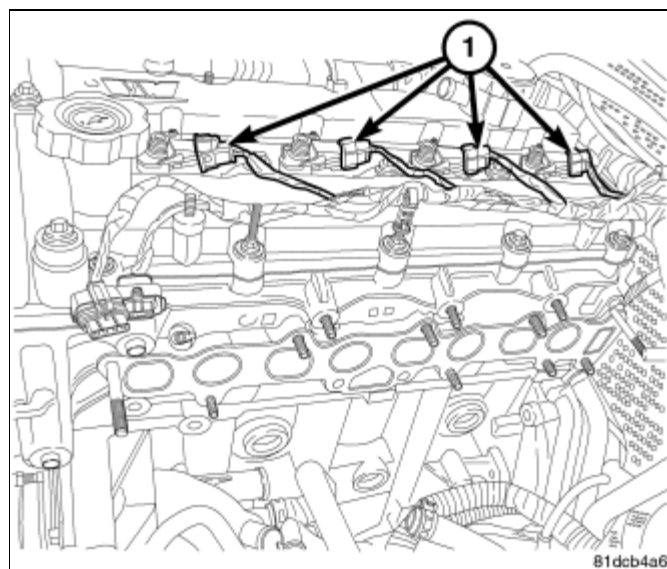
5. Remove the accessory drive belt.



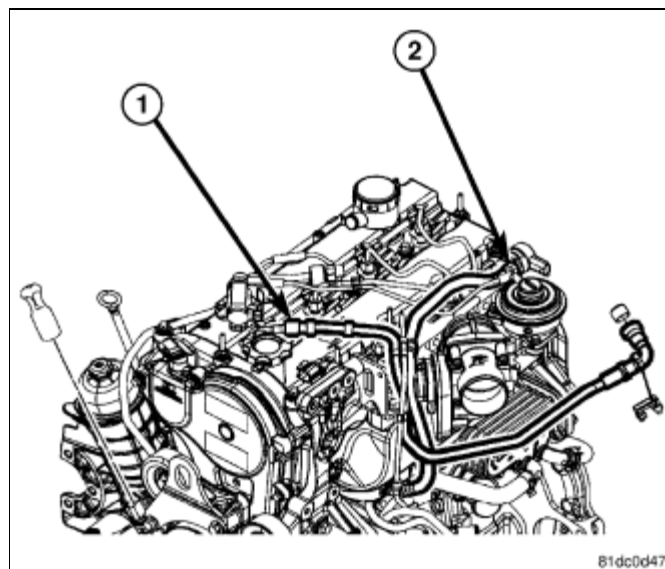
6. Remove the front engine lifting bracket (2) and the idler pulley and cooling fan pulley bracket assembly (1).



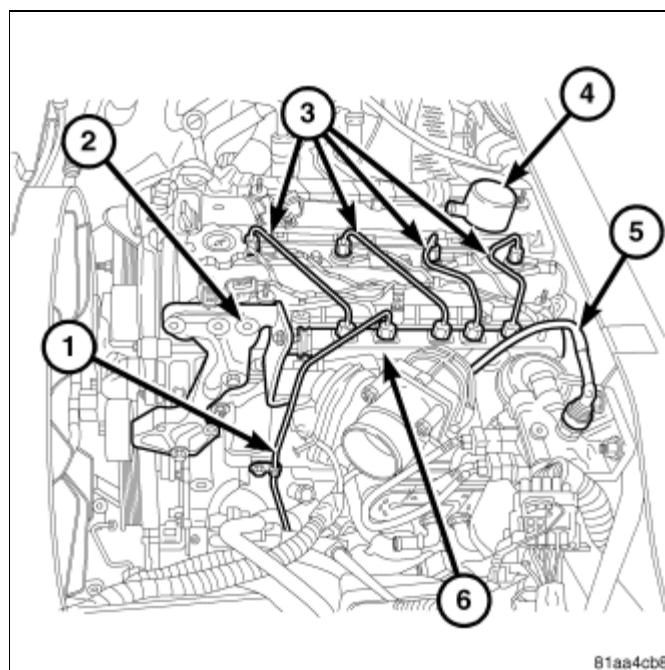
7. Disconnect the fuel injector harness connectors (1) from the fuel injectors.



8. Disconnect the fuel return lines (1) and (2).

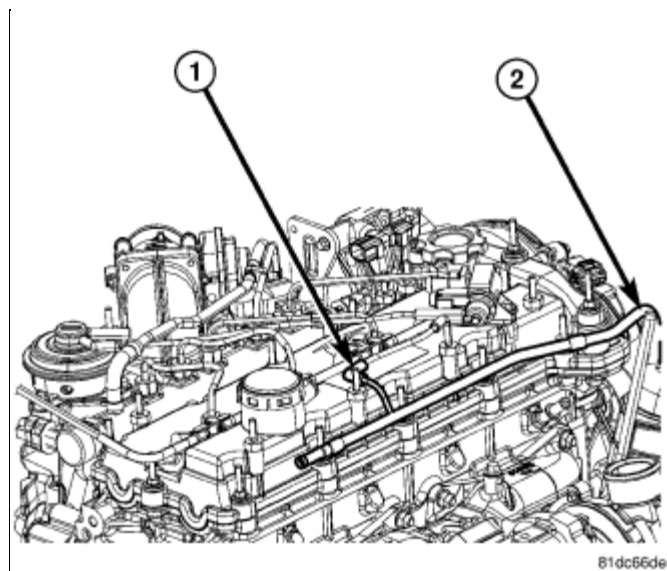


9. Disconnect the crankcase vent hose from the oil separator (4).

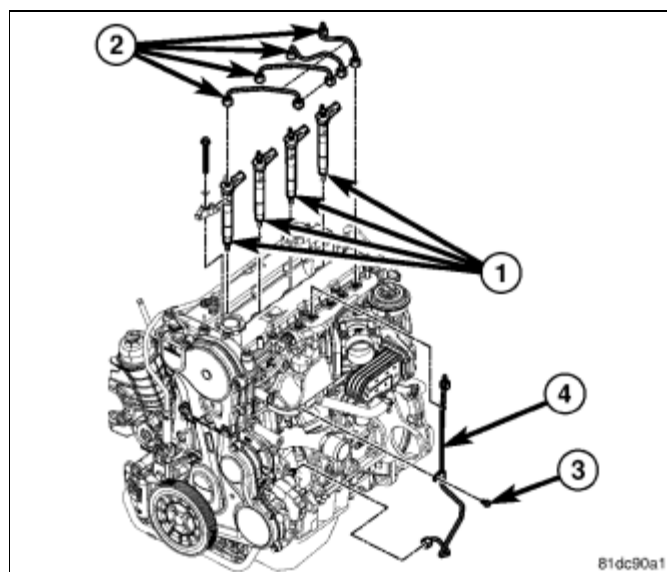


10. Disconnect the vacuum line (1) from the fitting on the cylinder head cover.

11. Disconnect the vacuum supply tube (2).

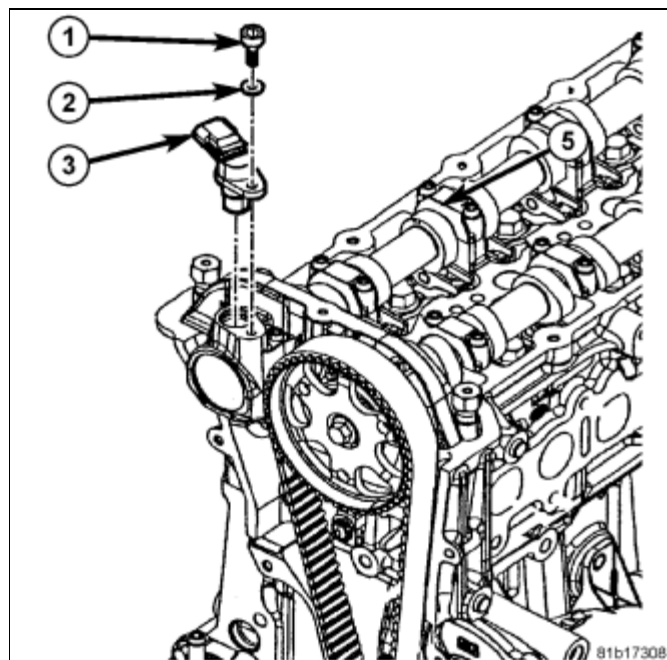


12. Remove the fuel lines (2) from the injectors and the fuel rail, and remove the fuel injectors (1).

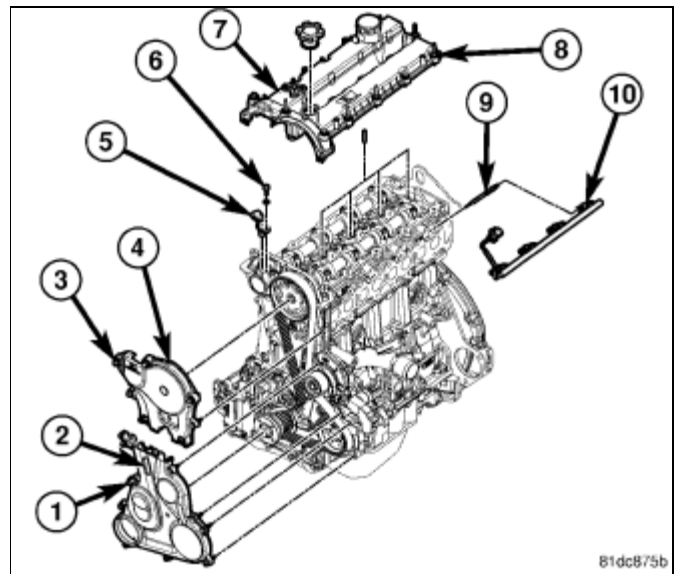


13. Disconnect the Camshaft Position Sensor (CMP) harness connector.

14. Remove the camshaft position sensor (3).

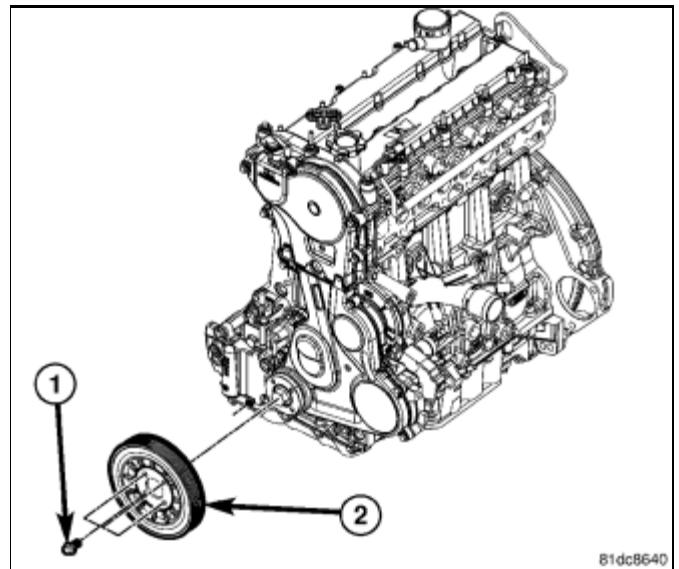


15. Remove the five bolts (3) and the upper front timing belt cover (4).
16. Remove the twelve fasteners (8) and the cylinder head cover (7).

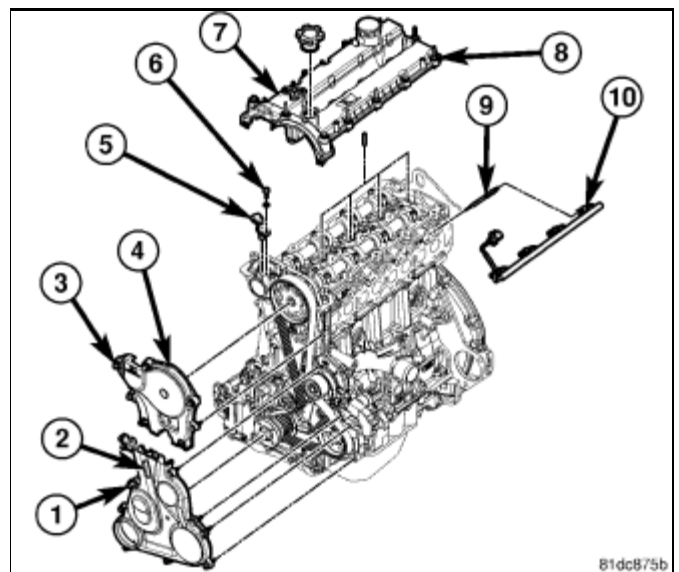


NOTE: The crankshaft sprocket bolt is a L.H. thread.

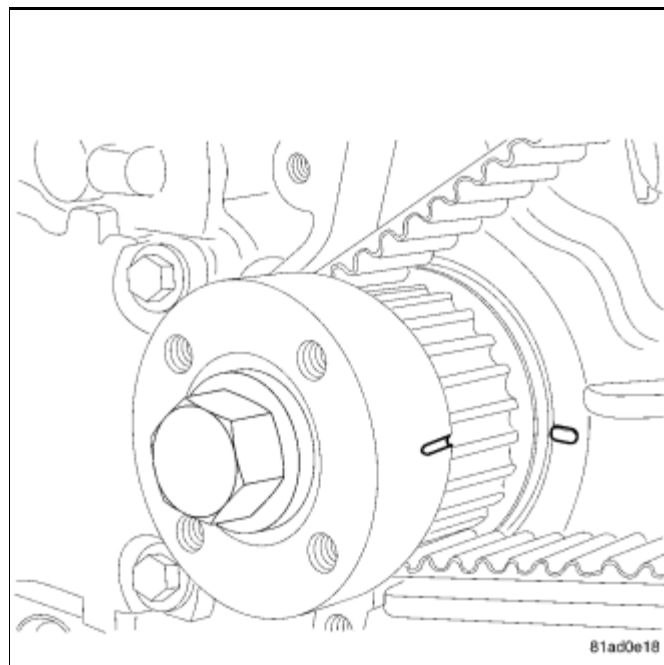
17. Remove the crankshaft damper bolts (1), and the crankshaft damper (2).



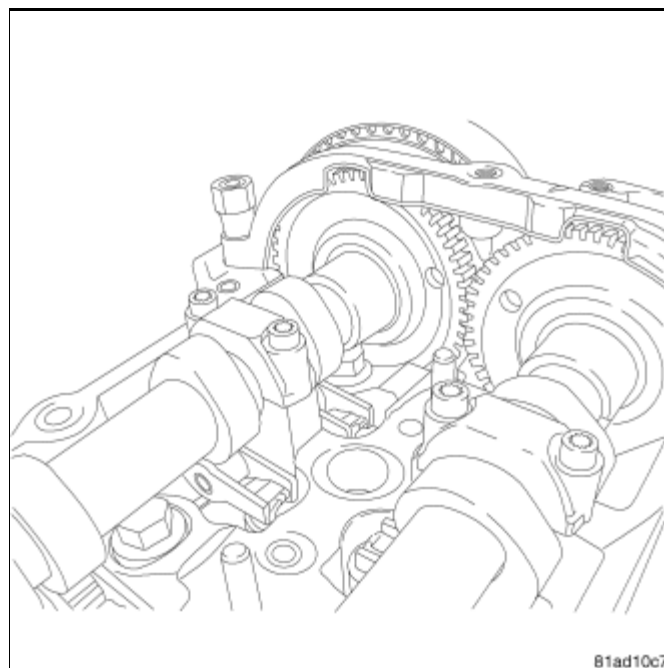
18. Remove the nine fasteners (1), and lower front cover (2).



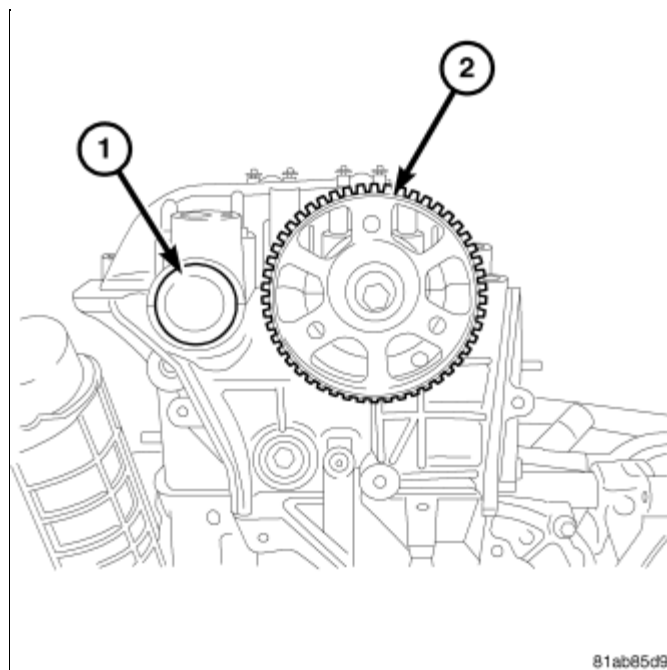
19. Rotate the engine by hand until the crankshaft 90° ATDC marks are aligned.



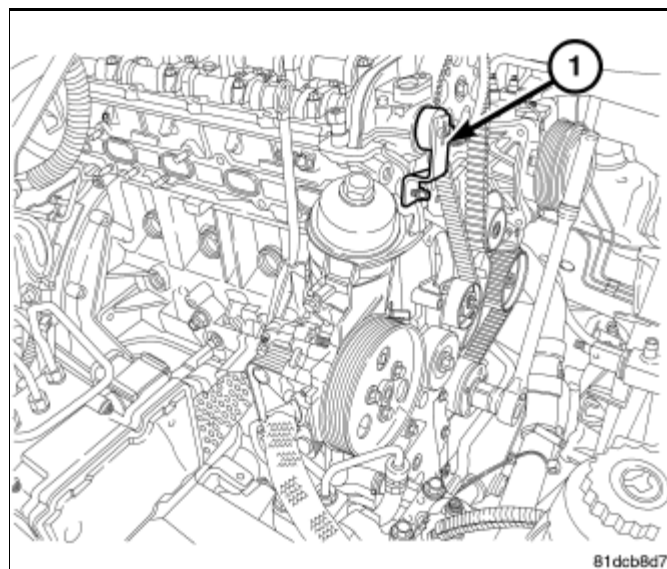
20. Verify the camshaft timing alignment holes on the camshaft gears are aligned horizontally.



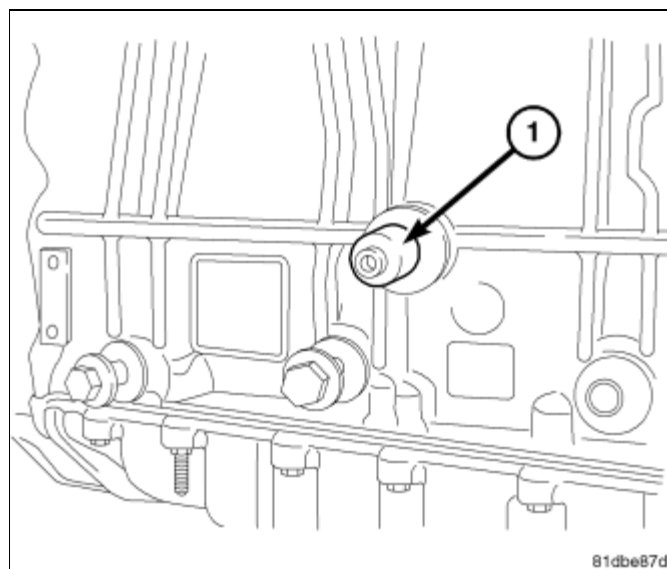
21. Remove the exhaust camshaft cap (1).



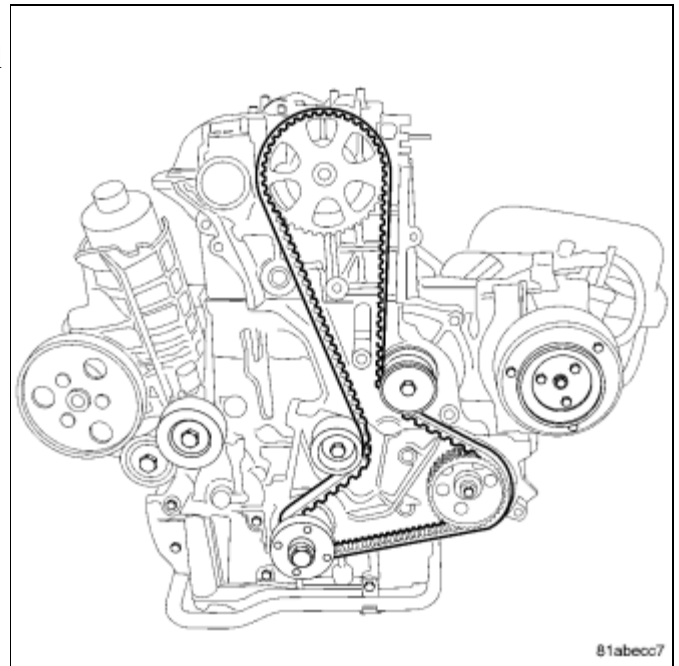
22. Install the camshaft locking tool VM 9991 (1).



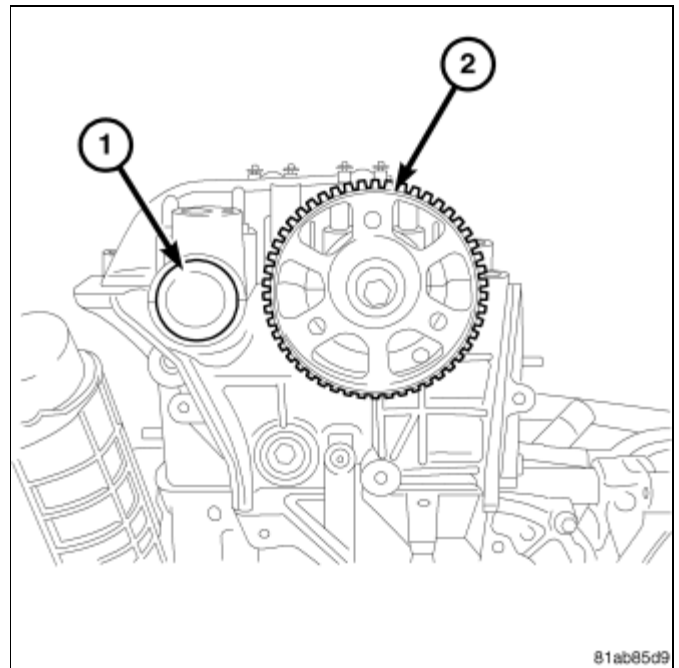
23. Install the crankshaft locking tool VM 9992 (1).



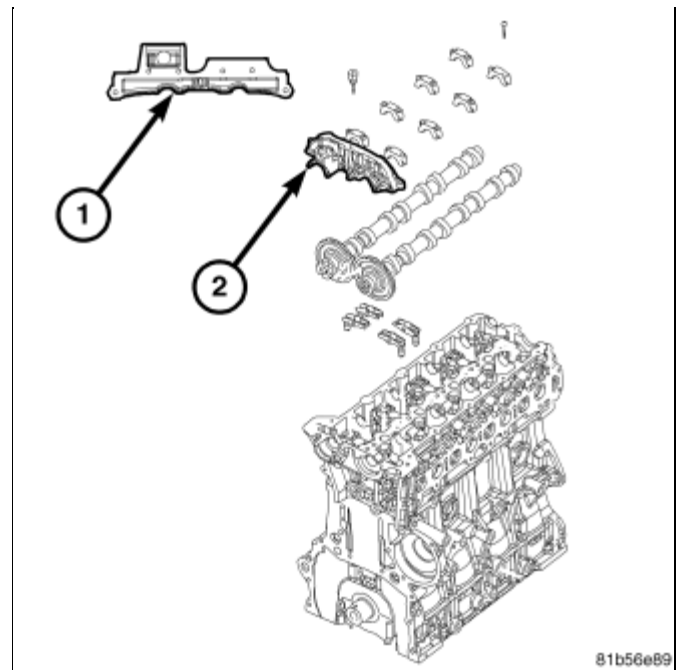
24. Loosen the timing belt tensioner bolt, release tension, and remove the timing belt.



25. Remove the intake camshaft sprocket (2) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

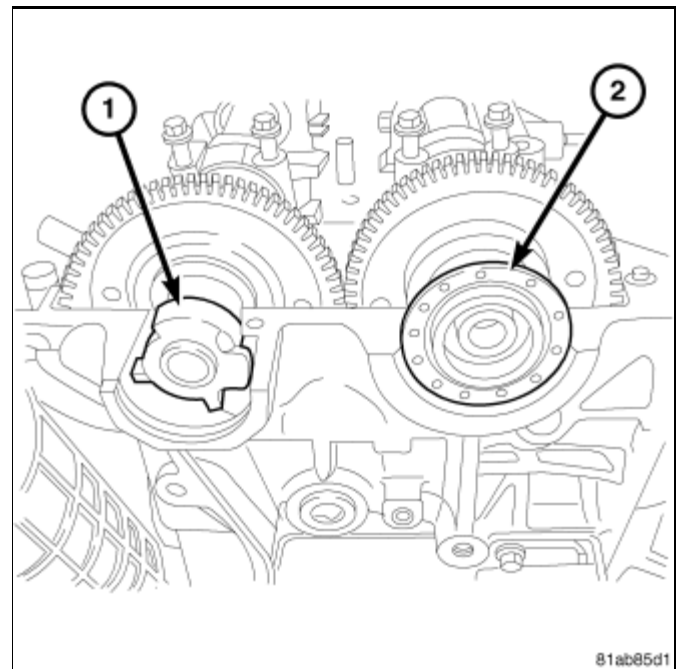


26. Remove the front camshaft bearing journal (2).

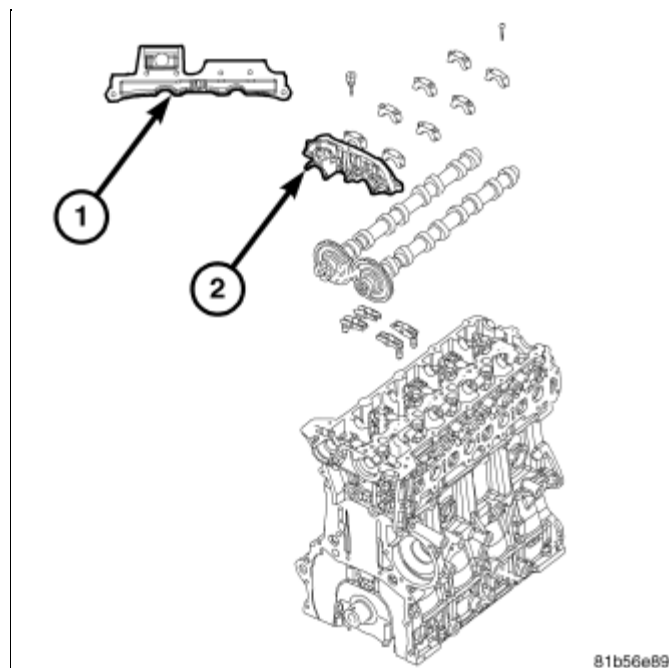


27. Remove the intake camshaft oil seal (2).

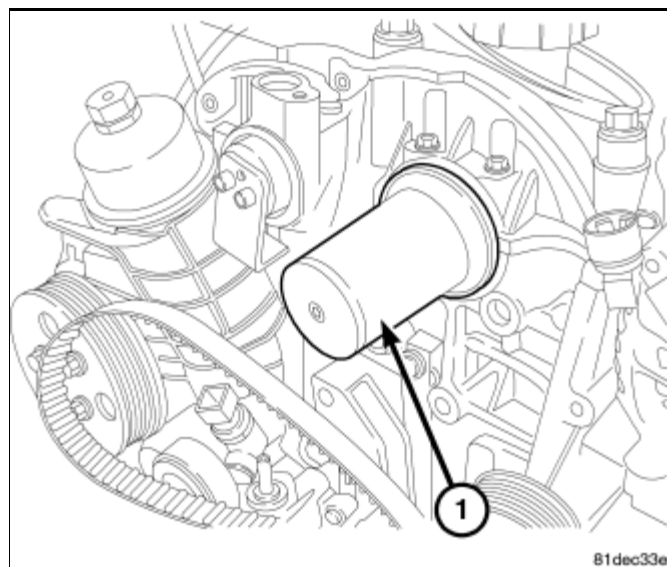
INSTALLATION



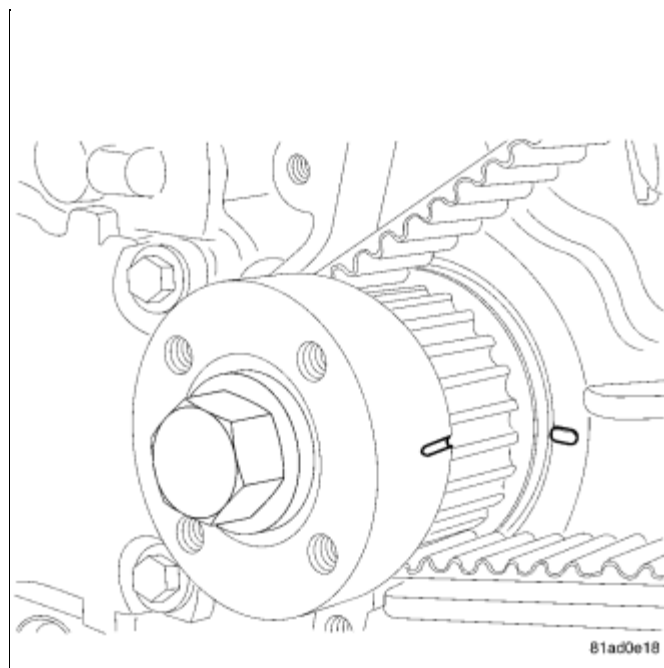
1. Apply a thin bead of Loctite 510 to the front camshaft bearing journal (2) in the location shown (1).
2. Install the front camshaft bearing journal (2). Tighten bolts to 11 Nm (8 lb. ft).



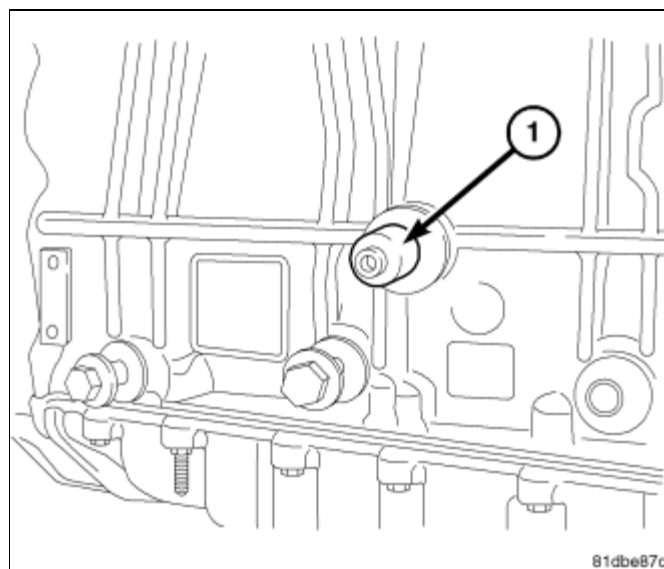
3. Use the 9973-1 seal installer (1) to install the intake camshaft oil seal.



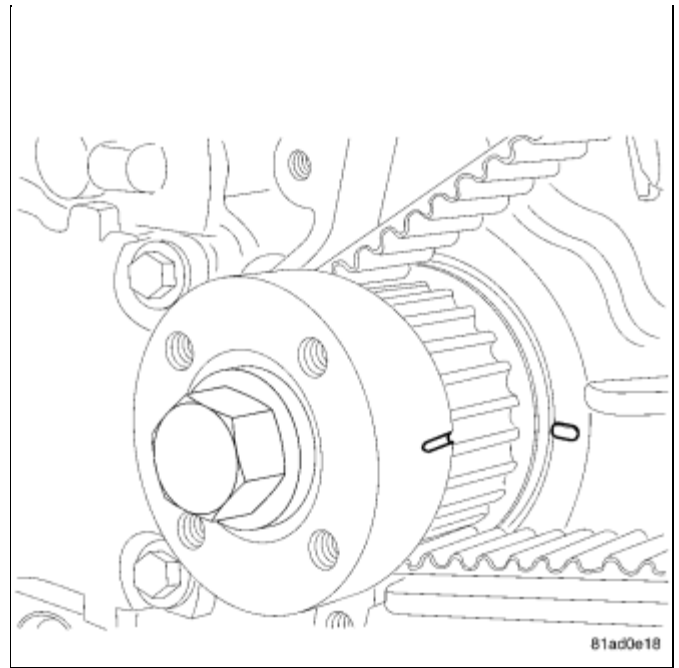
4. If the crankshaft locking tool was removed for any reason, re-align the 90° ATDC marks on the crankshaft timing belt drive sprocket and rear timing belt cover.



5. If necessary, install the crankshaft locking tool (1).



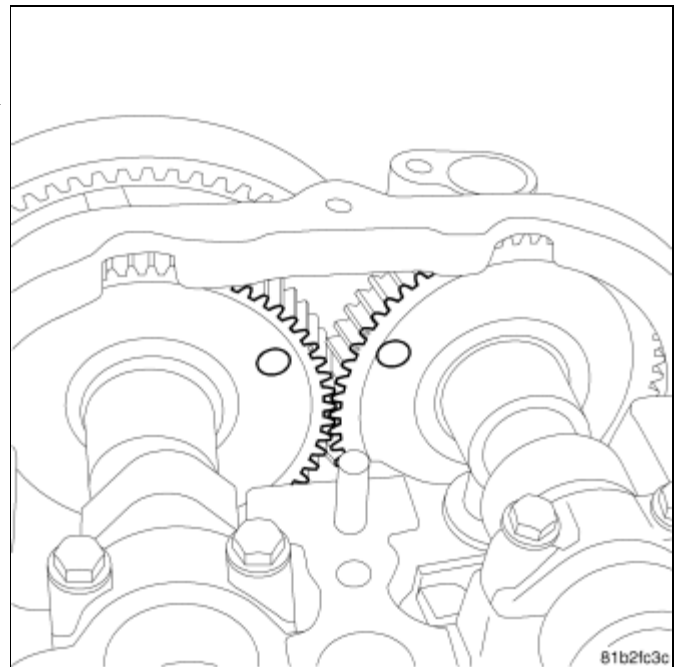
6. With the crankshaft locking pin installed, verify the 90° ATDC marks on the crankshaft timing belt drive sprocket and rear timing belt cover are aligned. Otherwise, damage to the engine can occur during installation of the timing belt.



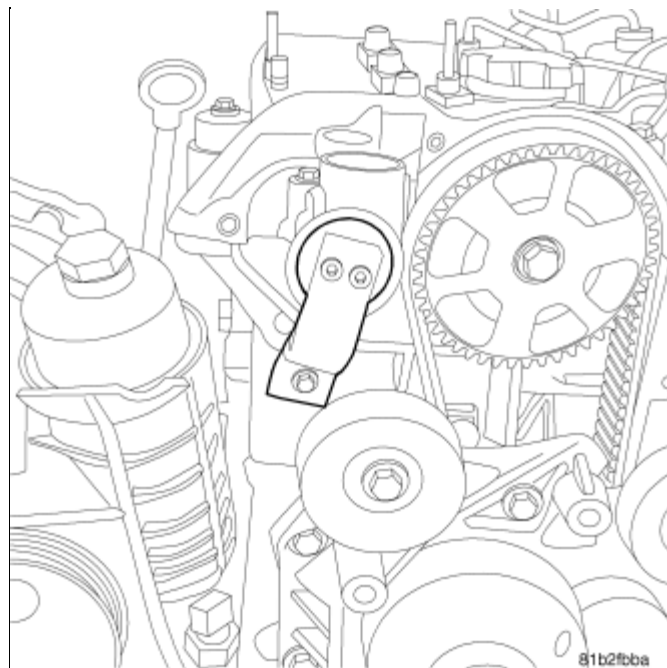
7. Make sure the camshafts are correctly timed in relation to each other by rotating the camshafts until the dots on the cam gears line up as shown.

NOTE: The camshafts are correctly timed to each other when the dots line up as shown. Use the camshaft locking tool to set and lock the camshafts to 90° ATDC during timing belt installation.

8. If the camshaft dots line up, rotate the camshafts until the camshaft locking tool can be installed.

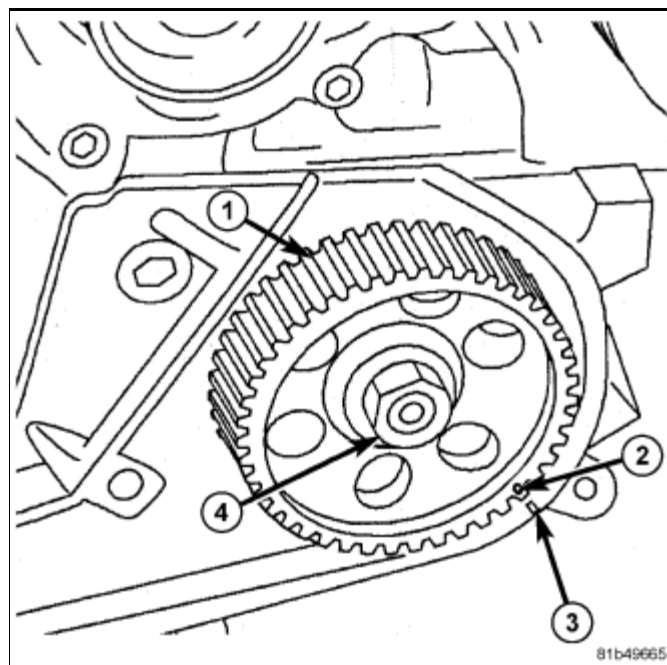


9. Make sure that the camshaft locking tool is correctly installed, and the camshafts are locked in position.



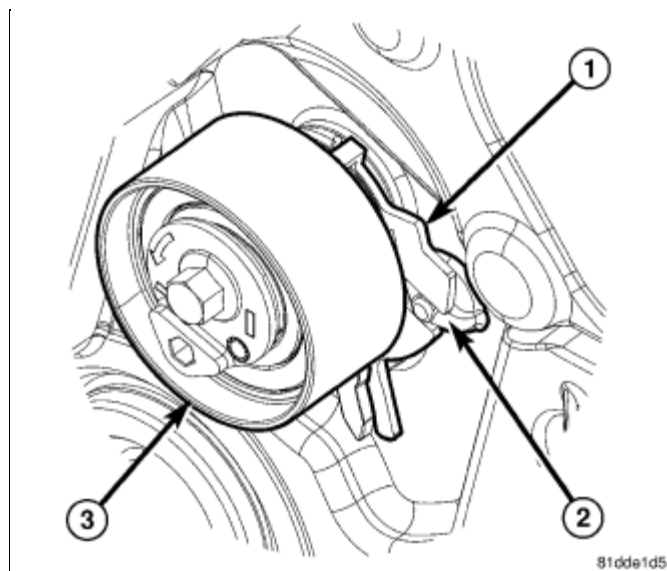
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10. Align the high pressure fuel pump sprocket timing mark (2) with the timing mark (3) on the block.

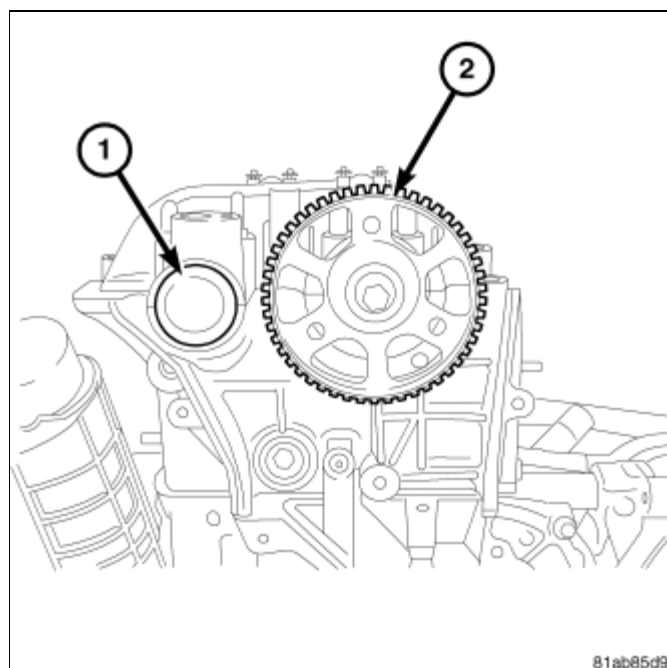


81b49665

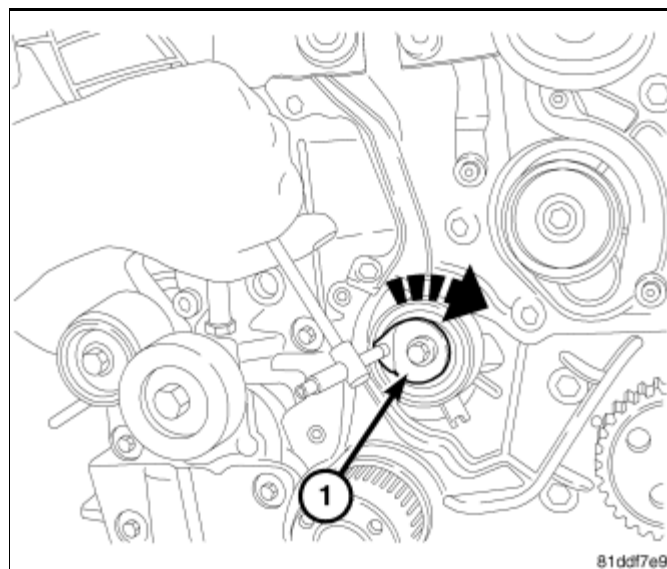
11. Install the timing belt tensioner (3). Do not tighten at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.



12. Install the camshaft sprocket (2). Do not tighten the bolt at this time.

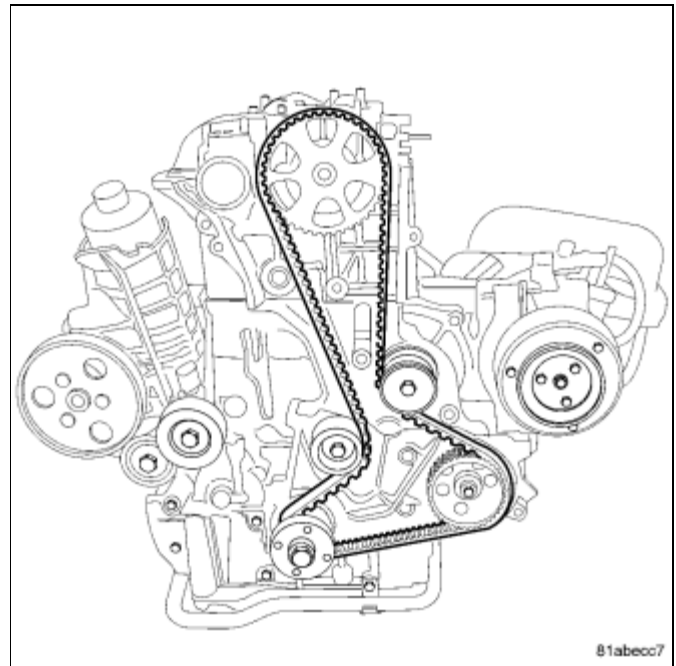


13. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed.

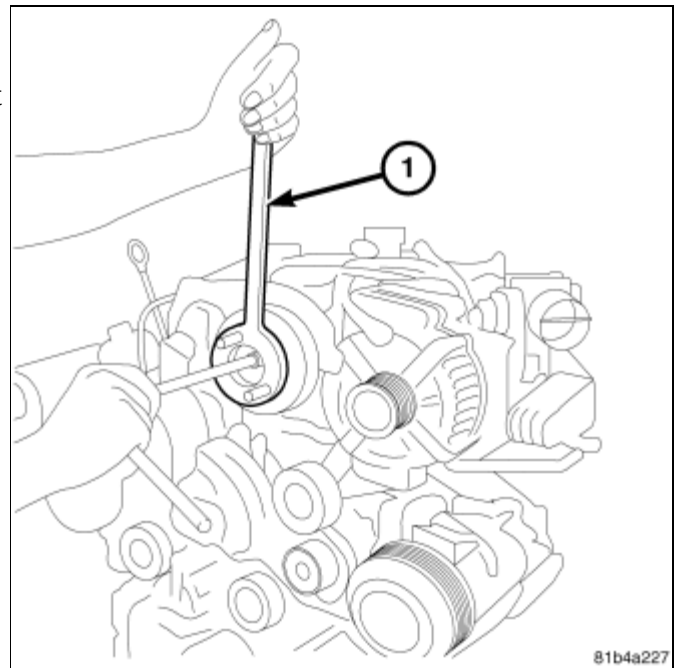


NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

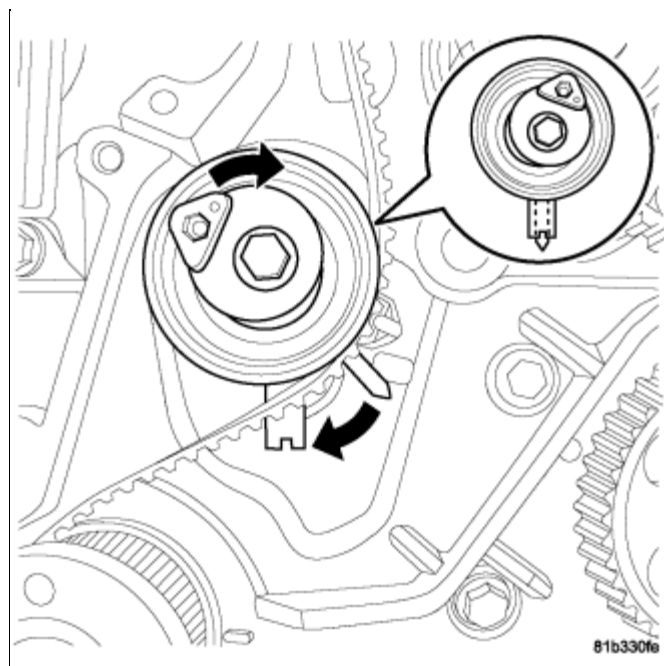
14. Install timing belt.



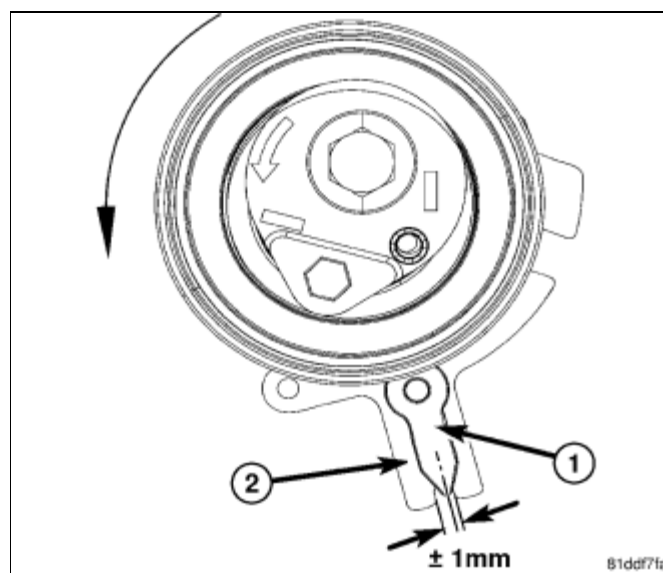
15. Use VM 1055 Gear Holder (1) to hold the camshaft sprocket while torquing. Torque the intake camshaft sprocket bolt to 64 Nm (47 lbs. ft.)



16. Adjust timing belt tensioner by lining up the arrow and the notch as illustrated.

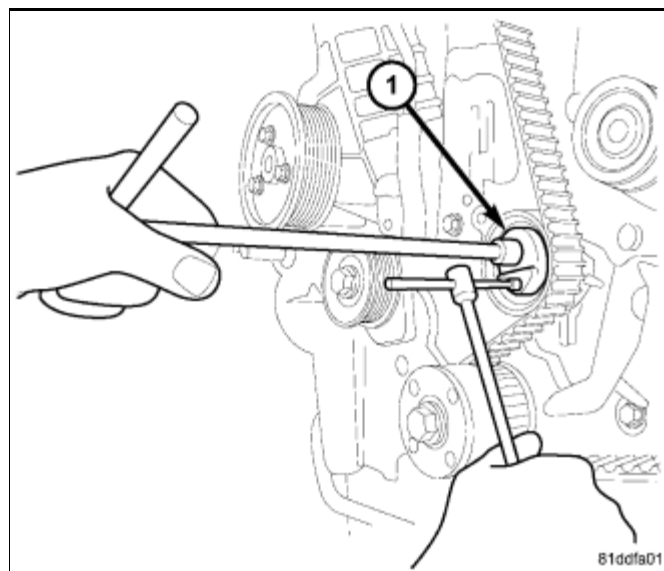


17. Verify the tensioner load indicator (1) is centered in the tensioner load gage (2).

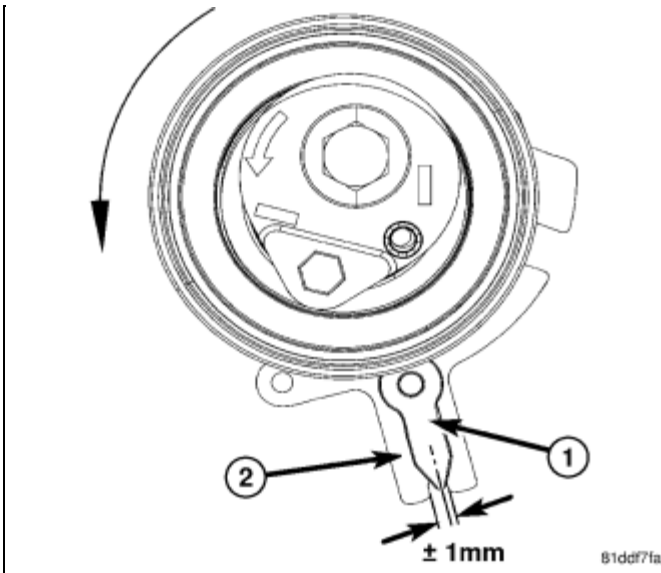


18. Tighten the timing belt tensioner bolt to 28 Nm (21 lb ft).

19.
Verify
the
tensioner
load
indicator
(1) is still
centered
in the
tensioner

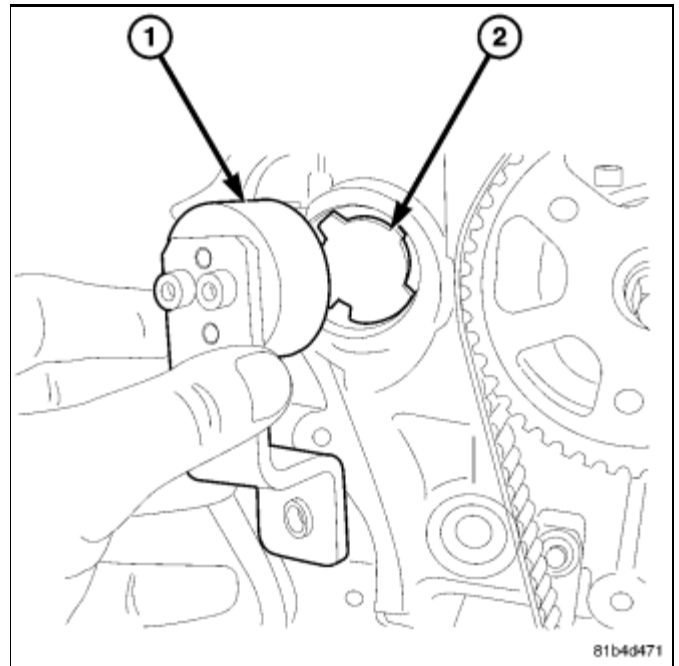


load gage
(2). If the
indicator
is not
centered

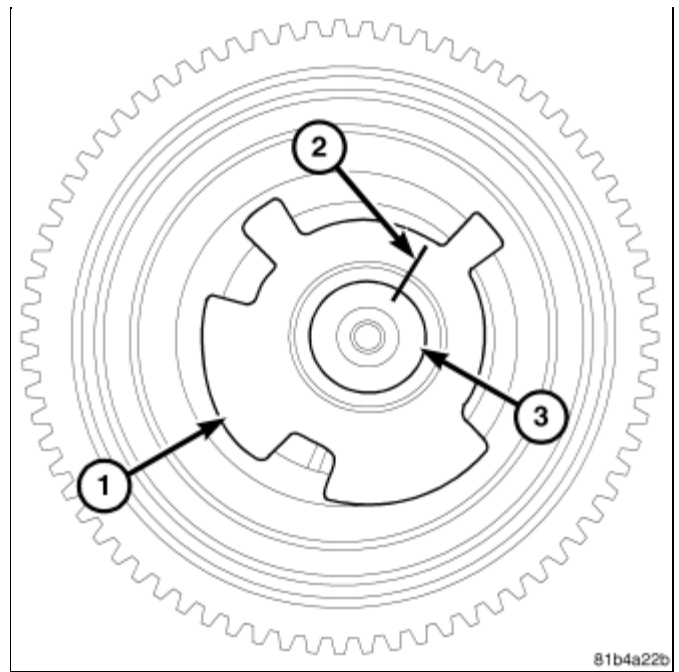


in the gage as shown, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

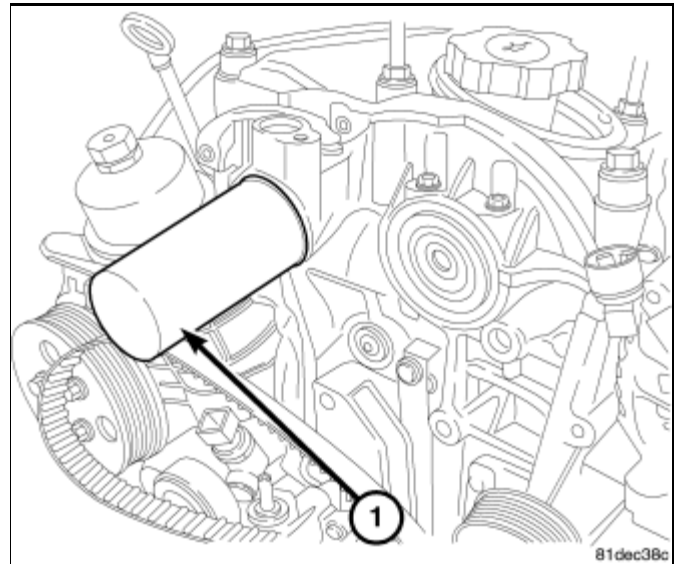
20. Remove the camshaft locking tool (1).



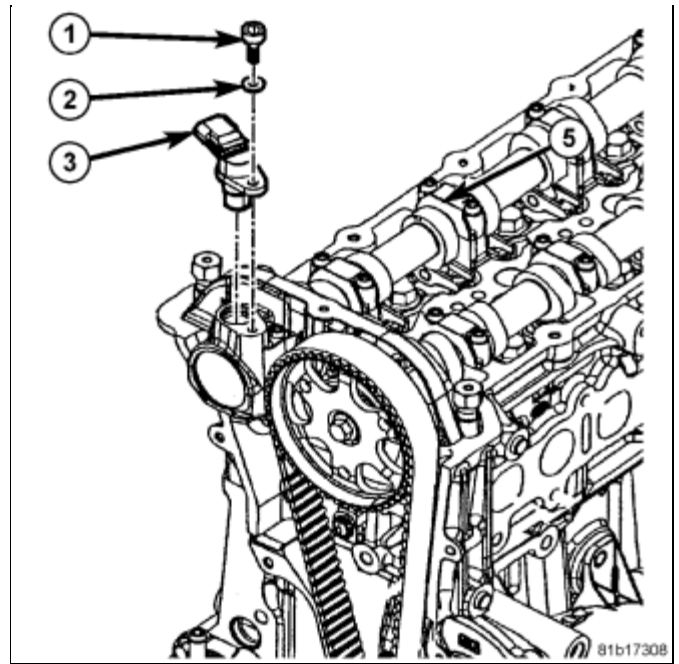
21. Verify that the reluctor wheel (1) has not moved on the camshaft. If the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, replace the camshaft.



22. Use VM 1057-2 Seal Installer (1) to install the exhaust camshaft oil seal.

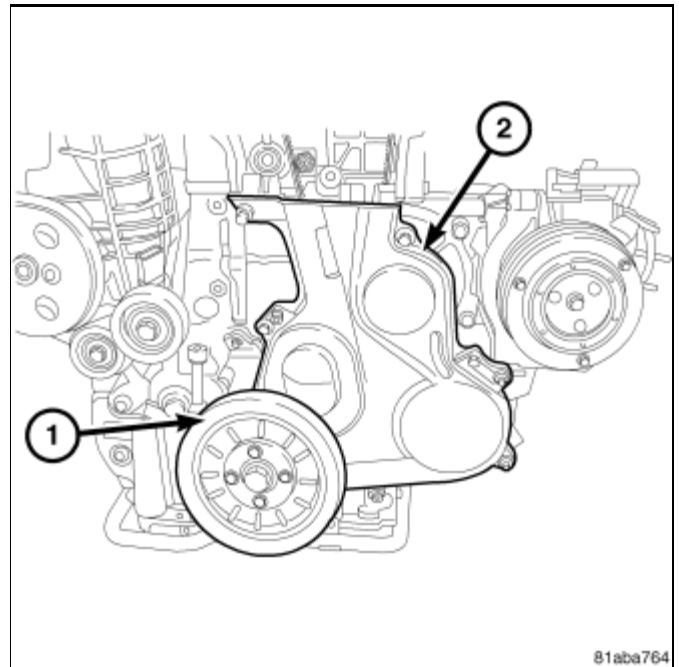


23. Install the cam position sensor (3), and connect the harness connector.



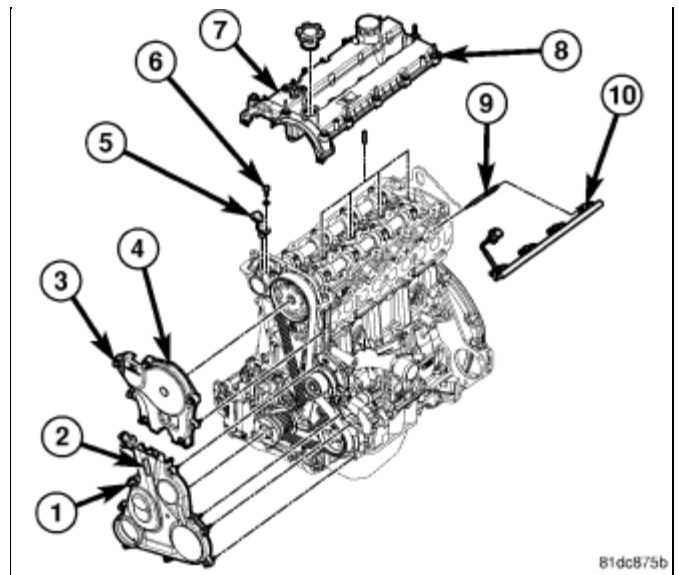
24. Install the lower front cover (2). Torque the bolts to 11 N·m (97 lbs. in.)

25. Install the crankshaft damper (1). Torque the bolts to 32 N·m (23 lbs. ft.)

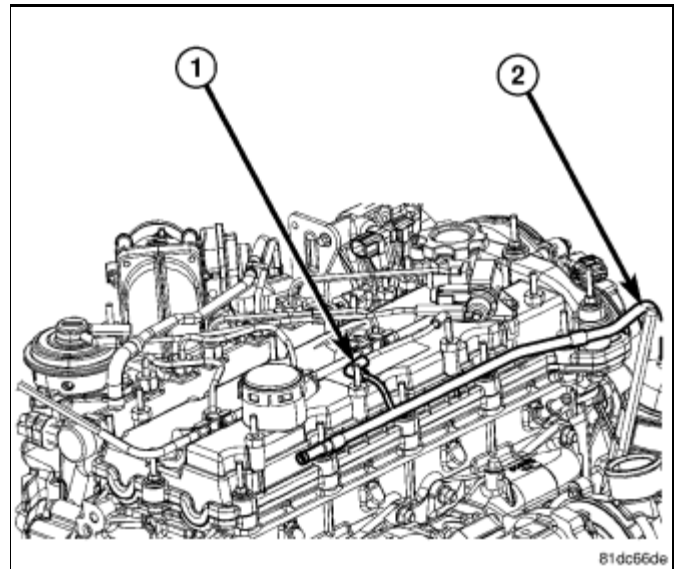


26. Install the upper front cover (3). Torque the bolts to 11 N·m (97 lbs in.).

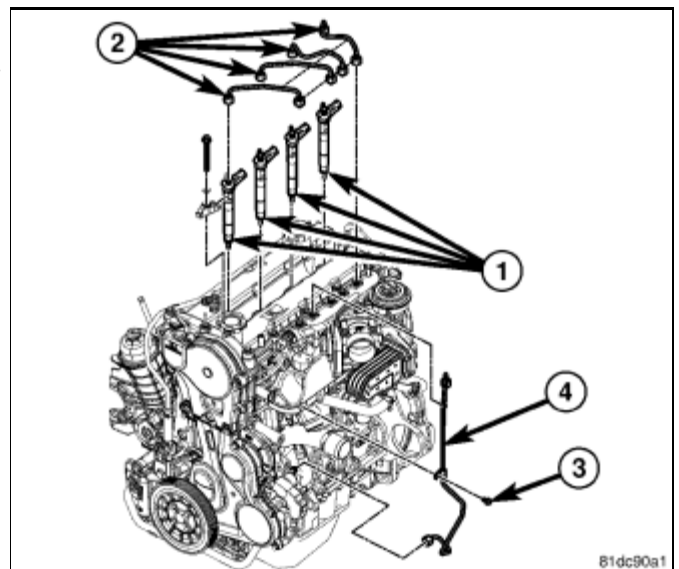
27. Install the cylinder head cover (7). Torque the bolts to 11 N·m (97 lbs in.).



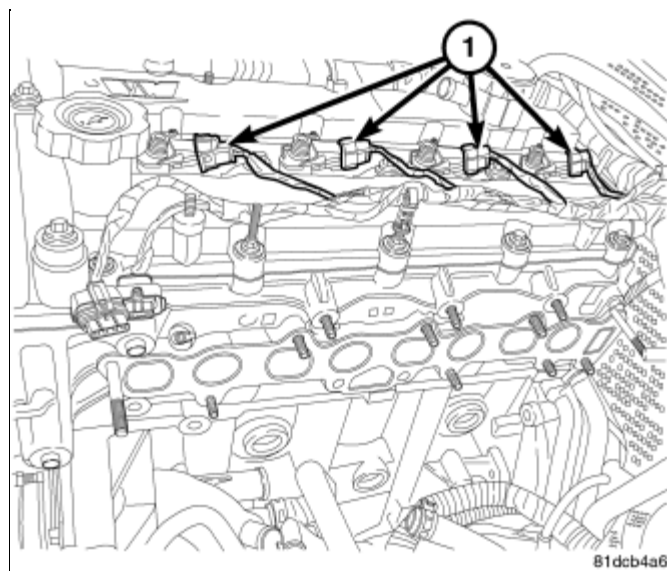
28. Install the vacuum line (2) to the vacuum pump.
29. Install the vacuum line (1) to the fitting on the cylinder head cover.



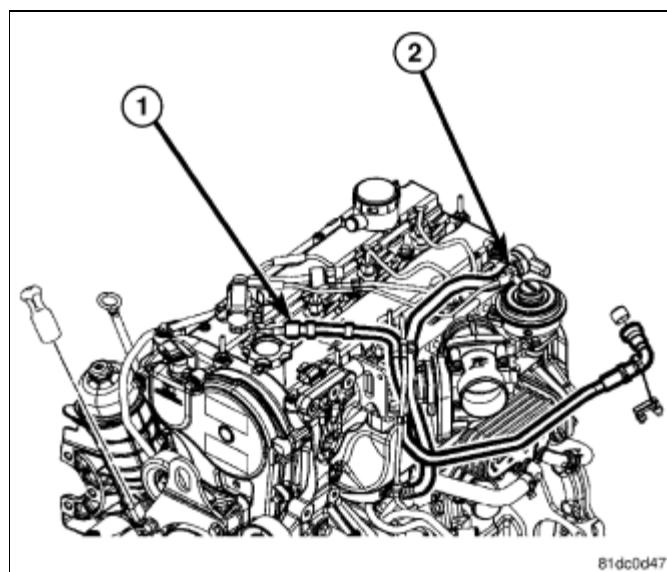
30. Install injectors (1) and injector retainer claw and washer.
31. Install the injector clamp bolts. Do not tighten at this time.
32. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.
33. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).
34. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).
35. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).
36. Torque the fuel lines at the fuel rail to 20 Nm (14.75 Ft lbs).
37. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



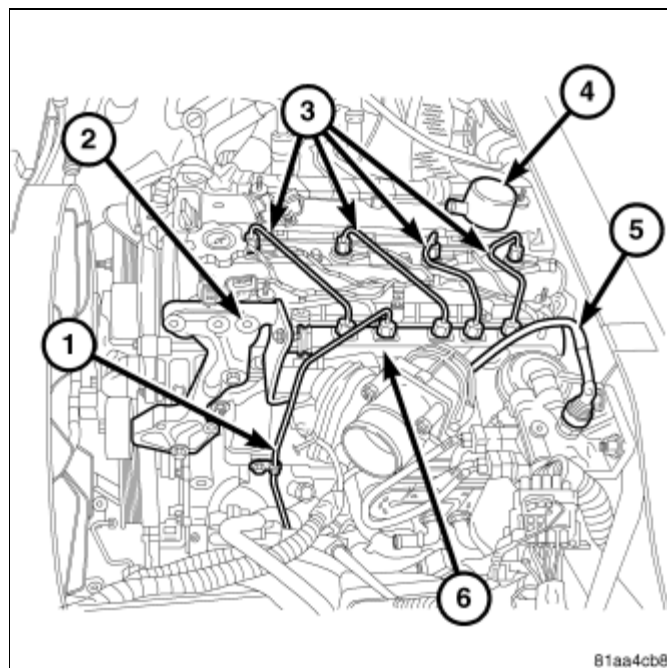
38. Connect the fuel injector harness connectors (1).



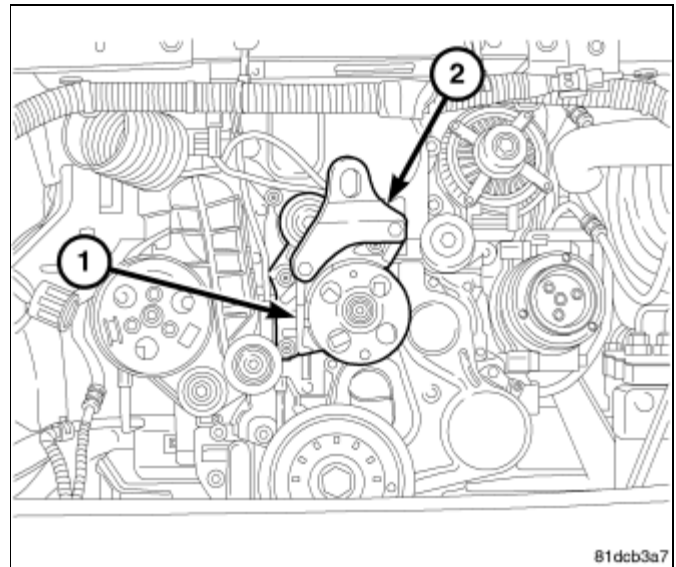
39. Connect the fuel return lines (1) and (2).



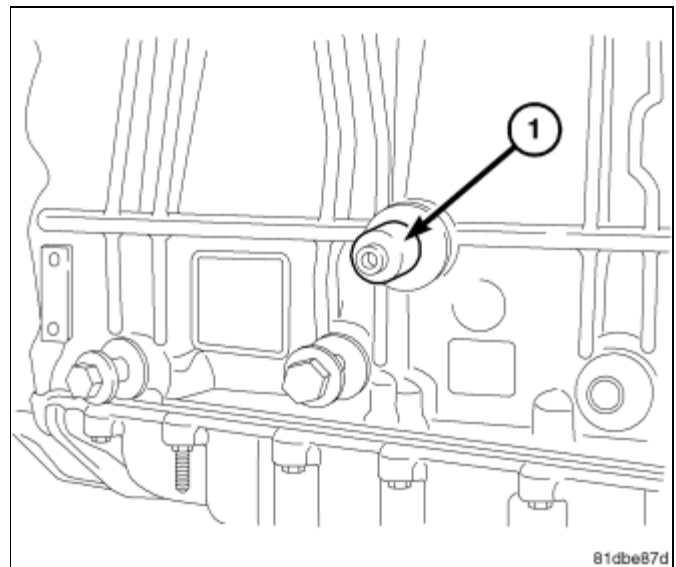
40. Connect the crankcase vent hose to the oil separator (4).



41. Install the idler pulley bracket (1).
42. Install the front engine lifting bracket (2). Torque the bolts to 45 N·m (33 ft.lbs.)



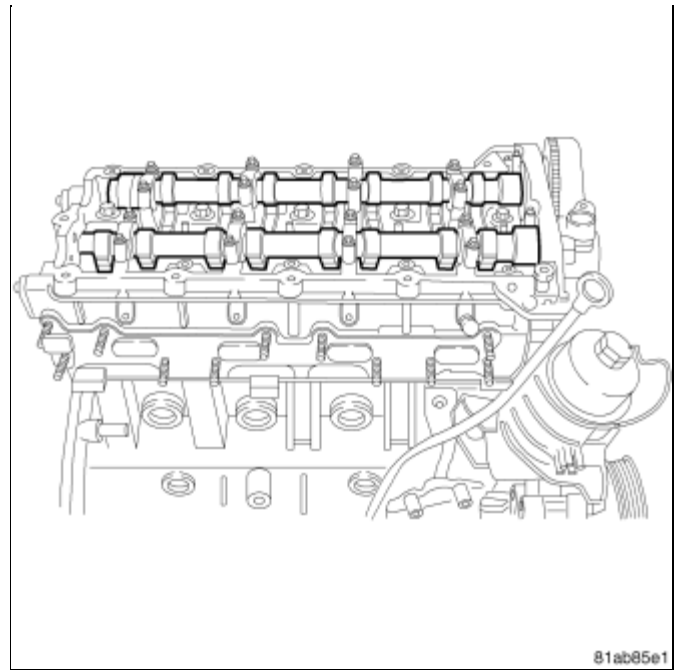
43. Remove crankshaft locking tool (1).
44. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) .
45. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
46. Connect negative battery cable.



CAMSHAFT(S)

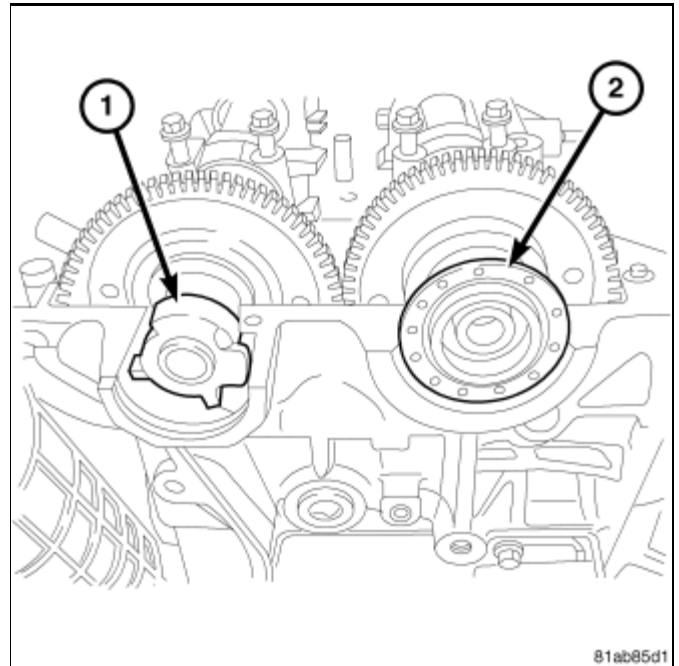
DESCRIPTION

The camshafts are made of cast iron with eight machined lobes and four bearing journals.



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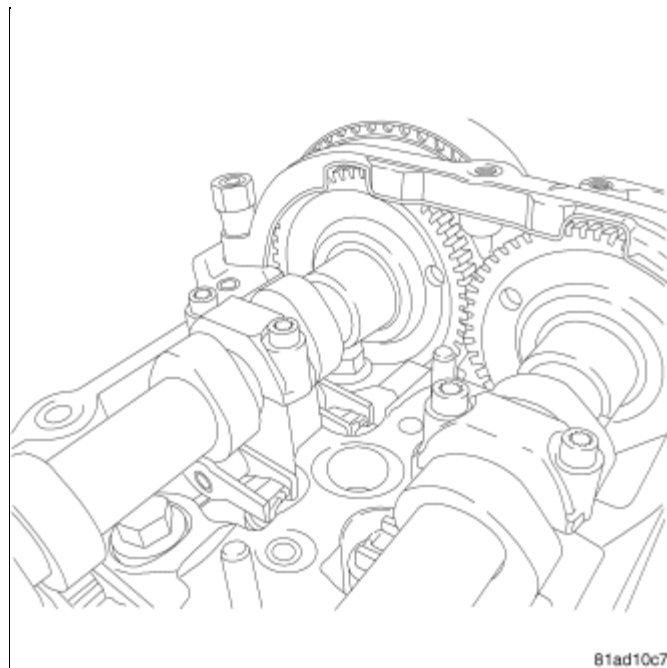
1. The exhaust camshaft (1) incorporates the CMP sensor reluctor wheel.



81ab85d1

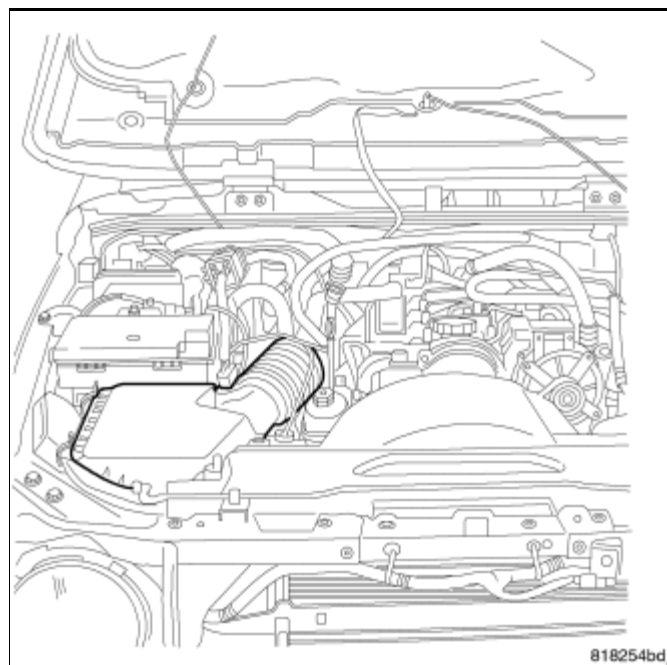
2. The dots on the back of the camshaft gears are for initial timing only. These dots are for timing the camshafts to each other. To correctly set engine timing, the camshafts must be set to 90° ATDC. The camshaft locking tool is used to correctly set the camshafts to their proper location.

REMOVAL - CAMSHAFTS



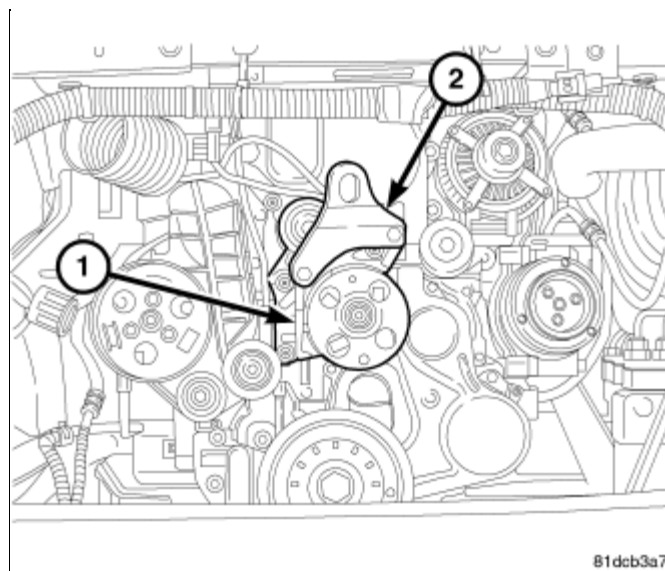
81ad10c7

1. Disconnect negative battery cable.
2. Remove engine cover. (Refer to 9 - ENGINE - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove the cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).



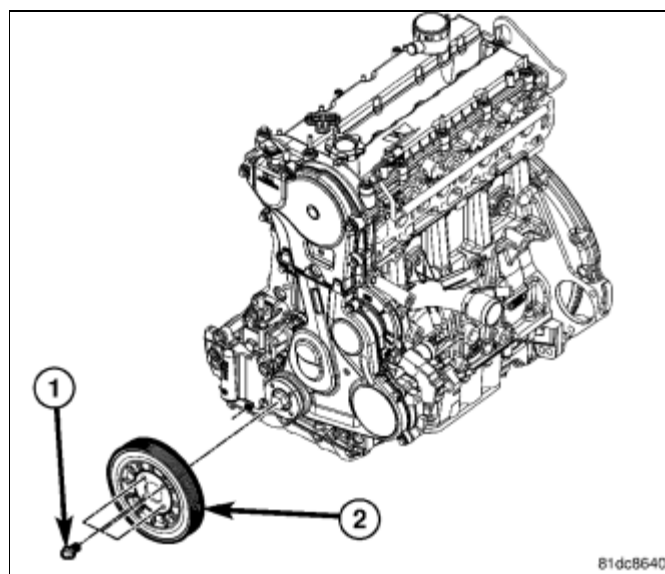
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5. Remove the front engine lifting bracket (2).
6. Remove the idler pulley and cooling fan pulley bracket assembly (1).



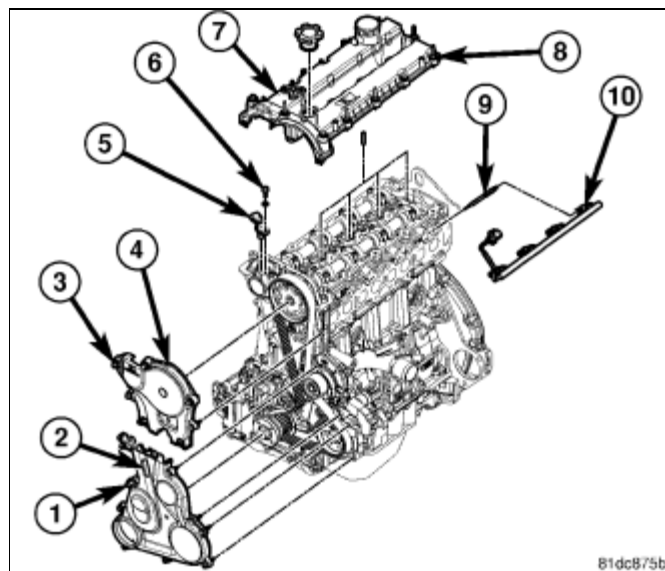
NOTE: The crankshaft sprocket bolt is a L.H. thread.

7. Remove the crankshaft damper bolts (1), and the crankshaft damper (2).

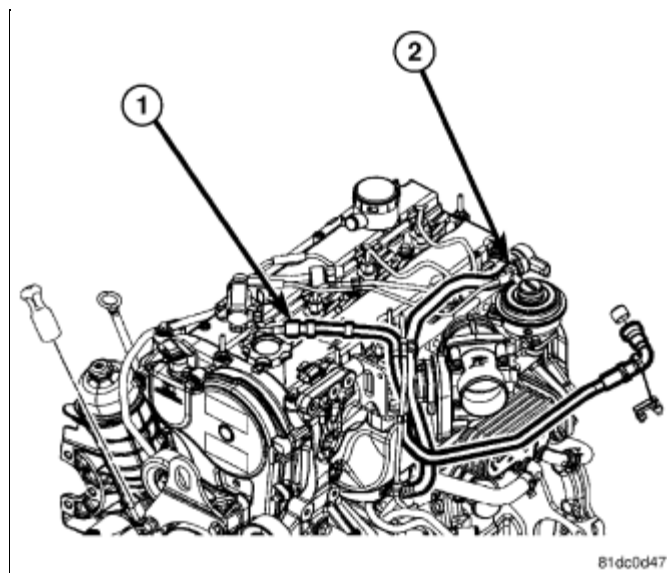


8. Remove the five bolts (3) and the upper front timing belt cover (4).

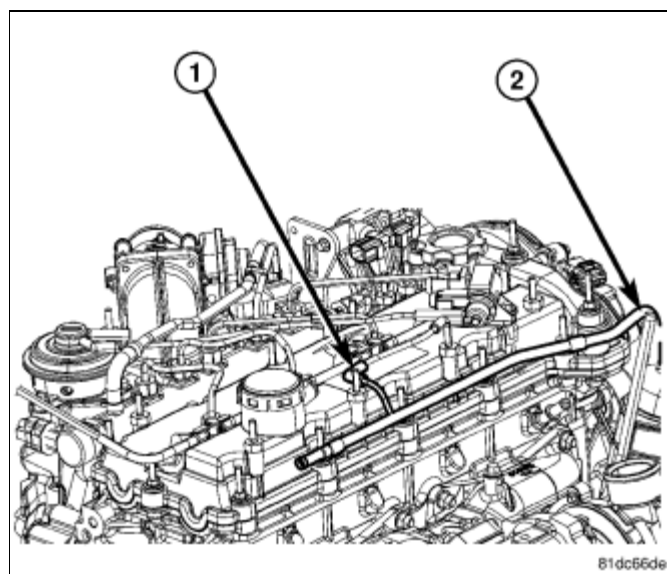
9. Remove the nine bolts (1) and the lower front timing belt cover (2).



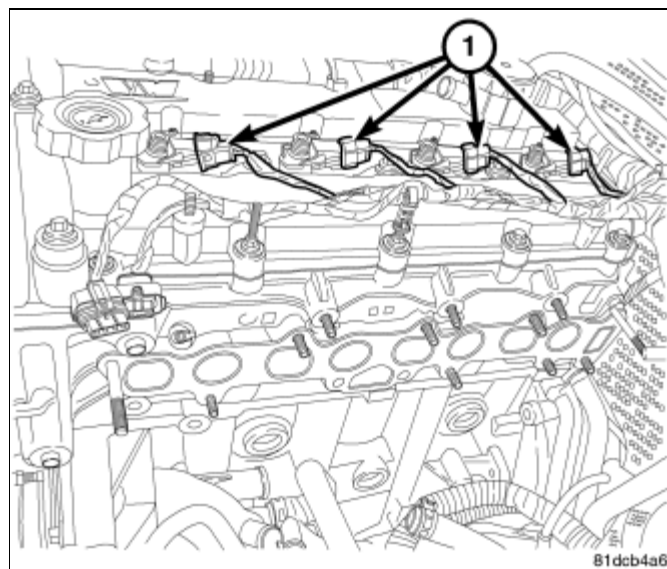
10. Disconnect the fuel return lines (1) and (2).



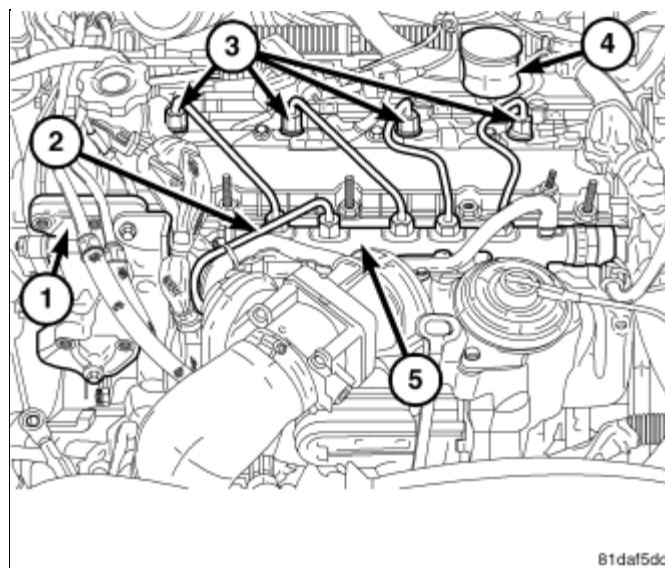
11. Disconnect the vacuum line (2) from the vacuum pump.
12. Disconnect the vacuum line (1).



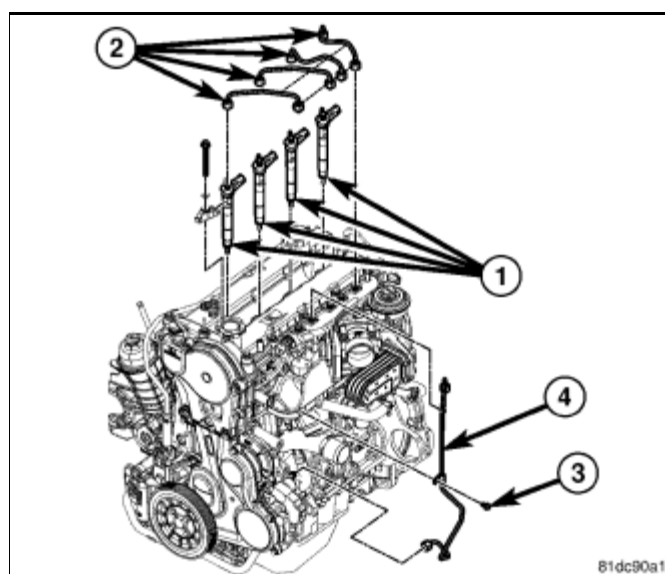
13. Disconnect the fuel injector harness connectors from the fuel injectors (1).



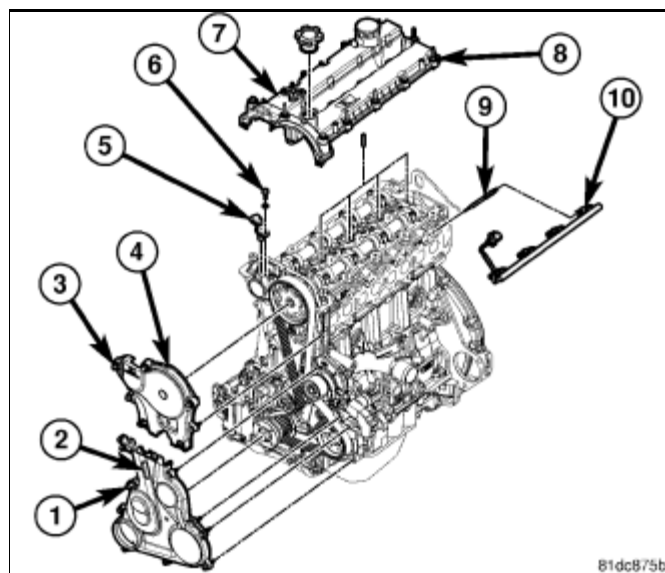
14. Remove the injector fuel lines (3) from the injectors and the fuel rail.



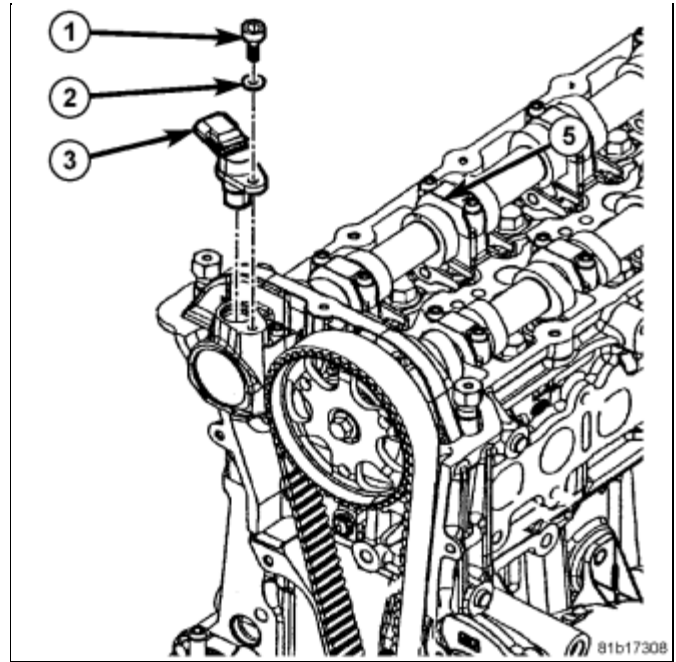
15. Remove the fuel injectors (1).



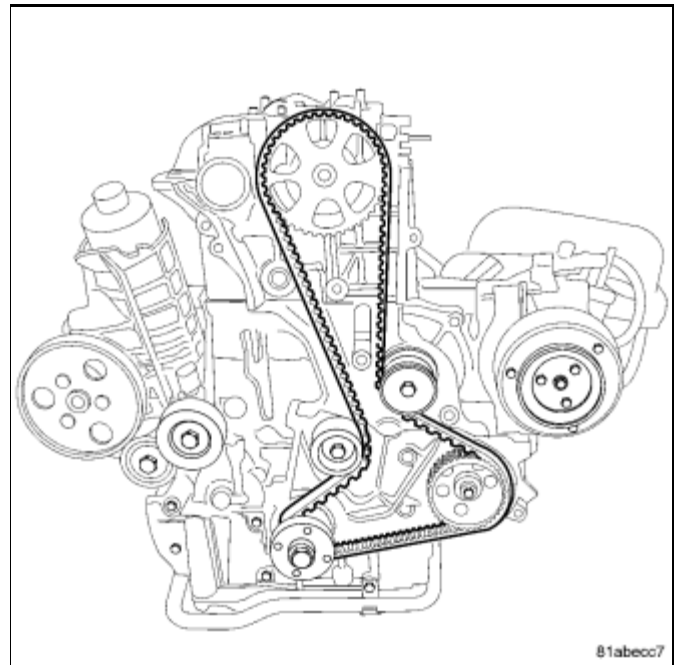
16. Remove the twelve fasteners (8) and the cylinder head cover (7).



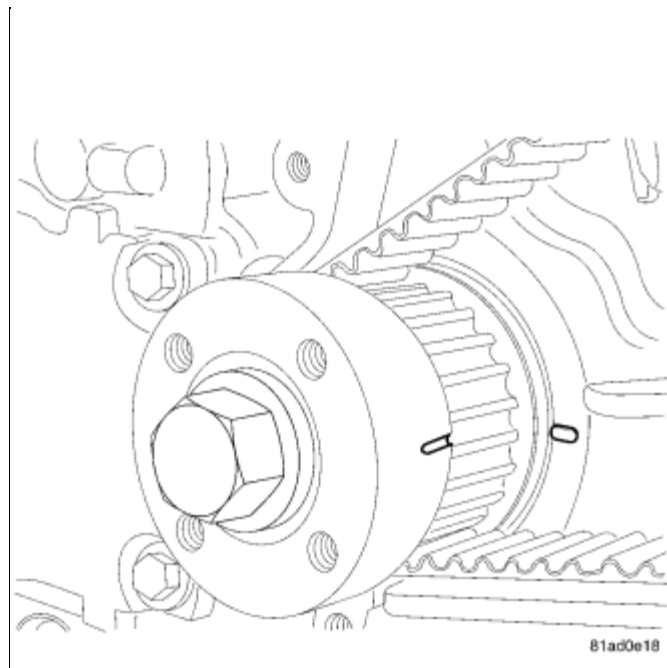
17. Disconnect the Camshaft Position Sensor (CMP) harness connector.
18. Remove the camshaft position sensor (3).



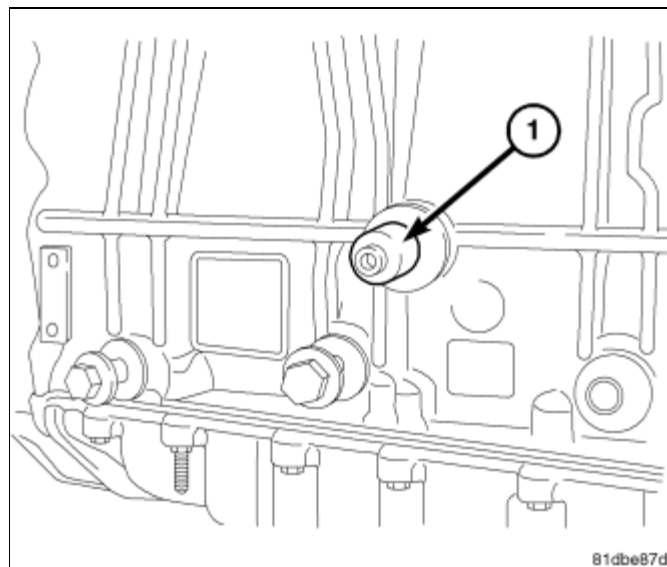
CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must be rotated to the 90° ATDC. The camshafts and the crankshaft must all be set to the correct position. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)



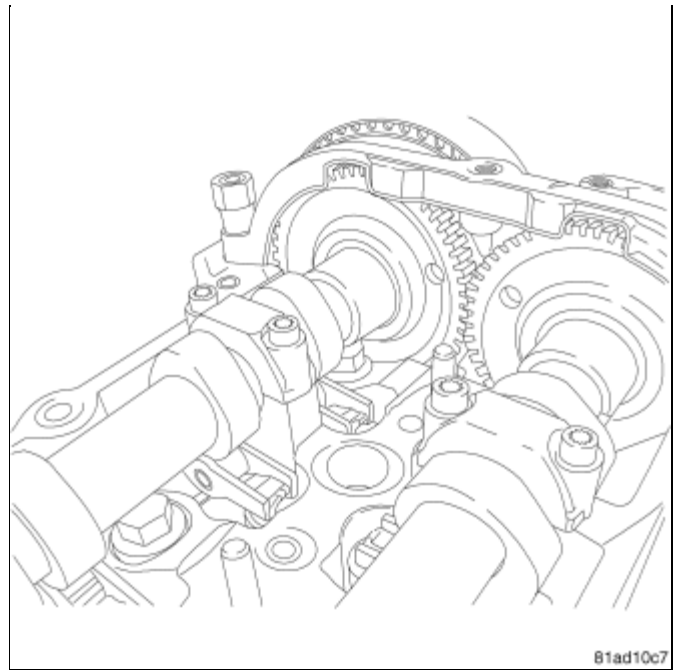
19. Rotate the engine by hand until the crankshaft 90° ATDC marks are aligned.



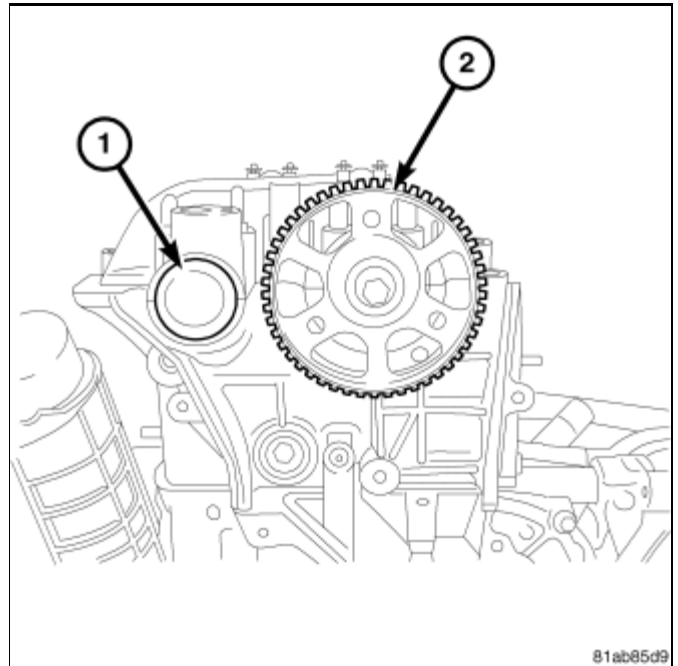
20. Remove the plug from the engine block, and install the crankshaft locking tool VM 9992 (1).



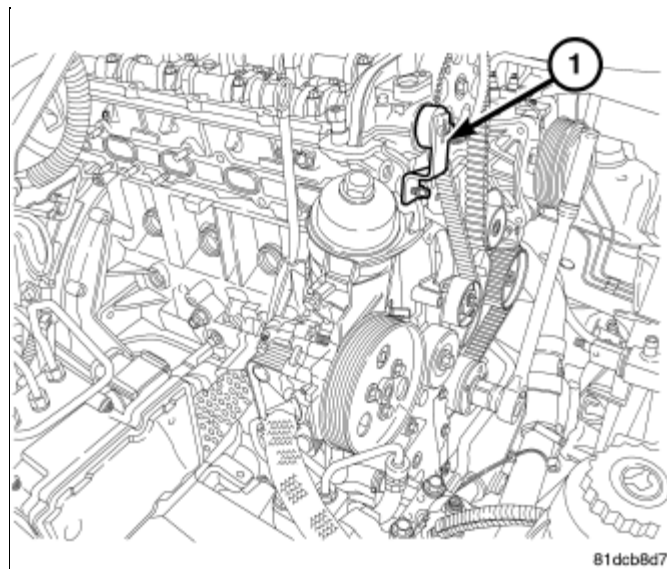
21. Verify the camshaft timing alignment holes on the camshaft gears are aligned horizontally.



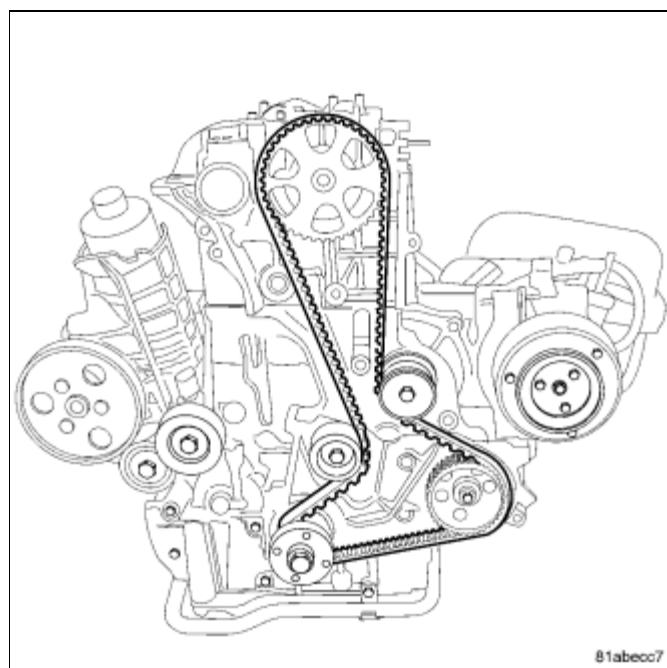
22. Remove the exhaust camshaft oil seal (1).



23. Install the camshaft locking tool VM 9991 (1).

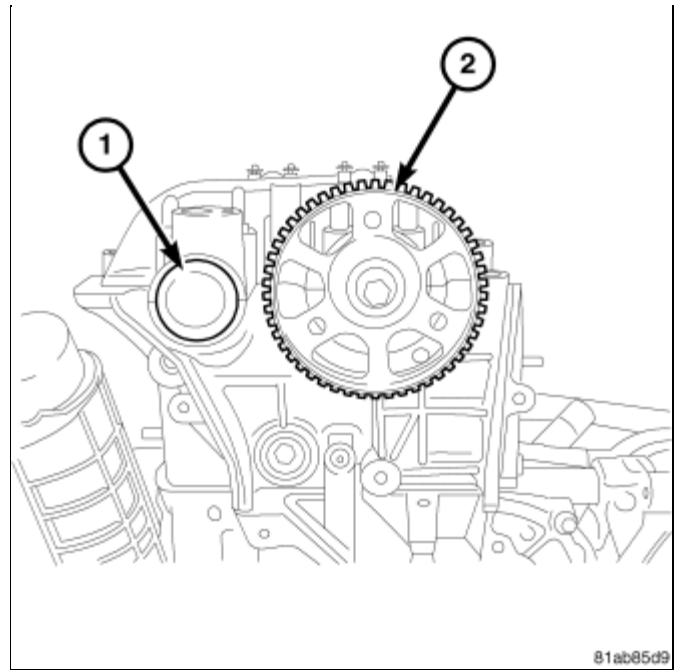


24. Loosen the timing belt tensioner bolt, release tension from the timing belt tensioner, and remove the timing belt.

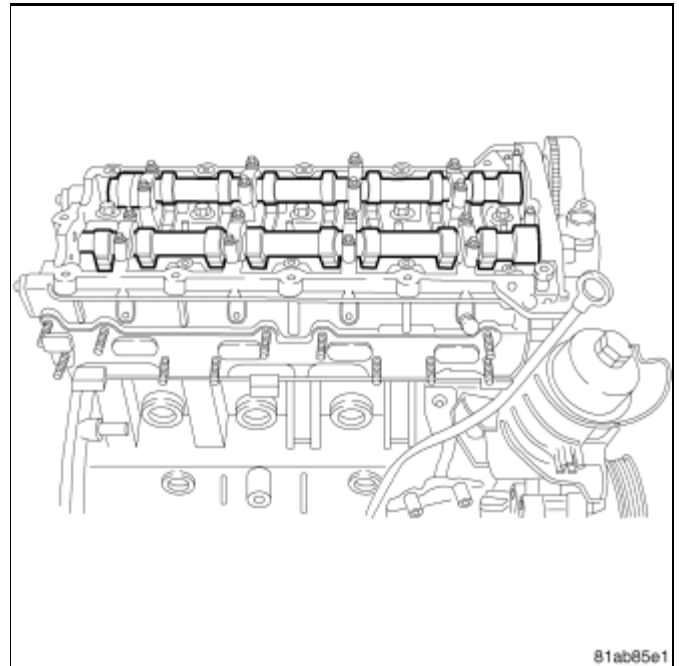


25. Remove the intake camshaft sprocket (2) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

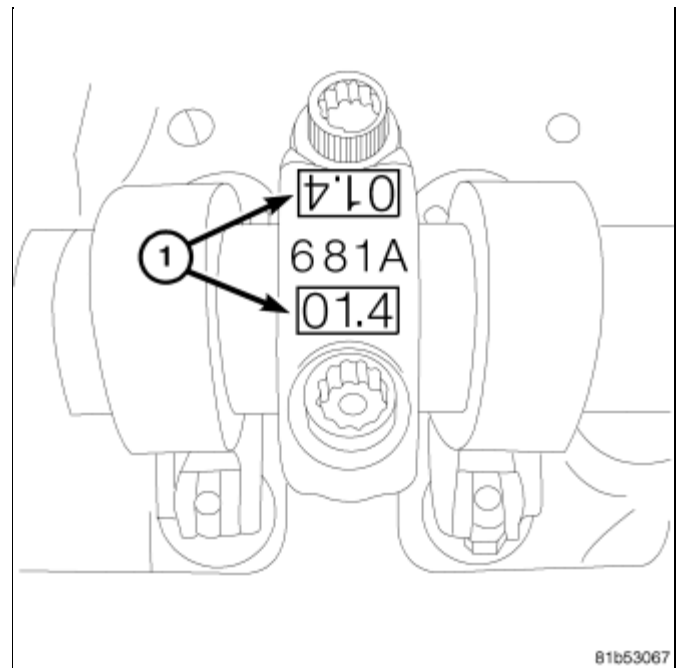
26. Remove the front cam bearing journal.



27. Using a circular pattern, loosen the camshaft caps.

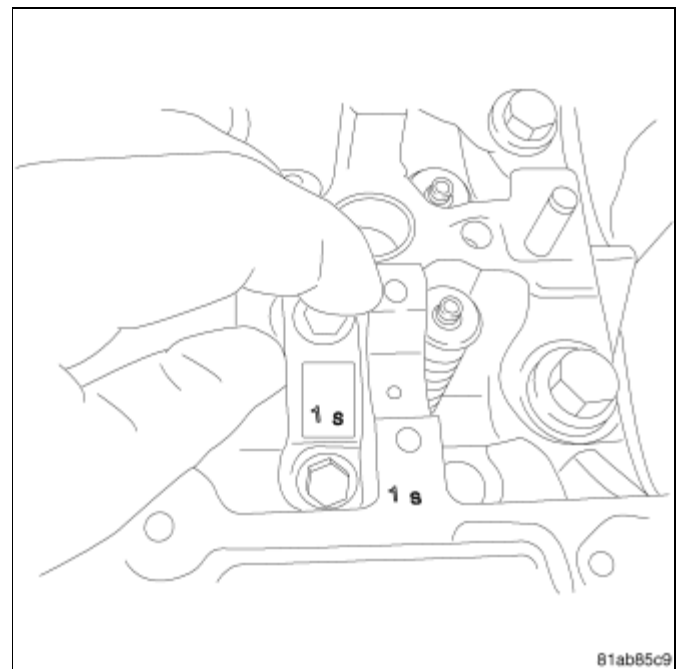


NOTE: The camshaft caps must be installed in the same location and direction as they were removed. Match the marks on the camshaft cap to the marks on the cylinder head. The illustration is an example of a camshaft cap mark.



28. Remove the camshaft caps.
29. Remove the camshafts.

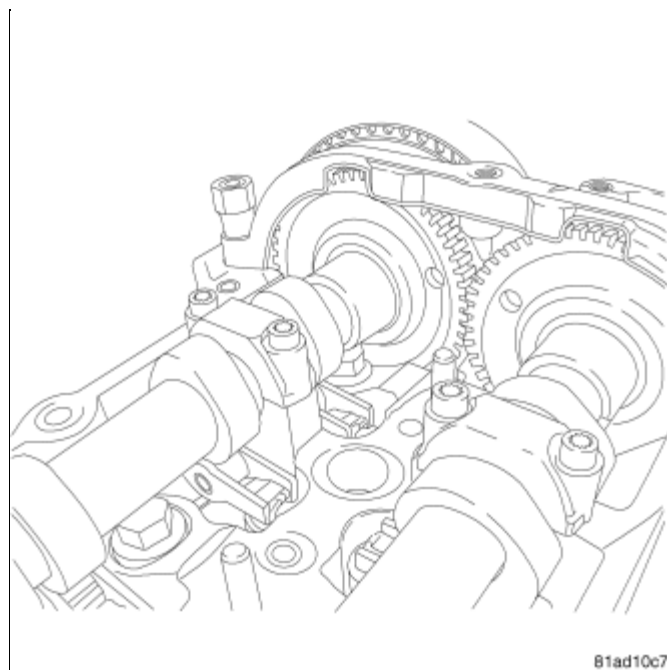
INSTALLATION - CAMSHAFTS



1. Lubricate the camshaft journals with Mopar® Engine Oil Supplement, or equivalent.
2. Make sure that the three small orientation dots marks on the back side of the camshaft gears are horizontal and facing each other.
3. Carefully install camshafts onto the camshaft journals.

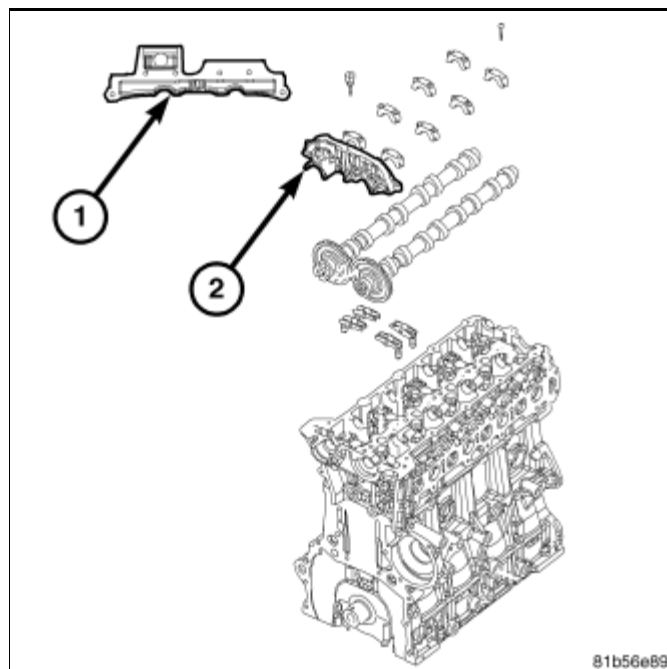
NOTE: The dots on the back of the camshaft gears are for initial timing only. These dots are for timing the camshafts to each other. To correctly set engine timing, the camshafts must be set to 90° ATDC. The camshaft locking tool is used to correctly set the camshafts to their

proper location.



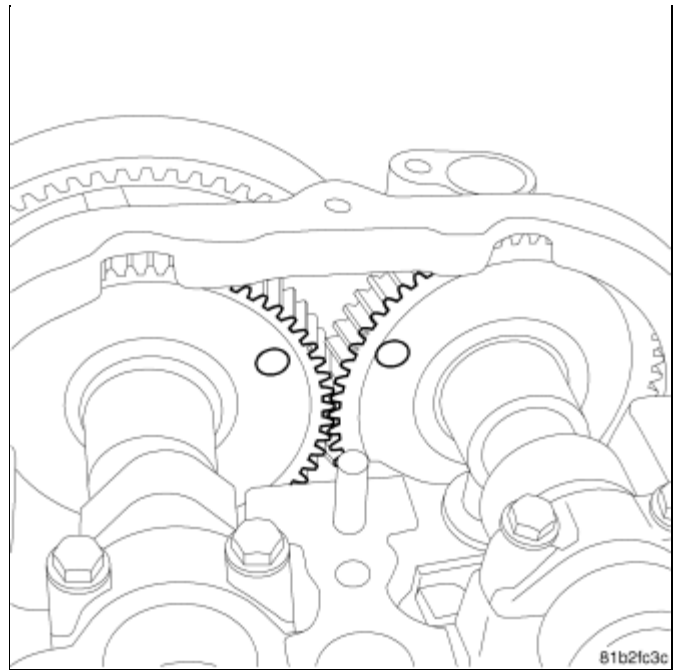
81ad10c7

4. Apply a thin bead of Loctite 510 to the front camshaft bearing journal (2) in the location illustrated (1).
5. Install the front camshaft bearing journal. Tighten bolts to 11 Nm (8 lb. ft).

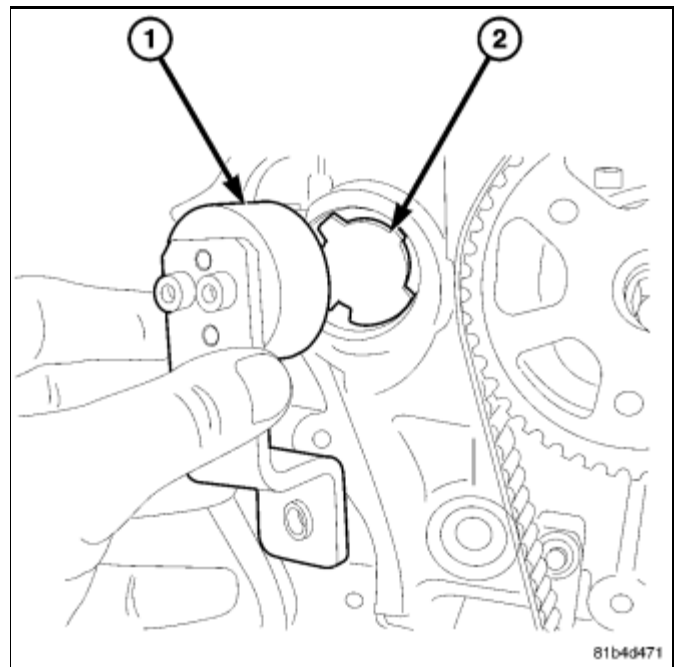


81b56e89

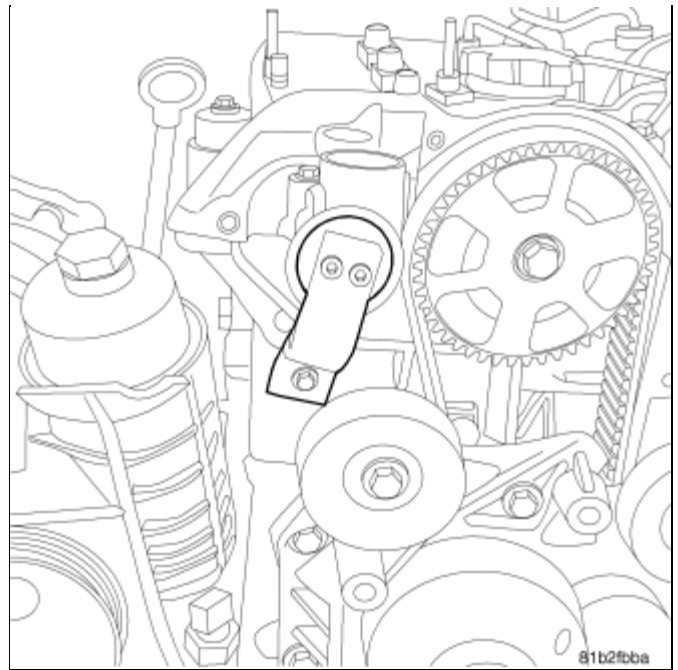
6. Rotate the camshafts so that the camshaft locking tool fits into place.



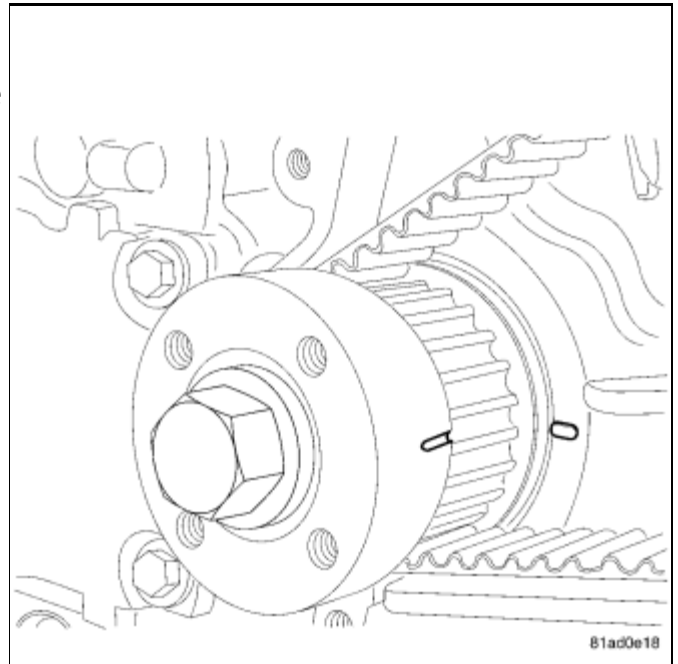
7. Install the camshaft locking tool.



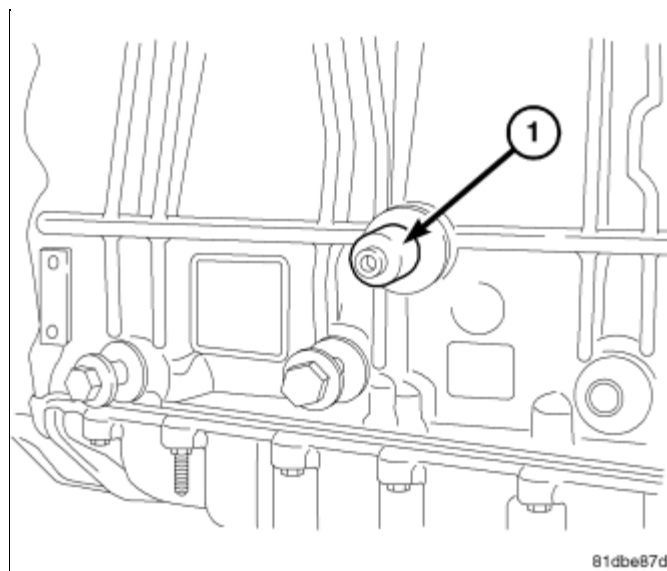
8. When the camshaft locking tool is bolted in place, the camshafts are locked at 90° ATDC.



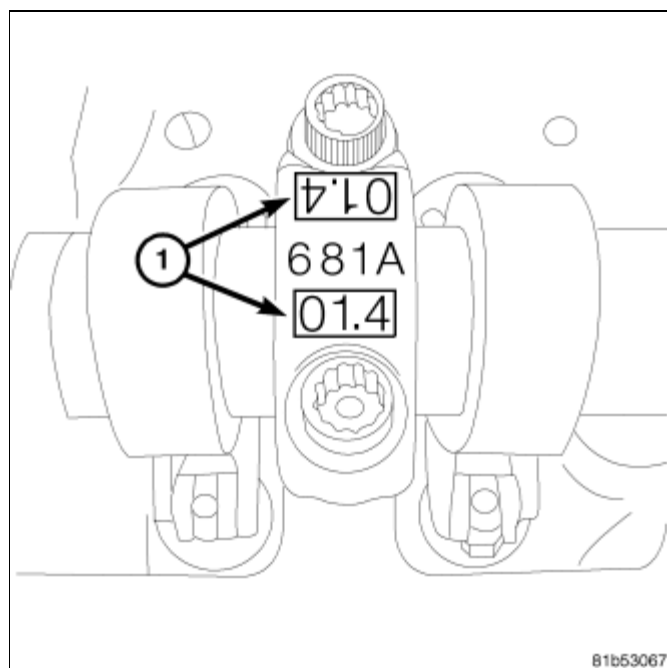
9. If the crank locking tool was removed for any reason, verify the crankshaft 90° ATDC marks are aligned. Align the crankshaft 90° ATDC marks if necessary



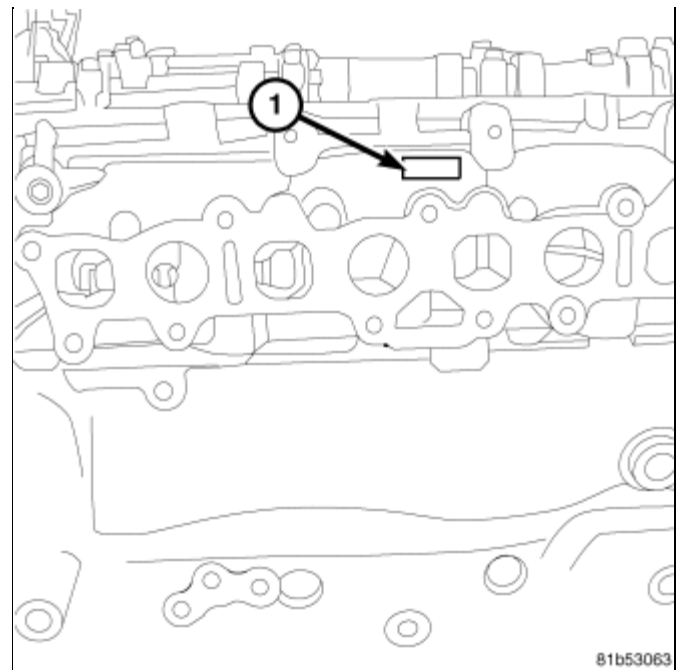
10. If necessary, install the crankshaft locking tool (1).



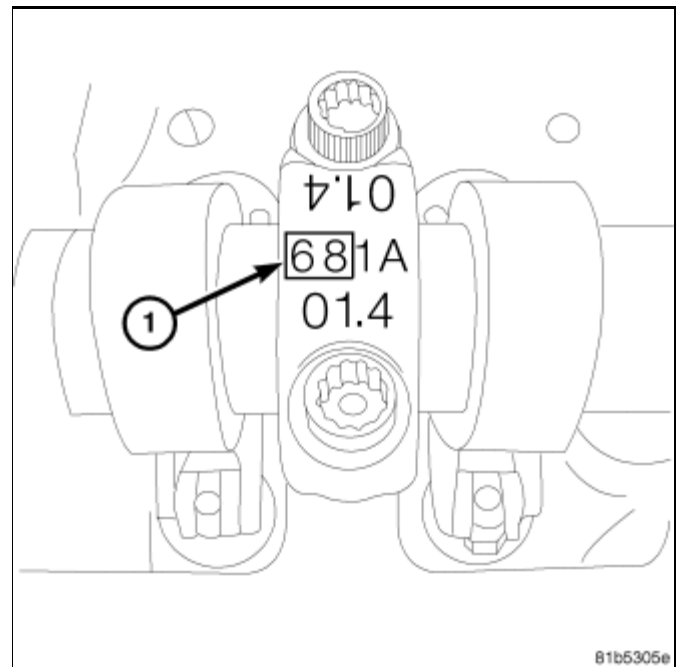
The camshaft caps have several markings. The die identification number (1) is used during manufacturing, and is not necessary for assembly.



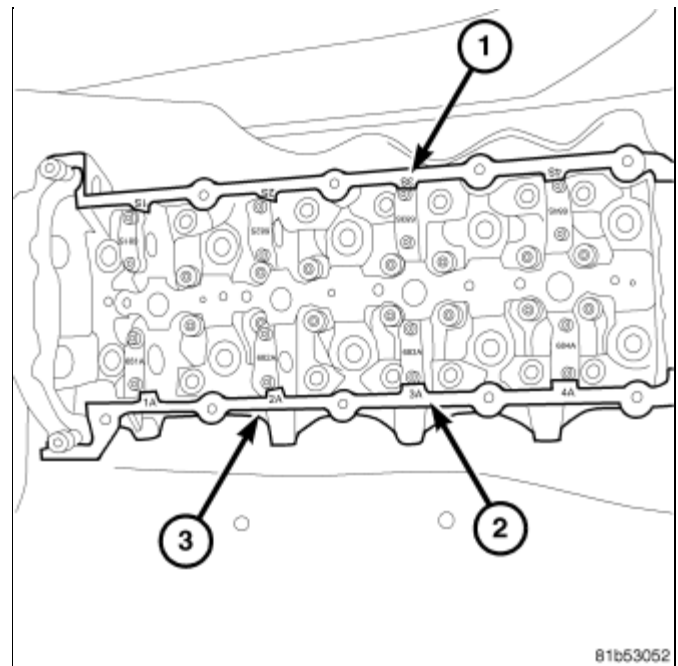
The progressive part number (1) is printed on the intake side of the cylinder head. The last 2 digits are the same as the number on the camshaft caps.



The last two digits of the progressive part number (1) are printed on the camshaft caps and will match the last two digits of the number on the side of the cylinder head. These numbers are stamped after the machining process and match the camshaft caps to the cylinder head.

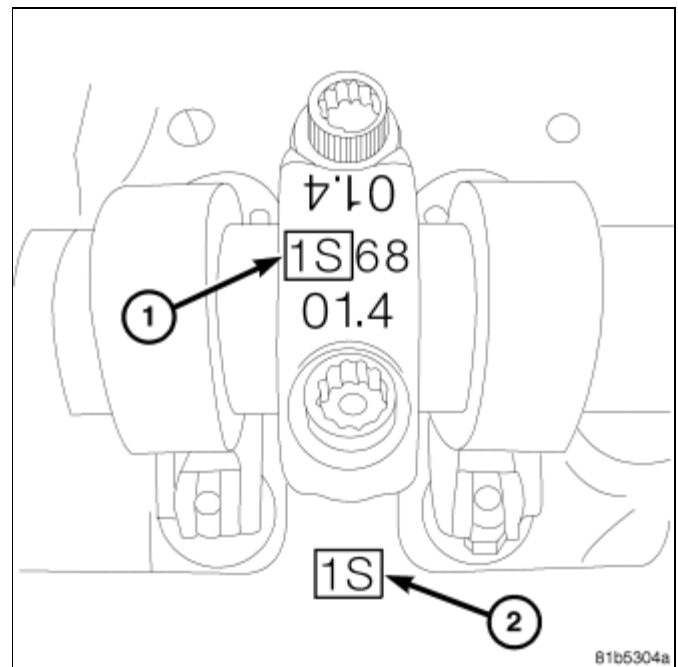


The camshaft cap locations are marked on the cylinder head near each camshaft cap. The exhaust side (1) are marked with a number and the letter "S". The intake side (2) is marked with a number and the letter "A".



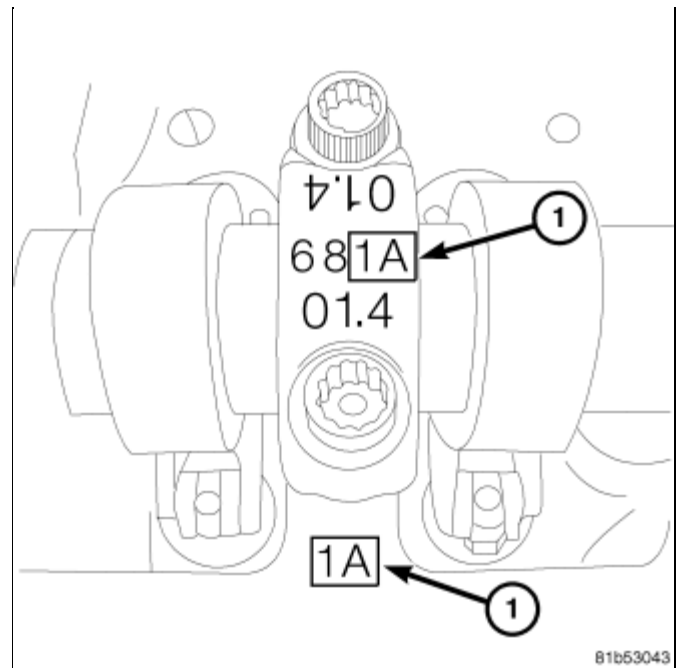
81b53062

The camshaft cap must be aligned with the mark (1) aligned in the same direction as the cylinder head mark (2). In the illustration, the camshaft cap is the first cylinder (indicated by the 1) on the exhaust side of the cylinder head (indicated by the S).

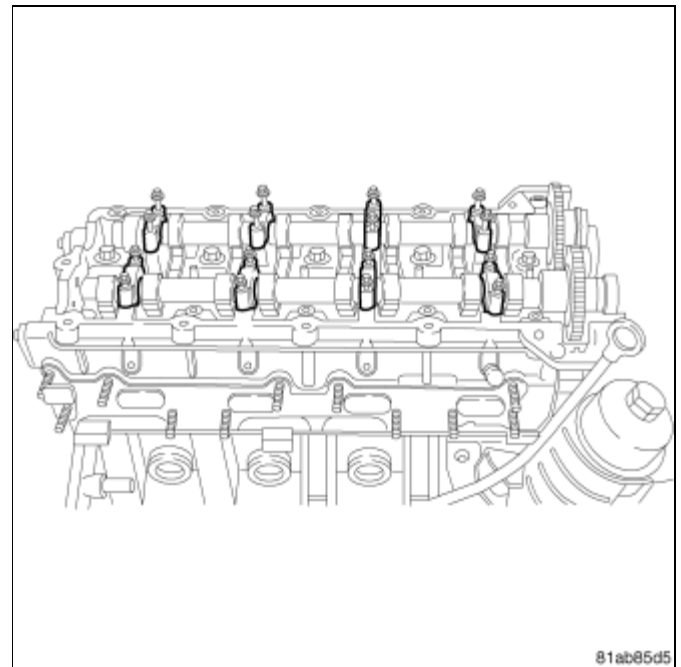


81b5304a

The first cylinder on the intake side is marked with the code 1A. Each camshaft cap location is marked in this manner on both the camshaft cap and cylinder head. It is critical that all of the camshaft caps are returned to their correct locations.



11. Loosely install the camshaft bolts finger tight.

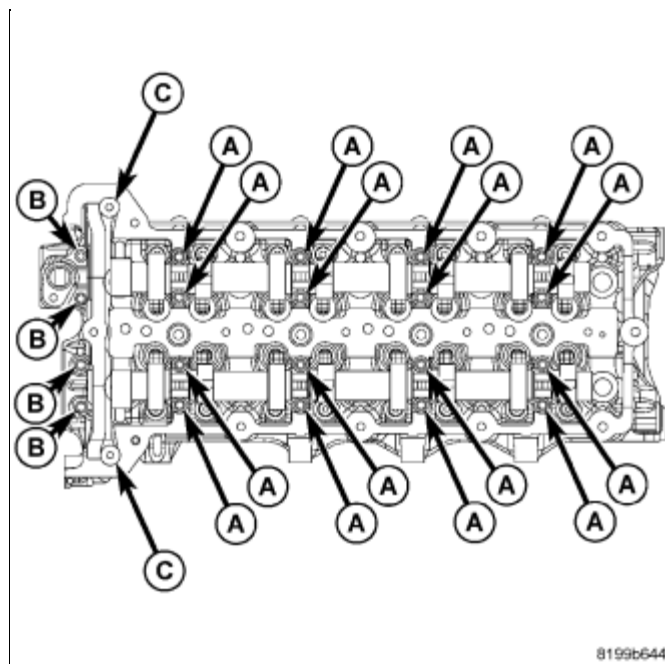


NOTE: When the camshaft caps are removed, always replace the camshaft cap bolts.

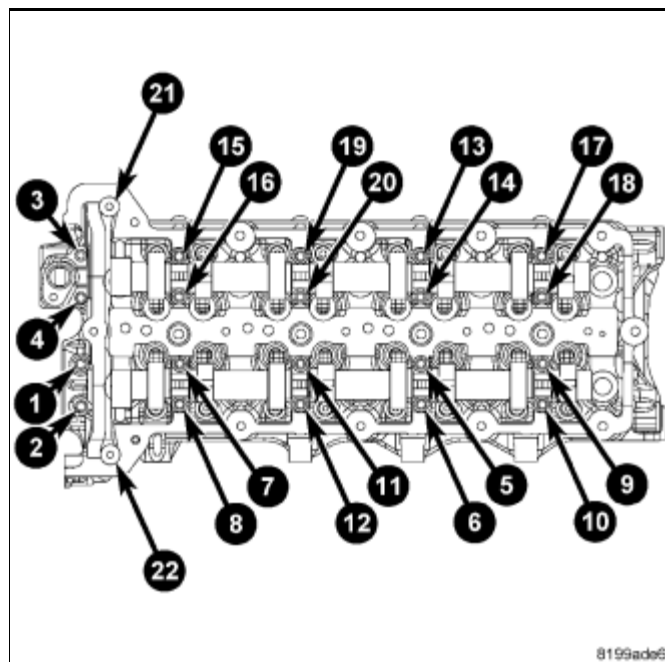
12. The camshaft bolts have 3 different bolt sizes.

- Bolts A are M6 35
- Bolts B are M6 45
- Bolts C are M6 stud bolts.

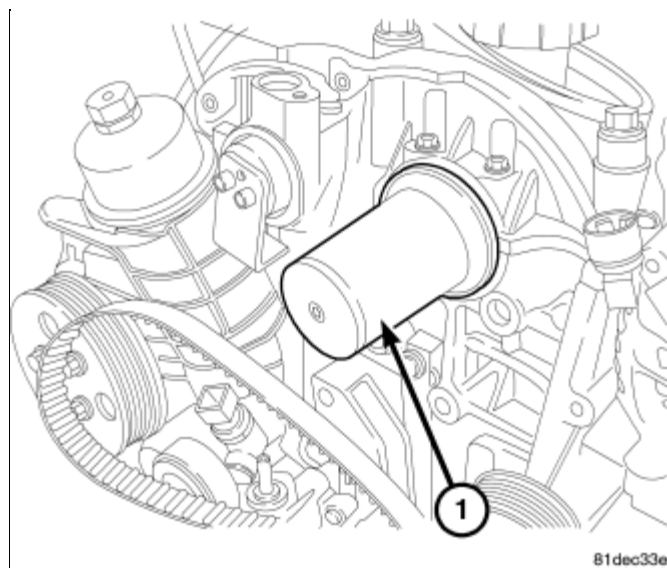
13. Put a thin bead of silicone on the front camshaft cap (the cap that are secured by bolts “b”).



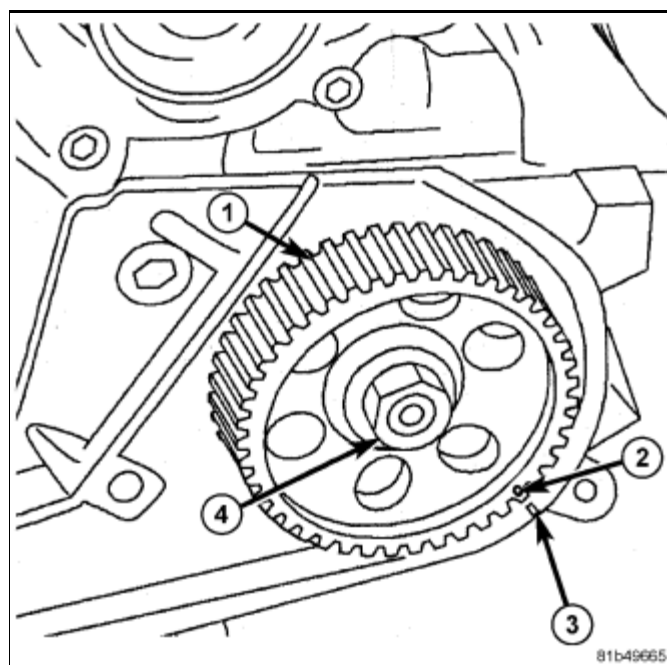
14. Following the illustrated pattern, torque the camshaft cap bolts to 11 Nm (98 lbs. in.).



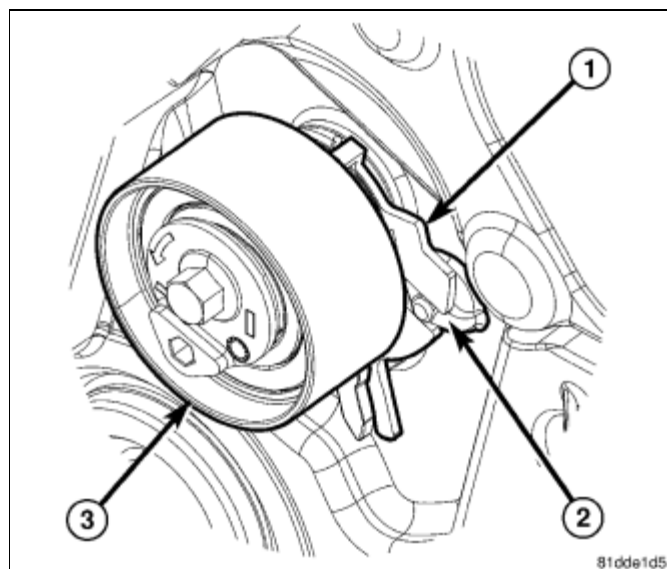
15. Using the 9937-1 seal installer (1), install the intake camshaft oil seal.



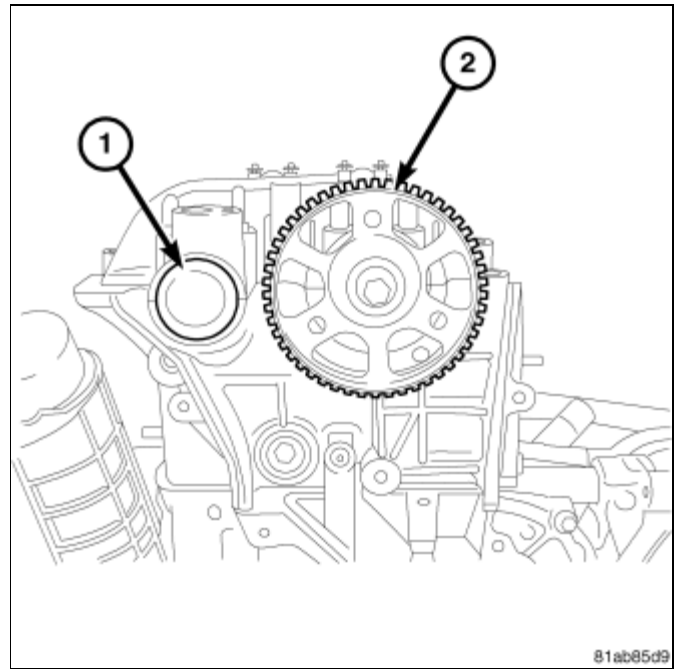
16. Align the high pressure fuel pump sprocket timing mark (2) with the timing mark (3) on the block.



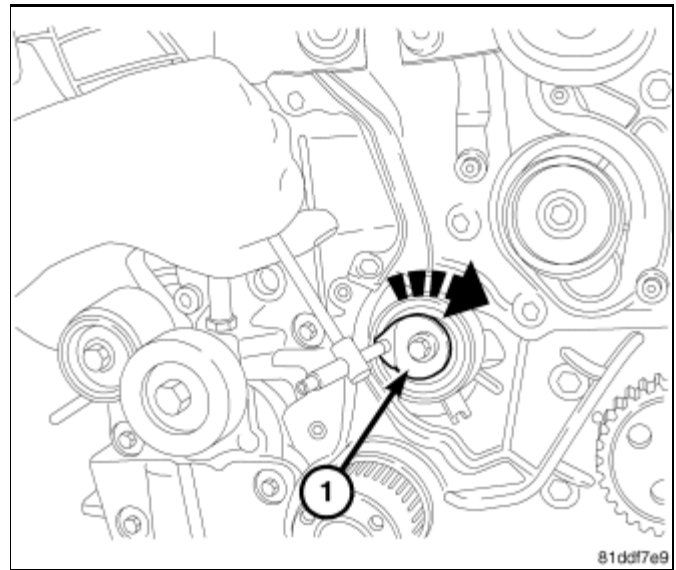
17. Install the timing belt tensioner (3). Do not tighten at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.



18. Install the camshaft sprocket (2). Do not tighten the bolt at this time.

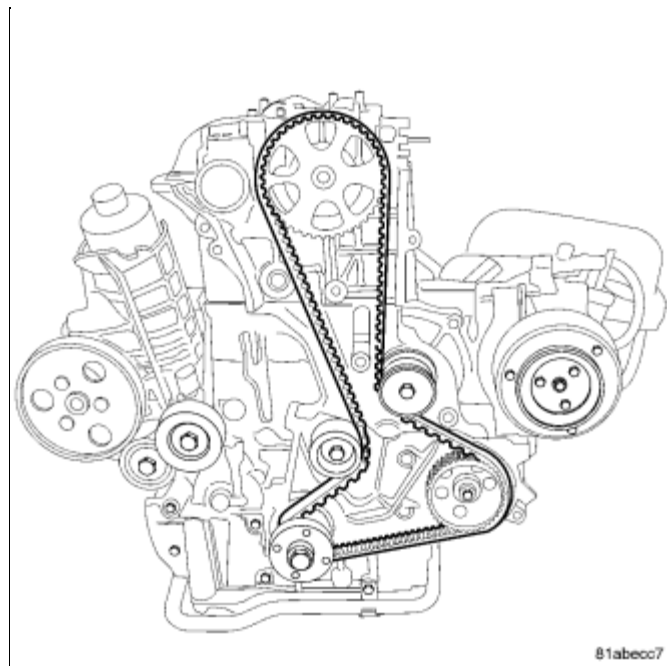


19. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed.

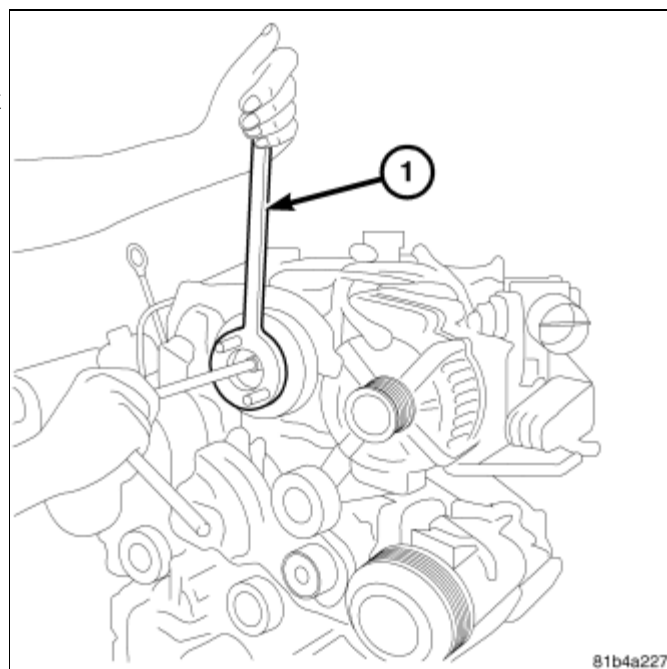


NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

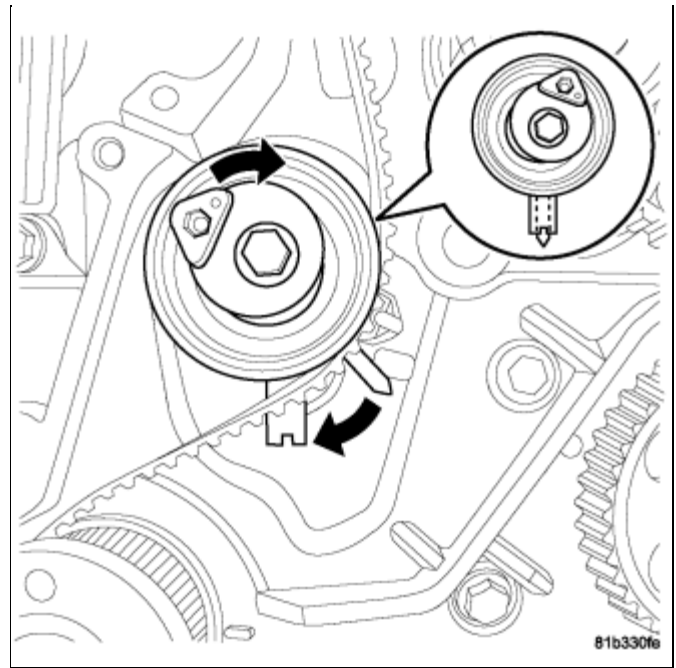
20. Install timing belt.



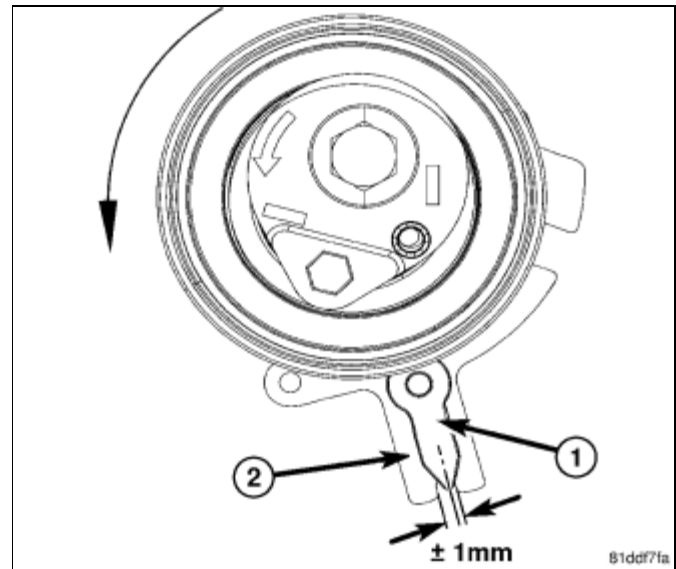
21. Use VM 1055 Gear Holder (1) to hold the camshaft sprocket while torquing. Torque the intake camshaft sprocket bolt to 64 Nm (47 lbs. ft.)



22. Adjust timing belt tensioner by lining up the arrow and the notch as illustrated.

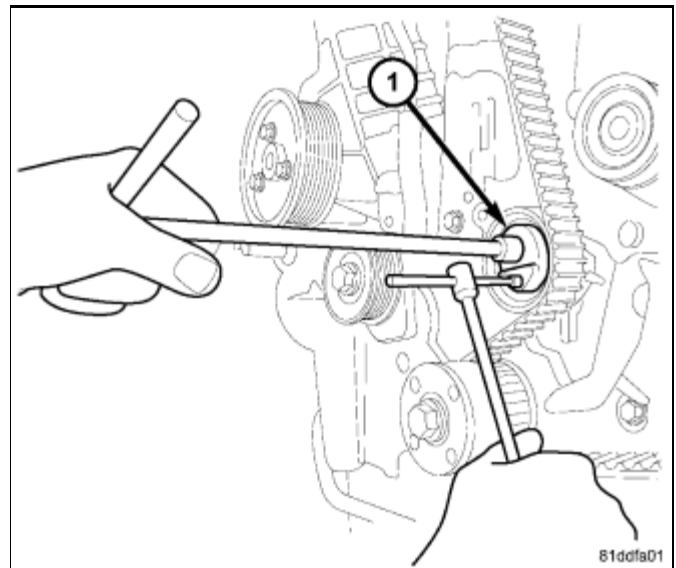


23. Verify the tensioner load indicator (1) is centered in the tensioner load gage (2).

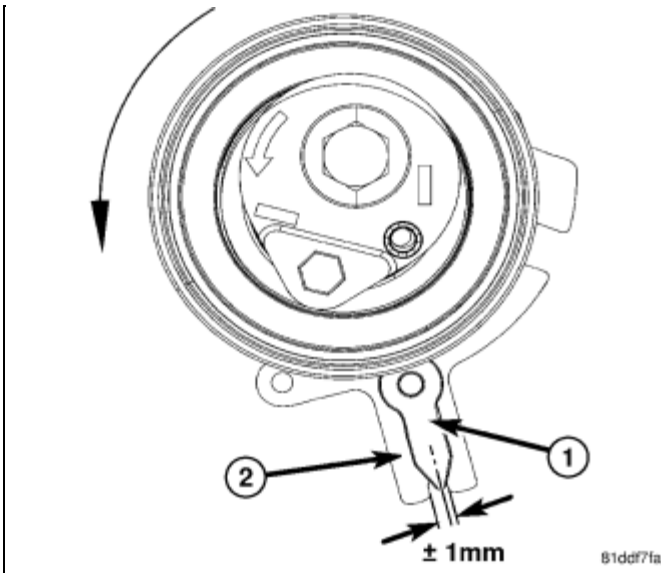


24. Tighten the timing belt tensioner bolt to 28 Nm (21 lb ft).

25.
Verify
the
tensioner
load
indicator
(1) is still
centered
in the
tensioner

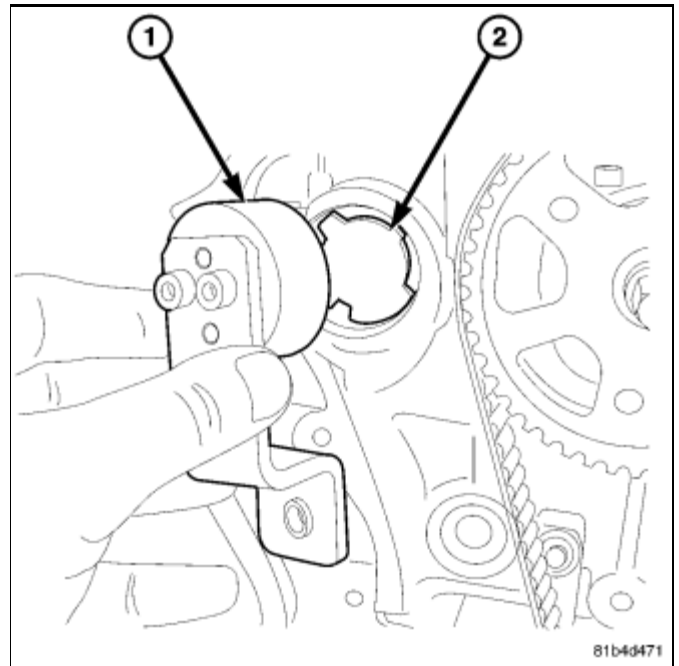


load gage
(2). If the
indicator
is not
centered

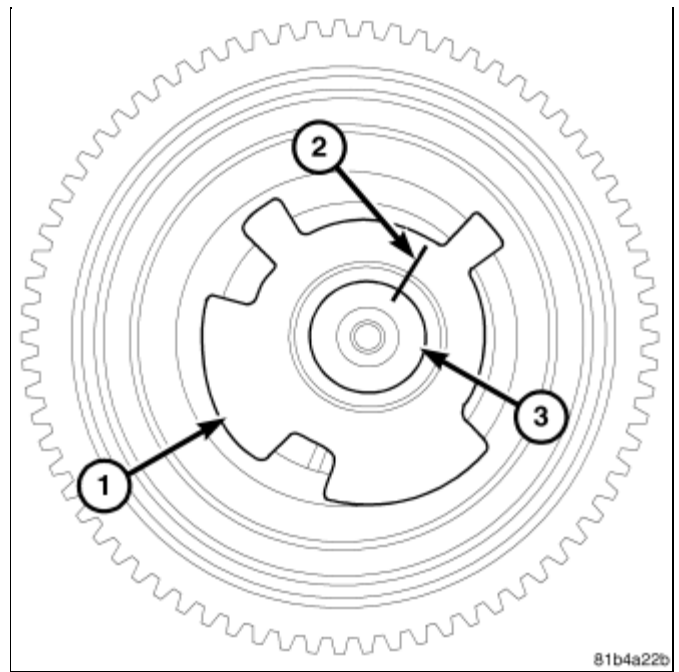


in the gage as shown, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

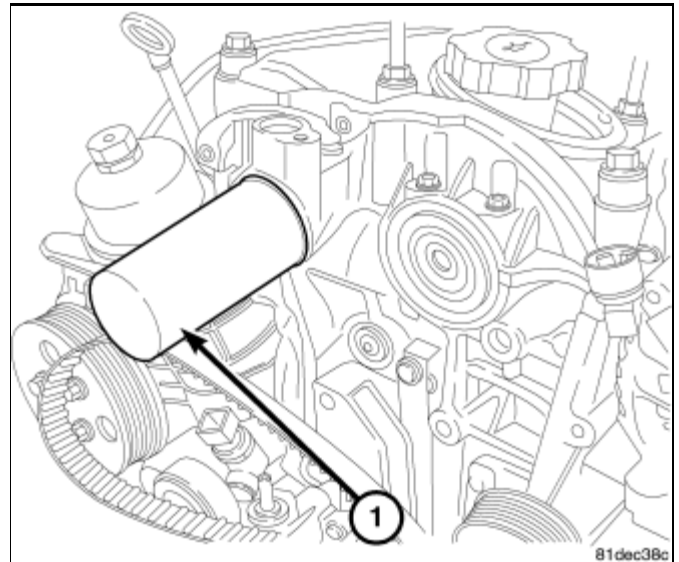
26. Remove the camshaft locking tool (1).



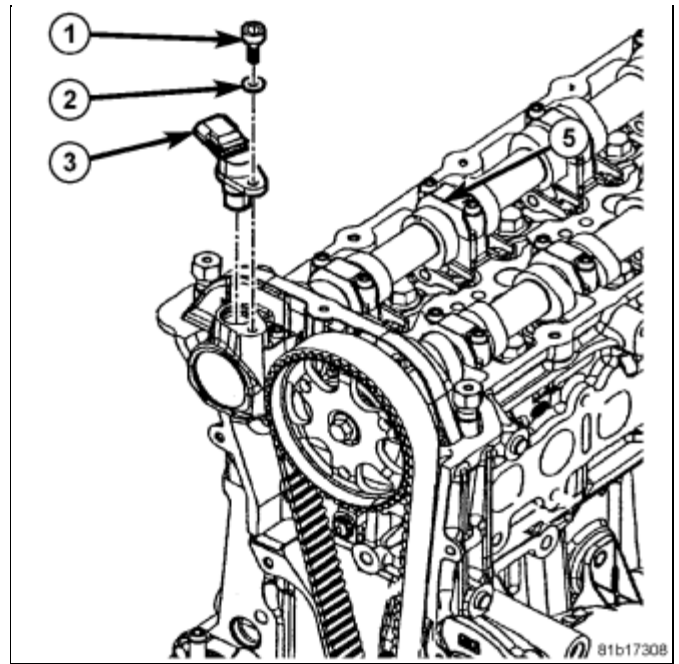
27. Verify that the reluctor wheel (1) has not moved on the camshaft. If the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, replace the camshaft.



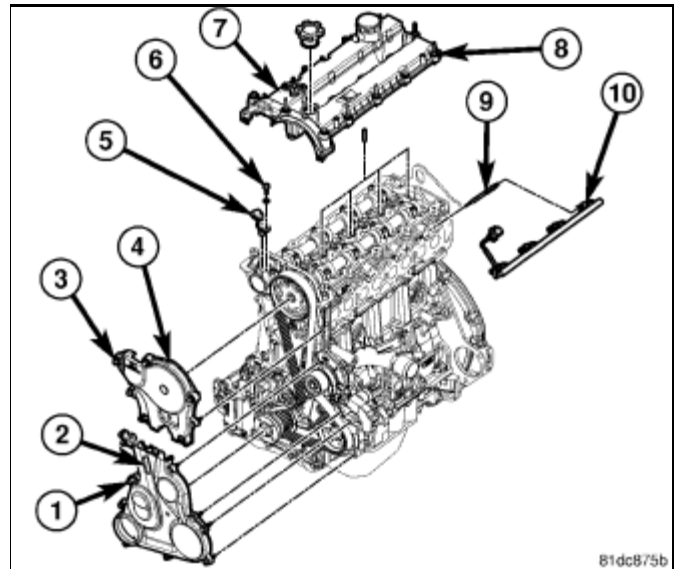
28. Use VM 1057-2 Seal Installer (1) to install the exhaust camshaft oil seal.



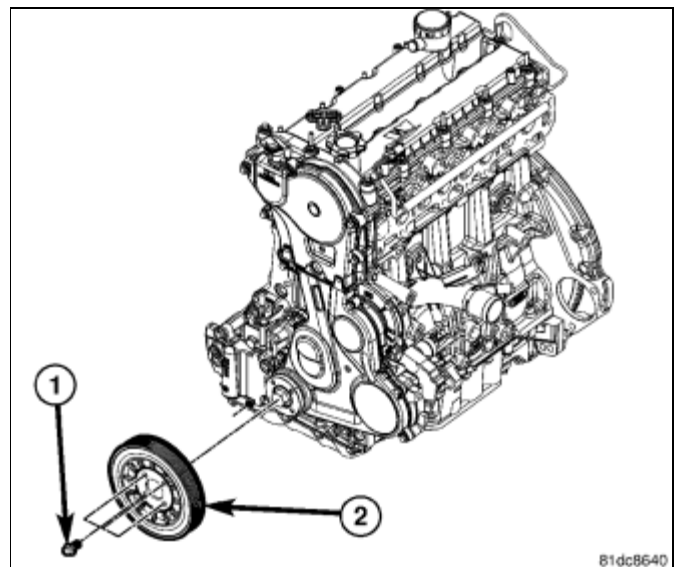
29. Install the cam position sensor (3), and connect the harness connector.



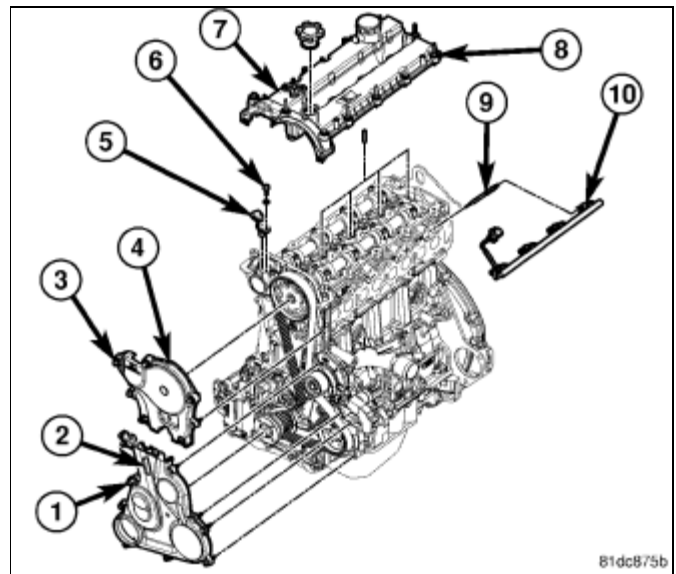
30. Install the lower front cover (2). Torque the bolts to 11 N·m (97 lbs. in.)



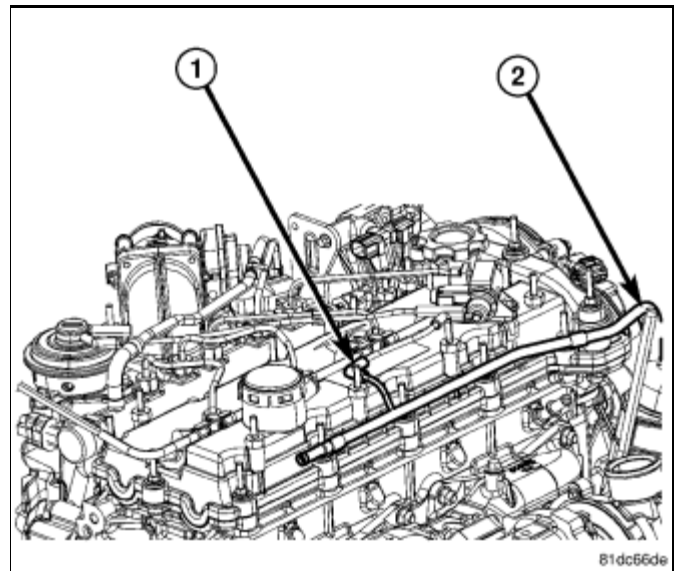
31. Install the crankshaft damper (1). Torque the bolts (1) to 32 N·m (23 lbs. ft.)



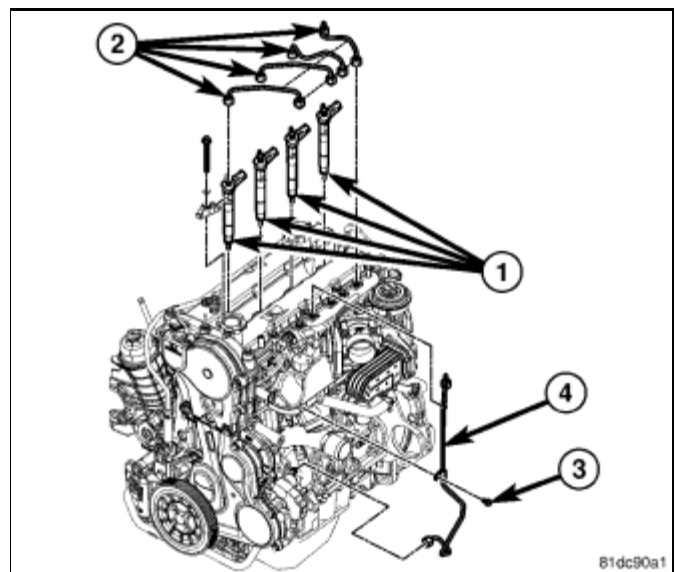
32. Install the upper front cover (3). Torque the bolts to 11 N·m (97 lbs in.)
33. Install the cylinder head cover (7).



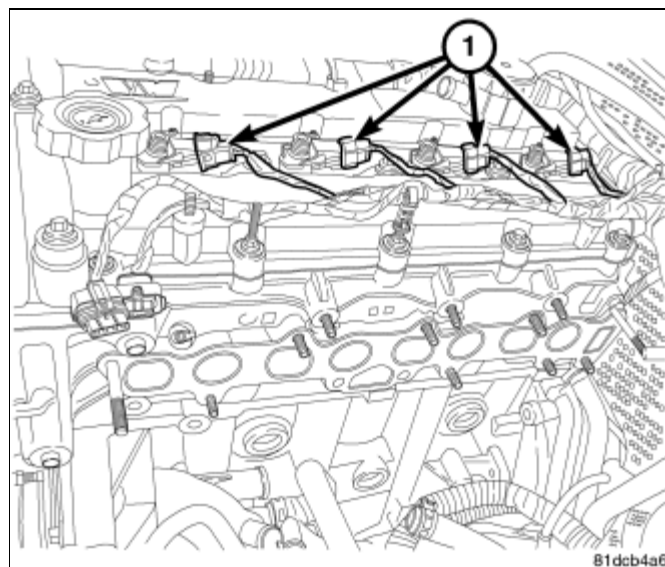
34. Install the vacuum line to the vacuum pump.
35. Install the vacuum line (2) to the camshaft cover.



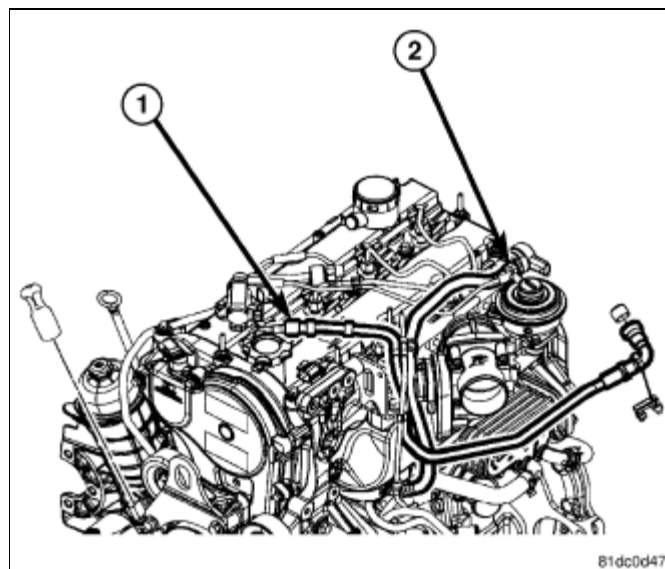
36. Install injectors and injector retainer claw and washer.
37. Install the injector clamp bolts. Do not tighten at this time.
38. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.
39. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).
40. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).
41. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).
42. Torque the fuel lines at the fuel rail to 20 Nm (14.75 Ft lbs).
43. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



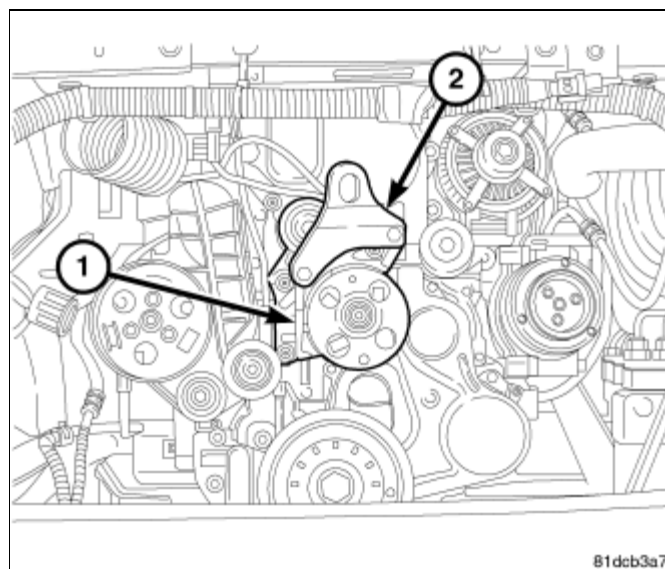
44. Connect the fuel injector harness connectors.



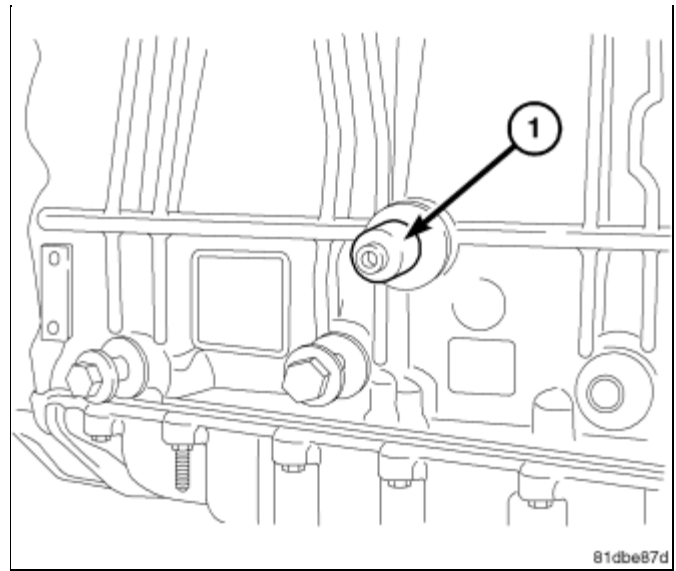
45. Connect the fuel return lines (1) and (2).



46. Install the idler pulley bracket (1).
 47. Install the front engine lifting bracket (2). Torque the bolts to 45 N·m (33 ft.lbs.)



48. Remove crankshaft locking tool (1).
49. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) .
50. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
51. Connect negative battery cable.



CHECKING CAMSHAFT ENDPLAY

1. After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator. The end play should be between 0.10 mm - 0.55 mm .

NOTE: If the camshaft endplay is not within specification, replace the cylinder head.

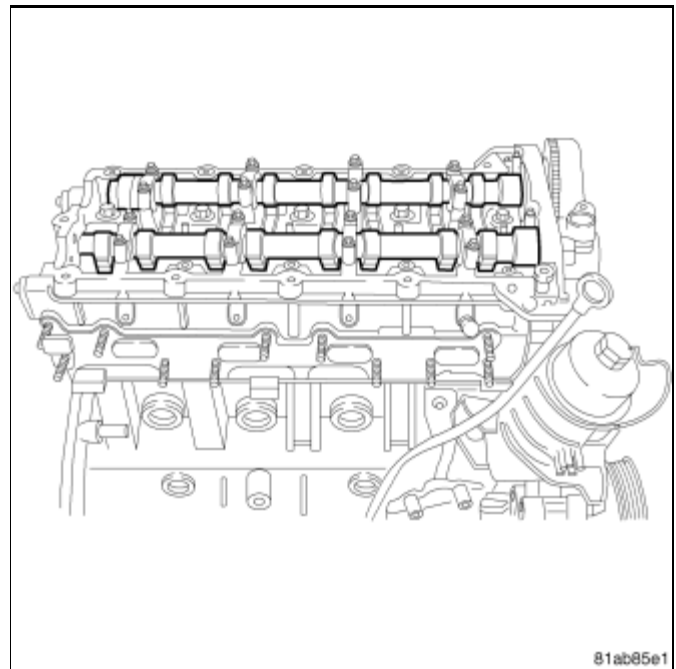
2. Measure the camshaft end play with a dial indicator. The end play should be between 0.15 mm 0.35 mm (0.006 in — 0.0138 in.).

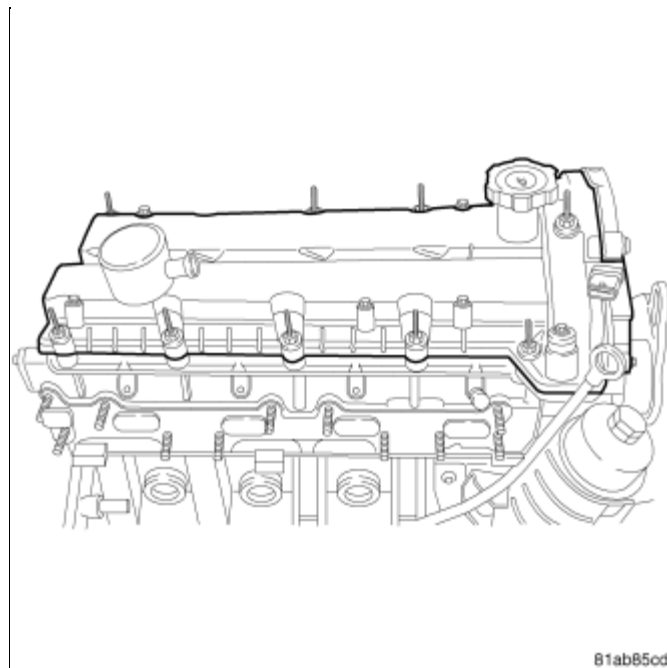
COVER-CYLINDER HEAD

DESCRIPTION

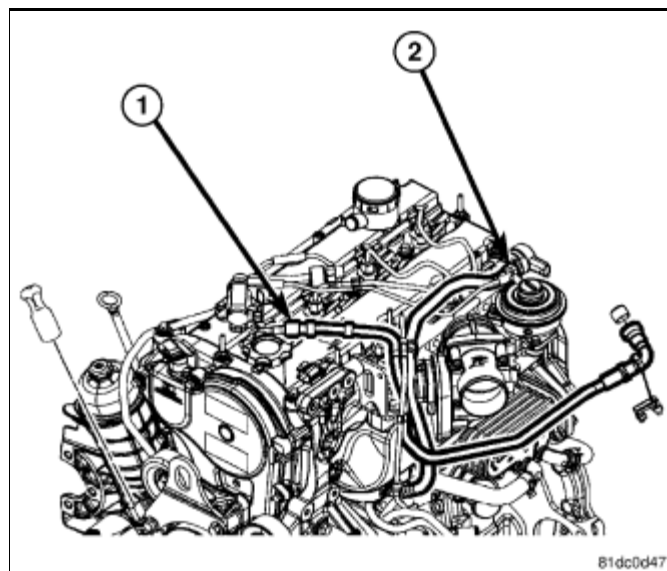
The cylinder head cover and the intake manifold on this engine are made of cast aluminum. The cylinder head cover also incorporates a oil drain back hole for the crankcase ventilation (CCV) system.

REMOVAL

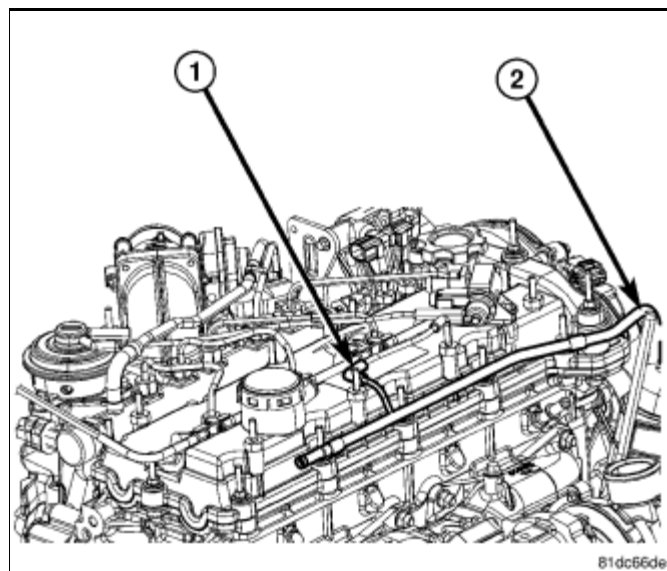




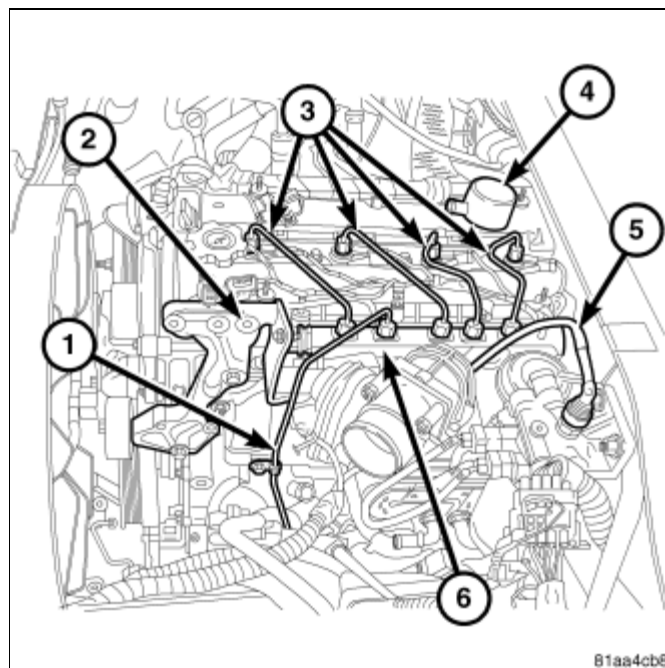
1. Disconnect the fuel return lines (1) and (2).



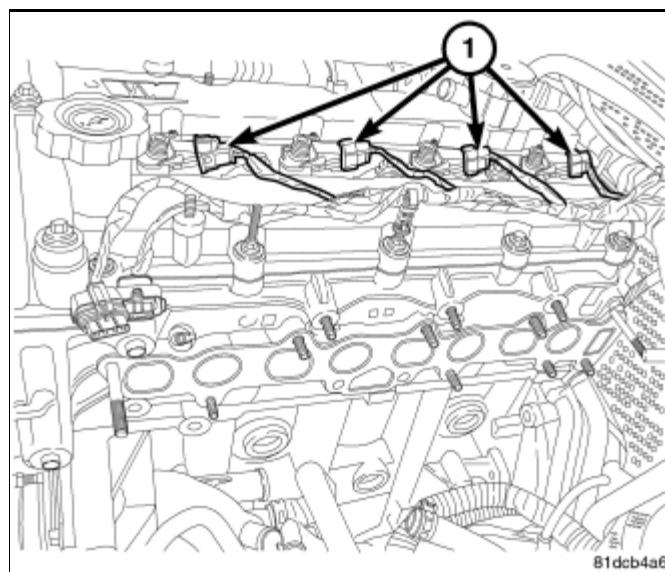
2. Disconnect the vacuum line (2) from the vacuum pump.
3. Disconnect the vacuum line (1).



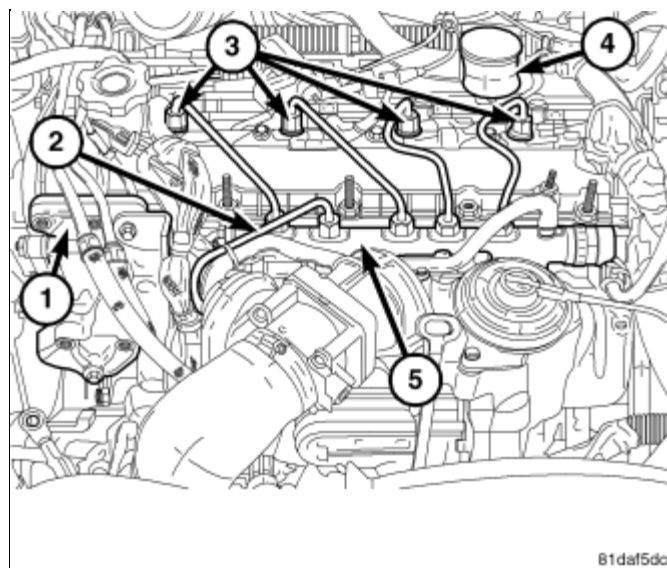
4. Disconnect the crankcase vent hose from the oil separator (4).



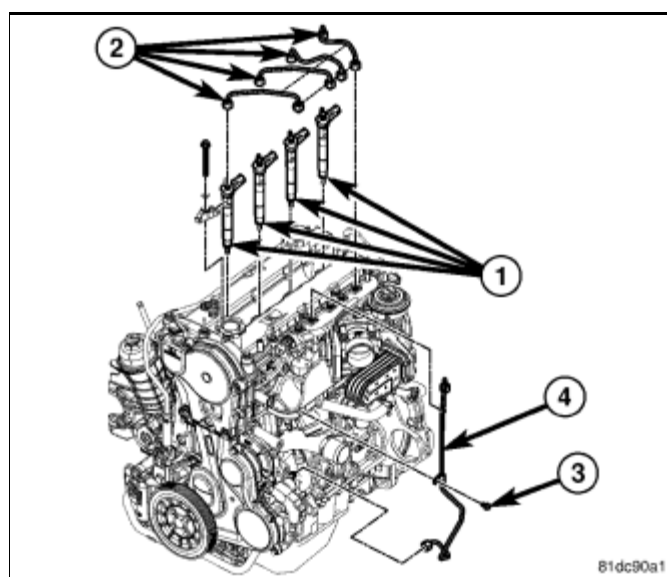
5. Disconnect the fuel injector harness connectors from the fuel injectors (1).



6. Remove the injector fuel lines (3) from the injectors and the fuel rail.

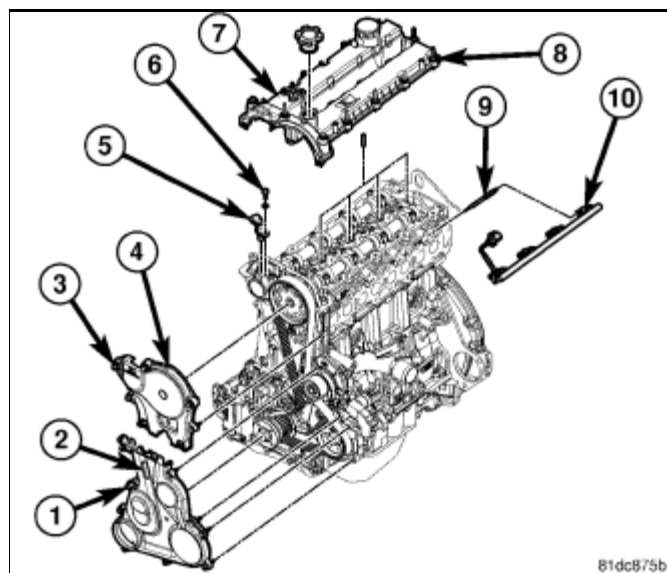


7. Remove the fuel injectors (1).

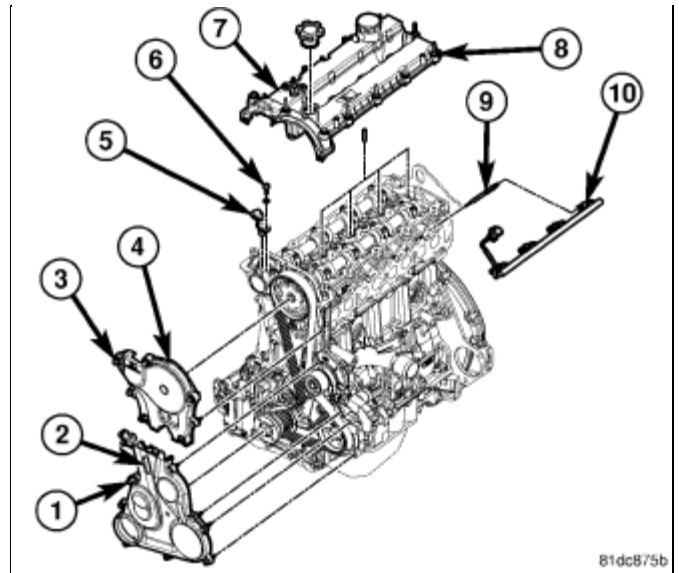


8. Remove the twelve fasteners (8) and the cylinder head cover (7).

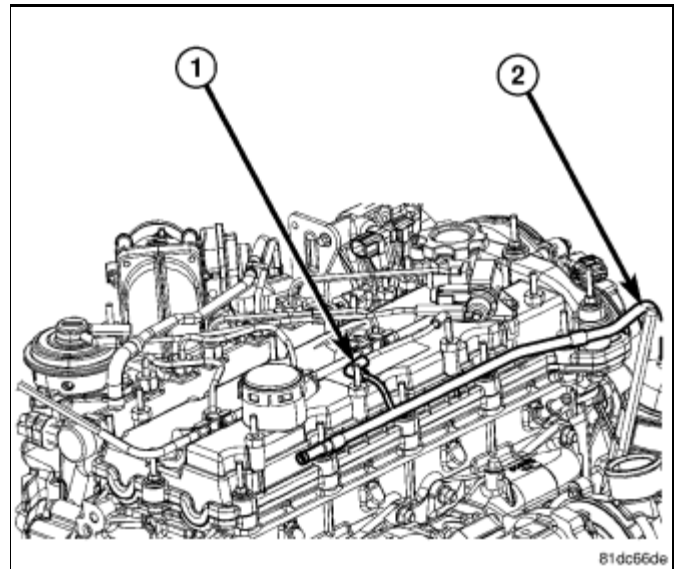
INSTALLATION



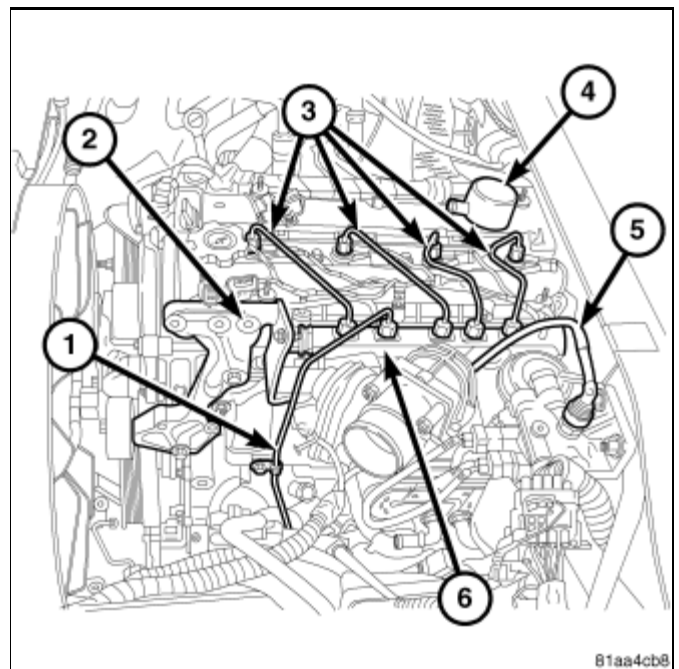
1. Install the upper front cover (3). Torque the bolts to 11 N·m (97 lbs in.)
2. Install a new cylinder head cover gasket, and install the cylinder head cover (7).



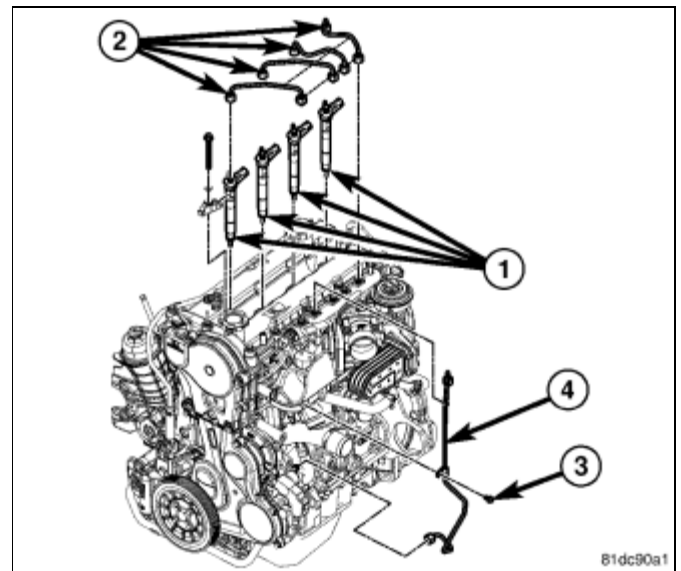
3. Install the vacuum line to the vacuum pump.
4. Install the vacuum line (1) to the fitting.



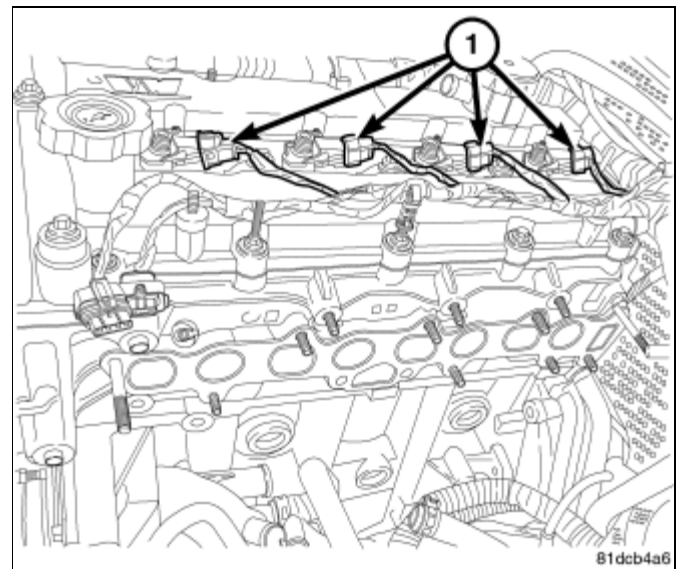
5. Reconnect the crankcase vent hose to the oil separator (4).



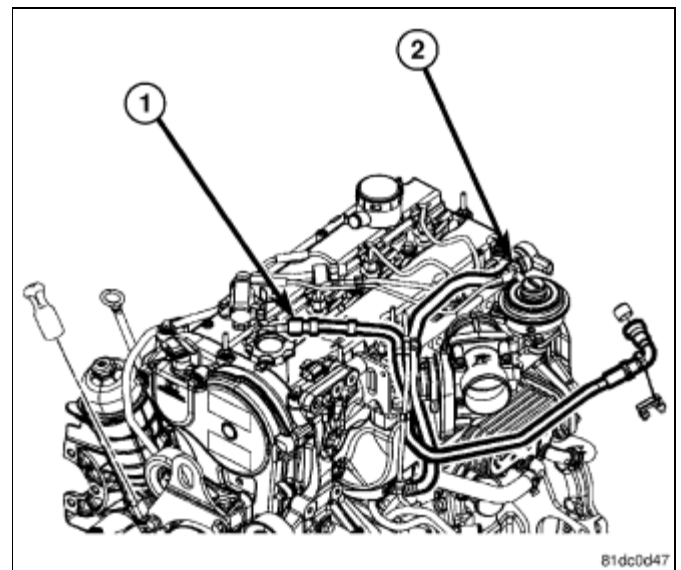
6. Install injectors and injector retainer claw and washer.
7. Install the injector clamp bolts. Do not tighten at this time.
8. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.
9. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).
10. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).
11. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).
12. Torque the fuel lines at the fuel rail to 20 Nm (14.75 Ft lbs).
13. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



14. Connect the fuel injector harness connectors (1).



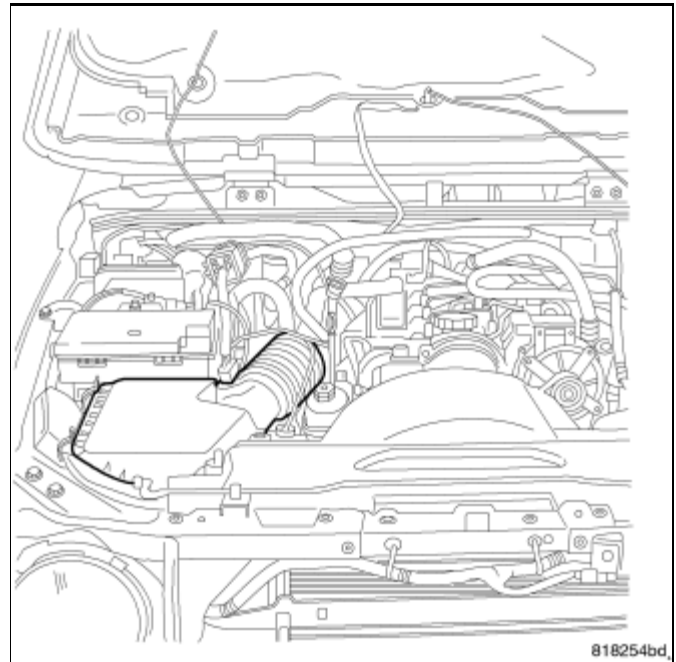
15. Connect the fuel return lines (1) and (2).



16. Connect the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
17. Install the air cleaner housing.
18. Install the upper air deflector.
19. Install the fan.

ARMS-ROCKER

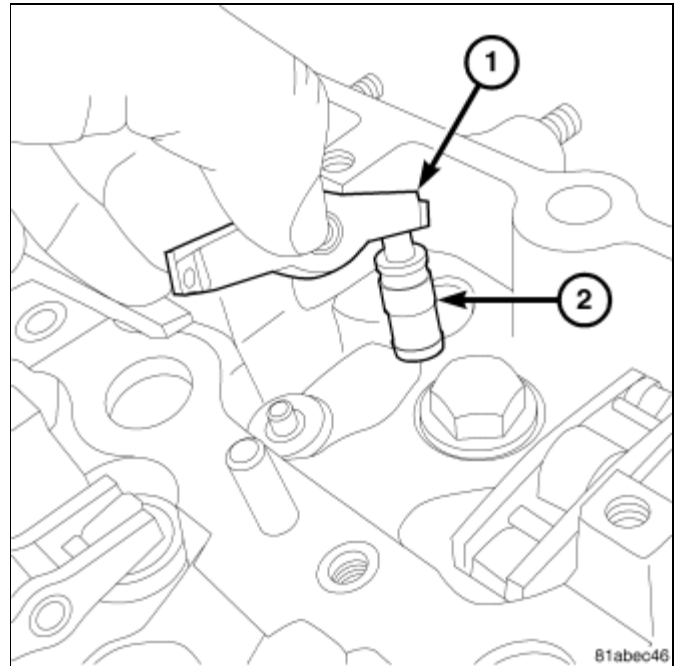
DESCRIPTION



The rocker arms (1) are made of stamped steel and serviced as an assembly along with the lifter.

The rocker arms (1) are used as a link between the camshaft and valves. As the camshaft rotates, the lobes of the camshafts apply downward pressure on the rocker arms (1). This pressure is then applied to the hydraulic lifter (2) which opens the valve.

REMOVAL



CAUTION: Before removing the cylinder head cover/intake manifold (2) the engine must rotated to 90° after TDC to assure proper alignment of the engine timing components. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

1. Disconnect negative battery cable.
2. Rotate the crankshaft to 90 degrees ATDC (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

3. Remove the camshafts. (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL)

4. Remove rocker arms (1) and lifters (2).

INSTALLATION

1. Clean and inspect gasket sealing surfaces.

2. Lubricate lifter ball end of lifter(s), valve(s), and rocker arm roller(s) with Mopar® Engine Oil Supplement or equivalent.

3. Connect rocker arm(s) to lifter and reposition on valve(s).

4. Install the camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

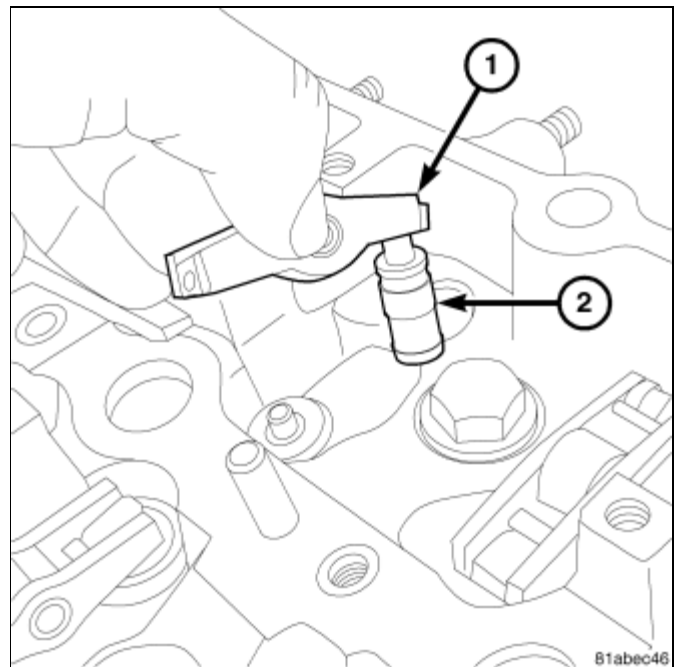
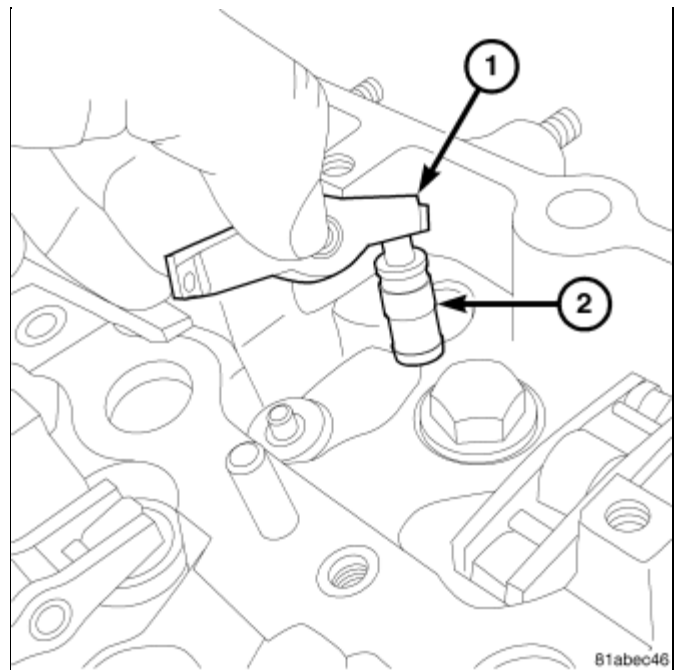
5. Connect negative battery cable.

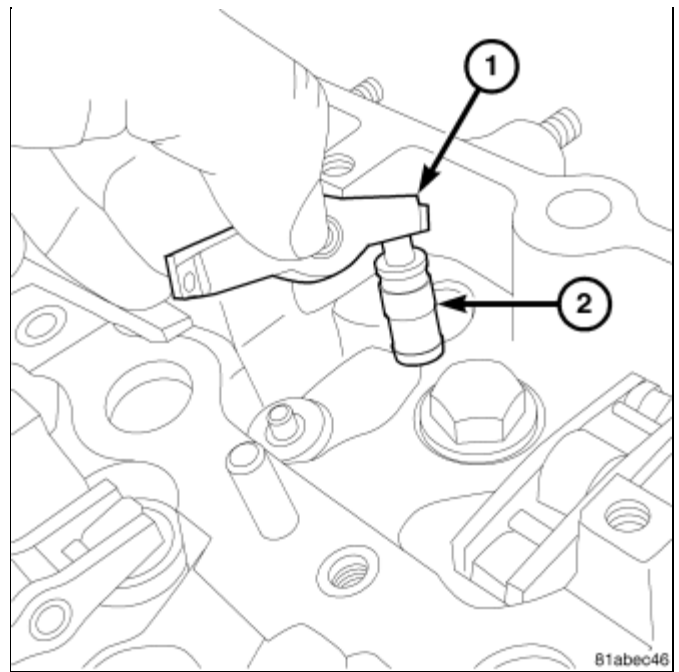
LIFTERS-HYDRAULIC

DESCRIPTION

Valve lash is controlled by hydraulic tappets (2) located inside the cylinder head, in tappet bores below the camshafts.

REMOVAL





1. Remove the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)
2. Remove the camshafts. (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL)

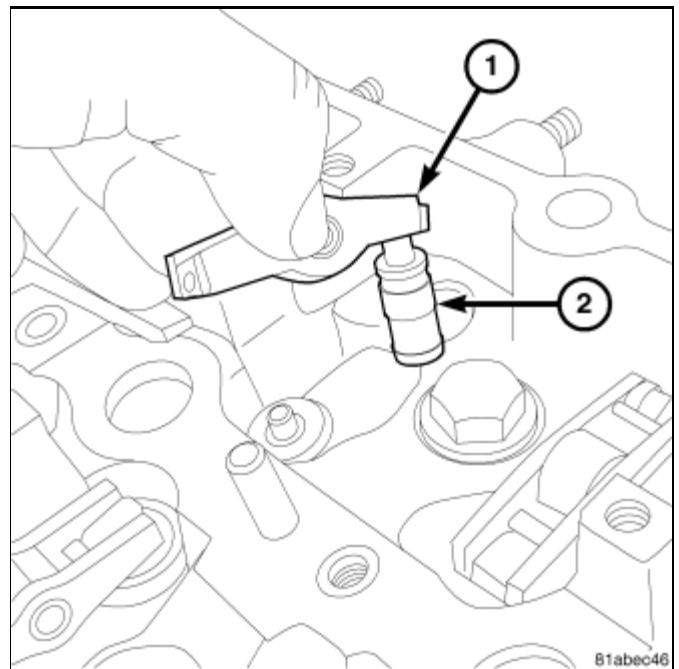
NOTE: Always return the hydraulic lifters to their original location in the cylinder head.

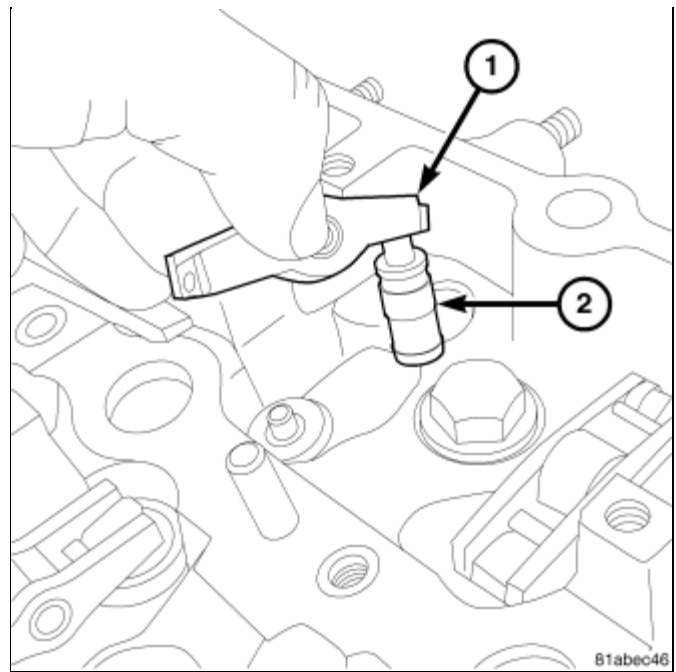
3. Remove the rocker arms (1) and hydraulic lifters (2).

INSPECTION

Clean each lifter assembly (1) in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body.

INSTALLATION

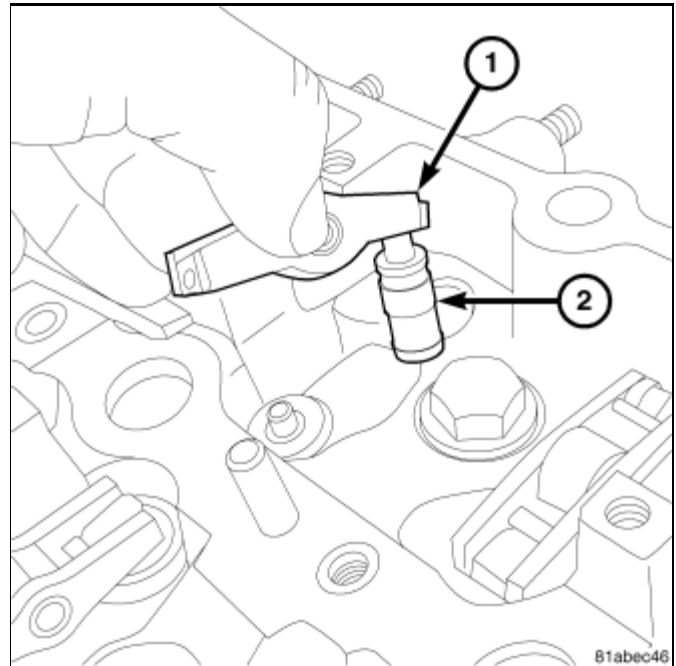




1. Install the rocker arms (1) and hydraulic lifters (2) into their original locations.
2. Install the camshafts. (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL)

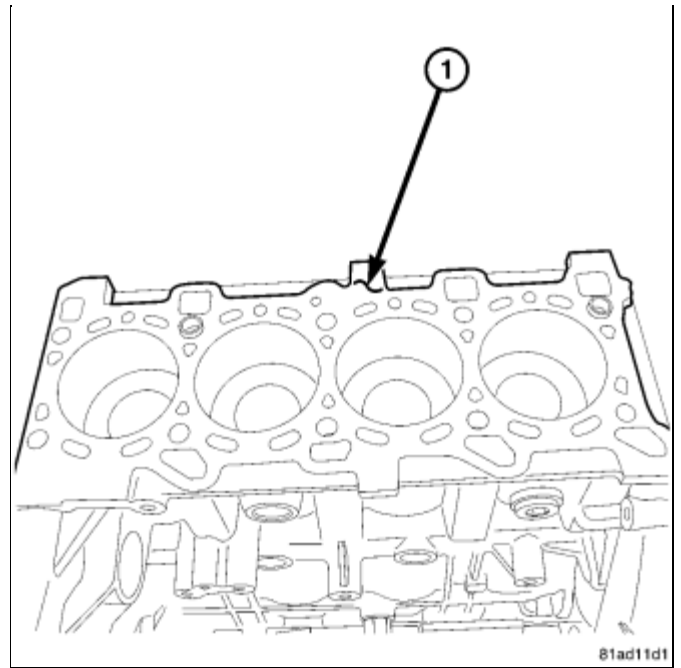
BLOCK-ENGINE

DESCRIPTION



The 2.8L CRD Diesel engine uses a cast iron engine block. The cylinder block has increased stiffness that reduces structural flexing and a fractured connecting rod cap design that can not distort connecting rod cap fit.

STANDARD PROCEDURE - BEARING SELECTION CHARTS



Connecting Rod Bearings — Large End

Connecting Rod Journal Diameter — Connecting Rod Large End		Connecting Rod Journal Diameter — Crankshaft				
		D	C	B	A	
		53.929 — 53.936	53.936 — 53.942	53.942 — 53.948	53.948 — 53.955	
A 57.563 — 57.568	Upper Bearing Shell	Blue	Blue	Red	Red	
	Lower Bearing Shell	Yellow	Blue	Blue	Red	
B 57.563 — 57.568	Upper Bearing Shell	Yellow	Blue	Blue	Red	
	Lower Bearing Shell	Yellow	Yellow	Blue	Blue	
C 57.563 — 57.568	Upper Bearing Shell	Yellow	Yellow	Blue	Blue	
	Lower Bearing Shell	Green	Yellow	Yellow	Blue	
D 57.563 — 57.568	Upper Bearing Shell	Green	Yellow	Yellow	Blue	

	Lower Bearing Shell	Green	Green	Yellow	Yellow		
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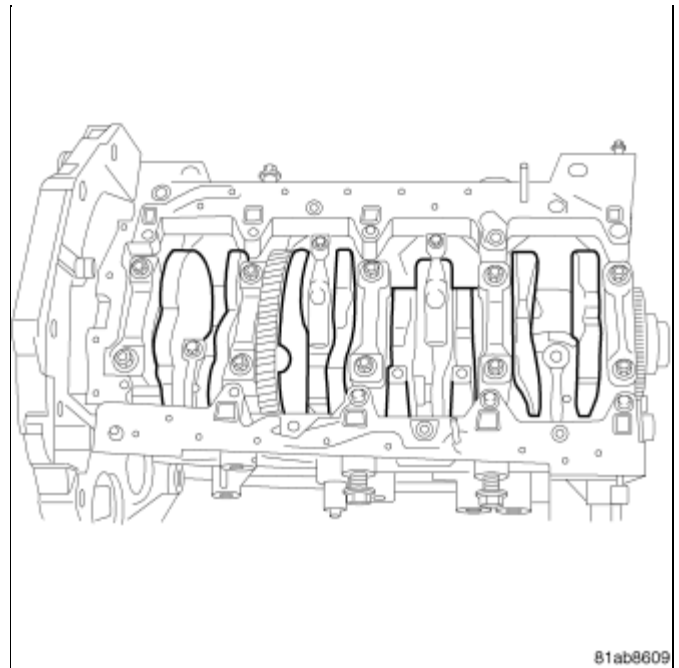
Crankshaft Bearings

Cylinder Block Seat Diameter		Crankshaft Main Journal Diameter					
		D	C	B	A		
		64.974 — 64.981	64.981 — 64.987	64.987 — 64.993	64.993 — 64.000		
A 69.000 — 69.005	Upper Bearing Shell	Blue	Blue	Red	Red		
	Lower Bearing Shell	Yellow	Blue	Blue	Red		
B 69.005 — 69.010	Upper Bearing Shell	Yellow	Blue	Blue	Red		
	Lower Bearing Shell	Yellow	Yellow	Blue	Blue		
C 69.010 — 69.015	Upper Bearing Shell	Yellow	Yellow	Blue	Blue		
	Lower Bearing Shell	Green	Yellow	Yellow	Blue		
D 69.015 — 69.020	Upper Bearing Shell	Green	Yellow	Yellow	Blue		
	Lower Bearing Shell	Green	Green	Yellow	Yellow		

CRANKSHAFT DESCRIPTION

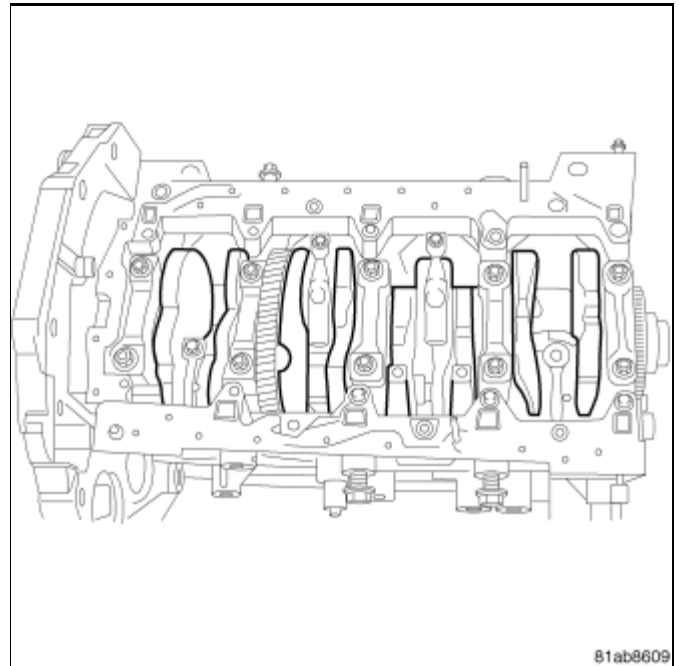
The crankshaft for the 2.8L is a forged steel type design with five main bearing journals. The crankshaft is located at the bottom of the engine block.

STANDARD PROCEDURE - CHECKING CRANKSHAFT END PLAY

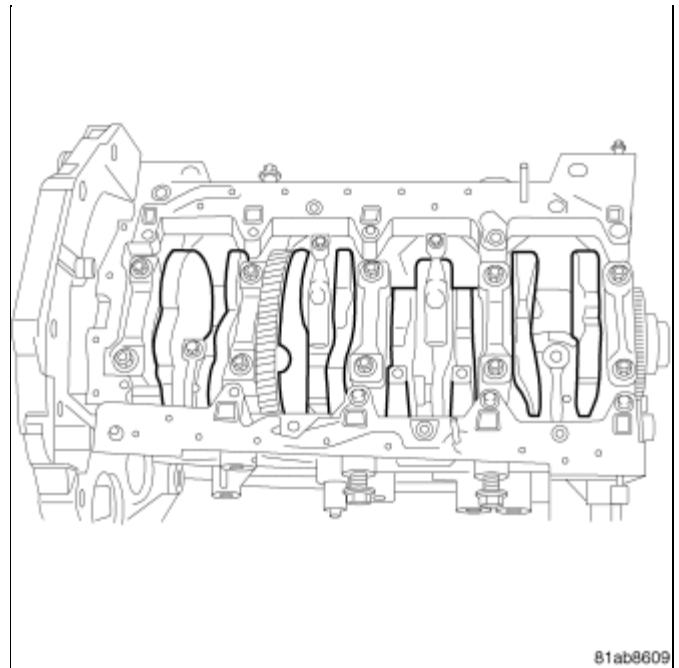


1. Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the flywheel.
2. Move the crankshaft all the way to the front of its travel.
3. Zero the dial indicator).
4. Move the crankshaft all the way to the rear and read dial indicator. For crankshaft end play clearances (Refer to 9 - ENGINE - SPECIFICATIONS).

REMOVAL - CRANKSHAFT



1. Remove the lower oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the upper oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
3. Remove the balance shaft assembly (Refer to 9 - ENGINE/ENGINE BLOCK/BALANCE SHAFT MODULE - REMOVAL).
4. Remove the rear crankshaft oil seal carrier (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).
5. Remove the front cover and front crank oil seal (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - FRONT -



REMOVAL).

6. Remove the bearing caps from the piston rods.
7. Remove the bearing caps from the crankshaft journals.
8. Remove the crankshaft.

INSTALLATION

1. Use the crankshaft bearing selection chart for main bearing selection. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE)

2. Lubricate and install the crankshaft bearings. Make sure the thrust washer is not touching the engine block.

3. Install the crankshaft.

4. Install the main bearing caps in the same location as they were removed. The notches on the top of the bearing caps indicate their proper position. The front cap has one notch, the next cap two, etc.

5. Using the black number bubbles in the torque pattern, torque the crankshaft bolts to 50 Nm (36 lbs. ft.)

6. Using the white number bubbles in the torque pattern, Turn the bolts an additional 90°.

7. Measure the crankshaft end play. Crankshaft end play must be between 0.1mm and 0.33mm (0.004in — 0.13in).

8. Install the connecting rod bearings.

9. Install the connecting rods. (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION)

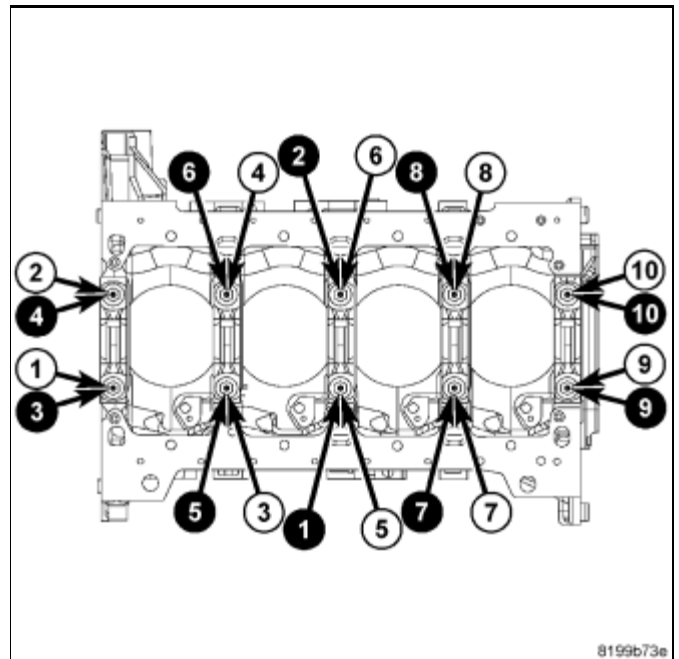
10. Install the balance shaft assembly. (Refer to 9 - ENGINE/ENGINE BLOCK/BALANCE SHAFT MODULE - INSTALLATION)

11. Install the upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

12. Install the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

13. Install the front main seal carrier. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION)

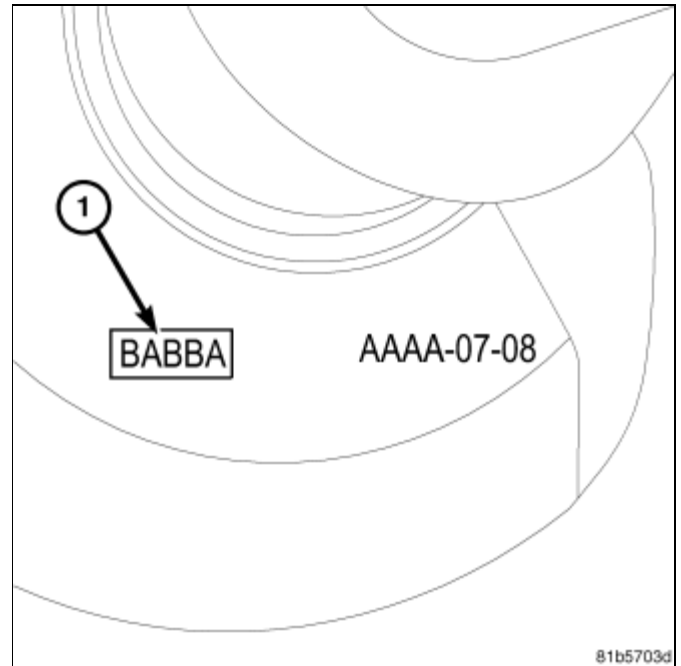
14. Install the rear main seal carrier. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - INSTALLATION)



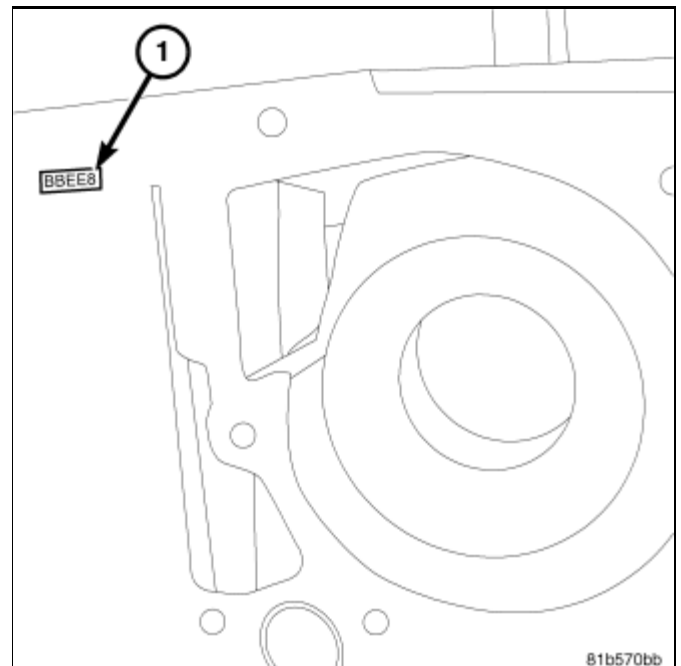
BEARINGS-CRANKSHAFT MAIN

INSTALLATION

1. Locate the crankshaft journal size (1) stamp on the crankshaft weight.

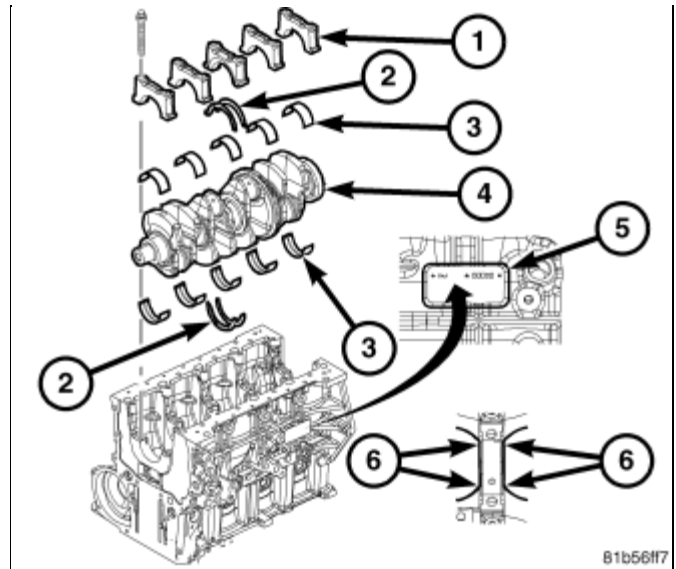


2. Locate the engine block crankshaft journal size stamp on the engine block (1).



3. Use the crankshaft stamp and engine block stamp to select the correct crankshaft bearing sizes from the bearing chart. The letters stamped into the block are in the same order as the cylinders (5). The first letter corresponds to the first

- cylinder, the second to the second, etc. (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE)
4. If the crankshaft was removed to install the bearings, install the crankshaft. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSTALLATION)
 5. Install the balance shaft assembly (Refer to 9 - ENGINE/ENGINE BLOCK/BALANCE SHAFT MODULE - INSTALLATION).
 6. Install the oil pan.



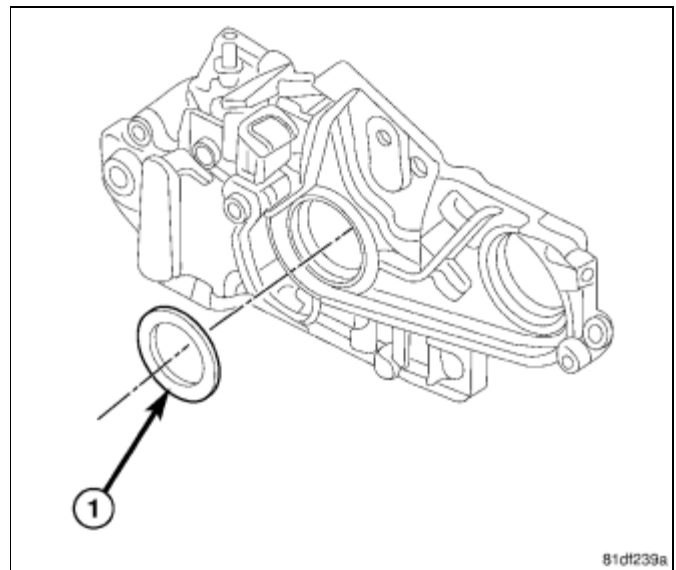
CRANKSHAFT OIL SEAL - FRONT REMOVAL

1. Remove the timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/BELT-TIMING - REMOVAL).
2. Remove the crankshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: Do not gouge or scratch the surface of the crankshaft when removing the front crankshaft oil seal.

3. Remove the front crankshaft oil seal (1).

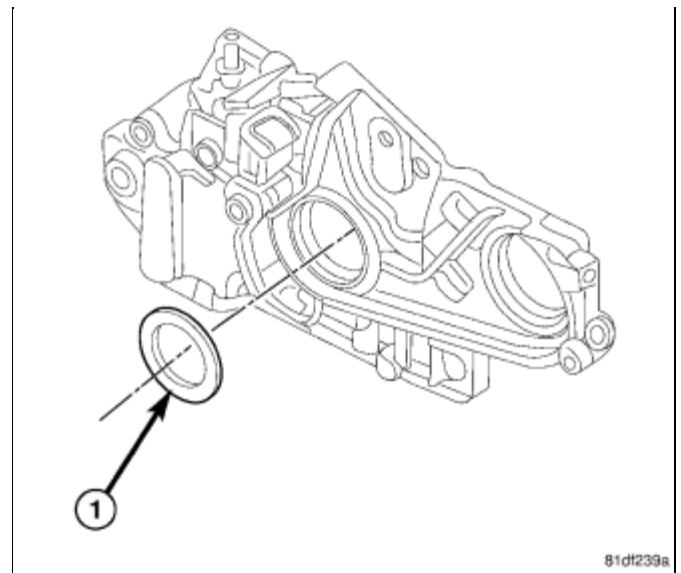
INSTALLATION



1. Use the 9937 seal installer to install the front crankshaft oil seal (1) into the rear timing belt cover.
2. Install the crankshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
3. Install the timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/BELT - TIMING - INSTALLATION).

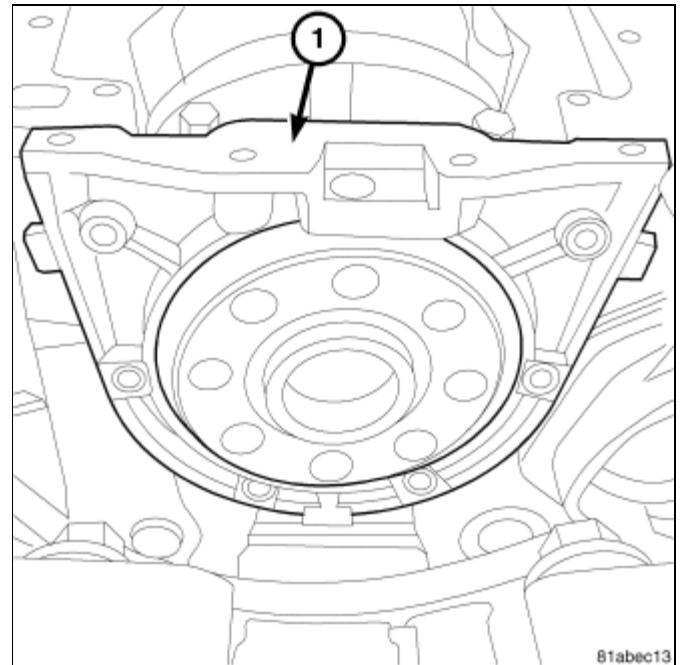
SEAL-CRANKSHAFT OIL - REAR

DESCRIPTION



The rear crankshaft seal consists of a seal and a seal carrier (1). The rear seal is inserted into the carrier. Once assembled the rear main seal assembly should not be separated to reduce the possibility of damage to the internal rear seal lip.

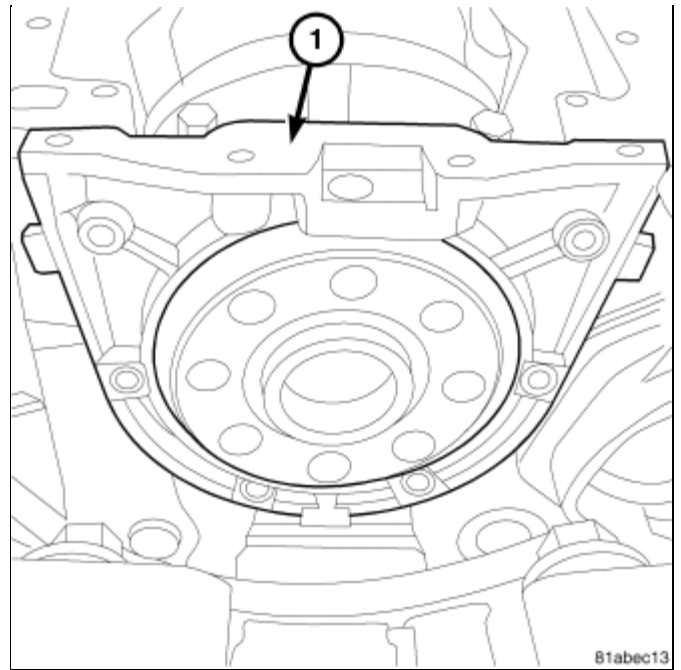
REMOVAL



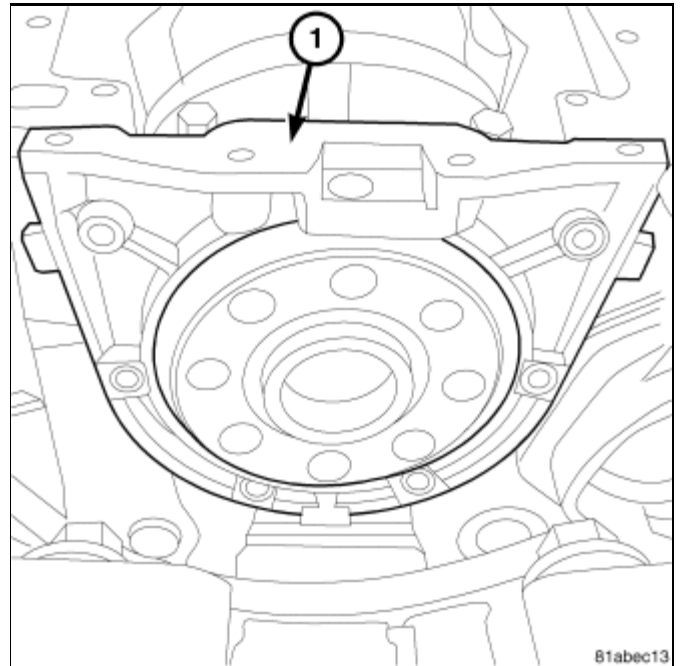
This must be done with either the engine or transmission removed from vehicle.

1. Remove flywheel assembly.
2. Pry out old crankshaft oil seal.

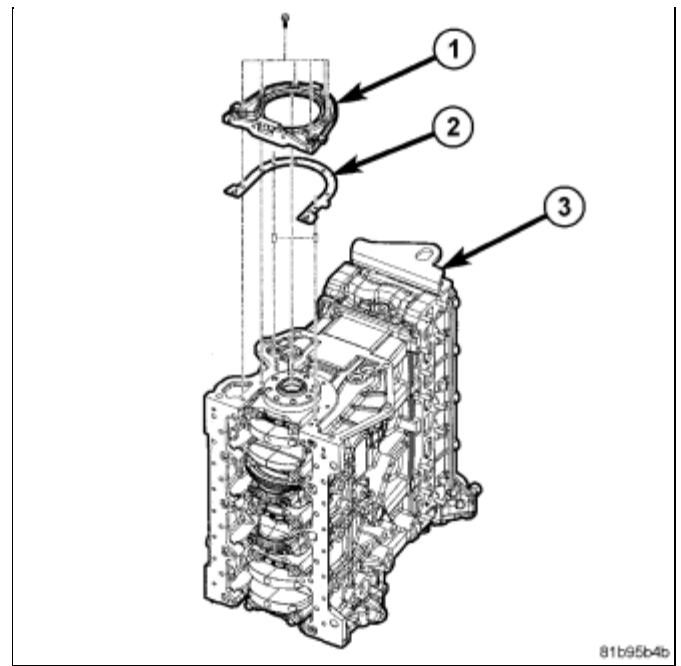
INSTALLATION



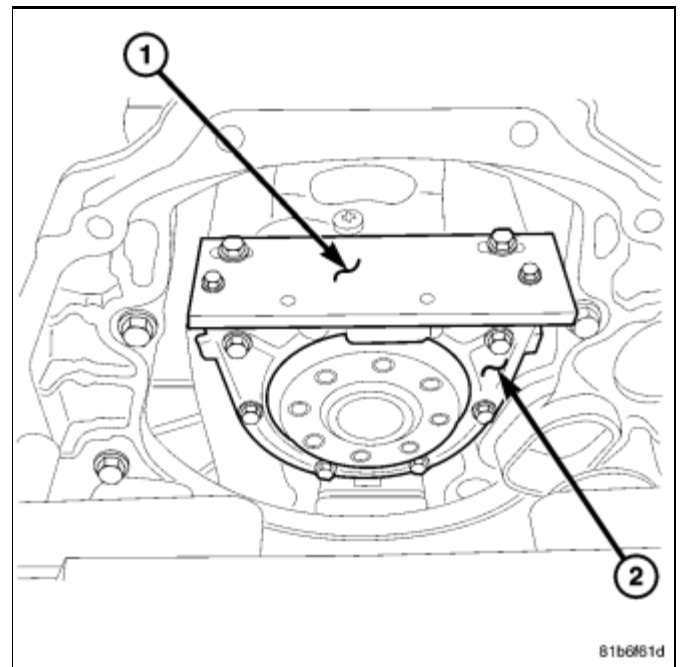
1. Make sure the rear main seal sealing surfaces are free of oil and debris.
2. Make sure the crankshaft sensor wheel is positioned correctly on the crankshaft.



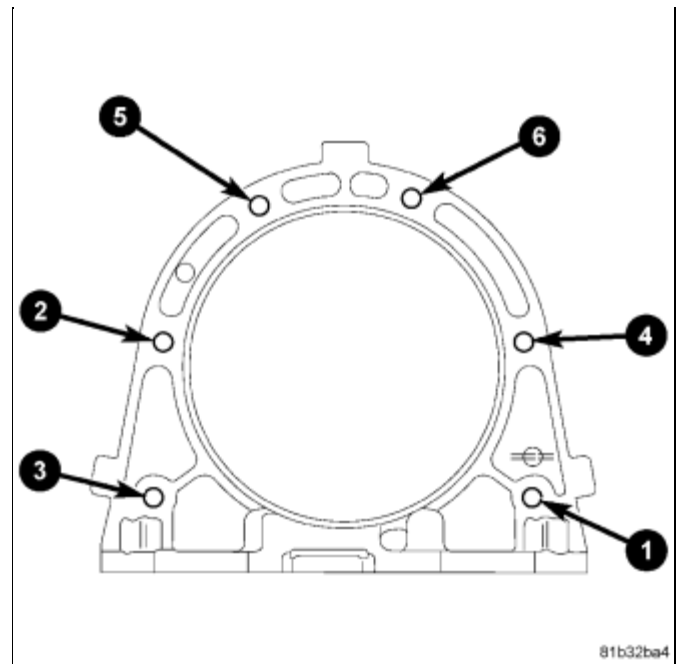
3. Position the rear main seal carrier gasket (2).
4. Using special tool VM. 9993, install rear crankshaft oil seal into the rear main seal carrier (1).
5. Using special tool VM 9993 install the rear main seal carrier onto the engine block (3).



6. Use special tool VM9990 (1) to set the depth of the rear main seal (2).



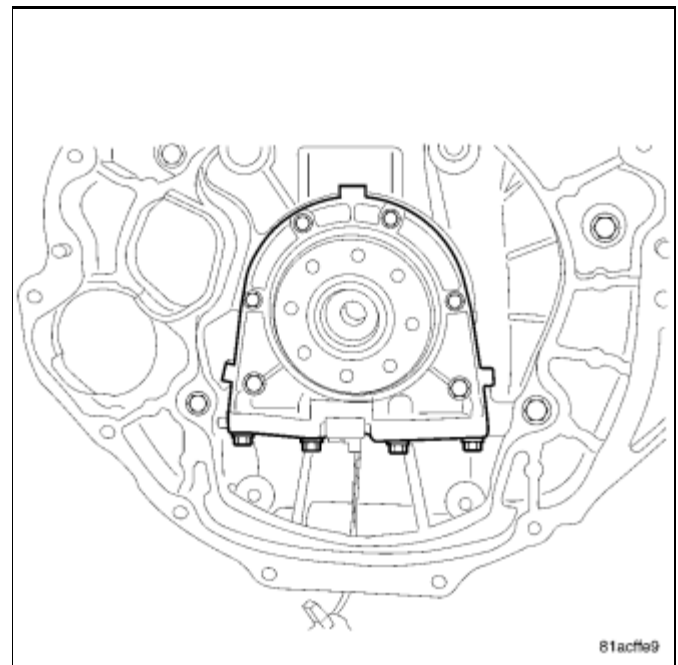
7. Use the illustrated pattern to torque the rear cover bolts to 15 Nm (133 lbs. in.).



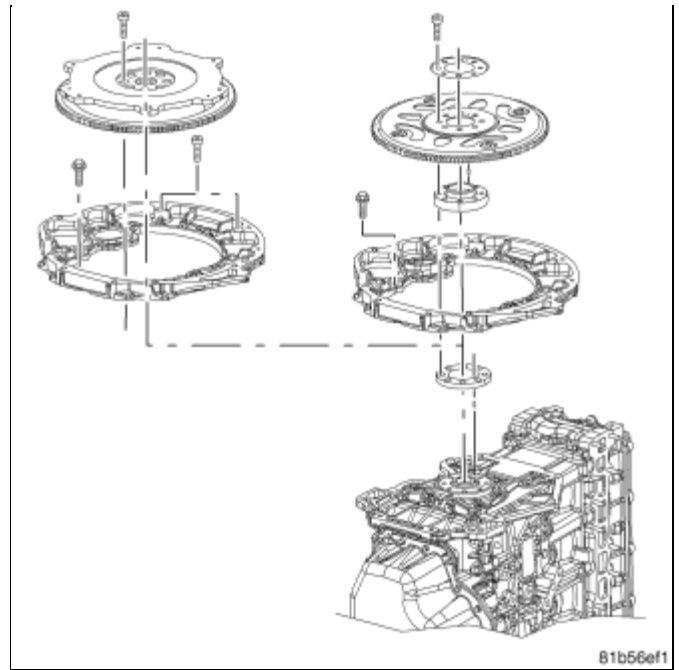
8. Install the upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
9. Install the Crankshaft Position Sensor (CKP). Torque the CKP bolt to 11 Nm (97 lbs. in.).
10. Install the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
11. Connect the CKP sensor.
12. Install engine or transmission in vehicle.

FLEX PLATE/FLYWHEEL

REMOVAL

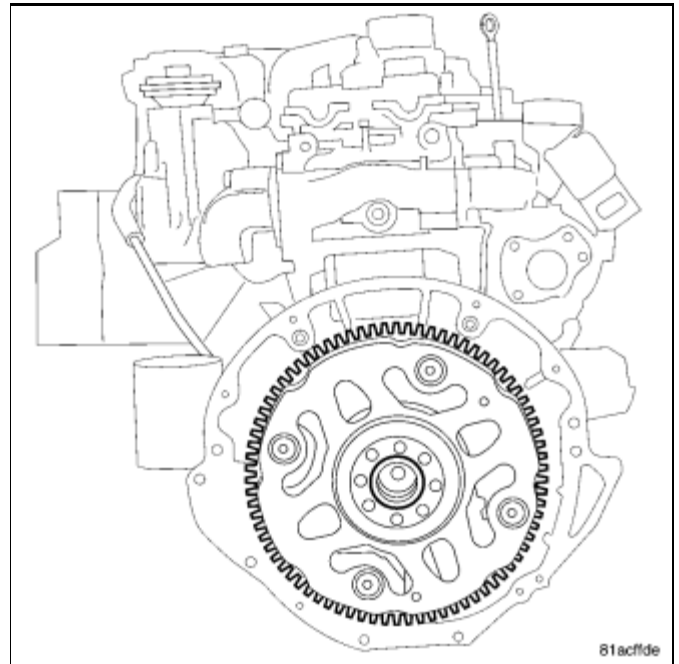


1. Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL).
2. Paint mark the flex plate hub to flex plate relation.
3. Remove the 40 mm flex plate bolts (1) and flex plate (2).



4. Inspect flex plate (2) for damage.

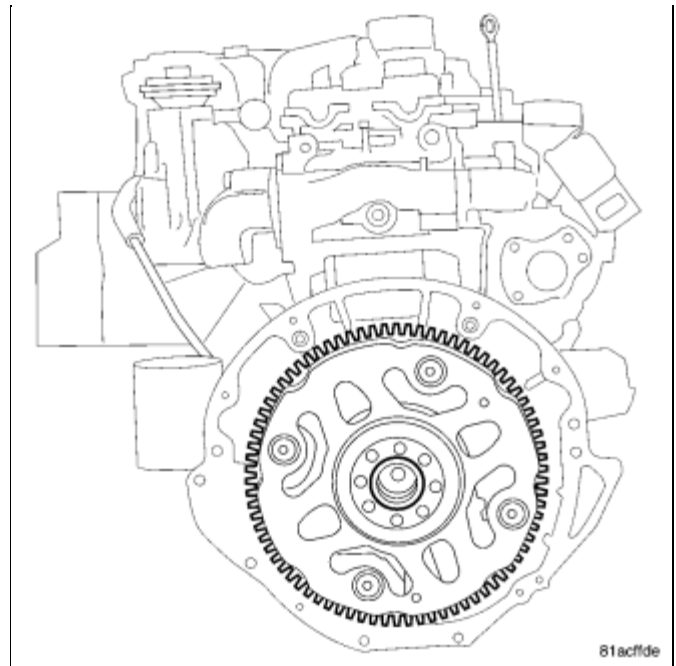
INSTALLATION



NOTE: Always use new flex plate or flywheel bolts.

1. Install the flex plate/flywheel hub and hand tighten the fasteners.

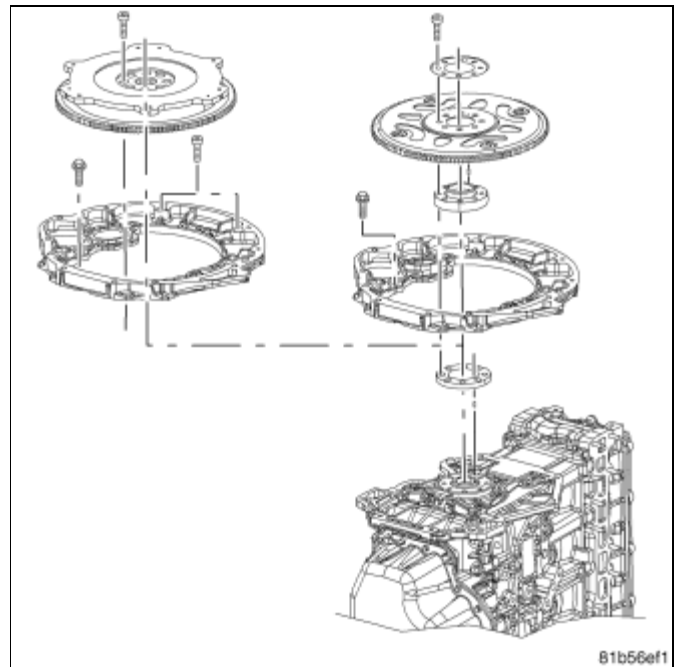
NOTE: Do not lubricate new bolts as they are already coated with an anti-scuff treatment. Align the flex plate to hub paint marks, where applicable.



2. Install the flex plate or flywheel bolts. Use a cross pattern to torque the bolts to 50 N·m (37 lbs. ft.).
 3. Loosen one flex plate/flywheel bolt at a time and tighten to 25 N·m (18 lbs. ft.).

- For 40 mm length bolts turn each bolt an additional 60°.
- For 50 mm length bolts turn each bolt an additional 75°.
- For 60 mm length bolts turn each bolt an additional 90°.

4. Install the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION).

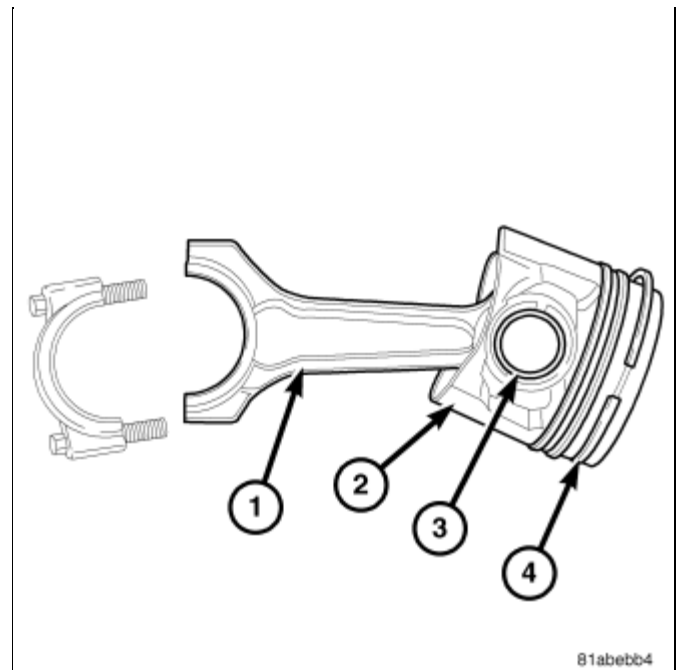


ROD-PISTON AND CONNECTING DESCRIPTION

The pistons (2) are of a free floating design. Oil jets in the engine block lubricate and cool the piston and piston pin (3) assembly. The connecting rods (1) have a pressed in place wrist pin bushing which is lubricated by the oil jets. Connecting rod (7) and bearing caps have cracked mating surfaces and are not interchangeable.

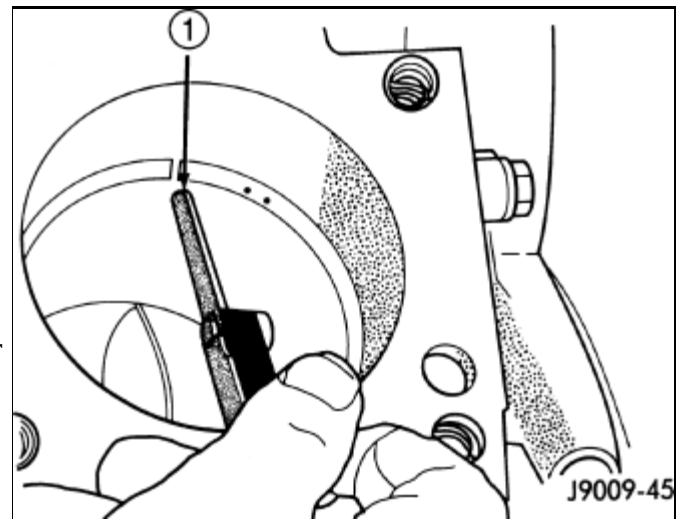
STANDARD PROCEDURE -

PISTON RING FITTING



81abebb4

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge. Top compression ring gap .30 to .45mm (.0118 to .0177 in.). Second compression ring gap .30 to .45mm (.0118 to .0177 in.). Oil control ring gap .25 to .50mm (.0098 to .0196 in.).
2. If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

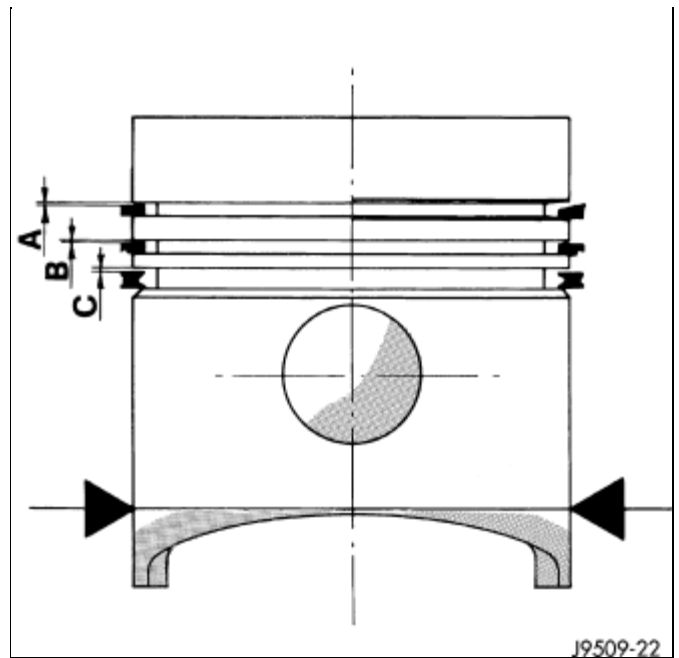


3. Check piston ring to groove clearance. Top compression ring gap .080 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .110mm (.0027 to .0043 in.). Oil control ring gap .040 to .080mm (.0015 to .0031 in.).

REMOVAL

NOTE: Both the connecting rod and the connecting rod cap are paint marked to aid during assembly. Paint marks disappear after time. If the rod and the cap are not marked with paint, paint mark or scribe them before disassembly.

1. Disconnect negative battery cable.



2. Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

3. Raise vehicle on hoist.

4. Remove the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

5. Remove upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

6. Remove the oil jets. (Refer to 9 - ENGINE/LUBRICATION/OIL JET - REMOVAL)

7. Remove balance shaft assembly. (Refer to 9 - ENGINE/ENGINE BLOCK/BALANCE SHAFT MODULE - REMOVAL)

8. Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep top of pistons covered during this operation.**

9. Piston and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

NOTE: Be careful not to nick or scratch crankshaft journals

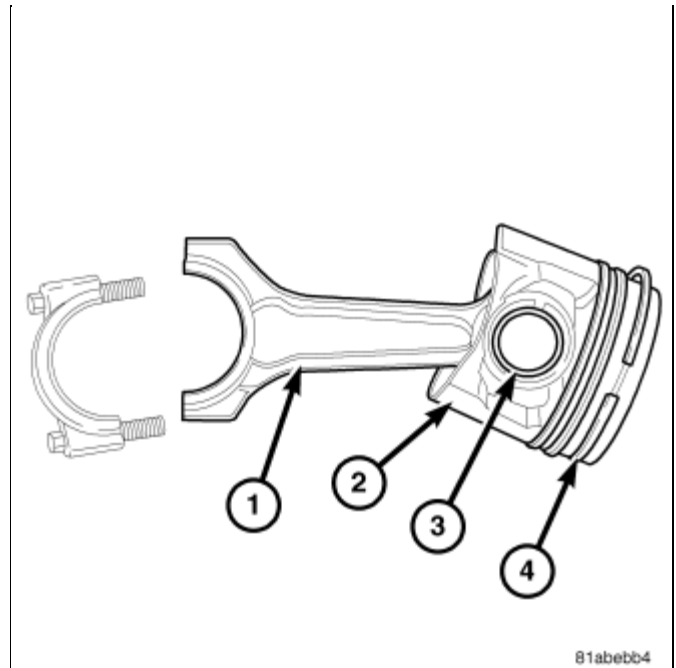
10. After removal, install bearing cap on the mating rod and mark pistons with matching cylinder number when removed from engine block.

PISTON PIN - REMOVAL

1. Secure connecting rods (1) in a soft jawed vice.

2. Remove 2 snap rings securing piston pin (3).

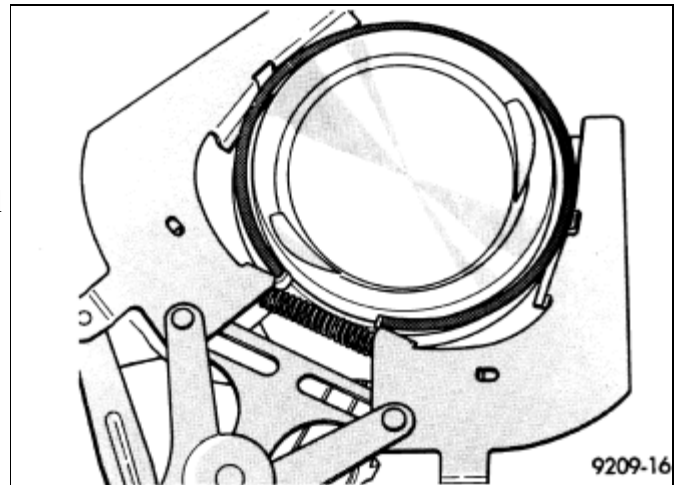
3. Push piston pin (3) out of piston (2) and connecting rod (1).



PISTON RING - REMOVAL

1. ID mark on face of top and second piston rings must point toward piston crown.
2. Using a suitable ring expander, remove top and second piston rings.
3. Remove upper oil ring side rail, lower oil ring side rail and then the oil expander from piston.
4. Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

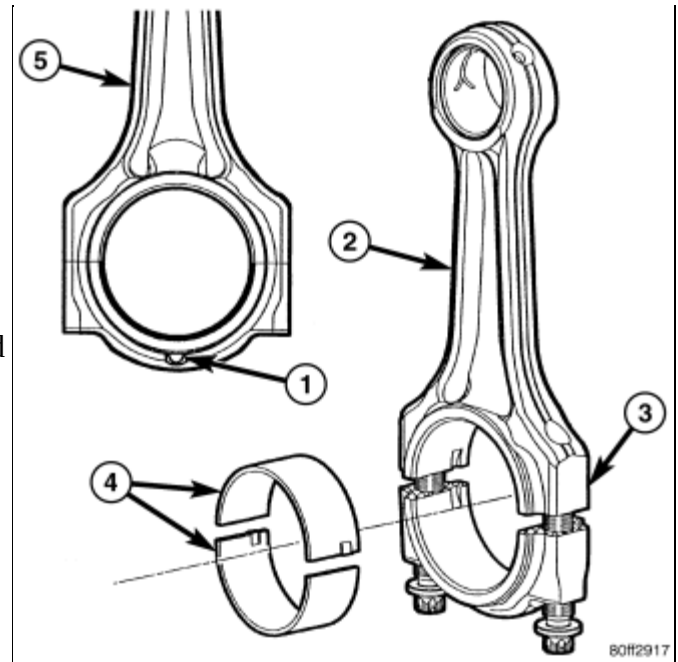
INSPECTION



PISTONS

1. Piston Diameter: Size: 91.912-91.928mm (3.6185-3.6192 in.) Maximum wear limit .05mm (.0019 in.).
2. Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019in.).
3. The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.

4. Skirt wear should not exceed 0.1 mm (.00039 in.).
5. The clearance between the cylinder liner and piston should not exceed 0.065-0.083 mm (.0025-.0032 in.).

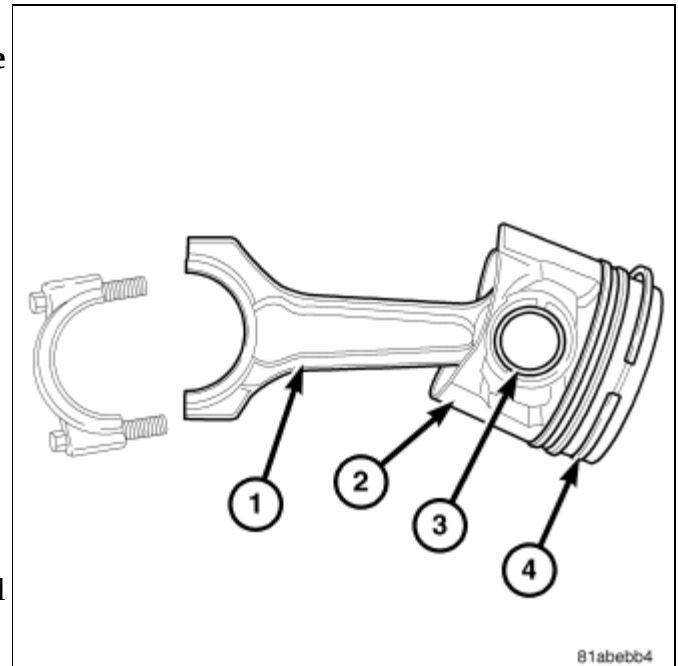


CONNECTING RODS

CAUTION: Connecting rod bolts must be replaced when disassembled. When assembling the connecting rod (2), be sure that the connecting rod pawl (1) on each of the connecting rod caps is facing the rear (fly wheel) side of the engine.

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.

1. Assemble connecting rod bearings (4) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.
2. Tighten connecting cap bolts to 10 N·m (88 in. lbs.).
3. Without loosening connecting rod bolts, tighten all bolts to 30N·m (22 ft.lbs.).
4. Using a torque angle gauge, tighten each bolt an additional 40°.
5. Recheck all bolt tightening with a torque wrench set to 88N·m (65 ft.lbs.).
6. Check and record internal diameter of crank end of connecting rod (2).



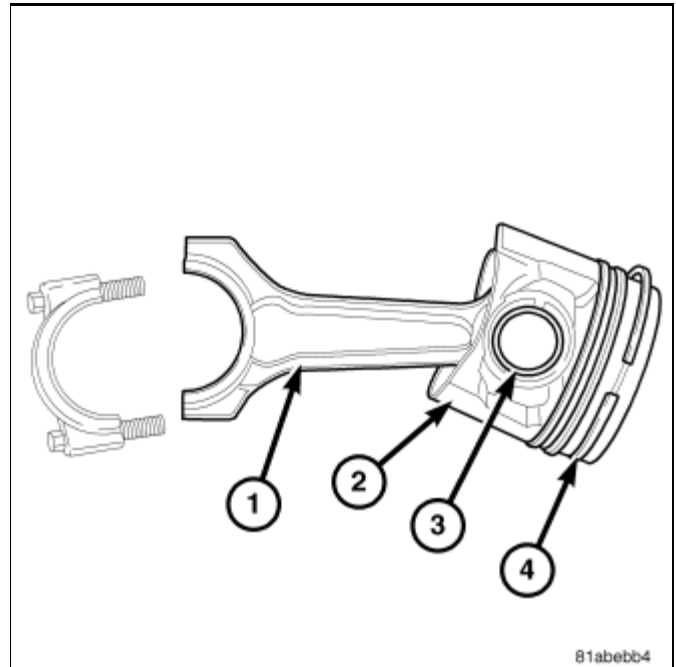
CAUTION: When changing connecting rods (2), DO NOT use a stamp to mark the cylinder location. Identify the connecting rods (2) and caps location using a paint marker. All four must have the same weight and the same number. Replacement connecting rods (2) will only be supplied in sets of four.

Connecting rods (2) are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 5 gr.

PISTON PINS

1. Measure the diameter of piston pin in the center and both ends. For specification, (Refer to 9 - ENGINE - SPECIFICATIONS), (Refer to 9 - ENGINE - SPECIFICATIONS).

INSTALLATION

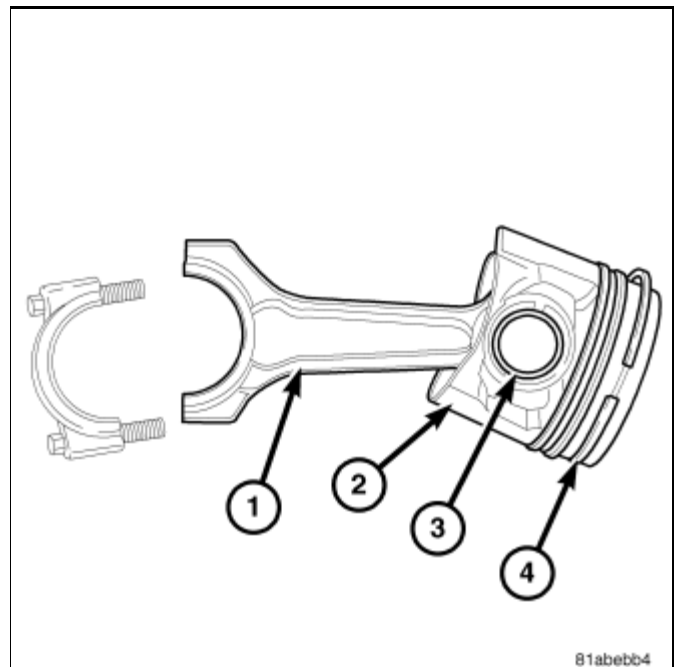


PISTON PIN INSTALLATION

1. Secure connecting rod (1) in soft jawed vice.
2. Lubricate piston pin (3) and piston (2) with clean engine oil.
3. Position piston (2) on connecting rod (1).

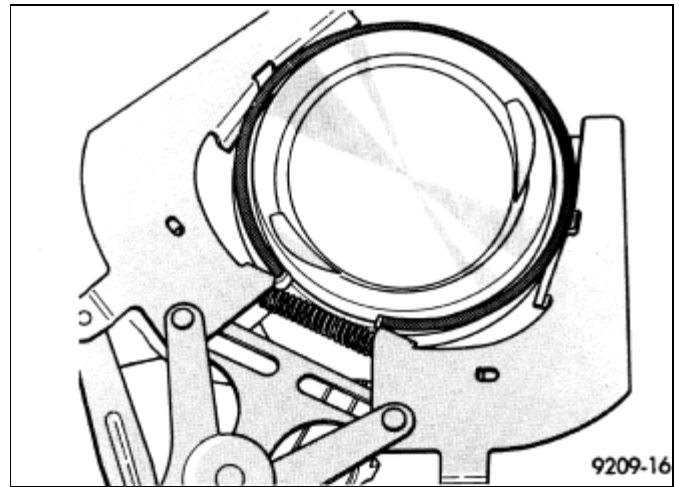
CAUTION: Ensure arrow on piston crown and the bearing cap numbers on the connecting rod are on the opposite side.

4. Install piston pin (1).
5. Install snap ring in piston (2) to retain piston pin (3)..
6. Remove connecting rod (1) from vice.



PISTON RINGS - INSTALLATION

1. Install rings on the pistons using a suitable ring expander.

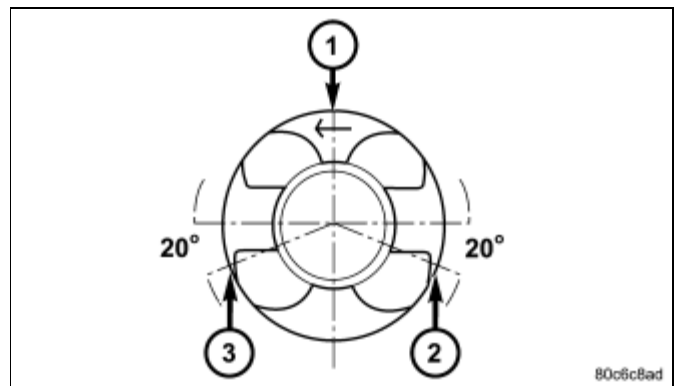


2. Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.

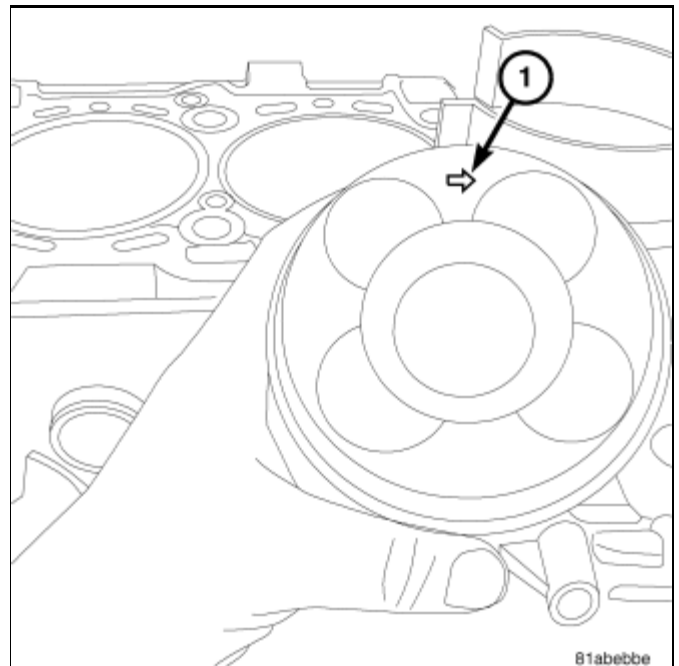
3. Top ring gap must be positioned at the #3 position (looking at the piston crown from above).

4. Second piston ring gap should be positioned at the #1 position.

5. Oil control ring gap should be positioned at the #2 position.

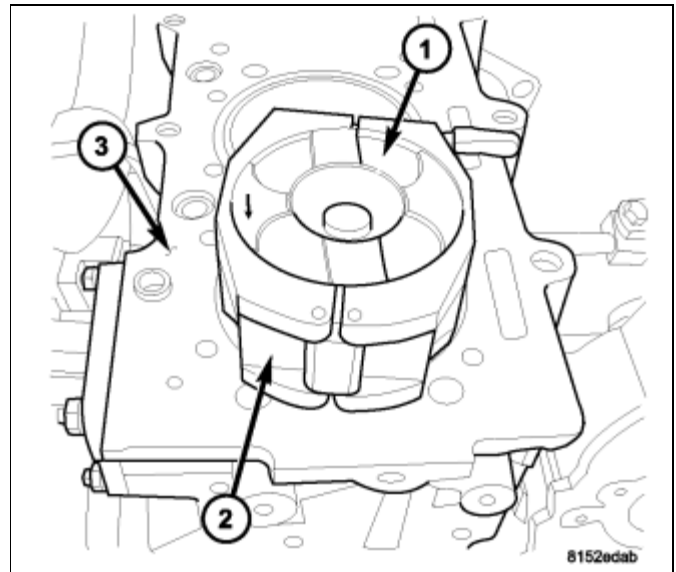


6. When assembling pistons check that components are installed in the same position as before disassembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face arrow on top of piston toward front of engine.** Therefore, the numbers stamped on connecting rod big end should face toward the injection pump side of engine. To insert piston into cylinder use a ring compressor as shown in.

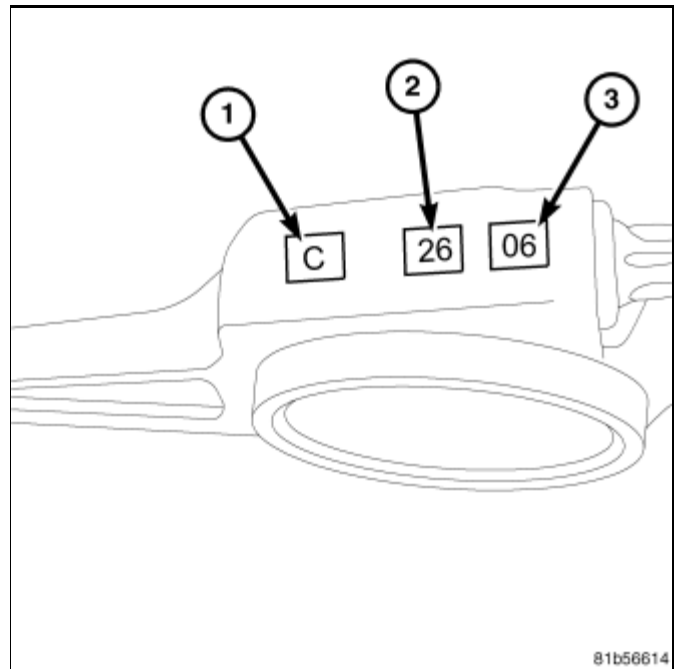


INSTALLATION

1. Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.
2. Before installing the ring compressor, make sure the oil ring expander ends are butted together.
3. Immerse the piston head and rings in clean engine oil, slide the piston ring compressor, over the piston and tighten. **Ensure position of rings does not change during this operation.**
4. Face arrow on piston towards front of engine.



5. The connecting rod bearing size (1) is stamped on the connecting rod.



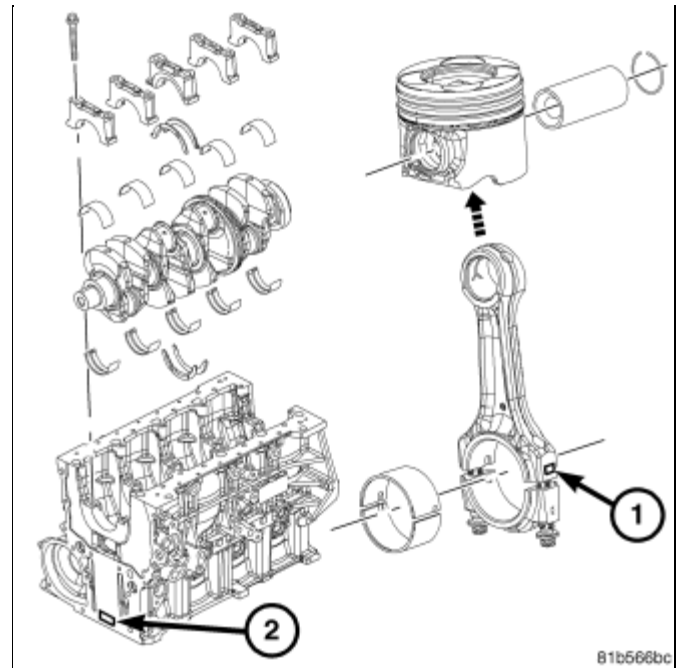
6. Compare the connecting rod diameter (1) and the crankshaft journal diameter (2) with the bearing selection chart to determine the correct bearing size for each cylinder. (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE)

NOTE: The connecting rod bolts must be replaced every time they are loosened or removed.

- 7.

CAUTION: Care must be taken not to nick crankshaft

journal when installing pistons.



8. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

9. Guide the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

10. Install connecting rod caps. Install rod bolts and torque to 10N·m (88 lbs. in.). Torque bolts the next stage to 30N·m (22 ft.lb.) plus 40°. Then with a torque wrench set at torque to 88N·m (65 ft.lb), make a tightening check.

11. Install the oil jets. (Refer to 9 - ENGINE/LUBRICATION/OIL JET - INSTALLATION)

12. Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

13. Install balance shaft assembly. (Refer to 9 - ENGINE/ENGINE BLOCK/BALANCE SHAFT MODULE - INSTALLATION)

14. Install upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

15. Install the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

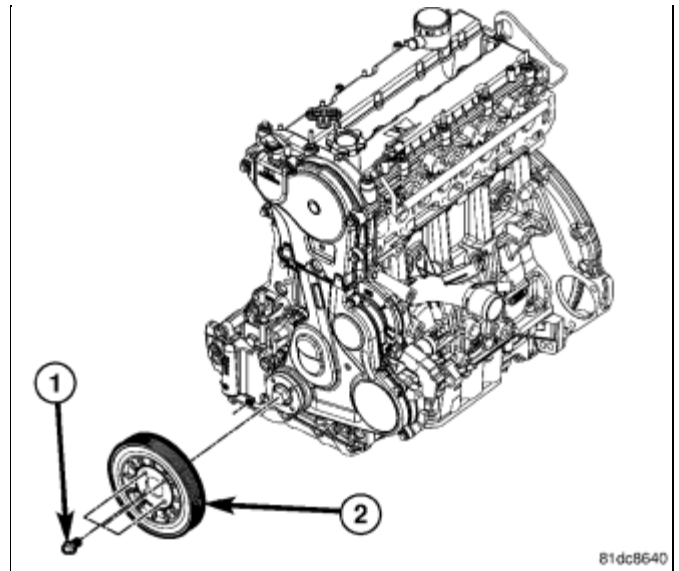
16. Connect negative battery cable.

DAMPER-VIBRATION

REMOVAL

1. Disconnect negative battery cable.
2. Remove viscous cooling fan and shroud.
3. Remove accessory drive belt (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
4. Remove vibration damper retaining bolts (1) and damper (2).

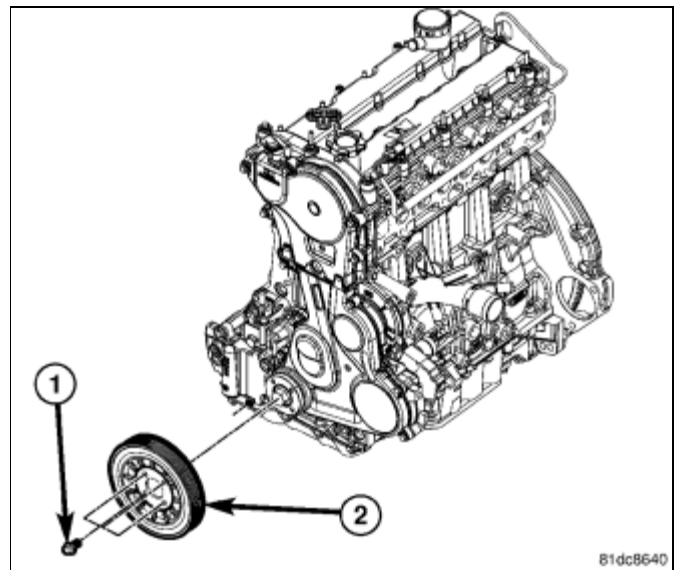
INSTALLATION



1. Install vibration damper (2) and retaining bolts (1). Torque the bolts to 32 N·m. (23 ft.lbs.).
2. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
3. Install viscous fan and fan shroud. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION)
4. Connect negative battery cable.

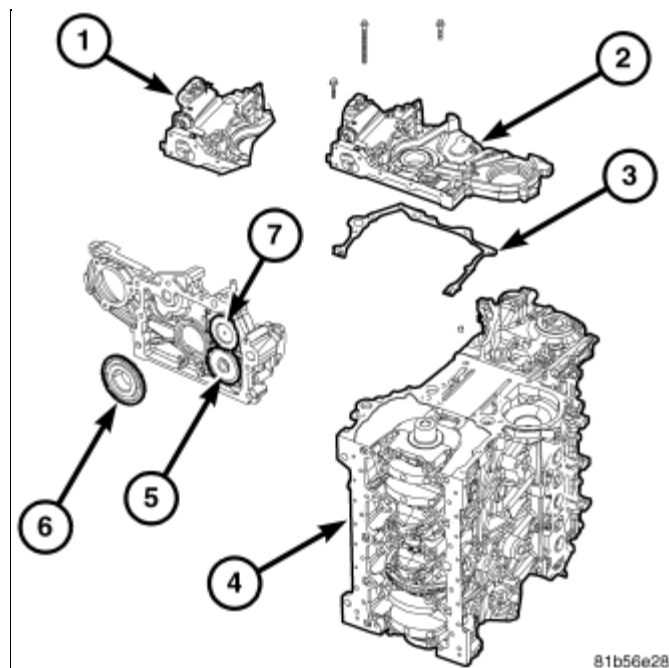
PUMP-INTERNAL VACUUM

DESCRIPTION



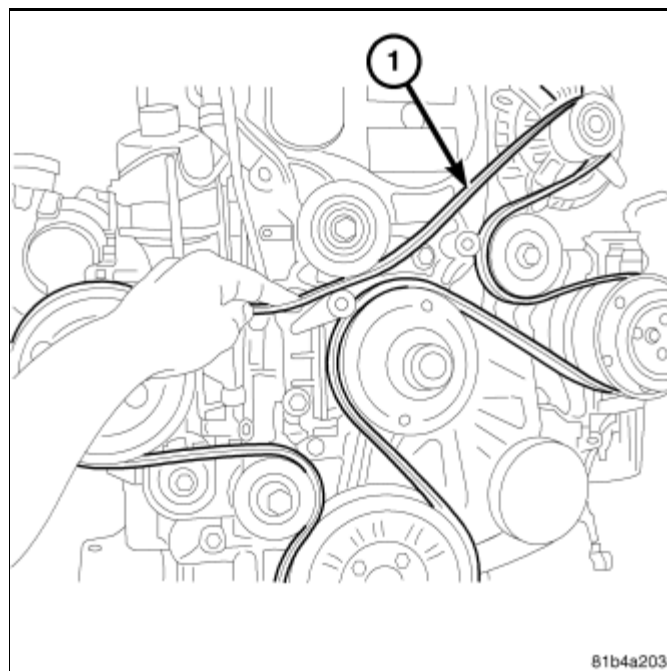
The diesel engine uses a internal vacuum pump (7). This vacuum pump (7) is mounted in the engine front cover (2). The vacuum pump is driven by a sprocket (6) on the crankshaft.

REMOVAL



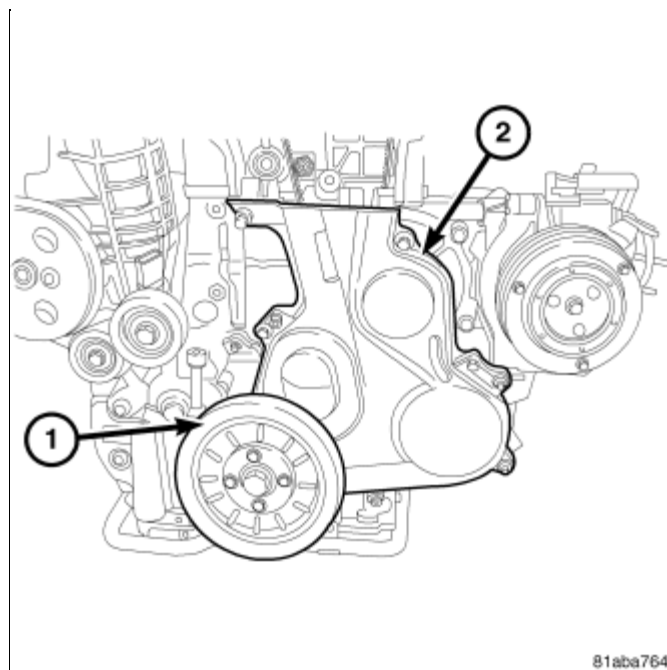
81b56e28

1. Remove the cooling fan module.
2. Remove the accessory drive belt.

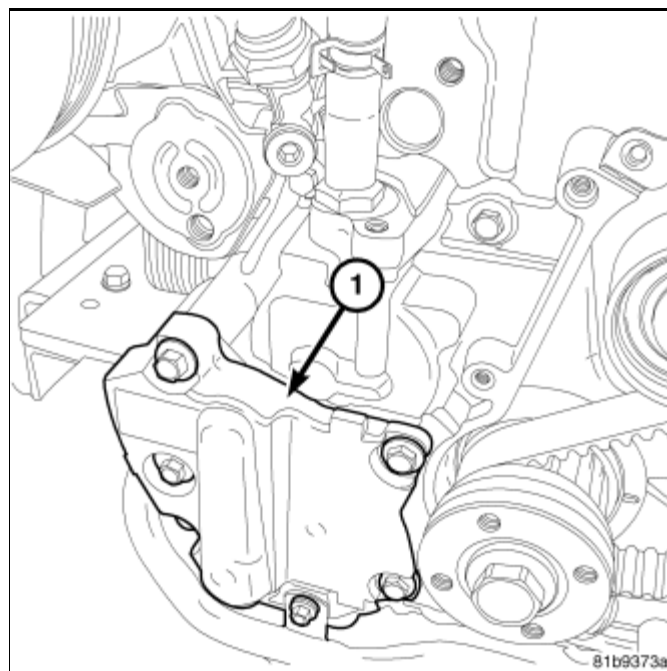


81b4a203

3. Remove the four crankshaft damper (1) bolts and remove the crankshaft damper.



4. Remove the oil pressure relief front cover (1) bolts.

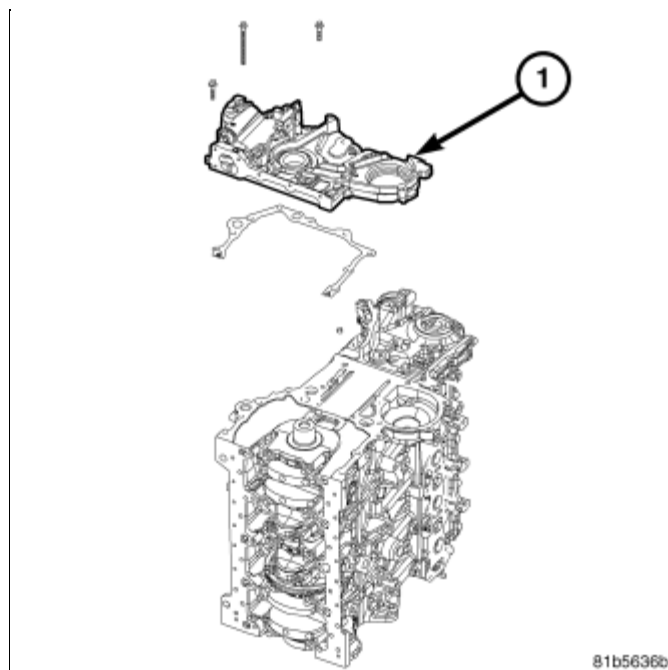


5. Remove the front cover. (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL)

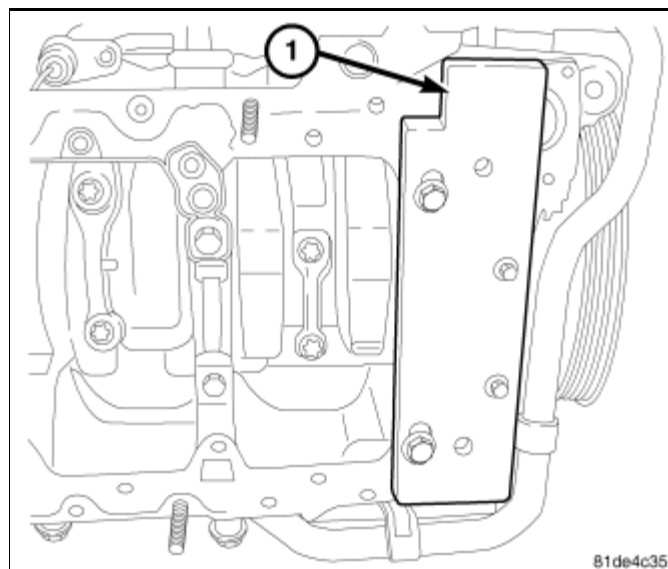
6. Remove the vacuum pump from the front cover.

INSTALLATION

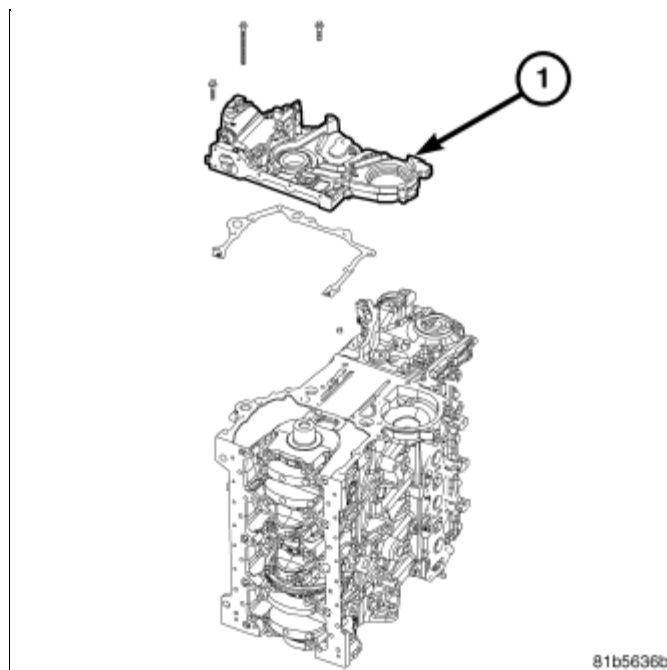
1. Install the vacuum pump into the front cover.



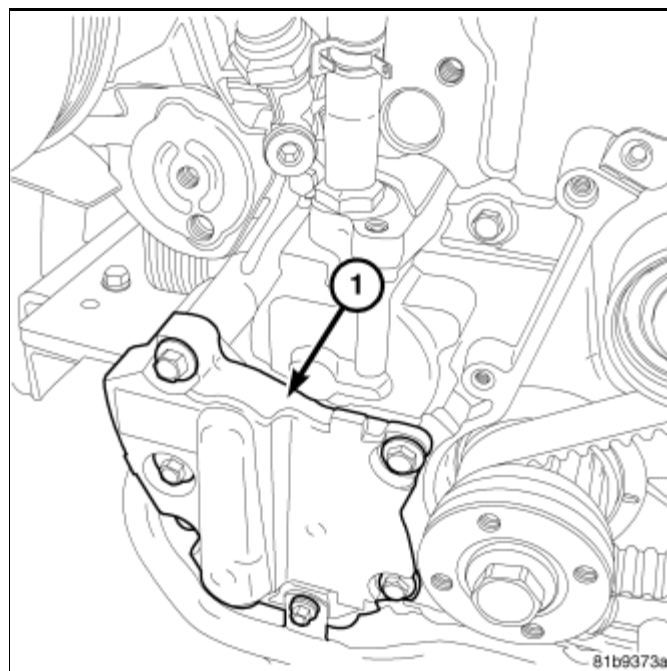
2. Install the special tool 9990 Front Cover Align Tool (1).



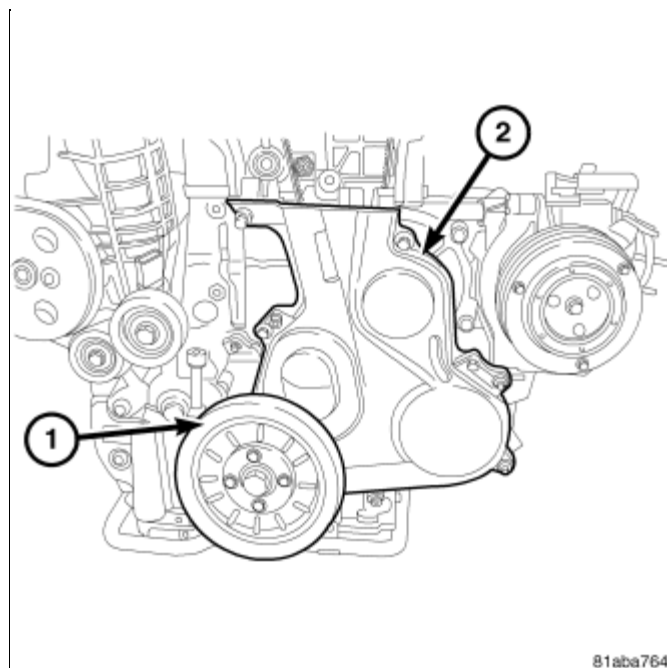
3. Install the front cover to the engine block (1). (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION)



4. Install the oil pressure relief valve cover (1).
5. Install the oil pressure relief valve cover bolts and tighten to 32 Nm (23 lbs. ft.).



6. Install the crankshaft damper.
7. Install and torque the crankshaft damper bolts to 32 Nm (23 lbs. ft.).

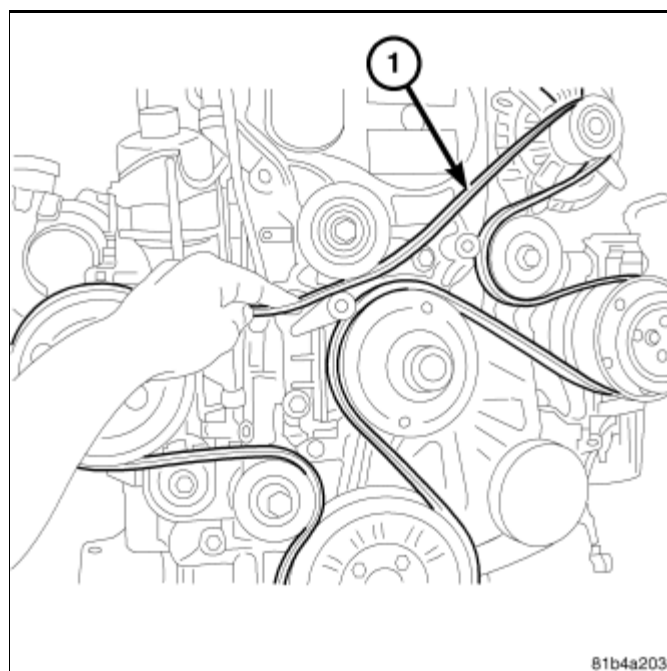


81aba764

8. Install the accessory drive belt.
9. Install the cooling fan module.

COVER-ENGINE - FRONT

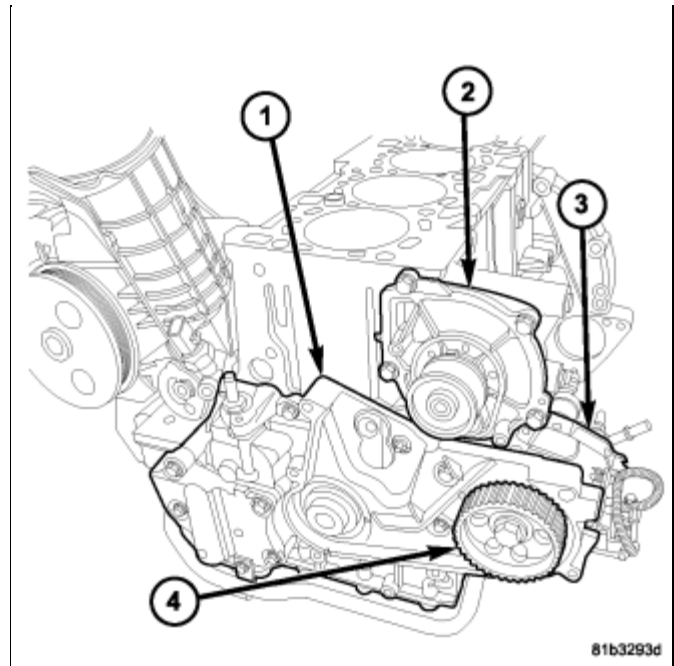
DESCRIPTION



81b4a203

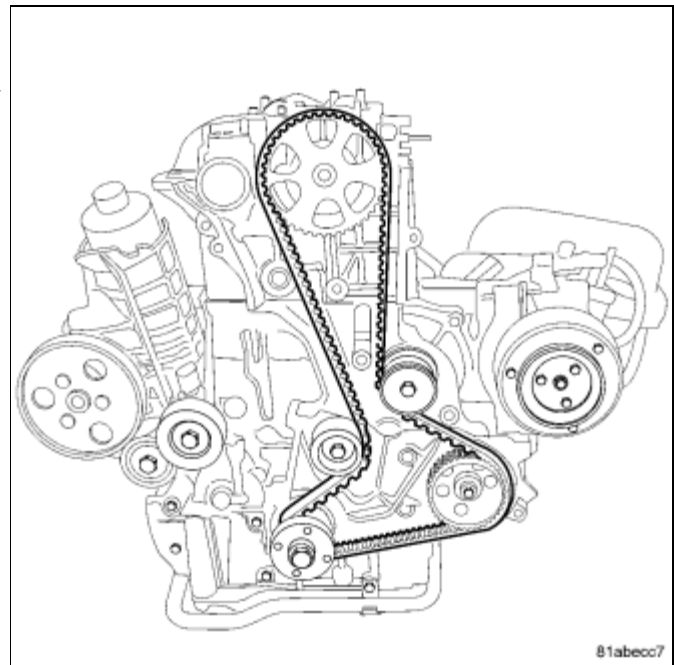
The oil pump cover assembly on this engine is an aluminum cover that incorporates the oil pump.

REMOVAL



81b3293d

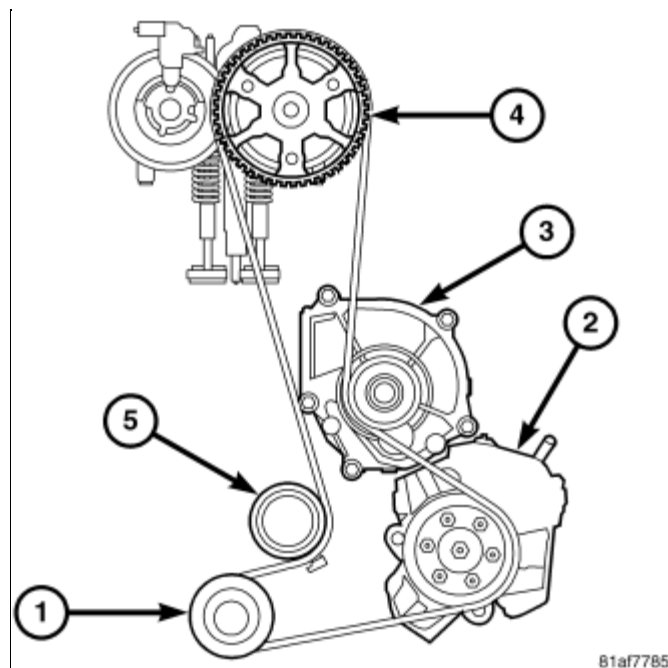
1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) .
4. Remove the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)



81abecc7

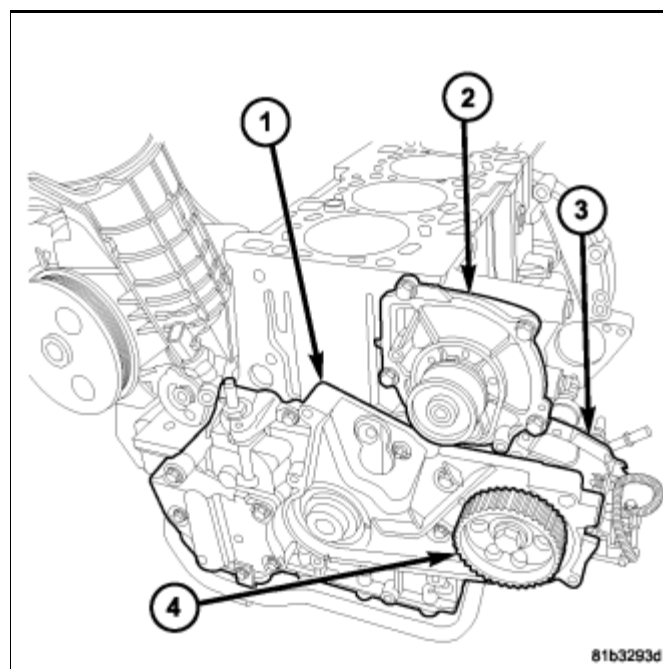
NOTE: The crankshaft sprocket bolt is a left handed thread.

5. Remove the crankshaft sprocket (1).

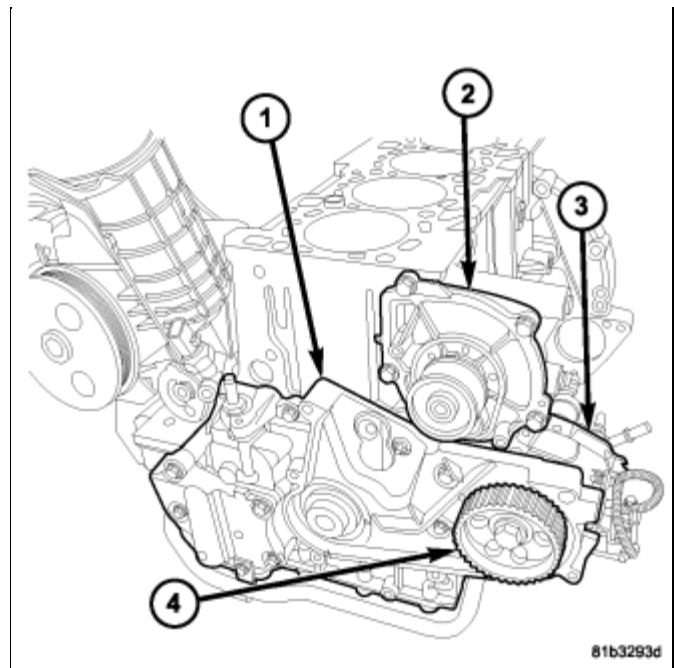


6. Remove the high pressure fuel pump (4) sprocket.
7. Remove the oil pump cover assembly (1).

INSTALLATION

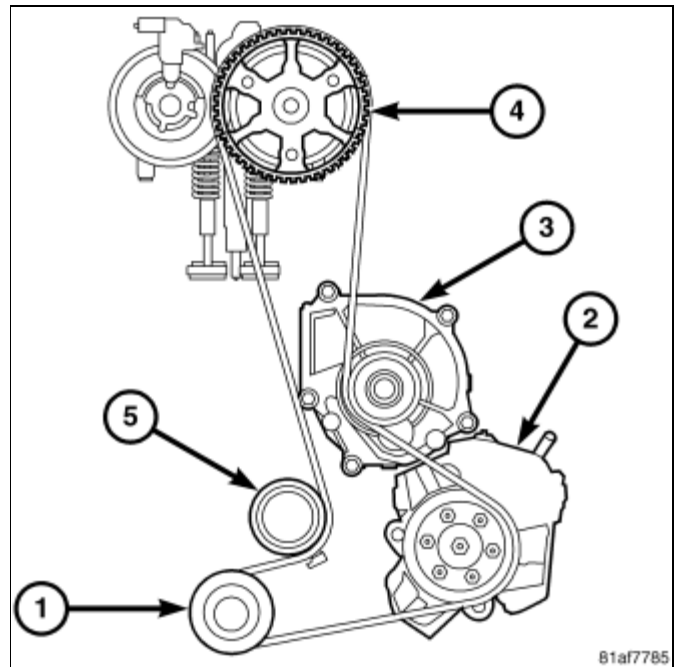


1. Install the oil pump gasket.
2. Install the oil pump cover assembly (1).



NOTE: The crankshaft sprocket bolt is a left handed thread.

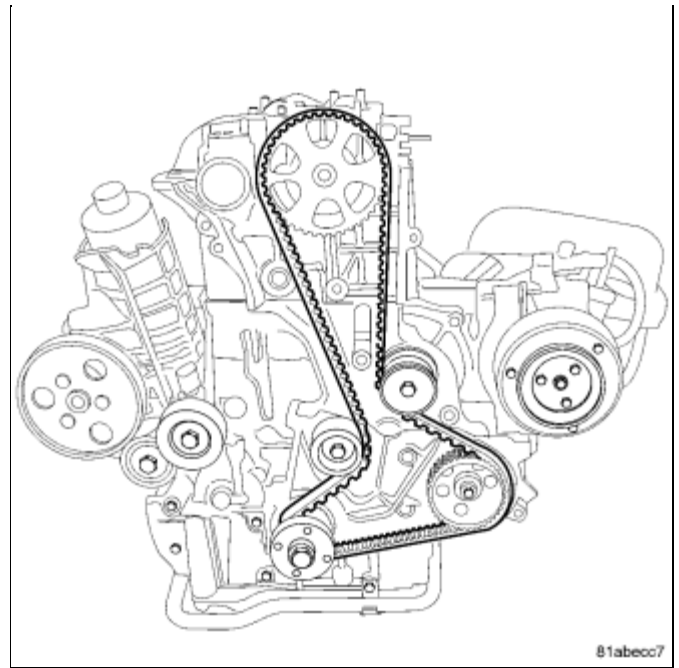
3. Install the crankshaft sprocket (1).
4. Install the high pressure pump (4) sprocket.



5. Install the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)
6. Install the cooling fan and fan drive viscous clutch assembly.
7. Install the accessory drive belt.
8. Connect negative battery cable.

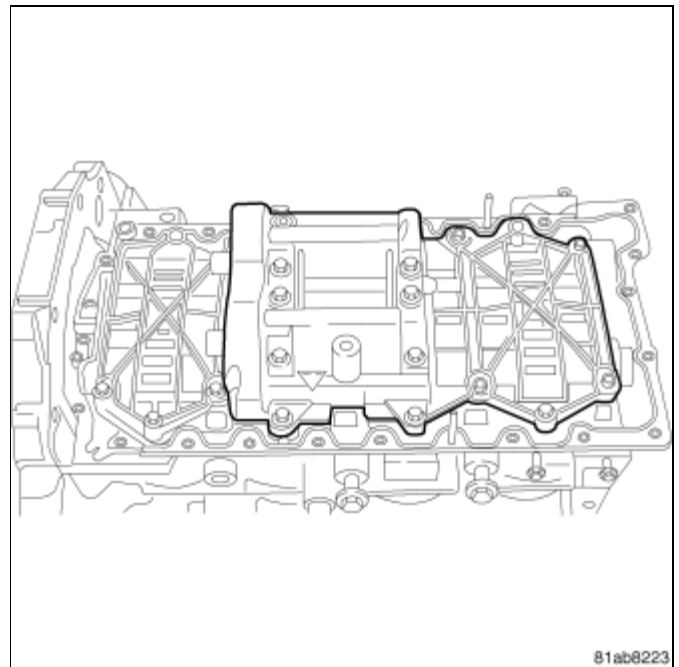
BALANCE SHAFT MODULE

DESCRIPTION

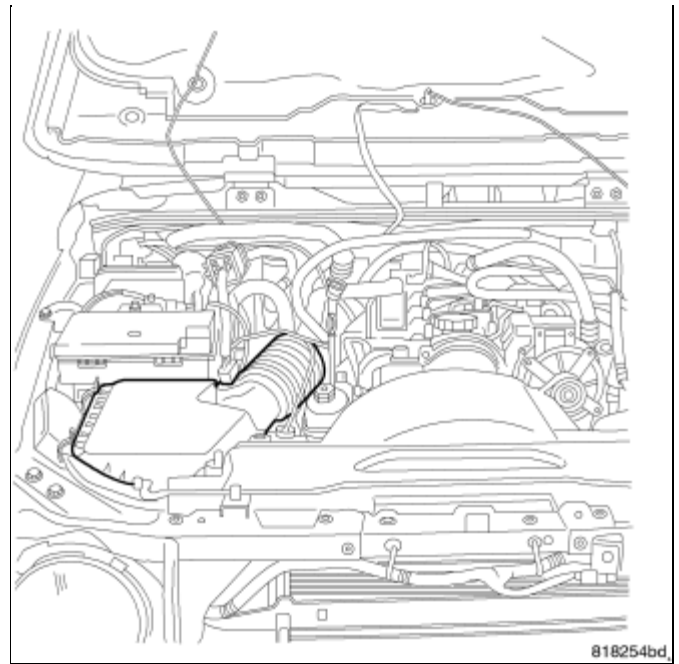


The balance shaft is gear-driven and is used to counteract engine vibration and roughness. The balance shaft assembly includes balancers on two shafts. It is only serviced as an assembly. Balance shafts must be timed to the crankshaft.

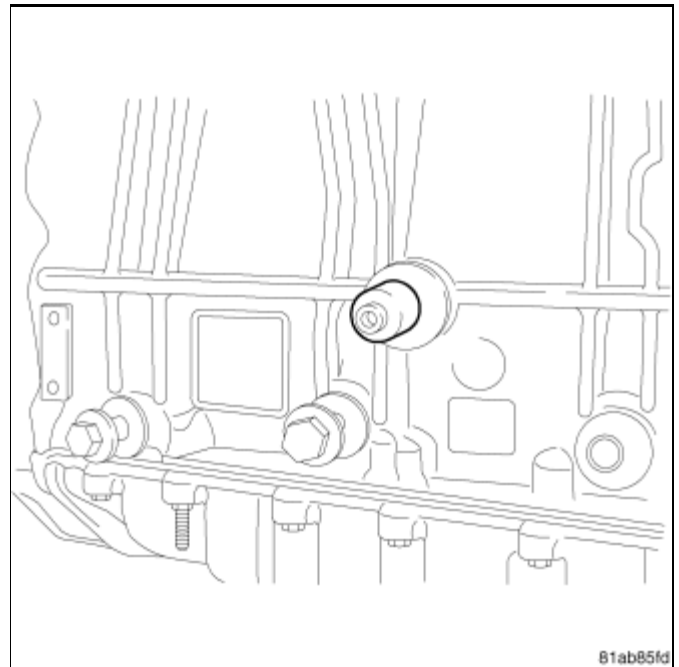
REMOVAL



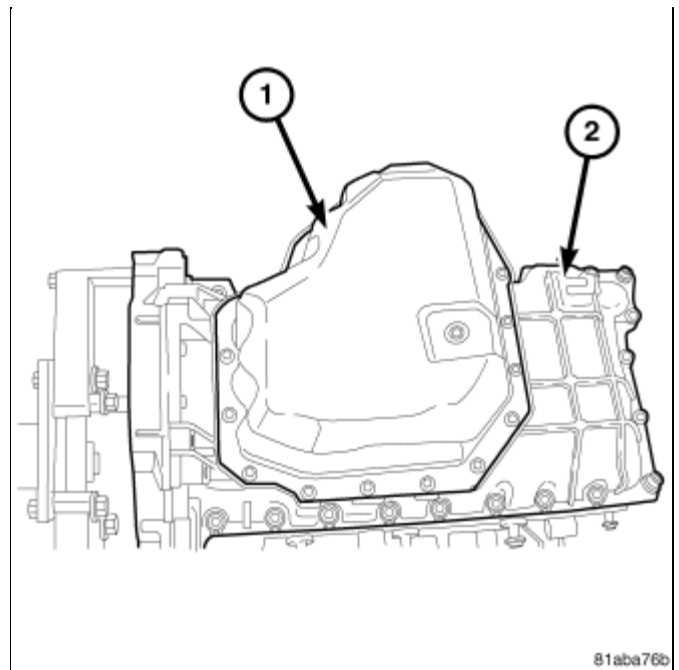
1. Disconnect the battery.
2. Drain the engine oil.



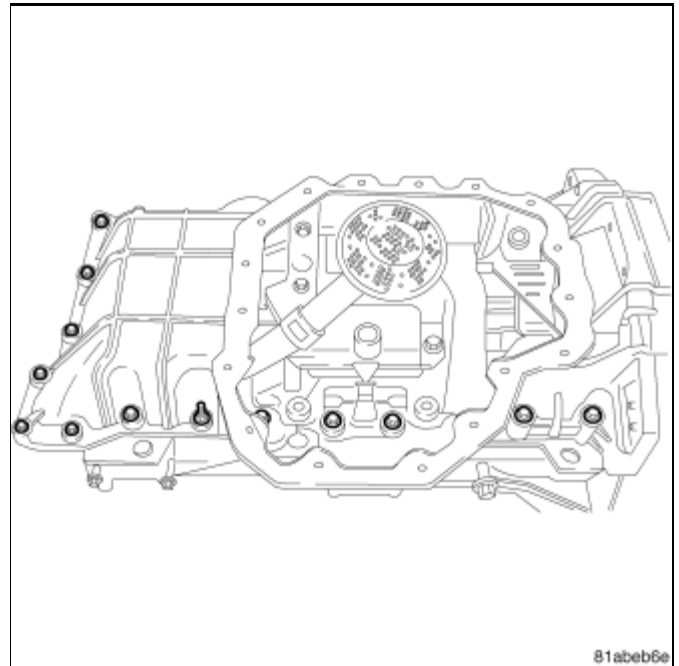
3. Install the TDC locking tool.



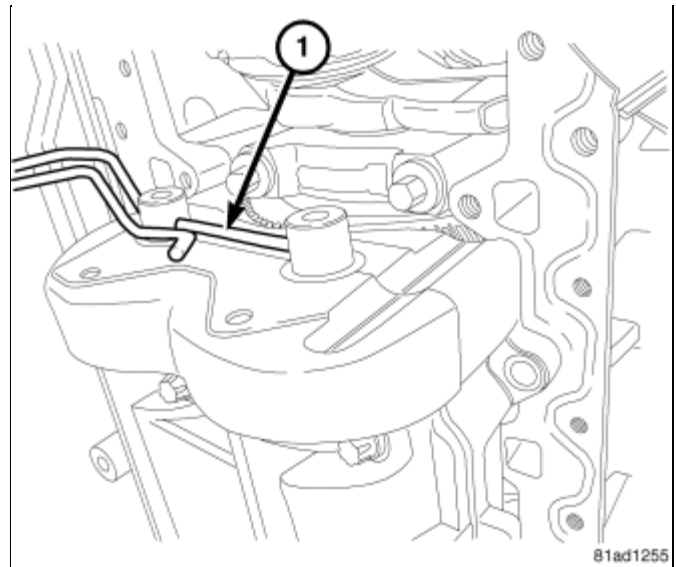
4. Remove the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)



5. Remove the upper oil pan.
6. Remove the oil pickup tube.

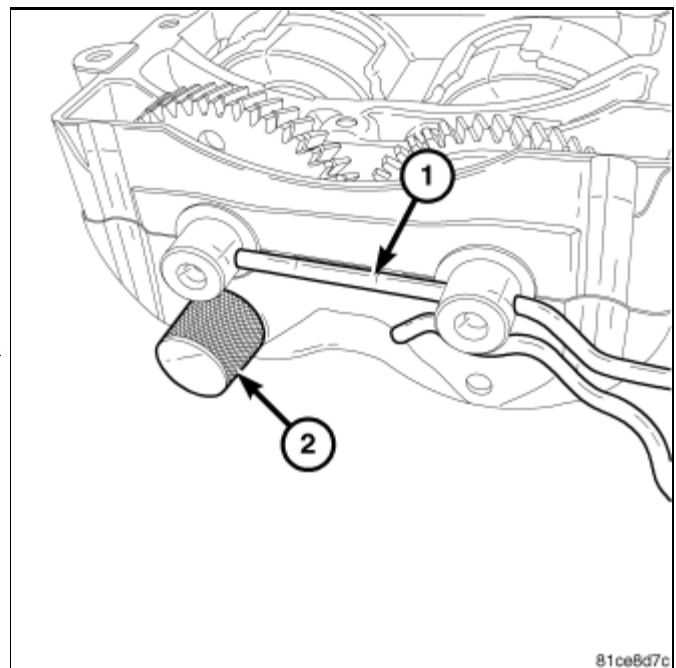


7. Place a dowel rod through the holes in the balance shaft axles to keep the balance shafts in the correct position for reassembly.



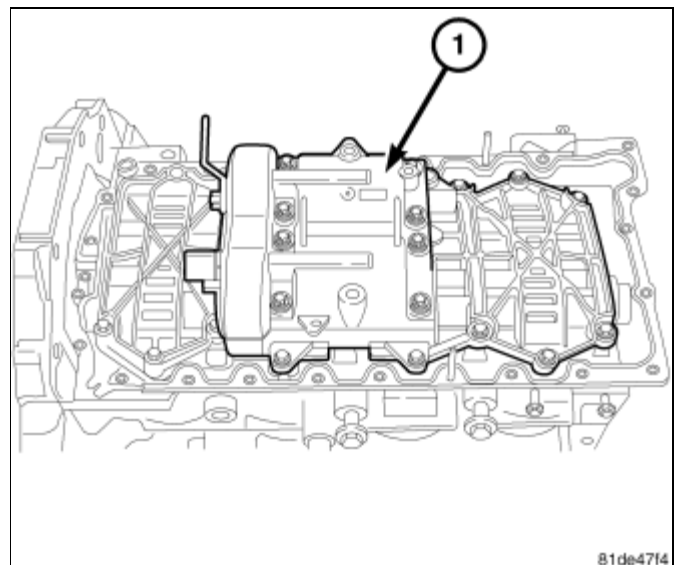
8. Insert the balance shaft locking pin (2) into the balance shaft assembly to lock the split gears together.

WARNING: The balance shaft pin must be installed before the balance shaft assembly is removed from the engine. The balance shaft pin must always remain in the balance shaft assembly while the assembly is removed from the engine. Do not remove the balance shaft pin until the balance shaft assembly is completely installed on the engine.

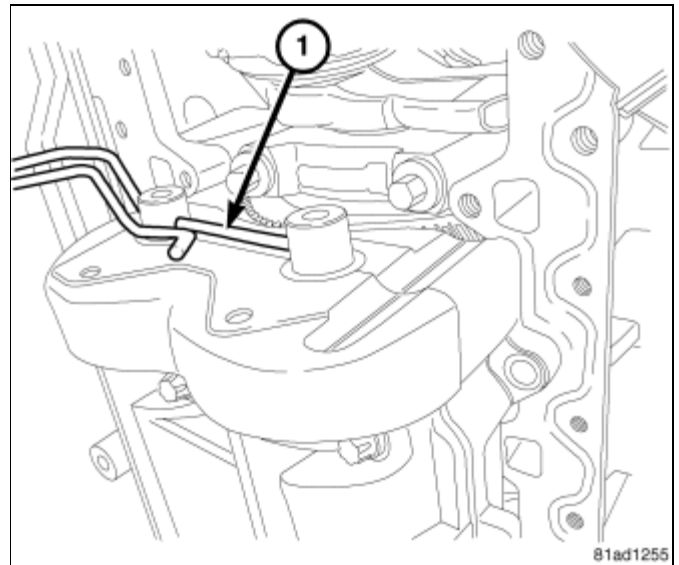


9. Remove the balance shaft housing (1).

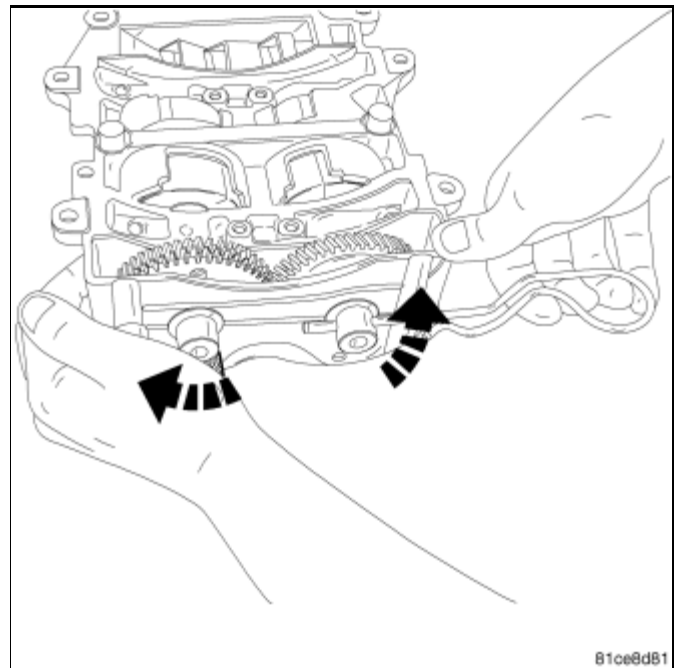
INSTALLATION



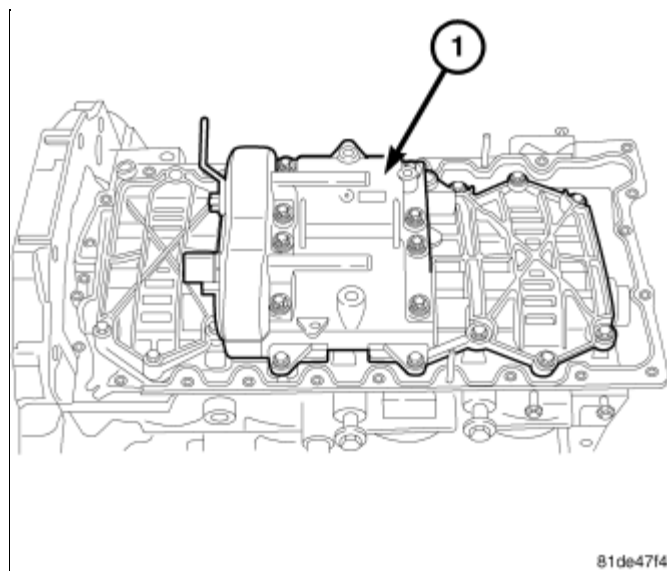
1. The balance shafts must remain aligned by the alignment dowel and the balance shaft pin must remain in the balance shaft assembly until the assembly is completely installed to the engine.



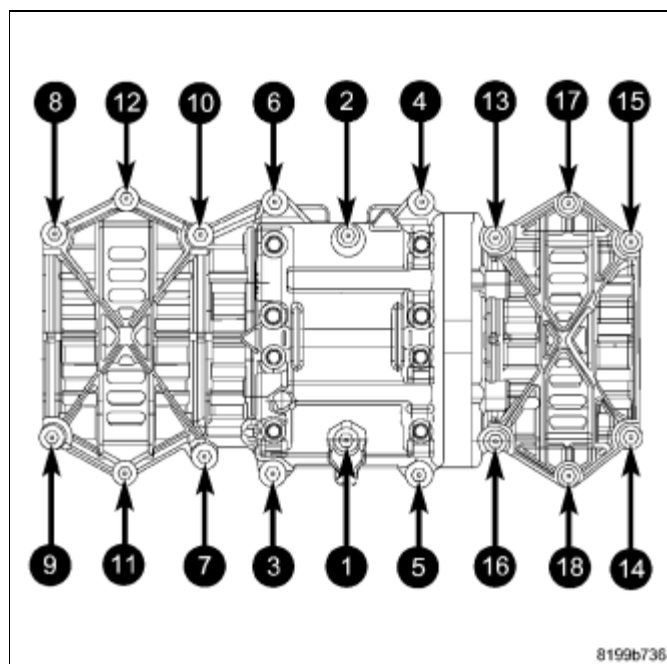
2. The balance shaft pin should never be removed from the balance shaft assembly when the balance shaft assembly is not installed in the engine. If the balance shaft was removed from the vehicle without the pin, or the pin was removed, use the dowel to load the spring while pressing the tool into place as shown.



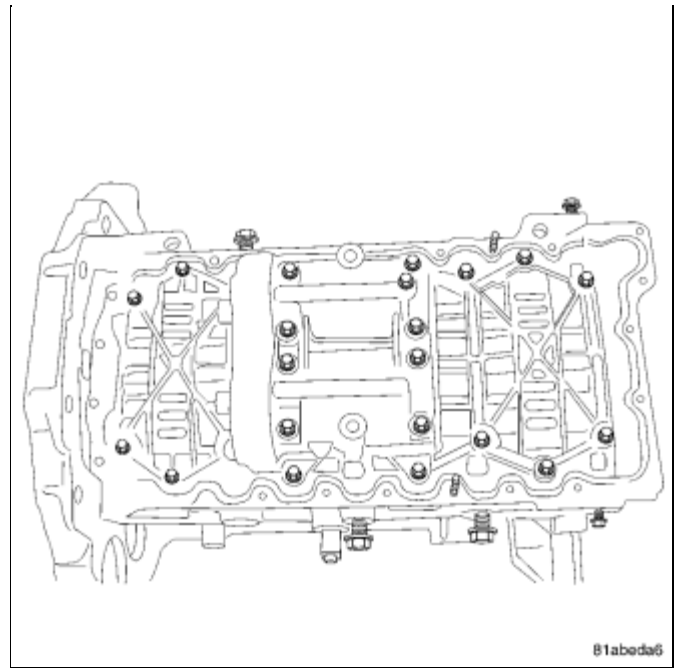
3. Install the balance shaft housing (1).



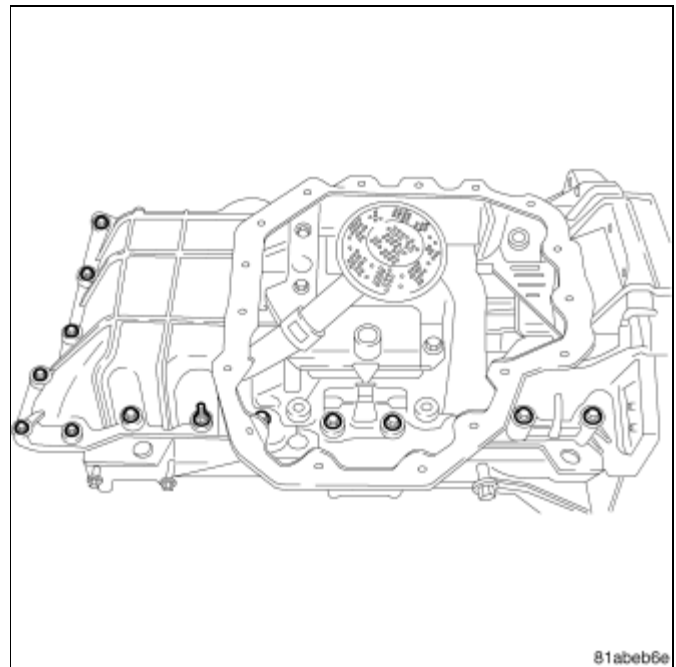
4. Use torque sequence in the graphic to torque the balance shaft bolts to 33 Nm (24 lbs. ft.).
5. Remove the balance shaft assembly dowel and the balance shaft pin.



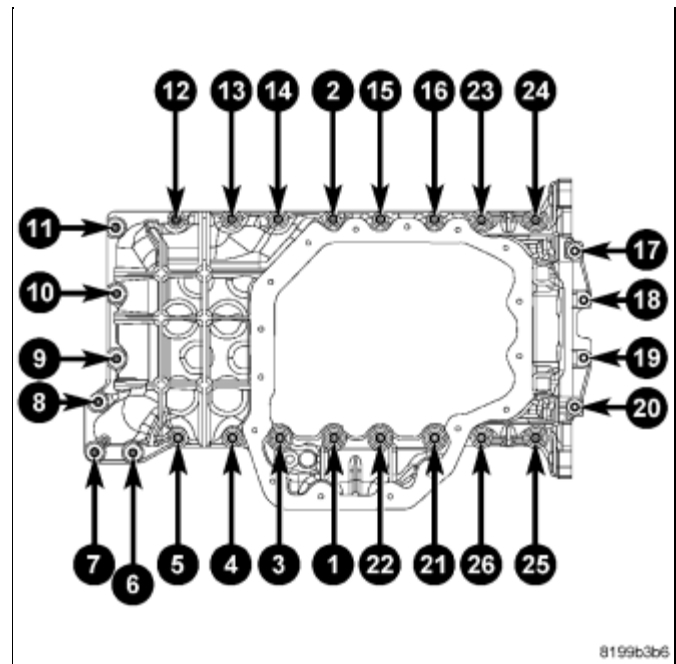
6. Install the upper oil pan gasket.



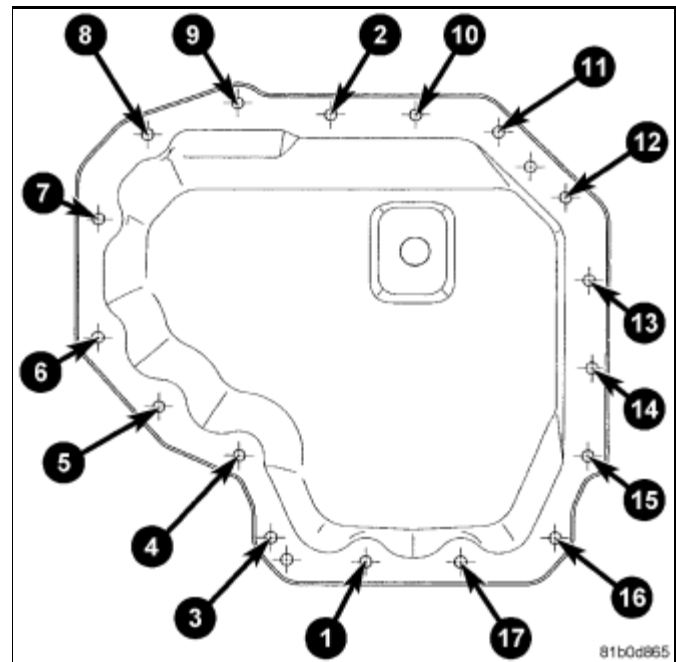
7. Install the oil pickup tube.
8. Install the upper oil pan.



9. Use the illustrated torque sequence and torque the M6 bolts to 15 Nm (132 lbs. in.).
10. Install the upper oil pan bolts in positions one and two, then follow the sequence illustrated for the remaining bolts. Once all of the bolts are installed, tighten the M6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).
11. Loosen all of the upper oil pan bolts and studs by 90 degrees and retighten the M6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).



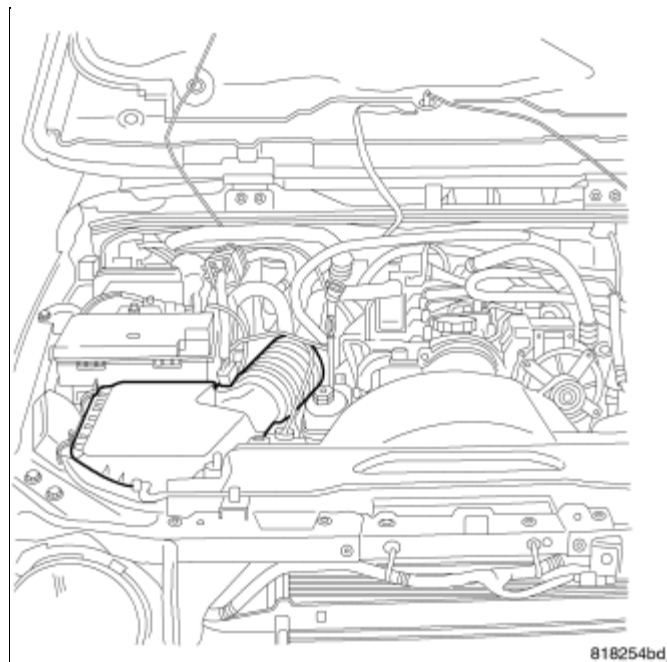
12. Install bolts 1 and 2 into the lower oil pan and torque to 15 Nm (133 lbs. in.).
13. Install the remaining bolts in the sequence illustrated.
14. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
15. Loosen each bolt 90° and use the illustrated sequence to torque the bolts to 15 Nm (133 lbs. in.).



16. Fill the engine oil.
17. Remove the TDC locking tool.
18. Reconnect the battery.

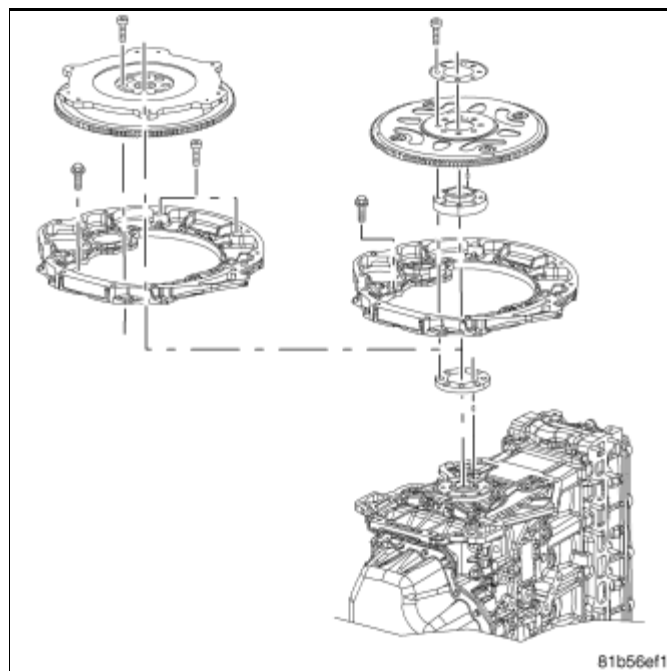
TRANSMISSION ADAPTER PLATE

DESCRIPTION

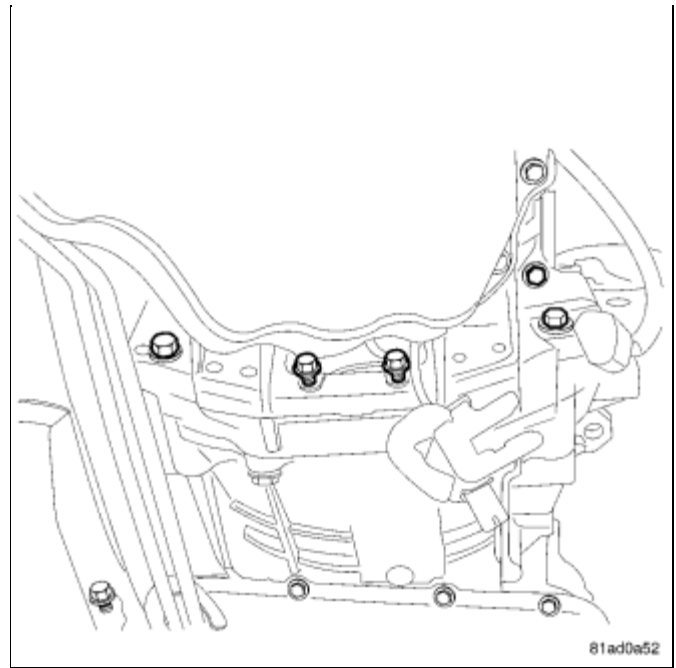


The transmission plate adapter is the component that allows the transmission to be bolted to the engine.

REMOVAL



1. Remove the transmission from the vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL)

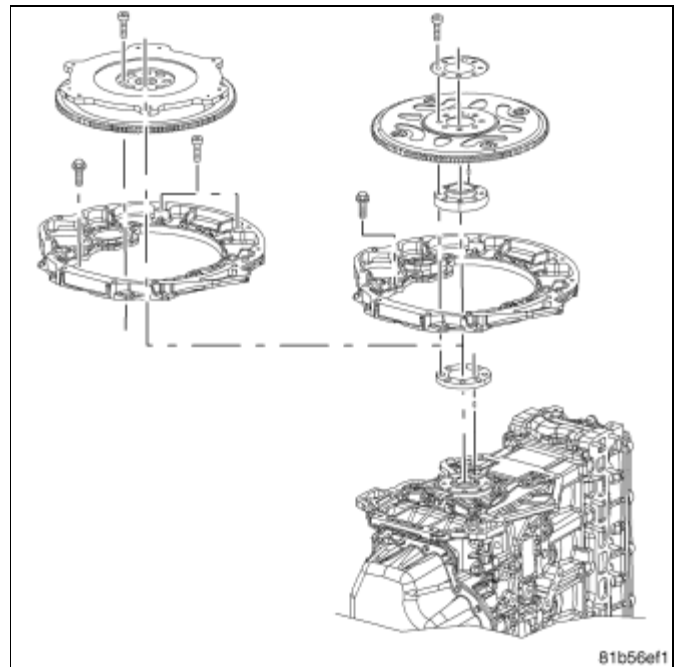


2. Remove the flex plate or flywheel. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL)

NOTE: Do not use any magnetic tools near the crankshaft tone ring.

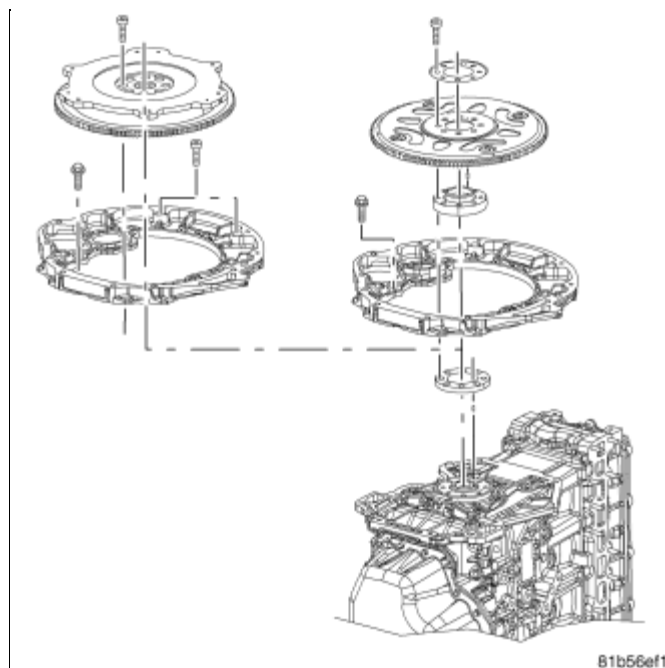
3. Remove the flex plate adapter bolts.

INSTALLATION



NOTE: Do not use any magnetic tools near the crankshaft tone ring.

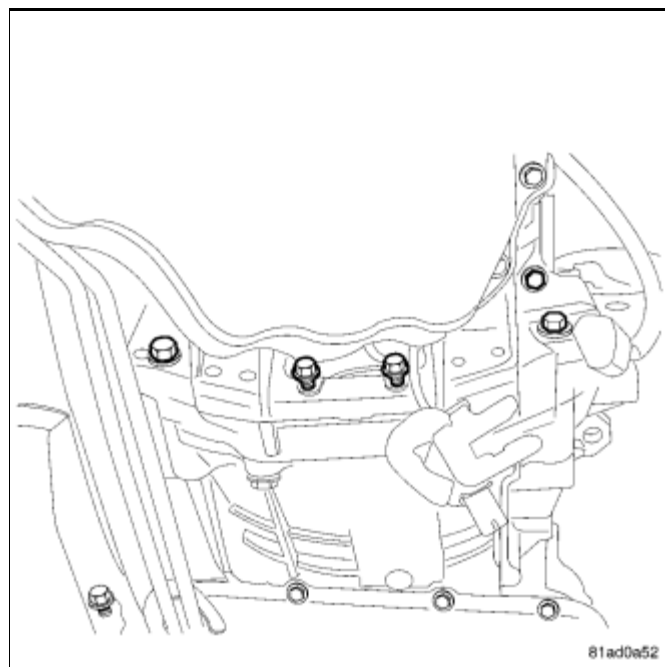
1. Install the flex plate adapter.
2. Install the flex plate adapter hex head bolts and tighten to 45 nm (ft. lbs.)
3. Install the flex plate torx head bolts and tighten to 78 nm (ft. lbs.)
4. Install the flex plate or flywheel. (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION)



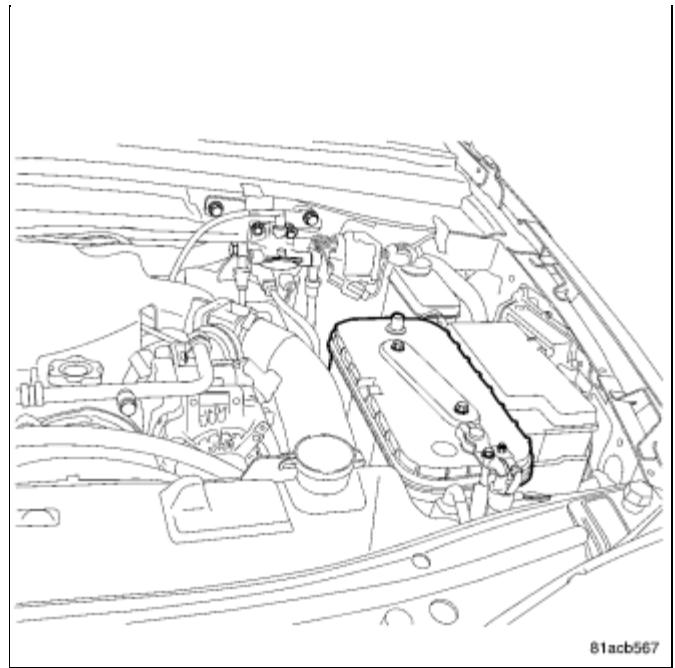
5. Install the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION)

MOUNT-LEFT ENGINE

REMOVAL

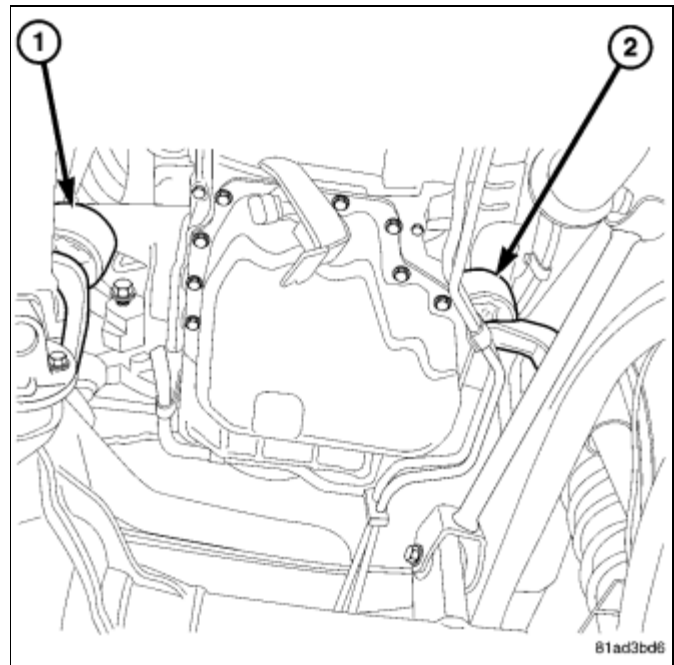


1. Disconnect the negative battery cable. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
2. Install the engine lift fixture.
3. Support the engine with the lift fixture.



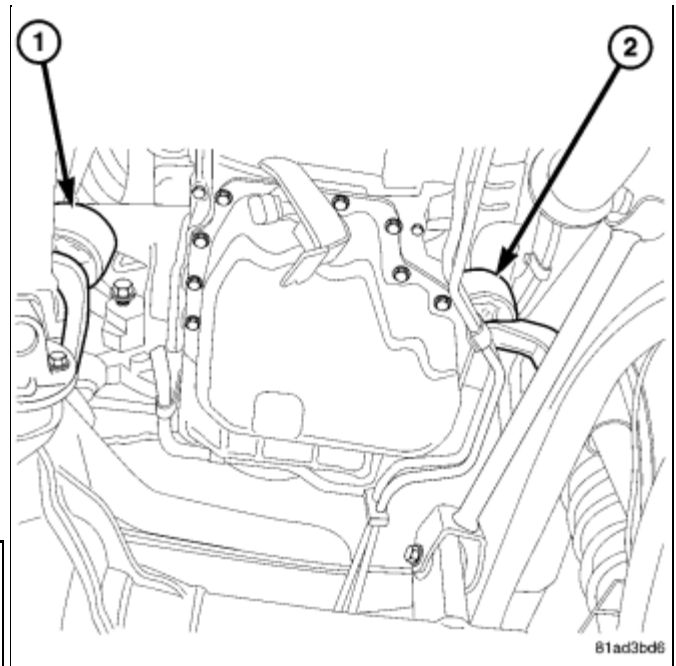
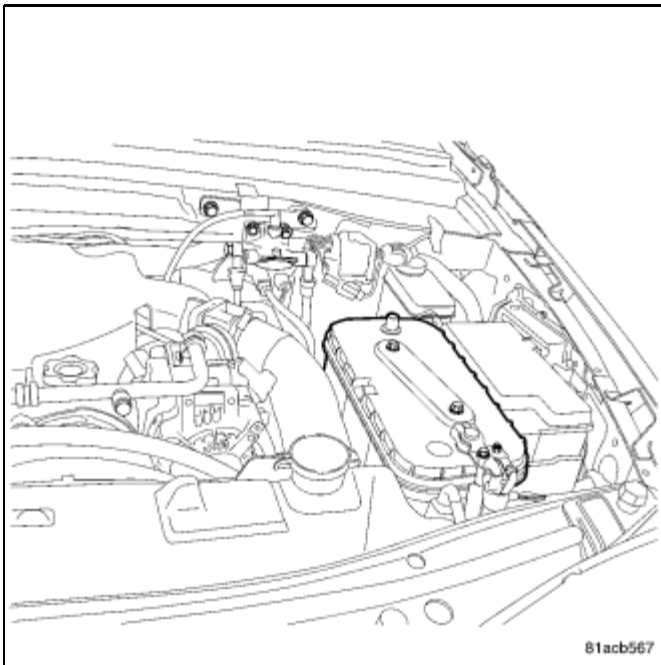
4. Remove the left front tire. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE)
5. Remove the inner fender. (Refer to 23 - BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - REMOVAL)
6. Remove the engine mount.

INSTALLATION



1. Position the engine mount and hand tighten the retaining bolts.
2. Lower the engine mount and through bolts into the engine mount support.
3. Lower the vehicle.
4. Install the left upper engine mount bolt. Tighten bolt to 54 N·m (40 lbs. ft.)
5. Raise and support the vehicle.
6. Tighten remaining mount to engine bolts to 54 N·m (40 lbs. ft.)
7. Tighten engine mount through bolts to 54 N·m (40 lbs. ft.)

8. Lower the vehicle.
9. Install the left inner fender. (Refer to 23 -



BODY/EXTERIOR/REAR WHEELHOUSE SPLASH SHIELD - INSTALLATION)

10. Install the left front wheel. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE)
11. Remove the engine support.
12. Connect the negative battery cable. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION)

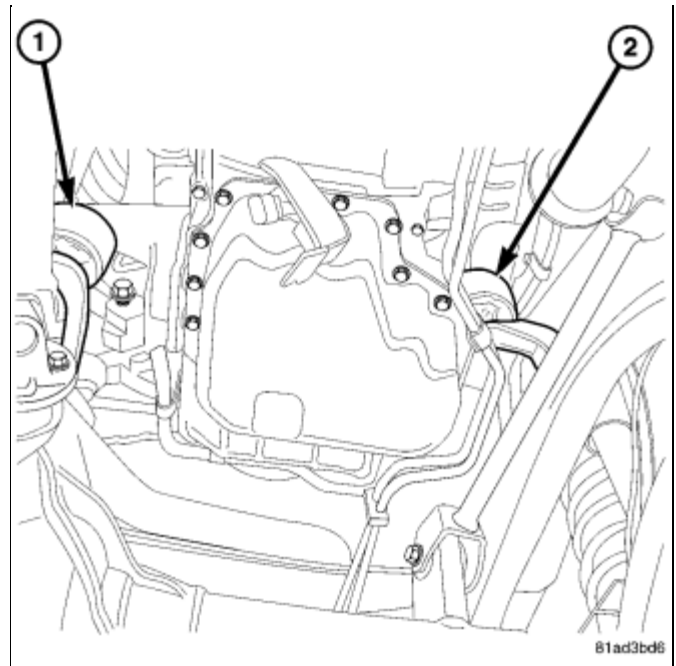
RIGHT ENGINE MOUNT

REMOVAL

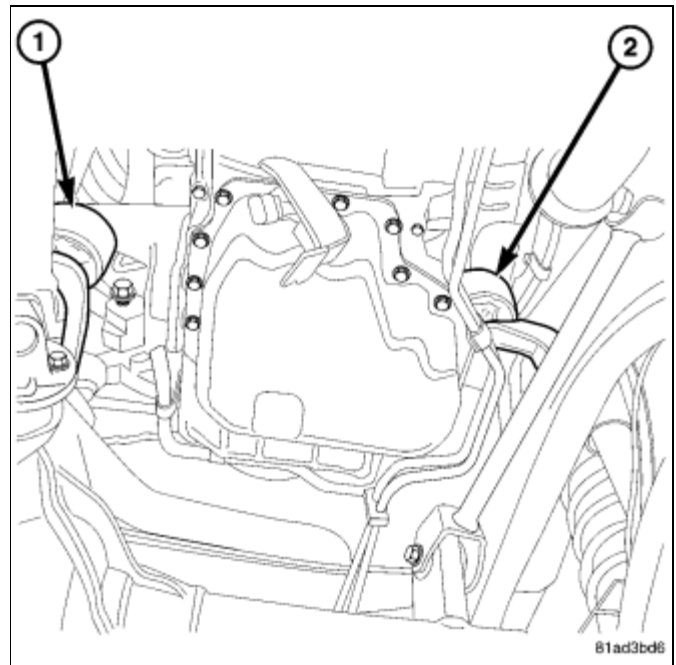
1. Disconnect the negative battery cable. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
2. Loosen the upper engine mount fastener at the engine mount bracket

3. Raise and support the vehicle.
4. Loosen the lower engine mount fastener.
5. Install the engine support and support the engine.
6. Remove the engine mount bolts and engine mount.

INSTALLATION



1. Position the engine mount and install the engine mount bolts. Tighten bolts to 54 N·m (40 lbs. ft.).
2. Lower the engine and remove the engine support.
3. Tighten the engine mount through bolts to 54 N·m (40 lbs. ft.).
4. Lower the vehicle.
5. Connect the negative battery cable. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION)



OIL

DESCRIPTION

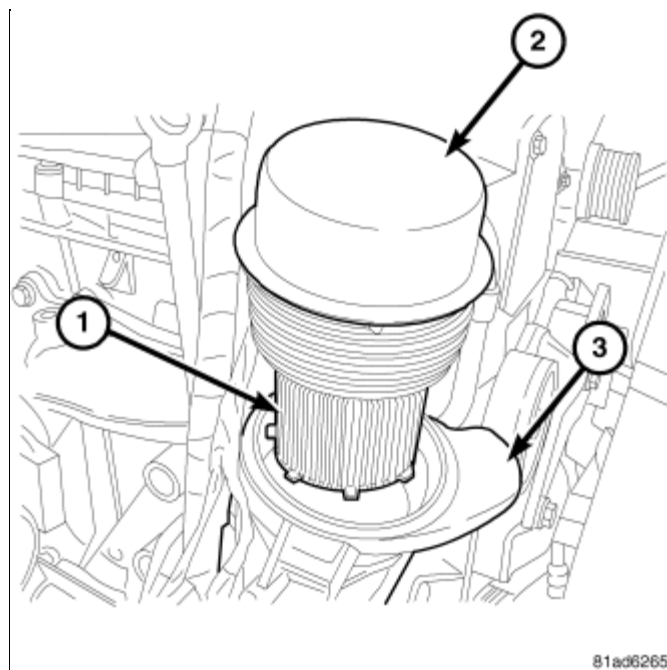
Refer to the Lube and Maintenance section for oil specifications (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).

ADAPTER-OIL FILTER

DESCRIPTION

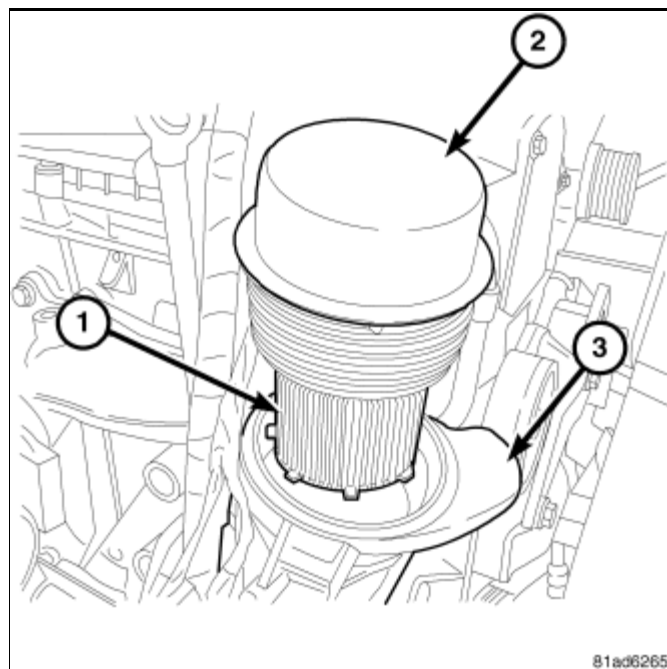
An oil filter adapter is used on this vehicle to relocate the oil filter for easier access when servicing.

REMOVAL



1. Disconnect the battery.
2. Drain the engine oil.
3. Remove the oil filter housing adapter cap (2).
4. Remove the oil filter (1).

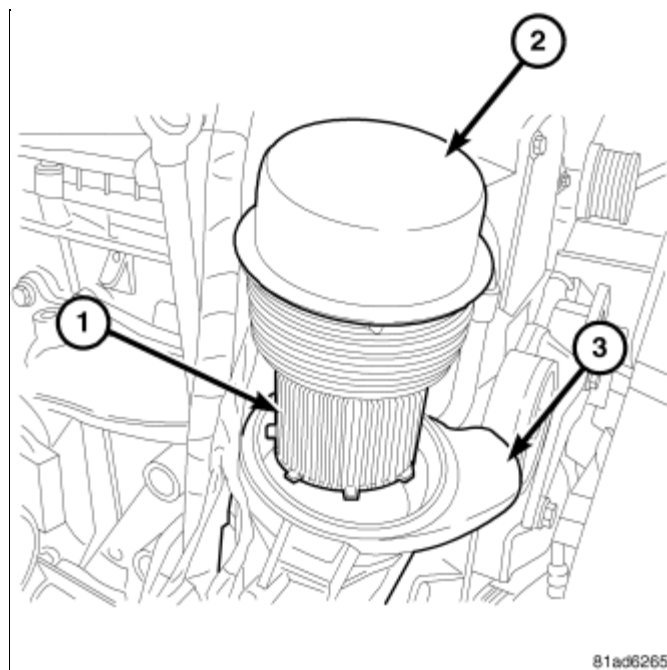
INSTALLATION



1. Install the oil filter (1).
2. Install the oil filter housing adapter cap (2).
3. Tighten to 25 Nm (18 ft. lbs.).
4. Fill the engine oil.
5. Connect the battery.

OIL COOLER & LINES

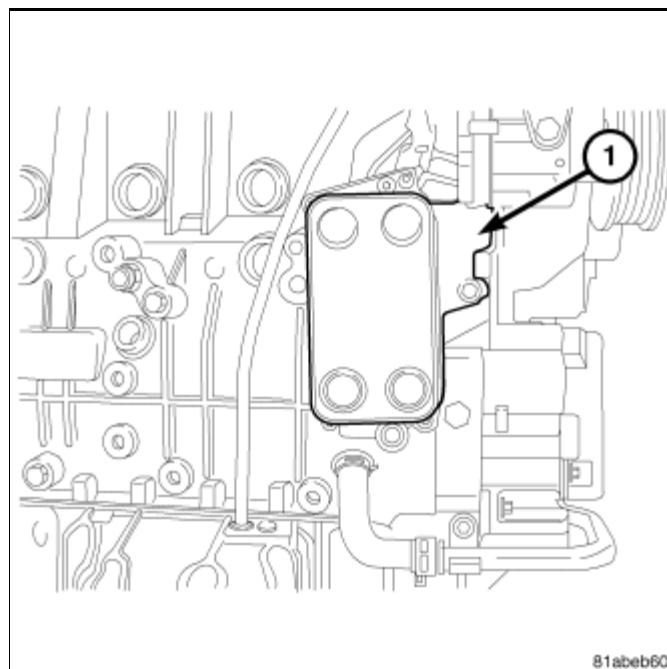
DESCRIPTION



81ad6265

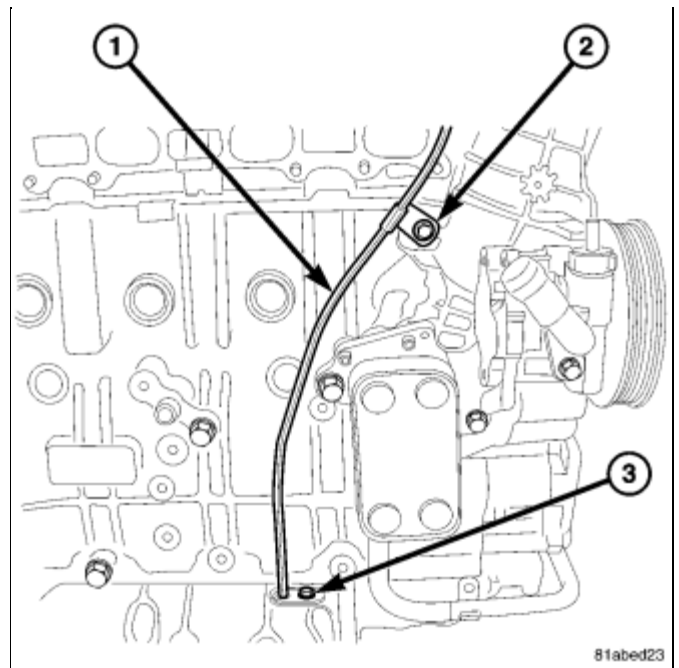
1. The engine oil cooler, located on the right side of the engine, is an oil to coolant cooler.

REMOVAL

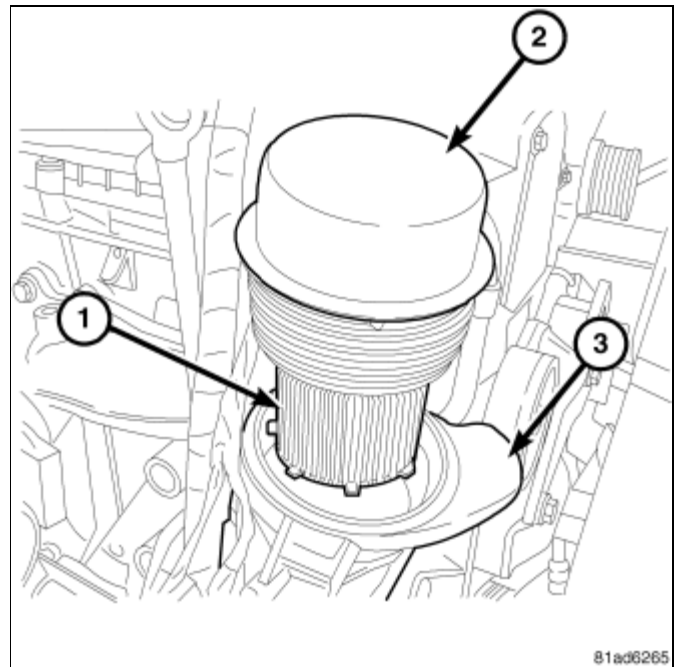


81abeb60

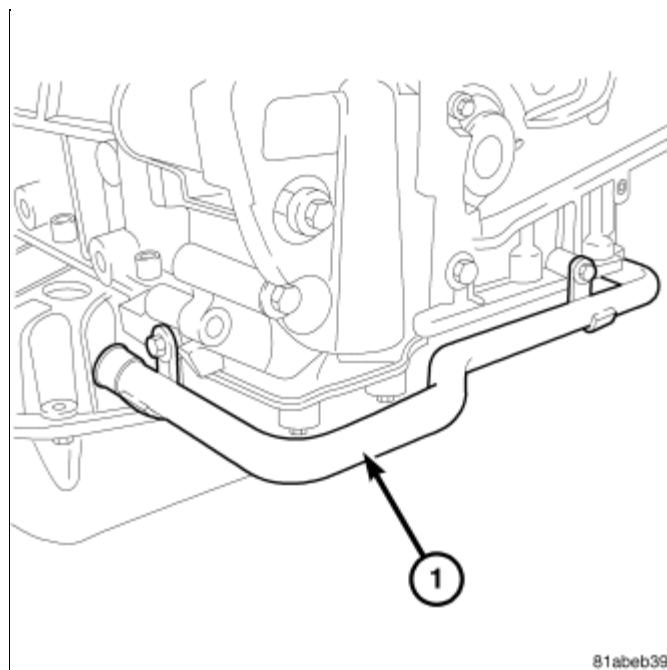
1. Disconnect the battery.
2. Drain the engine oil.
3. Remove the upper (2) and lower (3) dipstick bolts and remove the dipstick (1).



4. Remove the oil filter.

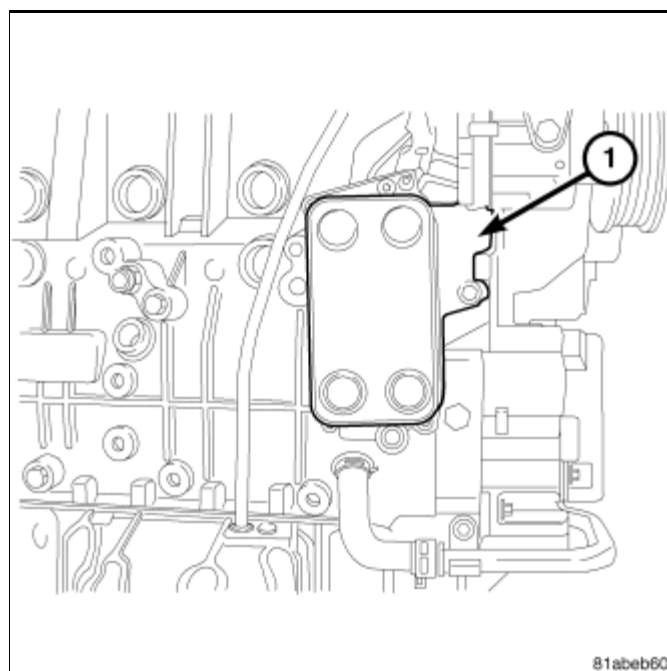


5. Disconnect the engine oil coolant line (1).

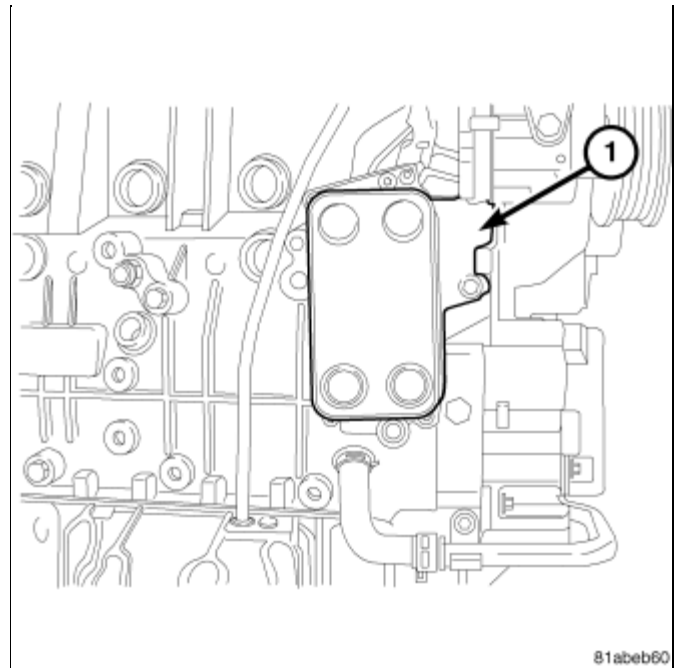


6. Remove the oil cooler.

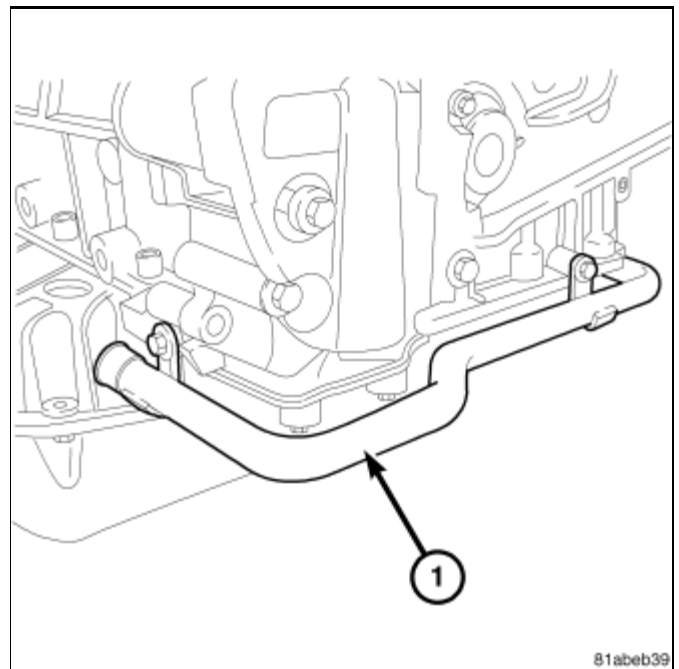
INSTALLATION



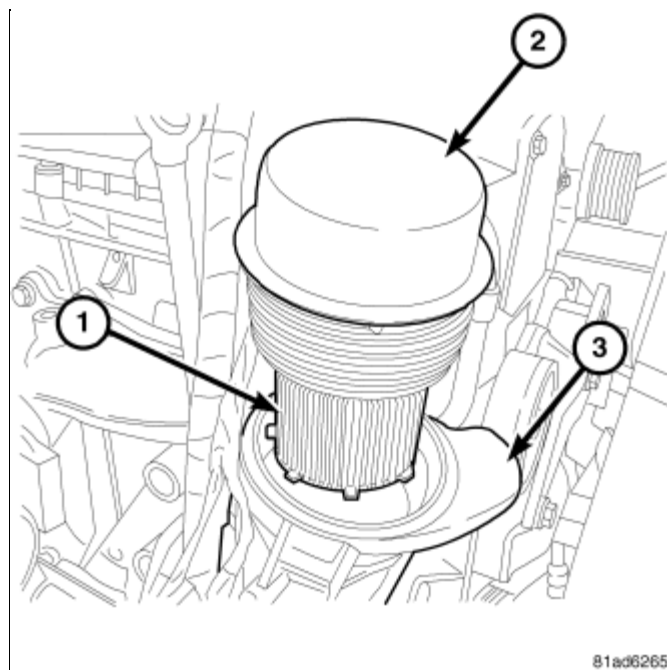
1. Install the oil cooler.



2. Connect the engine oil coolant line (1).



3. Install the oil filter.

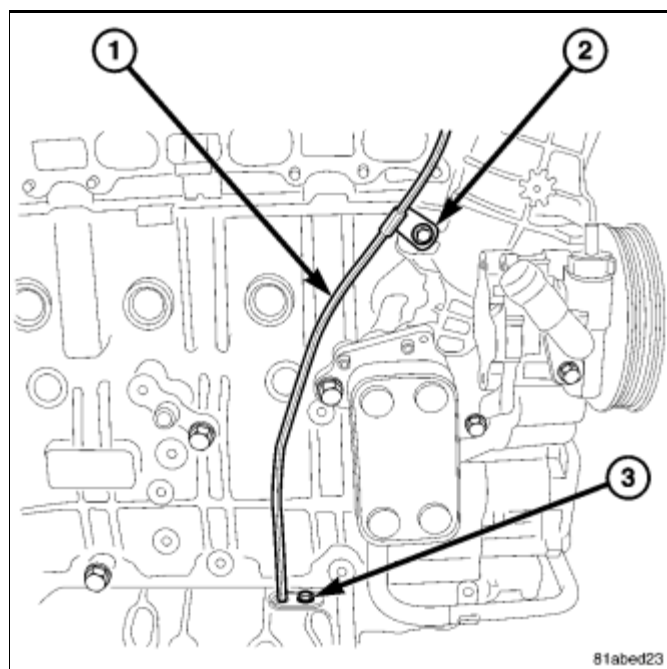


4. Install the dipstick (1).
5. Connect the battery.
6. Fill the engine oil.

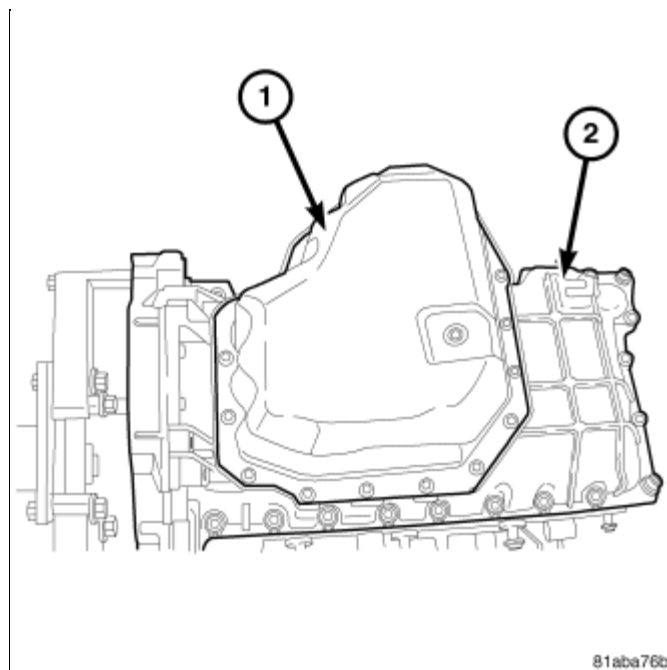
PAN-OIL

REMOVAL

UPPER OIL PAN

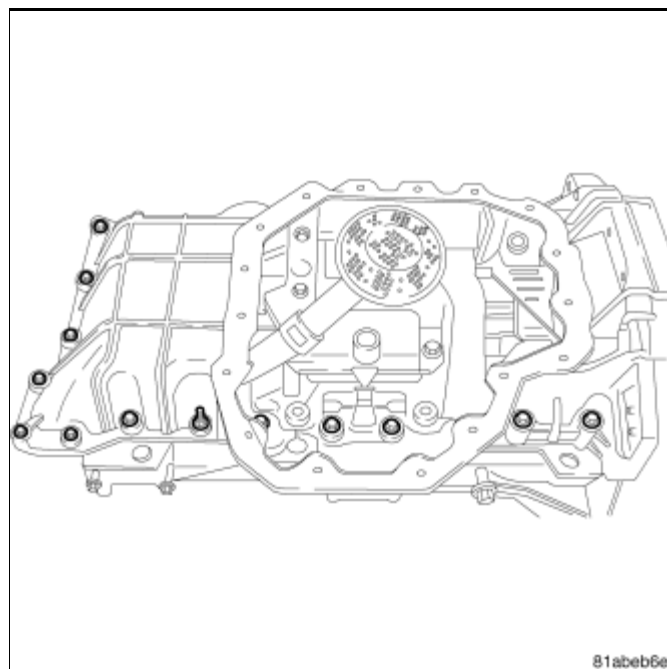


1. Disconnect the battery.
2. Drain the engine oil.
3. Remove the lower oil pan.



4. Remove the oil pickup tube bolt.
5. Remove the upper oil pan.

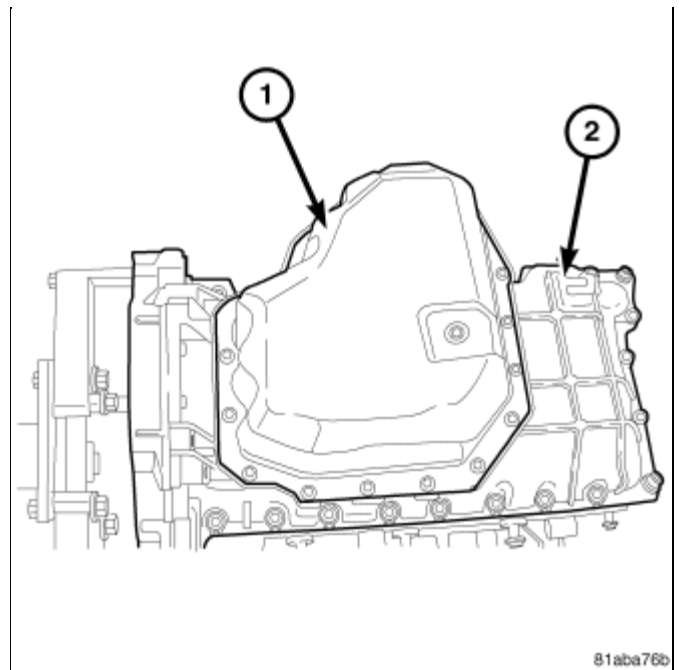
LOWER OIL PAN



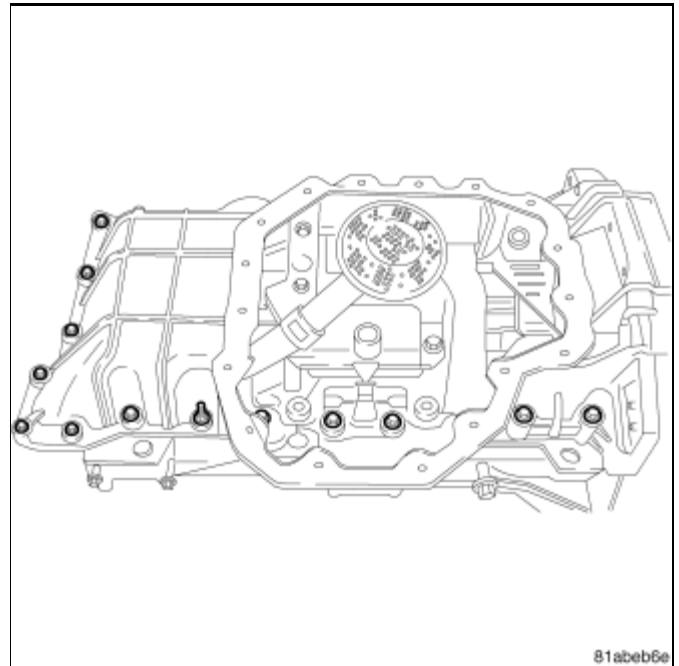
1. Disconnect the battery.
2. Drain the engine oil.
3. Remove the lower oil pan (1) bolts.

INSTALLATION

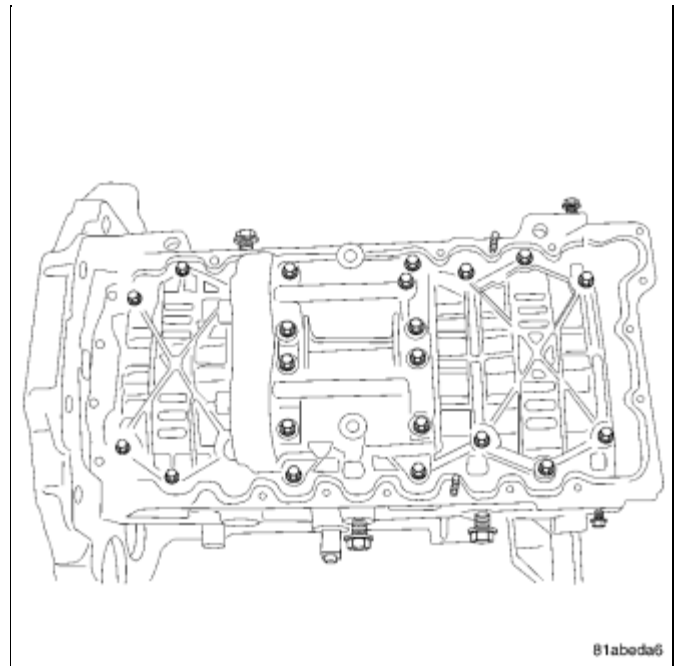
UPPER OIL PAN



1. Lubricate the oil pickup tube O-ring.
2. Install the oil pickup tube. Torque the bolt to 15 Nm (133 lbs. in.).

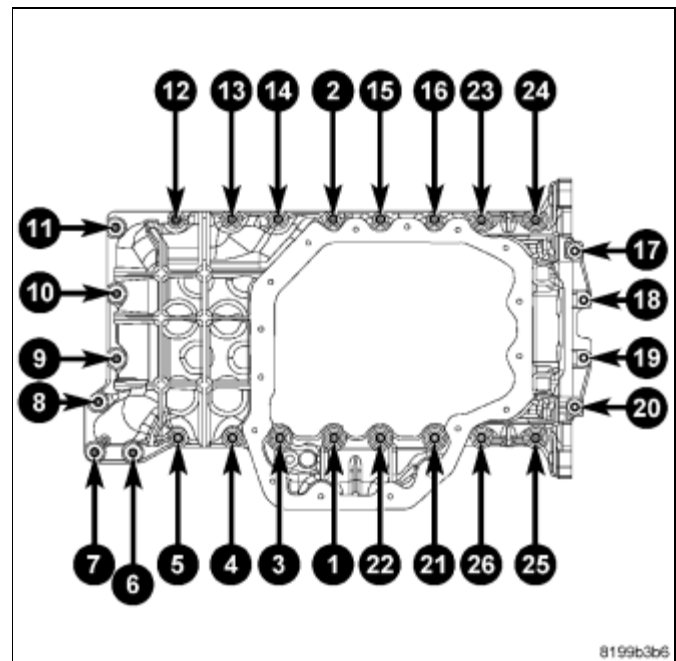


3. Install the upper oil pan gasket.



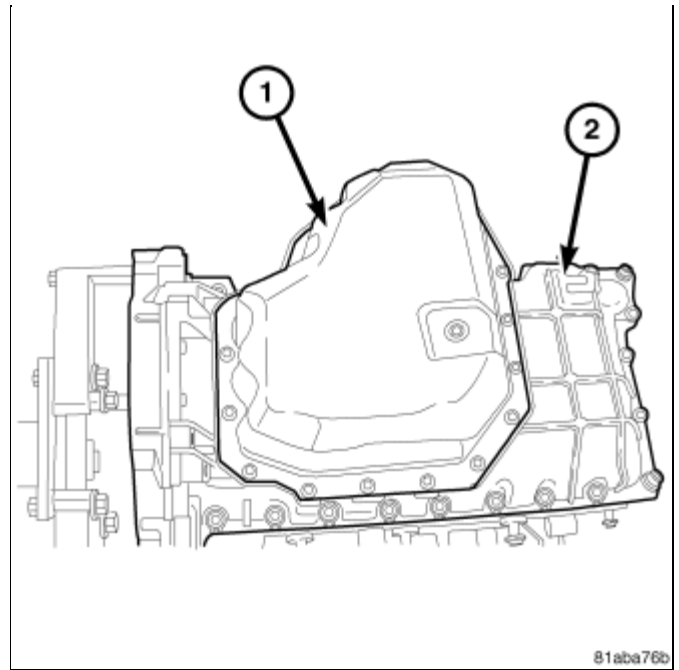
81abeda6

4. Install the upper oil pan gasket.
5. Install the upper oil pan bolts in positions one and two, then follow the sequence illustrated for the remaining bolts. Once all of the bolts are installed, tighten the M6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).
6. Loosen all of the upper oil pan bolts and studs by 90 degrees and retighten the M6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).

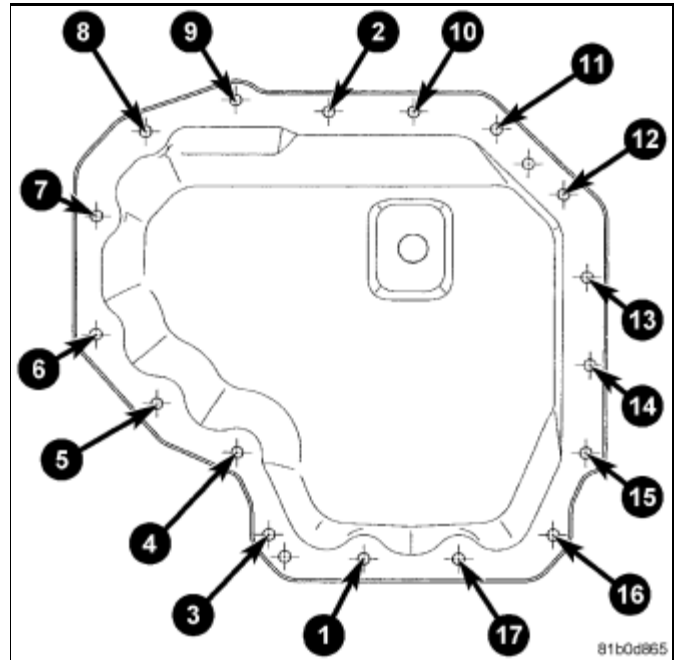


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7. Install the lower oil pan gasket.

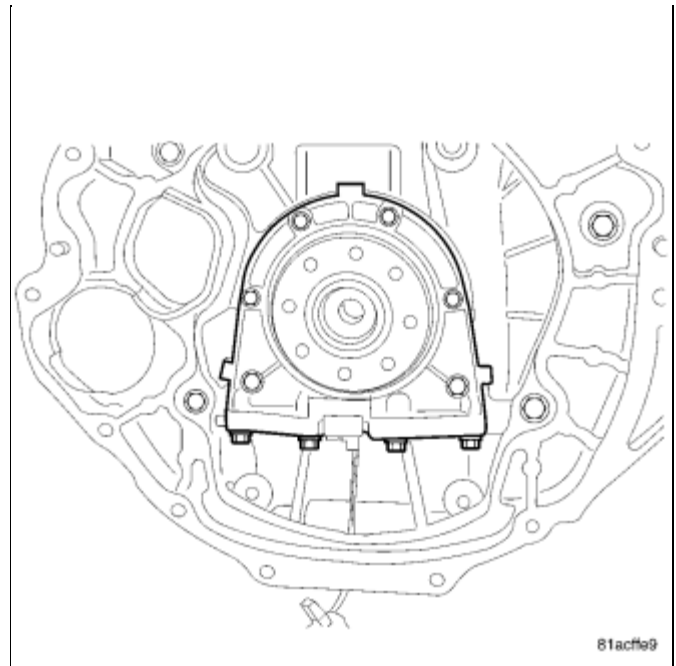


8. Install bolts one and two into the lower oil pan, then follow the sequence for the remaining bolts.
9. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
10. Loosen the oil pan bolts 90°.
11. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
12. Refill engine oil to proper level.

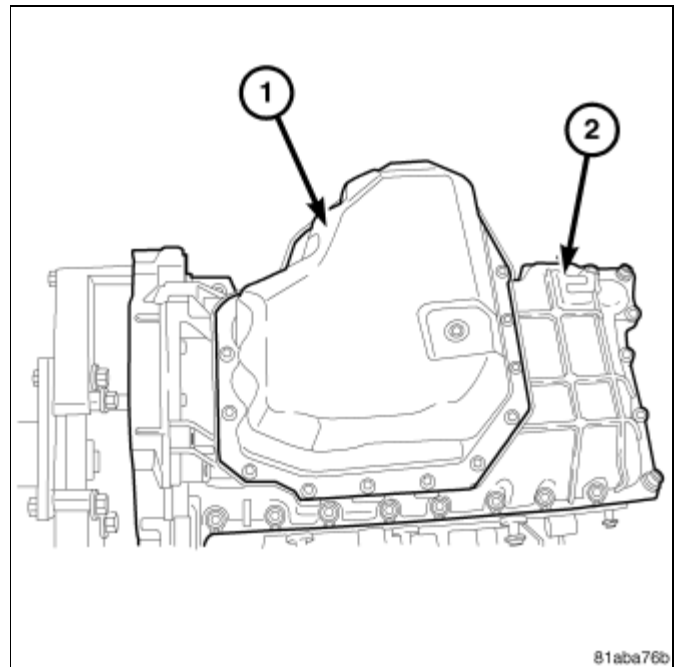


13. Connect the crankshaft position sensor (CKP).
14. Connect negative battery cable.

LOWER OIL PAN



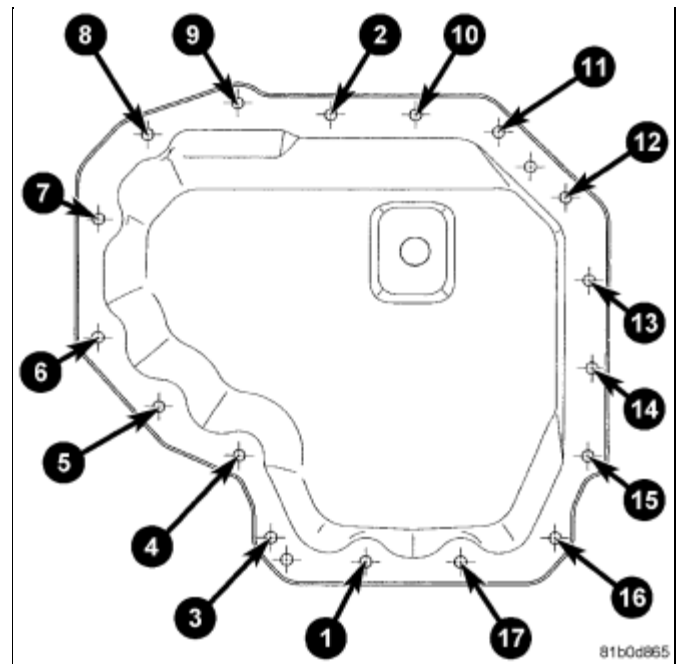
1. Make sure that the lower oil pan sealing surface is free of oil, debris and silicone.
2. Apply a 1/8 bead of silicone gasket to the lower oil pan (1) sealing surface.



3. Install bolts 1 and 2 into the lower oil pan and torque to 15 Nm (133 lbs. in.).
4. Install the remaining bolts in the sequence illustrated.
5. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
6. Loosen each bolt 90° and use the illustrated sequence to torque the bolts to 15 Nm (133 lbs. in.).
7. Refill engine oil to proper level.

UNIT-OIL PRESSURE SENDING

DESCRIPTION

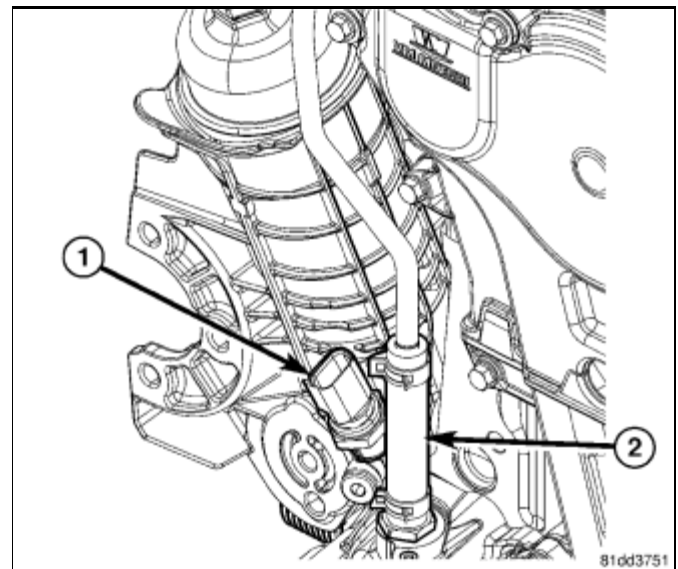


The oil pressure sending unit uses three circuits. They are:

- A signal circuit to the ECM.
- A sensor ground circuit through the ECM.
- A 5 volt reference circuit from the ECM.

The oil pressure sending unit returns a voltage signal back to the ECM relating oil pressure. Ground for the sensor is supplied by the ECM.

The oil pressure switch (1) is located on the right side of the engine block. The switch screws into the engines main oil gallery.

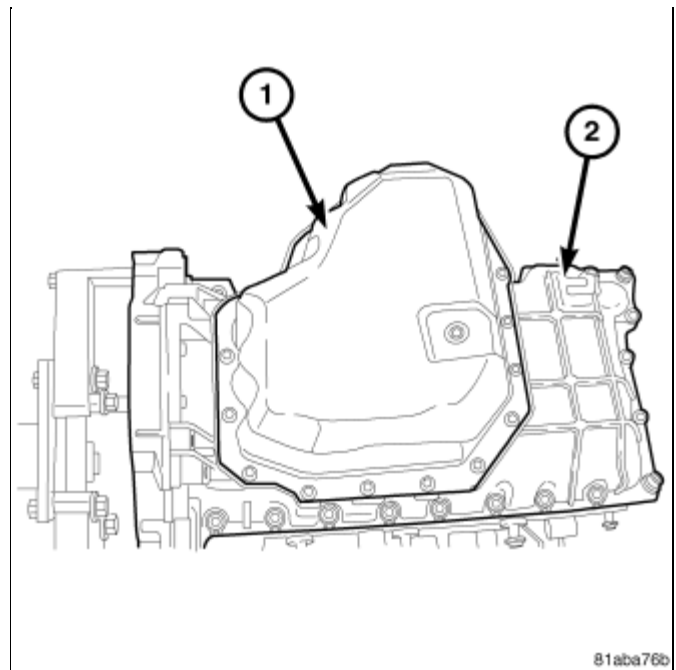


PUMP-OIL

REMOVAL

REMOVAL - OIL PUMP PICKUP TUBE

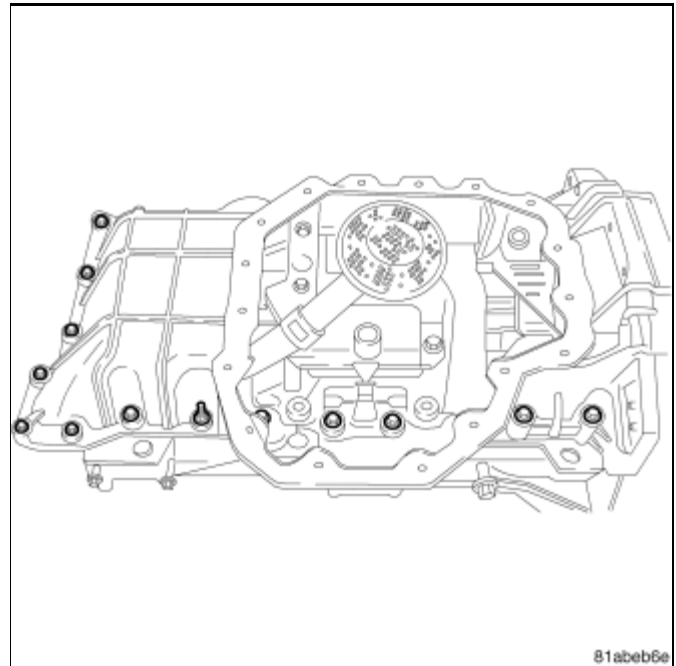
1. Drain the oil.
2. Disconnect negative battery cable. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
3. Raise vehicle on hoist.
4. Remove the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)



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5. Remove the upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
6. Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block. Discard O-rings.

REMOVAL - OIL PUMP



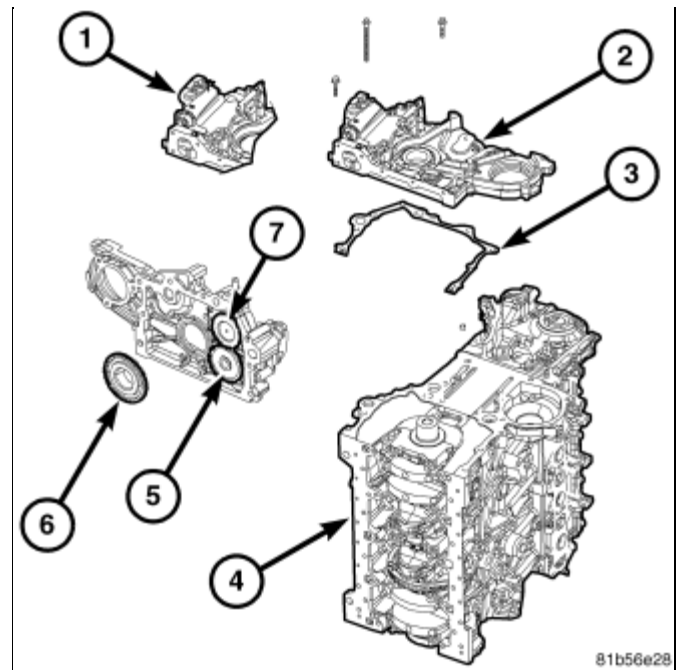
81abeb6e

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL) .
3. Remove the front cover. (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL)
4. Remove the oil pump (5) from the front cover (2).

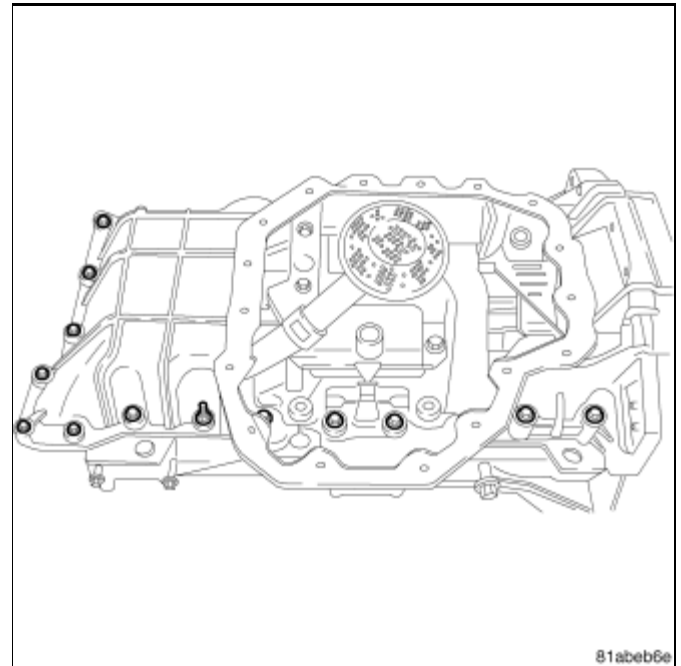
INSTALLATION

INSTALLATION - OIL PUMP

PICKUP TUBE

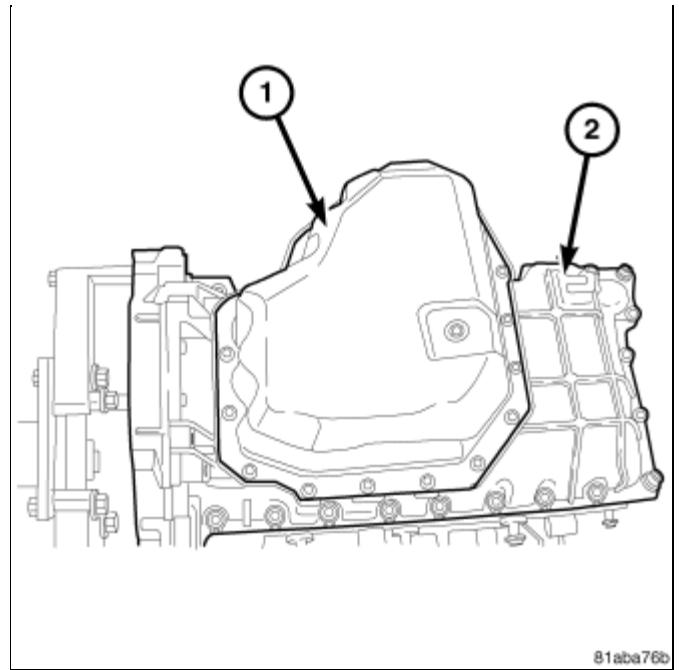


1. Lubricate o-ring on oil pump pickup tube with engine oil.
2. Install pickup tube in engine block and install retaining bolt. Torque bolt to 32.4N·m. (24 ft.lbs.).
3. Install the upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)



4. Install the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)
5. Refill engine oil to proper level.
6. Connect negative battery cable (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION).

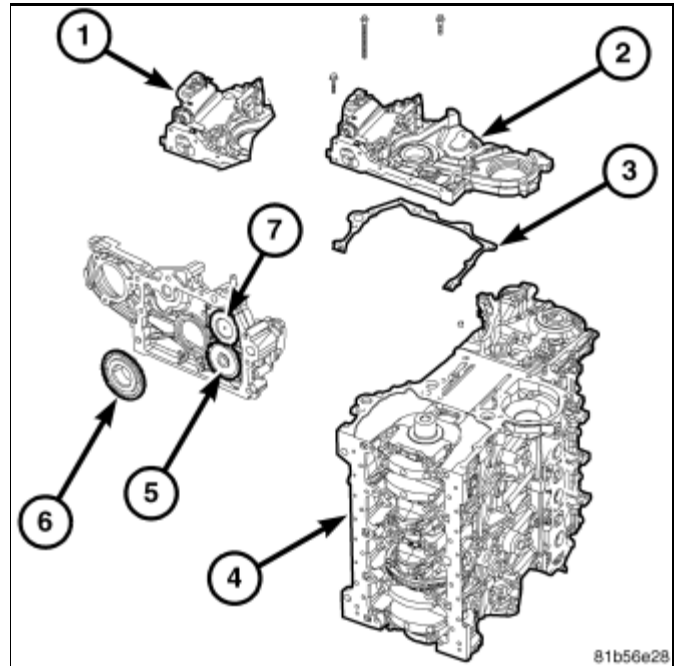
INSTALLATION - OIL PUMP



1. Make sure that the gasket surfaces are free of oil and debris.
2. Lubricate oil pump rotor with engine oil.
3. Install the oil pump gasket.
4. Install front cover assembly (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).

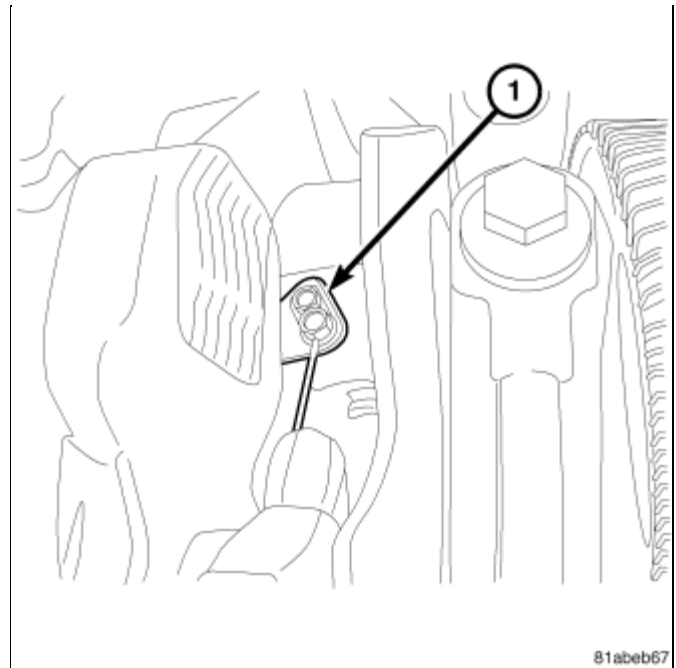
JET-OIL

DESCRIPTION



There are four oil jets installed in the engine block. These oil jets are used to cool and lubricate the piston assemblies.

REMOVAL

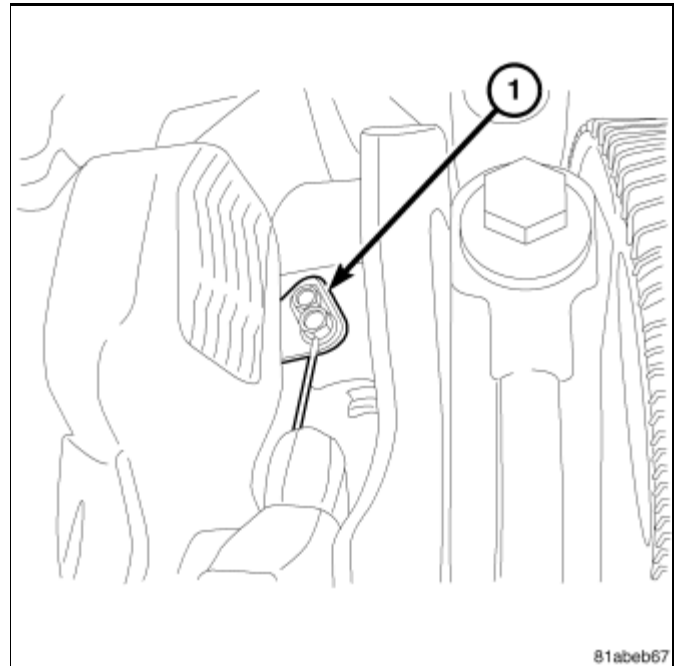


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CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.

NOTE: To prevent damage to the oil jets, remove the oil jets before removing the pistons.

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove the lower oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
4. Remove the oil pickup tube.
5. Remove the upper oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
6. Remove the balance shaft assembly.
7. Remove the oil jet.

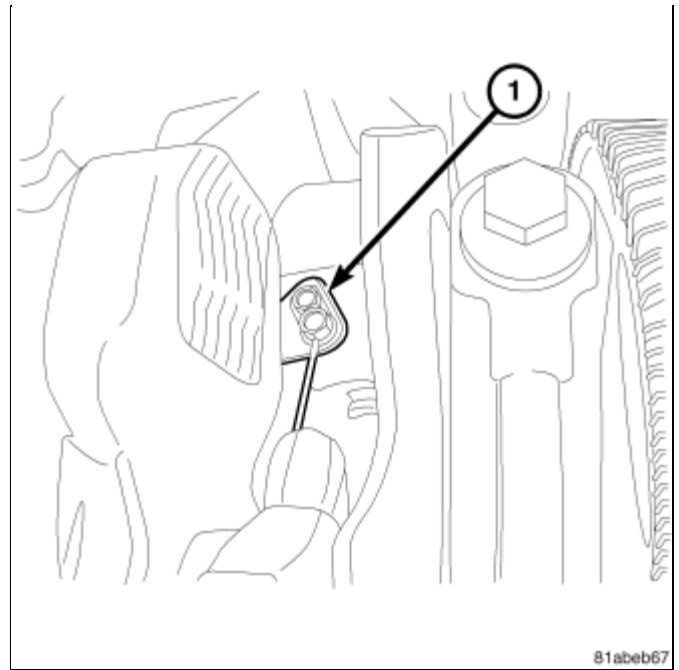


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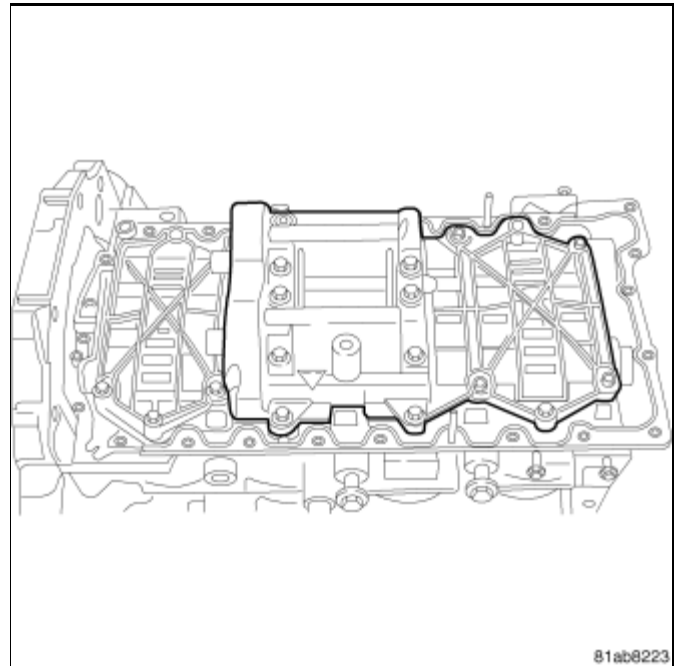
INSTALLATION

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

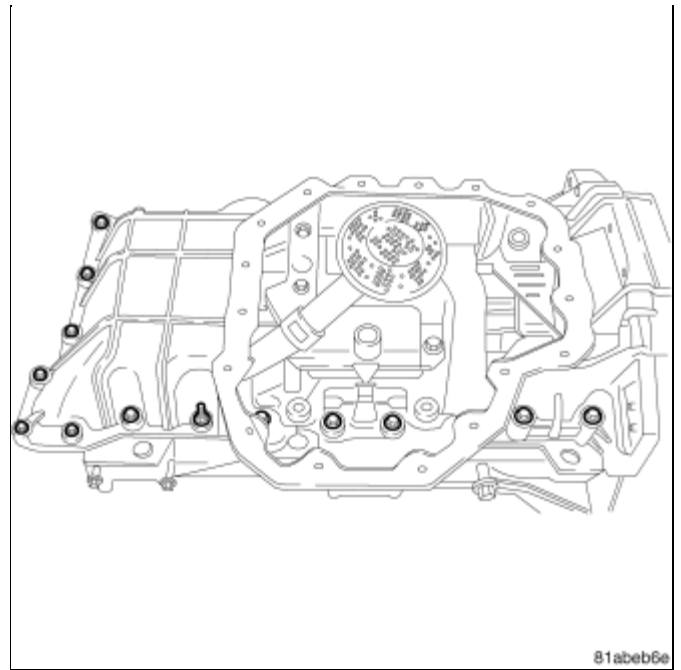
1. Lubricate o-ring on oil jet.
2. Install oil jet retaining bolt. Torque bolt to 10.8N·m.(96 in.lbs.).



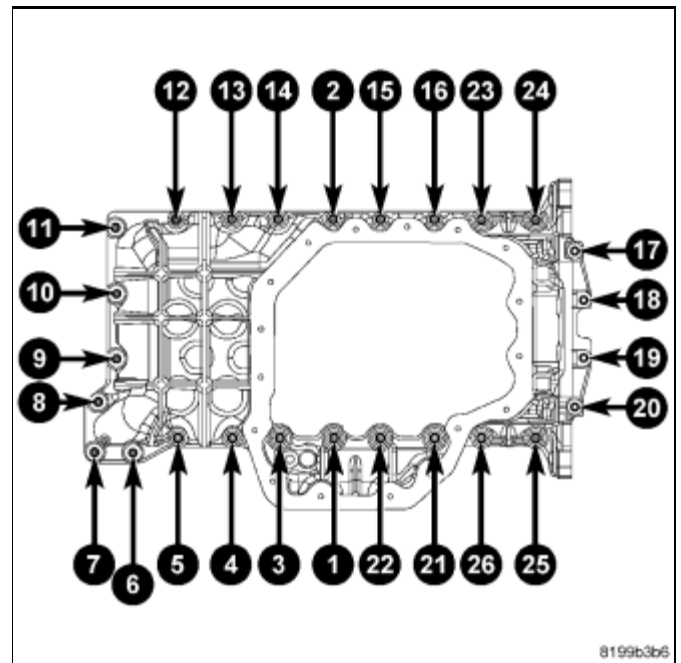
3. Install the balance shaft assembly.



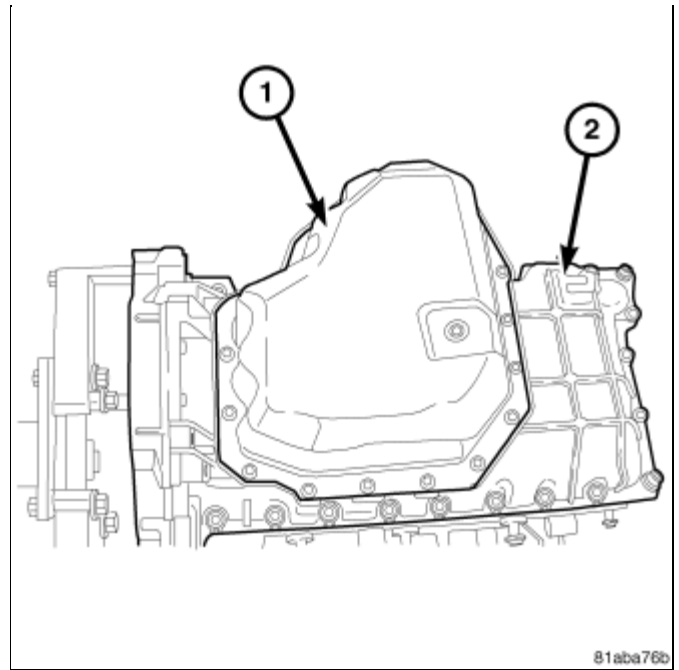
4. Lubricate the oil pickup tube oring before installation.
5. Install the oil pickup tube and torque the bolt to 15 Nm (12 lbs.ft).



6. Install the upper oil pan gasket.
7. Install the upper oil pan bolts in positions one and two, then follow the sequence illustrated for the remaining bolts. Once all of the bolts are installed, torque the m6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).

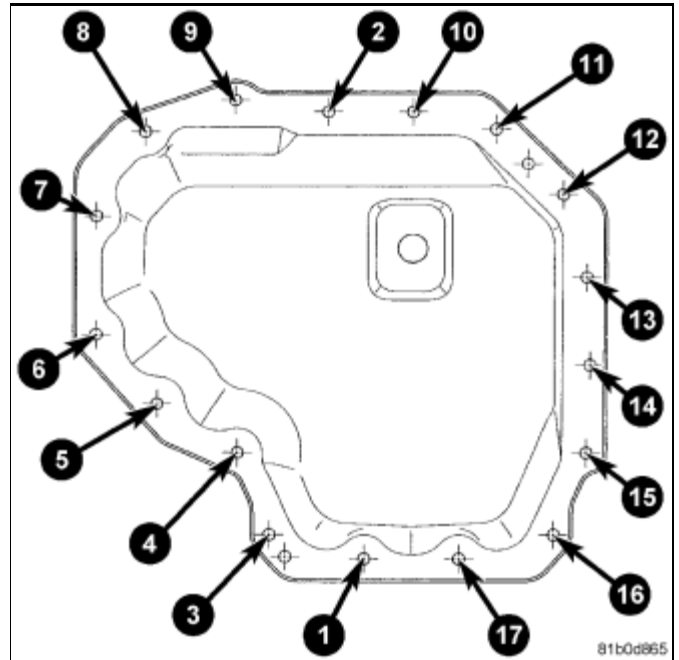


8. Install the lower oil pan gasket.



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9. Install bolts one and two into the lower oil pan, then follow the sequence for the remaining bolts.
10. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
11. Turn each bolt an additional 90°.
12. Refill engine oil to proper level.

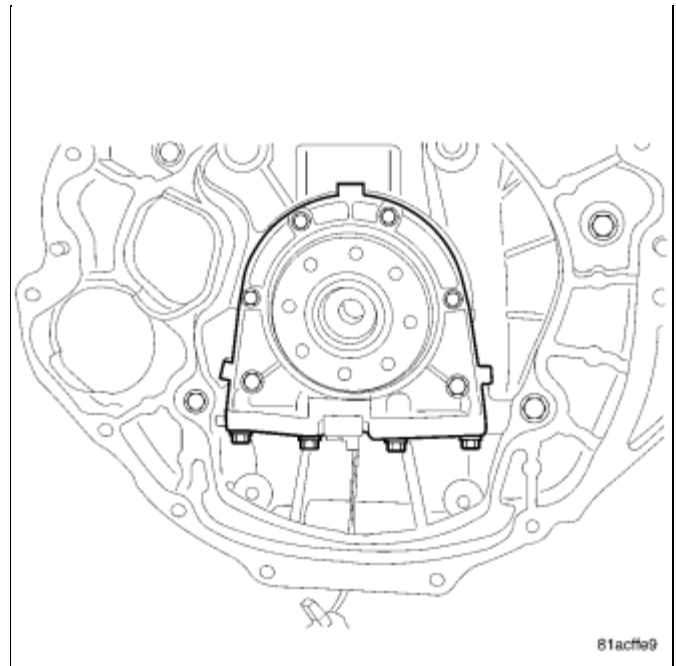


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13. Connect the crankshaft position sensor (CKP).
14. Connect negative battery cable.

SEPARATOR-OIL

REMOVAL

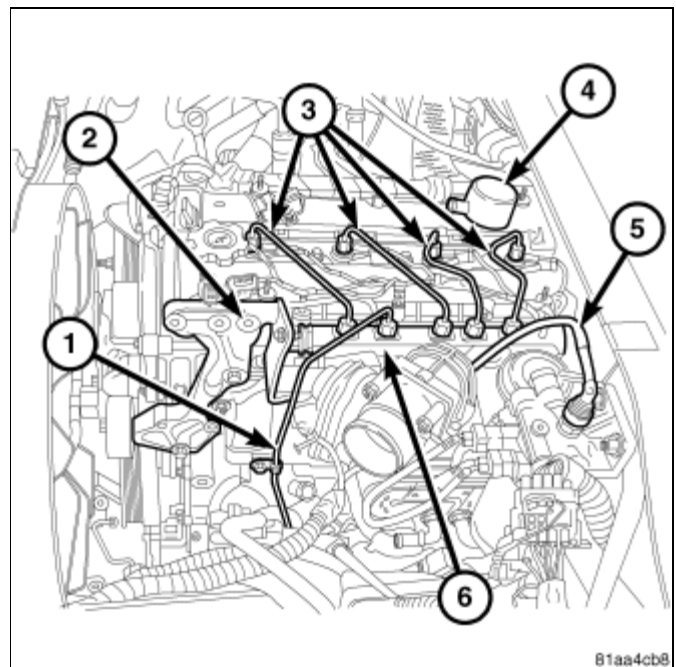


1. Remove the engine cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.

2. Remove the oil separator fasteners and oil separator (4).

INSTALLATION

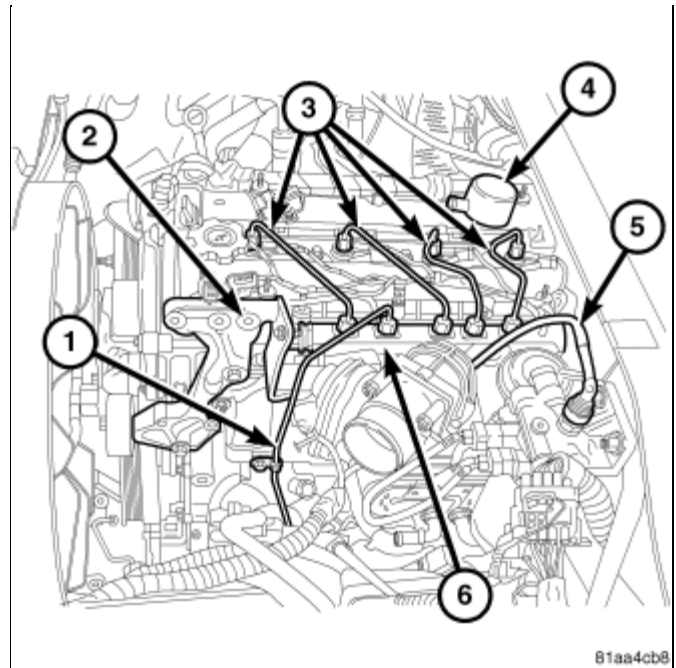


NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.

1. Lubricate the oil separator o-rings with clean engine oil.
2. Carefully position and push down on the oil separator to seat.
3. Install the oil separator retaining fasteners. Tighten fasteners to 10.8 N·m (96 lbs. in.).
4. Install the camshaft cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

OIL PRESSURE RELIEF VALVE

DESCRIPTION

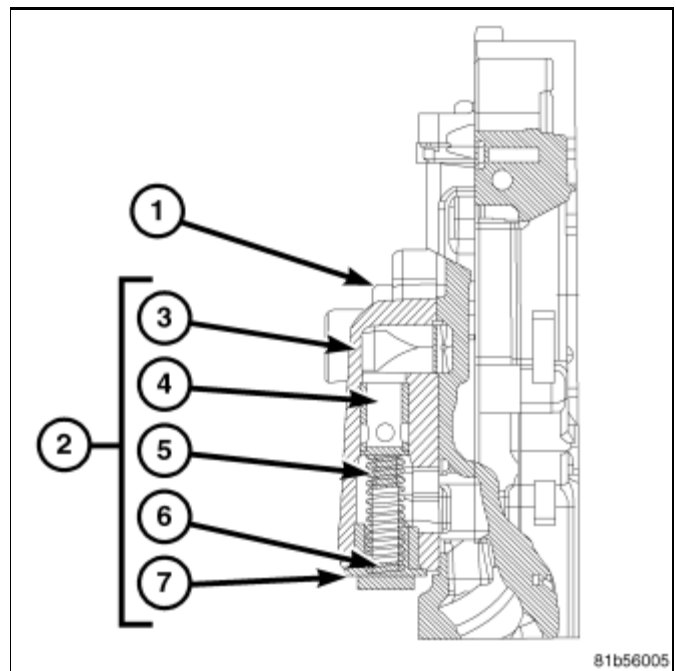


The oil pressure relief valve is built into the front cover (1). The oil pressure relief valve assembly (2) consists of several components. The plunger (4) is held in place by the spring (5). The plug (6) keeps the plug and spring in place, and the o-ring (7) prevents oil from leaking past the plug (6).

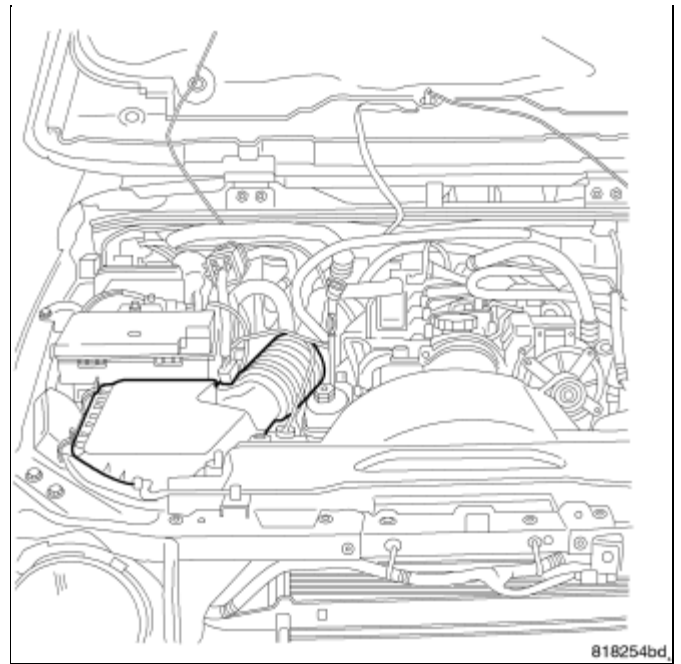
In the case of excessively high oil pressure, the oil pressure on the piston (4) overcomes the spring (5) pressure and the piston is forced off its seat. When the piston is forced off its seat, a drain back passage is opened and the excess oil pressure is vented back into the crankcase.

MANIFOLD-INTAKE

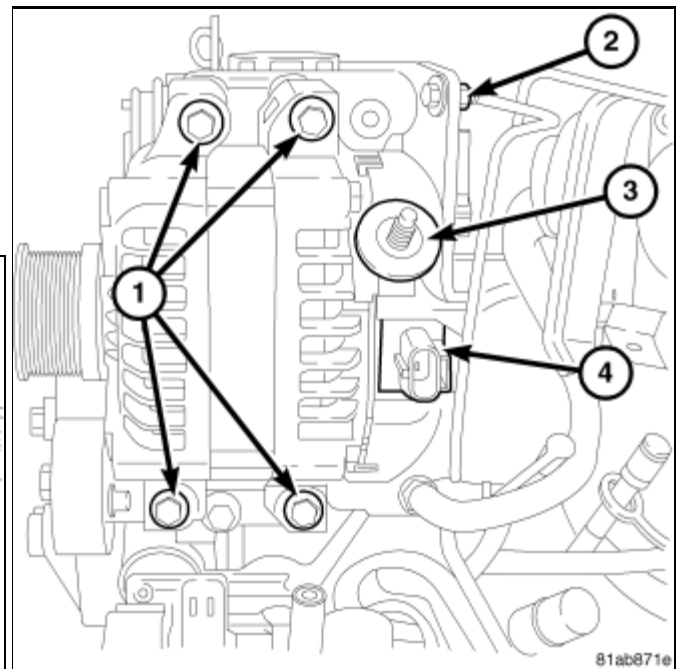
REMOVAL



1. Remove the engine cover.
2. Disconnect the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)
3. Remove the silencer.
4. Drain the coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
5. Remove the upper radiator hose.

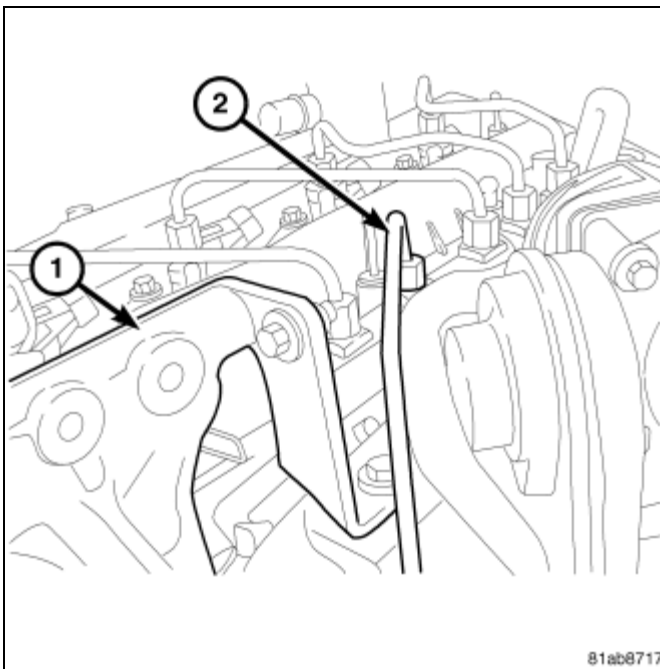


6. Disconnect the generator connector (4).
7. Remove the battery feed wire from the generator (3).
8. Remove the generator bolts (1), and remove the generator.

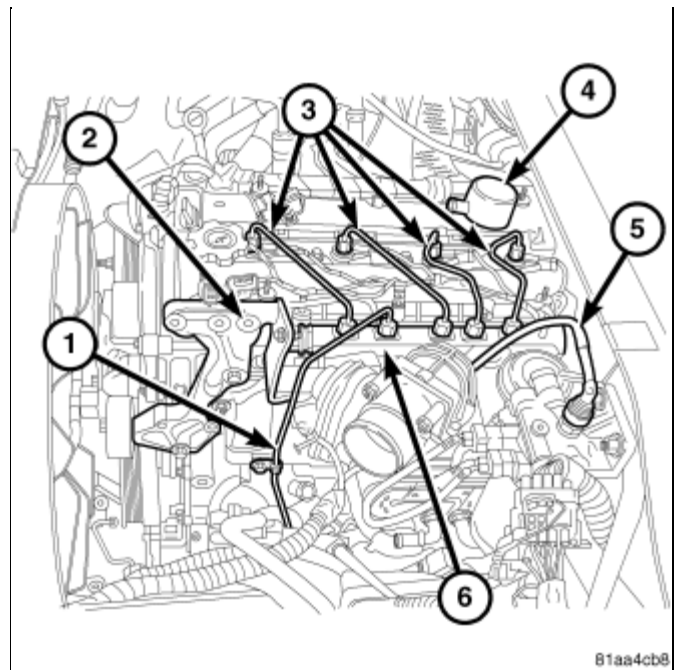


9. Remove the generator brace (1).

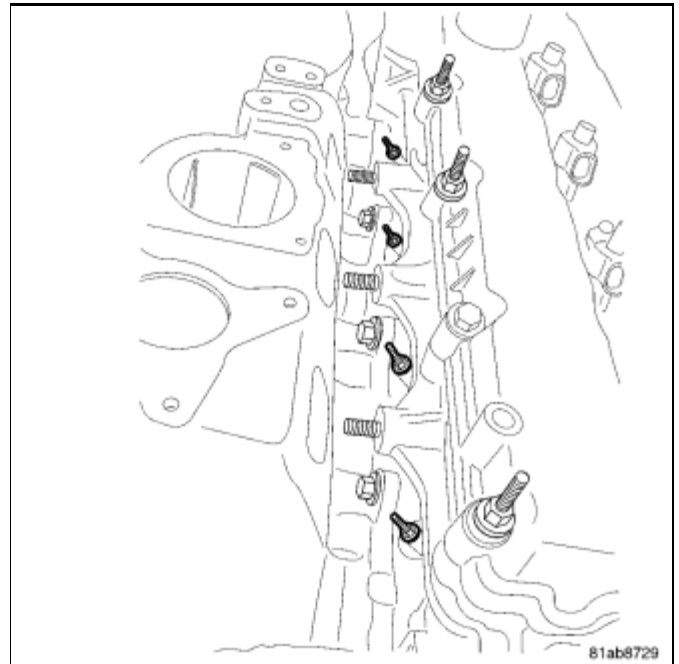
10. Remove the high pressure fuel line from the fuel rail.



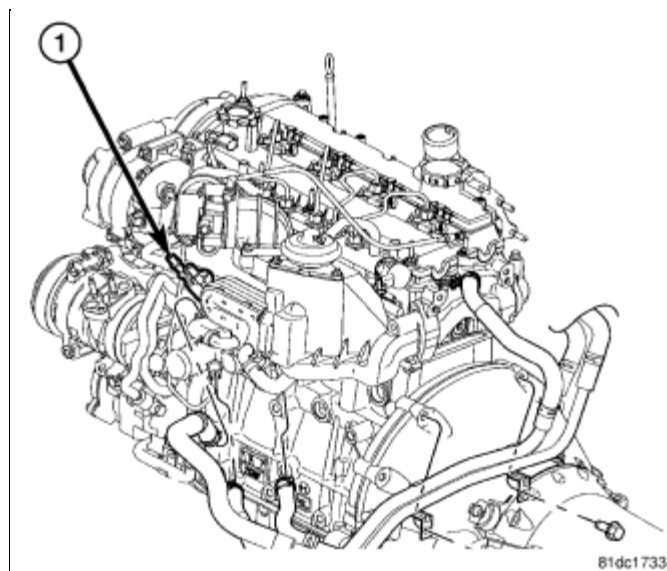
11. Remove the fuel lines (3).
12. Remove the fuel rail (6)..



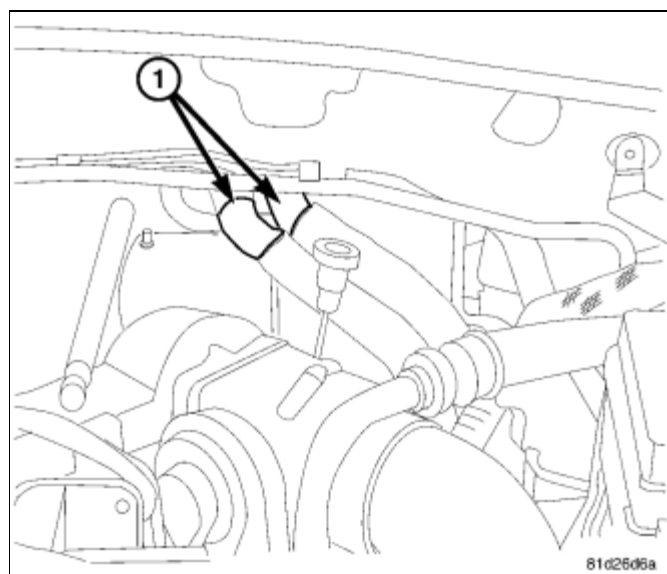
13. Disconnect the glow plug connectors.



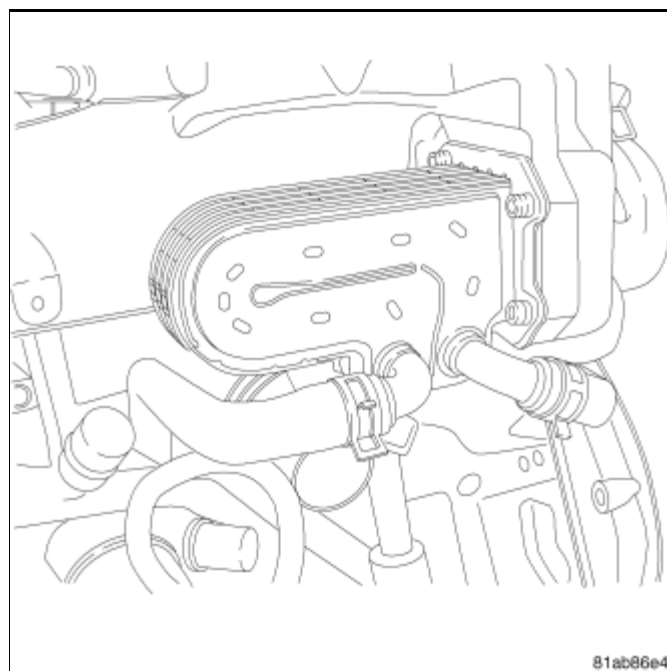
- 14. Disconnect the fuel return lines (1).
- 15. Remove the fuel return line junction block.



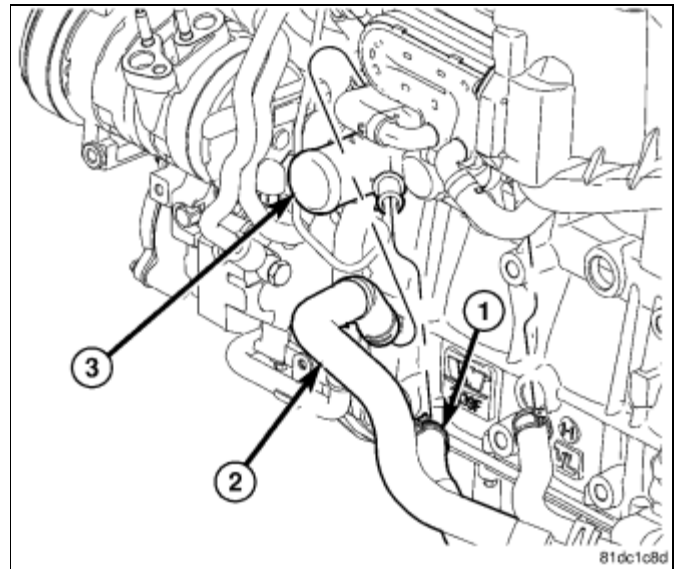
16. Remove the heater hoses (1) from the engine block.



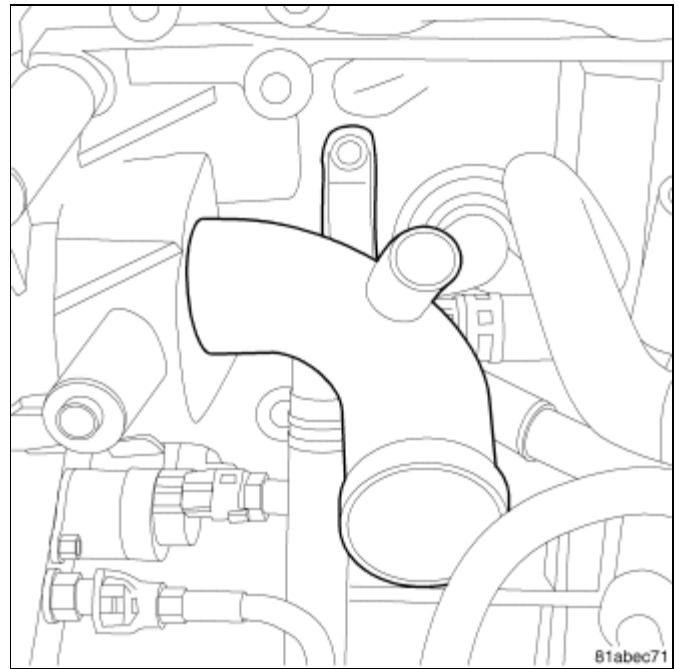
17. Remove the EGR cooler.



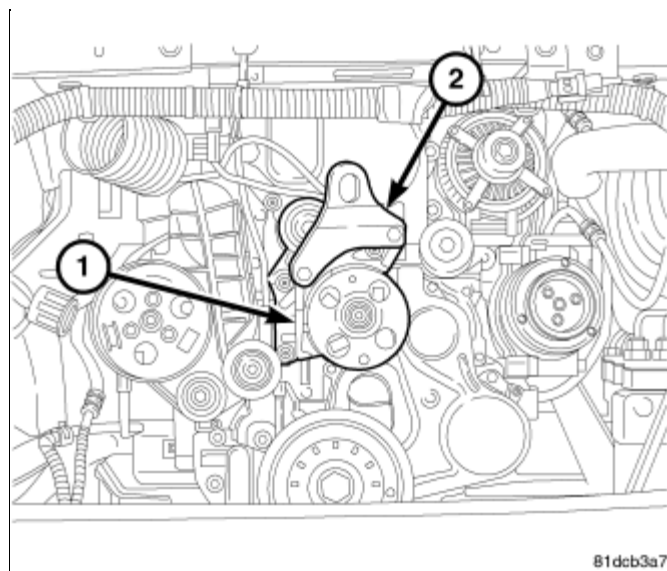
18. Remove the thermostat housing (3).



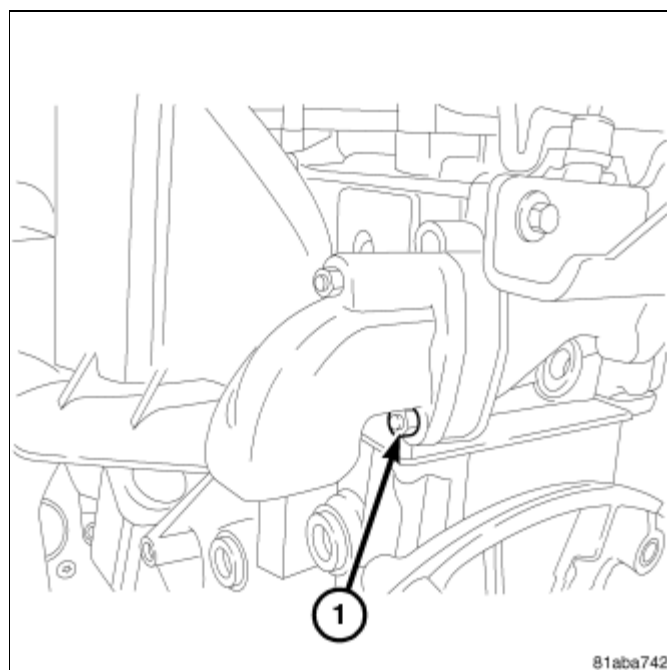
19. Remove the coolant hose from the water pump.
20. Disconnect the coolant temperature sensor.



21. Remove the front engine lift bracket (2).
22. Remove the cooling fan and idler pulley assembly (1).
23. Remove the fuel filter lines.
24. Remove the fuel filter.

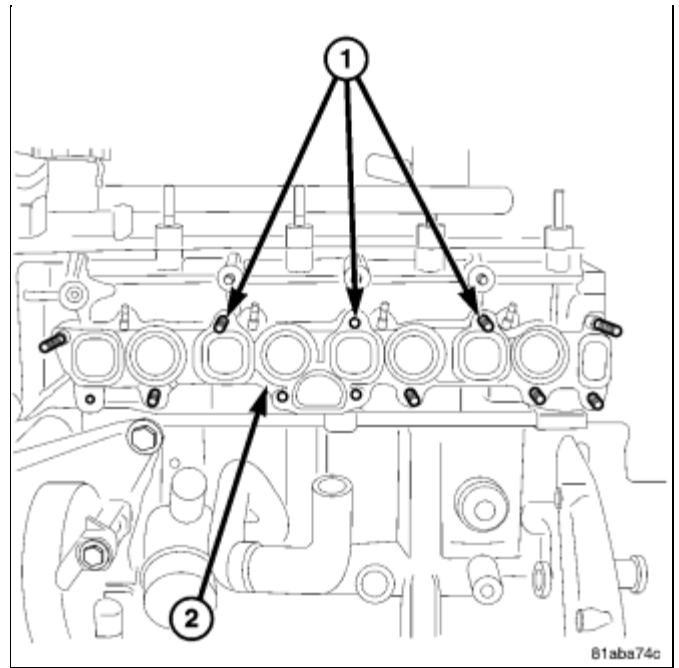


25. Remove the intake manifold.

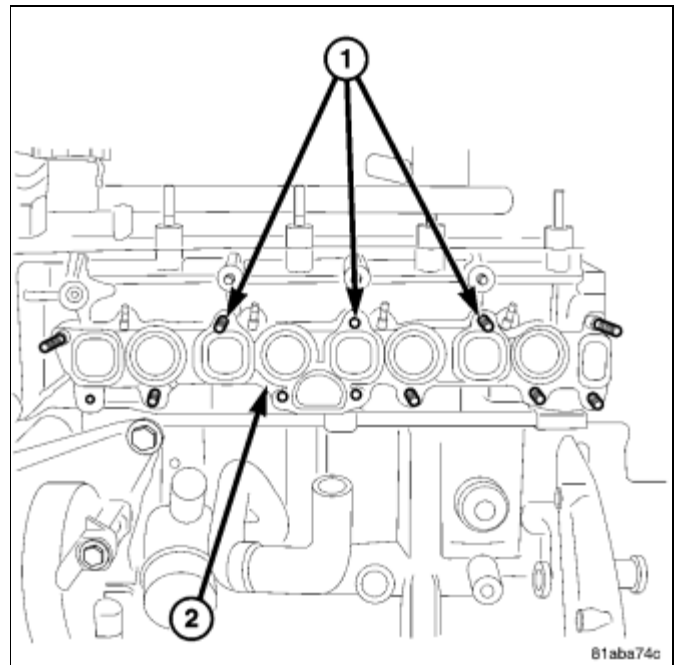


26. Remove the intake manifold gasket (2).

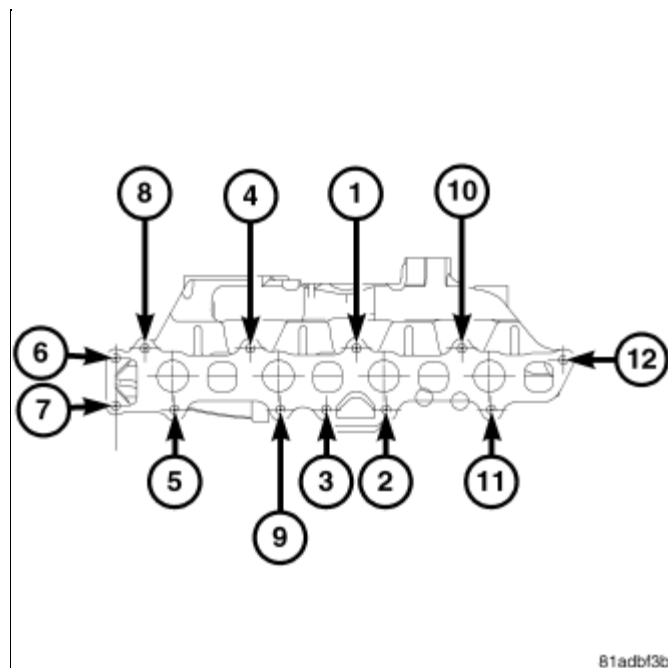
INSTALLATION



1. Clean and inspect the gasket surface of the intake manifold.
2. Clean and inspect the gasket surface of the cylinder head.
3. Install the intake manifold gasket (2).

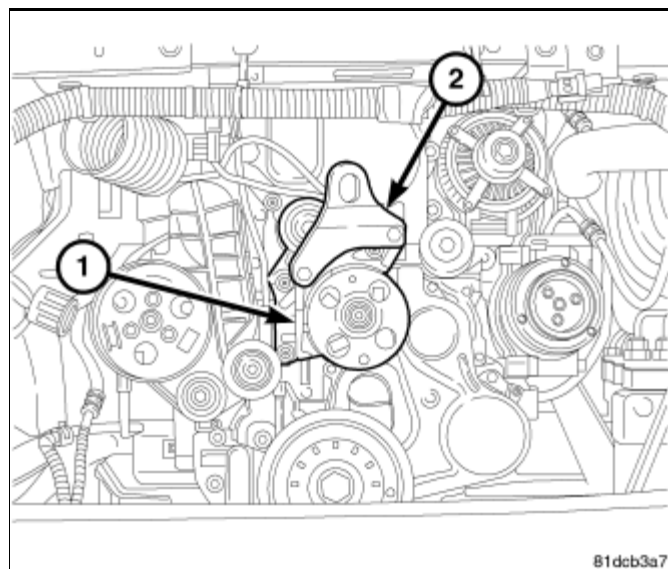


4. Install the intake manifold.
5. Using the torque sequence in the illustration, torque the intake manifold bolts to 25 nm (18.4 ft. lbs.).



81adb13b

6. Install the front engine lift bracket (2).
7. Install the cooling fan and idler pulley assembly (1).
8. Install the fuel filter.
9. Install the fuel filter lines.

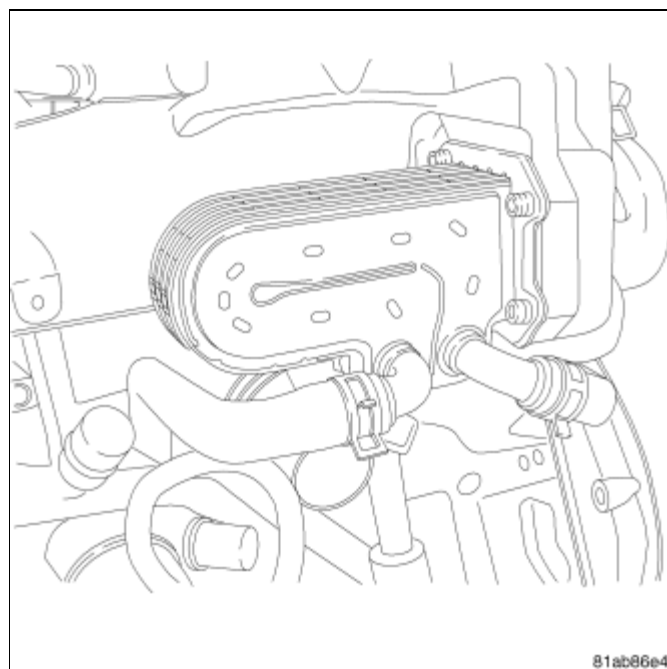


81dcb3a7

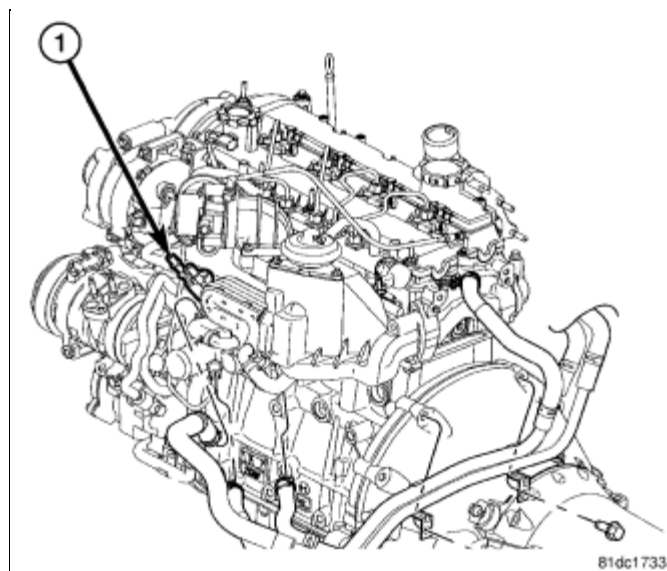
10. Connect the glow plug connectors.



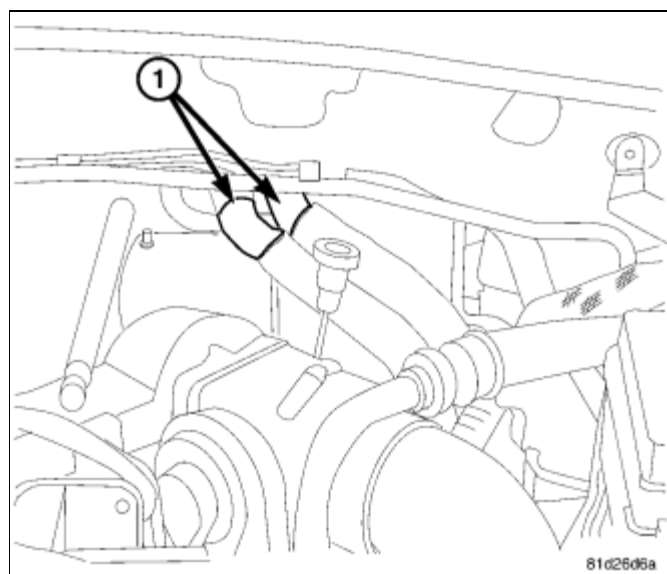
11. Install the EGR cooler.



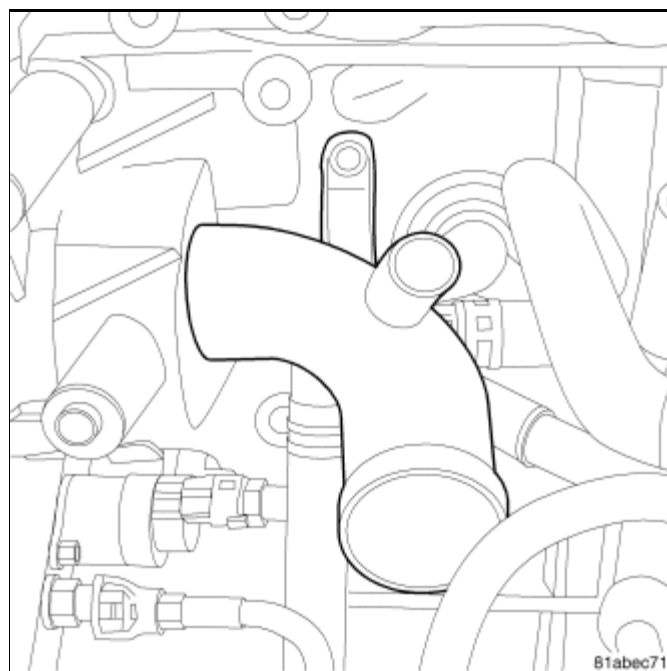
- 12. Install the fuel return line junction block.
- 13. Connect the fuel return lines (1).



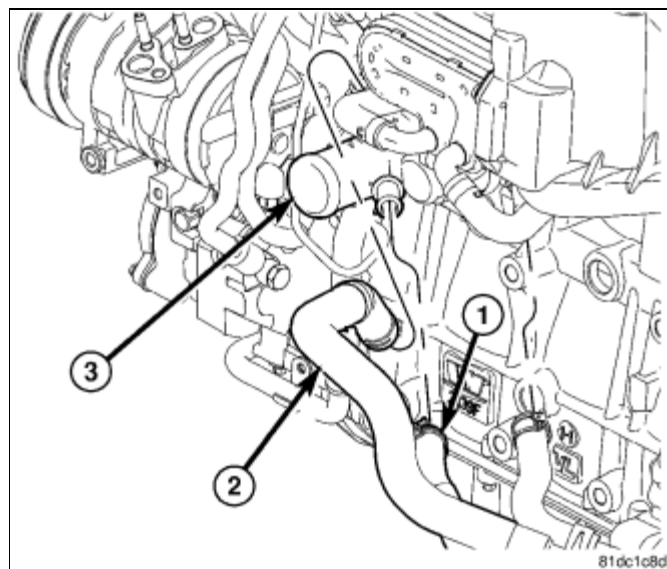
14. Install the heater hoses (1).



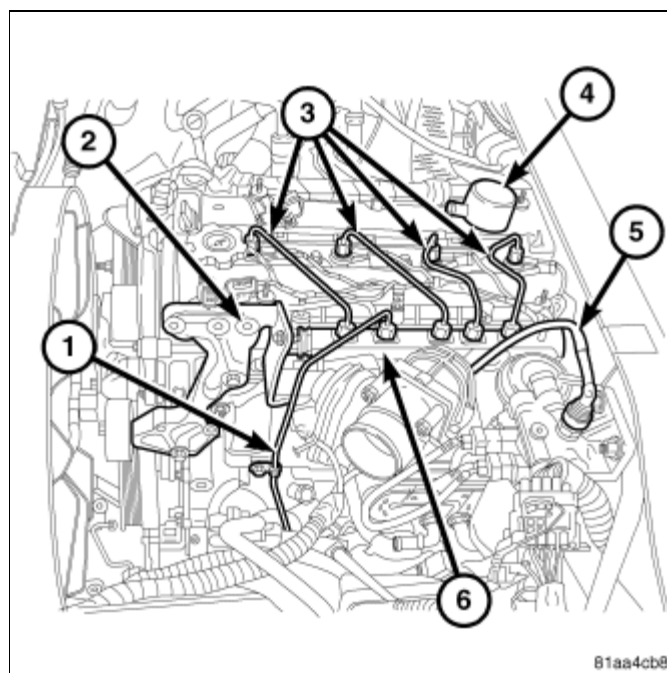
- 15. Install the coolant hose to the water pump.
- 16. Install the cooling lines to the water pump outlet.
- 17. Connect the coolant temperature sensor.



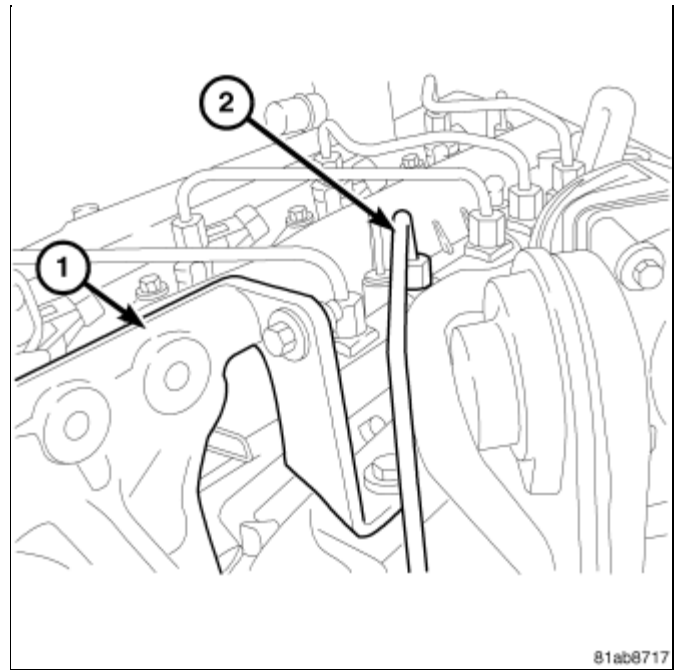
18. Install the thermostat housing (3).
19. Install the coolant lines to the thermostat housing.



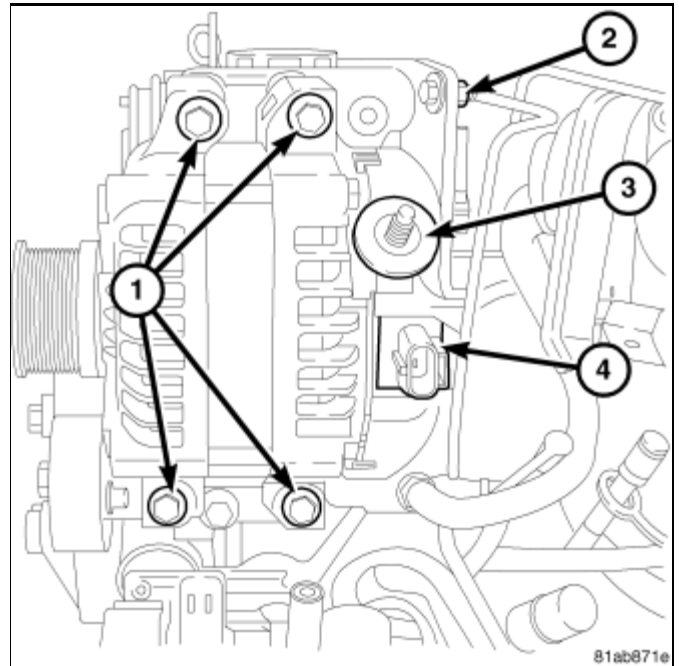
20. Install the fuel rail (6).
21. Install the fuel lines (3).



22. Install the generator brace (1).
23. Install the high pressure fuel line (2) to the fuel rail.



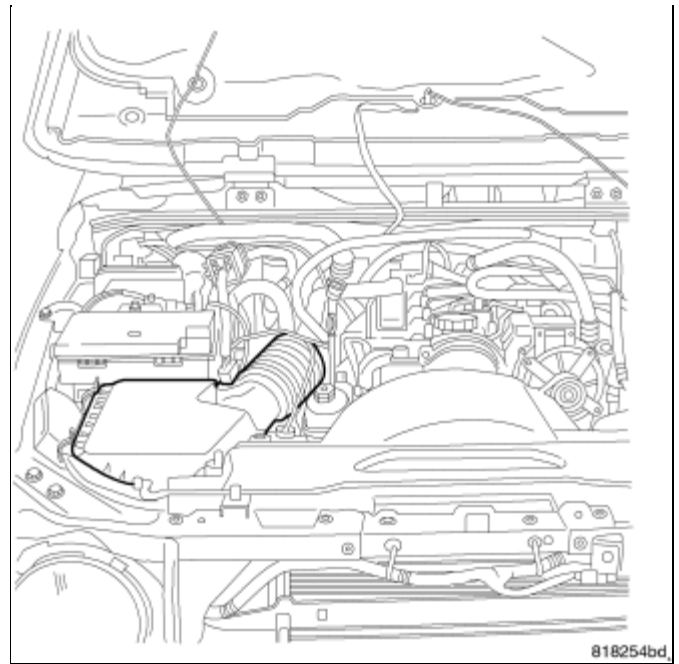
- 24. Install the generator.
- 25. Connect the generator connector (4).
- 26. Install the battery feed wire to the generator (3).



- 27. Remove the upper radiator hose.
- 28. Fill the coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
- 29. Install the silencer.
- 30. Connect the battery. (Refer to 7 - COOLING - STANDARD PROCEDURE)
- 31. Install the engine cover.

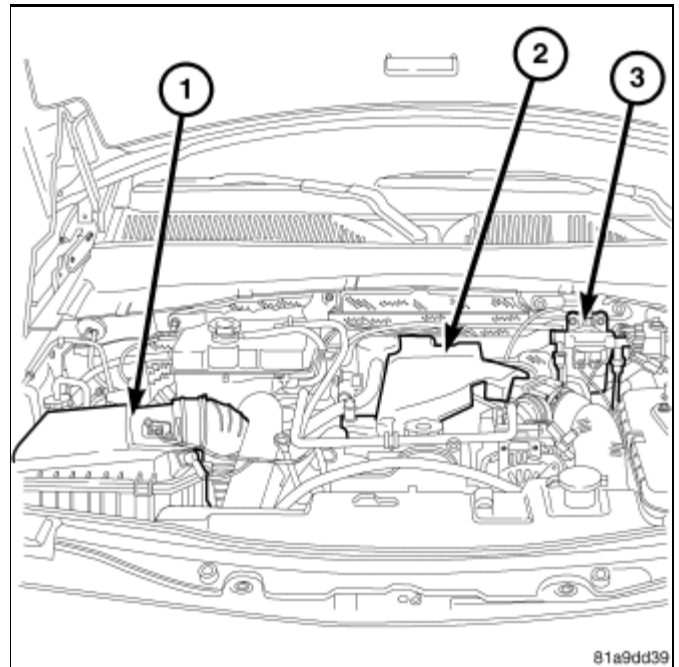
MANIFOLD-EXHAUST

REMOVAL



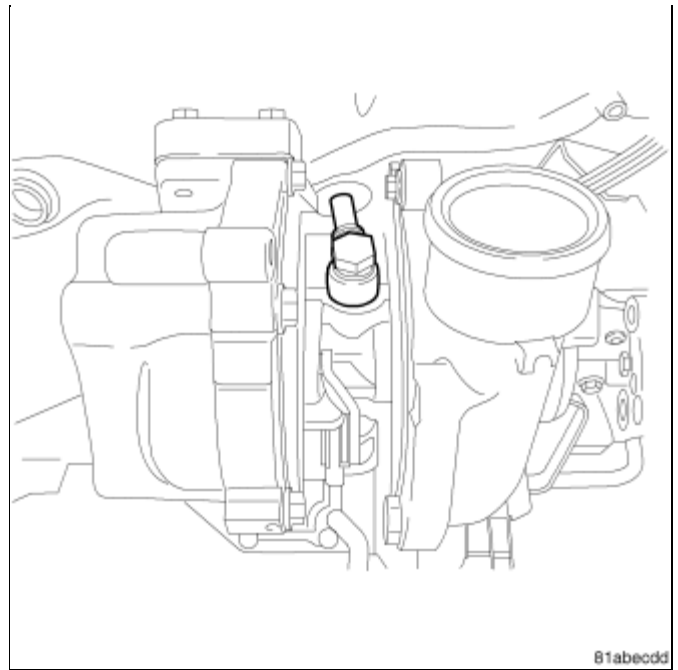
818254bd

1. Remove the engine cover (2).
2. Remove the silencer.
3. Remove the air cleaner housing (1).

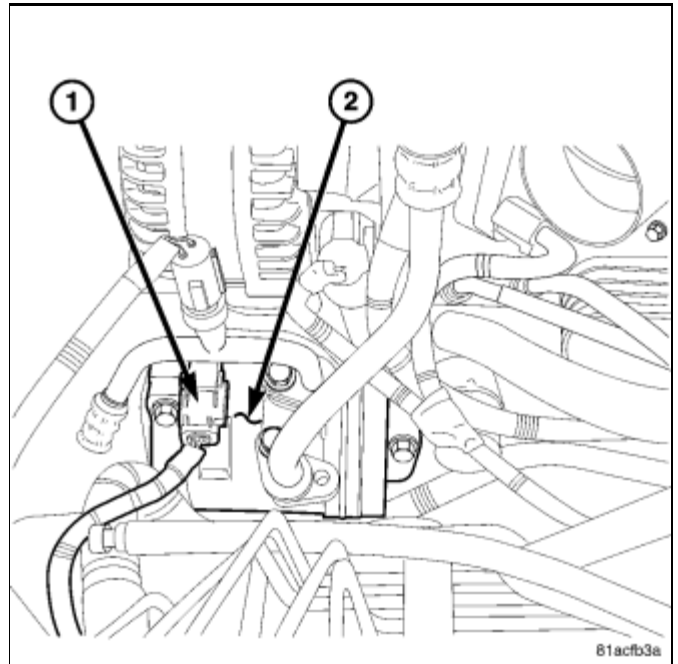


81a9dd39

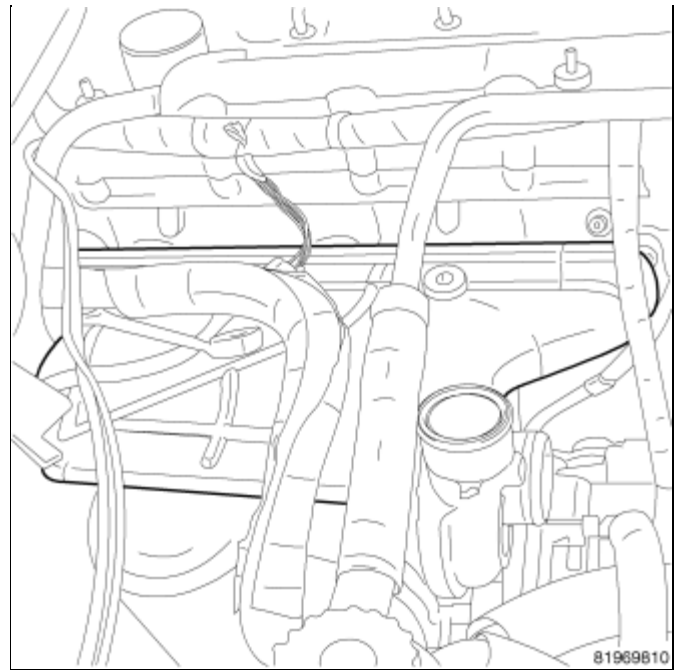
4. Disconnect the inlet temperature sensor connector.
5. Remove the inlet air tube from the turbocharger.



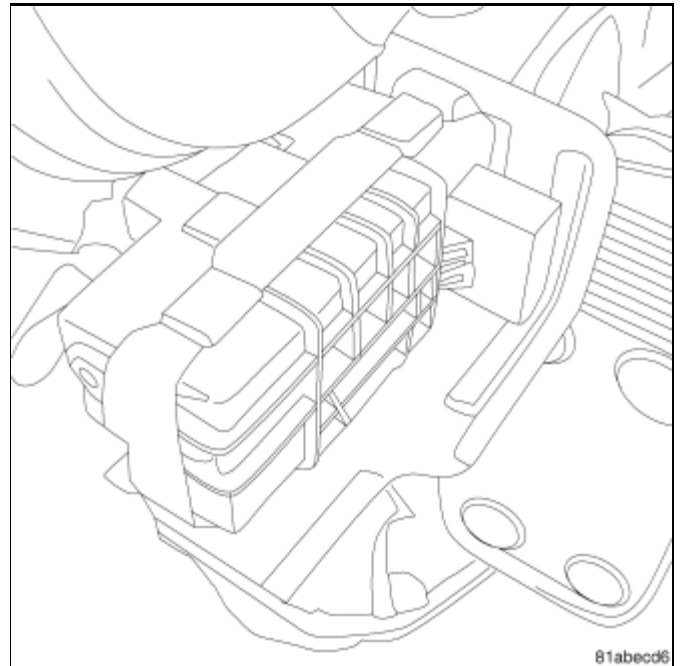
6. Remove the air conditioning bracket bolt.



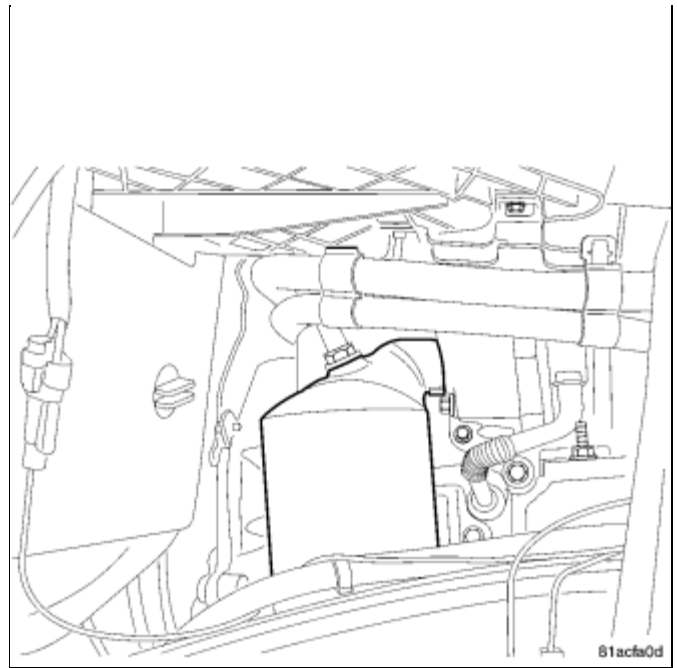
7. Remove the bolts from the exhaust manifold heat shield.
8. Remove the exhaust manifold heat shield.



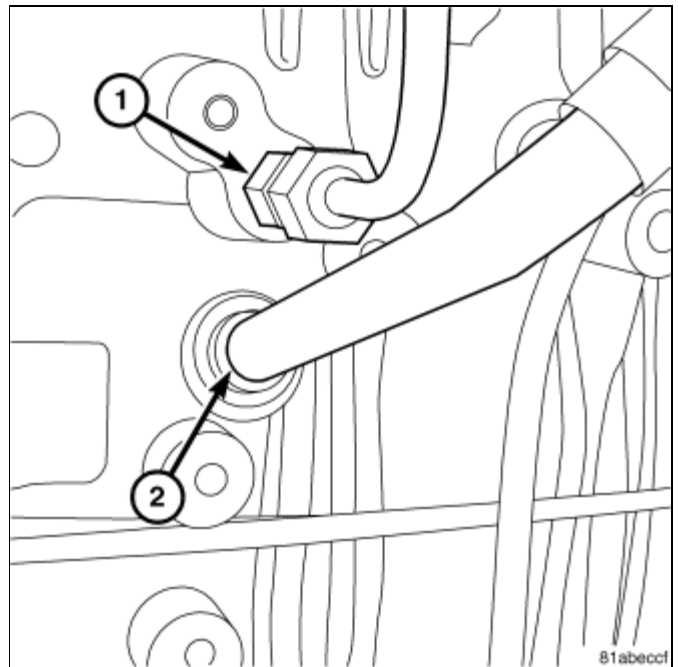
9. Disconnect the turbocharger module connector.
10. Remove the right front tire.
11. Remove the right front inner fender well.



12. Remove the bolts from the downstream flange of the turbocharger.
13. Remove the bolts from the turbocharger to engine bracket.
14. Remove the bolts from the upstream side of the muffler.
15. Remove the forward diesel particulate filter pressure tube.
16. Remove the bolts from the bottom of the maniverter.
17. Remove the diesel particulate filter.

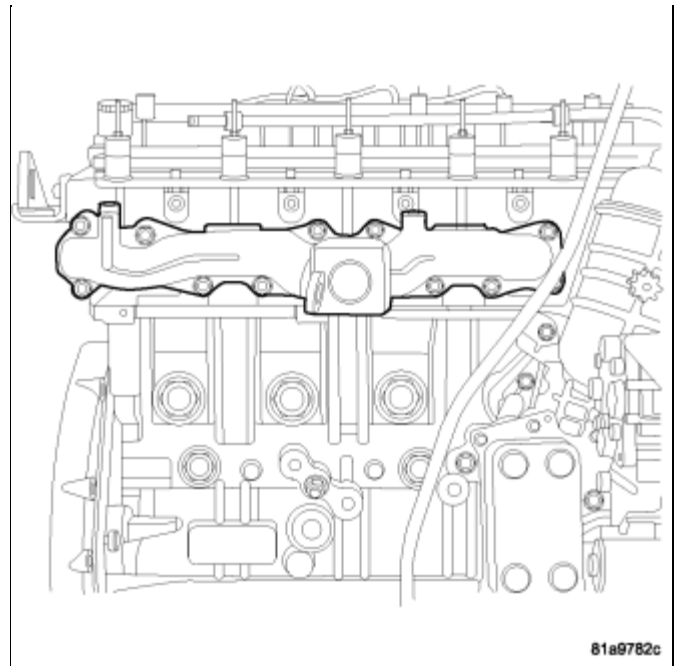


18. Remove the turbocharger to exhaust manifold bolts.
19. Remove the turbocharger oil lines.



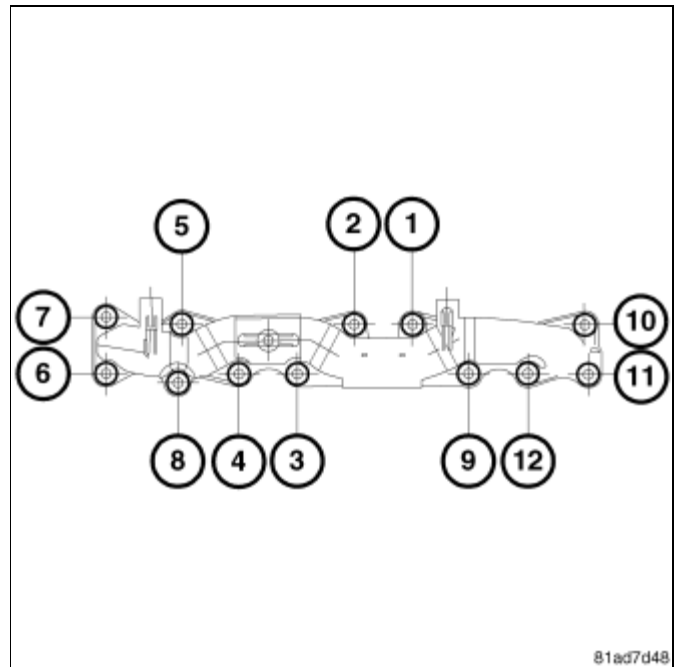
20. Remove the exhaust manifold.

INSTALLATION



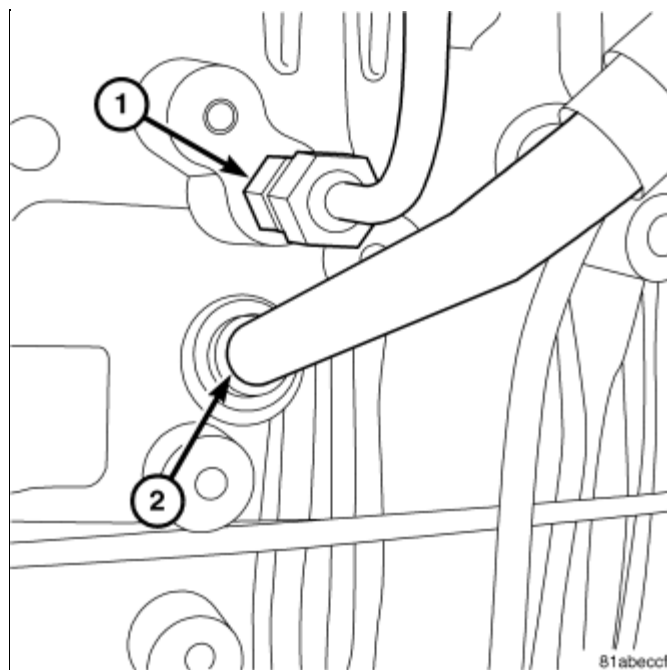
81a9782c

1. Clean the exhaust manifold surface and remove all debris.
2. Install a new exhaust manifold gasket.
3. Install the exhaust manifold.
4. Torque the following the correct exhaust manifold sequence torque the exhaust manifold nuts to 36 N.m (25.8 lbs. ft.).
5. Repeat the tightening procedure at the same torque.

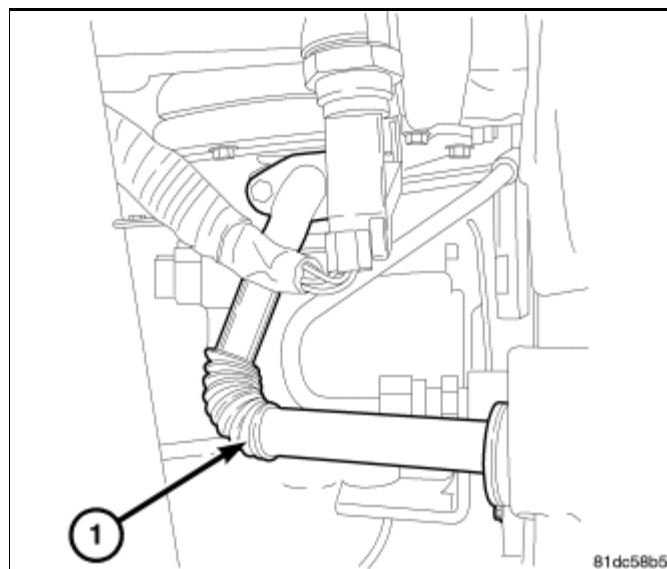


81ad7d48

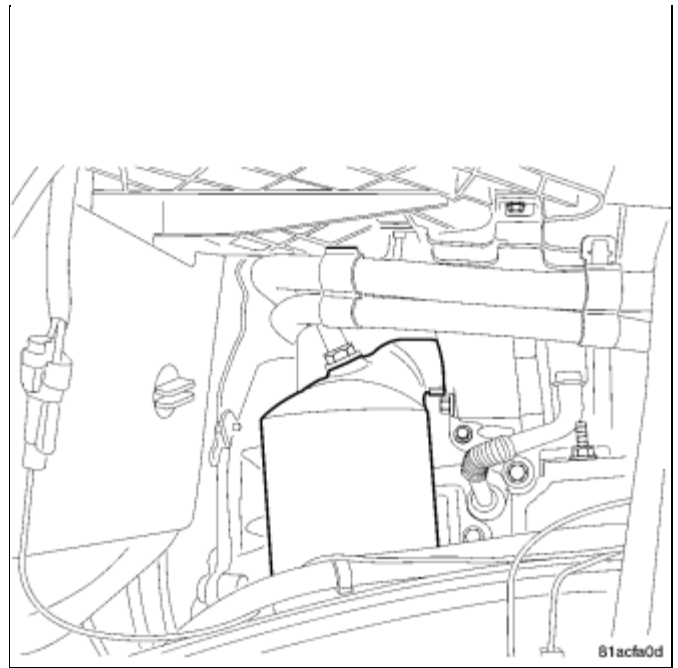
6. Install the turbocharger oil lines.



7. Install the turbocharger (1) to exhaust manifold bolts.

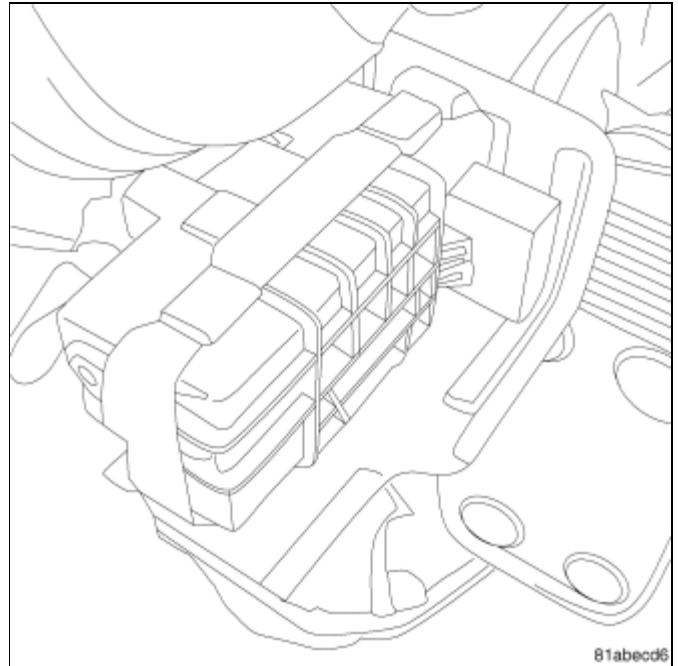


- 8. Install the diesel particulate filter.
- 9. Install the bolts from the bottom of the maniverter.
- 10. Install the forward diesel particulate filter pressure tube.
- 11. Install the bolts from the upstream side of the muffler.
- 12. Install the bolts from the turbocharger to engine bracket.

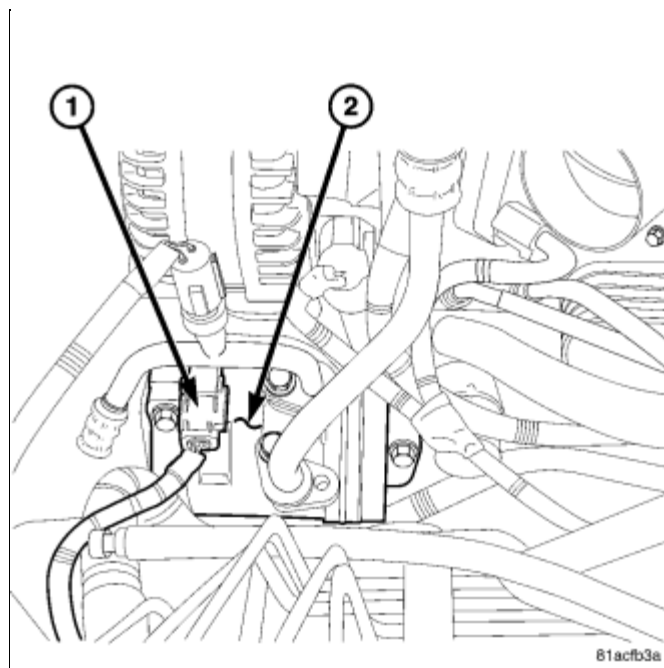


13. Install the bolts from the downstream flange of the turbocharger.

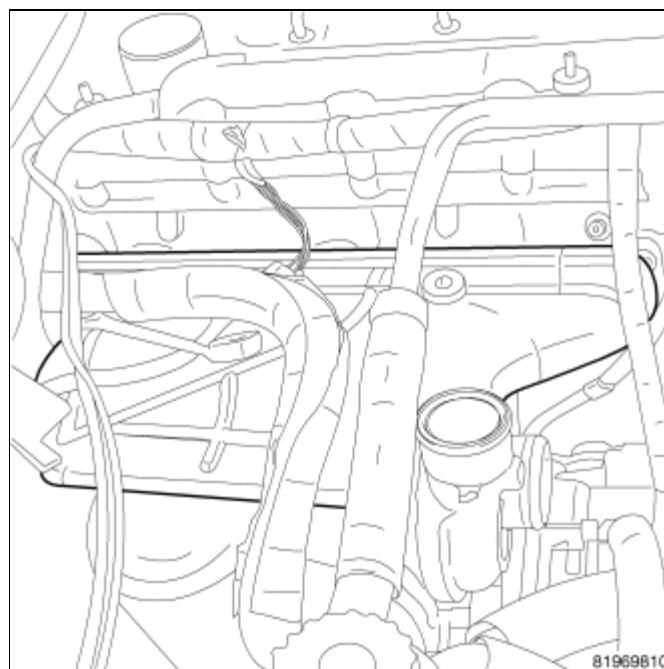
14. Connect the turbocharger module connector.



15. Install the air conditioning bracket bolt.



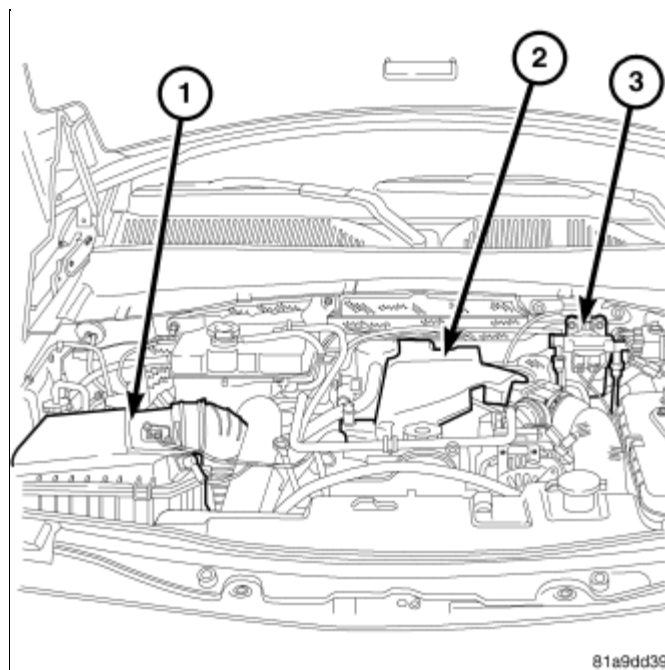
16. Install the exhaust manifold heat shield.
17. Install the bolts from the exhaust manifold heat shield.



18. Install the inlet air tube from the turbocharger.
19. Install the air cleaner housing.
20. Install the silencer.
21. Install the engine cover.

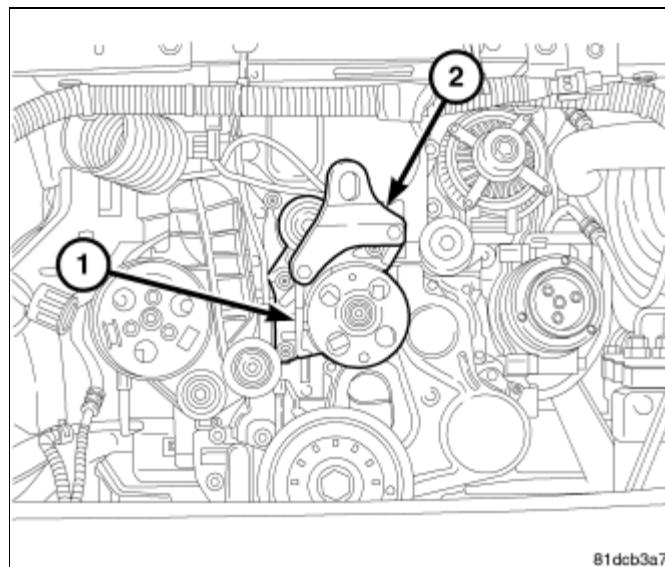
VALVE TIMING

STANDARD PROCEDURE - LOCKING ENGINE 90 DEGREES AFTER TDC

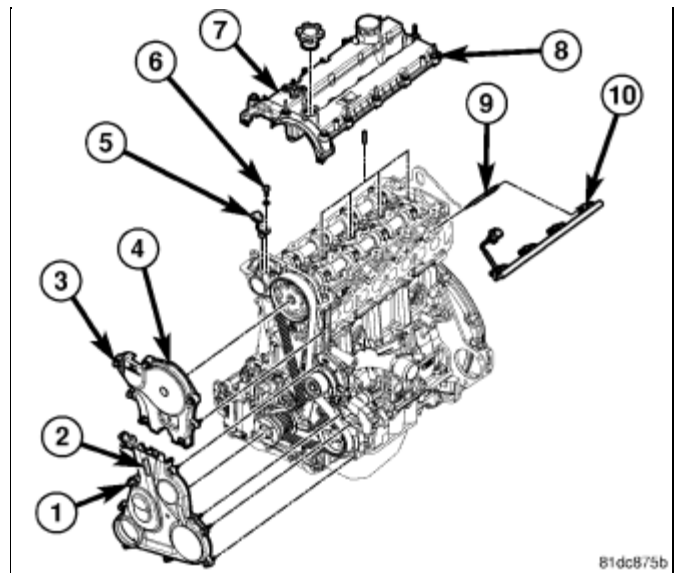


1. Disconnect negative battery cable.
2. Remove the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

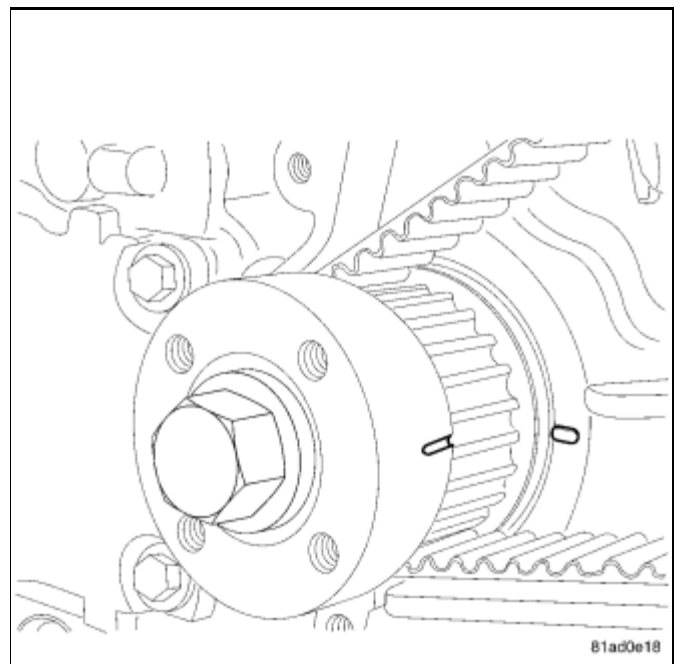
3. Remove the front lifting bracket (2).
4. Remove the Idler pulley bracket.



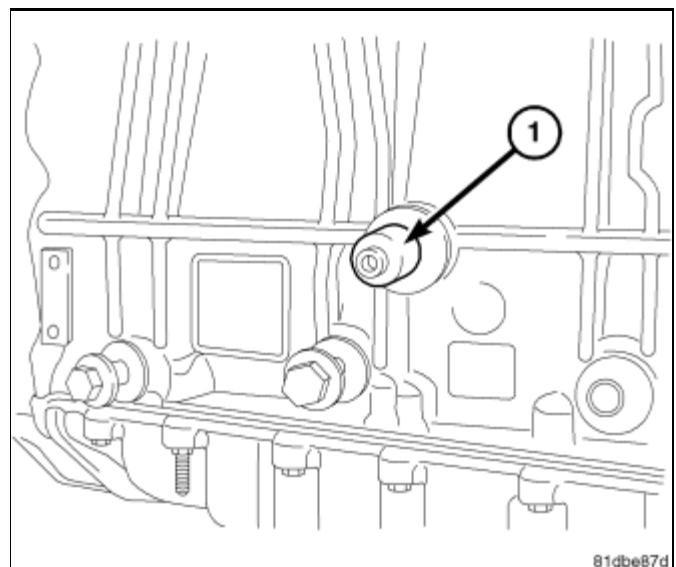
5. Disconnect the camshaft position sensor harness connector, and remove the camshaft position sensor (5).
6. Remove the upper (4) and lower (2) front covers.



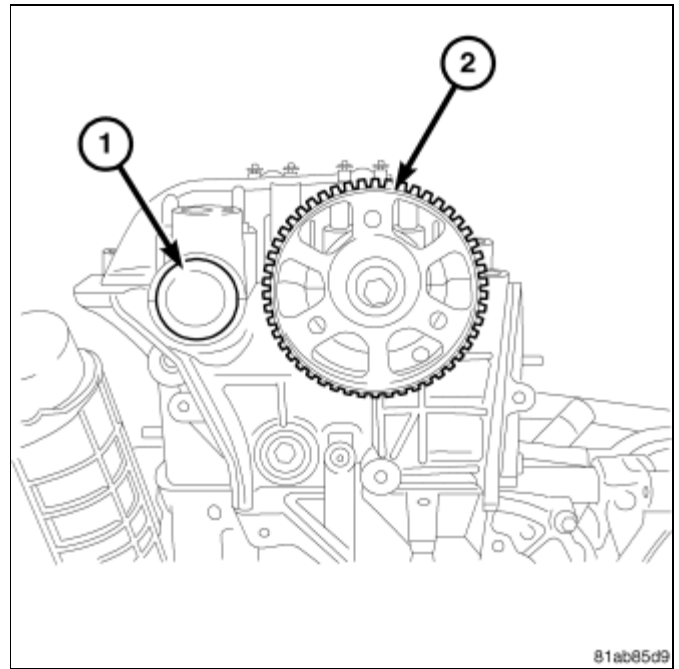
7. Rotate the engine until the 90° ATDC marks on the crankshaft timing belt drive sprocket and timing belt cover are aligned.



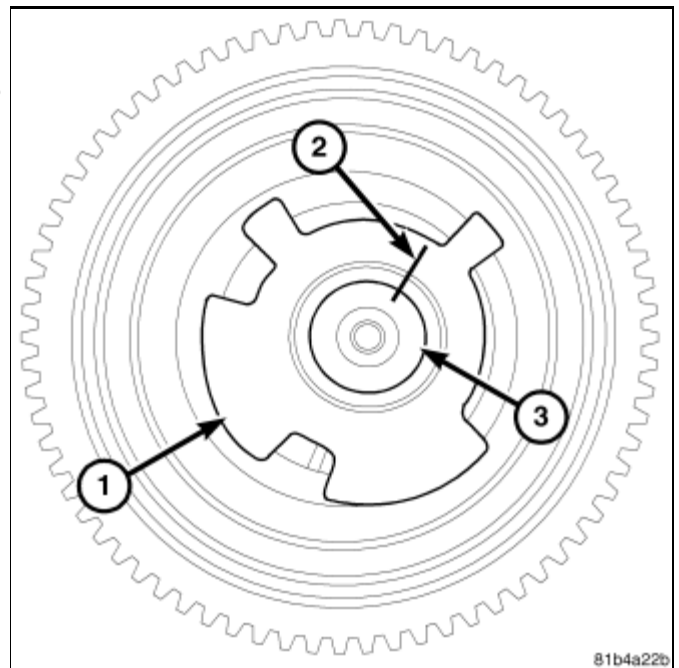
8. Install the VM 9892 Crankshaft locking tool into the left side of the engine block, slightly rearward of the left engine mount. Make sure that the outer portion of the tool threads into the block and the bolt threads into the crankshaft. If the bolt does not thread into the crankshaft, the crankshaft is not at 90° ATDC. If necessary, realign the 90° ATDC marks on the crankshaft timing belt drive sprocket and timing belt cover.



9. Remove the camshaft cap (1) to expose the camshaft reluctor.



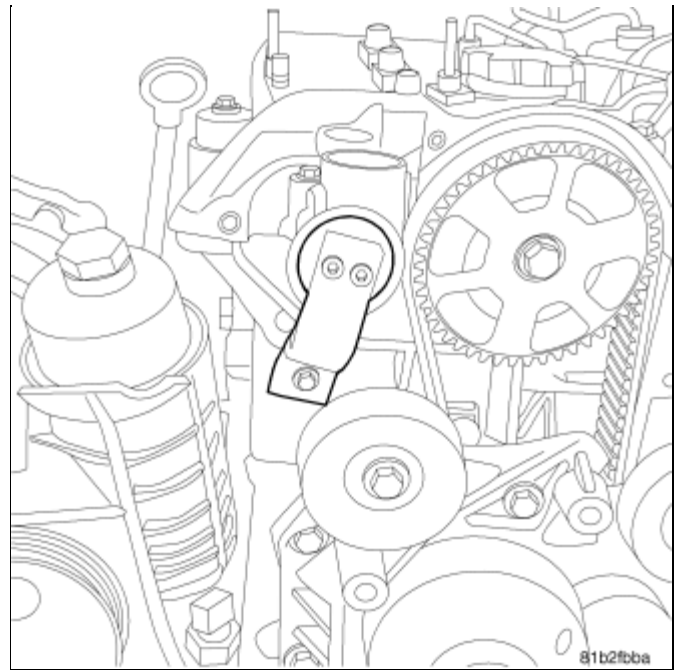
10. Make a mark (2) across the CMP reluctor wheel (1) and the exhaust camshaft (3). This mark is to verify that the CMP reluctor wheel did not rotate on the camshaft during assembly.



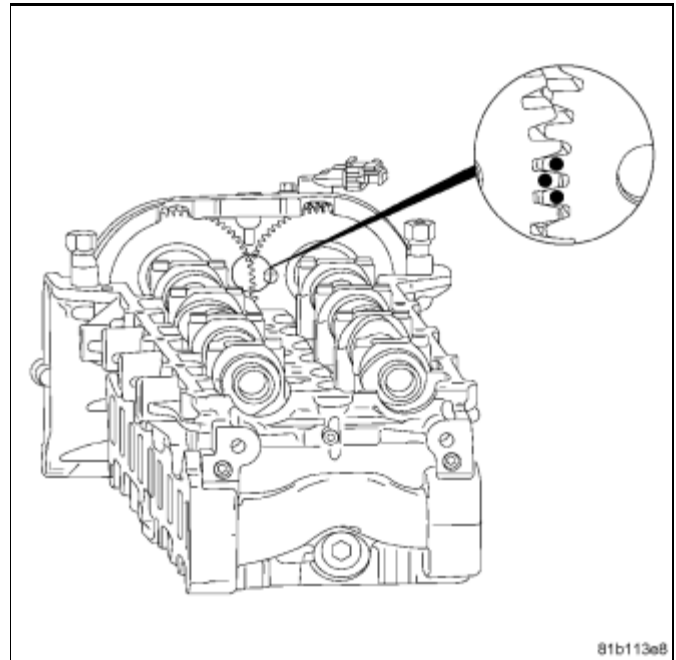
11. Install the camshaft locking tool onto the camshaft position sensor tone wheel.

NOTE: 90° after TDC pin must be installed.

12. The camshafts and crankshaft are now locked in the 90° ATDC position.



NOTE: If it is suspected that the camshafts are not correctly timed to each other, the valve cover must be removed to allow the verification of camshaft timing. When the dots on the back of the camshafts are lined up, the camshafts are correctly timed to each other. The engine is NOT timed to 90° ATDC with the camshaft dots lined up. Use the camshaft timing tool to set the camshafts to 90° ATDC.



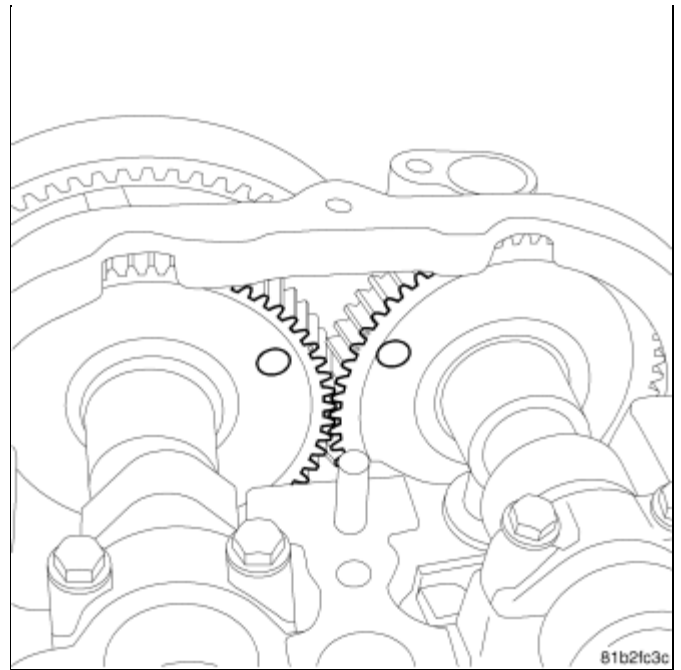
NOTE: When the camshafts are correctly timed to each other and turned to 90° ATDC, the camshaft marks are positioned as shown in the illustration to the right.

COVER(S)-TIMING BELT AND CHAIN

REMOVAL

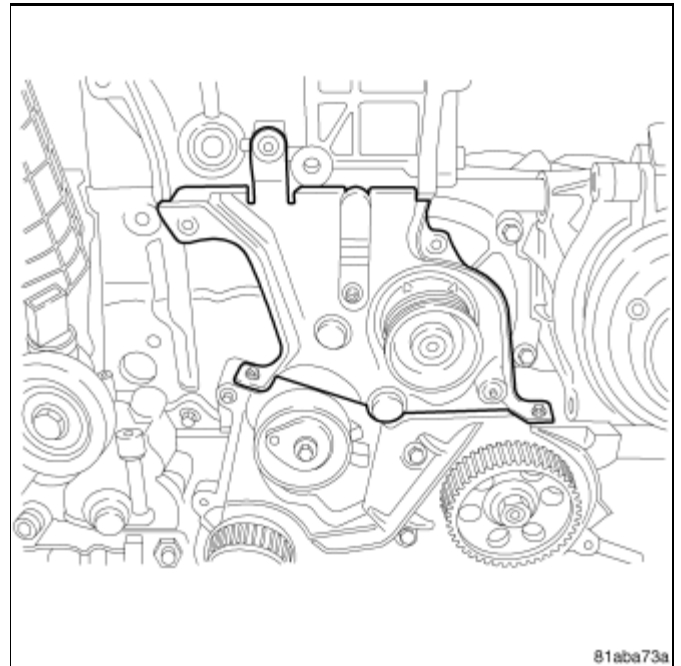
REMOVAL - TIMING BELT INNER

COVER

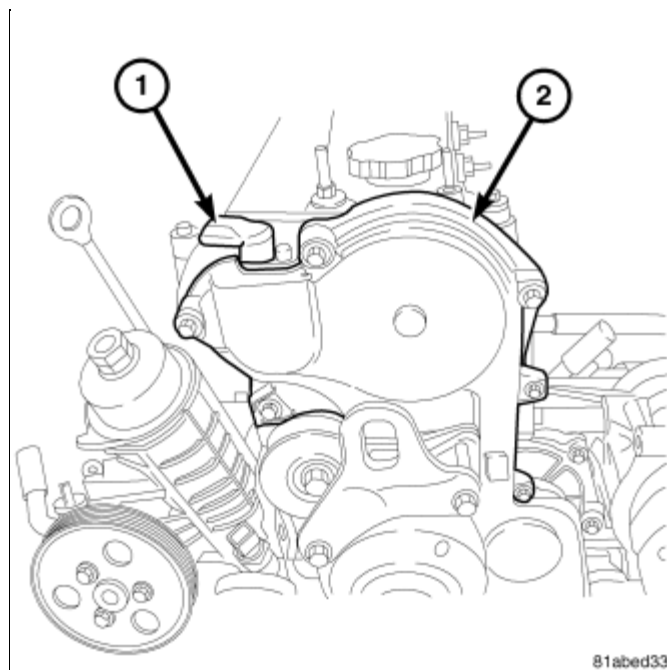


1. Disconnect the battery.
2. Remove the accessory drive belt.
3. Remove the upper and lower outer front covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)
4. Remove the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/BELT-TIMING - REMOVAL).

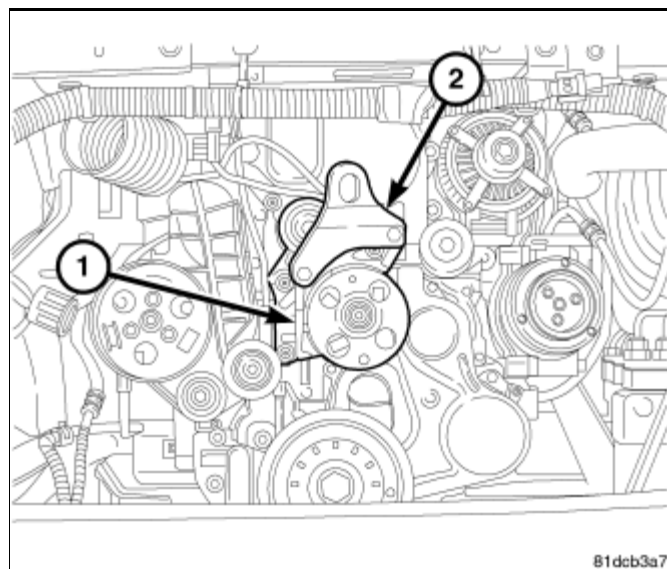
REMOVAL - UPPER AND LOWER TIMING BELT OUTER COVERS



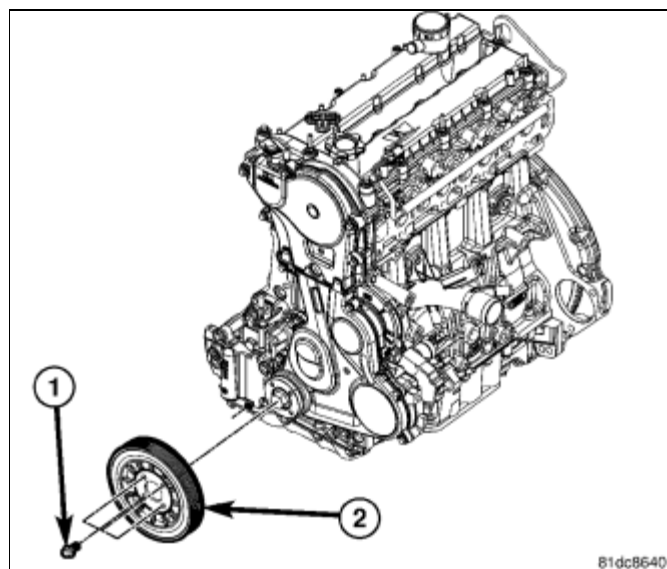
1. Disconnect negative battery cable.
2. Disconnect the CMP sensor (1).
3. Remove the upper front cover (2).



4. Remove the accessory drive belt.
5. Remove the front engine lift bracket (2).
6. Remove the accessory drive idler pulley bracket (1).



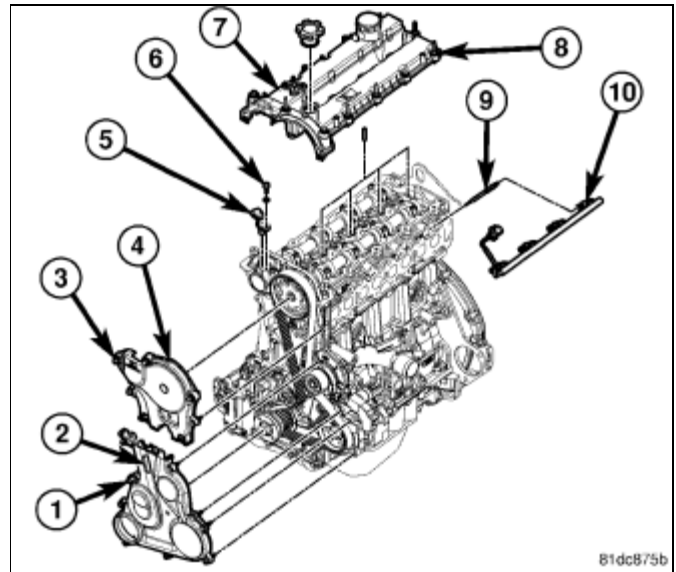
7. Remove the bolts (1) and the crankshaft damper (2).



8. Remove the lower front cover (2).

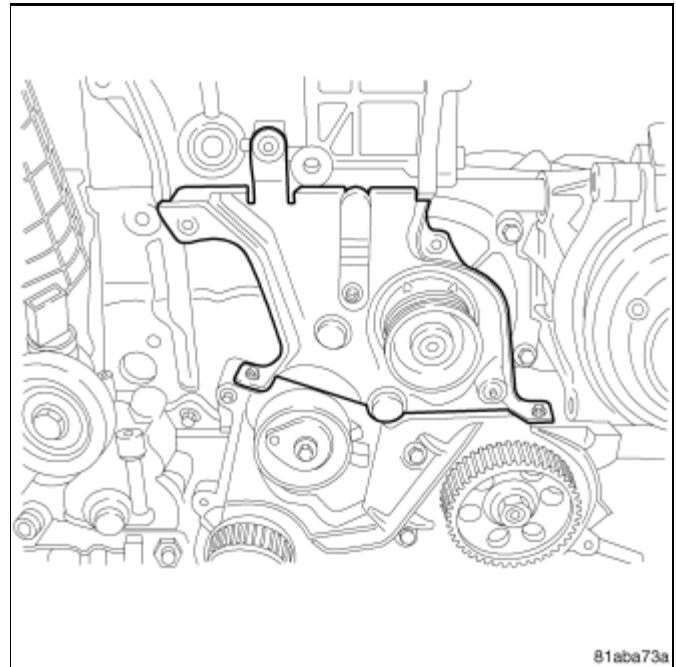
INSTALLATION

INSTALLATION - TIMING BELT INNER COVER

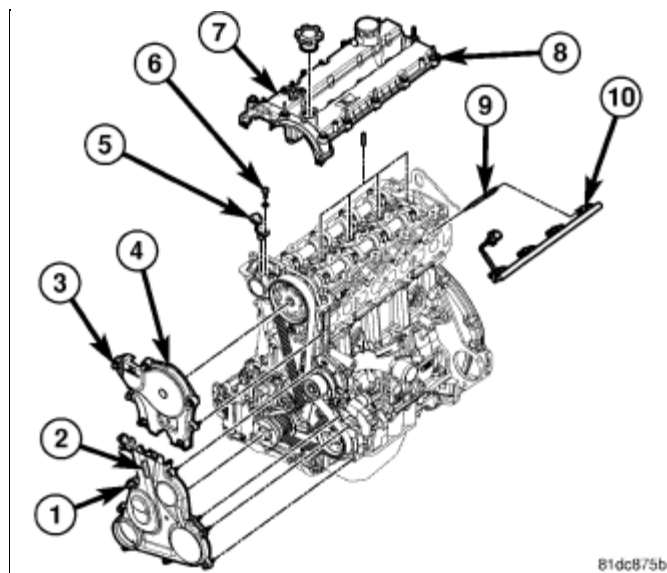


1. Install the inner front cover. Torque the bolts to 11 Nm (97 lbs. in.).
2. Install the timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/BELT-TIMING - INSTALLATION).
3. Install the upper and lower outer front covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)
4. Connect negative battery cable.

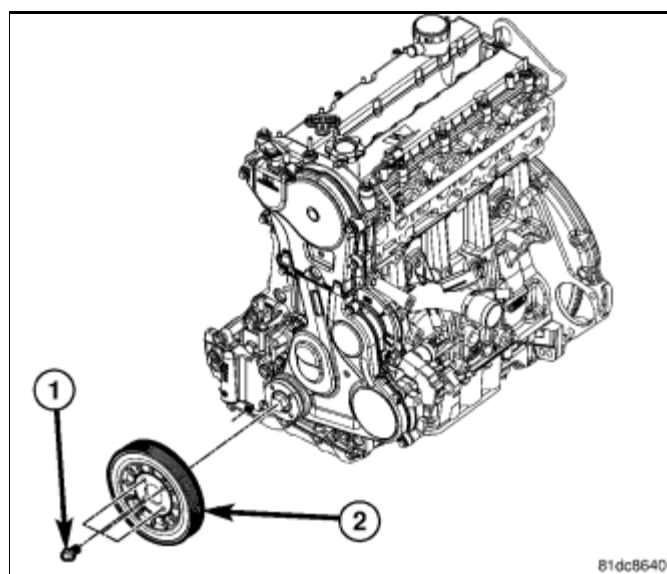
INSTALLATION - UPPER AND LOWER OUTER TIMING BELT COVERS



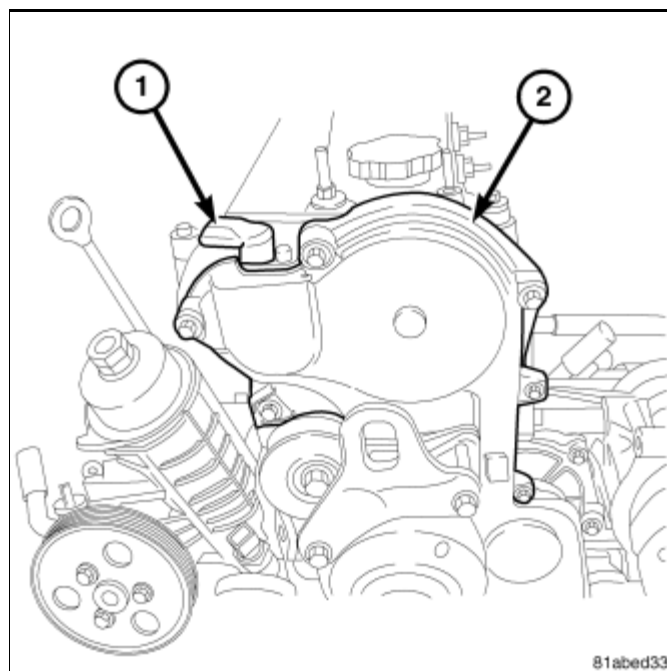
1. Install the lower front cover (2). Torque the bolts to 11 Nm (97 lbs. in.).



2. Install the crankshaft damper (1). Torque the bolts to 32 Nm (23 lbs. in.).



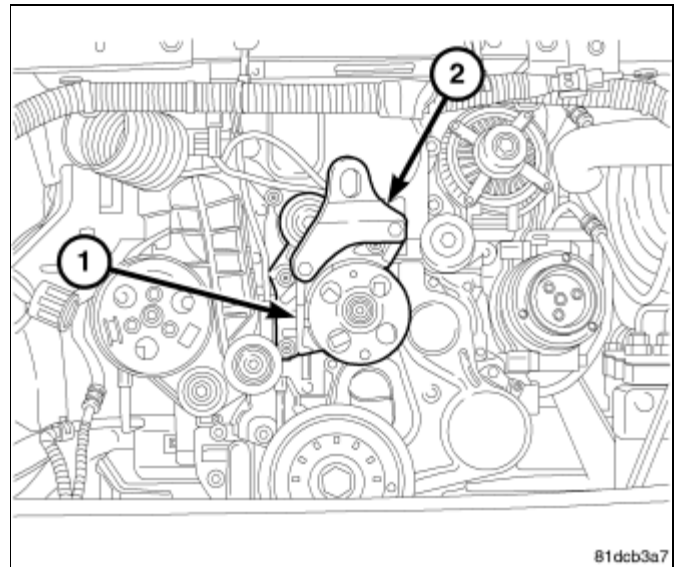
3. Install the upper front cover (2). Torque the bolts to 11 Nm (97 lbs. in.).
4. Install the CMP sensor. Torque the bolt to bolt to 11 Nm (97 lbs. in.).
5. Connect the CMP sensor (1).



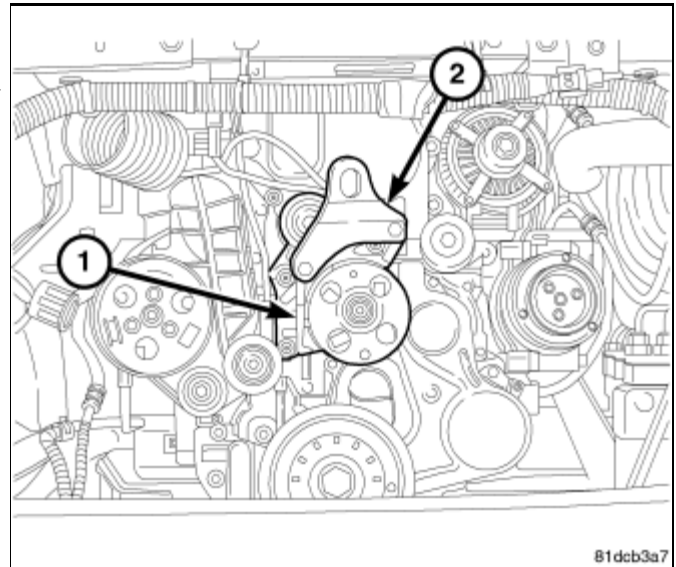
6. Install the accessory drive idler pulley bracket. Torque the bolts to 45 Nm (33 Lbs. ft.)
7. Install the front engine lift bracket (2). Torque the bolts to 45 Nm (33 Lbs. ft.)
8. Install the accessory drive belt.
9. Connect negative battery cable.

SPROCKET(S)-TIMING BELT AND CHAIN

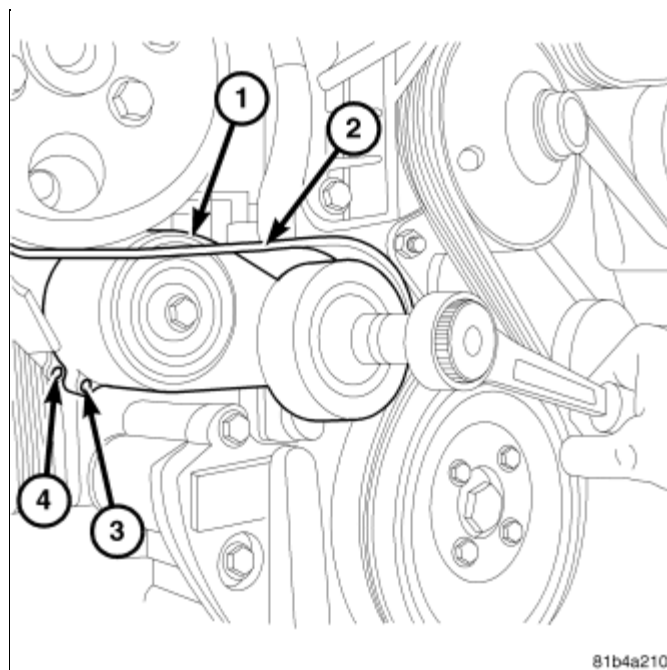
REMOVAL



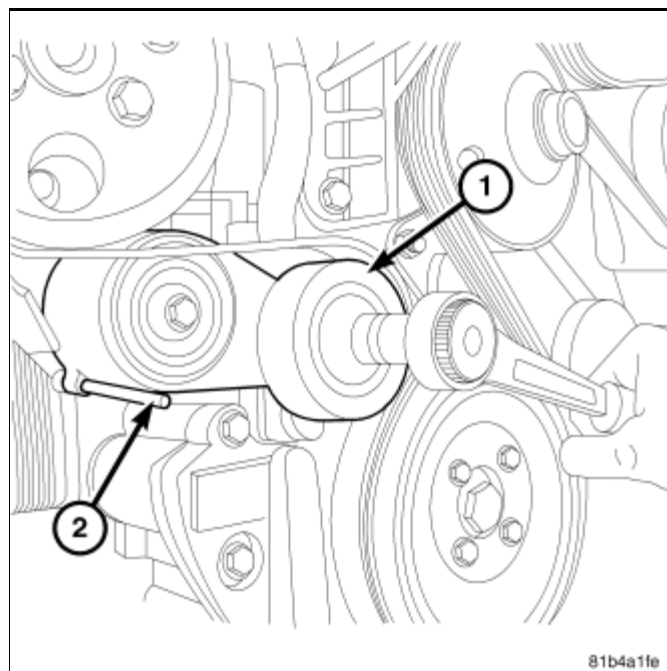
1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Remove the front engine lifting bracket (2) and pulley assembly (1).



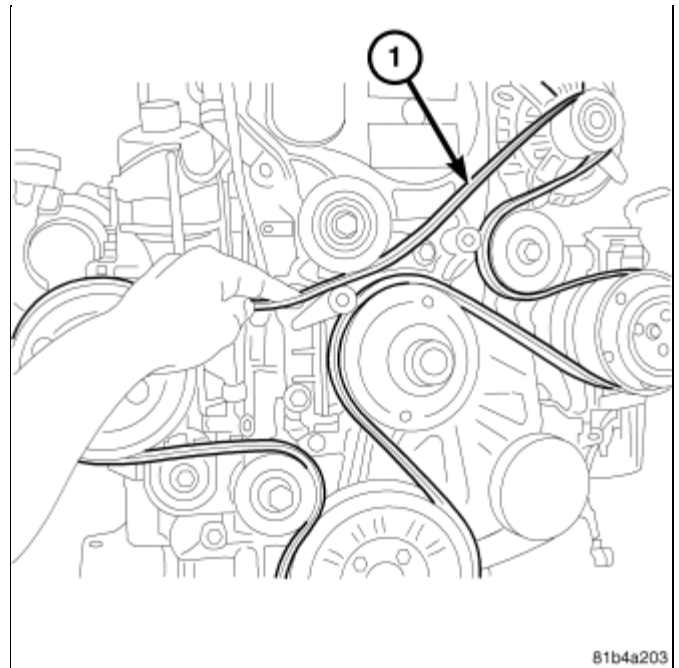
4. Loosen the accessory drive belt tension by rotating the accessory drive belt tensioner until holes 3 and 4 are lined up.



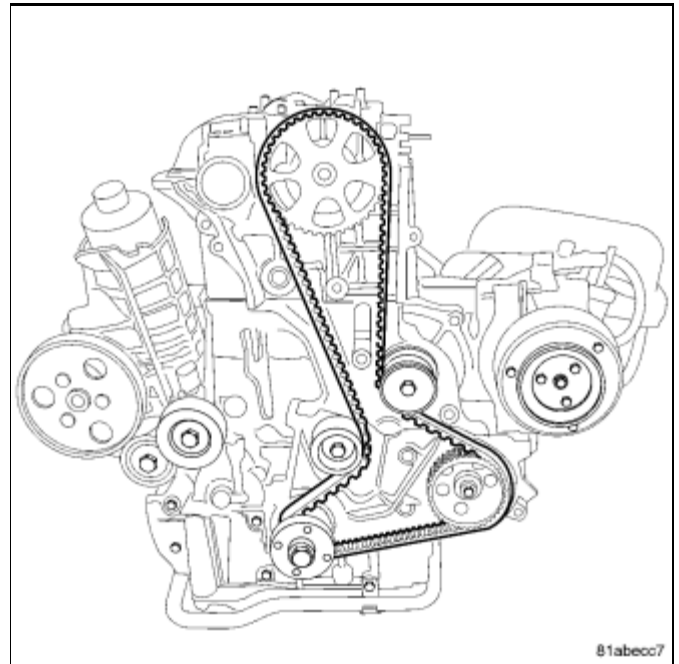
5. When the holes in the accessory drive belt tensioner are aligned, use a drift to lock the tensioner in place.



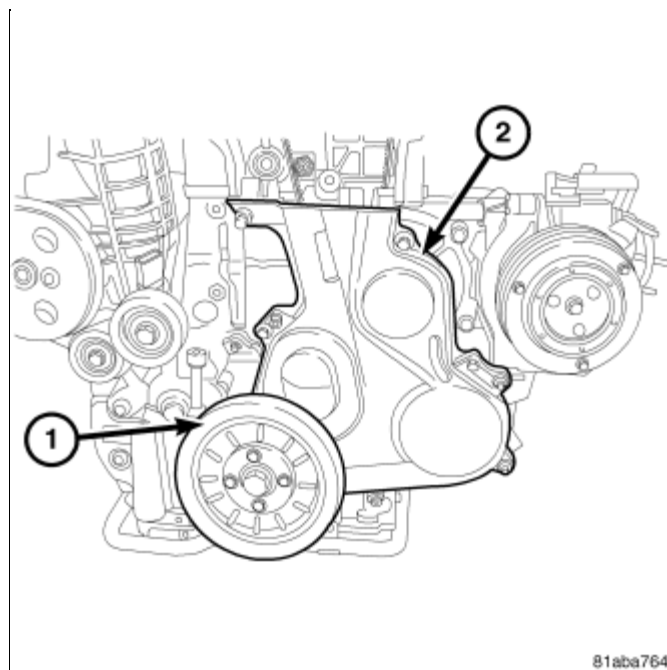
6. Remove the accessory drive belt.



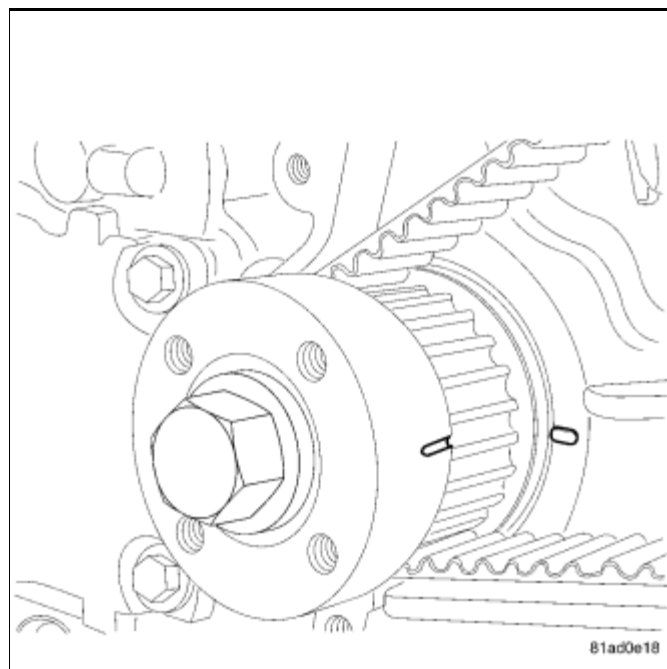
CAUTION: BEFORE REMOVING THE TIMING BELT, THE ENGINE MUST BE PLACED AT 90° AFTER TDC. FAILURE TO DO SO MAY RESULT IN VALVE AND/OR PISTON DAMAGE DURING ASSEMBLY.



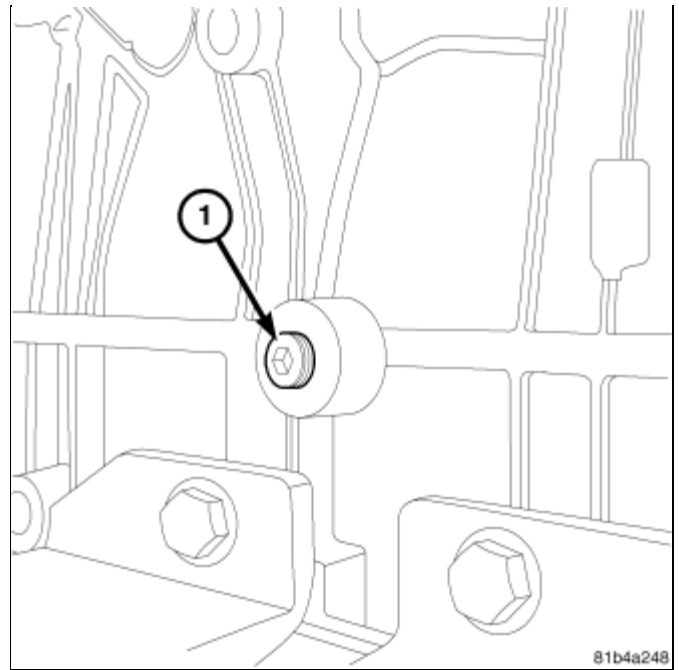
7. Remove the 4 bolts from the vibration damper (1).
8. Remove the vibration damper (1).
9. Unscrew the lower front cover bolts. The lower front cover bolts remain in the lower front cover.
10. Remove the lower front cover (2).



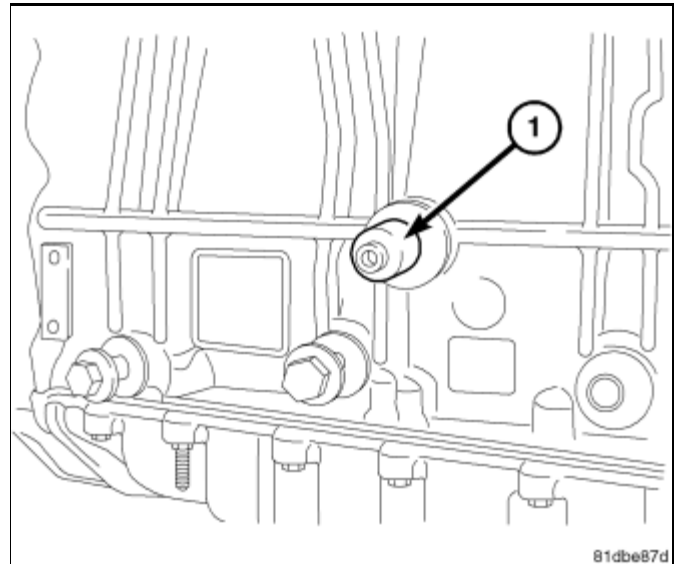
11. Bring piston #1 to 90° ATDC by turning crankshaft clockwise until the mark on the crankshaft lines up with the mark on the front cover.



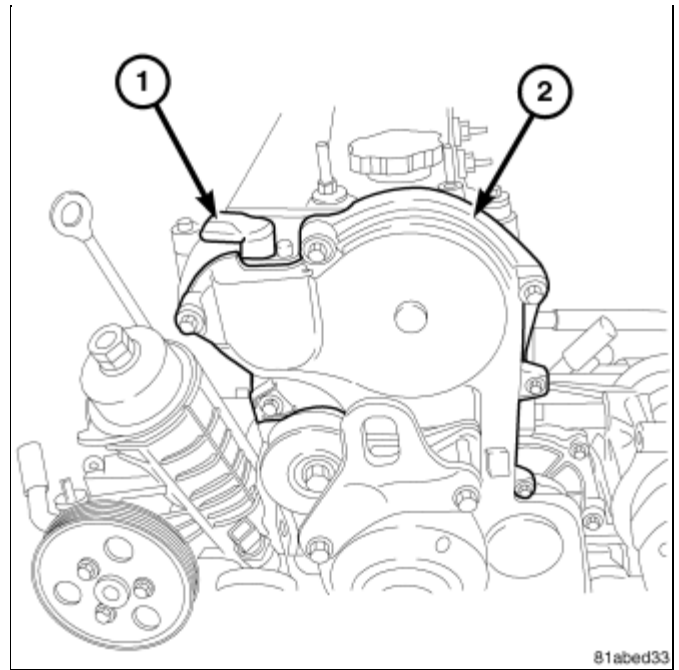
12. Remove the plug for the crankshaft locking tool. The crankshaft locking tool is installed in the left side of the engine slightly rearward of the engine mount.



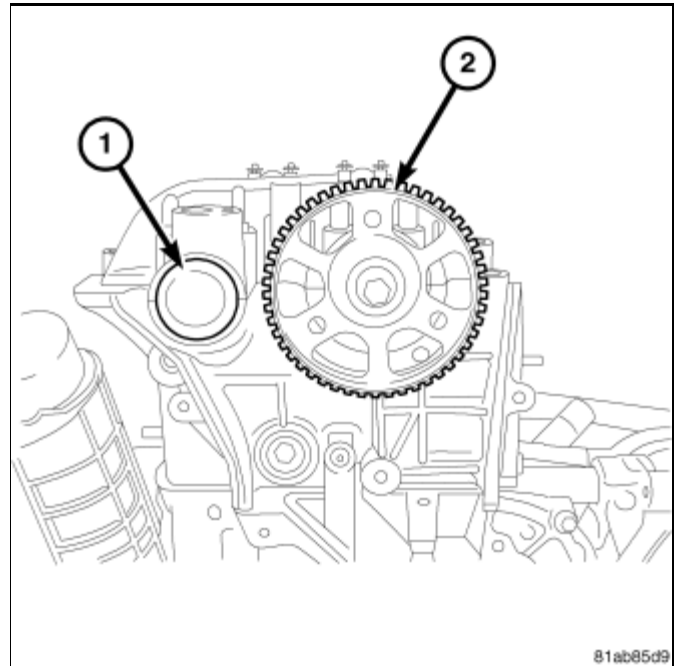
13. Install the crankshaft locking tool (1) into the engine block. Make sure that the crankshaft locking tool body is threaded into the engine block and the bolt is threaded into the crankshaft.



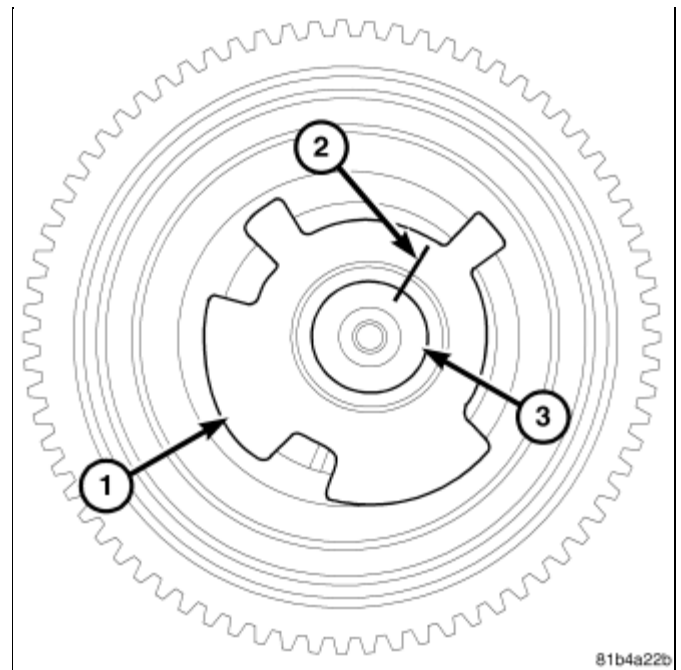
- 14. Disconnect the CMP sensor (1).
- 15. Remove the CMP sensor bolt.
- 16. Remove the CMP (1) sensor.
- 17. Remove the upper front cover (2).



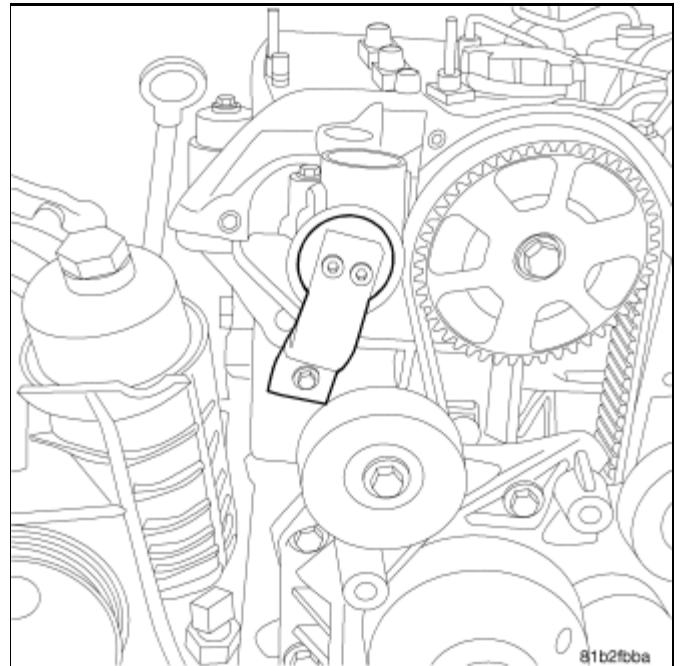
18. Remove the exhaust camshaft seal (1) from the cylinder head.



19. Use a paint pen to mark the location of the reluctor wheel (1) on the camshaft (2).

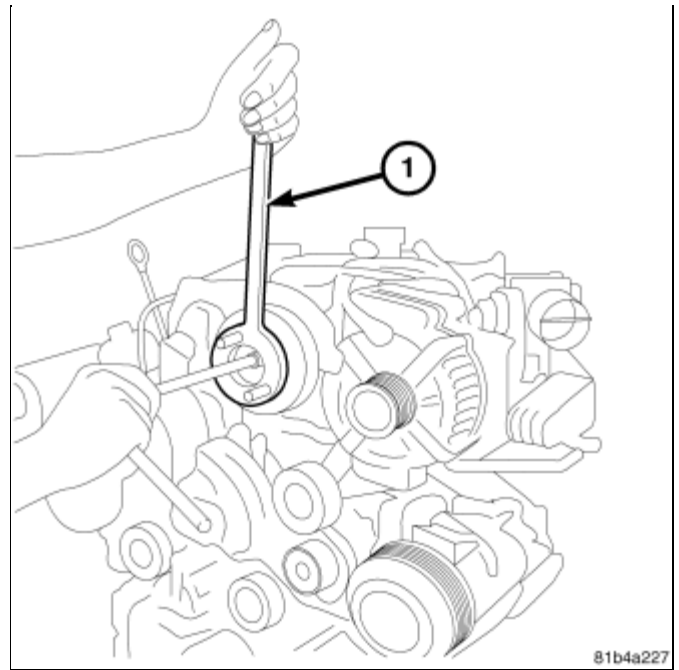


20. Install the camshaft locking tool on the exhaust camshaft.



21. Use VM 1055 to hold the intake camshaft sprocket.

22. Remove the bolt from the intake camshaft sprocket.



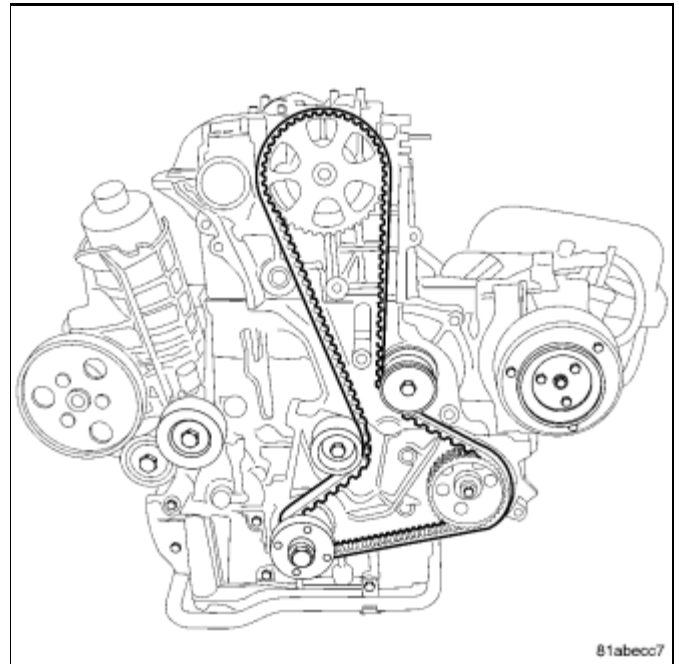
81b4a227

- 23. Loosen timing belt tensioner and remove timing belt.
- 24. Remove the camshaft sprocket bolt.
- 25. Remove the camshaft sprocket.

NOTE: The crankshaft sprocket is a left handed thread.

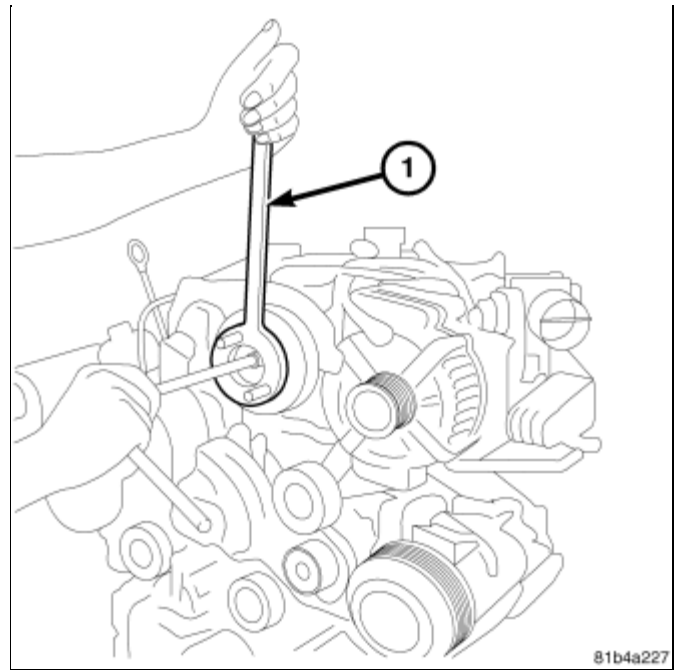
- 26. Remove the crankshaft sprocket bolt.
- 27. Remove the crankshaft sprocket.

INSTALLATION



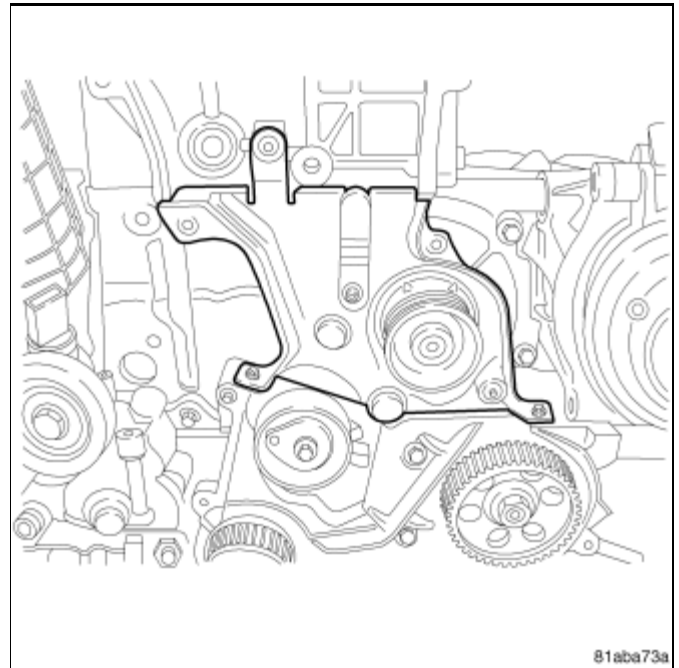
81abec7

- 1. Install VM 1055 on the intake camshaft sprocket.
- 2. Using VM 1055 to secure the camshaft sprocket, torque the camshaft sprocket (2) bolt to 64 N·m (47 ft.lbs.).



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3. Install the inner front cover. Torque the bolts to 11 Nm (97 lbs. in.).

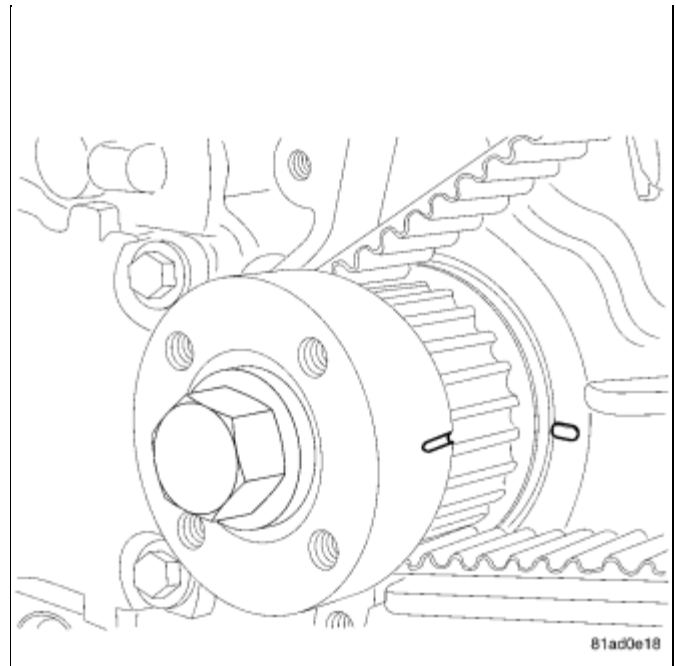


81aba73a

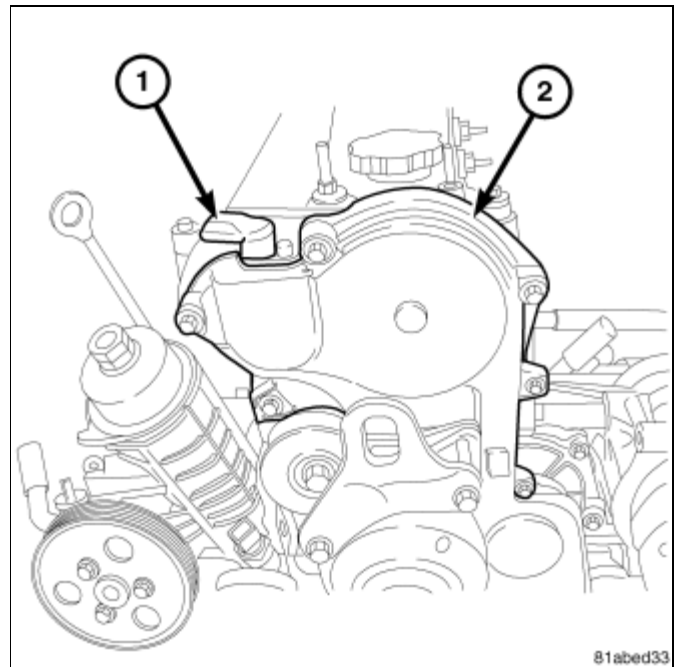
NOTE: The crankshaft sprocket bolt is a left handed thread.

4. Install the crankshaft sprocket.
5. Install the crankshaft sprocket bolt. Torque the crankshaft sprocket bolt to 100 Nm (74 lbs. ft.) + 120 degrees.
6. Install the timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/BELT-TIMING - INSTALLATION).
7. Install the lower front cover. Torque the bolts to 11 N·m (97 in. lbs.)
8. Install the crankshaft damper. Torque the bolts to 32 Nm

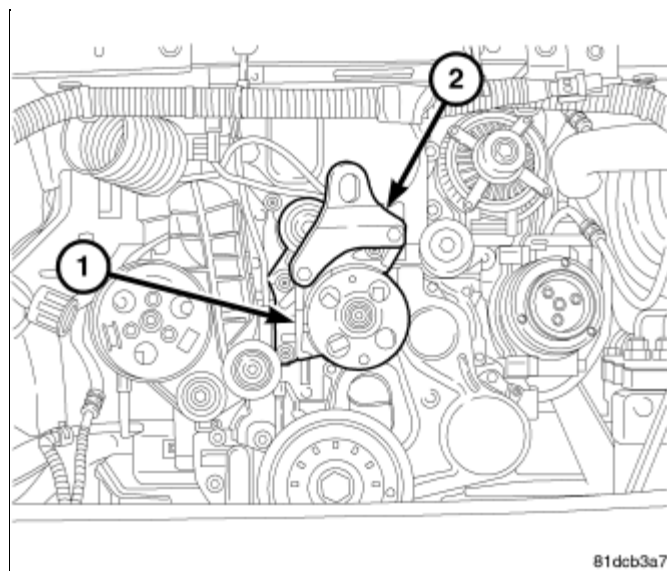
(23 lbs. ft.).



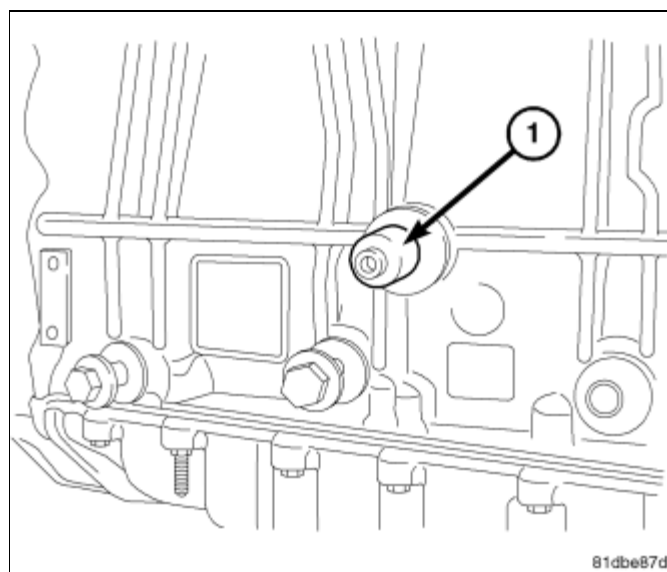
9. Install the upper front cover (2). Torque the bolts to 11 N·m (97 in. lbs.)
10. Install the camshaft position sensor. Torque the bolt to 11 Nm (97 lbs. in.).
11. Connect the CMP sensor.



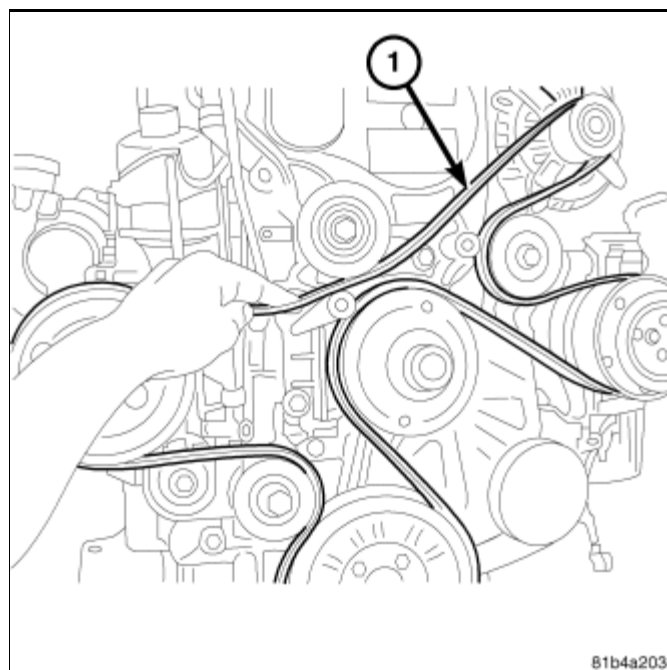
12. Install the accessory drive idler pulley bracket (1). Torque the bolts to 45 Nm (33 Lbs. ft.)
13. Install the front engine lift bracket (2). Torque the bolts to 45 Nm (33 Lbs. ft.)



14. Remove crankshaft locking tool (1).



15. Install the accessory drive belt.

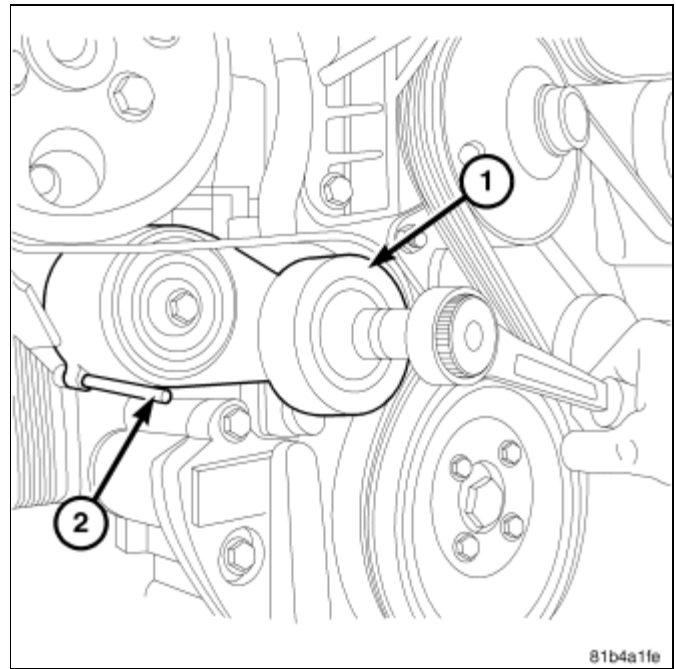


16. Remove the drift (2) from the accessory drive tensioner (1).
17. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION) .
18. Connect negative battery cable.

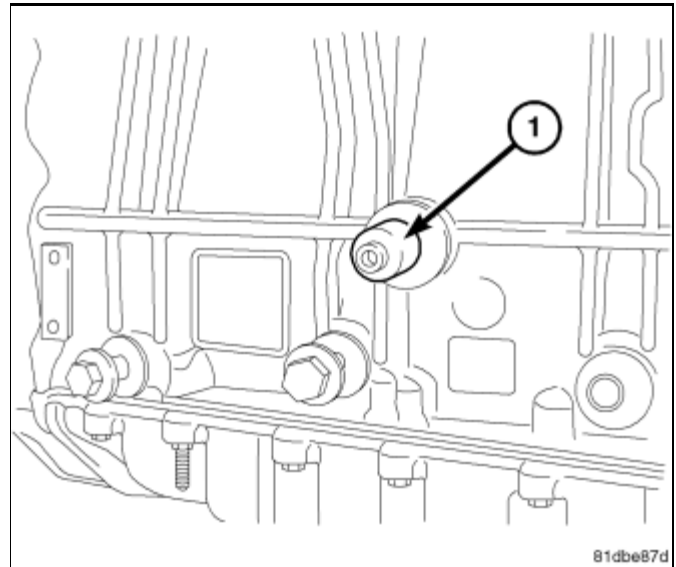
TENSIONER AND PULLEY- TIMING BELT AND CHAIN

REMOVAL

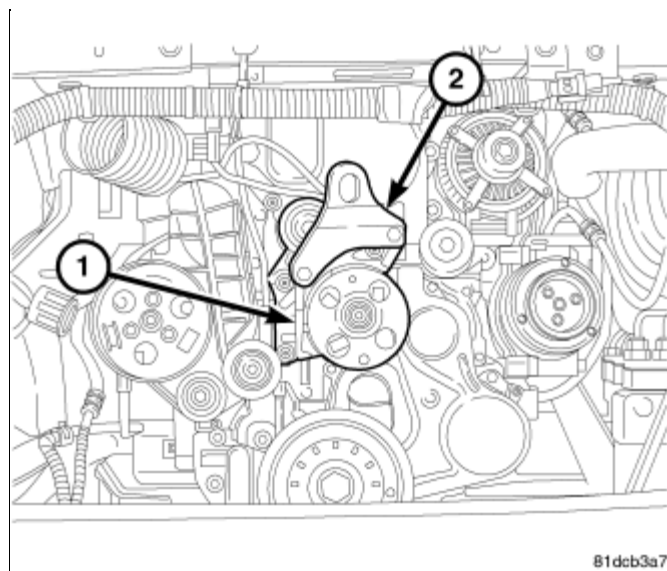
1. Disconnect negative battery cable.
2. Remove the radiator cooling fan. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)
3. Remove the accessory drive belt.



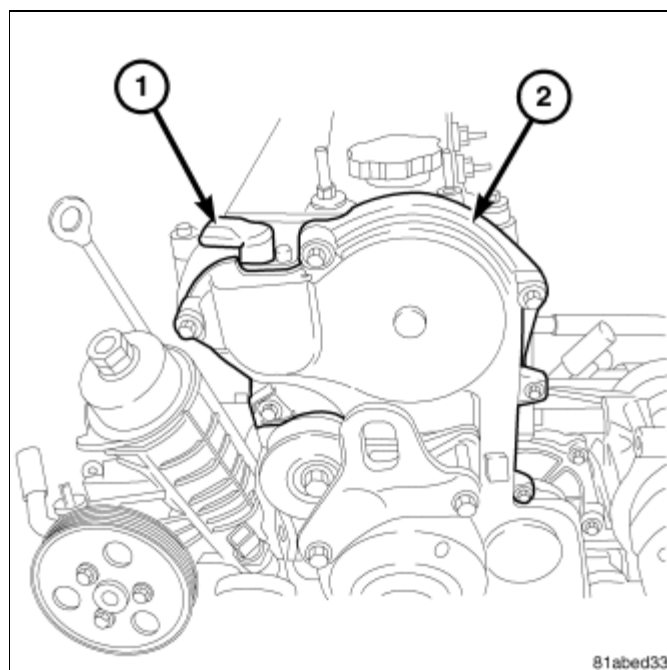
4. Rotate the engine until the VM 9992 Crankshaft locking tool (1) can be installed. Install the VM 9992 Crankshaft locking tool (1) into the left side of the engine block, slightly rearward of the left engine mount. Make sure that the outer portion of the tool threads into the block and the bolt threads into the crankshaft. If the Crankshaft locking tool (1) does not thread into the crankshaft, the crankshaft is not at 90° ATDC.



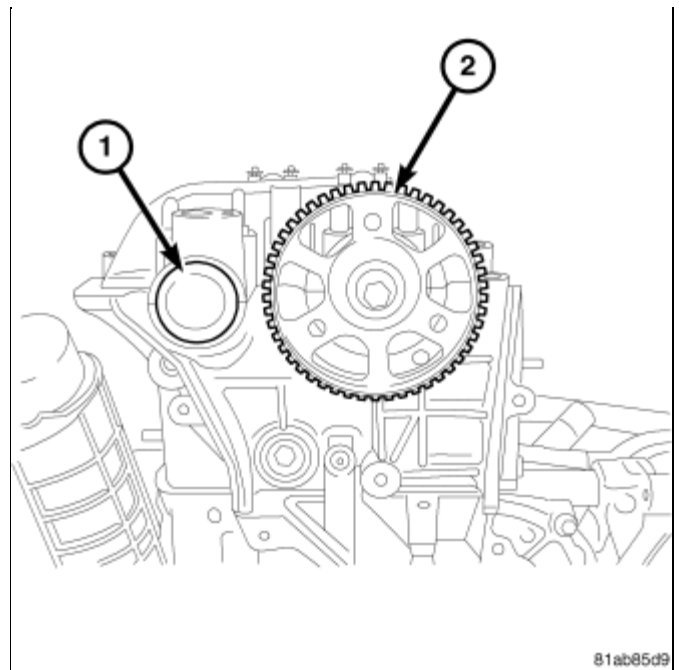
5. Remove the front lifting bracket (2).
6. Remove the Idler pulley bracket (1).



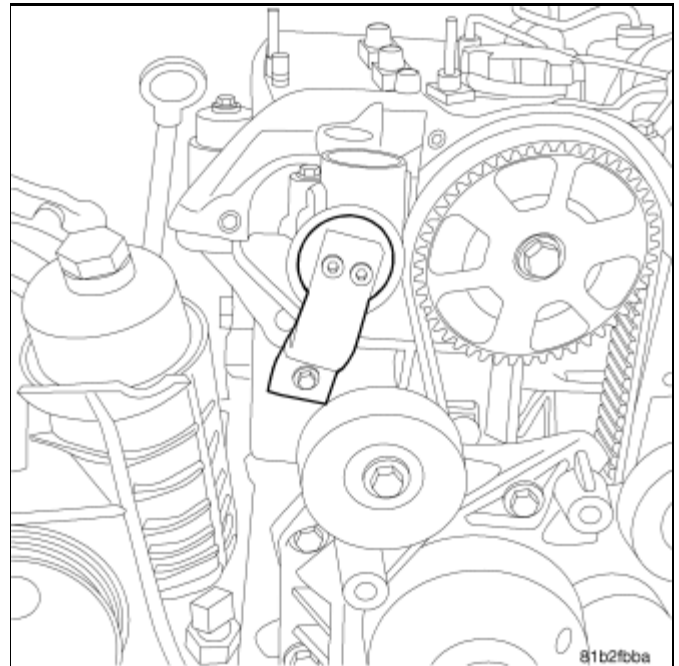
7. Remove the CMP sensor (1).
8. Remove the upper front cover (2).



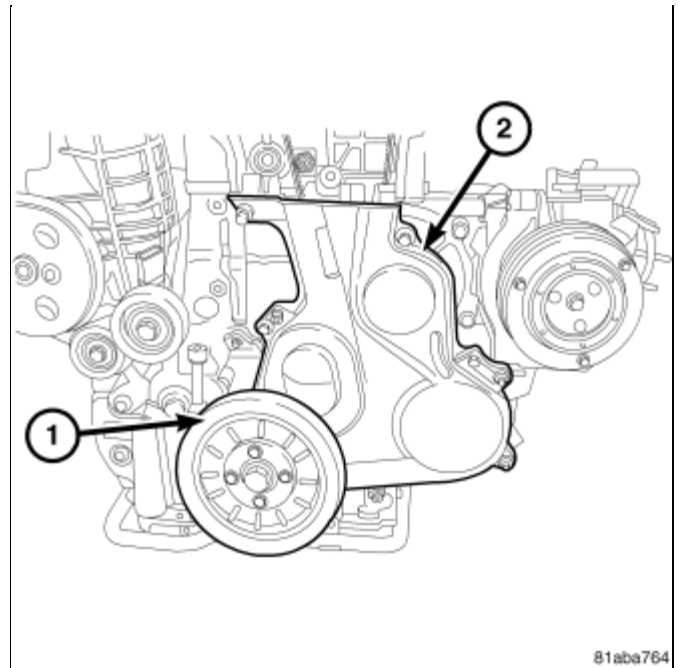
9. Remove the camshaft cap (1) to expose the camshaft reluctor.



10. Install the camshaft locking tool onto the camshaft position sensor reluctor.
11. The crankshaft and camshafts are now locked at 90° ATDC.

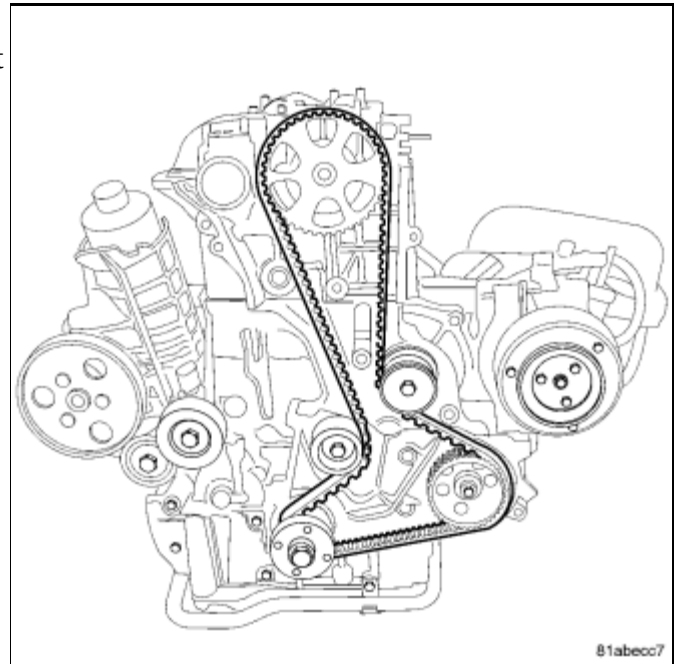


12. Remove the crankshaft damper (1).
13. Remove the lower front cover (2).

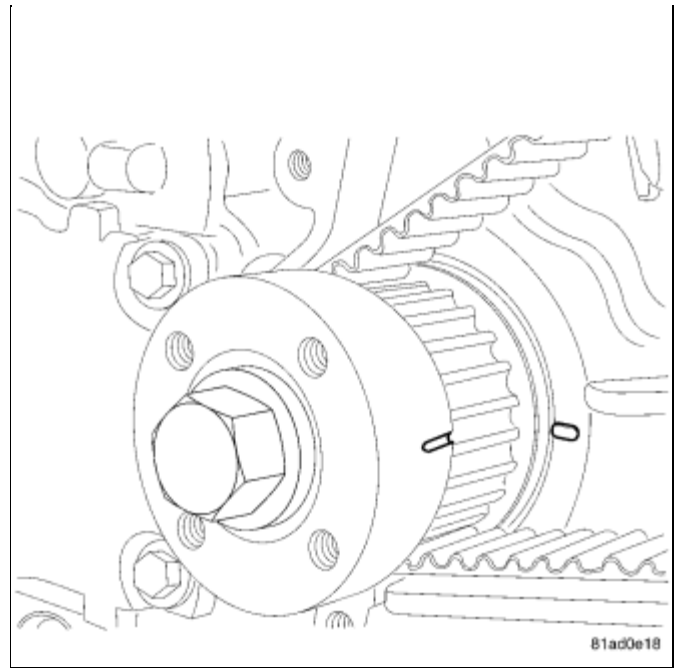


14. Remove the timing belt tensioner bolt, and the timing belt tensioner.

INSTALLATION



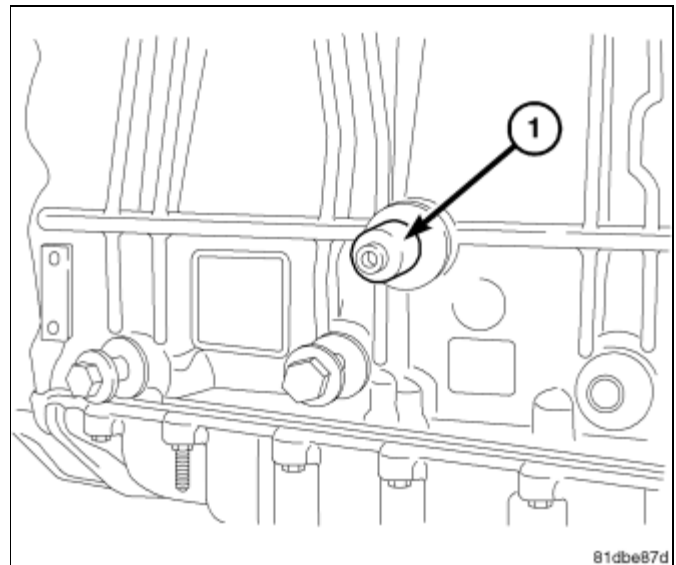
1. Return piston #1 to 90° ATDC, and align the crankshaft timing marks.



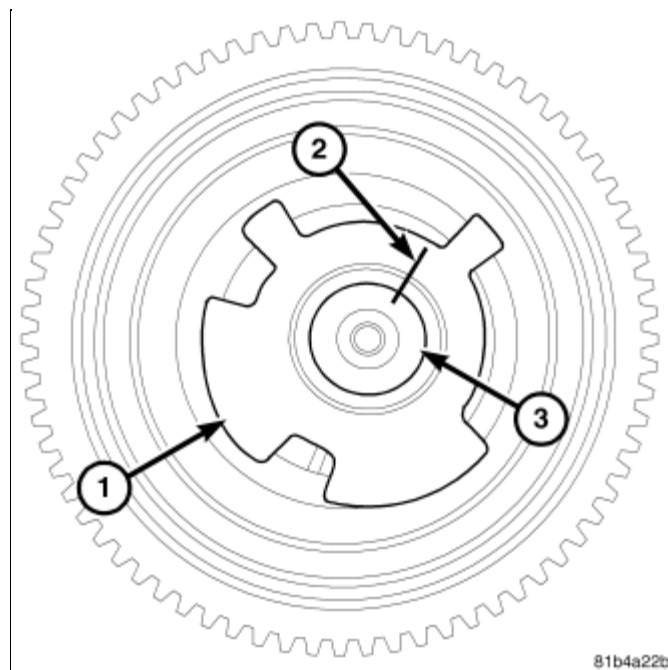
2. Reinstall the crankshaft locking tool (1).
3. Make sure that the timing dimples on the back of the camshaft gears are lined up horizontally.

NOTE: The engine is not in time with the camshaft dots facing each other. The camshafts are set so that the dots face each other and then rotated until the camshaft locking tool can be bolted to the cylinder head. The camshaft locking tool properly positions the camshafts at 90° ATDC. The dots on the camshafts are used during assembly to quickly orient the camshafts so that the camshaft locking tool can be installed.

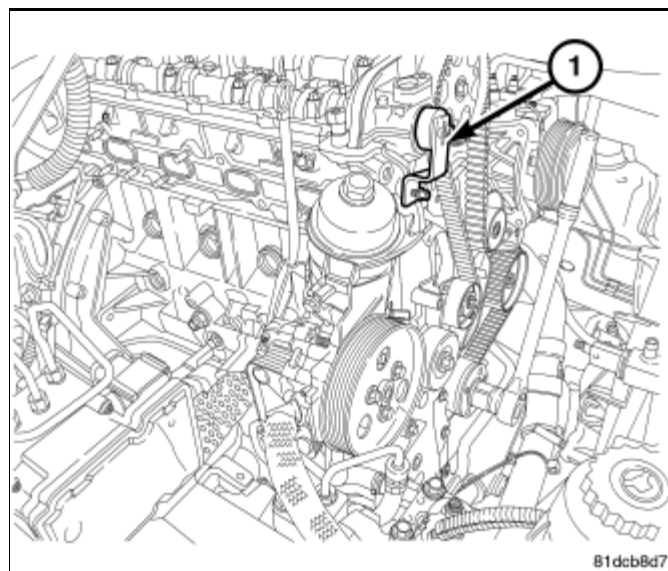
4. Turn the camshafts so that the 90° ATDC camshaft tool can be correctly installed.



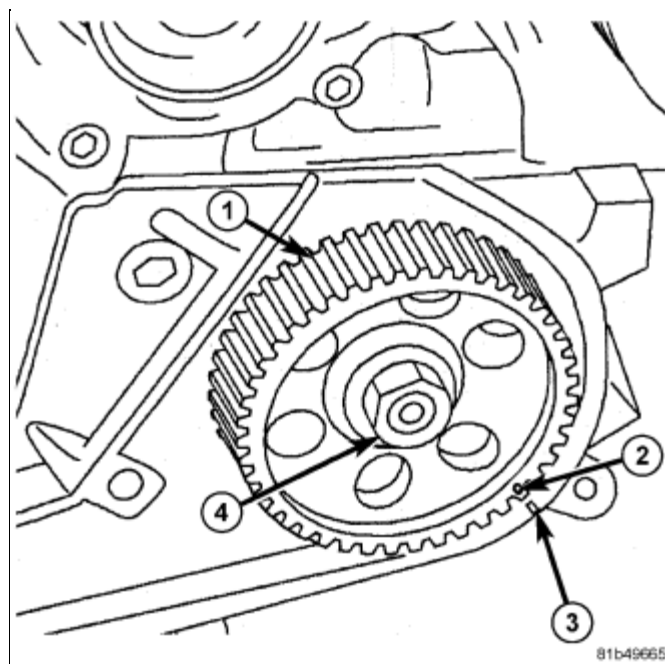
5. Make a mark (2) across the CMP retractor wheel (1) and the exhaust camshaft (3). This mark will be used to verify that the CMP retractor wheel did not rotate on the camshaft during assembly.



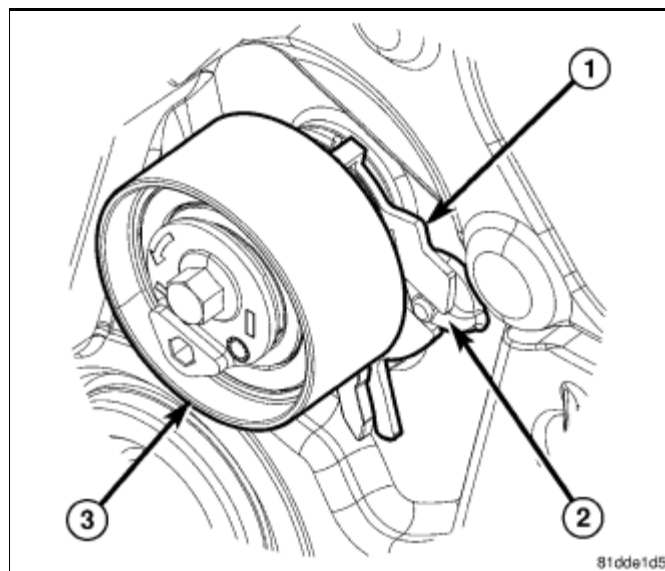
6. Install the camshaft locking tool (1).



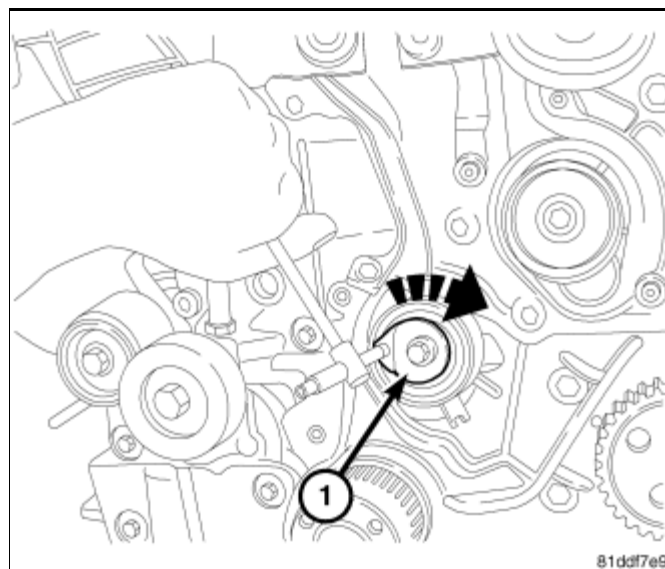
7. Verify the high pressure fuel pump sprocket timing mark (2) is aligned with the timing mark (3) on the block.



8. Install the timing belt tensioner (3). Do not tighten at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.



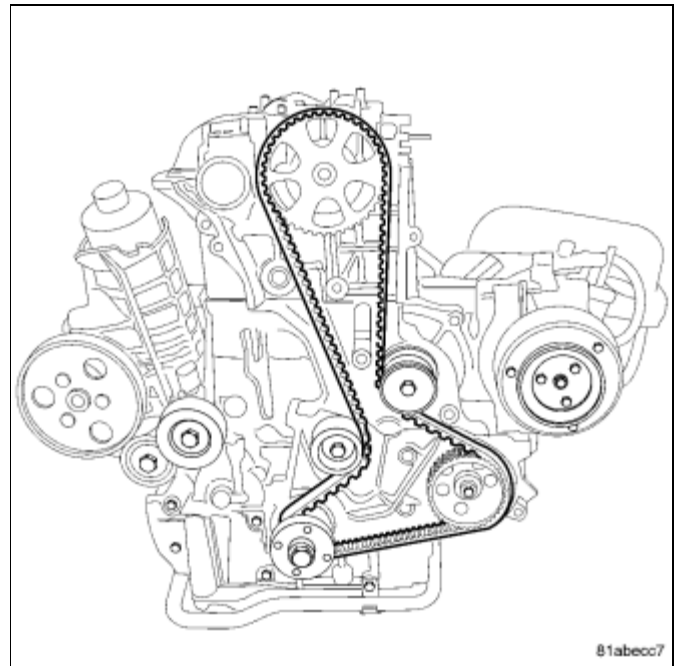
9. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed over the tensioner pulley.



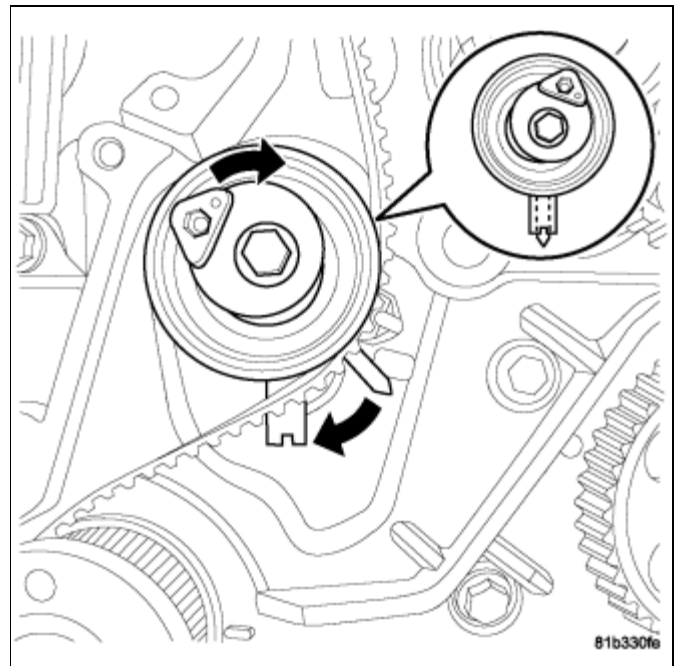
NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

10. If the timing belt was removed from the sprockets, install the timing belt on the components in the following order. Otherwise, go to [STEP 11](#).

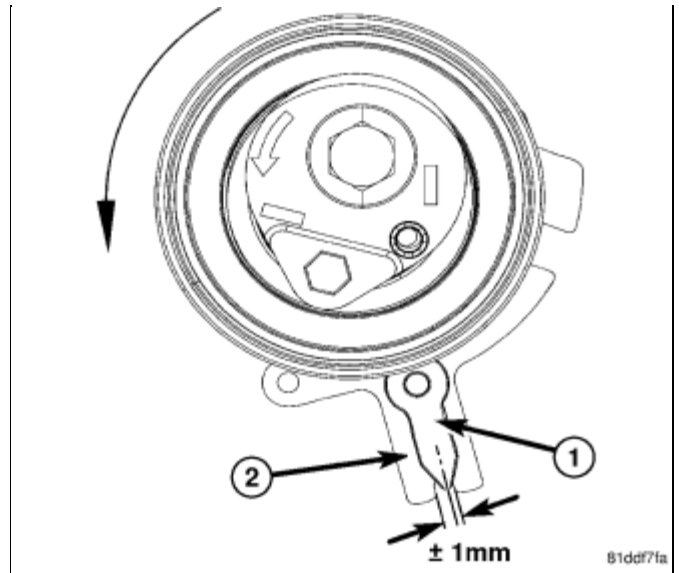
- Crankshaft sprocket (1).
- High pressure fuel pump (2).
- Water pump pulley (3).
- Intake camshaft pulley (4).
- Timing belt tensioner (5).



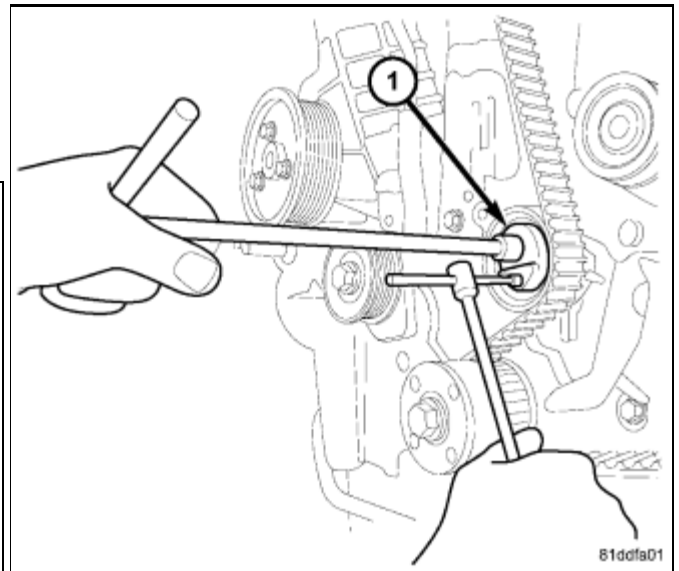
11. Adjust timing belt tensioner by lining up the arrow and the notch as illustrated.



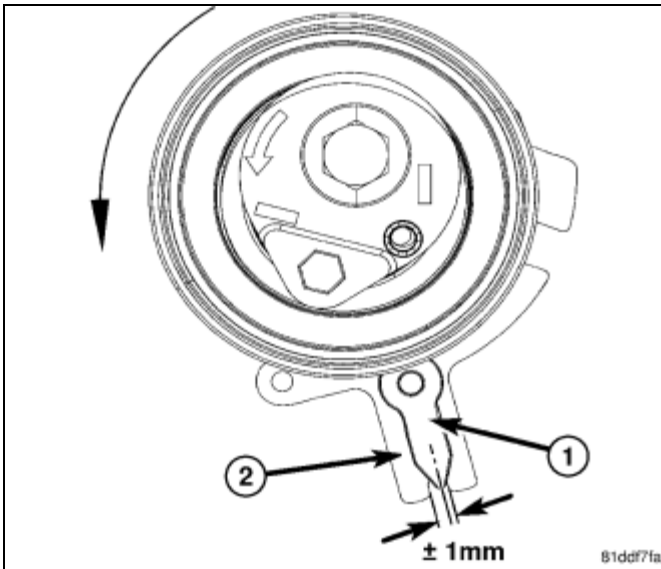
12. Verify the tensioner load indicator (1) is centered in the tensioner load gage (2).



13. Tighten the timing belt tensioner bolt to 28 Nm (21 lb ft).

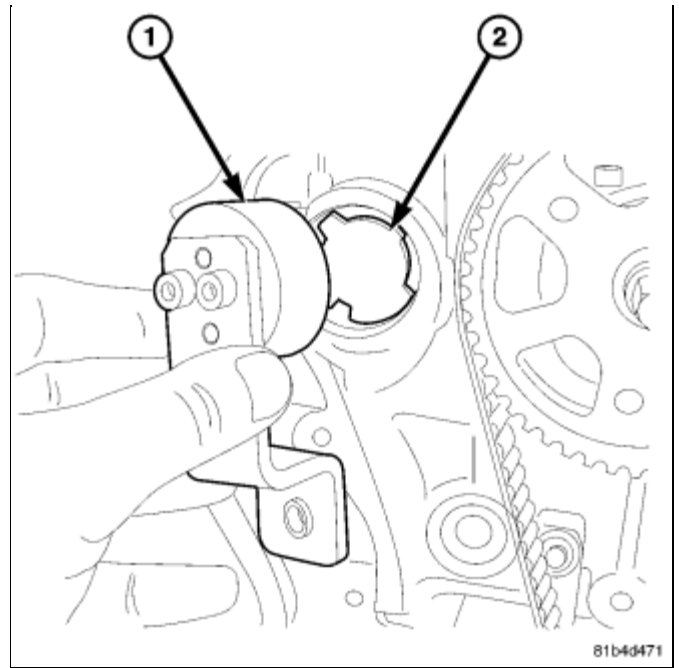


14. Verify the tensioner load indicator (1) is still centered in the tensioner load gage (2). If the indicator is not centered

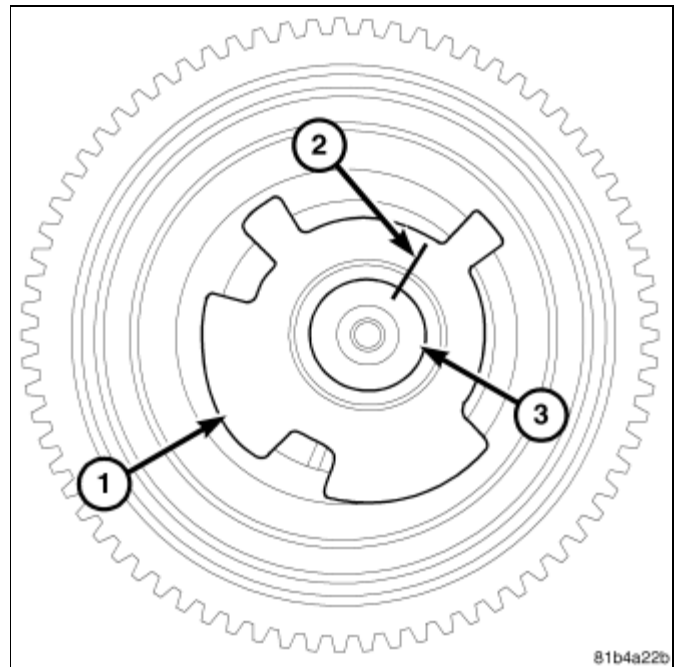


in the gage as shown, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

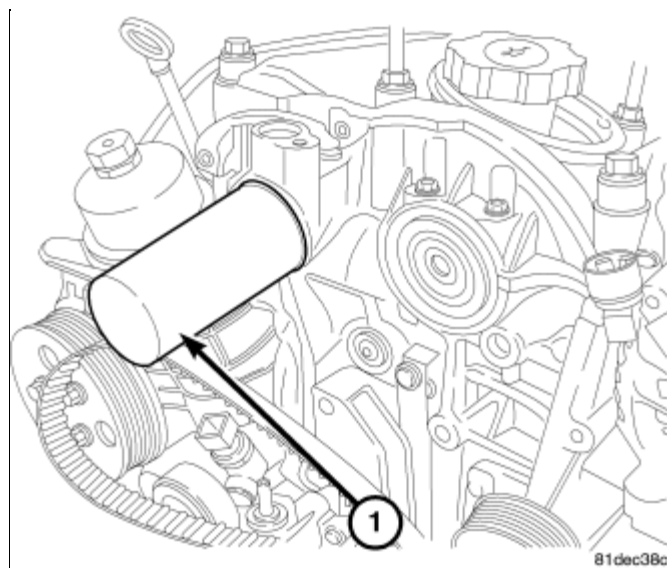
15. Remove the camshaft locking tool (1).



16. Verify that the reluctor wheel (1) has not moved on the camshaft. If the witness marks are not aligned, the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, and the exhaust camshaft must be replaced.

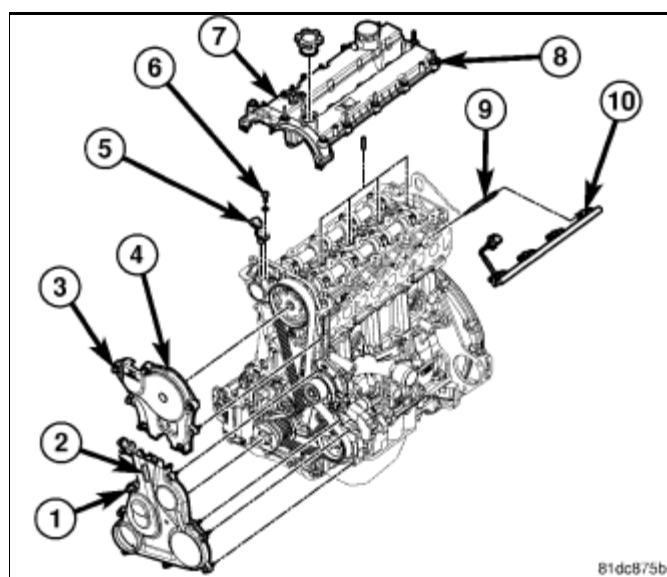


17. Use VM 1057-2 seal installer to install the exhaust cam cap.



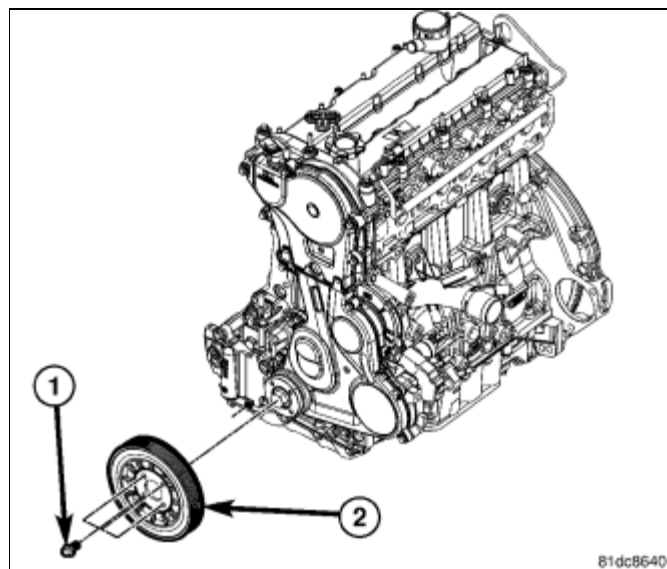
18. Install the lower front cover (2). torque the bolts (1) to 11 Nm (97 lbs. in.).

19. Install the upper front cover (4). torque the bolts (3) to 11 Nm (97 lbs. in.).

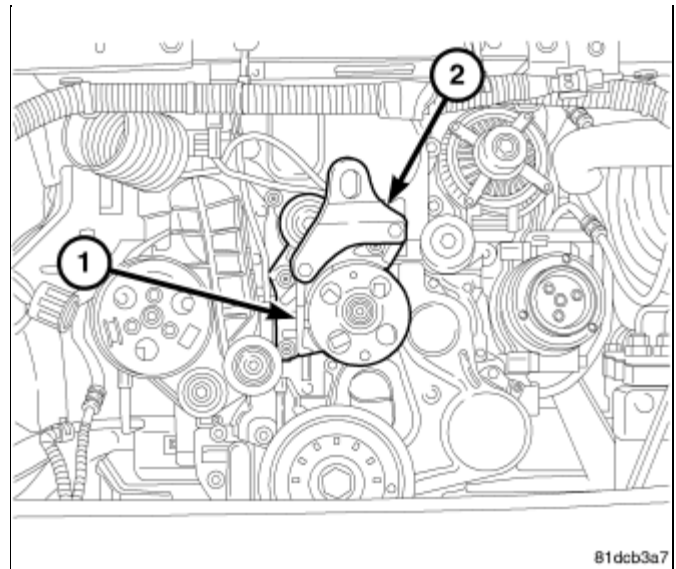


NOTE: The crankshaft sprocket bolt is a L.H. thread.

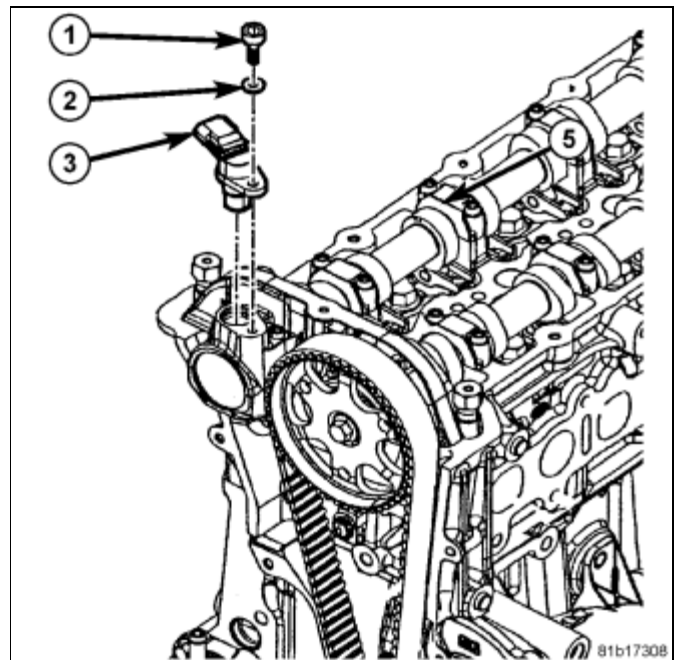
20. Install the crankshaft damper (2). Torque the bolts (1) to 32 Nm (23 lbs. ft.).



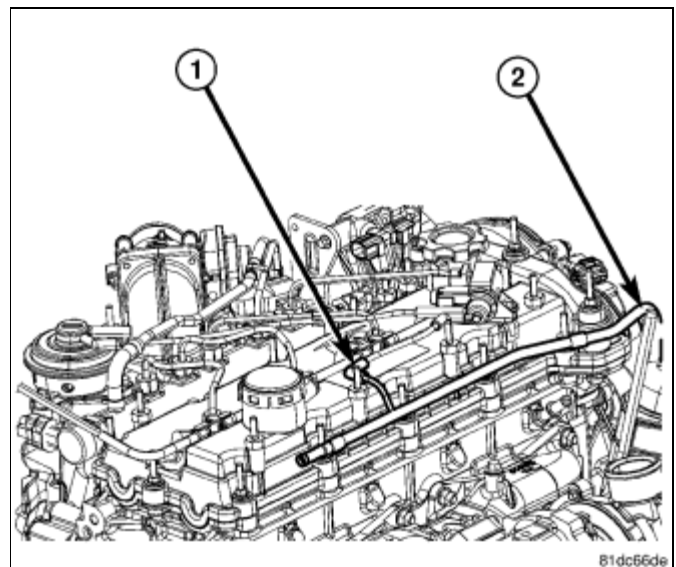
21. Install the idler pulley bracket (1) and torque the bolts to 45 Nm (33 lbs. ft.).
22. Install the front engine lifting bracket (2) and torque the bolts to 45 Nm (33 lbs. ft.).



23. Install the cam position sensor (3). Torque the cam position sensor bolt (1) to 11 Nm (97 lbs. in.).
24. Connect the cam position sensor harness connector.

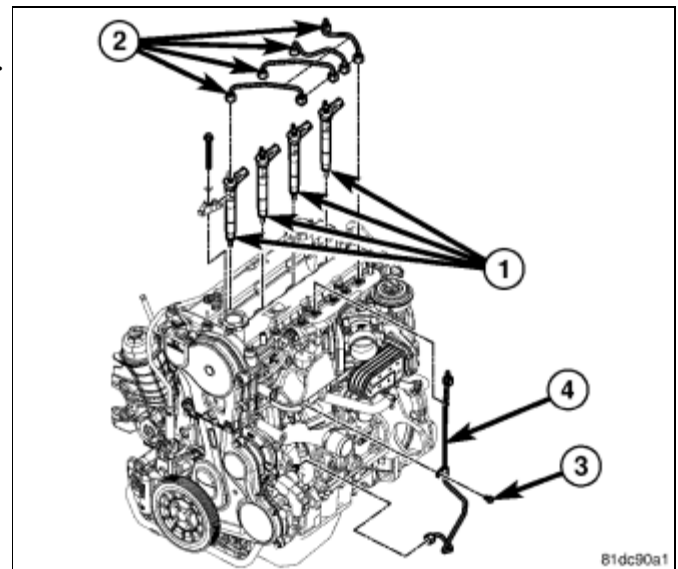


25. Install the vacuum line to the vacuum pump.
26. Install the vacuum line (2) to the camshaft cover.
27. Position the glow plug harness (10) and connect the glow plug harness connectors.



28. Install injectors (1) and injector retainer claw and washer.

29. Install the injector clamp bolts. Do not tighten at this time.



30. Install the fuel rail (5). Do not tighten fuel rail retainers at this time.

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed.

31. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.

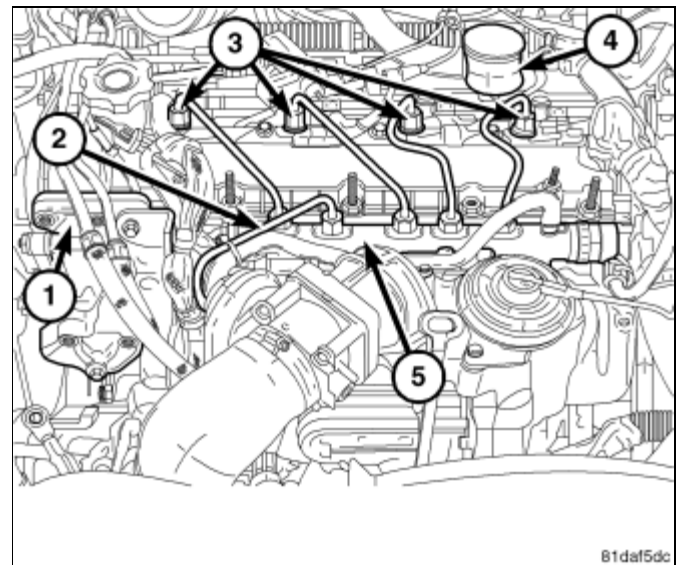
32. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).

33. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).

34. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).

35. Torque the fuel lines to at the fuel rail to 20 Nm (14.75 Ft lbs).

36. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



37. Connect the fuel injector harness connectors (1).

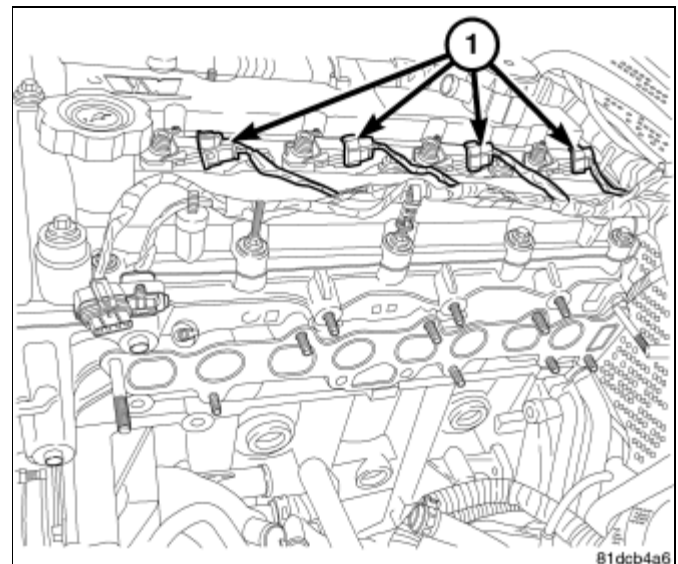
38. Install the accessory drive belt.

39. Install the intake air housing.

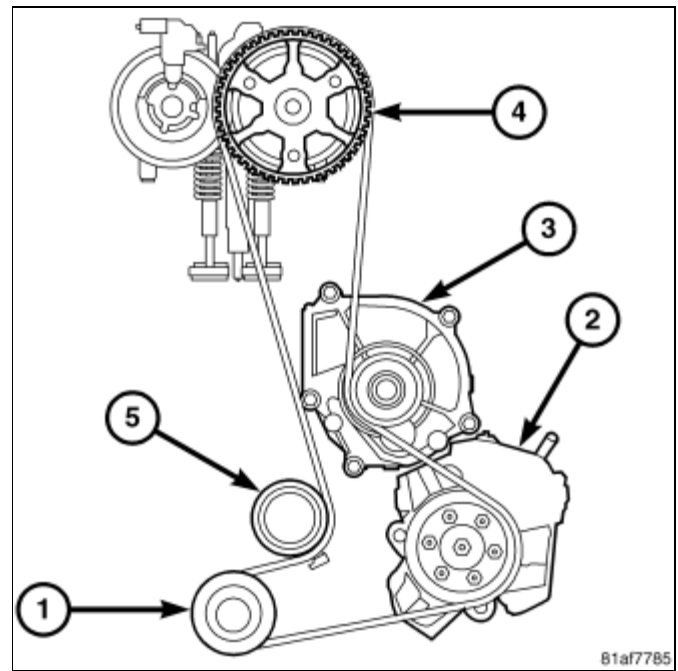
40. Connect the battery.

ADJUSTMENTS

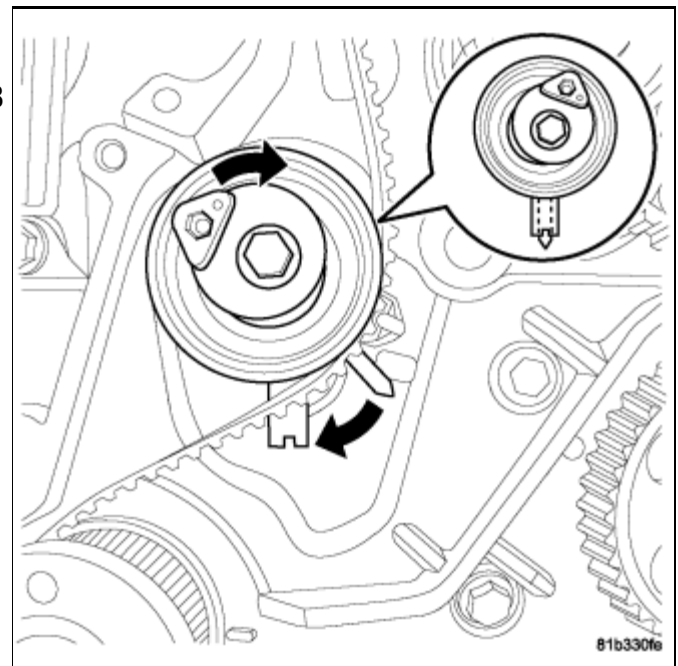
ADJUSTMENT - TIMING BELT TENSIONER



1. With the upper and lower front covers removed and the timing belt installed, loosen timing belt tensioner.



2. Align timing belt tensioner pointer so that it is centered in the notch and torque timing belt tensioner retaining bolt to 28 Nm (21 lb ft).

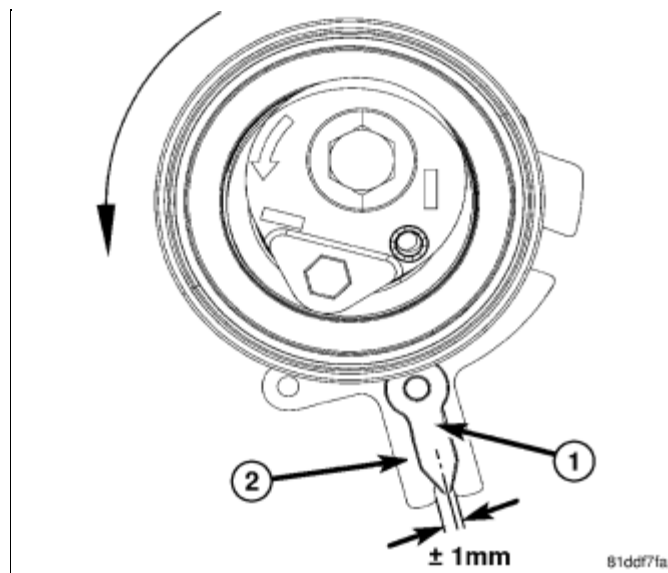


3. Rotate engine 2 complete revolutions and then recheck tensioner alignment. Verify that the tension indicator (1) is centered in the slot on the tensioner gage (2) slot as shown. Readjust tensioner alignment as necessary.

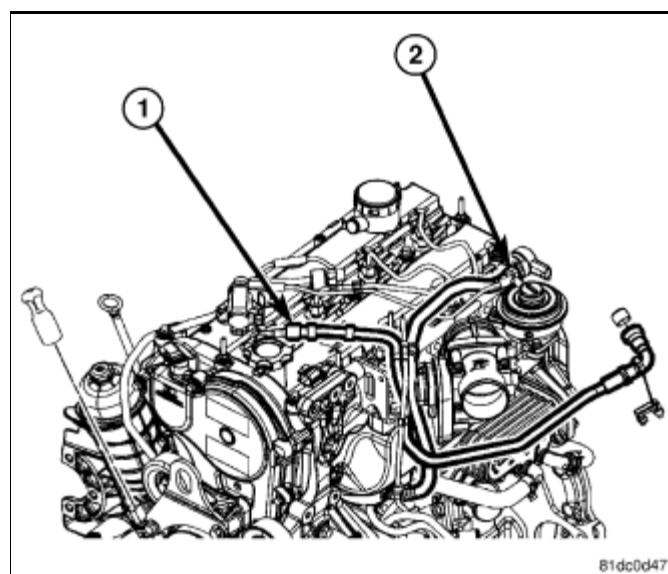
BELT-TIMING

REMOVAL

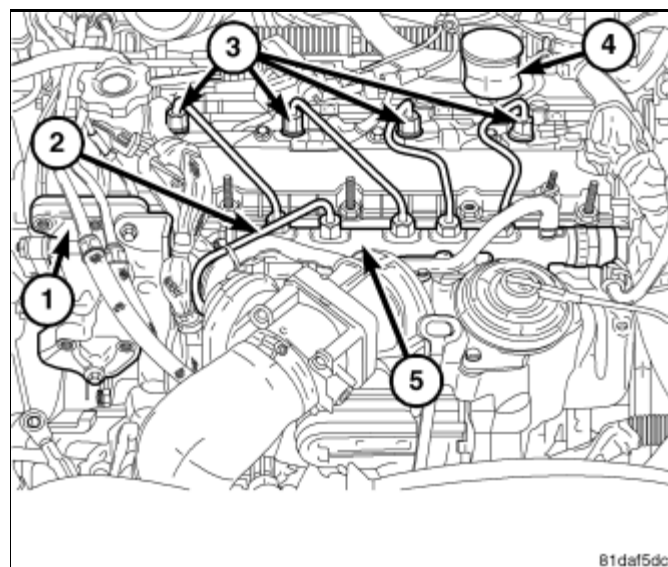
1. Disconnect the battery.
2. Remove the accessory drive belt.
3. Remove the intake air housing.



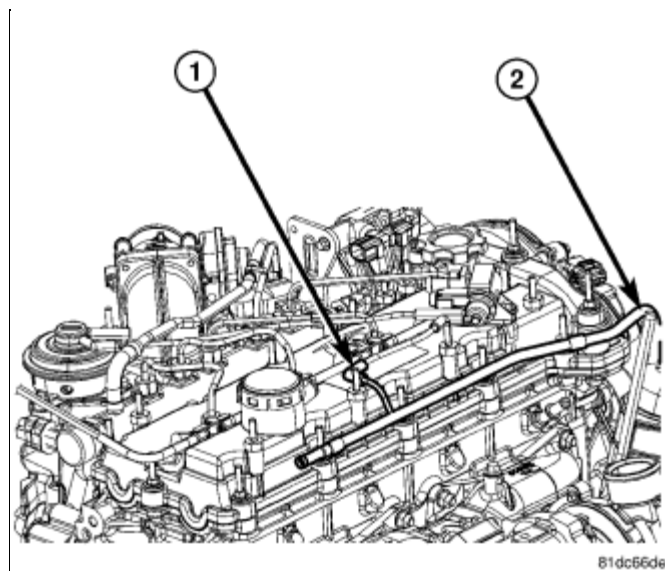
4. Disconnect the fuel return lines (1) and (2).



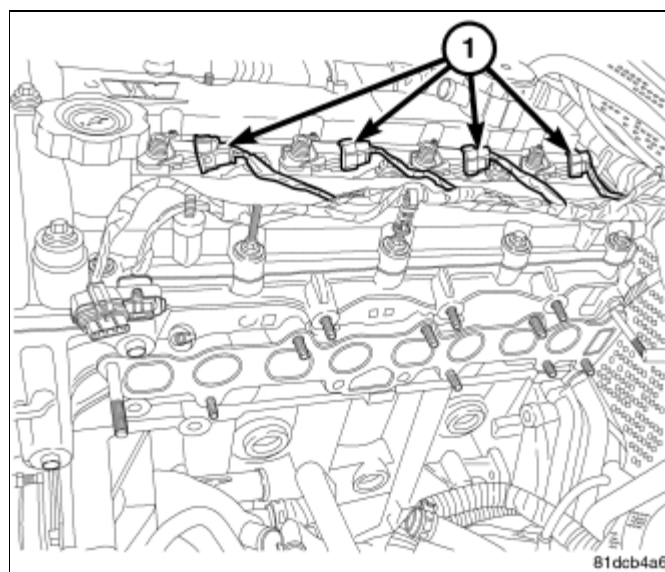
5. Disconnect the high pressure fuel line (2).
6. Remove the injector fuel lines (3) from the injectors and the fuel rail.



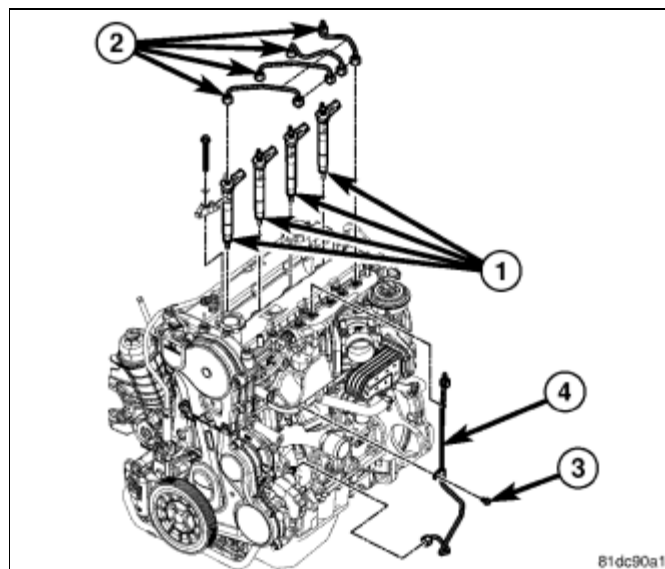
7. Disconnect the vacuum line (2) from the vacuum pump.
8. Disconnect the vacuum line (1).



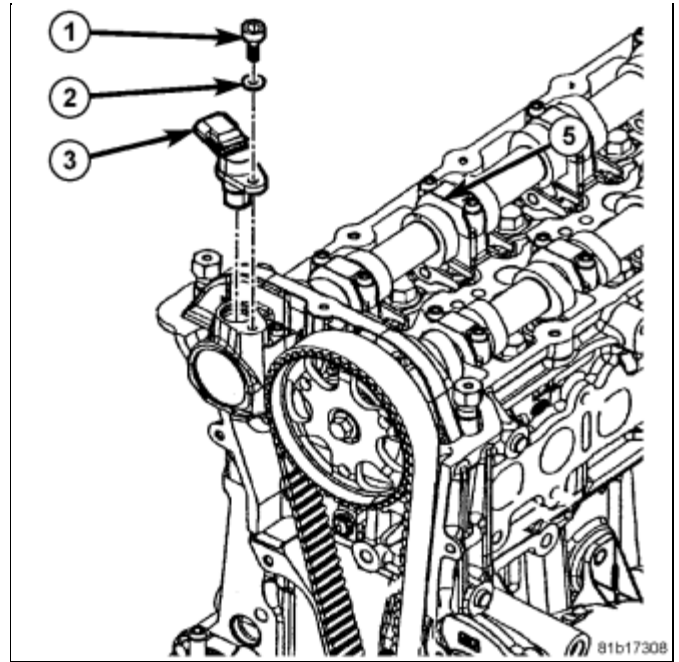
9. Disconnect the fuel injector harness connectors (1) from the fuel injectors.



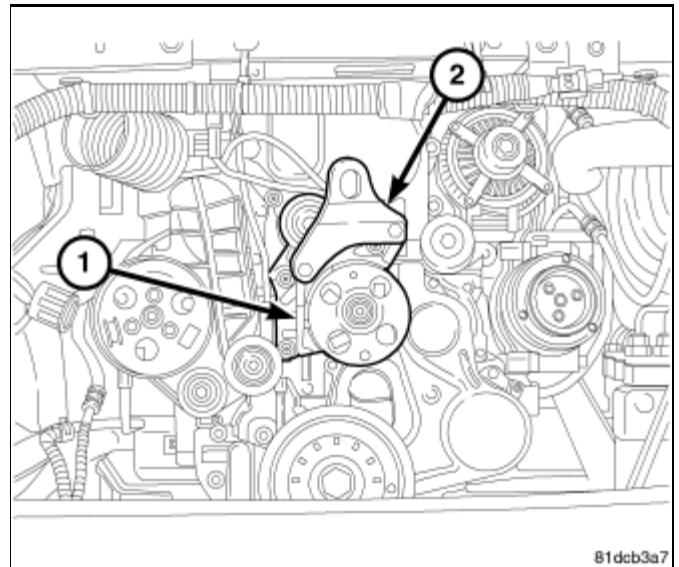
10. Remove the fuel injectors (1).



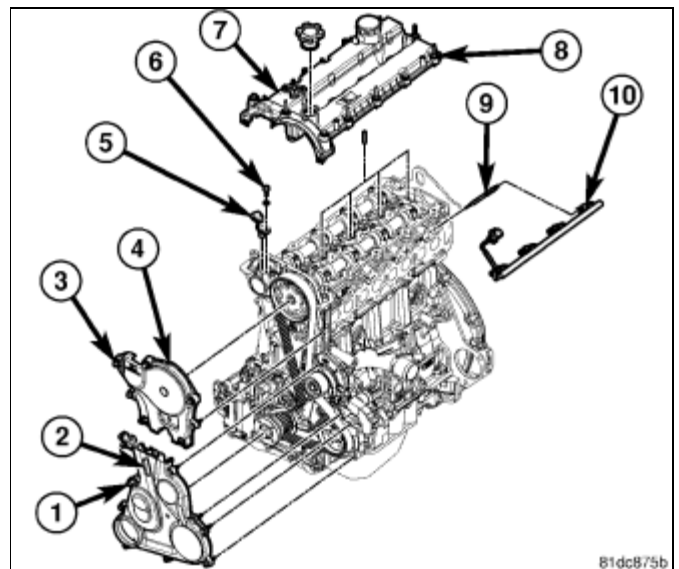
11. Disconnect the Camshaft Position Sensor (CMP) harness connector.
12. Remove the camshaft position sensor (3).



13. Remove the front engine lifting bracket (2).
14. Remove the idler pulley and cooling fan pulley bracket assembly (1).

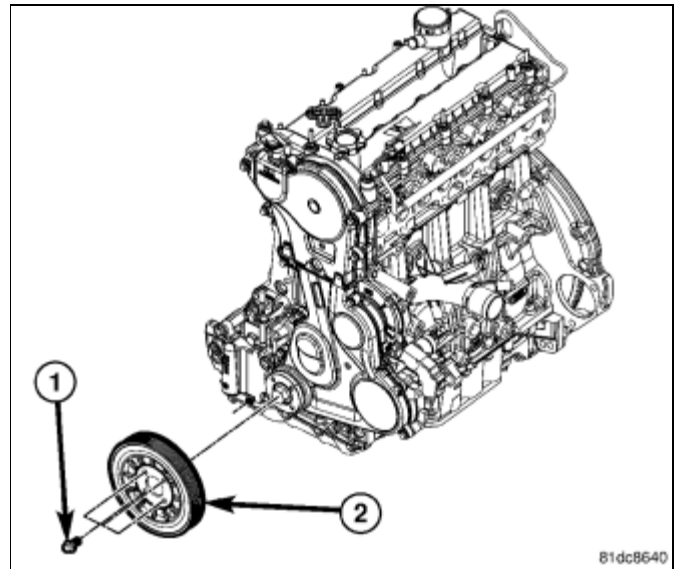


15. Remove the five bolts (3) and the upper front timing belt cover (4).
16. Remove the twelve fasteners (8) and the cylinder head cover (7).

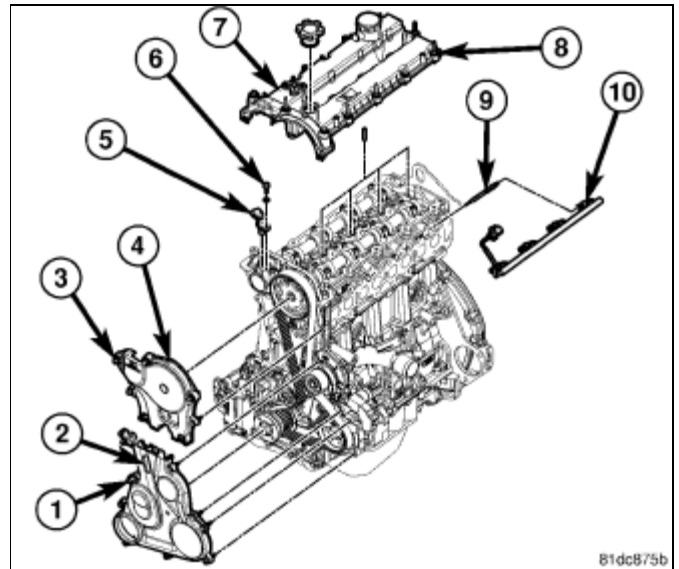


NOTE: The crankshaft sprocket bolt is a L.H. thread.

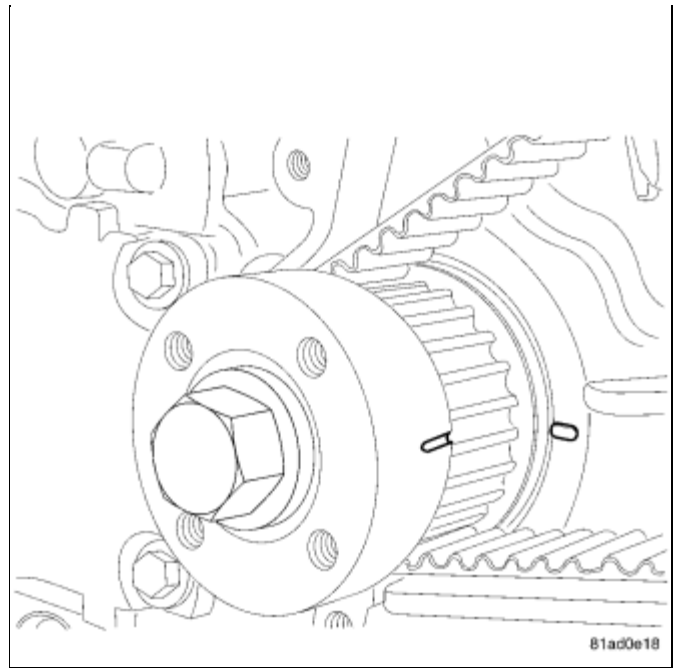
17. Remove the crankshaft damper bolts (1), and the crankshaft damper (2).



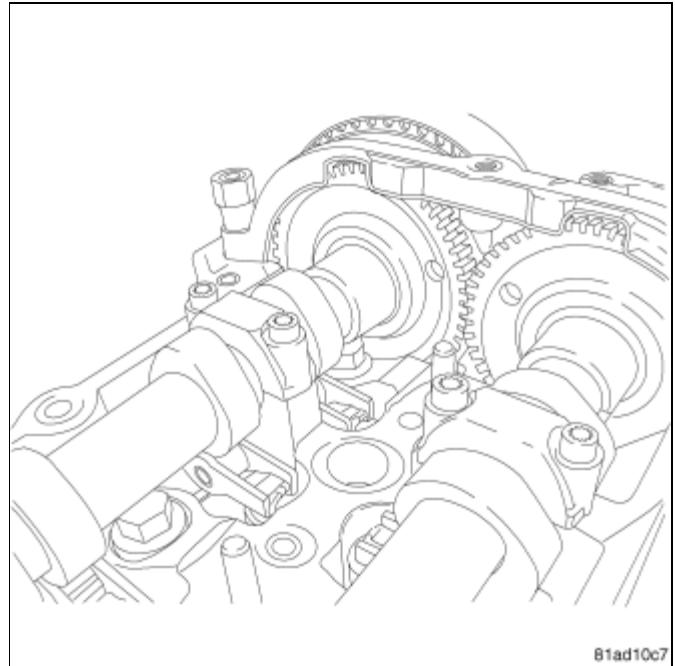
18. Remove the nine fasteners (1), and lower front cover (2).



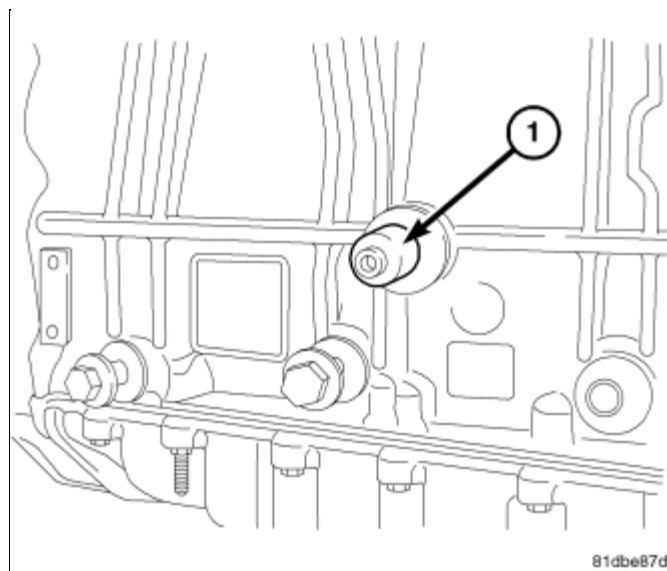
19. Rotate the engine by hand until the crankshaft 90° ATDC marks are aligned.



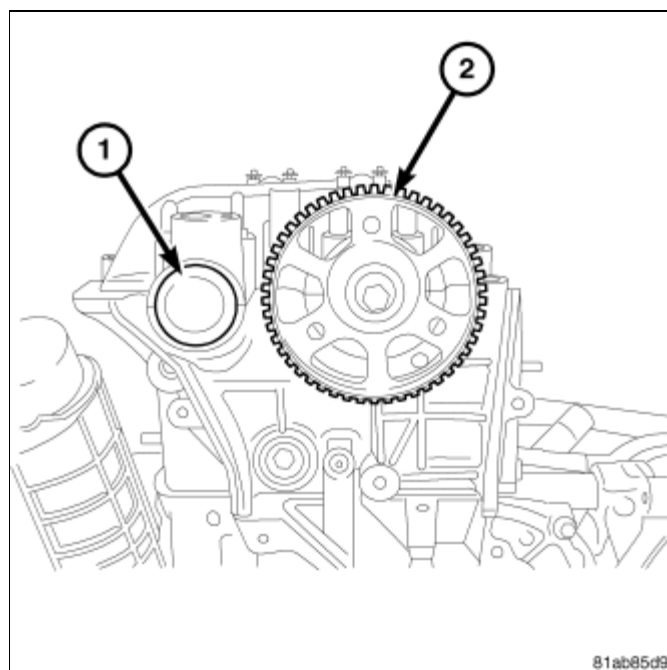
20. Verify the camshaft timing alignment holes on the camshaft gears are aligned horizontally.



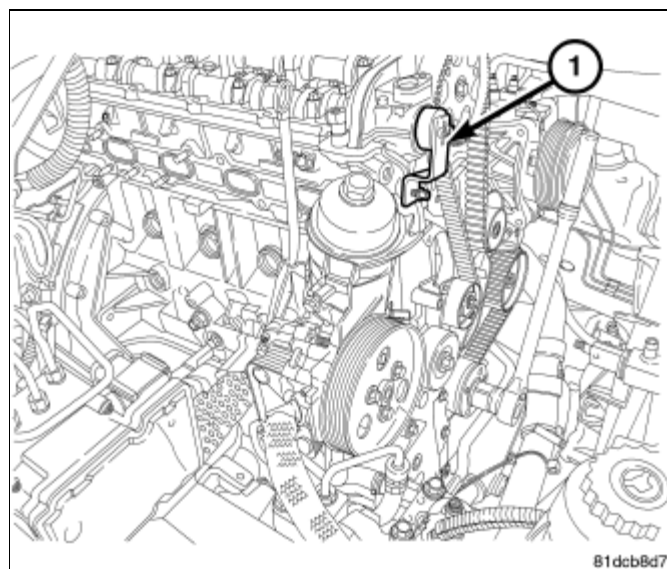
21. Install the crankshaft locking tool VM 9992 (1).



22. Remove the exhaust camshaft oil seal (1).

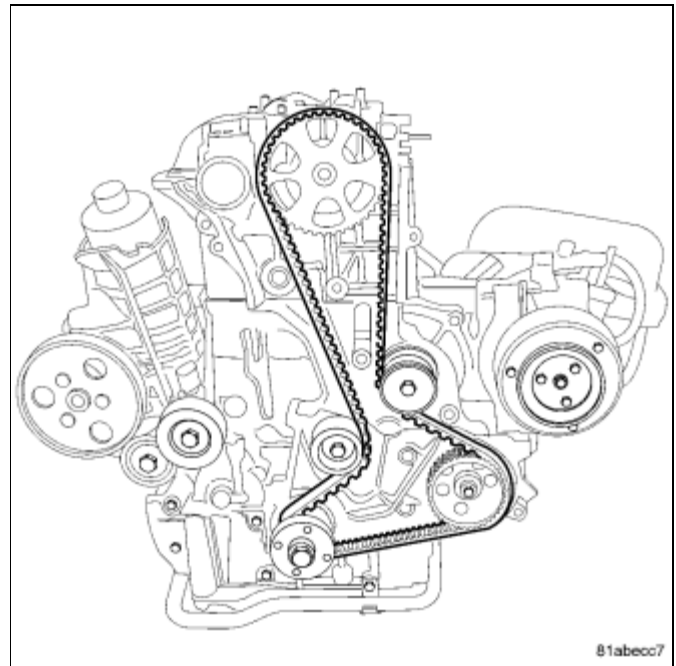


23. Install the camshaft locking tool VM 9991 (1).

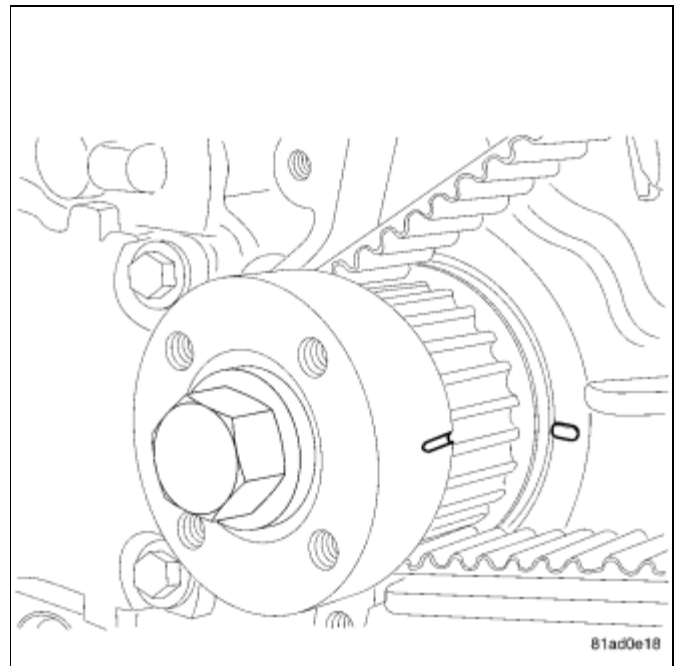


24. Loosen the timing belt tensioner bolt, and remove the timing belt.

INSTALLATION



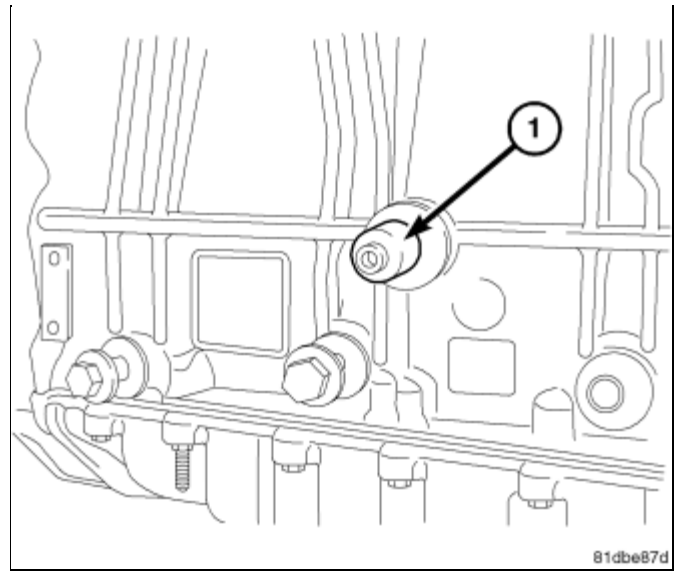
1. Return piston #1 to 90° ATDC, and align the crankshaft timing marks.



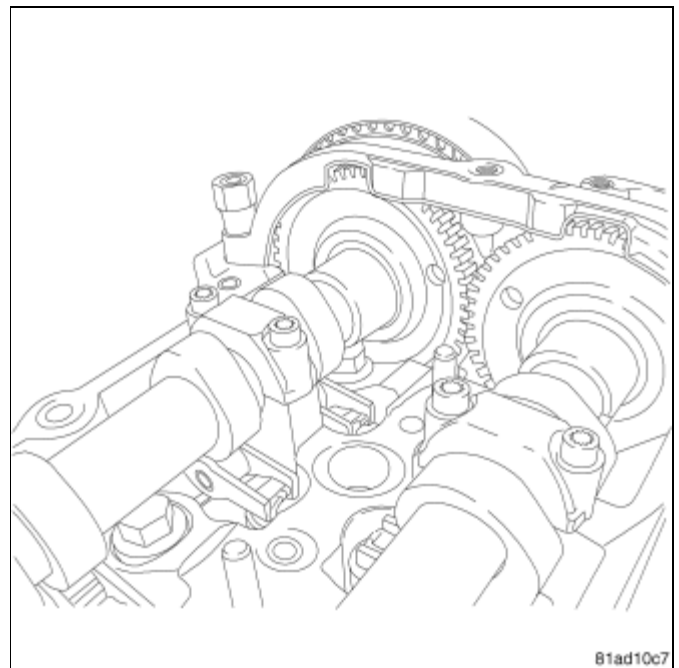
2. Reinstall the crankshaft locking tool (1).
3. Make sure that the timing dimples on the back of the camshaft gears are lined up horizontally.

NOTE: The engine is not in time with the camshaft dots facing each other. The camshafts are set so that the dots face each other and then rotated until the camshaft locking tool can be bolted to the cylinder head. The camshaft locking tool properly positions the camshafts at 90° ATDC. The dots on the camshafts are used during

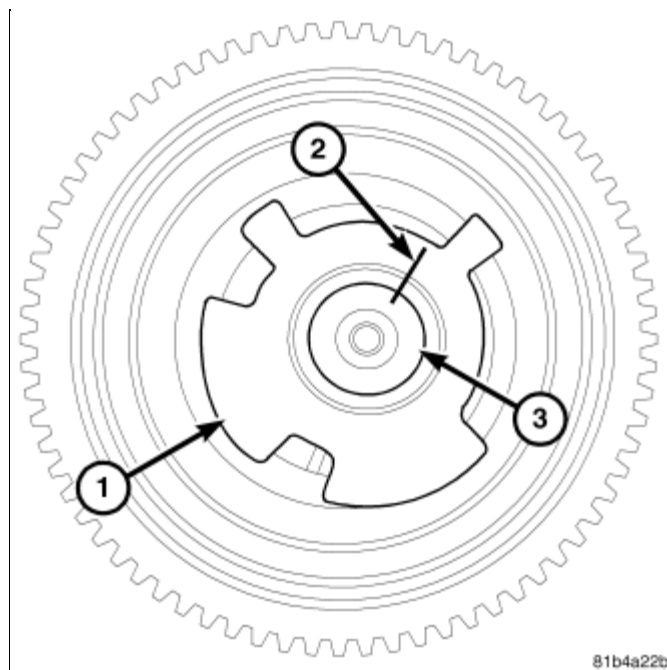
assembly to quickly orient the camshafts so that the camshaft locking tool can be installed.



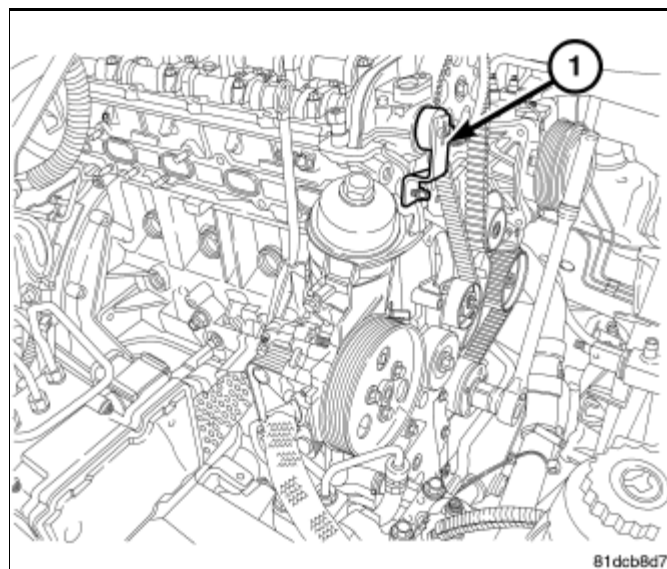
4. If necessary, turn the camshafts so that the 90° ATDC camshaft tool can be correctly installed.



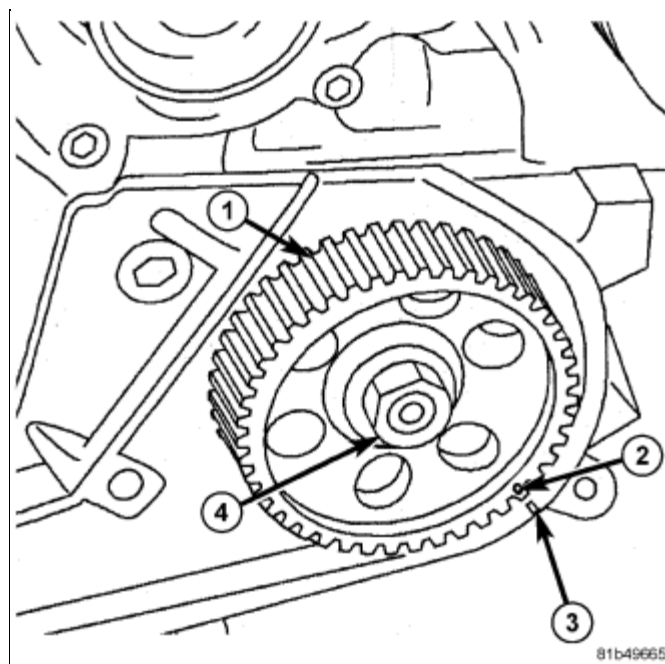
5. Make a mark (2) across the CMP reluctor wheel (1) and the exhaust camshaft (3). This mark will be used to verify that the CMP reluctor wheel did not rotate on the camshaft during assembly.



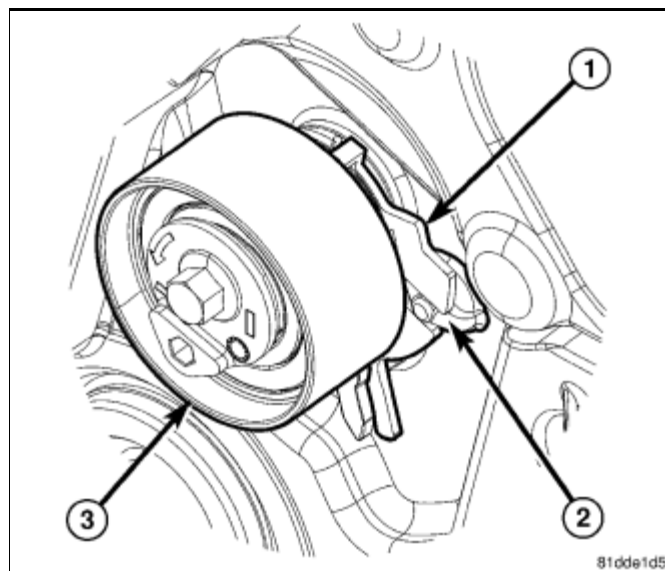
6. Install the camshaft locking tool (1).



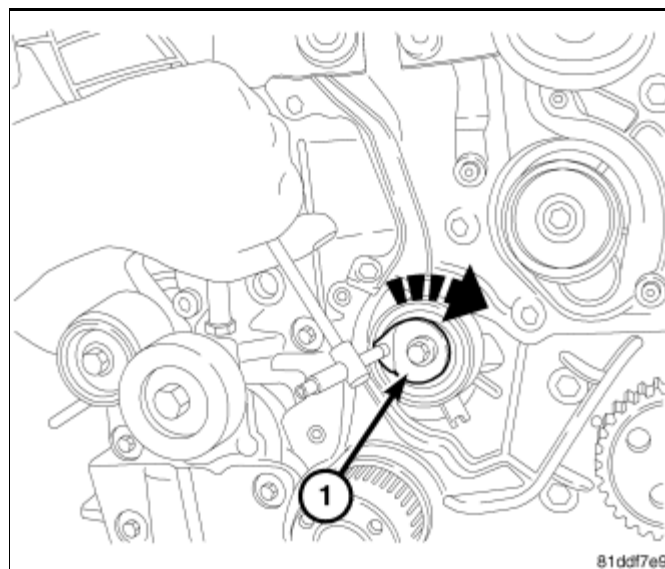
7. Align the high pressure fuel pump sprocket timing mark (2) with the timing mark (3) on the block.



8. Install the timing belt tensioner (3). Do not tighten at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.



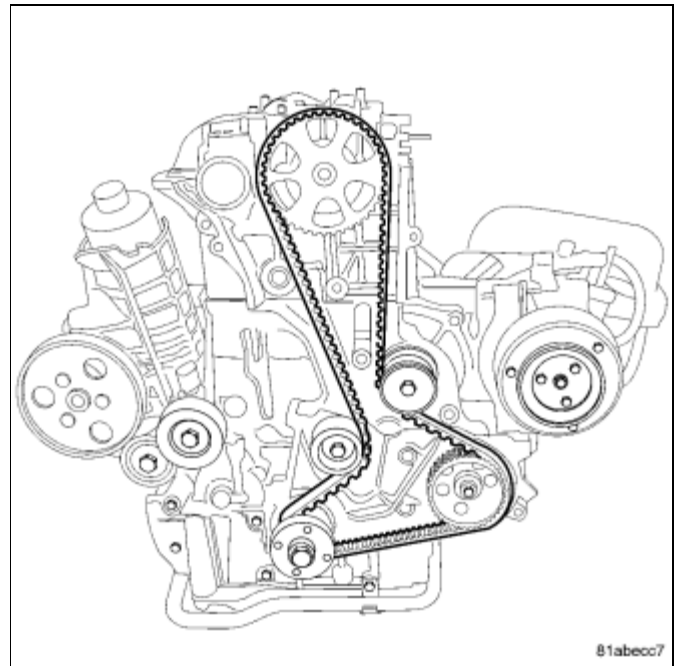
9. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed.



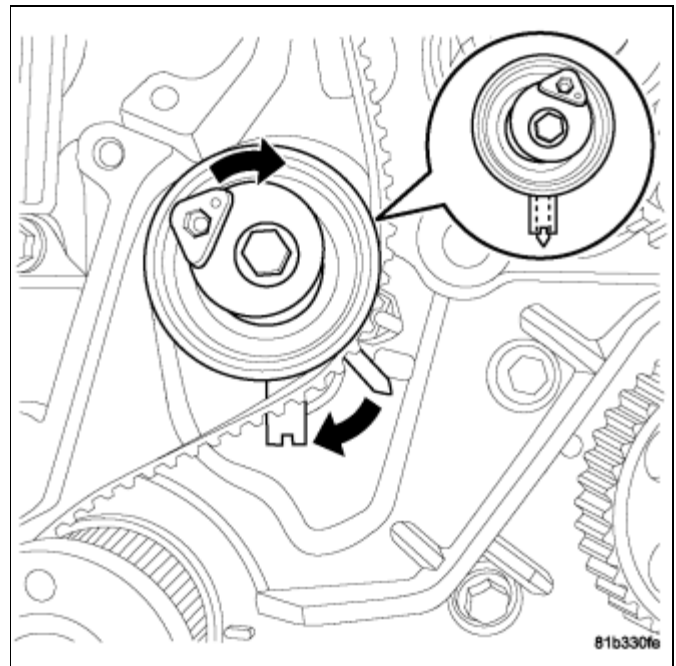
NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

10. Install the timing belt on the components in the following order.

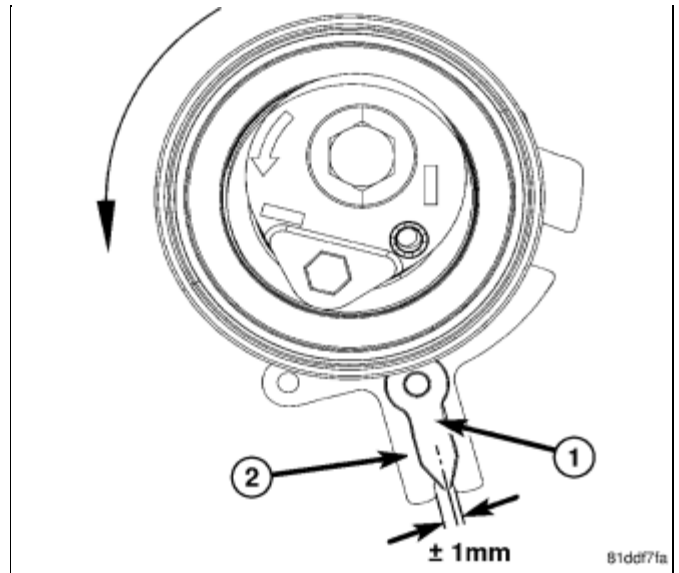
- Crankshaft sprocket (1).
- High pressure fuel pump (2).
- Water pump pulley (3).
- Intake camshaft pulley (4).
- Timing belt tensioner (5).



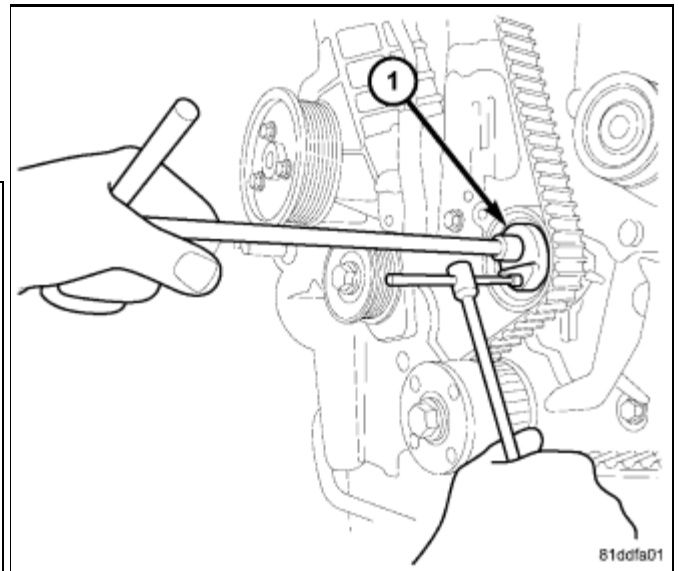
11. Adjust timing belt tensioner by lining up the arrow and the notch as illustrated.



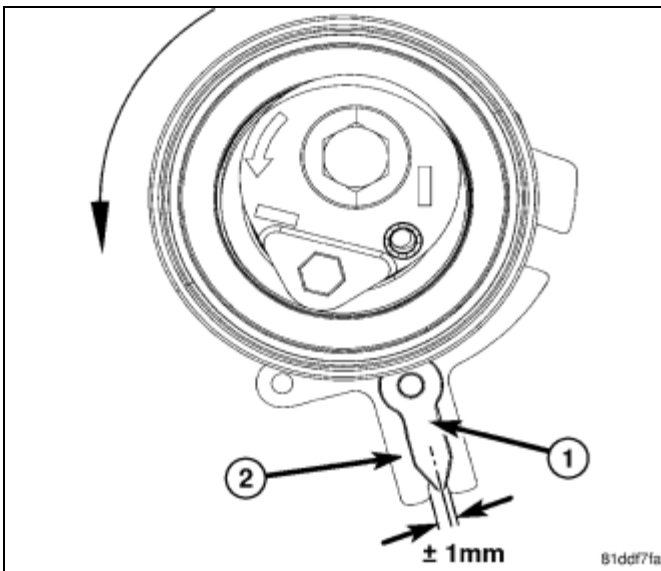
12. Verify the tensioner load indicator (1) is centered in the tensioner load gage (2).



13. Tighten the timing belt tensioner bolt to 28 Nm (21 lb ft).

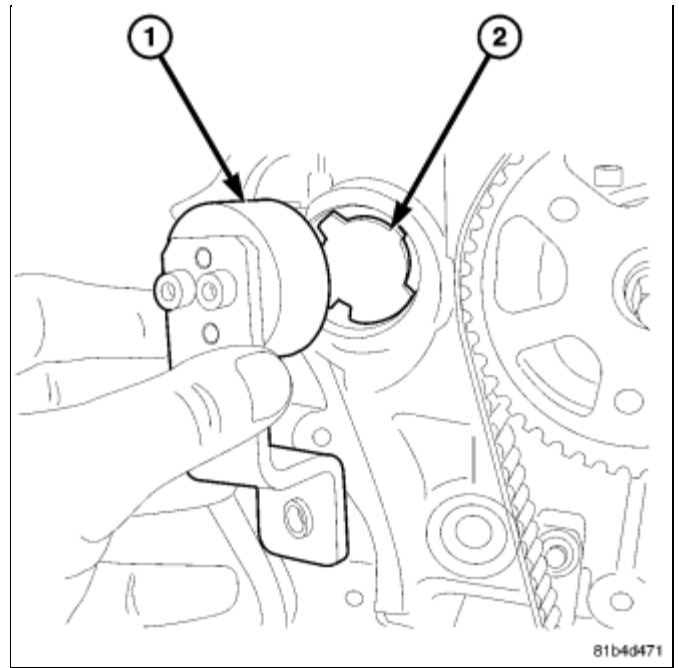


14. Verify the tensioner load indicator (1) is still centered in the tensioner load gage (2). If the indicator is not centered

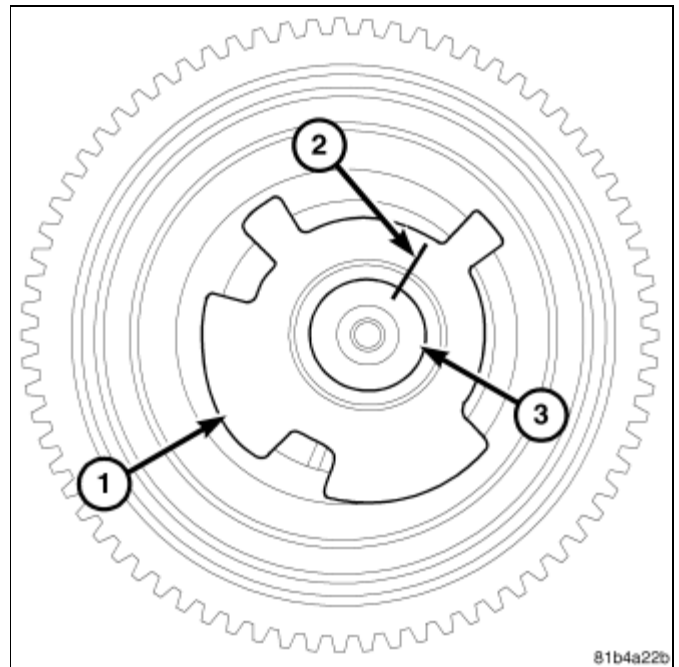


in the gage as shown, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

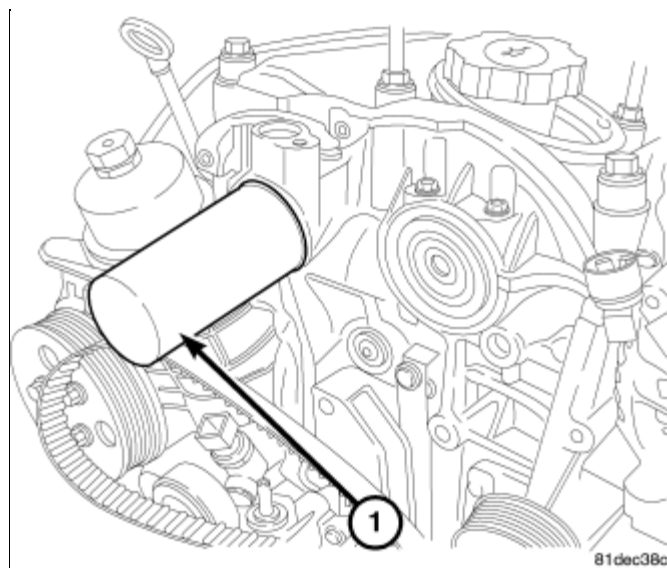
15. Remove the camshaft locking tool (1).



16. Verify that the reluctor wheel (1) has not moved on the camshaft. If the witness marks are not aligned, the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, and the exhaust camshaft must be replaced.



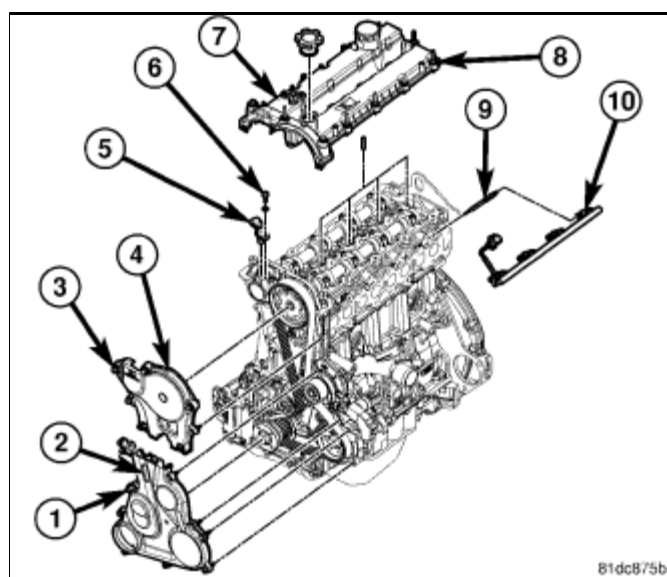
17. Use VM 1057-2 seal installer to install the exhaust cam cap.



18. Install the lower front cover (2). Torque the bolts (1) to 11 Nm (97 lbs. in.).

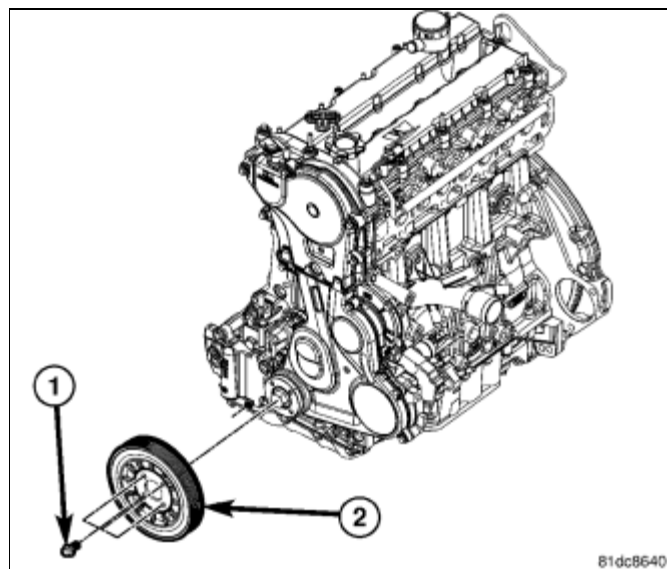
19. Install the upper front cover (4). Torque the bolts (3) to 11 Nm (97 lbs. in.).

20. Install the the cylinder head cover (7) and the twelve fasteners (8). Torque the bolts (1) to 11 Nm (97 lbs. in.).

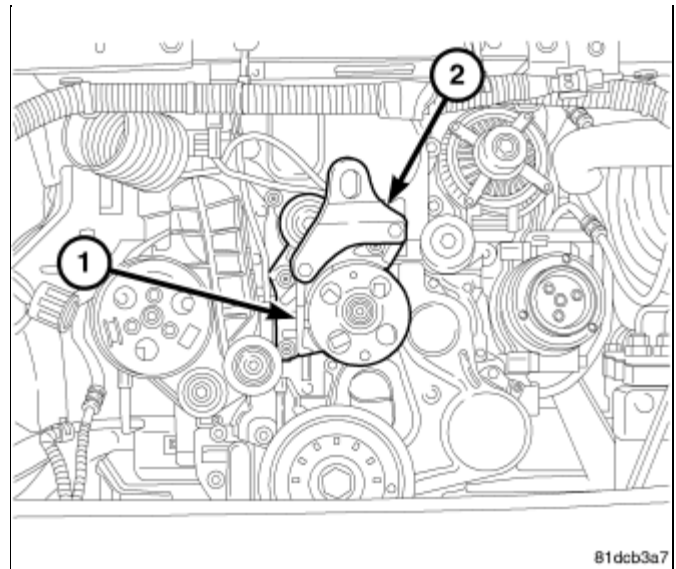


NOTE: The crankshaft sprocket bolt is a L.H. thread.

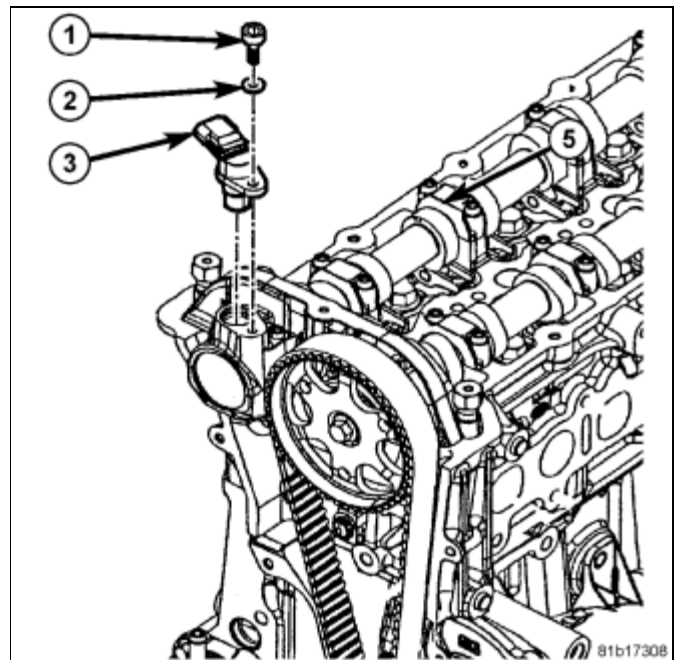
21. Install the crankshaft damper (2). Torque the bolts (1) to 32 Nm (23 lbs. ft.).



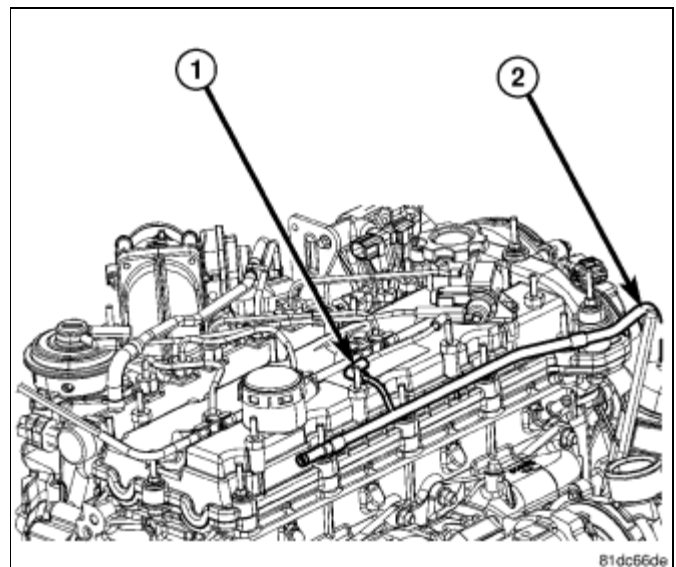
22. Install the idler pulley bracket (1) and torque the bolts to 45 Nm (33 lbs. ft.).
23. Install the front engine lifting bracket (2) and torque the bolts to 45 Nm (33 lbs. ft.).



24. Install the cam position sensor (3). Torque the cam position sensor bolt (1) to 11 Nm (97 lbs. in.).
25. Connect the cam position sensor harness connector.

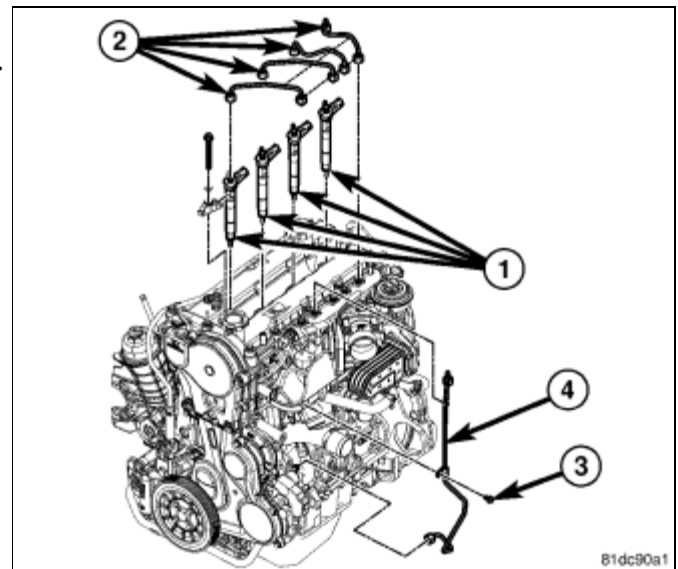


26. Install the vacuum line to the vacuum pump.
27. Install the vacuum line (2) to the camshaft cover.
28. Position the glow plug harness (10) and connect the glow plug harness connectors.



29. Install injectors (1) and injector retainer claw and washer.

30. Install the injector clamp bolts. Do not tighten at this time.



31. Install the fuel rail (5). Do not tighten fuel lines and retainers at this time.

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed.

32. Loosely install the high pressure fuel lines onto the fuel injectors and the fuel rail.

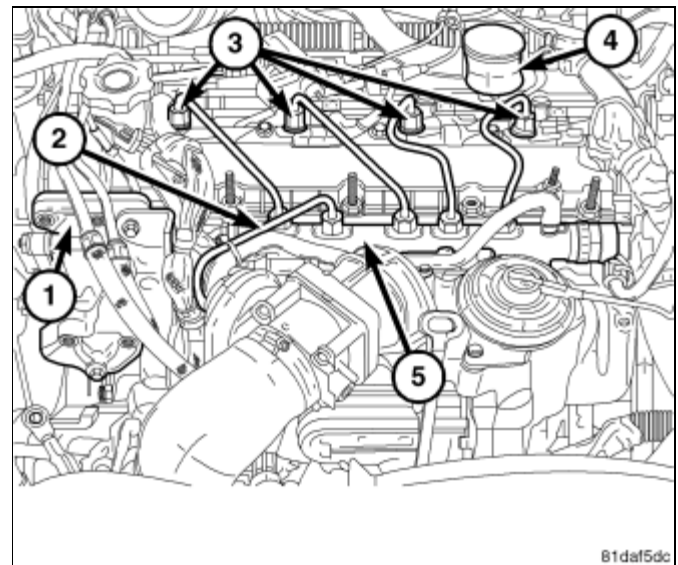
33. Torque injector clamp bolts to 32.4 Nm (23.8 Ft lbs).

34. Tighten the fuel rail nuts to 24.5 Nm (18 ft. lbs).

35. Torque the fuel lines at the fuel injectors to 28 Nm (20 ft lbs.).

36. Torque the fuel lines to at the fuel rail to 20 Nm (14.75 Ft lbs).

37. Install the high pressure fuel line bracket bolt and torque to 15 Nm (133 lbs. in.).



38. Connect the fuel injector harness connectors (1).

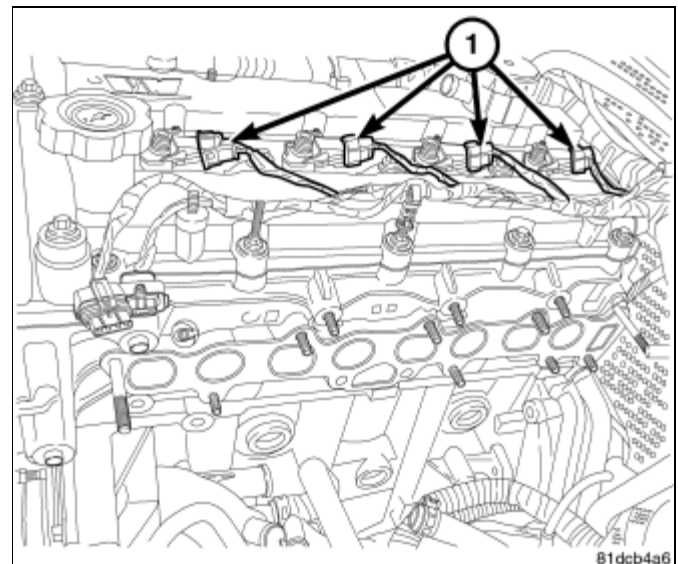
39. Install the accessory drive belt.

40. Install the intake air housing.

41. Connect the battery.

HOUSING-AIR CLEANER

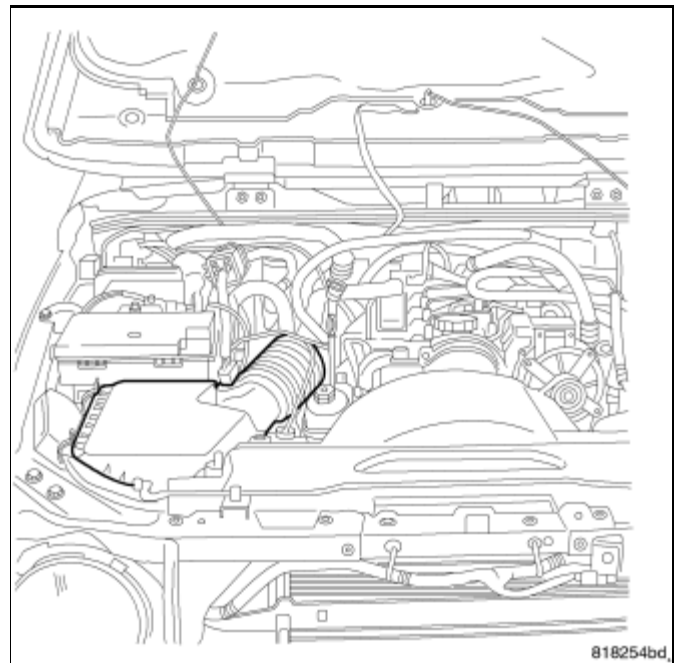
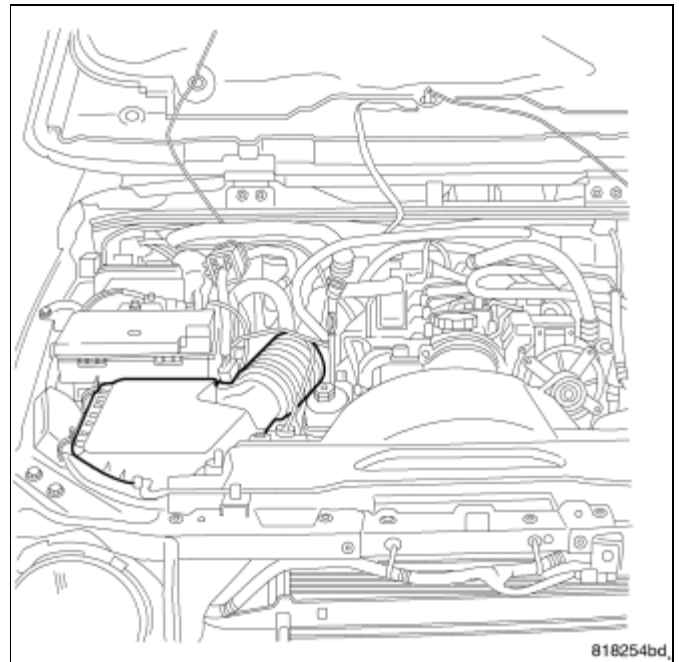
REMOVAL



1. Disconnect the IAT sensor.
2. Remove the intake air housing.

INSTALLATION

1. Install the intake air housing.
2. Install the air cleaner element.
3. Connect the IAT sensor.

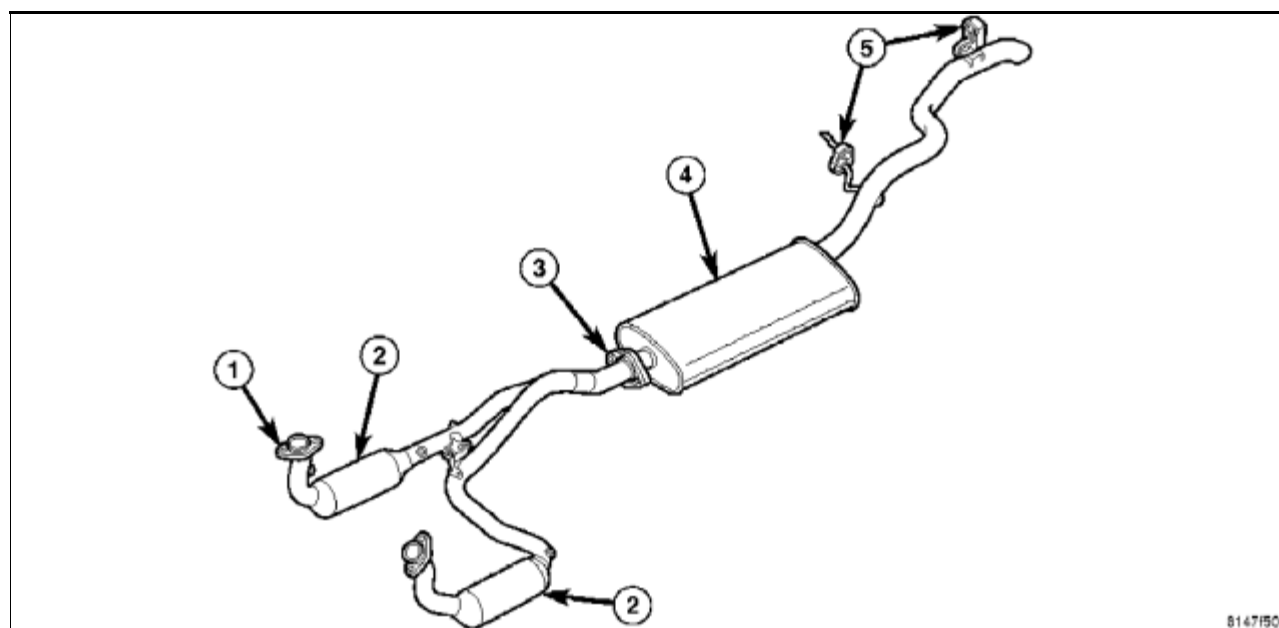


11 - EXHAUST SYSTEM

EXHAUST SYSTEM

DESCRIPTION

GAS ENGINES



EXHAUST SYSTEM - TYPICAL - GAS ENGINES

1 - EXHAUST FLANGE
2 - CATALYTIC CONVERTER
3 - FRONT EXHAUST PIPE ASSY-TO-MUFFLER FLANGE
4 - MUFFLER
5 - INSULATOR

The basic exhaust system consists of a exhaust pipe assembly with catalytic converters (2), muffler (4) and tailpipe assembly and heat shields.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. Minimum clearance

between any exhaust component and the body or frame is 25 mm (1.0 in.). If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or equivalent). This will assure proper engine function and system alignment.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

2.8L DIESEL

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, EGR valve with intercooler, front exhaust pipe with catalytic converter, muffler and tailpipe assembly.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. The exhaust components should be kept a minimum of 25.4 mm (1.0 in.) away from the body and frame. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

DIAGNOSIS AND TESTING

GAS ENGINE

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten clamps/bolts to specified torque at leaking joints.
	2. Rusted or blown out muffler.	2. Replace muffler. Inspect exhaust system.
	3. Broken or rusted out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten/replace flange attaching nuts/bolts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head bolts.

	7. Catalytic converter rusted or blown out.	7. Replace catalytic converter assy.
	8. Restriction in exhaust system.	8. Remove restriction, if possible. Replace restricted part if necessary.
CAUTION: When servicing and replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and oxygen sensor.		

DIESEL ENGINE

CAUTION: On high mileage vehicles it is normal to see some exhaust staining around the turbocharger control rod area. This is not a sign of turbocharger failure.

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten clamps/bolts at leaking joints.
	2. Rusted or blown out muffler.	2. Replace muffler. Inspect exhaust system.
	3. Broken or rusted out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten/replace flange attaching nuts/bolts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head bolts. Replace gasket if necessary.
	7. Turbocharger mounting flange cracked.	7. Remove turbocharger and inspect. (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - REMOVAL).
	8. Restriction in exhaust system.	8. Remove restriction, if possible. Replace restricted part if necessary.
	9. EGR pipe(s) leak.	9. Tighten bolts. Replace gasket.
	10. EGR assembly leak.	10. Tighten bolts. Replace gaskets.

Drivability Concern - Turbo	1. Vacuum hose disconnected.	1. Check connections, replace as necessary.
	2. Vacuum system leaks.	2. Inspect for damage. Check for leaks, replace as necessary.
	3. Boost pressure solenoid filter clogged.	3. Replace the filter.

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft.	In.
		Lbs.	Lbs.
Bolts, Crossmember to Sill	42	31	-
Nuts, Crossmember to Transmission Mount	22	16	-
Nuts/Bolt, Exhaust Manifold to Engine			
#6&7	31	23	-
#1,2,3,4,5,8,9,10&11	33	24	-
Nuts, Exhaust Pipe to Catalytic Converter Flange	27	-	19
Nuts, Catalytic Converter to Turbocharger	27	19	-
Bolt, DPF to Catalytic Converter	32	24	-
Bolts, DPF to Muffler	32	24	-
Clamp, Tailpipe to Rear Tailpipe Hanger	27	20	-
Oxygen Sensors	27	20	-
Heat Shields	45	33	-

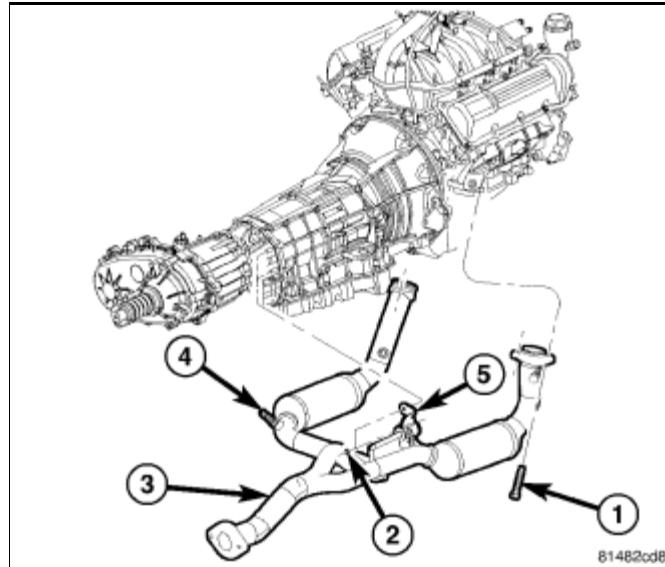
CONVERTER-CATALYTIC

REMOVAL

3.8L ENGINE

WARNING: If torches are used when working on the exhaust system, do not allow the flame near the fuel lines.

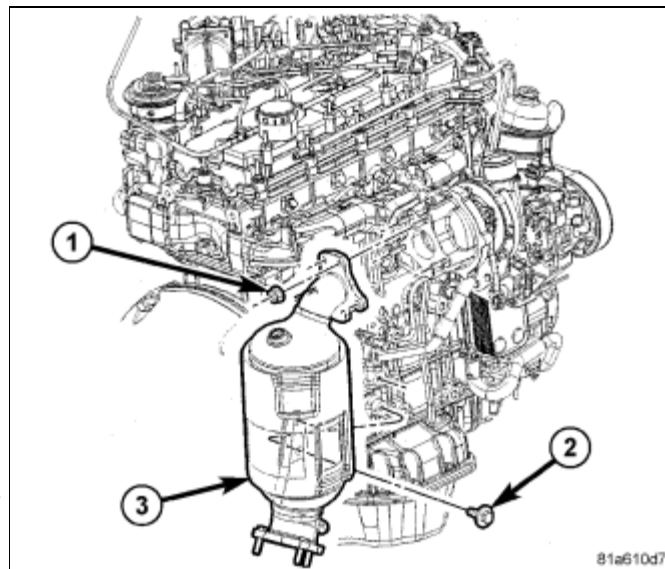
1. Raise and support the vehicle.
2. Saturate the bolts (1) and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Disconnect oxygen sensor electrical connectors.
4. Remove the nuts from the front exhaust pipe and catalytic converter assembly to muffler flange.
5. Remove bolts (1) and flanged nuts at the manifold.
6. Lower the front exhaust pipe/catalytic converter assembly (3) and slide out of the mount at the transmission (if equipped).
7. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.



2.8L DIESEL ENGINE - W/DPF

WARNING: If torches are used when working on the exhaust system, do not allow the flame near the fuel lines.

1. Raise and support the vehicle.
2. Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Remove diesel particulate filter (DPF), if equipped (Refer to 11 - EXHAUST SYSTEM/PARTICULATE FILTER - REMOVAL).
4. Remove two bracket bolts (2).
5. Remove the nuts (1) from the front catalytic converter to turbocharger flange.
6. Lower the catalyst assembly (2) and slide out of the mount at the transmission (if equipped).
7. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.



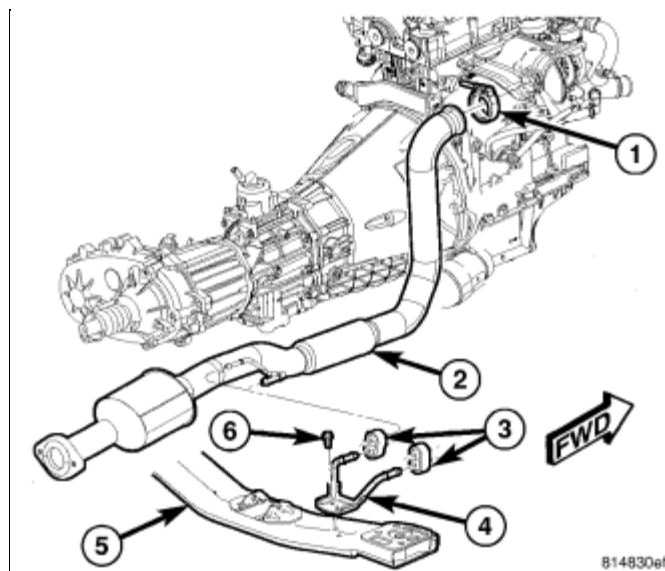
2.8L DIESEL ENGINE

WARNING: If torches are used when working on the exhaust system, do not allow the flame near the fuel lines.

1. Raise and support the vehicle.
2. Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Remove the nuts from the front exhaust pipe and catalytic converter to muffler flange.

NOTE: The front exhaust pipe and catalytic converter to turbocharger clamp is not reusable. Always use a new clamp when reinstalling the catalytic converter.

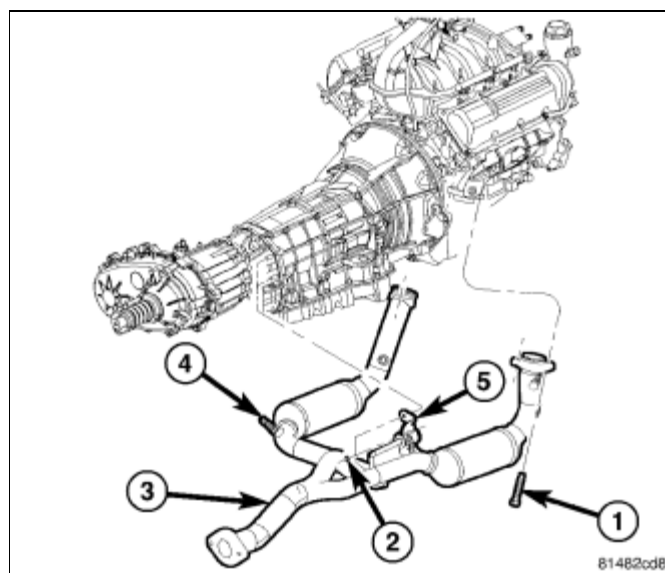
4. Remove the nut from the front exhaust pipe and catalytic converter to turbocharger clamp (1). Spread the clamp.
5. Lower the catalyst assembly (2) and slide out of the mount at the transmission (if equipped).
6. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.
7. Discard the front exhaust pipe and catalytic converter to turbocharger clamp (1). Discard clamp.



INSTALLATION

3.8L ENGINE

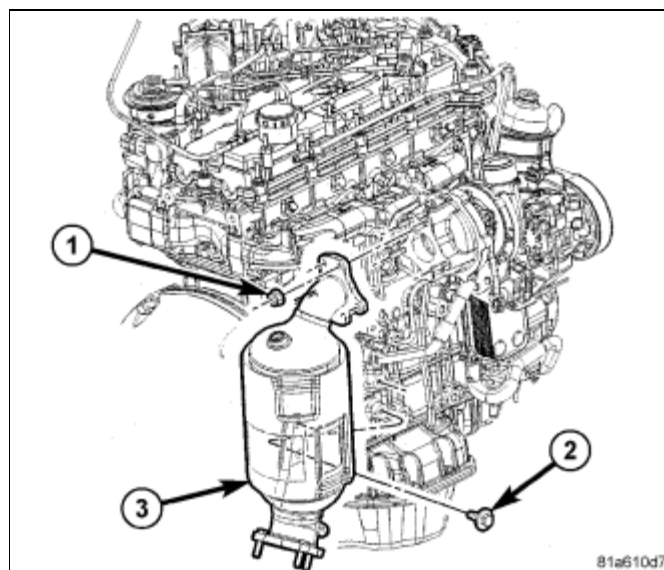
1. Position the front exhaust pipe and catalytic converter assembly (3) into the mount at the transmission (if equipped) and onto the exhaust manifold flange connection.
2. Install the nuts at the front exhaust pipe and catalytic converter assembly to muffler flange. Do not tighten.
3. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
4. Tighten the bolt (1) at exhaust manifold to 27 N·m (19 in. lbs.) torque.
5. Tighten the front exhaust pipe and catalytic converter assembly to muffler flange nuts to 27 N·m (19 ft. lbs.) torque.
6. Position the front pipe onto the exhaust manifold flange connection. Tighten the clamp to 10 N·m (95 in. lbs.) torque.



7. Connect oxygen sensor electrical connectors.
8. Lower the vehicle.
9. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
10. Check the exhaust system for contact with the body panels. Make adjustments, if necessary.

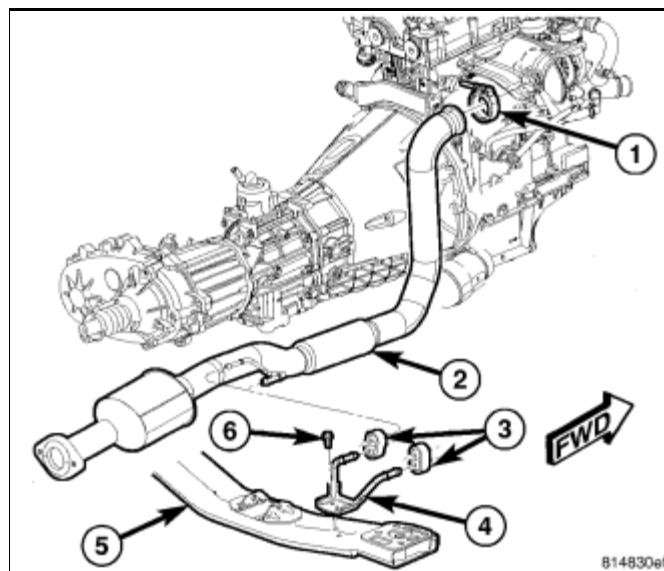
2.8L DIESEL - W/DPF

1. Position the front catalytic converter assembly (3) onto the turbocharger.
2. Install two catalytic converter mounting bolts. Tighten bolts to 27 N·m (19 ft. lbs.) torque.
3. Install DPF, if equipped (Refer to 11 - EXHAUST SYSTEM/PARTICULATE FILTER - REMOVAL).
4. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
5. Lower the vehicle.
6. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
7. Check the exhaust system for contact with the body panels. Make adjustments, if necessary.



2.8L DIESEL

1. Position new turbocharger to front exhaust pipe and catalytic converter clamp (1) on turbocharger.
2. Position the front exhaust pipe and catalytic converter assembly (2) into the mount at the transmission (if equipped) and onto the turbocharger.
3. Install the nuts at the front exhaust pipe and catalytic converter assembly to muffler flange. Do not tighten.
4. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
5. Tighten turbocharger to front exhaust pipe and catalytic converter assembly clamp nut to 27 N·m (19 ft. lbs.) torque.
6. Install the bolts at the front exhaust pipe and catalytic converter assembly (2) to muffler flange. Tighten the nuts to 27 N·m (19 ft. lbs.) torque.
7. Lower the vehicle.
8. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
9. Check the exhaust system for contact with the body panels. Make adjustments, if necessary.



PIPE-EXHAUST

REMOVAL

WARNING: The normal operating temperature of the exhaust system is very high. Therefore, never attempt to service any part of the exhaust system until it is cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operation time.

WARNING: If torches are used when working on the exhaust system, do not allow the flame near the fuel lines.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

1. Raise and support the vehicle.
2. Saturate the studs and nuts with a Mopar® rust penetrant. Allow 5 minutes for penetration.
3. Disconnect oxygen sensor connectors and remove sensors from the exhaust pipe and the catalytic converter.
4. Disconnect the catalytic converter from the engine exhaust manifold.
5. Remove exhaust pipe to muffler flange retaining nuts.
6. Slide exhaust pipe forward until exhaust pipe hanger disengages from transmission support. Remove exhaust pipe and catalytic converter from vehicle.

INSTALLATION

1. Position exhaust pipe and catalytic converter into vehicle.
2. Insert exhaust pipe hanger into transmission support.
3. Make sure the exhaust system is aligned and has the proper clearance. The minimum clearance is 25mm (1 inch).
4. Tighten muffler to catalytic converter flange retaining nuts to 28 N·m (21 ft. lbs.).
5. Tighten exhaust pipe to exhaust manifold mounting bolts to 31 N·m (23 ft. lbs.).
6. Install the oxygen sensors in the exhaust pipe and catalytic converter and connect oxygen sensor connectors.
7. Lower vehicle.
8. Start engine and inspect for leaks. Repair exhaust leaks as necessary.
9. Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

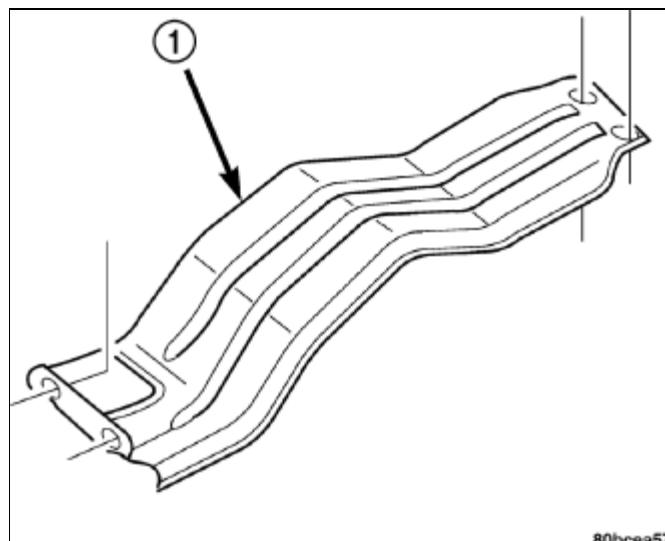
SHIELDS-HEAT

DESCRIPTION

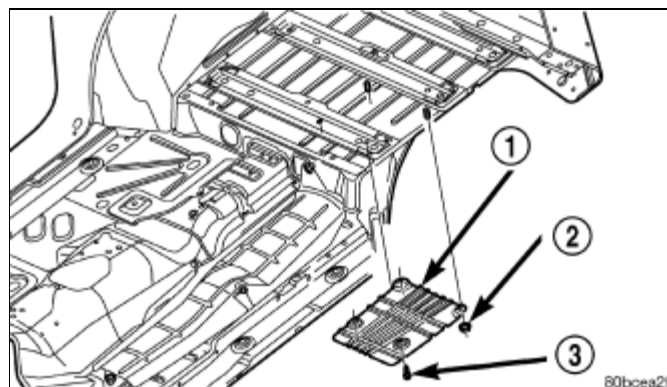
Heat shields are made of stamped/formed steel, or metal foil.

Exhaust heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency.

REMOVAL

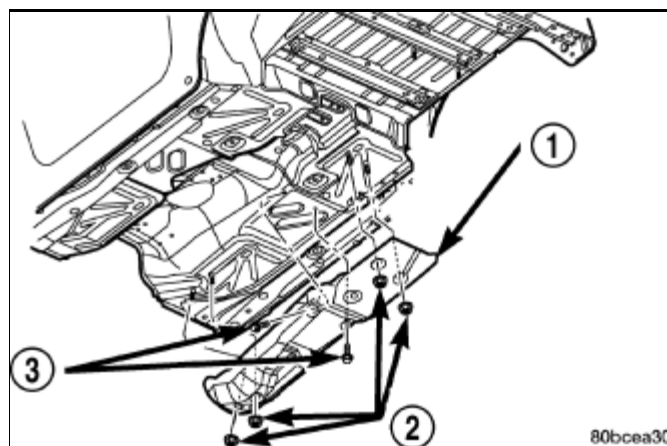


1. Raise and support the vehicle.
2. Remove the screws or nuts holding the heat shields to the frame or floor pan.

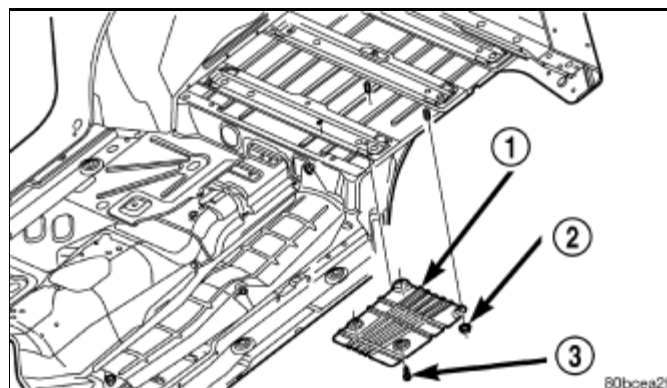


3. When removing muffler heat shield, the muffler front support bracket must be removed first.
4. Slide the shields out around the exhaust system.

INSTALLATION



1. Position the heat shields to the floor pan or the frame and install the screws or nuts

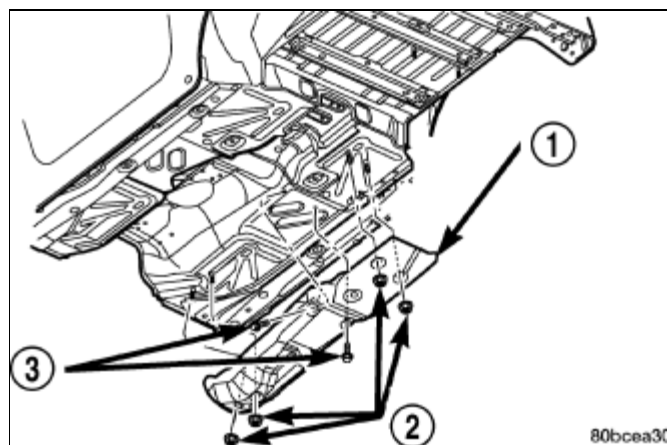


2. Tighten the nuts or screws to 45 N·m (33 ft. lbs.).
3. Lower the vehicle.

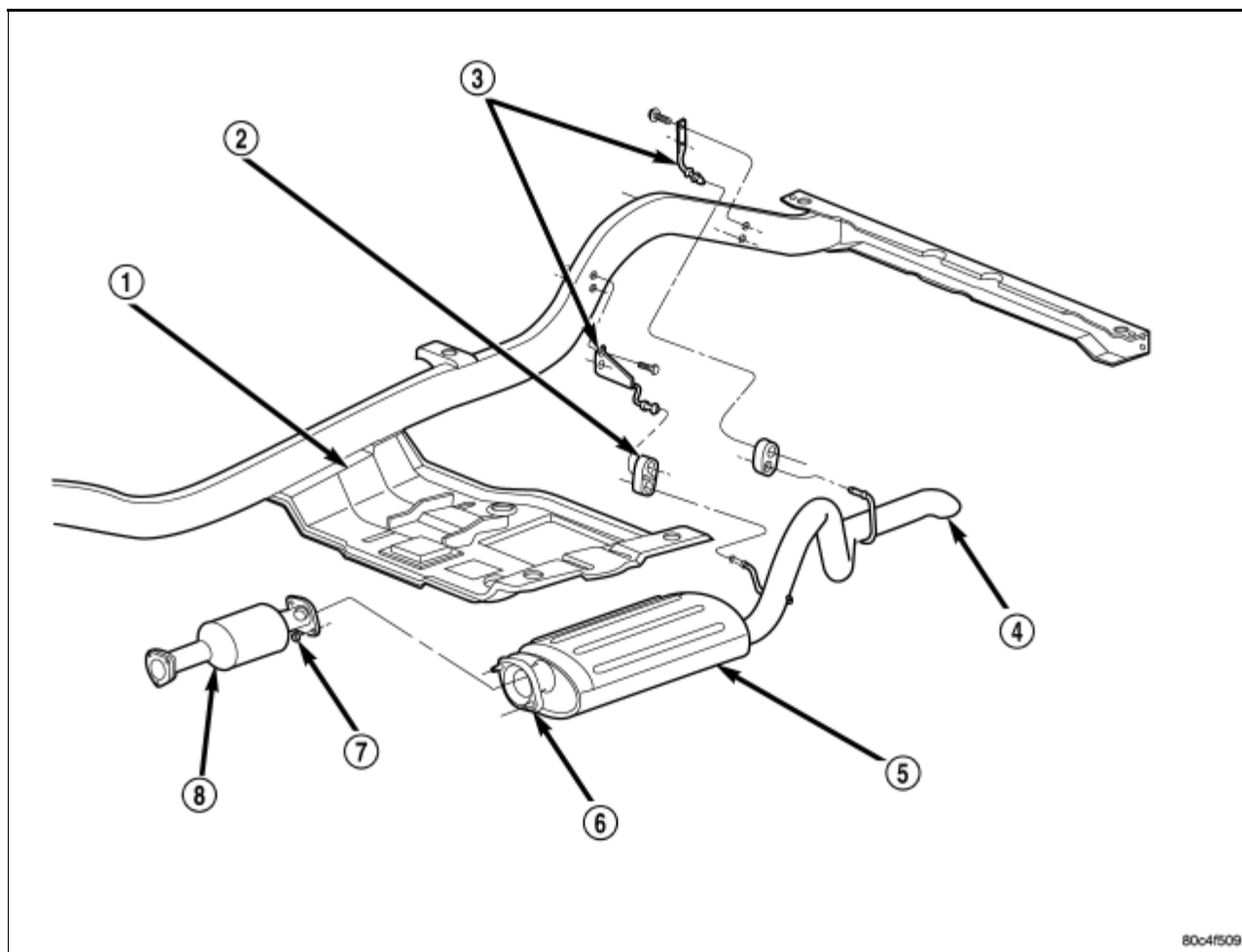
MUFFLER

DESCRIPTION

All engines use a stainless steel muffler and tailpipe assembly to control exhaust noise levels and exhaust back pressure.



REMOVAL



WARNING: The normal operating temperature of the exhaust system is very high. Therefore, never attempt to service any part of the exhaust system until it is cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operation time.

WARNING: If torches are used when working on the exhaust system, do not allow the flame near the fuel lines.

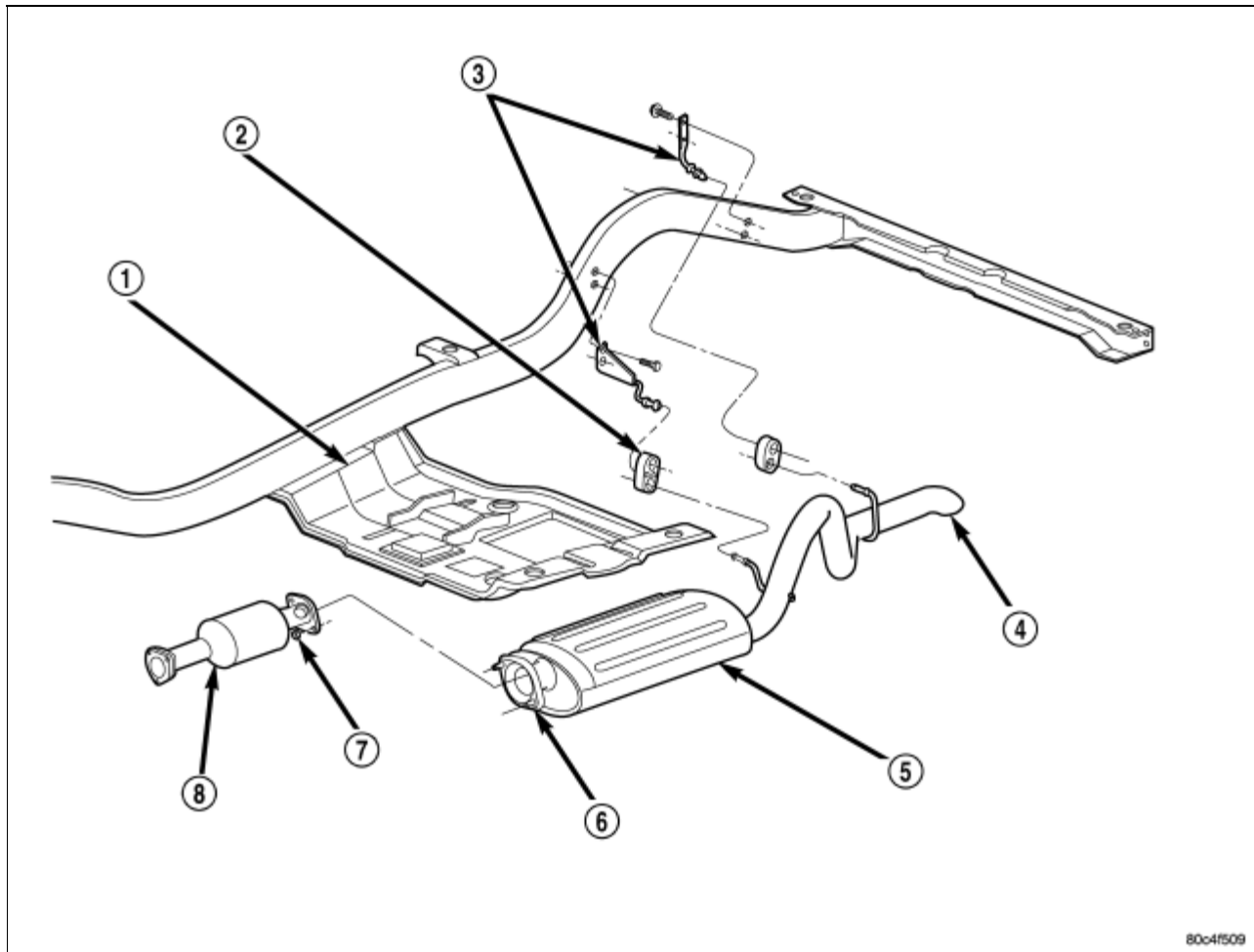
CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and oxygen sensor.

All original equipment exhaust systems are manufactured with the exhaust tailpipe welded to the muffler. Service replacement mufflers and exhaust tailpipes are either clamped together or welded together.

1. Raise the vehicle and support the rear of the vehicle by the side rails and allow the axle to hang free.
2. Remove the tailpipe hangers from the insulators.
3. Remove muffler to catalytic converter flange retaining nuts.

4. Remove muffler and tailpipe assembly from vehicle.

INSTALLATION



1. Position muffler and tailpipe assembly into vehicle.
2. Position muffler and catalytic converter flanges together and install nuts. **DO NOT** tighten nuts at this time.
3. Install tailpipe hangers into the insulators.
4. Make sure the muffler and tailpipe are correctly positioned and properly aligned. The minimum clearance between components is 25mm (1 inch).
5. Tighten muffler to catalytic converter flange nuts to 28.5 N·m (21 ft. lbs.).
6. Lower vehicle.
7. Start engine and inspect for leaks. Repair exhaust leaks as necessary.
8. Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

TAILPIPE

DESCRIPTION

The tailpipe is made of stainless steel.

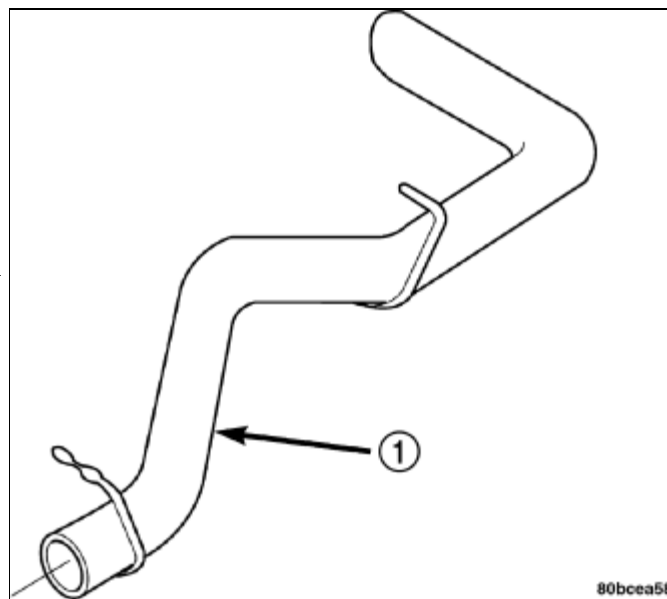
OPERATION

The tailpipe channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment. The tail pipe and muffler are serviced as an assembly.

FILTER-DIESEL PARTICULATE

DESCRIPTION

A diesel particulate filter (DPF) is installed for exhaust gas after-treatment. The DPF is located downstream of the main oxidation catalyst. The DPF filters, stores and burns particulate matter (soot) that is generated during the combustion process. The soot is oxidized to carbon dioxide CO₂ at exhaust temperatures over 600°C (1,112°F).



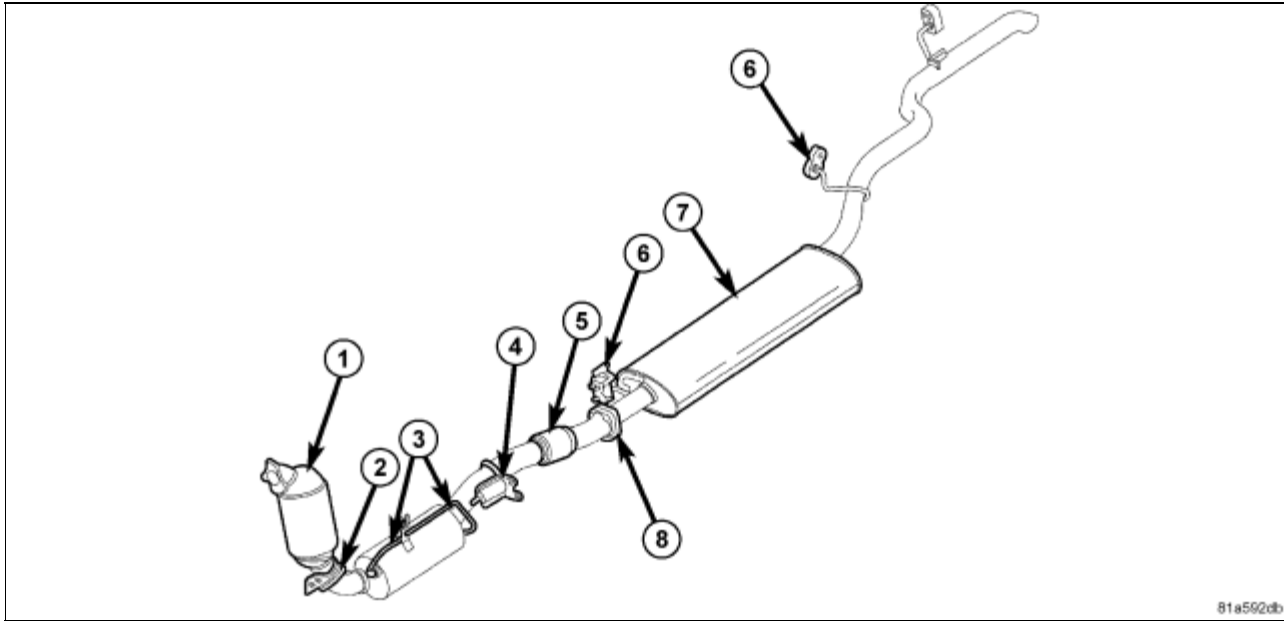
OPERATION

The oxidation catalysts raise the exhaust gas temperatures to regenerate the DPF, which is passive regeneration. If the passive regeneration cannot keep up with the build up of soot in the DPF, the ECM will actively regenerate the DPF to burn off the soot. Residue remains inside the DPF in the form of non burnable ash. Ash comes from the oils and other materials that are trapped in the oils and are present in the soot. Ash is not eliminated by the regeneration cycle. Excessive ash accumulation requires the replacement of the DPF. The DPF uses a silicon carbide wall-flow monolith with a platinum coating to trap particulates. The monolith contains a large number of square parallel channels, which run in the axial direction and are separated by thin porous walls. The channels are alternatively open at one end, but plugged at the other. The exhaust gases flow through the walls and escape through the pores in the wall material. Particulates, however, are too large to escape and are trapped in the monolith walls. The ECM starts the regeneration of the DPF if the soot load exceeds a performance map value. The ECM determines the load condition of the DPF based upon the exhaust gas pressure upstream and downstream of the DPF. A pressure differential sensor provides the pressure input to the ECM. During the regeneration process, the ECM raises the temperature in the DPF to burn off the soot accumulated. Under normal operation, the engine does not produce enough heat to oxidize the soot inside the DPF. This process requires temperatures above 550 °C (1,022 °F). After regeneration, the ECM reads the actual pressure difference at the DPF and compares it with a reference value. From this comparison, the ECM determines the ash quantity inside the DPF.

DIAGNOSIS AND TESTING

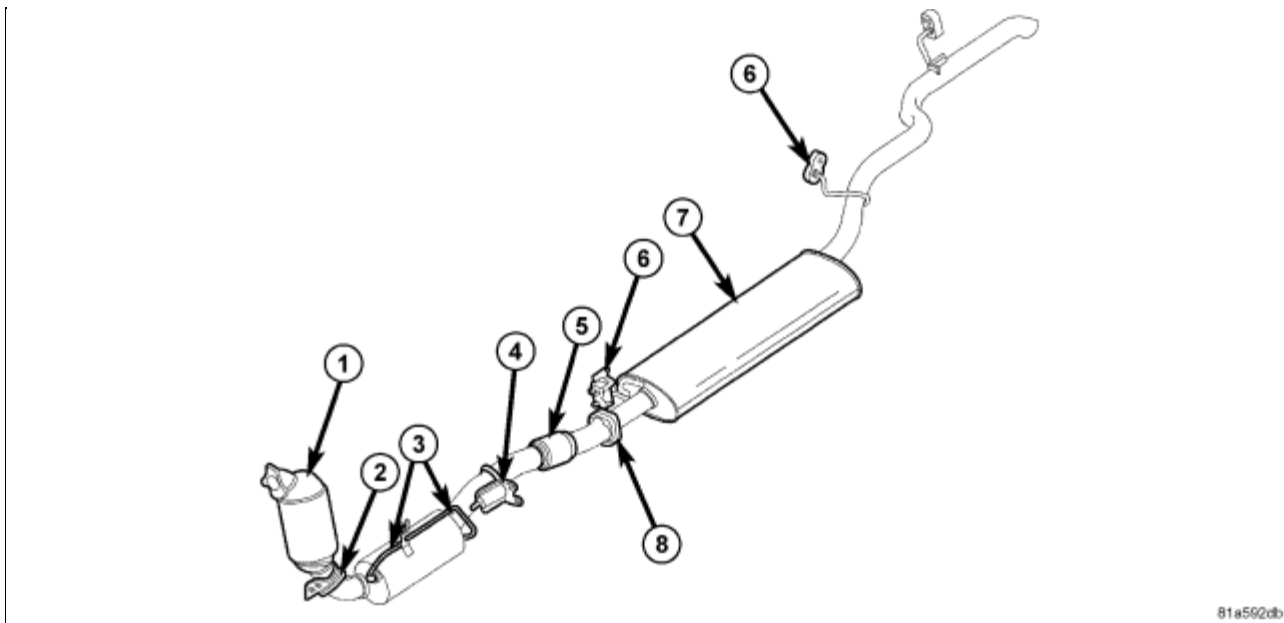
The engine Electronic Control Module (ECM) monitors the soot load in the diesel particulate filter. Under normal operating conditions the diesel particulate filter is self-cleaning, where accumulated soot is converted to ash. Under light load operating conditions, the driver may be notified via the vehicle's Electronic Vehicle Information Center (EVIC). The ECM will set a fault if it detects that the soot level has exceeded the normal desoot trigger threshold by a sufficient amount to indicate that the driver intervention is required. If the MIL light comes on, refer to the Engine Electrical Diagnosis and follow the procedure for the retrieved code.

REMOVAL



1. Disconnect negative battery cable.
2. Raise and support vehicle.
3. Disconnect differential pressure hoses from pressure sensor tubing (3).
4. Disconnect oxygen sensor electrical connector.
5. Remove muffler and tail pipe to DFP flange nuts.
6. Remove the DFP to exhaust manifold nuts.
7. Remove steady rest mounting bolts (4).
8. Remove the diesel particulate filter assembly.

INSTALLATION

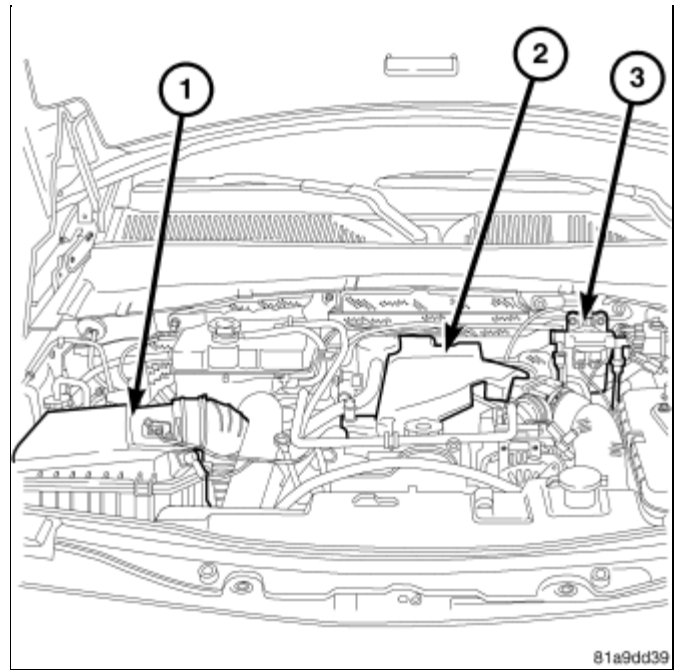


1. Position diesel particulate filter assembly in vehicle.
2. Install DPF to exhaust manifold bolts. Do not tighten at this time.
3. Install muffler/tailpipe to DPF flange nuts. Tighten nut to 32 N·m. (24 ft. lbs.).
4. Tighten DPF to exhaust manifold bolts to 32 N·m (24 ft. lbs.) Tighten muffler/tailpipe to DPF flange nuts to 34 N·m (24 ft. lbs.).
5. Lower vehicle.
6. Using scan tool, under ENGINE MISC. FUNCTIONS, perform DIESEL PARTICULATE FILTER REPLACEMENT function.

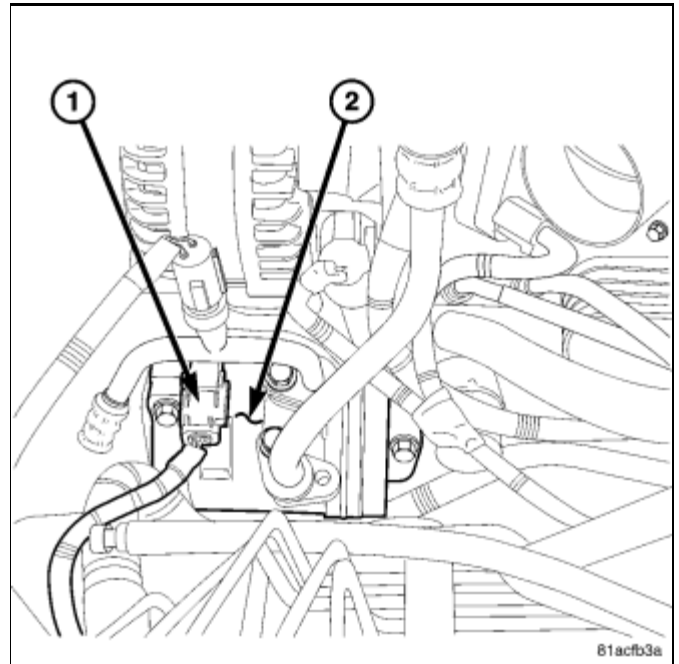
TURBOCHARGER

REMOVAL

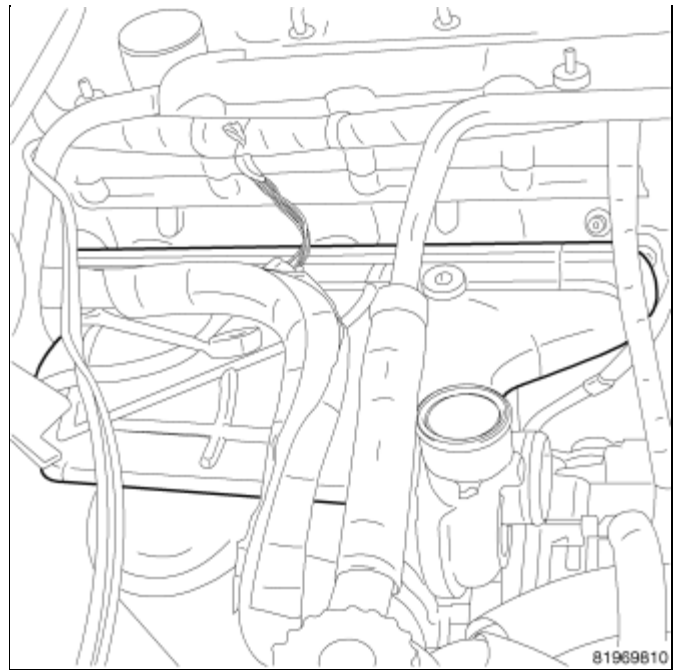
1. Disconnect negative battery cable.
2. Remove engine cover.
3. Disconnect the inlet air pressure sensor wiring harness connector, disconnect the air outlet duct from the turbocharger, and remove air cleaner assembly.
4. Remove air inlet tube from turbocharger.



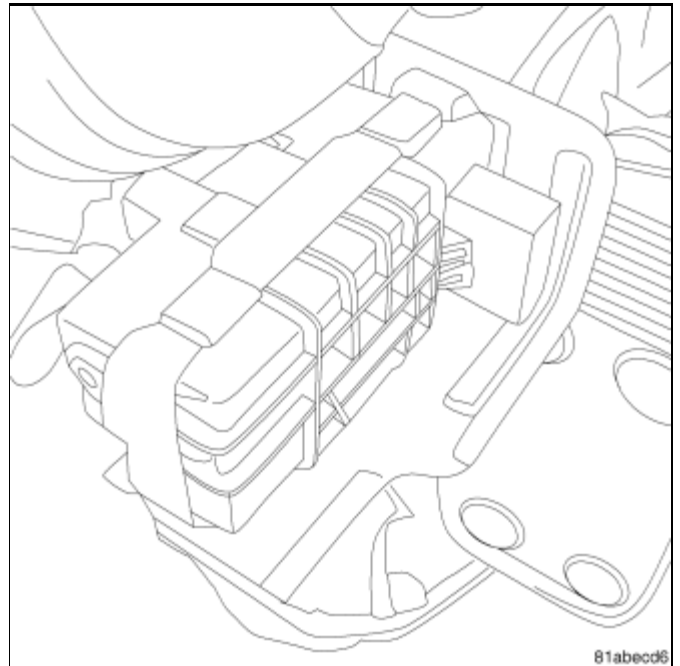
5. Remove air conditioning bracket bolt.



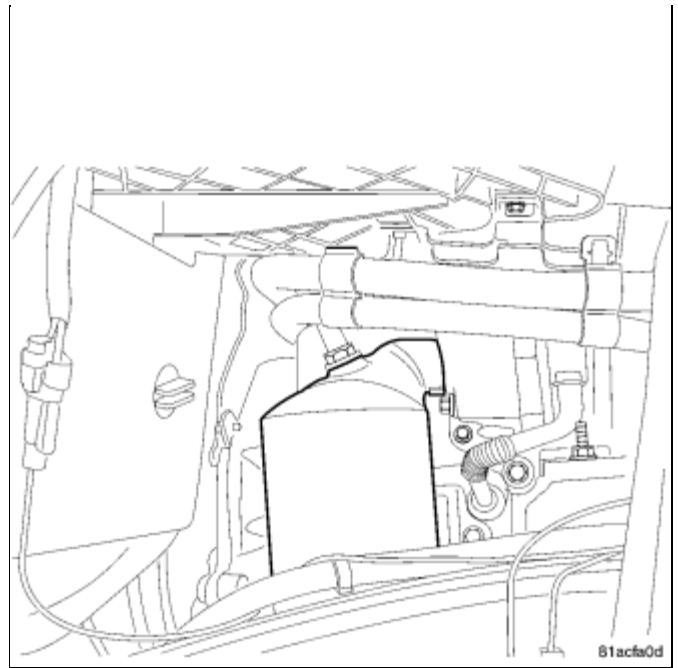
6. Remove the bolts from the exhaust manifold heat shield.
7. Remove the exhaust manifold heat shield.



8. Disconnect the turbocharger module connector.
9. Remove the right front tire.
10. Remove the right front inner fender well.

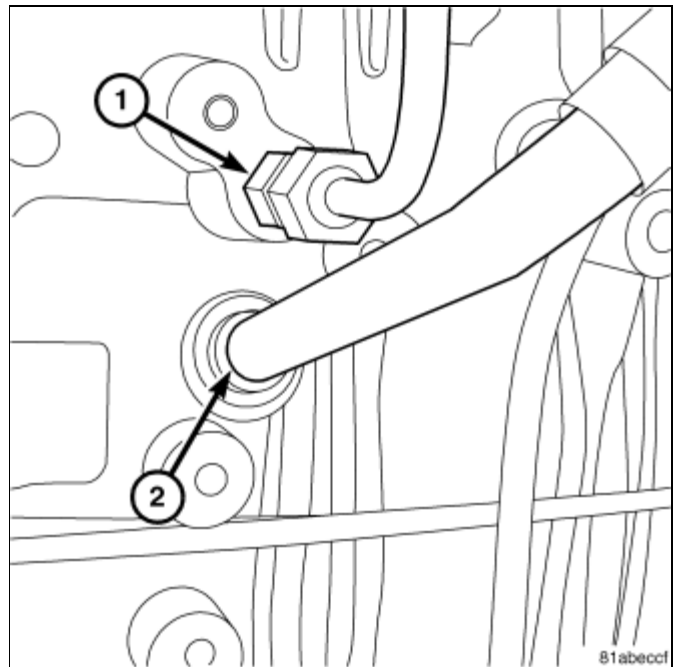


11. Remove the bolts from the downstream flange of the turbocharger.
12. Remove the bolts from the turbocharger to engine bracket.
13. Remove the bolts from the upstream side of the muffler.
14. Remove the bolts from the bottom of the maniverter.

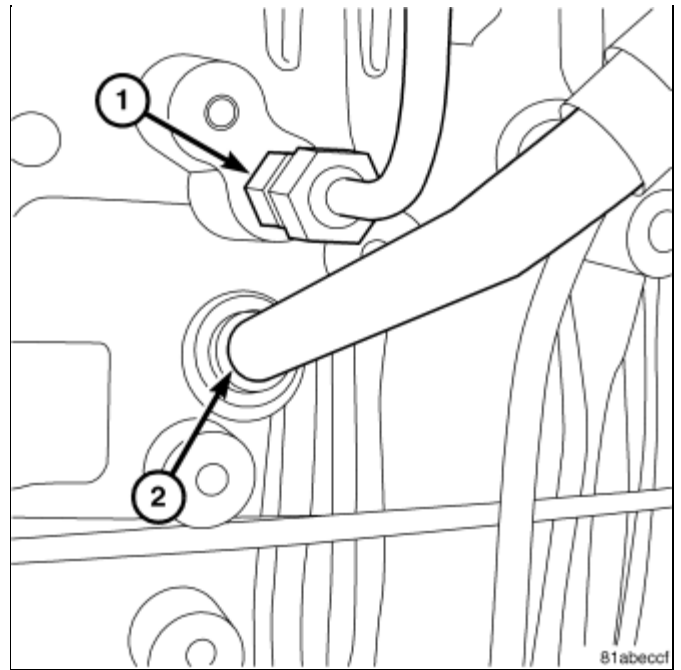


15. Remove the turbocharger oil lines.
16. Remove the turbocharger to exhaust manifold bolts.
17. Remove turbocharger.

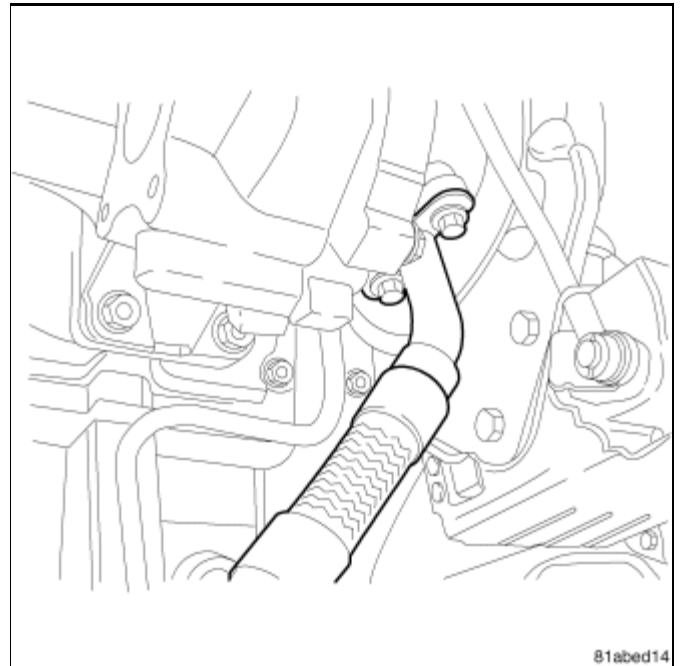
INSTALLATION



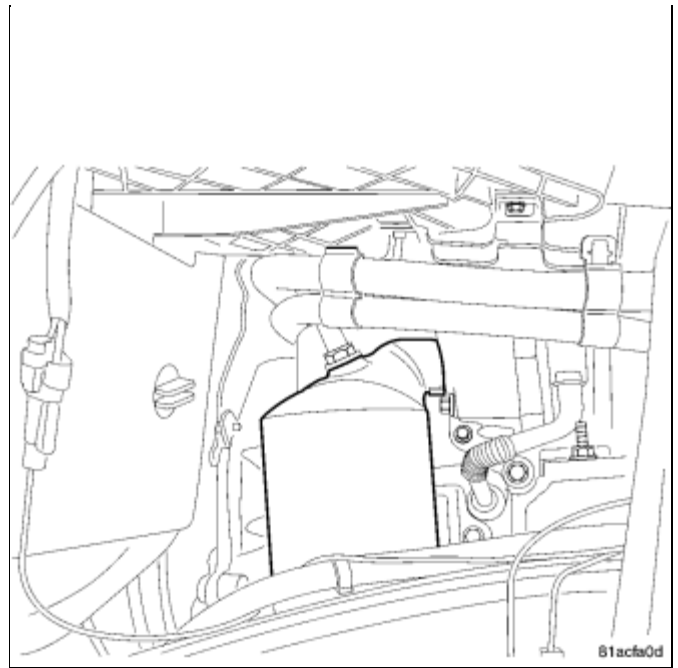
1. Position turbocharger to exhaust manifold with new gasket. Tighten retaining nuts to 32 N·m.
2. Install the turbocharger oil lines.



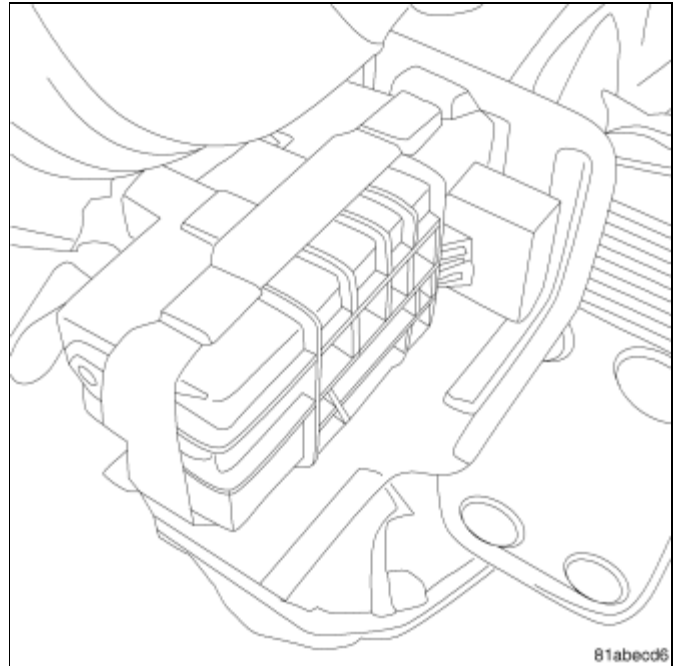
3. Install turbocharger return line. Tighten bolts to 11 N·m (11 in. lbs.).



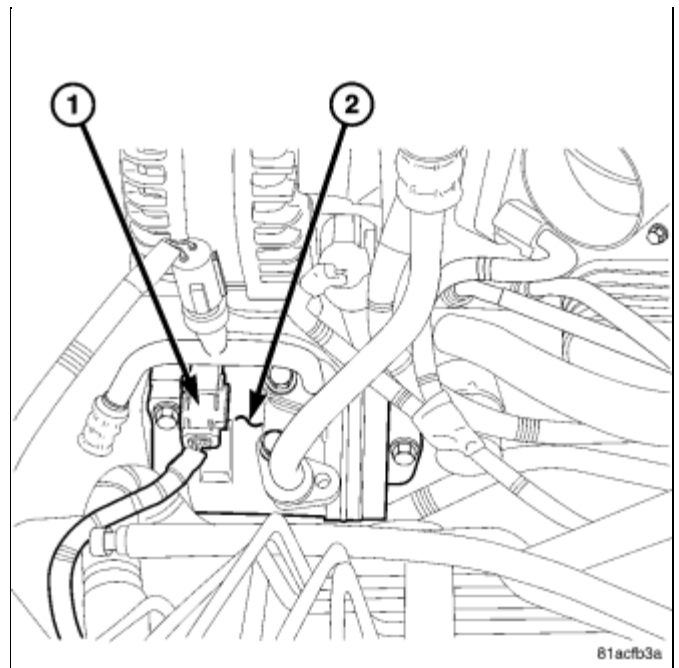
4. Install the diesel particulate filter.
5. Install the bolts from the bottom of the maniverter.
6. Install the forward diesel particulate filter pressure tube.
7. Install the bolts from the upstream side of the muffler.
8. Install the bolts from the turbocharger to engine bracket.



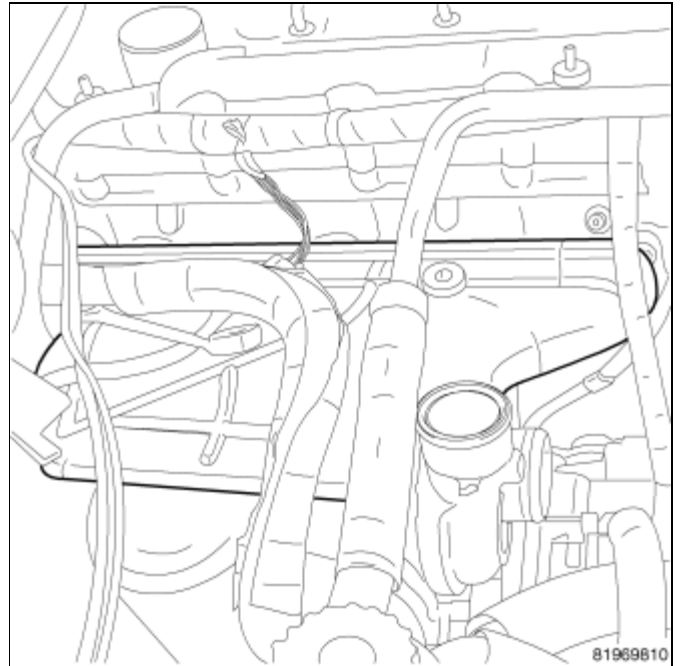
9. Install the bolts from the downstream flange of the turbocharger.
10. Connect the turbocharger module connector.



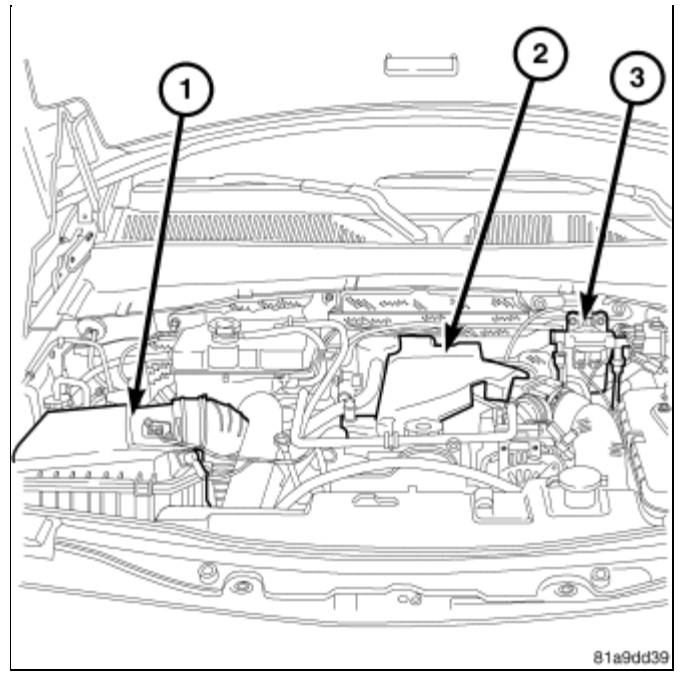
11. Install the air conditioning bracket bolt.



12. Install the exhaust manifold heat shield.
13. Install the exhaust manifold heat shield bolts.



14. Install the inlet air tube from the turbocharger.
15. Install the air cleaner housing.
16. Install the silencer.
17. Install the engine cover.



13 - FRAME & BUMPERS

FRAME & BUMPERS

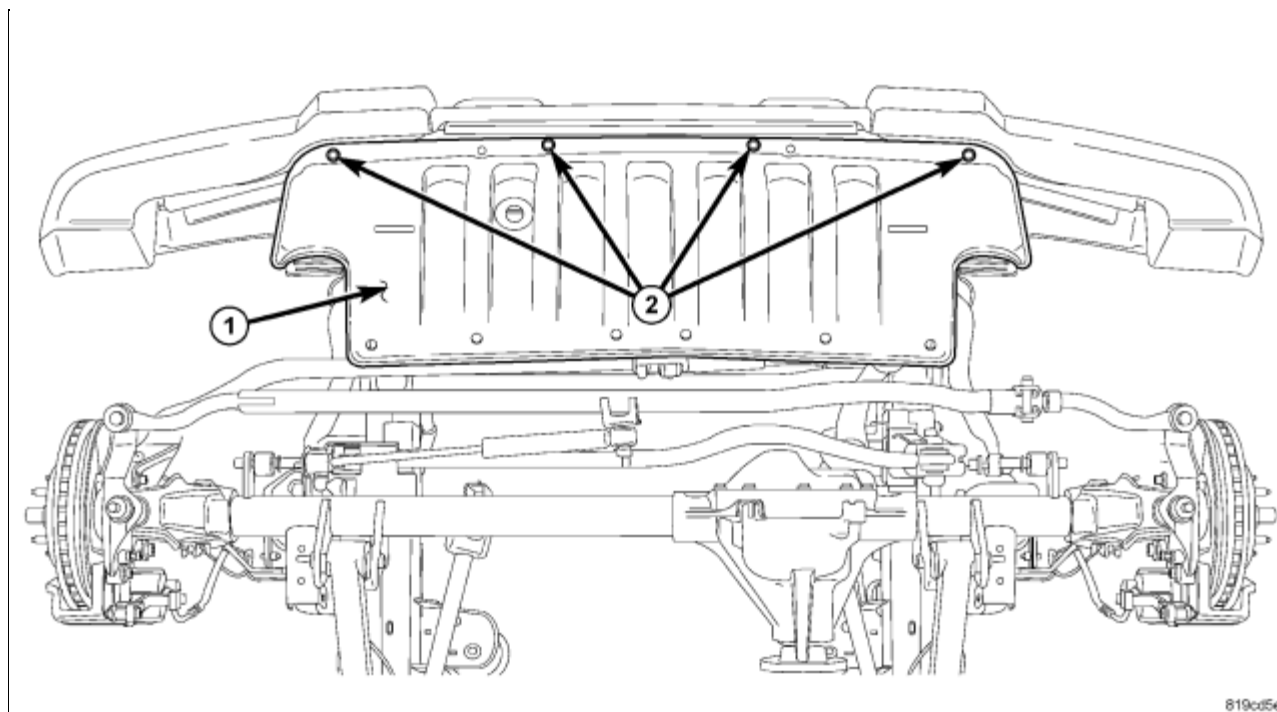
SPECIFICATIONS

TORQUE

Description	N·m	Ft. Lbs	In. Lbs.
Front bumper support bolts	90	66.5	—
Fuel tank skid plate to crossmember bolts	99	73	—
Rear bumper support bolts	25	18.5	—
Rear bumper support bracket to frame bolts	55	40.5	—
Trailer hitch/rear tow hook bolts	81	60	—
Transfer case skid plate crossmember bolts	65	48	—
Transfer case skid plate support bracket bolts	65	48	—
Transmission crossmember bolts	122	90	—
Transmission skid plate support crossmember bolts	65	48	—
Transmission skid plate to crossmember bolt	65	48	—

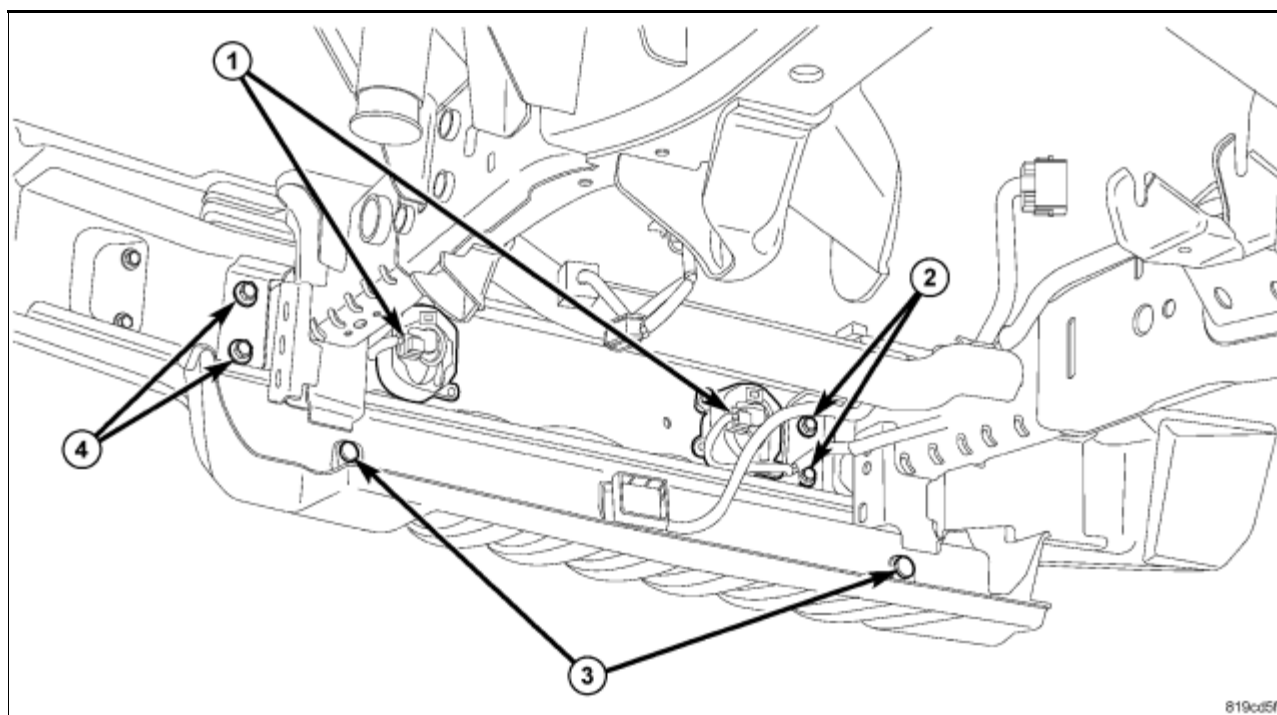
BUMPER - FRONT

REMOVAL



819cd5ef

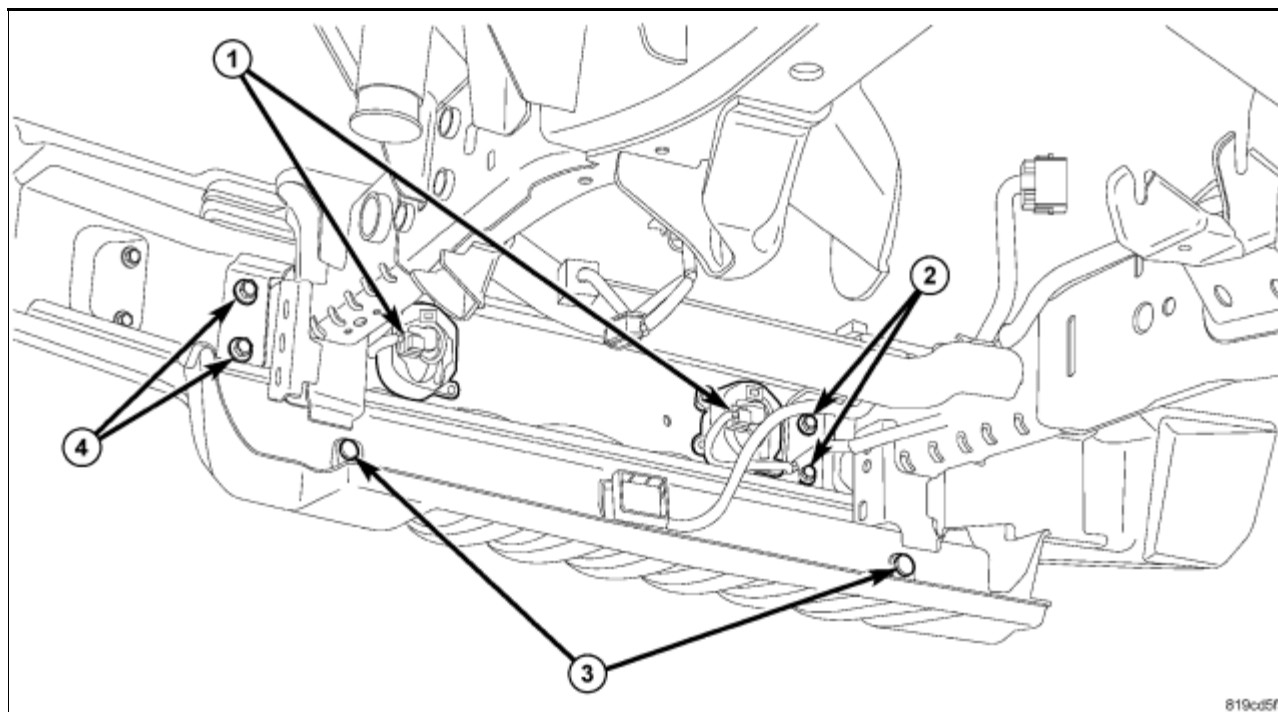
1. Remove the push pin fasteners (2) and release the splash shield (1) from the bumper.



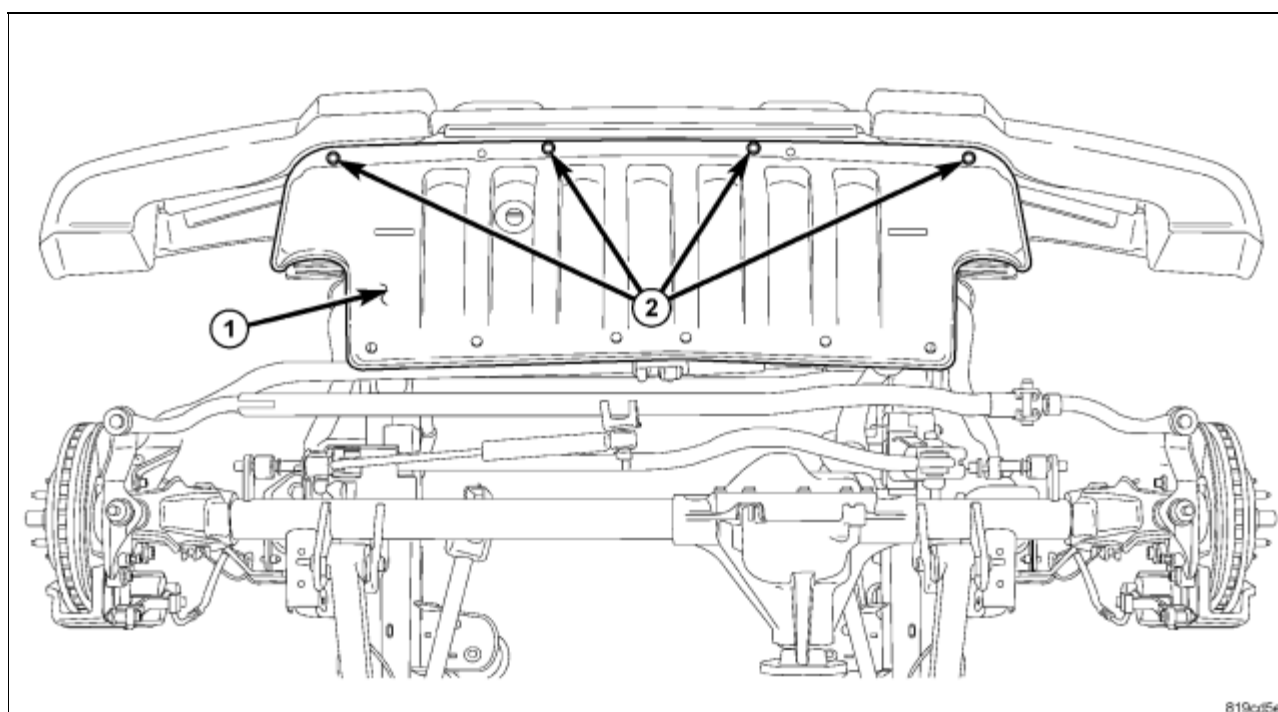
819cd5f3

2. Remove the push pin fasteners (3) and remove the splash shield.
3. Disconnect the electrical connectors (1).
4. Remove the outer (4) and inner support bolts (2) and remove the front bumper.

INSTALLATION



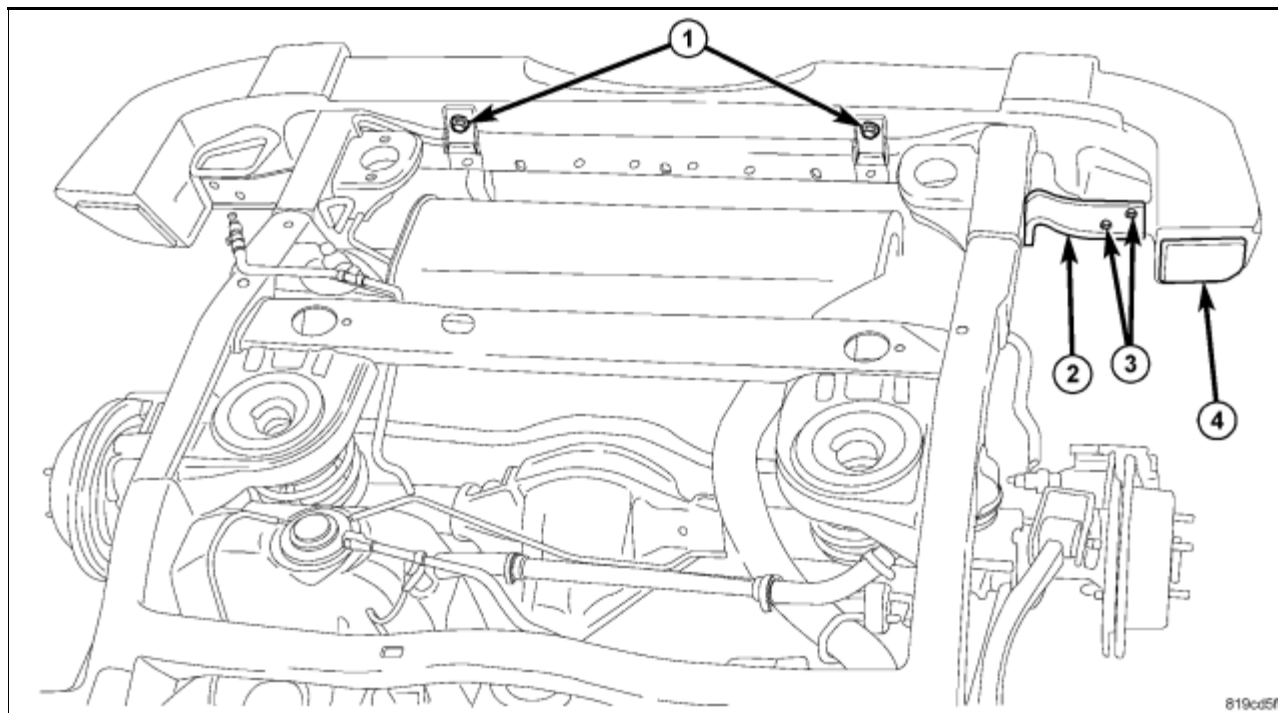
1. Install the bumper and install the inner (2) and outer support bolts (4).
2. Tighten the support bolts to 90 N·m (66.5 ft. lbs.).
3. Connect the electrical connectors (1).
4. Install the splash shield and install the push pin fastener (3).



5. Position the splash shield (1) onto the bumper and install the push pin fasteners (2).

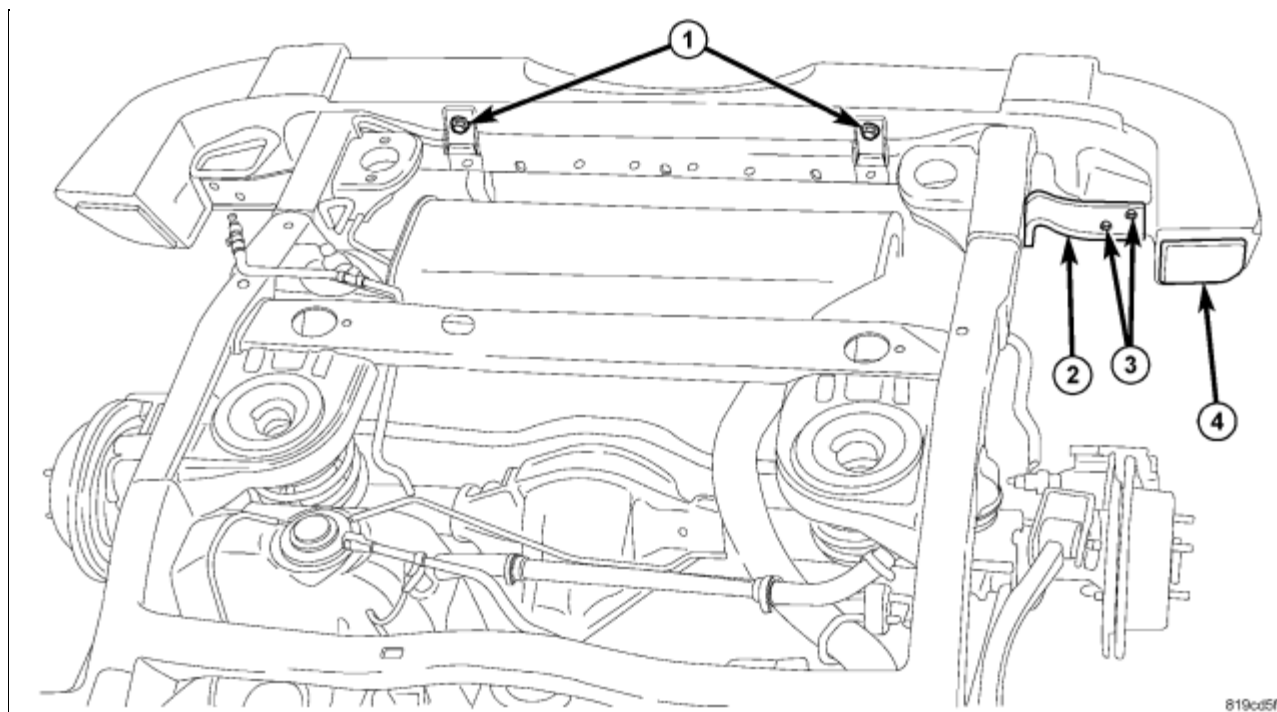
BUMPER - REAR

REMOVAL



1. Remove the bumper bracket bolts (3).
2. Remove the bumper support bolts (1) and remove the bumper (4).

INSTALLATION



1. Install the bumper (4) and install the bolts (1) and (3).
2. Tighten the bolts (1) and (3) to 25 N·m (18.5 ft. lbs.).

FRAME

WARNING

Use of Heat During Repair

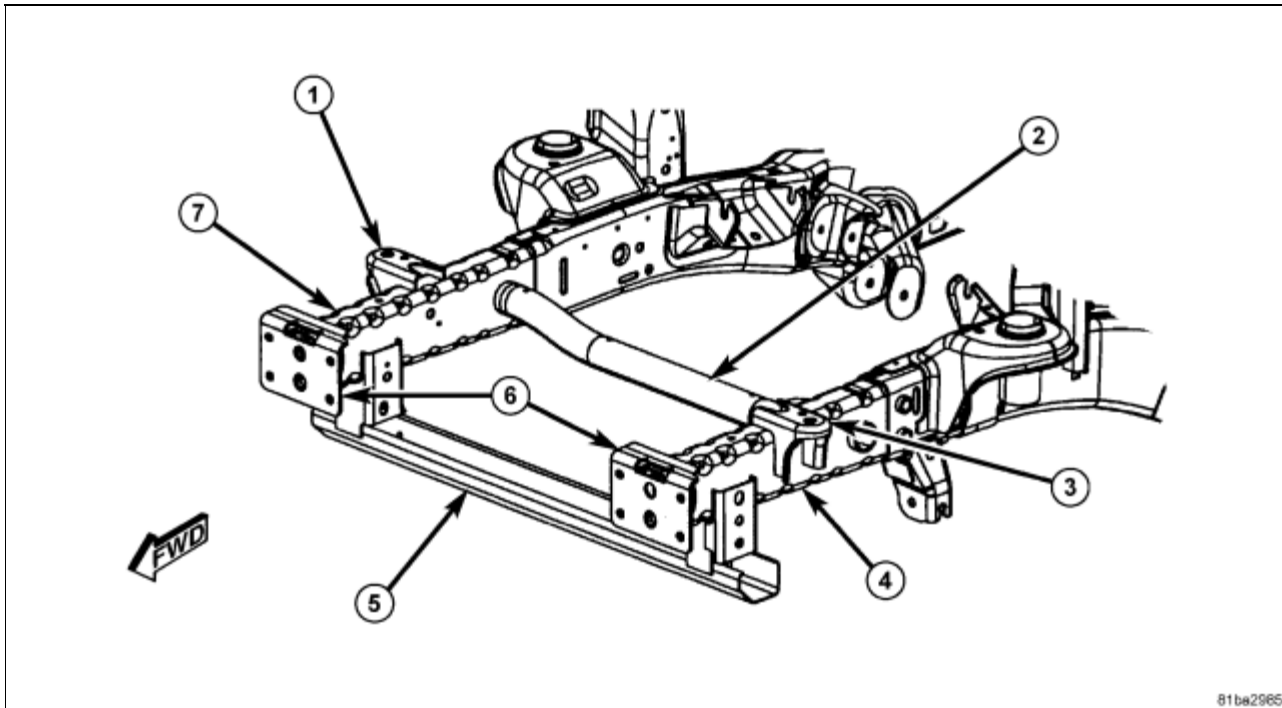
WARNING: Chrysler Group engineering's position on the use of heat during collision repair is as follows:

- Any body panel or frame component damaged which is to be repaired and reused, must be repaired using the "cold straightening" method. No heat may be used during the straightening process.
- During rough straightening prior to panel replacement, damaged panels or frame components may be heated to assist in body/frame realignment. The application of heat must be constrained to the parts which will be replaced and not allowed to affect any other components.

This "no heat" recommendation is due to the extensive use of high strength and advanced high strength steels in Chrysler Group products. High-strength materials can be substantially and negatively affected from heat input which will not be obviously known to the repairer or consumer. Ignoring these recommendations may lead to serious compromises in the ability to protect occupants in a future collision event, reduce the engineered qualities and attributes, or decrease the durability and reliability of the vehicle. Failure to follow these instructions may result in serious or fatal injury. This statement supersedes any previously released information by the Chrysler Group.

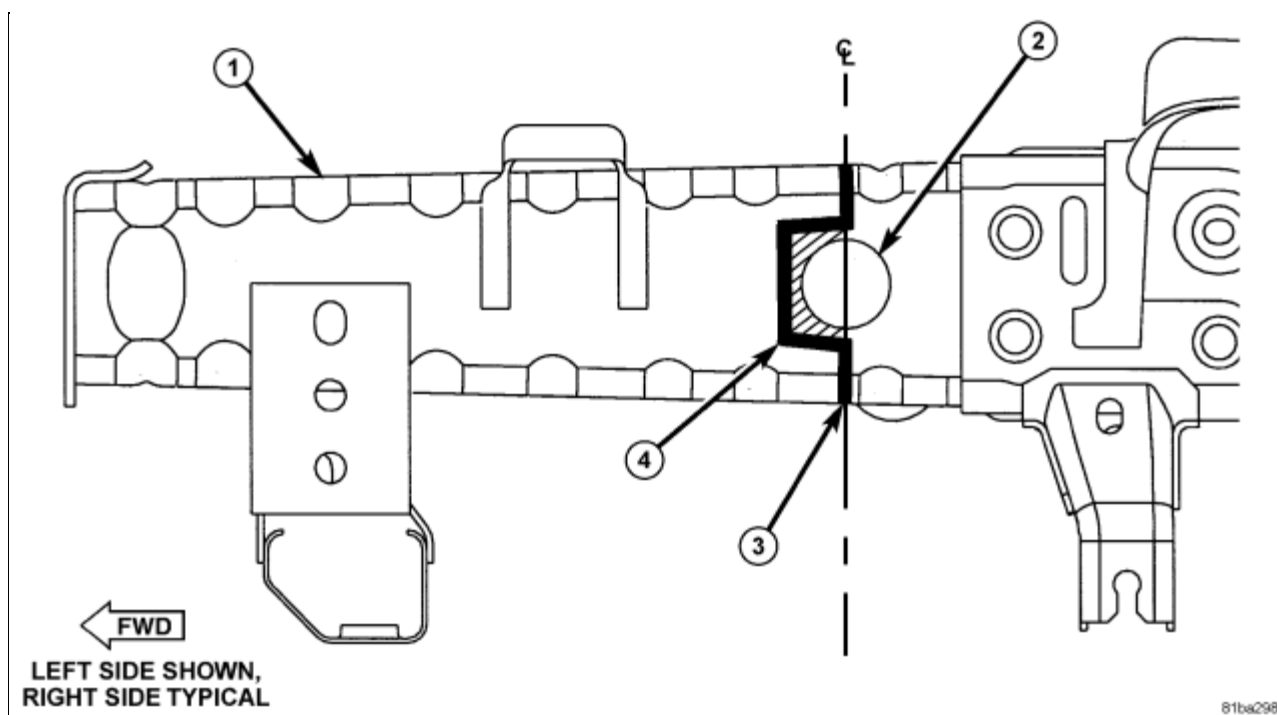
STANDARD PROCEDURE

FRONT FRAME RAIL TIP REPLACEMENT

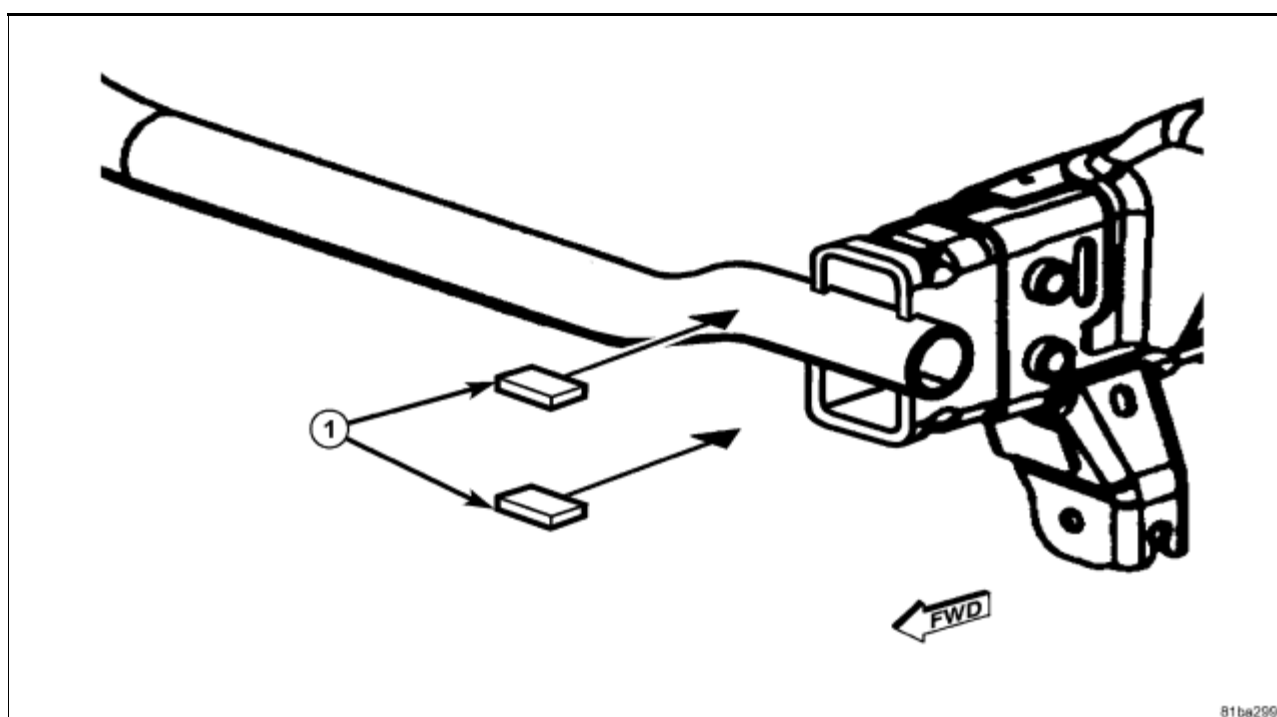


1 - FONT END SHEET METAL (FESM) BRACKET
2 - CROSS-FRAME TUBE
3 - FESM BRACKET
4 - LEFT FRAME RAIL
5 - COMPATIBILITY BEAM
6 - BUMPER MOUNTING BRACKETS
7 - RIGHT FRAME RAIL

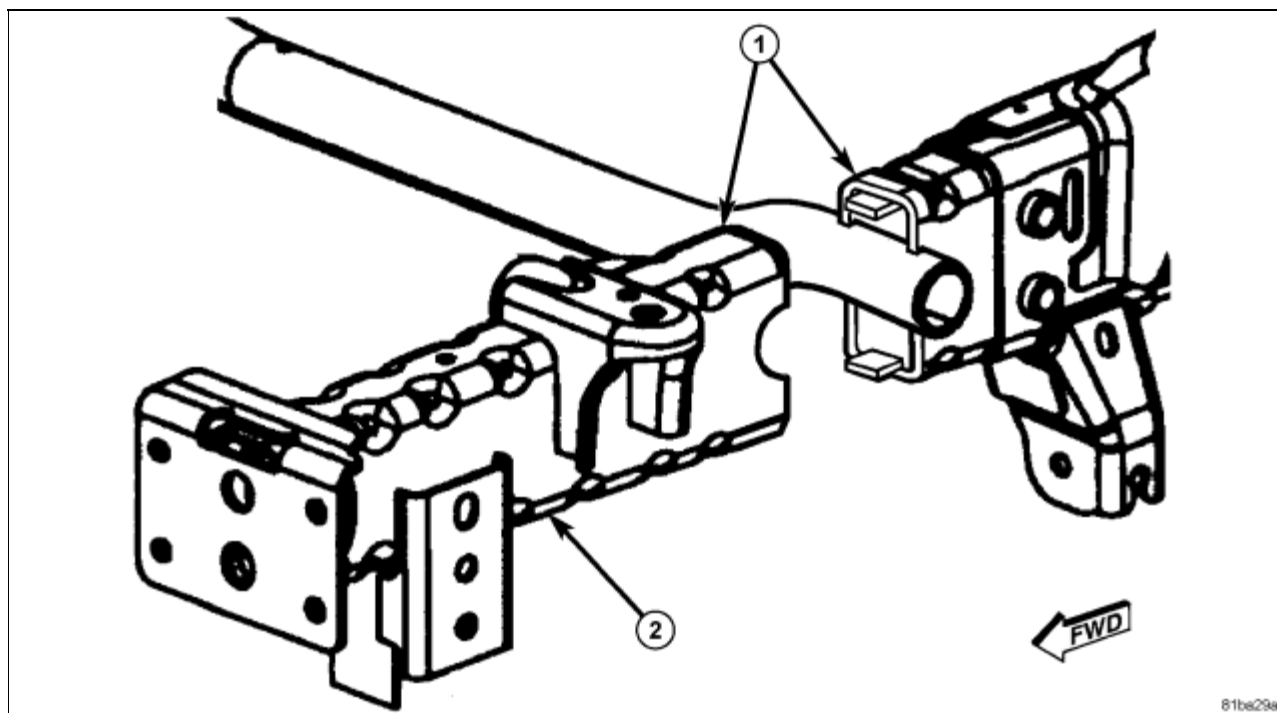
1. Mount the vehicle on appropriate frame correction equipment (“frame rack”) and using a three-dimensional measuring system measure frame/body and correct to vehicle specifications.
2. Release welds holding compatibility beam (5) brackets to rails (4 and 7) and remove – if compatibility beam is to be replaced also, the brackets only need to be removed from the undamaged rail.



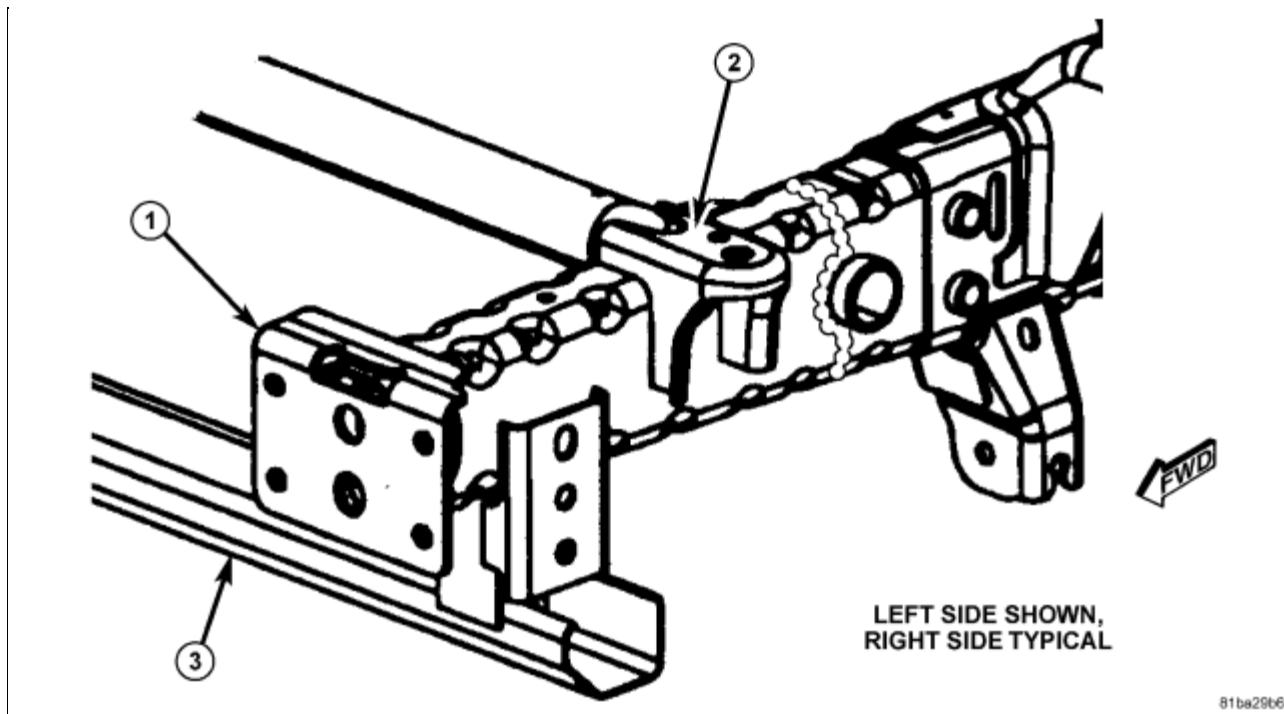
3. At the centerline of the cross-frame tube, use a reciprocating saw to make a vertical cut (3) through the frame rail to the tube (2) from both the top and bottom.
4. Using either a reciprocating saw or a plasma cutter, cut forward of the tube (4) to release the rail (1) from the tube (2).
5. Grind off any remaining rail or weld attached to the tubular crossmember forward of the original vertical cuts in preparation for the replacement part.
6. Any cuts into the tubular crossmember should be welded and dressed smooth before proceeding.



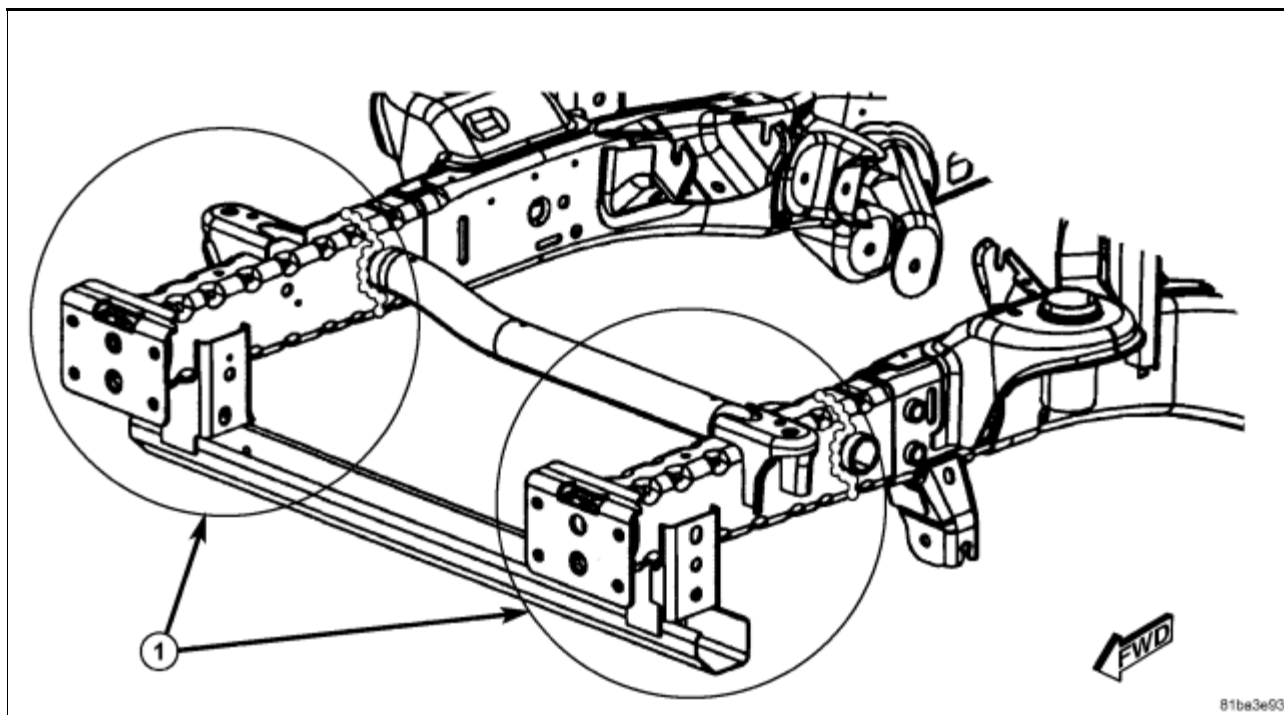
7. From the removed rail, cut weld-backers (1) which will fit snugly into the original frame at the cut location. Position these backers so 12.7 mm (1/2 inch) protrudes from the section location.
8. Cut the service part vertically at the same location as the original frame.
9. Clean and de-burr all cut edges, remove e-coat within 25.4 mm (1 inch) of the joint from the inside and outside of all the surfaces.
10. Make sure that a slight bevel is created at the butt-weld joint to allow complete weld penetration.
11. Refer to the weld chart (Refer to 13 - FRAME & BUMPERS/FRAME - SPECIFICATIONS) for proper weld rod and approximate welder settings, and adjust the welder to create a proper weld bead.



12. Position new (cut) rail tip (2) in proper position and tack-weld in place (1).
13. Weld replacement tip in place using a skip-stitch process – welding in 50.8 mm (2 inch) increments, weld the rail on opposing sides to avoid distortion, Also allow the rail to cool between the welding operations.



14. Position and tack-weld FESM bracket (2), bumper mounting bracket (1), and compatibility beam (3).
15. When dimensional accuracy is confirmed, finish weld all components using the original weld locations as a guideline.
16. If the FESM brackets and bumper mounting brackets were not pierced, create the appropriate piercings at this time. Refer to [Bracket Locations And Modifications](#) for correct dimensions.



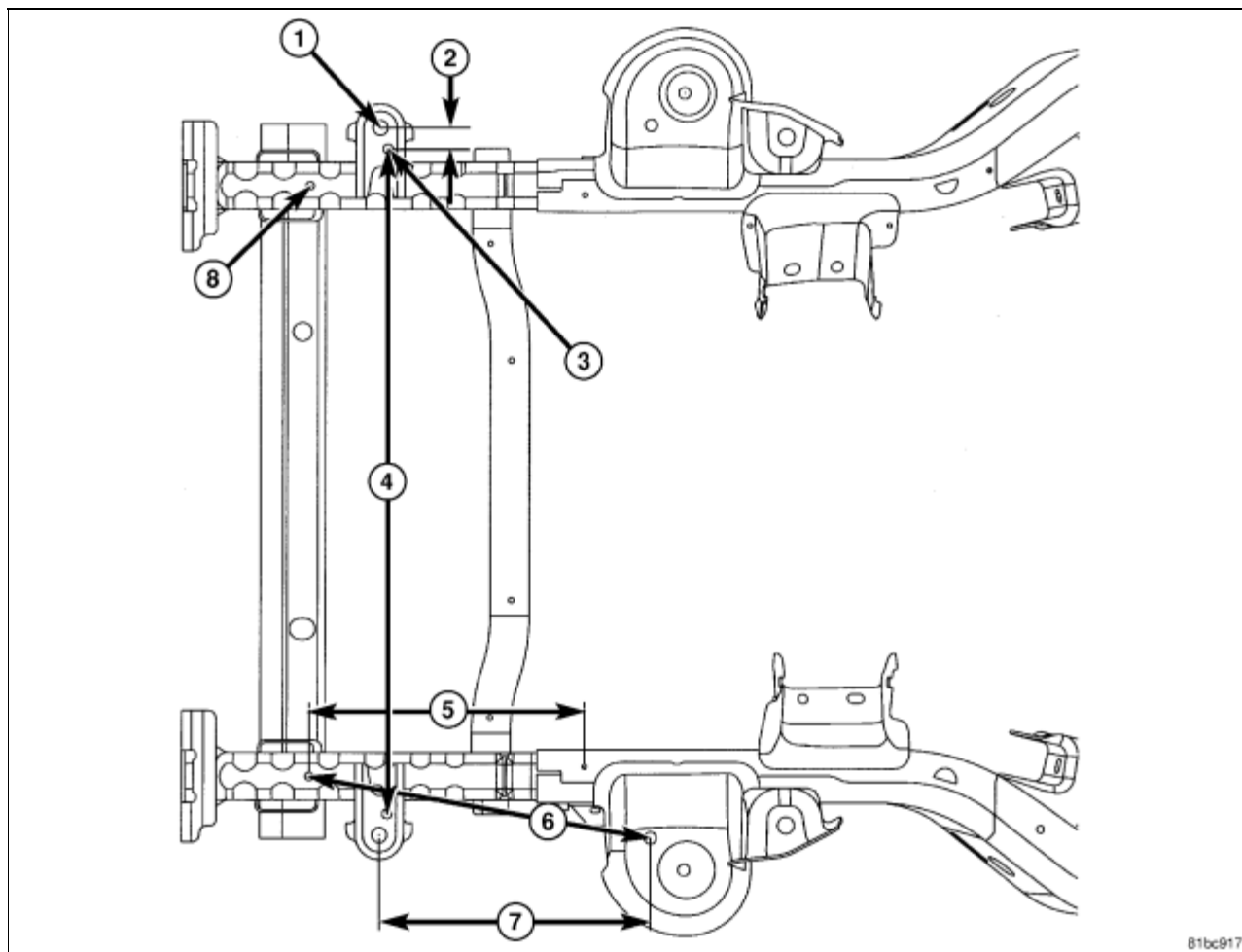
17. Cosmetically dress welds without removing any base metal – a skim coat of filler may be utilized for an

improved cosmetic appearance.

18. Refinish all components to a production appearance.

19. On all areas (1) inaccessible to the refinish operation, apply a creeping type rust proofing material ensuring 100% coverage. Be especially focused on those areas where welding may have burned off the original corrosion protection.

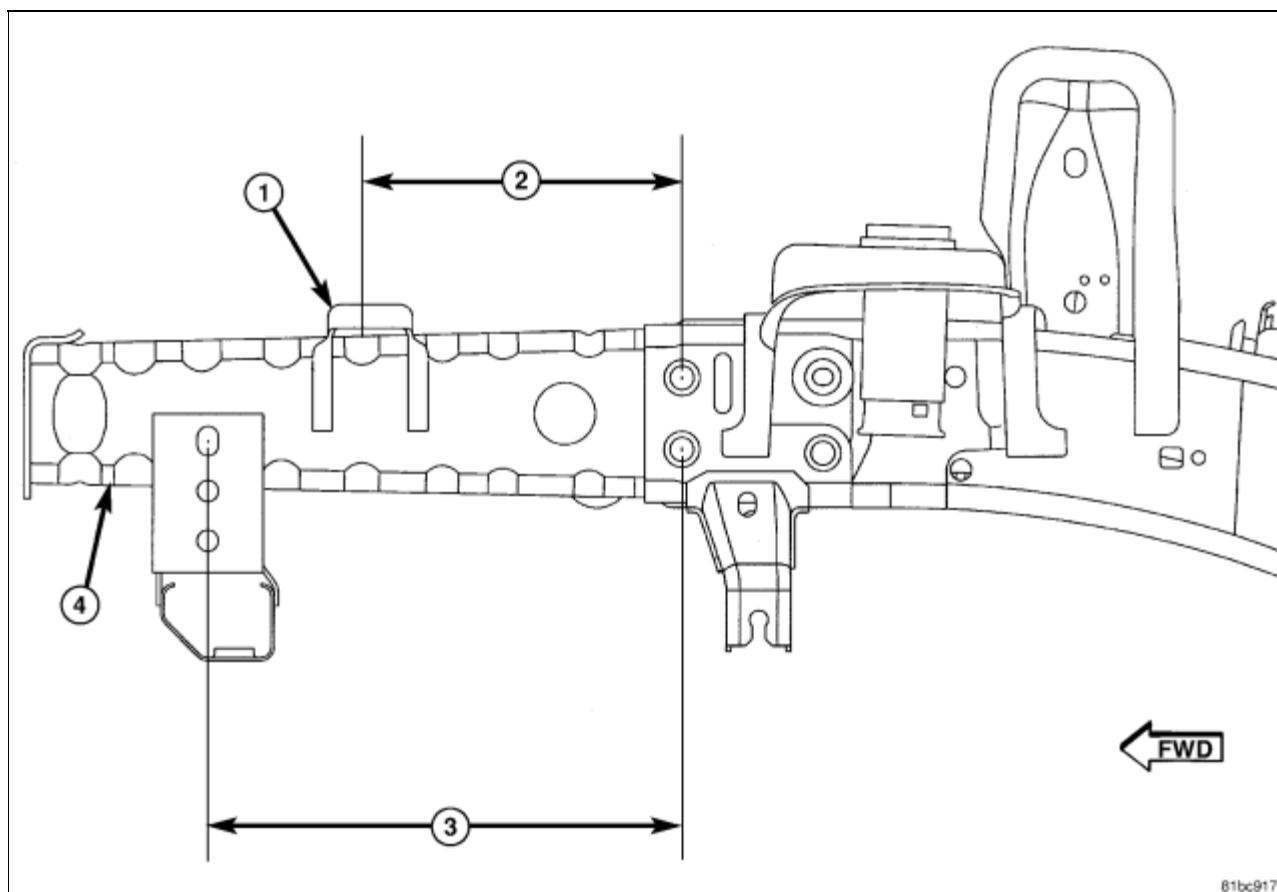
Bracket Locations And Modifications



BRACKET HOLES - PLAN VIEW

1 - 20 mm HOLE (13/16 inch)
2 - 27.7 mm (1.09 inch)
3 - 15 mm HOLE (5/8 inch)
4 - 869.2 mm (34.2 inch)
5 - 359.6 mm (14.2 inch)

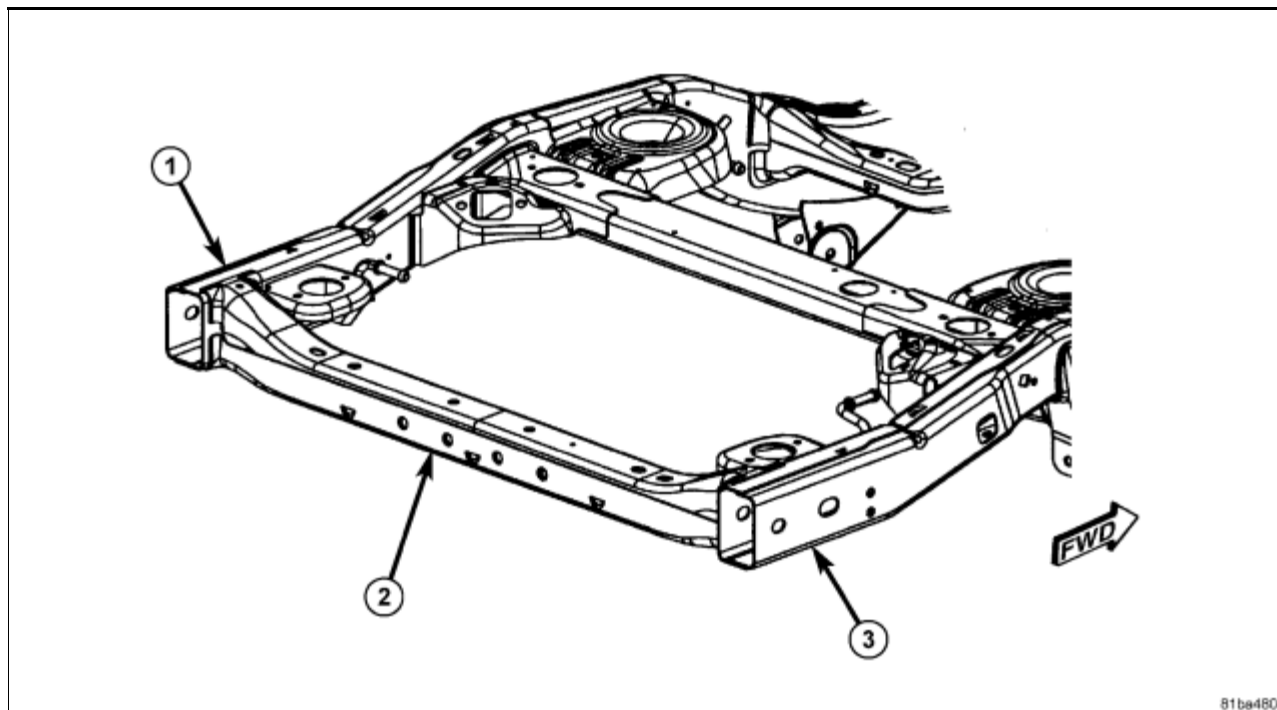
6 - 453.8 mm (17.9 inch)
7 - 354.8 mm (14 inch)
8 - 12.5 mm HOLE (1/2 inch)



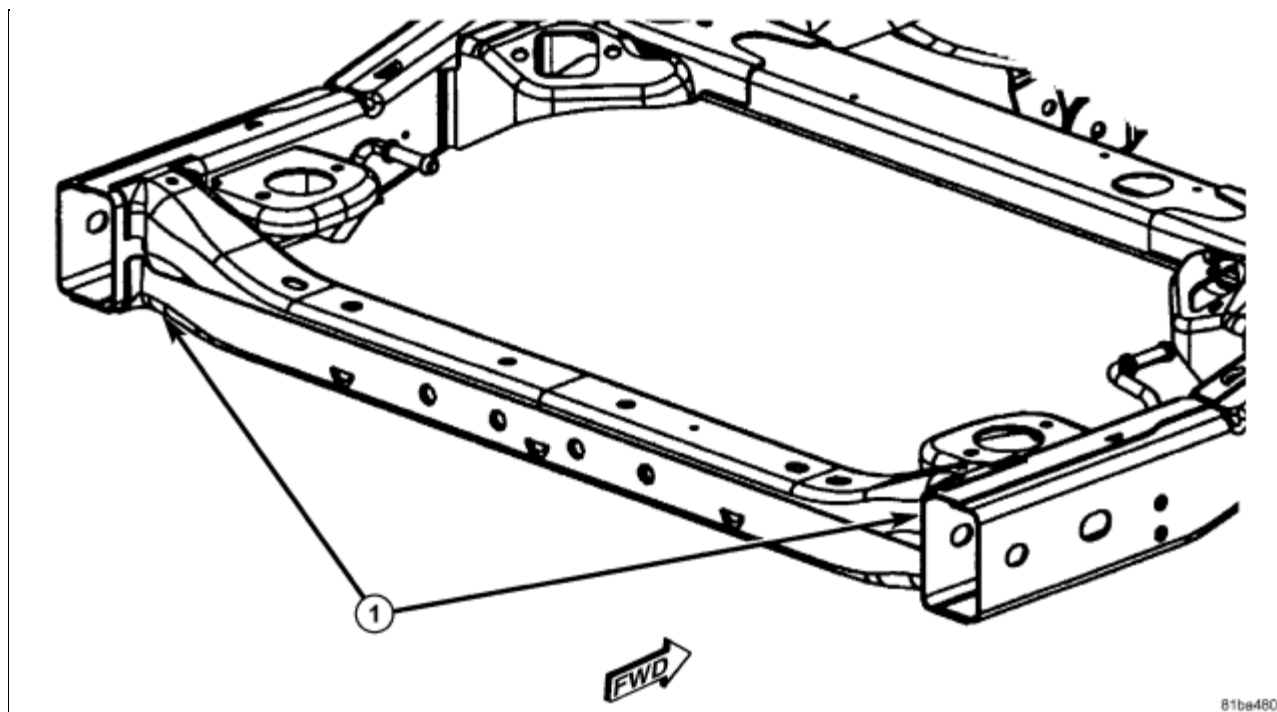
BRACKET LOCATIONS - SIDE VIEW

1 - FESM BRACKET
2 - 239.6 mm (9.43 inch)
3 - 335.1 mm (13.2 inch)
4 - FRAME RAIL TIP

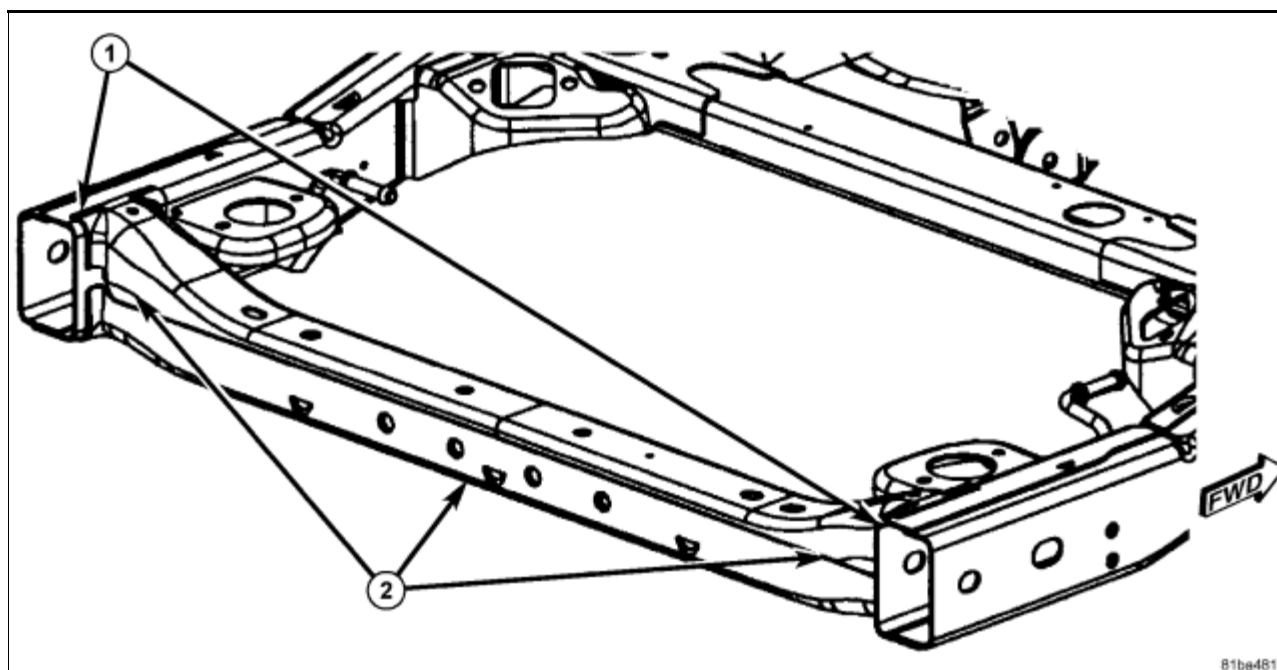
REAR CROSSMEMBER



1. Mount the vehicle on appropriate frame correction equipment (“frame rack”) and using a three-dimensional measuring system measure frame/body and correct to vehicle specifications, (Refer to 13 - FRAME & BUMPERS/FRAME - SPECIFICATIONS).
2. Remove rear bumper components, (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR BUMPER - REMOVAL).
3. Remove hitch receiver or tow hook if equipped, (Refer to 13 - FRAME & BUMPERS/FRAME/TRAILER HITCH - REMOVAL).
4. Release rear body mount fasteners, and loosen remaining body fasteners to allow lifting the body upward providing work access, (Refer to 23 - BODY/EXTERIOR/BODY ISOLATORS - REMOVAL).

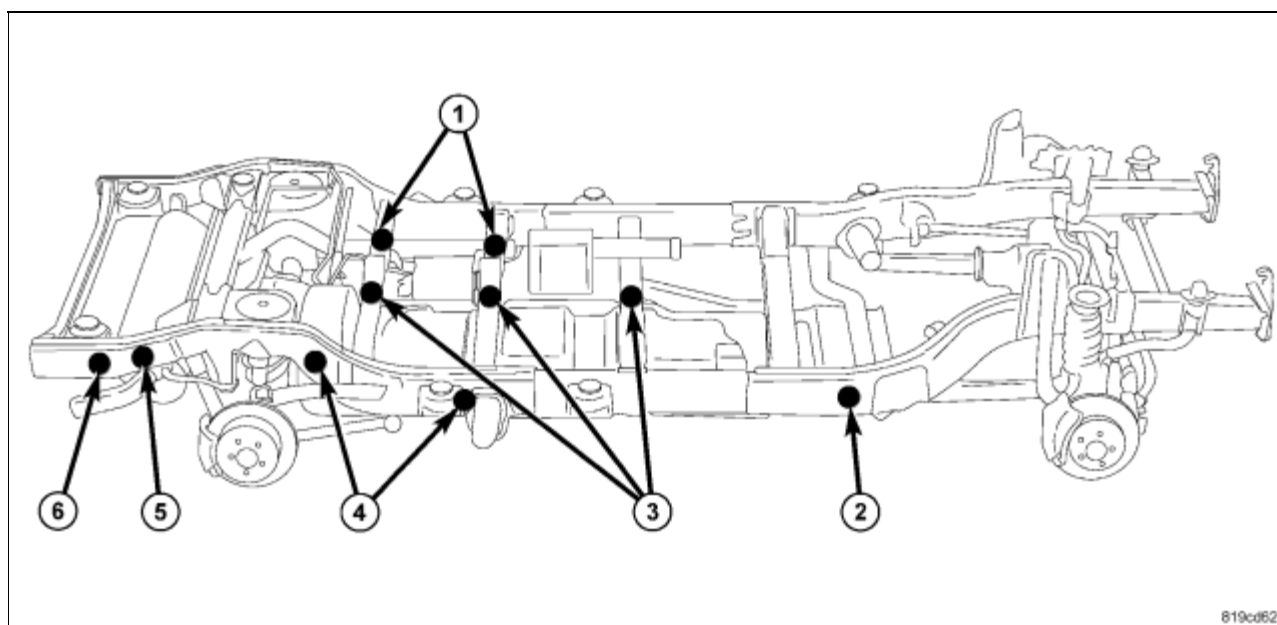


5. Using a reciprocating saw, or equivalent, cut the crossmember close to the welds to the side rails and body mount brackets (1) and remove (each side of crossmember has a total of 7 welds).
6. Using an angle grinder, grind off remaining crossmember and weldments.
7. Dress new crossmember at weld locations so that a very shallow bevel is created and remove any e-coat, inside and out, on replacement part within 25.4 mm (1") of weld zones as best possible.
8. Refer to the weld chart for proper weld rod and approximate welder settings, then using the old crossmember adjust the welder to create a proper weld bead, (Refer to 13 - FRAME & BUMPERS/FRAME - SPECIFICATIONS).



9. Install the crossmember and locate using three-dimensional measuring equipment.
10. When proper, tack-weld crossmember securely in position (1).
11. Complete weld installation of crossmember ensuring proper weld penetration.
12. Clean welded area of any burned coatings or spatter.
13. Apply refinish materials to exterior of crossmember and side rails (2) to restore appearance and corrosion protection.
14. Apply inner panel anti-corrosion material inside crossmember.
15. Install the rear body mount fasteners and tighten all fasteners, (Refer to 23 - BODY/EXTERIOR/BODY ISOLATORS - INSTALLATION).
16. Install hitch receiver/tow hook, (Refer to 13 - FRAME & BUMPERS/FRAME/TRAILER HITCH - INSTALLATION).
17. Install bumper components, (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR BUMPER - INSTALLATION).

WELD NUT SERVICE



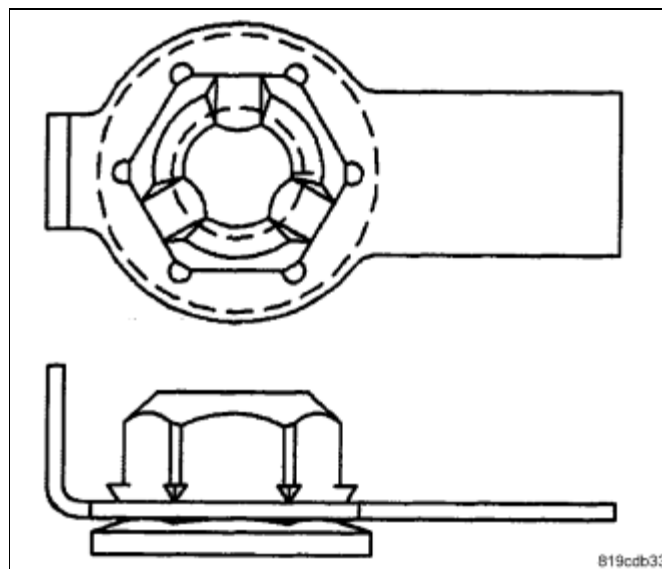
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SERVICE LOCATIONS

1 - THREE M10 FUEL VAPOR CANISTER CROSSMEMBER NUTS	- ACCESS HOLES LOCATED ON TOP OF CROSSMEMBERS
2 - TWO M12 TRANSMISSION SKID PLATE CROSSMEMBER NUTS	- ACCESS HOLES LOCATED ON INSIDE OF FRAME RAILS
3 - M12 FUEL TANK CROSSMEMBER NUTS (SWB has 2, LWB has 3)	- ACCESS HOLES LOCATED ON TOP OF CROSSMEMBERS
4 - M12 FUEL TANK FRAME RAIL NUTS	- ACCESS HOLES LOCATED ON OUTSIDE OF FRAME RAIL

5 - TWO M10 REAR STABILIZER NUTS	- ACCESS HOLES LOCATED ON THE OUTSIDE OF FRAME RAILS
6 - FOUR M10 STANDARD REAR BUMPER BRACKET NUTS	- ACCESS THROUGH REAR OF FRAME RAILS

Vapor Canister



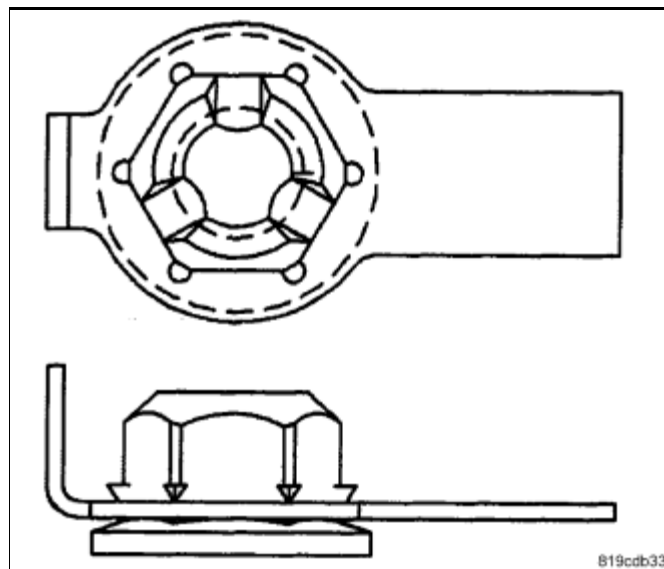
TYPE 1 NUT

M10 Locations:
Vapor Canister (1)
M12 Locations:
Fuel Tank Crossmember (3)

NOTE: Refer to (Fig. [SERVICE LOCATIONS](#)) for service locations.

1. Using a cut off wheel or equivalent, remove the vapor canister support bolt with the damaged weld nut.
2. Remove the damaged weld nut from the access hole in the top of the crossmember (1).
3. Position a new M10 type 1 nut into the access hole and install the vapor canister bolt, (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS/VAPOR CANISTER - INSTALLATION).

Fuel Tank

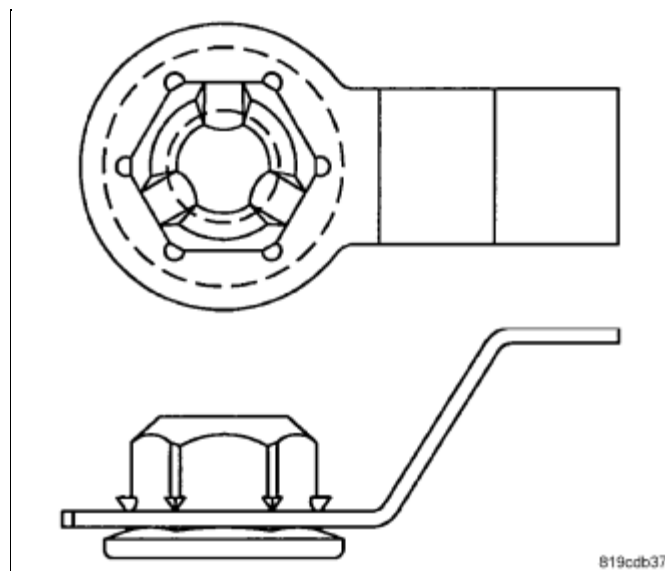


TYPE 1 NUT

M10 Locations:
Vapor Canister (1)
M12 Locations:
Fuel Tank Crossmember (3)

NOTE: Refer to (Fig. [SERVICE LOCATIONS](#)) for service locations.

1. Using a cut off wheel or equivalent, remove the fuel tank support bolt with the damaged weld nut.
2. If necessary remove the damaged weld nut from the access hole in the top of the crossmember (3).
3. If necessary remove the damaged weld nut from the access hole in the frame rail (4).
4. If necessary, position a new M12 type 1 nut into the access hole in the crossmember (3) and install the fuel tank bolt, (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - INSTALLATION).



TYPE 2 NUT

M10 Locations:
Stabilizer bar (5)
M12 Locations:
Fuel Tank Frame Rail (4)
Transmission Skid Plate (2)

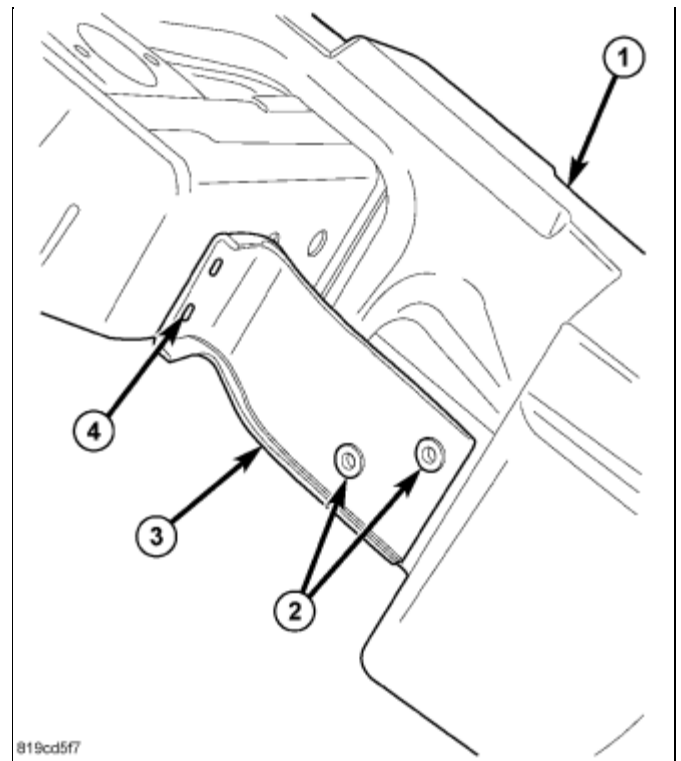
5. If necessary, position a new M12 type 2 nut into the access hole in the frame rail (4) and install the fuel tank bolt.

Rear Bumper Bracket

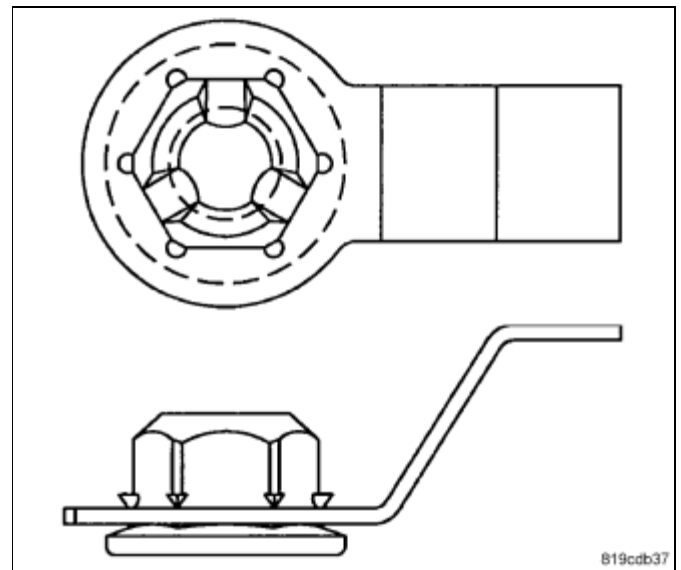
NOTE: Refer to (Fig. [SERVICE LOCATIONS](#)) for service locations.

1. Remove the rear bumper, (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR BUMPER - REMOVAL).
2. Using a cut off wheel or equivalent, remove the rear bumper support bracket bolt (4) with the damaged weld nut.
3. Remove the damaged weld nut from the rear of the frame rail.
4. Install a standard M10 nut into the end of the frame rail using a box end wrench and install the bracket bolt.
5. Tighten the bolt to 55 N·m (40.5 ft. lbs.).
6. Install the rear bumper, (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR BUMPER -

INSTALLATION).



Rear Stabilizer Bar



TYPE 2 NUT

M10 Locations:

Stabilizer bar (5)

M12 Locations:

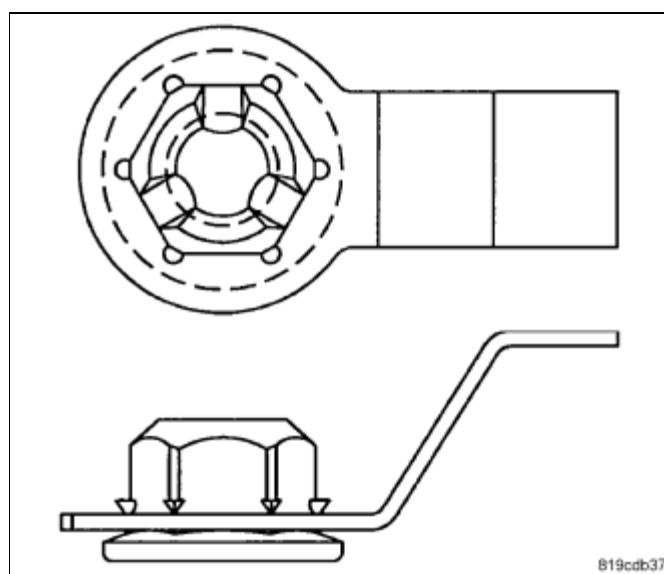
Fuel Tank Frame Rail (4)

Transmission Skid Plate (2)

NOTE: Refer to (Fig. [SERVICE LOCATIONS](#)) for service locations.

1. Using a cut off wheel or equivalent, remove the rear stabilizer bolt with the damaged weld nut.
2. Remove the damaged weld nut from the access hole in the in the frame rail (5).
3. Position a new M10 type 2 nut into access hole in the frame rail and install the stabilizer bar bolt, (Refer to 2 - SUSPENSION/REAR/STABILIZER BAR - INSTALLATION).

Transmission Skid Plate



TYPE 2 NUT

M10 Locations:
Stabilizer bar (5)
M12 Locations:
Fuel Tank Frame Rail (4)
Transmission Skid Plate (2)

NOTE: Refer to (Fig. [SERVICE LOCATIONS](#)) for service locations.

1. Using a cut off wheel or equivalent, remove the transmission skid plate bolt with the damaged weld nut.
2. Remove the damaged weld nut from the access hole in the frame rail (2).
3. Position a new M12 type 2 nut into the access hole in the frame rail and install the skid plate bolt, (Refer to 13

- FRAME & BUMPERS/FRAME/TRANSMISSION SKID PLATE - INSTALLATION)

SPECIFICATIONS

FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principle Locating Point (PLP), or from center to center of PLP and fastener location.

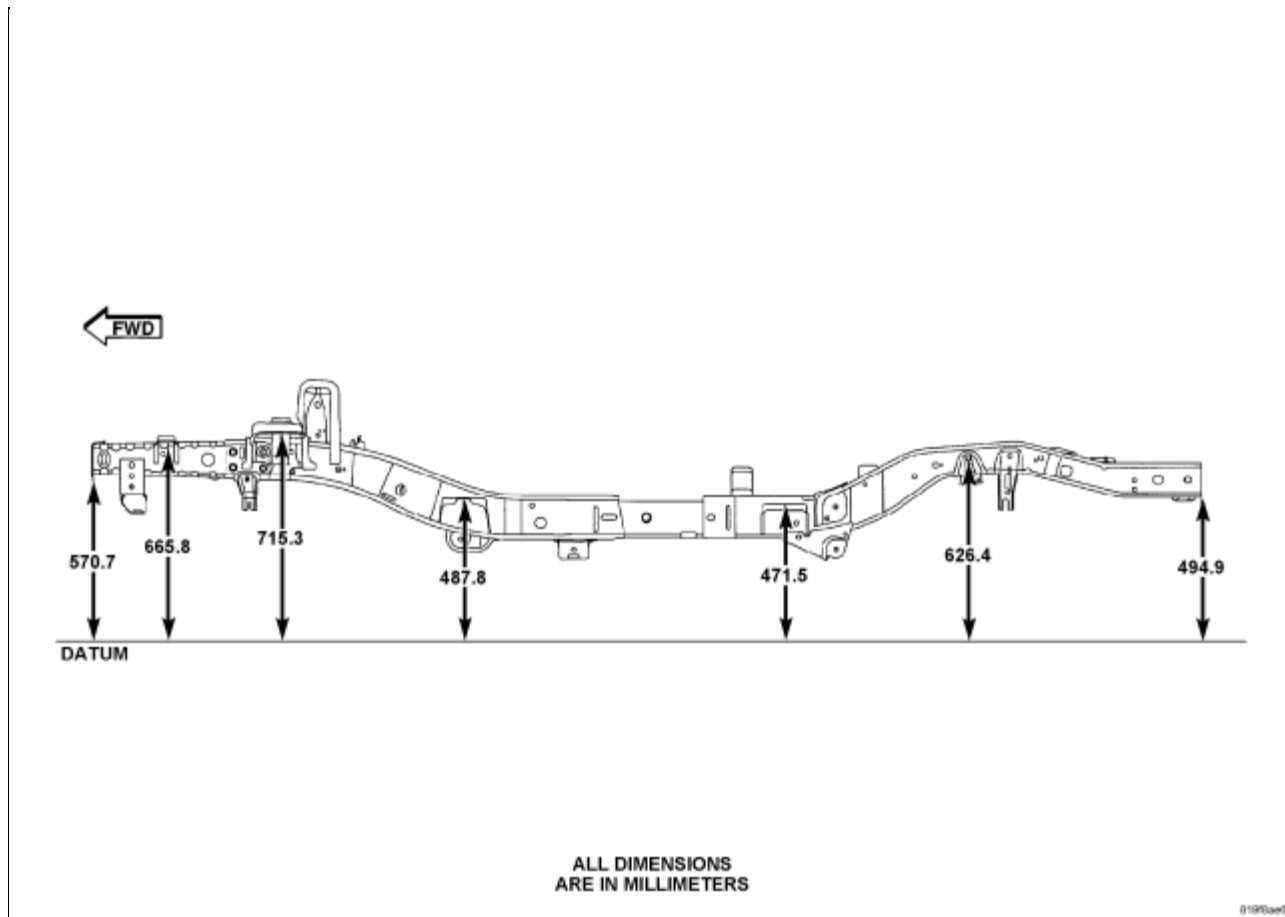
VEHICLE PREPARATION

Position the vehicle on a level work surface. Using screw or bottle jacks, adjust the vehicle PLP heights to the specified dimension above a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable.

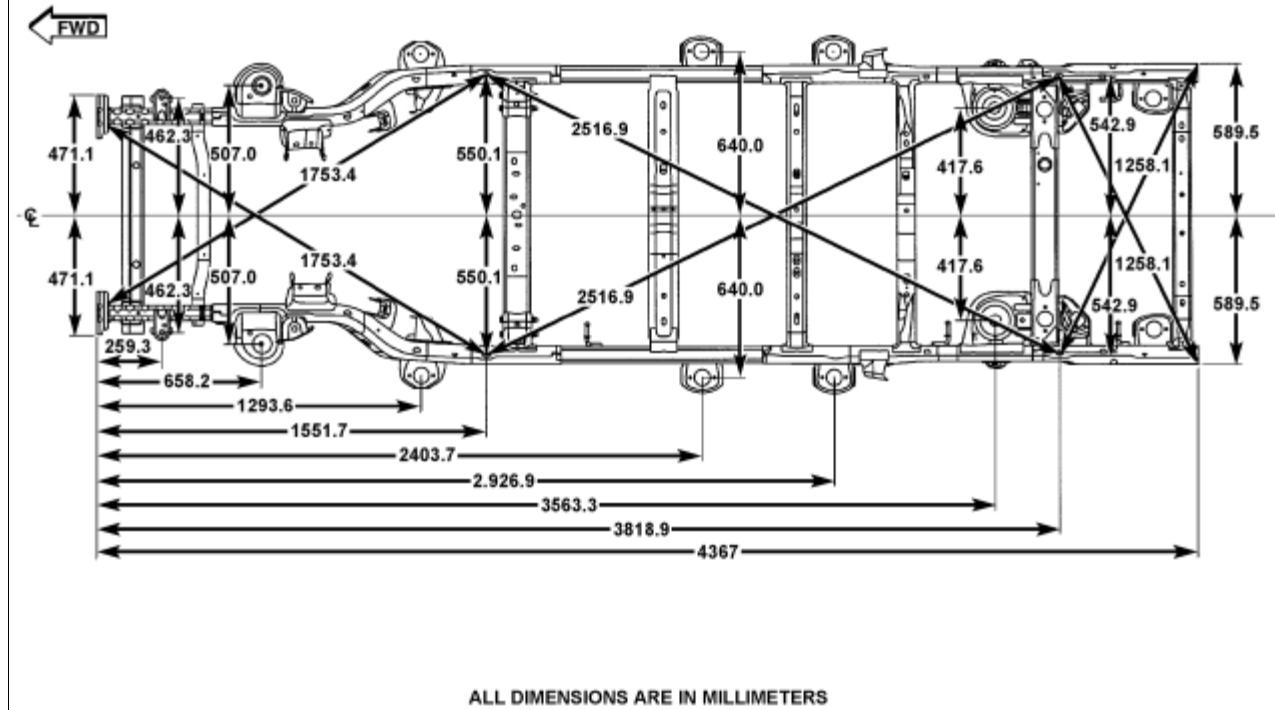
Index

DESCRIPTION	FIGURE
PLAN VIEW - TWO DOOR JK ONLY	PLAN VIEW - TWO DOOR JK ONLY
SIDE VIEW - TWO DOOR JK ONLY	SIDE VIEW - TWO DOOR JK ONLY
PLAN VIEW - FOUR DOOR JK ONLY	PLAN VIEW - FOUR DOOR JK ONLY
SIDE VIEW - FOUR DOOR JK ONLY	SIDE VIEW - FOUR DOOR JK ONLY

5111

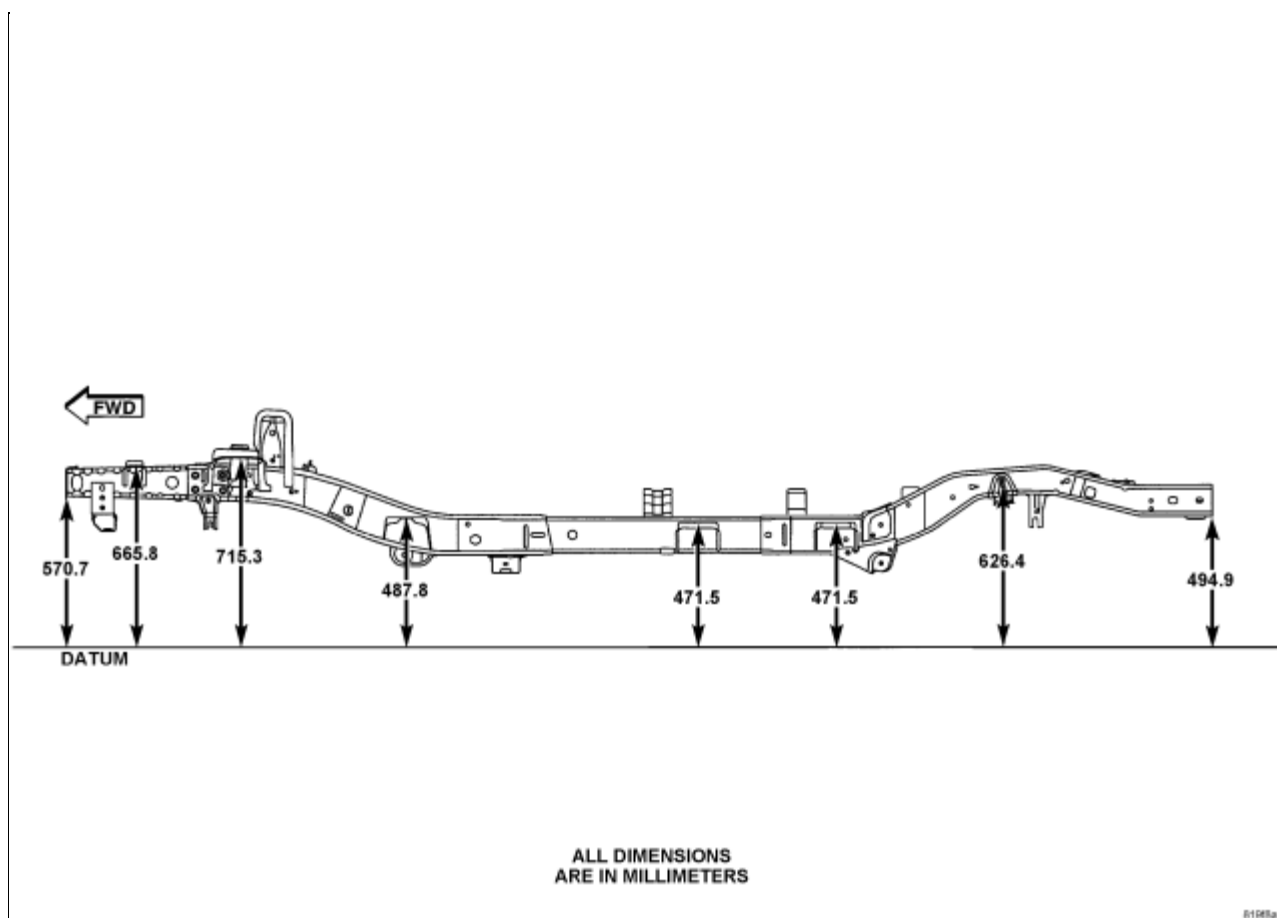


SIDE VIEW - TWO DOOR JK ONLY



©1998

PLAN VIEW - FOUR DOOR JK ONLY



SIDE VIEW - FOUR DOOR JK ONLY

WELD PROCESS

CAUTION: All welds should conform to DaimlerChrysler vehicle engineering process standard “PS 9472”.

WELDING PARAMETERS

WELDING PROCESS	FLUX CORED ARC	GAS METAL ARC (MIG)*	SHIELDED METAL ARC (STICK)
Material Thickness	3.7 mm to 4.2 mm	3.7 mm to 4.2 mm	3.7 mm to 4.2 mm
Electrode Type	Lincoln Electrical Co. Product #: NR-211 MP (Do Not Substitute)	AWS ER70S-6 (Do Not Substitute)	** AWS E 7018
Electrodes Size Inches	.045 Tubular	.035 Solid	3/32"
Electrode Stick Out	3/8" - 1/2"	1/2" - 5/8"	N/A

Polarity	Electrode "-" Work Piece "+"	Electrode "+" Work Piece "-"	Electrode "+" Work Piece "-"
Shielding Gas	Self Shielded	75% Ar 25% CO2	Self Shielded
Gas Flow Rate	N/A	25 - 35 CFM	N/A
Wire Feed Speed (inches per minute)	110 - 130 Vertical Down 70 - 90 Flat & Overhead	245 - 250 Vertical Down 210 - 225 Flat & Overhead	N/A
Approximate Amperage			
Vertical	110 - 130	175	85 (3/32" Diameter)
Flat & Overhead	70 - 90	155	90 (3/32" Diameter)
Voltage	15 - 18	19 - 20	N/A
Direction of Welding			
Vertical	Vertical Down Hill (only)	Vertical Down Hill (only)	Vertical - Up Hill (only)
Flat & Overhead	Flat - Push or Drag	Flat - Push or Drag	Flat - Drag

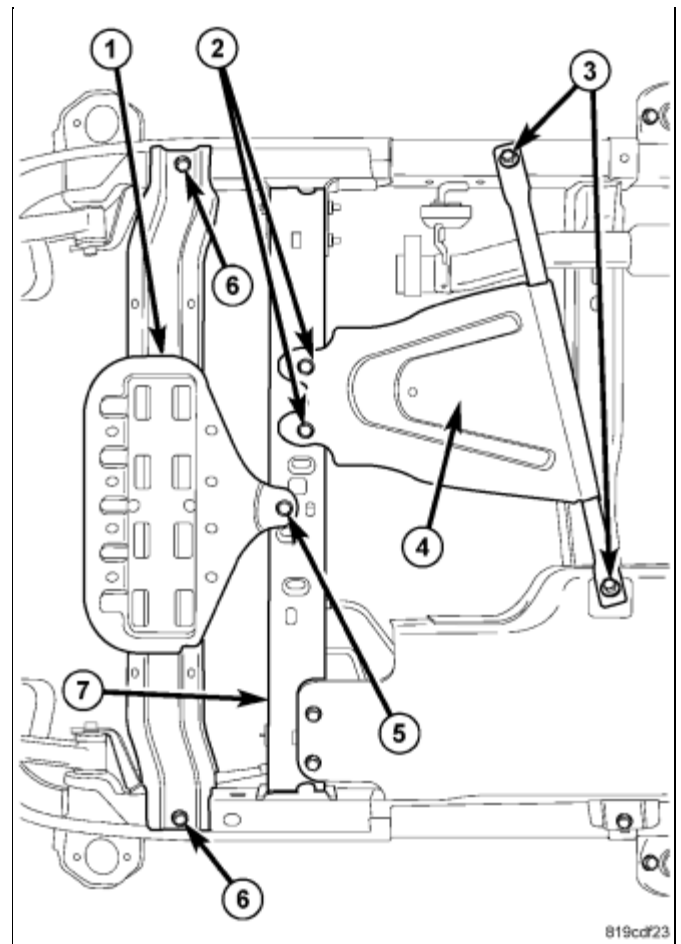
***First choice - Gas Metal Arc Welding Process:** Butt joints - apply two layers (passes) of weld metal. First pass should only fill approximately 5 the thickness. Vertical position welds - maintain electrode wire at leading edge of weld puddle while traveling down hill to produce maximum penetration into the sleeve. These techniques work for FCAW as well.

****E7018** new electrodes may be exposed to the atmosphere for up to ten hours with no harmful effect. Reconditioning schedules should come from the manufacturer.

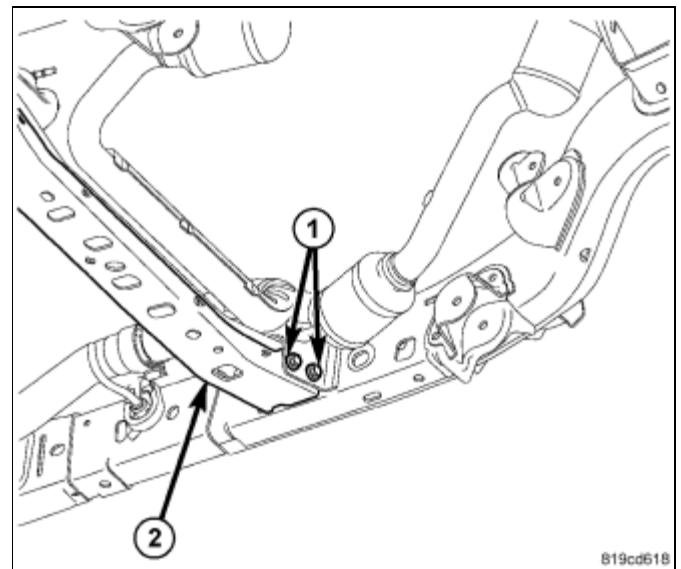
CROSSMEMBER - TRANSMISSION

REMOVAL

1. Remove the transmission skid plate (1), (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSMISSION SKID PLATE - REMOVAL).
2. Remove the transercase skid plate (4), (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION).

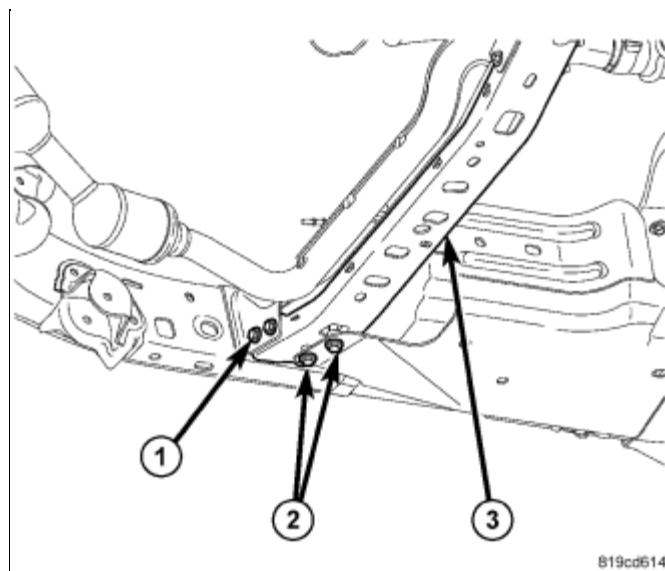


3. Remove the left side bolts (1).

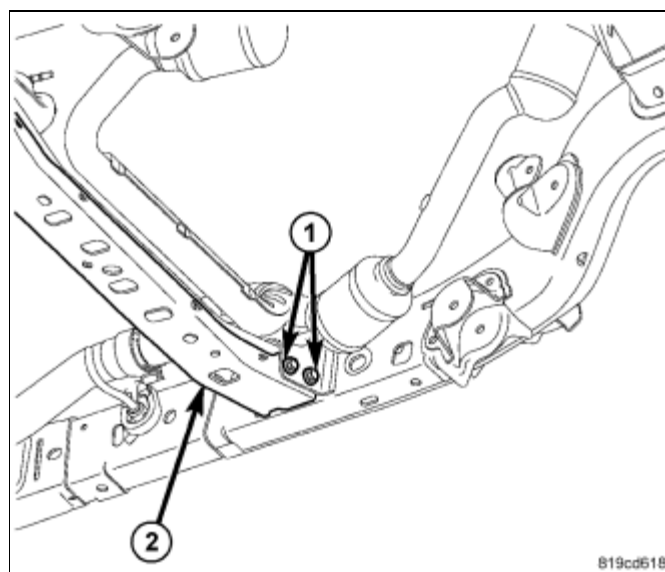


4. Remove the fuel tank skid plate bolts (2).
5. Remove the right side bolts (1) and remove the crossmember (3).

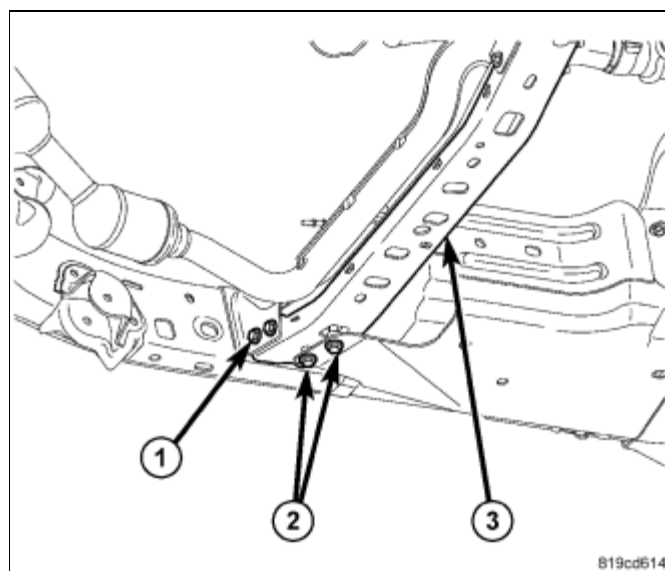
INSTALLATION



1. Install the crossmember (2) and install the bolts (1).



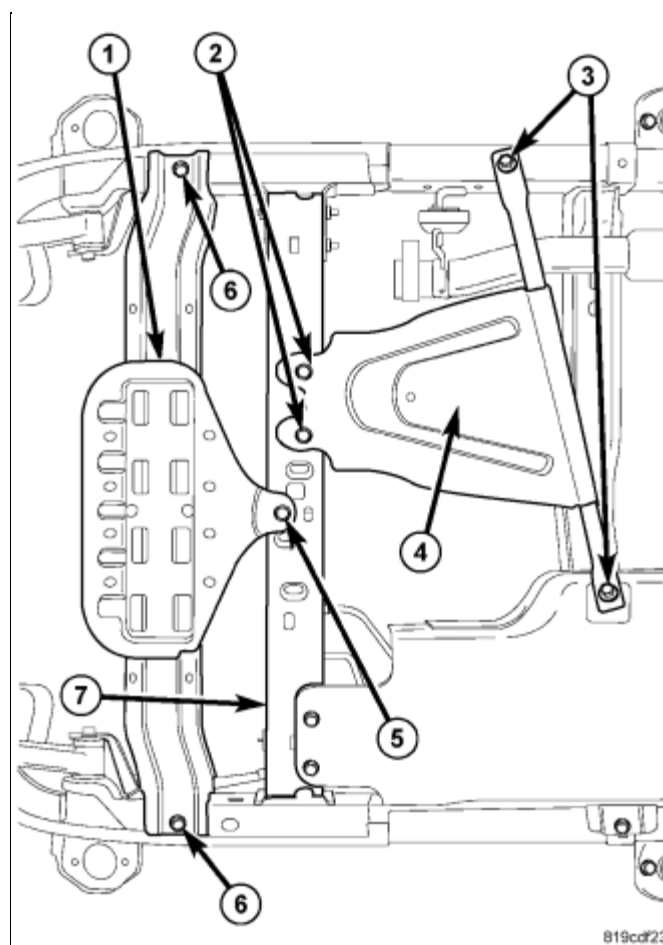
2. Install the right side bolts (1) and tighten all four crossmember bolts to 122 N·m (90 ft. lbs.).
 3. Install the fuel tank skid plate bolts (2) and tighten to 99 N·m (73 ft. lbs.).



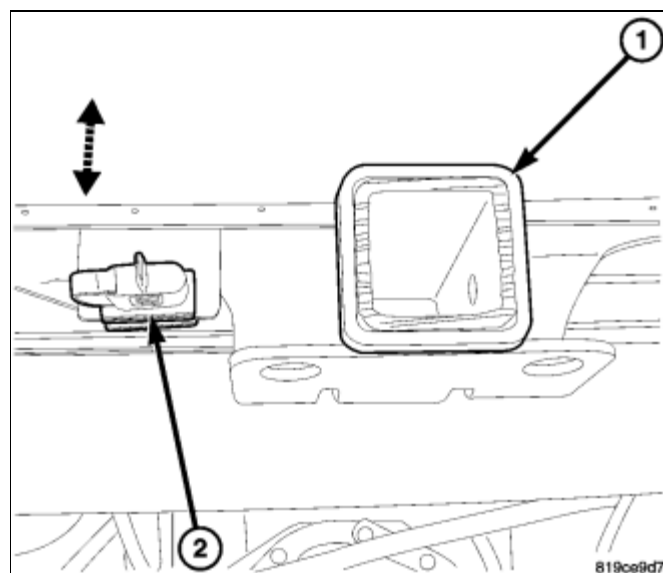
4. Install the transmission skid plate (1), (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSMISSION SKID PLATE - INSTALLATION).
5. Install the transfer case skid plate (4), (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION).

HITCH - TRAILER

REMOVAL

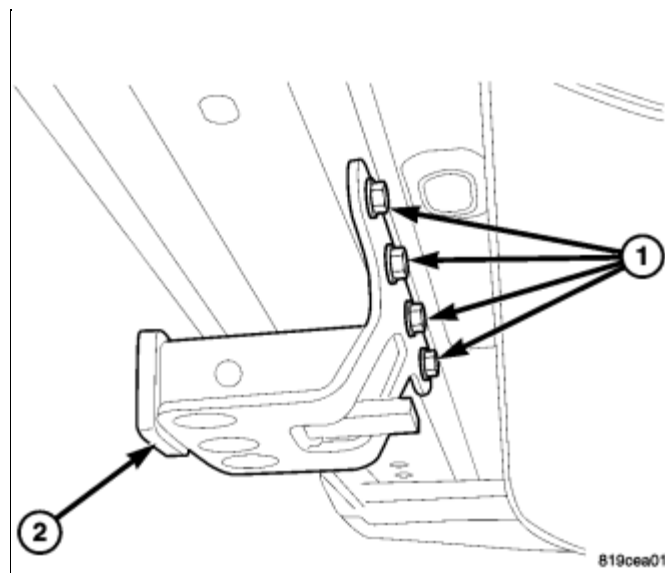


1. Separate the wire harness (2) from the trailer hitch (1).

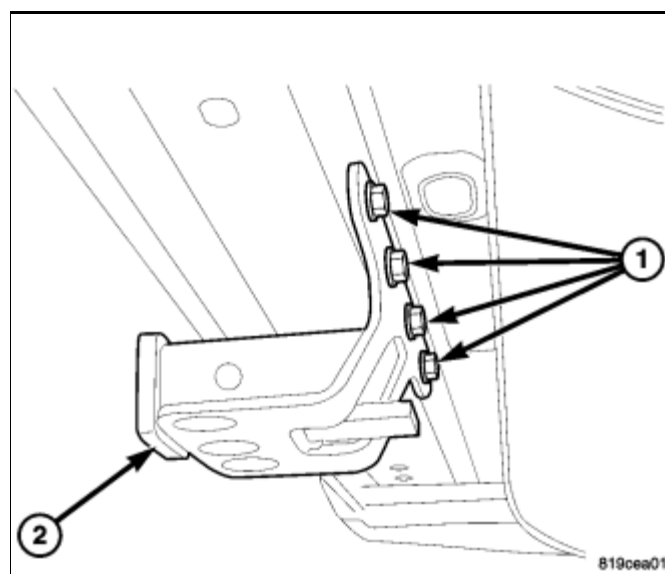


2. Remove the trailer hitch bolts (1) and remove the hitch (2).

INSTALLATION



1. Install the hitch (2) and install the bolts (1).
2. Tighten the bolts to 81 N·m (60 ft. lbs.)



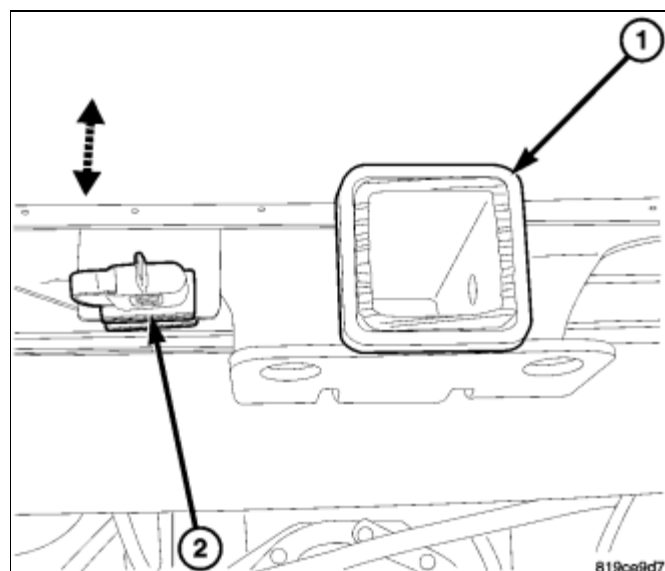
3. Install the wire harness connector (2) onto the hitch (1).

SKID PLATE - FUEL TANK

REMOVAL

1. Remove the fuel tank, (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - REMOVAL).

INSTALLATION



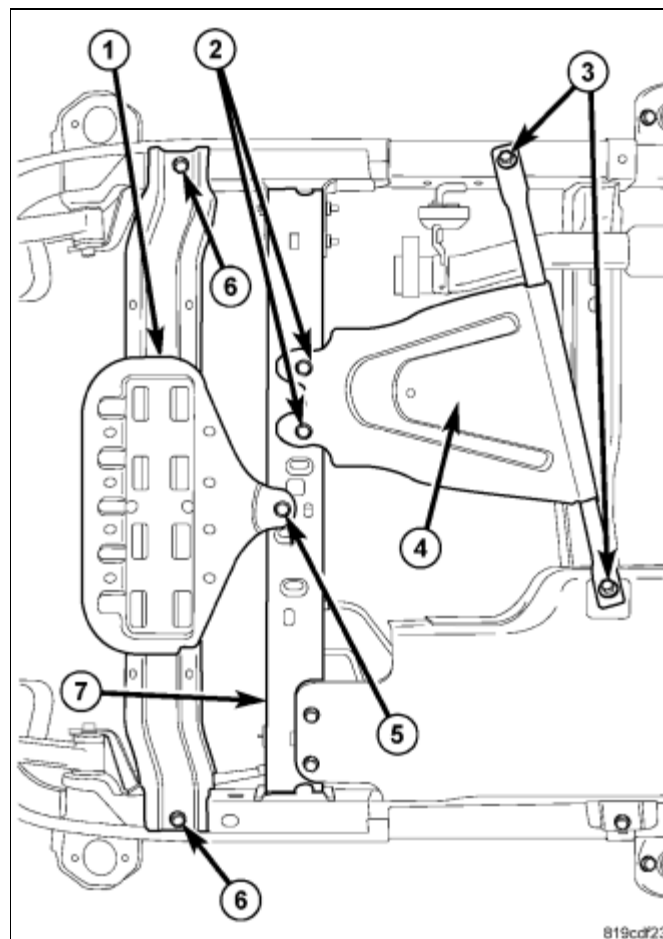
1. Install the fuel tank, (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - INSTALLATION).

SKID PLATE - TRANSFER CASE

REMOVAL

1. Raise and support the vehicle, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
2. Remove the crossmember bolts (2).
3. Remove the bracket bolts (3) and remove the transfercase skid plate (4).

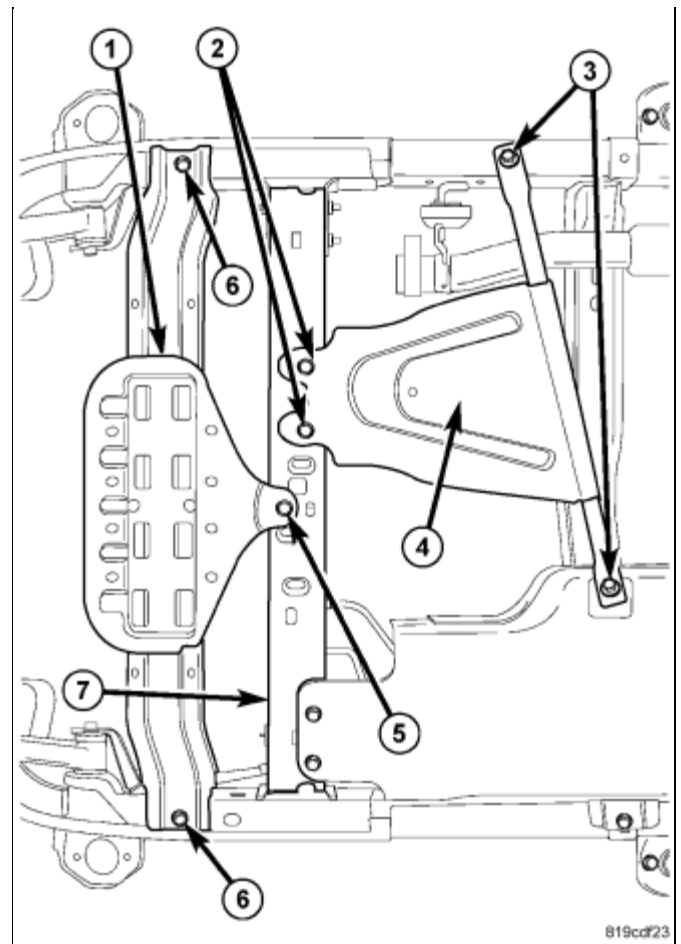
INSTALLATION



1. Install the skid plate (4).
2. Install the bracket bolts (3) and tighten to 65 N·m (48 ft. lbs.).
3. Install the crossmember bolts (2) and tighten to 65 N·m (48 ft. lbs.).

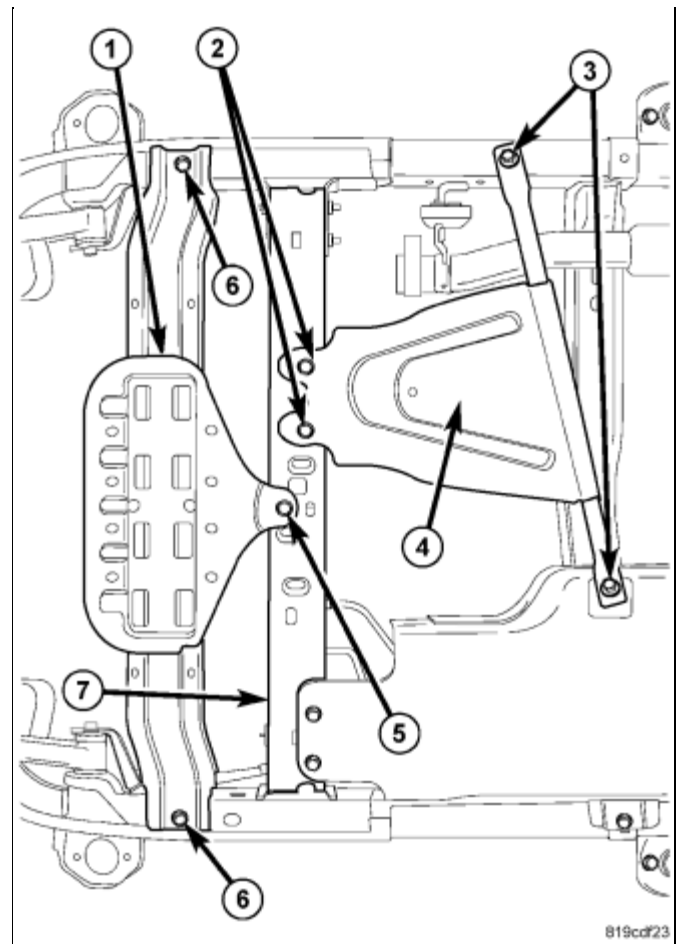
SKID PLATE - TRANSMISSION

REMOVAL

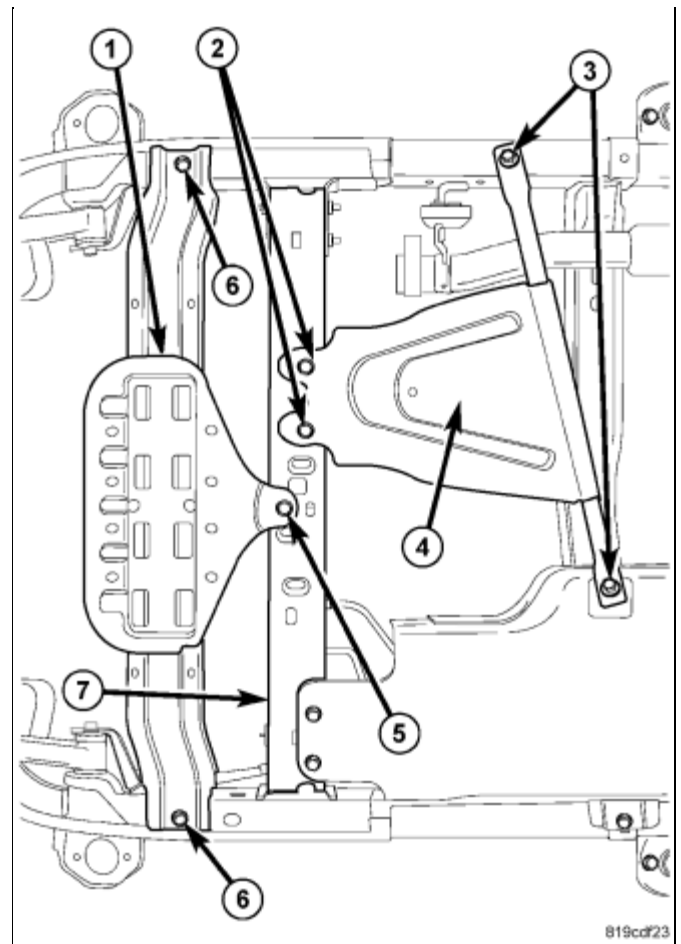


1. Raise and support the vehicle, (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
2. Remove the crossmember bolt (5).
3. Remove the skid plate support crossmember bolts (6) and remove the transmission skid plate (1).

INSTALLATION



1. Install the skid plate (1).
2. Install the support crossmember bolts (6) and tighten to 65 N·m (48 ft. lbs.).
3. Install the crossmember bolts (5) and tighten to 65 N·m (48 ft. lbs.).



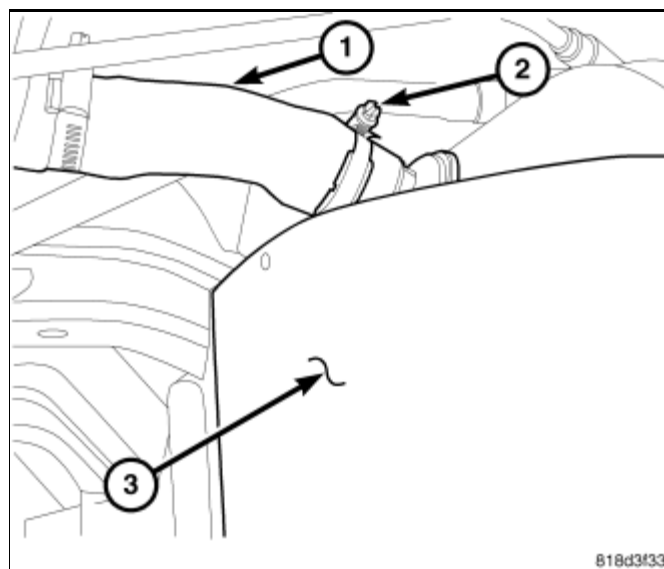
14 - FUEL SYSTEM

FUEL SYSTEM

STANDARD PROCEDURE

STANDARD PROCEDURE - DRAINING FUEL TANK

1. Disconnect negative battery cable.
2. Remove fuel fill cap.
3. Raise and support vehicle.
4. Remove fuel fill hose clamp (2) at rear of tank (3).
5. Remove fuel fill hose (1) from fuel tank.
6. Position a drain hose into the fuel fill hose opening. Note that a small flapper valve is installed into the opening.
7. Drain fuel tank using an approved gasoline, or diesel fuel draining station.



FUEL SYSTEM PRESSURE RELEASE

Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.

1. Remove fuel fill cap.
2. Disconnect wiring harness leading to fuel pump module at top of fuel tank. Refer to Wiring Diagrams for connector location.
3. Start and run engine until it stalls.
4. Attempt restarting engine until it will no longer run.
5. Turn ignition key to OFF position.
6. Place a rag or towel below fuel line quick-connect fitting at fuel rail.
7. Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.
8. After performing service procedure, reconnect fuel pump module.
9. One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to the disconnection of fuel pump module. A diagnostic scan tool must be used to erase a DTC.

SPECIFICATIONS

TORQUE - 3.8L GAS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.

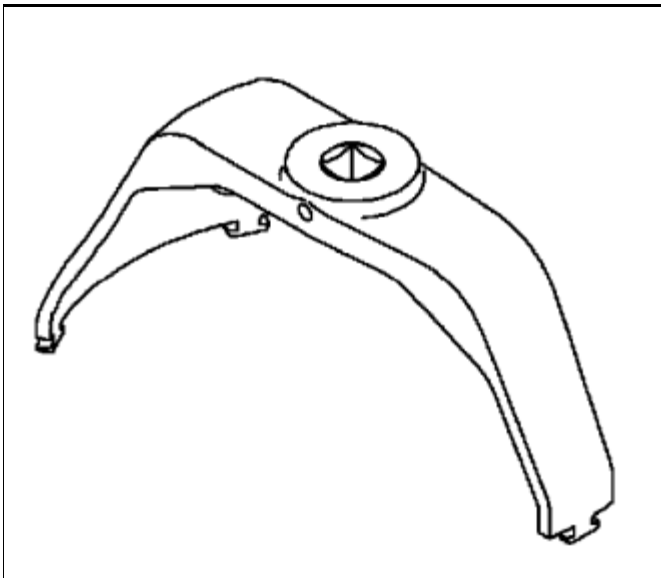
Accelerator Pedal Bracket Mounting	12	-	105
Clean Air Hose Clamps	4	-	35
Crankshaft Position Sensor - 3.8L	28	21	-
Camshaft Position Sensor - 3.8L	-	-	106
Fuel Filler Hose Clamp at Tank	3	-	30
Fuel Filler Housing-to-Body Screws	2	-	17
Fuel Rail Mounting Bolts - 3.8L	22	17	200
Fuel Tank Mounting Straps	41	30	-
Throttle Body Mounting Bolts - 3.8L	7.5	5.5	65
Oxygen Sensors	41	30	-

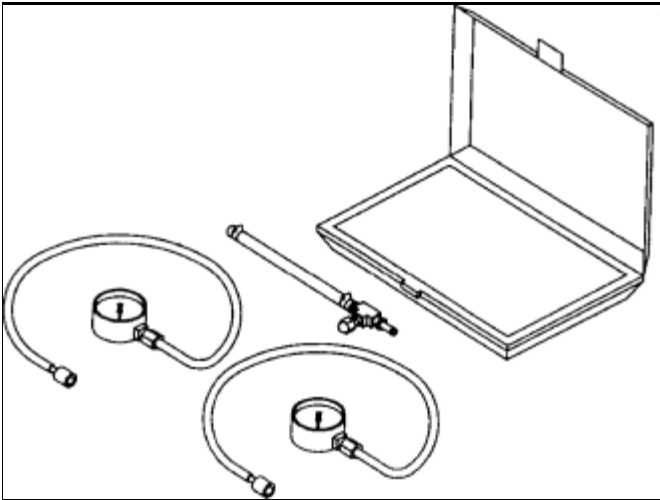
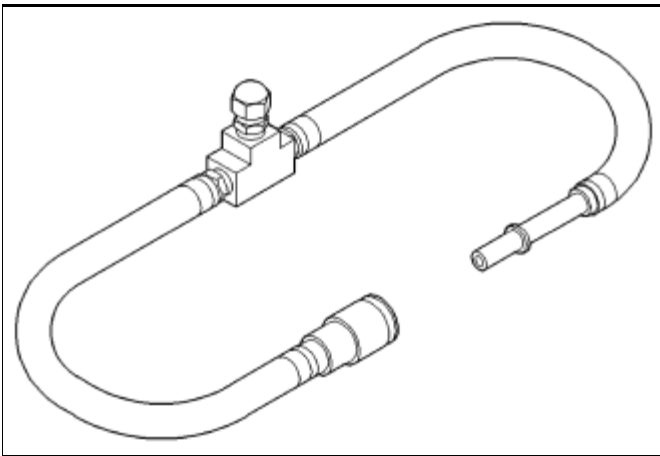
FUEL SYSTEM PRESSURE

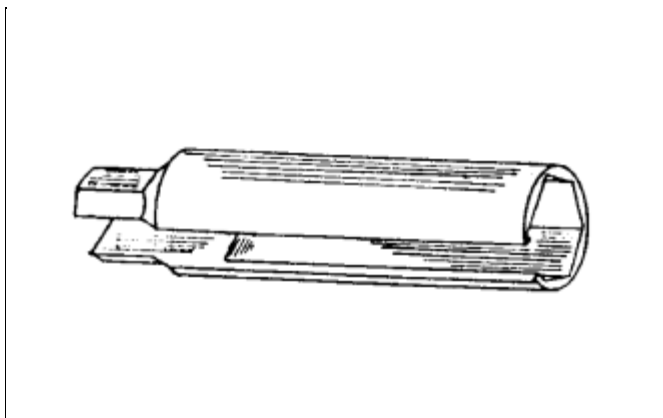
58 psi +/- 2 psi

SPECIAL TOOLS

FUEL SYSTEM



REMOVER/INSTALLER, LOCKRING - 9340**TEST KIT, FUEL PRESSURE - 5069****ADAPTERS, FUEL PRESSURE TEST - 6539/6631**



REMOVER/INSTALLER, OXYGEN SENSOR - C-4907

FUEL DELIVERY - 3.8L GAS ENGINE

SENSOR - FUEL LEVEL SENDING UNIT

DESCRIPTION

The fuel level sending unit is separately non-serviceable. The fuel pump module must be replaced.

LINES-FUEL

DESCRIPTION

WARNING: The fuel system may be under a constant pressure (even with the engine off). Before servicing any fuel system hoses, fittings, lines, or most components, fuel system pressure must be released. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

FITTING - QUICK CONNECT

DESCRIPTION

Different types of quick-connect fittings are used to attach the various fuel system components, lines and tubes. These are: a single-button type, a two-button type, a pinch type, a single-tab type, a two-tab type or a plastic

retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

CAUTION: Before separating a quick-connect fitting, pay attention to what type of fitting is being used by referring to Quick-Connect Fitting Removal. This will prevent unnecessary fitting or fitting latch breakage.

CAUTION: The interior components (O-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers and latches are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

STANDARD PROCEDURE - QUICK-CONNECT FITTINGS

Different types of quick-connect fittings are used to attach the various fuel system components, lines and tubes. These are: a single-button type, a two-button type, a pinch type, a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal.

DISCONNECTING

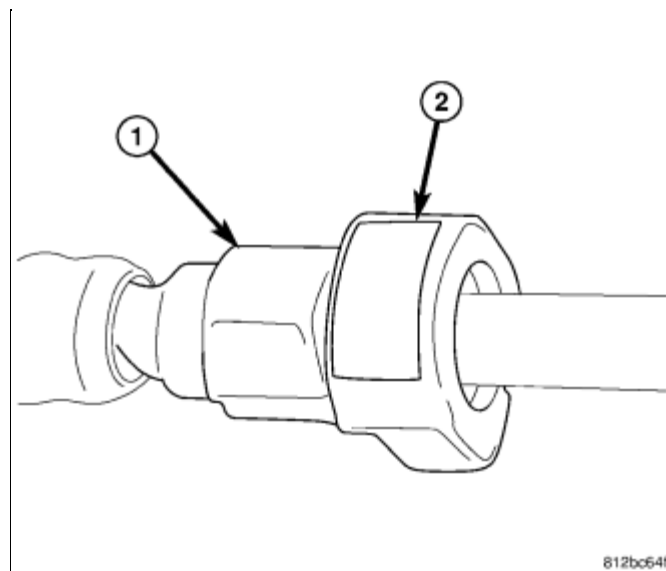
WARNING: The fuel system is under a constant pressure (even with engine off). Before servicing any fuel system hose, fitting or line, fuel system pressure must be released. Refer to fuel system pressure release procedure.

CAUTION: Before separating a quick-connect fitting, pay attention to what type of fitting is being used by referring to Quick-Connect Fitting Removal. This will prevent unnecessary fitting or fitting latch breakage.

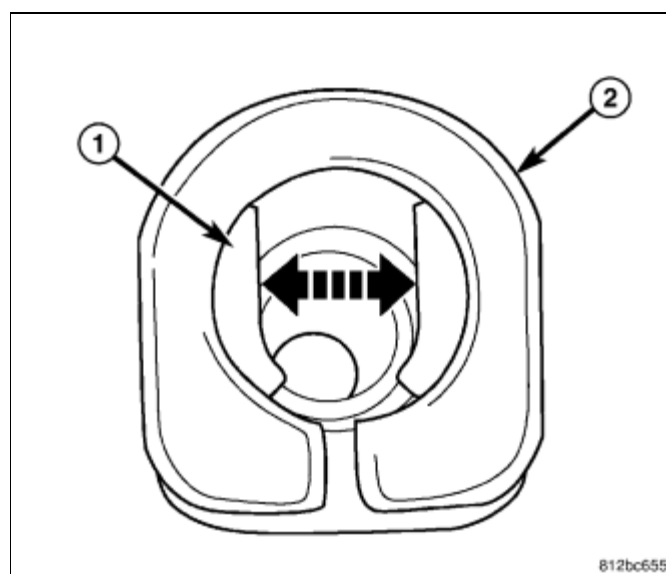
CAUTION: The interior components (O-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers and latches are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

1. Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure.
2. Disconnect negative battery cable from battery.
3. Clean fitting of any foreign material before disassembly.

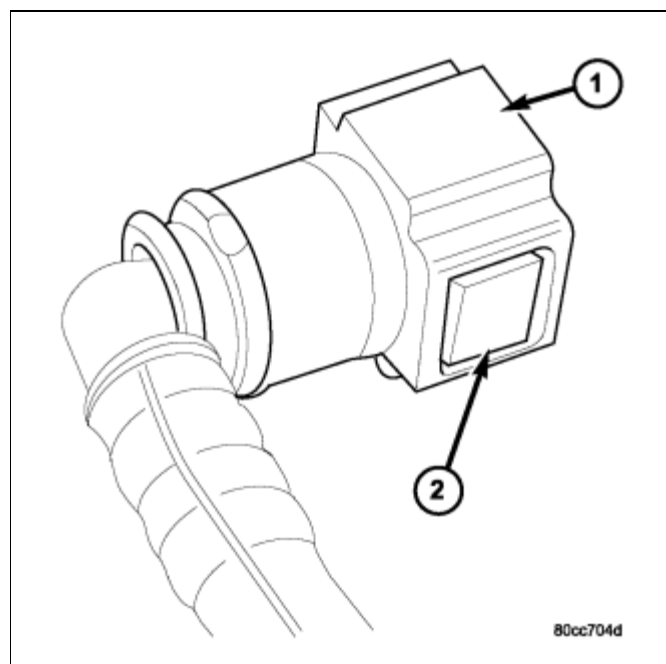
4. Single-Button Type Fitting: This type of fitting is equipped with a single push-button (2) located on the quick-connect fitting.



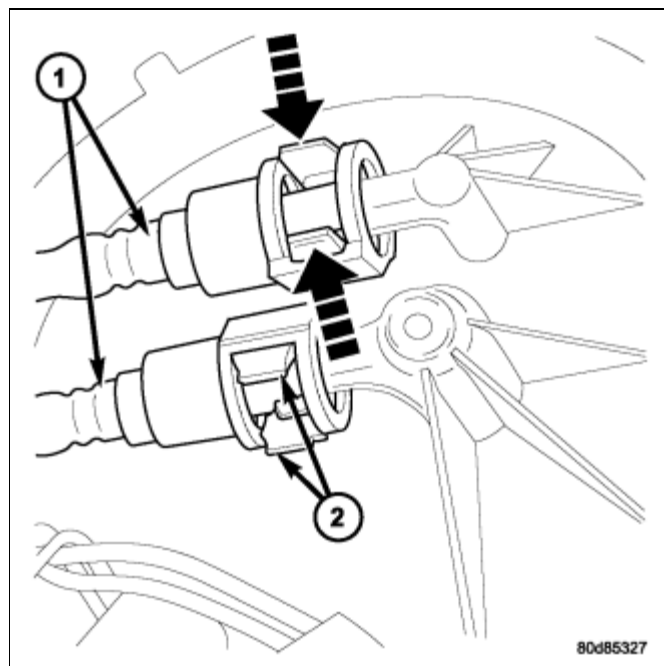
5. The push-button is attached to two internal latches (1). To disconnect, press on push-button with your thumb and unlatch fitting from fuel line. Special tools are not required for disconnection. **DO NOT ATTEMPT TO PRY OR PULL UP ON PUSH-BUTTON. LATCHES WILL BE BROKEN.**



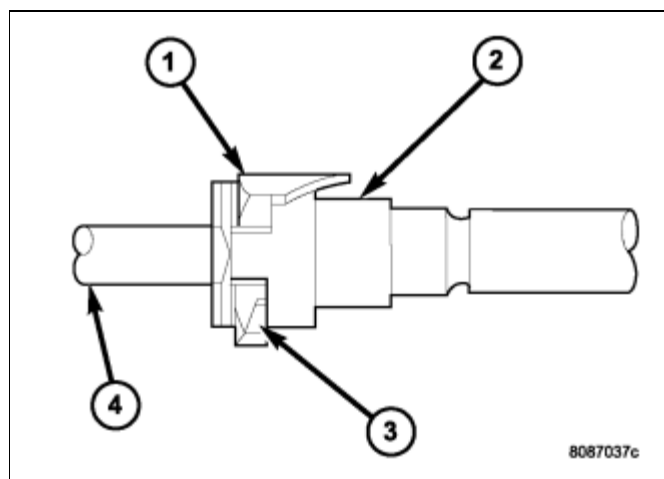
6. Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure.
 7. Disconnect negative battery cable from battery.
 8. Clean fitting of any foreign material before disassembly.
 9. **2-Button Type Fitting:** This type of fitting (1) is equipped with a push-button located on each side of quick-connect fitting (2). Press on both buttons simultaneously for removal. Special tools are not required for disconnection.



10. **Pinch-Type Fitting:** This fitting (1) is equipped with two finger tabs (2). Pinch both tabs together while removing fitting. Special tools are not required for disconnection.



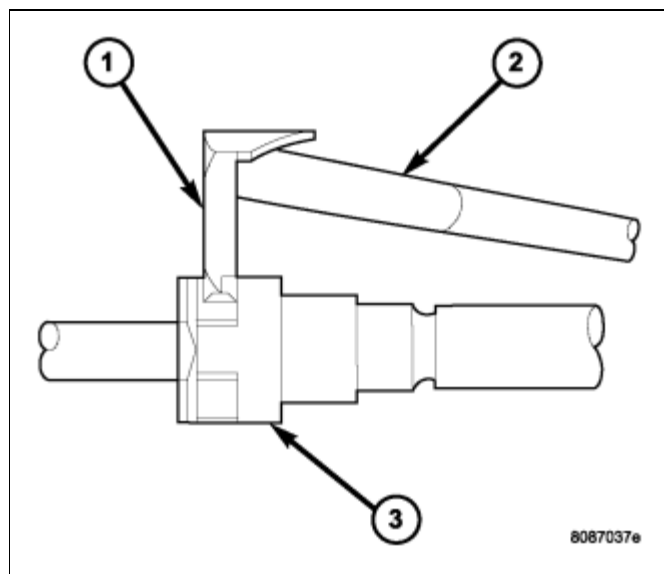
11. **Single-Tab Type Fitting:** This type of fitting (3) is equipped with a single pull tab (1). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component. Special tools are not required for disconnection.



12. Press release tab on side of fitting to release pull tab (1). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**

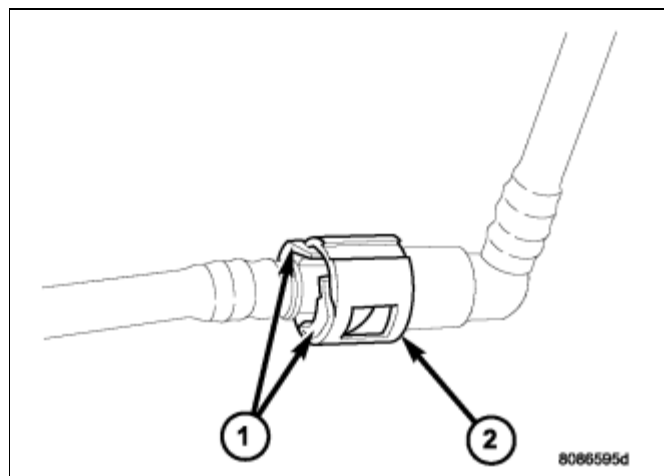
13. While pressing release tab on side of fitting, use screwdriver (2) to pry up pull tab.

14. Raise pull tab until it separates from quick-connect fitting.



15. **Two-Tab Type Fitting:** This type of fitting (2) is equipped with tabs located on both sides of fitting (1). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.

- a. To disconnect quick-connect fitting, squeeze plastic retainer tabs (1) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.
- b. Pull fitting from fuel system component being serviced.
- c. The plastic retainer will remain on component being serviced after fitting is disconnected. The O-rings and spacer will remain in quick-connect fitting connector body.

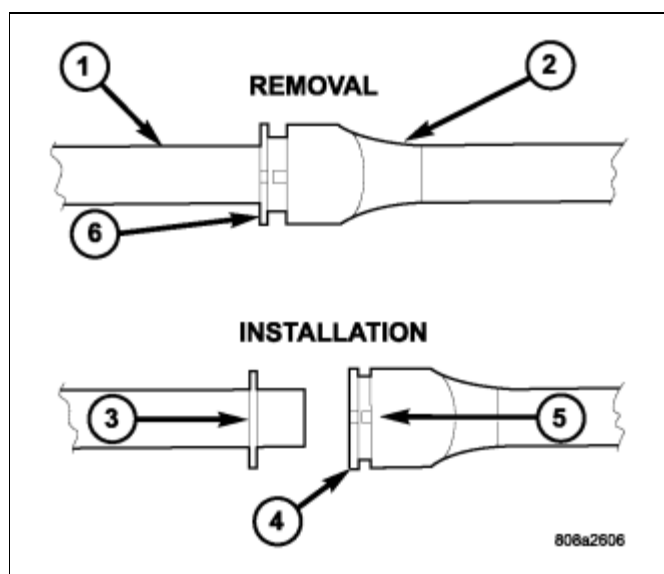


16. **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (4) usually black in color.

- a. To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (6). With plastic ring depressed, pull fitting from component.

The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.

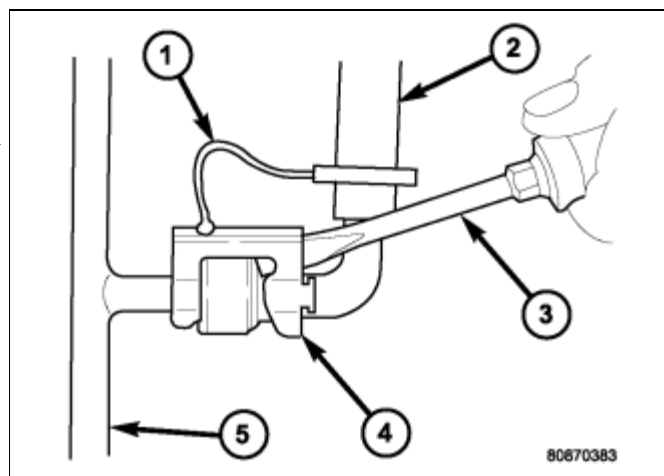
- b. After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.
- c. Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.



17. **Latch Clips — Type 1:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 (4) is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

18. Pry up on latch clip with a screwdriver (3).

19. Slide latch clip toward fuel rail while lifting with screwdriver.



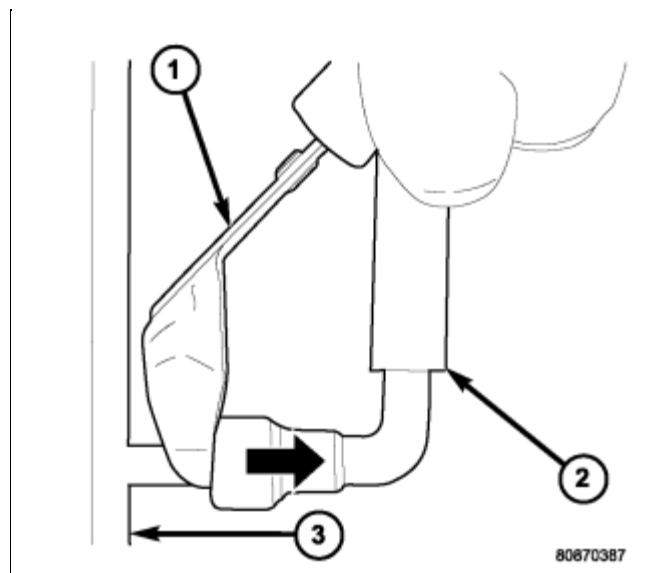
20. Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to

release locking fingers in end of line.

21. With special tool still inserted, pull fuel line from fuel rail.

22. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

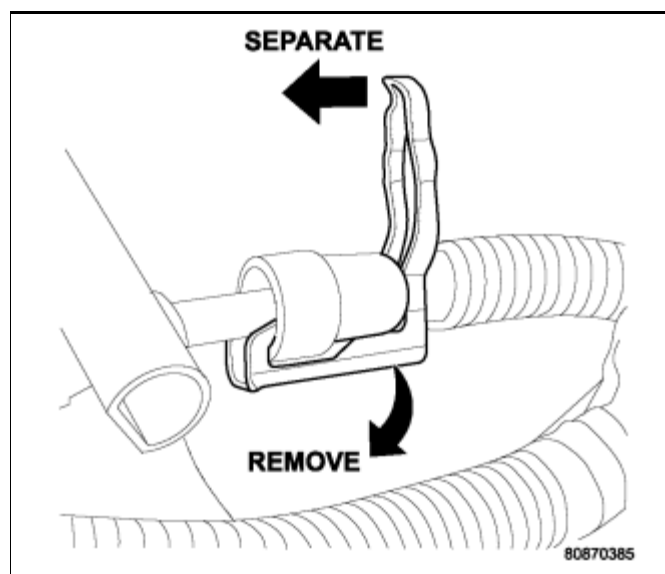
23. Disconnect quick-connect fitting from fuel system component being serviced.



24. **Latch Clips — Type 2:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

25. Type 2: Separate and unlatch small arms on end of clip and swing away from fuel line.

26. Slide latch clip toward fuel rail while lifting with screwdriver.

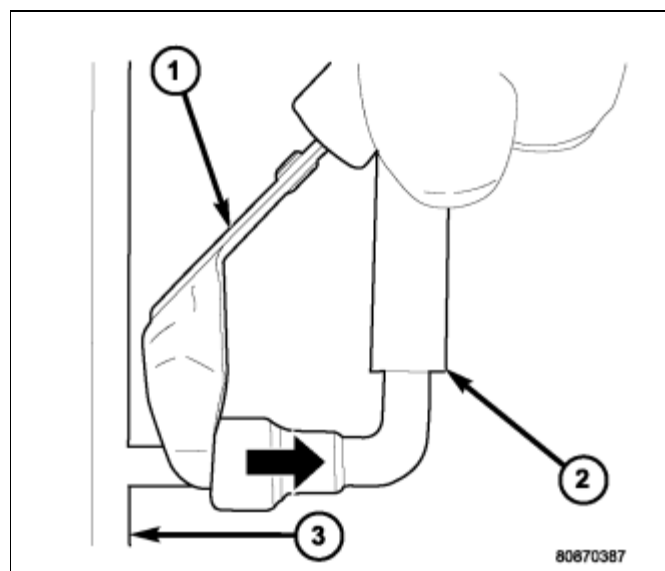


27. Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to release locking fingers in end of line.

28. With special tool still inserted, pull fuel line from fuel rail.

29. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

30. Disconnect quick-connect fitting from fuel system component being serviced.

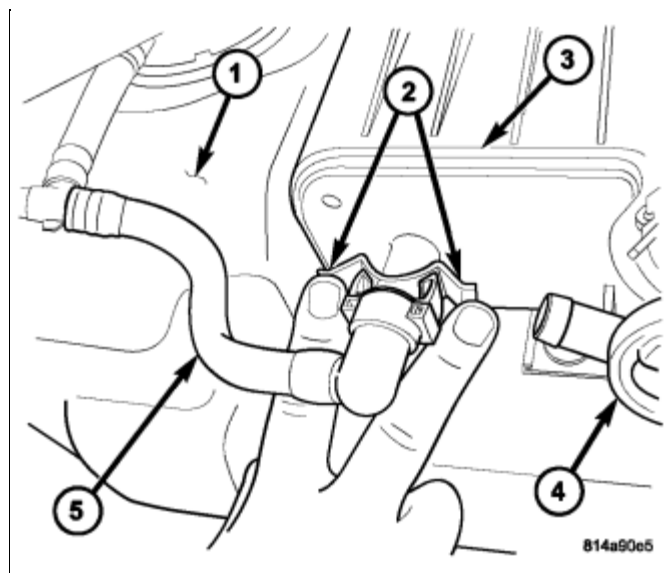


31. **Wing Type:** A special tool will not be necessary to disconnect this type of fitting (2). This line is used on different fuel and emission components. The graphic shows the fitting used on an EVAP canister.

32. Use two fingers to push on fitting wings (2)

33. Pull and disconnect fitting while holding wings.

34. After disconnection, locking fingers will remain within quick-connect fitting.



CONNECTING

1. Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.
2. Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.
3. Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.
4. Continue pushing until a click is felt.
5. Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.
6. Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).
7. Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**
8. Connect negative cable to battery.
9. Start engine and check for leaks.

MOTOR-FUEL PUMP

DESCRIPTION

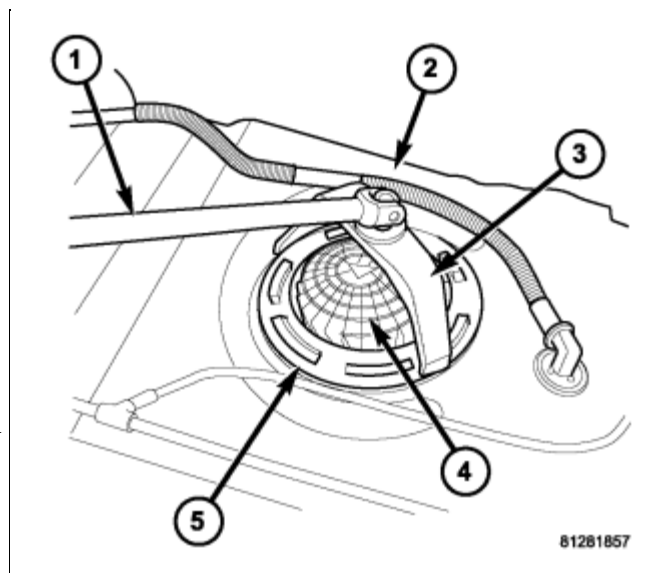
The electric fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump. The electric fuel pump is not a separate, serviceable component.

MODULE-FUEL PUMP

REMOVAL

WARNING: The fuel system is under a constant pressure (even with the engine off). Before servicing the fuel pump module, the fuel system pressure must be released. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)

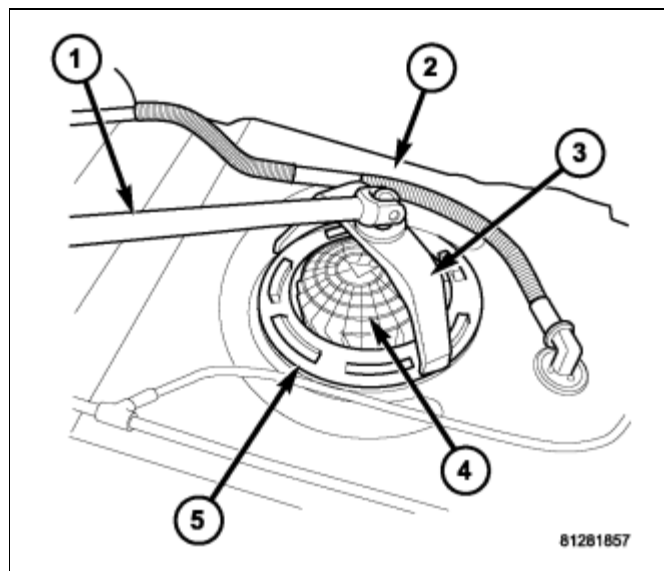
1. Drain and remove fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - REMOVAL) .
2. Note rotational position of module before attempting removal. An indexing arrow is located on top of module for this purpose.
3. Position special Lockring Remover/Installer tool 9340 (3) into notches on outside edge of lockring (5).
4. Install 1/2 inch drive breaker bar (1) to special Lockring Remover/Installer tool 9340 (3).
5. Rotate breaker bar counter-clockwise to remove lockring.
6. Remove lockring. The module will spring up slightly when lockring is removed.
7. Remove module from fuel tank. Be careful not to bend float arm while removing.



INSTALLATION

CAUTION: Whenever the fuel pump module is serviced, the rubber seal (gasket) must be replaced.

1. Using a new seal (gasket), position fuel pump module into opening in fuel tank.
2. Position lockring (5) over top of fuel pump module.
3. Rotate module until embossed alignment arrow points to center alignment mark. This step must be performed to prevent float from contacting side of fuel tank.
4. Install Lockring Remover/Installer 9340 (3) to lockring.
5. Install 1/2 inch drive breaker (1) into Lockring Remover/Installer 9340 (3).
6. Tighten lockring (clockwise) until all seven notches have engaged.
7. Install fuel tank.



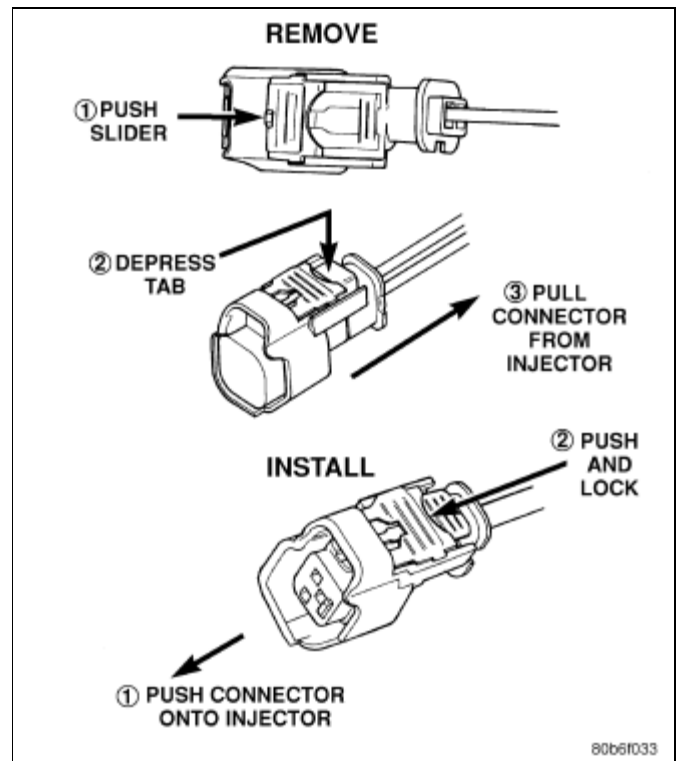
RAIL - FUEL

REMOVAL - 3.8L

WARNING: The fuel system is under constant pressure even with engine off. Before servicing fuel rail, fuel system pressure must be released. Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE

1. Remove fuel tank filler tube cap.
2. Perform Fuel System Pressure Release Procedure. Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE
3. Remove negative battery cable at battery.
4. Remove upper half of intake manifold. Refer to ENGINE section.

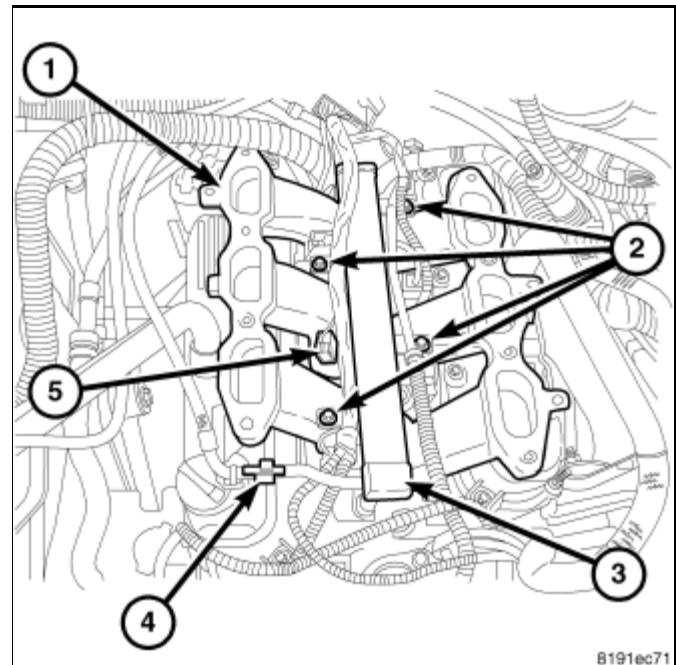
5. Disconnect electrical connectors at all six fuel injectors. Refer to graphic. Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.



6. Disconnect fuel line latch clip (4) and fuel line at fuel rail.
7. Remove four fuel rail mounting bolts (2).
8. Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.
9. Remove fuel rail (3) (with injectors attached) from engine.
10. If fuel injectors are to be removed, refer to Fuel Injector Removal.

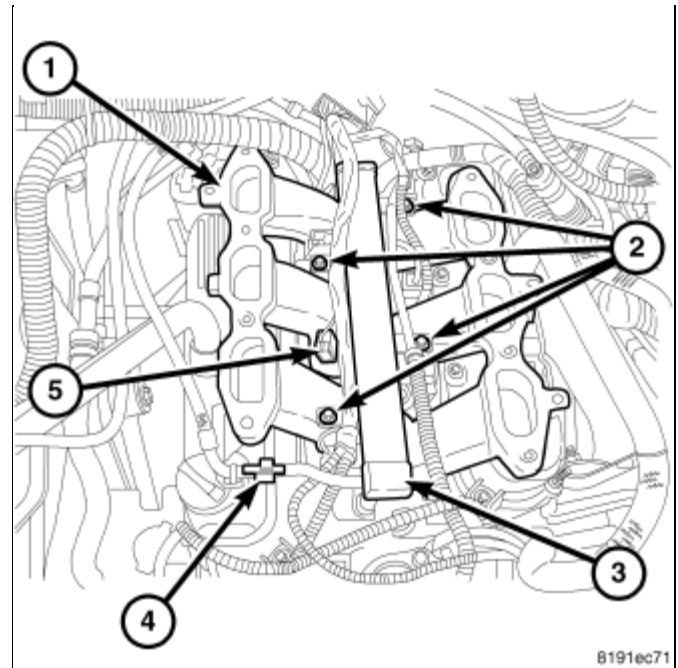
INSTALLATION - 3.8L

1. If fuel injectors are to be installed, refer to Fuel Injector Installation.
2. Clean out fuel injector machined bores in intake manifold.
3. Apply a small amount of engine oil to each fuel injector O-ring. This will help in fuel rail installation.
4. Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.
5. Guide each injector into cylinder head. Be careful not to tear injector O-rings.
6. Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.



7. Install four fuel rail mounting bolts (2) and tighten. Refer to Torque Specifications.

8. Connect fuel line latch clip (4) and fuel line to fuel rail.



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9. Connect electrical connectors at fuel injectors. Refer to graphic. Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

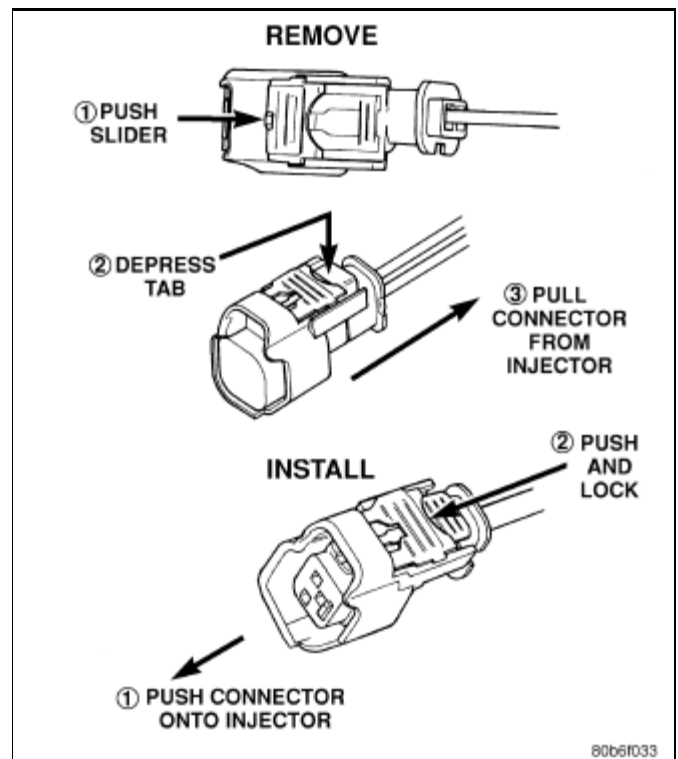
10. Install upper half of intake manifold. Refer to ENGINE section.

11. Connect battery cable to battery.

12. Start engine and check for leaks.

TANK - FUEL

REMOVAL



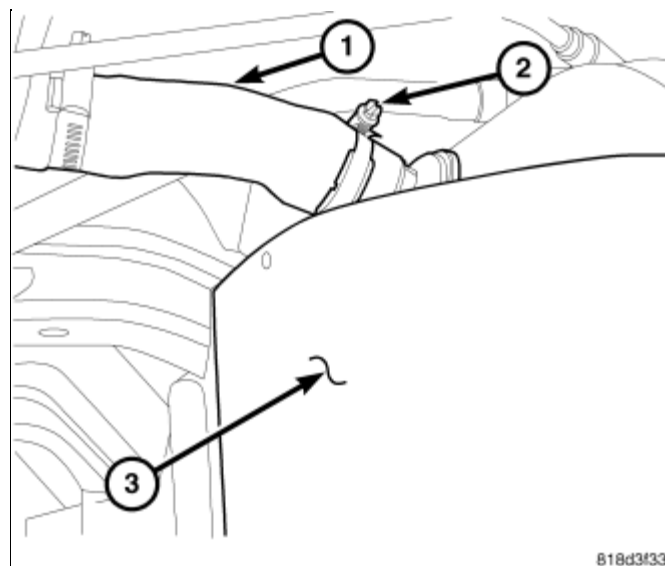
80b6f033

GAS POWERED

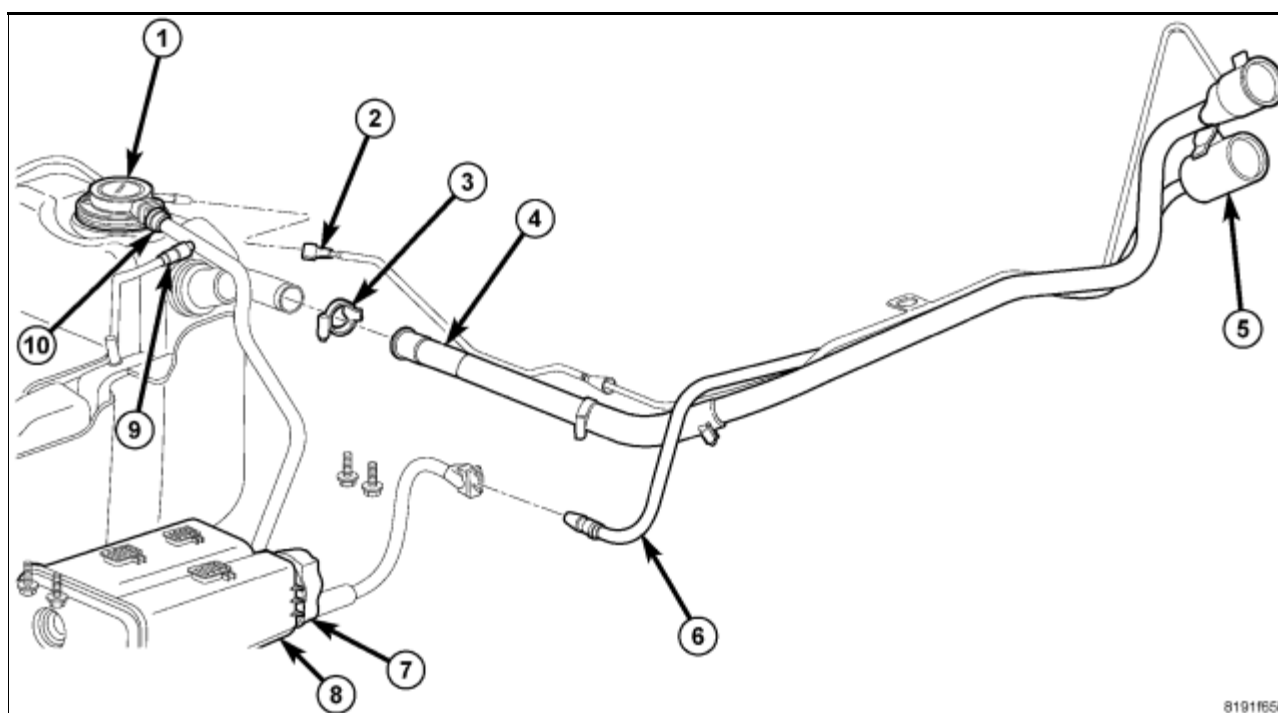
WARNING: The fuel system is under constant pressure even with engine off. Before servicing fuel rail, fuel system pressure must be released.

1. Remove fuel tank filler tube cap.

2. Perform Fuel System Pressure Release Procedure.
3. Remove fuel fill cap.
4. Raise and support vehicle.
5. Remove fuel fill hose clamp (2) at rear of tank (3).
6. Remove fuel fill hose (1) from fuel tank.
7. Position a drain hose into the fuel fill hose opening. Note that a small flapper valve is installed into the opening.
8. Drain fuel tank using an approved gasoline fuel draining station.



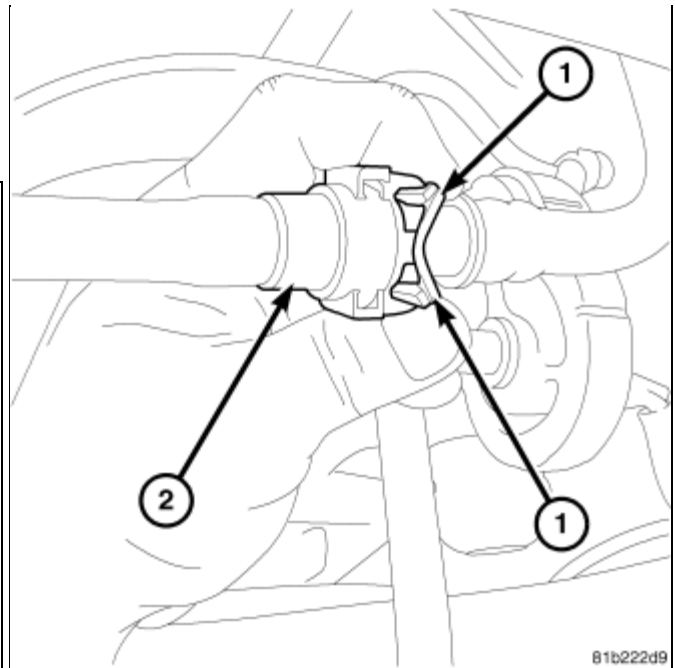
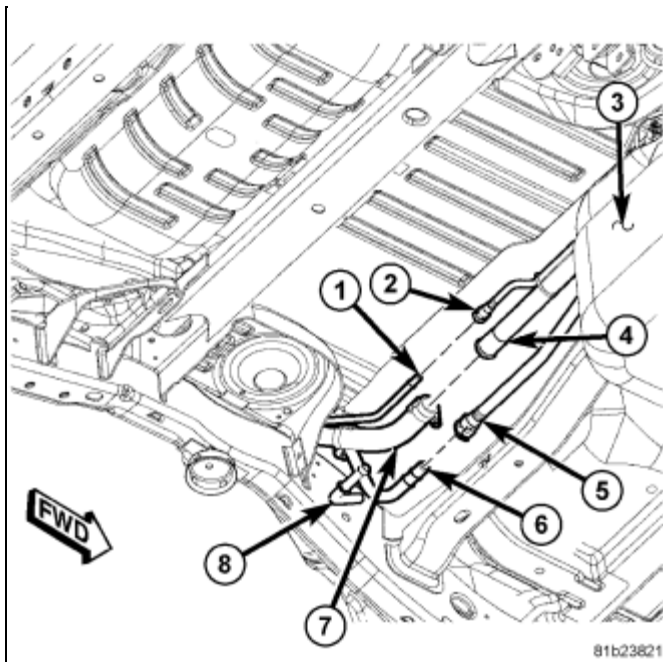
818d3f33



8191f55b

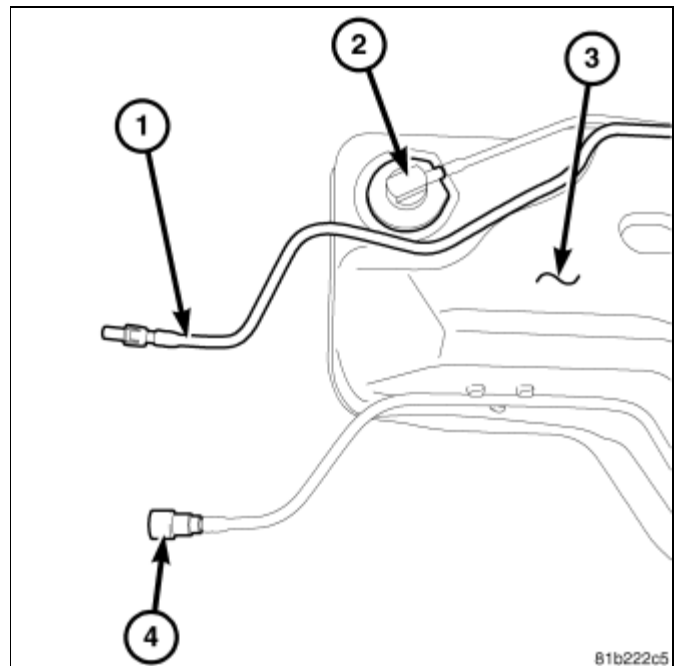
The fuel tank skid plate and the fuel tank assembly are removed at the same. They share common fasteners.

9. Disconnect quick-connect fitting (2).
10. Disconnect quick-connect fitting (9).
11. Disconnect quick-connect fitting (10).
12. Remove hose clamp (3) and disconnect hose (4) at tank.
13. Support tank with a hydraulic jack.
14. Disconnect quick-connect fittings at front of tank.
15. Remove two tank mounting bolts at rear of fuel tank.
16. Remove three tank mounting bolts at right side of fuel tank.
17. Remove three tank mounting bolts at left side of fuel tank.
18. Partially lower tank to gain access to pump module electrical connector.
19. Disconnect electrical connector at fuel pump module.



Disconnect quick-connect fitting (2).
10. Support tank with a hydraulic jack.

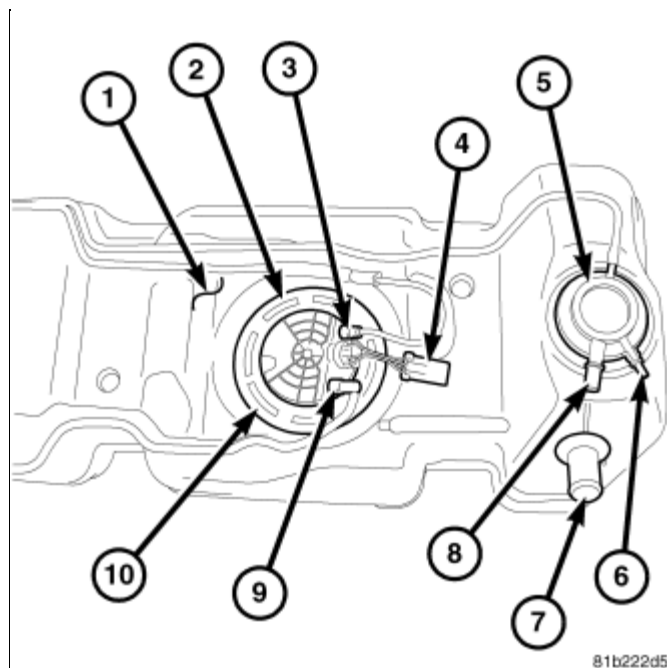
11. Disconnect quick-connect fittings (1) and (4) for fuel supply and return lines at front of tank.
12. Remove two tank mounting bolts at rear of fuel tank.
13. Remove three tank mounting bolts at right side of fuel tank.
14. Remove three tank mounting bolts at left side of fuel tank.



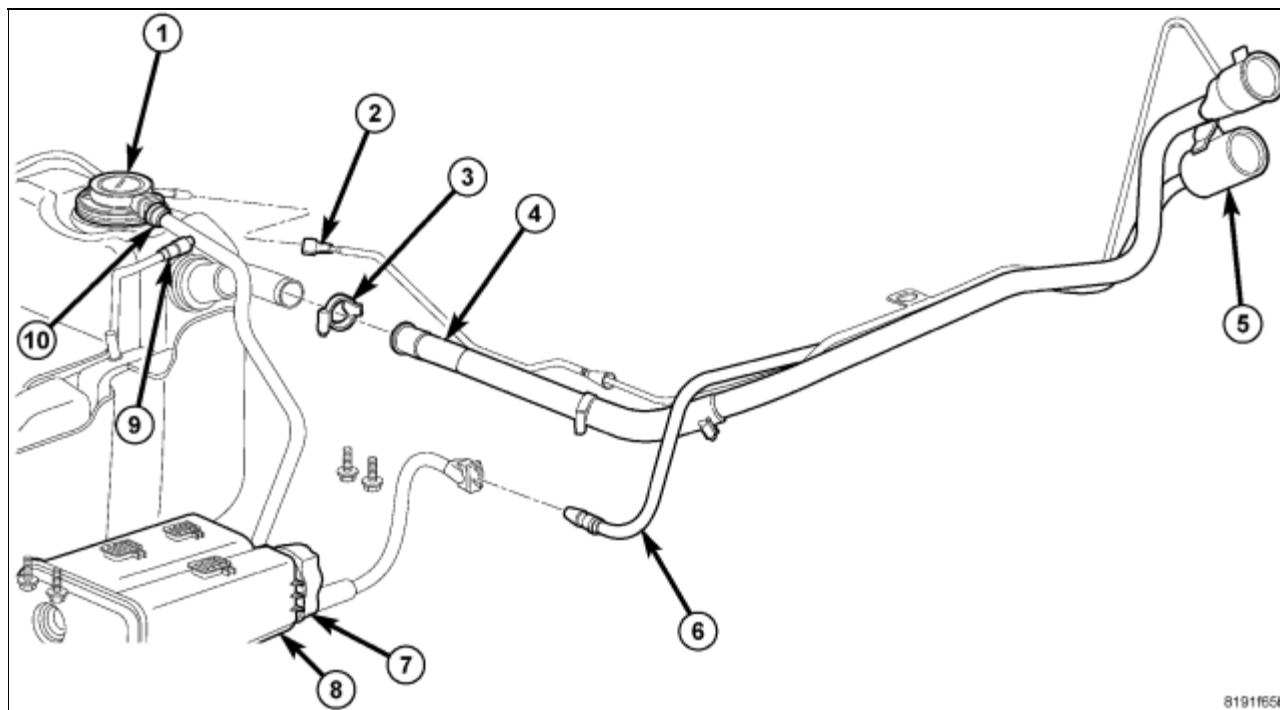
15. Partially lower tank to gain access to pump module electrical connector (4).
16. Disconnect electrical connector (4) at fuel pump module.
17. Continue lowering tank for removal.
18. Lift fuel tank from skid plate.

19. If fuel tank is to be replaced, remove fuel pump module from tank.

INSTALLATION



GAS POWERED



The fuel tank skid plate and the fuel tank assembly are installed at the same. They share common fasteners.

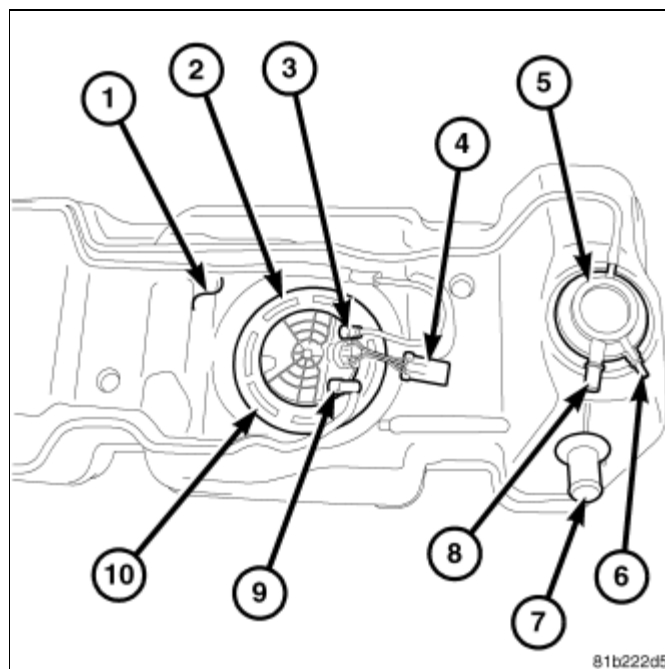
1. If fuel pump module had been removed, install module to tank.
2. Position fuel tank into skid plate.
3. Support tank with a hydraulic jack.
4. Partially raise tank to allow connections at top of tank.

5. Connect electrical connector to fuel pump module.
6. Continue raising tank snugly to body.
7. Connect quick-connect fitting (2).
8. Connect quick-connect fitting (9).
9. Connect quick-connect fitting (10).
10. Install hose (4) to tank and install clamp (3).
11. Connect quick-connect fittings at front of tank.
12. Install two tank mounting bolts at rear of fuel tank.
13. Install three tank mounting bolts at right side of fuel tank.
14. Install three tank mounting bolts at left side of fuel tank.

DIESEL POWERED

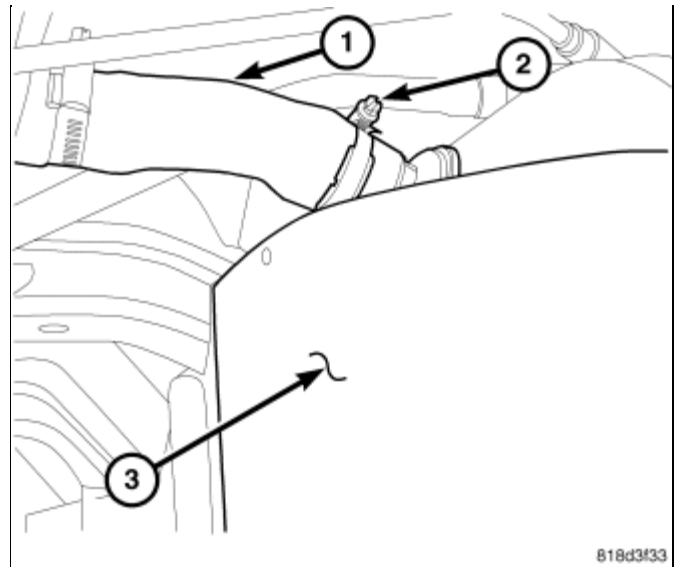
1. If fuel pump module had been removed, install module to tank.
2. Position fuel tank into skid plate.
3. Support tank with a hydraulic jack.

4. Partially raise tank to gain access to pump module electrical connector (4).
5. Connect electrical connector (4) to fuel pump module.
6. Continue raising tank snugly to body.



7. Connect quick-connect fittings (1) and (4) for fuel supply and return lines at front of tank.
8. Install two tank mounting bolts at rear of fuel tank.
9. Install three tank mounting bolts at right side of fuel tank.
10. Install three tank mounting bolts at left side of fuel tank.

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Both fuel filters are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

REGULATOR-FUEL PRESSURE

DESCRIPTION

The fuel pressure regulator is located within the fuel pump module. It is serviced by replacing the fuel pump module assembly.

FILTER-FUEL

DESCRIPTION

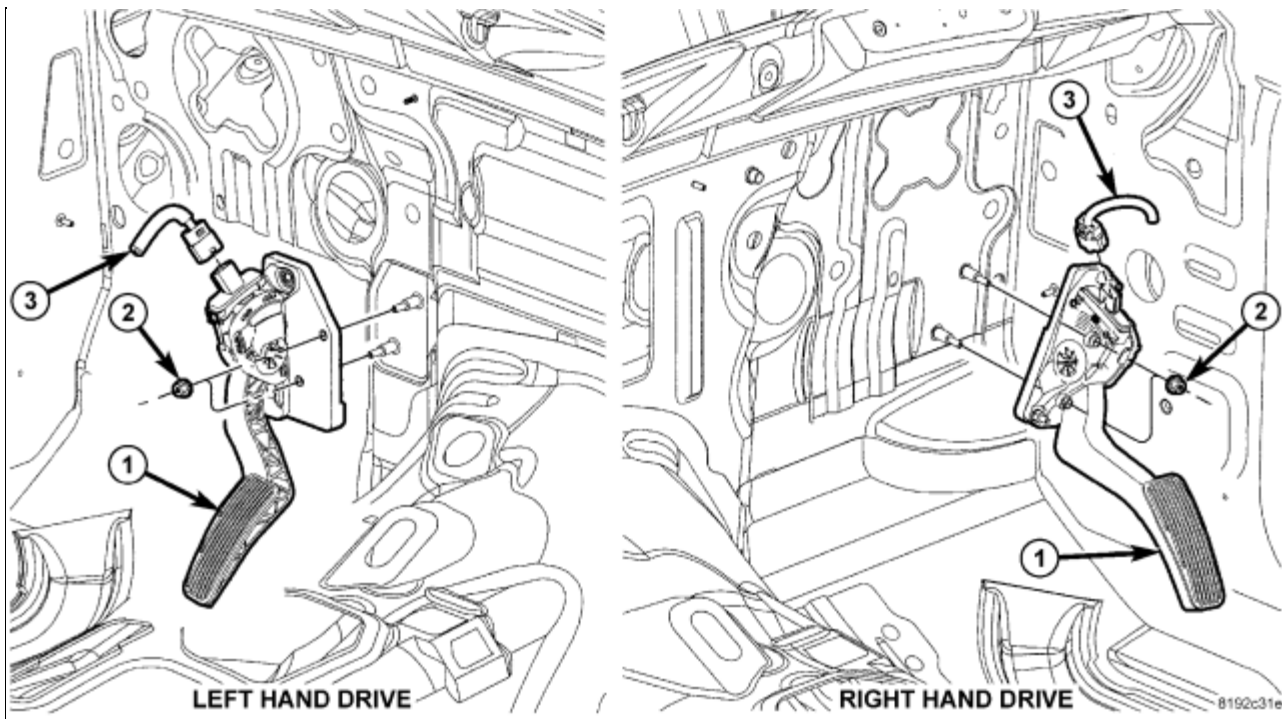
Two fuel filters are used. One is located at the bottom of the fuel pump module. The other is located inside the module. A separate frame mounted fuel filter is not used with any engine.

Both fuel filters are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

FUEL INJECTION - 3.8L GAS ENGINE

PEDAL - ACCELERATOR

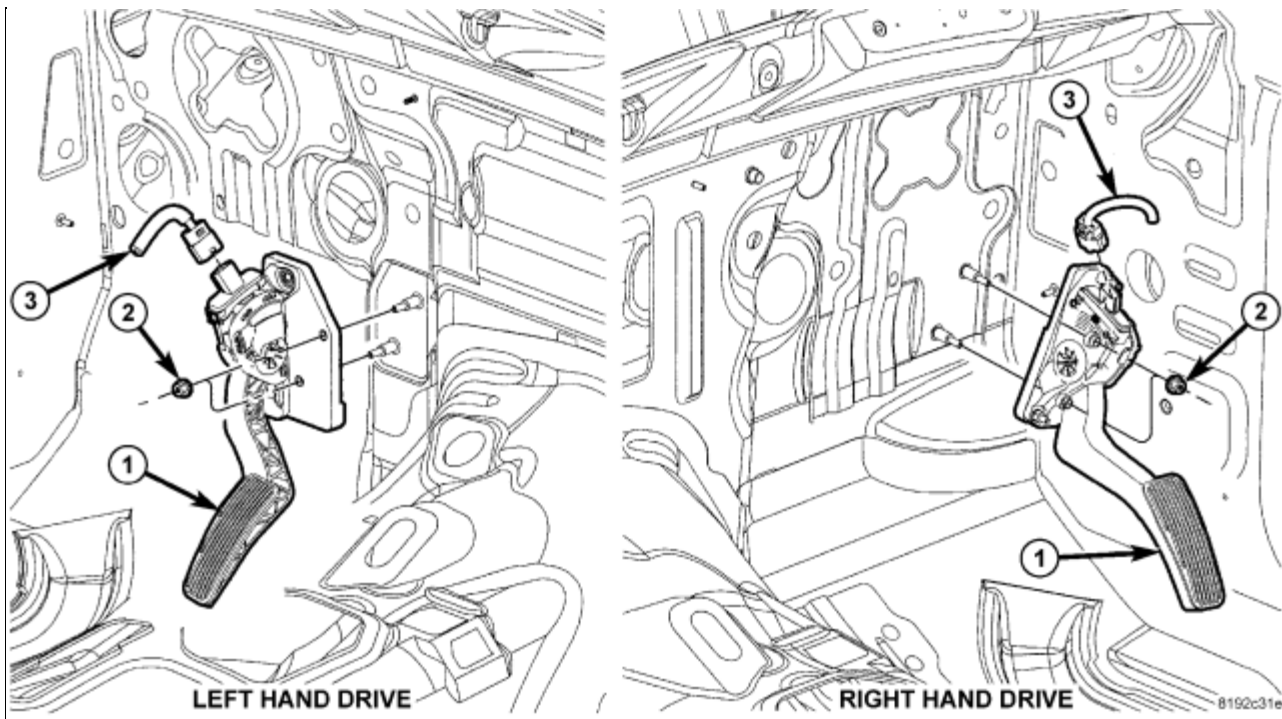
REMOVAL



The accelerator pedal and APPS (Accelerator Pedal Position Sensor) are serviced as a complete assembly including the bracket.

1. Disconnect electrical connector (3) at APPS.
2. Remove two accelerator pedal mounting bracket nuts (2).
3. Remove accelerator pedal/APPS assembly (1) from vehicle.

INSTALLATION

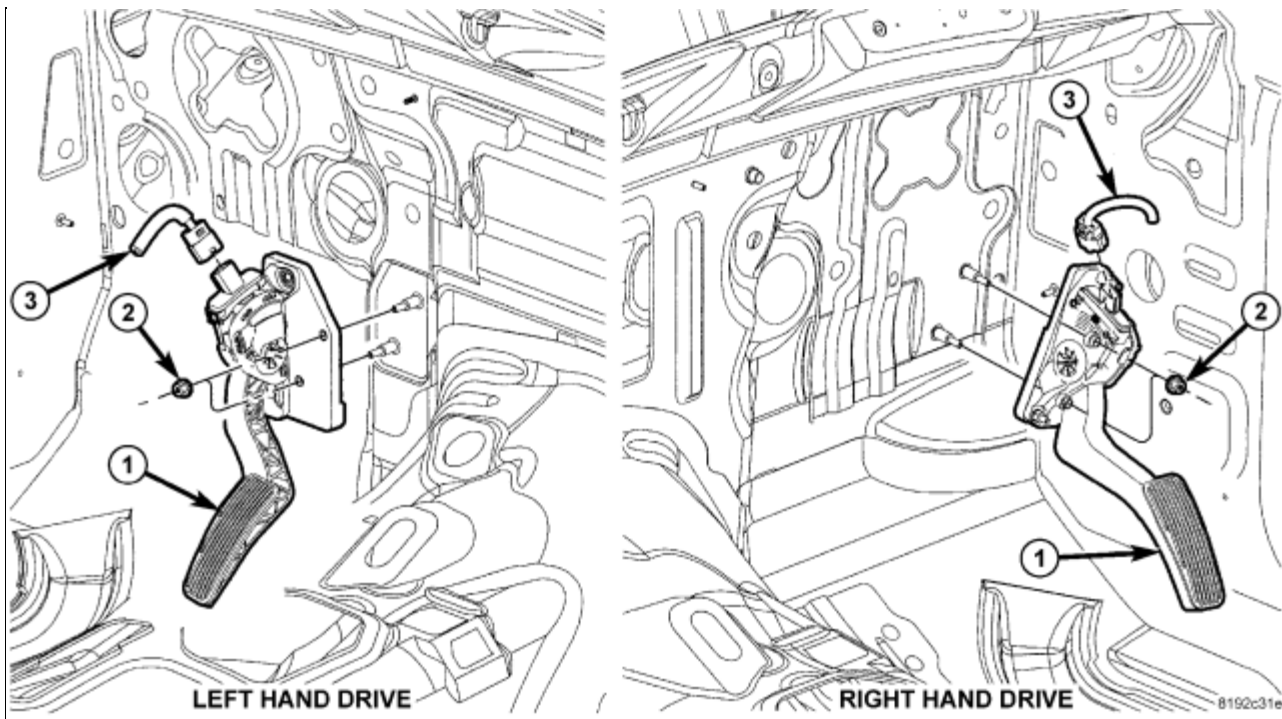


The accelerator pedal and APPS (Accelerator Pedal Position Sensor) are serviced as a complete assembly including the bracket.

1. Position accelerator pedal/APPS assembly over two mounting studs.
2. Install two accelerator pedal mounting bracket nuts (2).
3. Connect electrical connector (3) at APPS.
4. Before starting engine, operate accelerator pedal to check for any binding.

SENSOR - ACCELERATOR PEDAL POSITION

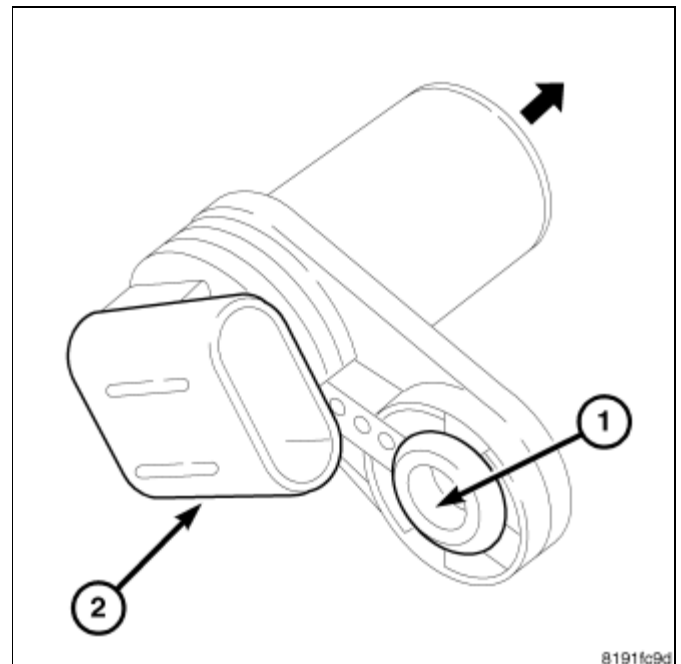
DESCRIPTION



The accelerator pedal and APPS (Accelerator Pedal Position Sensor) are serviced as a complete assembly including the bracket. Refer to Accelerator Pedal Removal and Installation procedures.

SENSOR - CRANKSHAFT POSITION

REMOVAL



The Crankshaft Position (CKP) sensor (2) is mounted into the right side of the transmission bellhousing (4). It is positioned and bolted into a machined hole.

1. Raise vehicle.
2. Disconnect sensor electrical connector (3).
3. Remove sensor mounting bolt (1).
4. Carefully twist sensor (2) from cylinder block.
5. Check condition of sensor o-ring.

INSTALLATION

1. Clean out machined hole in transmission bellhousing.
2. Apply a small amount of engine oil to sensor o-ring.
3. Install sensor (2) into transmission with a slight rocking and twisting action.

CAUTION: Before tightening sensor mounting bolt (1), be sure sensor is completely flush to transmission bellhousing. If sensor is not flush, damage to sensor mounting tang may result.

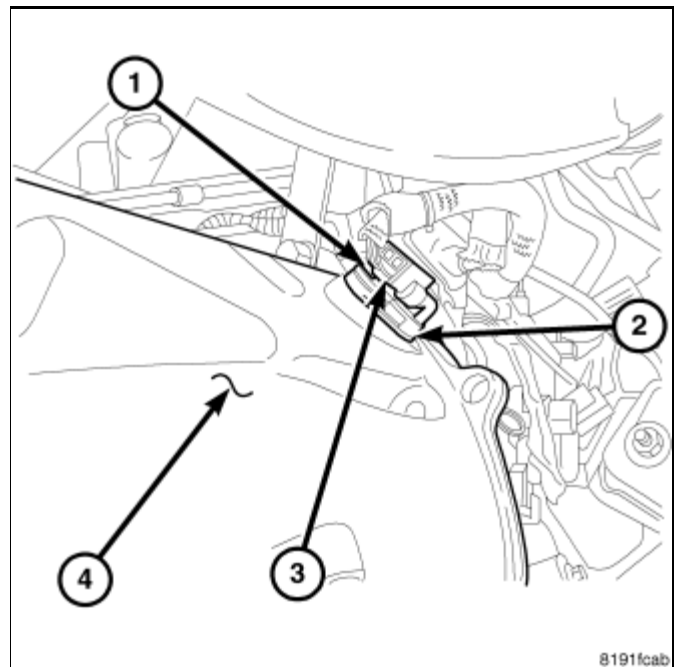
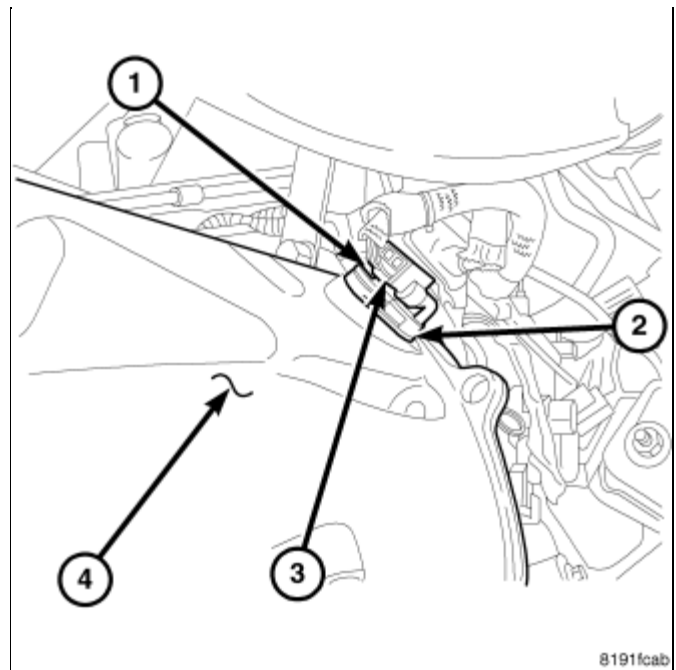
4. Install mounting bolt (1) and tighten to 28 N·m (21 ft. lbs.).
5. Connect electrical connector (3) to sensor.
6. Lower vehicle.

INJECTOR - FUEL

REMOVAL

The fuel rail must be removed to gain access to the fuel injectors. Refer to Fuel Rail Removal.

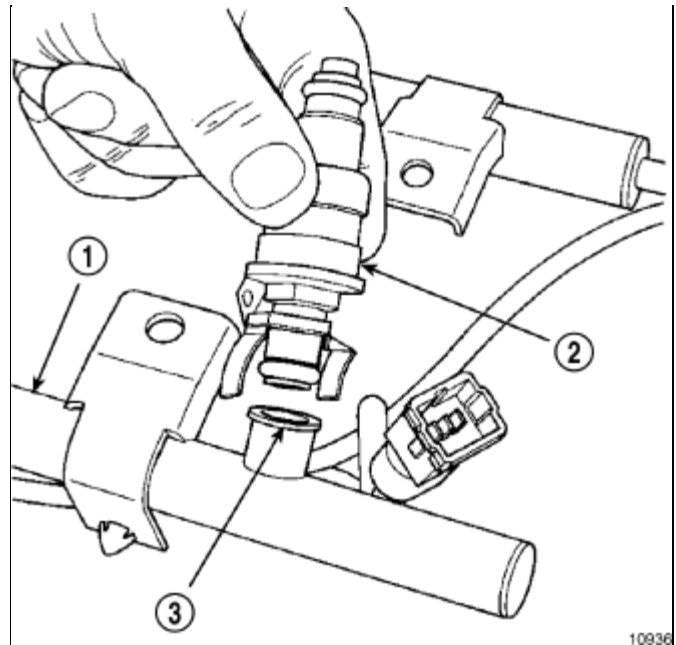
1. Disconnect injector wiring connector from each injector.
2. Rotate injector (2) and pull out of fuel rail. The clip will stay on injector.
3. Check injector O-ring for damage. If O-ring is damaged, it must be replaced. If injector is reused, a protective cap must



be installed on injector tip to prevent damage. Replace injector clip if it is damaged.

4. Repeat procedures for remaining injectors.

INSTALLATION

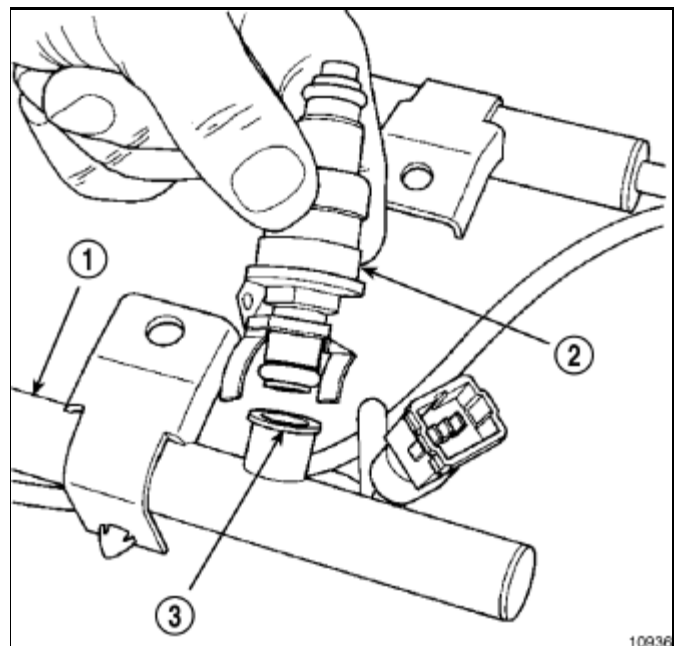


1. If same injector(s) is being reinstalled, install new O-ring(s).
2. Apply a small amount of clean engine oil to each injector O-ring. This will aid in installation.
3. Push fuel injector(s) into fuel rail assembly (3) until clip has latched.
4. Install fuel rail. Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).
5. Start engine and check for fuel leaks.

RELAY - FUEL PUMP

DESCRIPTION

The fuel pump relay is located in the TPIM (Totally Integrated Power Module).



SENSOR - INTAKE AIR TEMPERATURE

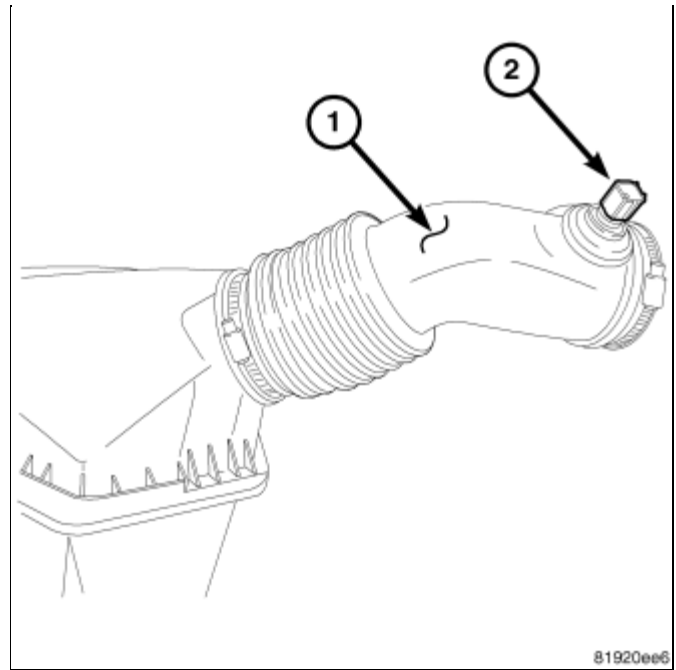
REMOVAL

The intake manifold air temperature (IAT) sensor (2) is installed into the rubber air intake tube (1) near the throttle body.

1. Disconnect electrical connector from IAT sensor.
2. Clean dirt from IAT sensor base.

3. Pull up on IAT sensor while rotating for removal.
4. Check condition of sensor O-ring.

INSTALLATION

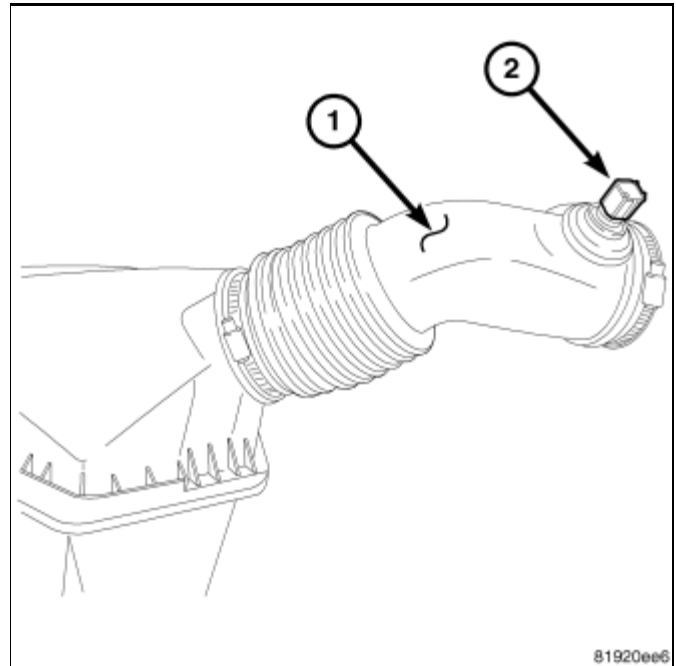


The intake manifold air temperature (IAT) sensor (2) is installed into the rubber air intake tube (1) near the throttle body.

1. Clean mounting hole.
2. Check condition of sensor O-ring.
3. Push IAT sensor into rubber intake tube while rotating for installation.
4. Connect electrical connector to IAT sensor.

SENSOR - MAP

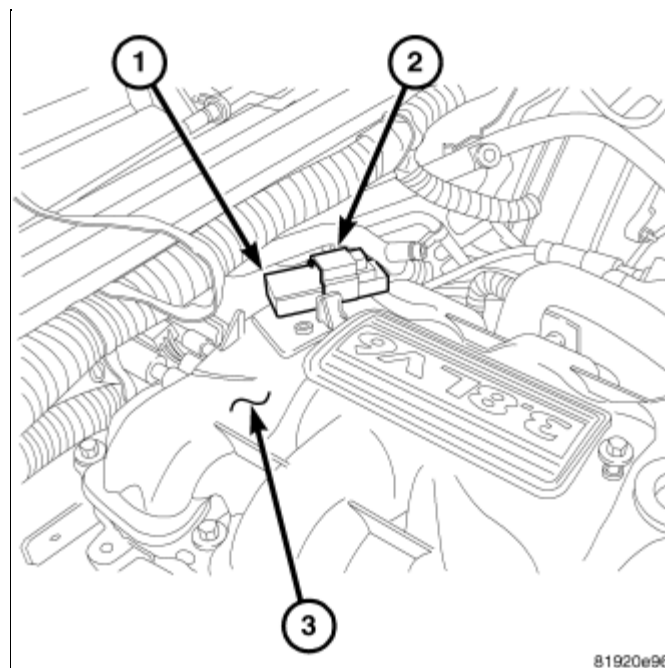
REMOVAL



The MAP sensor (1) is installed into the rear of the upper intake manifold (3).

1. Disconnect electrical connector from MAP sensor.
2. Clean dirt from MAP sensor base.
3. Pull up on MAP sensor while rotating counterclockwise about 1/4 turn for removal.
4. Check condition of sensor O-ring.

INSTALLATION



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The MAP sensor (1) is installed into the rear of the upper intake manifold (3).

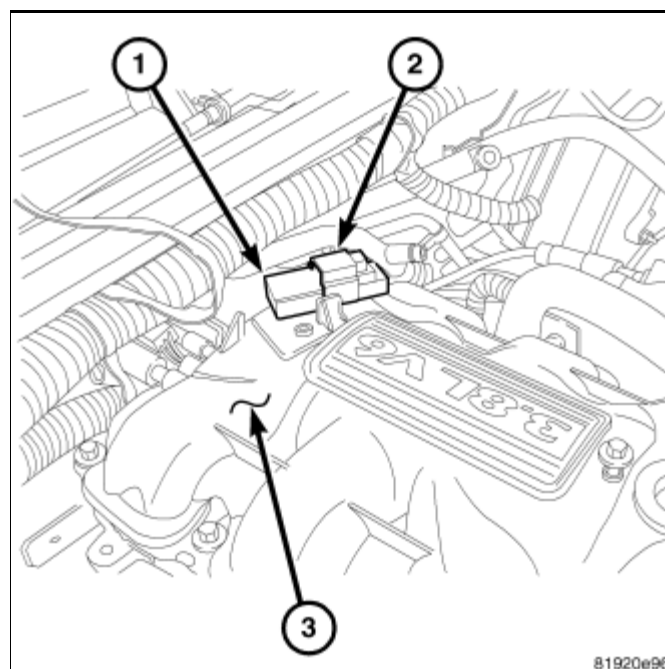
1. Check condition of sensor O-ring.
2. Clean dirt from MAP sensor base.
3. Push down on MAP sensor while rotating clockwise about 1/4 turn for installation.
4. Disconnect electrical connector from MAP sensor.

SENSOR - OXYGEN

REMOVAL

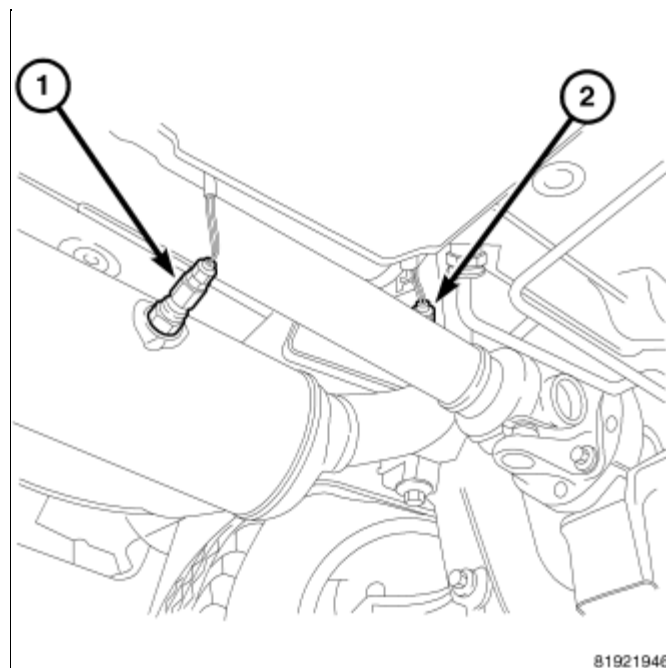
CAUTION: Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.

WARNING: The exhaust manifold, exhaust pipes and catalytic converter become very hot during engine operation. Allow engine to cool before removing oxygen sensor.



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Sensor (1) is referred to as the 2/2 sensor. Sensor (2) is referred to as the 1/2 sensor.



Sensor (1) is referred to as the 1/1 sensor. Sensor (2) is referred to as the 1/2 sensor.

1. Raise and support vehicle.
2. Disconnect wire connector from O2S sensor.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

3. Remove O2S sensor (1) or (2) with an oxygen sensor removal and installation tool. Certain sensors may be removed with a 22mm or 7/8" wrench.
4. Clean threads in exhaust pipe using appropriate tap.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT** add any additional anti-seize compound to threads of a new oxygen sensor.

1. Install O2S sensor. Tighten to 41 N·m (30 ft. lbs.) torque.
2. Connect O2S sensor wire connector.
3. Lower vehicle.

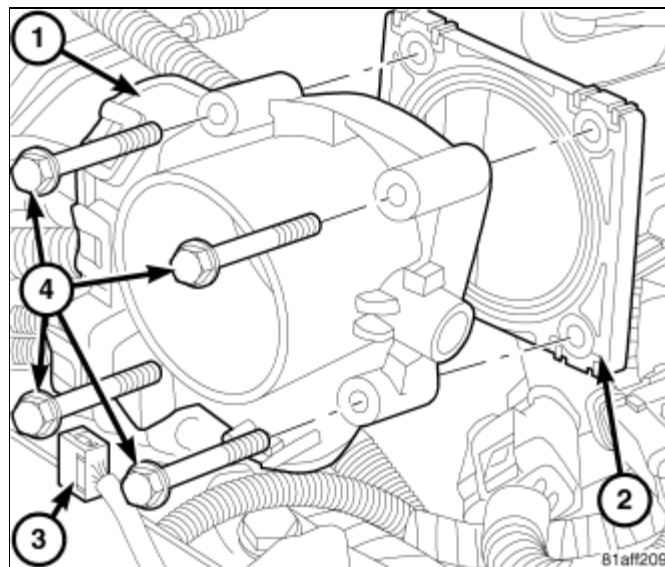
THROTTLE BODY

REMOVAL

CAUTION: Using a diagnostic scan tool, record any previous DTC's (Diagnostic Trouble Codes).

CAUTION: Never have the ignition key in the ON position when/if checking the throttle body shaft for a binding condition. This may set DTC's.

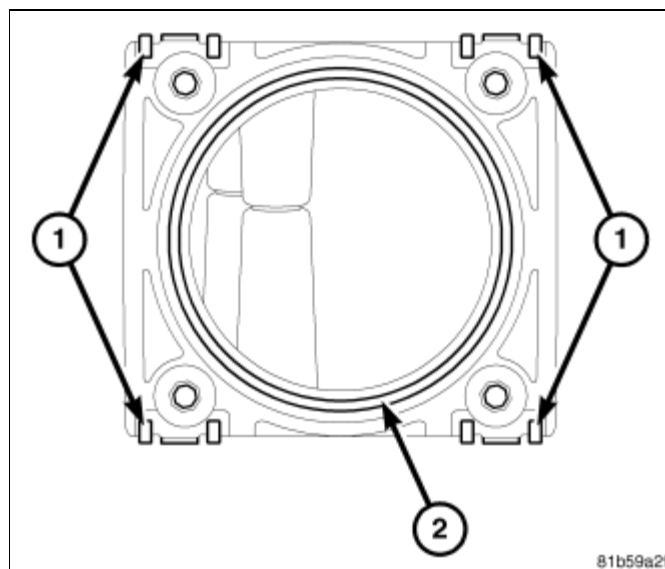
1. Disconnect and isolate negative battery cable at battery.
2. Remove throttle body air intake hose.
3. Disconnect throttle body electrical connector (3).
4. Remove four bolts (4).
5. Remove throttle body (1) from intake manifold (2).



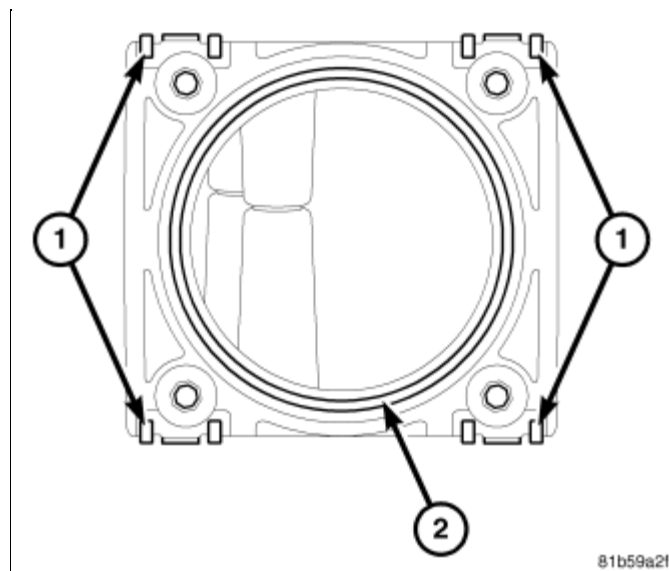
NOTE: Inspect intake manifold to throttle body gasket (2) for damage. Inspect the j-nuts for damage or excessive wear. Replace as necessary.

6. Inspect the four j-nuts (1) for damage or excessive wear, remove if necessary.
7. Inspect intake manifold to throttle body gasket (2) for damage, remove if necessary.

INSTALLATION

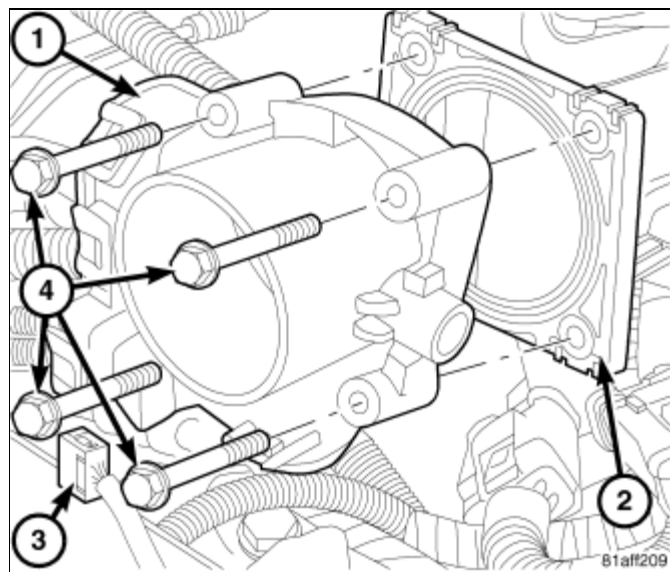


1. Install a new intake manifold to throttle body gasket (2), if replacement was necessary.
2. Install four new four j-nuts (1), if replacement was necessary.



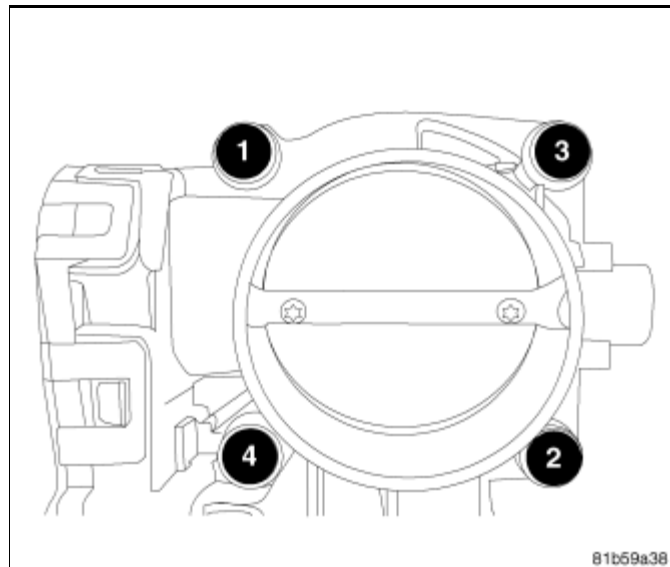
CAUTION: The throttle body mounting bolts **MUST** be torqued to specifications. **DO NOT OVER TIGHTEN MOUNTING BOLTS.** Over tightening can cause damage to the throttle body, throttle plate, gaskets, bolts and/or the intake manifold. Proper torque of the mounting bolts is critical to normal operation.

3. Install throttle body (1) to intake manifold (2).
4. Install four bolts (4) and hand tighten.
5. Connect throttle body (1) electrical connector (3).



CAUTION: The throttle body must be torqued in a mandatory torque sequence. Tighten in a criss - cross pattern to specification.

6. Obtain a torque wrench. Tighten mounting bolts (as shown) in a mandatory torque criss-cross pattern sequence to 7.5 N·m (65 in. lbs.).
7. Install clean air hose and tighten clamps to 4 N·m (35 in. lbs.).
8. Connect negative battery cable, tighten nut to 5 N·m (45 in. lbs.).
9. Using the diagnostic scan tool, erase all previous DTC's and perform the ETC Relearn function.



FUEL DELIVERY - 2.8L DIESEL

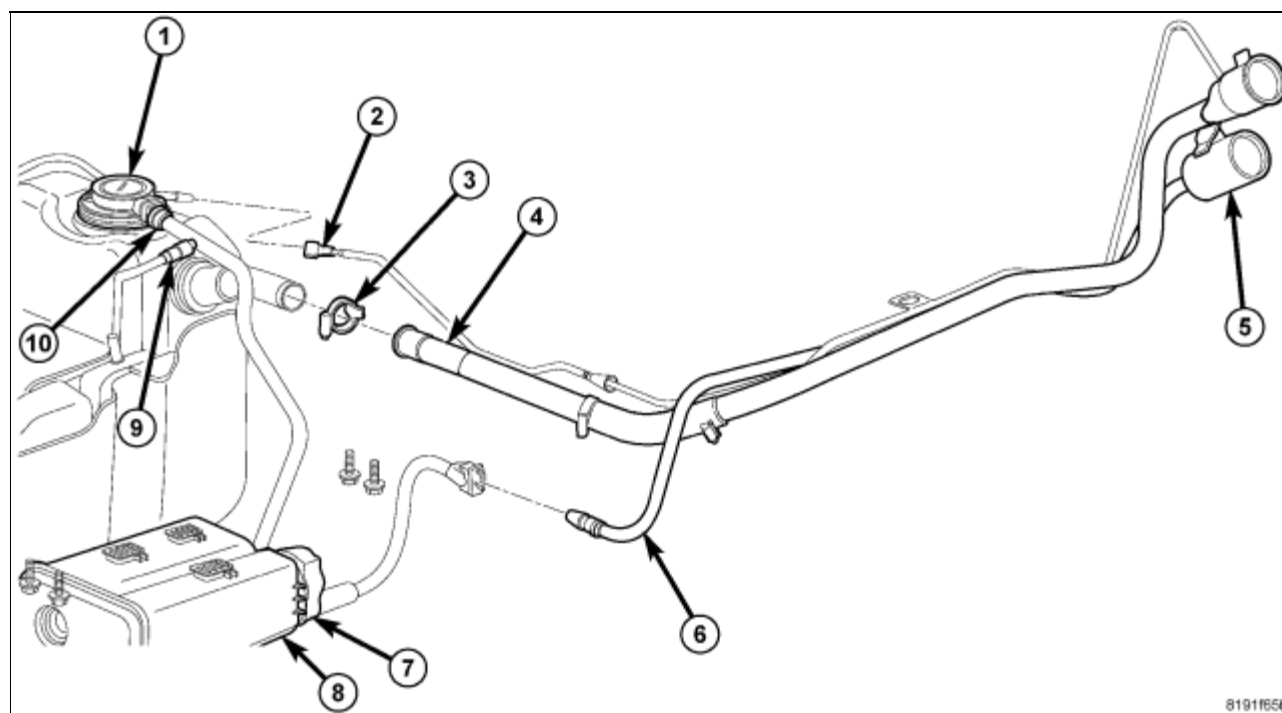
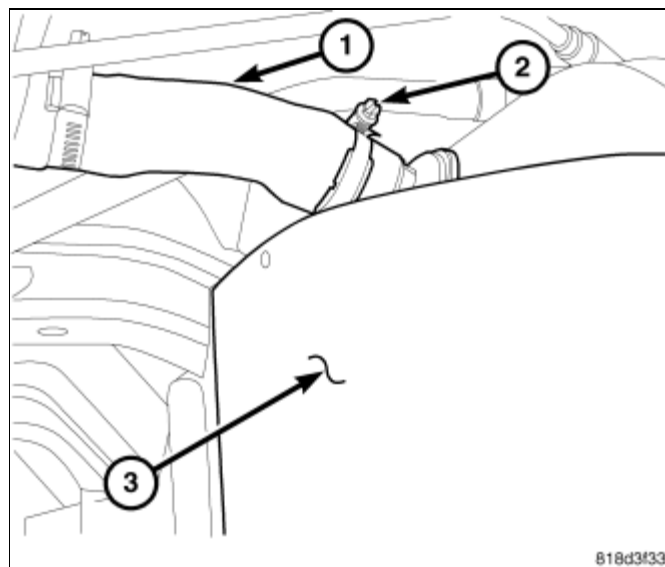
TANK-FUEL

REMOVAL

GAS POWERED

WARNING: The fuel system is under constant pressure even with engine off. Before servicing fuel rail, fuel system pressure must be released.

1. Remove fuel tank filler tube cap.
2. Perform Fuel System Pressure Release Procedure.
3. Remove fuel fill cap.
4. Raise and support vehicle.
5. Remove fuel fill hose clamp (2) at rear of tank (3).
6. Remove fuel fill hose (1) from fuel tank.
7. Position a drain hose into the fuel fill hose opening. Note that a small flapper valve is installed into the opening.
8. Drain fuel tank using an approved gasoline fuel draining station.



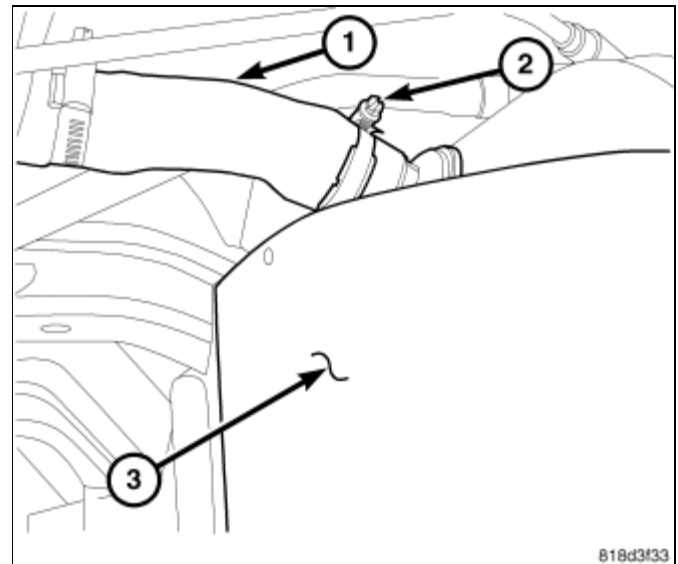
The fuel tank skid plate and the fuel tank assembly are removed at the same. They share common fasteners.

9. Disconnect quick-connect fitting (2).
10. Disconnect quick-connect fitting (9).
11. Disconnect quick-connect fitting (10).
12. Remove hose clamp (3) and disconnect hose (4) at tank.
13. Support tank with a hydraulic jack.
14. Disconnect quick-connect fittings at front of tank.
15. Remove two tank mounting bolts at rear of fuel tank.
16. Remove three tank mounting bolts at right side of fuel tank.
17. Remove three tank mounting bolts at left side of fuel tank.
18. Partially lower tank to gain access to pump module electrical connector.
19. Disconnect electrical connector at fuel pump module.
20. Continue lowering tank for removal.
21. Lift fuel tank from skid plate.
22. If fuel tank is to be replaced, remove fuel pump module from tank.

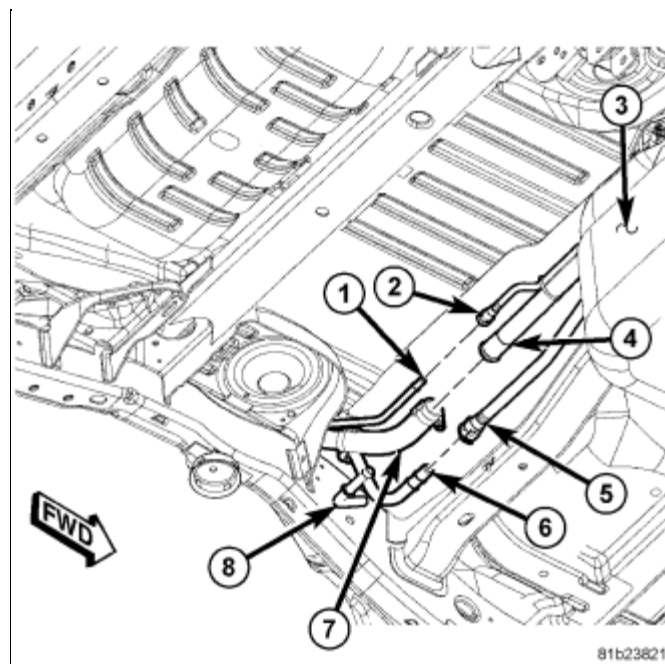
DIESEL POWERED

1. Remove fuel fill cap.
2. Raise and support vehicle.
3. Remove fuel fill hose clamp (2) at rear of tank (3).
4. Remove fuel fill hose (1) from fuel tank.
5. Position a drain hose into the fuel fill hose opening. Note that a small flapper valve is installed into the opening.
6. Drain fuel tank using an approved diesel fuel draining station.

The fuel tank skid plate and the fuel tank assembly are removed at the same. They share common fasteners.

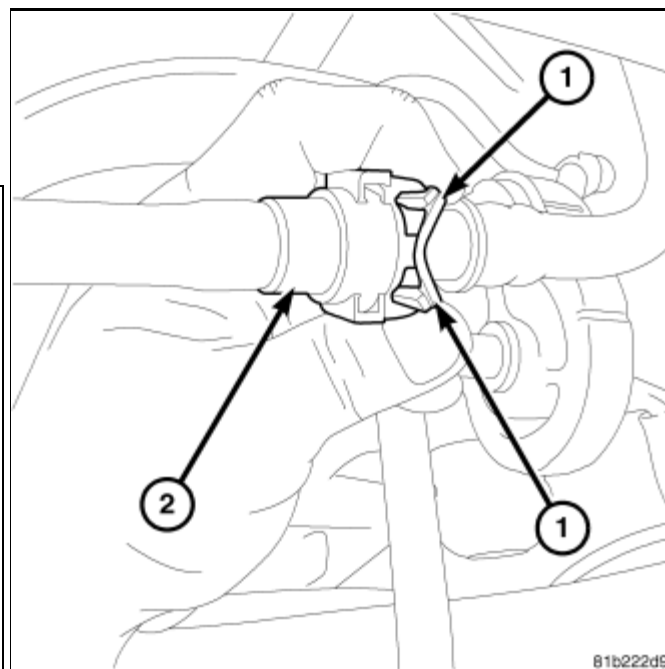
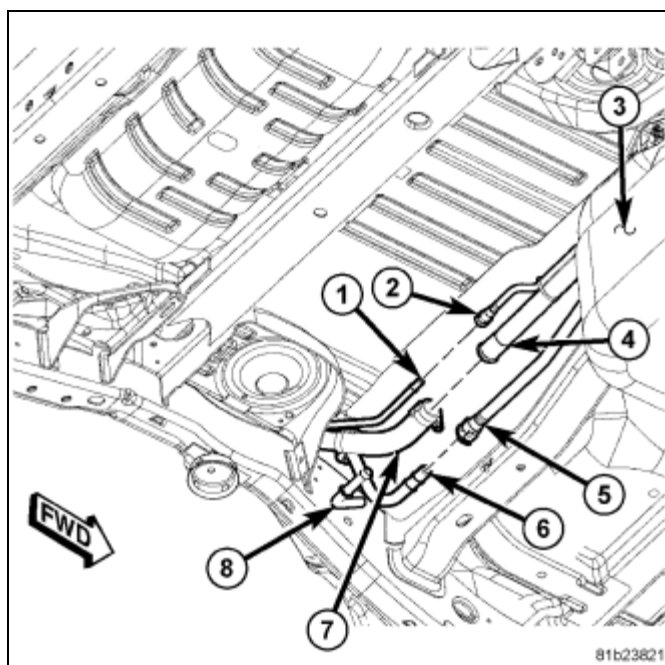


7. Locate quick-connect fitting (5).



8. Disconnect quick-connect fitting (5) by squeezing tabs (1).

9.



Disconnect quick-connect fitting (2).

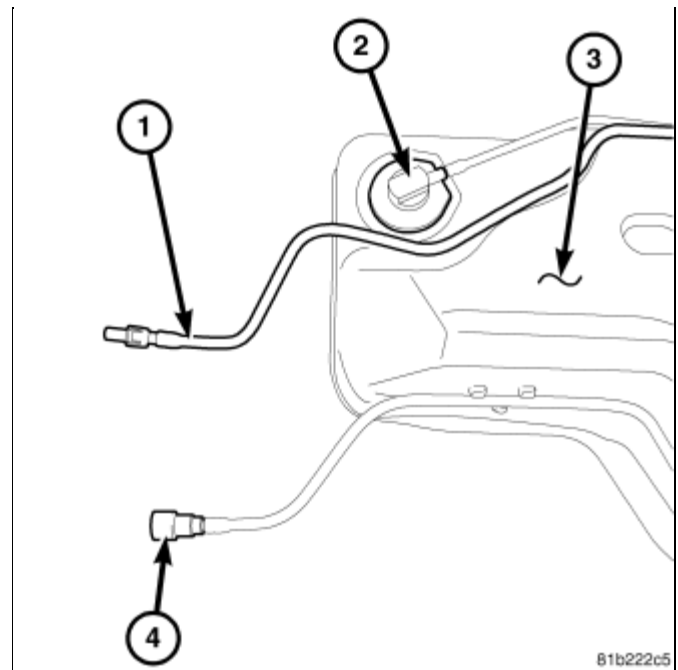
10. Support tank with a hydraulic jack.

11. Disconnect quick-connect fittings (1) and (4) for fuel supply and return lines at front of tank.

12. Remove two tank mounting bolts at rear of fuel tank.

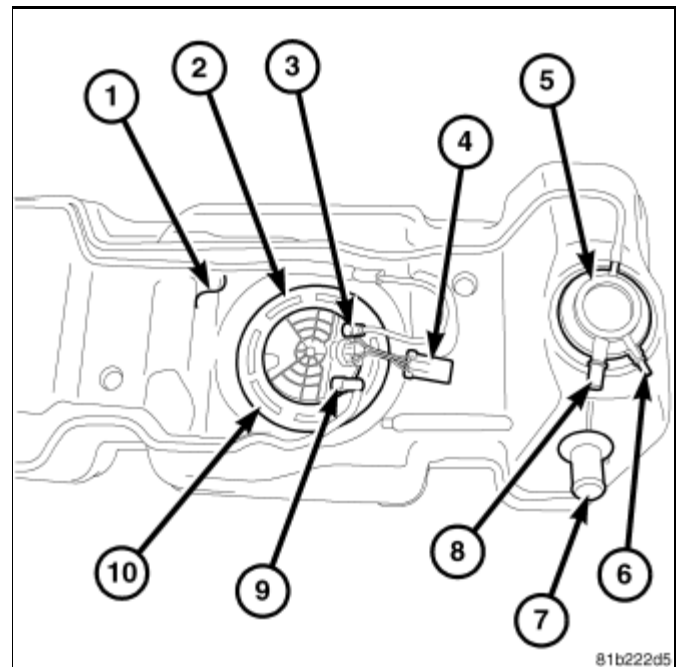
13. Remove three tank mounting bolts at right side of fuel tank.

14. Remove three tank mounting bolts at left side of fuel tank.

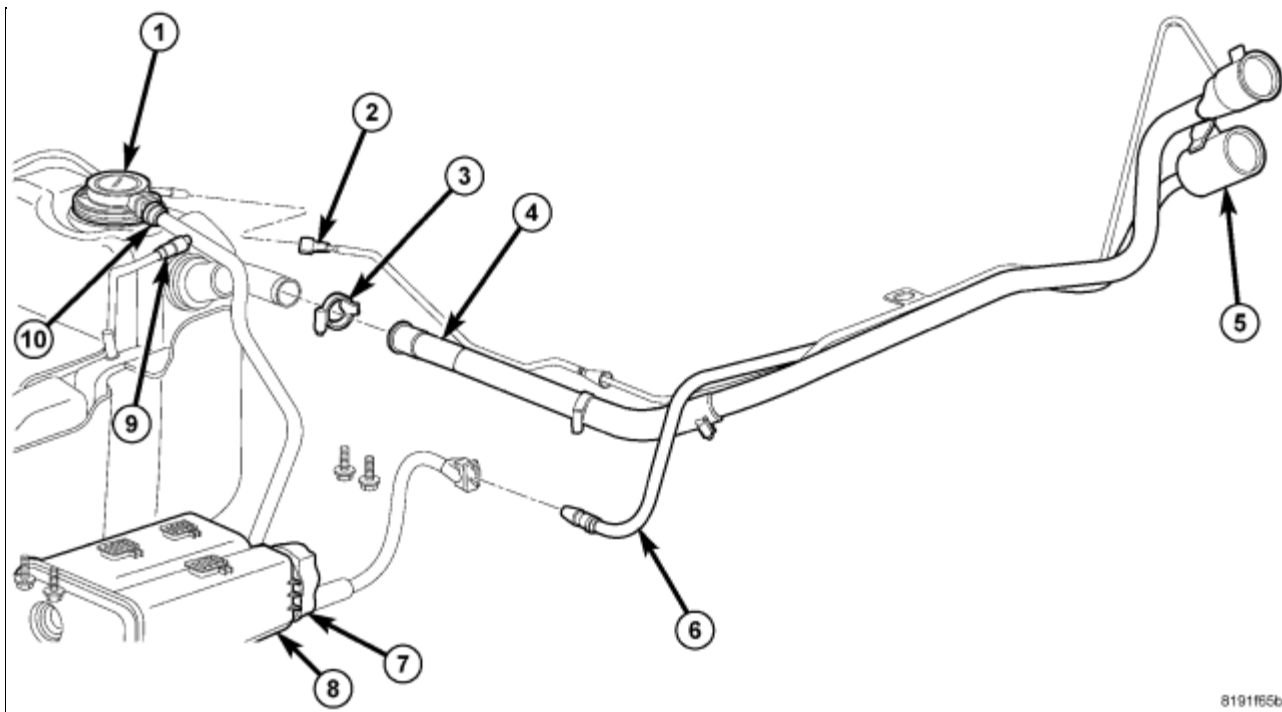


- 15. Partially lower tank to gain access to pump module electrical connector (4).
- 16. Disconnect electrical connector (4) at fuel pump module.
- 17. Continue lowering tank for removal.
- 18. Lift fuel tank from skid plate.
- 19. If fuel tank is to be replaced, remove fuel pump module from tank.

INSTALLATION



GAS POWERED



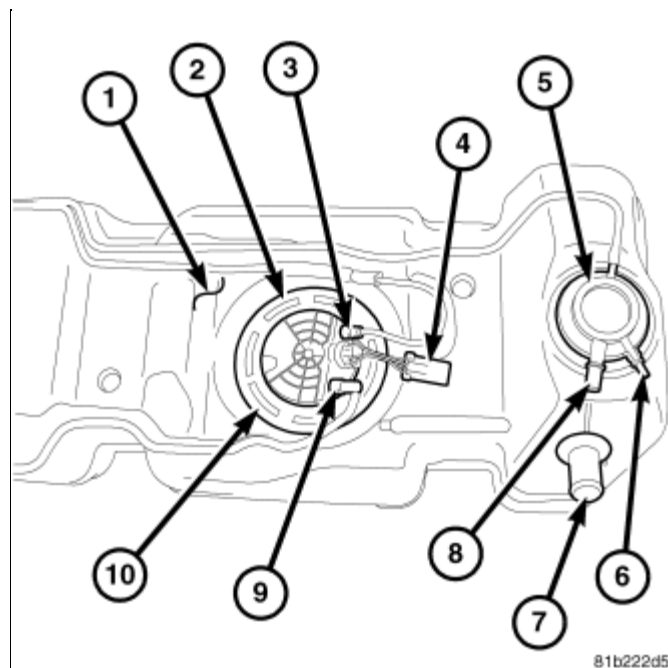
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The fuel tank skid plate and the fuel tank assembly are installed at the same. They share common fasteners.

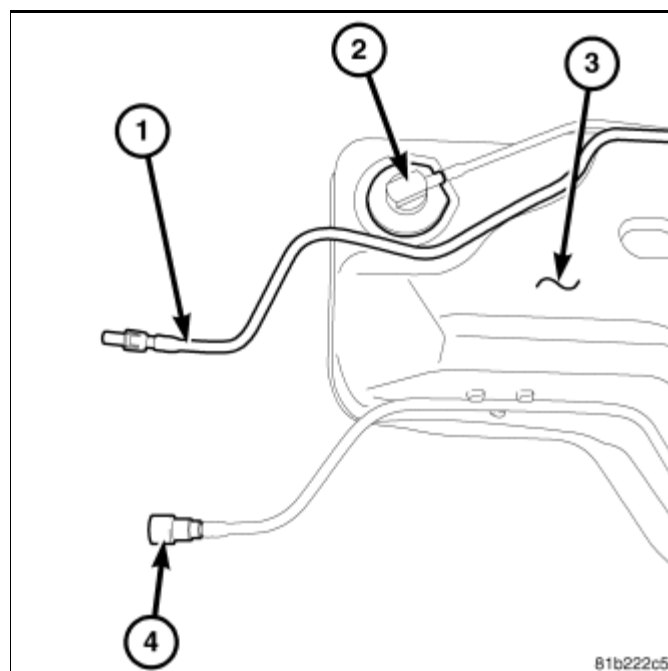
1. If fuel pump module had been removed, install module to tank.
2. Position fuel tank into skid plate.
3. Support tank with a hydraulic jack.
4. Partially raise tank to allow connections at top of tank.
5. Connect electrical connector to fuel pump module.
6. Continue raising tank snugly to body.
7. Connect quick-connect fitting (2).
8. Connect quick-connect fitting (9).
9. Connect quick-connect fitting (10).
10. Install hose (4) to tank and install clamp (3).
11. Connect quick-connect fittings at front of tank.
12. Install two tank mounting bolts at rear of fuel tank.
13. Install three tank mounting bolts at right side of fuel tank.
14. Install three tank mounting bolts at left side of fuel tank.

DIESEL POWERED

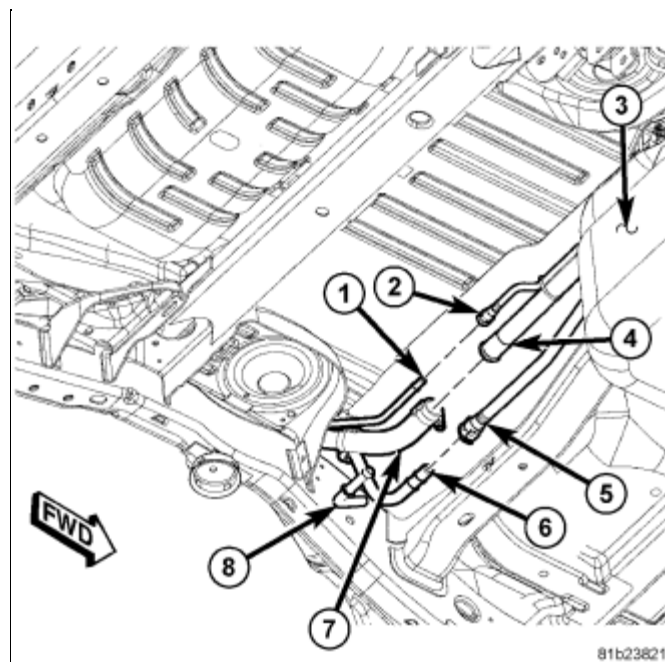
1. If fuel pump module had been removed, install module to tank.
2. Position fuel tank into skid plate.
3. Support tank with a hydraulic jack.
4. Partially raise tank to gain access to pump module electrical connector (4).
5. Connect electrical connector (4) to fuel pump module.
6. Continue raising tank snugly to body.



7. Connect quick-connect fittings (1) and (4) for fuel supply and return lines at front of tank.
8. Install two tank mounting bolts at rear of fuel tank.
9. Install three tank mounting bolts at right side of fuel tank.
10. Install three tank mounting bolts at left side of fuel tank.



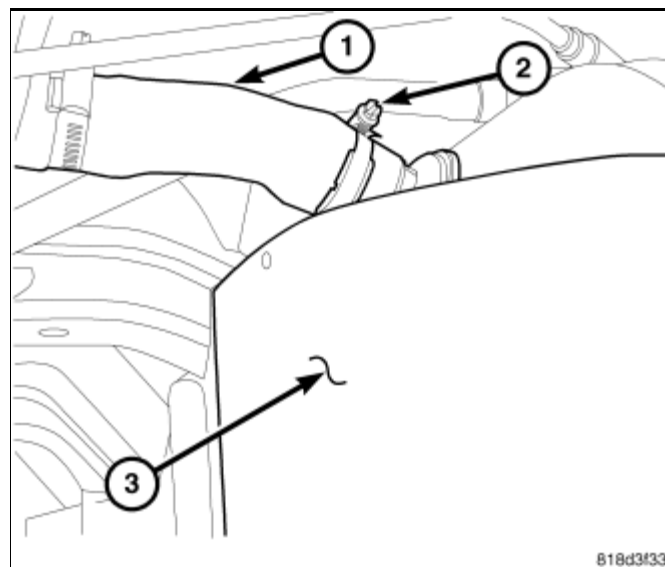
11. Connect quick-connect fitting (2).



12. Connect hose (1) and fuel fill hose clamp (2) at rear of tank (3).

SEPARATOR-FUEL FILTER / WATER

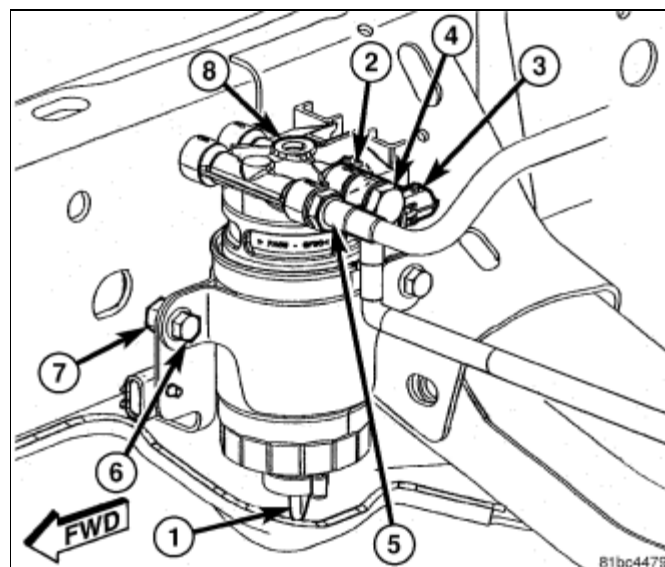
DESCRIPTION



The fuel filter/water separator assembly (8) is mounted to the frame rail near the fuel tank. The assembly includes the fuel filter, fuel heater (3), fuel temperature sensor (2), combination water drain valve/Water-In-Fuel (WIF) sensor (1), and quick-connect fittings attached at the side of the fuel filter canister.

OPERATION

The fuel filter/water separator protects the fuel injection pump by removing water and contaminants from the fuel. The construction of the filter/separator allows fuel to pass through it, but helps prevent moisture (water) from doing so. Moisture collects at the bottom of the filter.



Refer to the maintenance schedules in the owners manual for the recommended fuel filter replacement intervals.

For draining of water from canister, refer to Fuel Filter/Water Separator Removal/Installation section.

A Water-In-Fuel (WIF) sensor is attached to the bottom of fuel filter element.

The fuel heater and fuel temperature sensor are installed into the side of the filter/separator housing.

REMOVAL

Refer to maintenance schedules, or the Owner's Manual for recommended fuel filter replacement intervals.

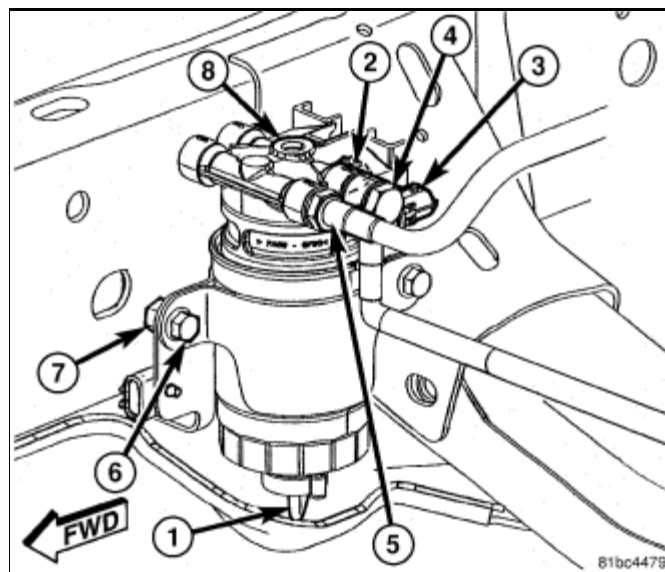
DRAINING WATER FROM FUEL FILTER CANISTER:

The combination housing drain valve/WIF sensor serves two purposes. One is to **partially** drain the filter housing of excess water. The other is to **partially** drain the housing for fuel temperature sensor, fuel filter or fuel heater element replacement.

The filter housing should be partially drained whenever the water-in-fuel warning lamp remains illuminated. (Note that lamp will be illuminated for approximately two seconds when ignition key is initially placed in ON position for a bulb check).

1. Raise and support vehicle.

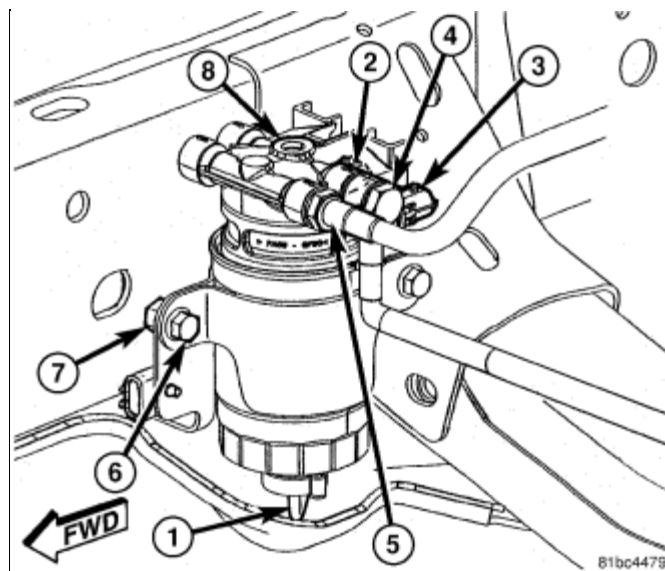
2. A nipple is located at the bottom of drain valve (1). Attach a drain hose to this nipple. Place drain pan under drain hose.
 3. **With engine not running**, Disconnect WIF sensor electrical connector (1), then rotate drain valve approximately two revolutions to open it. Leave open until all water and contaminants have been removed and clean fuel exits. Hand tighten drain valve after tightening.
 4. If fuel heater element is being replaced, drain housing completely. Dispose of mixture in drain pan according to applicable regulations.
 5. After draining operation, close and tighten drain valve (1).
 6. **FUEL FILTER REPLACEMENT:**
 7. Clean all dirt and debris from around filter canister and canister head, located at the bottom of the fuel filter/water separator assembly.



8. Open drain valve (1) two complete revolutions. Drain approximately 1 cup of fuel into a waste canister. Dispose of fuel according to environmental regulations.
 9. Remove drain hose from drain valve (1).
 10. Use an oil filter type wrench to loosen filter, located at the bottom of the fuel filter/water separator assembly (8). After loosening, unscrew the filter by hand.
 11. **WATER-IN-FUEL (WIF) SENSOR**

REPLACEMENT: The combination fuel drain valve/WIF sensor is located on the bottom of the fuel filter housing.

The WIF sensor is not a separately serviceable item. If diagnostics have led you to replace this sensor, then the whole fuel filter assembly needs to be changed.



12. FUEL HEATER ELEMENT REPLACEMENT: The fuel heater element is located in the fuel filter housing. To replace heater, the entire housing assembly must be replaced.

13. Drain fuel filter. See previous steps.

14. Disconnect the fuel temperature sensor (2) and fuel heater (3) harness connectors.

15. Disconnect the fuel lines (4) and (5) at the fuel filter/water separator housing (8).

16. Remove the two fuel filter/water separator housing fasteners (6).

17. Remove fuel filter/water separator housing assembly (8).

18. FUEL TEMPERATURE SENSOR

REPLACEMENT: The fuel temperature sensor is located in the fuel filter housing. To replace sensor, the entire housing assembly must be replaced.

19. Drain fuel filter. See previous steps.

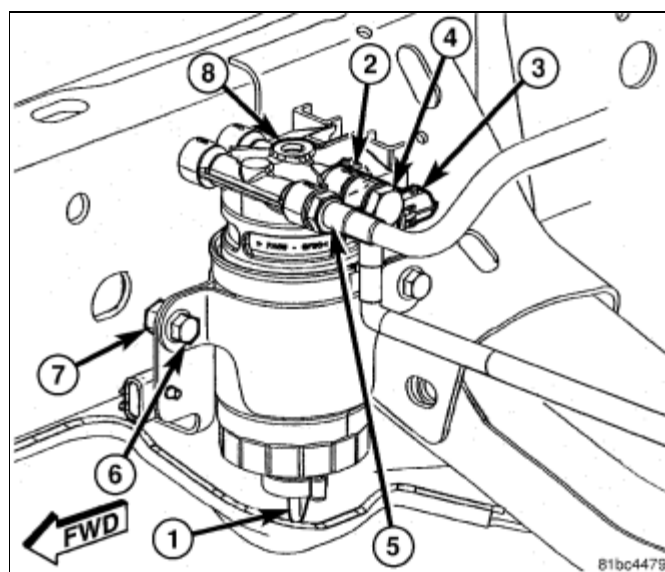
20. Disconnect electrical connectors .

21. Disconnect two quick-connect fittings and at housing.

22. Remove three housing mounting nuts.

23. Remove housing assembly.

24. DRAIN VALVE REPLACEMENT: The Drain Valve is located on the bottom of the fuel filter. This is not a separately serviceable item. If replacement is necessary, replace the entire filter/filter canister assembly.



INSTALLATION

Refer to maintenance schedules for recommended fuel filter replacement intervals.

1. FUEL FILTER:

2. Lubricate new fuel filter O-ring with clean engine oil.

3. Position new fuel filter/canister assembly to housing.

4. Rotate fuel filter/canister assembly until it comes to a hard stop.

5. Tighten the filter element an additional half-inch of rotation.

6. Connect WIF sensor electrical connector.

7. Be sure drain valve is tight.
8. Install left front tire/wheel.
9. Install left front wheel splash shield.
10. **FUEL HEATER ELEMENT OR FUEL TEMPERATURE SENSOR:**

Both the fuel heater element and fuel temperature sensor are attached to the fuel filter housing. To replace either of these components, the entire housing assembly must be replaced.

11. Position housing/canister assembly to body.
12. Install three housing mounting nuts.
13. Connect two quick-connect fittings and to housing fittings.
14. Connect electrical connectors.
15. **WATER-IN-FUEL (WIF) SENSOR REPLACEMENT:** The combination fuel drain valve/WIF sensor is located on the bottom of the fuel filter housing.

The WIF sensor is not a separately serviceable item. If diagnostics have led you to replace this sensor, then the whole fuel filter assembly needs to be changed.

SENSOR-WATER IN FUEL

DESCRIPTION

The combination drain valve/Water-In-Fuel (WIF) sensor is located on the bottom of the fuel filter/water separator filter canister.

OPERATION

The sensor sends an input to the Engine Control Module (ECM) when it senses water in the fuel filter/water separator. As the water level in the filter/separator increases, the resistance across the WIF sensor decreases. This decrease in resistance is sent as a signal to the ECM and compared to a high water standard value. Once the value reaches 30 to 40 kilohms, the ECM will activate the water-in-fuel warning lamp through CAN bus circuits. This all takes place when the ignition key is initially put in the ON position. The ECM continues to monitor the input while the engine is running.

REMOVAL

The Water-In-Fuel (WIF) sensor is located at the bottom of fuel filter/water separator canister. Refer to Separator–Fuel Filter/Water for removal and installation procedures.

HEATER - FUEL

REMOVAL

The fuel heater is located in the fuel filter/water separator canister housing. Refer to Separator–Fuel Filter/Water for removal and installation procedures.

RELAY - FUEL HEATER

REMOVAL

The fuel heater relay (1) is located in the left/rear of the engine compartment.

1. Disconnect negative battery cable.
2. Disconnect electrical connector (2) from relay.
3. Remove relay mounting bolt and remove relay.
4. Check condition of relay connector pins for corrosion, etc.

INSTALLATION

The fuel heater relay (1) is located in the left/rear of the engine compartment.

1. Check condition of relay connector pins for corrosion, etc.
2. Position relay and install mounting bolt.
3. Connect electrical connector (2) to relay.
4. Connect negative battery cable to battery.

SENSOR - FUEL TEMPERATURE

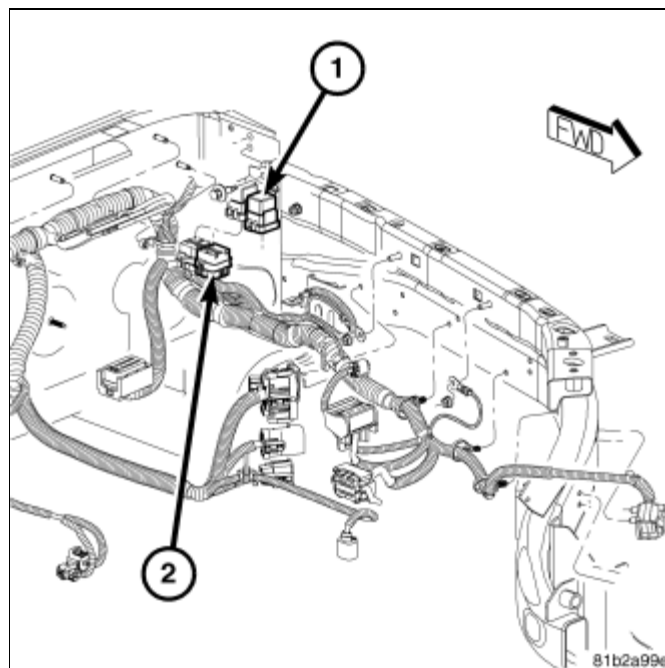
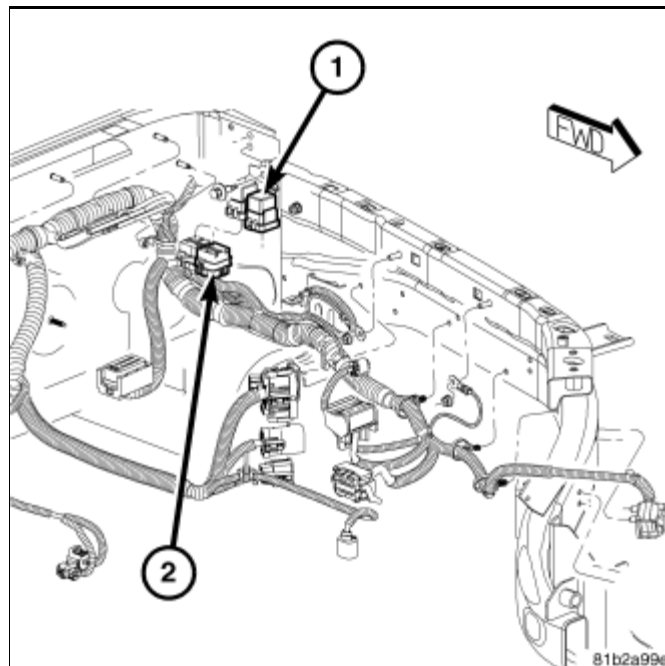
REMOVAL

The fuel temperature sensor is located in the fuel filter/water separator canister housing. Refer to Separator–Fuel Filter/Water for removal and installation procedures.

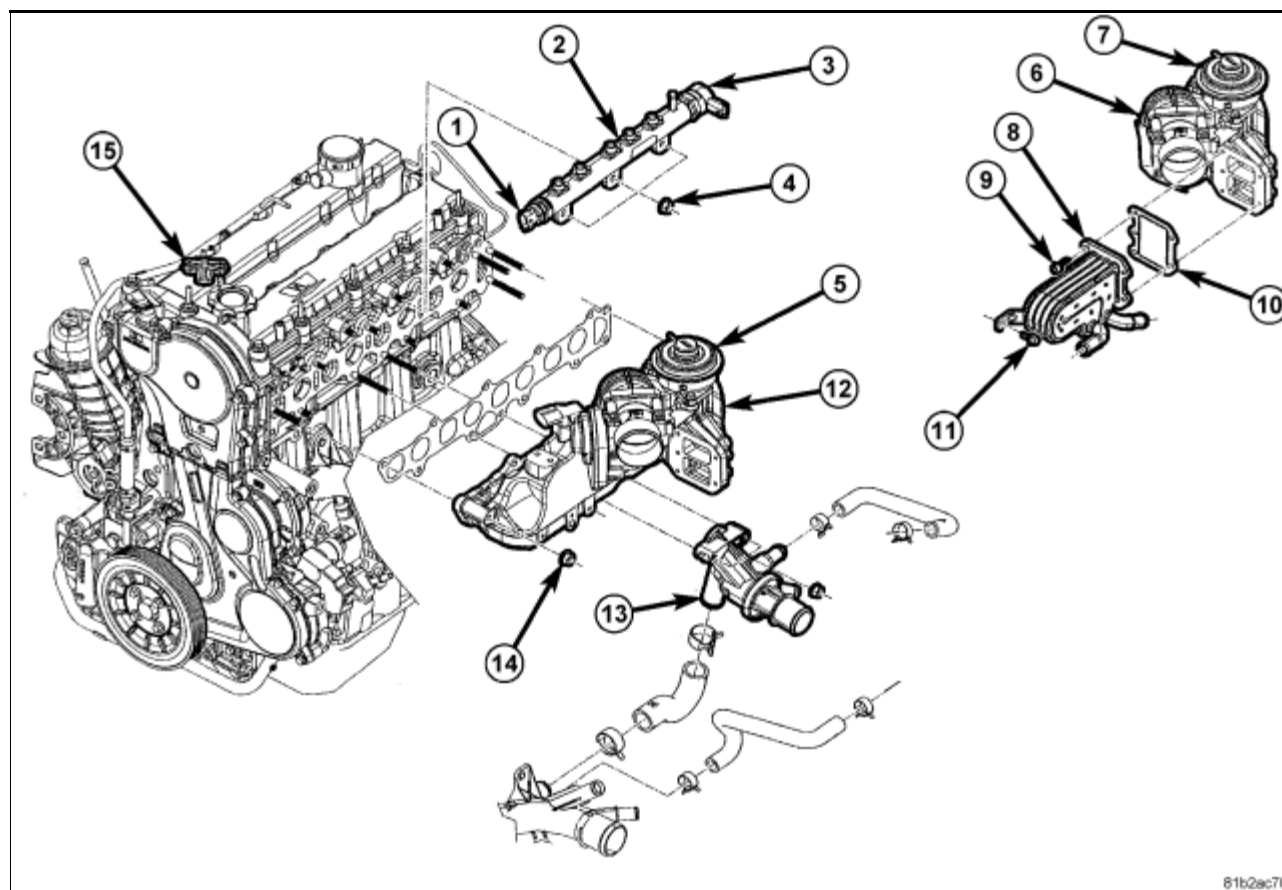
RAIL - FUEL

REMOVAL

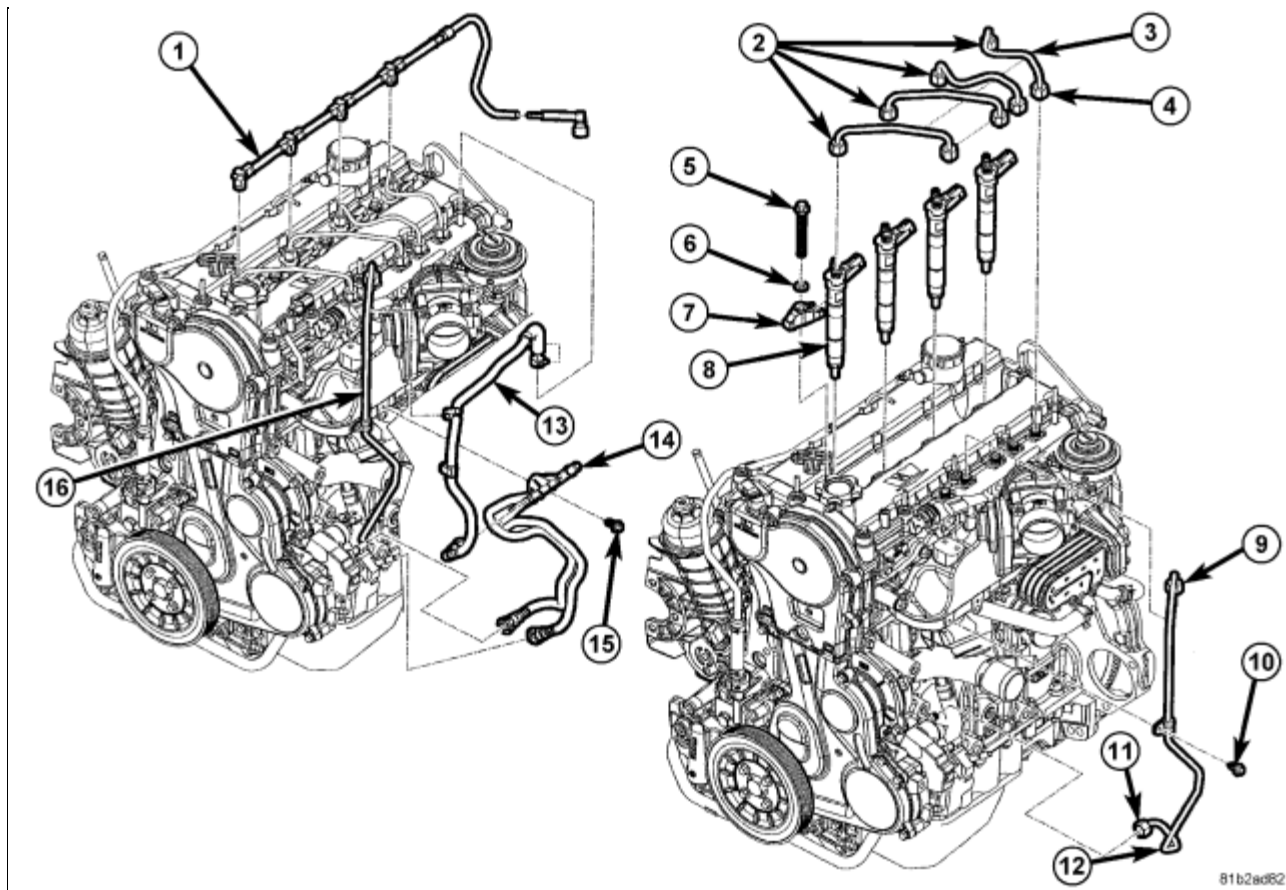
CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire.



Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

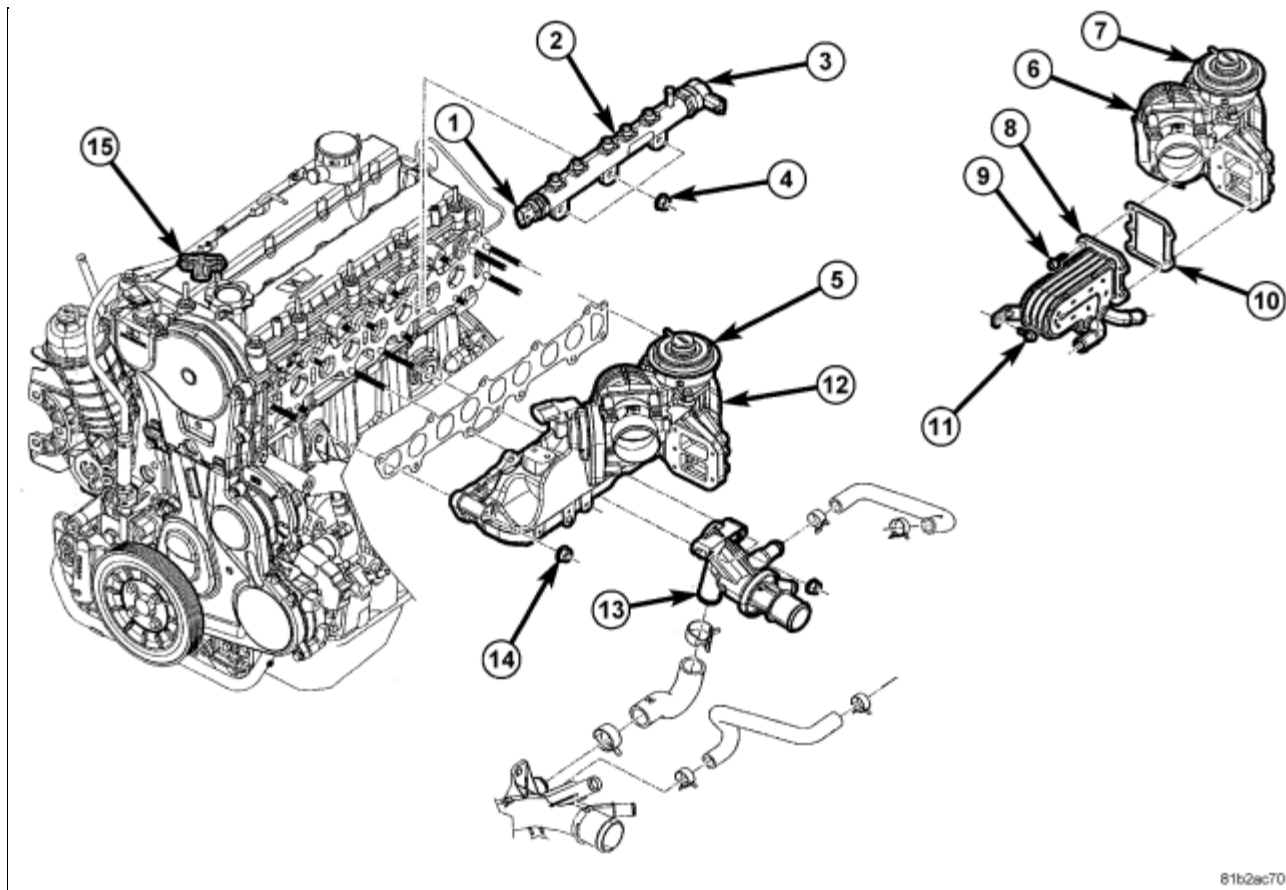


1. Disconnect negative battery cable at battery. Isolate end of cable.
2. Remove dress-up cover from top of engine.
3. Disconnect electrical connector at fuel pressure sensor (1).
4. Disconnect electrical connector at fuel pressure solenoid (3).



CAUTION: WHEN LOOSENING OR TIGHTENING HIGH-PRESSURE LINE FITTINGS ATTACHED TO A SEPARATE FITTING, USE A BACK-UP WRENCH ON FITTING. DO NOT ALLOW FITTING TO ROTATE. DAMAGE TO BOTH FUEL LINE AND FITTING WILL RESULT.

5. Disconnect fuel line fittings (2) and (4) and remove four fuel lines (3). Note and mark position of each fuel line while removing.
6. Remove fuel line clamp bolt (10).
7. Disconnect rail-to-injection pump high-pressure fuel line fittings (9) and (11) and remove fuel line (12). Note and mark position of fuel line while removing.



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8. Remove three fuel rail mounting nuts (4).

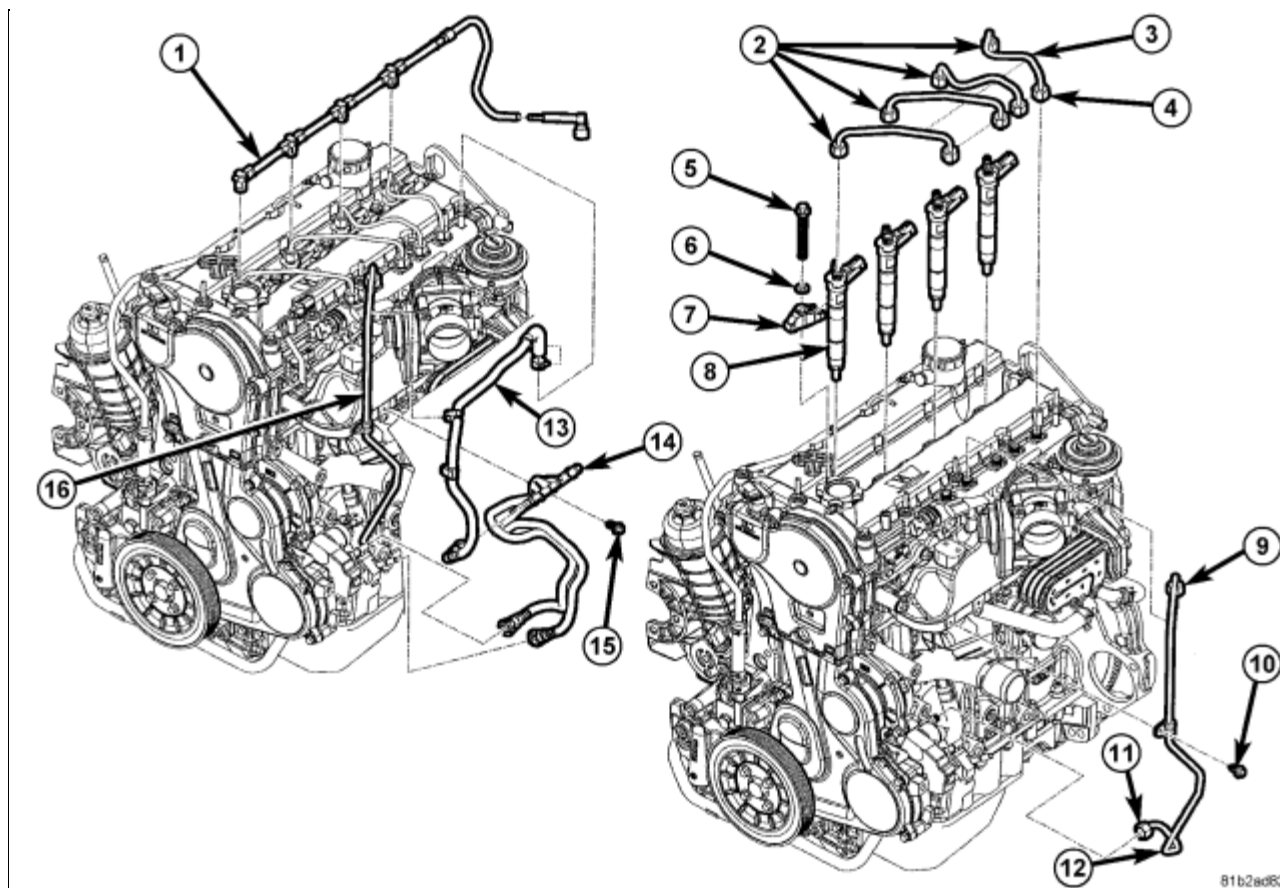
9. Remove rail (2) from cylinder head.

INSTALLATION

NOTE: New High Pressure Fuel Line must be used any time the High Pressure Fuel Lines have been removed.

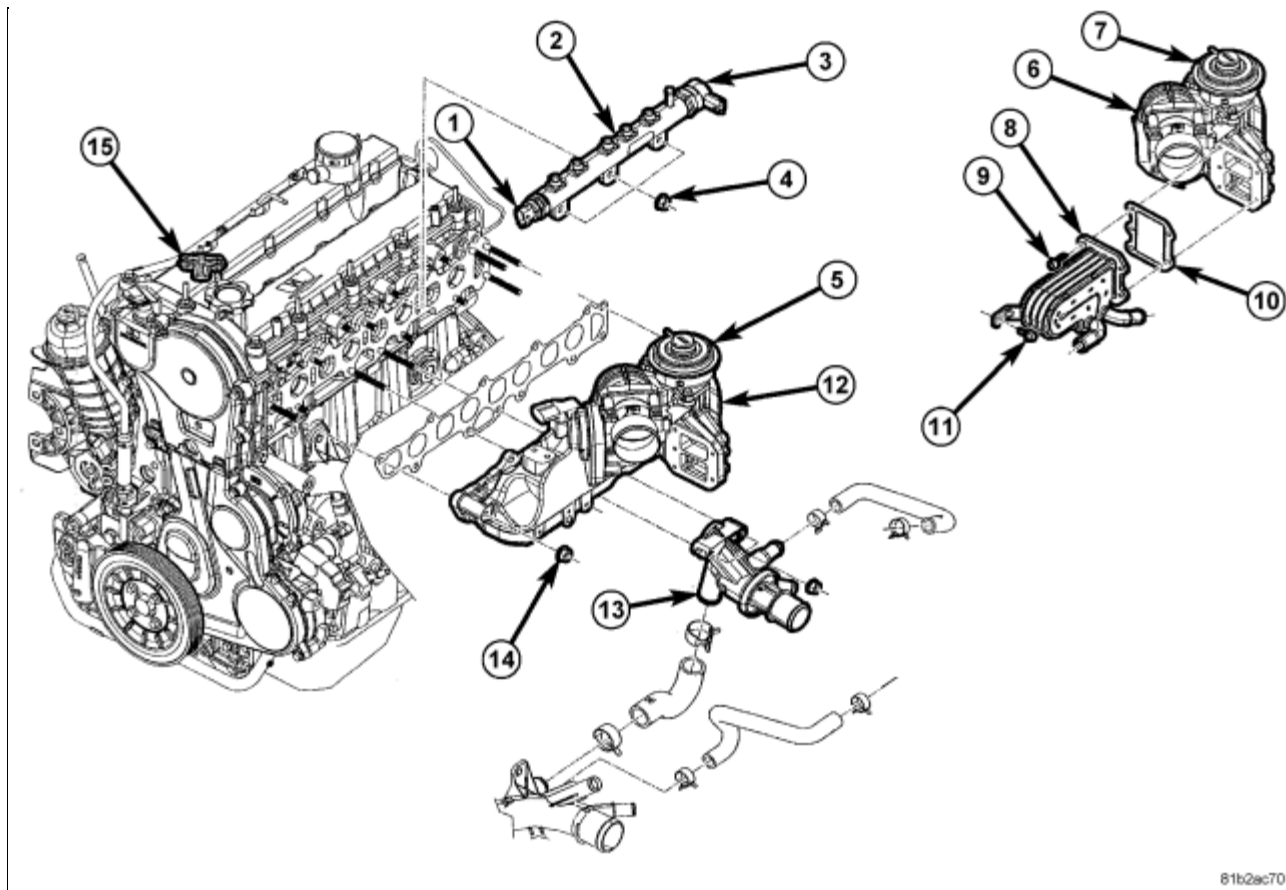
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CAUTION: WHEN LOOSENING OR TIGHTENING HIGH-PRESSURE LINE FITTINGS ATTACHED TO A SEPARATE FITTING, USE A BACK-UP WRENCH ON FITTING. DO NOT ALLOW FITTING TO ROTATE. DAMAGE TO BOTH FUEL LINE AND FITTING WILL RESULT.

3. Install the injectors (8), the injector clamps (7) and washers (6).
4. Install the injector bolts (5). Do not tighten at this time.
5. Position and connect the high pressure line (12) between the high pressure injection pump and the fuel rail. Do not tighten at this time.
6. Torque injector clamp bolts to 32.4 Nm (23 ft. lbs.).
7. Torque the rail side (4) of the high pressure lines between the injectors and the fuel rail to 24.5 Nm (18 ft. lbs.).
8. Torque the injector side (2) of the high pressure lines between the injectors and the fuel rail to 28 Nm (20 ft. lbs.).
9. Torque the rail side (9) of the high pressure fuel line between the high pressure injection pump and the fuel rail to 20 Nm (14 ft. lbs.).
10. Torque the high pressure pump side (11) of the high pressure fuel line between the high pressure injection pump and the fuel rail to 28 Nm (20 ft. lbs.).
11. Install fuel line clamp bolt (10). Tighten bolt to 15 N·m (11 ft. lbs.) torque.



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12. Connect electrical connectors to fuel injectors.
13. Connect electrical connector to fuel pressure solenoid (3).
14. Connect electrical connector to fuel pressure sensor (1).
15. Install the engine cover.
16. Connect negative battery cable to battery.

LINES-FUEL

DESCRIPTION

Low-Pressure Lines Are:

- the fuel supply line from fuel tank to fuel filter housing.
- the fuel return line back to fuel tank.
- the fuel drain line from each fuel injector.
- the fuel supply line from fuel filter to fuel injection pump.
- the fuel injection pump return line.

High-Pressure Lines Are:

- the fuel line from fuel injection pump to fuel rail.

- the four fuel lines from fuel rail up to the fuel injectors

WARNING: High-pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 160,000 kpa (23,206 psi). Use extreme caution when inspecting for high-pressure fuel leaks. Inspect for high-pressure fuel leaks with a sheet of cardboard. High fuel injection pressure can cause personal injury if contact is made with the skin.

OPERATION

High-Pressure Lines

CAUTION: The high-pressure fuel lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. If lines are ever kinked or bent, they must be replaced. Use only the recommended lines when replacement of high-pressure fuel line is necessary.

High-pressure fuel lines deliver fuel (under pressure) of up to approximately 160,000 kpa (23,206 psi) from the injection pump to the fuel injectors. The lines expand and contract from the high-pressure fuel pulses generated during the injection process. All high-pressure fuel lines are of the same length and inside diameter. Correct high-pressure fuel line usage and installation is critical to smooth engine operation.

WARNING: Use extreme caution when inspecting for high-pressure fuel leaks. Inspect for high-pressure fuel leaks with a sheet of cardboard. High fuel injection pressure can cause personal injury if contact is made with the skin.

DIAGNOSIS AND TESTING

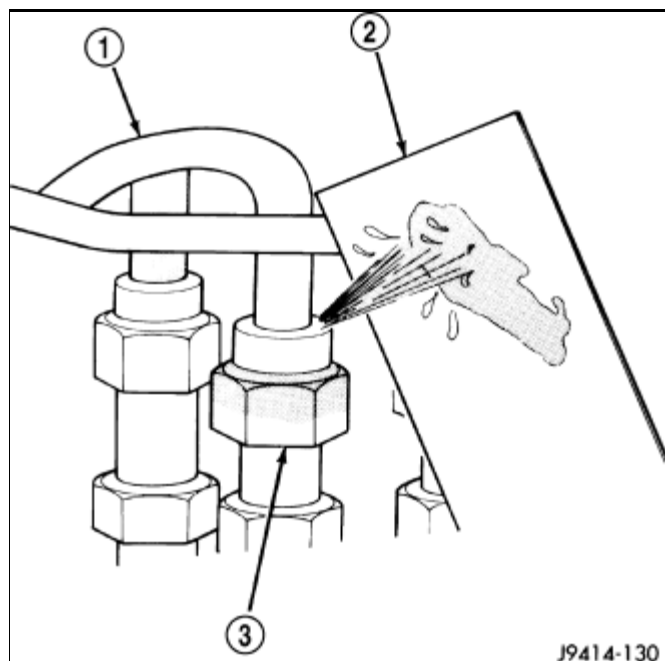
HIGH-PRESSURE FUEL LINE LEAKS

High-pressure fuel line leaks can cause starting problems and poor engine performance.

WARNING: Due to extreme fuel pressures of up to 180,000 kpa (26,107 psi), use extreme caution when inspecting for high-pressure fuel leaks. Do not get your hand or a finger near a suspected leak. Inspect for high-pressure fuel leaks with a sheet of cardboard (2) (typical picture). High fuel injection pressure can cause personal injury if contact is made with the skin.

Start the engine. Move the cardboard (2) over the suspected high-pressure fuel line leak, and check for fuel spray onto the cardboard. If line is leaking, retorque line while engine is shutdown. Replace damaged, restricted or leaking high-pressure fuel lines with the correct replacement line.

CAUTION: The high-pressure fuel lines cannot contact

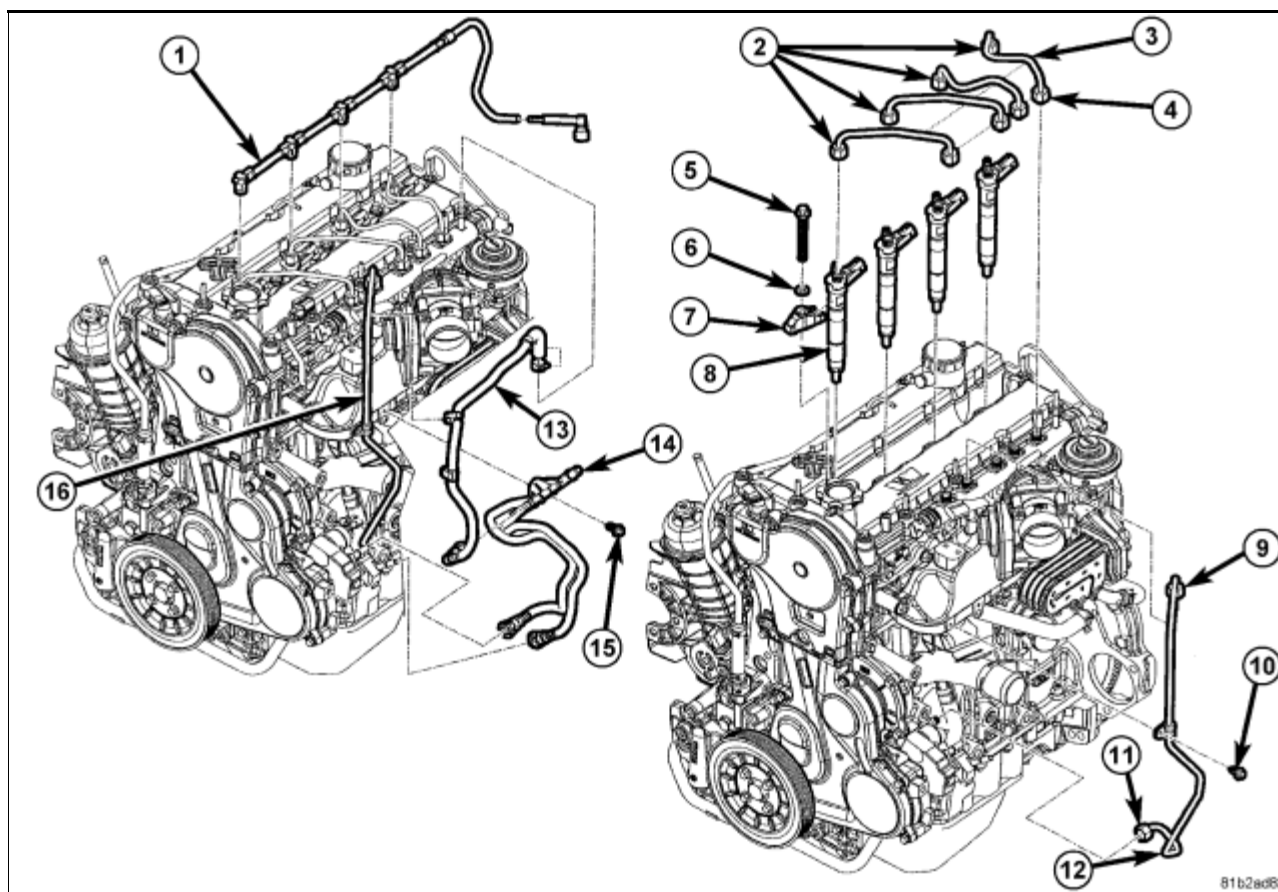


each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high-pressure fuel line is necessary.

REMOVAL

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

1. Disconnect negative battery cable at battery. Isolate end of cable.
2. Remove dress-up cover from top of engine.



CAUTION: WHEN LOOSENING OR TIGHTENING HIGH-PRESSURE LINE FITTINGS ATTACHED TO A SEPARATE FITTING, USE A BACK-UP WRENCH ON FITTING. DO NOT ALLOW FITTING TO ROTATE. DAMAGE TO BOTH FUEL LINE AND FITTING WILL RESULT.

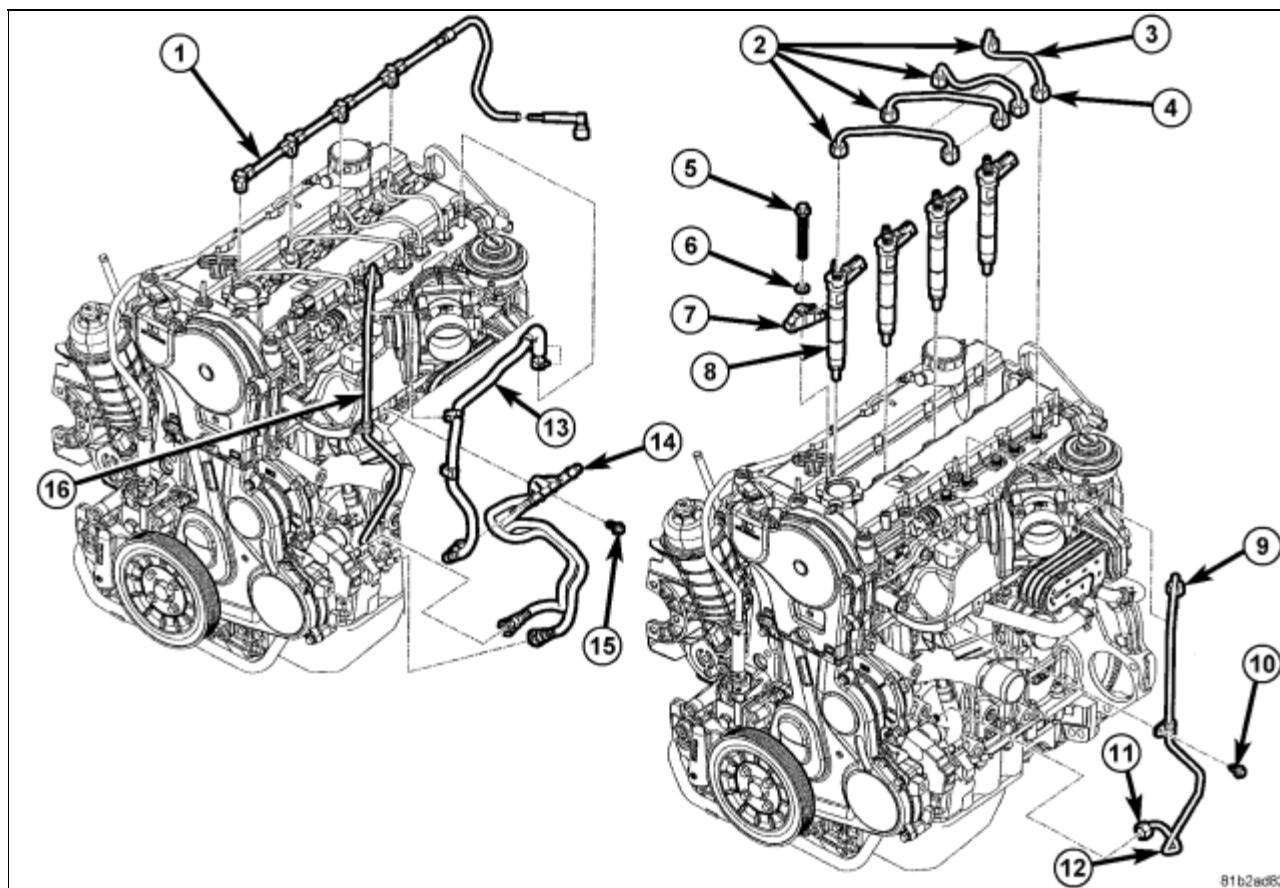
3. Disconnect fuel line fittings (2) and (4) and remove four fuel lines (3). Note and mark position of each fuel line while removing.

4. Remove fuel line clamp bolt (10).
5. Disconnect rail-to-injection pump high-pressure fuel line fittings (9) and (11) and remove fuel line (12). Note and mark position of fuel line while removing.

INSTALLATION

All high-pressure fuel lines are of the same length and inside diameter. Correct high-pressure fuel line usage and installation is critical to smooth engine operation.

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.



CAUTION: WHEN LOOSENING OR TIGHTENING HIGH-PRESSURE LINE FITTINGS ATTACHED TO A SEPARATE FITTING, USE A BACK-UP WRENCH ON FITTING. DO NOT ALLOW FITTING TO ROTATE. DAMAGE TO BOTH FUEL LINE AND FITTING WILL RESULT.

1. Position and connect rail-to-injection pump high-pressure fuel line (12). Tighten fittings (9) and (11) to 28

N·m (20 ft. lbs.) torque.

2. Install fuel line clamp bolt (10). Tighten bolt to 15 N·m (11 ft. lbs.) torque.

3. Position four fuel lines (3) to engine. Tighten fuel line fittings (2) to 28 N·m (20 ft. lbs.) torque. Tighten fuel line fittings (4) to 20 N·m (15 ft. lbs.) torque.

4. Install dress-up cover to top of engine.

5. Connect negative battery cable to battery.

MOTOR - FUEL PUMP

DESCRIPTION

An engine mounted, low-pressure mechanical fuel pump is **not used** with the 2.8L diesel engine.

An electric fuel pump is mounted to the fuel pump module. The pump supplies a low-pressure fuel supply to the engine.

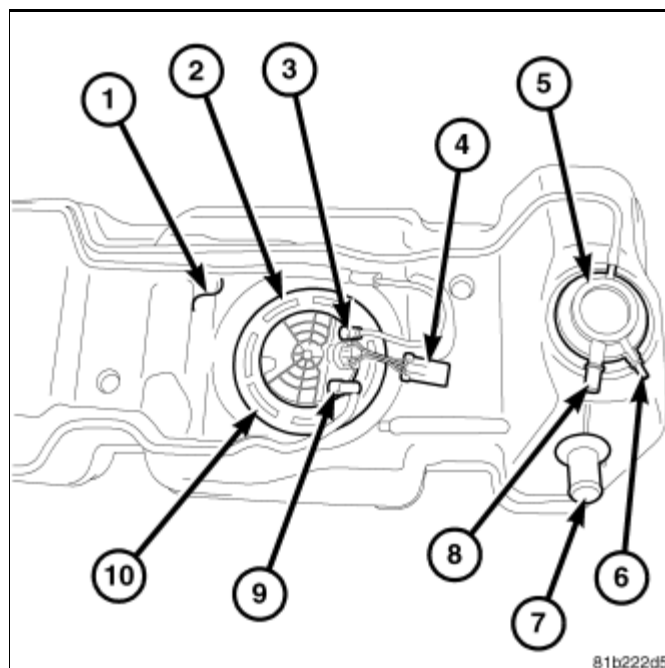
Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

The electric fuel pump is not a separate, serviceable component. The entire fuel pump module must be replaced.

MODULE - FUEL PUMP

REMOVAL

1. The 2.8L diesel fuel pump module (2) is located on the top of fuel tank.



2. Drain and remove fuel tank.

3. Note rotational position of module before attempting

removal. An indexing arrow is located on top of module for this purpose.

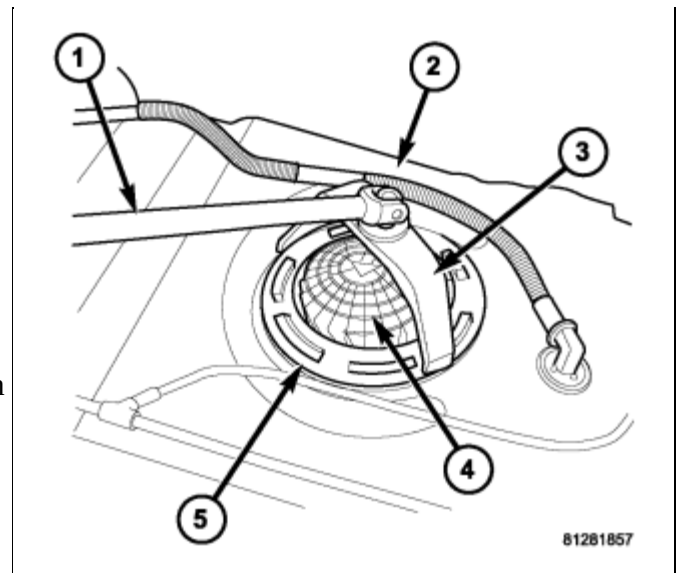
4. Position special Lockring Remover/Installer tool 9340 (3) into notches on outside edge of lockring (5).

5. Install 1/2 inch drive breaker bar (1) to special Lockring Remover/Installer tool 9340 (3).

6. Rotate breaker bar counter-clockwise to remove lockring.

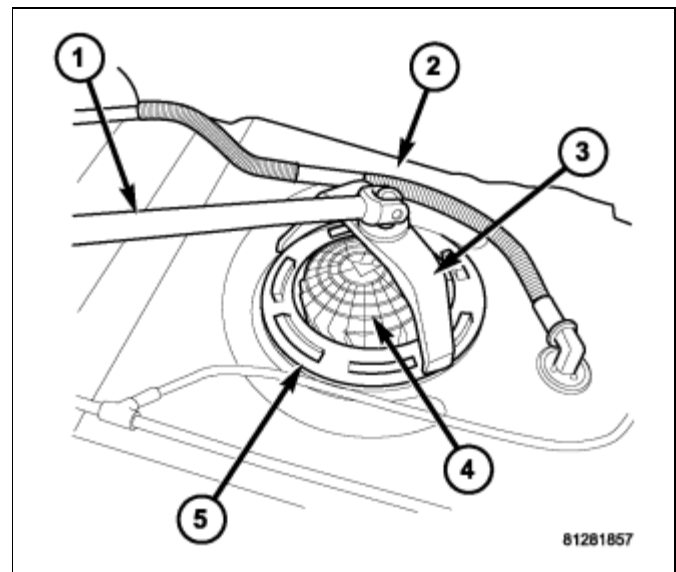
7. Remove lockring. The module will spring up slightly when lockring is removed.

8. Remove module from fuel tank. Be careful not to bend float arm while removing.



INSTALLATION

CAUTION: Whenever the fuel pump module is serviced, the rubber seal (gasket) must be replaced.



1. Using a new seal (gasket), position fuel pump module into opening in fuel tank.

2. Position lockring (5) over top of fuel pump module.

3. Rotate module until embossed alignment arrow points to center alignment mark. This step must be performed to prevent float from contacting side of fuel tank.

4. Install Lockring Remover/Installer 9340 (3) to lockring.

5. Install 1/2 inch drive breaker (1) into Lockring Remover/Installer 9340 (3).

6. Tighten lockring (clockwise) until all seven notches have engaged.

7. Install fuel tank.

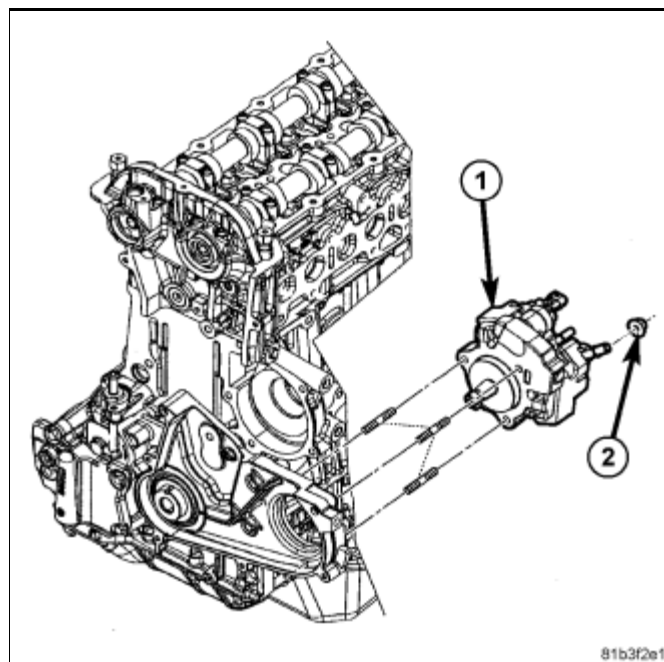
PUMP-FUEL INJECTION

DESCRIPTION

A radial, 3 piston pump (1) mounted to the timing belt cover, is used to deliver fuel under high pressure to the fuel rail.

The pump is driven by the timing belt. Pressure is generated independently of the injection process. The pump is lubricated with diesel fuel and is not responsible for fuel injection timing. However, there is a mark on the high pressure fuel pump sprocket that must be aligned with a mark on the timing belt cover whenever the high pressure pump, sprocket, or timing belt have been removed.

OPERATION



High Pressure Pumping Plungers

The fuel quantity solenoid supplies three high pressure pumping chambers. The pumping chambers have one way inlet valves that allow fuel to flow into the chambers. The valves then close during compression of the fuel and cause the high pressure fuel to overcome a ball and angled seat outlet valve.

All three pumping chambers are tied together in one circuit internal to the pump and provide high pressure fuel up to 1600 bar (23,000 psi) through a steel line, to the fuel rail.

The pump is driven at 1:1 engine speed and is not responsible for injection timing. The pump is only responsible for providing high pressure fuel while the ECM controls the injection timing.

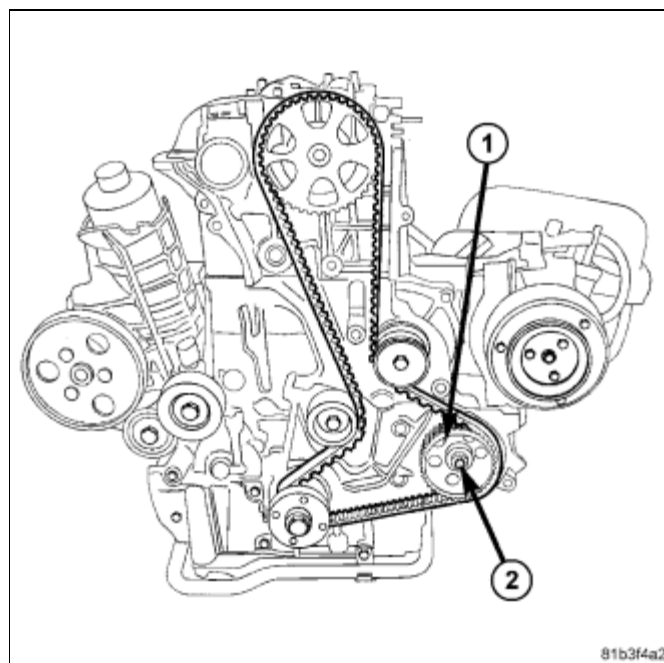
REMOVAL

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

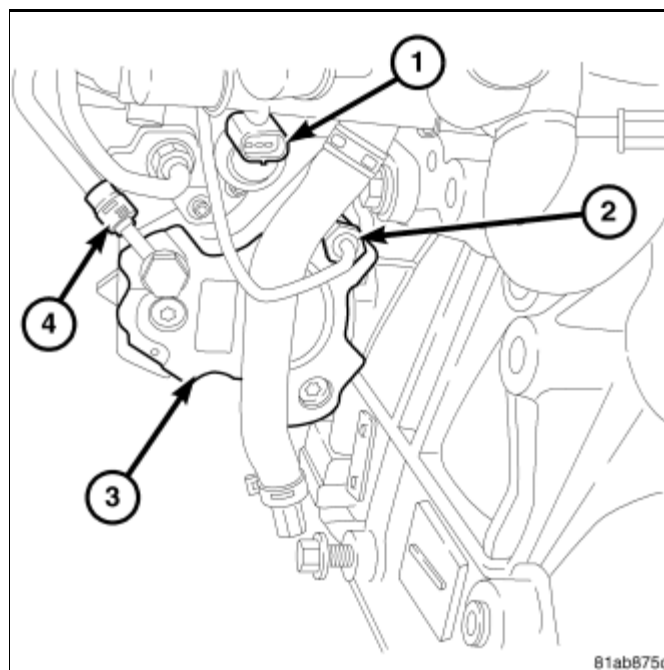
WARNING: High-pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. Use extreme caution when inspecting for high-pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high-pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.

1. Disconnect negative battery cable.
2. Drain engine coolant. Refer to Cooling section.
3. Raise and support vehicle.
4. Disconnect and reposition engine coolant hose near rear of injection pump.
5. Remove timing belt. Refer to Engine-2.8L Diesel for procedures.

6. Remove injection pump sprocket mounting nut (2). Attach a typical 3-jaw gear/sprocket puller such as special tool 1023 and remove sprocket (1) from pump.



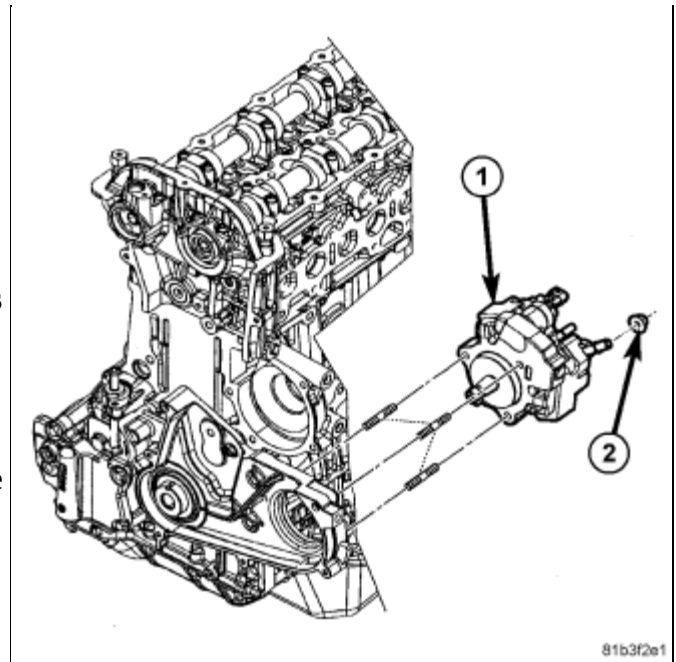
7. Disconnect high-pressure fuel line (4) at rear of pump by removing banjo bolt.
8. Disconnect high-pressure fuel line (2) at rear of pump by removing fitting at end of line.
9. Disconnect electrical connector at high-pressure fuel sensor (1).



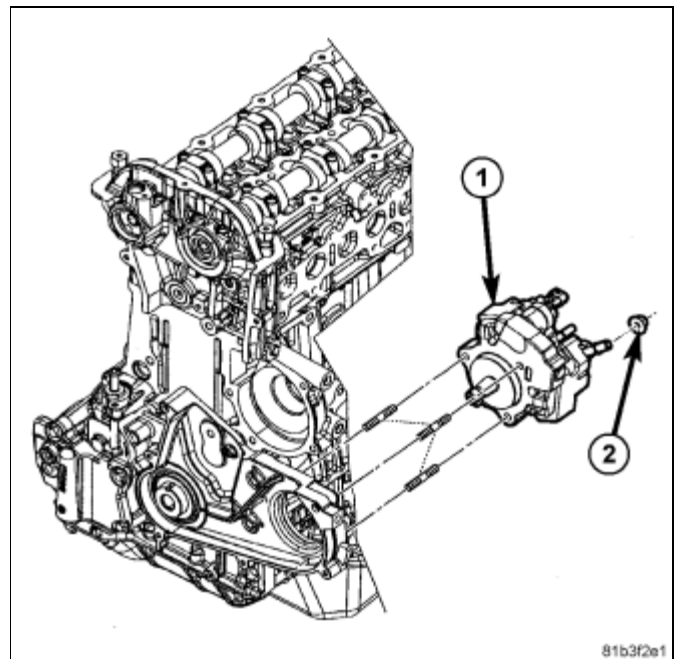
10. Remove fuel injection pump mounting nuts (2).
11. Slide pump rearward from mounting studs.

INSTALLATION

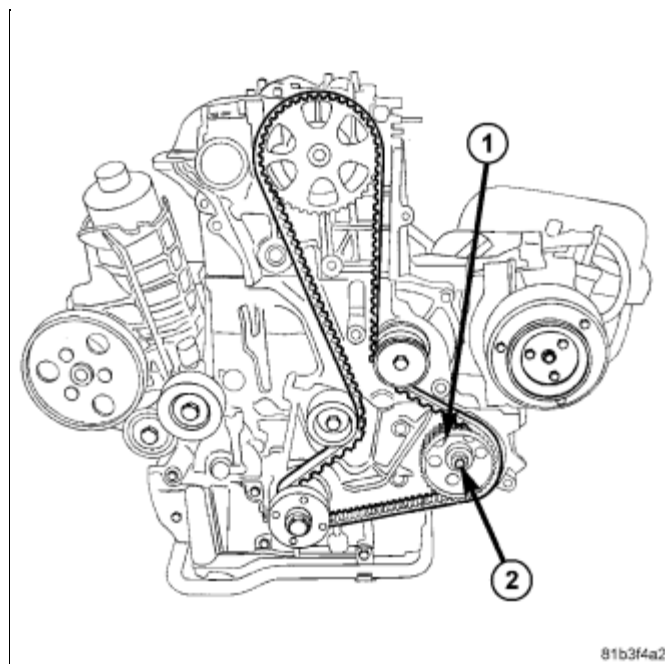
CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.



1. Slip pump (1) over mounting studs.
2. **Be sure pump is fully seated before tightening mounting nuts.** Tighten injection pump mounting nuts (2) to 24 N·m (18 ft. lbs.) torque.

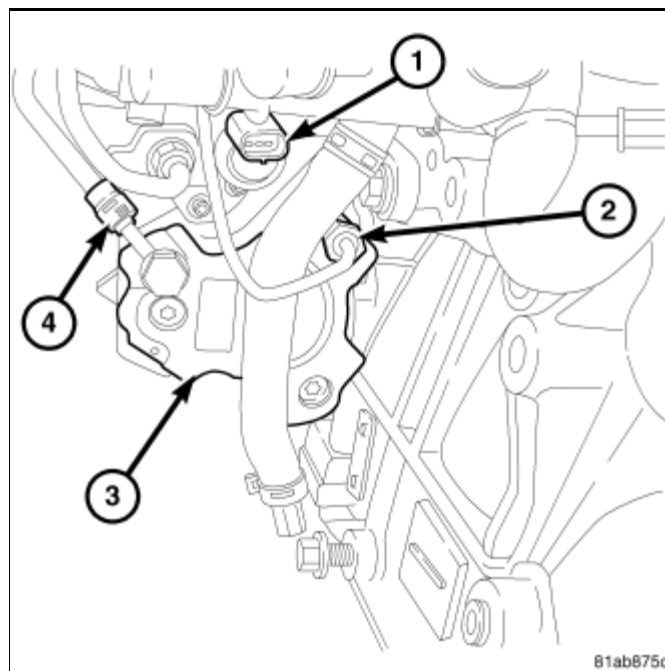


3. Position sprocket (1) to pump shaft and install nut (2) finger tight.



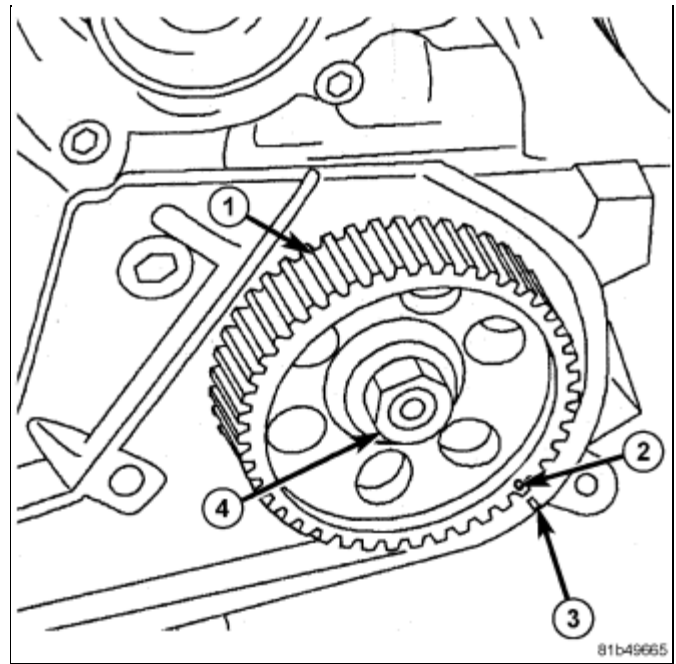
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4. Install banjo bolt for fuel line (4) at rear of injection pump. Tighten bolt to 28 N·m (20 ft. lbs.) torque.
5. Install fuel line (2) and fitting to rear of injection pump. Tighten fitting to 28 N·m (20 ft. lbs.) torque.
6. Connect electrical connector to high-pressure fuel sensor (1).



81ab675c

7. Tighten injection pump sprocket nut (4) to 88 N·m (65 ft. lbs.) torque.
8. **PUMP ALIGNMENT MARKS:** Rotate pump gear (1) until marks (2) and (3) are aligned.
9. Install timing belt. Refer to Engine-2.8L Diesel for procedures.
10. Connect engine coolant hose near rear of injection pump.
11. Fill engine cooling system. Refer to Cooling section.
12. Lower vehicle.
13. Connect negative battery cable.
14. Start engine and check for fuel leaks.



PUMP-FUEL TRANSFER

DESCRIPTION

The fuel transfer pump (fuel lift pump) is part of the fuel pump module. The fuel pump module is located in the fuel tank. The 12-volt electric pump is operated and controlled by the Engine Control Module (ECM).

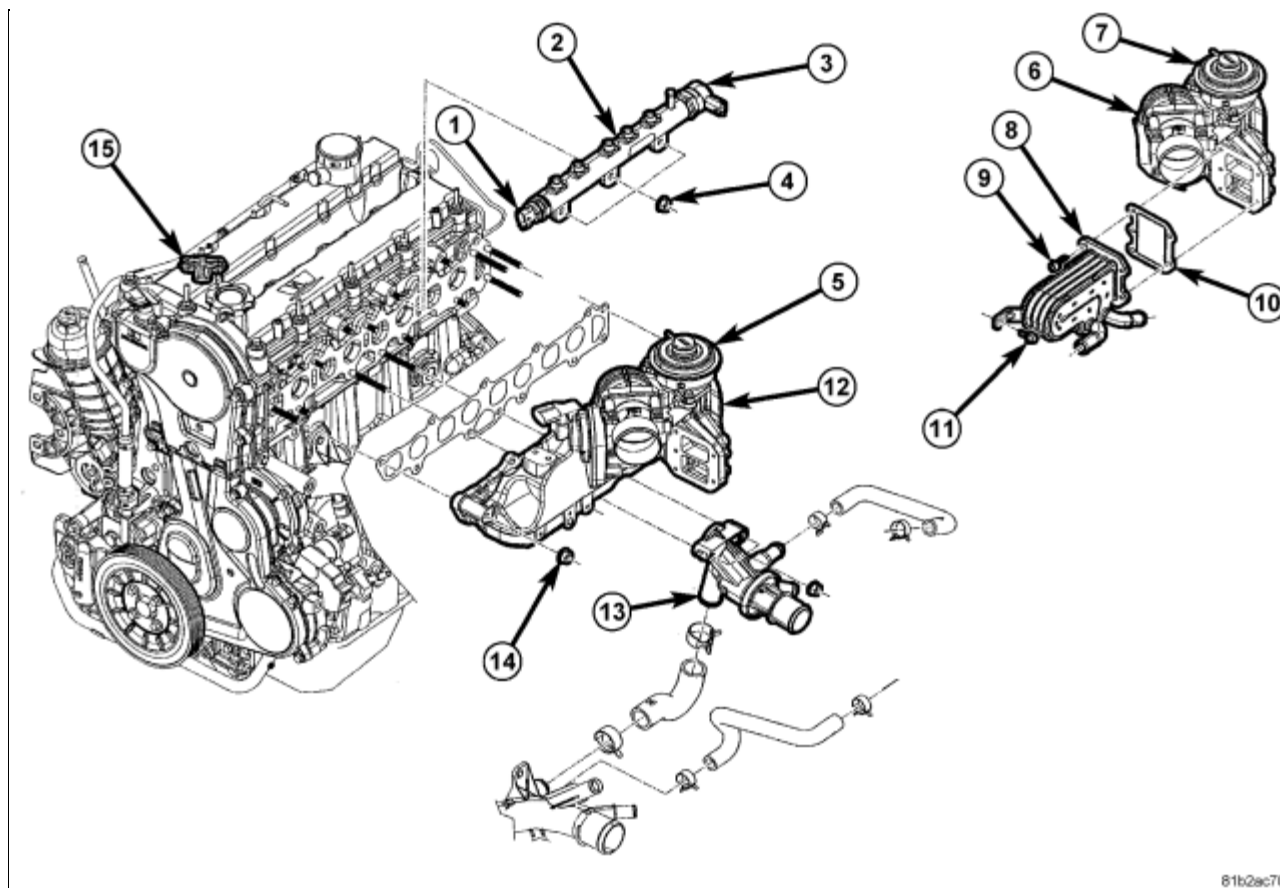
REMOVAL

The fuel transfer pump (fuel lift pump) is a part of the fuel tank module. It is not serviced separately. Refer to Fuel Tank Module Removal or Installation for procedures.

SENSOR-FUEL PRESSURE

DESCRIPTION

WARNING: High - pressure fuel line deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.



The fuel rail pressure sensor (1) screws into the fuel rail (2) at the top of the engine. The ECM uses this sensor to monitor the fuel rail pressure.

OPERATION

Review the high pressure fuel system warning.

The fuel flows to the fuel pressure sensor through an opening in the rail, the end of which is sealed off by the sensor diaphragm. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element (semiconductor device) converts the pressure to an electric signal is mounted on this diaphragm. The signal generated by the sensor is monitored by the ECM.

REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover.

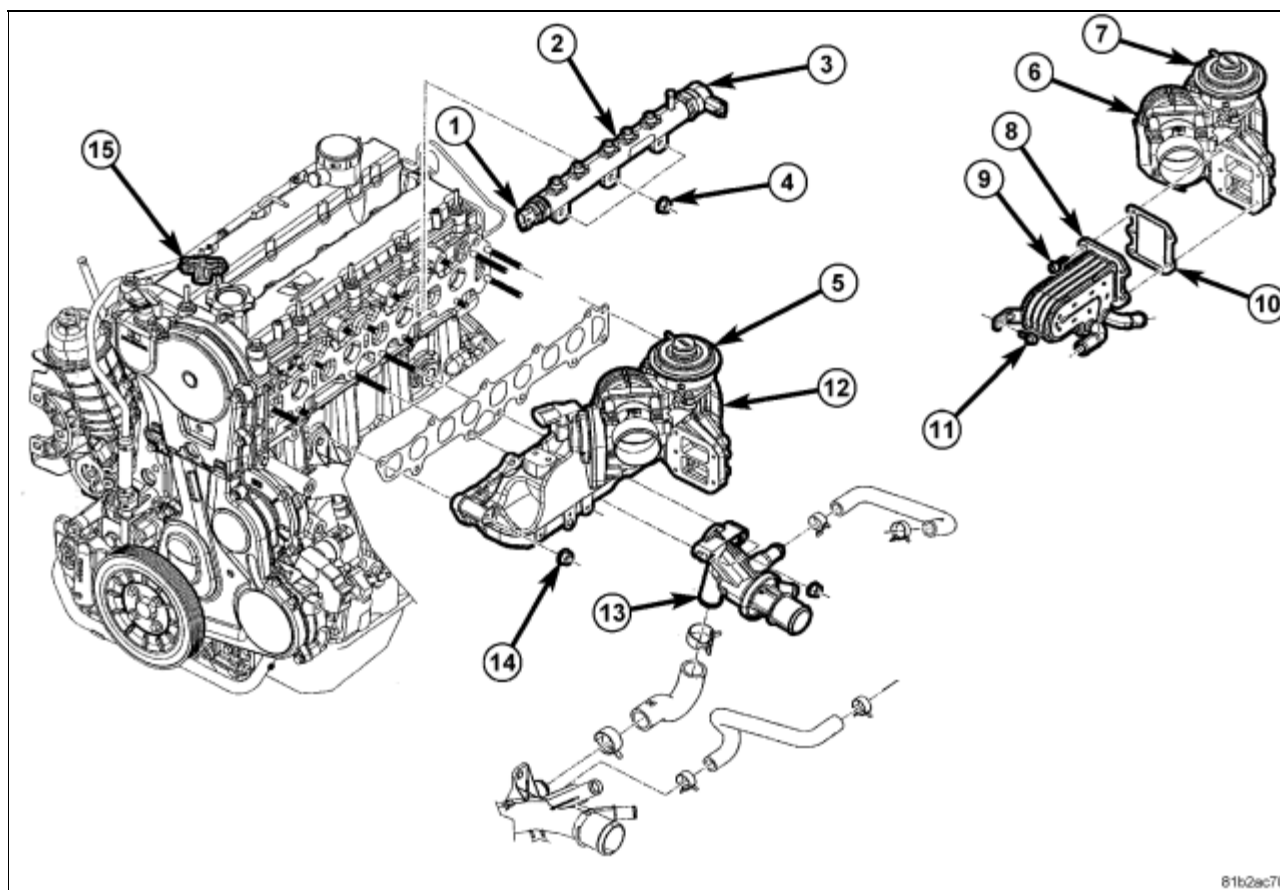
WARNING: High pressure fuel spray can cause severe cuts, and is extremely flammable. Before opening any part of the high pressure fuel system, wait for a minimum of 30 seconds after turning off the engine to allow pressure to bleed down from the high pressure side of the fuel system. Otherwise severe personal injury can result when the high pressure fuel system is opened.

WARNING: No sparks, open flames or smoking. Risk of poisoning from inhaling and swallowing fuel. Risk of injury to eyes and skin from contact with fuel. Pour fuels only into suitable and appropriately marked containers. Wear protective clothing.

NOTE: Do allow cleaning solvent or debris to enter the fuel pressure sensor harness connector.

3. Clean the area around the fuel pressure sensor with Mopar ® Throttle Body Cleaner P/N 04897156AA or equivalent degreasing solvent and compressed air.
4. Disconnect fuel pressure sensor electrical connector.

WARNING: When working with parts on the high side of the fuel injection system such as the fuel rail and high pressure injector lines, slowly loosen the part to allow any residual pressure to bleed down from the high pressure side of the system.



NOTE: Do not touch the connector terminals of the fuel rail pressure sensor. The internal electronic components of the sensor can be damaged.

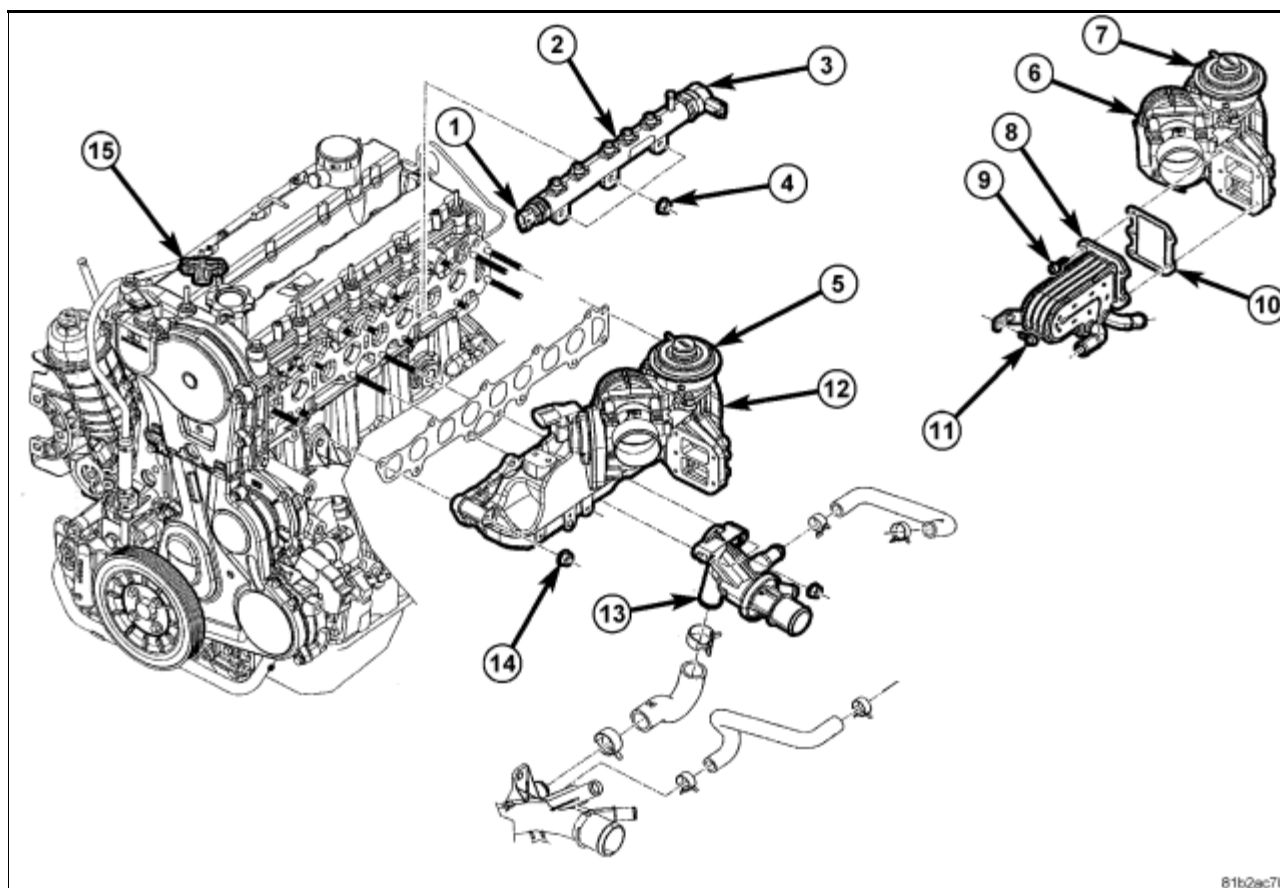
5. Remove fuel pressure sensor (1) from fuel rail.
6. If the sensor is to be reused, remove the fuel rail pressure sensor sealing ring. Do not damage or gouge the fuel rail pressure sensor threads. If any gouges or cuts are present in the fuel rail pressure sensor threads, the sensor must be replaced. Otherwise, fuel leaks can occur.

NOTE: Do not allow dirt or debris to enter the fuel rail and fuel rail solenoid threads after the fuel pressure solenoid has been removed from the fuel rail.

7. Clean the thread and fuel pressure sensor sealing surface of the fuel rail.
8. Use a clean plug to close off the fuel rail pressure sensor opening if the fuel pressure solenoid will not be immediately re-installed.

INSTALLATION

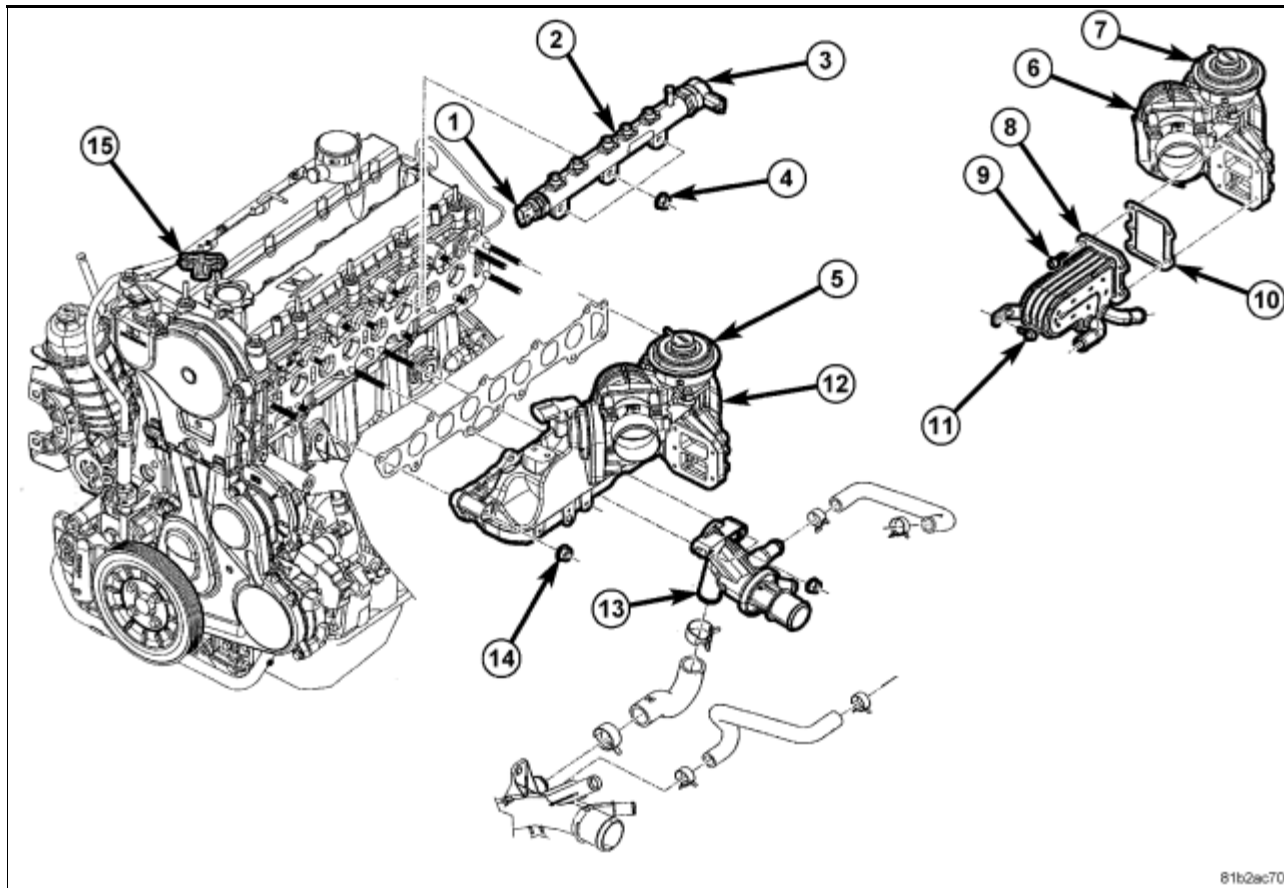
WARNING: Diesel fuel is under extreme pressure in the high pressure side of the fuel injection system between the fuel injectors and the high pressure fuel pump. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for leaks in the high pressure side of the fuel injection system. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing the high pressure side of the fuel system.



1. If reusing an existing fuel pressure sensor, install a new fuel pressure sensor sealing ring.
2. Lubricate the fuel pressure sensor threads and sealing ring with clean diesel fuel.
3. Install fuel pressure sensor (1) in fuel rail (2). Position the fuel rail pressure sensor so the harness connector is not stretched or under tension. Tighten sensor to 100 N·m (73 ft. lbs.).
4. Connect fuel pressure sensor electrical connector.
5. Install engine cover.
6. Connect negative battery cable.

SOLENOID-FUEL PRESSURE

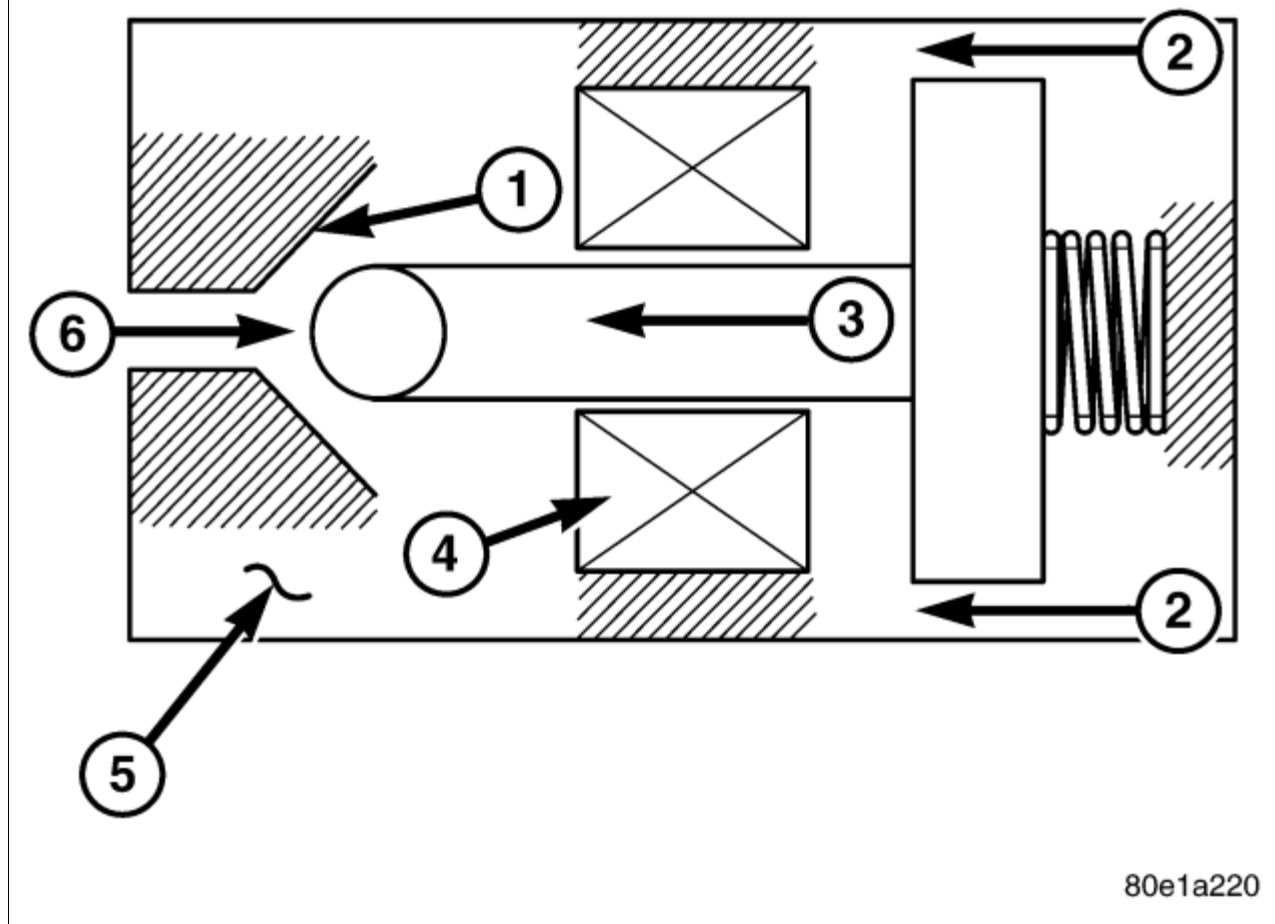
DESCRIPTION



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The fuel pressure solenoid (3) is attached to the rear of the fuel rail (2). The tip of the fuel pressure solenoid (3) uses a knife edge, for metal to metal sealing. The knife edge actually deforms the metal in the fuel rail in order to seal the surfaces. The solenoid must be replaced when ever it is removed from the rail. The solenoid controls and maintains constant rail pressure with a control current transmitted by the engine control module (ECM) .

OPERATION

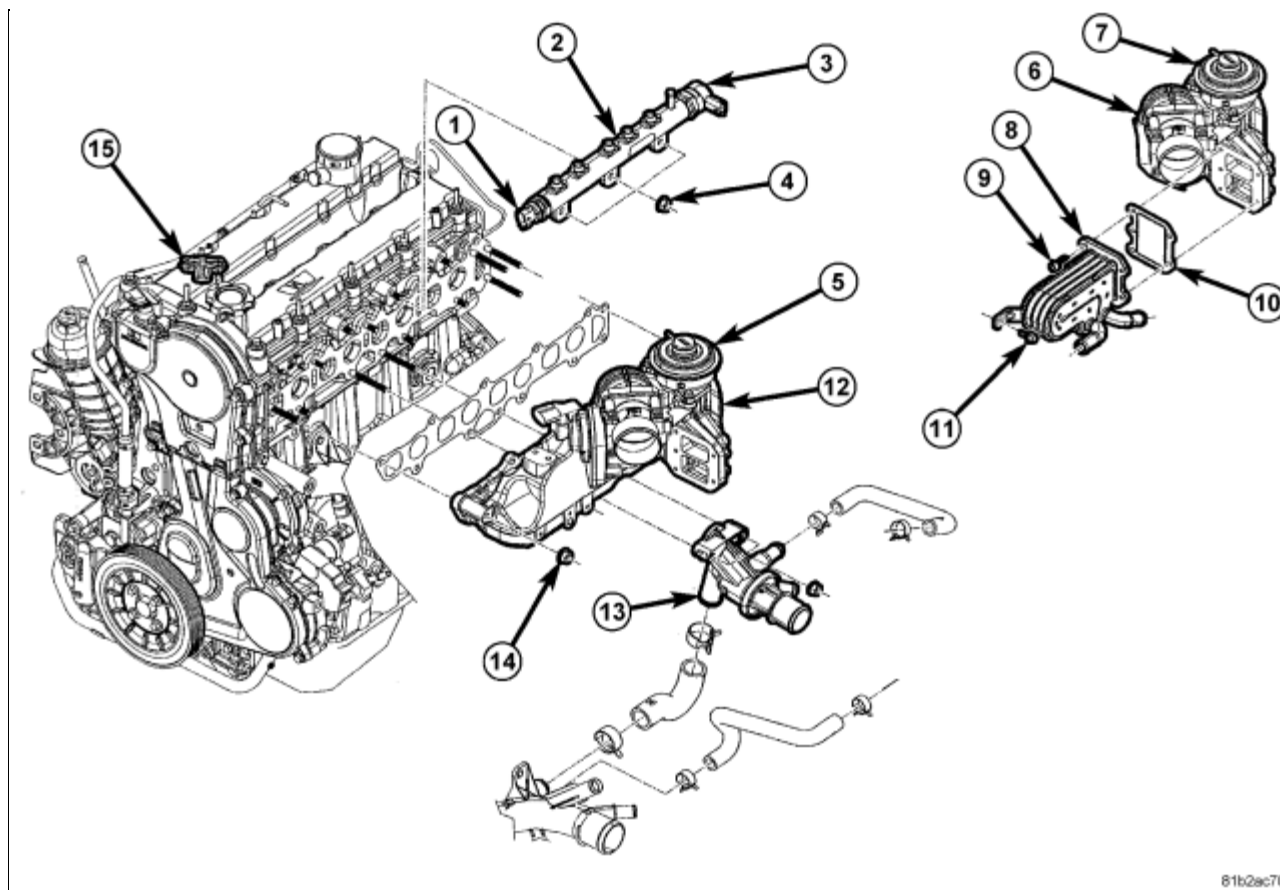


High pressure which is present in the fuel rail flows to the ball seat (1) of the pressure solenoid. The specified pressure required by the system is built up in the rail by the fuel pressure solenoid building up a magnetic force which corresponds to this specific pressure by means of a control current from the Electronic Control Module (ECM). This magnetic force equals a certain outlet cross section at the ball seat of the valve. The rail pressure is altered as a result of the quantity of fuel which flows off. The current fuel pressure is signaled by the fuel rail pressure sensor to the engine control module (ECM). The controlled fuel flows back along the return fuel line, into the tank.

In a de-energized state, the fuel pressure solenoid is closed as the spring force (2) presses the ball into the ball seat. When driving, the fuel pressure solenoid is constantly open. When engine is started, the fuel pressure solenoid is held closed by magnetic force. When driving, the pressure of the fluid counteracts the magnetic force of the coil and the slight spring force.

REMOVAL

Review the high pressure fuel system warning before beginning repair.



81b2ac70

WARNING: High pressure fuel spray can cause severe cuts, and is extremely flammable. Before opening any part of the high pressure fuel system, wait for a minimum of 30 seconds after turning off the engine to allow pressure to bleed down from the high pressure side of the fuel system. Otherwise severe personal injury can result when the high pressure fuel system is opened.

WARNING: No sparks, open flames or smoking. Risk of poisoning from inhaling and swallowing fuel. Risk of injury to eyes and skin from contact with fuel. Pour fuels only into suitable and appropriately marked containers. Wear protective clothing.

1. Disconnect negative battery cable.

NOTE: Do allow cleaning solvent or debris to enter the fuel pressure solenoid harness connector.

2. Clean the area around the fuel pressure solenoid with Mopar ® Throttle Body Cleaner P/N 04897156AA or equivalent degreasing solvent and compressed air.
3. Disconnect the fuel pressure solenoid harness connector.

WARNING: When working with parts on the high side of the fuel injection system such as the fuel rail and high pressure injector lines, slowly loosen the part to allow any residual pressure to bleed down from the high pressure side of the system.

4. Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
5. Clamp fuel rail (2) securely in vise with protective jaws.

CAUTION: Once removed, the solenoid must always be replaced. Do not re-use a fuel pressure solenoid

CAUTION: Do not reuse an existing fuel pressure solenoid. A new fuel pressure solenoid must be installed any time the existing solenoid has been removed from the fuel rail.

1. Position the fuel rail (2) into a soft jawed vise.
2. Inspect the sealing surfaces of the fuel pressure solenoid opening in the fuel rail. If any cuts or gouges are present in the fuel rail pressure solenoid opening, replace the fuel rail.
3. Lubricate the fuel pressure solenoid sealing rings with clean diesel fuel. Do not allow dirt or debris to come in contact with the fuel rail solenoid or the threads in the fuel rail.
4. Manually thread the fuel pressure solenoid (3) into the fuel rail until hand tight.
5. Position the fuel pressure solenoid electrical socket so the fuel pressure solenoid harness connector is not under stress. Otherwise, the connector or harness can be damaged.
6. Counterhold the fuel rail, and tighten the fuel rail solenoid (3) as follows:
 - a. Tighten the fuel pressure solenoid to 60 N·m (44 ft. lbs.)
 - b. Loosen the fuel pressure solenoid 90 degrees.
 - c. Retighten the fuel pressure solenoid to 85 N·m (62 ft. lbs.).
7. Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
8. Connect negative battery cable.
9. Start engine, allow to warm, turn engine off and inspect for leaks.

SOLENOID - FUEL QUANTITY

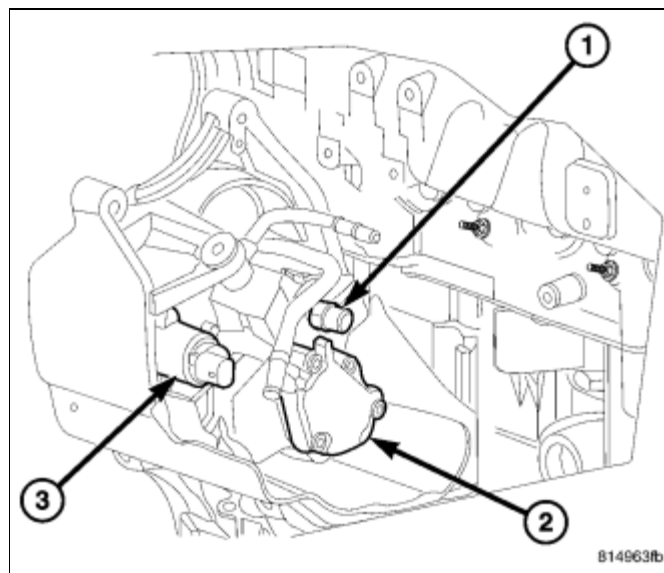
DESCRIPTION

The fuel quantity solenoid is located in the back of the high pressure pump. The solenoid is pulse width modulated by the ECM and meters the amount of fuel that flows into the high pressure elements inside of the high pressure pump. The solenoid is also inactive during the first 30 seconds to allow maximum fuel pressure to the fuel rail during start up .

OPERATION

The fuel quantity solenoid is a pulse width modulated valve that controls the amount of fuel sent or delayed to the high pressure pump elements inside of the high pressure pump. The ECM determines the fuel pressure set point based on engine sensor inputs. If the actual fuel rail pressure is too low, the ECM commands the solenoid to allow more fuel to flow to the high pressure pump. This minimizes the difference between the actual fuel rail pressure reading and the set point. The ECM will also operate the solenoid, delaying fuel if the fuel rail pressure becomes to high.

The fuel quantity solenoid is commanded open by the ECM to allow the high pressure pump to build maximum pressure (1600 BAR, 23,200 PSI). the solenoid also has fuel tank heat protection function that meters the exact amount of fuel to prevent excess heated fuel from returning to the fuel tank

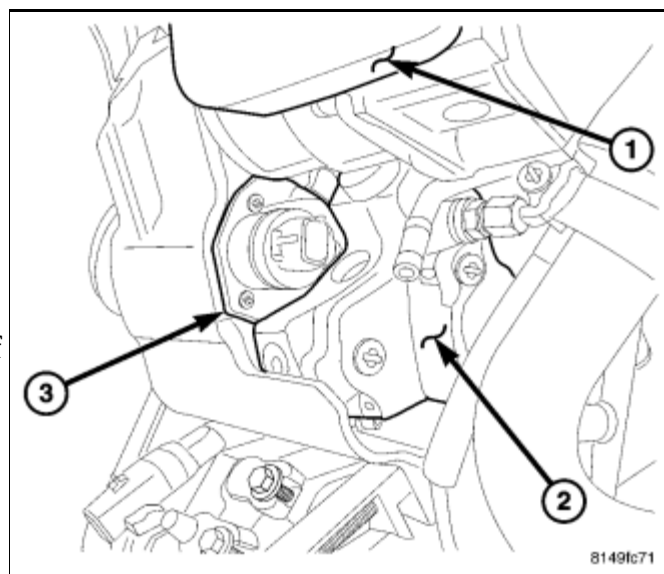


REMOVAL

1. Disconnect the negative battery cable
2. Remove the charge air inlet hose.
3. Disconnect the fuel quantity solenoid wiring harness connector.
4. Remove the solenoid from the back of the high pressure pump .

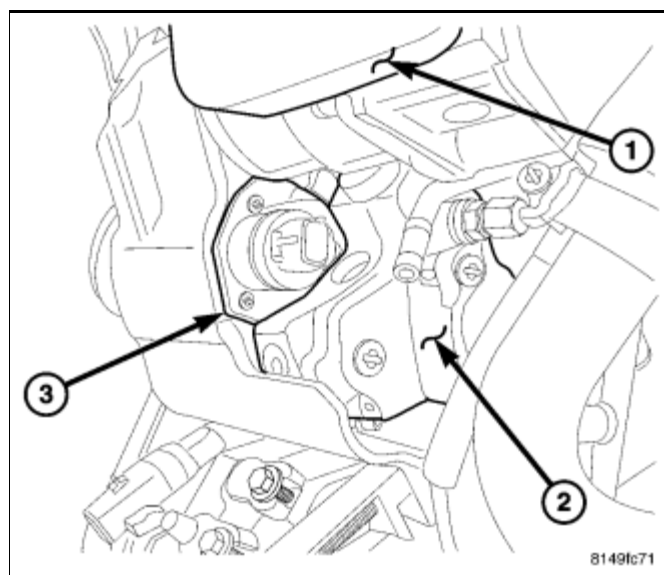
NOTE: Inspect the fuel quantity solenoid and high pressure pump passage for contamination or corrosion. If contamination or corrosion is present replace the high pressure pump.

5. Inspect solenoid and pump for corrosion.



INSTALLATION

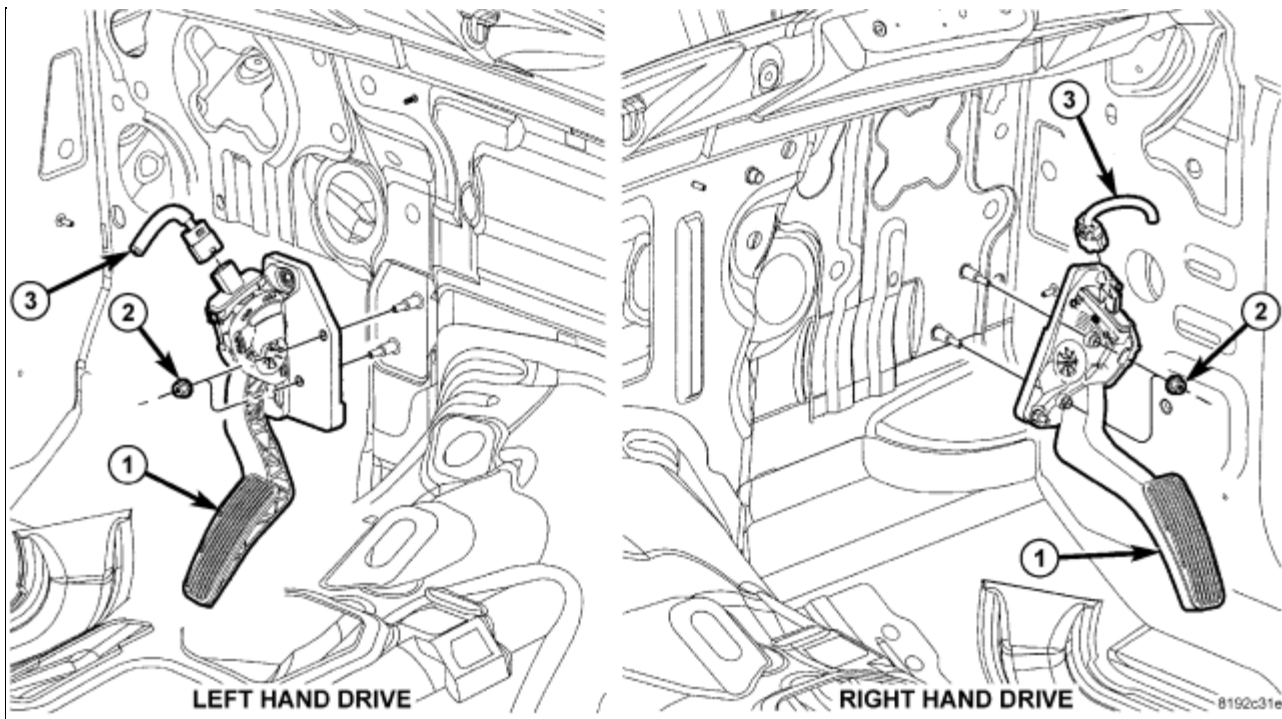
1. Review the high pressure fuel system warning.
2. Lubricate the fuel quantity solenoid and seal with clean diesel fuel.
3. Install the solenoid into the high pressure pump, hand tighten the fasteners .
4. Torque the solenoid fasteners to 10.8 N·m (96 in. lbs.).
5. Connect the wiring harness connector.
6. Install the charge air inlet hose.
7. Start engine, allow to warm, shut engine off and inspect for leaks.



FUEL INJECTION - 2.8L DIESEL

SENSOR-ACCELERATOR PEDAL POSITION

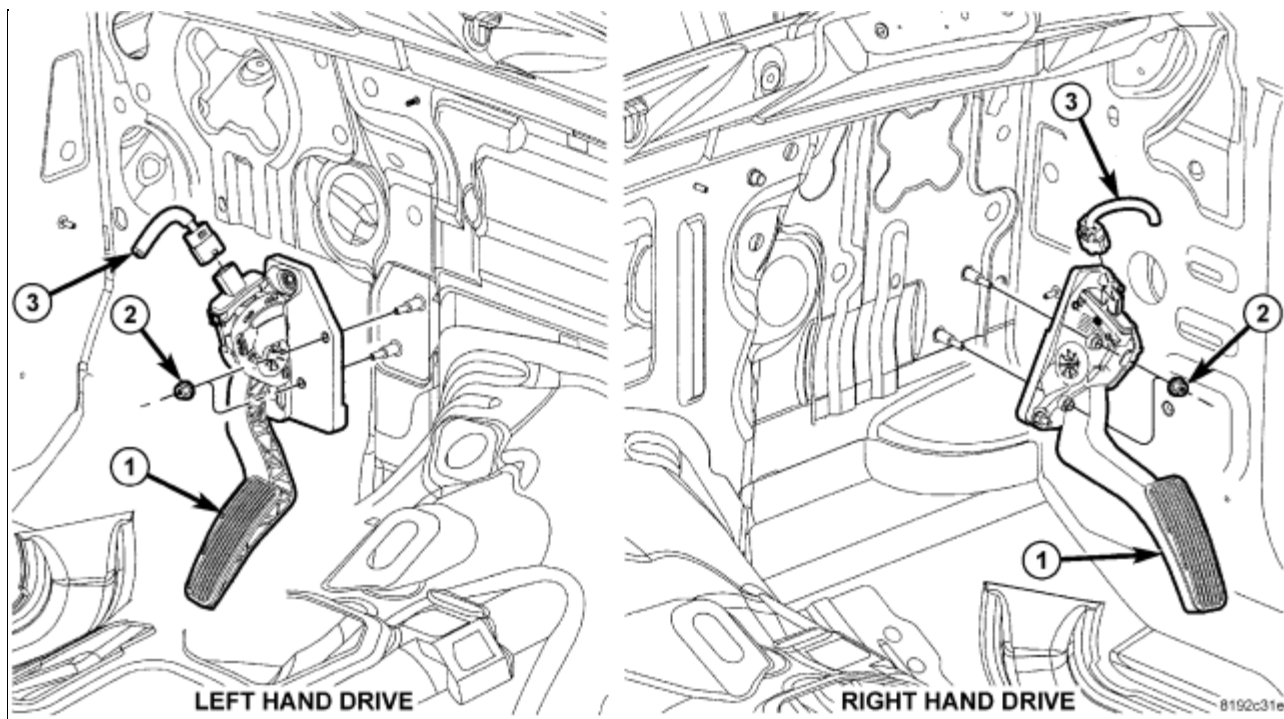
REMOVAL



The accelerator pedal and APPS (Accelerator Pedal Position Sensor) are serviced as a complete assembly including the bracket.

1. Disconnect electrical connector (3) at APPS.
2. Remove two accelerator pedal mounting bracket nuts (2).
3. Remove accelerator pedal/APPS assembly (1) from vehicle.

INSTALLATION



The accelerator pedal and APPS (Accelerator Pedal Position Sensor) are serviced as a complete assembly including the bracket.

1. Position accelerator pedal/APPS assembly over two mounting studs.
2. Install two accelerator pedal mounting bracket nuts (2).
3. Connect electrical connector (3) at APPS.
4. Before starting engine, operate accelerator pedal to check for any binding.

INJECTOR-FUEL

DESCRIPTION

To control the injection valves, the new Common-Rail injectors use a rapid-action actuator made of piezo crystals, which opens and closes the injection valve. The piezo crystals expand when electrical current is applied to them, and contract when electrical current is turned off. The piezo actuator can switch up to five times faster than a standard solenoid, because the movement of the piezo crystals does not rely on mechanical components to transmit motion to the injection valve. This doubles the piezo injector's switching speed, and enables fuel to be delivered with greater precision, which leads to lower emissions and better engine performance.

STANDARD PROCEDURE

INJECTOR CLASSIFICATION

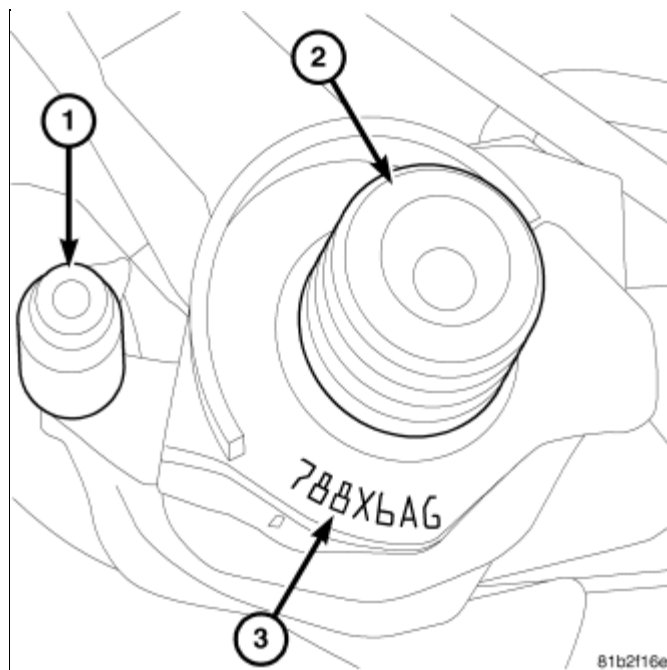
Each fuel injector has a alphanumeric correction code number. This correction code is printed on the upper part of

the fuel injector (3) and is used to identify injector calibration. When replacing any fuel injectors, this code must be entered into the vehicles Engine Control Module (ECM) using a diagnostic scan tool. In addition, if a new ECM is installed, use a diagnostic scan tool to program all of the injector codes from the original fuel injectors into the new ECM.

The classification of injectors describes the fuel flow quantity characteristic of the injector. This will make it possible in the future to match the engine software to the tolerances of the injector within a more narrowly graduated range. Classification can be clearly recognized, and assigned only by means of a scan tool.

These general conditions equally apply if, as a result of replacing an engine, carrying out repairs to the cylinder head etc., the cylinder selective assignment of the injectors or the engine control module assignment may have changed. If proper attention is not paid to the classification on these vehicles, driveability and smoking concerns could result.

If an injector is replaced, it is then necessary to assign the classification code to the corresponding cylinder in the ECM (Engine Control Module) with the appropriate scan tool.



INJECTOR CLASSIFICATION PROCEDURE

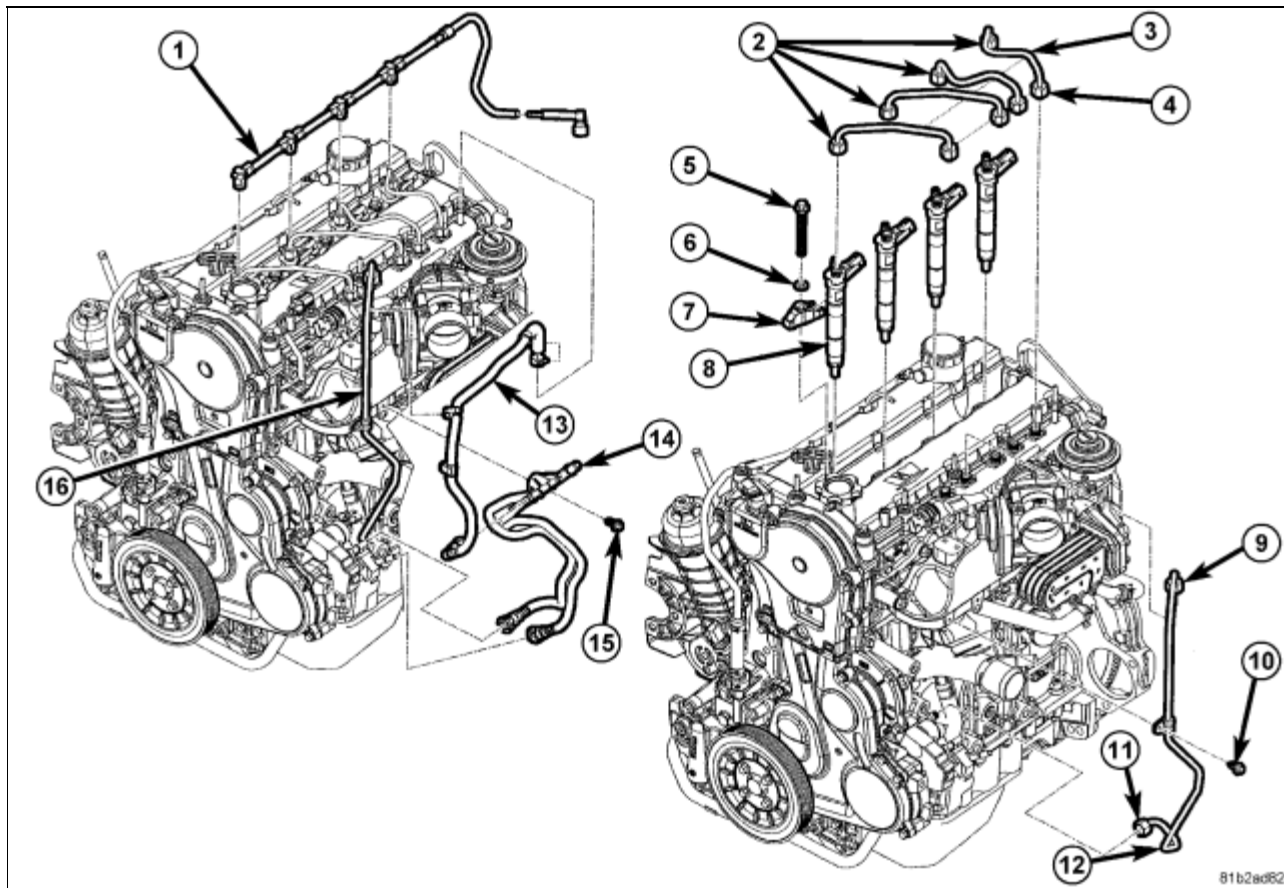
1. Turn ignition switch "ON".
2. Using the diagnostic scan tool, select ENGINE then MISCELLANEOUS.
3. Select LEARN INJECTORS.
4. Using the up and down arrows, scroll to the appropriate injector.
5. Using the right and left arrows, set injector to proper classification code.
6. Once injectors are classified, cycle ignition key to complete.

REMOVAL

CAUTION: Due to the complexity of the fuel injection system used on this engine, refer to the Diesel Engine Diagnostics, and service any fuel system DTCs prior to replacing any fuel injectors. If no DTCs are present, refer to the Diesel Engine Diagnostic Test for Lack of Engine Power, and perform all steps as directed prior to replacing any fuel injectors.

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

1. Disconnect negative battery cable at battery. Isolate end of cable.
2. Remove dress-up cover from top of engine.
3. Remove the high-pressure fuel lines from fuel rail to fuel injectors. Refer to Fuel Line Removal.

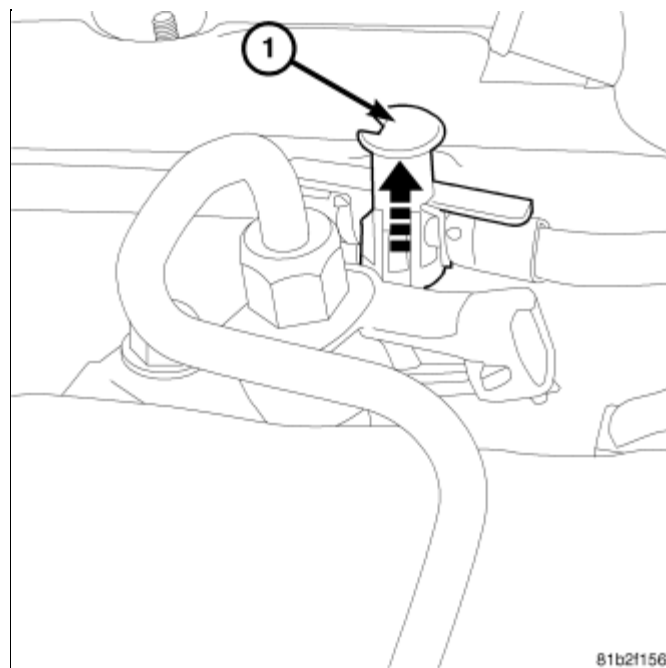


4. Locate common fuel return line (1).

5. Disconnect electrical connector at top of injector(s).

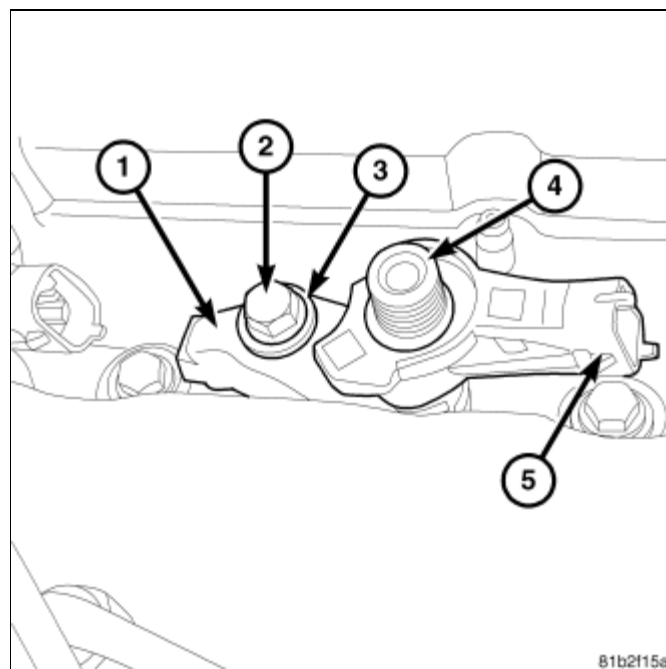
NOTE: The injector common fuel return line is connected to the low pressure fuel circuit (5 bar/72 psi).

6. A lock button (1) is used to secure the common fuel return line to each fuel injector. Use your fingers to lift all four lock buttons (1) up. After unlocking all four buttons, lift fuel return line assembly up for removal.



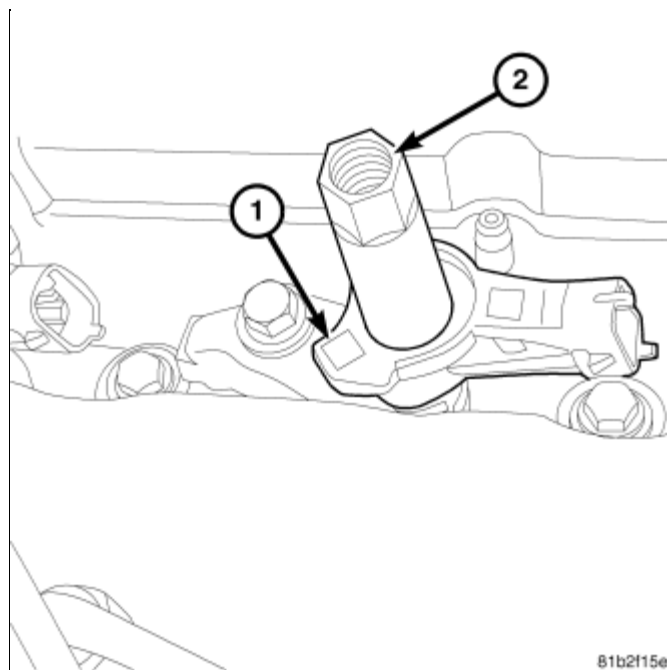
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7. Remove injector mounting bolt (2) and washer (3).
8. Remove injector mounting clamp (1).
9. Using compressed air, thoroughly clean surface area in and around injector bore to prevent foreign material from falling into the injector bore after injector removal.
10. Using your hand, pull fuel injector straight up from cylinder head for removal.



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11. If injector can't be removed by hand, install special fuel injector removal tool #9552 (2) to top of fuel injector.



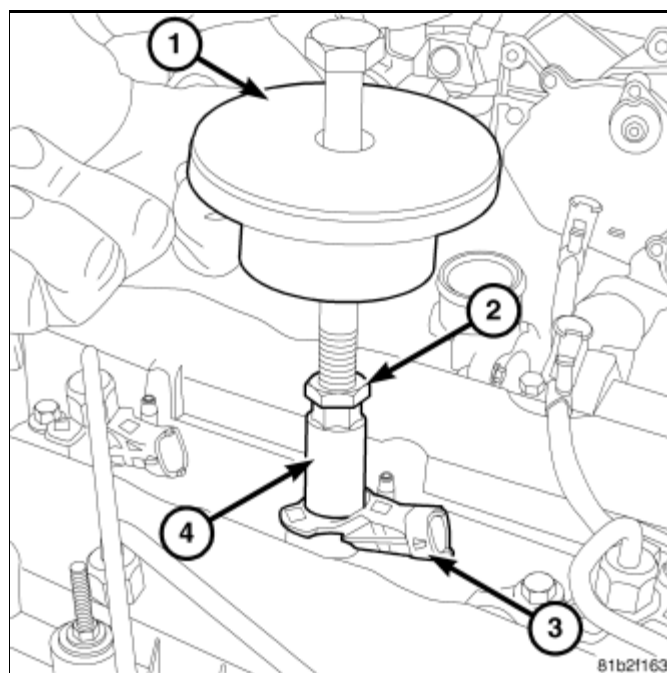
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12. Install special slide hammer tool #8941 (1) onto special tool #9552 (4). Tighten lock nut (2). Remove injector from cylinder head.

NOTE: DO NOT use a wire brush to clean the fuel injector or nozzle. Possible restriction of the injector needle may result.

INSTALLATION

CAUTION: Due to the complexity of the fuel injection system used on this engine, refer to the Diesel Engine Diagnostics, and service any fuel system DTCs prior to replacing any fuel injectors. If no DTCs are present, refer to the Diesel Engine Diagnostic Test for Lack of Engine Power, and perform all steps as directed prior to replacing any fuel injectors.



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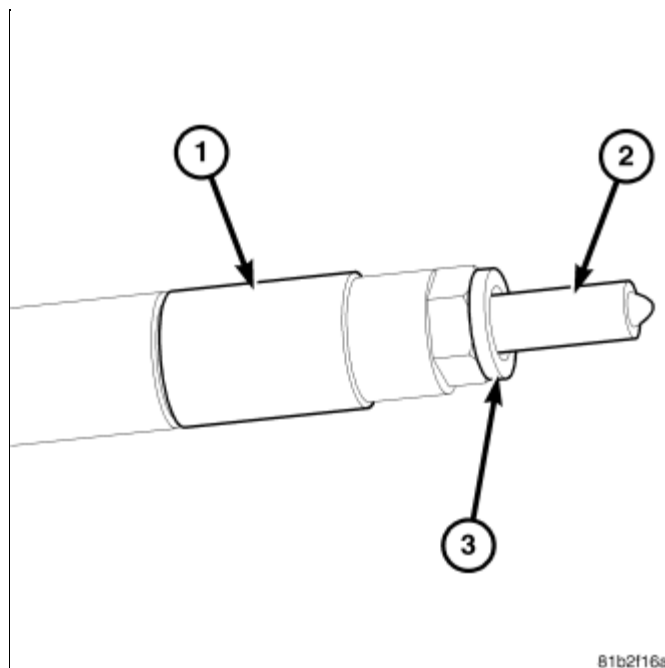
CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

NOTE: DO NOT use a brush to clean around the injector nozzle (2). DO NOT lubricate area around injector

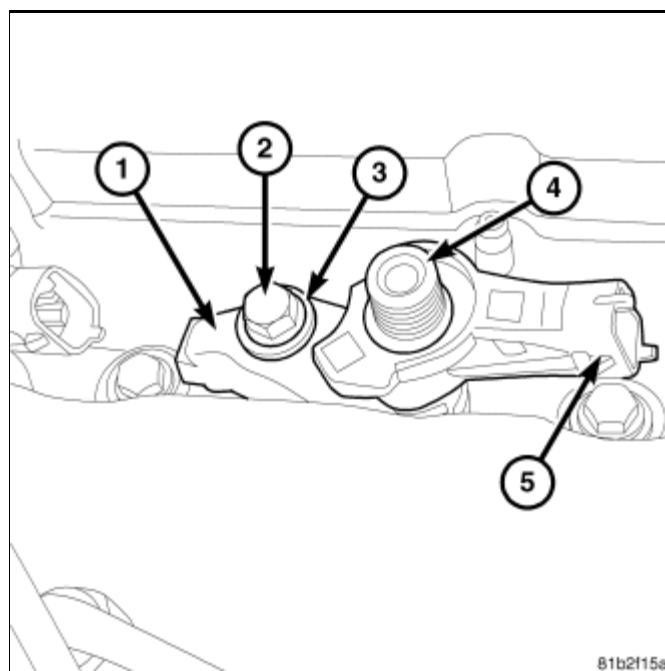
nozzle. The injector may become restricted with debris.

NOTE: Be sure a new copper washer/seal (3) is installed on end of injector and the old seal is removed, before installing in cylinder head.

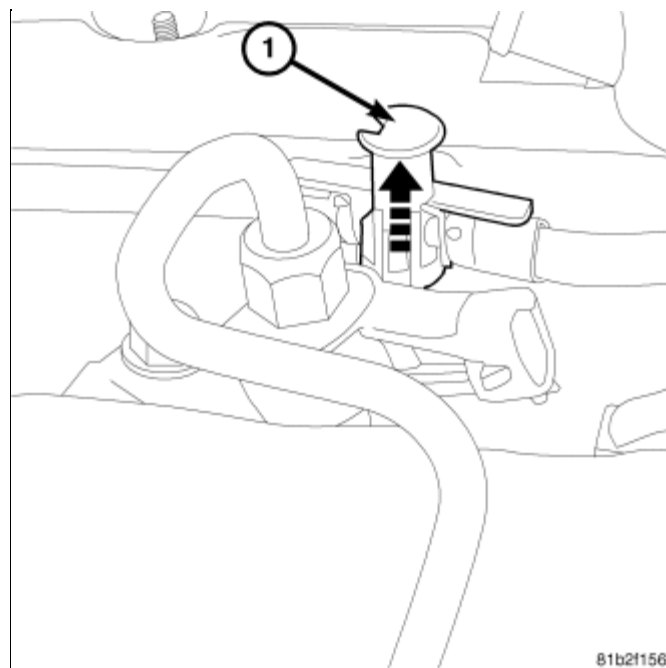
1. Install fuel injector into cylinder head with new seal.



2. Install fuel injector retainer clamp (1), washer (3) and bolt (2). Tighten clamp bolt (2) to 33 N·m (24 ft. lbs.) torque.
 3. Connect electrical connector to fuel injector.
 4. Install fuel injector high-pressure lines. Refer to Fuel Line Installation.



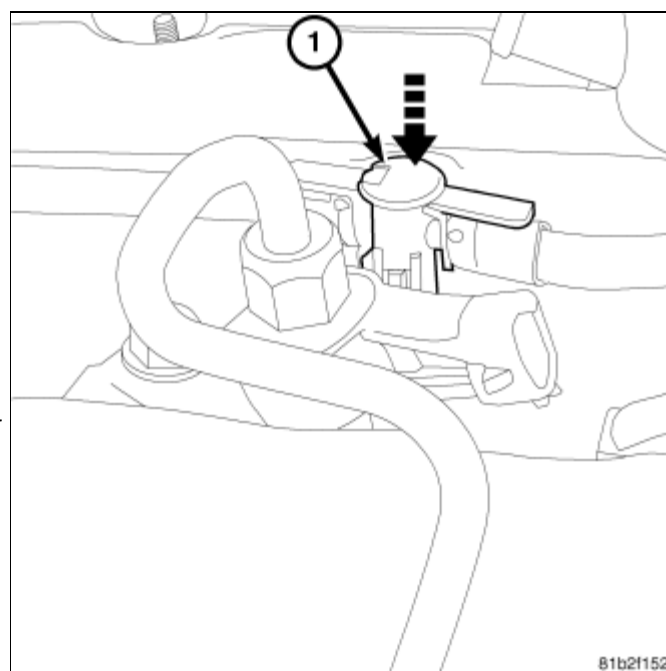
5. Position female fittings on fuel return line to male fittings at each fuel injector. **Be sure lock buttons (1) are in up position before positioning.**



6. After positioning, push each lock button (1) down to secure fuel return line to each fuel injector.
7. Connect each fuel injector electrical connector.
8. Connect negative battery cable.
9. Perform the injector classification procedure with a diagnostic scan tool.
10. Start the engine and allow to warm. **Turn off the ignition switch** and inspect for fuel leaks.
11. Install engine dress-up cover.

SENSOR-CRANKSHAFT POSITION

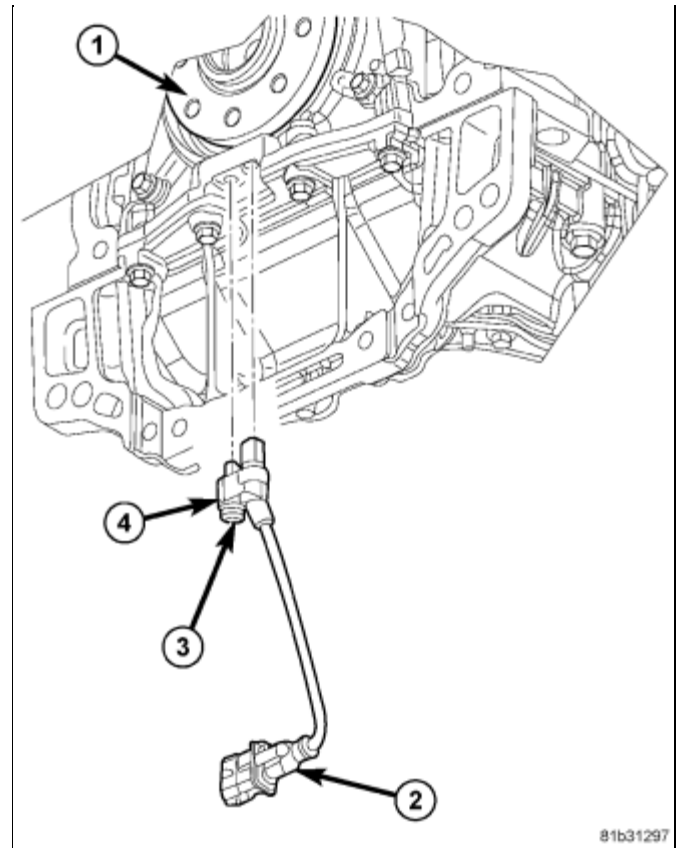
REMOVAL



The Crankshaft Position Sensor (CKP) (4) is located between the transmission and the rear of the engine block. It is bolted to the engine block below the crankshaft hub (1).

1. Raise and support vehicle.
2. Remove access cover.
3. Disconnect CKP electrical connector (2).
4. Remove CKP mounting bolt (3).
5. Remove CKP sensor (4).

INSTALLATION



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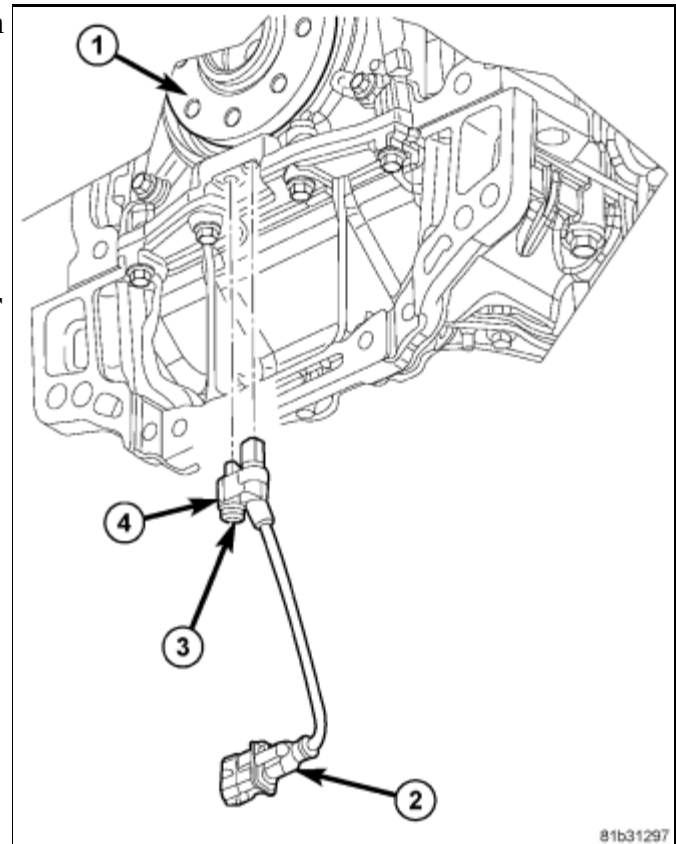
The Crankshaft Position Sensor (CKP) (4) is located between the transmission and the rear of the engine block. It is bolted to the engine block below the crankshaft hub (1).

1. Position CKP sensor (4) into mounting hole.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

2. Install CKP mounting bolt (3). Tighten bolt to 11 N·m (8 ft. lbs.) torque.
3. Connect CKP electrical connector (2).
4. Position CKP access cover. Install bolts and tighten to 15 N·m (11 ft. lbs.) torque.
5. Lower vehicle.

SENSOR-INTAKE AIR PRESSURE REMOVAL



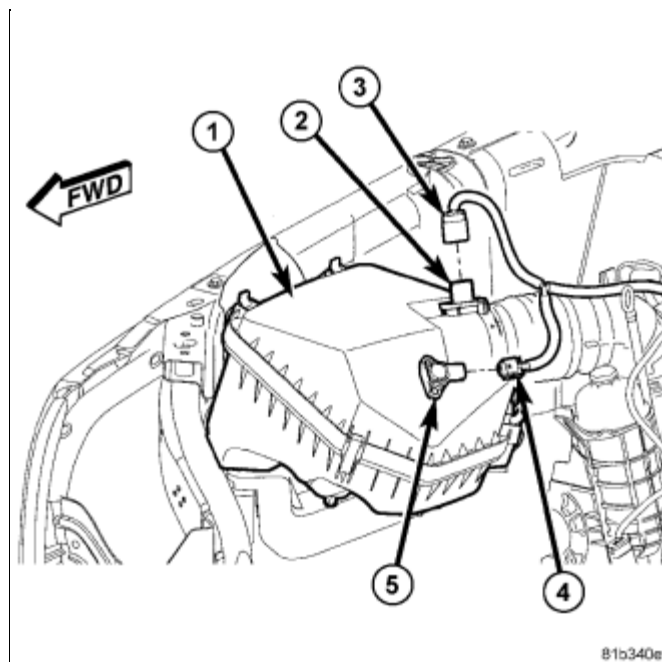
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The Inlet Pressure Sensor (5) is located on the air cleaner

cover (1).

1. Disconnect electrical connector (4) at sensor.
2. Remove mounting screws.
3. Remove sensor from air cleaner cover.

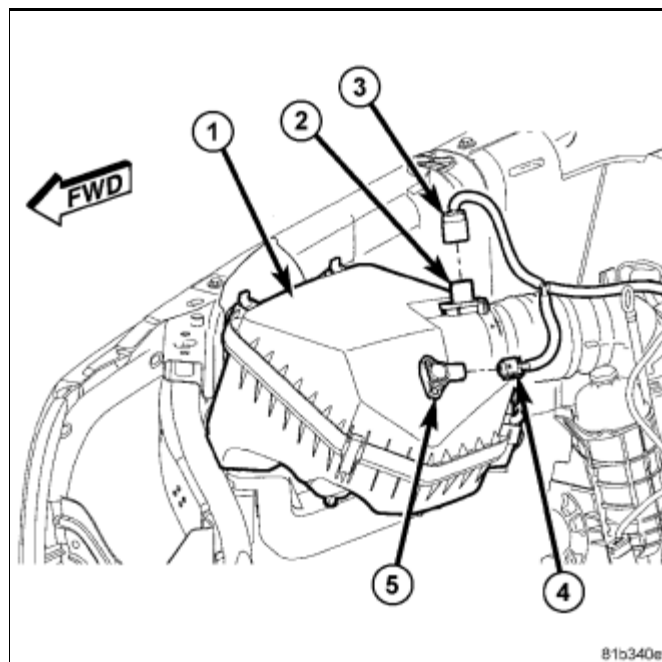
INSTALLATION



1. Check condition of sensor O-ring.
2. Position Inlet Pressure Sensor (5) into top of air cleaner cover with a slight twisting action.
3. Install mounting screw.
4. Install Inlet Pressure Sensor electrical connector (4).

SENSOR-MASS AIR FLOW

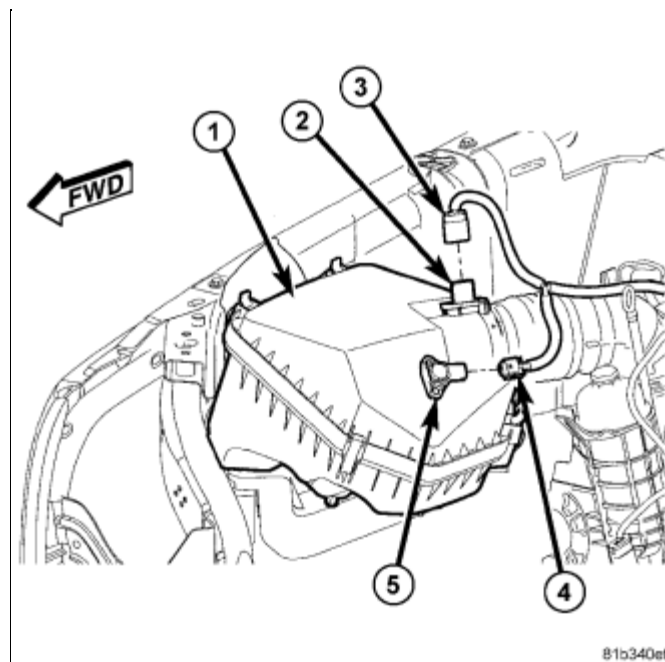
REMOVAL



The Mass Airflow Sensor (2) is located on the air cleaner cover (1).

1. Disconnect electrical connector (3) at sensor.
2. Remove mounting screws.
3. Remove sensor from air cleaner cover.

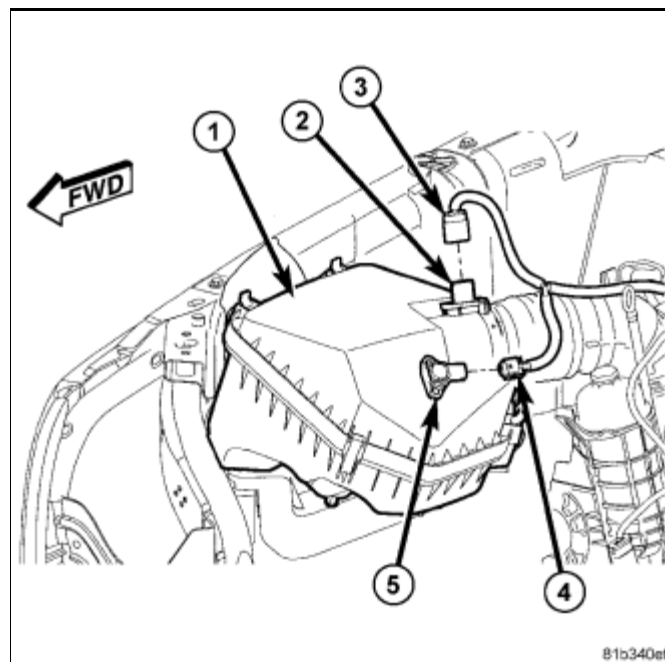
INSTALLATION



1. Check condition of sensor O-ring.
2. Position MAF sensor (2) into top of air cleaner cover with a slight twisting action.
3. Install mounting screw.
4. Install MAF electrical connector (3).

SENSOR- TEMPERATURE/PRESSURE-MAP OPERATION

The combination, dual function Intake Manifold Air Temperature Sensor/MAP Sensor is installed into the top of the intake manifold with the sensor element extending into the air stream.



The IAT portion of the sensor provides an input voltage to the Engine Control Module (ECM) indicating intake manifold air temperature. The MAP portion of the sensor provides an input voltage to the ECM indicating turbocharger boost pressure.

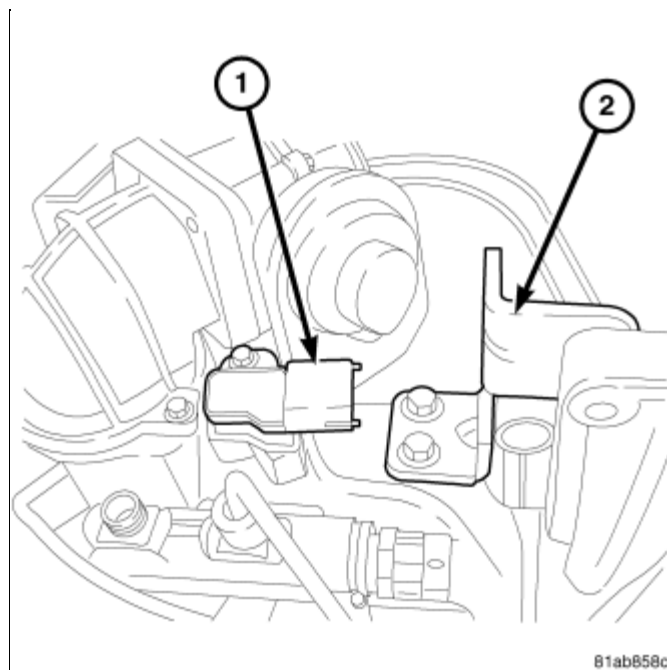
REMOVAL

The combination, dual function Intake Manifold Air Temperature Sensor/MAP (IAT/MAP) sensor (1) is installed into the top of the intake manifold near the fuel rail.

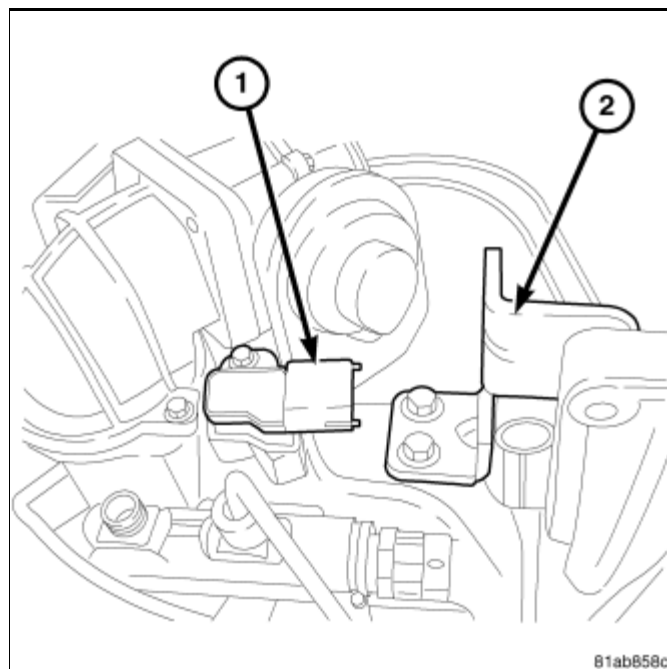
1. Clean area around sensor.
2. Disconnect electrical connector from IAT/MAP sensor.
3. Remove mounting screw.
4. Remove sensor from intake manifold by twisting.
5. Check condition of sensor O-ring.

INSTALLATION

1. Check condition of sensor O-ring.
2. Clean sensor mounting area at intake manifold.
3. Lubricate sensor O-ring and sensor mounting hole in intake manifold cover with clean engine or diesel oil.
4. Position sensor (1) into intake manifold.
5. Install and tighten sensor mounting screw to 1 N·m (9 in. lbs.) torque.
6. Connect electrical connector to sensor.



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19 - STEERING

STEERING

DESCRIPTION

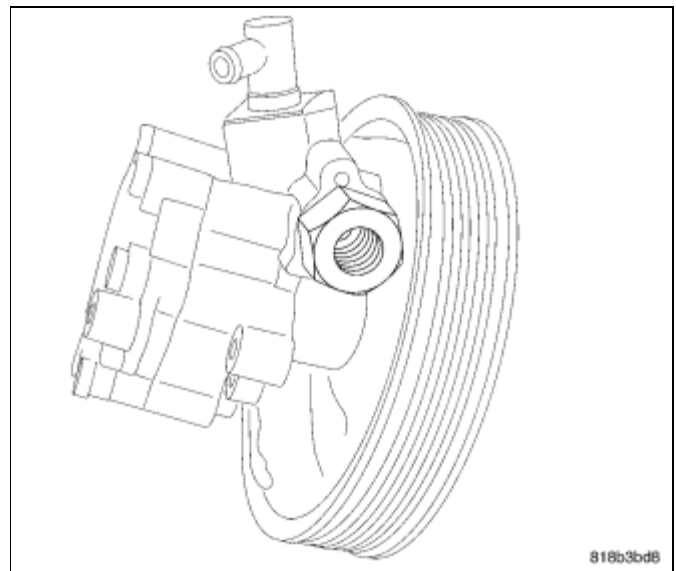
CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The power steering system has a hydraulic pump. The pump is a droop flow rate and displacement vane-type pump. The pump reservoir is remote located by the air box & headlamp.

The steering gear used is a straight ratio recirculating ball type gear.

OPERATION

The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the upper end. When the worm shaft is turned from input from the steering column the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.



DIAGNOSIS AND TESTING

STEERING SYSTEM DIAGNOSIS CHARTS

NOTE: There are three diagnosis charts following that cover NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES, PERFORMANCE ISSUES, and FLUID ISSUES.

NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
OBJECTIONABLE HISS OR WHISTLE WHILE TURNING STEERING WHEEL WHEN STATIONARY OR MOVING SLOWLY*	1. Damaged or mispositioned steering column shaft/coupling dash boot seal.	1. Check to ensure boot is properly installed and seals against sheet metal. Reposition or replace steering column shaft/coupling dash boot seal as necessary.

	2. Mis-routed power steering hose.	2. Check routing of power steering hoses. Ensure hoses do not come in unwanted contact with other components and objects.
	3. Restriction in pressure or return hose.	3. Using an electronic listening tool, determine if noise is coming from either pressure or return hose. Replace hose that noise is present within.
	4. Noisy valve in power steering gear.	4. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
RATTLE OR EXCESSIVE CLUNK**	1. Power steering gear loose on engine cradle/crossmember.	1. Check fastener torque and tighten to specifications. Replace as necessary. Check steering wheel center following repair.
	2. Loose strut assembly mounting fasteners at tower or knuckle.	2. Check fastener torque and tighten to specifications.
	3. Excessive play in outer tie rod.	3. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
	4. Engine cradle/crossmember mounting fasteners loose at frame or bushings worn.	4. Check fastener torque and tighten to specifications. Inspect bushings and repair as necessary.
	5. Wheel Mounting (Lug) nuts loose.	5. Inspect wheel mounting (Lug) nuts and studs and repair as necessary. Tighten nuts to specifications.
	6. Power steering hose touching the body or frame of vehicle.	6. For evaluation and correction, (Refer to 19 - STEERING/PUMP - DIAGNOSIS AND TESTING).
	7. Stabilizer bar link joints worn (occurs with steering input only when moving, not stationary).	7. At park, jounce only one side of vehicle front to exercise stabilizer bar. Replace stabilizer bar link.
	8. Loose lower control arm mounting bolts at engine cradle, frame or crossmember (occurs with steering input only when moving, not stationary).	8. Check control arm mounting bolts and tighten to specified torque.
	9. Loose intermediate shaft or column.	9. Rotate intermediate (steering) shaft in relationship to gear, checking for free-play. Check column fasteners and tighten to specifications as necessary.
	10. Lower control arm pivot bushing worn (occurs with steering input only when moving, not stationary).	10. Inspect bushings for wear and replace lower control arm as necessary.
	11. Internal power steering gear noise.	11. Drive vehicle on rough road, then steer rapidly back and forth when stopped. Replace power steering gear as necessary.
	12. Loose inner tie rod.	12. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).

		TESTING).
	13. Damaged engine cradle/crossmember.	13. Inspect the cradle/crossmember for cracks or other damage. Replace as necessary.
POPPING NOISE	1. Loose steering gear mounting fasteners.	1. Check fasteners for proper torque and retighten as necessary.
	2. Loose outer tie rod mounting nut or jam nut.	2. Check fastener torque. Replace nuts as necessary and tighten to specifications.
	3. Loose intermediate (steering) shaft coupling at gear input shaft.	3. Make sure coupling is fully seated on gear input shaft. Retighten or re-seat as necessary.
	4. Worn tie rod (outer or inner).	4. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
	5. Worn axle half-shaft.	5. For evaluation and correction, (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 186FBI - DIAGNOSIS AND TESTING).
CHIRP OR SQUEAL (POWER STEERING PUMP)	1. Loose power steering pump drive belt.	1. Inspect belt. Replace belt if worn or glazed. Tighten/adjust power steering pump drive belt if equipped with a manual tensioner.
	2. Pulley alignment incorrect.	2. Realign accessory drives.
	3. Malfunctioning belt auto-tensioner	3. Verify belt tension. Replace belt auto-tensioner.
	4. Power steering pump noisy (worn bearing/bushing noise).	4. Using an electronic listening tool, determine if noise is coming from pump. Replace power steering pump as required.
	5. Generator or water pump noisy.	5. Using an electronic listening tool, determine if noise is coming from Generator or water pump. Replace faulty component.
WHINE, GROWL, MOAN OR GROAN (POWER STEERING PUMP)***	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system fluid).
	2. Air in power steering fluid.	2. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid. (Refer to 19 - STEERING - STANDARD PROCEDURE)
	3. Power steering hose touching body or frame of vehicle.	3. For evaluation and correction, (Refer to 19 - STEERING/PUMP - DIAGNOSIS AND TESTING).
	4. Wear of power steering pump internal components.	4. For evaluation and correction, (Refer to 19 - STEERING/PUMP - DIAGNOSIS AND TESTING).
COLD START WHINE OR MOAN (POWER STEERING PUMP)***	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system fluid).

	2. Extremely low ambient temperature (near 0 F° (-18 C°) or below)	2. Some noise is expected as pump attempts to pull cold, thick fluid. Noise should go away as vehicle warms up. Acceptable levels of excessive noise are one second at 0 F° (-18 C°) and 15 seconds at -20 F° (-29 C°). If noise is excessive, look for poor sealing on the return hose or a possible fluid leak.
SQUEAKING OR RUBBING SOUND	1. Steering column shroud or shaft rubbing.	1. While turning the steering wheel, listen down column to locate. Check interference between moving components. Move or realign shrouds or shaft as necessary. Replace components if this does not correct problem.
	2. Clockspring inside steering column noisy.	2. Remove clockspring and reinstall steering wheel for testing. If noise is gone, replace clockspring.
	3. Boot/dash seal lubrication inadequate.	3. Remove boot seal and recheck for noise. Lubricate seal as necessary.
	4. Steering gear outer tie rod noisy.	4. While a helper turns the steering wheel, use an electronic listening tool to determine if noise is coming from either outer tie rod. Replace outer tie rods as necessary.
	5. Steering gear internally noisy.	5. Remove dash seal boot, then exercise the steering wheel. If noise is still present at gear, replace steering gear.
SCRUBBING OR KNOCKING SOUND.	1. Incorrect tire or wheel size.	1. Replace incorrect size tire or wheel with original equipment size.
	2. Worn motor or transmission mount.	2. Drive vehicle, moving accelerator pedal rapidly up and down attempting to locate noise. Try in both forward and reverse. Replace mounts as necessary.
	3. Tires contacting wheel well.	3. Make sure wheel house is properly positioned. If not, reposition as necessary. If steering wheel is properly centered, check steering gear travel left to right by rotating the steering wheel to each stop. Steering wheel should rotate the same amount in both directions from center. If not, replace steering gear.
	4. Interference between moving steering components and other components.	4. Check for bent or misaligned components. Correct or replace as necessary.
	5. Accessory drive pulley rubbing against another component.	5. Check pulleys for wear. Check for worn engine or transmission mount. Reposition components or replace mounts as necessary.

NOTE: * There is some noise in all power steering systems. One of the most common is a hissing sound evident when turning the steering wheel when at a standstill or when parking and the steering wheel is at the end of its travel. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results when high velocity fluid passes valve orifice edges. There is no relationship between this noise and the performance of the steering system.

NOTE: ** A light clunk may be felt or heard during steering wheel reversal while vehicle is stationary.

This results from internal steering gear rack movement at the bushings and in no way affects the performance of the steering system. This movement may be felt in the steering components during steering wheel reversal.

NOTE: * Power steering pump growl/moan/groan results from the development of high pressure fluid flow. Normally this noise level should not be high enough to be objectionable.**

PERFORMANCE ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
STEERING WHEEL OR COLUMN HAS FREEPLAY/LASH/LOOSENESS (CLUNKING OR RATTLING)	1. Loose coupling pinch bolt at gear input shaft.	1. Check pinch bolt torque. Replace pinch bolt if equipped with thread locker patch and tighten to specifications.
	2. Power steering gear loose on cradle/crossmember.	2. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.
	3. Excessive freeplay or noise from steering column bearings.	3. Replace steering column.
	4. Excessive intermediate (steering) shaft coupling u-joint free-play.	4. Rotate steering wheel back-and-forth while watching coupling. Observe for free-play. Replace intermediate shaft as necessary.
	5. Loose or worn outer tie rod.	5. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
	6. Lack of lubrication in lower ball joint or ball joint is damaged.	6. Lubricate ball joint if equipped with a zerk fitting and check for function . If not equipped with a zerk fitting, test and replace ball joint as necessary.
	7. Excessive lash inside steering gear.	7. Disconnect intermediate shaft and turn steering gear input shaft. Observe for any movement without a corresponding tire movement. Replace steering gear as necessary.
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	1. Steering wheel retaining bolt loose.	1. Check steering wheel retaining bolt torque and tighten to specifications as necessary.
	2. Loose steering column to instrument panel fasteners.	2. Check steering column to instrument panel fastener torque and tighten to specifications as necessary.
	3. Steering column lower bearing spring retainer slipped on	3. Pull steering wheel fore-and-aft while observing movement. Replace steering column as necessary.

	steering column shaft.	
STEERING WHEEL, DASH OR VEHICLE VIBRATES DURING STEERING MANEUVERS (ESPECIALLY AT LOW SPEED OR STANDSTILL).	1. Air in power steering fluid.	1. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid. (Refer to 19 - STEERING - STANDARD PROCEDURE)
	2. Tire(s) not properly inflated.	2. Check and inflate tires to the specified pressure.
	3. Excessive engine vibration.	3. Ensure that the engine is tuned properly.
	4. Loose tie rod end jam nut.	4. Check torque and tighten the inner to outer tie rod jam nut to specifications.
	5. Overcharged air conditioning (A/C) system.	5. Turn A/C off and verify issue goes away. Repair A/C as necessary.
	6. Grounded, damaged or loose engine mount.	6. Visually inspect for damaged or misaligned mounts. Check fastener torque. Replace, realign or retighten as necessary.
	7. Loose or worn outer tie rod.	7. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
	8. Steering gear noisy.	8. During a parking event at 0 mph, verify there is vibration only with steering. Steer in both directions and verify that the noise follows the steering input. Check TSB's for any known issues. Replace steering gear as necessary.
STEERING CATCHES, SURGES OR STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	1. Low power steering fluid level.	1. Check fluid level and fill to proper level as necessary. Check for leaks. Make sure all air is bled from system.
	2. Tire(s) not properly inflated.	2. Check and inflate tires to the specified pressure.
	3. Loose or slipping power steering/accessory drive belt.	3. Verify belt tension. Replace belt auto-tensioner and belt as necessary.
	4. Lack of lubrication in lower ball joint or ball joint is damaged.	4. Lubricate ball joint if equipped with a zerk fitting and check for function . If not equipped with a zerk fitting, test and replace ball joint as necessary.
	5. Lack of lubrication in steering gear outer tie rod end(s).	5. For evaluation and correction, (Refer to 19 - STEERING/LINKAGE/TIE ROD END - DIAGNOSIS AND TESTING).
	6. Faulty power	6. Perform Power Steering Flow and Pressure Test (Refer to 19 -

	steering pump.	STEERING - DIAGNOSIS AND TESTING). Look for low or erratic flow or pressure. Replace power steering pump as necessary.
	7. Excessive friction in intermediate shaft/coupler joint.	7. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions. Replace intermediate shaft/coupler joint.
	8. Excessive friction in steering column.	8. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. DO NOT turn past two revolutions. Damage to the clockspring may occur. Replace steering column as necessary.
	9. Worn or binding seat and bearing in front strut assembly.	9. Disconnect outer tie rod ends from knuckles, then turn tire and wheel assembly checking for smooth operation. Replace front strut assembly seat and bearing.
	10. Faulty steering gear.	10. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
STEERING WHEEL DOES NOT RETURN TO CENTER POSITION.	1. Tire(s) not properly inflated.	1. Check and inflate tires to the specified pressure.
	2. Improper front wheel alignment.	2. Check and adjust wheel alignment as necessary.
	3. Lack of lubrication in lower ball joint or ball joint is damaged.	3. Lubricate ball joint if equipped with a zerk fitting and check for function . If not equipped with a zerk fitting, test and replace ball joint as necessary.
	4. Excessive friction in intermediate shaft/coupler joint.	4. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions. Replace intermediate shaft/coupler joint.
	5. Excessive friction in steering column.	5. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. DO NOT turn past two revolutions. Damage to the clockspring may occur. Replace steering column as necessary.
	6. Worn or binding seat and bearing in front strut assembly.	6. Disconnect steering gear outer tie rod ends at knuckles, then turn tire and wheel assembly in and out checking for smooth operation. Replace seat and bearing as necessary.
	7. Excessive friction in power steering gear.	7. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
EXCESSIVE STEERING WHEEL KICKBACK FROM ROAD INPUTS	1. Air in power steering fluid.	1. Inspect for excessive air bubbles in fluid (fluid will appear foamy and lighter in color). Inspect hoses for leaks and replace as necessary. Bleed air from fluid. (Refer to 19 - STEERING - STANDARD PROCEDURE)
	2. Power steering gear loose on cradle/crossmember.	2. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.

	3. Steering column, coupling or intermediate shaft worn or loose.	3. Rotate steering wheel back-and-forth while inspecting intermediate shaft going into steering gear. Look for excessive free-play. Retighten if loose bolt is found. Replace steering column, coupling or intermediate shaft if necessary.
	4. Power steering pump flow is too low.	4. Perform Power Steering Flow and Pressure Test (Refer to 19 - STEERING - DIAGNOSIS AND TESTING). Look for low or erratic flow or pressure. Replace power steering pump as necessary.

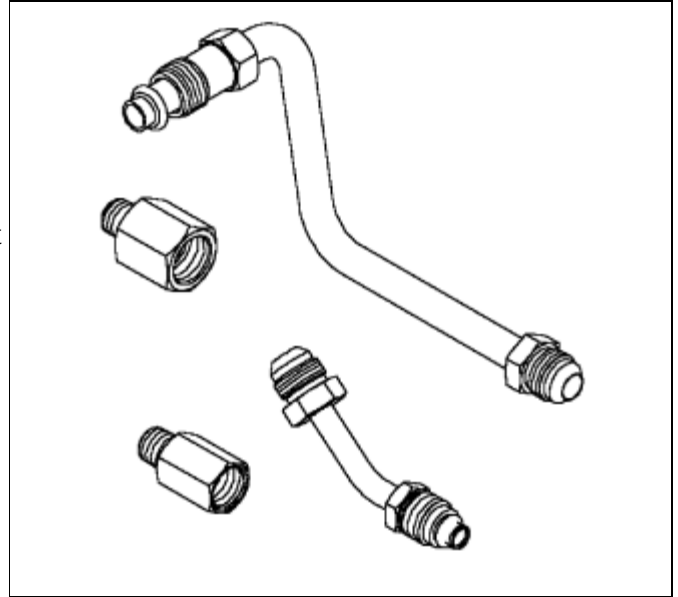
FLUID ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
LOW FLUID LEVEL WITH VISIBLE LEAK.	1. Loose power steering hose fittings or connections.	1. Check torque on all tube nuts (at gear and pump). Inspect clamps at all rubber hose connections for correct position, damage and tension. Tighten tube nuts as required. Reposition or replace clamps at hose connections. Clean joints and reinspect for leaks.
	2. Damaged or missing O-ring at power steering hose tube nuts.	2. Remove tube nut and inspect O-ring. If damaged or missing, replace O-ring. Clean joints and reinspect for leaks.
	3. Power steering line or hose failure.	3. Clean fluid from around suspect areas. Run vehicle and inspect for leaks. Look inside reservoir to see if air is being ingested. Replace hoses as necessary.
	4. Power steering component leaking (reservoir, pump, gear).	4. Clean fluid from around suspect areas. Run vehicle and inspect for leaks. Look inside reservoir to see if air is being ingested. Replace power steering component as necessary.
AERATED FLUID.*	1. Low power steering fluid level.	1. Check fluid level and fill to proper level as necessary. Check for leaks. Make sure all air is bled from system.
	2. Air leak at power steering supply hose, reservoir or pump.	2. Inspect components. Put a hand vacuum pump on the reservoir and verify that the system can keep a vacuum. System should not lose more than 1 psi in 2 minutes (make sure vacuum pump is sealed well to the reservoir).
	3. Air leak at power steering supply hose, reservoir or pump.	3. Inspect components. Place a hand vacuum pump with Adapter 9688 on reservoir and verify that system can sustain vacuum. System should not lose more than 1 psi in 2 minutes (make sure vacuum pump is sealed well to the reservoir). Replace steering component as necessary.
RESERVOIR FLUID OVERFLOW OR FLUID THAT IS MILKY IN COLOR	1. Water contamination of power steering fluid.	1. Inspect fluid for milky appearance. Completely drain power steering fluid. Refill and bleed system. (Refer to 19 - STEERING - STANDARD PROCEDURE)

*** NOTE: Extremely cold temperatures may cause power steering fluid aeration. The air should work its way out of the system as the fluid warms.**

HYDRAULIC FLOW

The following procedures are used to test the operation of the power steering and hydraulic fan systems on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with any maximum relief pressure. Perform test anytime a power steering system problem is present. This test will determine if the power steering pump, hydraulic fan, and power steering gear are not functioning properly. It will also determine if the flow coming out of the hydraulic fan motor is sufficient for the power steering gear. The following pressure and flow test is performed using the Power Steering Analyzer Tool kit 6815 and Adapter kit 8630.



FLOW TEST - FLOW FROM POWER STEERING PUMP

1. Check the power steering belt to ensure it is in good condition and adjusted properly.
2. Connect the pressure gauge hose from the Power Steering Analyzer to Tube 8630-2.
3. Connect Adapter 8630-3 to Power Steering Analyzer test valve end.
4. Disconnect the high pressure hose from the power steering pump.
5. Connect Tube 8630-2 to the pump hose fitting.
6. Connect the power steering hose from the fan motor to Adapter 8630-3.
7. Open the test valve completely.
8. Start engine and let idle long enough to circulate power steering fluid through the flow/pressure test gauge.
9. Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.
10. The initial pressure reading should be 483 - 690 kPa (70 - 100 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.
11. Increase the engine speed to 1100 rpm and read the flow meter. The reading should be 2.29GPM minimum, if the reading is below this specification, the pump should be replaced.

FLOW AND PRESSURE TEST - (should be done if necessary after the Pump flow test)

1. Connect the pressure gauge hose from the Power Steering Analyzer to Fitting 8630-1.
2. Connect Adapter 8630-4 to Power Steering Analyzer test valve end.
3. Disconnect the high pressure hose from the power steering gear.
4. Connect Fitting 8630-1 to the high pressure hose.
5. Connect Adapter 8630-4 to the power steering gear.
6. Open the test valve completely.

7. Start engine and let idle long enough to circulate power steering fluid through the flow/pressure test gauge.
8. Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.
9. The initial pressure reading should be 345-552 kPa (50-80 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.
10. Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.29 - 2.68 GPM if the reading is below this specification the fan should be replaced.

CAUTION: This next step involves testing maximum fan motor steering relief pressure. Do not leave the valve closed for more than three seconds.

11. Close the valve fully three times for three seconds and record highest pressures indicated each time. All three readings must be at fan motor steering relief pressures.
12. Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure readings at each position. If pressure readings are not within 50 psi from each other, the gear is leaking internally and must be repaired.

PUMP MOTOR SPECIFICATIONS

ENGINE	RELIEF PRESSURE $\pm$ 50 PSI	FLOW RATE (GPM)
3.8L	9997 kPa (1450 psi)	1100 RPM 2.4-2.8 GPM Minimum @ 200 psi

STANDARD PROCEDURE

POWER STEERING SYSTEM BLEEDING

WARNING: The fluid level should be checked with engine off to prevent injury from moving components.

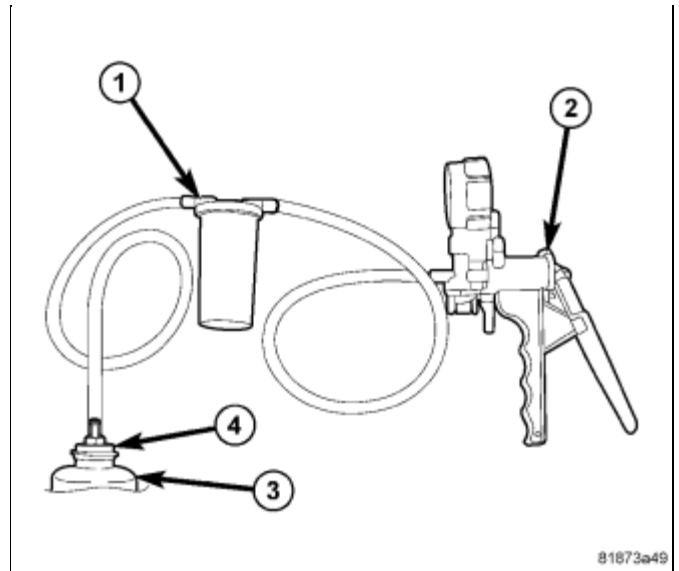
CAUTION: Mopar® Power Steering Fluid + 4 or Mopar® ATF+4 Automatic Transmission Fluid is to be used in the power steering system. Both Fluids have the same material standard specifications (MS-9602). No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if another fluid is used. Do not overfill the system.

CAUTION: If the air is not purged from the power steering system correctly, pump failure could result.

NOTE: Be sure the vacuum tool used in the following procedure is clean and free of any fluids.

1. Check the fluid level. As measured on the side of the reservoir, the level should indicate between MAX and MIN when the fluid is at normal ambient temperature. Adjust the fluid level as necessary. (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE)
2. Tightly insert Power Steering Cap Adapter (4), Special Tool 9688, into the mouth of the reservoir (3).

CAUTION: Failure to use a the vacuum pump reservoir (1) may allow power steering fluid to be sucked into the hand vacuum pump.



3. Attach Hand Vacuum Pump (2), Special Tool C-4207 or equivalent, with reservoir (1) attached, to the Power Steering Cap Adapter (4).

CAUTION: Do not run the engine while vacuum is applied to the power steering system. Damage to the power steering pump can occur.

NOTE: When performing the following step make sure the vacuum level is maintained during the entire time period.

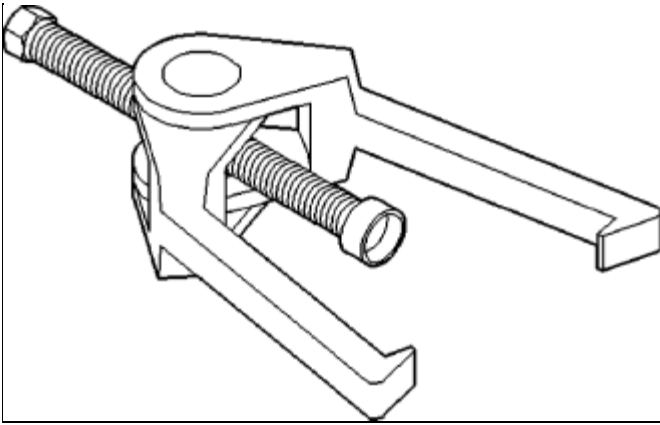
4. Using Hand Vacuum Pump (2), apply 68-85 kPa (20-25 in. Hg) of vacuum to the system for a minimum of three minutes.
5. Slowly release the vacuum and remove the special tools.
6. Adjust the fluid level as necessary. Refer to [STEP 1](#).
7. Repeat [STEP 1](#) through [STEP 6](#) until the fluid no longer drops when vacuum is applied.
8. Start the engine and cycle the steering wheel lock-to-lock three times.

NOTE: Do not hold the steering wheel at the stops.

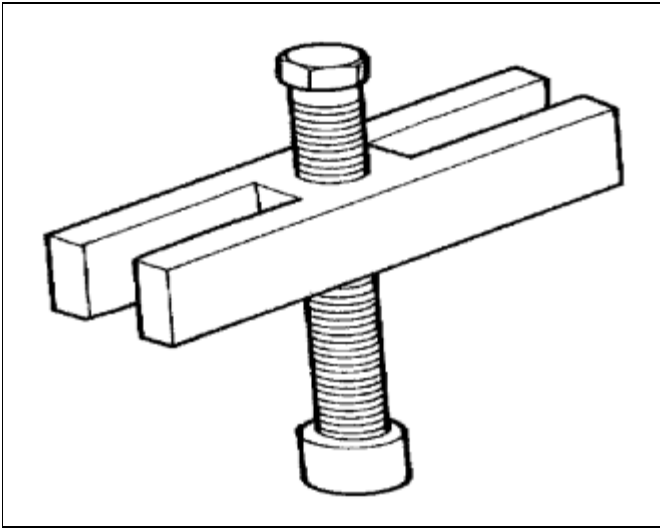
9. Stop the engine and check for leaks at all connections.
10. Check for any signs of air in the reservoir and check the fluid level. If air is present, repeat the procedure as necessary.

SPECIAL TOOLS

STEERING COLUMN



Puller C-3894-A



PULLER L-4407-A

COLUMN

COLUMN

DESCRIPTION

NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

The standard tilt steering column has been designed to be serviced as an assembly. The column is connected to the steering gear with an upper and lower intermediate shaft. The upper shaft has a support bearing mounted to a bracket. The bracket mounts to the dash panel wall with two nuts. These shafts and bearing are serviceable. The key cylinder, switches, clock spring, trim shrouds and steering wheel are serviced separately.

OPERATION - SERVICE PRECAUTIONS

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, refer to Electrical - Restraints and follow all WARNINGS and CAUTIONS.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

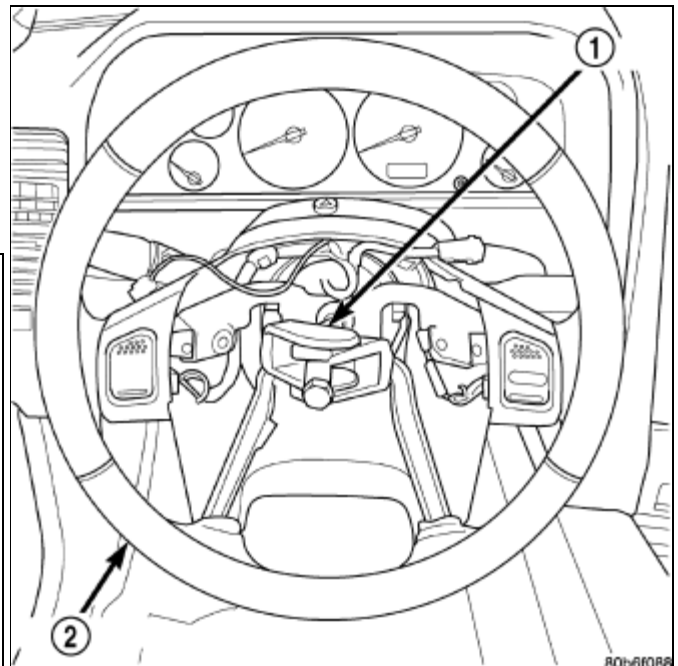
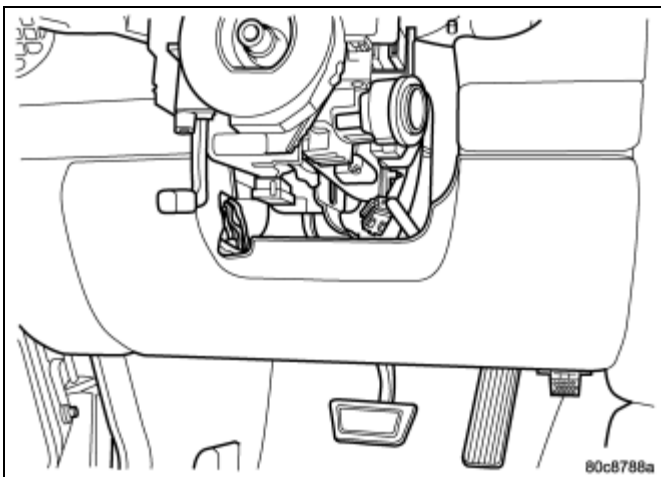
REMOVAL

1. Position front wheels **straight ahead**.
2. Remove and isolate the negative ground cable from the battery.
3. Remove the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

NOTE: If equipped with cruise control, disconnect clock spring harness from the cruise switch harness on the steering wheel.

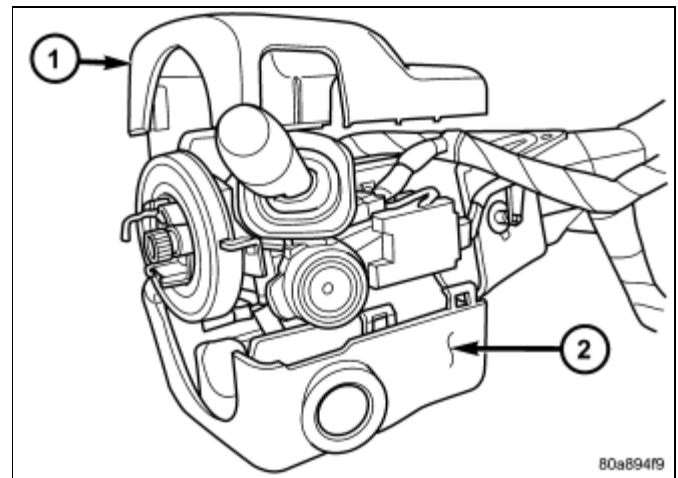
4. Remove the steering wheel (2) with puller C-3894-A (1) or an appropriate puller (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).

5. Remove steering column opening cover, (Refer to 23 -

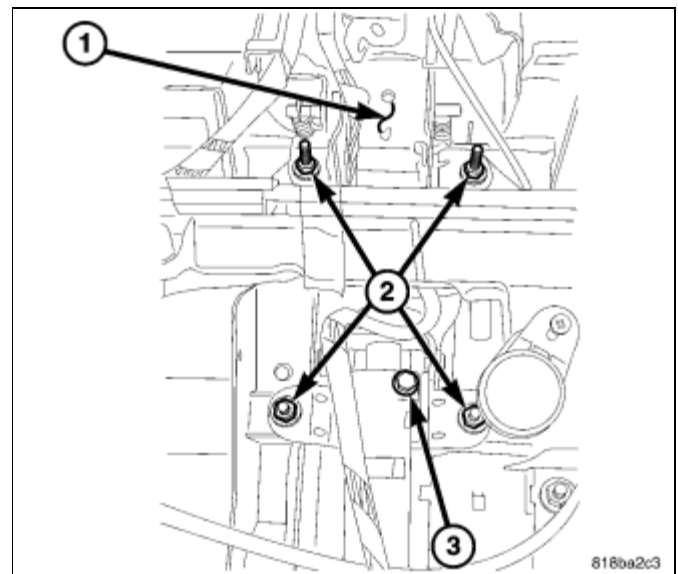


BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

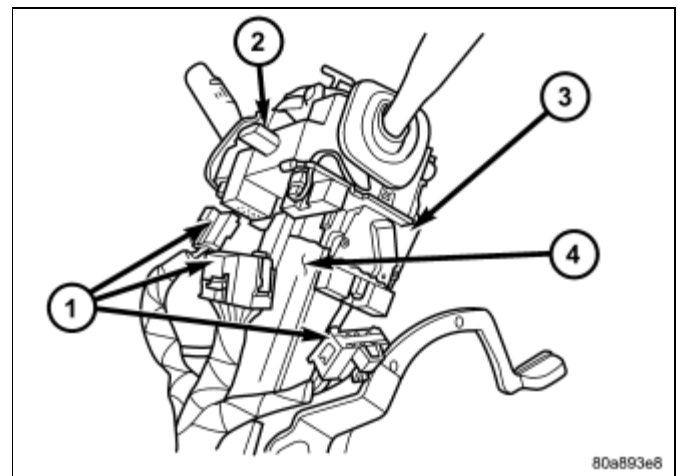
6. Remove screws from the lower column shroud (2) and remove both the upper and lower shrouds.



7. Turn ignition key to the on position.
 8. If vehicle is equipped with automatic transmission, disconnect shifter interlock cable from the column.
 9. Remove the steering coupler bolt and column mounting nuts (2) then lower column (1) off the mounting studs.



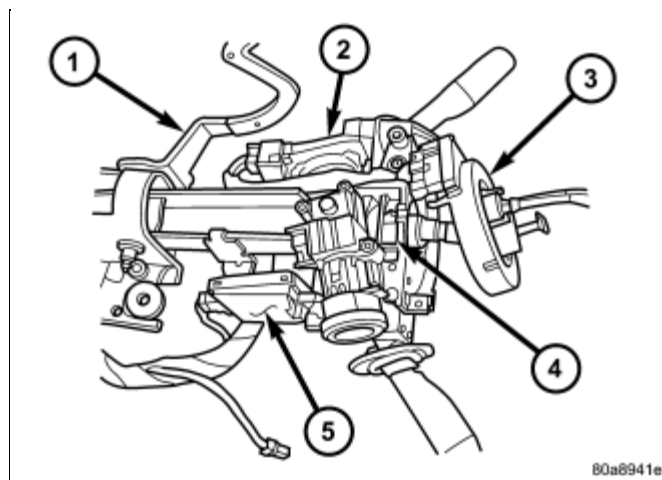
10. Disconnect and remove the wiring harness (1) from the column.
 11. Slide the shifter interlock cable from the tie straps.



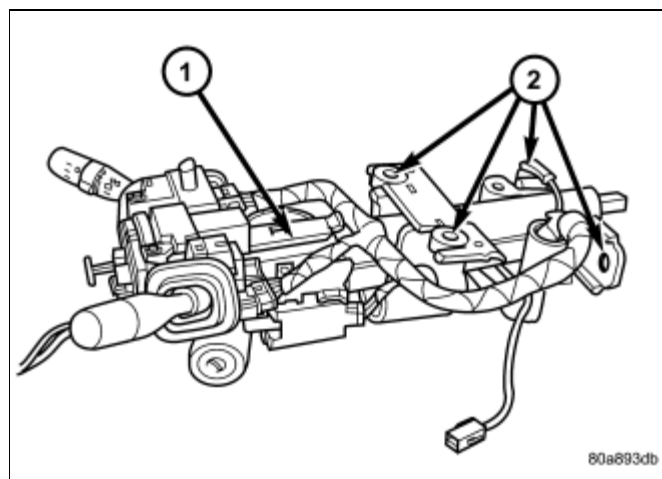
12. Remove column (4).
 13. Transfer the necessary parts if needed.
 14. Remove clock spring (3) , switches, (SKREEM if

equipped) (5) (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

INSTALLATION

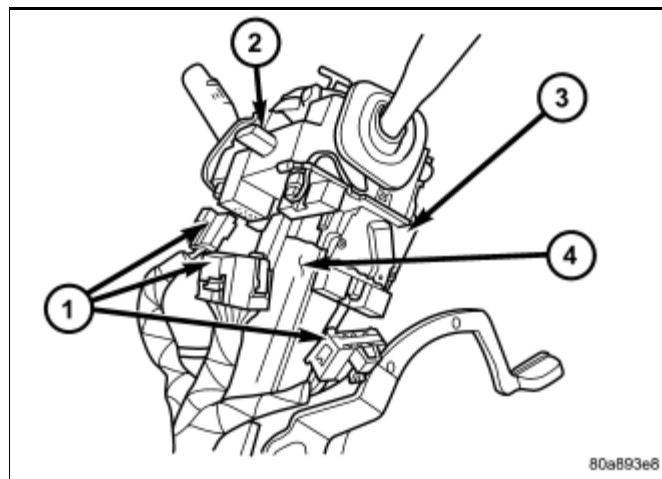


1. Align and install column (1) into the steering coupler .



2. Install column harness (1) and connect harness to switches .

3. Reroute the shifter interlock cable through the tie straps.

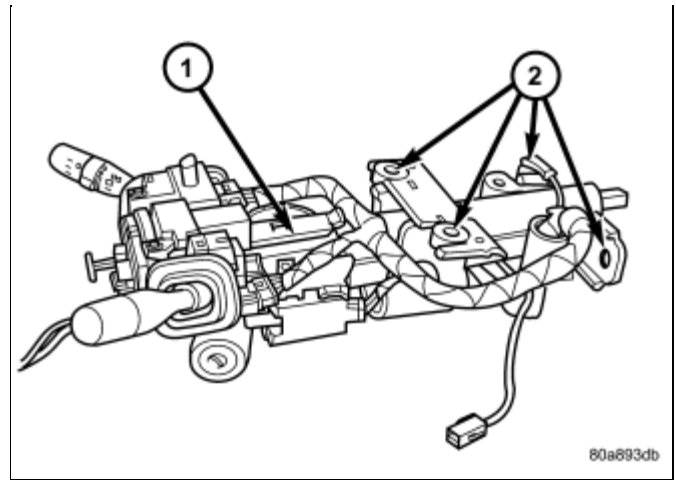


4. Install the column (1) onto the mounting studs (2) .

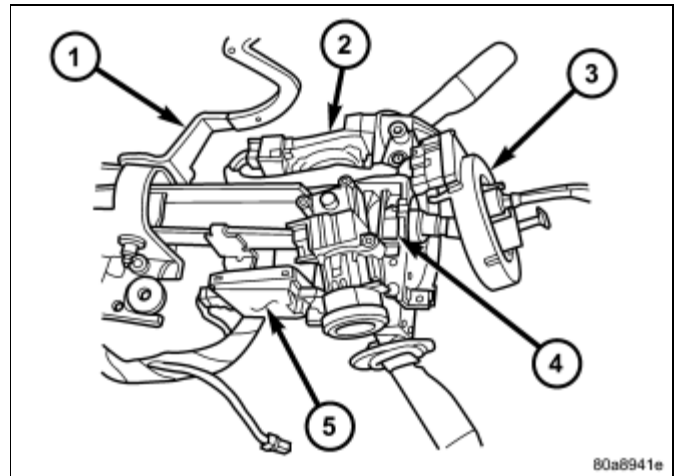
5. Install the two mounting nuts and the two mounting bolts all finger tight.

CAUTION: Lower nuts must be installed and tightened first then the upper nuts in order to prevent damage to the capsules.

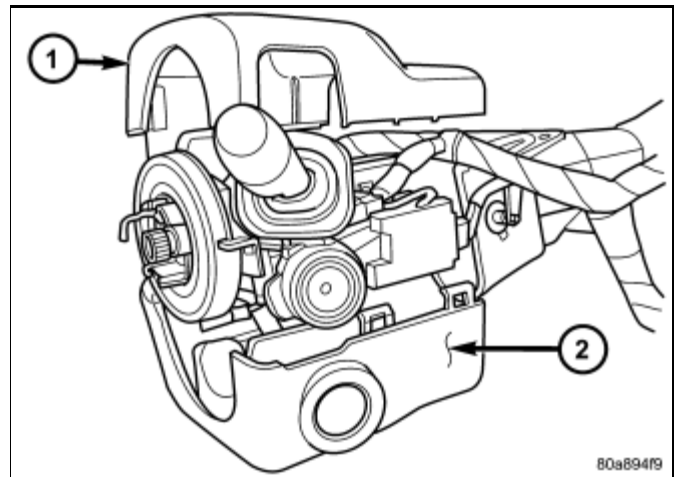
6. Tighten the lower mounting nuts to 17 N·m (150 in. lbs.).
7. Tighten the upper mounting nuts to 17 N·m (150 in. lbs.).



8. Install the steering column coupler bolt and tighten to 49 N·m (36 ft. lbs.).
9. Reconnect the shifter interlock cable.
10. Center the clock spring (3) (if necessary) and install it on the column (4) , (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

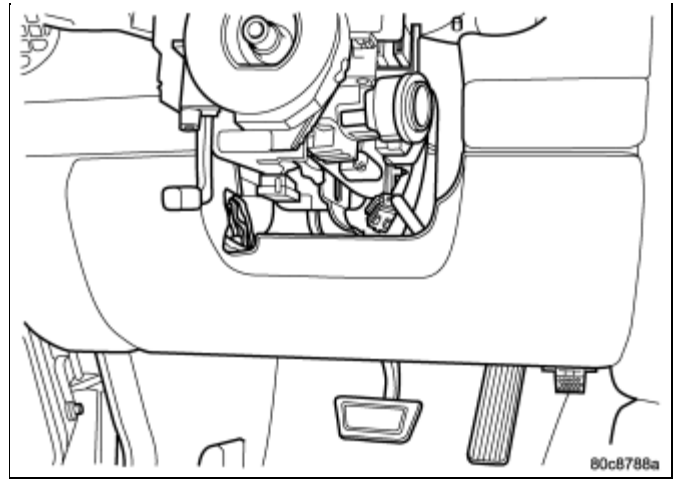


11. Snap together the column shrouds (1&2) and install the mounting screws .



12. Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)



NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.

13. Install the steering wheel and tighten bolt to 54 N·m (40 ft. lbs.) (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

NOTE: If equipped with cruise control, connect clock spring harness to cruise switch harness on the steering wheel.

14. Install the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

15. Install the negative battery terminal.

SPECIFICATIONS

TORQUE CHART

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Steering Wheel Nut	54	40	—
Steering Column Mounting Nuts	17	—	150
Intermediate Shafts Coupler Pinch Bolts Upper & Lower	49	36	—
Upper Intermediate Shaft Mounting Nuts	13	—	115

IGNITION SWITCH

DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.

DIAGNOSIS AND TESTING

IGNITION SWITCH

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, Refer to the appropriate section for the component.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock system is used to lock the transmission shifter in the PARK position when the key cylinder is rotated to any position. If the ignition key is difficult to rotate to or from any position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE/GEAR SHIFT CABLE - ADJUSTMENTS). The interlock system within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

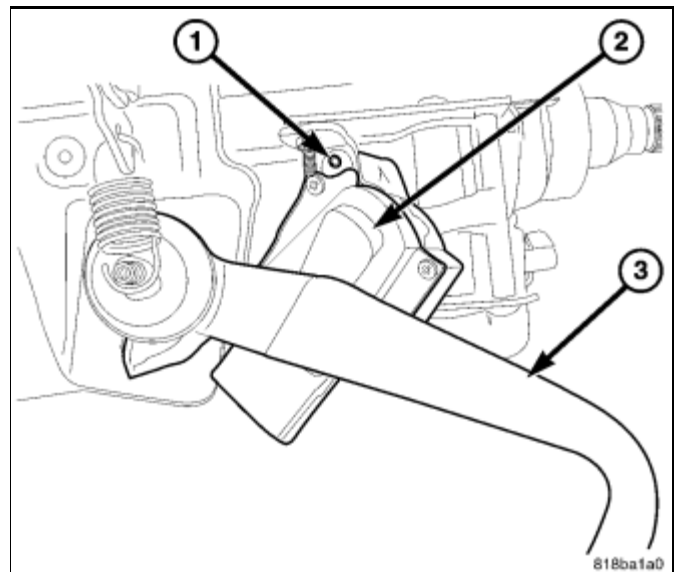
Vehicles equipped with a manual transmission and a floor mounted shifter: on certain models, a button is located on the steering column behind the ignition key cylinder. The button must be manually depressed to allow rotation of the ignition key cylinder to any position. If it is difficult to rotate the key to any position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

REMOVAL

1. Remove the steering column shrouds.

NOTE: The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

2. Remove lock cylinder. (Refer to 19 - STEERING/COLUMN/KEY/LOCK CYLINDER - REMOVAL).
3. Remove the multi-function switch.
4. Disconnect the electrical connector at the rear of the ignition switch.
5. Remove the ignition switch mounting screw (1). Use tamper proof torx bit to remove the screw.

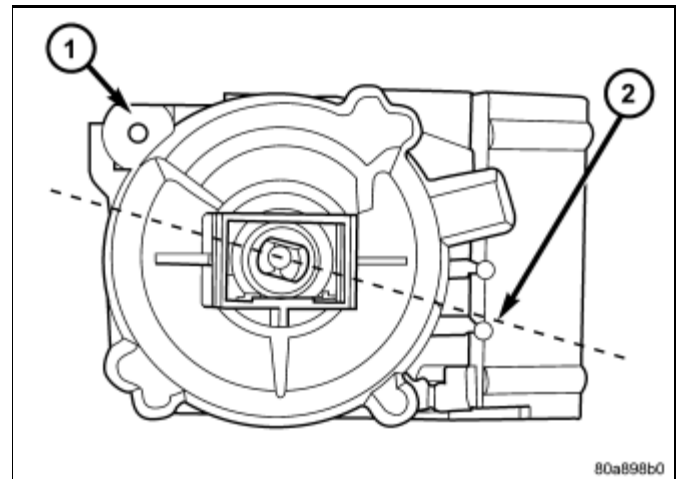


NOTE: Tilt arm (3) must be moved to allow removal of the switch.

6. Pull the ignition switch (2) straight out to remove from the locking tabs.

INSTALLATION

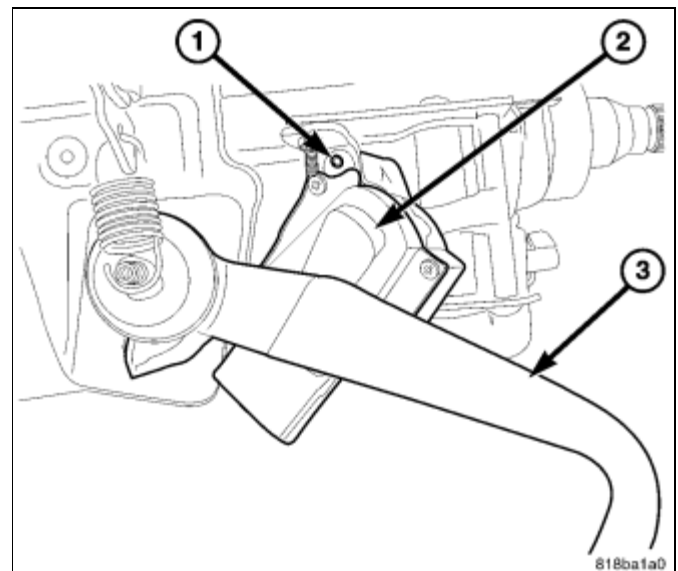
1. Before installing ignition switch (1), rotate the slot in the switch to the ON position (2).



NOTE: Tilt arm (3) must be moved to allow installation of the switch.

2. Position the switch (2) to the column and install tamper proof screw (1). Tighten screw to 2 N·m (17 in. lbs.).
3. Connect the electrical connector to rear of ignition switch. Make sure that locking tab is fully seated into wiring connector.

NOTE: The ignition key must be in the key cylinder for cylinder installation. The key cylinder must be aligned with the ignition switch for installation.



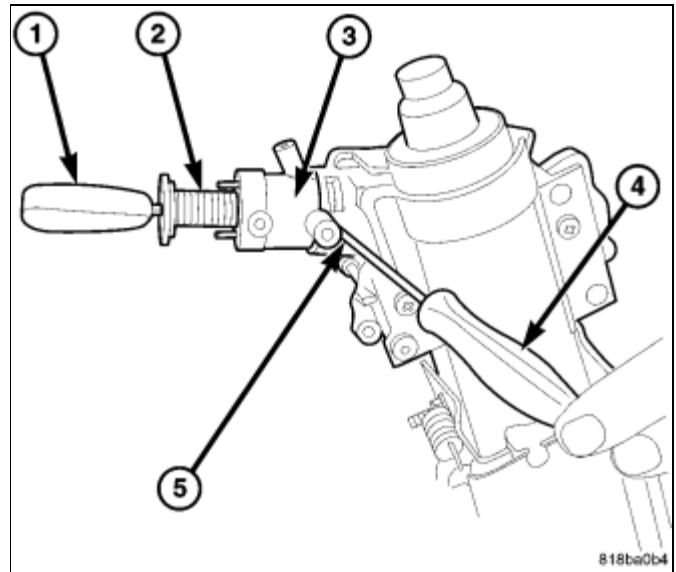
4. Install the lock cylinder (Refer to 19 - STEERING/COLUMN/KEY/LOCK CYLINDER - INSTALLATION).
5. Test the operation of the lock cylinder for smooth rotating.
6. Install the multi-function switch.
7. Install steering column lower cover.

KEY CYLINDER

REMOVAL

The ignition key (1) must be in the key cylinder (2) for cylinder removal. The key cylinder must be removed first before removing ignition switch.

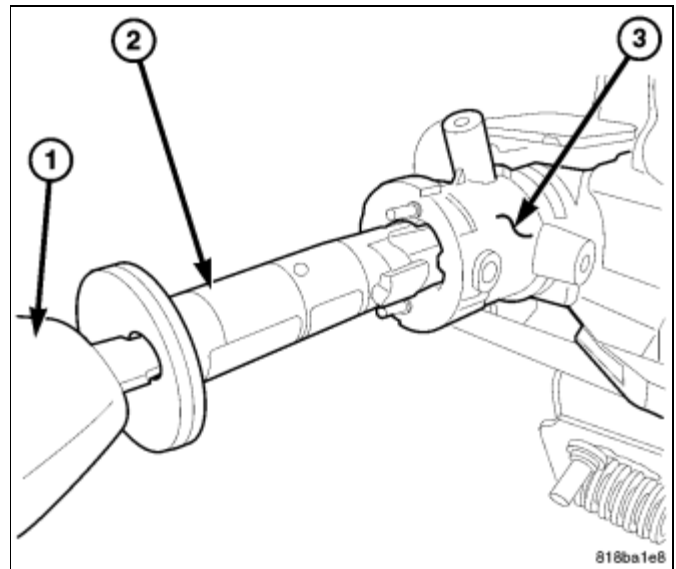
1. If equipped with an automatic transmission, place shifter in PARK position.
2. Remove the shroud covers.
3. Remove the remote keyless entry (S.K.R.E.E.M) module.
4. Remove the halo ring around the cylinder.
5. Rotate key to ON position.
6. A release pin is located on the bottom of the key cylinder (5) with the access hole on the top of the lock cylinder housing (3).
7. Position a small screwdriver or pin punch (4) into pin access hole (5).
8. Push the pin punch (5) up while pulling key cylinder (2) from lock cylinder housing (3).



INSTALLATION

The ignition key (1) must be in the key cylinder (2) for cylinder installation.

1. Install the key cylinder (2) into the housing (3) using care to align the end of the key cylinder with the ignition switch.
2. Push the key cylinder (2) in until it clicks.
3. Rotate the key to the insert position.
4. Install the halo ring around the key cylinder housing.
5. Install the (S.K.R.E.E.M) module.
6. Install the shroud covers.



KEY-IN IGNITION SWITCH

DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column, opposite the ignition cylinder. It closes a path to ground for the instrument cluster chime warning circuitry when the ignition key is inserted in the ignition cylinder and the driver door jamb switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition cylinder.

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced. (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

DIAGNOSIS AND TESTING - KEY-IN IGNITION SWITCH

For circuit descriptions and diagrams, Refer to the appropriate sections on the individual components.

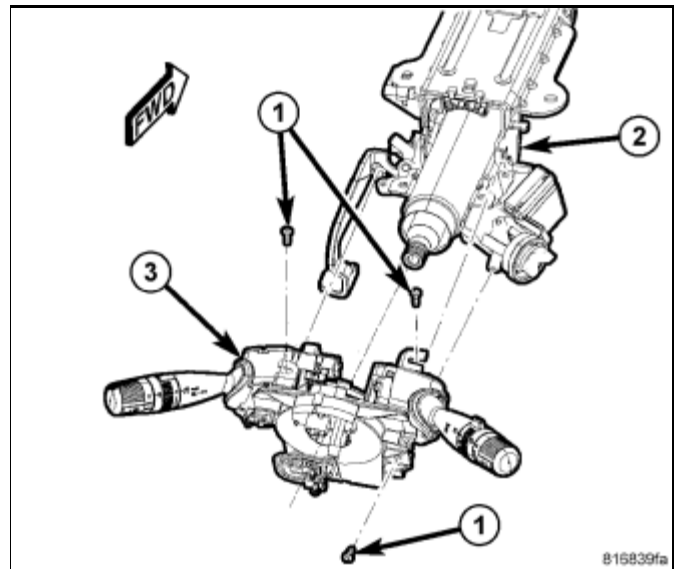
WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

1. Disconnect and isolate the battery negative cable. Remove the steering column shrouds. Unplug the key-in ignition switch wire harness connector from the ignition switch.
2. Check for continuity between the key-in switch sense circuit and the left front door jamb switch sense circuit terminals of the key-in ignition switch. There should be continuity with the key in the ignition cylinder, and no continuity with the key removed from the ignition cylinder. If OK, go to [STEP 3](#). If not OK, replace the faulty ignition switch assembly.
3. Check for continuity between the left front door jamb switch sense circuit cavity of the key-in ignition switch wire harness connector and a good ground. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, see the diagnosis for Instrument Cluster in this group. If not OK, repair the circuit to the driver door jamb switch as required.

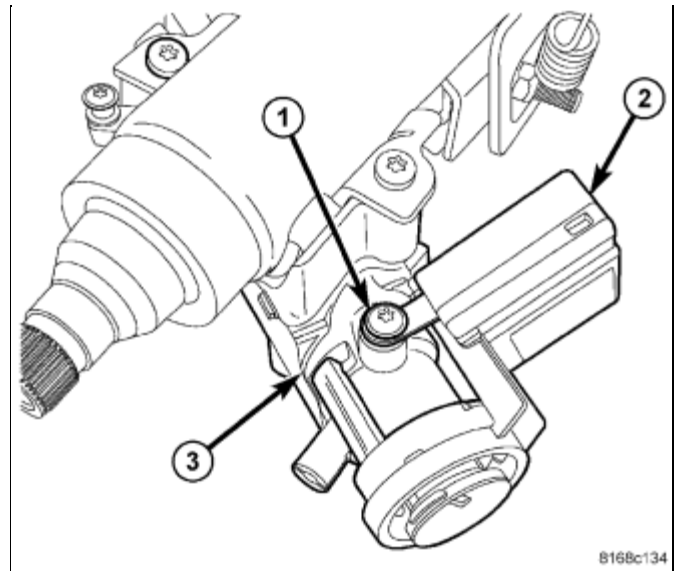
HOUSING-LOCK CYLINDER

REMOVAL

1. Access and remove the Steering Column Control Module (SCCM) (3) from the steering column (2). (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL). (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).



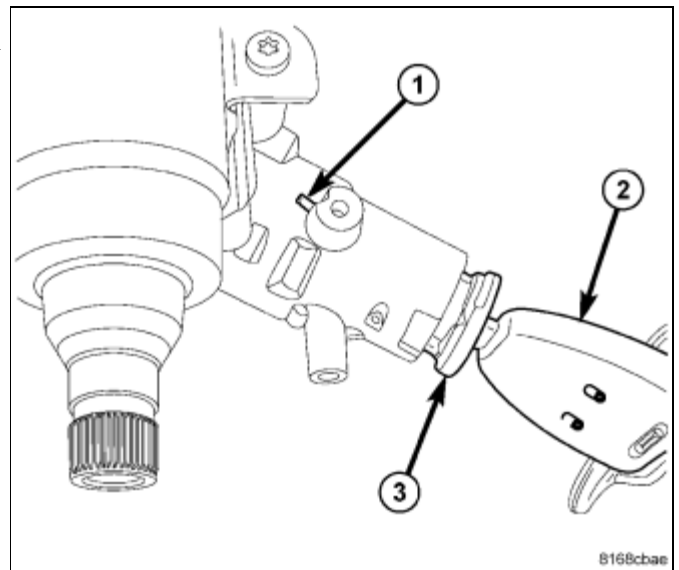
2. Remove the screw (1) fastening the SKREEM/WCM (2) to the lock cylinder housing (3).
3. Unhook the SKREEM/WCM (2) retainer fingers from the lock cylinder housing (3) and remove it.



4. Insert the key (2) and turn the key cylinder (3) to the RUN position.

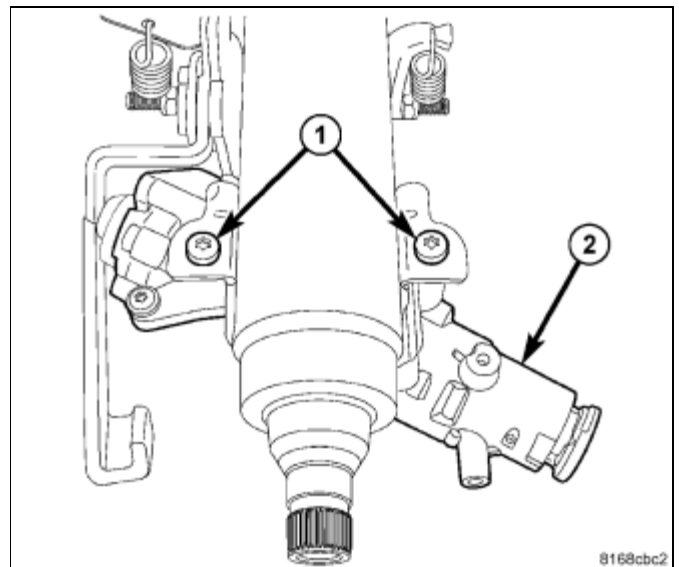
5. Insert an appropriate tool into the slot (1) formed into the lock cylinder housing depressing the key cylinder retaining tab.

6. Pull the key cylinder and key straight out of the lock cylinder housing as one unit.

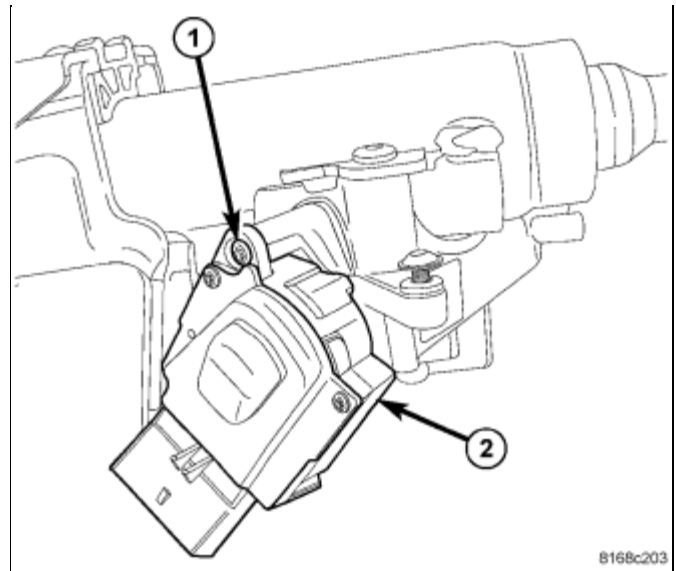


7. Using a Tamper-Proof Torx® Plus (five point) 30 bit, remove the two screws (1) fastening the lock cylinder housing (2) to the column.

8. Remove the lock cylinder housing from the steering column.

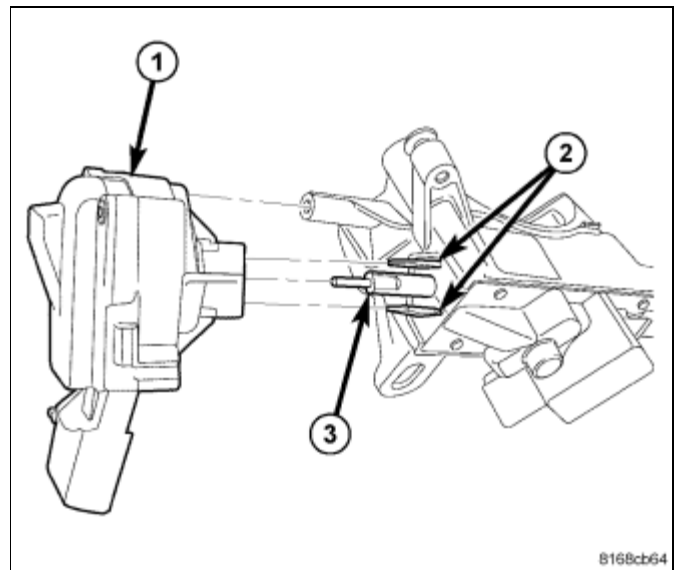


9. Remove the ignition module (2) mounting screw (1).



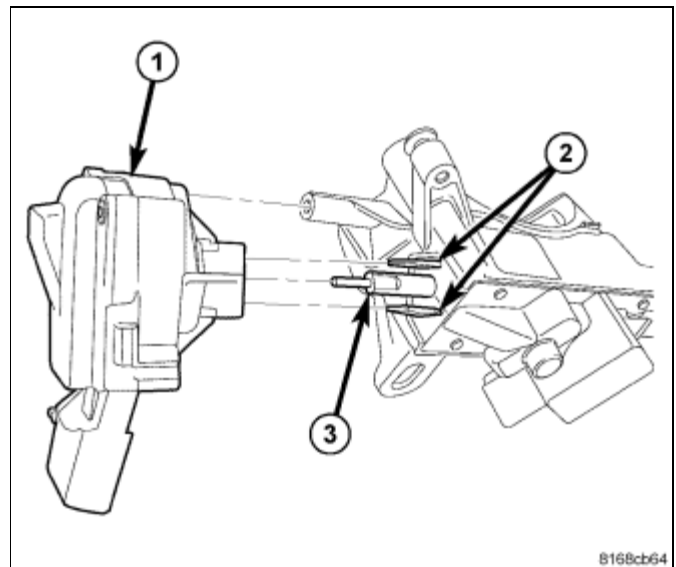
10. Pull the module (1) straight out and off the retaining tabs (2) located on the lock cylinder housing.

INSTALLATION

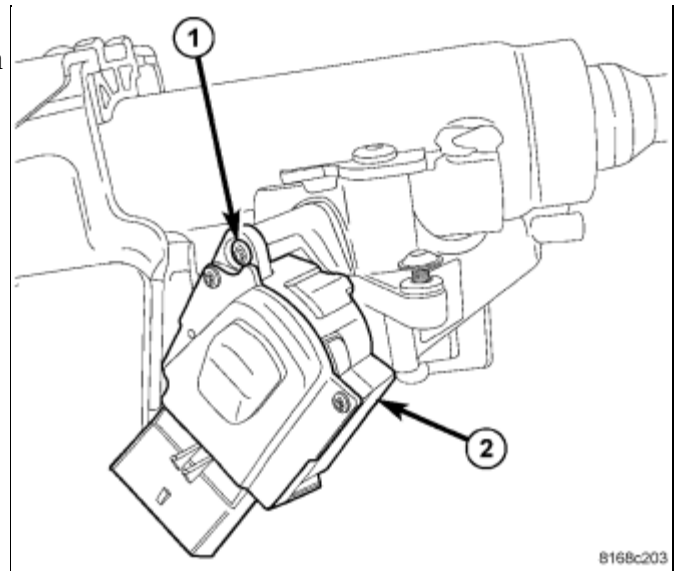


NOTE: Ignition module must be installed prior to lock housing installation on column. Otherwise, the tilt lever will obstruct installation of ignition switch.

1. Ensure the ignition module is in the RUN position and the actuator shaft in the lock housing is in the RUN position.
2. Align the ignition module with the pin (3), actuator shaft and retaining tabs (2) located on the lock cylinder housing. Carefully install the module, snapping it into place over the retaining tabs.

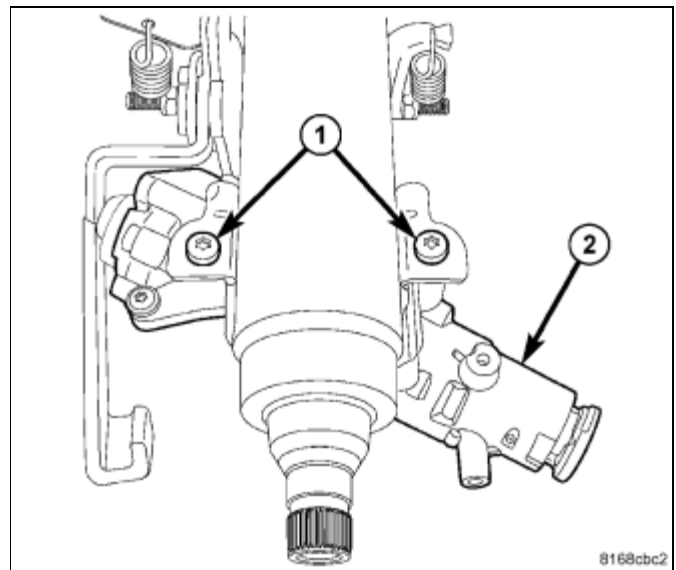


3. Install the ignition module (2) mounting screw (1). Tighten the screw to 2 N·m (18 in. lbs.).

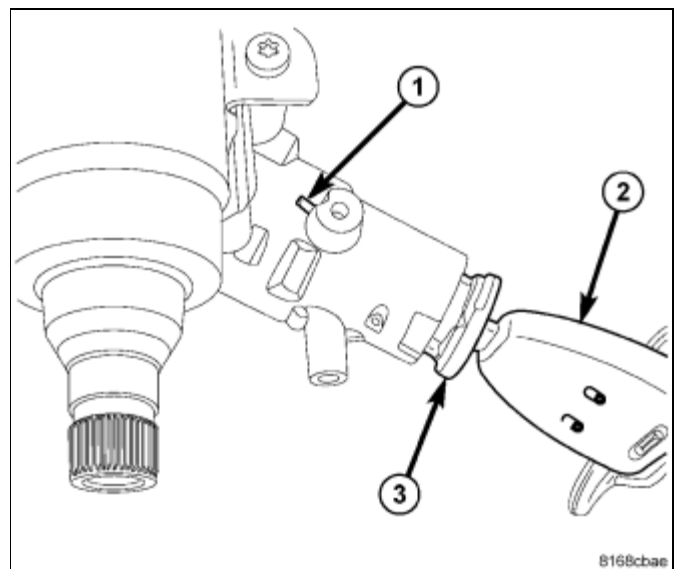


NOTE: Ignition module needs to be installed on lock cylinder housing before housing installation to clear tilt lever.

4. Position the lock cylinder housing in the RUN position.
5. Align the lock cylinder housing (2) with the steering column.
6. Install the two screws (1) fastening the lock cylinder housing (2) to the column. Tighten the screws to 12 N·m (110 in. lbs.).

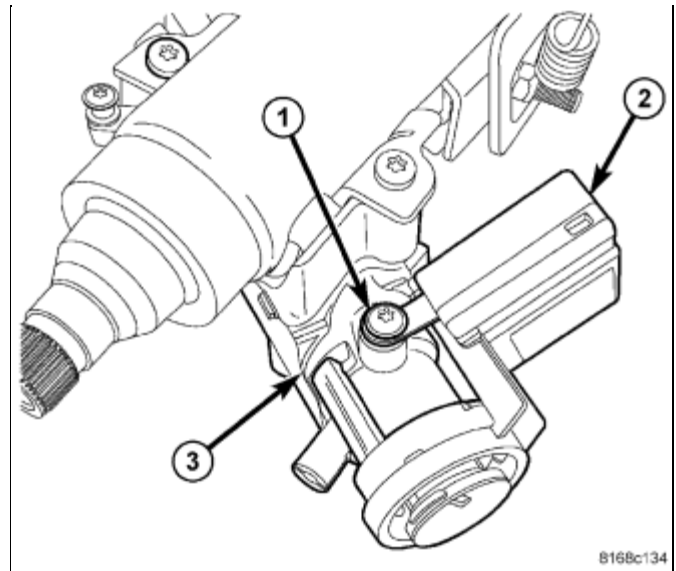


7. Place the actuator in the lock cylinder housing to the RUN position (if not already there).
8. Insert the key into the key cylinder and turn the key cylinder to the RUN position.
9. Align the retaining tab on the key cylinder with the slot in the top of the lock cylinder housing.
10. Slide the key cylinder into the lock cylinder housing until the key cylinder retaining tab locks the cylinder into place.
11. Rotate the key back and forth (OFF to START), then remove and reinstall it, making sure the key cylinder and lock cylinder housing operate properly.



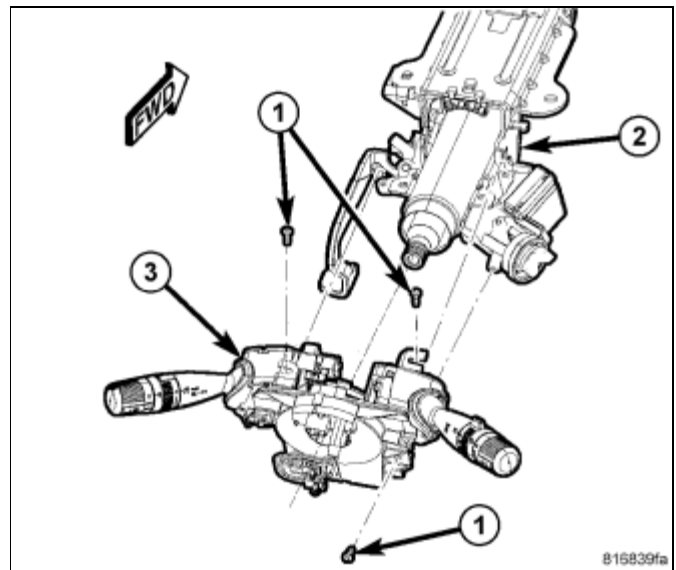
12. Slide the ring of the SKREEM/WCM (2) over the lock cylinder housing (3) and engage the retainer fingers in the recesses formed on the lock cylinder housing.

13. Install the screw (1) fastening the SKREEM/WCM (2) to the lock cylinder housing (3). Tighten the screw to 2.5 N·m (22 in. lbs.).



14. Install the Steering Column Control Module (SCCM) (3) and all components removed to access it. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

15. Check operation of all steering column mounted components.



STEERING WHEEL REMOVAL

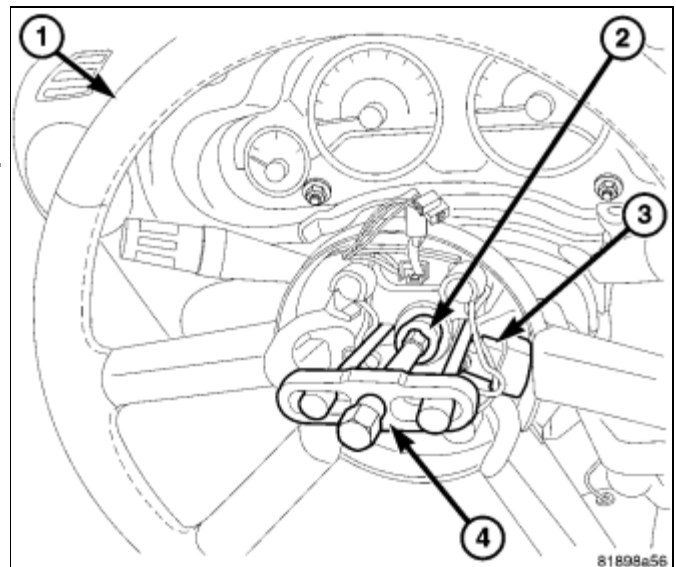
1. Disable and remove the drivers side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

2. Disconnect the speed control wiring (3) to allow access for the puller (4).

3. Partially remove the steering wheel bolt (2) and leave the bolt in the column.

4. Install steering wheel puller special tool L-4407A puller with OTC® 7929A jaws or equivalent (4) using the top of the bolt to push on.

NOTE: Ensure the puller jaws are seated in the pockets of the steering wheel armature.



5. Remove the steering wheel (1).

INSTALLATION

NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)

1. Install steering wheel to the column

NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.

2. Install the new steering wheel bolt. Tighten the bolt to 54 N·m (40 ft. lbs.).
3. Reconnect the speed control electrical wiring.
4. Install the drivers side air bag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

INTERMEDIATE SHAFT

DESCRIPTION

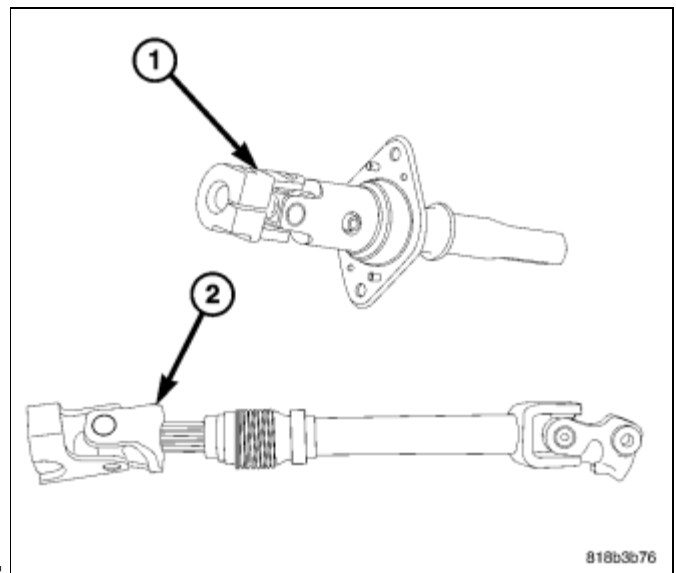
The intermediate shaft consists of an upper (1) and lower (2) shaft to connect the steering column to the gear box.

REMOVAL

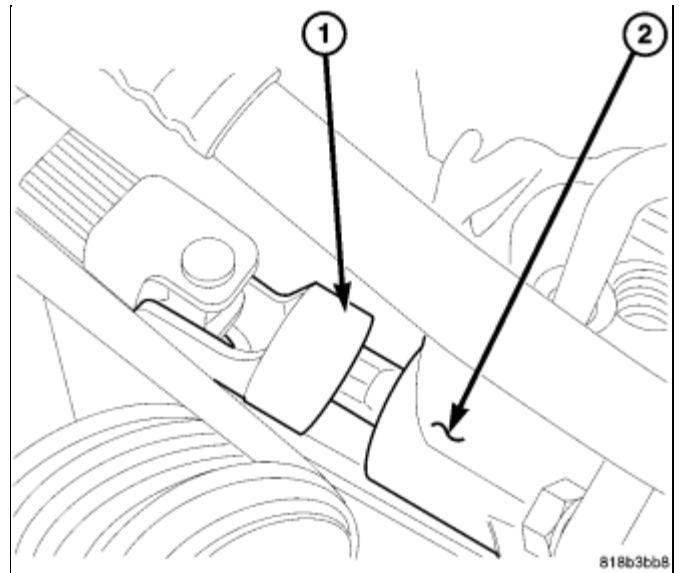
LOWER INTERMEDIATE SHAFT

1. Disconnect the negative battery cable.
2. Lock the steering wheel with the tires in the straight ahead position.

NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.



3. Move the coolant bottle to the side out of the way.
4. Remove the lower coupling pinch bolt at the steering gear (2).
5. Remove the coupler from the gear (1).

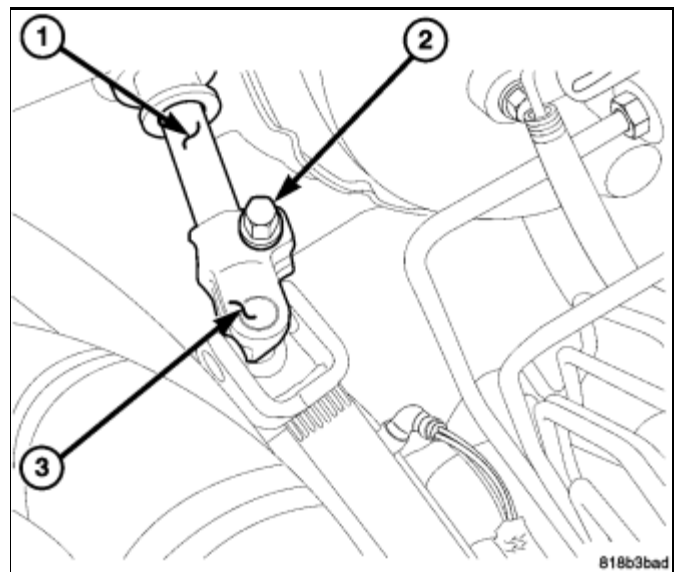


6. Remove the upper pinch bolt (2) at the upper intermediate shaft (1).
7. Remove the upper coupler (3) from the upper intermediate shaft (1).
8. Remove the intermediate shaft from the vehicle.

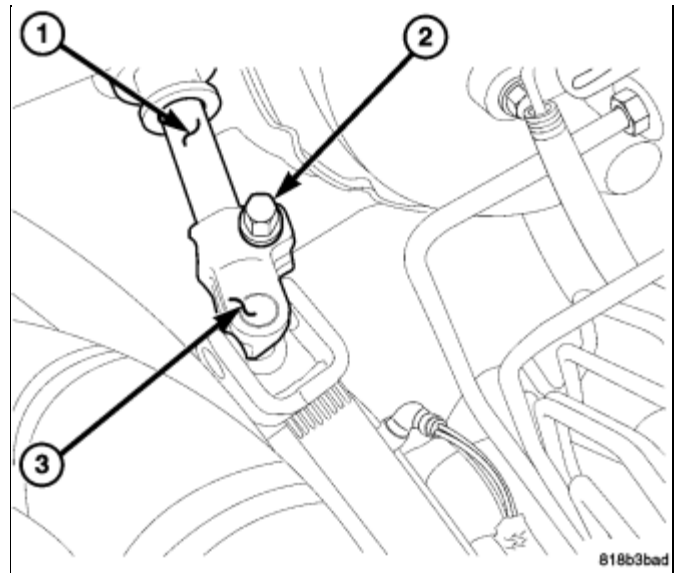
UPPER INTERMEDIATE SHAFT

1. Disconnect the negative battery cable.
2. Lock the steering wheel with the tires in the straight ahead position.

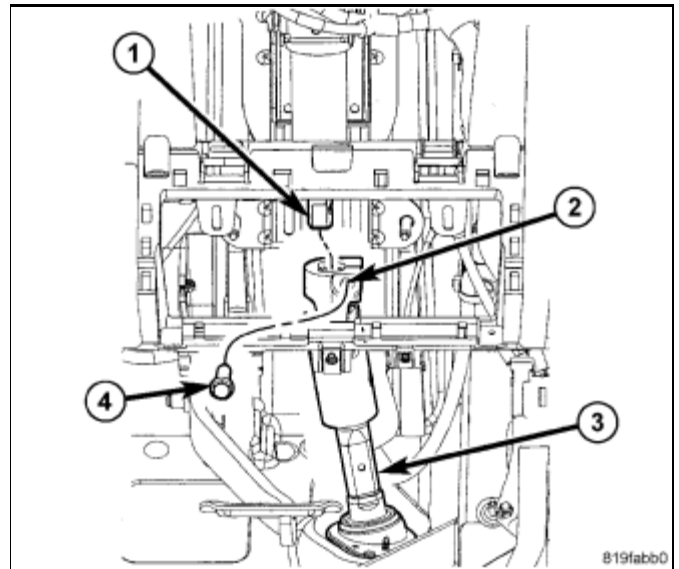
NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.



3. Remove the upper pinch bolt (2) at the upper intermediate shaft (1).
4. Remove the upper coupler on the lower shaft (3) from the upper intermediate shaft (1).



5. Remove the bolt (4) for the upper coupler (2) at the steering column (1).

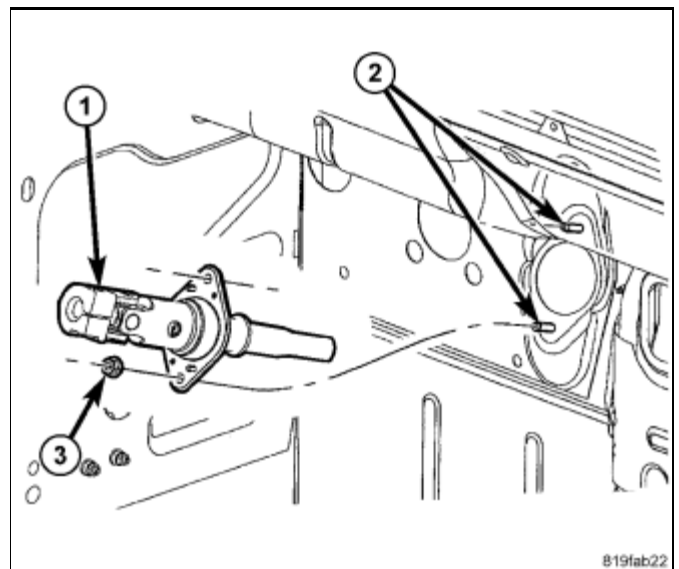


6. Remove the two nuts (3) securing the upper intermediate shaft to the cowl and remove the shaft (1) from the studs (2).

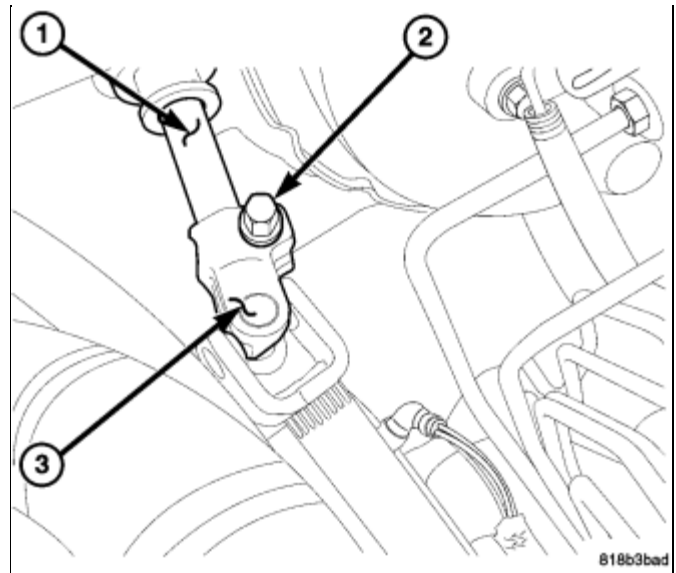
7. Remove the upper intermediate shaft from the vehicle.

INSTALLATION

LOWER INTERMEDIATE SHAFT

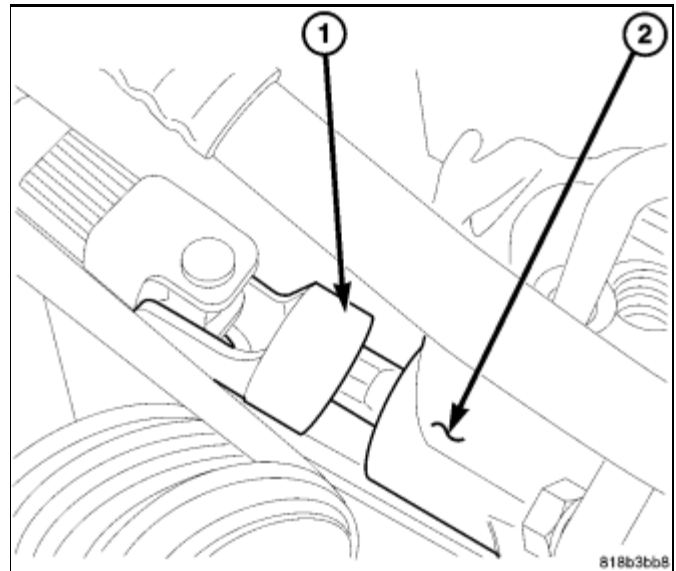


1. Install the intermediate shaft to the vehicle.
2. Install the lower intermediate shaft (3) to the upper intermediate shaft (1).
3. Install the upper pinch bolt (2) and tighten the bolt to 49 N·m (36 ft. lbs.).

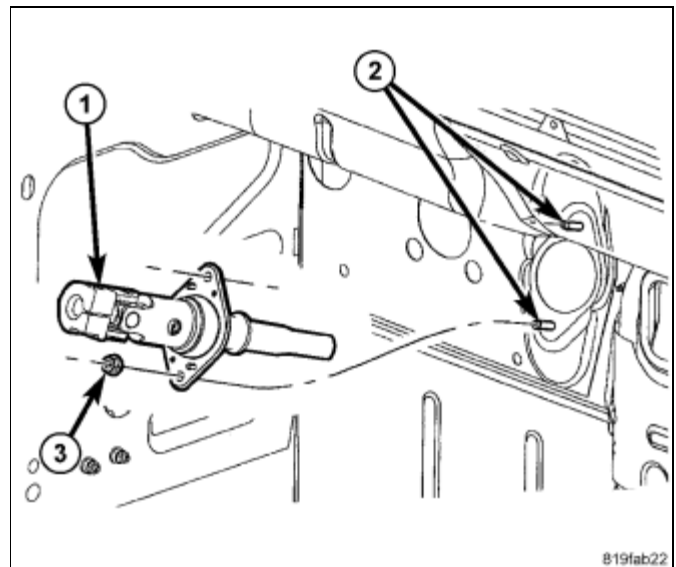


4. Install the coupler (1) at the steering gear (2).
5. Install the lower coupler pinch bolt at the steering gear and tighten the bolt to 49 N·m (36 ft. lbs.).
6. Unlock the steering wheel.
7. Reconnect the negative battery cable.

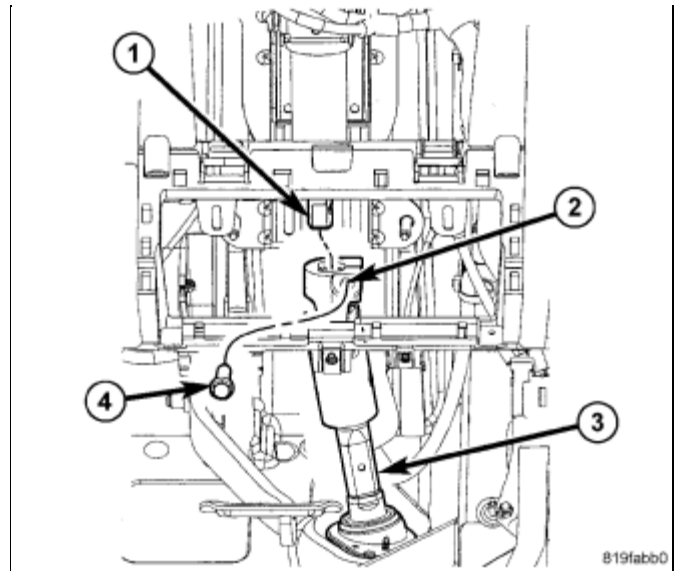
UPPER INTERMEDIATE SHAFT



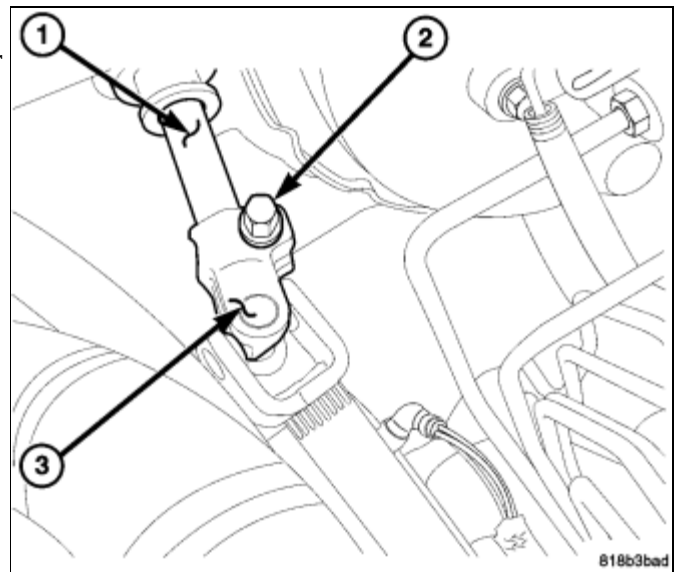
1. Install the intermediate shaft (1) to studs (2) at the cowl.
2. Install the two mounting nuts (3). Tighten to 13 N·m (115 in.lbs.).



3. Install the upper shaft coupler (2) to the steering column (1).
4. Install and tighten the pinch bolt (4) to 49 N·m (36 ft. lbs.).



5. Install the lower intermediate shaft coupler (3) to the upper intermediate shaft (1).
6. Install the pinch bolt (2) and tighten the bolt to 49 N·m (36 ft. lbs.).
7. Unlock the steering wheel.
8. Reconnect the negative battery cable.



GEAR

GEAR

DESCRIPTION

The power steering gear is a recirculating ball type gear.

OPERATION

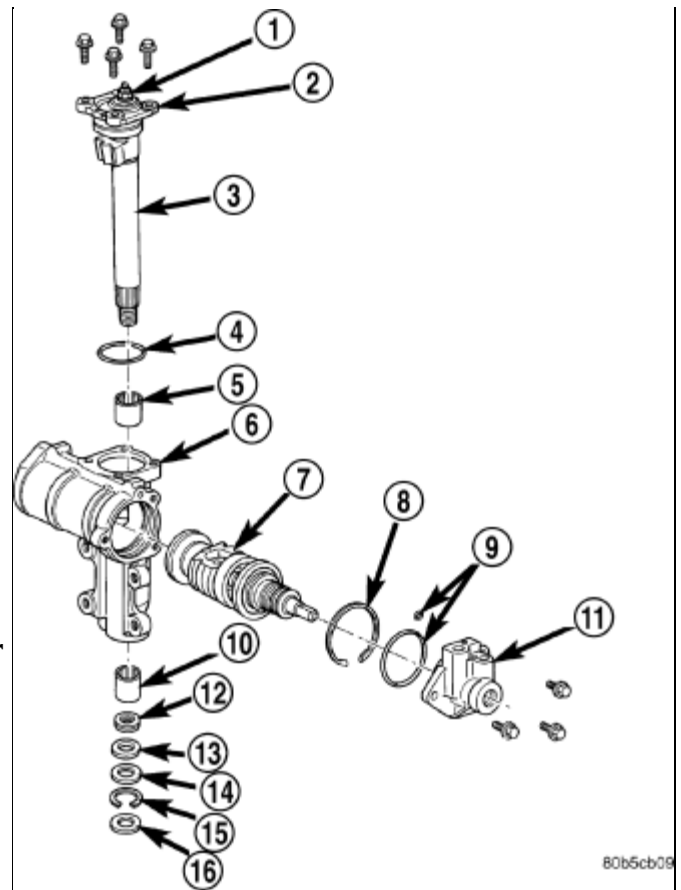
The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

REMOVAL

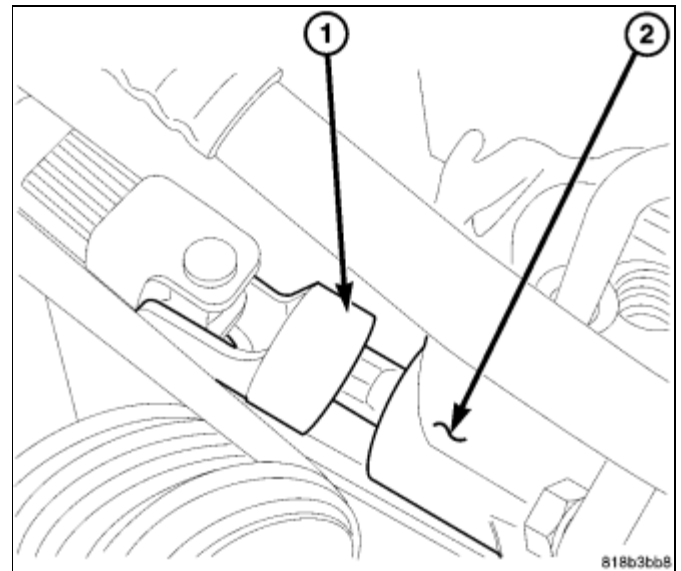
NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an

internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

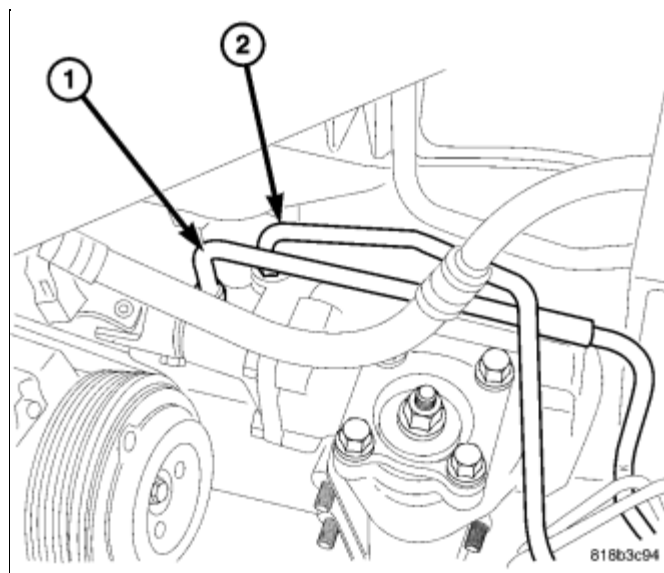
1. Place the front wheels in the straight ahead position with the steering wheel centered and locked.
2. Siphon out as much power steering fluid as possible.
3. Move the coolant bottle to the side out of the way.



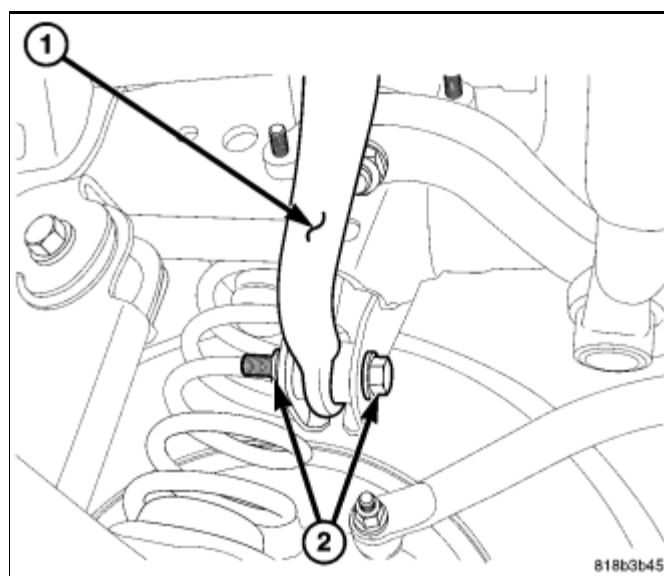
4. Remove the lower column pinch bolt at the gear (2).
5. Remove the lower column coupler shaft (1) from the gear (2).



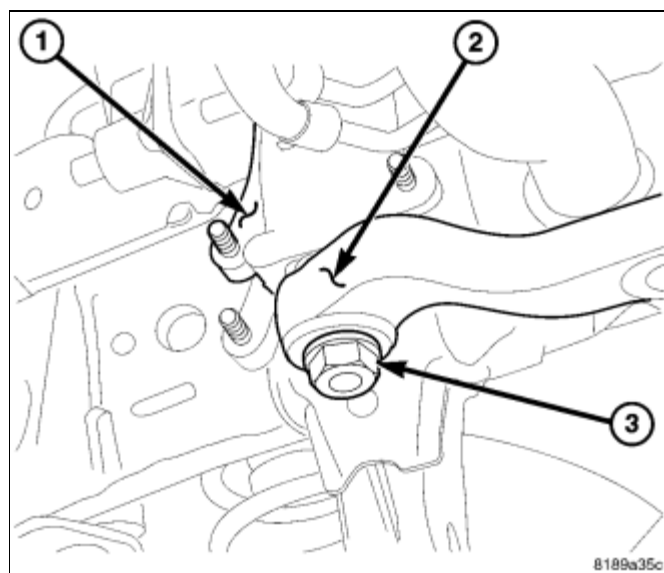
6. Remove power steering hoses/tubes (1&2) from steering gear (3).



7. Raise and support the vehicle.
8. Remove the track bar bolt (2) at the frame and lower the track bar (1).

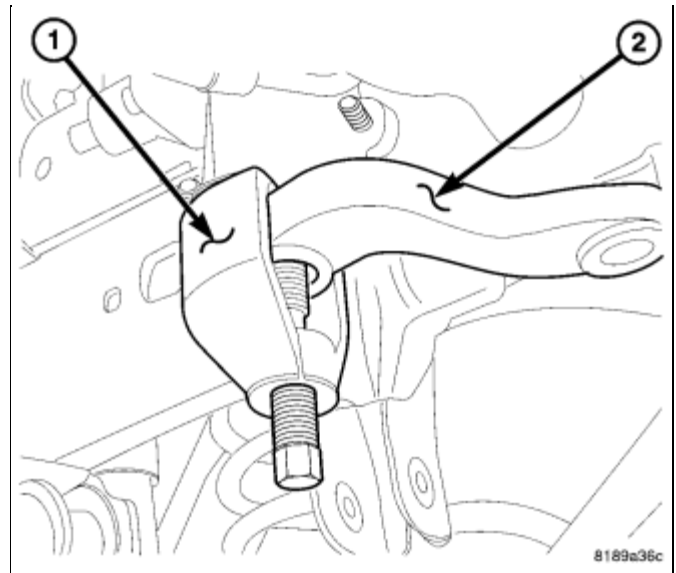


9. Remove the pitman arm nut (3).



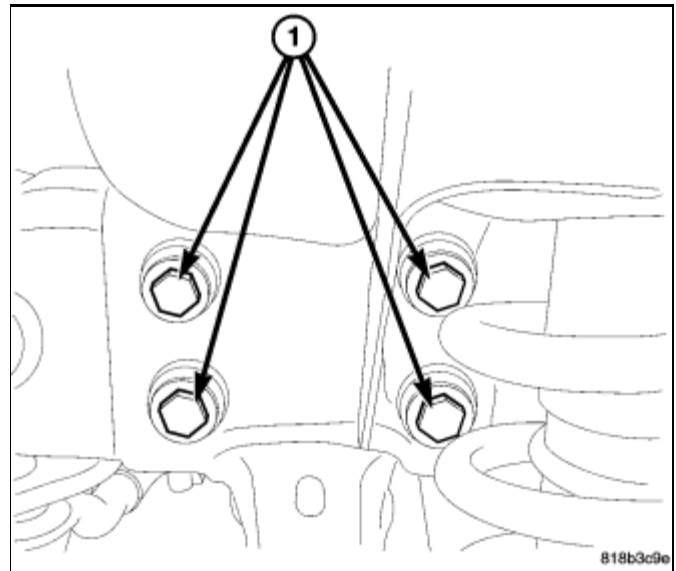
10. Separate the pitman arm (2) from the gear using special tool 9615 puller (1).

11. Remove pitman (2) arm from gear. (Refer to 19 - STEERING/LINKAGE/PITMAN ARM - REMOVAL).

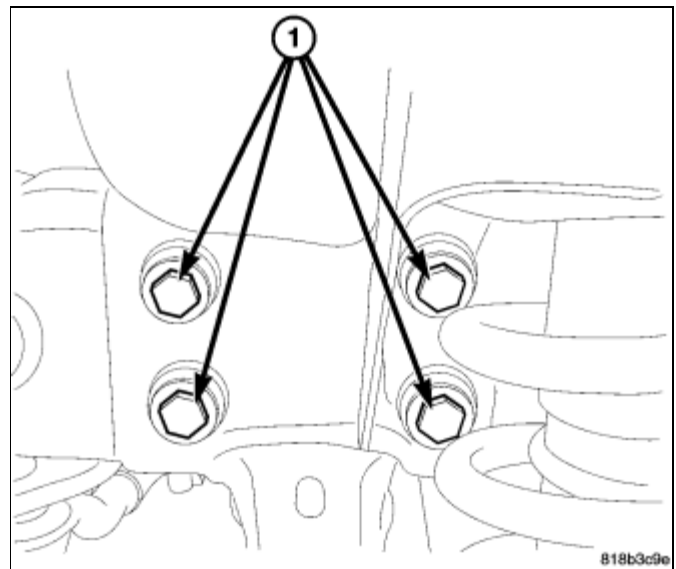


12. Remove the steering gear retaining bolts (1) and remove the gear.

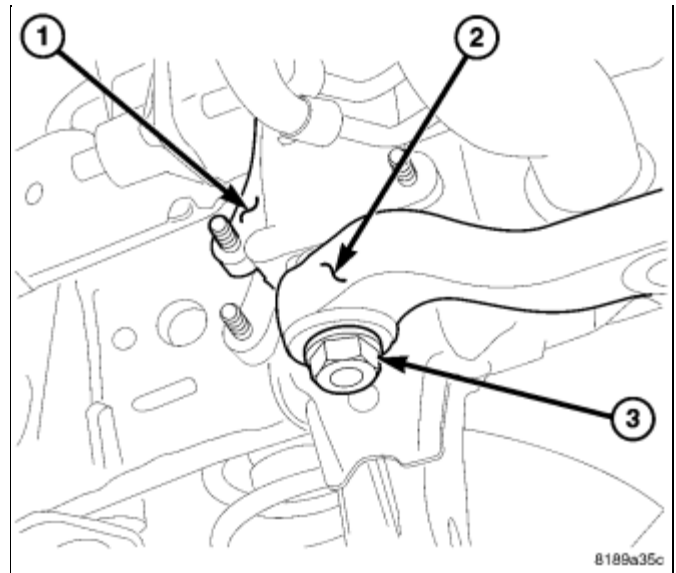
INSTALLATION



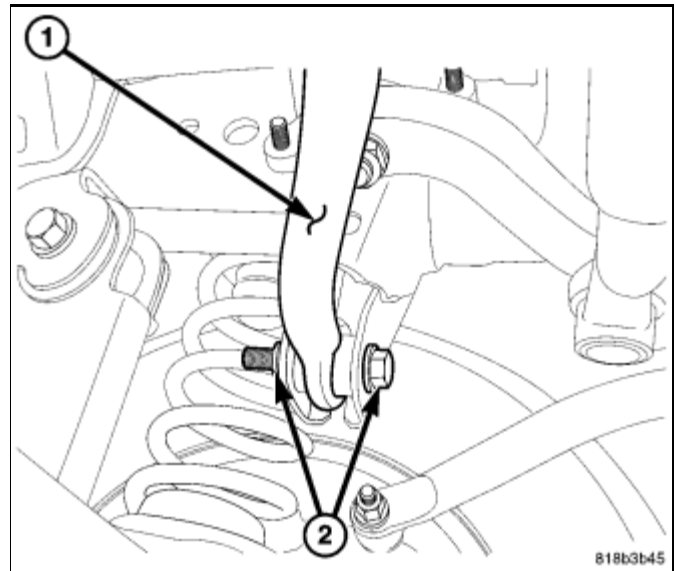
1. Install steering gear on the frame rail and tighten bolts (1) to 95 N·m (70 ft. lbs.)



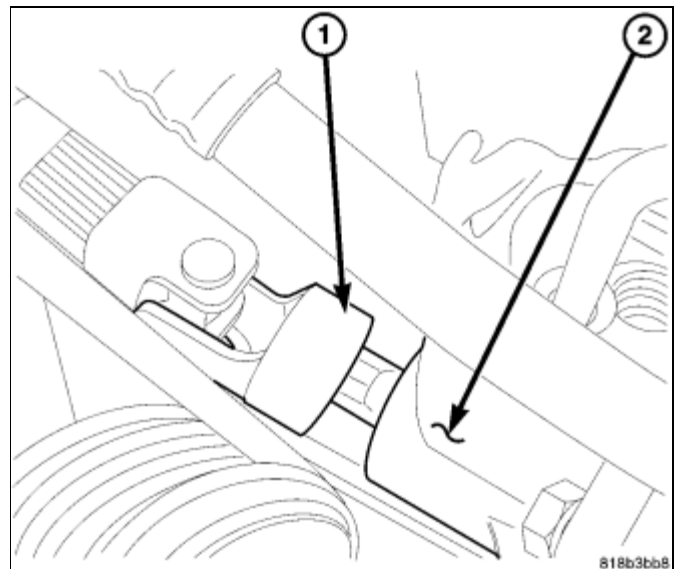
2. Align and install the pitman arm (2) and tighten nut (3) to 251 N·m (185 ft. lbs.).



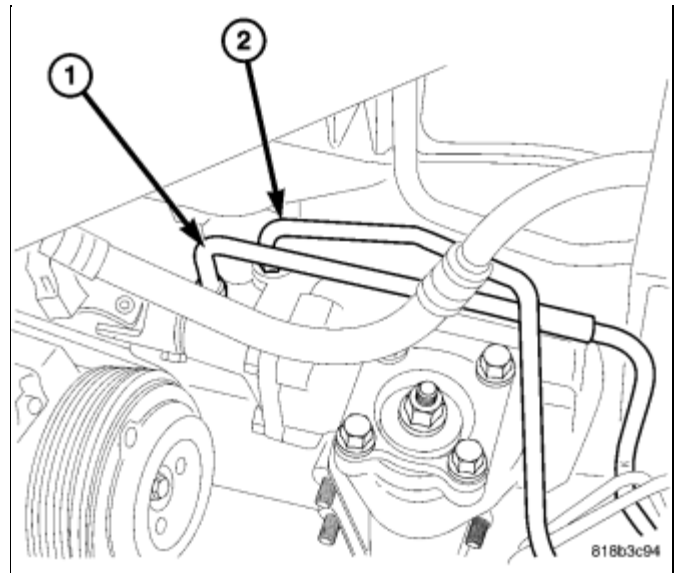
3. It may be necessary to pry the axle assembly over to install the track bar (1) at the frame rail. Install track bar at the frame rail bracket. Install the nut and bolt (2) at the frame rail bracket.
4. Tighten the bolt (2) at the frame bracket to 169 N·m (125 ft. lbs.).
5. Install the track bar (1) back into position at the frame.
6. Remove the support and lower the vehicle.



7. Align the column coupler shaft (1) to steering gear (2). Install a **new** coupler pinch bolt and tighten to 49 N·m (36 ft. lbs.).



8. Install power steering hoses/tubes (1&2) to steering gear (3) and tighten to 36 N·m (27 ft. lbs.).
9. Reinstall the coolant bottle back into position.
10. Fill power steering system to proper level, (Refer to 19 - STEERING - STANDARD PROCEDURE).
11. Check the toe setting, (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



ADJUSTMENTS

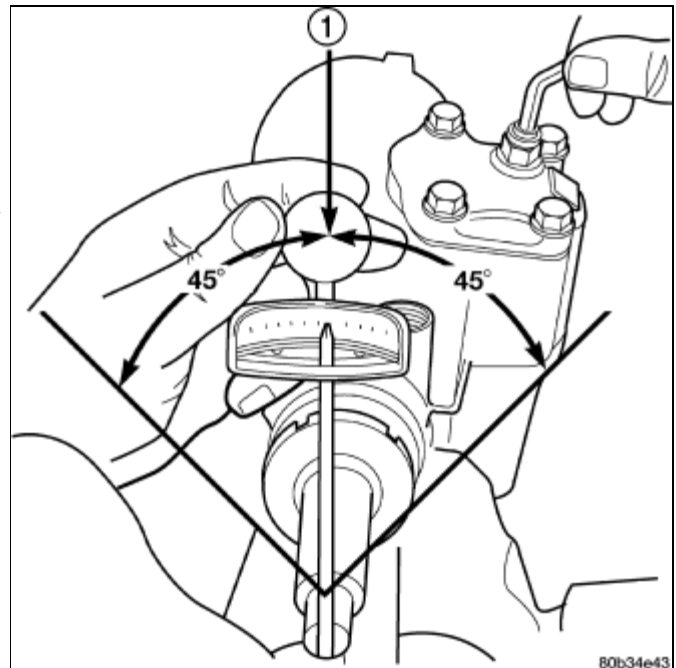
STEERING GEAR

NOTE: Adjusting the steering gear in the vehicle is not recommended. Remove gear from the vehicle and drain the fluid. Then mount gear in a vise to perform adjustments.

OVER-CENTER

1. Rotate the stub shaft with Socket 8343 from stop to stop and count the number of turns.
2. Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.
3. Place torque wrench and Socket 8343 in a vertical position on the stub shaft. Rotate the wrench 45 degrees each side of the center and record the highest rotational torque in this range. This is the Over-Center Rotating Torque.

NOTE: The stub shaft must rotate smoothly without sticking or binding.



4. Rotate the stub shaft between 90° and 180° to the left of center and record the left off-center preload. Repeat this to the right of center and record the right off-center preload. The average of these two recorded readings is the Preload Rotating Torque.
5. The Over-Center Rotating Torque should be 0.45-0.80 N·m (4-7 in. lbs.) **higher** than the Preload Rotating Torque.
6. If an adjustment to the Over-Center Rotating Torque is necessary, first loosen the adjuster lock nut. Then turn the pitman shaft adjuster screw back (COUNTERCLOCKWISE) until fully extended, then turn back in (CLOCKWISE) one full turn.
7. Remeasure Over-Center Rotating Torque. If necessary turn the adjuster screw and repeat measurement until correct Over-Center Rotating Torque is reached.

NOTE: To increase the Over-Center Rotating Torque turn the screw CLOCKWISE.

8. Prevent the adjuster screw from turning while tightening adjuster lock nut. Tighten the adjuster lock nut to 37-52 N·m (27-38 ft. lbs.).

SPECIFICATIONS

POWER STEERING GEAR

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Steering Gear Type	Recirculating Ball
Steering Gear Overall Ratio	14:1 LWB or 16:1 SWB

TORQUE

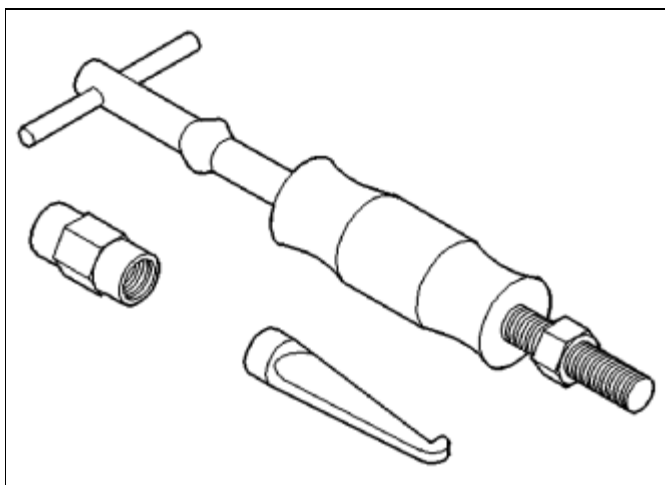
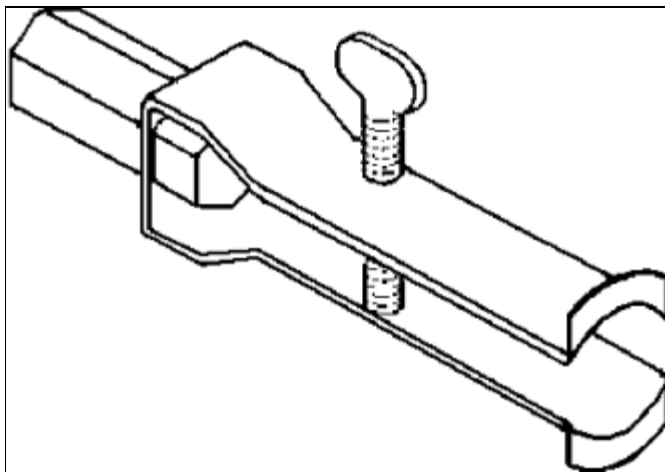
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pitman Shaft Overcenter Drag	0.45-0.80 + Worm Shaft Preload	—	4-7 + Worm Shaft Preload

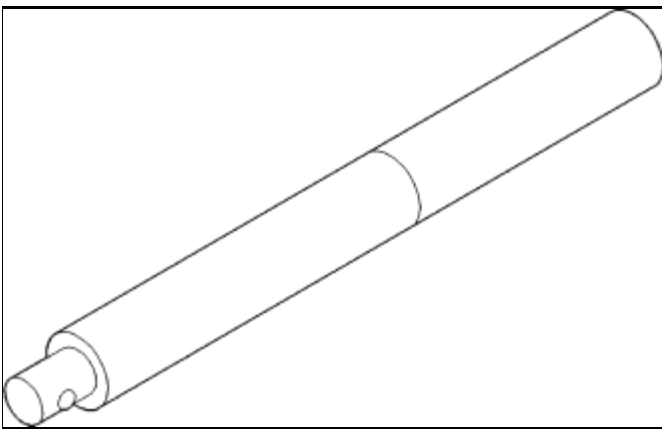
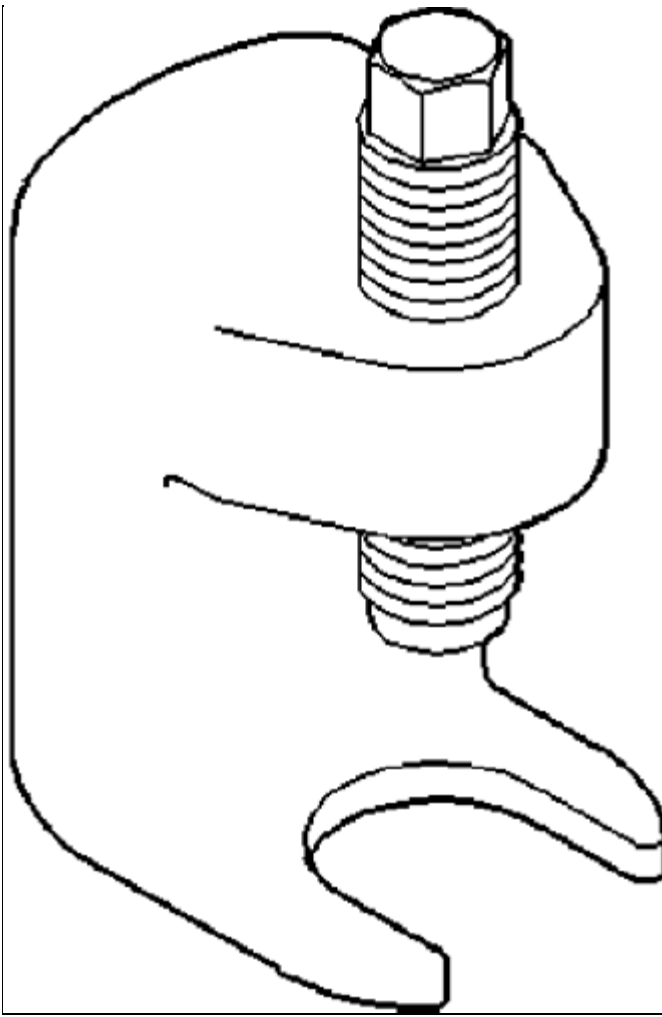
TORQUE CHART

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Gear Adjustment Screw Locknut	65	48	—
Power Steering Gear to Frame Bolts	108	870	—
Power Steering Gear Pitman Shaft Nut	251	185	—
Power Steering Gear Pressure Line	36	27	—
Power Steering Gear Return Line	36	27	—

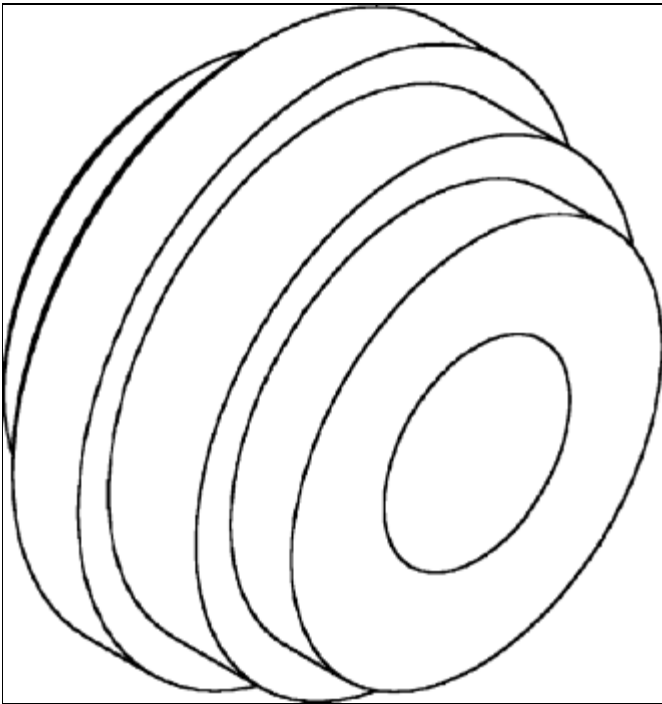
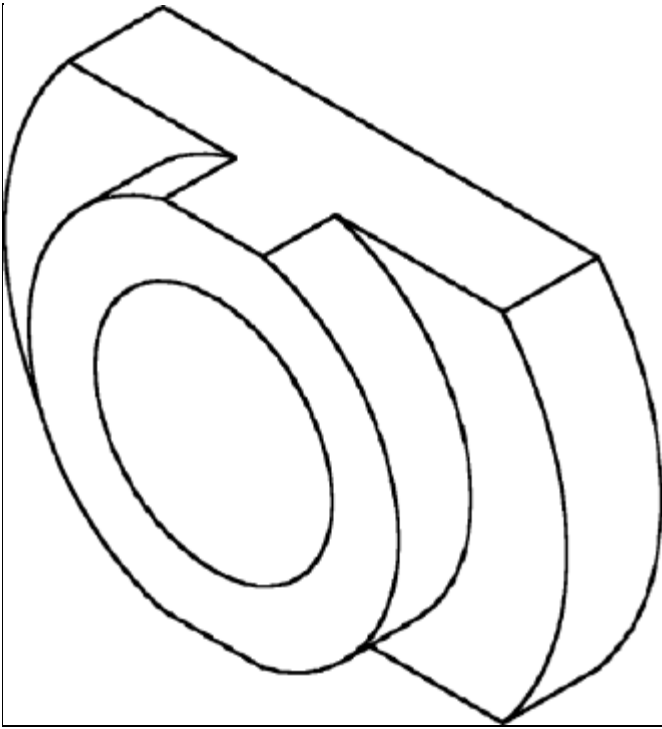
SPECIAL TOOLS

POWER STEERING GEAR





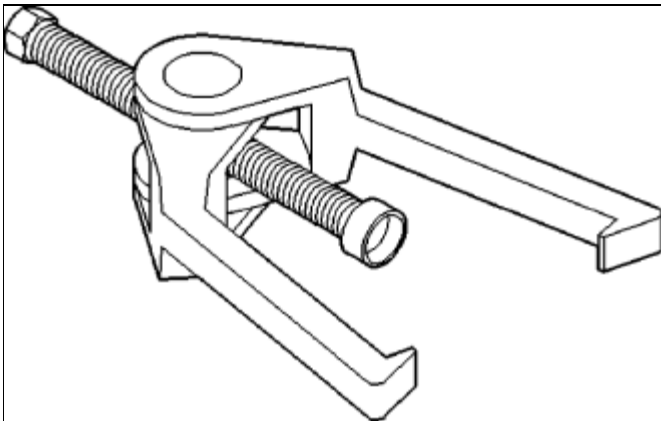
Handle C-4171



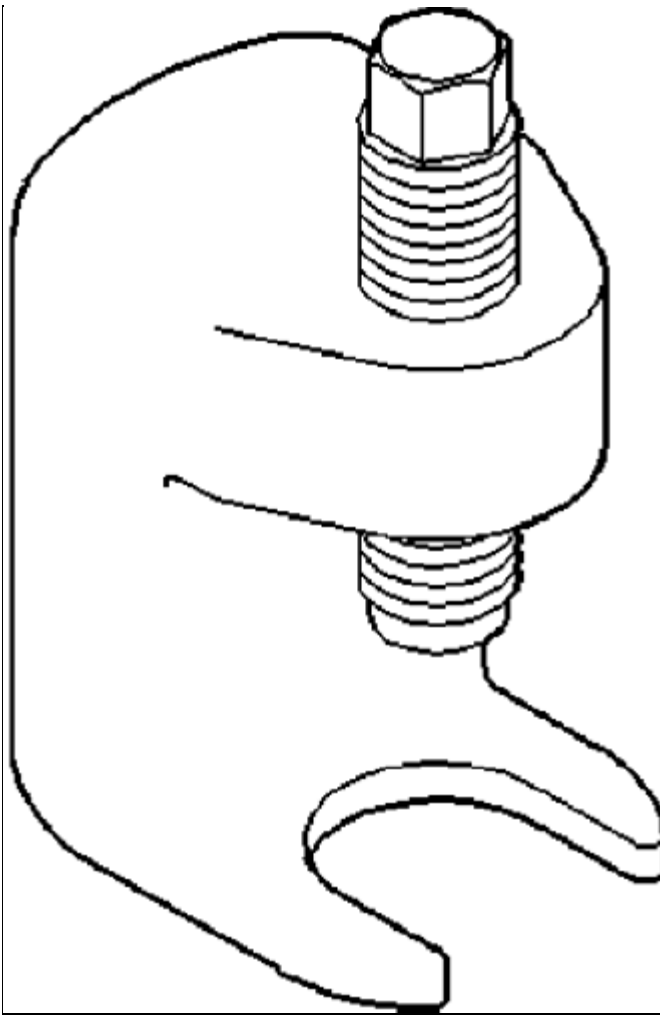
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pitman Arm Shaft	251	185	—
Drag Link Ball Stud to Pitman Arm	105	77	—
Drag Link Ball Stud to Knuckle	85	63	—
Drag Link Clamp	35	26	—
Tie Rod Ends Ball Studs	85	63	—
Tie Rod Ends Clamp	61	45	—
Steering Damper to Frame	68	50	—
Steering Damper Tie Rod nut	68	50	—
Track Bar Frame Bracket Nut	169	125	—
Track Bar Axle Bracket Bolt	169	125	—

SPECIAL TOOLS

STEERING LINKAGE



Puller C-3894-A



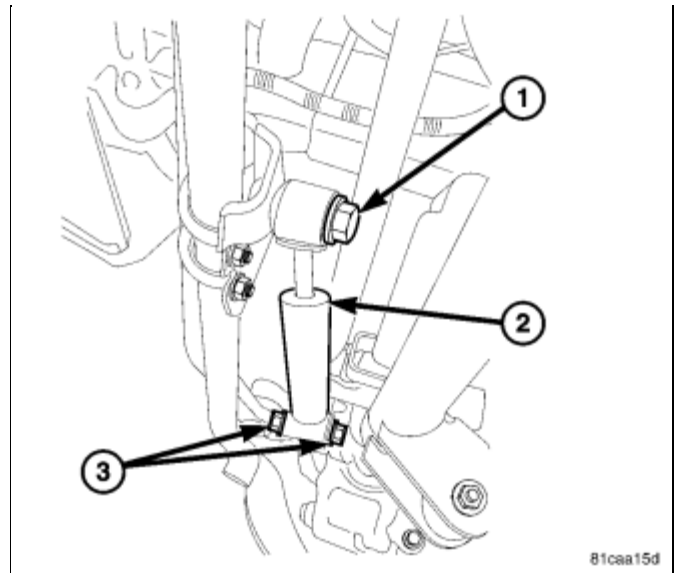
DAMPER

REMOVAL

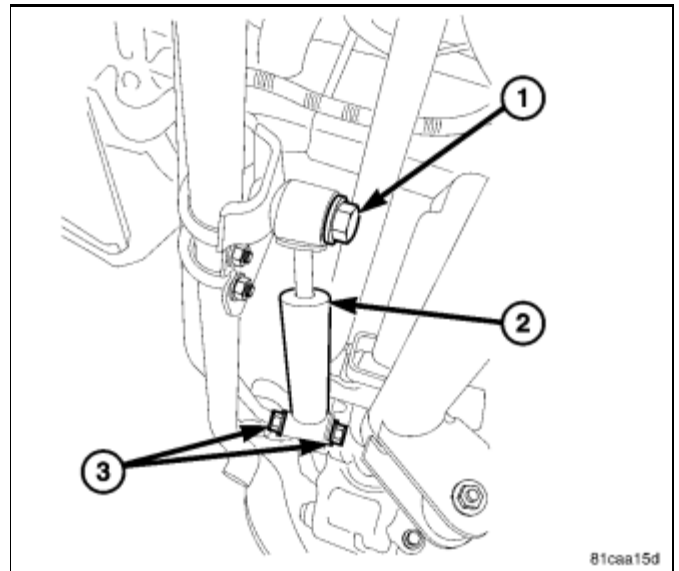
STEERING DAMPER

1. Place the front wheels in a straight ahead position.
2. Raise and support the vehicle.
3. Remove the steering damper retaining nut (1) from the steering damper bracket.
4. Remove the steering damper retaining nut and bolt from the axle bracket (3).
5. Remove the steering damper (2) from the vehicle.

STEERING DAMPER BRACKET



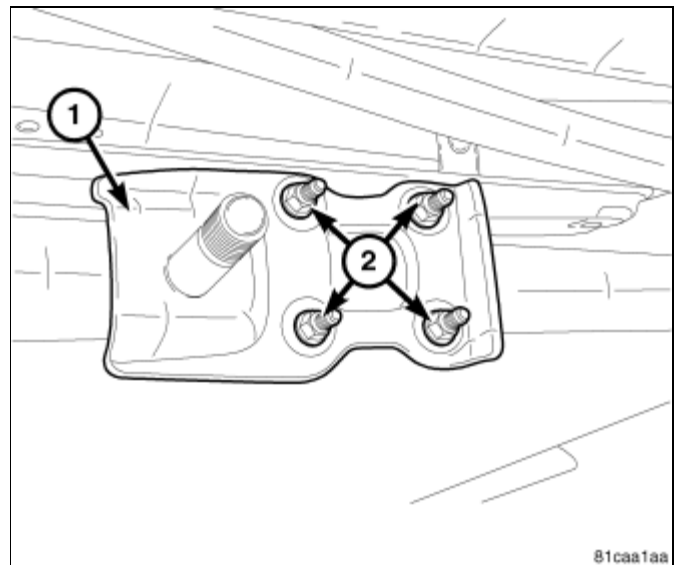
1. Remove the steering damper nut (1) from the bracket.



2. Remove the four nuts (2) for the U-bolts.
3. Remove the U-bolts and bracket (1).

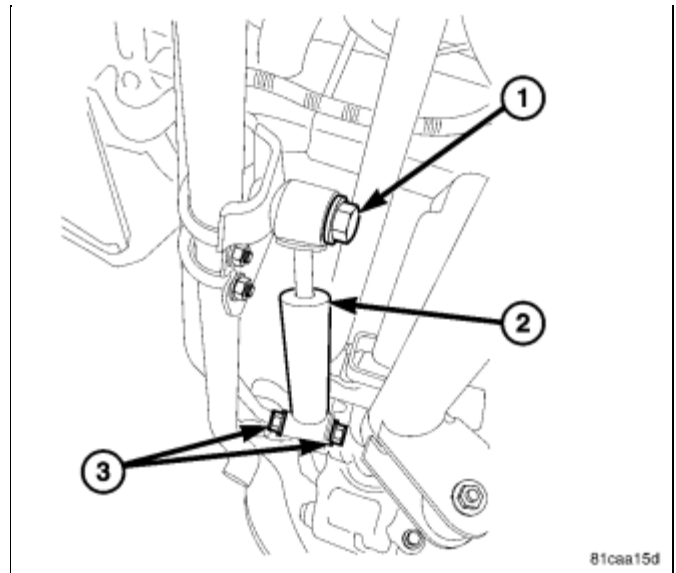
INSTALLATION

STEERING DAMPER

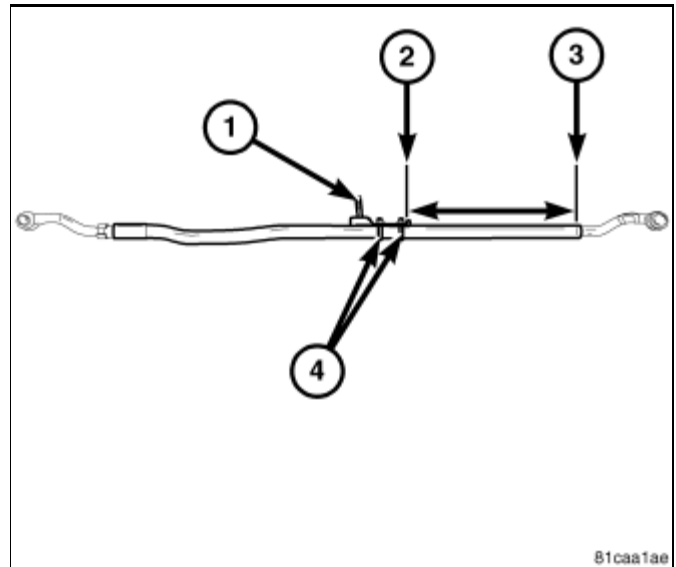


1. Install the steering damper (2) to the axle bracket and steering damper bracket.
2. Install the steering damper bolt (3) in the axle bracket and tighten nut to 68 N·m (50 ft. lbs.).
3. Install the steering damper nut (1) on the steering damper bracket and tighten nut to 68 N·m (50 ft. lbs.).
4. Remove the support and lower the vehicle.

STEERING DAMPER BRACKET

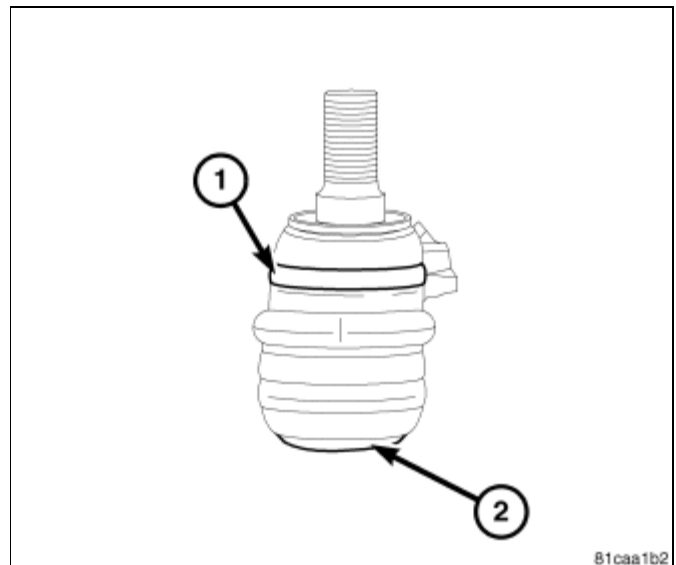


1. Install the bracket loosely to the tie rod tube.
2. The bracket should be oriented such that the stud (1) is on the left (driver) side and pointing rearward in the vehicle, and the U-bolts (4) should assemble on the front.
3. Slide the bracket so that the nearest edge (2) is facing the end of the tube (3) the stud (1) on the bracket should be facing the left side of the vehicle.
4. Measure from the edge of the bracket (2) to the edge of the tube (3) a distance of 402 mm (15.8 in).

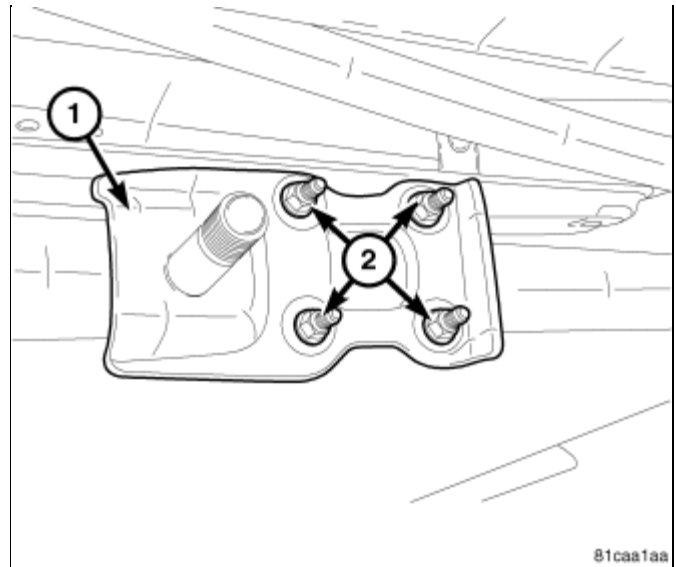


NOTE: The vehicle should be parked on a level surface. The tie rod should be level (front to back) prior to aligning the damper bracket.

5. To level the tie rod (1), place a small level on the bottom of the right side tie rod socket (2). Rotate the tie rod until it is level. While maintaining the tie rod at a level position, rotate the damper bracket so that the stud is horizontal and pointed rearward.



6. Hand tighten all four nuts (2) for equal thread engagement. Tighten the nuts for one U-bolt at a time, alternating between the top and bottom nut. The final torques should be 20 N·m (15 ft.lbs.) on all four nuts.



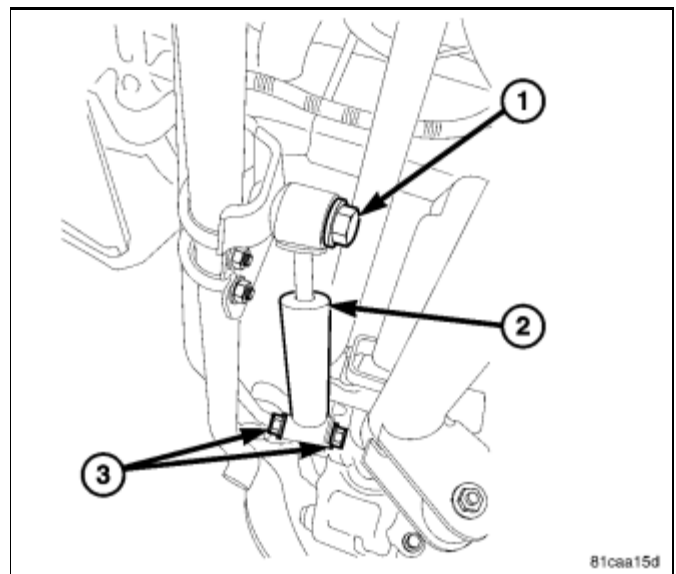
7. Install the steering damper nut (1) on the steering damper bracket and tighten nut to 68 N·m (50 ft. lbs.).

DRAG LINK

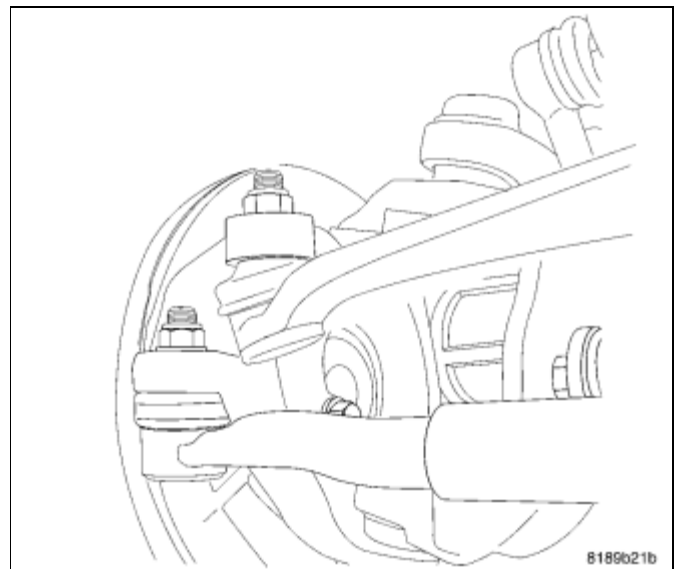
REMOVAL

DRAG LINK (KNUCKLE SIDE)

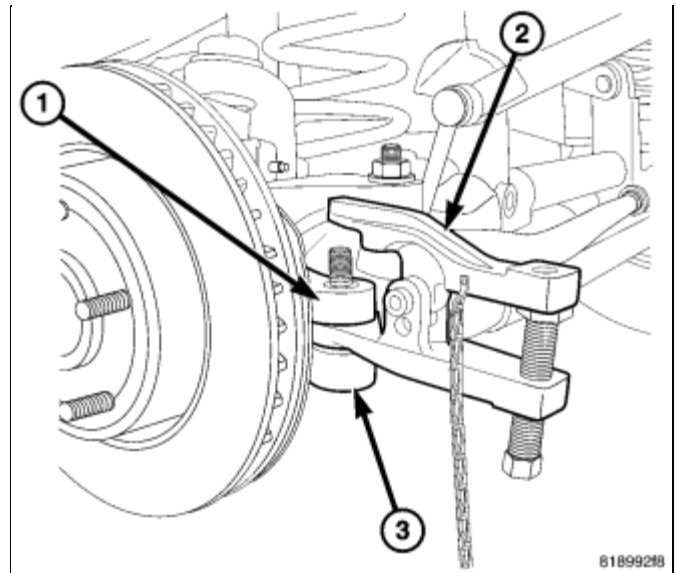
1. Raise and support the vehicle.
2. Remove the right front tire.



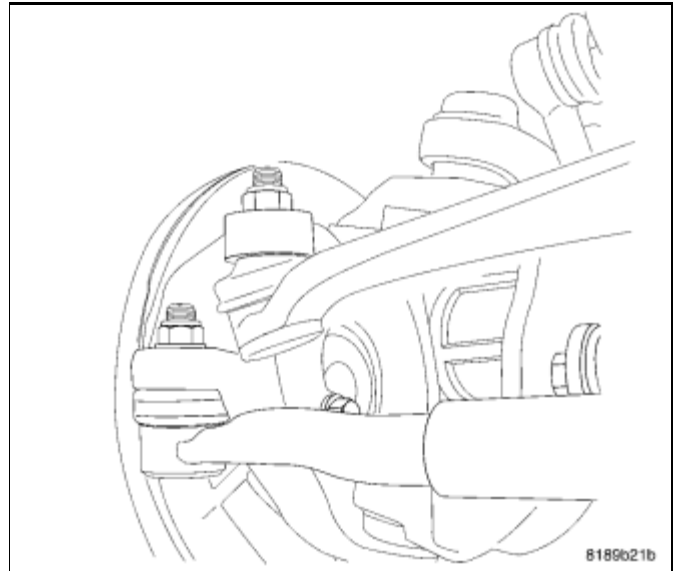
3. Remove the right side drag link nut at the knuckle.



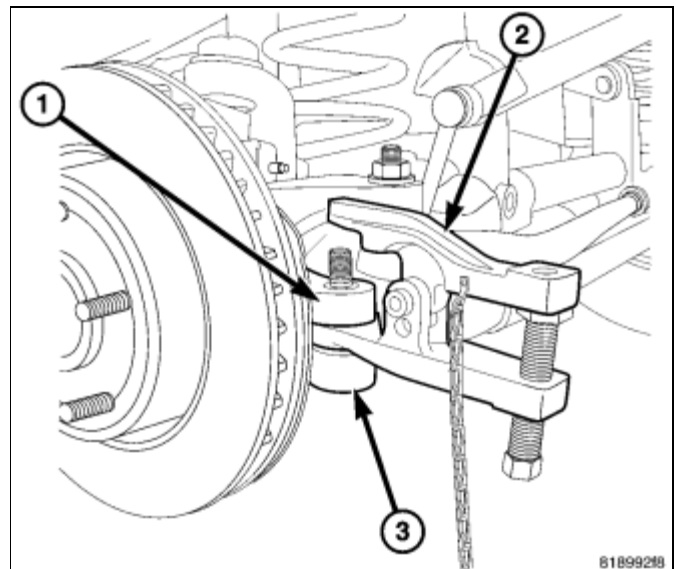
4. Separate the drag link using special tool 9360 separator (2).



5. Remove the tie rod nut at the knuckle.



6. Separate the tie rod using special tool 9360 separator (2).



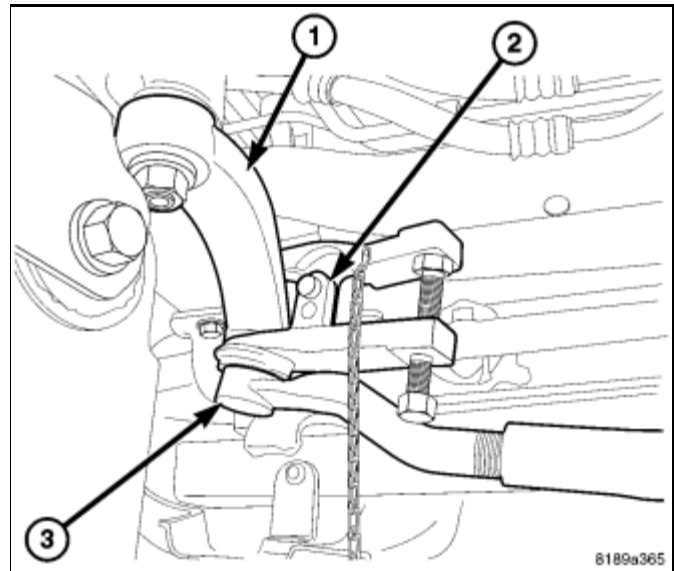
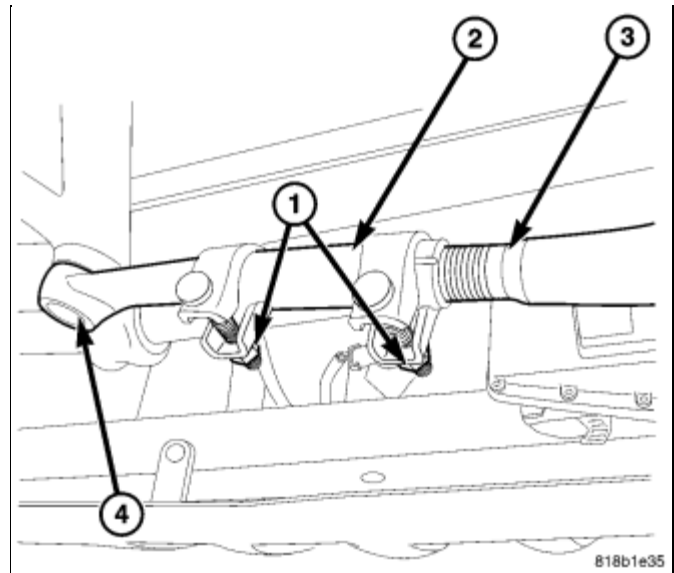
NOTE: Count the number of turns when removing the tie rod end, This will give a good starting point when reassembling and toe adjustment.

7. Loosen the nut and bolt (1) for the drag link adjustment sleeve.
8. Unthread the drag link socket from the adjuster.

DRAG LINK TIE ROD (PITMAN ARM SIDE)

1. Raise and support the vehicle.

2. Remove the drag link nut at the pitman arm.
3. Separate the drag link (3) from the pitman arm using special tool 9360 separator (2).

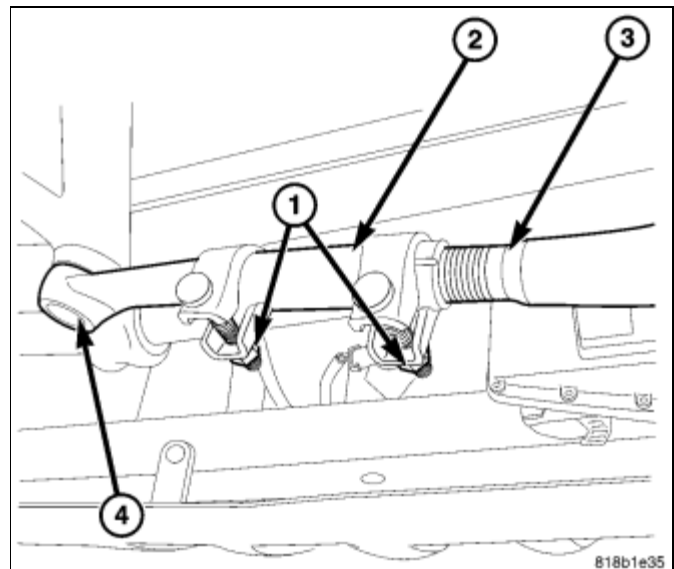


NOTE: Count the number of turns when removing the tie rod end, This will give a good starting point when reassembling and toe adjustment.

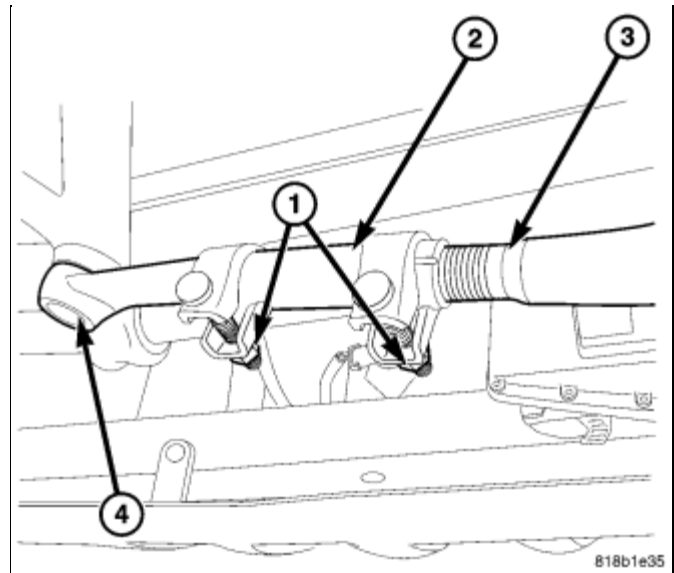
4. Loosen the nut and bolt (1) for the drag link adjustment sleeve.
5. Unthread the tie rod end from the tube.

INSTALLATION

DRAG LINK (KNUCKLE SIDE)

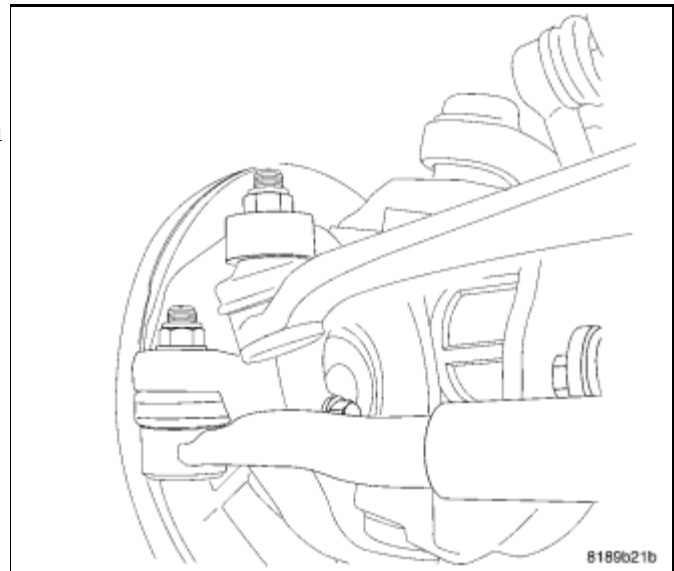


1. Thread the drag link socket into the adjuster . Tighten the adjustment sleeve bolt finger tight (1). Do not tighten to specs until after the toe set is complete.

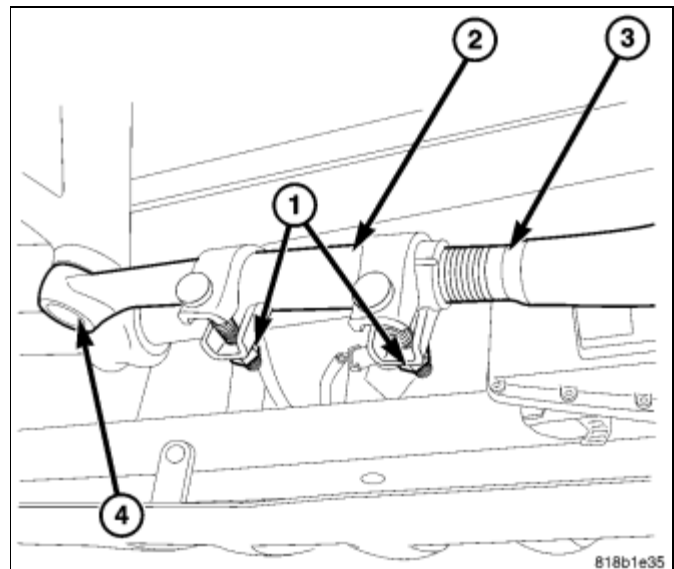


2. Install the drag link to the knuckle and tighten the nut to 85 N·m (63 ft. lbs.)
3. Install the tie rod end to the knuckle and tighten to 85 N·m (63 ft. lbs.).
4. Install the right side tire.
5. Lower the vehicle.
6. Set the toe. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

DRAG LINK TIE ROD (PITMAN ARM SIDE)



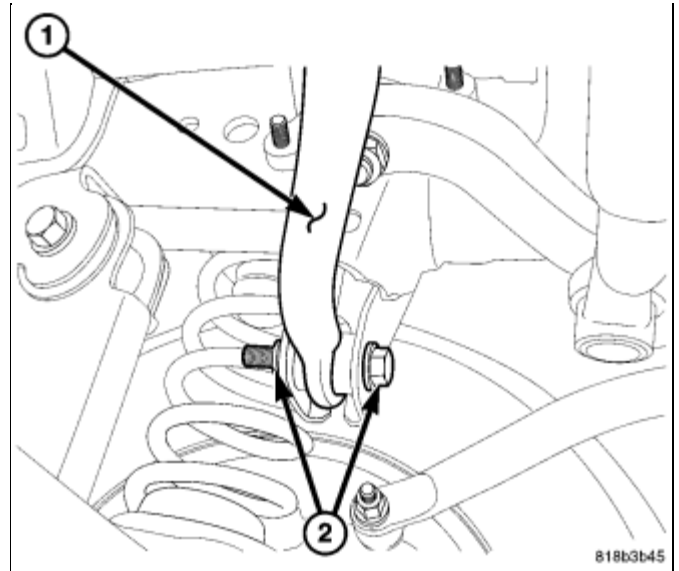
1. Thread the tie rod end onto the drag link tube. Tighten the tie rod end adjustment sleeve bolt finger tight (1). Do not tighten to specs until after the toe set is complete.
2. Install the tie rod end and nut to the pitman arm and tighten to 105 N·m (77 ft. lbs.).
3. Lower the vehicle.
4. Set the toe. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



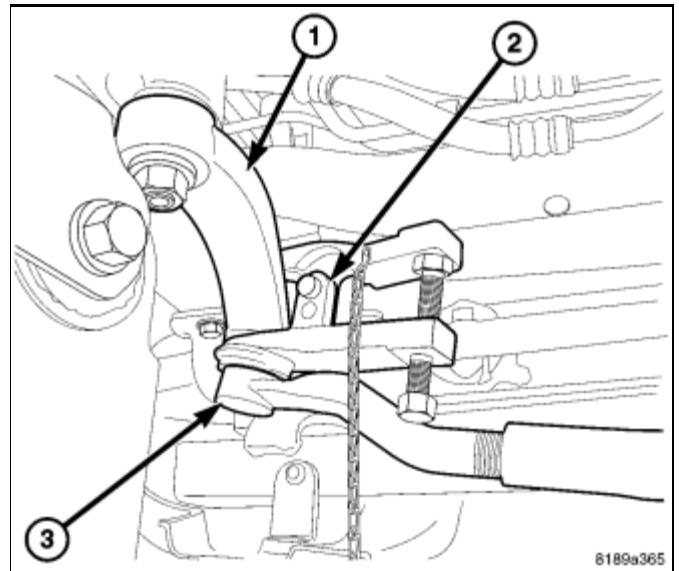
PITMAN ARM

REMOVAL

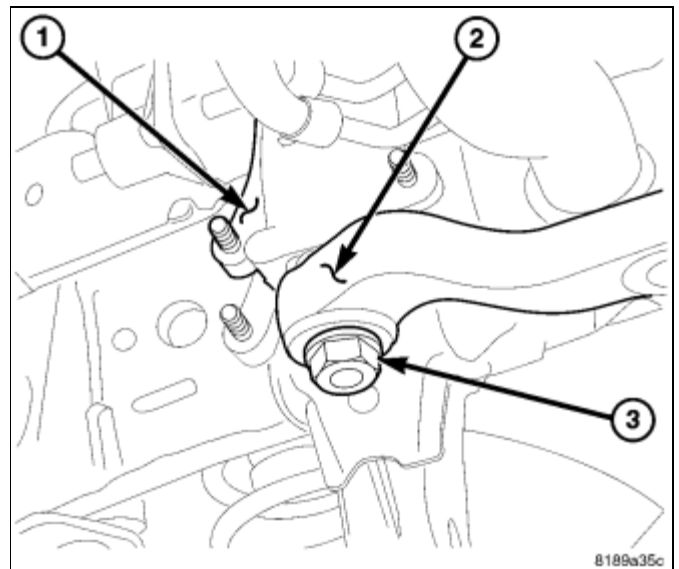
1. Raise and support the vehicle.
2. Remove the track bar bolt (2) at the frame and lower the track bar (1).



3. Remove the pitman arm nut at the drag link (3).
4. Separate the pitman arm (1) from the drag link (3) using special tool 9360 separator (2).

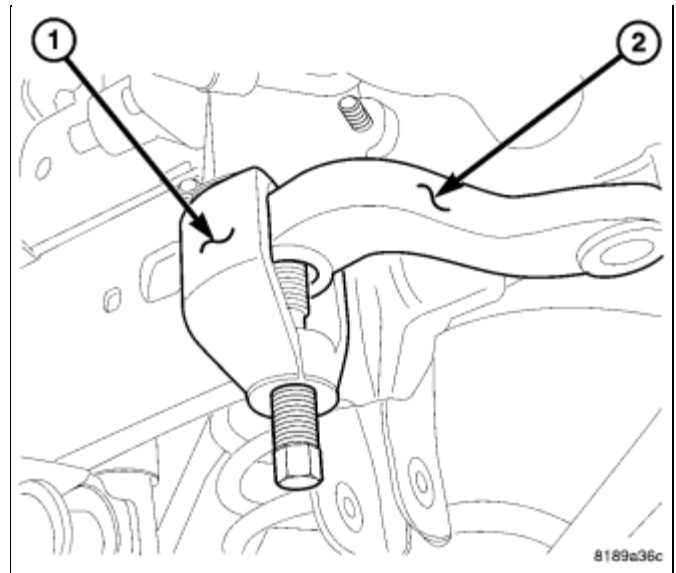


5. Remove the pitman arm nut (3). **Mark the pitman shaft and pitman arm for installation reference.**

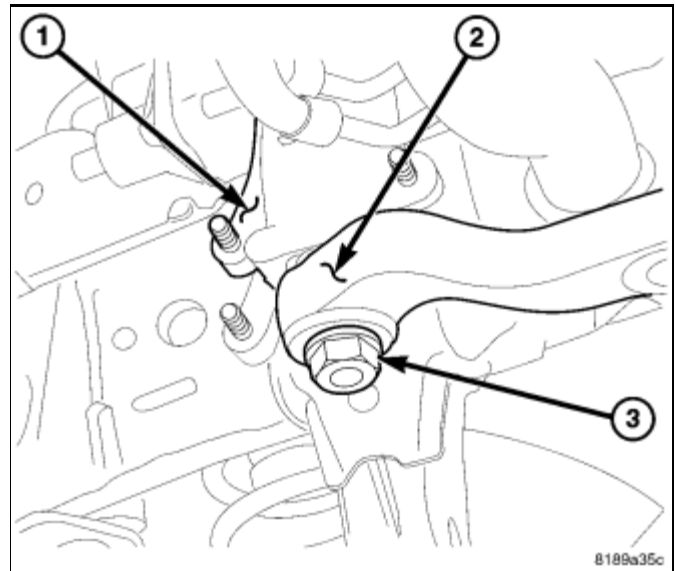


6. Separate the pitman arm (2) from the gear using special tool 9615 puller (1).
7. Remove pitman (2) arm from gear. (Refer to 19 - STEERING/LINKAGE/PITMAN ARM - REMOVAL).

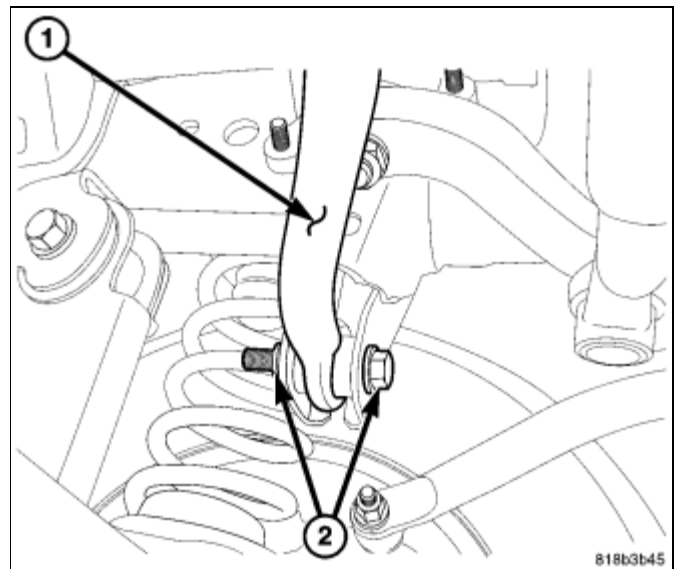
INSTALLATION



1. Align and install the pitman arm (2) on steering gear shaft.
2. Install the washer and nut (3) on the shaft and tighten the nut to 251 N·m (185 ft. lbs.).
3. Install drag link ball stud to pitman arm. Install nut and tighten to 105 N·m (77 ft. lbs.).



4. Install the track bar back into position at the frame.
5. It may be necessary to pry the axle assembly over to install the track bar (1) at the frame rail. Install track bar at the frame rail bracket. Install the nut and bolt (2) at the frame rail bracket.
6. Tighten the bolt (2) at the frame bracket to 169 N·m (125 ft. lbs.).
7. Remove the support and lower the vehicle.
8. Fill power steering system to proper level, (Refer to 19 - STEERING - STANDARD PROCEDURE).
9. Check the toe setting, (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



TIE ROD END

DIAGNOSIS AND TESTING

TIE ROD

Tie rod free-play can be measured using the following hand methods:

NOTE: When checking free-play, DO NOT rotate the tie rod. Just because a tie rod rotates easily, it is not necessarily faulty.

NOTE: Always check and repair (if necessary) outer tie rod free-play before checking inner tie rod free-play. False results can otherwise be obtained.

Grasp the outer tie rod near the ball stud and attempt to move the tie rod straight up and down. If any free-play is felt, replace the outer tie rod (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL). If no free-play is felt at the outer tie rod, attempt to move the inner tie rod in the same manner. Refer to the following procedure.

STANDARD PROCEDURE

CHECKING TIE ROD ENDS

Tie rod free-play can be measured using the following hand methods:

NOTE: When checking free-play, DO NOT rotate the tie rod. Just because a tie rod rotates easily, it is not necessarily faulty.

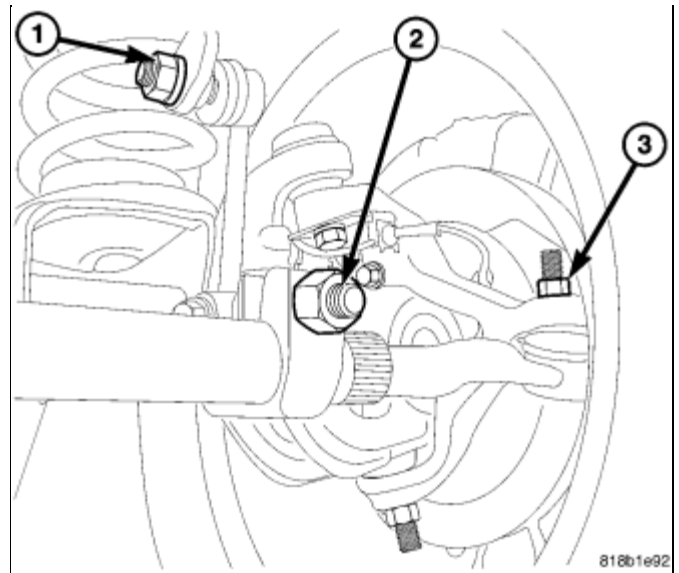
NOTE: Always check and repair (if necessary) outer tie rod free-play before checking inner tie rod free-play. False results can otherwise be obtained.

Grasp the outer tie rod near the ball stud and attempt to move the tie rod straight up and down. If any free-play is felt, replace the outer tie rod (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL). If no free-play is felt at the outer tie rod, attempt to move the inner tie rod in the same manner. Refer to the following procedure.

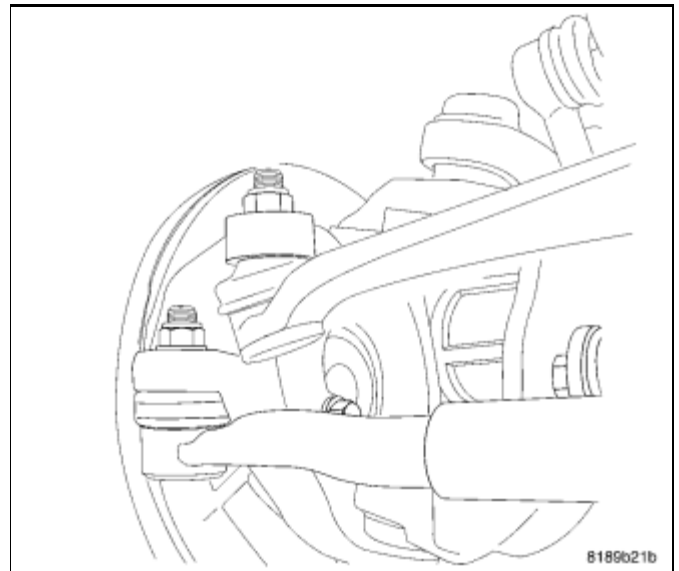
REMOVAL

TIE ROD TUBE

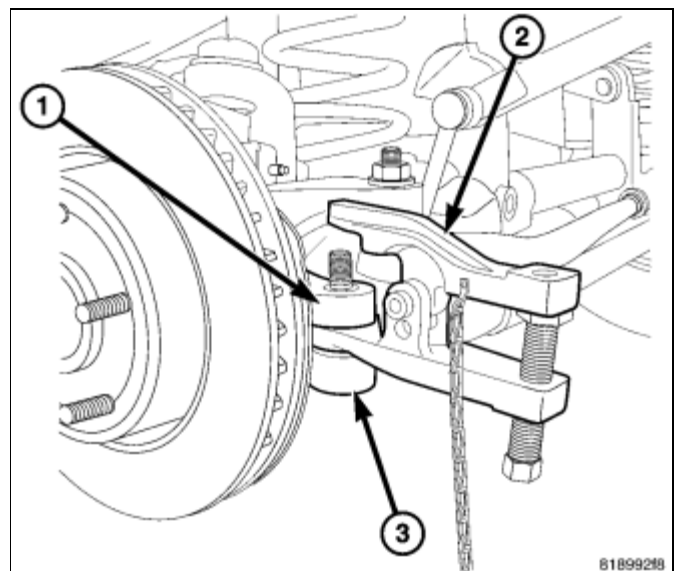
1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. loosen the end clamp bolt (2).



4. Remove the nut (3) at the steering knuckle.



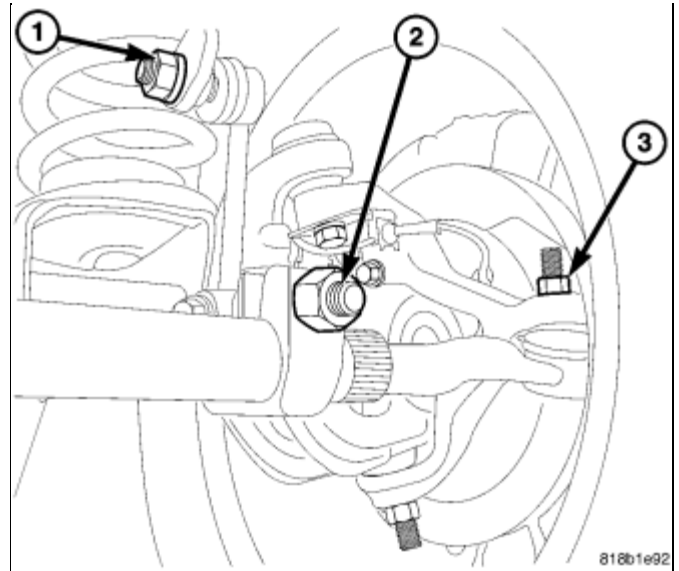
5. Separate the tie rod (3) from the knuckle (1) using special tool 9360 separator (2).



NOTE: Count the number of turns when removing the tie rod tube, This will give a good starting point when reassembling and toe adjustment.

6. Unthread the tie rod tube from the adjuster.

TIE ROD END



1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. loosen the end clamp bolt (2).
4. Remove the nut (3) at the steering knuckle.
5. Separate the tie rod from the knuckle using special tool 9360 separator.

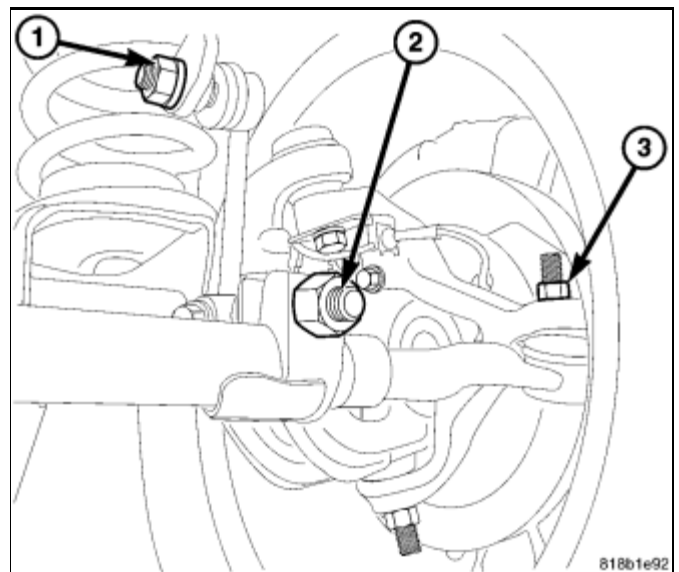
NOTE: Count the number of turns when removing the tie rod end, This will give a good starting point when reassembling and toe adjustment.

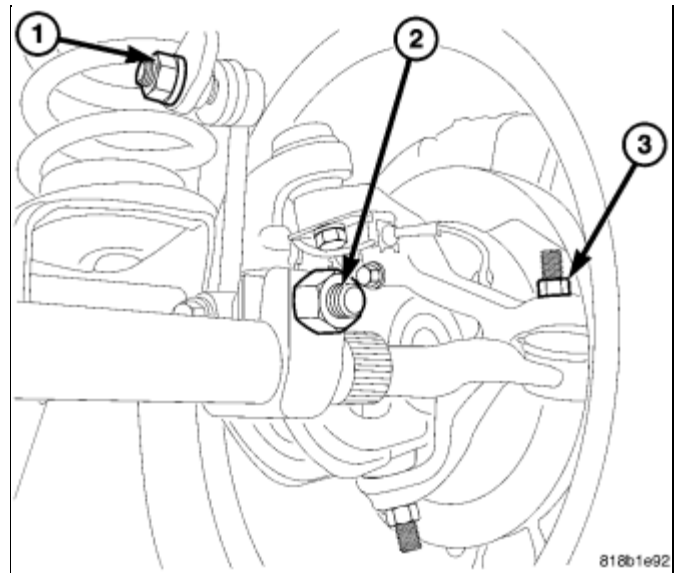
6. Unthread the tie rod end from the tube.

INSTALLATION

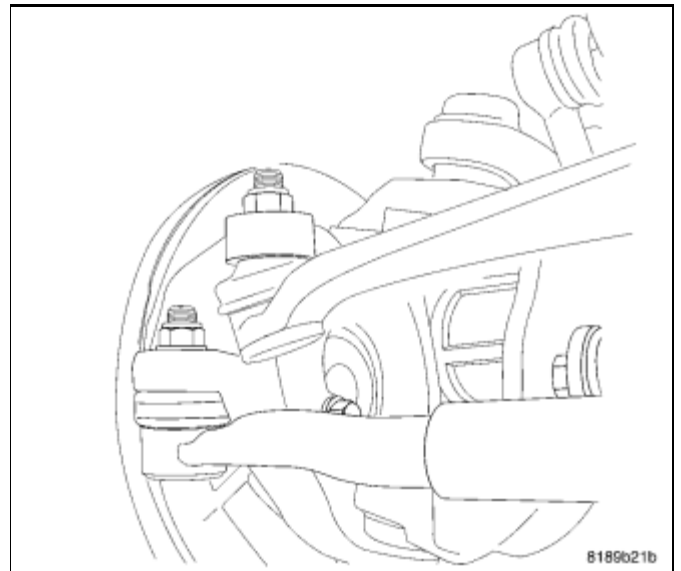
TIE ROD TUBE

1. Thread the tie rod tube onto the adjuster.



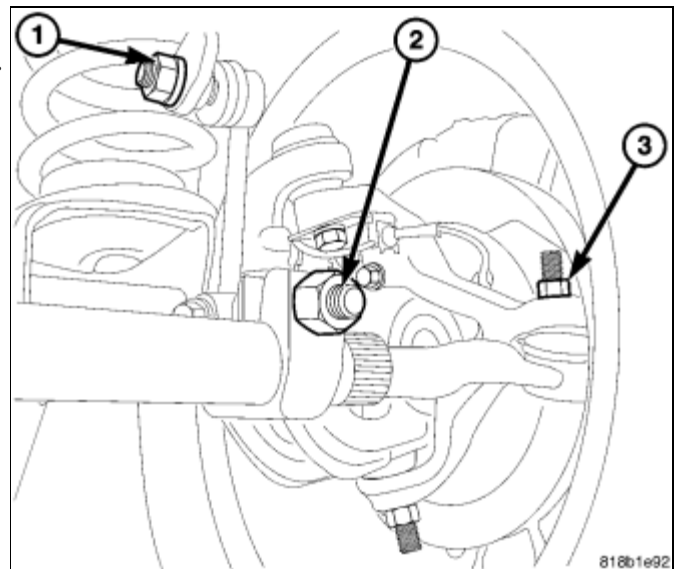


2. Install the tie rod in the steering knuckle.
3. Tighten the ball stud nut (3) on the steering knuckle to 85 N·m (63 ft. lbs.).

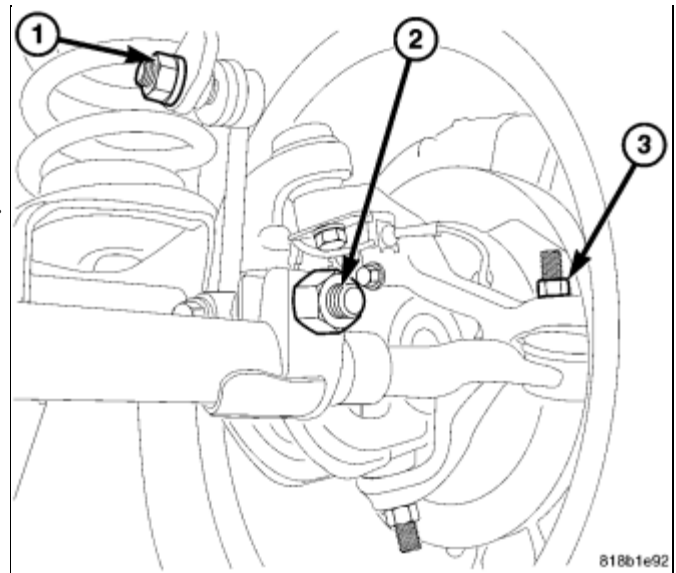


4. Position the tie rod clamp (2) and tighten to 61 N·m (45 ft. lbs.).
5. Install the tire and wheel assembly.
6. Lower the vehicle.
7. Set wheel toe, (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE) .

TIE ROD END



1. Thread the tie rod end in the tube.
2. Install the tie rod in the steering knuckle.
3. Tighten the ball stud nut (3) on the steering knuckle to 85 N·m (63 ft. lbs.).
4. Position the tie rod clamp (2) and tighten to 61 N·m (45 ft. lbs.).
5. Install the tire and wheel assembly.
6. Lower the vehicle.
7. Set wheel toe, (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE) .



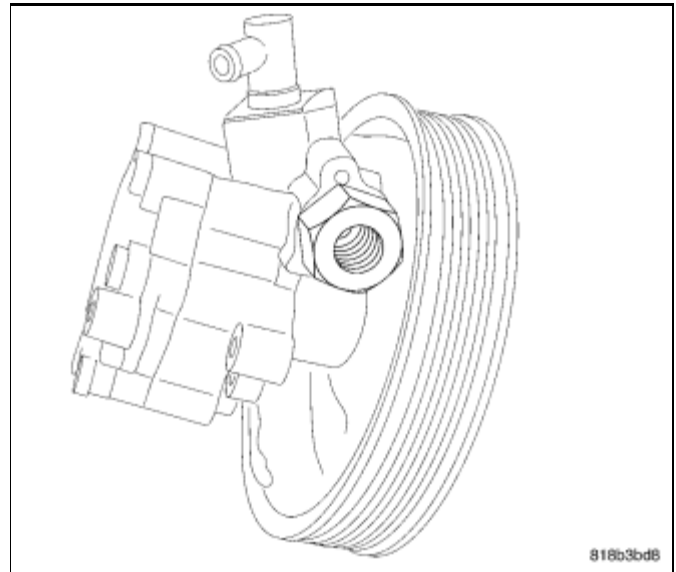
PUMP

PUMP

DESCRIPTION

GAS ENGINE

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump. The pump shaft has a pressed-on high strength plastic drive pulley that is belt driven by the crankshaft pulley. The reservoir is a remote reservoir located by the battery. The power steering pump is connected to the steering gear by the pressure and return hoses.



DIESEL ENGINE

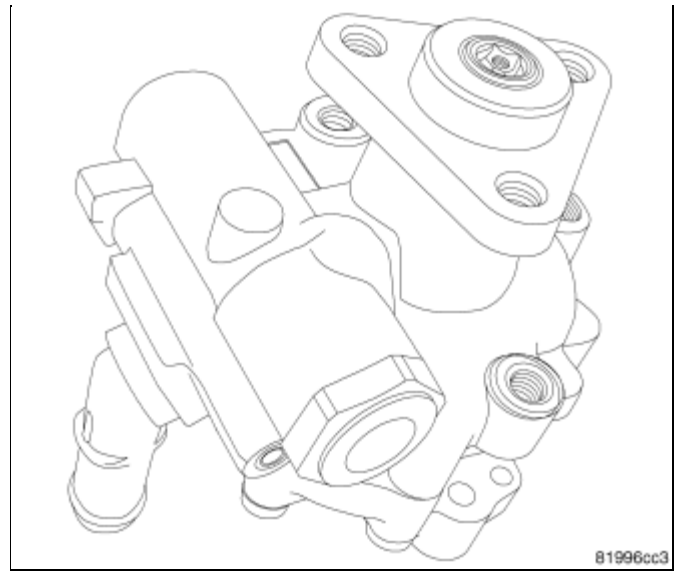
Hydraulic pressure for the power steering system is provided by a belt driven power steering pump. The pump shaft has a bolt on steel drive pulley that is belt driven by the crankshaft pulley. The reservoir is a remote reservoir located by the battery. The power steering pump is connected to the steering

gear by the pressure and return hoses.

OPERATION

The power steering pump is a droop flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure.

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.



DIAGNOSIS AND TESTING

POWER STEERING PUMP AND HOSES

NOTE: This information is designed to be used in conjunction with the diagnostic charts at the beginning of the Steering section. (Refer to 19 - STEERING - DIAGNOSIS AND TESTING)

CHECKING FOR WEAR OF POWER STEERING PUMP INTERNAL COMPONENTS

1. Place gear selector in PARK (or NEUTRAL) with wheels chalked.
2. With the engine idling, have a helper turn the steering wheel.
3. Using an electronic listening tool, determine if noise is coming from the pump.
4. Increase the engine speed and have a helper turn the steering wheel. Does the noise change with load?
5. Replace the power steering pump if excessive noise is present. (Refer to 19 - STEERING/PUMP - REMOVAL)

CHECKING FOR POWER STEERING HOSES TOUCHING BODY OR FRAME OF VEHICLE

Check hoses and hose tubes as following:

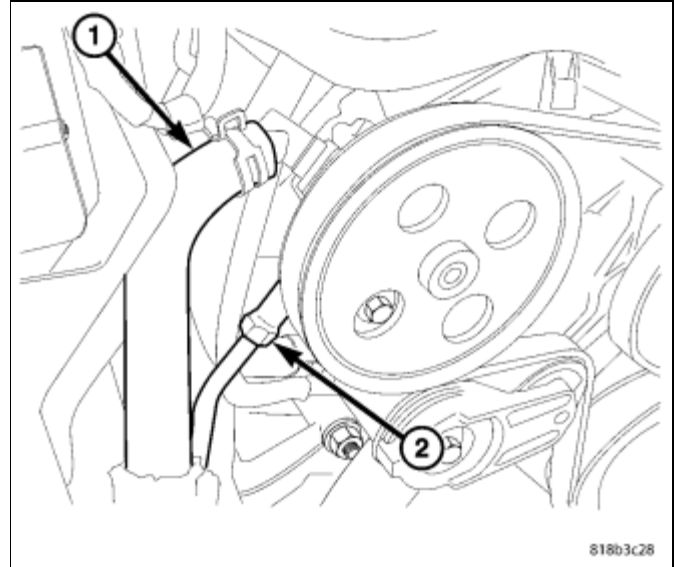
- Inspect hoses and hose tubes for witness marks. If witness marks are present, adjust hose(s) to the proper position by loosening, repositioning and tightening attachments to the specified torque (Refer to 19 - STEERING/PUMP - SPECIFICATIONS). **Do not bend tubing to adjust.** Replace the hose assembly if damaged.
- Check fastener torque of hose mounting brackets and tube nuts. (Refer to 19 - STEERING/PUMP - SPECIFICATIONS)
- Have a helper bump the steering gear off of the stops to induce pressure fluctuations which may move the hose. If hose contact is made, adjust hose(s) to the proper position by loosening, repositioning and

tightening attachments to the specified torque (Refer to 19 - STEERING/PUMP - SPECIFICATIONS). **Do not bend tubing to adjust.** Replace the hose assembly if damaged.

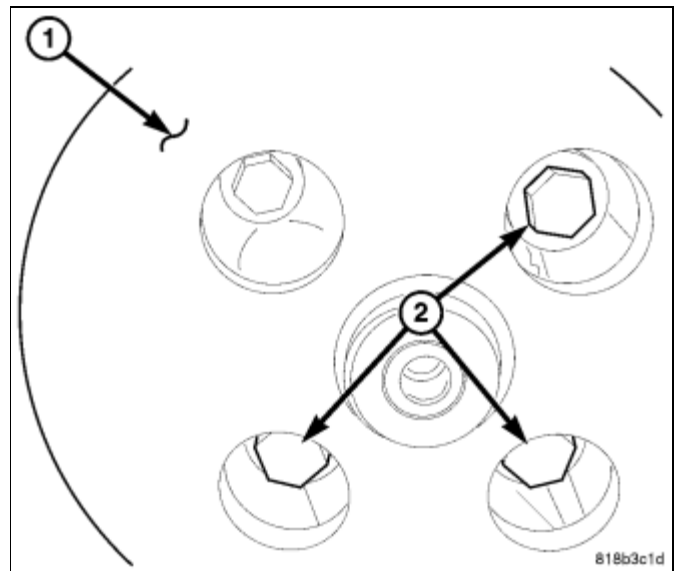
REMOVAL

3.8L

1. Remove cap from power steering fluid reservoir.
2. Siphon as much fluid as possible from the power steering fluid reservoir.
3. Remove the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL)..
4. Remove the pressure hose at the pump.
5. Remove the supply hose from the pump.

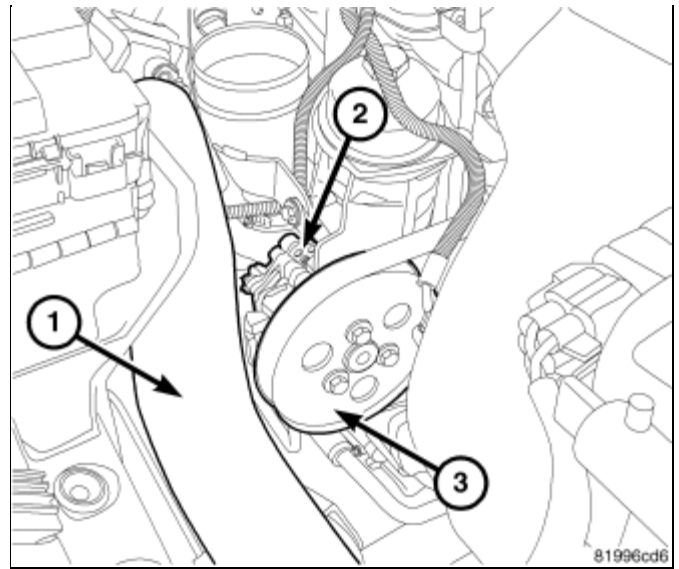


6. Remove the drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
7. Remove the three front mounting bolts through the pulley (2).
8. Remove the pump (with pulley).
9. If the pulley (1) needs removal, (Refer to 19 - STEERING/PUMP/PULLEY - REMOVAL).

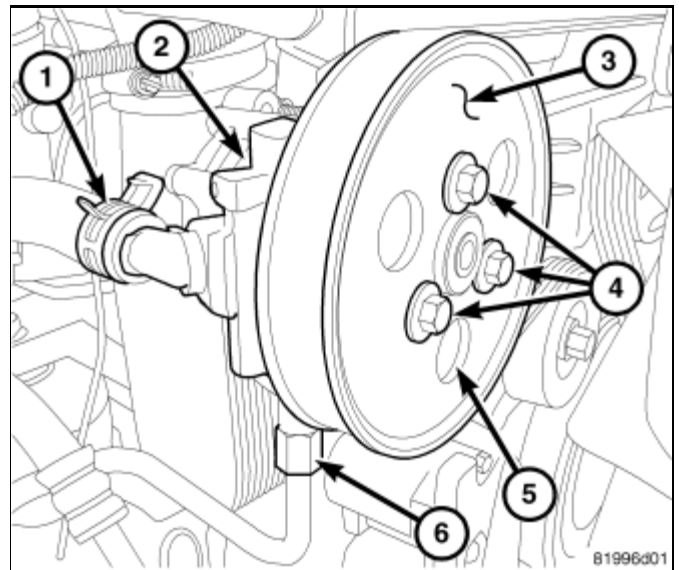


2.8L- DIESEL

1. Siphon out as much power steering fluid as possible.
2. Remove the air cleaner box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
3. Remove the turbo air inlet tube (1).



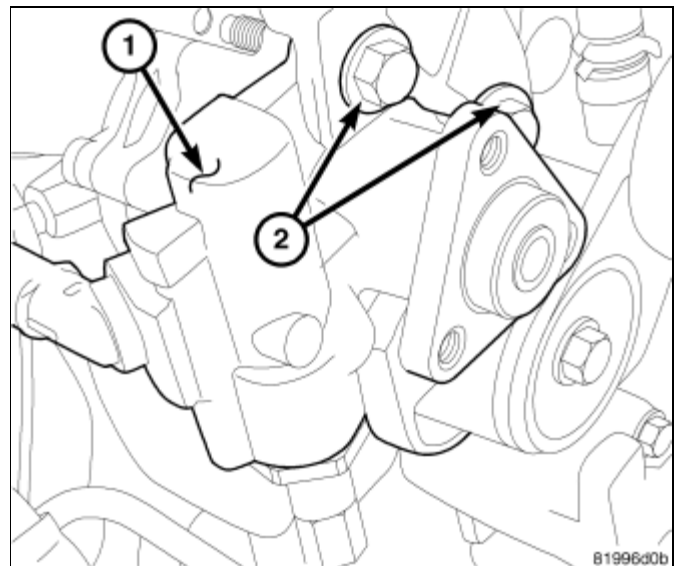
4. Remove the serpentine drive belt.
5. Remove the three bolts (4) securing the pulley (3) to the pump (2).
6. Remove the power steering hoses (1&6).



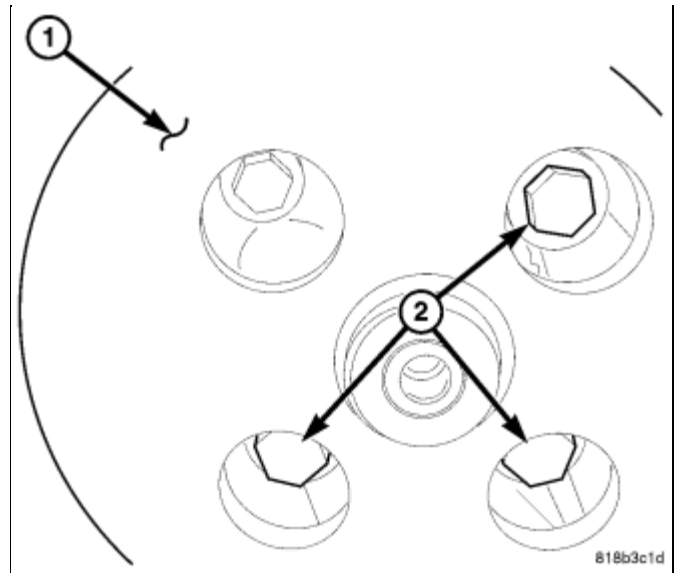
7. Remove the three bolts (2) securing the pump (1) to the engine.
8. Remove the pump (1) from the vehicle.

INSTALLATION

3.8L

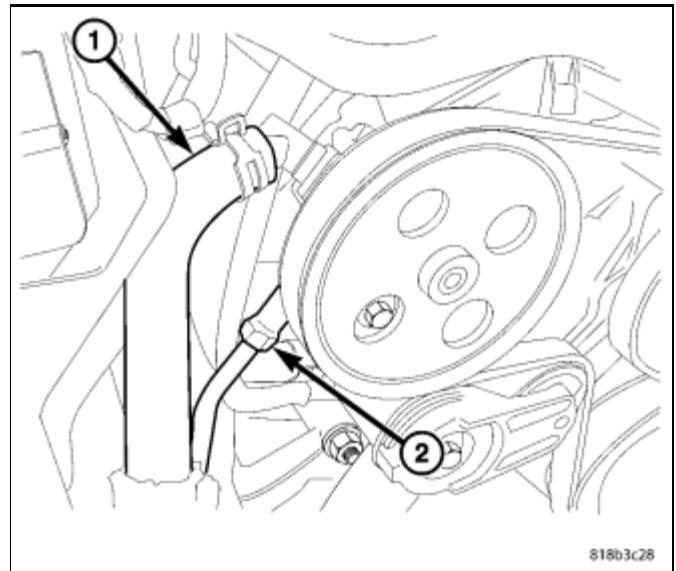


1. Install pulley (1) on pump (if removed). (Refer to 19 - STEERING/PUMP/PULLEY - INSTALLATION).
2. Install pump on the engine.
3. Install 3 pump mounting bolts (2) and tighten to 26 N·m (19 ft. lbs.).

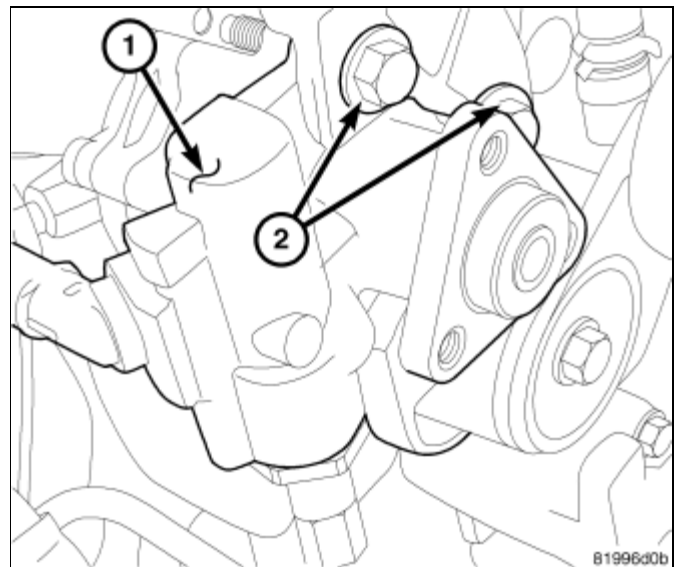


4. Install the pressure line on the pump and tighten to 31 N·m (23 ft. lbs.).
5. Install supply hose on pump.
6. Install drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Fill and bleed the power steering system (Refer to 19 - STEERING - STANDARD PROCEDURE).
8. Check for leaks.
9. Install the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

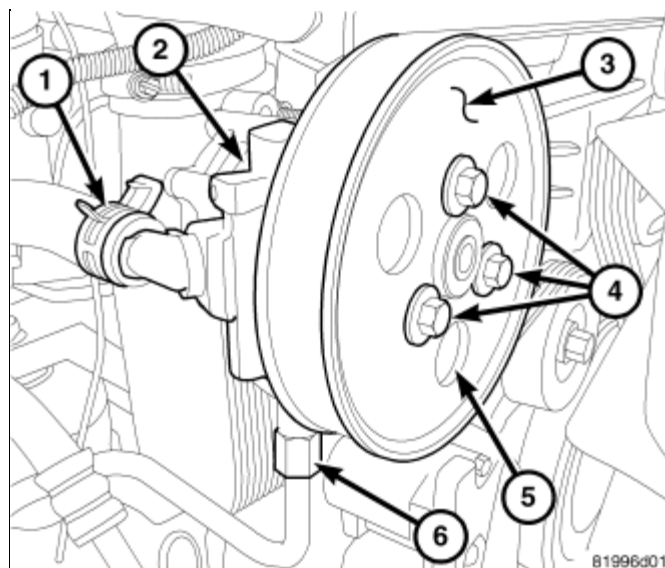
2.8L-DIESEL



1. Install the pump to the vehicle.
2. Install the three bolts (2) securing the pump (1) to the engine and tighten to 47 N·m (35 ft. lbs.).



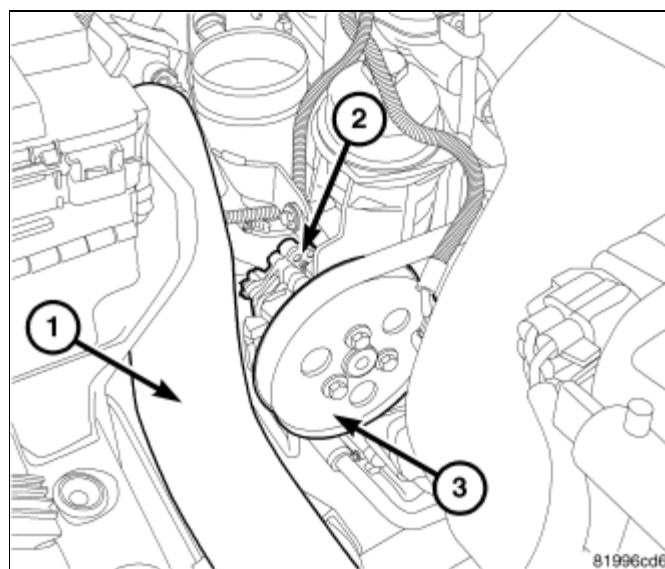
3. Install the power steering hoses (1&6). Tighten to 28 N·m (21 ft. lbs.).
4. Install the power steering pulley to the pump.
5. Install the three bolts (4) securing the pulley (3) to the pump (2).
6. Install the serpentine belt.



7. Install the air inlet tube (1).
8. Install the air cleaner box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).
9. Refill the power steering fluid and bleed the system (Refer to 19 - STEERING - STANDARD PROCEDURE).

SPECIFICATIONS

TORQUE CHART

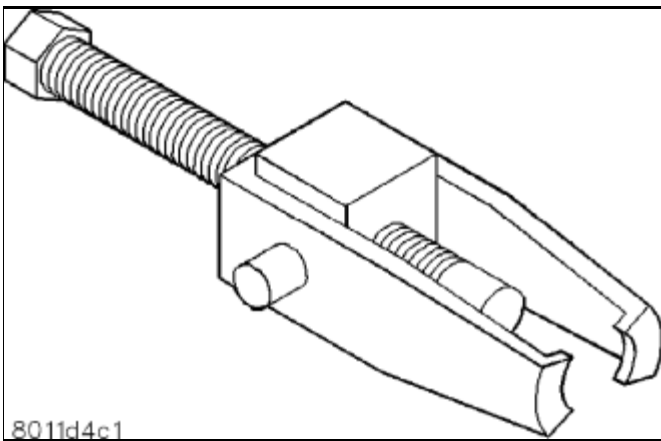
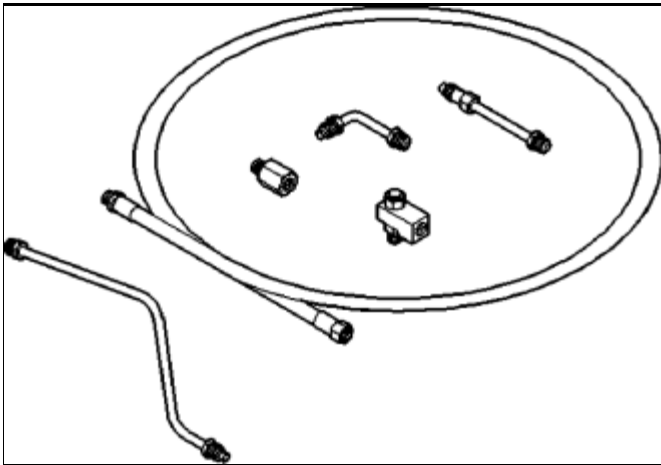
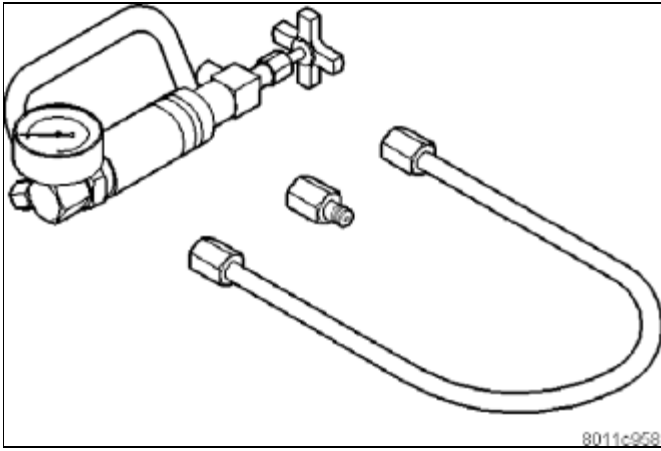


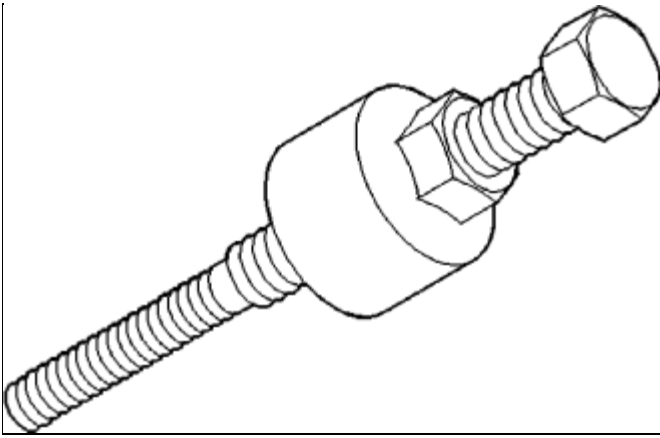
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump to engine	26	19	—
Diesel Power Steering Pump Pulley	28	21	—
Power Steering Pump Pressure Line	31	23	—

SPECIAL TOOLS

POWER STEERING PUMP





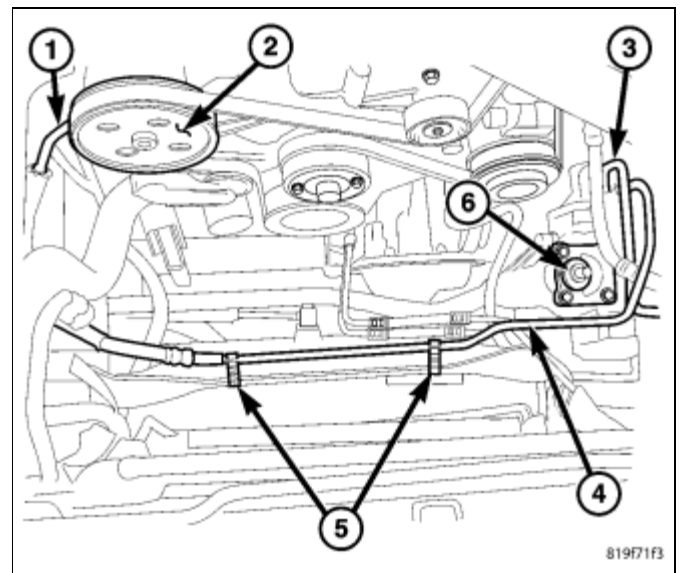
HOSES

DESCRIPTION

PRESSURE LINE

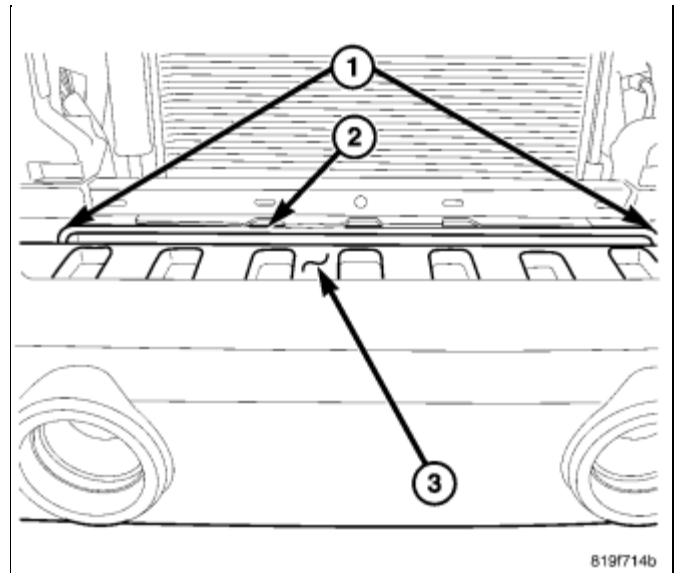
The pressure hose (4) consists of two metal ends two rubber sections and one center metal section. The hose connects to the gear box (6) and to the power steering pump (1).

RETURN LINE



Power steering return line (2) is a hose which is clamped at the reservoir and torqued at the gear mounted under the grille.

DESCRIPTION



The supply hose (3) consists of a rubber section that is clamped at the reservoir and pump (2).

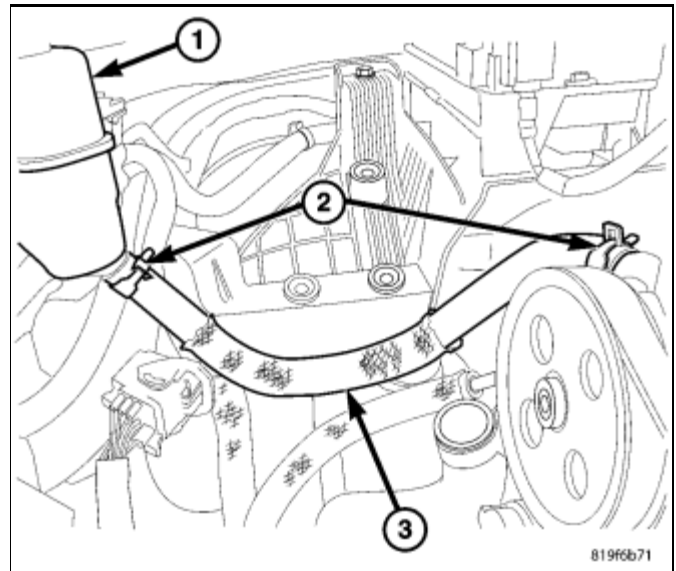
OPERATION

PRESSURE LINE

Power steering pressure line is used to transfer high pressure power steering fluid from the power steering pump to the power steering gear.

RETURN LINE

Power steering return line is used to transfer low pressure power steering fluid from the power steering gear to the power steering reservoir.



OPERATION

The supply hose is used to transfer low pressure P/S fluid from the reservoir to the pump.

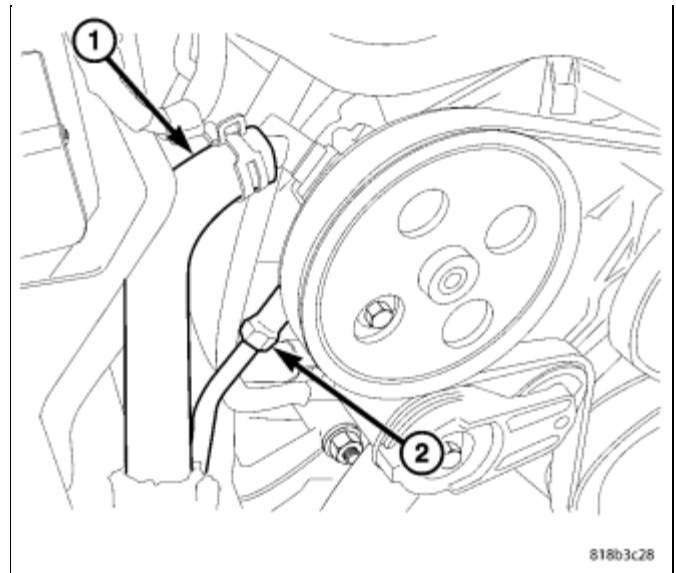
REMOVAL

PRESSURE HOSE

1. Siphon as much fluid as possible from the power steering fluid reservoir.
2. Remove the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING -

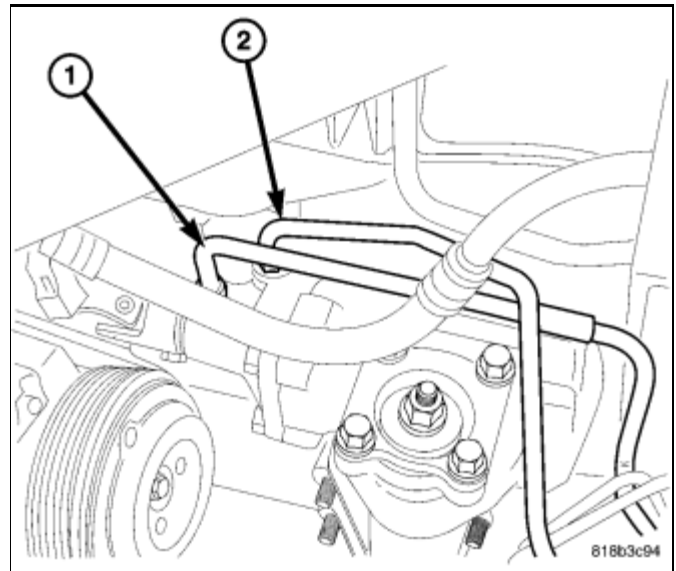
REMOVAL)..

3. Remove the pressure hose (2) at the pump.



4. Move the coolant bottle to the side out of the way.

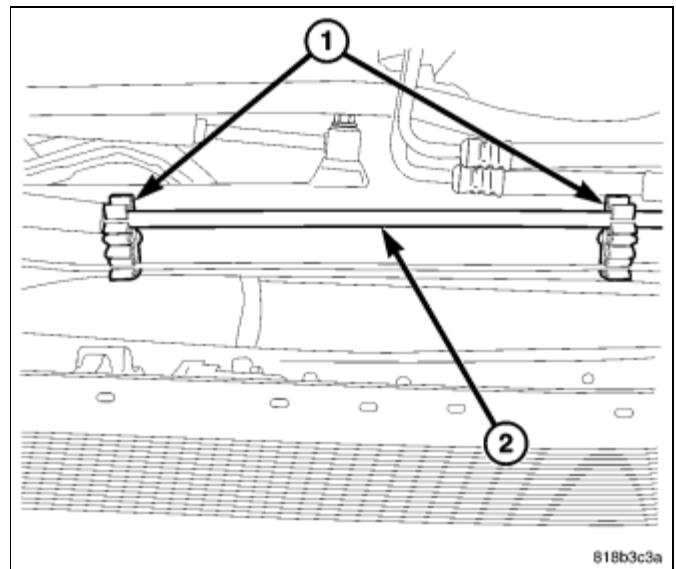
5. Remove the pressure hose (2) at the gear.



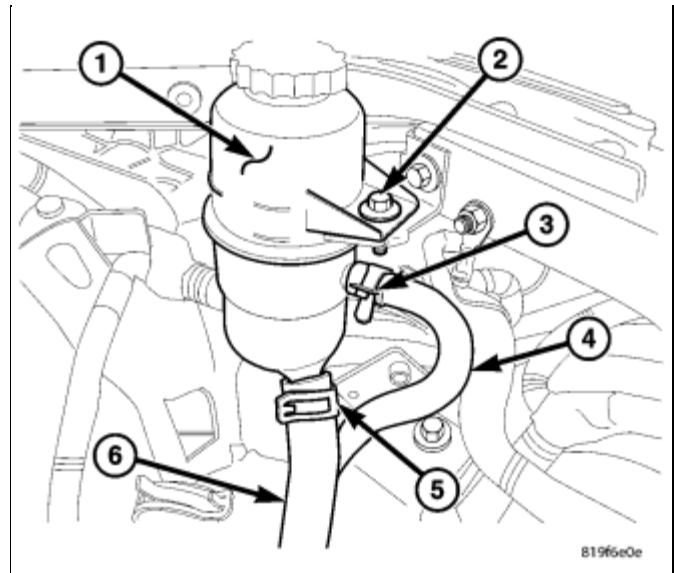
6. Remove the pressure hose from the routing clips (1).

7. Remove the pressure hose (2) from the vehicle.

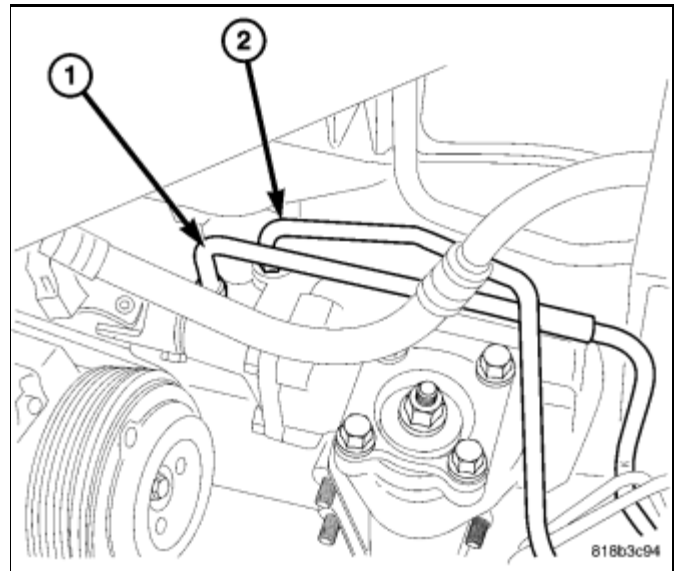
RETURN HOSE



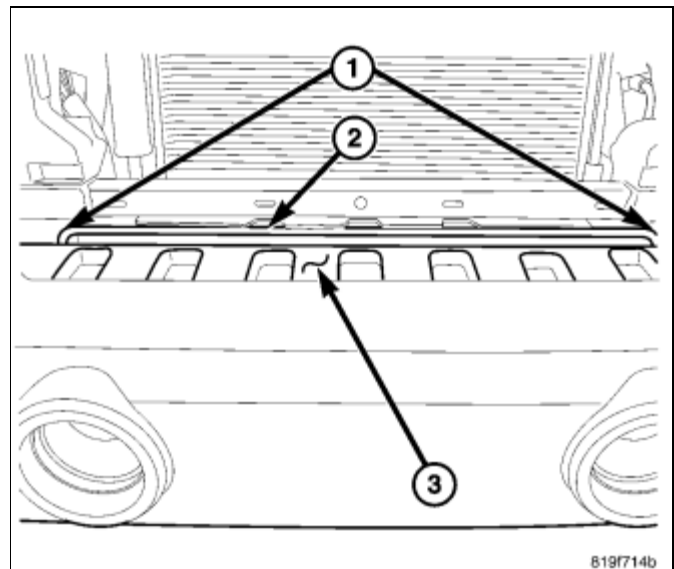
1. Siphon as much fluid as possible from the power steering fluid reservoir.
2. Remove the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
3. Remove the clamp (3) for the return hose (4) at the reservoir (1) and then remove the hose.



4. Move the coolant bottle to the side out of the way.
5. Remove the return hose (1) at the gear.



6. Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
7. Remove the panel in between the grille and the bumper (3).
8. Remove the return hose routing clips (1) at the body.
9. Remove the return hose (2) from the vehicle.

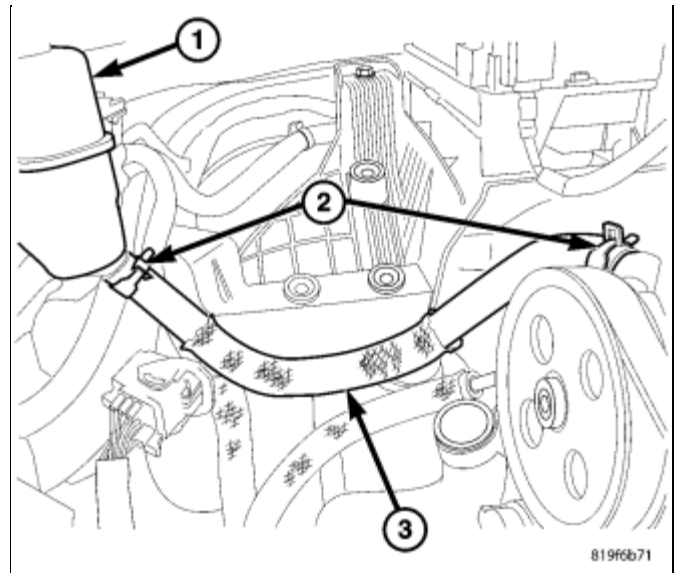


SUPPLY HOSE

1. Siphon as much fluid as possible from the power steering fluid reservoir.
2. Remove the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL)..
3. Remove the supply hose (3) at the reservoir (1).
4. Remove the supply hose (3) at the pump.
5. Remove the supply hose (3) from the vehicle.

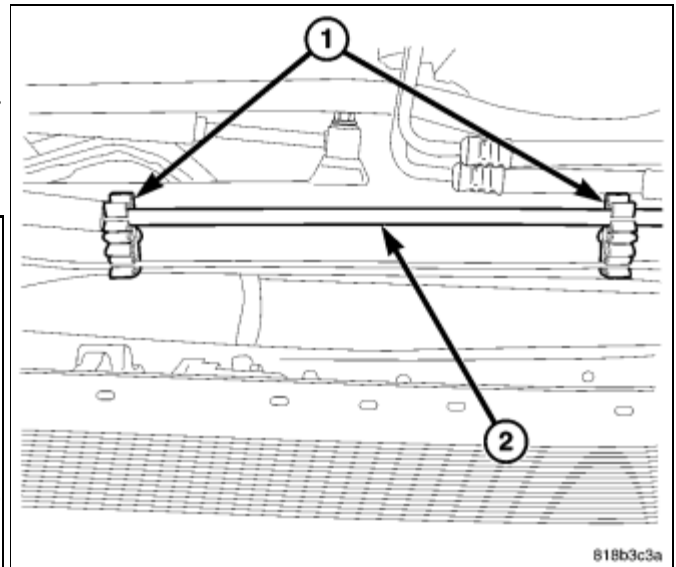
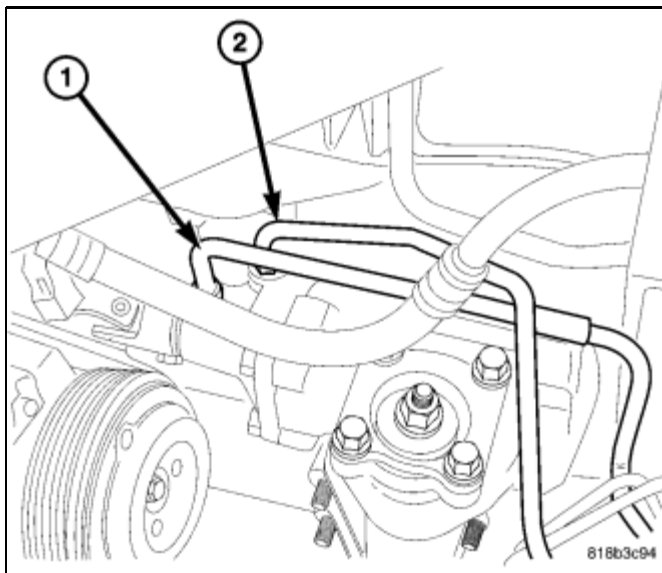
INSTALLATION

PRESSURE HOSE



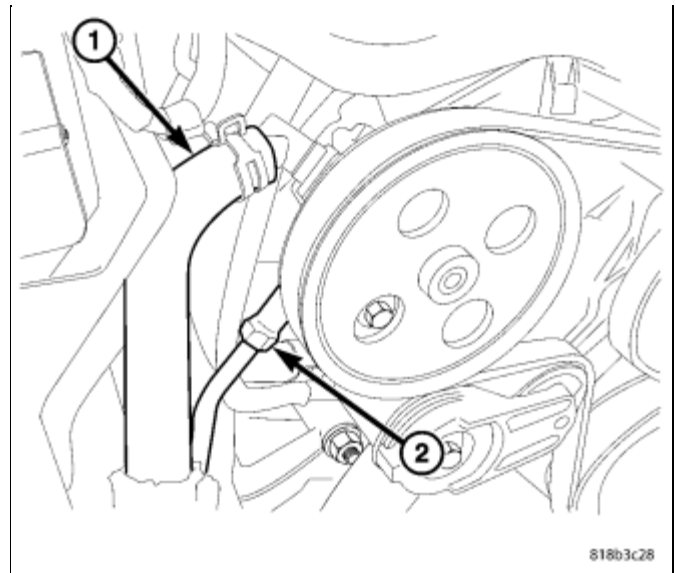
1. Install the pressure hose to the vehicle.
2. Install and secure the pressure hose at the routing clips (1).

3. Install the Pressure hose (2) at the gear. Tighten the tube nut to 36 N·m (27 ft. lbs.).

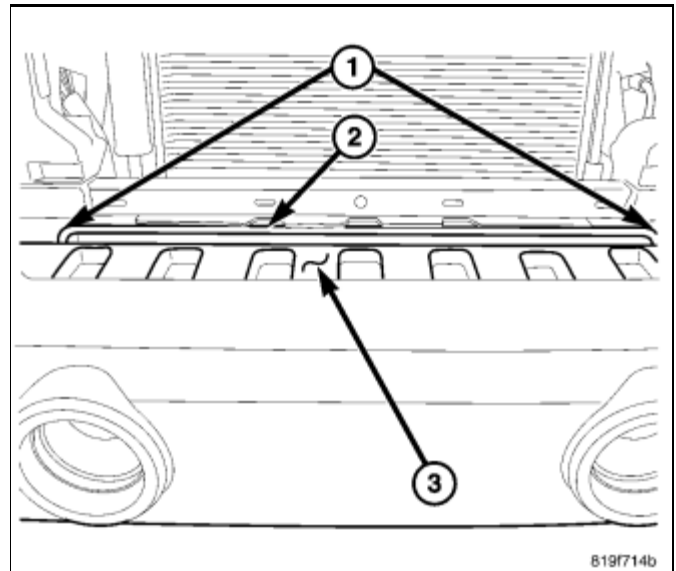


4. Install the pressure hose (2) at the pump pressure port. Tighten the tube nut to 31 N·m (23 ft. lbs.).
5. Reinstall the coolant bottle back into position.
6. Fill and bleed the power steering system (Refer to 19 - STEERING - STANDARD PROCEDURE).
7. Check for leaks.
8. Install the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

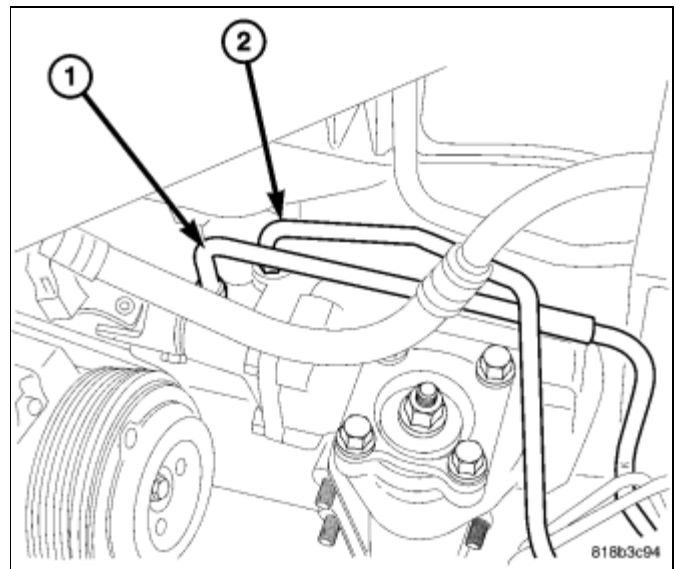
RETURN HOSE



1. Install the return hose (2) to the vehicle.
2. Install and secure the return hose at the routing clips (1).
3. Install the bumper to grille panel (3).

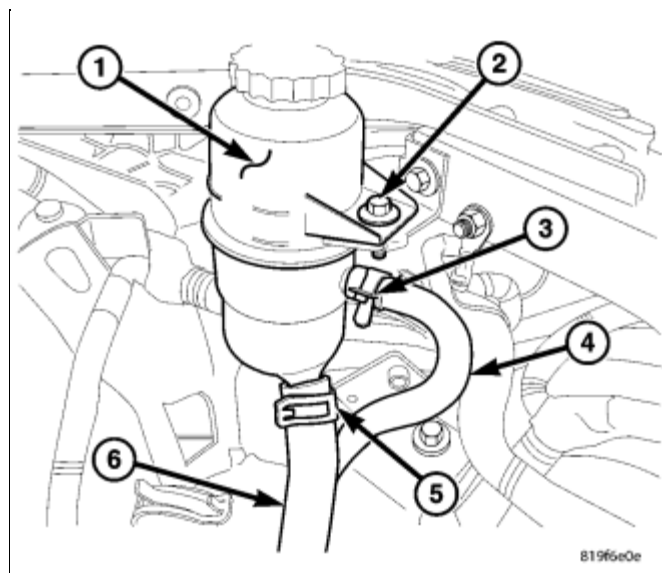


4. Install the return hose (1) at the gear. Tighten the tube nut to 32 N·m (24 ft. lbs.).



5. Install the return hose (4) at the reservoir (1) and reclamp (3).
6. Reinstall the coolant bottle back into position.
7. Fill and bleed the power steering system (Refer to 19 - STEERING - STANDARD PROCEDURE).
8. Check for leaks.
9. Install the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).
10. Install the front grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

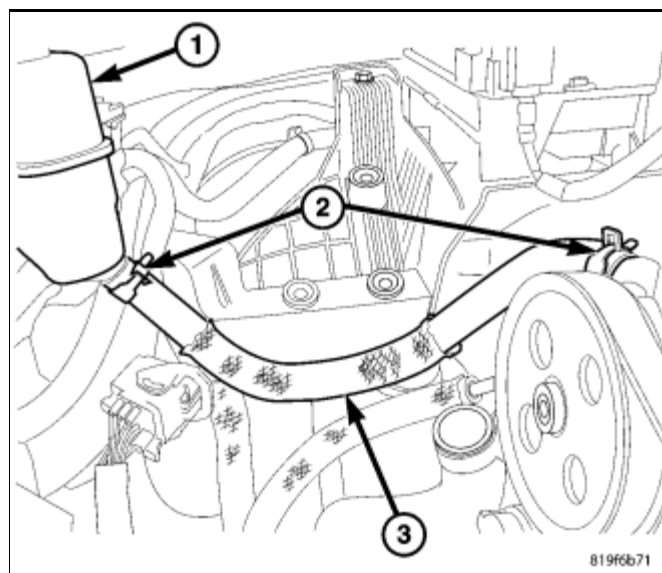
SUPPLY HOSE



1. Install the supply hose (3) to the vehicle.
2. Install the supply hose at the pump (2).
3. Install the supply hose to the reservoir (2).
4. Fill and bleed the power steering system (Refer to 19 - STEERING - STANDARD PROCEDURE).
5. Check for leaks.
6. Install the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

FLUID

DESCRIPTION



The recommended fluid for the power steering system is Mopar® ATF +4.

Mopar® ATF+4, when new is red in color. The ATF+4 is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF+4 will begin to look darker in color and may eventually become brown. **THIS IS NORMAL.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

STANDARD PROCEDURE

POWER STEERING FLUID LEVEL CHECKING

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH THE ENGINE OFF TO PREVENT PERSONAL INJURY FROM MOVING PARTS.

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The power steering fluid level can be viewed on the dipstick attached to the filler cap. There are two ranges listed on the dipstick, COLD and HOT. Before opening power steering system, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dipstick. When the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F), the fluid level should read between the minimum and maximum area of the cold range. When the fluid is hot, fluid level is allowed to read up to the highest end of the HOT range. Only add fluid when the vehicle is cold.

Use only **Mopar® ATF+4**. Do not overfill the power steering system.

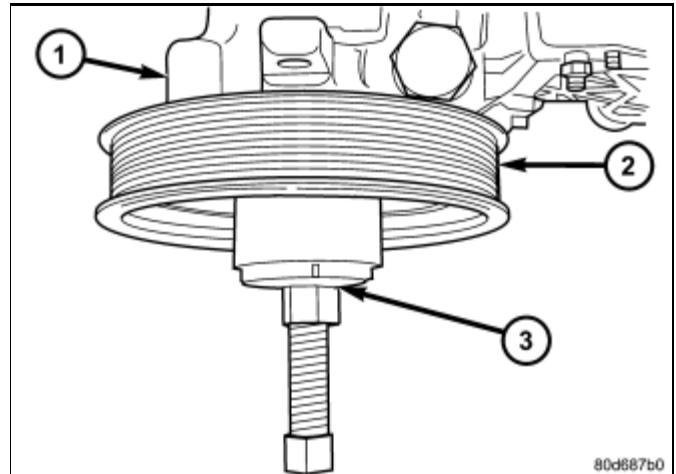
PULLEY

REMOVAL

GAS

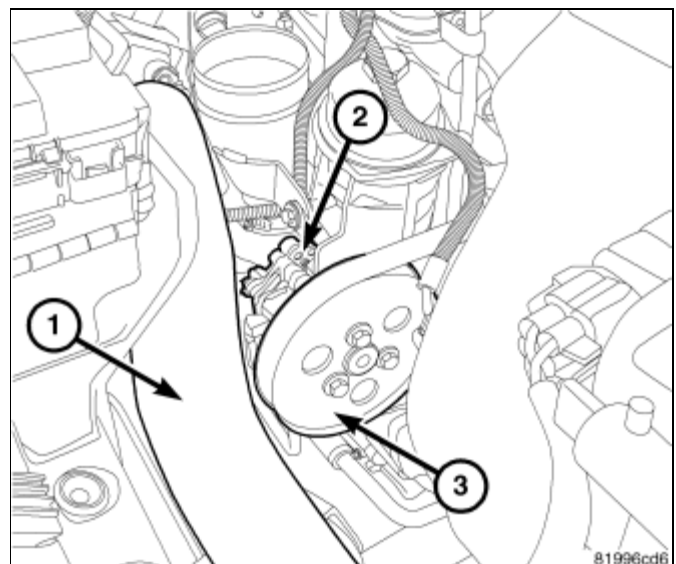
CAUTION: Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

1. Remove the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL)..
2. Remove the pulley (2) from the pump using (OTC® 7185) power steering pulley removal tool or equivalent (3).



DIESEL

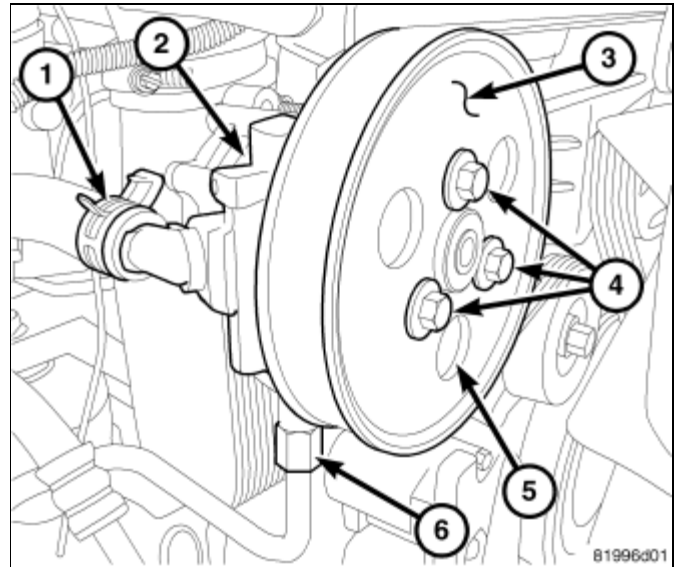
1. Remove the air cleaner box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
2. Remove the air inlet tube (1).



3. Remove the serpentine drive belt.
4. Remove the three bolts (4) securing the pulley (3) to the pump (2).

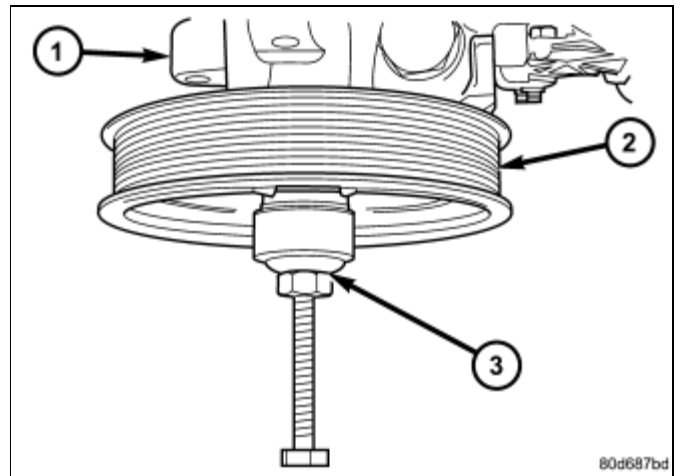
INSTALLATION

GAS



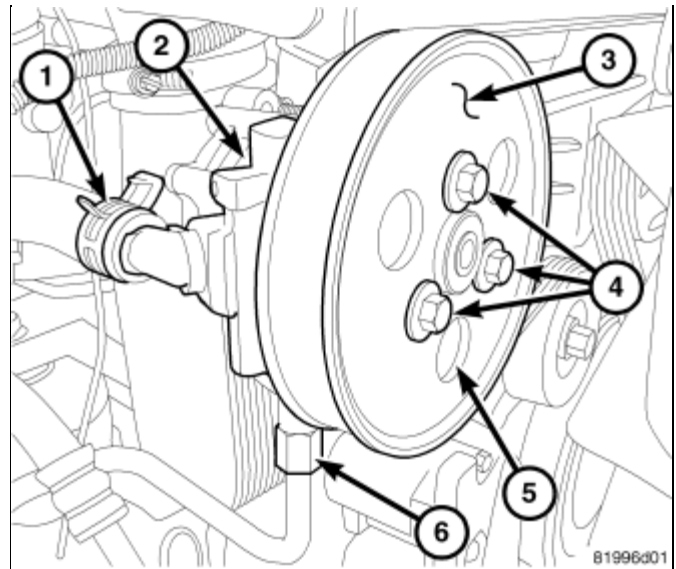
CAUTION: Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

1. Replace the pulley (2) if it's bent, cracked, or loose.
2. Install the pulley (2) on the pump (1) using (OTC® 7771) power steering pulley installation tool or equivalent (3) making sure it is flush with the end of the shaft. Ensure the tool and pulley remain aligned with the pump shaft.
3. Install the air box assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).
4. Run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**



DIESEL

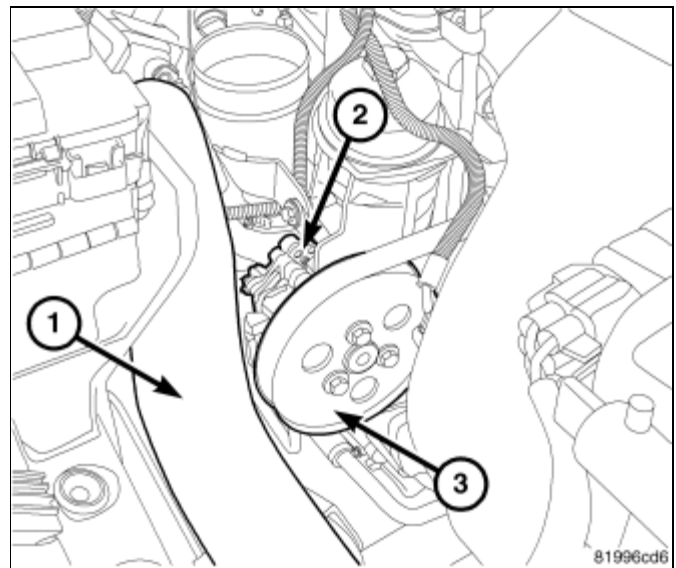
1. Install the pulley (3) to the pump shaft.
2. Install the three bolts (4) securing the pulley (3) to the pump (2). Tighten to 47 N·m (35 ft. lbs.).



3. Install the serpentine belt.
4. Install the air inlet tube (1).
5. Install the air cleaner box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

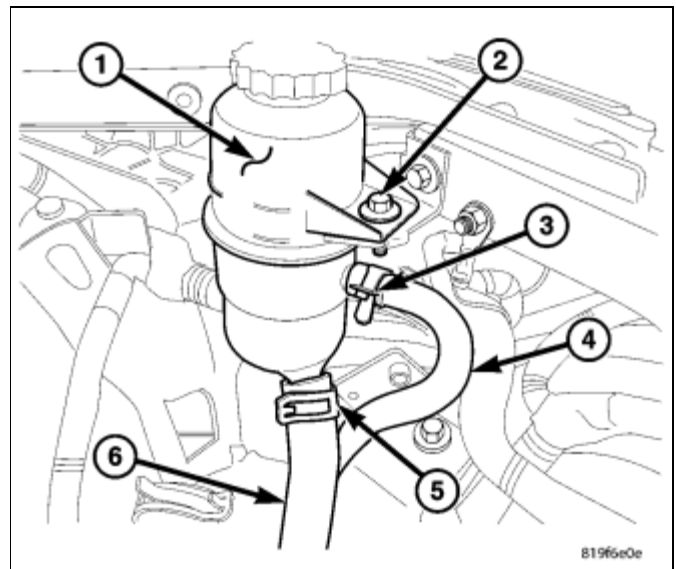
RESERVOIR

REMOVAL

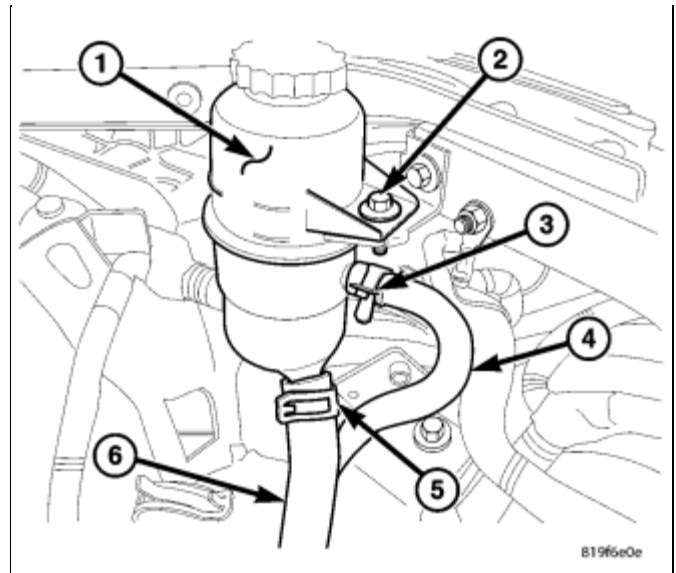


1. Siphon the power steering reservoir (1).
2. Loosen and move the hose clamps (3&5) backwards on the power steering hoses at the reservoir (1).
3. Remove the return hose (4) from the reservoir.
4. Remove the supply hose (6) from the reservoir.
5. Remove the reservoir mounting bolt (2).
6. Remove the reservoir (1).

INSTALLATION



1. Install the reservoir (1) onto the mounting bracket.
2. Install the mounting bolt (2).
3. Install the supply hose (6) to the reservoir (1).
4. Install the return hose (4) to the reservoir (1).
5. Reconnect the hose clamps (3&5) on the hoses at the reservoir (1).
6. Add power steering fluid, (Refer to 19 - STEERING - STANDARD PROCEDURE).



21 - TRANSMISSION AND TRANSFER CASE

MANUAL TRANSMISSION - NSG370

MANUAL TRANSMISSION - NSG370

DIAGNOSIS AND TESTING

MANUAL TRANSMISSION - NSG370

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill or incorrect lubricant level check.

Rear transmission leaks will be from the oil seals or component mating surfaces.

Front transmission leaks will be from the front input shaft retainer seal. Lubricant may drip from the clutch housing after extended operation. If leak is severe, it may contaminate the clutch disc.

Lubricant level check can only be made when the vehicle is level and allowing the lubricant to settle for a minute before checking. This will ensure an accurate check and avoid an under filled or over filled condition.

HARD SHIFTING

Hard shifting is usually caused by low lubricant level, improper or contaminated lubricants. This will cause noise, excessive wear, internal bind, and hard shifting. Substantial lubricant leaks can result in gear, shift rail, synchro, and bearing damage. The first indications of component damage is usually hard shifting and noise.

Shift component damage, clutch adjustment, worn pressure plate or disc are also causes of increased shift effort. If clutch problem is advanced, gear clash during shifts can result. Worn or damaged synchronizer rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

TRANSMISSION NOISE

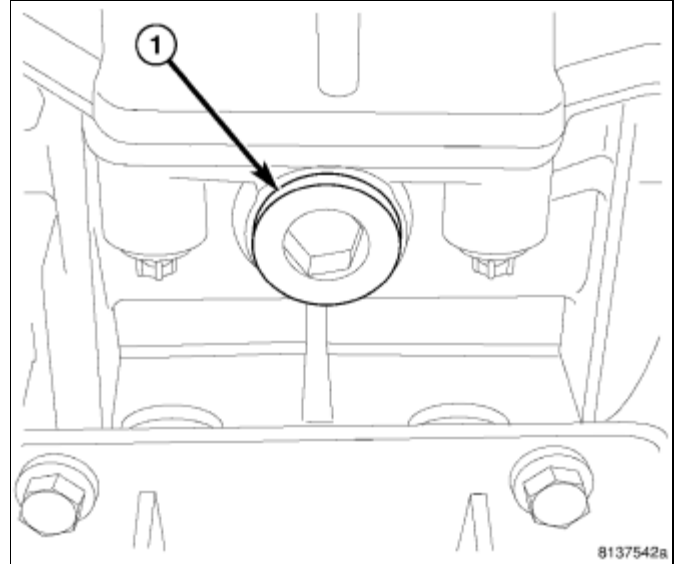
Most manual transmissions make some noise during normal operation. Rotating gears generate a mild whine that is audible, but generally only at extreme speeds.

Severe, highly audible transmission noise is generally the initial indicator of a lubricant problem. Insufficient, improper or contaminated lubricant will promote rapid wear of gears, synchronizers, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear and bearing damage.

STANDARD PROCEDURE

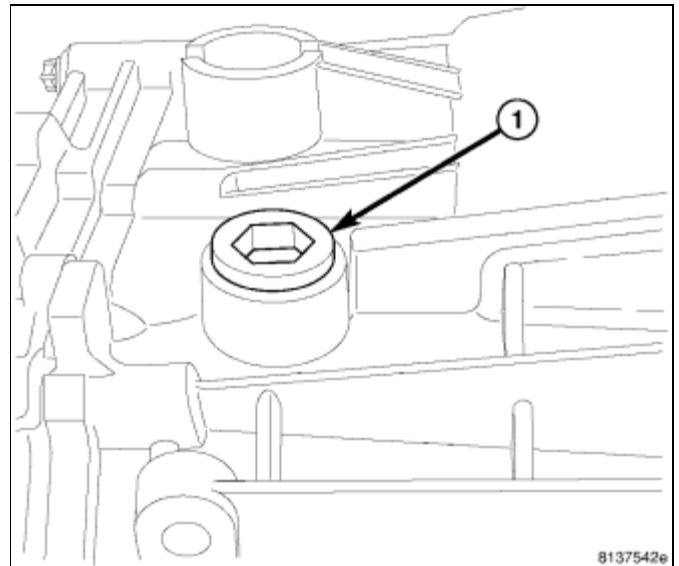
DRAIN AND FILL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove drain plug (1) and drain fluid.

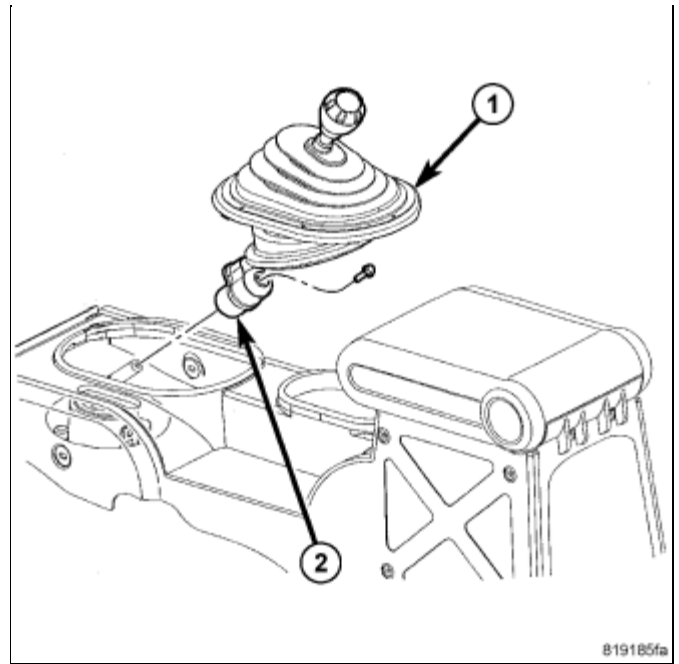


3. Install drain plug and remove fill plug (1).
4. Fill transmission with 1.5 L (3.17 pts.) of Mopar® Manual Transmission Lubricant MS-9224 or to the bottom of the fill plug (1) hole.

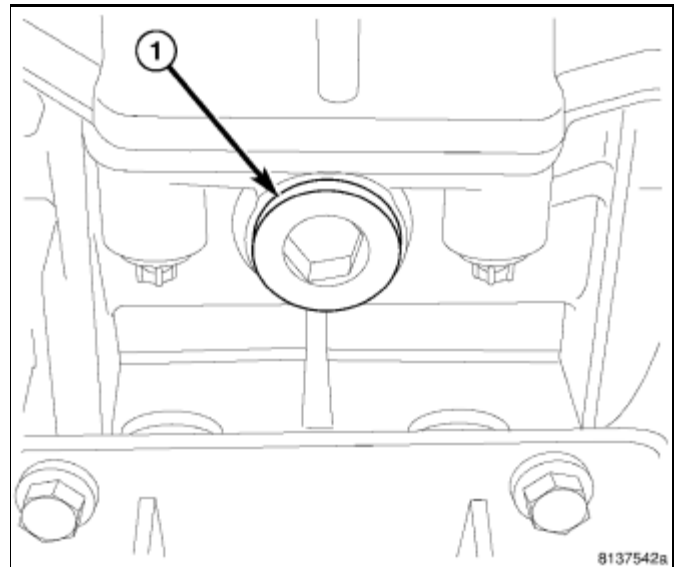
REMOVAL



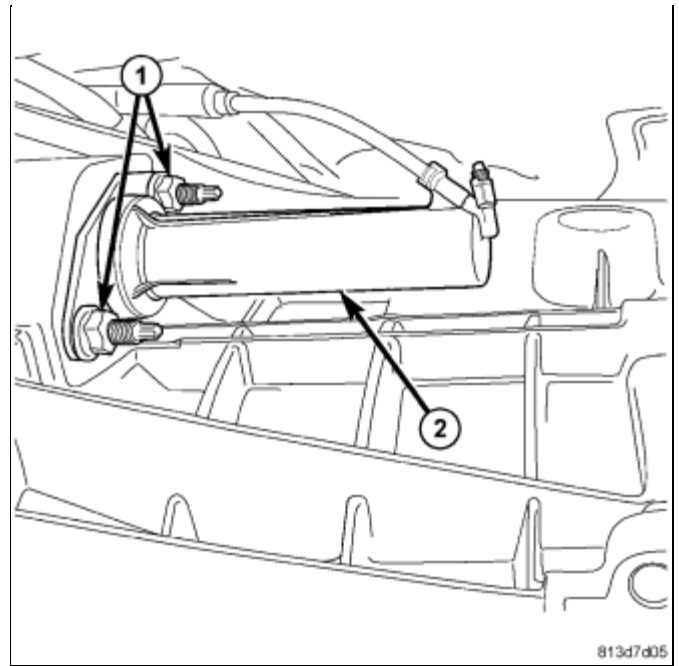
1. Disconnect negative battery cable.
2. With vehicle in neutral, position vehicle on hoist.
3. Slide shift lever boot (1) up and remove shift lever bolt and lever (2).



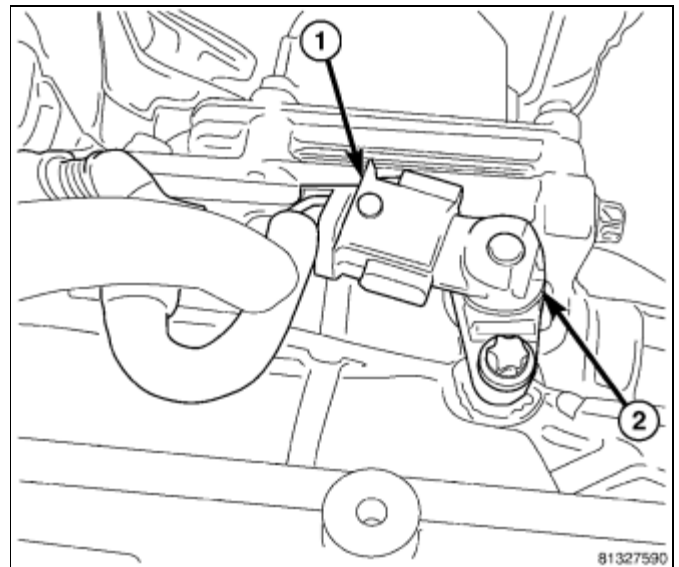
4. Remove drain plug (1) and drain fluid.
5. Remove transfer case skid plate.
6. Remove 3.8L catalyst assembly.
7. Mark installation reference marks on propeller shaft/shafts and remove shafts.
8. Remove transfer case shift linkage, wiring connector, and vent hose, if equipped.
9. Remove transfer case, if equipped.



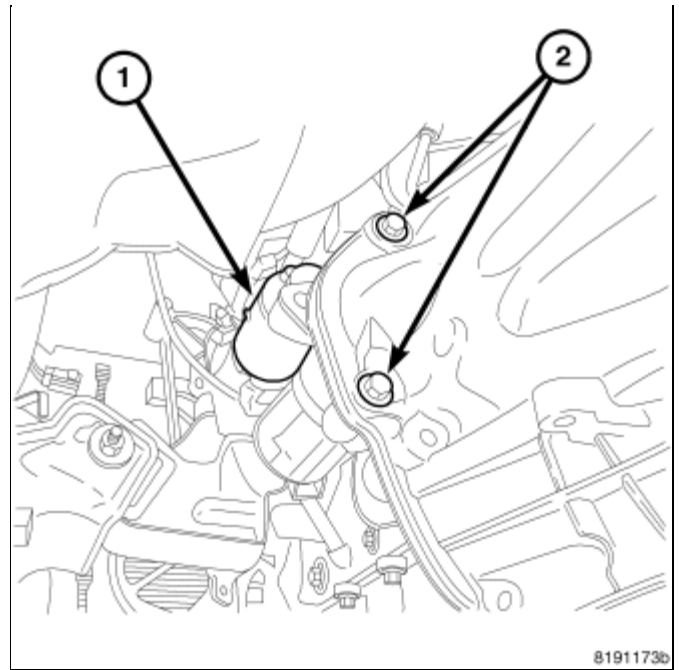
10. Remove clutch slave cylinder (1) nuts (2) and remove cylinder.



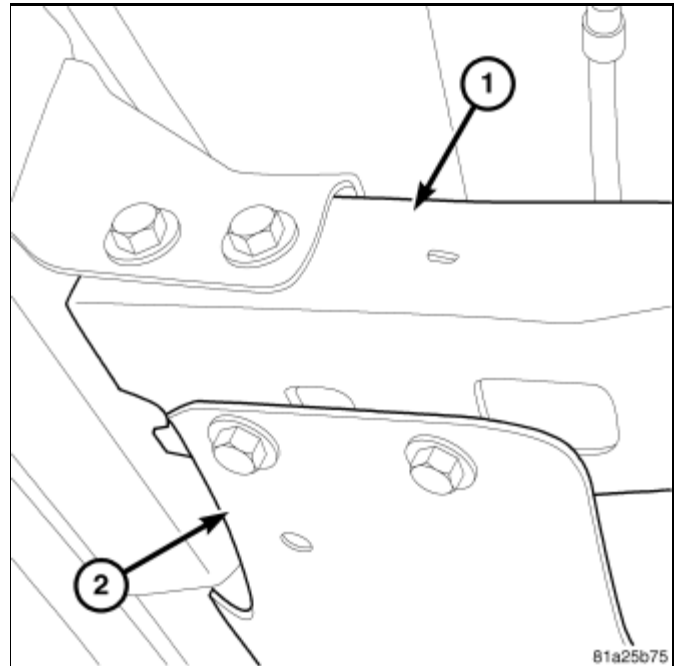
11. Remove backup lamp switch (2) wiring connector (1).



12. Remove starter (1) bolts (2) and remove starter.



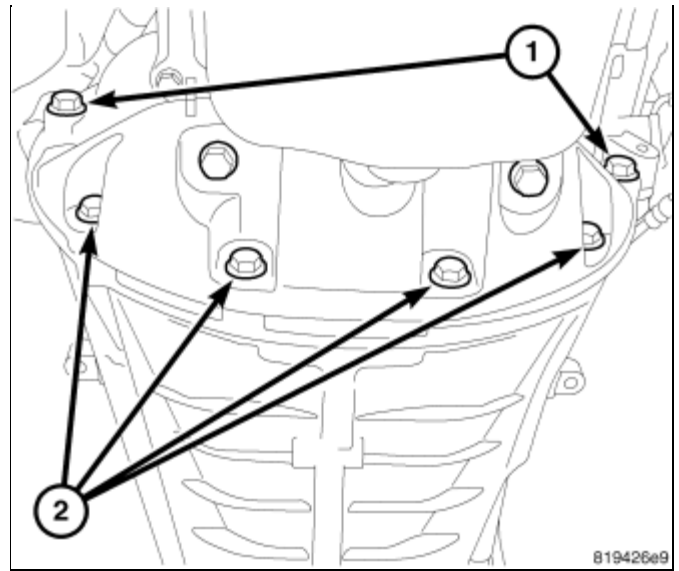
13. Support transmission with jack.
14. Remove transmission mount, crossmember (1) and skid plate (2) bolts. Lower and slid crossmember out left side of the vehicle.



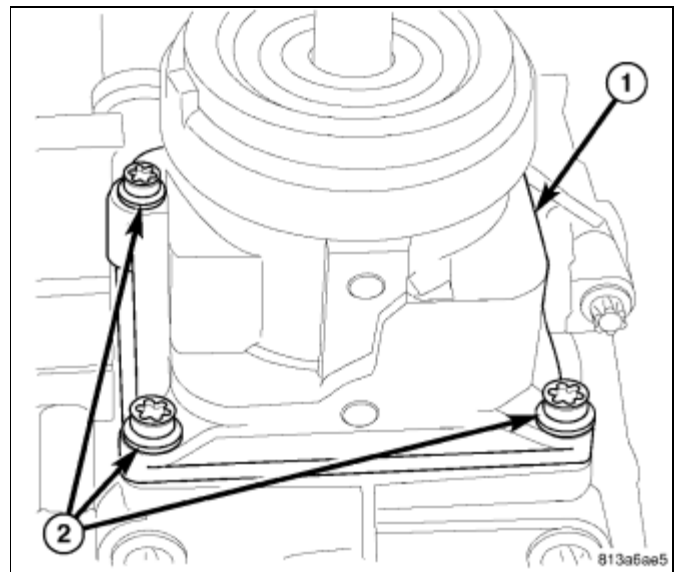
15. Remove transmission bolts from engine (1) and structural cover (2).

NOTE: Do not remove the structural cover from the engine. If cover is removed clutch housing and structural dust cover must be aligned with the engine.

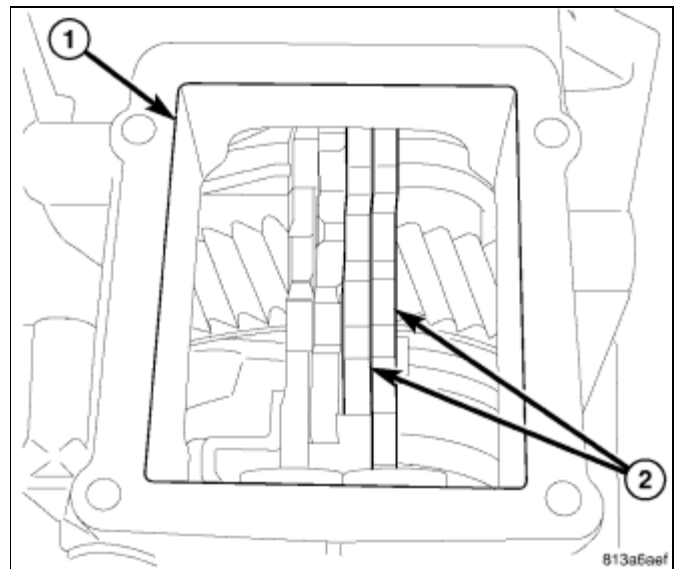
DISASSEMBLY



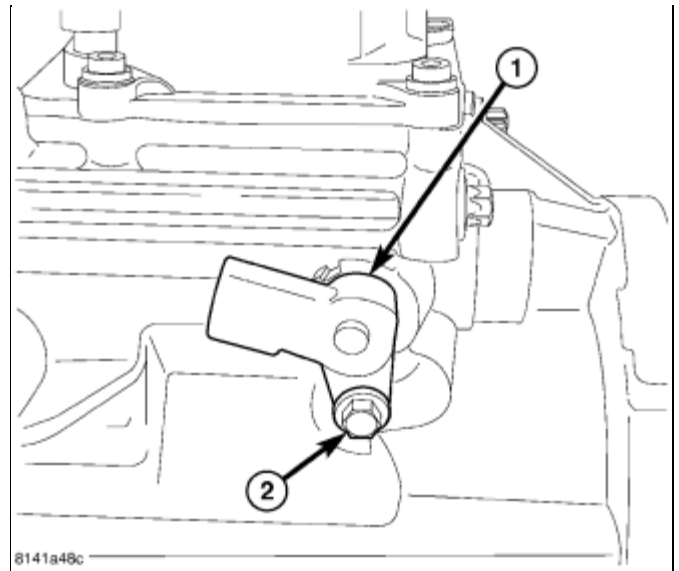
1. Remove shift tower (1) bolts (2) and remove tower.



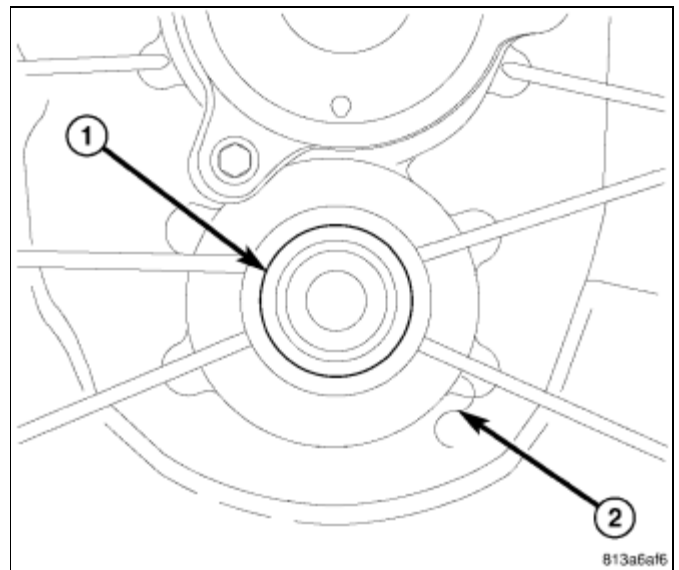
2. Through shift tower opening (1) shift two shift rails (2) forward to engage two gears.



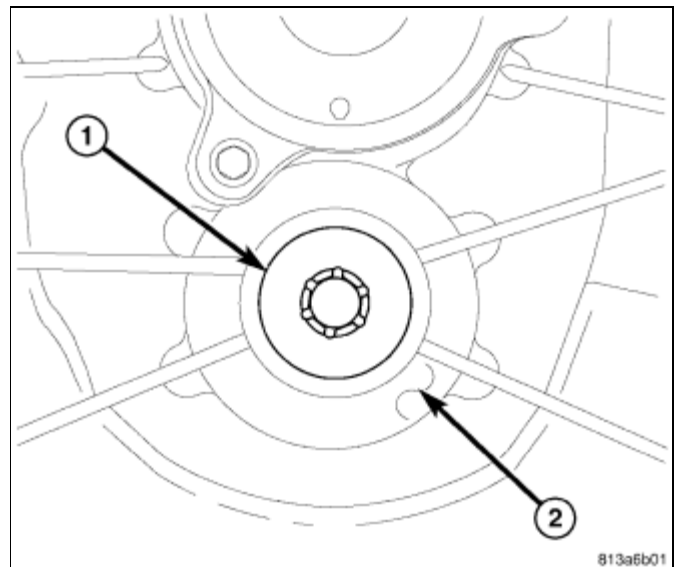
3. Remove back-up lamp switch (1) bolt (2) and remove switch.



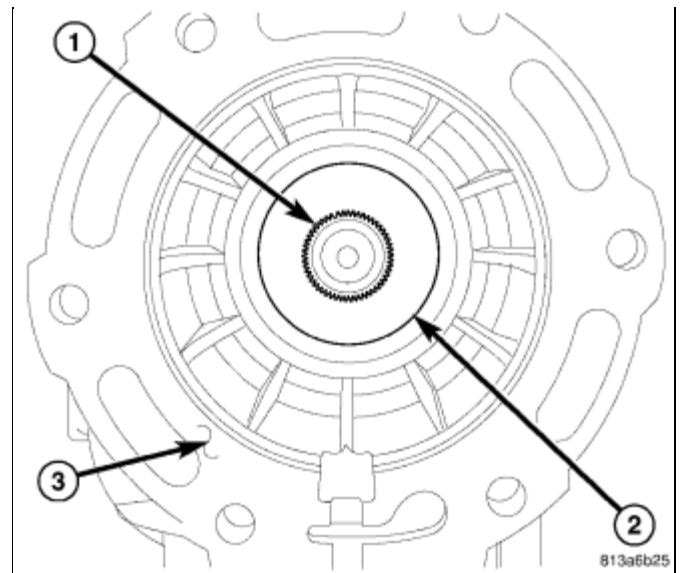
4. Remove countershaft plug (1) from the front housing (2) with a seal pick.



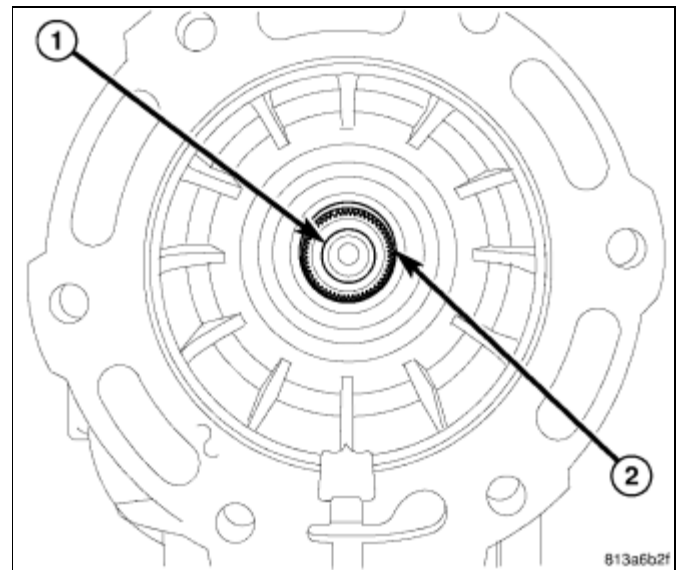
5. Remove countershaft bolt (1) from the front housing (2).



6. Remove output shaft (1) seal (2) from rear housing (3) with a seal pick.

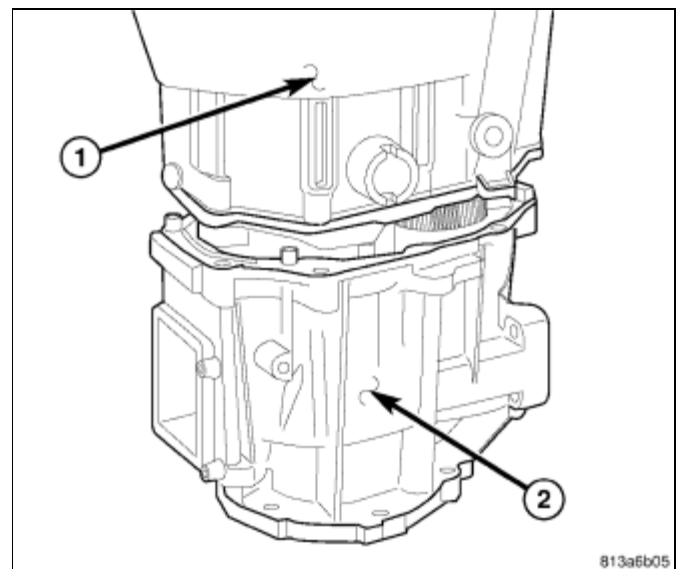


7. Remove output shaft (1) snap ring (2) 4x4 only.

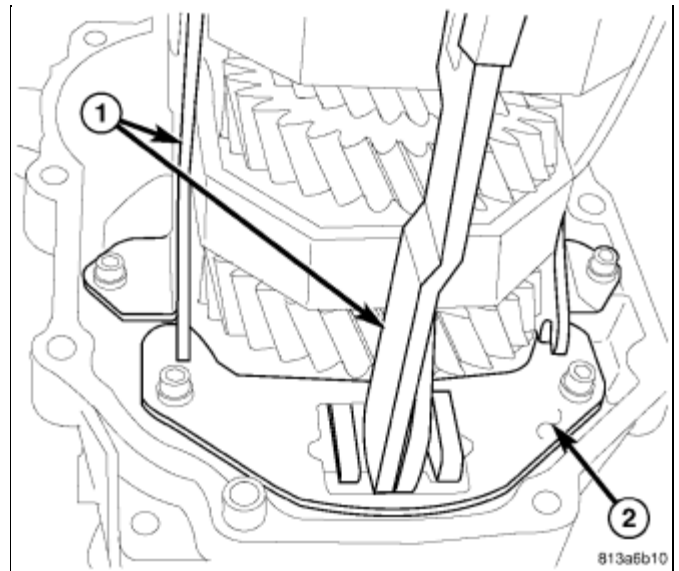


8. Stand transmission on the rear housing and remove the housing bolts.

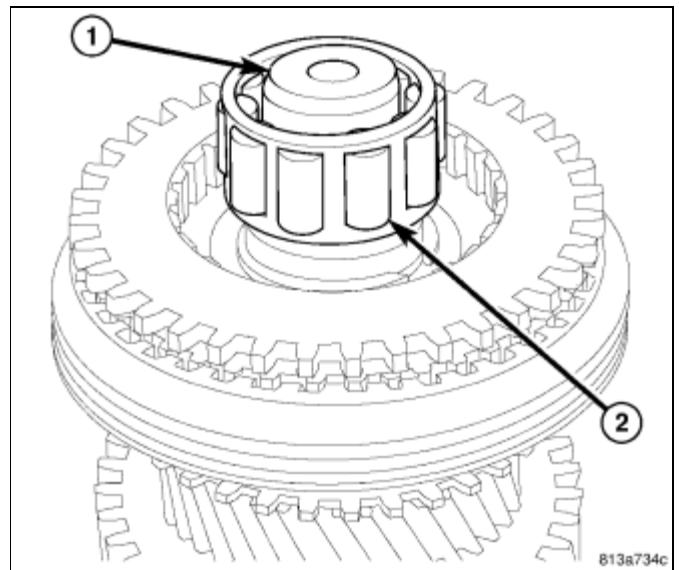
9. Remove front housing (1) from the rear housing (2).



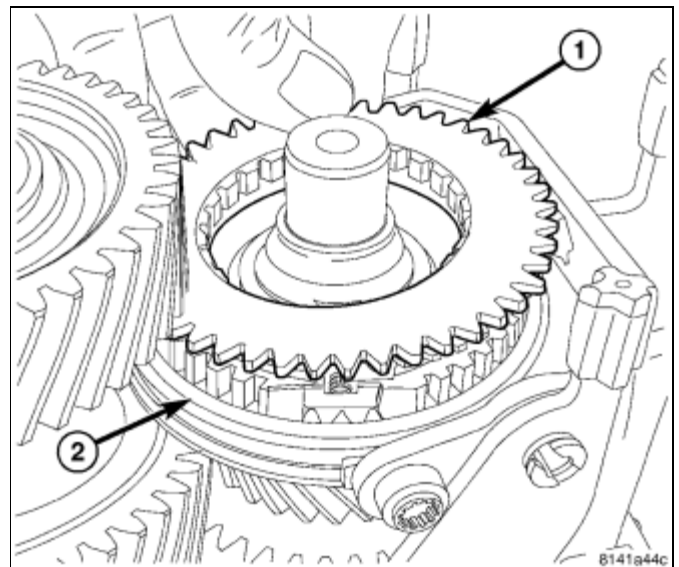
10. Remove shift rails (1) support plate (2) bolts.



11. Remove input shaft (1) roller bearing (2).

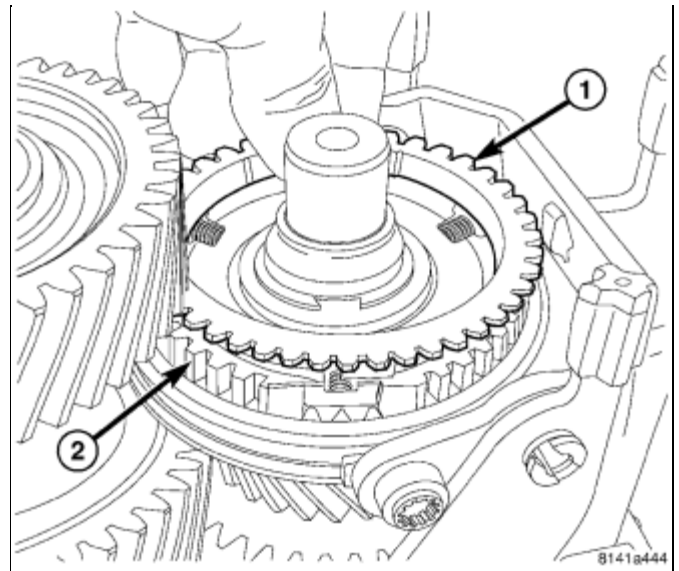


12. Remove fifth gear synchronizer blocker ring (1) from 5-6 synchronizer hub (2).

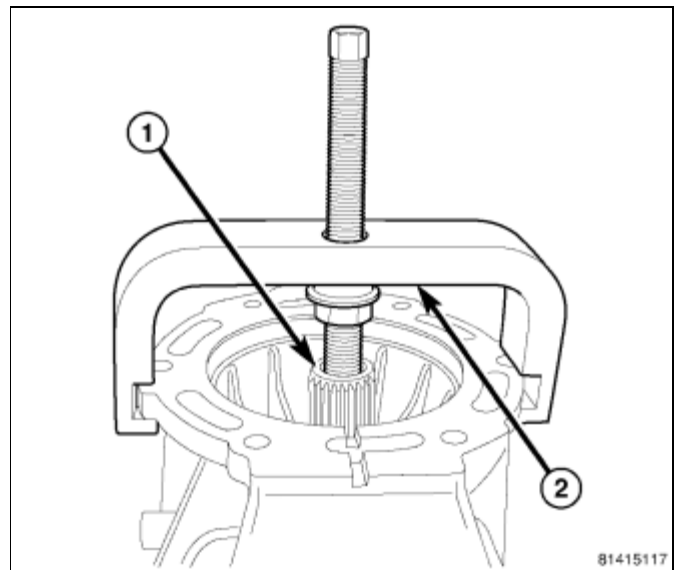


13. Remove fifth gear synchronizer friction ring (1) from 5-6 synchronizer hub (2).

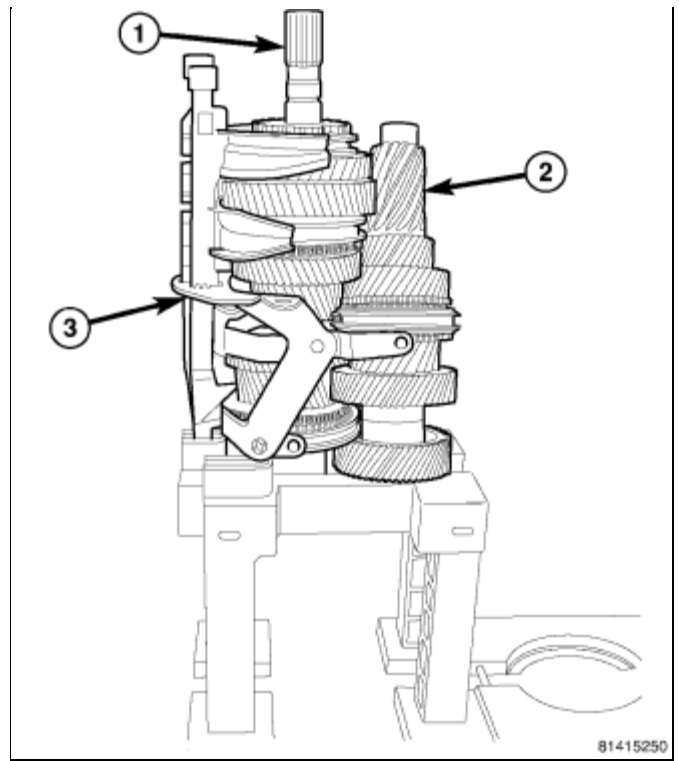
14. Set geartrain and shift rails with rear housing into Build Fixture 9633.



15. Remove mainshaft shaft (1) from rear housing bearing with Remover 9636 (2).

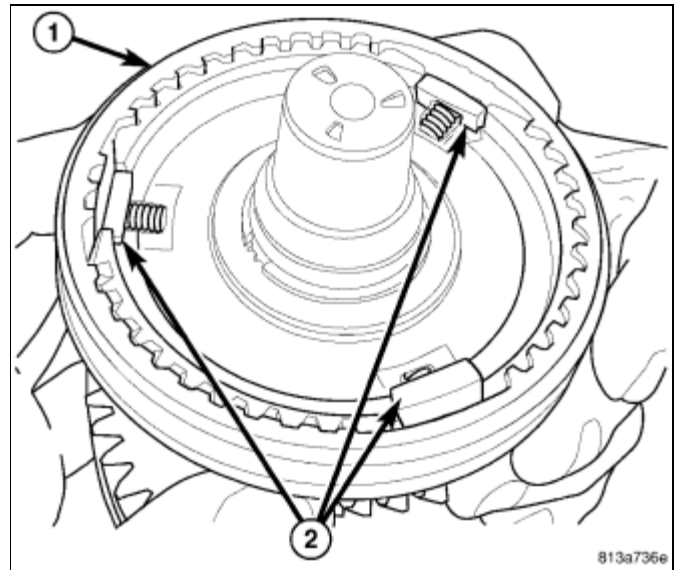


16. Remove mainshaft (1), countershaft (2) and shift rails/forks (3) from fixture.

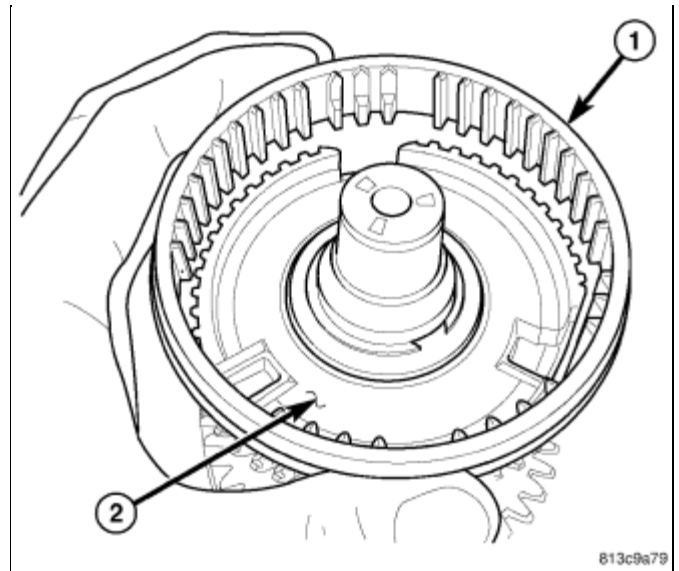


MAINSHAFT

1. Place mainshaft with 5-6 synchronizer facing up in build Fixture 9648 and place in a vise.
2. Push 5-6 synchronizer sleeve (1) down on hub and remove detents (2) springs and balls.

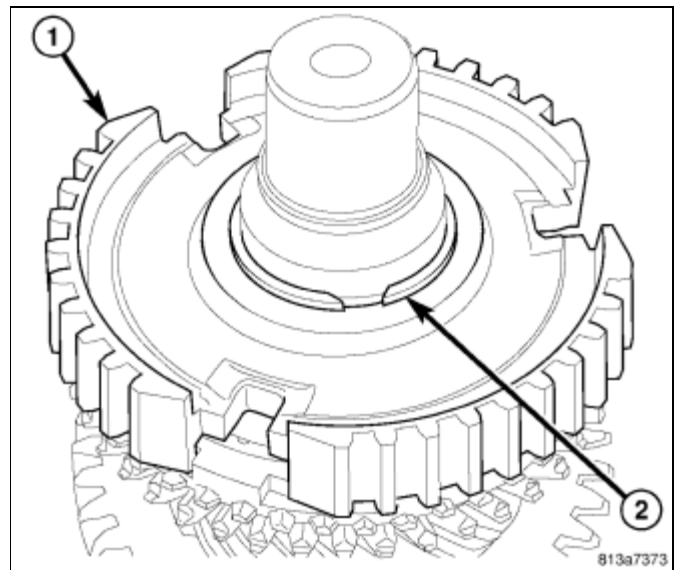


3. Remove 5-6 synchronizer sleeve (1) from hub (2).

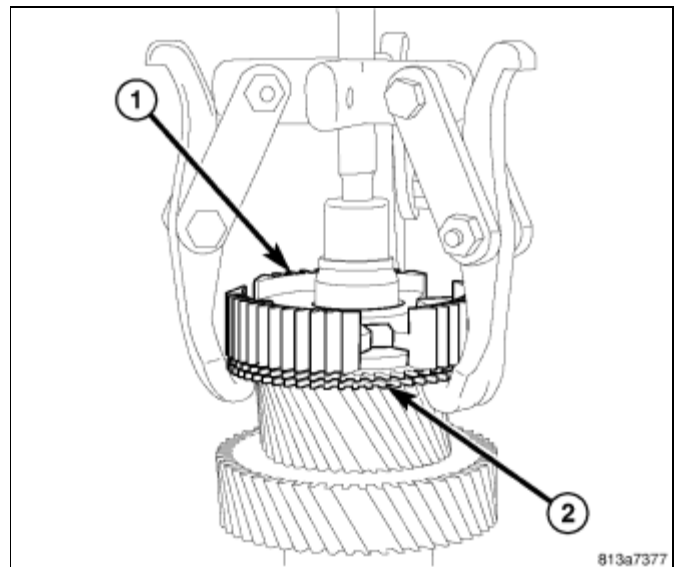


4. Remove 5-6 synchronizer hub (1) snap ring (2).

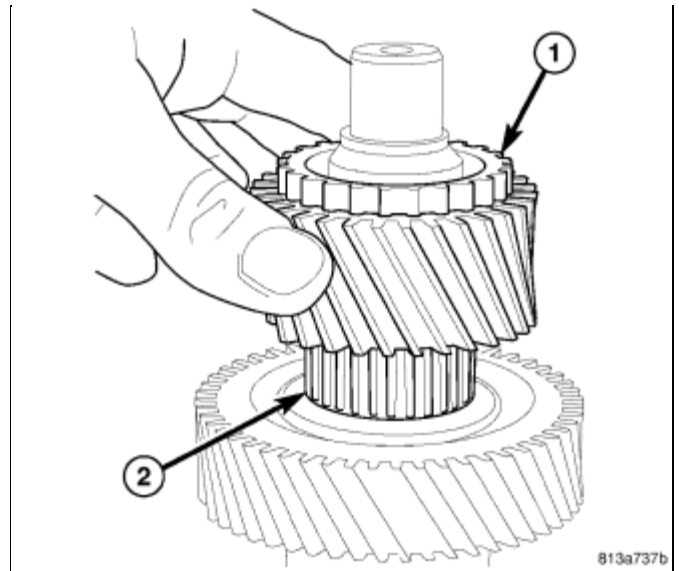
NOTE: All snap rings are select fit from the factory, and must be installed in their original location.



5. Remove 5-6 synchronizer hub (1) and sixth gear synchronizer rings (2) with a three jaw puller. Place puller jaws under sixth gear synchronizer rings (2).

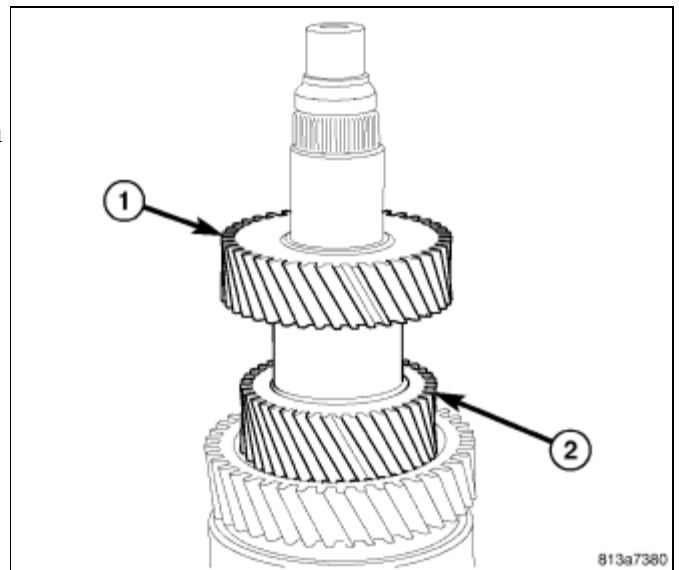


6. Remove sixth gear (1) and bearing (2).

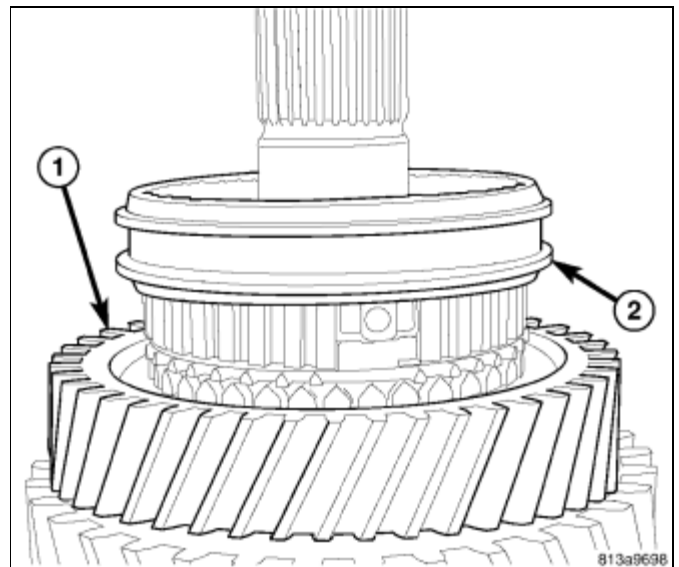


7. Third gear (1) and fourth gear (2) are serviced with the mainshaft only.

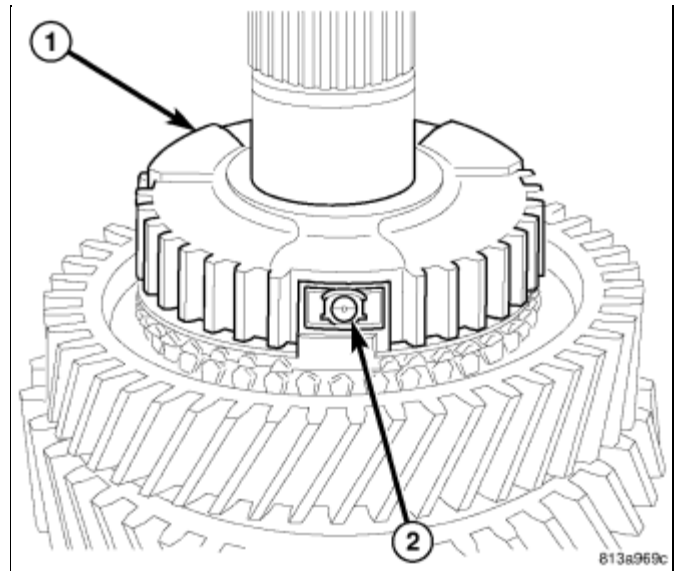
8. Remove mainshaft from Fixture 9648. Turn fixture over in vise and set opposite end of mainshaft in the fixture.



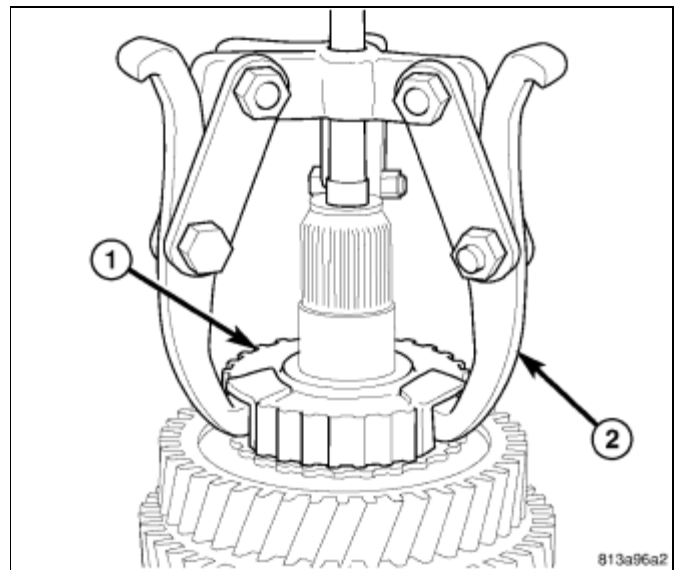
9. Remove reverse gear (1) synchronizer sleeve (2) off synchronizer hub.



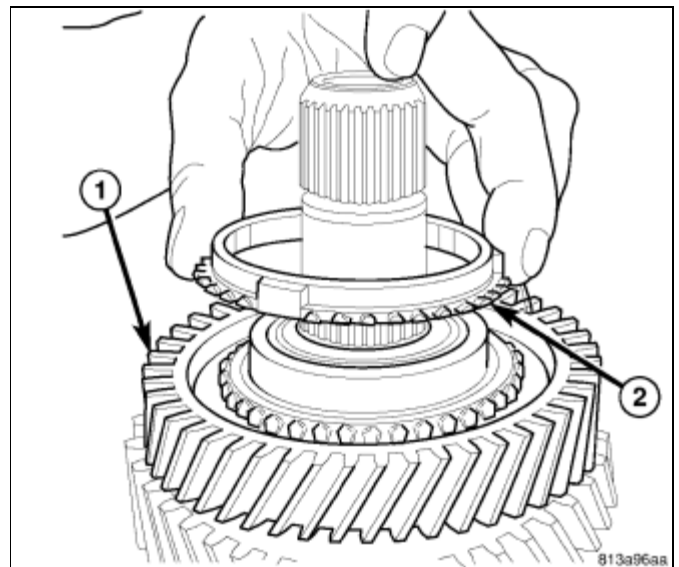
10. Remove reverse synchronizer hub (1) detents (2).



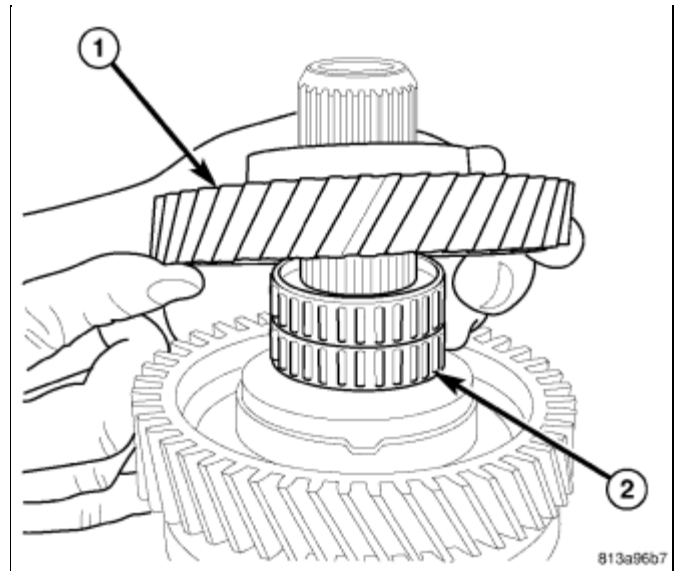
11. Remove reverse synchronizer hub (1) with three jaw puller (2). Place puller jaws in hub detent openings.



12. Remove reverse gear (1) synchronizer ring (2).

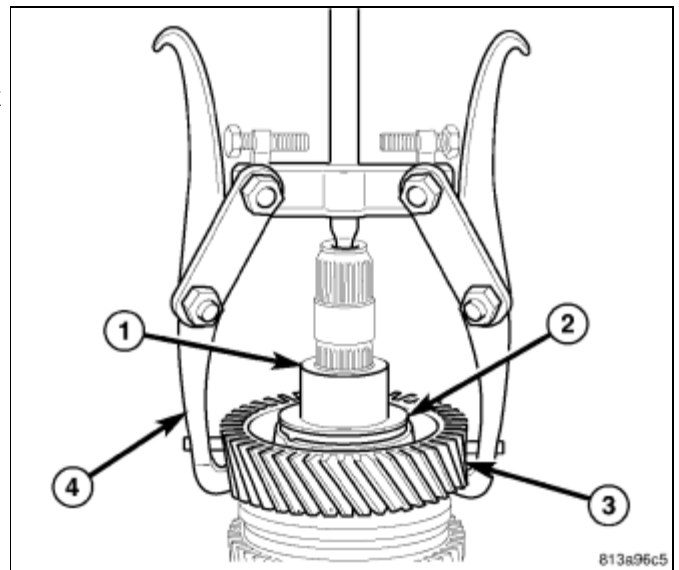


13. Remove reverse gear (1) and bearing (2).



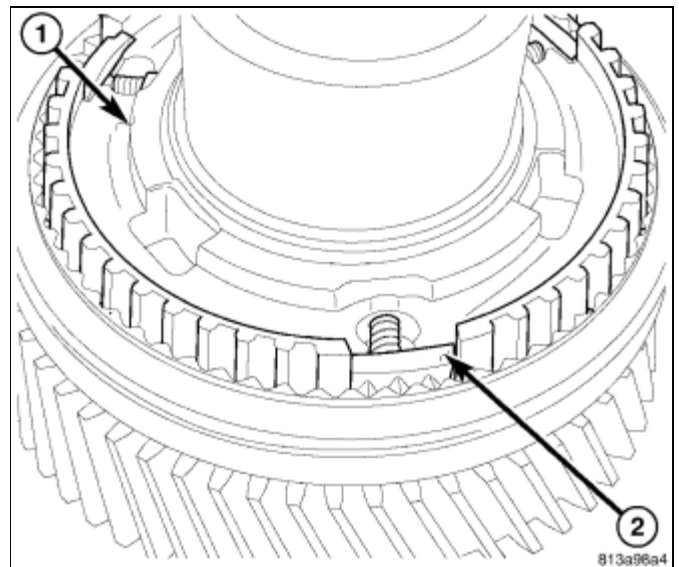
14. Remove reverse gear bearing race (1), thrust washer (2) and first gear (3) with puller (4). Place puller jaws under first gear (3).

15. Remove first gear bearing.

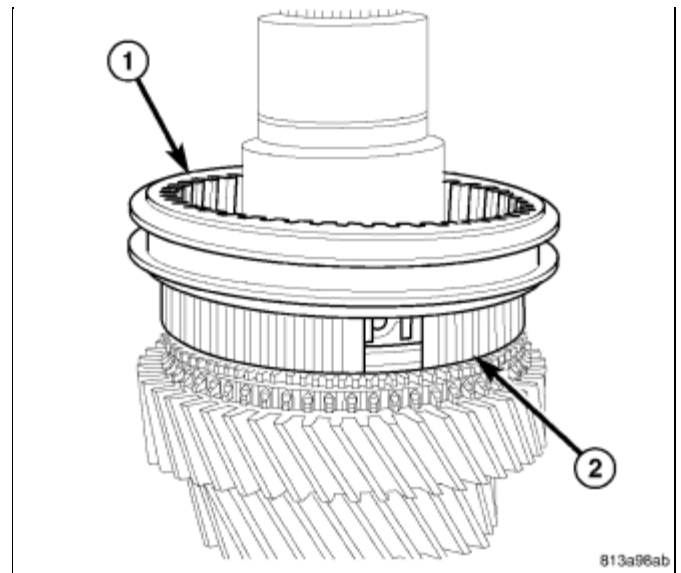


16. Remove first gear synchronizer rings.

17. Push 1-2 synchronizer sleeve down on hub. Remove 1-2 synchronizer hub (1) detents (2), balls and springs.

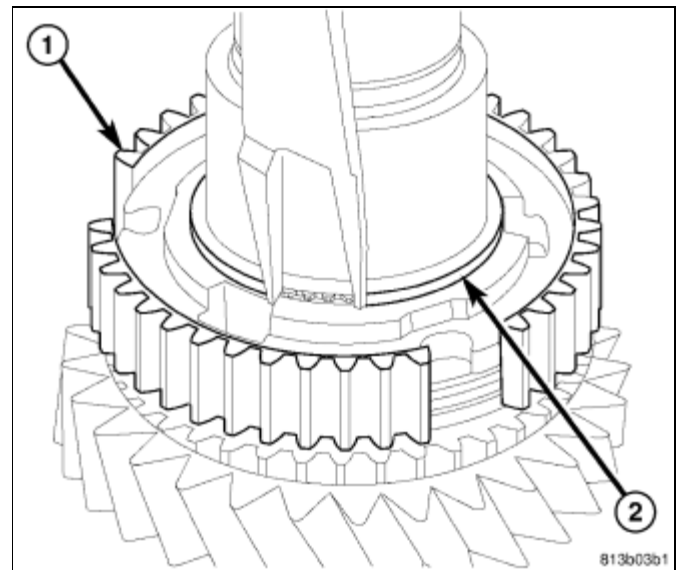


18. Remove 1-2 synchronizer sleeve (1) from synchronizer hub (2).

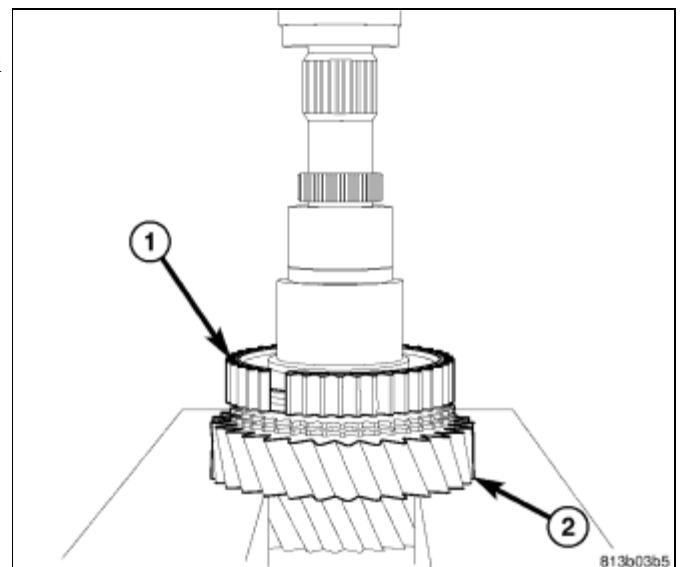


19. Remove 1-2 synchronizer hub (1) snap ring (2).

NOTE: All snap rings are select fit from the factory, and must be installed in their original location.

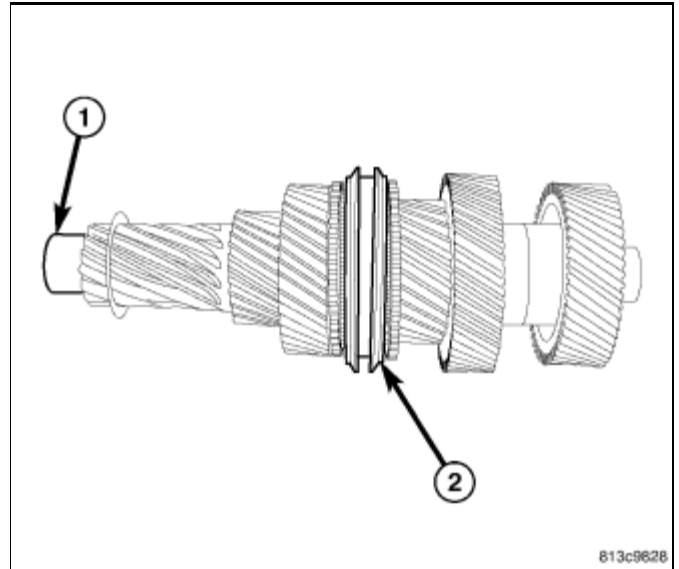


20. Remove 1-2 synchronizer hub (1), synchronizer rings and second gear (2) off shaft with a press. Place second gear (2) on press plates and press shaft through 1-2 synchronizer hub (1), synchronizer rings and second gear (2)



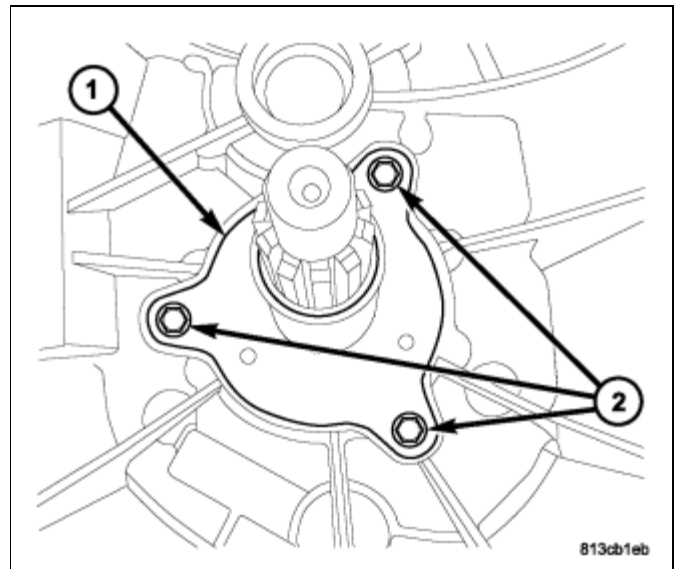
COUNTERSHAFT

The countershaft (1) and 3-4 synchronizer (2) are serviced as an assembly only .

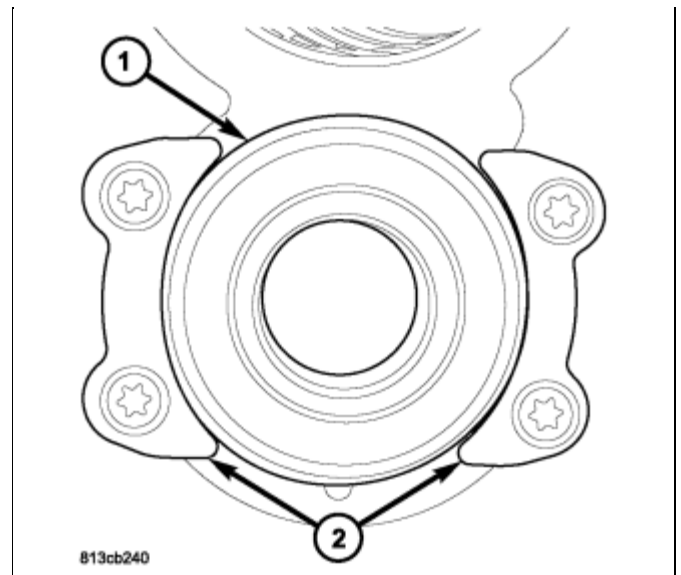


FRONT HOUSING

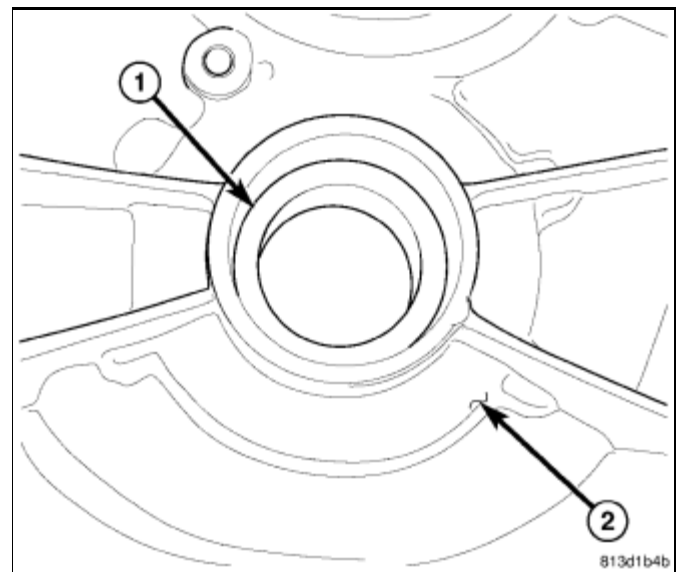
1. Remove input shaft retainer (1) bolts (2) and remove retainer.



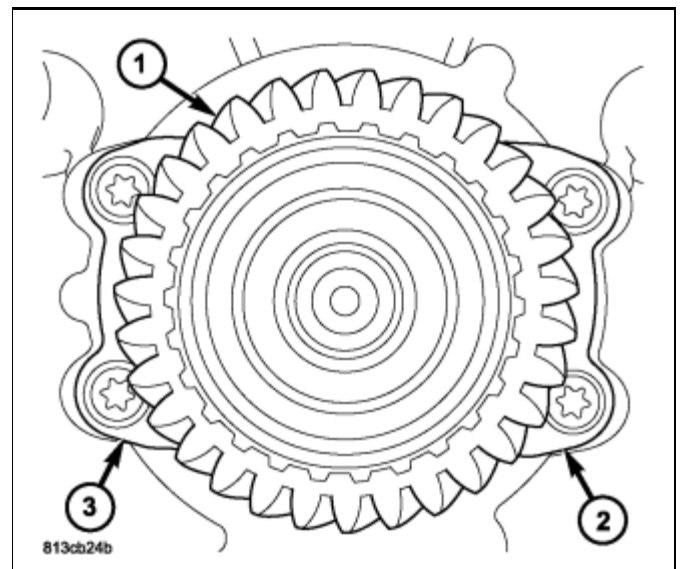
2. Remove countershaft bearing (1) retainer (2) bolts and remove retainers.



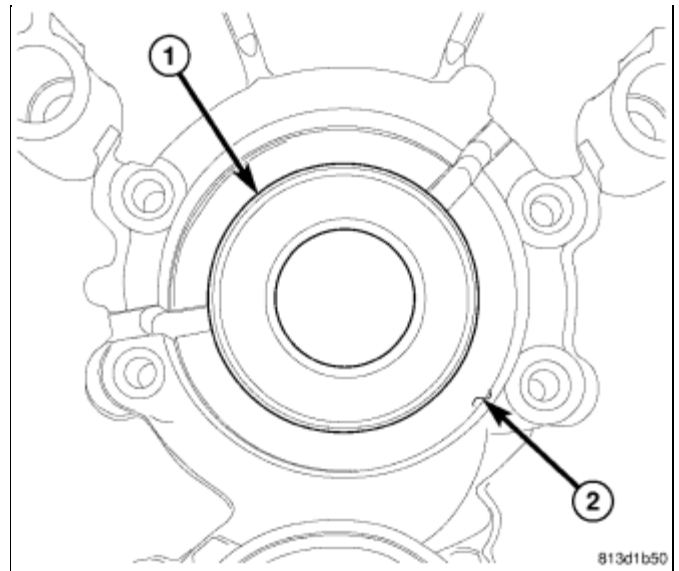
3. Remove countershaft bearing (1) from housing (2) with a hammer and driver.



4. Remove input shaft (1) bearing retainer (2, 3) bolts and remove retainers.
 5. Remove input shaft and bearing from housing with a dead blow hammer.



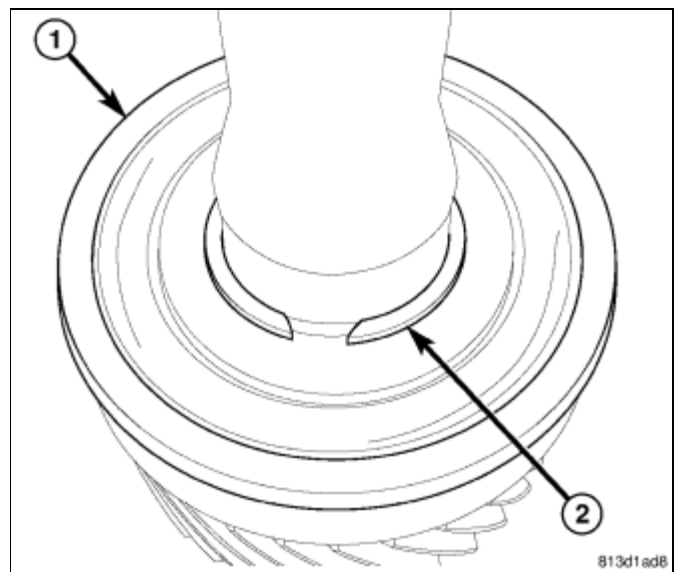
6. Remove input shaft seal (1) from housing (2) with a hammer and driver.



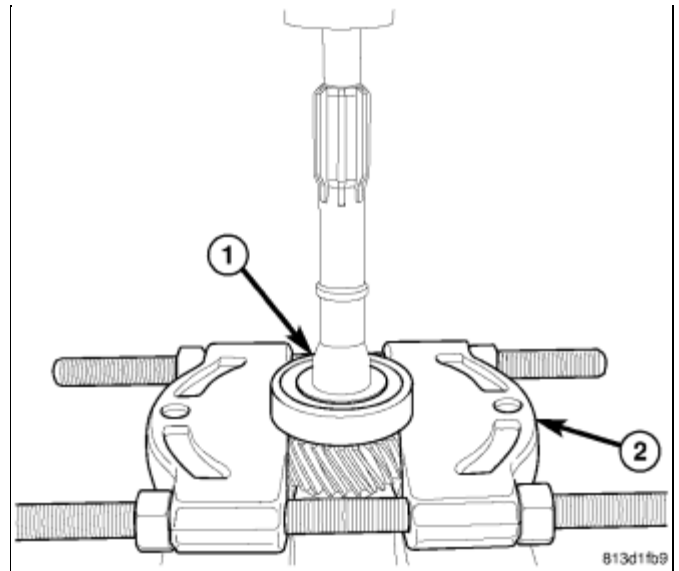
INPUT SHAFT

1. Remove input shaft bearing (1) snap ring (2).

NOTE: All snap rings are select fit from the factory, and must be installed in their original location.

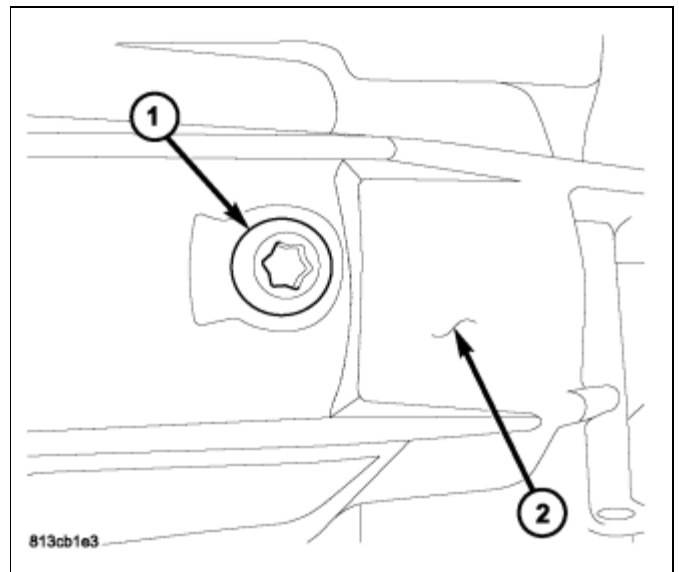


2. Remove input shaft bearing (1) with Splitter 1130 (2) and press. Place splitter around bearing retainer lip.

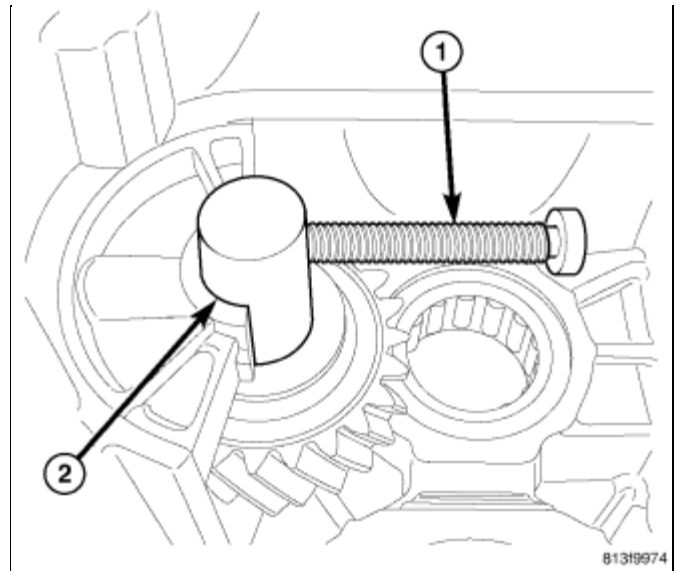


REAR HOUSING

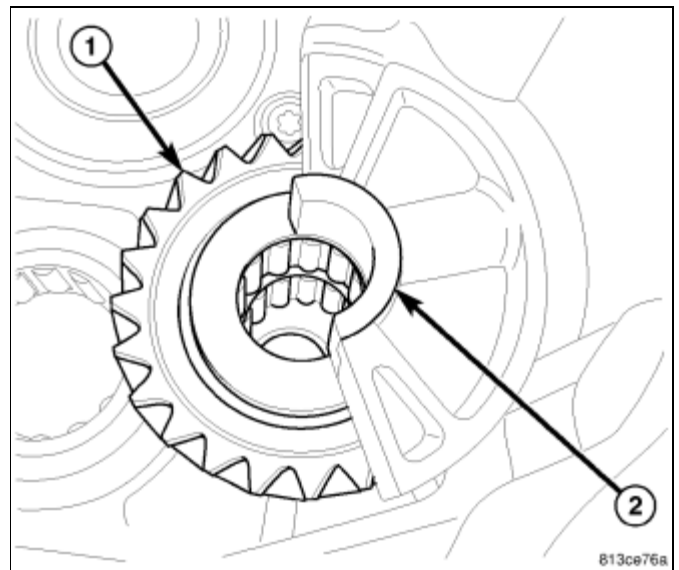
1. Remove reverse idler gear shaft bolt (1) from housing (2).



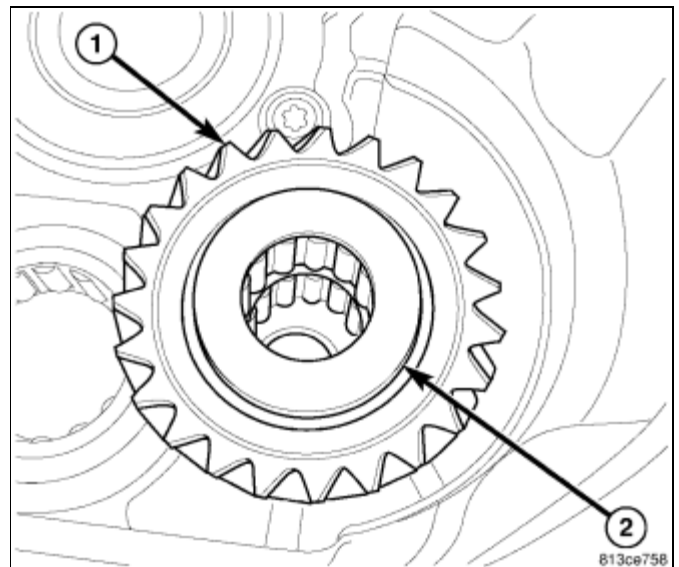
2. Thread idler gear shaft bolt (1) into the shaft (2). Then work shaft (2) out of the idler gear.



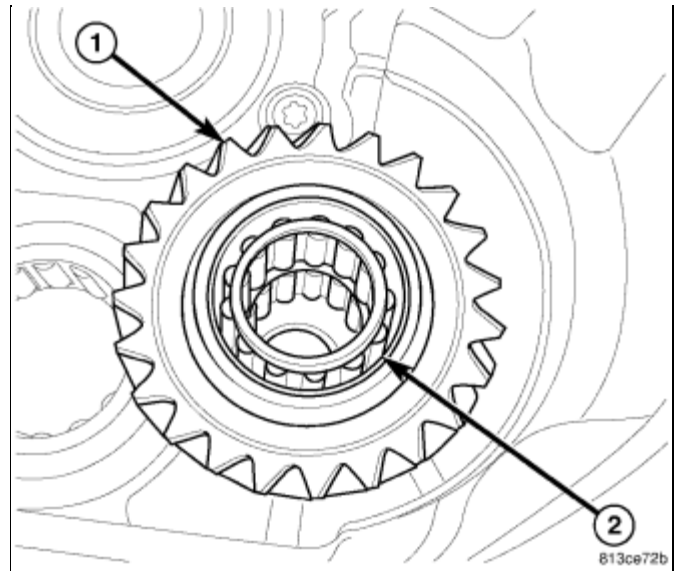
3. Remove reverse idler gear (1) shaft support (2).



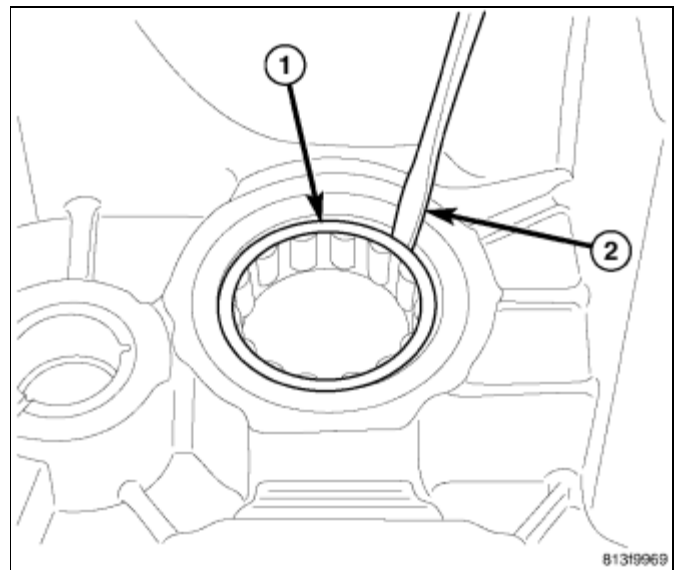
4. Remove reverse idler gear (1) thrust washer (2).



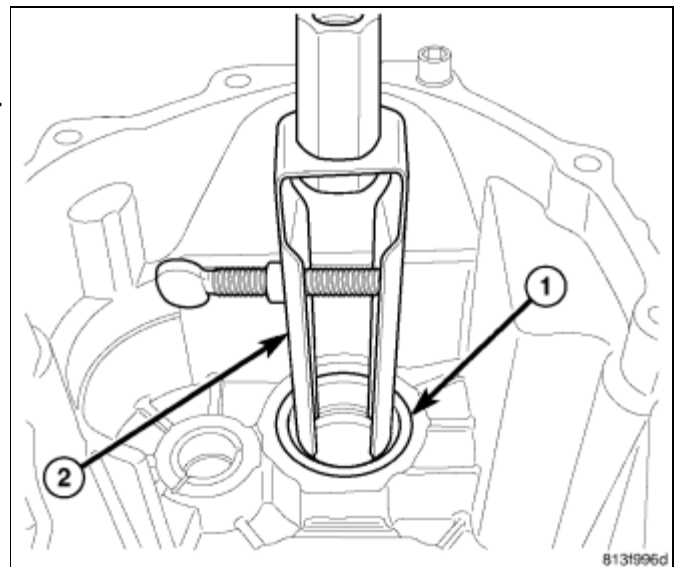
5. Remove reverse idler gear (1) and bearing (2).



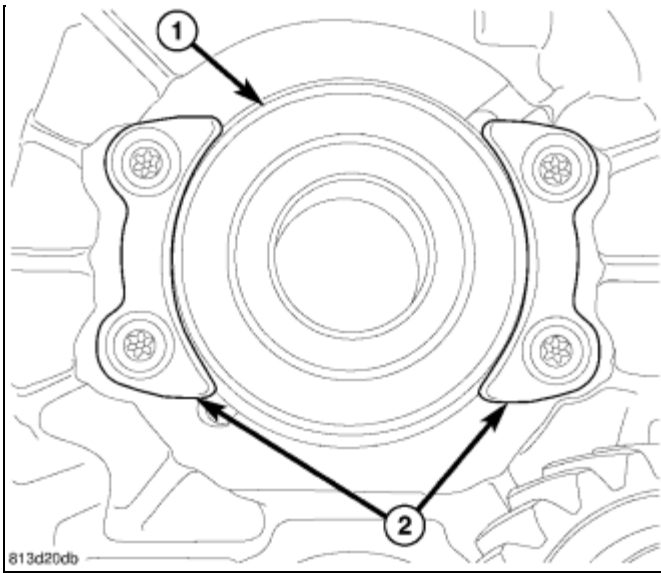
6. Break plastic countershaft roller bearing cage (1) with a screw driver (2). Then remove cage and roller bearing.



7. Remove countershaft roller bearing shell (1) from the rear housing with Remover 7794-A (2) and Slide Hammer C-637.



8.
Remove



mainshaft bearing (1) retainer (2) bolts and remove retainers.
9. Remove bearing from housing with a hammer and driver.

CLEANING

Clean gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean shaft bearings with a mild solvent such as Mopar™ degreasing solvent or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

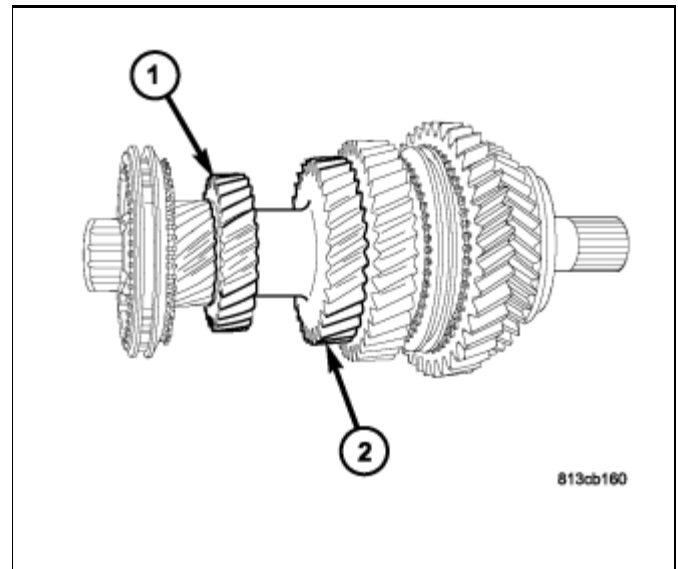
INSPECTION

NOTE: Minor corrosion, nicks, or pitting can be smoothed with 400 grit emery and polished out with crocus cloth.

Bearings: Inspect for worn, cracked, flat-spotted or brinnelled.

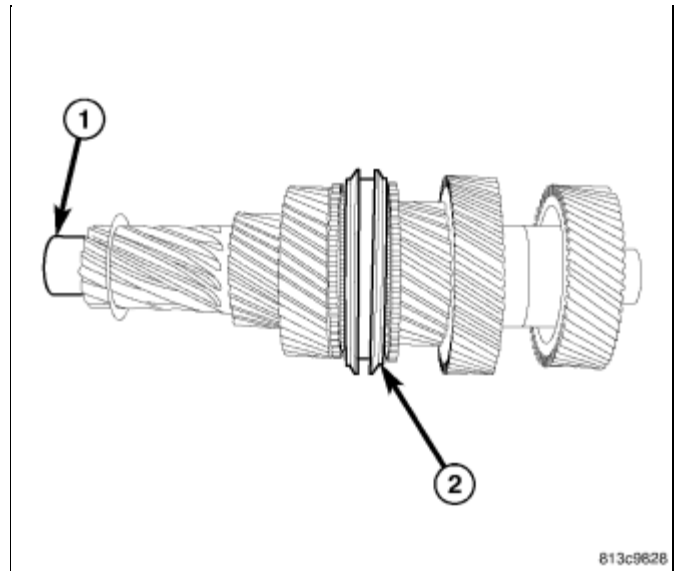
Gears: Inspect for worn, chipped or cracked teeth. Inspect bearing surfaces for ware or flat-spotted.

Mainshaft: Inspect for worn splines, snap ring grooves and threads. Inspect bearing surfaces for ware or flat-spotted. **Third gear (1) and fourth gear (2) are serviced with mainshaft only.**

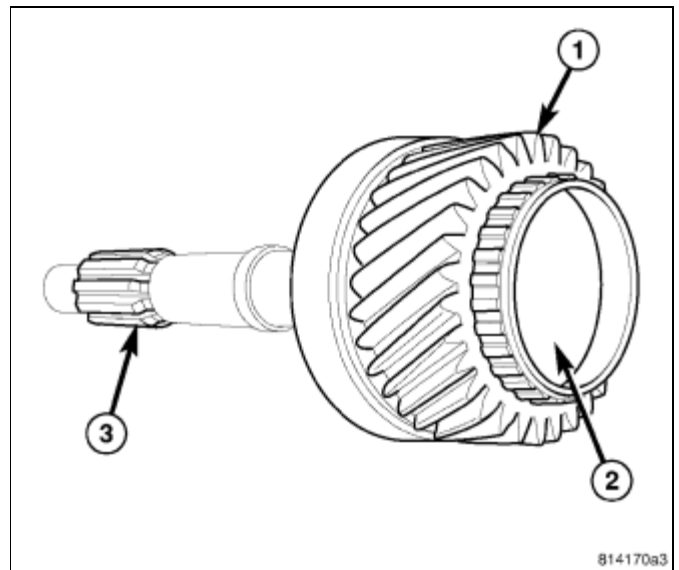


Countershaft: Inspect for worn, chipped or cracked teeth. Inspect bearing surfaces (1) for wear or flat-spots. Inspect 3-4 synchronizer assembly (2). **The countershaft is serviced as**

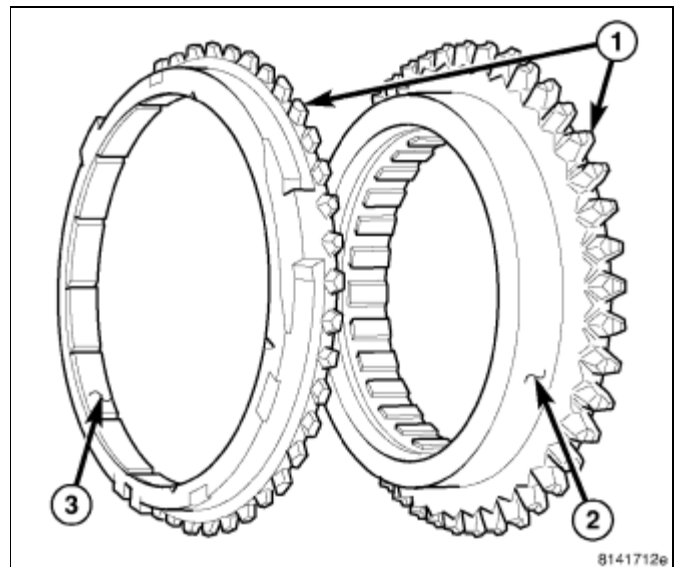
an assembly.



Input Shaft: Inspect for worn, chipped or cracked teeth (1). Inspect bearing surface (2) for wear or flat-spots. Inspect for worn splines (3).



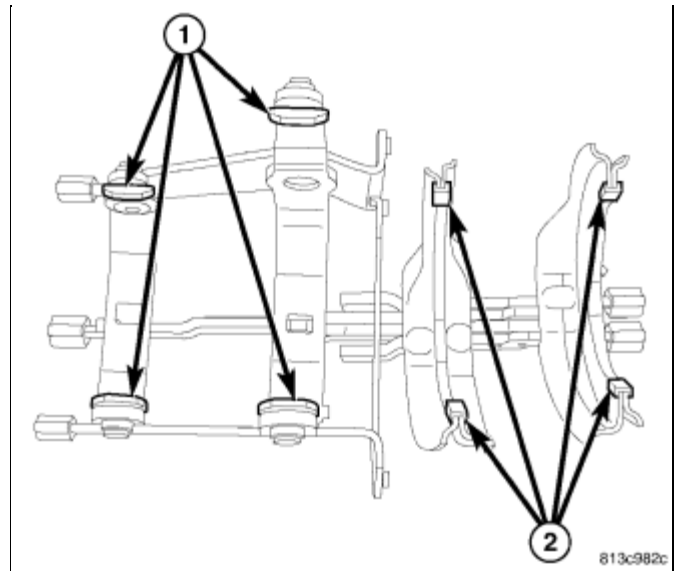
Synchronizer components: Inspect for worn, chipped or cracked teeth (1) and burned friction surface (2) or flaking off friction material (3). **Synchronizers are serviced as an assembly. 3-4 synchronizer assembly is serviced with countershaft.**



Shift forks: Inspect shift forks and shoes (1) for wear and

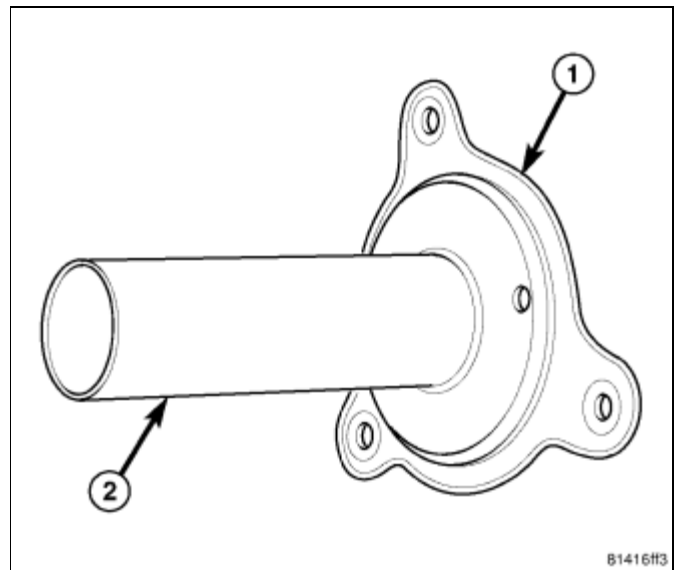
distortion. Check fit of fork shoes in synchronizer sleeve to ensure parts fit and work smoothly, replace if necessary. If shift fork pads (2) are worn, the shift fork must be replaced.

Housing/Tail housing: Inspect sealing and mating surfaces are free of burrs and nicks. Inspect alignment dowels are tight and in good condition.



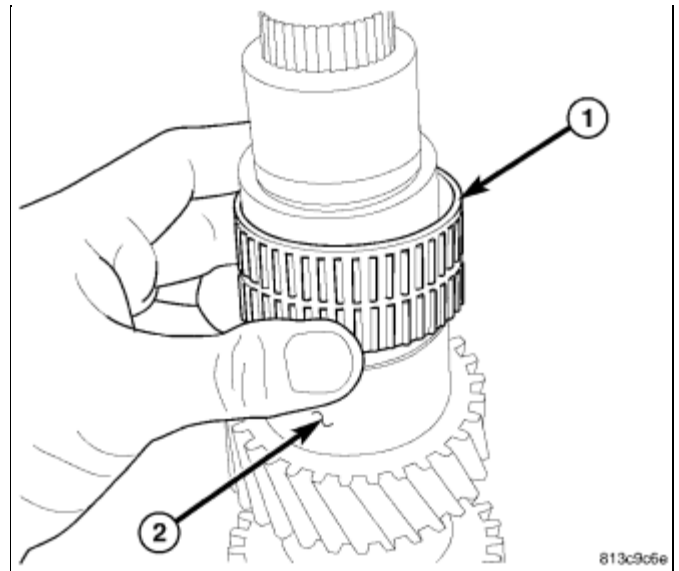
Input Shaft Retainer: Inspect retainer (1) release bearing slide surface (2).

ASSEMBLY

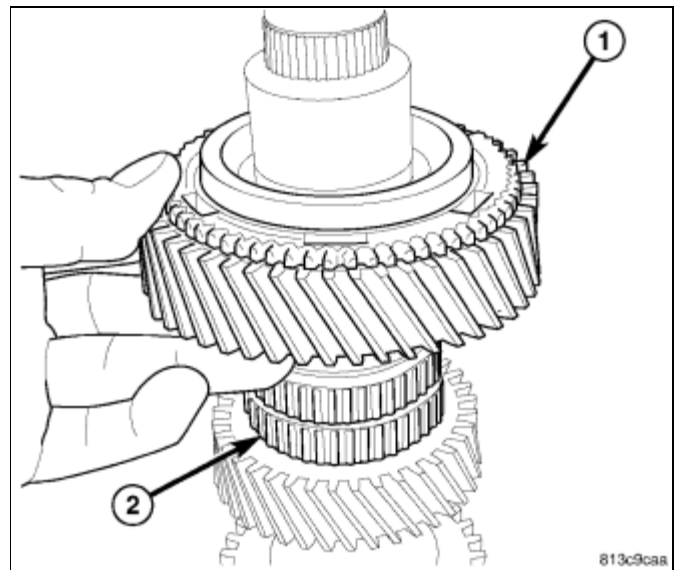


MAINSHAFT

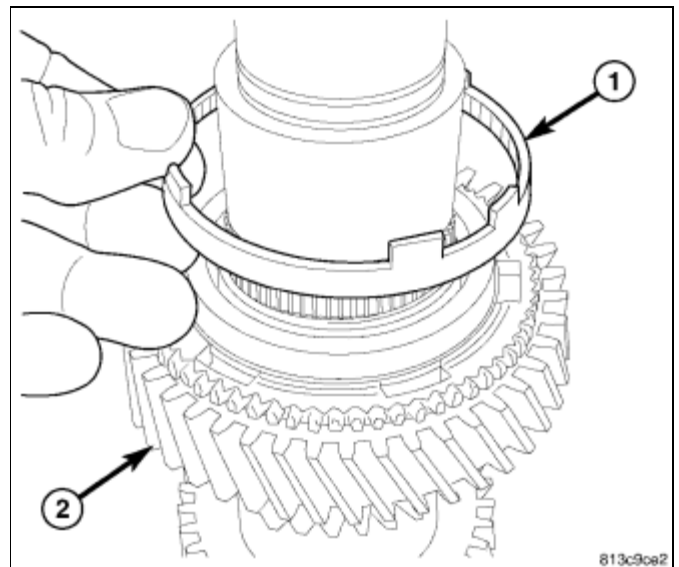
1. Place mainshaft in Fixture 9648 mounted in a vise.
2. Install second gear bearing (1) on mainshaft (2).



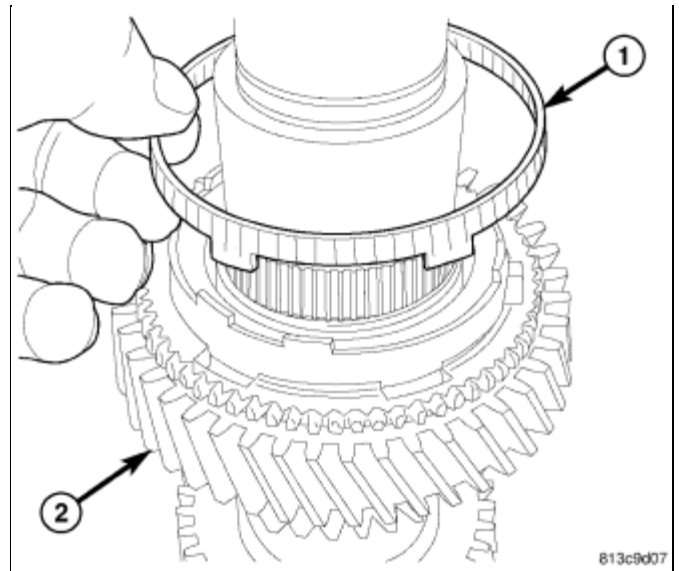
3. Install second gear (1) on bearing (2).



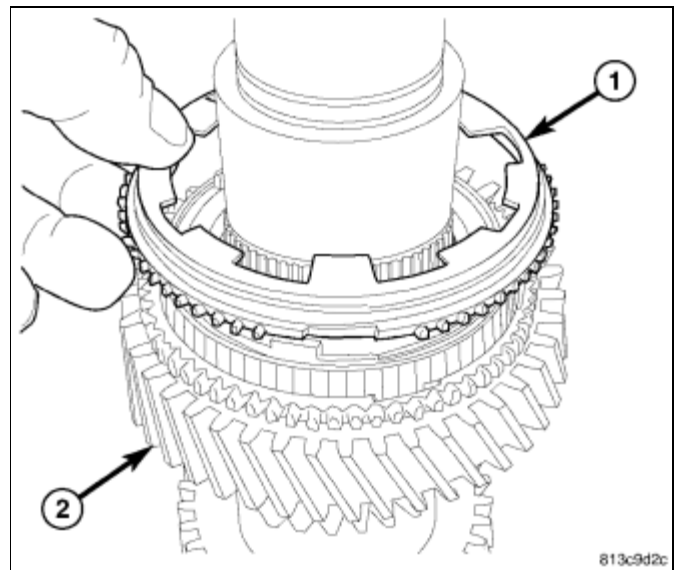
4. Install inner synchronizer friction ring (1) on second gear (2).



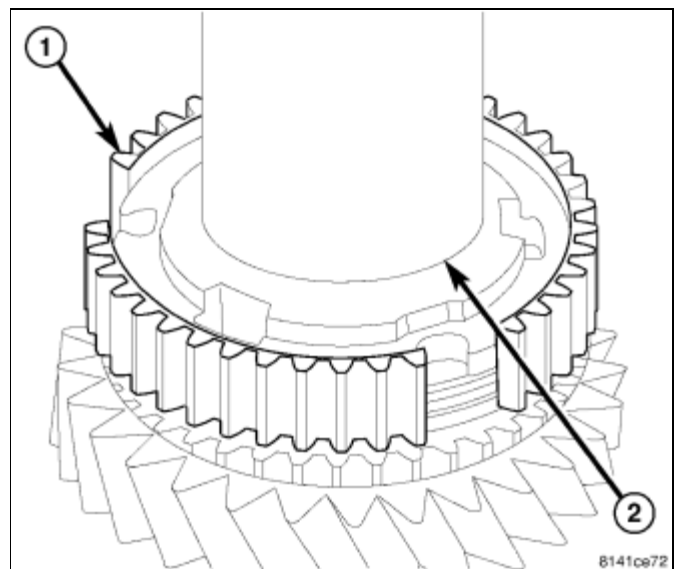
5. Install outer synchronizer friction ring (1) on second gear (2).



6. Install synchronizer blocker ring (1) on second gear (2).

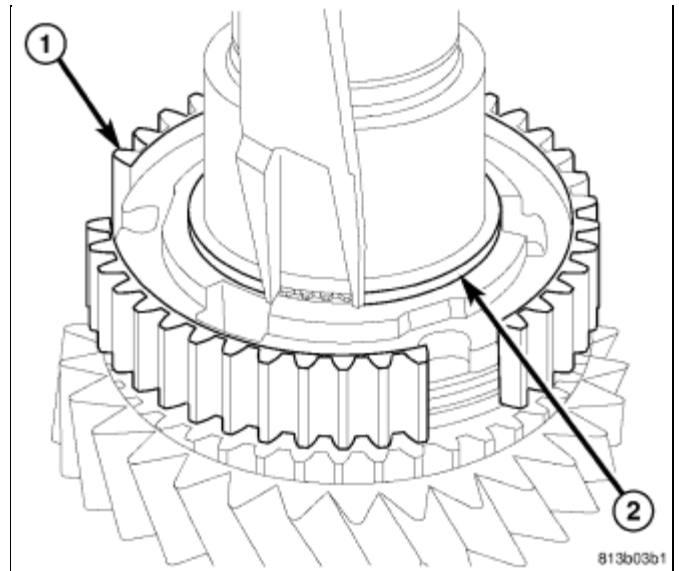


7. Install 1-2 synchronizer hub (1) with Installer 8228 (2) and a press. Align hub detent openings with synchronizer rings.

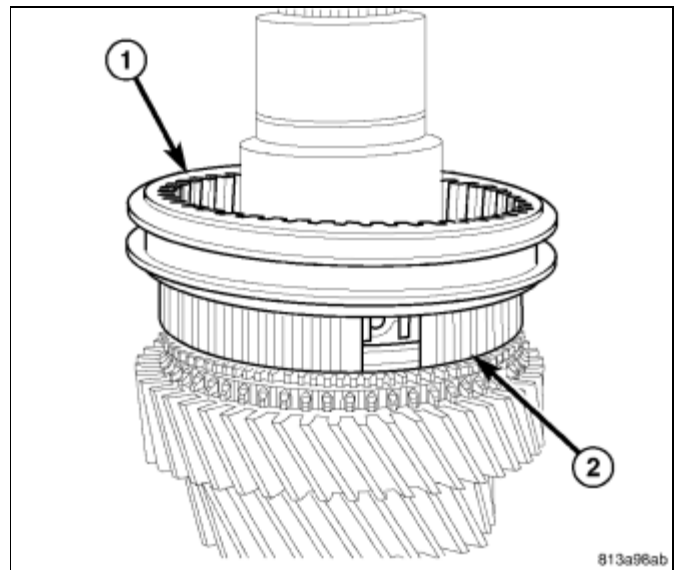


8. Install 1-2 synchronizer hub (1) snap ring (2).

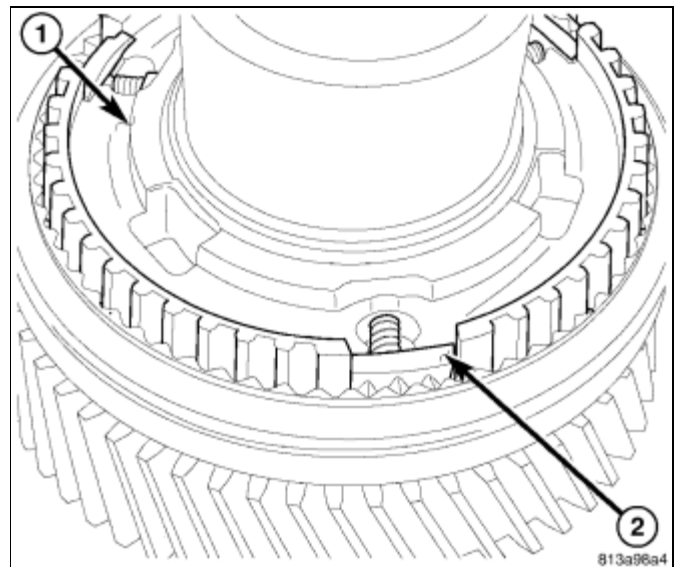
NOTE: Reuse original snap ring or thickest snap ring that will fit.



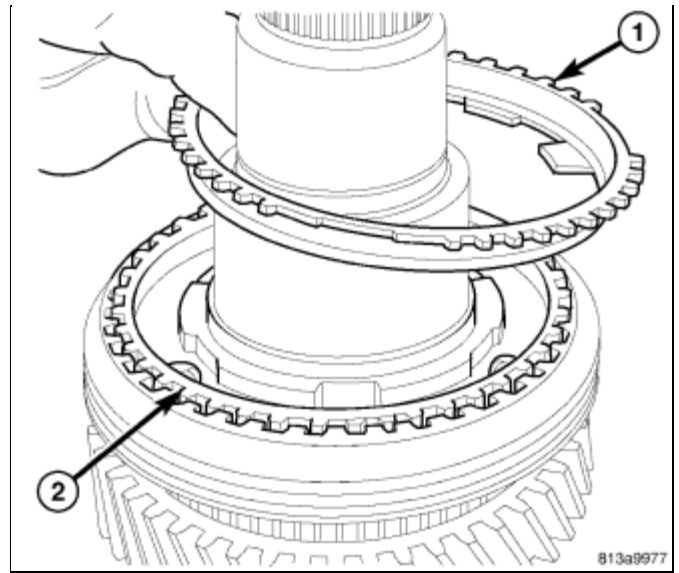
9. Install 1-2 synchronizer sleeve (1) and push to the bottom of the synchronizer hub (2).



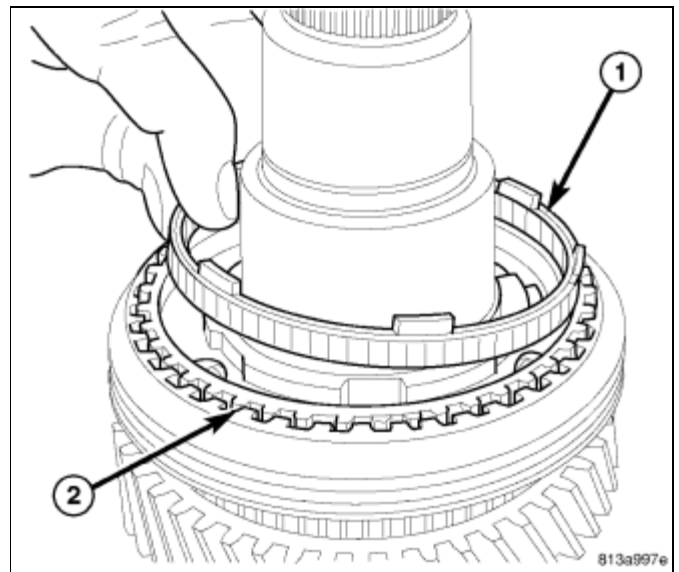
10. Install 1-2 synchronizer detents, springs, and balls (2).



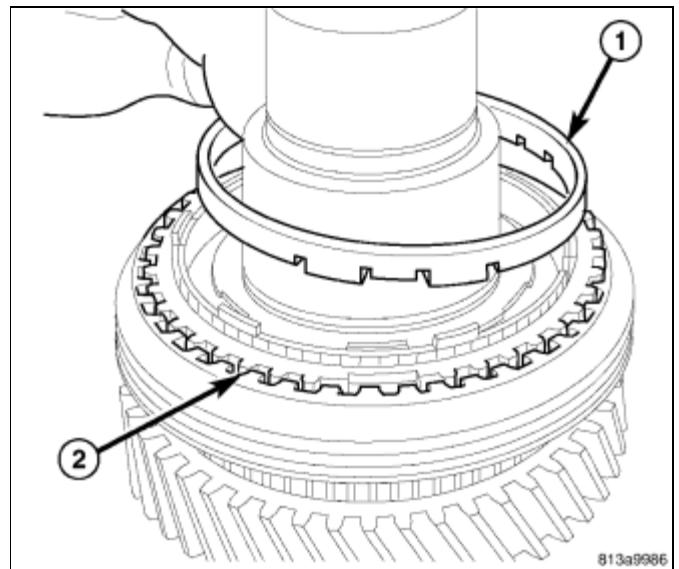
11. Install first gear blocker ring (1) into synchronizer hub (2).



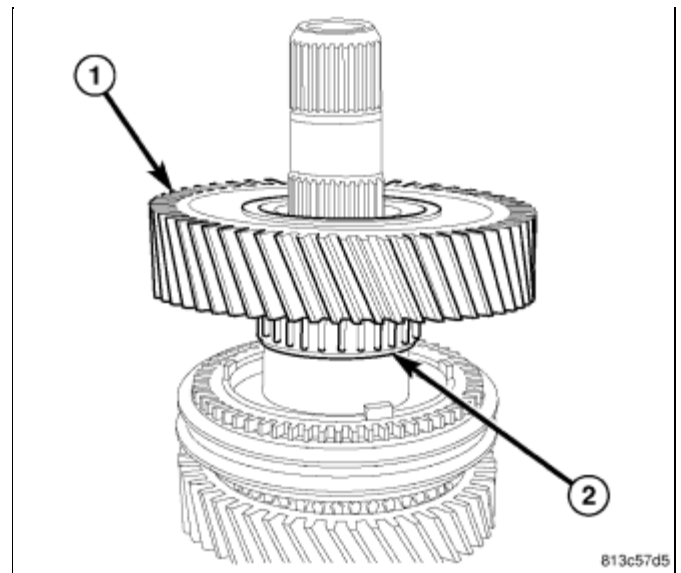
12. Install first gear outer friction ring (1) into synchronizer hub (2).



13. Install first gear inner friction ring (1) into synchronizer hub (2).

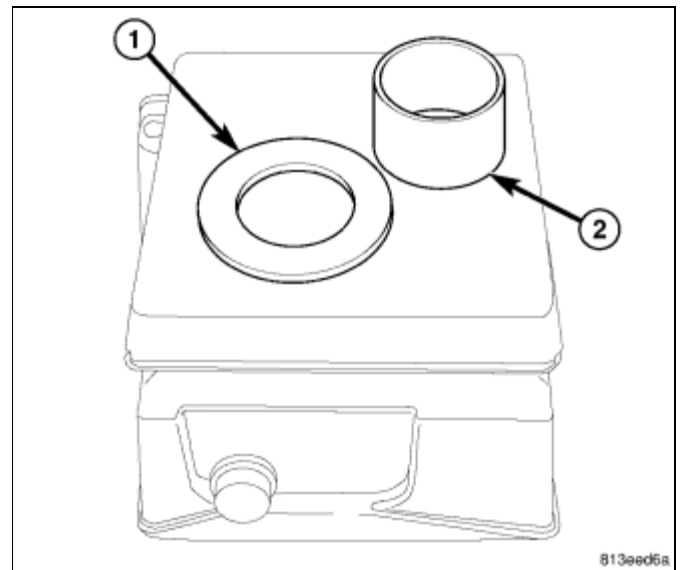


14. Install first gear (1) and bearing (2). Then center 1-2 synchronizer sleeve on synchronizer hub.



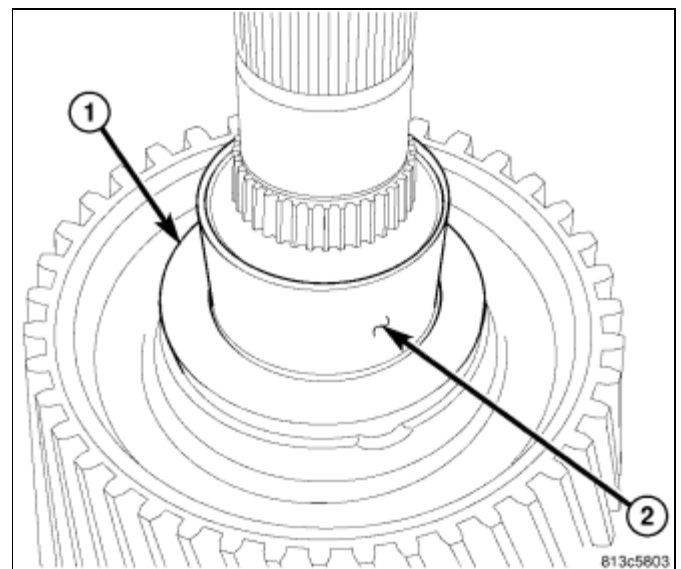
WARNING: Use welding gloves when handling heated components. Failure to follow these instructions will result in personal injury.

CAUTION: A bearing heater is used to assemble first gear thrust washer (1) and reverse gear bearing race (2). Use only a bearing heater/hot plate and follow manufacture's instructions. Heat components to 100 - 177 Celsius (212° Min - 350° Max Fahrenheit). Never use an open flame to heat components. Never leave components on heater for an extended amount of time. If component is discolored after heating, the component has been overheated and must not be used. Failure to follow these instructions will result in component damage.

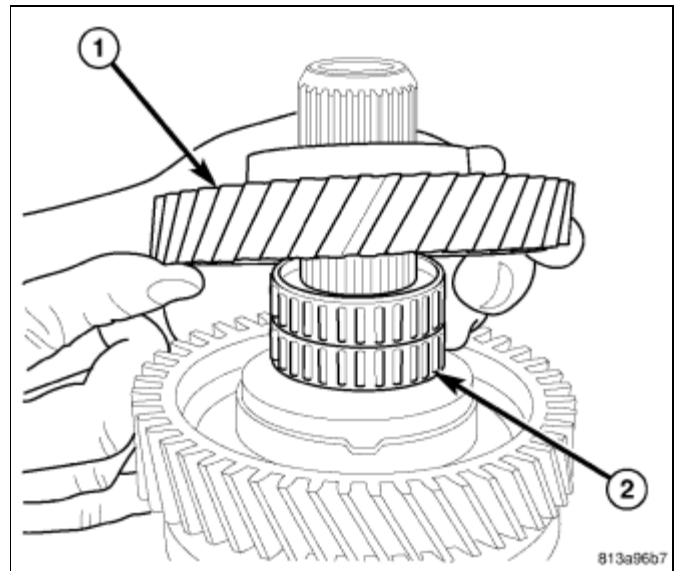


15. Heat first gear thrust washer (1) and reverse gear bearing race (2) with bearing heater.

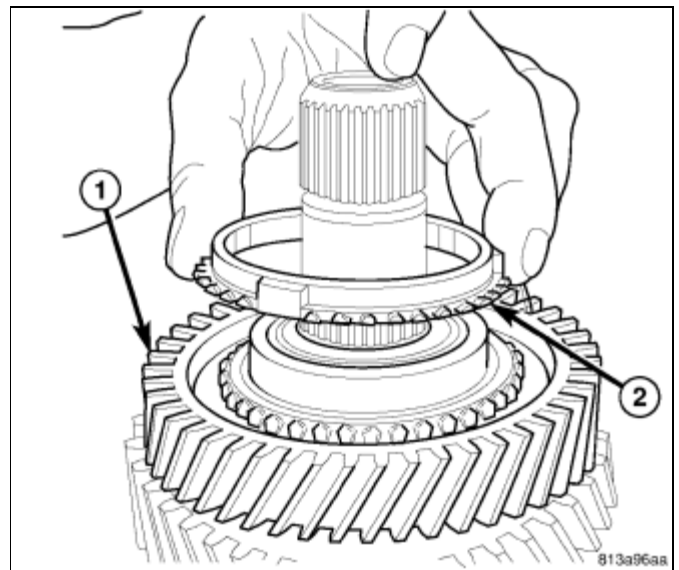
16. Using welding gloves or tongs, install first gear thrust washer (1) then reverse gear bearing race (2).



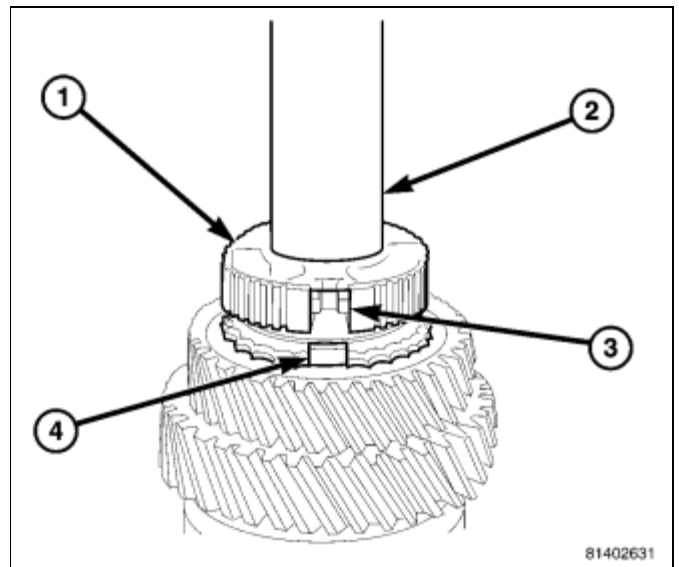
17. Install reverse gear (1) and bearing (2).



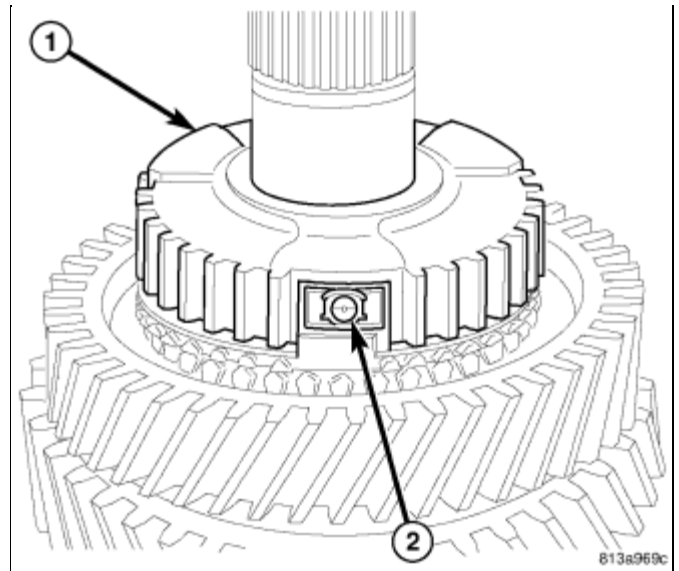
18. Install reverse gear (1) synchronizer friction ring (2).



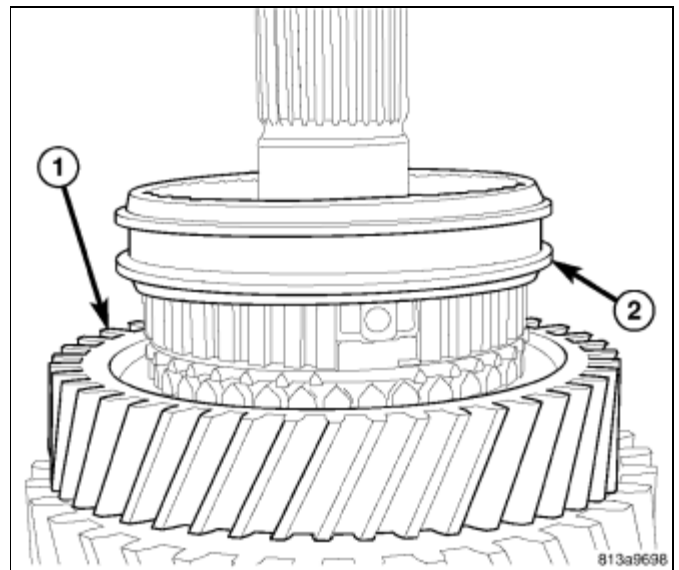
19. Install reverse gear synchronizer hub (1) on mainshaft with Installer W-262 (2) and a press. Align hub detent opening (3) with friction ring (4) lug.



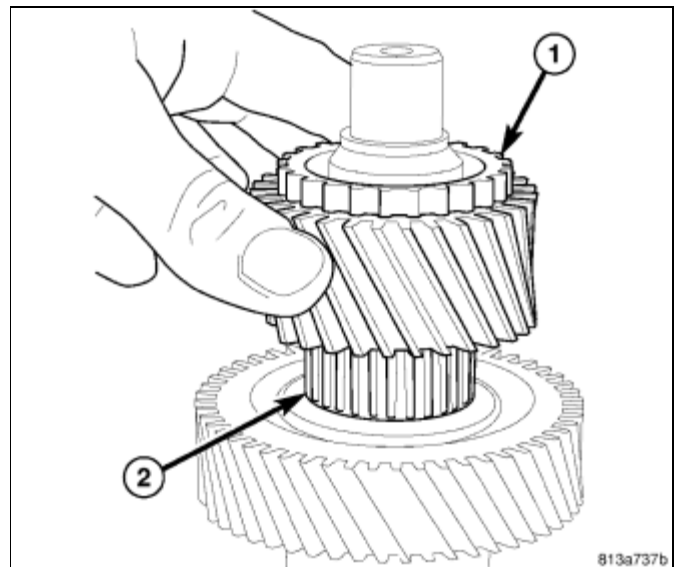
20. Install reverse gear synchronizer hub (1) detents (2).



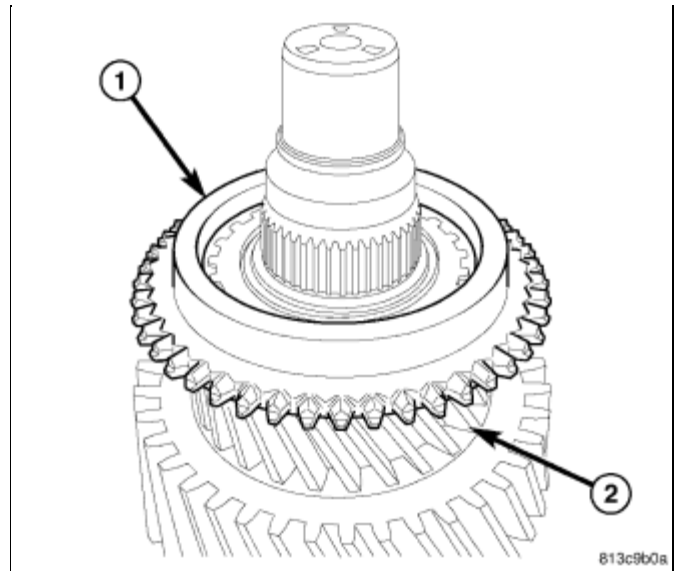
21. Install reverse gear (1) synchronizer sleeve (2) with tooth points pointing down and center sleeve on synchronizer hub.
 22. Remove mainshaft from Fixture 9648. Turn fixture over in the vise, then install opposite end of mainshaft in the fixture.



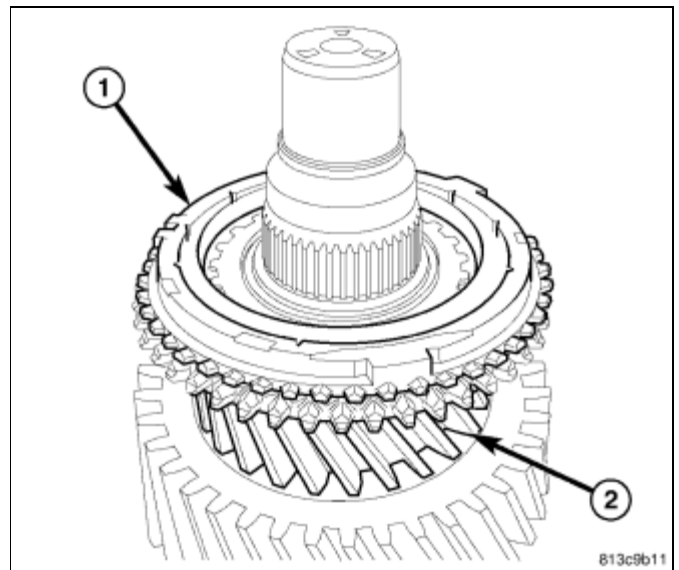
23. Install sixth gear (1) and bearing (2).



24. Install sixth gear synchronizer blocker ring (1) on sixth gear (2).

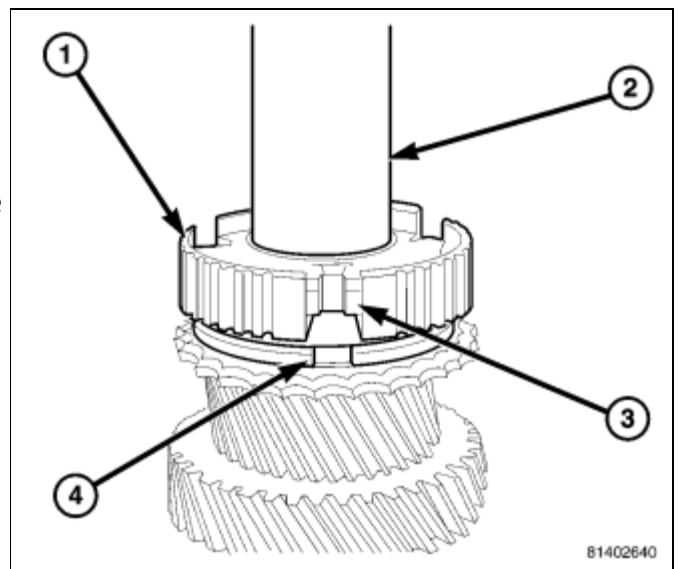


25. Install sixth gear synchronizer friction ring (1) on sixth gear (2).



26. Install 5-6 synchronizer hub (1) with Installer W-262 (2). Align hub detent opening (3) with friction ring lugs (4) and press hub on mainshaft.

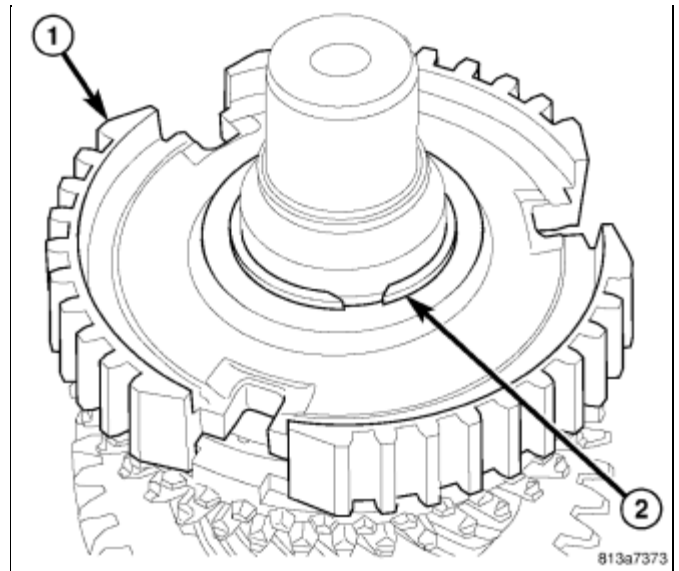
NOTE: 5-6 synchronizer hub center, is offset and must be install large offset down.



27. Install 5-6 synchronizer hub (1) snap ring (2).

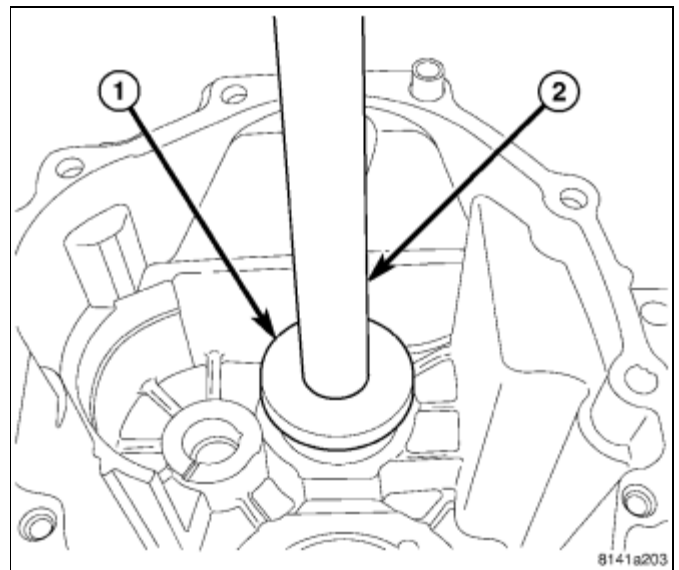
NOTE: Reuse original snap ring or thickest snap ring that will fit.

28. Install 5-6 synchronizer sleeve on hub (1).

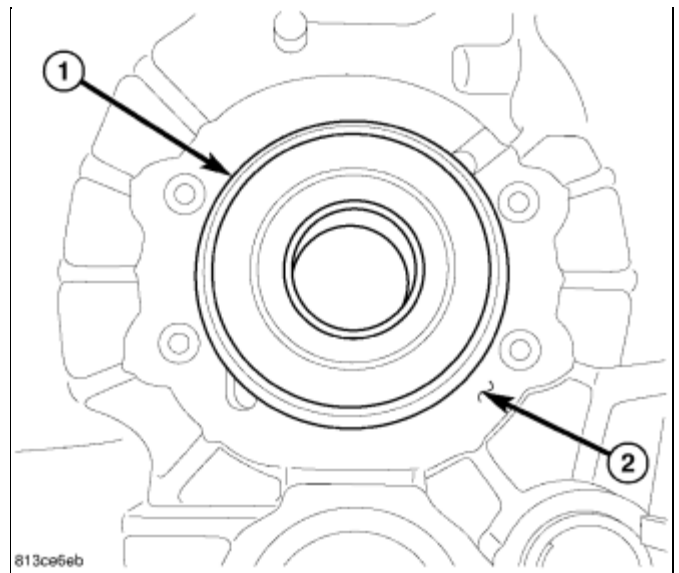


REAR HOUSING

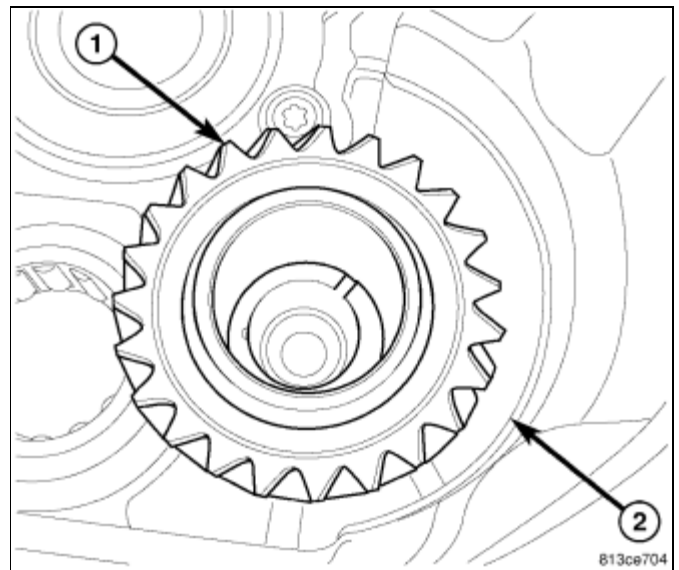
1. Install countershaft bearing into rear housing with Installer 9643 (1) and Handle C-4171.



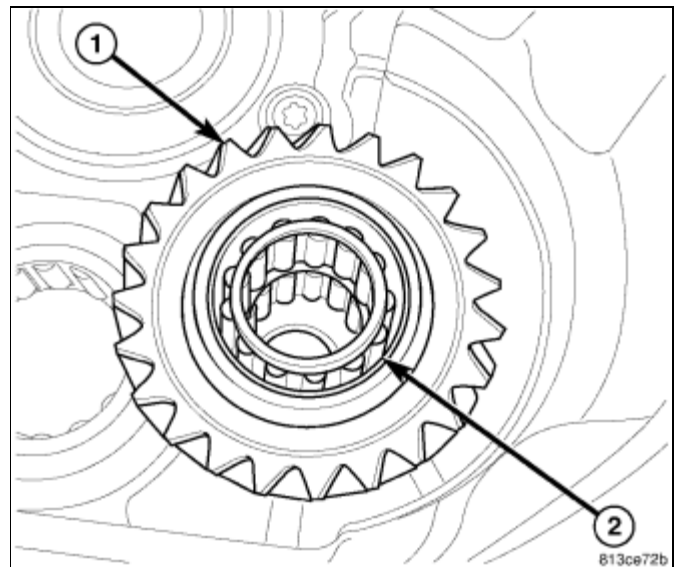
2. Install mainshaft bearing (1) into housing (2).
 3. Install bearing retainer and tighten bolts to 10 N·m (88 in. lbs.).



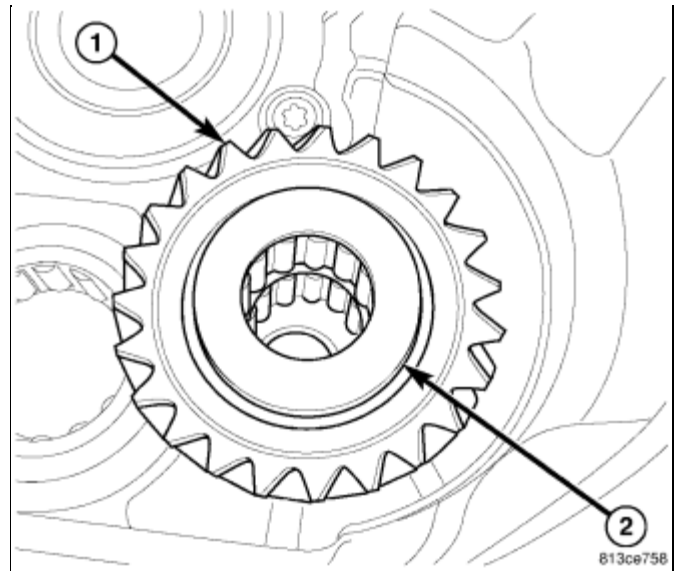
4. Install reverse idler gear (1) into housing (2).



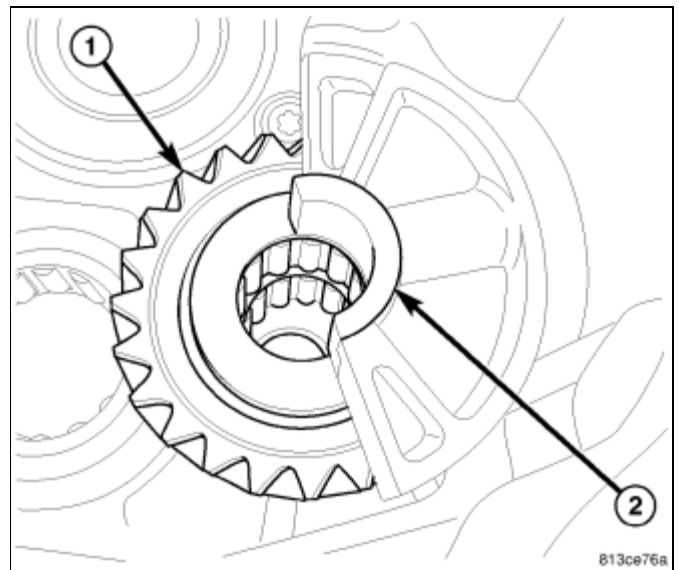
5. Install idler gear (1) bearing (2) into gear.



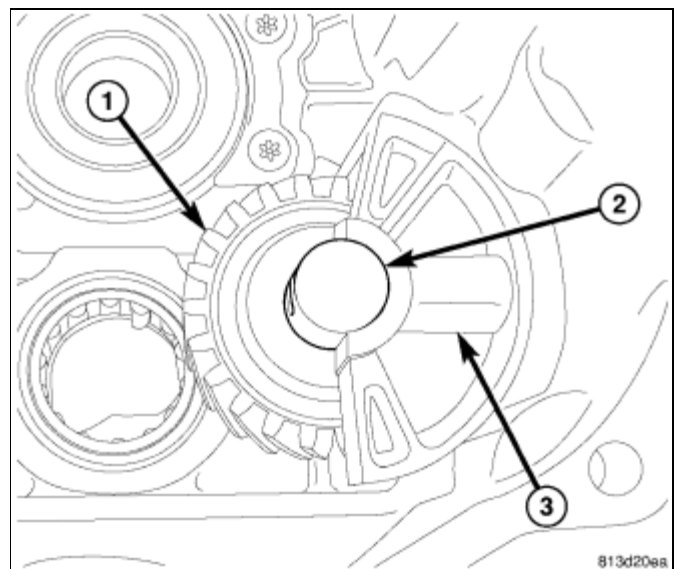
6. Install idler gear (1) thrust washer (2) on idler gear.



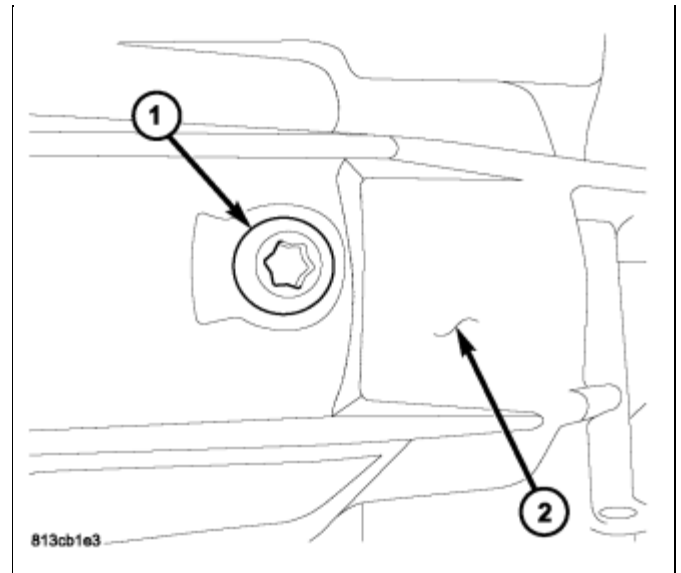
7. Install idler gear (1) shaft support (2) into housing.



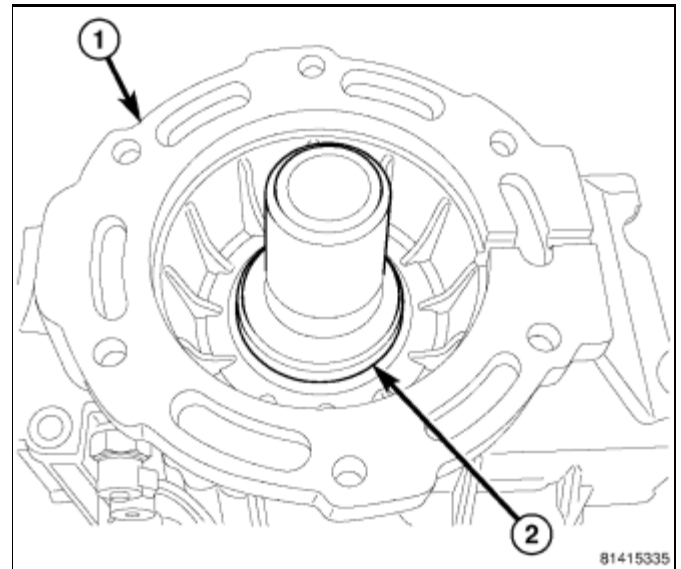
8. Install idler gear (1) shaft (2) with shaft bolt hole aligned with shaft support hole (3).



9. Install idler gear shaft bolt (1) into the housing (2) and tighten to 20 N.m (15 ft. lbs.).

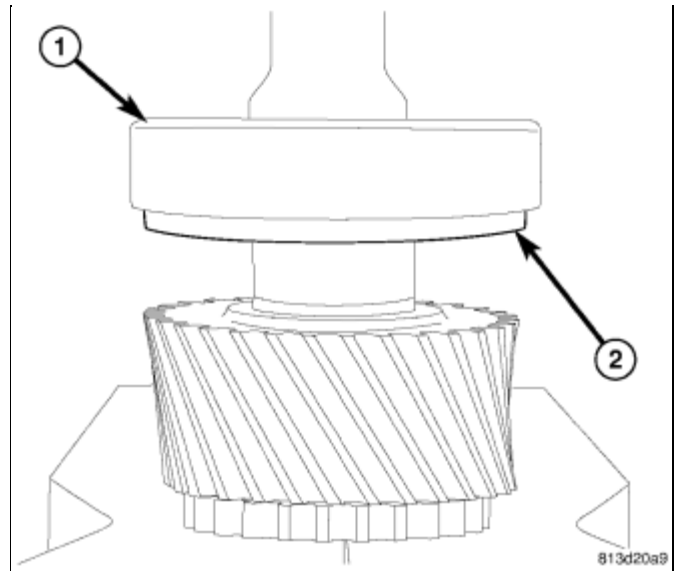


10. Install 4x4 output shaft seal into rear housing (1) with Installer 9638 (2). Install 4x2 output shaft seal into rear housing with Installer 9635 and Installer 6448A.

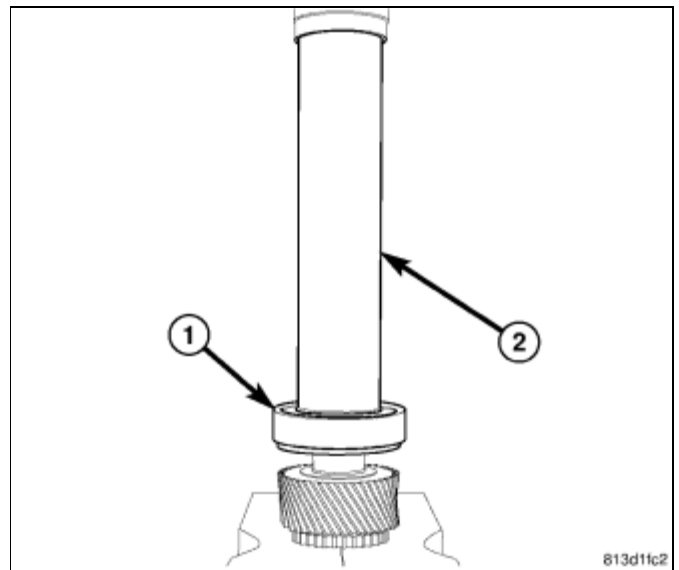


INPUT SHAFT

1. Install input shaft bearing (1) on input shaft with the bearing retainer lip (2) facing fifth gear.

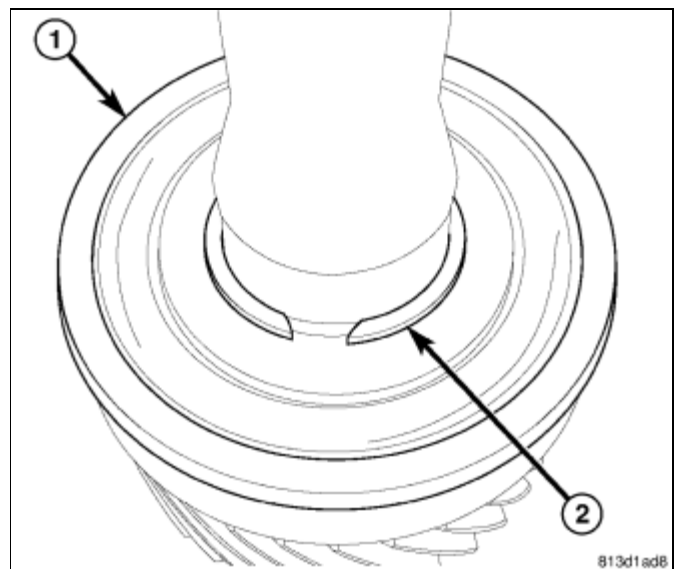


2. Install input shaft bearing (1) with Installer 6448A (2) and a press.



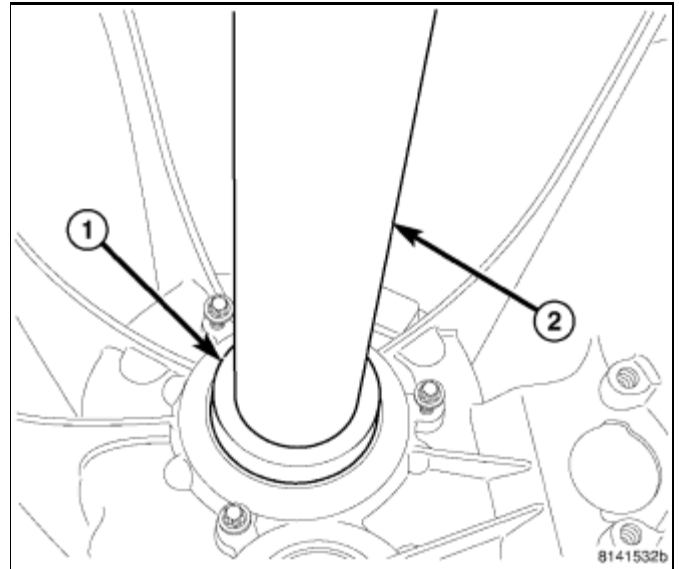
3. Install input shaft bearing (1) snap-ring (2).

NOTE: Reuse original snap ring or thickest snap ring that will fit.

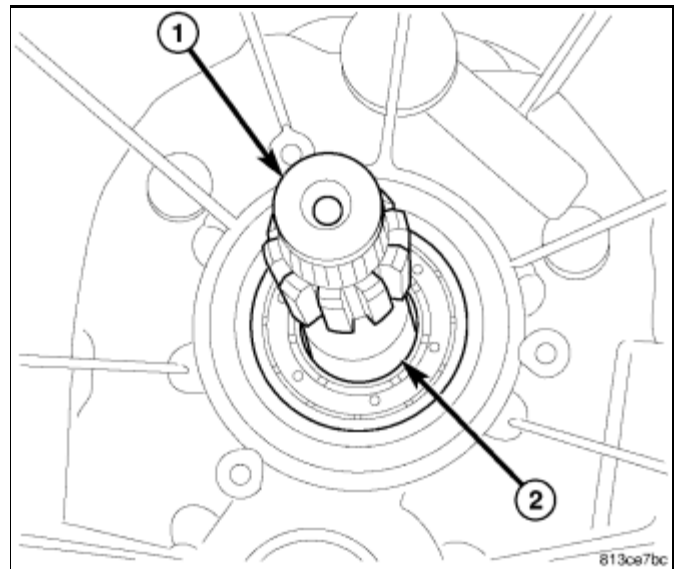


FRONT HOUSING

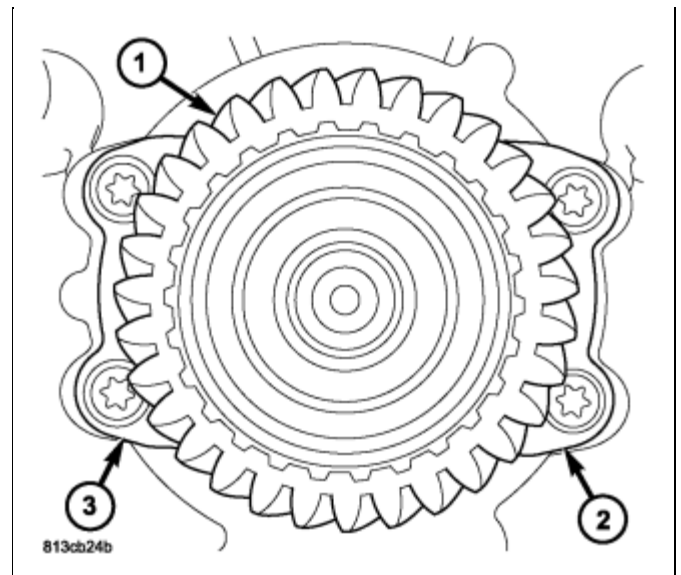
1. Install input shaft seal with Installer 9635 (1) and Installer 6448A (2).



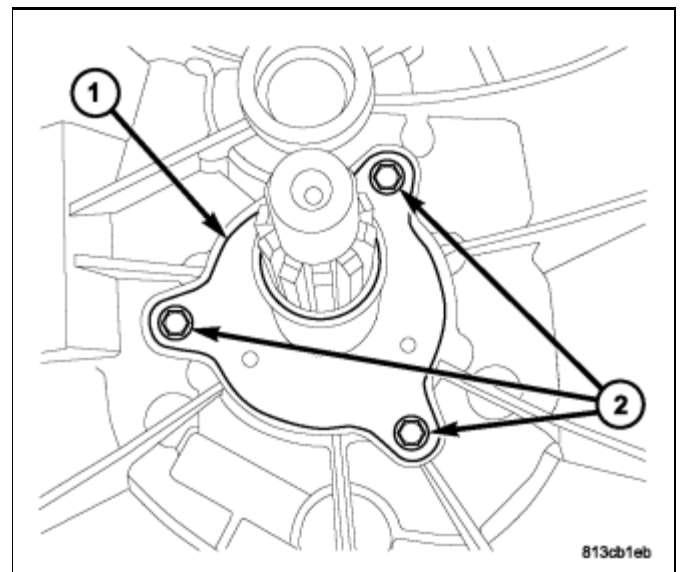
2. Install input shaft (1) with bearing (2) into housing.



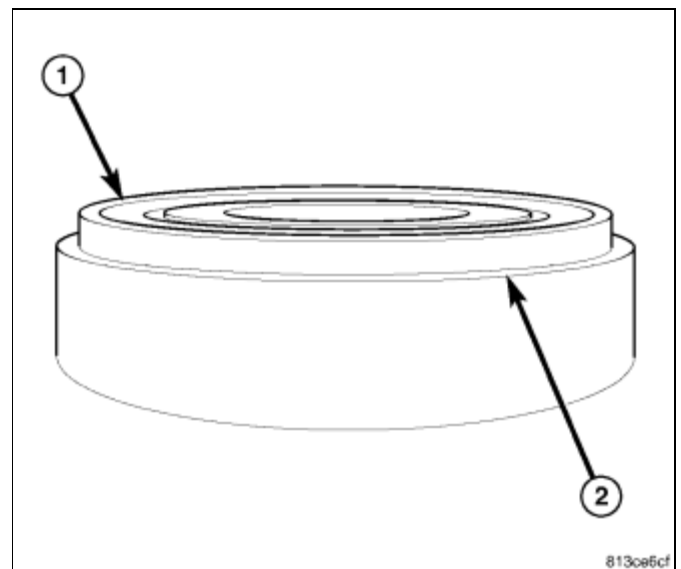
3. Install input shaft (1) bearing retainers (2, 3) and tighten bolts to 10 N·m (88 in. lbs.).



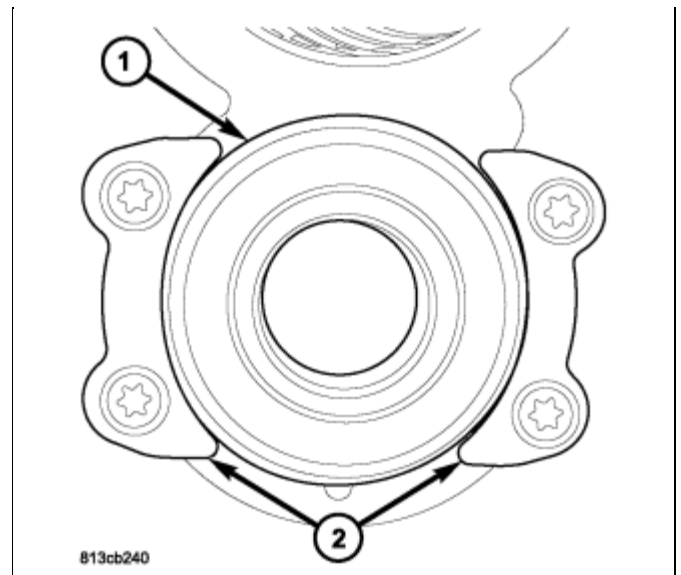
4. Install input shaft retainer (1) and tighten bolts (2) to 9 N·m (80 in. lbs.).



5. Install countershaft bearing (1) into housing with bearing retainer lip (2) facing up.

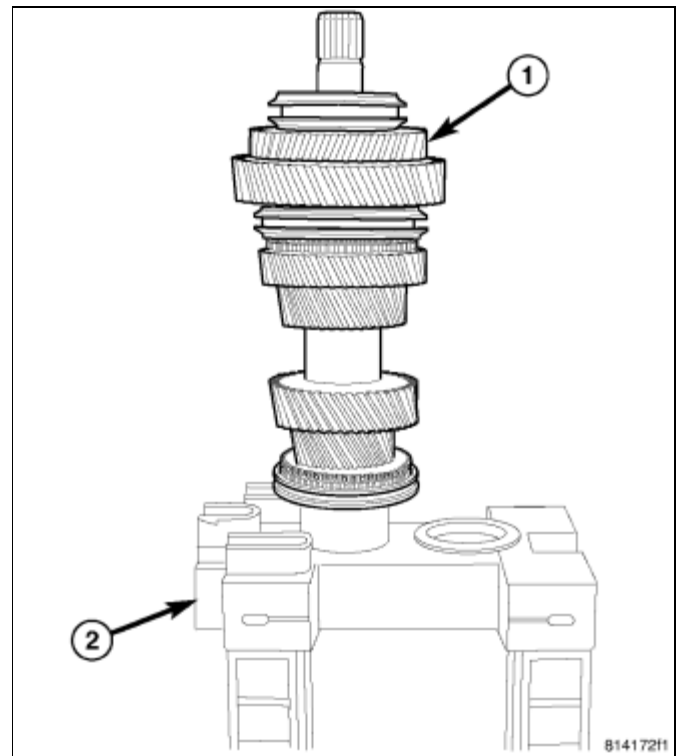


6. Install countershaft bearing (1) retainers (2) and tighten bolts to 10 N·m (88 in. lbs.).

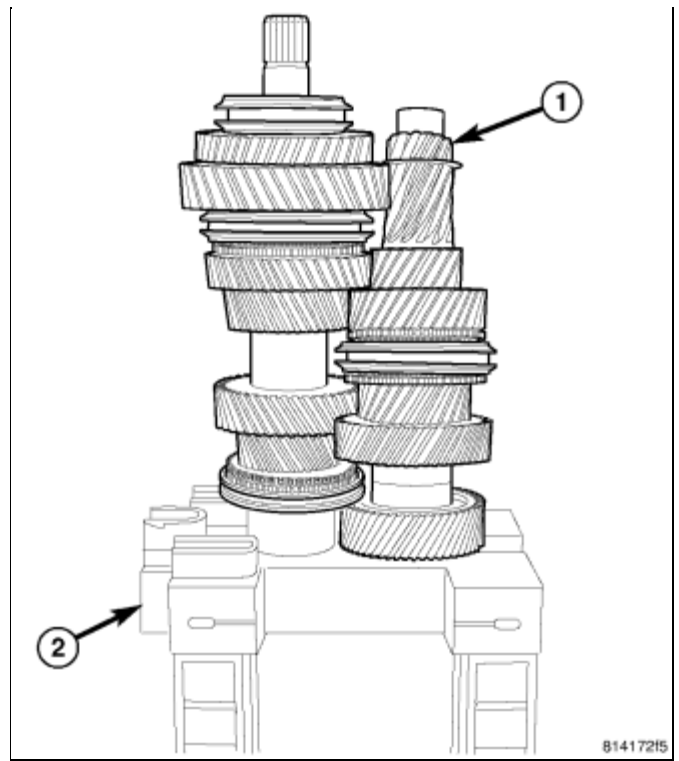


FINAL ASSEMBLY

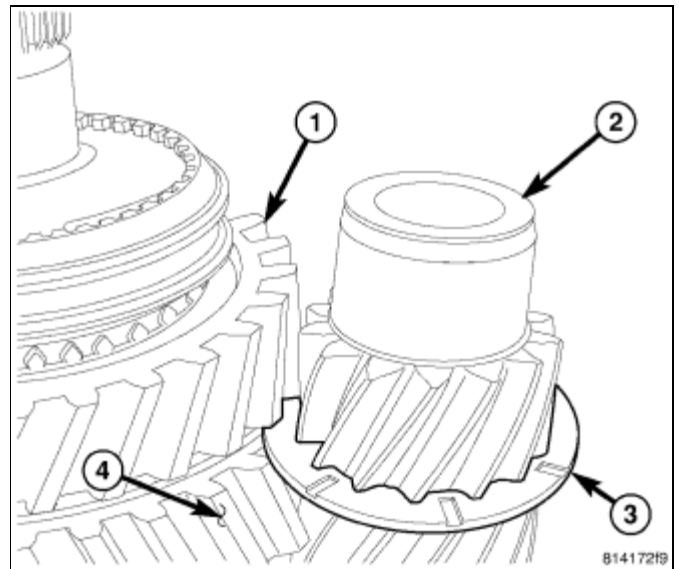
1. Install mainshaft (1) onto Build Fixture 9633 (2).



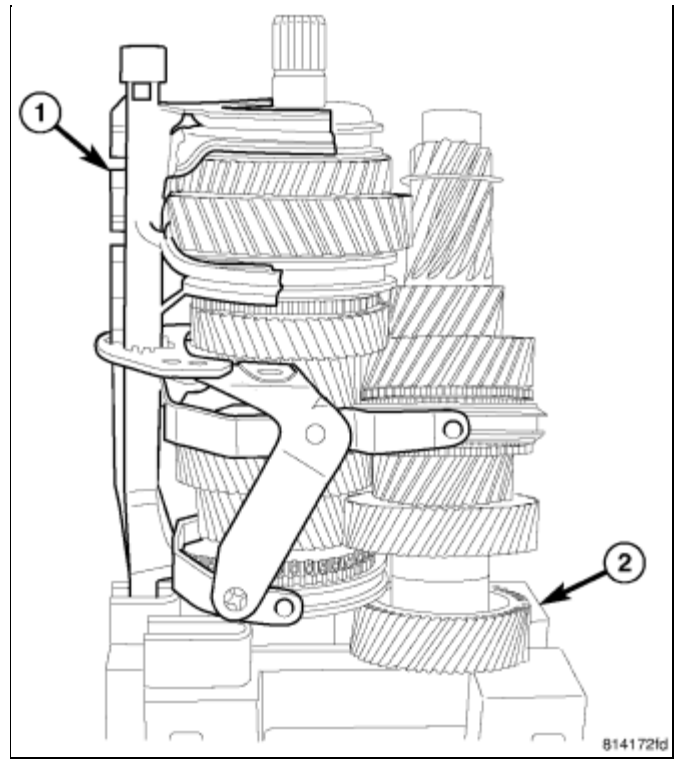
2. Install countershaft (1) onto Build Fixture 9633 (2).



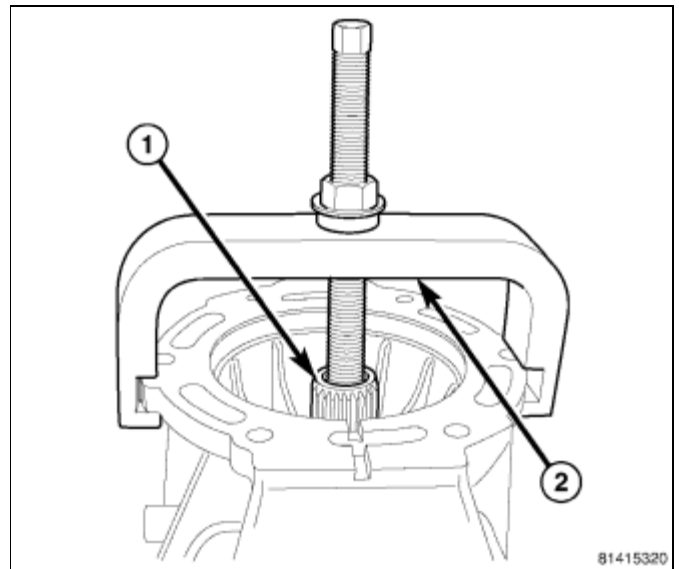
3. Install oil slinger (3) on countershaft (2) between reverse (1) and first gear (4).



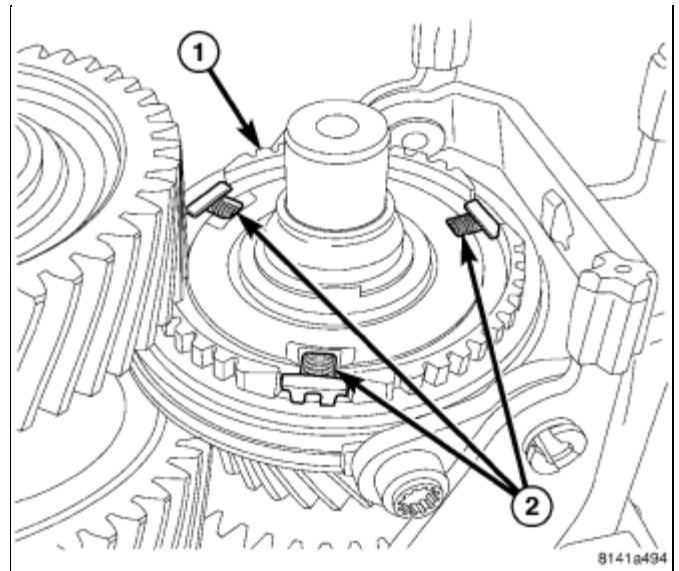
4. Install shift rails and forks (1) onto Fixture 9633 (2) and countershaft/mainshaft .



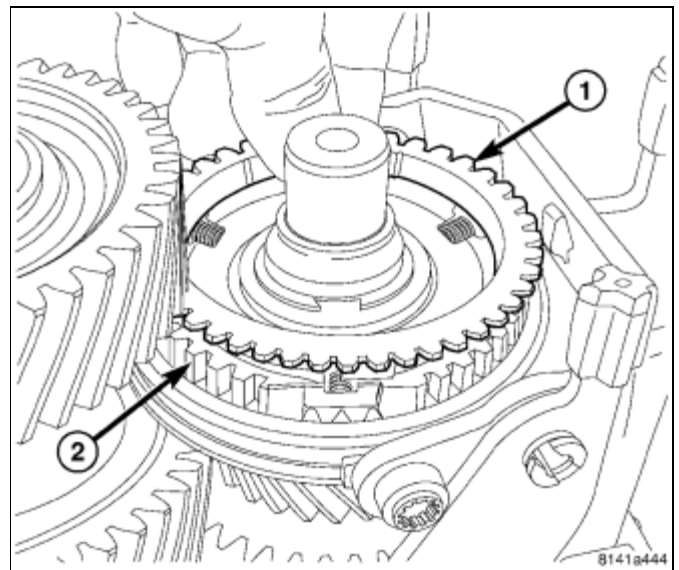
5. Install rear housing on mainshaft (1) with Installer 9636 (2).



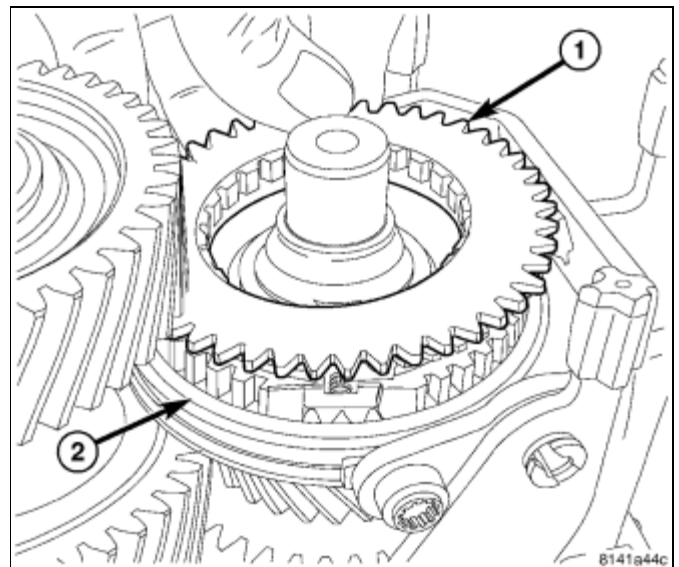
6. Remove rear housing with mainshaft, countershaft and shift rails from fixture. Set assembly on rear housing with shafts pointing up.
7. Install 5-6 synchronizer hub (1) detents, springs, and balls (2).



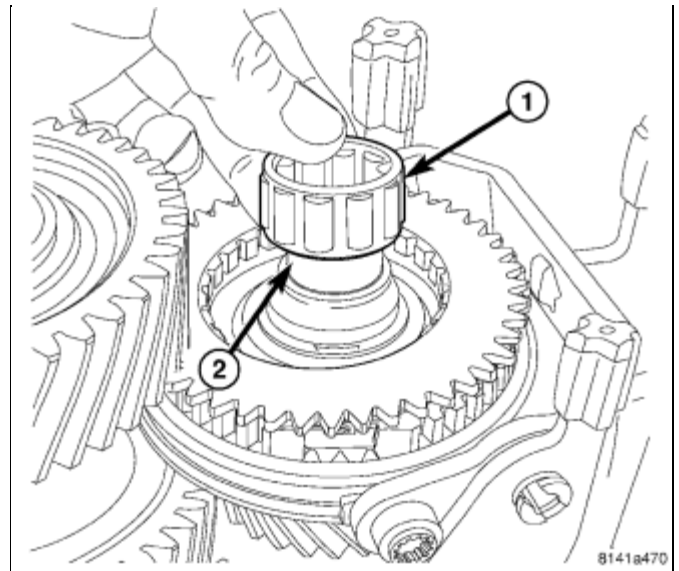
8. Install fifth gear synchronizer friction ring (1) on 5-6 synchronizer hub (2).



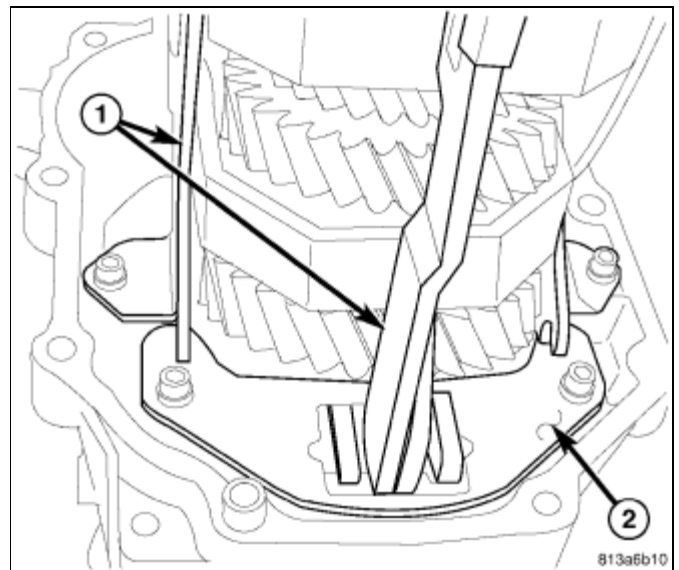
9. Install fifth gear blocker ring (1) on 5-6 synchronizer hub (2). Then hold blocker ring and center synchronizer sleeve.



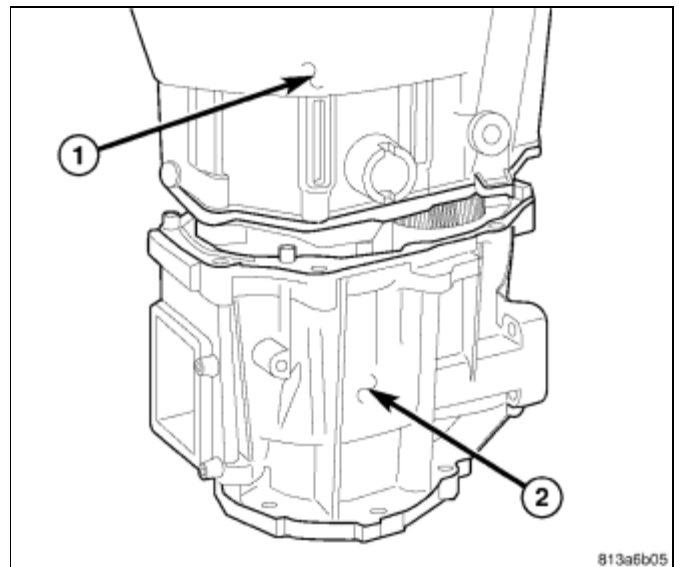
10. Install input shaft roller bearing (1) on mainshaft (2).



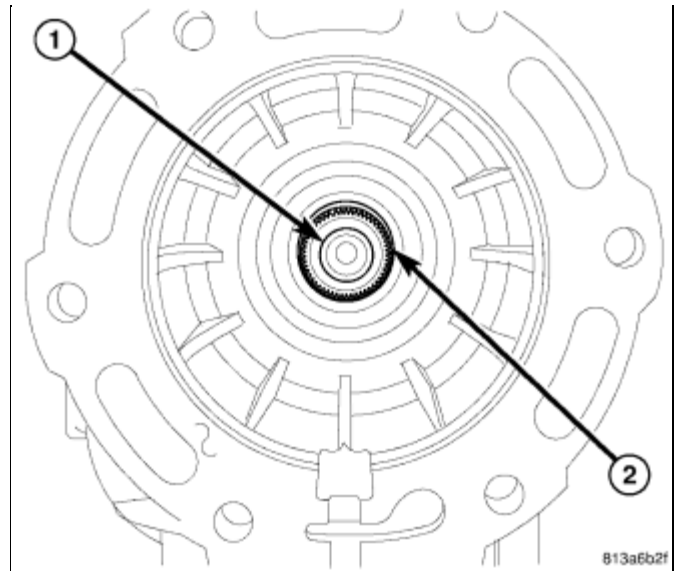
11. Install shift rail (1) support plate (2) bolts and tighten to 8 N·m (71 in. lbs.).



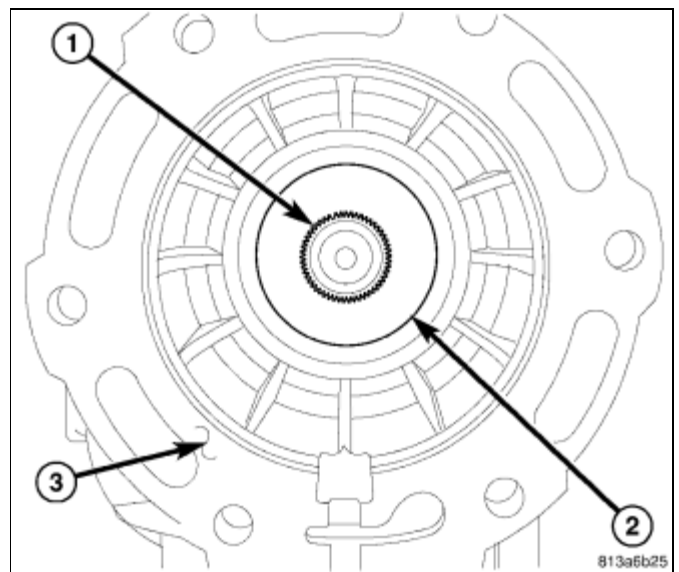
12. Apply MOPAR® Gasket Maker to front housing.
13. Install front housing (1) on rear housing (2) and tighten bolts to 28 N·m (20 ft. lbs.).



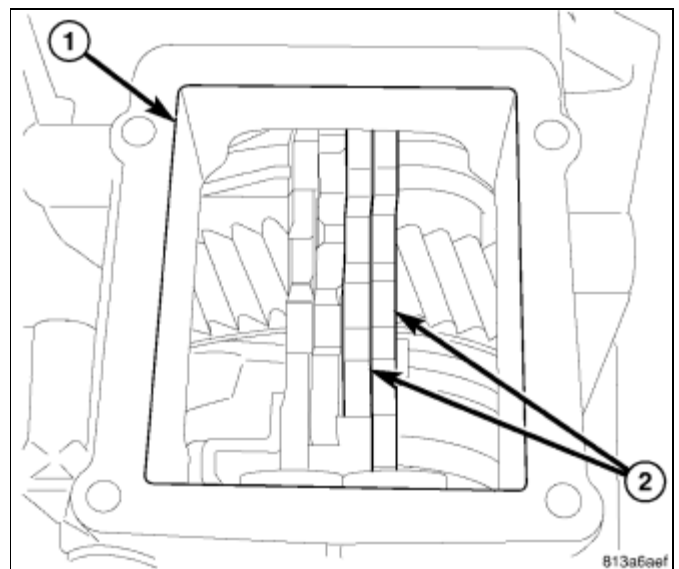
14. Install output shaft (1) snap ring (2) 4x4 only.



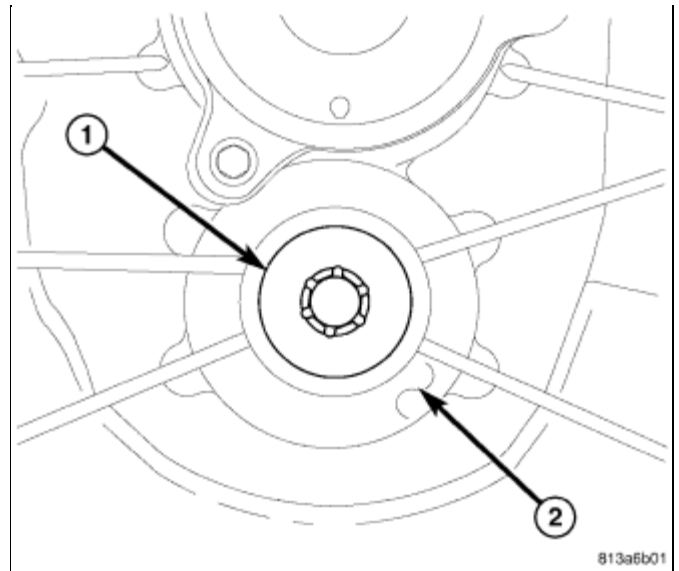
15. Install output shaft (1) seal (2) in rear housing with Installer 9638.



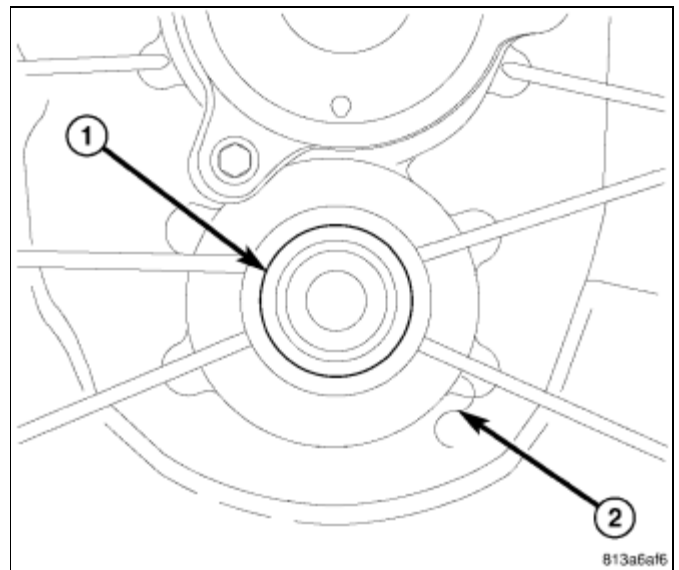
16. Through the shift tower opening (1) move two shift rails (2) forward to lock the transmission in two gear.



17. Install countershaft bolt (1) into the front housing (2) and tighten to 100 N·m (74 ft. lbs.).



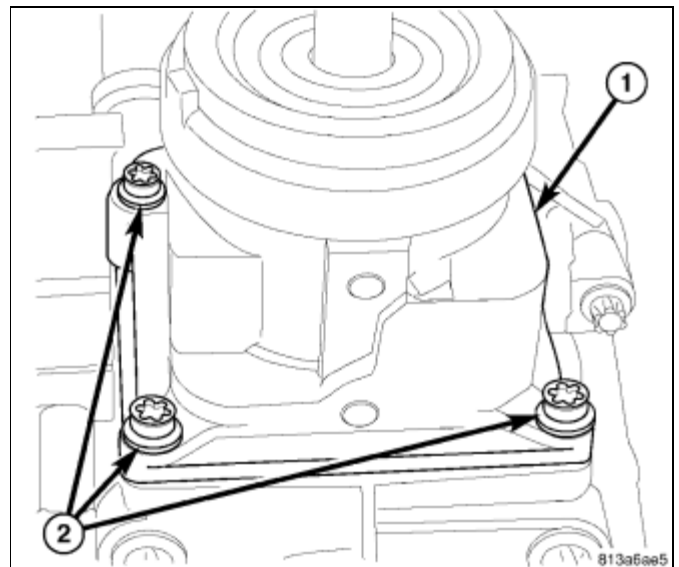
18. Install countershaft plug (1) in front housing (2) with Installer 7828-A and Handle C-4171.



19. Move shift rails to neutral.

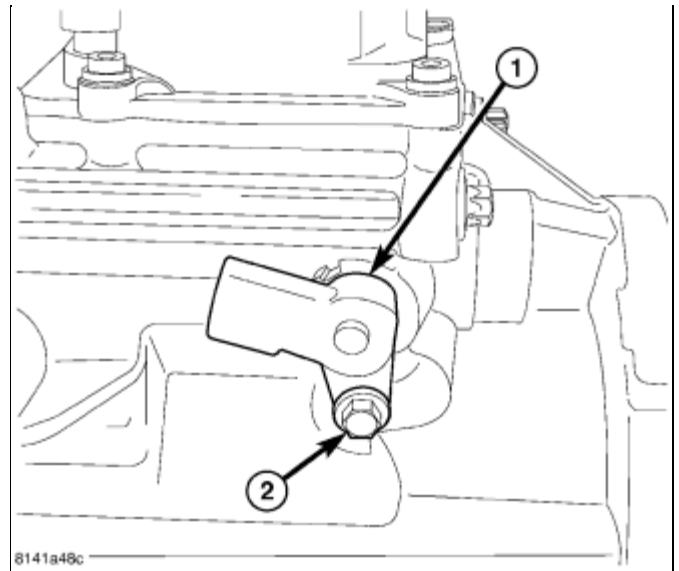
20. To prevent plugging the transmission vent, apply just a thin film of MOPAR® Gasket Maker to shift tower mating surface.

21. Install shift tower (1) and tighten bolts (2) to 14 N·m (10 ft. lbs.).

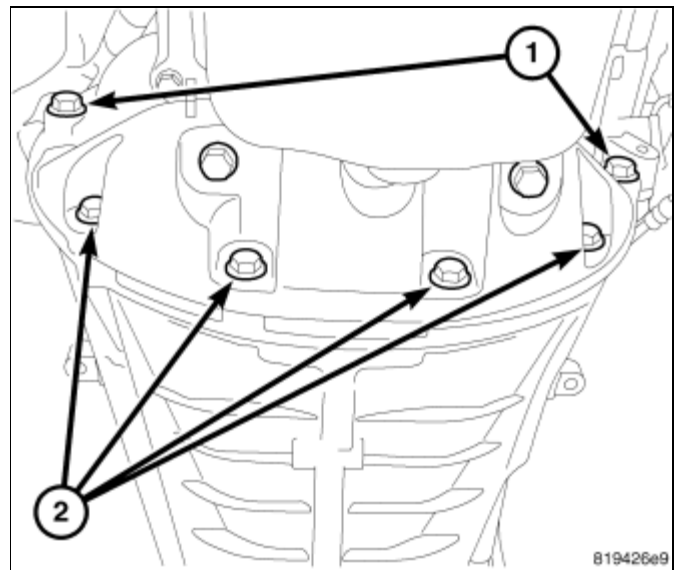


22. Install back up lamp switch (1) and bolt (2).

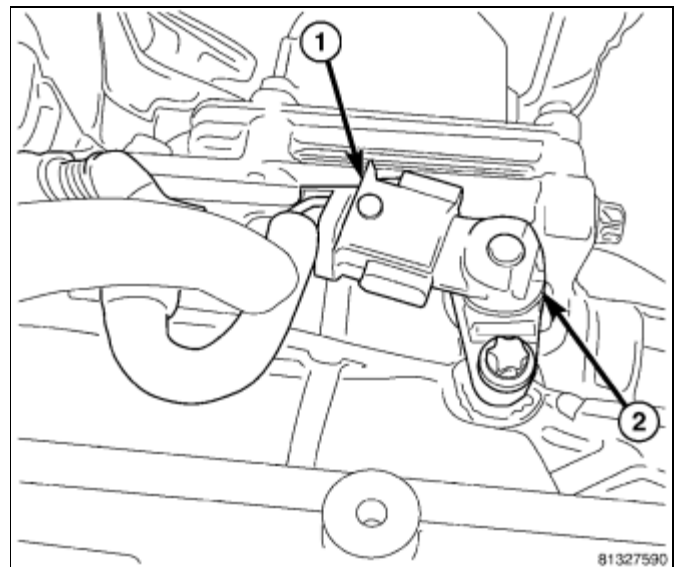
INSTALLATION



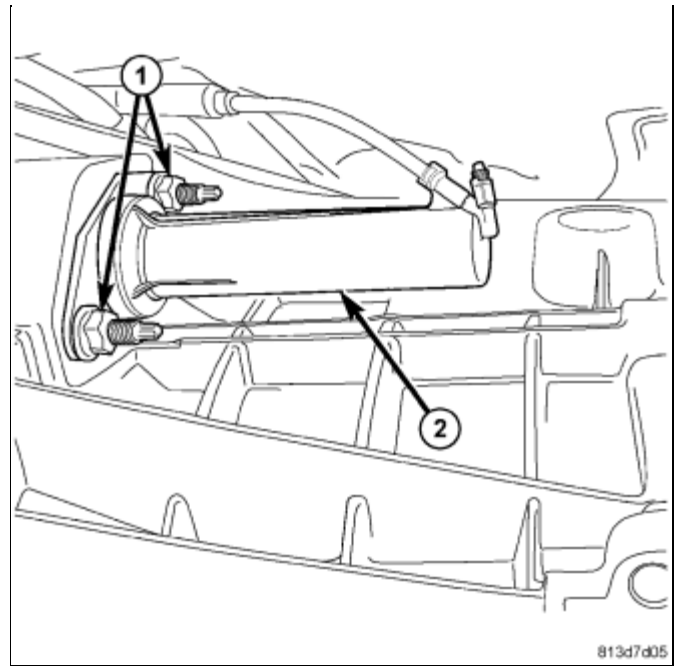
1. Install transmission on engine.
2. Tighten top transmission bolts to 40 N·m (30 ft. lbs.).
3. Tighten two side bolts (1) to 68 N·m (50 ft. lbs.).
4. Tighten four bottom bolts (2) to 54 N·m (40 ft. lbs.).



5. Install backup lamp (2) wiring connector (1).



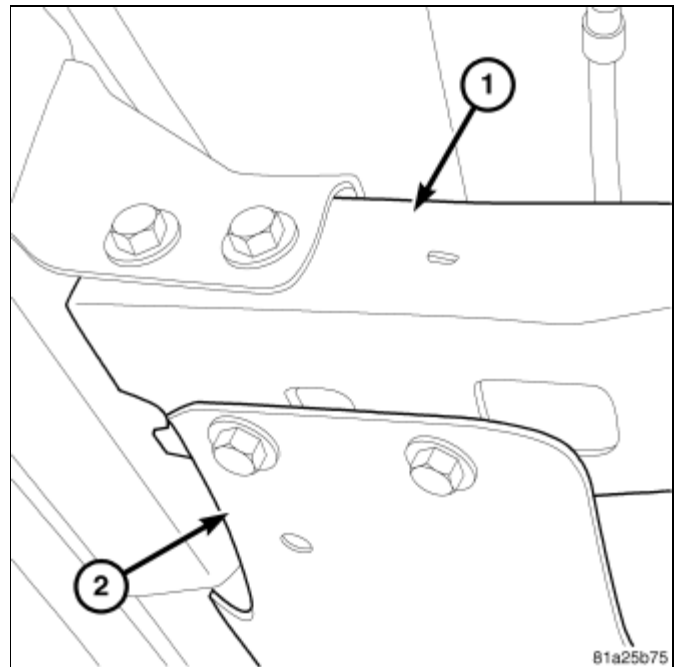
6. Install clutch slave cylinder (2) and tighten mounting nuts (1) to 23 N·m (17 ft. lbs.).



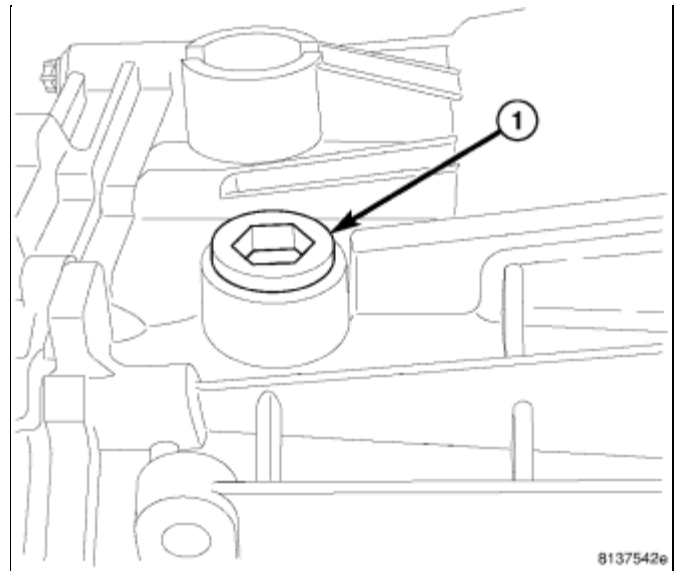
7. Install transmission crossmember (1) and tighten bolts to 47 N·m (35 ft. lbs.). Install transmission mount bolts and tighten to 47 N·m (35 ft. lbs.). Install and tighten skid plate bolts.

8. Install transfer case, if equipped.

9. Install propeller shaft/shafts with reference marks aligned.



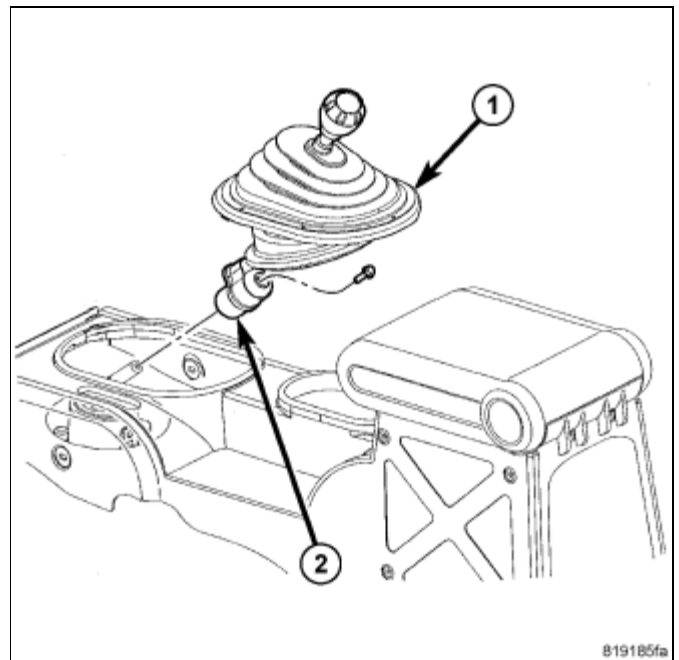
10. Remove fill plug (1) and fill transmission with lubricant.



11. Install shift lever (2) and tighten bolt to 4 N·m (33 in. lbs.).

SPECIFICATIONS

MANUAL TRANSMISSION - NSG370



TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Drain Plug	30	22	-
Fill Plug	30	22	-
Shift Tower Bolts	14	10	-
Shift Lever Bolt	4	-	33
Housing Bolts	28	20	-
Input Shaft Retainer Bolts	9	-	80

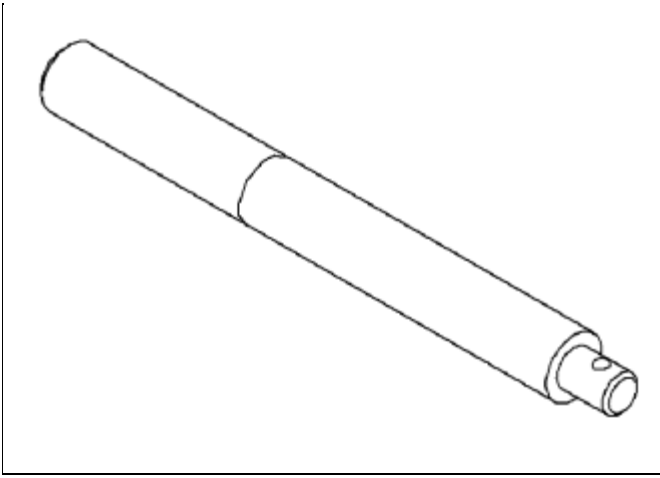
Bearing Retainer Bolts	10	-	88
Shift Rail Support Bolts	8	-	71
Idler Gear Shaft Bolt	20	15	-
Countershaft Bolt	100	74	-
Transmission - Top Four Bolts	40	30	-
Transmission - Side Two Bolts	68	50	-
Transmission - Bottom Four Bolts	54	40	-
Crossmember Bolts	47	35	-
Transmission Mount Bolts	47	35	-

GEAR RATIOS

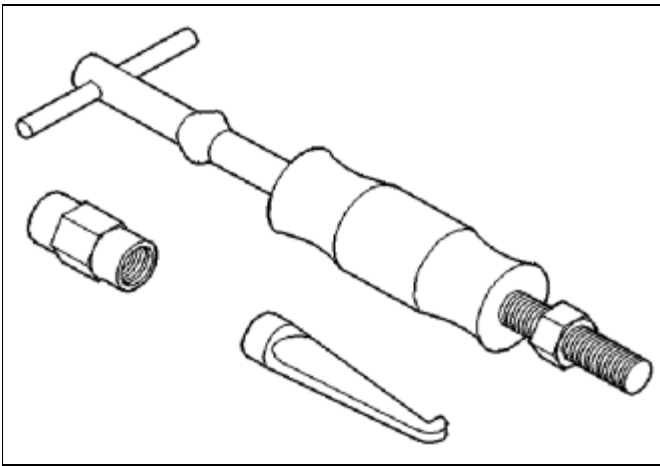
GEAR	RATIO
FIRST	4.46
SECOND	2.61
THIRD	1.72
FOURTH	1.24
FIFTH	1.00
SIXTH	0.84
REVERSE	4.06

SPECIAL TOOLS

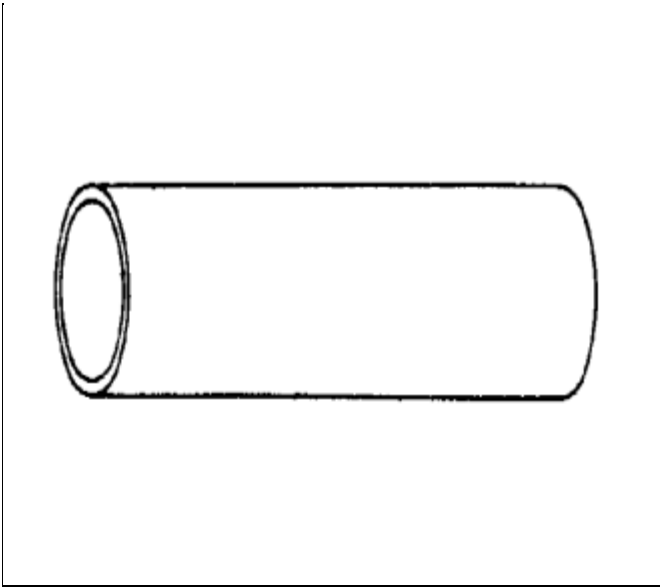
MANUAL TRANSMISSION - NSG370



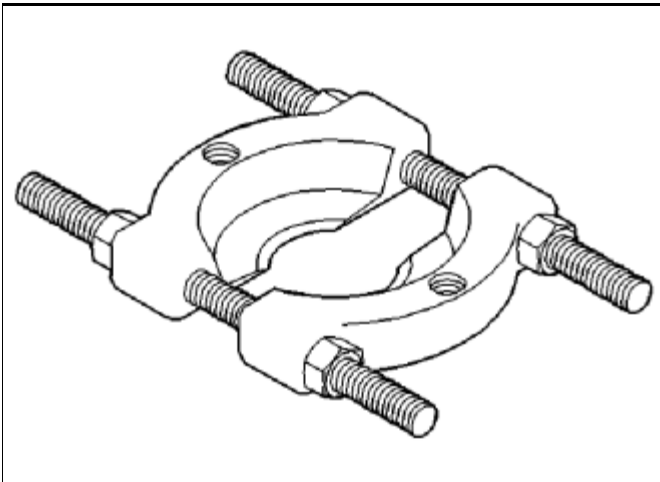
HANDLE C-4171



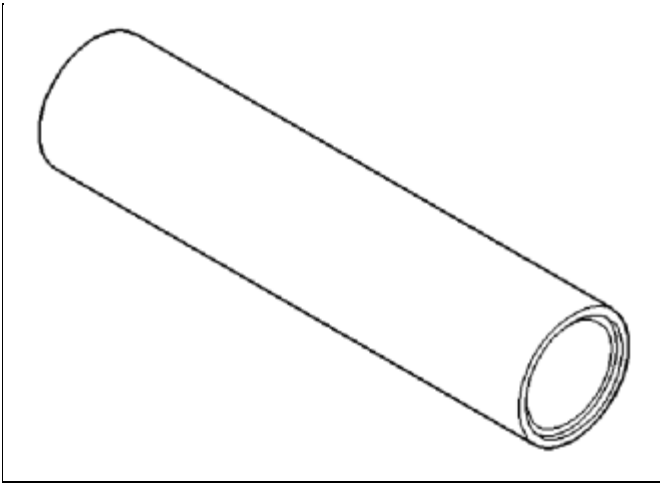
SLIDE HAMMER C-637



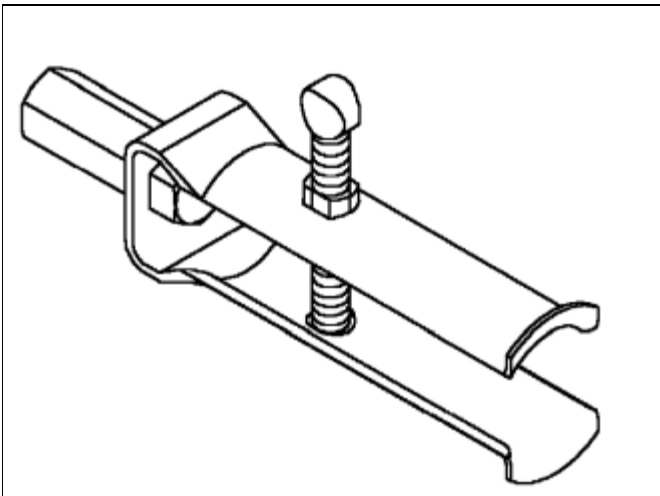
INSTALLER W-262



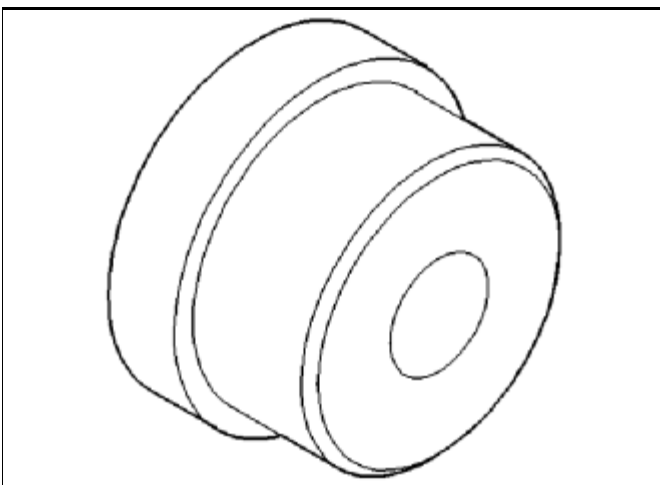
SPLITTER 1130



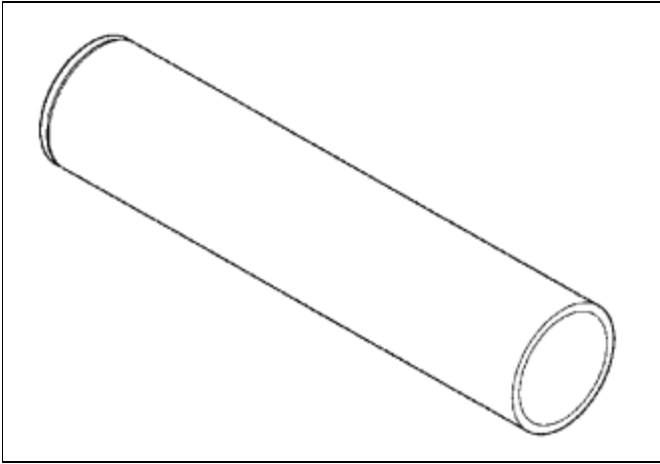
INSTALLER 6448A



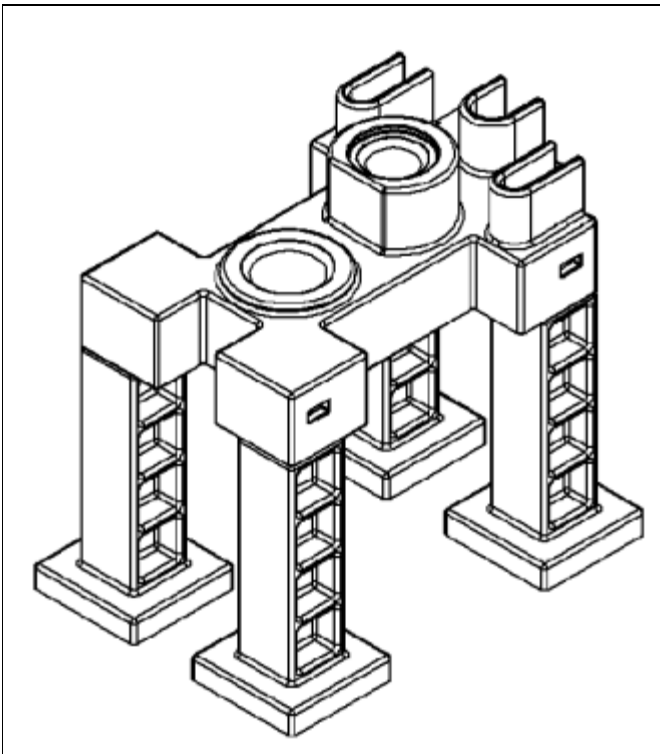
REMOVER 7794-A



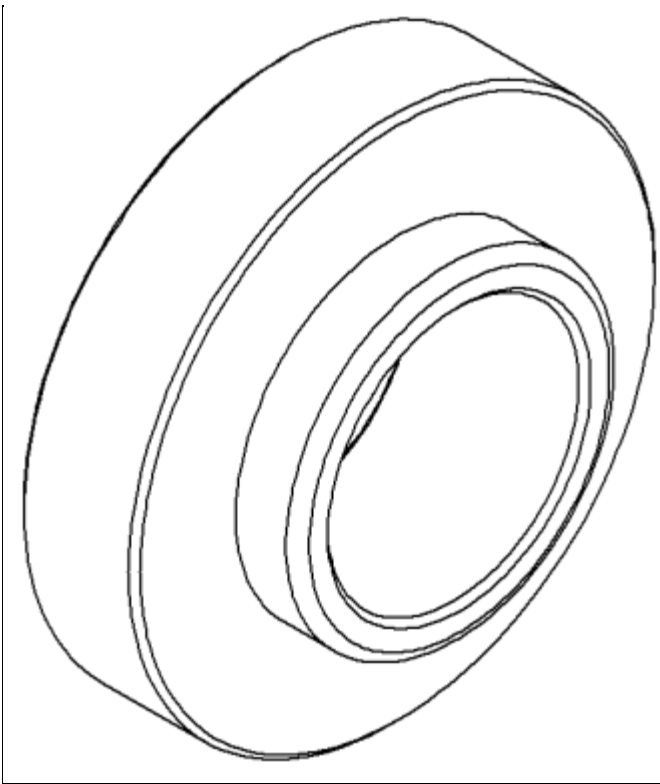
INSTALLER 7829-A



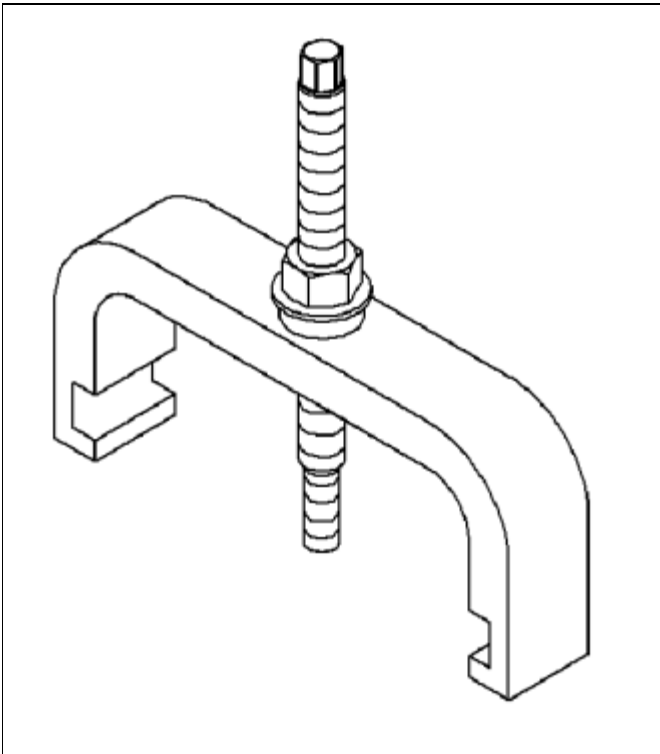
INSTALLER 8228



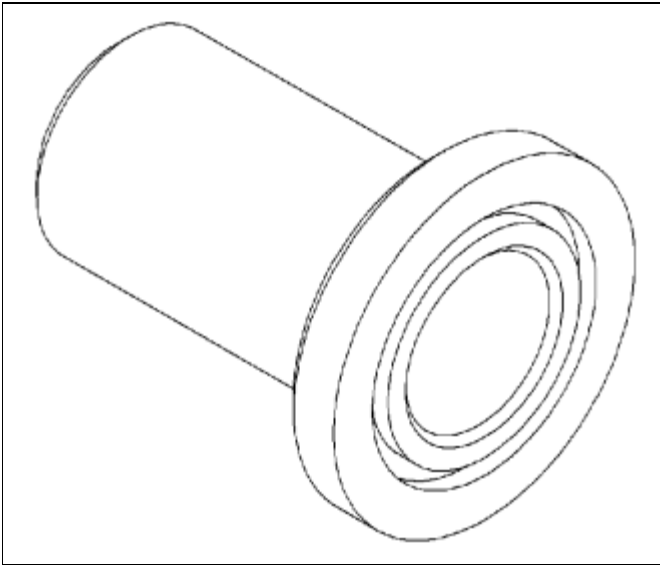
FIXTURE 9633



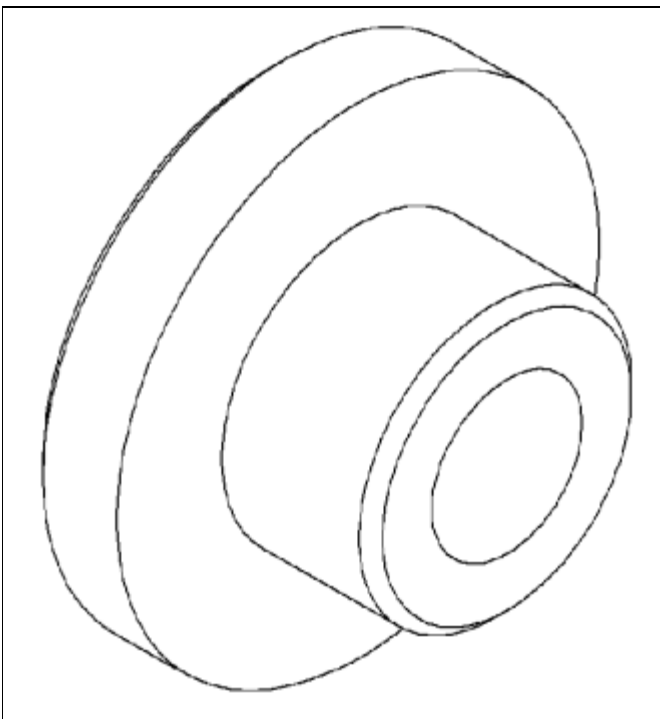
INSTALLER 9635



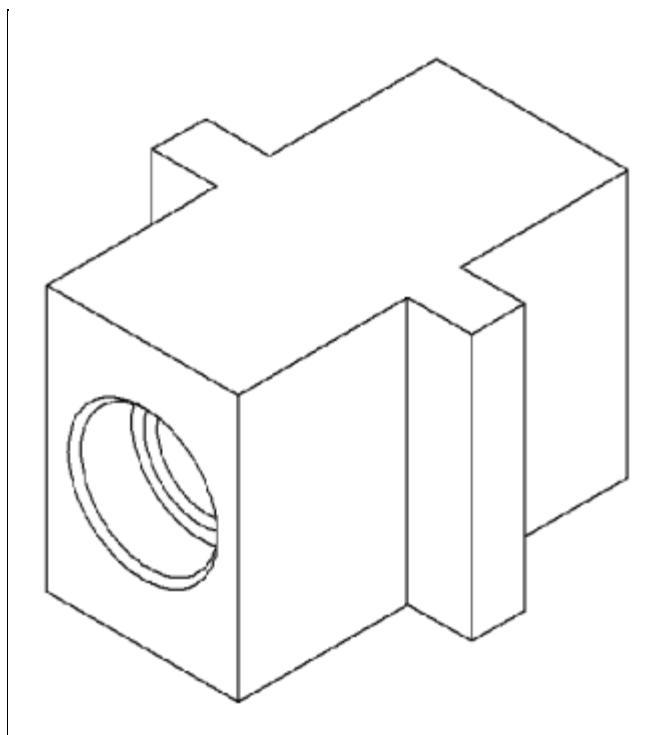
REMOVER/INSTALLER 9636



INSTALLER 9638



INSTALLER 9643



FIXTURE 9648

AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

P0122-TPS/APP CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCS, including pending DTCS and one trip failures.

Are there any Engine TPS DTCS present?

Yes

- Refer to the Driveability category and perform the appropriate diagnostic procedure.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.
With the scan tool, erase Transmission DTCS.

NOTE: Clearing DTCS does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults

and may cause poor shift quality until those values are relearned.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the Event Data. With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0123-TPS/APP CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of

range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

Are there any Engine TPS DTCs present?

Yes

- Refer to the Driveability category and perform the appropriate diagnostic procedure.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.
 With the scan tool, erase Transmission DTCs.

NOTE: Clearing DTCs does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults and may cause poor shift quality until those values are relearned.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the Event Data.
 With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
 Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
 Wiggle the wires while checking for shorted and open circuits.
 Pay particular attention to the TPS signal and sensor ground circuits.
 With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.
 Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0124-TPS/APP INTERMITTENT

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree change is greater than 5° within a period of less than 7.0 ms.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
THROTTLE POSITION SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCS, including pending DTCS and one trip failures.

Are there any Engine TPS DTCS present?

Yes

- Refer to the Driveability category and perform the appropriate diagnostic procedure.

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.
With the scan tool, erase Transmission DTCs.

NOTE: Clearing DTCs does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults and may cause poor shift quality until those values are relearned.

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the Event Data.
With the scan tool, read Transmission DTCs.

Does this DTC reset?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK THE THROTTLE POSITION SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the TPS voltage in the following step.
Slowly open and close the throttle while checking for erratic voltage changes.

Did the TPS voltage change smooth and consistent?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Replace the Throttle Position Sensor per the Service Information.

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The DTC is an informational code only and is being set to aid the technician in determining root cause of a customer driveability issue. The code is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler should be added to the vehicle if the customer regularly drives in a manner that overheats the transmission.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

Immediately when an Overheat shift schedule is activated when the Transmission Oil Temperature reaches 115° C (240° F).

Possible Causes
ENGINE COOLING SYSTEM OPERATION
TRANSMISSION OIL COOLER PLUGGED

HIGH TEMPERATURE OPERATIONS ACTIVATED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK ENGINE COOLING SYSTEM

Perform Engine Cooling System diagnostics per the Service Information.

Is the Engine Cooling System functioning properly?

Yes

- Go to [2](#)

No

- Repair the cause of the engine overheating. Refer to the Service Information for the related diagnostic or repair procedures.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

2. TRANSMISSION OIL COOLER RESTRICTED

Check the Transmission Oil Cooler Flow in accordance with the Service Information.

Is the transmission oil cooler restricted or plugged?

Yes

- Repair the cause of the plugged Transmission Oil Cooler as necessary and repair or replace the Transmission Oil Cooler per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints. This DTC indicates that the transmission has been operating in the "Overheat" shift schedule which may generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

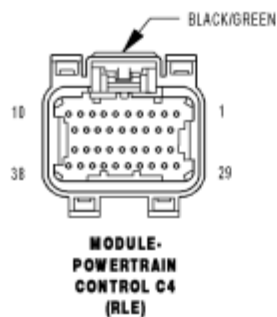
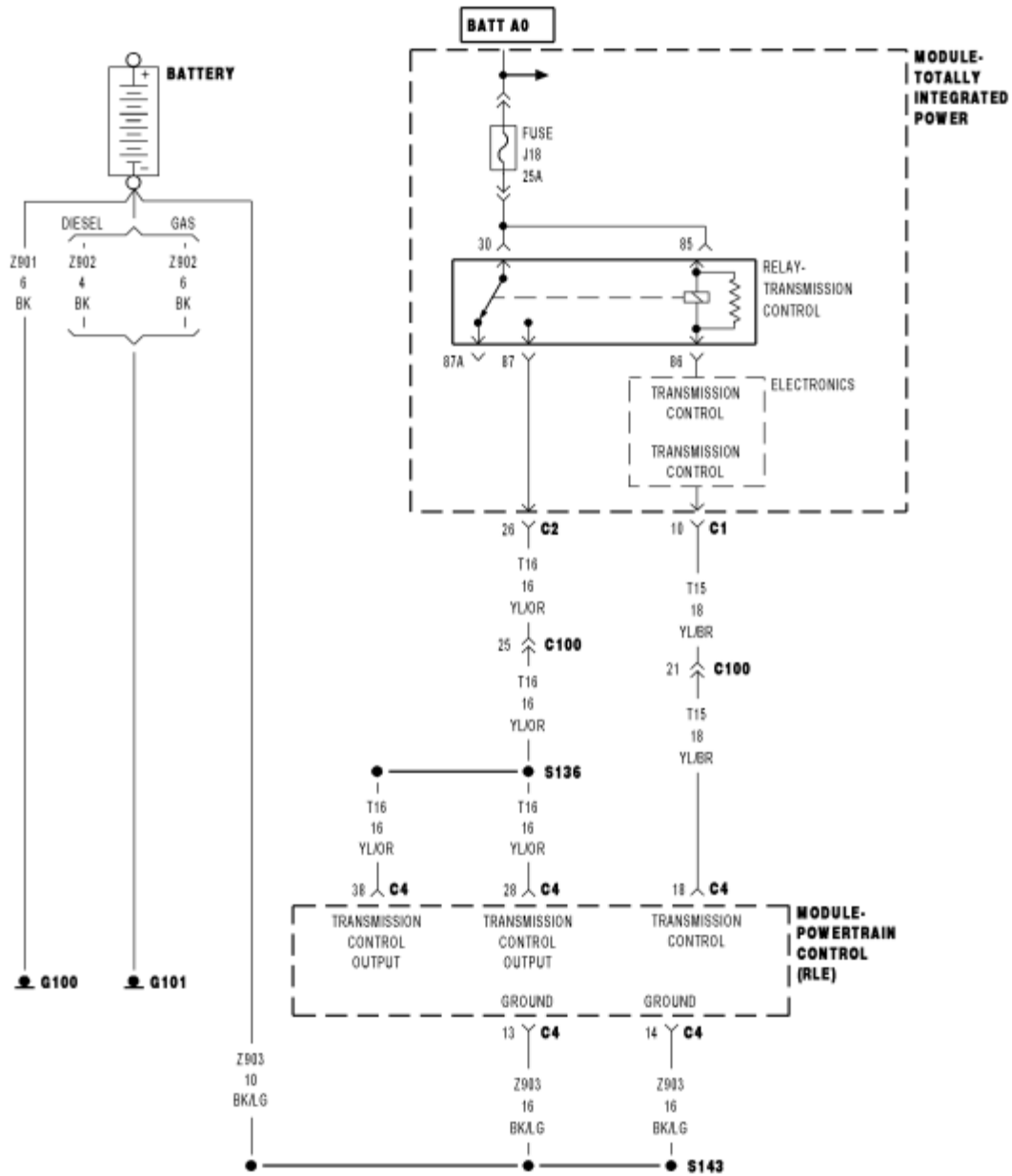
Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

If there are no possible causes remaining, view repair.

Repair

- Repair the cause of transmission overheating per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0562-BATTERY VOLTAGE LOW



RELAY-TRANSMISSION CONTROL (EATX) (IN TIPM)

0199cd03

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Transmission damage may occur if there is insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

- **When Monitored:**

With the engine running and the PCM has closed the Transmission Control Relay.

- **Set Condition:**

If the battery voltage of the Transmission Control Relay Output Sense circuit(s) to the PCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the PCM. The DTC will also set if the battery voltage sensed at the PCM is less than 6.5 volts for 200ms or when Transmission Control Relay Output circuits are less than 7.2 volts for 200ms.

Possible Causes
RELATED CHARGING SYSTEM DTCS
TRANSMISSION CONTROL RELAY
(Z903) GROUND CIRCUIT OPEN OR HIGH RESISTANCE
(T16) TRANSMISSION CONTROL OUTPUT TO TCM OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Theory of Operation

Transmission damage may occur if there is insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

Diagnostic Test

1. CHECK FOR RELATED CHARGING SYSTEM DTCS

With the scan tool, read the Engine DTCS.

Are there any Charging System related DTCS present?

Yes

- Refer to the Charging System category and repair any Charging System DTCS before proceeding. After repairing the Charging System DTCS, perform the Transmission Verification test to verify the transmission and or controller was not damaged.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK FOR TIPM DTCS

NOTE: Generator, battery, and charging system must be fully functional before performing this test.

With the scan tool, read TIPM DTCS.

Are there any TIPM TCM Power Control Circuit DTCS present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [3](#)

3. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCS.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [4](#)

No

- Go to [6](#)

4. CHECK THE (Z903) GROUND CIRCUITS FOR AN OPEN

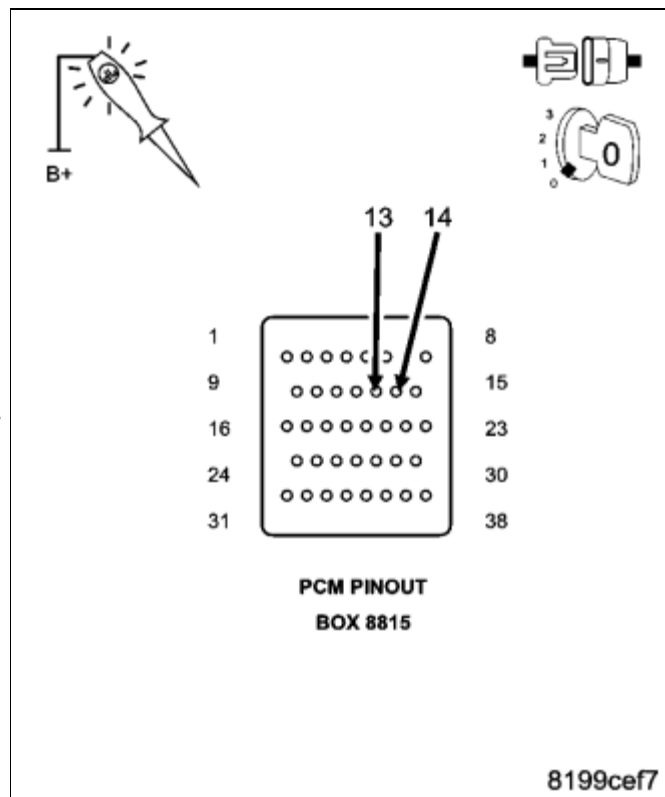
Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, check the (Z903) Ground circuits in the appropriate terminals of Miller tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.



Does the test light illuminate brightly for all the Ground circuits?

Yes

- Go to [5](#)

No

- Repair the (Z903) Ground circuit for an open circuit or high resistance.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.
Disconnect the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector (if equipped).
Ignition on, engine not running.

With the scan tool under TIPM, actuate the Transmission. Using a 12-volt test light connected to ground, check all (T16) Transmission Control Output circuits.

NOTE: The (T16) Transmission Control Output circuit branches off to both Transmission Solenoid/Pressure Switch Assembly, PCM and (if equipped) the Line Pressure Sensor/Variable Force Solenoid Assembly.

Does the test light illuminate brightly while cycling on and off on all (T16) Transmission Control Output circuits?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair the (T16) Transmission Control Relay Output circuit(s) for an open or high resistance.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorts and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

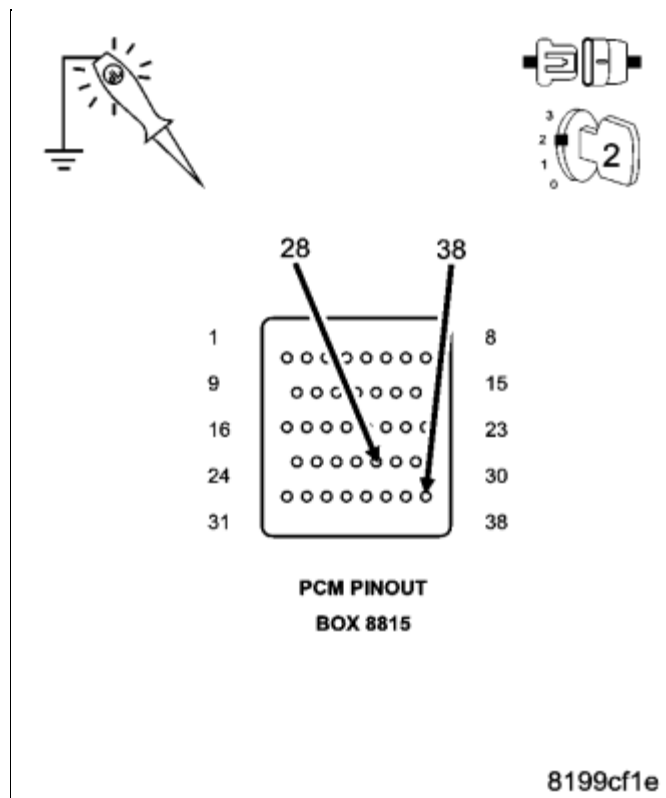
Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.



P0602-CONTROL MODULE PROGRAMMING ERROR/NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. This software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found, the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

- **When Monitored:**

Check for generic software is made at power-up.

- **Set Condition:**

If generic software is found, the MIL will light immediately. This DTC is designed to signal the technician that the controller still has generic software installed.

Possible Causes
PCM - PROGRAMMING ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CONTROL MODULE PROGRAMMING ERROR

NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.

Record the controller part number.

Update the controller with the correct software in accordance with the Service Information.

Verify that the controller updated successfully.

Test Complete

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0604-INTERNAL CONTROL MODULE RAM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

After the controller is reset, the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be the same as the written value. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

- **When Monitored:**

One time after the ignition key is turned to the run position.

- **Set Condition:**

The read value does not match the written value in any RAM location.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. PCM - INTERNAL ERROR

If there are no possible causes remaining, view repair.

Repair

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service

Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0605-INTERNAL CONTROL MODULE ROM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

After the controller is reset, the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in memory. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

- **When Monitored:**

One time after the ignition key is turned to the run position.

- **Set Condition:**

If the ROM checksum does not match a known constant.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0613-INTERNAL TRANSMISSION PROCESSOR

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The internal watchdog is a separate hardware circuit which continuously monitors the microprocessor. To make sure the transmission is operating properly, the watchdog must receive a signal from the microprocessor within a specific time window. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

- When Monitored:**

After the ignition key is turned to the run position and 60 seconds thereafter.

- Set Condition:**

Either of the following conditions occur 3 times in less than 590 milliseconds: The watchdog line remains high after the watchdog test or the transmission relay coil is energized and remains on after the watchdog delay expires.

Possible Causes
PCM - INTERNAL ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention

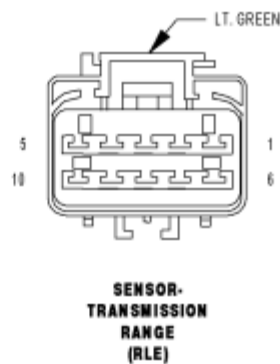
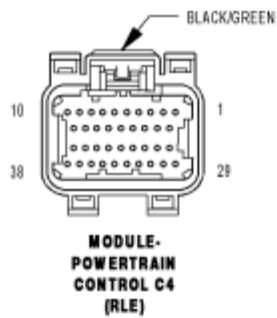
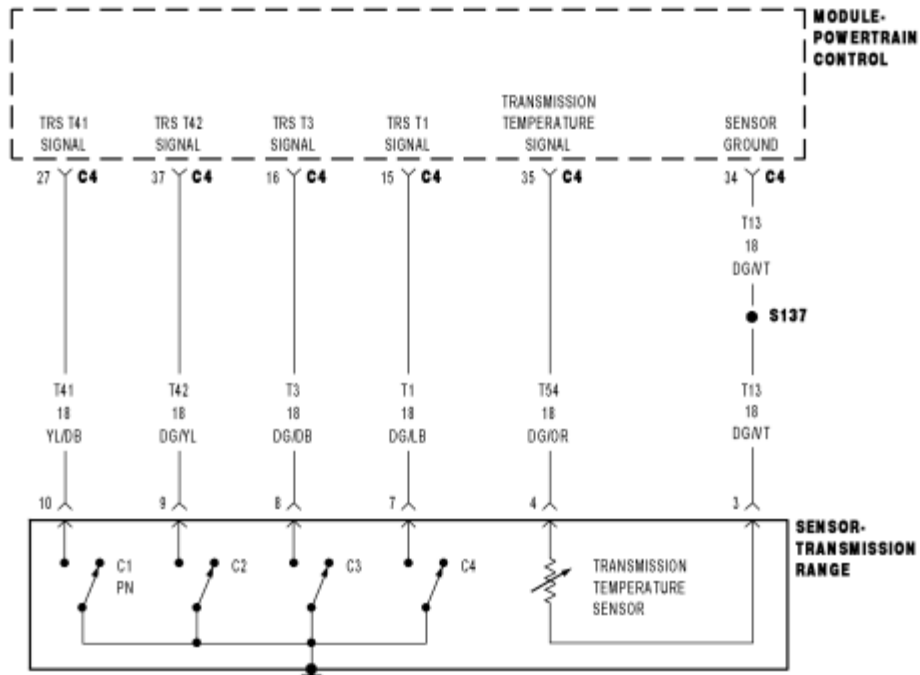
to all power and ground circuits.

If there are no possible causes remaining, view repair.

Repair

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0706-TRANSMISSION RANGE SENSOR RATIONALITY



01004164

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The C1 through C4 (T41, T42, T3, and T1) Signal circuits communicate the shift lever position to the PCM. Each circuit is terminated at the transmission with a switch. Each switch can be either open or closed, depending on the shift lever position. The PCM can decode this information and determine the shift lever position. Each shift lever position has a certain combination of switches, which will be open and closed, this is called a PRNDL code. There are 4 switches, therefore: there are many possible combinations of open and closed switches (codes). However, there are only 9 valid codes (8 for AutoStick), one for each gear position and three recognized between gear codes. The remainder of the codes should never occur, these are called invalid codes. The following chart shows the normal switch states for each shift lever position.

- **When Monitored:**

Continuously with the ignition on.

- **Set Condition:**

The DTC will set if the controller detects an invalid PRNDL code which lasts for more than 0.042 seconds.

Possible Causes
SHIFTER OUT OF ADJUSTMENT
TRS SIGNAL CIRCUIT OPEN
TRS SIGNAL CIRCUIT SHORT TO GROUND
TRS SIGNAL CIRCUIT SHORT TO VOLTAGE
METAL DEBRIS IN OIL PAN
TRANSMISSION RANGE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

TRS SWITCH STATES

SLP	T41 (C1)	T42 (C2)	T3 (C3)	T1 (C4)
P	CLOSED	CLOSED	CLOSED	OPEN
R	OPEN	CLOSED	OPEN	OPEN

N	CLOSED	CLOSED	OPEN	CLOSED
OD	OPEN	OPEN	OPEN	CLOSED
3 or AutoStick if equipped	OPEN	OPEN	CLOSED	OPEN
L	OPEN	CLOSED	CLOSED	CLOSED

SHIFT LEVER ERROR CODES REPORTED BY SCAN TOOL

ERROR CODE	SWITCH CIRCUIT STUCK	SWITCH POSITION
1	T1 (C4)	OPEN
2	T1 (C4)	CLOSED
3	T3 (C3)	OPEN
4	T3 (C3)	CLOSED
5	T42 (C2)	OPEN
6	T42 (C2)	CLOSED
7	T41 (C1)	OPEN
8	T41 (C1)	CLOSED

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the Shift Lever Position Test.

Select the test outcome from the following:

Test passes:

- Go to [6](#)

Test fails with Error Code:

- Go to [2](#)

Test fails without Error Code:

- Perform the Gearshift Adjustment Procedure per the Service Information.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

2. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing "ENTER" on the scan tool.

NOTE: When the scan tool requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with an error code 11 or OD-TOW/HALL STUCK OPEN.

NOTE: If the Shift Lever Position test fails, make sure to note the identification of the TRS Signal circuit for future reference.

Did the Shift Lever Position test pass?**Yes**

- Remove the Oil Pan and Main Valve Body Assembly per the Service Information. Check for metal debris on top of the TRS Assembly. If debris is present, determine the cause of the debris and repair the transmission as necessary. If no problems are found, replace the Transmission TRS Assembly per the Service Information.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. TRS SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors and install Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the identified (T41, T42, T3, and T1) TRS Signal circuit, from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the identified (T41, T42, T3, and T1) TRS Signal circuit for an open.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. TRS SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the identified (T41, T42, T3, and T1) TRS Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the identified (T41, T42, T3, and T1) TRS Signal circuit for a short to ground.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. TRS SIGNAL CIRCUIT SHORT TO OTHER CIRCUITS

Measure the resistance between the identified (T41, T42, T3, and T1) TRS Signal circuit and all other circuits in

the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 100k ohms between the identified (T41, T42, T3, and T1) TRS Signal circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the identified (T41, T42, T3, and T1) TRS Signal circuit for a short to other circuit(s).
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

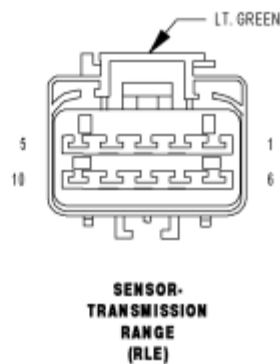
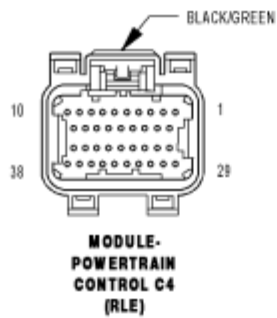
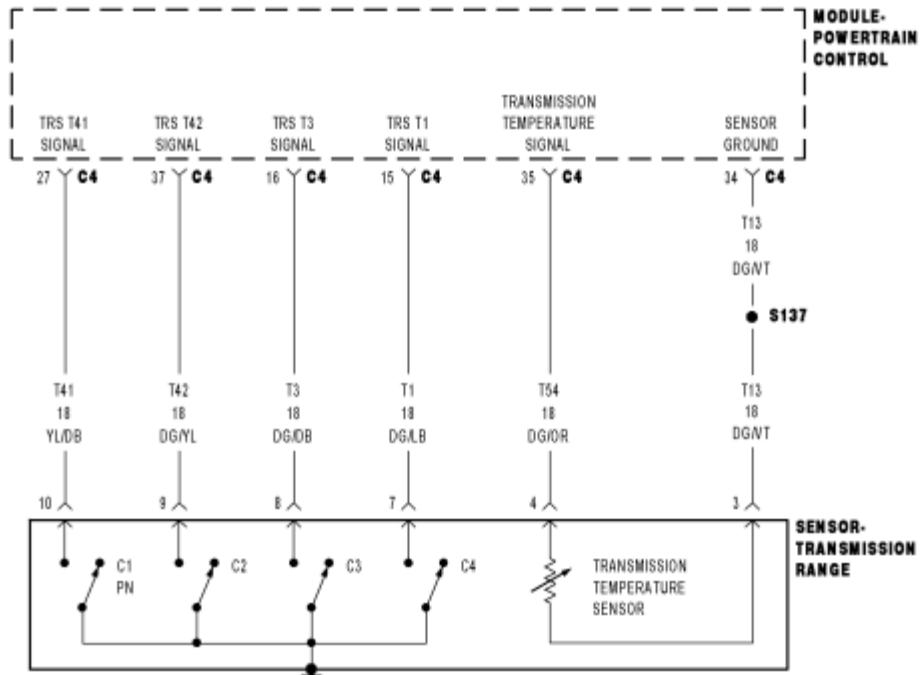
Yes

- Repair as necessary.
- Perform the PRNDL Fault Clearing Procedure (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE



01004164

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

DTC will set when the transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate DTC set time is 10 to 35 minutes. The following are starting temperature to warm up times to set this DTC: starting temperature - 40° C (-40° F) warm up time 35 minutes, starting temperature -28° C (-20° F) 25 minutes, starting temperature -6.6° C (20° F) 20 minutes, starting temperature 15.5 ° C (60° F) 10 minutes. When the fault is set, calculated temperature is substituted for measured temperature, however the DTC is stored only after three consecutive occurrences.

Possible Causes
RELATED TRANSMISSION TEMPERATURE DTCS PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED TRANSMISSION TEMPERATURE DTCS

With the scan tool, read DTCs.

Are there any other Transmission Temperature Sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the Transmission Temperature voltage while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings (± 0.2 volts)?

Yes

- Replace Transmission Range Sensor (TRS) Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for any Service Bulletins and for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0712-TRANSMISSION TEMPERATURE SENSOR LOW

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible Causes
RELATED DTCS PRESENT
(T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT SHORT TO GROUND
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, read DTCs.

Are there any Speed Sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [5](#)

3. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the Transmission Temperature voltage while turning the Thermistor voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings $\pm$ 0.2 volts?

Yes

- Replace Transmission Range Sensor (TRS) Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. CHECK THE (T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector.
 Disconnect the TRS Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T54) Transmission Temperature Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T54) Transmission Temperature Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

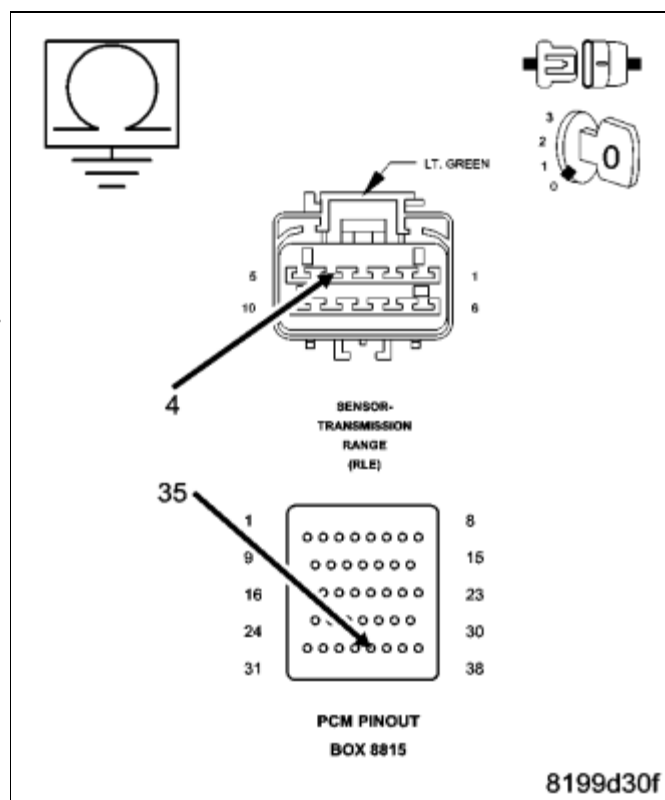
5. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
 Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
 Wiggle the wires while checking for shorted and open circuits.
 With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.
 Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

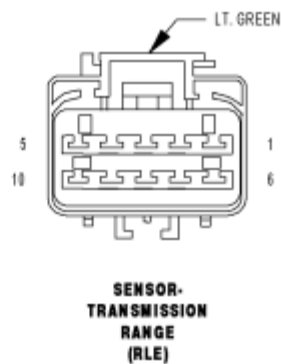
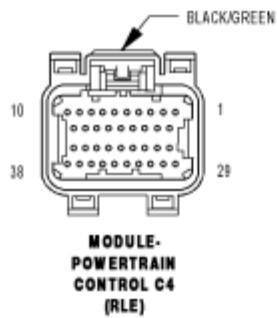
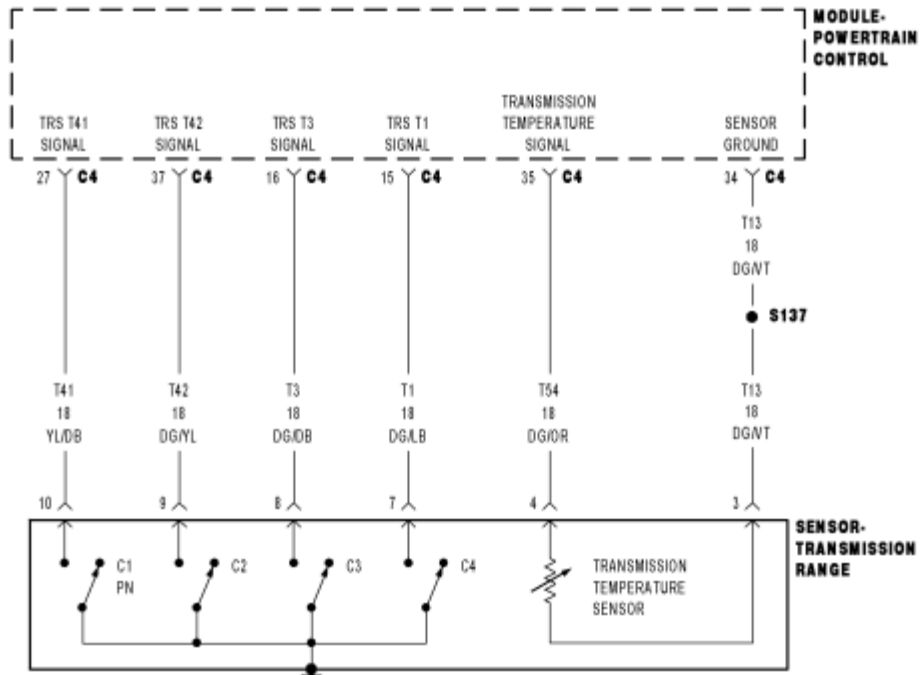
- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Test Complete.

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH



01004164

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible Causes
(K900) SENSOR GROUND OPEN
(T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT OPEN
(T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

1. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [2](#)

No

- Go to [6](#)

2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the Transmission Temperature voltage while turning the Thermistor voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings (± 0.2 volts)?

Yes

- Replace Transmission Range Sensor (TRS) Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

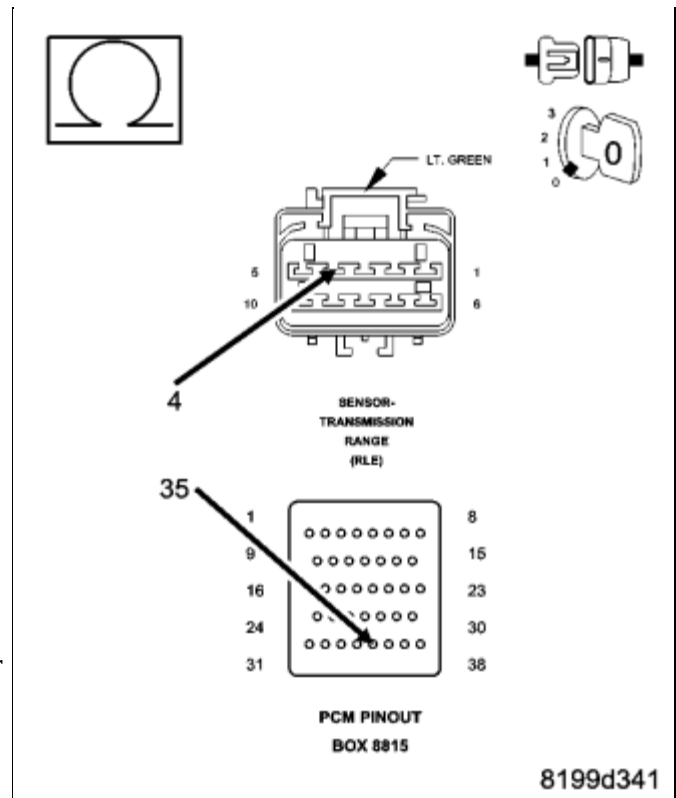
- Go to [3](#)

3. CHECK THE (T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the TRS harness connector

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the Transmission Temperature Signal circuit between the TRS harness connector and the appropriate terminal of Miller tool #8815.



Is the resistance above 5.0 ohms?

Yes

- Repair the Transmission Temperature Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN

Disconnect the PCM C2 harness connector. Measure the resistance of the (K900) Sensor Ground circuit between the TRS harness connector and the appropriate terminal of Miller tool #8815.

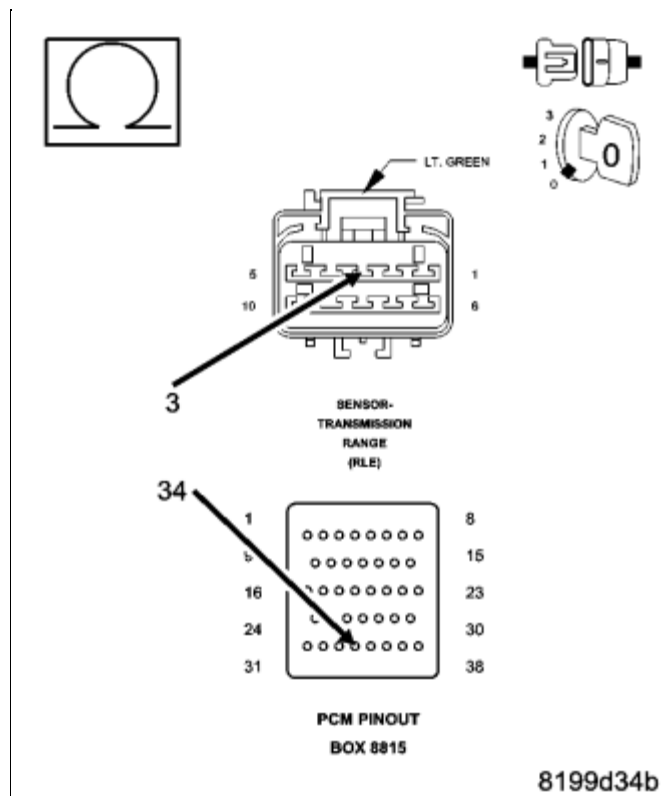
Is the resistance above 5.0 ohms?

Yes

- Repair the (K900) Sensor Ground circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. CHECK THE (T54) TRANSMISSION TEMPERATURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T54) Transmission Temperature Sensor Signal circuit in the appropriate terminal of Miller tool #8815.

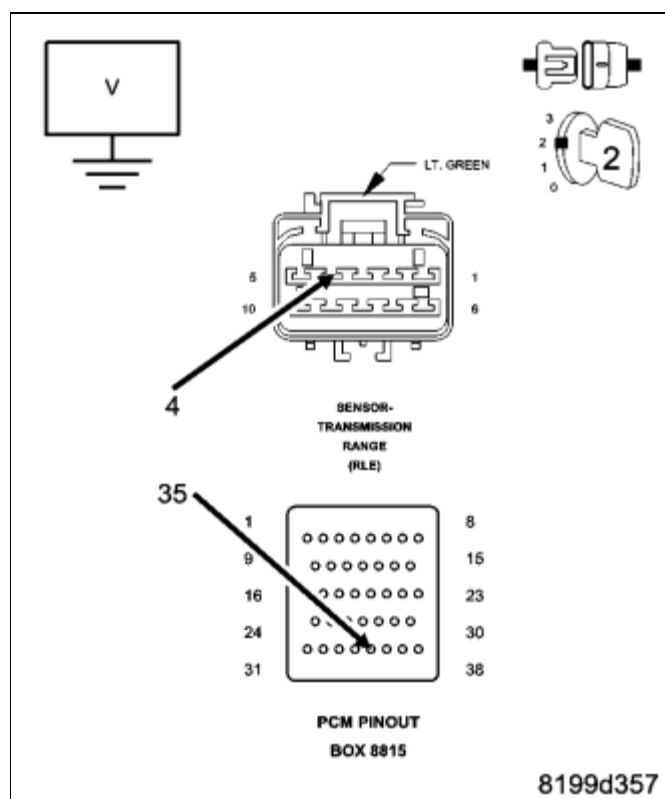
Is the voltage above 0.5 volts?

Yes

- Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are



found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

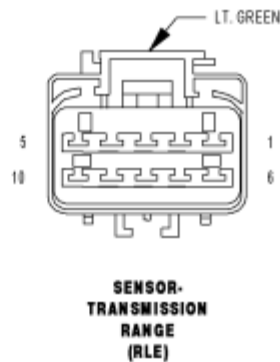
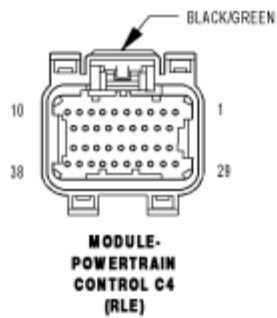
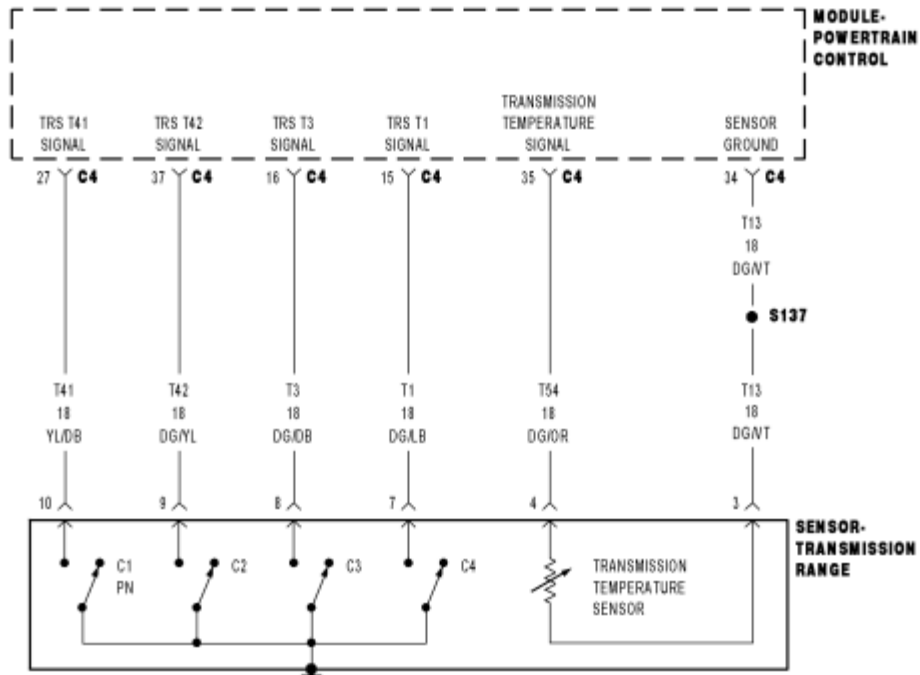
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT



01004164

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

Possible Causes
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

1. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [2](#)

No

- Go to [3](#)

2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being

started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the Transmission Temperature voltage while turning the Thermistor voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading (± 0.2 volts)?

Yes

- Replace Transmission Range Sensor (TRS) Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

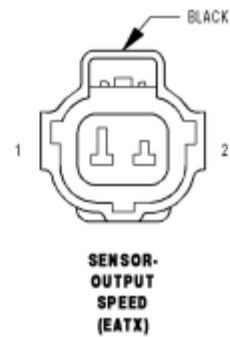
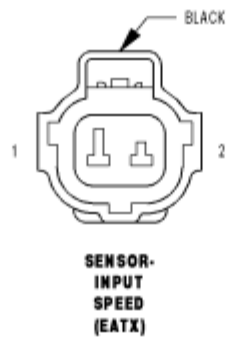
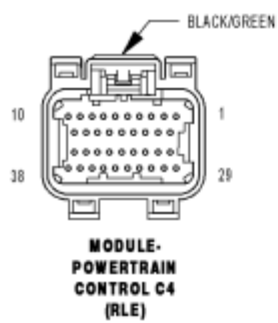
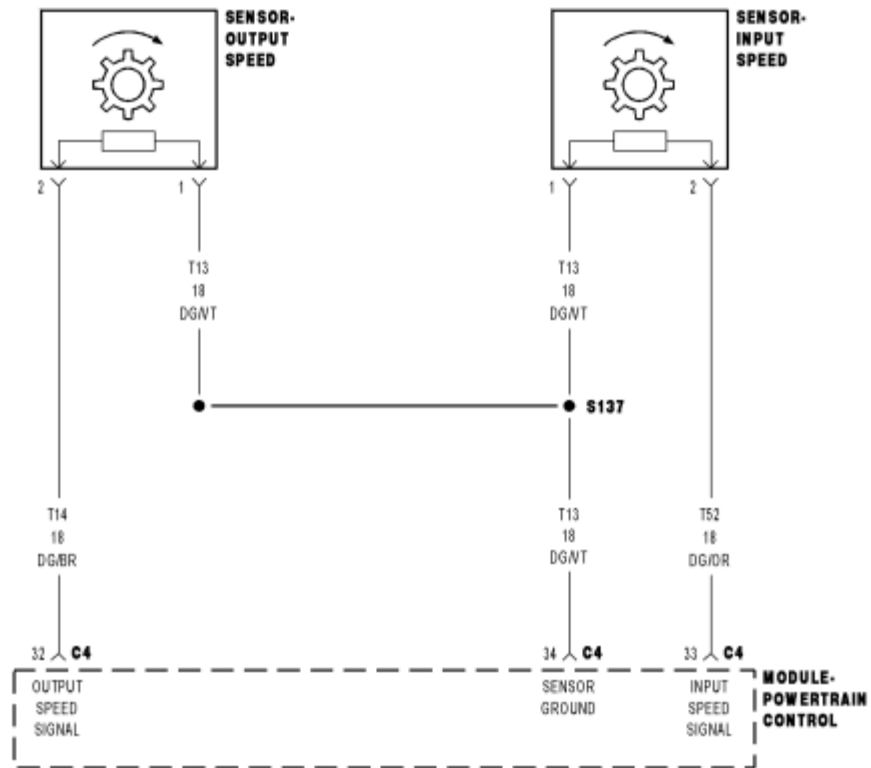
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0716-INPUT SPEED SENSOR 1 CIRCUIT PERFORMANCE



81994529

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission control system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

- **When Monitored:**

The transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If there is an excessive change in the Input rpm in any valid gear (R, 1st, 2nd, 3rd, or 4th).

Possible Causes
(T52) INPUT SPEED SIGNAL CIRCUIT OPEN
(T13) SENSOR GROUND CIRCUIT OPEN
(T52) INPUT SPEED SIGNAL CIRCUIT SHORT TO GROUND
(T52) INPUT SPEED SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

Start the engine.
Place the shifter in Park.

With the scan tool, read the Input Speed Sensor rpm.

Is the Input Speed Sensor reading below 400 rpm?

Yes

- Go to [2](#)

No

- Go to [8](#)

2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, set the "Input/Output Speed" switch to "ON" and the rotary switch to the "3000/1250" position.

With the scan tool, read the Input and Output rpm.

Does the Input speed read 3000 rpm and the Output speed read 1250 rpm ($\pm$ 50 rpm)?

Yes

- Replace the Input Speed Sensor per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK THE (T52) INPUT SPEED SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Input Speed Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T52) Input Speed Signal circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T52) Input Speed Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. CHECK THE (T13) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (T13) Sensor Ground circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

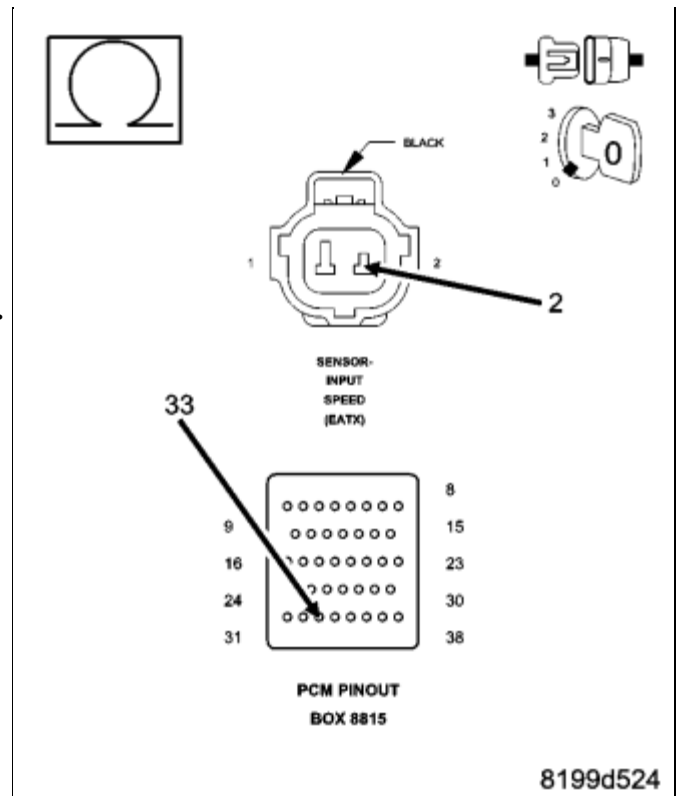
Is the resistance above 5.0 ohms?

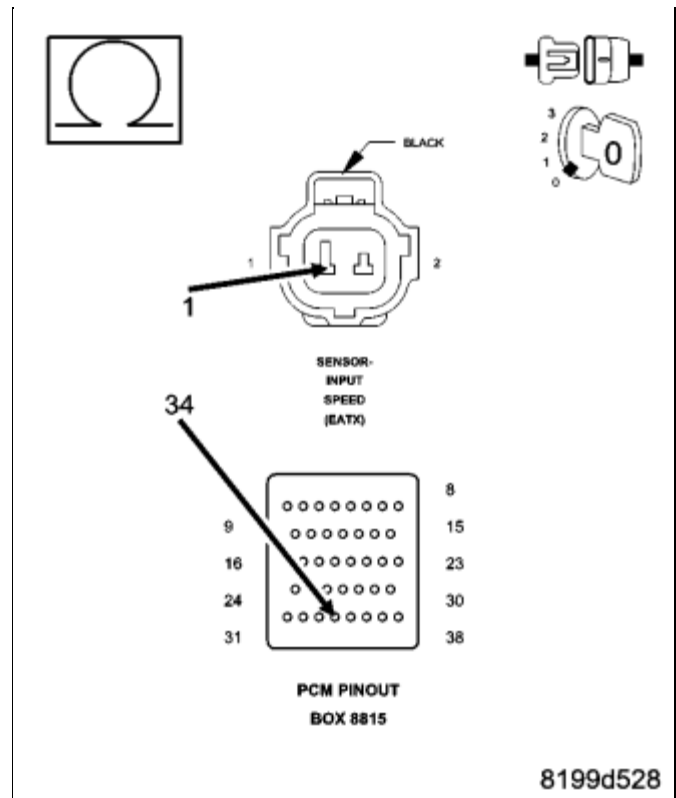
Yes

- Repair the (T13) Sensor Ground circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)





5. CHECK THE (T52) INPUT SPEED SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T52) Input Speed Signal circuit.

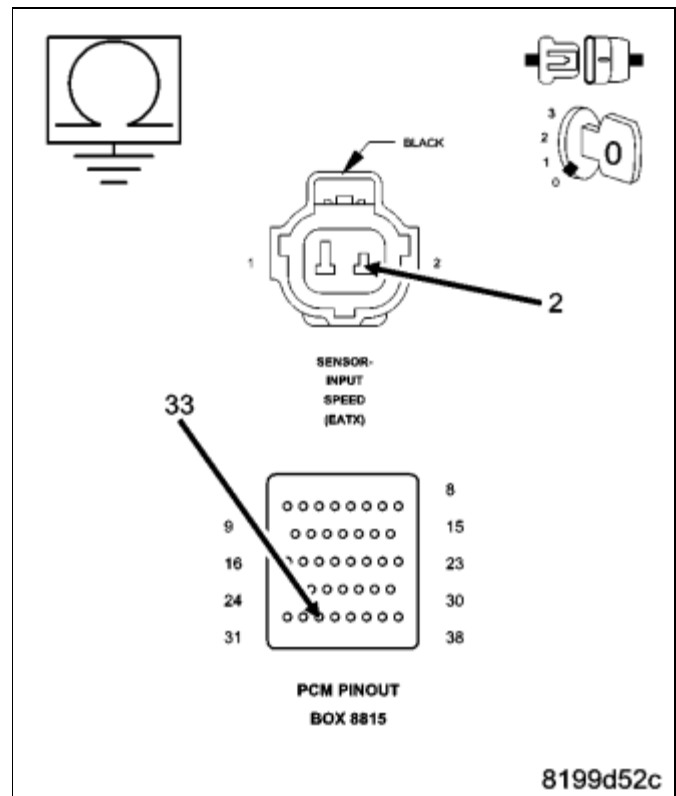
Is the resistance Below 5.0 ohms?

Yes

- Repair the (T52) Input Speed Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)



6. CHECK THE (T52) INPUT SPEED SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Output Speed Sensor harness connector.
 Ignition on, engine not running.
 With the scan tool under TIPM, actuate the Transmission.
 Measure the voltage of the (T52) Input Speed Signal circuit.

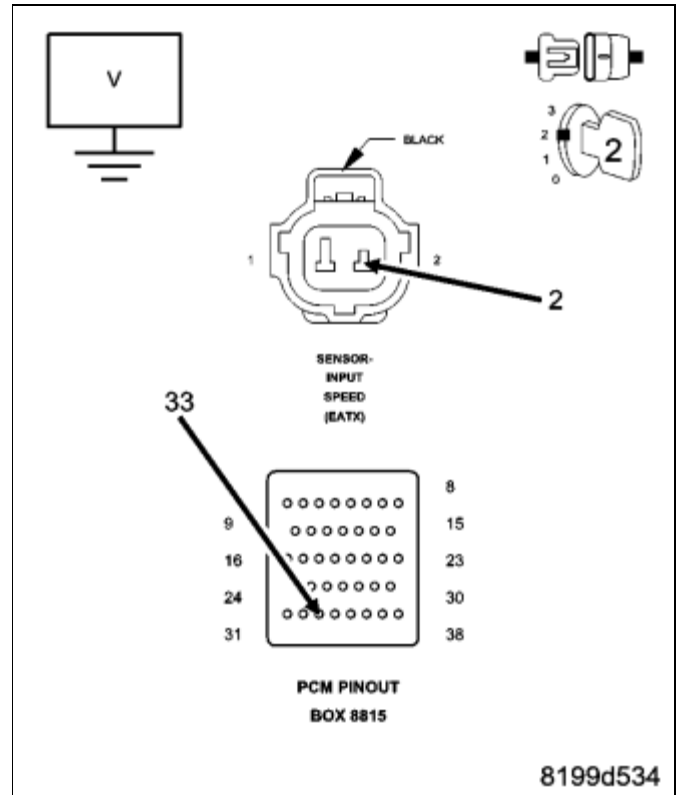
Is the voltage above 0.5 volt?

Yes

- Repair the (T52) Input Speed Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



7. CHECK THE (T13) SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

With the scan tool under TIPM, actuate the Transmission.
 Measure the voltage of the (T13) Sensor Ground circuit.

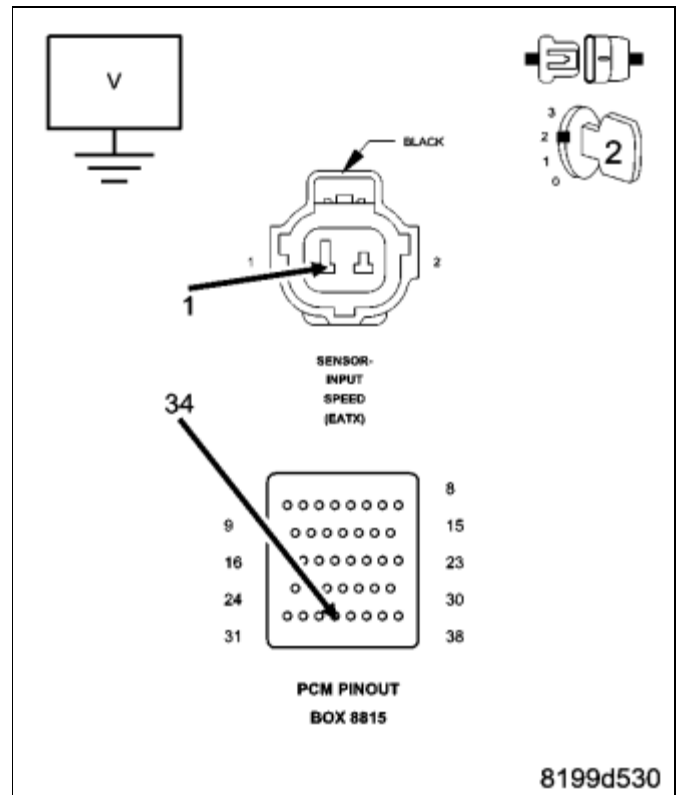
Is the voltage above 0.5 volts?

Yes

- Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service



Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

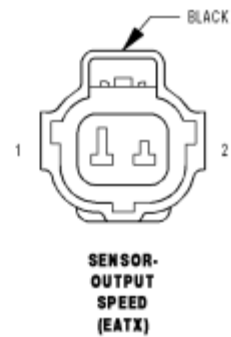
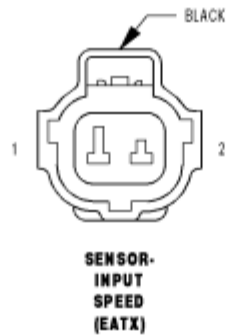
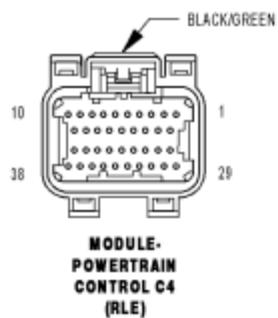
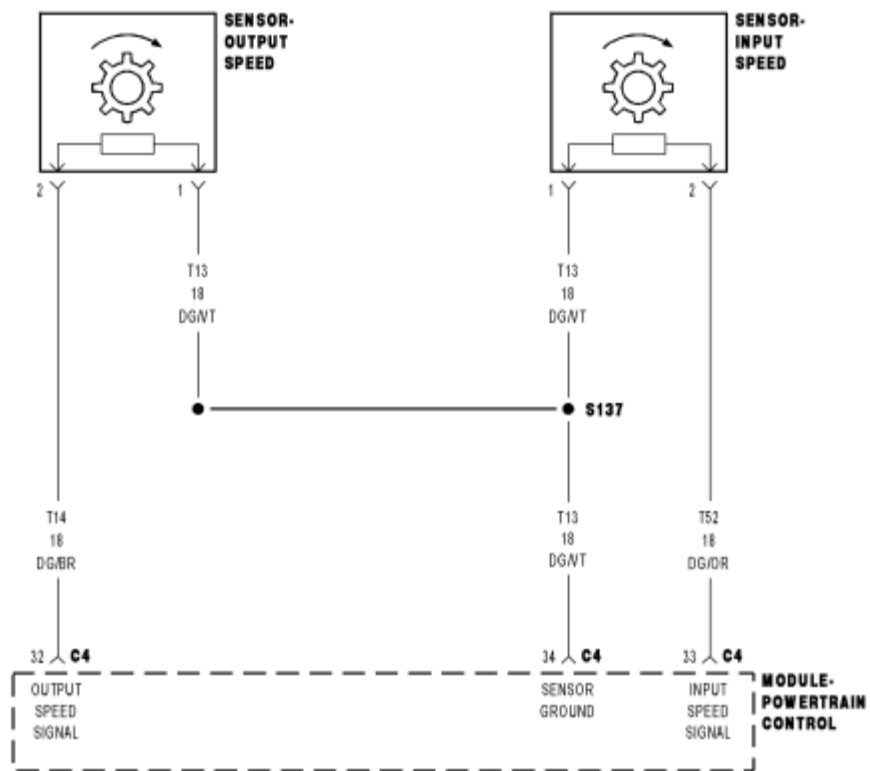
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0721-OUTPUT SPEED SENSOR CIRCUIT PERFORMANCE



01094520

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

- **When Monitored:**

The transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If there is an excessive change in the Output rpm in any gear.

Possible Causes
(T14) OUTPUT SPEED SIGNAL CIRCUIT OPEN
(T13) SENSOR GROUND CIRCUIT OPEN
(T14) OUTPUT SPEED SIGNAL CIRCUIT SHORT TO GROUND
(T14) OUTPUT SPEED SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

Start the engine in Park.

Raise the drive wheels off of the ground.

WARNING: Properly support the vehicle.

Firmly apply the brakes and place the transmission selector in Drive.

WARNING: Be sure to keep hands and feet clear of rotating wheels.

Release the brakes and allow the drive wheels to spin freely.

NOTE: The drive wheels must be turning at this point.

With the scan tool, read the Output rpm

Is the Output rpm below 100?

Yes

- Go to [2](#)

No

- Go to [8](#)

2. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, set the "Input/Output Speed" switch to "ON" and the rotary switch to the "3000/1250" position.

With the scan tool, read the Input and Output rpm.

Does the Input rpm read 3000 and the Output rpm read 1250 (within 50 rpm)?

Yes

- Replace the Output Speed per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

CHECK THE (T14) OUTPUT SPEED SIGNAL CIRCUIT FOR AN OPEN

3.

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Output Speed harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T14) Output Speed Signal circuit between the Output Speed harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T14) Output Speed Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

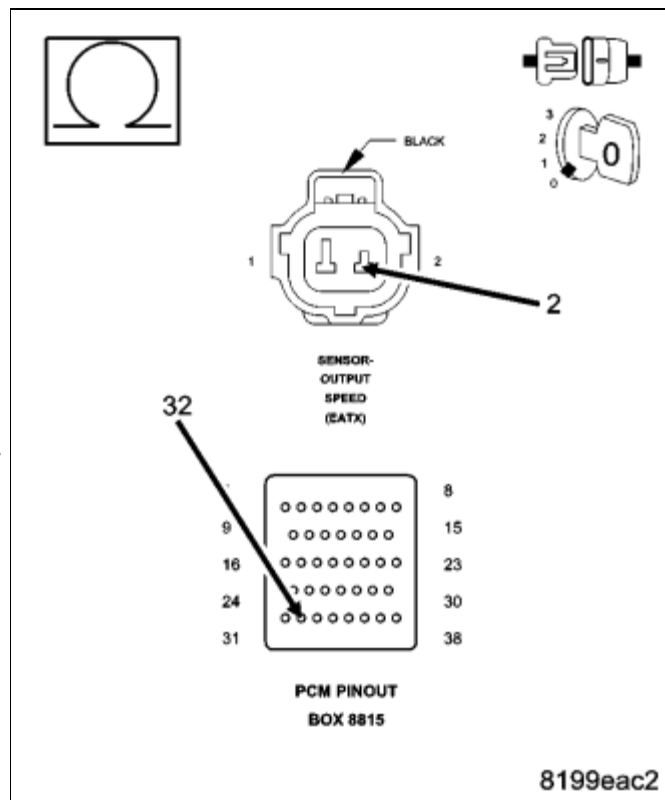
4. CHECK THE (T13) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Sensor Ground circuit between the Output Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

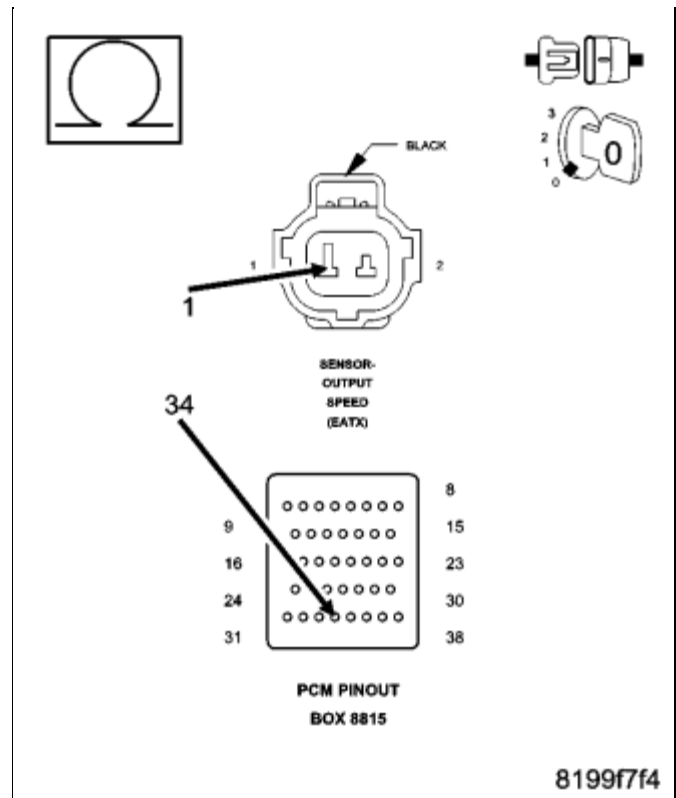
- Repair the (T13) Sensor Ground circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 -



TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. CHECK THE (T14) OUTPUT SPEED SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T14) Output Speed Signal circuit.

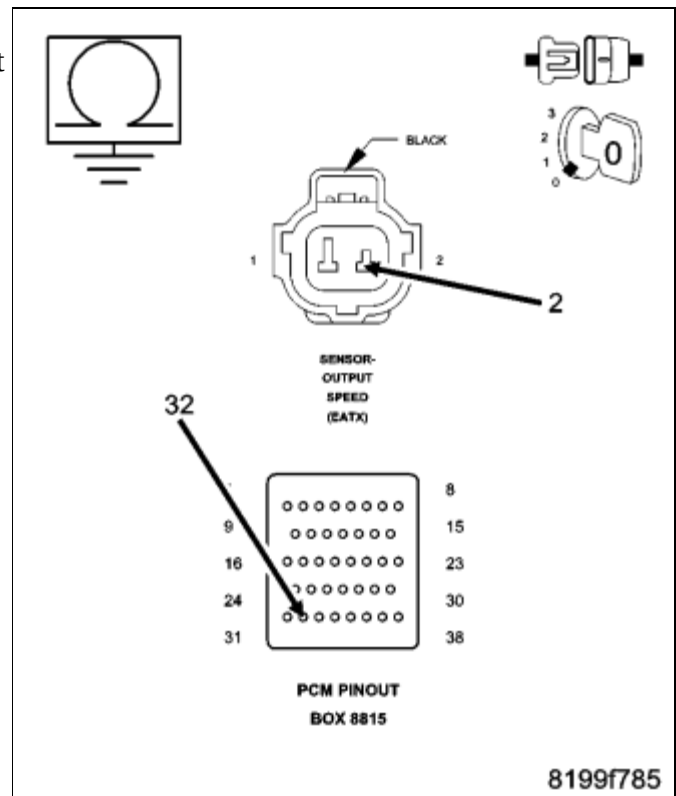
Is the resistance below 5.0 ohms?

Yes

- Repair the (T14) Output Speed Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)



6. CHECK THE (T14) OUTPUT SPEED SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T14) Output Speed Signal circuit.

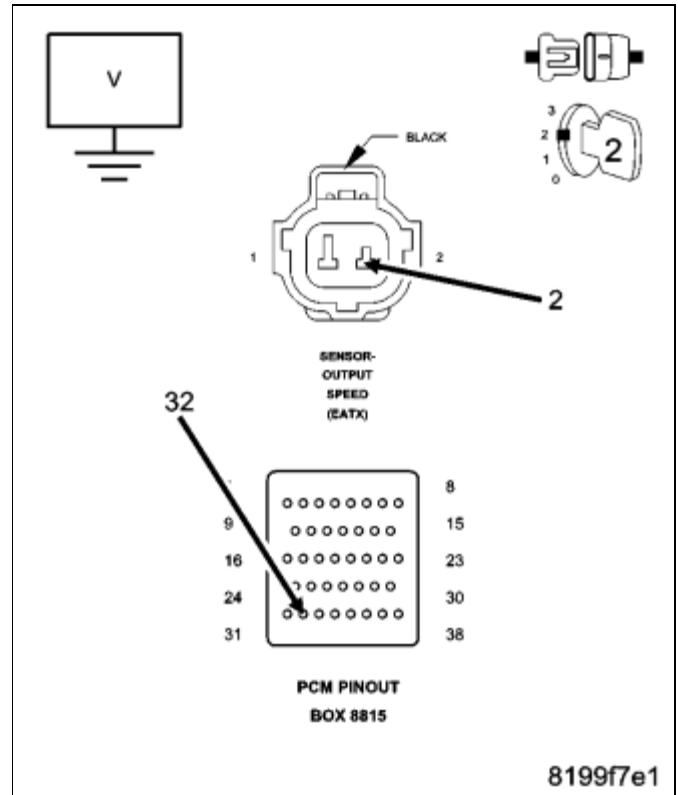
Is the voltage above 0.5 volt?

Yes

- Repair the (T14) Output Speed Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



7. CHECK THE (T13) SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T13) Speed Sensor Ground circuit.

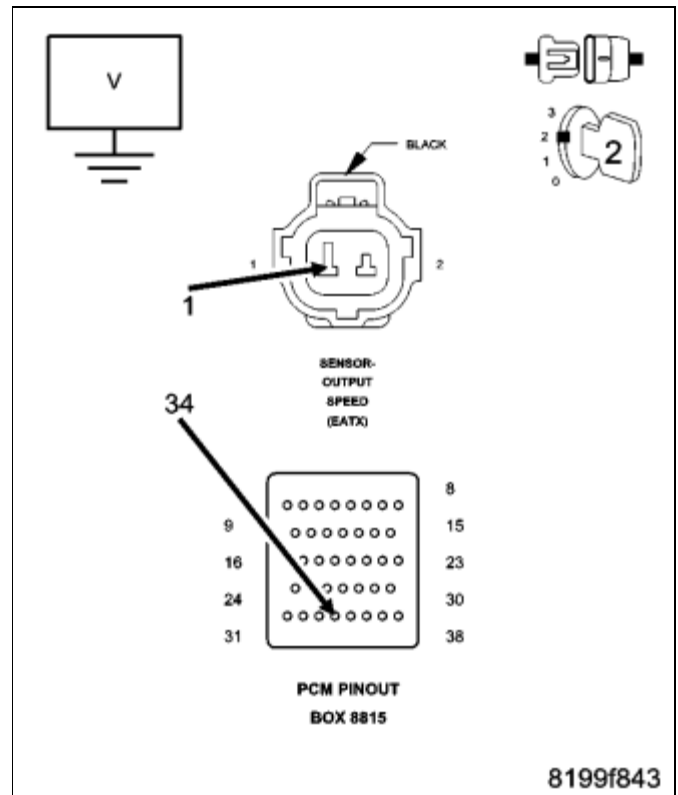
Is the voltage above 0.5 volts?

Yes

- Repair the (T13) Sensor Ground circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are



found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0726-ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The PCM uses a dual port RAM internal to the controller to send the engine speed signal to the Transmission Control System. The calculated engine RPM is compared to a minimum and maximum value. If the PCM interprets this signal to be out of range when the engine is running the code is set. The MIL illuminates after 10 seconds of vehicle operation and the transmission system defaults to limp-in mode.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

The Engine rpm is less than 390 or greater than 8000 for more than 2 seconds while the engine is running.

Possible Causes
ENGINE DTCS PRESENT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

Start the engine.

NOTE: This DTC is not a Transmission Input Speed Sensor DTC.

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter set at 0 for this DTC ?

Yes

- Go to [2](#)

No

- Go to [3](#)

2. CHECK IF ENGINE DTCS ARE PRESENT

With the scan tool, read engine DTCs.

Are there any engine DTCs present?

Yes

- Refer to Section 9 – Engine Electrical Diagnosis and Testing and perform the appropriate diagnostic procedure.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0731-GEAR RATIO ERROR IN 1ST

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into limp-in mode after four gear ratio error events occur in a given driving cycle.

- **When Monitored:**

The Transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT

INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read Transmission DTCS.

If any of these DTCS are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCS present?

Yes

- Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCS are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

No

- Go to [2](#)

2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the 1st gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes

- Go to [3](#)

No

- Repair internal Transmission as necessary. Check all of the components related to the UD and LR clutches. Inspect the Oil Pump and repair or replace as necessary. Refer to the Service Information for the proper repair procedures.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0732-GEAR RATIO ERROR IN 2ND

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm.

These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into limp-in mode after four gear ratio error events occur in a given driving cycle.

- **When Monitored:**

The Transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCS.

If any of these DTCS are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCS present?

Yes

- Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCS are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 2nd gear clutch test. Follow the instructions on the scan tool. Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors to the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCS.

Are the DTCS P0845 and/or P0846 present also?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair internal Transmission per the Service Information. Check all of the components related to the UD and 2/4 clutches. Inspect the Oil Pump and repair or replace as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0733-GEAR RATIO ERROR IN 3RD

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into limp-in mode after four gear ratio error events occur in a given driving cycle.

- **When Monitored:**

The Transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?

Yes

- Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 3rd gear clutch test. Follow the instructions on the scan tool. Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCs.

Are the DTCs P0870 and/or P0871 present also?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST.

No

- Repair internal Transmission per the Service Information. Check all of the components related to the UD and O/D clutches. Inspect the Oil Pump and repair or replace as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0734-GEAR RATIO ERROR IN 4TH

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into limp-in mode after four gear ratio error events occur in a given driving cycle.

- **When Monitored:**

The Transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCS.

If any of these DTCS are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**Yes**

- Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 4th gear clutch test. Follow the instructions on the scan tool. Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?**Yes**

- Go to [3](#)

No

- Go to [4](#)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets a Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCS.

Are the DTCS P0870 and/or P0871 present also?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair internal Transmission per the Service Information. Check all of the components related to the O/D and 2/4 clutches. Inspect the Oil Pump and repair or replace as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0736-GEAR RATIO ERROR IN REVERSE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into limp-in mode after four gear ratio error events occur in a given driving cycle.

◦ When Monitored:

The Transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio when compared to the known gear ratio.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCS.

If any of these DTCS are present, perform their respective tests first.

Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCS present?

Yes

- Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCS are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

No

- Go to [2](#)

2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the Reverse gear clutch test. Follow the instructions on the scan tool. Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes

- Go to [3](#)

No

- Repair internal Transmission per the Service Information. Check all of the components related to the Reverse and L/R clutches. Inspect the Oil Pump and repair or replace as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors related to the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0740-TCC OUT OF RANGE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

When in 2nd, 3rd, or 4th gear, the Torque Converter Clutch (TCC) can be locked or partially locked when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR/TCC solenoid until the torque converter slip difference (difference between engine and turbine speed) is within 60 rpm. Then the LR/TCC solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity. The transmission will attempt normal EMCC operation (not in limp-in) even after the MIL is illuminated. MIL will illuminate after 5 minutes of accumulated slip in FEMCC.

- **When Monitored:**

The Torque Converter Clutch (TCC) is in FEMCC or PEMCC, Transmission temperature is hot, Engine temperature is greater than 38° C or 100° F, Transmission Input Speed greater than engine speed, TPS less than 30°, and brake not applied.

- **Set Condition:**

The TCC is modulated by controlling the duty cycle of the L/R Solenoid until the difference between the Engine rpm and the Transmission Input Speed rpm or duty cycle is within a desired range. The DTC is set after the period of 10 seconds and 3 occurrences of either: FEMCC - with slip greater than 100 rpm or PEMCC - duty cycle greater than 85%.

Possible Causes
RELATED L/R SOLENOID OR PRESSURE SWITCH DTCS PRESENT
INTERNAL TRANSMISSION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCS.

Are the DTCS P0750 and/or P0841 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

Ignition on, engine not running.

With the scan tool, record and erase DTCs.

Drive the vehicle until it is fully warmed up to at least 43° C (110° F).

Perform the following step 3 times.

Drive the vehicle at 80 km/h (50 mph) and allow 4th gear to engage for at least 10 seconds. Close the throttle, then tip back in until the throttle angle is between 25 and 29 degrees. Note that if you go over 30 degrees, you must back off of the throttle and retry.

Did the TCC engage during any of the attempts?

Yes

- Go to [3](#)

No

- Perform the Hydraulic Pressure test per the Service Information and repair the internal transmission components and Torque convertor as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem.

Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

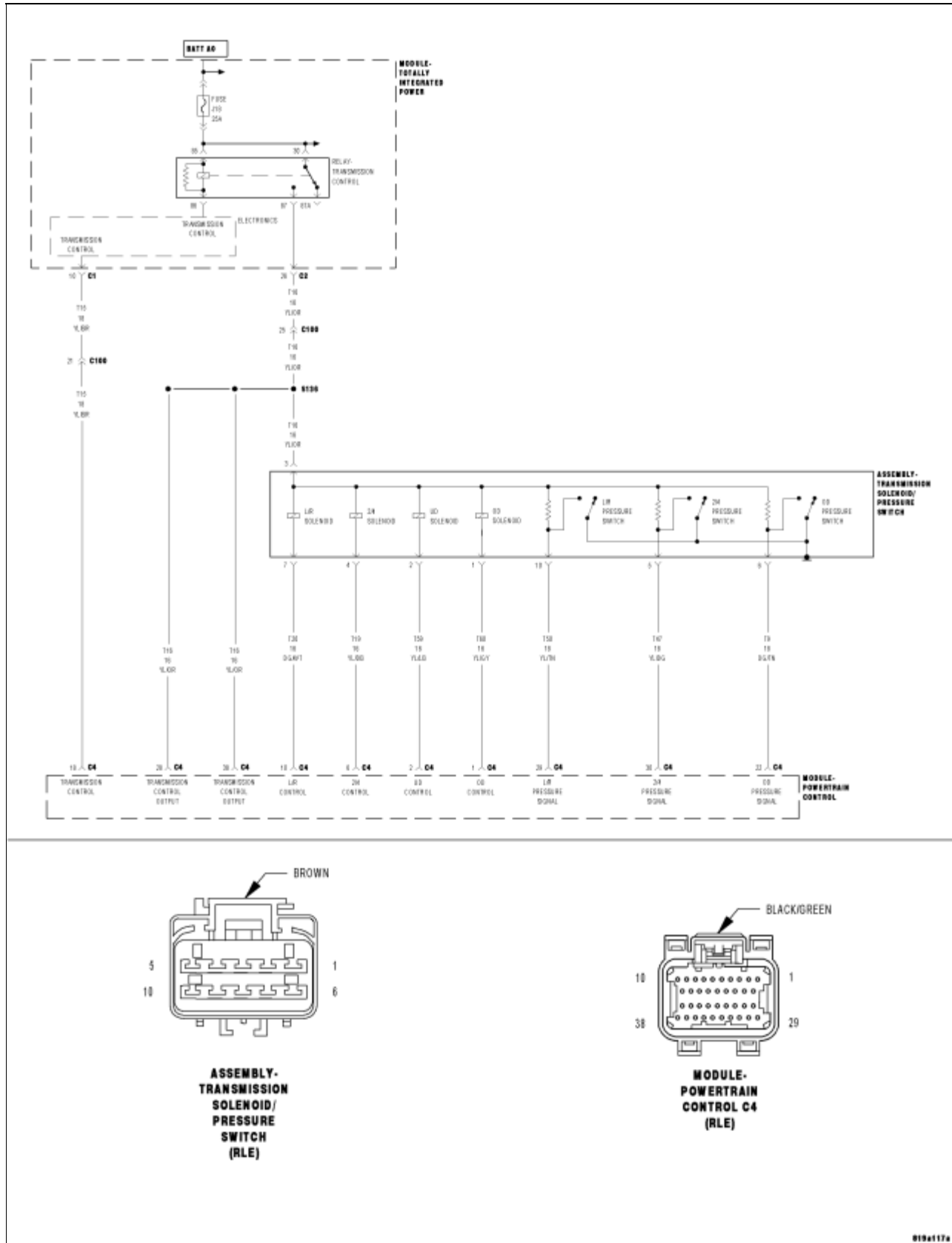
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0750-LR SOLENOID CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into Neutral, if the DTC is set above 35 Km/h (22 mph), limp-in mode when vehicle speed is below 35 Km/h (22 mph).

- **When Monitored:**

Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.

- **Set Condition:**

Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
(T20) L/R CONTROL CIRCUIT OPEN
(T20) L/R CONTROL CIRCUIT SHORT TO GROUND
(T20) L/R CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [3](#)

No

- Go to [8](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the L/R Solenoid.

Monitor the L/R Solenoid LED on the Transmission Simulator.

Did the L/R Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK WIRING USING THE TRANSMISSION SIMULATOR

With the scan tool, continue to actuate the L/R Solenoid.

While monitoring the L/R Solenoid LED on the Transmission Simulator, wiggle the related wiring harness and connectors.

Did the L/R Solenoid LED on the Transmission Simulator continue to blink on and off during the wiggle test?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair wiring or connectors as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T20) L/R CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

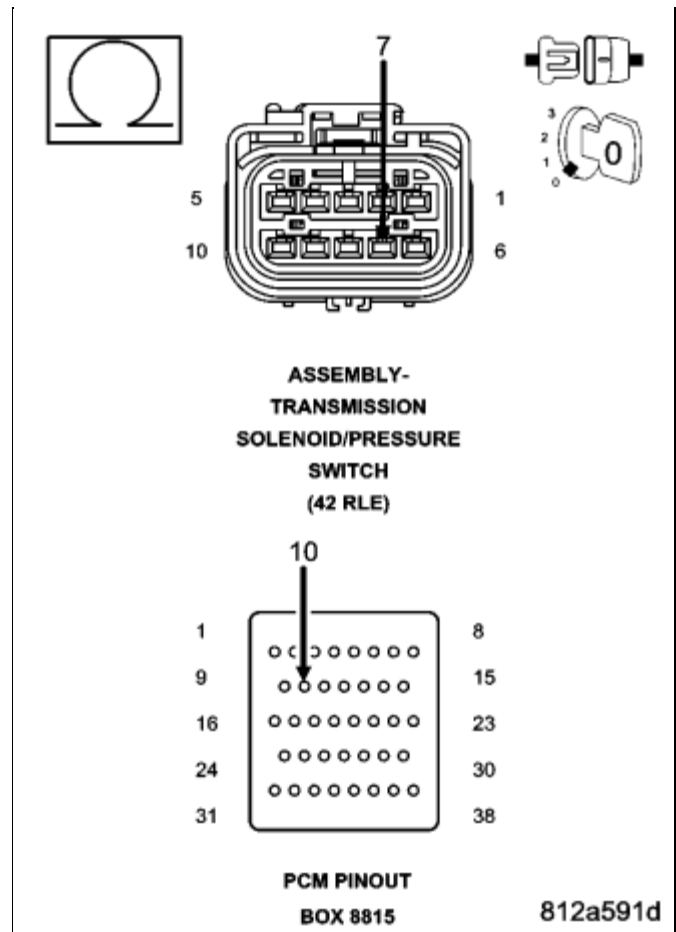
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T20) L/R Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T20) L/R Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. CHECK THE (T20) L/R CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T20) L/R Control circuit.

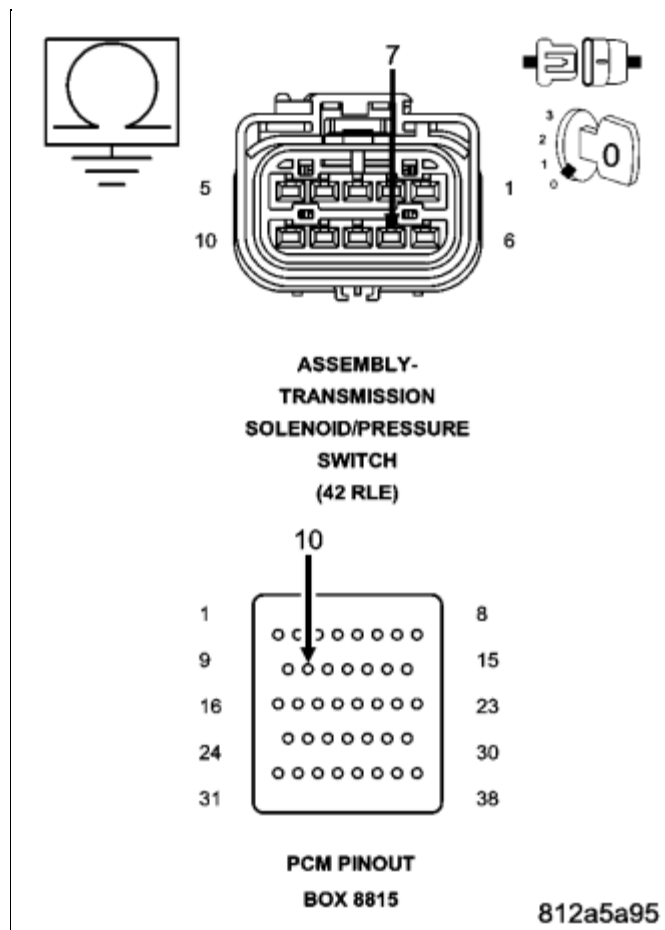
Is the resistance below 5.0 ohms?

Yes

- Repair the (T20) L/R Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



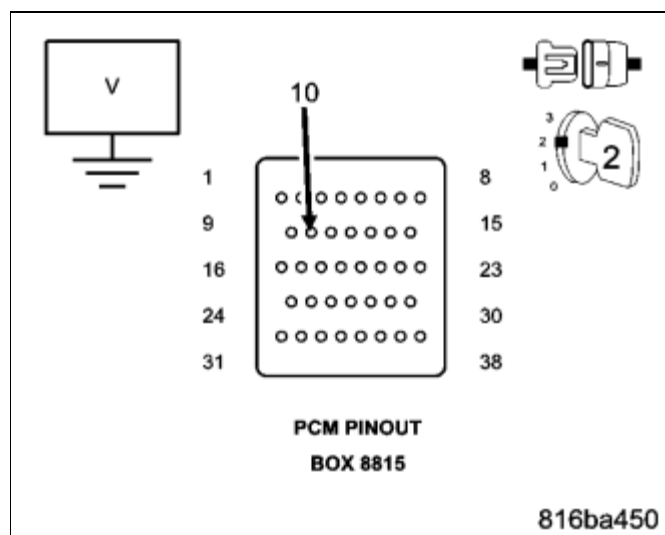
7. CHECK THE (T20) L/R CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T20) L/R Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T20) L/R Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

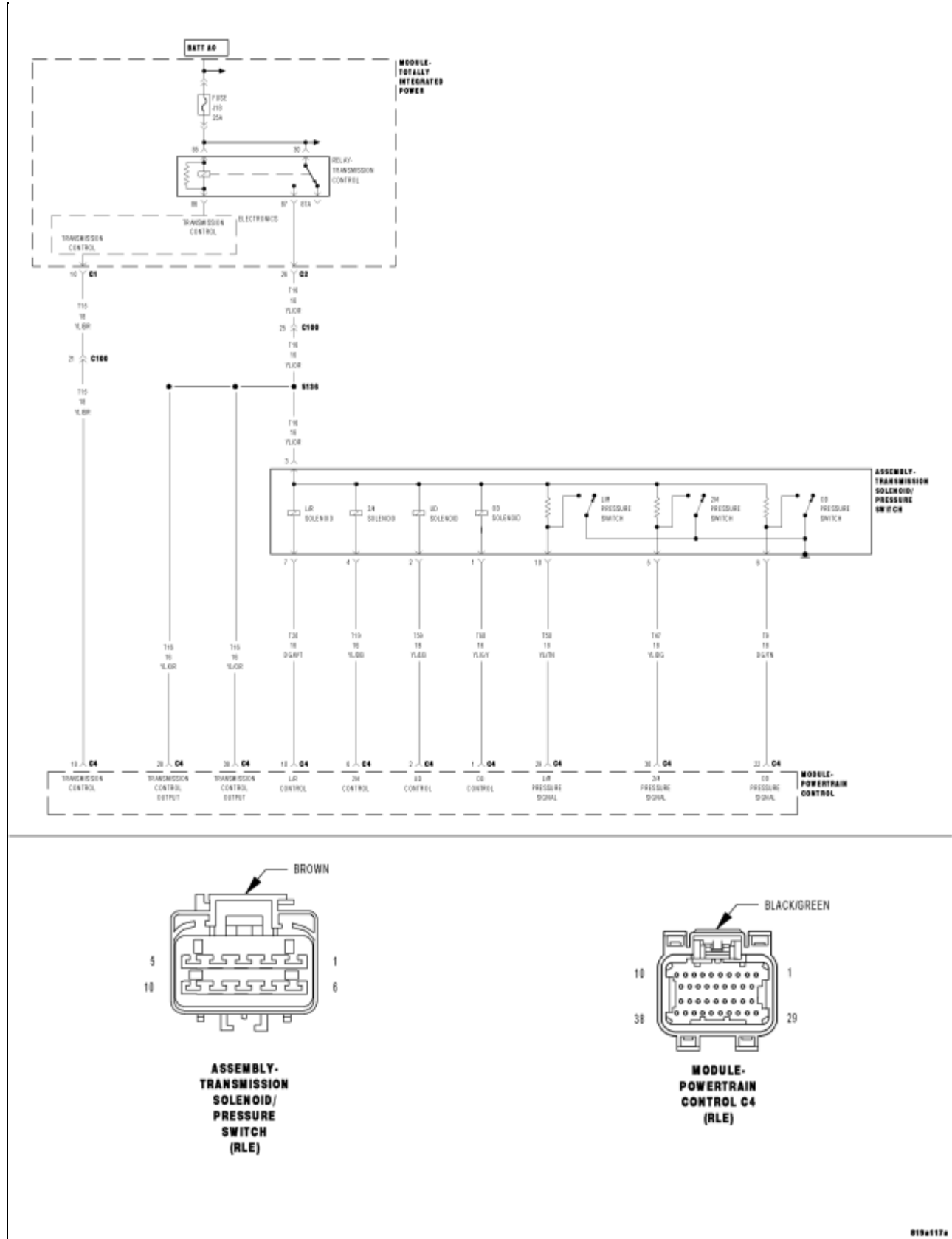
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0755-2/4 SOLENOID CIRCUIT



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into Neutral, if the DTC is set above 35 Km/h (22 mph), limp-in mode when vehicle speed is below 35 Km/h (22 mph).

- **When Monitored:**

Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.

- **Set Condition:**

Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
(T19) 2/4 CONTROL CIRCUIT OPEN
(T19) 2/4 CONTROL CIRCUIT SHORT TO GROUND
(T19) 2/4 CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [3](#)

No

- Go to [8](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the 2/4 Solenoid.

Monitor the 2/4 Solenoid LED on the Transmission Simulator.

Did the 2/4 Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK WIRING USING THE TRANSMISSION SIMULATOR

With the scan tool, continue to actuate the 2/4 Solenoid.

While monitoring the 2/4 Solenoid LED on the Transmission Simulator, wiggle the related wiring harness and connectors.

Did the 2/4 Solenoid LED on the Transmission Simulator continue to blink on and off during the wiggle test?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair wiring or connectors as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T19) 2/4 CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

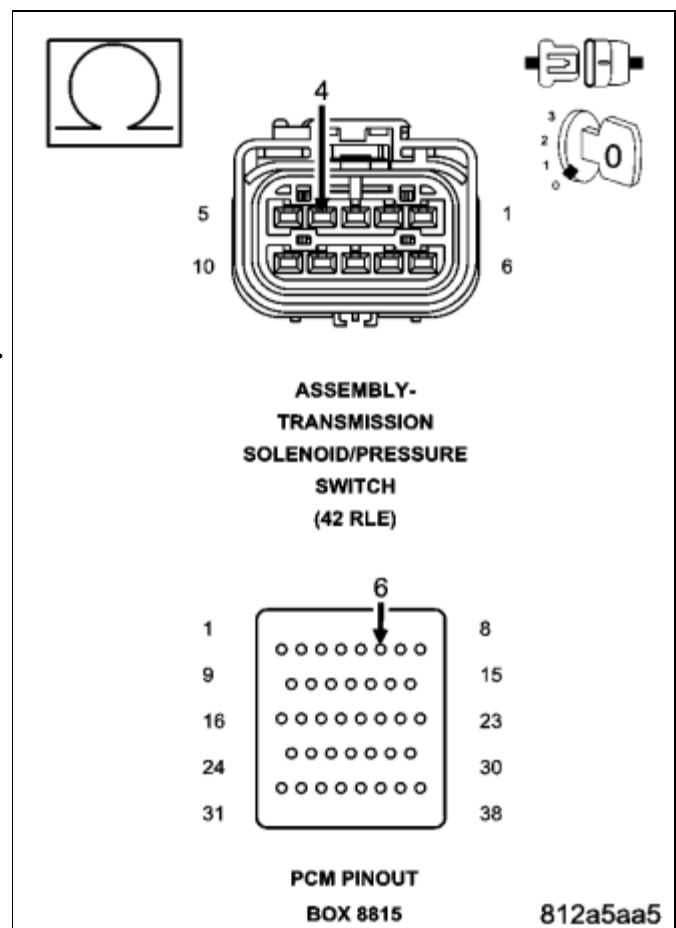
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T19) 2/4 Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T19) 2/4 Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. CHECK THE (T19) 2/4 CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T19) 2/4 Control circuit.

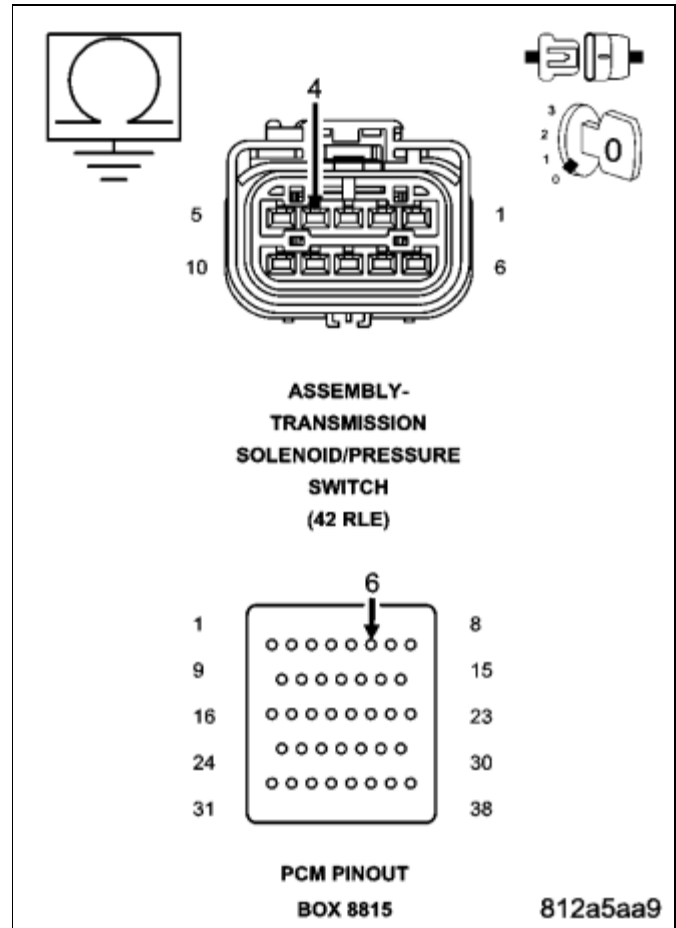
Is the resistance below 5.0 ohms?

Yes

- Repair the (T19) 2/4 Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



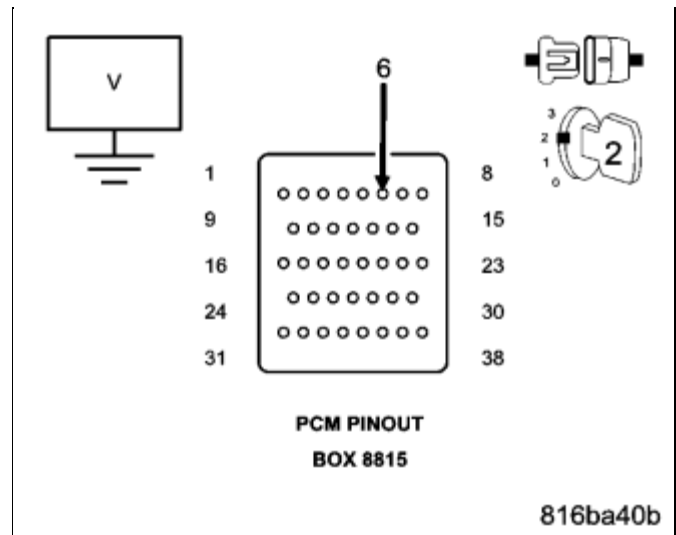
7. CHECK THE (T19) 2/4 CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T19) 2/4 Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T19) 2/4 Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -



42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Were there any problems found?

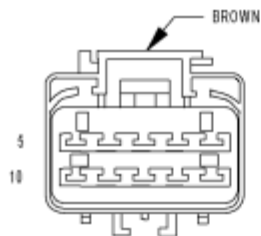
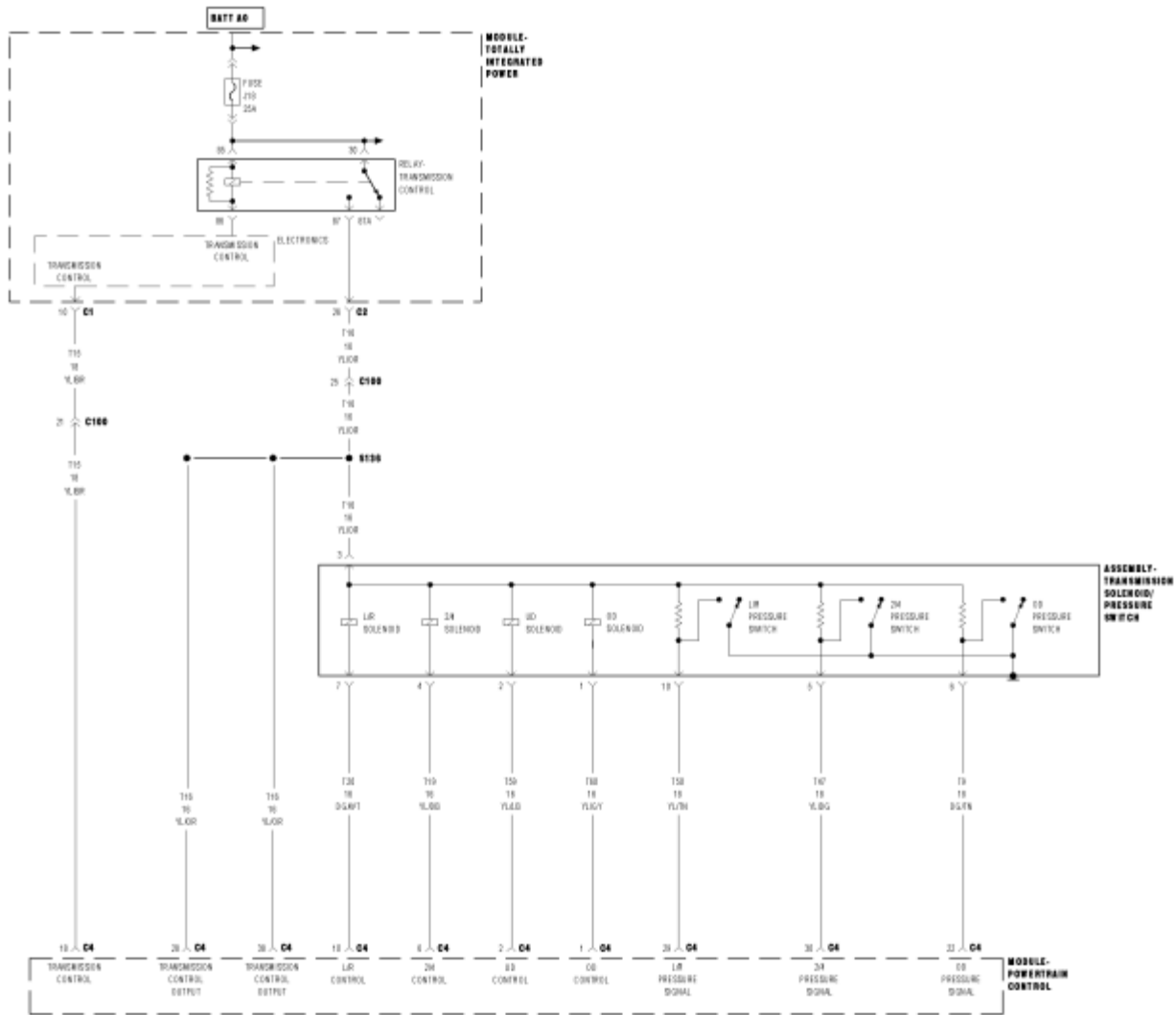
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

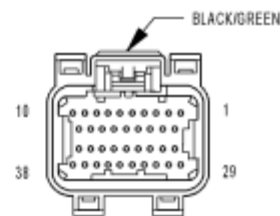
No

- Test Complete.

P0760-OD SOLENOID CIRCUIT



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into Neutral, if the DTC is set above 35 Km/h (22 mph), limp-in mode when vehicle speed is below 35 Km/h (22 mph).

- **When Monitored:**

Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.

- **Set Condition:**

Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
(T60) OD CONTROL CIRCUIT OPEN
(T60) OD CONTROL CIRCUIT SHORT TO GROUND
(T60) OD CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [3](#)

No

- Go to [8](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the OD Solenoid.

Monitor the OD Solenoid LED on the Transmission Simulator.

Did the OD Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK WIRING USING THE TRANSMISSION SIMULATOR

With the scan tool, continue to actuate the OD Solenoid.

While monitoring the OD Solenoid LED on the Transmission Simulator, wiggle the related wiring harness and connectors.

Did the OD Solenoid LED on the Transmission Simulator continue to blink on and off during the wiggle test?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair wiring or connectors as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T60) OD CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

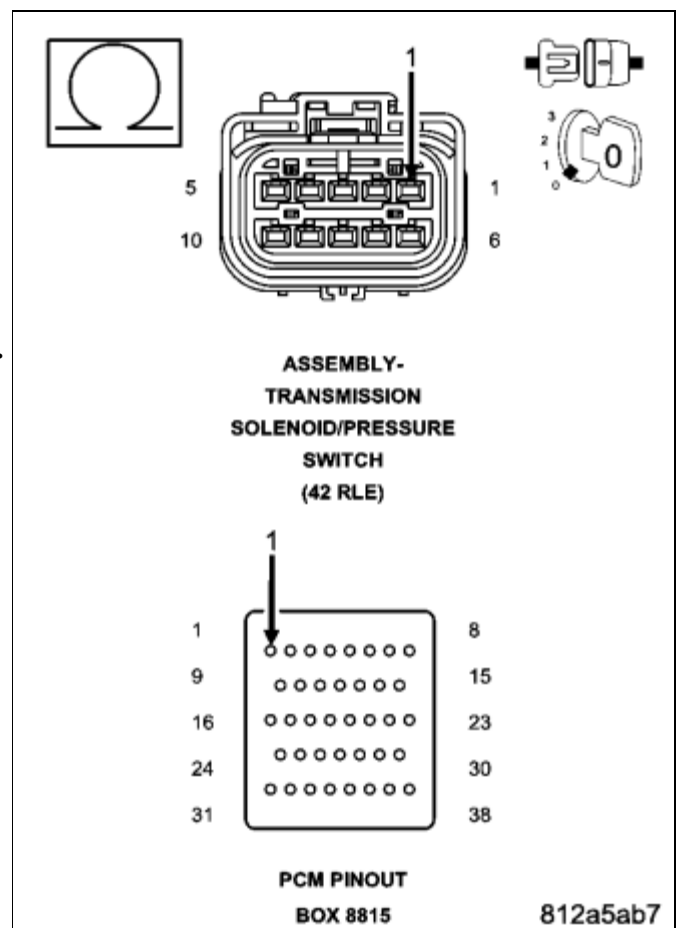
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T60) OD Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T60) OD Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. CHECK THE (T60) OD CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Control circuit.

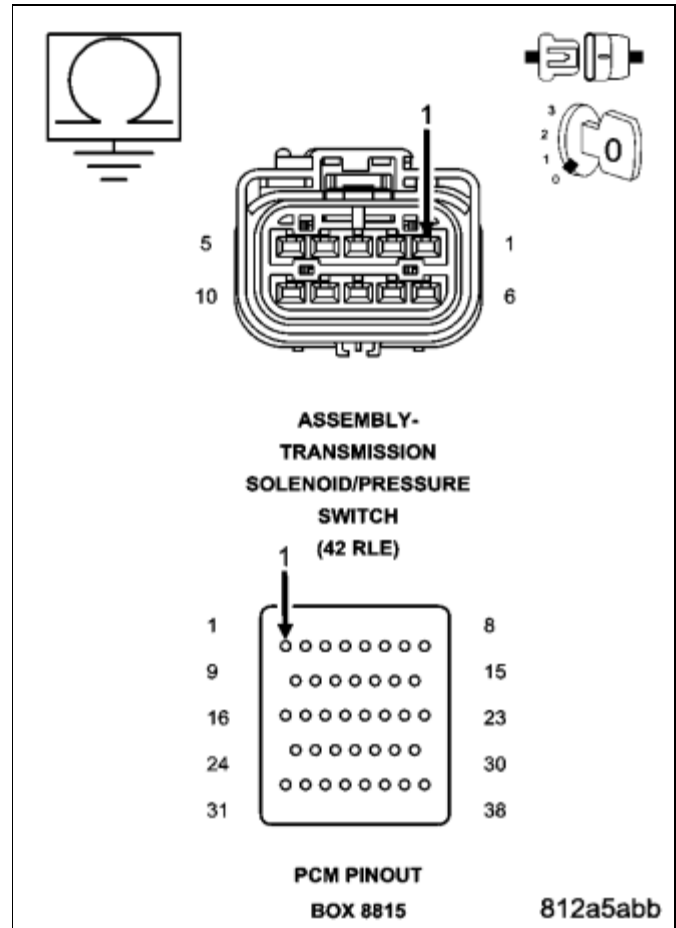
Is the resistance below 5.0 ohms?

Yes

- Repair the (T60) OD Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



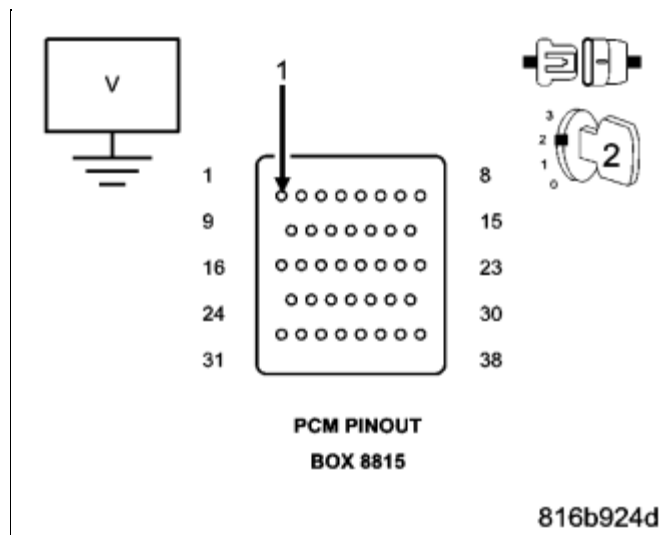
7. CHECK THE (T60) OD CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T60) OD Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T60) OD Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -



42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

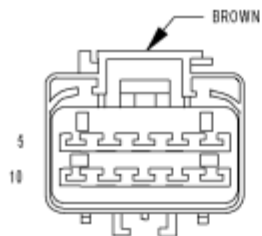
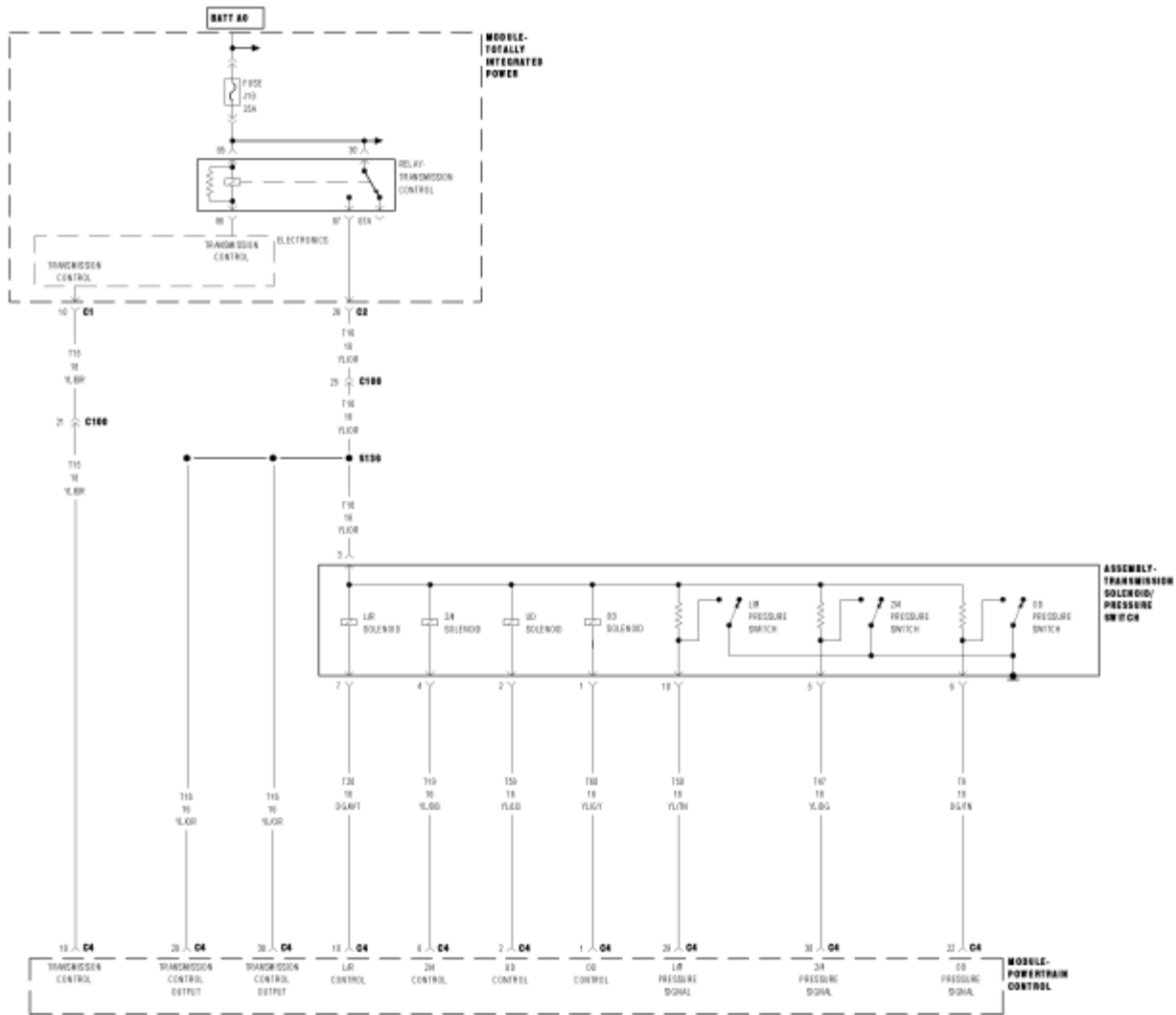
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

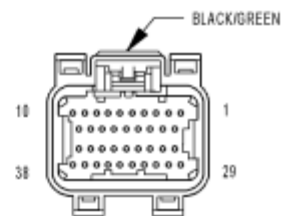
No

- Test Complete.

P0765-UD SOLENOID CIRCUIT



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into Neutral, if the DTC is set above 35 Km/h (22 mph), limp-in mode when vehicle speed is below 35 Km/h (22 mph).

- **When Monitored:**

Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.

- **Set Condition:**

Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
(T59) UD CONTROL CIRCUIT OPEN
(T59) UD CONTROL CIRCUIT SHORT TO GROUND
(T59) UD CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [3](#)

No

- Go to [8](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the UD Solenoid.

Monitor the UD Solenoid LED on the Transmission Simulator.

Did the UD Solenoid LED on the Transmission Simulator blink on and off during actuation?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK WIRING USING THE TRANSMISSION SIMULATOR

With the scan tool, continue to actuate the UD Solenoid.

While monitoring the UD Solenoid LED on the Transmission Simulator, wiggle the related wiring harness and connectors.

Did the UD Solenoid LED on the Transmission Simulator continue to blink on and off during the wiggle test?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair wiring or connectors as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T59) UD CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

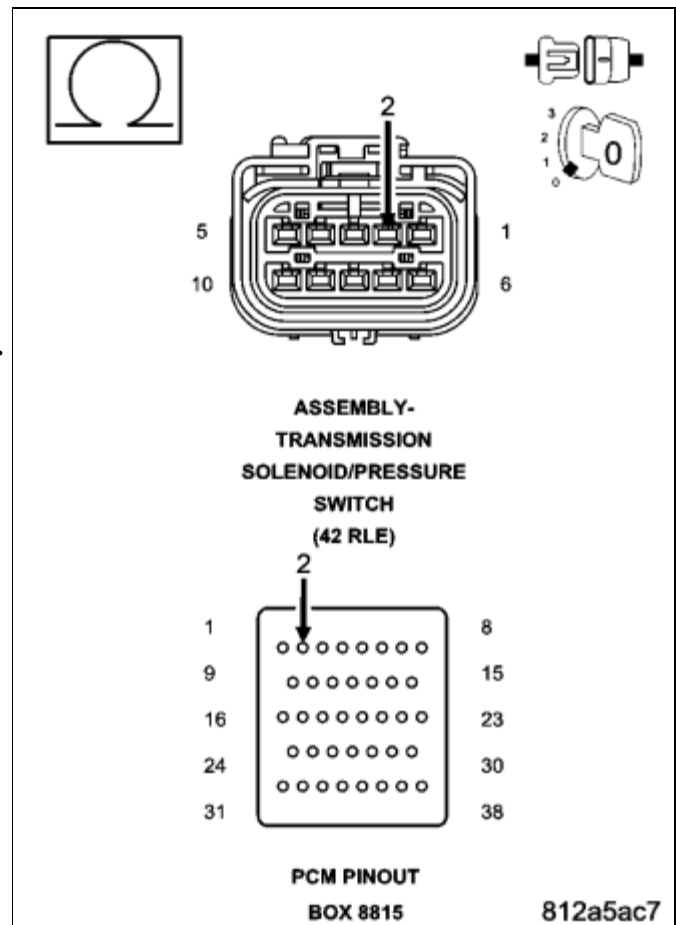
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T59) UD Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T59) UD Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. CHECK THE (T59) UD CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T59) UD Control circuit.

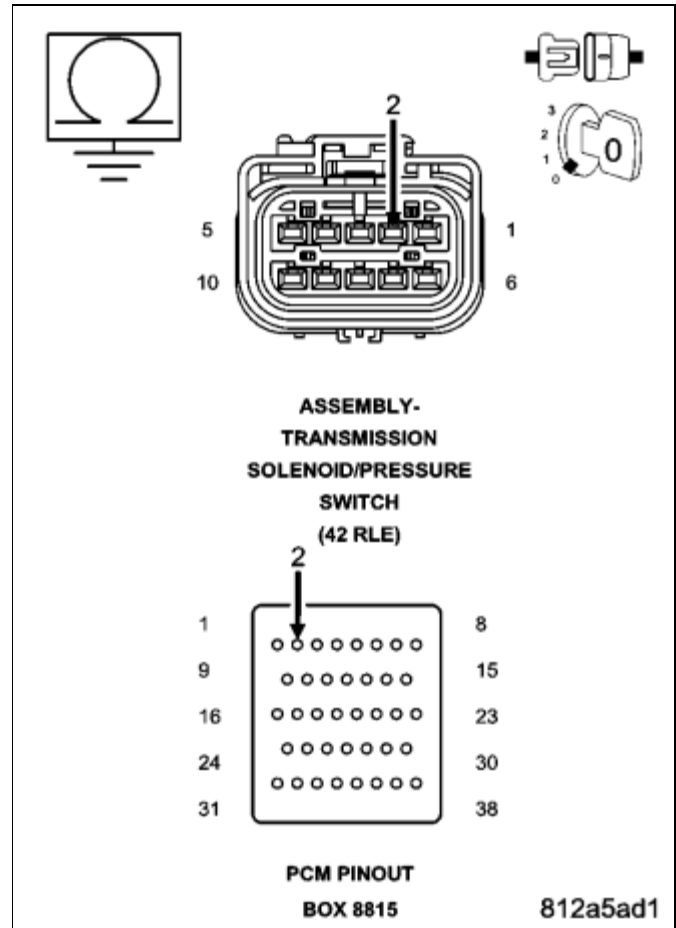
Is the resistance below 5.0 ohms?

Yes

- Repair the (T59) UD Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



7. CHECK THE (T59) UD CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T59) UD Control circuit.

Is the voltage above 0.5 volts?

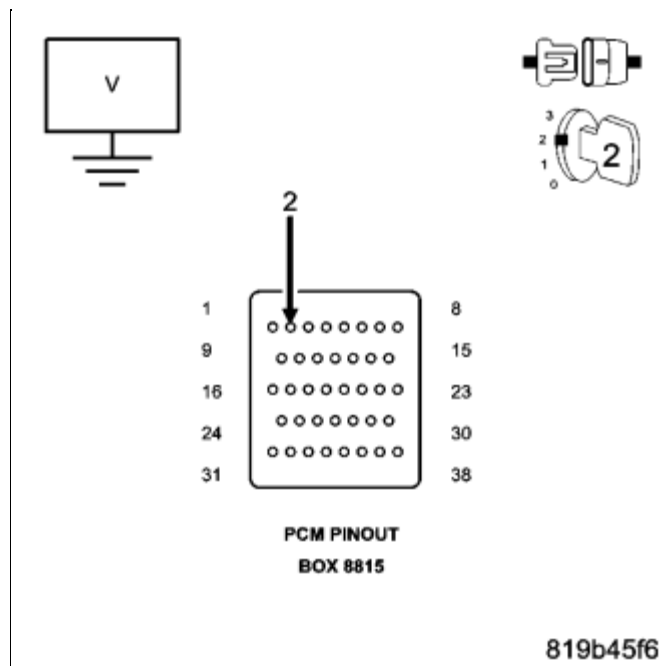
Yes

- Repair the (T59) UD Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -

42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0841-LR PRESSURE SWITCH RATIONALITY

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. If a set condition is identified, 1st gear and torque converter lock-up (EMCC) will be inhibited. The vehicle will launch in 2nd gear and shift normally through the gears without allowing EMCC. If during the same key start, the set condition is no longer valid, the transmission will return to normal operation (1st and EMCC available). Limp-in will not occur unless DTC P0841 is accompanied by a code P0706 and the MIL will illuminate after 5 minutes of substituted operation.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T50) L/R PRESSURE SIGNAL CIRCUIT OPEN
(T50) L/R PRESSURE SIGNAL CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OPEN	OPEN	OPEN
P/N	CLOSED	OPEN	OPEN

1st	CLOSED	OPEN	OPEN
2nd	OPEN	CLOSED	OPEN
D	OPEN	OPEN	CLOSED
OD	OPEN	CLOSED	CLOSED

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

Is the DTC P0944 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [3](#)

3. CHECK TO SEE IF P0841 IS CURRENT

With the scan tool, view DTCs.

Is the status active for this DTC or is the Starts Since Set counter 2 or less?

Yes

- Go to [4](#)

No

- Go to [8](#)

4. PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to L/R.

With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the L/R Pressure Switch state change?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. (T50) L/R PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Signal circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. (T50) L/R PRESSURE SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Signal circuit.

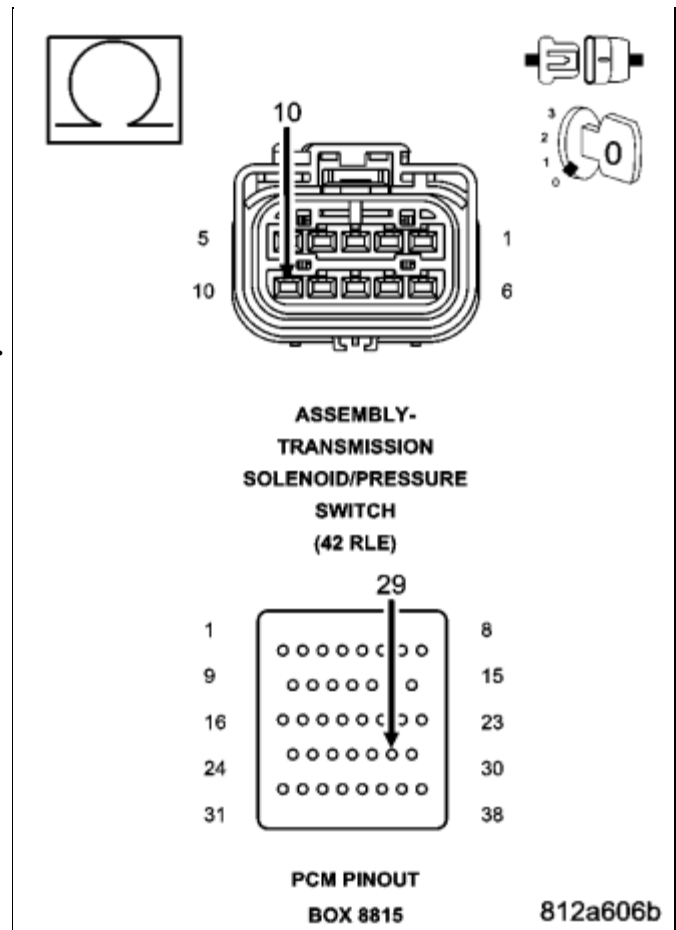
Is the resistance below 5.0 ohms?

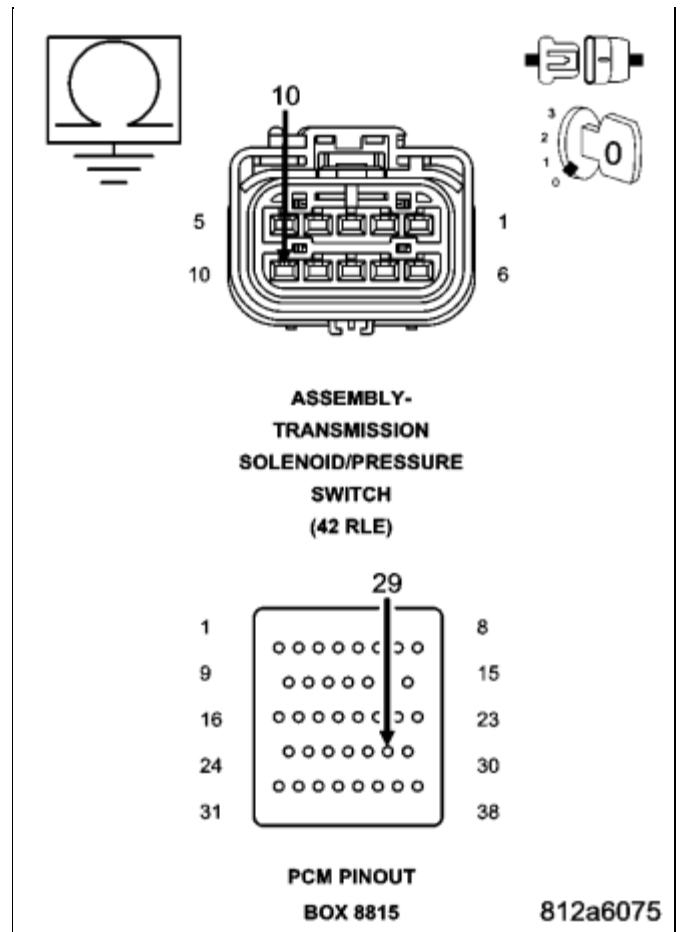
Yes

- Repair the (T50) L/R Pressure Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)





7. (T50) L/R PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T50) L/R Pressure Signal circuit.

Is the voltage above 0.5 volts?

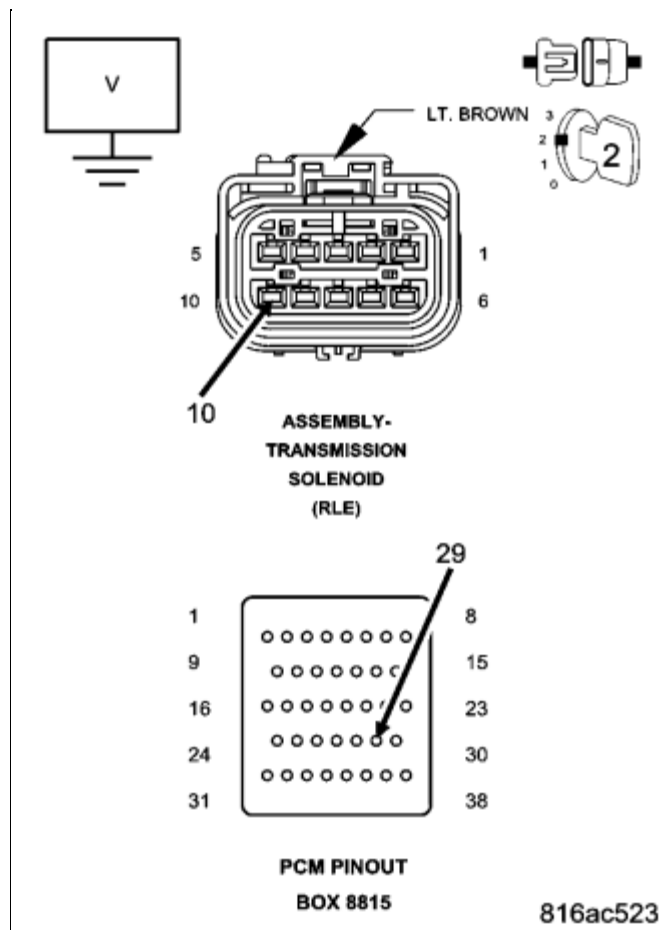
Yes

- Repair the (T50) L/R Pressure Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are

- found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorted and open circuits. With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

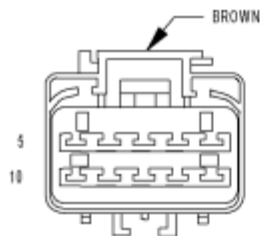
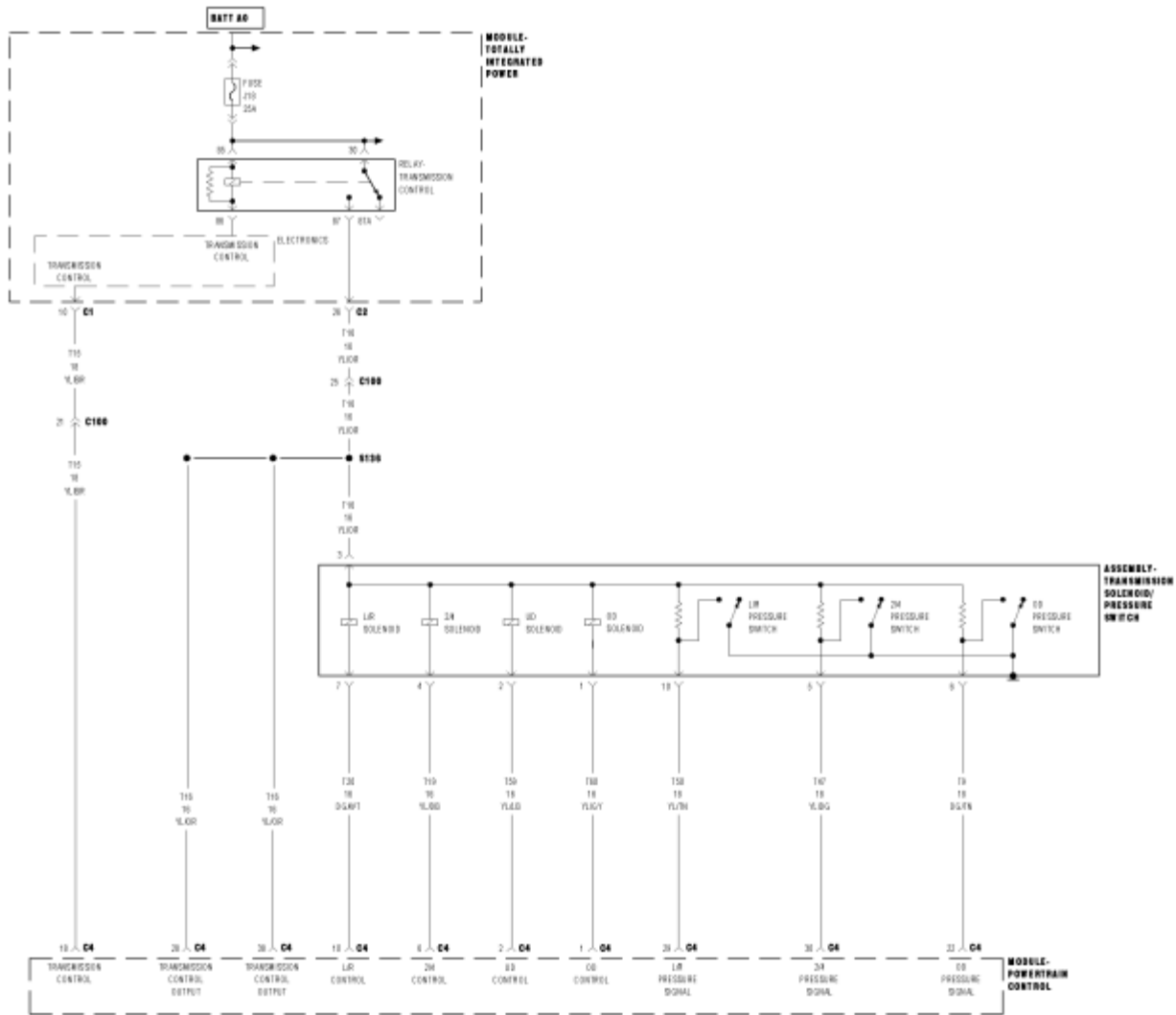
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

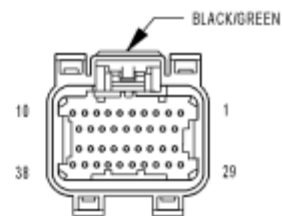
No

- Test Complete.

P0845-2/4 HYDRAULIC PRESSURE TEST



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to limp-in mode.

- **When Monitored:**

In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed greater than 1000 rpm the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to verify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets

Possible Causes
LOSS OF PRIME P0944 PRESENT
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
(T47) 2/4 PRESSURE SIGNAL CIRCUIT OPEN
(T47) 2/4 PRESSURE SWITCH CIRCUIT SHORT TO GROUND
(T47) 2/4 PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, read DTCs.

Is the DTC P0944 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read DTCs.

Are any of the DTCs P0732, P0734 and/or P0846 present also?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [4](#)

No

- Go to [9](#)

4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to 2/4.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

Did the 2/4 Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. (T47) 2/4 PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

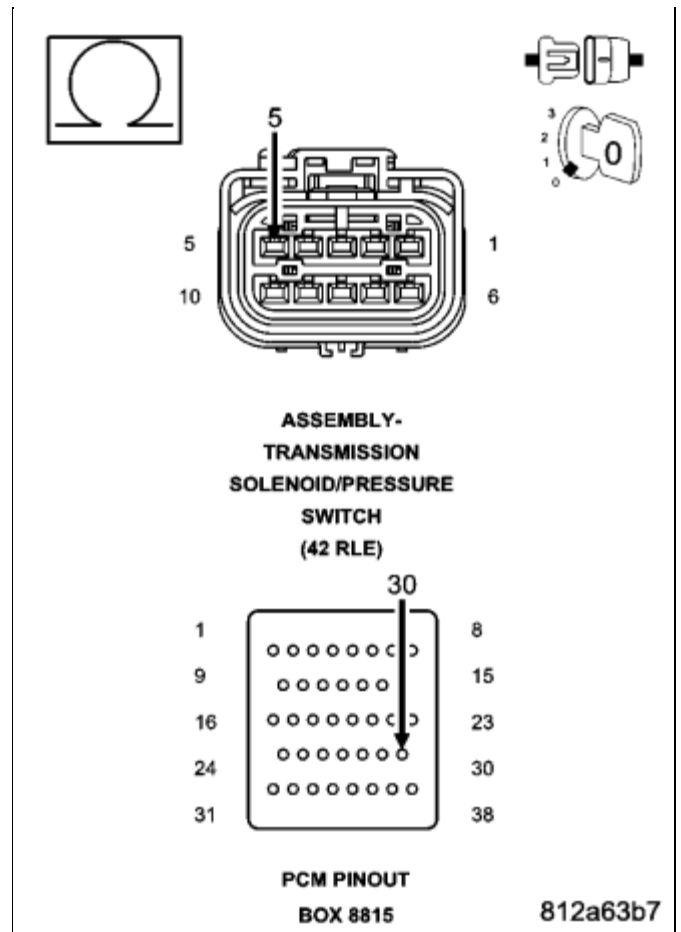
Measure the resistance of the (T47) 2/4 Pressure Signal circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T47) 2/4 Pressure Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION

TEST (Refer to 21 -
TRANSMISSION/TRANSAXLE/AUTOMATIC -
42RLE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. (T47) 2/4 PRESSURE SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T47) 2/4 Pressure Signal circuit.

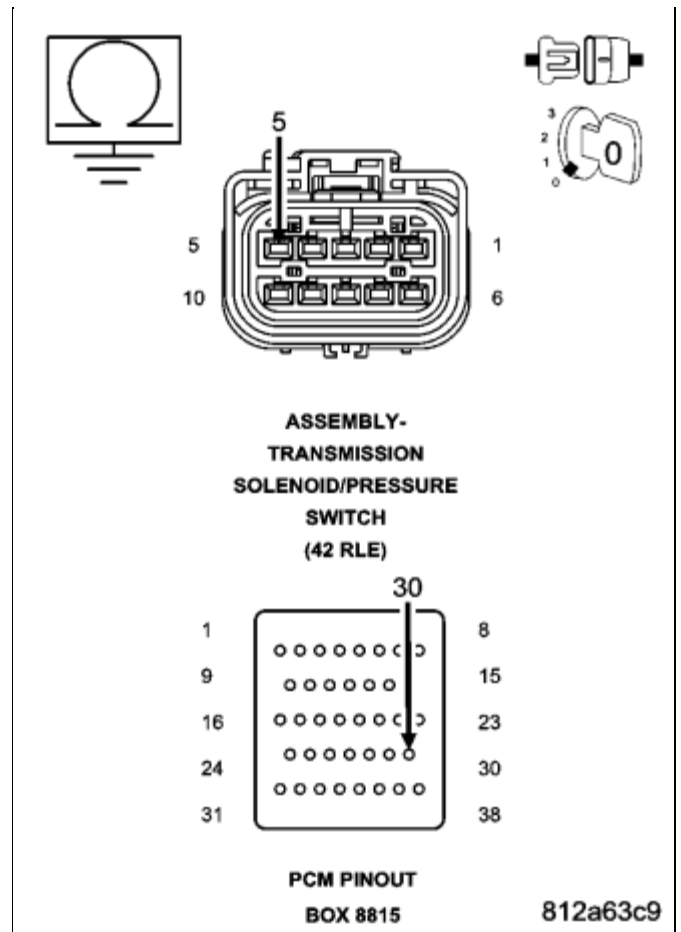
Is the resistance below 5.0 ohms?

Yes

- Repair the (T47) 2/4 Pressure Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)



7. (T47) 2/4 PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T47) 2/4 Pressure Signal circuit.

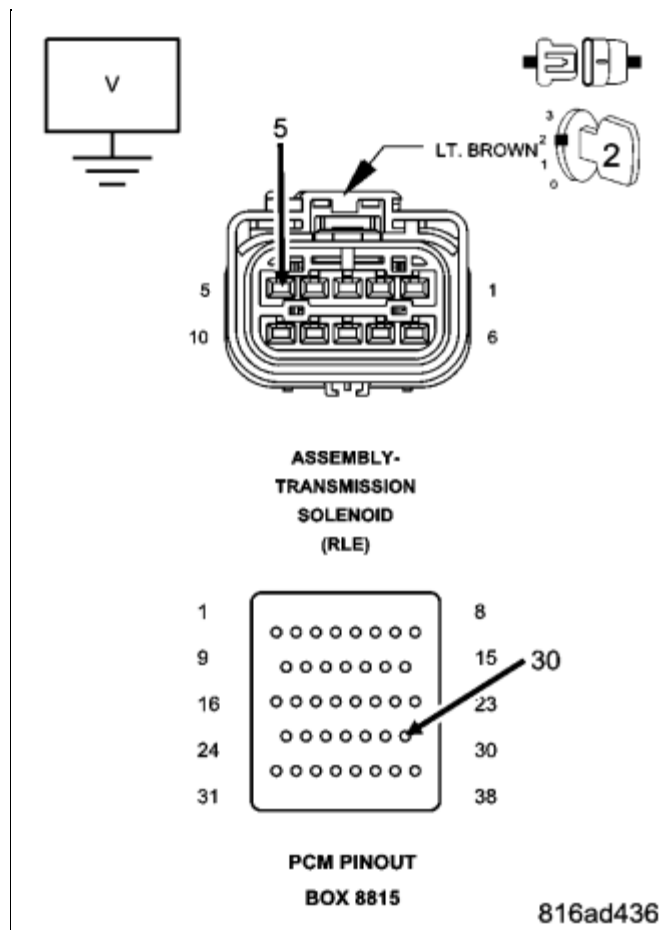
Is the voltage above 0.5 volts?

Yes

- Repair the (T47) 2/4 Pressure Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [8](#)



8. TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN

With the scan tool under TIPM, actuate the Transmission. Using a 12-volt test light connected to ground, check (T16) Transmission Control Relay Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

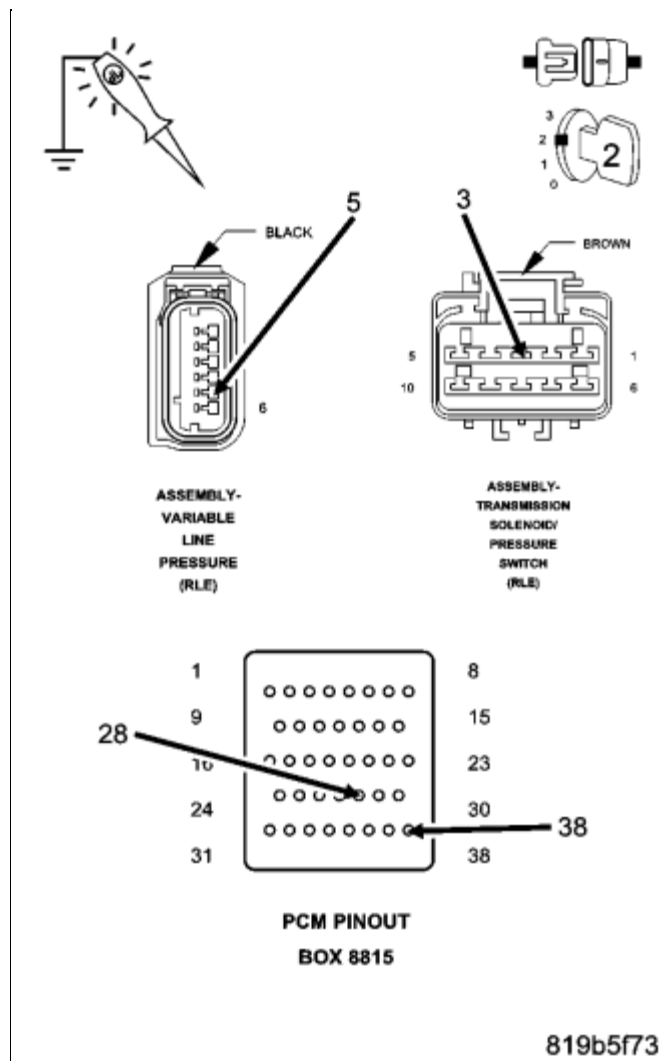
Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



9. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

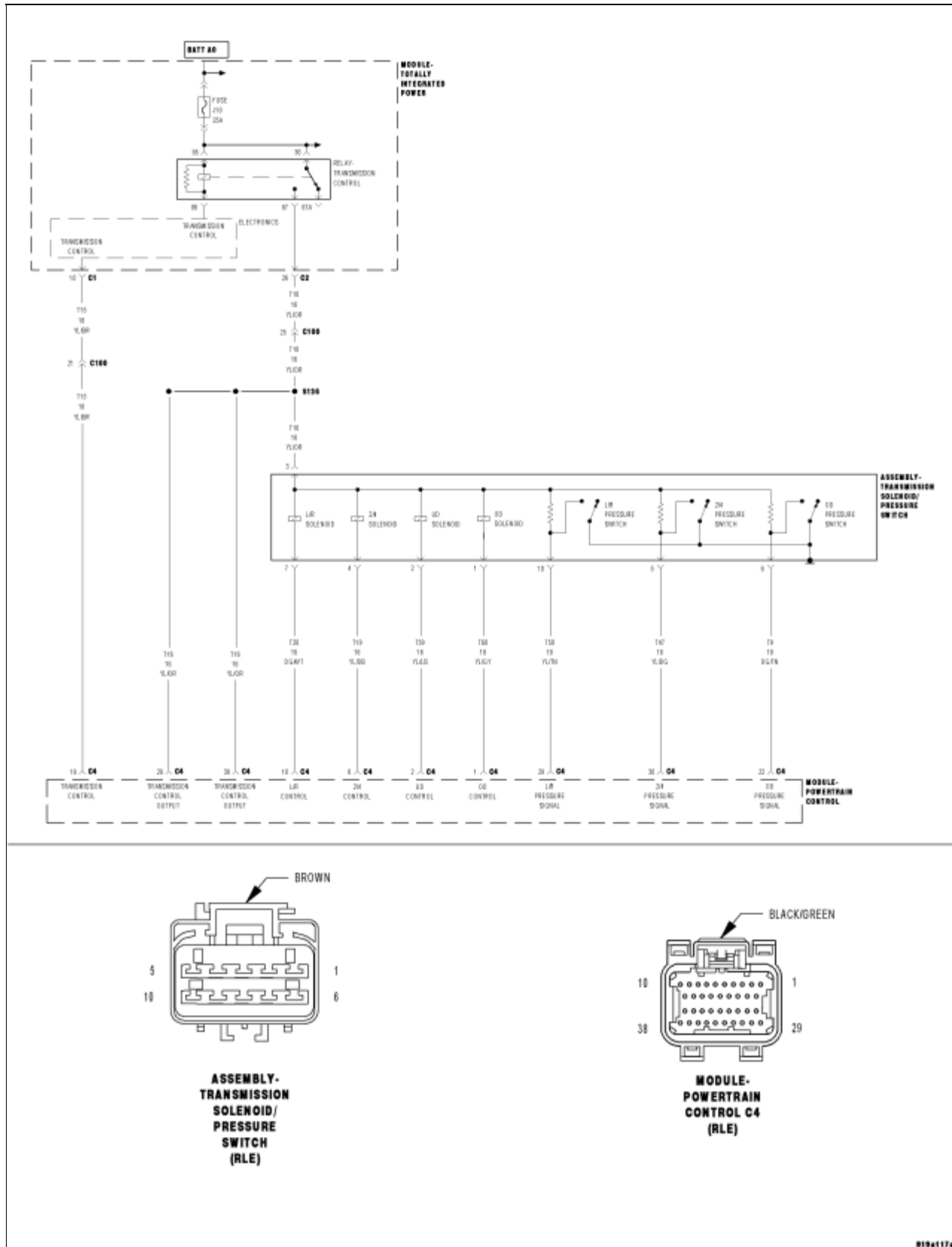
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0846-2/4 PRESSURE SWITCH RATIONALITY



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. The 2/4 pressure switch monitors the fluid pressure to the 2/4 clutch to confirm proper operation of the 2/4 solenoid. If the 2/4 pressure switch is identified as closed in P or N, the code will immediately be set and normal operation will be allowed for that given key start. If the problem is identified for 3 successive ignition cycles, the transmission will go into limp-in mode.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TIPM TCM POWER CONTROL CIRCUIT DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T47) 2/4 PRESSURE SIGNAL CIRCUIT OPEN
(T47) 2/4 PRESSURE SIGNAL CIRCUIT SHORT TO GROUND
(T47) 2/4 PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD

R	OPEN	OPEN	OPEN
P/N	CLOSED	OPEN	OPEN
1st	CLOSED	OPEN	OPEN
2nd	OPEN	CLOSED	OPEN
D	OPEN	OPEN	CLOSED
OD	OPEN	CLOSED	CLOSED

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, read DTCs.

Is the DTC P0944 present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [3](#)

3. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [4](#)

No

- Go to [8](#)

4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to 2/4.

With the scan tool, monitor the 2/4 Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the 2/4 Pressure Switch state change?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CHECK THE (T47) 2/4 PRESSURE SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch

Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T47) 2/4 Pressure Signal circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T47) 2/4 Pressure Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)

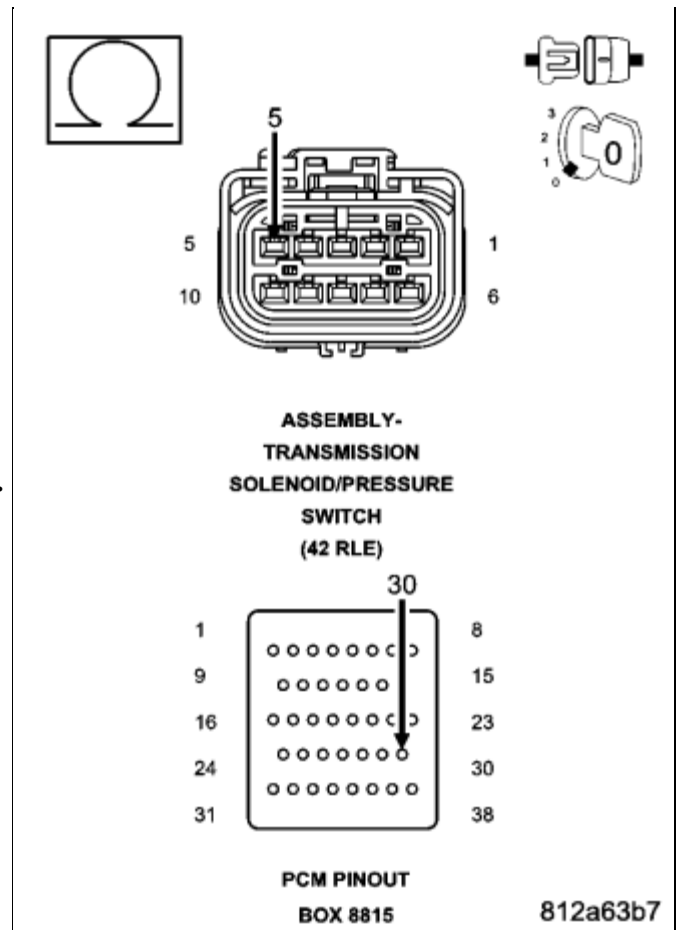
6. CHECK THE (T47) 2/4 PRESSURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

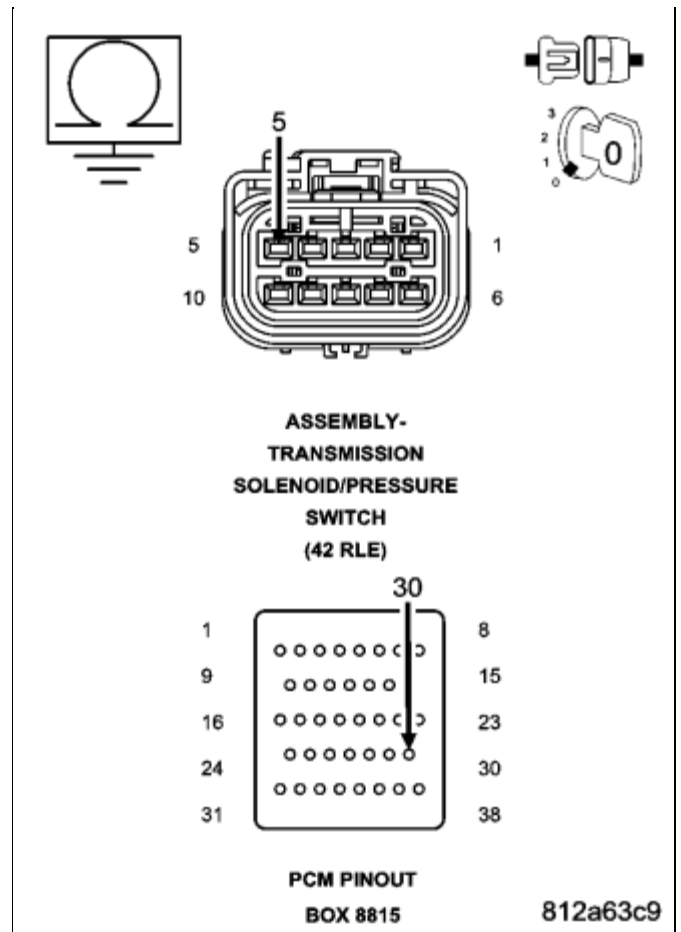
Measure the resistance between ground and the (T47) 2/4 Pressure Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T47) 2/4 Pressure Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)





No

- Go to [Z](#)

7. CHECK THE (T47) 2/4 PRESSURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T47) 2/4 Pressure Signal circuit.

Is the voltage above 0.5 volts?

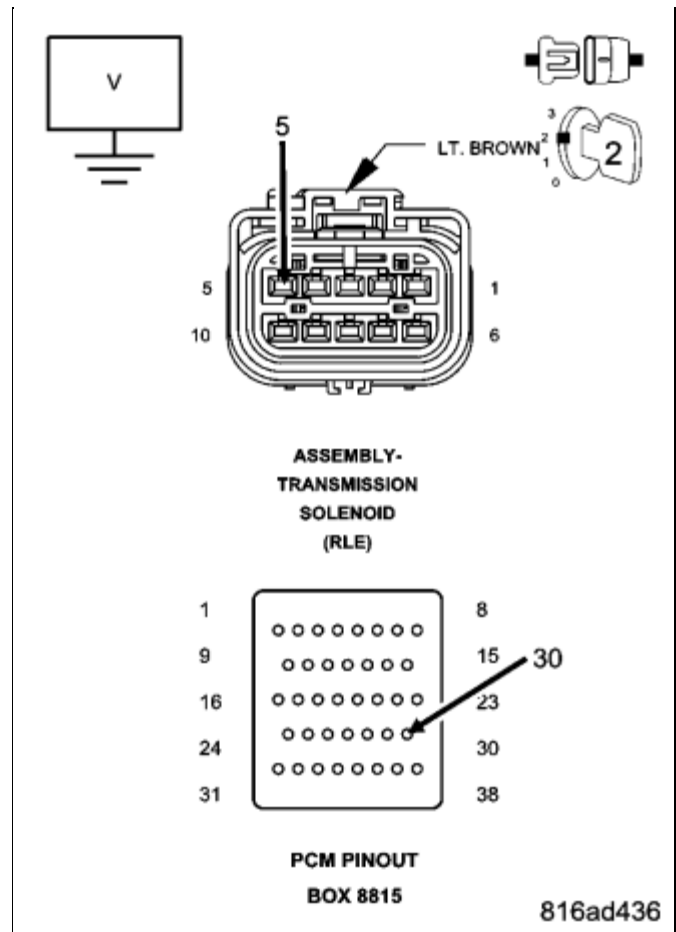
Yes

- Repair the (T47) 2/4 Pressure Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service

- Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

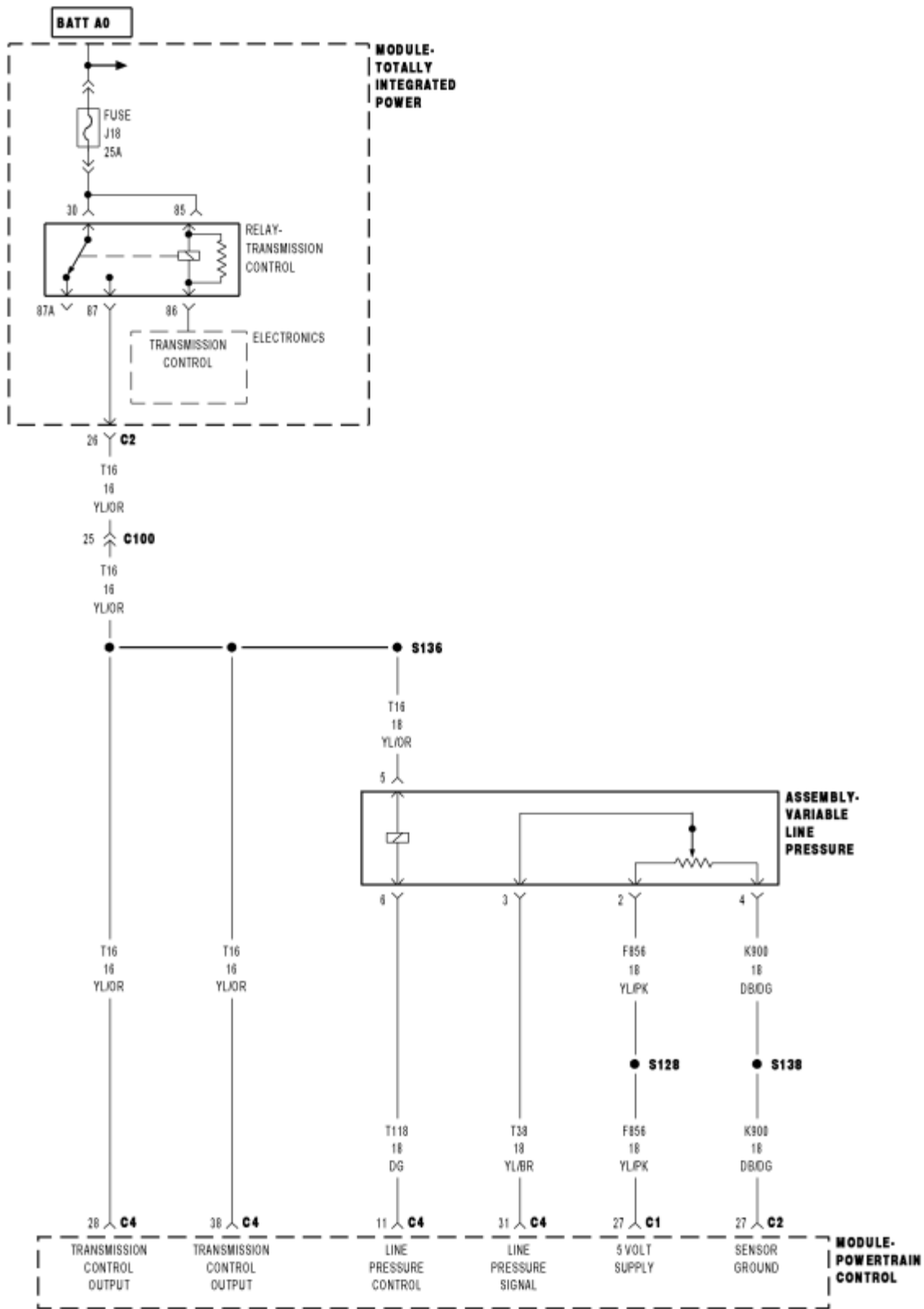
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0868-LINE PRESSURE LOW



019a2008

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently lower than the target while driving, the line pressure low DTC P0868 will set.

- **When Monitored:**

Continuously while driving in a forward gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure is more than 10 psi below Desired Line Pressure, this DTC will set.

Possible Causes
CHECK FOR RELATED DTCS
LOW FLUID LEVEL
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE
(T118) LP VFS CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT
INTERNAL TRANSMISSION
LINE PRESSURE SENSOR
CRACKED, PLUGGED, OR MIS-INSTALLED OIL FILTER
STUCK OR STICKING MAIN REGULATOR VALVE
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCs

Is the DTC P0932 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [10](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.
Remove the from the TIPM.

CAUTION: Removal of the from the TIPM will prevent the vehicle from being started in gear.

WARNING: The must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.
On the Transmission Simulator select the "OFF" position of the "Input/Output Speed" switch.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure during the following steps.

Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?

Yes

- Go to [4](#)

No

- Go to [6](#)

4. CHECK THE LINE PRESSURE SENSOR

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install a Pressure Gauge, 0 to 2000 kPa or 0 to 300 psi to the L/R test port.

Start the engine in Park.

Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

Is the line pressure gauge reading within 34 kPa or 5 psi of the scan tool reading?

Yes

- Go to [5](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK FOR A PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Transmission Oil Filter per the Service Information.

Does the Oil Pan contain excessive debris and/or is the Transmission Oil Filter plugged?

Yes

- Repair as necessary. If the Transmission Oil Filter is plugged or there is excessive debris, refer to the Service Information for the proper Hydraulic repair procedure.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.
Reconnect all previously disconnected connectors except the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.

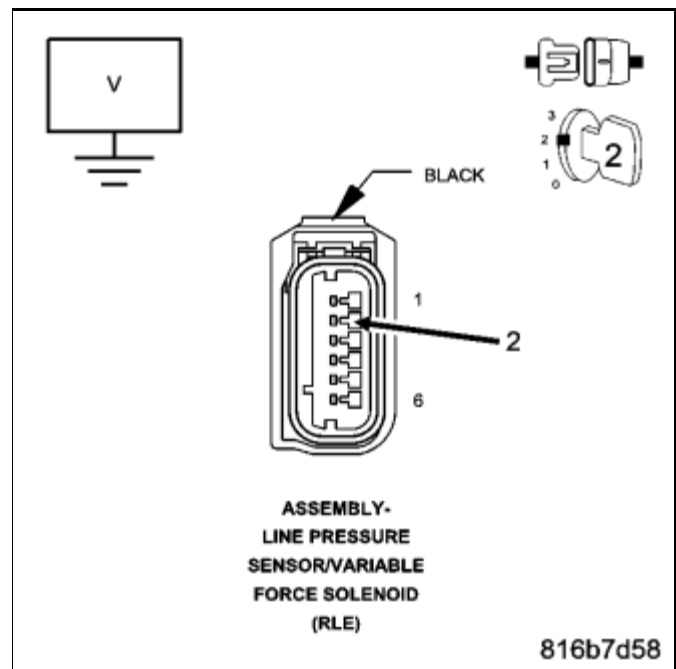
Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit.

Is the voltage above 5.5 volts?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [7](#)

7. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor/Variable Force Solenoid

Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

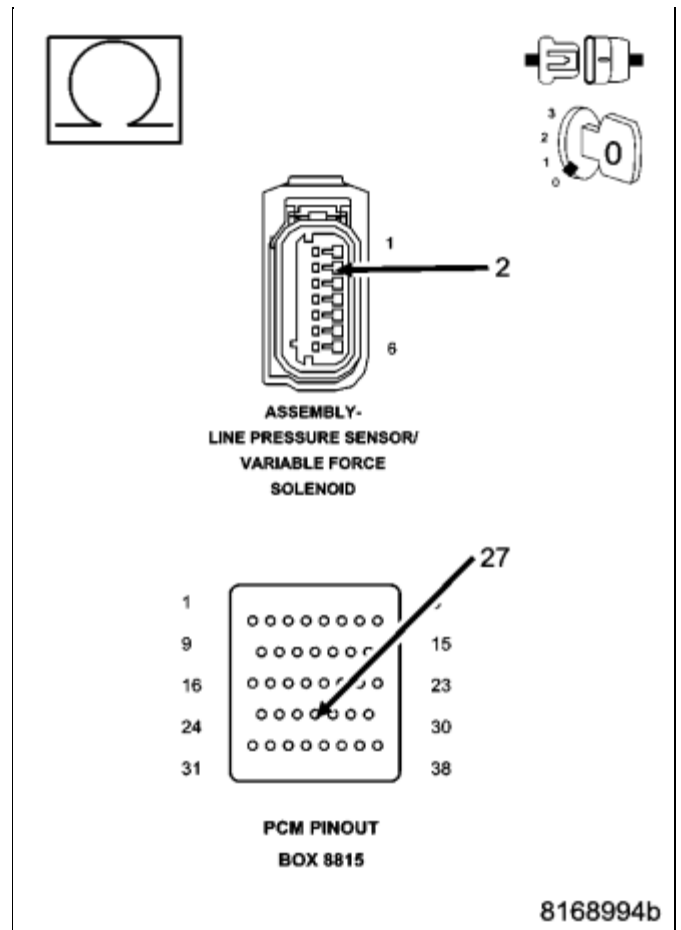
Is the resistance below 5.0 ohms?

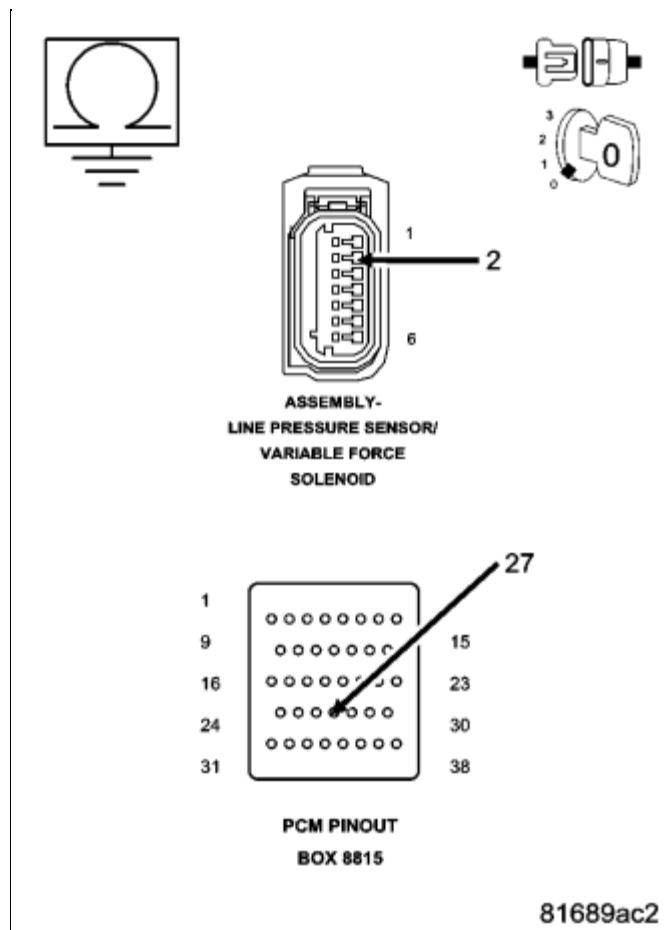
Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [9](#)





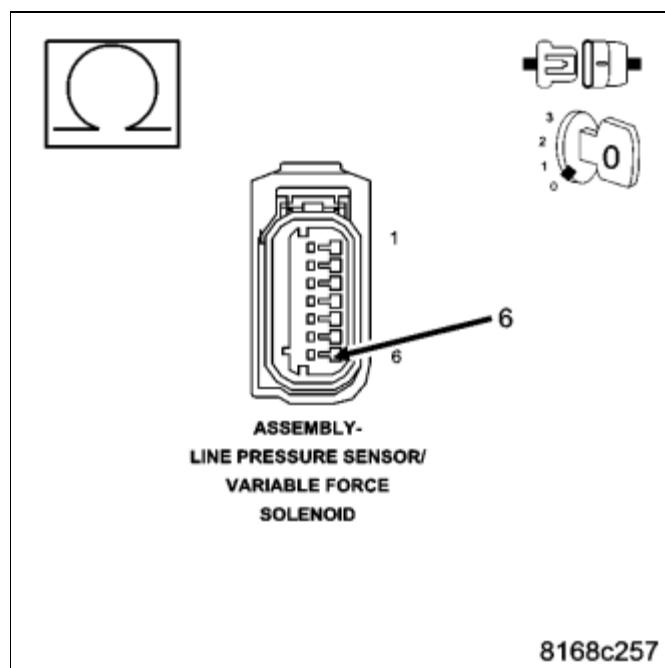
9. CHECK THE (T118) LP VFS CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.
 Disconnect all PCM harness connectors.
 Measure the resistance between the (T118) LP VFS Control circuit and all other circuits in the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.

Is the resistance below 5.0 ohms between the (T118) LP VFS Control circuit and any other circuit(s) in the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector?

Yes

- Repair the (T118) LP VFS Control circuit for a short to another circuit(s).
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

10. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0869-LINE PRESSURE HIGH

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

- **When Monitored:**

Continuously while driving in a forward gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure. If the Actual Line Pressure reading is greater than the highest Desired Line Pressure ever used in the current gear, while the Pressure Control Solenoid duty cycle is at or near its maximum value (which should result in minimum line pressure), the DTC will set.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
LINE PRESSURE SENSOR CONNECTION
(T118) LP VFS CONTROL CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T118) LP VFS CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION CONTROL OUTPUT CIRCUIT
LINE PRESSURE SENSOR
STUCK OR STICKING MAIN REGULATOR VALVE
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCs.

Are there any line pressure sensor or transmission relay output DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [9](#)

3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi (0.2 volts) of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa or 2.0 psi (0.2 volts) in all three positions?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK THE LINE PRESSURE SENSOR CALIBRATION

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit and reconnect all previously disconnected connectors.

Install the Line Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 psi in the L/R pressure port. Start the engine in Park.

Monitor the Line Pressure readings on the scan tool and the pressure gauge.

Compare the Line Pressure readings between the scan tool and the pressure gauge.

Is the pressure gauge reading within 34 kPa or 5 psi of the scan tool reading?

Yes

- Repair the internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Pressure Control Solenoid.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Replace the Line Pressure Sensor per the Service information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK THE (T118) LP VFS CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the Powertrain Control Module C4 harness connector.

CAUTION: Do not probe the PCM harness connectors.

Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T118) LP VFS Control circuit between the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T118) LP VFS Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. CHECK THE (T118) LP VFS CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T118) LP VFS Control circuit.

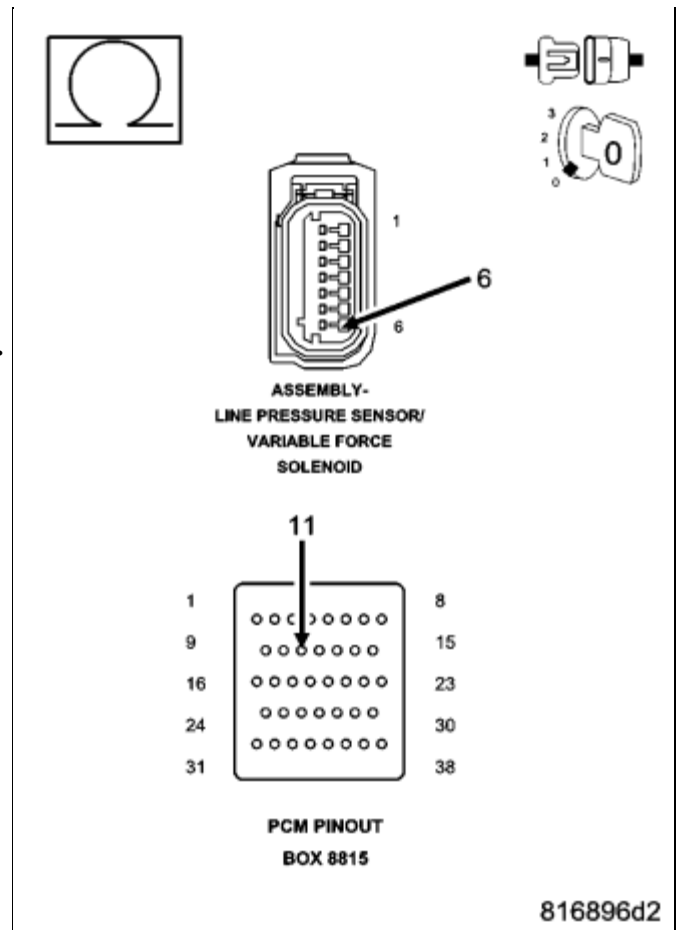
Is the resistance below 5.0 ohms?

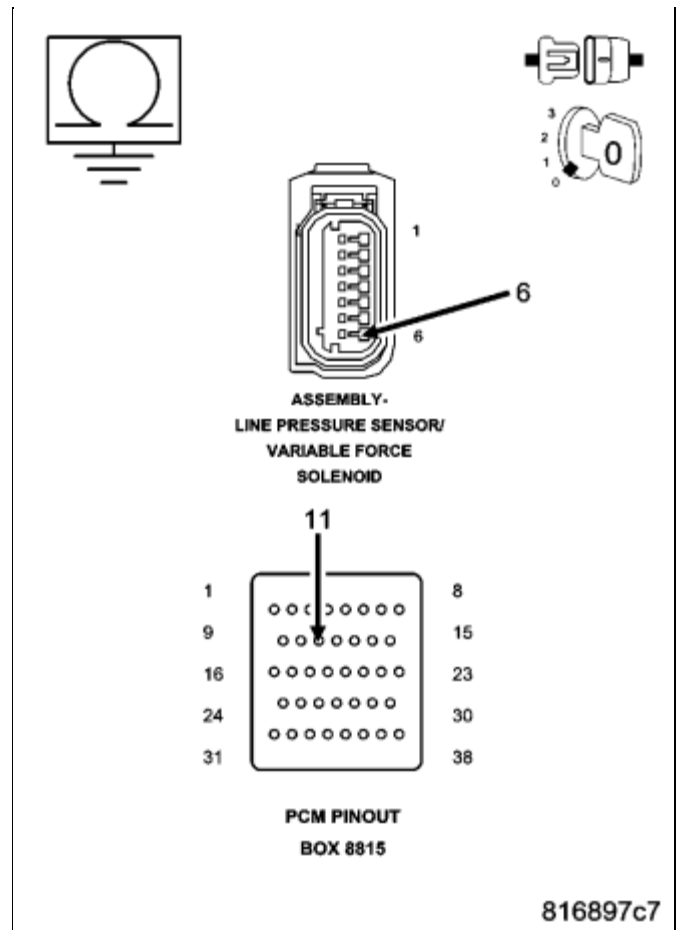
Yes

- Repair the (T118) LP VFS Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [7](#)





7. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Disconnect the PCM C1 harness connector.

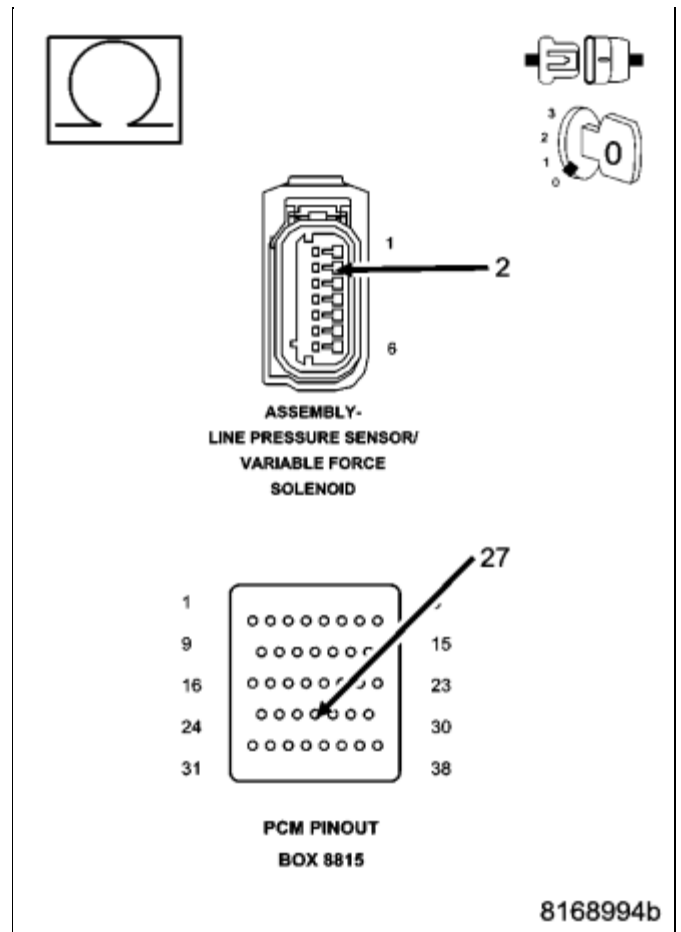
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

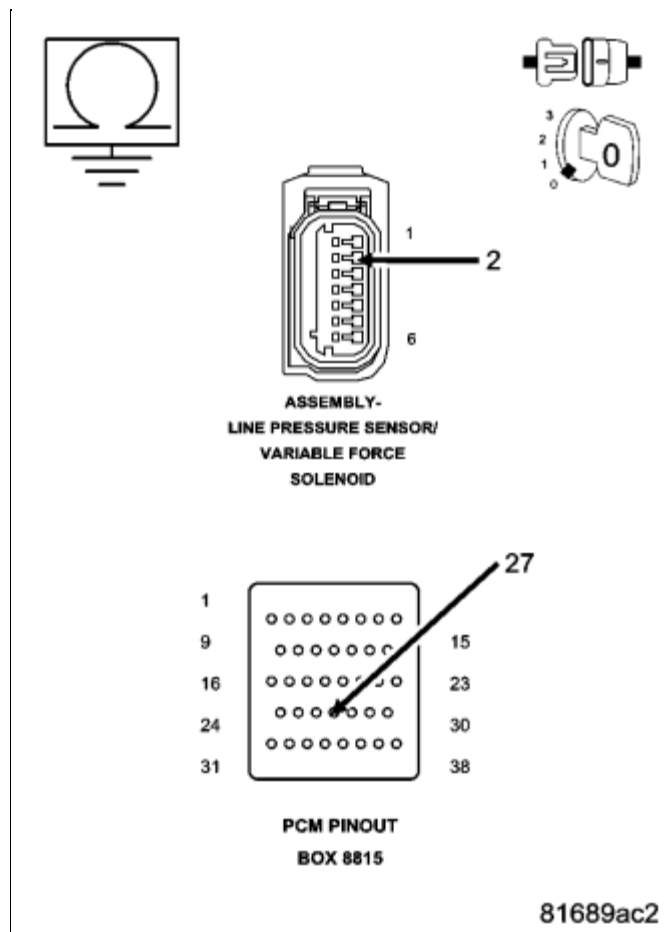
Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service

- Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



9. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorted and open circuits. With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

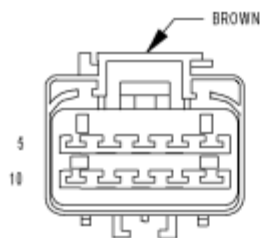
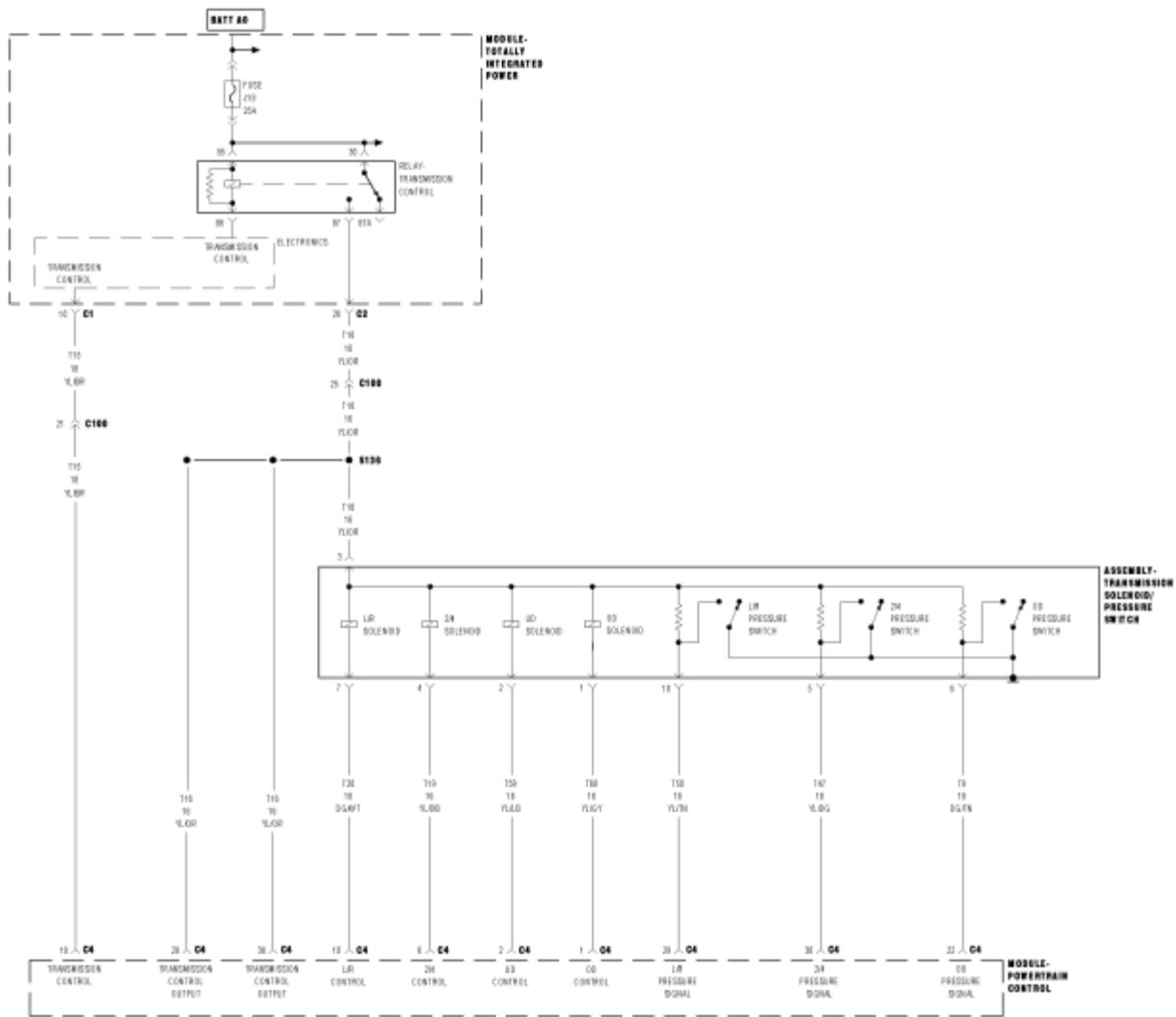
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

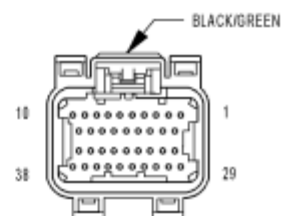
No

- Test Complete.

P0870-OD HYDRAULIC PRESSURE TEST



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to limp-in mode.

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm, shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed greater than 1000 rpm, the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times, the DTC sets.

Possible Causes
LOSS OF PRIME P0944 PRESENT
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
(T9) OD PRESSURE SIGNAL CIRCUIT OPEN
(T9) OD PRESSURE SIGNAL CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, read DTCs.

Is the DTC P0944 present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK FOR RELATED DTCS

With the scan tool, read DTCs.

Are any of the DTCs P0732, P0734 and/or P0846 present also?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [4](#)

No

- Go to [9](#)

4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

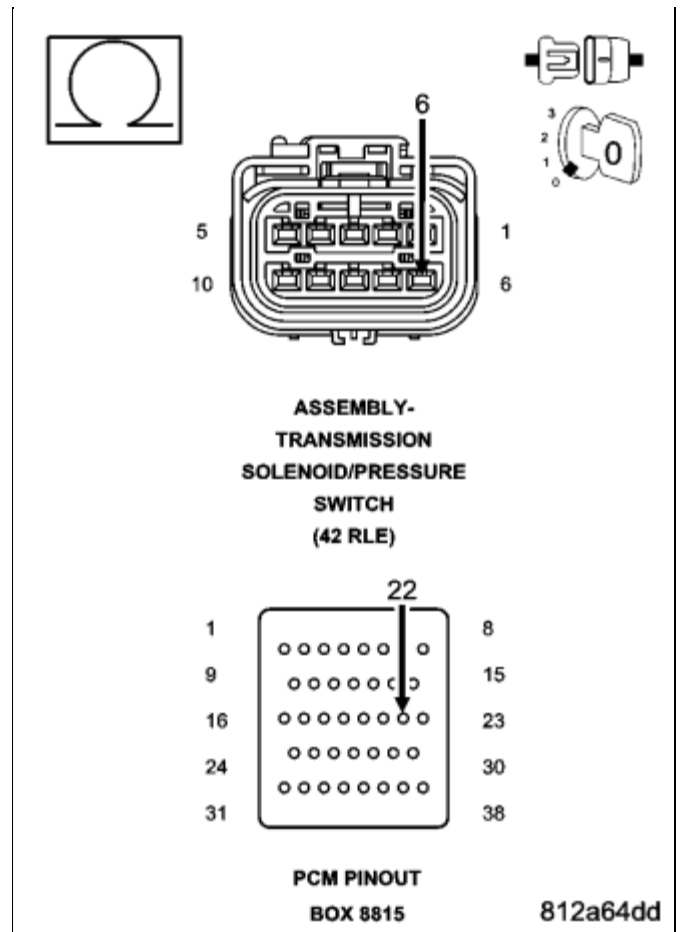
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Signal circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?



Yes

- Repair the (T9) OD Pressure Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)

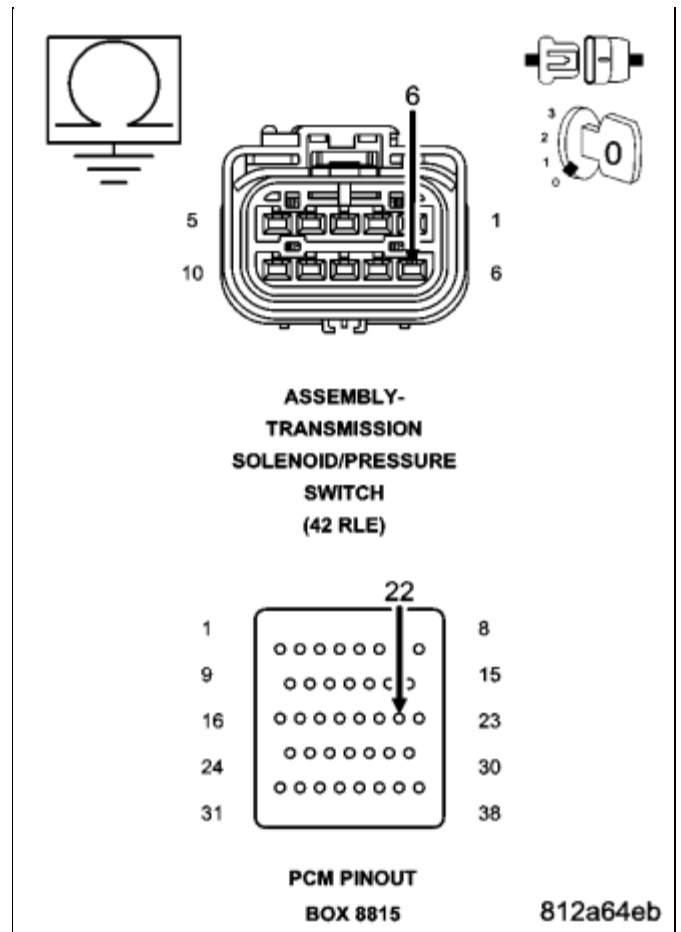
6. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T9) OD Pressure Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go to [7](#)

7. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T9) OD Pressure Signal circuit.

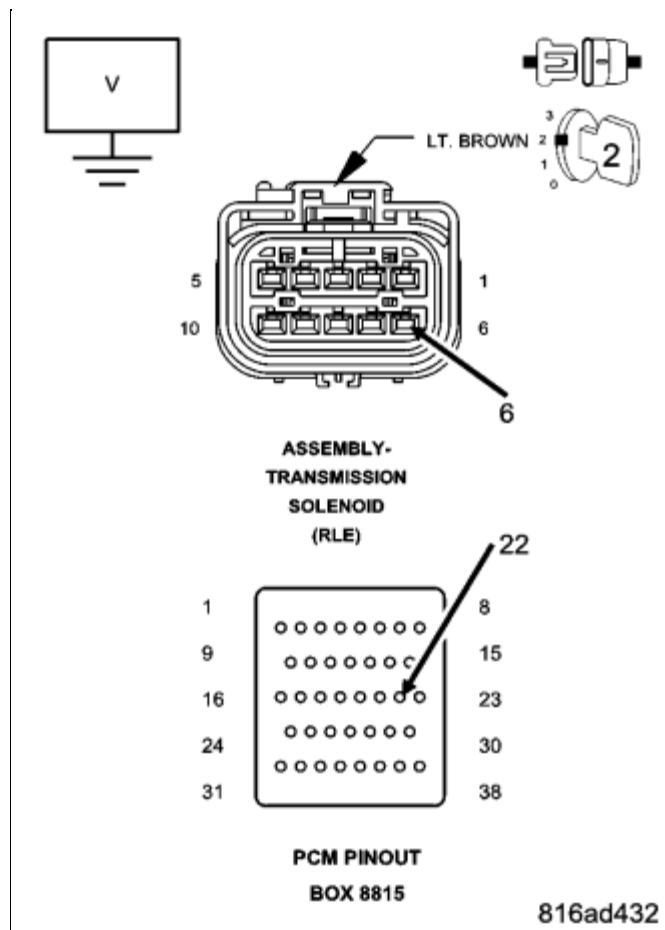
Is the voltage above 0.5 volts?

Yes

- Repair the (T9) OD Pressure Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [8](#)



8. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

With the scan tool under TIPM, actuate the Transmission. Using a 12-volt test light connected to ground, check (T16) Transmission Control Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

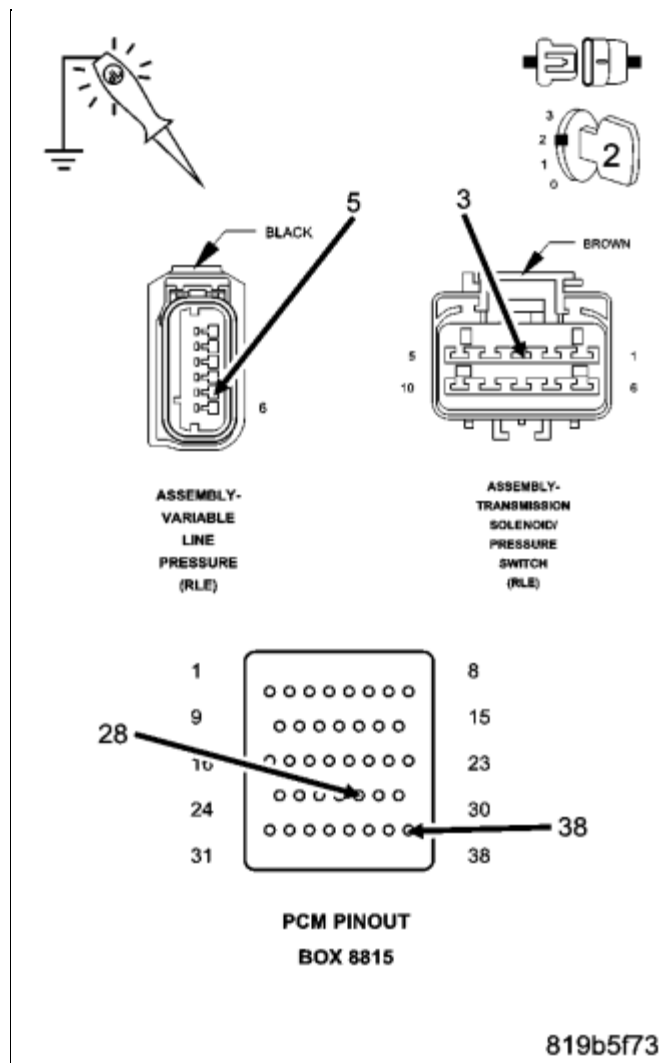
Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION

TEST (Refer to 21 -
TRANSMISSION/TRANSAXLE/AUTOMATIC -
42RLE - STANDARD PROCEDURE)

No

- Repair the (T16) Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



9. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

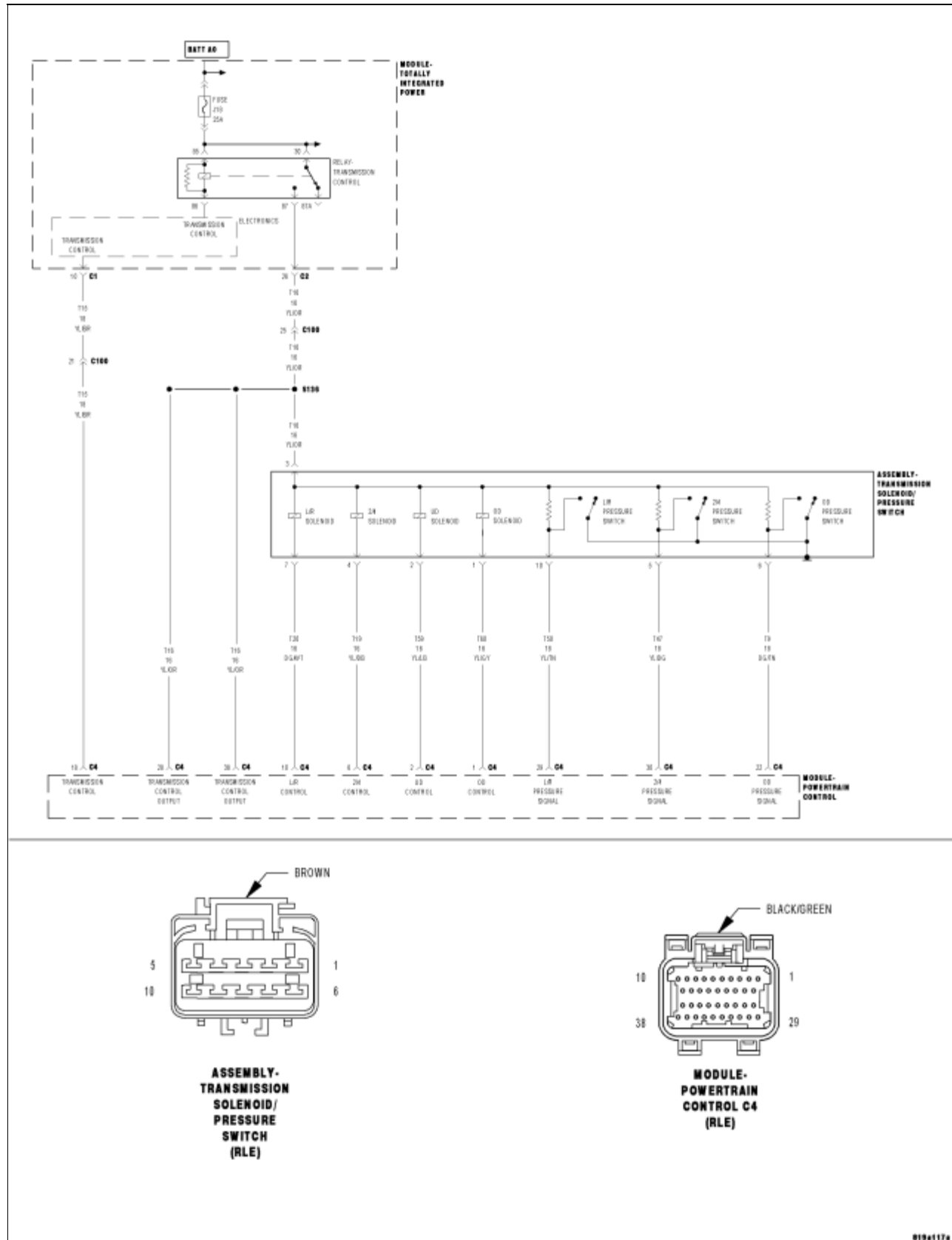
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0871-OD PRESSURE SWITCH RATIONALITY



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the L/R, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. Normal operation will be experienced if no other codes are present. Transmission Control System will ignore the code. Limp-in condition will only occur if DTC P0871 is present with a DTC P0706.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

Possible Causes
RELATED TIPM DTCS PRESENT
LOSS OF PRIME DTC PRESENT
(T9) OD PRESSURE SIGNAL CIRCUIT OPEN
(T9) OD PRESSURE SIGNAL CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OPEN	OPEN	OPEN

P/N	CLOSED	OPEN	OPEN
1st	CLOSED	OPEN	OPEN
2nd	OPEN	CLOSED	OPEN
D	OPEN	OPEN	CLOSED
OD	OPEN	CLOSED	CLOSED

Diagnostic Test

1. CHECK FOR TIPM TCM POWER INPUT DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control Circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [2](#)

2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, read DTCs.

Is the DTC P0944 present also?

Yes

- Refer to the Transmission category and perform the appropriate diagnostic procedure.

No

- Go to [3](#)

3. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [4](#)

No

- Go to [8](#)

4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to OD.

With the scan tool, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the OD Pressure Switch state change?

Yes

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Signal circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T9) OD Pressure Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [6](#)

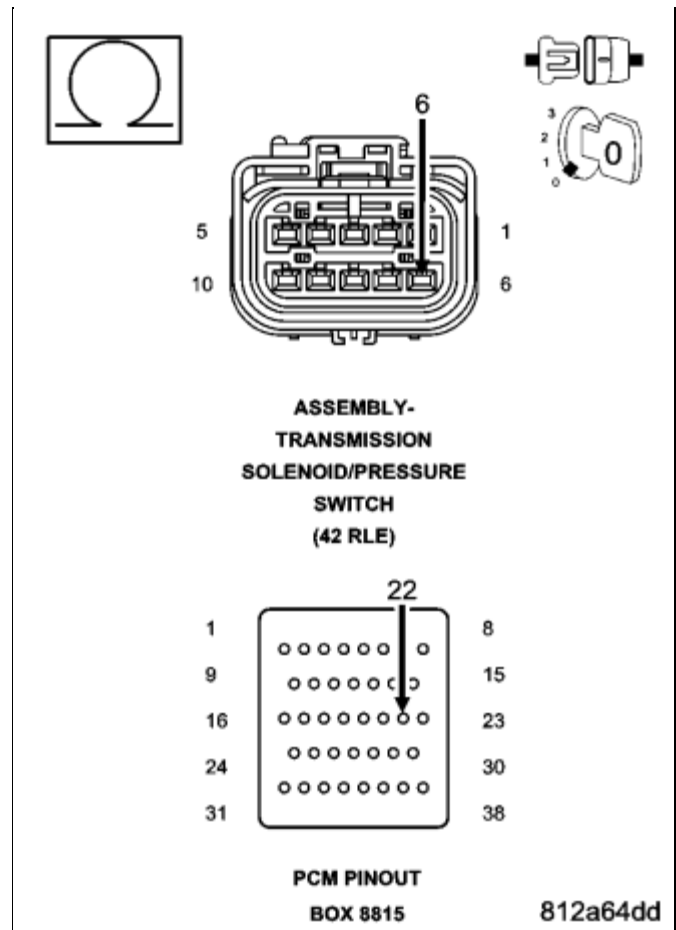
6. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

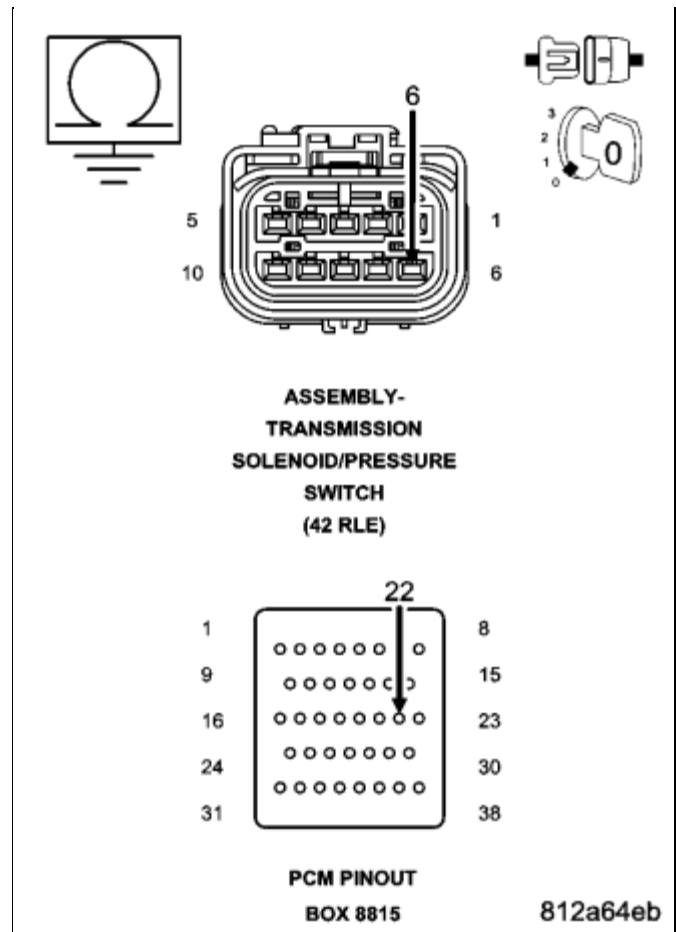
Measure the resistance between ground and the (T9) OD Pressure Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T9) OD Pressure Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)





No

- Go to [Z](#)

7. CHECK THE (T9) OD PRESSURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T9) OD Pressure Signal circuit.

Is the voltage above 0.5 volts?

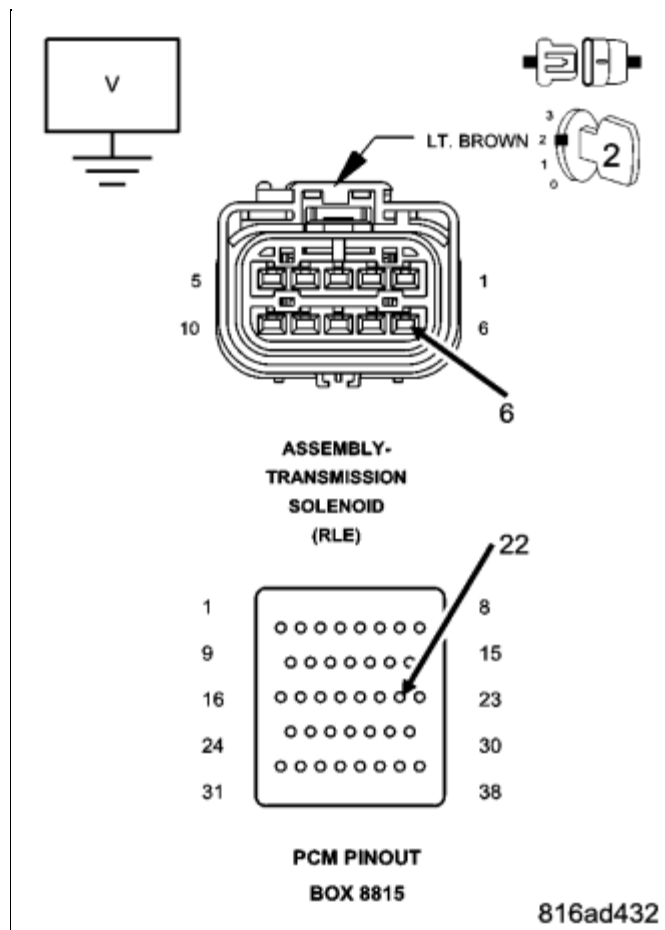
Yes

- Repair the (T9) OD Pressure Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service

- Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



8. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0882-TCM POWER INPUT LOW

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Powertrain Control Module, Transmission Solenoid/pressure Switch Assembly and the PCM when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/TRS Assembly in event that the transmission should need to be placed into limp-in mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System requests for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If the Transmission Control System detects less than 3.0 volts when the output is commanded on, the DTC will set. **Note: Inadequate Transmission Control Output voltage can also cause DTCs P0846, P0869, or P0871 to set. Repairing the P0882 fault should also eliminate the related DTCs.**

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set when there is less than 3.0 volts present at the transmission control output circuits located in the Powertrain Control Module (PCM) when the Transmission Control System request the power up of those circuits. .

Possible Causes
RELATED TIPM DTCS
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO GROUND
(T15) TRANSMISSION CONTROL CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [2](#)

No

- Go to [6](#)

2. CHECK FOR TIPM RELATED DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [3](#)

3. CHECK THE TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Install a substitute Relay in place of the Transmission Control Relay.
Ignition on, engine not running.
With the scan tool, monitor the Switched Battery voltage in the next step.

NOTE: The switched battery voltage should remain steady and around 12-volts

Does the Switched Battery voltage remain a steady voltage (12-volts) and the DTC not reset?

Yes

- Replace the Transmission Control Relay.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Disconnect the TIPM C1 harness connector.
Measure the resistance between ground and the (T15) Transmission Control circuit.

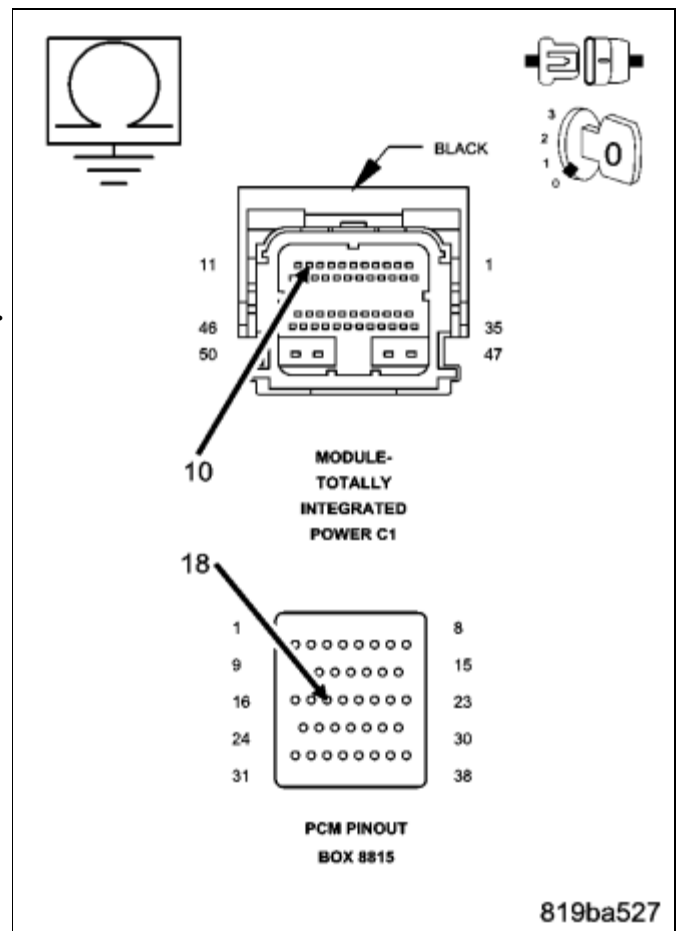
Is the resistance below 5.0 ohms?

Yes

- Repair the (T15) Transmission Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go to [5](#)



5. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T15) Transmission Control circuit between the TIPM C1 harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

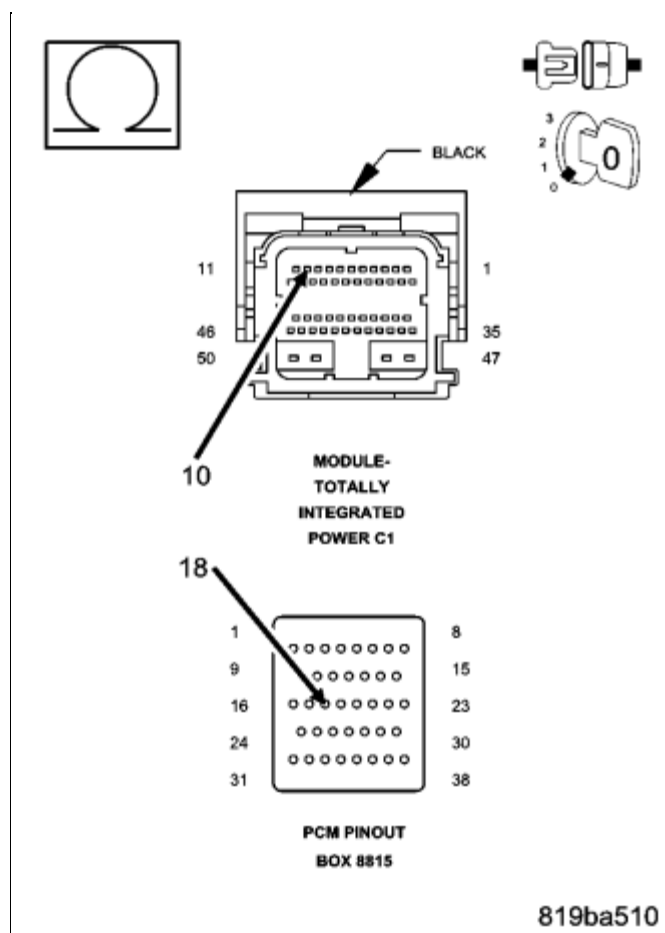
Yes

- Repair the (T15) Transmission Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

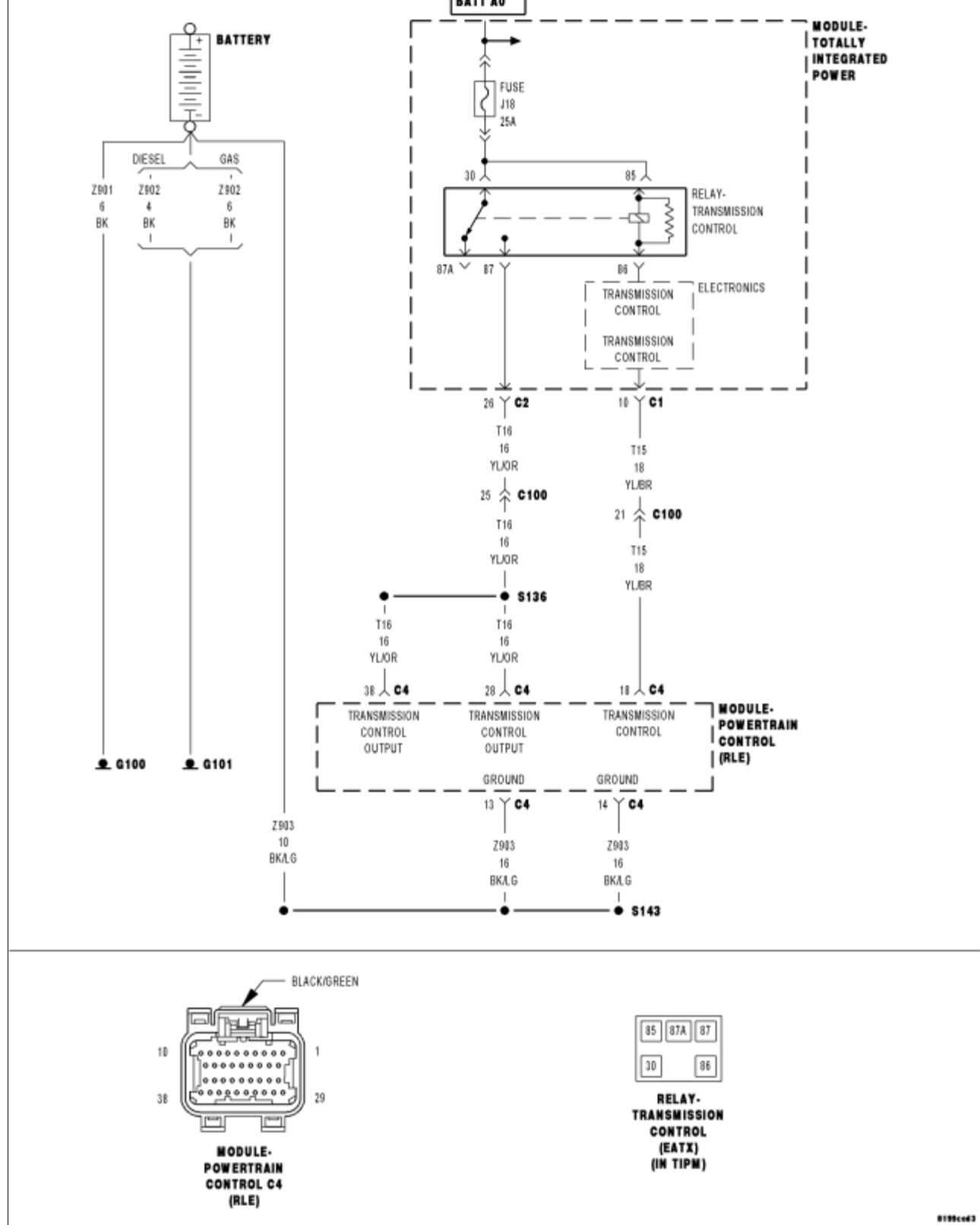
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0883-TCM POWER INPUT HIGH



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Transmission Solenoid/Pressure Switch Assembly, Powertrain Control Module (PCM) and the LP VFS Solenoid when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/pressure Switch Assembly in the event that the transmission should need to be placed into limp-in mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System request for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If voltage is detected on the Transmission Output circuits before the request is sent, the DTC will set.

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set if the Powertrain Control Module senses greater than 3.0 volts on the Transmission Control Relay Output circuits prior to a request from the PCM to TIPM to energize the Transmission Output circuits.

Possible Causes
TIPM DTCS PRESENT
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO VOLTAGE
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT VOLTAGE
TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR TCM TIPM DTCS

With the scan tool, read TIPM DTCs.

Are there any TIPM TCM Power Control circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 0 for this DTC?

Yes

- Go to [3](#)

No

- Go to [7](#)

3. CHECK THE TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Install a substitute Relay in place of the Transmission Control Relay.
Ignition on, engine not running.

Does the DTC reset?

Yes

- Go to [4](#)

No

- Replace the Transmission Control Relay.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. CHECK THE (T16) TRANSMISSION OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Disconnect the TIPM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.
 Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.

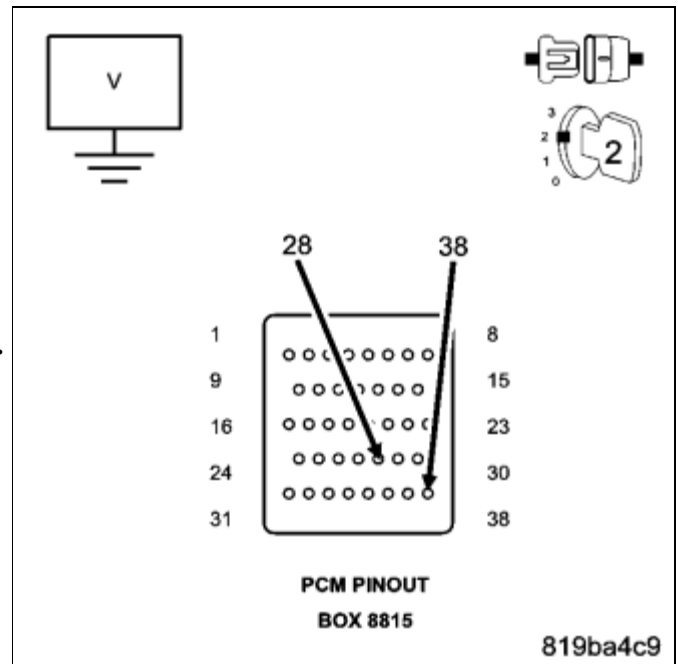
Is the voltage above 0.5 volts on any (T16) Transmission Control Output circuit?

Yes

- Go to [5](#)

No

- Go to [6](#)



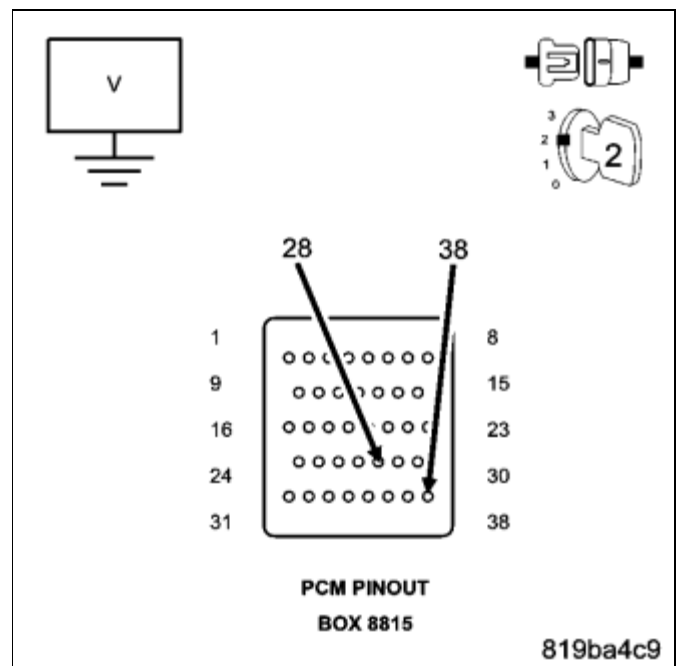
5. CHECK THE TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY

Turn the ignition off to the lock position.
 Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.
 Ignition on, engine not running.
 Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.

Is the voltage above 0.5 volts?

Yes

- Repair the (T16) Transmission Control Output circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

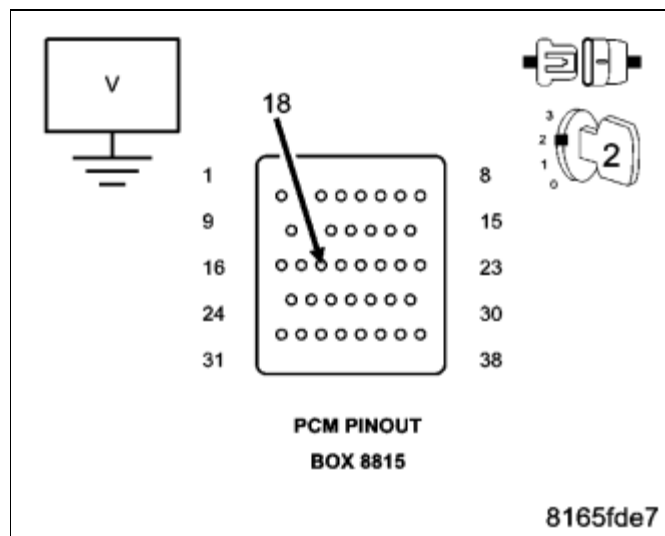
6. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Measure the voltage of the (T15) Transmission Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T15) Transmission Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No**

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

7. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0884-POWER UP AT SPEED

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

If a vehicle loses power to the PCM, the vehicle will go to the 2nd gear mode since there is no power available to control the transmission solenoids. However if power is restored, the PCM will power-up and normal operation will be restored. This DTC identifies that power to the PCM was restored when the gear selector was in a "Drive" position while the vehicle was moving at speeds above 32 km/h (20 mph). If a customer shifts to Neutral and cycles the ignition key and quickly shifts to "Drive" while moving before the PCM comes out of its START ROUTINE, the DTC can be set. Therefore it is critical that this DTC diagnosis repair procedure should only be used if the vehicle is experiencing intermittent 2nd gear operation and subsequently a return to normal operation during normal driving. The transmission will not be placed in limp-in. This is an informational DTC to be used when attempting to diagnose an intermittent 2nd gear operation and subsequent return to normal transmission operation.

- **When Monitored:**

One time after each controller reset. Note: the Transmission Control Module is integrated with Powertrain Control Module. The Transmission Control Module has separate powers and grounds specifically to its portion of the PCM.

- **Set Condition:**

This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear (no PRNDL DTCs) with an output speed above 800 rpm, approximately 32 km/h or 20 mph.

Possible Causes
INTERMITTENT POWER AND GROUND CIRCUITS

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK THE POWER AND GROUND CIRCUITS

This DTC is set when the PCM is initialized while the vehicle is moving in a valid forward gear. This is usually caused by a momentary loss of power to the Transmission portion of the PCM.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Check all of the Fused B(+), Fused Ignition Switch Output, and Ground circuits related to the PCM for an intermittent open or short to ground.

Perform a wiggle test on all wiring and connectors pertaining to the PCM while looking for shorted or open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0888-TRANSMISSION RELAY ALWAYS OFF

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Transmission Solenoid/TRS Assembly and to the PCM when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/TRS Assembly in the event that the transmission should need to be placed into limp-in mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System requests for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If the Transmission Control System detects less than 3.0 volts when the output is commanded on, the DTC will set. **Note: Inadequate Transmission Control Output voltage can also cause DTCs P0846, P0869, or P0871 to set. Repairing the P0882 fault should also eliminate the related DTCs.**

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set when there is less than 3.0 volts present at the transmission control output circuits located in the Powertrain Control Module (PCM) when the Transmission Control System request the power up of those circuits. **Note: Due to the integration of the Transmission Control Module and the Powertrain Control Module, both systems have their own power and ground circuits..**

Possible Causes
RELATED TIPM DTCS
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO GROUND
(T15) TRANSMISSION CONTROL CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC P0888 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0888.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter equal to 0?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECK FOR TIPM RELATED DTCS

With the scan tool, check TIPM DTCS.

Are there any TIPM TCM Power Control circuit DTCS present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [3](#)

3. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Install a substitute Relay in place of the Transmission Control Relay.
Ignition on, engine not running.
With the scan tool, monitor the Switched Battery voltage in the next step.

NOTE: The switched battery voltage should remain steady and around 12-volts.

Does the Switched Battery voltage remain a steady voltage (12-volts) and the DTC not reset?

Yes

- Replace the Transmission Control Relay.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Disconnect the TIPM C1 harness connector.
Measure the resistance between ground and the (T15) Transmission Control circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T15) Transmission Control circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

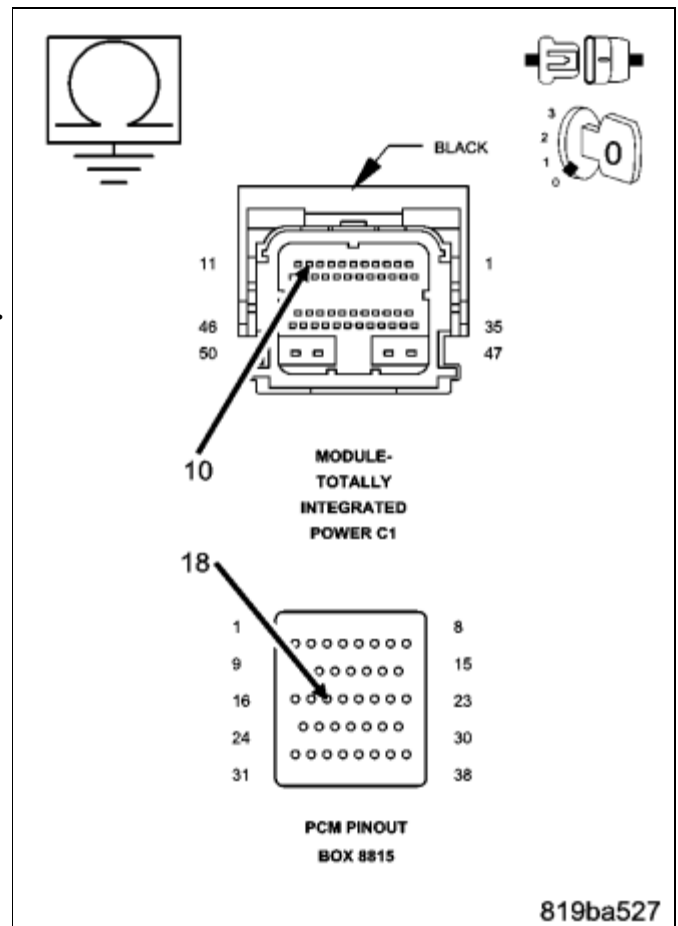
- Go To [5](#)

5. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T15) Transmission Control circuit between the TIPM C1 harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

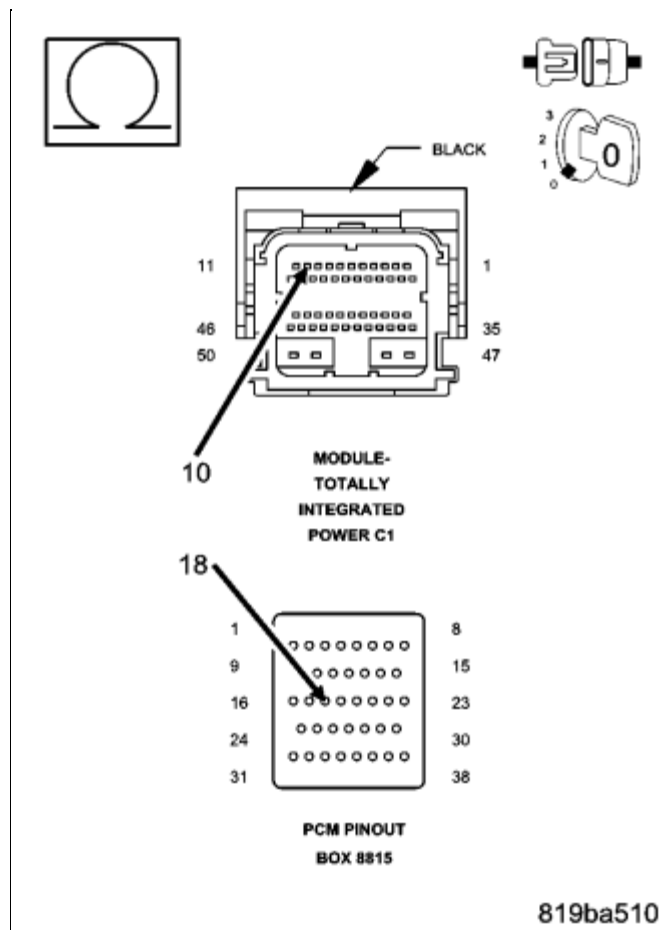
Yes



- Repair the (T15) Transmission Control circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

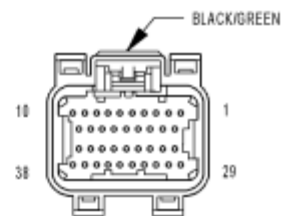
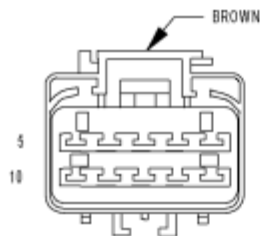
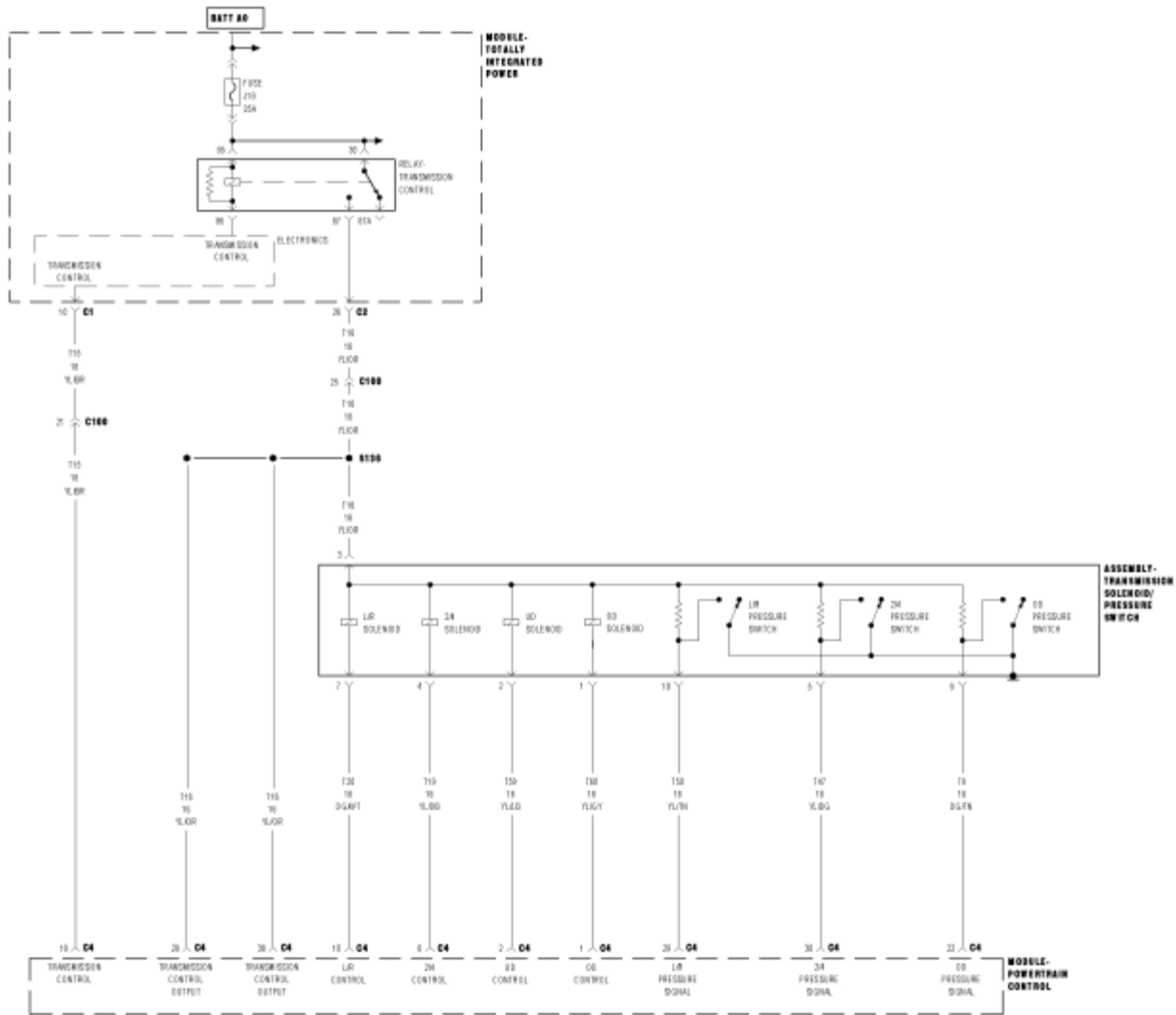
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0890-SWITCHED BATTERY



019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission limp-in mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller. It is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (transmission control relay output) before the relay is energized. After switched battery is verified for no voltage, the voltage of each of the solenoid pack pressure switches is also checked. Since the solenoid pack is not powered up, there should be no voltage on any of the pressure switches.

- **When Monitored:**

One time after a reset (ignition key turned to the RUN position or after cranking engine).

- **Set Condition:**

A fault is set if voltage greater than 4.5 volts is detected for 7 ms on any of the pressure switch circuits before the relay is energized. The transmission is placed in limp-In. The MIL is on after 10 seconds. of vehicle operation.

Possible Causes
(T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter set at 0?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector.
 Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.
 Ignition on, engine not running.
 With the scan tool under TIPM, actuate the Transmission.

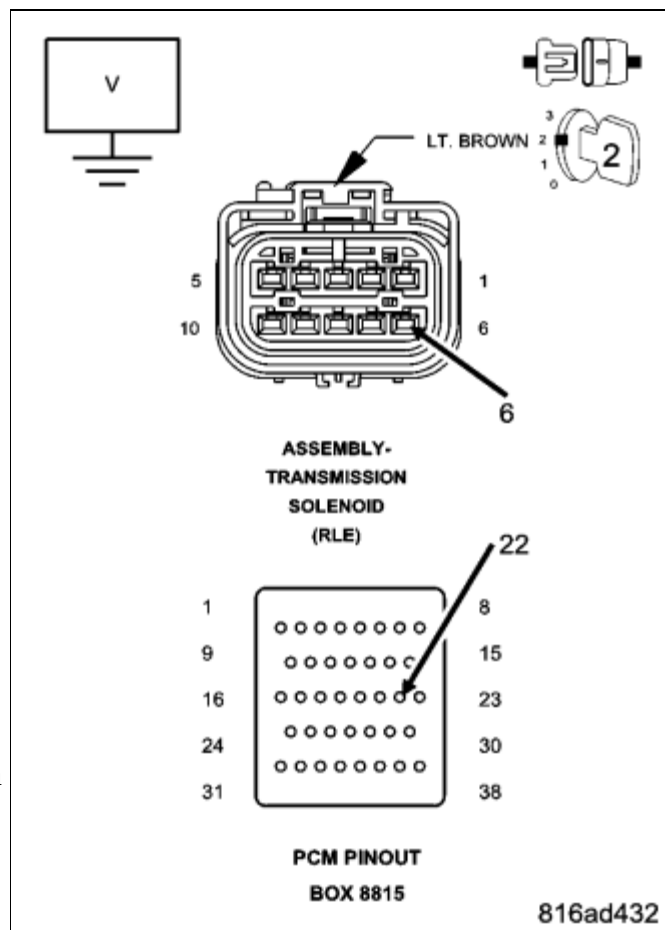
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

Is the voltage above 0.5 volt?

Yes

- Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go To [3](#)

3. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

With the scan tool under TIPM, actuate the Transmission.
 Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.

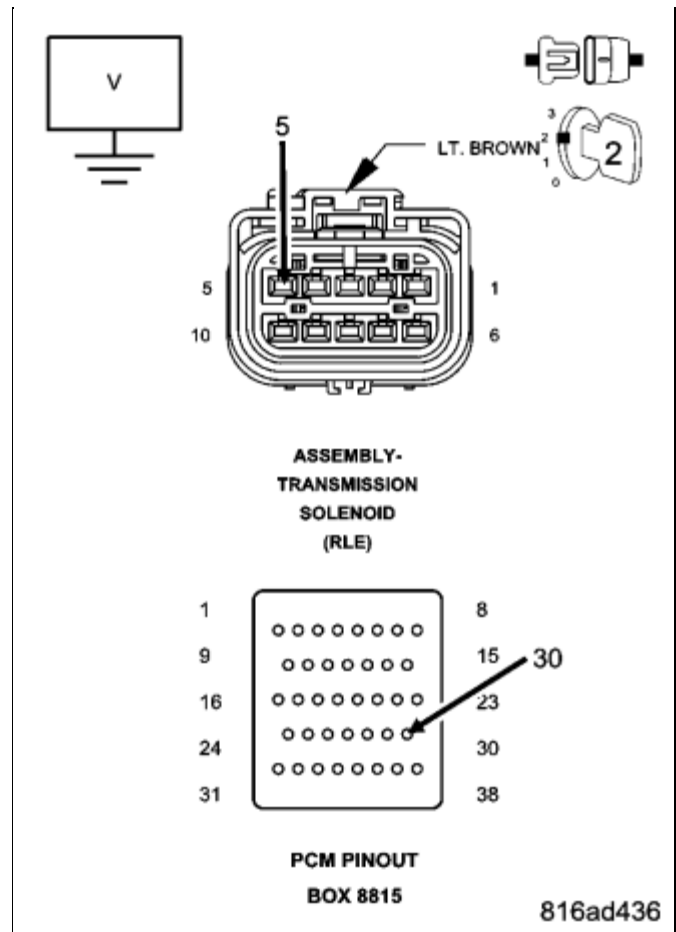
Is the voltage above 0.5 volt?

Yes

- Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

With the scan tool under TIPM, actuate the Transmission. Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes

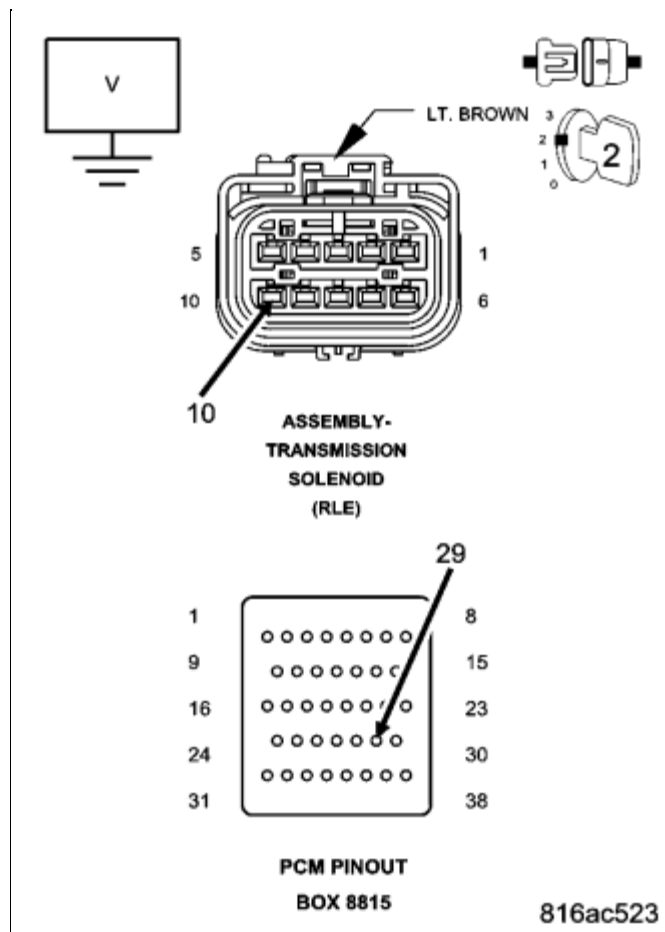
- Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service

Information. With the scan tool, perform QUICK LEARN.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

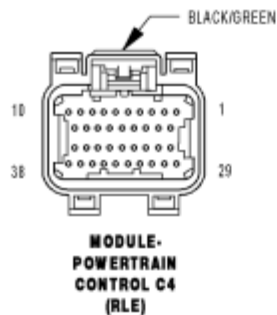
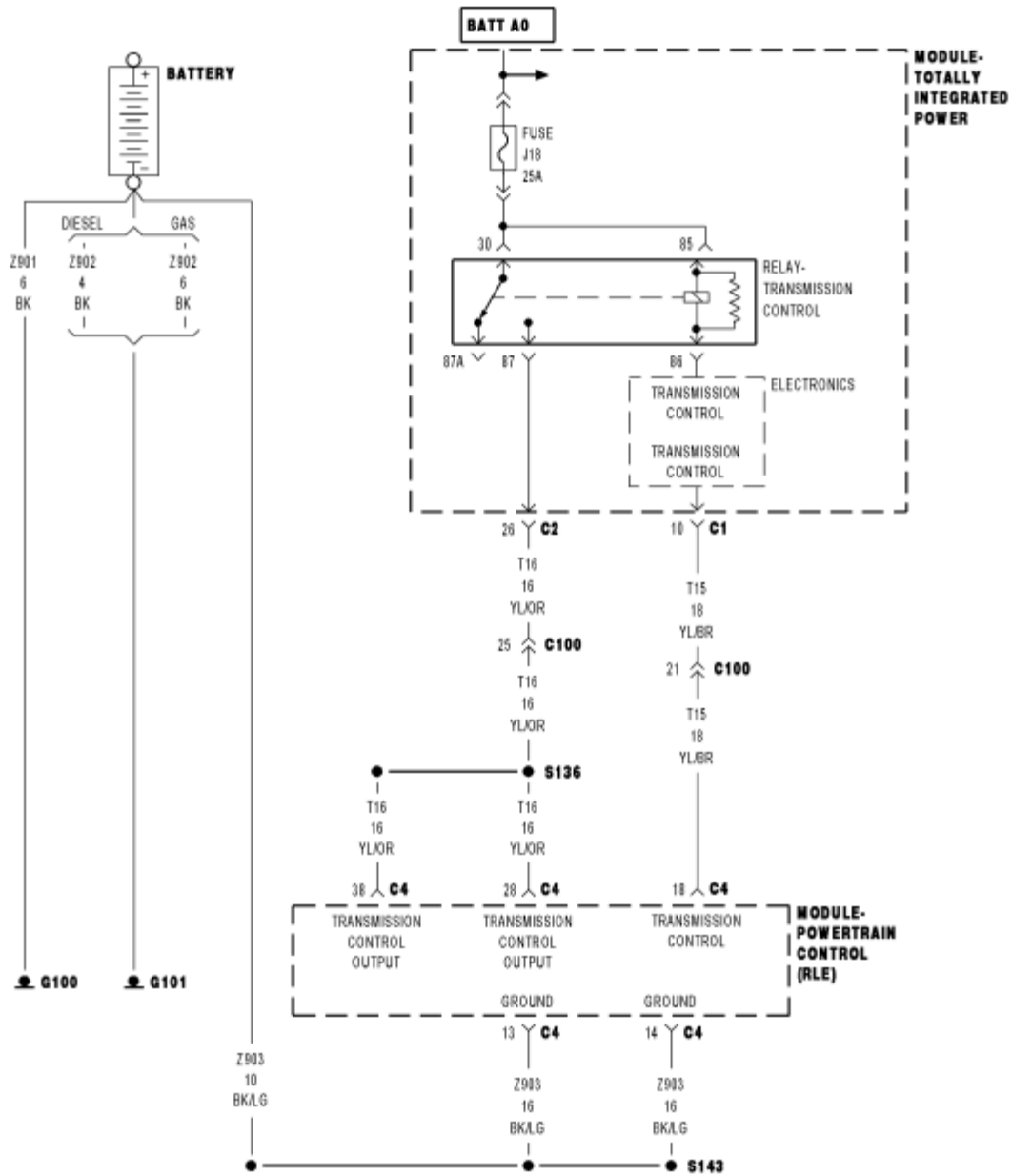
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0891-TRANSMISSION RELAY ALWAYS ON



0109ced3

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Transmission Solenoid/Pressure Switch Assembly and to the PCM when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/TRS Assembly in the event that the transmission should need to be placed into limp-in mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System request for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If voltage is detected on the Transmission Output circuits before the request is sent, the DTC will set.

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set if the Powertrain Control Module senses greater than 3.0 volts on the Transmission Control Relay Output circuits prior to a request from the PCM to TIPM to energize the Transmission Output circuits.

Possible Causes
TIPM DTCS PRESENT
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO VOLTAGE
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR TCM TIPM DTCS

With the scan tool under TIPM, check for TCM Power Control circuit DTCs.

Are there any TIPM TCM Power Control circuit DTCS present?**Yes**

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF DTC P0891 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter set to 0?**Yes**

- Go To [3](#)

No

- Go To [7](#)

3. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.
Remove the Transmission Control Relay.

NOTE: Check connectors - Clean/repair as necessary.

Install a substitute Relay in place of the Transmission Control Relay.
Ignition on, engine not running.

Does the DTC reset?**Yes**

- Go To [4](#)

No

- Replace the Transmission Control Relay.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. (T16) TRANSMISSION OUTPUT CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.
Disconnect the TIPM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.
Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.

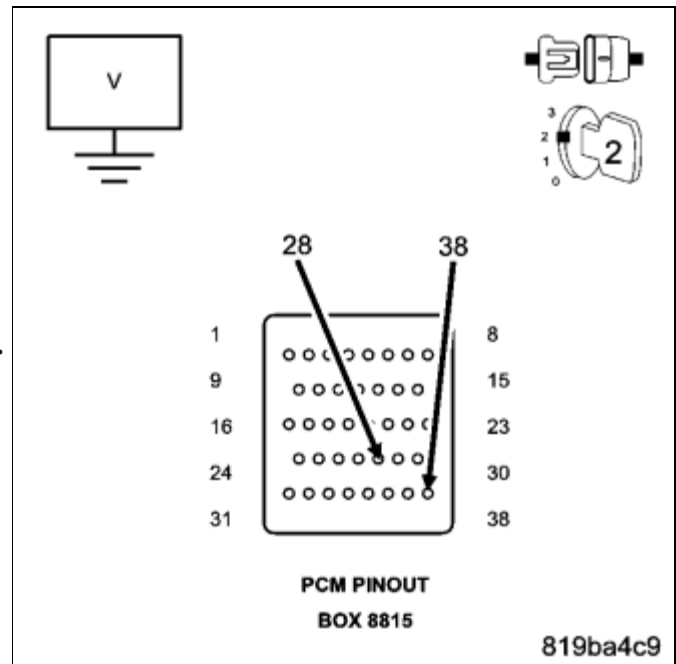
Is the voltage above 0.5 volts on any (T16) Transmission Control Output circuit?

Yes

- Go To [5](#)

No

- Go To [6](#)



5. CHECK THE TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY

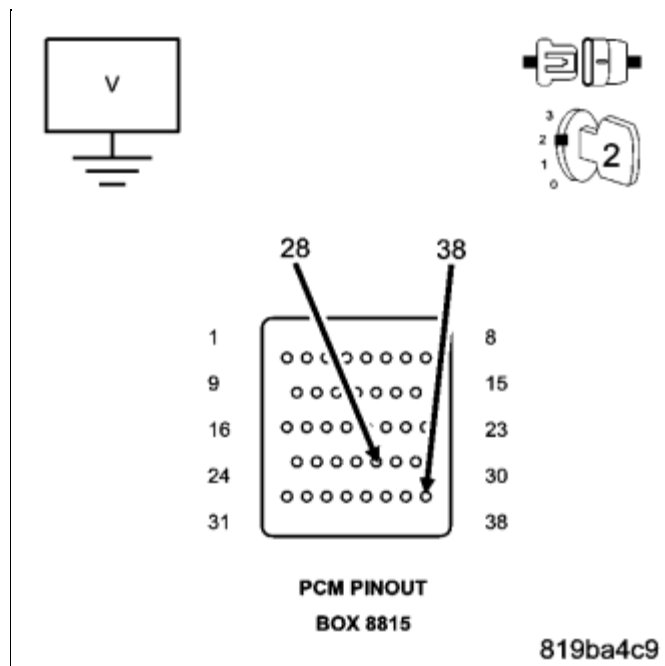
Turn the ignition off to the lock position.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.
Ignition on, engine not running.
Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.

Is the voltage above 0.5 volts?

Yes

- Repair the (T16) Transmission Control Output circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -

42RLE - STANDARD PROCEDURE)



No

- Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

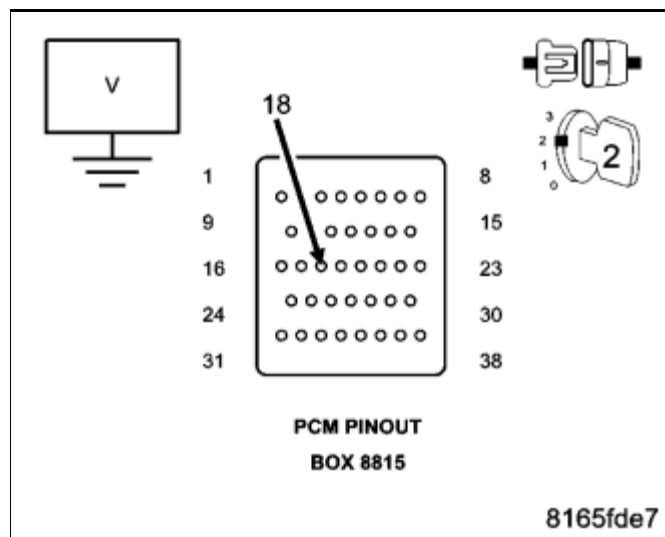
6. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Measure the voltage of the (T15) Transmission Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T15) Transmission Control circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

7. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0897-TRANSMISSION FLUID DETERIORATED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

To prevent a bump due to A/C clutch engagement, a temporary torque converter partial EMCC condition is established prior to A/C clutch engagement. A message is received over the bus indicating that A/C clutch engagement is imminent. Partial EMCC is then established and a reply message, "OK to engage A/C clutch" is sent via the bus. Partial EMCC will be held for 450 ms before returning to full EMCC. During the transition from full to partial EMCC, a turbine acceleration sum is calculated, if this value exceeds a threshold value for several transitions, degraded transmission fluid is indicated.

◦ When Monitored:

Each transition from full EMCC to partial EMCC for A/C bump prevention.

◦ Set Condition:

DTC set if 20 occurrences of a turbine acceleration sum. Fault Set Time: 20 transitions from full EMCC to partial EMCC. Transmission will not use partial EMCC. Established for A/C bump prevention.

Possible Causes
WORN OUT/ BURNT TRANSAXLE FLUID

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. WORN OUT/ BURNT TRANSMISSION FLUID

Turn the ignition off to the lock position.

Flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

NOTE: The Transmission Cooler must be flushed before proceeding.

Allow the engine to idle for 10 minutes, in Park.

Turn the ignition off to the lock position.

Again, flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

With the scan tool, perform a Battery Disconnect.

NOTE: The Battery Disconnect must be done to re-enable EMCC during an A/C Clutch engagement.

NOTE: The vehicle may exhibit intermittent shudder during the first few hundred miles. The new Transmission Fluid will gradually penetrate the Torque Converter Clutch friction material and the shudder should disappear.

Erase the DTC and return the vehicle to the customer.

Did the DTC reset and/or does the vehicle still shudder after a few thousand miles?

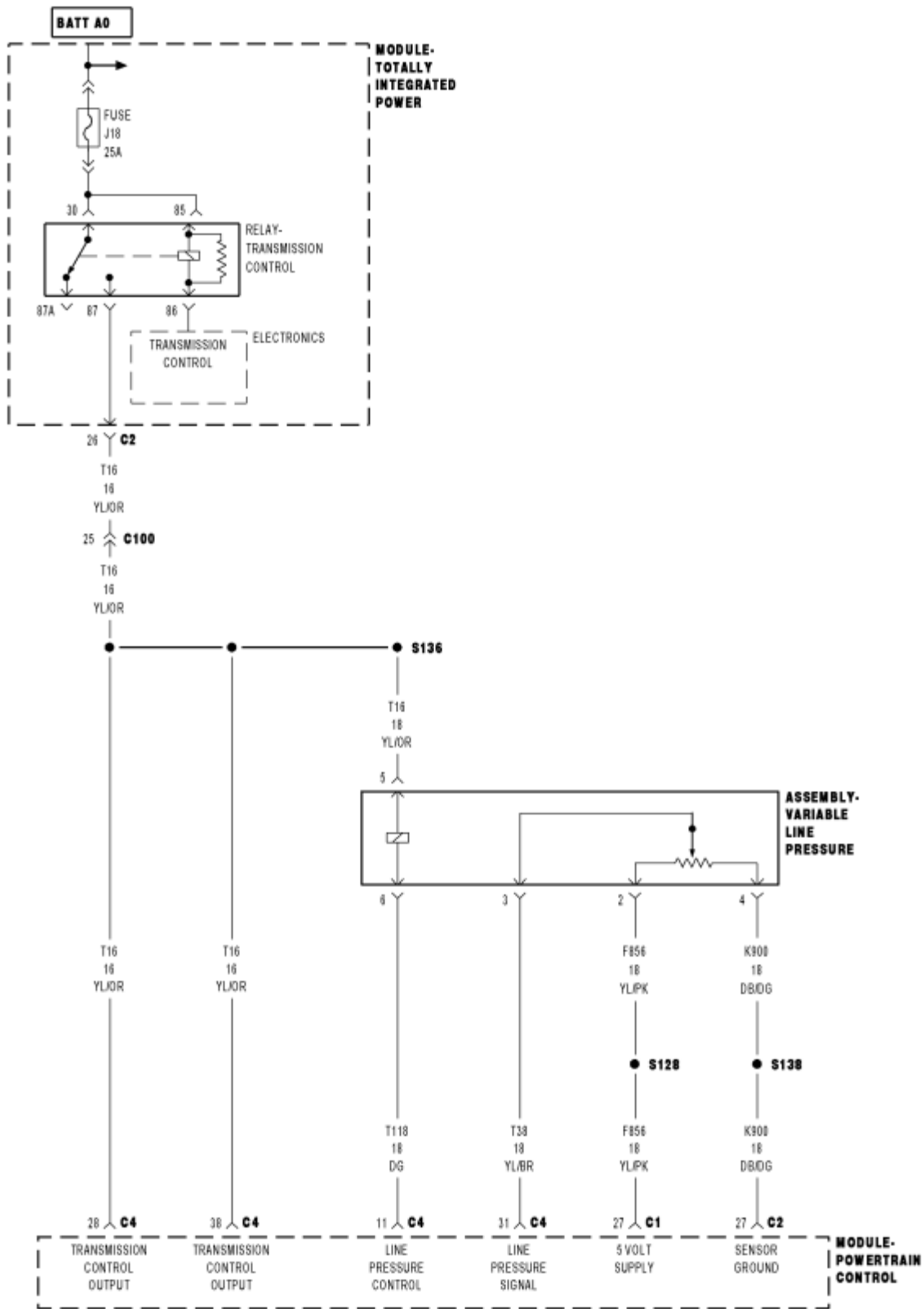
Yes

- Replace the Torque Converter per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0933-LINE PRESSURE SENSOR CIRCUIT PERFORMANCE



019a2008

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality.

- **When Monitored:**

Continuously with the ignition on, engine running, with the transmission in gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure reading is more than 172.4 kPa (25 psi) higher than the Desired Line Pressure, but is less than the highest Line Pressure ever used in the current gear, the DTC sets.

Possible Causes
RELATED DTC'S PRESENT
LINE PRESSURE CONNECTOR AND WIRING
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other transmission DTCs.

Are there any other line pressure related DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. Perform the test for P0934 and/or P0935 first if present.

No

- Go To [2](#)

2. COMPARE ACTUAL LINE PRESSURE TO DESIRED LINE PRESSURE

CAUTION: Apply Parking Brake

Start the engine.

CAUTION: Firmly apply the brakes.

With the scan tool, monitor the Line Pressure, Desired Line Pressure and the TPS degrees. While firmly applying the brakes, place the shifter in Reverse, then slowly press the accelerator pedal to a TPS degree of 15°. Compare the Line Pressure reading to the Desired Line Pressure reading on the scan tool.

Does the Line Pressure stay within ± 34 kPa or 5 psi of the Desired Line Pressure?

No

- Go To [3](#)

Yes

- Go To [5](#)

3. CHECK LINE PRESSURE CONNECTOR AND WIRING

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor/Variable Force Solenoid Assembly.

Did the voltage remain steady while wiggling the wiring harness and connectors?

Yes

- Go To [4](#)

No

- Disconnect and properly reconnect the Line Pressure Sensor/Variable Force Solenoid Assembly connector. Inspect terminals and repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. CHECK PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.
With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure during the following step.
With the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Repair internal transmission and inspect the oil pump per the Service information and replace if necessary. If no problems are found, replace the Line Pressure Sensor/Variable Force Solenoid Assembly — possible cause is the Pressure Control Solenoid is stuck.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

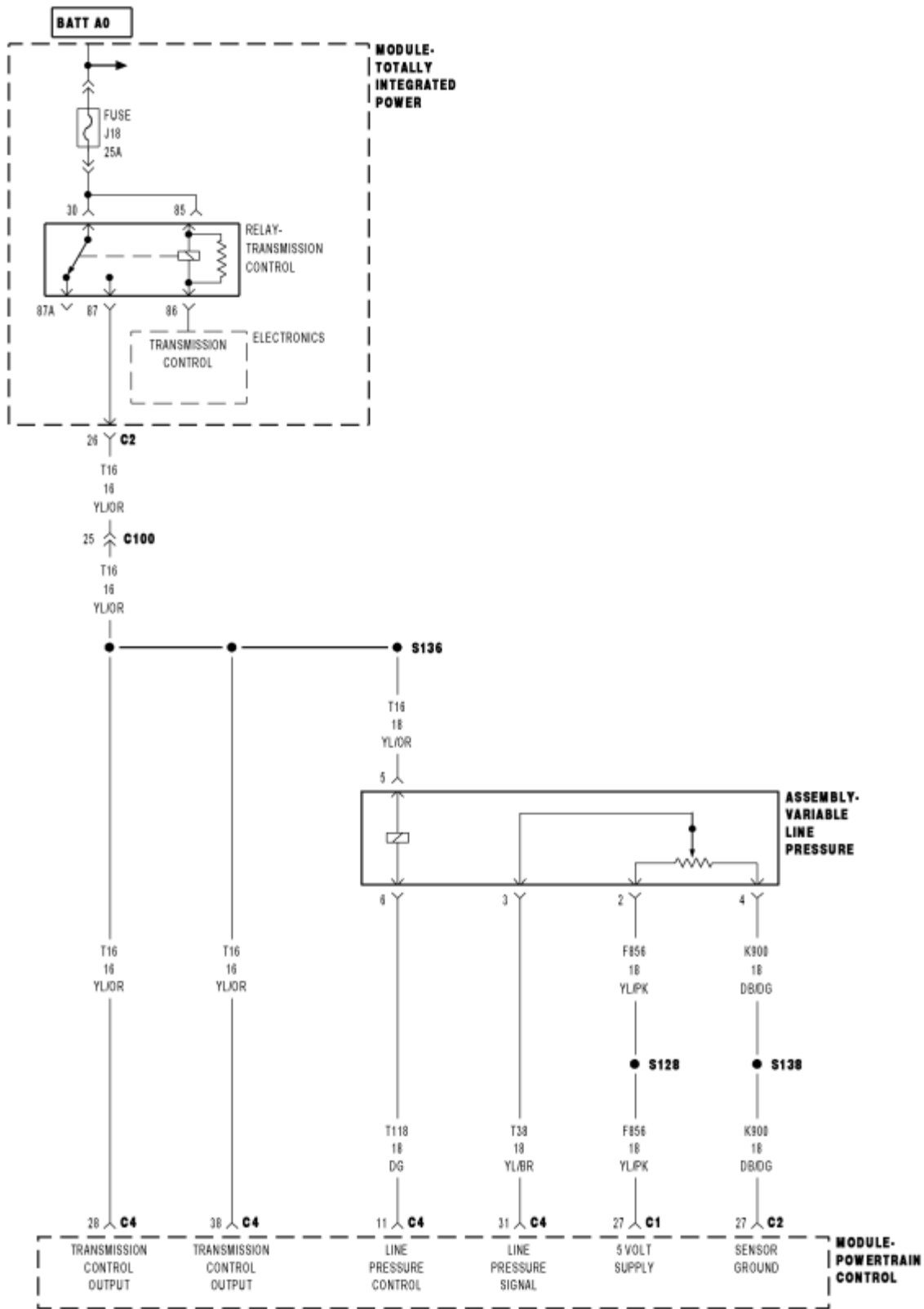
Where there any problems found?**Yes**

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0934-LINE PRESSURE SENSOR CIRCUIT LOW



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate a Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set when the monitored Line Pressure Sensor voltage is less than or equal to 0.35 volts for 0.18 seconds.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0934.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the from the TIPM.

CAUTION: Removal of the from the TIPM will prevent the vehicle from being started in gear.

WARNING: The must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T38) Line Pressure Sensor Signal circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T38) Line Pressure Sensor Signal circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Disconnect the PCM C1 harness connector and connect Miller tool #8815.
 Measure the resistance of the (F856) 5-volt Supply circuit between Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.

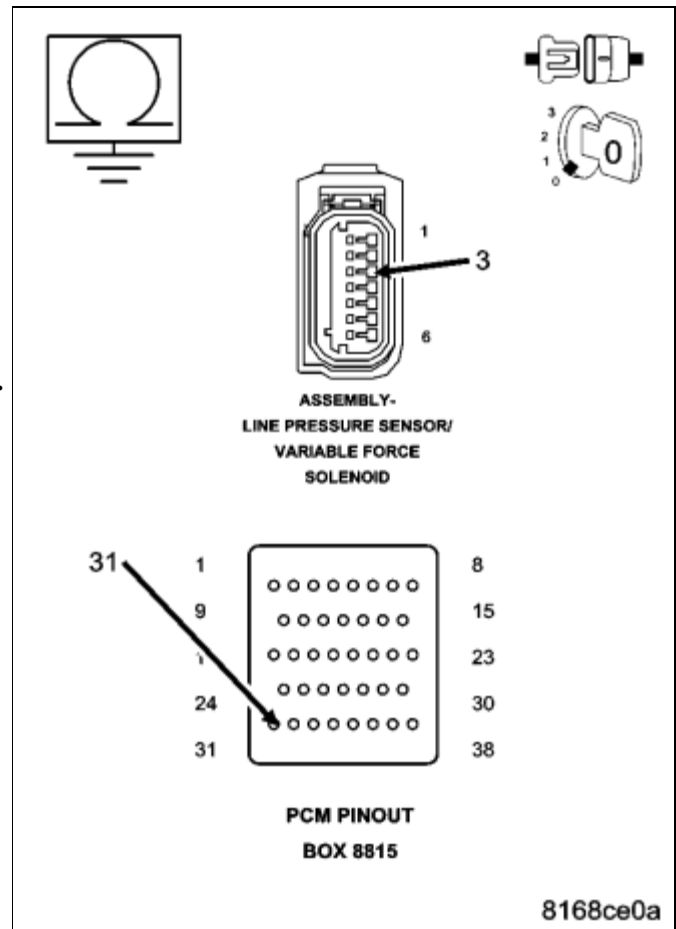
Is the resistance below 5.0 ohms?

Yes

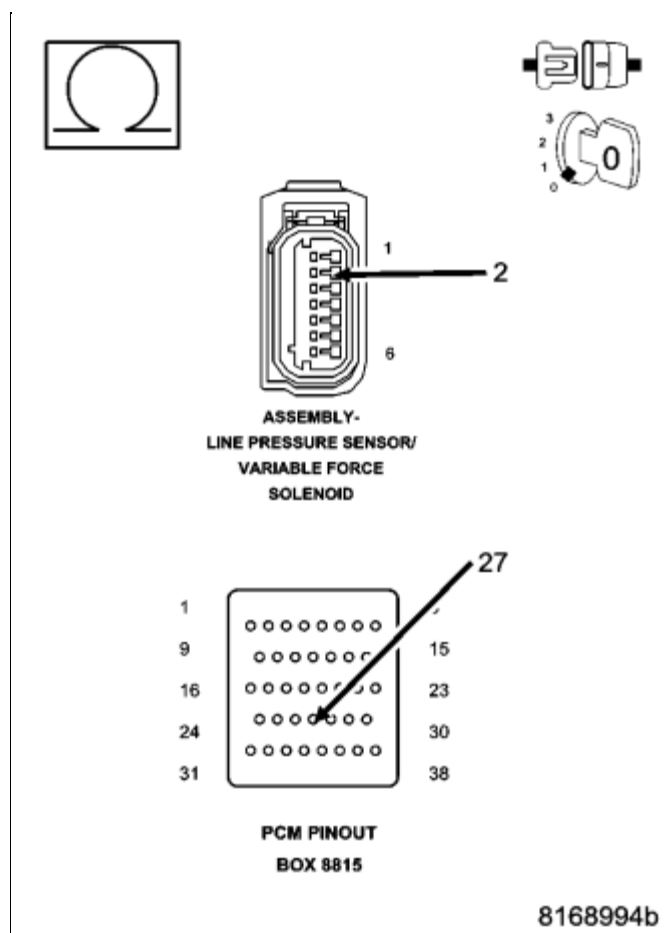
- Go To [5](#)

No

- Repair the (F856) 5-volt Supply circuit for an open.



- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



5. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes

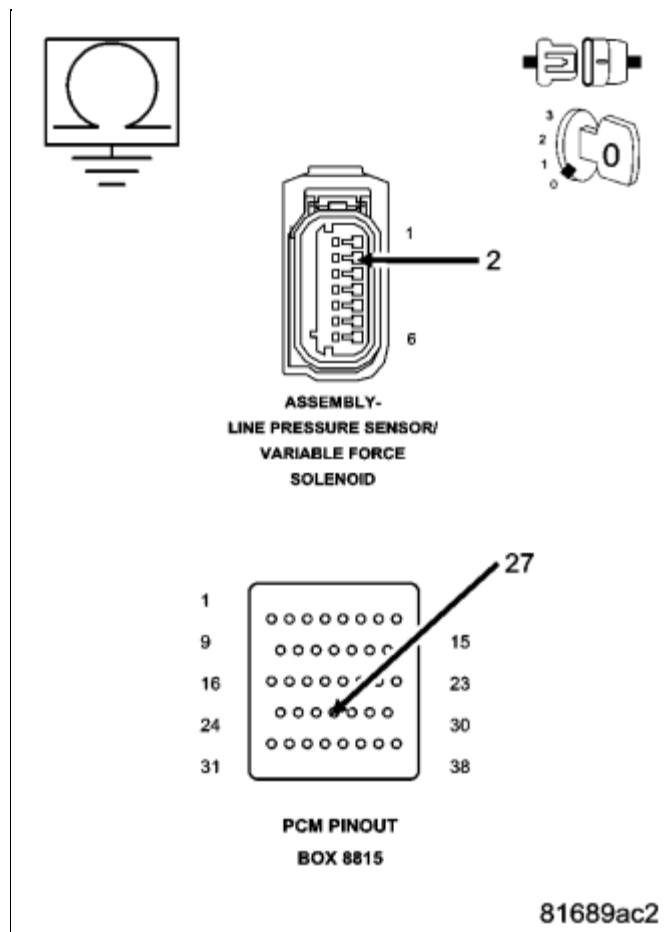
- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are

found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

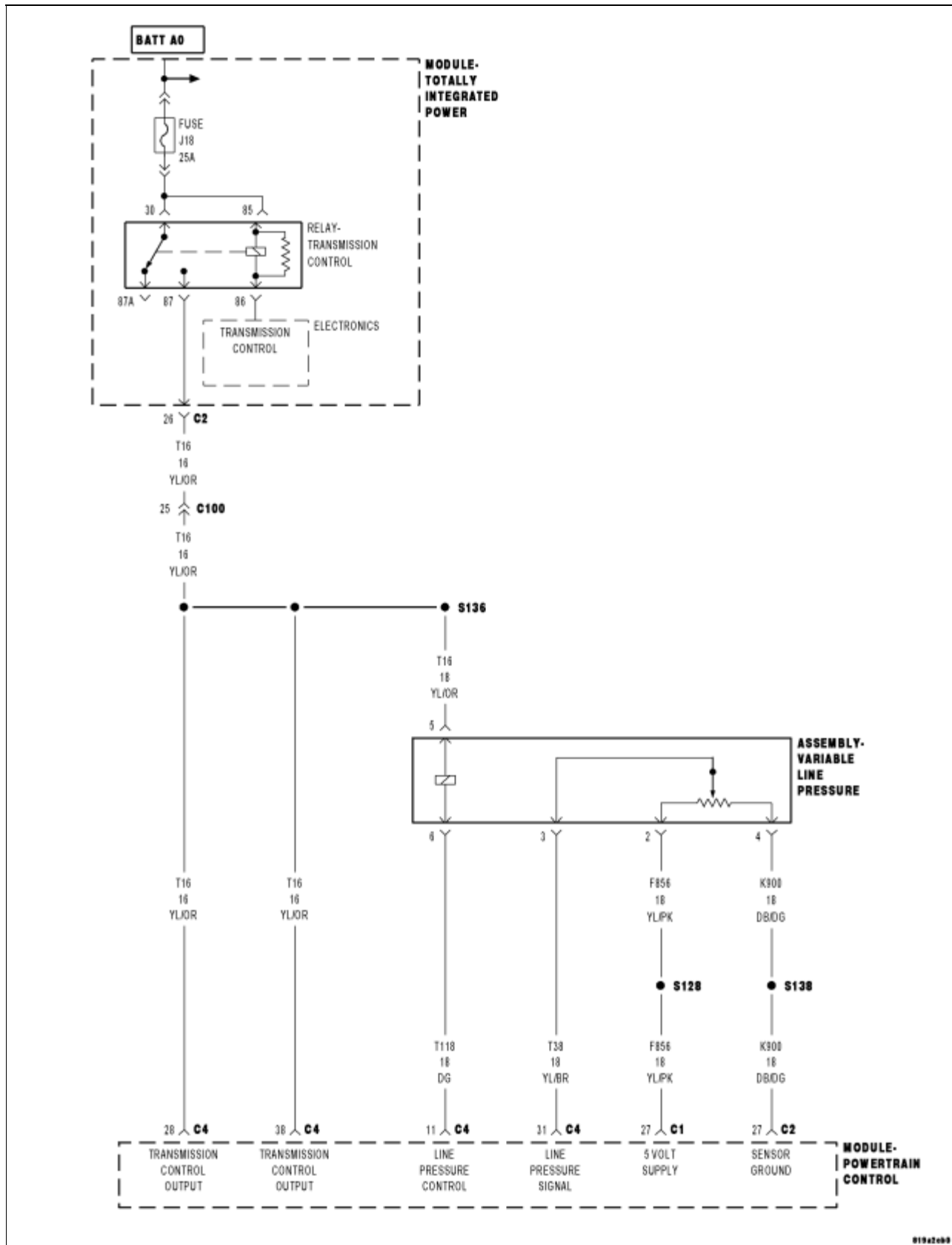
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0935-LINE PRESSURE SENSOR CIRCUIT HIGH



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate a Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

- **When Monitored:**

Continuously with ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored Line Pressure Sensor voltage is greater than or equal to 4.75 volts for the period of 0.18 seconds

Possible Causes
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0935.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

Remove the from the TIPM.

CAUTION: Removal of the from the TIPM will prevent the vehicle from being started in gear.

WARNING: The must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.
 Disconnect the PCM C2 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (K900) Sensor Ground circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

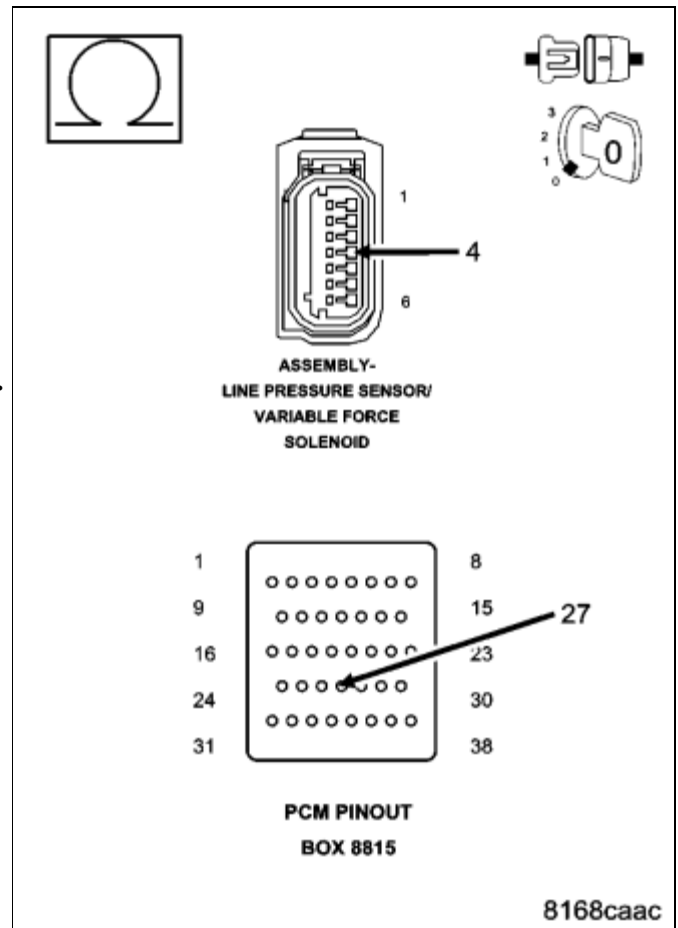
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance of the (T38) Line Pressure Sensor Signal circuit from the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

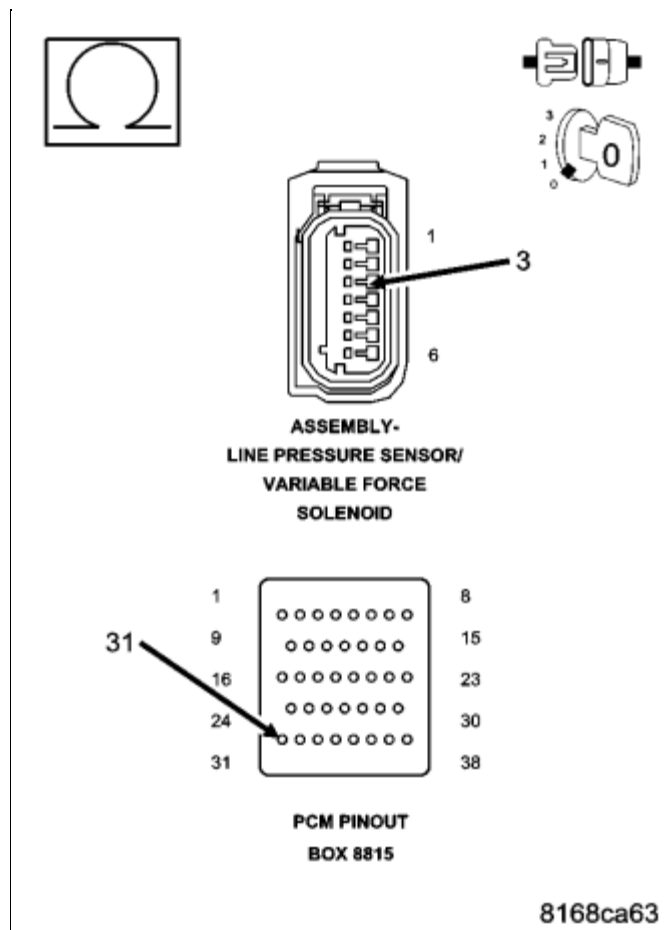
- Repair the (T38) Line Pressure Sensor Signal circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION



TEST (Refer to 21 -
TRANSMISSION/TRANSAXLE/AUTOMATIC -
42RLE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T38) Line Pressure Sensor
Signal circuit.

Is the voltage above 5.5 volts?

Yes

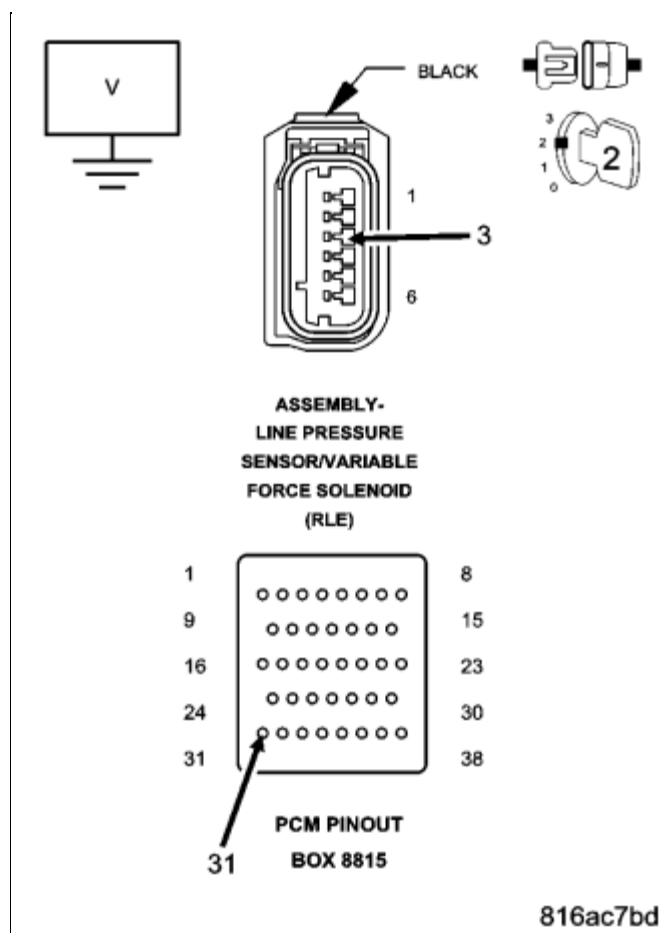
- Repair the (T38) Line Pressure Sensor Signal circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention

to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P0944-LOSS OF HYDRAULIC PUMP PRIME

For a complete wiring diagram Refer to Section 8W.

Theory of Operation

The Loss of Prime Test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or ruptured oil filter. The Loss of Prime fault is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

- **When Monitored:**

Every 350 ms

- **Set Condition:**

If the transmission begins to slip in any forward gear, and the pressure switch or switches that should be closed for a given gear are open, a loss of prime test begins. All available elements (in 1st gear LR, 2/4 and OD, in 2nd, 3rd, and 4th gear 2/4 and OD) are turned on by the PCM to see if pump prime exists. The code is set if none of the pressure switches respond. The PCM will continue to run the loss of prime test until pump pressure returns. The vehicle will not move or the transmission will slip. Normal operation will continue if pump prime returns.

Possible Causes
LOW TRANSMISSION FLUID LEVEL
SHIFT LEVER POSITION
PLUGGED TRANSMISSION FILTER
TRANSMISSION OIL PUMP

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC IS CURRENT

Place the gear selector in Park.
Start the engine.

NOTE: The Transmission Temperature must be at least 43° C (110° F) before performing the following

steps.

The Transmission must be at operating temperature prior to checking pressure. Cold transmission fluid will result in higher pressure readings.

Place the Transmission in Reverse.

With the scan tool, observe the Transmission Pressure Switch states.

Are any of the Pressure Switches closed?**Yes**

- Go to [2](#)

No

- Go to [4](#)

2. INTERMITTENT OPERATION

The conditions necessary to set this DTC are not present at this time.

Test drive the vehicle. Allow the Transmission to shift through all gears and ranges.

Was a delayed engagement and/or a no drive condition present during the test drive?**Yes**

- Go to [4](#)

No

- Go to [3](#)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?**Yes**

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

4. SHIFT LEVER POSITION TEST

With the scan tool, perform a Shift Lever Position test. Follow the instructions on the screen.

Did the Shift Lever Position Test pass?

Yes

- Go to [5](#)

No

- Perform the diagnostic procedure for P0706-TRANSMISSION RANGE SENSOR RATIONALITY.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. CHECK FOR PLUGGED TRANSMISSION FILTER

Remove the Transmission Pan and inspect the Transmission Fluid and Transmission Filter per the Service Information.

Does the Transmission Oil Pan contain excessive debris and/or is the Oil Filter plugged?

Yes

- Repair the cause of the plugged Transmission Filter. Refer to the Service Information for the proper repair procedure.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Replace the Transmission Oil Pump per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P0992-2/4/OD HYDRAULIC PRESSURE TEST

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to limp-in

mode.

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm, shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed greater than 1000 rpm, the PCM momentarily turns on element pressure to the clutch circuits that do not have pressure to identify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

Possible Causes
CONDITION P0992 PRESENT

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

1. CHECK IF THE DTC IS CURRENT

NOTE: The vehicle must be driven to set this DTC. The transmission must be at operating temperature with the Engine rpm above 1000 rpm.

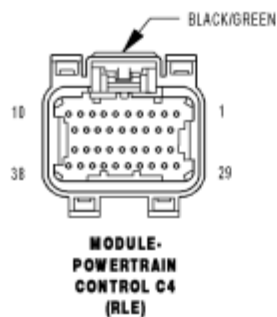
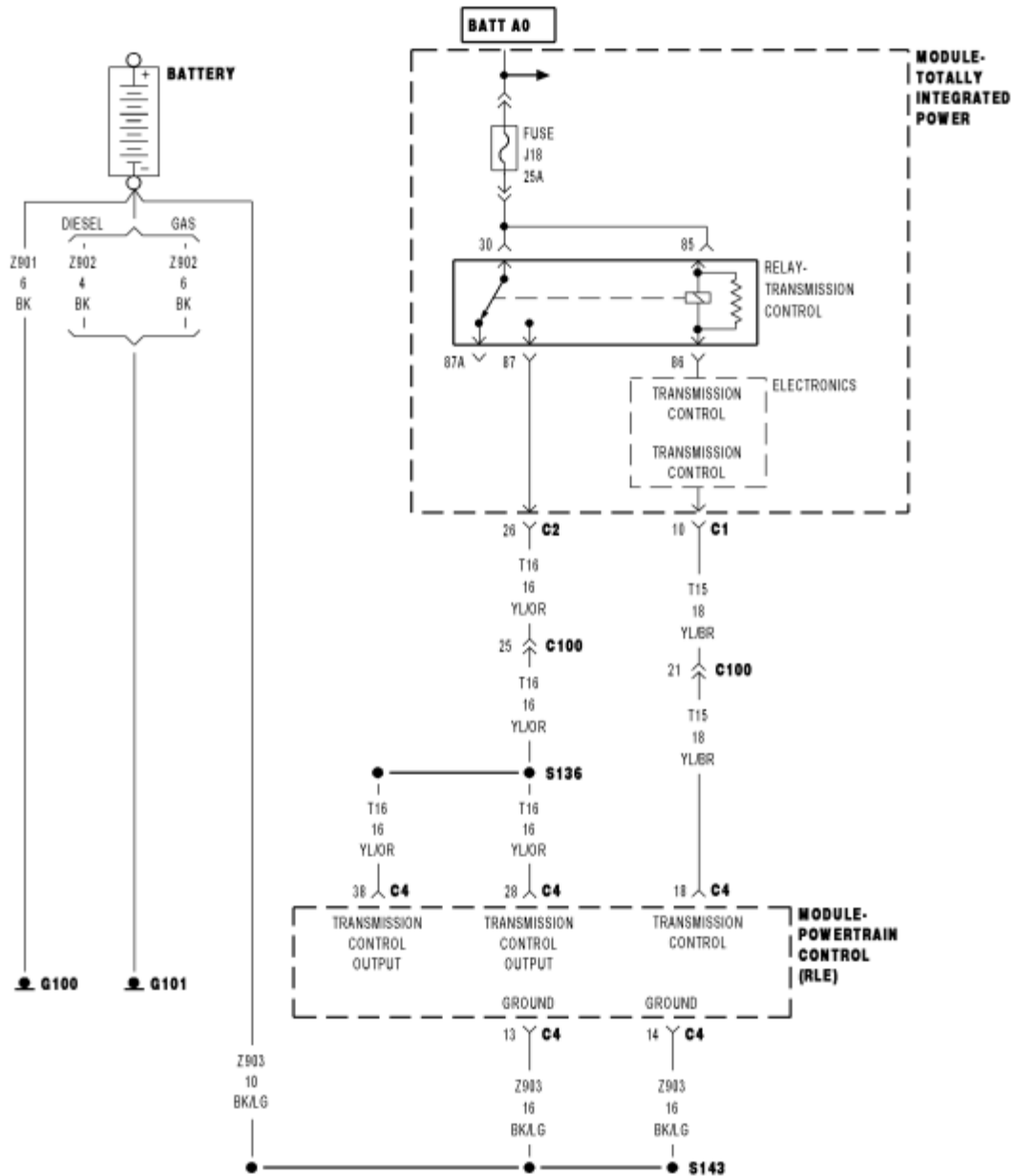
This DTC is an indication of both the 2/4 and the O/D Hydraulic Pressure Switch DTCs being present. Perform the diagnostic procedures for both P0845 and P0870. With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

- Refer to the Transmission category and perform the diagnostic procedures for P0845 and P0870.

P128B-TCM POWER CONTROL CIRCUIT 2 LOW - TIPM



0109ced3

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

A shorted condition is detected in the Transmission Control Output circuit.

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO GROUND
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, check TIPM DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off.
Disconnect the TIPM C2 harness connector.
Disconnect the PCM C4 harness connector and install Miller tool #8815.

**CAUTION: Do not probe the PCM harness connectors.
Probing the PCM harness connectors will damage the
PCM terminals resulting in poor terminal to pin**

connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T16) Transmission Control Output circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T16) Transmission Control Output circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

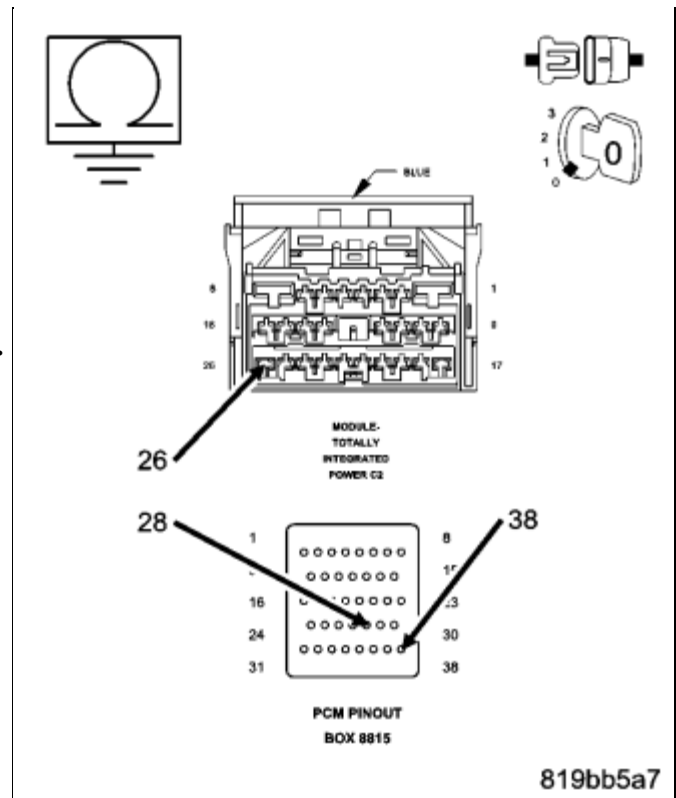
No

- Go to [3](#)
-

3. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Reconnect the TIPM C2 harness connector.
 Disconnect the Transmission Solenoid/Pressure Switch harness connector.
 Disconnect the Line Pressure Sensor/Variable Force Solenoid harness connector (if equipped).
 Ignition on, engine not running.
 Using the scan tool under the TIPM Actuators, actuate the Transmission.
 Using a 12-volt test light connected to ground, check the (T16) Transmission Control Output circuits.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.



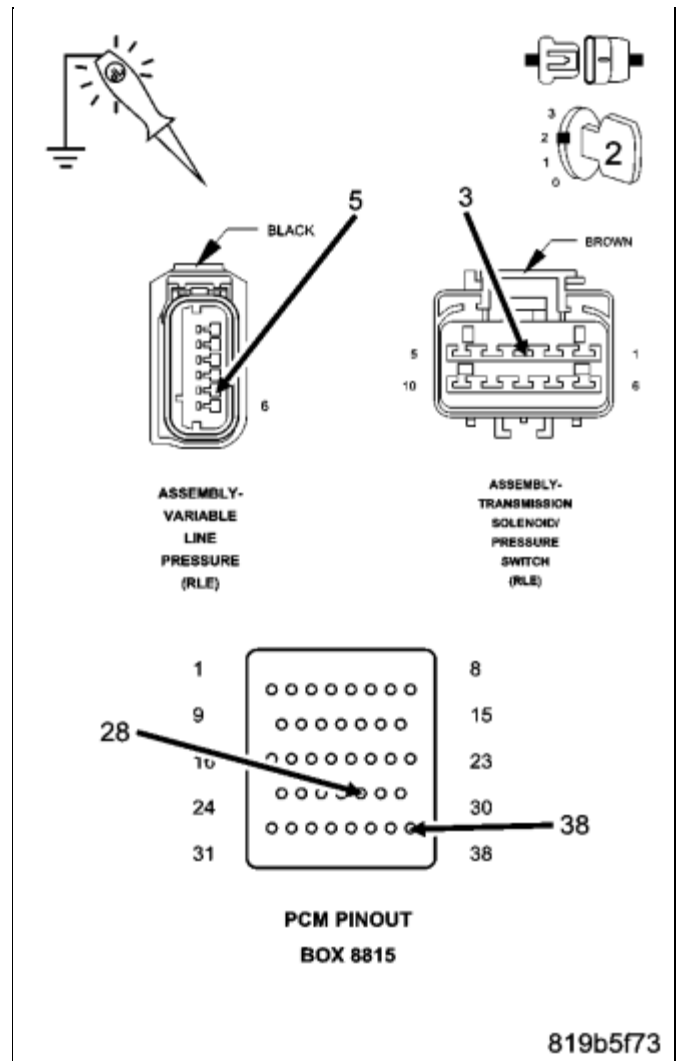
Does the test light illuminate brightly at all the (T16) Transmission Control Output circuits?

Yes

- Go To [4](#)

No

- Repair the (T16) Transmission Control Output circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



4. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors. Check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

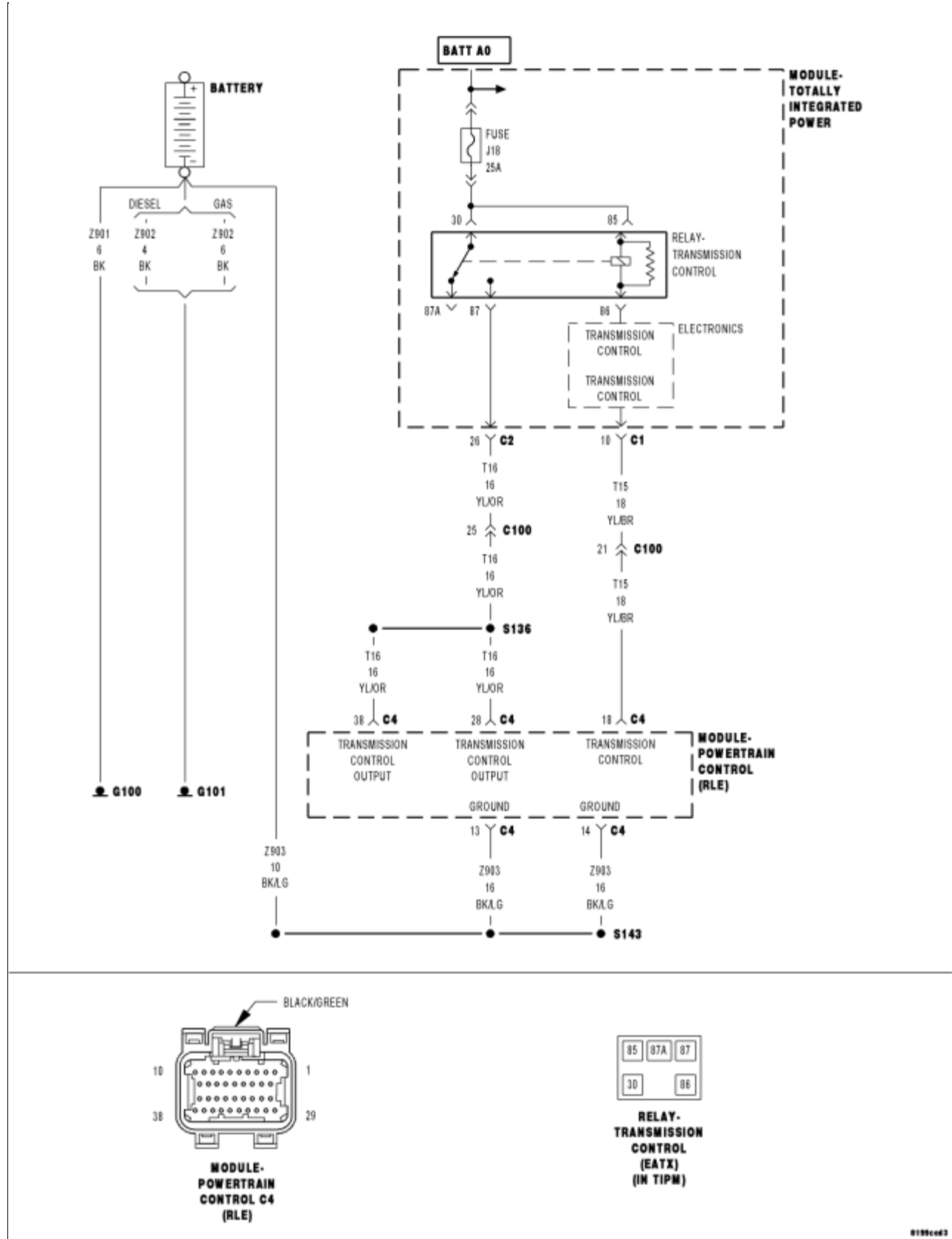
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test complete.

P128C-TCM POWER CONTROL CIRCUIT 2 HIGH - TIPM



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

A shorted condition is detected in the TIPM TCM Power control circuit.

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, read TIPM DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Go To [4](#)

2. (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.
Disconnect the TIPM C10 harness connector.
Disconnect the PCM C4 harness connector.
Measure the voltage of the (T16) Transmission Control Output circuit.

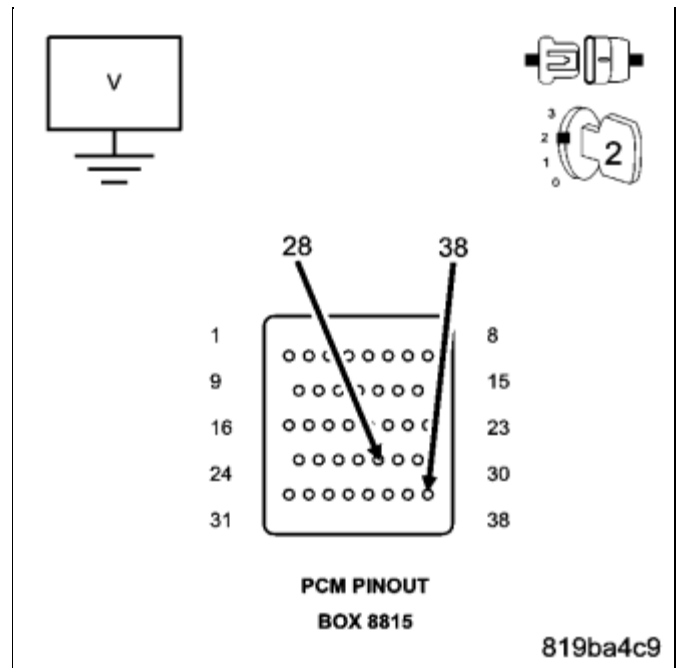
Is the voltage above 10.0 v?

Yes

- Repair the (T16) Transmission Control Output circuit

for a short to voltage.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go To [3](#)
-

3. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors.

Check the TIPM harness connector terminals for corrosion, damage, or terminal push out.

Pay particular attention to all power and ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

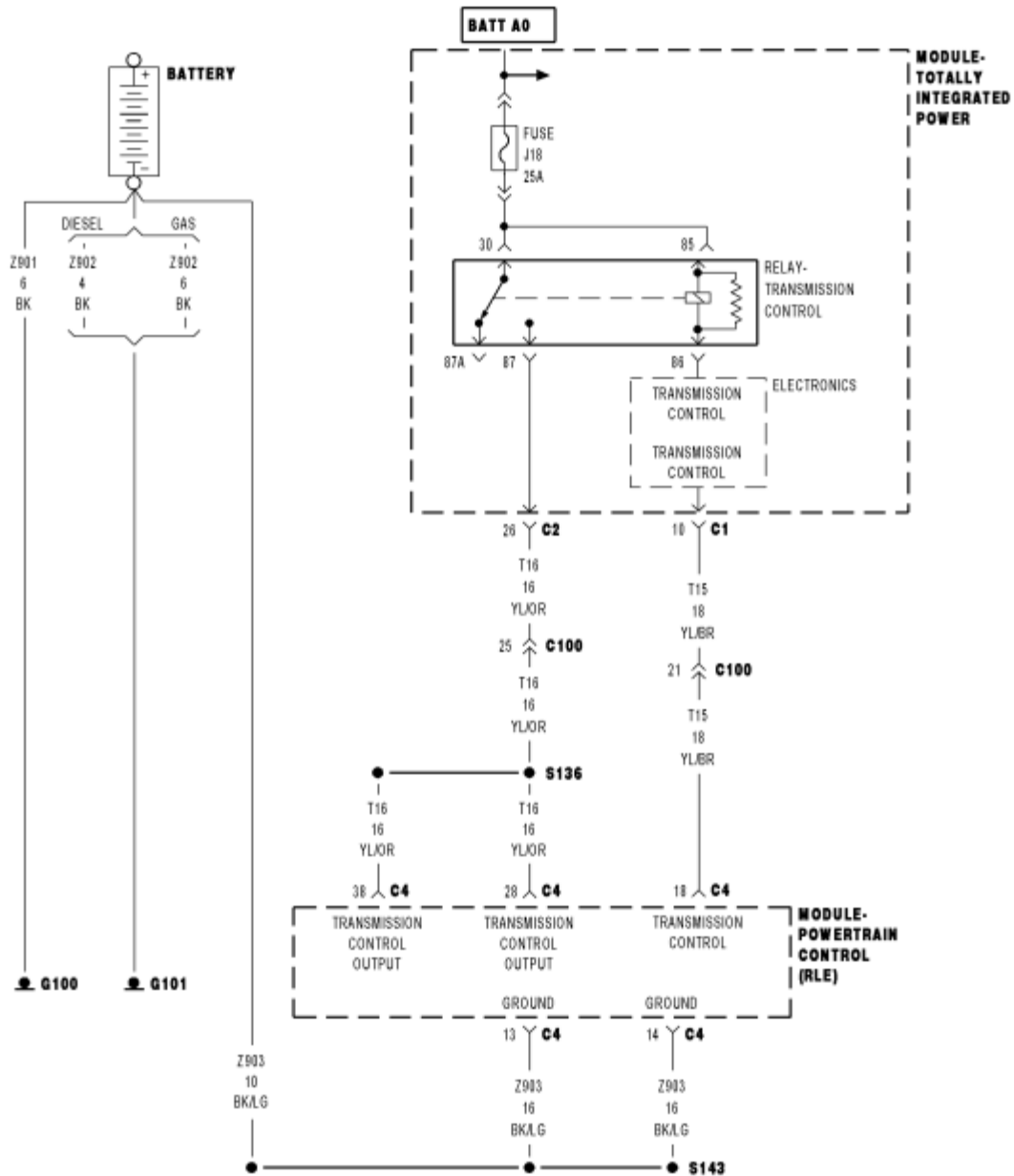
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test complete.

P128D-TCM POWER CONTROL CIRCUIT 2 OPEN - TIPM



0100c03

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

An open condition of the Transmission Control Output circuit is detected by the Totally Integrated Power Module (TIPM).

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, select View DTCs.

Is the status Active for this DTC?

Yes

- Go To [2](#)

No

- Go To [4](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and install Miller tool #8815.
Disconnect the Transmission Solenoid harness connector.
Disconnect the Line Pressure Sensor/Variable Force Solenoid harness connector (if equipped).

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the

PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.

Using the scan tool under the TIPM Actuators, actuate the Transmission.

Using a 12-volt test light connected to ground, check the (T16) Transmission Control Output circuits.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes

- Go To [3](#)

No

- Repair the (T16) Transmission Control Output circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors.

Check the TIPM harness connector terminals for corrosion, damage, or terminal push out.

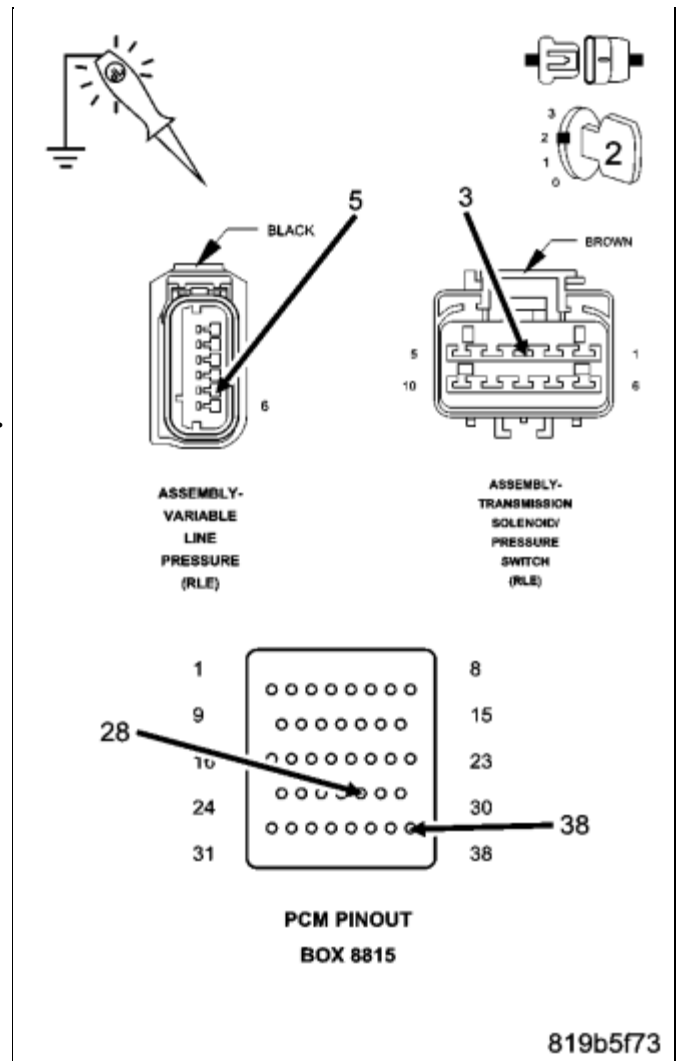
Pay particular attention to all power and ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No



- Replace the Totally Integrated Power Module per Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

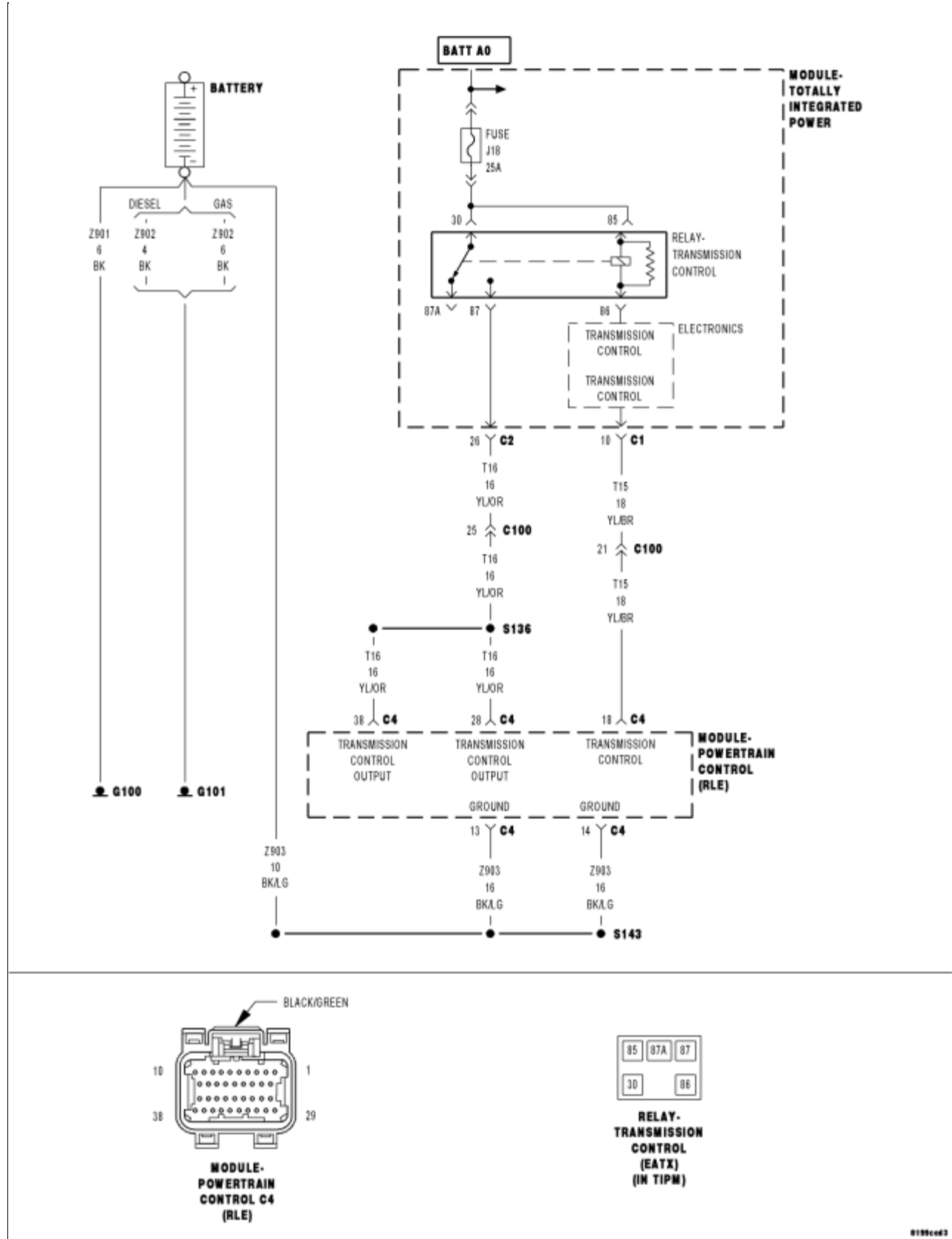
Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test complete.

P128E-TCM POWER CONTROL CIRCUIT 2 OVERCURRENT - TIPM



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

An overcurrent condition is detected in the TCM Power Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LINE PRESSURE SENSOR VARIABLE FORCE SOLENOID
SOLENOID/PRESSURE SWITCH ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With a scan tool, read TIPM DTCs.

Is the DTC active at this time?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT

Turn the ignition off.
Disconnect the TIPM C2 harness connector.
Connect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C2 harness connector.

Read the amperage on the ammeter.

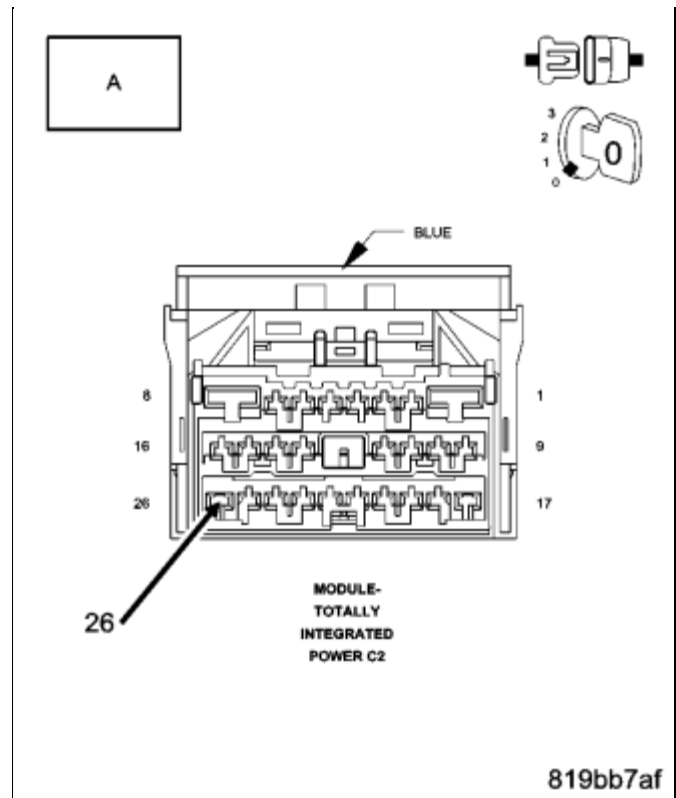
Does the amperage read below 2.0 amps?

Yes

- Go To [4](#)

No

- Go To [3](#)



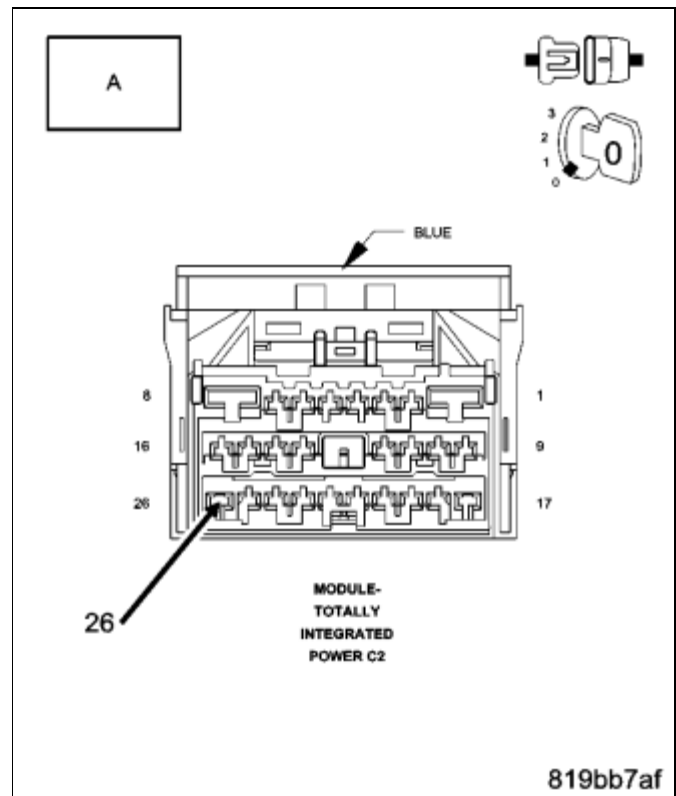
3. CHECK THE PCM

Disconnect the ammeter from the TIPM C2 harness connector and battery positive.
 Disconnect the PCM C4 harness connector.
 Reconnect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C2 harness connector.
 Read the amperage on the ammeter.

Does the amperage read below 2.0 amps?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go To [4](#)

4. CHECK THE TRANSMISSION SOLENOIDS

Disconnect the ammeter from the TIPM C2 harness connector.

Disconnect the PCM C4 harness connector and install Miller tool #8815.

Connect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C2 harness connector. While monitoring the amperage reading of the ammeter and using a jumper wire, jump each solenoid control circuit to ground one at a time in the appropriate terminals of Miller tool #8815.

NOTE: The amperage draw should be approximately .02 milliamperes on each solenoid circuit with the PCM C4 harness connector disconnected.

Does the amperage read between .05 and .015 milliamperes $\pm$.005 milliamperes on each solenoid tested?

Yes

- Replace the Totally Integrated Control Module per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

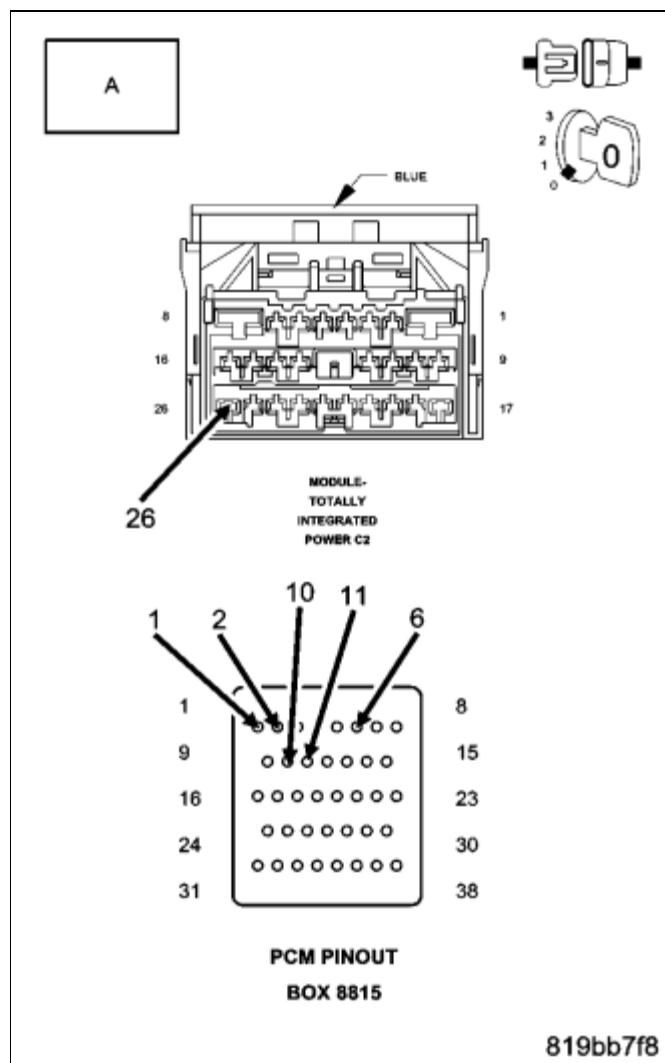
- Depending on the identified circuit in the test, replace either Transmission Solenoid/Pressure Switch Assembly or the Line Pressure Solenoid (if equipped) per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.



819bb7f8

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P1684-BATTERY WAS DISCONNECTED

Theory of Operation

Note: This is not a fault code. It exists to provide reference information only. A battery backed RAM is used to maintain some learned values. When the battery is disconnected, this memory is lost. When the battery is reconnected, the loss of learned values will be detected by the controller. The code will be set and the learned values will be initialized to known constants and the learning process will continue. Setting the code has no effect except for re-initialization of learned values.

- **When Monitored:**

After a reset (ignition key turned to the RUN position).

- **Set Condition:**

The checksum of the battery backed RAM does not match the stored checksum. Set Time: Less than 7 ms.

Possible Causes
BATTERY WAS DISCONNECTED
PCM WAS REPLACED OR DISCONNECTED
QUICK LEARN WAS PERFORMED
(A919) FUSED B+ CIRCUIT TO PCM OPEN
(Z908 and Z977) GROUND CIRCUIT OPEN

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. BATTERY WAS DISCONNECTED

Has the battery been disconnected, lost its charge, or been replaced recently?

Yes

- Disconnecting or replacing the battery will set this DTC. Erase the DTC.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CHECK IF THE QUICK LEARN WAS PERFORMED

Has a Quick Learn procedure been performed?

Yes

- Performing Quick Learn will set this DTC. Erase the DTC.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. PCM REPLACED OR DISCONNECTED

Has the PCM been replaced or disconnected?

Yes

- Replacing or disconnecting the PCM will set this DTC. Erase the DTC.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

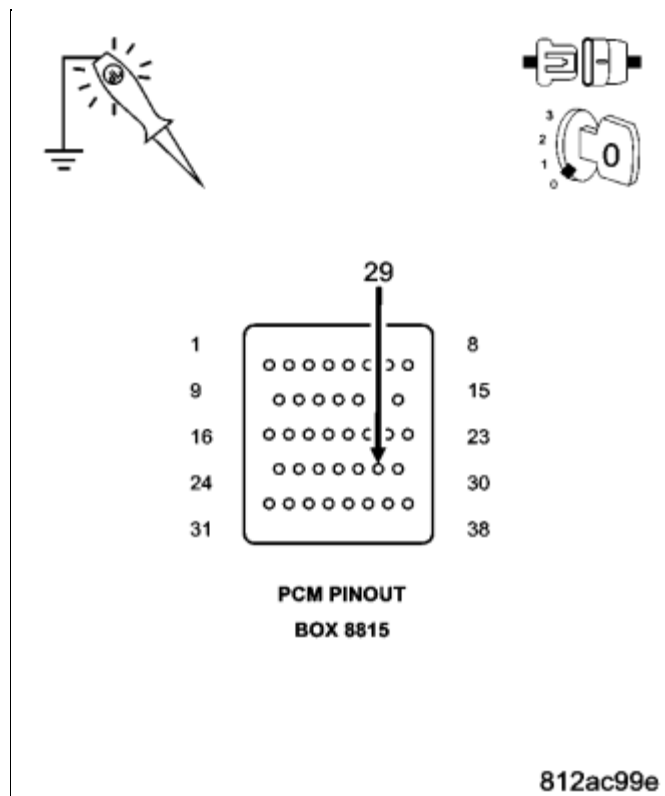
- Go To [4](#)

4. (A919) FUSED B(+) CIRCUIT

Turn the ignition off to the lock position.
Disconnect the PCM C1 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.



Using a 12-volt test light connected to ground, check the (A919) Fused B(+) circuit.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes

- Go To [5](#)

No

- Repair the Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

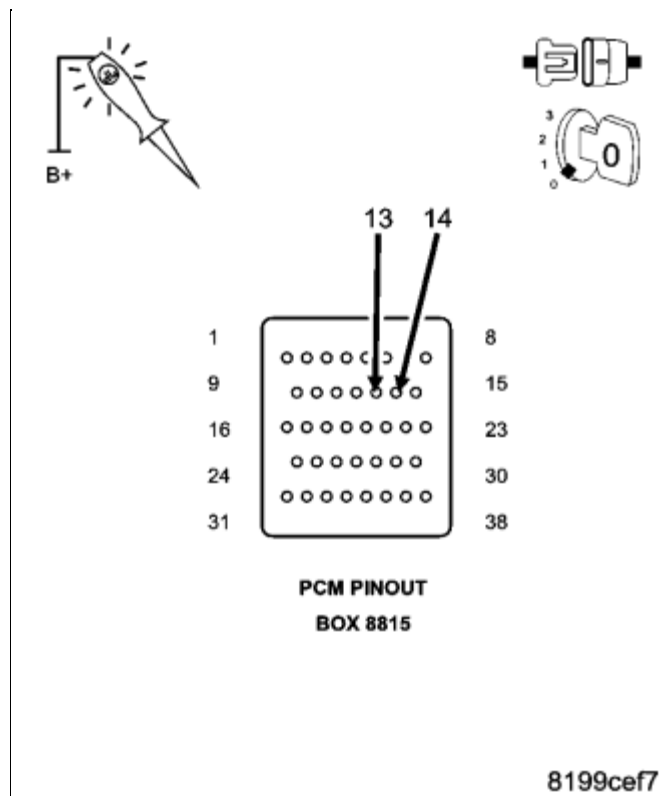
5. (Z908) AND (Z977) GROUND CIRCUITS

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Using a 12-volt test light connected to 12-volts, check the (Z908) and (Z977) Ground circuits in the appropriate terminal of Miller tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.



Does the test light illuminate brightly for all of the ground circuits?

Yes

- Go To [6](#)

No

- Repair the Ground circuits for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P1713-RESTRICTED MANUAL VALVE IN T2 RANGE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Ignition on, engine running with the gear shift selector in a valid forward gear.

- **Set Condition:**

This DTC sets whenever Transmission control system detects the manual valve is in the T2 range when it should be in OD. This is mainly an informational DTC.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
CUSTOMER DRIVING HABITS
MIS-ADJUSTED SHIFTER CABLE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other transmission DTCS.

Are there any speed sensor or gear ratio DTCS present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK THE GEAR SHIFT CABLE FOR PROPER ADJUSTMENT

Check the Gear shift cable adjustment per the Service Information.
Also check the cable for possible binding or improperly routed.

Is the Gear shift cable properly adjusted and not binding or improperly routed?

Yes

- Go to [3](#)

No

- Adjust the Shifter Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. CHECK CUSTOMER DRIVING HABIT

This DTC can be set if the customer does not move the shift lever completely into the OD position (in between gears) causing the manual valve to be in the T2 position.

When this occurs, the feed port to the clutch is restricted, the transmission will declare Neutral, and this DTC will set.

This DTC can also be set by simply bumping the shift lever toward Neutral while accelerating.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

- This DTC can be set by the shift lever in the wrong position or not completely in the OD position. Make sure the customer is properly informed.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P1745-TRANSMISSION LINE PRESSURE TOO HIGH FOR TOO LONG

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This DTC is an informational DTC to inform the technician that transmission has been operating in an open-loop line pressure control for 3220 kilometers (2000 miles) or 1000 2-3 upshifts resulting from a Line Pressure DTC. The 42RLE Transmission is not designed to operate in open-loop line pressure control for an extended period time. This DTC is intended to protect the transmission. If the DTC sets, the transmission controller will place the transmission into limp-in mode.

- **When Monitored:**

Continuously with ignition on.

- **Set Condition:**

If the transmission has been operating in an open-loop line pressure control for 3220 kilometers (2000 miles) or 1000 2-3 upshifts.

Possible Causes
LINE PRESSURE DTCS PRESENT

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for Transmission Line Pressure DTCS.

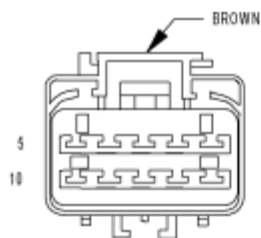
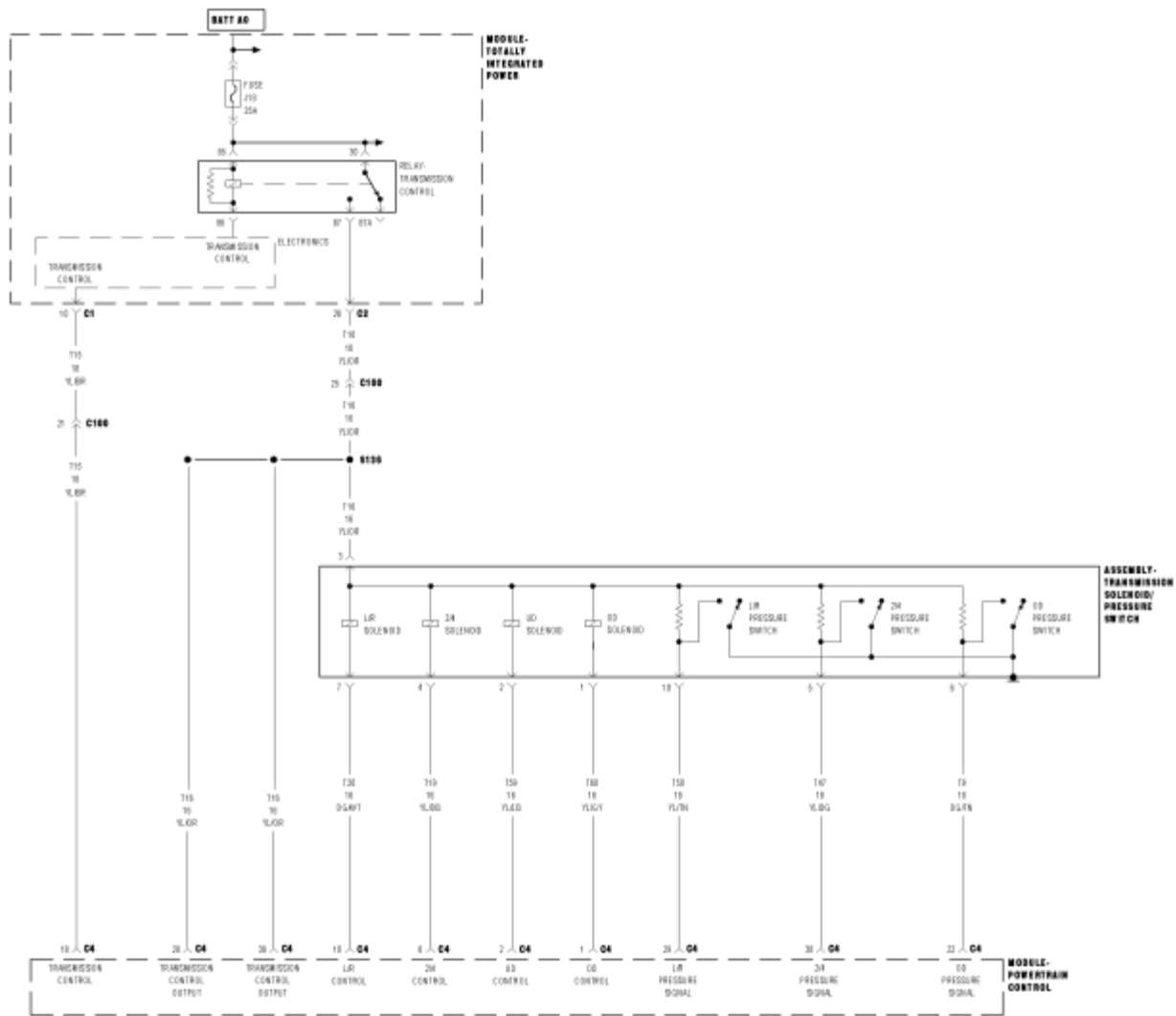
NOTE: In order to erase this DTC you must reset (erase) the VLP Shift Counter and the Output tooth counter which is a single procedure under Miscellaneous functions in the scan tool called “Clear Variable Line Pressure (VLP) counters”.

View repair

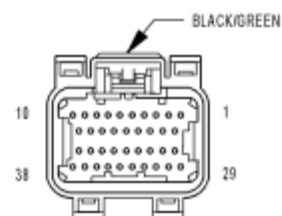
Repair

- Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the LR solenoid is energized. When the solenoid switch valve is in the downshifted position and the LR solenoid is energized, fluid is directed to the LR element for 1st gear. When the solenoid switch valve is in the up-shifted position (2nd, 3rd, and 4th gear) and the LR solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When shifting into 1st gear, a special sequence is followed to insure solenoid switch valve movement into the downshifted position. The LR pressure switch is monitored to confirm switch valve movement. If the solenoid switch valve movement is not confirmed (i.e. no LR pressure when the LR solenoid is energized), 2nd gear is substituted for 1st. No 1st gear (2nd gear is substituted). The transmission Torque converter FEMCC operation is inhibited. MIL on after 5 min. of substituted operation.

- **When Monitored:**

Prior to a shift into 1st gear.

- **Set Condition:**

Transmission temperature must be hot. DTC is set after six unsuccessful attempts to shift into 1st gear.

Possible Causes
RELATED DTC P0841 PRESENT
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other Transmission DTCs.

Is the DTC P0841 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF DTC P1775 IS CURRENT

With the scan tool, view DTCs.

Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [3](#)

No

- Go To [8](#)

3. PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.
Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

Did the Pressure Switch state change from open to closed when the test button was pressed?

Yes

- Repair internal transmission as necessary per the Service Information. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Transmission Solenoid/Pressure Switch Assembly.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN

Turn the ignition off to the lock position.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.
Disconnect the PCM C4 harness connector.
With the scan tool under TIPM, actuate the Transmission.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminals of Miller tool #8815.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly on all (T16) Transmission Control Output circuits?

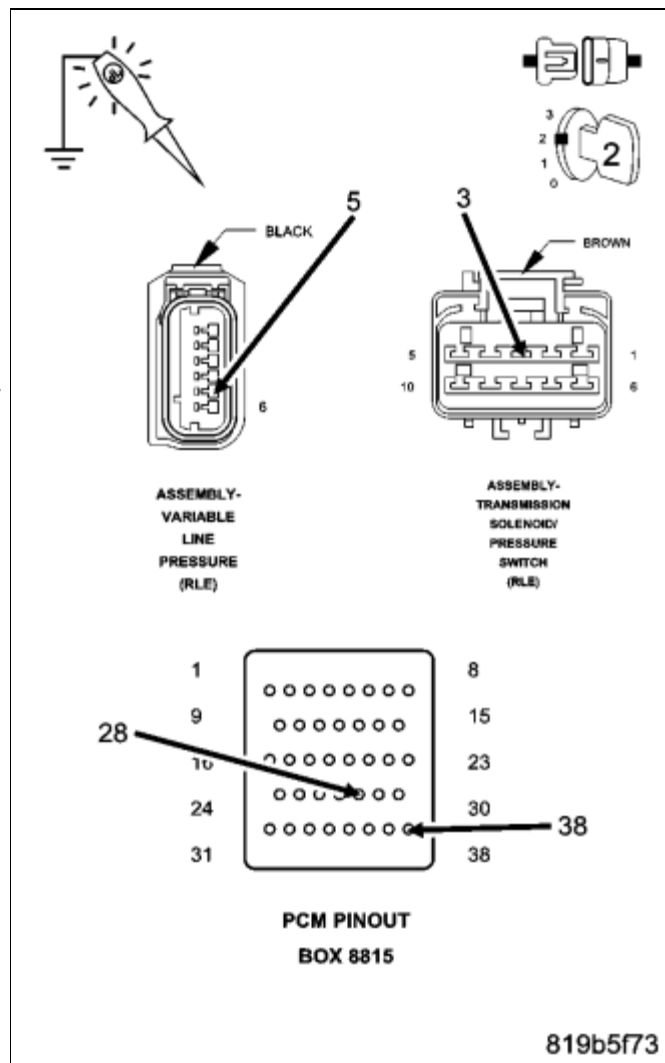
Yes

- Go To [5](#)

No

- Repair the (T16) Transmission Control Relay Output circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

5. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN



With the scan tool under TIPM, stop the Transmission actuation.

Turn the ignition off to the lock position.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

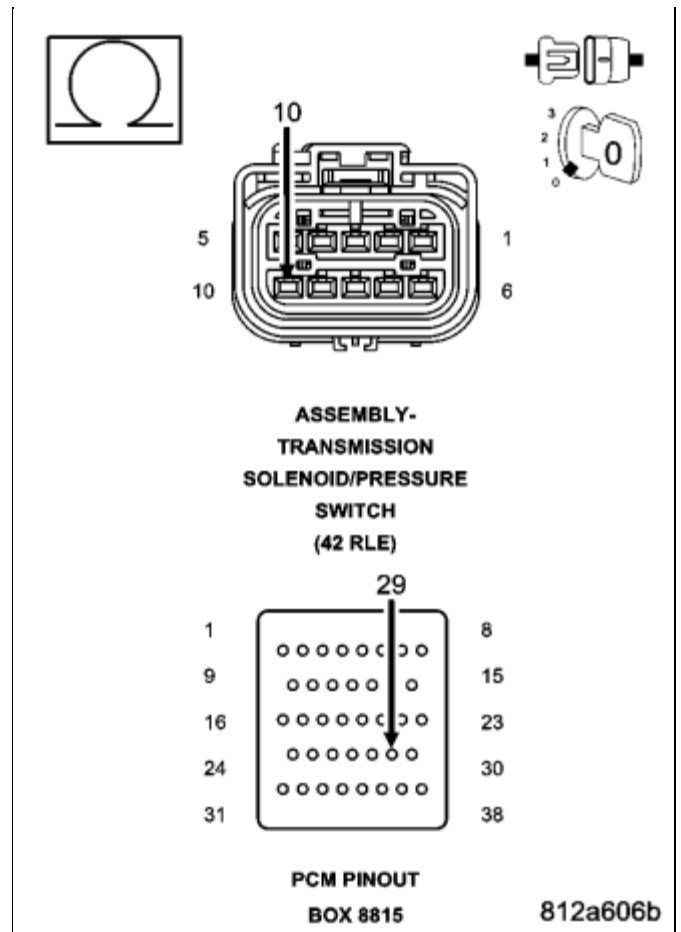
Is the resistance above 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

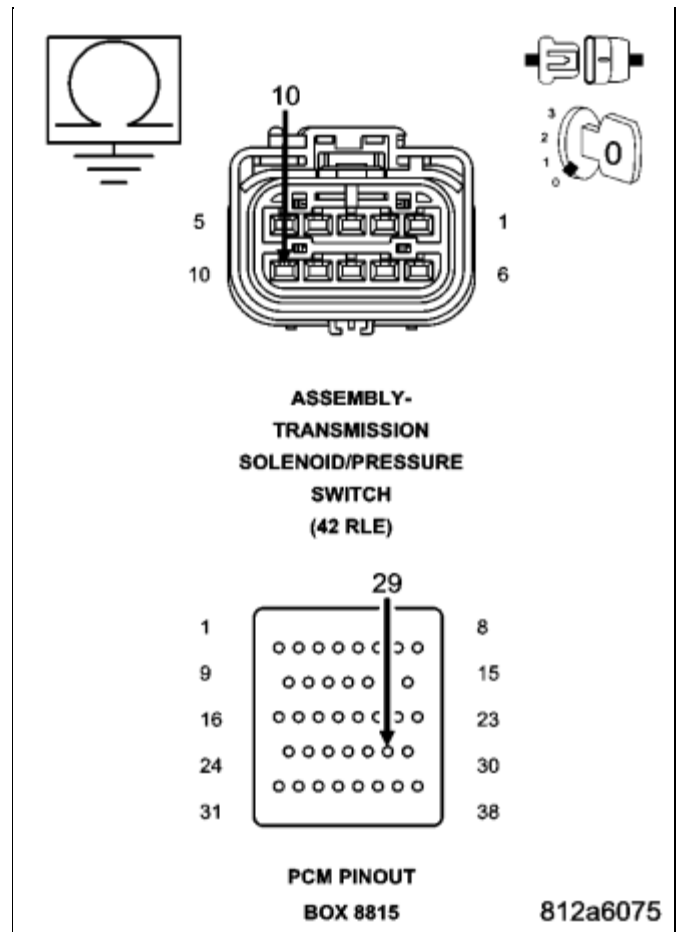
Is the resistance below 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [7](#)



7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes

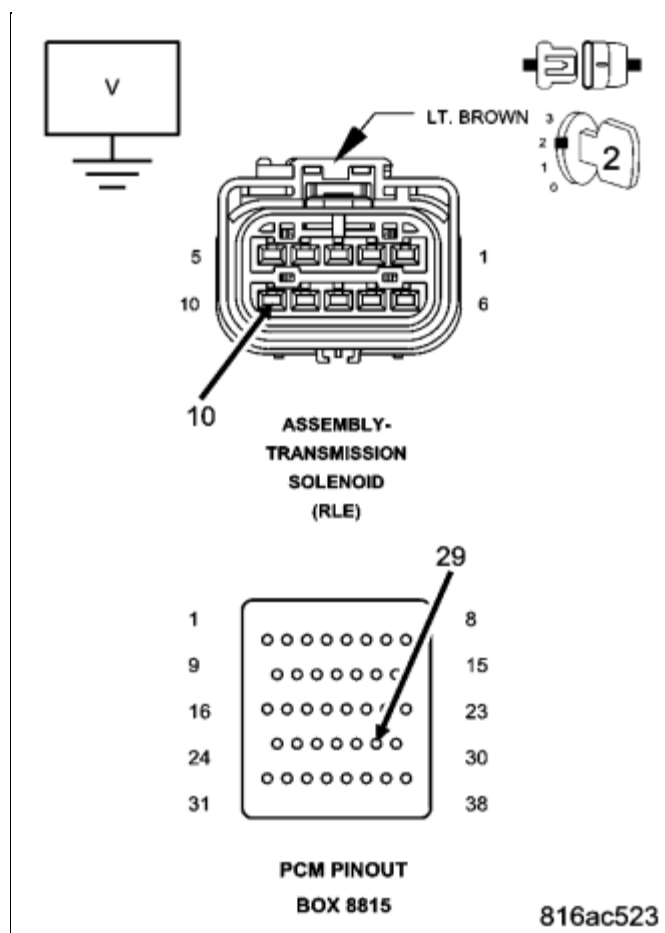
- Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK

LEARN.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test drive and verify if the transmission is launching in 2nd gear and/or no TCC engagement.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Are there 2nd gear launches and/or no TCC engagement?

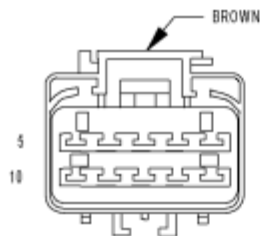
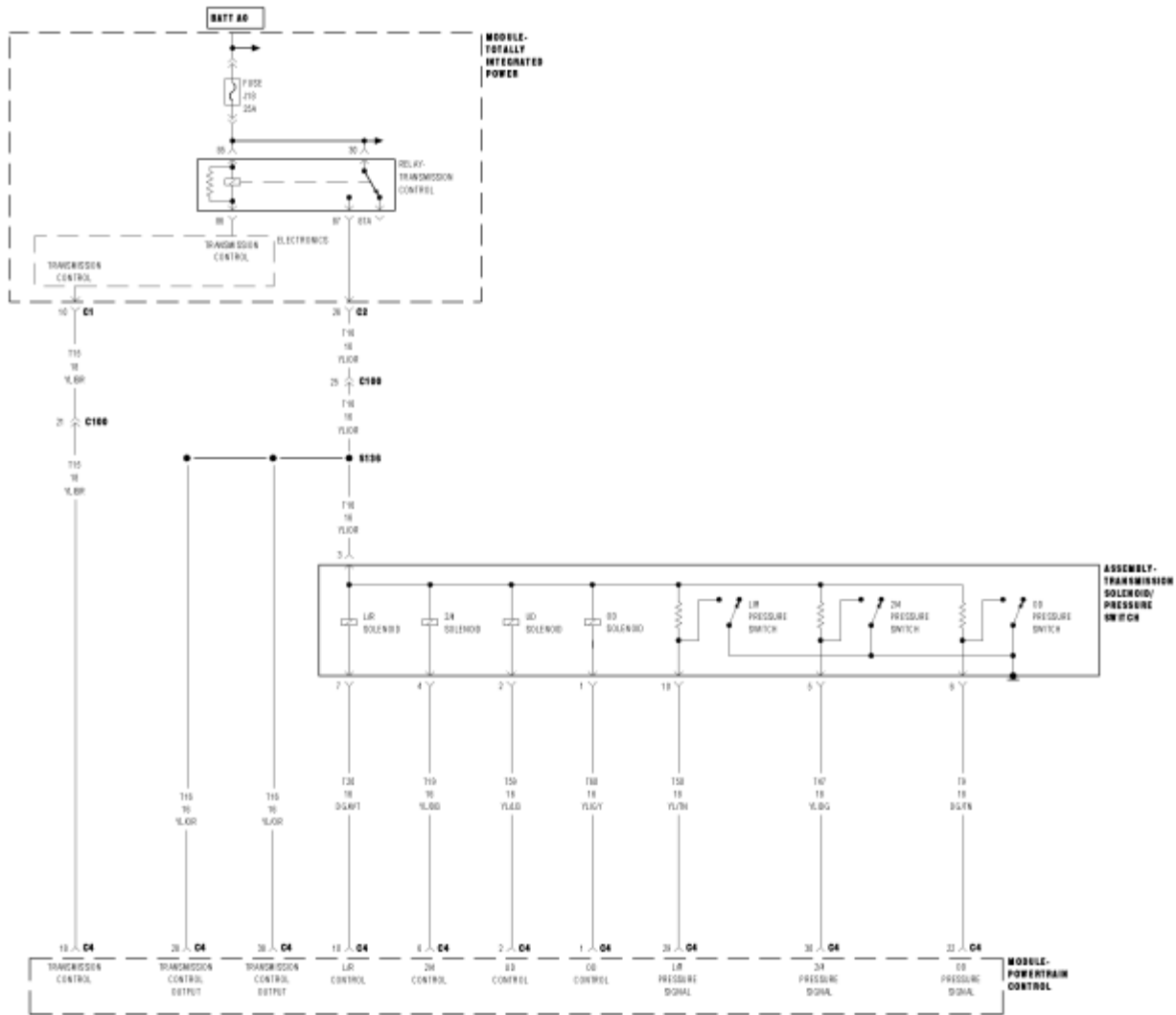
Yes

- Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid Pressure Switch Assembly.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

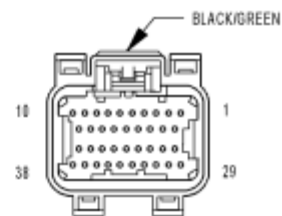
No

- Test Complete.

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION



**ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
(RLE)**



**MODULE-
POWERTRAIN
CONTROL C4
(RLE)**

019a117a

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the L/R solenoid is energized. When the solenoid switch valve is in the downshifted position and the L/R solenoid is energized, fluid is directed to the L/R element for 1st gear. When the solenoid switch valve is in the up-shifted position (2nd, 3rd, and 4th gear) and the L/R solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When doing PEMCC or FEMCC, the L/R pressure switch should indicate no pressure if the solenoid switch valve is in the L/R position. If the L/R pressure switch indicates pressure for some time while in partial or full EMCC, the EMCC operation is aborted and momentarily inhibited to avoid accidental application of the L/R clutch. EMCC is attempted again when there is no L/R pressure. The fourth detection of L/R pressure while in PEMCC or FEMCC will result in setting the DTC. Torque converter EMCC operation inhibited. MIL on after 5 min. of substituted operation.

- **When Monitored:**

Every 7 ms when doing PEMCC or FEMCC.

- **Set Condition:**

Must be in partial or full EMCC. The DTC is set if L/R pressure is detected high for the fourth time.

Possible Causes
RELATED DTC P0841 PRESENT
DTC EVENT DATA SHOWS TRS CODE TR2 - SHIFT LEVER OR MANUAL CONTROL VALVE IN A INVALID POSITION
SHIFTER CABLE OUT OF ADJUSTMENT
SOLENOID SWITCH VALVE STICKING IN ITS BORE
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
VALVE BODY
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other Transmission DTCs.

Is the DTC P0841 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK THE DTC EVENT DATA FOR TRS CODE TR2

With the scan tool, check the DTC EVENT DATA for P1776.

Does the DTC EVENT DATA show a TRS Code of TR2?

Yes

- This indicates the shift lever and the manual control valve were in an invalid position between Neutral and OD. Check the shifter cable for: proper adjustment, binding, friction, improper routing, or the shifter was moved in transit. Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK TO SEE IF DTC P1776 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P1776.

NOTE: This counter only applies to the last DTC set.

Is the status Active or is the STARTS SINCE SET counter 2 or less for this DTC?

Yes

- Go To [4](#)

No

- Go To [9](#)

4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.
Remove the Starter Solenoid Relay from the TIPM.

CAUTION: Removal of the Starter Solenoid Relay from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Starter Solenoid Relay must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

Did the Pressure Switch state change from open to closed when the test button was pressed?

Yes

- Go To [5](#)

No

- Go To [6](#)

5. CHECK THE SOLENOID SWITCH VALVE FOR STICKING

Remove the transmission oil pan and Valve body and inspect the Solenoid Switch Valve for sticking in its bore, repair or replace as necessary.

NOTE: This DTC may be caused by debris lodged in the Transmission Solenoid Switch Valve bore. If debris is found, clean the valve body and reassemble the transmission per the Service Information.

With the scan tool, record the DTC EVENT DATA for P1776 and erase DTCs.

Reassemble the transmission and test drive the vehicle. Try to duplicate the original set conditions using the DTC EVENT DATA recorded earlier.

With the scan tool, check Transmission DTCs.

Did the DTC P1776 reset?

Yes

- Replace the Transmission Solenoid Assembly per the Service Information.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

6. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

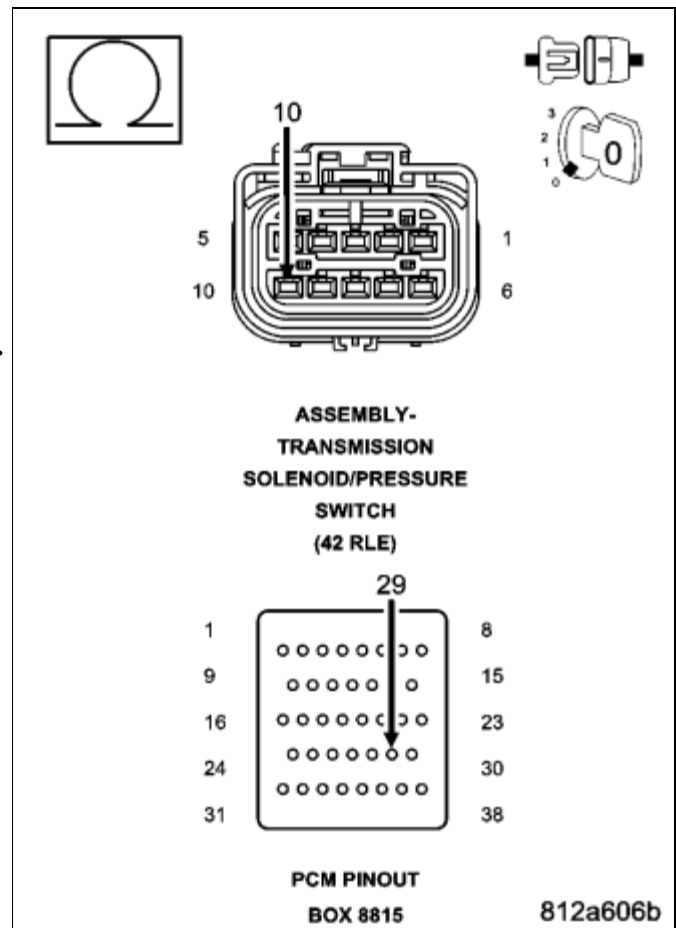
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit between the Transmission Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



No

- Go To [7](#)

7. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

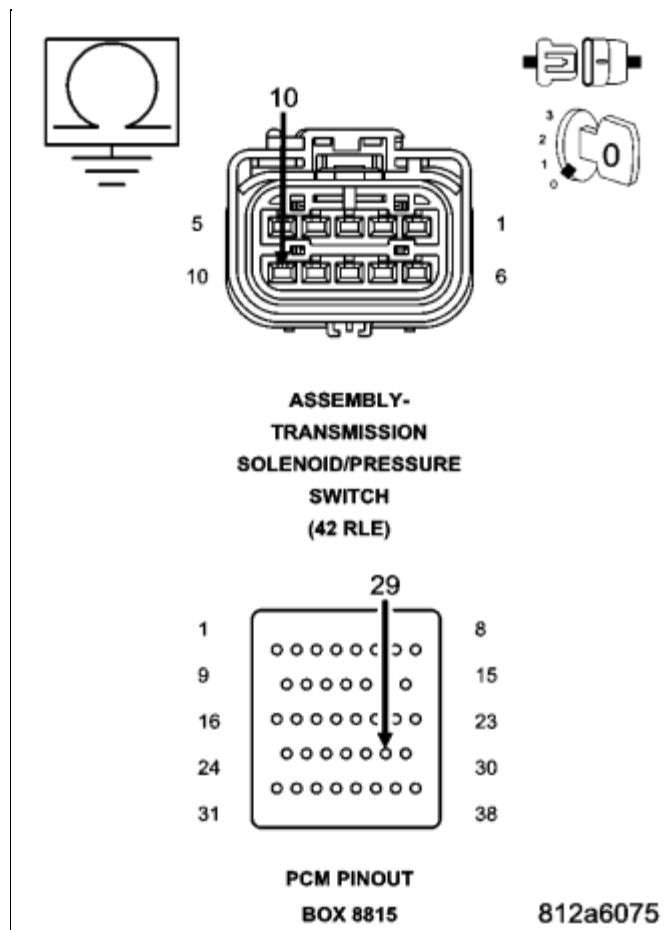
Is the resistance below 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Go To [8](#)



8. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.

With the scan tool under TIPM, actuate the Transmission.

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

Is the voltage above 0.5 volts?

Yes

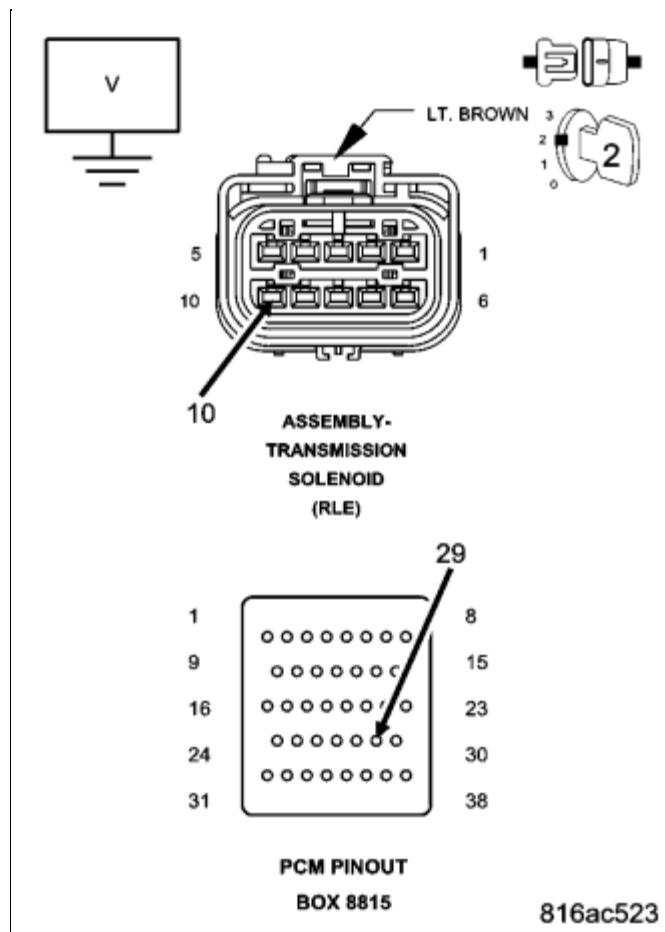
- Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service

Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test drive the vehicle and verify if the transmission is launching in 2nd gear and/or there is no TCC engagement.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for possible causes that may apply.

Are there 2nd gear launches and/or no TCC engagement?

Yes

- Disassemble and inspect the Valve Body per the Service Information Inspect the Solenoid Switch Valve for sticking in its bore and repair or replace as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P1790-FAULT IMMEDIATELY AFTER SHIFT

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

This DTC is not stored alone. It is stored if a Gear Ratio DTC is detected immediately after shift. The existence of DTC P1790 indicates a mechanical or hydraulic (not electrical) related problems. It should be noted, however, that all mechanical problems don't necessarily result in DTC P1790. When this DTC exists, diagnosing the system should be based on the associated DTC and only mechanical causes should be considered.

- **When Monitored:**

After a Gear Ratio Error code is stored.

- **Set Condition:**

After a Gear Ratio Error DTC has already been set. The DTC is set if the fault happened within 1.3 seconds of a shift. The DTC set time will vary from 1.214 seconds to 15 seconds.

Possible Causes
FAULT AFTER SHIFT

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. FAULT AFTER SHIFT

This DTC is set along with a Gear Ratio DTC. Perform the appropriate test for the Gear Ratio DTC stored.

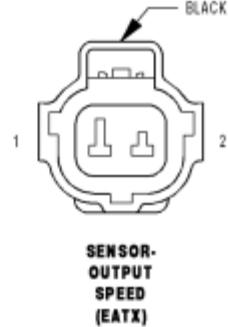
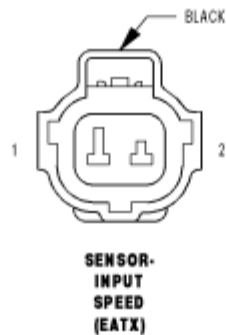
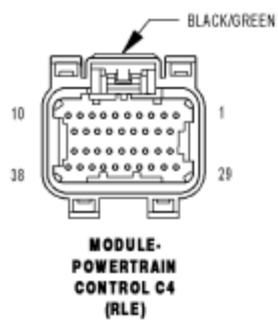
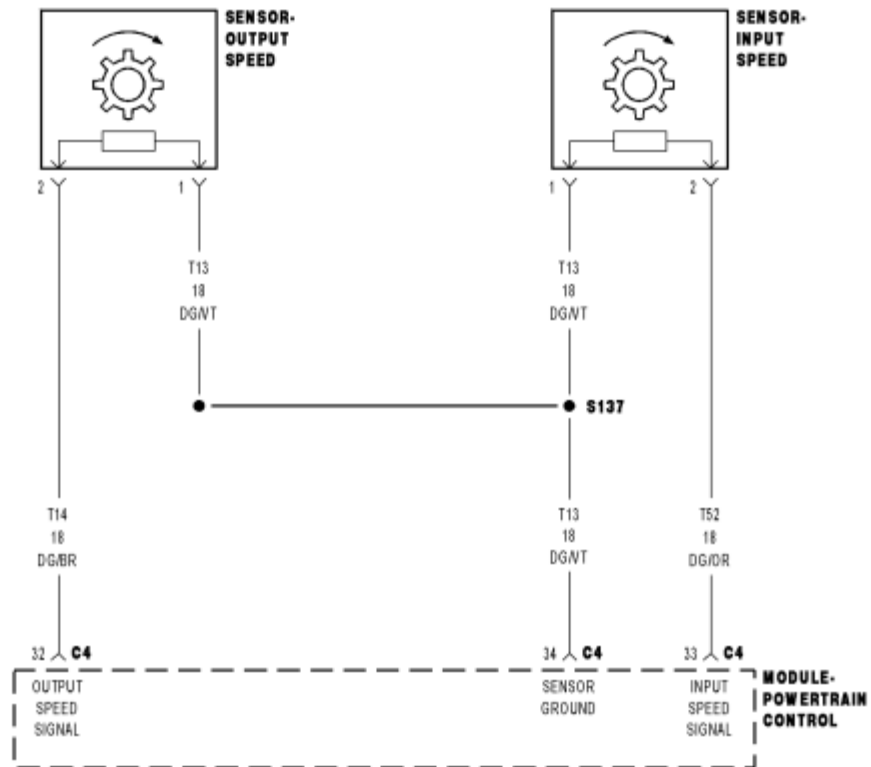
NOTE: Check Pending DTCs or 1 trip failures if there are no Active or Stored Gear Ratio DTCs.

If there are no possible causes remaining, view repair.

Repair

- Refer to the Transmission category and perform the appropriate symptom.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

P1794-SPEED SENSOR GROUND ERROR



91004529

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The input and output speed sensors use a common ground circuit. The loss of this common ground results in the input signal being sensed for both. After a reset in Neutral, and after observing a specific ratio, the Speed Check Fault Counter will increment. Because the speed sensors and the thermistor share the same ground circuit, this DTC may indicate a loss of the common speed sensor ground. In some cases this fault will cause a Gear Ratio Error DTC to be set.

- **When Monitored:**

Every 7 ms after a controller reset with transmission in Neutral.

- **Set Condition:**

After a PCM reset in Neutral and Input and Output sensor ratio equals 2.50 to 1.0 $\pm$ 50.0 RPM.

Possible Causes
SPEED SENSOR GROUND CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. PCM AND WIRING

Turn the ignition off to the lock position.
Remove the from the TIPM.

CAUTION: Removal of the from the TIPM will prevent the vehicle from being started in gear.

WARNING: The must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. Ignition on, engine not running.

With the Transmission Simulator, set the "Input/Output Speed" switch to "ON" and the rotary switch to the "3000/1250" position.

With the scan tool, monitor the Input and Output Speed Sensor readings.

Does the Input Speed read 3000 RPM and the Output Speed read 1250 RPM, $\pm$ 50 RPM?

Yes

- Go To [2](#)

No

- Go To [3](#)

2. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector.
Disconnect the Input and Output Speed Sensor harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of both of the (T13) Speed Sensor Ground circuits from the appropriate terminal of special tool #8815 to the Input and Output Speed Sensor harness connectors.

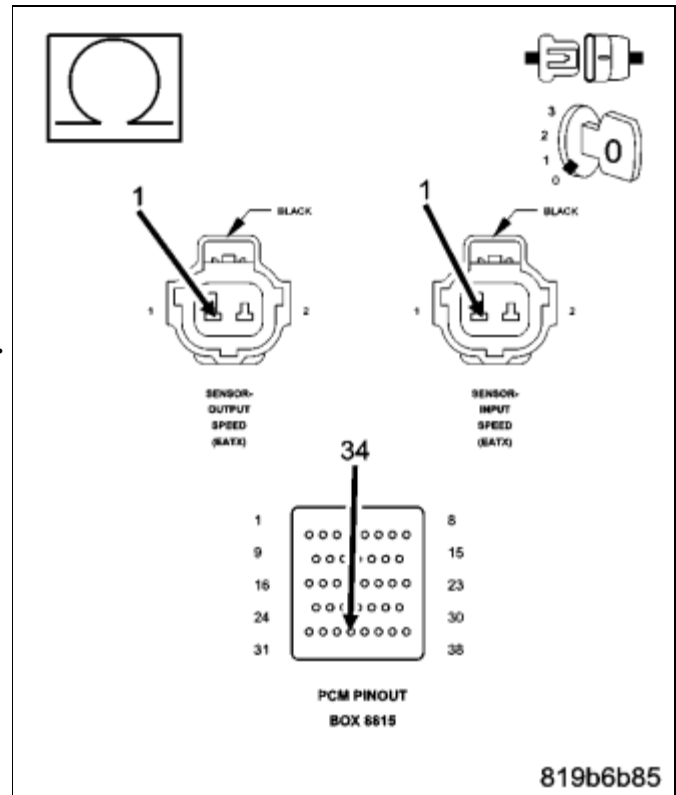
Is the resistance above 5.0 ohms on either circuit?

Yes

- Repair the (T13) Speed Sensor Ground circuit for an open.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 -



819b6b85

TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Test Complete.

P1797-MANUAL SHIFT OVERHEAT

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The major cause of heat build up in the transmission is torque converter slip. With the transmission in the AutoStick® mode, the torque converter can slip during aggressive driving or heavy loading conditions such as trailer towing or driving up steep grades. In the non AutoStick® mode, internal controller logic prevents the transmission from overheating by managing the shift and EMCC schedule. In the AutoStick® mode, when the transmission or engine temperature approaches an overheat condition, the manual shift overheat DTC sets and the AutoStick® mode is temporarily suspended until the temperature returns to normal.

◦ **When Monitored:**

Continuously with engine running.

◦ **Set Condition:**

If the Engine Temperature exceeds 123° C (255° F) or the Transmission Temperature exceeds 135° C (275° F) while in AutoStick® mode. Note: Aggressive driving or driving in Low for extended periods of time will set this DTC.

Possible Causes
MANUAL SHIFT OVERHEAT

Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

Diagnostic Test

1. MANUAL SHIFT OVERHEAT

This is an informational DTC only.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Check the engine and transmission cooling system for proper operation.

Check the Radiator Cooling Fan operation.

Check the Transmission Cooling operation.

Check the Transmission Fluid Level per the Service Information to verify that it is not overfilled.

NOTE: Aggressive driving or driving in Low for extended periods of time will set this DTC.

If there are no possible causes remaining, view repair.

Repair

- If the Transmission Fluid is low, repair any Transmission Fluid leak as necessary and adjust the Transmission Fluid Level per the Service Information. Refer to Service Information for the related symptoms and repair as necessary.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

U0100 LOST COMMUNICATION WITH ECM/PCM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The NGC controller communicates over the CAN C BUS. The transmission controller continuously monitors BUS activity. The CAN C BUS is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

- **When Monitored:**

Every 7 ms with:

- 1) Engine speed greater than 500 RPM.
- 2) Battery voltage between 10 and 16 volts.

- **Set Condition:**

CAN C BUS messages are not received for 10 seconds.

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0002 CAN C BUS OFF PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The NGC controller communicates over the CAN C BUS. The transmission controller continuously monitors BUS activity. The CAN C BUS is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

- **When Monitored:**

Every 7 ms with:

- 1) Engine speed greater than 500 RPM.
- 2) Battery voltage between 10 and 16 volts.

- **Set Condition:**

CAN C BUS messages are not received for 10 seconds.

Diagnose the U0002 CAN C BUS OFF PERFORMANCE as the U0001 CAN C BUS CIRCUIT test in 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0121 LOST COMMUNICATION WITH ABS

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The NGC controller communicates over the CAN C BUS. The transmission controller continuously monitors BUS activity. The CAN C BUS is also used to communicate transmission MIL status to the Engine Controller. If

the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

- **When Monitored:**

Every 7 ms with:

- 1) Engine speed greater than 500 RPM.
- 2) Battery voltage between 10 and 16 volts.

- **Set Condition:**

CAN C BUS messages are not received for 10 seconds.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141 LOST COMMUNICATION WITH FCM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The NGC controller communicates over the CAN C BUS. The transmission controller continuously monitors BUS activity. The CAN C BUS is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

- **When Monitored:**

Every 7 ms with:

- 1) Engine speed greater than 500 RPM.
- 2) Battery voltage between 10 and 16 volts.

- **Set Condition:**

CAN C BUS messages are not received for 10 seconds.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

STANDARD PROCEDURE

42RLE - PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete wiring diagram **Refer to Section 8W.**

Perform the following steps prior to any diagnostic procedure(s).

NOTE: Due to different power control configurations, the Transmission Control Relay (if equipped) may be referred to as a PCM relay.

1. Many transmission symptoms can be caused by a low fluid level. If the fluid level is low, locate and repair any leaks and fill the transmission to the proper fluid level. Refer to the Service Information for the proper repair and fluid fill procedures.
2. Testing should only be performed with the battery fully charged to avoid false diagnosis.
3. With the scan tool check pinion factor (if equipped) for proper tire identification and program or reprogram if necessary.
4. With the scan tool, read Engine (PCM) DTCs. If Engine DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.
5. With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.
6. With the scan tool, read Event Data. Use this data to identify the conditions in which the DTC was set.

NOTE: Event Data may exist even if no DTCs are stored. Event Data is only erased by a Battery Disconnect, reflash, or QuickLearn procedure. Clearing DTCs does NOT erase the Event Data. Some DTCs require two "bad trips" before they are stored (and the MIL illuminates). The transmission may enter "limp-in" mode during the first "bad trip," but if the fault condition is not present after the vehicle is restarted, the pending DTC may be cleared without lighting the MIL. Nevertheless, the Event Data for the pending DTC will remain stored and can still be retrieved with the scan tool. If the customer reports a "limp-in" event but no DTCs are present, check the Event Data.

NOTE: Performing a Battery Disconnect will clear all Event Data and reset all learned Transmission values to the controllers default values which may temporarily result in erratic shift schedules.

7. With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706-TRANSMISSION RANGE SENSOR RATIONALITY.
8. For Gear Ratio Error DTCs, use the scan tool to read and record the Clutch Volume Index (CVI) information.
9. Use the wiring diagram as a guide, inspect the wiring and connectors related to this circuit and repair as necessary.
10. Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, driving under specific conditions, and after controller diagnostic monitors have run.
11. Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.
12. Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

Did any of the above procedures repair the vehicle?

Yes

- Testing is complete.
- Perform 42RLE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

No

- Refer to the transmission category and perform the appropriate diagnostic procedure(s).

- (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

42RLE TRANSMISSION VERIFICATION TEST

Perform the following after completion of a diagnostic repair:

NOTE: After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed. Refer to the Engine Category.

1. Reconnect any disconnected components.
2. With the scan tool, erase all Transmission and Engine DTCs.
3. With the scan tool check pinion factor (if equipped) for proper tire identification and program or reprogram if necessary.
4. Erase DTC P0700 under engine to turn the MIL off after completion of transmission repairs.
5. Perform a PRNDL FAULT CLEARING PROCEDURE after completion of repairs for P0706-TRANSMISSION RANGE SENSOR RATIONALITY (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE).
6. If the Powertrain Control Module or the Transmission has been repaired or replaced, it is necessary to perform the scan tool Quick Learn Procedure.
7. If the Torque converter has been replaced, with the scan tool perform TCC BREAK-IN.
8. If the Powertrain Control Module or Front Control Module has been replaced you must reset the Pinion Factor in the Front Control Module.
9. With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT, above 43° C or 110° F.
10. Check the transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure.
11. Road test the vehicle. With the scan tool, monitor the engine rpm. Make 15 to 20 1-2, 2-3, 3-4 upshifts. Perform these shifts from a standing start to 72 km/h (45 mph) with a constant throttle opening of 20 to 25 degrees.
12. With speeds below 40 km/h (25 mph), make 5 to 8 wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.
13. For a specific DTC, drive the vehicle to the Symptom's When Monitored/When Set conditions to verify the DTC is repaired.
14. If equipped with AutoStick®, upshift and downshift several times using the AutoStick® feature during the road test.

NOTE: Use the OBDII task manager to run a Good Trip in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.

15. Check for any Diagnostic Trouble Codes (DTCs) during and after the road test.

Did any Diagnostic Trouble Codes set during the road test?

Yes

- Repair is not complete. Refer to the Transmission category and perform the appropriate symptom(s).

No

- Repair is complete.

PRNDL FAULT CLEARING PROCEDURE

1. With the scan tool, erase Transmission DTCs.
2. Cycle the ignition off, then start the vehicle.
3. Firmly apply the brakes and shift into Overdrive.

NOTE: Vehicle must remain in Overdrive for at least 3.0 seconds.

4. With the brakes firmly applied, shift slowly through all gears (PRNDL) as least three times, pausing momentarily in each gear.

NOTE: If all the PRNDL lights box individually then the error was cleared.

5. Shift into park and turn the ignition off to the lock position.
6. With the ignition on, engine not running, using the scan tool, read DTCs.

Does the DTC P0706 reset, or do all the PRNDL indicators remain boxed in park or neutral?

Yes

- Return to the symptom list and perform diagnostics for P0706-TRANSMISSION RANGE SENSOR RATIONALITY.

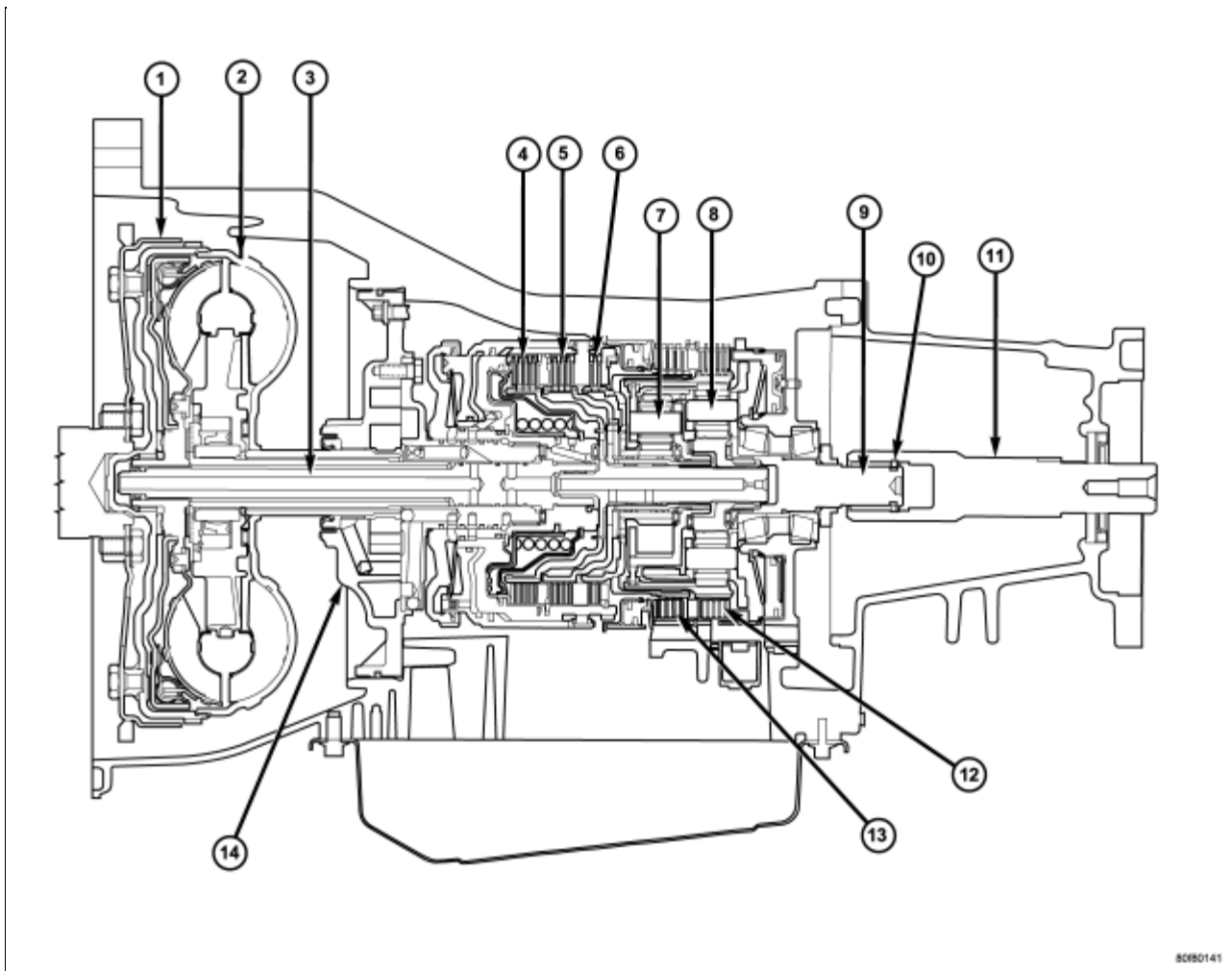
No

- Test Complete.
- Perform 42RLE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

AUTOMATIC TRANSMISSION - 42RLE

AUTOMATIC TRANSMISSION - 42RLE

DESCRIPTION



The 42RLE is a four-speed transmission that is a conventional hydraulic/mechanical assembly controlled with adaptive electronic controls and monitors. The hydraulic system of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid/Pressure switch assembly

Control of the transmission is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor feedback information provided to the Transmission Control Module (TCM) portion of the Powertrain Control Module (PCM).

The TCM is the heart of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data,

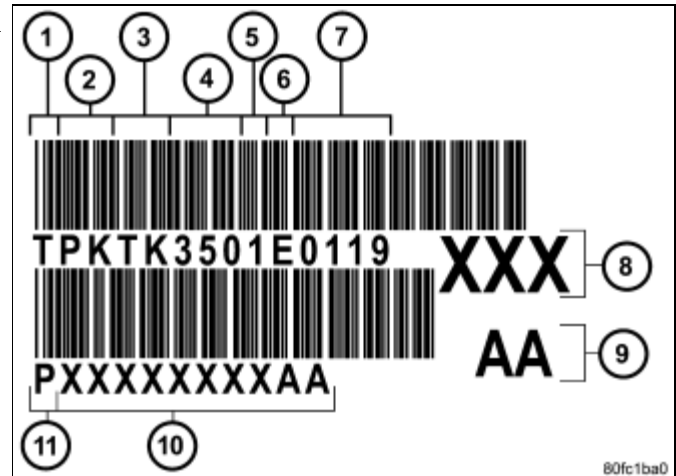
DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB® scan tool.

TRANSMISSION IDENTIFICATION

The 42RLE transmission can be identified by a barcode label that is affixed to the upper left area of the bellhousing.

The label contains a series of digits that can be translated into useful information such as transmission part number (10), date of manufacture (4, 5), manufacturing origin (2), assembly line identifier (6), build sequence number (7), etc..

If the tag is not legible or is missing, the “PK” number, which is stamped into the left rear flange of the transmission case, can be referred to for identification. The entire part number, build code, and sequence number are stamped into the flange.

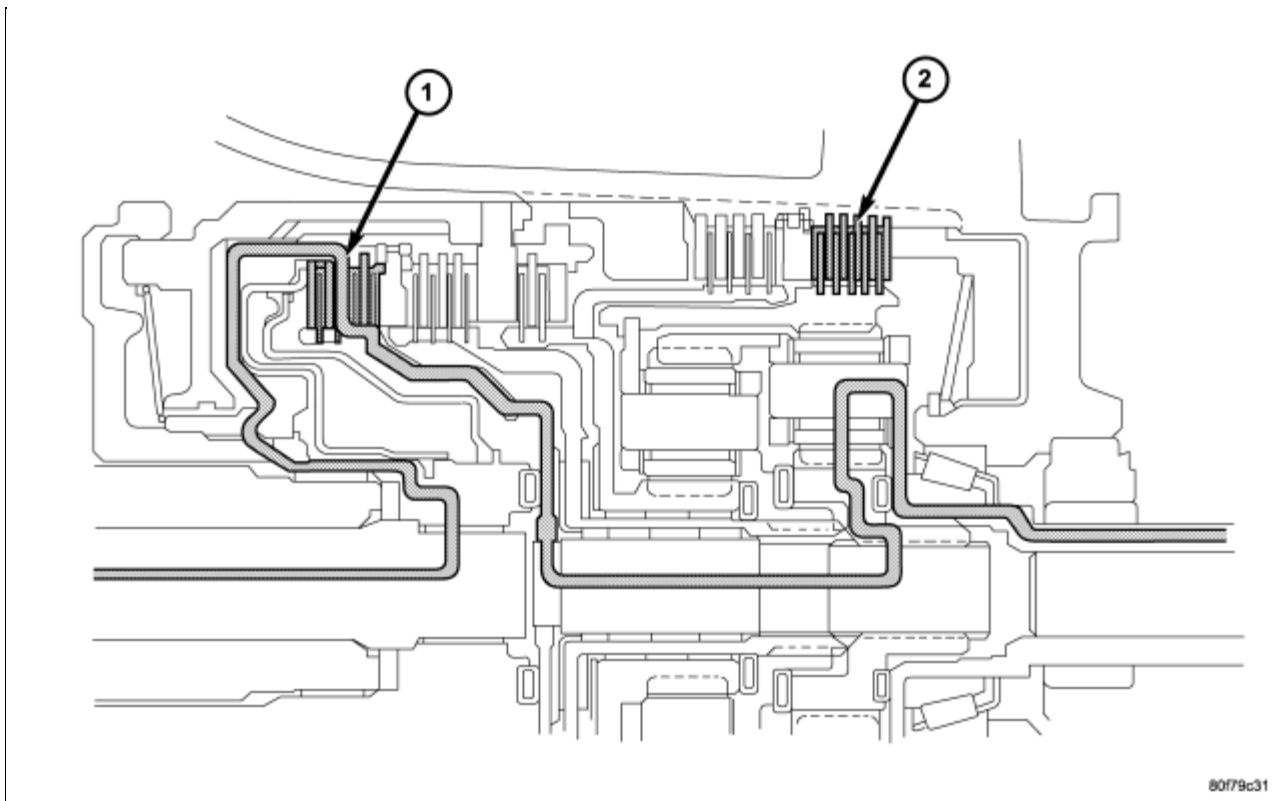


OPERATION

The 42RLE transmission ratios are:

First	2.84 : 1
Second	1.57 : 1
Third	1.00 : 1
Overdrive	0.69 : 1
Reverse	2.21 : 1

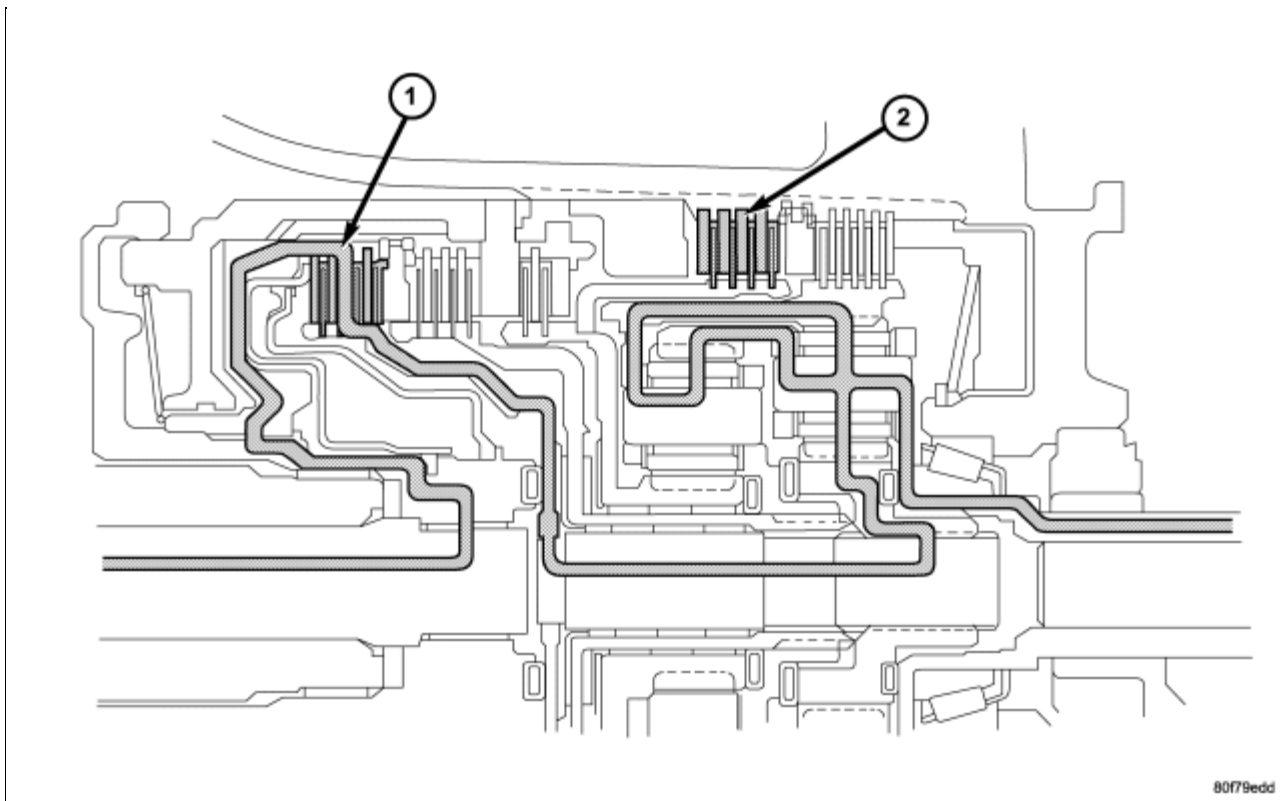
FIRST GEAR POWERFLOW



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In first gear range, torque input is through the underdrive clutch (1) to the underdrive hub assembly. The underdrive hub is splined to the rear sun gear. When the underdrive clutch is applied, it rotates the underdrive hub and rear sun gear. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly. The rear sun gear drives the rear planetary pinion gears. The rear planetary pinion gears are forced to walk around the inside of the stationary rear annulus gear. The pinions are pinned to the rear carrier and cause the rear carrier assembly to rotate as they walk around the annulus gear. This provides the torque output for first gear. The other planetary gearset components are freewheeling. The first gear ratio is 2.84:1.

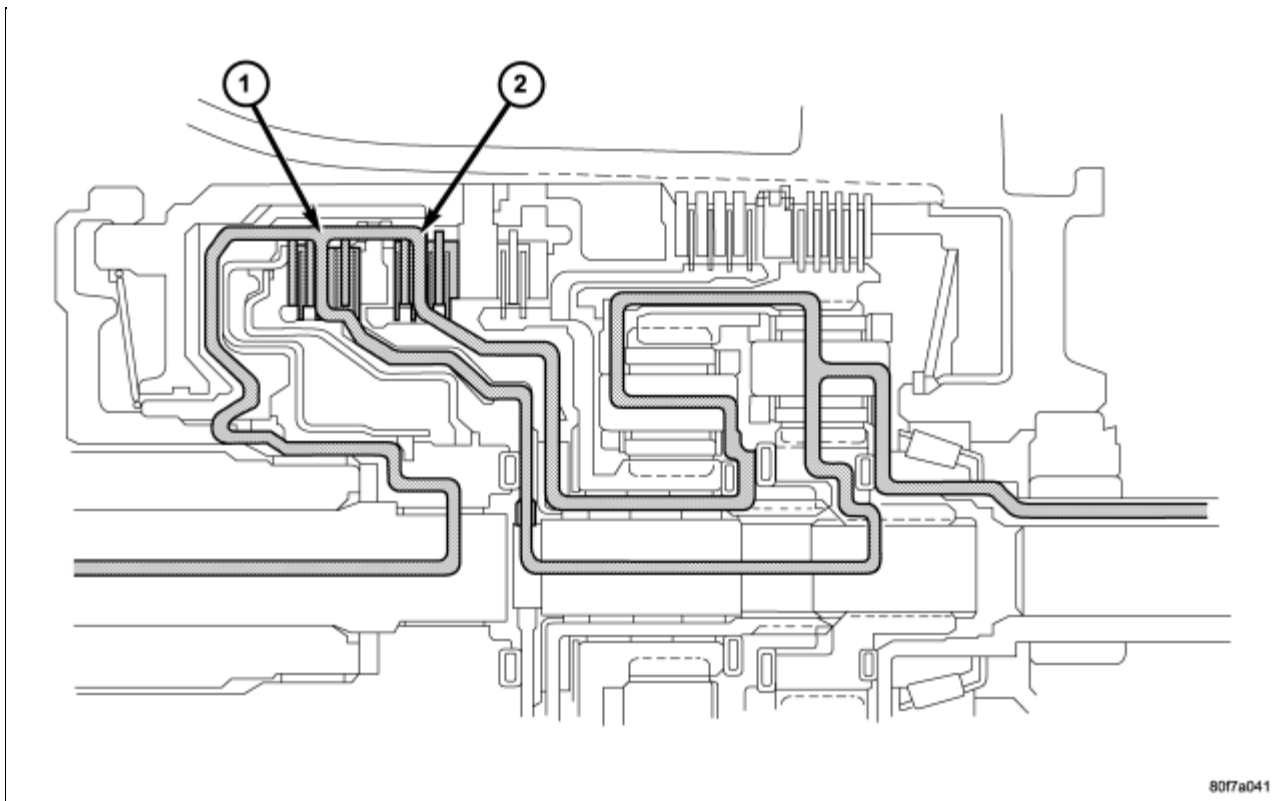
SECOND GEAR POWERFLOW



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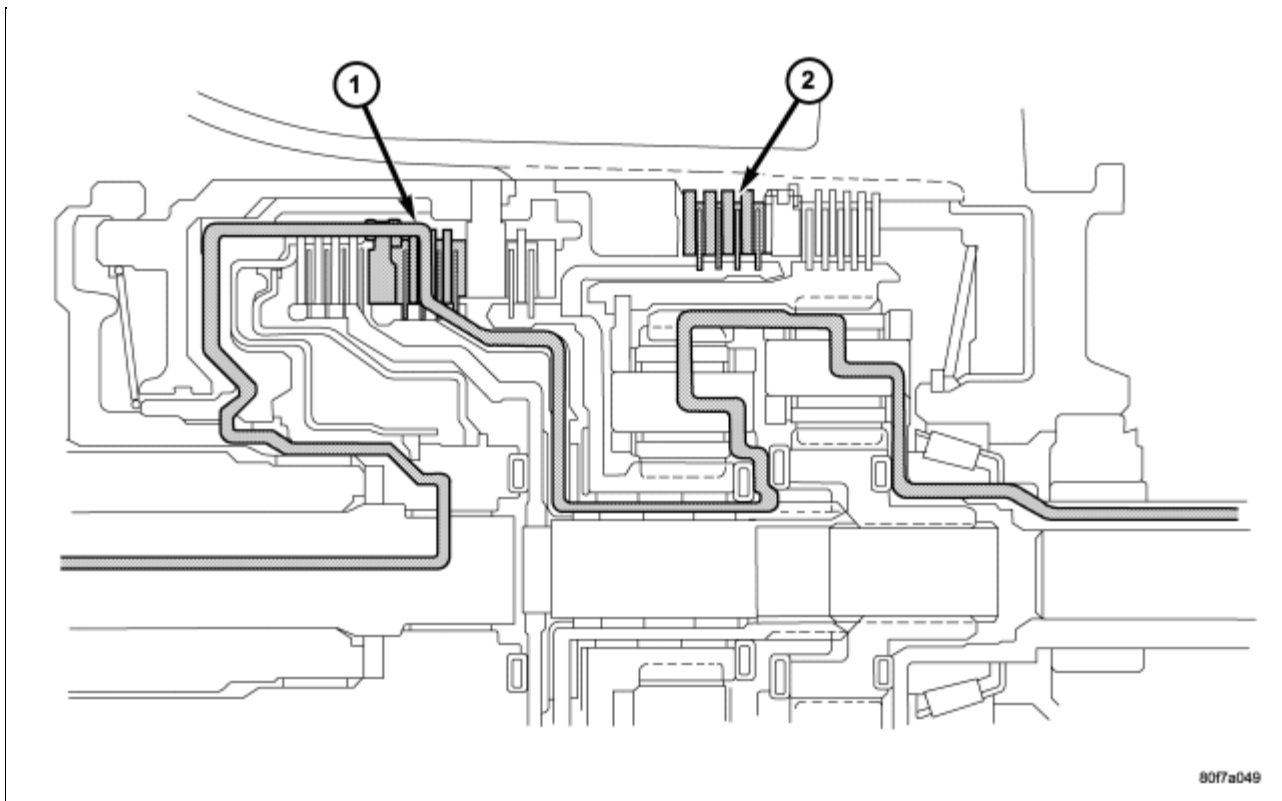
Second gear is achieved by having both planetary gear sets contribute to torque multiplication. As in first gear, torque input is through the underdrive clutch (1) to the rear sun gear. The 2/4 clutch (2) is applied to hold the front sun gear stationary. The rotating rear sun gear turns the rear planetary pinions. The rear pinions rotate the rear annulus/front carrier assembly. The pinions of the front carrier walk around the stationary front sun gear. This transmits torque to the front annulus/rear carrier assembly, which provides output torque and a gear ratio of 1.57:1.

THIRD GEAR POWERFLOW



In third gear, two input clutches are applied to provide torque input: the underdrive clutch (1) and overdrive clutch (2). The underdrive clutch rotates the rear sun gear, while the overdrive clutch rotates the front carrier/rear annulus assembly. The result is two components (rear sun gear and rear annulus gear) rotating at the same speed and in the same direction. This effectively locks the entire planetary gearset together and is rotated as one unit. The gear ratio in third is 1:1.

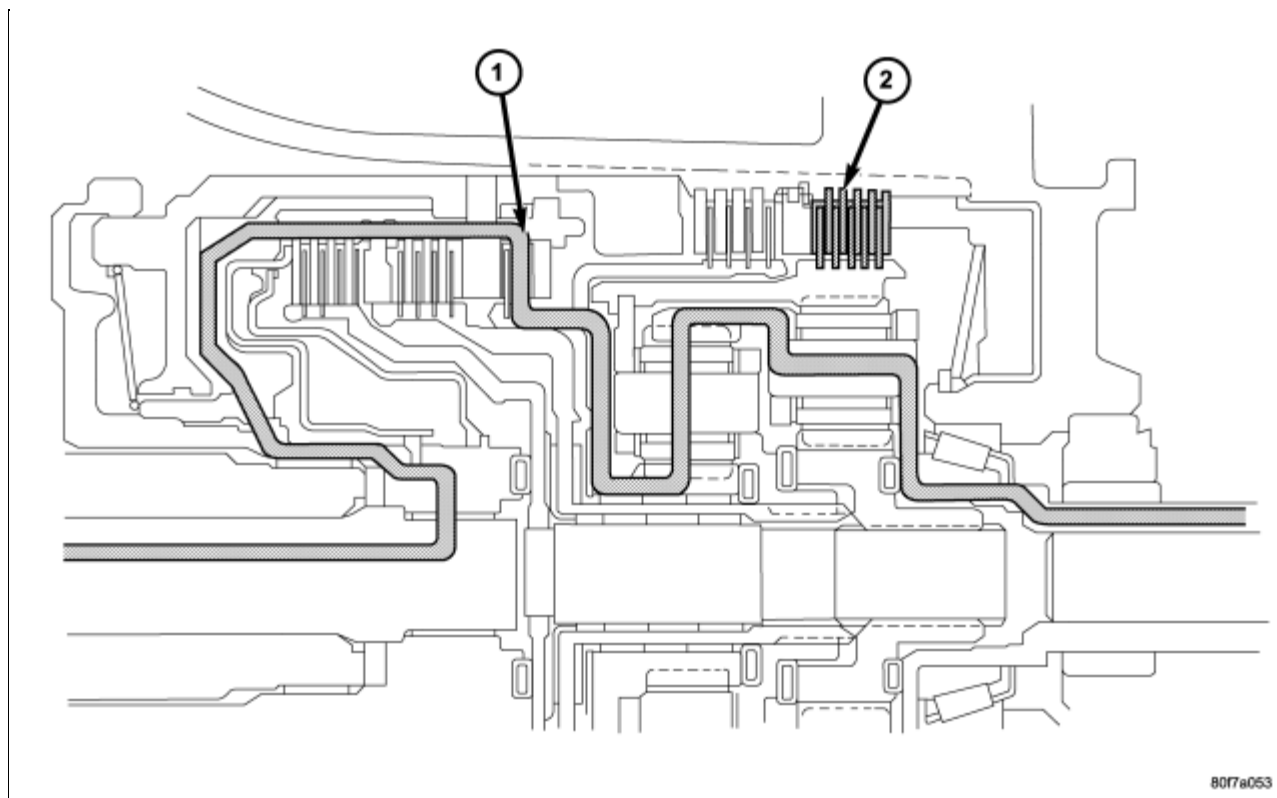
FOURTH GEAR POWERFLOW



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In fourth gear input torque is through the overdrive clutch (1) which drives the front carrier. The 2/4 clutch (2) is applied to hold the front sun gear. As the overdrive clutch rotates the front carrier, it causes the pinions of the front carrier to walk around the stationary front sun gear. This causes the front carrier pinions to turn the front annulus/rear carrier assembly which provides output torque. In fourth gear, transmission output speed is more than engine input speed. This situation is called overdrive and the gear ratio is 0.69:1.

REVERSE GEAR POWERFLOW



In reverse, input power is through the reverse clutch (1). When applied, the reverse clutch drives the front sun gear through the overdrive hub and shaft. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly stationary. The front carrier is being held by the L/R clutch so the pinions are forced to rotate the front annulus/rear carrier assembly in the reverse direction. Output torque is provided, in reverse, with a gear ratio of 2.21:1.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on the 42RLE Four Speed Automatic Transmission, always check for proper shift cable adjustment. Also check for diagnostic trouble codes with the DRB® scan tool and the 42RLE Transmission Diagnostic Procedure Manual.

42RLE automatic transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

When diagnosing a problem always begin with recording the complaint. The complaint should be defined as specific as possible. Include the following checks:

- Temperature at occurrence (cold, hot, both)
- Dynamic conditions (acceleration, deceleration, upshift, cornering)
- Elements in use when condition occurs (what gear is transmission in during condition)

- Road and weather conditions
- Any other useful diagnostic information.

After noting all conditions, check the easily accessible variables:

- Fluid level and condition
- Shift cable adjustment
- Diagnostic trouble code inspection

Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

DIAGNOSIS AND TESTING - ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transmission should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transmission cleaning.

Slipping clutches can be isolated by comparing the “Elements in Use” chart with clutch operation encountered on a road test. This chart identifies which clutches are applied at each position of the selector lever.

A slipping clutch may also set a DTC and can be determined by operating the transmission in all selector positions.

ELEMENTS IN USE AT EACH POSITION OF SELECTOR LEVER

Shift Lever Position	INPUT CLUTCHES			HOLDING CLUTCHES	
	Underdrive	Overdrive	Reverse	2/4	Low/Reverse
P - PARK					X
R - REVERSE			X		X
N - NEUTRAL					X
OD - OVERDRIVE					
First	X				X
Second	X			X	
Direct	X	X			

Overdrive		X		X	
D - DRIVE*					
First	X				X
Second	X			X	
Direct	X	X			
L - LOW*					
First	X				X
Second	X			X	
Direct	X	X			
* Vehicle upshift and downshift speeds are increased when in these selector positions.					

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

1. Record all DTCs and the accompanying DTC Event Data.
2. Check for an appropriate Technical Service Bulletin that applies to the customer complaint.
3. Check fluid level and condition.
4. Road test and note how transmission upshifts, downshifts, and engages.
5. If the complaint was related to shift quality, perform the Quick Learn procedure, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE), and the Drive Learn Procedure, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).
6. If the shift complaint still exists, compare actual line pressure (sensor reading, using the scan tool) to the Desired Line Pressure reading, in Park, Drive, and Reverse at 1500 RPM. Check that the LP sensor reads 30 psi (the minimum it should ever display) with key on / engine off.
7. Perform air-pressure test to check clutch operation. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)
8. Replace the Transmission Solenoid/TRS Assembly and perform the Quick Learn and Drive Learn procedures

again.

9. If the complaint still exists, remove, inspect, and repair the transmission as necessary.

VEHICLE IS DISABLED

1. Record all DTCs and the accompanying DTC Event Data.
2. With engine running, place transmission in gear and verify correct PRNDL reading. Observe the Input and Output speeds using the scan tool. If output RPM is greater than zero but vehicle does not move, check for transfer case in Neutral (or failed internally), failed propshaft, or failed / disconnected drive axle. If output RPM is zero and input RPM is greater than zero, internal transmission slippage is indicated. Run clutch slip tests using the scan tool, check oil pan for debris, and air check the various clutch circuits.
3. Shift the transmission into neutral, if both input and output speeds are zero, check flexplate bolts, torque converter, and transmission input shaft.
4. Compare actual line pressure (sensor reading, using the scan tool) to the Desired Line Pressure reading, in Park, Drive, and Reverse at 1500 RPM. Check that the LP sensor reads 30 psi (the minimum it should ever display) with key on / engine off. If line pressure is incorrect, check fluid level and condition.
5. Remove, inspect, and repair the transmission as necessary.

HYDRAULIC PRESSURE TESTS

NOTE: Before performing the hydraulic pressure tests be certain to disconnect the Variable Line Pressure (VLP) electrical connector at the transmission. Check for and clear any codes that may have been set after performing any hydraulic pressure test and connecting the Variable Line Pressure (VLP) electrical connector.

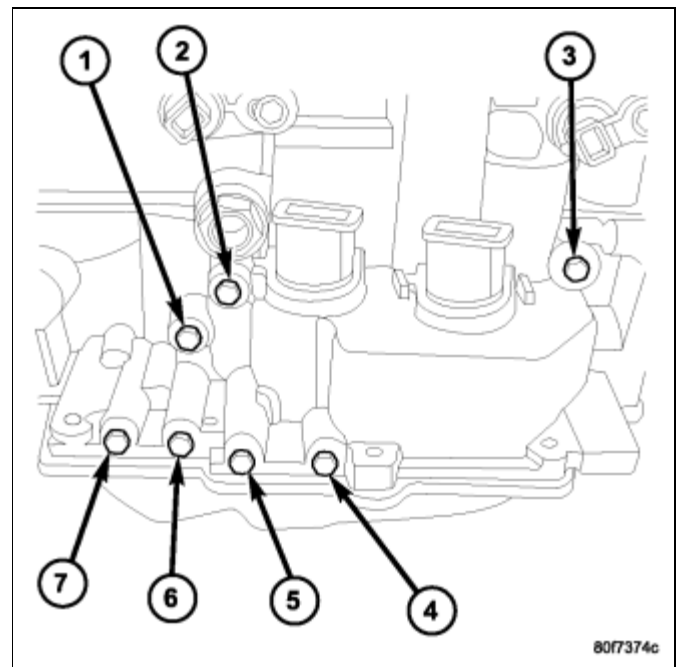
Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows the wheels to turn, and position tachometer so it can be read.

Using special adapters L-4559, attach 300 psi gauge(s) C-3293SP to the port(s) required for test being conducted.

Test port locations are shown in the Pressure Taps graphic.



TEST ONE - SELECTOR IN MANUAL 1 (1st Gear)

NOTE: This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

1. Attach pressure gauge to the low/reverse clutch tap.
2. Move selector lever to the MANUAL 1 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.
4. Low/reverse clutch pressure should read 115 to 145 psi.

TEST TWO - SELECTOR IN MANUAL 2 (Second Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the MANUAL 2 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
4. In second gear the underdrive clutch pressure should read 110 to 145 psi.

TEST TWO A - SELECTOR IN DRIVE (OD ON - Fourth Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the DRIVE position. Verify that the OD switch is ON.
3. Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
4. Underdrive clutch pressure should read below 5 psi. If not, than either the solenoid assembly or controller is at fault.

TEST THREE - SELECTOR IN DRIVE (OD OFF - Third and Second Gear)

NOTE: This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

1. Attach gauge to the overdrive clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph.
4. Overdrive clutch pressure should read 74 to 95 psi.
5. Move selector lever to the DRIVE position and increase indicated vehicle speed to 30 mph.
6. The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.

TEST FOUR - SELECTOR IN DRIVE (OD ON - Fourth Gear)

NOTE: This test checks the 2/4 clutch hydraulic circuit.

1. Attach gauge to the 2/4 clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph. Vehicle should be in fourth gear.
4. The 2/4 clutch pressure should read 75 to 95 psi.

TEST FIVE-SELECTOR IN DRIVE (OD ON - Fourth Gear, CC on)

NOTE: These tests check the torque converter clutch hydraulic circuit.

1. Attach gauge to the torque converter clutch off pressure tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph. Vehicle should be in 4th gear, CC on.

CAUTION: Both wheels must turn at the same speed.

4. Torque converter clutch off pressure should be less than 5 psi.
5. Now attach the gauge to the torque converter clutch on pressure tap.
6. Move selector to the OD position.
7. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.
8. Verify the torque converter clutch is applied mode using the RPM display of the scan tool.
9. Torque converter clutch on pressure should be 60-90 psi.

TEST SIX-SELECTOR IN REVERSE

NOTE: This test checks the reverse clutch hydraulic circuit.

1. Attach gauge to the reverse and low/reverse clutch tap.
2. Move selector lever to the REVERSE position.
3. Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.
4. Reverse and low/reverse clutch pressure should read 165 to 235 psi.

TEST RESULT INDICATIONS

1. If proper line pressure is found in any one test, the pump and pressure regulator are working properly.
2. Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.
3. Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.
4. If the overdrive clutch pressure is greater than 5 psi in [STEP 6](#) of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.
5. If the underdrive clutch pressure is greater than 5 psi in [STEP 4](#) of Test Two-A, a defective solenoid/pressure switch assembly or controller is the cause.

ALL PRESSURE SPECIFICATIONS ARE PSI (on hoist, with wheels free to turn)

Gear Selector Position	Actual Gear	PRESSURE TAPS							
		Underdrive Clutch	Overdrive Clutch	Reverse Clutch	Torque Converter Clutch Off	Torque Converter Clutch On	2/4 Clutch	Low/Reverse Clutch	
PARK - 0 mph *	PARK	0-2	0-5	0-2	60-110	45-100	0-2	115-145	
REVERSE - 0 mph *	REVERSE	0-2	0-7	165-235	50-100	35-85	0-2	165-235	

NEUTRAL - 0 mph *	NEUTRAL	0-2	0-5	0-2	60-110	45-100	0-2	115-145
Low - 20 mph #	FIRST	110-145	0-5	0-2	60-110	45-100	0-2	115-145
Third - 30 mph #	SECOND	110-145	0-5	0-2	60-110	45-100	115- 145	0-2
Third - 45 mph #	DIRECT	75-95	75-95	0-2	60-90	45-80	0-2	0-2
OD - 30 mph #	OVERDRIVE	0-2	75-95	0-2	60-90	45-80	75-95	0-2
OD - 50 mph #	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	60-95	75-95	0-2
* Engine Speed at 1500 rpm								
# CAUTION: Both wheels must be turning at same speed.								

DIAGNOSIS AND TESTING - CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located by substituting air pressure for fluid pressure. The clutches may be tested by applying air pressure to their respective passages after the valve body has been removed. Use 6599-1 (1) and 6599-2 (1) from special tool Plate Set 6599 to perform test .

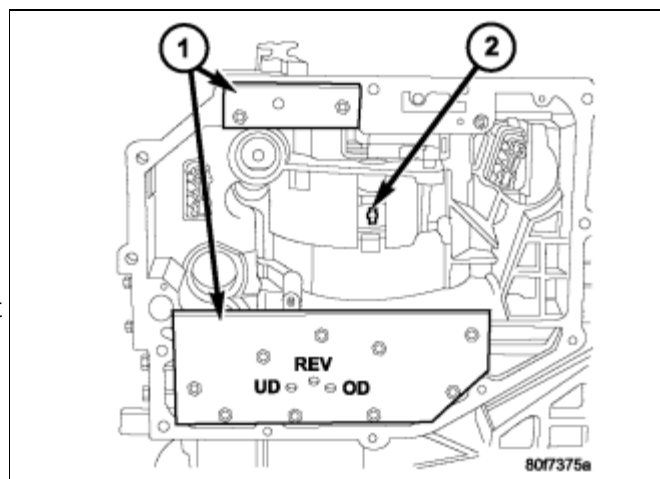
To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

1. Remove oil pan and valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)

2. Apply air pressure to the holes in the special tool (1), one at a time.

3. Listen for the clutch to apply. It will give a slight thud sound. If a large amount of air is heard escaping, the transmission must be removed from vehicle, disassembled and all seals inspected.



2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer (2). Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

REVERSE CLUTCH

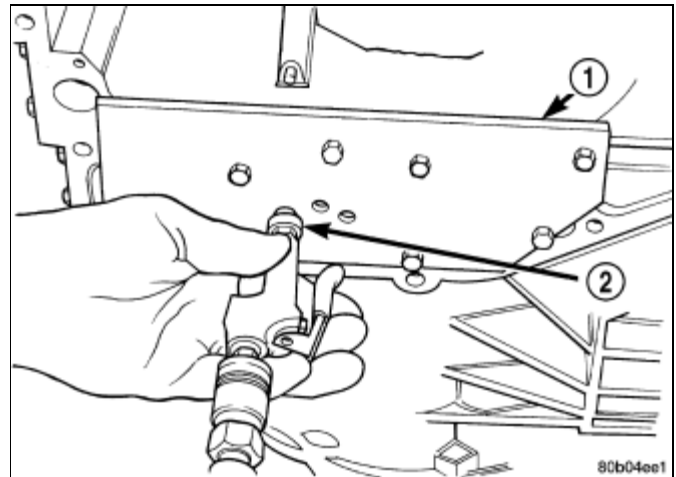
Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole passage. Look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Air pressure is applied to the low/reverse or the 2/4 clutches. This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.



DIAGNOSIS AND TESTING - FLUID LEAKAGE

FLUID LEAKAGE - TORQUE CONVERTER HOUSING AREA

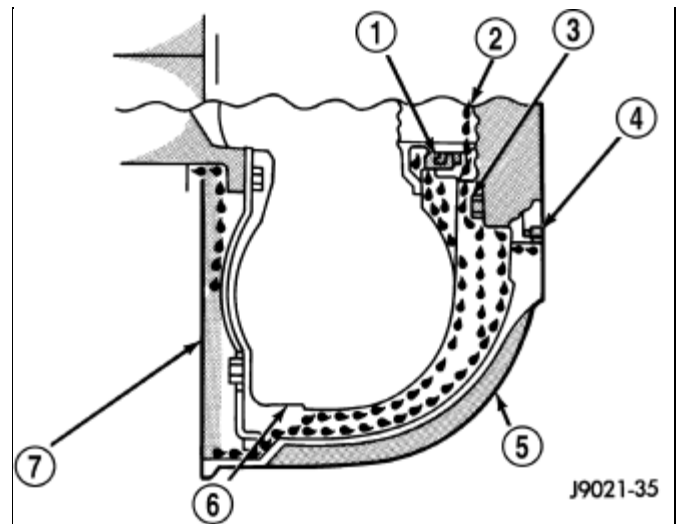
When diagnosing converter housing fluid leaks, three actions must be taken before repair:

1. Verify proper transmission fluid level.
2. Verify that the leak originates from the converter housing area and is transmission fluid.
3. Determine the true source of the leak.

Fluid leakage at or around the torque converter area may originate from an engine oil leak. The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill, or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump o-ring or pump body leaks follow the same path as a seal leak. Pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself. Pump seal or gasket leaks usually travel down the inside of the converter housing.

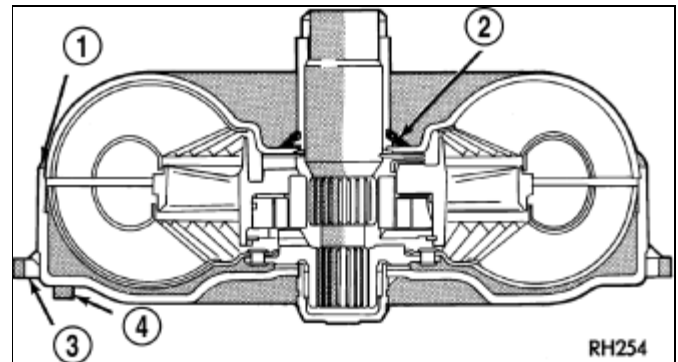


TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter weld.
- Torque converter hub weld.

STANDARD PROCEDURE - ALUMINUM THREAD REPAIR



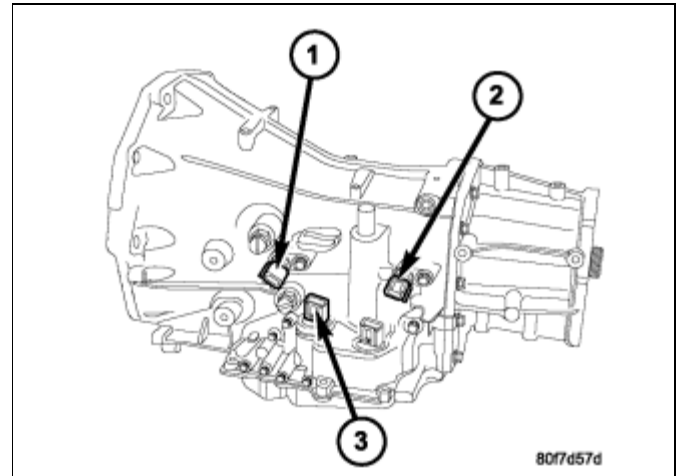
Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils®, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil® tap, or equivalent, and installing a Heli-Coil® insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil®, or equivalent, tools, and inserts are readily available from most automotive parts suppliers.

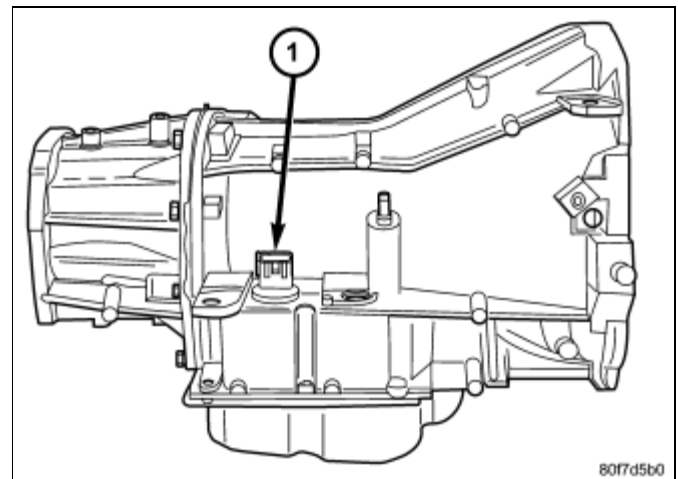
REMOVAL

1. Disconnect battery negative cable.
2. Raise and support vehicle.

3. Disconnect and lower or remove necessary exhaust components.
4. Remove engine-to-transmission bending braces or engine collar.
5. Remove starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)
6. If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)
7. Remove torque converter access structural collar.
8. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.
9. Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
10. Disconnect wires from the input and output speed sensors .
11. Disconnect wires from the transmission range sensor and the solenoid/pressure switch assembly .

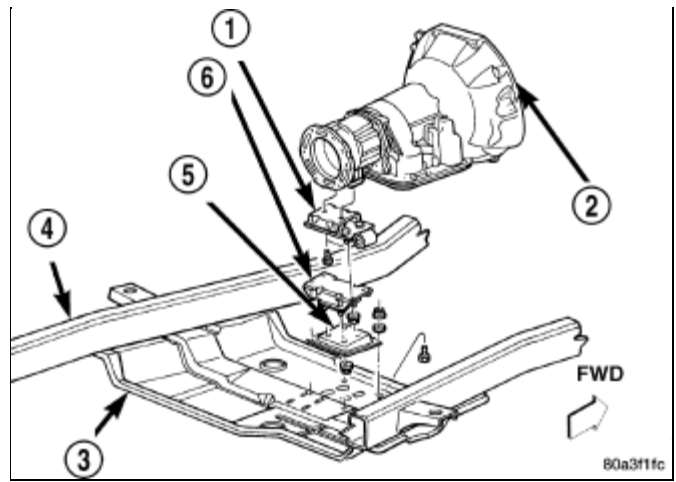


12. Disconnect gearshift cable from transmission manual valve lever.
13. Disconnect shift cable and electrical connector from transfer case.
14. Support rear of engine with safety stand or jack.
15. Raise transmission slightly with service jack to relieve load on skid plate and transmission support.
16. Remove bolts securing rear support and cushion to transmission and skid plate.
17. Remove bolts attaching skid plate to frame and remove skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)



18. Disconnect transfer case vent hose.
19. Remove transfer case. (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL)
20. Remove fill tube bracket bolts and pull tube and vent hose out of transmission. Retain fill tube seal. Remove the bolt attaching transfer case vent tube to converter housing.
21. Remove the fuel line bracket bolt.
22. Disconnect fluid cooler lines at transmission.

23. Remove crank shaft position sensor.
24. Remove all converter housing bolts.
25. Carefully work transmission and torque converter assembly rearward off engine block dowels.
26. Hold torque converter in place during transmission removal.
27. Lower transmission and remove assembly from under the vehicle.
28. To remove torque converter, carefully slide torque converter out of the transmission.



DISASSEMBLY

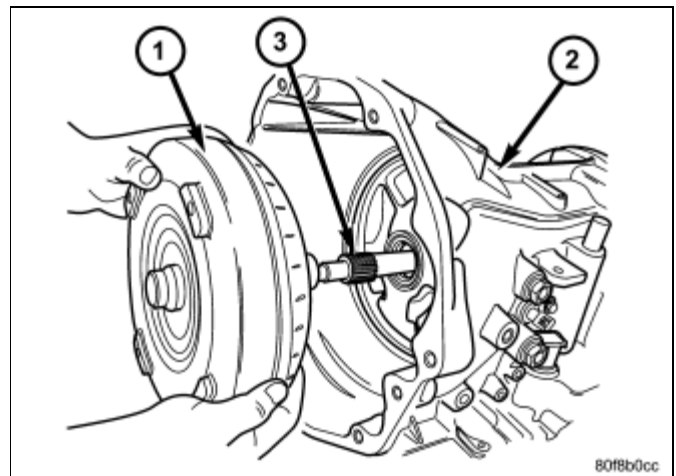
NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

Before disassembling transmission, move the shift lever clockwise as far as it will go and then remove the shift lever.

NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.

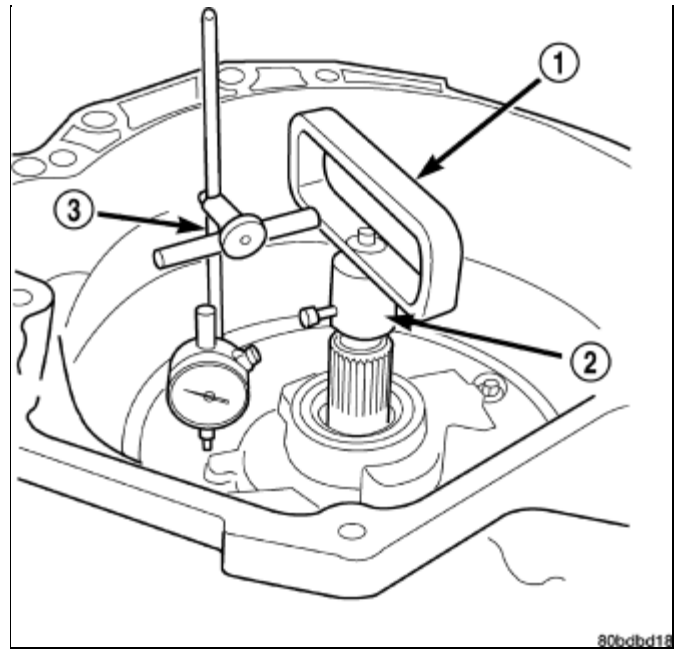
CAUTION: Do not intermix clutch discs or plates as the unit might then fail.

1. Remove the torque converter from the transmission input shaft .



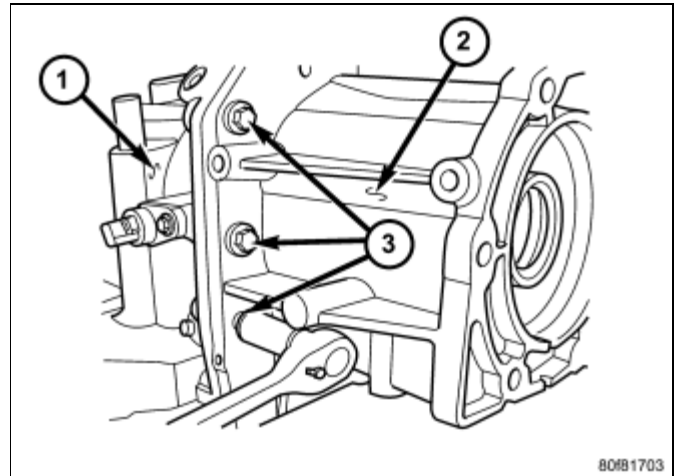
2. Measure input shaft end play using End Play Set 8266. Set up the required pieces from End Play Set 8266 and a dial

indicator as . Move input shaft in and out to obtain end play reading. End play specifications are 0.127 to 0.635 mm (0.005 to 0.025 inch). Record indicator reading for reference when reassembling the transmission. If endplay exceeds the specified range, the #4 thrust plate needs to be inspected and changed if necessary.



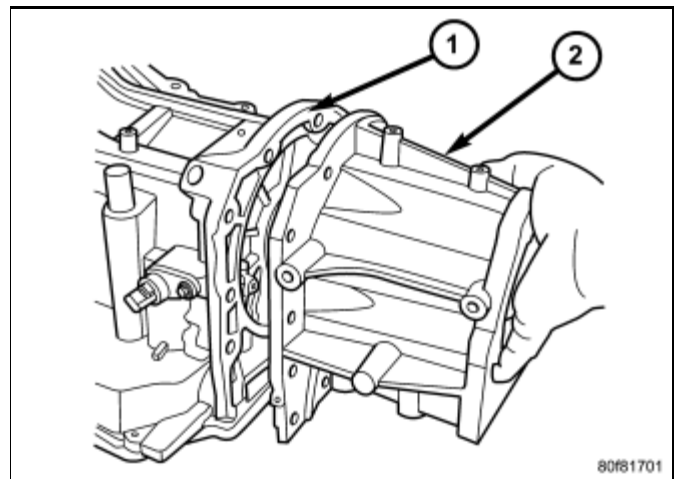
NOTE: The four bolts along the bottom of the adapter housing have a sealing patch applied from the factory. Note the locations of these bolts and separate these bolts for reuse.

3. Remove the bolts that hold the adapter housing onto the transmission case.

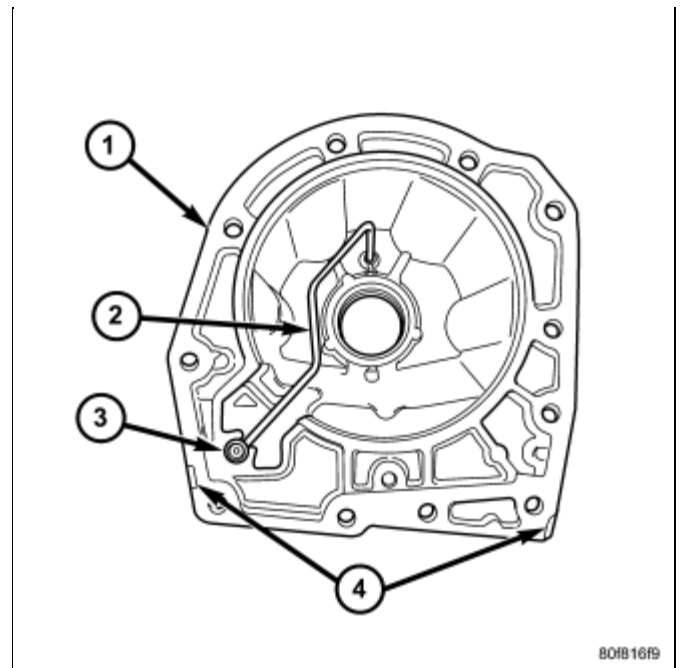


NOTE: There are two pry slots located near the bottom corners of the housing for separating the housing from the transmission case

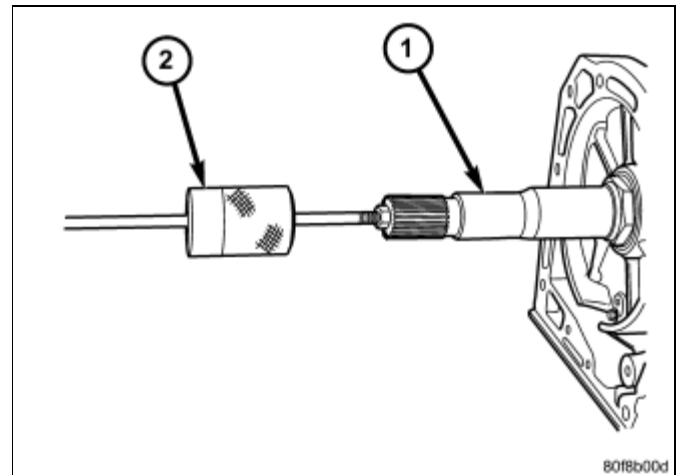
4. Remove the adapter housing from the transmission case.



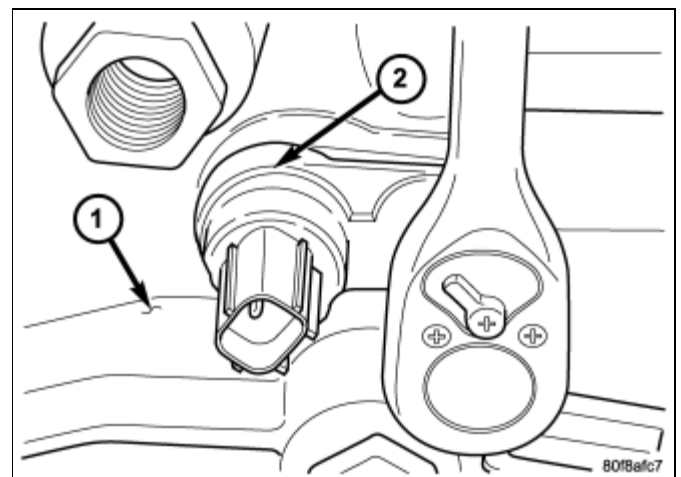
5. Inspect the lube tube grommet for damage. If the grommet lip is damaged, it will need to be replaced.



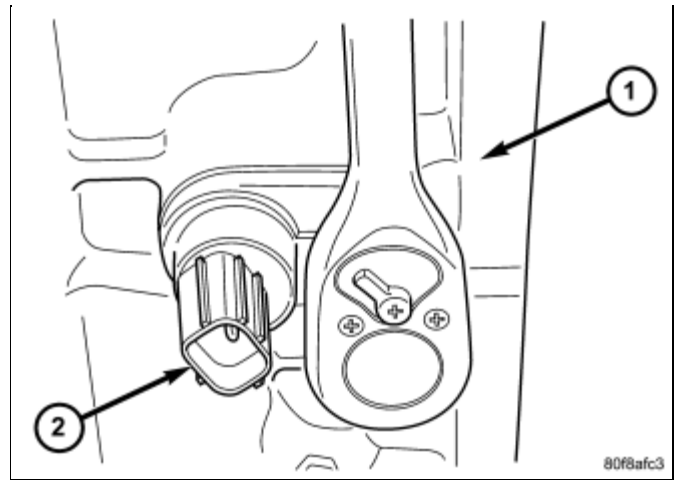
6. Using a Slide Hammer C-3752 , remove the 4X4 stub shaft from the transmission output shaft. Inspect the cir-clip on the shaft for damage and replace the clip if necessary.



7. Remove the input speed sensor bolt and sensor.

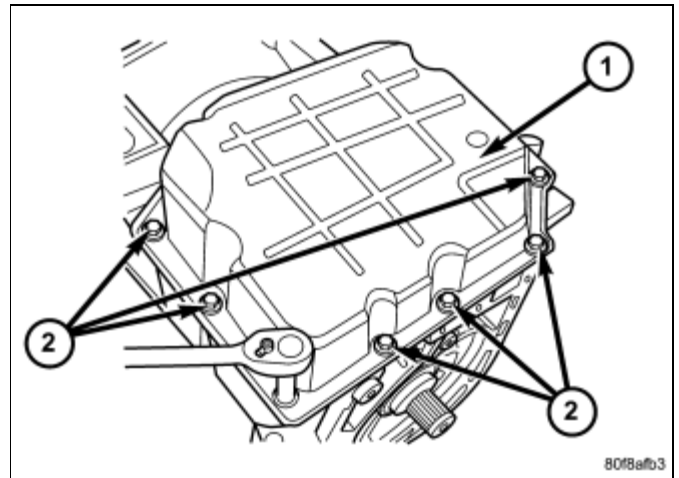


8. Remove the output speed sensor bolt and sensor .

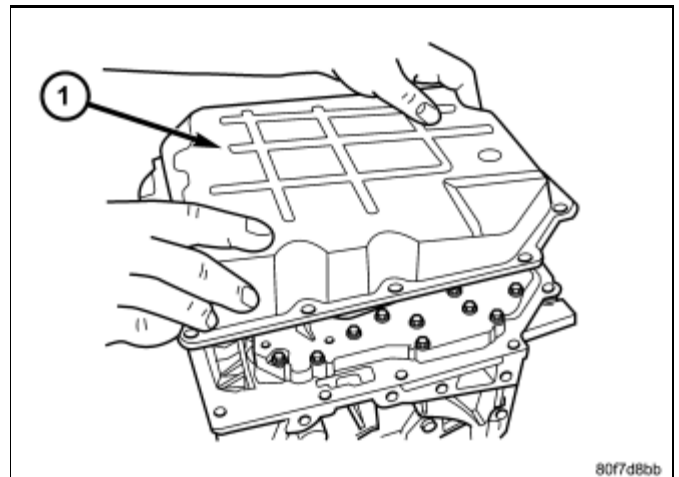


NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolt for reuse.

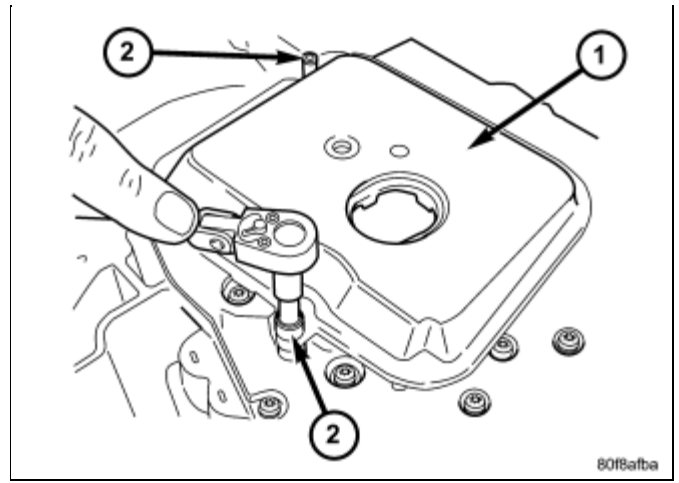
9. Remove the transmission oil pan bolts .



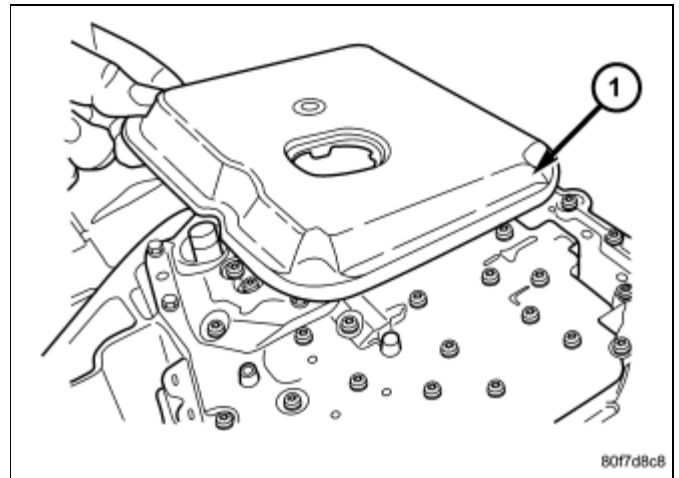
10. Remove the transmission oil pan .



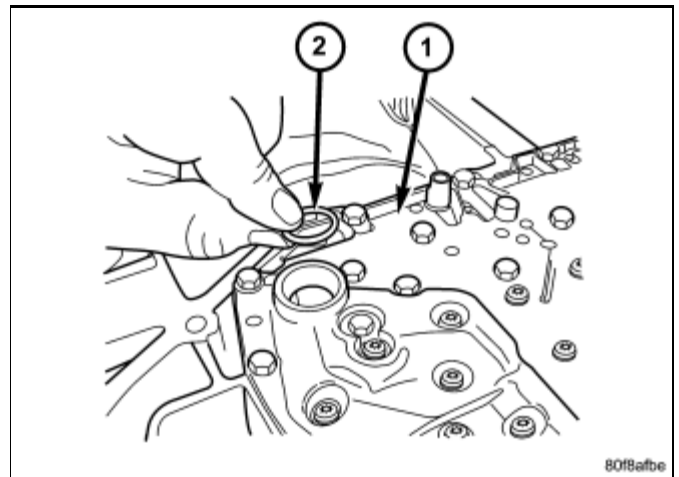
11. Remove the transmission oil filter screws .



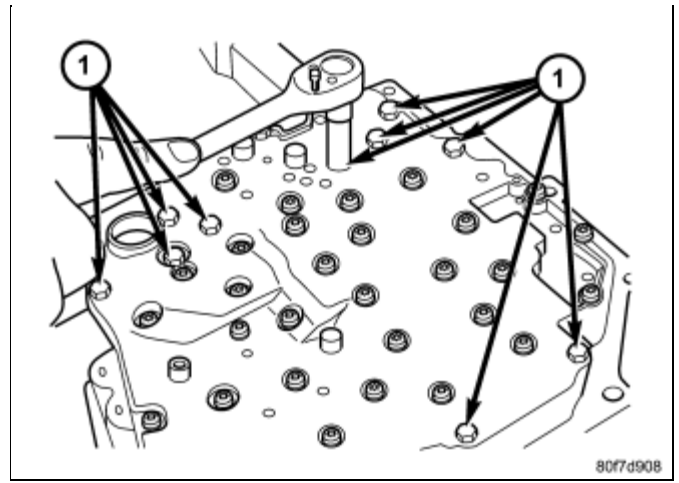
12. Remove transmission oil filter.



13. Remove the oil filter o-ring from the valve body .

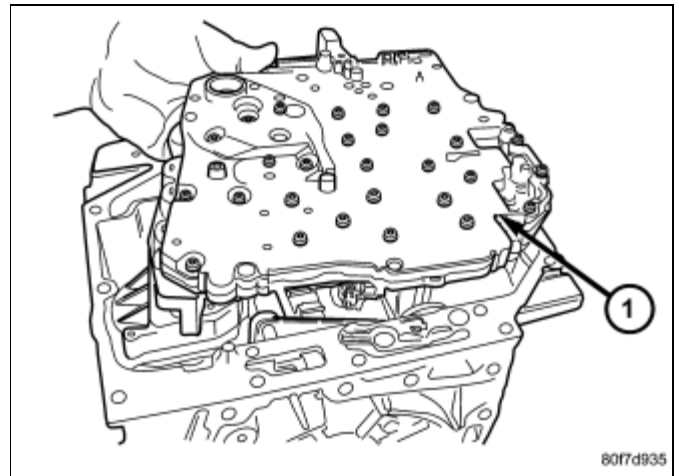


14. Remove valve body-to-case bolts .

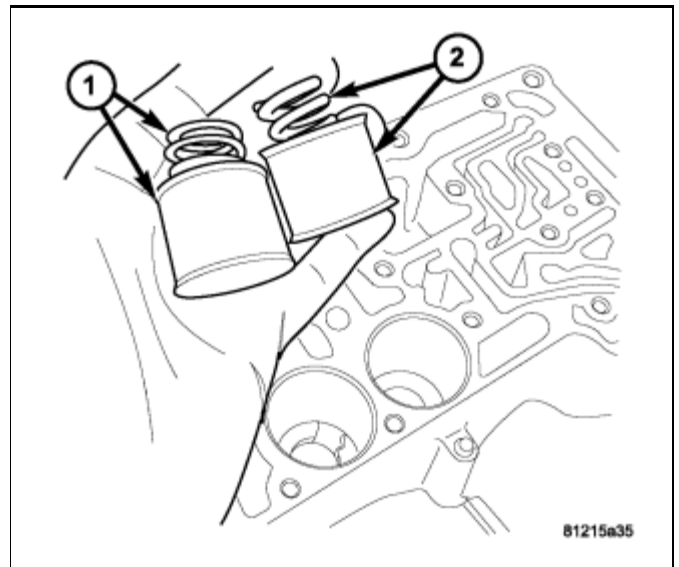


CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

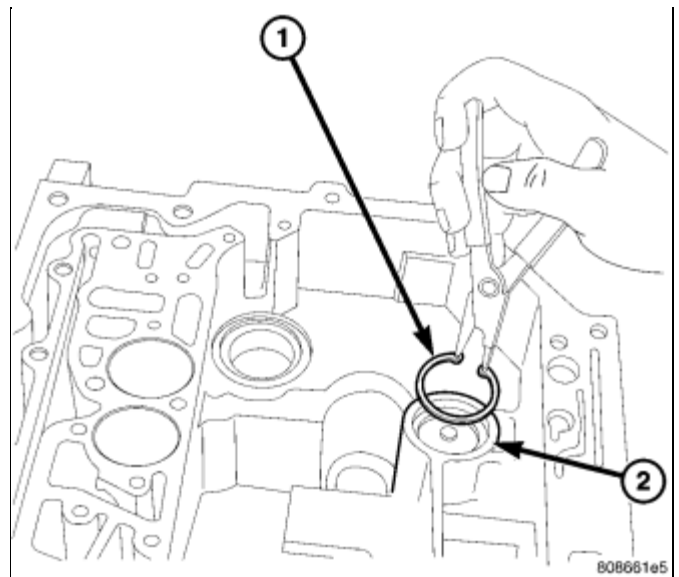
15. Remove valve body from transmission .



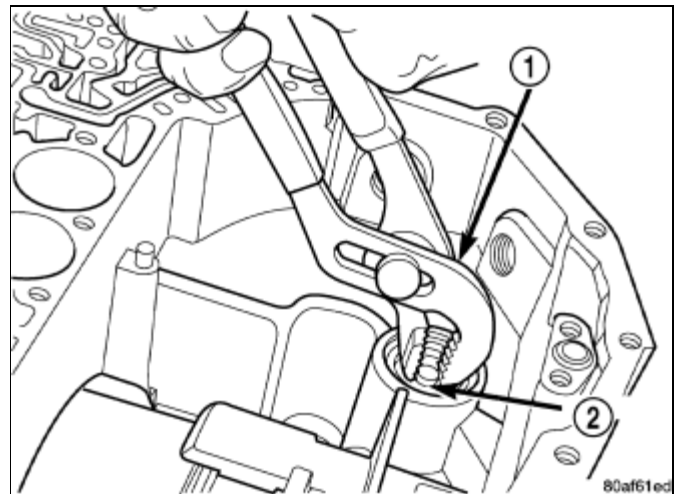
16. Remove underdrive and overdrive accumulators .



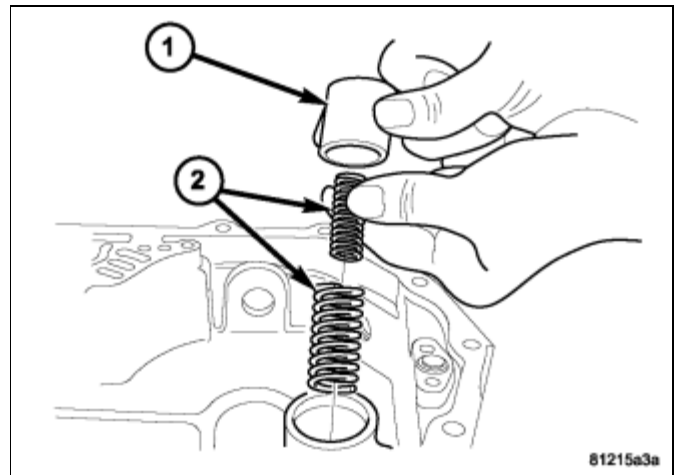
17. Remove the low/reverse accumulator snap ring .



18. Remove the low/reverse accumulator plug .

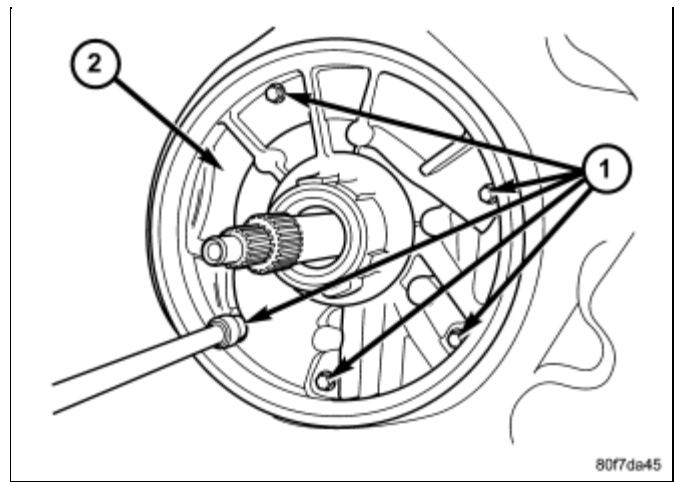


19. Remove low/reverse accumulator piston and springs .

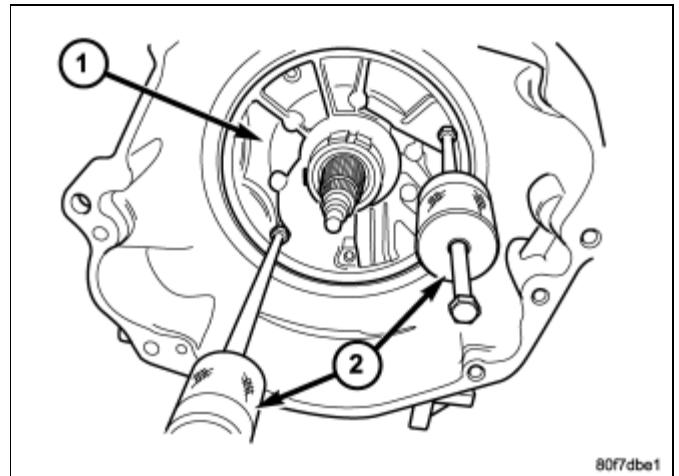


NOTE: The oil pump bolts are not to be reused.

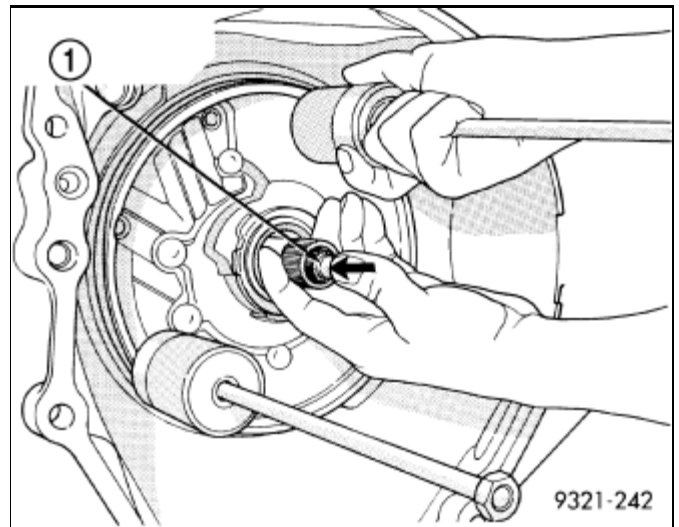
20. Remove and discard the oil pump-to-case bolts .



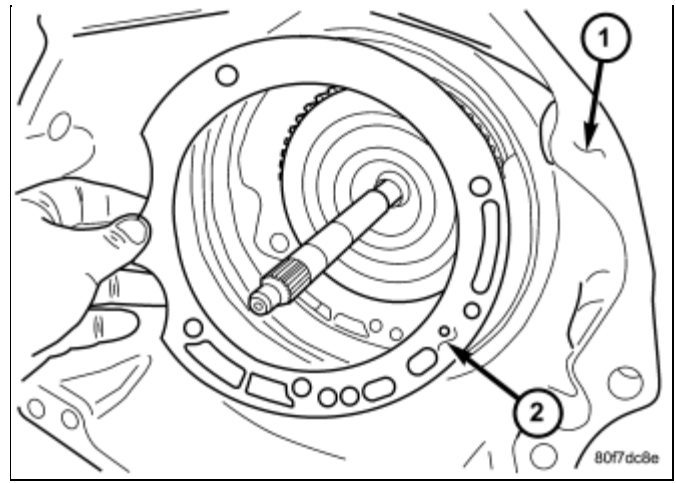
21. Remove oil pump using Slide Hammers C-3752 .



22. Remove oil pump while pushing in on input shaft .

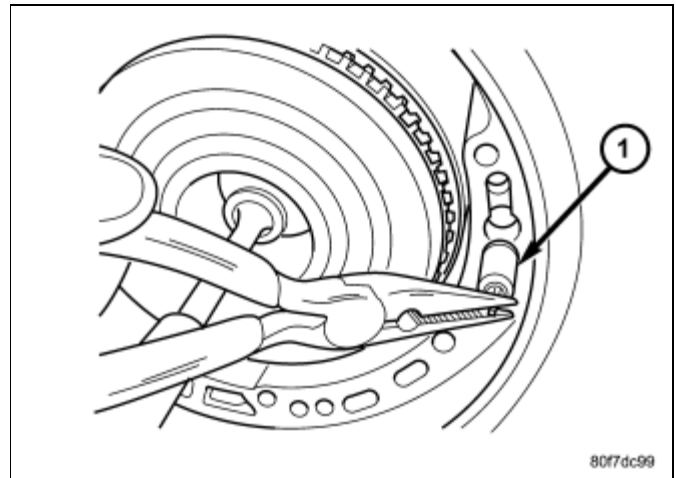


23. Remove oil pump gasket .

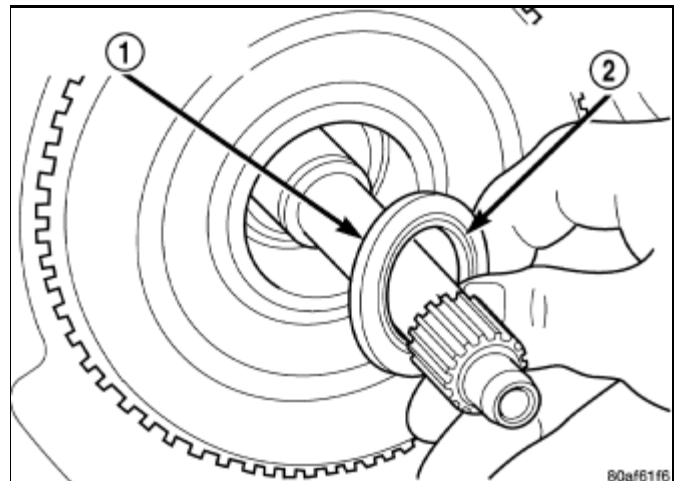


CAUTION: By-pass valve must be replaced if transmission failure occurs.

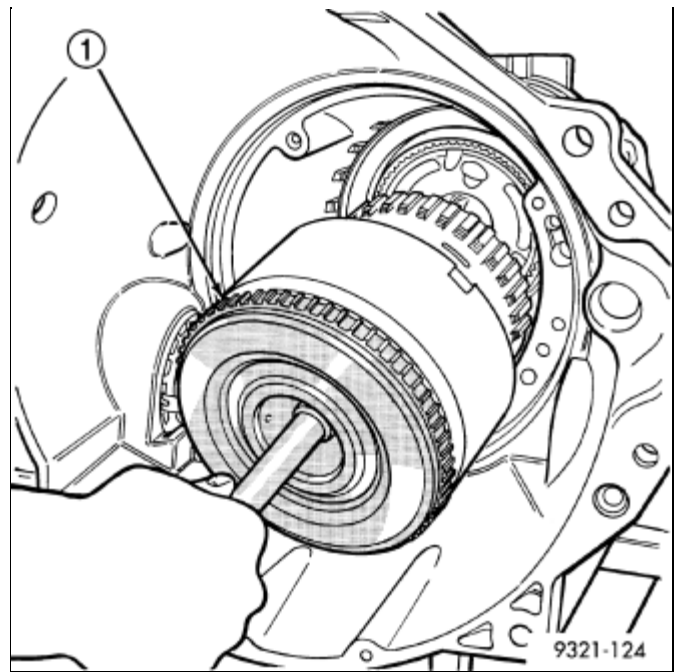
24. Remove the cooler by-pass valve .



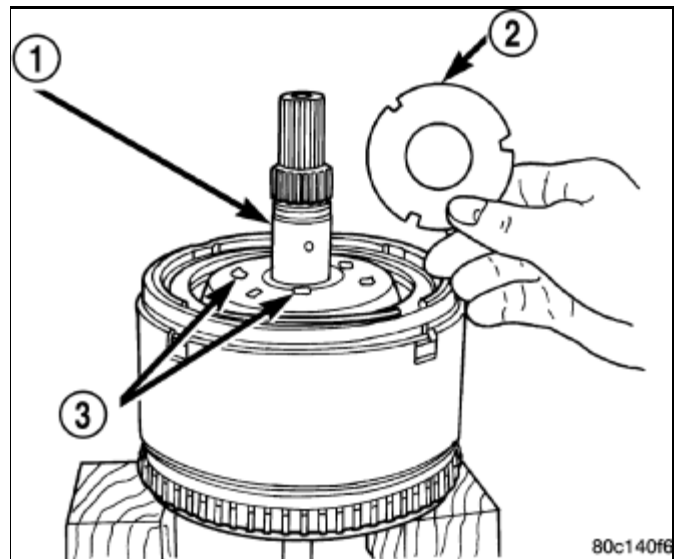
25. Remove the #1 caged needle bearing .



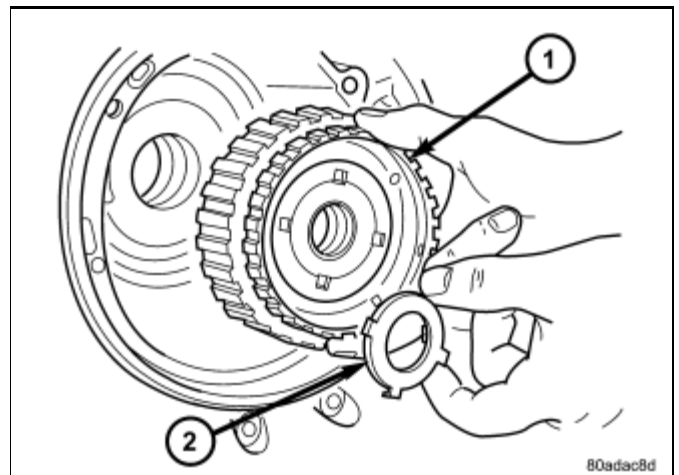
26. Remove the input clutch assembly .



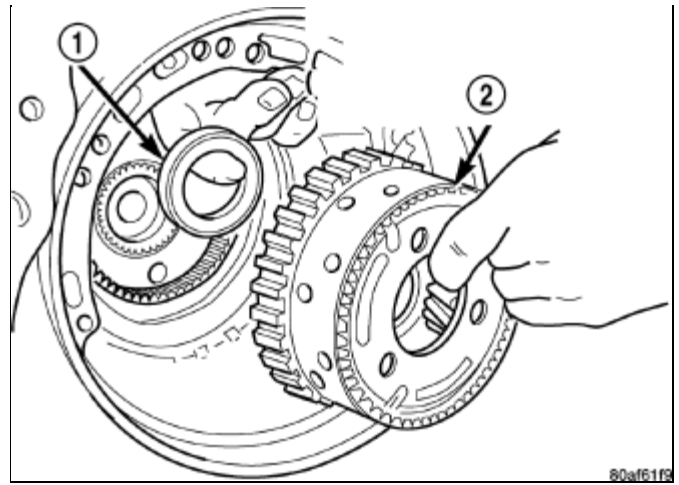
27. Remove the #4 thrust plate .



28. Remove the front sun gear assembly and #4 thrust washer (if still in place) .

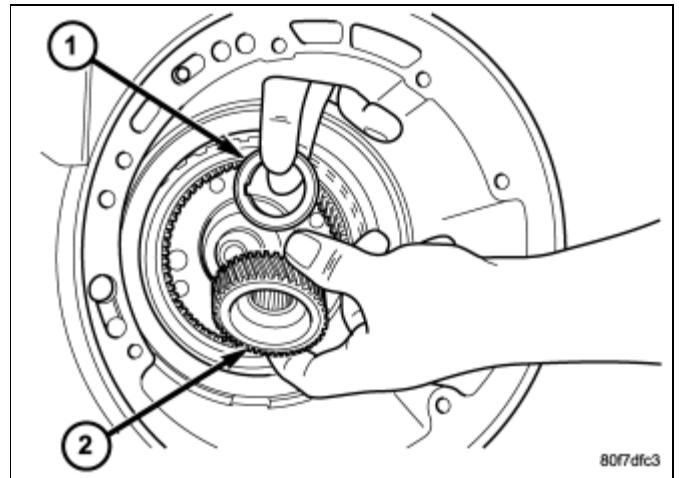


29. Remove the front carrier/rear annulus and #6 needle bearing .



NOTE: The number seven needle bearing has three antireversal tabs and is common with the number five and number two position. The orientation should allow the bearing to seat flat against the rear sun gear .

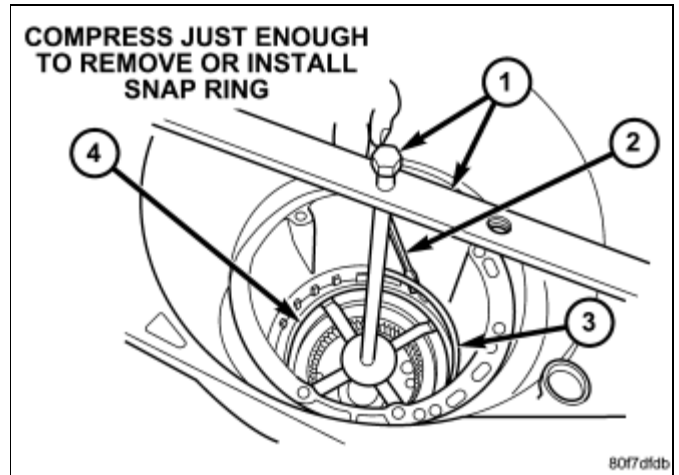
30. Remove the rear sun gear and #7 needle bearing and .



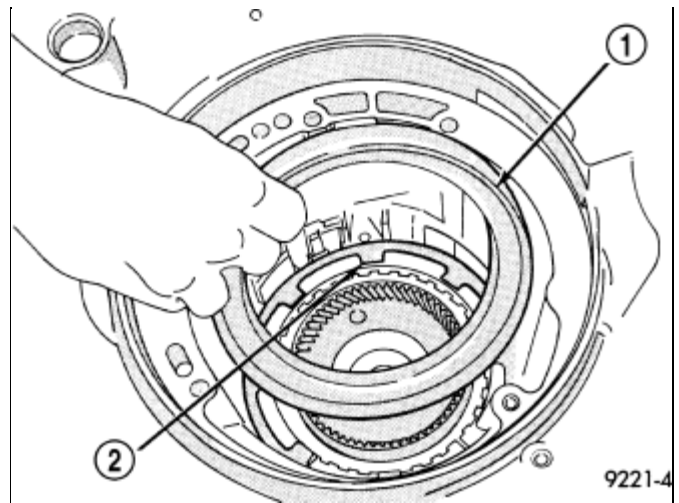
NOTE: Verify that Compressor 5058A is centered properly over the 2/4 clutch retainer before compressing. If necessary, fasten the Compressor 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

31. Install and load Compressor 5058A to remove the 2/4 clutch retainer snap ring .

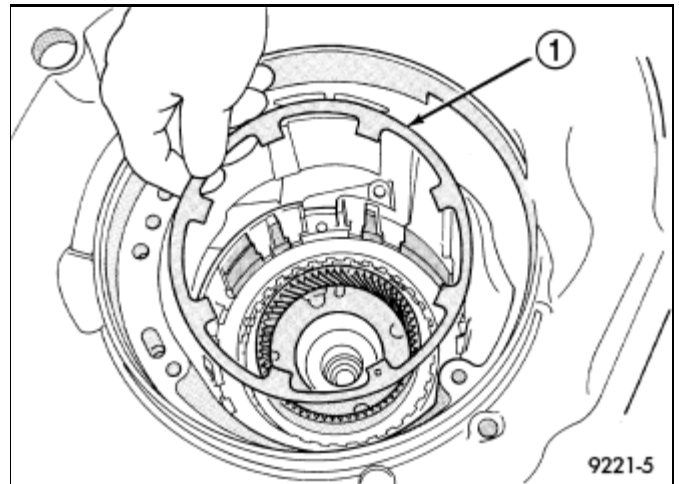
NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.



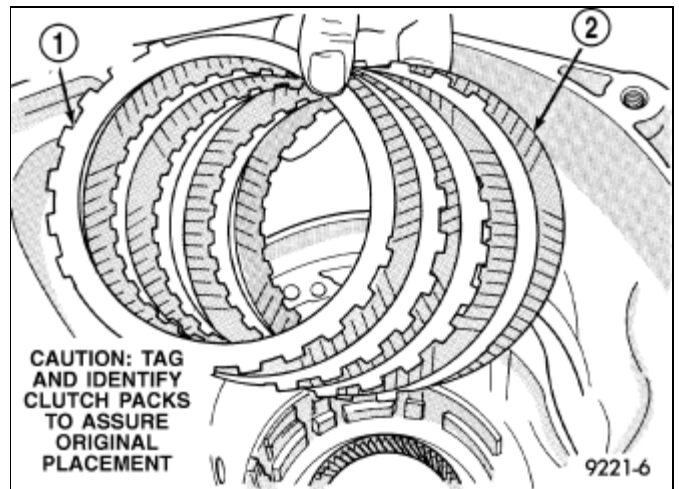
32. Remove the 2/4 clutch retainer .



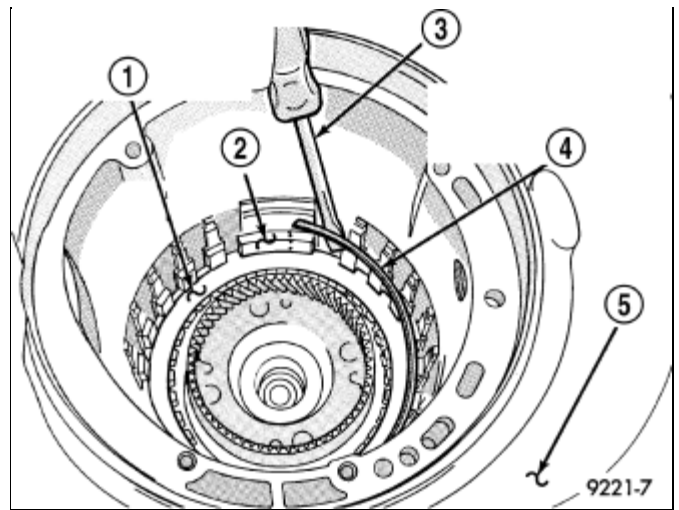
33. Remove the 2/4 clutch return spring .



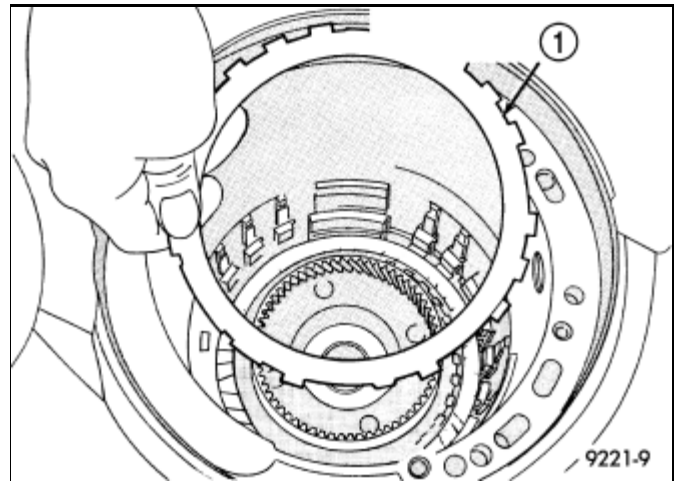
34. Remove the 2/4 clutch pack.



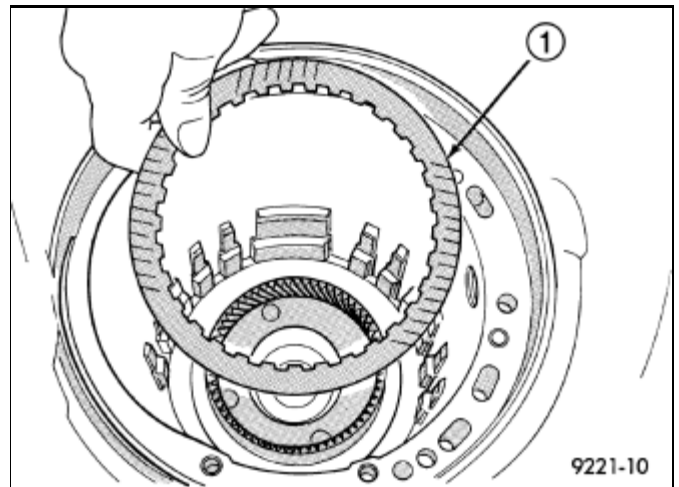
35. Remove the tapered snap ring .



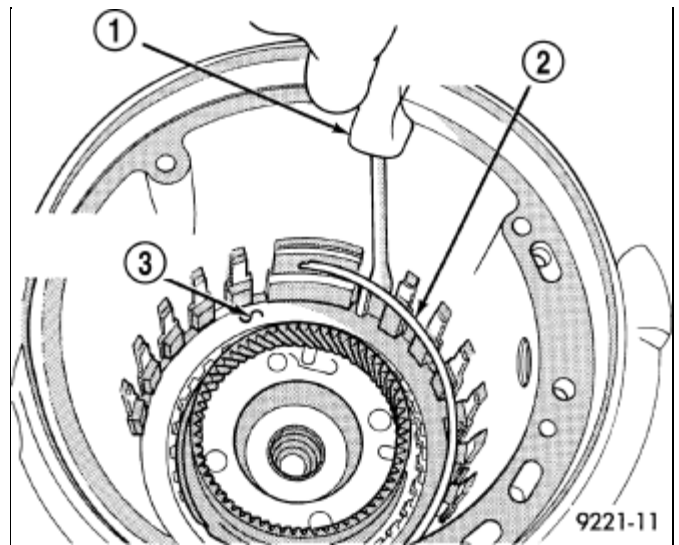
36. Remove the low/reverse reaction plate .



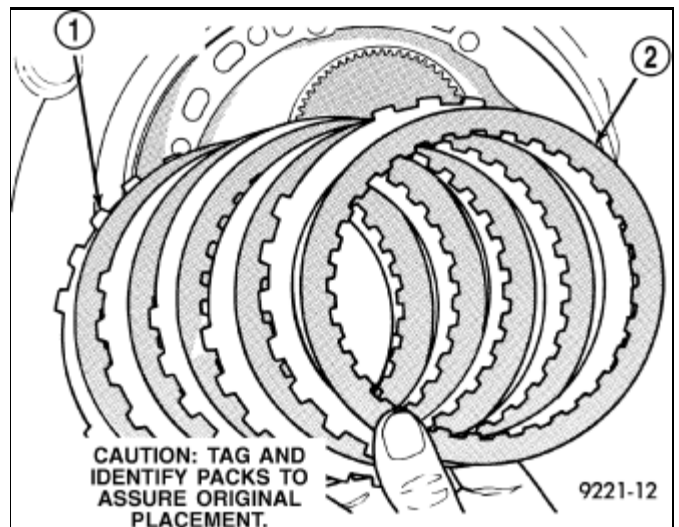
37. Remove one (1) low/reverse clutch disc to facilitate snap ring removal .



38. Remove the low/reverse reaction plate snap ring .



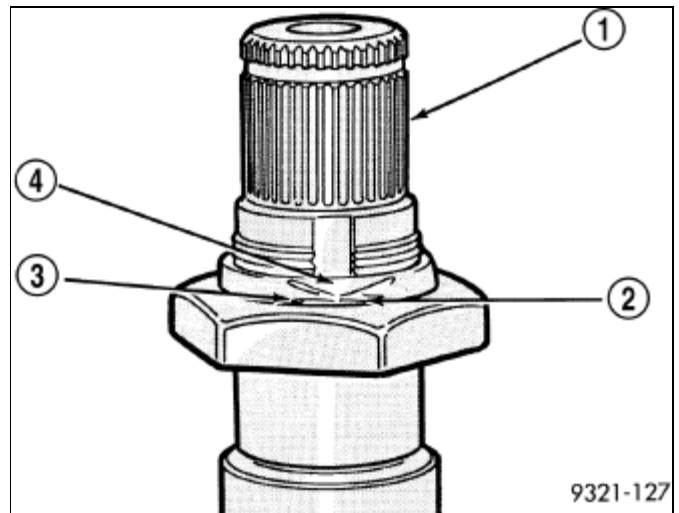
39. Remove the low/reverse clutch pack .



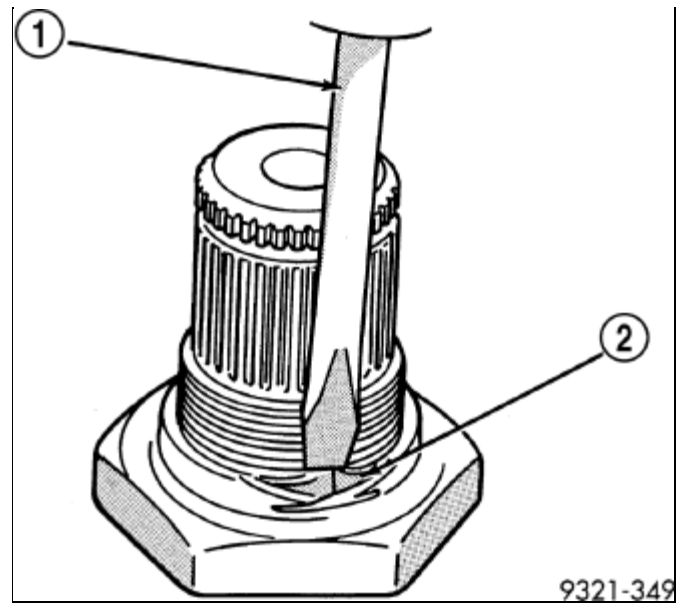
CAUTION: Failure to grind and open stakes of the output shaft nut will result in thread damage to the shaft during nut removal.

WARNING: Wear safety goggles while grinding stake nuts.

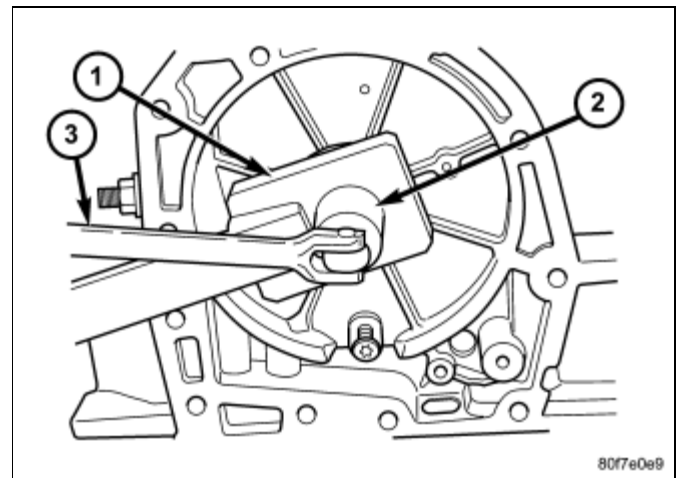
40. Using a die grinder or equivalent, grind the stakes in the shoulder of the shaft nuts as shown in . Do not grind all the way through the nut and into the shaft. There are two stakes on each nut.



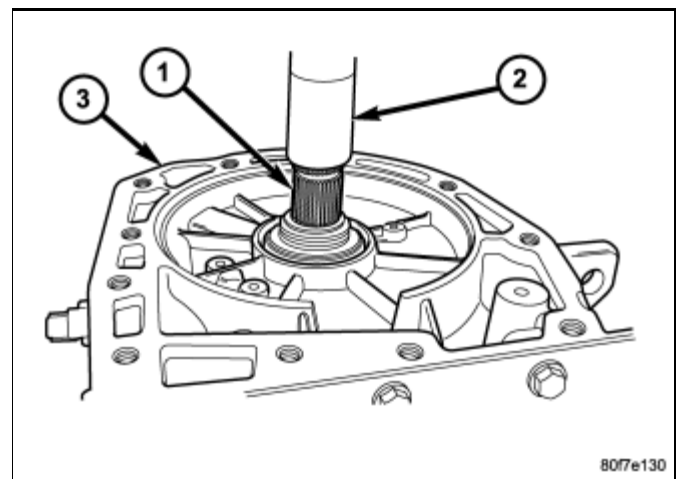
41. Using a small chisel, carefully open the stakes on nut .



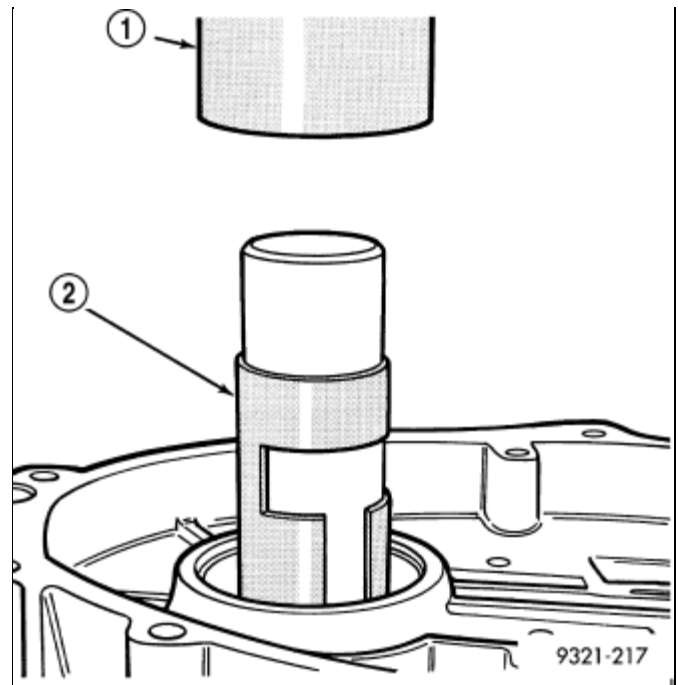
42. Use Wrench 6497 and Wrench 6498A to remove the transfer shaft nut or the output shaft nut .



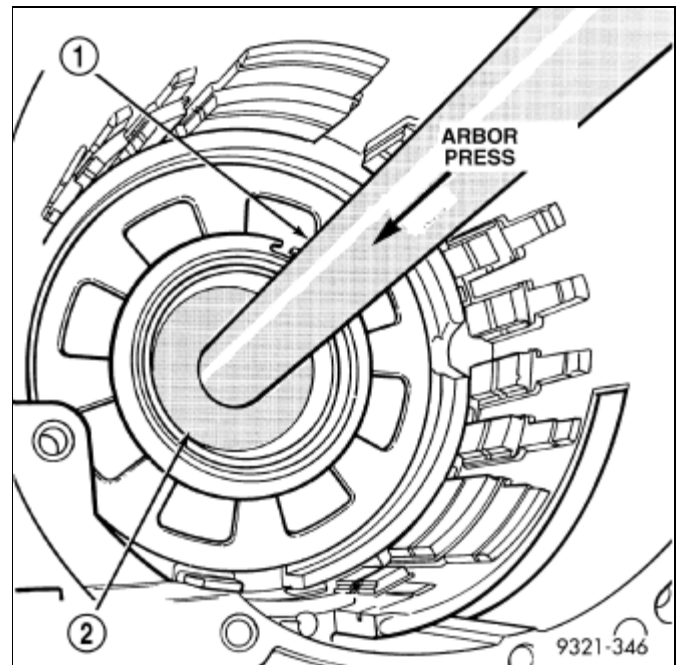
43. Remove the output shaft from case using a press .



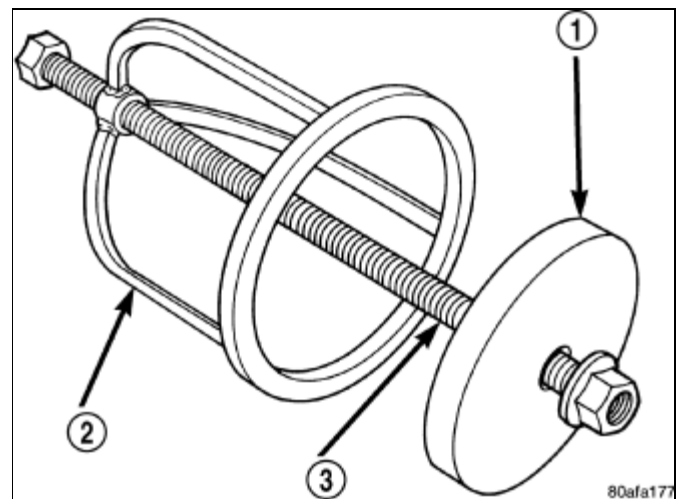
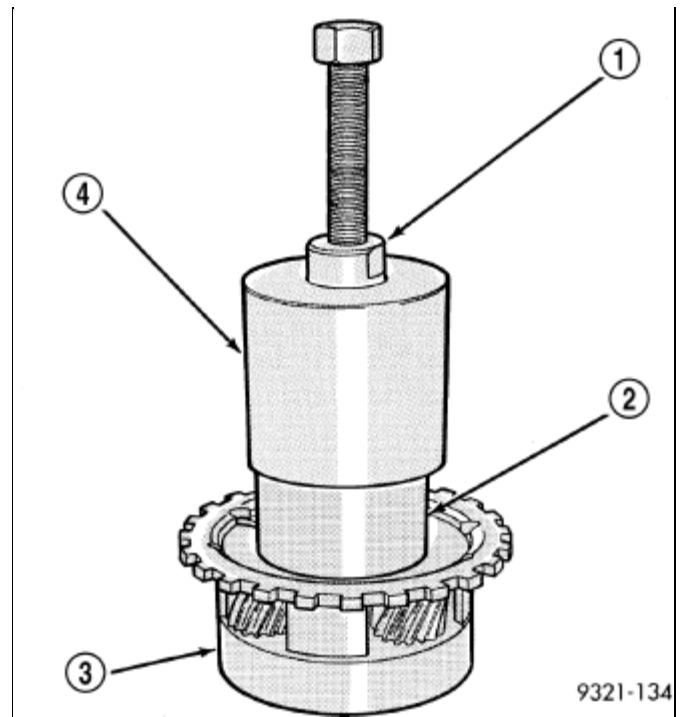
Use Remover 6596 with a press to remove the front output shaft bearing cup .



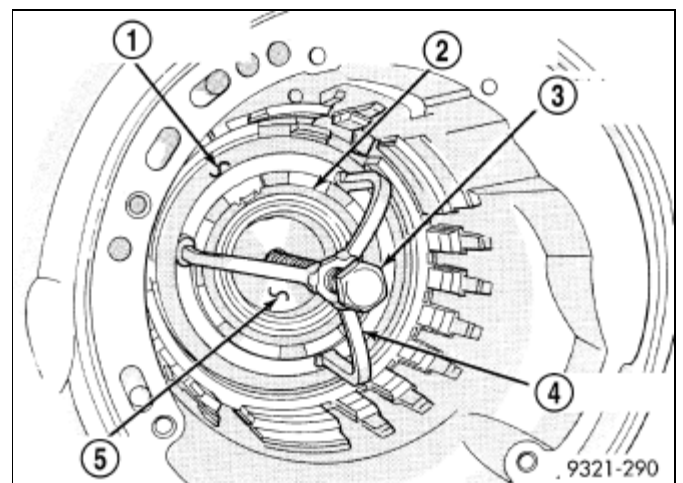
44. Use Remover 6597 and Universal Handle C-4171 and Handle Extension C-4171-2 to press the rear output shaft bearing cup rearward .



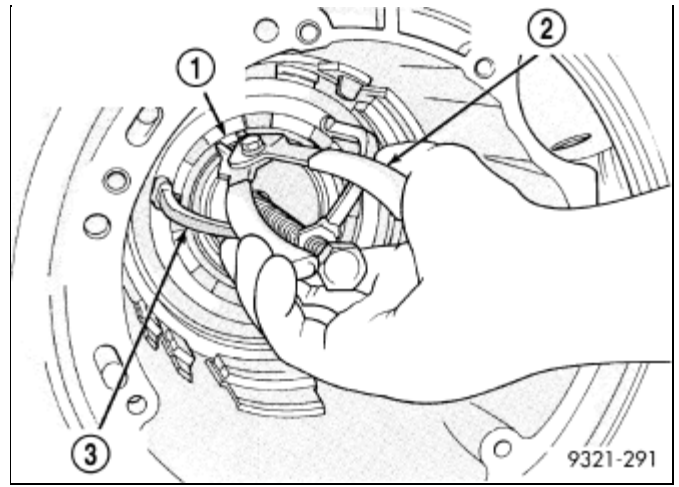
45. Remove the rear carrier front bearing cone .



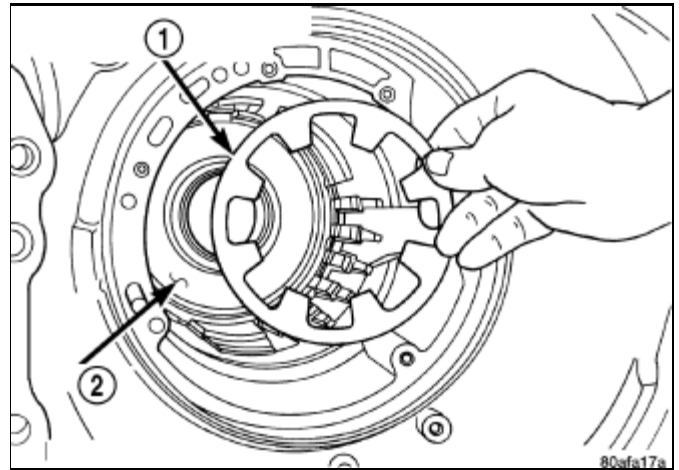
46. Install and load compressor



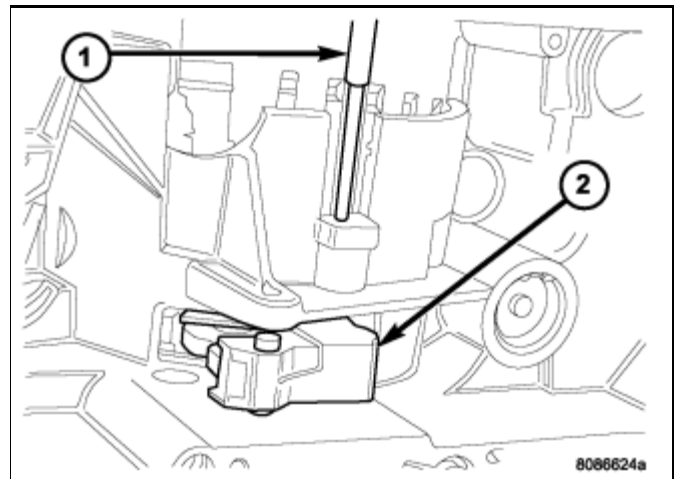
47. Remove the low/reverse belleville spring snap ring .

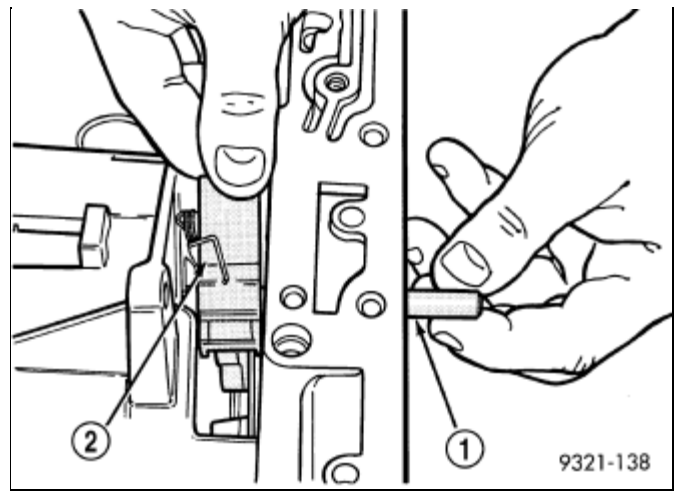


48. Remove the low/reverse piston belleville spring .
49. Remove the park sprag pivot retaining screw.

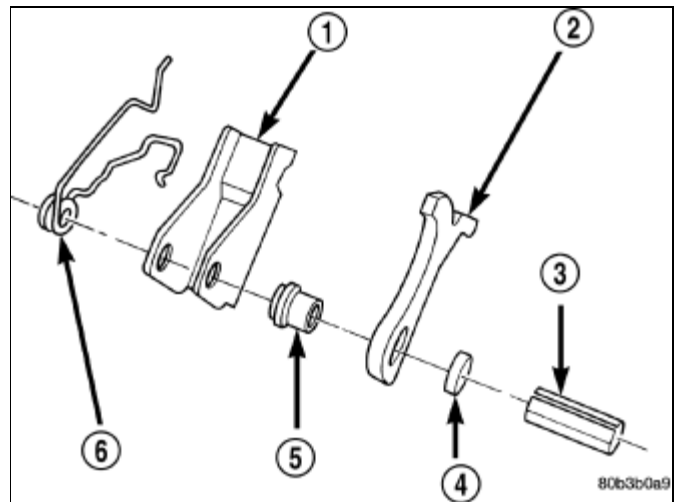


50. Drive out the anchor shaft using suitable punch .



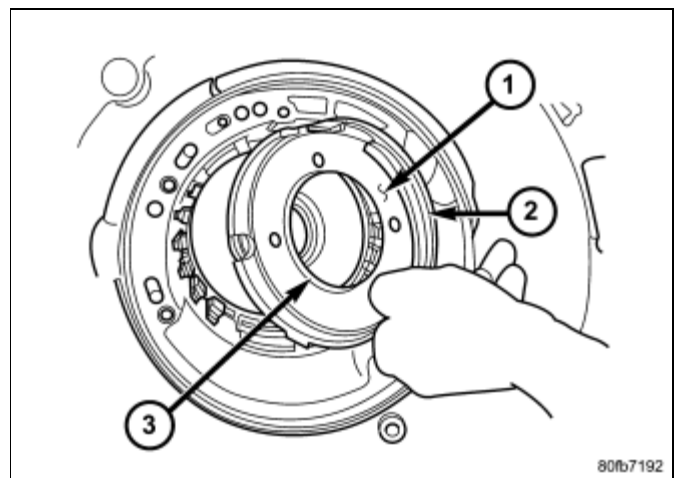


51. Remove the guide bracket pivot shaft . Inspect all components for wear and replace if necessary.

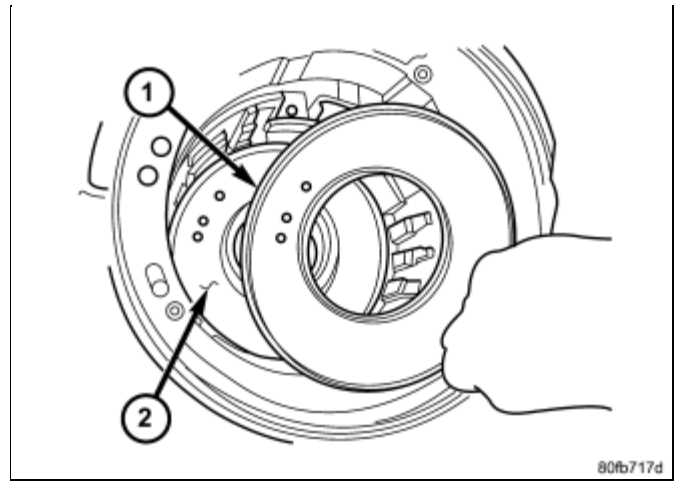


NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

52. Remove the low/reverse clutch piston .
53. Remove the low/reverse piston retainer screws.



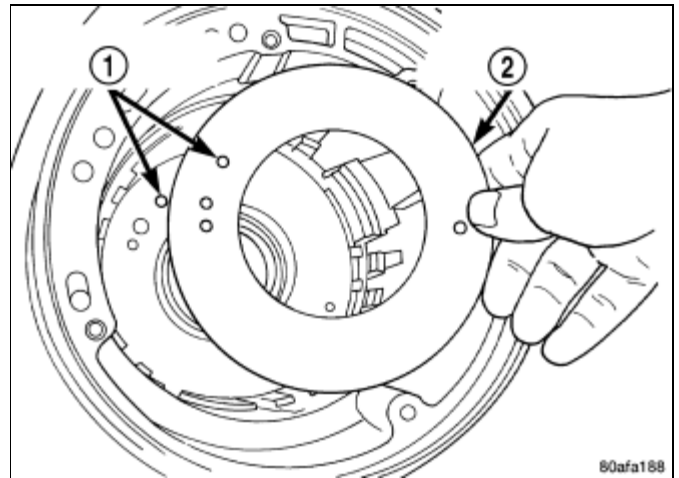
54. Remove low/reverse piston retainer .

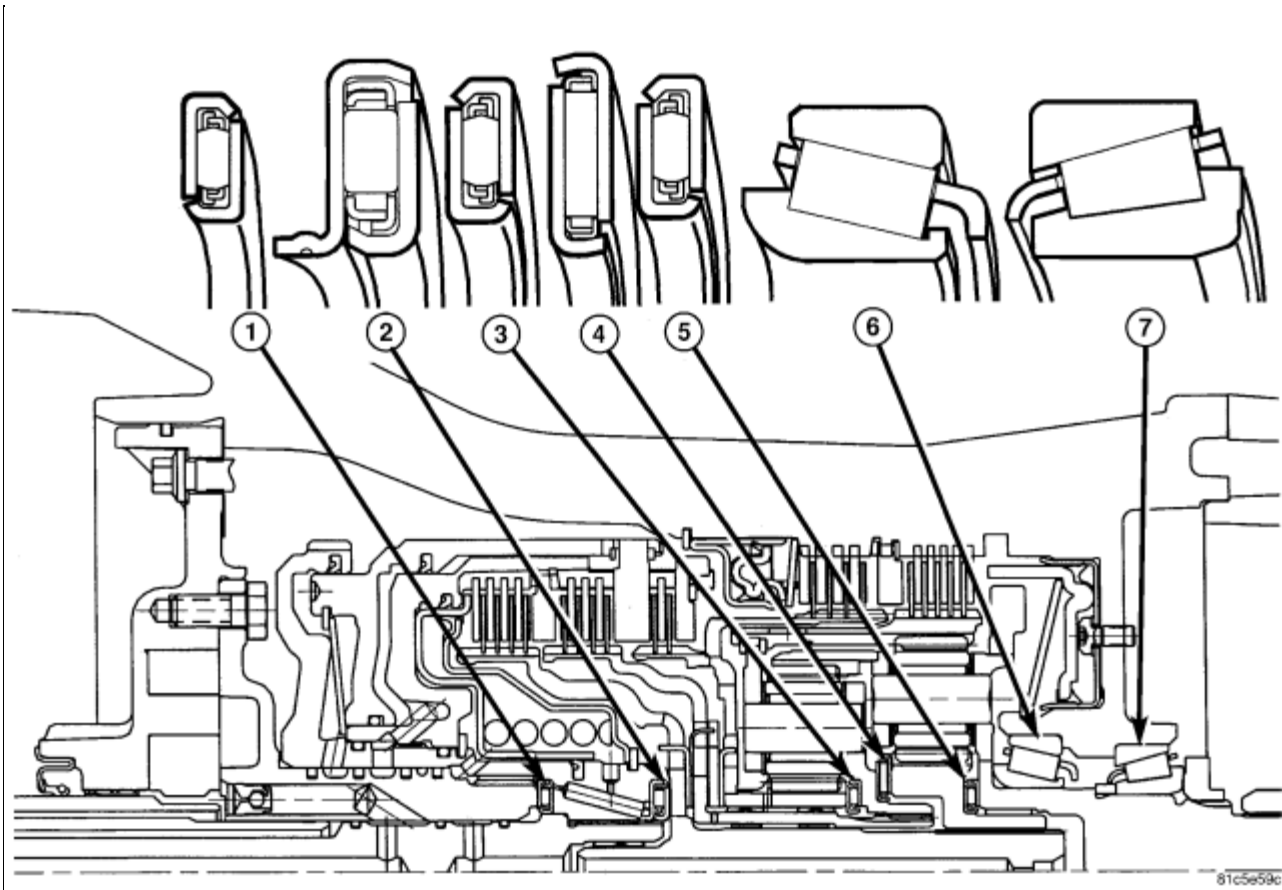


55. Remove the low/reverse piston retainer gasket .

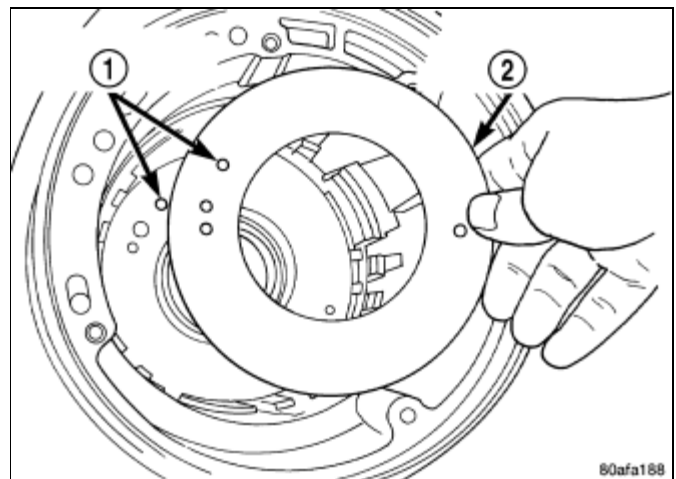
ASSEMBLY

NOTE: If the transmission assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the Scan Tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

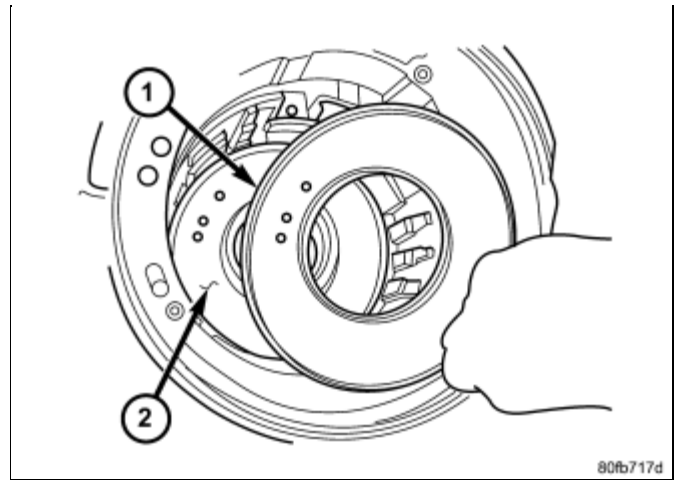




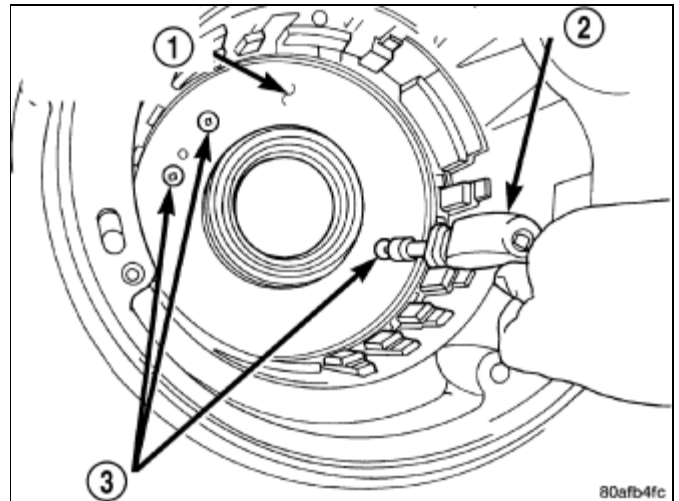
1. Install the output bearing cups using Installer 5050A.
2. Install low/reverse piston retainer gasket .



3. Install low/reverse piston retainer .

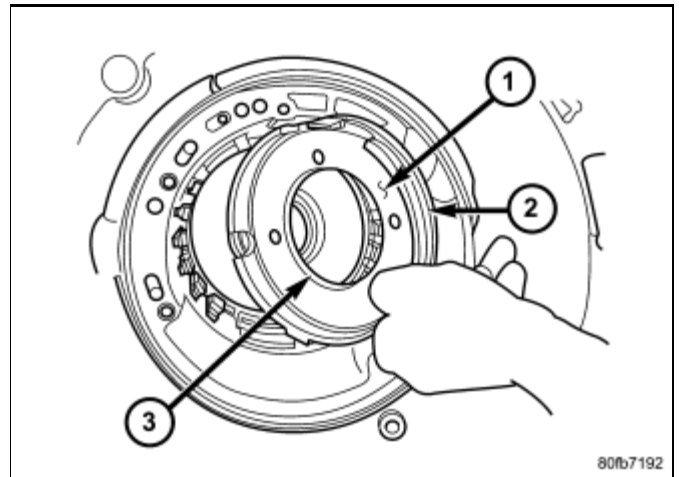


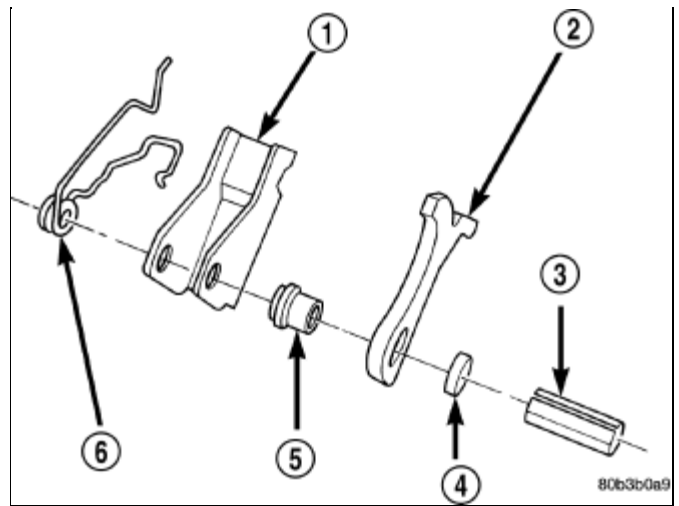
4. Install low/reverse piston retainer-to-case screws and torque to 5 N·m (45 in. lbs.).



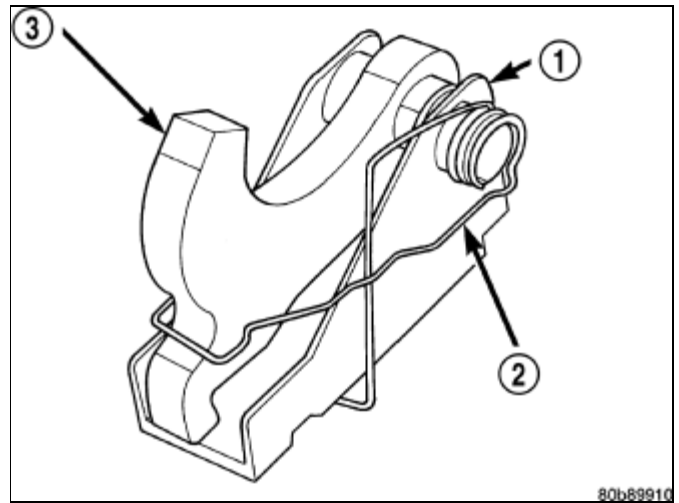
NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

5. Install low/reverse clutch piston .





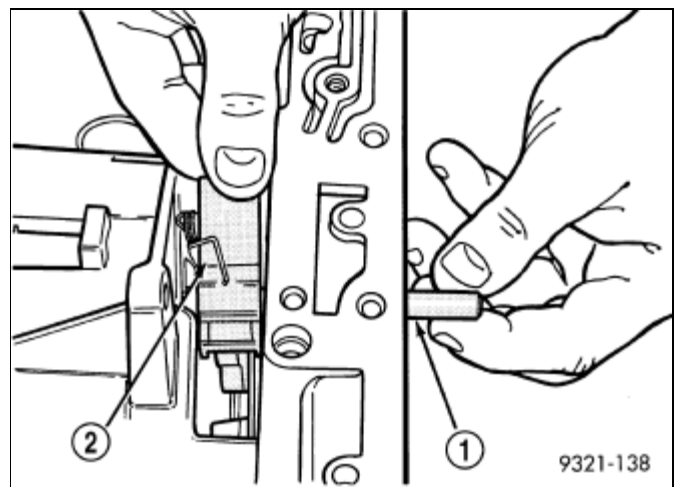
6. Assemble guide bracket assembly as shown in .



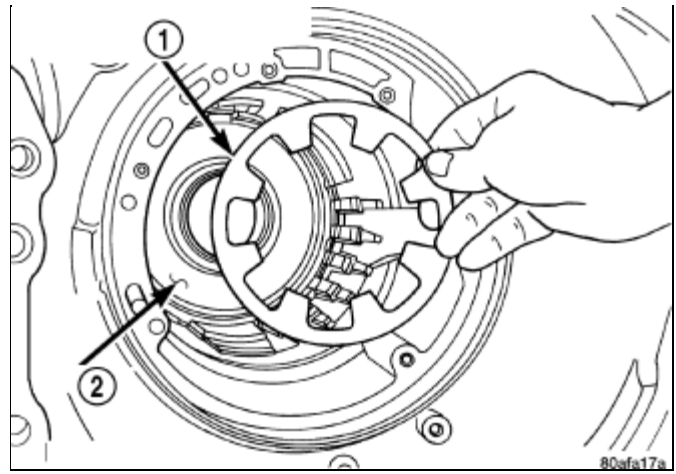
CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transmission case.

7. Install guide bracket pivot shaft .

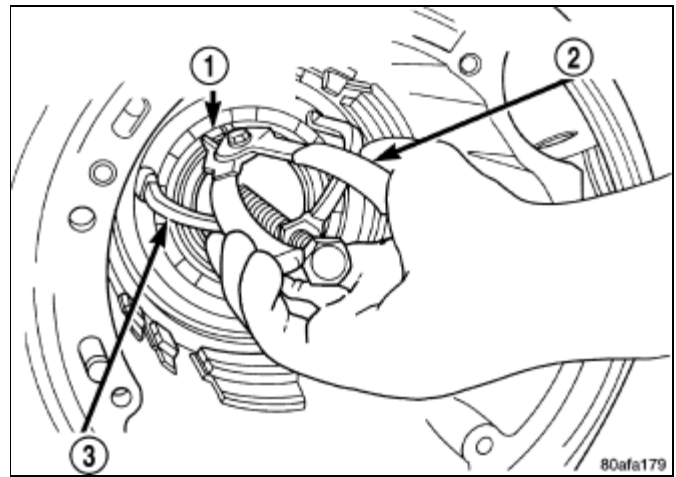
8. Install park sprag pivot retaining screw and torque to 4.5 N·m (40 in. lbs.).



9. Install low/reverse piston belleville spring into position .



10. Install snap ring and remove compressor tool .



11. Install rear carrier front bearing cone .

12. Check output bearing preload. **Output bearing preload must be checked and adjusted if any of the following items have been replaced:**

- Output shaft (rear carrier assembly)
- Output shaft bearings
- Transmission case

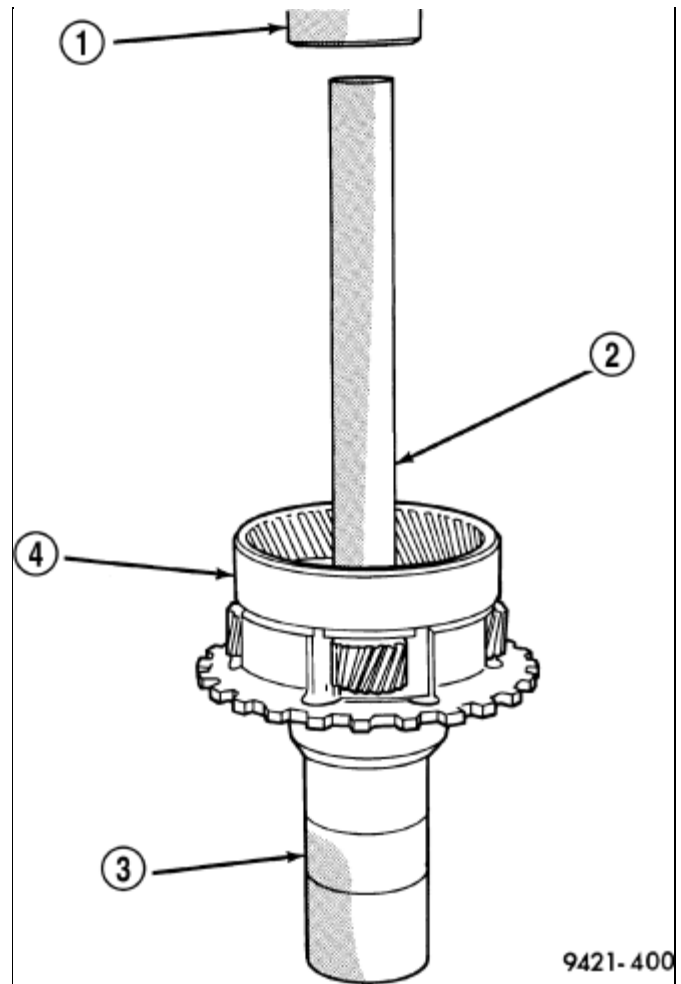
a. **PRELOAD CHECK/SHIM SELECTION:** Install rear output shaft bearing cone and Support Plate 6618 A.

b. Install Support Plate 6618 A . Lightly tighten retaining screws. Screws should be below the plate surface, but do not snug screws.

c. Turn case over on arbor press so that the plate is resting on the press base. **CAUTION: The output shaft will extend through the hole of Support Plate 6618 A. Ensure your press table has clearance for the output shaft.**

d. Install shim on output shaft . Apply small amount of petrolatum onto the shim to hold it in place. Use the original shim as a starting point. If original shim is not available, use the thickest shim available.

e. Install output shaft/rear carrier into rear bearing. The shaft must be pressed into position. Use special tool Bearing



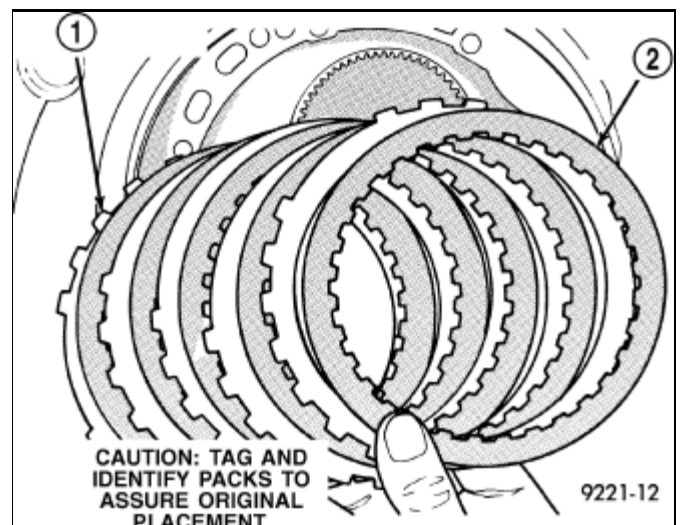
Installer MD-998911 (Disc) Extension handle C- 4171 and C4171-2 (Handle) to press shaft into rear bearing .

f. **Do not re-use old output shaft nut because the removed stake weakens the nut flange.** Using special Wrench 6497 and Wrench socket 6498-A, install new output shaft nut. Do not reuse old output shaft nut. Tighten new output shaft nut to 271 N·m (200 ft. lbs.).

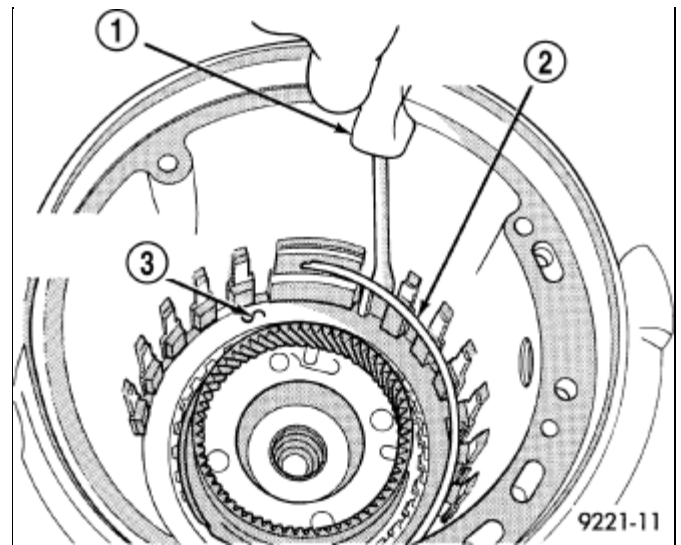
g. Check the turning torque of the output shaft . The shaft should have 1 to 8 in. lbs. of turning torque. If the turning torque is **higher than** 8 in. lbs., install a thicker shim. If turning torque is **less than** 1 in. lb., install a thinner shim. Make sure there is no end play.

h. The new nut must be staked after the correct turning torque is obtained . Use special Staking Tool 6639 to stake output shaft nut. **CAUTION: Failure to stake nut could allow the nut to back-off during use.**

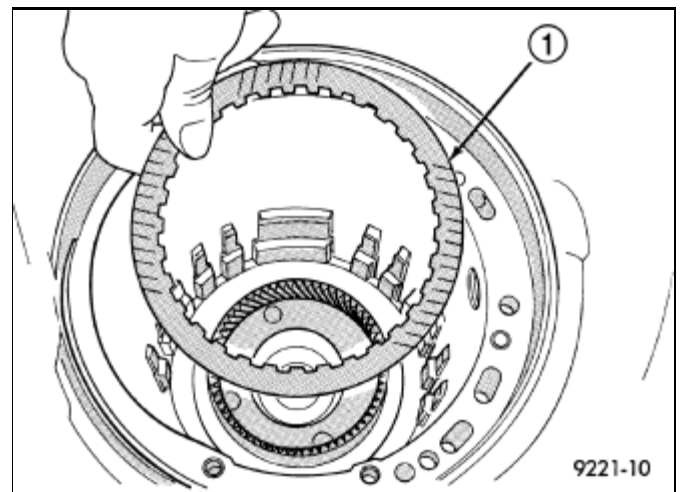
13. Install low/reverse clutch pack . Leave uppermost disc out to facilitate snap ring installation.



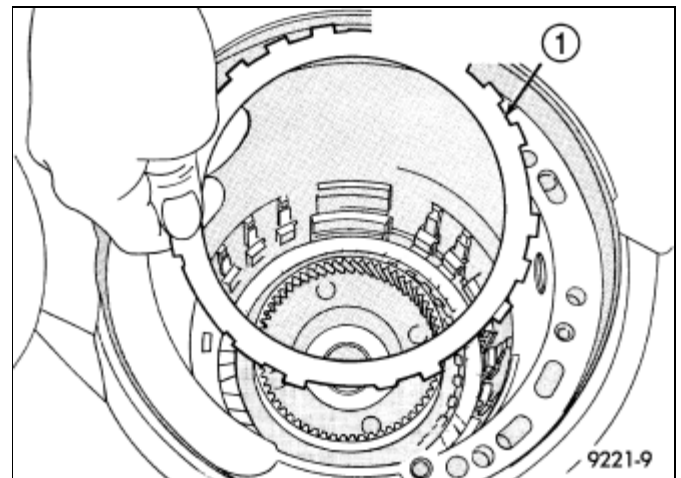
14. Install low/reverse reaction plate snap ring .

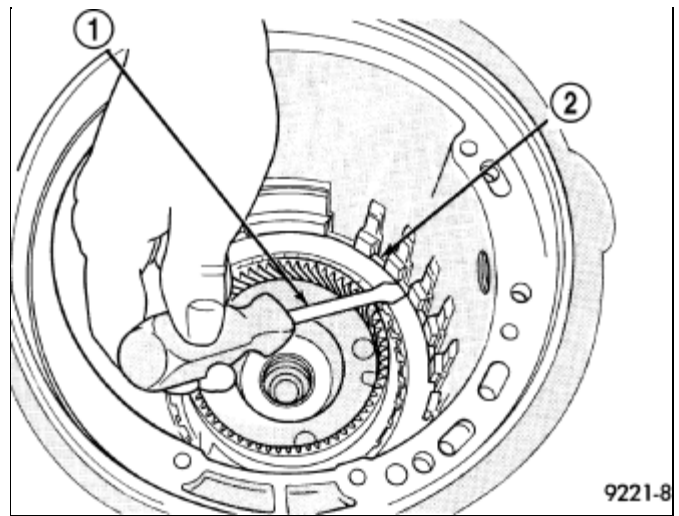


15. Install one low/reverse clutch disc .

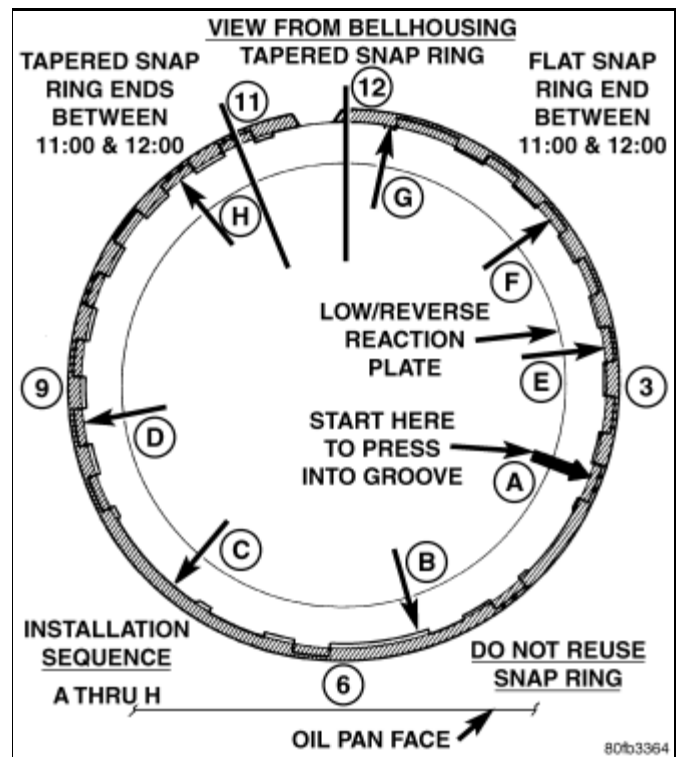


16. Install low/reverse reaction plate with flat side up .



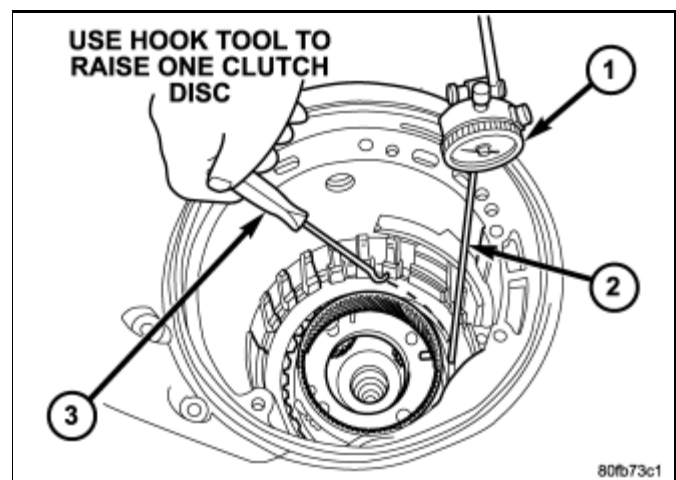


17. Install a new tapered snap ring (tapered side out) . Make sure that the snap ring ends are oriented as shown.



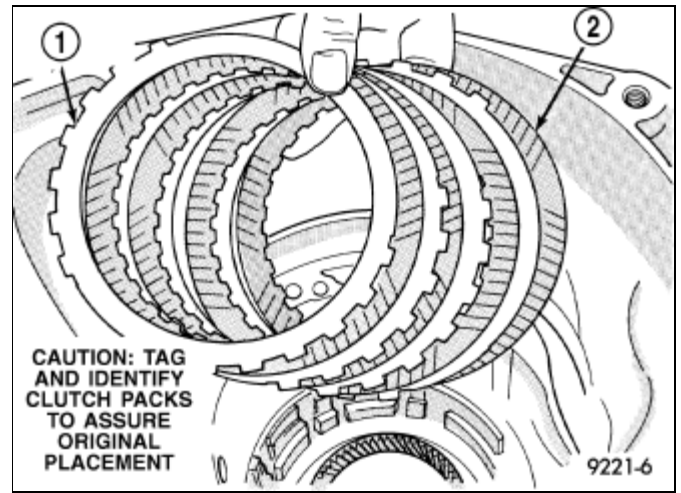
18. Measure low/reverse clutch pack. . Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **Low/Reverse clutch pack clearance is 0.84 to 1.60 mm (0.033 to 0.063 inch).**

19. Select the proper low/reverse reaction plate to achieve specifications.

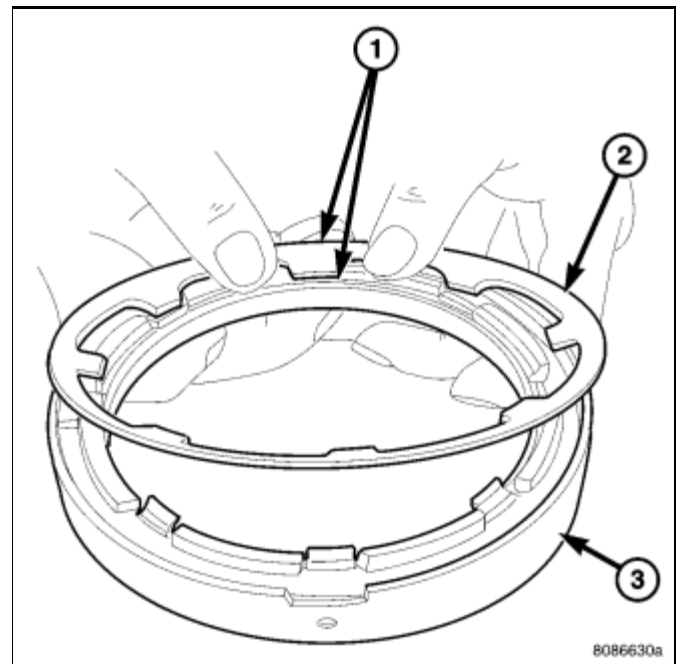
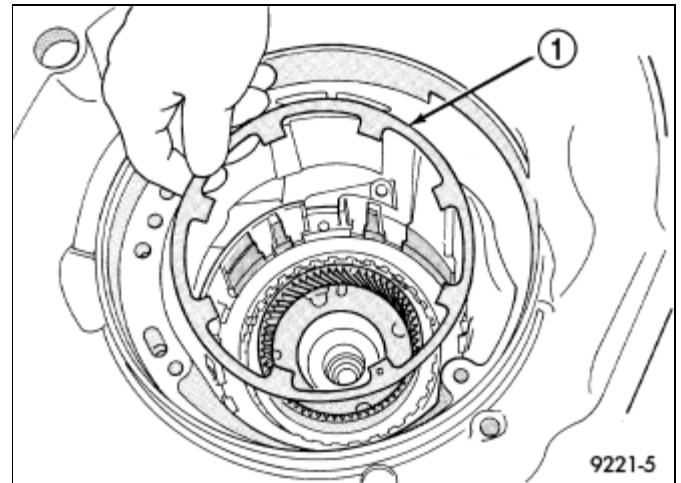


NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

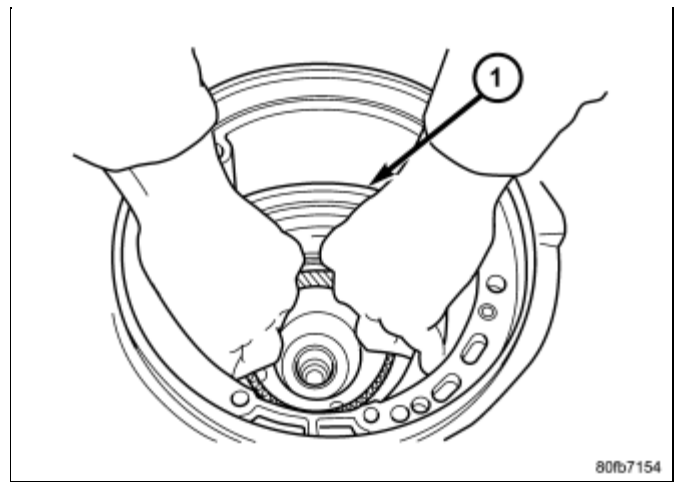
20. Install 2/4 clutch pack .



21. Install 2/4 clutch belleville spring .

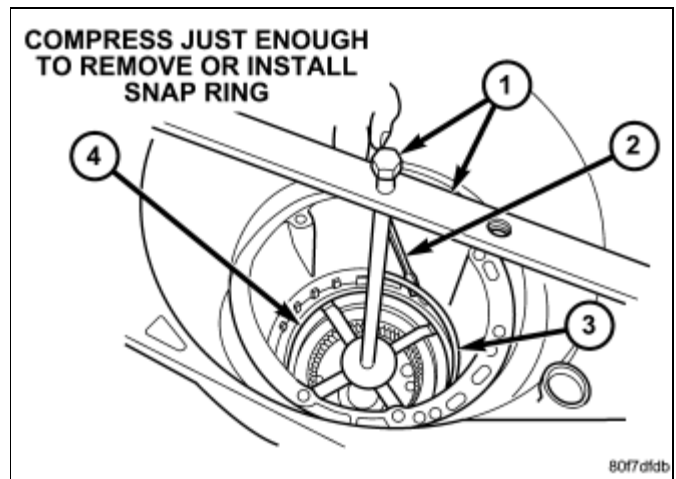


22. Install 2/4 clutch retainer .

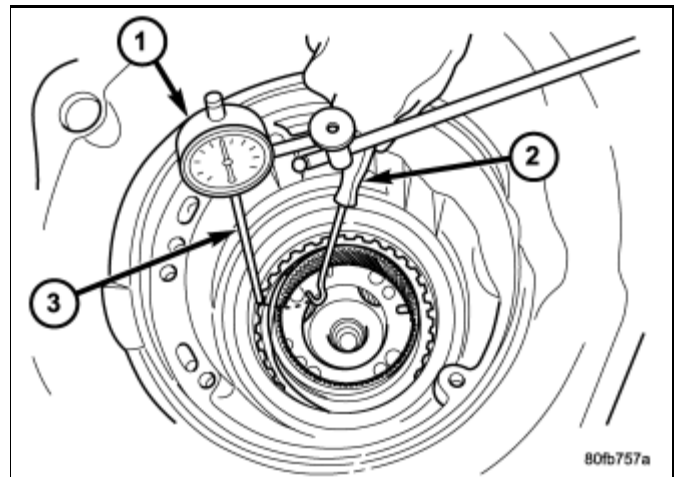


NOTE: Verify that Compressor 5058A is centered properly over the 2/4 clutch retainer before compressing. If necessary, fasten the 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

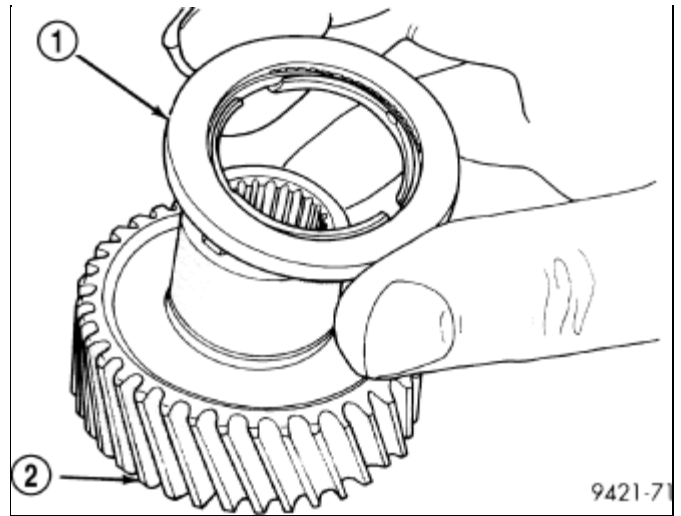
23. Compress 2/4 clutch just enough to facilitate snap ring installation.



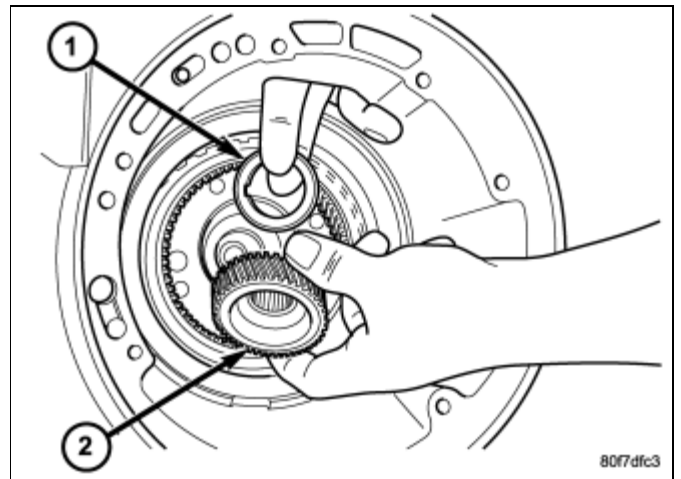
24. **Measure 2/4 clutch clearance:** Set up dial indicator as shown in . Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **The 2/4 clutch pack clearance is 0.76 to 2.64 mm (0.030 to 0.104 inch).** If not within specifications, the clutch is not assembled properly or is excessively worn. **There is no adjustment for the 2/4 clutch clearance.**



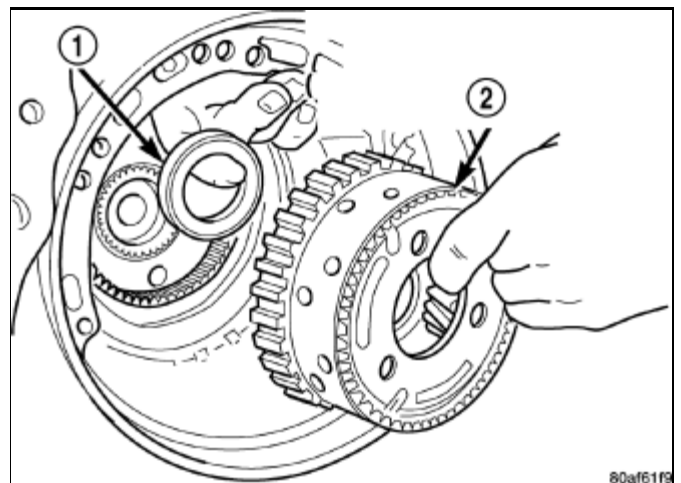
25. Install the #7 needle bearing to the rear sun gear . **The number 7 needle bearing has three antireversal tabs and is common with the number 5 and number 2 position.** The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.



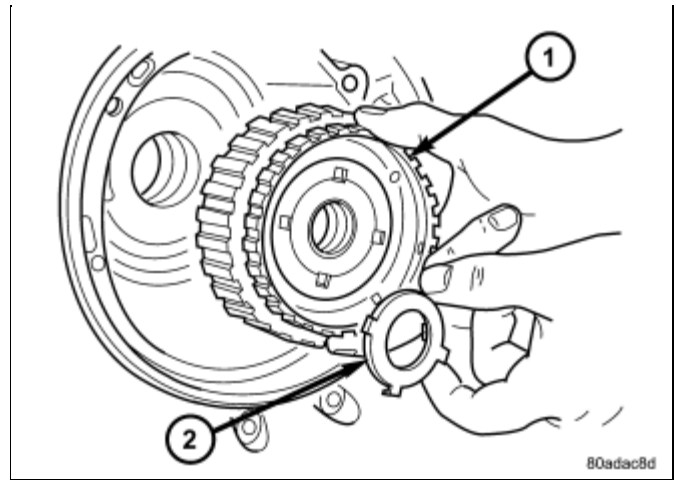
26. Install rear sun gear and #7 needle bearing .



27. Install front carrier/rear annulus assembly and #6 needle bearing .

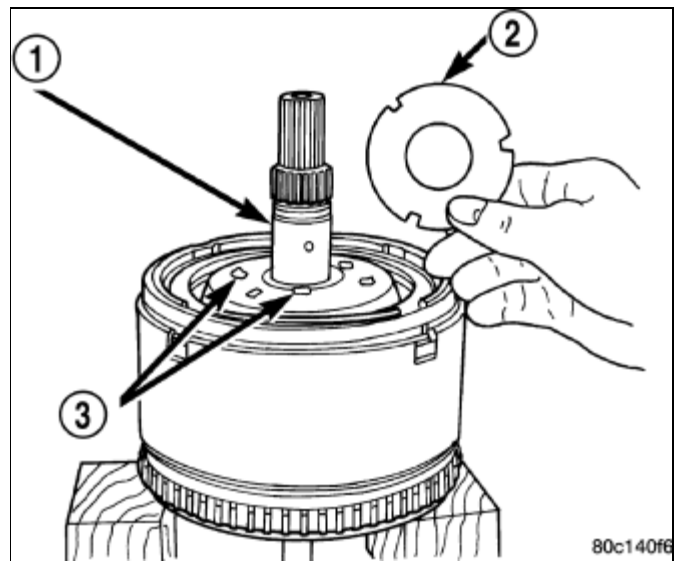


28. Install front sun gear assembly and #4 thrust washer .

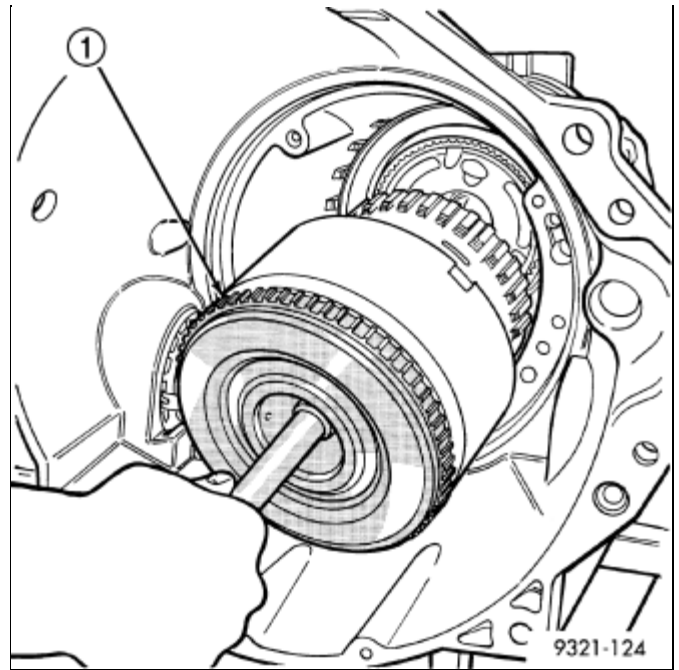


29. **Determine proper #4 thrust plate thickness.**

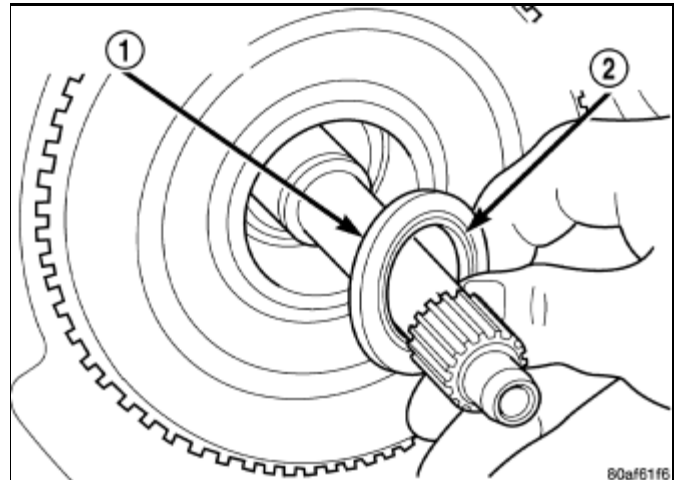
- a. Select the thinnest #4 thrust plate thickness.
- b. Install #4 thrust plate using petrolatum to hold into position.
- c. Install input clutch assembly. Ensure the input clutch assembly is completely seated by viewing position through input speed sensor hole. **If the speed sensor tone wheel is not centered in the opening, the input clutch assembly is not seated properly.**
- d. Remove the oil pump o-ring and install oil pump and gasket to transmission. Tighten the oil pump bolts to 30 N·m (265 in. lbs.). **Use screw-in dowels or phillips-head screwdrivers to align pump to case. Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.**
- e. Measure the input shaft end play with the transmission in the vertical position. This will ensure that the measurement will be accurate.
- f. Set up and measure endplay using End Play Set 8266 and Dial Indicator Set C3339.
- g. Measure input shaft end play. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** For example, if end play reading is 0.055 inch, select No. 4 Thrust Plate which is 0.071 to 0.074 thick. This should provide an input shaft end play reading of 0.020 inch, which is within specifications.
- h. Remove oil pump, gasket, and input clutch assembly to gain access to and install proper #4 thrust plate.



30. Install #1 caged needle bearing .

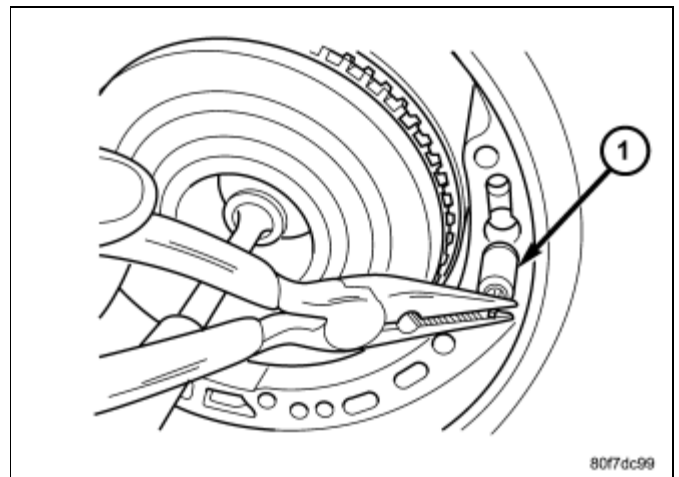


31. Install input clutch assembly with proper thrust plate .



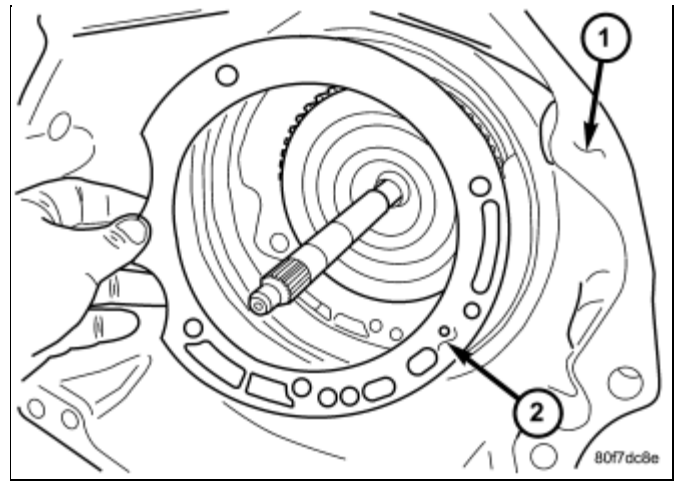
CAUTION: By-pass valve MUST be replaced if transmission failure occurs.

32. Replace cooler by-pass valve if transmission failure has occurred .



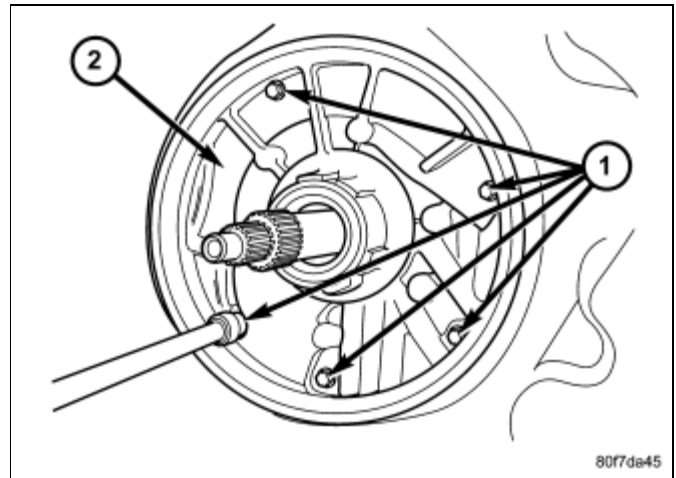
NOTE: To align oil pump, gasket, and case during installation, use threaded dowels or phillips screwdrivers.

33. Install oil pump gasket .

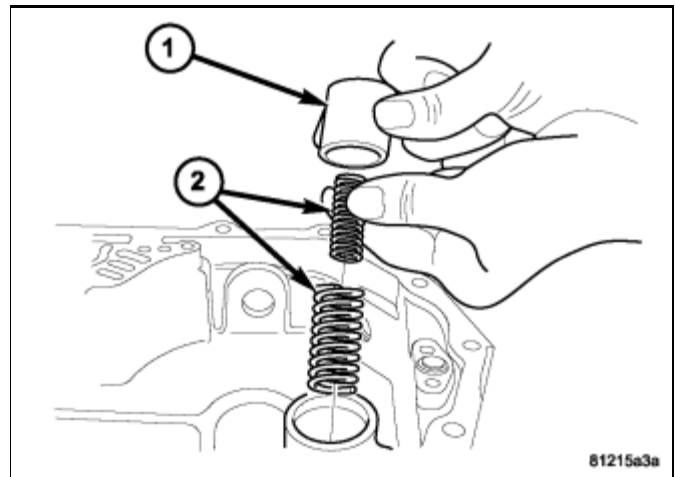


NOTE: Do not reuse original oil pump bolts.

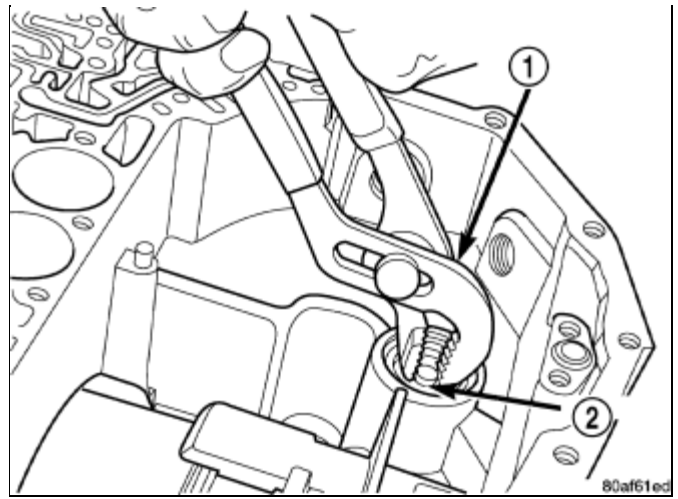
34. Install oil pump and torque the new oil pump-to-case bolts to 30 N·m (265 in. lbs.) .



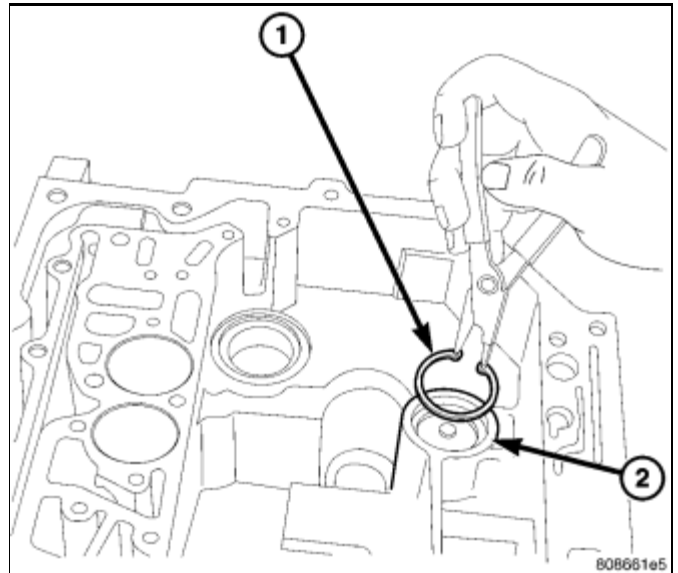
35. Install low/reverse accumulator.



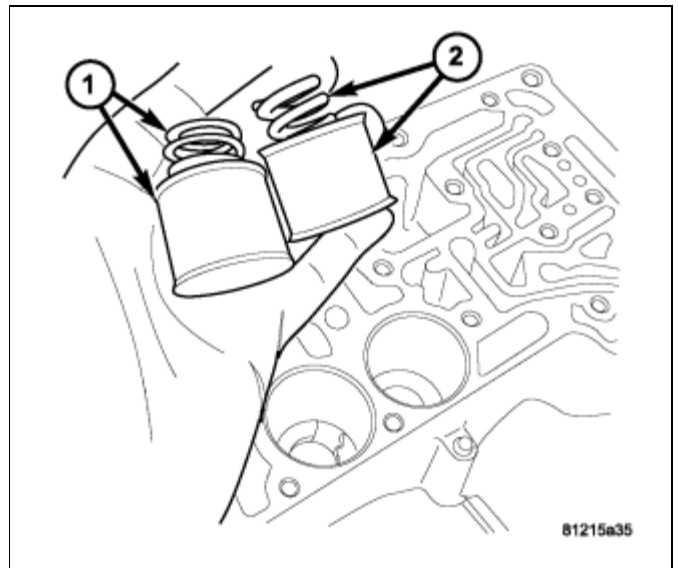
36. Install low/reverse accumulator plug .



37. Install low/reverse accumulator snap ring .

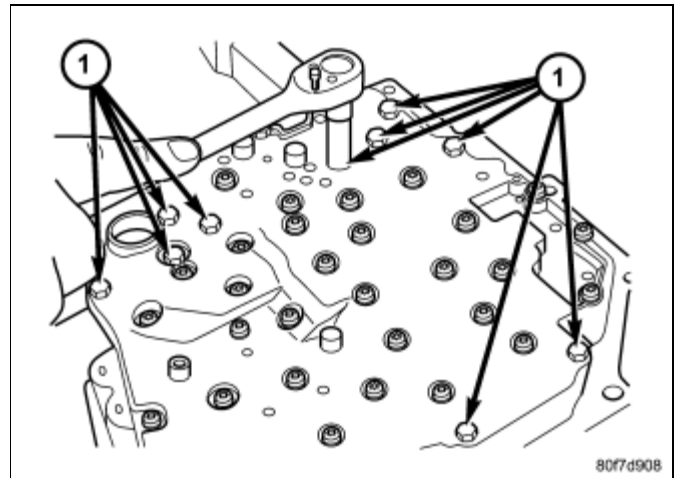
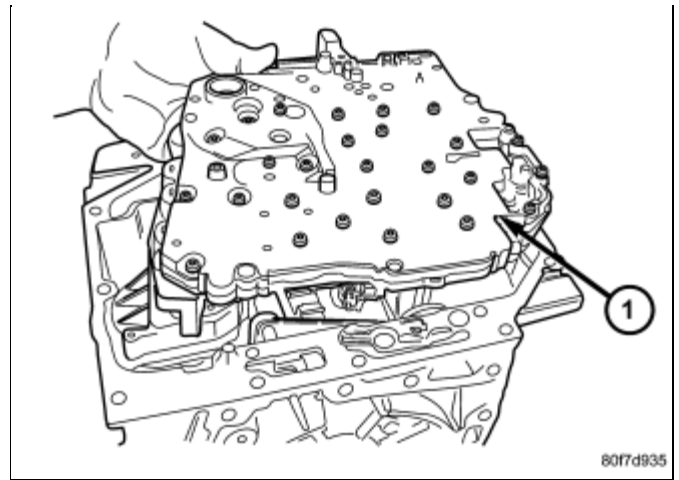


38. Install underdrive and overdrive accumulators and springs .

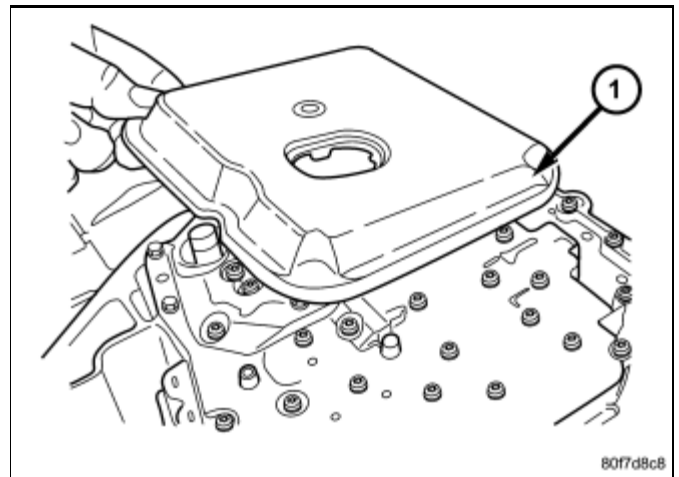


CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

39. Install valve body into place .



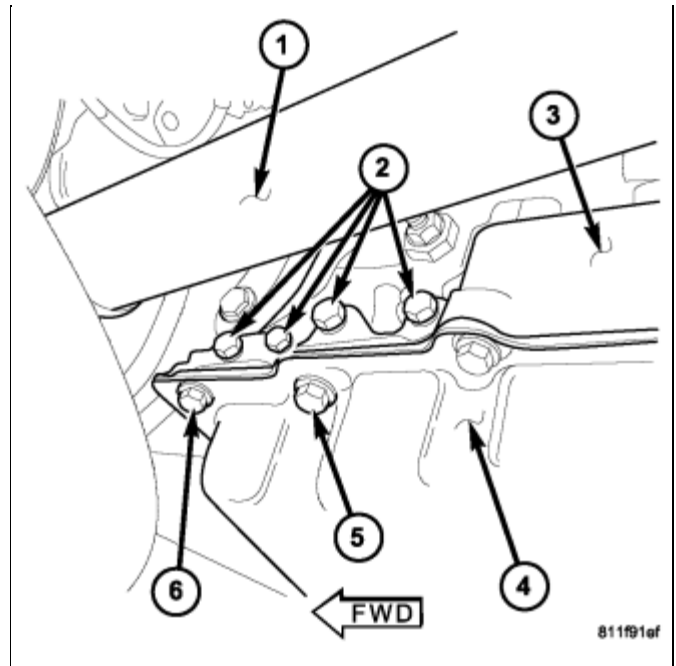
40. Install seven (7) valve body-to-case bolts and torque to 12 N·m (105 in. lbs.).



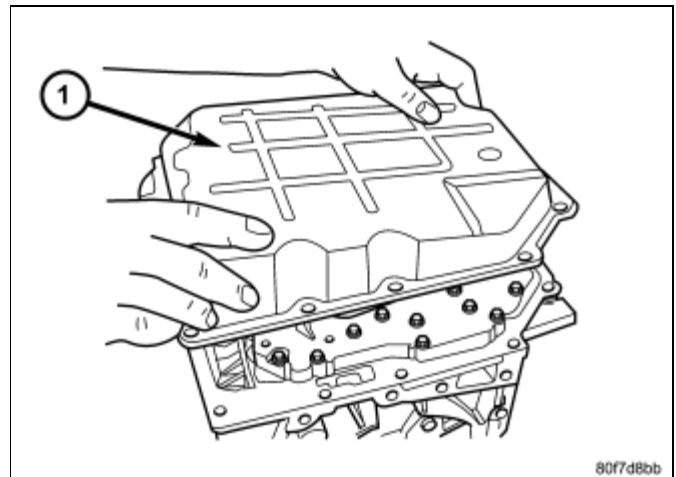
NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits , it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

41. Install transmission oil filter . Tighten the bolts to 5 N·m

(45 in. lbs.)

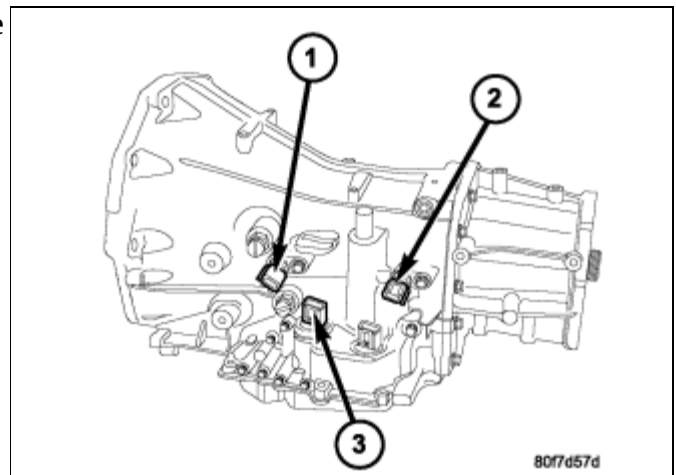


42. Install transmission oil pan with a bead of Mopar® ATF RTV. Torque oil pan-to-case bolts to 20 N·m (14.5 ft. lbs.).



NOTE: Before installing either speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

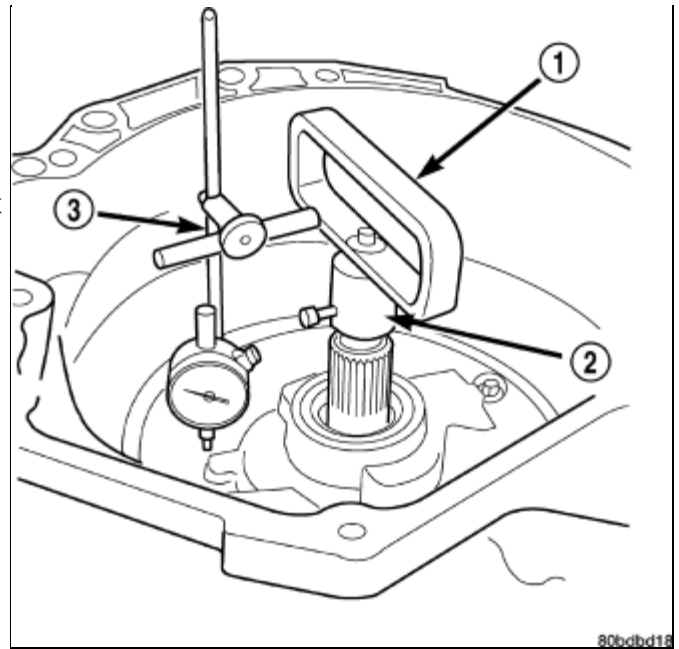
43. Install both speed sensors into transmission case. Torque the speed sensor bolts to 9 N·m (80 in. lbs.).



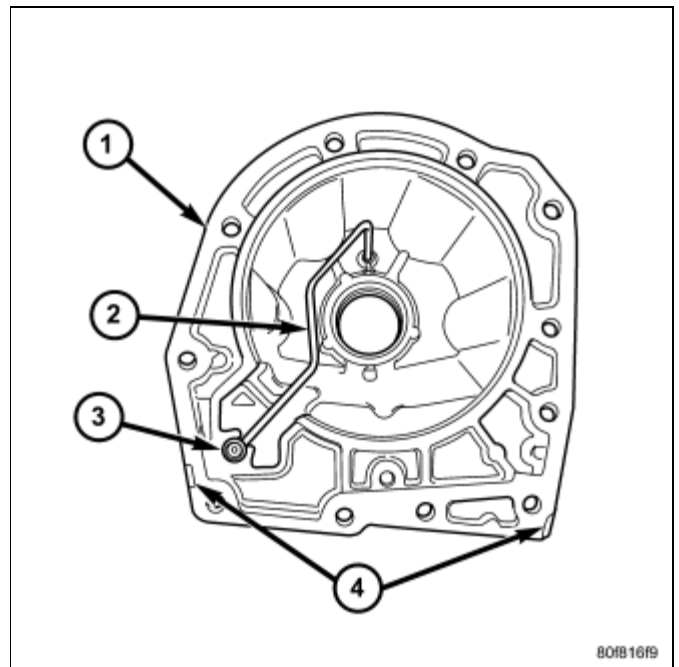
44. As a final check of the transmission, measure the input shaft end play. This will indicate when a #4 thrust plate

change is required. The #4 thrust plate is located behind the overdrive clutch hub. Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft. Move input shaft in and out to obtain end play reading.

Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch). If not within specifications, make the necessary thrust plate adjustment.



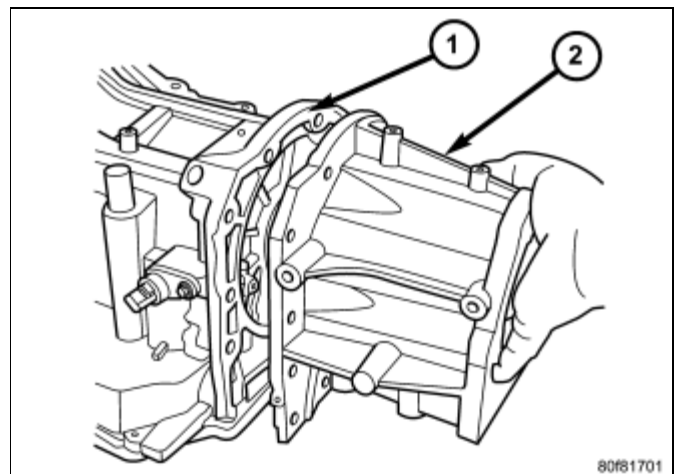
45. Inspect the lube tube grommet for damage. If the grommet lip is damaged, it will need to be replaced.



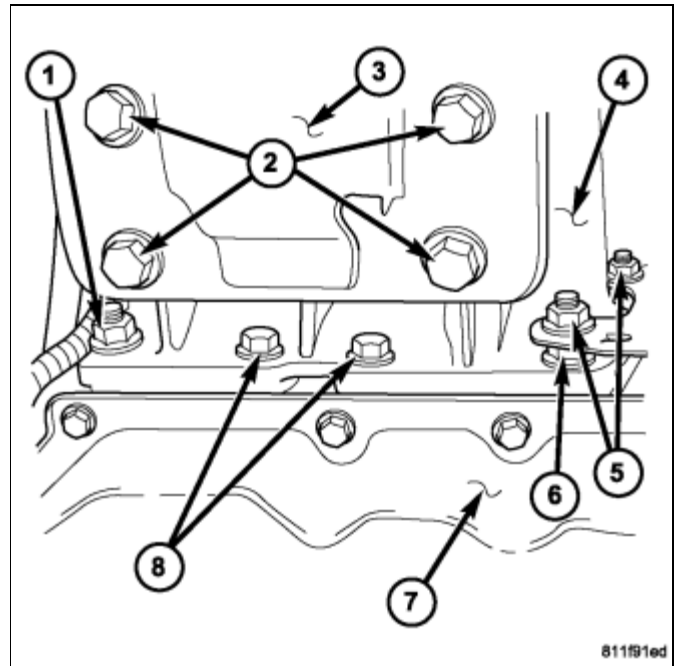
46. Install the 4X4 stub shaft onto the transmission output shaft.

47. Place a bead of Mopar® ATF RTV on the rear surface of the transmission case for the adapter housing.

48. Install the adapter housing onto the transmission case.



NOTE: Before installing the lowermost four adapter housing bolts, it will be necessary to replenish the sealing patch on the bolts using Mopar® Lock & Seal Adhesive.



49. Install the bolts that hold the adapter housing onto the transmission case. Be sure to install any stud bolts to their original locations. Tighten the bolts to 54 N·m (40 ft.lbs.).

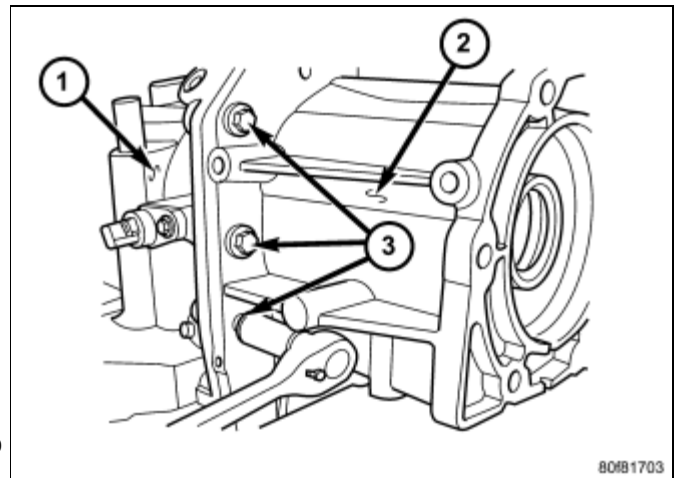
INSTALLATION

1. Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

2. Lubricate converter drive hub and oil pump seal lip with transmission fluid.

3. Align converter and oil pump.

4. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.



5. Check converter seating with steel scale and straightedge . Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

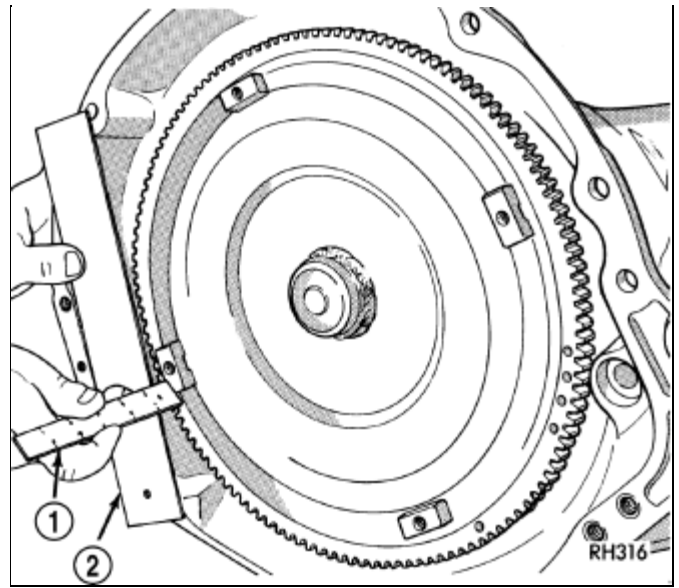
6. Temporarily secure converter with C-clamp.

7. Lightly grease crankshaft flange hole.

8. Position transmission on jack and secure it with safety chains.

9. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

10. Raise transmission and align converter with drive plate



and converter housing with engine block.

11. Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

12. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

13. Install bolts that attach transmission converter housing to engine block. Tighten bolts to 129 N·m (95 ft. lbs)

CAUTION: Be sure the converter housing is fully seated on the engine block dowels before tightening any bolts.

14. Install torque converter attaching bolts. Tighten bolts to 88 N·m (65 ft. lbs.).

15. Install transmission fill tube , new seal and breather hose

16. Install fuel line bracket bolt.

17. Install crank shaft position sensor.

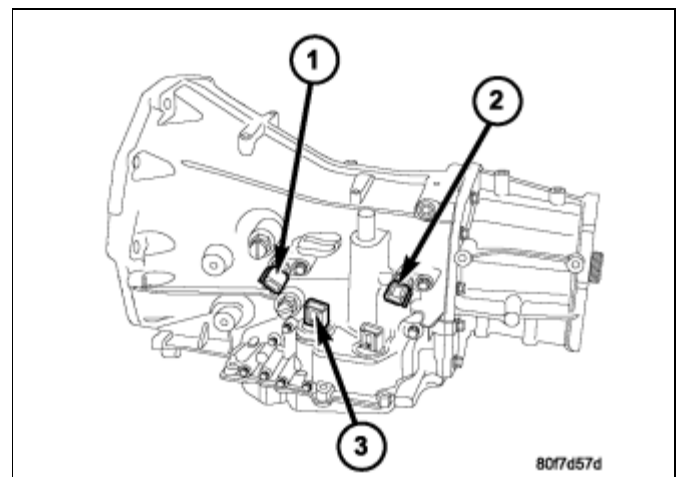
18. Connect transmission cooler lines to transmission.

19. Install transfer case onto transmission. (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION)

20. Remove engine support fixture.

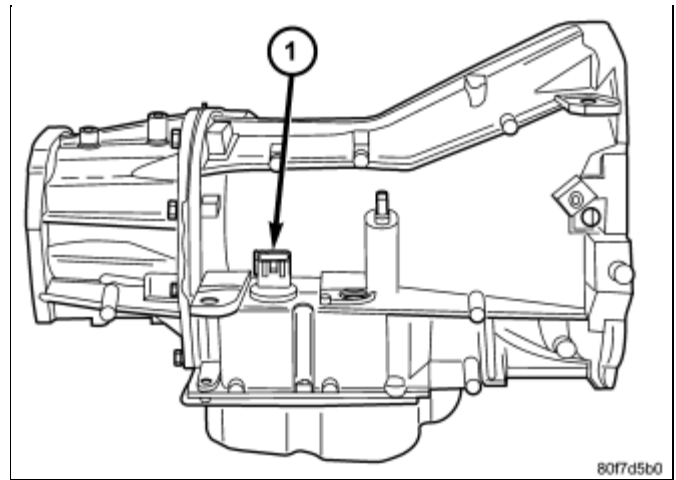
21. Remove transmission jack.

22. Connect input and output speed sensor wires .



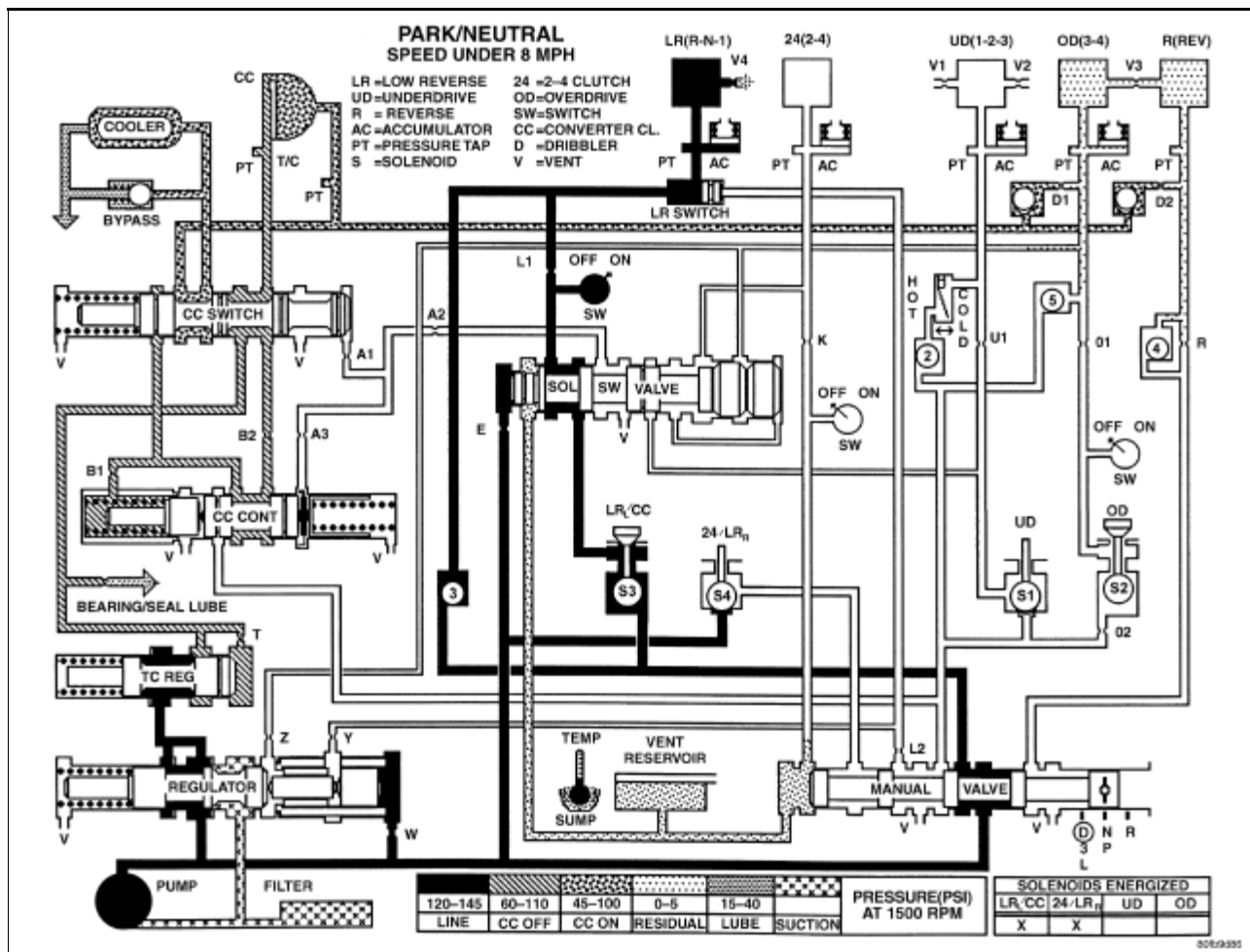
23. Connect wires to the transmission range sensor and the solenoid/pressure switch assembly .

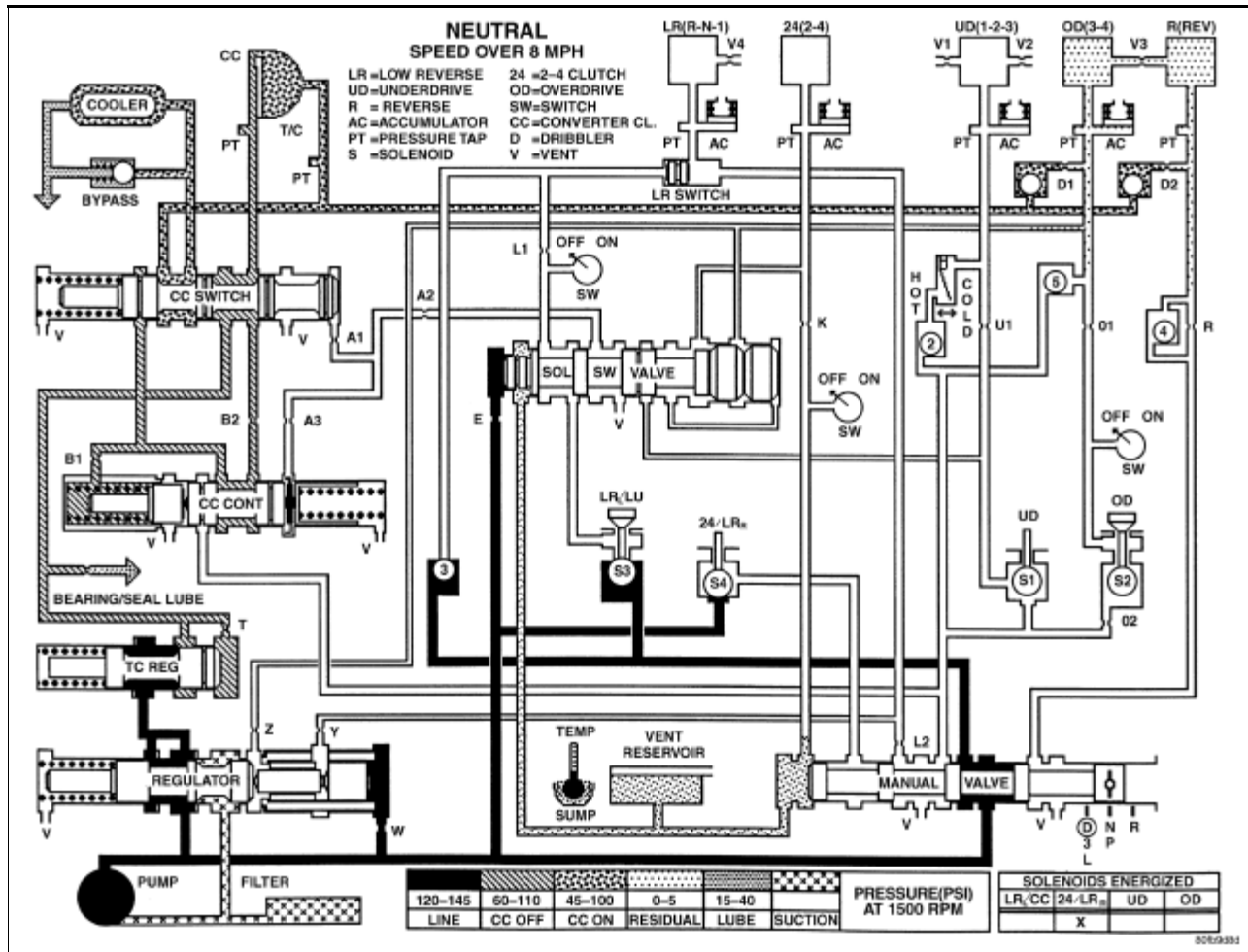
24. Install converter housing support collar.
25. Install exhaust pipes and support brackets, if removed.
26. Install starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION) and cooler line bracket. \
27. Connect transfer case shift cable and electrical connectors.
28. Adjust gearshift linkage, if necessary.
29. Align and connect propeller shaft(s). (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
30. Install transmission structural collar.
31. Fill transfer case to bottom edge of fill plug hole.
32. Install all skid plates and attach skid plate to transmission rear support. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
33. Lower vehicle and connect battery negative cable.
34. Fill transmission to correct level with Mopar® ATF +4.

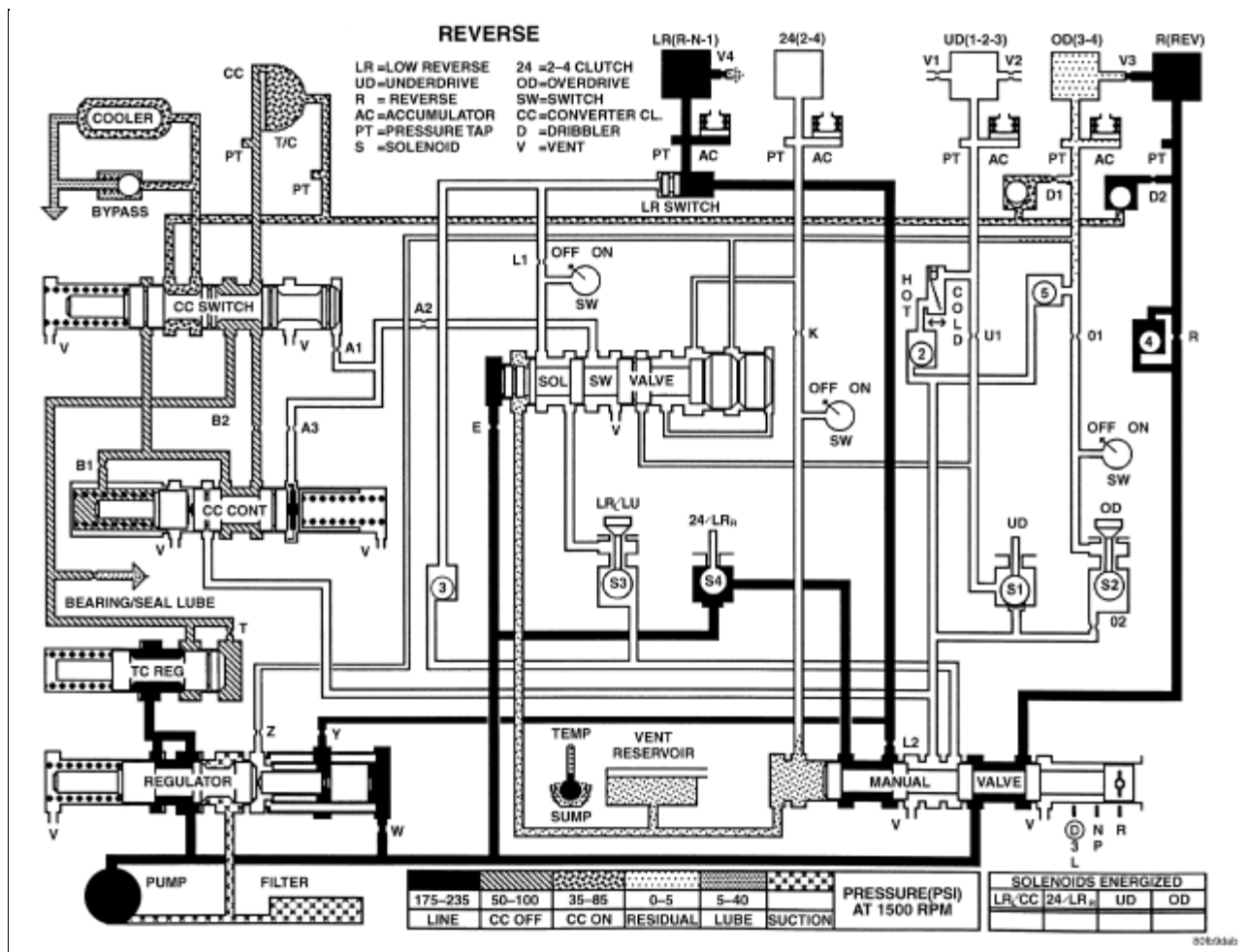


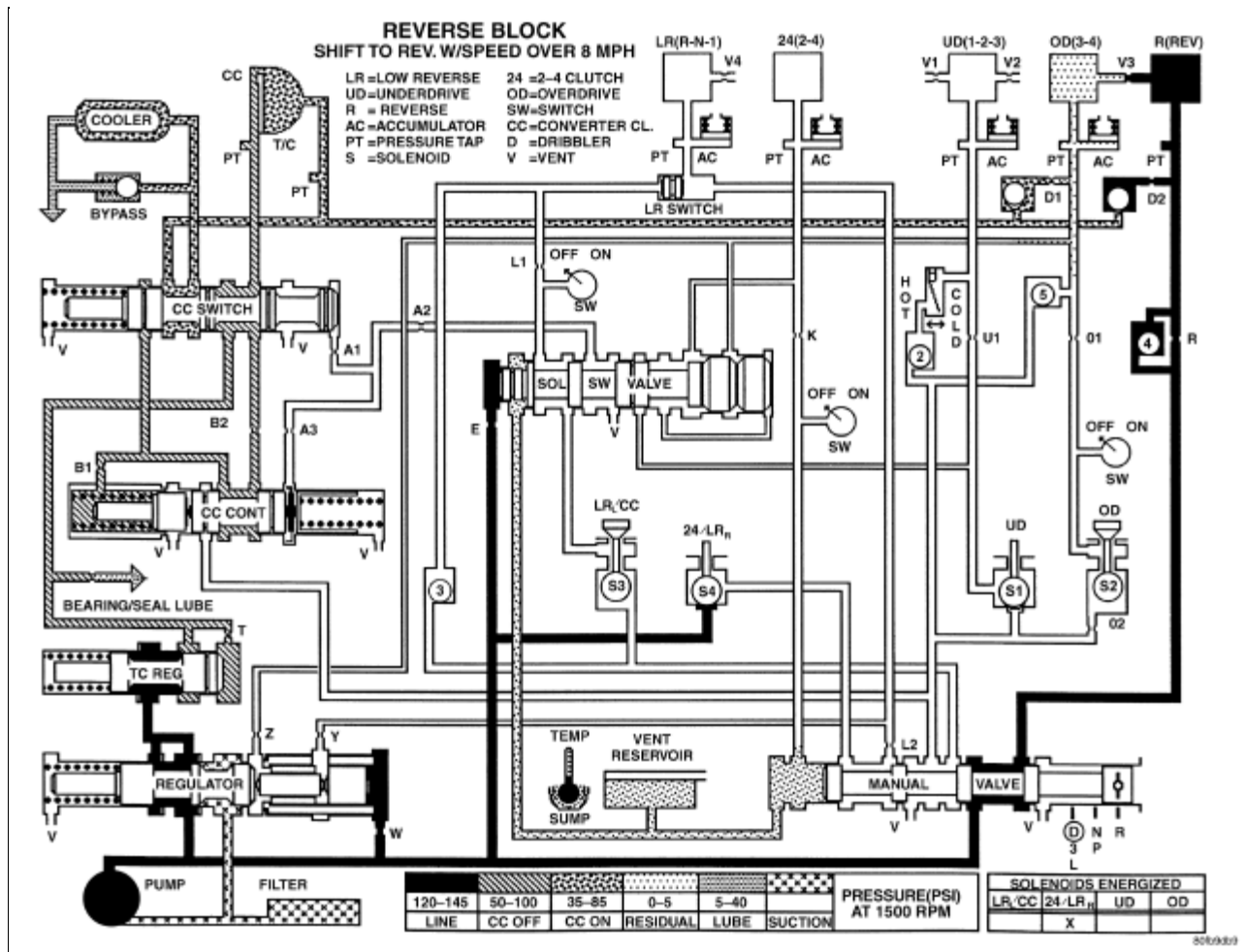
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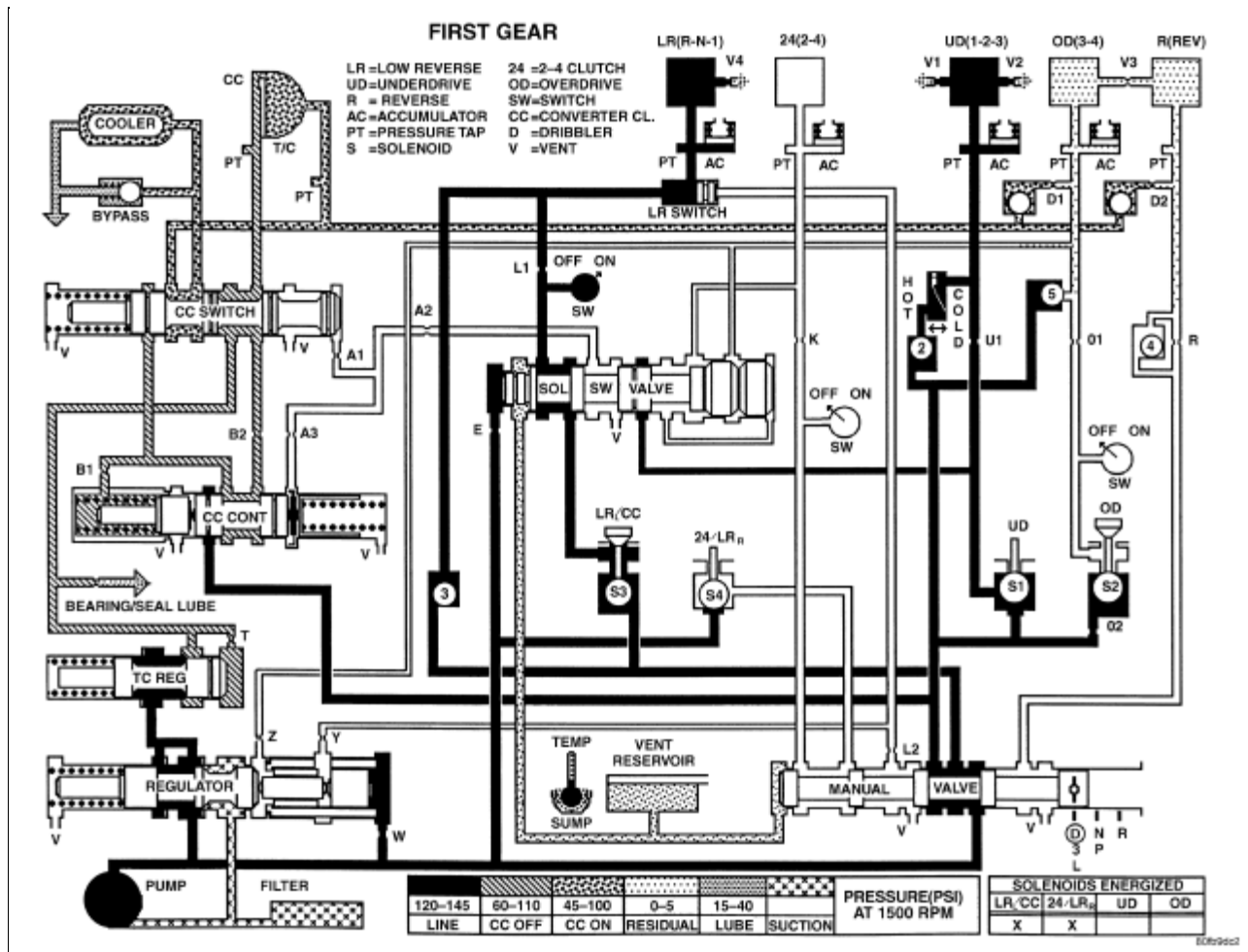
SCHEMATICS AND DIAGRAMS - 42RLE TRANSMISSION

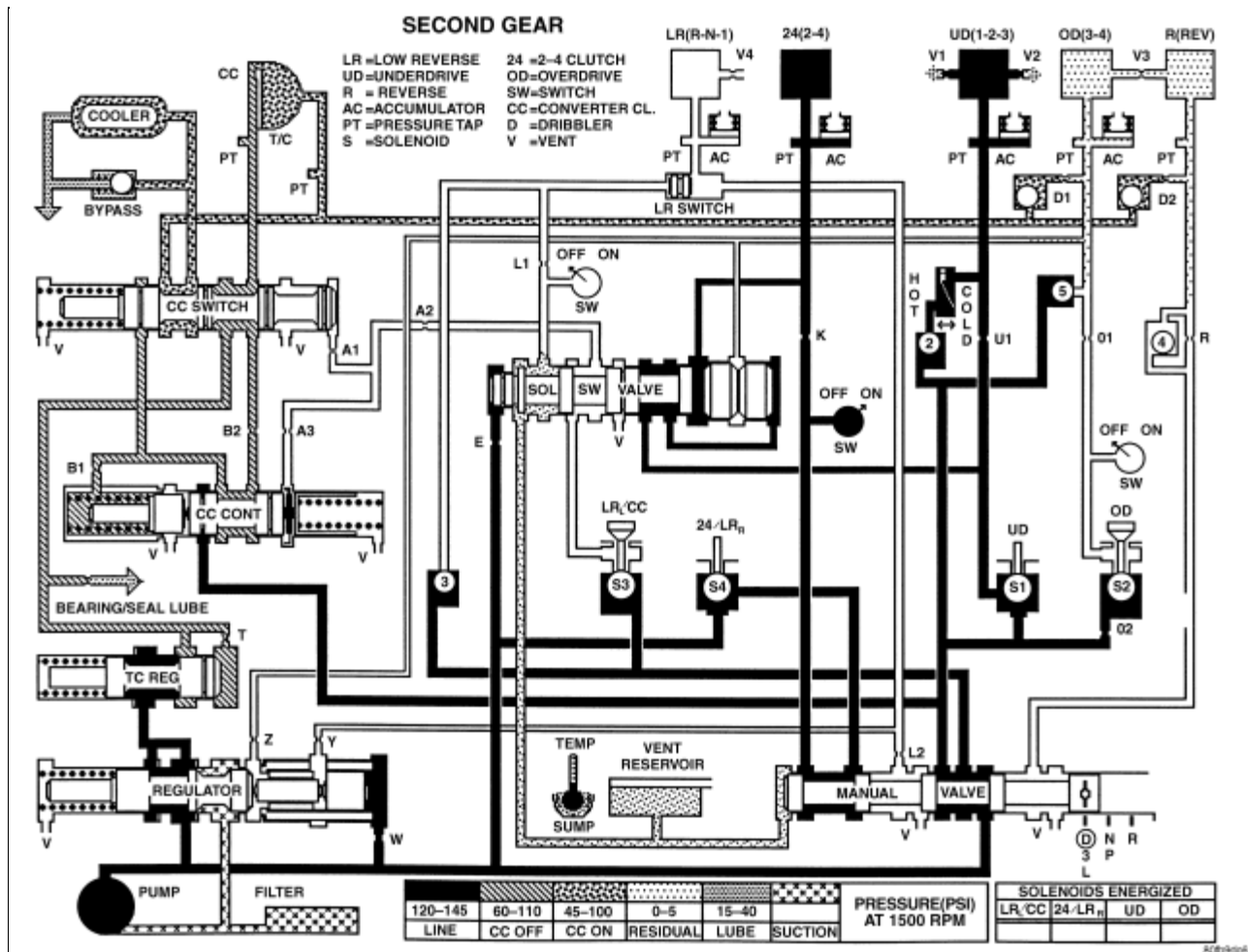


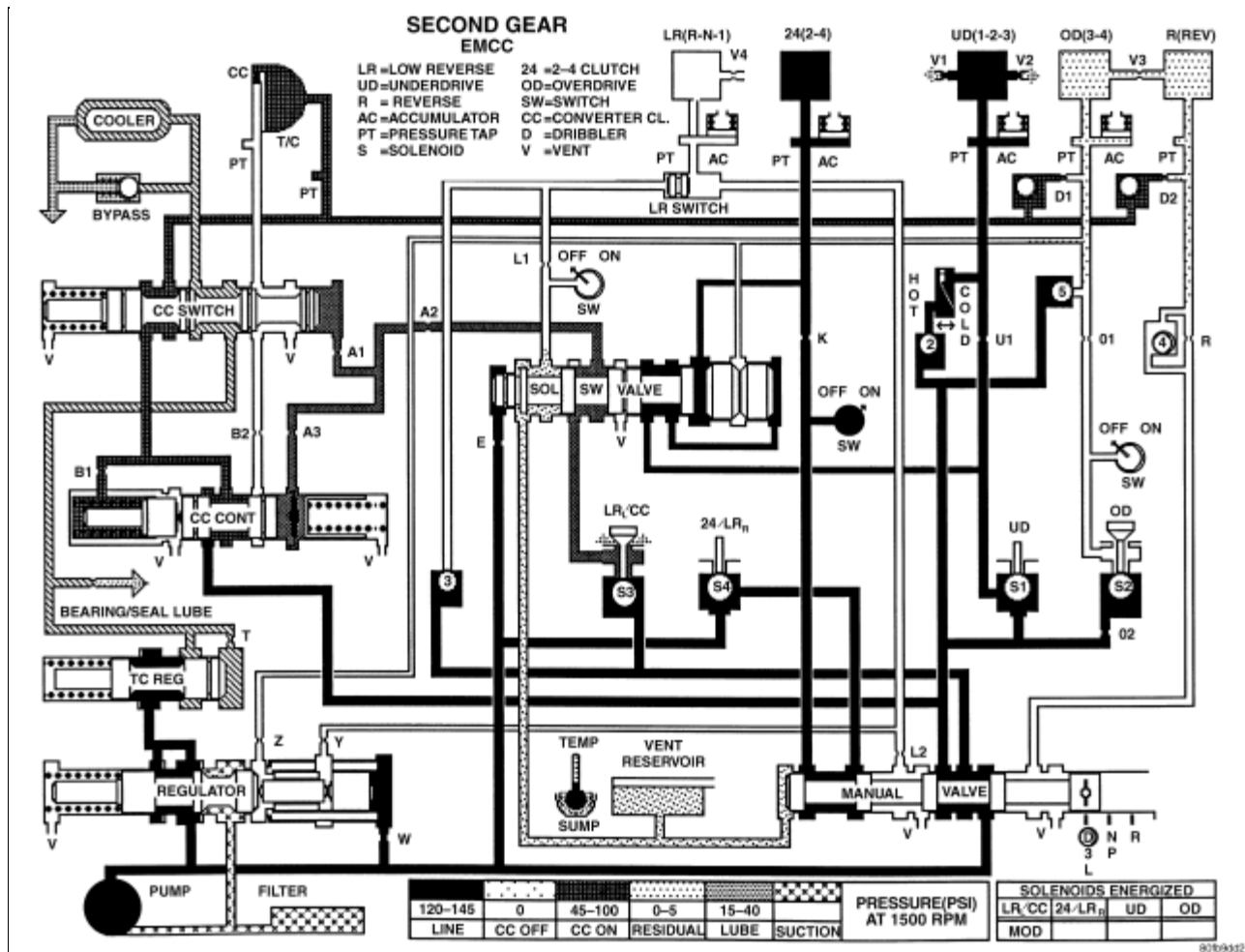


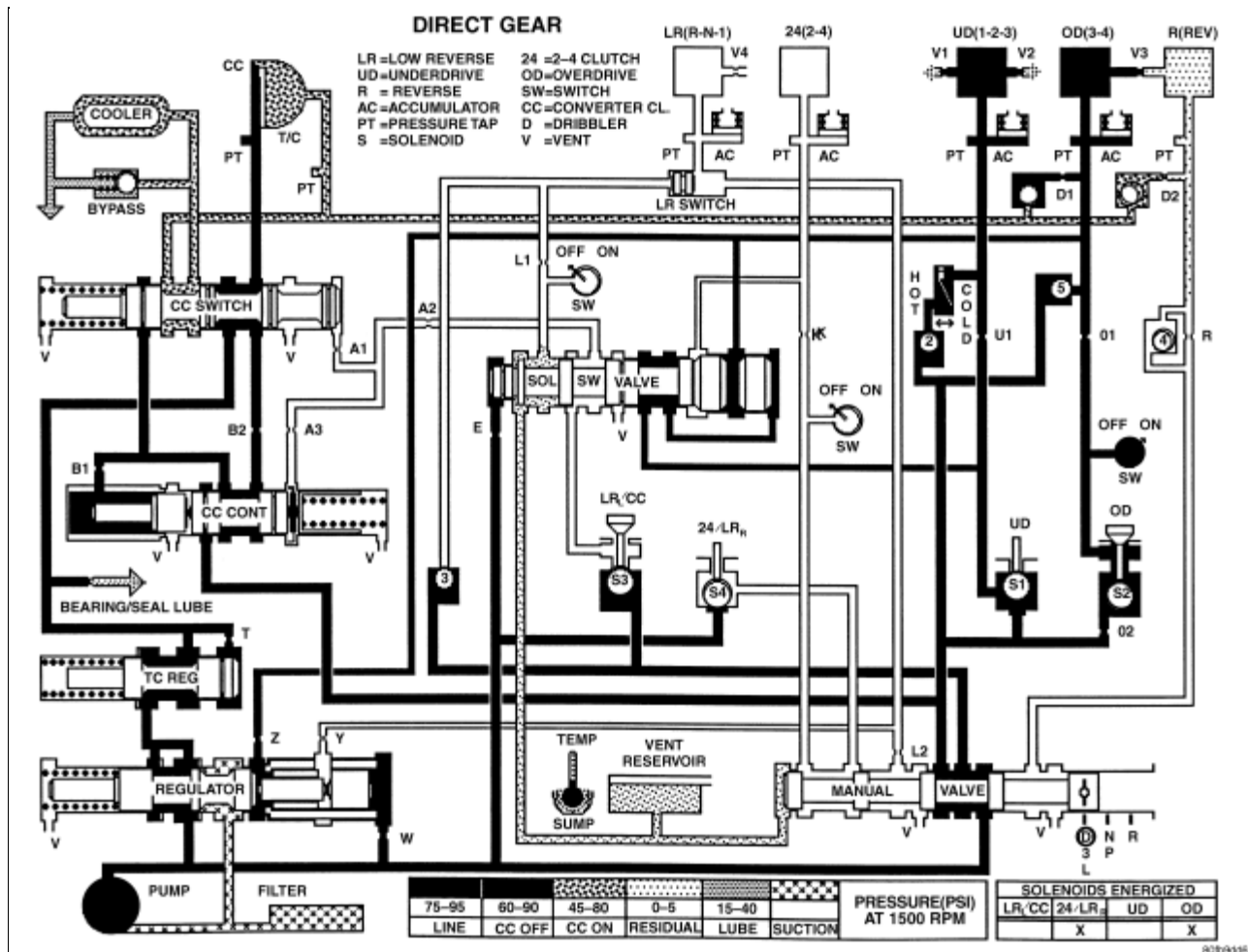


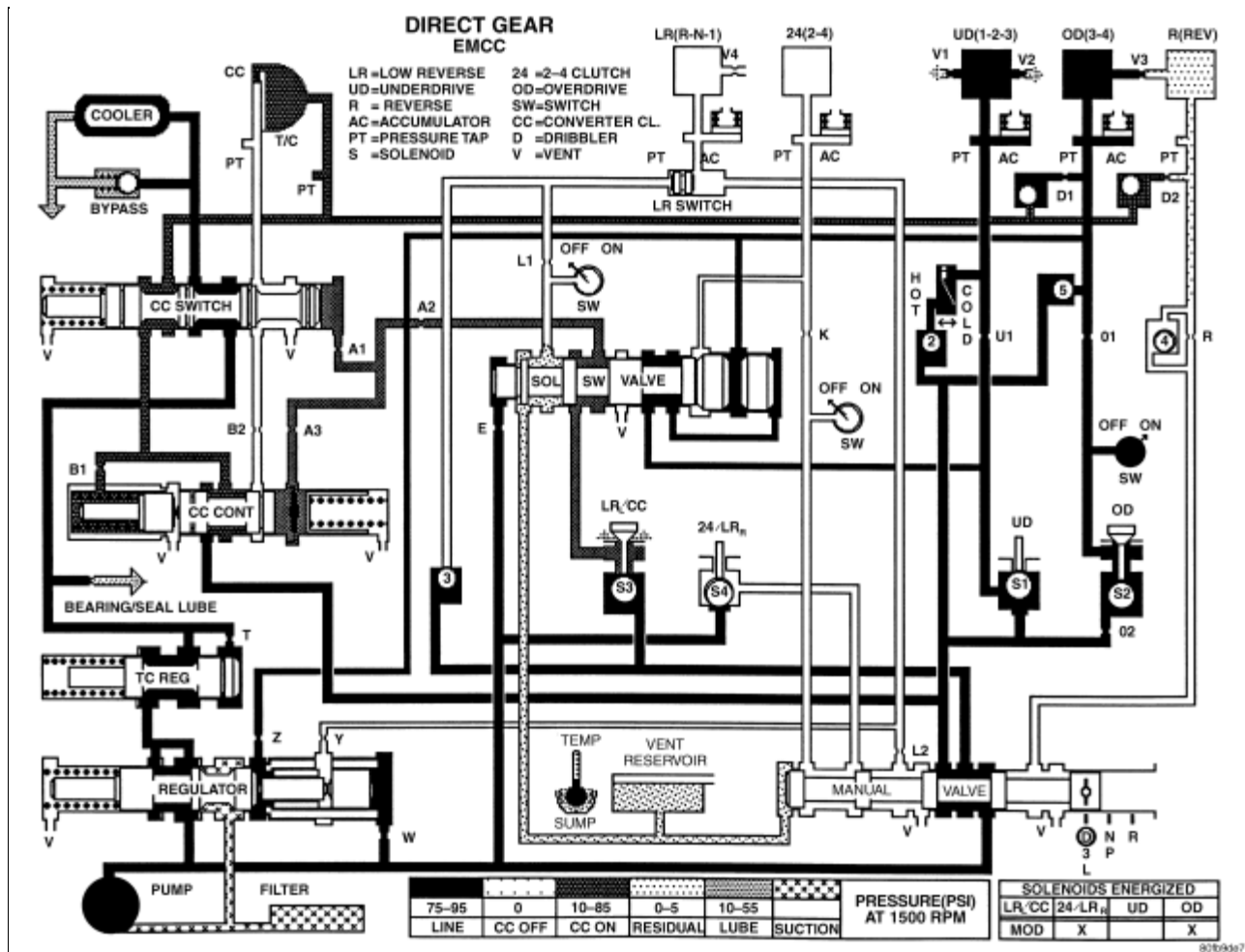


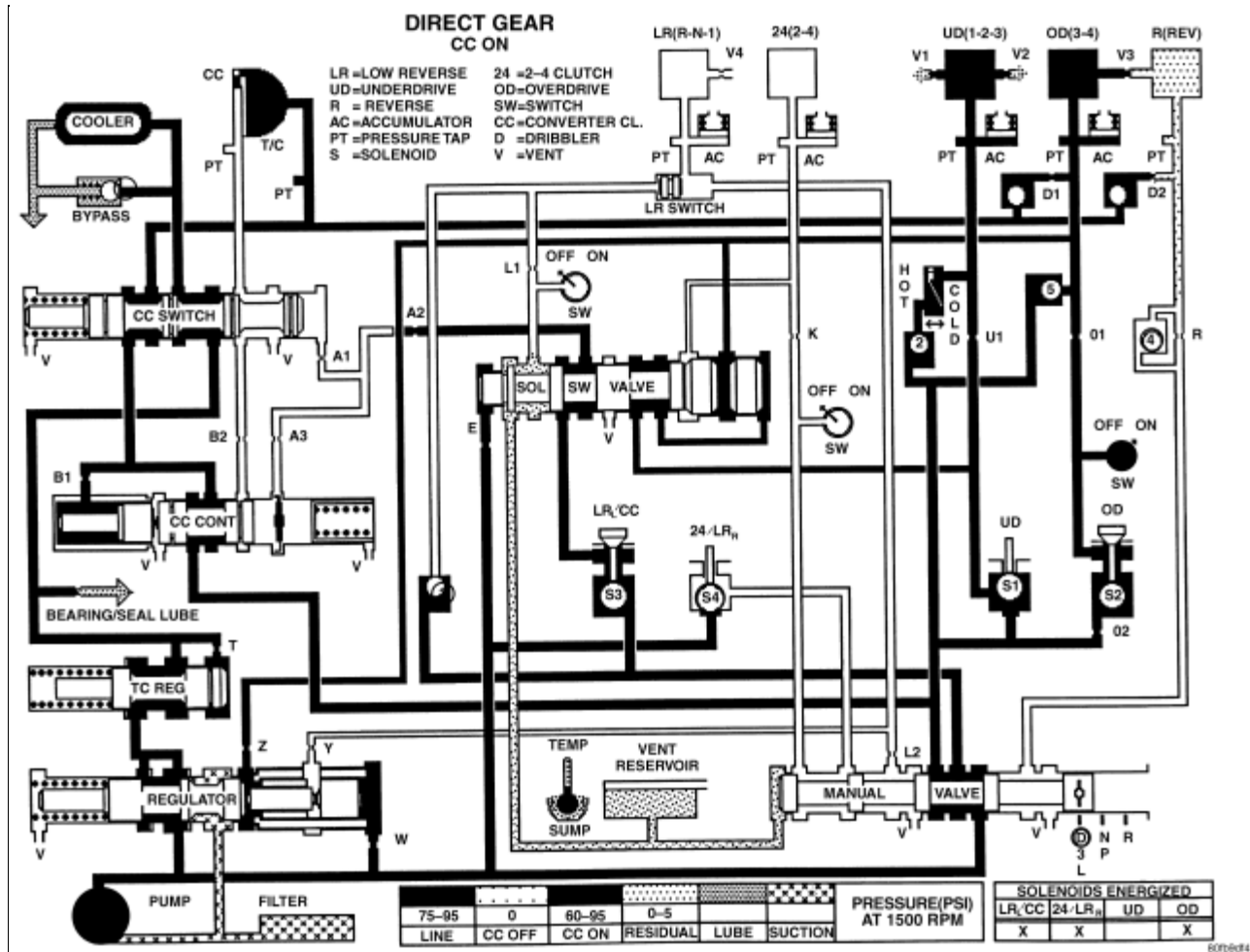


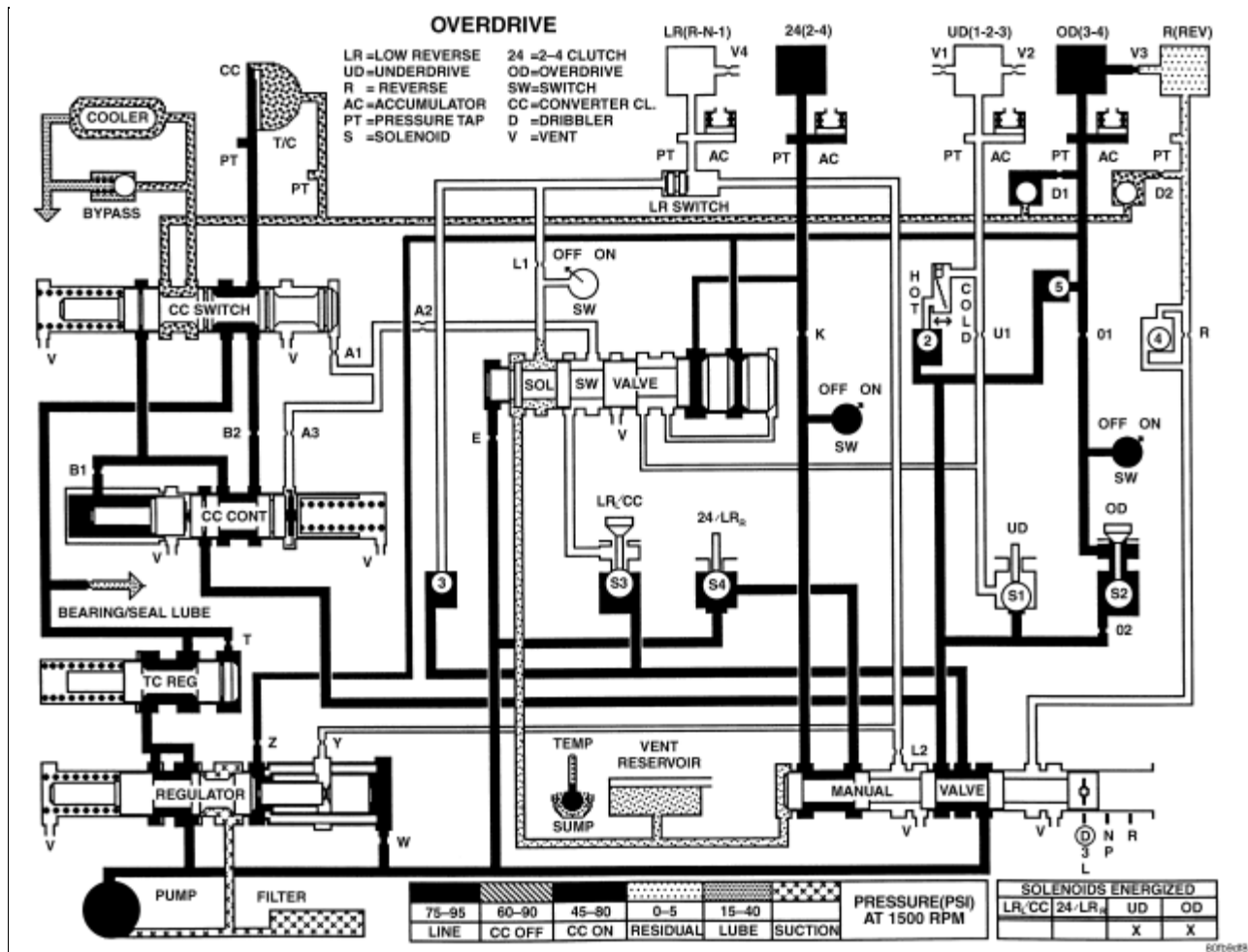


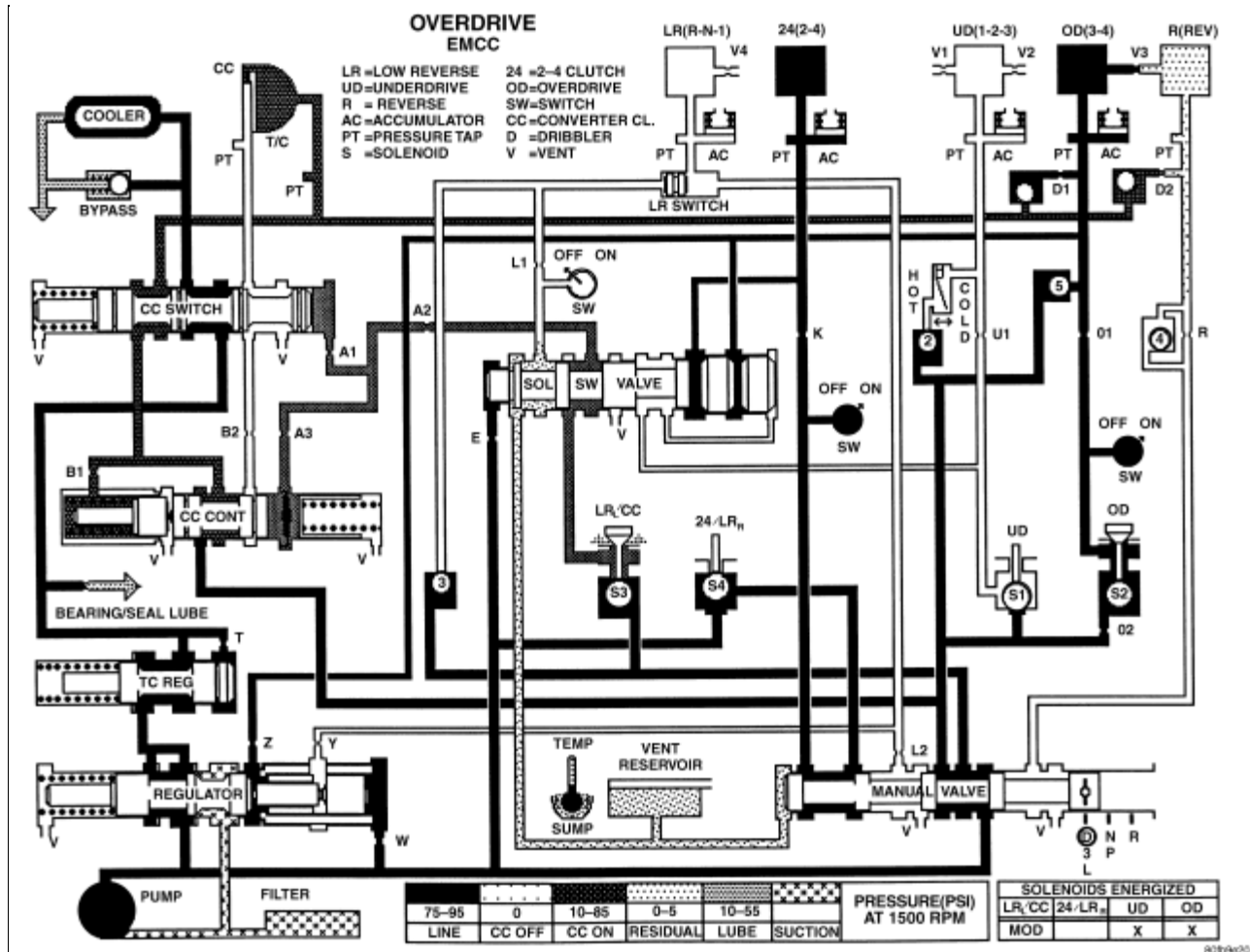


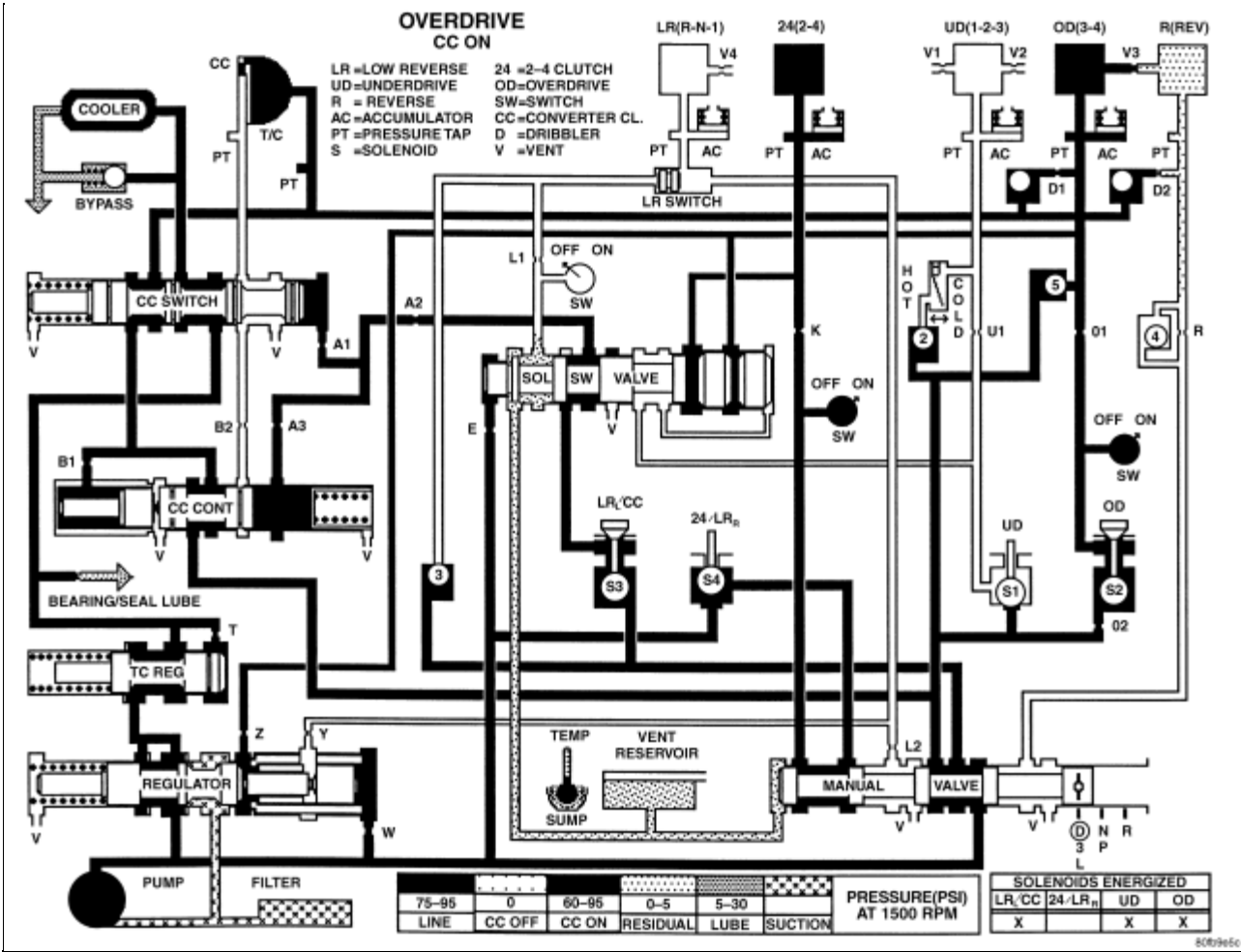












SPECIFICATIONS

42RLE AUTOMATIC TRANSMISSION

GENERAL SPECIFICATIONS

Transmission Type	Four-Speed Automatic, Electronically Controlled, Fully Adaptive, Electronically Modulated Torque Converter
Lubrication Method	Pump (internal - external gear-type)
Cooling Method	Water Heat Exchanger / Air-to-Oil Heat Exchanger

GEAR RATIOS

1st Gear	2.84:1
2nd Gear	1.57:1

3rd Gear (Direct)	1.00:1
4th Gear (Overdrive)	0.69:1
Reverse Gear	2.21:1

BEARING PRELOAD (Drag Torque)

Description	Metric	Standard
Output Shaft	0.22-0.903 N·m	1-8 in. lbs.

CLUTCH PACK

Description	Metric	Standard
Low/Reverse Clutch (Select Reaction Plate)	0.84-1.60 mm	0.033-0.063 in.
Two/Four Clutch (No Select)	0.76-2.64 mm	0.030-0.104 in.
Reverse Clutch (Select Snap Ring)	0.89-1.37 mm	0.035-0.054 in.
Overdrive Clutch (No Select)	1.07-3.25 mm	0.042-0.128 in.
Underdrive Clutch (Select Reaction Plate)	0.94-1.50 mm	0.037-0.059 in.

INPUT SHAFT

Description	Metric	Standard
End Play	0.127-0.635 mm	0.005-0.025 in.

OIL PUMP CLEARANCES

DESCRIPTION	METRIC	STANDARD
Outer Gear-to-Crescent	0.060-0.298 mm	0.0023-0.0117 in.

Inner Gear-to-Crescent	0.093-0.385 mm	0.0036-0.0151 in.
Outer Gear-to-Pocket	0.089-0.202 mm	0.0035-0.0079 in.
Outer Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.
Inner Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.

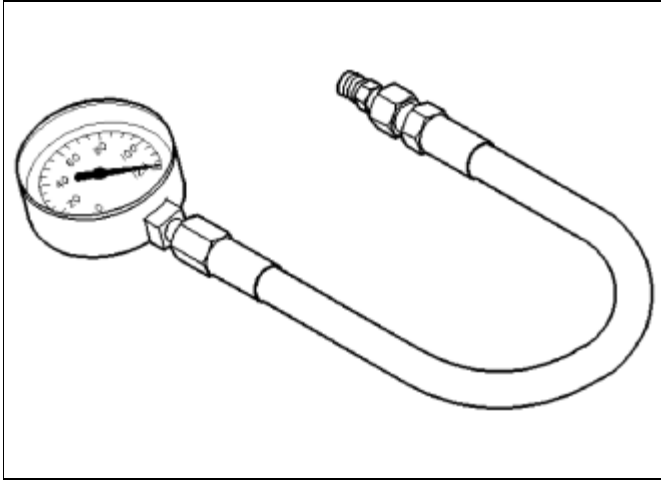
TORQUE SPECIFICATIONS

Description	N·m	Ft. Lbs.	In. Lbs.
Bolt, Converter-to-Driveplate	88	65	-
Bolt, Fluid Filter-to-Valve Body	5	-	45
Bolt, L/R Clutch Retainer-to-Case	5	-	45
Bolt, Adapter/Extension Housing	54	40	-
Bolt, Manual Valve Lever-to-Manual Valve	5	-	45
Bolt, Oil Pan-to-Case	20	14.5	-
Bolt, Oil Pump-to-Case	30	-	265
Bolt, Park Sprag Retainer	4.5	-	40
Bolt, Reaction Shaft Support Halves	28	-	250
Bolt, Solenoid/Pressure Switch Assy-to-Valve Body	5.5	-	50
Bolt, Torque Converter Housing to Engine Block	129	95	
Bolt, Valve Body-to-Case	12	-	105
Bolt, Valve Body-to-Transfer Plate	5	-	45
Fitting, Cooler Line	47.5	35	-
Nut, Output Shaft	271	200	-
Plug, Pressure Tap	5	-	45
Bolt, Input Speed-to-Case Sensor	9	-	80
Bolt, Output Speed-to-Case Sensor	9	-	80

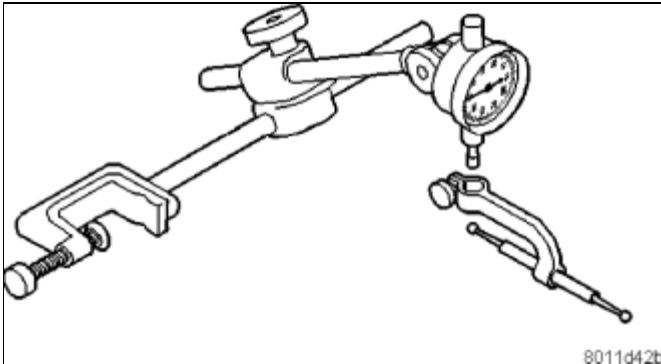


SPECIAL TOOLS

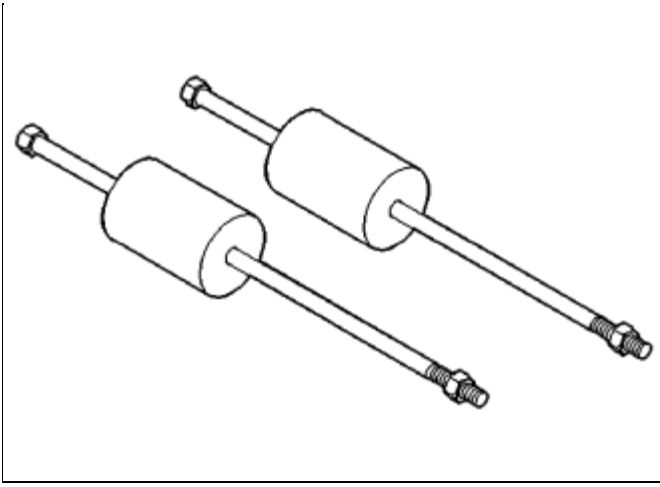
42RLE AUTOMATIC TRANSMISSION



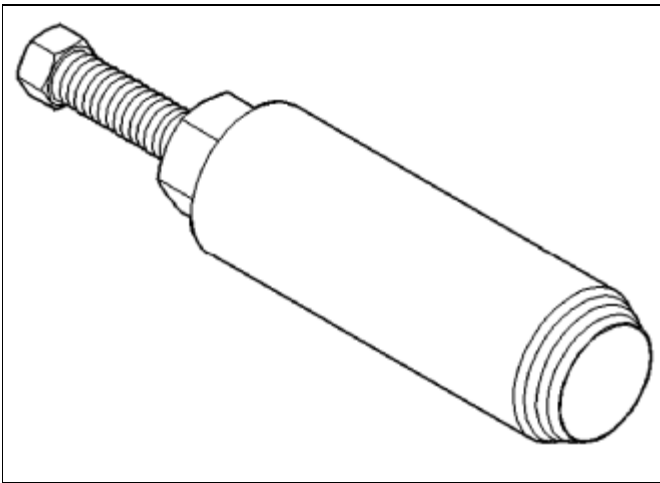
Pressure Gauge (High) C-3293SP



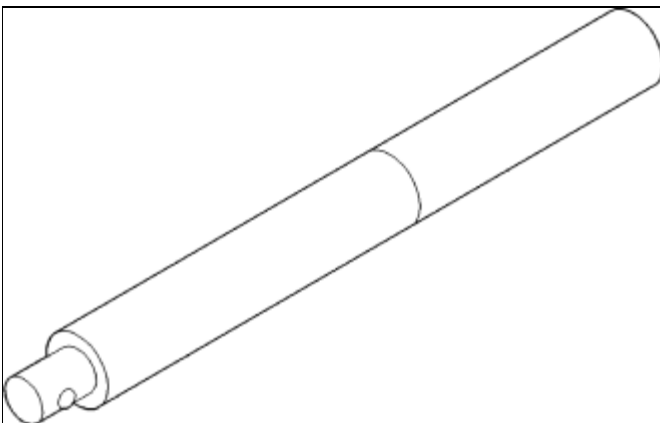
Dial Indicator C-3339

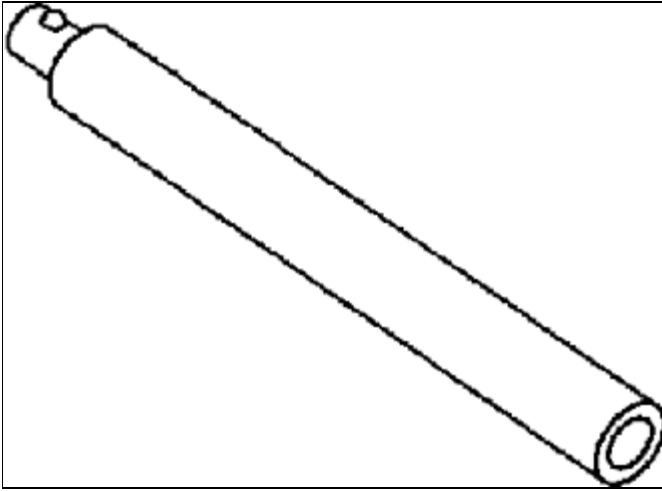
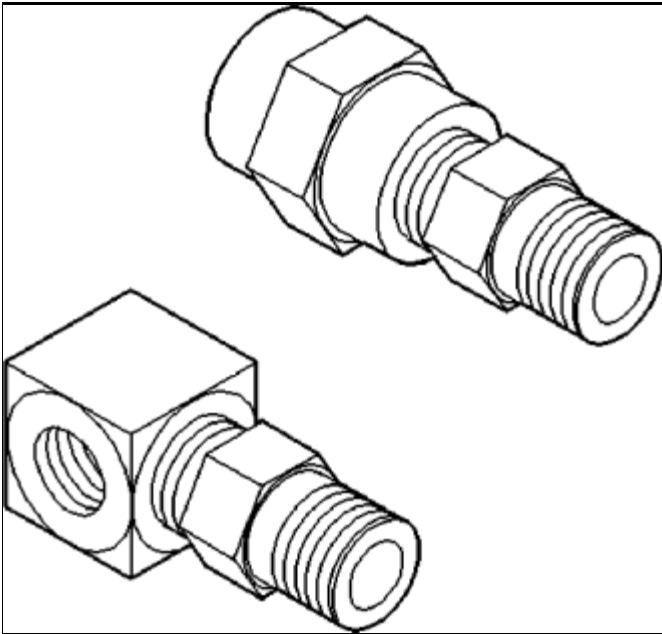


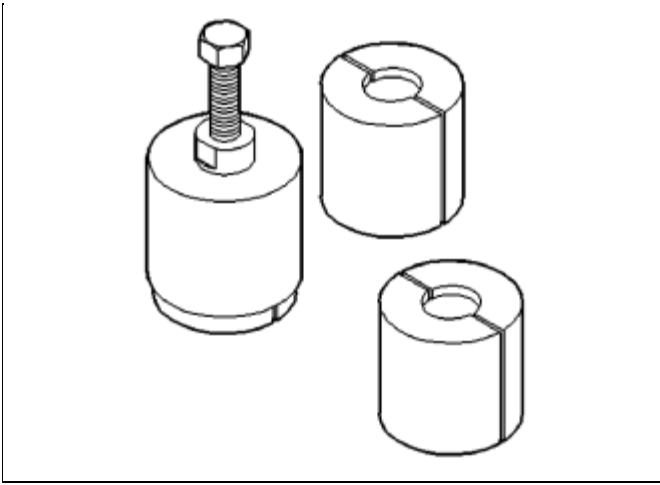
Hammer, Slide - C-3752



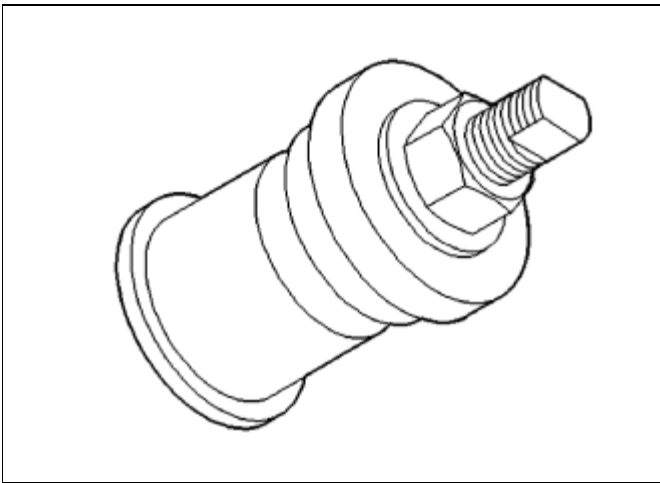
Puller, Seal - C-3981B



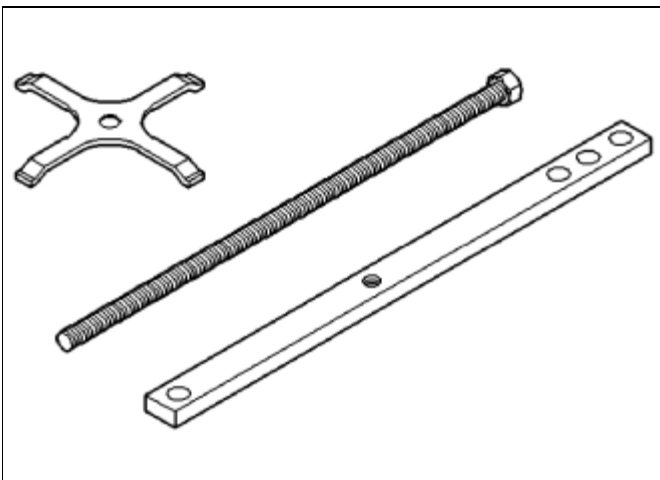
Universal Handle C-4171**Extension, Handle - C-4171-2****Adapter Set - L-4559**

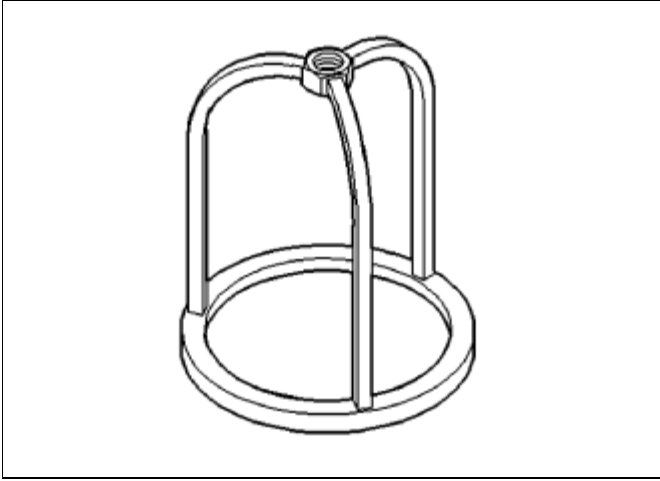
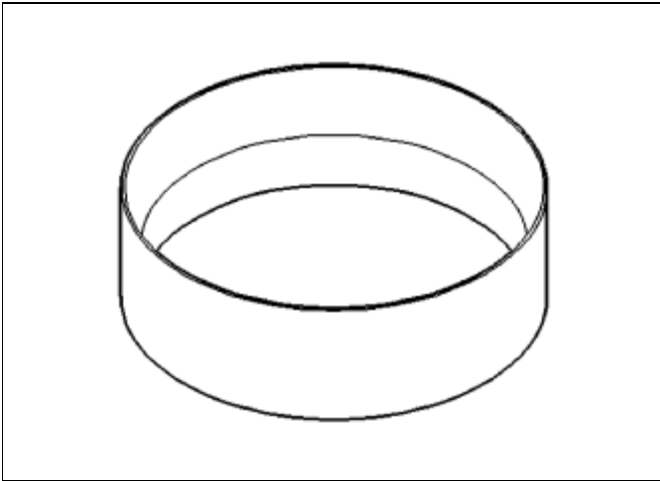


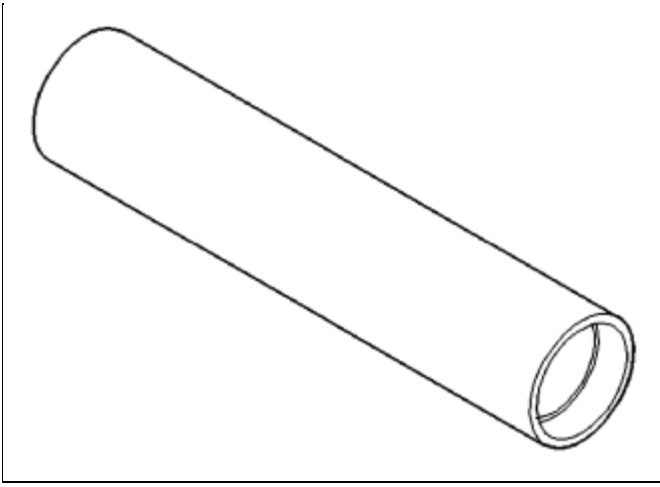
Puller Set 5048



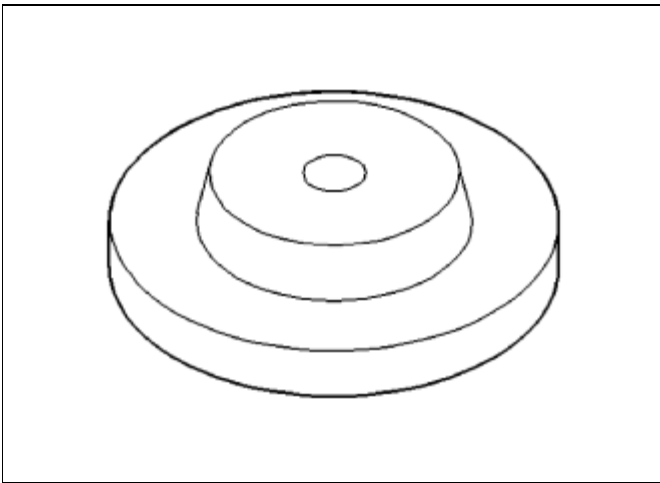
Installer - 5050A



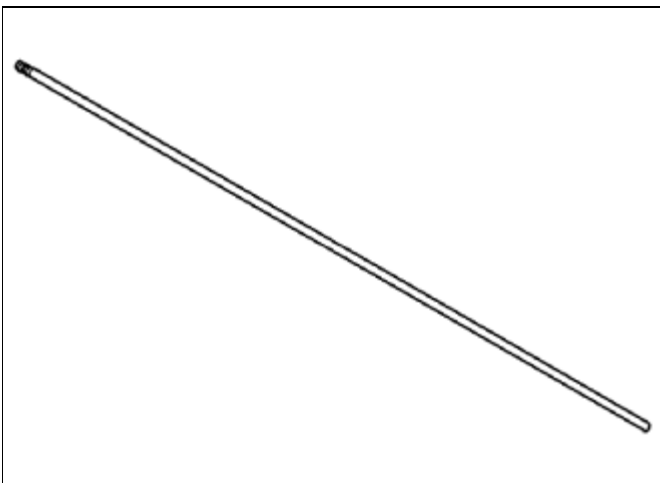
Compressor - 5058A**Compressor - 5059-A****Installer - 5067**

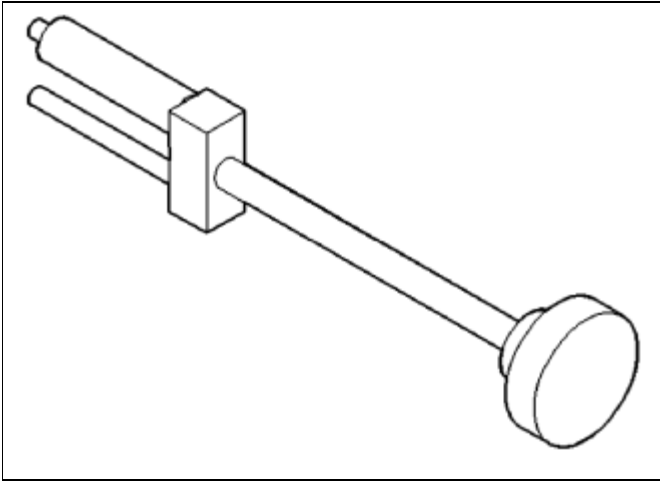
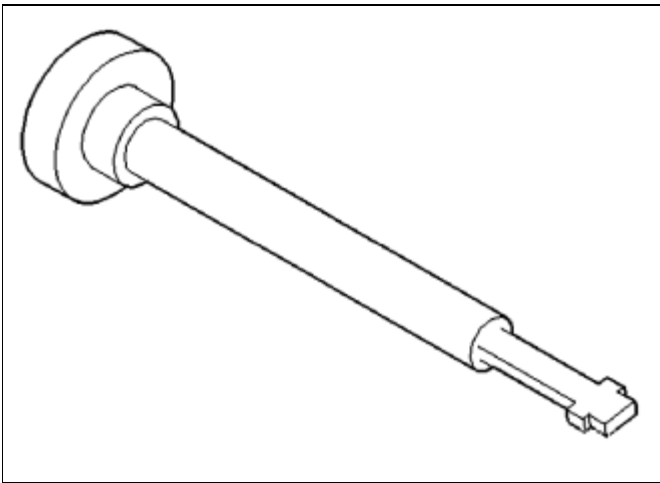


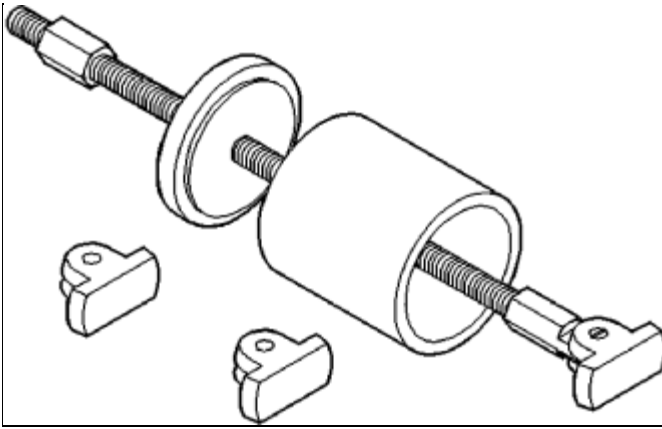
Installer - 6052



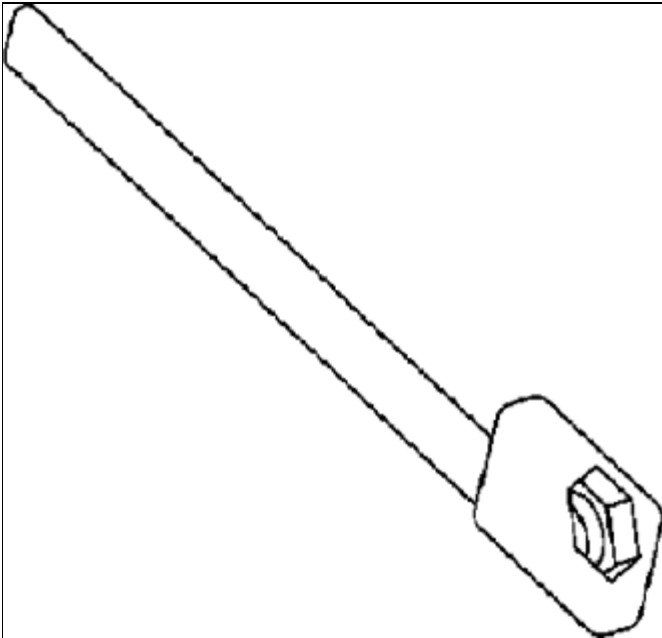
Disc - 6057



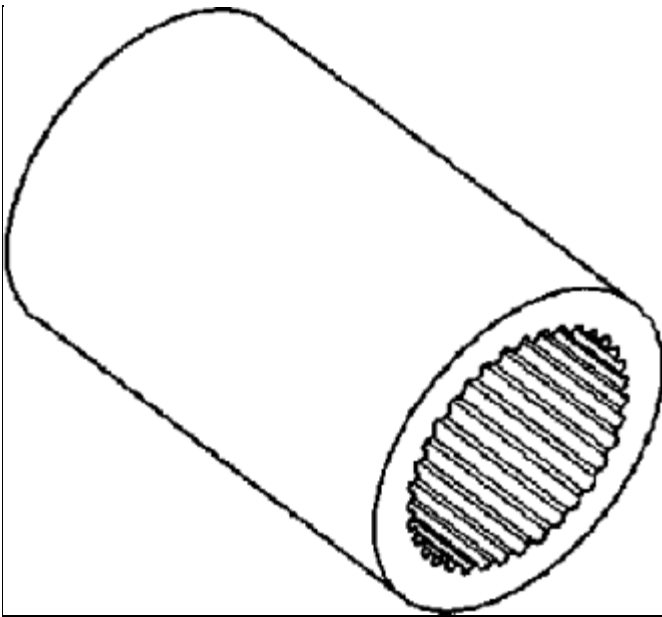
Tip - 6268**Remover/Installer - 6301****Remover/Installer - 6302**



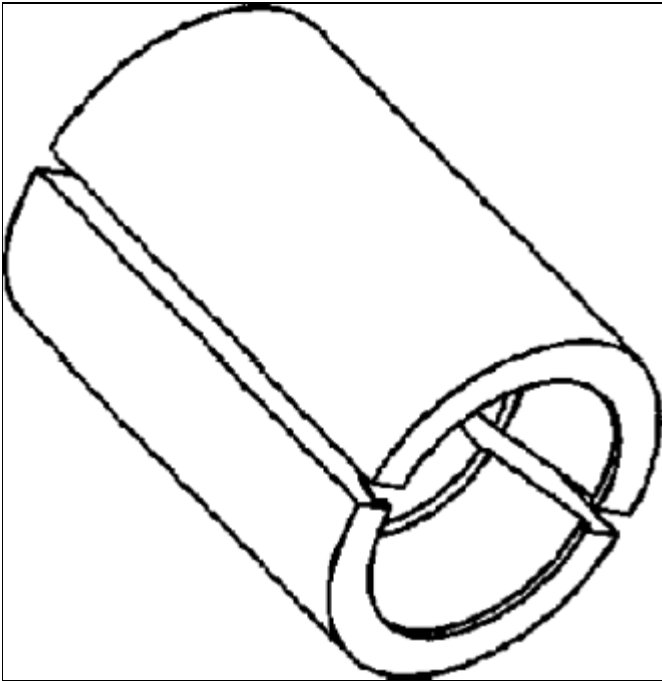
Remover 6310



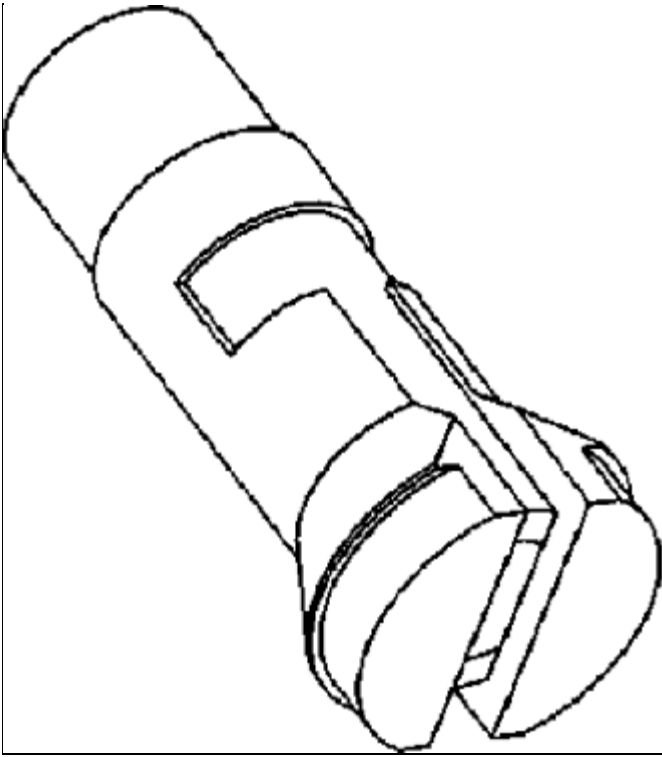
Wrench - 6497



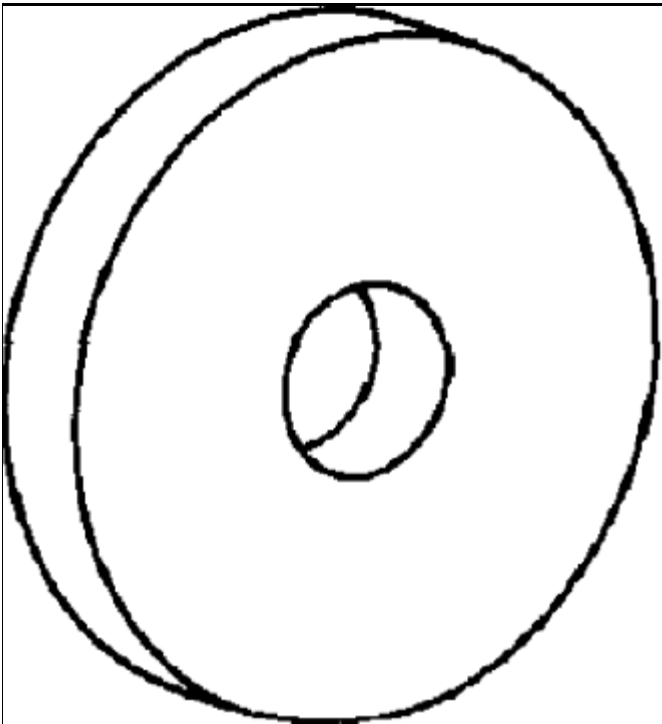
Wrench - 6498-A



Puller Jaws - 6545



Remover - 6596



Remover - 6597

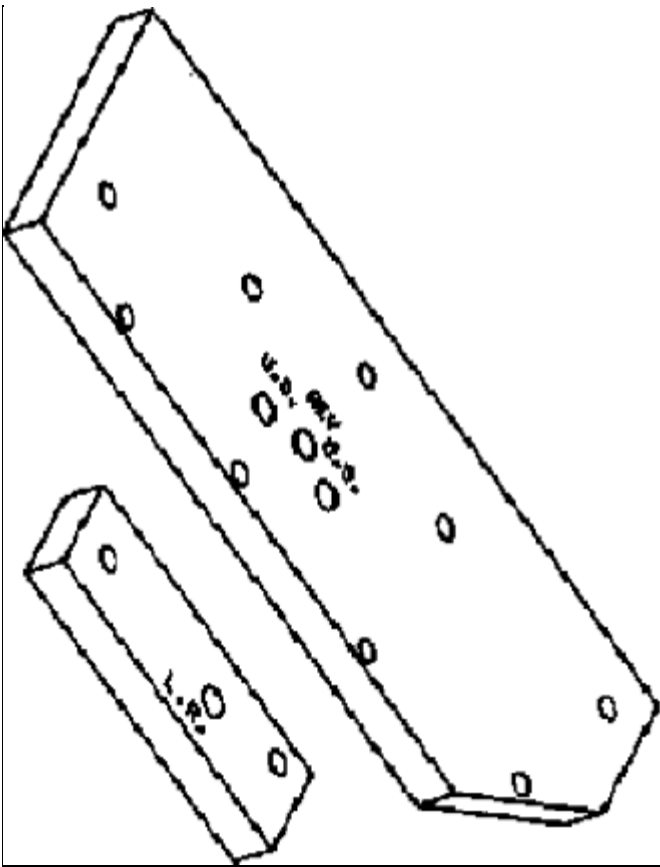
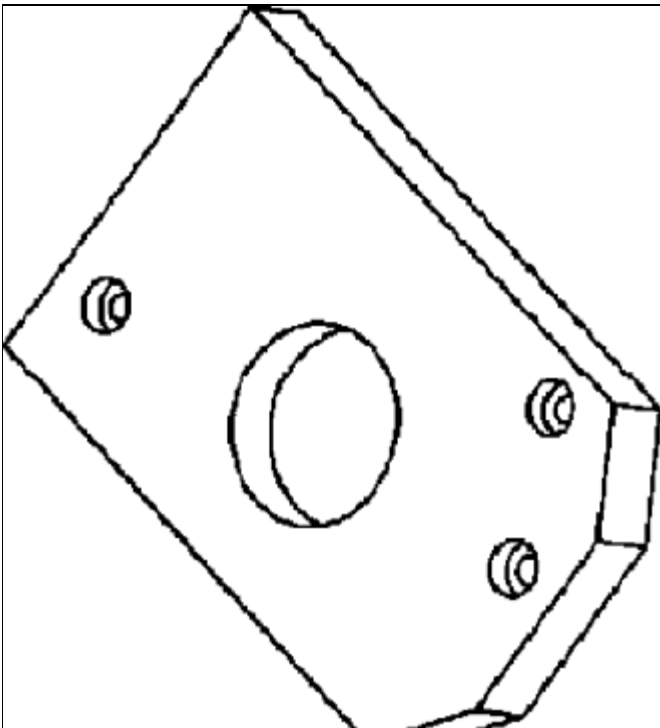
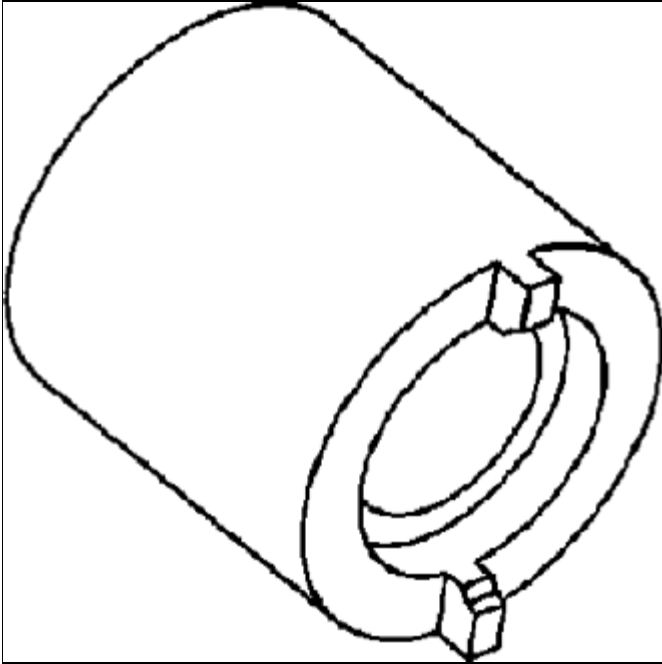


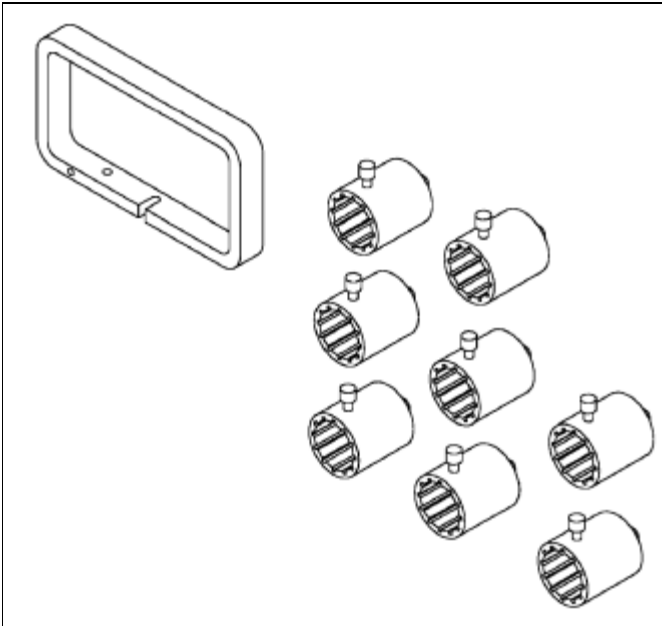
Plate Set - 6599



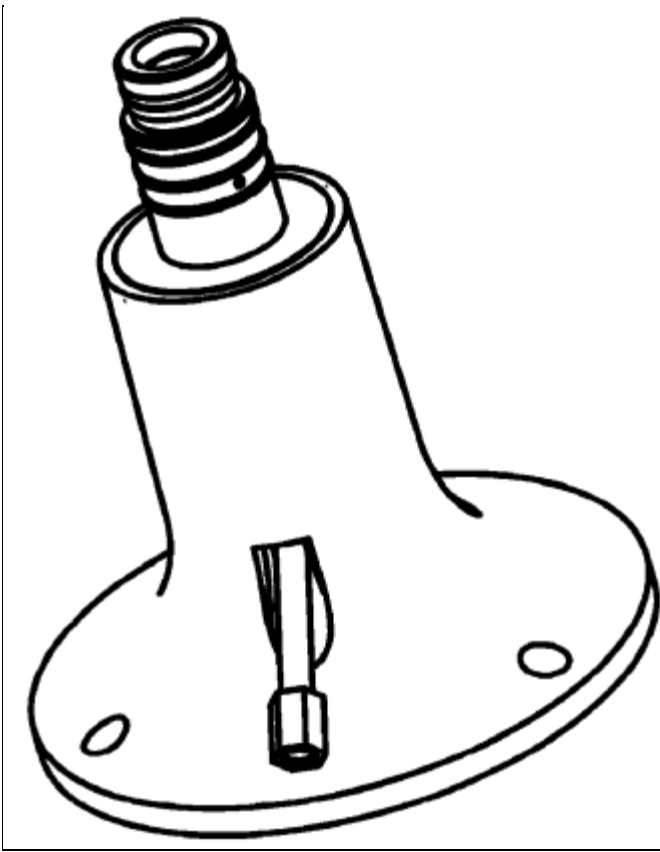
Plate, Support - 6618A



Tool, Staking - 6639



End Play Set - 8266

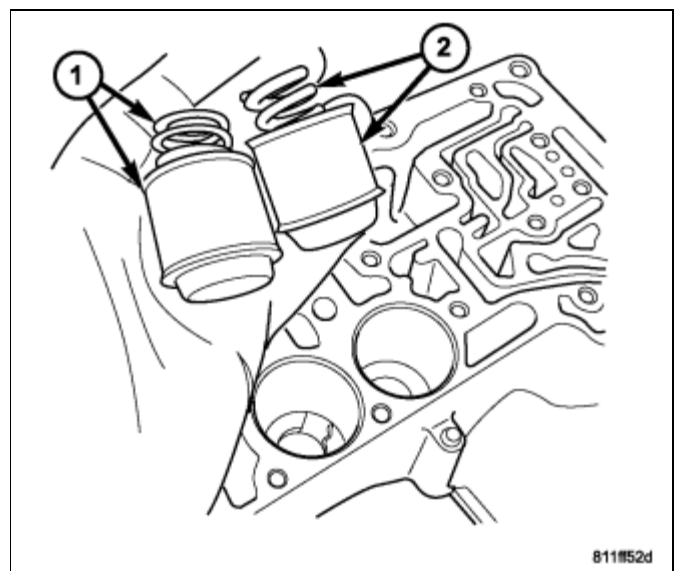


Fixture, Pressure - 8391

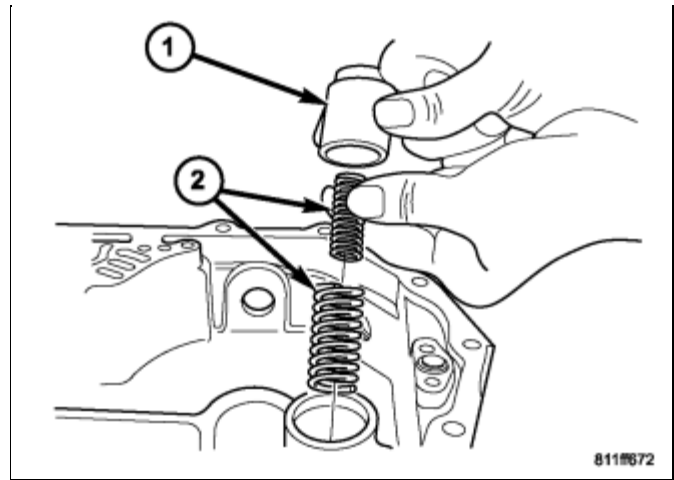
ACCUMULATOR

DESCRIPTION

The 42RLE underdrive, overdrive, low/reverse, and 2/4 clutch hydraulic circuits each contain an accumulator. An accumulator typically consists of a piston, return spring(s), and a cover or plug. The overdrive (1) and underdrive (2) accumulators are located within the transmission case, and are retained by the valve body.



The low reverse (1) accumulator is also located within the transmission case, but the assembly is retained by a cover and a snap-ring.



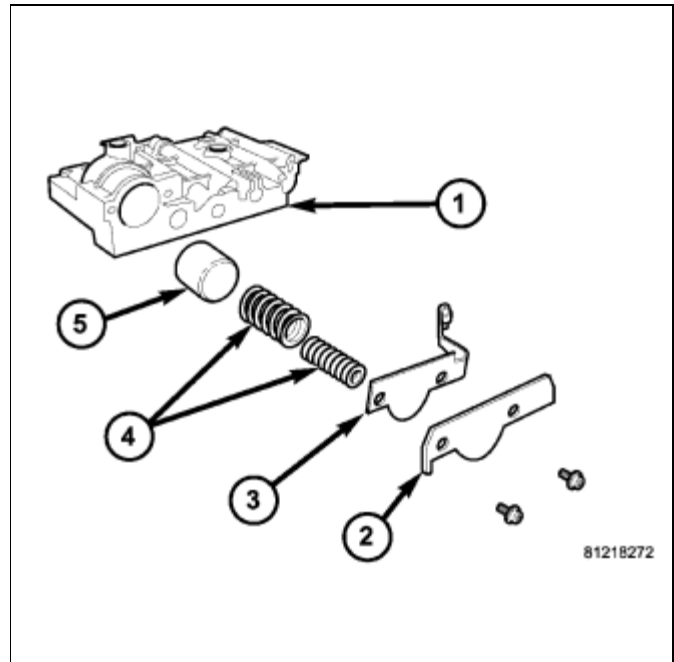
The 2/4 accumulator (5) is located in the valve body. It is retained by a cover and retaining screws .

OPERATION

The function of an accumulator is to cushion the application of a frictional clutch element. When pressurized fluid is applied to a clutch circuit, the application force is dampened by fluid collecting in the respective accumulator chamber against the piston and springs. The intended result is a smooth, firm clutch application.

ADAPTER HOUSING SEAL

REMOVAL



1. Remove the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL).
2. Using a screw mounted in a slide hammer, remove the adapter housing seal.

INSTALLATION

1. Install a new adapter housing seal with Universal Handle C-4171 and Installer C-3860-A.
2. Install the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION).

BEARINGS

ADJUSTMENTS

BEARING ADJUSTMENT PROCEDURES

Take extreme care when removing and installing bearing cups and cones. **Use only an arbor press for installation**, as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will

give a false end play reading, while gauging for proper shims. Improperly seated bearing cup and cones are subject to low-mileage failure.

Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

NOTE: Bearing drag torque specifications must be maintained to avoid premature bearing failures.

Used (original) bearing may lose up to 50 percent of the original drag torque after break-in.

NOTE: All bearing adjustments must be made with no other component interference or gear inter-mesh.

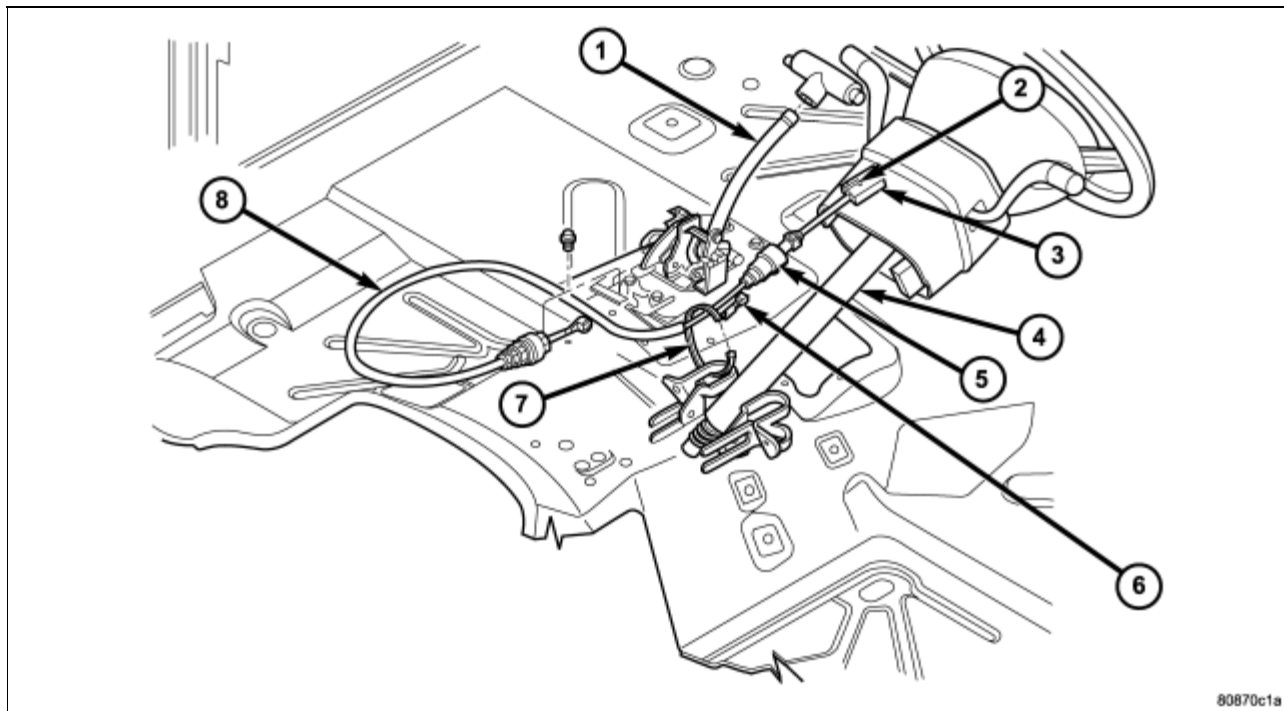
Oil all bearings before checking turning torque.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

DESCRIPTION

DESCRIPTION

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch .



DESCRIPTION

The Brake Transmission Shift Interlock System (BTSI), consists of a Park-Interlock cable and a solenoid mounted in the shift lever assembly. The Park-Interlock cable connects the automatic transmission floor mounted

shifter to the steering column ignition switch.

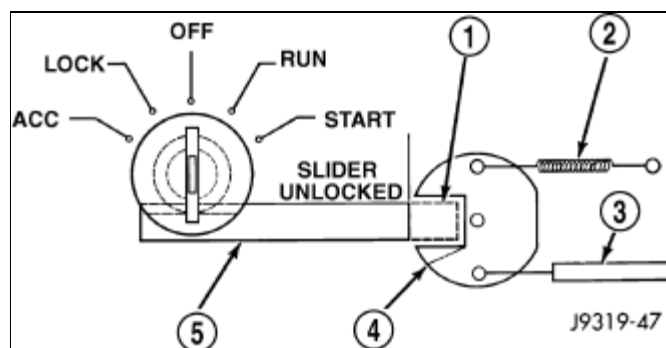
OPERATION

OPERATION

The system locks the shifter into the PARK position. The Interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A magnetic holding device in line with the park/brake interlock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position unless the shifter is fully locked into the PARK position.

OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shift lever assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

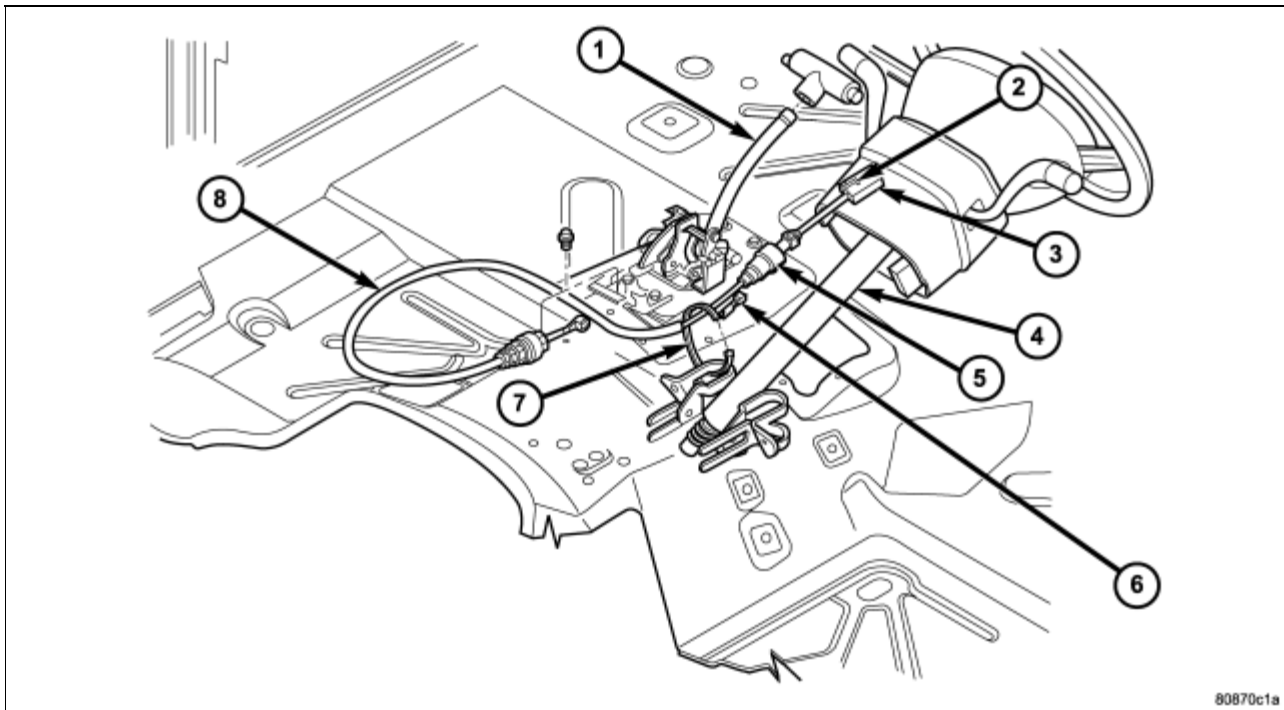
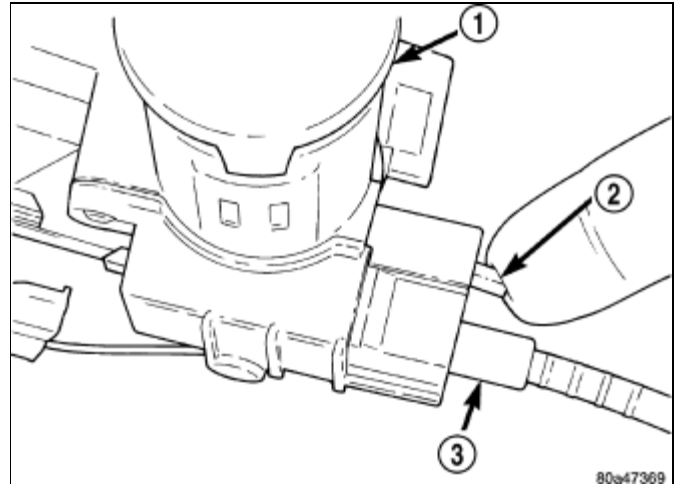


DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM

1. Verify that the key can only be removed in the PARK position
2. When the shift lever is in PARK And the shift handle pushbutton is in the "OUT" position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

REMOVAL

1. Remove lower steering column cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL)
2. Remove lower steering column shroud.
3. Remove tie strap near the solenoid retaining the brake transmission interlock cable to the steering column.
4. Disengage wire connector from solenoid.
5. With the ignition removed or in the unlocked position, disengage lock tab holding cable end to steering column .
6. Pull cable end from steering column.
7. Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
8. Disconnect the cable from the bellcrank .



9. Disconnect and remove the cable from the shift bracket.

INSTALLATION

1. Route replacement cable behind instrument panel and under floor console area to shift mechanism.
2. Insert cable end into opening in steering column hub under ignition lock. Push cable inward until lock tab engages.
3. Insert the cable end into the shifter bellcrank.
4. Place gear selector in PARK.
5. Push the spring-loaded cable adjuster forward and snap cable into bracket.
6. Adjust the brake transmission shifter interlock cable.
7. Verify that the cable adjuster lock clamp is pushed downward to the locked position.
8. Test the park-lock cable operation.
9. Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)
10. Install tie strap to hold cable to base of steering column.
11. Install lower steering column shroud and ignition lock.
12. Install lower steering column cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION)

ADJUSTMENTS

ADJUSTMENT - BRAKE TRANSMISSION SHIFT INTERLOCK CABLE

1. Shift transmission into PARK.
2. Remove shift lever bezel and console screws. Raise bezel and console for access to cable. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Pull cable lock button up to release cable.
4. Turn ignition switch to LOCK position.
5. Use a spacer to create a one millimeter gap between the shifter pawl and top of the shift gate.
6. Pull the cable forward and release. Ensure the cable end is seated in the bellcrank and press cable lock button down until it snaps in place.
7. Check adjustment as follows:
 - a. Check movement of release shift handle button (floor shift) or release lever (column shift). You should not be able to press button inward or move column lever.
 - b. Turn ignition switch to RUN position.
 - c. Shifting out of park should not be possible.
 - d. Apply the brake and attempt to shift out of PARK. Shifting should be possible.
 - e. While the transmission is shifted out of PARK, release the brake and attempt to shift through all gears. Release the shift button at least once during this procedure. The ignition key should not go to the LOCK position.
 - f. Return transmission to the PARK position without applying the brake.
8. Move shift lever back to PARK and check ignition switch operation. You should be able to turn switch to LOCK position and shift lever release button/lever should not move.
9. Install shift lever bezel and console screws. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)

DRIVING CLUTCHES

DESCRIPTION

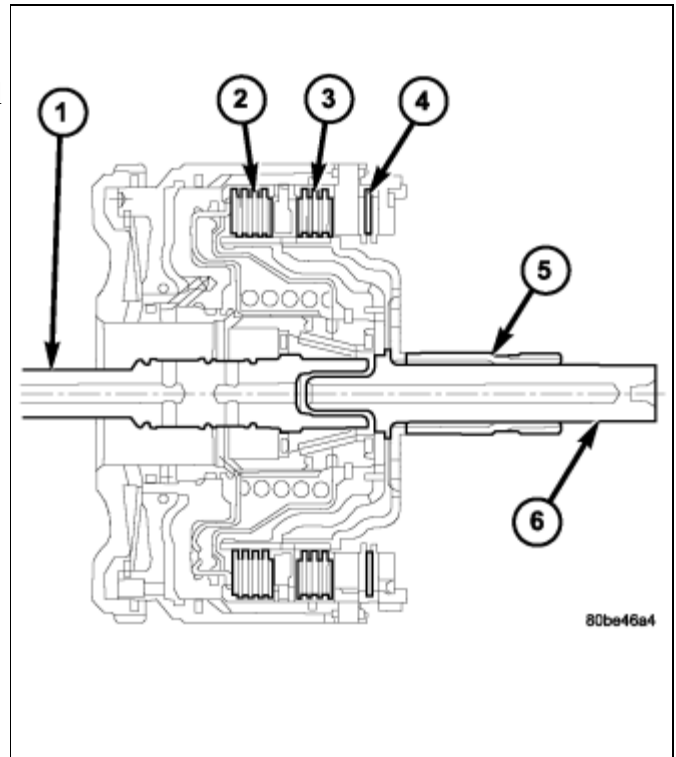
Three hydraulically applied input clutches are used to drive planetary components. The underdrive (2), overdrive (3), and reverse (4) clutches are considered input/driving clutches and are contained within the input clutch assembly. The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.



UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the rear sun gear.

OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the front planet carrier.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear only by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the front sun gear assembly is driven.

FLUID AND FILTER

DIAGNOSIS AND TESTING

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

1. A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged oil cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
2. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

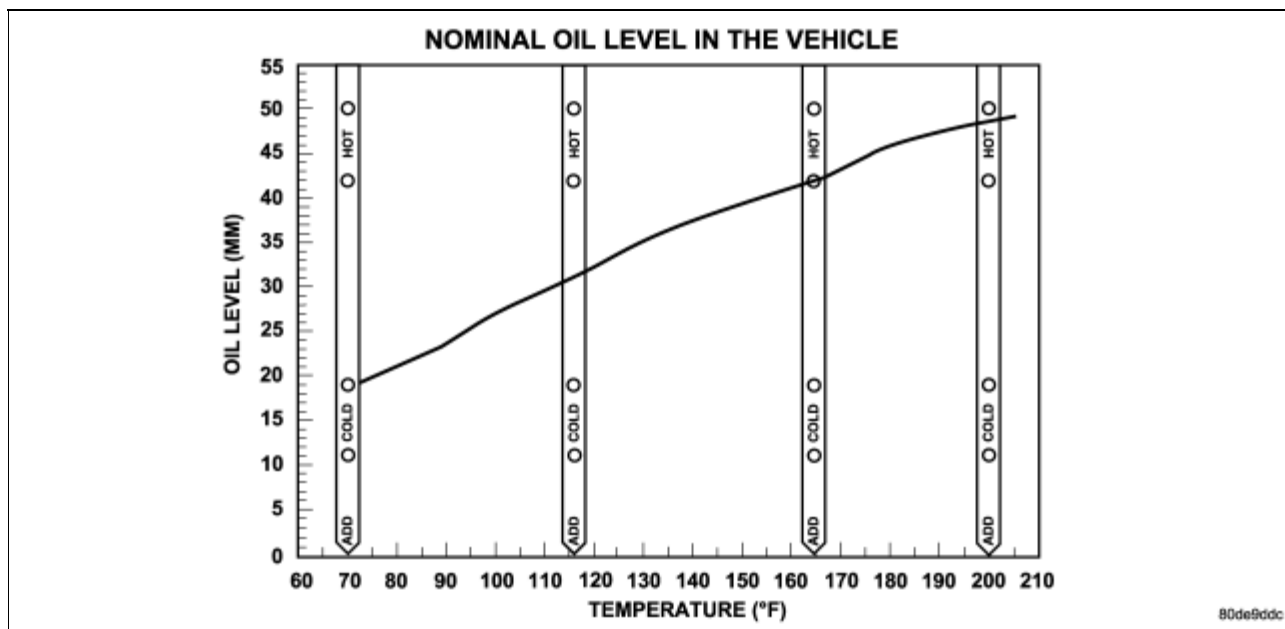
STANDARD PROCEDURE

FLUID LEVEL CHECK

The transmission sump has a dipstick to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the PARK and NEUTRAL positions. Place the selector lever in PARK to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82° C or 180° F), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level should be in COLD region at 21° C (70° F) fluid temperature. Adjust fluid level as necessary. Use only Mopar® ATF+4, Automatic Transmission Fluid.

FILL TUBE EQUIPPED WITH INDICATOR



42RLE Fluid Temperature Chart

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

1. Start engine and apply parking brake.
2. Connect scan tool and select transmission.
3. Select sensors.
4. Read the transmission temperature value.
5. Compare the fluid temperature value with the chart.
6. Adjust transmission fluid level shown on the dipstick according to the 42RLE Fluid Temperature Chart. Use only Mopar® ATF+4, Automatic Transmission Fluid.
7. Check transmission for leaks.

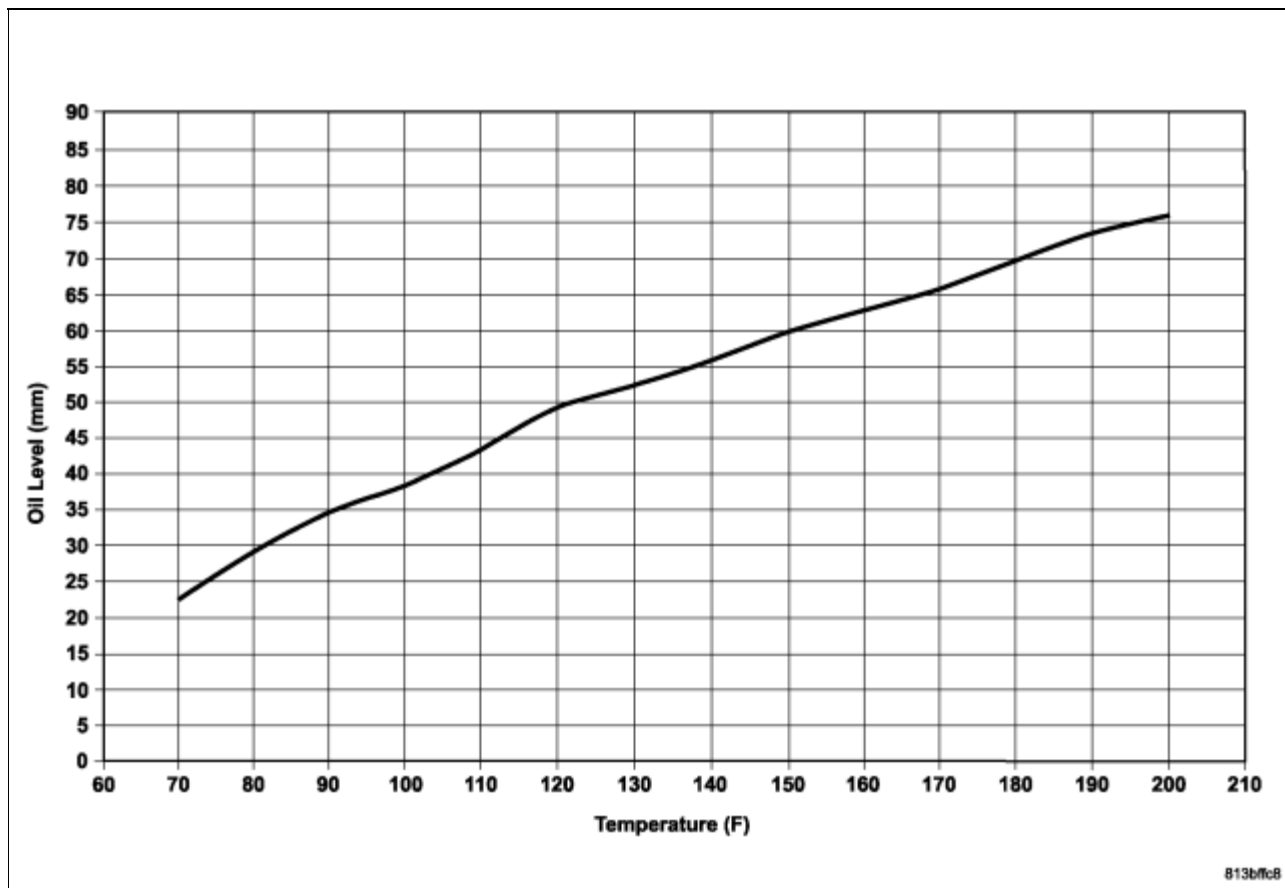
CAPPED FILL TUBE

1. Verify that the vehicle is parked on a level surface.
2. Remove the dipstick tube cap.

WARNING: There is a risk of accident from vehicle starting off by itself when engine running. There is a risk of injury from contusions and burns if you insert your hands into the engine when it is started or when it is running. Secure vehicle to prevent it from moving off by itself. Wear properly fastened and close-fitting work clothes. Do not touch hot or rotating parts.

3. Actuate the service brake. Start engine and let it run at idle speed in selector lever position "P".
4. Shift through the transmission modes several times with the vehicle stationary and the engine idling
5. Warm up the transmission, wait at least 2 minutes and check the oil level with the engine running. Push the Oil Dipstick 9336 into transmission fill tube until the dipstick tip contacts the oil pan and pull out again, read off oil level, repeat if necessary.

NOTE: The dipstick will protrude from the fill tube when installed.



6. Check transmission oil temperature using the appropriate scan tool.

NOTE: The true transmission oil temperature can only be read by a scan tool in REVERSE or any

forward gear position.

7. The transmission Oil Dipstick 9336 has indicator marks every 10mm. Determine the height of the oil level on the dipstick and using the height, the transmission temperature, and the Transmission Fluid Graph, determine if the transmission oil level is correct.
8. Add or remove oil as necessary and recheck the oil level.
9. Once the oil level is correct, install the dipstick tube cap.

FLUID/FILTER SERVICE

NOTE: Only fluids of the type labeled Mopar® ATF+4, Automatic Transmission Fluid, should be used in the transmission sump. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

NOTE: If the transmission is disassembled for any reason, the fluid and filter should be changed.

1. Raise vehicle on a hoist. Place a drain container with a large opening, under transmission oil pan.

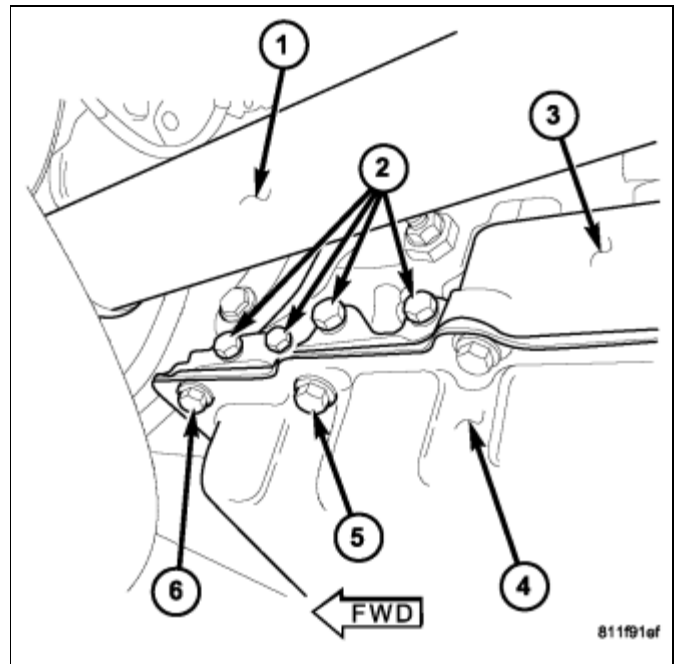
NOTE: One of the oil pan bolts (5) has a sealing patch applied from the factory. Separate this bolt for reuse.

2. Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.
3. Install a new filter and o-ring on bottom of the valve body and tighten retaining screws to 5 N·m (45 in. lbs.).

NOTE: Before installing the oil pan bolt (5) in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

4. Clean the oil pan and magnet. Reinstall pan using new Mopar® Silicone Adhesive sealant. Tighten oil pan bolts to 20 N·m (14.5 ft. lbs.).

5. Pour four quarts of Mopar® ATF+4, Automatic Transmission Fluid, through the dipstick opening.
6. Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.
7. Check the transmission fluid level and add an appropriate amount to bring the transmission fluid level to 3mm (1/8 in.) below the lowest mark on the dipstick.
8. Recheck the fluid level after the transmission has reached normal operating temperature, 82° C (180°F).
9. To prevent dirt from entering transmission, make certain that dipstick is fully seated into the dipstick opening.



TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4 to transmission:
 - a. If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF +4 to transmission.
 - b. If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF +4 to transmission.
3. Apply parking brakes.
4. Start and run engine at normal curb idle speed.
5. Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.
6. Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick**. Check to see if the oil level is equal on both sides of the dipstick. If one side is noticeably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.
7. Drive vehicle until transmission fluid is at normal operating temperature.
8. With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

9. Add fluid to bring level up to MAX arrow mark.

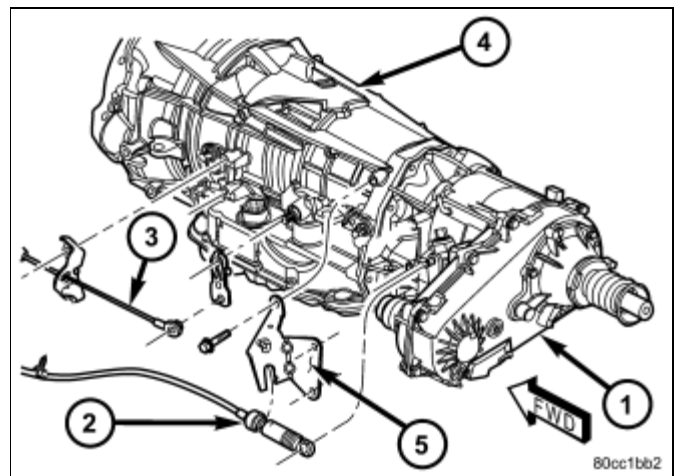
When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

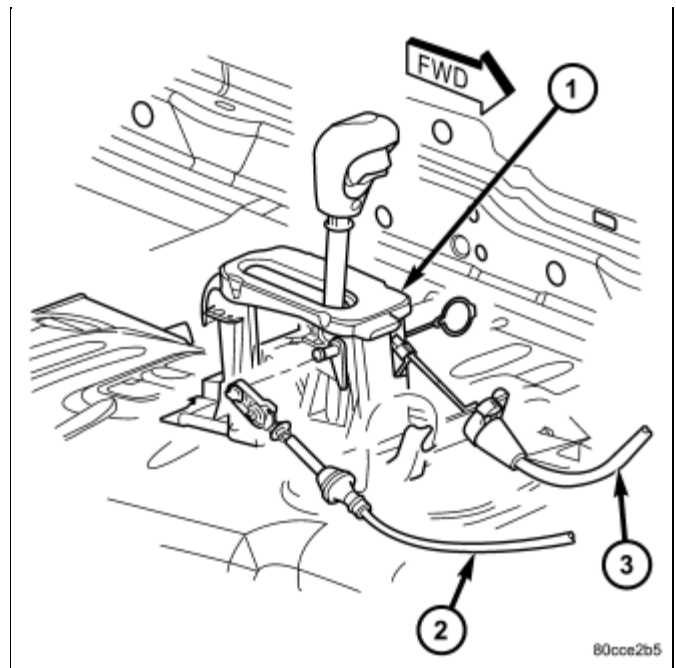
GEARSHIFT CABLE

REMOVAL

1. Shift transmission into PARK.
2. Raise vehicle.
3. Remove the shift cable eyelet from the transmission manual shift lever .
4. Remove shift cable from the cable support bracket.

5. Lower vehicle.
6. Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
7. Disconnect cable at shift lever and shifter assembly bracket .
8. Remove the nuts holding the shift cable seal plate to the floor pan .

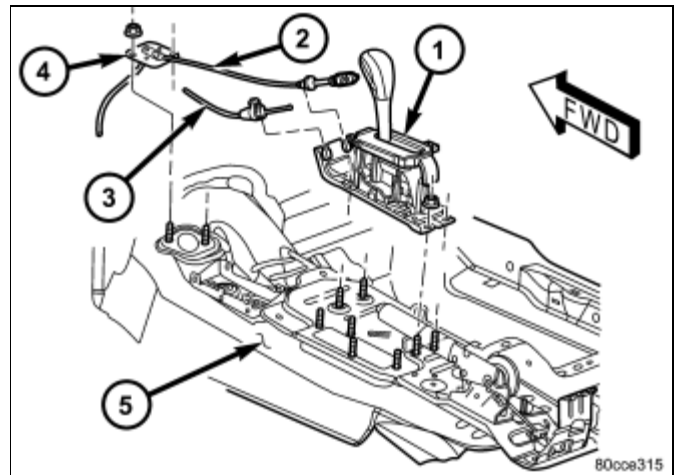




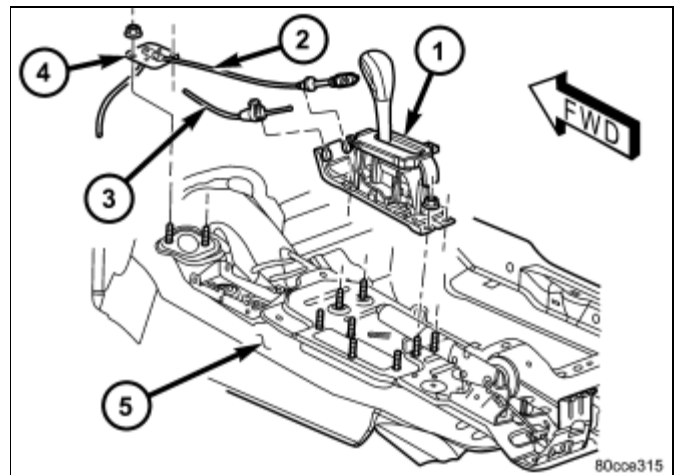
9. Pull cable through floor panel opening.
10. Remove shift cable from vehicle.

INSTALLATION

1. Route cable through hole in floor pan.
2. Install seal plate to studs in floor pan .
3. Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).

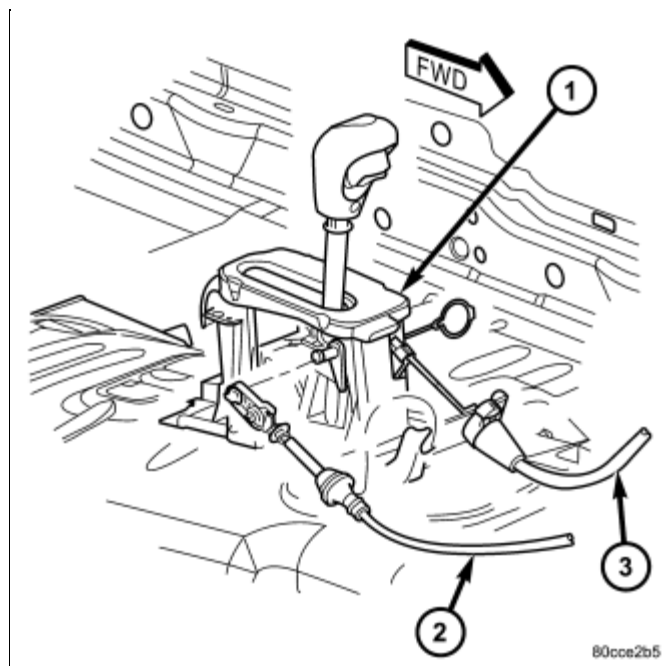


4. Install the shift cable to the shifter assembly bracket . Push cable into the bracket until secure.
5. Place the floor shifter lever in PARK position.
6. Loosen the adjustment screw on the shift cable.
7. Snap the shift cable onto the shift lever pin.



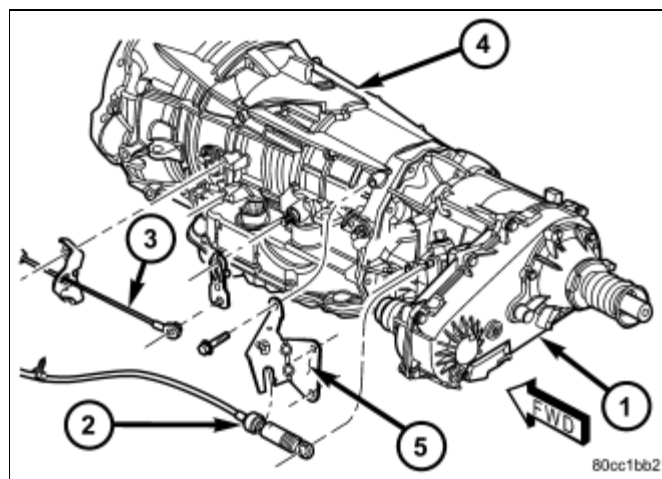
8. Raise the vehicle.
9. Install the shift cable to the shift cable support bracket .

10. Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.
11. Snap the shift cable onto the transmission manual shift lever.



12. Lower vehicle.
13. Verify that the shift lever is in the PARK position.
14. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
15. Verify correct shifter operation.
16. Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)

ADJUSTMENTS - GEARSHIFT CABLE

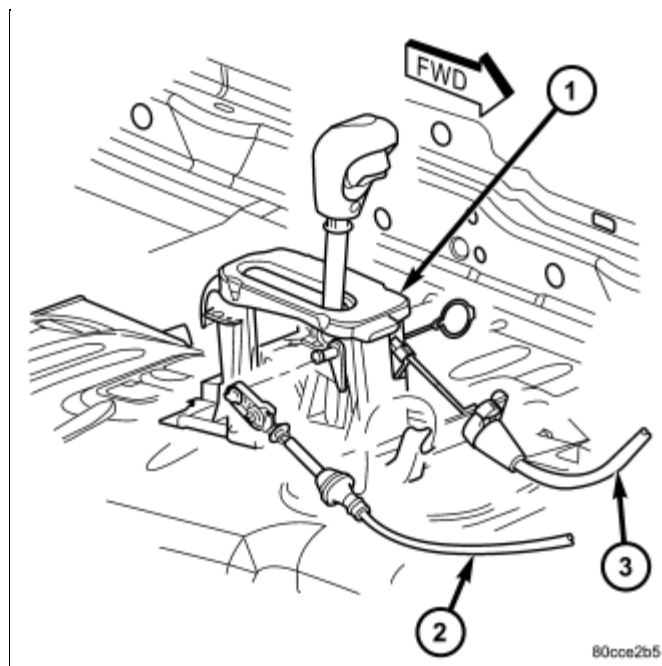


Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

Gearshift Adjustment Procedure

1. Shift transmission into PARK.
2. Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Loosen the shift cable adjustment screw .
4. Raise vehicle.
5. Unsnap cable eyelet from transmission shift lever.

6. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
7. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
8. Snap cable eyelet onto transmission shift lever.
9. Lower vehicle
10. Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct operation.
12. Install any floor console components removed for access.
(Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)



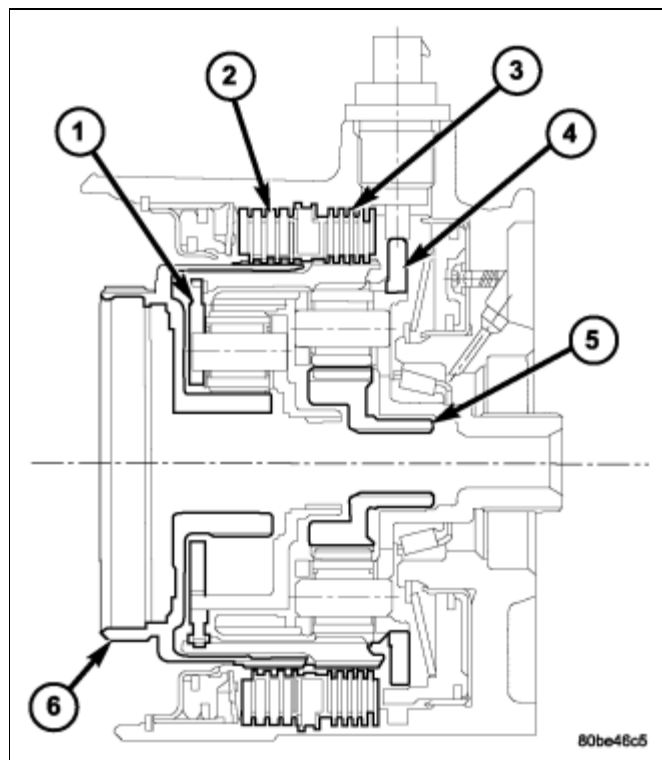
HOLDING CLUTCHES

DESCRIPTION

Two hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2/4 (2) and Low/Reverse (3) clutches are considered holding clutches and are contained at the rear of the transmission case .

OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.



2/4 CLUTCH

The 2/4 clutch is hydraulically applied in second and fourth gears by pressurized fluid against the 2/4 clutch piston. When the 2/4 clutch is applied, the front sun gear assembly is held or grounded to the transmission case.

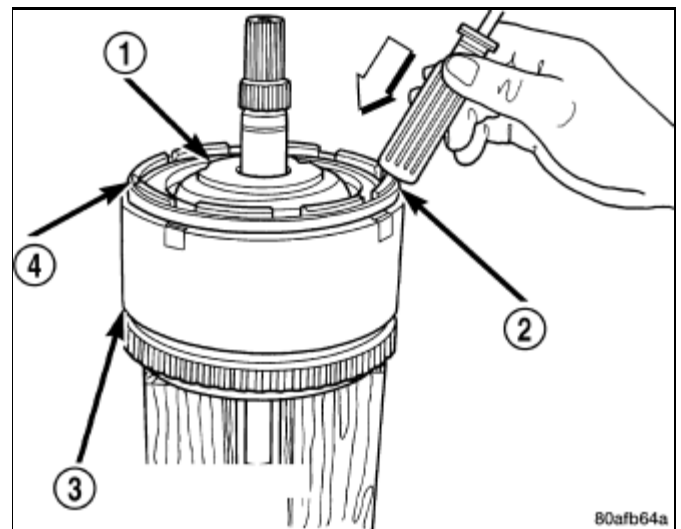
LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the front planet carrier/rear annulus assembly is held or grounded to the transmission case.

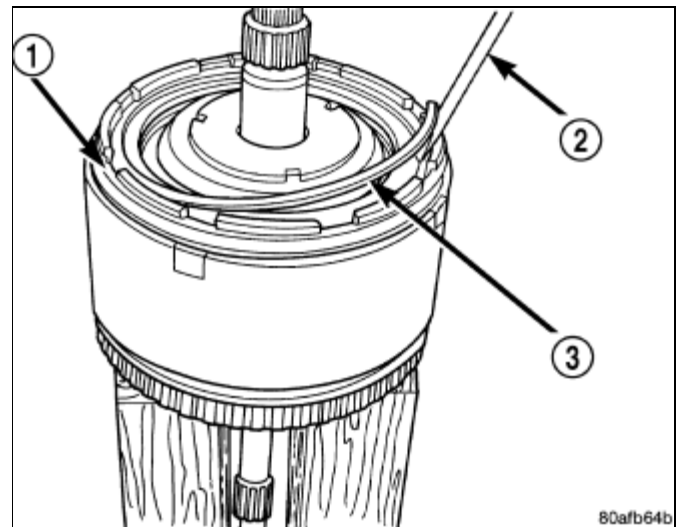
INPUT CLUTCH ASSEMBLY

DISASSEMBLY

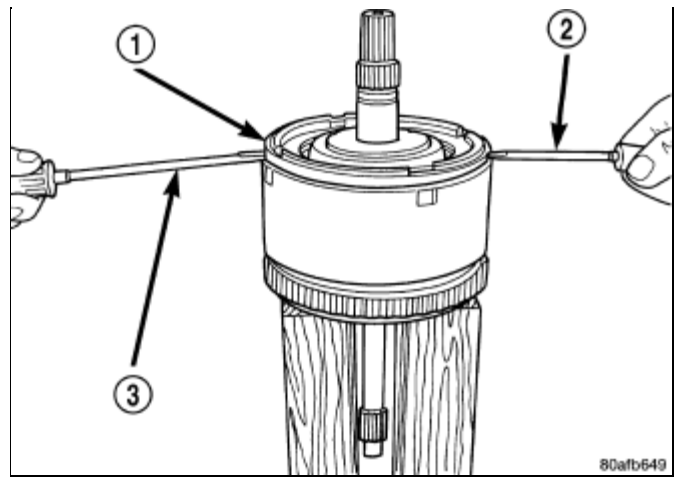
1. Mount input clutch assembly to Input Clutch Pressure Fixture (Tool 8391).
2. Tap down (2) reverse clutch reaction plate (4) to release pressure from snap ring .



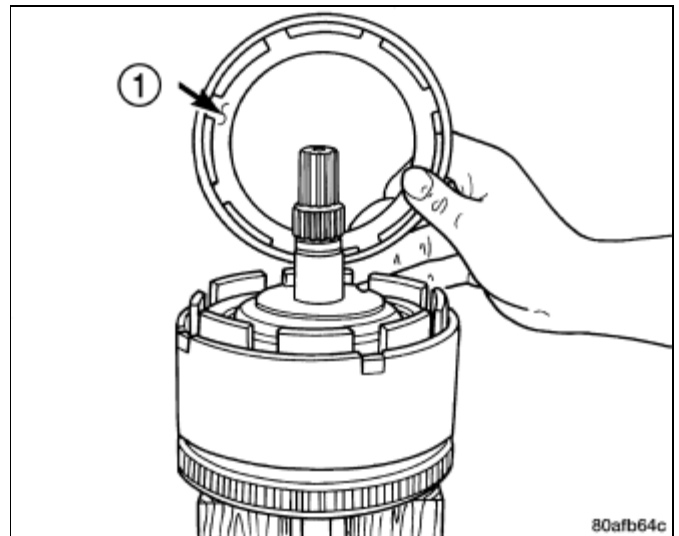
3. Remove reverse clutch snap ring (3).



4. Pry up reverse clutch reaction plate (1).

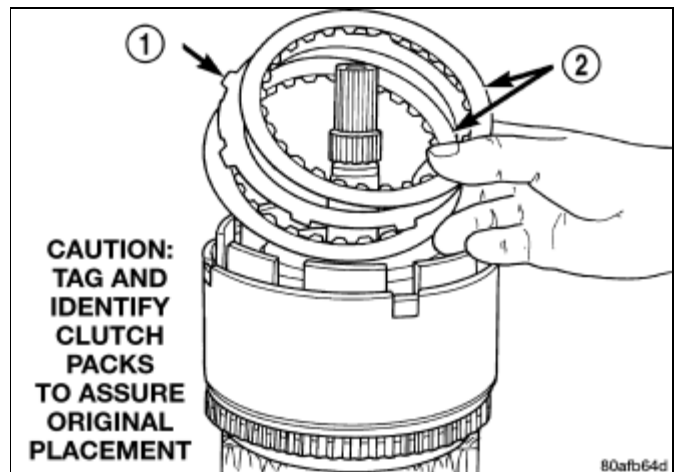


5. Remove reverse clutch reaction plate (1).

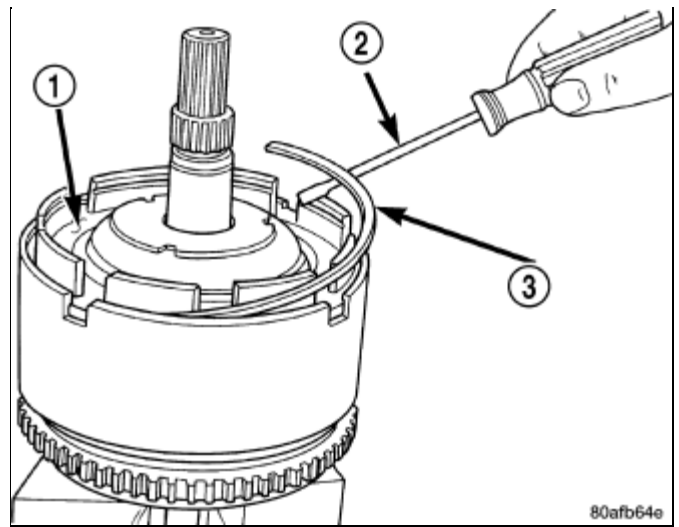


NOTE: Tag reverse clutch pack for reassembly identification.

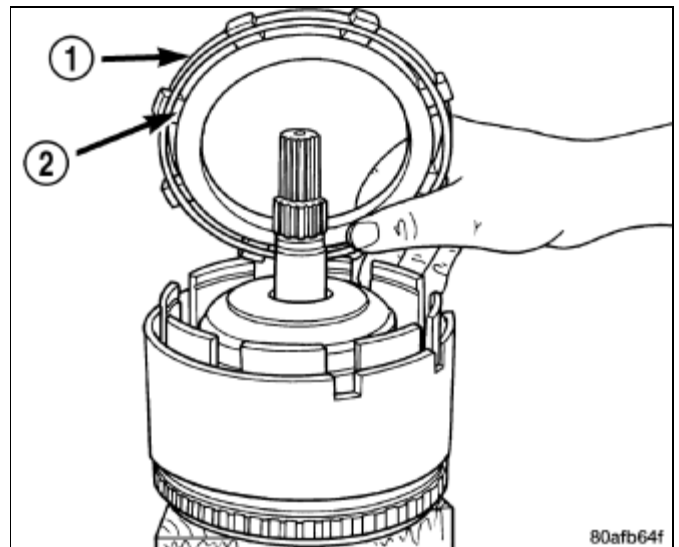
6. Remove the reverse clutch pack (two fibers/one steel) (1, 2).



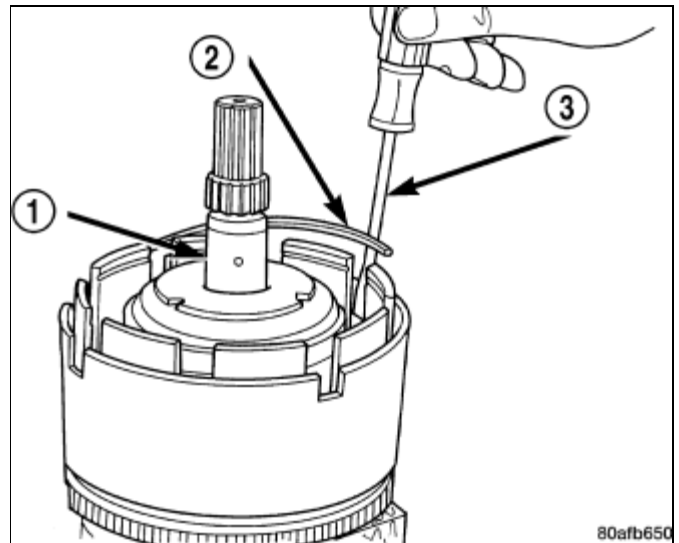
7. Remove the OD/Reverse reaction plate (1) snap ring (3).



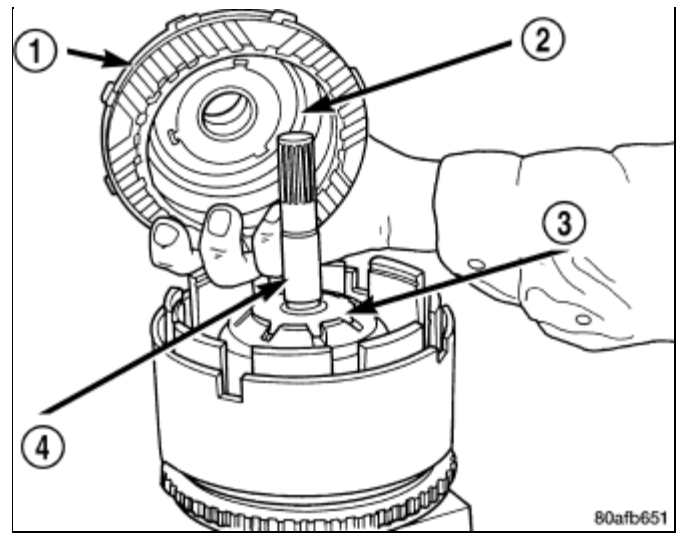
8. Remove OD/Reverse pressure plate (1).



9. Remove OD/Reverse reaction plate wave snap ring (2).

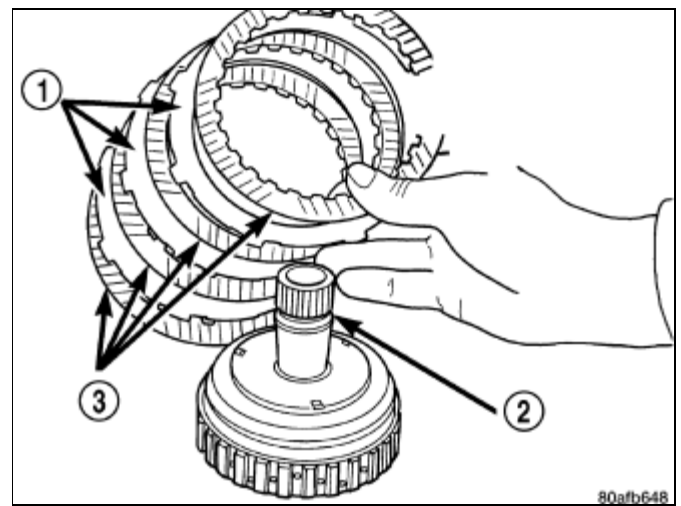


10. Remove OD shaft/hub and OD clutch pack (1).

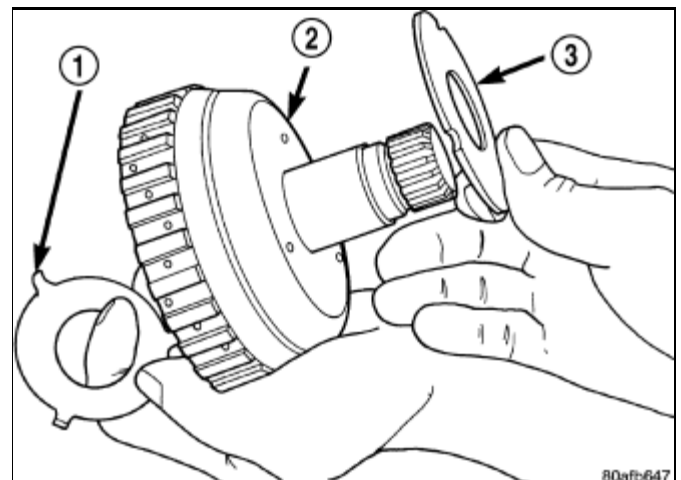


NOTE: Tag overdrive clutch pack for reassembly identification.

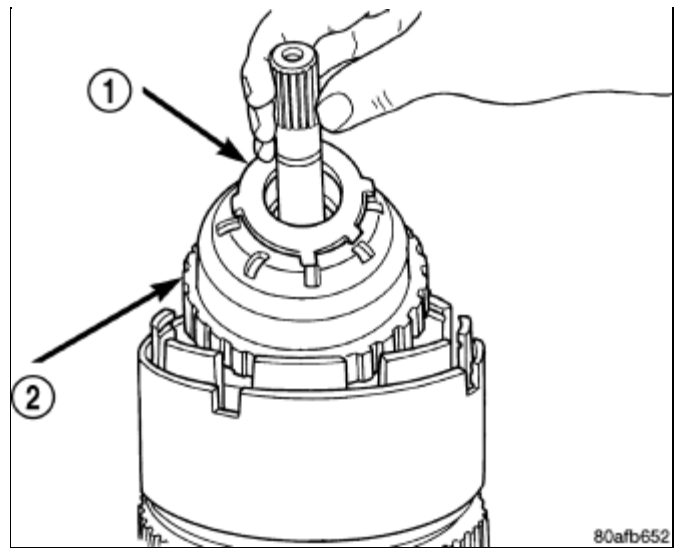
11. Remove the overdrive clutch (1, 3) from the overdrive hub/shaft (2).



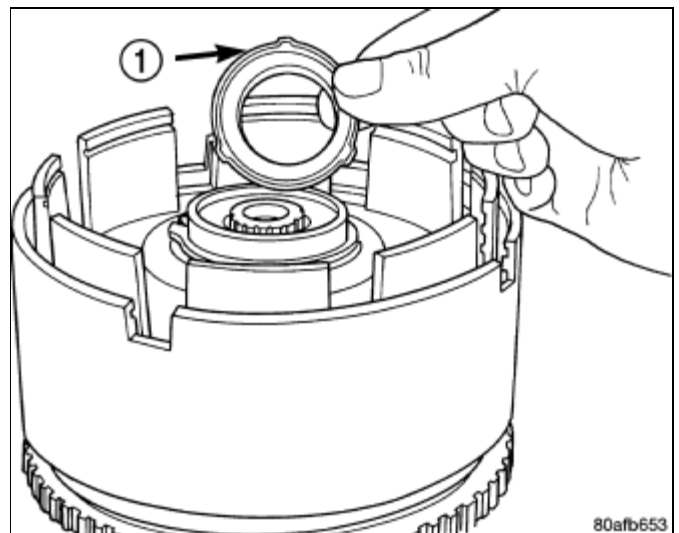
12. Remove and inspect number 3 and 4 thrust plates (1, 3).



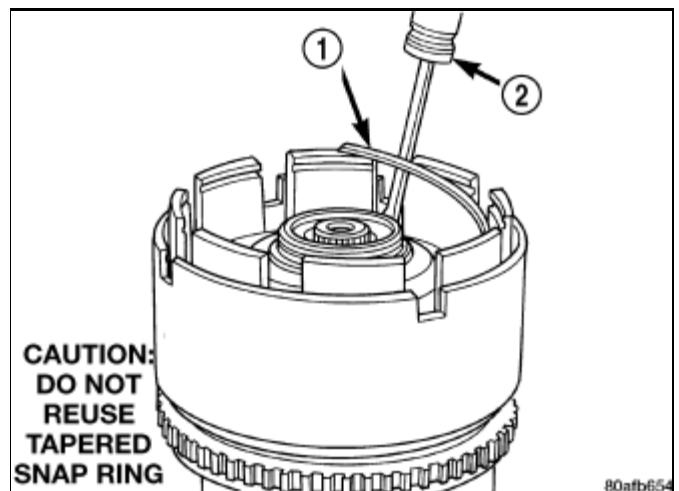
13. Remove the underdrive shaft assembly (2).



14. Remove the number 2 needle bearing (1).

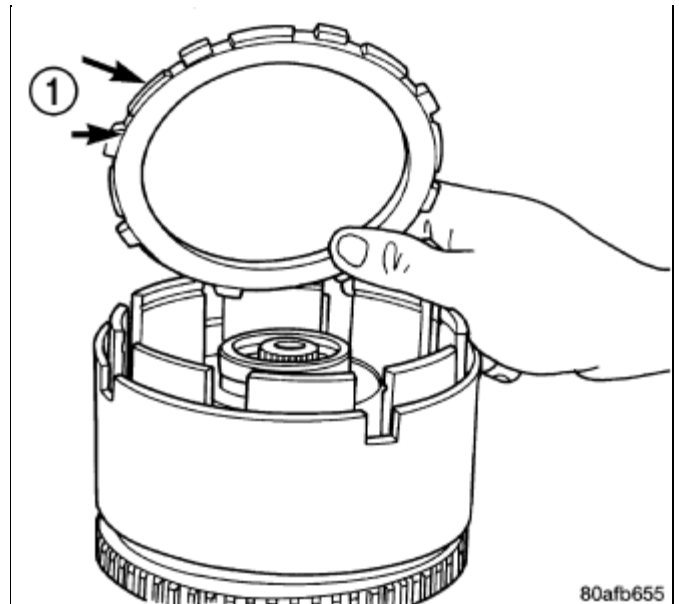


15. Remove the OD/UD reaction plate tapered snap ring (1).

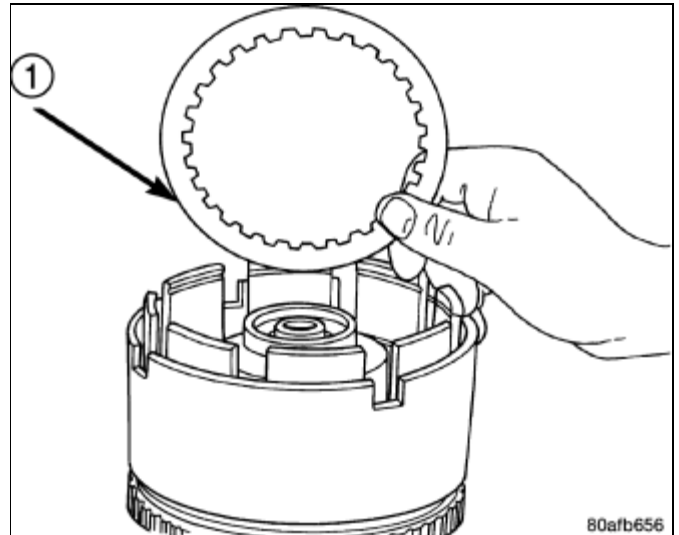


NOTE: The OD/UD clutch reaction plate has a step on both sides. The OD/UD clutches reaction plate goes tapered step side up.

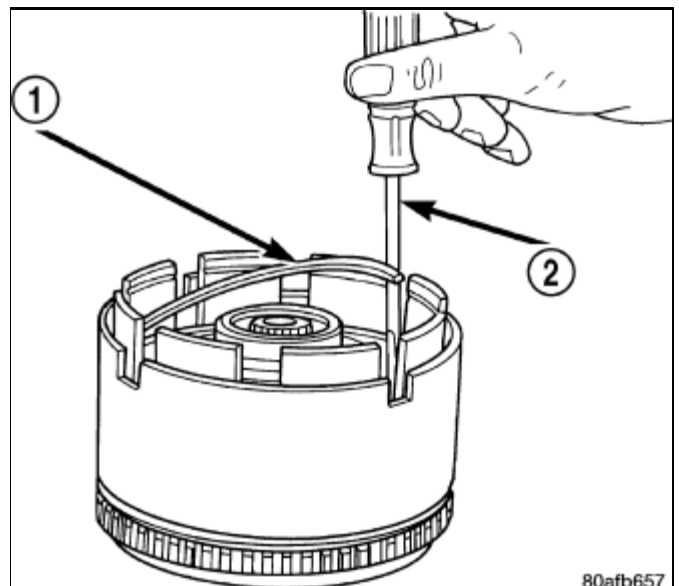
16. Remove the OD/UD reaction plate (1).



17. Remove the first UD clutch disc (1).

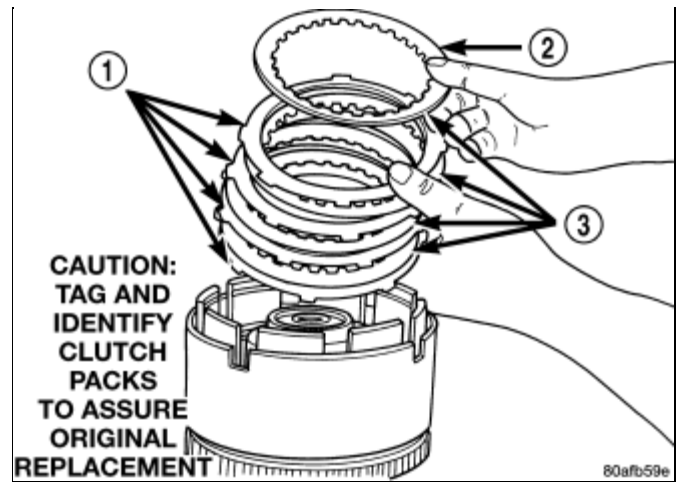


18. Remove the UD clutch flat snap ring (1).



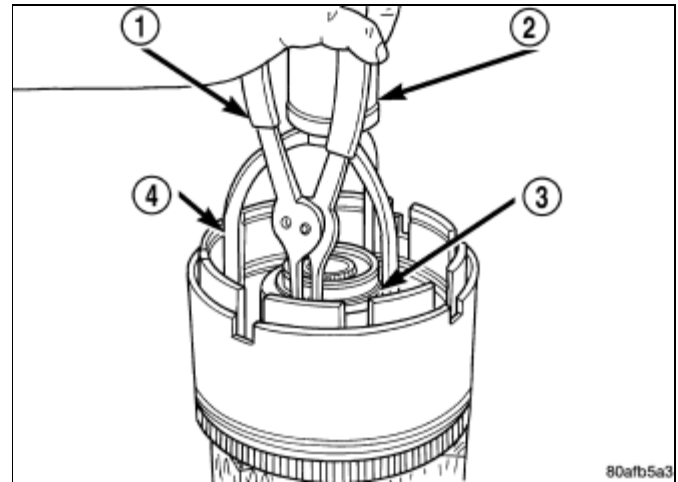
NOTE: Tag underdrive clutch pack for reassembly identification.

19. Remove the UD clutch pack (1, 3).

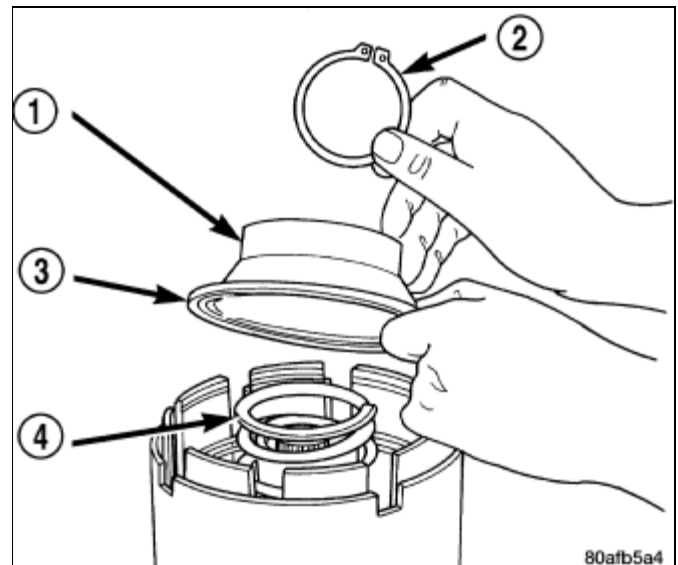


CAUTION: Compress return spring just enough to remove or install snap ring.

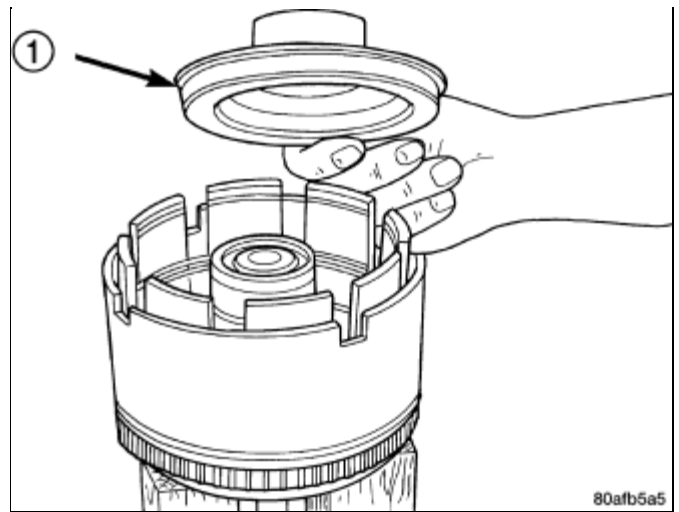
20. Using Compressor Tool 5059A (4) and an arbor press (2), compress UD clutch piston enough to remove snap ring (3).



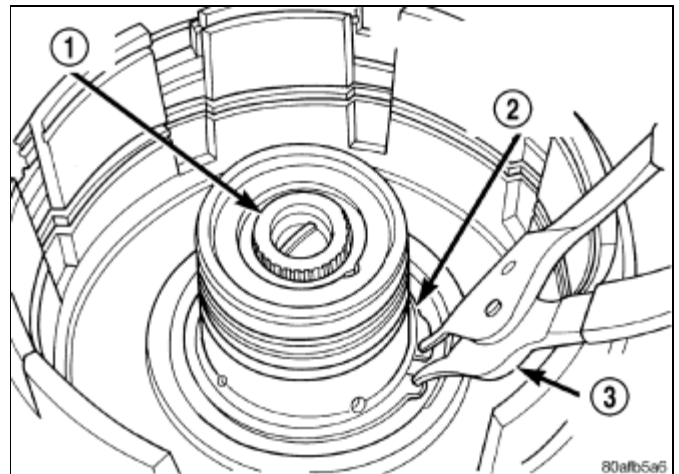
21. Remove the underdrive spring retainer snap ring (2), spring retainer (1), and spring (4).



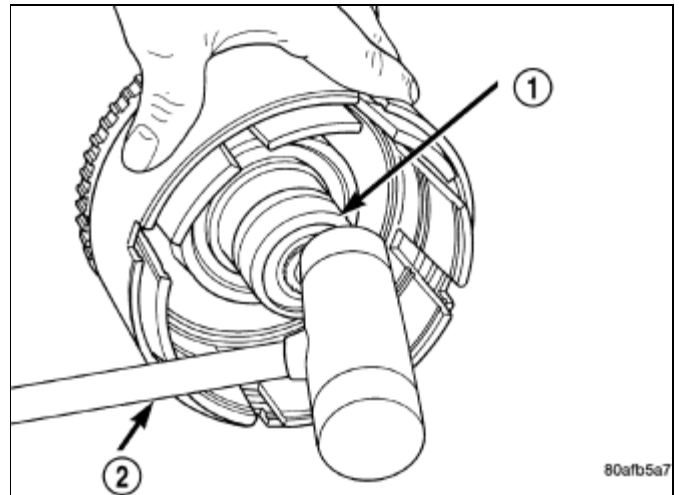
22. Remove the UD clutch piston (1).



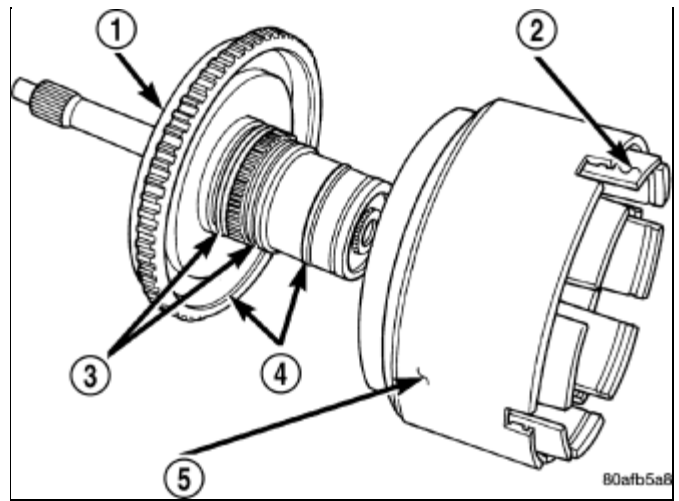
23. Remove the input hub tapered snap ring (2).



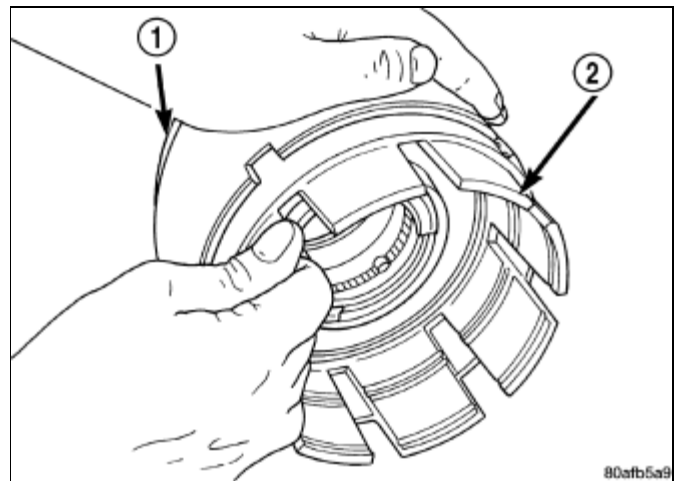
24. Tap on input hub (1) with soft faced hammer (2) and separate input hub from OD/Reverse piston and clutch retainer .



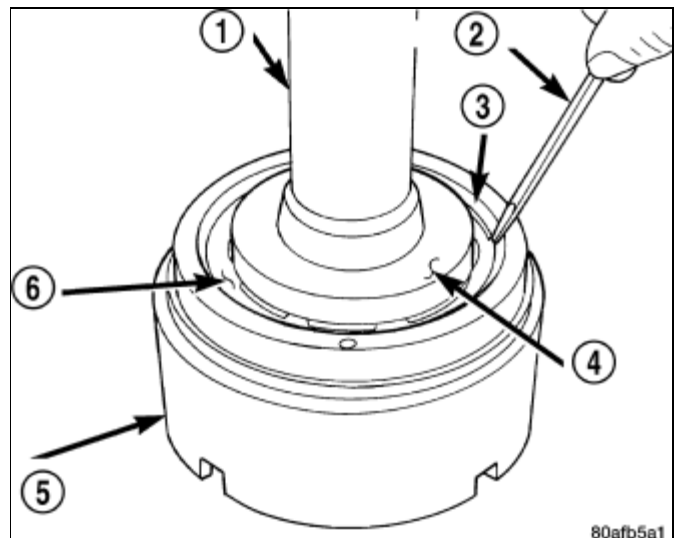
25. Separate the input hub from OD/Reverse piston (5) and clutch retainer (2).



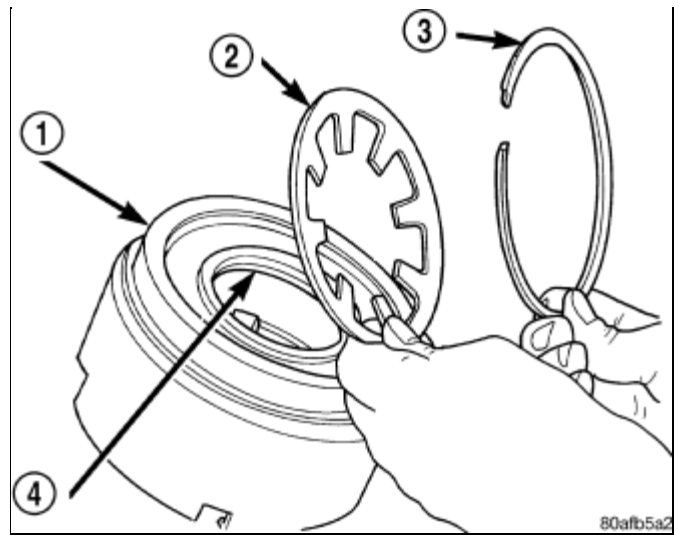
26. Separate clutch retainer (2) from OD/Reverse piston (1).



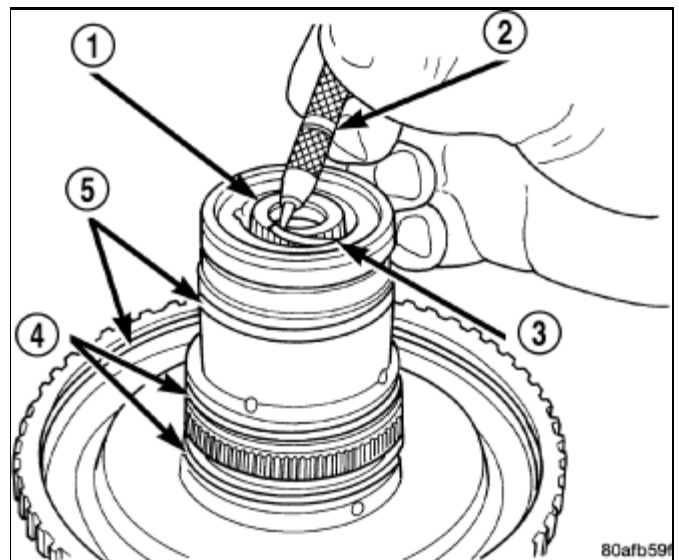
27. Using Disc 16057 (4) and an arbor press (1), compress OD/Reverse piston (5) return spring just enough to remove snap ring (3).



28. Remove the OD/Reverse piston (5) return spring and snap ring (3).



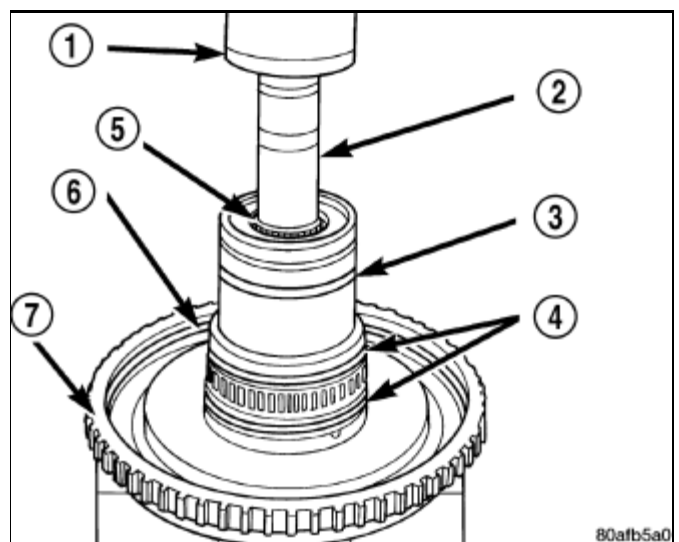
29. Remove input shaft (1) to input clutch hub snap ring (3).



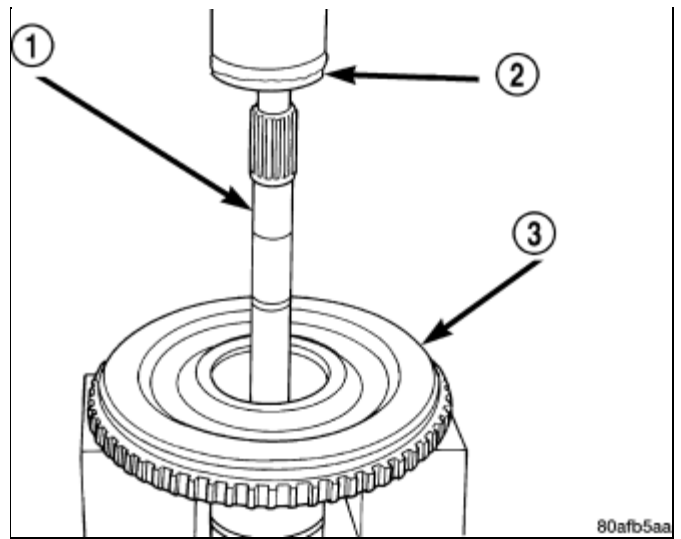
30. Using a suitably sized socket (2) and an arbor press (1), remove input shaft (5) from input shaft hub .

ASSEMBLY

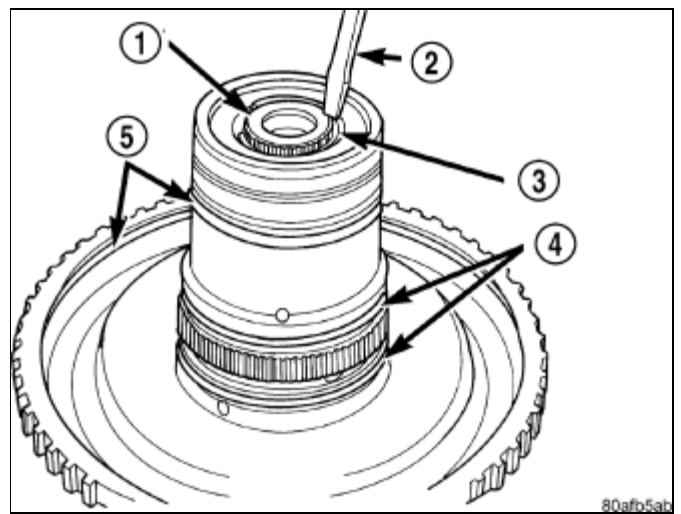
Use petrolatum on all seals to ease assembly of components.



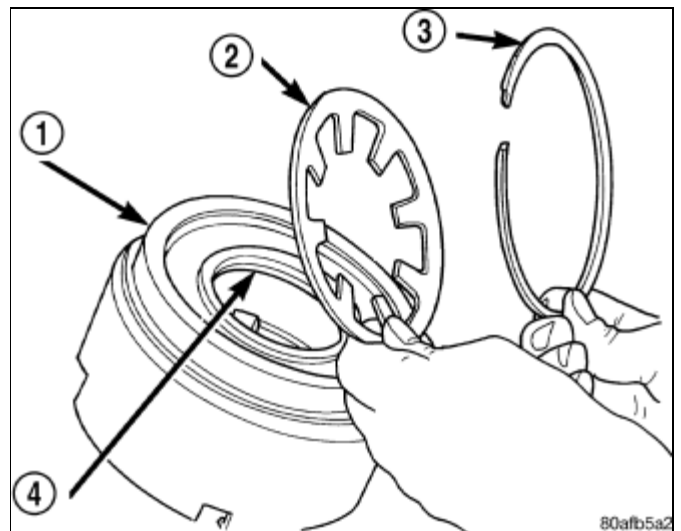
1. Using an arbor press (2), install input shaft (1) to input shaft hub (3).



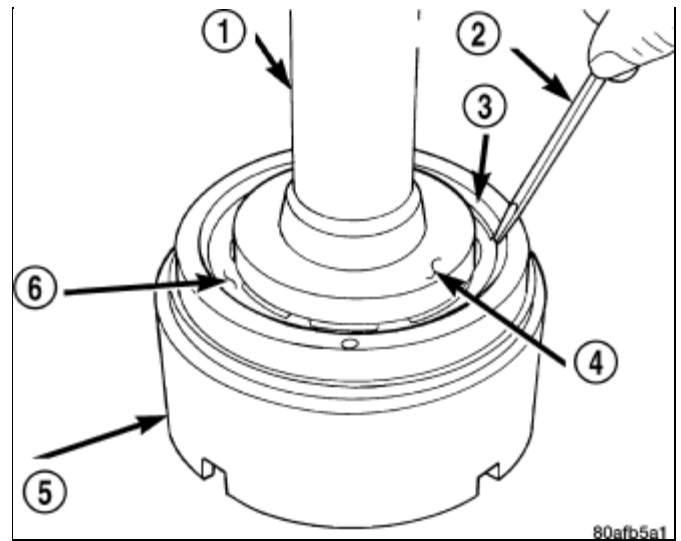
2. Install input shaft snap ring (3).



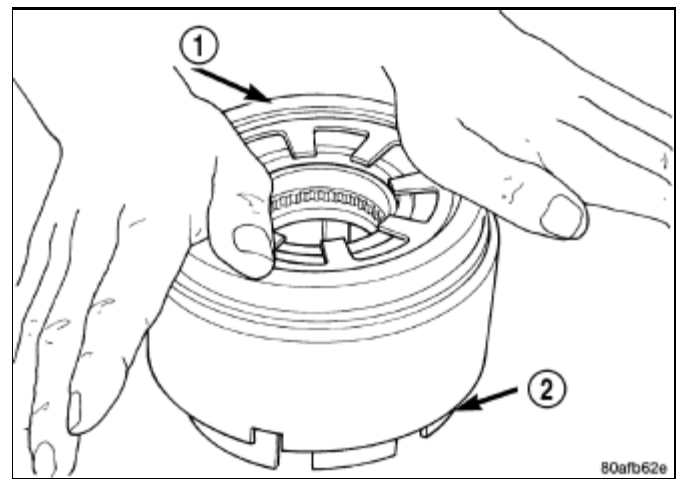
3. Position the OD/Reverse piston return spring (2) and snap ring (3) onto the OD/Reverse piston (1).



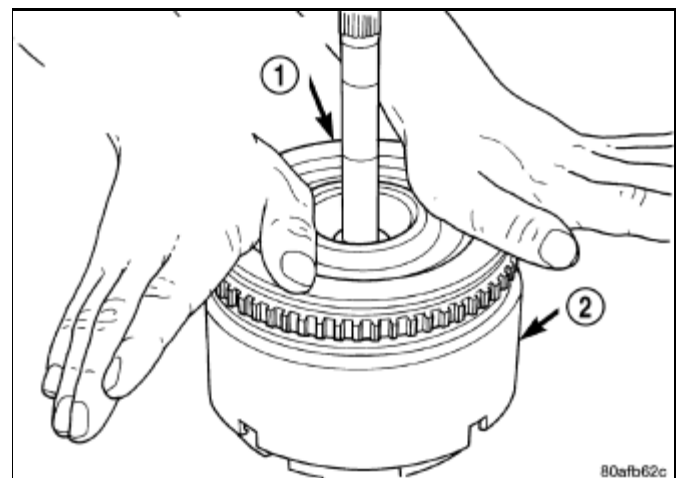
4. Using an arbor press (1) and Disc 6057 (4), install the OD/Reverse piston return spring (6) and snap ring (3).



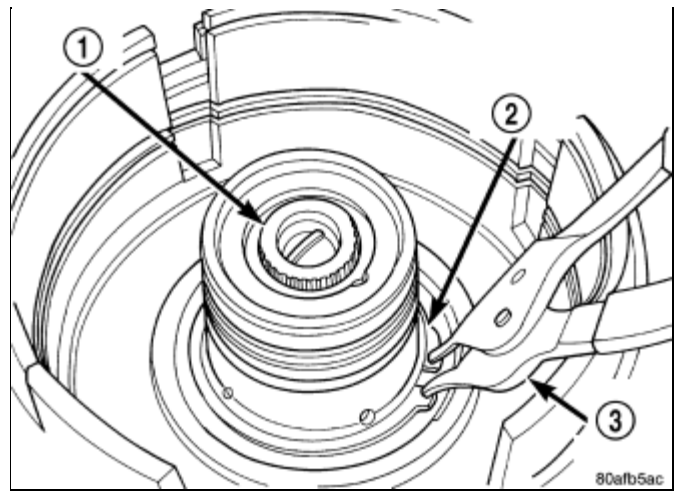
5. Install the OD/Reverse piston (1) assembly to the input clutch retainer (2).



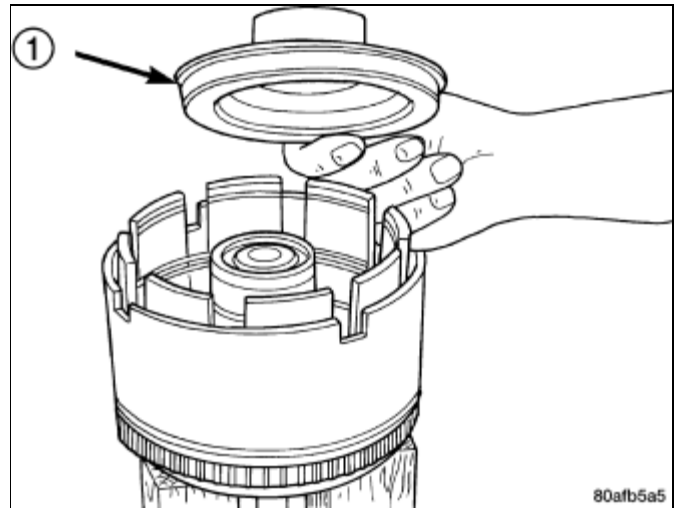
6. Install the input hub/shaft assembly (1) to the OD/Reverse piston/clutch retainer assembly (2).



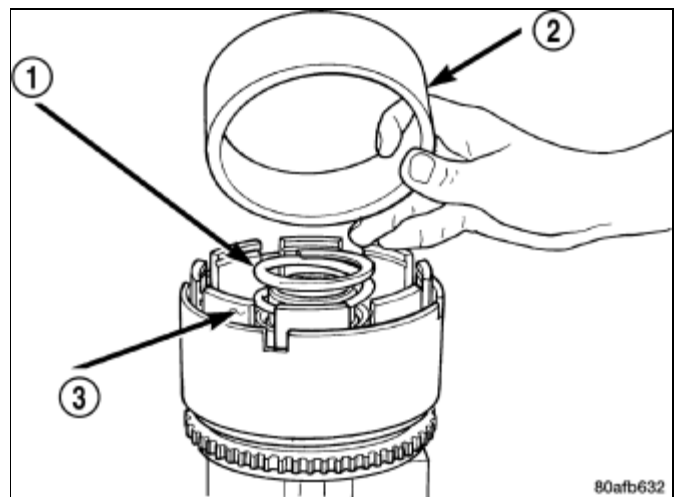
7. Install input hub tapered snap ring (2). **Make sure snap ring is fully seated.**



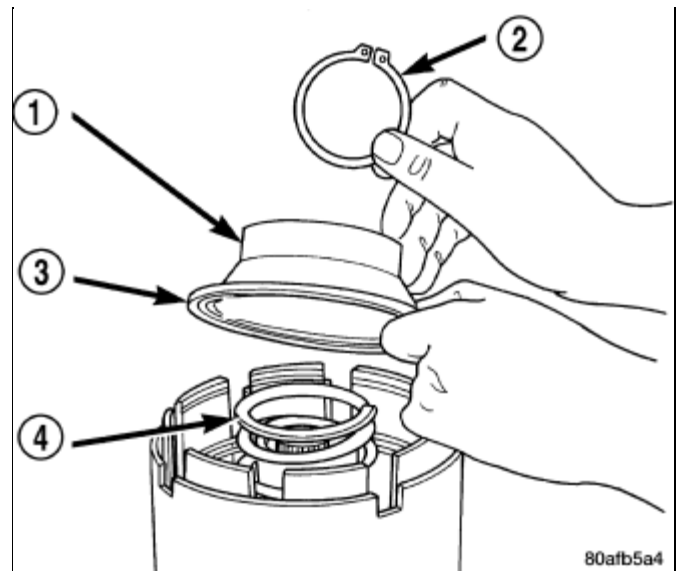
8. Install the UD clutch piston (1).



9. Install UD piston return spring (1) and Compressor 5067 (2).

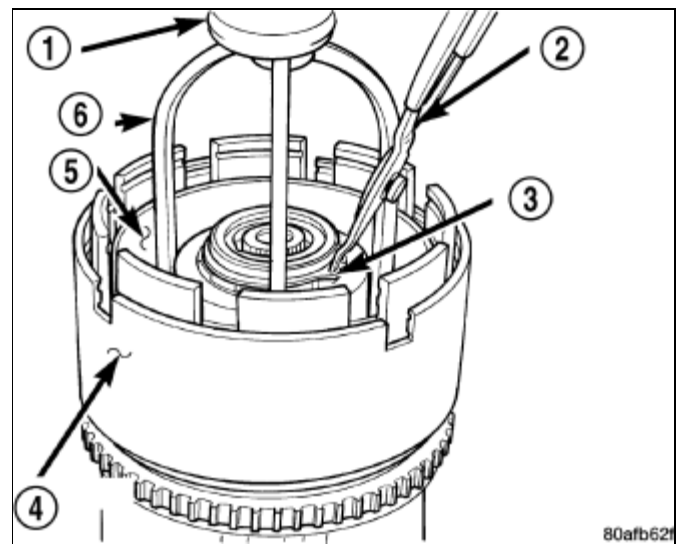


10. Position the UD spring retainer (1) and snap ring (2) on the piston return spring (4).

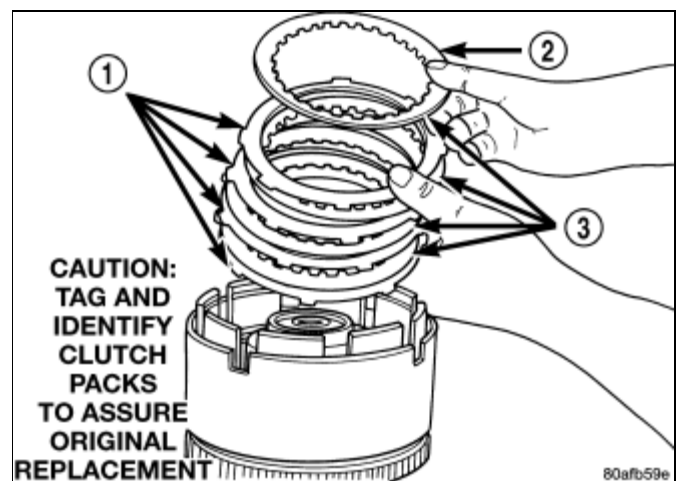


CAUTION: Compress return spring just enough to install snap ring.

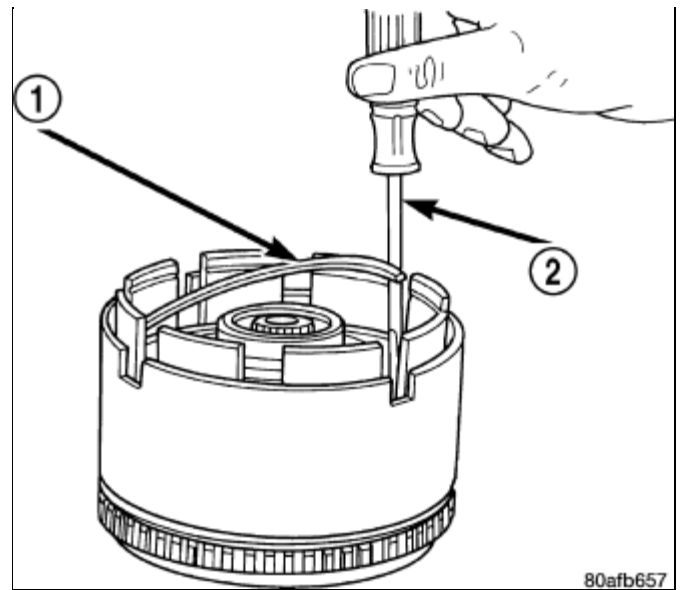
11. Using Compressor 5059A (6) and an arbor press (1), install the UD spring retainer and snap ring (3).



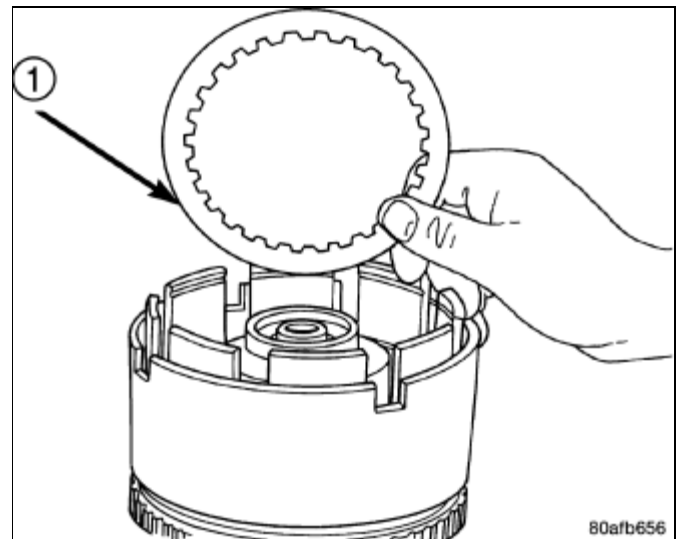
12. Install the UD clutch pack (four fibers/four steels) (1, 3). Leave the top disc (2) out until after the snap ring is installed.



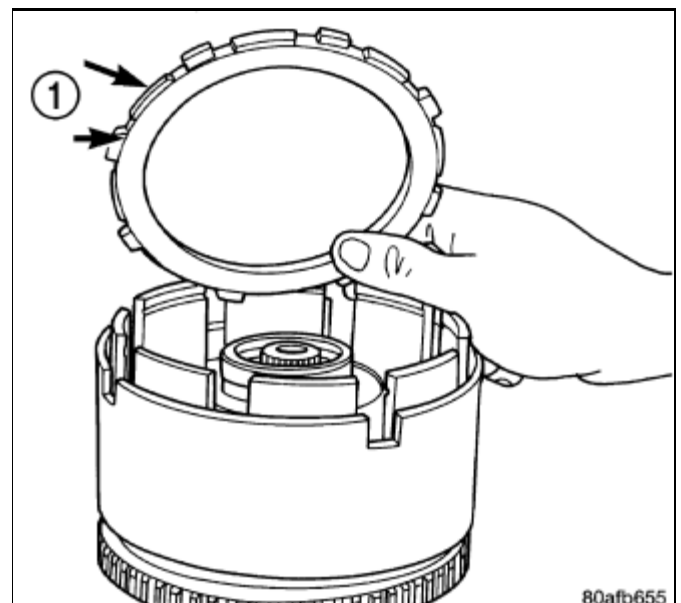
13. Install the UD clutch flat snap ring (1).



14. Install the last UD clutch disc (1).

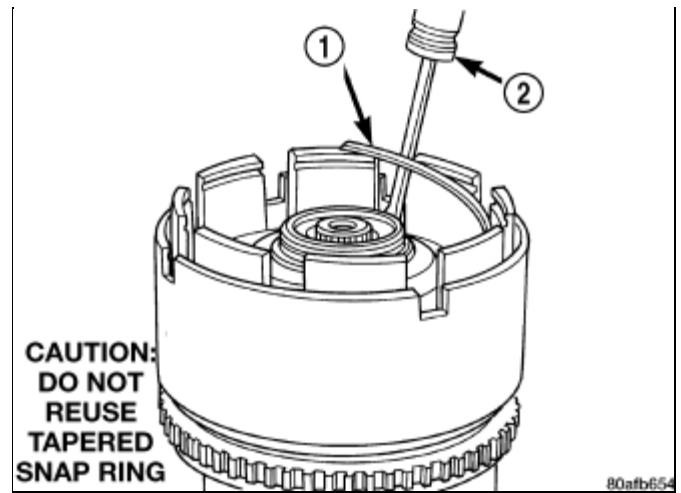


15. Install the OD/UD clutch reaction plate (1). The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

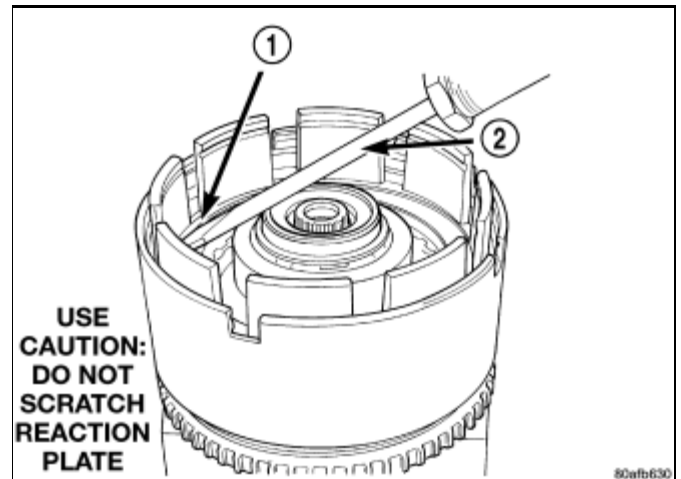


NOTE: Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.

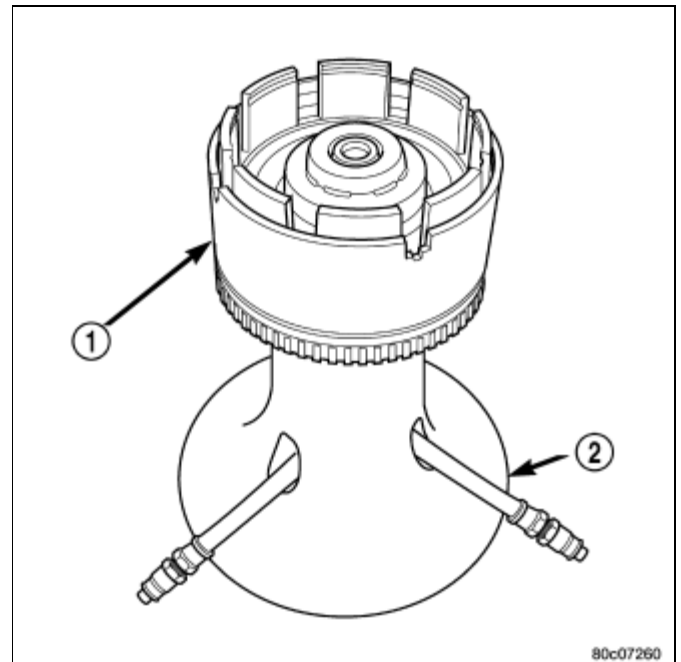
16. Install the UD/OD tapered snap ring (1).



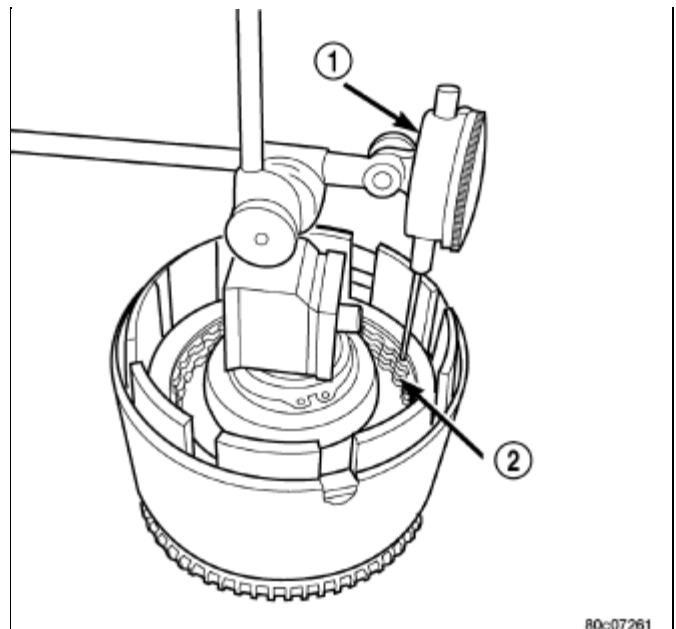
17. Seat tapered snap ring (1) to ensure proper installation .



18. Install input clutch assembly (1) to the Input Clutch Pressure Fixture 8391 (2).



19. Set up dial indicator (1) on the UD clutch pack (2).



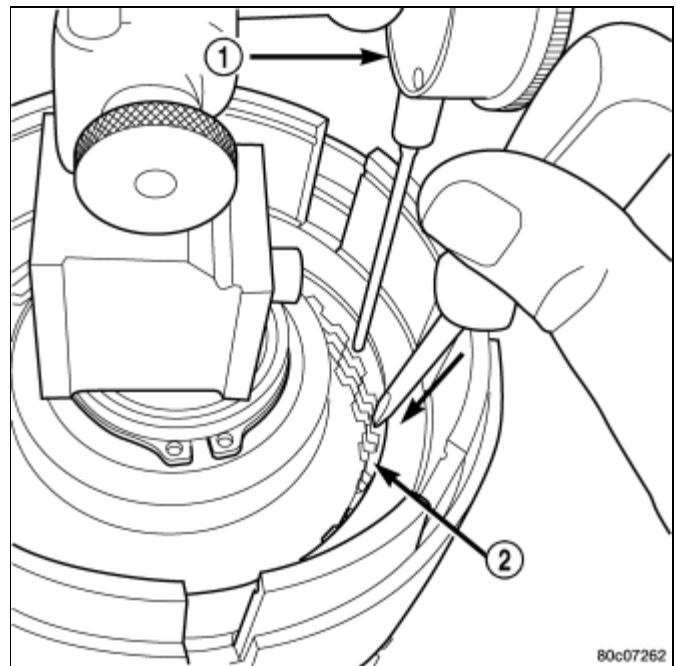
20. Using moderate pressure, press down and hold (near indicator) the UD clutch pack (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure on clutch pack, indicator reading should advance 0.005-0.010 inches.

CAUTION: Do not apply more than 30 psi (206 kPa) to the underdrive clutch pack.

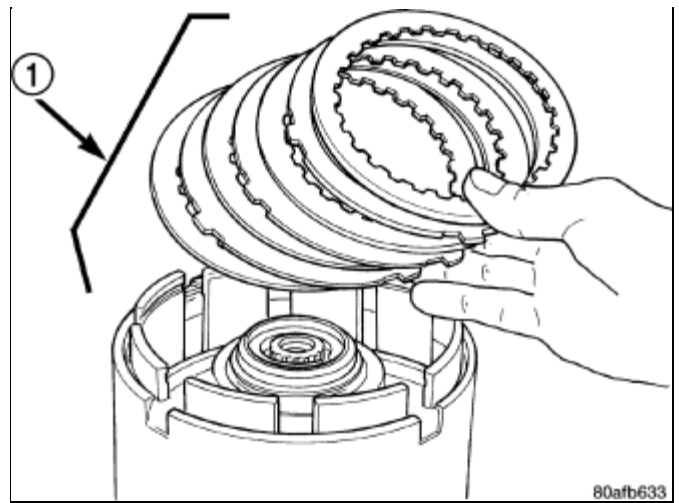
21. Apply 30 psi (206 kPa) to the underdrive hose on Pressure Fixture 8391 and measure UD clutch clearance. Measure and record UD clutch pack measurement in four (4) places, 90° apart.

22. Take average of four measurements and compare with UD clutch pack clearance specification. **Underdrive clutch pack clearance must be 0.94-1.50 mm (0.037-0.059 in.).**

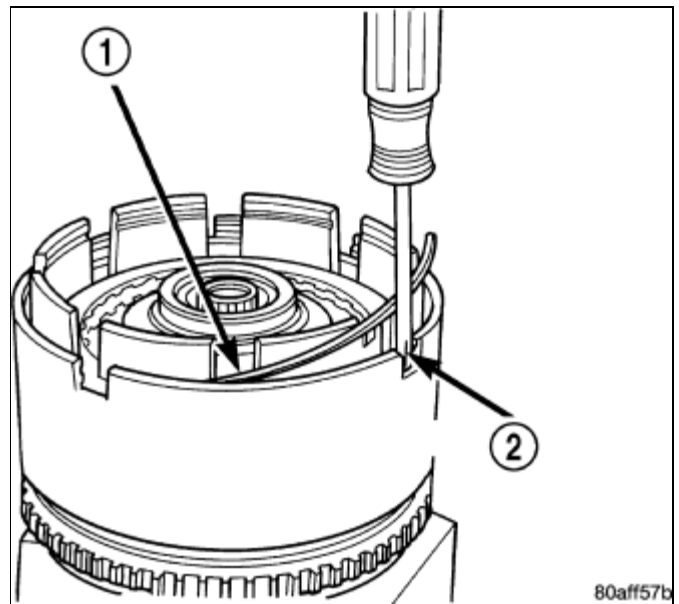
23. If necessary, select the proper reaction plate to achieve specifications.



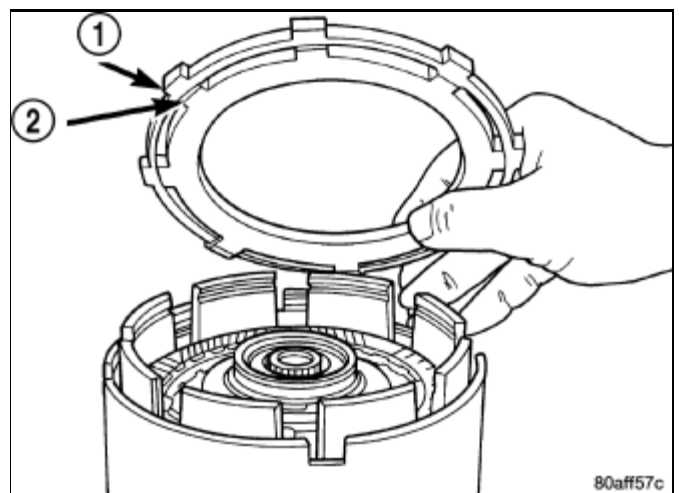
24. Install the OD clutch pack (four fibers/three steels) (1).



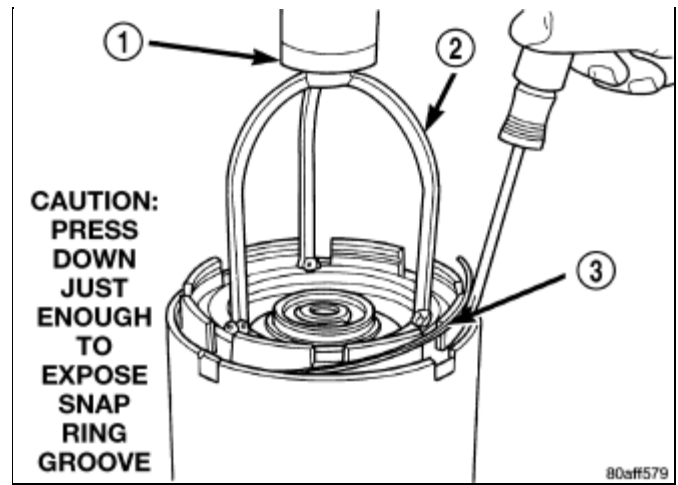
25. Install OD reaction plate waved snap ring (1).



26. Install the OD/Reverse reaction plate (1) with large step down (towards OD clutch pack).



27. Install OD reaction plate flat snap ring (3).

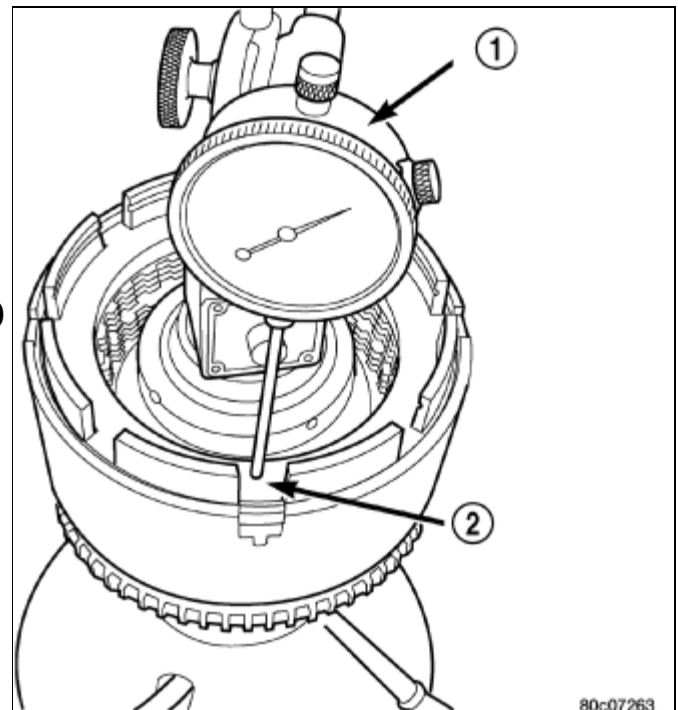


28. Measure OD clutch pack clearance. Set up dial indicator (1) on top of the OD/Reverse reaction plate (2).

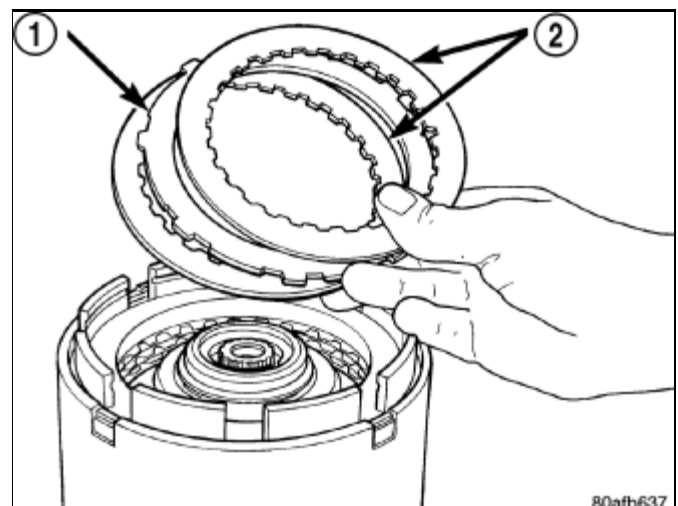
29. Zero dial indicator and apply 30 psi (206 kPa) air pressure to the overdrive clutch hose on Pressure Fixture 8391. Measure and record OD clutch pack measurement in four (4) places, 90° apart.

30. Take average of four measurements and compare with OD clutch pack clearance specification. **The overdrive (OD) clutch pack clearance is 1.07-3.25 mm (0.042-0.128 in.).**

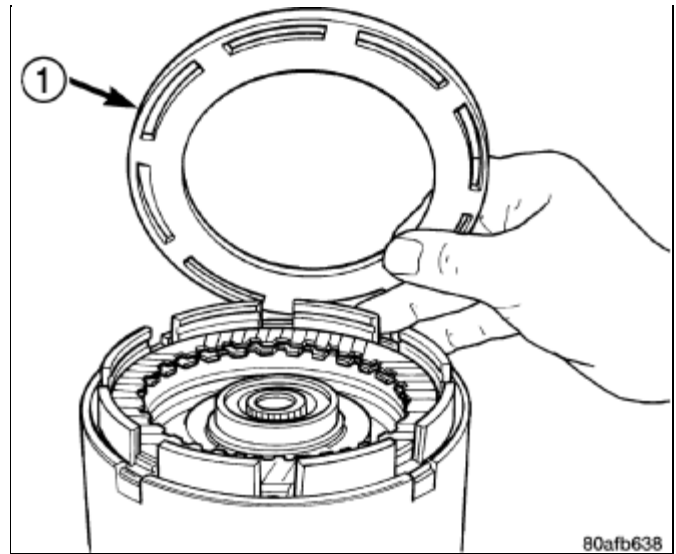
If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.



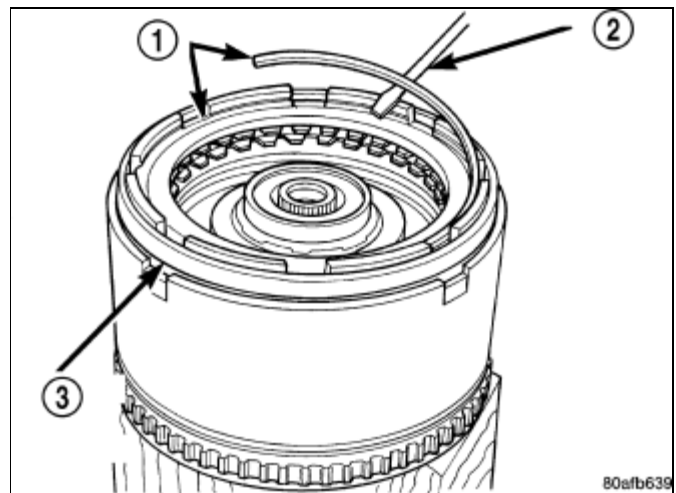
31. Install reverse clutch pack (two fibers/one steel) (1, 2).



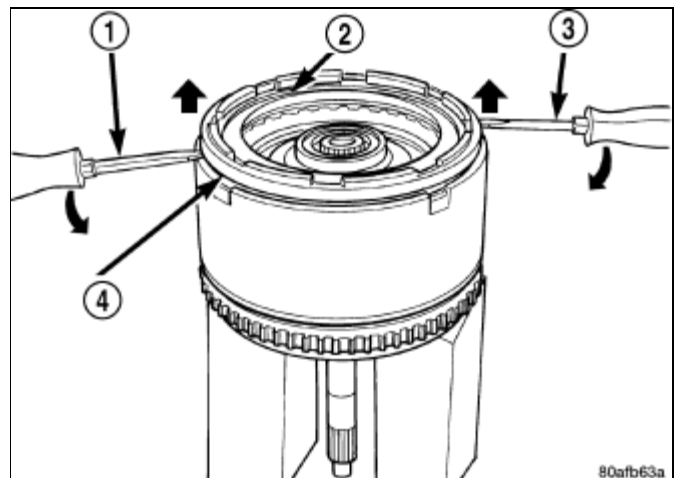
32. Install reverse clutch reaction plate (1) with the flat side down towards reverse clutch.



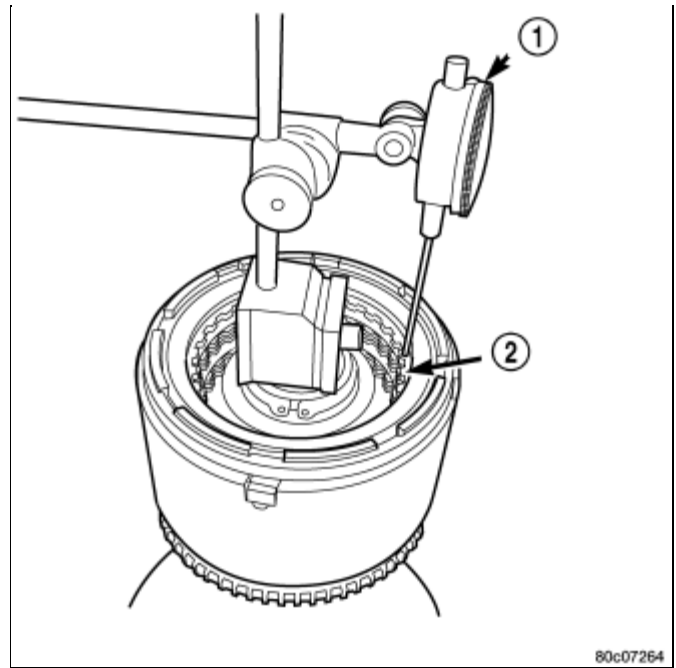
33. Tap reaction plate (3) down to allow installation of the reverse clutch snap ring (1). Install reverse clutch snap ring (1).



34. Pry up reverse reaction plate (4) to seat against snap ring (2).



35. Set up a dial indicator (1) on the reverse clutch pack (2).

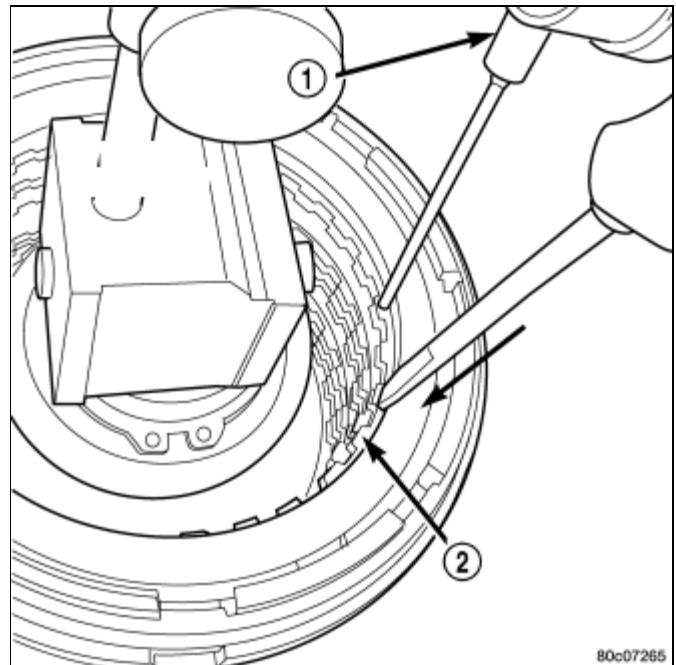


36. Using moderate pressure, press down and hold (near indicator) reverse clutch disc (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure, indicator should advance 0.005-0.010 inches as clutch pack relaxes.

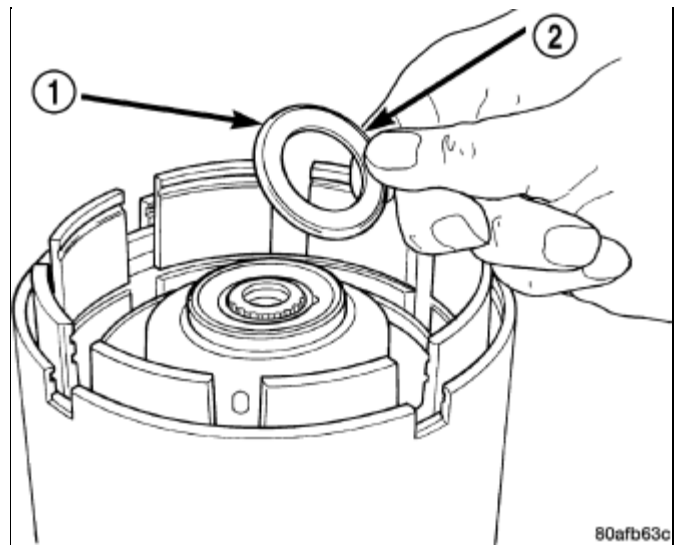
37. Apply 30 psi (206 kPa) air pressure to the reverse clutch hose on Tool 8391. Measure and record reverse clutch pack measurement in four (4) places, 90° apart.

38. Take average of four measurements and compare with reverse clutch pack clearance specification. **The reverse clutch pack clearance is 0.89-1.37 mm (0.035-0.054 in.).** Select the proper reverse clutch snap ring to achieve specifications.

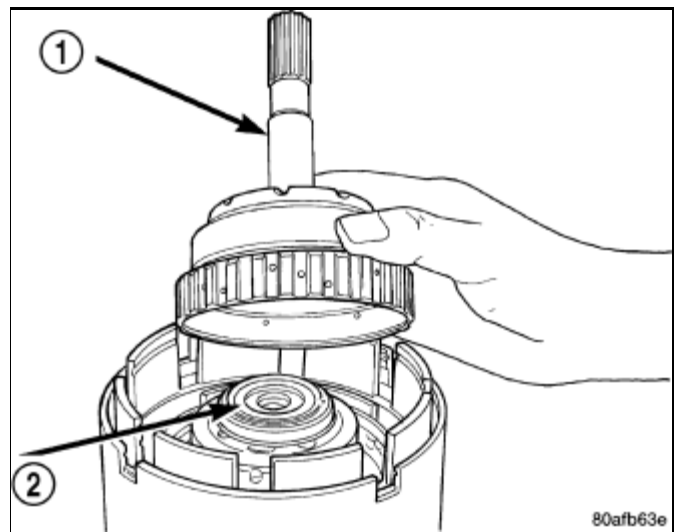
39. To complete the assembly, reverse clutch and overdrive clutch must be removed.



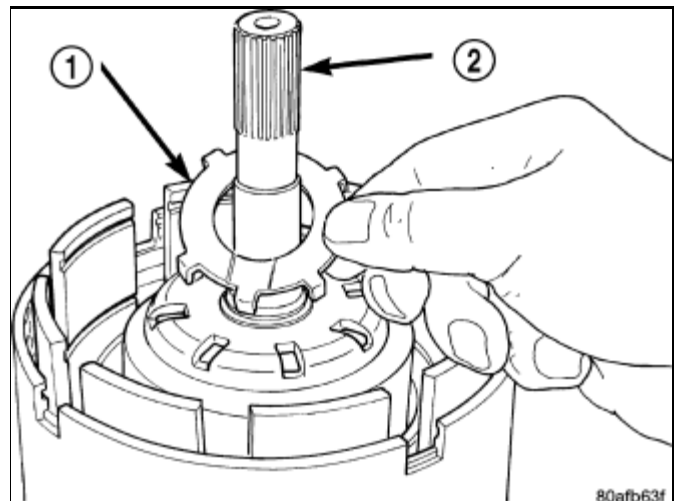
40. Install the number 2 needle bearing (1).



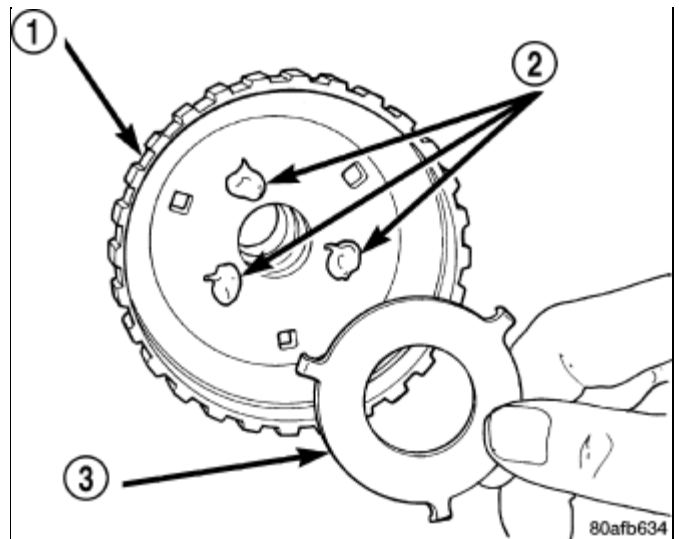
41. Install the underdrive shaft assembly (1).



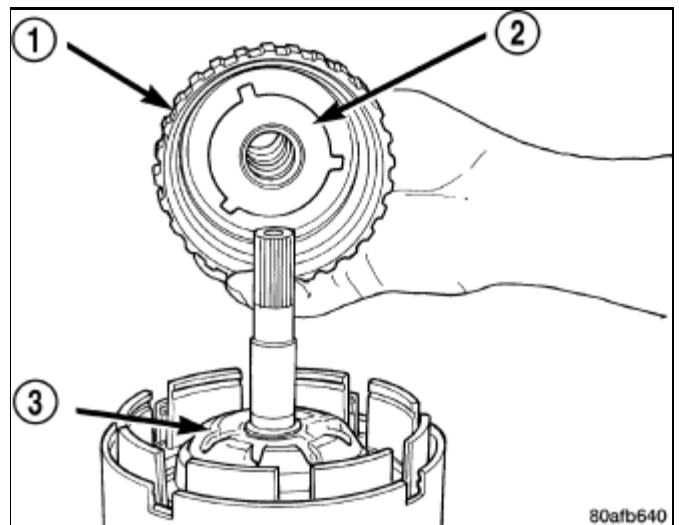
42. Install the number 3 thrust washer (1) to the underdrive shaft assembly (2). Be sure five tabs are seated properly.



43. Install the number 3 thrust plate (3) to the bottom of the overdrive shaft assembly (1). Retain with petrolatum or transmission assembly gel (2).



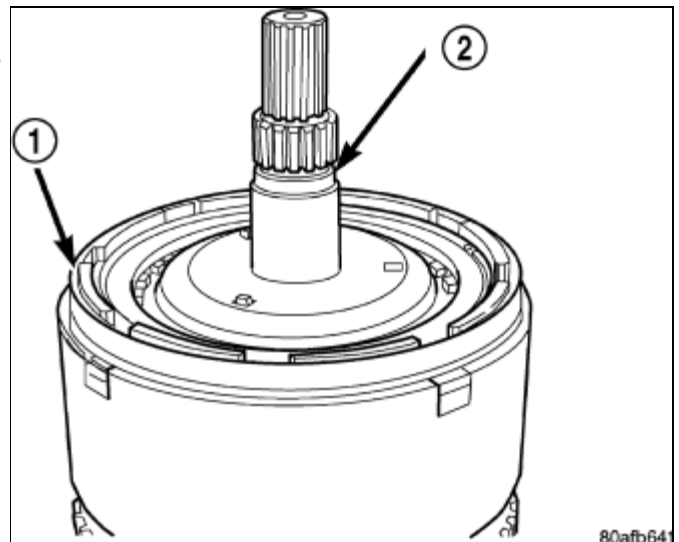
44. Install the overdrive shaft assembly (1).



45. Reinstall overdrive and reverse clutch. **Rechecking these clutch clearances is not necessary.**

INPUT SPEED SENSOR

DESCRIPTION



The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission

Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

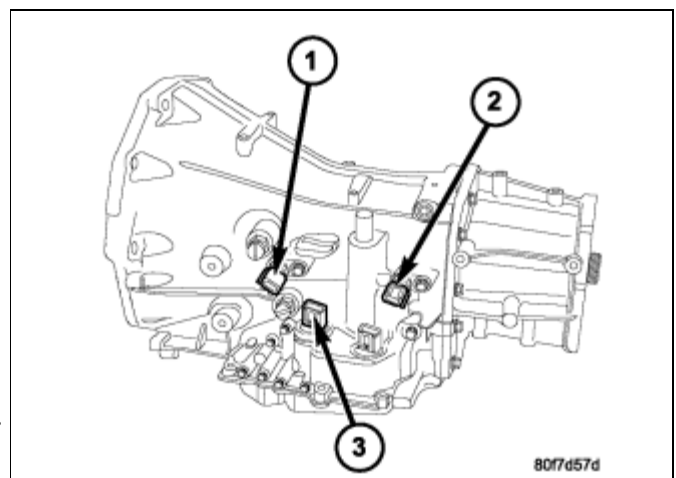
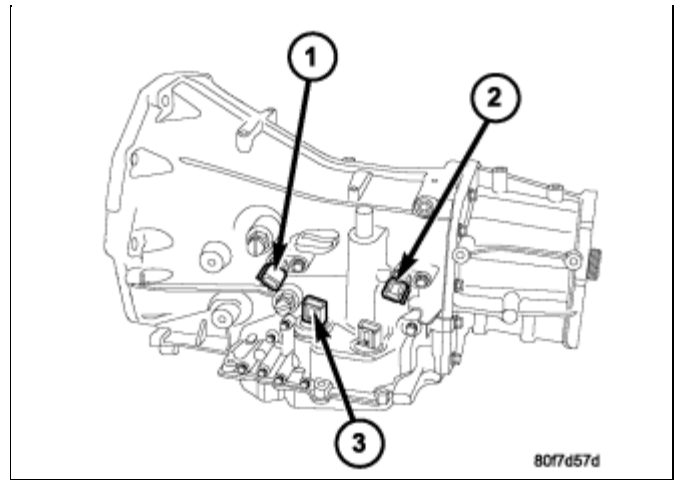
1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor.

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor from the transmission case.

INSTALLATION

1. Install the input speed sensor (1) into the transmission

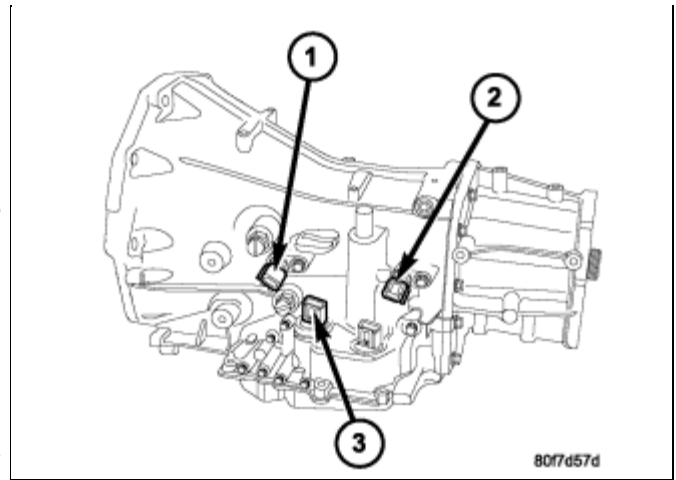


case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

2. Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the input speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.

5. Lower vehicle.



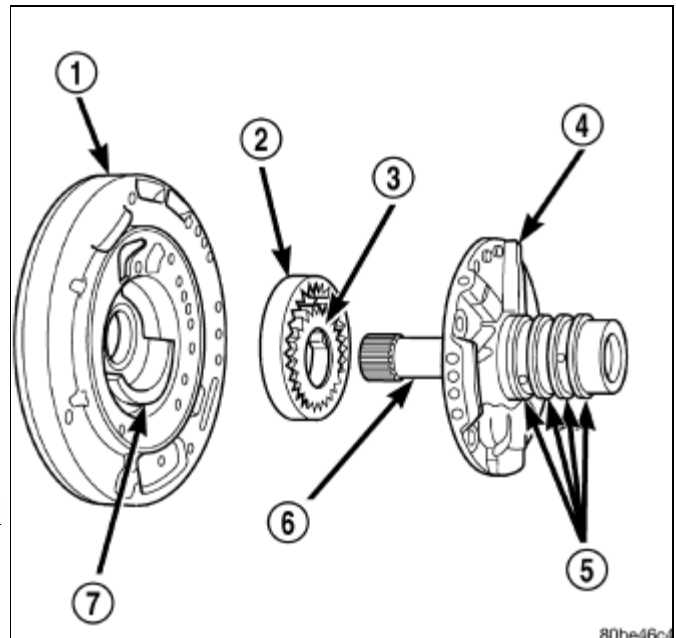
OIL PUMP

DESCRIPTION

The oil pump is located in the pump housing inside the bell housing of the transmission case. The oil pump assembly consists of an inner (3) and outer (2) gear, a housing (1), and a cover that also serves as the reaction shaft support (6).

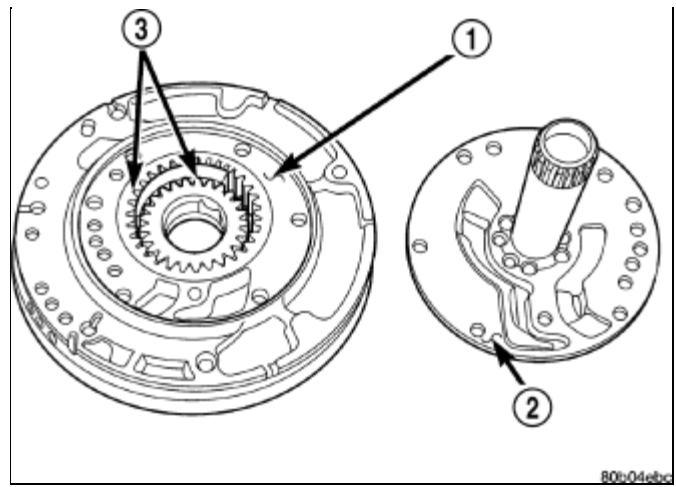
OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

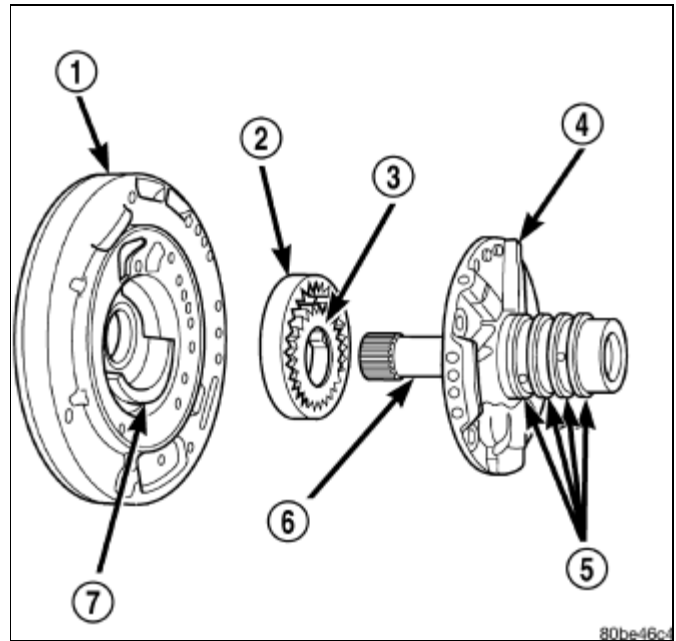


DISASSEMBLY

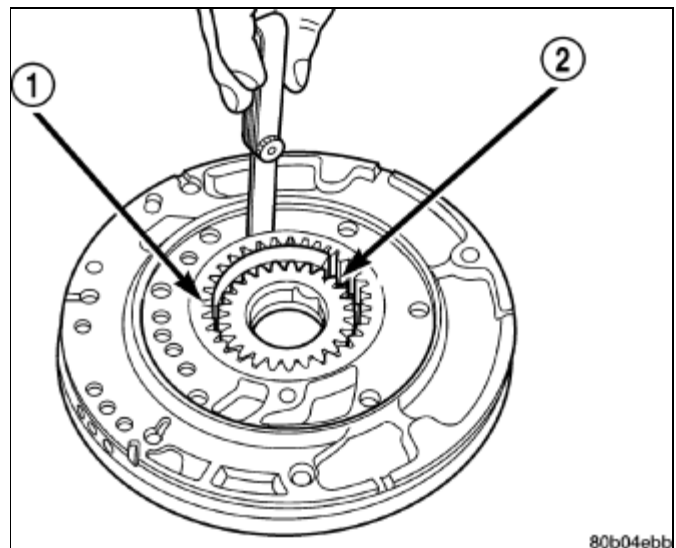
1. Remove the reaction shaft support bolts.
2. Remove the reaction shaft support (2) from the pump housing (1).



3. Remove the pump gears (2, 3) and check for wear and damage on pump housing (1) and gears (2, 3).



4. Re-install the gears and check clearances.
5. Measure the clearance between the outer gear (1) and the pump pocket (2). Clearance should be 0.089-0.202 mm (0.0035-0.0079 in.).
6. Measure clearance between outer gear and crescent. Clearance should be 0.060-0.298 mm (0.0023-0.0117 in.).
7. Measure clearance between inner gear and crescent. Clearance should be 0.093-0.385 mm (0.0036-0.0151 in.).
8. Position an appropriate piece of Plastigage across both pump gears.
9. Align the Plastigage to a flat area on the reaction shaft support housing.
10. Install the reaction shaft to the pump housing. Tighten the bolts to 27 N·m (20 ft. lbs.).
11. Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.
12. Clearance between outer gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.).



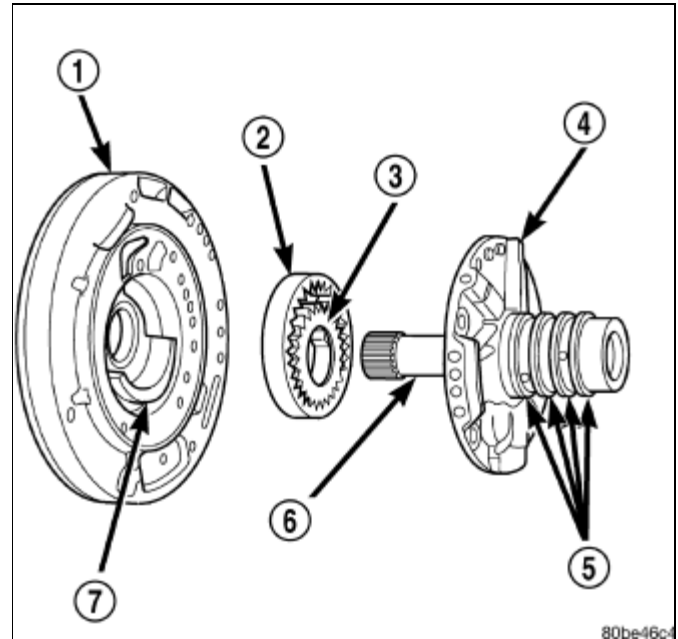
in.).

ASSEMBLY

1. Assemble oil pump as shown
2. Install and torque reaction shaft support-to-oil pump housing bolts to 28 N·m (20 ft. lbs.) torque.

OUTPUT SPEED SENSOR

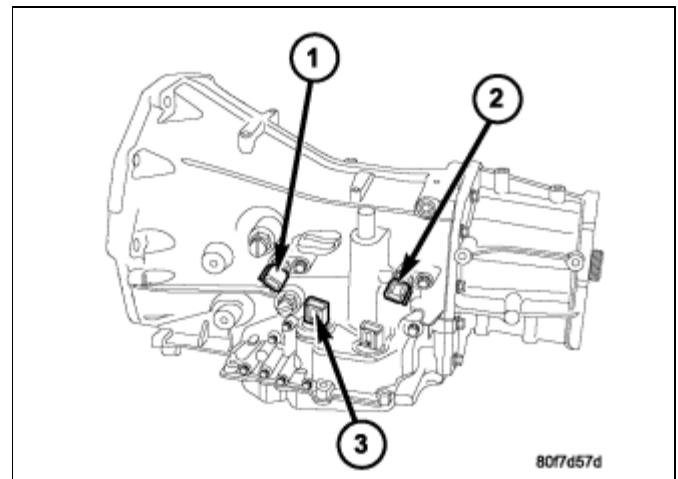
DESCRIPTION



The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.



The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage

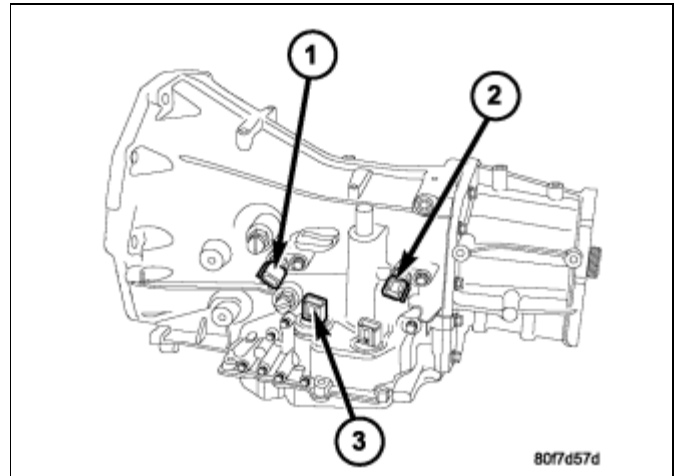
Torque converter element speed ratio

REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (2).

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

4. Remove the bolt holding the output speed sensor to the transmission case.
5. Remove the output speed sensor (2) from the transmission case.



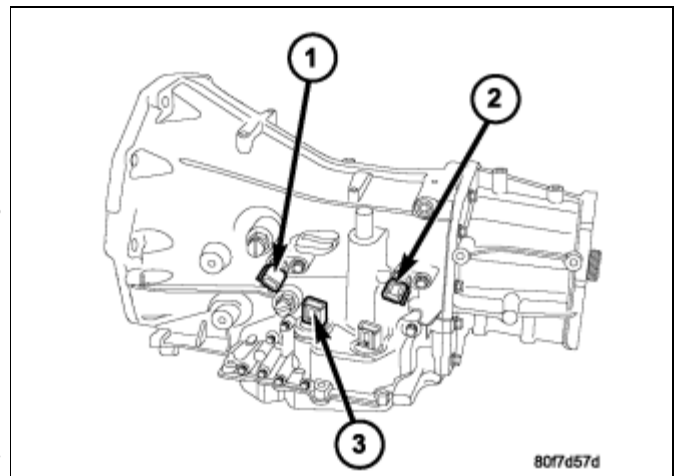
INSTALLATION

1. Install the output speed sensor (2) into the transmission case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

2. Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the output speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.

5. Lower vehicle.



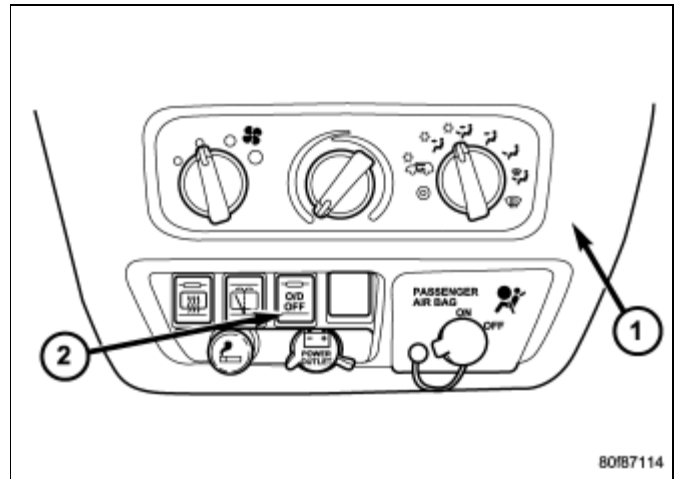
OVERDRIVE SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the center console . The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

OPERATION

At key-on, overdrive operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

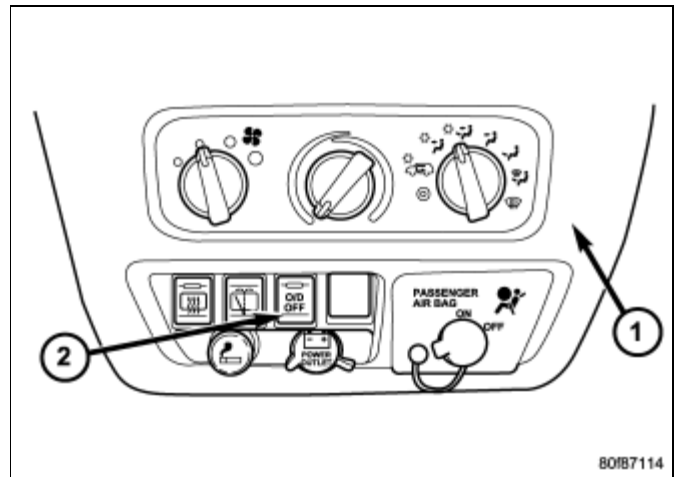


REMOVAL

1. Remove the accessory switch bezel.
2. Remove the overdrive off switch from the accessory switch bezel.

INSTALLATION

1. Install the overdrive off switch to the accessory switch bezel.
2. Install the accessory switch bezel.



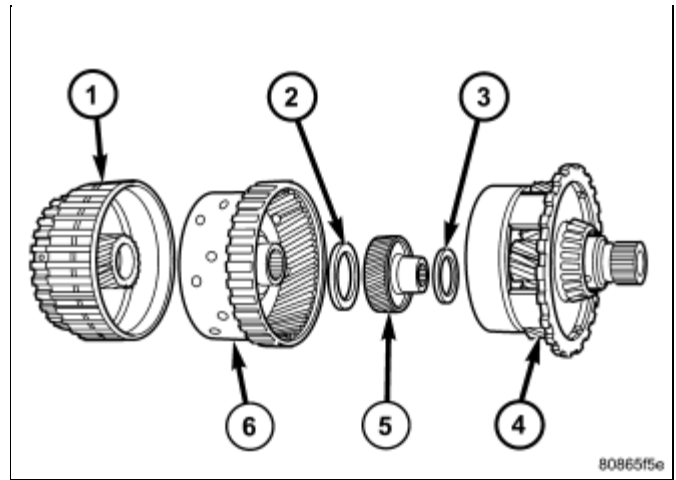
PLANETARY GEARTRAIN

DESCRIPTION

The planetary geartrain is located between the input clutch assembly and the rear of the transmission case. The planetary geartrain consists of two sun gears, two planetary carriers, two annulus (ring) gears, and one output shaft.

OPERATION

The planetary geartrain utilizes two planetary gear sets that connect the transmission input shaft to the output shaft. Input and holding clutches drive or lock different planetary



members to change output ratio or direction.

OIL PUMP SEAL

REMOVAL

1. Remove the transmission from the vehicle (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - REMOVAL) .
2. Remove the torque converter from the transmission bellhousing.
3. Use special tool C-3981B to remove oil pump seal.

INSTALLATION

1. Clean and inspect oil pump seal seat. Then install seal using special tool C-4193-A.
2. Clean and inspect torque converter hub. If nicks, scratches or hub wear are found, torque converter replacement will be required.

CAUTION: If the torque converter is being replaced, apply a light coating of grease to the crankshaft pilot hole. Also inspect the engine drive plate for cracks. If any cracks are found replace the drive plate. Do not attempt to repair a cracked drive plate. Always use new torque converter to drive plate bolts.

3. Apply a light film of transmission oil to the torque converter hub and oil seal lips. Then install torque converter into transmission. Be sure that the hub lugs mesh with the front pump lugs when installing.
4. Reinstall the transmission into the vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION)

SHIFT MECHANISM

DESCRIPTION

The shift mechanism is cable operated and provides six shift positions. The shift indicator is located on the console next to the gear shift. The shift positions are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)

- Manual Second (2)
- Manual Low (1)

OPERATION

Manual low (1) range provides first gear only. Over run braking is also provided in this range. Manual second (2) range provides first and second gear only. Drive range provides first, second, and third gear ranges.

DIAGNOSIS AND TESTING - SHIFT MECHANISM

1. The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.
2. Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.
3. With floor shift lever handle push-button not depressed and lever in:
 - a. PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.
 - b. PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.
 - c. NEUTRAL position - Normal position. Engine starts must be possible.
 - d. NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

ADJUSTMENTS - SHIFT MECHANISM

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

Gearshift Adjustment Procedure

1. Shift transmission into PARK.
2. Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Loosen the shift cable adjustment nut.
4. Raise vehicle.
5. Unsnap cable eyelet from transmission shift lever.
6. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
7. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
8. Snap cable eyelet onto transmission shift lever.
9. Lower vehicle
10. Tighten the shift cable adjustment screw to 12 N·m (105 in.lbs.).
11. Verify correct operation.
12. Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/CENTER

CONSOLE - INSTALLATION)

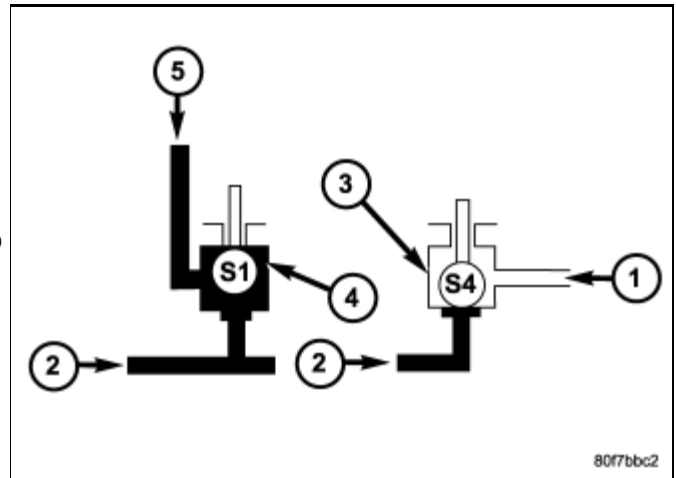
SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

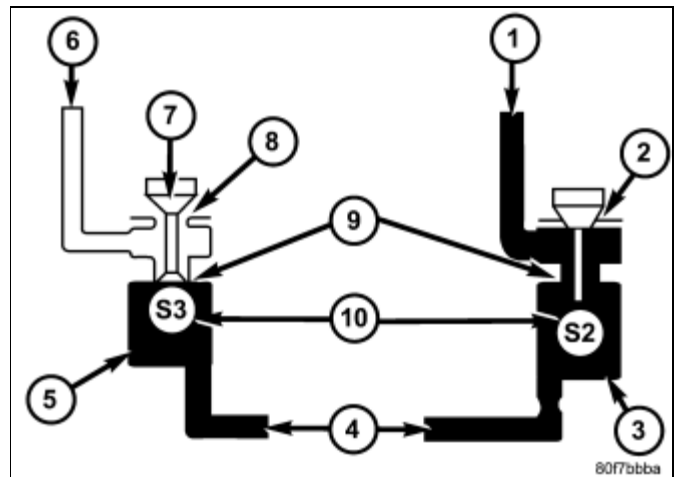
The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.



The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

- Increase the amount of current applied to the coil or
- Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.



A solenoid can also be described by the method by which it is controlled. Some of the possibilities include

variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

SOLENOID/PRESSURE SWITCH ASSY

DESCRIPTION

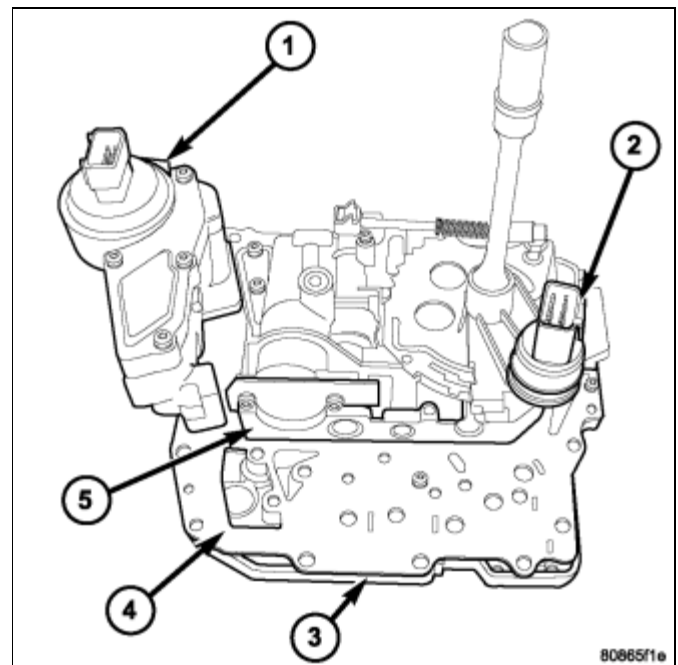
The Solenoid/Pressure Switch Assembly (1) is inside the transmission and mounted to the valve body assembly. The assembly consists of four solenoids that control hydraulic pressure to the L/R, 2/4, OD, and UD friction elements (transmission clutches), and the torque converter clutch. The reverse clutch is controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid/Pressure Switch Assembly, and can only be serviced by replacing the assembly.

The solenoid assembly also contains pressure switches that monitor and send hydraulic circuit information to the TCM. Likewise, the pressure switches can only be serviced by replacing the assembly.

OPERATION

SOLENOIDS

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.



The 2/4 and UD solenoids are normally applied, which allows fluid to pass through in their relaxed or “off” state. By design, this allows transmission limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

PRESSURE SWITCHES

The TCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The range for the pressure switch closing and opening points is 11-23 psi. Typically the switch opening point will be approximately one psi lower than the closing point. For example, a switch may close at 18 psi and open at 17 psi. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL
OP = OPEN			
CL = CLOSED			

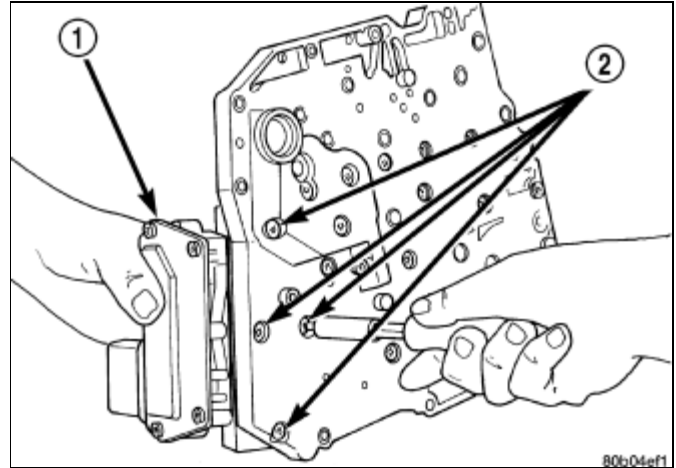
A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

The TCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 3rd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the TCM momentarily turns on element pressure to the 2/4 and OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

REMOVAL

NOTE: If the Solenoid/Pressure Switch Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

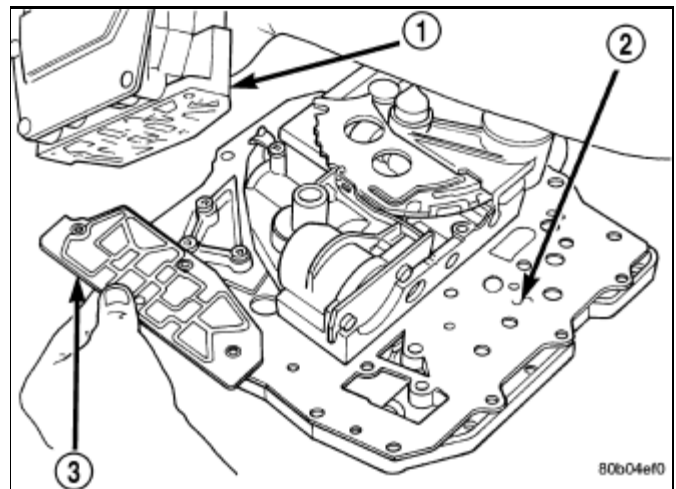
1. Raise vehicle on hoist.
2. Remove valve body assembly from transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
3. Remove Solenoid/Pressure Switch Assembly retaining screws (2) from solenoid.



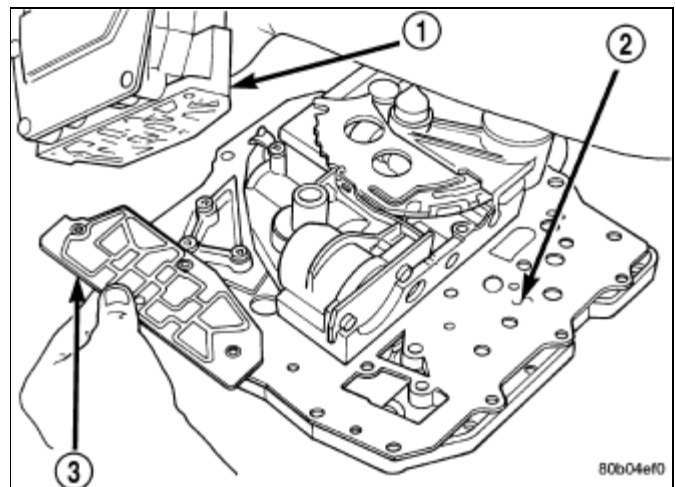
4. Remove Solenoid/Pressure Switch Assembly (1) and screen from valve body (2).

INSTALLATION

NOTE: If the Solenoid/Pressure Switch assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)



1. Install Solenoid/Pressure Switch Assembly (1) and screen (3) to the separator and transfer plates.



2. Install and tighten retaining screws (2) to 5.5 N·m (50 in. lbs.) torque.
3. Install valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)

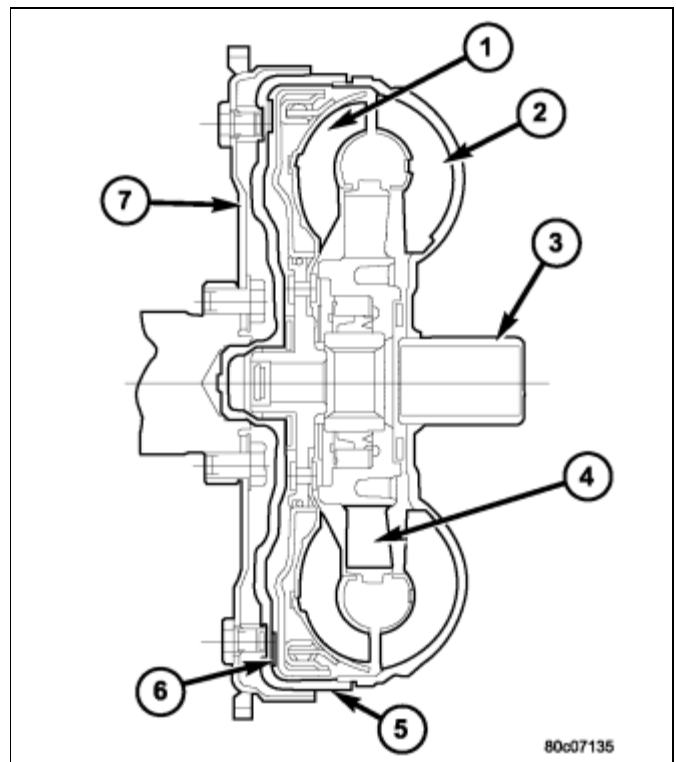
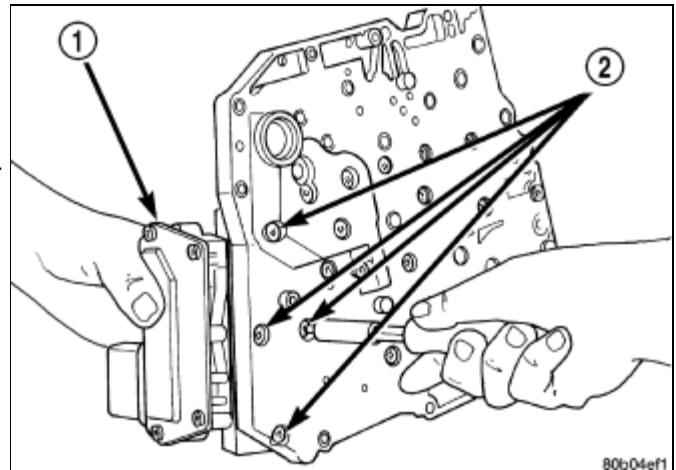
TORQUE CONVERTER

DESCRIPTION

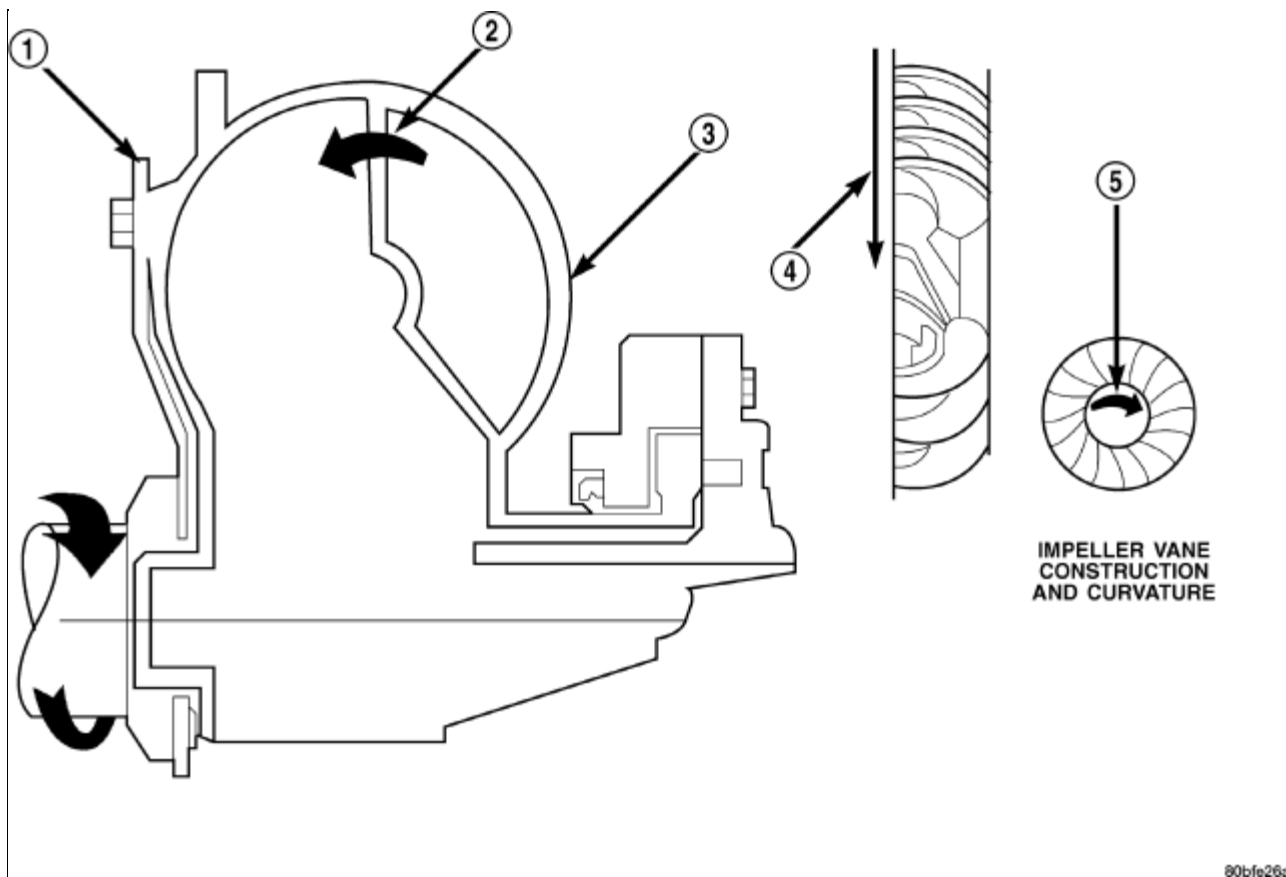
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

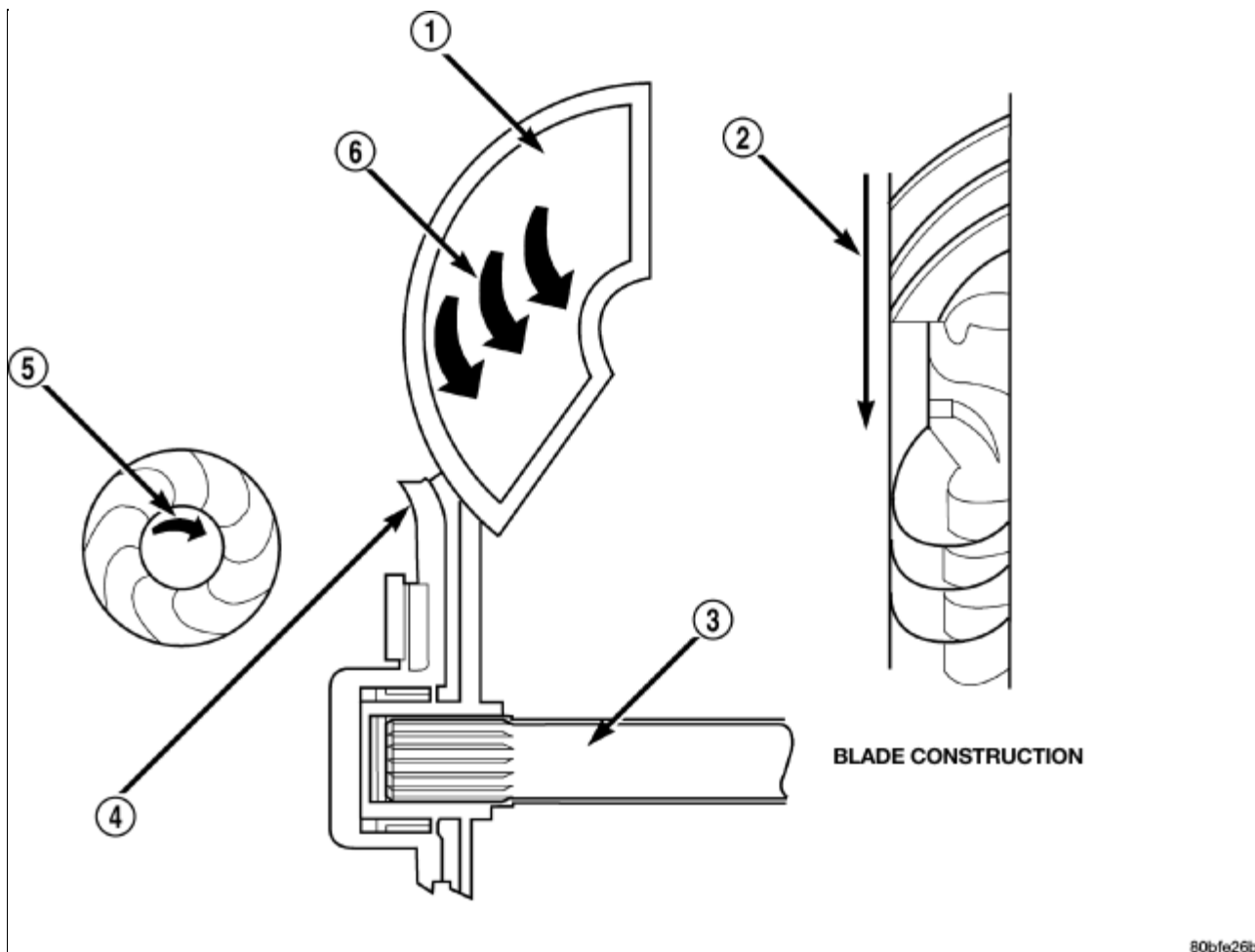


IMPELLER



The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

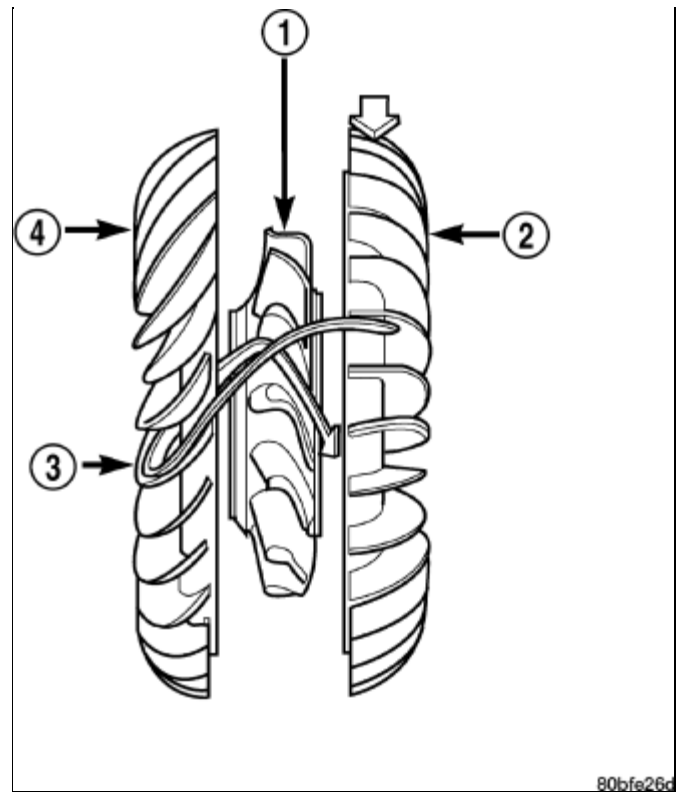
TURBINE



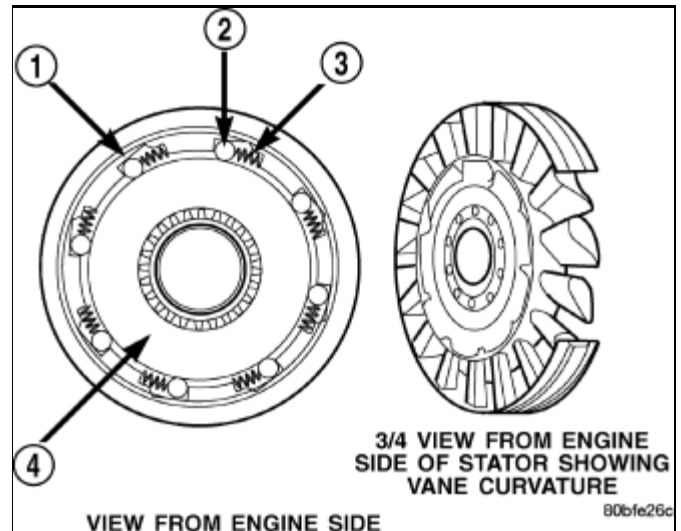
The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.



The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

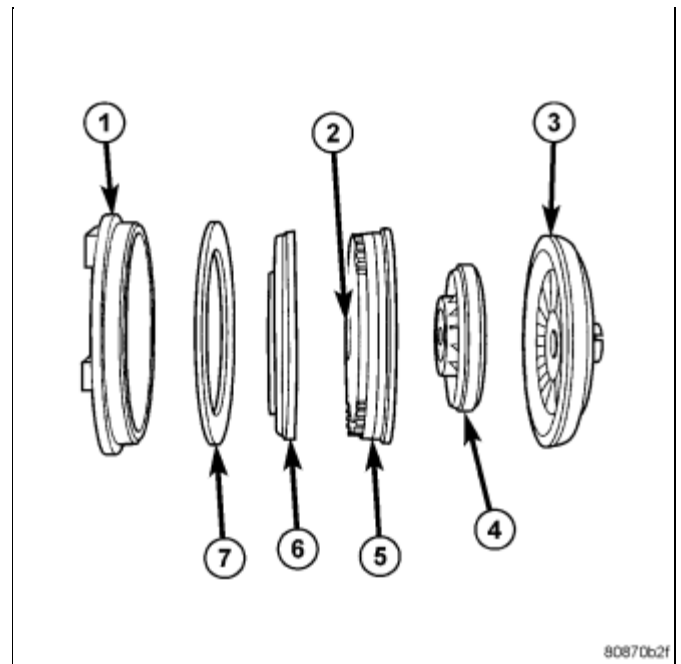


TORQUE CONVERTER CLUTCH (TCC)

The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.

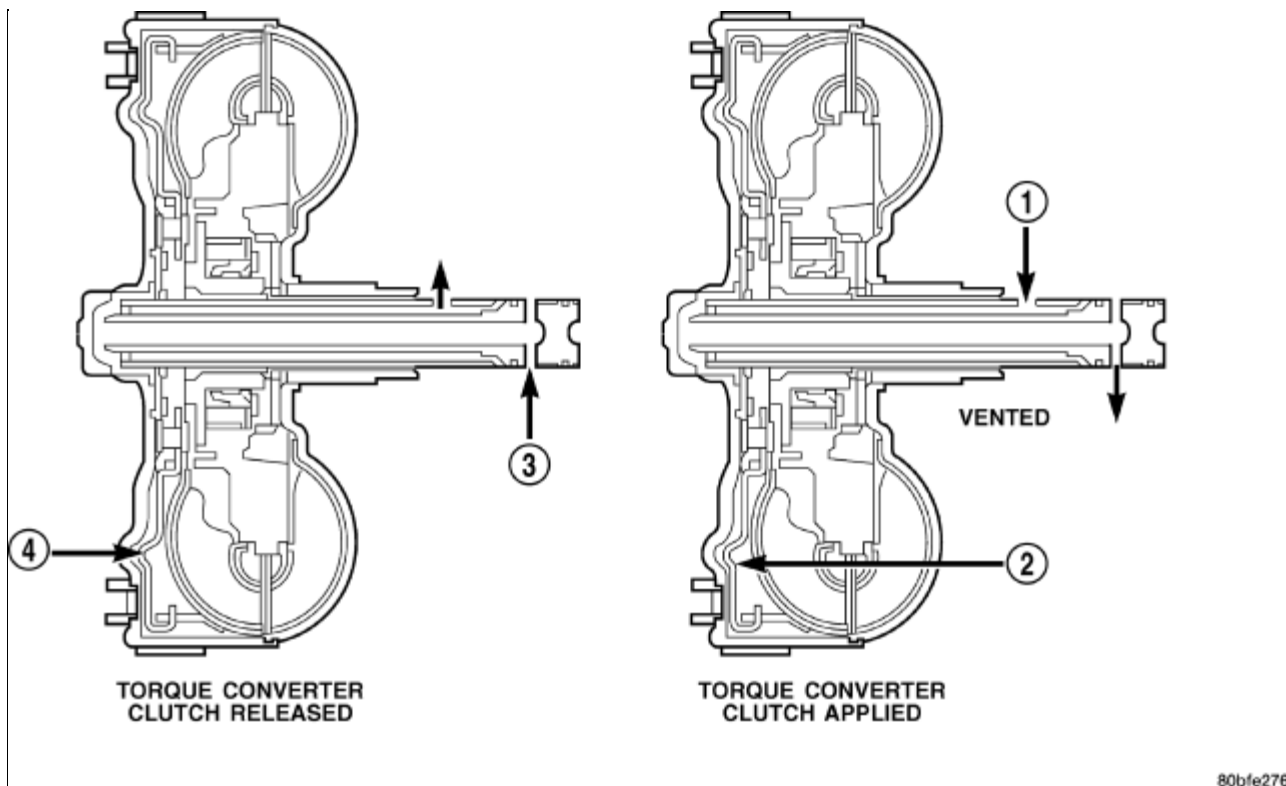
In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed



OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

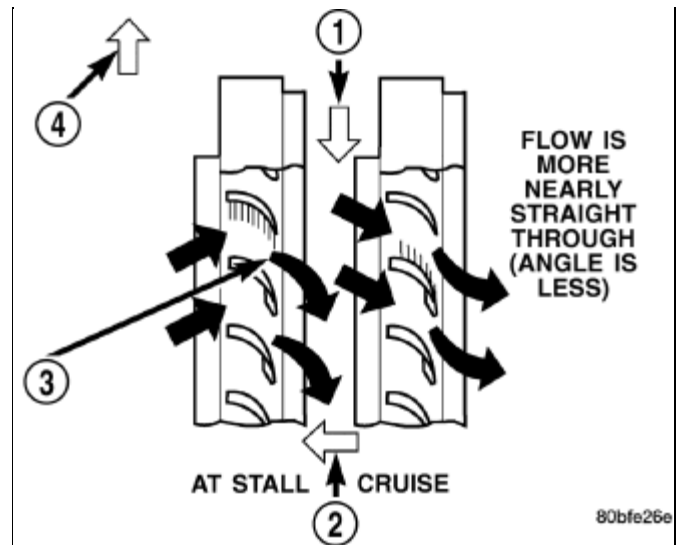


TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a “hindering” direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the overrunning clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a “helping” direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such a way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.



TORQUE CONVERTER CLUTCH (TCC)

The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased.

REMOVAL

1. Remove transmission and torque converter from vehicle.
2. Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

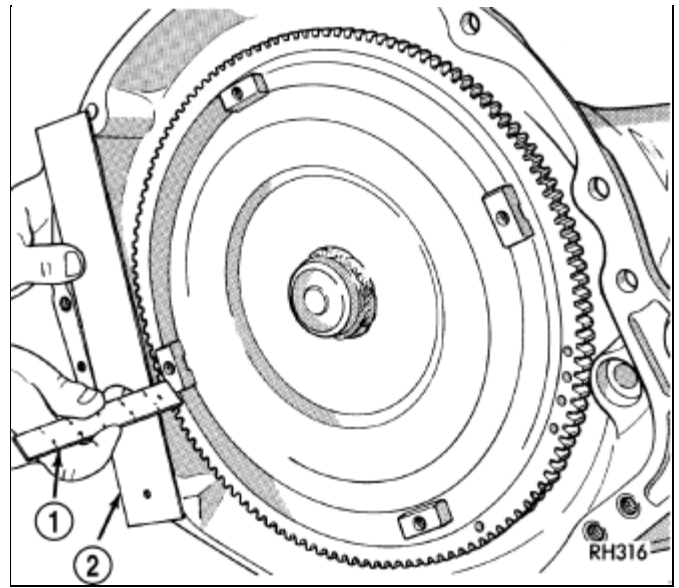
INSTALLATION

NOTE: Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
8. Install the transmission in the vehicle.
9. Fill the transmission with the recommended fluid.



TRANSMISSION CONTROL RELAY

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

TRANSMISSION RANGE SENSOR

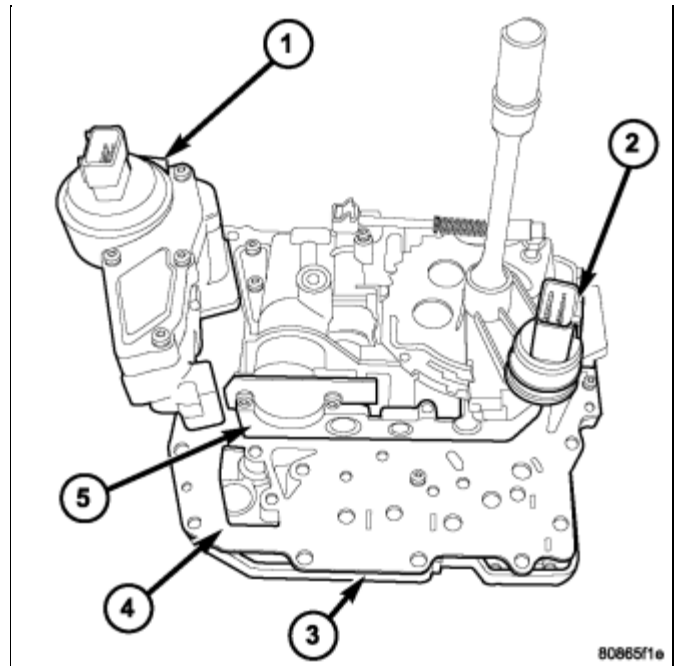
DESCRIPTION

The Transmission Range Sensor (TRS) (2) is mounted to the top of the valve body inside the transmission and can only be serviced by removing the valve body assembly. The electrical connector extends through the transmission case.

The Transmission Range Sensor (TRS) has four switch contacts that monitor shift lever position and send the information to the PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position (SLP) to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.



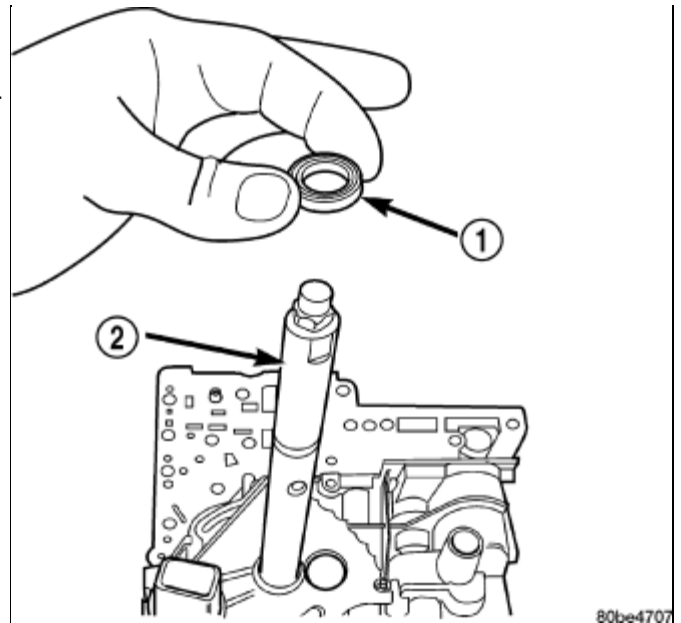
Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as “between gear” codes. This results in six codes which should never occur. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

TRS SWITCH STATES

SLP	T42	T41	T3	T1
P	CL	CL	CL	OP
R	CL	OP	OP	OP
N	CL	CL	OP	CL
D	OP	OP	OP	CL
2	OP	OP	CL	OP
1	CL	OP	CL	CL

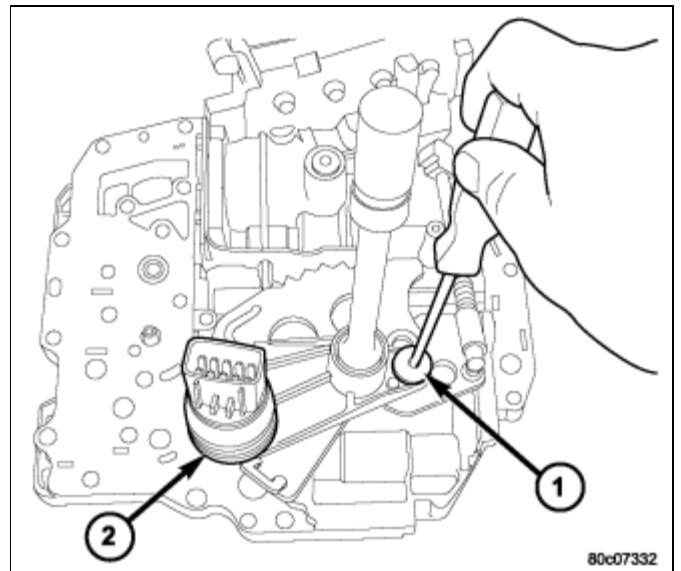
REMOVAL

1. Remove valve body assembly from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
2. Remove the manual shaft seal (1).

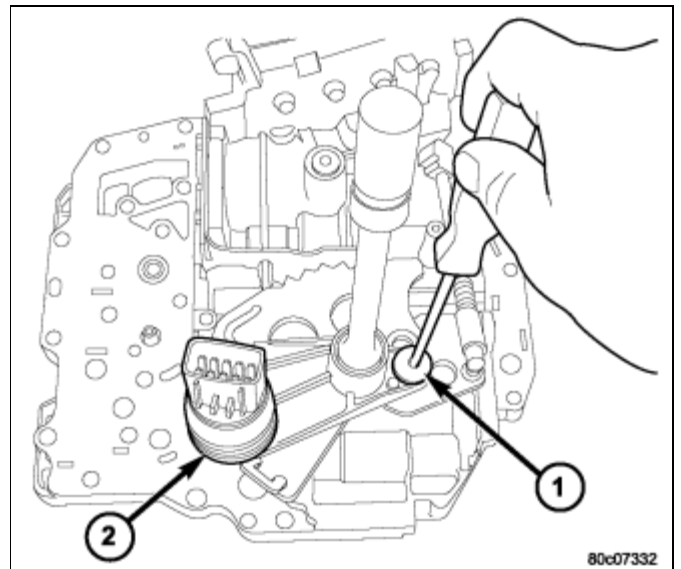


3. Remove manual shaft/TRS retaining screw (1).
4. Slide TRS off of manual valve shaft.

INSTALLATION



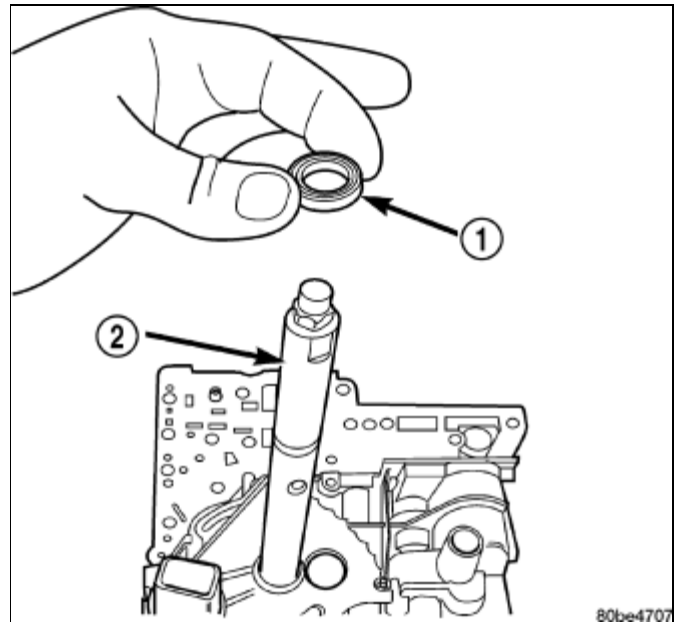
1. Install the TRS (2) to the manual shaft. Make sure TRS locating pin rests in manual valve bore slot.
2. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.) torque.



3. Install the manual shaft seal (1).
4. Install valve body to the transmission. (Refer to 21 - TRANSMISSION//AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)

TRANSMISSION TEMPERATURE SENSOR

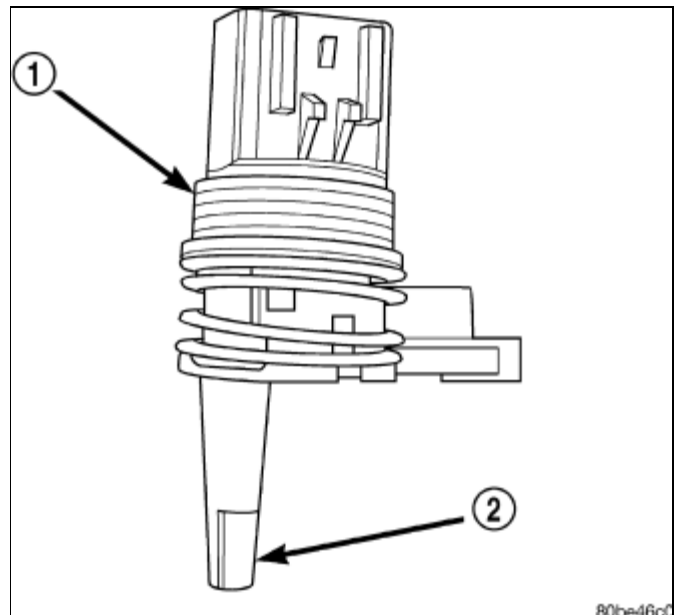
DESCRIPTION



The transmission temperature sensor (2) is located in the transmission range sensor (1) and communicates transmission sump temperature to the TCM.

OPERATION

The transmission range sensor (TRS) has an integrated thermistor that the TCM uses to monitor the transmission's sump temperature. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in. The TCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission "overheat" condition exists. If the thermistor circuit fails, the TCM will revert to calculated oil temperature usage.



CALCULATED TEMPERATURE

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

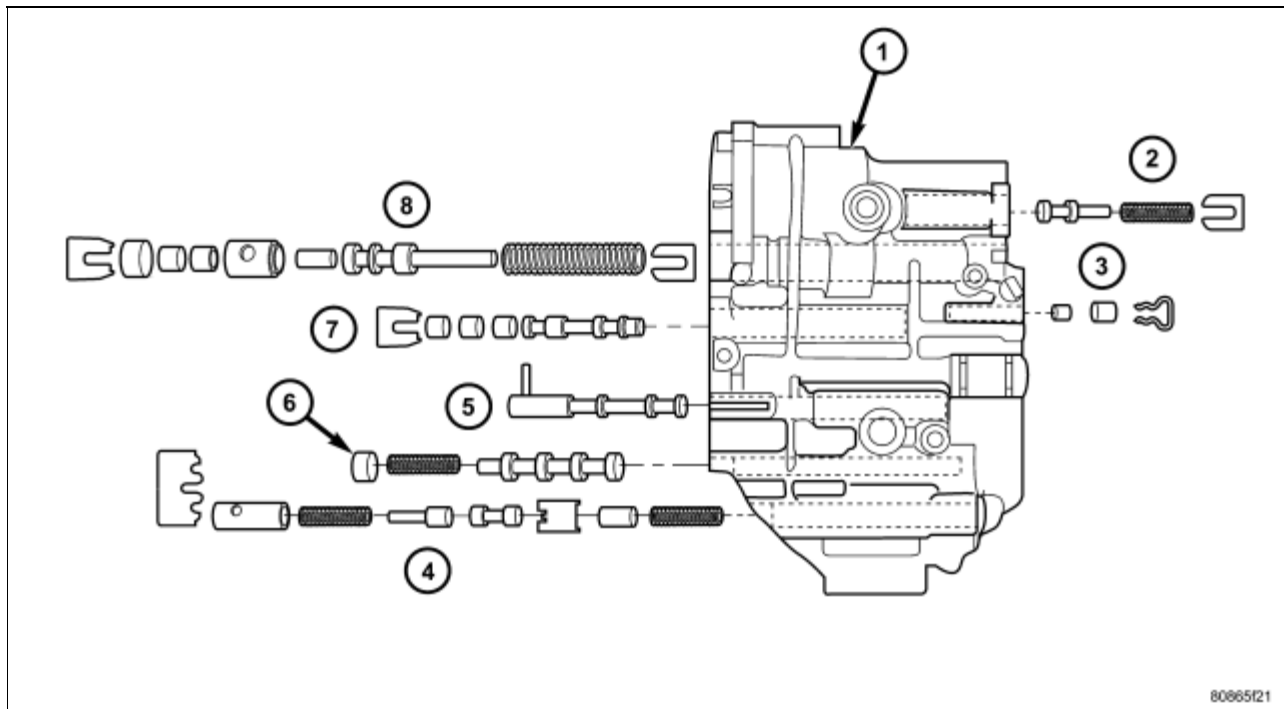
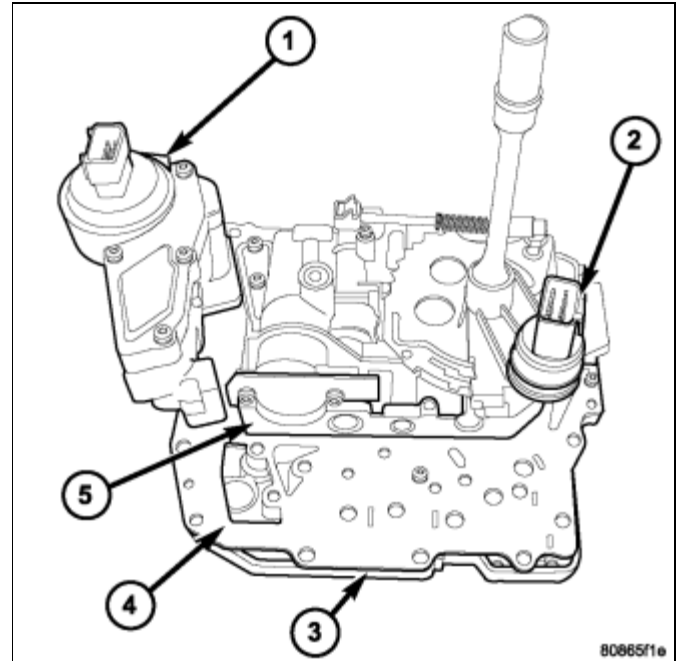
- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

VALVE BODY

DESCRIPTION

The valve body assembly consists of a cast aluminum valve body (5), separator plate (4), and transfer plate (3). The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, solenoid/pressure switch assembly, and frictional clutches.

Also mounted to the valve body assembly are the solenoid/pressure switch assembly and the transmission range sensor (2).



The valves contained within the valve body (1) include the following :

- Regulator valve(2)
- Solenoid switch valve(7)
- Manual valve(5)
- Converter clutch switch valve(6)
- Converter clutch control valve(4)
- Torque converter regulator valve(2)

- Low/Reverse switch valve(3)

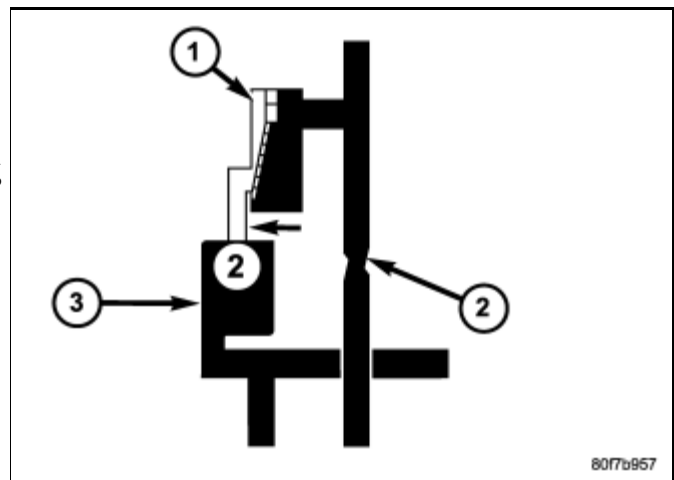
In addition, the valve body also contains the thermal valve, #2, 3, 4 & 5 check balls and the 2/4 accumulator assembly.

OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS) for a visual aid in determining valve location, operation and design.

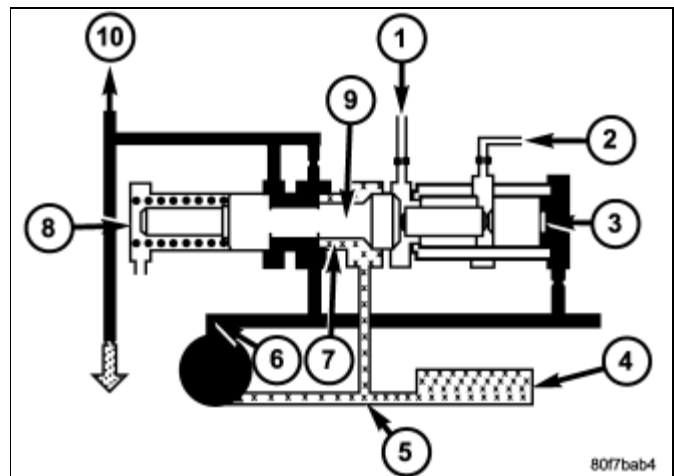
THERMAL VALVE

The thermal valve (1) is a bi-metallic shudder valve that helps control the venting rate of oil pressure in the underdrive clutch passage during release of the clutch. When the oil temperature is approximately 20 degrees F. (- 6 degrees C.) or less, the valve is fully open to assist in venting oil past the U1 orifice (2). At temperatures above 20 degrees F. (- 6 degrees C.) , the valve starts to close and becomes fully closed at approximately 140 degrees. The thermal valve is located in the transfer plate of the valve body.



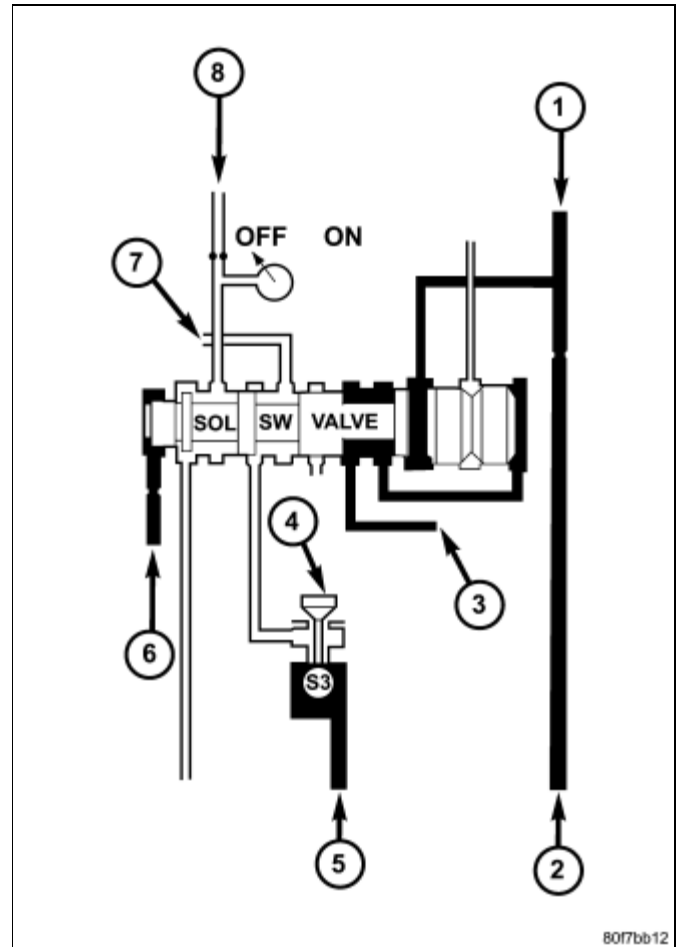
REGULATOR VALVE

The regulator valve (9) controls hydraulic pressure in the transmission. It receives unregulated pressure from the pump (6), which works against spring tension (8) to maintain oil at specific pressures. A system of sleeves and ports allows the regulator valve to work at one of three predetermined pressure levels. Regulated oil pressure is also referred to as “line pressure.”



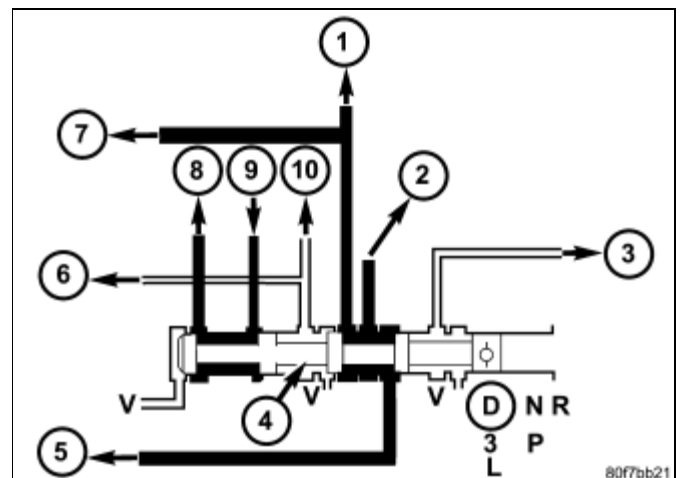
SOLENOID SWITCH VALVE

The solenoid switch valve controls line pressure from the LR/CC solenoid (4). In one position, it allows the low/reverse clutch to be pressurized. In the other, it directs line pressure to the converter control and converter clutch valves (7).



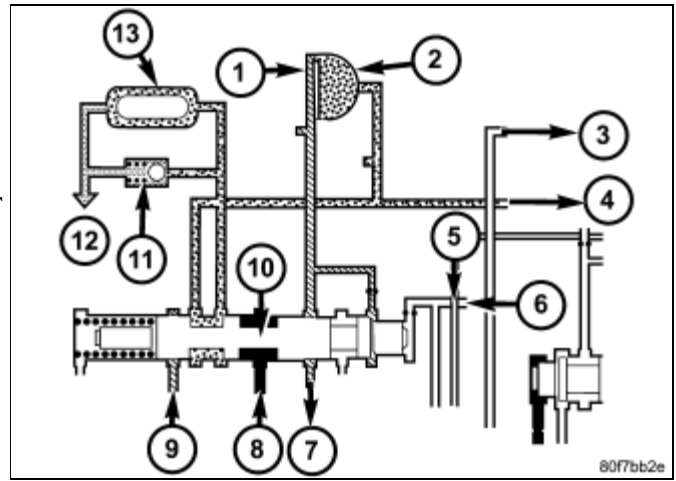
MANUAL VALVE

The manual valve (4) is operated by the mechanical shift linkage. Its primary responsibility is to send line pressure to the appropriate hydraulic circuits and solenoids. The valve has three operating ranges or positions.



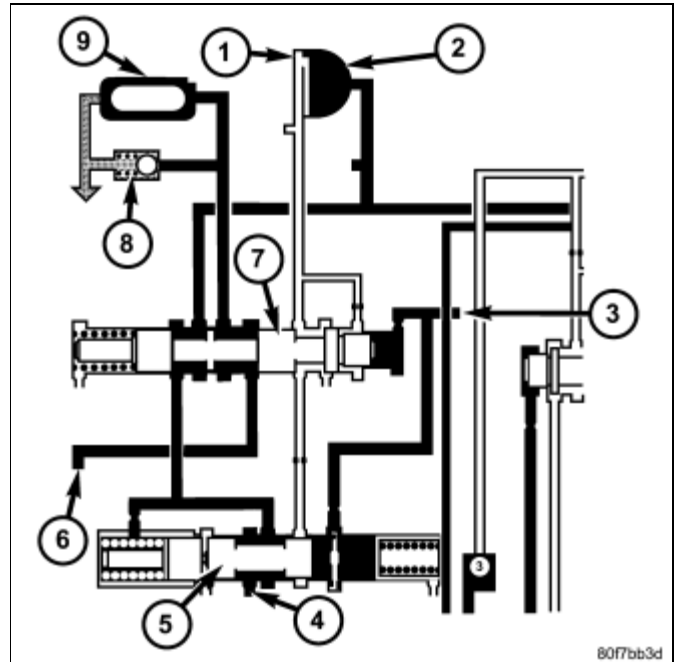
CONVERTER CLUTCH SWITCH VALVE

The main responsibility of the converter clutch switch valve (10) is to control hydraulic pressure applied to the front (off) side of the converter clutch piston. Line pressure from the regulator valve (5) is fed to the torque converter regulator valve (8). The pressure is then directed to the converter clutch switch valve (10) and to the front side of the converter clutch piston. This pressure pushes the piston back and disengages the converter clutch.



CONVERTER CLUTCH CONTROL VALVE

The converter clutch control valve (5) controls the back (on) side of the torque converter clutch (1). When the controller energizes or modulates the LR/CC solenoid to apply the converter clutch piston, both the converter clutch control valve (5) and the converter control valve move, allowing pressure to be applied to the back side of the clutch.



T/C REGULATOR VALVE

The torque converter regulator valve slightly regulates the flow of fluid to the torque converter.

LOW/REVERSE SWITCH VALVE

The low/reverse clutch is applied from different sources, depending on whether low (1st) gear or reverse is selected. The low/reverse switch valve alternates positions depending on from which direction fluid pressure is applied. By design, when the valve is shifted by fluid pressure from one channel, the opposing channel is blocked. The switch valve alienates the possibility of a sticking ball check, thus providing consistent application of the low/reverse clutch under these operating conditions.

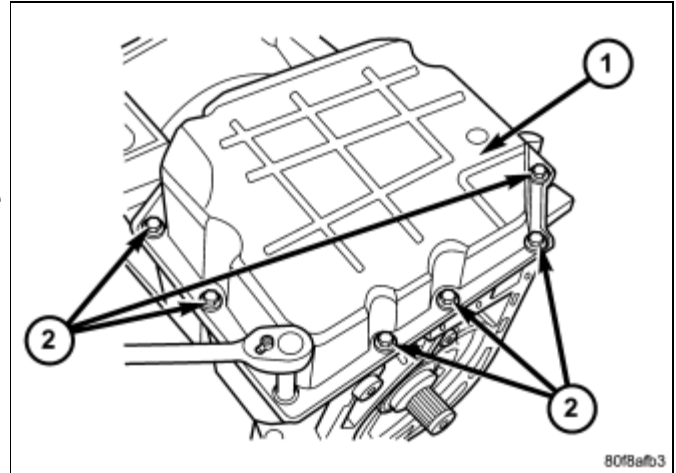
REMOVAL

NOTE: If valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

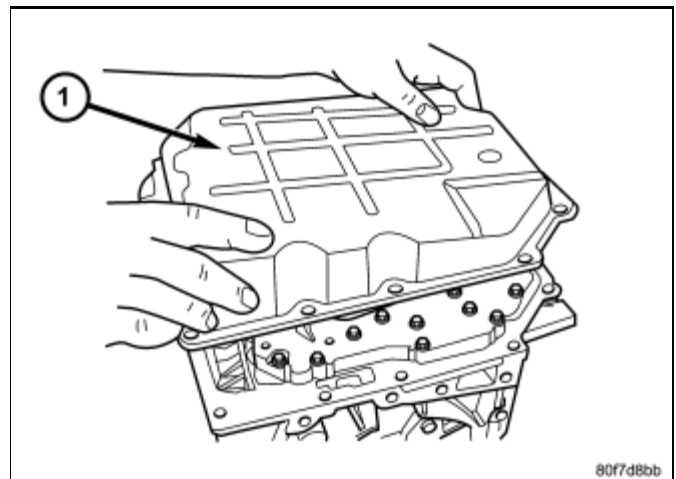
1. Disconnect the TRS and solenoid wiring connectors.
2. Disconnect the shift cable from the shift lever (at the transmission).
3. Move the manual shift lever clockwise as far as it will go. This should be one position past the L position. Then remove the manual shift lever.

NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolts for reuse.

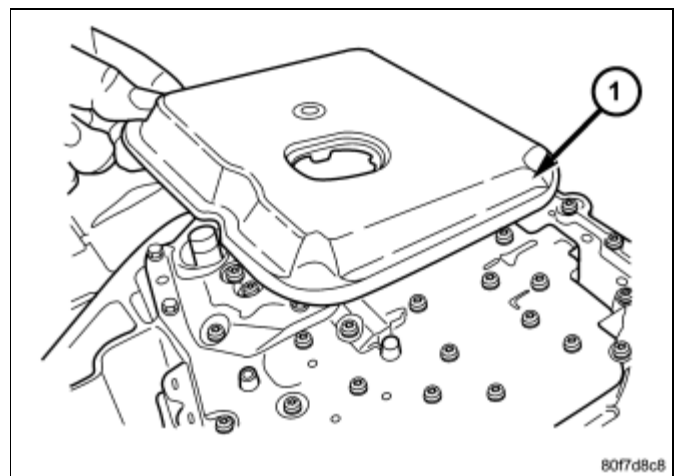
4. Remove transmission pan bolts (2).



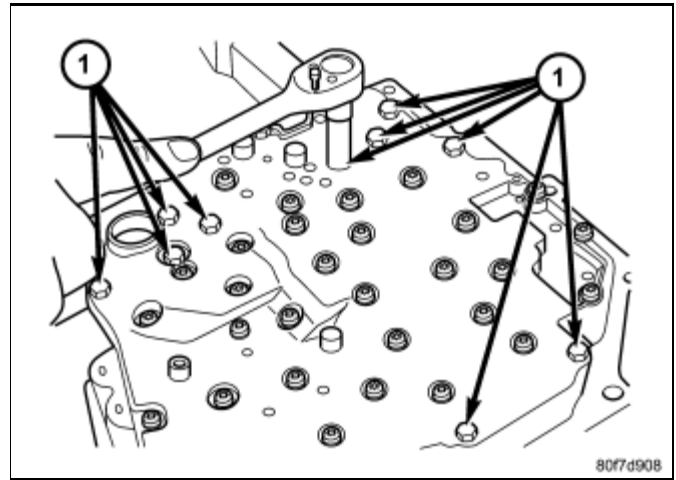
5. Remove transmission oil pan (1).



6. Remove oil filter (1) from valve body. It is held in place by two screws.



7. Remove valve body bolts-to-case (1).

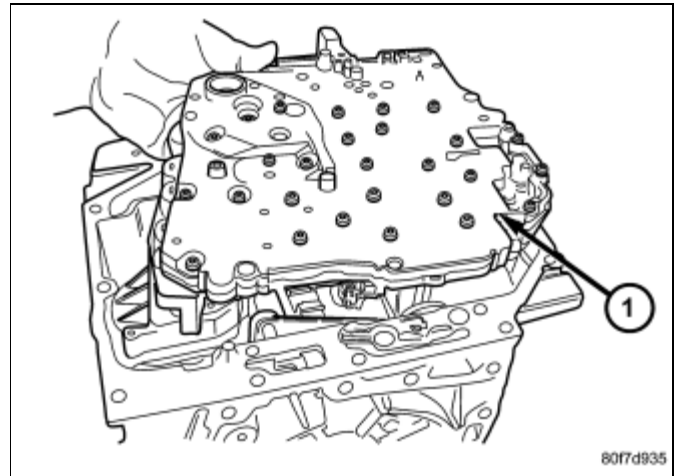


CAUTION: The overdrive and underdrive accumulators and springs may fall out when removing the valve body.

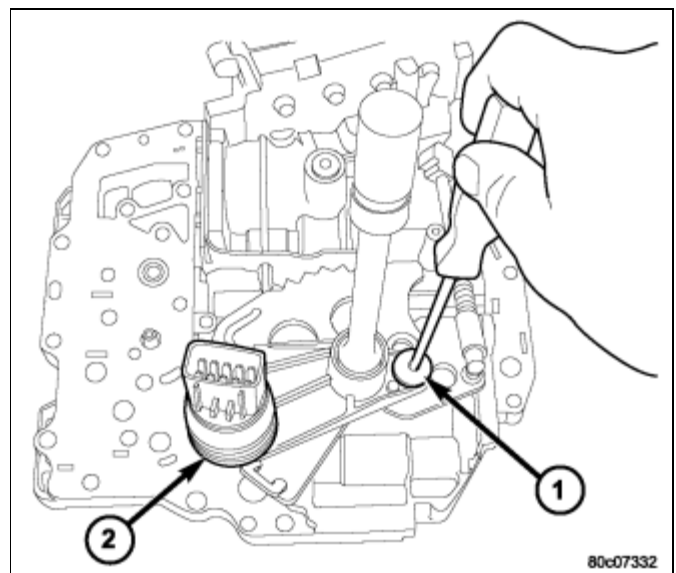
8. Carefully remove valve body assembly (1) from the transmission.

DISASSEMBLY

NOTE: If the valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

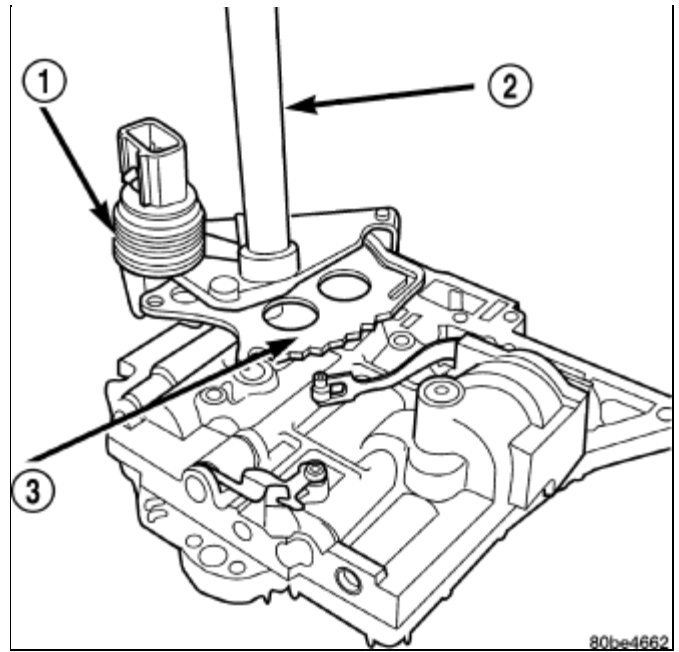


1. Remove manual shaft seal.
2. Remove manual shaft screw (1).

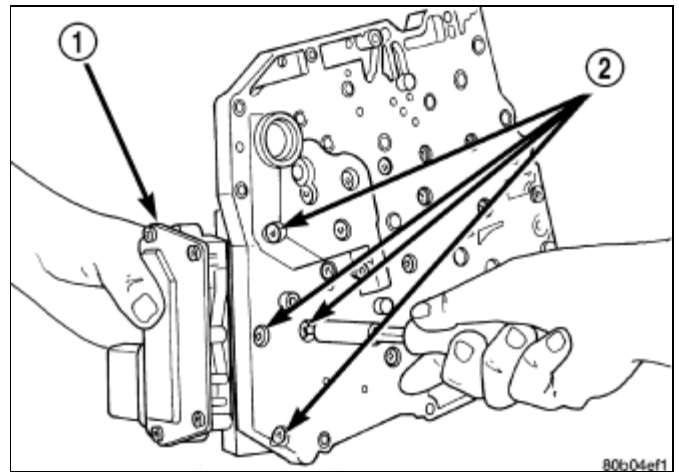


3. Remove Transmission Range Sensor (TRS) (1) and

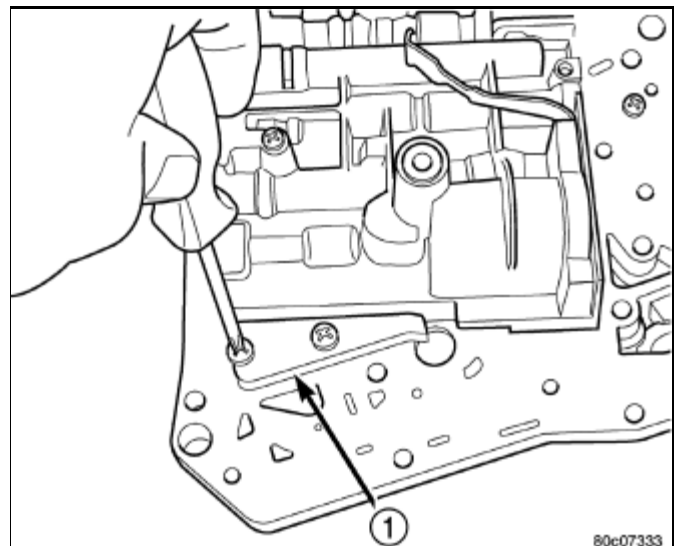
manual shaft (2).



4. Remove Solenoid/Pressure Switch Assembly (1) from valve body.

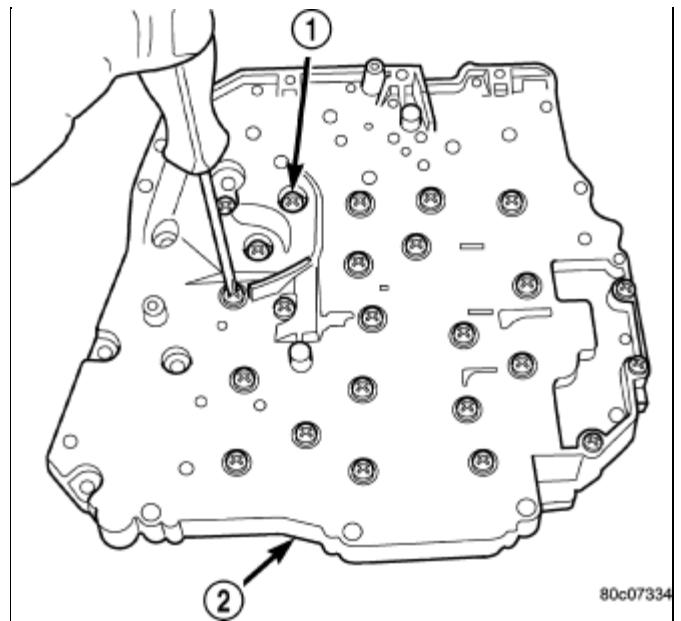


5. Remove valve body stiffener plate (1).

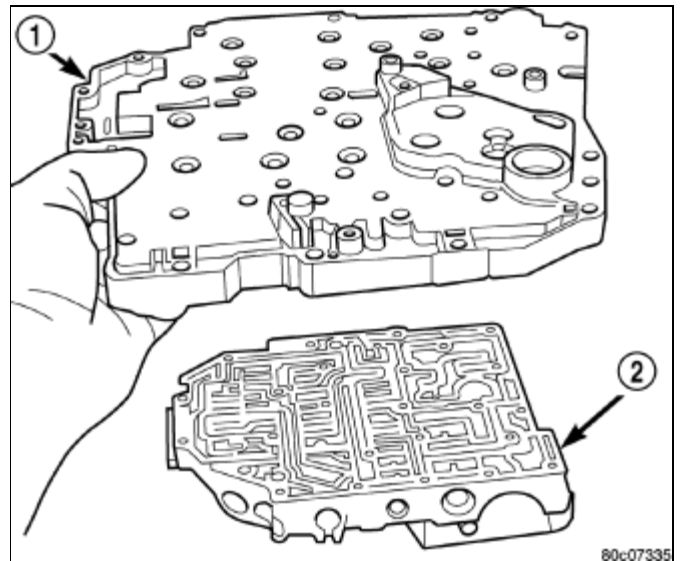


6. Invert valve body assembly and remove transfer plate-to-

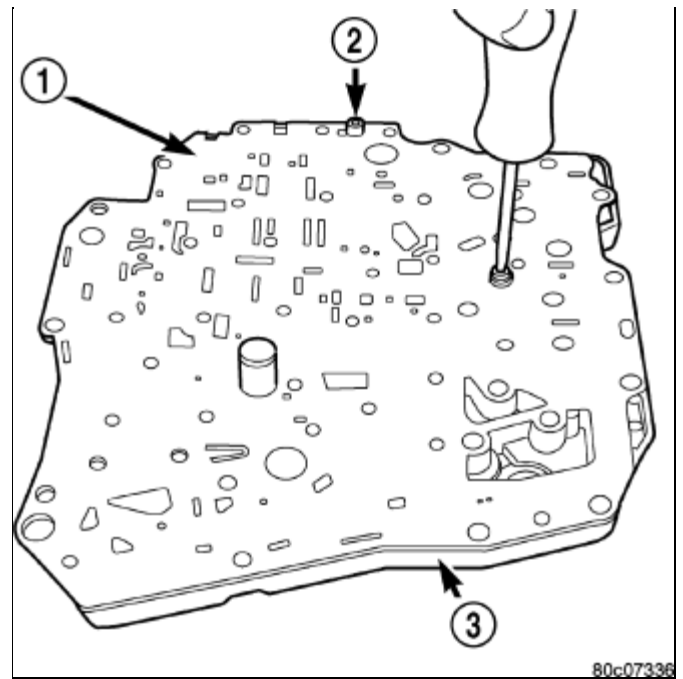
valve body screws (1).



7. Remove transfer/seperator plate (1) from valve body (2)

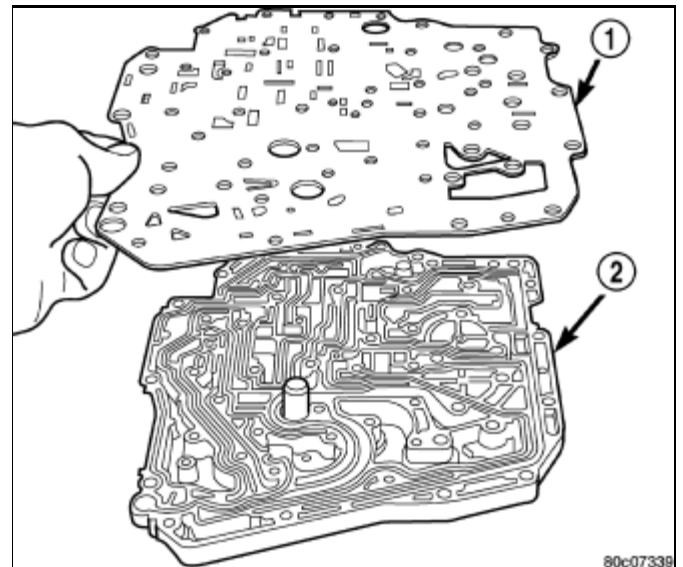


8. Remove separator plate-to-transfer plate screws (2).



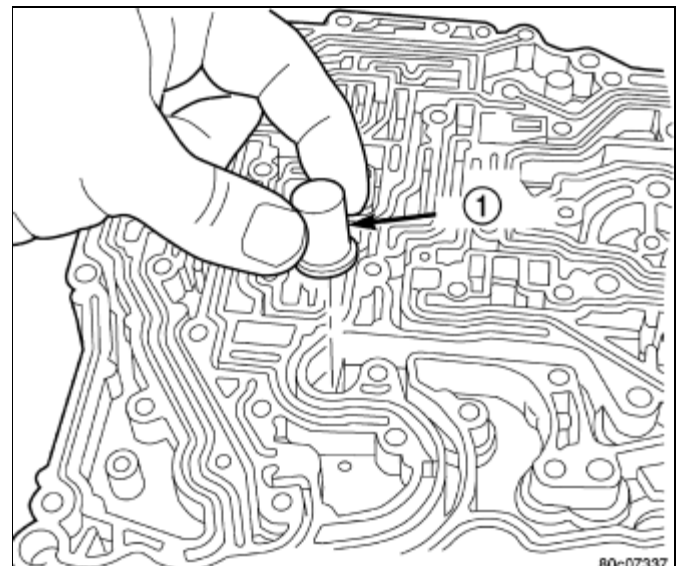
80c07336

9. Remove separator plate (1) from transfer plate (2).



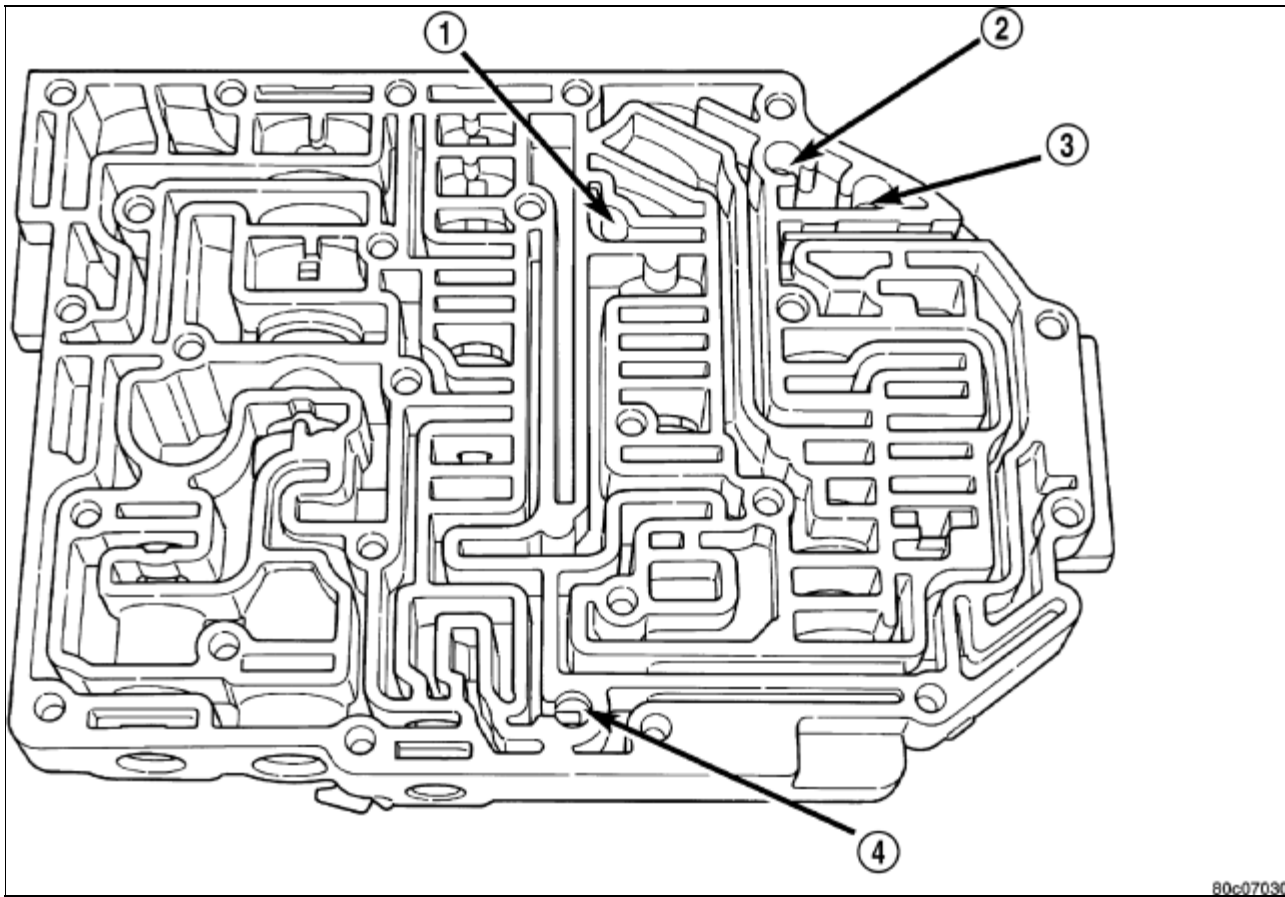
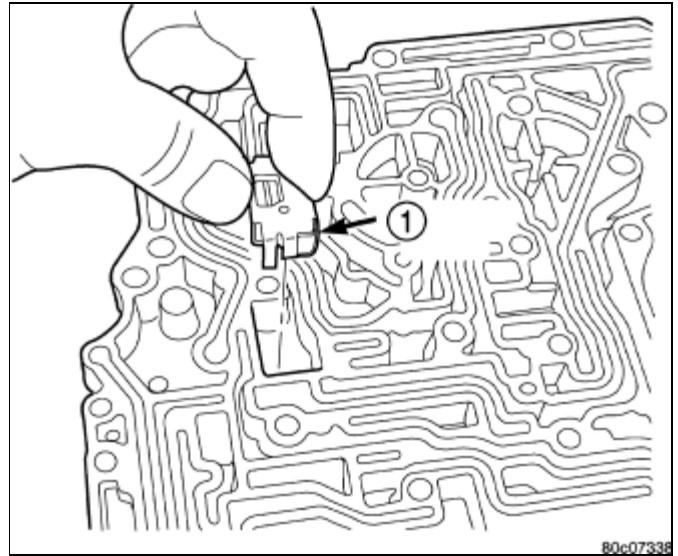
80c07335

10. Remove the oil screen (1) from the transfer plate.



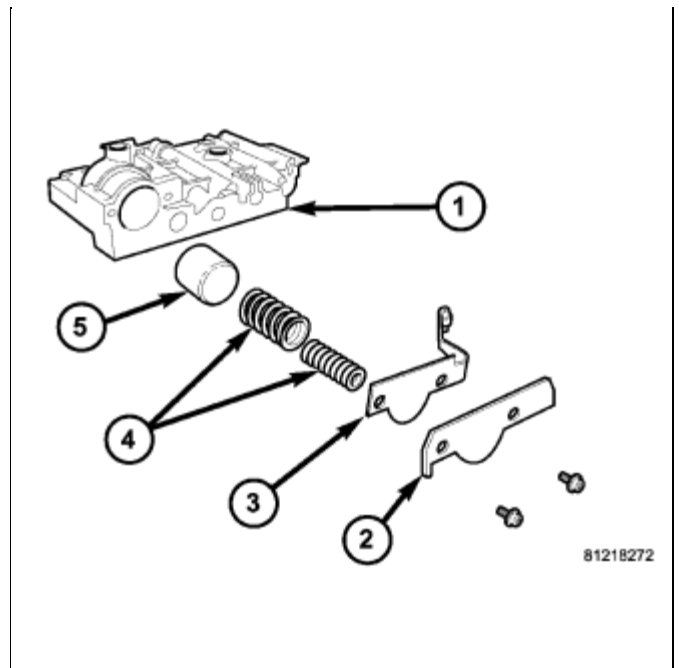
80c07337

11. Remove thermal valve (1) from transfer plate.

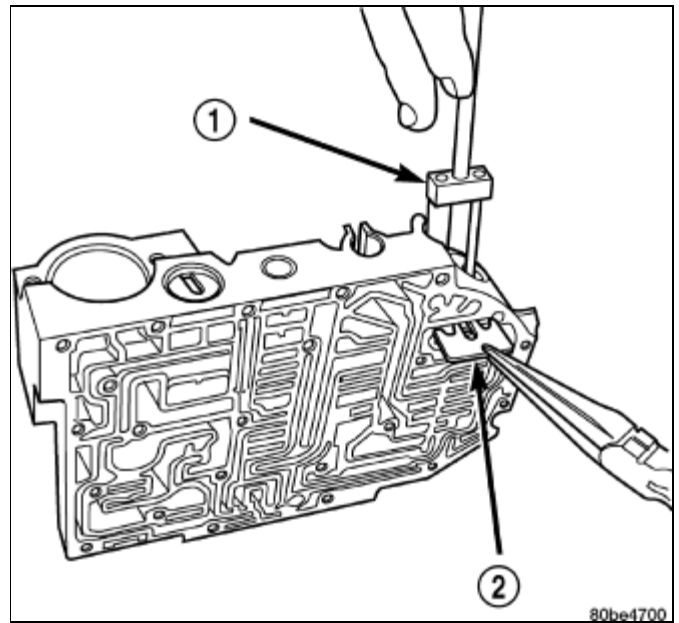


12. Remove valve body check balls (1-4). Note their location for assembly ease .

13. Remove 2/4 accumulator assembly (1-5).

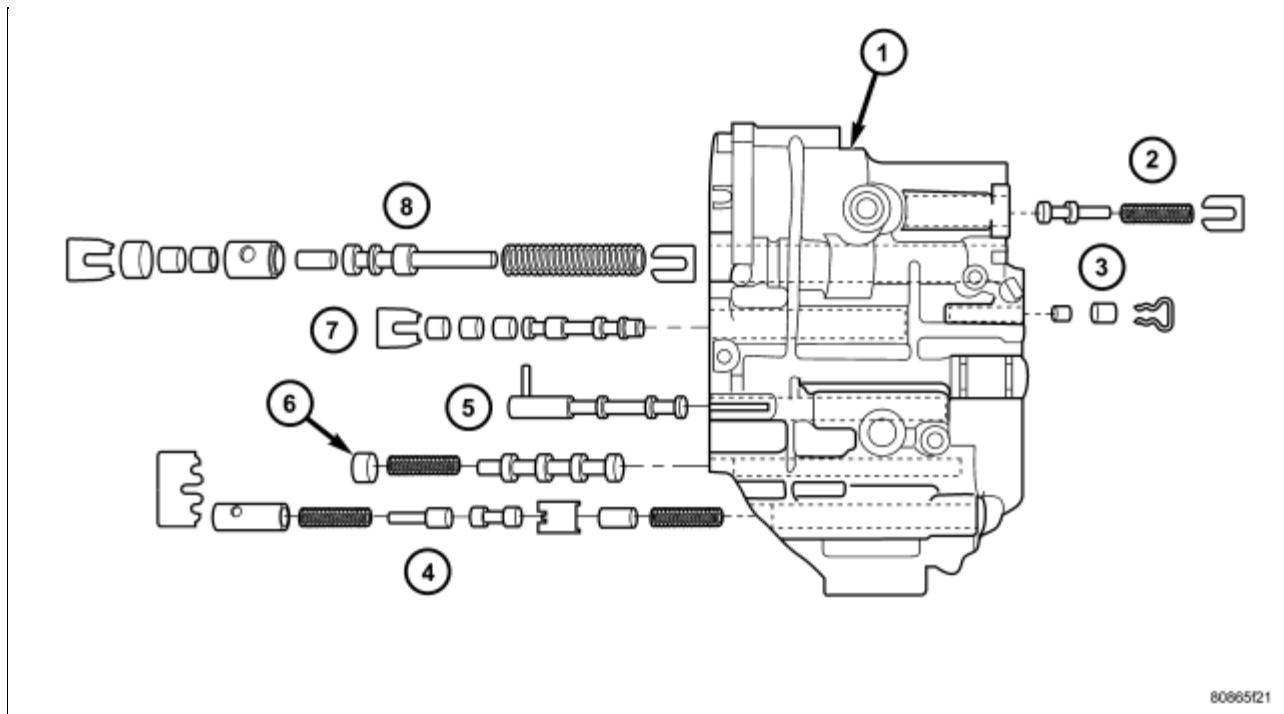


14. Remove dual retainer plate (2) from valve body. Use special Remover / Installer tool 6301 (1) to remove plate (2).



15. Remove regulator valve spring retainer (2).

A detailed line drawing of the back of an HP-41C calculator, showing the internal circuit board. The board is populated with various electronic components, including integrated circuits, resistors, and capacitors. Two callouts are present: callout 1 points to a small component on the right side of the board, and callout 2 points to a component on the left side. The board has a complex layout of traces and pads.



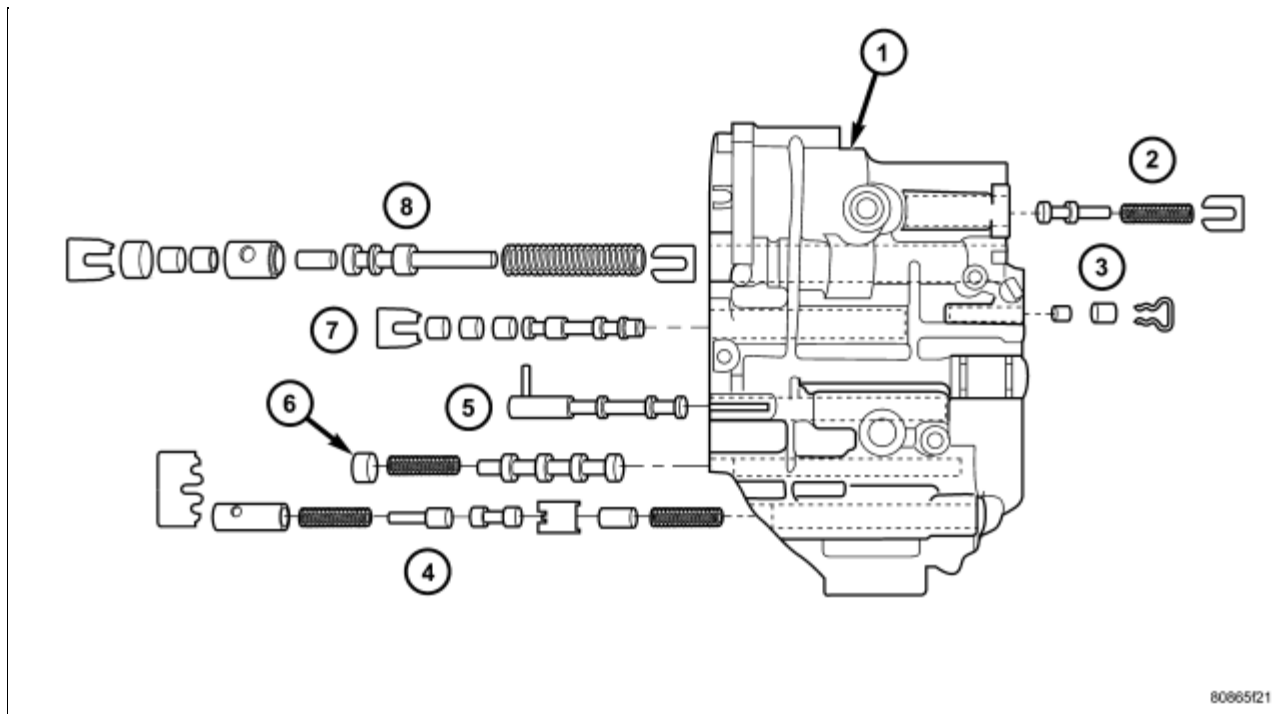
80665121

17. Remove all valves and springs.

18. Cleanliness through entire disassembly and assembly of the valve body cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the valve body are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

ASSEMBLY

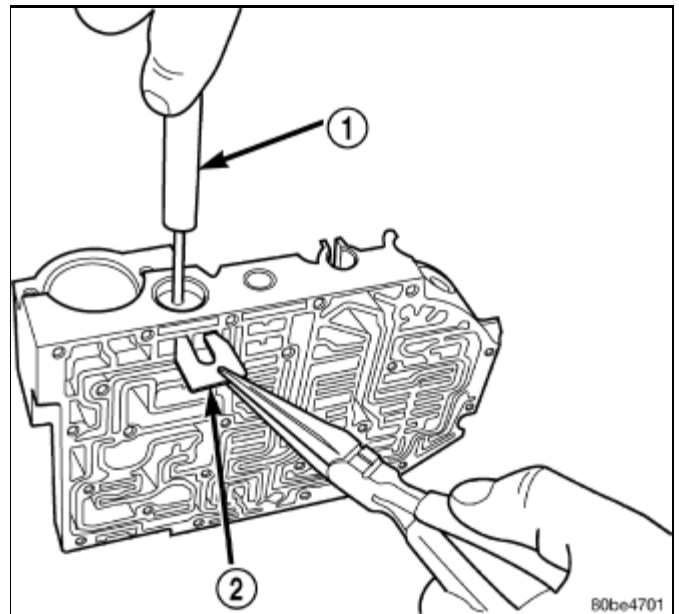
NOTE: If the valve body assembly is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)



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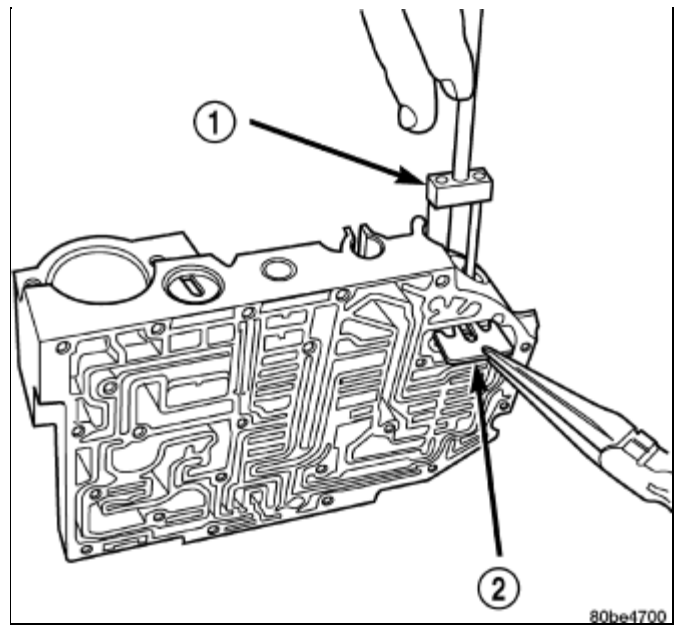
1. Install all valves and springs as shown.

2. Install regulator valve spring retainer (2).



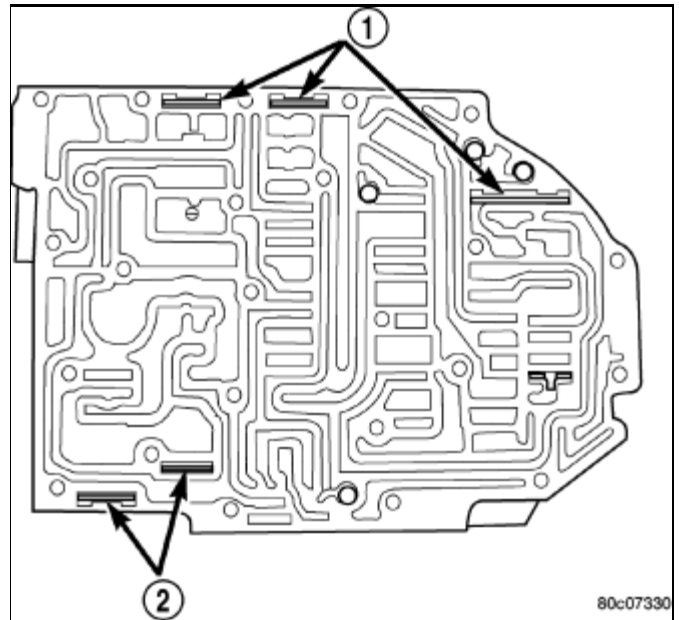
80be4701

3. Install dual retainer plate (2) using Tool 6301 (1).



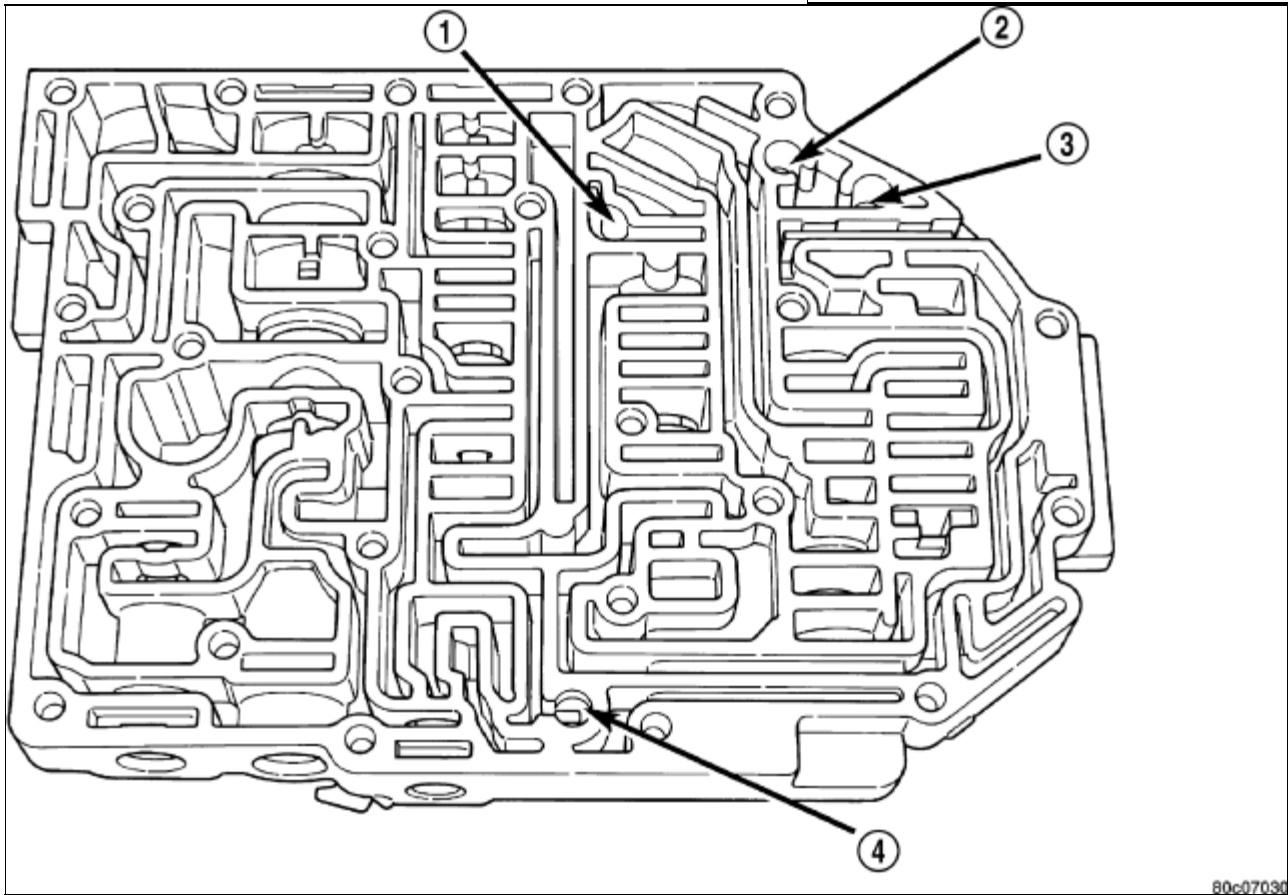
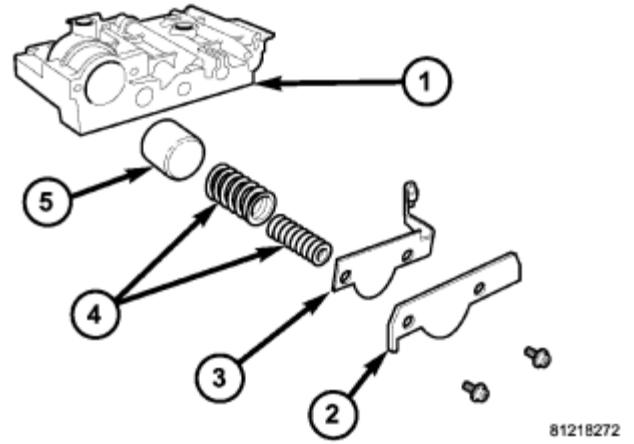
80be4700

4. Verify that all retainers (1, 2) are installed as shown. Retainers should be flush or below valve body surface.



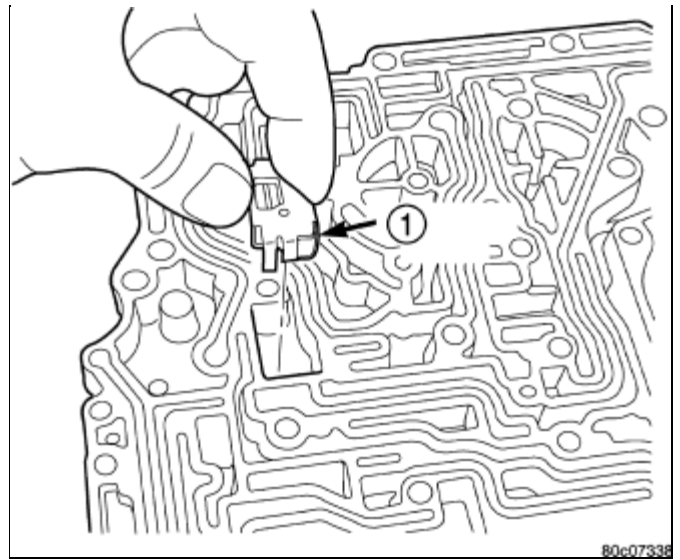
80c07330

5. Install 2/4 Accumulator components (1-5) as shown. Torque 2/4 Accumulator retainer plate to 5 N·m (45 in. lbs.).

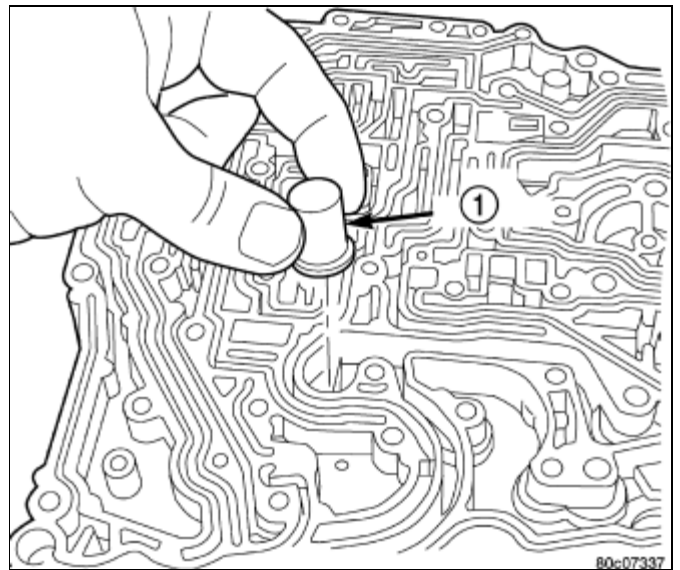


6. Install check balls into position as shown. If necessary, secure them with petrolatum or transmission assembly gel for assembly ease.

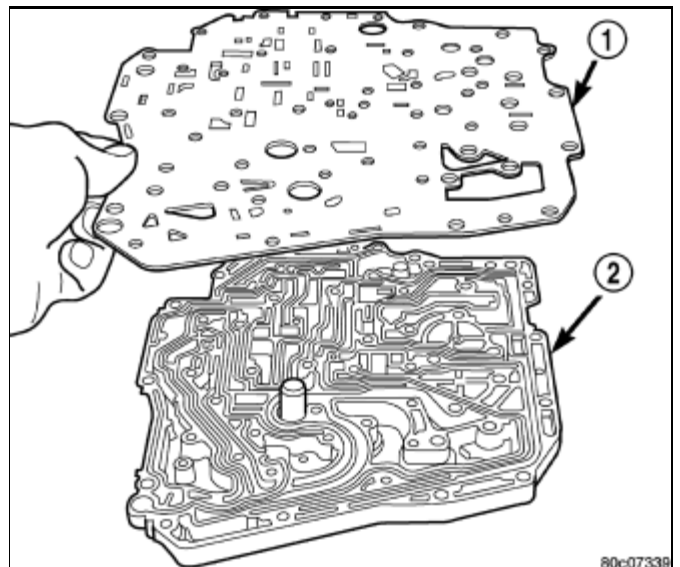
7. Install thermal valve (1) to the transfer plate.



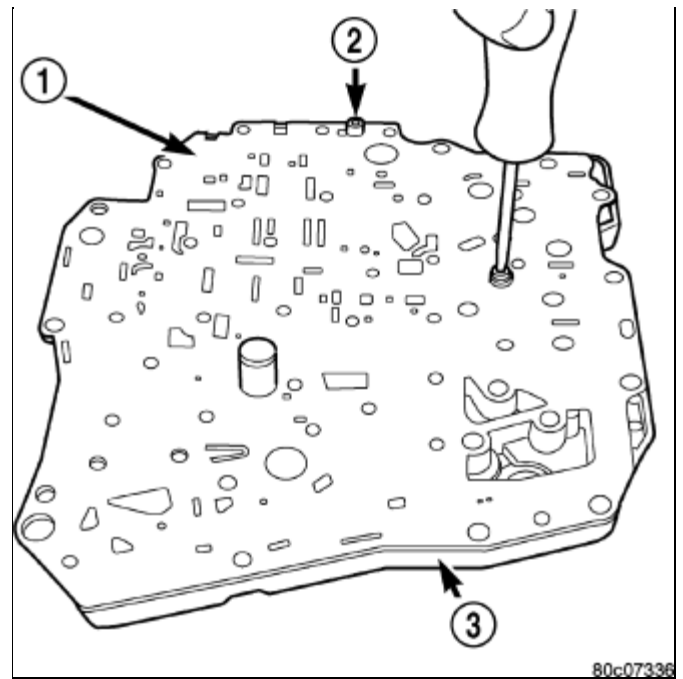
8. Install the oil screen (1) to the transfer plate.



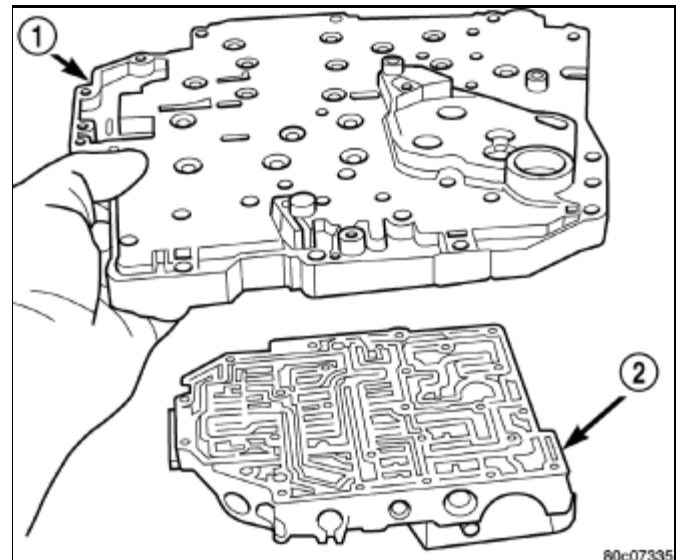
9. Install separator plate (1) to transfer plate (2).



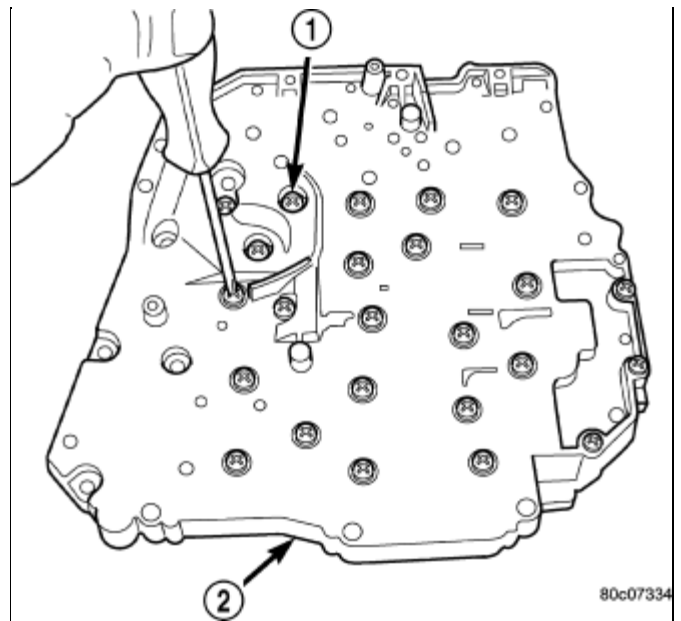
10. Install the two separator plate-to-transfer plate screws (2).



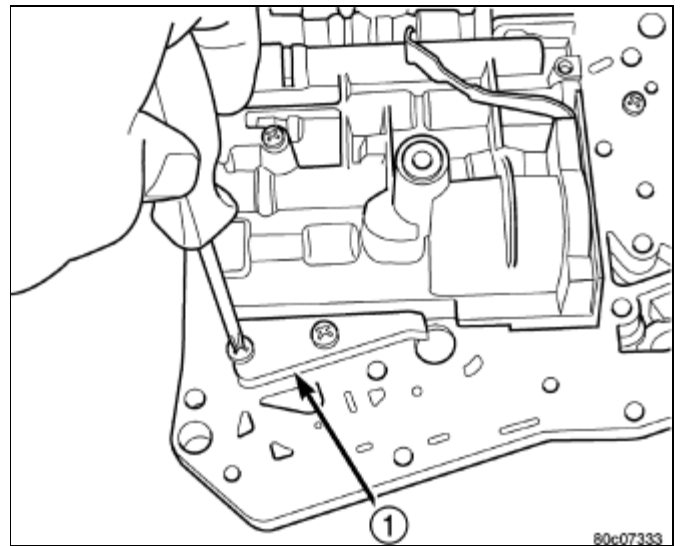
11. Install the transfer plate (1) to the valve body (2).



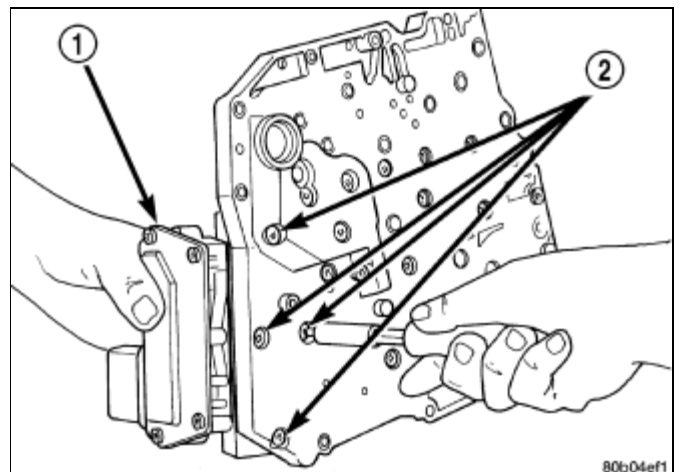
12. Install the transfer plate-to-valve body screws (1) and torque to 5 N·m (45 in. lbs.).



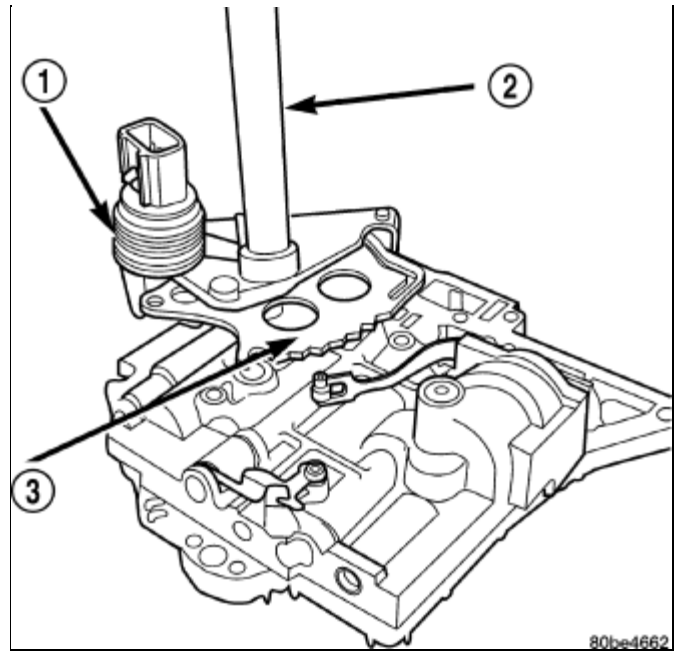
13. Install the stiffener plate (1).



14. Install the solenoid/pressure switch assembly (1) and screws to the transfer plate and torque to 5.5 N·m (50 in. lbs.).

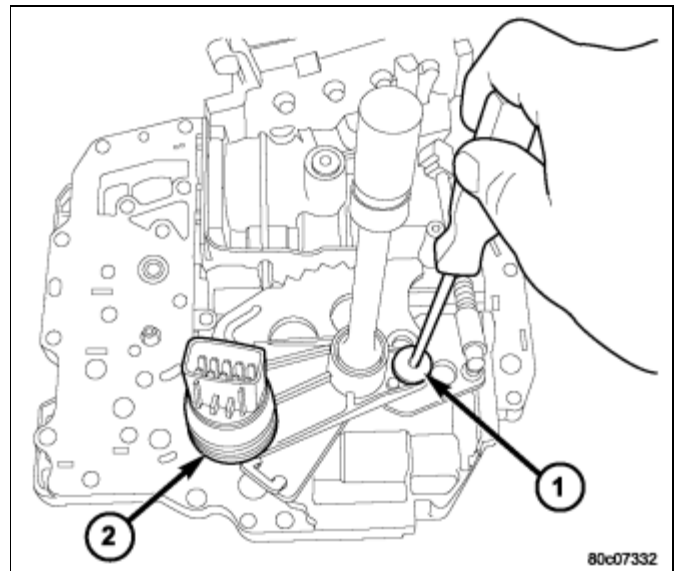


15. Install the manual shaft/rooster comb (3) and transmission range sensor (1) to the valve body.

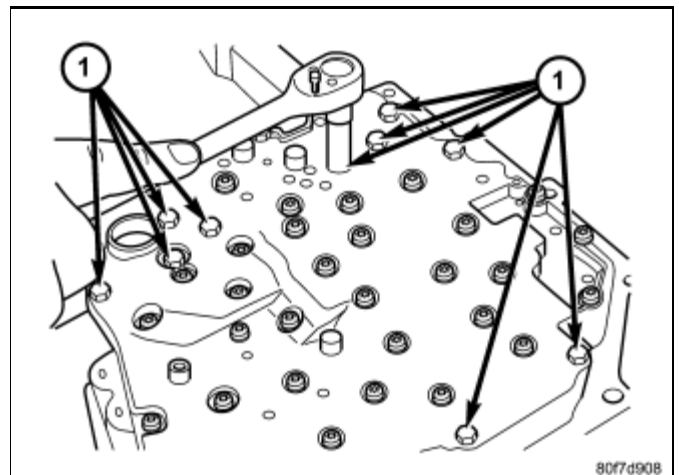


16. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.).
17. Install manual shaft seal.

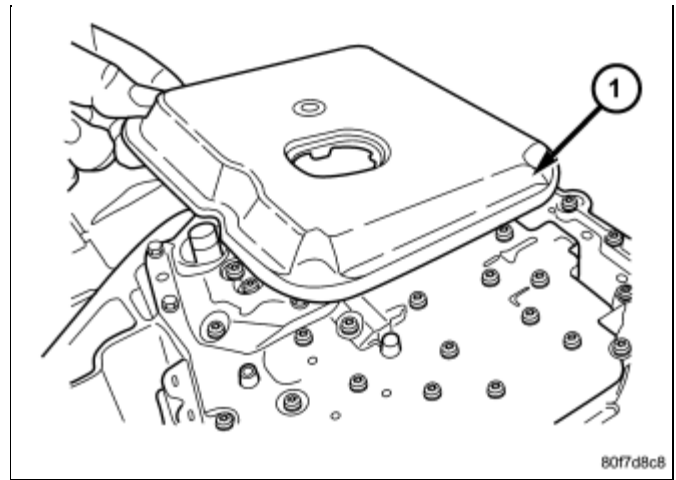
INSTALLATION



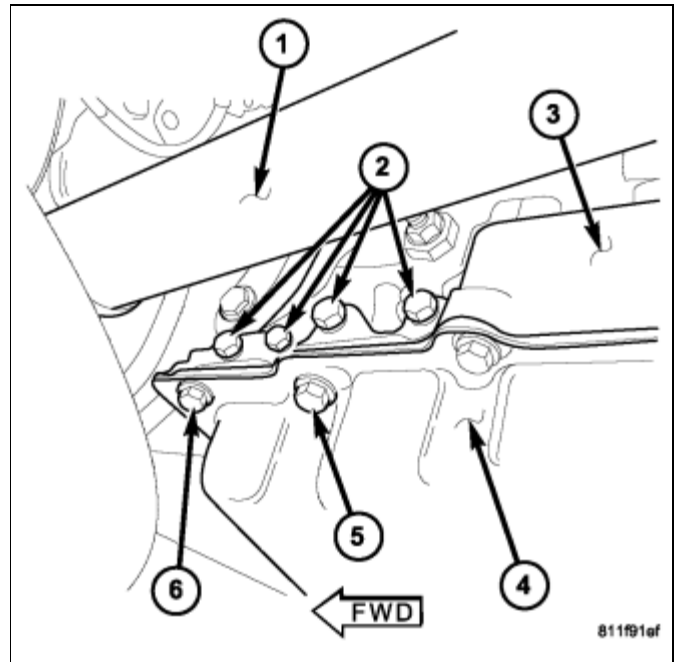
1. Install valve body into position and start bolts (1). Torque valve body to transmission case bolts (1) to 12 N·m (105 in. lbs.) torque.



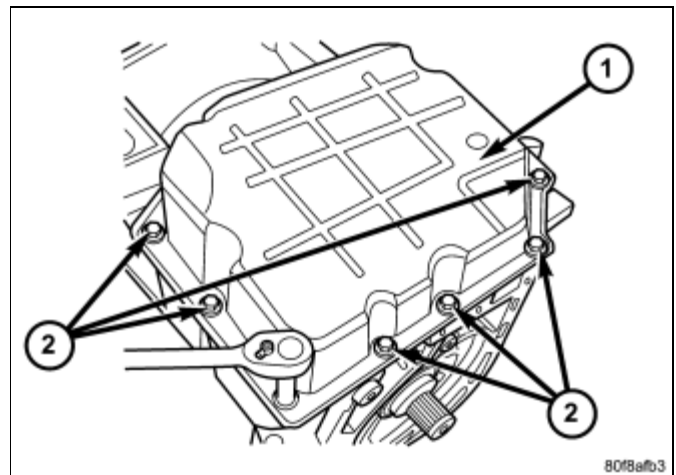
2. Install transmission oil filter (1).



NOTE: Before installing the oil pan bolt in the bolt hole (5) located between the torque converter clutch on and U/D clutch pressure tap circuits, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.



3. Make sure oil pan (1) and case rail are clean and dry. Install an 1/8" bead of RTV to the transmission oil pan and install to case. Tighten bolts (2) to 20 N·m (14.5 ft. lbs.).
4. Lower vehicle and connect the TRS connector.
5. Connect solenoid/pressure switch assembly connector.
6. Lower vehicle.
7. Fill transmission with ATF+4, Automatic Transmission Fluid. Verify proper fluid level. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)



NOTE: If the valve body has been reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

AUTOMATIC TRANSMISSION - 545RFE - ELECTRICAL

DIAGNOSTICS (DIESEL)

AUTOMATIC TRANSMISSION - 545RFE - ELECTRICAL DIAGNOSTICS (DIESEL)

DIAGNOSIS AND TESTING

P0122-TPS/APP CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The 3 wire TPS provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The Throttle Position Sensor (TPS) is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5.0 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range from 0.26 volts at minimum throttle opening (idle), to 4.49 volts at maximum opening (wide open throttle).

The APPS is a linear potentiometer. It provides the PCM/ECM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM/ECM to calculate the throttle plate position.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

Possible Causes
RELATED ENGINE TPS/APPS DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED ENGINE TPS/APPS DTCS ARE PRESENT

With the scan tool, read Engine DTCs.

Are there any Engine TPS/APPS DTCs present?

Yes

- Refer to the Driveability Category and perform the appropriate Symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.

With the scan tool, erase PCM DTCs and the Event Data.

NOTE: Clearing DTCs does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults and may cause poor shift quality until those values are relearned.

Using the Event Data recorded earlier, test drive the vehicle while trying to duplicate the operating conditions in which the DTC originally set.

With the scan tool, read DTCs.

Did this DTC reset during the road test?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0123-TPS/APP CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The 3 wire TPS provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The Throttle Position Sensor (TPS) is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5.0 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range from 0.26 volts at minimum throttle opening (idle), to 4.49 volts at maximum opening (wide open throttle).

The APPS is a linear potentiometer. It provides the PCM/ECM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM/ECM to calculate the throttle plate position.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

Possible Causes
RELATED ENGINE TPS/APPS DTCS PRESENT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS/APPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, this includes all one trip failures.

Are there any Engine TPS/APPS DTCs present?

Yes

- Refer to the Driveability category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.
With the scan tool, erase PCM DTCs and the Event Data.

NOTE: Clearing DTCs does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults and may cause poor shift quality until those values are relearned.

Using the Event Data recorded earlier, test drive the vehicle while trying to duplicate the operating conditions in which the DTC originally set.

With the scan tool, read DTCs.

Did this DTC reset during the road test?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0124-TPS/APP INTERMITTENT

For a complete Transmission wiring diagram **Refer to Section 8W**

Theory of Operation

The 3 wire TPS provides the PCM with an input signal voltage that represents the throttle blade position of the throttle body. The Throttle Position Sensor (TPS) is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5.0 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range from 0.26 volts at minimum throttle opening (idle), to 4.49 volts at maximum opening (wide open throttle).

The APPS is a linear potentiometer. It provides the PCM/ECM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the PCM/ECM to calculate the throttle plate position.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree

change is greater than 5° within a period of less than 7.0 msec.

Possible Causes
RELATED TPS ENGINE DTCS PRESENT
THROTTLE POSITION SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, read Engine DTCS.

Are there any Engine TPS/APPS DTCS present?

Yes

- Refer to the Powertrain category and perform the appropriate symptom.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the Event Data to help identify the conditions in which the DTC was set.
With the scan tool, erase PCM DTCS and the Event Data.

NOTE: Clearing DTCS does NOT erase the Event Data. To erase the Event Data you must either perform a Quick Learn procedure or battery disconnect (if available) with the scan tool, or manually disconnect the battery. Whatever method used might reset certain learned transmission values to controller defaults and may cause poor shift quality until those values are relearned.

Using the Event Data recorded earlier, test drive the vehicle while trying to duplicate the operating conditions in

which the DTC originally set.
With the scan tool, read DTCs.

Did this DTC reset during the road test?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK THROTTLE POSITION SENSOR OPERATION

Ignition On, Engine Not Running.

With the scan tool, under Transmission Sensors, monitor the TPS voltage in the following step.

Slowly open and close the throttle while checking for erratic voltage changes.

If equipped with ETC, use the ETC Throttle Follower test in the scan tool to check for erratic voltage changes.

Was the TPS voltage change smooth and consistent?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Throttle Position Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The DTC is intended as an informational DTC to aid the technician in determining the root cause of a customer driveability issue. The DTC is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler is needed to support the customers driving behavior.

- **When Monitored:**

Whenever the engine is running.

- **Set Condition:**

Immediately after a Overheat shift schedule is activated when the Transmission temperature exceeds 127° C or 260° F.

Possible Causes
HIGH TEMPERATURE OPERATION ACTIVATED
TORQUE CONVERTER CLUTCH SLIPPING / NOT ACTIVATING
OPERATING VEHICLE WITH TRANSMISSION IN LIMP-IN MODE FOR AN EXTENDED PERIOD OF TIME
EXCESSIVE TIME IDLING IN GEAR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints. This DTC indicates that the transmission has been operating in the "Overheat" shift schedule which may

generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

Verify proper Engine cooling system operation which would affect proper transmission operation.

Verify proper torque converter clutch operation.

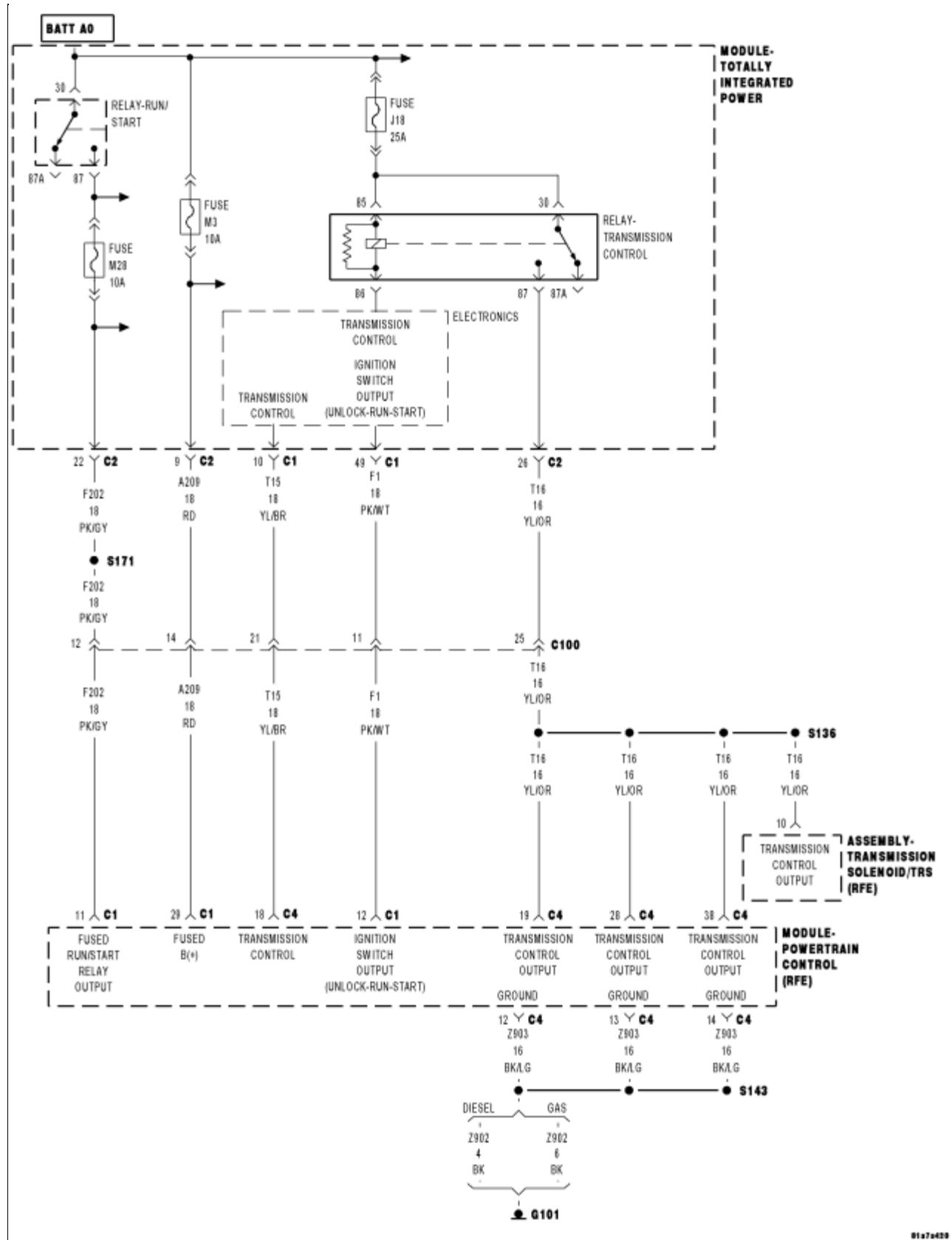
With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

- Repair the cause of transmission overheating. Refer to the Service Information for the proper repair procedure. Make sure to check for any Service Bulletins pertaining to this problem.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0562-BATTERY VOLTAGE LOW



Friction element distress could result from an insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

- **When Monitored:**

With the engine running and the PCM has requested the TIPM to activate the Transmission Control Output circuit.

- **Set Condition:**

If the battery voltage of the Transmission Output circuit(s) to the PCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the PCM. The DTC will also set if the battery voltage sensed at the PCM is less than 6.5-volts for 200ms or where the Transmission Output circuits are less than 7.2-volts for 200ms.

Possible Causes
RELATED CHARGING SYSTEM DTCS
(Z903) GROUND CIRCUITS OPEN OR HIGH RESISTANCE
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
TOTALLY INTEGRATED POWER MODULE (TIPM)
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. RELATED CHARGING SYSTEM DTCS

With the scan tool, read the Engine DTCs.

Are there any related Charging System DTCs also present?

Yes

- Refer to the Charging System category and repair any Engine Charging System DTCs, before testing DTC P0562. NOTE: After repairing the Engine Charging System DTC's, perform the Transmission Verification

test to verify the transmission control system was not damaged.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [2](#)

2. CHECK FOR TIPM DTCS

NOTE: Generator, battery, and charging system must be fully functional before performing this test.

With the scan tool, read TIPM DTCS.

Are there any TCM TIPM DTCS present.

Yes

- Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

No

- Go To [3](#)

3. CONDITION P0562 PRESENT

With the scan tool, read Transmission DTCS.

With the scan tool, check the Starts Since Set counter for P0562.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter set at 0?

Yes

- Go To [4](#)

No

- Go To [7](#)

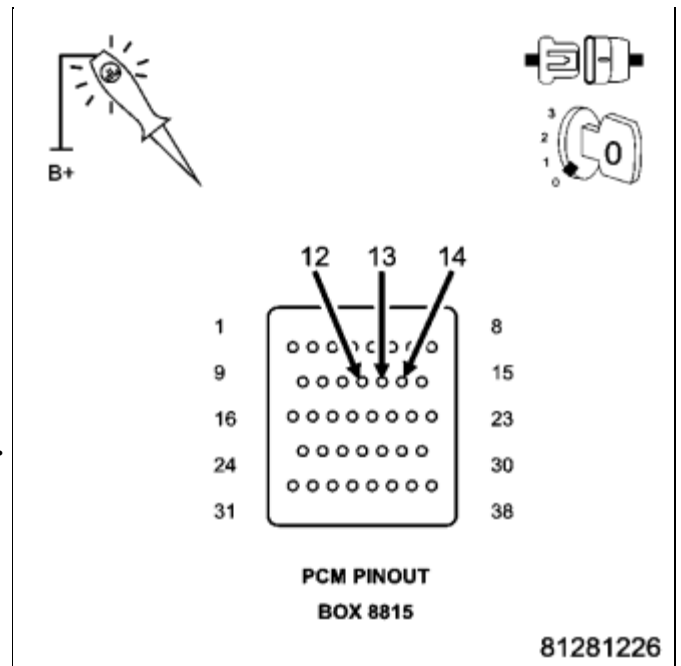
4. CHECKING (Z903) GROUND CIRCUITS

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, check the PCM (Z903) Ground circuits at the appropriate terminals of Miller tool #8815.



NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly for all of the Ground circuits?

Yes

- Go To [5](#)

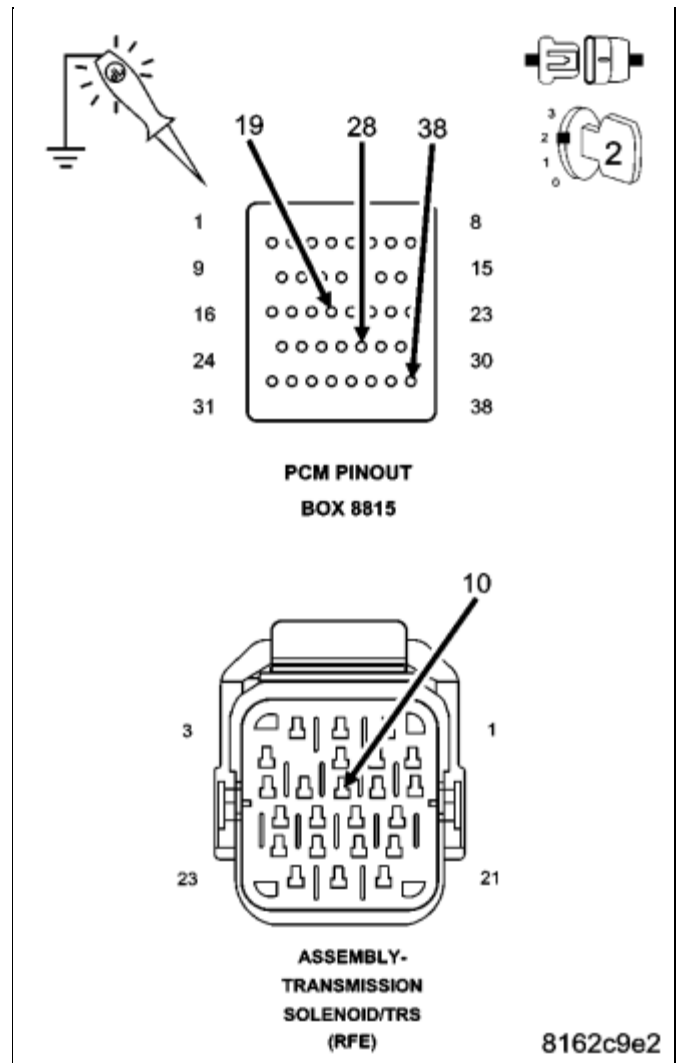
No

- Repair the (Z903) Ground circuit(s) for an open or high resistance.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT

Turn the ignition off to the lock position.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.
Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Using a 12-volt test light connected to ground, check all (T16) Transmission Control Output circuits at the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminals of Miller tool #8815.

NOTE: The (T16) Transmission Control Output circuit branches off to both Transmission Solenoid/TRS



Assembly and the PCM.

Does the test light illuminate brightly while cycling on and off on all (T16) Transmission Control Output circuits?

Yes

- Go To [6](#)

No

- Repair the (T16) Transmission Control Output circuit for an open or high resistance.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the TIPM C2 harness connector.
Measure the resistance of the (T16) Transmission Control Output circuit between the TIPM C2 harness connector and both the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminals of Miller tool #8815.

Is the resistance above 5.0 ohms on any circuit?

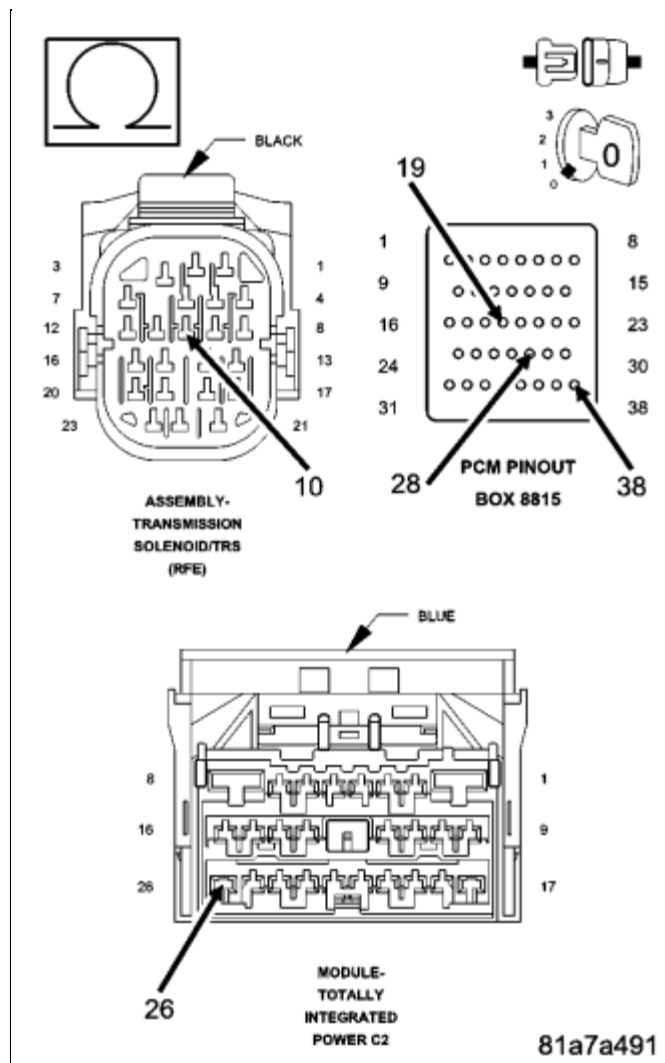
Yes

- Repair the (T16) Transmission Control Output circuit for an open or high resistance.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace and program the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0602-CONTROL MODULE PROGRAMMING ERROR/NOT

PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. However, generic software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found, the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

- **When Monitored:**

Check for generic software is made at power-up

- **Set Condition:**

If generic software is found, the MIL will light immediately. This DTC is designed to inform the technician that the controller still has generic software installed.

Possible Causes
PCM - PROGRAMMING ERROR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CONTROL MODULE PROGRAMMING ERROR

NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.

With the scan tool.

Record the vehicles controller part number.

Select Use Controller Part Number under the Flash Tab.

Flash the controller with the correct software.

Verify the controller flashed successfully.

Test Complete

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0604-INTERNAL CONTROL MODULE RAM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

After the controller is reset (ignition turned to the RUN position), the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be same as value written.

- **When Monitored:**

One time after the controller is reset (ignition turned to the RUN position).

- **Set Condition:**

Whenever the Powertrain Control Module (PCM) detects an internal controller problem.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair the power and/or ground circuits to the PCM and Transmission Control Relay or TIPM (if equipped) as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0605-INTERNAL CONTROL MODULE ROM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

After the controller is reset (ignition turned to the RUN position) the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in the program memory.

- **When Monitored:**

One time after the controller is reset (ignition turned to the RUN position).

- **Set Condition:**

Whenever the Powertrain Control Module (PCM) detects an internal controller problem.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair the power and/or ground circuits as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0613-INTERNAL TRANSMISSION PROCESSOR

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The internal Watchdog (WD) is a separate hardware circuit that continuously monitors the microprocessor. To insure the proper operation of the Transmission controller the watchdog must receive a signal from the microprocessor within a specific time window (14 msec $\pm$ 1 msec) to prevent a system shutdown after a short delay (570 msec). The microprocessor periodically tests the WDs ability to provide this shutdown function using a three phase test;

- 1) Send the signal too late > 15 msec
- 2) Send the signal too early < 13 msec
- 3) Delay test < 590 msec

If the watchdog input signal arrives too early or too late, the Watchdog Fault line will go low and the watchdog delay will start to time out. The delay will be reset by the correct timing of watchdog signal sent during subsequent operations.

The Delay Test checks the delay time out. The Delay Monitor line is pulled low, which forces the delay to start timing out. At the end of the delay time the Transmission Relay will be turned off. The delay test, upon detection of the relay turning off, will immediately turn the relay back on before shutdown can occur.

- **When Monitored:**

1) One time after the controller is reset (ignition turned to the RUN position) and every 60 seconds thereafter. The Delay Test is executed after a reset only.

2) 2 seconds after an invalid test.

◦ **Set Condition:**

If either of the following conditions occur 3 times:

1) The watchdog fault line remains high after the period has elapsed for the too early - too late watchdog test.

2) The Transmission Control Relay remains on after the watchdog delay expired.

Possible Causes
POWER OR GROUND CIRCUIT
POWERTRAIN CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK THE WIRING AND CONNECTORS

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

Were there any problems found?

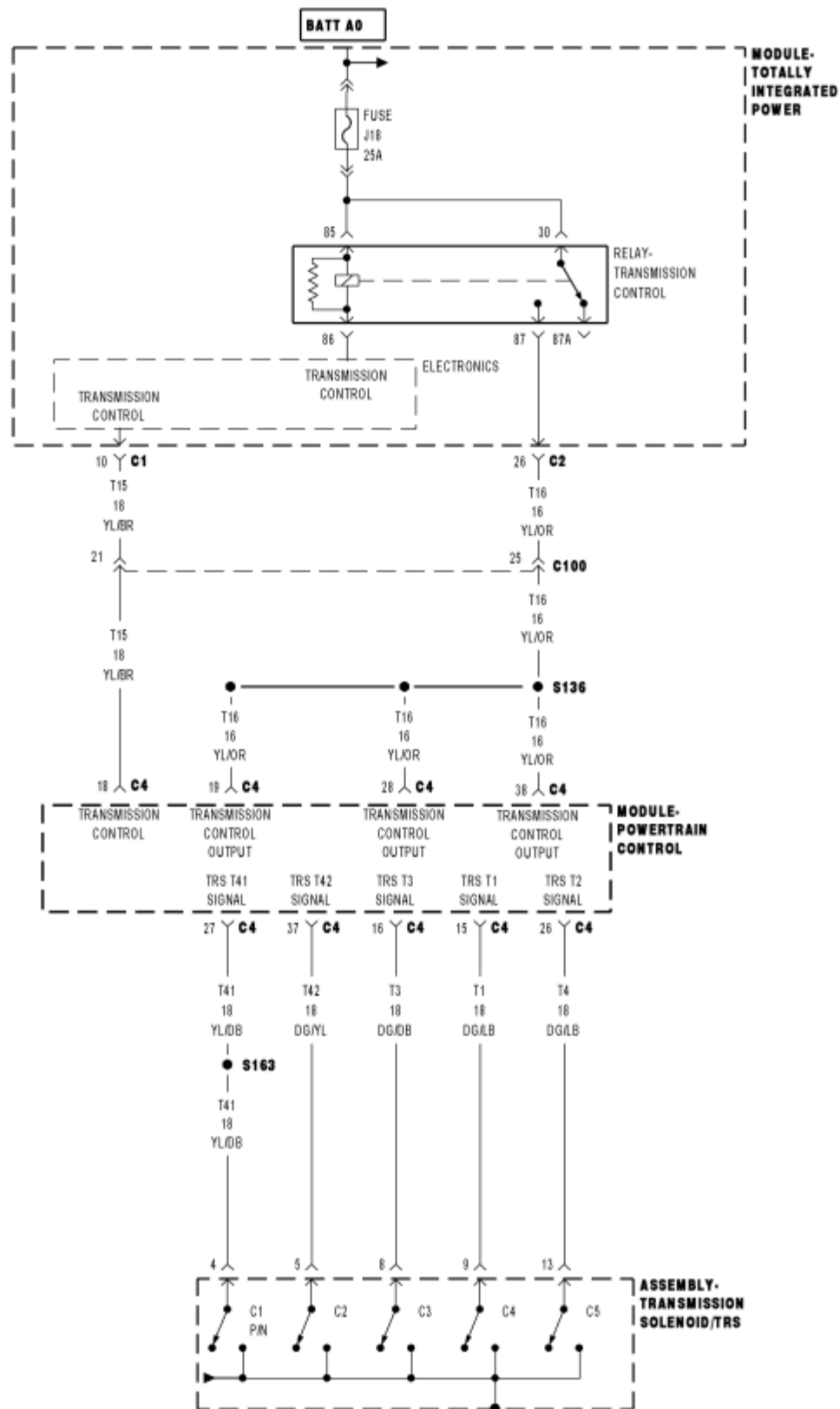
Yes

- Repair the power and/or ground circuits as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0706-TRANSMISSION RANGE SENSOR RATIONALITY



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5) Sense circuits communicate the shift lever position to the Transmission Control System. Each circuit is terminated at the transmission by a switch (TRS). Each switch can be either open or closed, depending on the shift lever position. The PCM can decode this information and determine the shift lever position.

Each shift lever position has its own unique combination of closed and open switches. This is called a PRNDL code. There are 5 switches, therefore: there are many possible combinations of open and closed switches (codes). There are 12 valid codes: two for neutral, one for each other gear position (5), and five temporary (transition zone) codes. The remainder of the codes should never occur, these are called invalid codes.

- **When Monitored:**

Continuously with the ignition on.

- **Set Condition:**

The DTC will set if the controller detects an invalid PRNDL code which lasts for more than 0.042 seconds.

Possible Causes
TRS SENSE CIRCUIT OPEN
TRS SENSE CIRCUIT SHORT TO GROUND
TRS SENSE CIRCUIT SHORT TO VOLTAGE
METAL DEBRIS IN OIL PAN
TRANSMISSION RANGE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

SHIFT LEVER ERROR CODES

ERROR CODE	SWITCH STUCK	POSITION

1	T41 (C1)	OPEN
2	T41 (C1)	CLOSED
3	T42 (C2)	OPEN
4	T42 (C2)	CLOSED
5	T3 (C3)	OPEN
6	T3 (C3)	CLOSED
7	T1 (C4)	OPEN
8	T1 (C4)	CLOSED
9	T2 (C5)	OPEN
10	T2 (C5)	CLOSED
11	OD LOCKOUT	OPEN
12	OD LOCKOUT	CLOSED

TRS SWITCH STATES

	PARK	TMP 1	REV	TMP 2	N1	N2	TMP 3	D	TMP 4	2	TMP 5	L
T41 (C1)	CLOSED	OPEN	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
T42 (C2)	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN
T3 (C3)	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	CLOSED
T1 (C4)	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN
T2 (C5)	CLOSED	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED	CLOSED

Diagnostic Test

1. CHECK TO SEE IF P0706 DTC IS CURRENT

With the scan tool, perform the Shift Lever Position Test.

Select the test outcome from the following:

Test passes:

- Go To [6](#)

Test fails with Error Code:

- Go To [2](#)

Test fails without Error Code:

- Perform the Gearshift Adjustment Procedure per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

2. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing "ENTER" on the scan tool.

NOTE: When the scan tool requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with an error code 11 or OD-TOW/HALL STUCK OPEN.

NOTE: If the Shift Lever Position test fails, make sure to note the identification of the TRS Sense circuit for future reference.

Did the Shift Lever Position test pass?

Yes

- Remove the Oil Pan and Main Valve Body Assembly per the Service Information. Check for metal debris on top of the Solenoid/TRS Assembly and the manual valve code plate. If debris is present, determine the cause of the debris and repair the transmission as necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. TRS SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and install Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit, from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Go To [4](#)

4. TRS SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. TRS SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Measure the resistance between the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 100k ohms between the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the identified (T41 (C1), T42 (C2), T3 (C3), T1 (C4), T2 (C5)) TRS Sense circuit for a short to other circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

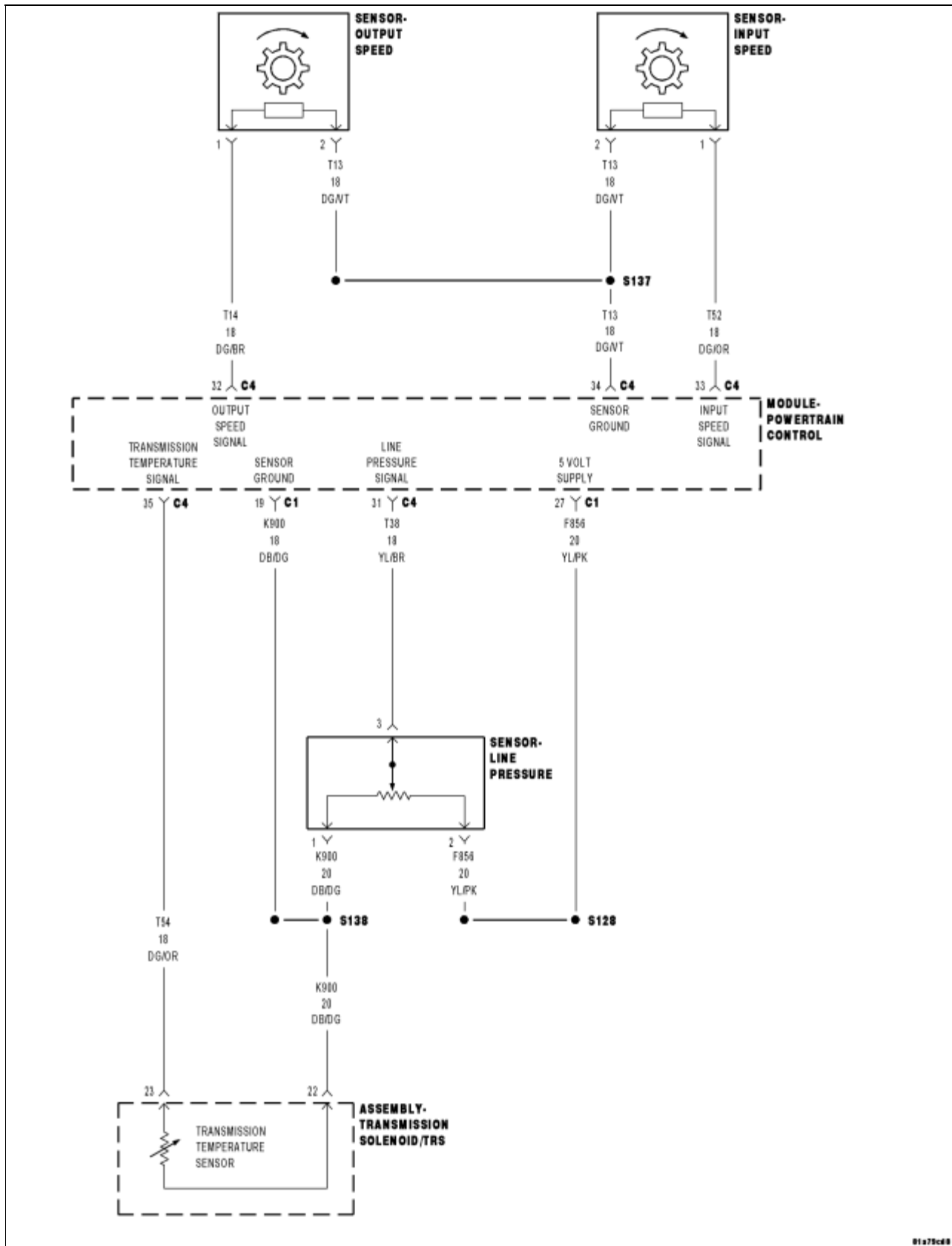
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter clutch engagement, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set when the desired transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate times are starting temperature to warm up time: (-40° F / -40° C - 35 min) (-20° F / -28° C - 25 min) (20° F / -6.6° C - 20 min) (60° F / 15.5 ° C - 10 min)

Possible Causes
RELATED DTCS PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check DTCs.

Are there any other related Transmission Temperature Sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0711.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings to the voltage readings listed on the Transmission Simulator.

Do the readings on the scan tool match the Transmission Simulator readings $\pm$ 0.2 volts?

Yes

- Replace Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

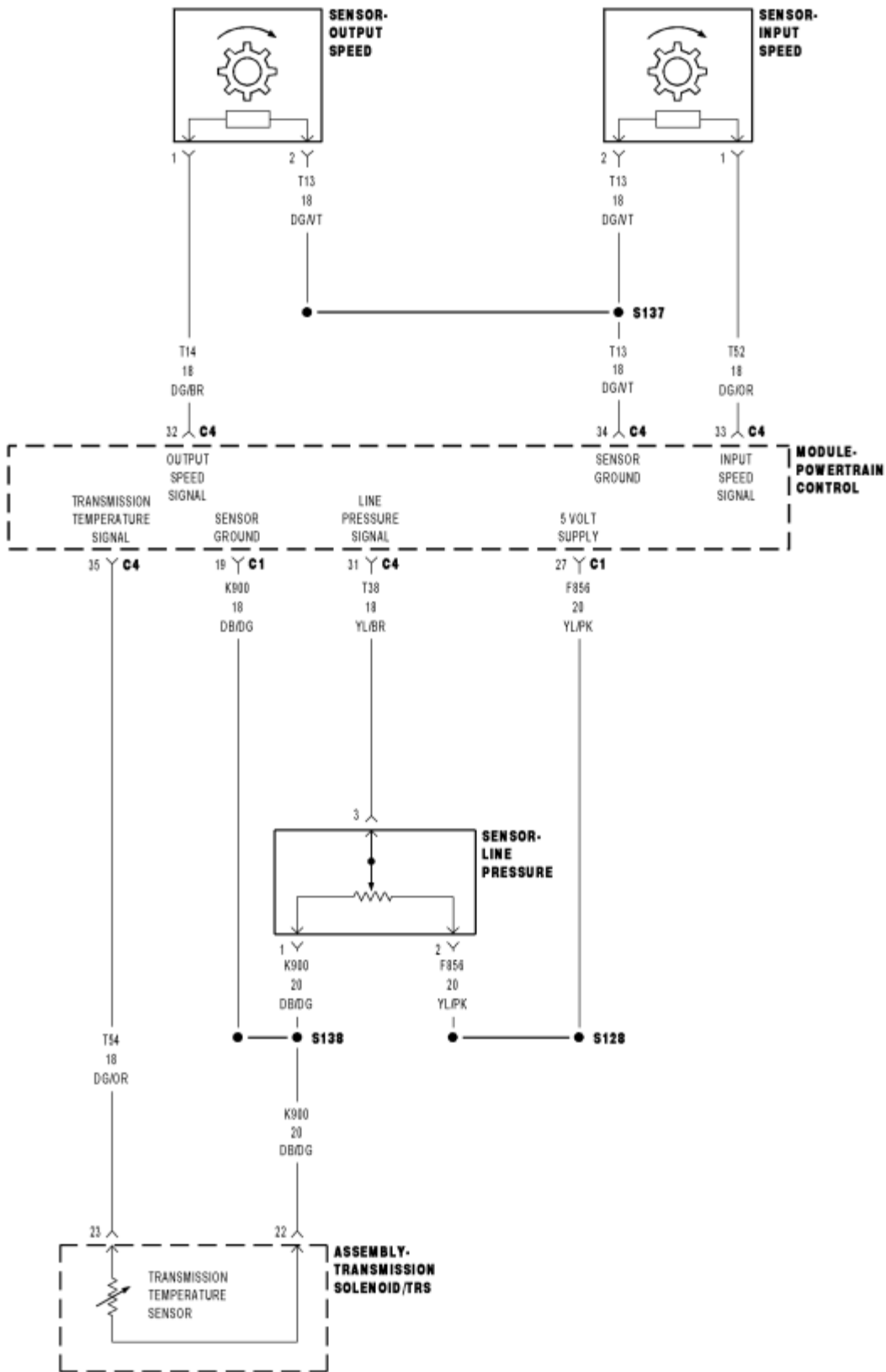
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0712-TRANSMISSION TEMPERATURE SENSOR LOW



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter clutch engagement, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 0.45 seconds.

Possible Causes
RELATED DTCS PRESENT
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTCs.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0712.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the Transmission Simulator, turn the Input/Output switch to OFF.
With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.
Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings $\pm$ 0.2 volts?

Yes

- Replace Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T54) Transmission Temperature Sensor Signal circuit.

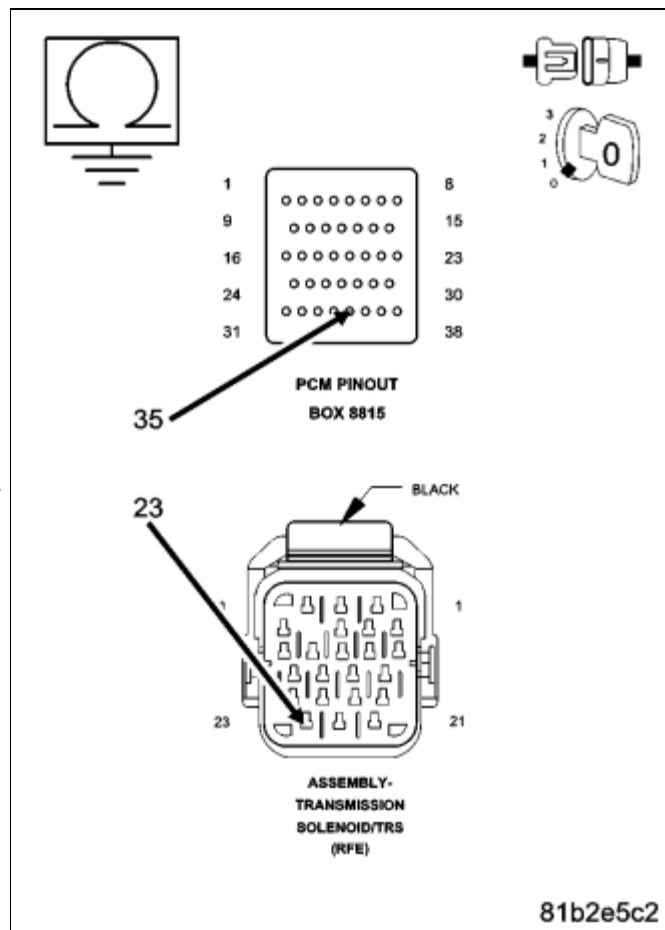
Is the resistance below 5.0 ohms?

Yes

- Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

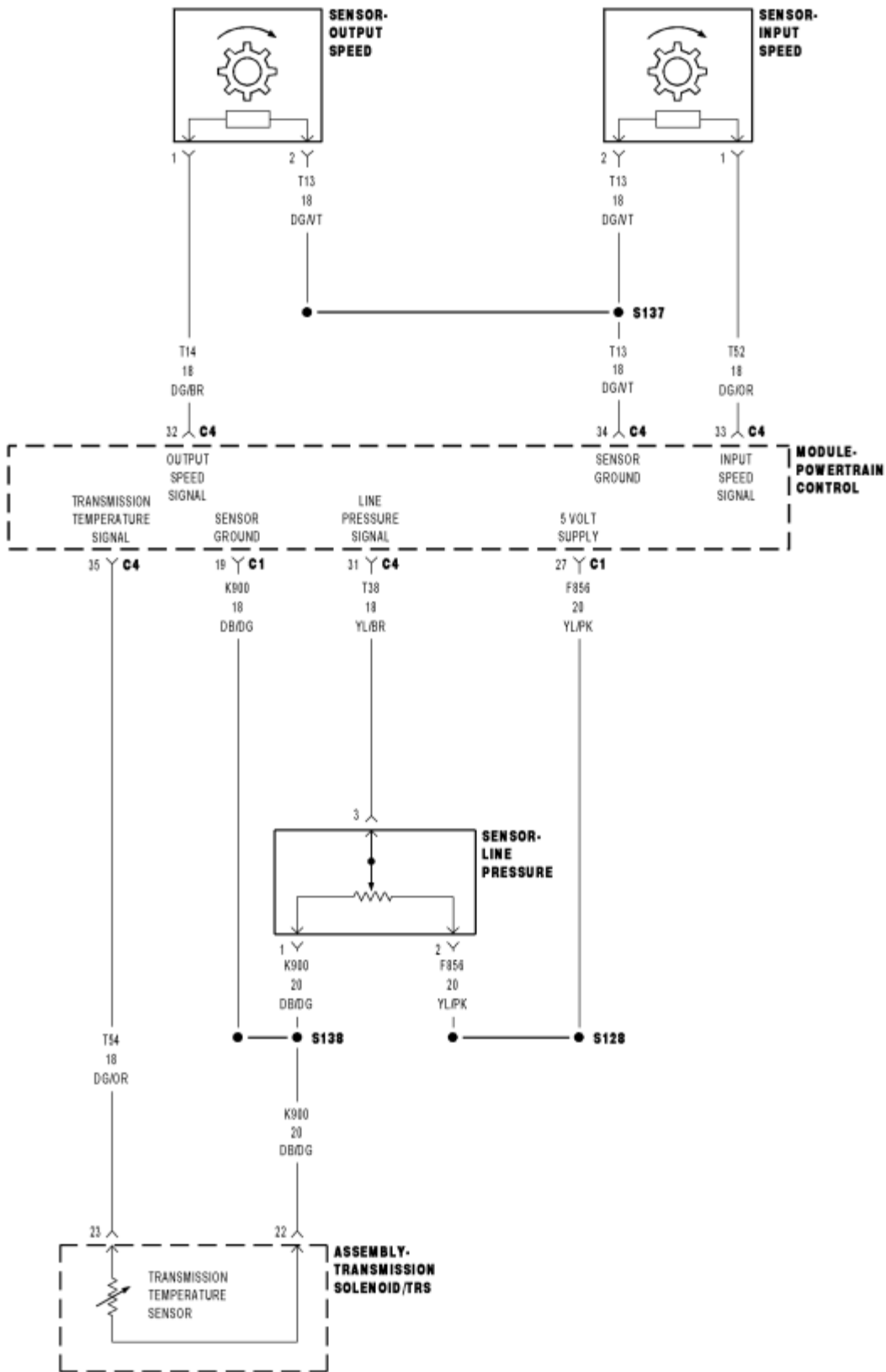
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermistor. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter clutch engagement, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 0.45 seconds.

Possible Causes
RELATED DTCS PRESENT
(T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUITS
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTCs.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0713.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the Transmission Simulator, turn the Input/Output switch to OFF.
With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.
Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match the scan tool readings $\pm$ 0.2 volts?

Yes

- Replace Transmission Solenoid/TRS assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

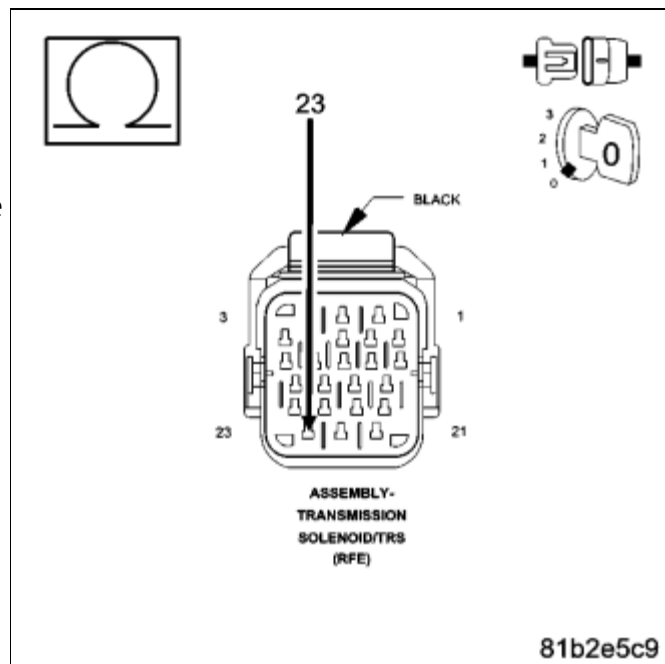
4. (T54) TRANSMISSION SENSOR SIGNAL CIRCUIT SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333.
 Disconnect the PCM harness connectors.
 Measure the resistance between the (T54) Transmission Temperature Sensor Signal circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T54) Transmission Temperature Sensor Signal circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the Transmission Temperature Sensor Signal circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
 Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
 Wiggle the wires while checking for shorted and open circuits.
 With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

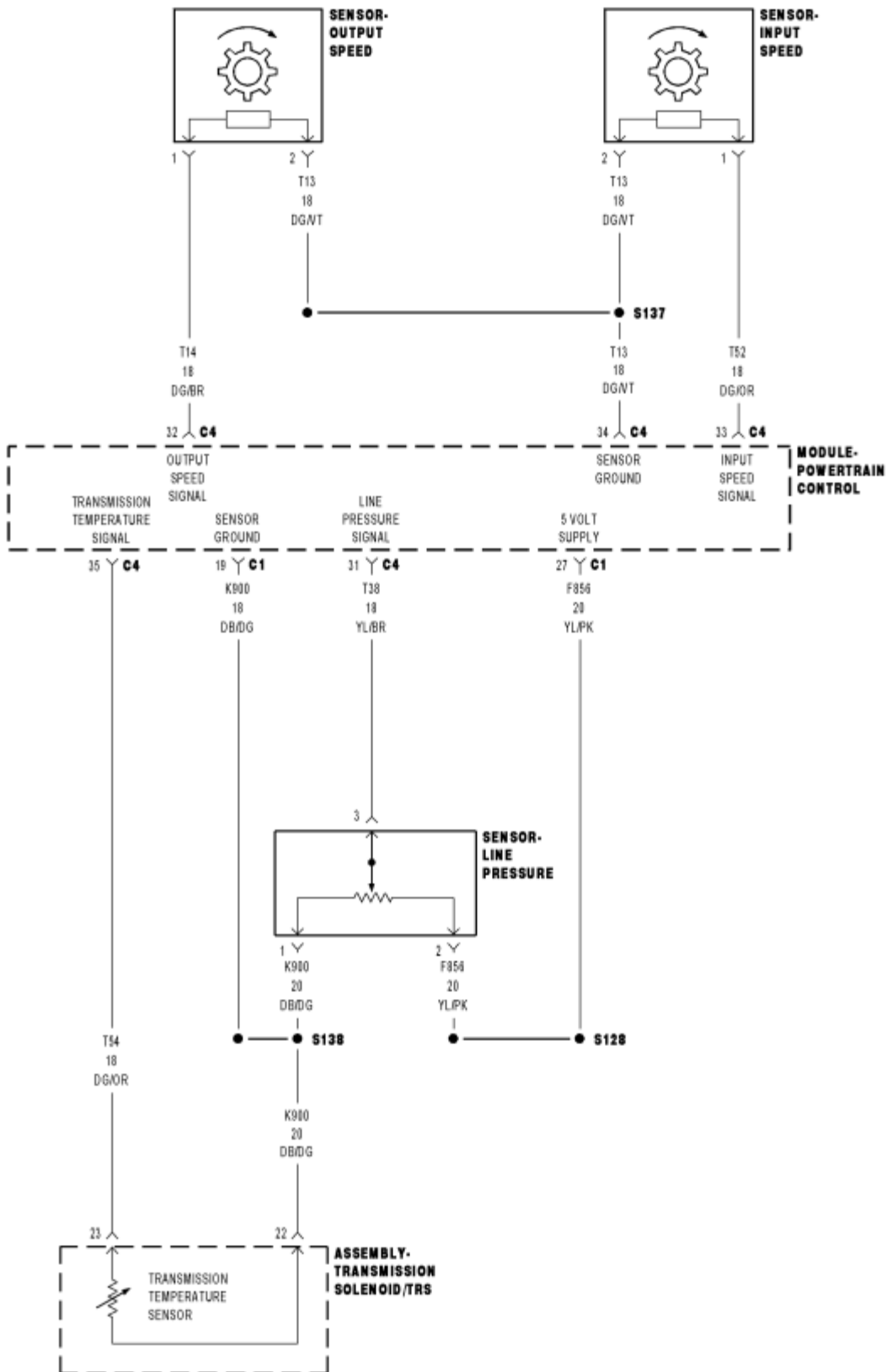
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

Test Complete.

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Powertrain Control Module (PCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

Possible Causes
RELATED DTCS PRESENT
TRANSMISSION TEMPERATURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTCs.

Are there any line pressure sensor or throttle position sensor DTCs present?

Yes

Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0714.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading ± 0.2 volts?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion,

damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

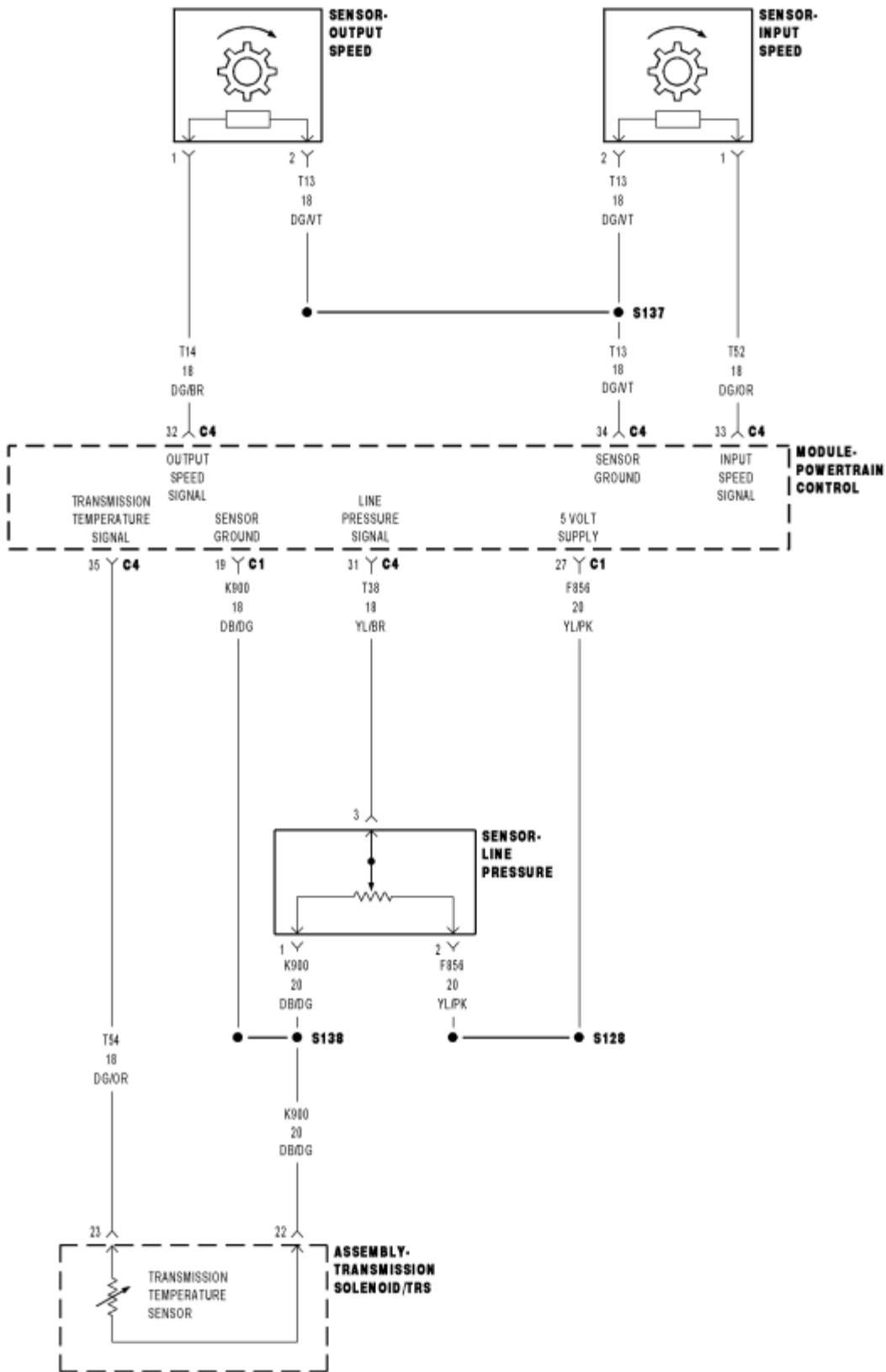
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0716-INPUT SPEED SENSOR 1 CIRCUIT PERFORMANCE



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent which will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

- **When Monitored:**

The transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If there is an excessive change in input rpm in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC P0716 IS CURRENT

Start the engine in park.

With the scan tool, monitor the Input Speed Sensor rpm.

Is the Input Speed Sensor rpm below 400 rpm?

Yes

- Go To [2](#)

No

- Go To [9](#)

2. INPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor rpm.

Does the Input speed read 3000 rpm and the Output speed read 1000 rpm $\pm$ 50 rpm?

Yes

- Replace the Input Speed Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Make sure to leave the Speed Sensor, Transmission Solenoid/TRS Assembly, and Line Pressure Sensor harness connectors disconnected.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.
With the scan tool in TIPM, actuate the TCM output.
Measure the voltage of the (T52) Input Speed Sensor Signal circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T52) Input Speed Sensor Signal circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

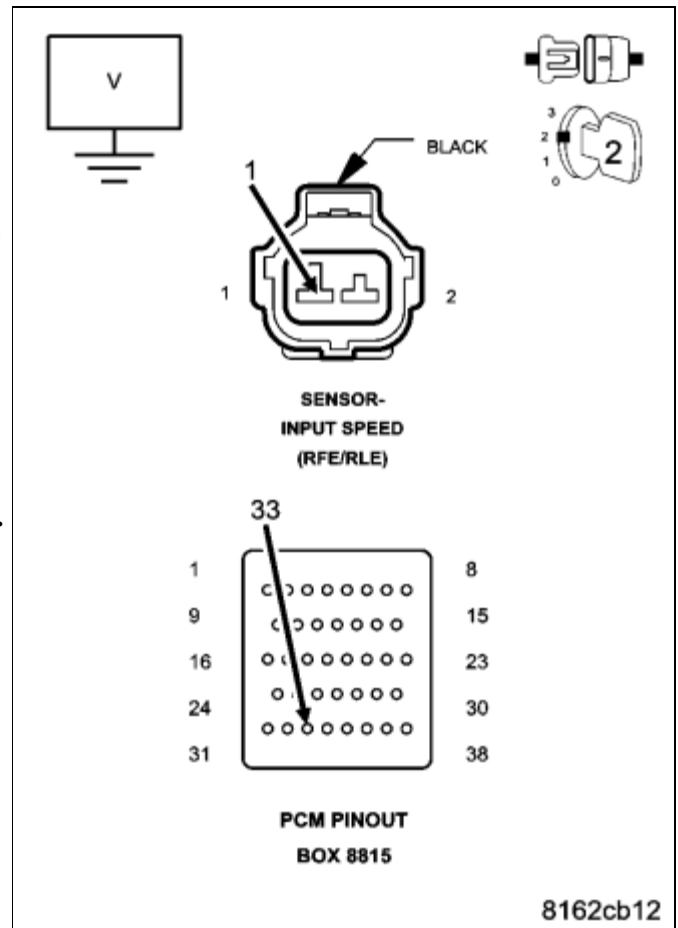
4. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

With the scan tool in TIPM, actuate the TCM output.
Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volts?

Yes

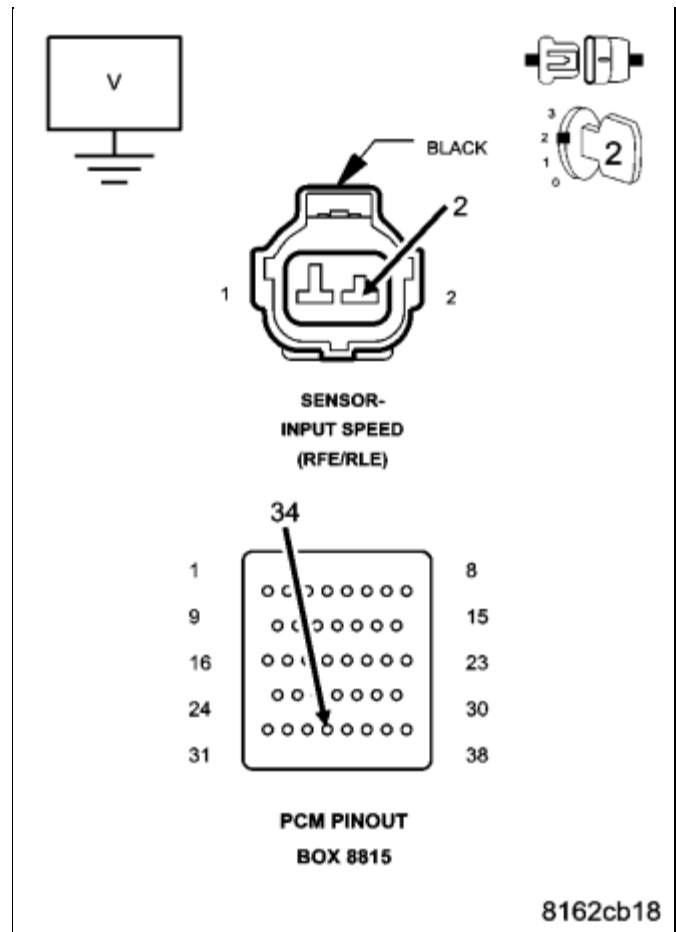
- Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION



VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN

With the scan tool in TIPM, stop the actuation the TCM output.

Turn the ignition off to the lock position.

Measure the resistance of the (T52) Input Speed Sensor Signal circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

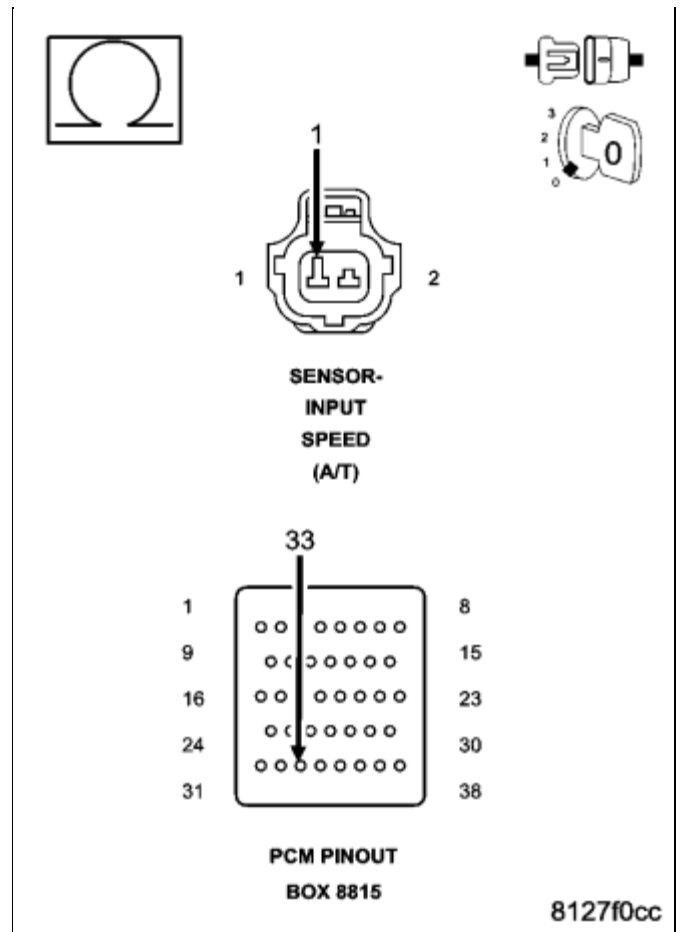
Is the resistance above 5.0 ohms?

Yes

- Repair the (T52) Input Speed Sensor Signal circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

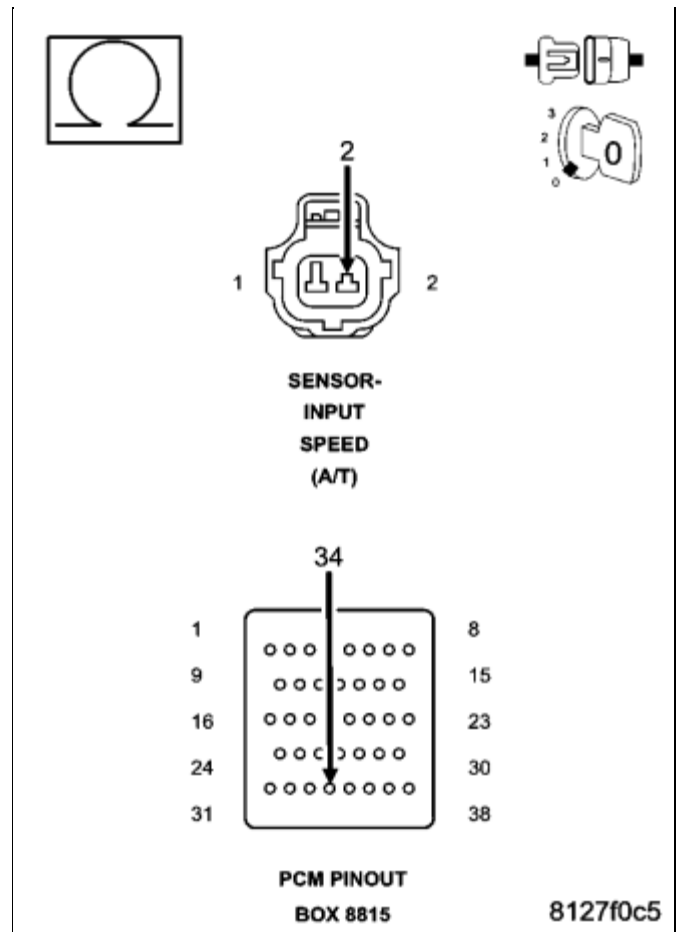
Is the resistance above 5.0 ohms?

Yes

- Repair the (T13) Speed Sensor Ground circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [7](#)



7. (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the Input Speed Sensor Signal circuit.

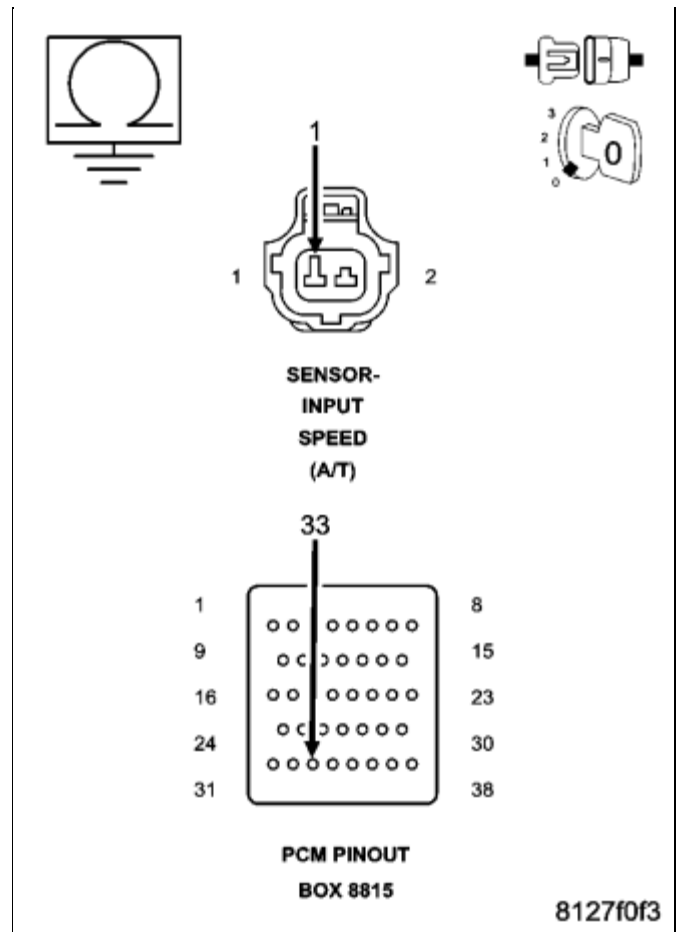
Is the resistance below 5.0 ohms?

Yes

- Repair the (T52) Input Speed Sensor Signal circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)



8. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.

Is the resistance below 5.0 ohms?

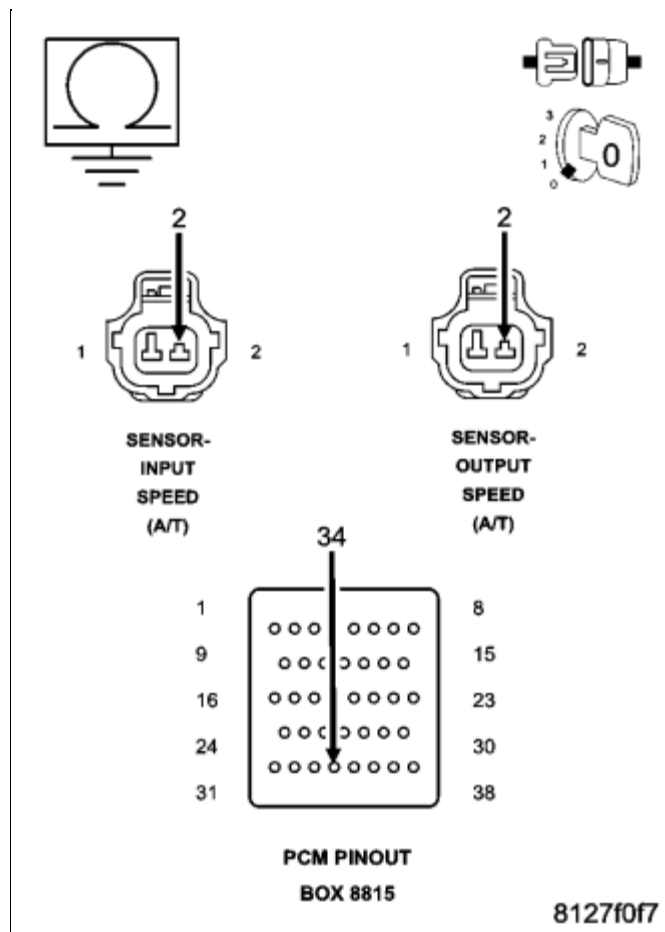
Yes

- Repair the (T13) Speed Sensor Ground circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

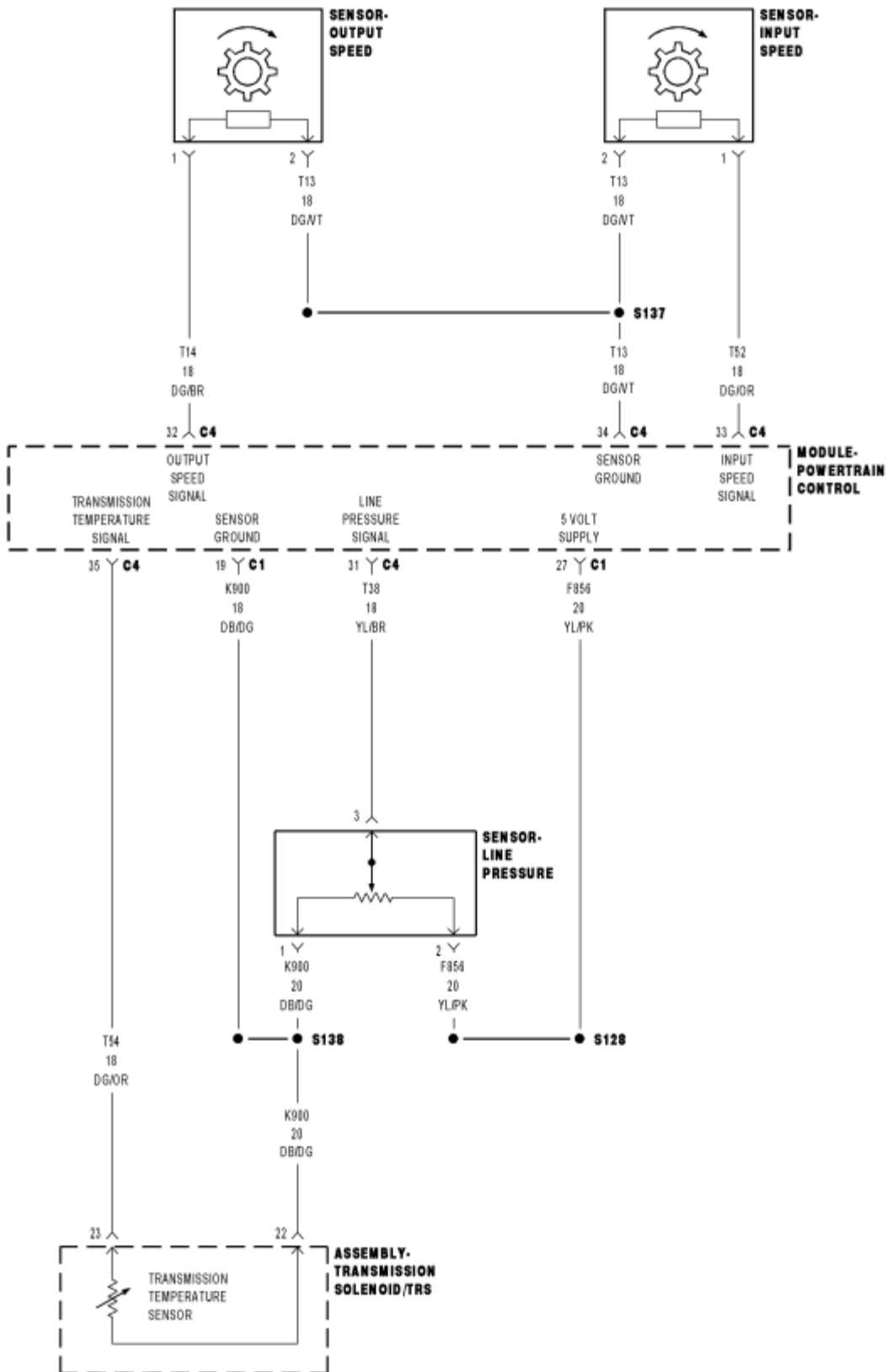
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0721-OUTPUT SPEED SENSOR CIRCUIT PERFORMANCE



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0729 and P0731-P0736).
- 2) An excessive change in input or output speeds indicating signal intermittent will result in codes P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor has 60 teeth and the output speed sensor has 30 teeth, this results in an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

The transmission gear ratio is monitored continuously while the transmission is in gear.

- **Set Condition:**

If there is an excessive change in output rpm in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC P0721 IS CURRENT

Turn the ignition off to the lock position.

CAUTION: Properly support the vehicle and raise all drive wheels off the ground.

Release the parking brake.

Start the engine in park.

Place the transmission gear selector in drive, release foot from brake.

WARNING: Be sure to keep hands and feet clear of rotation wheels.

With the scan tool, monitor the Output Speed Sensor rpm.

Is the Output Speed Sensor rpm below 100 rpm?

Yes

- Go To [2](#)

No

- Go To [9](#)

2. OUTPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor rpm

Does the Input Speed read 3000 rpm and the Output Speed read 1000 rpm, $\pm$ 50 rpm?

Yes

- Replace the Output Speed Sensor per the Service Information.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the PCM harness connectors and connect Miller special tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

Measure the resistance of the (T14) Output Speed Sensor Signal circuit from the Output Speed Sensor harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

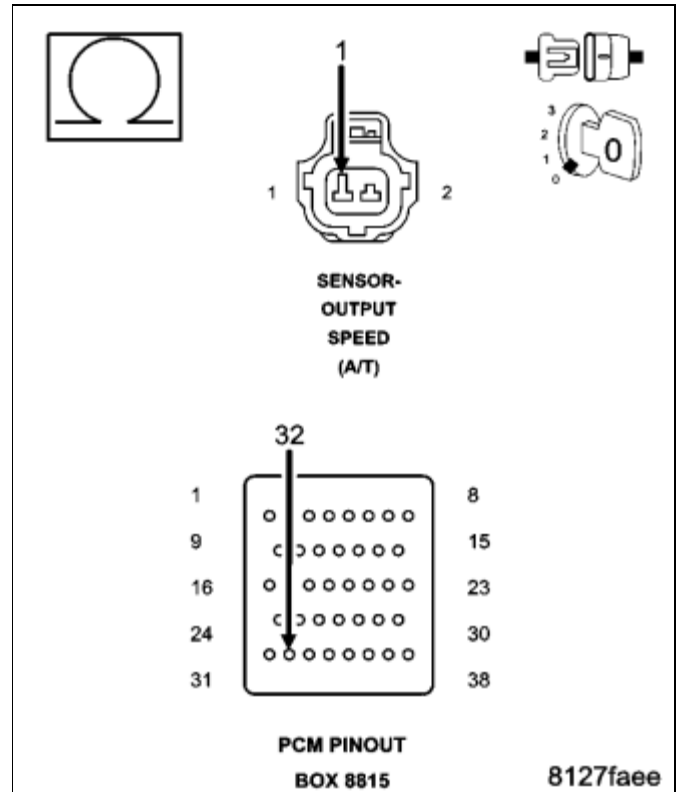
- Repair the (T14) Output Speed Sensor Signal circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit from the Output Speed Sensor harness connector to the appropriate terminal in the Miller tool #8815.



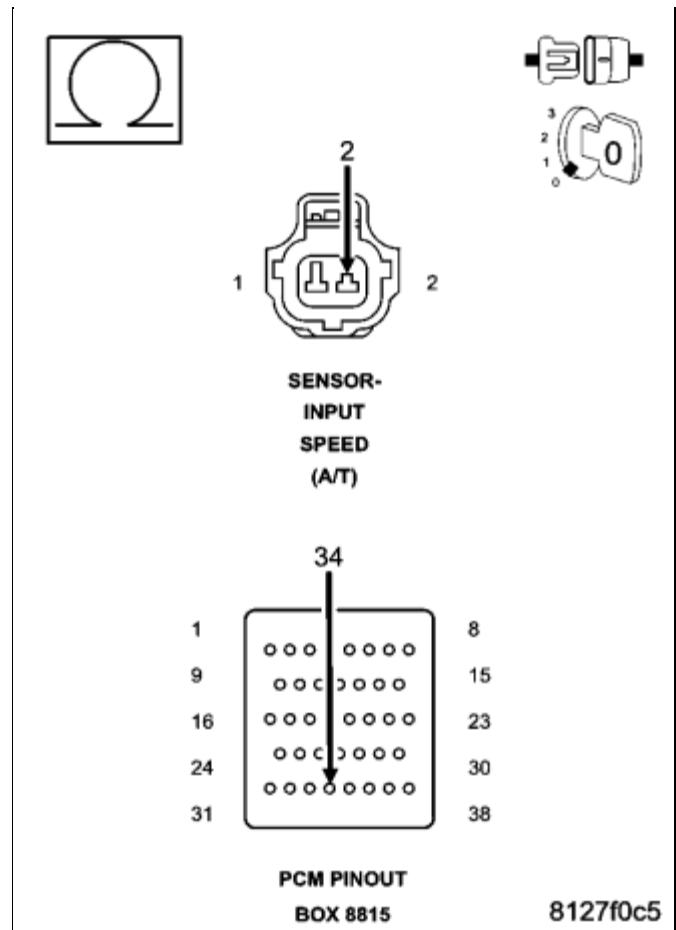
Is the resistance above 5.0 ohms?

Yes

- Repair the (T13) Speed Sensor Ground circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T14) Output Speed Sensor Signal circuit.

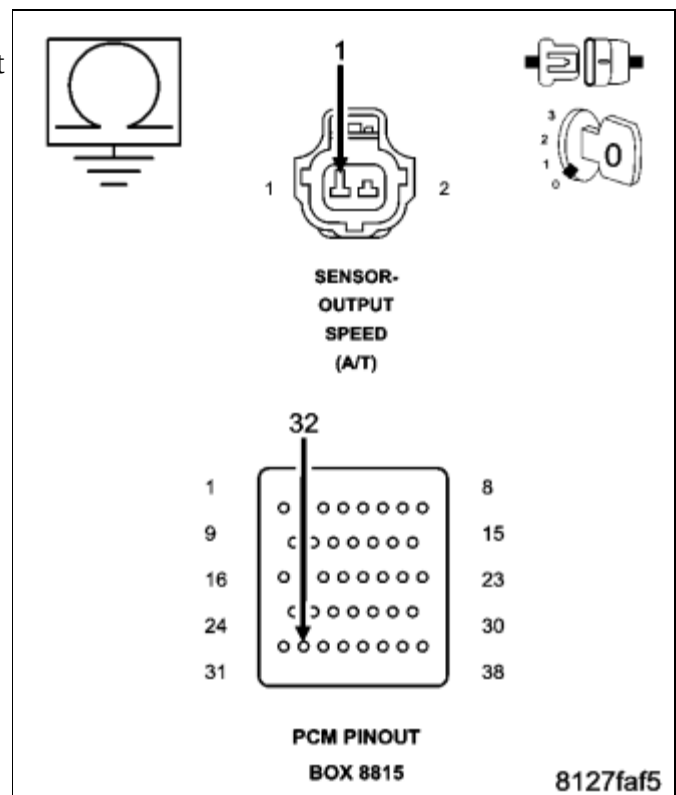
Is the resistance below 5.0 ohms?

Yes

- Repair the (T14) Output Speed Sensor Signal circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.

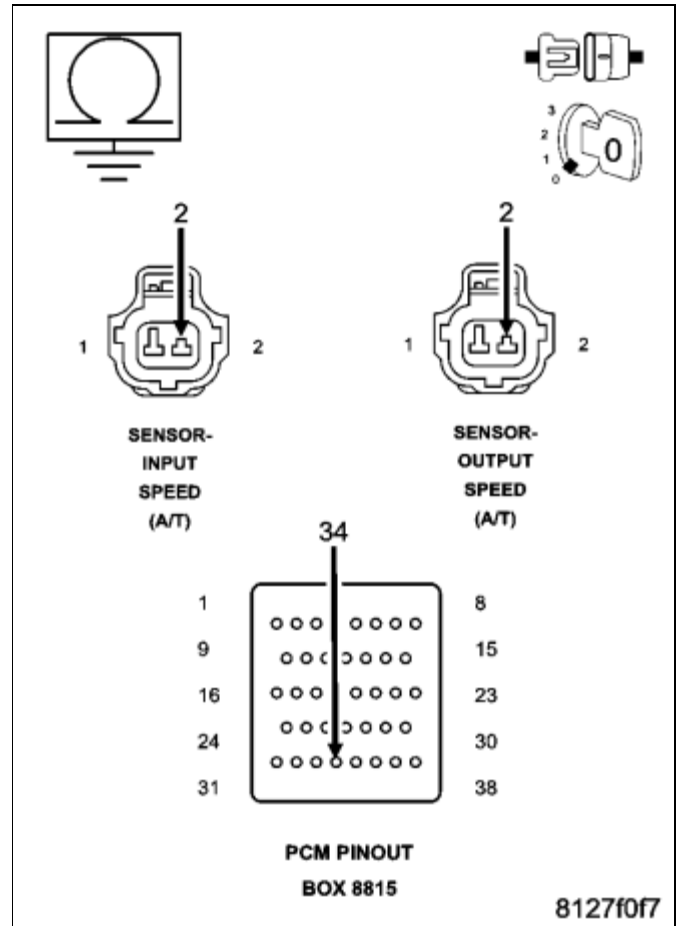
Is the resistance below 5.0 ohms?

Yes

- Repair the (T13) Speed Sensor Ground circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [7](#)



7. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool in TIPM, actuate the TCM output.
Measure the voltage of the (T14) Output Speed Sensor Signal circuit.

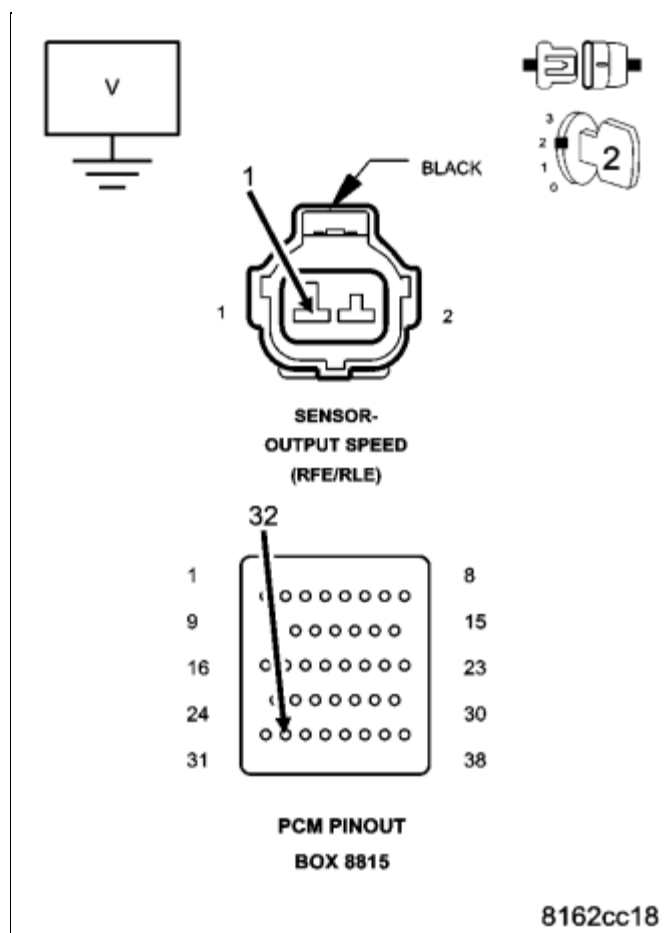
Is the voltage above 0.5 volts?

Yes

- Repair the (T14) Output Speed Sensor Signal circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)



8162cc18

8. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

With the scan tool in TIPM, actuate the TCM output. Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volts?

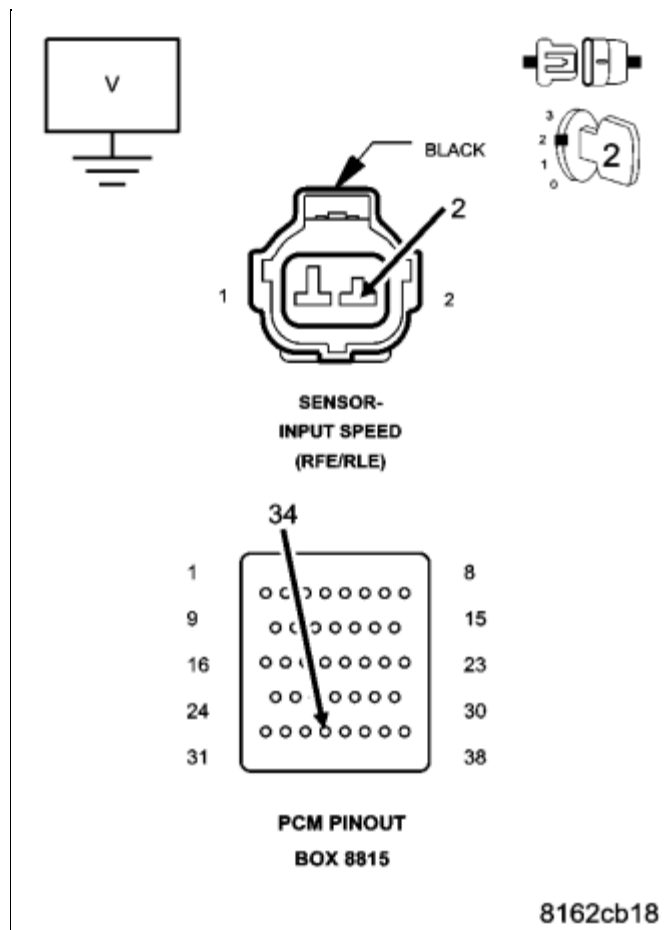
Yes

- Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information.

- With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



8162cb18

9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0726-ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control System calculates the engine rpm by directly reading the engine crank position sensor. It compares the calculated value to the engine speed sensor signal transmitted from the Engine Control System over the controllers internal BUS. The calculated engine rpm is also compared to a minimum and a maximum value. **Note: Due to the integration of the Powertrain Control Module (PCM) and Transmission Control Module (TCM), BUS communication between the modules is internal and unserviceable.**

- **When Monitored:**

Continuously every 7 msec with the ignition on and engine running.

- **Set Condition:**

This DTC will set when the calculated engine speed is less than 390 rpm with the engine running, or greater than 8000 rpm, for the period of 2.0 seconds. The PCM will place the Transmission in Limp-in when this DTC is set. **Note: This is not a Transmission Input Speed Sensor DTC.**

Possible Causes
RELATED ENGINE DTCS PRESENT
CRANK POSITION SENSOR OR WIRING
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED ENGINE DTCS

NOTE: This is not a Transmission Input Speed Sensor DTC.

Ignition on, engine not running.

With the scan tool, read all Engine DTCS. This includes any active or stored or one trip DTCS.

Are there any engine rpm related DTCS present?

Yes

- Refer to the Powertrain category and perform the appropriate symptom.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK IF DTC IS CURRENT

Ignition on, engine not running.

With a scan tool, read and record all Event Data.

With the scan tool, erase all active and stored transmission DTCs. (Note: it may be necessary to perform a battery disconnect with the scan tool to clear Event Data.)

Using the Event Data, duplicate the conditions in which the original DTC set.

With the scan tool, read transmission and engine DTCs.

NOTE: Refer to all engine DTCs first in the following question.

Pick the answer below that best describes your findings, (this includes one trip failures).

Transmission DTC P0726 set

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Also check the Crank Position sensor and wiring. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Engine DTC set

- Refer to the Driveability category and perform the appropriate symptom.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No DTC set at all

- Go to [3](#)

3. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0731-GEAR RATIO ERROR IN 1ST

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

NOTE: Various Gear Ratio Error DTCs will set only if the transmission slips after first achieving the correct ratio. Therefore, a transmission with no drive (or reverse) may not set any Gear Ratio Error DTC because it never achieves a correct gear ratio.

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent which will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
CUT UD PISTON SEAL
LOW FLUID LEVEL

CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL
STUCK OR STICKING MAIN REGULATOR VALVE
FAILED OVERRUNNING CLUTCH
CUT UD ACCUMULATOR SEAL RING
BROKEN UD ACCUMULATOR PISTON
BROKEN REACTION SHAFT SUPPORT SEAL RING
LOW LINE PRESSURE
BROKEN / MISSING MAIN VALVE BODY BLEED ORIFICE
BROKEN / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
POOR MACHINING ON PUMP VALVE BODY FACE
INPUT SPEED SENSOR AND RELATED WIRING
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Gear Ratio Error. Perform the test for P0944 first if it is present.

No

- Go to [2](#)

2. CHECK IF DTC P0731 IS CURRENT

With the scan tool, perform the 1st Gear Clutch Test. Follow the instructions on the scan tool. Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

Did the Clutch Test pass, Input Speed remain at zero?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

- If the Event Data shows fault P0731 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the Event Data shows fault P0731 set with input rpm = zero, check the input speed sensor and related wiring.
- If the Event Data shows fault P0731 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, mis-installed or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the Event Data shows fault P0731 set with the UD pressure switch open (but line pressure matches Desired Line Pressure), air check the UD hydraulic clutch circuit for leakage per the Service Information. If the UD hydraulic clutch circuit is OK, replace the solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

4. CHECK INTERNAL TRANSMISSION

Repair internal transmission as necessary. Refer to the Service Information.

If there were any line pressure DTCs present along with this DTC, make sure to inspect the: Primary oil filter and seal, Transmission Oil Pump, and the Main regulator valve per the Service Information.

If DTCs P0876 and/or P0875 were present in addition to the P0731, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs.

Pay particular attention to the following list of possible causes when repairing the transmission:

- Cut UD piston seal
- Failed overrunning clutch
- Cut UD accumulator seal ring
- Burned UD clutch
- Broken UD accumulator piston
- Low line pressure
- Broken/missing main valve body bleed orifice
- Broken/missing dribbler orifice assembly in reaction shaft support
- Poor machining on pump valve body face
- Transmission Solenoid/TRS Assembly

View repair

Repair

- **NOTE: If the UD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve, low line pressure in Event Data, etc.) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.**

Repair internal transmission per the Service Information.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0732-GEAR RATIO ERROR IN 2ND

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTCS PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR 2C CLUTCH
CUT 2C OR UD PISTON SEAL
BROKEN 2C PISTON CASTING
BROKEN OR MISSING 2C BLEED ORIFICE

BROKEN OR MISSING UD BLEED ORIFICE
CUT 2C OR UD ACCUMULATOR PISTON SEAL
CRACKED 2C OR UD ACCUMULATOR PISTON
CUT OR MISSING #5 OR #7 CHECK BALL
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR
MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCs.

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?

Yes

- Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

No

- Go to [2](#)

2. CHECK IF DTC IS CURRENT

With the scan tool, read and record the Event Data.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data display information for the DTC P0732?

Yes

- Go to [4](#)

No

- Go to [3](#)

3. CHECK EVENT DATA

In the Event Data, identify the DTC that was recorded earlier.

Does the Event Data display information for the DTC P1790, with target gear = 2nd, or with both 2C and UD clutches applying?

Yes

- Go to [4](#)

No

- Go to [7](#)

4. CHECK RPM IN THE EVENT DATA

Refer to the Event Data recorded earlier.

Does the Input rpm read zero?

Yes

- Check the input speed sensor and wiring. Refer to test P0716 and diagnose as if the DTC is current.

No

- Go to [5](#)

5. CHECK LINE PRESSURE READING

Refer to the Event Data recorded earlier.

Is the line pressure reading more than 10 psi below the desired line pressure?

Yes

- Go to [6](#)

No

- Go to [7](#)

6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or mis-installed?

Yes

- Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK IF THE DTC P0732 IS CURRENT

With the scan tool, perform the 2nd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the 2C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd gear clutch test will not detect a faulty 2C clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes

- Go to [8](#)

No

- Go to [10](#)

8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

Is there an obvious slippage noticed in 2nd gear, or runaway on the 1–2 shift?

Yes

- Go to [12](#)

No

- Go to [15](#)

10. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?

Yes

- Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and the dribbler assembly, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.

NOTE: If the UD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [11](#)

11. CHECK THE UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?**Yes**

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

12. CHECK FOR EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

If grey sludge is present, check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

Remove the valve body and air check the 2C hydraulic clutch circuit (in the 2C/4C clutch retainer) per the Service Information.

NOTE: The 2C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris, improperly assembled 2C clutch and/or excessive air leakage in the 2C hydraulic clutch circuit?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 2C piston seals and bleed orifice.

NOTE: If the 2C clutch has failed but no obvious cause is found (such as a cut piston seal, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [13](#)

13. CHECK THE 2C ACCUMULATOR

Check the 2C Accumulator piston for cracks or a cut seal.

Check for a cut or missing #7 or #5 check ball.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found**Yes**

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [14](#)

14. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

- 1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.
- 2) Rotate the Input Annulus gear and drive shell (the drum that encloses the two rearmost carriers).
- 3) Check to see if the reaction carrier (the front-most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?**Yes**

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the reaction carrier per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. CHECK IF DTC RESETS

Did the DTC P0732 reset during the road test?**Yes**

- Go to [16](#)

No

- Go to [17](#)

16. LIST OF POSSIBLE CAUSES

If any other DTCs set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTCs set during the road test, below is a list of possible causes, but not strictly limited to those:

- Check for excessive debris in the Transmission Oil pan, plugged, cracked, or misinstalled Primary Transmission Oil Filter and/or seal.
- Check for cut and/or missing #7 and #5 check balls in the main valve body.
- Check the 2C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.
- Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assembly.
- Check the 2C clutch piston seals, and bleed orifice.
- Check the main regulator valve for sticking in its bore and the flatness of the pump valve body and pump housing faces.
- Check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

View repair**Repair**

- Repair as necessary. Refer to the Service Information for proper repair procedures.

NOTE: If the UD or 2C clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

17. INTERMITTENT DTC

The conditions to set this DTC are not currently present.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

- If the Event Data shows fault P0732 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the Event Data shows fault P0732 set with input rpm = zero, check the input speed sensor and related wiring.
- If the Event Data shows fault P0732 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the Event Data shows fault P0732 set with the UD or 2C pressure switch open (but line pressure matches Desired Line Pressure), air check the UD and 2C hydraulic clutch circuits for leakage per the Service Information. If the UD and 2C hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0733-GEAR RATIO ERROR IN 3RD

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTCS PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL
BENT OR BROKEN ACCUMULATOR COVER ON MAIN VALVE BODY
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR OD CLUTCH
CUT OD OR UD PISTON SEAL
BROKEN OR MISSING UD OR OD BLEED ORIFICE IN MAIN VALVE BODY
BROKEN OR MISSING BLEED ORIFICE IN UD OR OD CLUTCH PISTON
CUT OD OR UD ACCUMULATOR PISTON SEAL

CRACKED OD OR UD ACCUMULATOR PISTON
CUT OR MISSING NO. 6 CHECK BALL
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REVERSE CARRIER HUB TO CARRIER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, read DTCs

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?

Yes

- Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

No

- Go to [2](#)

2. CHECK EVENT DATA

With the scan tool, read and record the Event Data.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data display information for the DTC P0733?

Yes

Go to [4](#)

No

- Go to [3](#)

3. CHECK THE TARGET GEAR IN THE EVENT DATA

In the Event Data, identify the DTC that was recorded earlier.

Does the Event Data display information for the DTC P1790, with target gear = 3rd, or with both OD and UD clutches applying?

Yes

- Go to [4](#)

No

- Go to [7](#)

4. CHECK THE INPUT RPM IN THE EVENT DATA

Refer to the Event Data recorded earlier.

Does the Input rpm read zero?

Yes

- Check the input speed sensor and wiring. Refer to test P0716 and diagnose as if the DTC is current.

No

- Go to [5](#)

5. CHECK LINE PRESSURE READING

Refer to the Event Data recorded earlier.

Is the line pressure reading more than 10 psi below the desired line pressure?

Yes

- Go to [6](#)

No

- Go to [7](#)

6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or mis-installed?

Yes

- Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK IF DTC P0733 IS CURRENT

With the scan tool, perform the 3rd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the OD clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 3rd gear clutch test will not detect a faulty OD clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes

- Go to [8](#)

No

- Go to [10](#)

8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle. Check operation in 3rd gear, 4th gear, and Reverse.

Is there an obvious slippage noticed in 3rd gear, or runaway on the 2-3 shift?

Yes

- Go to [12](#)

No

- Go to [16](#)

10. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD hydraulic clutch circuit?

Yes

- Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.

NOTE: If the UD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [11](#)

11. CHECK UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.

No

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

12. CHECK FOR EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

Remove the valve body and check if the accumulator cover is intact.

Air check the OD hydraulic clutch circuit (in the case) per the Service Information.

NOTE: The OD clutch passage contains a small bleed orifice which connects to the Reverse clutch hydraulic circuit, a small amount of air leakage into the Reverse clutch passage is normal.

Were there any problems found, excessive debris, and/or excessive air leakage in the OD hydraulic clutch circuit?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the bleed orifice in the OD/Reverse clutch piston.

NOTE: If the OD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [13](#)

13. CHECK THE OD ACCUMULATOR

Check the OD Accumulator piston for cracks or a cut seal.

Check for a cut or missing No. 6 check ball.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [14](#)

14. CHECK FOR NO REVERSE

During the road test on a previous test, did the vehicle have no reverse and no 3rd gear, but 1st and 2nd gears were OK?

Yes

- Go to [15](#)

No

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. CHECK FOR BROKEN REVERSE CARRIER WELD

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?**Yes**

- Repair as necessary.

No

- Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

16. CHECK IF DTC RESETS

Did the DTC P0733 reset during the road test?**Yes**

- Go to [17](#)

No

- Go to [18](#)

17. LIST OF POSSIBLE CAUSES

If any other DTCs set during the road test, refer to the appropriate symptom in the Transmission category. If no other DTCs set during the road test, below is a list of possible causes, but not strictly limited to those. Check for:

- Excessive debris in the Transmission Oil pan, plugged, cracked, or mis-installed Primary Transmission Oil Filter and/or seal.
- Cut or missing No. 6 check ball in the main valve body.
- OD and UD accumulator pistons and seals and bleed orifices, and the Solenoid Switch Valve and Plugs in the main valve body.
- OD and UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness

- of the pump valve body and pump housing faces.
- Main regulator valve for sticking in its bore.

View repair

Repair

- Repair as necessary. Refer to the Service Information for proper repair procedures.

NOTE: If the OD or UD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

18. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

- If the Event Data shows fault P0733 was set in the Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the Event Data shows fault P0733 set with input rpm = zero, check the input speed sensor and related wiring.
- If the Event Data shows fault P0733 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the Event Data shows fault P0733 set with the OD or UD pressure switch open (but line pressure matches Desired Line Pressure), air check the OD and UD hydraulic clutch circuits for leakage per the Service Information. If the OD and UD hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

Were there any problems found.

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0734-GEAR RATIO ERROR IN 4TH

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P01736).
- 2) An excessive change in input or output speeds indicating signal intermittent will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
LOW FLUID LEVEL
INPUT SPEED SENSOR OR WIRING
VALVE BODY ACCUMULATOR COVER FAILED

CUT OD OR 4C ACCUMULATOR SEAL
CRACKED OD OR 4C ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY
CUT 4C TOWER SEAL
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OR MISSING NO. 5 OR NO. 6 CHECK BALL
WORN SOLENOID SWITCH VALVE OR PLUGS
CUT OD OR 4C PISTON SEAL
STUCK MAIN REGULATOR VALVE
BURNED OD OR 4C CLUTCH
BROKEN OR MISSING 4C BLEED ORIFICE IN 2C/4C RETAINER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs
If any of these DTCs are present, perform their respective tests first.

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Gear Ratio Error. Perform the test for P0944 first if it is present.

No

- Go to [2](#)

2. CHECK EVENT DATA

With the scan tool, read and record the Event Data.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data display information for the DTC P0734?

Yes

- Go to [4](#)

No

- Go to [3](#)

3. CHECK FOR ANOTHER DTC

In the Event Data recorded earlier, does the Event Data show the DTC P1790, with Target Gear = 4th, or with both the 4C and OD clutches applying?

Yes

- Go to [4](#)

No

- Go to [6](#)

4. CHECK INPUT RPM

In the Event Data recorded earlier, does the Input rpm read zero?

Yes

Refer to the Transmission category and perform the diagnostic procedure for P0715 (Input Speed Sensor Error). Diagnose the DTC as if it is set and current.

No

- Go to [5](#)

5. CHECK LINE PRESSURE READING

In the Event Data recorded earlier, is the line pressure reading more than 10 PSI below the desired line pressure reading?

Yes

- Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

During the road test, was there any obvious slippage noted in 4th gear or a runaway during the 3-4 shift?

Yes

- Go to [8](#)

No

- Go to [7](#)

7. CHECK IF DTC RESETS

With the scan tool, check for Transmission DTCs after the road test.

Did the DTC P0734 reset?

Yes

- Go to [8](#)

No

- Test Complete.

8. CHECK INTERNAL TRANSMISSION

Remove the Transmission Oil Pan and Valve Body per the Service Information and check for the following:

- Excessive debris in the oil pan.
- Remove the Valve Body and check if the accumulator cover is intact and the 4C tower seal is not cut or split.
- OD and 4C accumulator pistons for cracks and/or cut seals.
- Solenoid Switch Valve and its plugs for stickiness or wear.
- Cut or missing No. 5 and/or No. 6 check ball.
- OD bleed orifice on top of the Valve Body
- Air check the OD and 4C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

NOTE: Both the OD and 4C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.

NOTE: If the OD or 4C clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. CHECK REVERSE GEAR

Was there no reverse gear during the road test?

Yes (no reverse)

- Go to [10](#)

No (reverse gear OK)

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

10. CHECK ROAD TEST RESULTS

During the road test, was there no 2nd gear and no 4th gear, but 3rd gear (limp-in) was OK?

Yes

- Go to [11](#)

No

- Go to [12](#)

11. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

- 1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.
- 2) Rotate the Input Annulus gear and drive shell (the drum that encloses the two rearmost carriers).
- 3) Check to see if the reaction carrier (the front most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the reaction carrier per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

12. CHECK REVERSE CARRIER HUB WELD

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0735-GEAR RATIO ERROR IN 5TH

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
LOW FLUID LEVEL

INPUT SPEED SENSOR OR WIRING
VALVE BODY ACCUMULATOR COVER FAILED
CUT OD OR 2C ACCUMULATOR SEAL
CRACKED OD OR 2C ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY
CUT 2C TOWER SEAL
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OR MISSING NO. 5, NO. 6, OR NO. 7 CHECK BALL
WORN SOLENOID SWITCH VALVE OR PLUGS
CUT OD OR 2C PISTON SEAL
STUCK MAIN REGULATOR VALVE
BURNED OD OR 2C CLUTCH
BROKEN OR MISSING 2C BLEED ORIFICE IN 2C/4C RETAINER
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.
If any of these DTCs are present, perform their respective tests first.

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Gear Ratio Error. Perform the test for P0944 first if it is present.

No

- Go to [2](#)

2. CHECK EVENT DATA

With the scan tool, read and record the Event Data.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data display information for the DTC P0735?

Yes

- Go to [4](#)

No

- Go to [3](#)

3. CHECK THE TARGET GEAR

In the Event Data recorded earlier, does the Event Data show the DTC P1790, with Target gear = 5th, or with both the 2C and OD clutches applying?

Yes

- Go to [4](#)

No

- Go to [6](#)

4. CHECK INPUT RPM

In the Event Data recorded earlier, does the Input rpm read zero?

Yes

- Refer to the Transmission category and perform the diagnostic procedure for P0716. Diagnose the DTC as if it is set and current.

No

- Go to [5](#)

5. CHECK LINE PRESSURE READING

In the Event Data recorded earlier, is the line pressure reading more than 10 psi below the desired line pressure reading?

Yes

- Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [6](#)

6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

During the road test, was there any obvious slippage noted in 5th gear or a runaway during the 4–5 shift?

Yes

- Go to [8](#)

No

- Go to [7](#)

7. CHECK IF DTC RESETS

With the scan tool, check for Transmission DTCs after the road test.

Did the DTC P0735 reset?**Yes**

- Go to [8](#)

No

- Test Complete.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

8. CHECK INTERNAL TRANSMISSION

Remove the Transmission Oil Pan and Valve Body, per the Service Information, and check for the following:

- Excessive clutch and or metal debris in the oil pan.
- If the accumulator cover is intact and the 2C tower seal is not cut or split.
- OD and 2C accumulator pistons for cracks or cut seals.
- Solenoid Switch Valve and its plugs for stickiness or wear.
- Cut or missing No. 5, No. 6, or No. 7 check ball.
- OD bleed orifice on top of the valve body.
- Air check the OD and 2C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

NOTE: Both the OD and 2C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.

Were there any problems found?**Yes**

- Repair as necessary. Refer to the Service Information for proper repair procedures.

NOTE: If the OD or 2C clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0736-GEAR RATIO ERROR IN REVERSE

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

NOTE: Various Gear Ratio Error DTCs will set only if the transmission slips after first achieving the correct ratio. Therefore, a transmission with no drive (or reverse) may not set any Gear Ratio Error DTC because it never achieves a correct gear ratio.

- 1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent which will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

◦ **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

◦ **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
LOW FLUID LEVEL
CUT L/R TOWER SEAL ON MAIN VALVE BODY
CUT L/R CLUTCH PISTON SEALS
BROKEN OR MISSING L/R CLUTCH BLEED ORIFICE (IN L/R CLUTCH RETAINER)
CUT L/R ACCUMULATOR PISTON SEAL IN MAIN VALVE BODY
CRACKED L/R ACCUMULATOR PISTON IN MAIN VALVE BODY

CUT OD/REV PISTON SEALS
BROKEN OR MISSING OD/REV BLEED ORIFICE (IN OD/REV CLUTCH PISTON)
BROKEN REVERSE CARRIER HUB WELD
BROKEN REVERSE SUN GEAR WELD TO THE REACTION CARRIER

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCS.

Are there any Transmission solenoid, line pressure, speed sensor, and/or loss of prime DTCS present?

Yes

- Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

No

- Go to [2](#)

2. CHECK IF DTC IS CURRENT

With the scan tool, perform the Reverse Gear Clutch test. Follow the instructions on the scan tool. Increase the throttle angle, TPS degree, to 30°, for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Did the clutch test pass, input speed remain at zero?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK EVENT DATA

The conditions necessary to set this DTC are not currently present.
With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Does the Event Data show an input speed reading of zero?

Yes

- Go to [8](#)

No

- Go to [4](#)

4. POSSIBLE INTERNAL TRANSMISSION CAUSES

Remove the Transmission Oil Pan and Valve Body and check the following per the Service Information:

- Clutch or metal debris in the pan
- L/R clutch tower seal on the main valve body for cuts and the L/R accumulator piston and seals.
- Air check the Reverse and L/R Hydraulic Clutch circuits (in the case) for excessive air leakage.

NOTE: Both Hydraulic Clutch circuits contain a small bleed orifice , a small amount of air leakage is normal. The Reverse hydraulic clutch circuit bleed orifice connects to the OD hydraulic clutch cavity. A small amount of air leakage into the OD hydraulic clutch circuit is considered normal.

Were there any problems found?

Yes

- Repair as necessary. If clutch debris is present, remove the transmission and inspect the Reverse and L/R clutches, and inspect the Transmission Oil Pump and Main Regulator Valve for damage or sticking in its bore.

NOTE: If the L/R clutch has failed but no obvious cause is found (such as a cut piston seal, stuck regulator valve, low line pressure reading in the Event Data, or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CLUTCH TEST FAILURE

Did the clutch test fail in reverse?

Yes

- Go to [6](#)

No

- Test complete.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

- 1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.
- 2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).
- 3) Check to see if the reaction carrier (the front-most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes

- Go to [7](#)

No

- Replace the reaction carrier per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK REVERSE CARRIER HUB

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Disassemble and inspect the input clutch assembly. Check the Reverse clutch reaction plate snap ring. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the Reverse hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

8. CHECK FOR INTERMITTENT OPERATION

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test complete.

P0740-TCC OUT OF RANGE

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

When in 2nd, through 5th gear, the torque converter clutch (TCC) can be engaged when certain conditions are met. The L/R-TCC piston is electronically modulated by increasing the duty cycle of the L/R-TCC Solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 rpm. Then the L/R-TCC solenoid is fully energized (FEMCC – 100% duty cycle). Torque converter slip is

monitored in FEMCC to ensure adequate clutch capacity.

- **When Monitored:**

During Electronically Modulated Converter Clutch (EMCC) Operation.

- **Set Condition:**

Transmission must be in EMCC, with input speed greater than 1750 rpm. L/R-TCC Solenoid achieves the maximum duty cycle and can not pull engine speed within 60 rpm of input speed. Also when the transmission is in FEMCC and the engine slips TCC more than 100 rpm for 10 seconds. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
RELATED DTC P0750 PRESENT
L/R-TCC SOLENOID
TCC SWITCH VALVE STUCK
TCC REGULATOR VALVE STUCK
INPUT SHAFT SEAL RING CUT
TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTC P0750

With the scan tool, read transmission DTCs.

Is the DTC P0750 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

Go to [2](#)

2. CHECK IF DTC P0740 IS CURRENT

With the scan tool, Read and RECORD ALL Transmission DTCs. After recording DTCs, erase DTCs. Drive the vehicle until the transmission temperature is at least 43° C or 110° F and the engine temperature at least 49° C or 120° F.

Perform the following steps 3 times.

Drive the vehicle to the speed of at least 88 Km/h or 55 mph.

Allow 4th or 5th gear to engage for at least 10 seconds.

Close the throttle.

Tip back into the throttle until the TPS angle is between 25 and 29 degrees.

NOTE: If the throttle angle goes over 30 degrees, you must close the throttle and try again.

Did the TCC engage during any of the attempts, Engine speed approximately equal to input speed?

Yes

- Go to [3](#)

No

- Go to [4](#)

3. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorts and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

4. CHECK THE L/R-TCC SOLENOID

With the scan tool, check for other transmission DTCs.

Are the DTCs P1775 and P0841 present also?

Yes

- Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CHECK THE TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION

Repair internal transmission as necessary.

Check for the following possible causes. Refer to the Service information for the proper repair procedures.

Inspect the Transmission Oil Pump and Valve Body.

Check the Torque Converter Switch Valve and the Torque Converter Clutch Control Valve for sticking in the bore.

Check the Teflon seal rings on the input shaft. Note: If one of the seal rings is cut, the loose piece will often lodge in the TCC switch valve, causing it to stick in its bore.

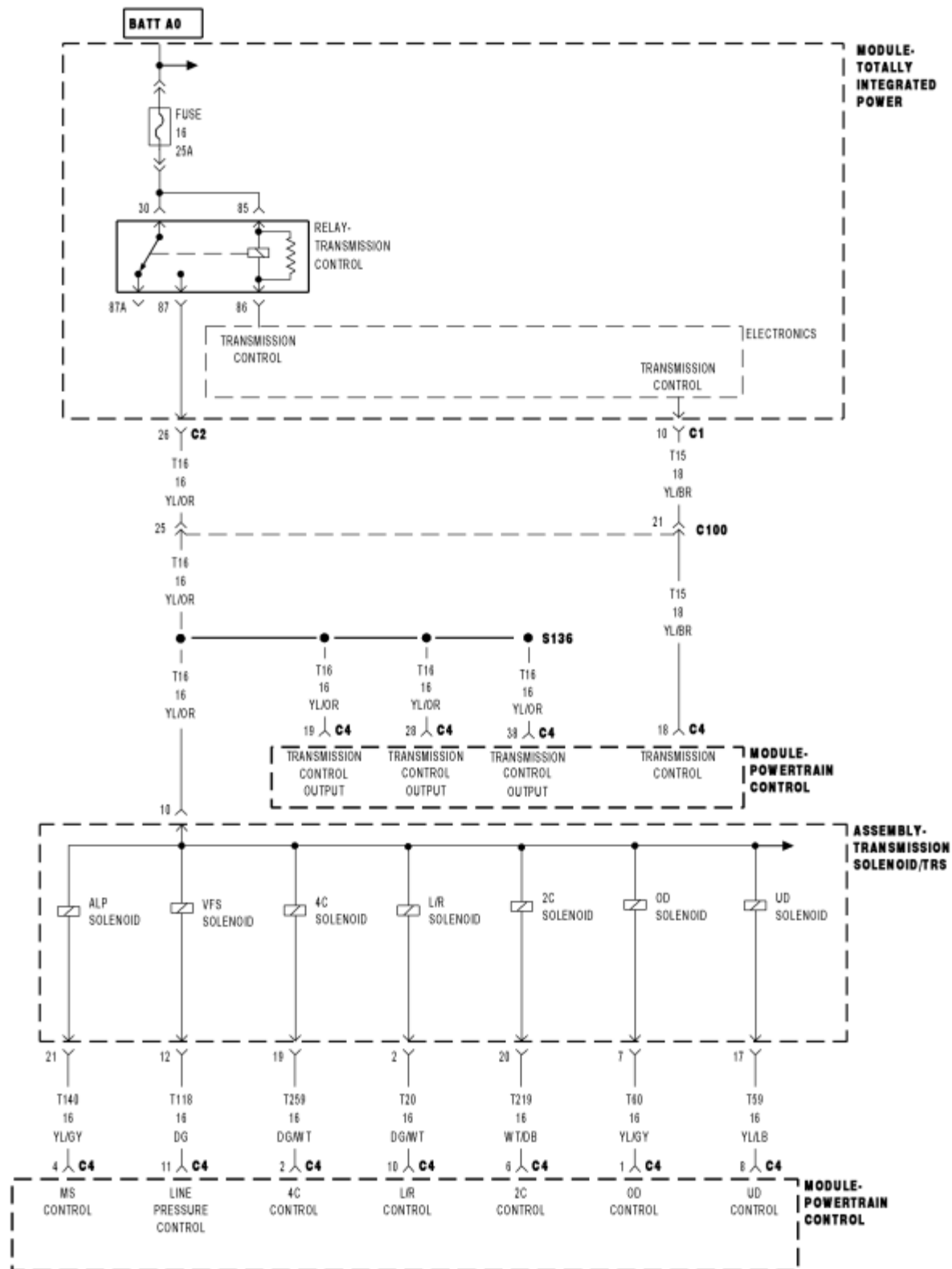
If no problems are found, replace the Transmission Solenoid/TRS Assembly.

View repair

Repair

- In all cases, replace the Torque Converter. Make sure to check all other possible causes in addition to the Torque Converter.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0750-LR SOLENOID CIRCUIT



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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T20) L/R SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T20) L/R SOLENOID CONTROL CIRCUIT OPEN
(T20) L/R SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK DTCS

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF P0750 IS PRESENT

Ignition on, engine not running.

With the scan tool, erase all Transmission DTCs.

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the L/R Solenoid.

Monitor the L/R Solenoid LED on the Transmission Simulator.

Did the L/R Solenoid LED on the Transmission Simulator blink on and off?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the Transmission simulator still connected, continue to actuate the L/R solenoid for 2 minutes.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0750 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the L/R solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0750 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

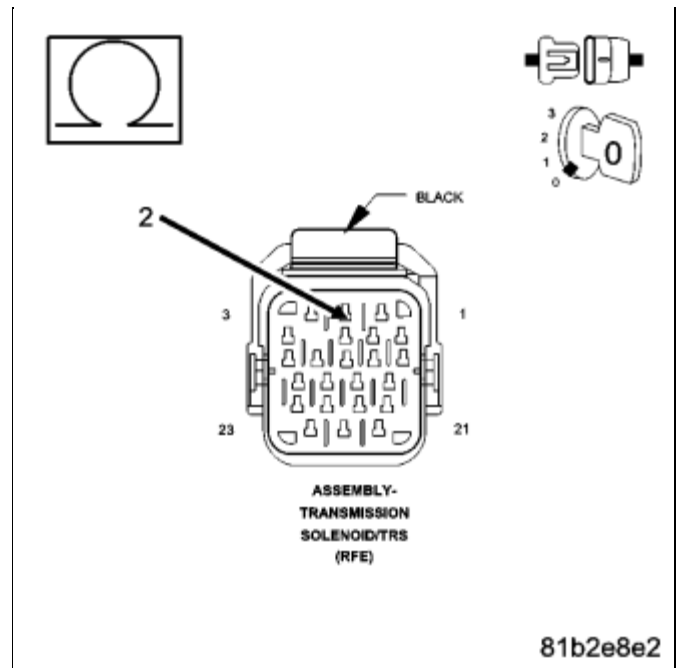
Disconnect the PCM harness connectors.

Measure the resistance between the (T20) L/R Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T20) L/R Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T20) L/R Solenoid Control circuit for a short to another circuit(s).



Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR AN OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

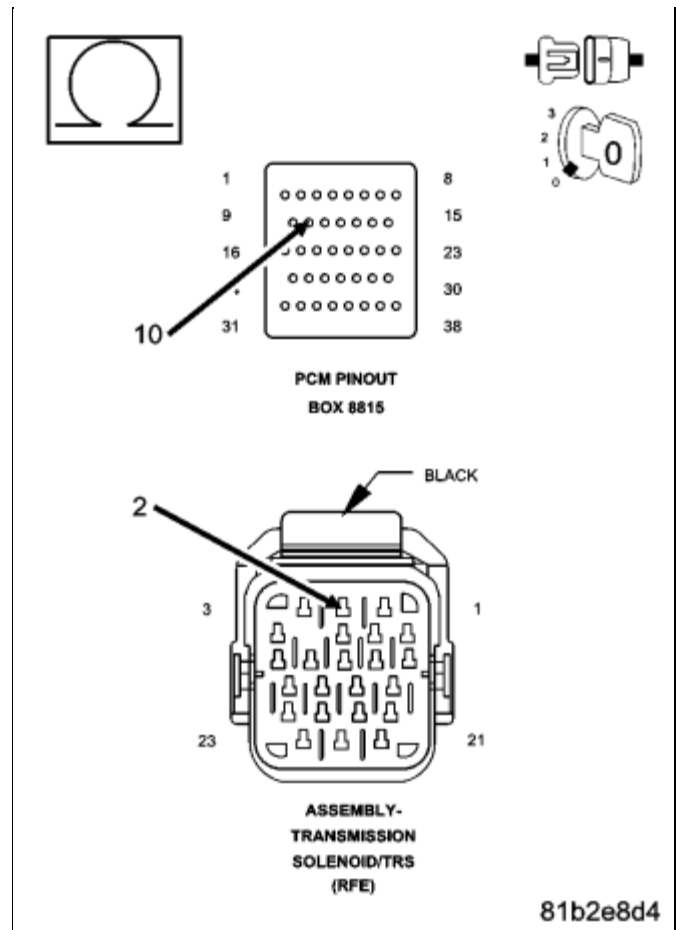
Measure the resistance of the (T20) L/R Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T20) L/R Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -

45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [7](#)

7. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T20) L/R Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes

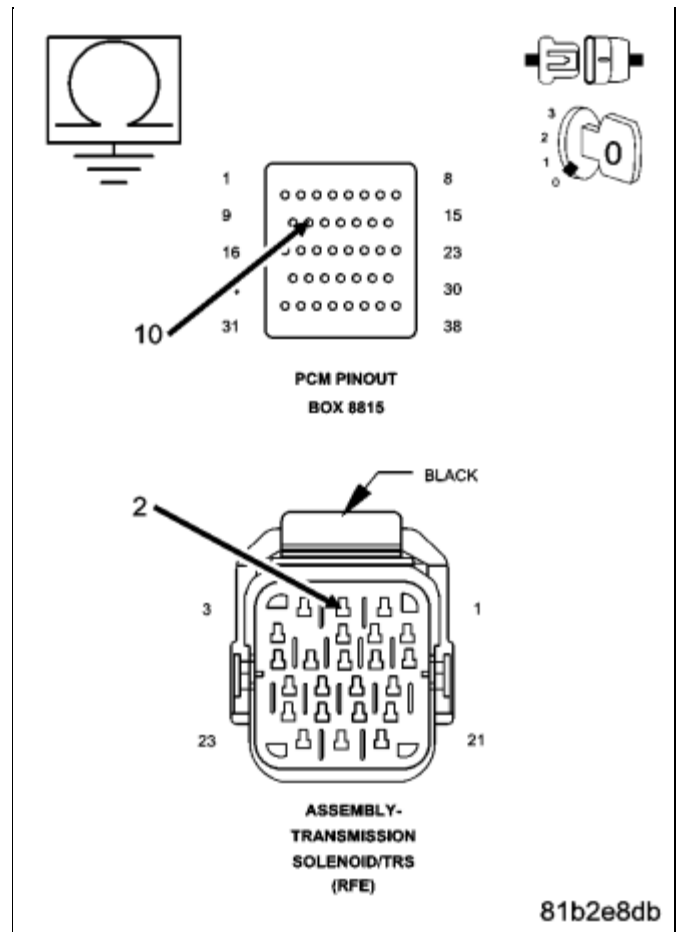
- Repair the (T20) L/R Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

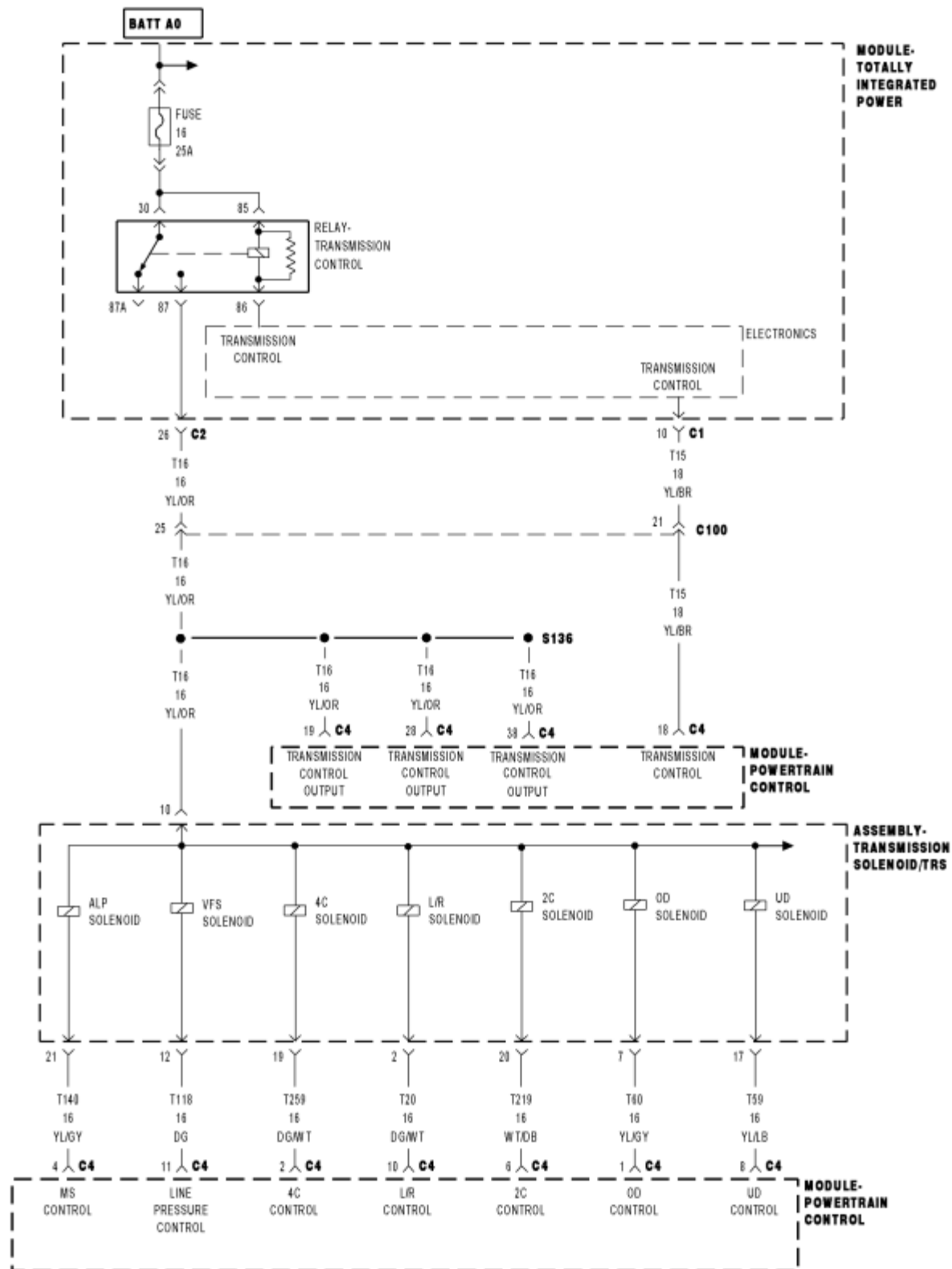
No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention

- to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0755-2C SOLENOID CIRCUIT





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Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T219) 2C SOLENOID CONTROL CIRCUIT OPEN
(T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK DTCS

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF P0755 IS PRESENT

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, actuate the 2C Solenoid.

Did the 2C Solenoid LED blink on and off on the Transmission Simulator?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the Transmission simulator still connected, continue to actuate the 2C solenoid for 2 minutes.
After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0755 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the 2C solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0755 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

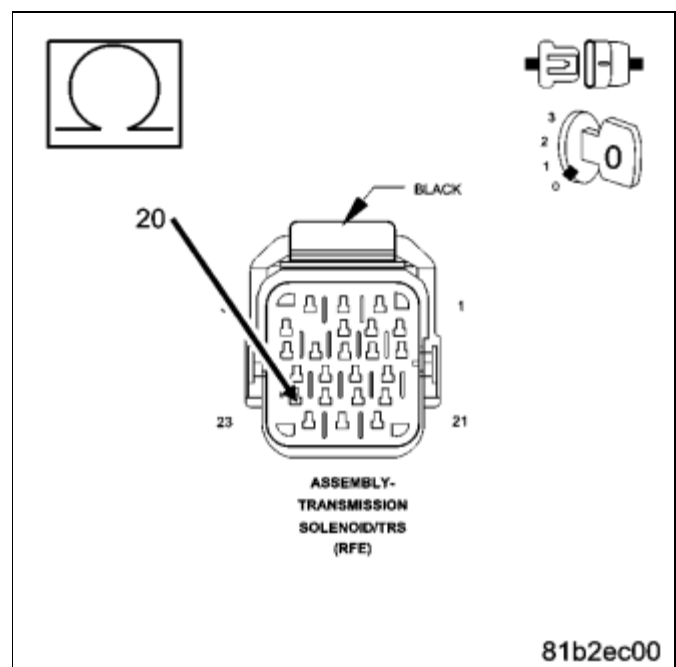
5. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the PCM harness connectors.
Measure the resistance between the (T219) 2C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T219) 2C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T219) 2C Solenoid Control circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [6](#)

6. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT FOR AN OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T219) 2C Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T219) 2C Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [7](#)

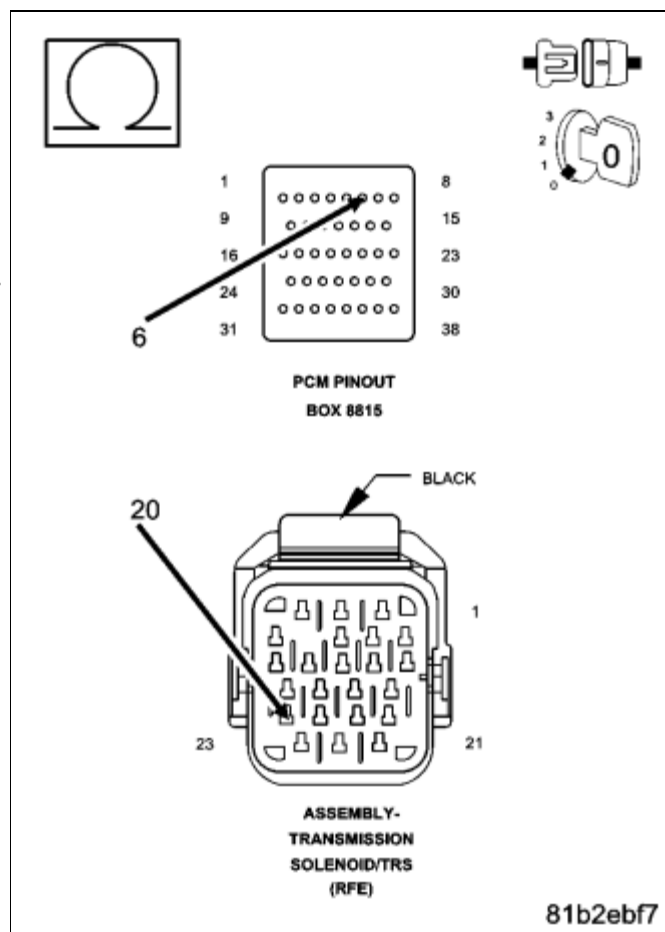
7. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T219) 2C Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T219) 2C Solenoid Control circuit for a short to ground.

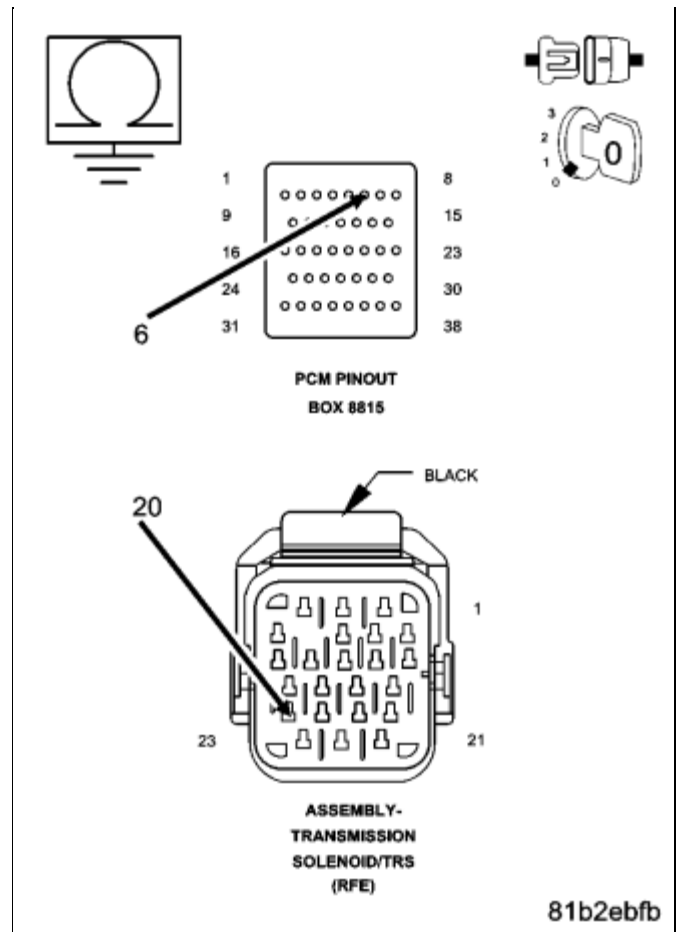


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- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



P0760-OD SOLENOID CIRCUIT

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T60) OD SOLENOID CONTROL CIRCUIT OPEN
(T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK DTCS

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF P0760 IS PRESENT

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, clear Transmission DTCs.
With the scan tool, actuate the OD Solenoid.
Monitor the OD Solenoid LED on the Transmission Simulator.

Did the OD Solenoid LED on the Transmission Simulator blink on and off?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the Transmission simulator still connected, continue to actuate the OD solenoid for 2 minutes.
After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0760 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the OD solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0760 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

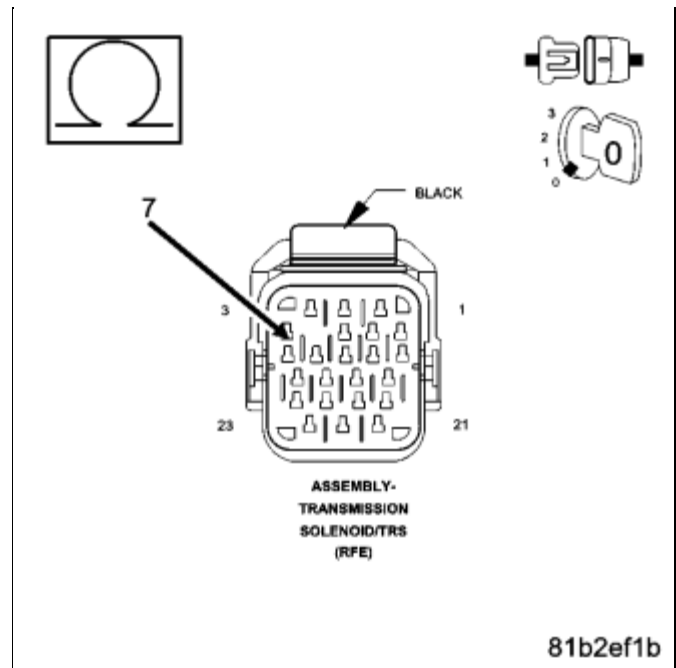
Disconnect the PCM harness connectors.

Measure the resistance between the (T60) OD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T60) OD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T60) OD Solenoid Control circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION



VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR AN OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

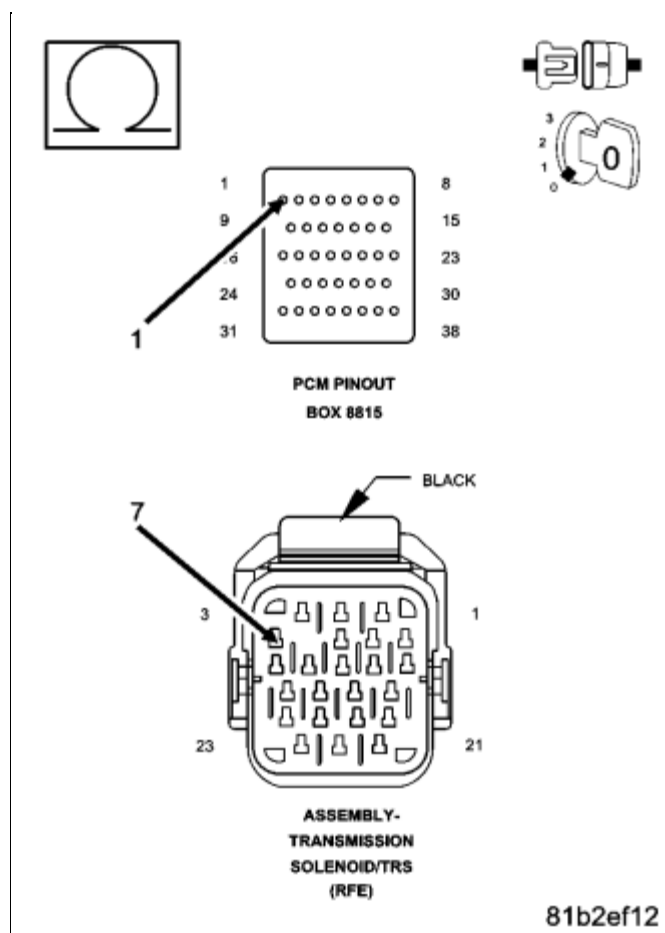
Measure the resistance of the (T60) OD Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T60) OD Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC -
45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [7](#)

7. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes

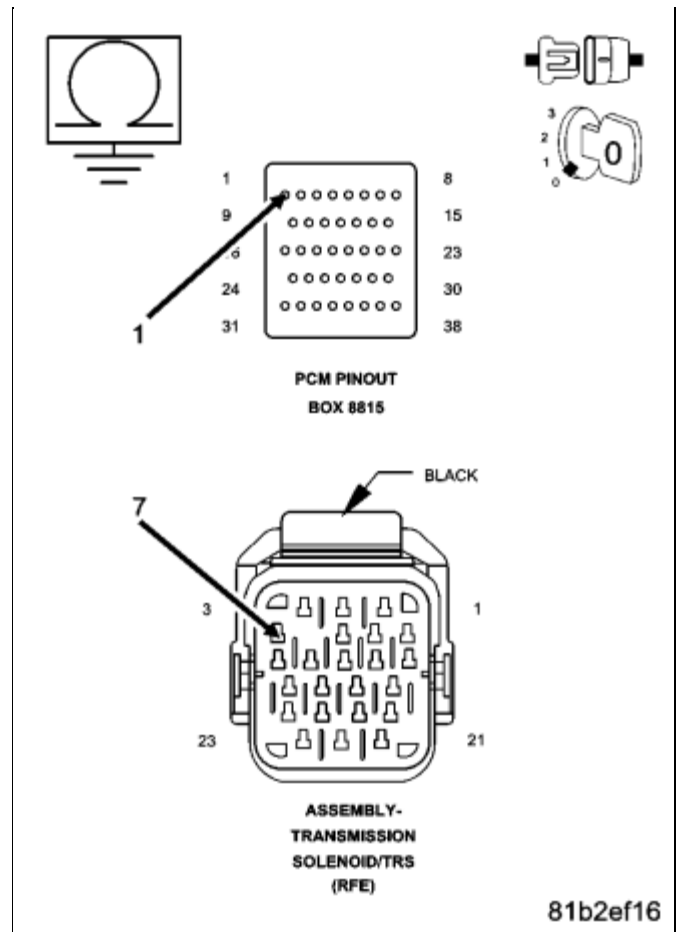
- Repair the (T60) OD Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

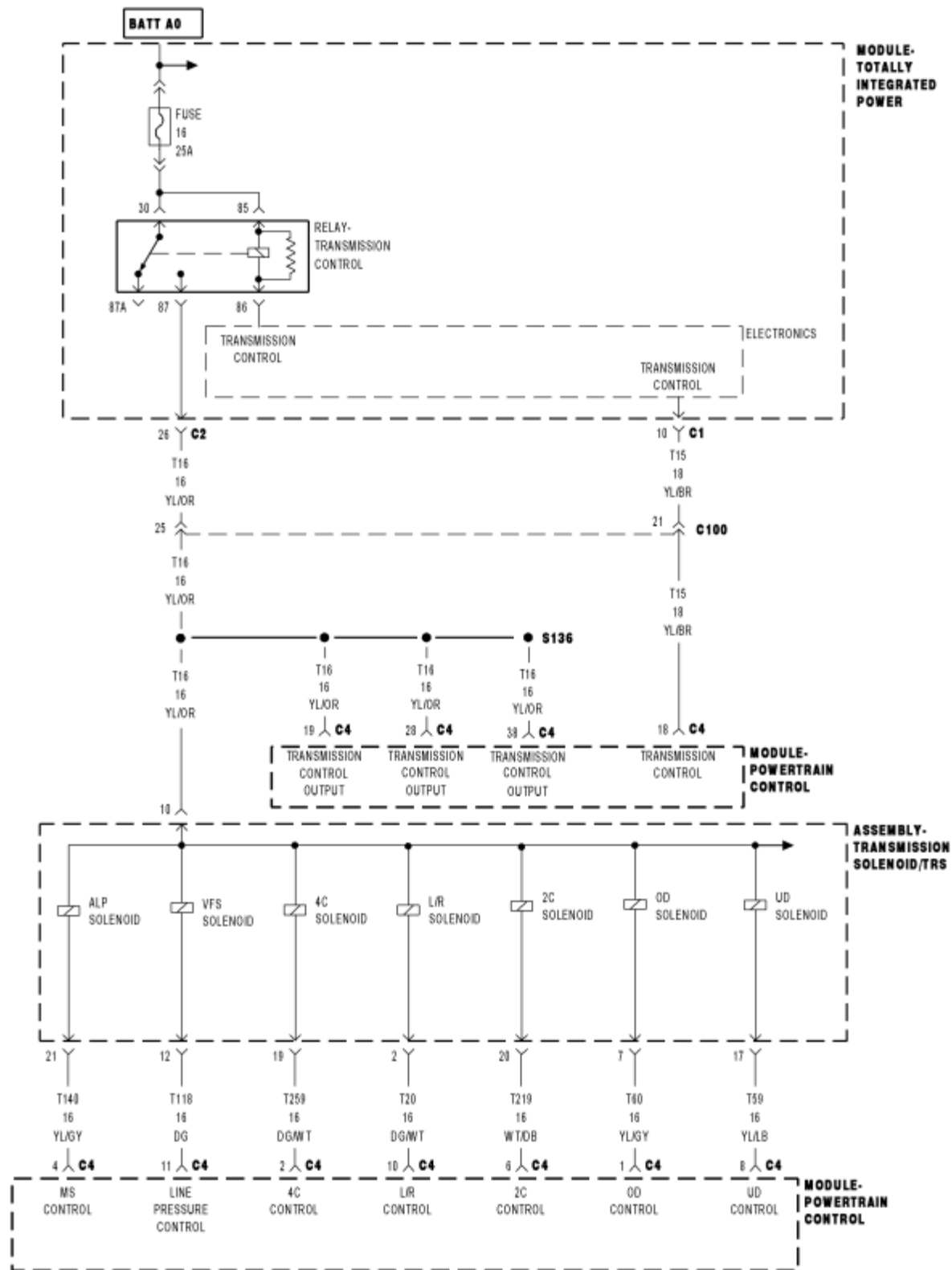
- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion,

damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



P0765-UD SOLENOID CIRCUIT



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For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T59) UD SOLENOID CONTROL CIRCUIT OPEN
(T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK DTCS

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF P0765 IS PRESENT

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, clear Transmission DTCs.
With the scan tool, actuate the UD Solenoid.
Monitor the UD Solenoid LED on the Transmission Simulator.

Did the UD Solenoid LED on the Transmission Simulator blink on and off?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the Transmission simulator still connected, continue to actuate the UD solenoid for 2 minutes.
After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0765 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the UD solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0765 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

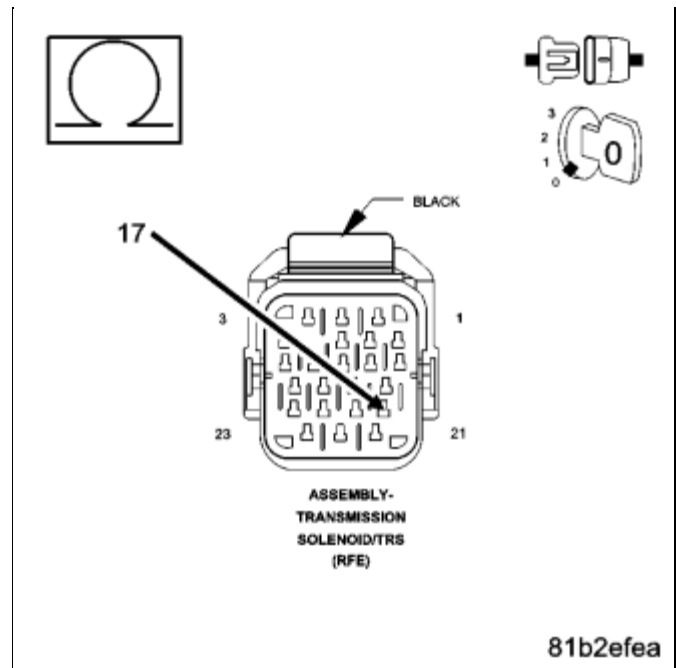
5. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333.
 Disconnect the PCM harness connectors.
 Measure the resistance between the (T59) UD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T59) UD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T59) UD Solenoid Control circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION



VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR AN OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

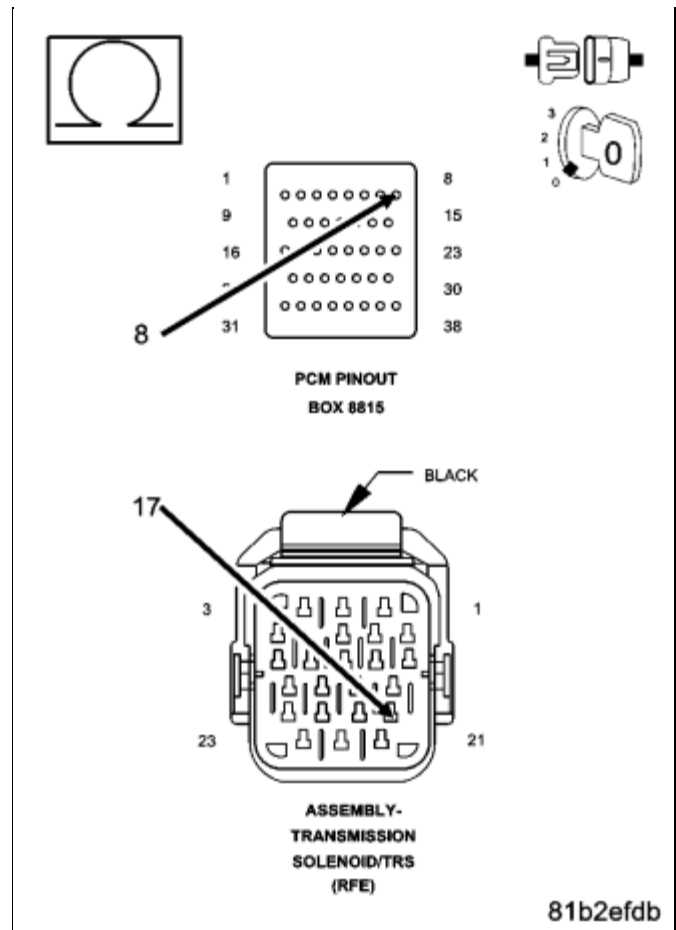
Measure the resistance of the (T59) UD Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T59) UD Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC -

45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [7](#)

7. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T59) UD Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes

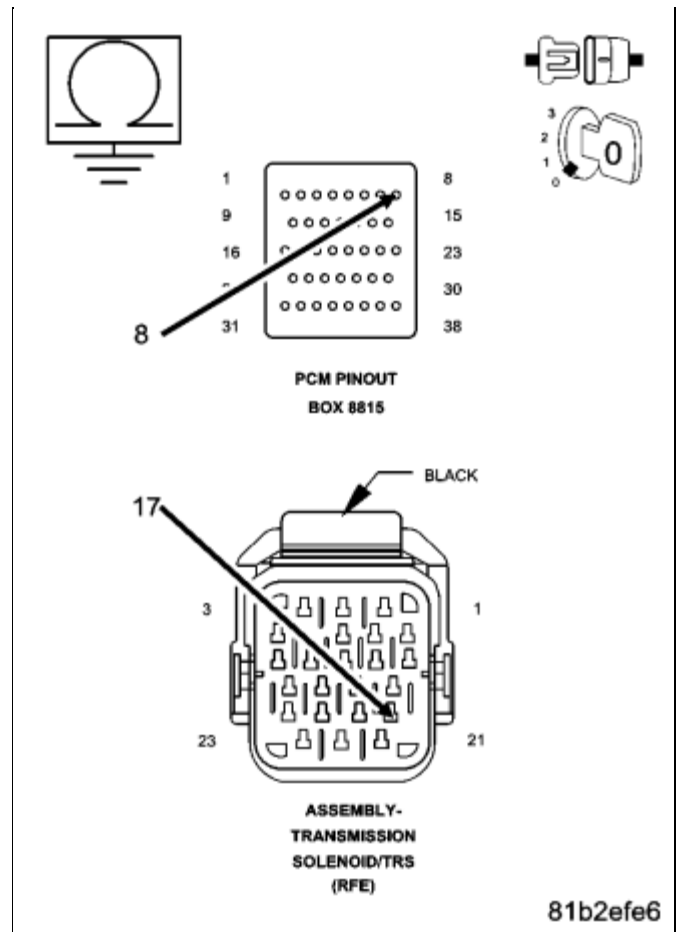
- Repair the (T59) UD Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

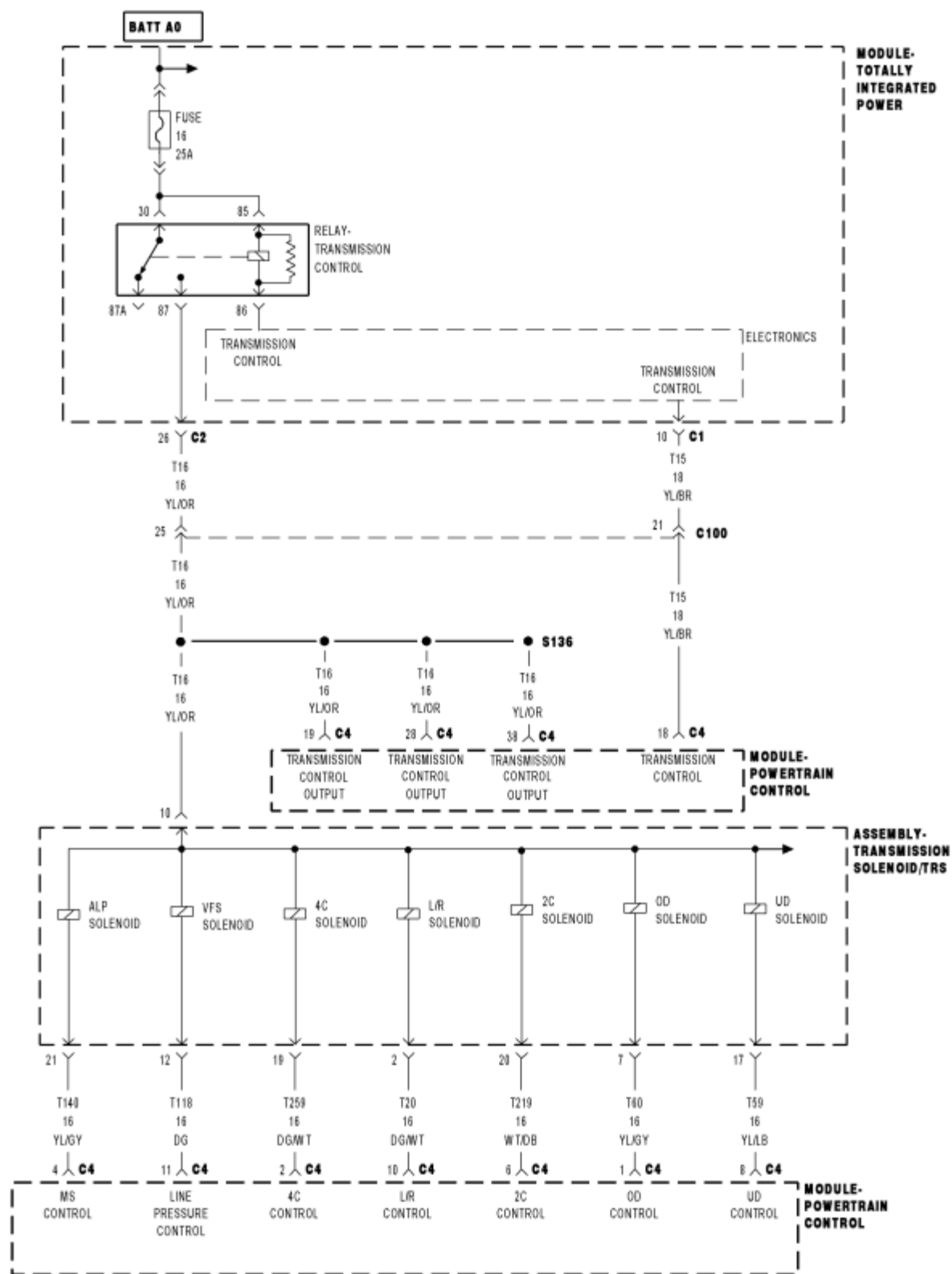
- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention

to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



P0770-4C SOLENOID CIRCUIT



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T259) 4C SOLENOID CONTROL CIRCUIT OPEN
(T259) 4C SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK DTCS

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF P0770 IS PRESENT

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, clear Transmission DTCs.
With the scan tool, actuate the 4C Solenoid.
Monitor the 4C Solenoid LED on the Transmission Simulator.

Did the 4C Solenoid LED on the Transmission Simulator blink on and off?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the Transmission simulator still connected, continue to actuate the 4C solenoid for 2 minutes.
After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0770 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the 4C solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0770 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE (T259) 4C SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

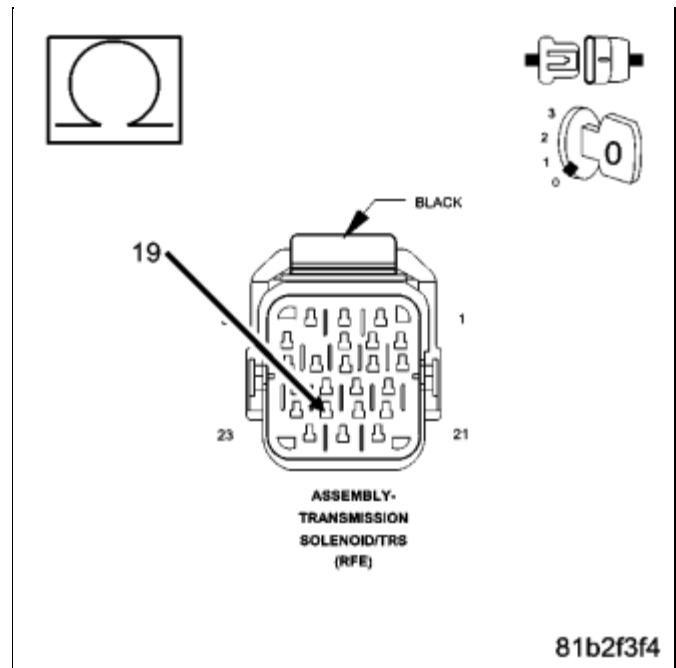
Disconnect the PCM harness connectors.

Measure the resistance between the (T259) 4C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T259) 4C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T259) 4C Solenoid Control circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION



VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. CHECK THE (T259) 4C SOLENOID CONTROL CIRCUIT FOR AN OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

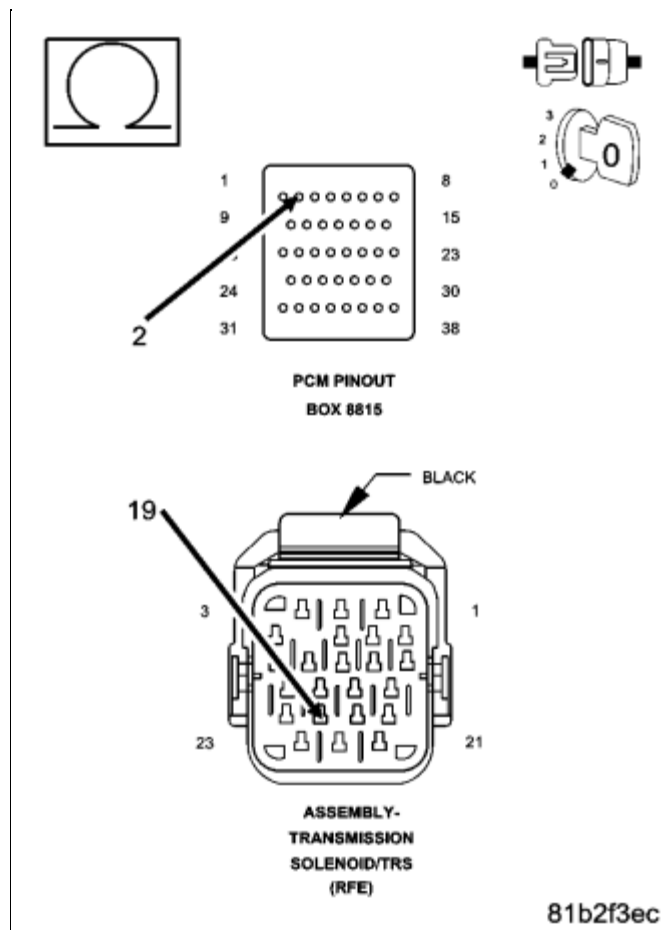
Measure the resistance of the (T259) 4C Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T259) 4C Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC -
45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [7](#)

7. CHECK THE (T259) 4C SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T259) 4C Solenoid Control circuit.

Is the resistance below 5.0 ohms?

Yes

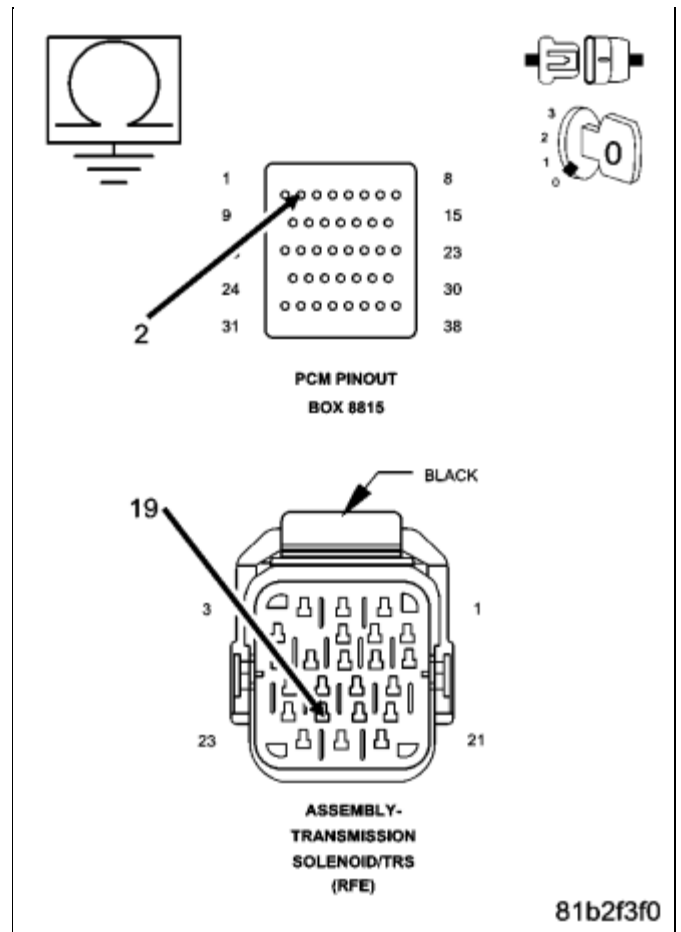
- Repair the (T259) 4C Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

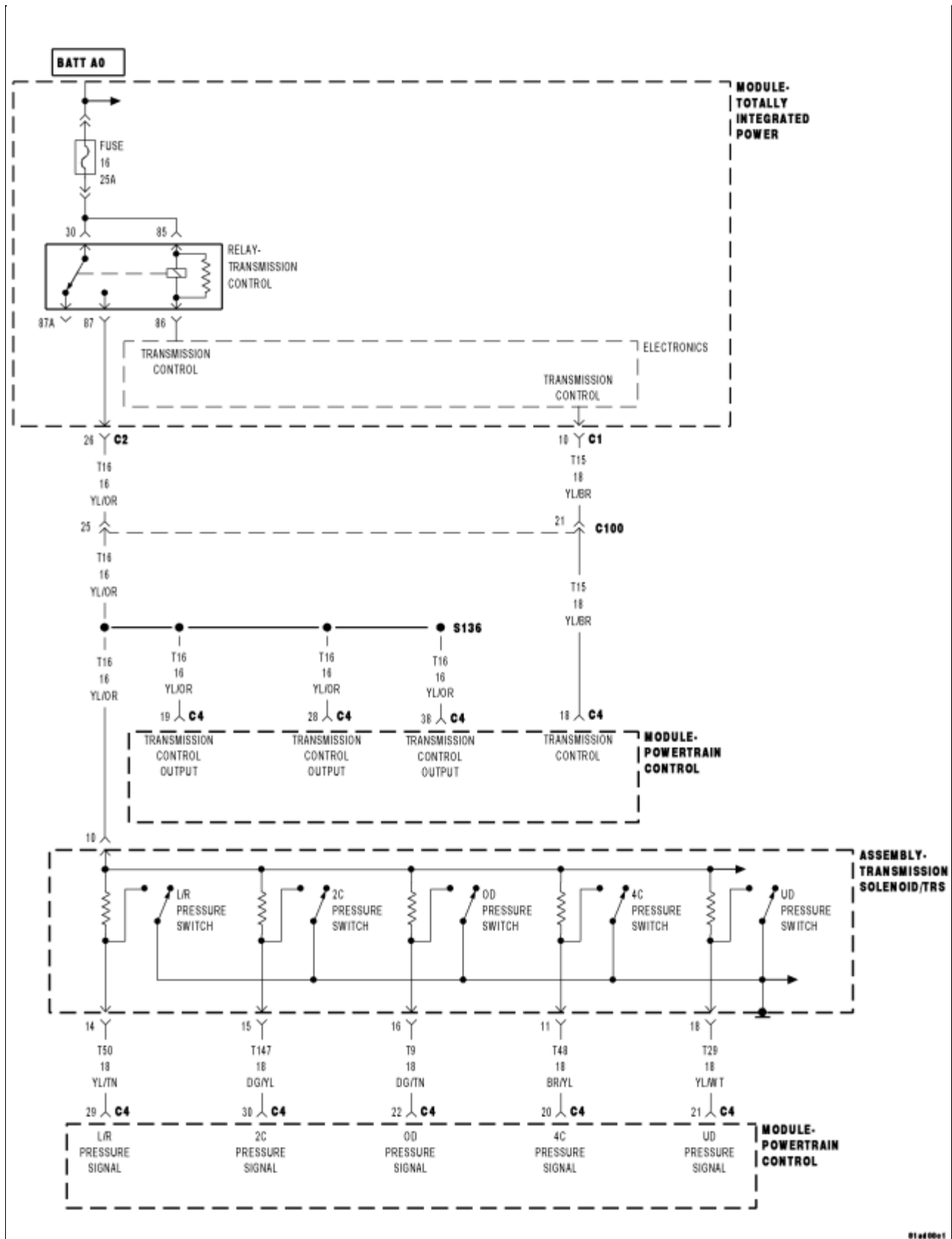
- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion,

damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



P0841-LR PRESSURE SWITCH RATIONALITY



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The DTC will set if the L/R Pressure Switch reads open or closed at the wrong time in a given gear.

Possible Causes
LOSS OF PRIME AND/OR TIPM DTC PRESENT
LOW FLUID LEVEL
LOW LINE PRESSURE
REVERSE CARRIER SNAP RING DISLODGED
CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR FILTER SEAL
STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY
NO. 1 CHECK BALL CUT OR DAMAGED
WIRING AND CONNECTORS
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

GEAR	L/R	2C	4C	UD	OD

REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2nd PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3TH	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

Diagnostic Test

1. CHECK IF OTHER RELATED DTCS PRESENT

Ignition on, engine not running.

With the scan tool, check for other transmission DTCs.

Are there any Loss of Prime, TCM Power Input, and/or TIPM TCM Power Control Circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first.

No

- Go To [2](#)

2. CHECK IF THE CONDITION P0841 IS PRESENT

With the scan tool, check the DTC EVENT DATA for P0841.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA show the DTC P0841?

Yes

- Go To [3](#)

No

- Refer to the Transmission category and perform diagnostics for the DTC reported in the DTC EVENT DATA.

3. CHECK IF THE DTC SET IN REVERSE

Does the DTC EVENT DATA show the DTC P0841 set while in Reverse?

Yes

- Go To [10](#)

No

- Go To [4](#)

4. CHECK IF THE L/R PRESSURE SWITCH IS CLOSED

Does the DTC EVENT DATA show the L/R Pressure Switch reading CLOSED when the DTC P0841 was set?

Yes

- Go To [5](#)

No

- Go To [14](#)

5. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

Turn the Pressure Switch selector to L/R on the Transmission Simulator.

With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the L/R Pressure Switch state change from open to closed while pressing the Pressure Switch Test button on the Transmission Simulator?

Yes

- Go To [6](#)

No

- Go To [10](#)

6. CHECK FOR POOR WIRING AND CONNECTIONS

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorted and open circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK IF THE DTC SET IN FIRST GEAR

With the DTC EVENT DATA recorded earlier, check what gear the transmission was in when the DTC P0841 was set.

Does the DTC EVENT DATA show the Present Gear as first gear when the DTC P0841 was set ?

Yes

- Go To [8](#)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

8. CHECK IF THE NO. 1 CHECK BALL IS CUT OR DAMAGED

Turn the ignition off to the lock position.

Remove the Transmission Valve Body per the Service Information.

Check the No. 1 Check Ball for any possible cuts or damage.

Is the No. 1 Check Ball cut or damaged?

Yes

- Replace the No. 1 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the L/R Clutch assembly. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. CHECK IF THE REVERSE CARRIER SNAP RING IS DISLODGED AND THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Looking through the windows in the bottom of the case, check whether the snap ring at the front of the Reverse (center) Carrier has dislodged.

NOTE: It may be necessary to pry the Input Annulus Gear Shell rearward to check this snap ring.

Is the Reverse Carrier Snap Ring dislodged?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

10. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333 if connected in a previous step or disconnect the Transmission Solenoid/TRS Assembly harness connector.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.

NOTE: Check connectors - Clean/repair as necessary.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit between the Solenoid/TRS Assembly harness connector and the appropriate terminal of the Miller tool #8815.

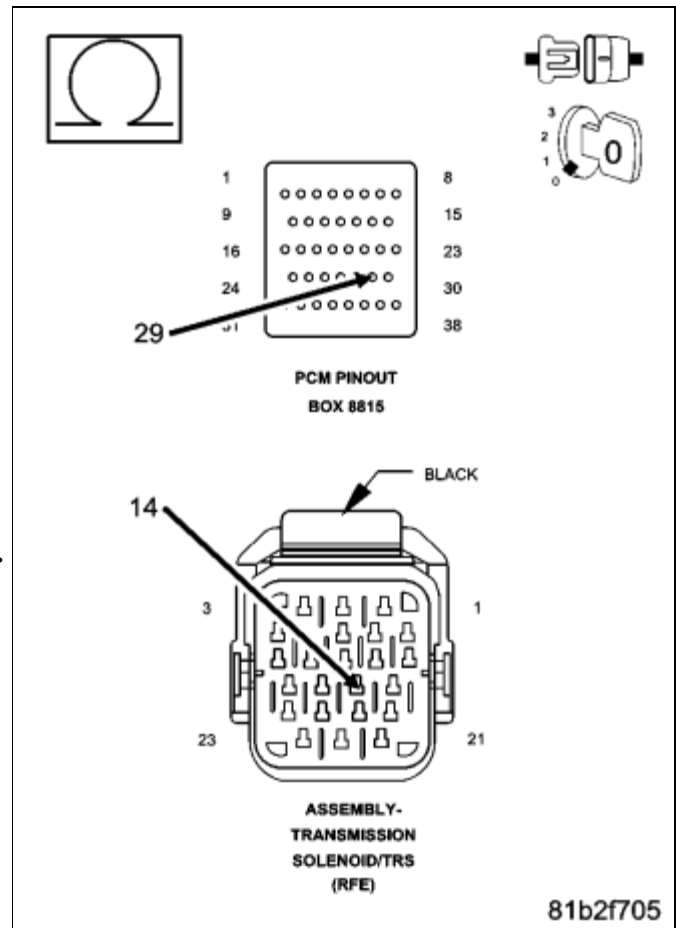
Is the resistance above 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [11](#)



11. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

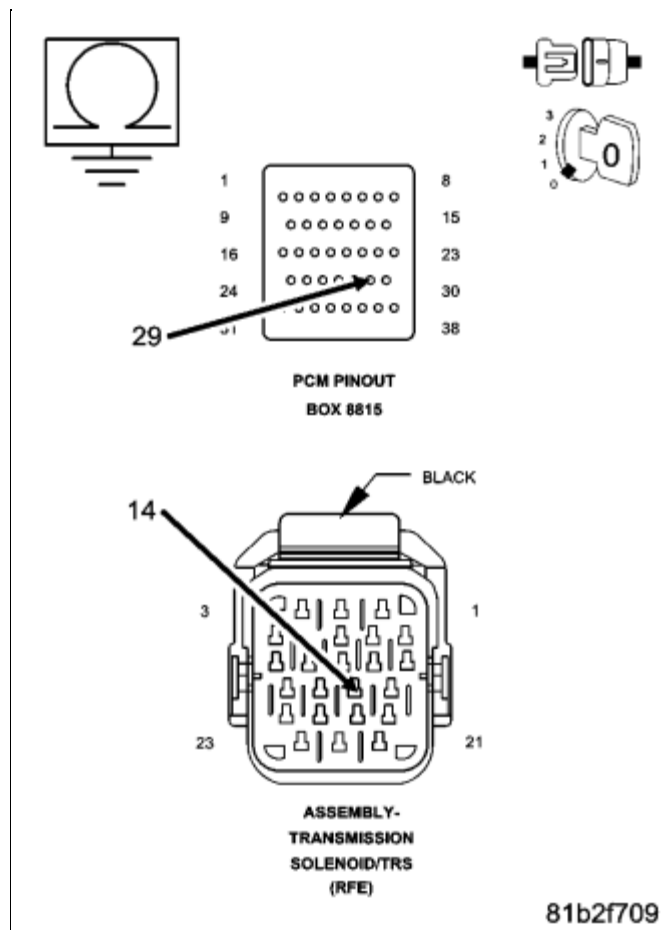
Is the resistance below 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [12](#)



12. CHECK THE PCM POWERS AND GROUNDS

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. ROAD TEST THE VEHICLE

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the DTC EVENT DATA recorded earlier.

Did the DTC P0841 reset?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [17](#)

14. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check for low fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and Primary Oil Filter are OK, check the Main Regulator Valve in the Oil Pump per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

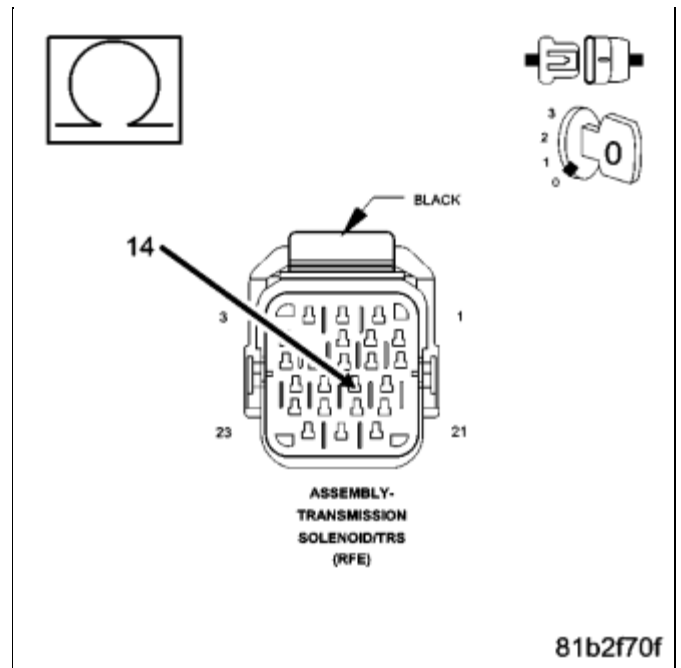
- Go To [15](#)

15. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Transmission Solenoid/TRS Assembly harness connector.
 Disconnect all PCM harness connectors.
 Measure the resistance between the (T50) L/R Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T50) L/R Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes



Repair the (T50) L/R Pressure Switch Sense circuit for a short to another circuit(s).

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [16](#)

16. ROAD TEST THE VEHICLE

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the DTC EVENT DATA recorded earlier.

Did the DTC P0841 reset?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [17](#)

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?**Yes**

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0845-2C HYDRAULIC PRESSURE TEST

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed above 1000 rpm, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTCS PRESENT
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check DTCs.

Is there any Loss of Prime, TCM Power Input, Line Pressure Sensor and/or TIPM TCM Power Control Circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944-LOSS OF PRIME is present, perform its respective test first.

No

- Go To [2](#)

2. CHECK IF THE DTC P0755 IS PRESENT

With the scan tool, check DTCs.

Is the DTC P0755 also present?

Yes

- Refer to the symptom list and perform diagnostics for P0755-2C SOLENOID CIRCUIT.

No

- Go To [3](#)

3. CHECK IF THE DTCS P0732, P0729 AND/OR P0846 ARE PRESENT

With the scan tool, check DTCs.

Are the DTCs P0732, P0733, and/or P0846 present also?

Yes

- Go To [12](#)

No

- Go To [4](#)

4. CHECK TO SEE IF DTC P0845 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0845.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [5](#)

No

- Go To [15](#)

5. CHECK IF THE LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa (85 and 95 psi) in each position?

Yes

- Go To [6](#)

No

- Go To [10](#)

6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running**.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa (30 psi) or 0.7 volts and did not change)

- Go To [7](#)

7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa (2.0 psi) or 0.1 volts of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect Transmission Simulator.
 Disconnect the PCM C1 harness connector and connect
 Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

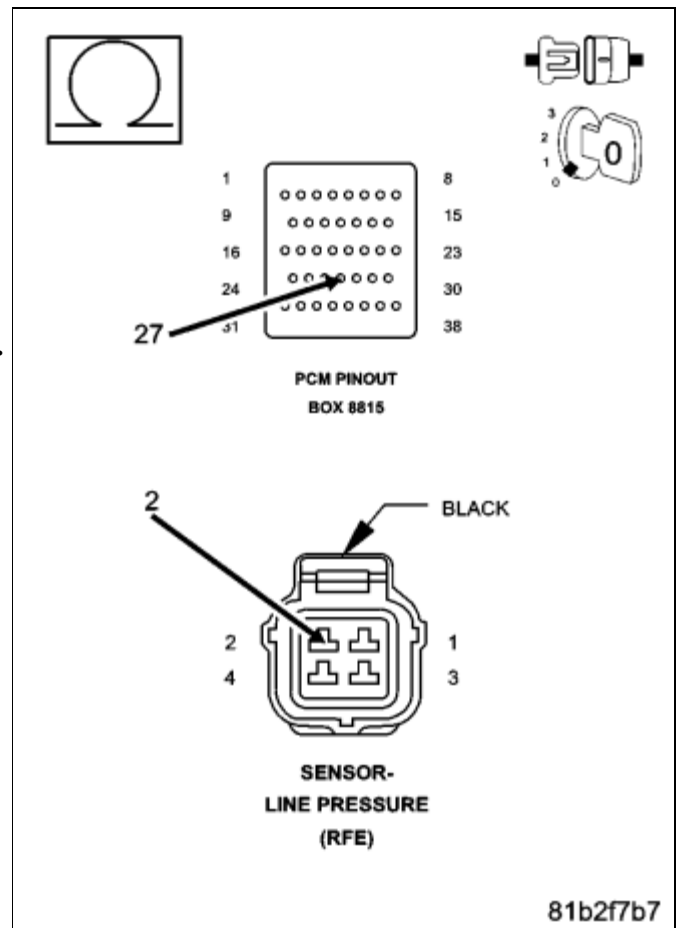
Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)



9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

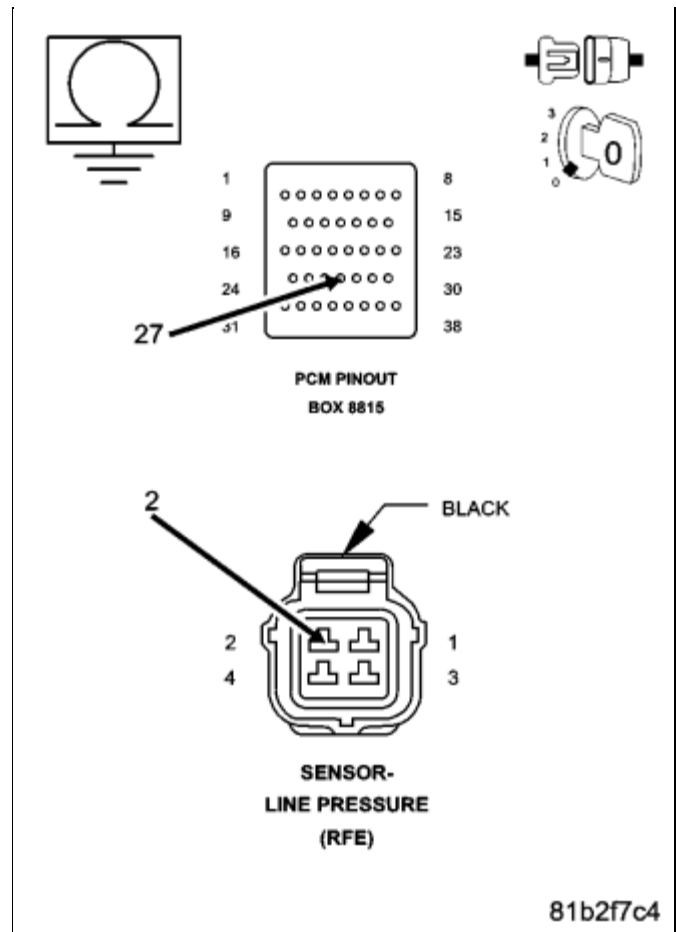
Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are

- found, replace the PCM per the Service Information.
 With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the rpm to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the rpm to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the rpm to 1500, and compare the line pressure readings.

Did the scan tool Line Pressure readings match the Pressure Gauge readings $\pm$ 10 psi?

Yes

- Go To [11](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. CHECK THE WIRING AND CONNECTORS

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.
Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 2C.

Ignition on, engine not running.

With the scan tool, monitor the 2C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 2C Pressure Switch.

Did the 2C Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Go To [12](#)

No

- Go To [14](#)

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.
Remove the Transmission Simulator, Miller tool #8333.
Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes

- Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. CHECK THE 2C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 2C clutch hydraulic circuit, in the 2C/4C clutch retainer, for leakage per the Service Information.

NOTE: The 2C hydraulic clutch circuit contains a small bleed orifice, a small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes

- Repair as necessary. Check the 2C clutch piston, piston seals and bleed orifice assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Disassemble and inspect the Valve Body and repair as necessary. Inspect the 2C Accumulator piston and seals. Check for an extra check ball downstream from the #7 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

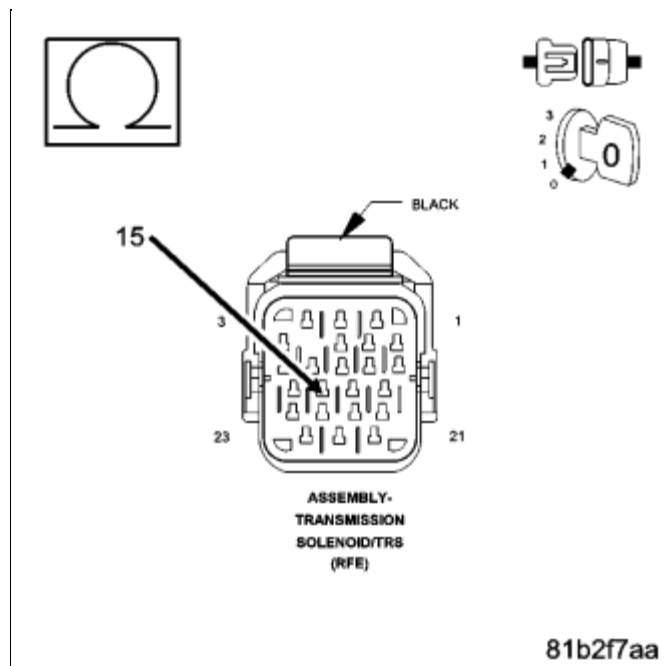
14. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T147) 2C Pressure Switch Sense circuit and any other circuit(s) in



the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0845 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

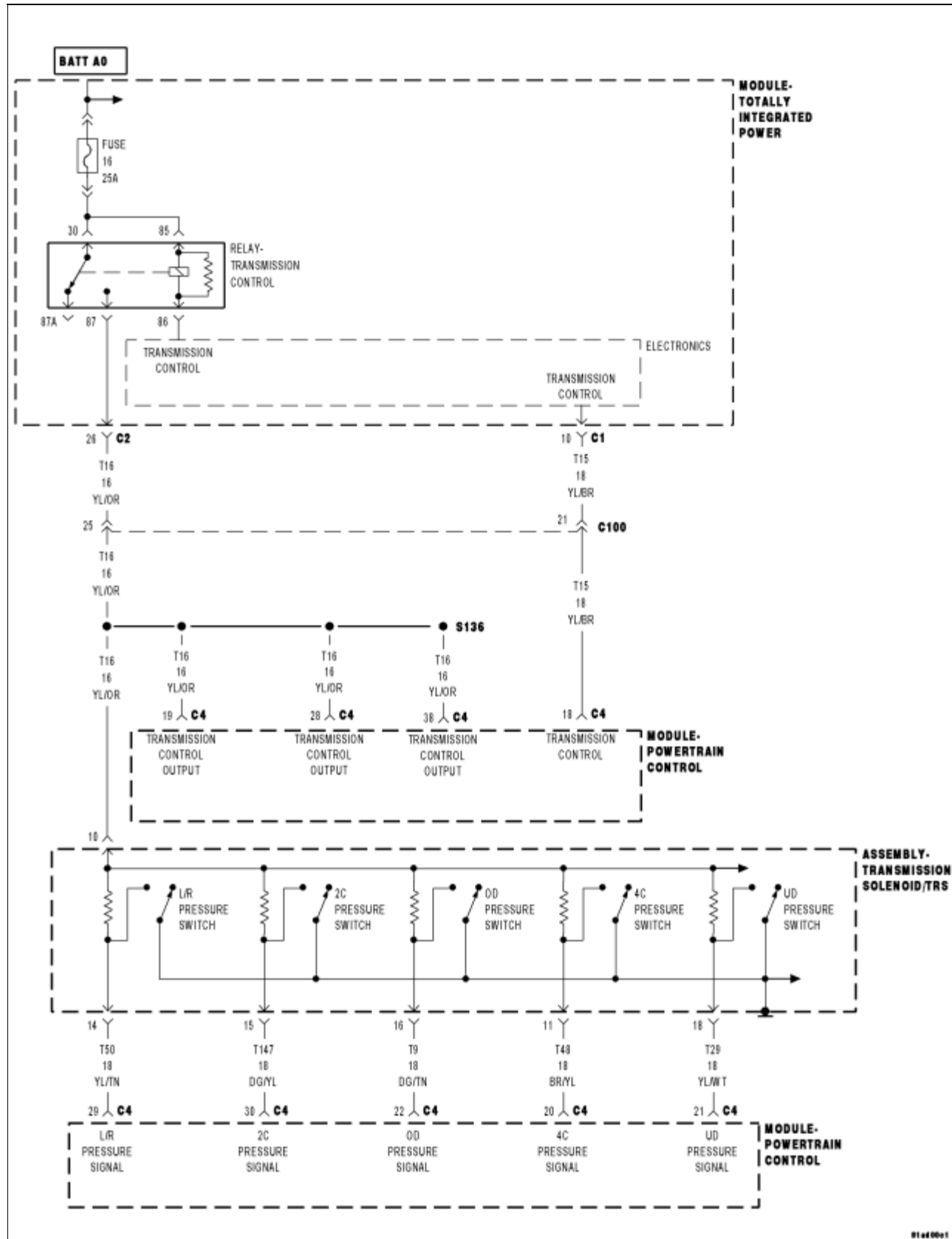
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0846-2C PRESSURE SWITCH RATIONALITY



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

- **When Monitored:**

Continuously with the ignition on, engine running, with the transmission in gear.

- **Set Condition:**

The DTC is set if the 2C Pressure Switch reads open or closed at the wrong time in a given gear .

Possible Causes
RELATED TIPM TCM DTCS PRESENT
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
EXCESSIVE FLUID LEAKAGE IN 2C CLUTCH CIRCUIT
NO. 5 AND/OR NO. 7 CHECK BALL CUT OR DAMAGED
EXTRA CHECK BALL DOWNSTREAM OF THE NO. 7 CHECK BALL SOCKET
LOW LINE PRESSURE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE
WIRING AND CONNECTORS

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2nd PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3TH	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.					
**May be open when rolling in Neutral or at low oil temperatures.					

Diagnostic Test

1. CHECK FOR TCM TIPM DTCS

With the scan tool read DTCS.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCS present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

No

- Go To [2](#)

2. CHECK IF THE DTC DATA SHOWS THE CURRENT DTC

With the scan tool, check the DTC EVENT DATA.

Does the DTC EVENT DATA show data for DTC P0846?

Yes

- Go To [3](#)

No

- Refer to the Transmission category and perform the appropriate symptom shown in the DTC EVENT DATA.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

3. CHECK IF MULTIPLE DTCS ARE PRESENT

With the scan tool, check DTCs.

Are there two or more related pressure switch rationality DTCs present in addition to P0846?

Yes

- Go To [4](#)

No

- Go To [7](#)

4. CHECK IF ALL THE PRESSURE SWITCHES READ CLOSED

With the scan tool, check the DTC EVENT DATA for P0846.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the DTC EVENT DATA for P0846?

Yes

- Refer to Transmission category and perform diagnostics for P0882.

No

- Go To [5](#)

5. CHECK IF ALL THE PRESSURE SWITCHES READ OPEN

In the DTC EVENT DATA recorded earlier, read the state of all pressure switches.

Do all the pressure switches read OPEN?

Yes

- Go To [6](#)

No

- Go To [7](#)

6. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK IF THE DTC SET IN PARK, NEUTRAL, OR REVERSE

With the scan tool, check the DTC EVENT DATA for P0846.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA show the DTC P0846 set in Park, Neutral, or Reverse?

Yes

- Go To [12](#)

No

- Go To [8](#)

8. CHECK IF THE 2C PRESSURE SWITCH READS CLOSED

With the scan tool, check the DTC EVENT DATA for P0846.

Does the DTC EVENT DATA show the 2C Pressure Switch reading CLOSED?

Yes

- Go To [10](#)

No

- Go To [9](#)

9. CHECK THE LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [15](#)

10. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the 2C position.

With the scan tool, monitor the 2C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

Did the state of the 2C Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Go To [11](#)

No

- Go To [12](#)

11. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorted and open circuits.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

12. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333.
 Disconnect the PCM C4 harness connector.
 Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T147) 2C Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connect and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T147) 2C Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

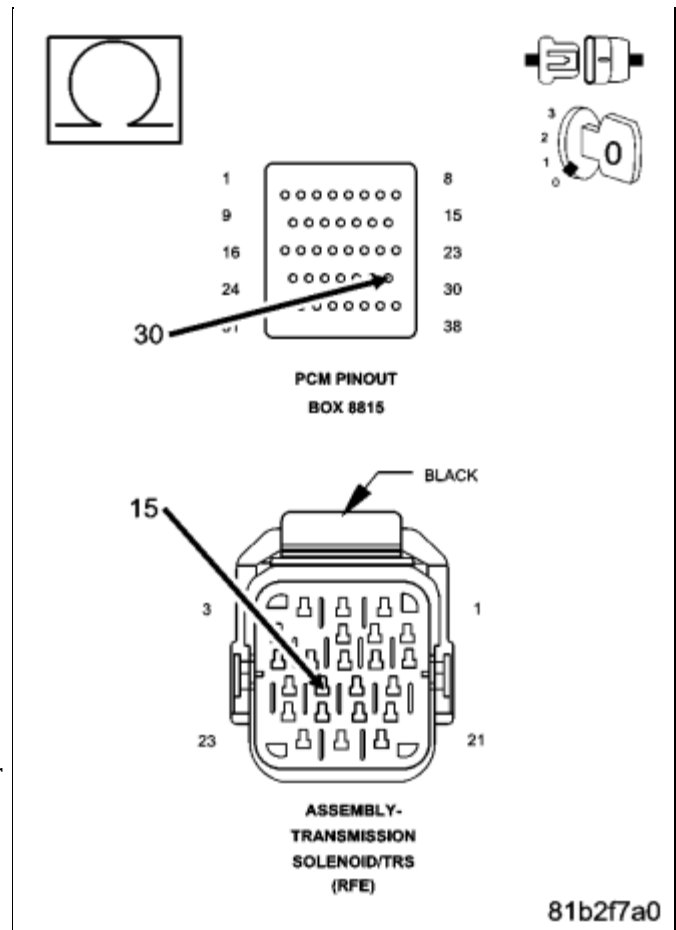
Measure the resistance between ground and the (T147) 2C Pressure Switch Sense circuit.

Is the resistance below 5.0 ohms?

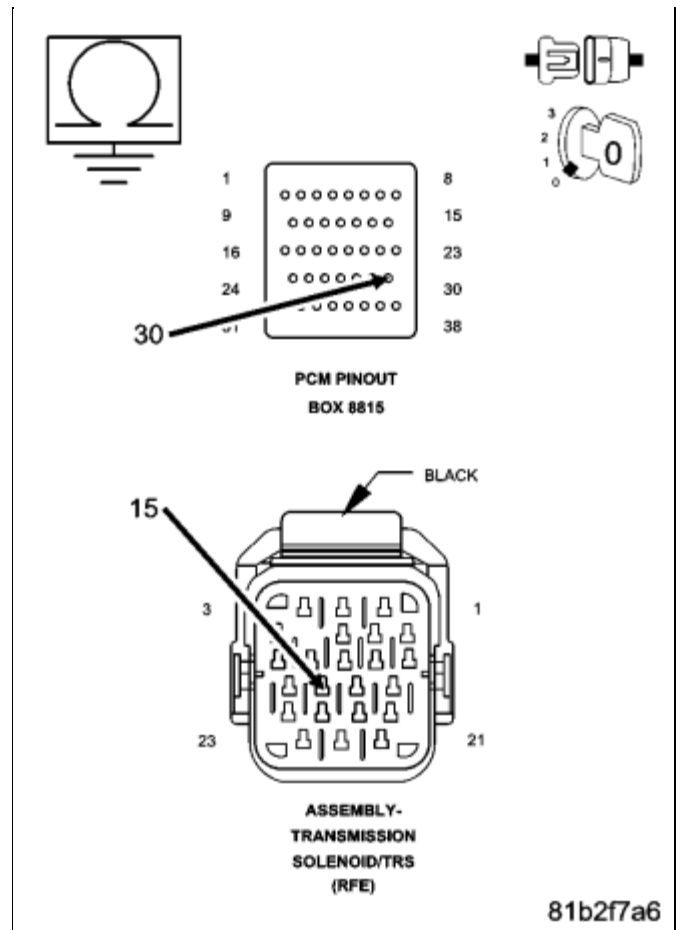
Yes

- Repair the (T147) 2C Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No



- Go To [14](#)



14. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all the other circuits in the Transmission Solenoid/TRS Assembly harness connector.

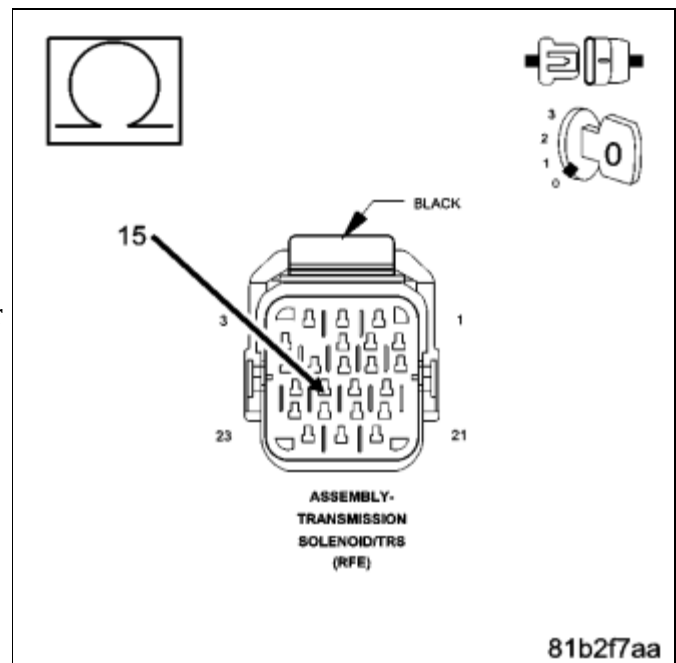
Is the resistance below 5.0 ohms?

Yes

- Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.



- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. CHECK IF THE #5 AND/OR #7 CHECK BALL IS CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Check for an extra check ball in the passage downstream from the #7 check ball pocket.

Inspect the 2C accumulator piston and seals and also the 2C tower seal on top of the valve body. Refer to the Service Information.

Where there any problems found?

Yes

- Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 2C clutch as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [16](#)

16. CHECK FOR EXCESSIVE FLUID LEAKAGE WITHIN THE 2C CLUTCH CIRCUIT

Air check the 2C Clutch hydraulic circuit. Refer to the Service Information.

NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.

Was there excessive air leakage in the 2C Clutch hydraulic circuit?

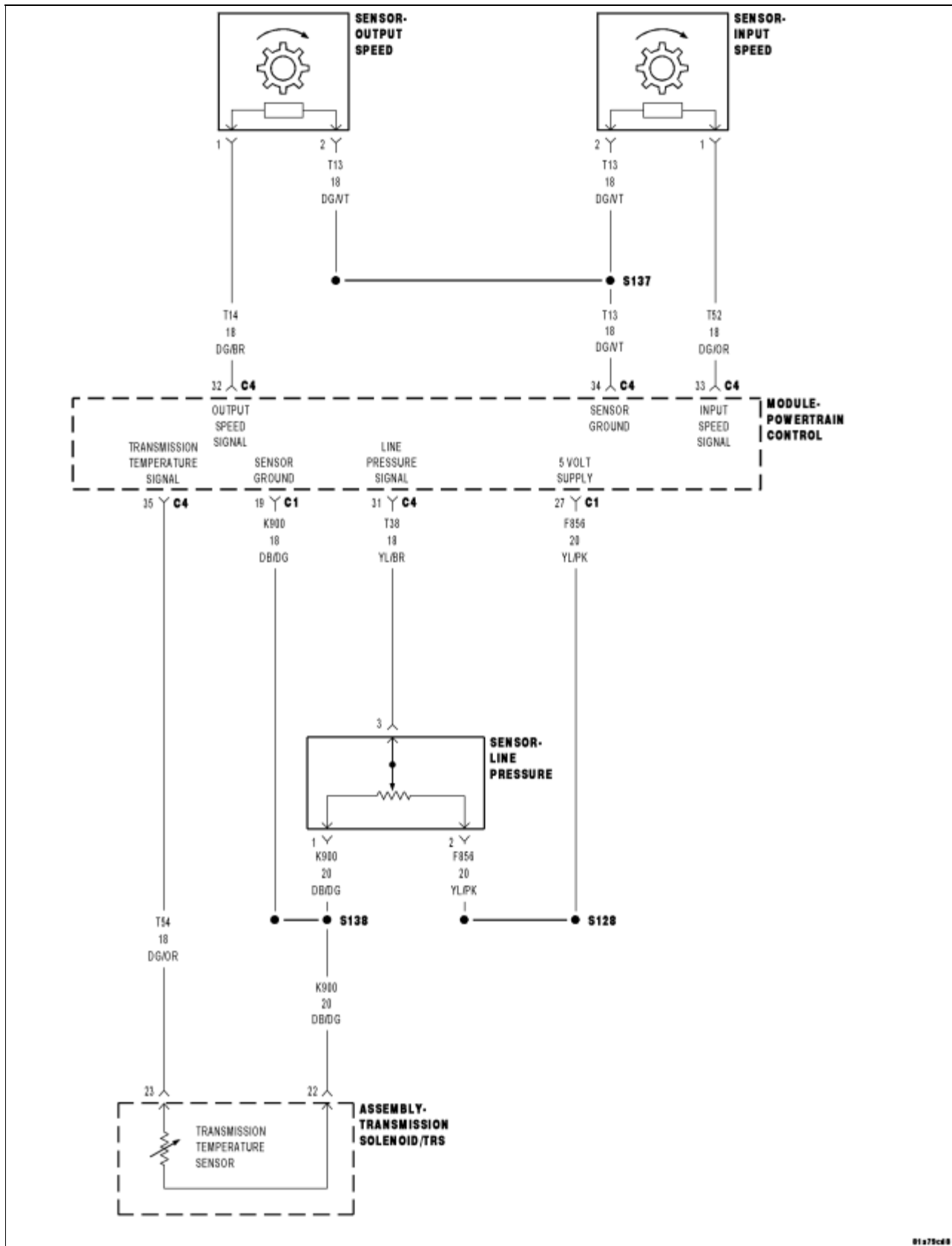
Yes

- Repair as necessary. Refer to the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0868-LINE PRESSURE LOW



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The actual line pressure is continuously being compared to the desired (target) line pressure. If the actual line pressure is consistently lower than the target while driving, the line pressure low DTC P0868 will set.

- **When Monitored:**

Continuously while driving in a forward gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure is more than 15 psi below Desired Line Pressure for 3.5 seconds continuously will cause this DTC to set.

Possible Causes
CHECK FOR RELATED DTCS
LOW FLUID LEVEL
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
POOR LINE PRESSURE SENSOR CONNECTION
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE
(T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT
INTERNAL TRANSMISSION
LINE PRESSURE SENSOR
CRACKED, PLUGGED, OR MIS-INSTALLED PRIMARY OIL FILTER
LOOSE COOLER RETURN SPIN ON FILTER (IF EQUIPPED)
STUCK OR STICKING MAIN REGULATOR VALVE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

Is the DTC P0932 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0868.

NOTE: This counter only applies to the last DTC set.

Is the START SINCE SET COUNTER 2 or less?

Yes

- Go To [3](#)

No

- Go To [11](#)

3. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running.**

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa (30 psi) or 0.7 volts and did not change)

- Go To [4](#)

4. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure during the following steps.
Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa (2.0 psi) of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa (2.0 psi) in all three positions?

Yes

- Go To [5](#)

No

- Go To [7](#)

5. CHECK THE LINE PRESSURE SENSOR

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors. Install the Line Pressure Adaptor, Miller tool #8259, and the Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa (0 to 300 psi).

Start the engine in park.

Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

Is the line pressure gauge reading within 34 kPa (5 psi) of the scan tool reading?

Yes

- Go To [6](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK FOR A PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and/or O-ring is not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?

Yes

- Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or O-ring. If the Primary Transmission Oil Filter is plugged refer to the Service Information for the proper Hydraulic repair procedure.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Repair internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Solenoid/TRS Assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Transmission Simulator, Miller tool #8333.
Reconnect all previously disconnected connectors except the Line Pressure Sensor harness connector.

Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit in the Line Pressure Sensor harness connector.

Is the voltage above 5.5 volts?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

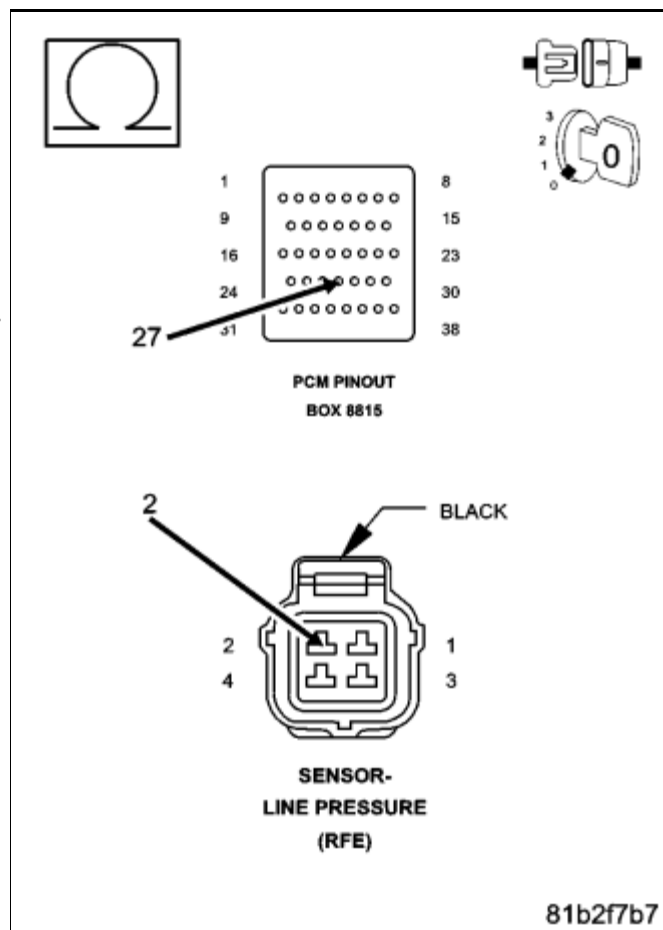
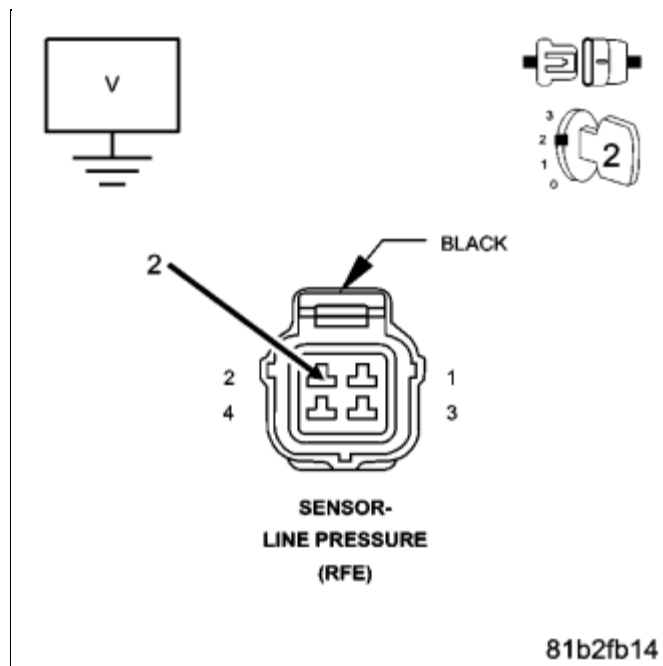
Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No



- Go To [9](#)

9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

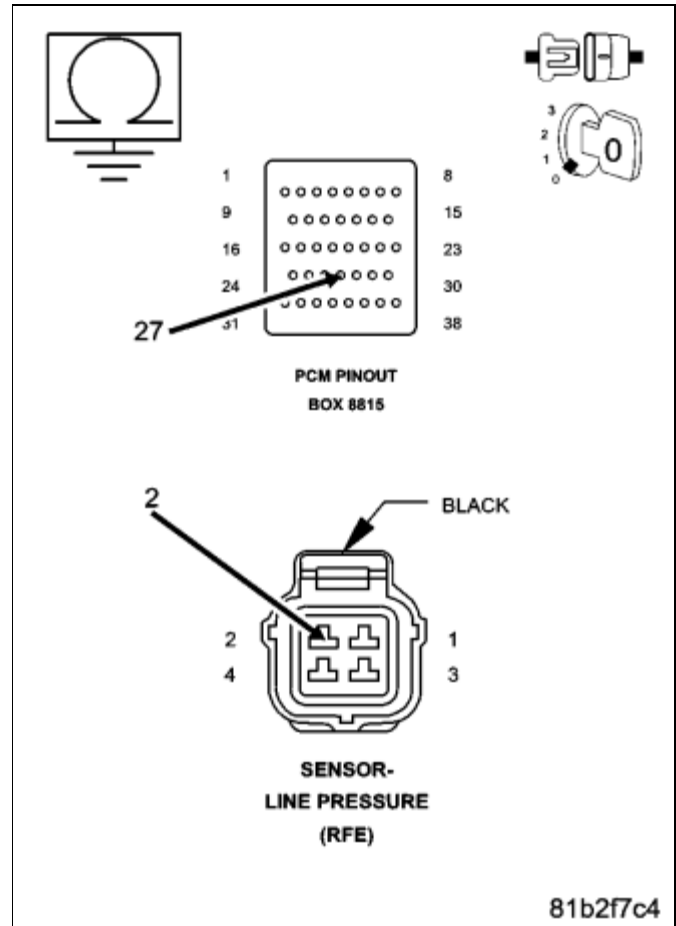
Is the resistance below 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

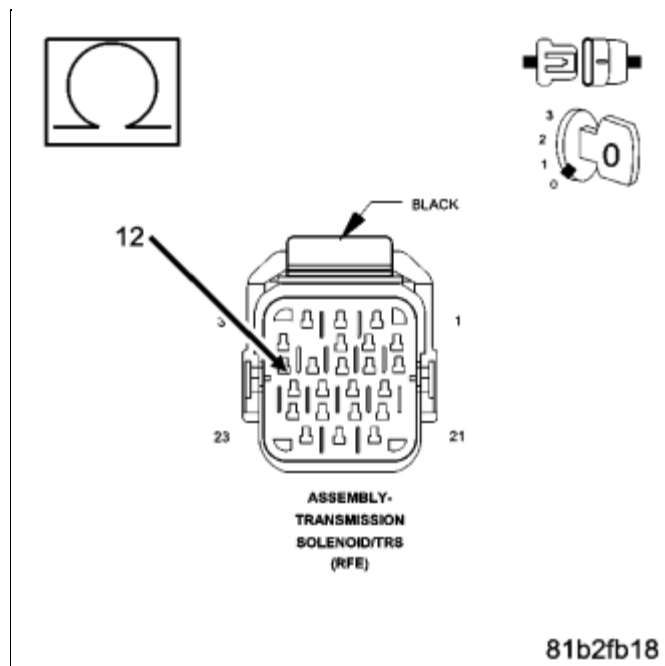
- Go To [10](#)



10. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Transmission Solenoid/TRS Assembly harness connector.
 Disconnect all PCM harness connectors.
 Measure the resistance between the (T118) Pressure Control Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T118) Pressure Control Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

**Yes**

- Repair the (T118) Pressure Control Solenoid Control circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

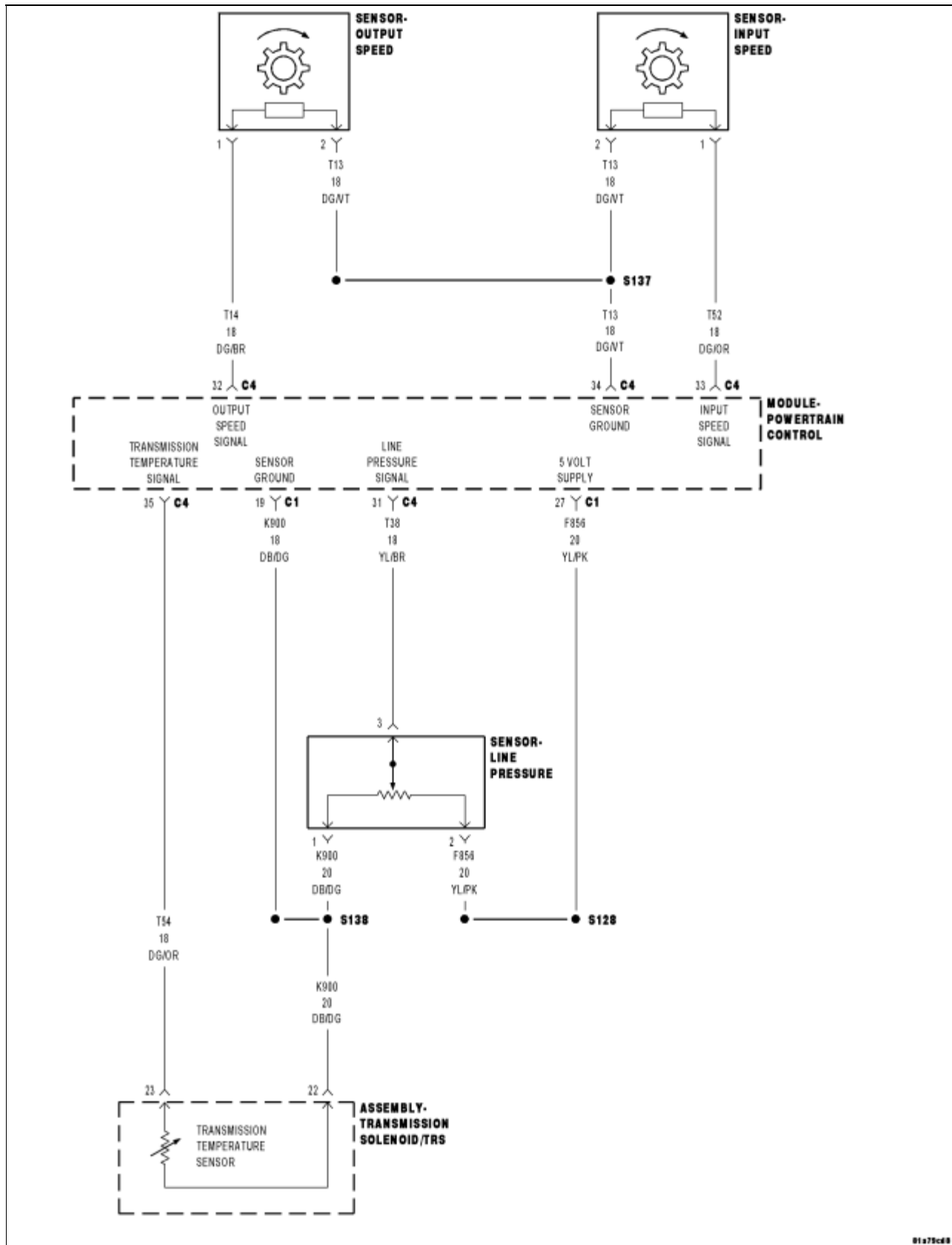
Where there any problems found?**Yes**

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0869-LINE PRESSURE HIGH



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The actual line pressure is continuously being compared to the desired (target) line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

- **When Monitored:**

Continuously while driving in a forward gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure. If the Actual Line Pressure reading is greater than the maximum desired line pressure ever used in the current gear, while the Pressure Control Solenoid duty cycle is at or near its maximum value (which should result in minimum line pressure) for 3.5 seconds continuously will cause this DTC to set.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
LINE PRESSURE SENSOR CONNECTION
(T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT
LINE PRESSURE SENSOR
STUCK OR STICKING MAIN REGULATOR VALVE
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTC'S

With the scan tool, check DTCs.

Is the DTC P0932 or P0882 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0869.

Is the STARTS SINCE SET COUNTER 2 or less?

Yes

- Go To [3](#)

No

- Go To [10](#)

3. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running**.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa

(30 psi) or 0.7 volts and did not change)

- Go To [4](#)

4. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure during the following step.
Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa (2.0 psi) or 0.1 volts of the reading specified on the Transmission Simulator.

Did the Line Pressure read within ± 14 kPa (2.0 psi) in all three positions?

Yes

- Go To [5](#)

No

- Go To [6](#)

5. CHECK THE LINE PRESSURE SENSOR CALIBRATION

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.
Install the Line Pressure Adaptor, Miller tool #8259, and Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa (0 to 300 psi).
Start the engine in park.
Monitor the Line Pressure readings on the scan tool and the pressure gauge.
Compare the Line Pressure readings between the scan tool and the pressure gauge.

Is the pressure gauge reading within 34 kPa (5 psi) of the scan tool reading?

Yes

- Repair the internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly, possible cause is a stuck Pressure Control Solenoid.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Line Pressure Sensor per the Service information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the Powertrain Control Module C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T118) Pressure Control Solenoid Control circuit between the Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

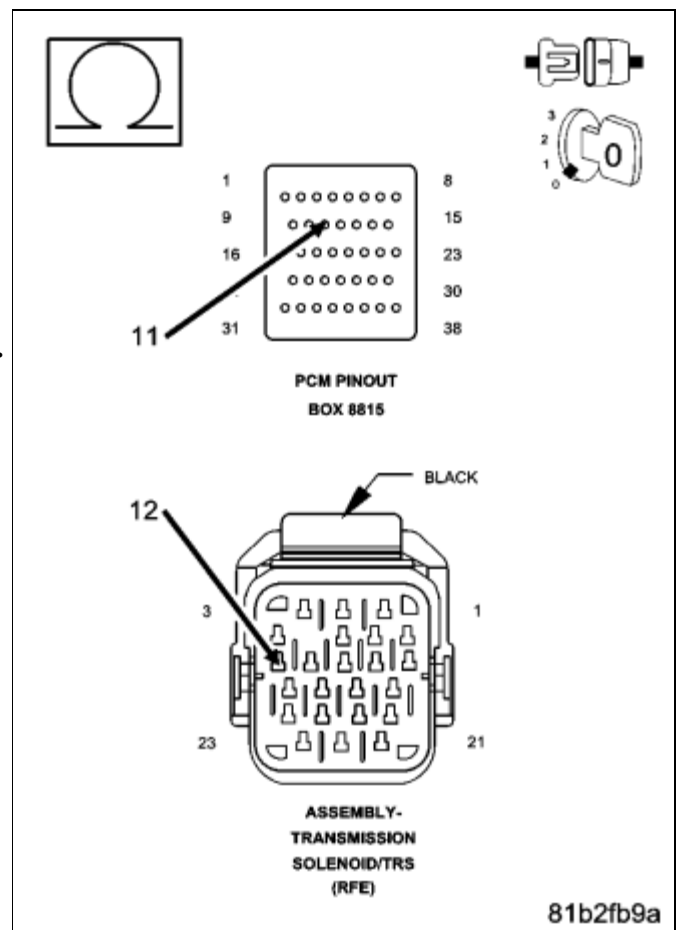
Yes

- Repair the (T118) Pressure Control Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [7](#)

7. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND



Measure the resistance between ground and the (T118) Pressure Control Solenoid Control circuit.

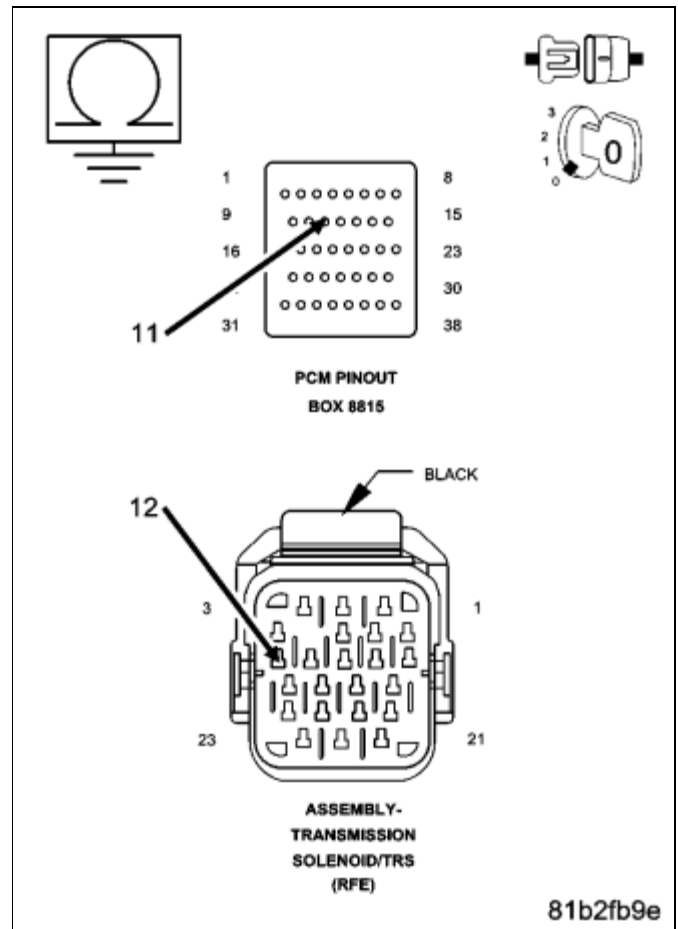
Is the resistance below 5.0 ohms?

Yes

- Repair the (T118) Pressure Control Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)



8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

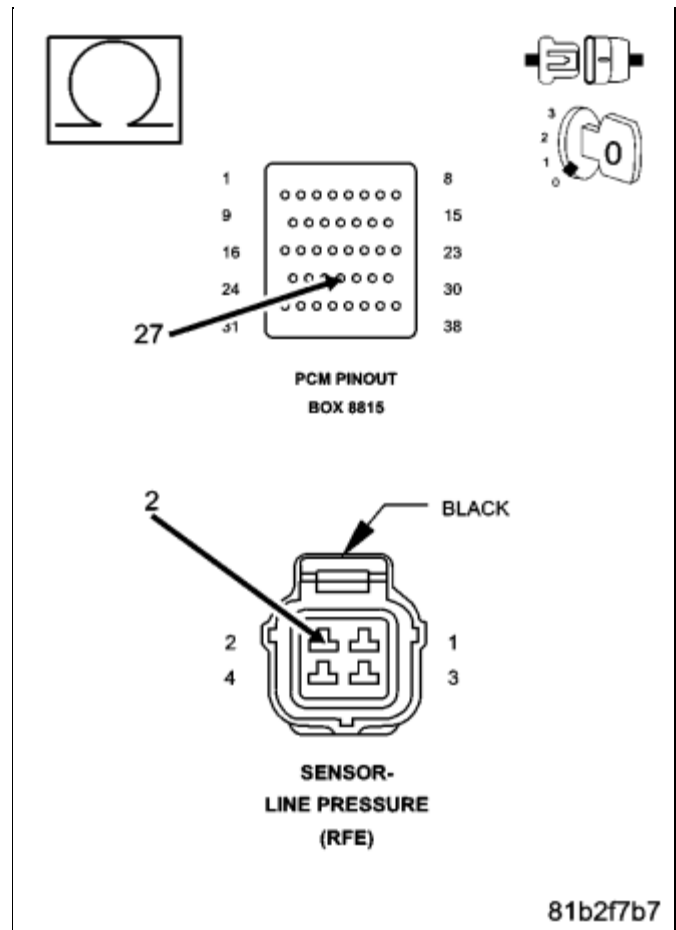
Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)



9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the PCM C1 harness connector.
Disconnect the Line Pressure Sensor harness connector.

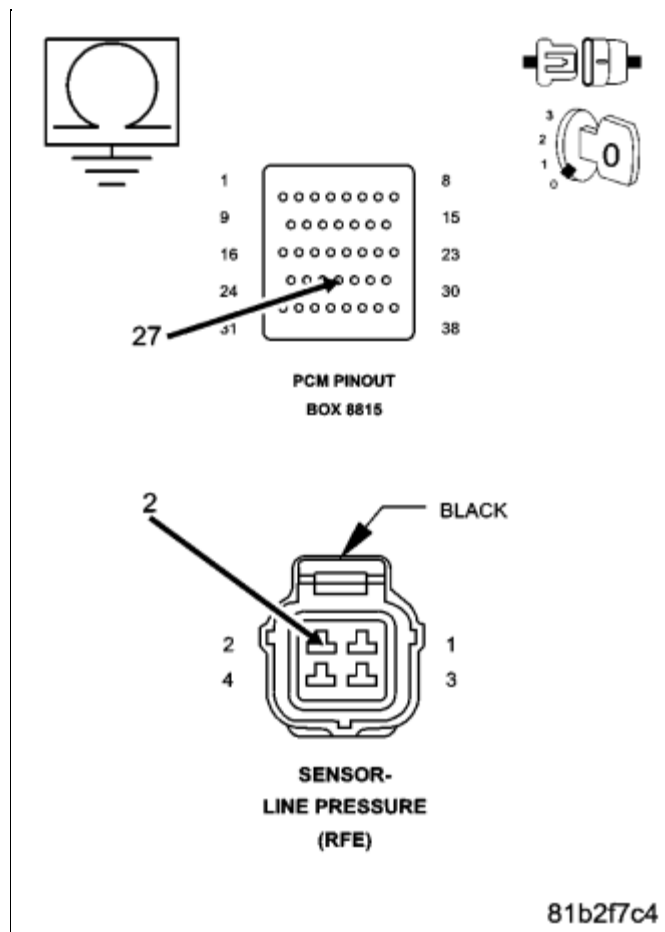
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No**

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

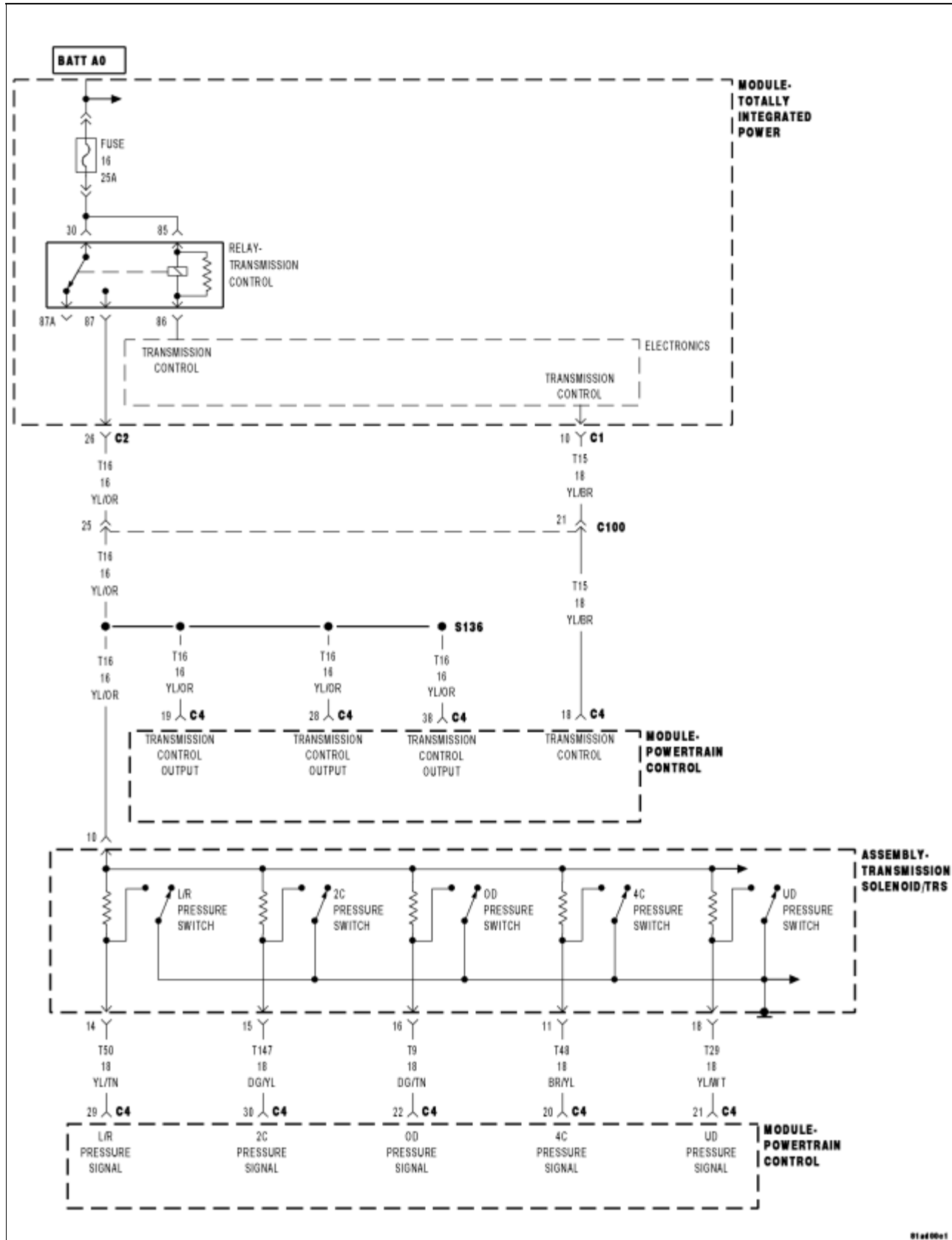
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0870-OD HYDRAULIC PRESSURE TEST



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed above 1000 rpm, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTCS PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
TRANSMISSION CONTROL RELAY DTCS PRESENT
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, check DTCs.

Is there any Loss of Prime, TCM Power Input, Line Pressure Sensor and/or TIPM TCM Power Control Circuit DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.

No

- Go To [2](#)

2. CHECK IF THE DTC P0760 IS PRESENT

With the scan tool, check DTCs.

Is the DTC P0760 also present?

Yes

- Refer to the symptom list and perform diagnostics for P0760-OD SOLENOID CIRCUIT.

No

- Go To [3](#)

3. CHECK IF OTHER DTCS ARE PRESENT

With the scan tool, check DTCs.

Are any of the DTCs, P0733, P0734 ,P0735 and/or P0871 present also?

Yes

- Go To [12](#)

No

- Go To [4](#)

4. CHECK TO SEE IF DTC P0870 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0870.

Is the STARTS SINCE SET COUNTER 2 or less?

Yes

- Go To [5](#)

No

- Go To [15](#)

5. CHECK IF THE LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C (180° F).

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa (85 and 95 psi) in each position?

Yes

- Go To [6](#)

No

- Go To [10](#)

6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running**.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as

necessary.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa (30 psi) or 0.7 volts and did not change)

- Go To [7](#)

7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa (2.0 psi) of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect Transmission Simulator.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

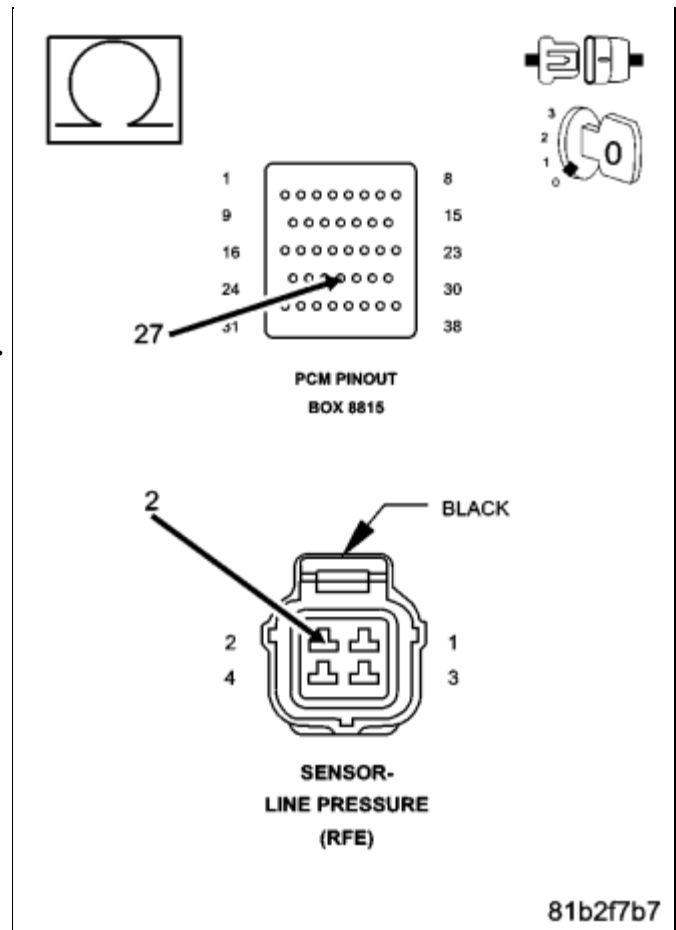
Is the resistance below 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

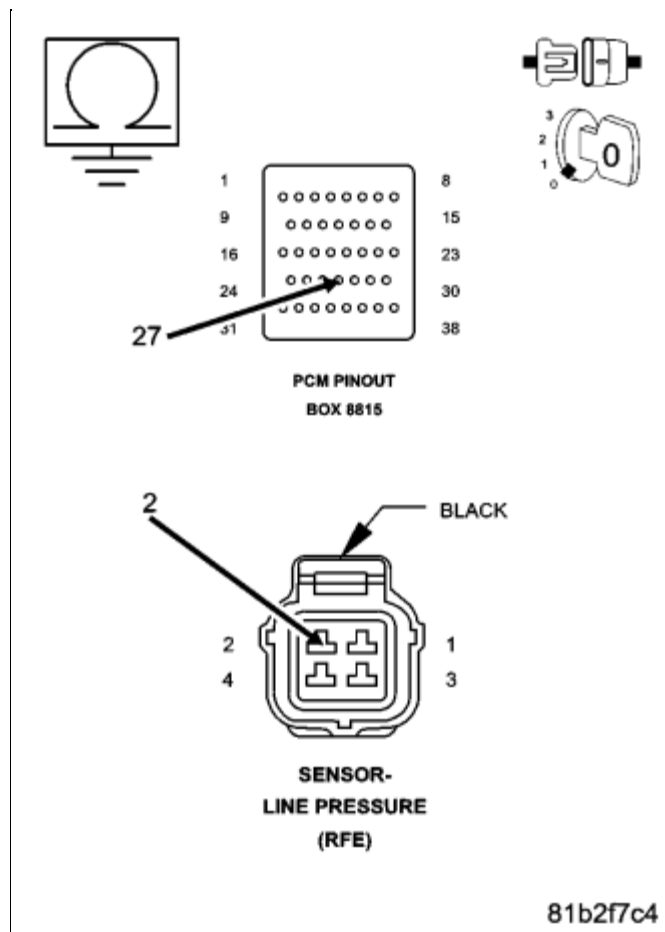
- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention



81b2f7b7

to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



10. COMPARE THE SCAN TOOL TO THE PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the rpm to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the rpm to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the rpm to 1500, and compare the line pressure readings.

Did the scan tool Line Pressure readings match the Pressure Gauge readings $\pm$ 10 psi?

Yes

- Go To [11](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. CHECK THE WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to OD.

Ignition on, engine not running.

With the scan tool, monitor the OD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the OD Pressure Switch.

Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Go To [12](#)

No

- Go To [14](#)

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes

- Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. CHECK THE OD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the OD hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The OD hydraulic clutch circuit contains a small bleed orifice which connects to the Reverse hydraulic clutch circuit. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes

- Repair as necessary. Check the OD/Rev clutch piston seals, bleed orifice assembly, reaction shaft support seal rings, and machining of the main mating faces on the pump housing, pump valve body, and reaction shaft support.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

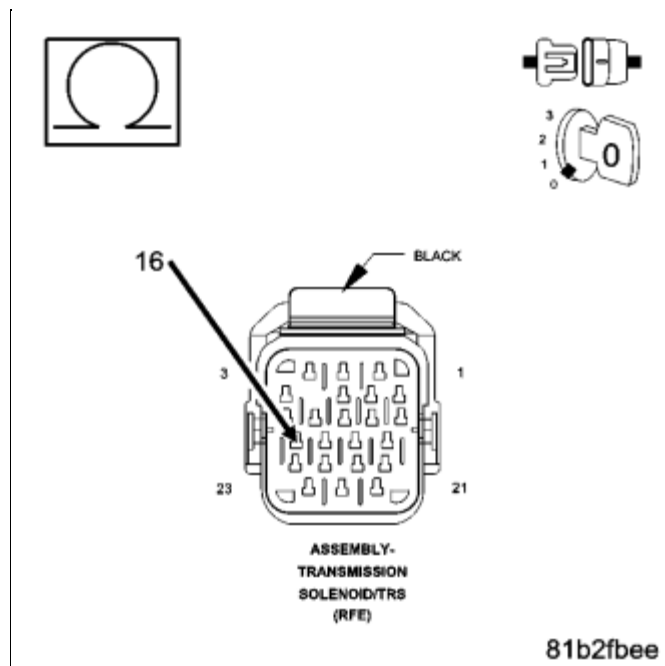
- Disassemble and inspect the Valve Body and repair as necessary. Inspect the OD Accumulator piston and seals. Check for an extra check ball downstream from the #6 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

14. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.



Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T9) OD Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0870 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

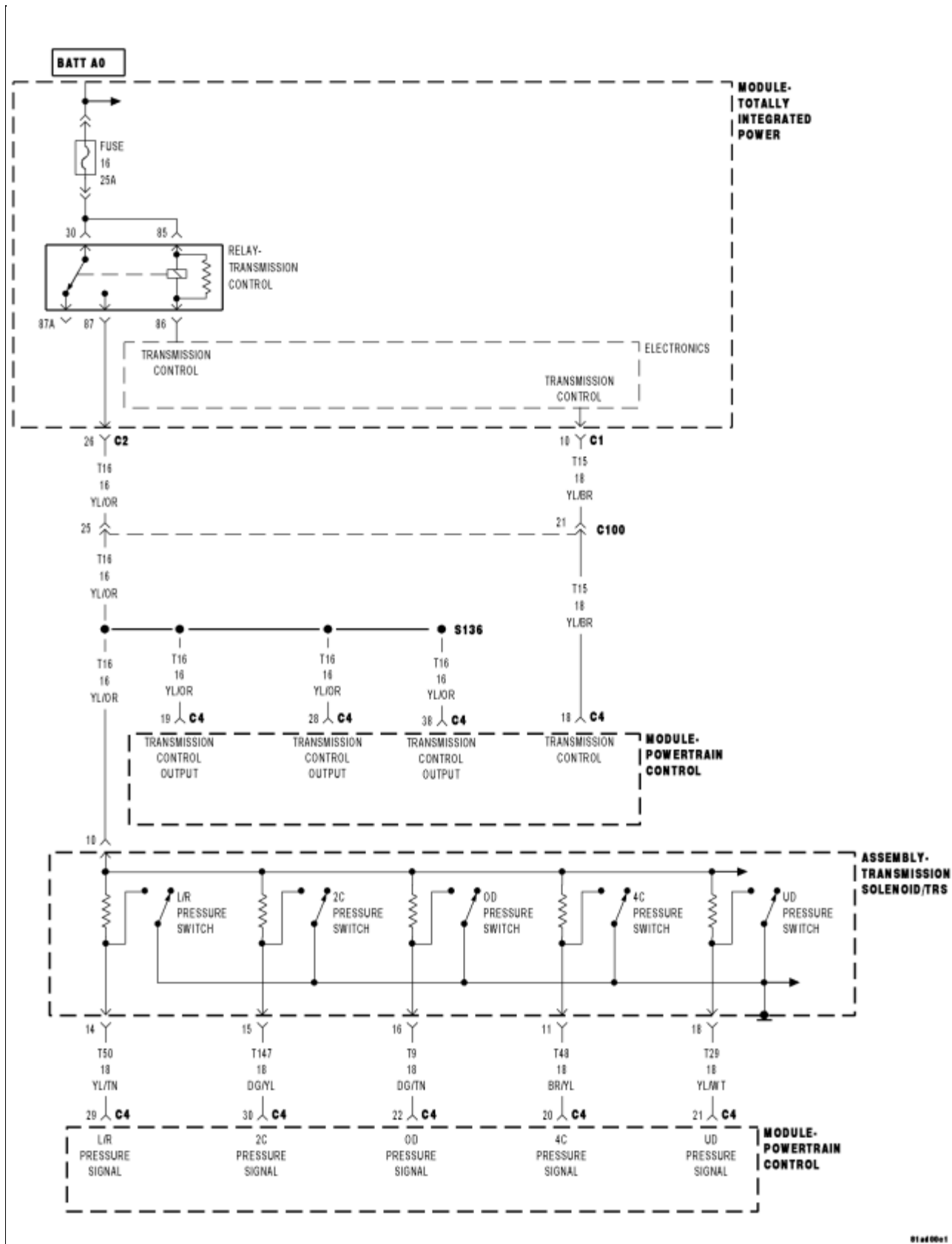
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0871-OD PRESSURE SWITCH RATIONALITY



01ad00a1

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

The appropriate DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear.

Possible Causes
RELATED TCM POWER INPUT DTCS PRESENT
LINE PRESSURE DTCS PRESENT
NO. 4 OR 6 CHECK BALL CUT OR DAMAGED
(T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
LOW LINE PRESSURE
WIRING AND CONNECTORS
CUT OD/REV PISTON SEAL
BROKEN OR MISSING OD/REV PISTON BLEED ORIFICE
BROKEN REACTION SHAFT SUPPORT SEAL RING
POOR MACHINING ON PUMP VALVE BODY FACE
BROKEN OR MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT
TRANSMISSION SOLENOID/TRS ASSEMBLY
CUT OD ACCUMULATOR PISTON SEAL
CRACKED OD ACCUMULATOR PISTON
BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY

POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2nd PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3TH	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.					
**May be open when rolling in Neutral or at low oil temperatures.					

Diagnostic Test

1. CHECK DTCS

With the scan tool, read DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK IF LINE PRESSURE DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

Are there any Line Pressure DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [3](#)

3. CHECK FOR OTHER PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCs.

Are there two or more other pressure switch rationality DTCs present in addition to P0871?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. CHECK IF DTC IS CURRENT

With the scan tool, read and record the DTC EVENT DATA.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA show data for P0871

Yes

- Go To [8](#)

No

- Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

CHECK IF RELATED DTC IS PRESENT

5.

With the scan tool, read and record the DTC EVENT DATA.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the DTC EVENT DATA?

Yes

- Refer to the Transmission category and perform diagnostics for P0882. Follow instructions as if the DTC is current. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

No

- Go To [6](#)

6. CHECK IF PRESSURE SWITCHES READ OPEN

In the DTC EVENT DATA recorded earlier, read the state of all pressure switches.

Do all the pressure switches read open?

Yes

- Go To [7](#)

No

- Go To [8](#)

7. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure to the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter weal for a spit, crack , or improperly installed. If the filer and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

8. CHECK IF IN PARK, NEUTRAL, OR REVERSE

Ignition on, engine not running.

With the scan tool, read and record the DTC EVENT DATA for P0871.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA show the OD Pressure Switch DTC set while in Park, Neutral, or Reverse?

Yes

- Go To [18](#)

No

- Go To [9](#)

9. CHECK IF THE OD PRESSURE SWITCH WAS OPEN

Refer to the DTC EVENT DATA recorded earlier for P0871.

Did the OD Pressure Switch read OPEN?

Yes

- Go To [10](#)

No

- Go To [15](#)

10. CHECK FOR LOW LINE PRESSURE

Refer to the DTC EVENT DATA recorded earlier and compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

Repair as necessary to correct low line pressure. Check the fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and filter are OK, check the Main Regulator Valve in the Oil Pump.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [11](#)

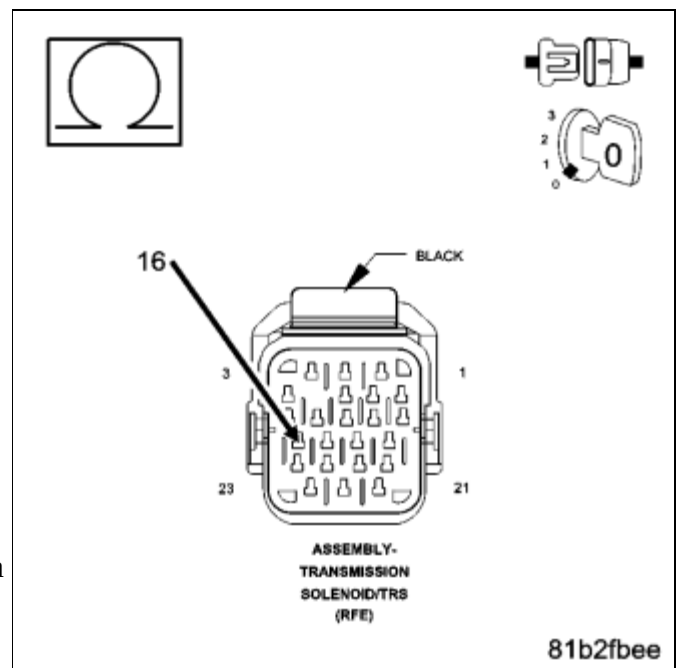
11. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.
Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T9) OD Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [12](#)

12. CHECK TO SEE IF THE DTC RESETS

Reconnect all previously disconnected connectors.

With the scan too, erase transmission DTCs.

Test drive the vehicle, use the DTC EVENT DATA recorded earlier to help duplicate the conditions when the DTC originality set.

Does the DTC P0871 reset?

Yes

- Go To [13](#)

No

- Go To [22](#)

13. CHECK THE POWERTRAIN CONTROL MODULE

Remove the Transmission Control Relay.

Operate the vehicle in Drive.

Is the transmission slipping while in Drive?

Yes

- Go To [14](#)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

14. AIR CHECK TRANSMISSION CLUTCH OPERATION

Perform an Air Check Transmission Clutch Operation procedure per the Service Information.

NOTE: The OD/Rev piston contains a small bleed orifice, a small amount of leakage between the OD and Reverse hydraulic clutch circuits is considered normal.

Is there excessive air leakage in any clutch circuit?

Yes

- Check the OD/Rev piston seals and bleed orifice, reaction shaft support seal rings, dribbler orifice assemblies in the reaction shaft support and for poor machine on the pump valve body faces. Refer to the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Repair the Valve Body. Check the OD Accumulator piston and seals, OD bleed orifice, and No.6 check ball cuts or damage. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

15. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the OD Pressure Switch change from OPEN to CLOSED while pressing the Test button?

Yes

- Go To [16](#)

No

- Go To [18](#)

16. CHECK IF THE NO. 4 AND/OR NO. 6 CHECK BALL IS CUT OR DAMAGED

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the DTC EVENT DATA to help duplicate the conditions when the DTC originality set. Note any DTCs that may set.

Remove the Transmission Valve Body per the Service Information.

Check the No. 4 and No. 6 Check Balls for cuts or damage.

Is the No. 4 and/or No. 6 Check Ball cut or damaged?

Yes

- Replace the No. 4 and/or No. 6 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the OD Clutch Assembly. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [17](#)

17. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Did the DTC P0871 reset during the test drive in the previous step?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [22](#)

18. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.
Disconnect the Transmission Solenoid /TRS Assembly harness connector

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of Miller tool #8815 to the Solenoid/TRS Assembly harness connector.

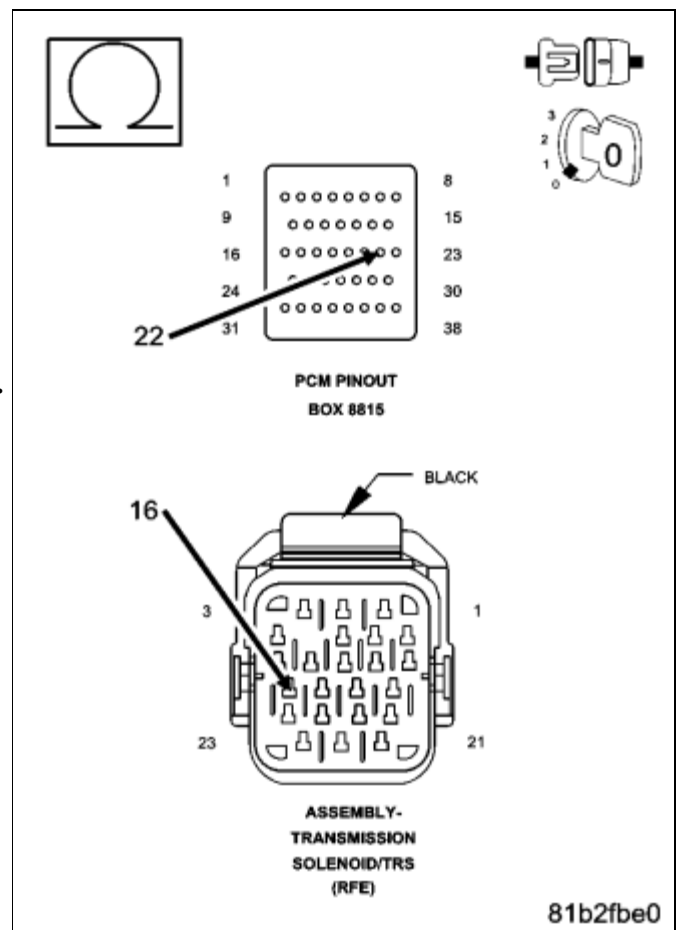
Is the resistance above 5.0 ohms?

Yes

- Repair the (T9) OD Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [19](#)



19. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

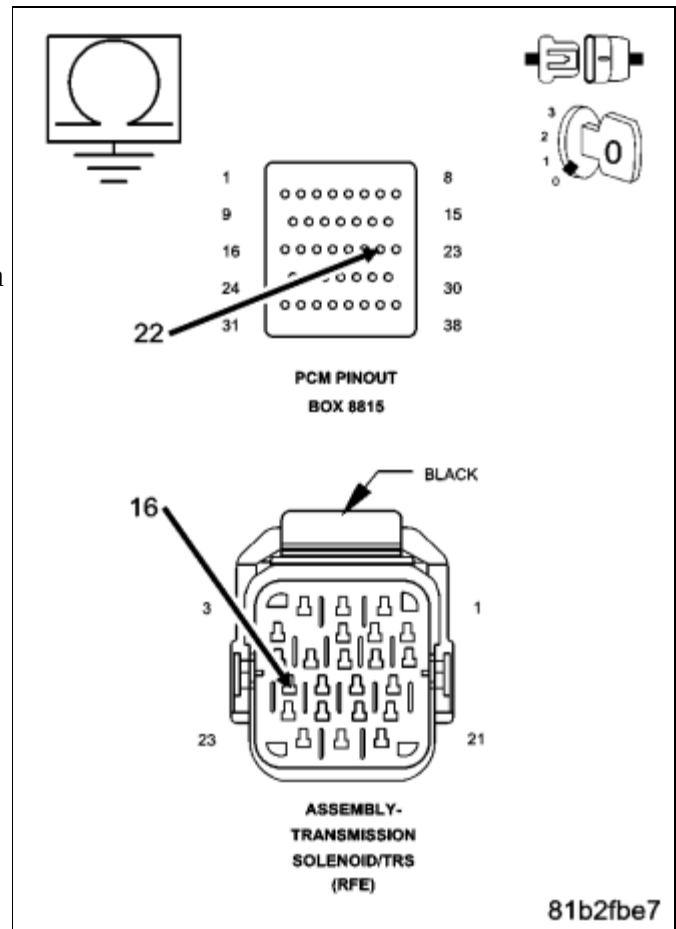
Is the resistance below 5.0 ohms?

Yes

- Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [20](#)



20. CHECK WIRING AND CONNECTORS

Using the schematics as a guide, inspect the wiring and connectors. Pay particular attention to all power and ground circuits.

Were there any problems found

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [21](#)

21. CHECK THE POWERTRAIN CONTROL MODULE

Reconnect all previously disconnected connectors.

Make sure all DTC EVENT DATA is recorded.

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the DTC EVENT DATA to help duplicate the conditions when the DTC originality set.

Does the DTC P0871 reset?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [22](#)

22. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

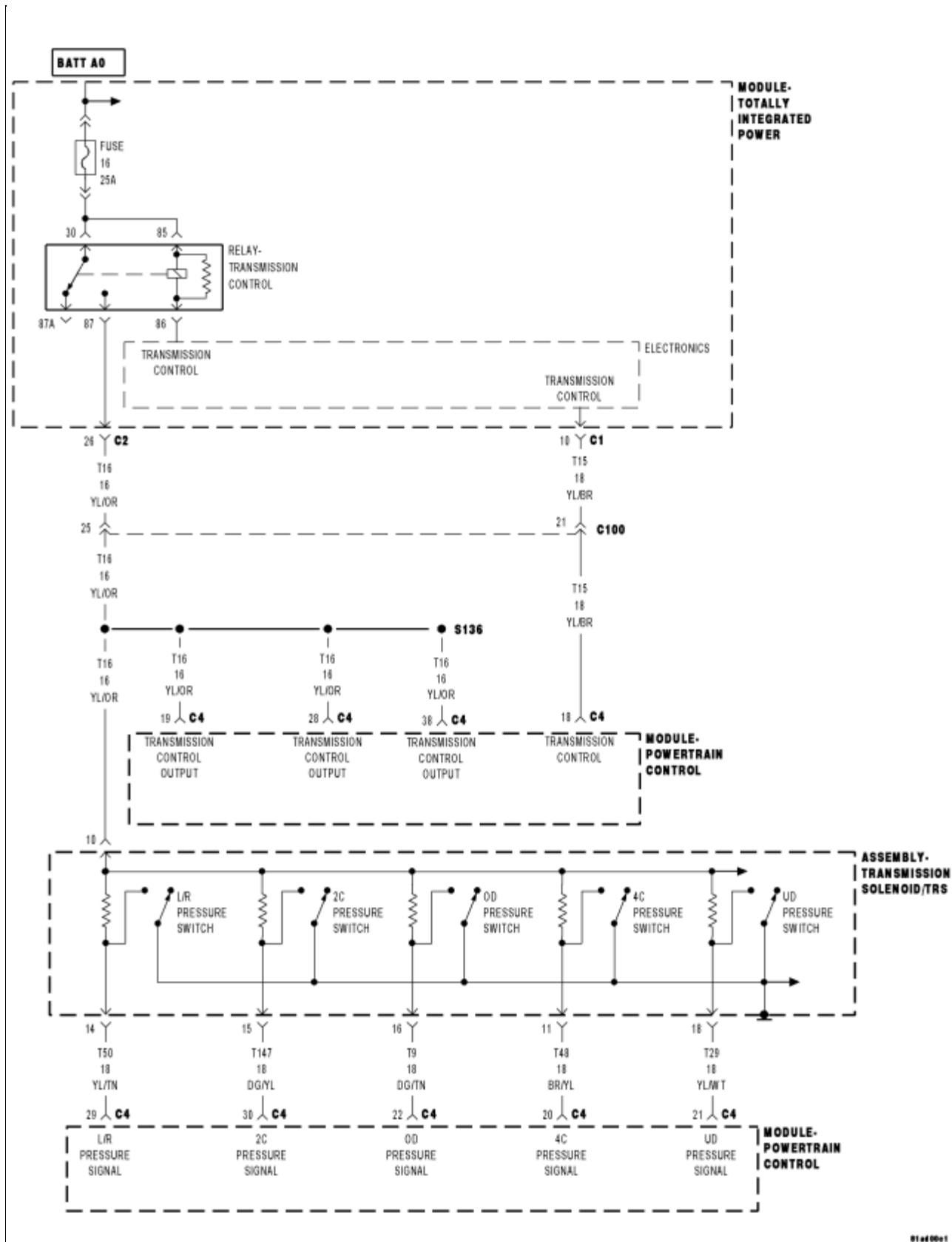
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0875-UD HYDRAULIC PRESSURE TEST



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine .

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed above 1000 rpm, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
RELATED DTCS PRESENT
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
TRANSMISSION CONTROL RELAY DTCS PRESENT
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, check DTCs.

Is there any Loss of Prime, TCM Power Input, TIPM TCM Power Control Circuit and/or Line Pressure Sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.

No

- Go To [2](#)

2. CHECK IF THE DTC P0765 IS PRESENT

With the scan tool, check DTCs.

Is the DTC P0765 also present?

Yes

- Refer to the Transmission category and perform diagnostics for the symptom P0765-UD SOLENOID CIRCUIT.

No

- Go To [3](#)

3. CHECK IF OTHER DTCS ARE PRESENT

With the scan tool, check DTCs.

Are any of the DTCs, P0731, P0732, P0733, P1736, and/or P0876 present also?

Yes

Go To [12](#)

No

- Go To [4](#)

4. CHECK TO SEE IF DTC P0875 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0875.

Is the STARTS SINCE SET COUNTER 2 or less?

Yes

- Go To [5](#)

No

- Go To [17](#)

5. CHECK IF THE LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 psi in each position?

Yes

- Go To [6](#)

No

- Go To [10](#)

6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running**.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa (30 psi) or 0.7 volts and did not change)

- Go To [7](#)

7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect Transmission Simulator.
 Disconnect the PCM C1 harness connector and connect
 Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)

9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

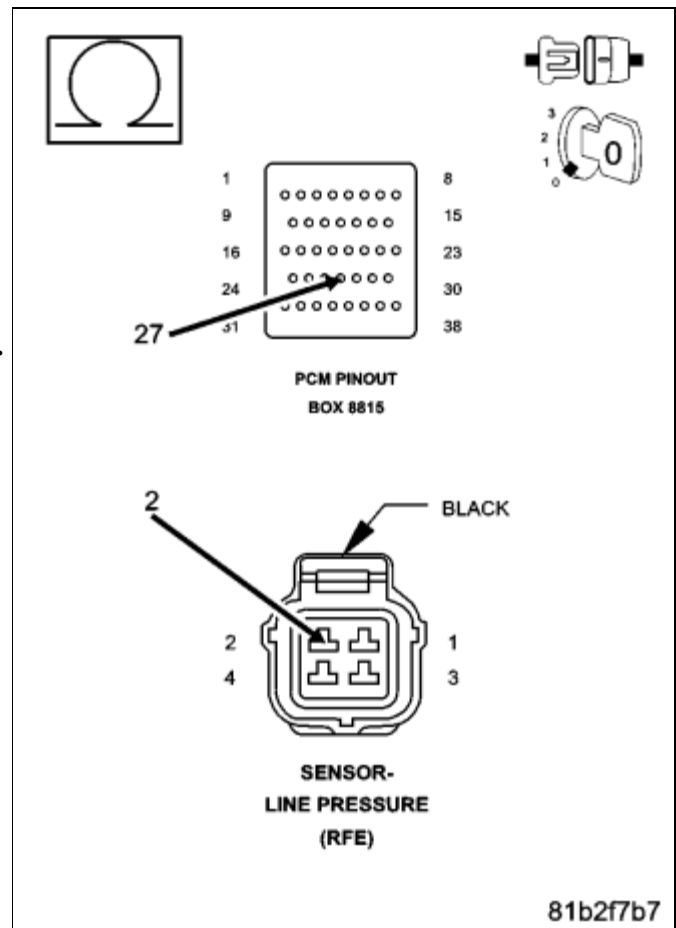
Is the resistance below 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

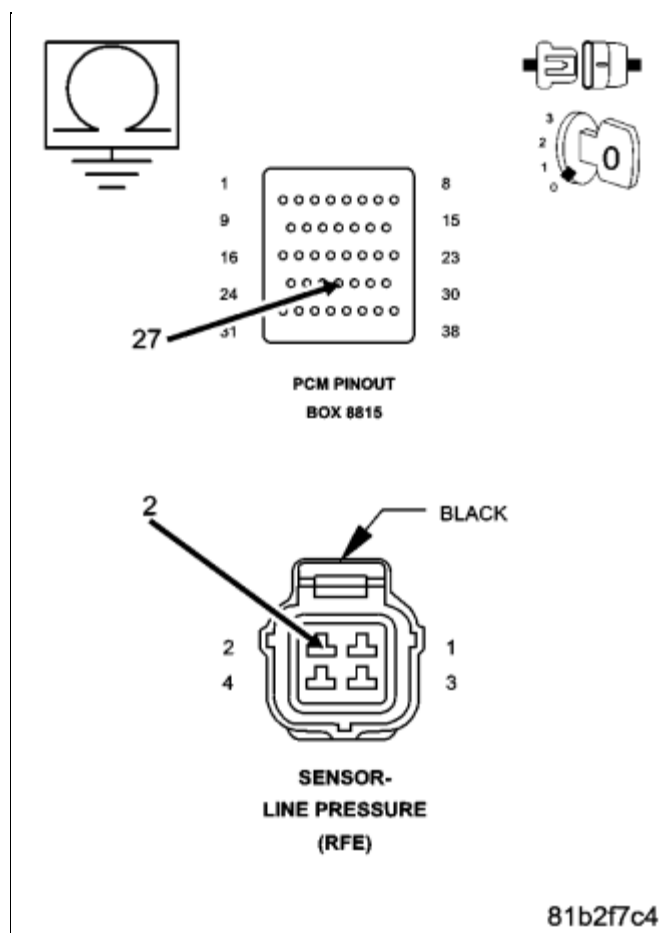
No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion,



damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



10. COMPARE THE SCAN TOOL READING TO PRESSURE GAUGE READING

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the rpm to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the rpm to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the rpm to 1500, and compare the line pressure readings.

Did the scan tool Line Pressure readings match the Pressure Gauge readings $\pm$ 10 psi?

Yes

- Go To [11](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. CHECK THE WIRING AND CONNECTORS

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.
Install the Transmission Simulator, Miller tool #8333.
On the Transmission Simulator, turn the Pressure Switch selector switch to UD.
Ignition on, engine not running.
With the scan tool, monitor the UD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the UD Pressure Switch.

Did the UD Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Go To [12](#)

No

- Go To [14](#)

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.
Remove the Transmission Simulator, Miller tool #8333.
Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes

- Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)

13. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The UD hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes

- Repair as necessary. Check the UD clutch piston, piston seals and bleed orifice, reaction shaft support seal rings, and machining of the main mating faces of the pump housing, pump valve body, and reaction shaft support.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Disassemble and inspect the Valve Body and repair as necessary. Inspect the UD Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

14. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Remove the Transmission Simulator, Miller tool #8333.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Measure the resistance of the (T29) UD Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

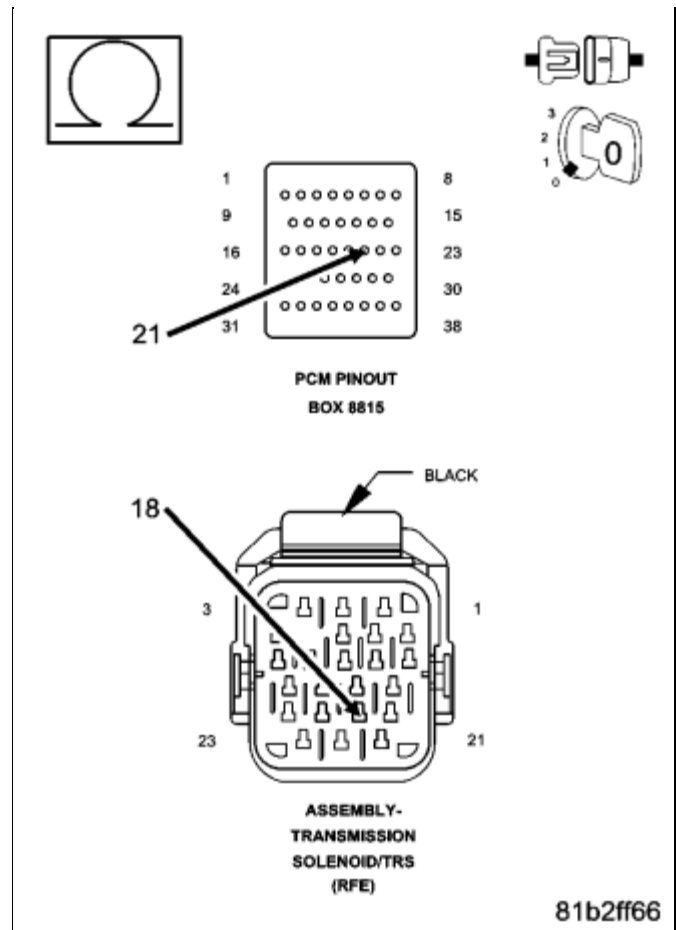
- Repair the (T29) UD Pressure Switch Sense circuit for

an open.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [15](#)



15. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.

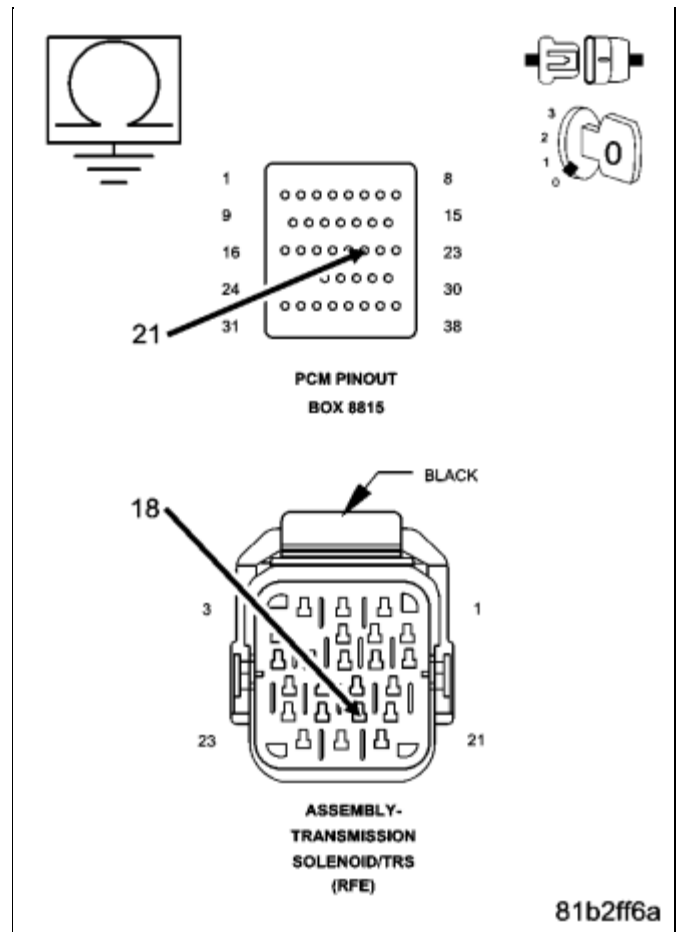
Is the resistance below 5.0 ohms?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [16](#)



16. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

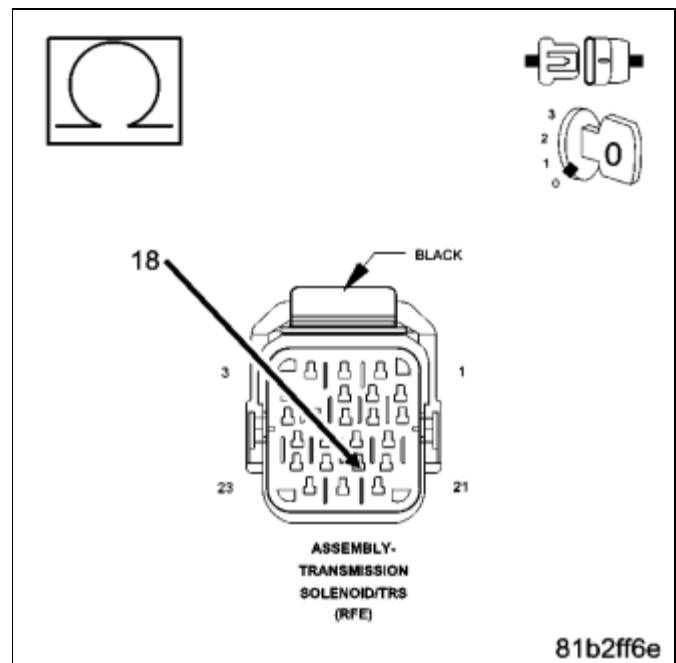
NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -



TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0875 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

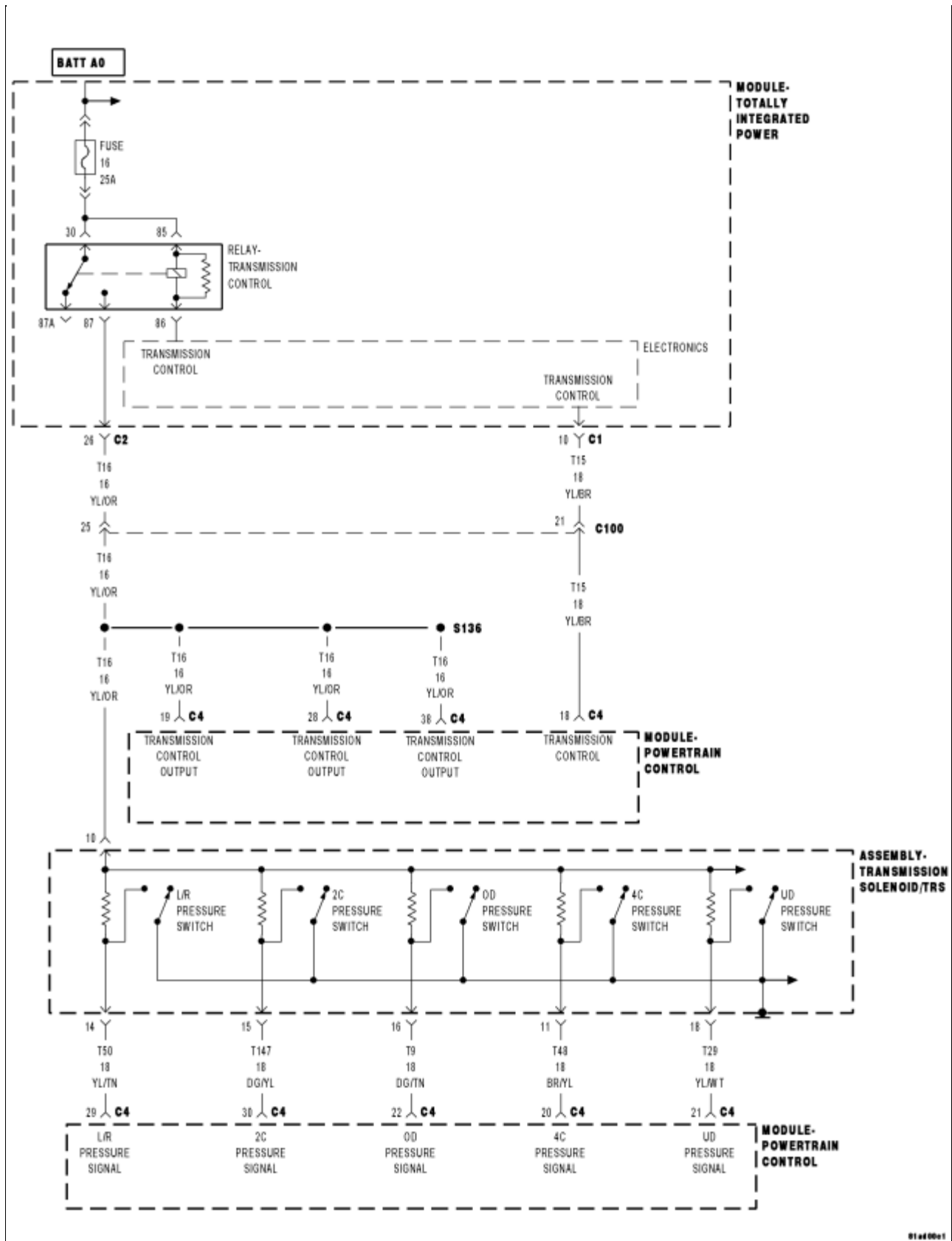
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0876-UD PRESSURE SWITCH RATIONALITY



01ad00e1

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC is set if the UD pressure switch is in the wrong state for the current gear. For example, this code would be set if the UD pressure switch remained off while the transmission was in second gear.

Possible Causes
RELATED DTCS PRESENT
LOW FLUID LEVEL
NO. 2 CHECK BALL CUT OR DAMAGED
LOW LINE PRESSURE
CRACKED OR MIS-INSTALLED SUMP FILTER OR SEAL
LOOSE COOLER RETURN SPIN ON FILTER (IF EQUIPPED)
STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY
(T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN
(T29) UD PRESSURE SWITCH CIRCUIT SHORT TO GROUND
(T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUITS
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN

P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN
1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2nd PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3TH	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.					
**May be open when rolling in Neutral or at low oil temperatures.					

Diagnostic Test

1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, check DTCs.

Are there any TCM Power Input, TIPM TCM Power Control Circuit, Line Pressure, and/or Loss of Prime DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If a Loss of Prime DTC is present, perform its respective test first.

No

- Go To [2](#)

2. CHECK FOR PRESSURE SWITCH DTCS

Are there two or more other pressure switch rationality DTCs present in addition to P0876?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. CHECK IF ALL PRESSURE SWITCHES READ CLOSED

With the scan tool, read and record all DTC EVENT DATA.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA show all pressure switches reading CLOSED?

Yes

- Refer to the Transmission category and perform the diagnostics for P0882. Diagnose the symptom as if the DTC is current.

No

- Go To [4](#)

4. CHECK FOR OTHER DTCS

With the scan tool, check DTCs.

Is the DTC P2704 present also?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)

5. CHECK THE DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.

Does the DTC EVENT DATA display information for the DTC P0876?**Yes**

- Go To [6](#)

No

- Refer to the Transmission category and perform the diagnostics for the DTC listed in the DTC EVENT DATA. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

6. CHECK IF DTC EVENT DATA WAS SET IN PARK, NEUTRAL OR REVERSE

Refer to the DTC EVENT DATA recorded earlier.

Did the DTC P0876 set in Park, Neutral, or Reverse?**Yes**

- Go To [10](#)

No

- Go To [7](#)

7. CHECK THE UD PRESSURE SWITCH STATUS

Refer to the DTC EVENT DATA recorded earlier.

Did the DTC P0876 set with the UD Pressure Switch closed?**Yes**

- Go To [10](#)

No

- Go To [8](#)

8. CHECK THE LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**Yes**

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are

OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [9](#)

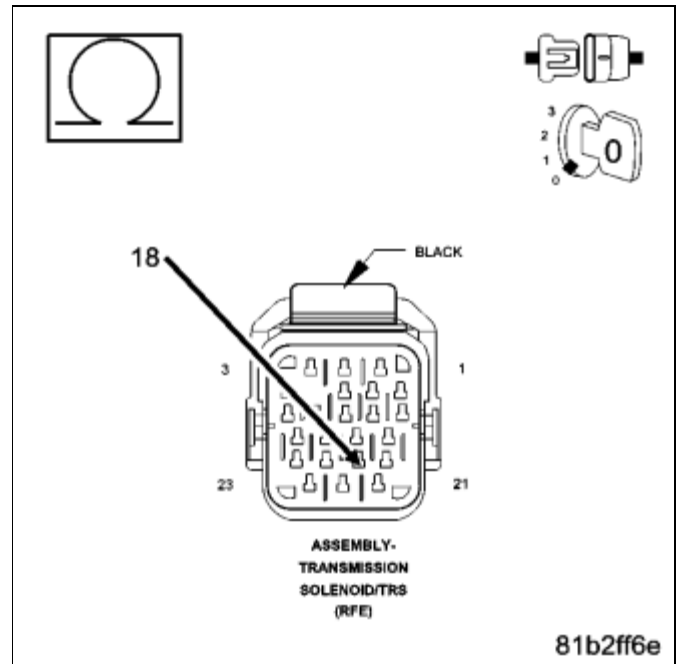
9. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.
Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

10. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the UD position.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Go To [14](#)

No

- Go To [11](#)

11. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

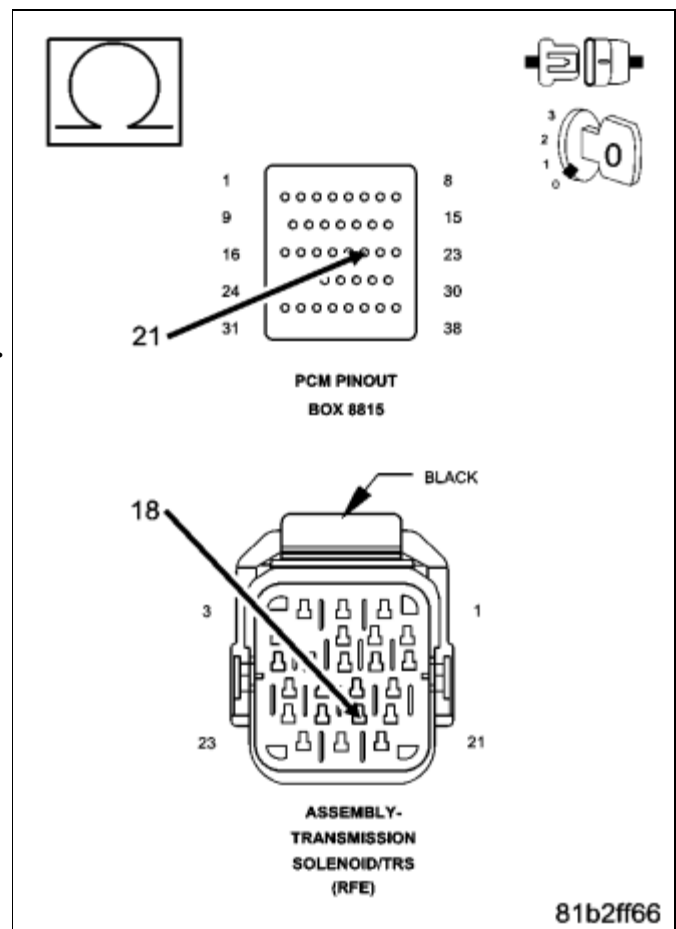
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T29) UD Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of the Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [12](#)

12. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.

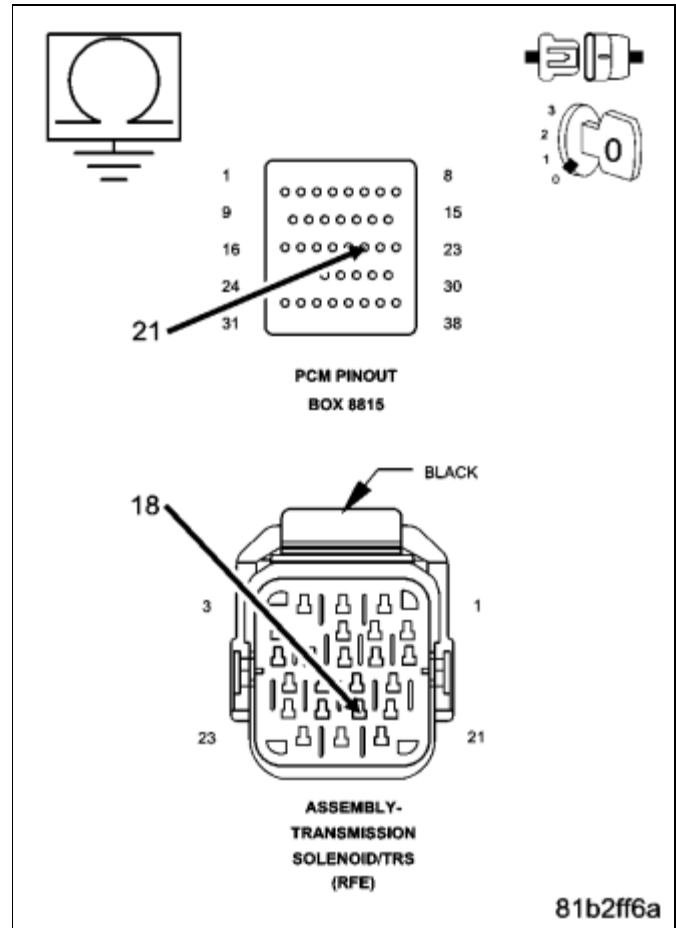
Is the resistance below 5.0 ohms?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [13](#)



13. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect all PCM harness connectors.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

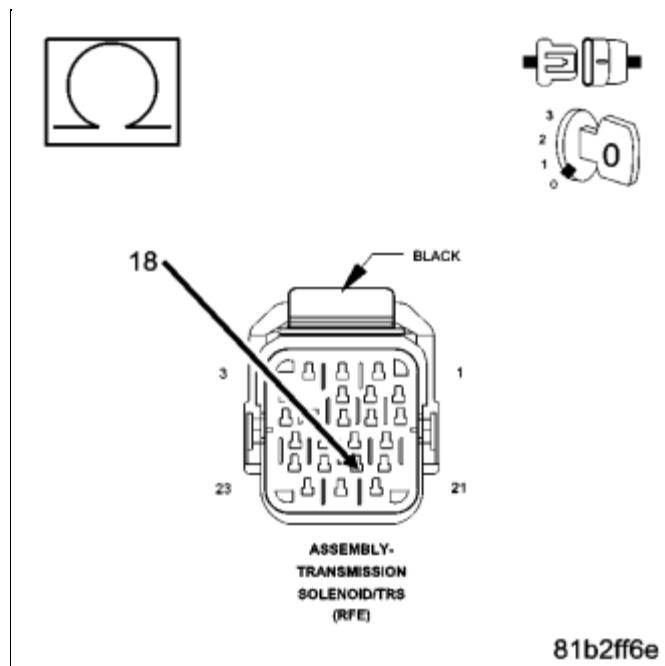
Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



14. PERFORM A WIGGLE TEST USING THE TRANSMISSION SIMULATOR

Perform the steps in the previous test while wiggling the wiring harness and connectors pertaining to the UD Pressure Switch.

Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Repair the wiring harness and/or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [15](#)

15. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY FOR A SHORT TO GROUND

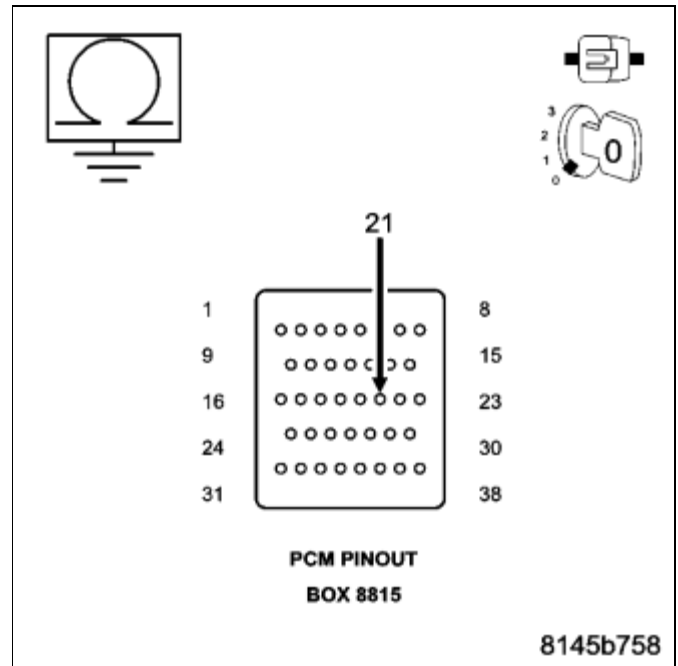
Disconnect the Transmission Simulator and reconnect the Transmission Solenoid/TRS Assembly harness connector. Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit in the appropriate terminal of Miller tool #8815.

Is the resistance below 5.0 ohms?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go To [16](#)

16. CHECK IF THE DTC RESETS

Reconnect all previously disconnected connectors.

With the scan tool, erase all transmission DTCs.

Test drive the vehicle. Using the DTC EVENT DATA recorded earlier, try to duplicate the conditions in which the DTC originally set.

Does the DTC P0876 reset?

Yes

- Go To [17](#)

No

- Go To [18](#)

17. CHECK FOR A CUT NO. 2 CHECK BALL

Remove the Valve Body per the Service Information.

Check the No. 2 check ball for cuts or damage.

Is the No. 2 check ball cut or damaged?

Yes

Replace the No. 2 check ball. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

18. CHECK FOR INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Were there any problems found?

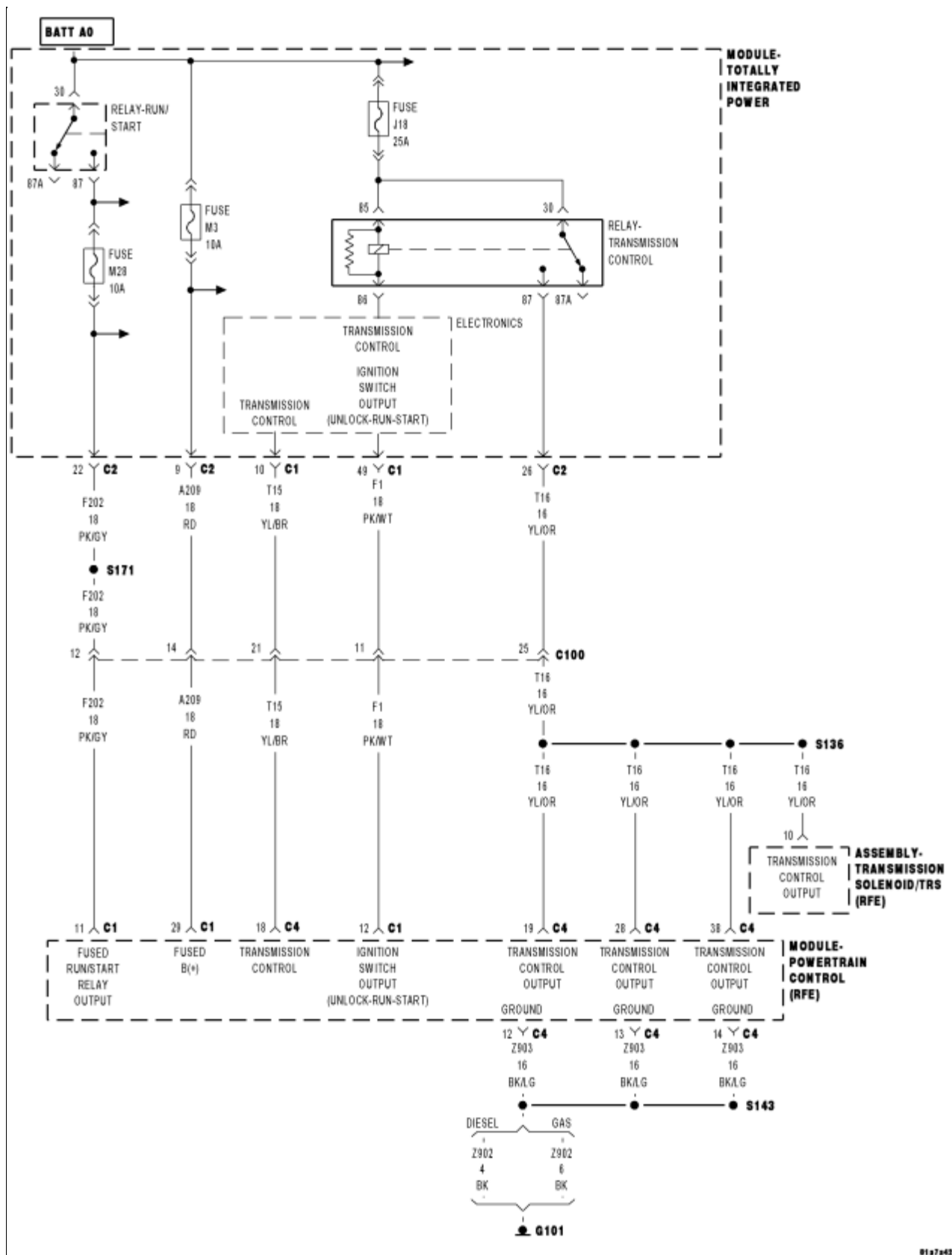
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0882-TCM POWER INPUT LOW



For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Transmission Solenoid/TRS Assembly and to the PCM when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/TRS Assembly in event that the transmission should need to be placed into “limp-in” mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System request for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If the Transmission Control System detects less than 3.0 volts when the output is commanded on, the DTC will set. **Note: Inadequate Transmission Control Output voltage can also cause DTCs P0846, P0869, P0871, P0876 or P0988 to set. Repairing the P0882 fault should also eliminate the related DTCs.**

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set when there is less than 3.0 volts present at the transmission control output circuits located in the Powertrain Control Module (PCM) when the Transmission Control System request the power up of those circuits. .

Possible Causes
RELATED TIPM DTCS
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO GROUND
(T15) TRANSMISSION CONTROL CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF THE DTC P0882 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0882.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter equal to 0?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. CHECK FOR TIPM RELATED DTCs

With the scan tool, check TIPM DTCs.

Are there any TCM TIPM DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [3](#)

3. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.

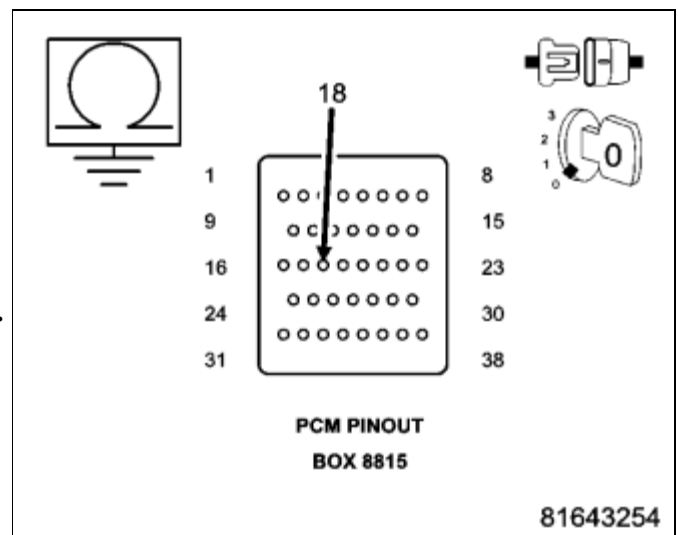
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Disconnect the TIPM C1 harness connector.
Measure the resistance between ground and the (T15) Transmission Control circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T15) Transmission Control circuit for a short to ground.



- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE (T15) TRANSMISSION CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T15) Transmission Control circuit between the TIPM C1 harness connector and the appropriate terminal of Miller tool #8815.

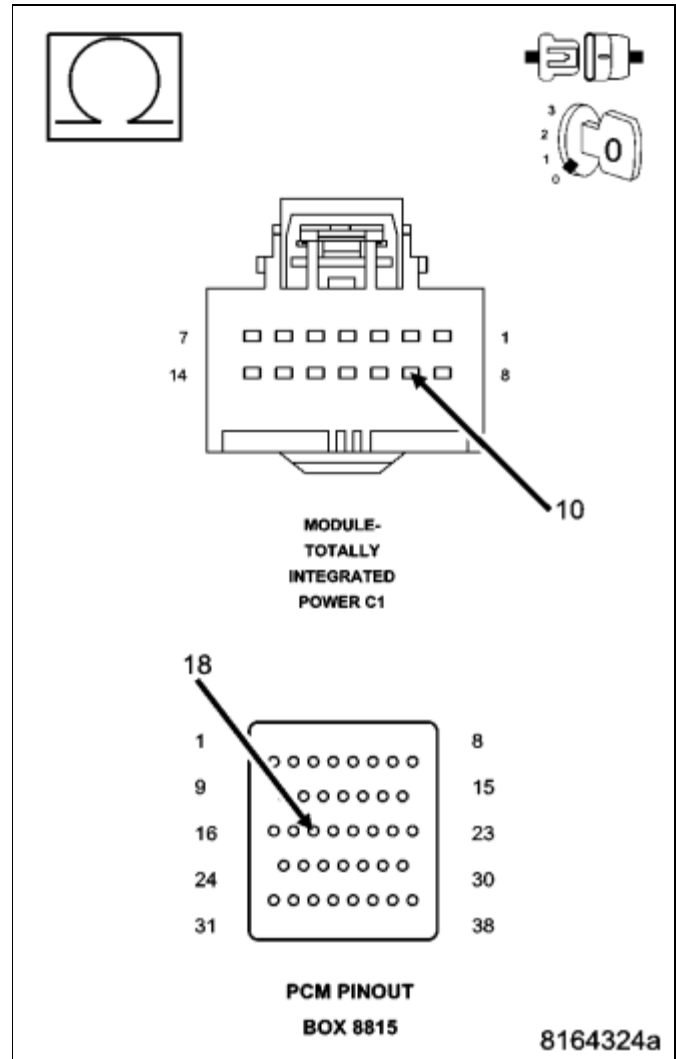
Is the resistance above 5.0 ohms?

Yes

- Repair the (T15) Transmission Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



5. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

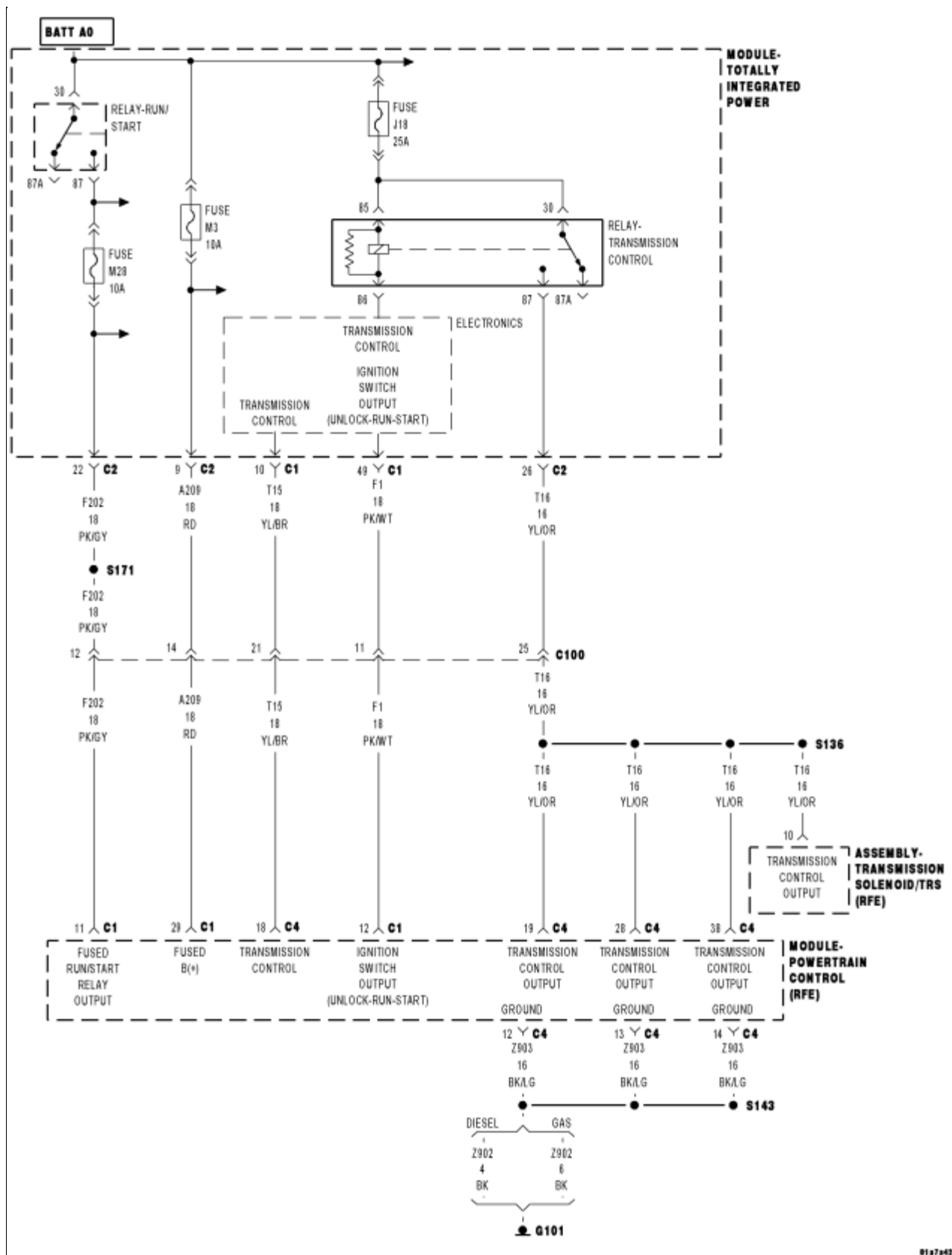
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0883-TCM POWER INPUT HIGH



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control Output circuit is used to supply power to the Transmission Solenoid/TRS Assembly and to the PCM when in normal operating mode. The purpose of the Transmission Output circuit is to allow the Transmission Control System to turn off the power to the Transmission Solenoid/TRS Assembly in event that the transmission should need to be placed into "limp-in" mode due to a DTC.

After a PCM reset, (ignition switch turned to the run position, or after cranking the engine) the Transmission Control System verifies that the Transmission Output circuit is open by checking for voltage on the Transmission Output circuits before the Transmission Control System request for the circuit to be powered up. The request is sent by a direct circuit control from the PCM to the TIPM. If voltage is detected on the Transmission Output circuits before the request is sent, the DTC will set.

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set if the Powertrain Control Module senses greater than 3.0 volts on the Transmission Control Relay Output circuits prior to a request from the PCM to TIPM to energize the Transmission Output circuits.

Possible Causes
TIPM DTCS PRESENT
(T15) TRANSMISSION CONTROL CIRCUIT SHORT TO VOLTAGE
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR TCM TIPM DTCS

With the scan tool, read DTCs.

Are there any TIPM TCM Power Control Circuit DTCS present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF DTC P0883 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter set to 0?

Yes

- Go To [3](#)

No

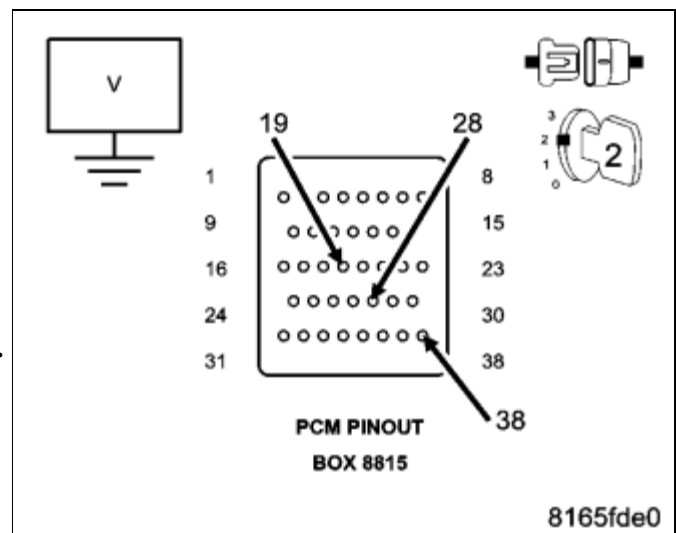
- Go To [6](#)

3. (T16) TRANSMISSION OUTPUT CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.
Disconnect the TIPM C10 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.
Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.



Is the voltage above 0.5 volts on any (T16) Transmission Control Output circuit?

Yes

- Go To [4](#)

No

- Go To [5](#)

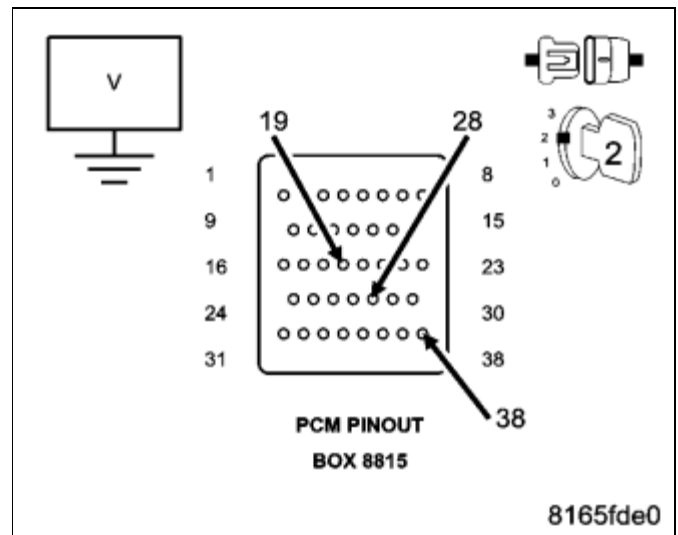
4. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.
Ignition on, engine not running.
Measure the voltage of the (T16) Transmission Control Output circuits in the Miller tool #8815.

Is the voltage above 0.5 volts?

Yes

- Repair the (T16) Transmission Control Output circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

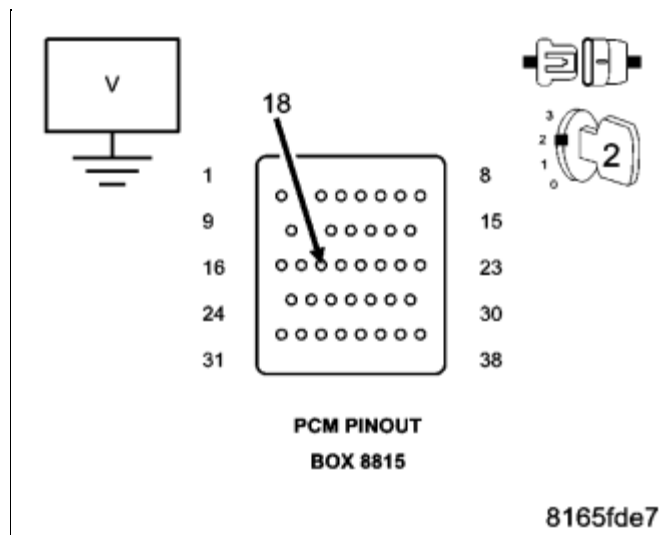
5. CHECK THE (T515) TRANSMISSION CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Measure the voltage of the (T515) Transmission Control circuit.

Is the voltage above 0.5 volts?

Yes

- Repair the (T515) Transmission Control circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0884-POWER UP AT SPEED

If a vehicle loses power to the Transmission Control System, the solenoids (L/R, 2C, OD, UD, 4C) will go to their respective power off state. Some solenoids are normally vented and some are normally applied in their power off state. The transmission is designed to be in 3rd gear with all of the solenoids in this state. However, if power is restored, the Transmission Control System will power-up and normal operation will be restored.

This code identifies that power to the Transmission Control System was restored when the gear selector was in a "Drive" position while the vehicle was moving at speeds above 32 Km/h (20 mph). **This DTC does not indicate a problem with the transmission or Transmission Control System**, instead, it suggests intermittent problems in the fused ignition switch output, fused B(+), or ground circuits to the TCM. Alternately, if a person performs a rolling restart maneuver, the DTC can be set. Therefore it is critical that this DTC be investigated if the vehicle is experiencing intermittent 3rd gear operation and a subsequent return to normal operation.

- **When Monitored:**

When Powertrain Control Module initially powers up.

- **Set Condition:**

This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear, with no PRNDL DTCs, and an output speed above 800 rpm, approximately 32 Km/h or 20 mph.

Possible Causes
POWER UP AT SPEED

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK THE POWER AND GROUND CIRCUITS

This DTC is set when the Transmission portion of the Powertrain Control Module is initialized while the vehicle is moving down the road in a valid forward gear.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check all of the Fused B(+), Fused Ignition Switch Output, and ground circuits to the PCM for an intermittent open or short to ground.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

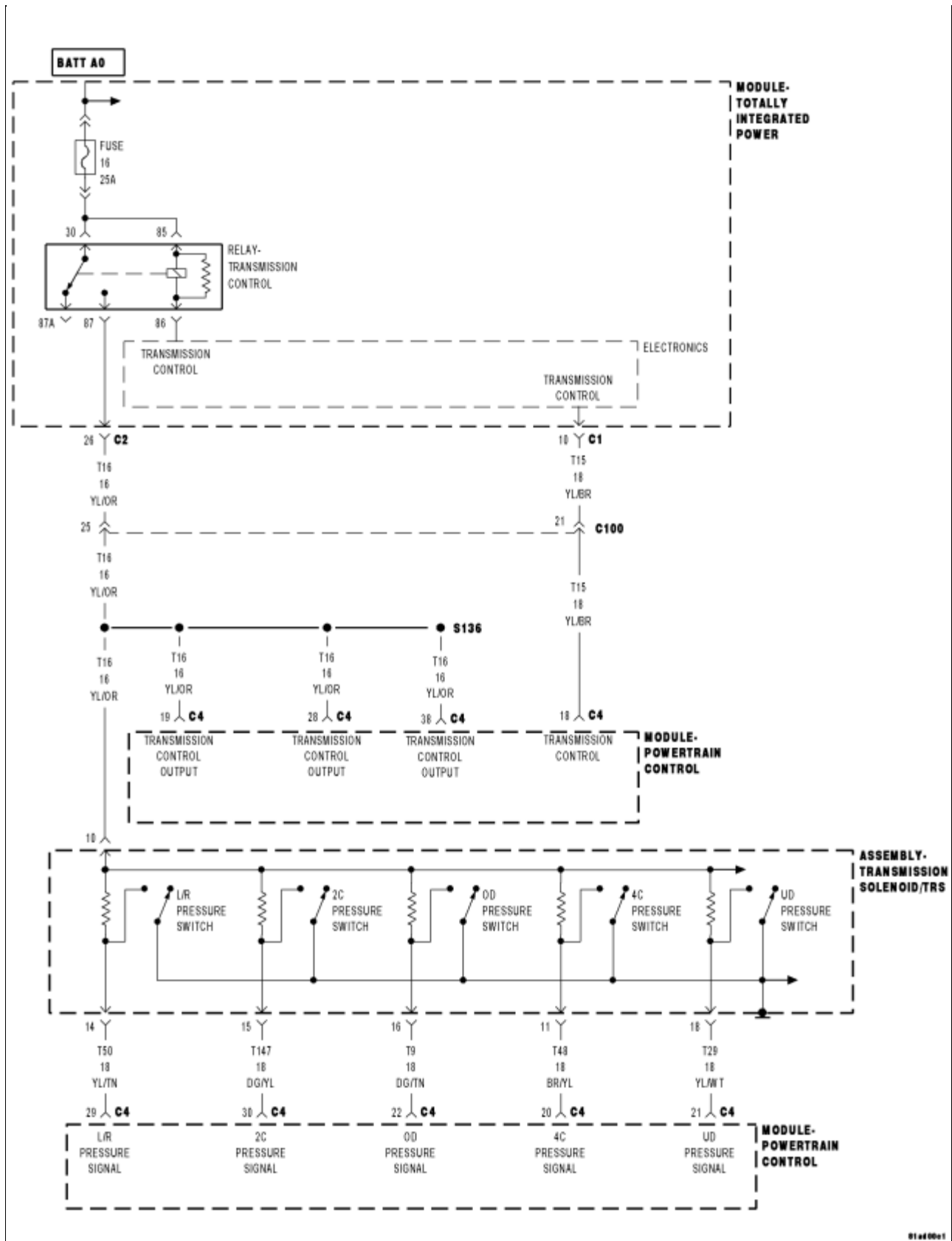
View repair.

Repair

Check all power and ground circuits to the PCM and repair as necessary.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0890-SWITCHED BATTERY



01ad00a1

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Totally Integrated Control Module (TIPM) replaces the Transmission control relay. The Transmission Control Output circuit is used to supply power to the solenoids and pressure switches (Transmission Solenoid/TRS Assembly) when the transmission is in normal operating mode. When the Transmission Control Output circuit is off, no power is supplied and the transmission.

Immediately after a controller reset (ignition key turned to the "run" position or after cranking engine), the TCM verifies that the Transmission Control Output circuits are open by checking for no voltage at the transmission control output terminals at the PCM. After this is verified, the voltage at the pressure switches are checked. There should be no voltage on the pressure switches at this time. The PCM will then activate the relay.

- **When Monitored:**

When the ignition is turned from "OFF" position to "RUN" position and/or the ignition is turned from "START" position to "RUN" position.

- **Set Condition:**

This DTC is set if the Powertrain Control Module senses voltage on any of the pressure switch inputs prior to the Transmission Control Output circuit being energized.

Possible Causes
PRESSURE SWITCH SENSE CIRCUITS SHORT TO VOLTAGE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR TIPM TCM DTCS

With the scan tool, read DTCs.

Are there any TCM Power Control DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, Check the STARTS SINCE SET counter for P0890.

NOTE: This counter only applies to the last DTC set.

Is the "Starts Since Set" counter set at 0?

Yes

- Go To [3](#)

No

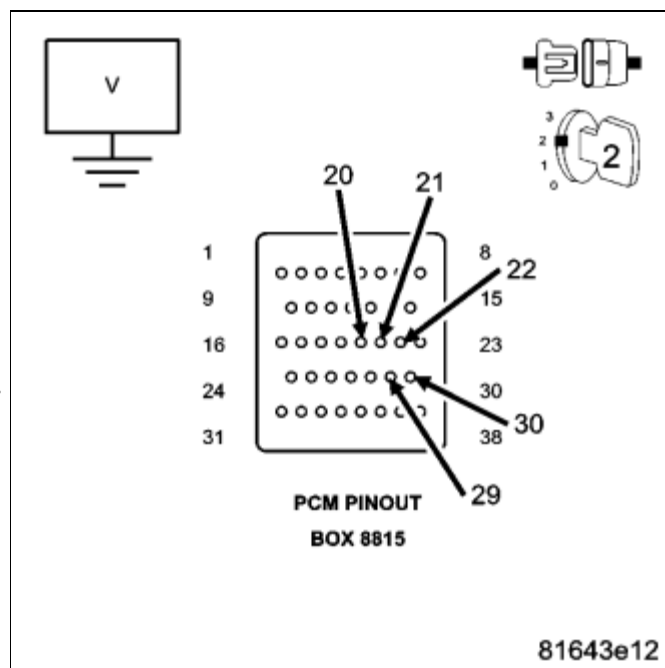
- Go To [5](#)

3. CHECK THE PRESSURE SWITCH SENSE CIRCUITS FOR A SHORT TO VOLTAGE

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Disconnect the Transmission Solenoid/TRS Assembly harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.
 With the scan tool under TIPM, actuate the Transmission.
 Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in Miller tool #8815.



Is the voltage above 0.5 volt on any of the measured circuits?

Yes

- Repair the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and/or (T29) UD Pressure Switch Sense circuit(s) for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)

4. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool under TIPM, stop the Transmission actuation.

Turn the ignition off.

Reconnect the Transmission Solenoid/TRS Assembly harness connector.

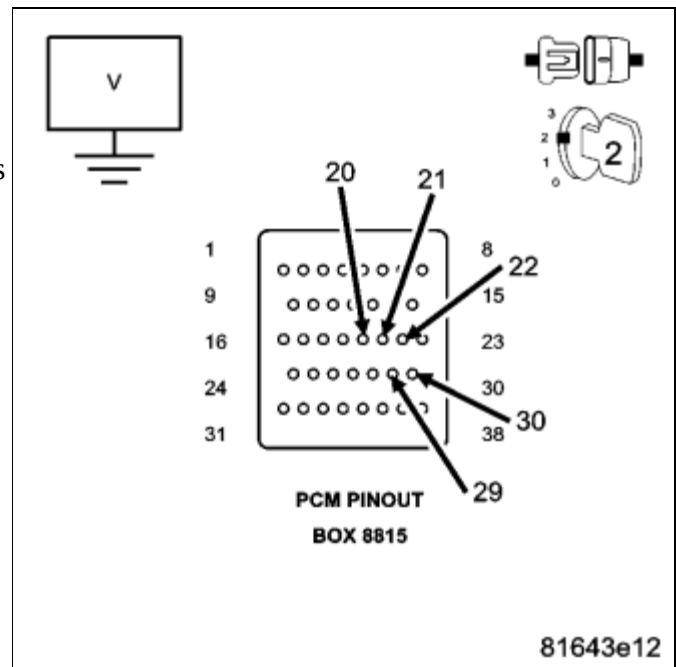
Ignition on, engine not running.

Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in Miller tool #8815.

Is the voltage above 0.5 volts on any of the sense circuits?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No**

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

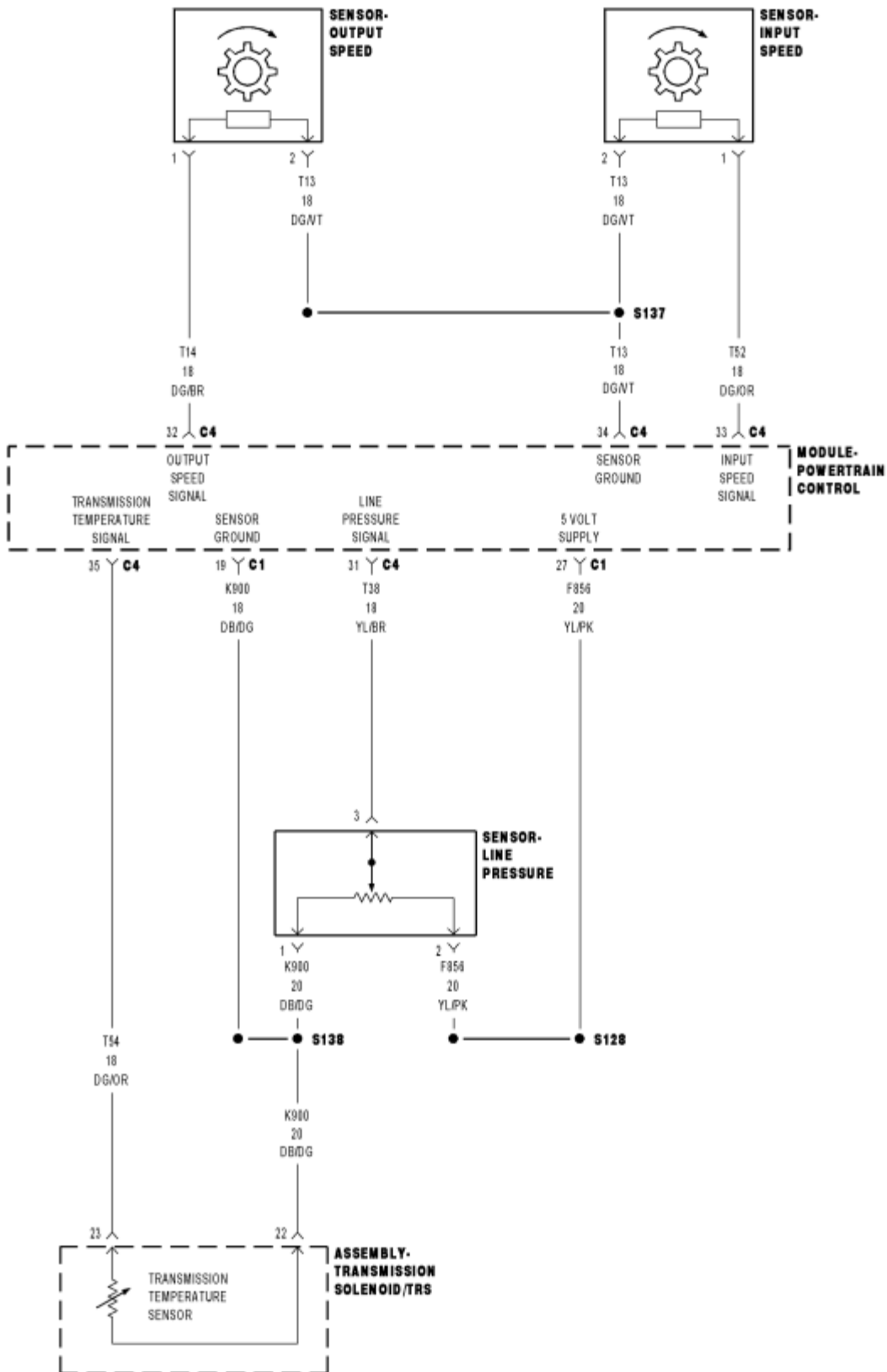
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0933-LINE PRESSURE SENSOR CIRCUIT PERFORMANCE



01a79c68

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality.

- **When Monitored:**

Continuously with the ignition on, engine running, with the transmission in gear.

- **Set Condition:**

The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure reading is more than 172 kPa (25 psi) higher than the Desired Line Pressure, but is less than the highest Line Pressure ever used in the current gear, the DTC sets.

Possible Causes
RELATED DTCS PRESENT
LINE PRESSURE CONNECTOR AND WIRING
LINE PRESSURE SENSOR
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCs.

Are there any other line pressure DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. Perform the test for P0934 and/or P0935 first if present.

No

- Go to [2](#)

2. COMPARE ACTUAL LINE PRESSURE TO DESIRED LINE PRESSURE

CAUTION: Apply Parking Brake

Start the engine.

CAUTION: Firmly apply the brakes.

With the scan tool, monitor the Line Pressure, Desired Line Pressure and the TPS degrees.

While firmly applying the brakes, place the shifter in reverse, then slowly press the accelerator pedal to a TPS degree of 15°.

Compare the Line Pressure reading to the Desired Line Pressure reading on the scan tool.

Does the Line Pressure stay within ± 34 kPa or 5 psi of the Desired Line Pressure?**No**

- Go to [3](#)

Yes

- Go to [6](#)

3. CHECK LINE PRESSURE CONNECTOR AND WIRING

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor and the Transmission Solenoid/TRS Assembly.

Did the voltage remain steady while wiggling the wiring harness and connectors?**Yes**

- Go to [4](#)

No

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. CHECK PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure during the following step.
With the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi or 0.1 volts of the reading specified on the Transmission Simulator.

Does the Line Pressure on the scan tool fluctuate up and down more than 69 kPa or 10 psi at any of the 3 line pressure positions on the Transmission Simulator?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [5](#)

5. CHECK THE LINE PRESSURE SENSOR

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.
Install the Line Pressure Adaptor, Miller tool #8259, and the Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa (0 to 300 psi).
Start the engine in park.
Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

Is the line pressure gauge reading within 34 kPa (5 psi) of the scan tool reading?**Yes**

- Repair internal transmission and inspect the oil pump per the Service information and replace if necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly — possible cause is the Pressure Control Solenoid is stuck.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

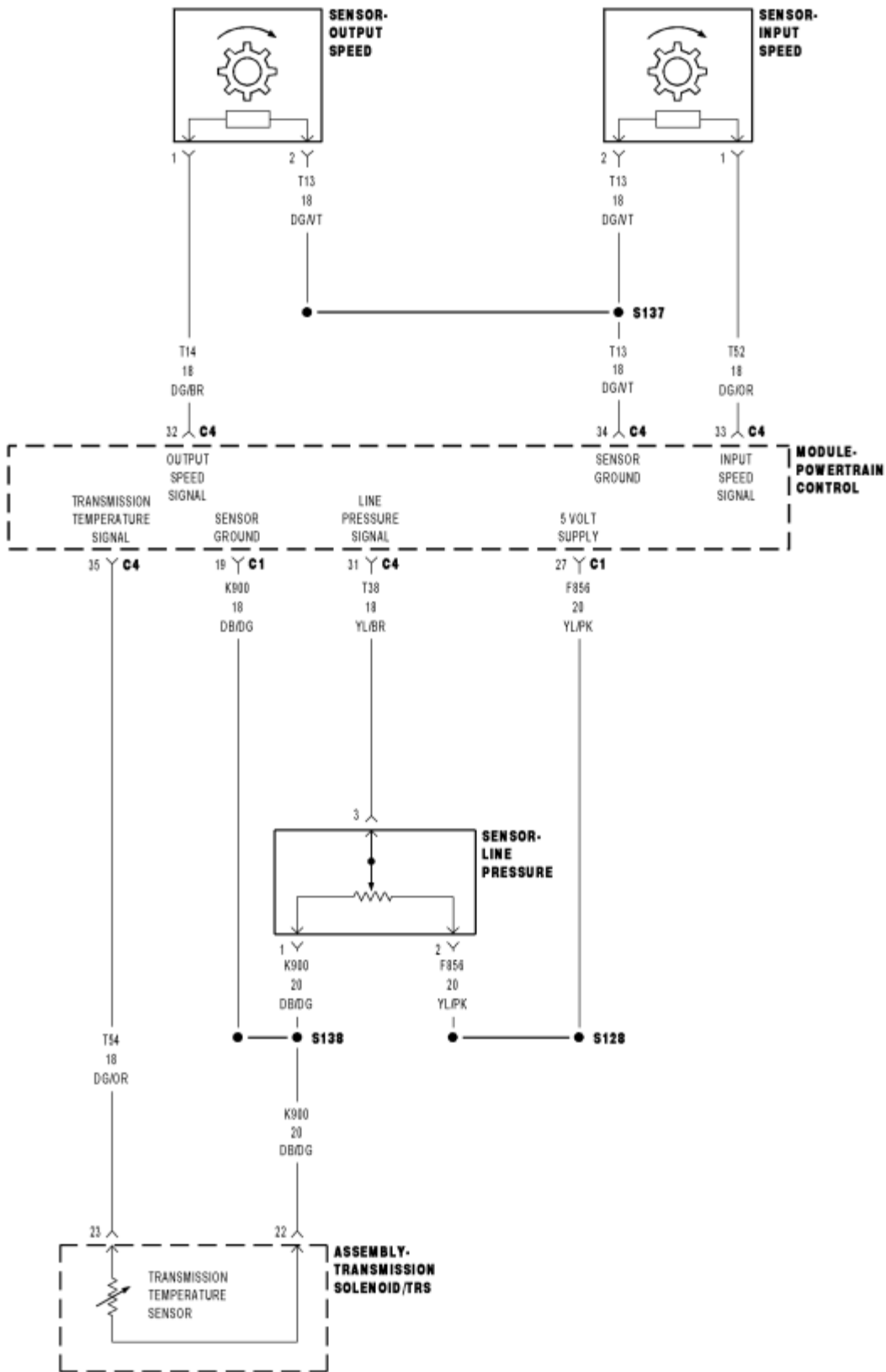
Where there any problems found?**Yes**

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0934-LINE PRESSURE SENSOR CIRCUIT LOW



01a79c68

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

- **When Monitored:**

Continuously with the ignition on and engine running.

- **Set Condition:**

This DTC will set when the monitored Line Pressure Sensor voltage is less than or equal to 0.35 volts for 0.18 seconds.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0934.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [2](#)

No

- Go To [7](#)

2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, under Transmission Sensors, monitor the Line Pressure.
Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: The readings should be within ± 14 kPa (2.0 psi) on the scan tool to the pressure readings specified on Transmission Simulator.

Does the Line Pressure on the scan tool match the line pressures on the Transmission Simulator?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [3](#)

3. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.
 Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Disconnect the Transmission Simulator, Miller tool #8333.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T38) Line Pressure Sensor Signal circuit.

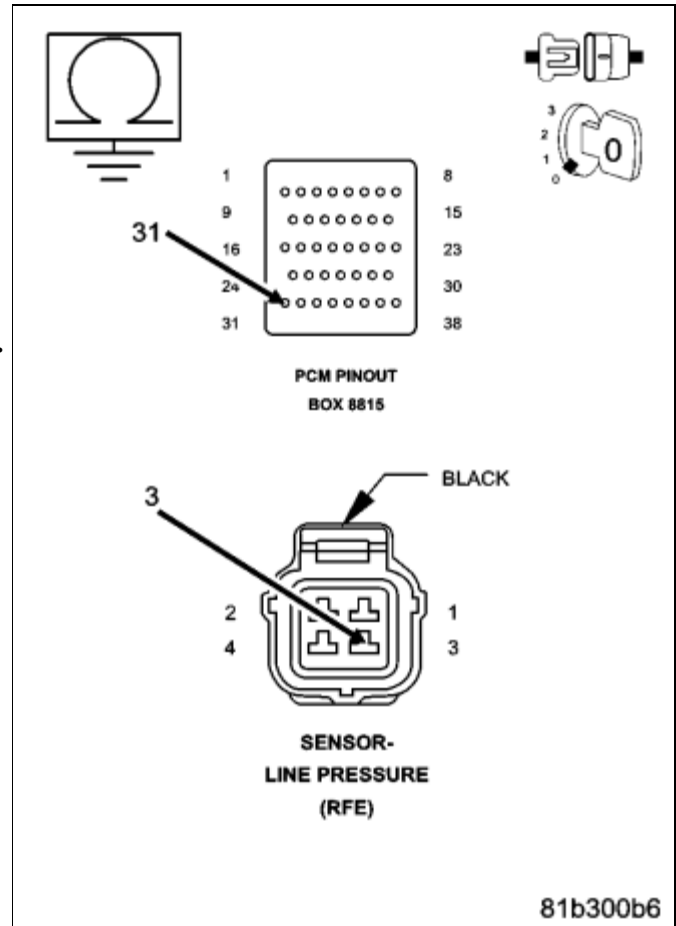
Is the resistance below 5.0 ohms?

Yes

- Repair the (T38) Line Pressure Sensor Signal circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the PCM C4 harness connector and connect Miller tool #8815.
 Measure the resistance of the (T38) Line Pressure Sensor Signal circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

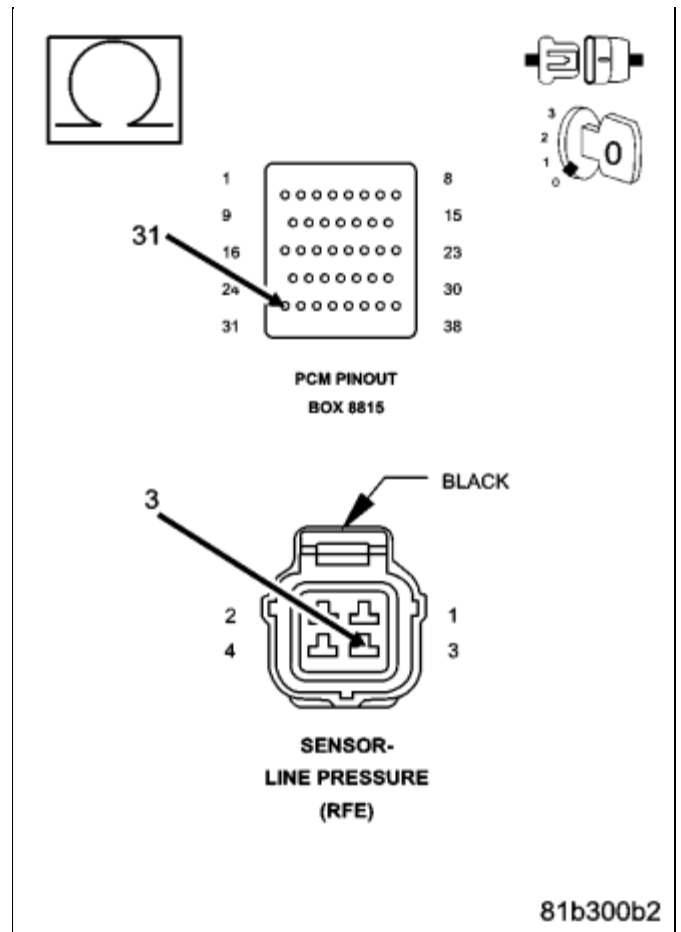
Yes

- Repair the (T38) Line Pressure Sensor Signal circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION

VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure sensor harness connector and the appropriate terminal of Miller tool #8815.

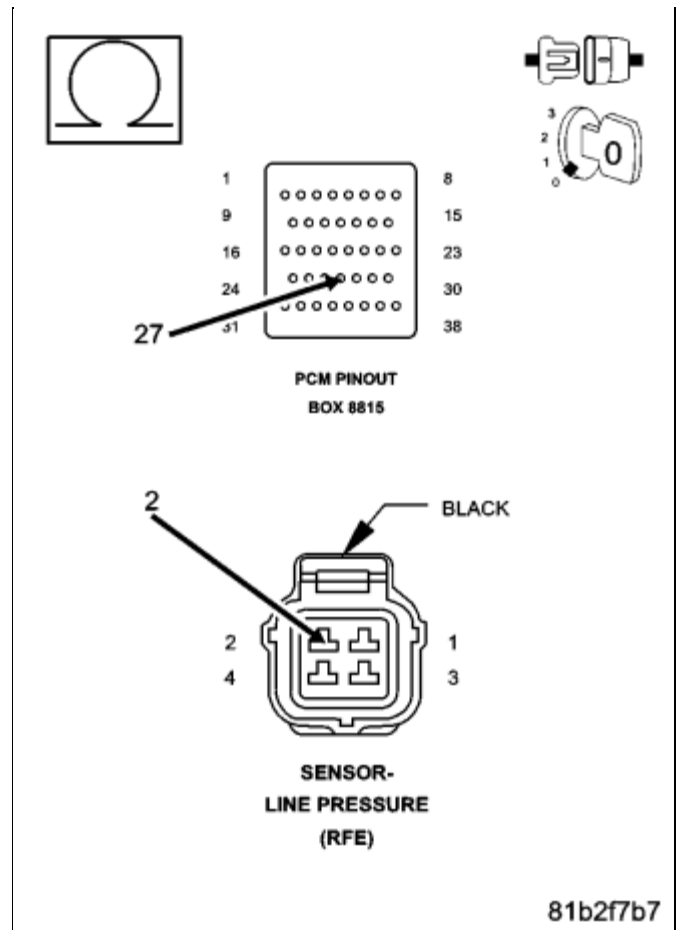
Is the resistance below 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes

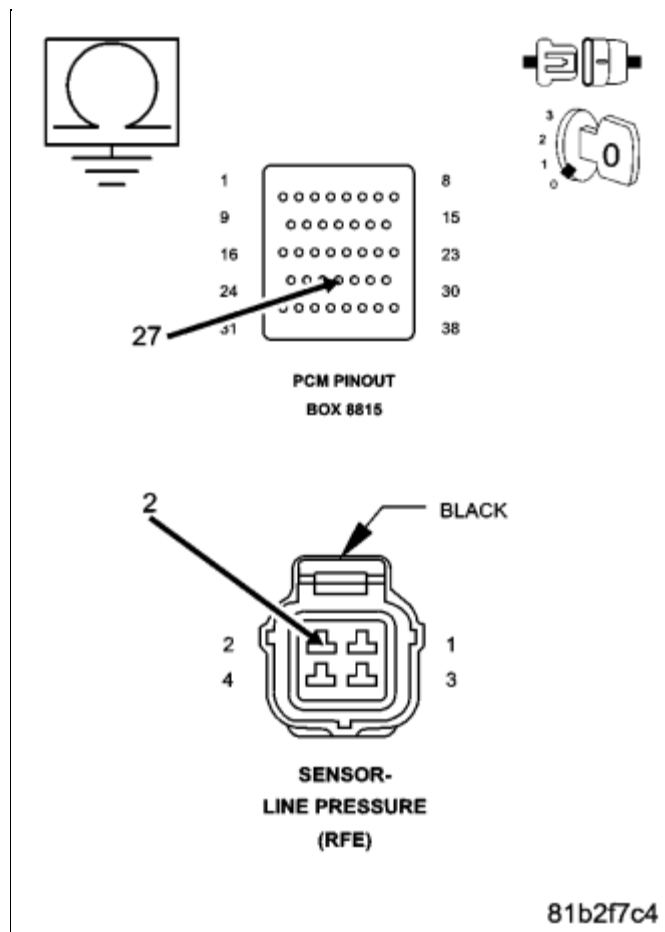
- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are

found, replace the PCM per the Service Information.
With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

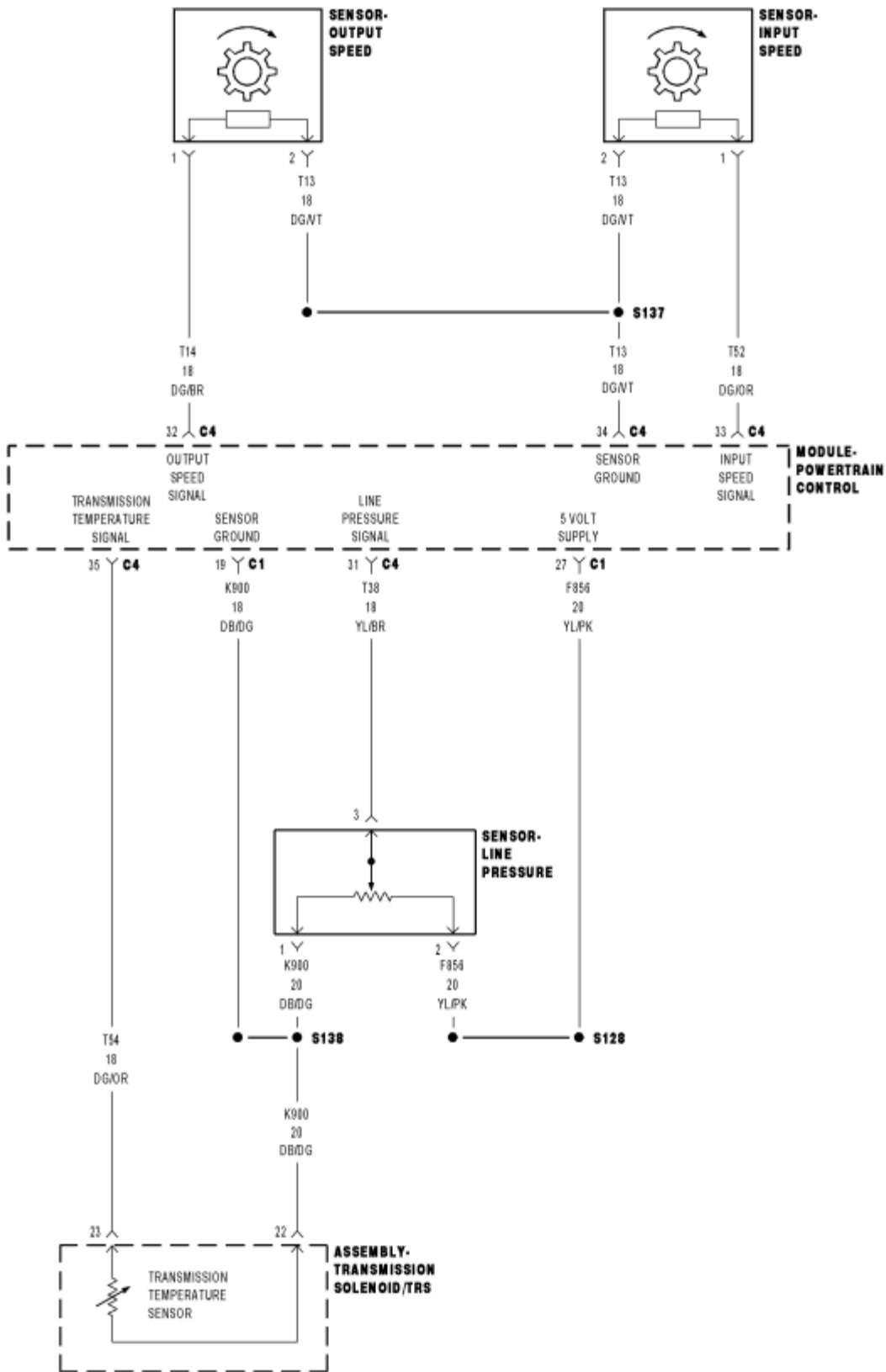
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0935-LINE PRESSURE SENSOR CIRCUIT HIGH



01a79c68

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

- **When Monitored:**

Continuously with ignition on and engine running.

- **Set Condition:**

This DTC will set if the monitored Line Pressure Sensor voltage is greater than or equal to 4.75 volts for the period of 0.18 seconds

Possible Causes
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
LINE PRESSURE SENSOR
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0935.

NOTE: This counter only applies to the last DTC set.

Is the STARTS SINCE SET counter 2 or less?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, monitor the Line Pressure.
Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

NOTE: The readings should be within ± 14 kPa or 2.0 psi on the scan tool of the pressure reading specified on Transmission Simulator.

Does the 3 line pressures on the scan tool match the Line pressure readings on the Transmission Simulator?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [3](#)

CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN

3.

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the PCM C1 harness connector and connect Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

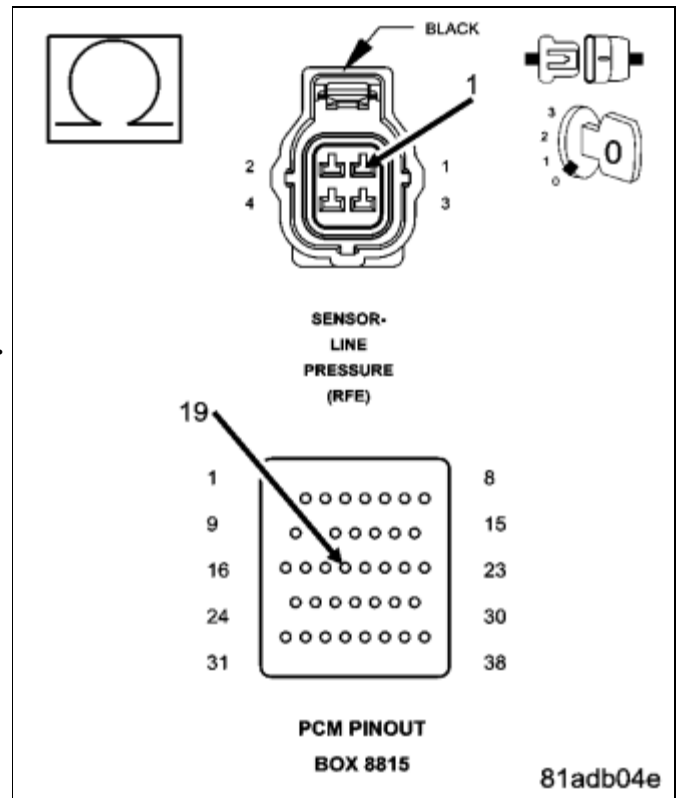
Is the resistance above 5.0 ohms?

Yes

- Repair the (K900) Sensor Ground circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance of the (T38) Line Pressure Sensor Signal circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

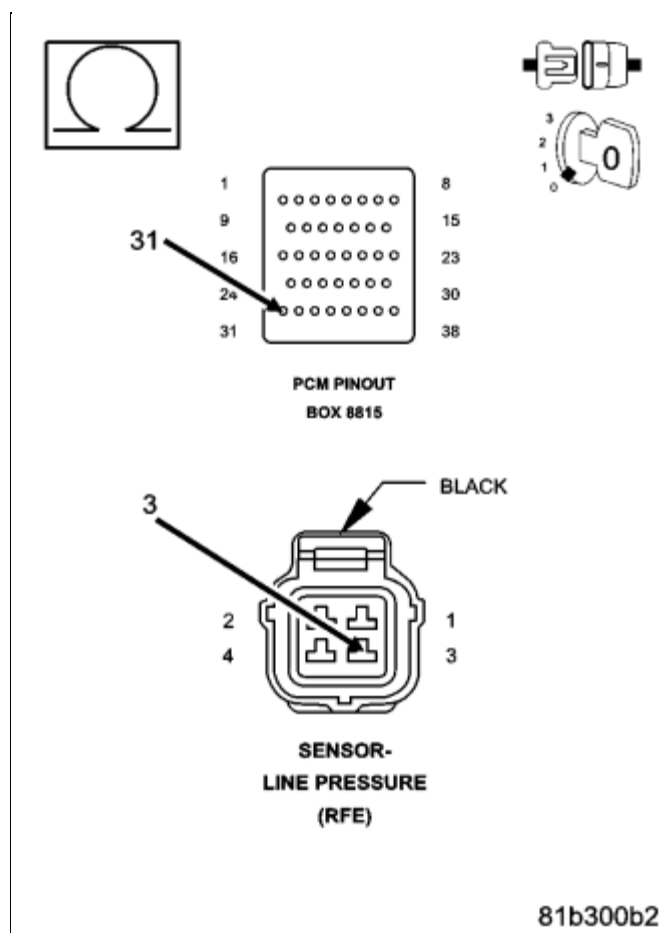
Yes

- Repair the (T38) Line Pressure Sensor Signal circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION

VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T38) Line Pressure Sensor Signal circuit.

Is the voltage above 5.5 volts?

Yes

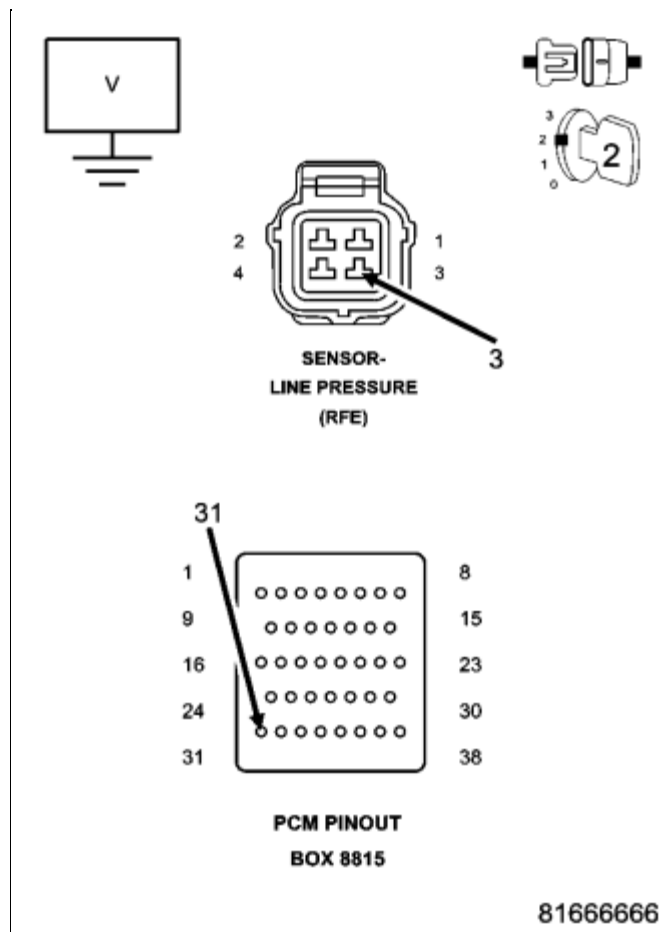
- Repair the (T38) Line Pressure Sensor Signal circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention

to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0944-LOSS OF HYDRAULIC PUMP PRIME

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Loss of prime test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or cracked oil filter.

The Loss of Prime DTC is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

- **When Monitored:**

If the transmission is slipping in any forward gear and all the pressure switches are not indicating pressure, a loss of prime test is run.

- **Set Condition:**

If the transmission begins to slip in a forward gear and all the pressure switch(s) that should be closed are open a loss of prime test begins. Available elements are turned on by the PCM to see if pump prime exists. The DTC sets if no pressure switch(s) respond.

Possible Causes
SHIFT LEVER OUT OF ADJUSTMENT
IMPROPER FLUID LEVEL
CRACKED OR IMPROPERLY INSTALLED PRIMARY OIL FILTER OR SEAL
LOOSE COOLER RETURN FILTER
STUCK OR STICKING MAIN REGULATOR VALVE
TRANSMISSION OIL PUMP

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. SHIFT LEVER POSITION TEST

Using the scan tool, perform a Shift Lever Position test. Follow the instructions on the scan tool.

Did the Shift Lever Position Test pass?**Yes**

- Go to [2](#)

No

- Refer to the Transmission category and perform the appropriate symptom.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

2. CHECK TO SEE IF DTC P0944 IS CURRENT

Place the gear selector in Park.

Start the engine.

The transmission must be at operating temperature prior to checking pressure. A cold transmission will give higher readings.

Run the engine at 1500 rpm.

With the scan tool, monitor the Transmission Line Pressure.

Does the Line Pressure match the Desired Line Pressure within ± 5 psi?**No**

- Go to [6](#)

Yes

- Go to [3](#)

3. CHECK LINE PRESSURE IN DRIVE AND REVERSE

Firmly apply the brake and repeat the previous test in both Drive and the Reverse gear positions.

With the scan tool, monitor the Transmission Line Pressure.

Does the Line Pressure match the Desired Line Pressure within ± 5 psi in all gear ranges?**Yes**

- Go to [4](#)

No

- Go to [5](#)

4. REVIEW CUSTOMER COMMENTS

The conditions necessary to set this DTC are not present at this time.

Verify with the customer if a delayed engagement and/or an intermittent "No Drive" condition has occurred.

If the customers answer is "No" erase the DTC and return the vehicle to the customer.
 Make sure to check for any TSBs or controller flash updates that may apply.
 With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Has the customer experienced any delayed engagement and/or "No Drive" conditions?

Yes

- Go to [6](#)

No

- Test Complete.

5. DTC VERIFICATION

Read and record the DTC and the Event Data information.
 Test drive the vehicle and attempt to operate the vehicle within the parameters in which the DTC set.
 With the scan tool, read DTCs.

Did any following DTCs set, P0868, P0944, P0841, P0846, P0871, P0876, or P0988?

Yes

- Go to [6](#)

No

- Test Complete.

6. CHECK TRANSMISSION OIL FILTER

Remove and inspect the Transmission Oil Pan per the Service Information.
 Remove and inspect the Primary Oil Filter per the Service Information.
 Inspect the oil filter seal for damage and proper installation.

Does the Oil Pan contain excessive debris, or is the oil filter plugged, loose, or damaged?

Yes

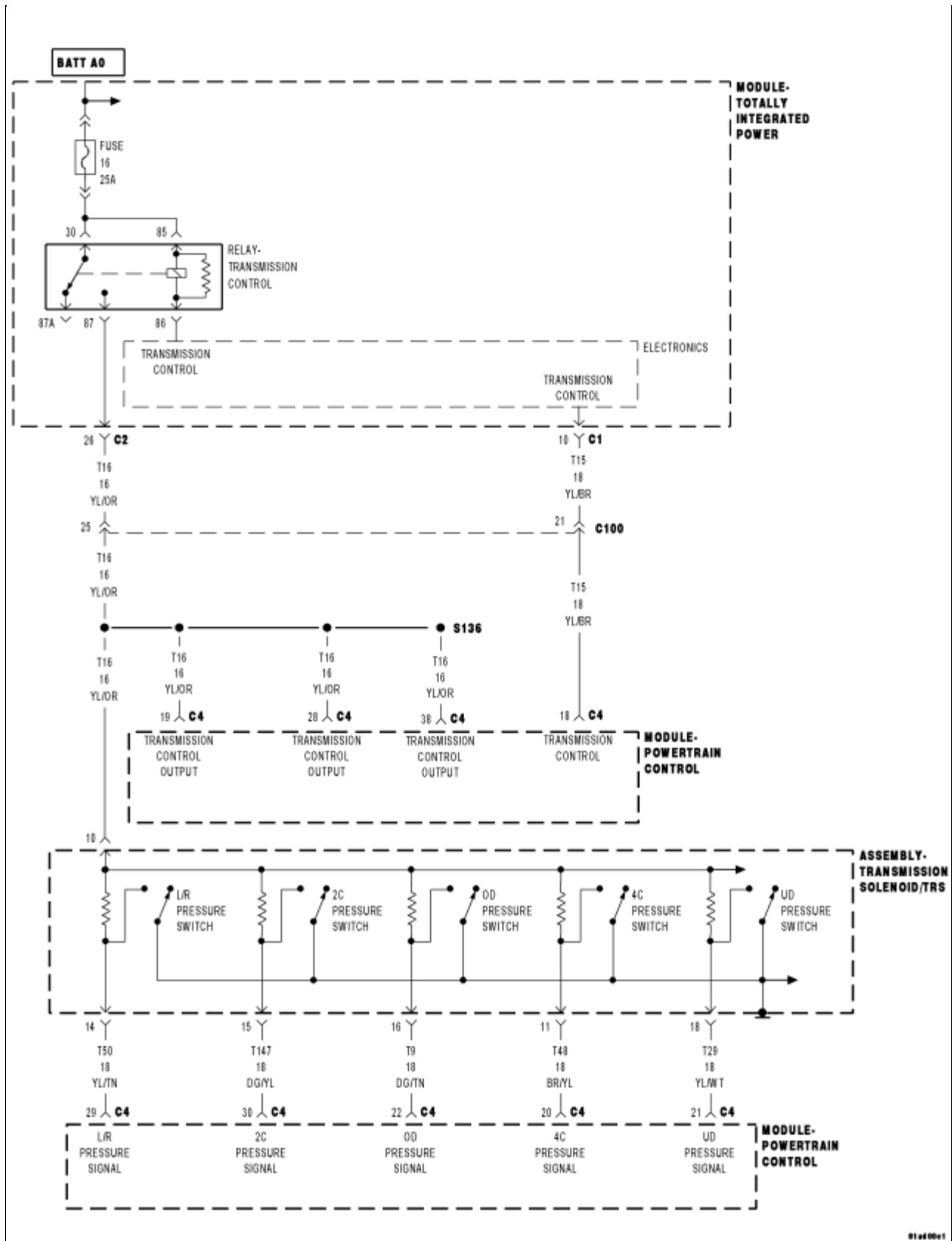
- Repair the cause of the plugged transmission oil filter or excessive debris. Check the Transmission Oil Filter seal for improper installation onto filter neck instead of into the pump bore, not fully seated against pump housing, filter neck not engaged into pump. Check that the spin-on cooler return filter (if equipped) is not loose, and that its gasket is in good condition and properly seated. Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Repair the Transmission Oil Pump as necessary. Check for a stuck main regulator valve and clean if necessary. Refer to the Service Information for the proper repair procedure.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P0987-4C HYDRAULIC PRESSURE TEST



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

- **When Monitored:**

In any forward gear with engine speed above 1000 rpm shortly after a shift and every minute thereafter.

- **Set Condition:**

After a shift into a forward gear, with engine speed above 1000 rpm, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

Possible Causes
LINE PRESSURE SENSOR
TRANSMISSION FLUID CONTAMINATION
RELATED DTCS PRESENT
TRANSMISSION SOLENOID/TRS ASSEMBLY
EXCESSIVE DEBRIS IN OIL PAN
POOR LINE PRESSURE SENSOR CONNECTION
RELATED TCM POWER INPUT DTCS PRESENT
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHERS
TRANSMISSION SOLENOID/TRS ASSEMBLY
INTERNAL TRANSMISSION
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, read DTCs.

Is there any Loss of Prime, TCM Power Input, TIPM TCM Power Control Circuit and/or Line Pressure Sensor DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first.

No

- Go to [2](#)

2. CHECK FOR DTCS

With the scan tool, check Transmission DTCs.

Is the DTC P0770 also present?

Yes

- Refer to the symptom list and perform diagnostics for P0770.

No

- Go to [3](#)

3. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs

Are the DTCs P0988 and/or P1736 present also?

Yes

- Go to [12](#)

No

- Go to [4](#)

4. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, check if the DTC is active or stored.

Is the DTC active?

Yes

- Go to [5](#)

No

- Go to [17](#)

5. CHECK IF THE LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 psi in each position?

Yes

- Go to [6](#)

No

- Go to [10](#)

6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running**.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

Did the Line Pressure reading on the scan tool CHANGE to about 207 kPa (30 psi) or 0.7 volts when the connector was pushed inward?

Yes (value was higher and changed to 207 kPa (30 psi) or 0.7 volts)

- Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as

necessary.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No (value is higher than 207 kPa (30 psi) or 0.7 volts and did not change or the value was already 207 kPa (30 psi) or 0.7 volts and did not change)

- Go to [7](#)

7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the "OFF" position on the "Input/Output Speed" switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.

Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?

Yes

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [8](#)

8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect Transmission Simulator.
 Disconnect the PCM C1 harness connector and connect
 Miller tool #8815.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (F856) 5-volt Supply circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [9](#)

9. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

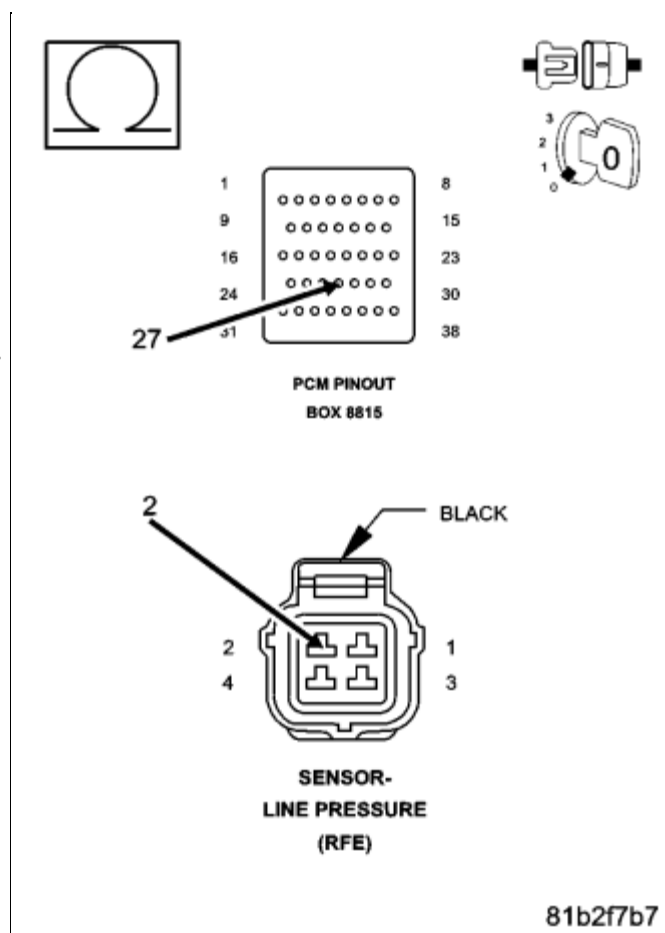
Is the resistance below 5.0 ohms?

Yes

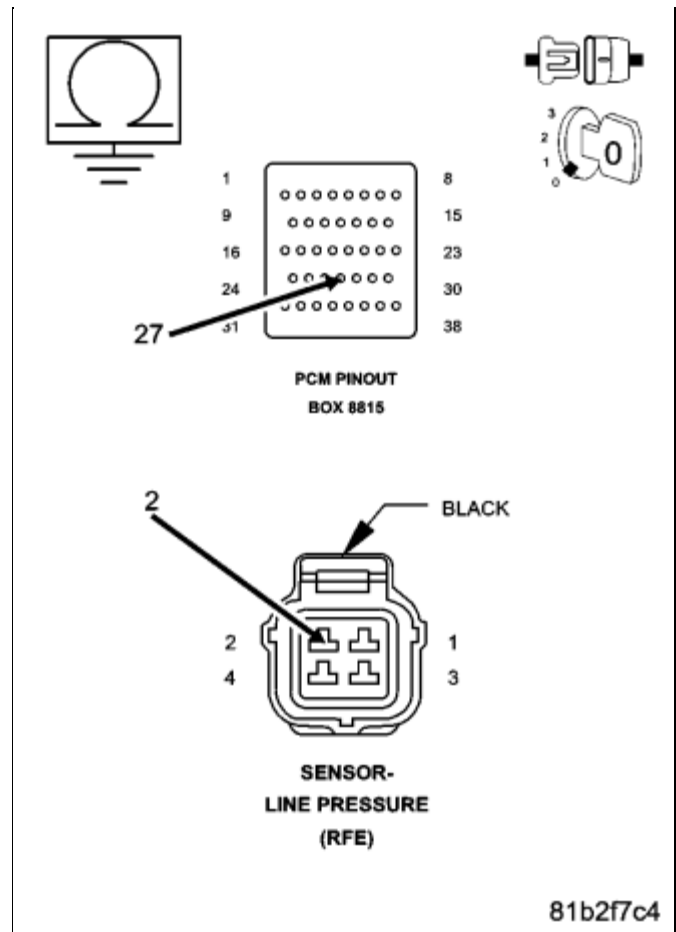
- Repair the (F856) 5-volt Supply circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information.



- With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

CAUTION: Apply parking brake.

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

CAUTION: Do not overheat transmission.

With the gear selector in park, raise the rpm to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the rpm to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the rpm to 1500, and compare the line pressure readings.

Did the scan tool Line Pressure readings match the Pressure Gauge readings $\pm$ 10 psi?

Yes

- Go to [11](#)

No

- Replace the Line Pressure Sensor per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. CHECK PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 4C.

Ignition on, engine not running.

With the scan tool, monitor the 4C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 4C Pressure Switch.

Did the 4C Pressure Switch state change to closed and remain closed while wiggling the wires?

Yes

- Go to [12](#)

No

- Go to [14](#)

12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

Does the Transmission Oil Pan contain excessive debris or contamination?

Yes

- Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [13](#)

13. CHECK 4C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 4C hydraulic clutch circuit (in the case) for leakage per the Service Information.

NOTE: The 4C hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.

Was there excessive air leakage noticed during the air check?

Yes

- Repair as necessary. Check the 4C clutch piston, piston seals and bleed orifice assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Disassemble and inspect the Valve Body and repair as necessary. Inspect the 4C Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

14. CHECK THE (T48) 4C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333 and connect Miller tool #8815.

Disconnect the PCM C4 harness connector.

Measure the resistance of the (T48) 4C Pressure Switch

Sense circuit between the Transmission Solenoid/TRS

Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

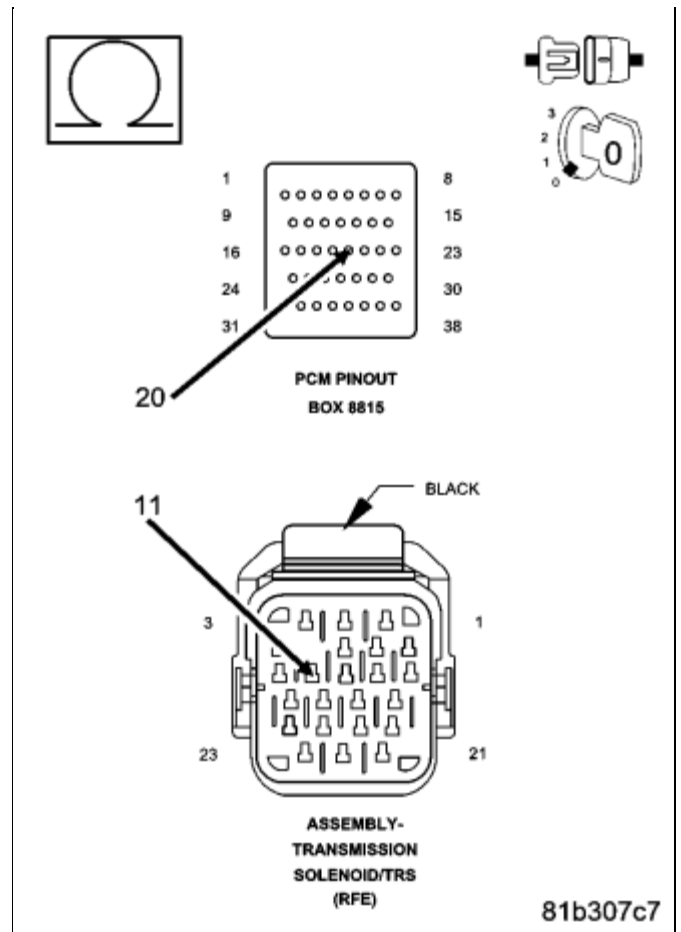
Yes

- Repair the (T48) 4C Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC -
45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [15](#)



15. CHECK THE (T48) 4C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.

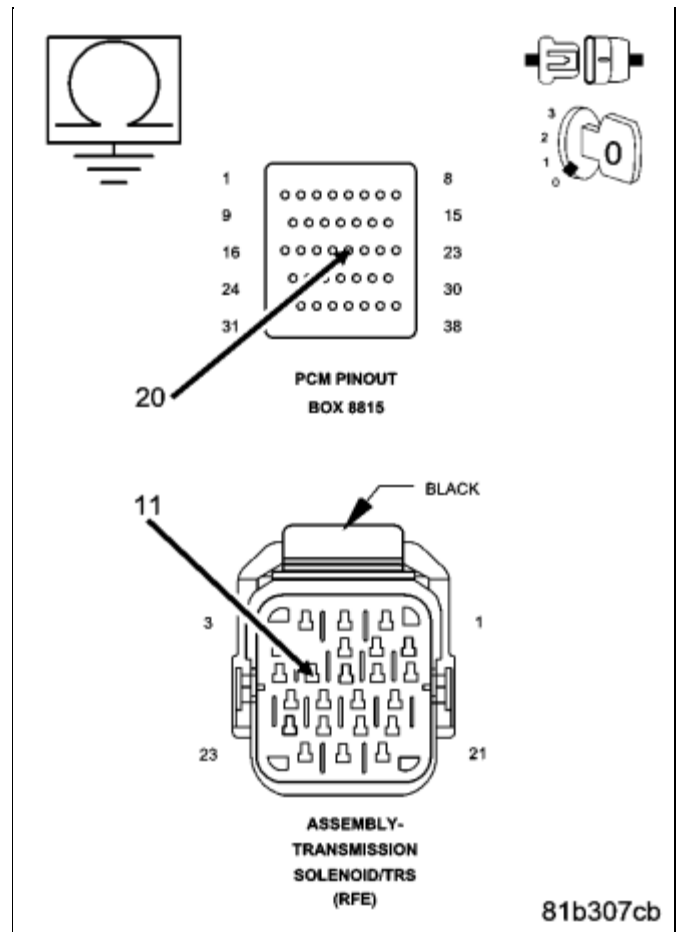
Is the resistance below 5.0 ohms?

Yes

- Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [16](#)



16. CHECK THE (T48) 4C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

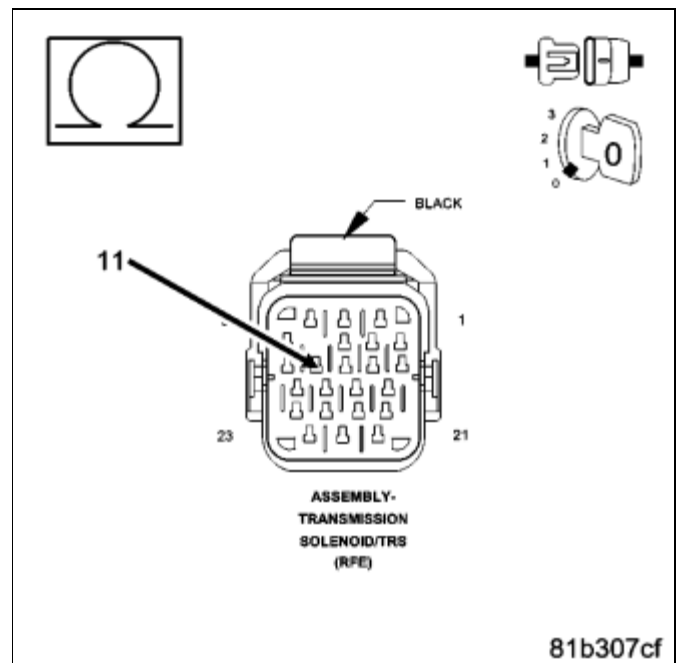
Disconnect all PCM harness connectors.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (T48) 4C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T48) 4C Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?



Yes

- Repair the (T48) 4C Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

17. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If the Event Data shows the DTC Pie set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

Where there any problems found?

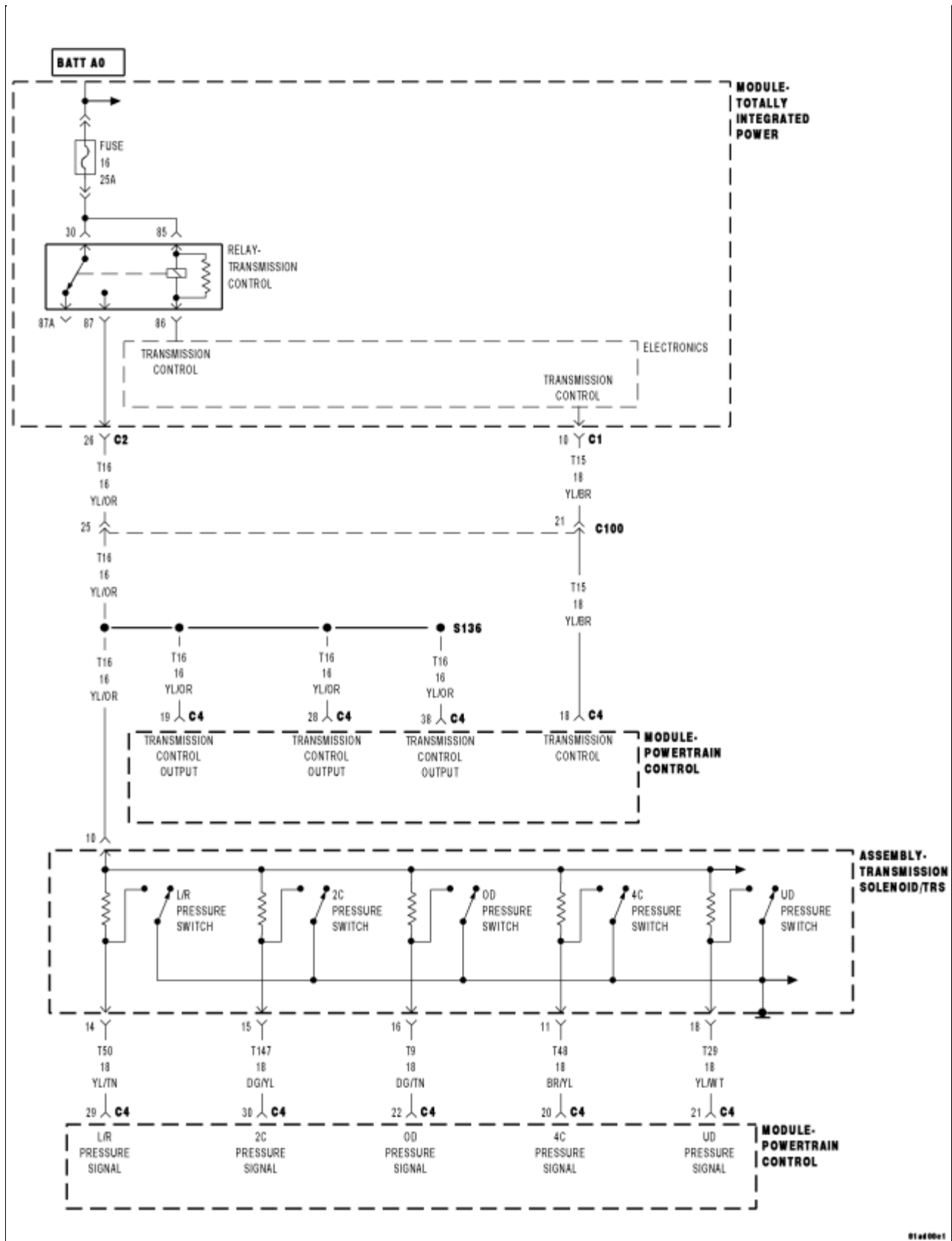
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P0988-4C PRESSURE SWITCH RATIONALITY



01ad00e1

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the L/R, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

- **When Monitored:**

Continuously with the ignition on, engine running, with the transmission in gear.

- **Set Condition:**

The DTC is set if the 4C Pressure Switch reads open or closed at the wrong time in a given gear .

Possible Causes
RELATED DTCS PRESENT
DTC P0871 ALSO PRESENT
LOSS OF 12-VOLT FEED
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN
(T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
EXCESSIVE FLUID LEAKAGE WITH 4C CLUTCH CIRCUIT
NO. 5 CHECK BALL CUT OR DAMAGED
LOW LINE PRESSURE
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE
WIRING AND CONNECTORS

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

GEAR	L/R	2C	4C	UD	OD
REVERSE	OPEN	OPEN	OPEN	OPEN	OPEN
P/N	CLOSED**	OPEN	OPEN	OPEN	OPEN

1ST	CLOSED*	OPEN	OPEN	CLOSED	OPEN
2ND	OPEN	CLOSED	OPEN	CLOSED	OPEN
2nd PRIME	OPEN	OPEN	CLOSED	CLOSED	OPEN
3TH	OPEN	OPEN	OPEN	CLOSED	CLOSED
4TH	OPEN	OPEN	CLOSED	OPEN	CLOSED
5TH	OPEN	CLOSED	OPEN	OPEN	CLOSED
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.					
**May be open when rolling in Neutral or at low oil temperatures.					

Diagnostic Test

1. CHECK FOR OTHER DTCS

With the scan tool, read DTCs.

Are there any TCM Power Input DTCs or TIPM TCM Power Control Circuit present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. DTC DATA SHOW CURRENT DTC

With the scan tool, read the Event Data.

Does the Event Data show data for DTC P0988?

Yes

- Go to [3](#)

No

- Refer to the Transmission category and perform the appropriate symptom identified in the Event Data.

3. CHECK IF MULTIPLE DTCS ARE PRESENT

With the scan tool, check DTCs.

Are there two or more related Pressure Switch Sense DTCs present in addition to P0988?

Yes

- Go to [4](#)

No

- Go to [7](#)

4. RELATED DTC PRESENT

With the scan tool, read the Event Data for P0988.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Do all the pressure switches read CLOSED in the Event Data for P0988?

Yes

- Refer to Transmission category and perform diagnostics for the DTC P0882.

No

- Go to [5](#)

5. CHECK IF THE PRESSURE SWITCHES READ OPEN

In the Event Data recorded earlier, read the state the state of all pressure switches.

Do all the pressure switches read OPEN?

Yes

- Go to [6](#)

No

- Go to [7](#)

6. CHECK FOR LOW LINE PRESSURE

In the Event Data recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

7. CHECK IF THE DTC P0871 ALSO SET

With the scan tool, check DTCs.

Is the DTC P0871 also present?

Yes

- Refer to the Transmission category and perform the diagnostic procedure for P0871.

No

- Go to [8](#)

8. CHECK IF THE DTC SET IN PARK, REVERSE OR NEUTRAL

With the scan tool, read the Event Data for P0988.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data show the DTC P0988 set in Park, Neutral, or Reverse?

Yes

- Go to [13](#)

No

- Go to [9](#)

9. CHECK IF THE Event Data READS CLOSED

With the scan tool, read the Event Data for P0988.

Does the Event Data show the 4C Pressure Switch reading CLOSED?

Yes

- Go to [11](#)

No

- Go to [10](#)

10. CHECK THE PRIMARY OIL FILTER SEAL

In the Event Data recorded earlier, compare the Line Pressure and the Desired Line Pressure.

Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?

Yes

- Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [15](#)

11. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the Transmission Simulator, turn the Pressure Switch selector switch to the 4C position.

With the scan tool, monitor the 4C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

Did the state of the 4C Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Go to [12](#)

No

- Go to [13](#)

12. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorted and open circuits.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

13. CHECK THE (T48) 4C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
 Disconnect the Transmission Simulator, Miller tool #8333.
 Disconnect the PCM C4 harness connector.
 Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T48) 4C Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of

Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T48) 4C Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [14](#)

14. CHECK THE (T48) 4C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.

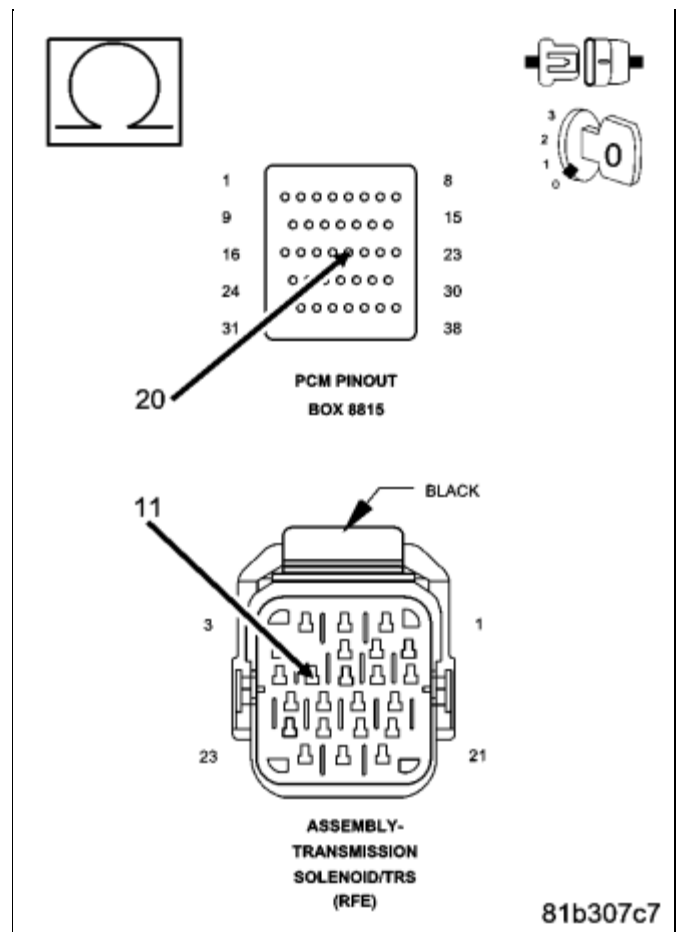
Is the resistance below 5.0 ohms?

Yes

- Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST.

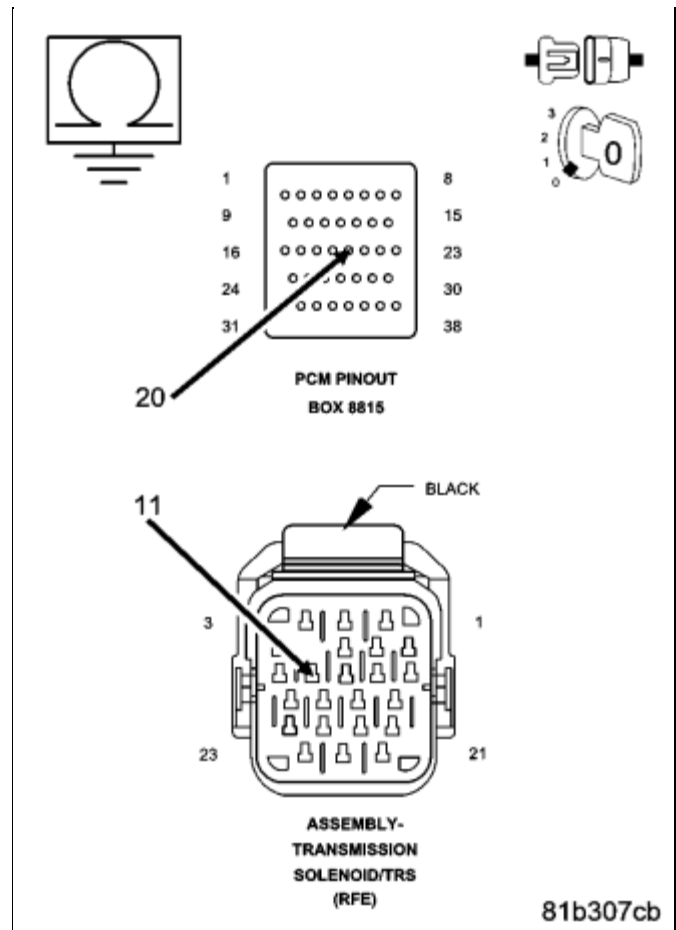
No

- Replace the Powertrain Control Module per the Service Information. With the scan tool, perform the



Quick Learn procedure.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



15. CHECK IF THE NO. 5 AND/OR NO. 7 CHECK BALL IS CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Inspect the 4C accumulator piston and seals and also the 4C tower seal on top of the valve body. Refer to the Service Information.

Where there any problems found?

Yes

- Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 4C clutch as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [16](#)

16. CHECK FOR EXCESSIVE LEAKAGE WITHIN THE 4C CLUTCH CIRCUIT

Air check the 4C Clutch hydraulic circuit. Refer to the Service Information.

NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.

Was there excessive air leakage in the 4C Clutch hydraulic circuit?

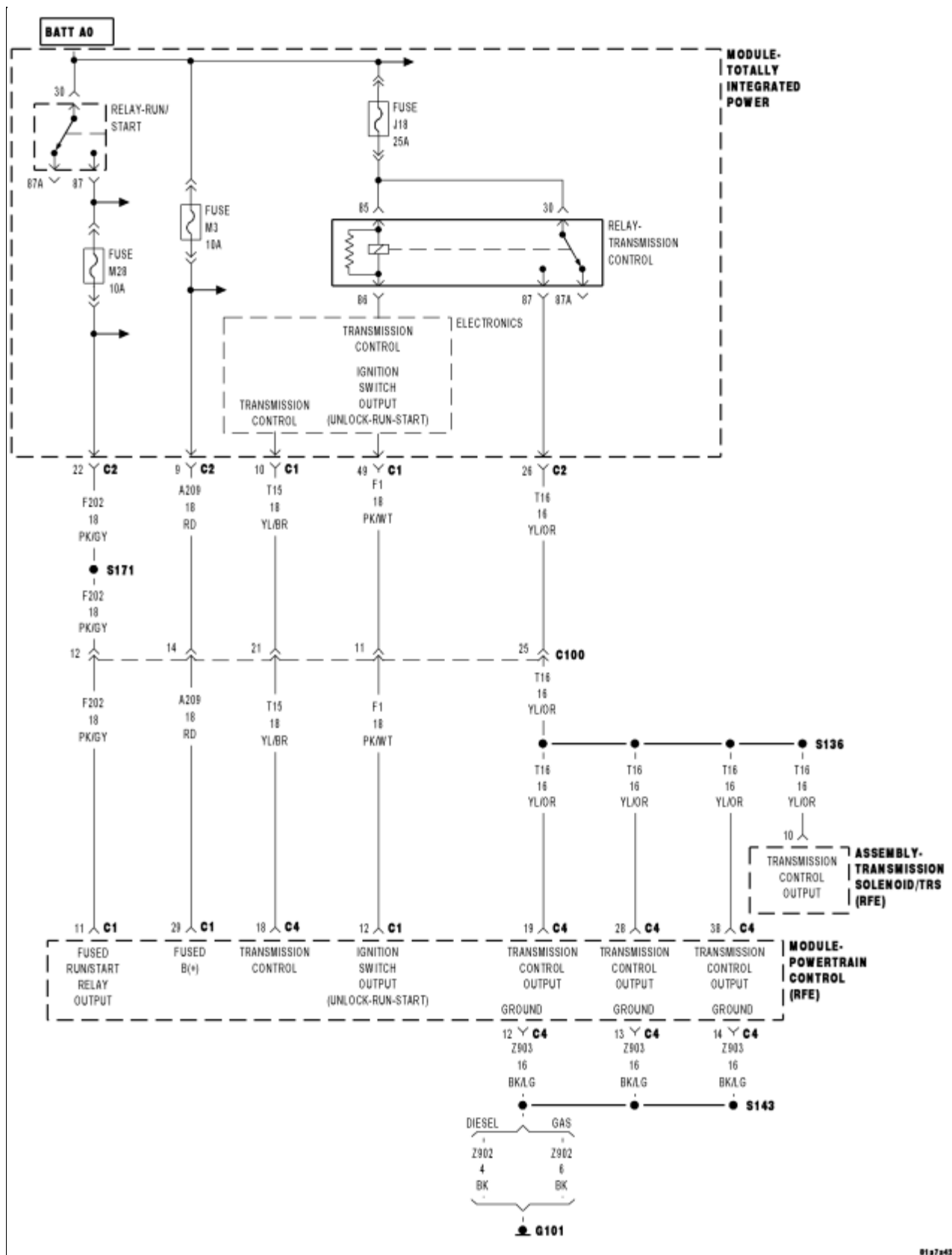
Yes

- Repair as necessary. Refer to the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P128B-TCM POWER CONTROL CIRCUIT 2 LOW - TIPM



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

- **Set Condition:**

A shorted condition is detected in the Transmission Control Output circuit.

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO GROUND
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, read TIPM DTCs.

Is the status Active for this DTC?

Yes

- Go to [2](#)

No

- Go to [5](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off
Disconnect the TIPM C2 harness connector.
Disconnect the PCM C4 harness connector and install Miller tool #8815.

**CAUTION: Do not probe the PCM harness connectors.
Probing the PCM harness connectors will damage the
PCM terminals resulting in poor terminal to pin**

connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance between ground and the (T16) Transmission Control Output circuit.

Is the resistance below 5.0 ohms?

Yes

- Repair the (T16) Transmission Control Output circuit for a short to ground.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [3](#)
-

3. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Connect the TIPM C2 harness connector.
Disconnect the Transmission Solenoid/TRS Assembly harness connector.

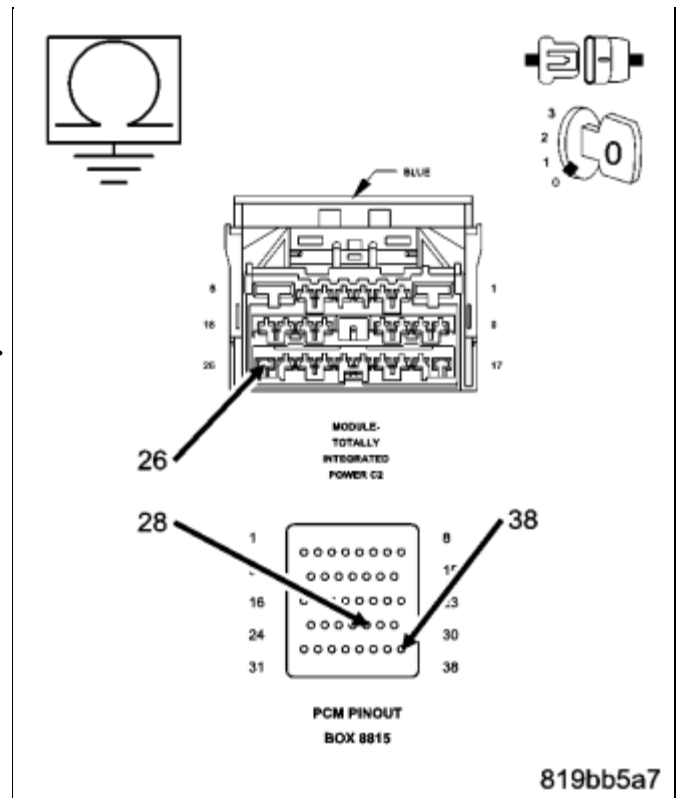
Ignition on, engine not running.

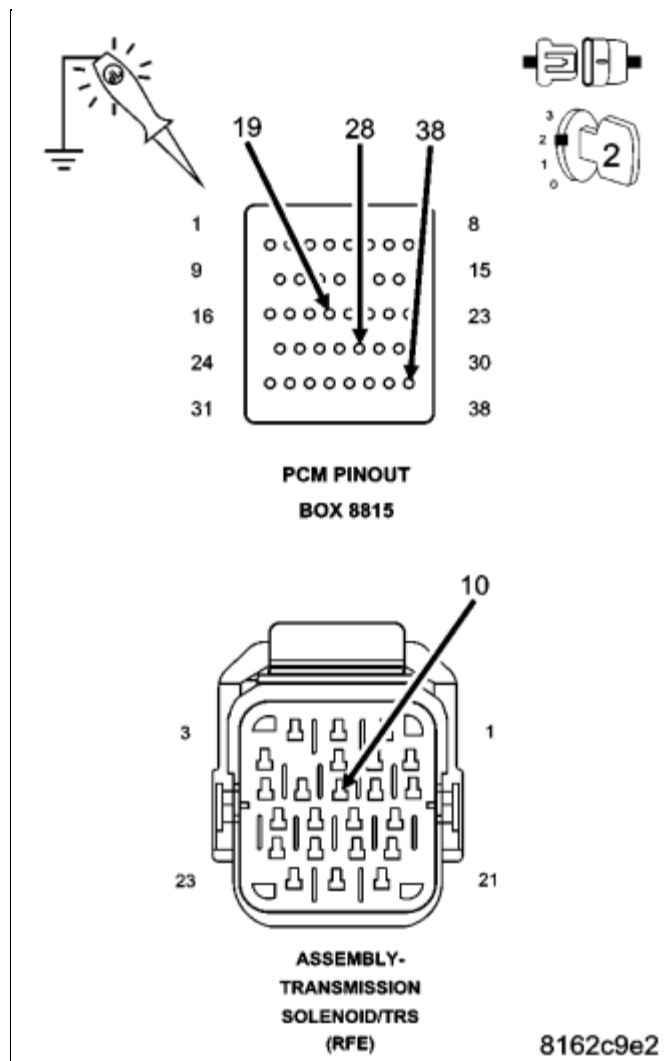
Using the scan tool under the TIPM Actuators, actuate the Transmission.

Using a 12-volt test light connected to ground, check the (T16) Transmission Control Output circuits.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly at all the (T16)





Transmission Control Output circuits?

Yes

- Go to [4](#)

No

- Repair the (T16) Transmission Control Output circuit for an open.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors.

Check the TIPM harness connector terminals for corrosion, damage, or terminal push out.

Pay particular attention to all power and ground circuits.

Were any problems found?

Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test complete.

P128C-TCM POWER CONTROL CIRCUIT 2 HIGH - TIPM

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

A shorted condition is detected in the TIPM Transmission Control Output circuit.

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO VOLTAGE
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, read TIPM DTCs.

Is the status Active for this DTC?

Yes

- Go to [2](#)

No

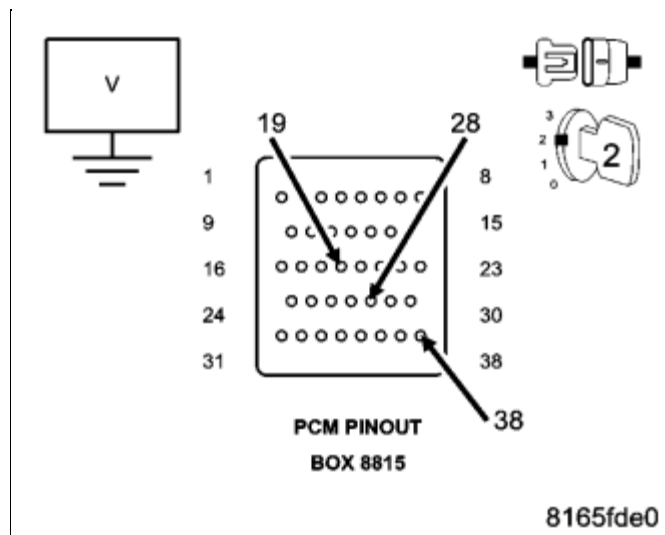
- Go to [4](#)

2. (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.
Disconnect the TIPM C2 harness connector.
Disconnect the PCM C4 harness connector.
Ignition on, engine not running.
Measure the voltage of the (T16) Transmission Control Output circuit.

Is the voltage above 10.0 volts?

Yes



- Repair the (T16) Transmission Control Output circuit for a short to voltage.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors. Check the TIPM harness connector terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

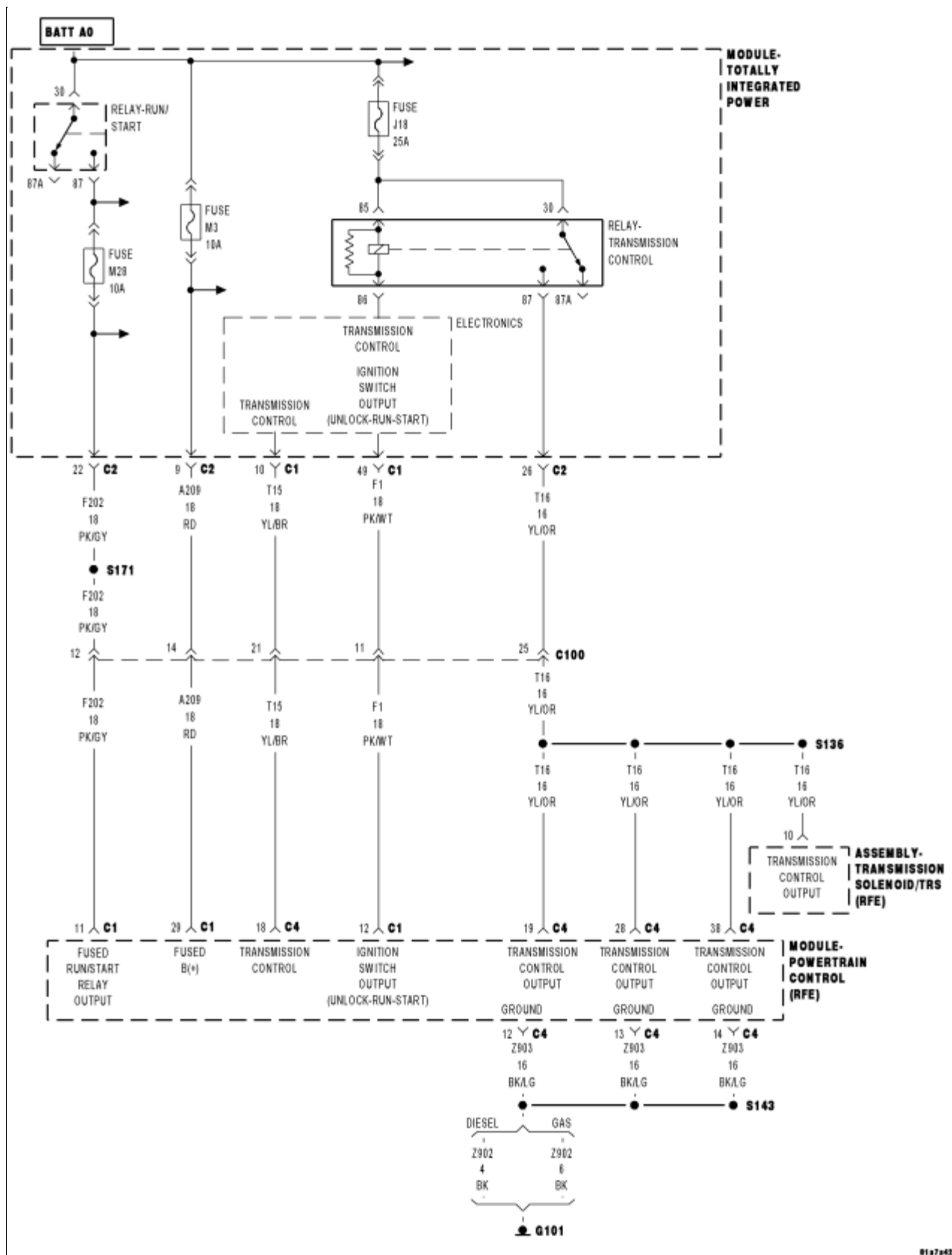
Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test complete.

P128D-TCM POWER CONTROL CIRCUIT 2 OPEN - TIPM



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

An open condition of the Transmission Control Output circuit is detected by the Totally Integrated Power Module (TIPM).

Possible Causes
(T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With the scan tool, read DTCs.

Is the status Active for this DTC?

Yes

- Go to [2](#)

No

- Go to [4](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and install Miller tool #8815.
Disconnect the Transmission Solenoid harness connector.
Disconnect the Line Pressure Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin

connection. Install Miller tool #8815 to perform diagnosis.

Ignition on, engine not running.

Using the scan tool under the TIPM Actuators, actuate the Transmission.

Using a 12-volt test light connected to ground, check the (T16) Transmission Control Output circuits.

NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes

- Go to [3](#)

No

- Repair the (T16) Transmission Control Output circuit for an open.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

3. TOTALLY INTEGRATED POWER MODULE

Using the schematics as a guide, inspect the wire harness and connectors.

Check the TIPM harness connector terminals for corrosion, damage, or terminal push out.

Pay particular attention to all power and ground circuits.

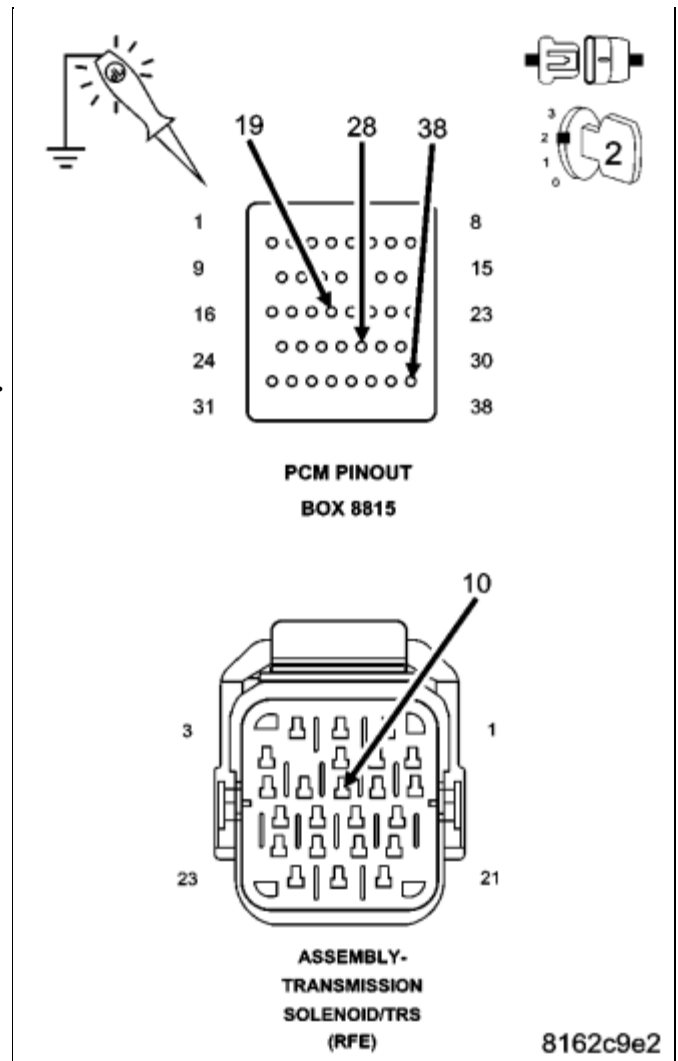
Were any problems found?

Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module per Service Information.



- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

4. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test complete.

P128E-TCM POWER CONTROL CIRCUIT 2 OVERCURRENT - TIPM

With the ignition on. Battery voltage greater than 10 volts.

◦ **Set Condition:**

An overcurrent condition is detected in the TCM Power Control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE (PCM)
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. CHECK IF THE DTC IS ACTIVE

Ignition on, engine not running.
With a scan tool, read TIPM DTCs.

Is the DTC active at this time?

Yes

- Go to [2](#)

No

- Go to [5](#)

2. CHECK THE (T16) TRANSMISSION CONTROL OUTPUT

Turn the ignition off to the lock position.
Disconnect the TIPM C2 harness connector.
Connect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C2 harness connector.
Read the amperage on the ammeter.

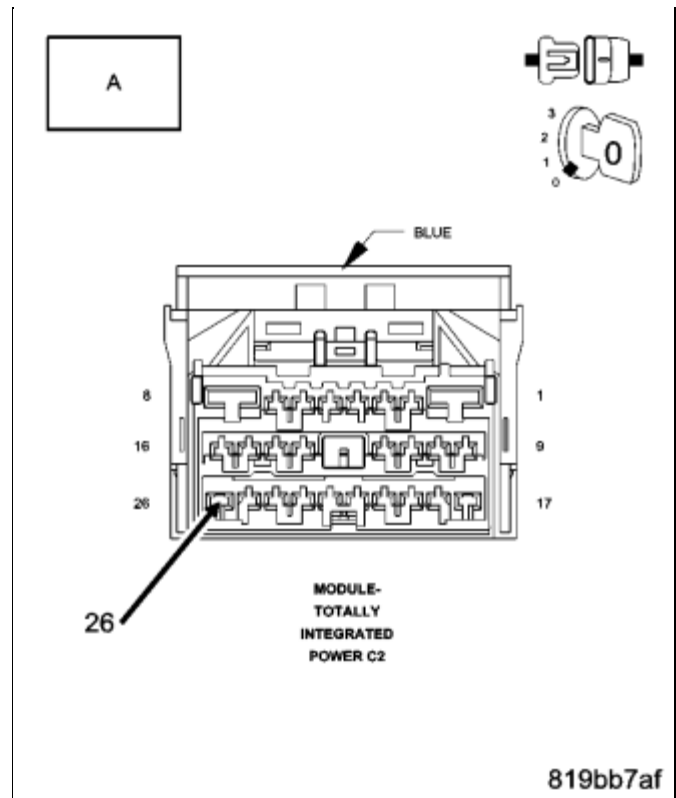
Does the amperage read below 2.0 amps?

Yes

- Go to [4](#)

No

- Go to [3](#)



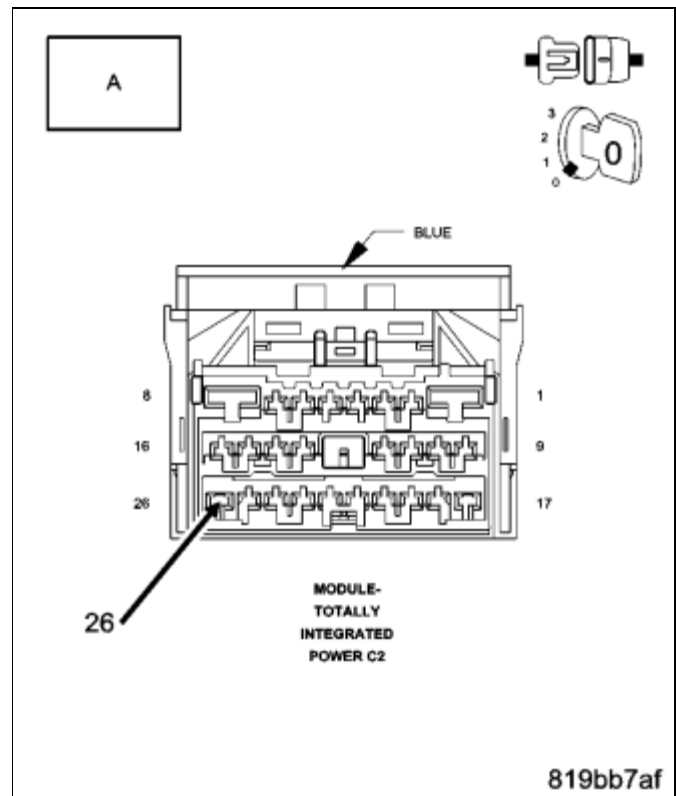
3. CHECK THE PCM

Disconnect the ammeter from the TIPM C2 harness connector and battery positive.
 Disconnect the PCM C4 harness connector.
 Reconnect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C2 harness connector.
 Read the amperage on the ammeter.

Does the amperage read below 2.0 amps?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go to [4](#)

4. CHECK THE TRANSMISSION SOLENOIDS

Disconnect the ammeter from the TIPM C2 harness connector.

Disconnect the PCM C4 harness connector and install Miller tool #8815.

Connect the positive probe of an ammeter to battery positive and connect the negative probe to the (T16) Transmission Control Output circuit in the TIPM C10 harness connector. While monitoring the amperage reading of the ammeter and using a jumper wire, jump each solenoid control circuit to ground one at a time in the appropriate terminals of Miller tool #8815.

NOTE: The amperage draw should be approximately .02 milliampere on each solenoid circuit with the PCM C4 harness connector disconnected.

Does the amperage read between .05 and .015 milliampere ($\pm .005$ milliampere) on each solenoid tested?

Yes

- Replace the Totally Integrated Control Module per the Service Information.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS per the Service Information.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

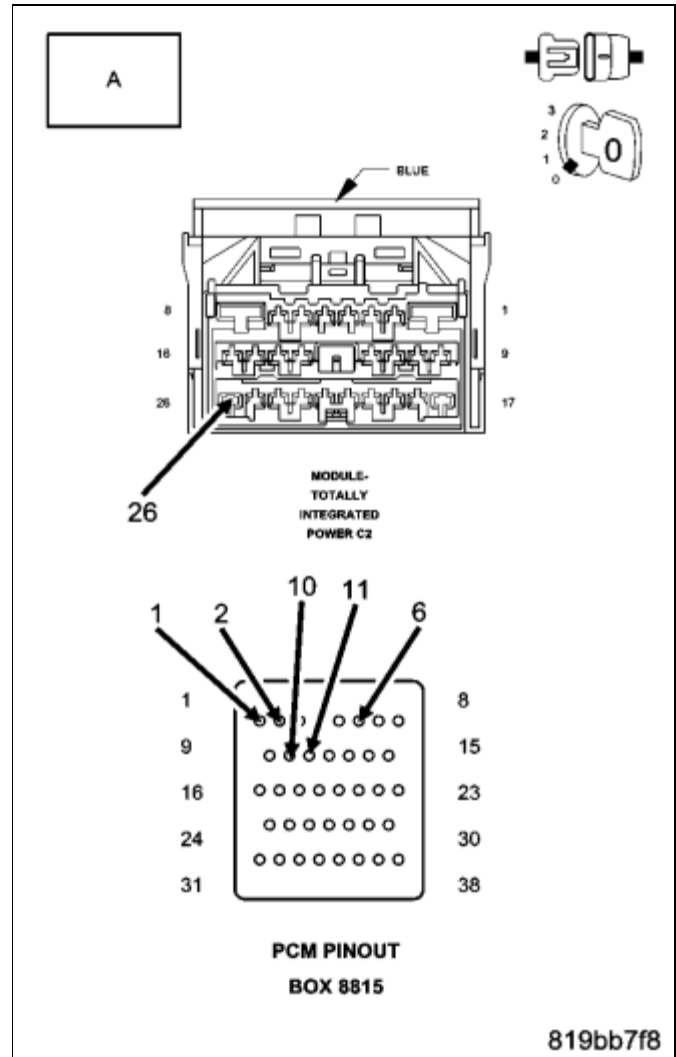
5. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Were there any problems found?



Yes

- Repair as necessary.
- Perform 545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P1684-BATTERY WAS DISCONNECTED

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The PCM uses a battery backed RAM (Random Access Memory) is used to maintain some learned values. When the battery B(+) is disconnected, the memory is lost. When the B(+) is restored, this memory loss is detected by the Transmission Control System. The DTC is set and the learned values are initialized to known constants or previously learned values from EEPROM (Electronic Erasable Programmable Read Only Memory). This results in the reinitialization of some parameters.

- **When Monitored:**

Whenever the ignition is in the Run/Start position.

- **Set Condition:**

This DTC will set whenever Powertrain Control Module is disconnected from Fused B(+) or ground. It will also be set using the scan tool to perform a Battery Disconnect and/or Quick Learn procedure.

Possible Causes
BATTERY WAS DISCONNECTED
SCAN TOOL BATTERY DISCONNECT PERFORMED
PCM WAS REPLACED OR DISCONNECTED
QUICK LEARN WAS PERFORMED

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. POSSIBLE CAUSES

This DTC is an informational DTC only.

This DTC is set due to a momentary loss of power and/or the ground circuits to the PCM.

Below are a list of possible causes associated with this DTC.

Battery was disconnected.

The Battery Disconnect feature (if equipped) on the scan tool was performed.

The Quick Learn feature on the scan tool was performed.

PCM was replaced or disconnected.

Were any of the above possible causes performed?

Yes

- This is the cause of the DTC. Erase the DTC and return vehicle to customer.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [2](#)

2. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

NOTE: Check all power and ground circuits to the PCM for a intermittent or high resistance condition.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P1715-RESTRICTED MANUAL VALVE IN T3 RANGE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**

Whenever the PRNDL code indicates Temp 3.

- **Set Condition:**

This DTC sets when conditions for the DTC P1776 are satisfied or 3 unsuccessful attempts to engage 1st gear while the shifter is in the temp 3 zone. This indicates a restricted port at the manual valve because the shifter is not fully engaged in the drive position.

Possible Causes
RELATED TRANSMISSION DTCS PRESENT
CUSTOMER DRIVING HABITS
MISADJUSTED SHIFTER

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check DTCs.

Are any of the following DTCs P0731, P0732, P0733, P0734, P0736, or P0716 present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK SHIFTER ADJUSTMENT

Check Shifter adjustment per the Service Information.

Is the shifter properly adjusted?

Yes

- Go to [3](#)

No

- Adjust the Shifter Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

3. CHECK CUSTOMER DRIVING HABIT

This DTC can be set if the customer rests their hand on the shift lever while they are driving. The transmission can be put in the T3 position if just enough upward pressure towards neutral is exerted on the shift lever. When this occurs, the feed port to the clutch is restricted, the transmission will declare neutral, and this DTC will be set. The customer should be informed not to rest their hand on the shifter while driving. This DTC can also be set by simply bumping the shift lever toward neutral while accelerating. With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

If there are no possible causes remaining, view repair.

Repair

- This DTC can be set by putting too much forward pressure on the shift lever while it is in the OD position. Make sure the customer is informed.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

P1736-GEAR RATIO ERROR IN 2ND PRIME

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

NOTE: Various Gear Ratio Error DTCs will set only if the transmission slips after first achieving the correct ratio. Therefore, a transmission with no drive (or reverse) may not set any Gear Ratio Error DTC because it never achieves a correct gear ratio.

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).

2) An excessive change in input or output speeds indicating signal intermittent which will result in the DTCs P0716 and/or P0721 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the

output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

- **When Monitored:**

Continuously with the ignition on, engine running, and after the transmission has achieved the proper gear ratio.

- **Set Condition:**

If the ratio of the Input rpm to the Output rpm does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

Possible Causes
RELATED DTCS PRESENT
INPUT SPEED SENSOR OR WIRING
LOW FLUID LEVEL
CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL
WORN SOLENOID SWITCH VALVE OR PLUGS
STUCK OR STICKING MAIN REGULATOR VALVE
BURNED UD OR 4C CLUTCH
CUT 4C OR UD PISTON SEAL
BROKEN 4C PISTON CASTING
BROKEN OR MISSING 4C BLEED ORIFICE
BROKEN OR MISSING UD BLEED ORIFICE
CUT 4C OR UD ACCUMULATOR PISTON SEAL
CRACKED 4C OR UD ACCUMULATOR PISTON
TRANSMISSION SOLENOID/TRS ASSEMBLY
BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR
MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer

to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**Diagnostic Test****1. CHECK IF RELATED DTCS ARE PRESENT**

With the scan tool, read DTCs.

Are any Transmission solenoid, line pressure, speed sensor, or loss of prime DTCs present?

Yes

- Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

No

- Go to [2](#)

2. CHECK THE EVENT DATA

With the scan tool, read and record the Event Data.

NOTE: Make sure to record all Event Data stored in the scan tool for future reference in this test procedure.

Does the Event Data display information for the DTC P1736?

Yes

- Go to [3](#)

No

- Go to [6](#)

3. CHECK INPUT RPM IN THE EVENT DATA

In the Event Data recorded earlier, does the Input rpm read zero?

Yes

- Check the input speed sensor and wiring. Refer to test P0716 and diagnose as if the DTC is current.

No

- Go to [4](#)

4. CHECK LINE PRESSURE READING

In the Event Data recorded earlier, is the line pressure reading more than 10 psi below the desired line pressure?

Yes

- Go to [5](#)

No

- Go to [6](#)

5. PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

NOTE: Make sure the Primary Transmission Oil Filter and/or seal is not cracked or split.

Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?

Yes

- Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If the Primary Transmission Oil Filter is plugged, refer to the Service Information for the proper hydraulic clutch repair procedure.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK IF THE DTC P1736 IS CURRENT

With the scan tool, perform the 2nd Prime Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

CAUTION: Do not overheat the transmission.

NOTE: If the 4C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd Prime Gear Clutch Test will not detect a faulty 4C clutch. However, it will detect a faulty UD clutch.

Did the clutch test pass, did the Input Speed remain at zero?

Yes

- Go to [7](#)

No

- Go to [9](#)

7. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [8](#)

8. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

During the road test, operate in 4th gear, and perform kickdown shifts from 4th to 2nd (prime) gears.

Is there an obvious slippage noticed in 4th or 2nd prime gears, or runaway on the 4-2 shift?

Yes

- Go to [11](#)

No

- Go to [14](#)

9. UD CLUTCH HYDRAULIC CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD clutch hydraulic circuit (in the case) per the Service Information.

NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?

Yes

- Repair as necessary. Check the UD clutch piston seals and the dribbler assembly, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore .

NOTE: If the UD clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [10](#)

10. UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

11. EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

Remove the valve body and air check the 4C clutch hydraulic circuit per the Service Information.

NOTE: The 4C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.

Were there any problems found, excessive debris, improperly assembled 4C clutch and/or excessive air leakage in the 4C clutch hydraulic circuit?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 4C piston seals and bleed orifice.

NOTE: If the 4C clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [12](#)

12. 4C ACCUMULATOR

Check the 4C Accumulator piston for cracks or a cut seal.

Check for a cut or missing No. 5 check ball.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

Were there any problems found?

Yes

- Repair as necessary. Refer to the Service Information for proper repair procedures.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [13](#)

13. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

- (1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.
- (2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).
- (3) Check to see if the reaction carrier (the front most carrier, whose outer shell is splined to the 4C clutch) is

rotating faster than the drive shell is being turned.

Is the reaction carrier turning faster than the drive shell?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the reaction carrier per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

14. CHECK IF THE DTC RESET

Did the DTC P1736 reset during the road test?

Yes

- Go to [15](#)

No

- Go to [16](#)

15. LIST OF POSSIBLE CAUSES

If any other DTCs set during the road test, refer to the appropriate symptom in the Transmission category.
If no other DTCs set during the road test, below is a list of possible causes, but not strictly limited to those:
Check for excessive debris in the Transmission Oil pan, plugged, cracked, or split Primary Transmission Oil Filter and/or seal.

Check for cuts or missing No. 5 check ball in the main valve body.

Check the 4C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.

Check the UD clutch piston seals, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces.

Check the 4C clutch piston seals, and bleed orifice.

Check the UD clutch piston seals, reaction shaft support seal rings, and dribbler assemblies, and the flatness of the pump valve body and pump housing faces.

View repair

Repair

- Repair as necessary. Refer to the Service Information for proper repair procedures.

NOTE: If the UD or 4C clutch has failed but no obvious cause is found (such as a cut piston seal, broken seal ring, stuck regulator valve or any other items listed above) replace the Transmission

Solenoid/TRS Assembly in addition to any necessary internal repairs.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

16. INTERMITTENT DTC

The conditions necessary to set this DTC are not present at this time.

Use the Event Data to help identify the conditions and/or possible causes that may have caused the DTC to set. Check for any Service Information Tune-ups or Technical Service Bulletins that may apply.

Where there any problems found?

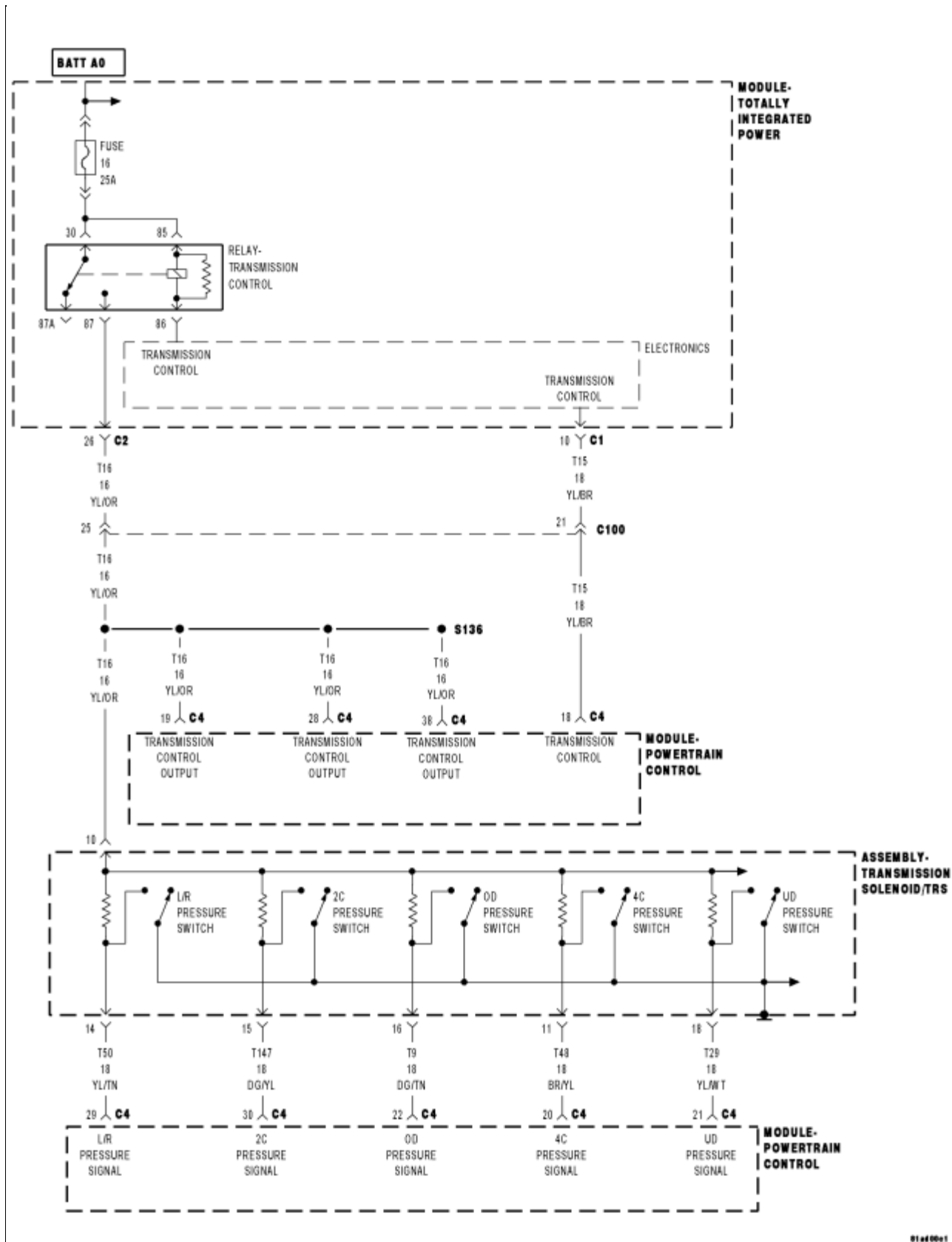
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION



For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gear, it will be in the upshifted position and directing the fluid to the torque converter clutch (TCC) control circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R Pressure Switch is monitored to confirm SSV movement. If movement is not confirmed (the L/R pressure switch does not close), EMCC is inhibited until SSV operation is confirmed.

- **When Monitored:**

During an attempted shift into 1st gear.

- **Set Condition:**

This DTC is set if three unsuccessful attempts are made to shift the Solenoid Switch Valve (SSV) into the downshifted position in one given ignition start. This DTC can take up to five minutes to mature before illuminating the MIL.

Possible Causes
RELATED DTC P0841 PRESENT
SOLENOID SWITCH VALVE STICKING
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, read DTCs.

Is the DTC P0841 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [6](#)

3. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the L/R Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK IF THE SOLENOID SWITCH VALVE STICKING

Turn the ignition off to the lock position.
 Remove the Transmission Oil Pan per the Service Information.
 Remove the Transmission Valve body per the Service Information.
 Inspect the Solenoid Switch Valve and Plugs for sticking.

Is the Solenoid Switch Valve or Plugs sticking?

Yes

- Clean and inspect per the Service Information. Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. CHECK THE L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.
 Disconnect the Transmission Solenoid/TRS Assembly harness connector.
 Disconnect all PCM harness connectors.
 Measure the resistance between the (T50) L/R Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

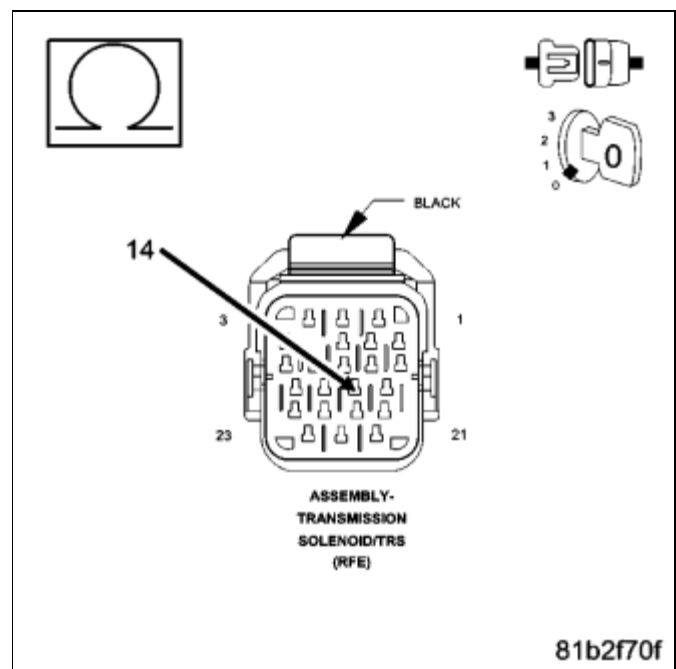
Is the resistance below 5.0 ohms between the (T50) L/R Pressure Switch Sense circuit and all other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for a short to another circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion,



damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

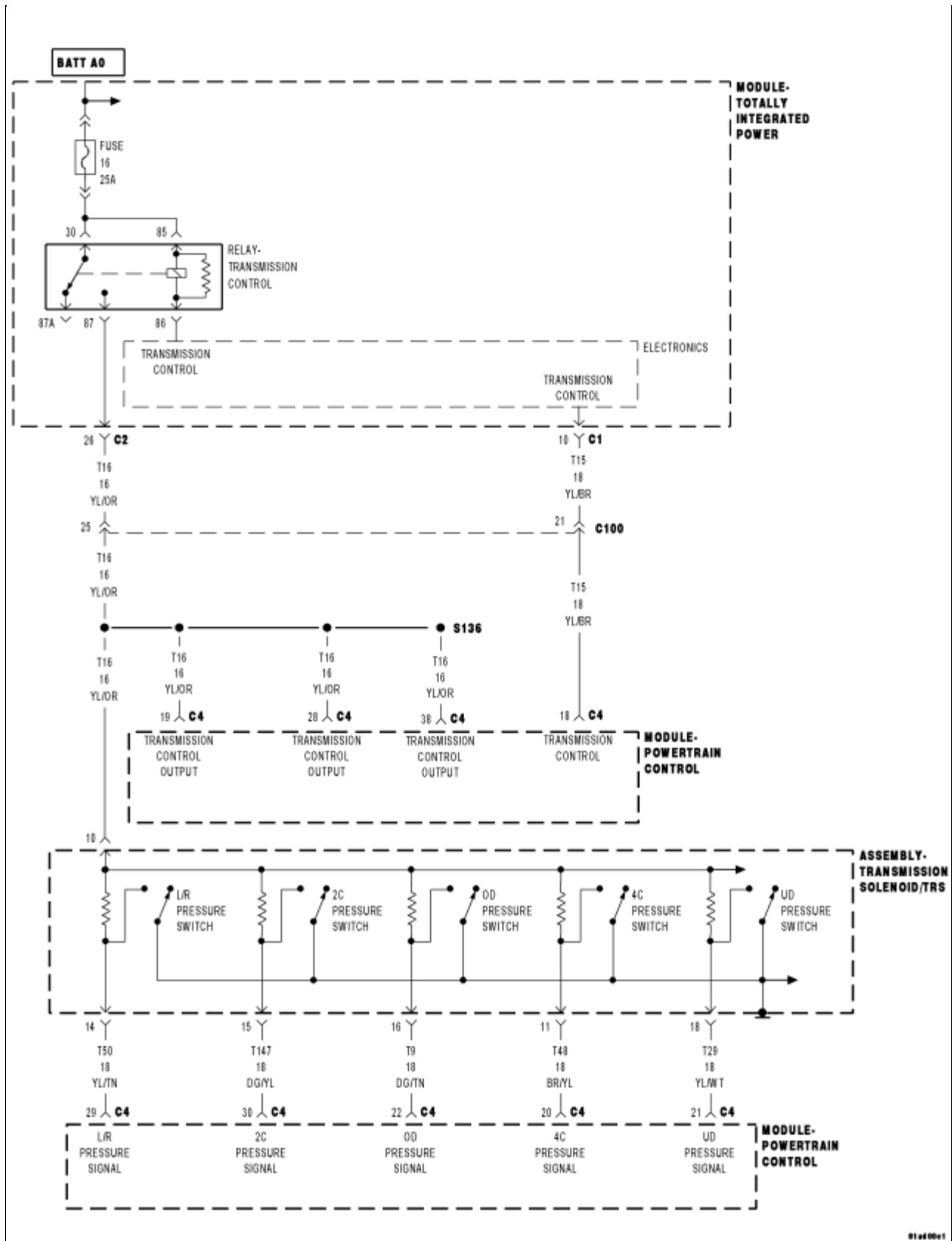
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION



For a complete wiring diagram Refer to Section 8W.

Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gear, it will be in the upshifted position and directing the fluid to the torque converter clutch (TCC) control circuit.

When in 2nd through 5th gear, the Torque Converter Clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the L/R solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 rpm. Then the L/R solenoid is fully energized (FEMCC - 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

- **When Monitored:**

Continuously when performing partial or full EMCC - PEMCC or FEMCC.

- **Set Condition:**

If the transmission senses the L/R pressure switch closing while performing PEMCC or FEMCC. This DTC will set after two unsuccessful attempts to perform PEMCC or FEMCC. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
RELATED DTC P0841 PRESENT
L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
SOLENOID SWITCH VALVE
POWERTRAIN CONTROL MODULE
CHECK THE WIRING AND CONNECTORS

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK FOR RELATED DTCS

With the scan tool, read DTCs.

Is the DTC P0841 present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK IF THE DTC IS CURRENT

With the scan tool, read DTCs.

Is the status Active or is the Starts Since Set counter 2 or less for this DTC?

Yes

- Go to [3](#)

No

- Go to [7](#)

3. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the Transmission Simulator, turn the Pressure Switch selector switch to the L/R position.
With the scan tool, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Did the state of the L/R Pressure Switch change while pressing the Pressure Switch Test button?

Yes

- Go to [4](#)

No

- Go to [5](#)

4. CHECK THE SOLENOID SWITCH VALVE

Remove the Valve Body per the Service Information.

Inspect the Solenoid Switch Valve and plugs for sticking in the bore and/or wear.

Were there any problems found?

Yes

- Clean and repair as necessary per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [7](#)

5. CHECK THE L/R PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

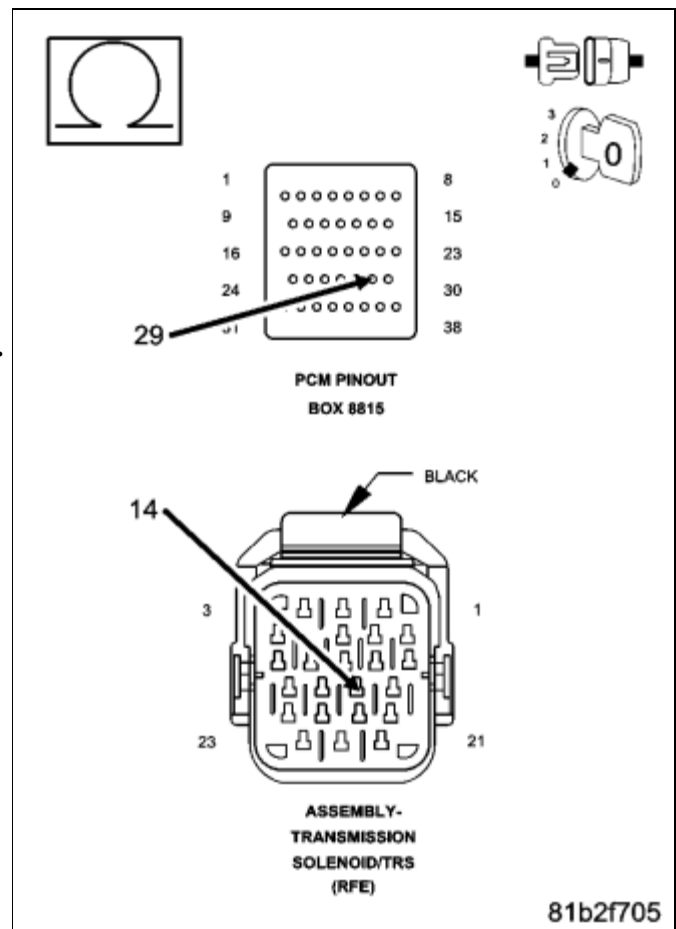
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit between the Solenoid/TRS Assembly harness connector and the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



No

- Go to [6](#)

6. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.

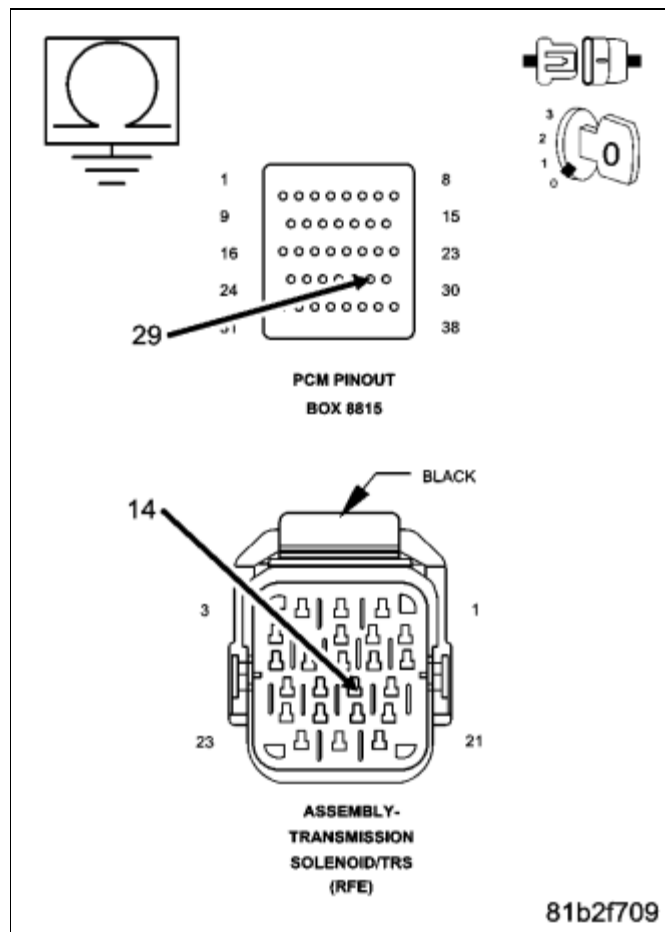
Is the resistance below 5.0 ohms?

Yes

- Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



7. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

This DTC can also be set by the Solenoid Switch Valve intermittently sticking in its bore under extreme temperature conditions, or by a worn Solenoid Switch Valve or plugs.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

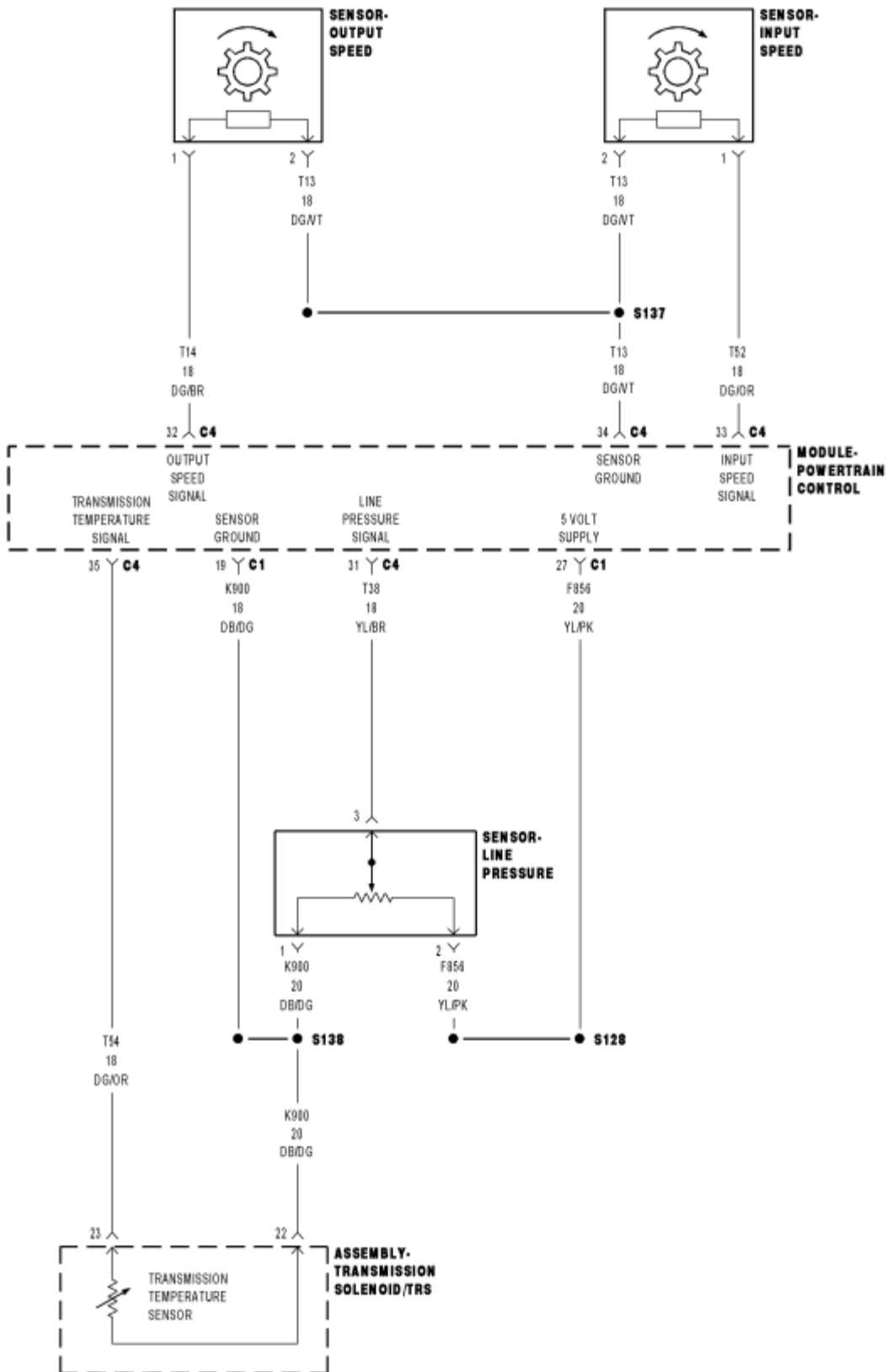
Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P1794-SPEED SENSOR GROUND ERROR



01a79c68

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The transmission system uses two speed sensors, one to measure input rpm and one to measure output rpm. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

- 1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36 and P1736).
- 2) An excessive change in input or output speeds indicating signal intermittent which will result in the DTCs P0716 and/or P0721 being set.
- 3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

- **When Monitored:**

The gear ratio is monitored continuously while the Transmission is in gear.

- **Set Condition:**

After a controller reset in neutral and a ratio of input to output, of 1 to 2. This DTC can take up to five minutes of problem identification before illuminating the MIL.

Possible Causes
(T13) SPEED SENSOR GROUND CIRCUIT OPEN
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND
(T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK TO SEE IF DTC P1794 IS CURRENT

Engine Running, Shift lever in park.

With the scan tool, read the Transmission Output and Input Speed Sensor states.

Is the Output Speed Sensor reading twice the Input Speed Sensor reading?

Yes

- Go to [2](#)

No

- Go to [6](#)

2. PCM AND WIRING

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install the Transmission Simulator, Miller tool 8333.
With the Transmission Simulator, set the Input/Output Speed selector switch to the "3000/1000" position. Turn the Input/Output Speed switch to "ON".
Ignition on, engine not running.
With the scan tool, monitor the Input and Output Speed Sensor state.

Does the Input speed read 3000 rpm and the Output speed read 1000 rpm, within 50 rpm?

Yes

- Go to [6](#)

No

- Go to [3](#)

3. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Turn the ignition off to the lock position.
Disconnect the PCM C4 harness connector and connect Miller tool #8815.
Disconnect the Transmission Simulator, Miller tool #8333.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.

Measure the resistance of the (T13) Speed Sensor Ground circuit between both Input and Output Speed Sensor harness connectors and the appropriate terminal of Miller tool #8815 to the.

Is the resistance above 5.0 ohms on any of the above measurements?

Yes

- Repair the (T13) Speed Sensor Ground circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

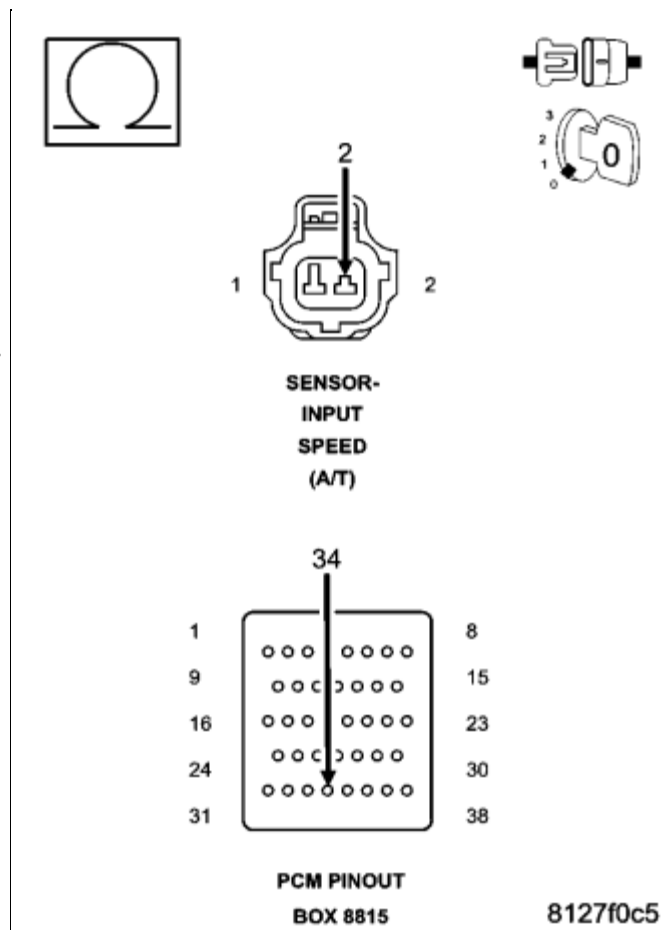
Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.

Is the resistance below 5.0 ohms?

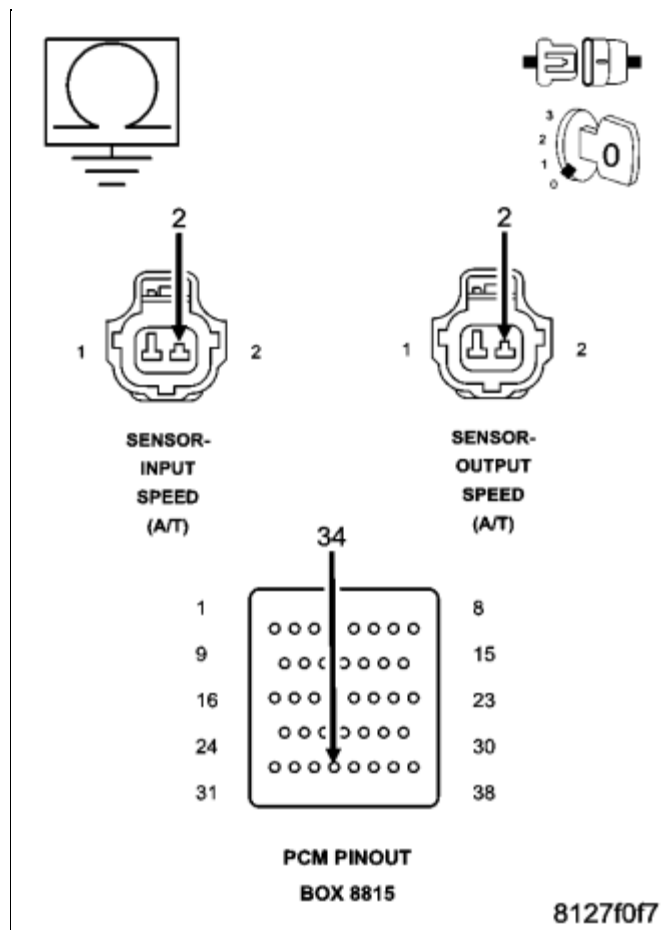
Yes

- Repair the (T13) Speed Sensor Ground circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No



- Go to [5](#)



5. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.
With the scan tool under TIPM, actuate the Transmission.
Measure the voltage of the (T13) Speed Sensor Ground circuit.

Is the voltage above 0.5 volt?

Yes

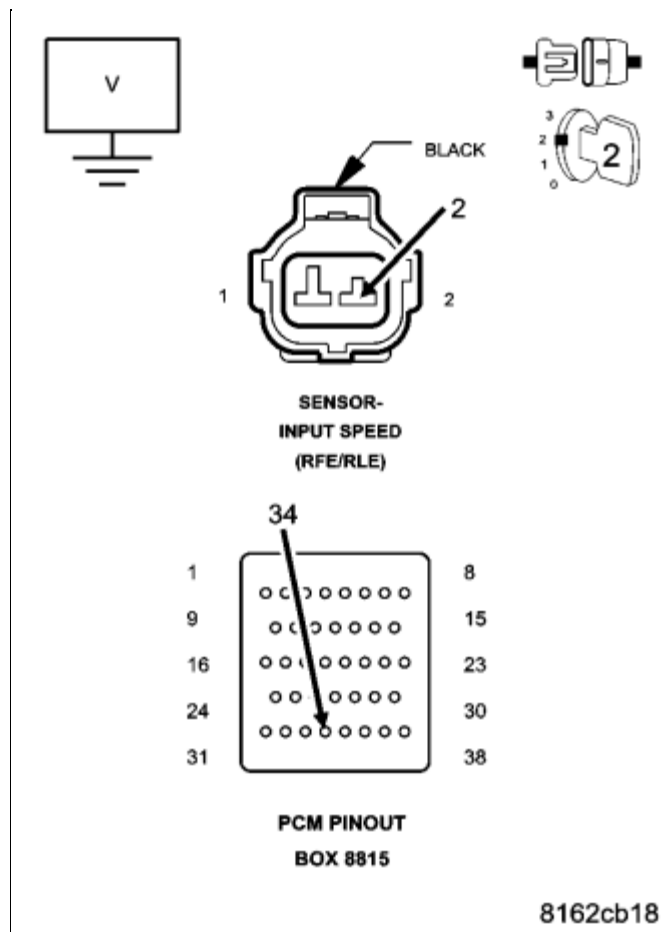
- Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are

found, replace the PCM per the Service Information.
With the scan tool, perform Quick Learn.

- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



6. CHECK THE WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the Event Data to help identify the conditions in which the DTC was set.

Where there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2700-INADEQUATE ELEMENT VOLUME LR

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTCs, which indicates an internal transmission problem.

- **When Monitored:**

Whenever the engine is running. The L/R clutch volume index (CVI) is updated during a 3-1 or 2-1 manual downshift with throttle angle below 5 degrees. Transmission temperature must be at least 43° C (110° F).

- **Set Condition:**

When the L/R clutch volume index (CVI) falls below 16.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN L/R CLUTCH PISTON RETURN SPRING OR SPRING RETAINERS
BROKEN L/R ACCUMULATOR SPRING(S)
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, read DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK L/R CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

Start the engine and warm the transmission.

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Drive the vehicle and perform at least ten 3-1 manual downshifts at closed throttle from speeds of about 32 Km/h or 20 mph.

With the scan tool, read the L/R CL VOL INDEX.

Is the L/R CL VOL INDEX below 20?

Yes

- Go to [3](#)

No

- Go to [5](#)

3. L/R CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the L/R accumulator springs.

Look for possible leak paths into the L/R clutch hydraulics circuit within the valve body.

Were any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. AIR CHECK L/R CLUTCH CIRCUITS

Perform an air check on the L/R Clutch circuit per the Service Information.

Watch and listen for L/R Clutch piston movement.

Does the L/R piston stroke and return properly?

Yes

- Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Repair internal transmission as necessary. Pay attention to the components related to the L/R clutch. A broken or weak L/R clutch return spring, Accumulator Spring, and/or dislocated snap ring could cause this problem.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C (110° F) before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Km/h or 50 mph, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVIs and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVIs less than 5 or different than before the BATTERY DISCONNECT?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2701-INADEQUATE ELEMENT VOLUME 2C

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTCs, which indicates an internal transmission problem.

- **When Monitored:**

Whenever the engine is running. The 2C clutch volume index (CVI) is updated during a 3-2 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).

- **Set Condition:**

When the 2C CVI falls below 5.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN 2C CLUTCH PISTON RETURN SPRING / DISLODGED SNAP RING
BROKEN ACCUMULATOR SPRING(S)
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, read DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK 2C CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

Drive the vehicle at about 80 Km/h (50 mph), then depress the OD off button. This will put the vehicle into third gear.

NOTE: The TRANS TEMP DEG must be at least 43° C (110° F) before performing the following steps.

Perform at least ten 3-2 kickdowns by depressing the throttle between 10 and 54 TPS Degrees at speeds of about 80 Km/h (50 mph).

With the scan tool, read the 2C CL VOL INDEX.

Is the 2C CL VOL INDEX below 10?

Yes

- Go to [3](#)

No

- Go to [5](#)

3. 2C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the 2C accumulator springs .

Look for possible leak paths into the 2C clutch hydraulics circuit within the valve body.

Were any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. AIR CHECK 2C CLUTCH CIRCUIT

Turn the ignition off to the lock position.

Perform an air check on the 2C Clutch circuit per the Service Information.

Watch and listen for 2C Clutch piston movement.

Dose the piston stroke and return properly?**Yes**

- Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Repair internal transmission as necessary. Pay attention to the components related to the 2C clutch. A broken or dislodged 2C return spring, snap ring or broken 2C Accumulator Spring could cause this problem.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Km/h or 50 mph, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVIs and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVIs less than 5 or different than before the BATTERY DISCONNECT?**Yes**

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2702-INADEQUATE ELEMENT VOLUME OD

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTCs, which indicates an internal transmission problem.

- **When Monitored:**

Whenever the engine is running. The OD clutch volume index (CVI) is updated during a 2-3 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).

- **Set Condition:**

When the OD CVI falls below 5.

Possible Causes
HYDRAULIC LEAK IN THE VALVE BODY
BROKEN OD ACCUMULATOR SPRING
BROKEN OD/REV PISTON BELLEVILLE SPRING OR DISLODGED SNAP RING
INTERNAL LEAKAGE IN PUMP ASSEMBLY
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK THE OD CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

NOTE: The TRANS TEMP DEG must be at least 43° C (110° F) before performing the following steps.

Drive the vehicle and perform at least ten 2-3 upshifts with the TPS degree between 10 and 54.
With the scan tool, read the OD CL VOL INDEX.

Is the OD CL VOL INDEX below 10?

Yes

- Go to [3](#)

No

- Go to [5](#)

3. OD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the OD accumulator spring.

Look for possible leak paths into the OD clutch hydraulics circuit within the valve body.

Were any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. AIR CHECK OD CLUTCH CIRCUIT

Perform an air check on the OD Clutch circuit per the Service Information.

Watch and listen for OD Clutch piston movement.

Air check all other pump passages and watch for air leakage into the OD clutch passage.

NOTE: There is a bleed orifice between the OD and Reverse Clutch passages, so a small amount of air leakage from Reverse to OD is normal.

Were any problems found?

Yes

- Repair internal transmission. Pay attention to the OD Clutch. Broken or weak return spring or a dislocated snap ring could cause this problem. If no problems were found in the OD clutch, or if leakage into the OD passage was noted, replace Pump Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission/TRS Solenoid Assembly per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Km/h or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVIs and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVIs less than 5 or different than before the BATTERY DISCONNECT?

Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2703- INADEQUATE ELEMENT VOLUME UD

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTCs, which indicates an internal transmission problem.

- **When Monitored:**

Whenever the engine is running. The UD clutch volume index (CVI) is updated during a 4-3 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).

- **Set Condition:**

When the UD CVI falls below 11.

Possible Causes
BROKEN UD ACCUMULATOR SPRING(S)
BROKEN UD CLUTCH PISTON SPRING OR DISLODGED SNAP RING
INTERNAL LEAKAGE IN PUMP OR VALVE BODY ASSEMBLIES
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. OTHER DTCS PRESENT

With the scan tool, check DTCs.

Are there any Pressure Switch Sense circuit DTCs present also?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go to [2](#)

2. CHECK UD CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Drive the vehicle and perform at least ten 4-3 kickdowns by depressing the throttle between 30 and 54 TPS degrees at speeds about 80 Km/h or 50 mph.

With the scan tool, read the UD clutch volume index (CVI).

Is the UD CVI below 10?

Yes

- Go to [3](#)

No

- Go to [5](#)

3. UD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan and valve body per the Service Information.

Check the condition of the UD accumulator springs.

Look for possible leak paths into the UD clutch hydraulics circuit within the valve body.

Were there any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. AIR CHECK UD CLUTCH CIRCUIT

Perform an air check on the UD Clutch circuit per the Service Information.

Watch and listen for UD Clutch piston movement.

Air check all other pump passages for air leakage into the UD Clutch circuit.

Were any problems found?**Yes**

- Repair internal transmission. Pay attention to components related to the UD clutch. Broken or weak return spring or a dislocated snap ring. If no trouble is found in UD clutch component or UD clutch leakage was noted in passage, replace the Pump Assembly.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. VERIFY PCM OPERATION

NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Km/h or 50 mph, then brake lightly to a stop. Turn off engine.

With the scan tool, record the clutch volume index (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVIs and compare them to the readings recorded before the BATTERY DISCONNECT.

Are any of the CVIs less than 5 or different than before the BATTERY DISCONNECT?**Yes**

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2704-INADEQUATE ELEMENT VOLUME 4C

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTCs, which indicates an internal transmission problem.

- **When Monitored:**

Whenever the engine is running. The 4C clutch volume index (CVI) is updated during a 3-4 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).

- **Set Condition:**

When the 4C CVI falls below 5.

Possible Causes
BROKEN 4C RETURN SPRING OR DISLODGED SNAP RING
BROKEN 4C ACCUMULATOR SPRING(S)
HYDRAULIC LEAK IN THE VALVE BODY
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. CHECK THE 4C CLUTCH VOLUME

With the scan tool, record the 4C clutch volume index (CVI) and erase DTCs.

Perform at least 10, 3-4 upshifts with the throttle between 10 and 54 degrees. The Transmission temperature must be at least 43° C or 110° F.

With the scan tool, read the 4C CVI.

Is the current 4C CVI below 10?

Yes

- Go to [2](#)

No

- Go to [5](#)

2. DTC P0876 PRESENT

With the scan tool, check DTCs.

NOTE: The DTC P0876 must also be set with P2704 in order for this test to be valid.

Is the DTC P0876 also present?

Yes

- Replace the Transmission Solenoid/TRS Assembly per the Service Information.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [3](#)

3. 4C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the Service Information.

Check condition of the 4C accumulator springs.

Look for possible leak paths into the 4C clutch hydraulics circuit within the valve body.

Were any problems found?

Yes

- Repair as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go to [4](#)

4. AIR CHECK 4C CLUTCH CIRCUIT

Perform an air check on the 4C Clutch circuit per the Service Information.

Listen for proper 4C Clutch piston movement.

Were any problems found?

Yes

- Repair Internal transmission as necessary. Pay attention to the mechanical components related to the 4th clutch. A broken or weak return spring or a dislocated snap ring could cause this problem.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the service information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

5. VERIFY PCM OPERATION

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record Transmission CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVIs and compare them to the reading recorded before the BATTERY DISCONNECT.

Are any of the CVIs less than 5 or are they different than before the battery disconnect?

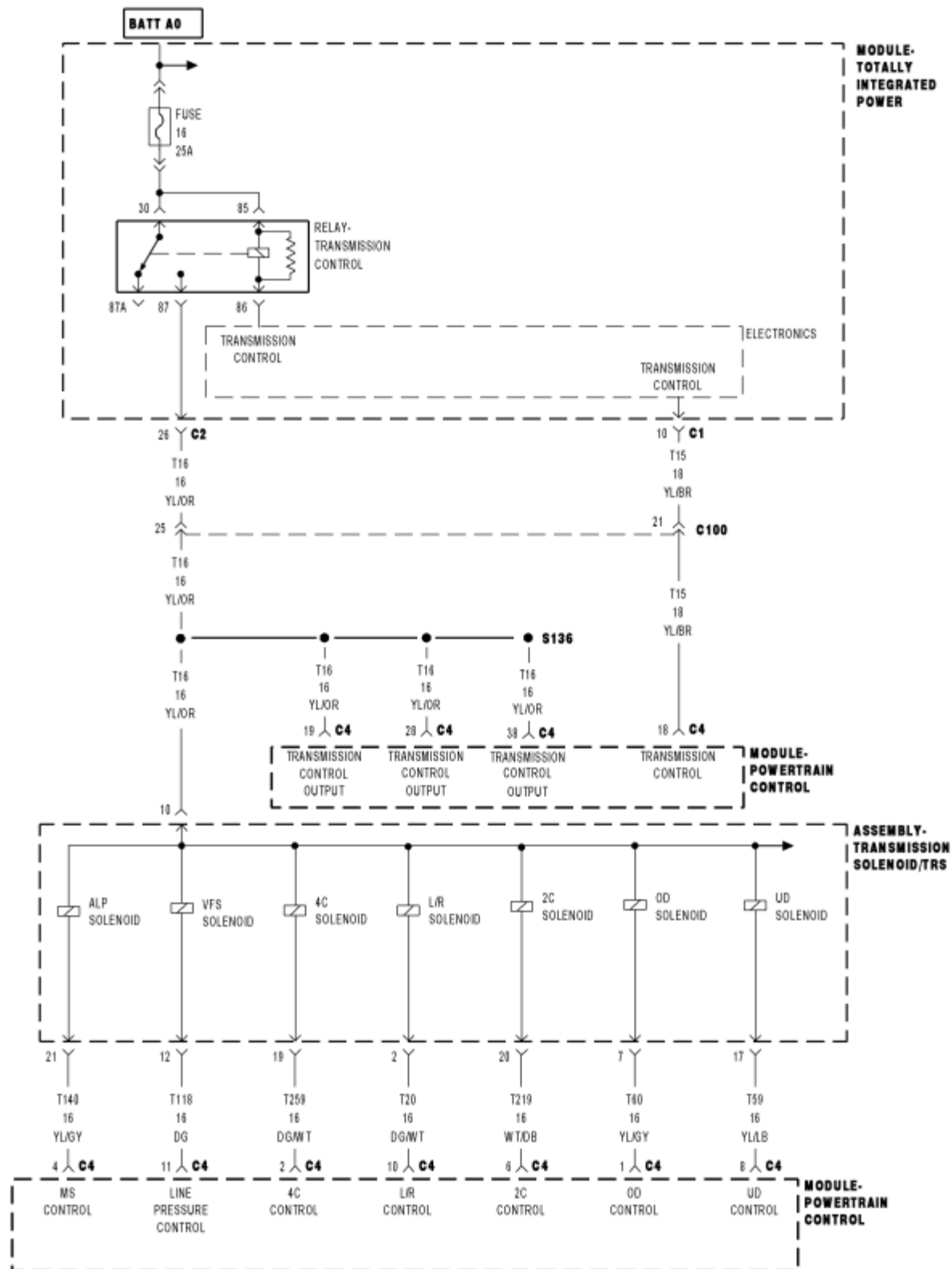
Yes

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform Quick Learn.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Test Complete.

P2706-MS SOLENOID CIRCUIT



81ac056

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC.

- **When Monitored:**

Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.

- **Set Condition:**

After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

NOTE: This DTC is strictly an electrical fault and cannot be caused by any internal transmission failure other than an open in the Transmission Solenoid/TRS Assembly. If the Transmission Solenoid/TRS Assembly is in need of replacement — do not replace the Valve Body.

Possible Causes
RELATED DTCS PRESENT
(T140) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS
(T140) MS SOLENOID CONTROL CIRCUIT OPEN
(T140) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND
TRANSMISSION SOLENOID/TRS ASSEMBLY
POWERTRAIN CONTROL MODULE

Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

Diagnostic Test

1. RELATED TCM POWER INPUT DTCS PRESENT

With the scan tool, check DTCs.

Are there any TIPM TCM Power Control Circuit or TCM Power Input DTCs present?

Yes

- Refer to the Transmission category and perform the appropriate symptom.

No

- Go To [2](#)

2. TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.
Remove the Ignition Switch Feed fuse from the TIPM.

CAUTION: Removal of the Ignition Switch Feed fuse from the TIPM will prevent the vehicle from being started in gear.

WARNING: The Ignition Switch Feed fuse must be removed from the TIPM. Failure to do so can result in personal injury or death.

Install Transmission Simulator, Miller tool #8333.
Ignition on, engine not running.
With the scan tool, actuate the MS Solenoid.
Monitor the MS Solenoid LED on the Transmission Simulator.

Did the MS Solenoid LED on the Transmission Simulator blink on and off?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the MS Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P2706 reset during the actuation test?

Yes

- Go To [5](#)

No

- Go To [4](#)

4. WIGGLE TEST WITH TRANSMISSION SIMULATOR

With the Transmission simulator still connected, continue to actuate the 4C solenoid for another 2 minutes while wiggling the related wiring harness and connectors.

With the scan tool, stop the actuation and check for transmission DTCs.

Did the DTC P0770 reset during the actuation test?

Yes

- Repair wiring harness or connectors as necessary.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Replace the Transmission Solenoid/TRS Assembly per the Service Information. **Note: Do NOT replace the entire Valve Body.** (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

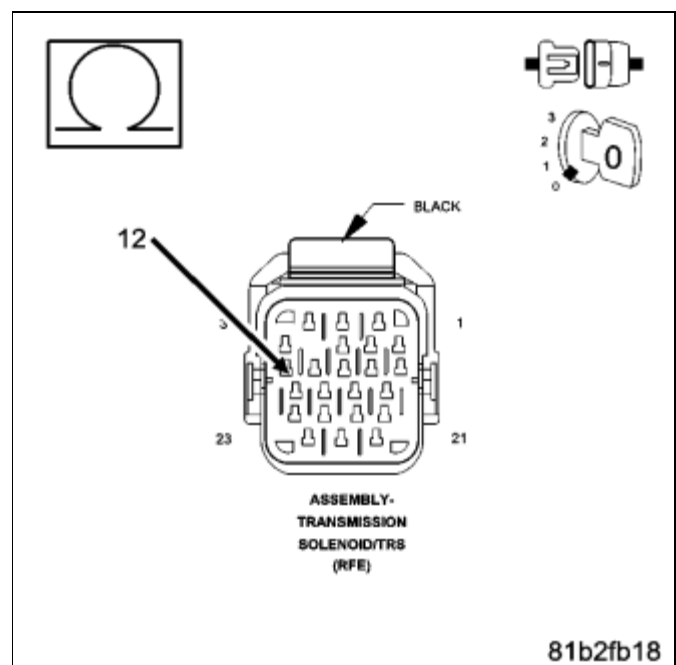
5. (T140) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.
Disconnect the Transmission Simulator, Miller tool #8333.
Disconnect the PCM harness connectors.
Measure the resistance between the (T140) MS Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

Is the resistance below 5.0 ohms between the (T140) MS Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?

Yes

- Repair the (T140) MS Solenoid Control circuit for a short to other circuit(s).
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 -



TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Go To [6](#)

6. (T140) MS SOLENOID CONTROL CIRCUIT OPEN

Connect Miller tool #8815 to the PCM C4 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller special tool #8815 to perform diagnosis.

Measure the resistance of the (T140) MS Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

Is the resistance above 5.0 ohms?

Yes

- Repair the (T140) MS Solenoid Control circuit for an open.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

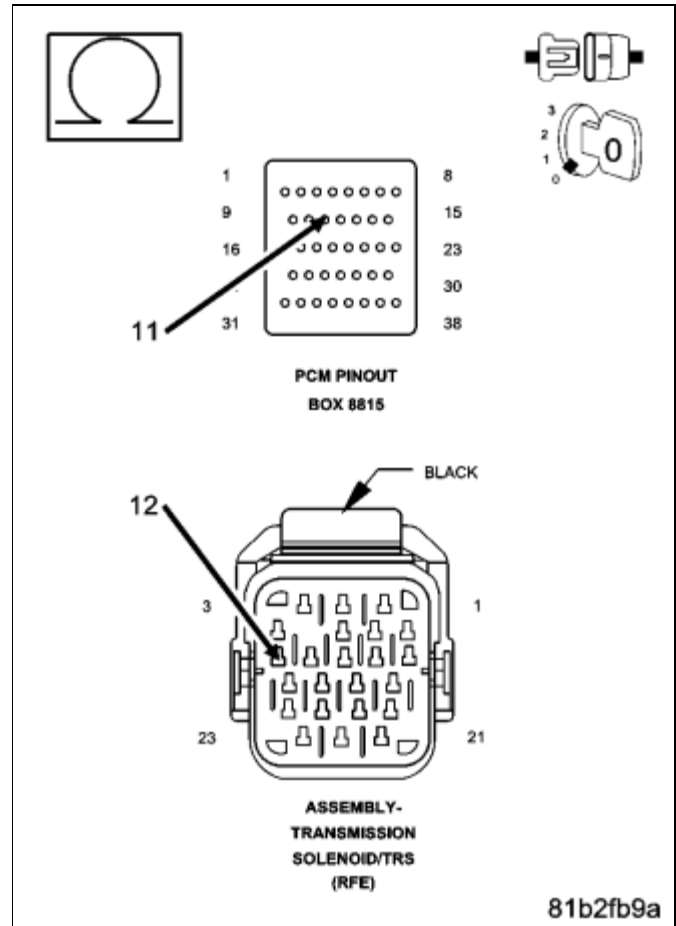
No

- Go To [7](#)

7. (T140) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T140) MS Solenoid Control circuit.

Is the resistance below 5.0 ohms?



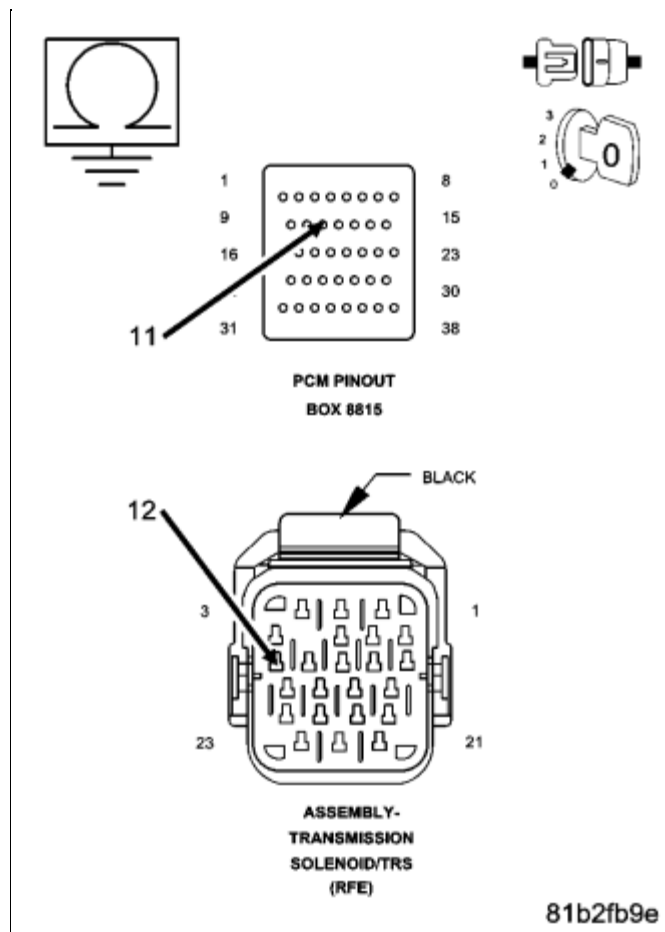
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Yes

- Repair the (T140) MS Solenoid Control circuit for a short to ground.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



U0002-CAN C BUS OFF PERFORMANCE

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C Bus. The transmission controller continuously monitors the Bus activity and receives the messages it needs. The CAN C Bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

- **When Monitored:**

Every 7 msec. when:

- 1) Engine speed greater than 500 rpm.
- 2) Battery voltage greater than 10v but less than 16v.

- **Set Condition:**

CAN C Bus messages not received for 10 seconds.

Diagnose the U0002 CAN C BUS OFF PERFORMANCE as the U0001 CAN C BUS CIRCUIT test in 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0100-NO COMMUNICATION WITH THE ECM/PCM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Communication over the CAN bus is continuously monitored between the Engine Control System and the Transmission Control System. Due to the integration of both systems into one module (NGC3), (Powertrain Control Module) the bus communication between the systems is internally transmitted over the dual port ram. The NGC4 controller contains only one processor. This DTC will set if the NGC4 controller (transmission only) is used in conjunction with an Engine Controller (ECM).

- **When Monitored:**

Every 7 msec. with the ignition on.

- **Set Condition:**

ECM/PCM CAN bus message not received by the Transmission Control System for the period of 10 seconds.

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0121-LOST COMMUNICATION WITH ABS

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C Bus. The transmission controller continuously monitors the Bus activity and receives the messages it needs. The CAN C Bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

- **When Monitored:**

Every 7 msec. with:

- 1) Engine speed greater than 500 rpm.
- 2) Battery voltage greater than 10v but less than 16v.

- **Set Condition:**

CAN C Bus messages not received for 10 seconds.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

U0141 LOST COMMUNICATION WITH FCM

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

Some NGC controllers communicate with other controllers over the CAN C Bus. The transmission controller continuously monitors the Bus activity and receives the messages it needs. The CAN C Bus is also used to communicate transmission MIL status to the Engine Controller, If the Engine Controller is unable to communicate with the Transmission Controller, the Engine Controller will light the MIL.

- **When Monitored:**

Every 7 msec. with:

- 1) Engine speed greater than 500 RPM.
- 2) Battery voltage greater than 10v but less than 16v.

- **Set Condition:**

CAN C Bus messages not received for 10 seconds.

Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

STANDARD PROCEDURE

45RFE/545RFE PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete wiring diagram **Refer to Section 8W.**

Perform the following before attempting any diagnostic procedures:

- With the scan tool check pinion factor (if equipped) for proper tire identification and program or reprogram if necessary.
- Check the transmission fluid level. If the fluid level is low, locate and repair any leaks and fill the

transmission to the proper level. Refer to the appropriate Service Information for procedures. Many transmission symptoms can be caused by a low fluid level.

- Check the battery. To avoid false diagnosis, testing should only be performed with the battery fully charged.
- With the scan tool, read Engine (PCM) DTCs. If DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.
- With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.
- With the scan tool, read and record the DTC EVENT DATA. Use this data to identify the conditions in which the DTC was set.
- **NOTE: DTC Event Data may exist even if no DTCs are stored. DTC Event Data is only erased by a Battery Disconnect, reflash, or QuickLearn procedure. Clearing DTCs does NOT erase the DTC Event Data. Some DTCs require two "bad trips" before they are stored (and the MIL illuminates). The transmission may enter "limp-in" mode during the first "bad trip," but if the fault condition is not present after the vehicle is restarted, the pending DTC may be cleared without lighting the MIL. Nevertheless, the DTC Event Data for the pending DTC will remain stored and can still be retrieved with the scan tool. If the customer reports a "limp-in" event but no DTCs are present, check the DTC Event Data.**
- Performing a Battery Disconnect will clear all DTC EVENT DATA and reset all learned Transmission values to the default values, which may temporarily result in erratic shift schedules.
- With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706 Transmission Range Sensor Rationality.
- For Gear Ratio Error DTCs, use the scan tool to view CVI Monitor data. Read and record the Clutch Volume Index information.
- Use the wiring diagram as a guide. Inspect the wiring and connectors related to this circuit. Repair as necessary.
- Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, after driving under specific conditions and after diagnostic monitors have been run.
- Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.
- Refer to any Service Information Tune Ups or Technical Service Bulletins that apply.

Were there any repairs made that fixed the vehicle?

Yes

- Testing complete.
- Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

No

- Refer to the Transmission category and perform the appropriate diagnostic procedure(s).

45RFE/545RFE TRANSMISSION VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W.**

Perform the following after completion of a diagnostic repair:

After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed.

- With the scan tool check pinion factor (if equipped) for proper tire identification and program or reprogram if necessary.
- Connect the scan tool to the Data Link Connector (DLC).
- Reconnect any disconnected components.
- If the PCM has been replaced or updated (flashed), or the transmission has been repaired or replaced, using the scan tool, perform a Quick Learn Procedure.
- With the scan tool, erase all Transmission and Engine DTCs.
- With the scan tool, perform a BATTERY DISCONNECT, this will clear the DTC EVENT DATA
- With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT.
- Check the Transmission fluid level and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE)
- Road test the vehicle.
- Perform the following shifts from a standing start with a constant throttle opening of 20 to 25 degrees to the speeds of 97 Km/h (60 mph); make fifteen to twenty 1 to 2, 2 to 3, 3 to 4 4 to 5.upshifts.
- Perform the following shifts with speeds below 40 Km/h (25 mph); make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.
- Check for DTCs during and after the road test.
- If after performing the road test, if any shift concerns are noted, perform the drive learn procedure for those affected shifts. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)
- **Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC does not re-mature.**

Were there any Diagnostic Trouble Codes (DTCs) set during the road test?

Yes

- Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

No

- Repair is complete.

AUTOMATIC TRANSMISSION - 545RFE

AUTOMATIC TRANSMISSION - 545RFE

DESCRIPTION

The 545RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4-2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range. An additional overdrive ratio (0.67:1) is also provided for greater fuel economy and less NVH at highway speeds.

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

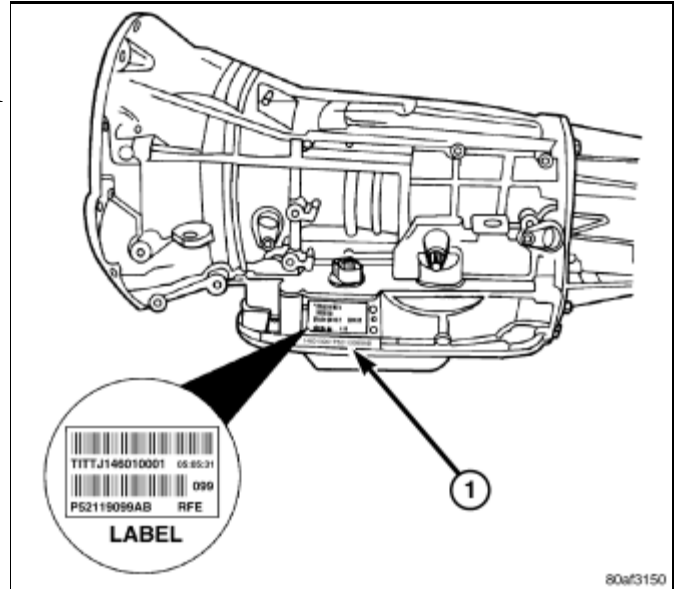
The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

The Transmission Control Module (TCM) is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. Depending on the vehicle configuration, the TCM may be a standalone module or it may be housed along with the Powertrain Control Module (PCM) in a single module. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

TRANSMISSION IDENTIFICATION

Transmission identification numbers (1) are stamped on the left side of the case just above the oil pan sealing surface . Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.



GEAR RATIOS

The 545RFE gear ratios are: **1st** - 3.00:1

2nd - 1.67:1

2nd Prime - 1.50:1

3rd - 1.00:1

4th - 0.75:1

5th - 0.67:1

Reverse - 3.00:1

OPERATION

The 545RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmissions includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output capacity greatly exceeds that which is needed to keep the clutches applied. The 45RFE/545RFE pump-pressure control system monitors input torque and adjusts the pump pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allows earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 45RFE/545RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A cooler return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the scan tool.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on a 545RFE automatic transmission, check for Diagnostic Trouble Codes with the scan tool.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and

condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

1. Record all DTCs and the accompanying DTC Event Data.
2. Check for an appropriate Technical Service Bulletin that applies to the customer complaint.
3. Check fluid level and condition.
4. Road test and note how transmission upshifts, downshifts, and engages.
5. If the complaint was related to shift quality, perform the Quick Learn procedure, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE), and the Drive Learn Procedure, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).
6. If the shift complaint still exists, compare actual line pressure (sensor reading, using the scan tool) to the Desired Line Pressure reading, in Park, Drive, and Reverse at 1500 RPM. Check that the LP sensor reads 30 psi (the minimum it should ever display) with key on / engine off.
7. Perform air-pressure test to check clutch operation. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)
8. Replace the Transmission Solenoid/TRS Assembly and perform the Quick Learn and Drive Learn procedures again.
9. If the complaint still exists, remove, inspect, and repair the transmission as necessary

VEHICLE IS DISABLED

1. Record all DTCs and the accompanying DTC Event Data.
2. With engine running, place transmission in gear and verify correct PRNDL reading. Observe the Input and Output speeds using the scan tool. If output RPM is greater than zero but vehicle does not move, check for transfer case in Neutral (or failed internally), failed propshaft, or failed / disconnected drive axle. If output RPM is zero and input RPM is greater than zero, internal transmission slippage is indicated. Run clutch slip tests using the scan tool, check oil pan for debris, and air check the various clutch circuits.
3. Shift the transmission into neutral, if both input and output speeds are zero, check flexplate bolts, torque converter, and transmission input shaft.
4. Compare actual line pressure (sensor reading, using the scan tool) to the Desired Line Pressure reading, in Park, Drive, and Reverse at 1500 RPM. Check that the LP sensor reads 30 psi (the minimum it should ever display) with key on / engine off. If line pressure is incorrect, check fluid level and condition.
5. Remove, inspect, and repair the transmission as necessary

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line pressure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

545RFE CLUTCH APPLICATION CHART

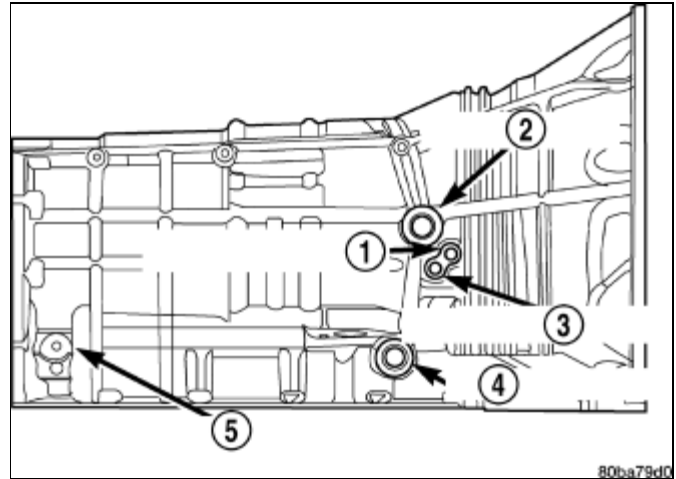
SLP	UD	OD	R	2C	4C	L/R	OVERRUNNING
P-PARK						ON	
R-REVERSE			ON			ON	
N-NEUTRAL						ON	
D-FIRST	ON					ON*	ON
D-SECOND	ON			ON			
D-SECOND PRIME	ON				ON		
D-THIRD	ON	ON					
D-FOURTH		ON			ON		
D-FIFTH		ON		ON			
D-LIMP-IN	ON	ON					
2-FIRST	ON					ON*	ON
2-SECOND	ON			ON			
2-LIMP-IN	ON			ON			
1-LOW	ON					ON	ON
*L/R clutch is on only with the output shaft speed below 150 rpm.							

HYDRAULIC PRESSURE TEST

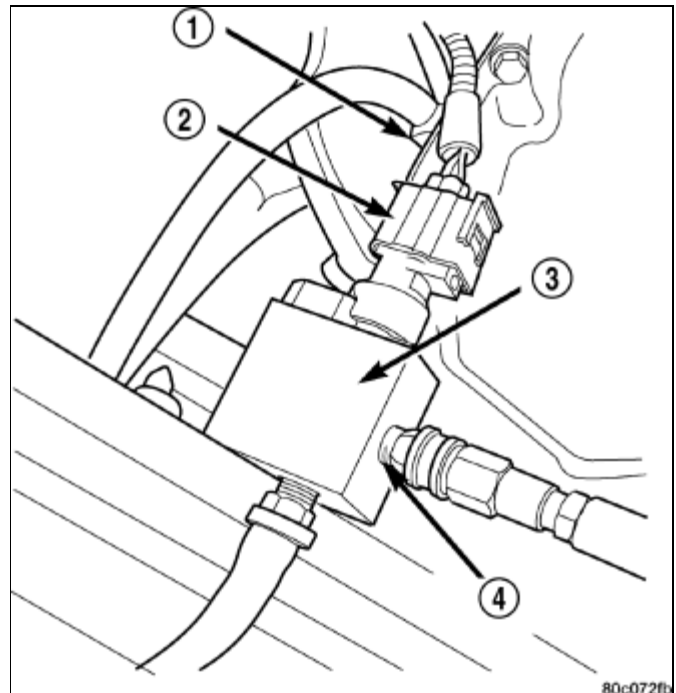
An accurate tachometer and pressure test gauges are required. Oil Pressure Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

Pressure Test Port Locations

Only two pressure ports are supplied on the transmission case. The torque converter clutch apply (3) and release (1) ports are located on the right side of the transmission case.



To determine the line pressure, there are two available methods. The scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 (3) into the transmission case and then install the pressure gauge and the original sensor (2) into the adapter. This will allow a comparison of the scan tool readings and the gauge reading to determine the accuracy of the line pressure sensor. The scan tool line pressure reading should match the gauge reading within ± 10 psi.



TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employ that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

NOTE: The 45RFE/545RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures, garage shift pressures, and TCC pressure. The upshift/downshift pressure for all shifts are shown in [UPSHIFT PRESSURES](#) and [DOWNSHIFT PRESSURES](#). In-gear maximum pressure for each gear position is shown in [IN-GEAR PRESSURES](#). The garage shift pressure when performing a N-R shift is 220 psi. The garage shift pressure for the R-N shift is 120 psi. The garage shift pressure for the N-1 shift is 135 psi. Torque converter lock-up pressure is 120 psi.

UPSHIFT PRESSURES

1-2	2-3	2prime-3	3-4	2prime-4	2-5	3-5	4-5
120	120	120	120	120	120	120	130

DOWNSHIFT PRESSURES

5-4	5-3	5-2	4-3	4-2prime	3-2	3-2prime	2prime-1	2-1	3-1
120	120	120	120	120	120	120	120	120	120

IN-GEAR PRESSURES

1	2	2prime	3	4	5	NEUTRAL	REVERSE
135	120	120	120	120	120	120	220

AIR CHECKING TRANSMISSION CLUTCH OPERATION

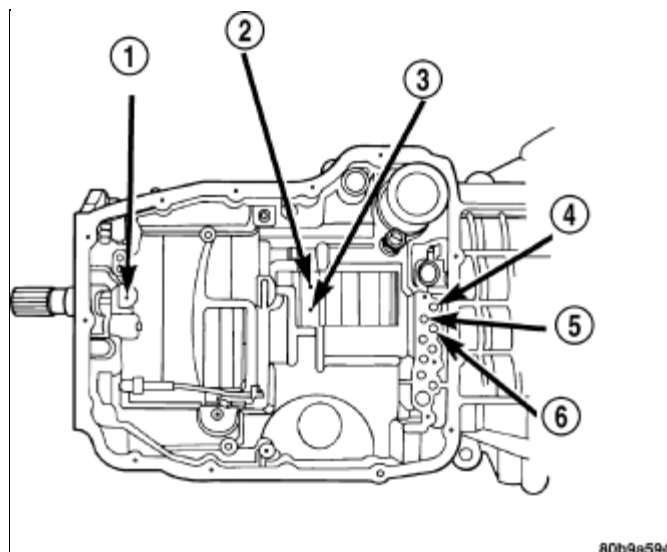
Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown in the Air Pressure Test Passages graphic .

NOTE: The air supply which is used must be free of

moisture and dirt. Use a pressure of 30 psi to test clutch operation.

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.



CONVERTER HOUSING FLUID LEAK

When diagnosing converter housing fluid leaks, two items must be established before repair.

1. Verify that a leak condition actually exists.
2. Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Torque converter seal leaks tend to move along the drive hub and onto the rear of the converter. Pump cover seal leaks tend to run down the cover and the inside surface of the bellhousing.

Some leaks, or suspected leaks, may be particularly difficult to locate. If necessary, a Mopar® approved dye should be used to locate and confirm a leak.

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

1. Leaks at the weld joint around the outside diameter weld .
2. Leaks at the converter hub weld .

In most cases, a torque converter which is wet from transmission fluid indicates a leak at one of these areas.

STANDARD PROCEDURE -

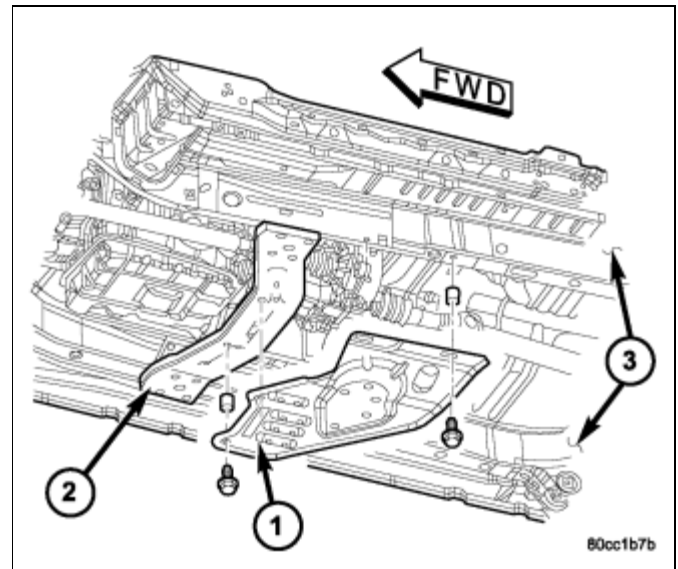
ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

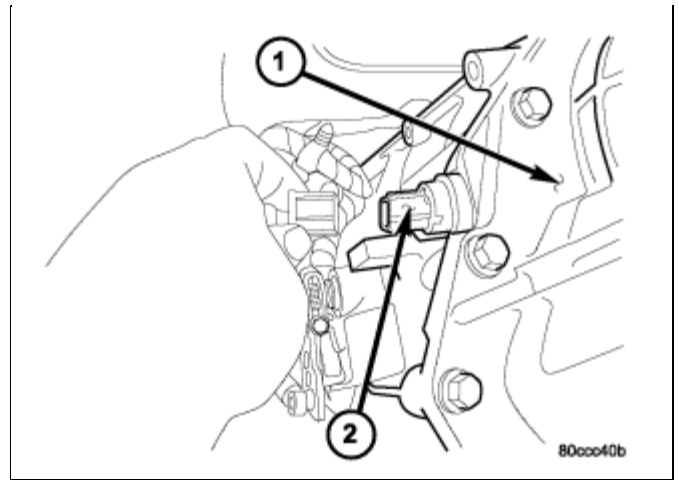
REMOVAL

1. Disconnect the negative battery cable.
2. Raise and support the vehicle
3. Remove any necessary skid plates (1). (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)

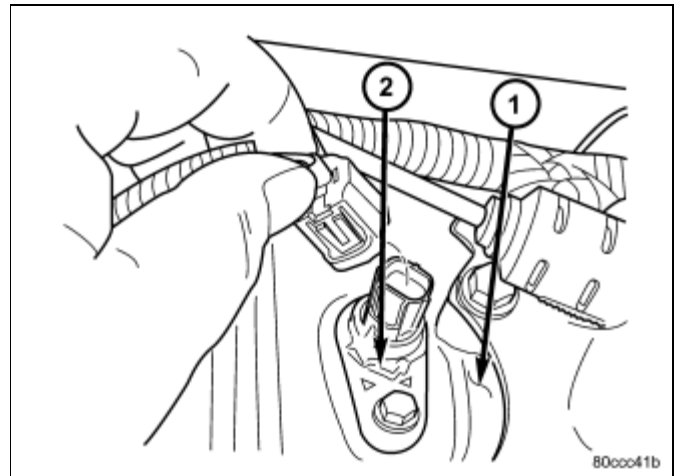


4. Mark propeller shaft and axle companion flanges for assembly alignment.
5. Remove the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
6. Remove the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disengage the output speed sensor connector from the

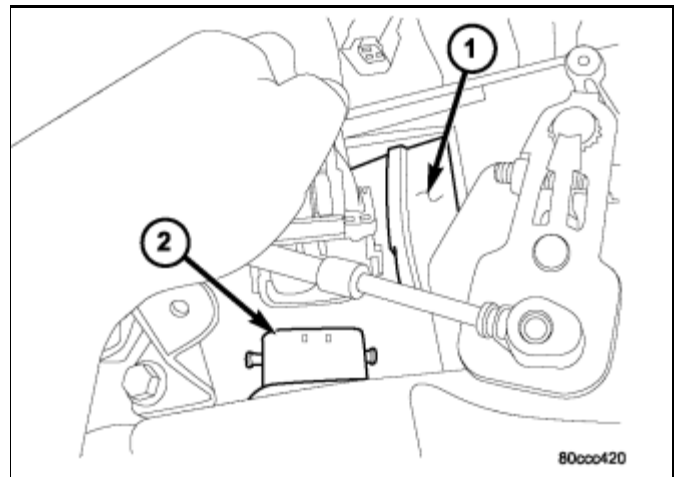
output speed sensor (2).



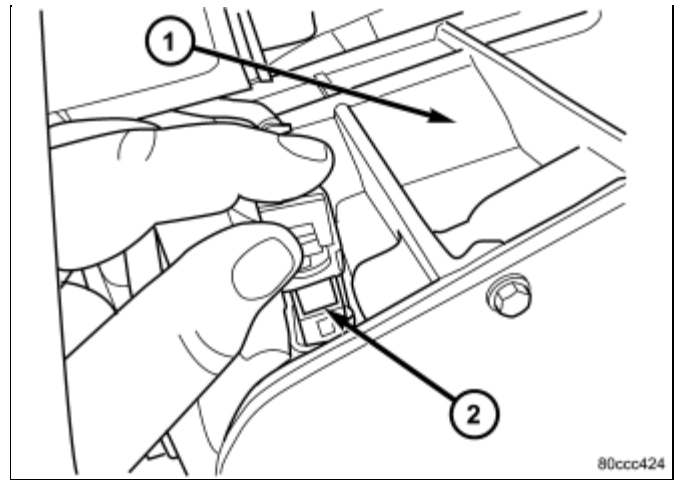
8. Disengage the input speed sensor connector from the input speed sensor (2).



9. Disengage the transmission solenoid/TRS assembly connector from the transmission solenoid/TRS assembly (2).

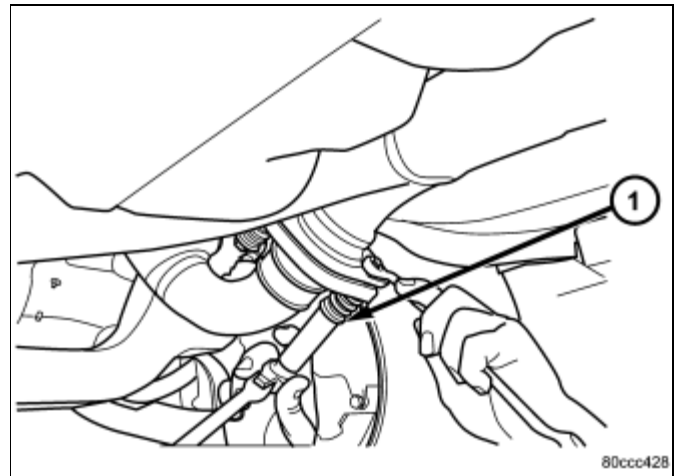


10. Disengage the line pressure sensor connector from the line pressure sensor (2).

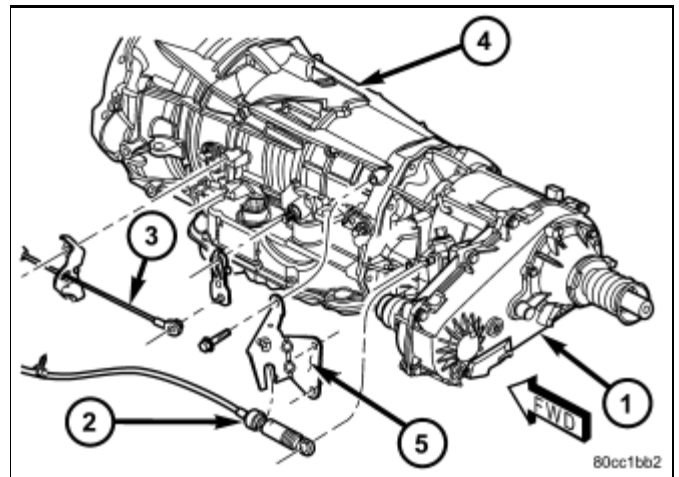


11. Remove the bolts (1) holding the exhaust crossover pipe to the pre-catalytic converter pipe flanges.

12. Remove the bolts holding the exhaust crossover pipe to the catalytic converter flange.



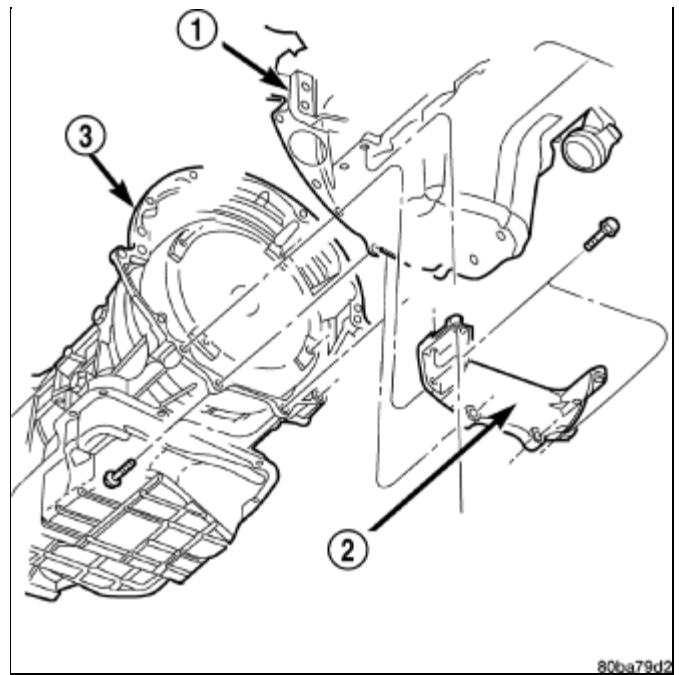
13. Disconnect gearshift cable (2) from transmission manual valve lever.



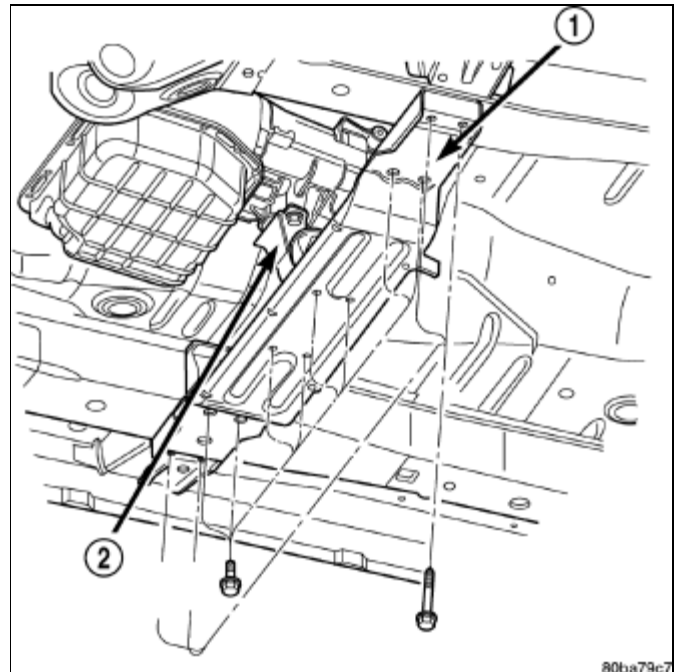
14. Disengage the shift cable from the cable support bracket.

15. Remove the starter motor.

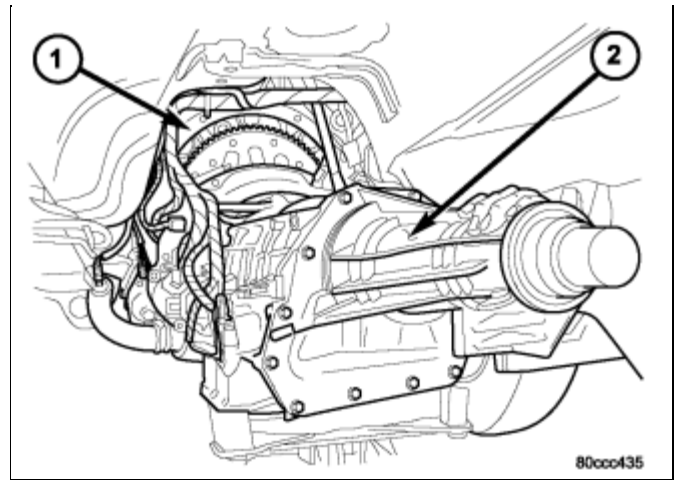
16. Remove the engine to transmission collar (2).



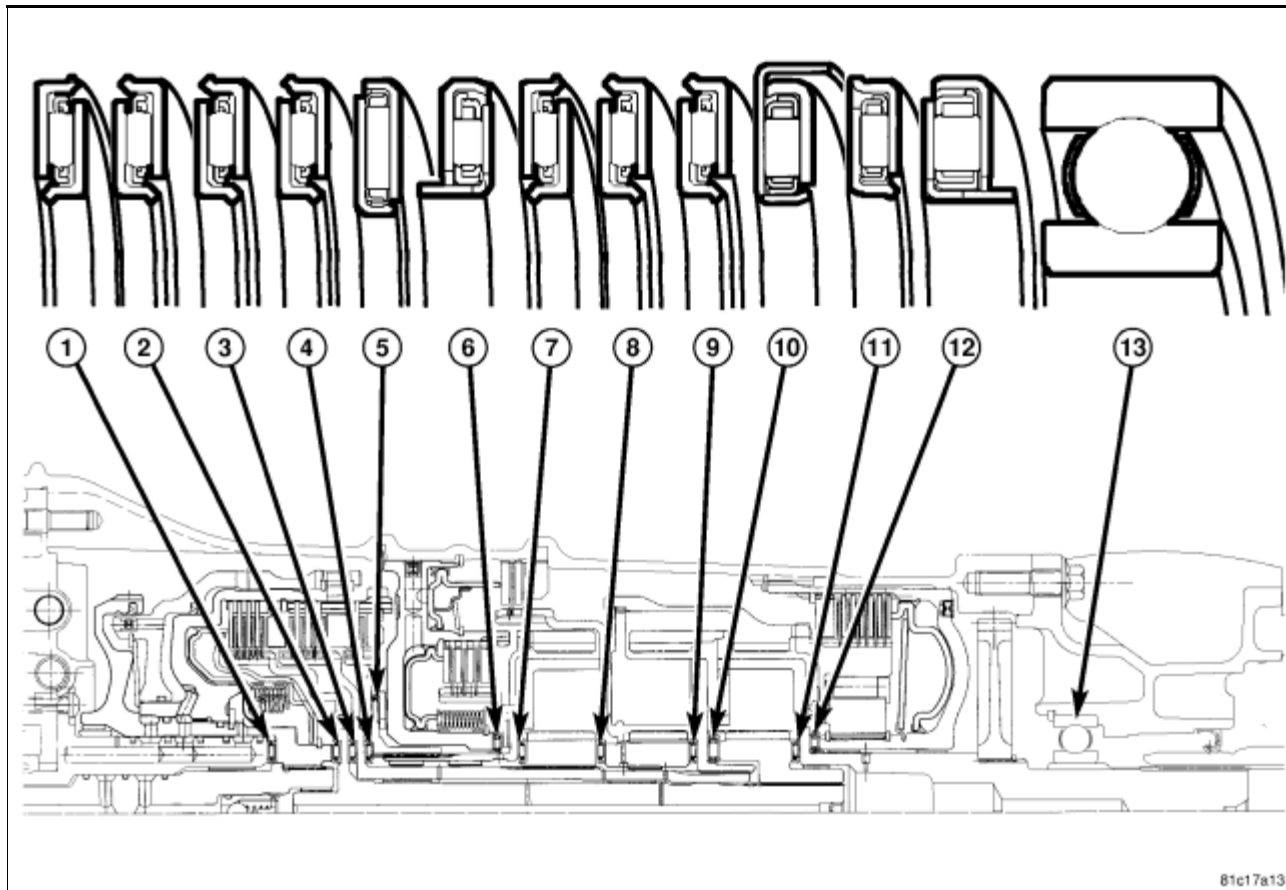
17. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.
18. Disconnect transmission fluid cooler lines at transmission fittings and clips.
19. Disconnect the transmission vent hose from the transmission.
20. Remove transfer case.
21. Support rear of engine with safety stand or jack.
22. Raise transmission slightly with service jack to relieve load on crossmember and supports.
23. Remove bolts securing rear support and cushion (2) to transmission and crossmember (1).
24. Remove bolts attaching crossmember to frame and remove crossmember.



25. Remove all remaining converter housing bolts.
26. Disconnect fuel line retainers at the transmission (if necessary).
27. Carefully work transmission and torque converter assembly rearward off engine block dowels.
28. Hold torque converter in place during transmission removal.
29. Lower transmission and remove assembly (2) from under the vehicle.
30. To remove torque converter, carefully slide torque converter out of the transmission.

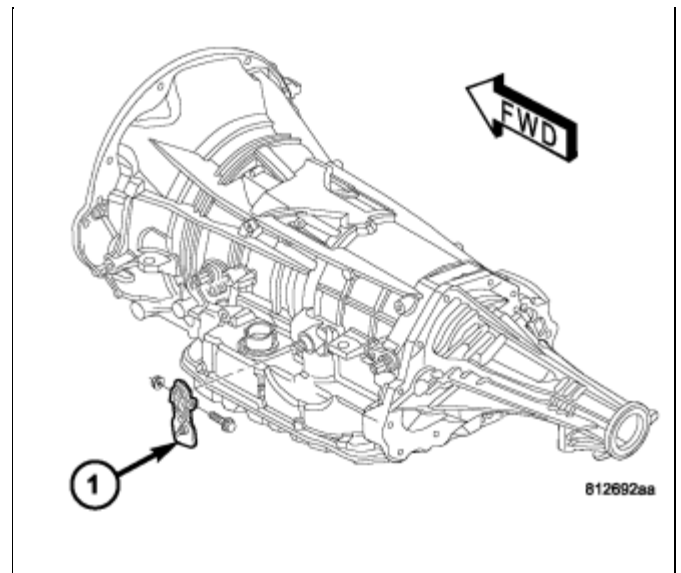


DISASSEMBLY



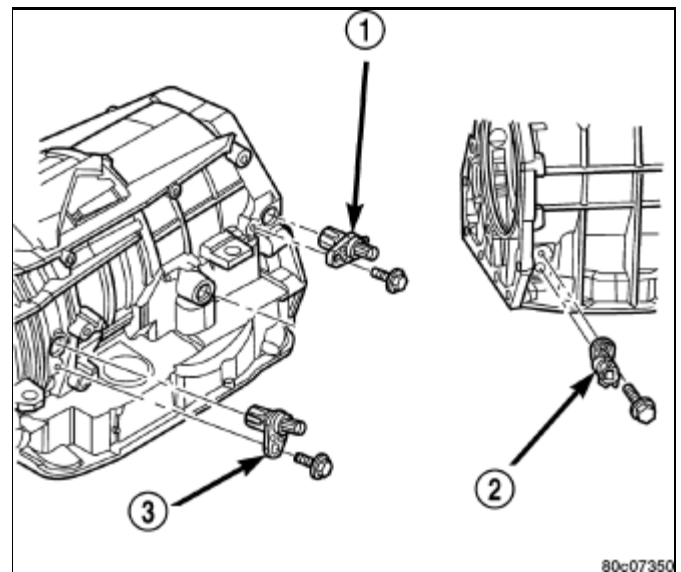
1. Drain fluid from transmission.
2. Clean exterior of transmission with suitable solvent or pressure washer.
3. Remove the torque converter from the transmission.

4. Remove the manual shift lever (1) from the transmission.

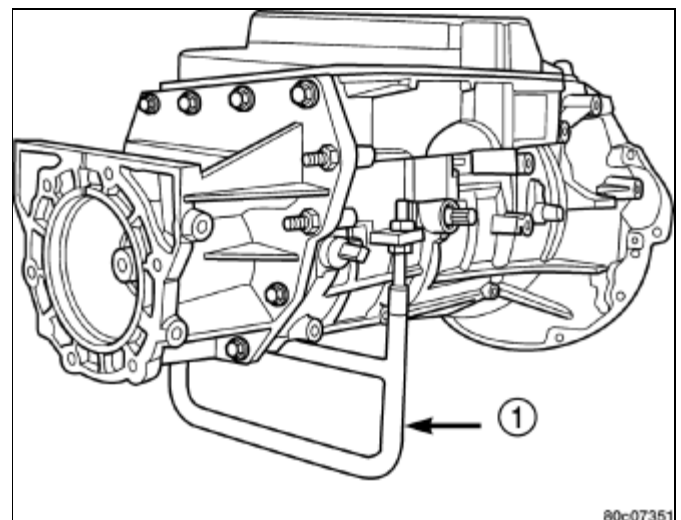


5. Remove the input (3), output (1), and line pressure sensors (2) from the transmission case.

6. Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.



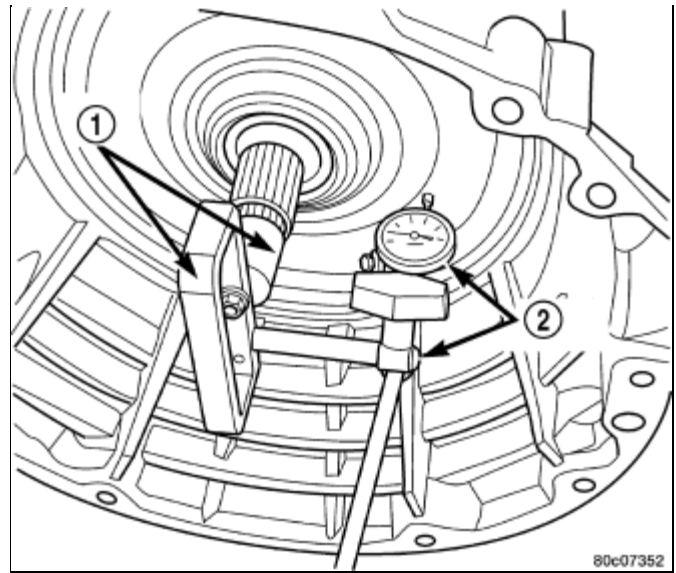
7. Install Support Stand 8257 (1) onto the transmission case.



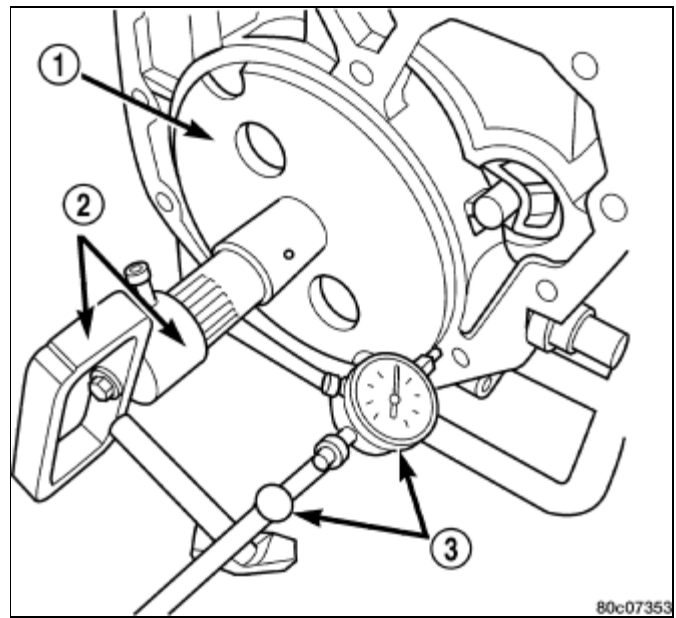
8. Using Adapter 8266-1 from End-Play Tool Set 8266 (1)

and Dial Indicator C-3339 (2), measure and record the input shaft end-play.

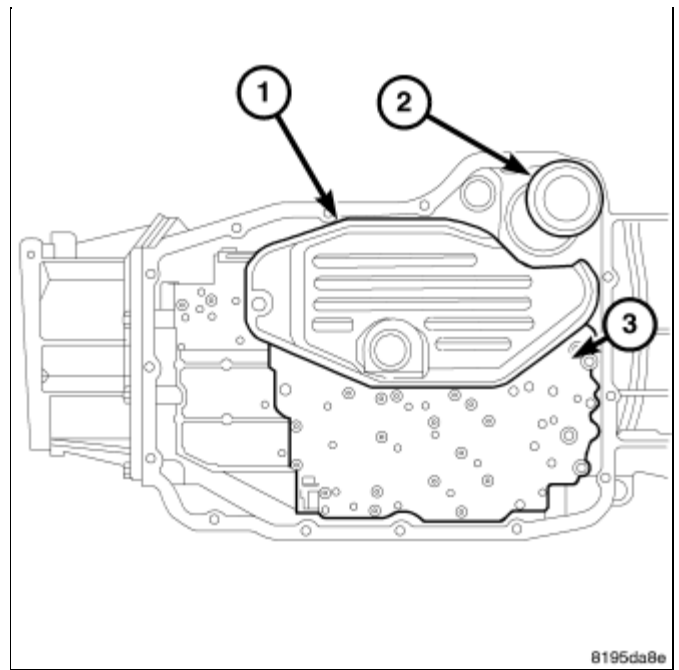
NOTE: When measuring the input shaft end-play, two "stops" will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first "stop" felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.



9. Remove the bolts holding the transmission extension/adaptor housing to the transmission case.
10. Remove the extension/adaptor housing from the transmission case.
11. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play.

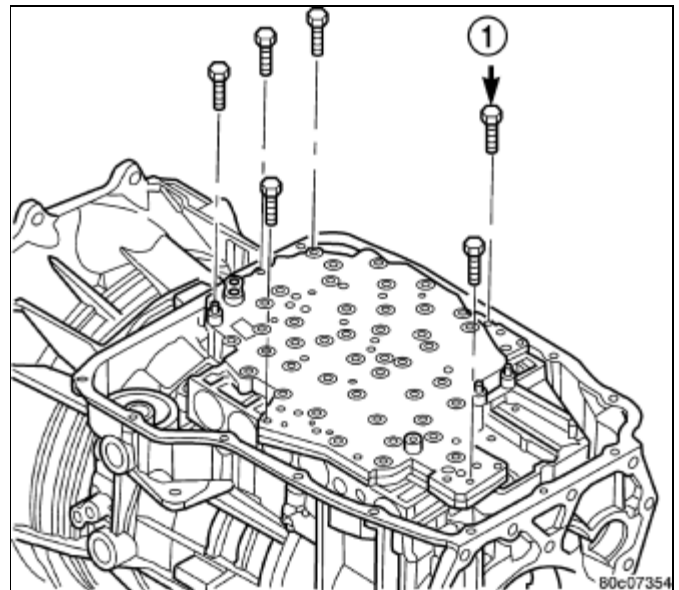


12. Remove the bolts holding the transmission oil pan to the transmission case.
13. Remove the transmission oil pan from the transmission case.
14. Remove the primary oil filter (1) and the oil cooler return filter (2).



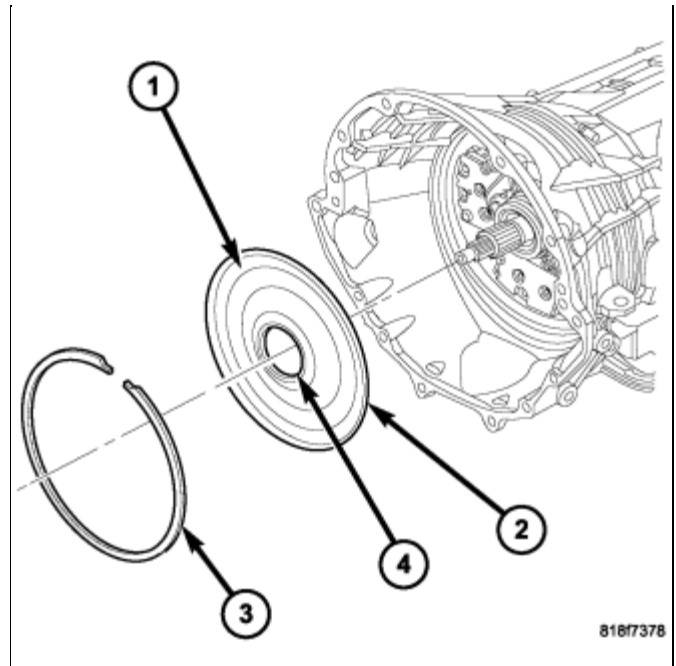
15. Remove the bolts (1) holding the valve body to the transmission case.

16. Remove the valve body from the transmission case.



17. Remove the outer snap-ring (3) securing the transmission front cover (1) into the transmission case.

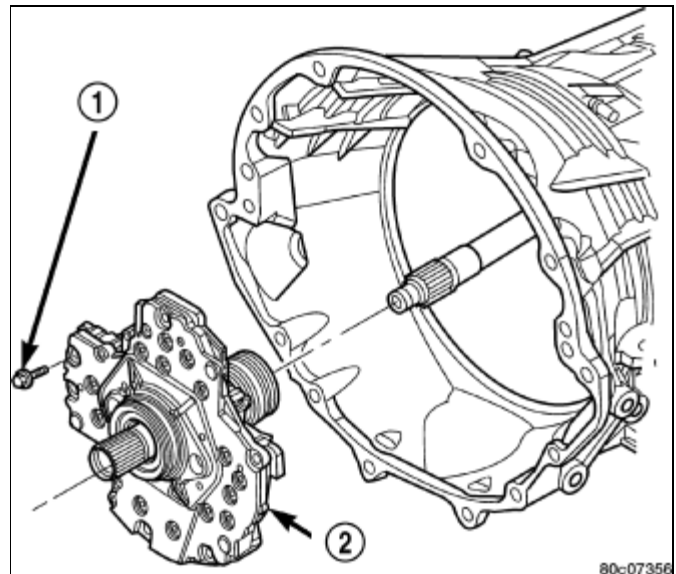
18. Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover (1) from the transmission case.



19. Remove the bolts (1) holding the oil pump into the transmission case.

20. Remove the oil pump (2). Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump.

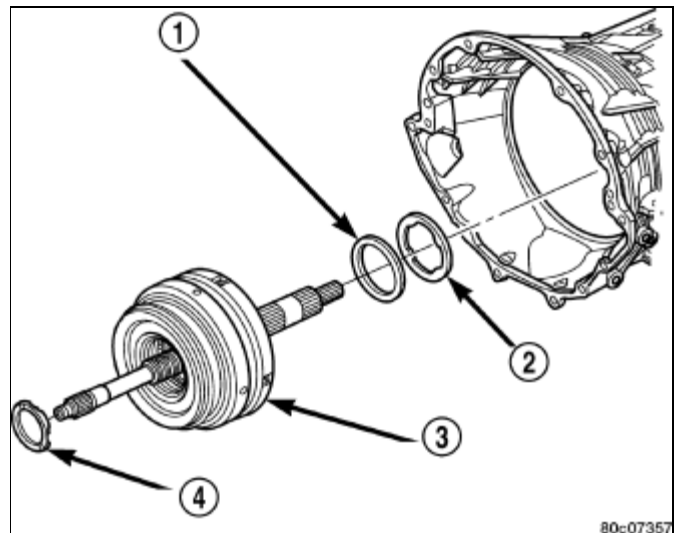
CAUTION: If the input shaft is not held during oil pump removal, the input clutch assembly will attempt to move forward with the oil pump and the numbers 2, 3, or 4 bearings inside the input clutch assembly may become dislodged.



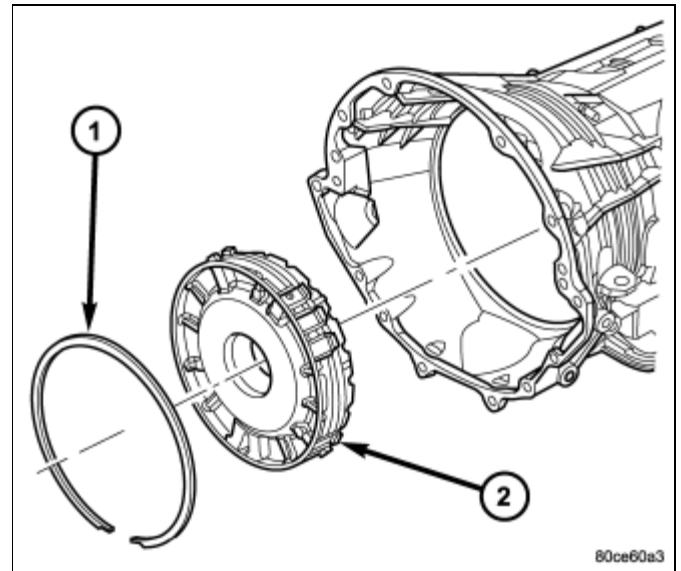
21. Remove the number 1 thrust bearing (4) from the input clutch assembly.

22. Remove the input clutch assembly (3) from the transmission case.

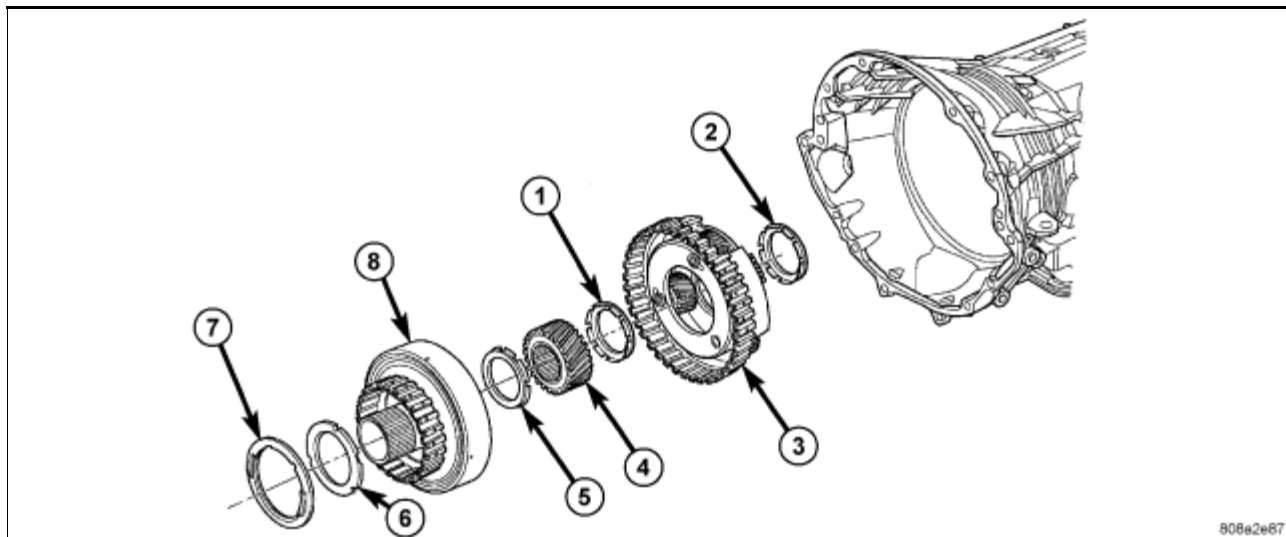
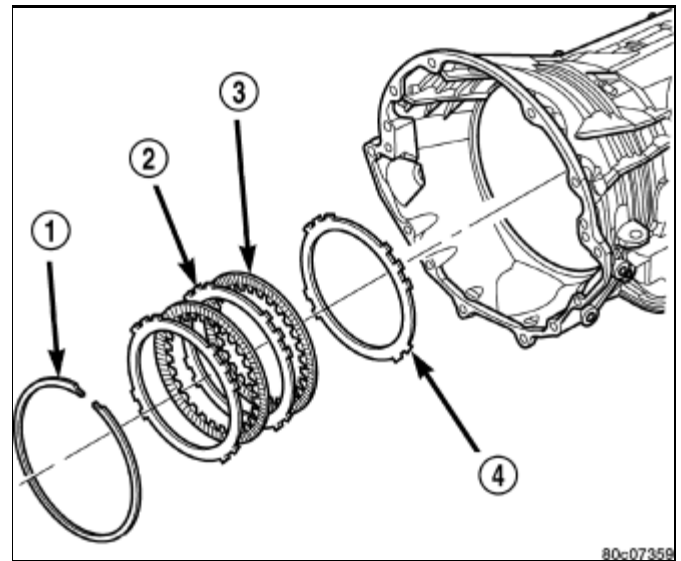
23. Remove the number 5 thrust bearing (1) and selective thrust plate (2) from the input clutch assembly (3), or the 4C clutch retainer/bulkhead.



24. Remove the 4C clutch retainer/bulkhead tapered snap-ring (1) from the transmission case.
25. Remove the 4C clutch retainer/bulkhead (2) from the transmission case.



26. Remove the front 2C clutch pack snap-ring (1) from the transmission case.
27. Remove the 2C clutch pack (2, 3, 4) from the transmission case.

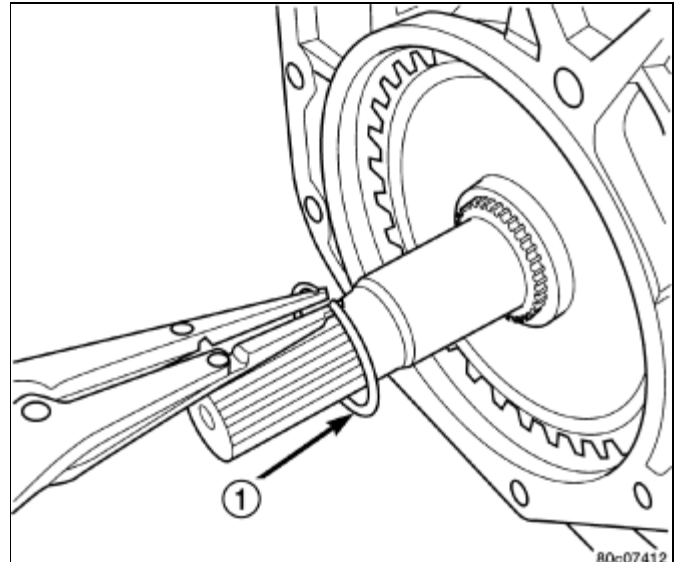


Remove Reaction Annulus and Carrier

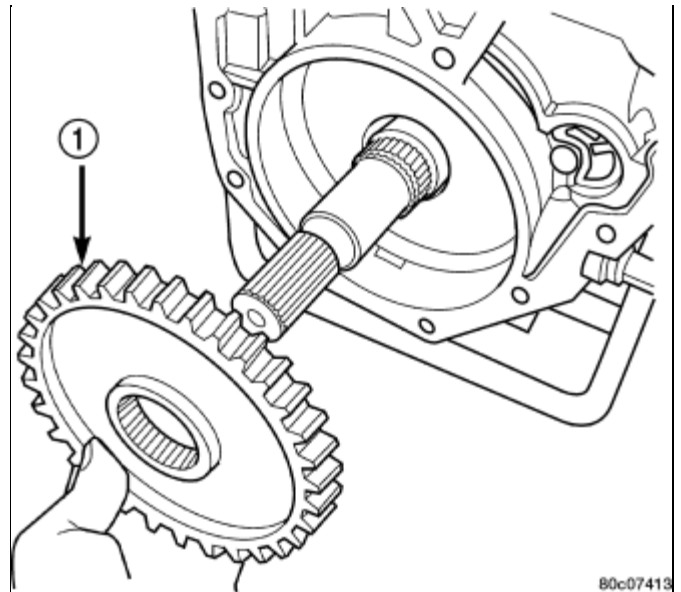
1 - THRUST BEARING NUMBER 8	5 - THRUST BEARING NUMBER 7
2 - THRUST BEARING NUMBER 9	6 - THRUST PLATE (SELECT)
3 - REACTION PLANETARY CARRIER	7 - THRUST BEARING NUMBER 6
4 - REACTION SUN GEAR	8 - REACTION ANNULUS

28. Remove the rear selective thrust plate (6) and number 6 thrust bearing (7) from the reaction annulus (8).
29. Remove the reaction annulus (8) from the reaction planetary carrier (3).
30. Remove the number 7 thrust bearing (5).
31. Remove the reaction sun gear (4).
32. Remove the number 8 thrust bearing (1) from the reaction planetary carrier (3).
33. Remove the reaction planetary carrier (3) . Note that this planetary gear set has three pinion gears.
34. Remove the number 9 thrust bearing (2) from the reverse planetary gear set.

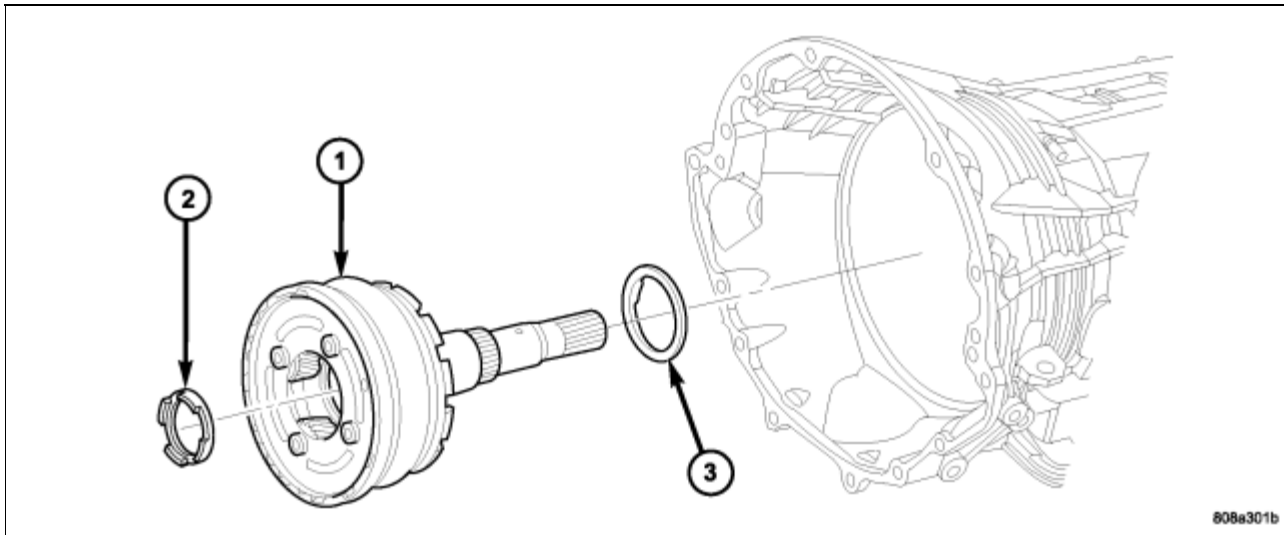
35. Remove the snap-ring (1) holding the park sprag gear onto the output shaft.



36. Remove the park sprag gear (1) from the output shaft.

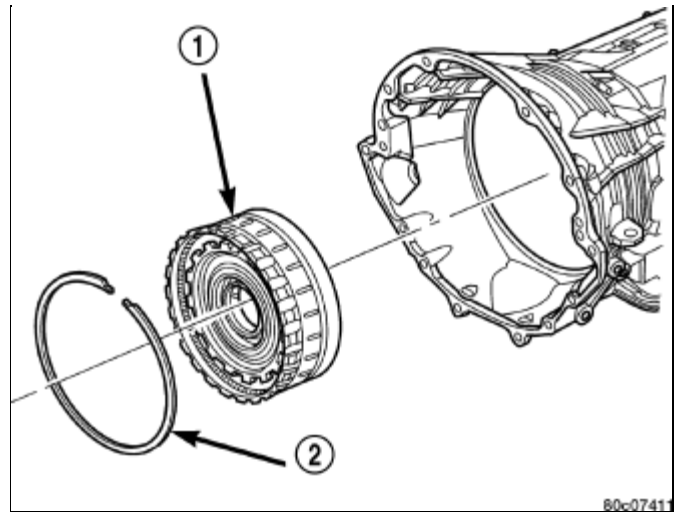


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37. Remove the input/reverse planetary assembly (1).
38. Remove the number 12 thrust bearing (3) from the input/reverse planetary assembly (1).
39. Remove the snap-ring (2) holding the low/reverse clutch retainer (1) into the transmission case.
40. Remove the low/reverse clutch retainer (1) from the transmission case.

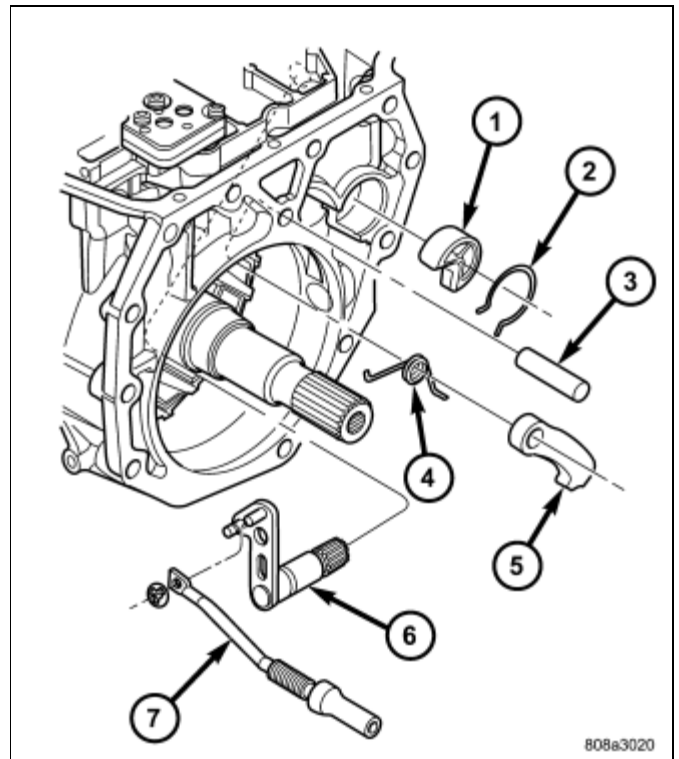


41. Remove the park rod (7) and e-clip.
42. Remove the park rod guide snap-ring (2).
43. Remove the park rod guide (1).
44. Remove the park pawl pivot shaft (3), park pawl (5), and spring (4).
45. Remove the manual selector shaft (6).
46. Remove the manual selector shaft seal.
47. Remove the dipstick tube seal.

CLEANING

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.



Lubricate transmission parts with Mopar® ATF +4, Automatic Transmission Fluid, during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

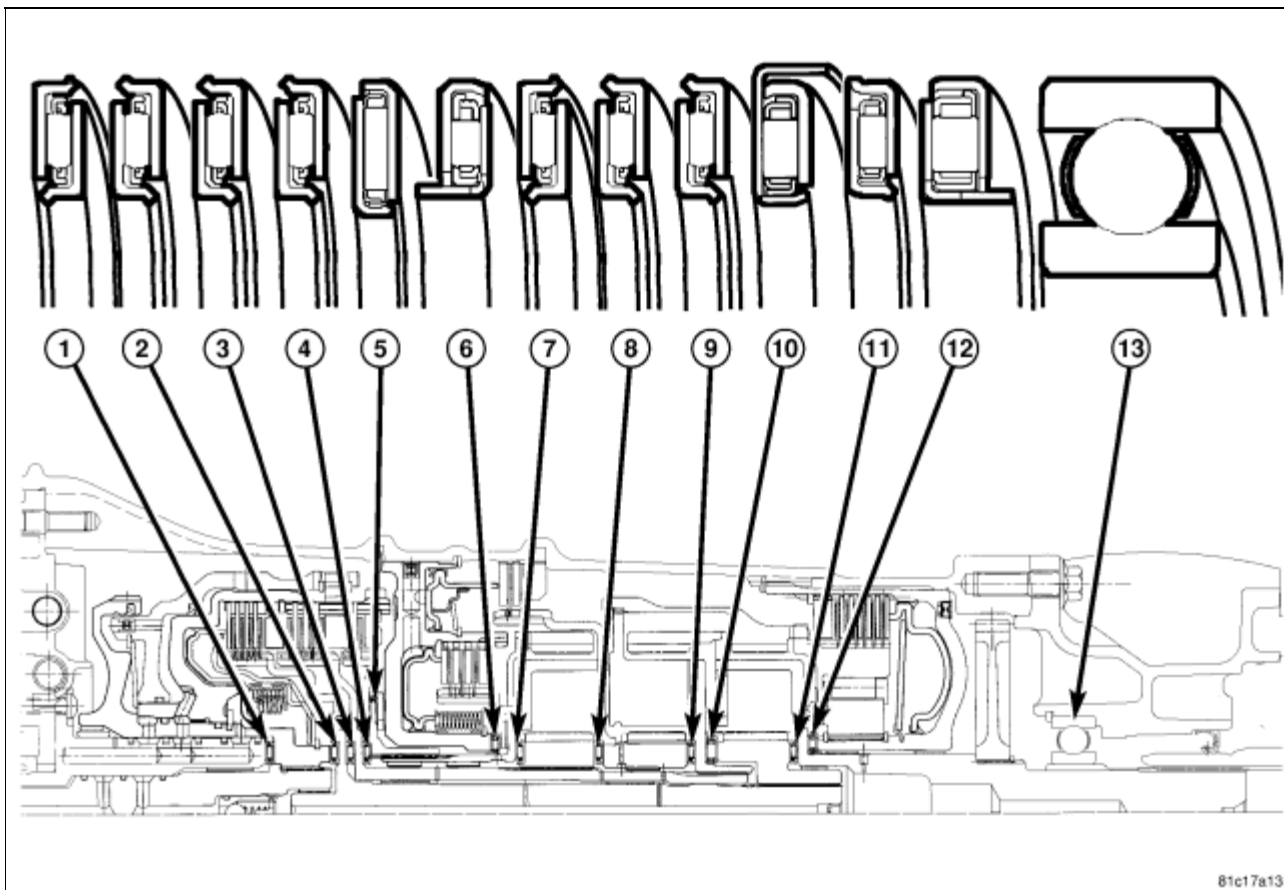
INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil® thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

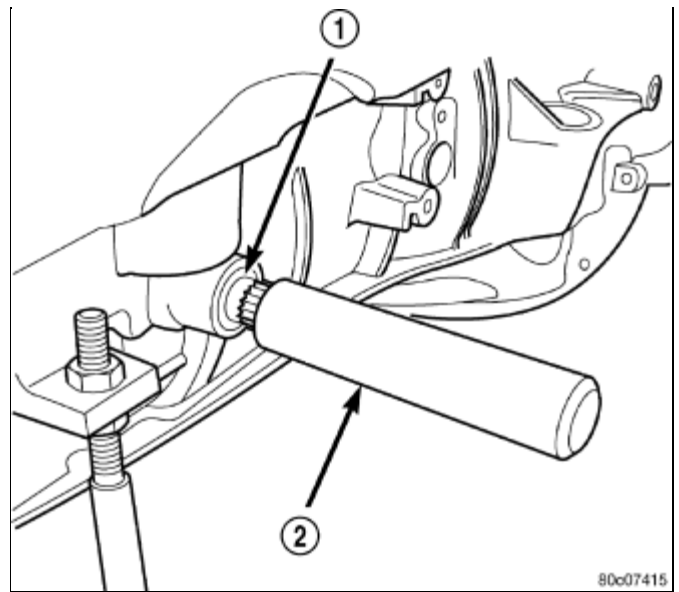
ASSEMBLY

NOTE: Apply trans jell or petroleum jelly to all slide portions, rolling contacts surfaces, thrust surfaces etc. to prevent burnout during initial operation. Lubricate O-rings and O-ring seals with MOPAR® ATF+4. Soak all friction disks in MOPAR® ATF+4 for at least two hours before assembly of clutch packs.

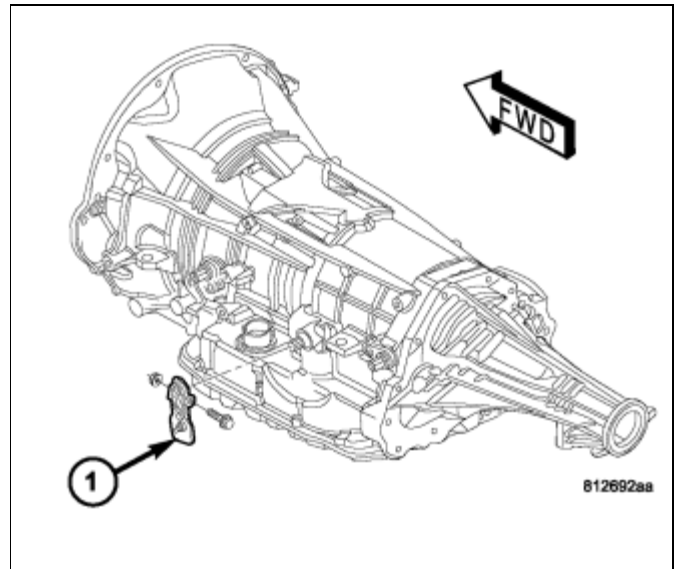
NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.



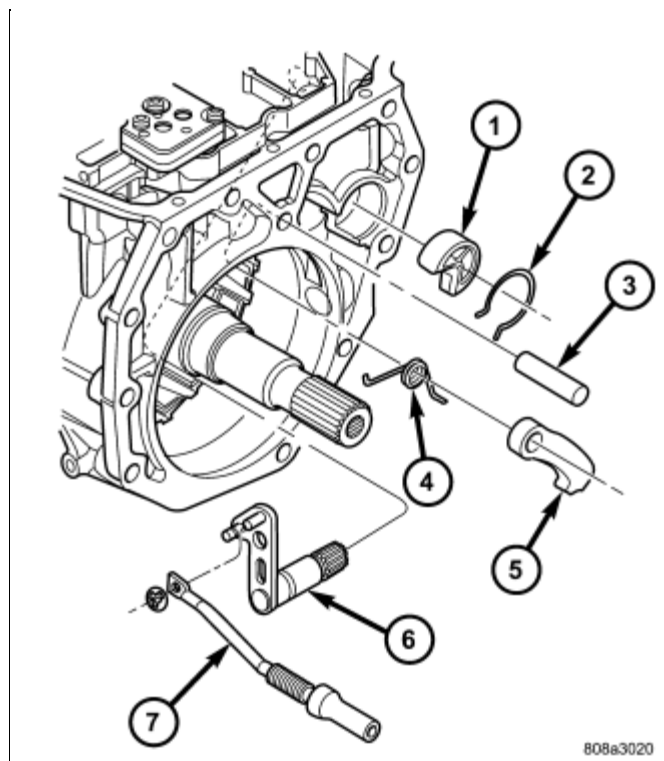
1. Install a new selector shaft seal (1) using Seal Installer 8253 (2).



2. Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in.lbs.).
3. Install the manual shift lever (1) onto the manual selector shaft. Tighten the retaining cross-bolt to 16 N·m (140 in.lbs.).



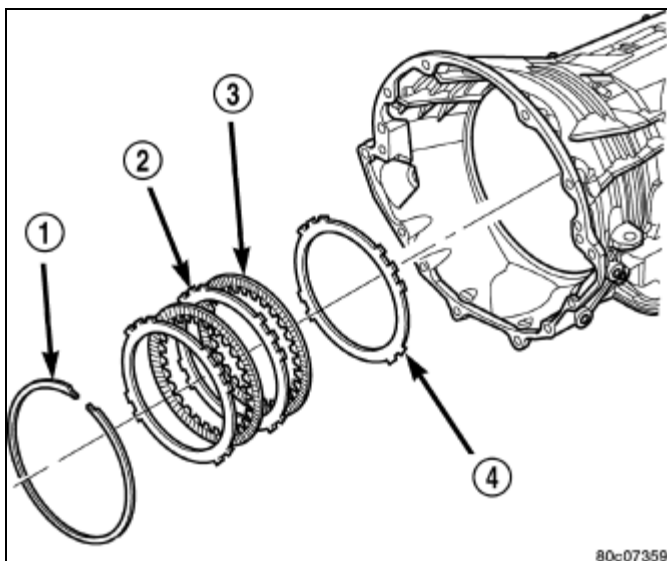
4. Install the park pawl (5), spring (4), and shaft (3).
5. Install the park rod (7) and e-clip.
6. Install the park rod guide (1) and snap-ring (2).



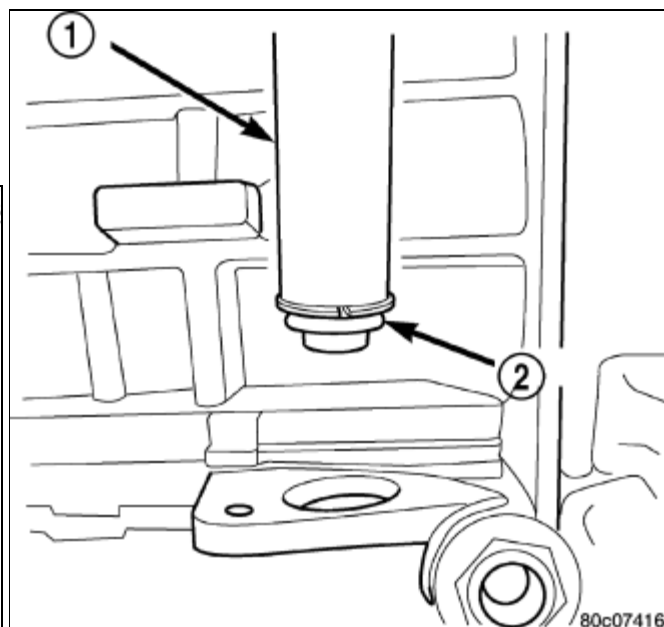
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7. Install a new fill tube seal (2) using Seal Installer 8254 (1).

NOTE:
Before
final
assembly
of



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transmission centerline, the 2C/4C clutch components should be installed into position and measured as follows:

8. Install the 2C reaction plate (4) with the beveled edge down (rearward) into the transmission case.
9. Install the 2C clutch pack (2, 3) into the transmission case.
10. Install the flat 2C clutch snap-ring (1) into the transmission case.

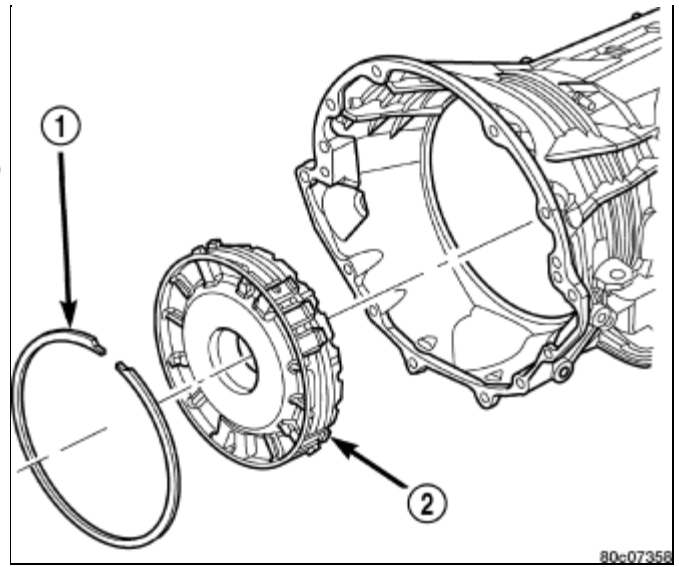
11. Install the 4C retainer/bulkhead (2) into the transmission

case. Make sure that the oil feed holes are pointing toward the valve body area.

12. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

13. Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. The correct clutch clearance is 0.455-1.335 mm (0.018-0.053 in.). The reaction plate is not selective. If the clutch pack clearance is not within specification, the reaction plate, all the friction discs, and steels must be replaced.

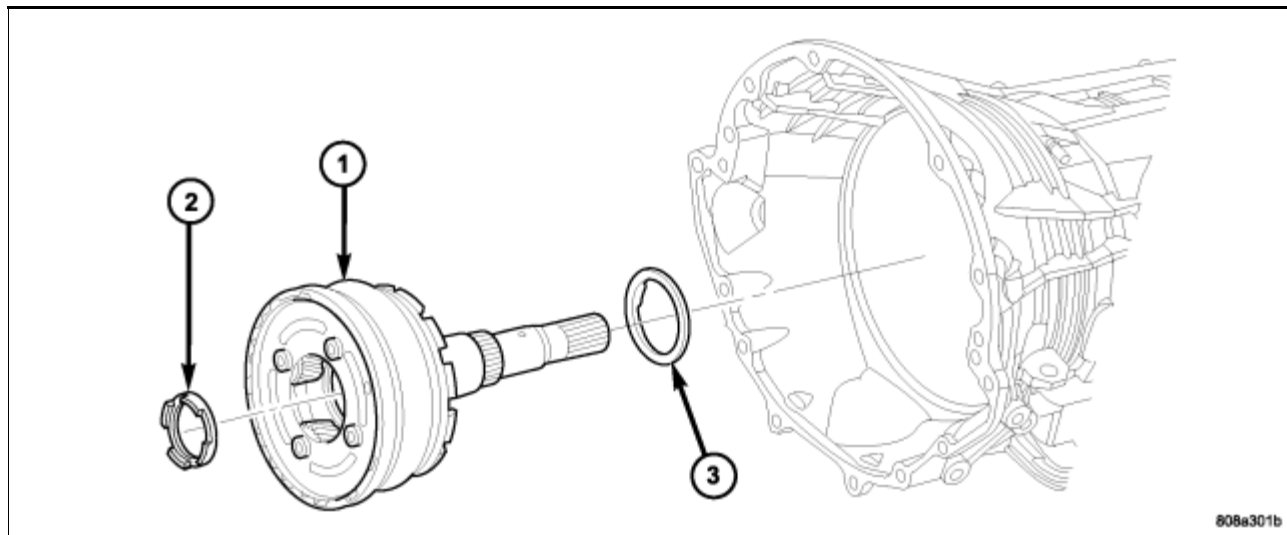
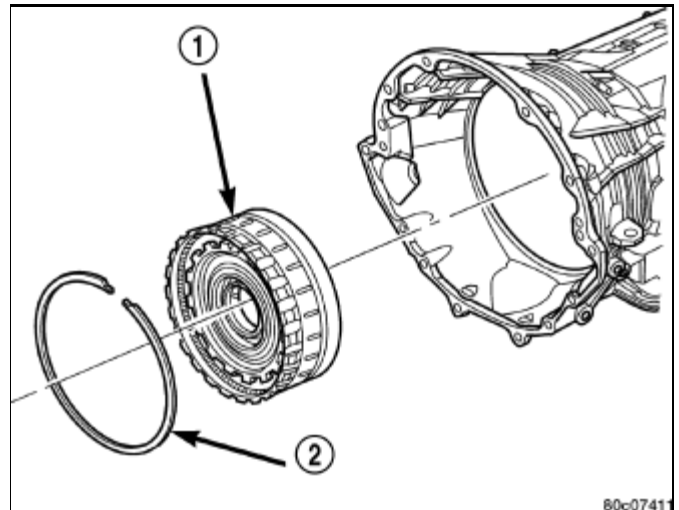
14. Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.



15. Install the low/reverse clutch assembly (1). Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.

16. Install the snap-ring (2) to hold the low/reverse clutch retainer into the transmission case. The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.

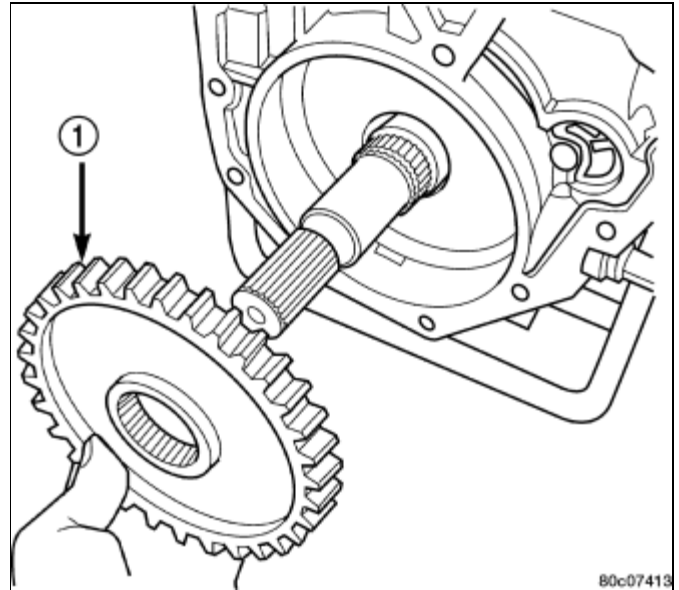
17. Air check the low/reverse clutch and verify correct overrunning clutch operation.



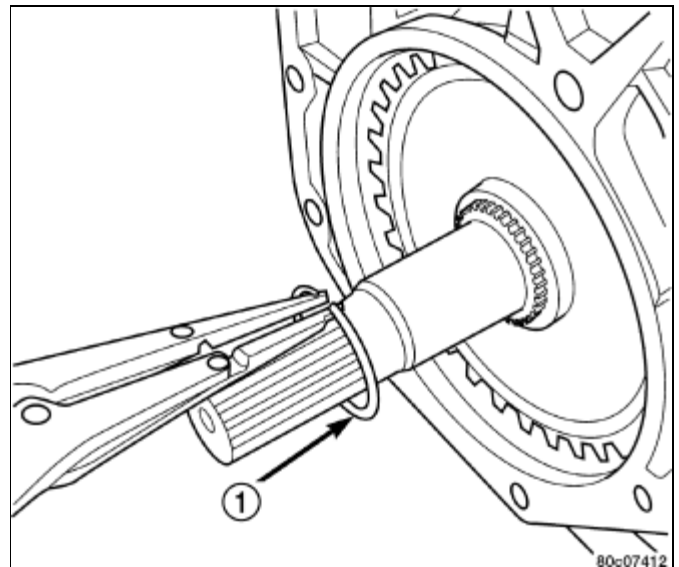
18. Install the number 12 thrust bearing (3) over the output shaft and against the rear planetary gear set. The flat side of the bearing goes toward the planetary gearset and the raised tabs on the inner race should face the rear of the transmission.

19. Install the reverse/input planetary assembly (1) through the low/reverse clutch assembly.

20. Install the park sprag gear (1) onto the output shaft.

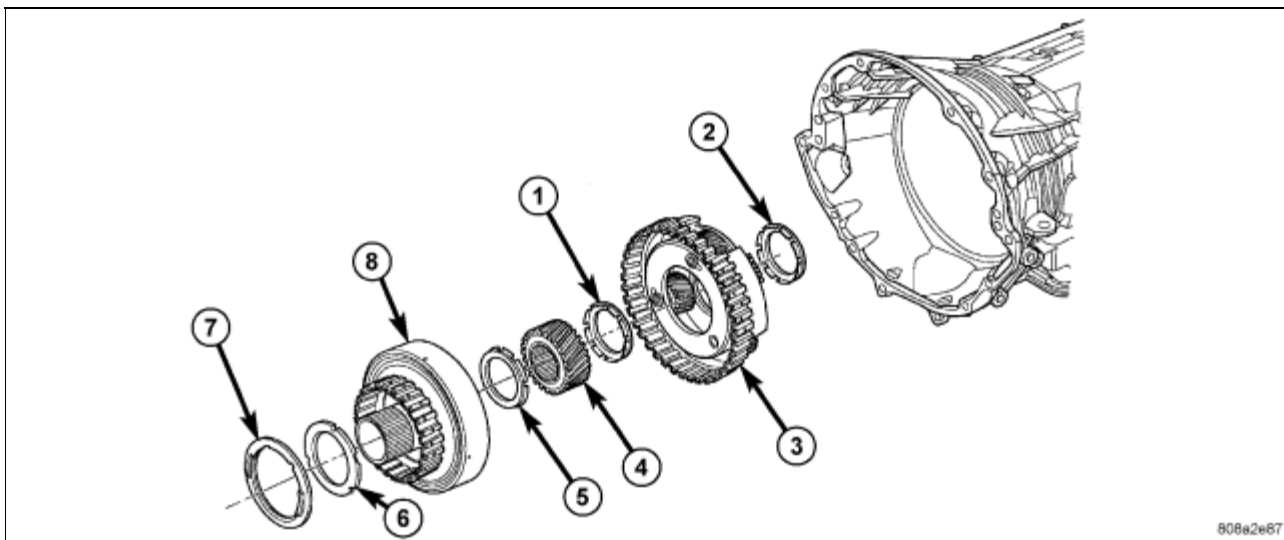
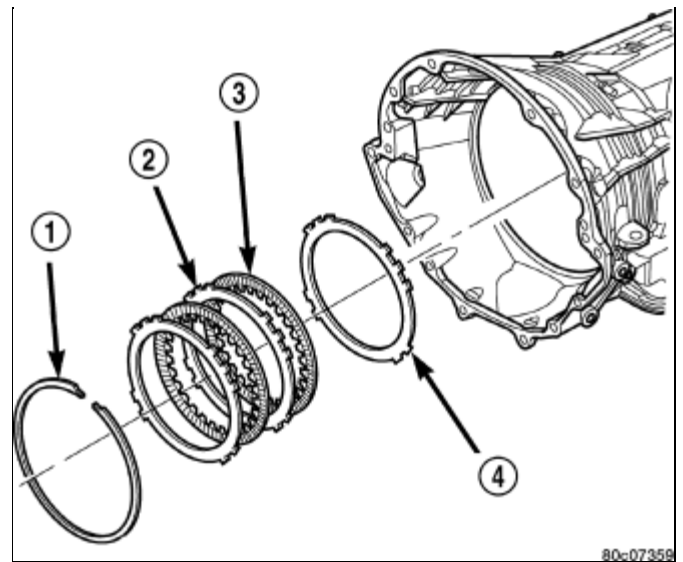


21. Install the snap-ring (1) to hold the park sprag onto the output shaft.



22. Install the 2C reaction plate (4) with the beveled edge down (rearward) into the transmission case.

23. Install the 2C clutch pack (2, 3, 4) into the transmission case.



Install Reaction Annulus and Carrier

1 - THRUST BEARING NUMBER 8	5 - THRUST BEARING NUMBER 7
2 - THRUST BEARING NUMBER 9	6 - THRUST PLATE (SELECT)
3 - REACTION PLANETARY CARRIER	7 - THRUST BEARING NUMBER 6
4 - REACTION SUN GEAR	8 - REACTION ANNULUS

24. Install the number 8 thrust bearing (1) inside the reaction carrier with the outer race against the reaction planetary carrier (3).

25. Install the reaction planetary gear set and the number 9 thrust bearing (2), with the inner race against the reaction planetary carrier (3), into the transmission case.

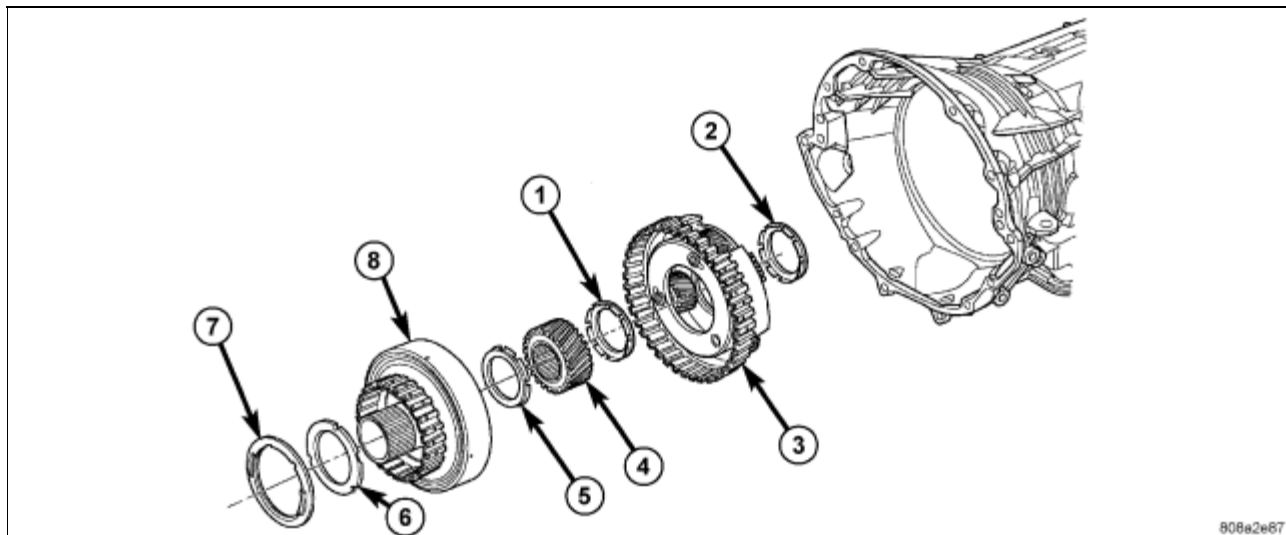
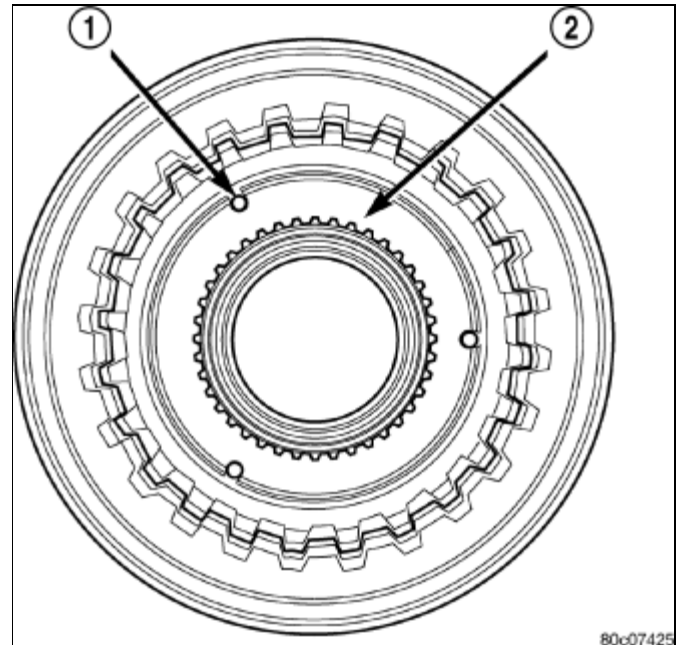
26. Install the flat 2C clutch snap-ring into the transmission case.

27. Install the reaction sun gear (4) into the reaction planetary gear set. **Make sure** the small shoulder is facing

the front of the transmission.

28. Install the number 7 thrust bearing (5) onto the reaction sun gear (4) with the inner race against the sun gear.

29. Install the output shaft selective thrust plate (2) onto the reaction annulus with the oil grooves facing the annulus gear and the lugs (1) and notches aligned as shown.

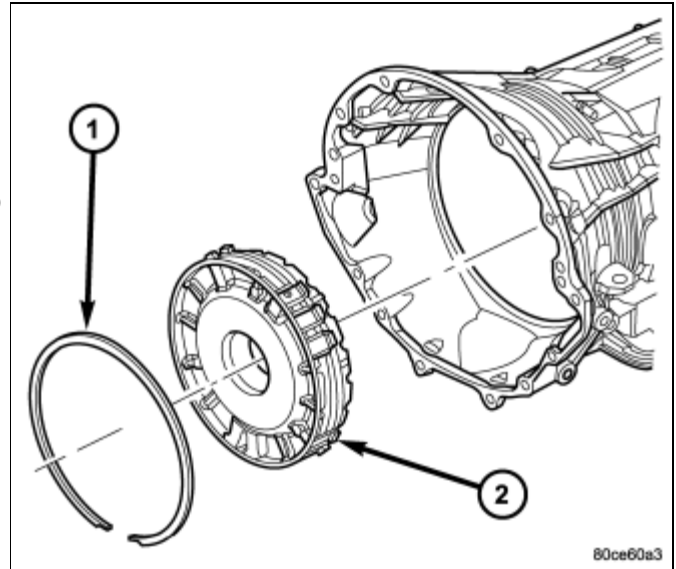


Install Reaction Annulus and Carrier

1 - THRUST BEARING NUMBER 8	5 - THRUST BEARING NUMBER 7
2 - THRUST BEARING NUMBER 9	6 - THRUST PLATE (SELECT)
3 - REACTION PLANETARY CARRIER	7 - THRUST BEARING NUMBER 6
4 - REACTION SUN GEAR	8 - REACTION ANNULUS

30. Install the number 6 thrust bearing (7) against the output shaft selective thrust plate (6) with the flat side against the thrust plate and the raised tabs on the inner race facing the front of the transmission.
31. Install the reaction annulus (8) into the reaction planetary gear set.

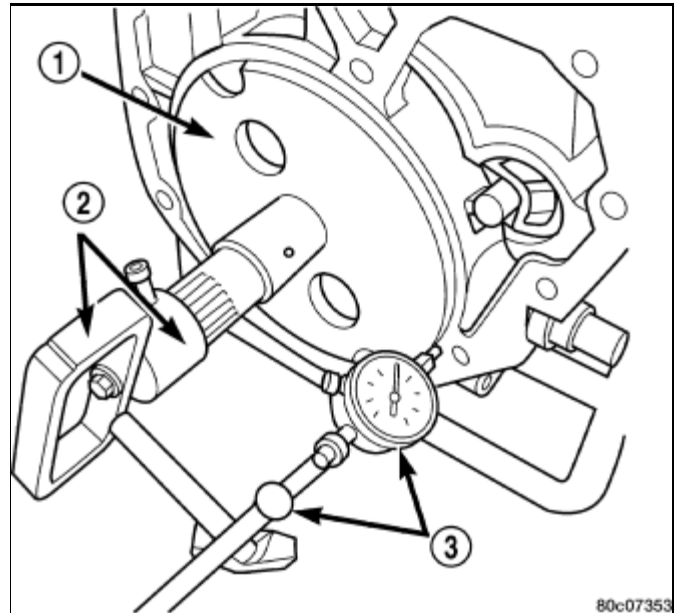
32. Install the 4C retainer/bulkhead (2) into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.
33. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case with the taper toward the front of the case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.
34. Air check the 2C and 4C clutch operation.



35. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play. The correct output shaft end-play is 0.22-0.55 mm (0.009-0.021 in.). Adjust as necessary. Install the chosen output shaft selective thrust plate and re-measure end-play to verify selection.

Output Shaft End Play Selectable Bearing Spacer Thickness

- 09 = 2.18 mm (0.086 in.)
- 10 = 2.33 mm (0.092 in.)
- 11 = 2.48 mm (0.098 in.)
- 12 = 2.63 mm (0.103 in.)
- 13 = 2.78 mm (0.109 in.)
- 14 = 2.69 mm (0.115 in.)
- 43 = 3.08 mm (0.121 in.)
- 16 = 3.23 mm (0.127 in.)
- 17 = 3.38 mm (0.133 in.)
- 18 = 3.53 mm (0.139 in.)
- 19 = 3.68 mm (0.145 in.)



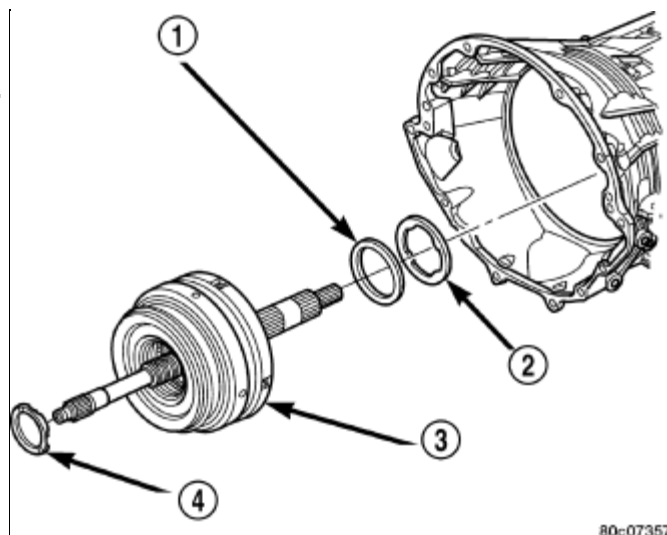
36. Apply a bead of RTV silicone and install the extension/adaptor housing onto the transmission case.
37. Install and torque the bolts to hold the extension/adaptor housing onto the transmission case. The correct torque is 54 N·m (40 ft.lbs.).

38. Install the number 5 thrust bearing (1) and selective thrust

plate (2) onto the 4C retainer/bulkhead. Be sure that the outer race of the bearing is against the thrust plate.

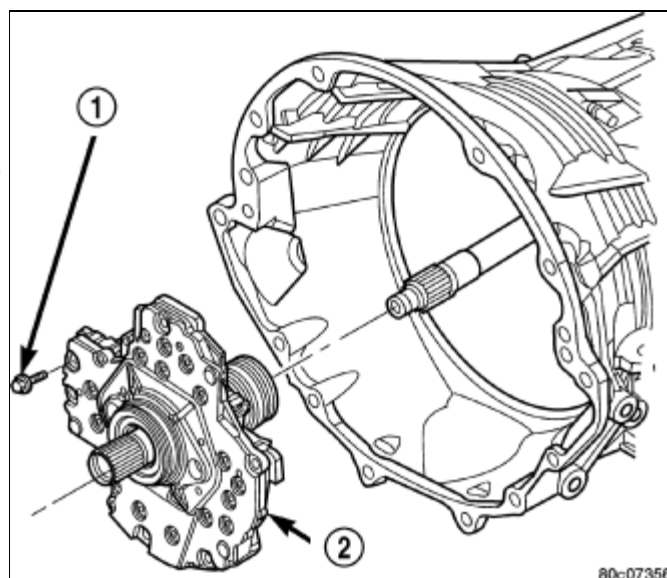
39. Install the input clutch assembly (3) into the transmission case. Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel teeth on the input clutch assembly are centered in the hole, the assembly is fully installed.

40. Install the number 1 thrust bearing (4) with the outer race up in the pocket of the input clutch assembly.

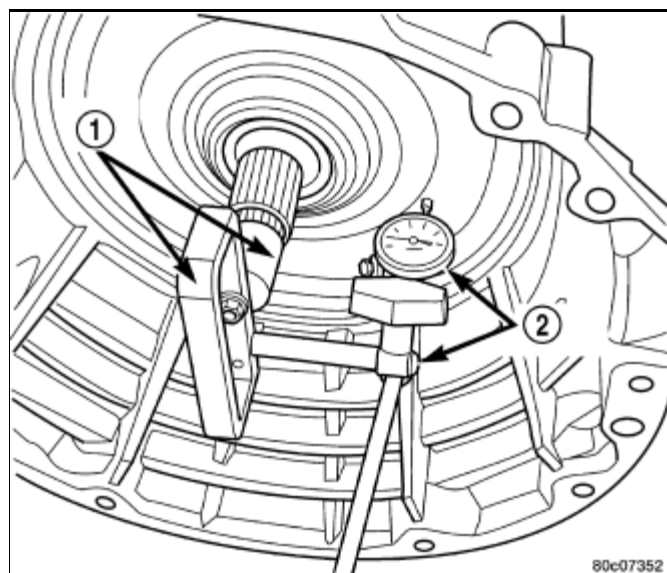


41. Install the oil pump (2) into the transmission case making certain the oil pump is flush with the transmission case.

42. Install the bolts (1) to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in.lbs.).



NOTE: When measuring the input shaft end-play, two "stops" will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first "stop" felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading. If NO input shaft end play is noted, disassemble the input clutch assembly and check for the #2, #3, or #4 thrust bearing fallen out of position or cracked. Replace any cracked thrust bearing and reassemble using trans jell or petroleum jelly to retain the thrust bearings.



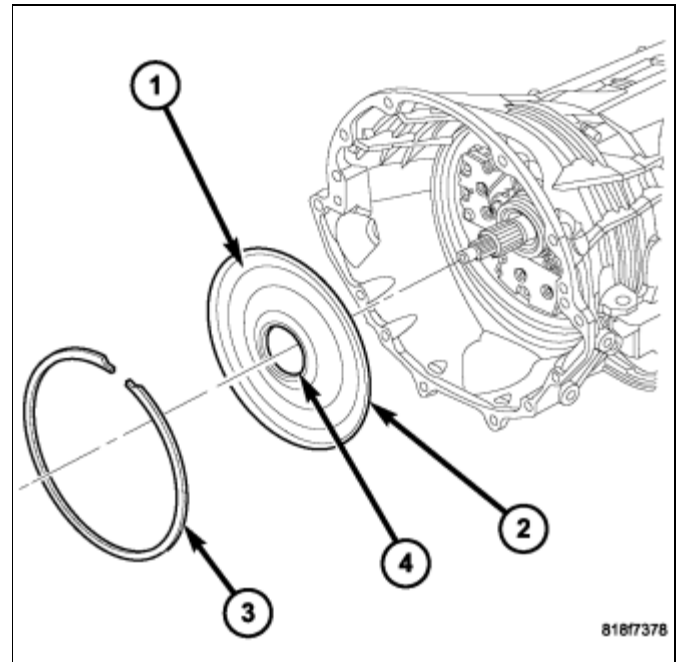
43. Using Adapter 8266-1 from End-Play Tool Set 8266 (1) and Dial Indicator C-3339 (2), measure and record the input shaft end-play. The correct end-play is 0.46-0.89 mm (0.018-0.035 in.). Adjust as necessary. Install the chosen thrust plate on the number 5 thrust bearing and re-measure end-play to verify selection.

Input Shaft End Play Selectable Bearing Spacer Thickness

- 27 = 1.57 mm (0.062 in.)
- 28 = 1.71 mm (0.067 in.)
- 29 = 1.85 mm (0.073 in.)
- 30 = 1.99 mm (0.078 in.)
- 31 = 2.13 mm (0.084 in.)
- 32 = 2.27 mm (0.089 in.)
- 33 = 2.41 mm (0.095 in.)
- 34 = 2.55 mm (0.100 in.)
- 35 = 2.69 mm (0.106 in.)
- 36 = 2.83 mm (0.111 in.)
- 37 = 2.97 mm (0.117 in.)
- 38 = 3.11 mm (0.122 in.)
- 39 = 3.25 mm (0.128 in.)
- 40 = 3.39 mm (0.133 in.)
- 41 = 3.67 mm (0.144 in.)

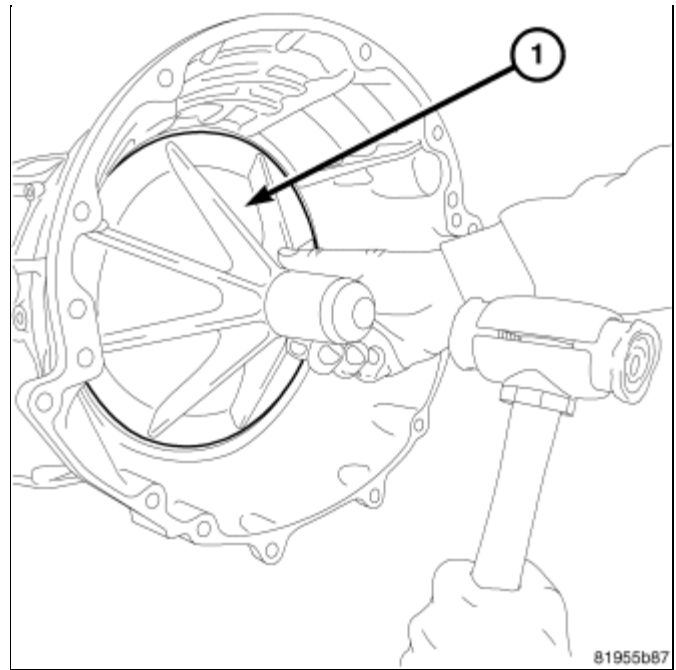
NOTE: To avoid contamination and garter spring dislodgement, do not handle the front cover seal when installing the front cover into the transmission case.

44. Position the new front cover (1) onto transmission case.

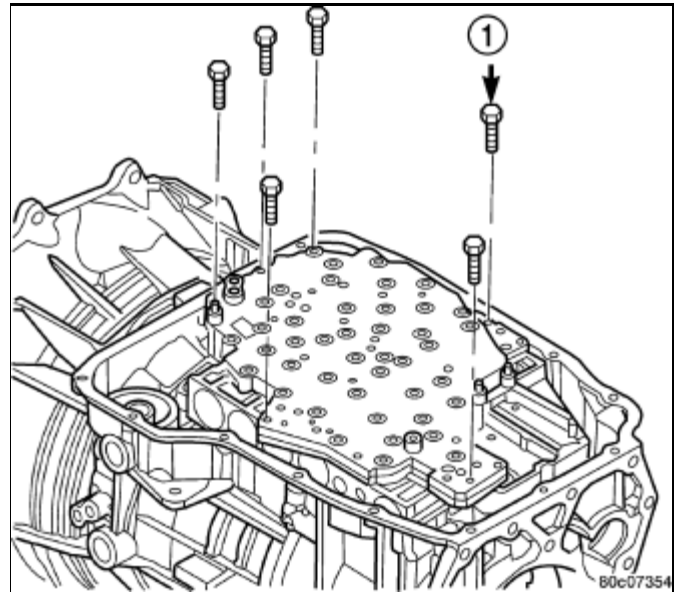


45. Using a dead-blow mallet and the Front Cover installation tool 9955, install the front cover into the transmission case .

46. Install the snap ring into the transmission case.



47. Install the valve body. Verify that the pin on the manual lever has properly engaged the TRS selector plate. Tighten the valve body to transmission case bolts (1) to 12 N·m (105 in.lbs.).

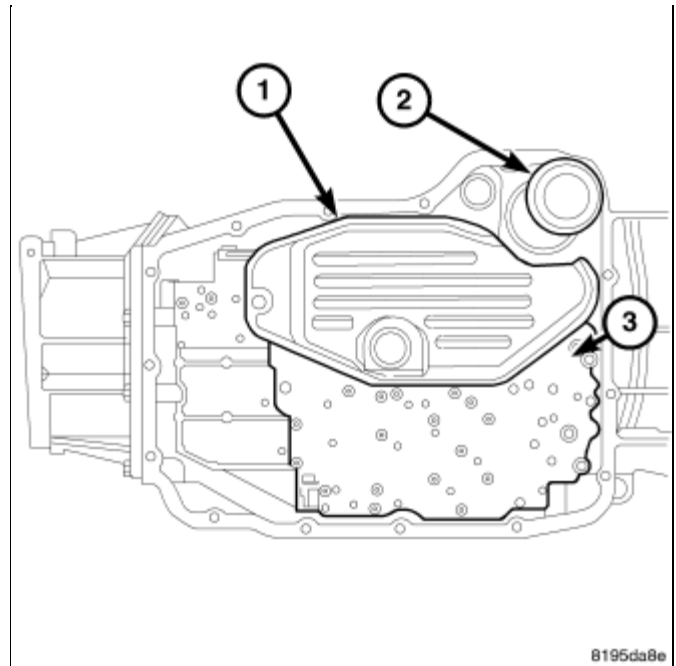


CAUTION: The primary oil filter seal **MUST** be fully installed flush against the oil pump body. **DO NOT** install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.

48. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.

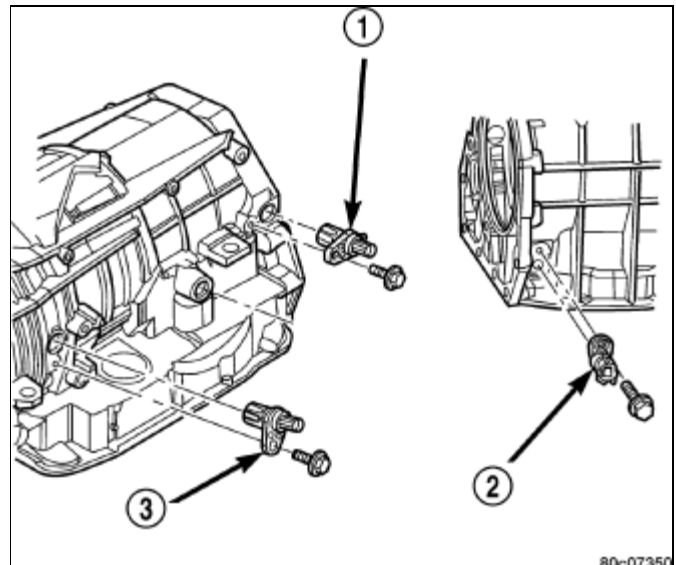
49. Install the primary oil filter (1) and the oil cooler return filter (2) . Tighten the screw to hold the primary oil filter to the valve body to 4.5 N·m (40 in.lbs.). Using Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 9.5 N·m (84 in.lbs.).

50. Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in.lbs.).

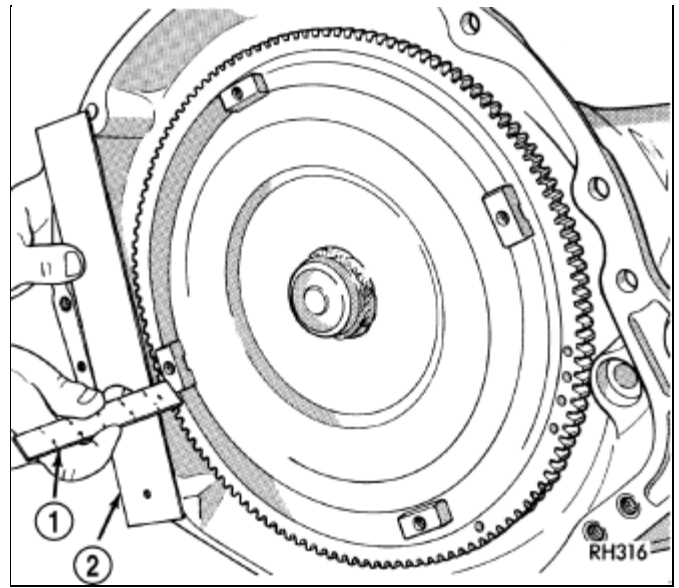


51. Install the input (3), output (1), and line pressure sensors (2). Tighten the bolts to 12 N·m (105 in.lbs.).

INSTALLATION

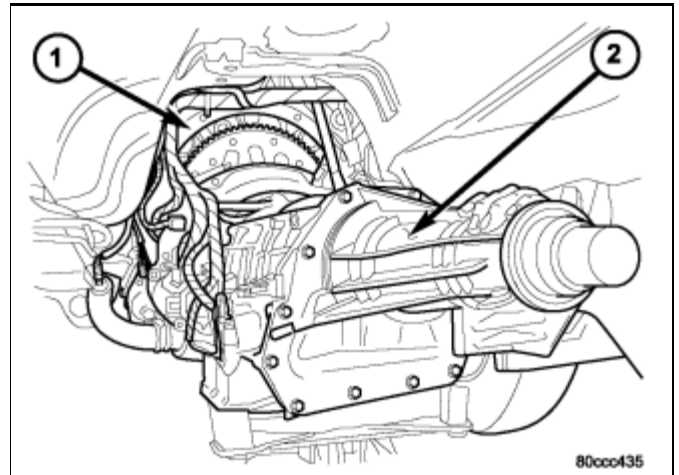


1. Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free of any debris. The hub must be smooth to avoid damaging pump seal at installation.
2. If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.
3. Lubricate oil pump seal lip with transmission fluid.
4. Align converter and oil pump.
5. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.
6. Check converter seating with steel scale (1) and

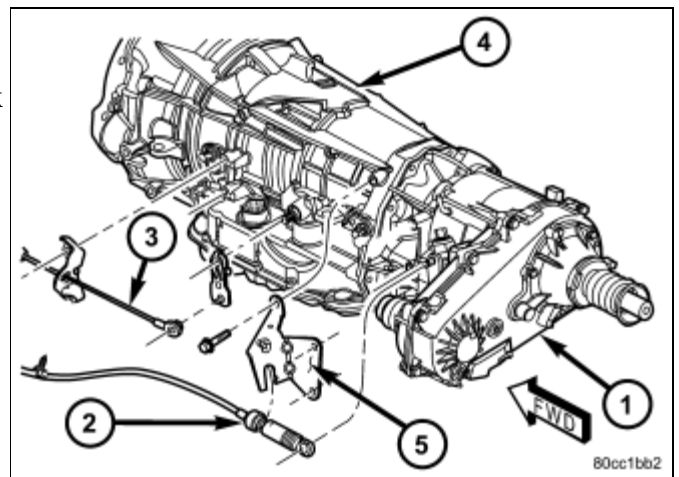


straightedge (2). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.
7. Temporarily secure converter with C-clamp.

8. Position transmission on jack and secure it with chains.
9. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**
10. Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.
11. Raise transmission (2) and align the torque converter with the drive plate and transmission converter housing with the engine block.



12. Move transmission forward. Then raise, lower or tilt transmission to align the converter housing with engine block dowels.
13. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.
14. Install two bolts to attach the transmission to the engine.
15. Install remaining torque converter housing to engine bolts. Tighten the four upper bolts to 41 N·m (30 ft. lbs.), tighten the four lower bolts to 54 N·m (40 ft. lbs.), tighten the four collar bolts to 68 N·m (50 ft. lbs.).



16. Install transfer case, if equipped. Tighten transfer case nuts to 35 N·m (26 ft. lbs.).
17. Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft. lbs.).
18. Install rear support to transmission. Tighten bolts to 47 N·m (35 ft. lbs.).
19. Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember.

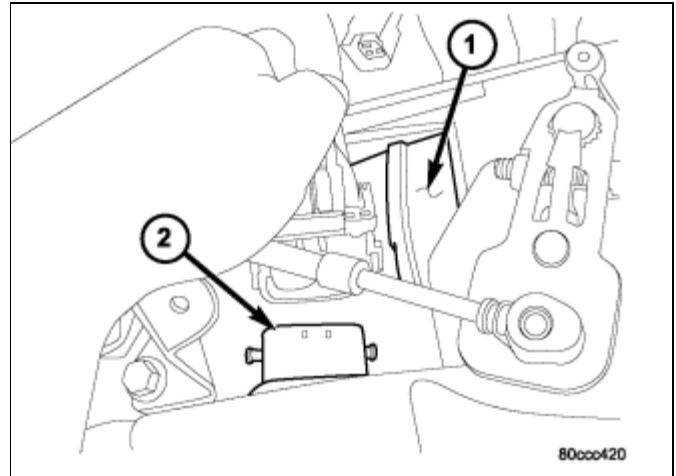
Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

20. Remove engine support fixture.

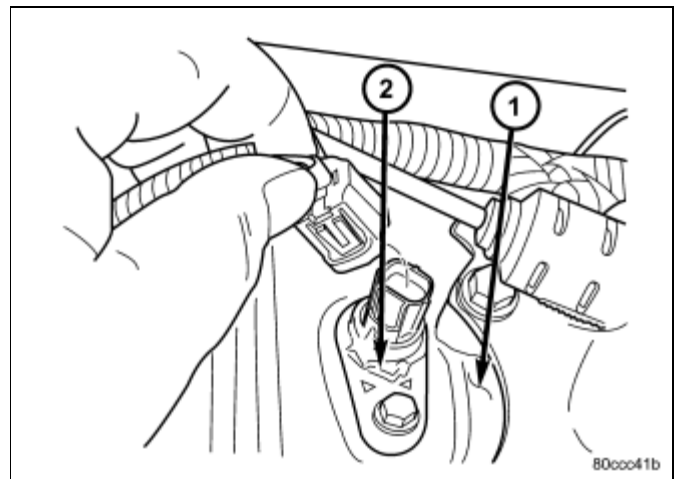
21. Connect fuel line retainer at transmission (if necessary).

22. Connect gearshift cable (3) to support bracket and transmission manual lever.

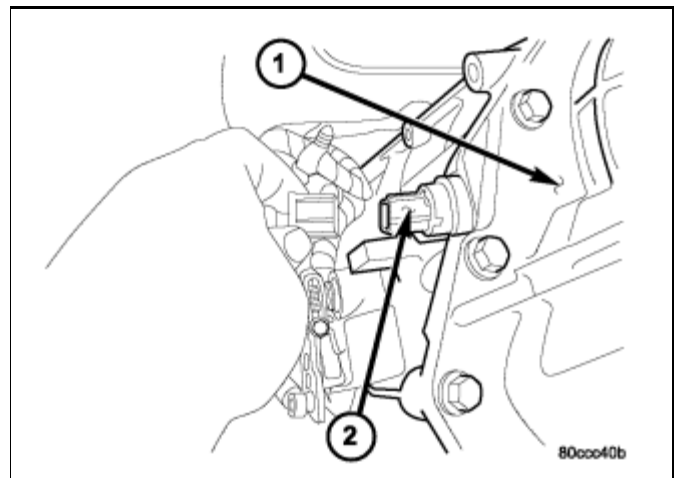
23. Connect wires to solenoid and pressure switch assembly (2).



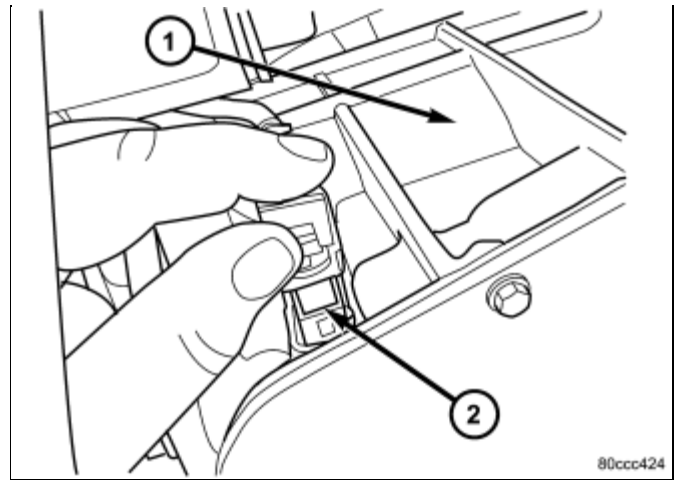
24. Connect wires to input speed sensor (2).



25. Connect wires to output speed sensor (2).



26. Connect wires to line pressure sensor (2). Be sure transmission harnesses are properly routed.



CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

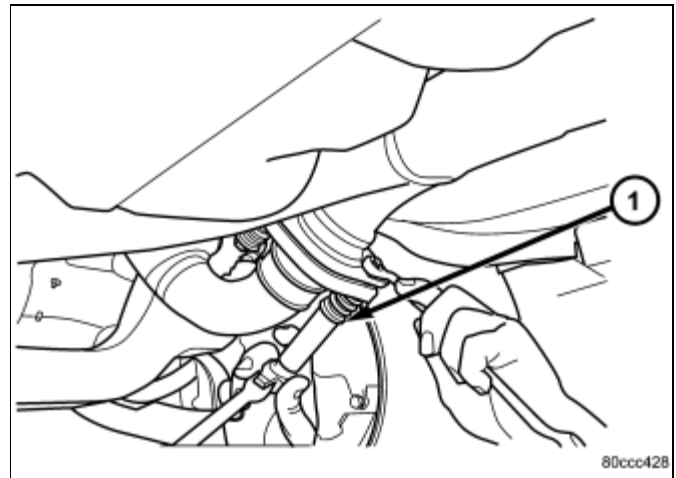
27. Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in.lbs.).

28. Install starter motor and cooler line bracket.

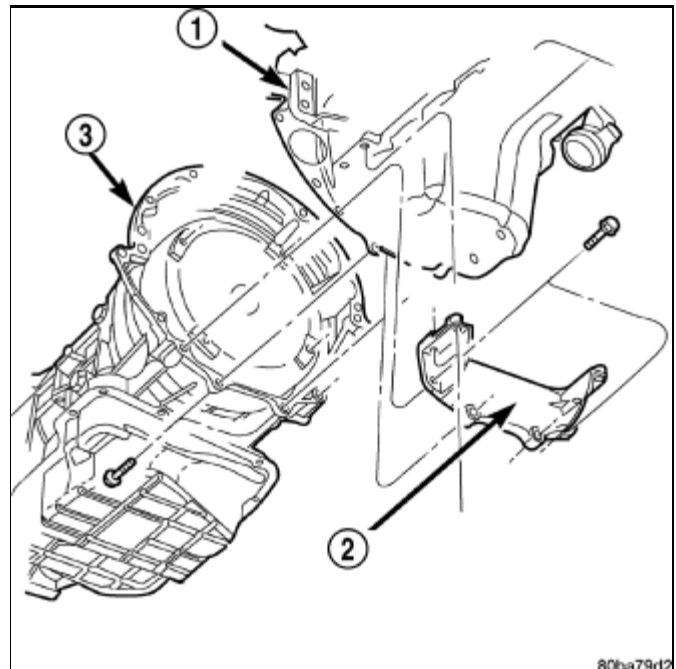
29. Connect cooler lines to transmission.

30. Install transmission fill tube.

31. Install exhaust components (1).



32. Install the structural dust cover (2) onto the transmission and the engine.



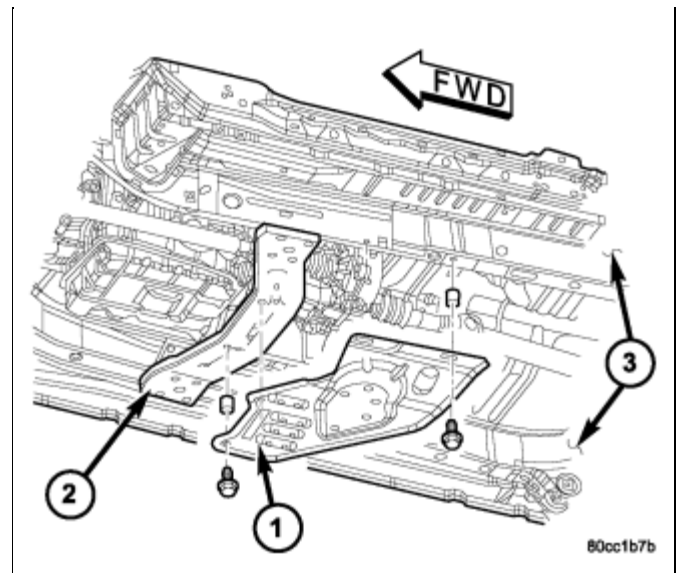
33. Align and connect propeller shaft(s).

34. Adjust gearshift cable if necessary.

35. Install any skid plates (1) removed previously. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)

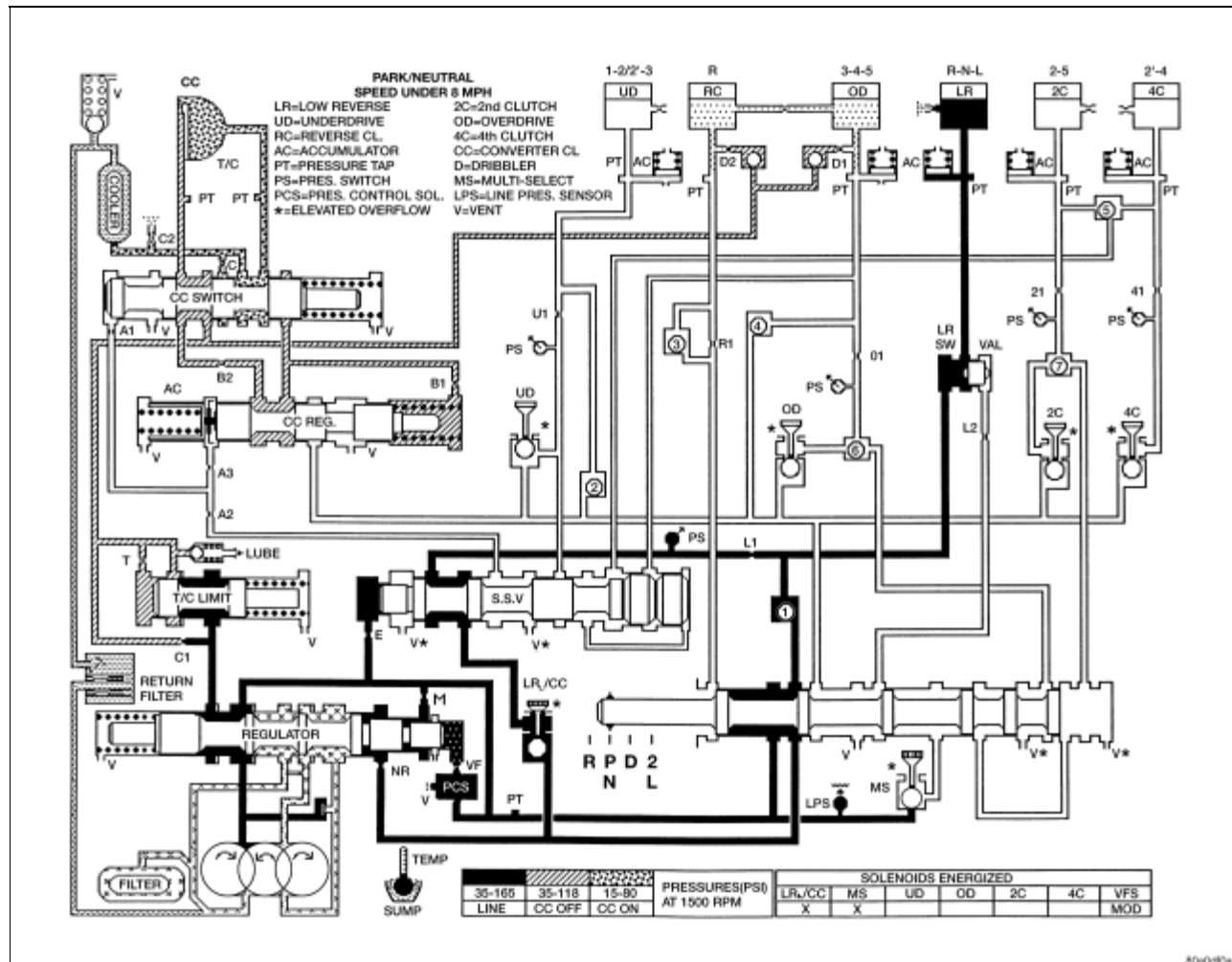
36. Lower vehicle.

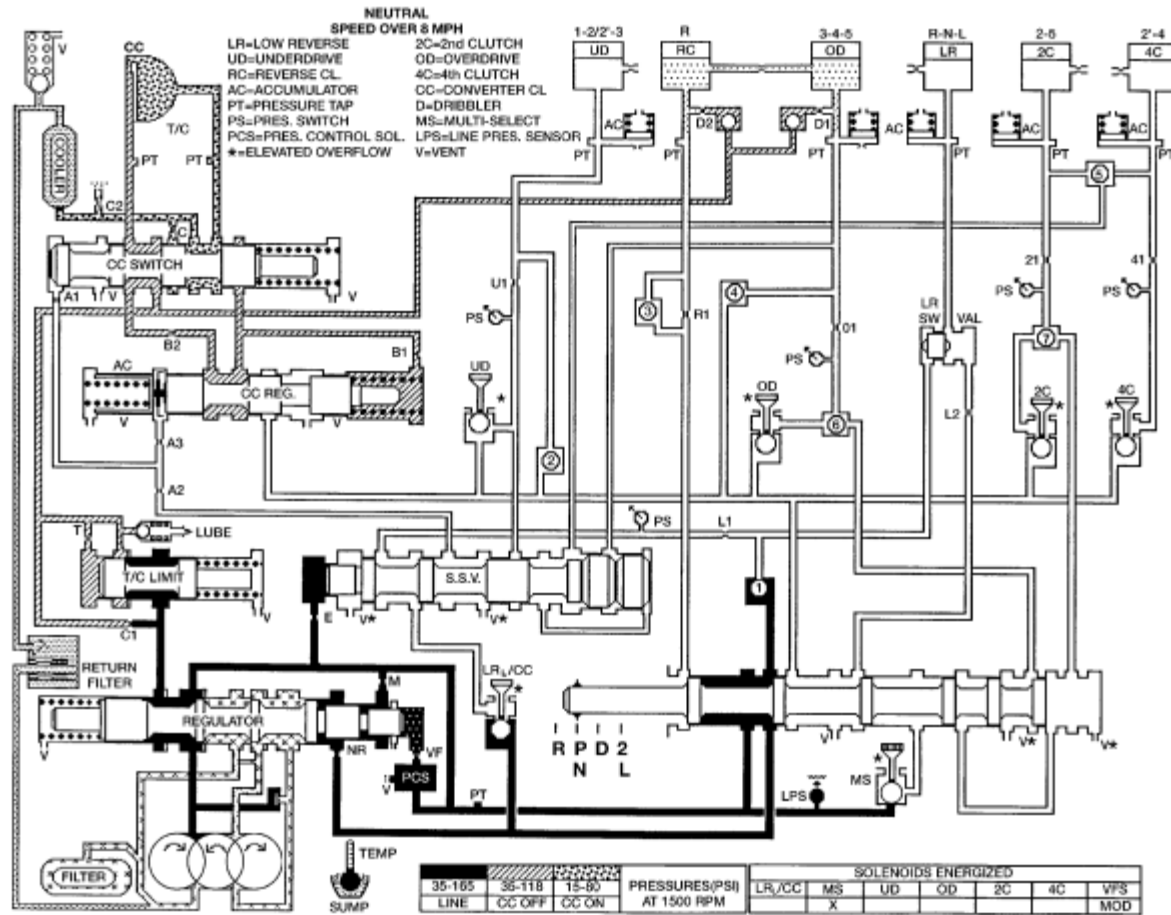
37. Fill transmission with Mopar® ATF +4, type 9602, Automatic Transmission Fluid.



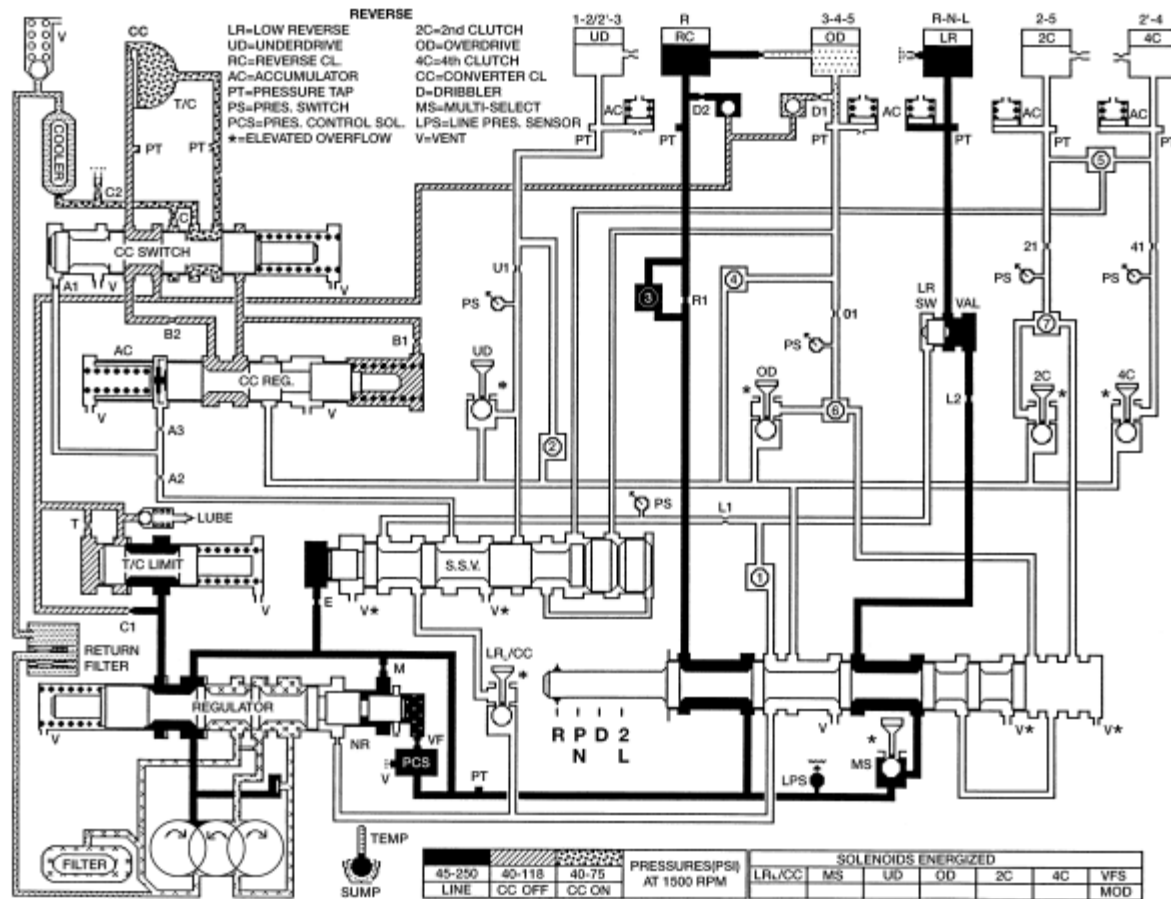
SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS

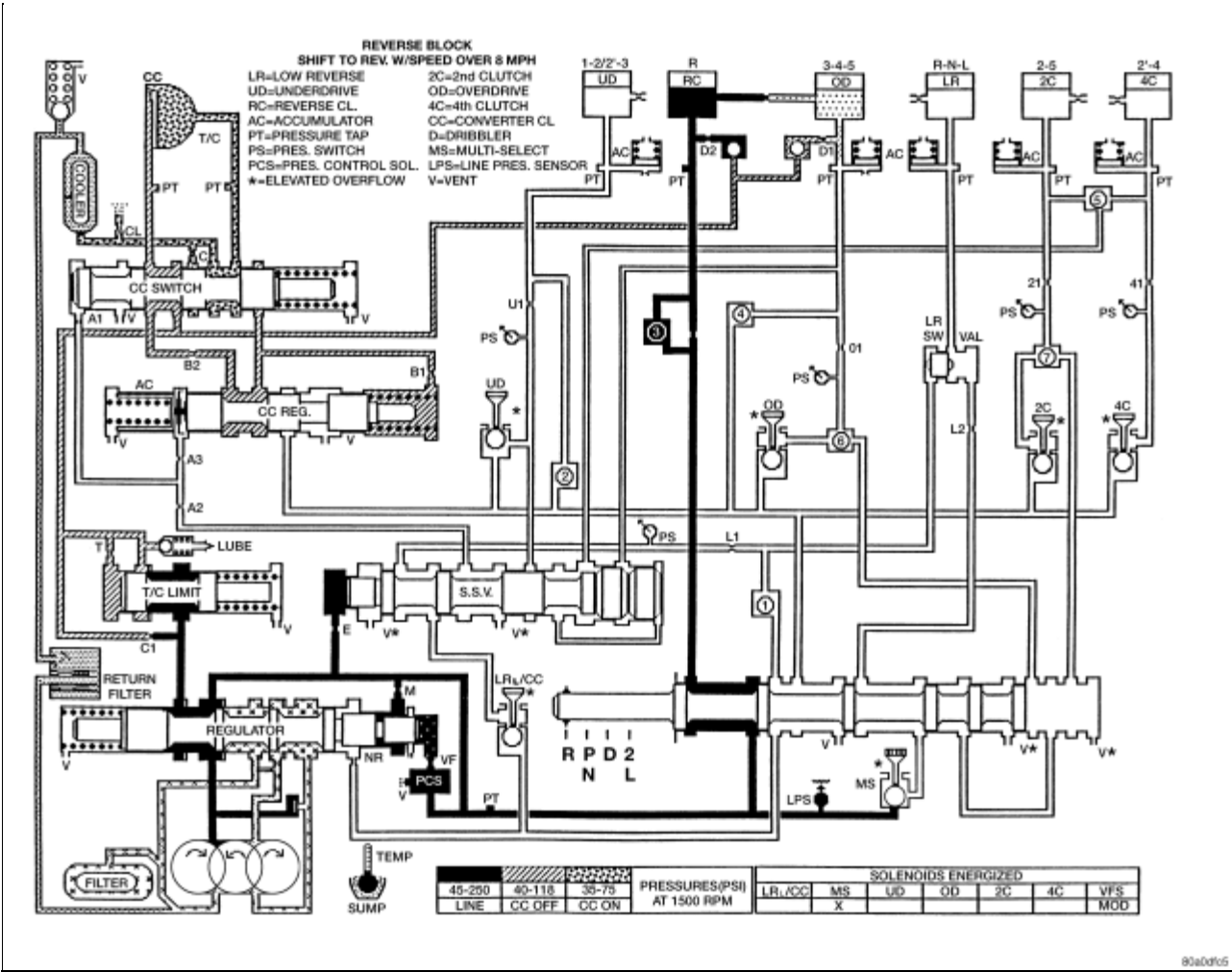




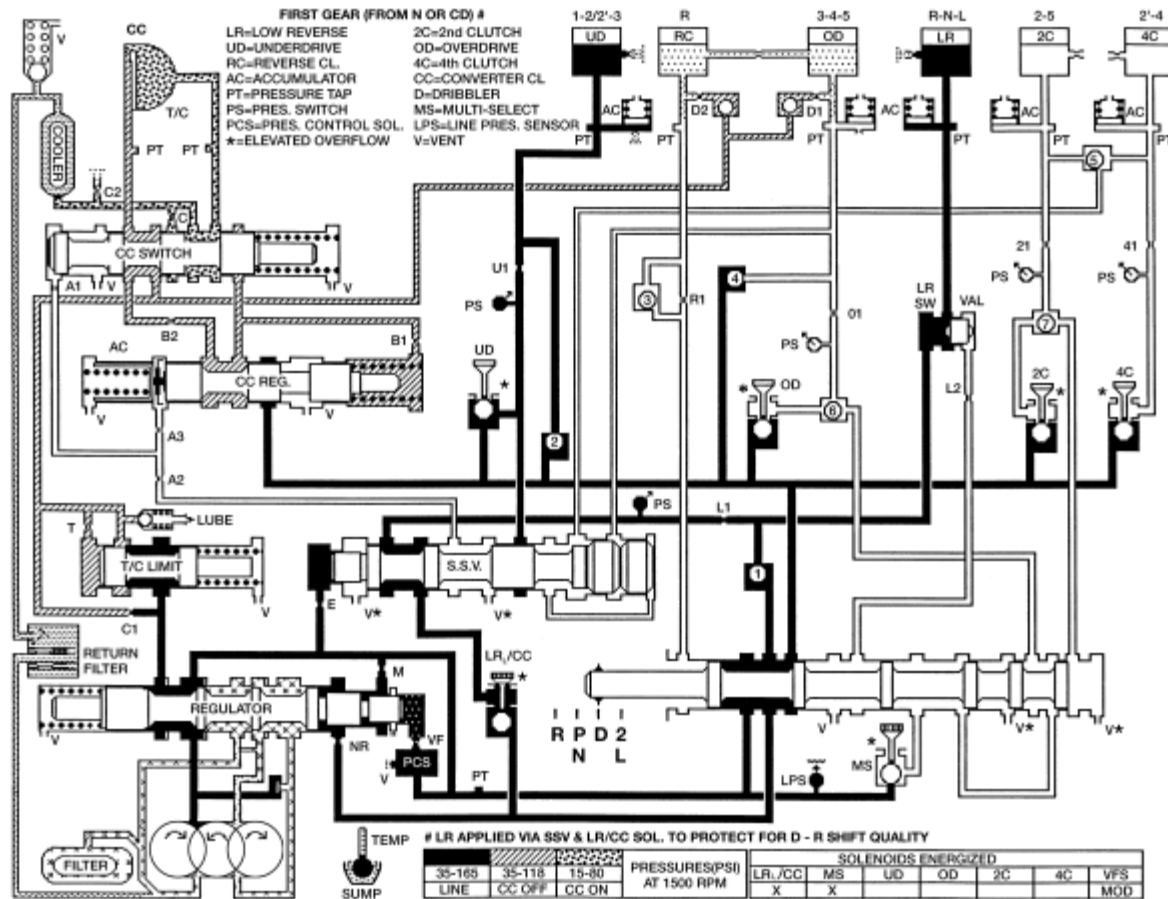
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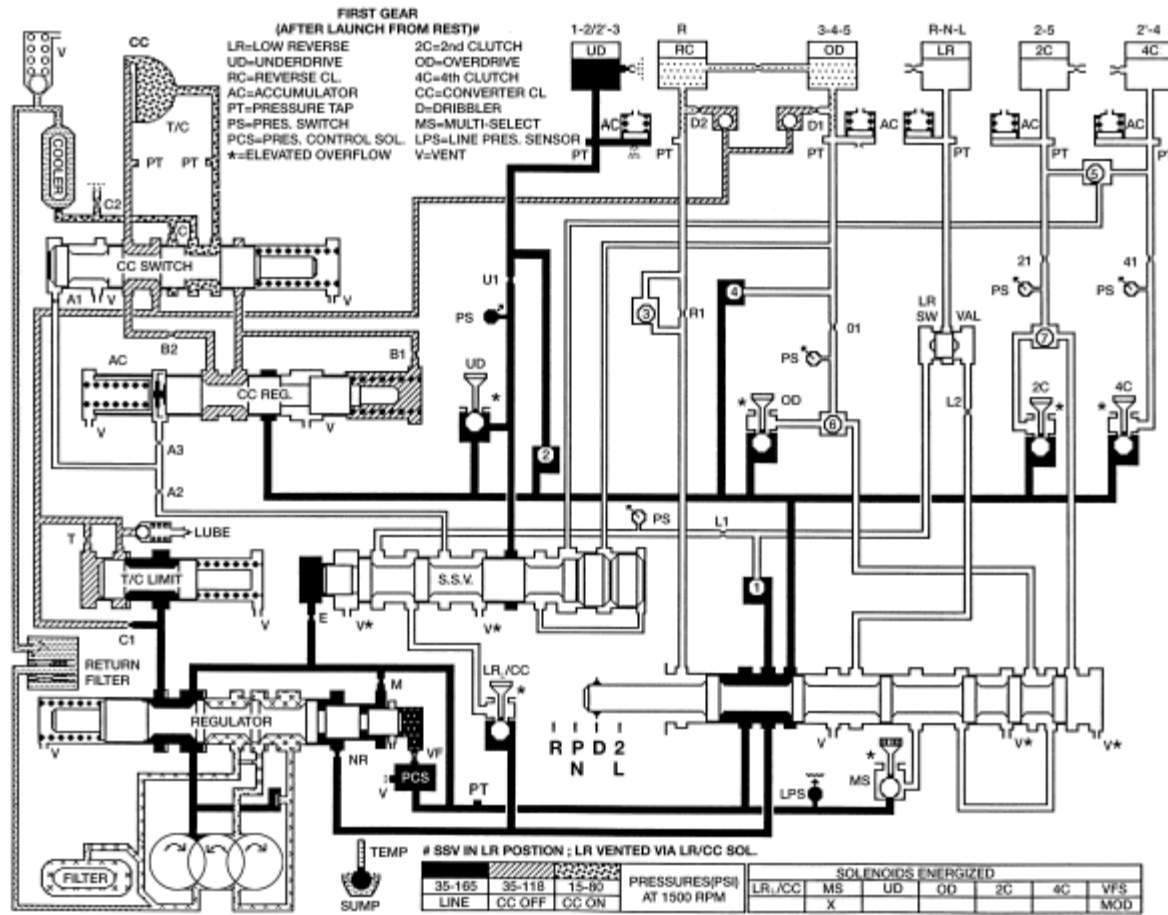
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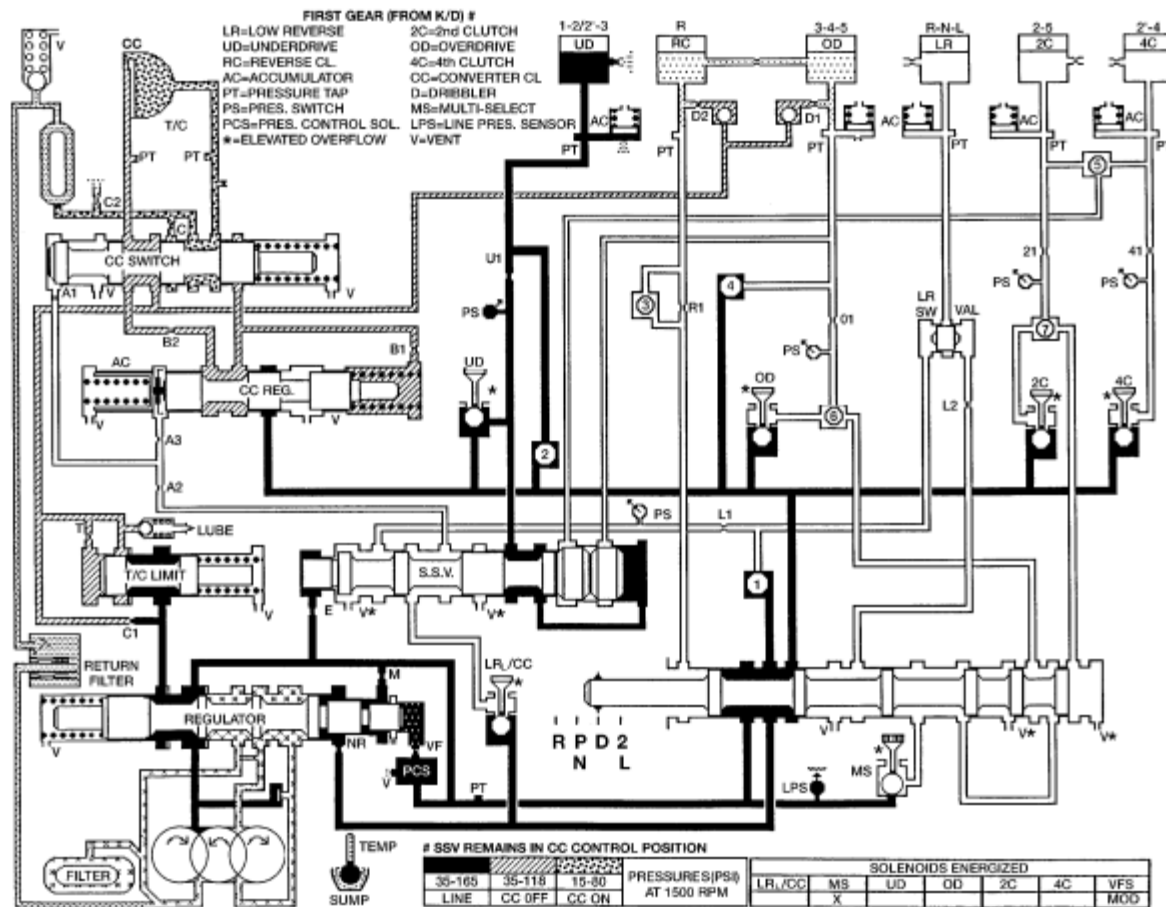
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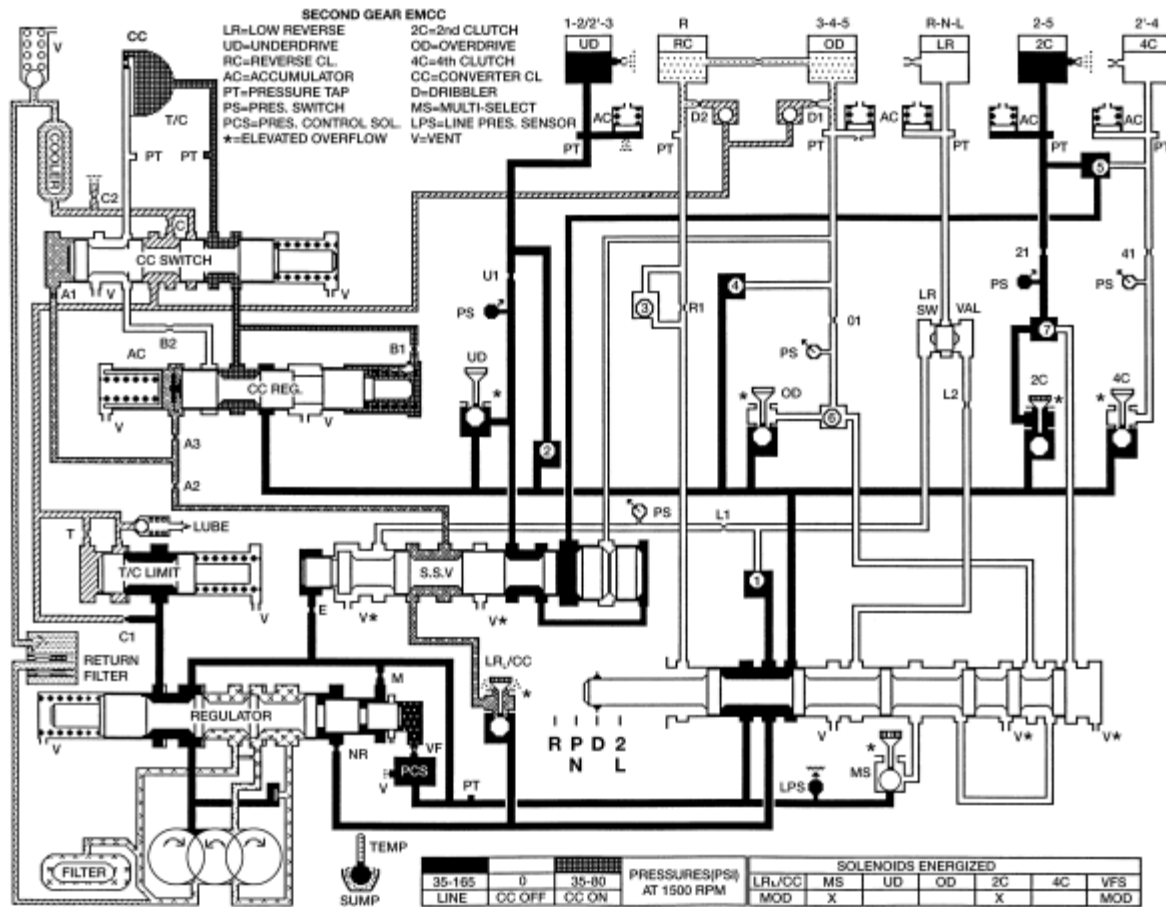


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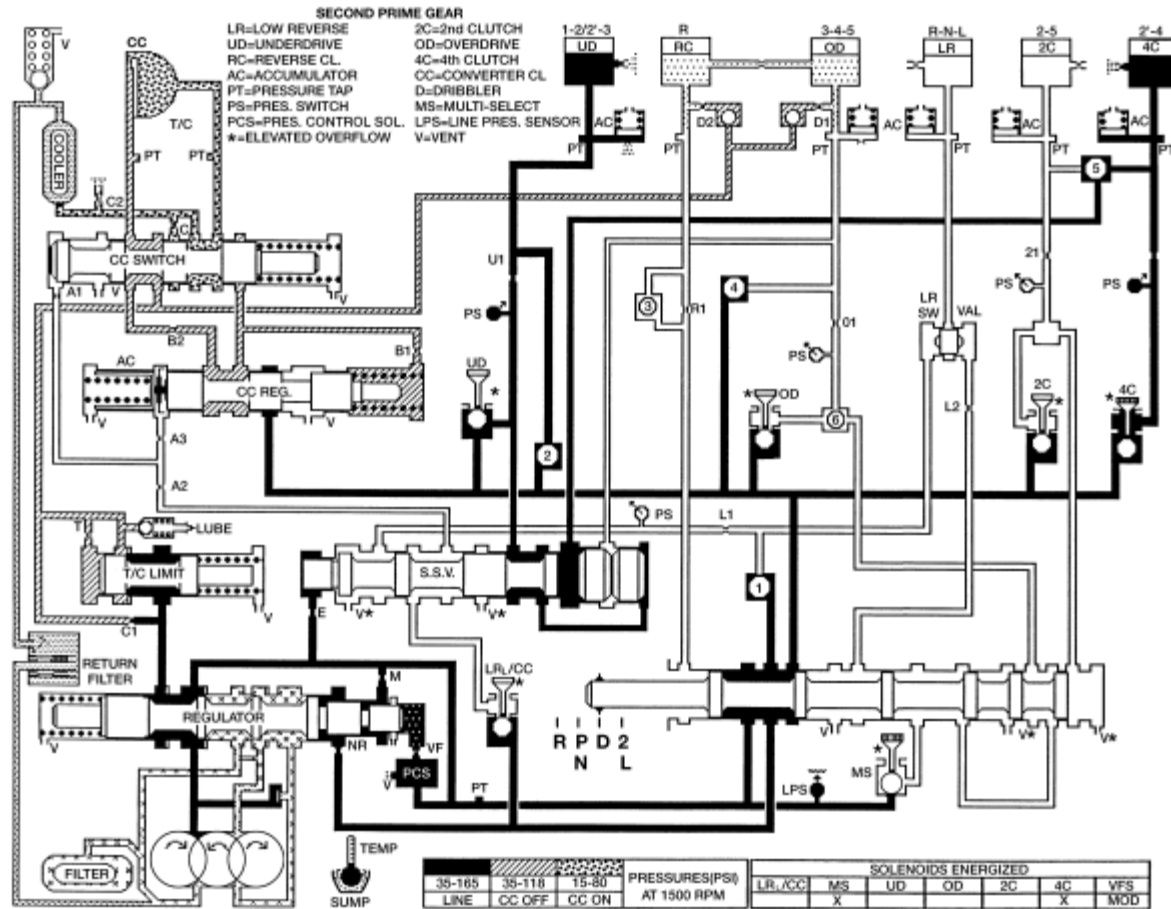


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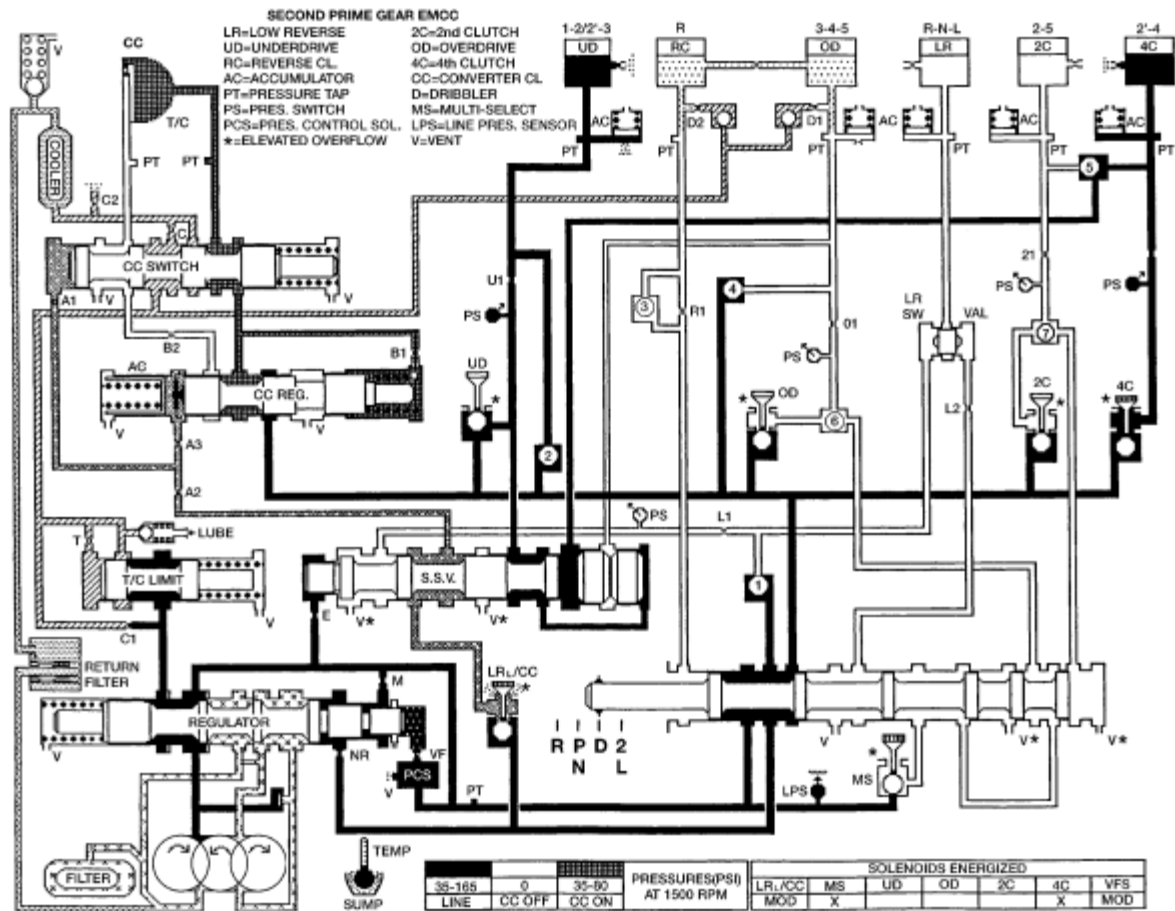




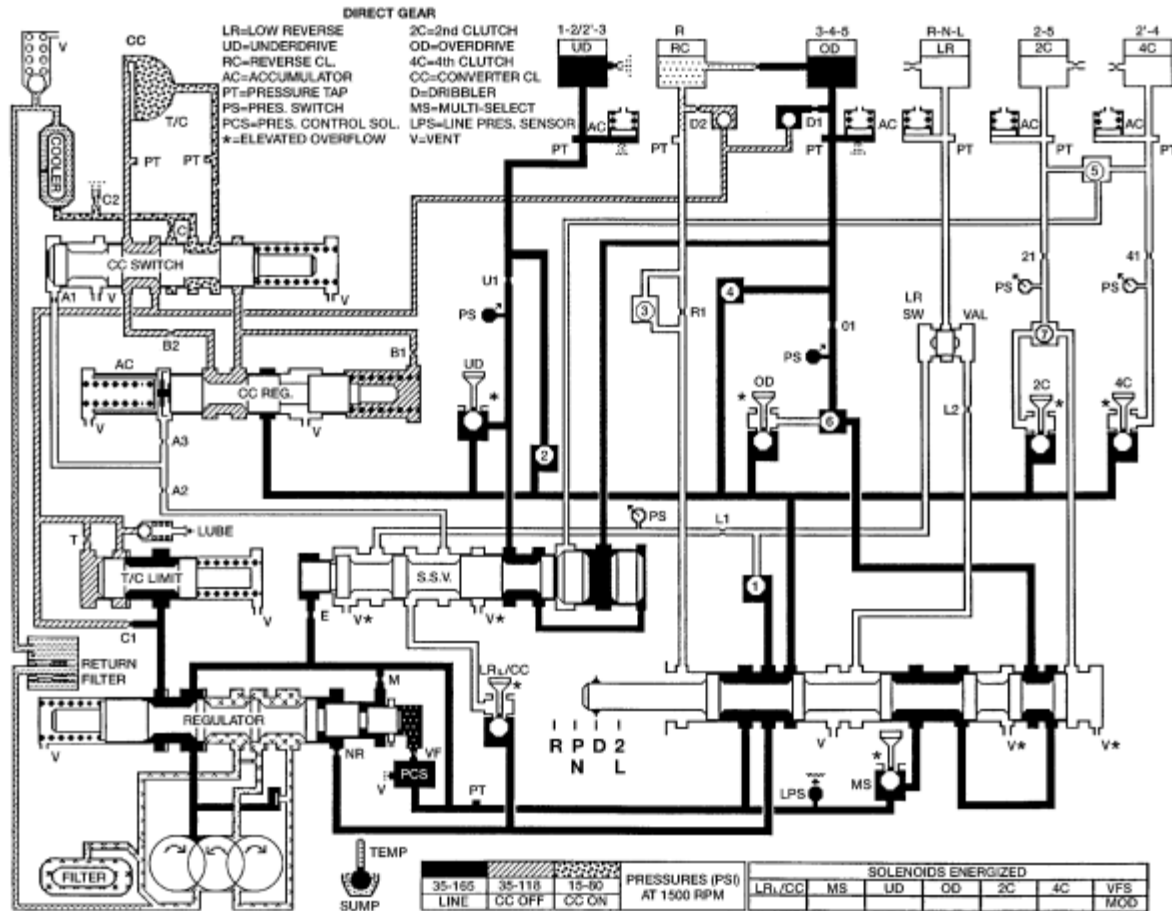
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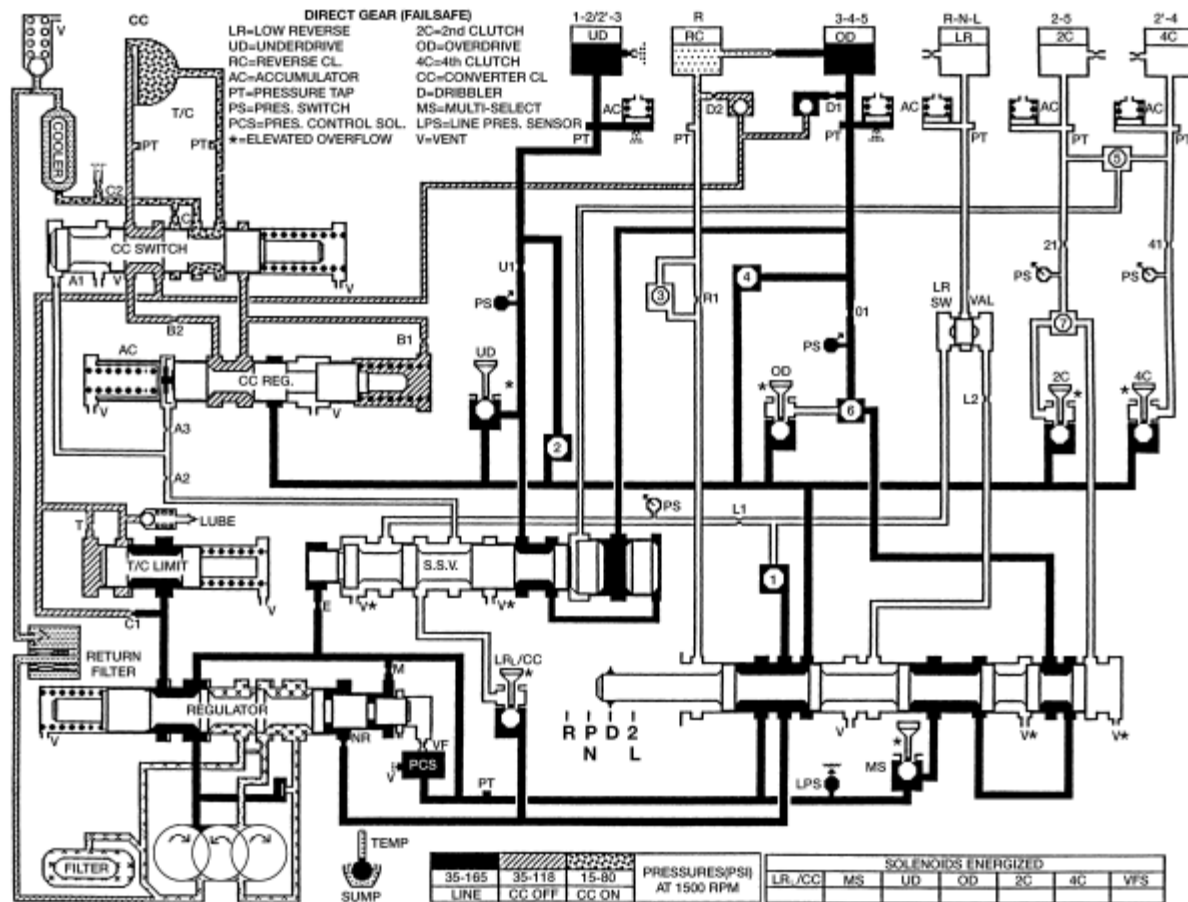
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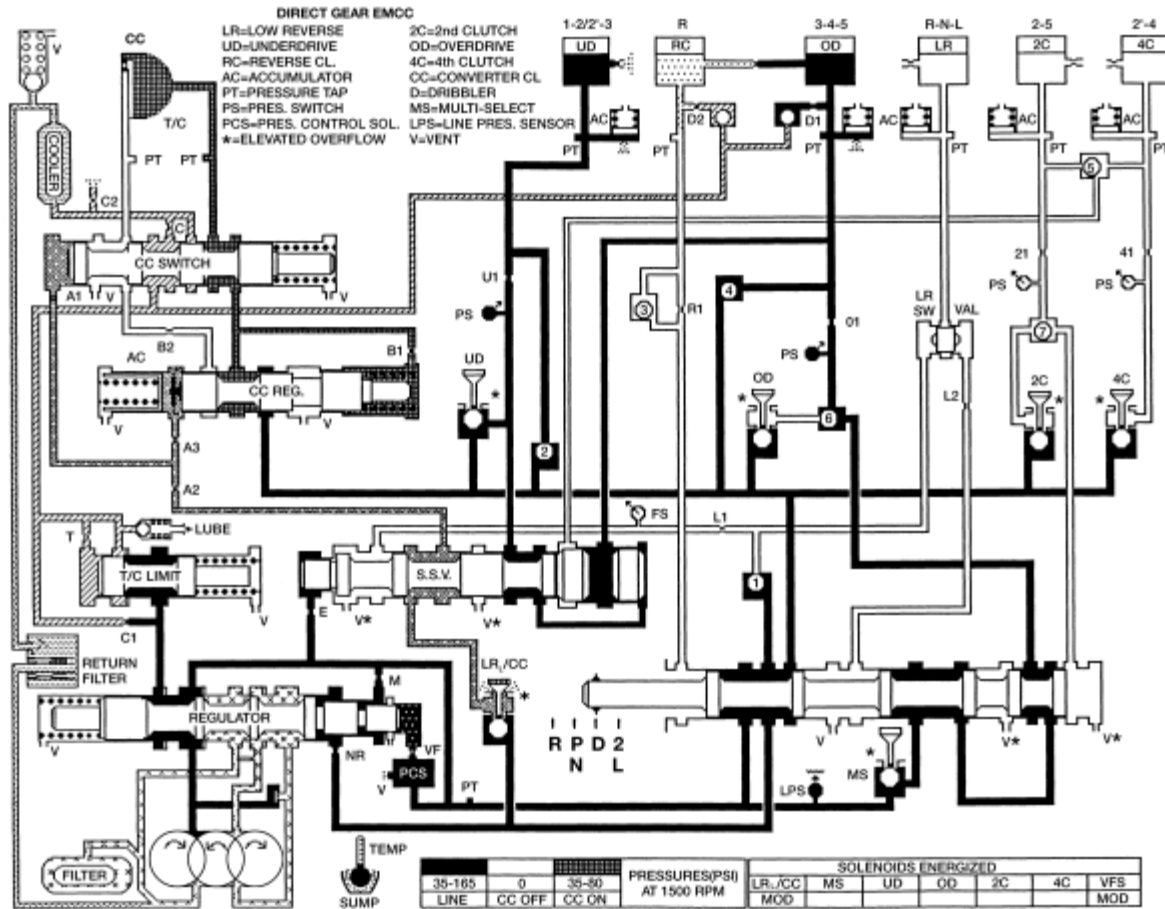
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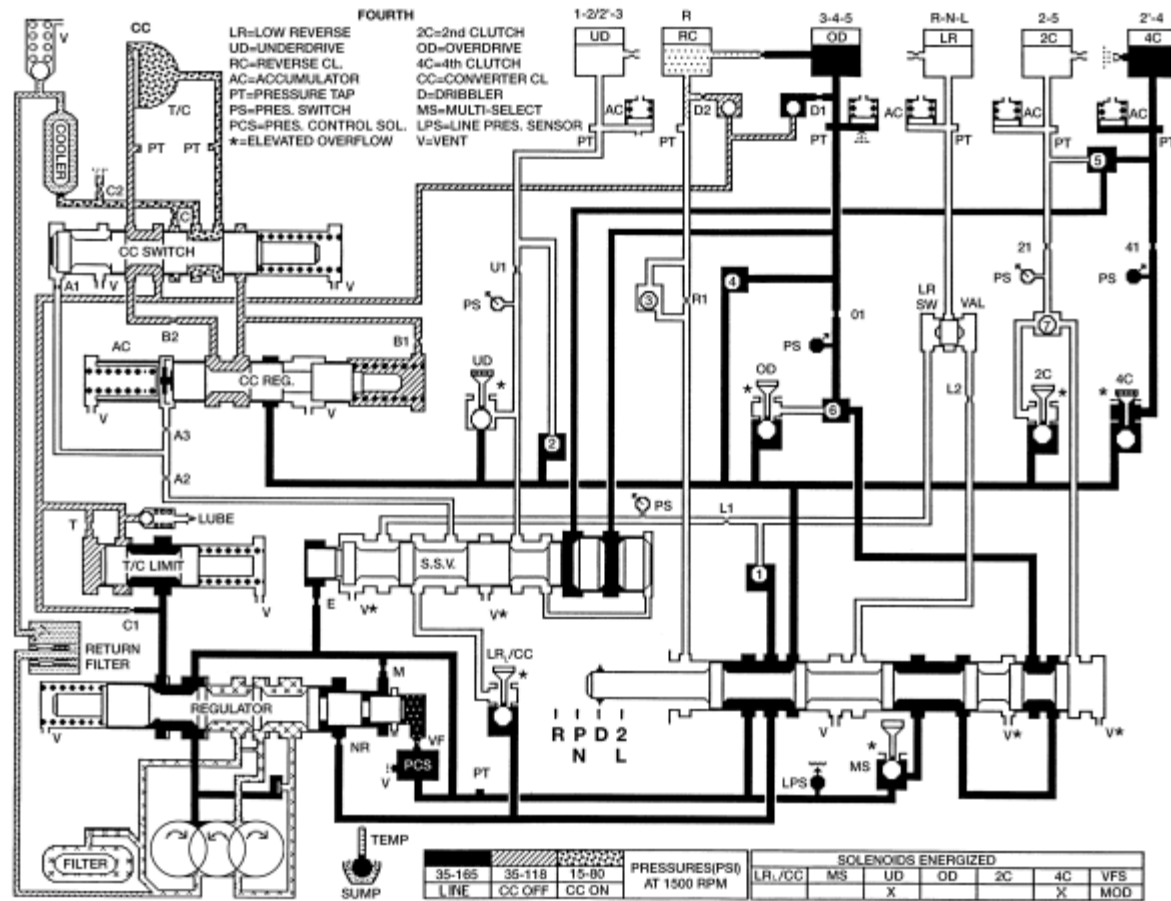
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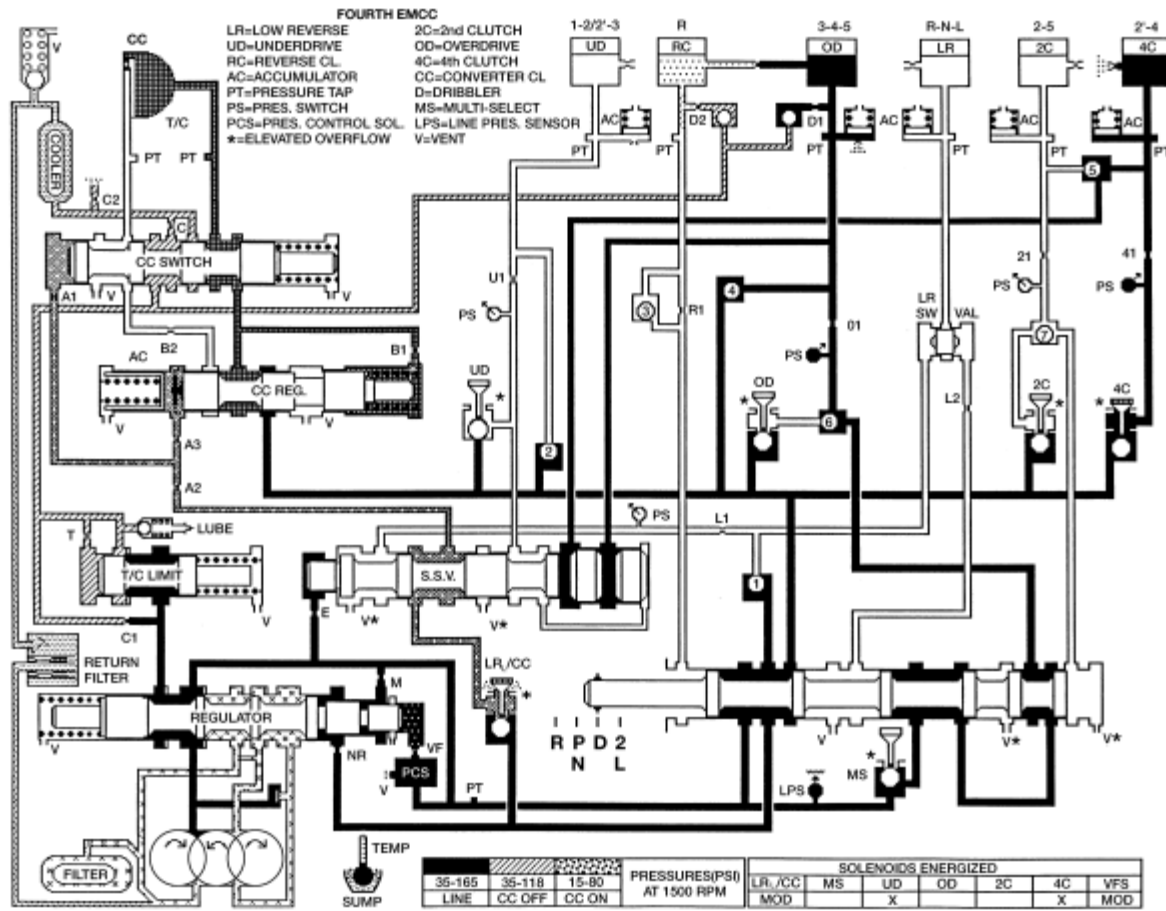
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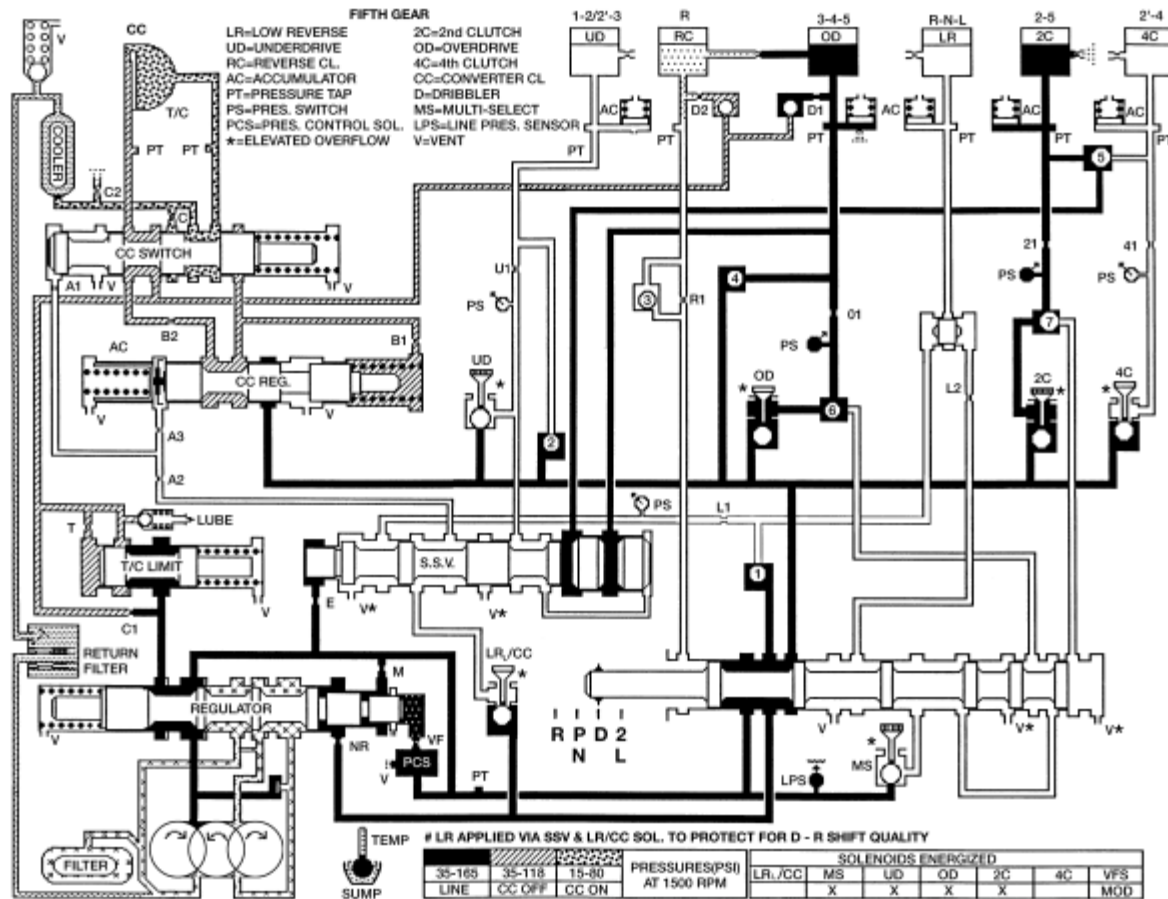
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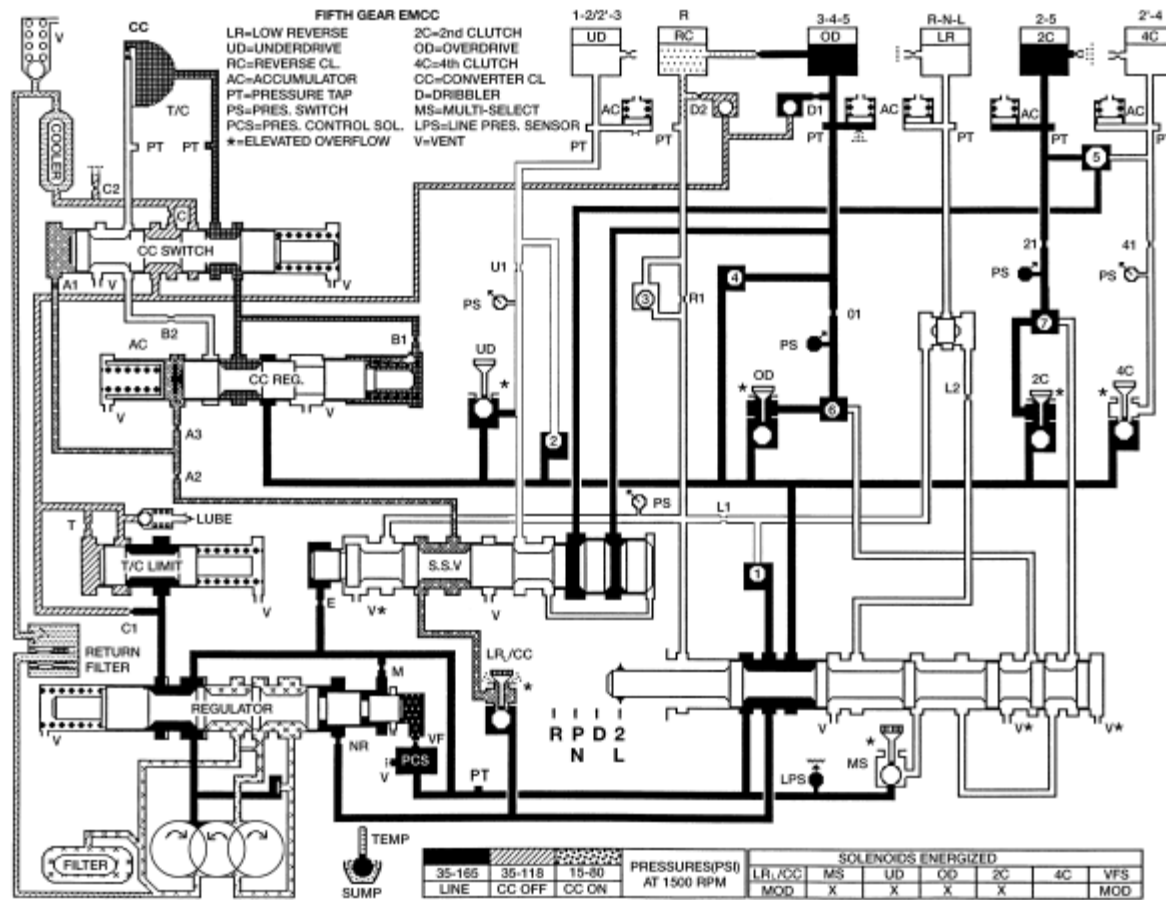
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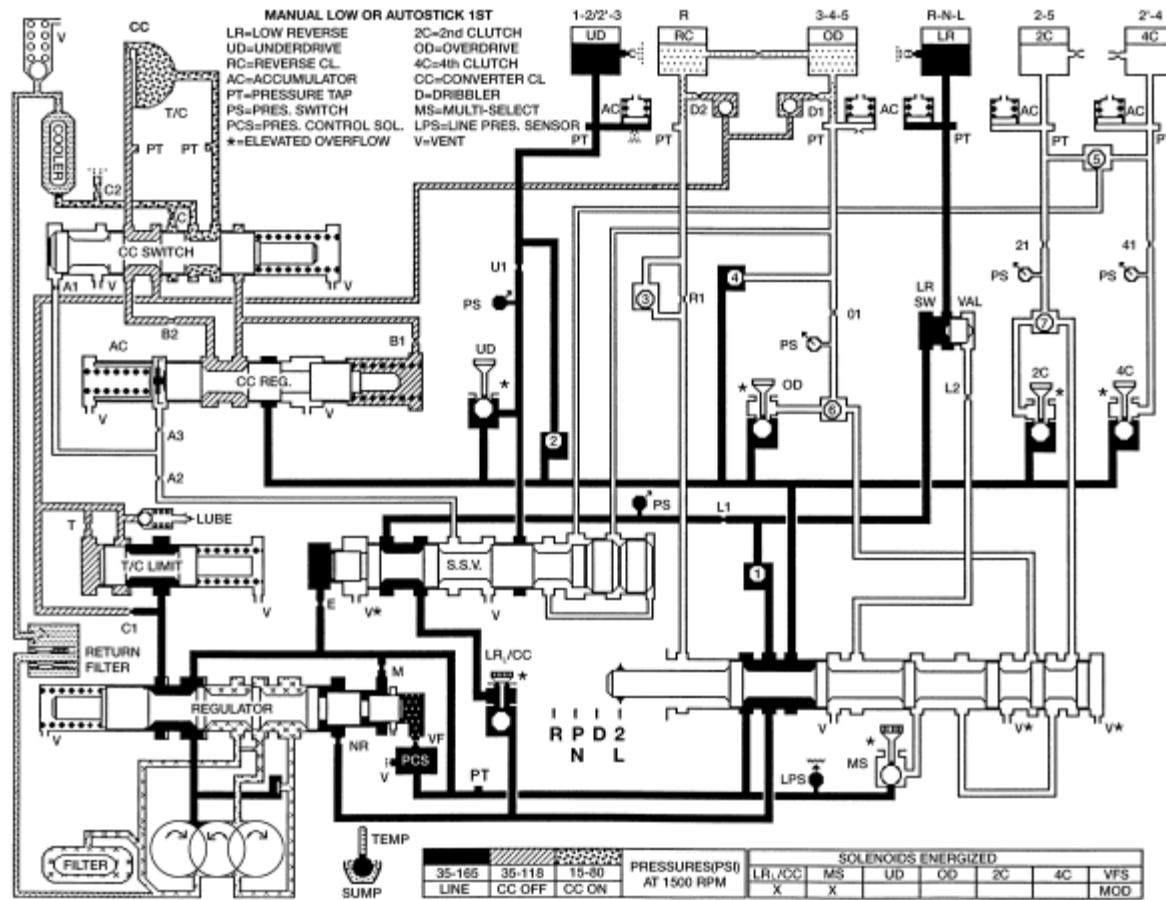
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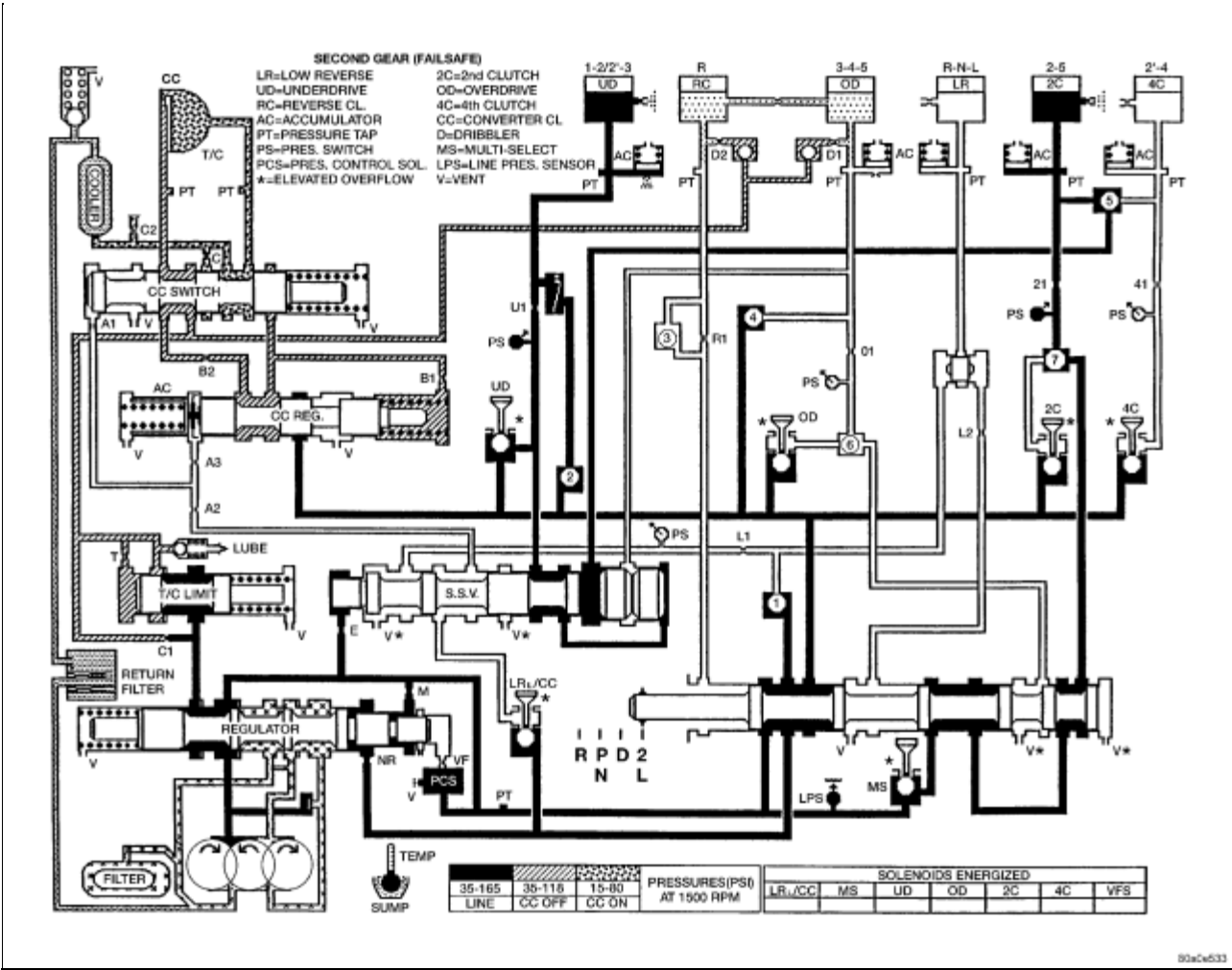


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SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Output Shaft End Play	0.22-0.55 mm	0.009-0.021 in.
Input Shaft End Play	0.46-0.89 mm	0.018-0.035 in.
2C Clutch Pack Clearance	0.455-1.335 mm	0.018-0.053 in.
4C Clutch Pack Clearance	0.770-1.390 mm	0.030-0.055 in.
L/R Clutch Pack Clearance	1.00-1.74 mm	0.039-0.069 in.
OD Clutch Pack Clearance	1.103-1.856 mm	0.043-0.073 in.

UD Clutch Pack Clearance	0.84-1.54 mm	0.033-0.061 in.
Reverse Clutch Pack Clearance	0.81-1.24 mm	0.032-0.049 in.
Recommended fluid	Mopar® ATF +4	

GEAR RATIOS

1ST	3.00:1
2ND	1.67:1
2ND PRIME	1.50:1
3RD	1.00:1
4TH	0.75:1
5TH	0.67:1
REVERSE	3.00:1

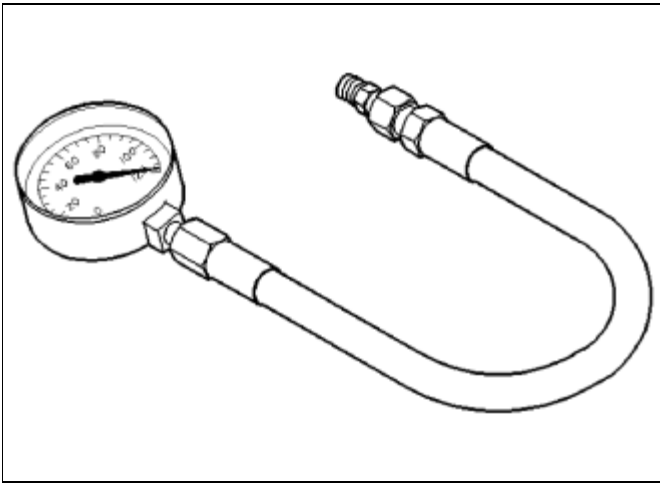
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fitting, cooler line at trans	17.5	-	155
Bolt, torque converter housing to engine upper four	41	30	-
Bolt, torque converter housing to engine lower four	54	40	-
Bolts, transmission collar	68	50	-
Bolt, torque converter to driveplate	31	23	270
Bolt/nut, crossmember	68	50	-
Bolt, driveplate to crankshaft	75	55	-
Bolts, clevis bracket / rear support	47	35	-
Bolt , converter housing	68	50	-

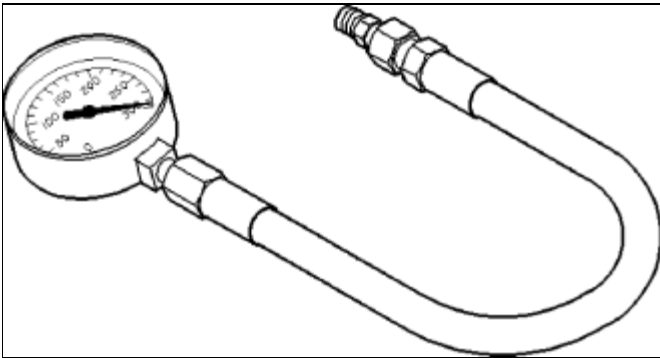
Bolt, oil pan	12	-	105
Screw, primary fluid filter	4.5	-	40
Nuts, transfer case	35	26	-
Oil Filter, Cooler Return	9.5		84
Bolt, oil pump	28	-	250
Bolt, oil pump body to cover	4.5	-	40
Screw, plate to oil pump body	4.5	-	40
Bolt, valve body to case	12	-	105
Plug, pressure test port	5	-	45
Bolt, reaction shaft support	12	-	105
Screw, valve body to transfer plate	5.5	-	50
Screw, solenoid module to transfer plate	6	-	50
Screw, accumulator cover	7	-	60
Screw, detent spring	4.5	-	40
Bolt, input speed sensor	12	-	105
Bolt, output speed sensor	12	-	105
Bolt, line pressure sensor	12	-	105
Bolt, extension housing	54	40	-
Screw, manual valve cam retaining	4.5	-	40
Screw, manual selector shaft retaining	28	-	250
Cross-bolt, manual selector shaft	16	-	140

SPECIAL TOOLS

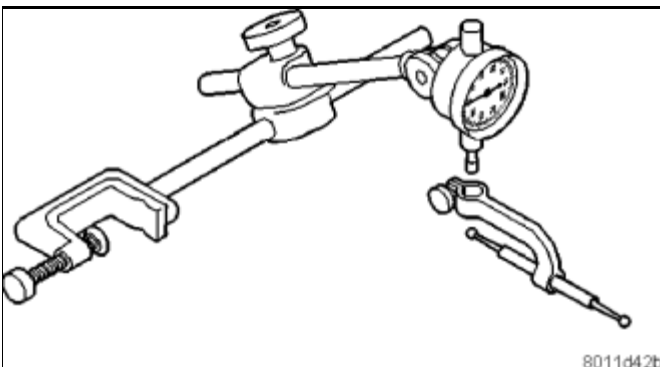
AUTOMATIC TRANSMISSION - RFE



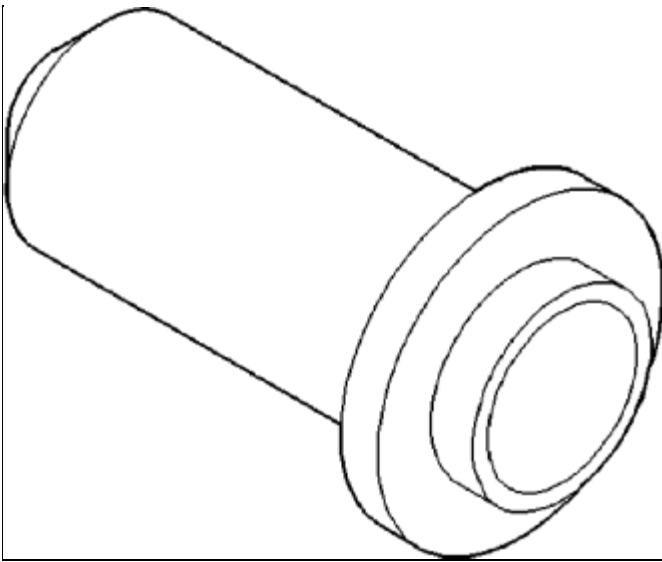
Gauge, Oil Pressure - C-3292



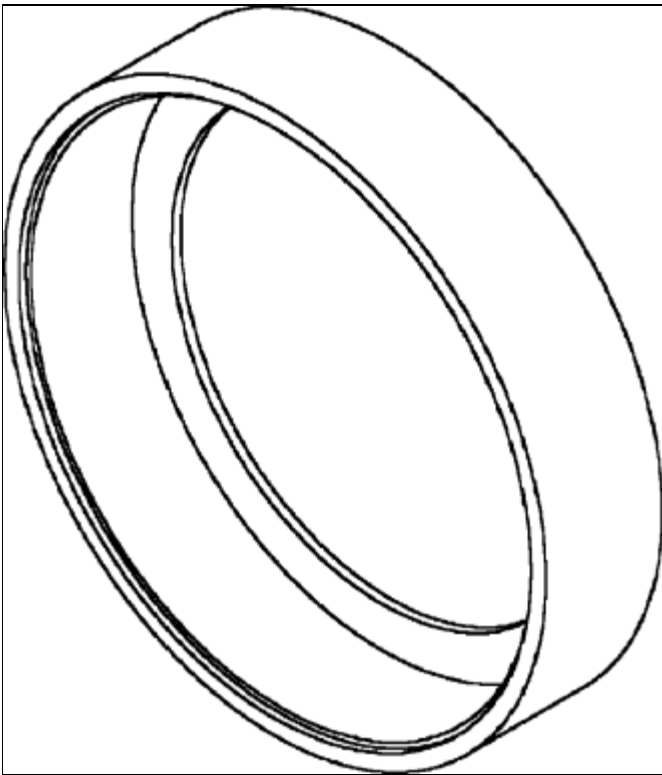
Gauge, Oil Pressure - C-3293SP



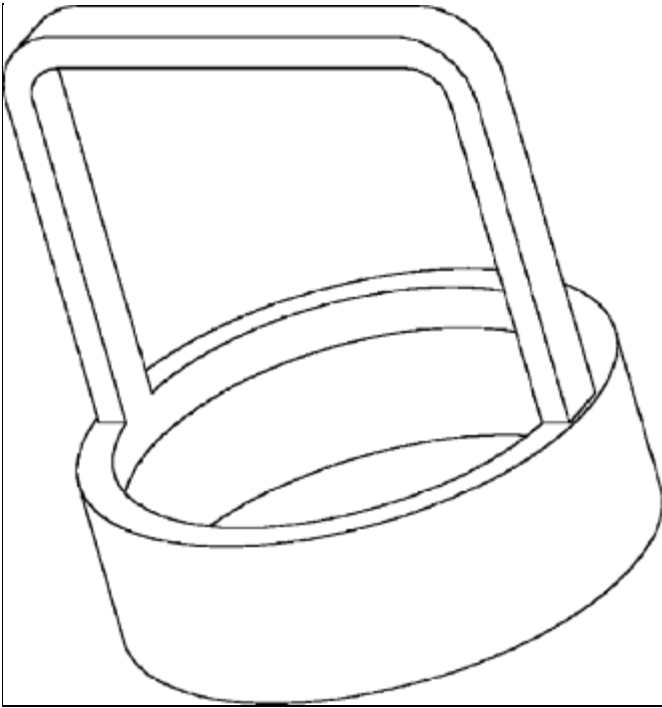
Dial Indicator - C-3339



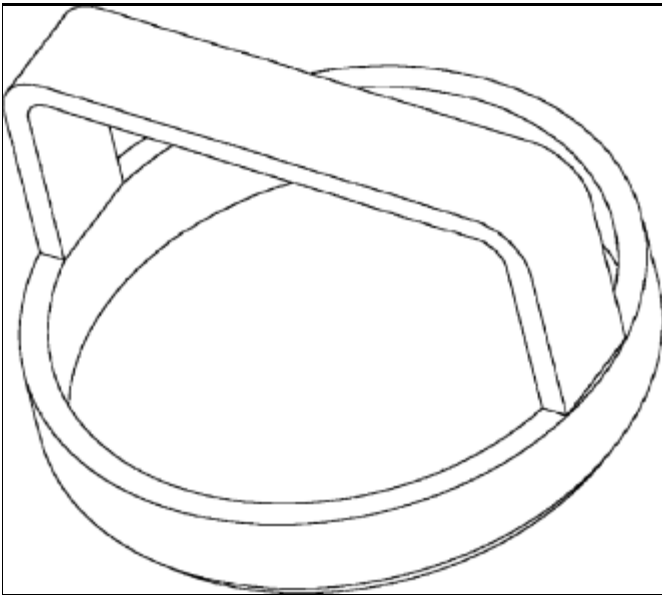
Installer, Seal - C-3860-A



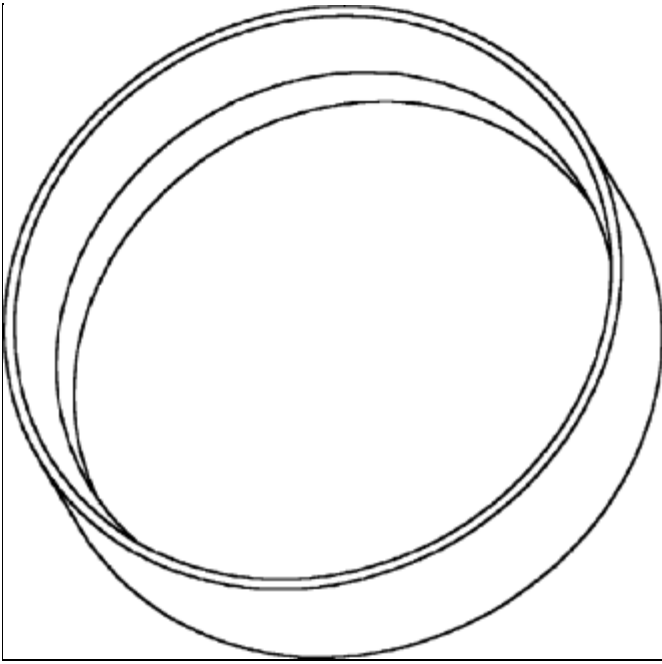
Compressor, Spring - 8249



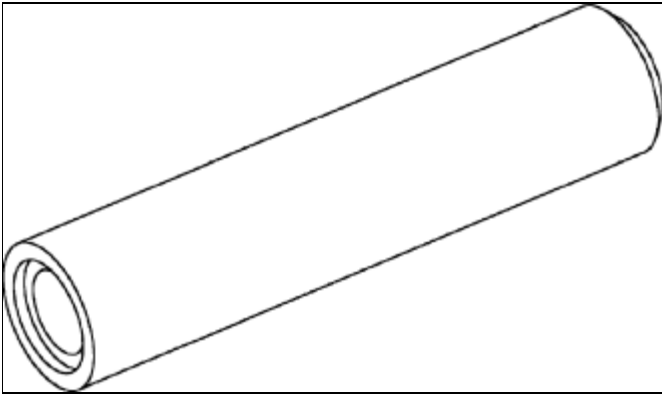
Compressor, Spring - 8250



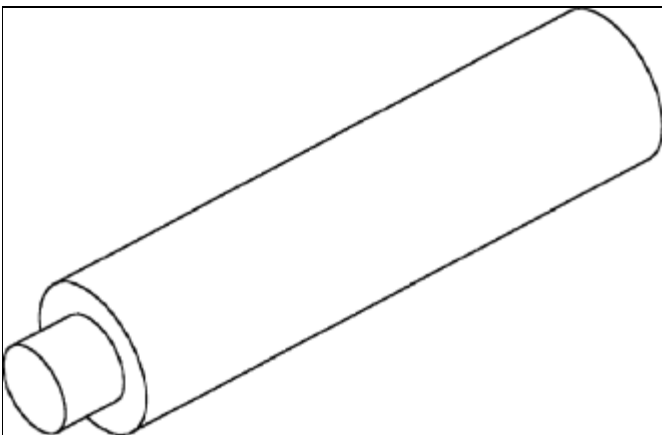
Compressor, Spring - 8251

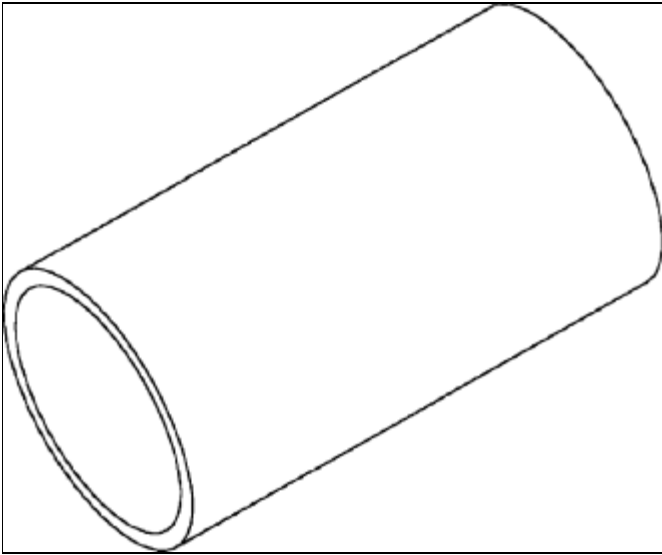
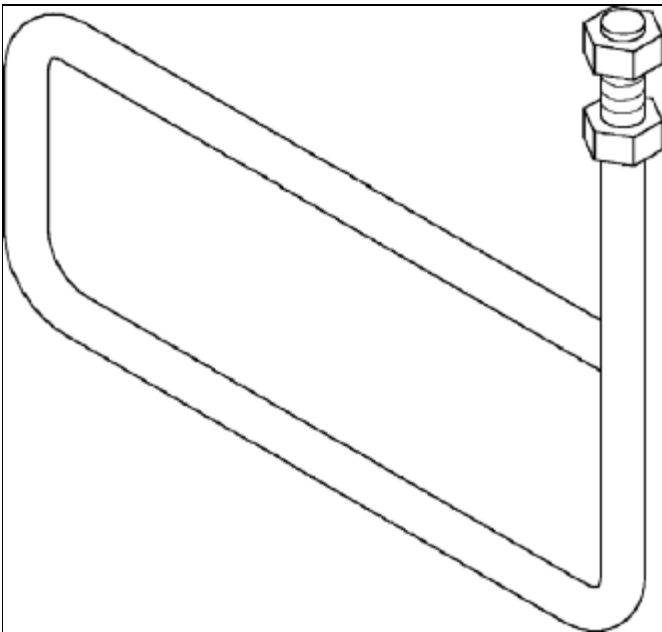


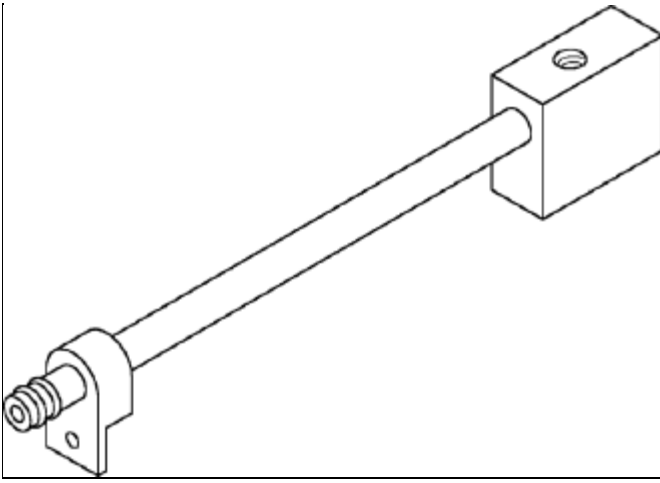
Installer, Piston - 8252



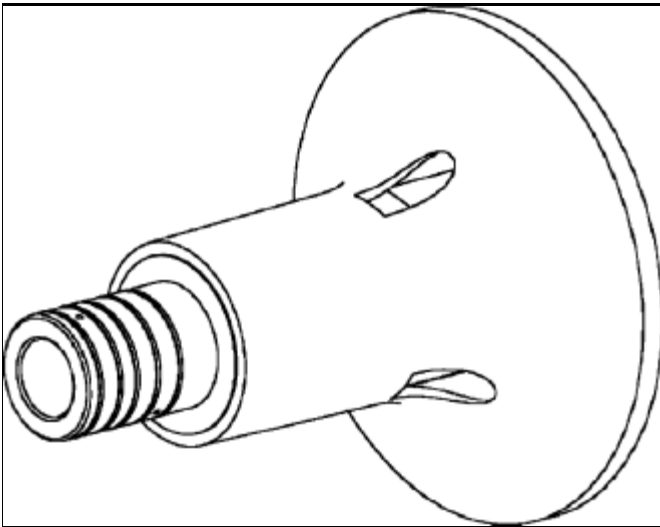
Installer, Seal - 8253



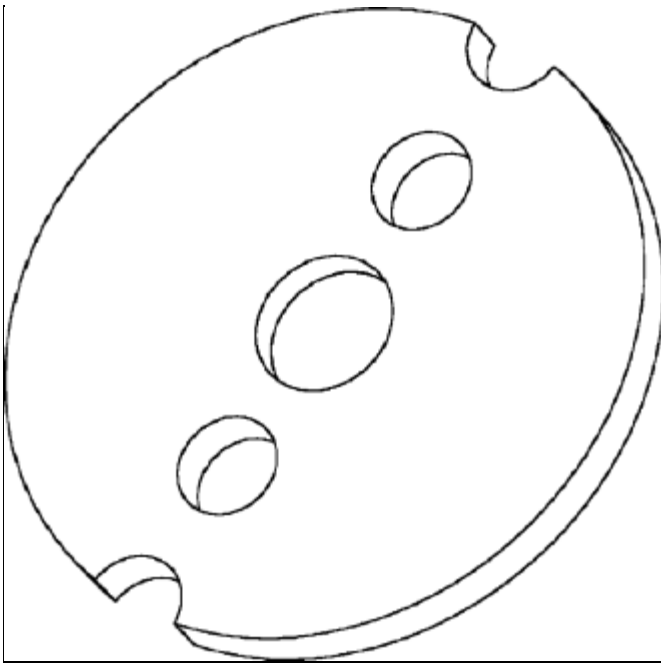
Installer, Seal - 8254**Installer, Snap-ring - 8255****Stand, Support - 8257**



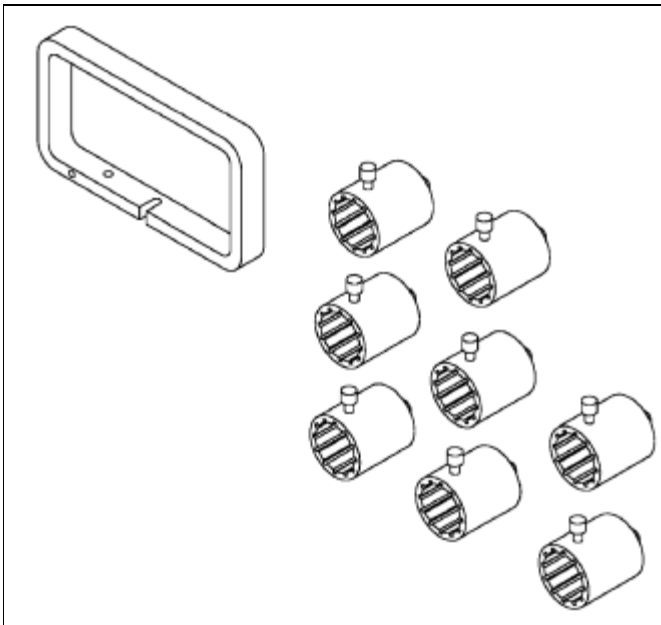
Adapter, Line Pressure - 8259



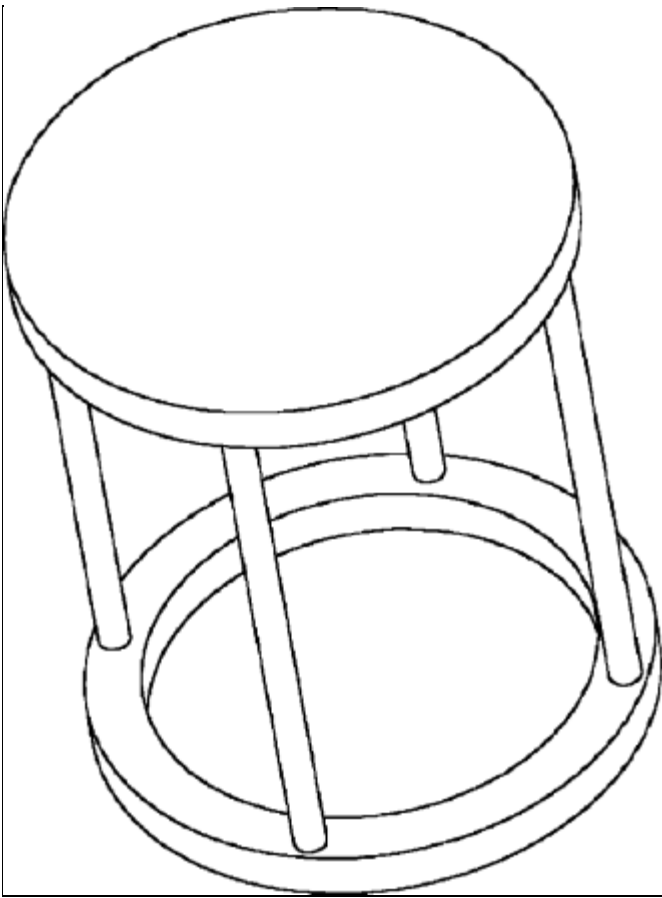
Fixture, Input Clutch Pressure - 8260



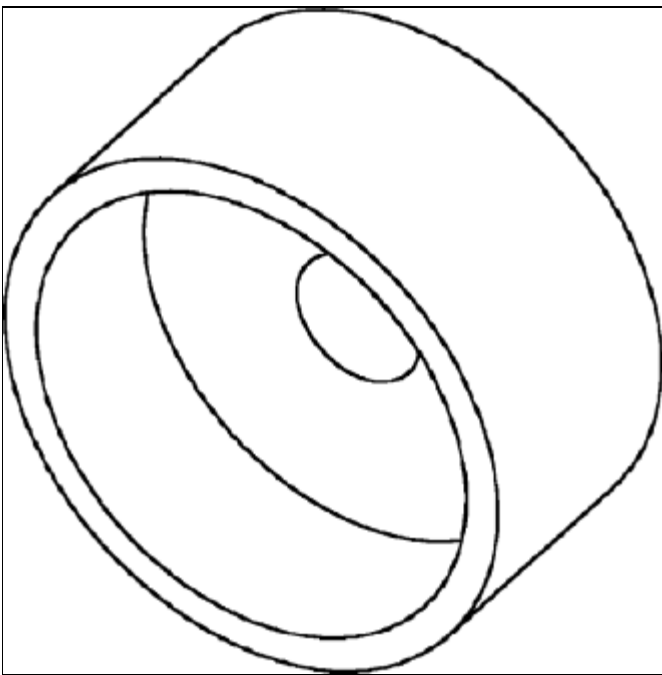
Plate, Alignment - 8261



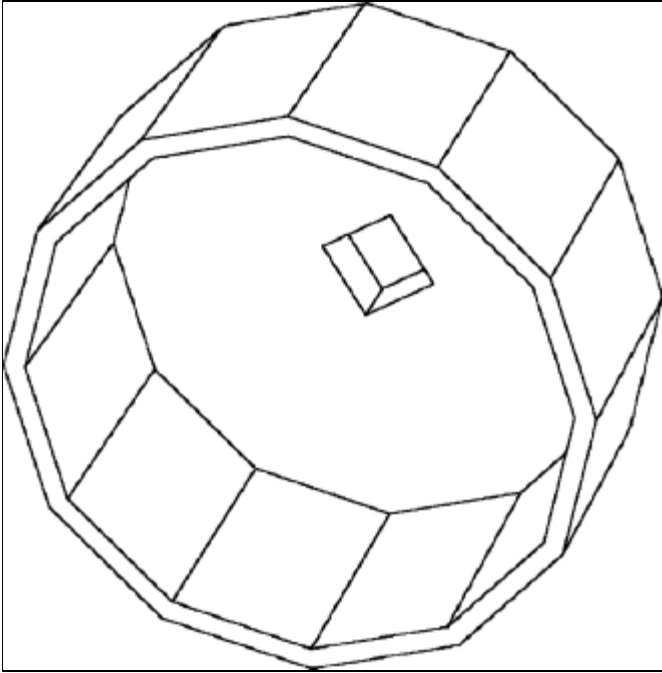
END PLAY TOOL SET - 8266



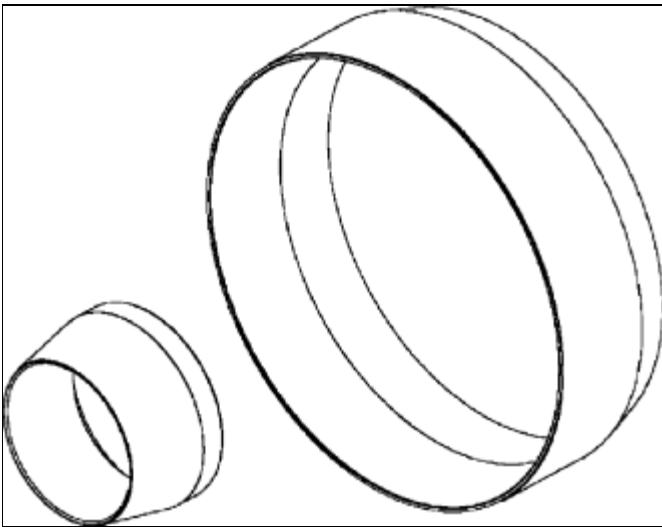
Compressor, Spring - 8285



Installer, Bearing - 8320



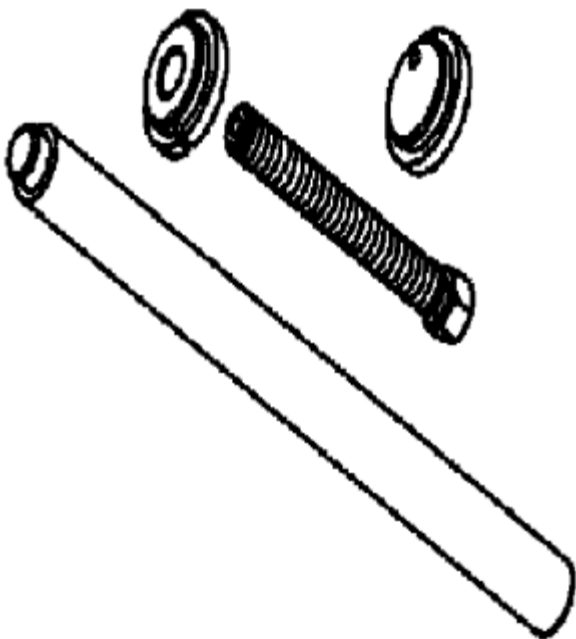
Wrench, Filter - 8321

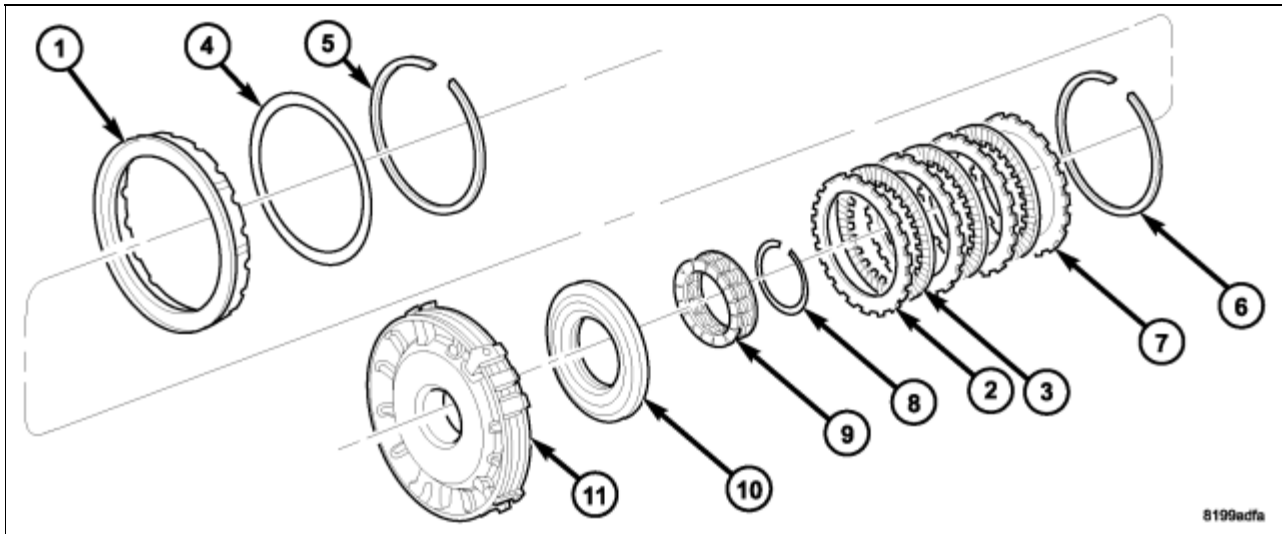


Installer, Piston - 8504

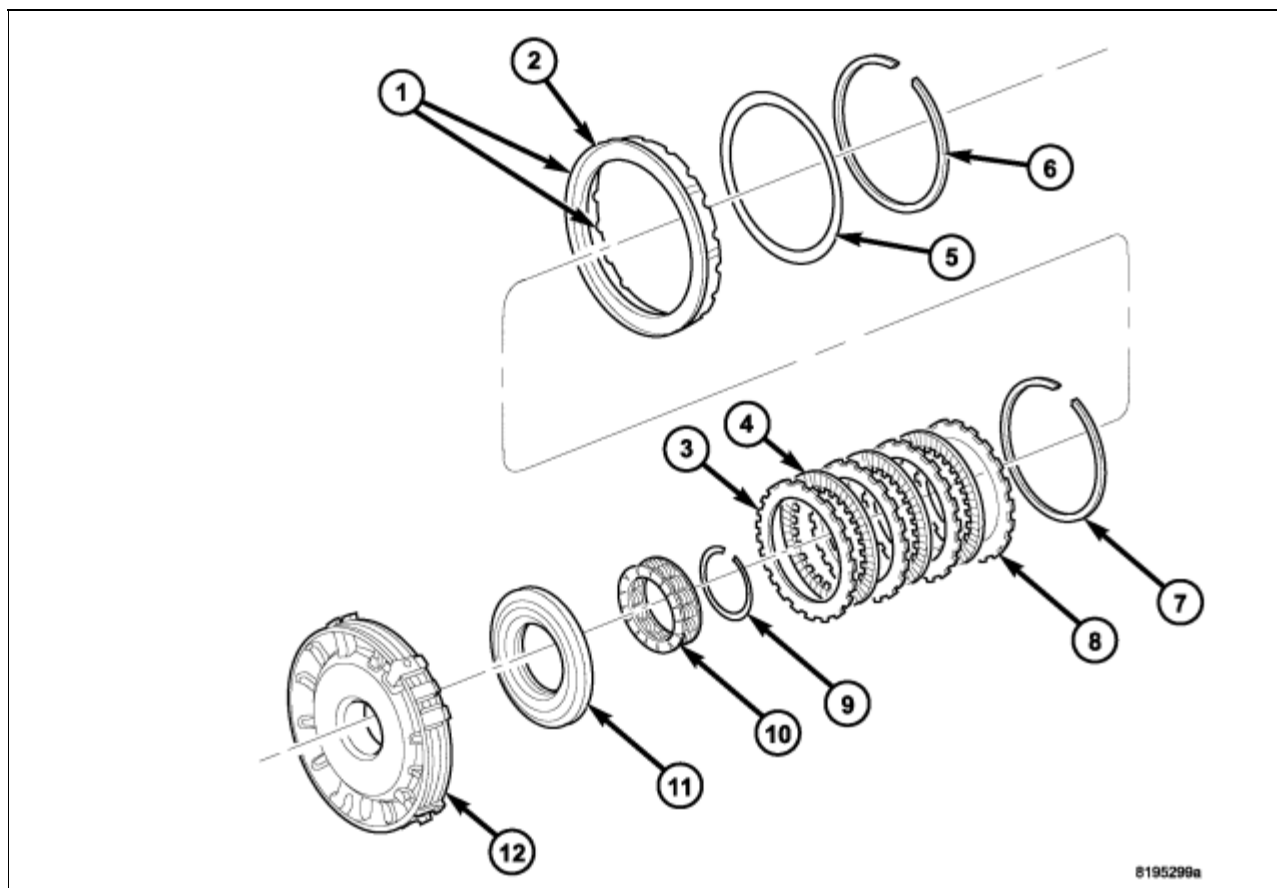
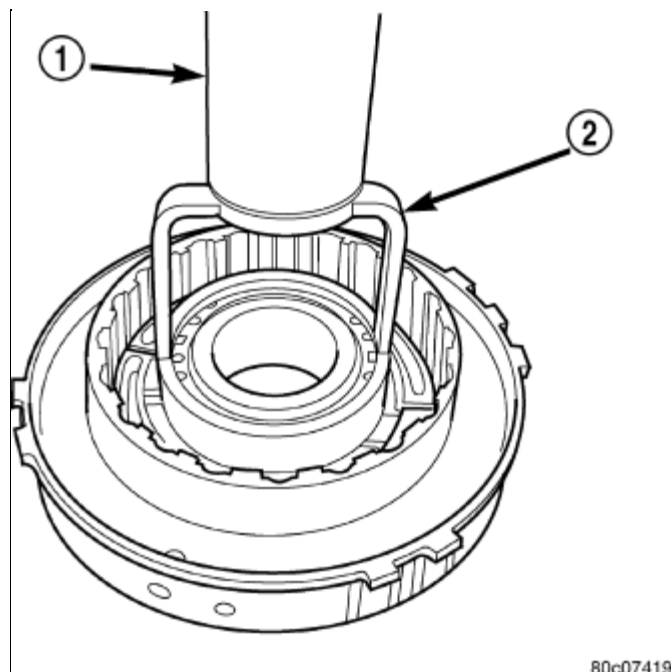


INSTALLER, FRONT COVER - 9955



INSTALLER - 6960**RETAINER/BULKHEAD-4C****DISASSEMBLY**

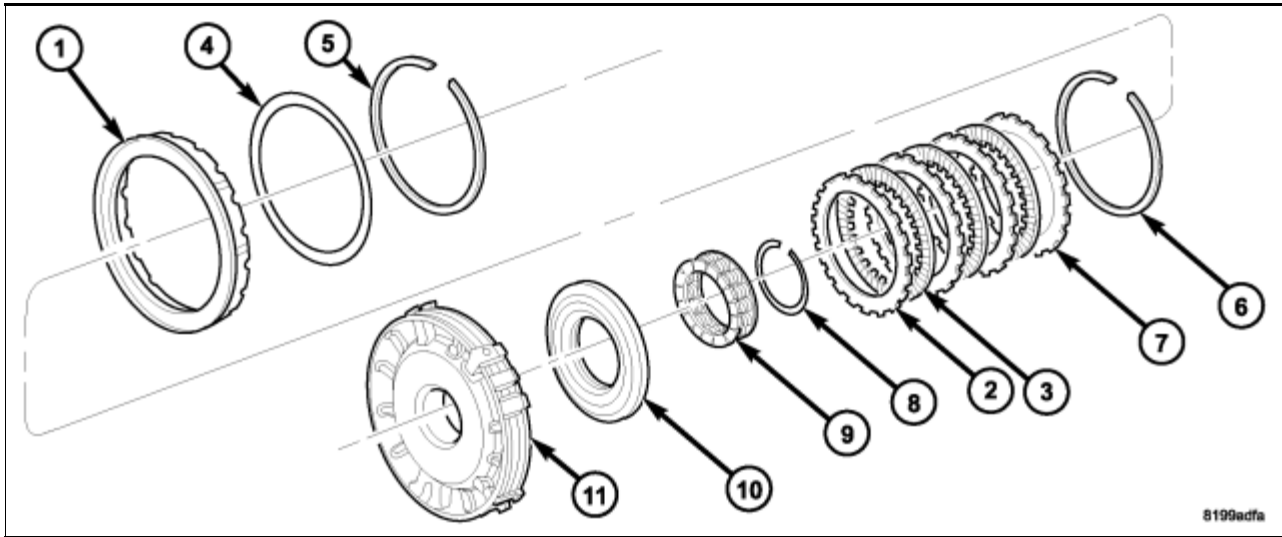
1. Remove the 2C piston Belleville spring snap-ring (5) from the 4C retainer/bulkhead (11).
2. Remove the 2C piston Belleville spring (4) from the retainer/bulkhead (11).
3. Remove the 2C piston (1) from the retainer/bulkhead (11). Use 20 psi of air pressure to remove the piston if necessary.
4. Remove the 4C clutch snap-ring (6) from the retainer/bulkhead (11)
5. Remove the 4C clutch pack (2, 3, 7) from the retainer/bulkhead (11).
6. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring and remove the snap-ring.



7. Remove the 4C piston return spring (10) and piston (11) from the retainer/bulkhead (12). Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

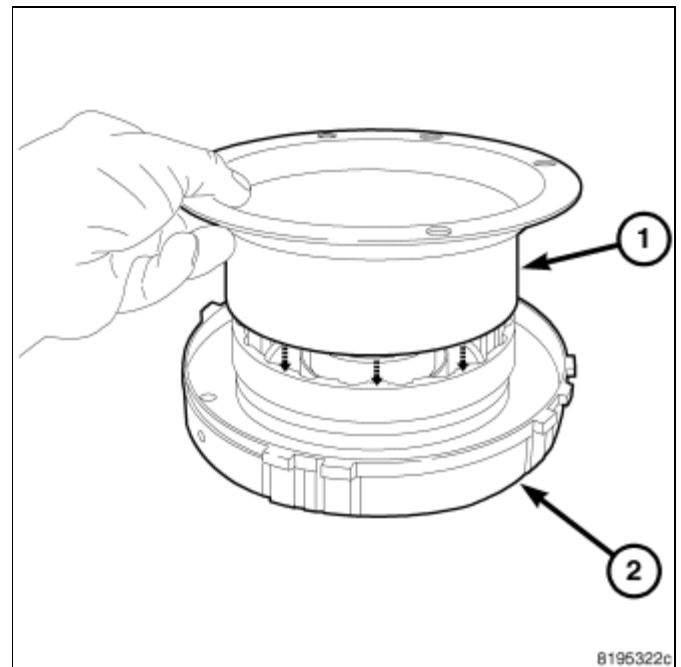
NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.



1. Lubricate all seals with Mopar® ATF +4 prior to installation.

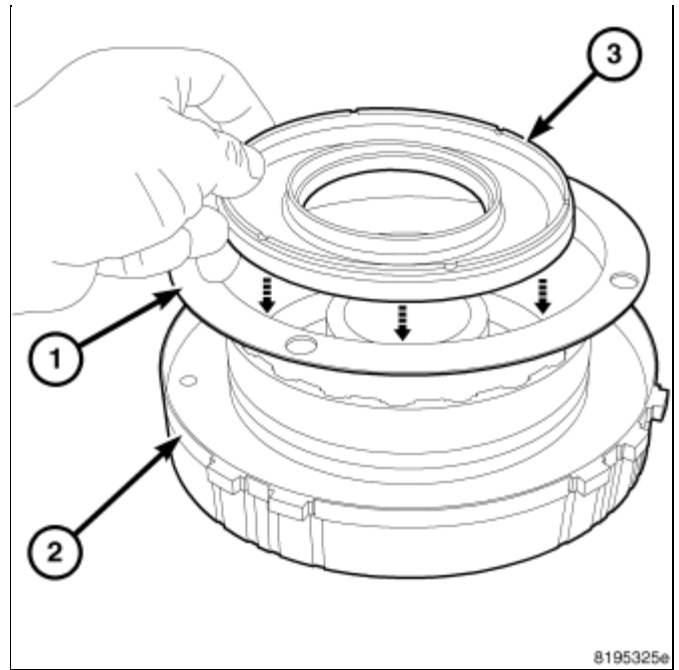
NOTE: The 4C piston installation aid is only available with procurement of a new 4C piston.

2. Insert the installation aid (1) into the 4C retainer / bulkhead (2) .

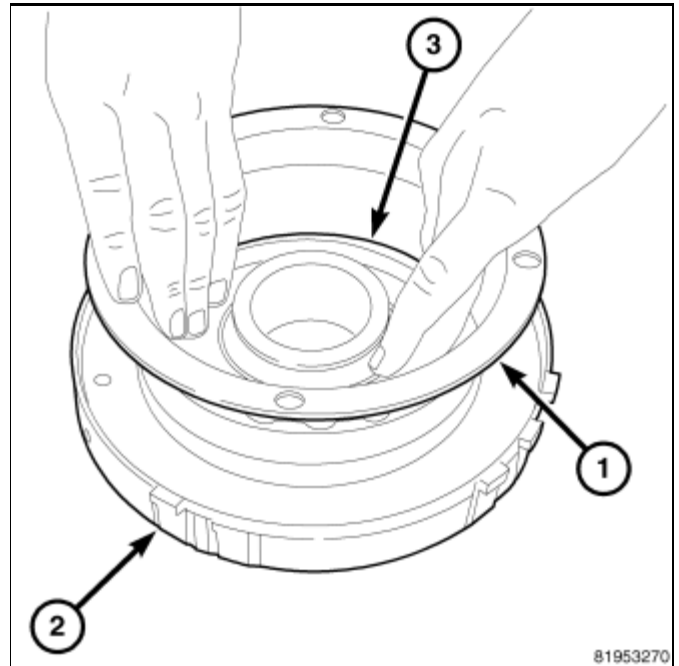


3. Lubricate the inner and outer 4C piston seals (3) with MOPAR® ATF+ 4.

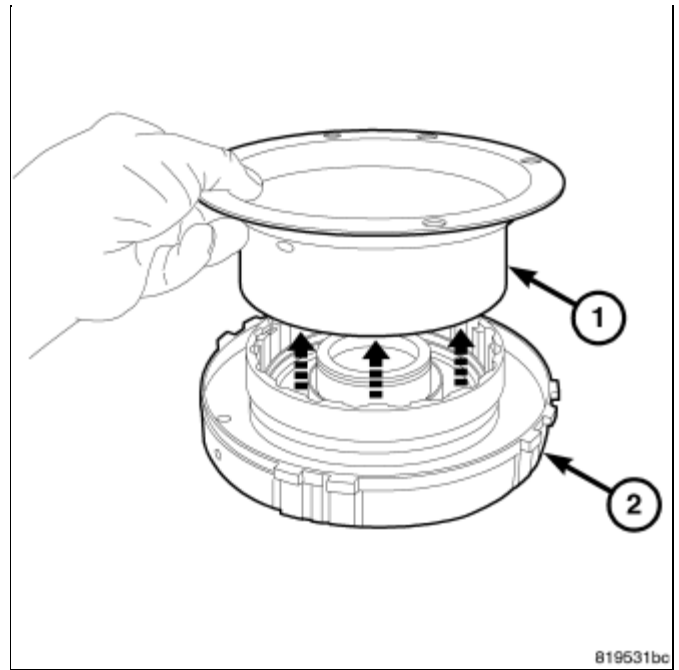
4. Install the 4C piston (3) into the installation aid (1) .



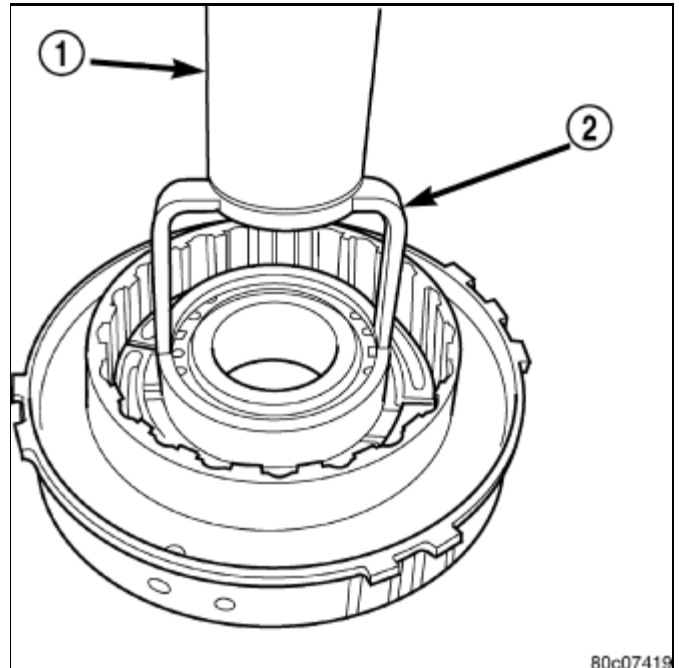
5. Push the 4C piston (3) down evenly until it is seated in the 4C retainer / bulkhead (2).

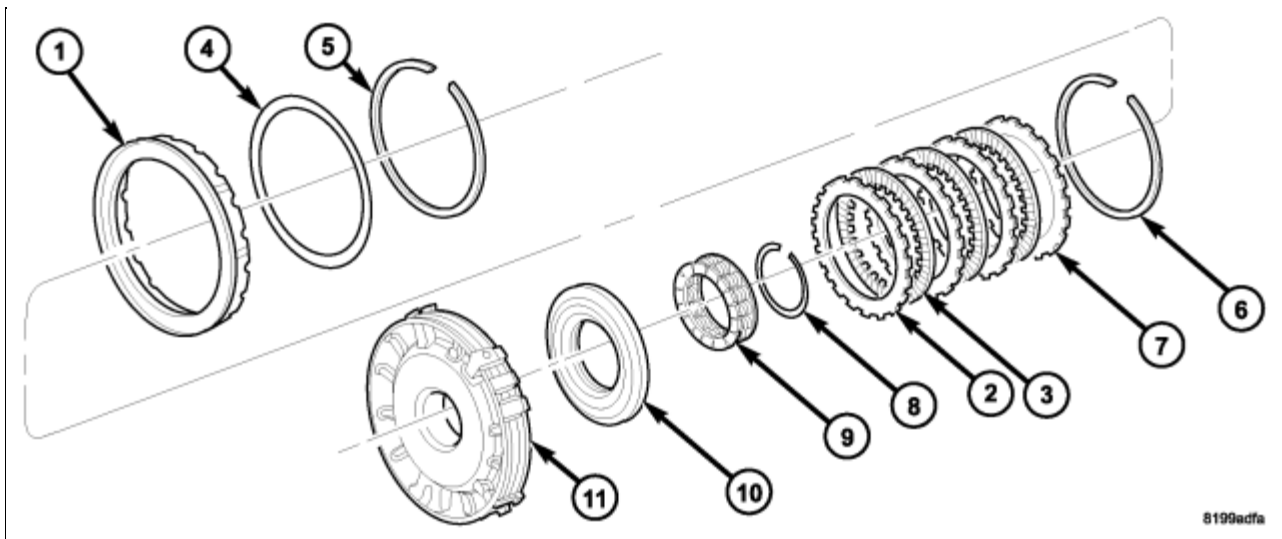


6. Remove the installation aid (1) from the 4C retainer / bulkhead (2).



7. Position the 4C piston return spring onto the 4C piston.
8. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring and install the snap-ring.





9. Assemble and install the 4C clutch pack (2, 3) into the retainer/bulkhead (11) with a steel separator plate against the piston.
10. Install the 4C reaction plate (7) and snap-ring (6) into the retainer/bulkhead (11) . The 4C reaction plate is non-directional.
11. Measure the 4C clutch clearance. The correct clutch clearance is 0.770-1.390 mm (0.030-0.055 in.). The snap-ring (6) is selectable. Install the chosen snap-ring and re-measure to verify the selection.

The 4C selectable snap ring thickness are as follows:

4C SELECTABLE SNAP RING THICKNESS

- One Butterfly End, One Square End = 1.79 mm (0.070 in.).
- Both Ends Buttery Fly Cut = 2.20 mm (0.087 in.).
- One Butterfly End, One Inverted Butterfly End = 2.61 mm (0.103 in.).

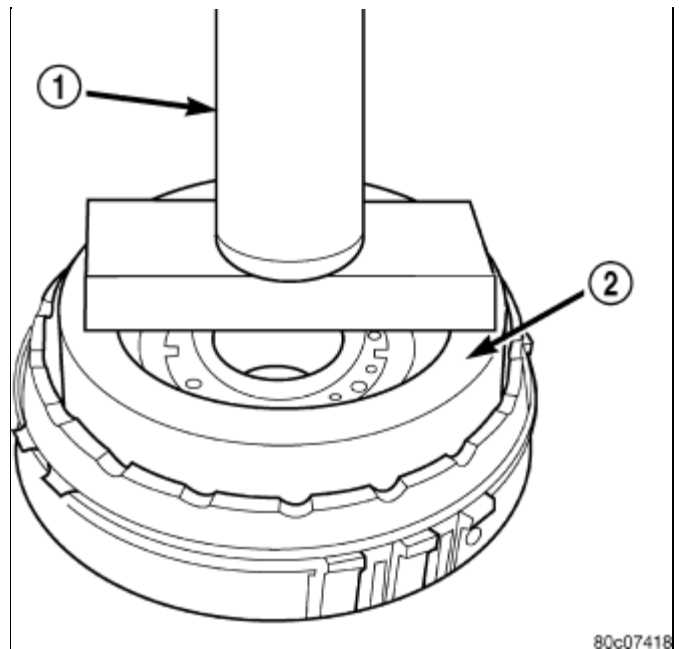
12. Install the 2C piston (1) into the retainer/bulkhead (11).
13. Position the 2C Belleville spring (5) onto the 2C piston (2).
14. Position the 2C Belleville spring snap-ring (6) onto the 2C Belleville spring (5).

15. Using Spring Compressor 8249 (2) and a suitable shop press (1), compress the Belleville spring until the snap-ring is engaged with the snap-ring groove in the retainer/bulkhead.

SEAL-ADAPTER HOUSING

REMOVAL

1. Remove the transfer case from the transmission.
2. Using a screw mounted on a slide hammer, remove the adapter housing seal.



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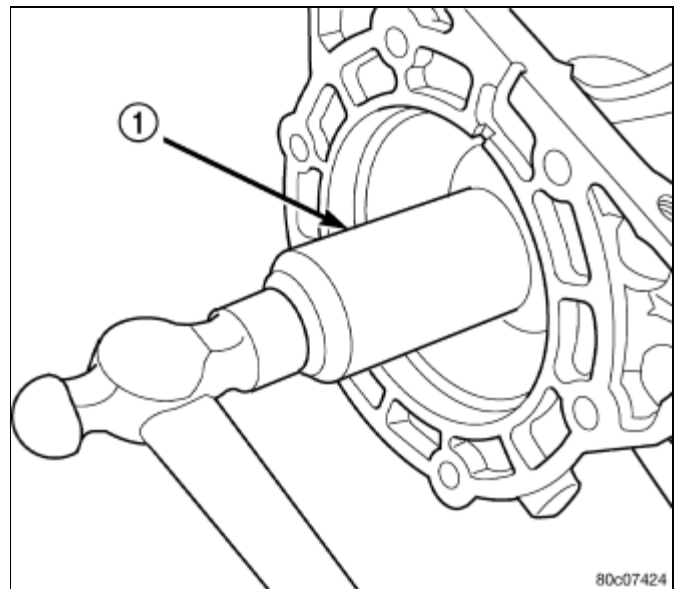
INSTALLATION

1. Clean the adapter seal bore in the adapter housing of any residue or particles remaining from the original seal.
2. Install new oil seal in the adapter housing using Seal Installer C-3860-A (1) . A properly installed seal is flush to the face of the seal bore.
3. Install the transfer case onto the transmission.

SYSTEM-BRAKE TRANSMISSION SHIFT INTERLOCK

DESCRIPTION

The Brake Transmission Shift Interlock System (BTSI), consists of a Park-Interlock cable and a solenoid mounted in the shift lever assembly. The Park-Interlock cable connects the automatic transmission floor mounted shifter to the steering column ignition switch.



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OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shift lever assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT

INTERLOCK SYSTEM

1. Verify that the key can only be removed in the PARK position
2. When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

COVER-FRONT

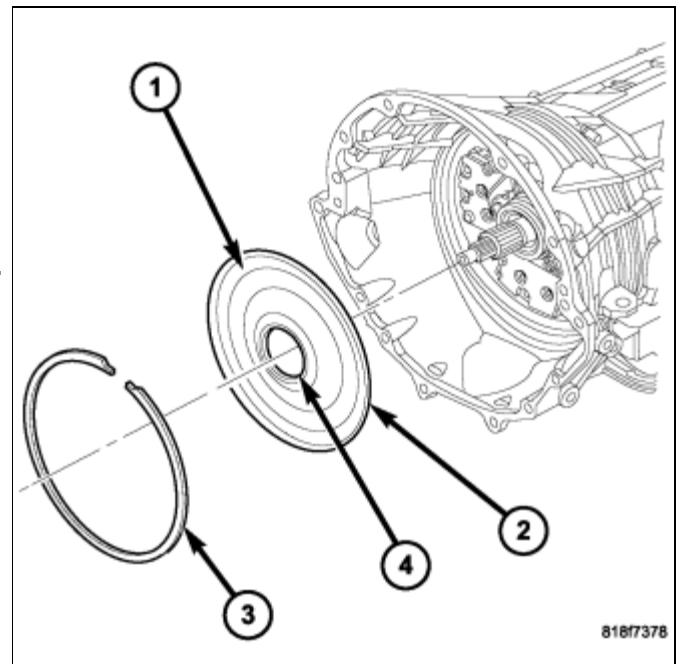
REMOVAL

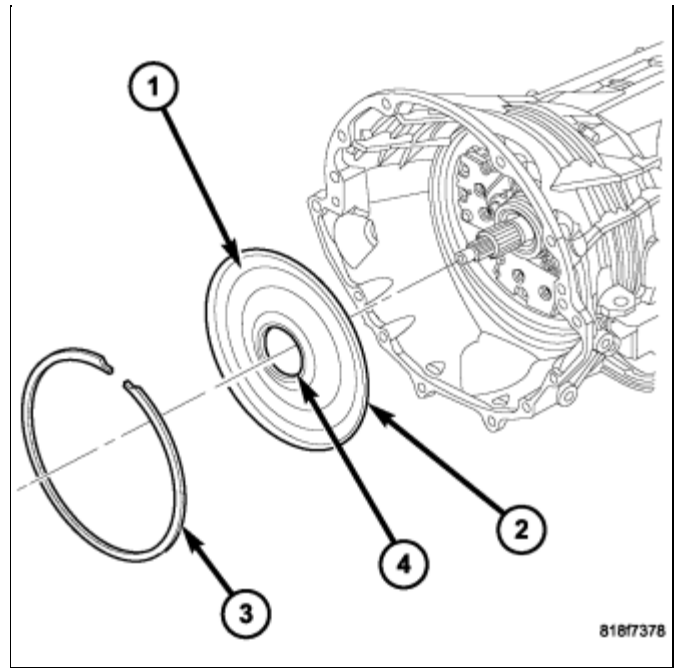
1. Remove the bolts holding the transmission oil pan to the transmission case .
2. Remove the transmission oil pan from the transmission case.
3. Remove the snap ring (3) from the transmission case.
4. Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover (1) from the transmission case.

INSTALLATION

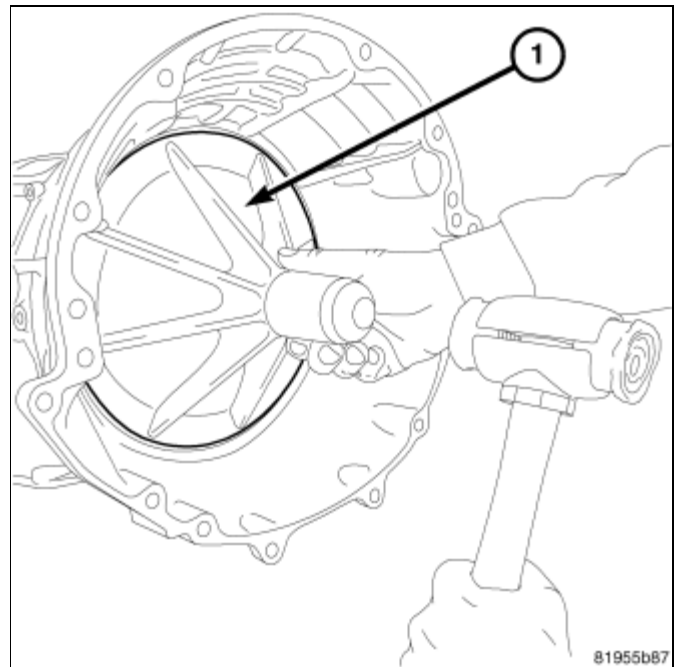
NOTE: To avoid contamination and garter spring dislodgement, do not handle the front cover seal (4) when positioning the front cover into the transmission case.

1. Position a new front cover (1) into the transmission case.





2. Using the front cover installation tool 9955 (1) and a dead-blow mallet, install the front cover into transmission case .



3. Install the snap ring (3) into the transmission case.
4. Apply RTV silicone to the oil pan and install the transmission oil pan.
5. Tighten the bolts to 12 N·m (105 in. lbs.).

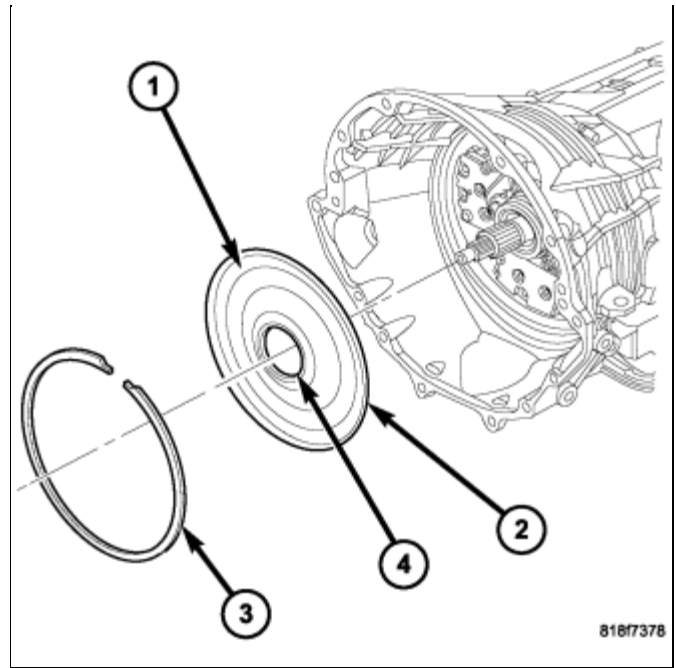
FLUID AND FILTER

DIAGNOSIS AND TESTING

EFFECTS OF INCORRECT FLUID

LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.



CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

1. Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.
2. A result of restricted fluid flow through the main and auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged oil cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
3. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition

by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

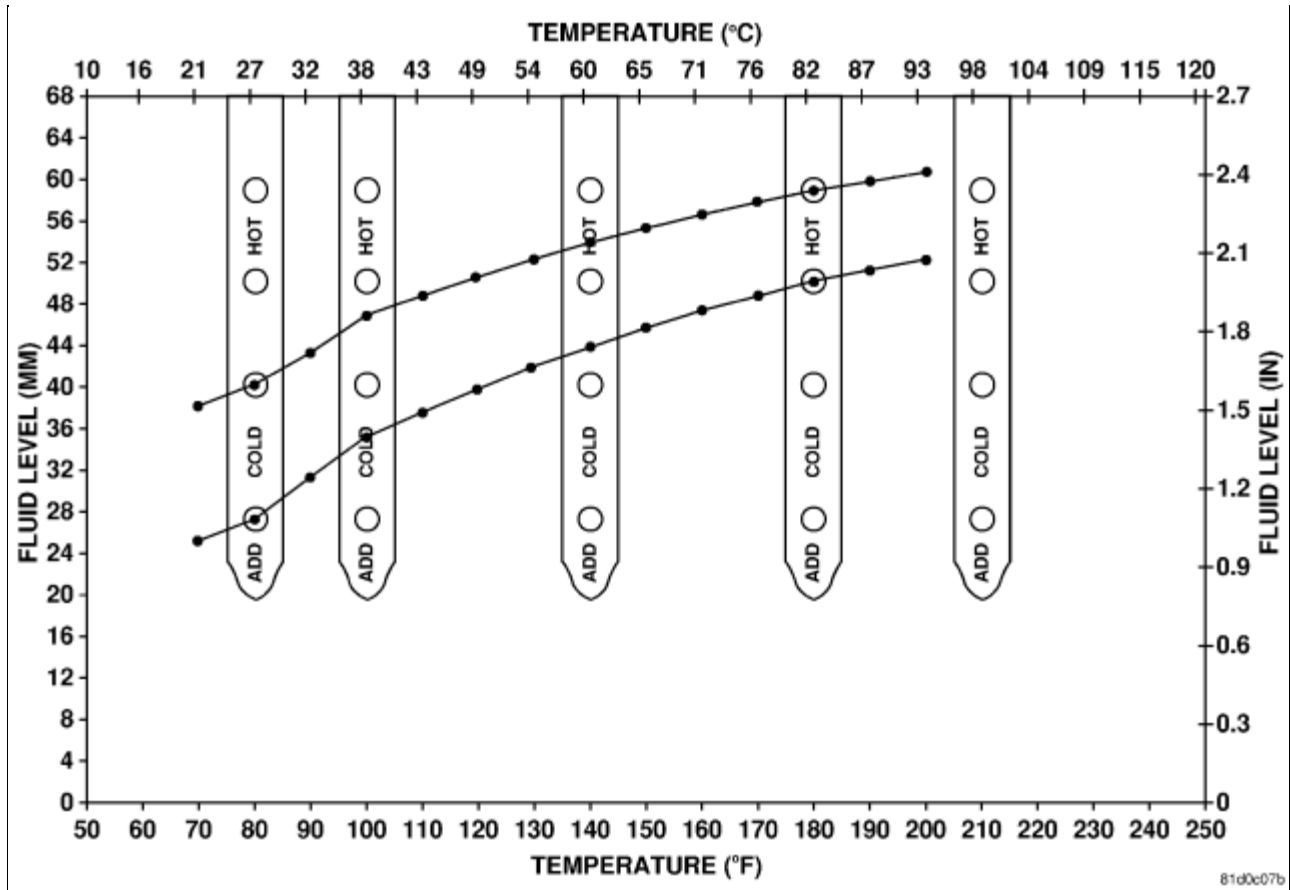
Improper filling can also raise the fluid level too high. When the transmission has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

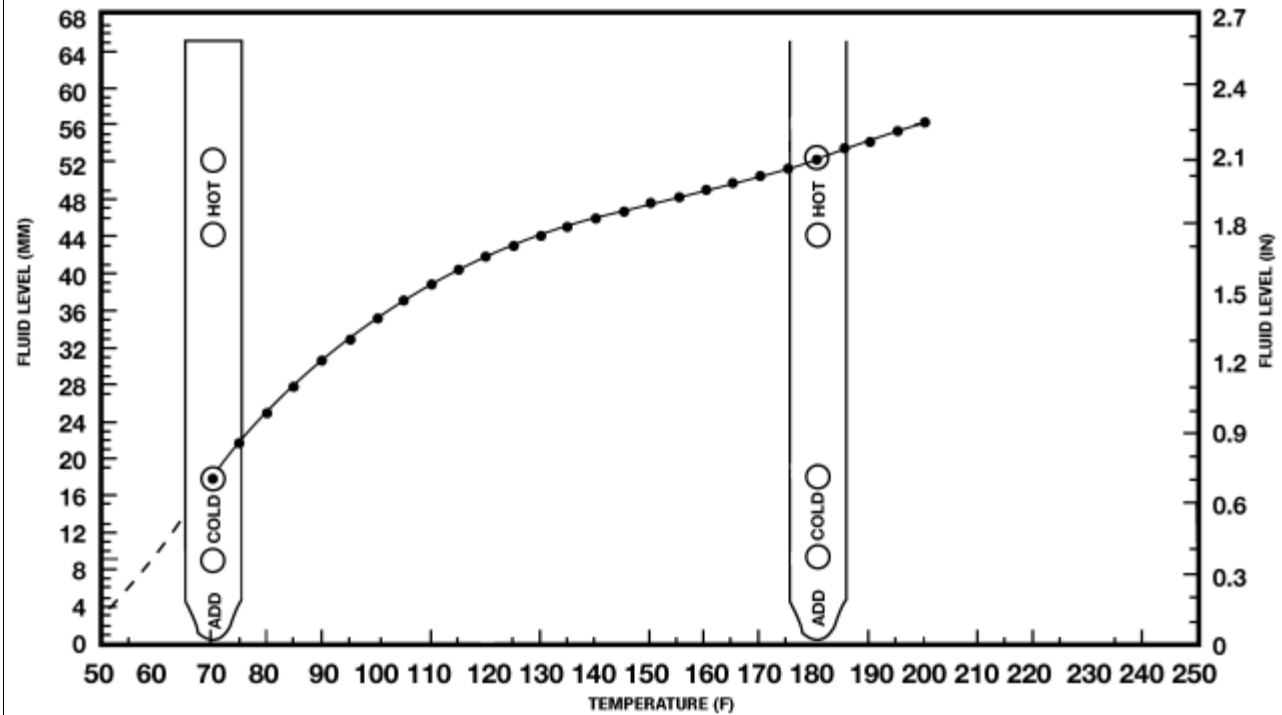
The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P (PARK) and N (NEUTRAL) positions. Place the selector lever in P (PARK) to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82° C. or 180° F), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level will be approximately at the upper COLD hole of the dipstick at 21° C (70° F) fluid temperature.

FILL TUBE EQUIPPED WITH INDICATOR



BUX 545RFE FLUID FILL CHART



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NAFTA 545 RFE FLUID TEMPERATURE

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure. After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

1. Start engine and apply parking brake.
2. Shift the transmission into DRIVE for approximately 2 seconds.
3. Shift the transmission into REVERSE for approximately 2 seconds.
4. Shift the transmission into PARK.
5. Hook up scan tool and select transmission.
6. Select sensors.
7. Read the transmission temperature value.
8. Compare the fluid temperature value with the chart.
9. Adjust transmission fluid level shown on the dipstick according to the Transmission Fluid Temperature Chart.

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

10. Check transmission for leaks.

CAPPED FILL TUBE

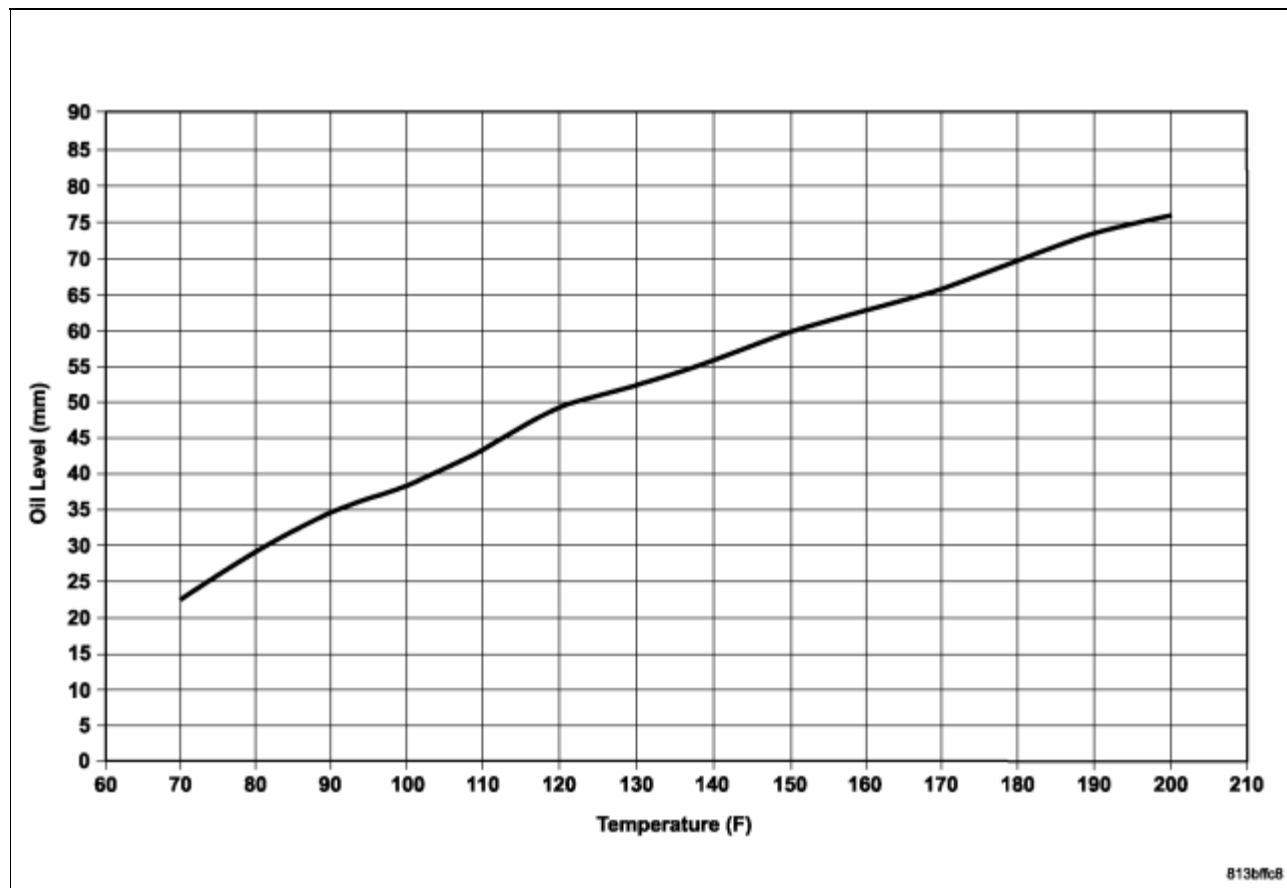
1. Verify that the vehicle is parked on a level surface.
2. Remove the dipstick tube cap.

WARNING: There is a risk of accident from vehicle starting off by itself when engine is running. There is

a risk of injury from contusions and burns if you insert your hands into the engine when it is started or when it is running. Secure vehicle to prevent it from moving off by itself. Wear properly fastened and close-fitting work clothes. Do not touch hot or rotating parts.

3. Actuate the service brake. Start engine and let it run at idle speed in selector lever position "P".
4. Shift through the transmission modes several times with the vehicle stationary and the engine idling.
5. Warm up the transmission, wait at least 2 minutes and check the oil level with the engine running. Push the Oil Dipstick 9336 into transmission fill tube until the dipstick tip contacts the oil pan and pull out again, read off oil level, repeat if necessary.

NOTE: The dipstick will protrude from the fill tube when installed.



6. Check transmission oil temperature using the appropriate scan tool.

NOTE: The true transmission oil temperature can only be read by a scan tool in REVERSE or any forward gear position.

7. The transmission Oil Dipstick 9336 has indicator marks every 10 mm. Determine the height of the oil level on the dipstick and using the height, the transmission temperature, and the Transmission Fluid Graph, determine if the transmission oil level is correct.
8. Add or remove oil as necessary and recheck the oil level.
9. Once the oil level is correct, install the dipstick tube cap.

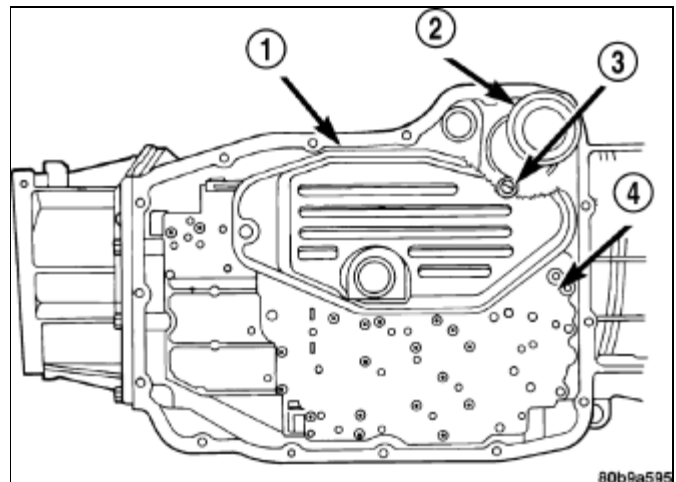
FLUID AND FILTER REPLACEMENT

For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

REMOVAL

1. Hoist and support vehicle on safety stands.
2. Place a large diameter shallow drain pan beneath the transmission pan.
3. Remove bolts holding front and sides of pan to transmission.
4. Loosen bolts holding rear of pan to transmission.
5. Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.
6. Hold up pan and remove remaining bolts holding pan to transmission.
7. While holding pan level, lower pan away from transmission.
8. Pour remaining fluid in pan into drain pan.

9. Remove the screw holding the primary oil filter (1) to valve body.
10. Separate filter from valve body and oil pump and pour fluid in filter into drain pan.
11. Inspect the oil filter seal in the bottom of the oil pump. If the seal is not installed completely in the oil pump, or is otherwise damaged, then remove and discard the oil filter seal from the bottom of the oil pump. If the seal is installed correctly and is in good condition, it can be reused.
12. If replacing the cooler return filter (2), use Oil Filter Wrench 8321 to remove the filter from the transmission.
13. Dispose of used trans fluid and filter(s) properly.



INSPECTION

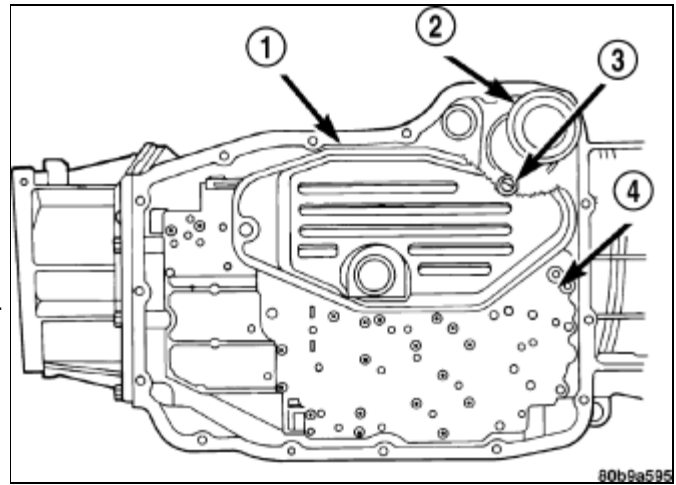
Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts of debris, refer to the diagnosis section of this group.

CLEANING

1. Using a suitable solvent, clean pan and magnet.
2. Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

INSTALLATION

CAUTION: The primary oil filter seal **MUST** be fully installed flush against the oil pump body. **DO NOT** install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.



1. If necessary, install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with Installer 6960-A or another suitable tool (appropriately sized drift or socket, the butt end of a hammer etc.).
2. Place replacement filter in position on valve body and into the oil pump.
3. Install screw to hold the primary oil filter (1) to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.
4. Install new cooler return filter (2) onto the transmission, if necessary. Torque the filter to 9.5 N·m (84 in.lbs.).
5. Place bead of Mopar® RTV sealant onto the transmission case sealing surface.
6. Place pan in position on transmission.
7. Install bolts to hold pan to transmission. Tighten bolts to 12 N·m (105 in. lbs.) torque.
8. Lower vehicle and fill transmission with MOPAR® ATF +4.

TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4 to transmission:
 - a. If only fluid and filter were changed, add **10 pints (5 quarts)** of ATF +4 to transmission.
 - b. If transmission was completely overhauled and the torque converter was replaced or drained, add **24 pints (12 quarts)** of ATF +4 to transmission.
3. Check the transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - RFE/FLUID - STANDARD PROCEDURE) and adjust as required.

CABLE-GEARSHIFT

DIAGNOSIS AND TESTING - SHIFT MECHANISM

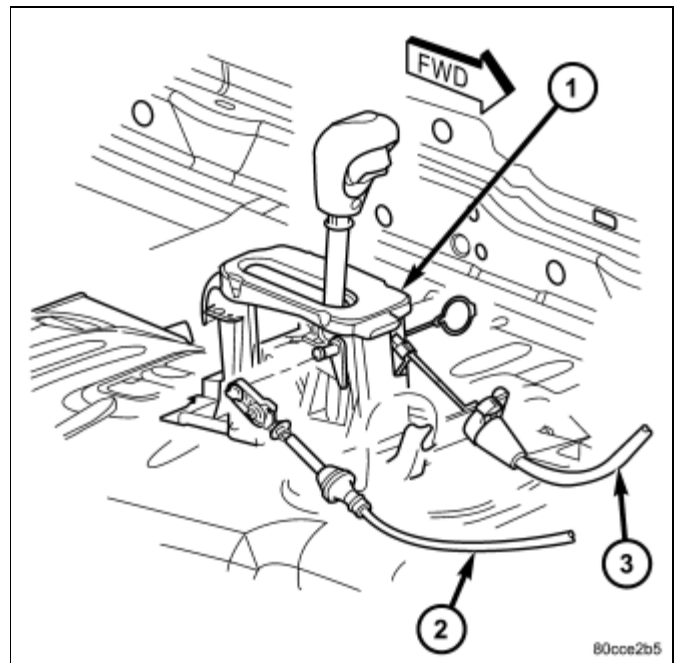
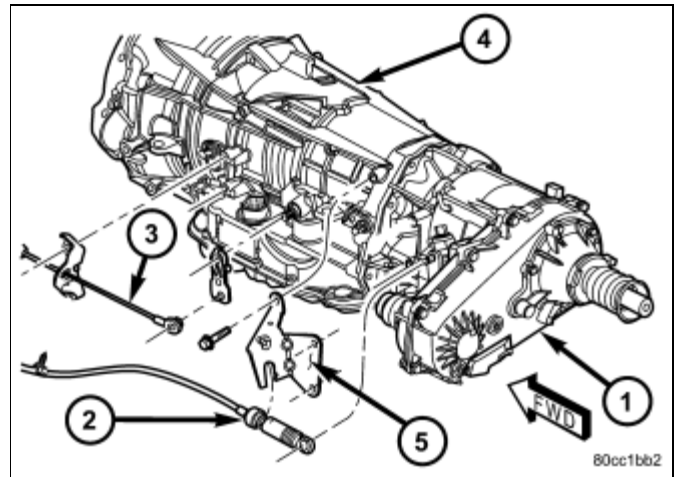
1. The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.
2. Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.
3. With floor shift lever handle push-button not depressed and lever in:
 - a. PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.
 - b. PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.
 - c. NEUTRAL position - Normal position. Engine starts must be possible.

d. NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

REMOVAL

1. Shift transmission into PARK.
2. Raise vehicle.
3. Remove the shift cable eyelet from the transmission manual shift lever .
4. Remove shift cable from the cable support bracket.

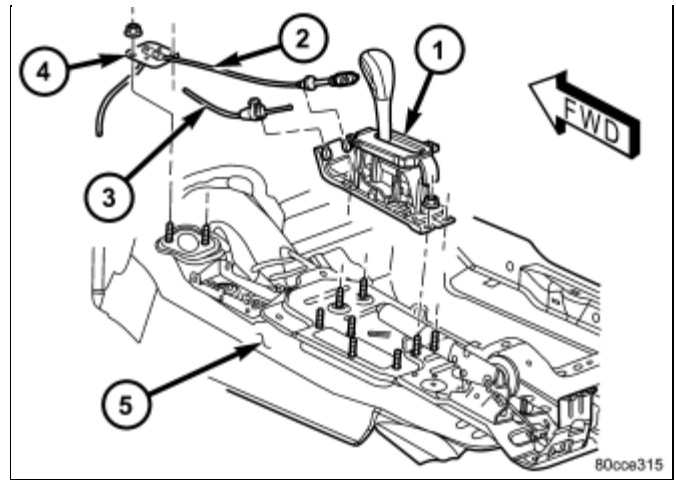
5. Lower vehicle.
6. Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
7. Disconnect cable at shift lever and shifter assembly bracket .
8. Remove the nuts holding the shift cable seal plate to the floor pan .



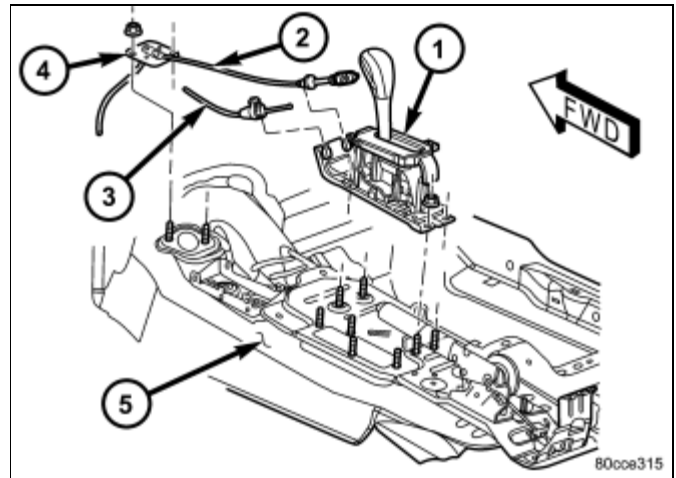
9. Pull cable through floor panel opening.
10. Remove shift cable from vehicle.

INSTALLATION

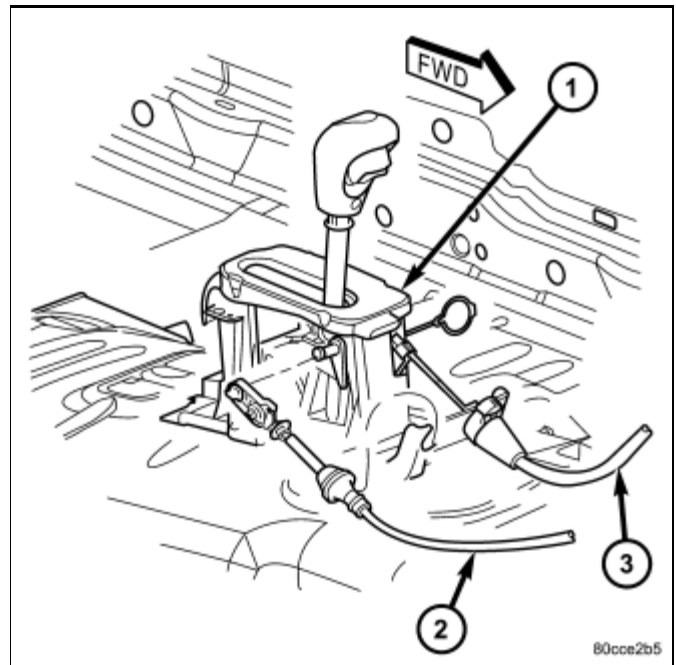
1. Route cable through hole in floor pan.
2. Install seal plate to studs in floor pan .
3. Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).



4. Install the shift cable to the shifter assembly bracket . Push cable into the bracket until secure.
5. Place the floor shifter lever in PARK position.
6. Loosen the adjustment screw on the shift cable.
7. Snap the shift cable onto the shift lever pin.



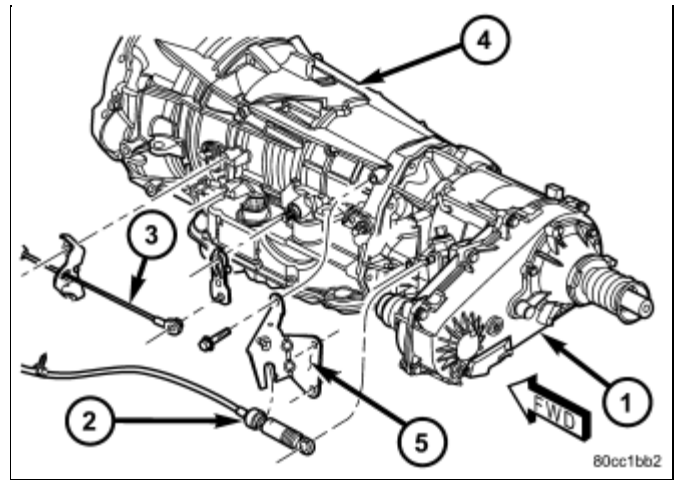
8. Raise the vehicle.
9. Install the shift cable to the shift cable support bracket .
10. Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.
11. Snap the shift cable onto the transmission manual shift lever.



12. Lower vehicle.
13. Verify that the shift lever is in the PARK position.

14. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
15. Verify correct shifter operation.
16. Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)

ADJUSTMENTS - GEARSHIFT CABLE

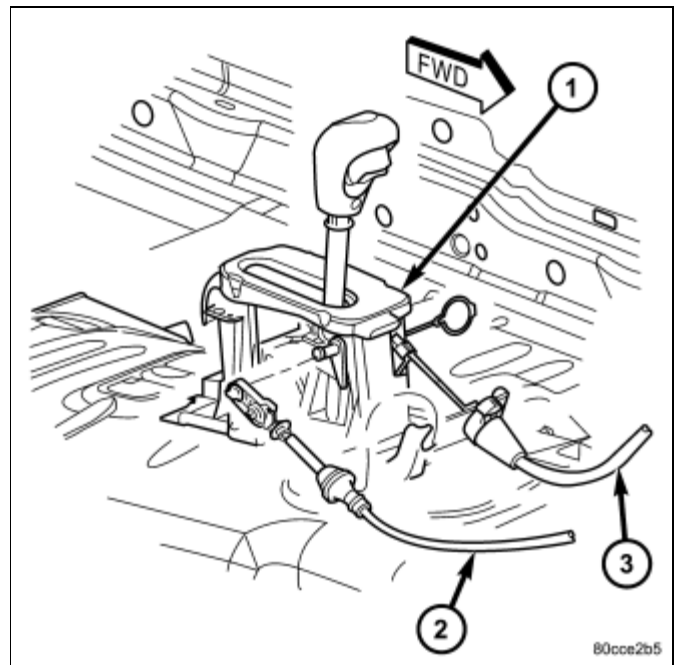


Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

Gearshift Adjustment Procedure

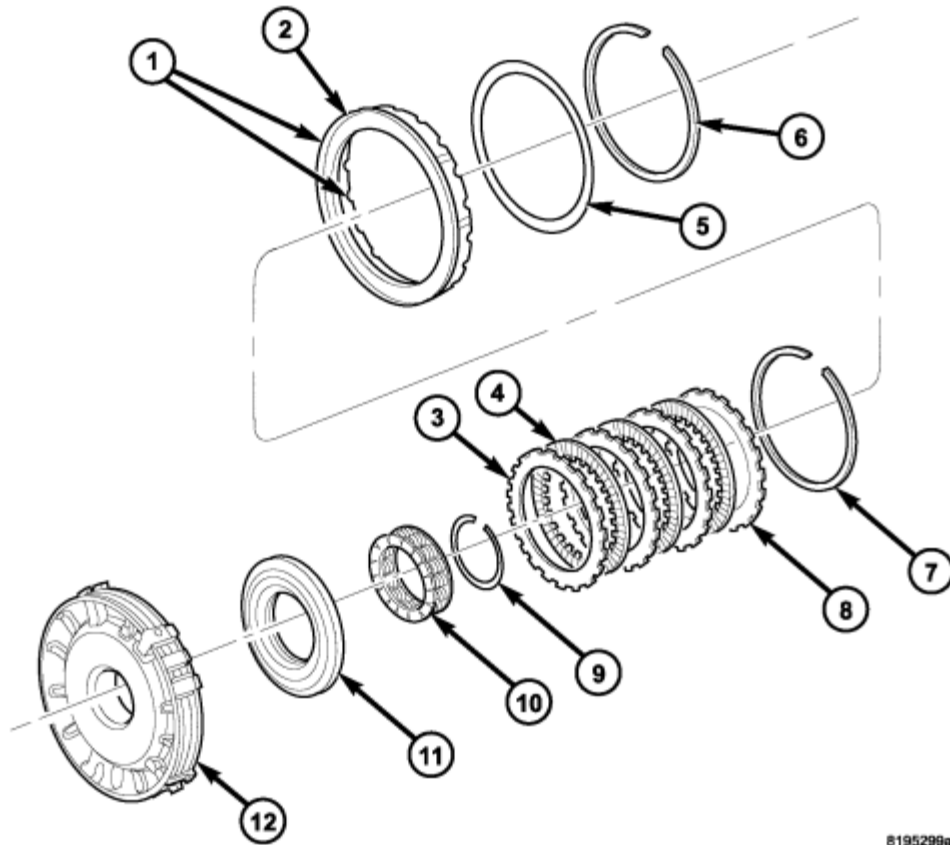
1. Shift transmission into PARK.
2. Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Loosen the shift cable adjustment screw .

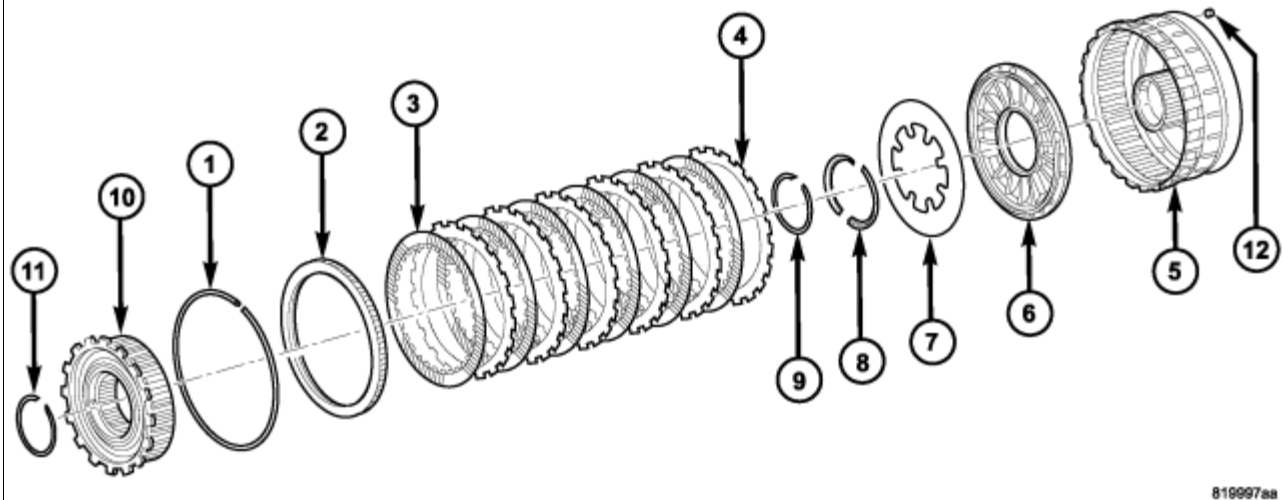
4. Raise vehicle.
5. Unsnap cable eyelet from transmission shift lever.
6. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
7. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
8. Snap cable eyelet onto transmission shift lever.
9. Lower vehicle
10. Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct operation.
12. Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)



CLUTCHES-HOLDING

DESCRIPTION





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Three hydraulically applied multi-disc clutches are used to hold some planetary geartrain components stationary while the input clutches drive others. The 2C, 4C, and Low/Reverse clutches are considered holding clutches. The 2C and 4C clutches are located in the 4C retainer/bulkhead (12).

The Low/Reverse clutch is located at the rear of the transmission case.

OPERATION

2C CLUTCH

The 2C clutch is hydraulically applied in second and fifth gear by pressurized fluid against the 2C piston. When the 2C clutch is applied, the reverse sun gear assembly is held or grounded to the transmission case by holding the reaction planetary carrier.

4C CLUTCH

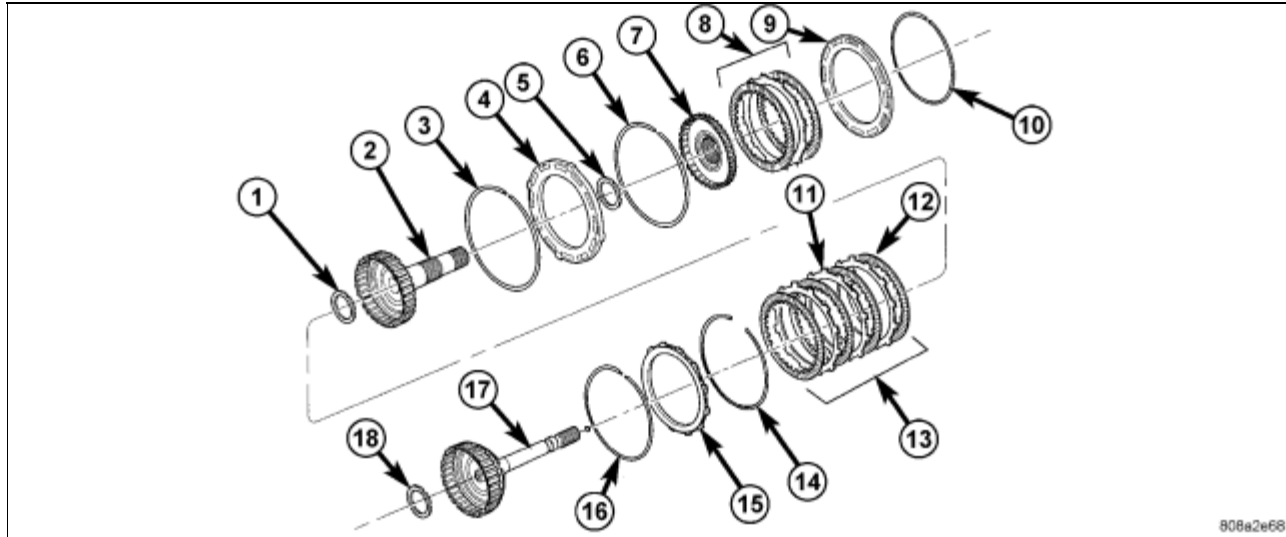
The 4C clutch is hydraulically applied in second prime and fourth gear by pressurized fluid against the 4C clutch piston. When the 4C clutch is applied, the reaction annulus gear is held or grounded to the transmission case.

LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gear, only at low speeds, by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the input annulus assembly is held or grounded to the transmission case.

ASSEMBLY-INPUT CLUTCH

DESCRIPTION



1 - THRUST BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - THRUST BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)
8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - THRUST BEARING NUMBER 2

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly.

The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, second prime, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the input sun gear.

OVERDRIVE CLUTCH

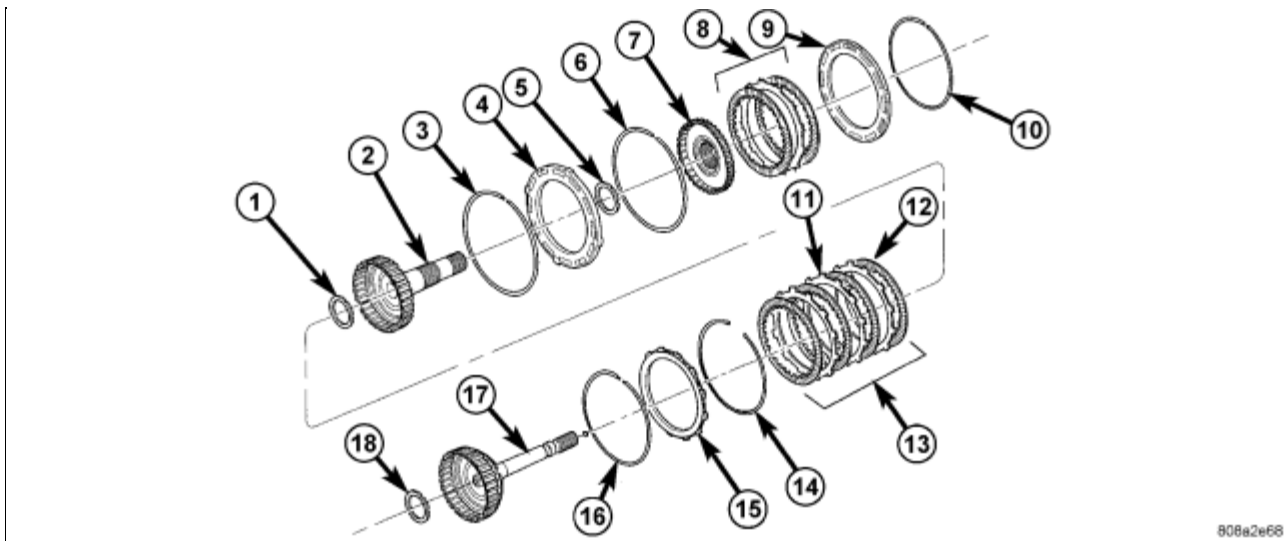
The overdrive clutch is hydraulically applied in third (direct), fourth, and fifth gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the reverse carrier/input annulus assembly.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the reaction annulus gear is driven.

DISASSEMBLY

NOTE: If the input clutch assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).



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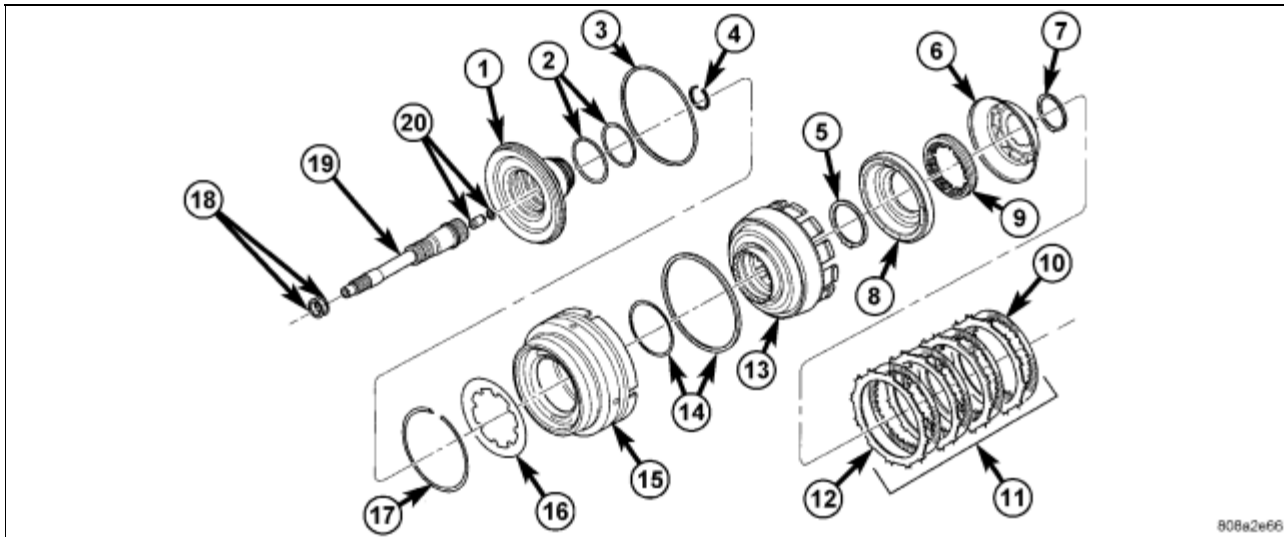
1 - THRUST BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - THRUST BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)
8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - THRUST BEARING NUMBER 2

1. Remove the reverse reaction plate selective snap-ring (10) from the input clutch retainer.
2. Remove the reverse reaction plate (9) from the input clutch retainer.
3. Remove the reverse hub (7) and reverse clutch pack (8) from the input clutch retainer.
4. Remove the number 4 thrust bearing (5) from the overdrive hub (2).
5. Remove the overdrive hub (2) from the input clutch retainer.
6. Remove the number 3 thrust bearing (1) from the underdrive hub (17).
7. Remove the OD/reverse pressure plate snap-ring (6) from the OD/reverse piston.
8. Remove the underdrive hub (17), overdrive clutch (13), and overdrive reaction plate (15) from the input clutch retainer.

NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.

9. Remove the number 2 thrust bearing (18) from the input clutch hub.
10. Remove the overdrive clutch wave snap-ring (3) from the OD/reverse piston.

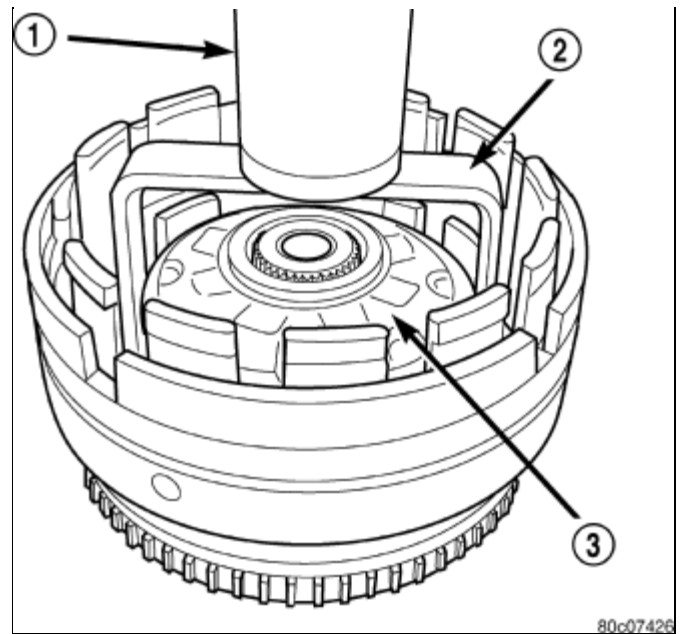
11. Remove the UD/OD reaction plate tapered snap-ring (14) from the input clutch retainer (13).
12. Remove the UD/OD reaction plate (15) from the input clutch retainer.
13. Remove the UD/OD reaction plate flat snap-ring (16) from the input clutch retainer.



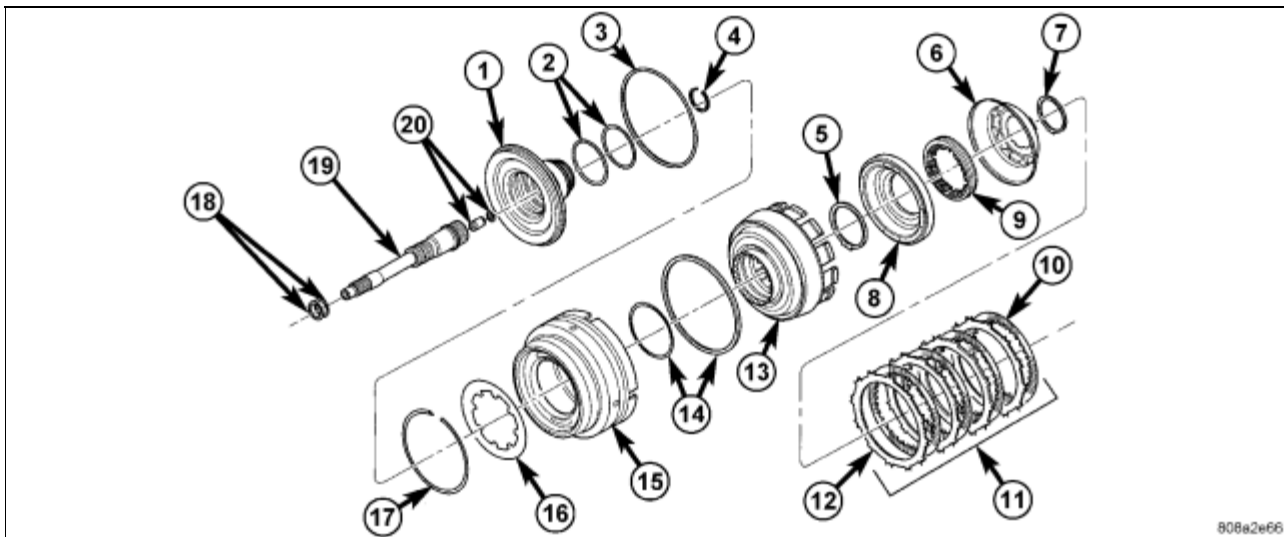
1 - INPUT CLUTCH HUB	11 - UD CLUTCH
2 - O-RING SEALS	12 - PLATE
3 - SEAL	13 - CLUTCH RETAINER
4 - SNAP-RING	14 - SEAL
5 - SNAP-RING	15 - OD/REV PISTON
6 - UD BALANCE PISTON	16 - BELLEVILLE SPRING
7 - SNAP-RING	17 - SNAP-RING
8 - UD PISTON	18 - SEAL RINGS
9 - SPRING	19 - INPUT SHAFT
10 - DISC	20 - LUBRICATION CHECK VALVE AND SNAP-RING

14. Remove the underdrive clutch pack (11) from the input clutch retainer (13).

15. Using Spring Compressor 8251 (2) , compress the UD balance piston (3) and remove the snap-ring from the input clutch hub.



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1 - INPUT CLUTCH HUB	11 - UD CLUTCH
2 - O-RING SEALS	12 - PLATE
3 - SEAL	13 - CLUTCH RETAINER
4 - SNAP-RING	14 - SEAL
5 - SNAP-RING	15 - OD/REV PISTON
6 - UD BALANCE PISTON	16 - BELLEVILLE SPRING
7 - SNAP-RING	17 - SNAP-RING
8 - UD PISTON	18 - SEAL RINGS

9 - SPRING	19 - INPUT SHAFT
10 - DISC	20 - LUBRICATION CHECK VALVE AND SNAP-RING

16. Remove the UD balance piston (6) and piston return spring (9) from the input clutch retainer (13).
17. Remove the underdrive piston (8) from the input clutch retainer (13).

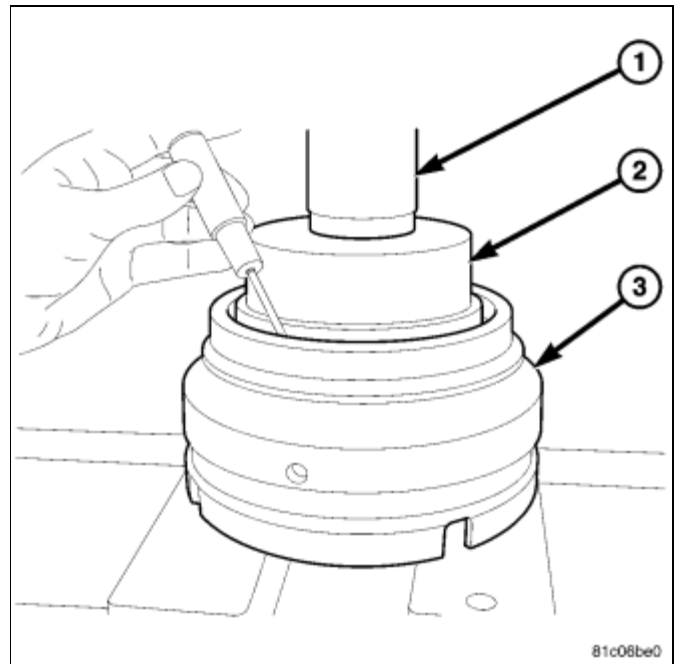
NOTE: Both the UD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.

18. Remove the input clutch retainer tapered snap-ring (5).
19. Separate input clutch retainer (13) from input clutch hub (1).
20. Separate OD/reverse piston (15) from input clutch hub retainer (13).

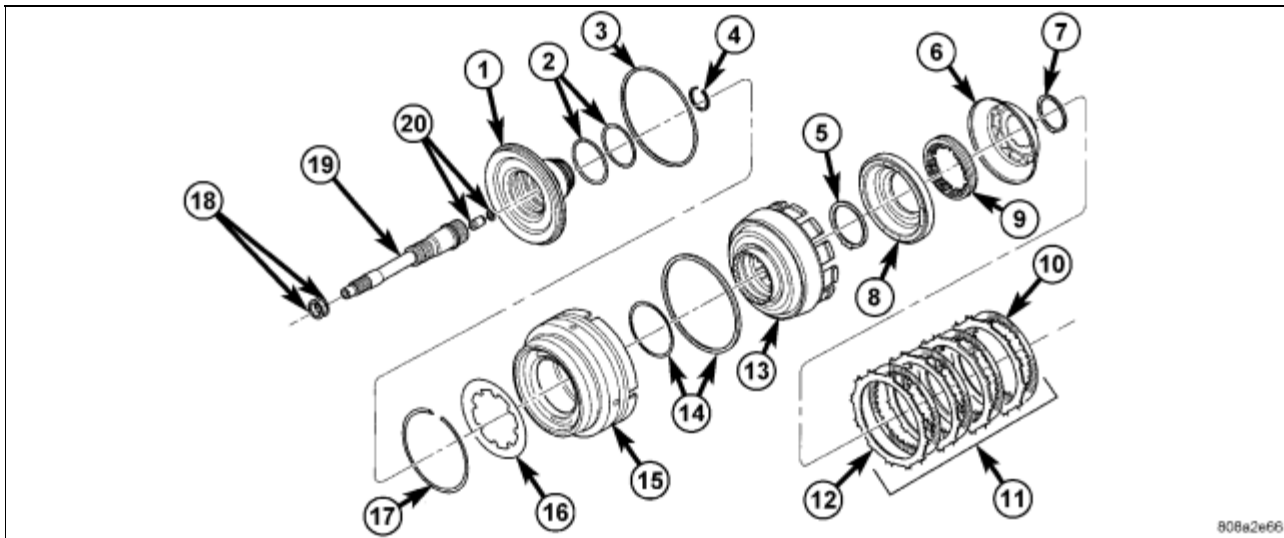
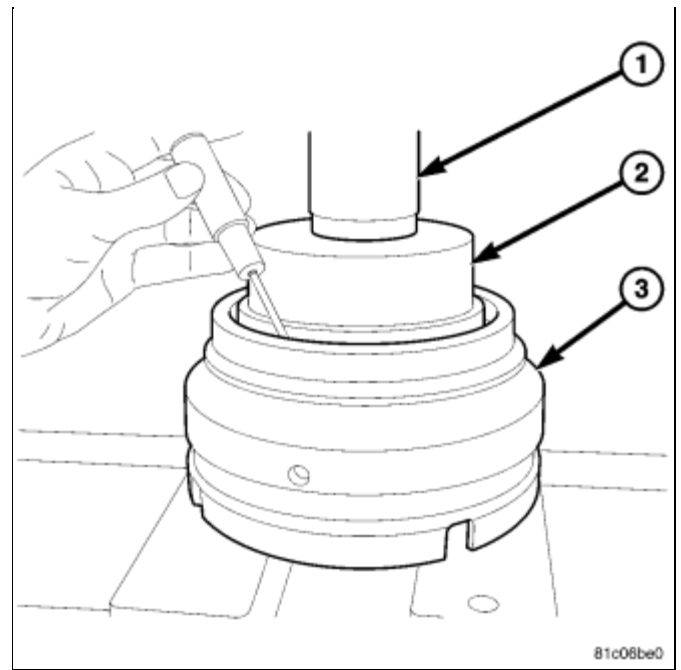
21. Using Arbor Press (1) and tool 8349-1 (2) compress the OD / Reverse belleville spring just enough to remove the snap ring.
22. Remove the belleville spring and snap ring from the OD / Reverse piston (3).
23. Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

ASSEMBLY

NOTE: When installing the OD / Reverse piston belleville spring, orientate it such that it contacts a new surface on the piston.



1. Install the belleville spring and snap ring loosely onto the OD / Reverse piston (3).
2. Using an Arbor Press (1) and tool 8349-1 (2) compress the belleville spring just enough to install the snap ring.



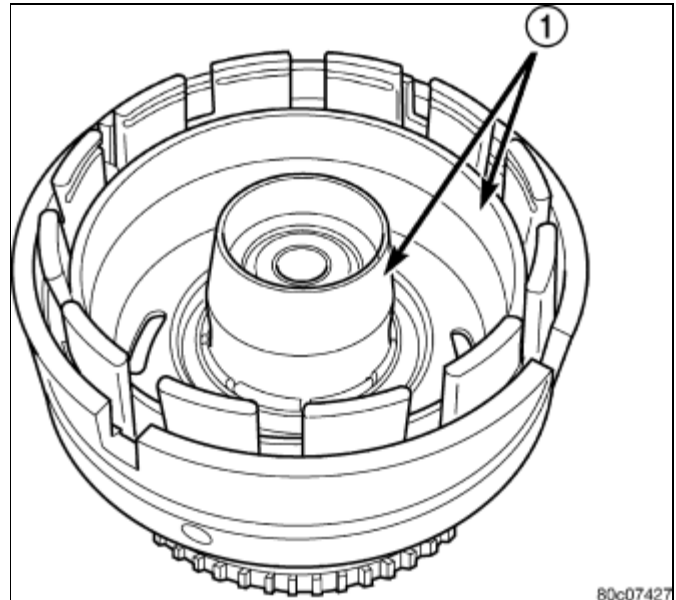
1 - INPUT CLUTCH HUB	11 - UD CLUTCH
2 - O-RING SEALS	12 - PLATE
3 - SEAL	13 - CLUTCH RETAINER
4 - SNAP-RING	14 - SEAL
5 - SNAP-RING	15 - OD/REV PISTON
6 - UD BALANCE PISTON	16 - BELLEVILLE SPRING
7 - SNAP-RING	17 - SNAP-RING
8 - UD PISTON	18 - SEAL RINGS

9 - SPRING	19 - INPUT SHAFT
10 - DISC	20 - LUBRICATION CHECK VALVE AND SNAP-RING

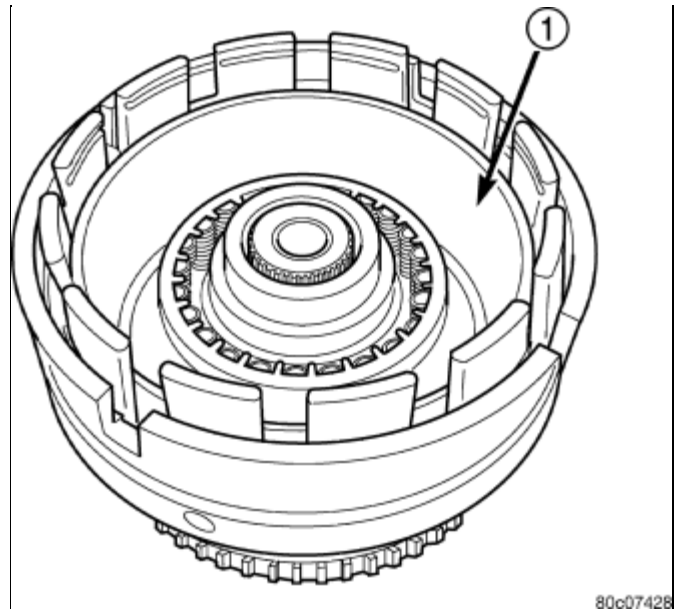
NOTE: Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.

3. Check the transmission lubrication check valve (20) located in the input shaft using shop air. The valve should only allow air flow in one direction. If the valve allows no air flow, or air flow in both directions, the valve will need to be replaced.
4. Lubricate all seals with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
5. Assemble the OD/reverse piston (15) onto the input clutch hub (1).
6. Assemble the input clutch retainer (13) onto the input clutch hub (1).
7. Install the input clutch retainer tapered snap-ring (5) with tapered side up onto the input clutch hub (1).

8. Install Piston Installer 8504 (1) into the input clutch retainer and onto the input clutch hub to guide the inner and outer underdrive piston seals into position.
9. Install the underdrive piston into the input clutch retainer and over the input clutch hub.



10. Install the UD balance piston return spring pack into the input clutch retainer.
11. Install Piston Installer 8252 (1) into the input clutch retainer to guide the UD balance piston seal into position inside the underdrive piston.



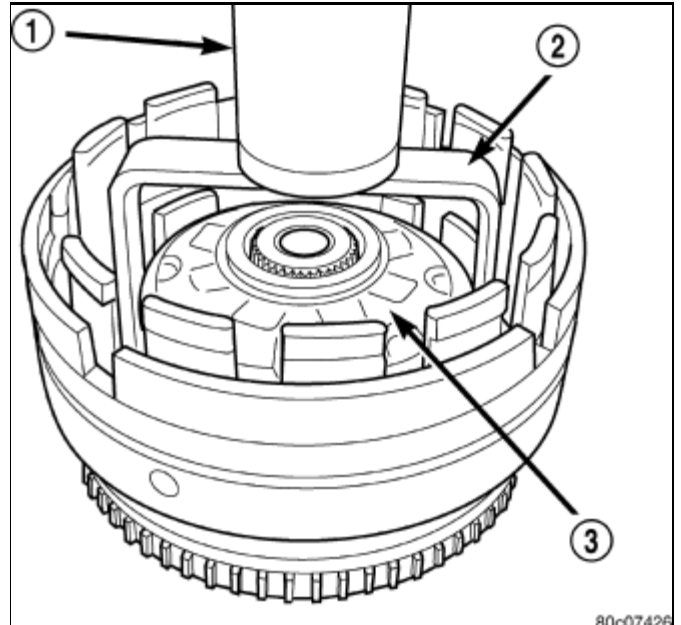
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NOTE: The UD clutch discs can be identified by their tan color and cross-hatched groove pattern (two sets of parallel grooves at 90 degrees to each other). The UD separator plates can be identified by semi-circular cutouts on the edges of the teeth. The reverse clutch and UD clutch use common separator plates.

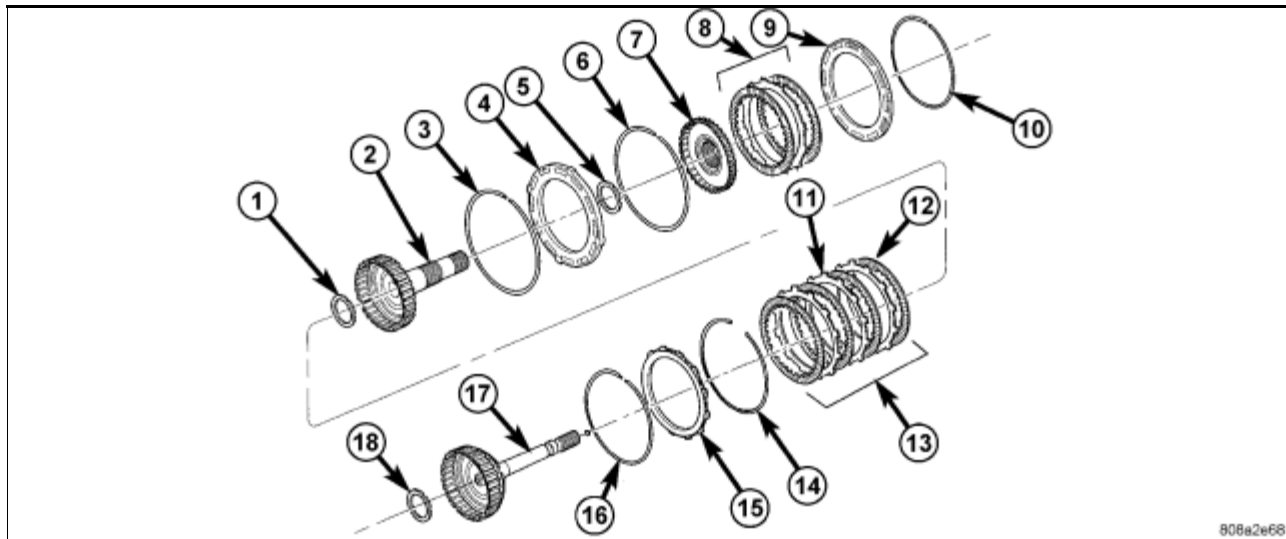
12. Install the UD balance piston (3) into the input clutch retainer and the underdrive piston.

13. Using Spring Compressor 8251 (2), compress the UD return spring pack and secure the piston in place with the snap-ring.

14. Install the underdrive clutch pack into the input clutch retainer.



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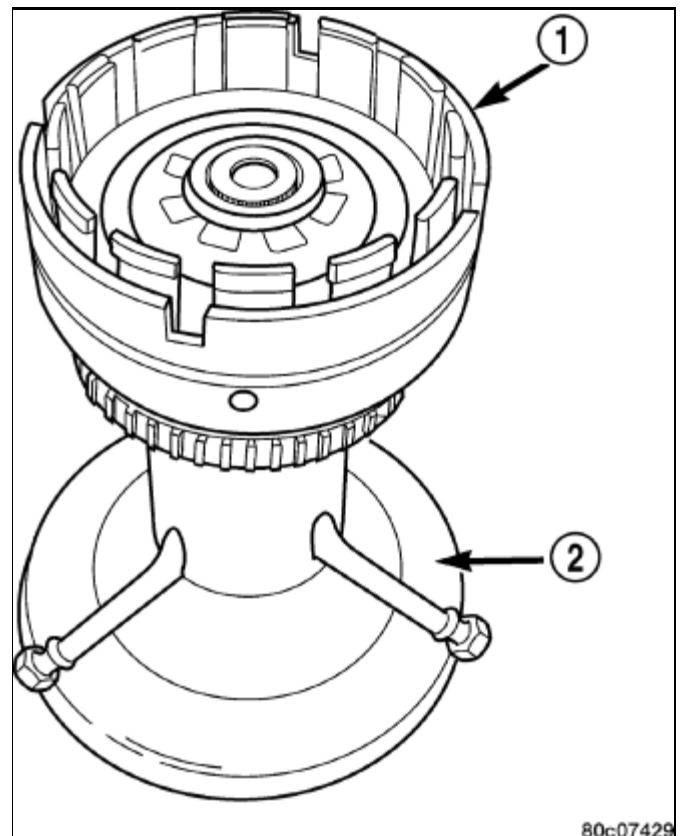
1 - THRUST BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - THRUST BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)
8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - THRUST BEARING NUMBER 2

15. Install the UD reaction plate lower flat snap-ring (16) . The correct snap-ring can be identified by the two tabbed ears.

16. Install the UD reaction plate (15) into the input clutch retainer. The reaction plate is to be installed with the big step down.

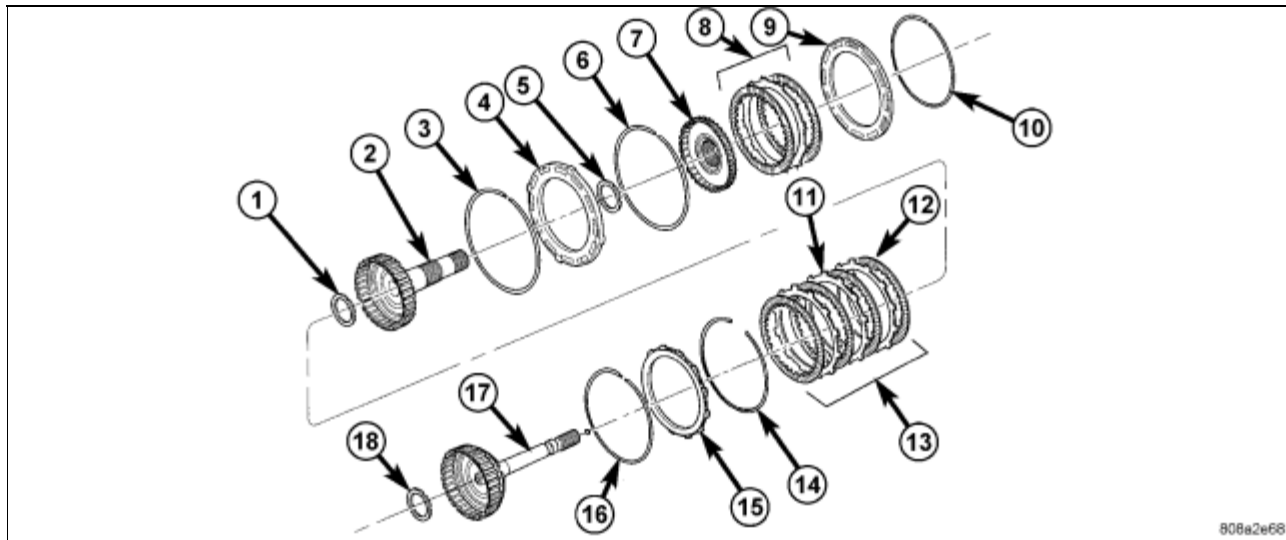
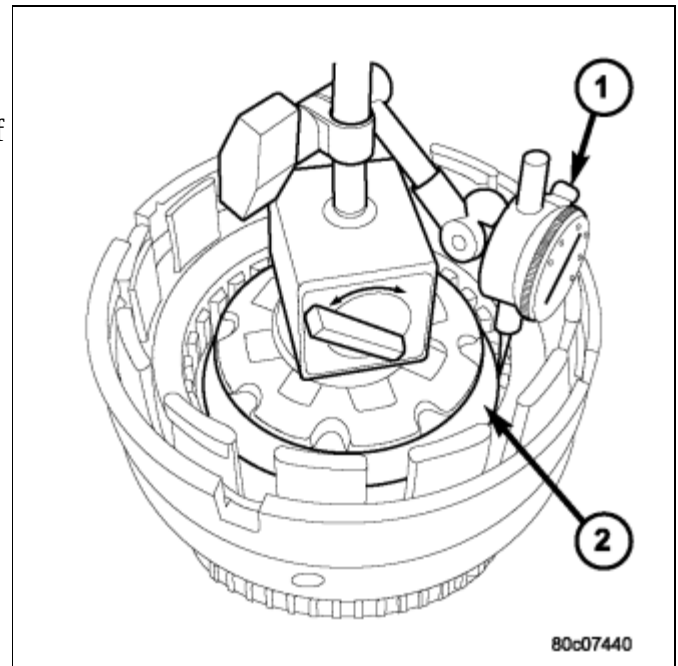
17. Install the UD reaction plate upper tapered snap-ring (14) with tapered side up.

18. Install the input clutch assembly into Input Clutch Pressure Fixture 8260 (2).



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19. Mount a dial indicator C-3339A (1) on the input clutch hub. Push down on the UD clutch discs and zero the indicator against the underdrive clutch discs. Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. Measure and record UD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with UD clutch pack clearance specification. The correct clutch clearance is 0.84-1.54 mm (0.033-0.061 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.



1 - THRUST BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - THRUST BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)

8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - THRUST BEARING NUMBER 2

20. Install the overdrive clutch pack (13) into the input clutch retainer. The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs. The OD clutch discs can be identified by their radial groove pattern. The OD clutch discs can be identified by their radial groove pattern.

21. Install the overdrive clutch wavy snap-ring (3) with the two tabbed ears into the OD/reverse piston .

22. Install the OD/reverse pressure plate (4) into the input clutch retainer. The pressure plate is non-directional.

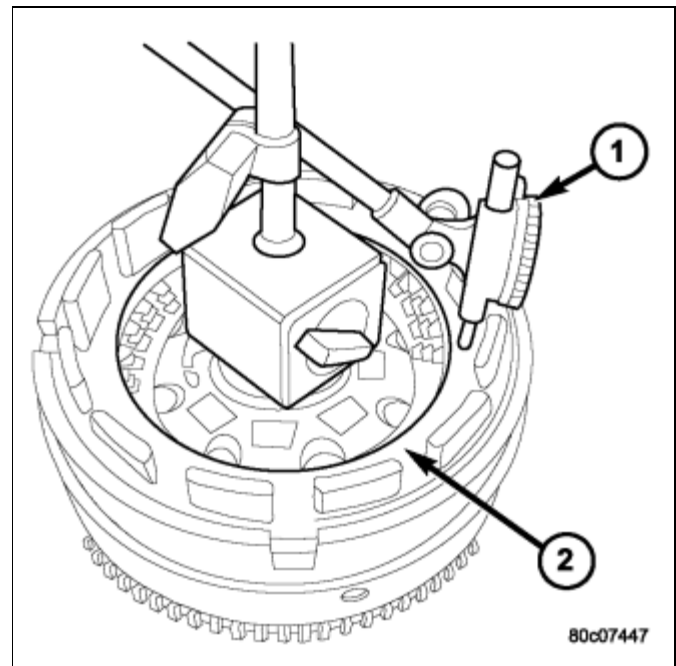
23. Install the OD/reverse reaction plate flat snap-ring (6) into the OD/reverse piston .

24. Mount a dial indicator C-3339A (1) on the input clutch hub and zero the indicator against the OD/reverse pressure plate (2). . Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Measure and record OD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with OD clutch pack clearance specification. Verify that the clutch clearance is 1.103-1.856 mm (0.043-0.073 in.). The pressure plate is not selective. If the clutch clearance is not within specification, replace the pressure plate along with all the friction and steel discs.

25. Install the reverse clutch pack into the input clutch retainer.

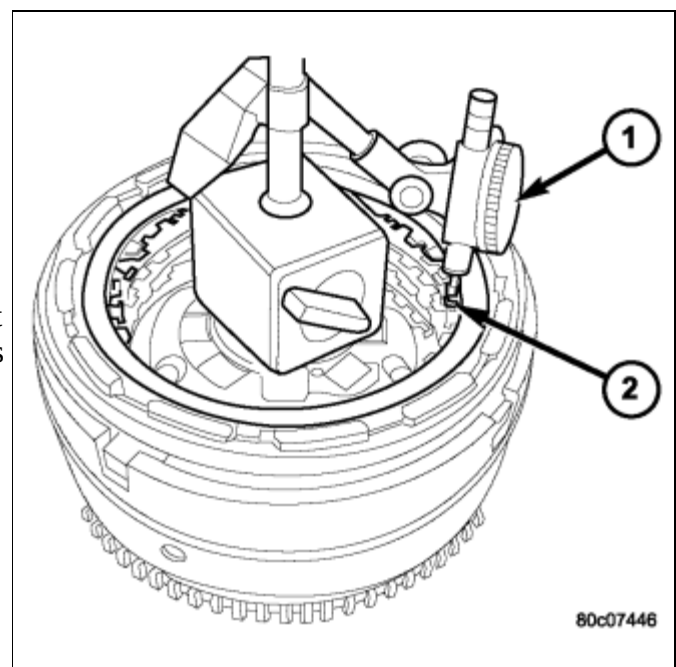
26. Install the reverse reaction plate into the input clutch retainer.

27. Install the reverse reaction plate selective snap-ring into the input clutch retainer.



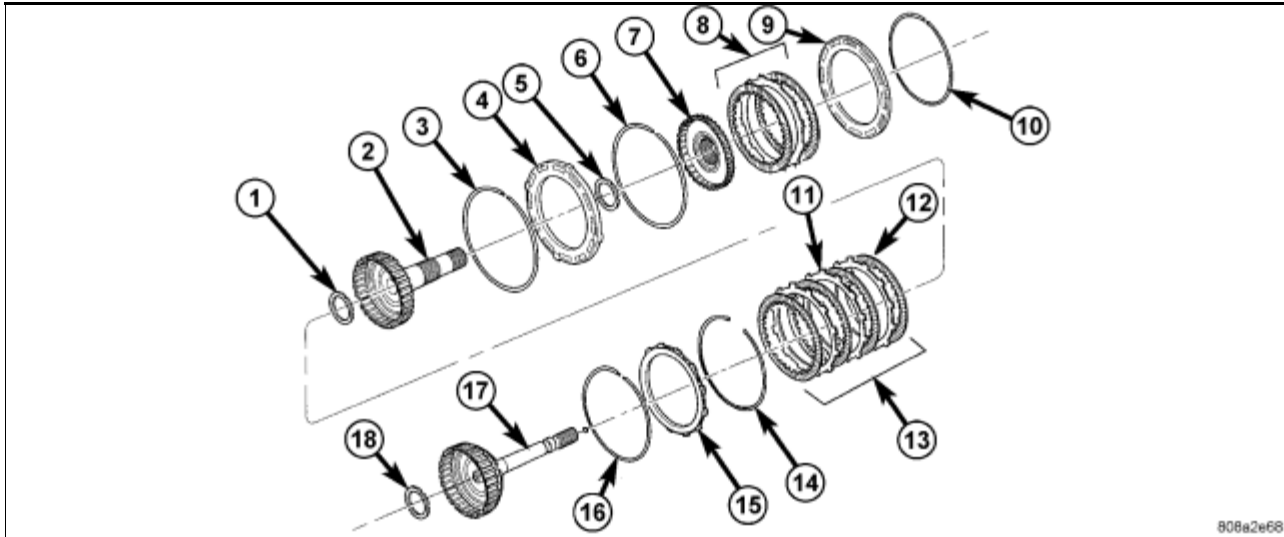
28. Mount a dial indicator to the assembly, push down on the clutch discs, pull up on the reaction plate to ensure the plate is properly seated and zero the indicator against the reverse clutch discs (2) . Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. Measure and record Reverse clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with Reverse clutch pack clearance specification. The correct clutch clearance is 0.81-1.24 mm (0.032-0.049 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.

NOTE: The 545RFE uses one of three (3) different selective snap rings. They are identified by the end cuts (either straight [square] cut or "butterfly" [S-curved] cut):



SELECTABLE END PLAY SNAP RINGS

- One Square End, One Buttery Fly End = 1.55 mm (0.061 in.)
- Both Ends Square Cut = 1.85 mm (0.073 in)
- Both Ends Buttery Fly Cut = 2.2 mm (0.087 in.)



1 - THRUST BEARING NUMBER 3	10 - SNAP-RING (SELECT)
2 - OD HUB/SHAFT	11 - PLATE
3 - SNAP-RING (WAVE)	12 - DISC
4 - REV/OD REACTION PLATE	13 - OD CLUTCH
5 - THRUST BEARING NUMBER 4	14 - SNAP-RING (TAPERED)
6 - SNAP-RING (FLAT)	15 - UD/OD REACTION PLATE
7 - REVERSE HUB/SHAFT	16 - SNAP-RING (FLAT)
8 - REVERSE CLUTCH	17 - UD HUB/SHAFT
9 - REVERSE REACTION PLATE	18 - THRUST BEARING NUMBER 2

29. Remove the reverse clutch pack (8) from the input clutch retainer.
30. Install the number 2 thrust bearing (18) onto the underdrive hub (17) with outer race against the hub with petroleum jelly.
31. Install the underdrive hub (17) into the input clutch retainer.
32. Install the number 3 thrust bearing (1) into the overdrive hub (2) with the outer race against the hub with petroleum jelly.
33. Install the overdrive hub (2) into the input clutch retainer.
34. Install the number 4 thrust bearing (5) into the reverse hub with outer race against the hub with petroleum

jelly.

35. Install the reverse hub (7) into the input clutch retainer.
36. Install the complete reverse clutch pack (8).
37. Install the reverse reaction plate (9) and snap-ring (10).
38. Push up on reaction plate to allow reverse clutch to move freely.

SENSOR-INPUT SPEED

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM . The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the park gear teeth . The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

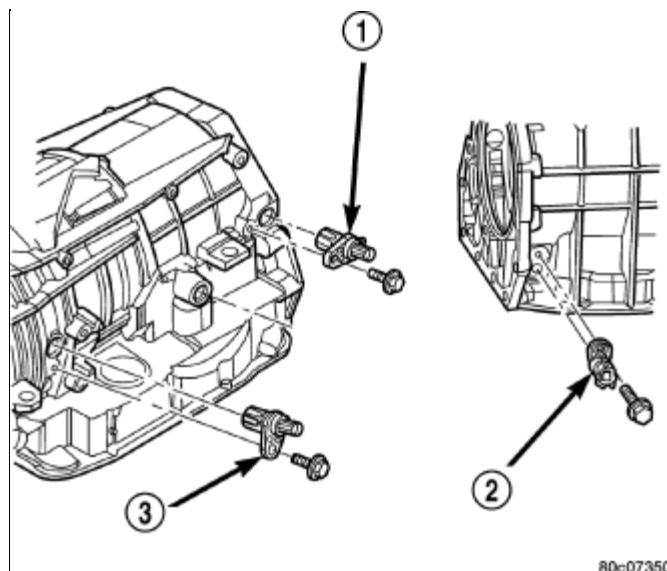
The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor (3).
4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor (3) from the transmission case.

INSTALLATION



1. Install the input speed sensor (3) into the transmission case.
2. Install the bolt to hold the input speed sensor (3) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the input speed sensor.
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.

SENSOR-LINE PRESSURE (LP)

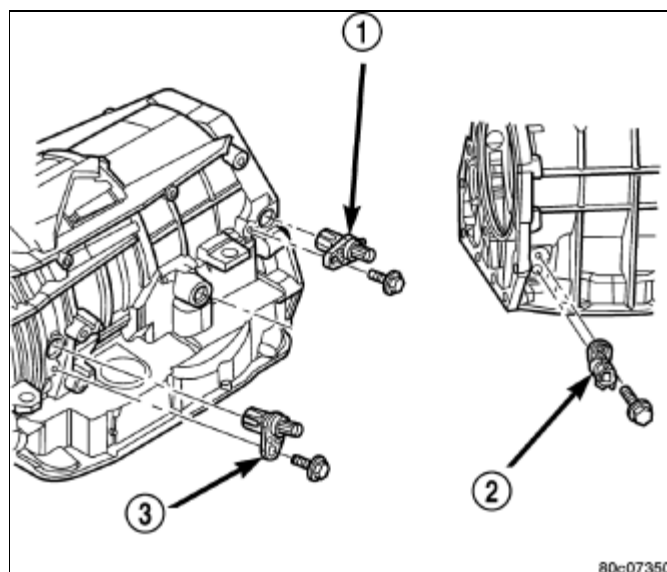
DESCRIPTION

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, which is part of the pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the pump inlet. The system contains a Line Pressure Sensor, which is a direct input to the TCM. The line pressure sensor monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

OPERATION

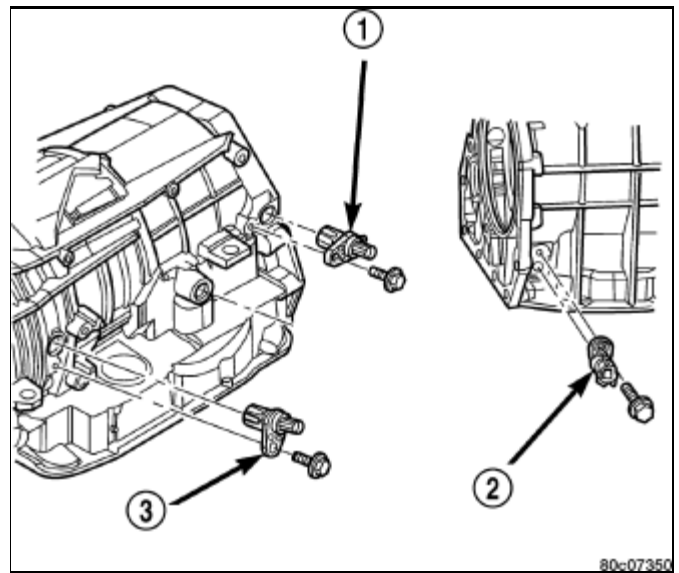
The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts, to ensure consistent shift quality. During all other operation, the desired line pressure value is adjusted based on torque level and other transmission requirements.

REMOVAL



1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the line pressure sensor (2).
4. Remove the bolt holding the line pressure sensor (2) to the transmission case.
5. Remove the line pressure sensor (2) from the transmission case.

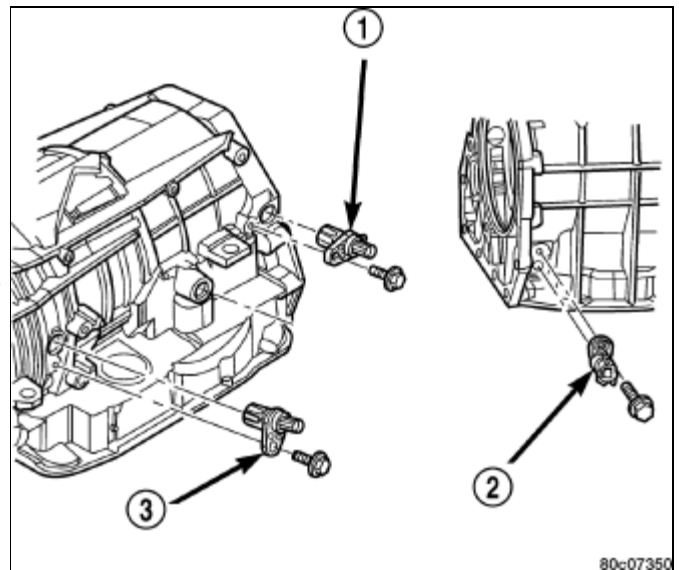
INSTALLATION

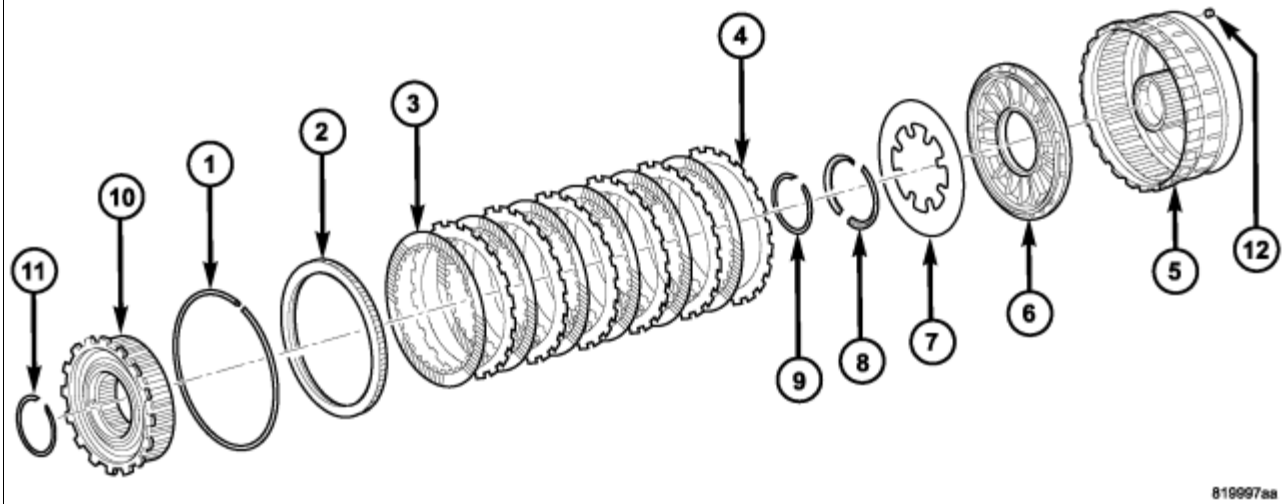


1. Install the line pressure sensor (2) into the transmission case.
2. Install the bolt to hold the line pressure sensor (2) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the line pressure sensor (2).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.

CLUTCH-LOW/REVERSE

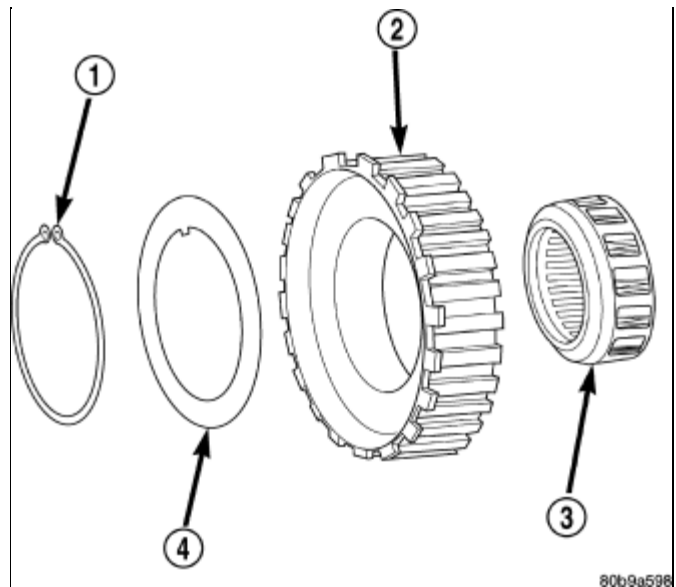
DISASSEMBLY





1. Remove the inner overrunning clutch snap-ring (11) from the low/reverse clutch retainer (5).
2. Remove the outer low/reverse reaction plate flat snap-ring (1).
3. Remove the low/reverse clutch (3, 4) and the overrunning clutch (10) from the low/reverse clutch retainer (5) as an assembly.
4. Separate the low/reverse clutch (3, 4) from the overrunning clutch (10).

NOTE: The ORC is no longer serviced , it is sold an assembly only. Be certain that the outer race will rotate in one direction but not both relative to the inner race



5. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse Belleville spring (3) and remove the split retaining ring holding the Belleville spring into the low/reverse clutch retainer.

6. Remove the low/reverse Belleville spring (3) and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.

CLEANING

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

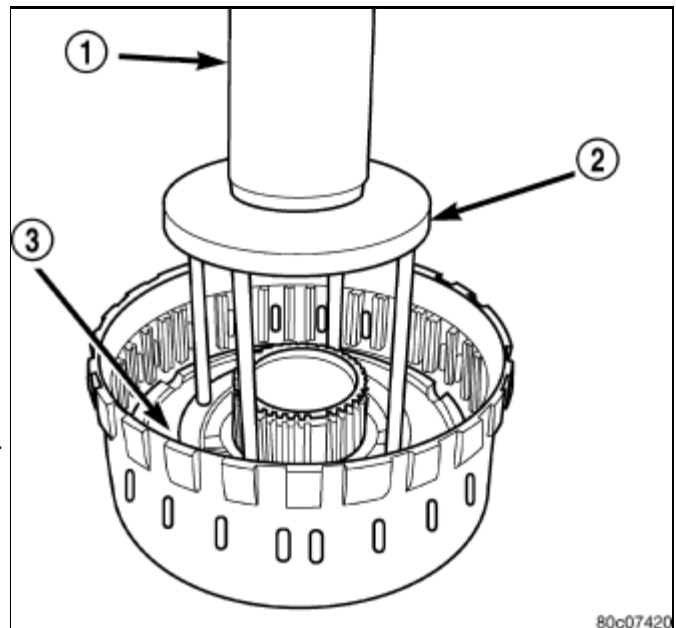
INSPECTION

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the LR clutch retainer if the piston bores or ID bushings are scored or damaged.

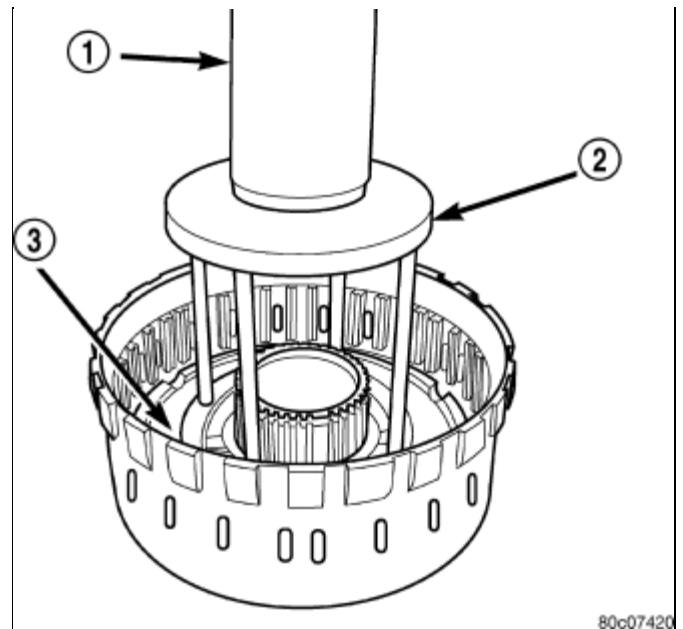
ASSEMBLY

1. Check the bleed orifice to ensure that it is not plugged or restricted.
2. Lubricate the seals with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
3. Install the low/reverse piston into the low/reverse clutch

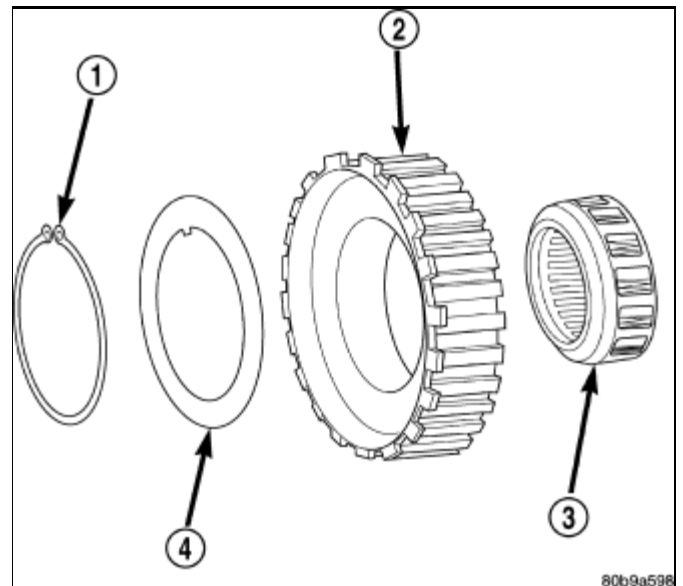


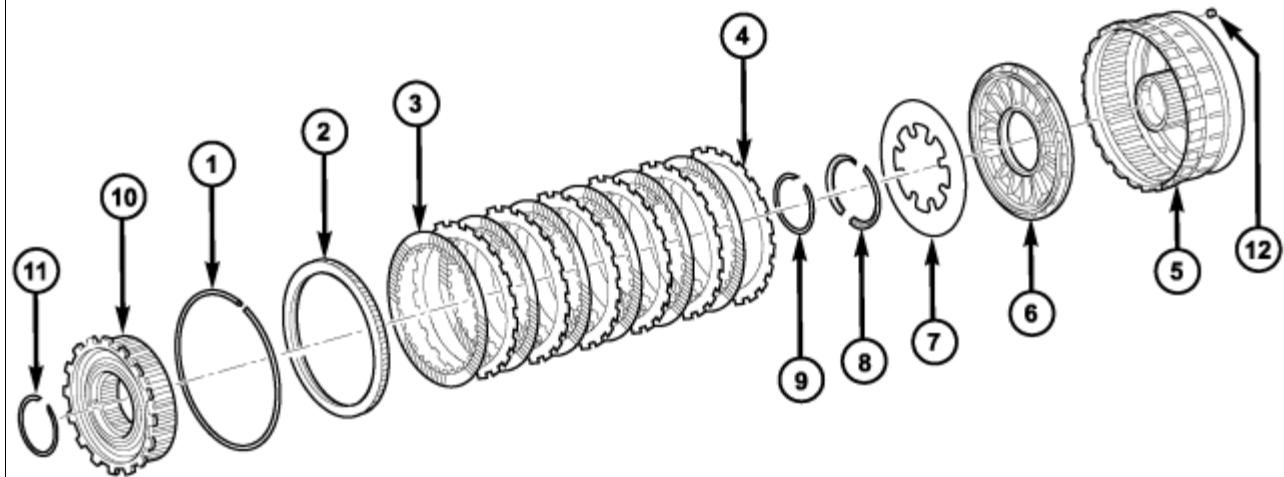
retainer.

4. Position the low/reverse Belleville spring (3) on the low/reverse piston.
5. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse Belleville spring (3) and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.



6. Install the lower overrunning clutch snap-ring.
7. Assemble the inner and outer races (2) of the overrunning clutch (3).
8. Position the overrunning clutch spacer (4) on the overrunning clutch (3).
9. Install the upper overrunning clutch snap-ring (1).





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10. Assemble and install the low/reverse clutch pack (3, 4) into the low/reverse clutch retainer (5).
11. Install the low/reverse reaction plate (2) into the low/reverse clutch retainer (5). The reaction plate is directional and must be installed with the flat side down.
12. Install the low/reverse clutch pack snap-ring (1). The snap-ring is selectable and should be chosen to give the correct clutch pack clearance.
13. Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.00-1.74 mm (0.039-0.069 in.).

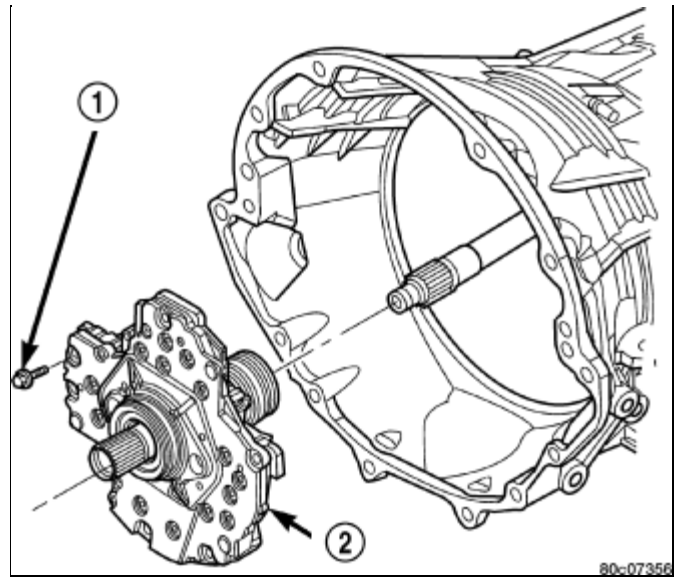
NOTE: When installing the overrunning clutch be certain the steps on the gear face upward.

14. Install the overrunning clutch (10) into the low/reverse clutch retainer (5) making sure that the index splines are aligned with the retainer.
15. Install the overrunning clutch inner snap-ring (11).

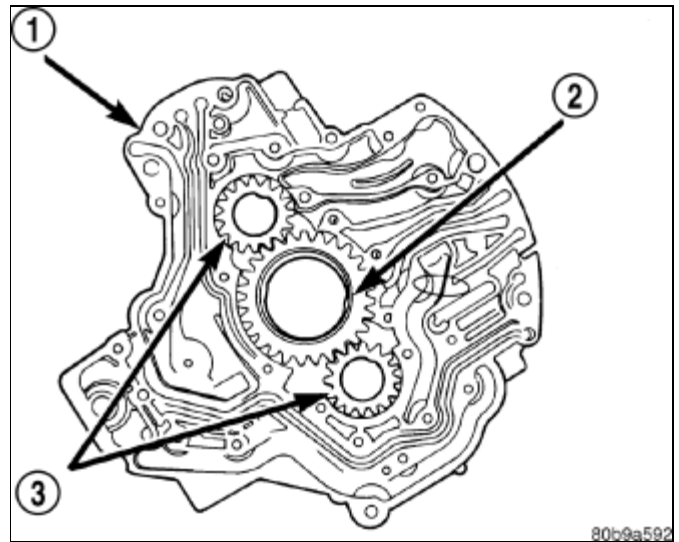
PUMP-OIL

DESCRIPTION

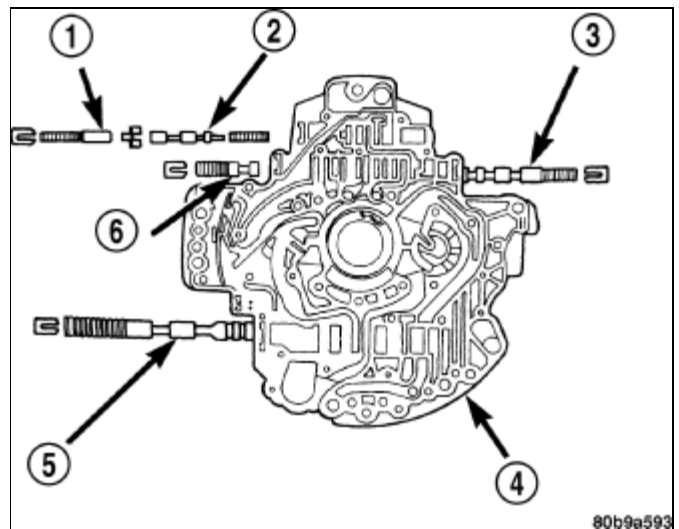
The oil pump (2) is located at the front of the transmission inside the bell housing and behind the transmission front cover.

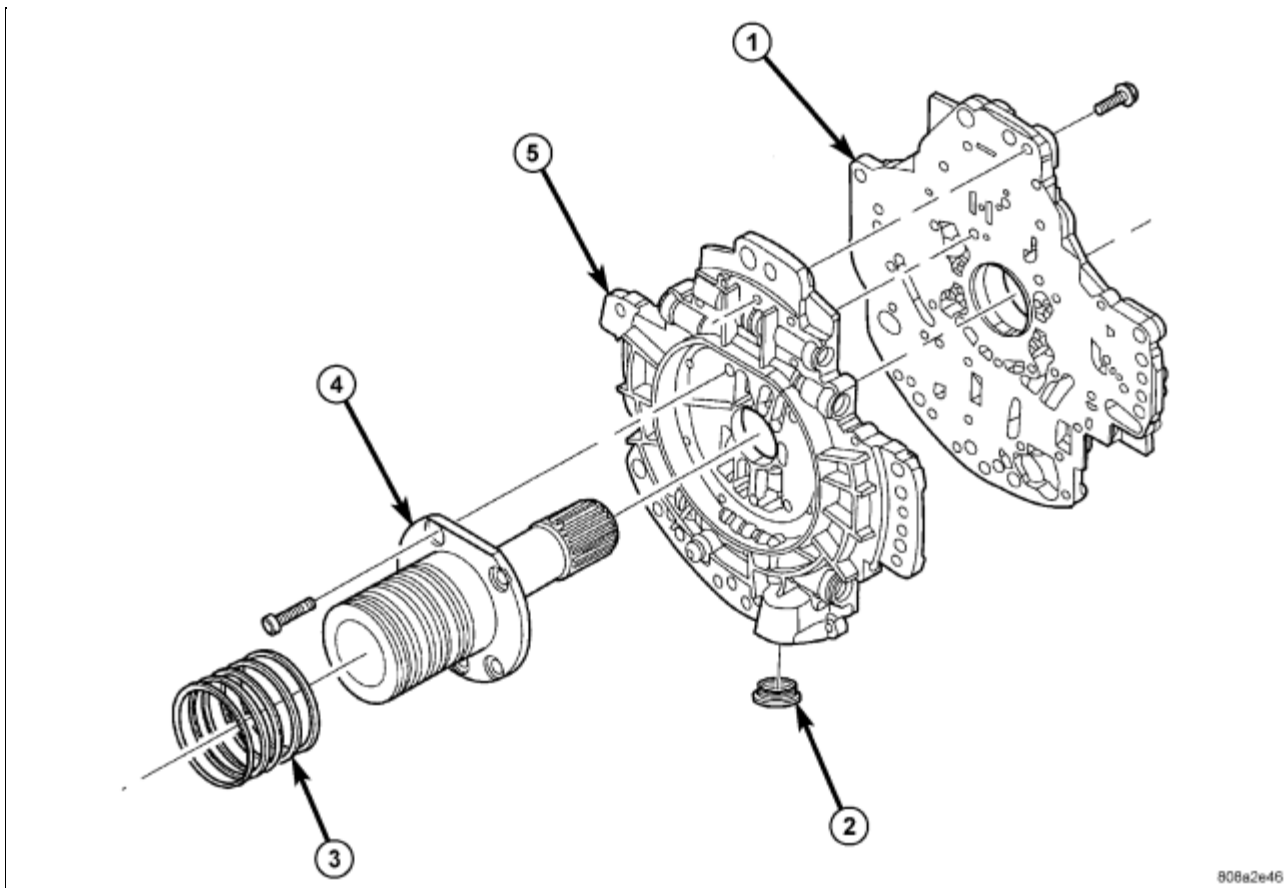


The oil pump consists of two independent pumps.



The oil pump also contains a number of valves. The converter clutch switch (3) and control valves (2), pressure regulator valve (5), and converter pressure limit valve (6) are all located in the oil pump valve body.





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A filter seal (2), and a bolt on reaction shaft (4) complete the oil pump assembly.

OPERATION

As the torque converter rotates, the converter hub rotates the oil pump drive gear. As the drive gear rotates both driven gears, a vacuum is created when the gear teeth come out of mesh. This suction draws fluid through the pump inlet from the oil pan. As the gear teeth come back into mesh, pressurized fluid is forced into the pump outlet and to the oil pump valves.

At low speeds, both sides of the pump supply fluid to the transmission. As the speed of the torque converter increases, the flow from both sides increases until the flow from the primary side alone is sufficient to meet system demands. At this point, the check valve located between the two pumps closes. The secondary side is shut down and the primary side supplies all the fluid to the transmission.

CONVERTER CLUTCH SWITCH VALVE

The converter clutch switch valve is used to control the direction of oil flow to the torque converter. When the converter clutch is released (CC switch valve downshifted), hydraulic pressure is supplied to the front (OFF) side of the torque converter clutch. When the converter clutch is applied (CC switch valve upshifted), regulated oil pressure is supplied to the back (ON) side of the converter clutch.

CONVERTER CLUTCH REGULATOR VALVE

The converter clutch regulator valve is used to control the hydraulic pressure supplied to the back (ON) side of the torque converter clutch.

TORQUE CONVERTER LIMIT VALVE

The torque converter limit valve serves to limit the available line pressure to the torque converter clutch.

STANDARD PROCEDURE - OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

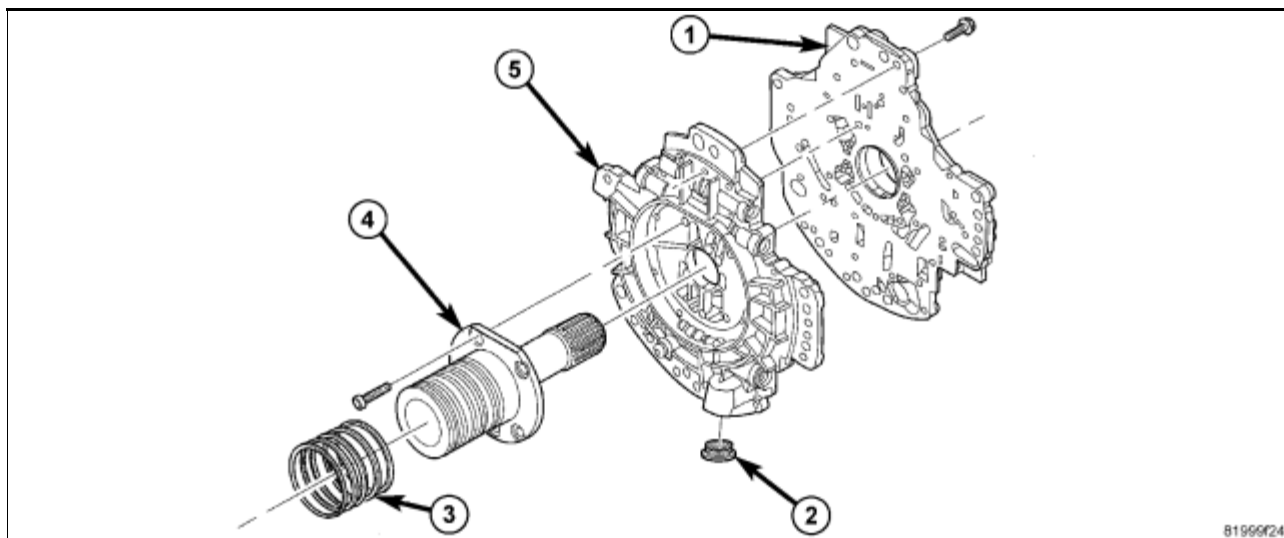
Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF +4, Automatic Transmission Fluid.

1. Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

2. Run the engine **at 1800 rpm**, with the shift selector in neutral. Verify that the transmission fluid temperature is below 104.5° C (220° F) for this test.
3. If one quart of transmission fluid is collected in the container in 30 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 30 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.
4. Re-connect the **To cooler** line to the transmission cooler inlet.
5. Refill the transmission to proper level.

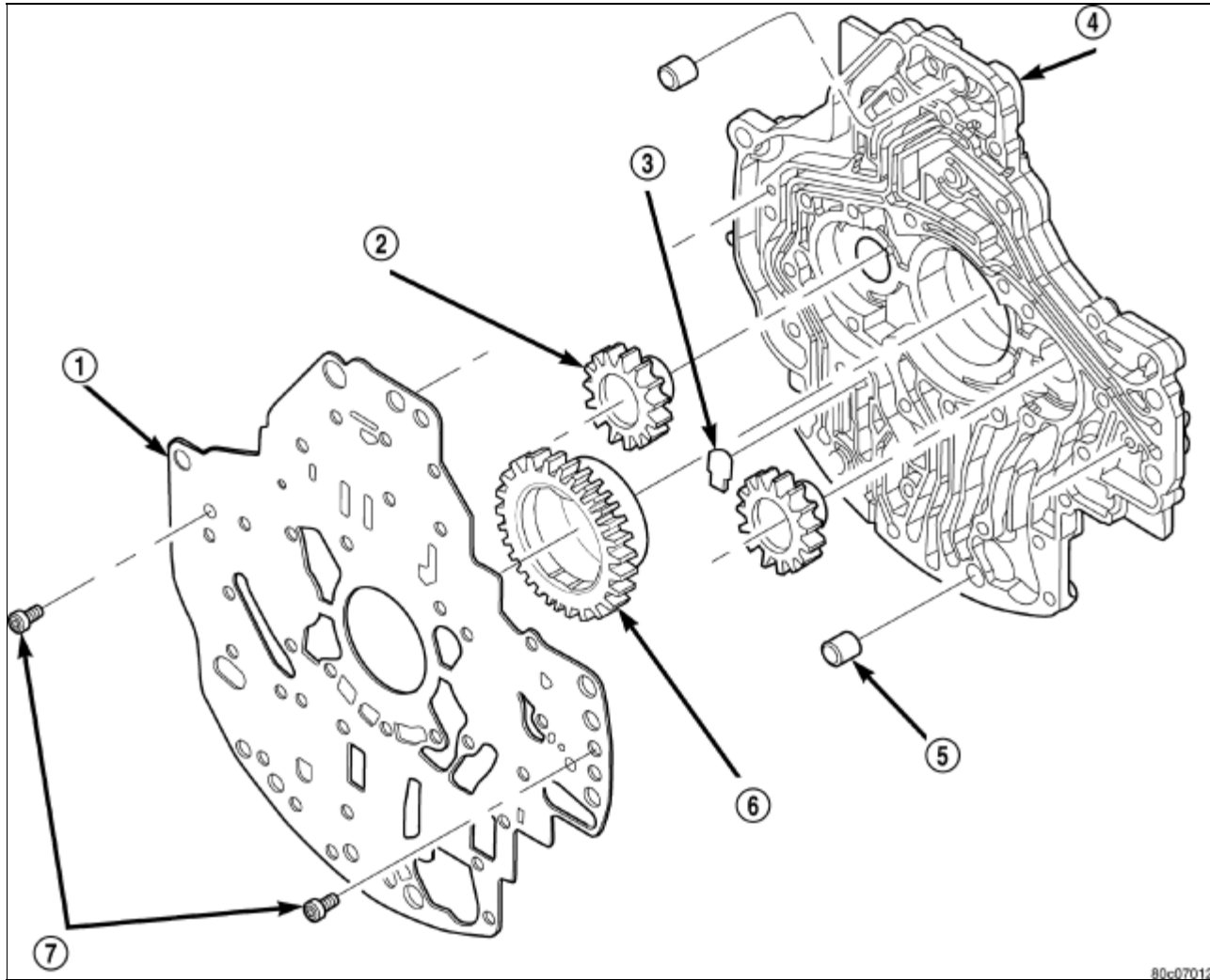
DISASSEMBLY



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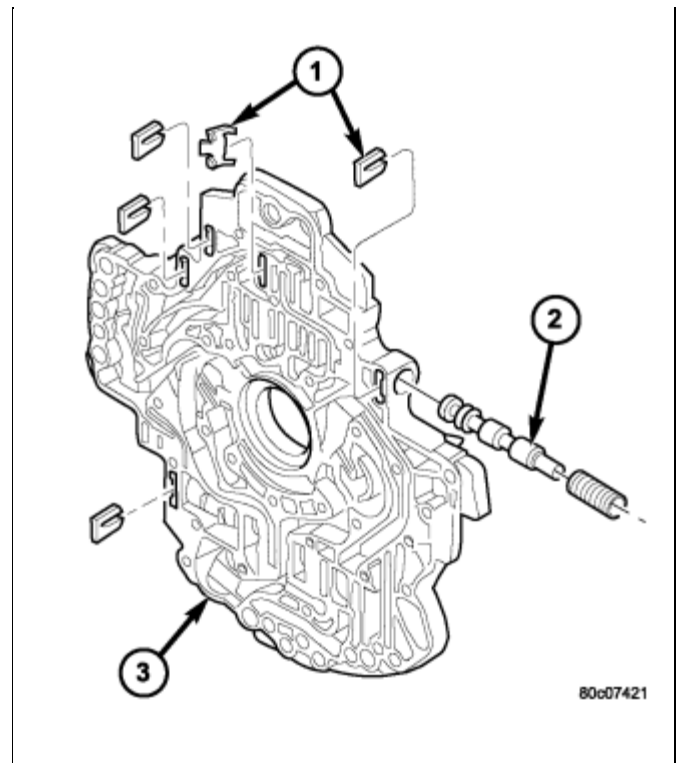
1. Remove the bolts holding the reaction shaft support (4) to the oil pump.
2. Remove the reaction shaft support (4) from the oil pump.
3. Remove all bolts holding the oil pump halves together.
4. Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.



5. Remove the screws (7) holding the separator plate (1) onto the oil pump housing (4).
6. Remove the separator plate (1) from the oil pump housing (4).
7. Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.
8. Remove the oil pump flapper valve (3) from its pocket in the pump housing.
9. Remove the oil pump gears (2, 6) from the oil pump housing (4).

10. Remove the oil pump valve retainers (1) and associated valve (2) and spring one at a time. Mark the combination of components as a group and tag them as to the location from which they were removed.



11. Remove the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).

CLEANING

Clean pump and support components with solvent and dry them with compressed air.

INSPECTION

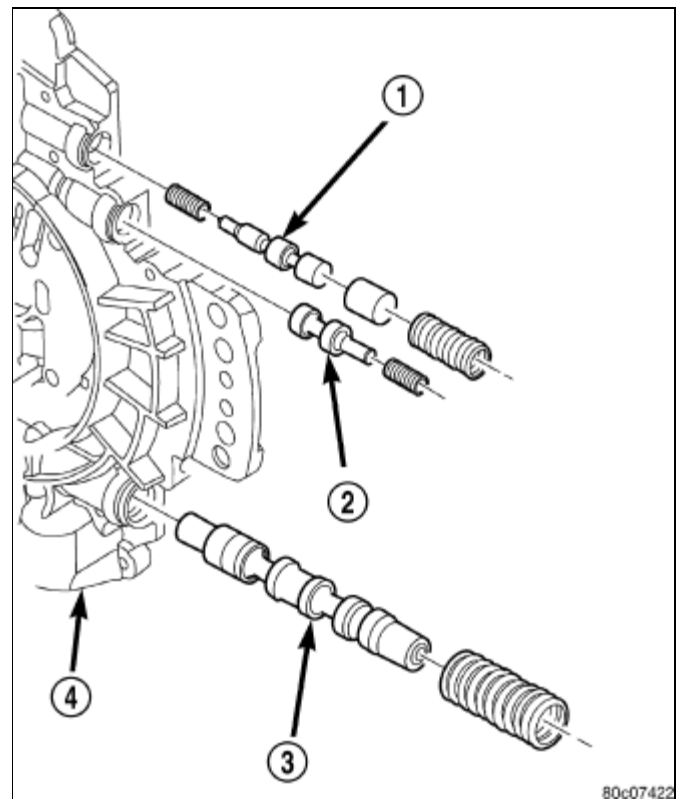
Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump reaction shaft support bushings. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands**. Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the oil pump valve body. Use a penlight to view the bore interiors.



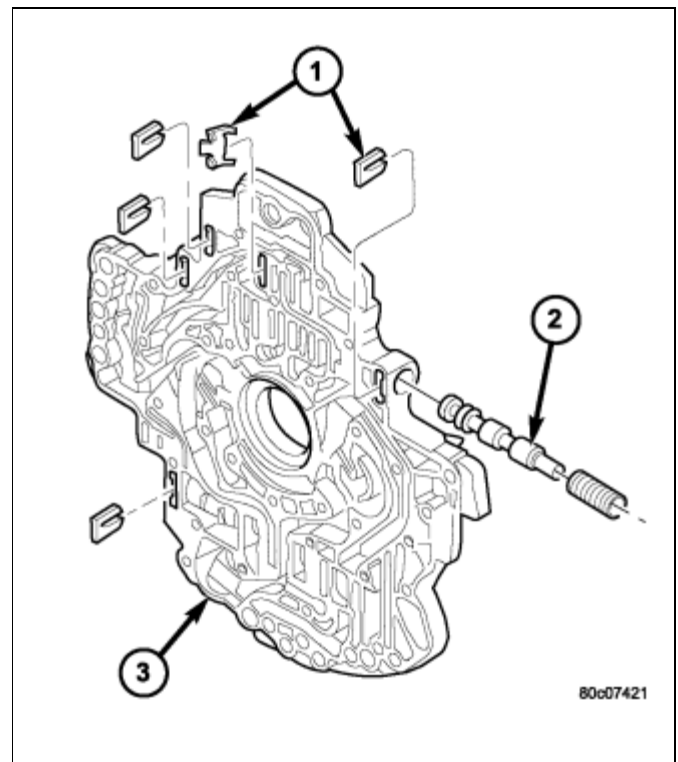
Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores. Tip the pump valve body back and forth and check to see that each valve slides freely in its bore under its own weight (without pushing or prying).

ASSEMBLY

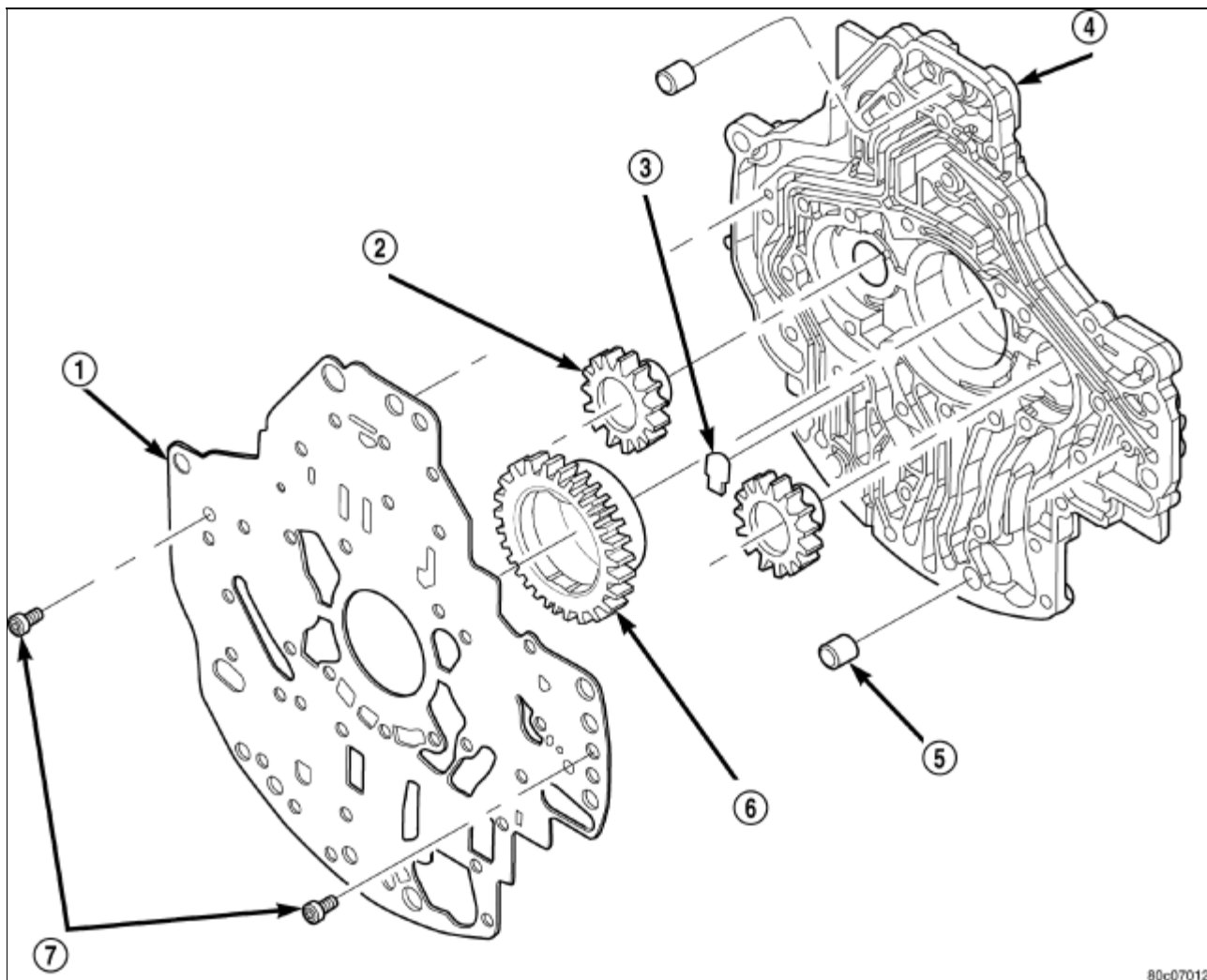
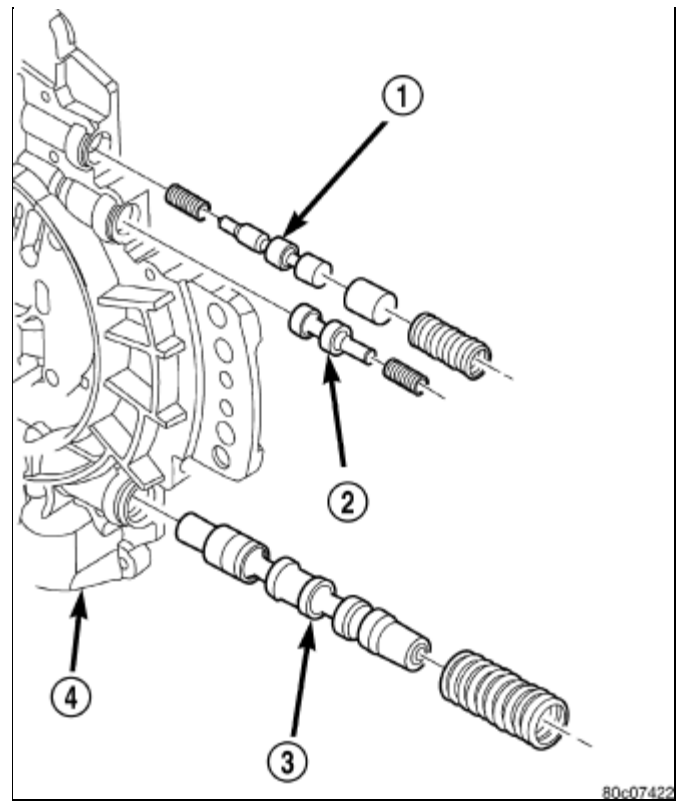
NOTE: Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.

1. Lubricate the oil pump valves with Mopar® ATF +4 and install the valve (2), spring, and retainer (1) into the appropriate oil pump valve body (3) bore.

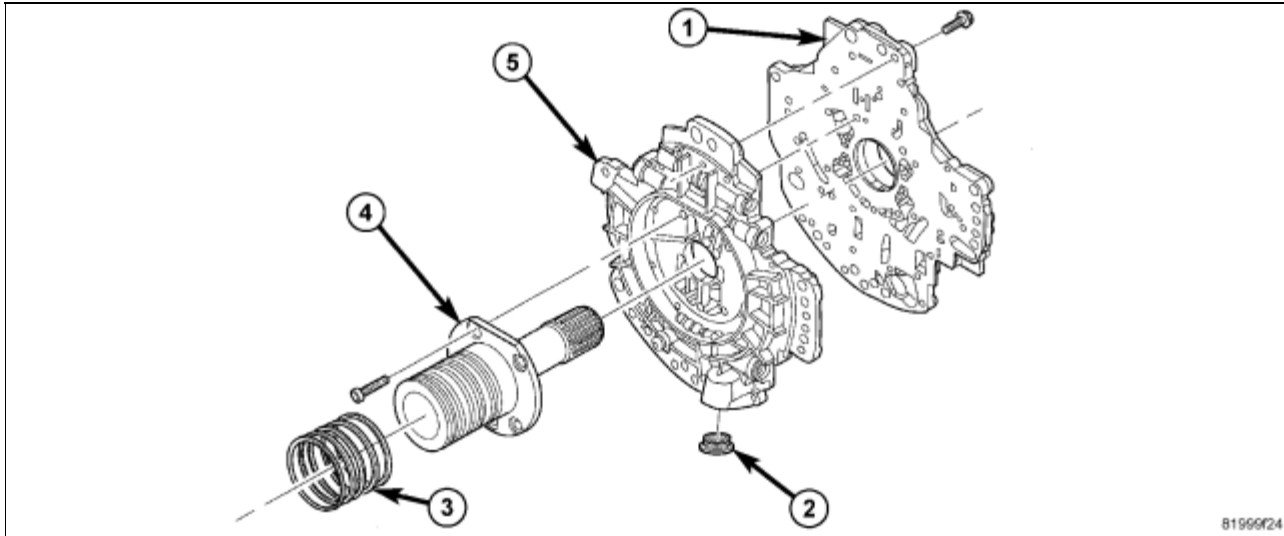


2. Install the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).

NOTE: The pump separator plate is heat treated and therefore may exhibit a blue color or other discoloration in some areas. This is normal.



3. Coat the gears (2, 6) with Mopar® ATF +4 and install into their original locations.
4. Place the oil pump flapper valve (3) into its pocket in the pump housing, with the rounded edges facing down.
5. Place the separator plate (1) onto the oil pump housing (4).
6. Install the screws (7) to hold the separator plate (1) onto the oil pump housing (4). Tighten the screws to 4.5 N·m (40 in.lbs.).



7. Position the oil pump valve body (5) onto the locating dowels.
8. Seat the two oil pump halves together and install all bolts finger tight.
9. Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in.lbs.).
10. Verify that the oil pump gears rotate freely and smoothly.
11. Position the reaction shaft support (4) onto the oil pump valve body (6).
12. Install and tighten the bolts to hold the reaction shaft support (4) to the oil pump valve body (5). The correct torque is 12 N·m (105 in.lbs.).

SENSOR-OUTPUT SPEED

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the park gear teeth. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

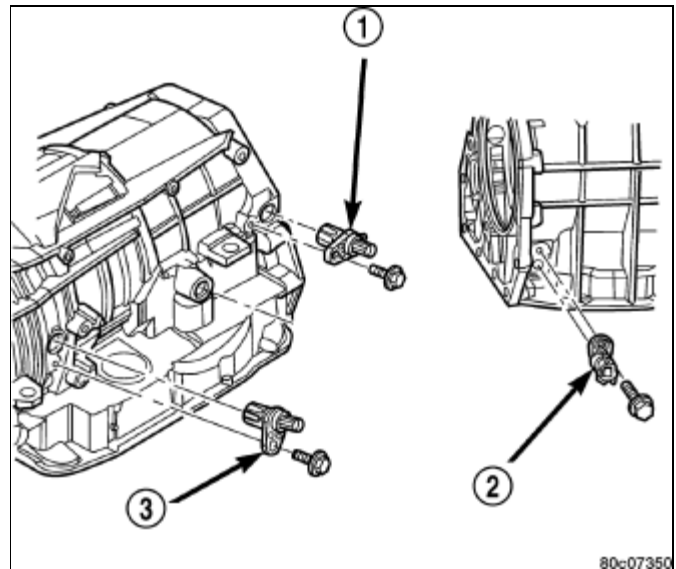
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

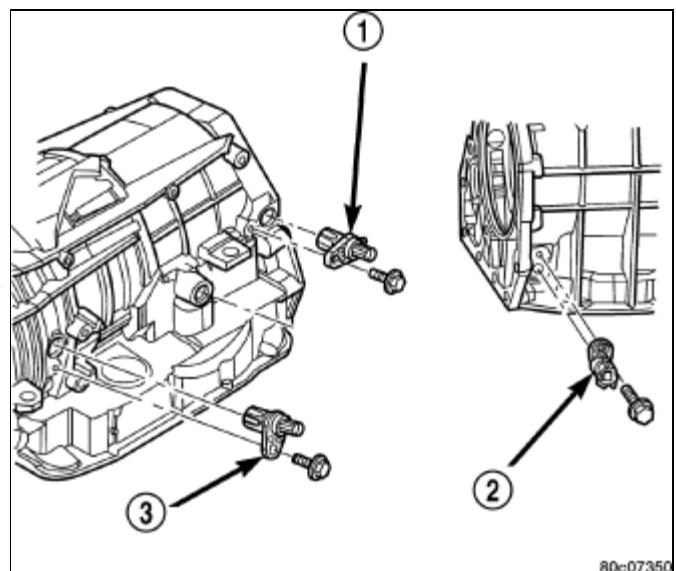
REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (1).
4. Remove the bolt holding the output speed sensor (1) to the transmission case.
5. Remove the output speed sensor (1) from the transmission case.



INSTALLATION

1. Install the output speed sensor (1) into the transmission case.
2. Install the bolt to hold the output speed sensor (1) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the output speed sensor (1).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



SWITCH-OVERDRIVE

DESCRIPTION

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

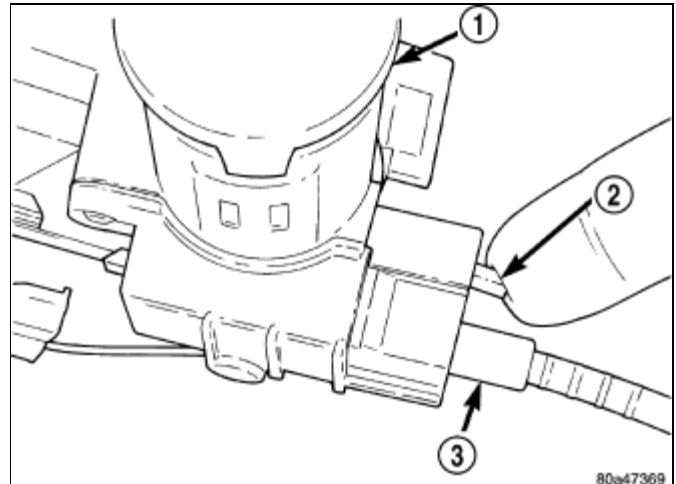
OPERATION

At key-on, fourth gear operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoids and allow upshifts to fourth gear. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

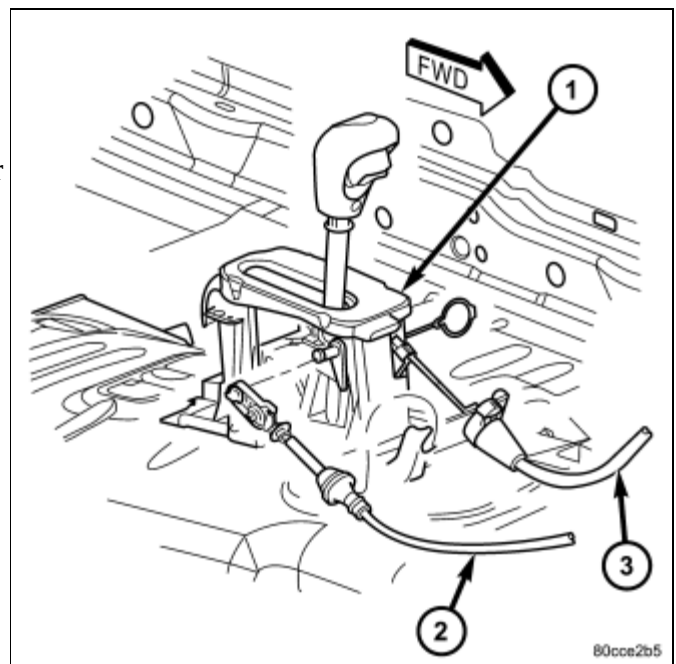
CABLE-PARK INTERLOCK

REMOVAL

1. Lower the steering column.
2. With the ignition switch in the "RUN" position depress the park-interlock cable locking tab (2), located on top of the cable connector at the steering column and pull the cable straight out.



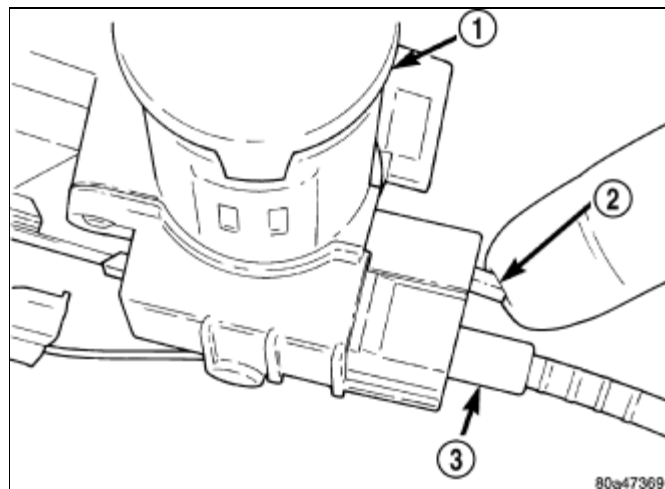
3. Remove the park-interlock cable from steering column.
4. Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
5. Disconnect the park-interlock cable (3) from the shift lever assembly and remove the cable from the shifter assembly bracket.
6. Release the park-interlock cable from any remaining clips.
7. Remove park-interlock cable from the vehicle.



INSTALLATION

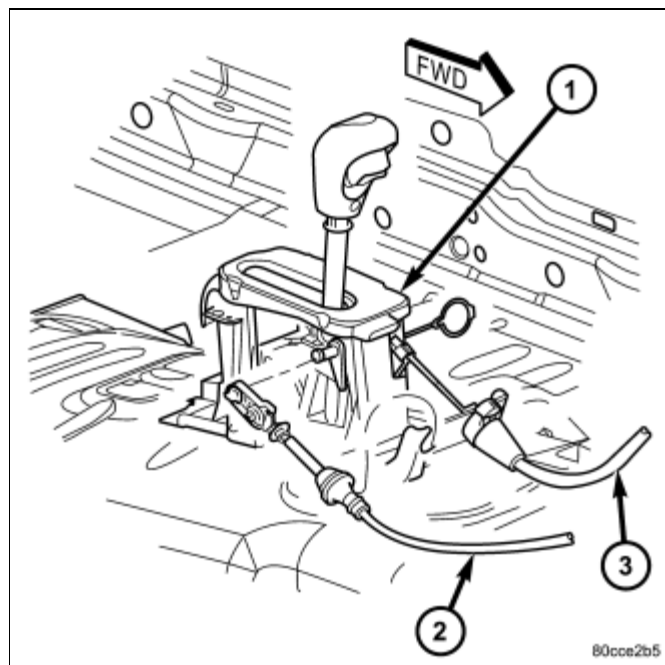
NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park-Interlock Cable.

1. Push the park-interlock cable (3) straight into the square mounting hole in the steering column until cable snaps in place.
2. Snap park-interlock cable tie strap into hole in steering column tube.



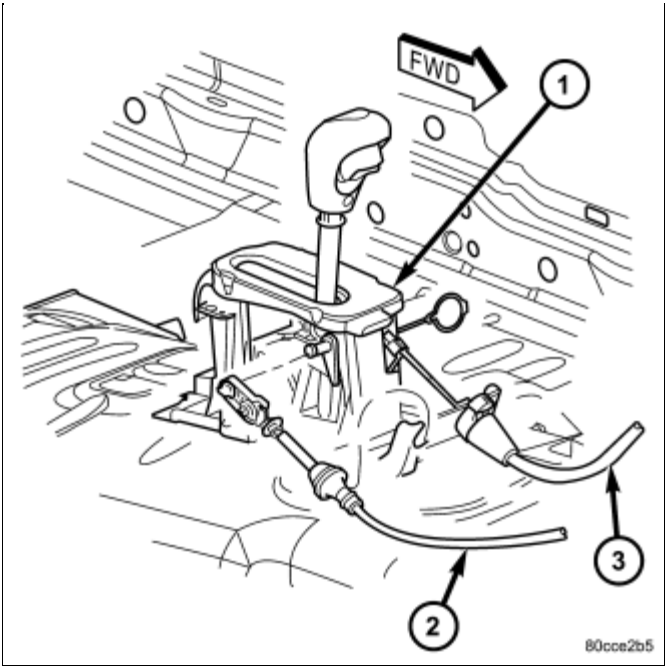
3. Route cable to the shifter mechanism.
4. Install the cable end fitting into shifter lever (1).
5. Snap cable adjuster ears into floor shifter bracket.
6. Place the ignition key cylinder in the LOCK position.
7. Push the cable adjuster lock clamp downward to lock it.
8. Test the park-interlock cable operation.
9. Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)

ADJUSTMENTS - PARK-INTERLOCK CABLE



The park-interlock cable is part of the Brake Transmission Shift Interlock (BTSI) system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

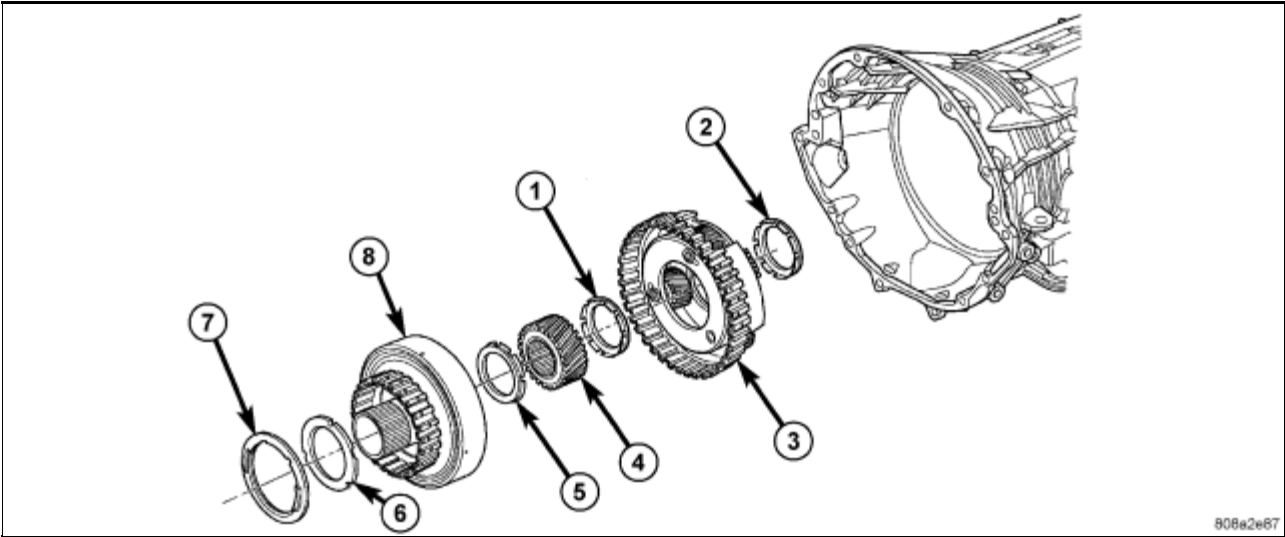
1. Remove floor console as necessary for access to the park-interlock cable.
2. Shift the transmission into the PARK position.
3. Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**
4. Pull cable lock button up to release cable (3).
5. Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
6. Push lock button down until it snaps in place.
7. Verify proper operation. (Refer to 21 -



TRANSMISSION/TRANSAXLE/AUTOMATIC -
42RLE/SHIFT INTERLOCK MECHANISM - DIAGNOSIS AND TESTING)
8. Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE -
INSTALLATION)

GEARTRAIN-PLANETARY

DESCRIPTION



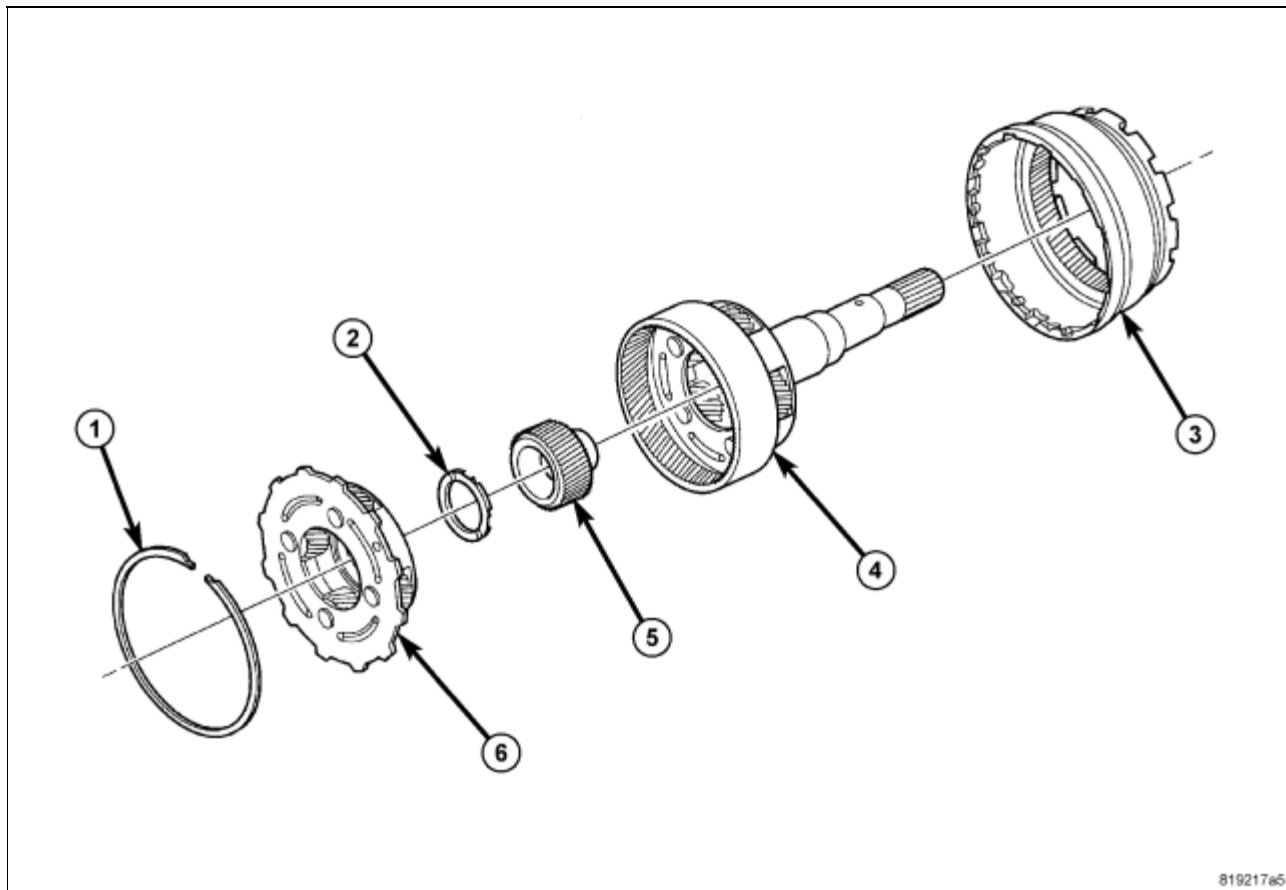
Reaction Planetary Geartrain

1 - THRUST BEARING NUMBER 8	5 - THRUST BEARING NUMBER 7
2 - THRUST BEARING NUMBER 9	6 - THRUST PLATE (SELECT)

3 - REACTION PLANETARY CARRIER	7 - THRUST BEARING NUMBER 6
4 - REACTION SUN GEAR	8 - REACTION ANNULUS

The planetary geartrain is located behind the 4C retainer/bulkhead, toward the rear of the transmission. The planetary geartrain consists of three primary assemblies:

- Reaction (3, 4, 8).



1. Snap Ring	4. Input Planetary Carrier
2. Thrust Bearing No. 10	5. Input Sun Gear
3. Input Annulus	6. Reverse Carrier

- Reverse (6).
- Input (3, 4, 5).

OPERATION

REACTION PLANETARY GEARSET

The reaction planetary carrier and reverse sun gear of the reaction planetary gearset are a single component which is held by the 2C clutch when required. The reaction annulus gear is a stand alone component that can be driven by the reverse clutch or held by the 4C clutch. The reaction sun gear is driven by the overdrive clutch.

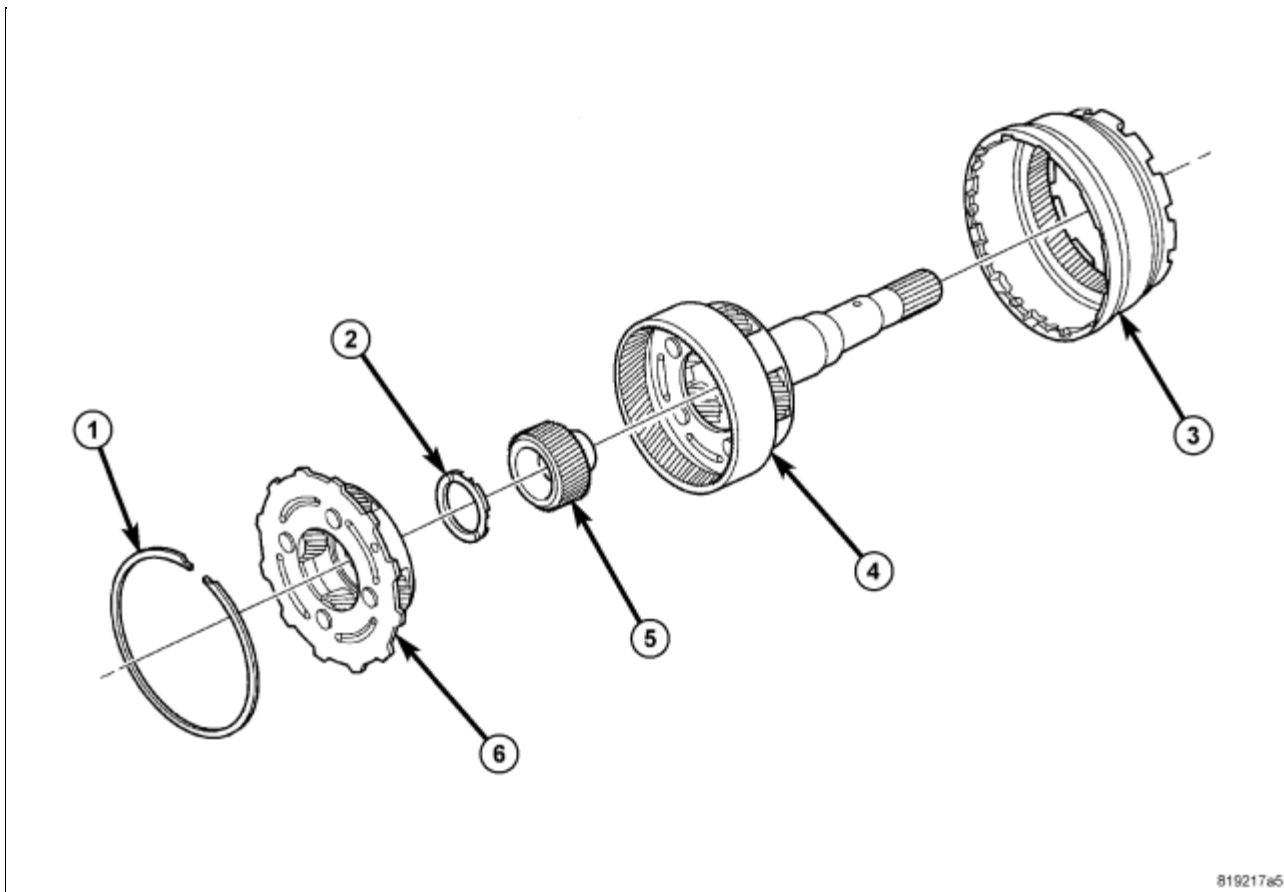
REVERSE PLANETARY GEARSET

The reverse planetary gearset is the middle of the three planetary sets. The reverse planetary carrier can be driven by the overdrive clutch as required. The reverse planetary carrier is also splined to the input annulus gear, which can be held by the low/reverse clutch. The reverse planetary annulus, input planetary carrier, and output shaft are all one piece.

INPUT PLANETARY GEARSET

The input sun gear of the input planetary gearset is driven by the underdrive clutch.

DISASSEMBLY



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1. Snap Ring	4. Input Planetary Carrier
2. Thrust Bearing No. 10	5. input Sun Gear
3. Input Annulus	6. Reverse Carrier

1. Remove the snap-ring (1) holding the input annulus (3) into the input carrier (4).
2. Remove the input annulus (3) from the input carrier (4).
3. Remove the reverse planetary gear carrier (6).
4. Remove the number 10 thrust bearing (2) from the input sun gear (5).
5. Remove the input sun gear (5) from the input carrier (4).

CLEANING

Clean the planetary components in solvent and dry them with compressed air.

INSPECTION

Inspect each planetary carrier assembly for damage. Check that each pinion gear rotates freely and smoothly on its shaft. Check that the tabbed thrust washer on each side of each pinion gear is in place. Check that the outer ends of the pinion shafts are not discolored from overheating. Replace the carrier assembly if jammed or sticky pinion gears, spun or missing tabbed washers, or blackened pinion shafts are found.

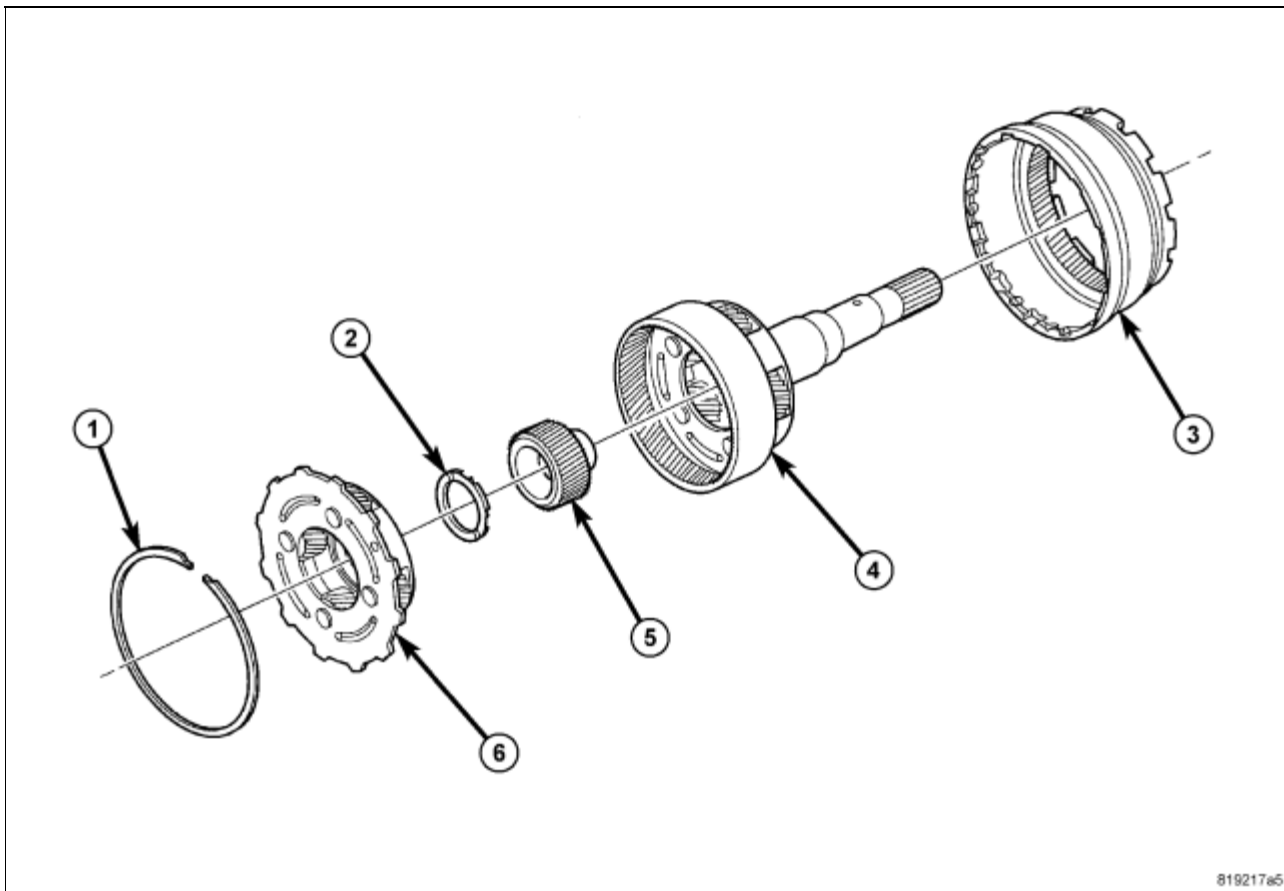
Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location.

ASSEMBLY

NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.



1. Snap Ring	4. Input Planetary Carrier
2. Thrust Bearing No. 10	5. input Sun Gear
3. Input Annulus	6. Reverse Carrier

1. Install the input sun gear (5) into the input carrier (4).
2. Install the number 10 thrust bearing (2) onto the rear of the reverse planetary carrier (6) with the inner race toward the carrier.
3. Install the reverse planetary gear carrier (6) into the input carrier (4).
4. Install the input annulus gear (3) into the input carrier (4).
5. Install the snap-ring (1) to hold the input annulus gear (3) into the input carrier (4).

MECHANISM-SHIFT

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

MANUAL LOW (1) range provides FIRST gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides FIRST and SECOND gear only.

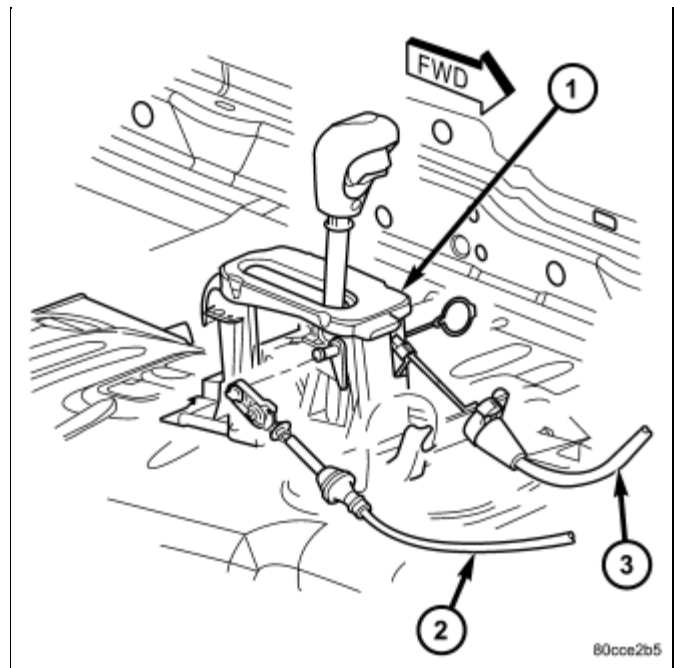
DRIVE range provides FIRST, SECOND, THIRD and OVERDRIVE FOURTH and FIFTH gear ranges. The shift into OVERDRIVE FOURTH and FIFTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 or 4-5 shifts.

The FOURTH and FIFTH gear upshifts occurs automatically when the overdrive selector switch is in the ON position. An upshift to FOURTH and FIFTH gears may not occur or may be delayed in some of the possible shift schedules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - OPERATION)

REMOVAL

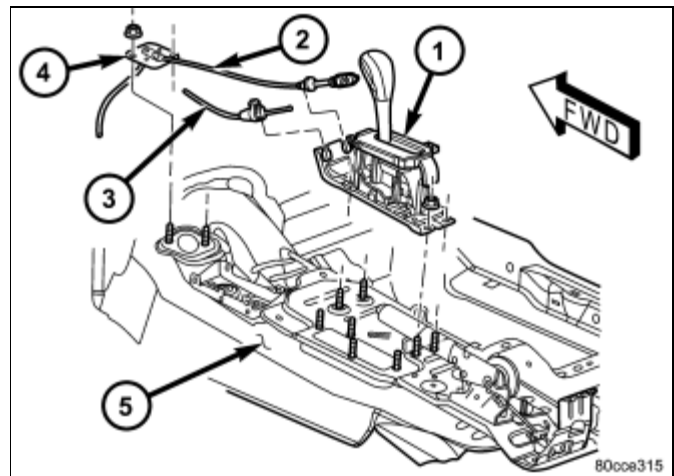
1. Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
2. Shift transmission into PARK.
3. Disconnect the transmission shift cable at shift lever and shifter assembly bracket .
4. Disconnect the park-interlock cable from the shifter lever and the shifter assembly bracket.
5. Disengage all wiring connectors from the shifter assembly.
6. Remove all nuts holding the shifter assembly to the floor pan .

7. Remove the shifter assembly from the vehicle.



INSTALLATION

1. Install shifter assembly onto the shifter assembly studs on the floor pan.
2. Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).
3. Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.
4. Install the park-interlock cable into the shifter assembly bracket and into the shifter lever.
5. Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
6. Place the floor shifter lever in park position.
7. Loosen the adjustment screw on the shift cable.
8. Snap the shift cable onto the shift lever pin.
9. Verify that the shift lever is in the PARK position.
10. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct shifter operation.
12. Verify proper BTSI operation. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RL/SHIFT INTERLOCK MECHANISM - DIAGNOSIS AND TESTING)
13. Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)



SWITCH-VALVE-SOLENOID

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the main valve body and directs the output from the L/R-TCC solenoid to either the L/R clutch or the TCC control valves

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and 5th gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

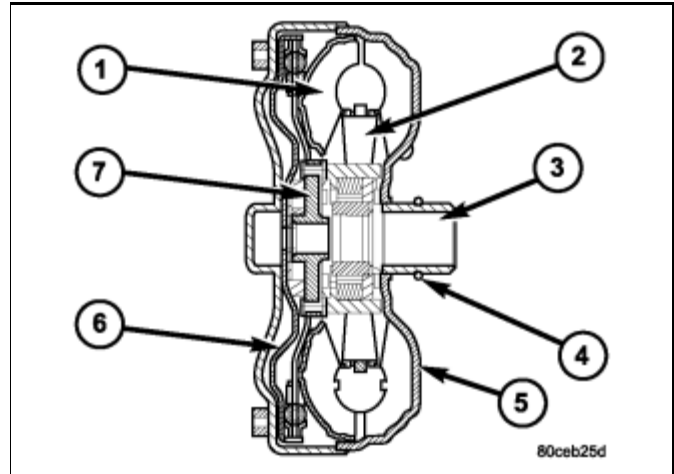
When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

CONVERTER-TORQUE

DESCRIPTION

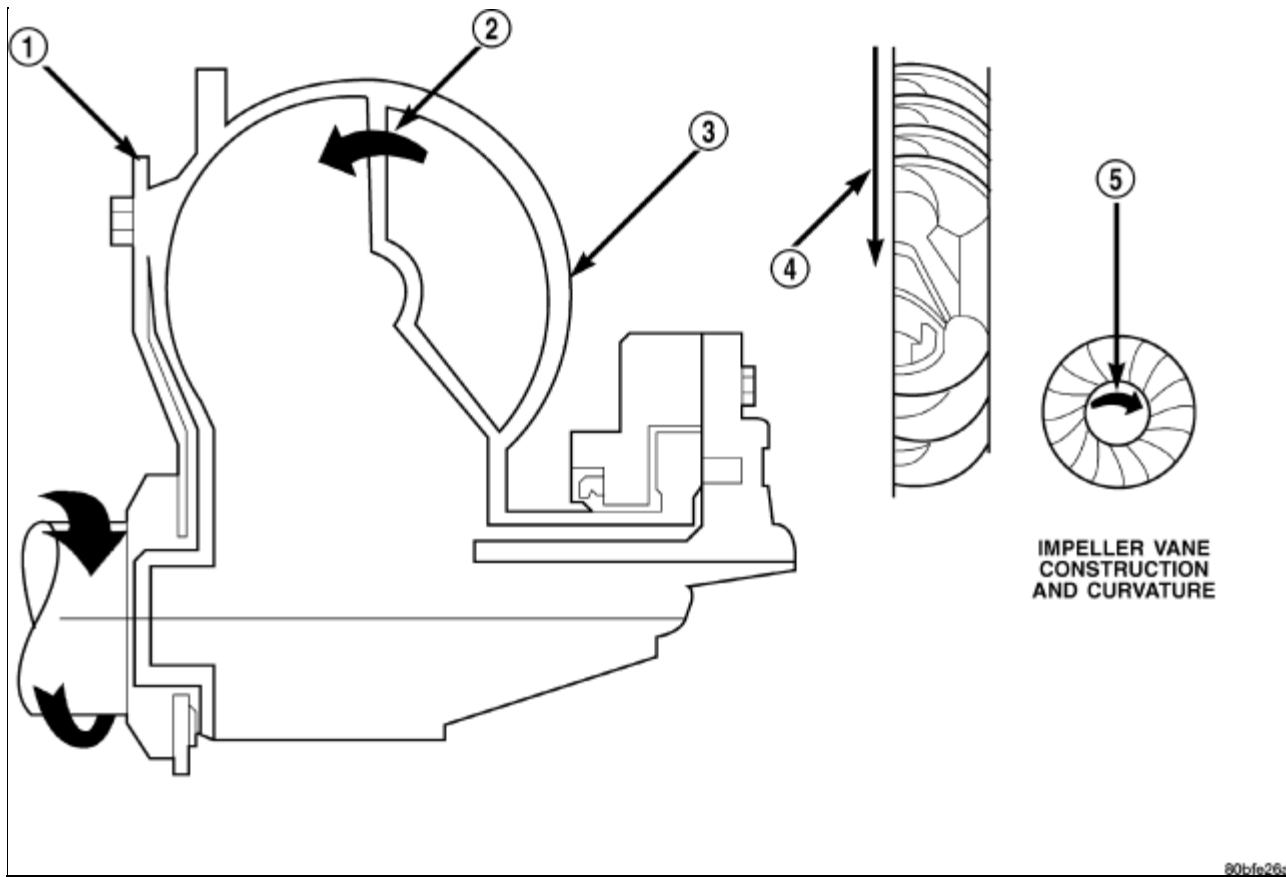
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine (1), a stator (2), an overrunning clutch, an impeller (5), and an electronically applied converter clutch (6). The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub (3) drives the transmission oil (fluid) pump and contains an o-ring seal (4) to better control oil flow.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.



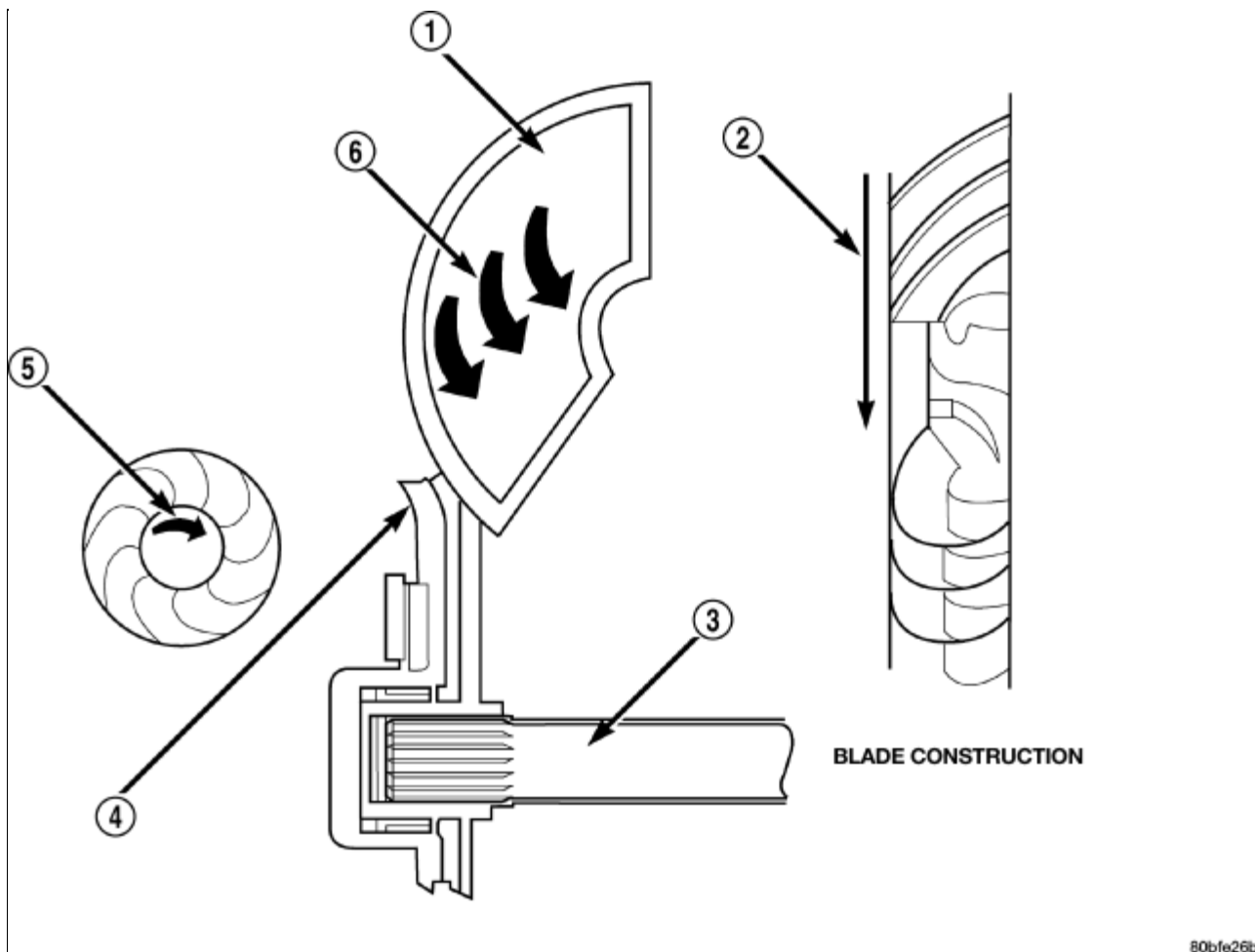
CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

IMPELLER



The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

TURBINE

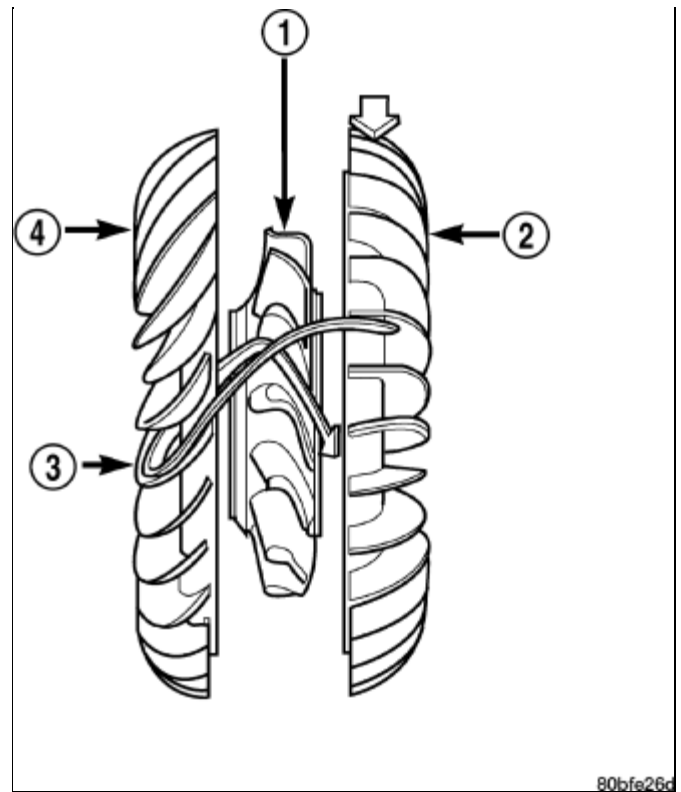


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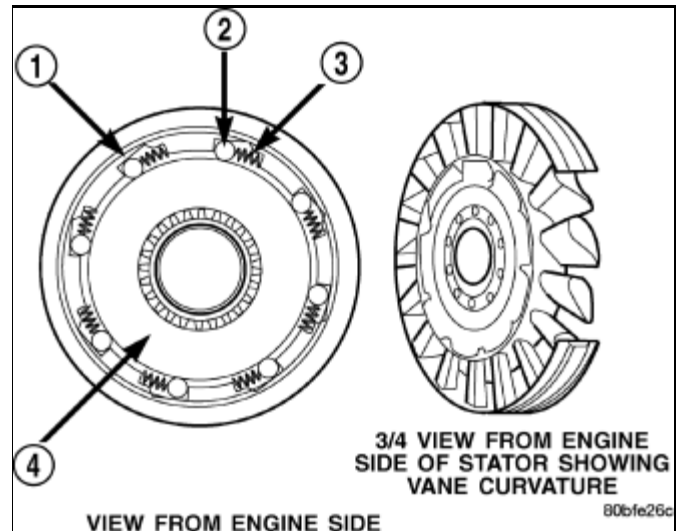
The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.



The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

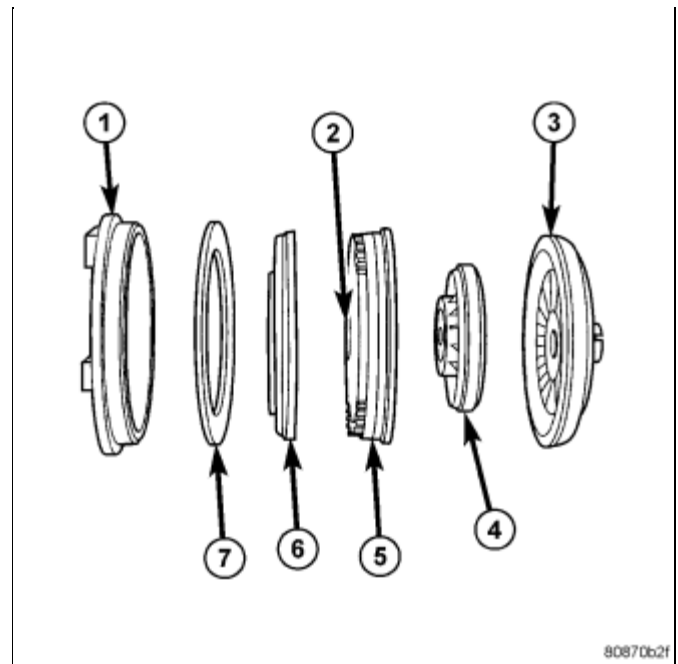


TORQUE CONVERTER CLUTCH (TCC)

The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.

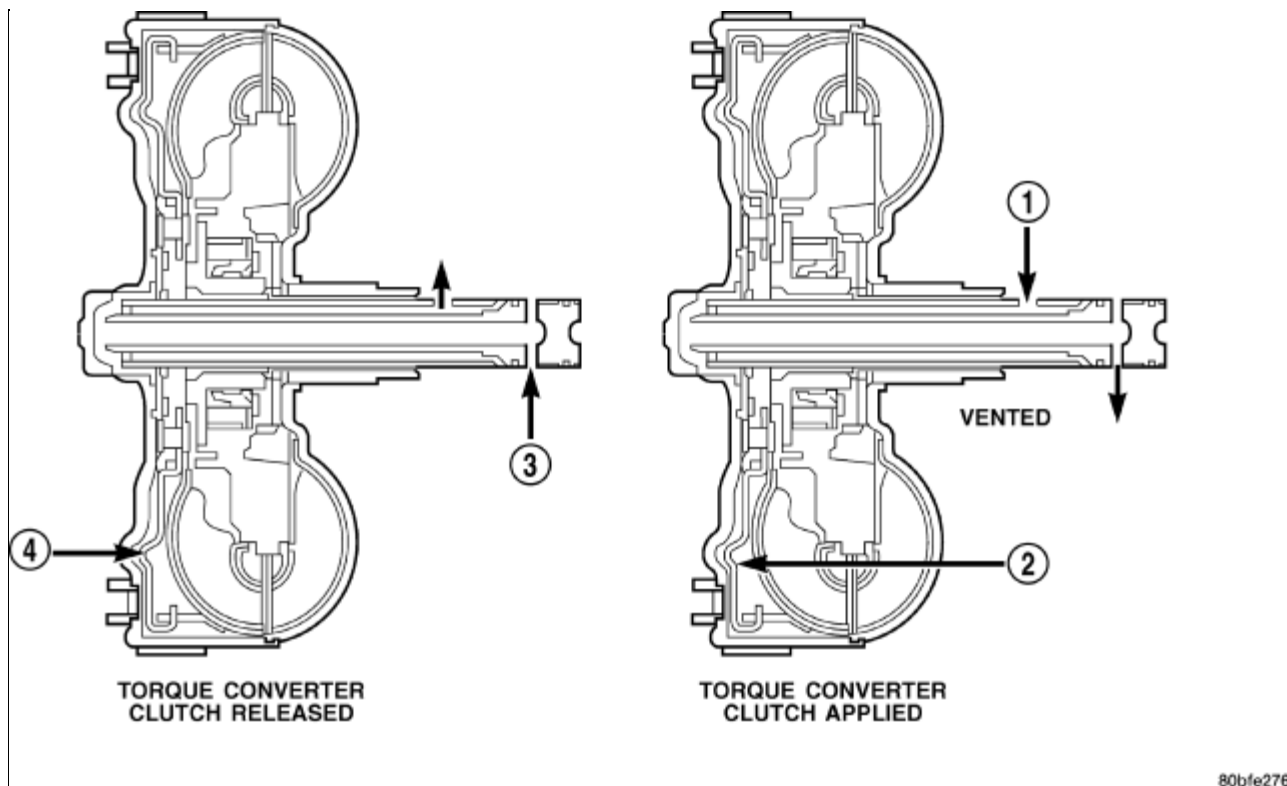
In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed



OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

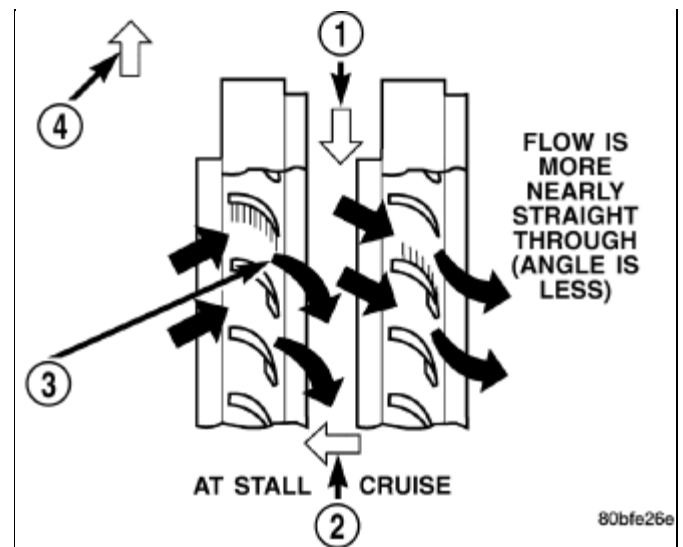


TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a “hindering” direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a “helping” direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such a way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.



TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, fourth, and fifth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

REMOVAL

1. Remove transmission and torque converter from vehicle.
2. Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

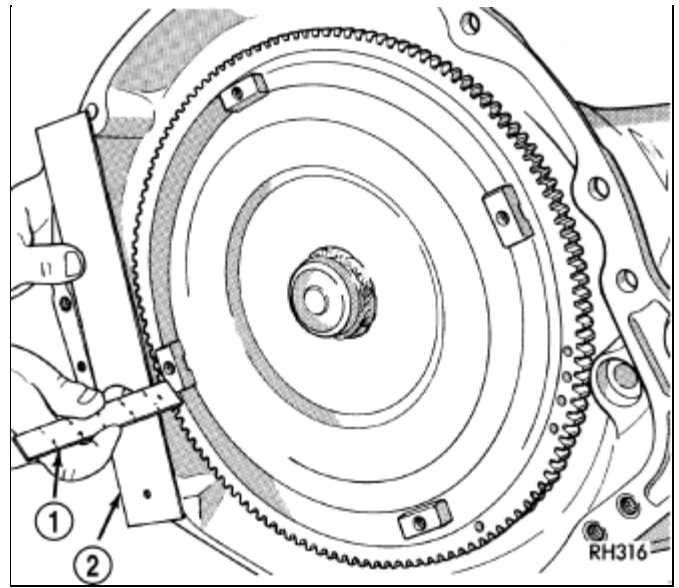
INSTALLATION

NOTE: Check converter hub and drive flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper or crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free from debris. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub o-ring while inserting torque converter into the front of the transmission.

3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be at least 13 mm (1/2



- in.) to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
 8. Install the transmission in the vehicle.
 9. Fill the transmission with the recommended fluid.

RELAY-TRANSMISSION CONTROL

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

SENSOR-TRANSMISSION RANGE

DESCRIPTION

The Transmission Range Sensor (TRS) is part of the solenoid module, which is mounted to the top of the valve body inside the transmission.

The Transmission Range Sensor (TRS) has five switch contact pins that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply +12 V to the backup lamps in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

GEAR	C5	C4	C3	C2	C1
Park	CL	OP	OP	CL	CL
Temp 1	CL	OP	OP	CL	OP
Reverse	OP	OP	OP	CL	OP
Temp 2	OP	OP	CL	CL	OP
Neutral 1	OP	OP	CL	CL	CL
Neutral 2	OP	CL	CL	CL	CL
Temp 3	OP	CL	CL	CL	OP
Drive	OP	CL	CL	OP	OP
Temp 4	OP	CL	OP	OP	OP
Manual 2	CL	CL	OP	OP	OP
Temp 5	CL	OP	OP	OP	OP
Manual 1	CL	OP	CL	OP	OP

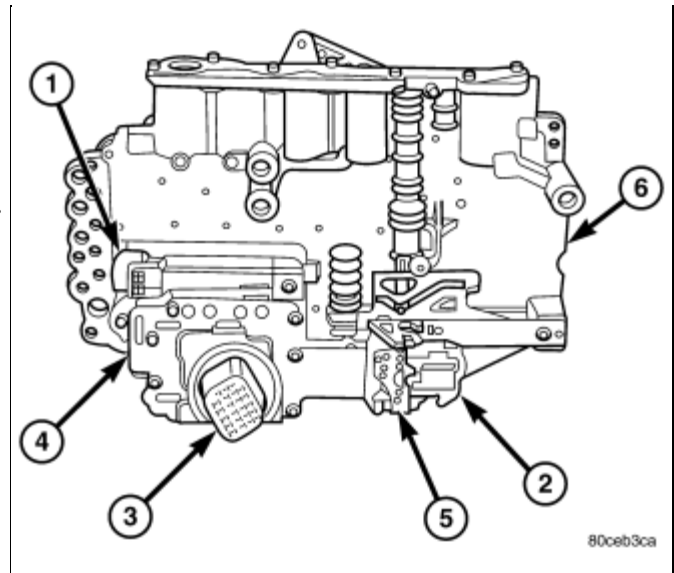
ASSEMBLY-TRANSMISSION SOLENOID/TRS

DESCRIPTION

The transmission solenoid/TRS assembly is internal to the

transmission and mounted on the valve body assembly . The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid/TRS assembly. The solenoid/TRS assembly also contains the Transmission Range Sensor (TRS) and five pressure switches that feed information to the TCM.

OPERATION



SOLENOIDS

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

PRESSURE SWITCHES

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at approximately 23 psi and open at approximately 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

GEAR	L/R	2C	4C	UD	OD
R	OP	OP	OP	OP	OP
P/N	CL	OP	OP	OP	OP

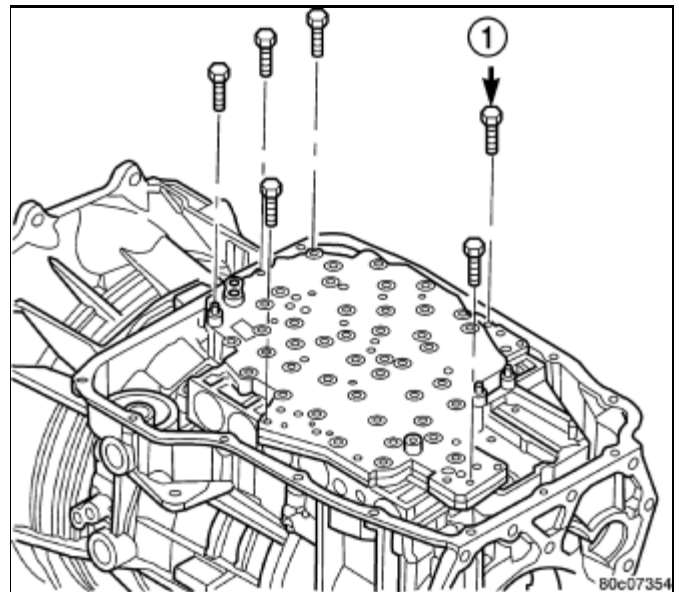
1ST	CL*	OP	OP	CL	OP
2ND	OP	CL	OP	CL	OP
2ND PRIME	OP	OP	CL	CL	OP
D	OP	OP	OP	CL	CL
4TH	OP	OP	CL	OP	CL
5TH	OP	CL	OP	OP	CL
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.					

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

REMOVAL

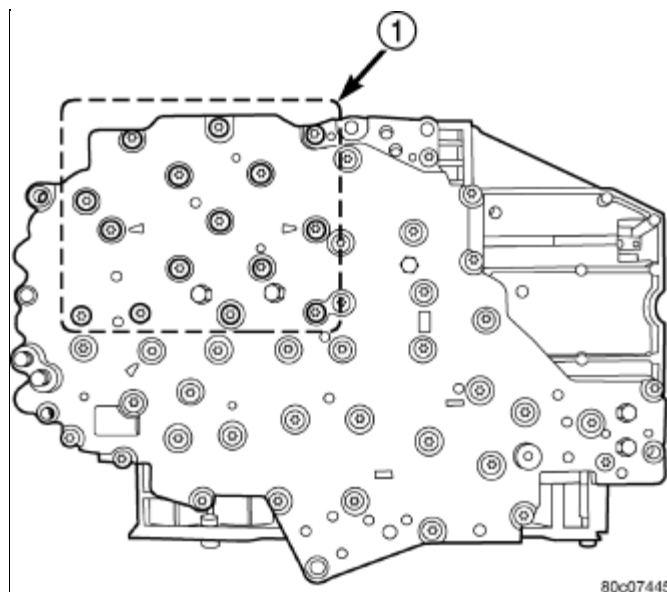
NOTE: If the Transmission Solenoid/TRS Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

1. Remove the valve body from the transmission . (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/545RFE/VALVE BODY - REMOVAL)

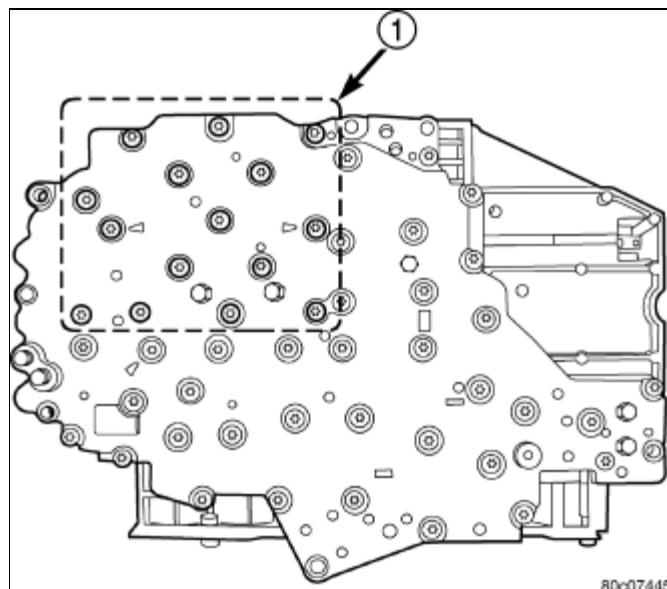


2. Remove the bolts (1) holding the transmission solenoid/TRS assembly onto the valve body .
3. Separate the transmission solenoid/TRS assembly from the valve body.

INSTALLATION



1. Place TRS selector plate in the PARK position.
2. Position the transmission solenoid/TRS assembly onto the valve body. Be sure that both alignment dowels are fully seated in the valve body and that the TRS switch contacts are properly positioned in the selector plate
3. Install the bolts (1) to hold the transmission solenoid/TRS assembly onto the valve body.
4. Tighten the solenoid assembly screws adjacent to the arrows cast into the bottom of the valve body first. Tighten the screws to 6 N·m (50 in.lbs.).
5. Tighten the remainder of the solenoid assembly screws to 6 N·m (50 in.lbs.).
6. Install the valve body into the transmission.



SENSOR-TRANSMISSION TEMPERATURE

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and converter lock up, the TCM requires this information to determine which shift schedule to operate in.

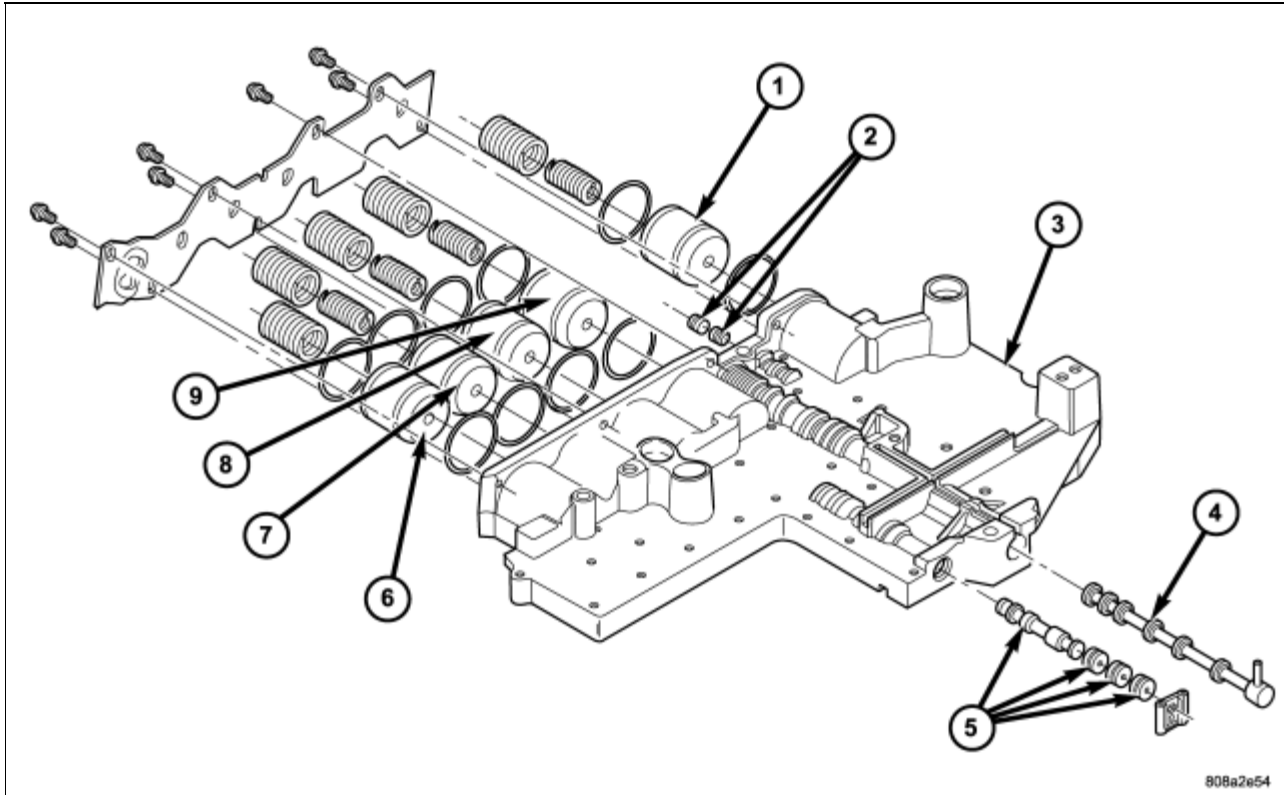
Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

BODY-VALVE

DESCRIPTION

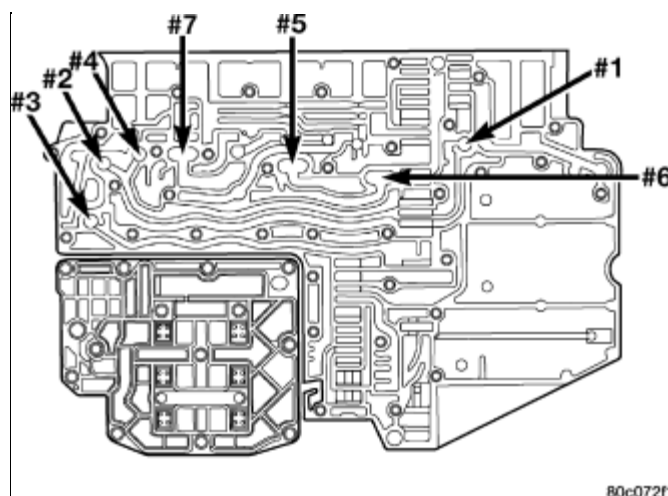


The valve body consists of a cast aluminum valve body, a separator plate, and a transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch and frictional clutches. The valve body contains the following components:

- Solenoid switch valve
- Manual valve
- Low/reverse shuttle valve
- 5 Accumulators
- 7 check balls

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.



SOLENOID SWITCH VALVE

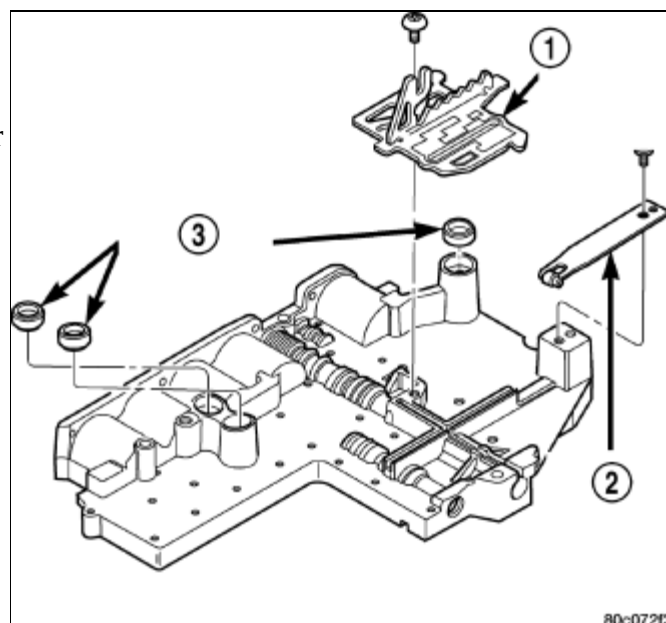
The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and fifth gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

MANUAL VALVE

The manual valve is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the top of the valve body. The valve is connected mechanically by a cable to the gearshift mechanism. The valve is held in each of its positions by a roller detent spring (2) that engages the roostercomb of the TRS selector plate (1).



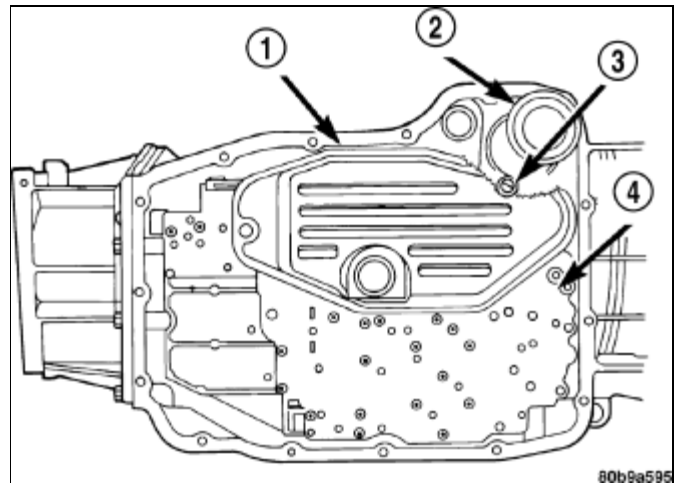
LOW/REVERSE SWITCH VALVE

The low/reverse switch valve allows the low/reverse clutch to be operated by either the LR/CC solenoid or the MS solenoid.

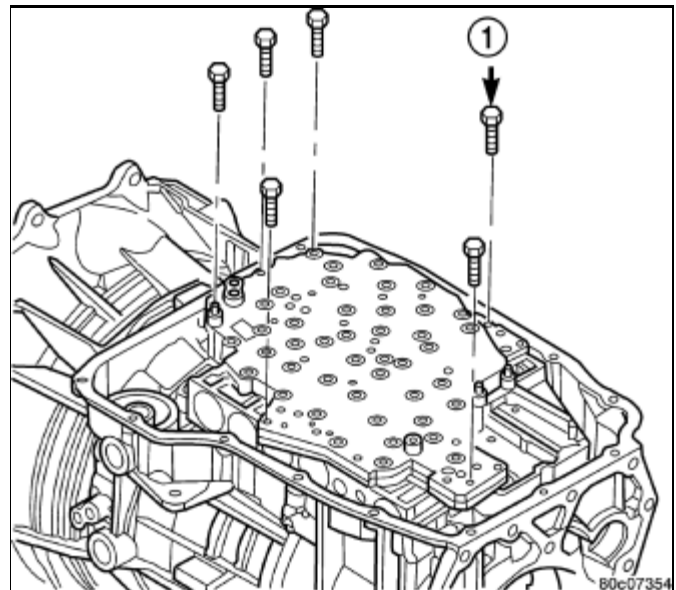
REMOVAL

NOTE: The valve body can be removed for service without having to remove the transmission assembly. The valve body can be disassembled for cleaning and inspection of the individual components. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/VALVE BODY - DISASSEMBLY)

1. Shift transmission into PARK.
2. Raise vehicle.
3. Disconnect wires at the solenoid and pressure switch assembly 23 pin electrical connector.
4. Position drain pan under transmission oil pan.
5. Remove transmission oil pan.
6. Remove the primary oil filter (1) from valve body.



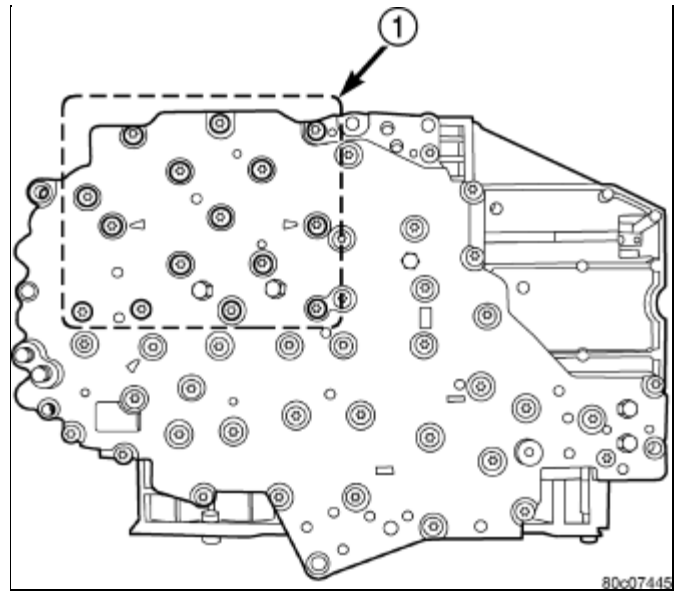
7. Remove bolts (1) attaching valve body to transmission case.
8. Lower the valve body and work the electrical connector out of transmission case.
9. Separate the valve body from the transmission.



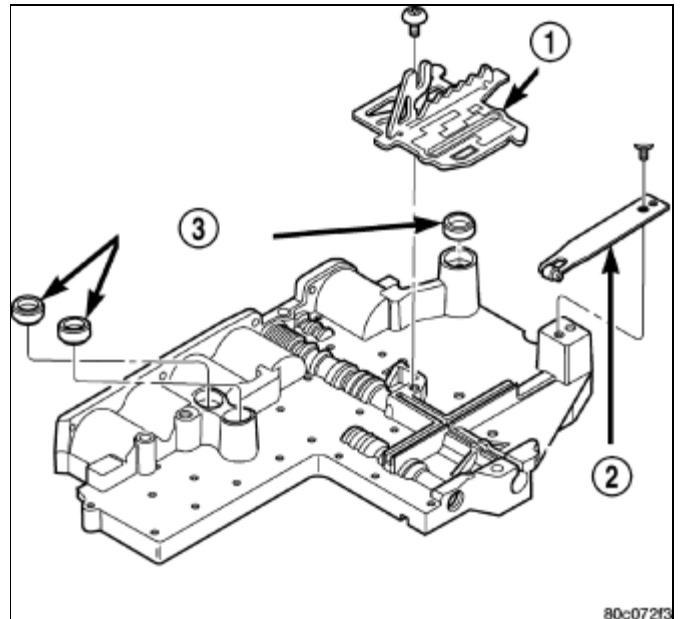
DISASSEMBLY

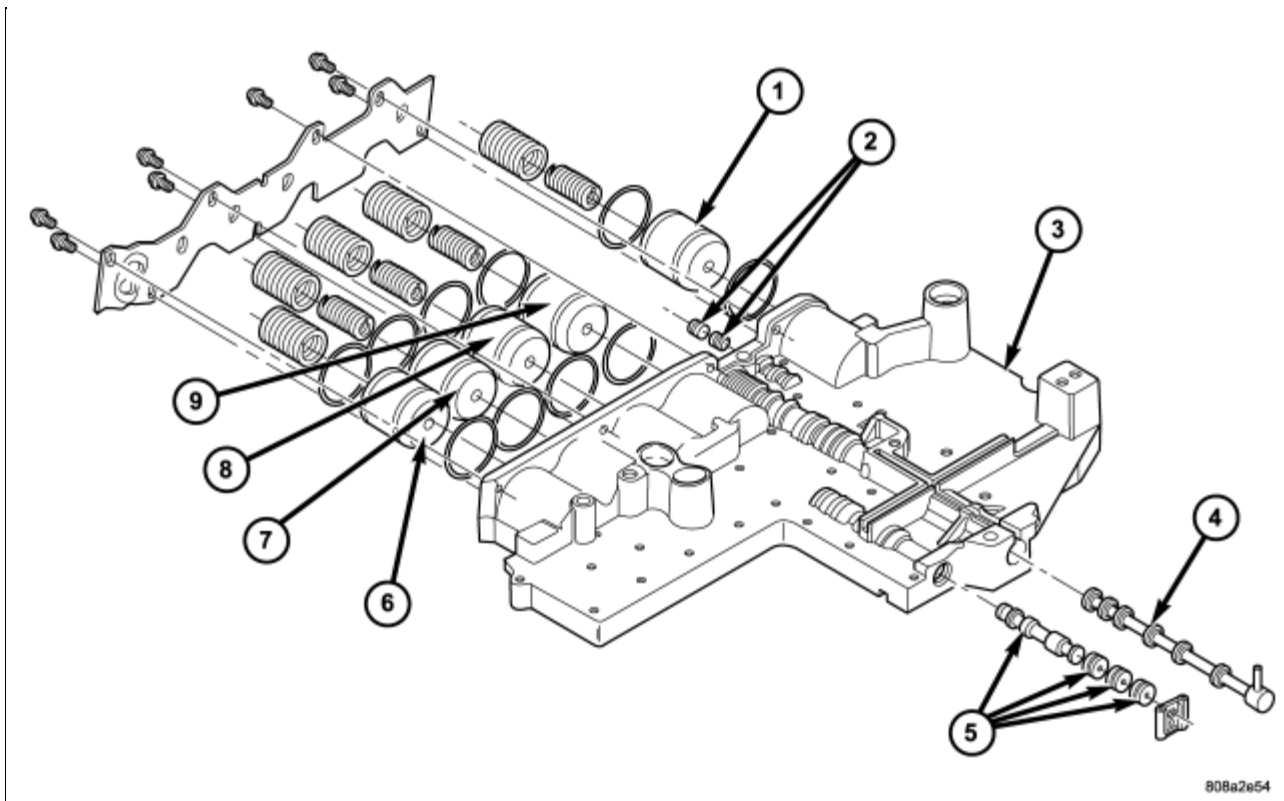
1. Remove the bolts (1) holding the solenoid and pressure switch assembly to the valve body. Do not remove the screws on the top of the solenoid and pressure switch assembly.

2. Separate the solenoid and pressure switch assembly from the valve body.



- 3. Remove the screw holding the detent spring (2) onto the valve body.
- 4. Remove the detent spring (2) from the valve body.
- 5. Remove the TRS selector plate (1) from the valve body and the manual valve.
- 6. Remove the clutch passage seals (3) from the valve body, if necessary.





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7. Remove the screws holding the accumulator cover onto the valve body .

8. Remove the accumulator springs and pistons (1, 6-9) from the valve body. Note which accumulator piston and spring belong in each location.

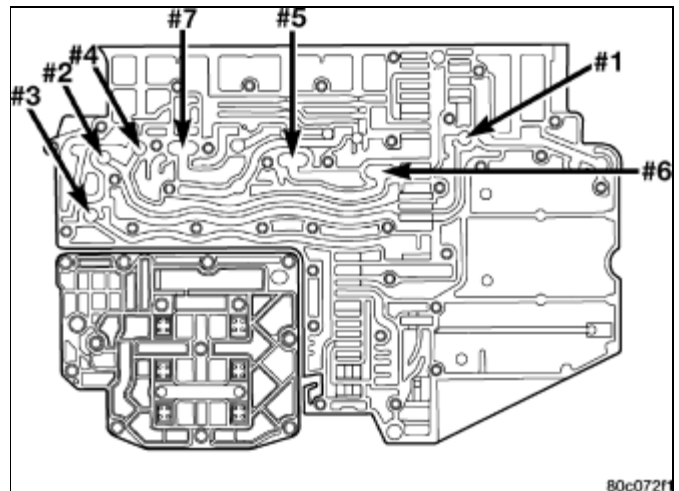
9. Place the valve body on the bench with the transfer plate upward.

NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.

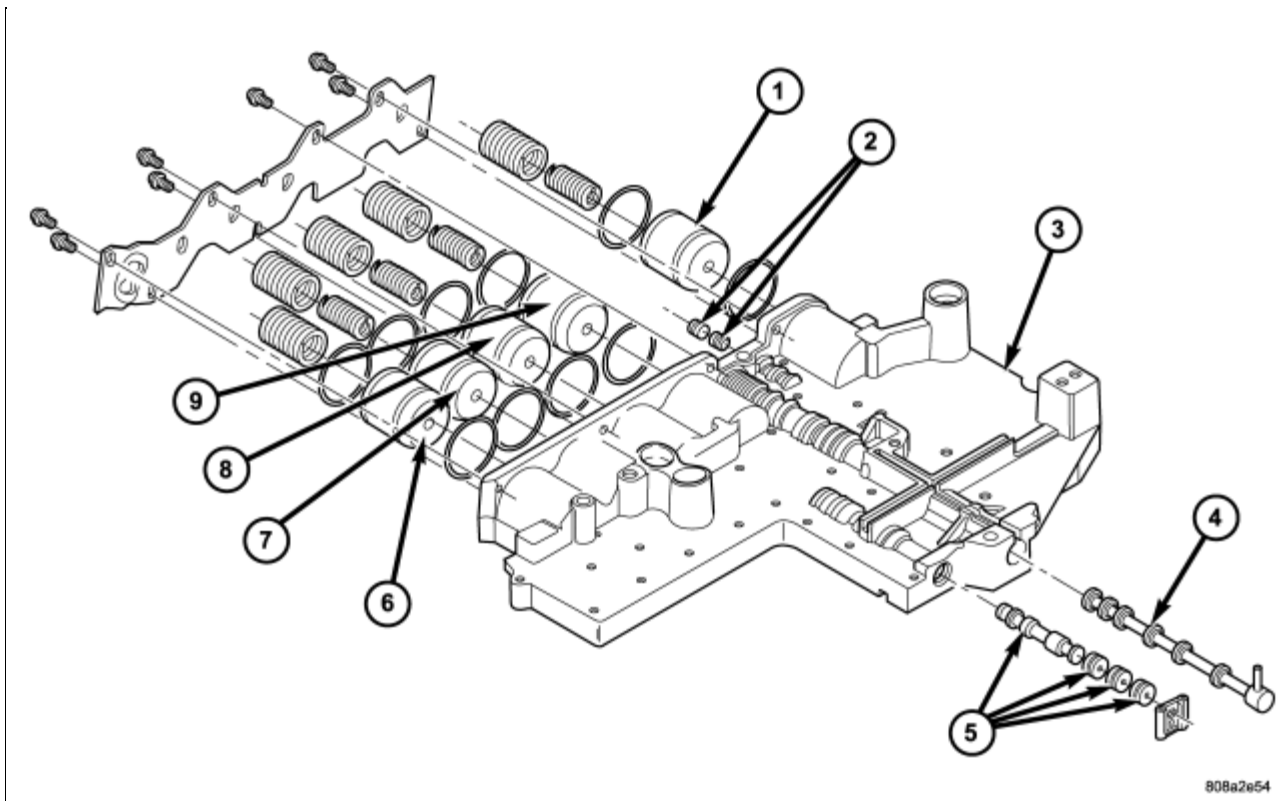
10. Remove the screws holding the valve body to the valve body transfer plate.

11. Remove the transfer plate from the valve body. Note the location of all check balls .

12. Remove the check balls from the valve body.

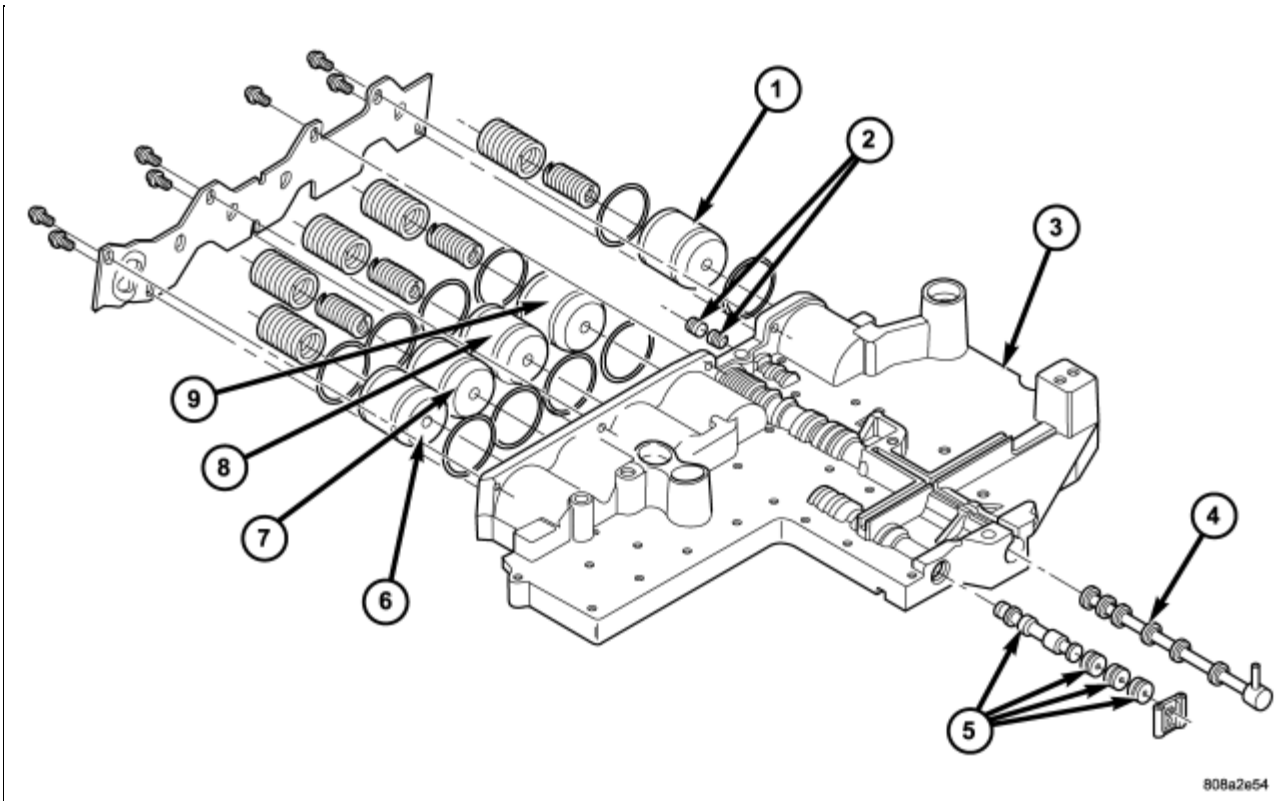


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13. Remove the retainer securing the solenoid switch valve (5) from the valve body. Remove the solenoid switch valve and plugs (5), the manual valve (4) and low reverse shuttle valve and plug (2). Tag each valve and plug combination with location information to aid in assembly.

CLEANING

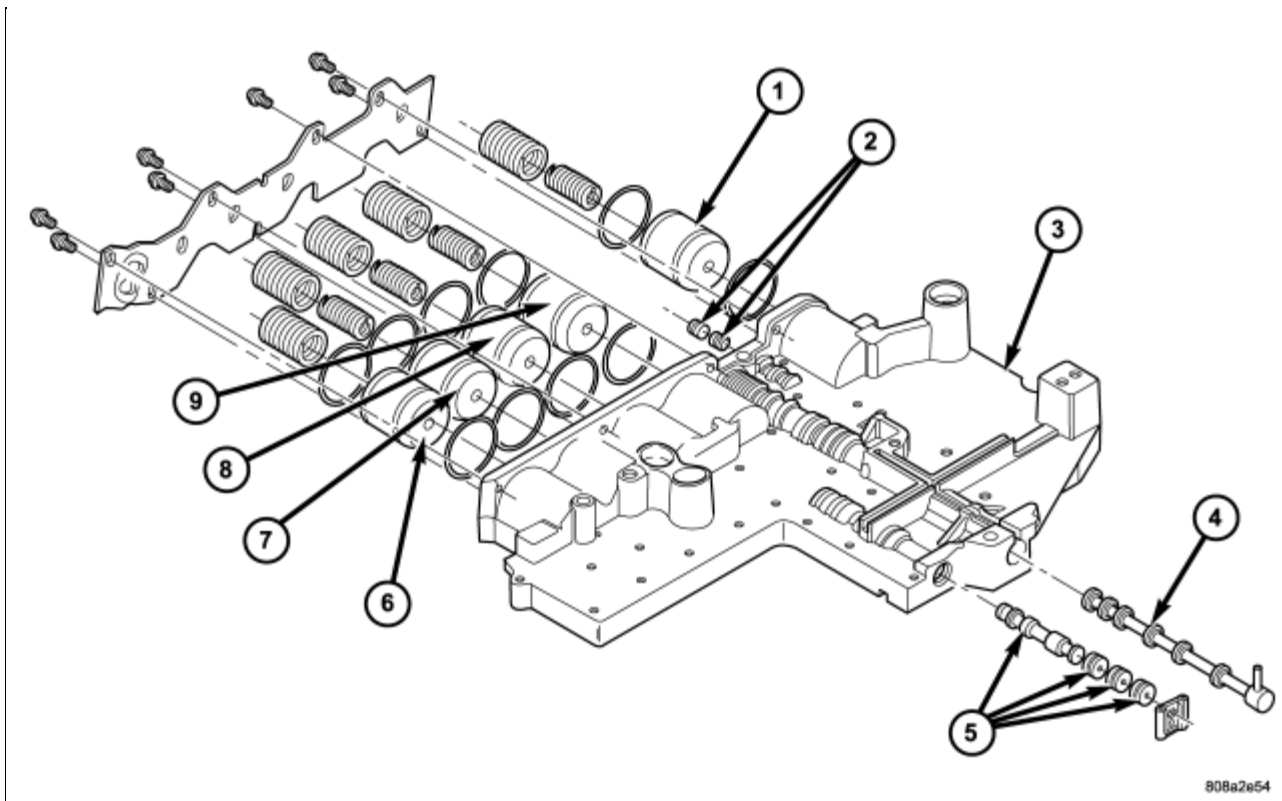


Clean the valve housings, valves, plugs, springs, and separator plate with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the electrical components by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

INSPECTION



NOTE: Only the INNER accumulator seal ring actually seals the pressure in the bore. The outer seal ring only serves to guide the piston in the bore. Gouges which do not extend past the inner seal ring (and have no raised edges, which could damage the guide ring) are acceptable. The machined accumulator bores often have a tiger-striped appearance. This is NORMAL and does NOT require replacement, as long as the bores are smooth in the inner seal ring area.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands**. Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

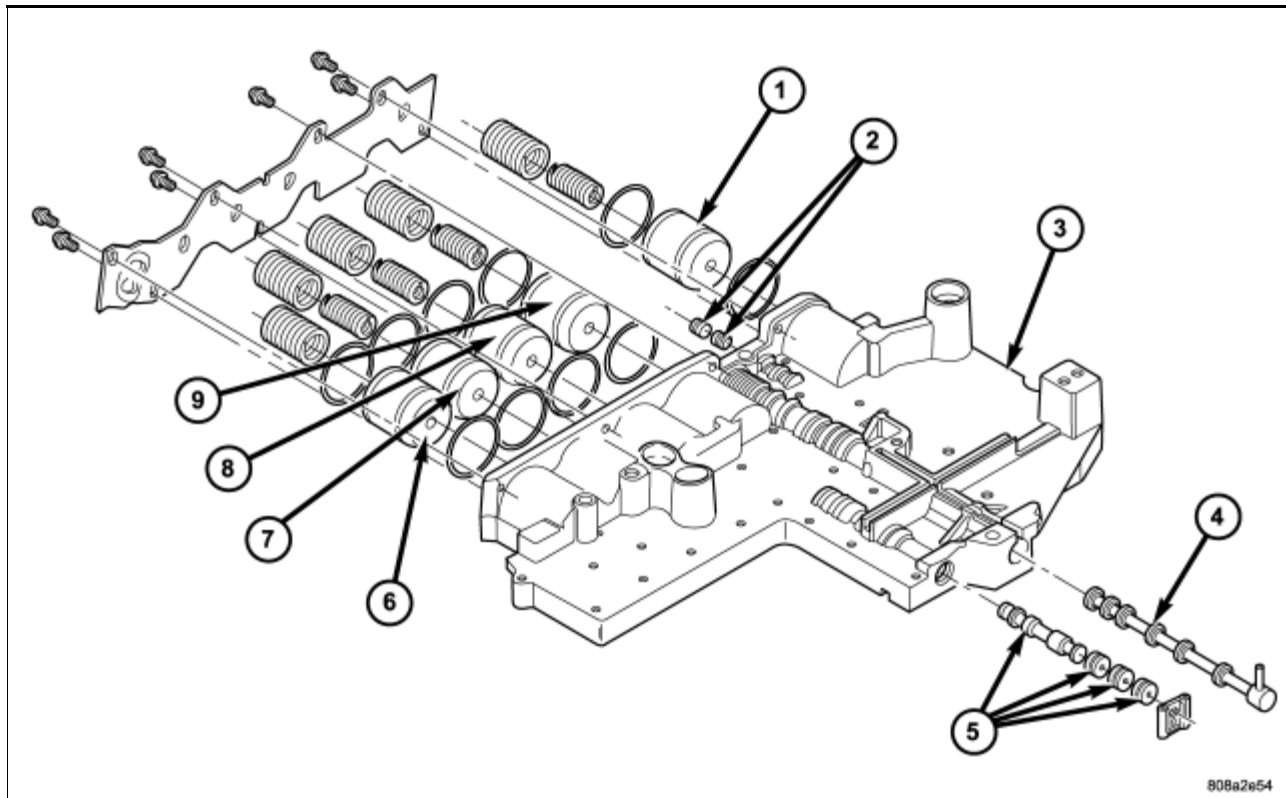
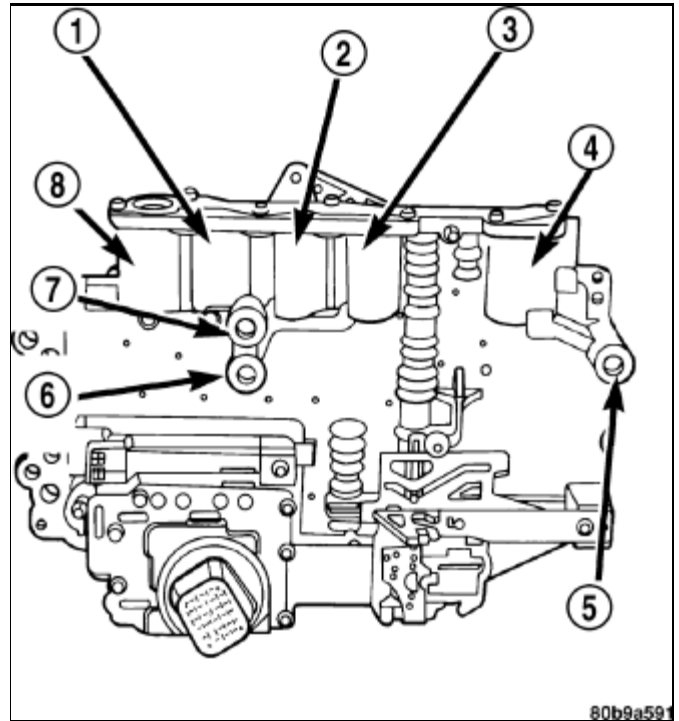
Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

Inspect all the accumulator bores in the valve body. Use a penlight to view the bore interiors. Replace the valve

body if any bores are distorted or scored. Inspect all of the accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body. Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

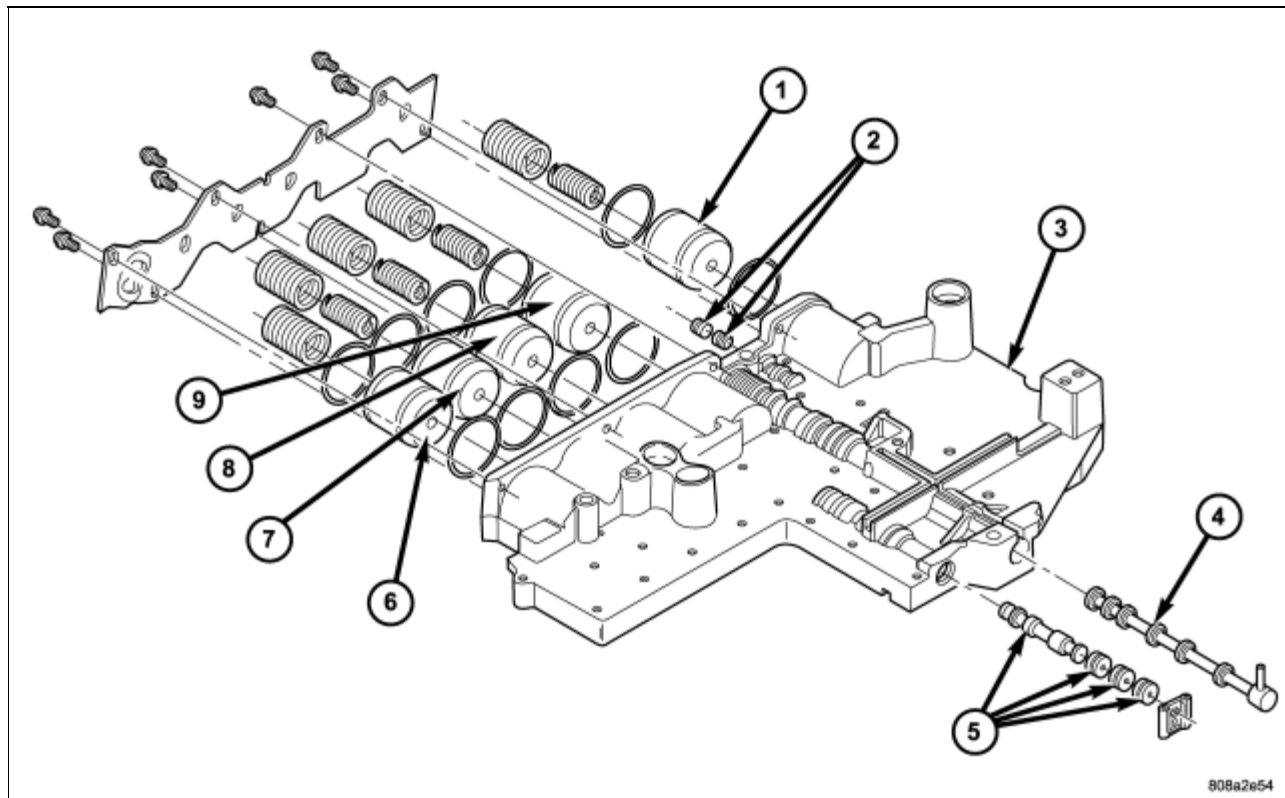
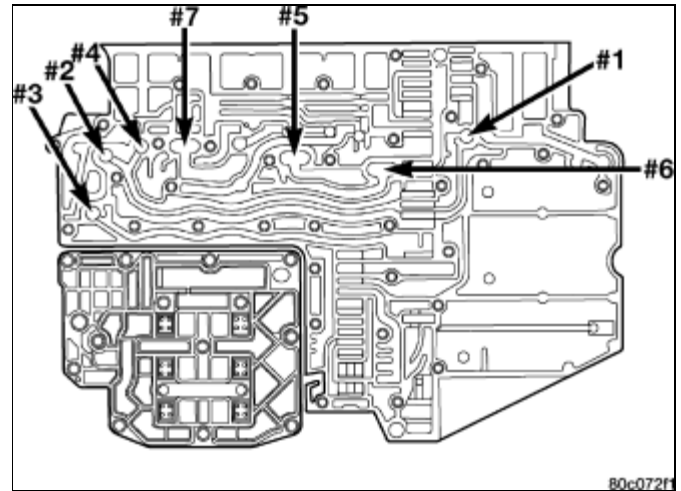
ASSEMBLY



1. Lubricate valves and the housing valve bores with clean transmission fluid.

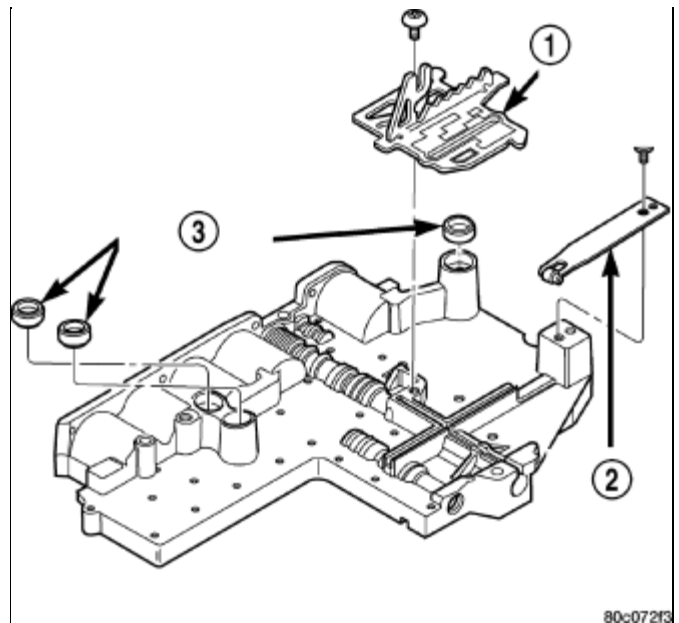
2. Install solenoid switch valve and plugs (5) and manual valve (4) into the valve body.
3. Install the retainers to hold each valve into the valve body.

4. Install the valve body check balls into their proper locations.
5. Position the separator and transfer plate onto the valve body.
6. Install the screws to hold the transfer plate to the valve body. Tighten the screws to 6 N·m (50 in. lbs.).



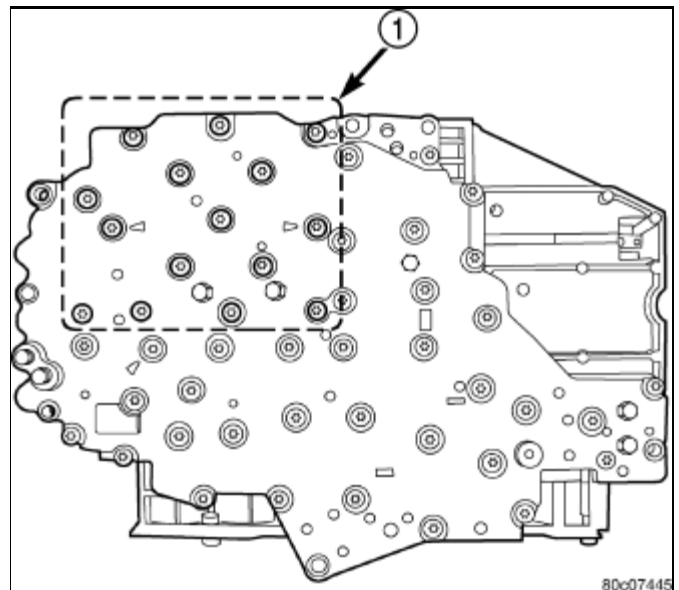
7. Install the accumulator pistons (1, 6-9) and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston (6) has only one spring.
8. Install the Low / Reverse shuttle valve, plug and retainer (2) into the valve body housing.
9. Position the accumulator cover onto the valve body.
10. Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 7 N·m (60 in. lbs.).

11. Install the TRS selector plate (1) onto the valve body and the manual valve.
12. Position the detent spring (2) onto the valve body.
13. Install the screw to hold the detent spring (2) onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).
14. Install new clutch passage seals (3) onto the valve body, if necessary.

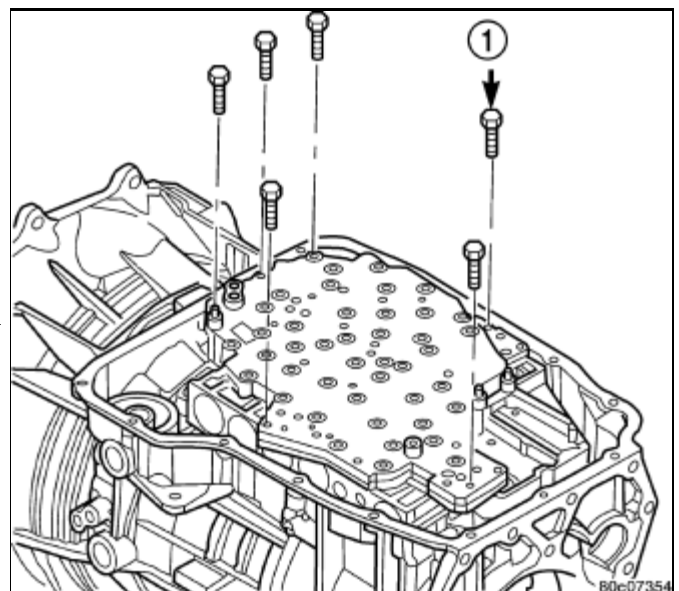


15. Install the solenoid and pressure switch assembly onto the valve body.
16. Install the bolts (1) to hold the solenoid and pressure switch assembly onto the valve body. Tighten the bolts to 6 N·m (50 in. lbs.). Tighten the bolts adjacent to the arrows cast into the bottom of the transfer plate first.

INSTALLATION

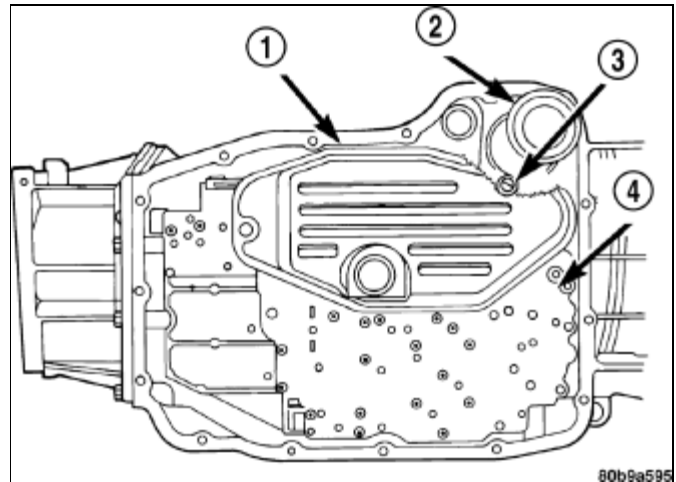


1. Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.
2. Place TRS selector plate in the PARK position.
3. Place the transmission in the PARK position.
4. Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.
5. Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.
6. Seat valve body in case and install one or two bolts to hold valve body in place.
7. Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.
8. Operate the external manual shift lever and ensure that the TRS selector plate moves correctly into all gear range



positions.

CAUTION: The primary oil filter seal **MUST** be fully installed flush against the oil pump body. **DO NOT** install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.



9. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.

10. Place replacement filter (1) in position on valve body and into the oil pump.

11. Install screw to hold filter to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.

12. Connect the solenoid and pressure switch 23 pin electrical assembly connector.

13. Install oil pan using silicone gasket sealer. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.

14. Lower vehicle and fill transmission with Mopar® ATF +4.

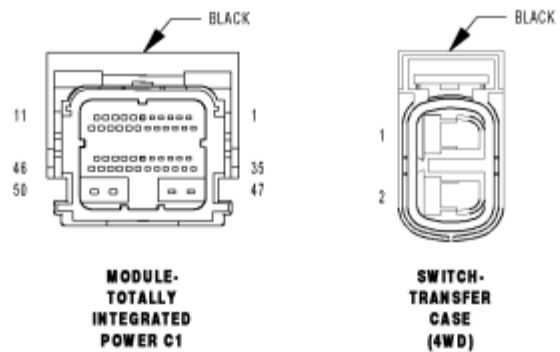
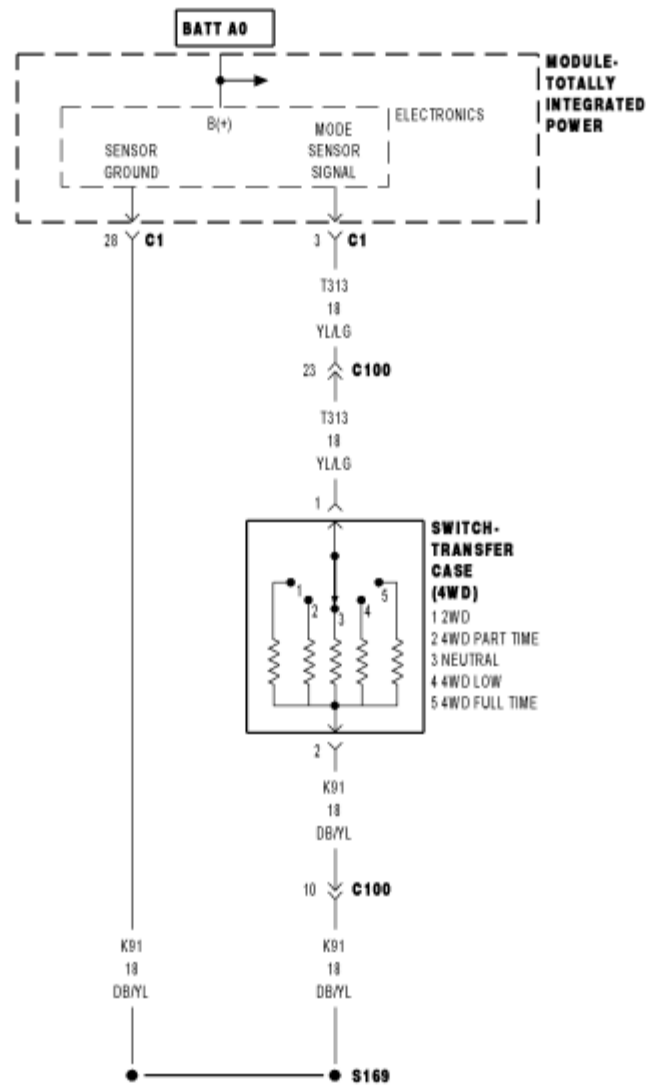
15. Check and adjust gearshift cable, if necessary.

TRANSFER CASE - ELECTRICAL DIAGNOSTICS

TRANSFER CASE - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

C1404- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT LOW



01940104

For a complete wiring diagram **Refer to Section 8W.**

◦ **When Monitored:**

Ignition on. Battery voltage between 9.0 and 16.0 volts.

◦ **Set Condition:**

The TIPM detects a short to ground on the Transfer Case Position Sensor Signal circuit for 2.0 seconds.

Possible Causes
(T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO (K91) SENSOR GROUND CIRCUIT
TRANSFER CASE (4WD) SWITCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. T-CASE POSITION SENSOR VOLTAGE BELOW 0.2 VOLTS

Ignition on, engine not running.

With the scan tool under TIPM, read the T-Case Position Sensor voltage.

Is the voltage below 0.2 volts?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. (T313) MODE SENSOR SIGNAL CIRCUIT VOLTAGE BELOW 4.9 VOLTS

Turn the ignition off to the lock position.

Disconnect the Transfer Case (4WD) Switch harness connector.

Ignition on, engine not running.

Measure the voltage of the (T313) Mode Sensor Signal circuit and the (K91) Sensor Ground at the Transfer Case

(4WD) Switch harness connector.

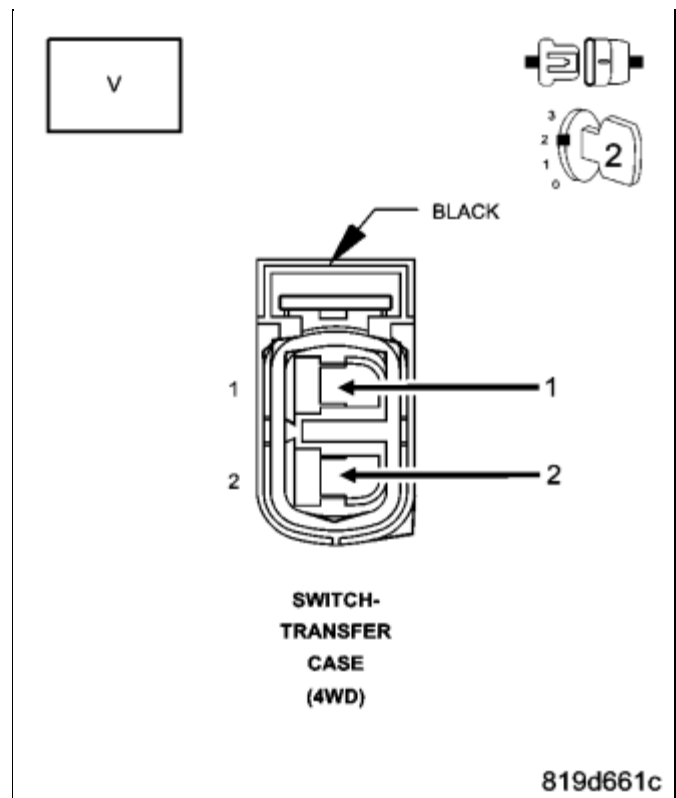
Is the voltage below 4.9 volts?

Yes

- Go To [3](#)

No

- Replace the Transfer Case (4WD) Switch in accordance with the Service Manual.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)



3. (T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off to the lock position.
Disconnect the TIPM C1 harness connector.
Measure the resistance between ground and the (T313) Mode Sensor Signal circuit at the Transfer Case (4WD) Switch harness connector.

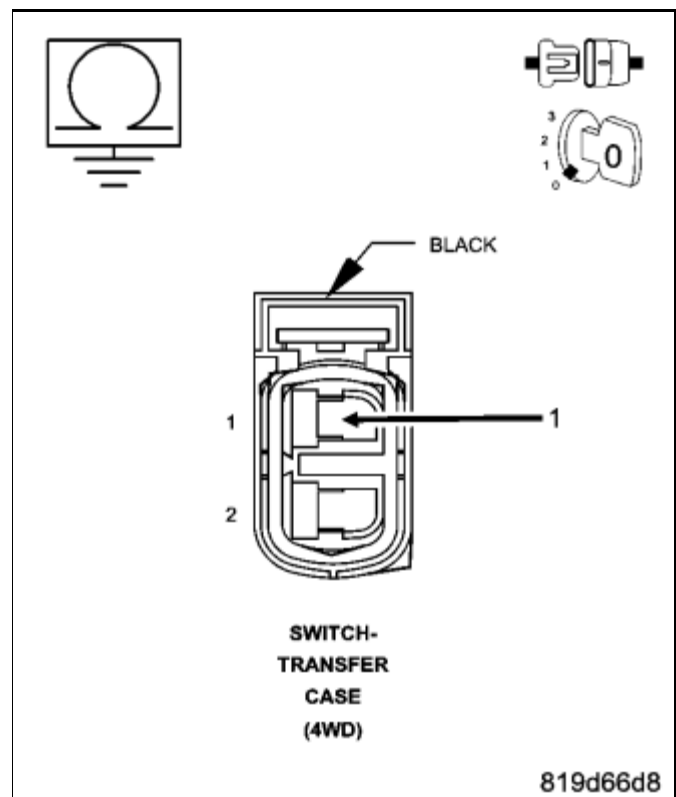
Is the resistance below 5.0 ohms?

Yes

- Repair the (T313) Mode Sensor Signal circuit for a short to ground.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO (K91) SENSOR GROUND CIRCUIT

Measure the resistance between the (T313) Mode Sensor Signal circuit and the (K91) Sensor Ground circuit at the Transfer Case (4WD) Switch harness connector.

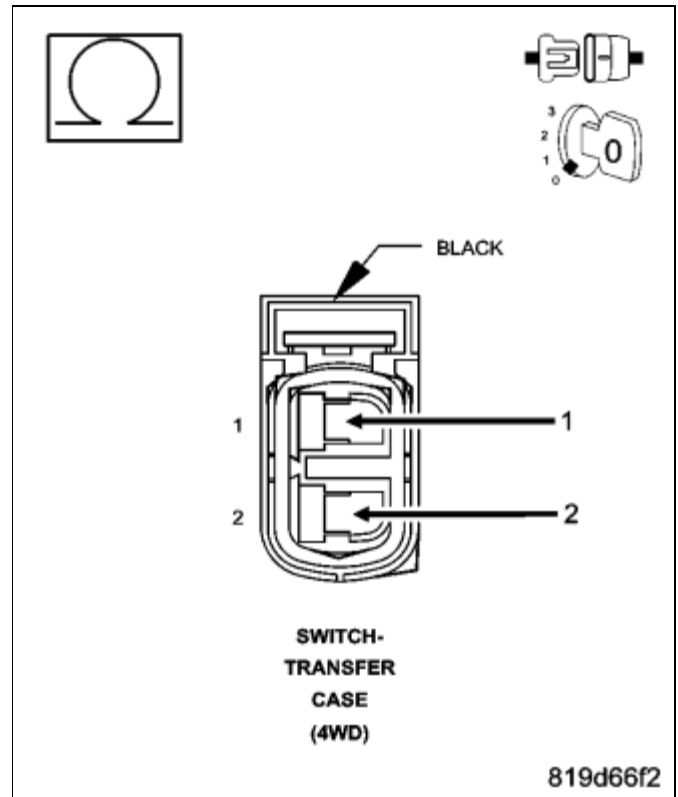
Is the resistance below 5.0 ohms?

Yes

- Repair the (T313) Mode Sensor Signal circuit for a short to the (K91) Sensor Ground circuit.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with the Service Information.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)



5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors. Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

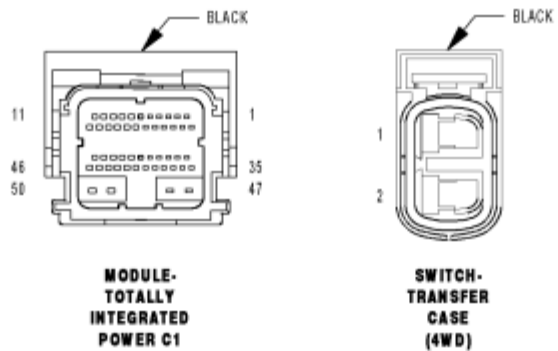
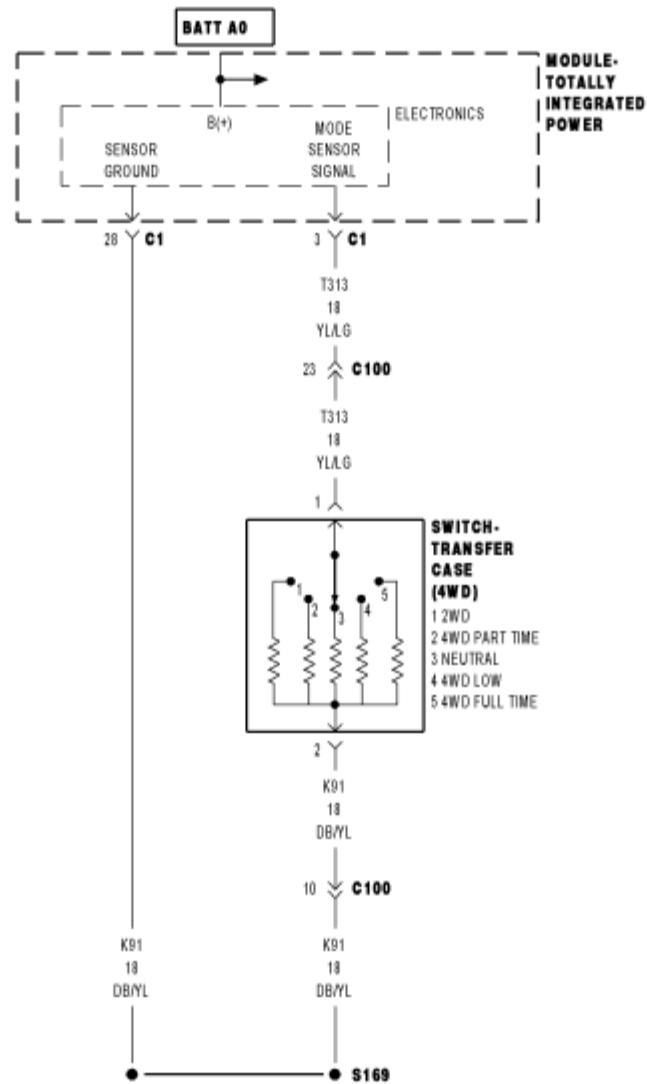
Yes

- Repair as necessary.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer To 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Test complete.

C1405- TRANSFER CASE RANGE POSITION SENSOR CIRCUIT HIGH



01940104

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on. Battery voltage between 9.0 and 16.0 volts

◦ **Set Condition:**

The TIPM detects 5.0 volts on the Transfer Case Range Position Sensor Signal circuit for 2.0 seconds when voltage should not be present.

Possible Causes
(T313) MODE SENSOR SIGNAL CIRCUIT OPEN
(K91) SENSOR GROUND CIRCUIT OPEN
(T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
TRANSFER CASE (4WD) SWITCH
TOTALLY INTEGRATED POWER MODULE (TIPM)

Diagnostic Test

1. T-CASE POSITION SENSOR VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

With the scan tool under TIPM, read the T-Case Position sensor voltage.

Is the voltage above 4.8 volts?

Yes

- Go To [2](#)

No

- Go To [7](#)

2. (T313) MODE SENSOR SIGNAL CIRCUIT VOLTAGE

Turn the ignition off to the lock position.

Disconnect the Transfer Case (4WD) Switch harness connector.

Ignition on, engine not running.
Measure the voltage of the (T313) Mode Sensor Signal circuit and the (K91) Sensor Ground at the Transfer Case (4WD) Switch harness connector.

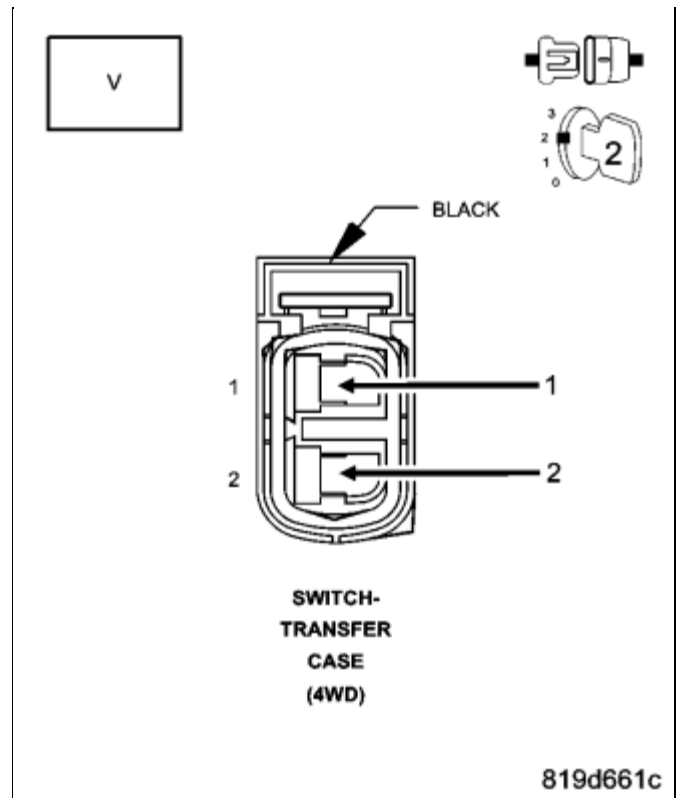
Is the voltage between 4.8 and 5.2 volts?

Yes

- Replace the Transfer Case (4WD) Switch in accordance with the Service Manual.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Go To [3](#)



3. (T313) MODE SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.
Disconnect the TIPM C1 harness connector.
Measure the resistance of the (T313) Mode Sensor Signal circuit between the Transfer Case (4WD) Switch harness connector and the TIPM C1 harness connector.

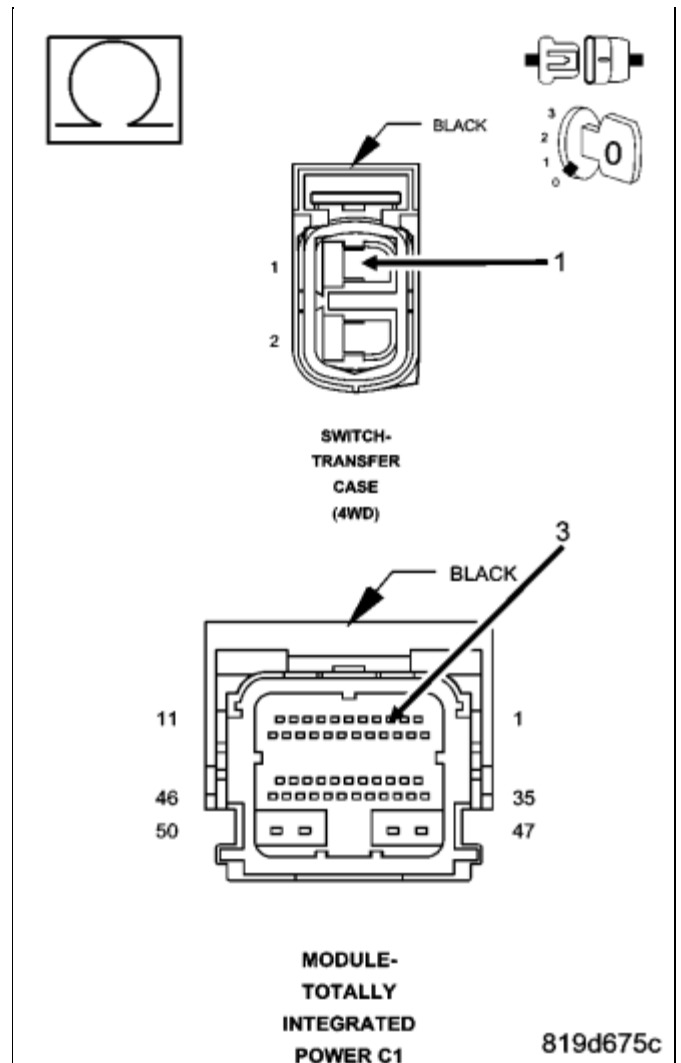
Is the resistance above 5.0 ohms?

Yes

- Repair the (T313) Mode Sensor Signal circuit for an open.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Go To [4](#)



4. (K91) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K91) Sensor Ground circuit between the Transfer Case (4WD) Switch harness connector and the TIPM C1 harness connector.

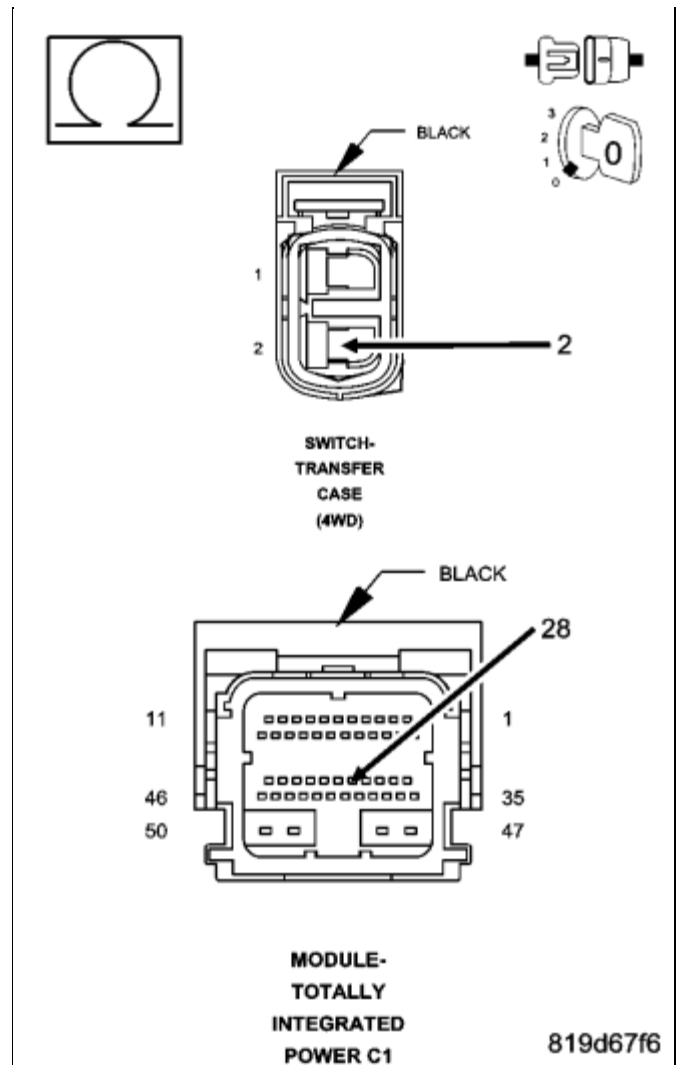
Is the resistance above 5.0 ohms?

Yes

- Repair the (K91) Sensor Ground circuit for an open.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Go To [5](#)



5. (T313) MODE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Ignition on, engine not running.
Measure the voltage of the (T313) Mode Sensor Signal circuit at the Transfer Case (4WD) Switch harness connector.

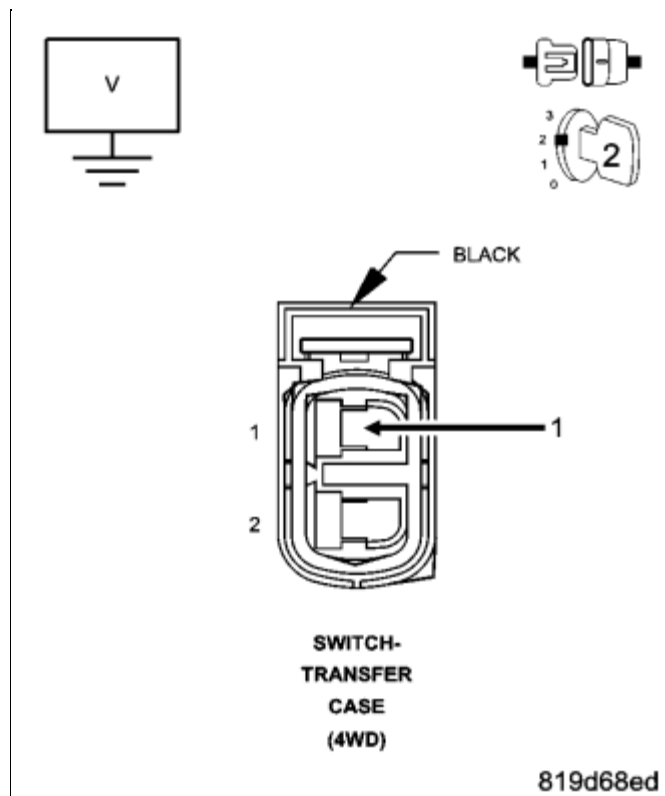
Is the voltage above 0.2 volts?

Yes

- Repair the (T313) Mode Sensor Signal circuit for a short to voltage.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Go To [6](#)



6. (K91) SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage of the (K91) Sensor Ground circuit at the Transfer Case (4WD) Switch harness connector.

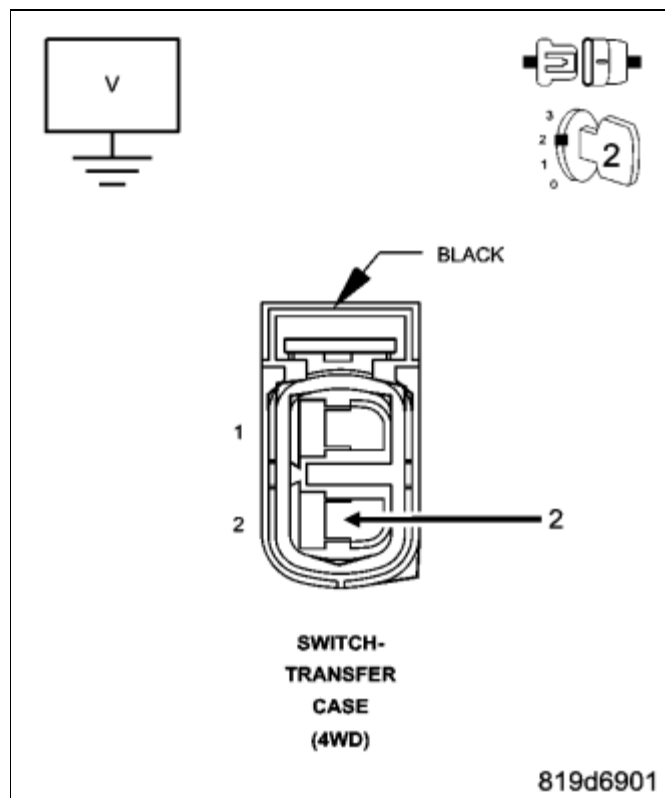
Is the voltage above 0.2 volts?

Yes

- Repair the (K91) Sensor Ground circuit for a short to voltage.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Replace the Totally Integrated Power Module in accordance with the Service Information.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)



7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
 Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.
 While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.
 Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSFER CASE VERIFICATION TEST. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - STANDARD PROCEDURE)

No

- Test complete.

STANDARD PROCEDURE

TRANSFER CASE VERIFICATION TEST VER 1

Diagnostic Test

1. TRANSFER CASE VERIFICATION TEST— VER 1

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.
 With the scan tool, select Clear Stored DTCs.
 Make sure that all accessories are turned off and that the battery is fully charged.
 Test drive the vehicle in each Transfer Case range and verify proper operation in each range.

NOTE: To shift into 4LO (if equipped), vehicle speed must be below 3 M.P.H. (5 KM/H) with the ignition ON and the transmission in neutral (auto trans).

NOTE: To shift the Transfer Case into Neutral, vehicle speed must be 0 M.P.H. with the ignition ON, engine OFF, the brake pedal applied, and the transmission in neutral (auto trans). Shift the Transfer Case until the Neutral Indicator is illuminated solidly and the cluster displays '4WD System in Neutral'.

WARNING: Apply the parking brake. The vehicle may roll with the Transfer Case in neutral.

NOTE: To verify that the Transfer Case is in Neutral, shift the automatic transmission into reverse and release the brake pedal for three seconds. There should be no vehicle movement if the Transfer Case is in

Neutral.

With the scan tool, select View DTCs in the Final Drive Control Module.

Are there any DTCs present in the Final Drive Control Module?**Yes**

- Return to the symptom list and perform the appropriate diagnostic test.

No

- Repair is complete.
-

TRANSFER CASE - NV241 GENII**TRANSFER CASE - NV241 GENII****DESCRIPTION**

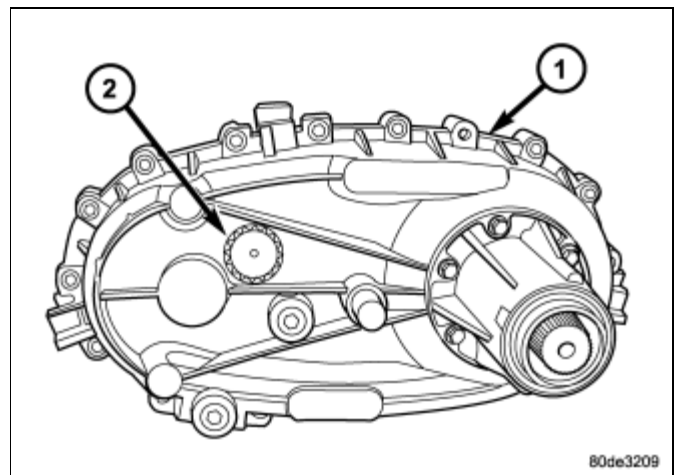
The NV241 GENII transfer case is a part-time transfer case with a low-range gear system. It provides three operating ranges plus a NEUTRAL position. The low range position provides a gear reduction ratio of 2.72:1 for increased low speed torque capability.

The gear cases and extension are all of aluminum. Drive sprockets and an interconnecting drive chain are used to transmit engine torque to the front/rear propeller shafts. The mainshaft, input gear and front output shaft are supported by ball and needle bearings.

IDENTIFICATION

An identification tag (2) is attached to the rear case of every transfer case. The tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

OPERATION**OPERATING RANGE**

Transfer case operating ranges are:

- 2H (2-wheel drive)
- 4H (4-wheel drive)
- 4LO (4-wheel drive low range)

The 2H range is for use on any road surface at any time.

The 4H and 4LO ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is covered by ice and snow.

The low range reduction gear system is operative in 4LO range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by a shift cable. A straight line shift pattern is used. Range positions are marked on the shifter knob bezel.

SHIFTING

The transfer case can be shifted between the 2H and 4H operating ranges while the vehicle is in motion. The vehicle must have the transmission placed in NEUTRAL, or the clutch depressed in the case of a manual transmission, and be moving less than 2-3 MPH when shifting into and out of the 4L operating range.

DIAGNOSIS AND TESTING - TRANSFER CASE - NV241 GENII

Before beginning repair on a suspected transfer case malfunction, check all other driveline components beforehand.

The actual cause of a problem may be related to such items as: front hubs, axles, propeller shafts, wheels and tires, transmission, or clutch instead. If all other driveline components are in good condition and operating properly, refer to the Diagnosis Chart for further information.

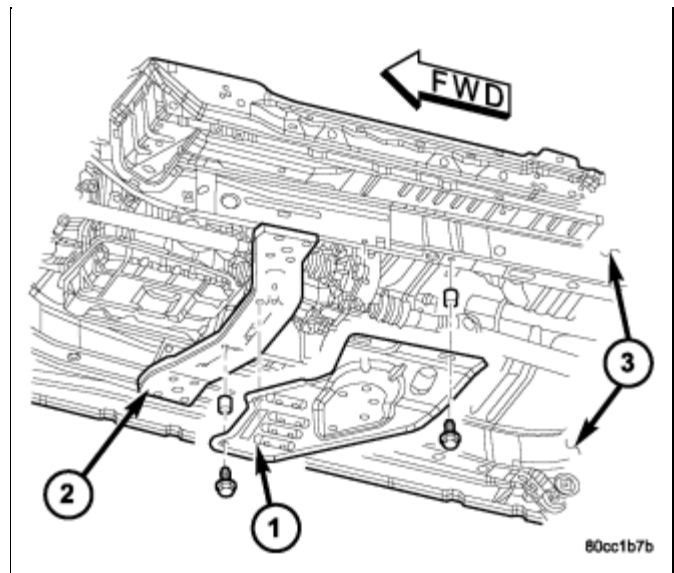
DIAGNOSIS CHART

Condition	Possible Cause	Correction
Transfer Case difficult to shift or will not shift into desired range.	1) Vehicle speed too great to permit shifting.	1) Stop vehicle and shift into desired range. Or, reduce speed to below 3-4 km/h (2-3 mph) before attempting the shift.
	2) If vehicle was operated for an extended period in 4H on a dry paved surface, the driveline torque load may be causing a bind.	2) Stop vehicle and shift the transmission into neutral. Shift the transfer case to 2H and operate vehicle in 2H on dry paved surfaces.

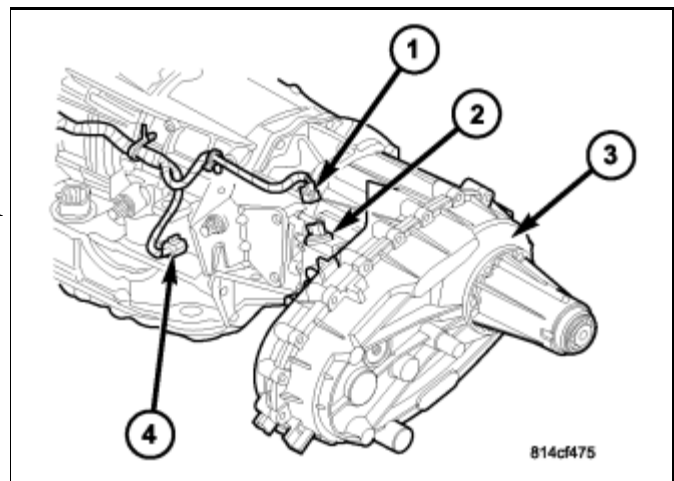
	3) Transfer case external shift linkage binding.	3) Lubricate, repair, or replace linkage bushings, or tighten loose components as necessary.
	4) Insufficient or incorrect lubricant.	4) Drain and refill to edge of fill hole with Mopar® ATF +4, Automatic Transmission fluid.
	5) Internal components binding, worn, or damaged.	5) Disassemble the transfer case and replace worn or damaged components as necessary.
Transfer Case noisy in all operating ranges.	1) Insufficient or incorrect lubricant.	1) Drain and refill to edge of fill hole with Mopar® ATF +4, Automatic Transmission fluid.
Noisy in, or jumps out of, four wheel drive low range.	1) Transfer case not completely engaged in 4L position.	1) With the transmission in NEUTRAL, or the clutch depressed in the case of a manual transmission and the vehicle moving under 3-4 km/h (2-3 mph), shift the transfer case to NEUTRAL and then shift into the 4L position.
	2) Shift linkage out of adjustment.	2) Adjust linkage.
	3) Shift linkage loose or binding.	3) Tighten, lubricate, or repair linkage as necessary.
	4) Range fork damaged, inserts worn, or fork is binding on the shift rail.	4) Disassemble unit and repair as necessary.
	5) Low range gear worn or damaged.	5) Disassemble unit and repair as necessary.
Lubricant leaking from output shaft seal or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Vent closed or restricted.	2) Clear or replace vent as necessary.
	3) Output shaft seals damaged or installed incorrectly.	3) Replace seal as necessary. Check to ensure that another component, the propeller shaft slip yoke for example, is not causing damage to seal.
Abnormal tire wear.	1) Extended operation on hard, dry surfaces in the 4H position.	1) Operate vehicle in the 2H position on hard, dry surfaces.

REMOVAL

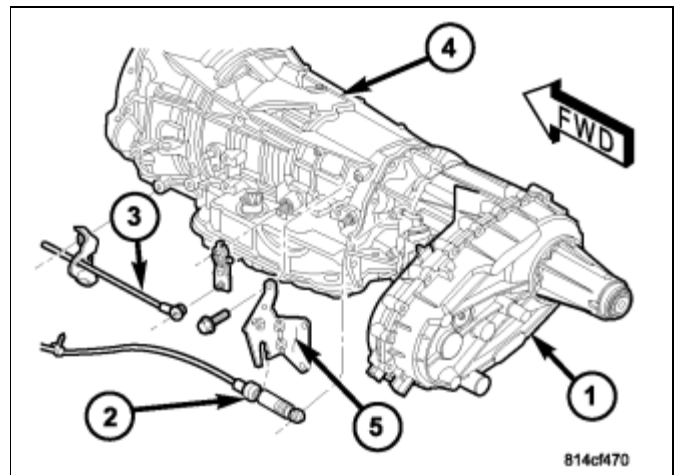
1. Shift transfer case into NEUTRAL.
2. Raise vehicle.
3. Remove skid plate (1).



4. Drain transfer case lubricant.
5. Mark front and rear propeller shaft yokes for alignment reference.
6. Remove the front/rear propeller shafts at transfer case.
(Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect transfer case position sensor connector (1) from the position sensor (2).



8. Disconnect transfer case shift cable (2) at the range lever.
9. Disconnect the transfer case shift cable (2) from the shift cable bracket (5).



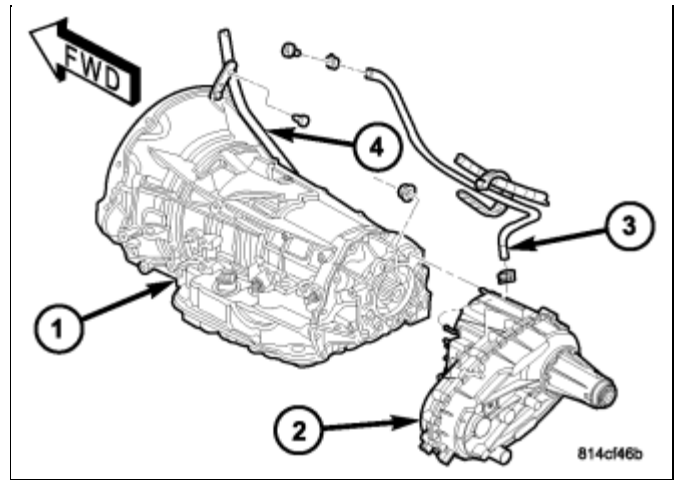
10. Disconnect transfer case vent hose (3).
11. Support transfer case (2) with transmission jack.
12. Secure transfer case to jack with chains.
13. Remove nuts attaching transfer case to transmission (1).
14. Pull transfer case and jack rearward to disengage transfer

case.

15. Remove transfer case from under vehicle.

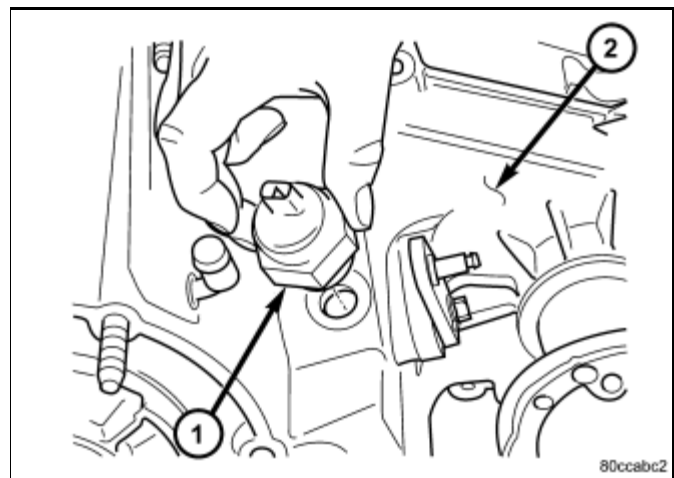
DISASSEMBLY

Position transfer case in a shallow drain pan. Remove drain plug and drain any remaining lubricant remaining in case.

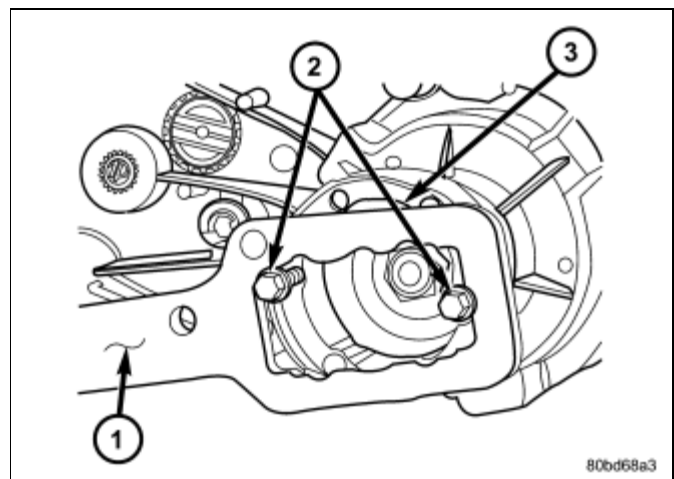


COMPANION FLANGE AND RANGE LEVER

1. Remove transfer case position sensor (1).

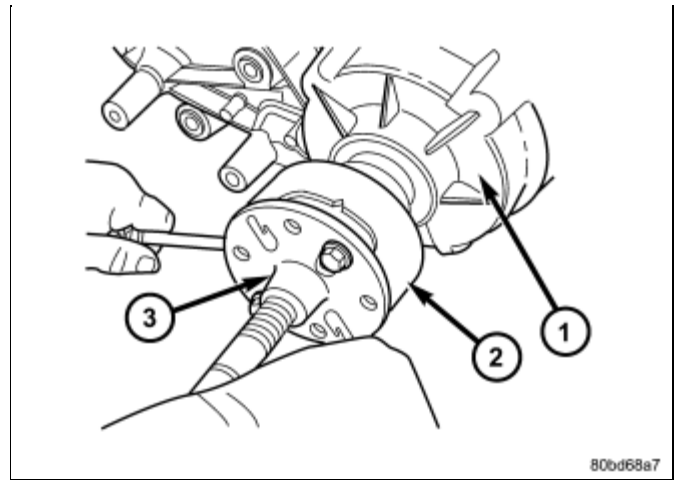


2. Install two bolts (2) partially into the propeller shaft companion flange (3), 180° from each other.
3. Install the rectangular end of the Flange Holder C-3281 (1) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



4. Use Remover C-452 (3) to remove the companion flange

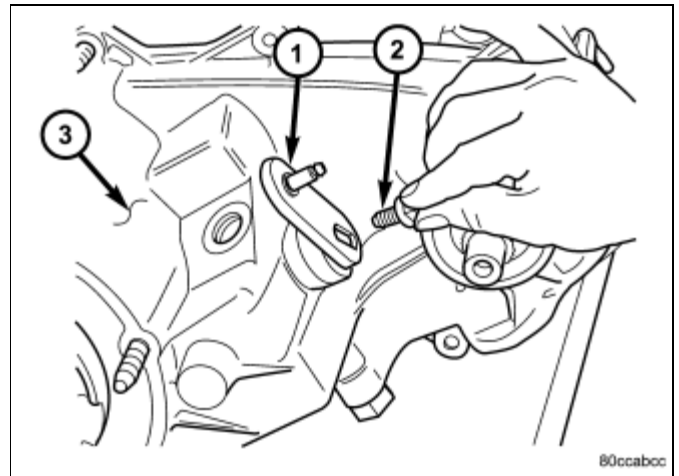
(2).



5. Remove seal washer from front output shaft. Discard washer as it should not be reused.

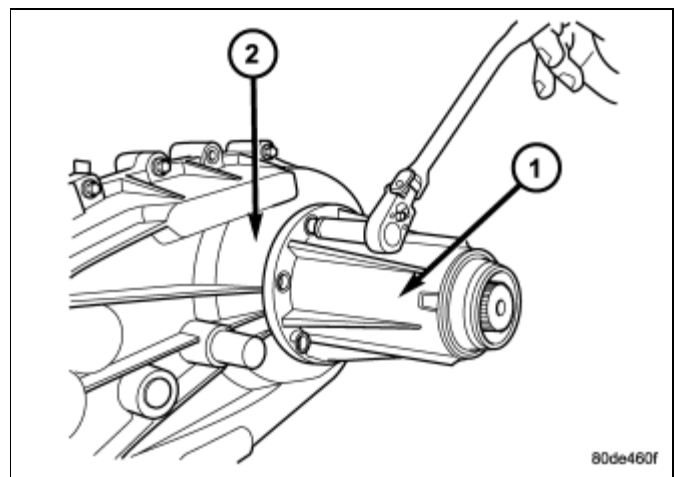
6. Remove the bolt (2) that attaches the range lever (1) to sector shaft. Then move sector to neutral position and remove range lever from shaft.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.



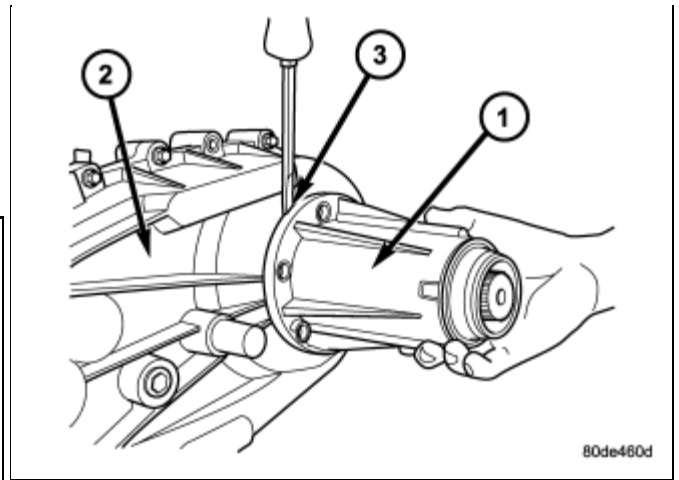
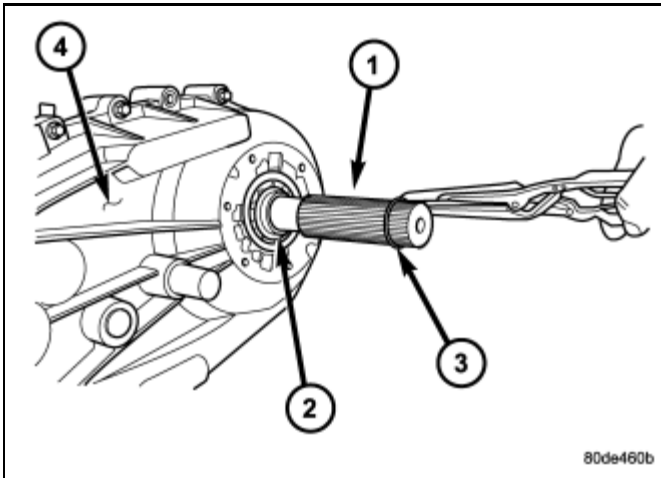
REAR EXTENSION

1. Remove rear extension (1) bolts.



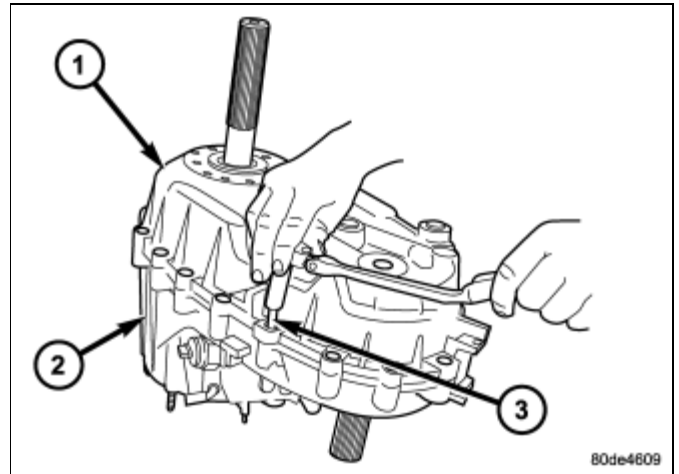
2. Remove rear extension housing (1). Tap extension once or twice with a plastic mallet to break sealer bead and loosen it.

3. Remove output bearing (2) retaining ring (3) with heavy duty snap-ring pliers.

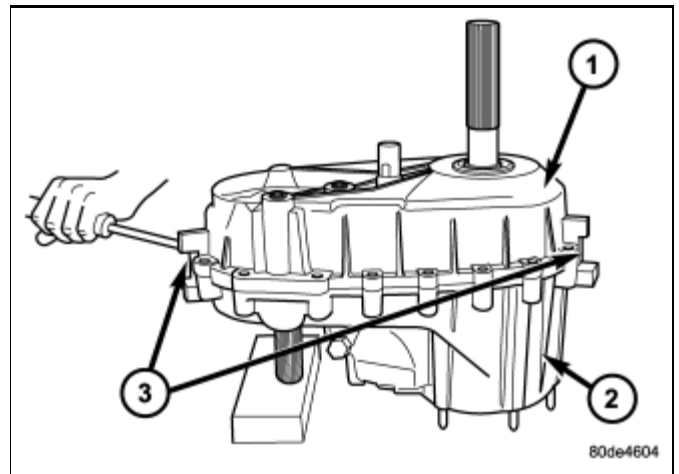


OIL PUMP AND REAR CASE

1. Remove rear case(1)-to-front case (2) bolts (3).

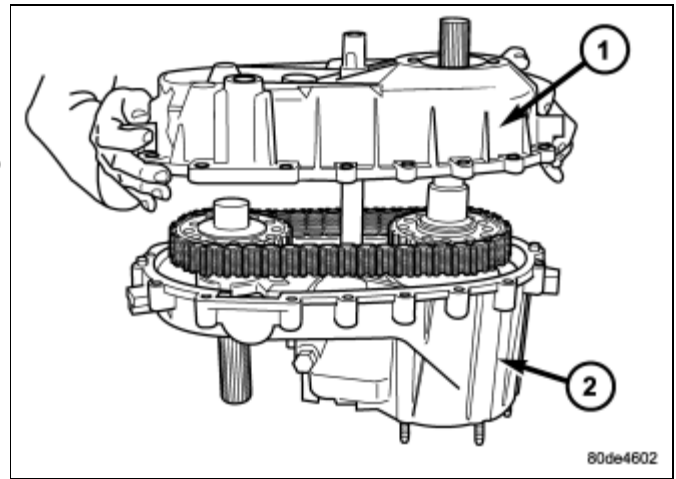


2. Loosen rear case (1) with pry tool to break sealer bead. Insert tool in slot (3) at each end of case.



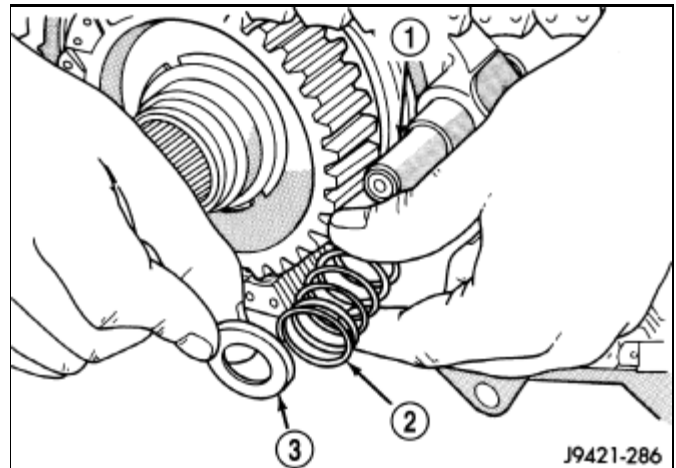
3. Unseat rear case (1) from alignment dowels.
4. Remove rear case and oil pump assembly from front case.

CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft bearing inner race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly **MUST** be replaced.

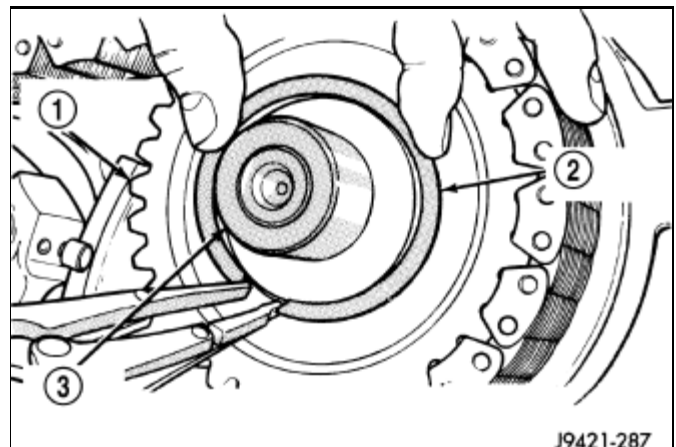


FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Remove shift rail (1) cup (3) and spring (2).

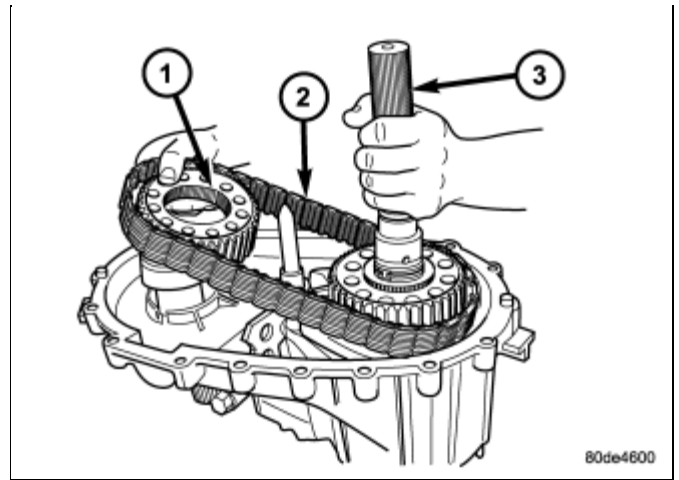


2. Remove front sprocket (1) retaining ring (2).



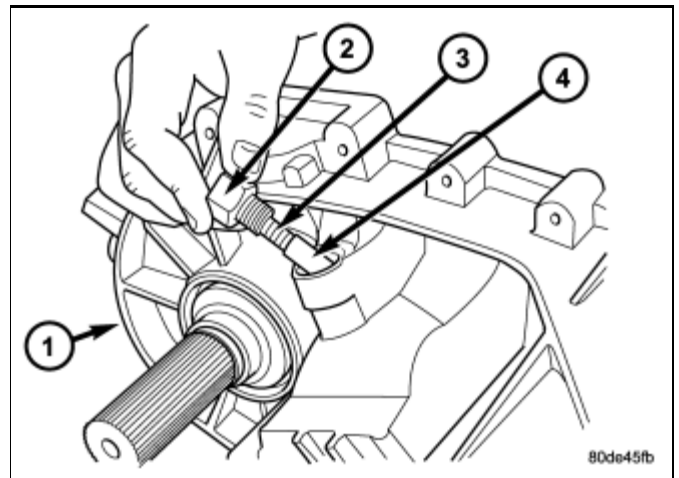
3. Pull mainshaft (3), front sprocket (1) and chain outward about 25.4 mm (1-inch) simultaneously.

4. Remove chain from mainshaft drive sprocket and remove front sprocket and chain as assembly.

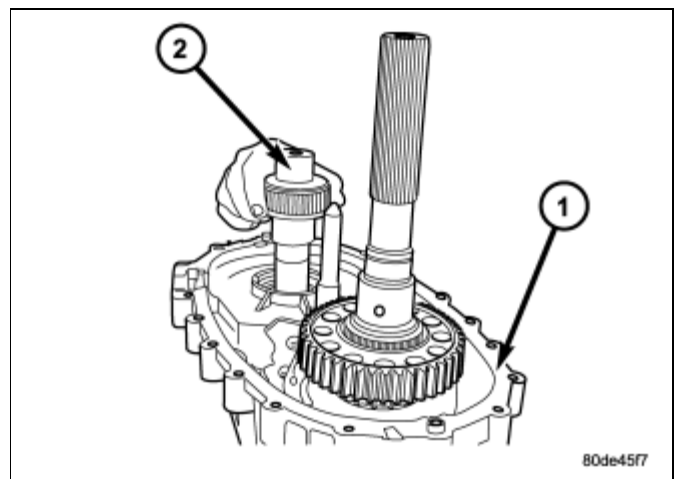


SHIFT FORKS AND MAINSHAFT

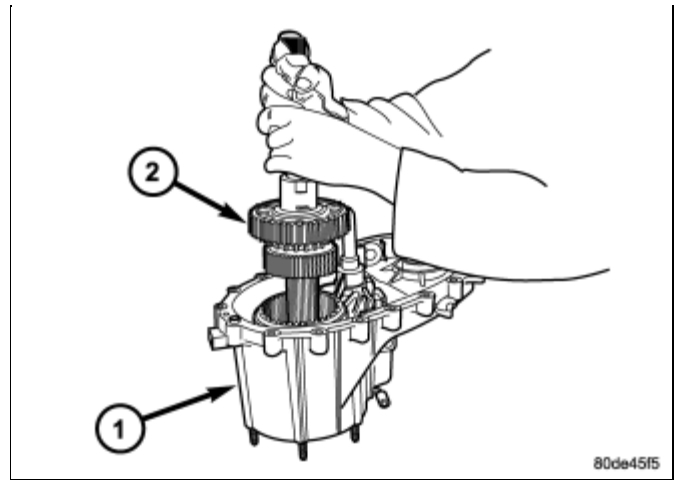
1. Loosen detent plug (2).
2. Remove detent plug (2), spring (3), and plunger (4). Note that the plug has an O-ring seal. Remove and discard this seal.



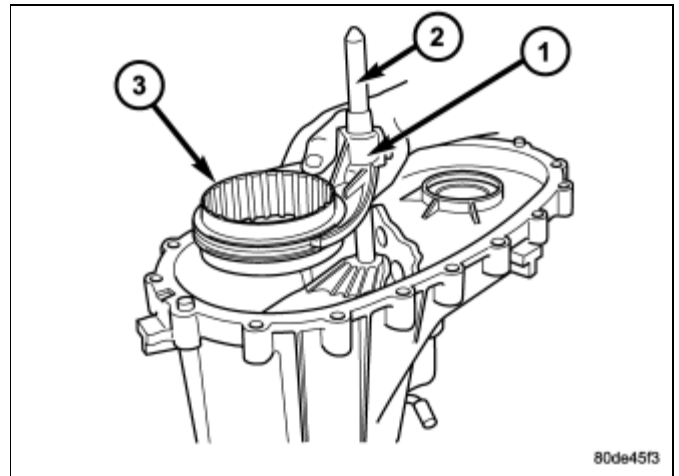
3. Remove front output shaft (2) from bearing in the front case (1).



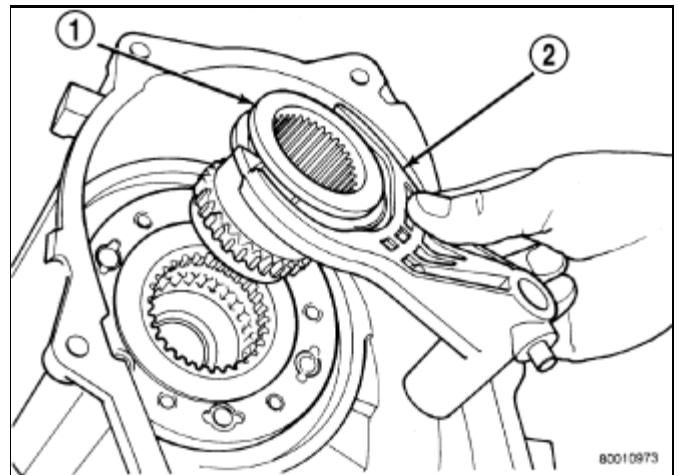
4. Pull mainshaft assembly (2) out of input gear, mode sleeve, and front case (1).



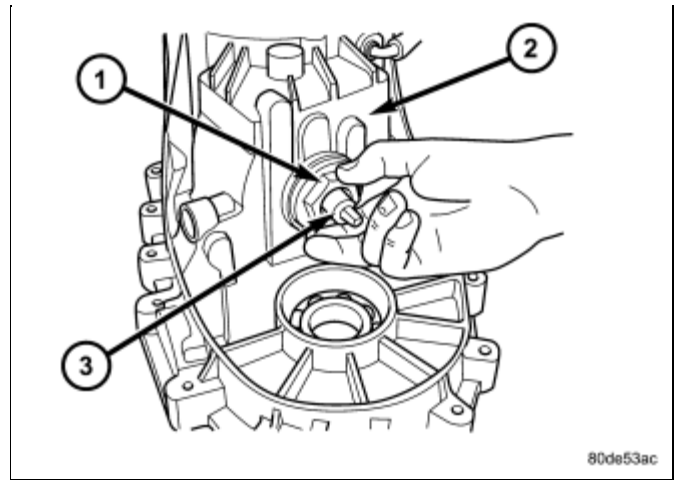
5. Remove mode fork (1), mode sleeve (3), and shift rail (2) as assembly. Note which way the sleeve fits in the fork (long side of sleeve goes to front).



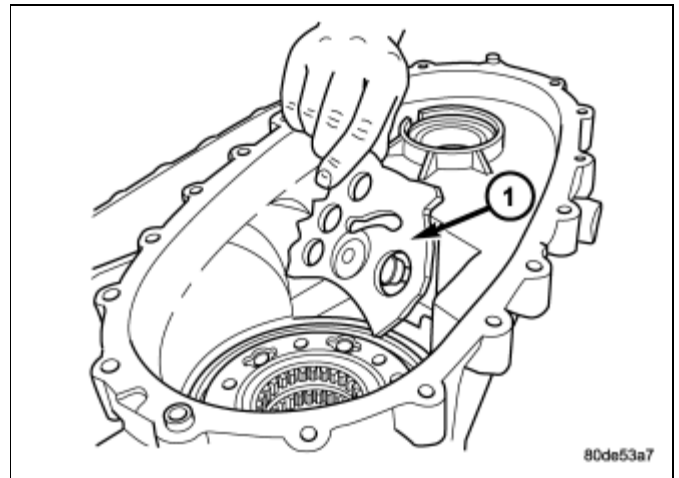
6. Remove range fork retaining ring.
7. Remove range fork (2) and hub (1) as an assembly. Note fork position for installation reference.



8. Remove the shift sector support (1).

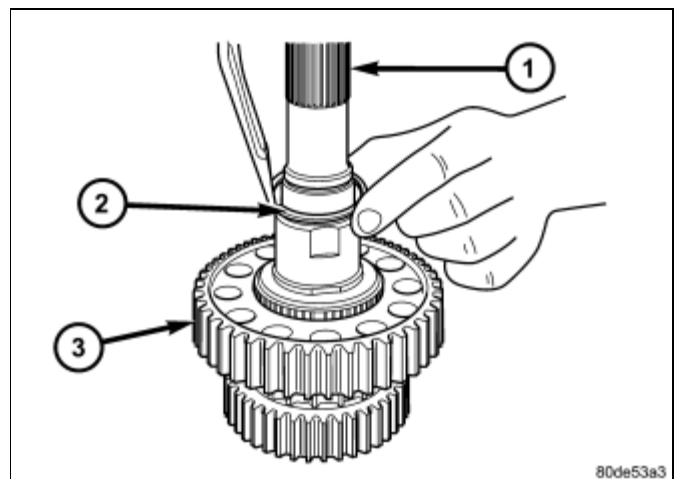


9. Remove shift sector (1).

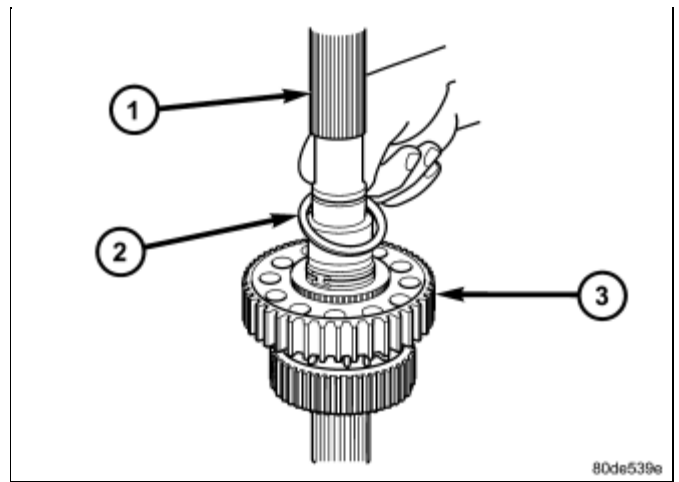


MAINSHAFT

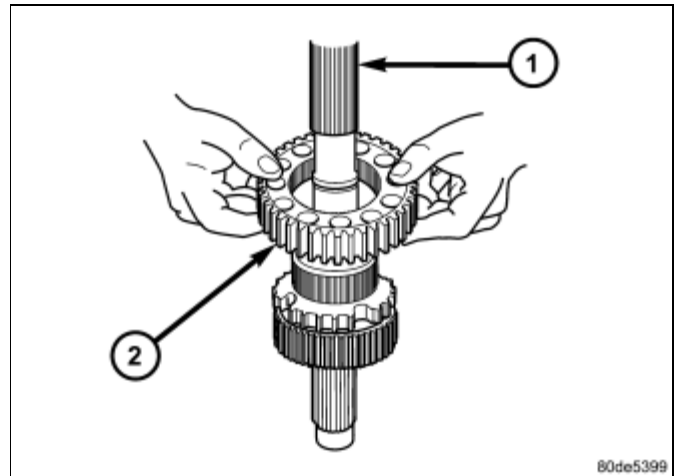
1. Remove the drive sprocket retaining ring (2) from the output shaft (1).



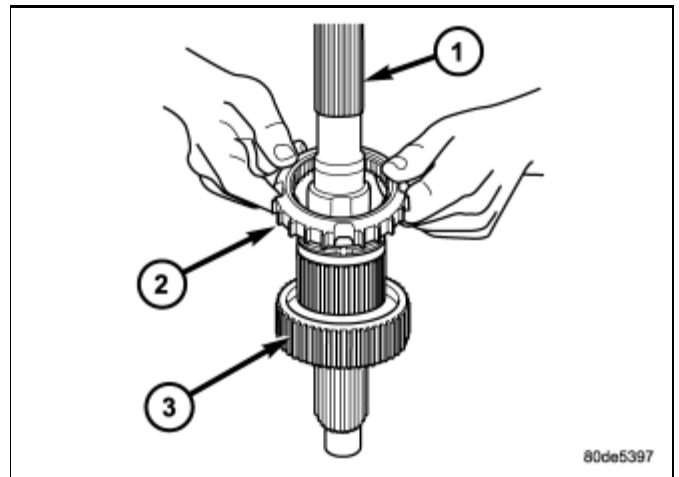
2. Remove the drive sprocket (3) thrust washer (2) from the output shaft (1).



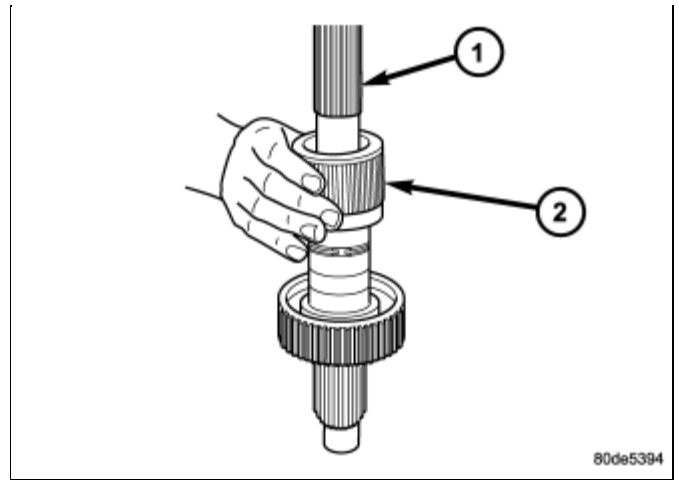
3. Remove drive sprocket (2) from the output shaft (1).



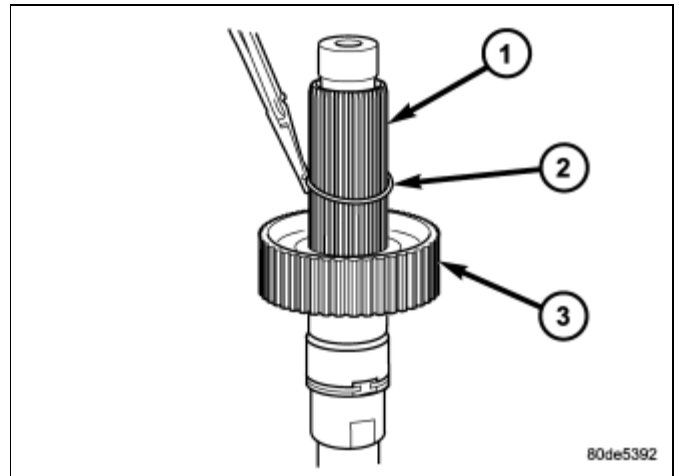
4. Remove the clutch gear (2) from the output shaft (1).



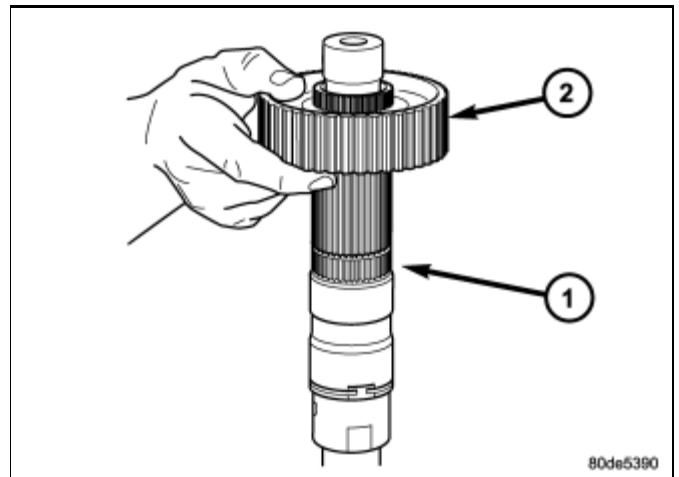
Remove the sprocket hub (2) from the output shaft (1).



5. Remove the mode hub (3) retaining ring (2) from the output shaft (1).



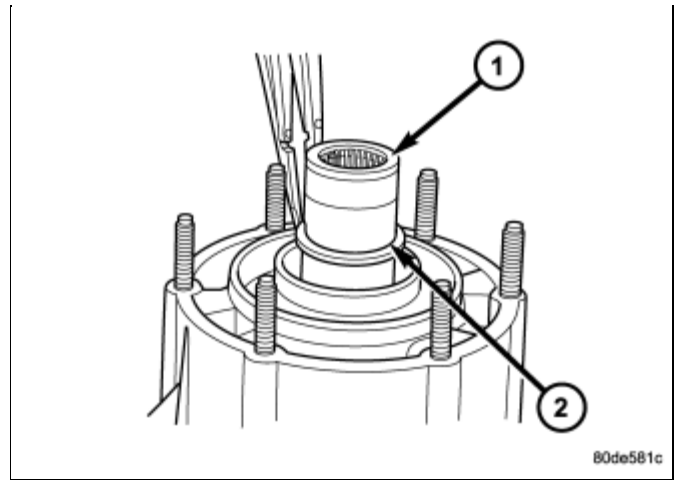
6. Remove the mode hub (2) from the output shaft (1).



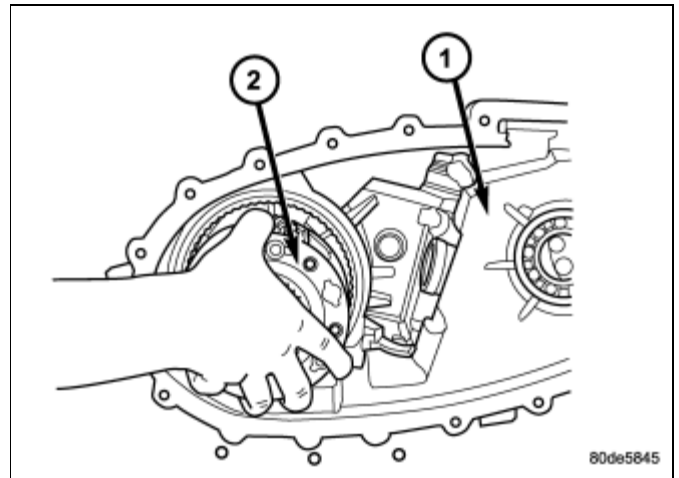
INPUT AND PLANETARY GEAR

1. Remove input gear seal with suitable screw and slide hammer.
2. Remove input gear (1) retaining ring (2) with heavy duty

snap-ring pliers.

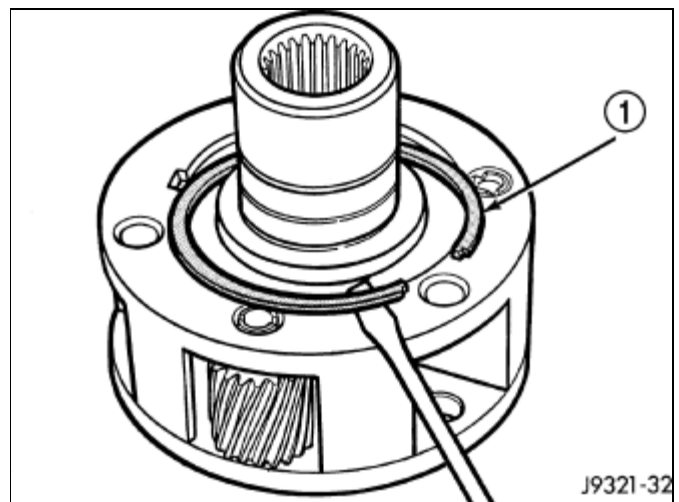


3. Place front case in horizontal position. Then remove input gear and low range gear as an assembly (2). Tap gear out of bearing with plastic mallet, if necessary.

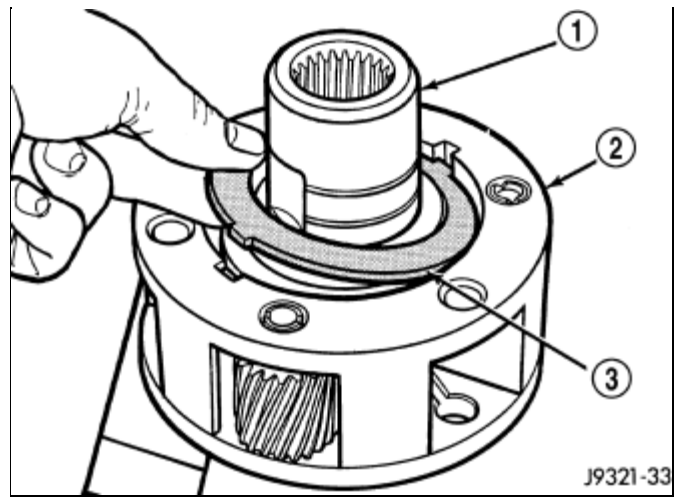


INPUT AND PLANETARY GEAR

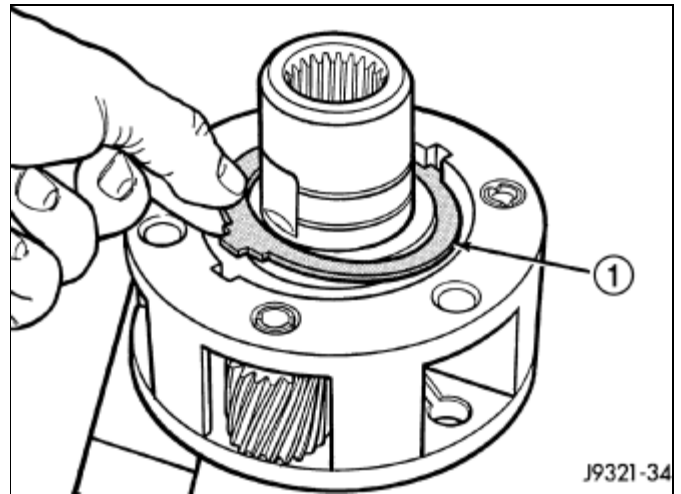
1. Remove snap-ring (1) that retains input gear in low range gear.



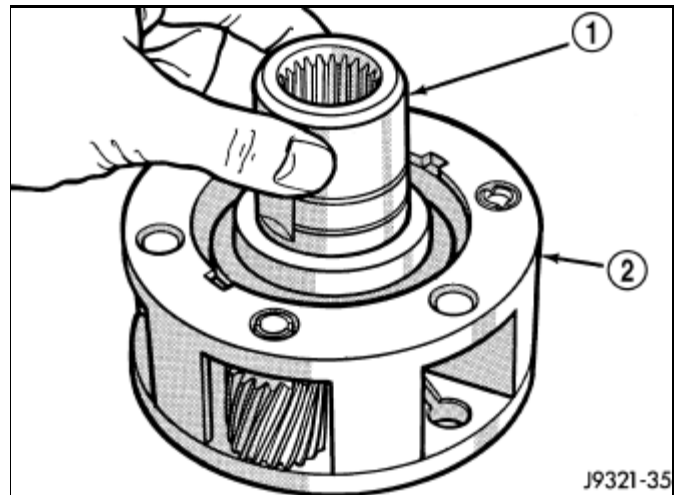
2. Remove retainer (3).



3. Remove front tabbed thrust washer (1).



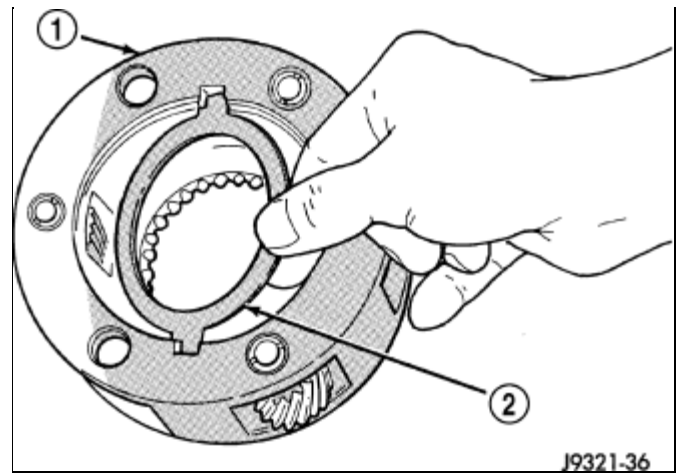
4. Remove input gear (1).



5. Remove rear tabbed thrust washer (2) from low range gear (1).

CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.



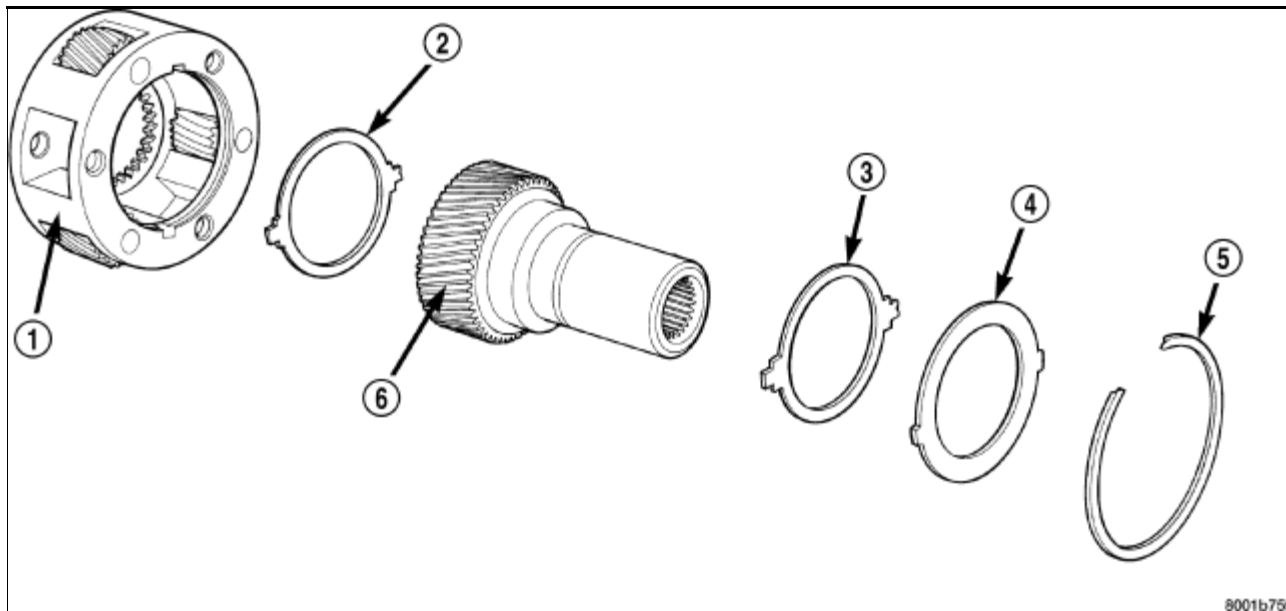
INSPECTION

MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone, however, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER



Input Gear and Carrier Components

1 - PLANETARY CARRIER	4 - CARRIER LOCK RING
2 - REAR THRUST WASHER	5 - CARRIER LOCK RETAINING RING
3 - FRONT THRUST WASHER	6 - INPUT GEAR

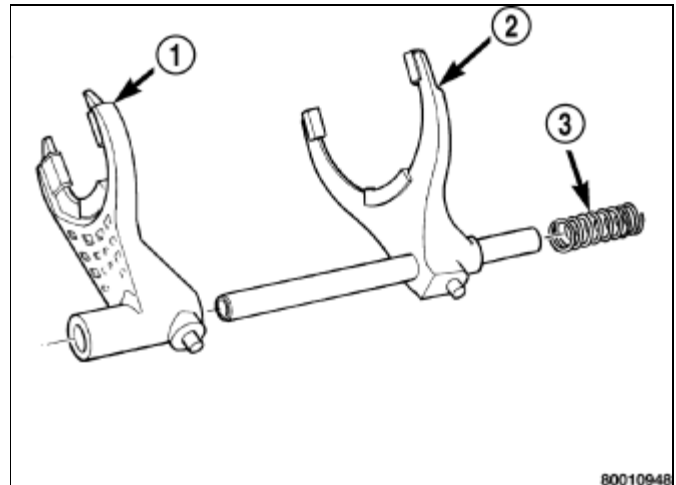
Check the teeth on the input gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the planetary carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the carrier lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the carrier lock retaining ring (5) if bent, distorted, or broken.

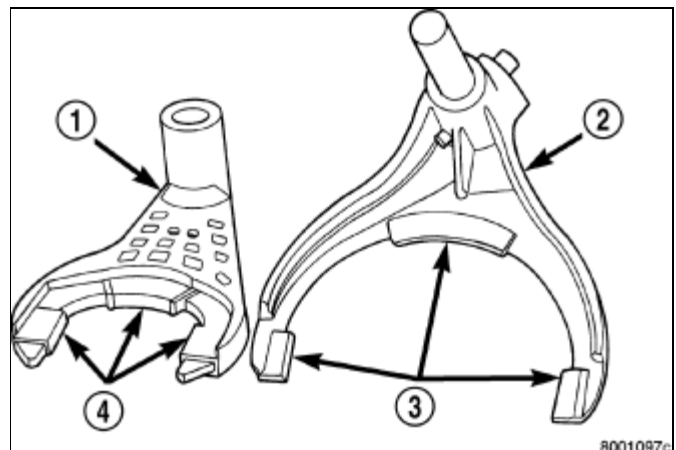
SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (2). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.



Inspect the shift fork wear pads (3, 4). The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are not serviceable. The fork must be replaced as an assembly if the pads are worn or damaged.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.



REAR RETAINER COMPONENTS

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

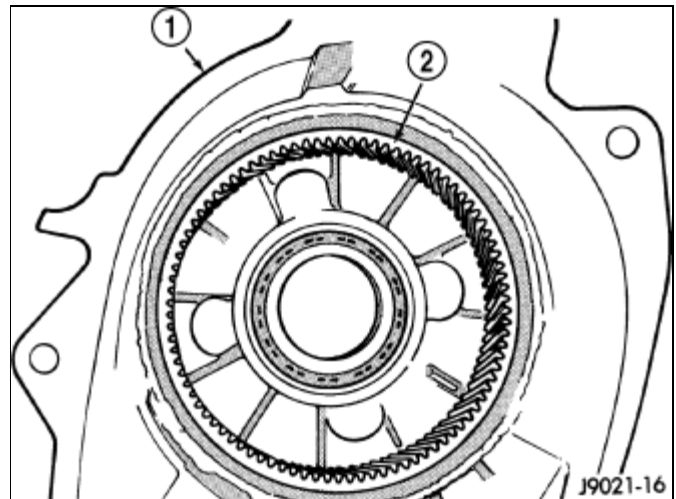
Inspect rear extension bushing. Replace if worn or scored.

DRIVE CHAIN

Examine the drive chain and shaft bearings. replace the chain if stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear (2) condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear.



FRONT CASE AND REAR CASE

Inspect the cases for wear and damage.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

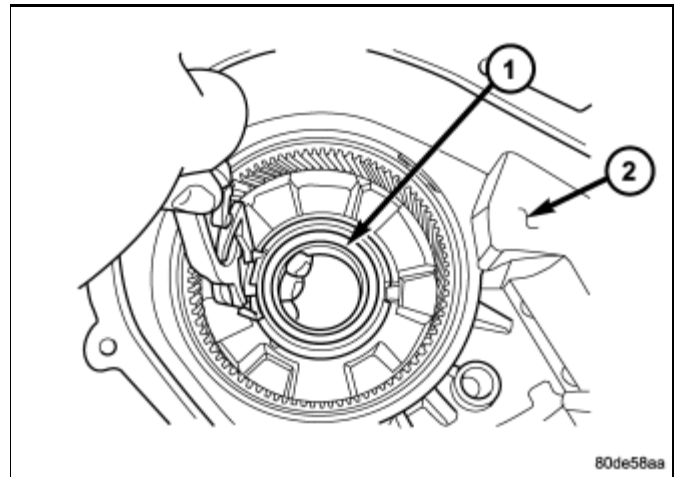
OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

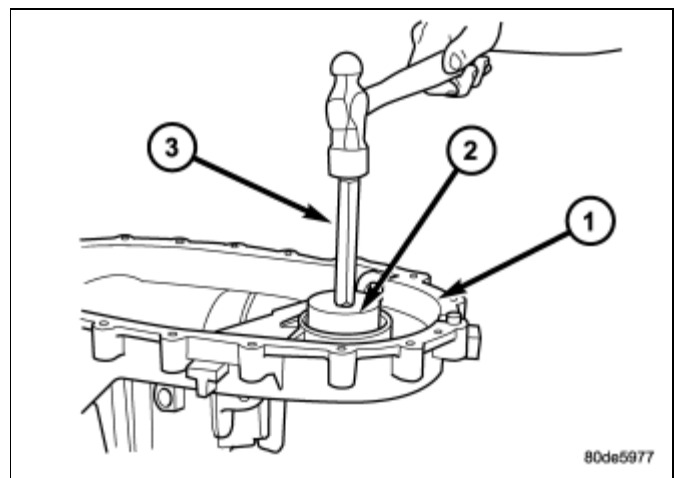
ASSEMBLY

BEARINGS AND SEALS

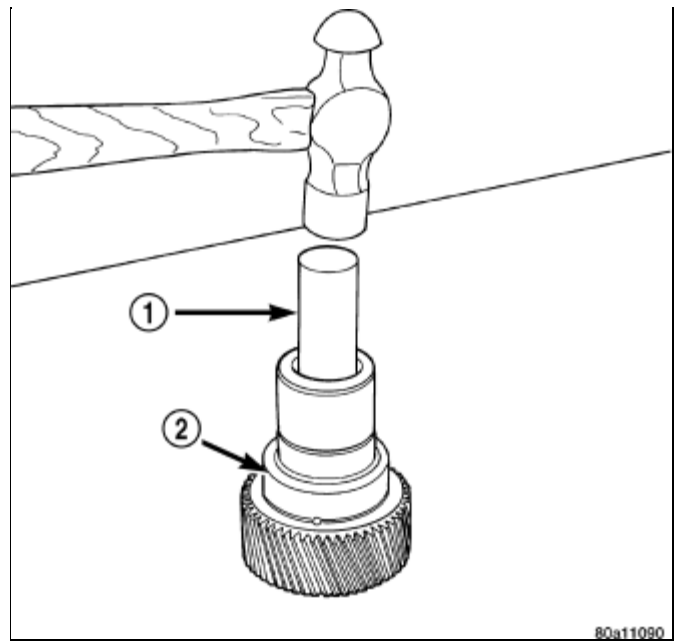
1. Remove the input shaft bearing (1) from the front case (2) with suitable snap-ring pliers.
2. Transfer the retaining ring to the new bearing if necessary and install the bearing into the front case.



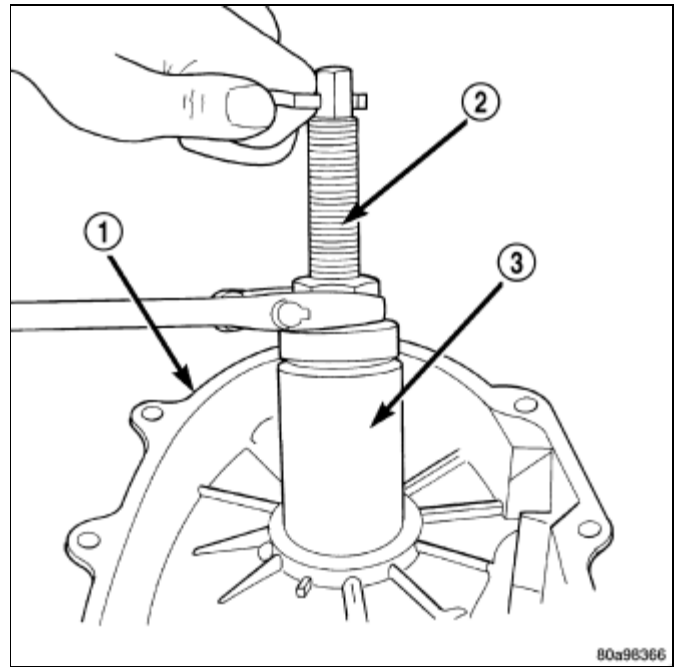
3. Using Installer 6436 (2) and Universal Handle C-4171 (3), remove front output shaft bearing.
4. Start front output shaft bearing in case. Then seat bearing with Universal Handle C-4171 and Bearing Installer 6953.
5. Install front output shaft bearing retaining ring.



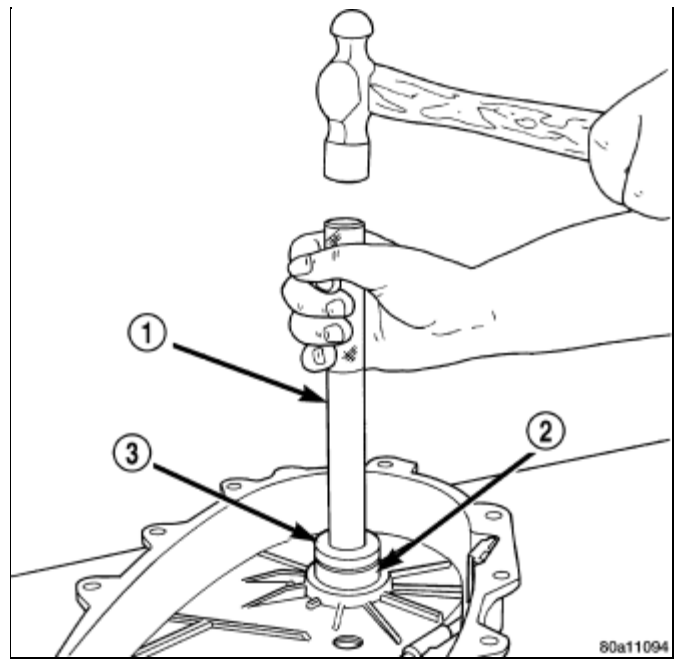
6. Remove input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.
7. Install new pilot bearing with Bearing Installer 8684.



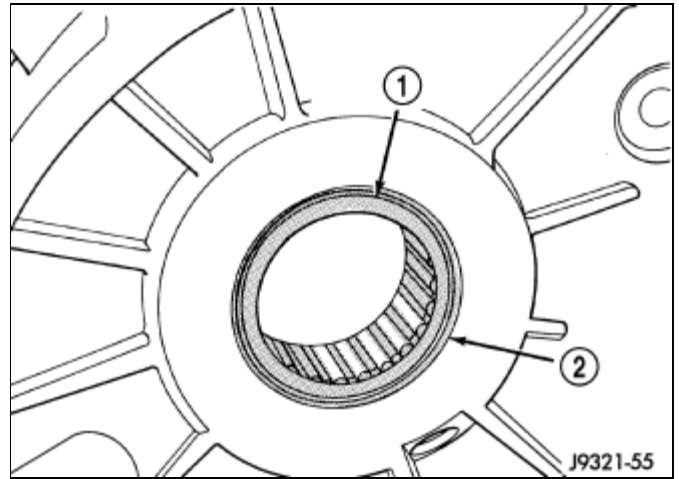
8. Remove the front output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



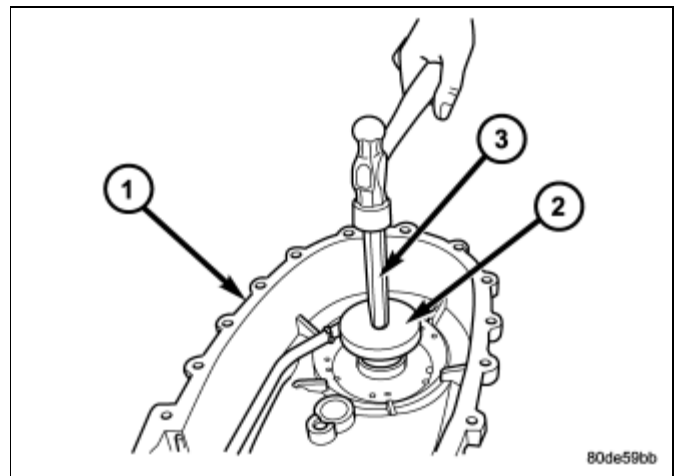
9. Install new bearing with Universal Handle C-4171 (1) and Bushing Installer 5066 (3).



10. The bearing bore is chamfered (1) at the top. Install the bearing so it is flush with the lower edge of this chamfer.

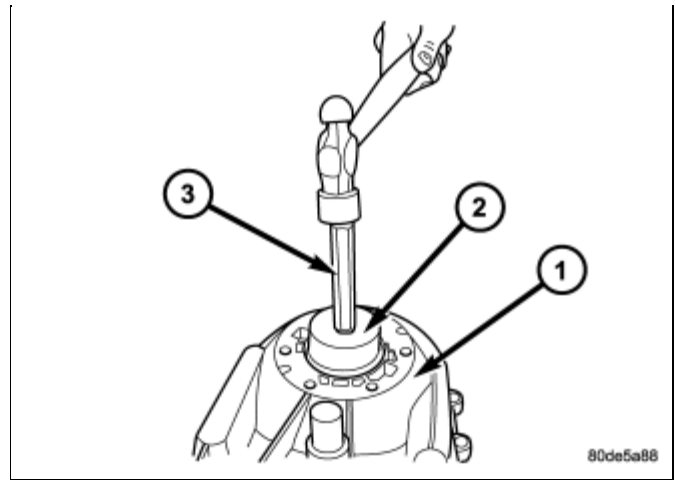


11. Remove the rear output shaft bearing from the rear case using Bearing Installer 8684 (2) and Universal Handle C-4171 (3).



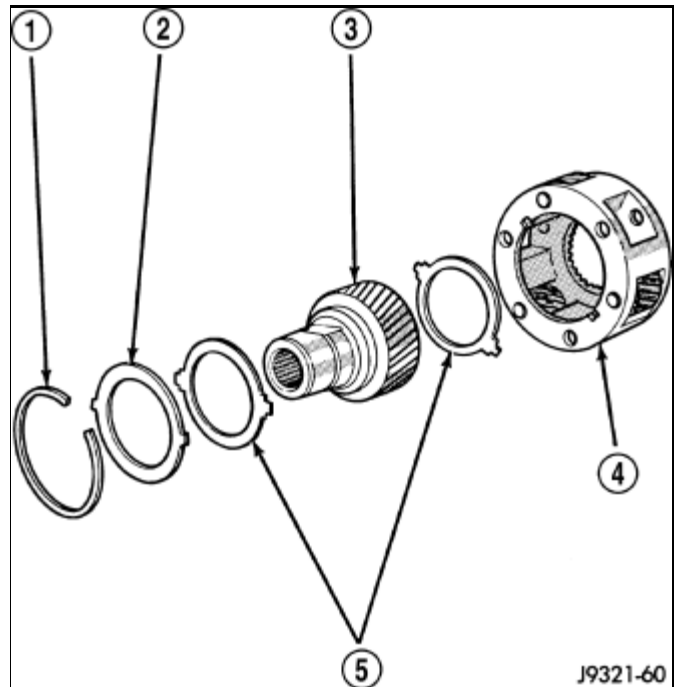
12. Install the rear output shaft bearing into the rear case (1) using Bearing Installer 6953 (2) and Universal Handle C-

4171 (3).

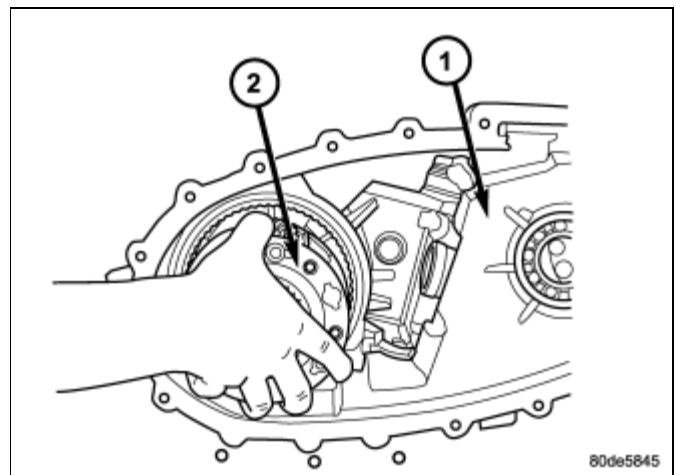


INPUT AND PLANETARY GEAR

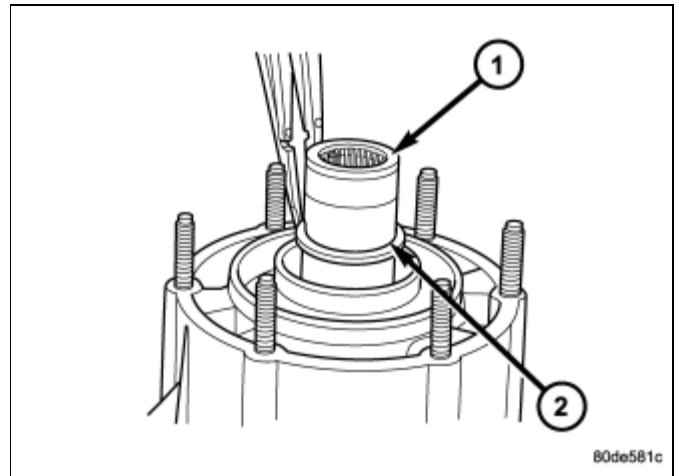
1. Lubricate gears (3, 4) and thrust washers (5) with recommended transmission fluid.
2. Install first thrust washer (5) in low range gear (3). Be sure washer tabs are properly aligned in gear notches.
3. Install input gear (3) in low range gear (4). Be sure input gear is fully seated.
4. Install remaining thrust washer (5) in low range gear (4) and on top of input gear (3). Be sure washer tabs are properly aligned in gear notches.
5. Install retainer (2) on input gear and install snap-ring (1).



6. Align and install low range/input gear assembly (2) in front case (1). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

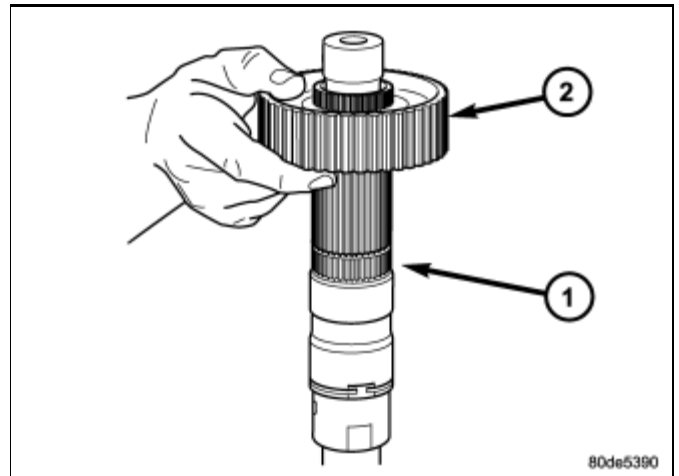


7. Install snap-ring (2) to hold input/low range gear (1) into front bearing.
8. Install a new input gear seal using Installer 8841 and Universal Handle C-4171.

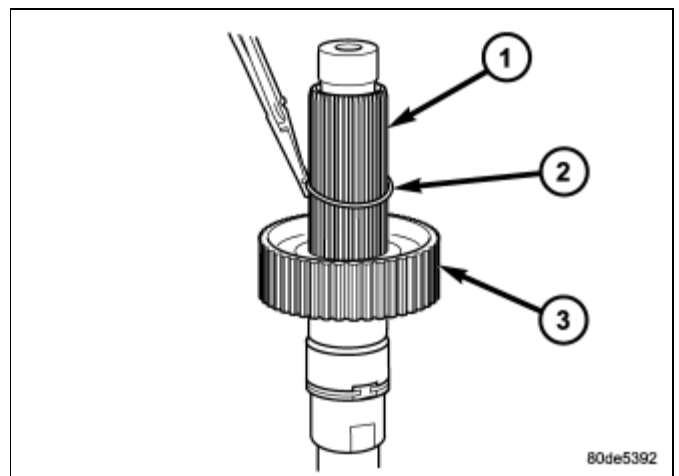


SHIFT FORKS AND MAINSHAFT

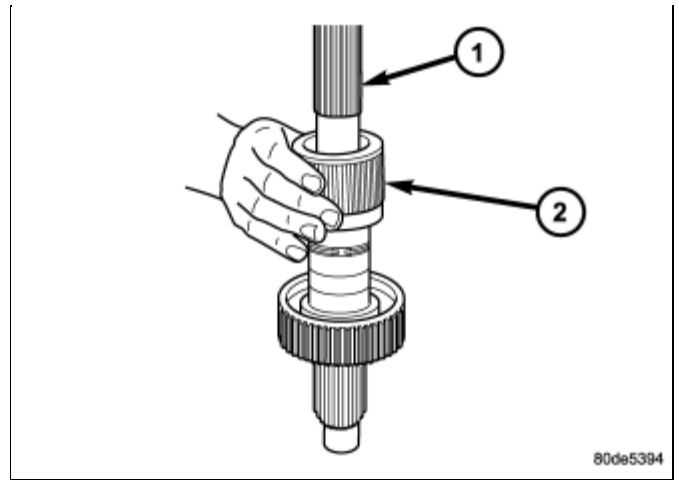
1. Lubricate mainshaft splines with recommended transmission fluid.
2. Install the mode hub (1) onto the output shaft.



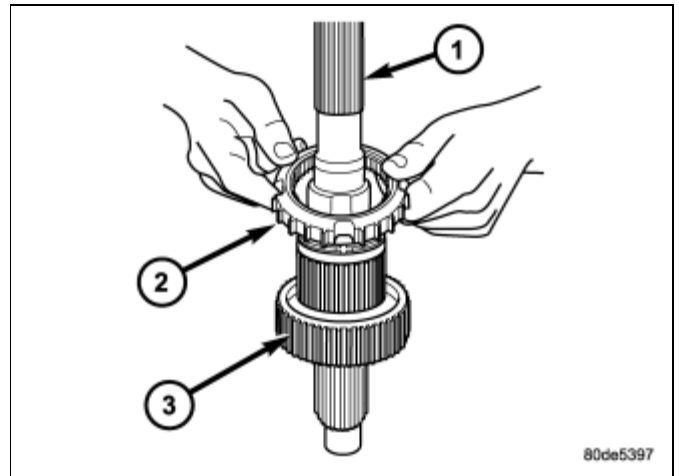
3. Install the mode hub retaining ring (2) onto the output shaft (1).



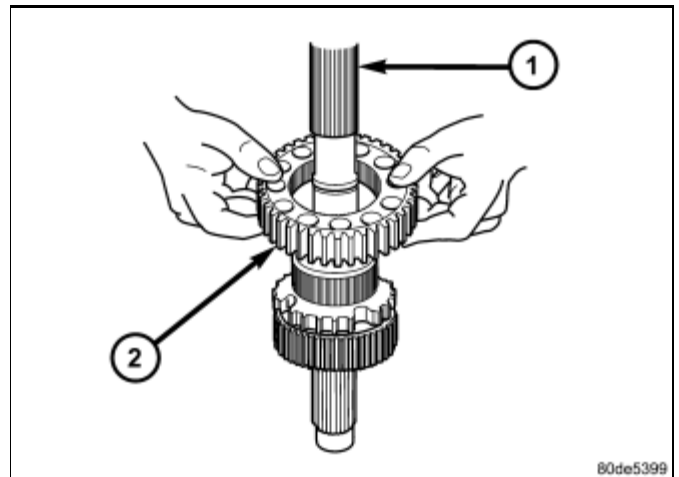
4. Install the sprocket hub (2) onto the output shaft (1).



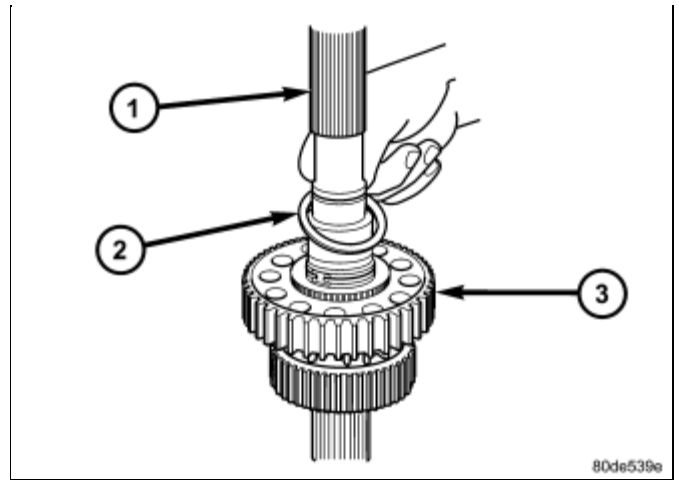
5. Install the clutch gear (2) onto the output shaft (1).



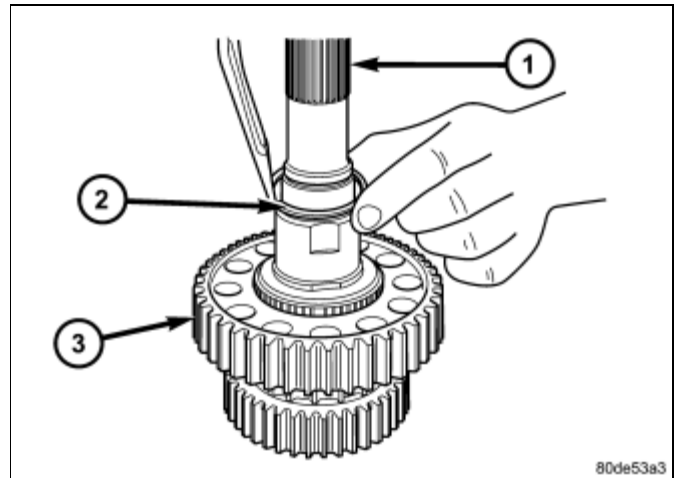
6. Install the drive sprocket (2) onto the output shaft (1).



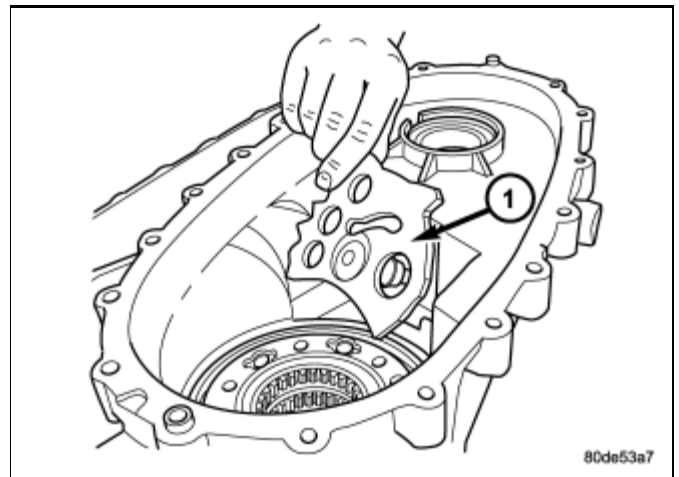
7. Install the drive sprocket (3) thrust washer (2) onto the output shaft (1).



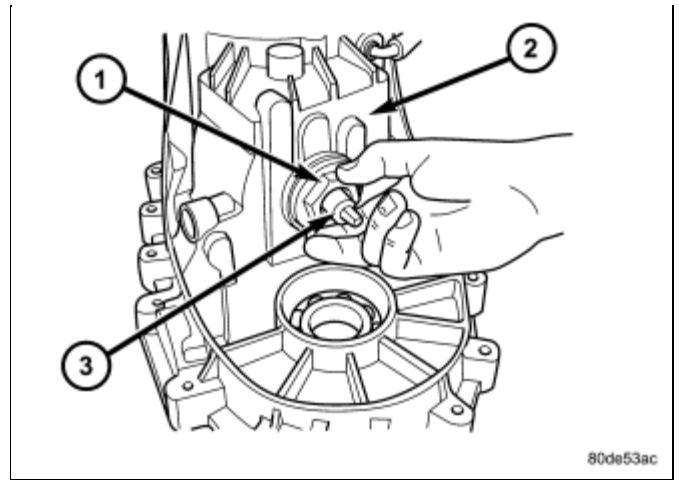
8. Install the drive sprocket retaining ring (2) onto the output shaft (1).



9. Lubricate sector shaft with transmission fluid and install shift sector (1) in case. Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.



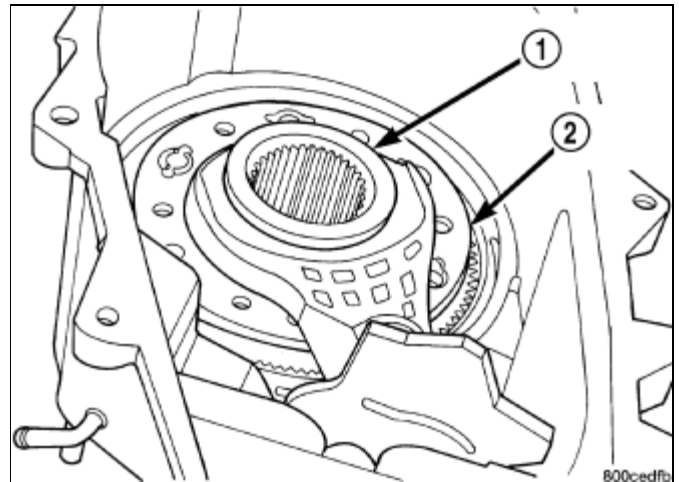
10. Install the shift sector support (1). Tighten the sector support to 27-42 N·m (20-30 ft.lbs.).



11. Assemble and install range fork (2) and hub (1). Be sure hub is properly seated in low range gear and engaged to the input gear.

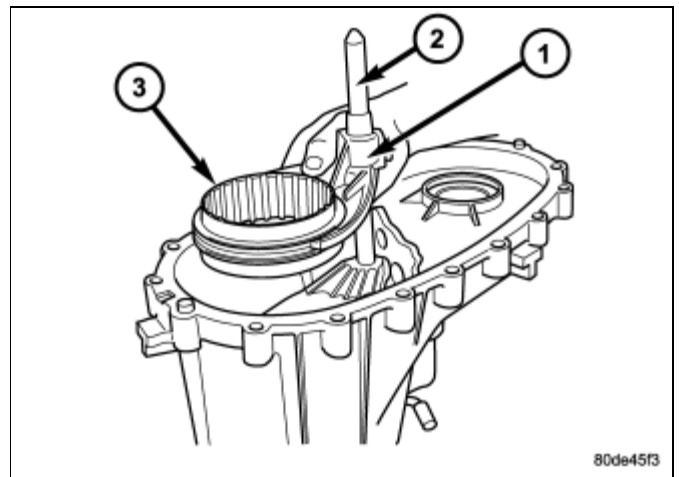
12. Align and insert range fork pin in shift sector slot.

13. Install the range fork retaining ring.

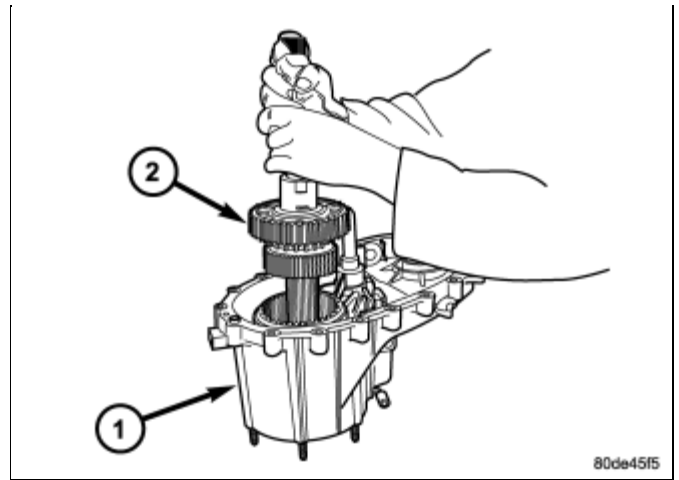


14. Install mode fork (1) and shift rail (2) onto the mode sleeve (3).

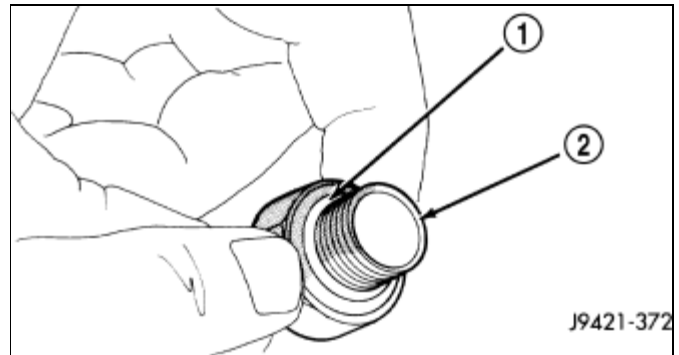
15. Install the mode fork, sleeve, and shift rail into the transfer case.



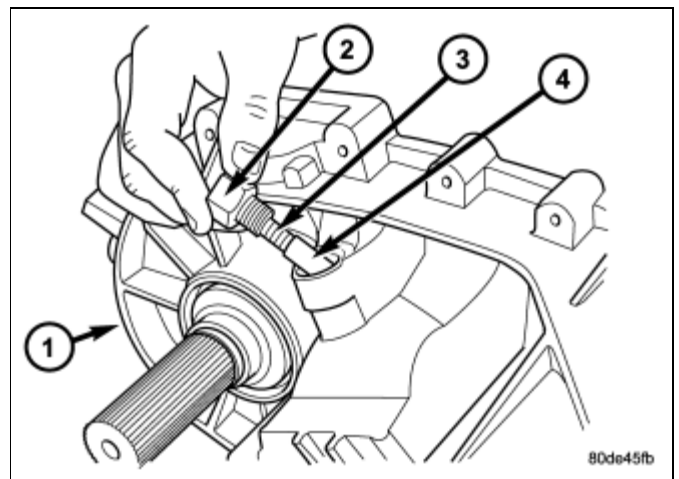
16. Install mainshaft (2) into the transfer case (1). Guide mainshaft through the mode and range sleeves and into the input gear.



17. Install new o-ring on detent plug (2).

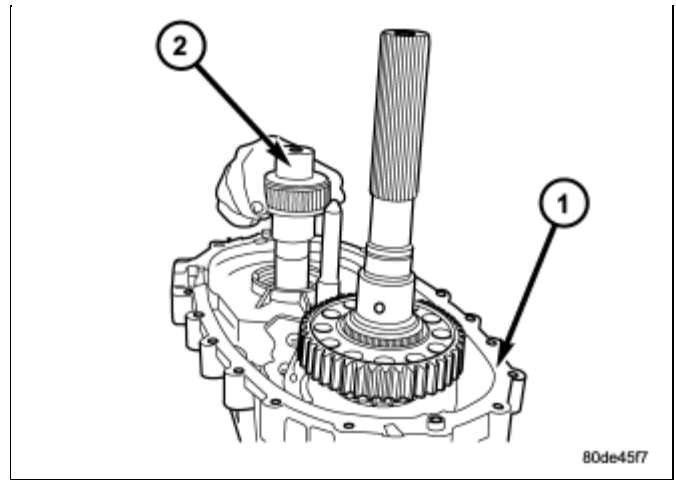


18. Install detent plunger (4), spring (3), and plug (2). Tighten the plug to 16-25 N·m (12-18 ft. lbs.).

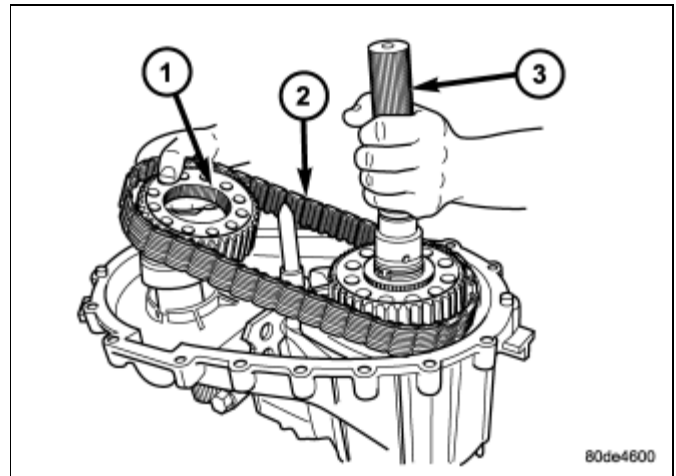


FRONT OUTPUT SHAFT AND DRIVE CHAIN

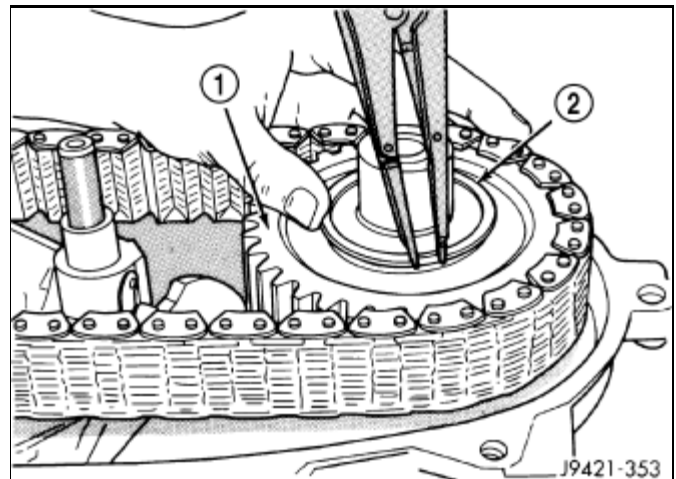
1. Install the front output shaft (2) into the front output shaft bearing.



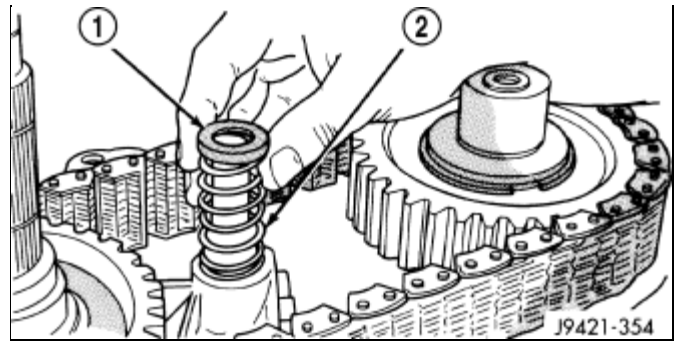
2. Insert front sprocket in drive chain.
3. Install drive chain (2) around mainshaft sprocket (1). Then position front sprocket over front shaft.
4. Raise mainshaft about 2.54 cm (one inch) and seat front sprocket on front output shaft.



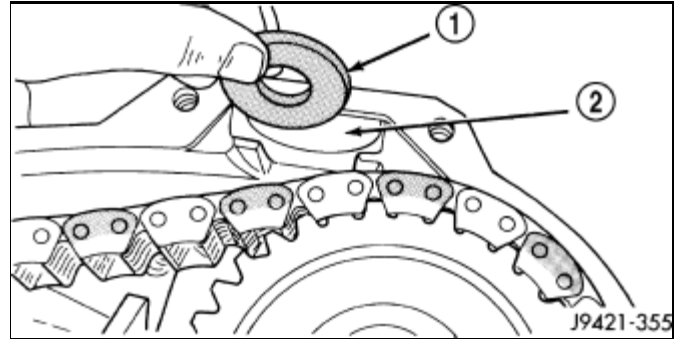
5. If mainshaft and mode sleeve were unseated during chain installation, align and reseat mainshaft in input gear and hub.
6. Install front sprocket (1) retaining ring (2).



7. Install spring (2) and cup (1) on shift rail.



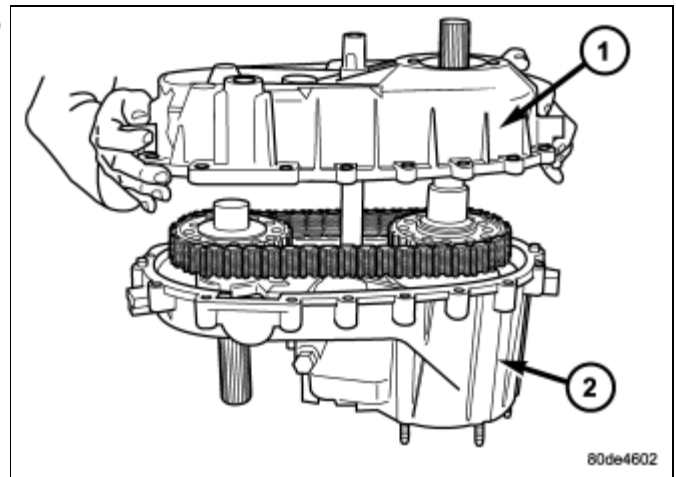
8. Insert magnet (1) in front case pocket (2).



OIL PUMP AND REAR CASE

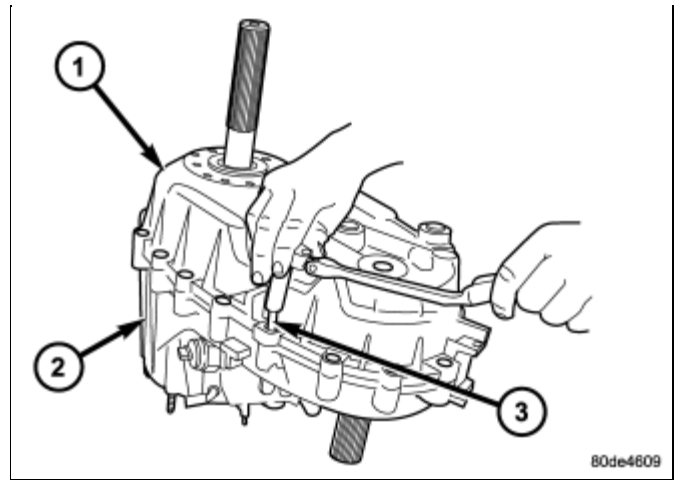
CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft inner bearing race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly **MUST** be replaced.

1. Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of front case. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.
2. Align oil pump with mainshaft and align shift rail with bore in rear case. Then install rear case (1) and oil pump assembly.



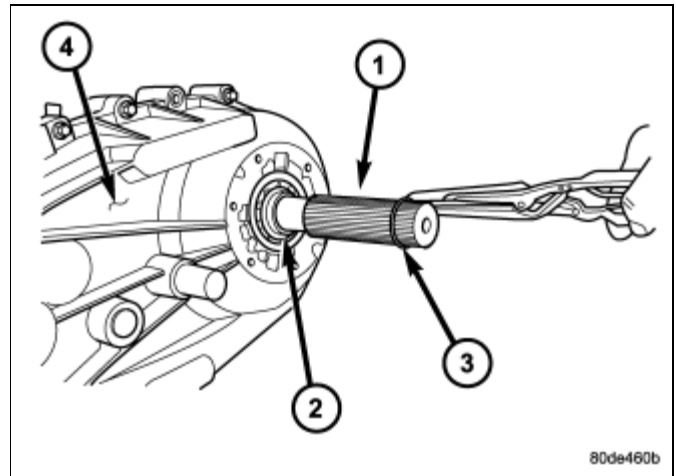
3. Install 4-5 rear case(1)-to front case (2) bolts to hold rear case in position. Tighten bolts snug but not to specified torque at this time.

CAUTION: Verify that shift rail, and case alignment dowels are seated before installing any bolts. Case could be cracked if shaft rail or dowels are misaligned.

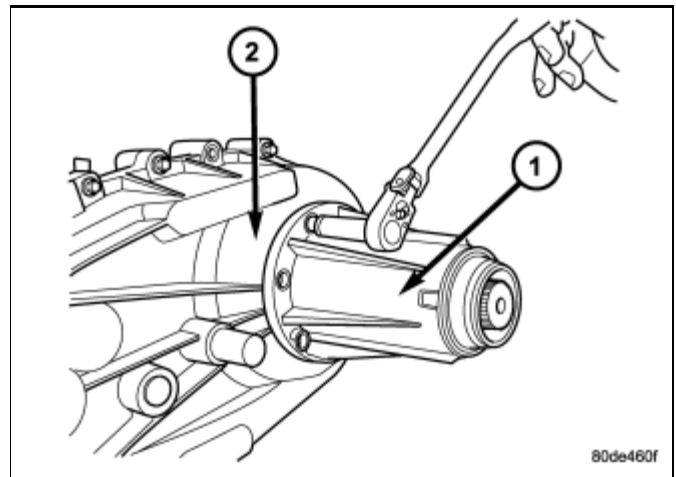


4. Apply Loctite™ 242 to remainder of rear case-to-front case bolt threads and install bolts. Tighten bolts to 20-27 N·m (15-24 ft. lbs.),
5. Install rear output bearing (2) snap-ring (3) to output shaft.

REAR EXTENSION

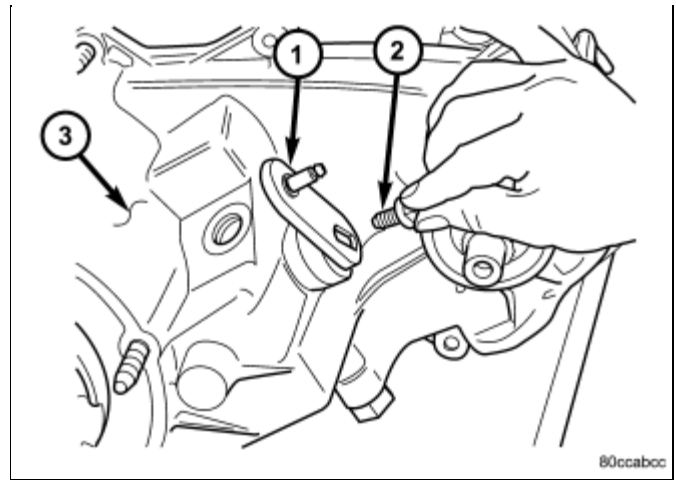


1. Install new seal in rear extension housing seal with Installer D-163 and Universal Handle C-4171..
2. Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of rear extension housing. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess could be displaced into output bearing.
3. Align and install rear extension housing (1) on retainer.
4. Apply Mopar® Silicone Sealer to threads of rear extension housing bolts. Then install and tighten bolts to 16-24 N·m (12-18 ft. lbs.) torque.

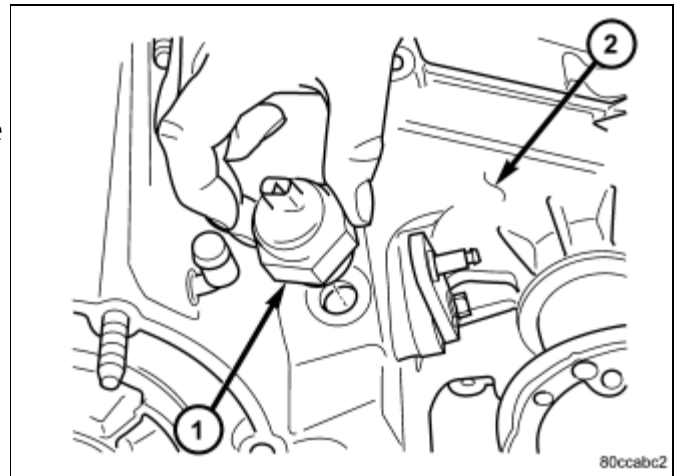


COMPANION FLANGE AND RANGE LEVER

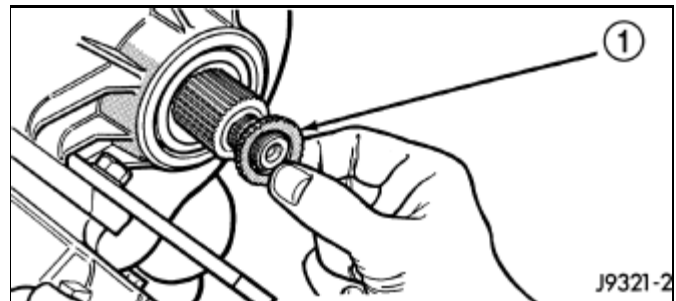
1. Install range lever (1) and bolt (2) on sector shaft. Tighten bolt to 27-34 N·m (20-25 ft. lbs.) torque.



2. Inspect the o-ring on the transfer case position sensor. Replace the o-ring if necessary.
3. Install the transfer case position sensor (1) in the front case (2). Tighten sensor to 20-34 N·m (15-25 ft. lbs.) torque.

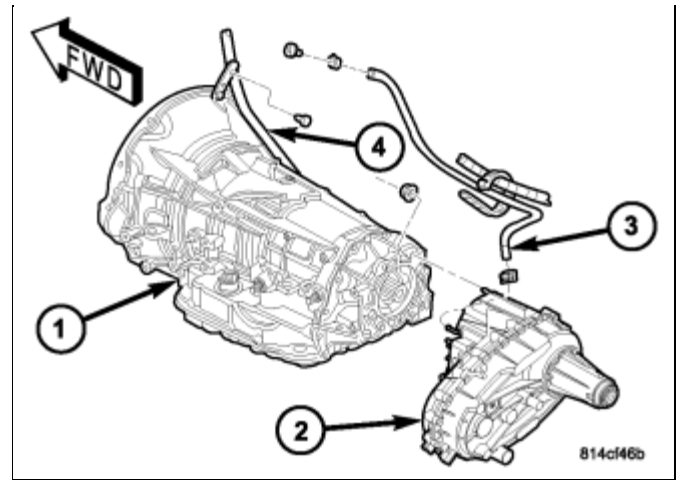


4. Install new seal washer (1) on front output shaft.
5. Lubricate companion flange hub with transmission fluid and install flange onto the front output shaft.
6. Install new flange nut onto front output shaft.
7. Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque.



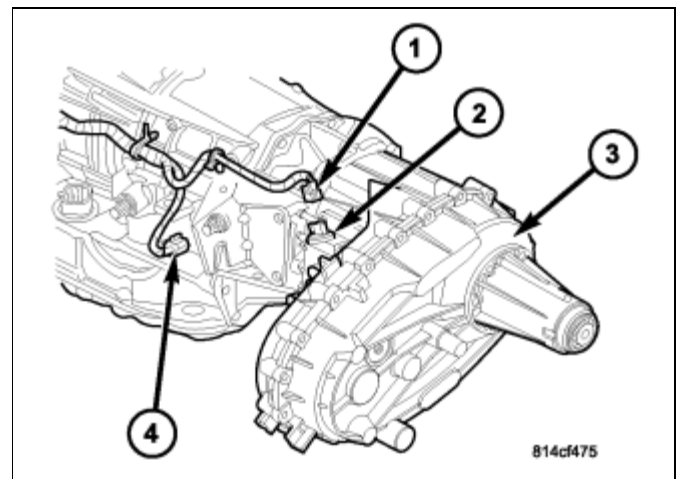
INSTALLATION

1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case on transmission.
5. Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque.
6. Connect vent hose (3).

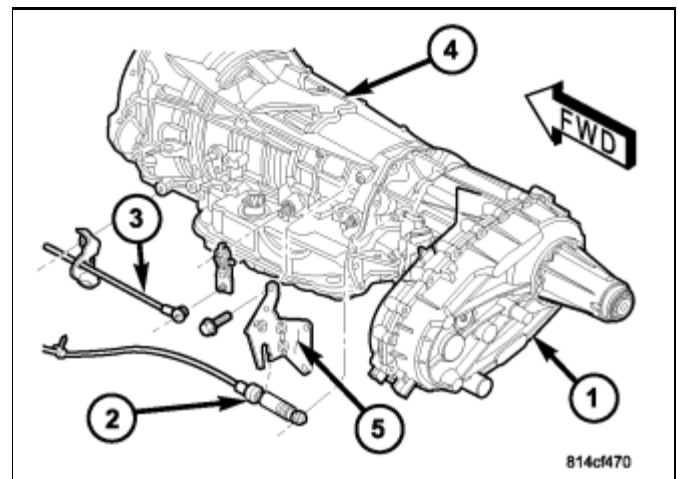


7. Connect transfer case position sensor connector (1) to sensor (2).

8. Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION) .



9. Connect shift cable (2) to transfer case range (1) lever.



10. Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.

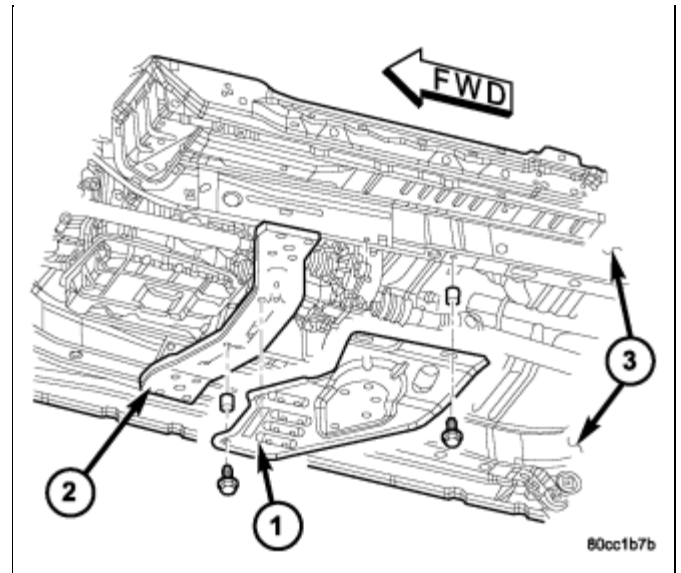
11. Install skid plate (1). (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)

12. Remove transmission jack and support stand.

13. Lower vehicle and verify transfer case shift operation.

SPECIFICATIONS

TRANSFER CASE - NV241 GENII

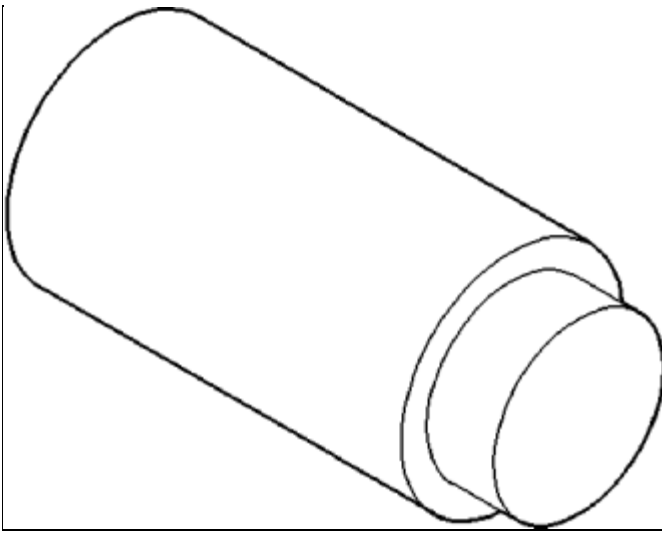


TORQUE SPECIFICATIONS

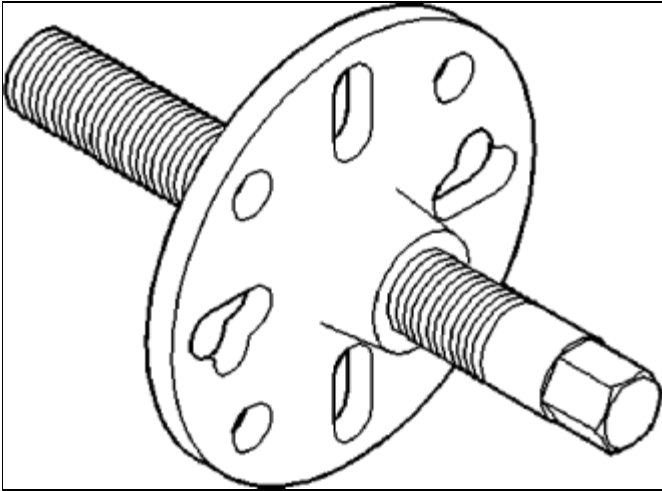
DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-24	12-18	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Extension Housing	16-24	12-18	-
Bolt, Case Half	20-27	15-24	-
Screw, Oil Pump	12-16	8-12	-
Nut, Front Companion Flange	122-176	90-130	-
Nut, Range Lever	27-34	20-25	-
Sector Support	27-42	20-30	-
Nuts, Mounting	30-41	20-30	-
Position Sensor	20-34	16-25	-

SPECIAL TOOLS

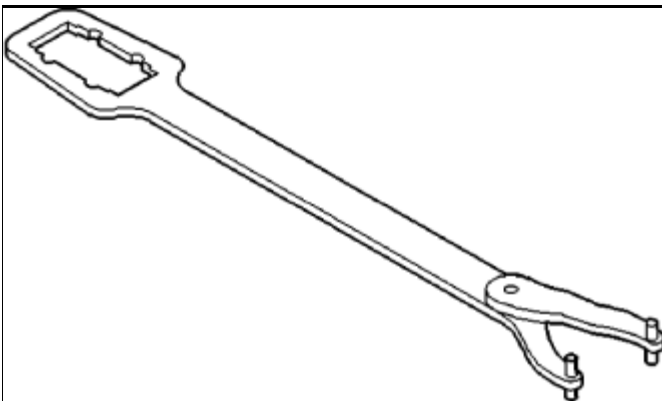
TRANSFER CASE - NV241 GENII

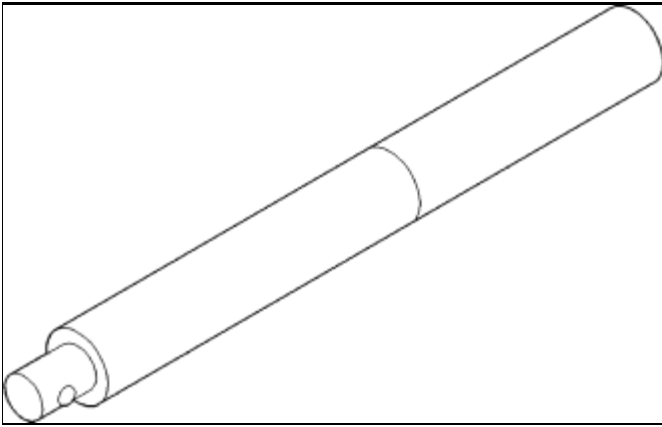
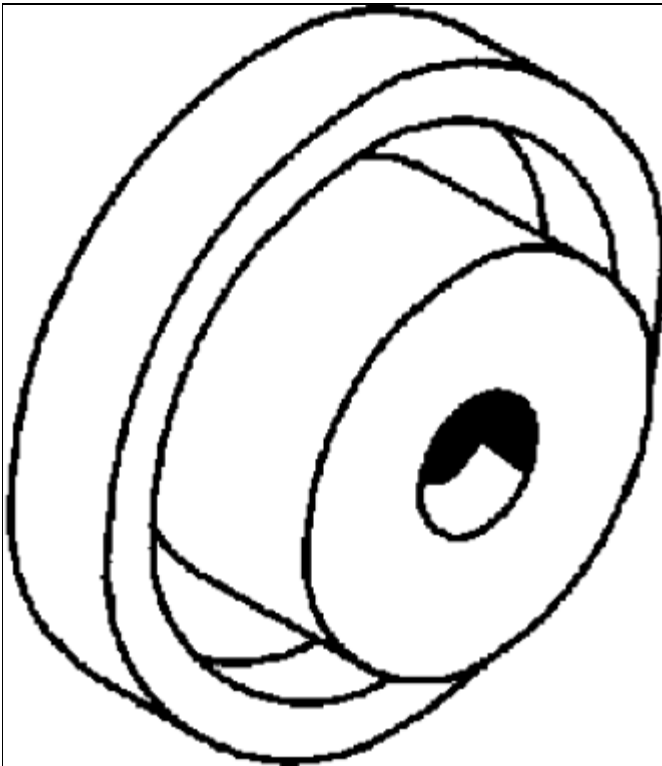


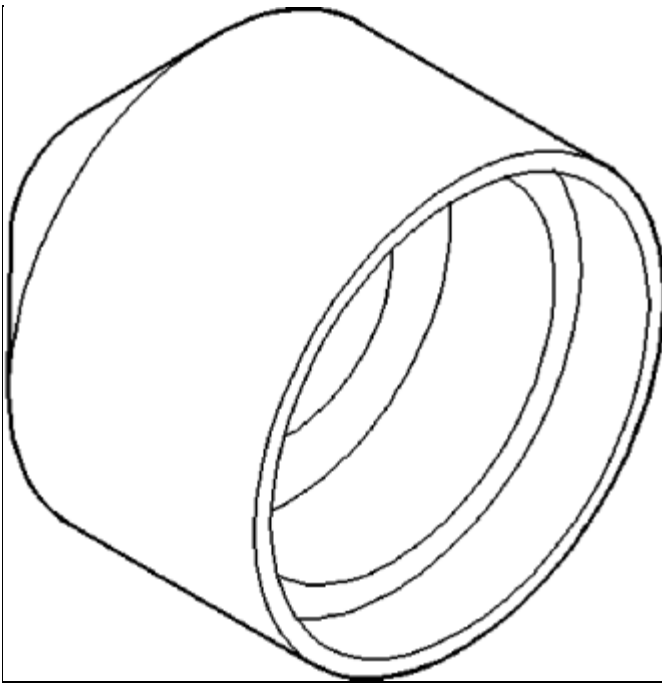
Plug, Extension - C-293-3



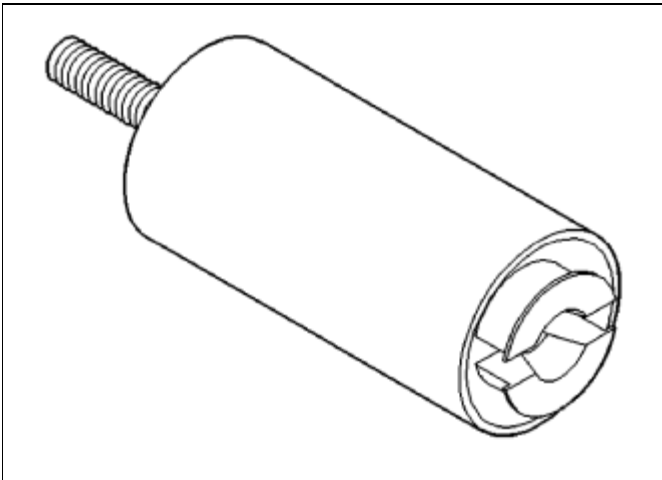
Remover - C-452



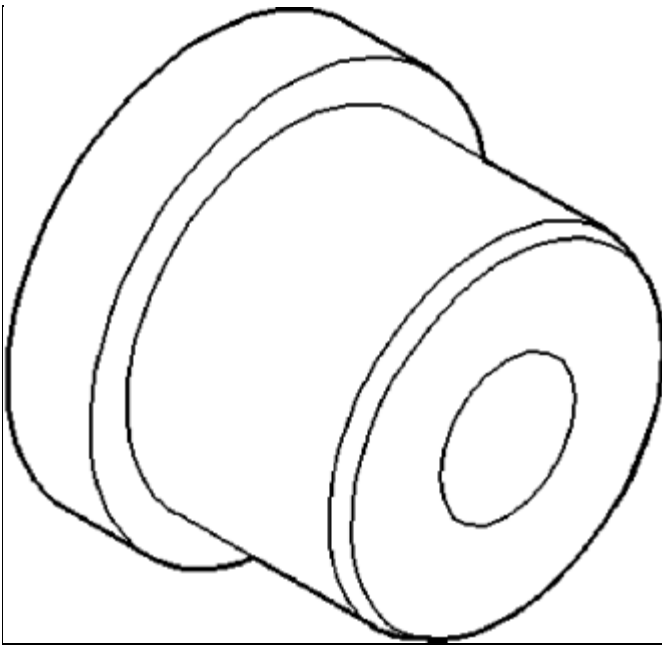
Flange Holder - C-3281**Handle, Universal - C-4171****Installer, Seal - C-4210**



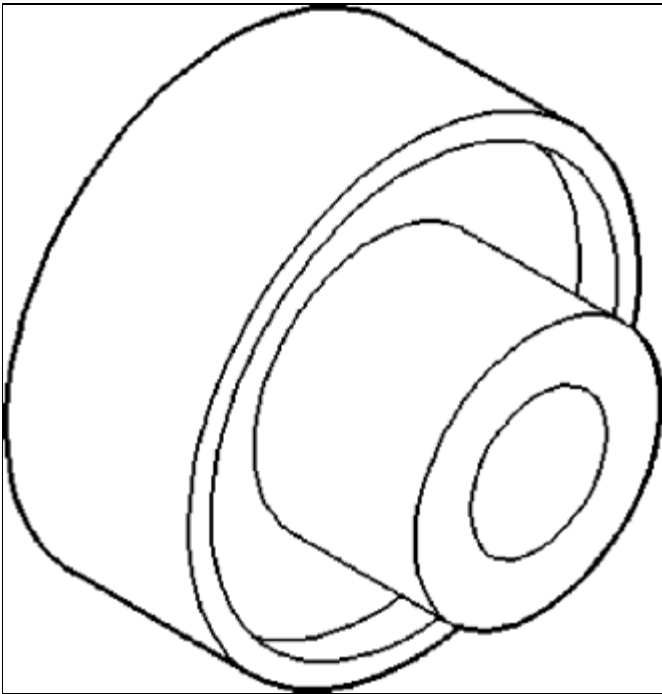
Installer, Seal - D-163



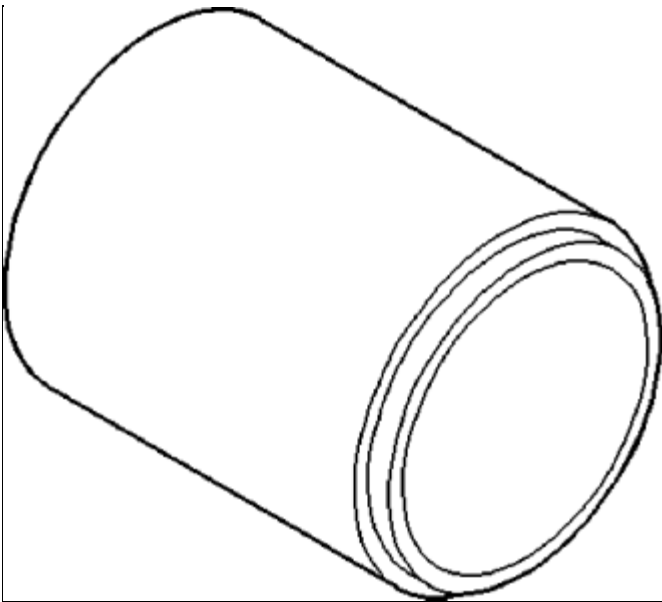
Remover - L-4454



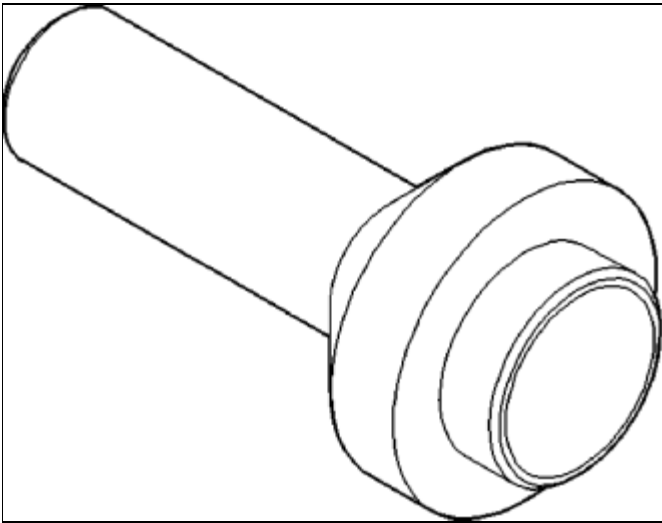
Installer, Bushing - 5066



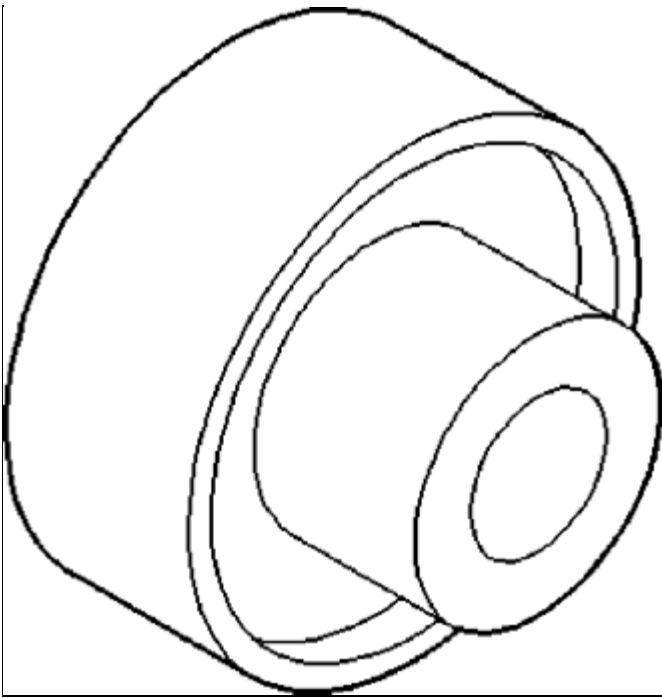
Installer - 6436



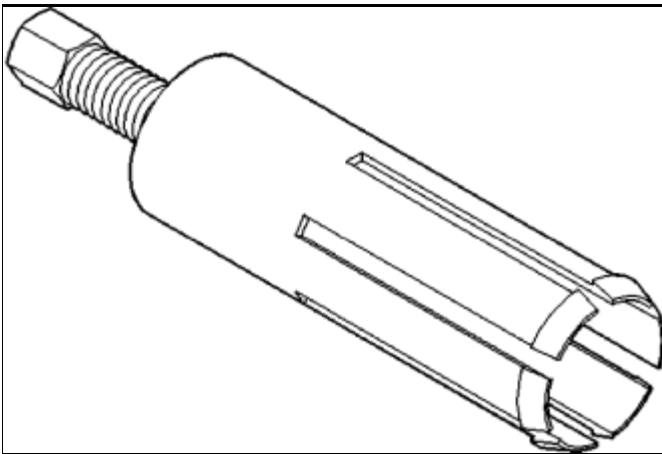
Installer, Seal - 6888



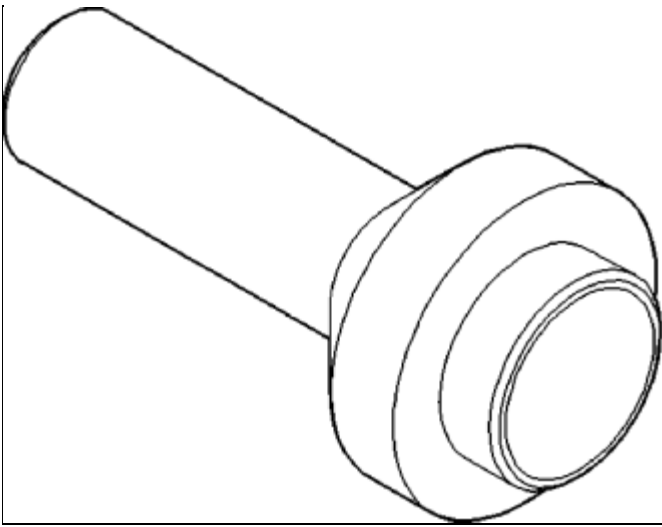
Installer, Seal - 6952A



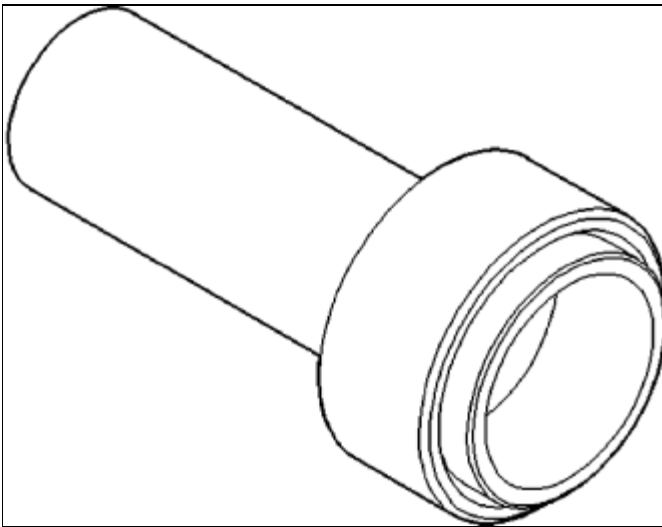
Installer, Bearing - 6953



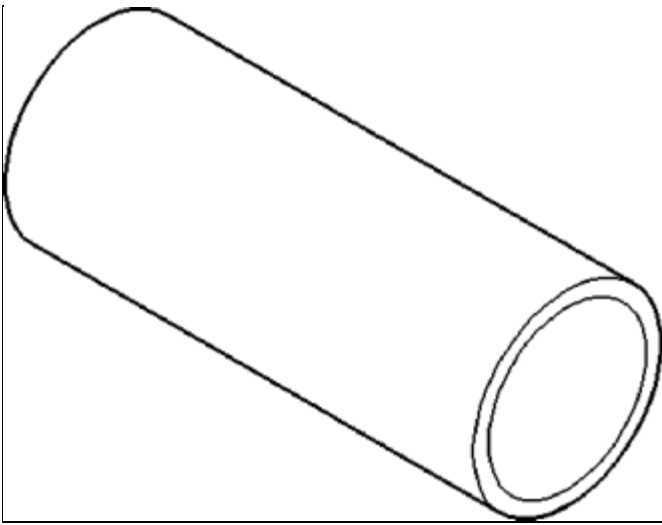
Remover, Bushing - 6957



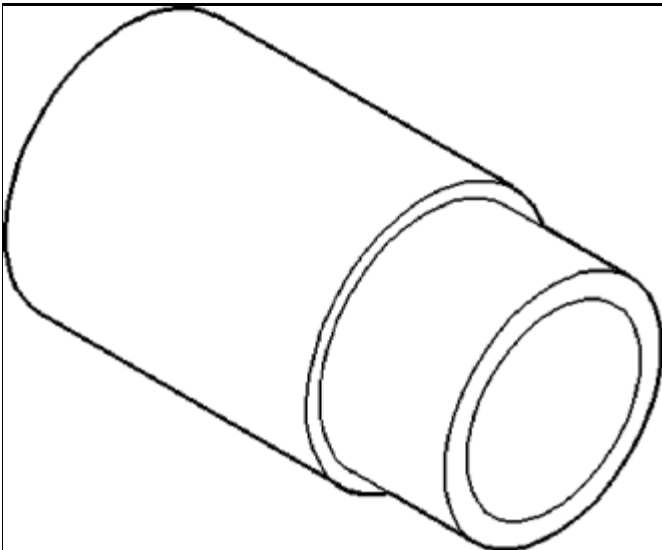
Installer, Seal - 7884



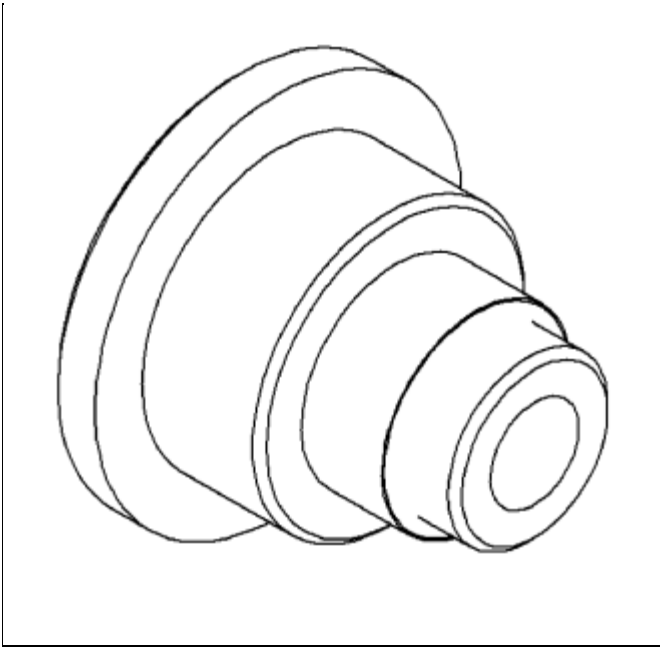
Installer, Pump Housing Seal - 7888



Cup - 8148



Installer, Bushing - 8157



Installer, Bearing - 8684

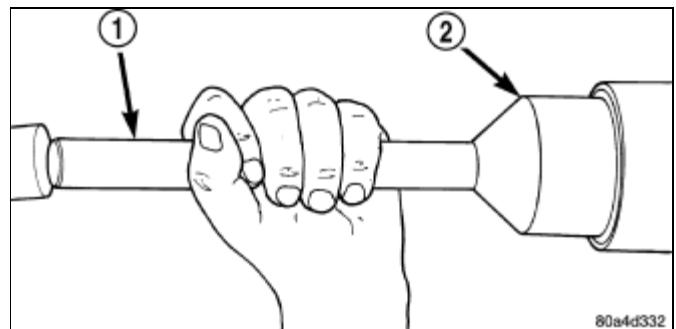
SEAL-EXTENSION HOUSING

REMOVAL

1. Raise and support vehicle.
2. Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Using a suitable pry tool or slide-hammer mounted screw, remove the extension housing seal.

INSTALLATION

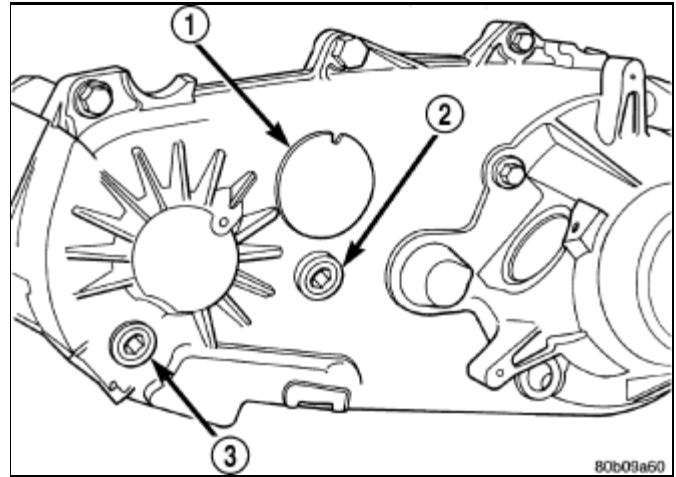
1. Clean fluid residue from sealing surface and inspect for defects.
2. Using Seal Installer D-163 (2) and Universal Handle C-4171 (1), install seal in extension housing .
3. Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
4. Verify proper transfer case fluid level.
5. Lower vehicle.



FLUID

STANDARD PROCEDURE - FLUID DRAIN AND FILL

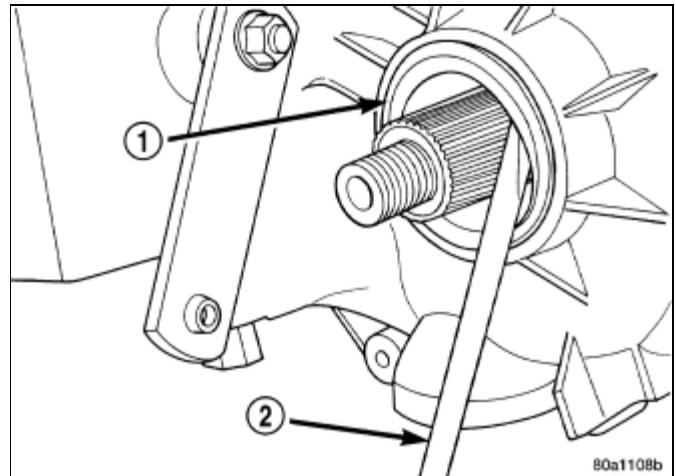
The fill (2) and drain (3) plugs are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.



SEAL-FRONT OUTPUT SHAFT

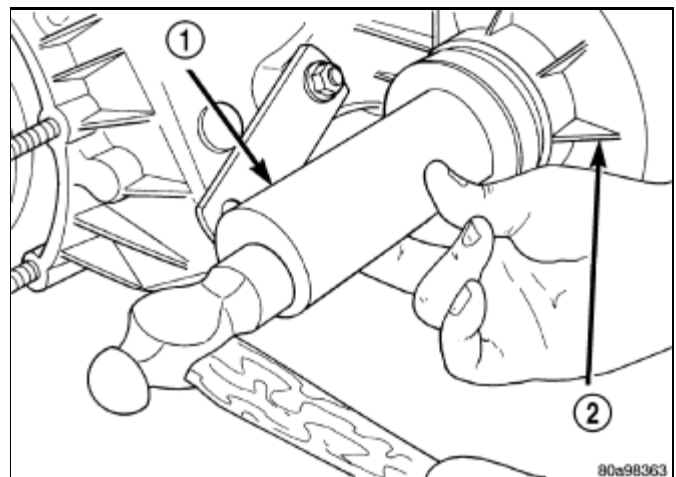
REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with pry tool (2).



INSTALLATION

1. Install new front output seal in front case (2) with Seal Installer 6952-A (1) as follows:
 - a. Place new seal on tool. Garter spring on seal goes toward interior of case.
 - b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange. Tighten the companion flange nut to 149 N·m (110 ft.lbs.).
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

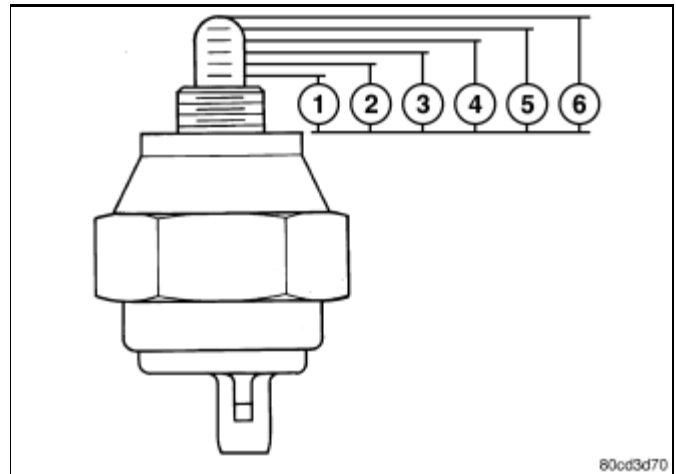
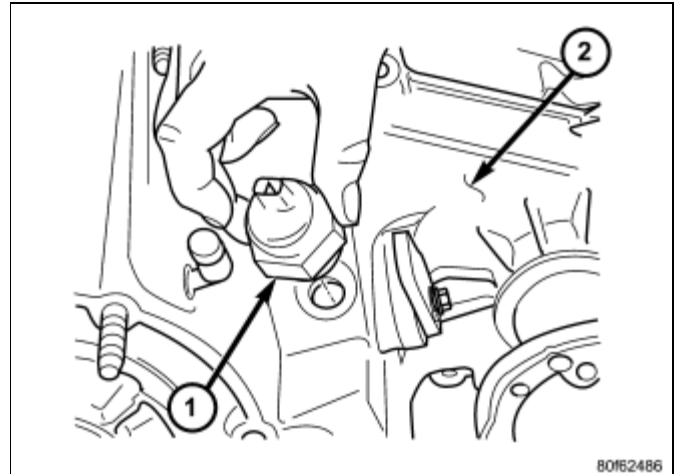


SENSOR-POSITION

DESCRIPTION

The transfer case position sensor (2) is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.

OPERATION



Position Sensor Linear Movement

1 - POSITION 1 - 10mm ± 0.5 mm
2 - POSITION 2 - 12mm ± 0.5 mm
3 - POSITION 3 - 14mm ± 0.5 mm
4 - POSITION 4 - 16mm ± 0.5 mm
5 - POSITION 5 - 18mm ± 0.5 mm
6 - POSITION 6 - 20mm ± 0.5 mm - FULL EXTENSION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the [Operating Mode Versus](#)

[Resistance](#) table for the correct resistance for each position.

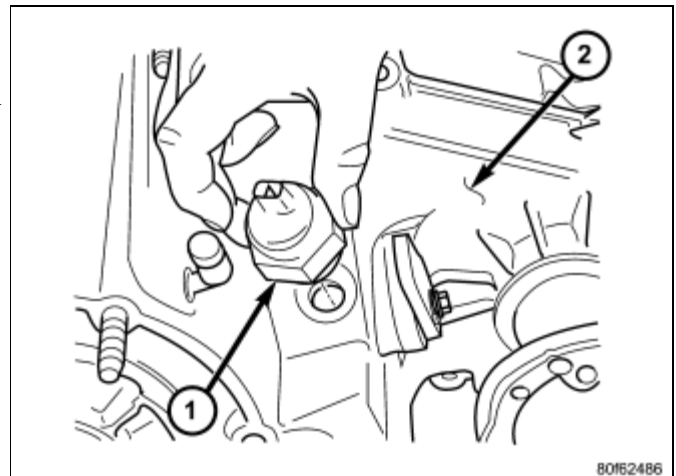
Operating Mode Versus Resistance

SENSOR POSITION	OPERATING MODE	SENSOR RESISTANCE (ohms)
1	2WD	1124-1243
2	4WD PART TIME	650-719
3	4WD FULL TIME	389-431
4	NEUTRAL	199-221
5	4WD LOW	57-64

REMOVAL

1. Raise and support the vehicle.
2. Disengage the transfer case position sensor connector from the position sensor (2).
3. Remove the position sensor from the transfer case.

INSTALLATION

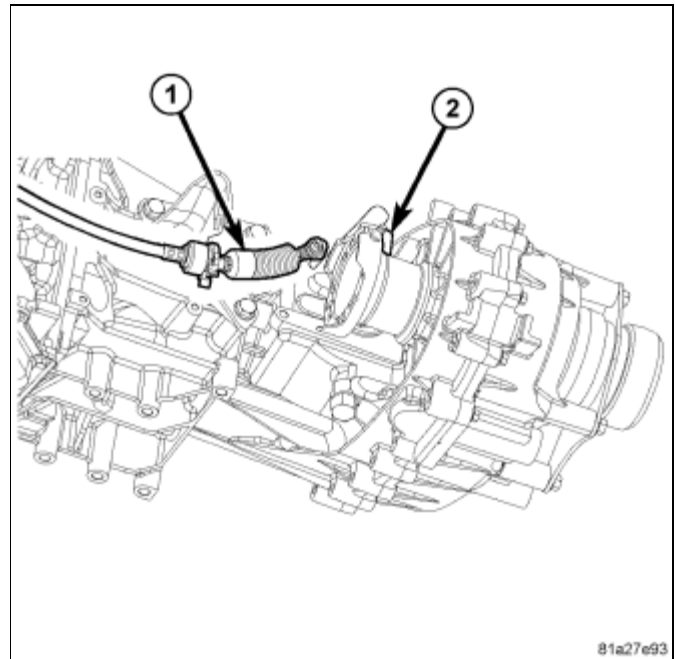


1. Inspect the o-ring seal on the transfer case position sensor (1). Replace the o-ring if necessary.
2. Install the transfer case position sensor into the transfer case. Torque the sensor to 27 N·m (20 ft.lbs.).
3. Engage the transfer case position sensor connector to the position sensor.
4. Lower vehicle.
5. Verify proper sensor operation.

CABLE-SHIFT

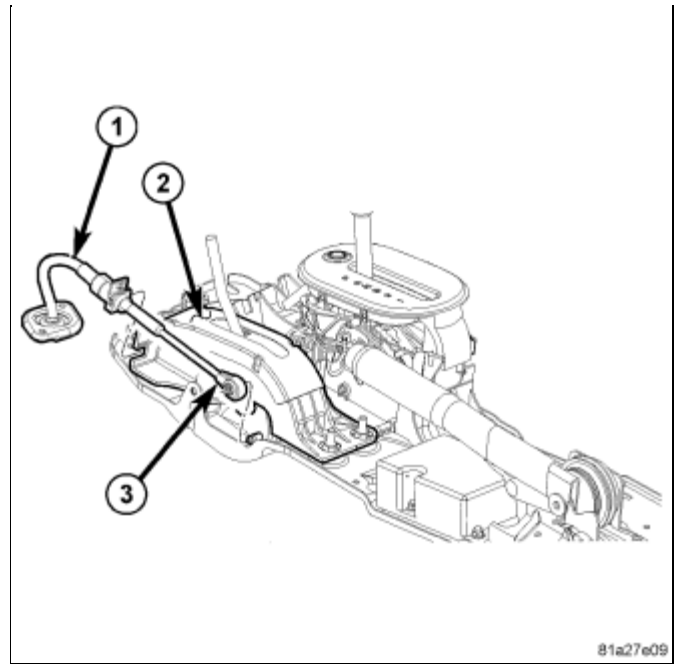
REMOVAL

1. Shift transfer case into 4L.
2. Raise vehicle.
3. Remove clip securing the transfer case shift cable (2) to the shift cable support bracket.
4. Disengage any additional shift cable routing clips, if necessary.
5. Disengage the shift cable from the transfer case manual lever.



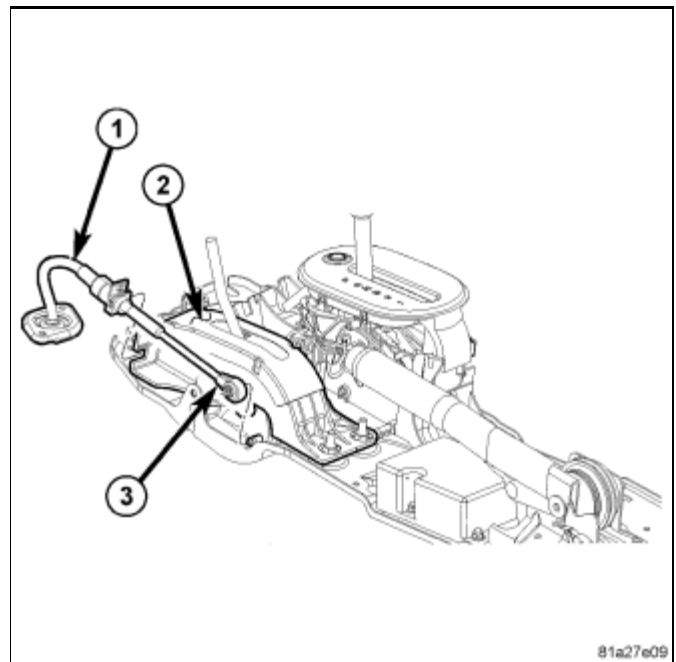
6. Lower the vehicle.
7. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
8. Disengage the transfer case shift cable from the shift lever pin and body.
9. Disengage the shift cable grommet from the floor and remove the shift cable from the vehicle.

INSTALLATION



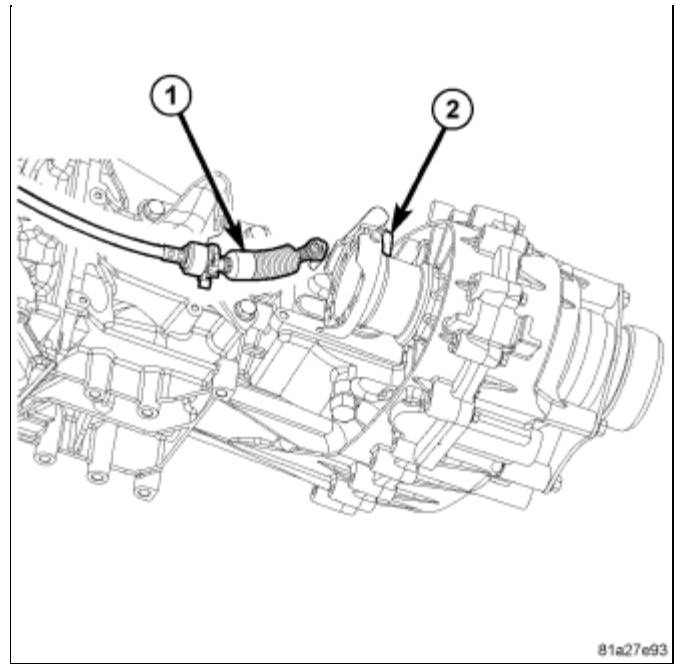
81a27e09

1. Route the shift cable through the opening in the floor pan.
2. Connect the transfer case shift cable to the shift lever body and pin.
3. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)
4. Verify that the floor shifter is in the 4L position.



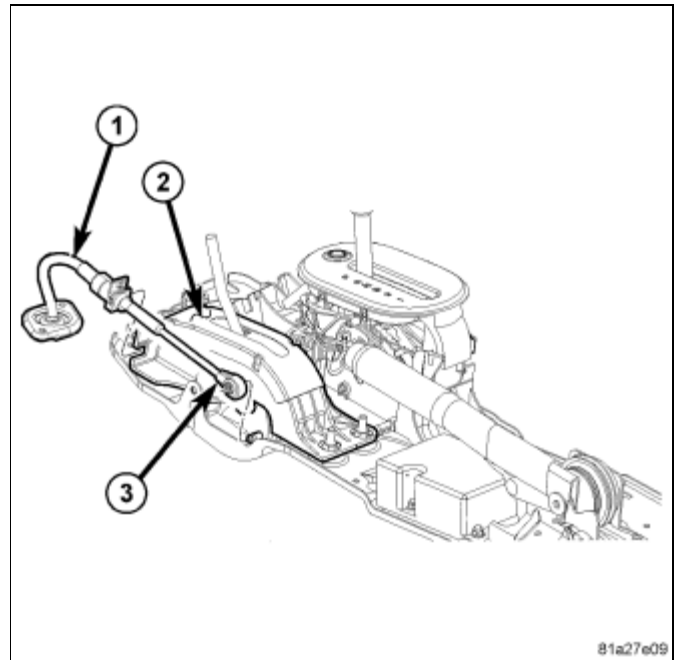
81a27e09

5. Raise vehicle.
6. Route the shift cable through the opening in the shift cable support bracket.
7. Install the cable and a new spring clip into the slot in the support bracket.
8. Install any additional routing clips on the shift cable.
9. Verify that the transfer case is in the 4L position. The 4L position for the transfer case is with the manual lever to the full rearward position.
10. Attach the shift cable to the transfer case manual lever.
11. Lower vehicle and check for proper transfer case shifter operation.



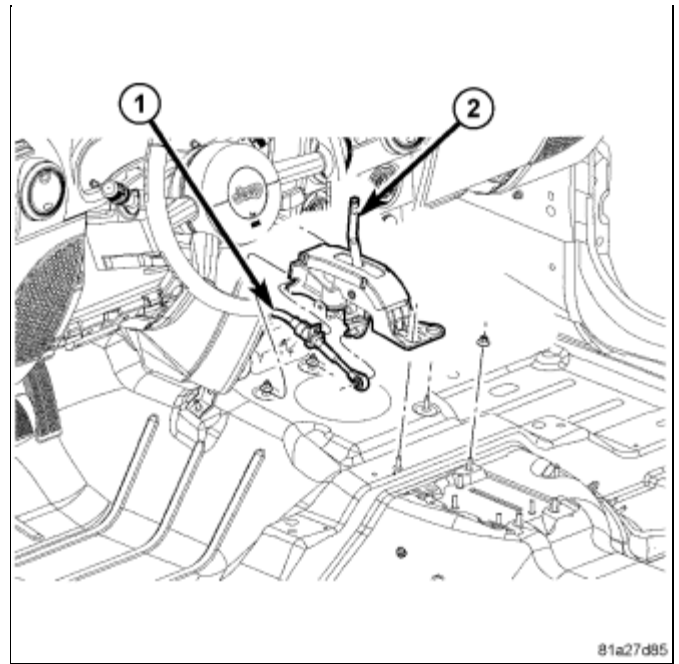
LEVER AND KNOB-SHIFT REMOVAL SHIFT LEVER

1. Shift transfer case into 4L.
2. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Disengage the transfer case shift cable from the shift lever pin and body.



4. Remove the nuts attaching lever assembly (1) to floorpan and remove assembly (2).
5. Remove the shifter mechanism from the vehicle.

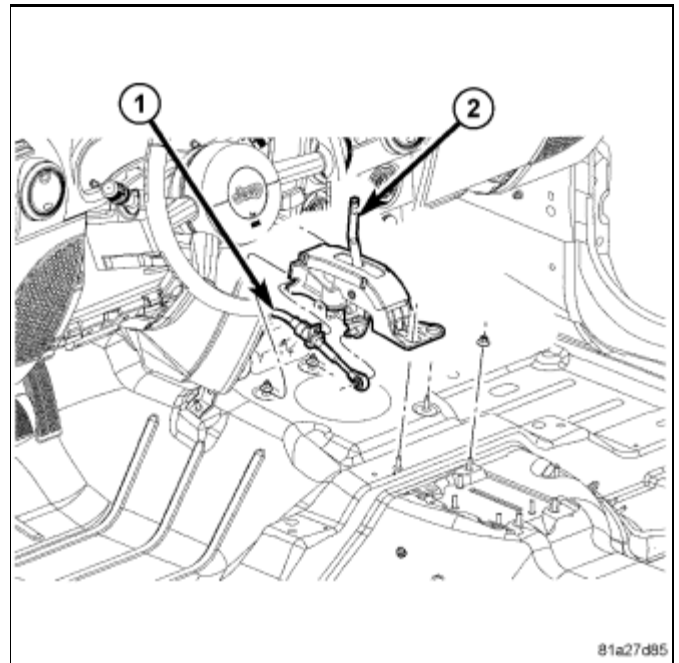
REMOVAL



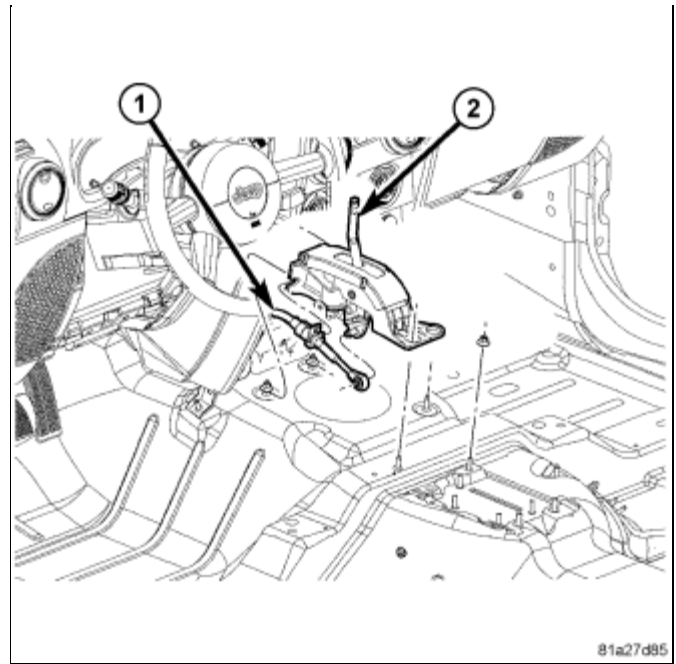
1. Pull up on gearshift knob with moderate force to remove from gearshift mechanism.

INSTALLATION

SHIFT LEVER



1. Position the shift mechanism over the shifter retaining studs on the floor pan.
2. Install the nuts to hold the shifter mechanism to the floor pan. Tighten the nuts to 11.9 N·m (105 in.lbs.).

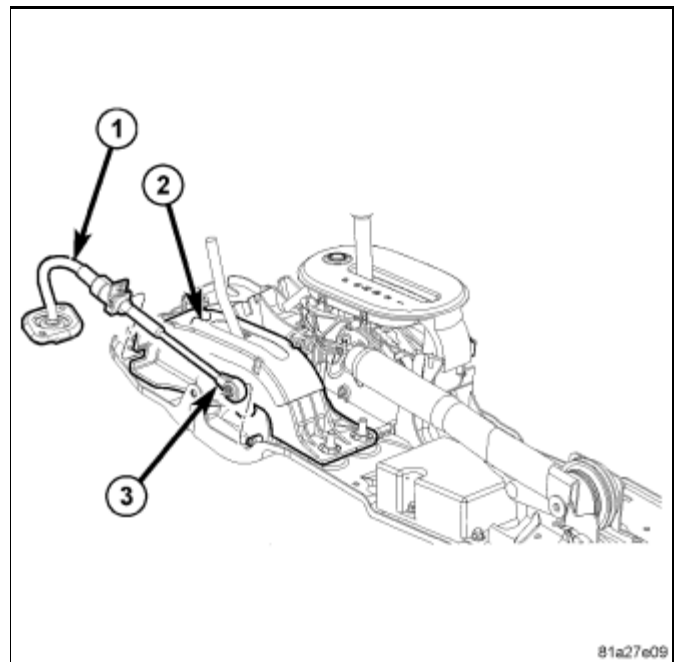


81a27d95

3. Verify that the floor shifter is in the 4L position.
4. Connect the transfer case shift cable to the shift lever body and pin.
5. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)
6. Check for proper transfer case shifter operation.

INSTALLATION

CAUTION: Do not strike the gearshift mechanism knob during the installation procedure. Failure to follow this caution may result in gearshift mechanism damage.



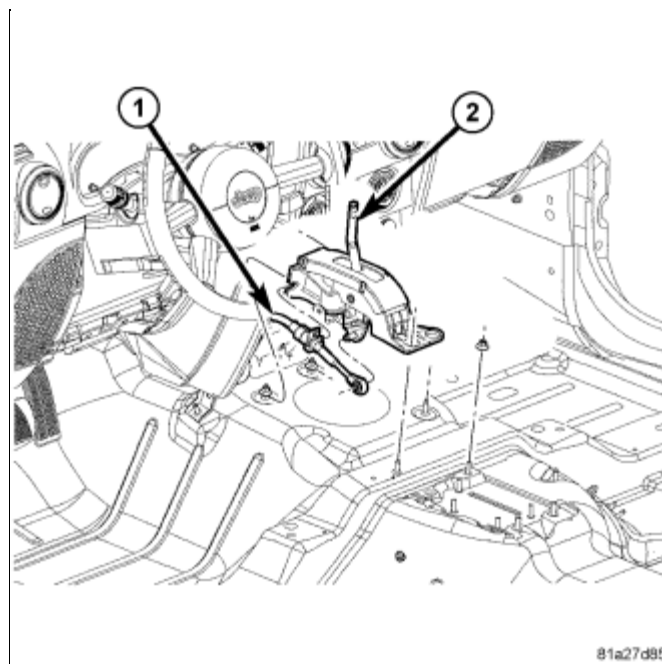
81a27e09

1. Position knob hole over the gearshift mechanism and align the shift pattern.
2. Apply downward pressure by **HAND** on the knob to engage the gearshift mechanism.
3. Verify that shift pattern is aligned properly.

TRANSFER CASE - NV241OR

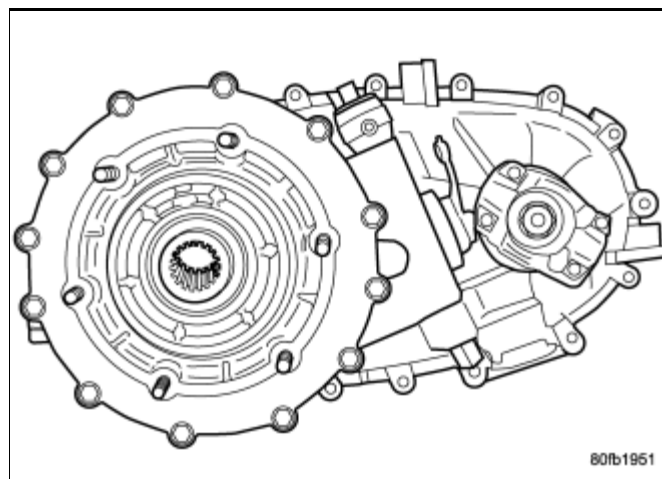
TRANSFER CASE - NV241OR

DESCRIPTION



The NV241OR transfer case is a part-time transfer case with a low-range gear system. It provides three operating ranges plus a NEUTRAL position. The low range position provides a gear reduction ratio of 4.0:1 for increased low speed torque capability.

The gear cases, retainer and extension are all of aluminum. Drive sprockets and an interconnecting drive chain are used to transmit engine torque to the front/rear propeller shafts. The mainshaft, input gear and front output shaft are supported by ball and needle bearings.

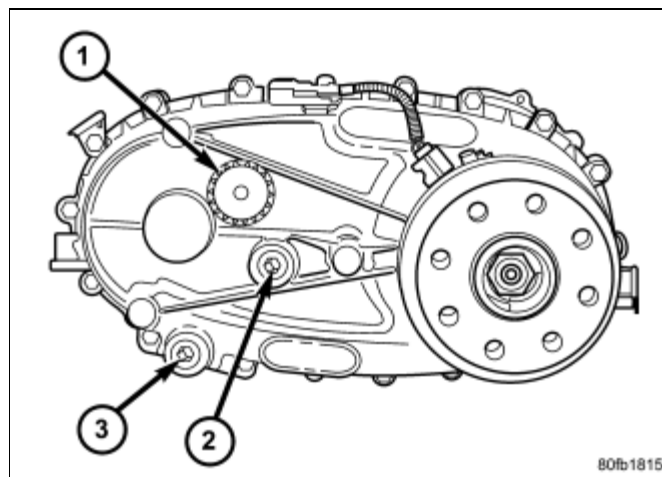


IDENTIFICATION

An identification tag (1) is attached to the rear case of every transfer case. The tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

OPERATION



OPERATING RANGES

Transfer case operating ranges are:

- 2H (2-wheel drive)
- 4H (4-wheel drive)
- 4LO (4-wheel drive low range)

The 2H range is for use on any road surface at any time.

The 4H and 4LO ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is covered by ice and snow.

The low range reduction gear system is operative in 4LO range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 4.0:1.

SHIFT MECHANISM

The transfer case is operated by an adjustable floor mounted shift linkage. The transfer case shift lever is directly attached to the shift sector. The sector operates the range and mode forks within the transfer case.

A straight line shift pattern is used with a NEUTRAL detent. Lever range positions are imprinted in the shift knob.

SHIFTING

The vehicle must have the transmission placed in NEUTRAL, or the clutch depressed in the case of a manual transmission, and be moving less than 2-3 MPH when shifting into the 4L operating range.

DIAGNOSIS AND TESTING - TRANSFER CASE

Before beginning repair on a suspected transfer case malfunction, check all other driveline components beforehand.

The actual cause of a problem may be related to such items as: front hubs, axles, propeller shafts, wheels and tires, transmission, or clutch instead. If all other driveline components are in good condition and operating properly, refer to the Diagnosis Chart for further information.

DIAGNOSIS CHART

Condition	Possible Cause	Correction
Transfer Case difficult to shift or will not shift into desired range.	1) Vehicle speed too great to permit shifting.	1) Stop vehicle and shift into desired range. Or, reduce speed to below 3-4 km/h (2-3 mph) before attempting the shift.
	2) If vehicle was operated for an extended period in 4H on a dry paved	2) Stop vehicle and shift the transmission into neutral. Shift the transfer case to 2H and operate vehicle in 2H on dry paved surfaces.

	surface, the driveline torque load may be causing a bind.	
	3) Transfer case external shift linkage binding.	3) Lubricate, repair, or replace linkage bushings, or tighten loose components as necessary.
	4) Insufficient or incorrect lubricant.	4) Drain and refill to edge of fill hole with Mopar® ATF +4, type 9602, Automatic Transmission fluid.
	5) Internal components binding, worn, or damaged.	5) Disassemble the transfer case and replace worn or damaged components as necessary.
Transfer Case noisy in all operating ranges.	1) Insufficient or incorrect lubricant.	1) Drain and refill to edge of fill hole with Mopar® ATF +4, type 9602, Automatic Transmission fluid.
Noisy in, or jumps out of, four wheel drive low range.	1) Transfer case not completely engaged in 4L position.	1) With the transmission in NEUTRAL, or the clutch depressed in the case of a manual transmission and the vehicle moving under 3-4 km/h (2-3 mph), shift the transfer case to NEUTRAL and then shift into the 4L position.
	2) Shift linkage out of adjustment.	2) Adjust linkage.
	3) Shift linkage loose or binding.	3) Tighten, lubricate, or repair linkage as necessary.
	4) Range fork damaged, inserts worn, or fork is binding on the shift rail.	4) Disassemble unit and repair as necessary.
	5) Low range gear worn or damaged.	5) Disassemble unit and repair as necessary.
Lubricant leaking from output shaft seal or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Vent closed or restricted.	2) Clear or replace vent as necessary.
	3) Output shaft seals damaged or installed incorrectly.	3) Replace seal as necessary. Check to ensure that another component, the propeller shaft slip yoke for example, is not causing damage to seal.
Abnormal tire wear.	1) Extended operation on hard, dry surfaces in the 4H position.	1) Operate vehicle in the 2H position on hard, dry surfaces.

REMOVAL

1. Raise and support vehicle.
2. Remove skid plate, if equipped. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)
3. Position drain oil container under transfer case.
4. Remove transfer case drain plug and drain lubricant into container.
5. Disconnect vent hose and vacuum harness at transfer case switch.
6. Disconnect shift rod from grommet in transfer case shift lever, or from floor shift arm whichever provides easy access. Use channel lock style pliers to press rod out of lever grommet.

7. Support transmission with jack stand.
8. Remove rear crossmember.
9. Mark front and rear propeller shafts for assembly reference.
10. Remove front and rear propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
11. Support transfer case with suitable jack. Secure transfer case to jack with safety chains.
12. Remove nuts attaching transfer case to transmission.
13. Move transfer case assembly rearward until free of transmission output shaft.
14. Lower jack and move transfer case from under vehicle.

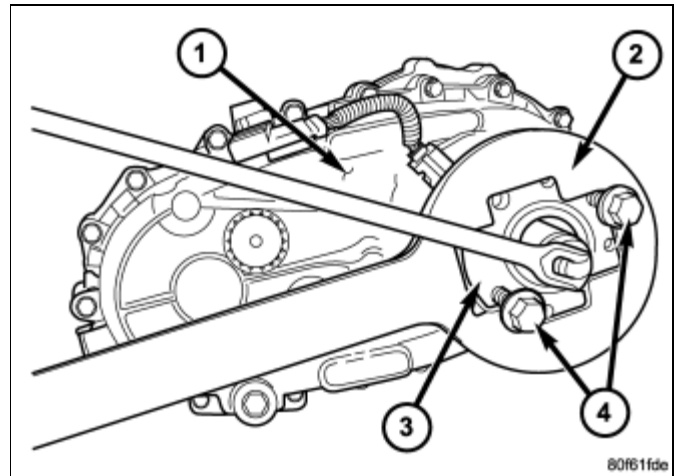
DISASSEMBLY

Position transfer case in a shallow drain pan. Remove drain plug and drain any remaining lubricant remaining in case.

REAR EXTENSION, RETAINER, AND REAR CASE

1. Install bolts (4) into two threaded holes in the rear propeller shaft companion flange 180° apart.
2. Place the Holder 6719 (2) over the two bolts and use the Holder to remove the rear companion flange nut.
3. Remove the rear companion flange (3) from the output shaft.

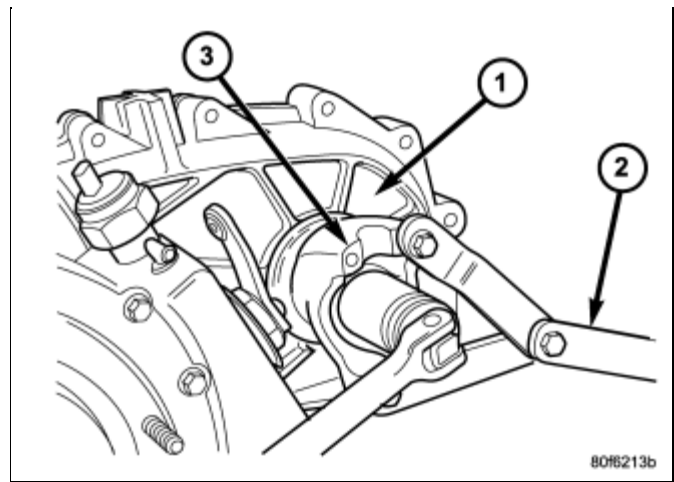
NOTE: The companion flange is a taper fit onto the output shaft. It may be necessary to use Puller 8992 to remove the companion flange.



4. There is a seal slinger located on the rear of the companion flange that can be replaced if necessary. Use a suitable cold chisel to strike the slinger hub parallel to the centerline in several spots to expand the slinger hub. A new slinger can be driven onto the flange hub using a suitable pipe tool.
5. Remove rear extension bolts.
6. Remove rear extension housing. Tap extension once or twice with a plastic mallet to break sealer bead and loosen it.

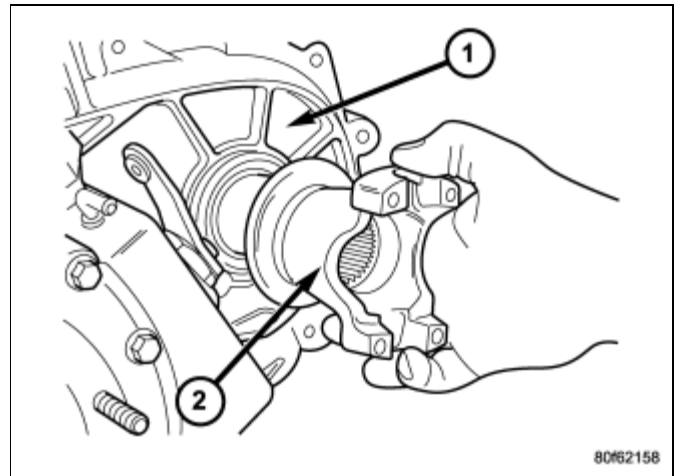
YOKE AND SHIFT LEVER

1. Shift transfer case into a 4WD mode.
2. Use Spanner Wrench 6958 to secure the yoke (3) and remove the yoke nut. Discard nut after removal. It is not reusable.

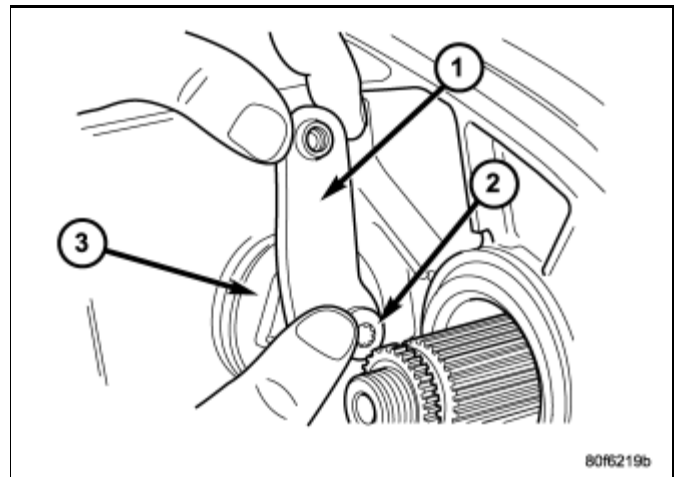


NOTE: The yoke is a taper fit onto the output shaft. It may be necessary to use a puller such as C-452 to remove the yoke.

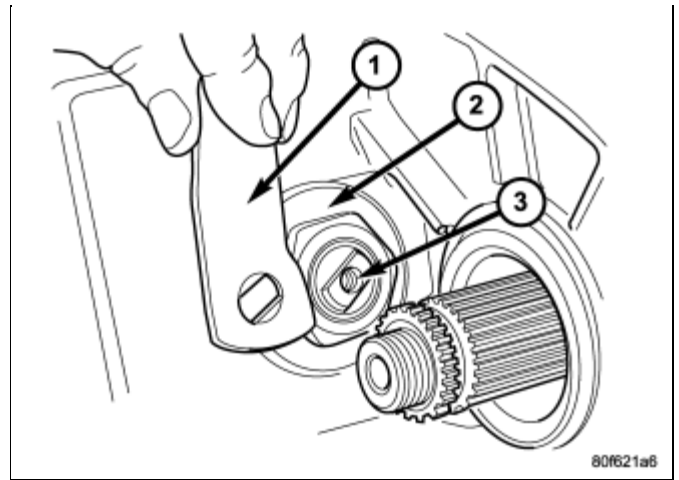
3. Remove the yoke (2) from the front output shaft.
4. There is a seal slinger located on the rear of the yoke that can be replaced if necessary. Use a suitable cold chisel to strike the slinger hub parallel to the centerline in several spots to expand the slinger hub. A new slinger can be driven onto the yoke hub using a suitable pipe tool.
5. Remove yoke rubber seal from front output shaft.



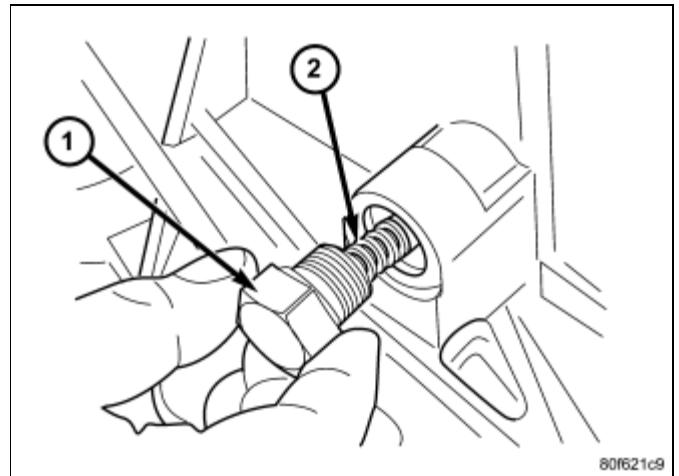
6. Remove bolt (2) that retains the shift lever (1) to sector shaft (3).



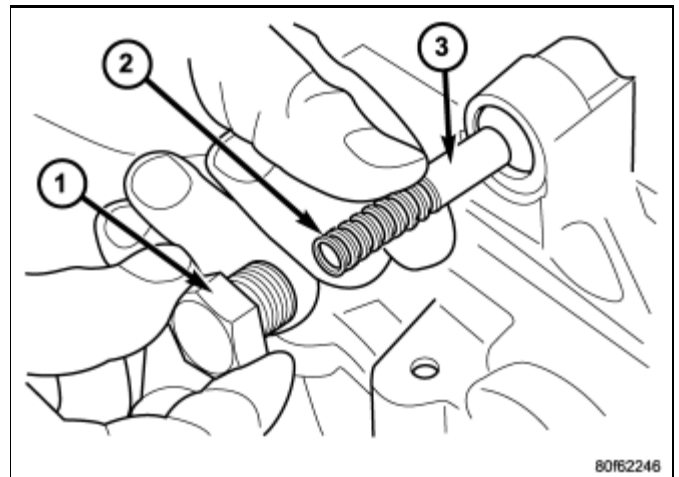
7. Remove the shift lever (1) from the shift sector (3).



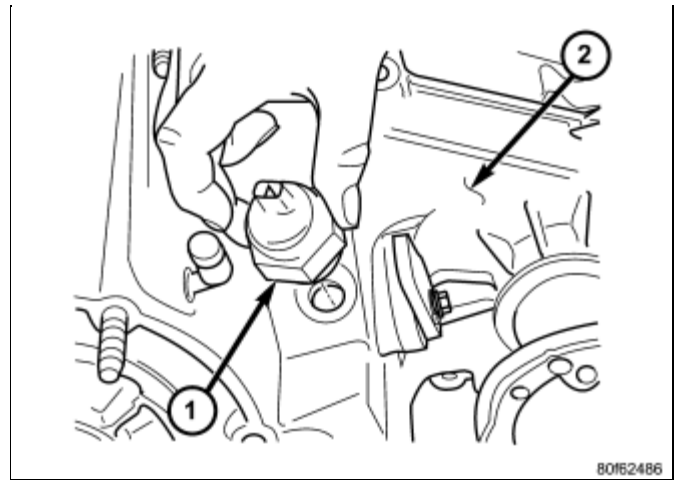
8. Remove the detente plug (1).



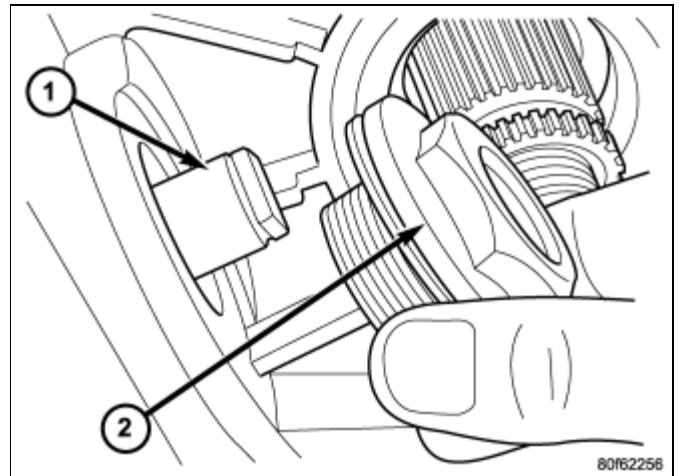
9. Remove the detente plug (1), spring (2), and plunger (3) from the transfer case.



10. Remove the transfer case position sensor (1).



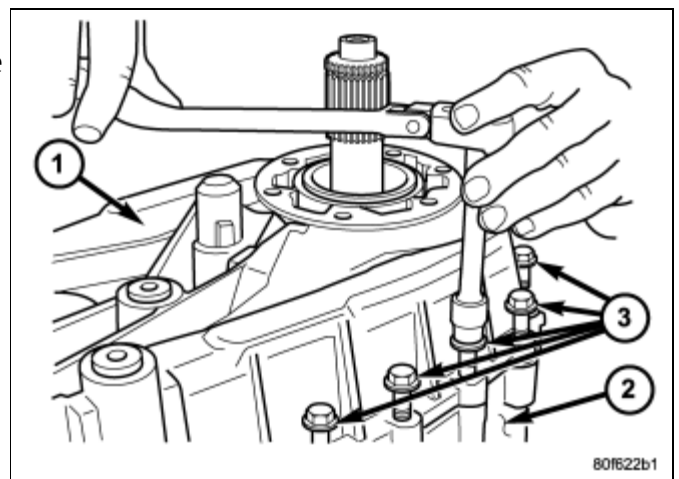
11. Remove the shift sector support (2).



MAINSHAFT, FRONT OUTPUT SHAFT, AND DRIVE CHAIN

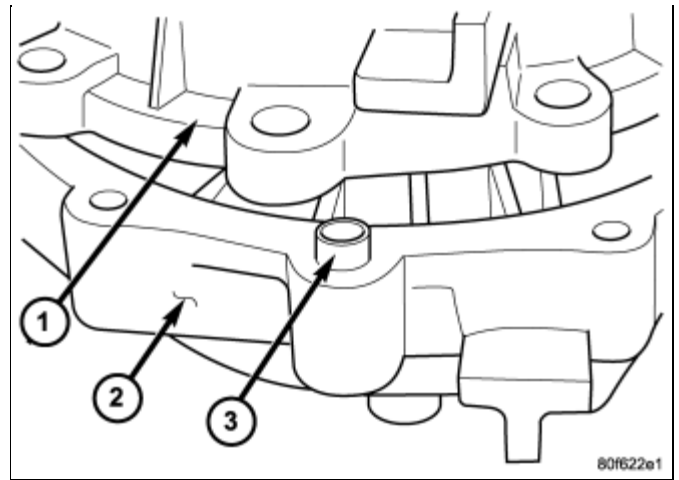
1. Note position of bolts that attach rear case (1) to front case (2). Some bolts are unique. Mark position of these bolts with paint or scribe.

2. Remove rear case-to-front case bolts (3).



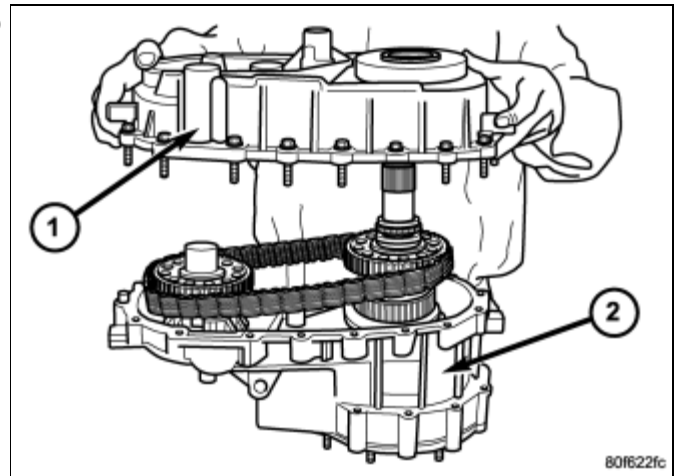
3. Loosen rear case (1) with pry tool to break sealer bead.

4. Unseat rear case from alignment dowels (3).

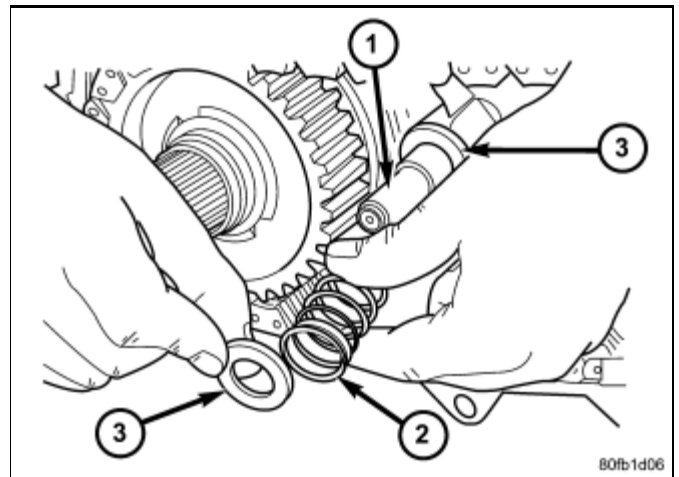


CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft bearing inner race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly **MUST** be replaced.

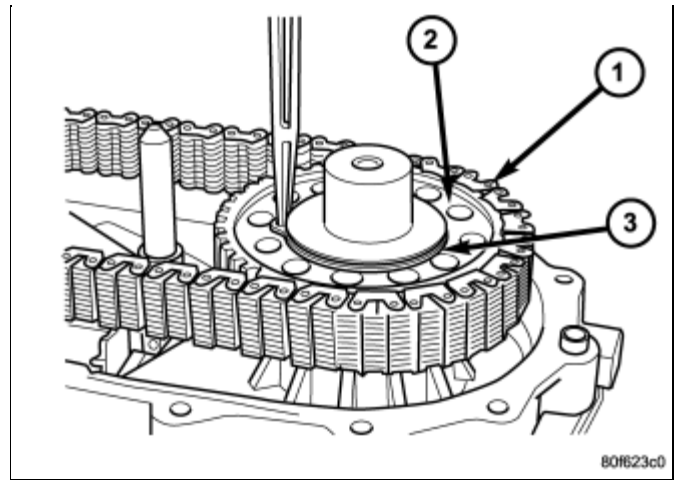
5. Remove rear case (1) and oil pump assembly from front case (2).



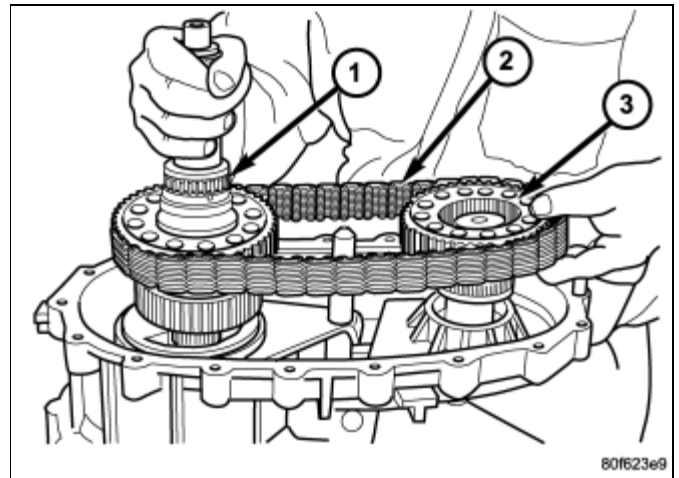
6. Remove shift rail cups (3) and spring (2).



7. Remove front drive sprocket (2) retaining ring (3).

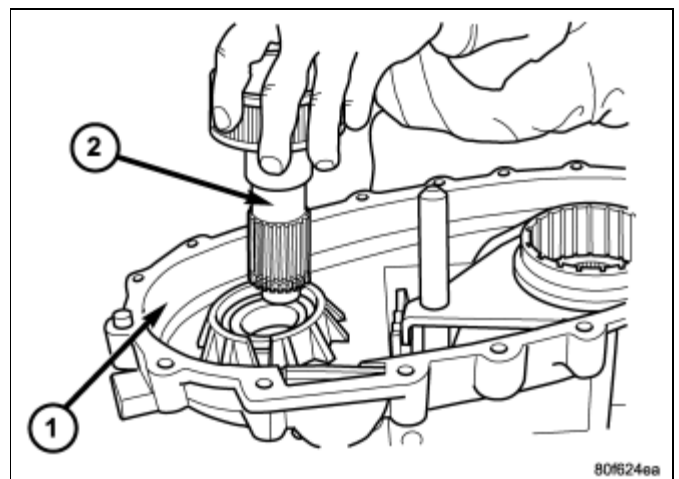


8. Remove mainshaft (1), front sprocket (3), and chain (2) as an assembly.

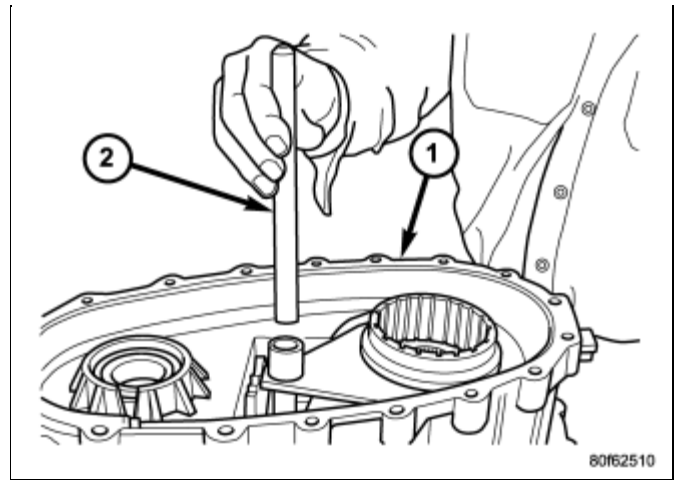


SHIFT FORKS

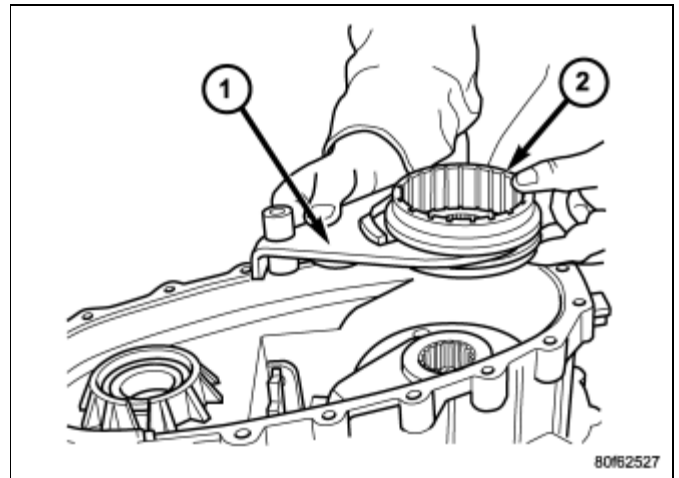
1. Remove front output shaft (2) from bearing in case (1).



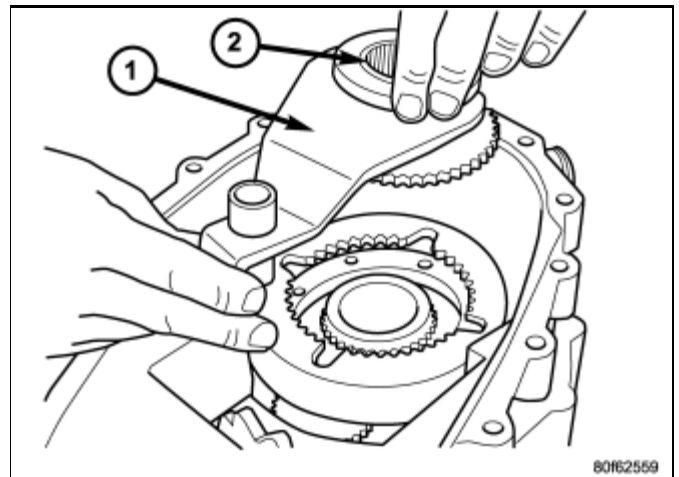
2. Remove the shift rail (2) from the shift forks.



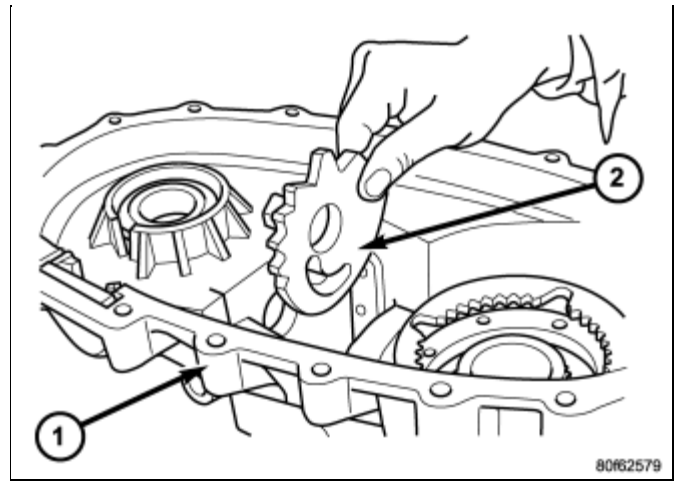
3. Remove mode fork (1), mode sleeve (2). Note which way sleeve fits in fork (long side of sleeve goes to front).



4. Remove range fork (1) and hub (2) as an assembly. Note fork position for installation reference.

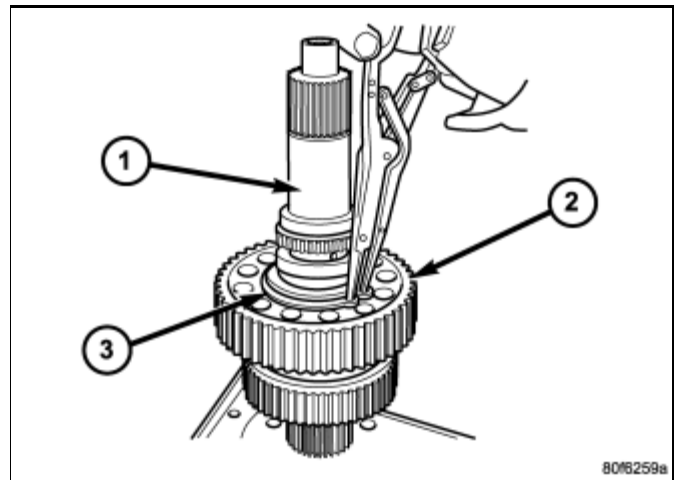


5. Remove shift sector (2).

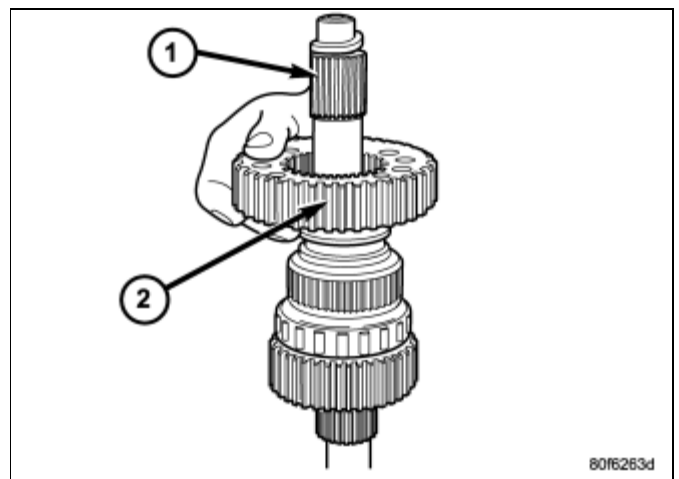


MAINSHAFT

1. Remove the snap-ring (3) that secures the chain drive sprocket (2) onto mainshaft (1). Use standard (instead of parallel jaw) snap-ring pliers to remove this snap-ring.

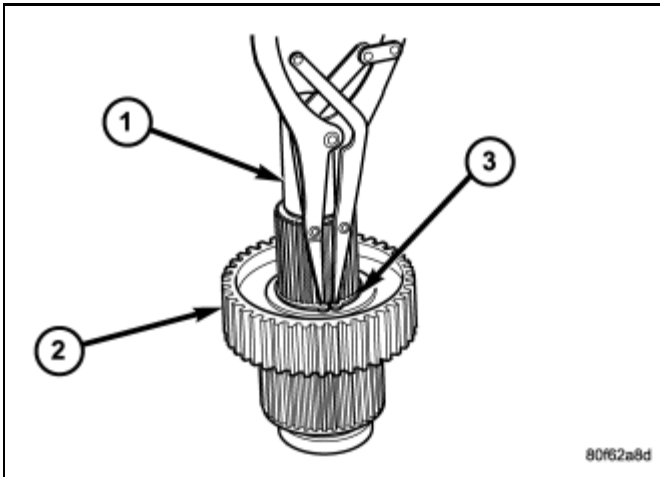


2. Remove drive sprocket (2).



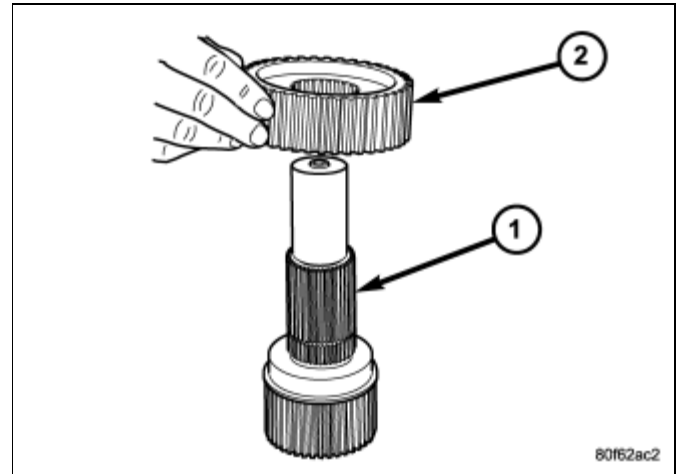
3. Remove the sliding clutch gear (2) from the mainshaft (1).

4. Rotate the

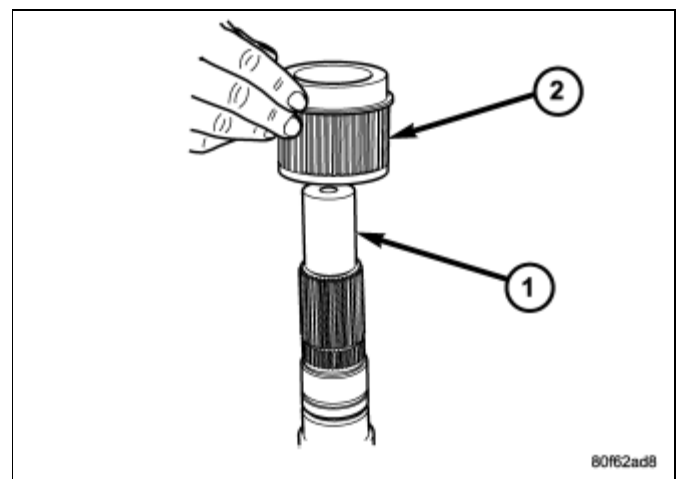


mainshaft (1) 180° and remove the mode hub (2) snap-ring (3).

5. Remove the mode hub (2) from the mainshaft.

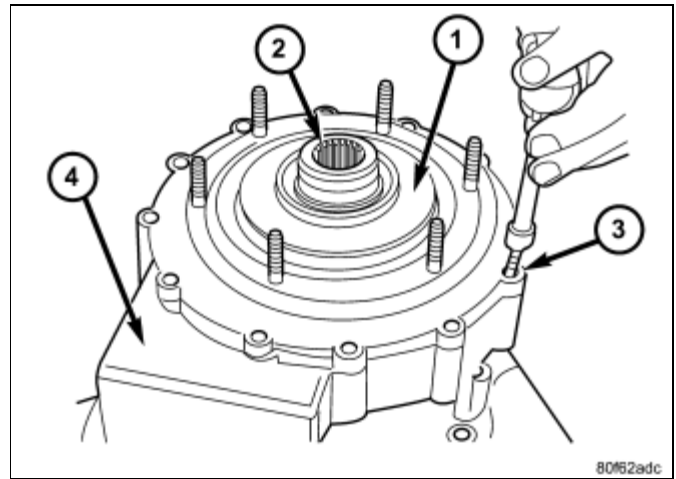


6. Remove the drive sprocket drive hub (2) from the mainshaft (1).



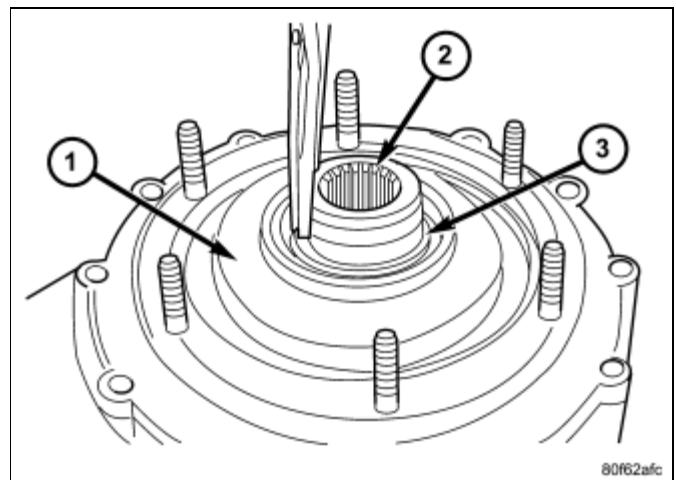
INPUT AND PLANETARY GEAR

1. Remove front input retainer (1) attaching bolts (3).

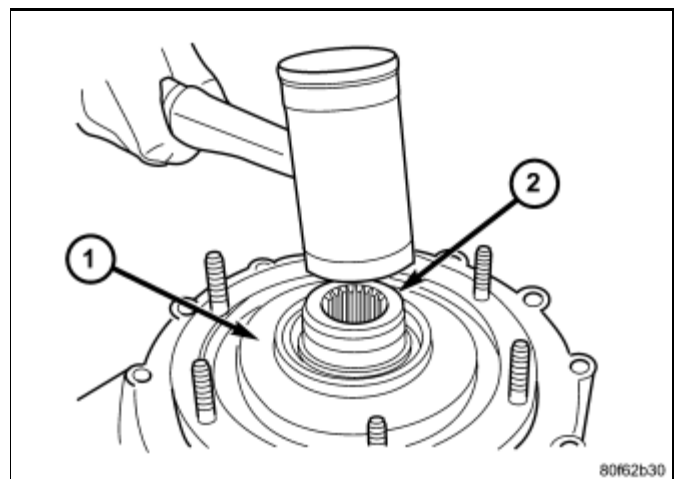


2. Remove the input gear (2) seal with a suitable screw and slide hammer.

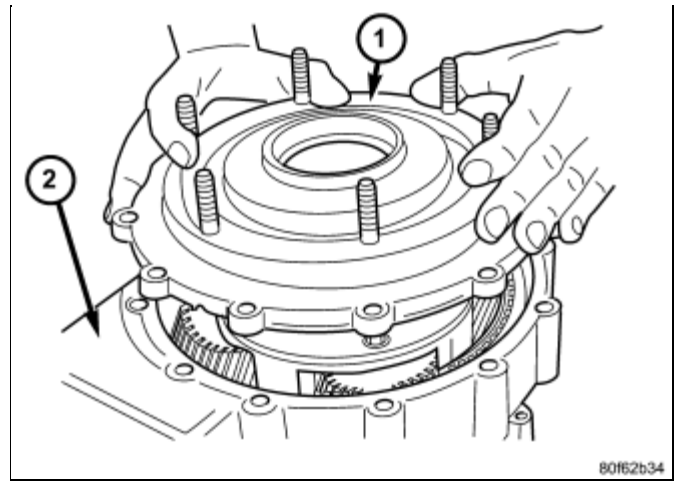
3. Remove the input gear snap-ring (3) from the input retainer (1).



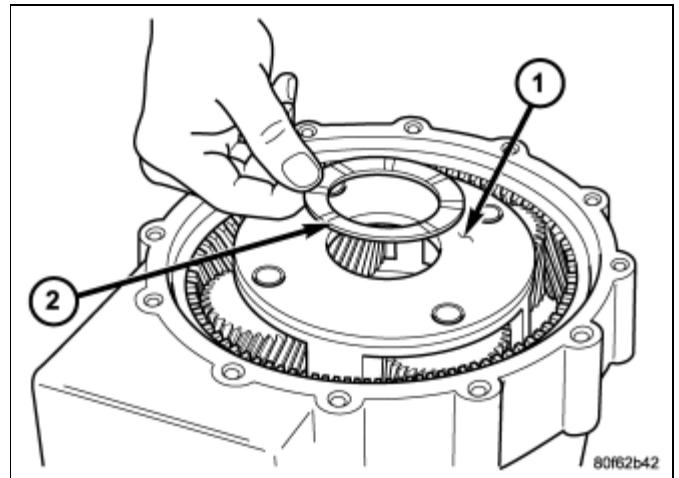
4. Remove the input gear (2) from the input gear bearing with suitable hammer.



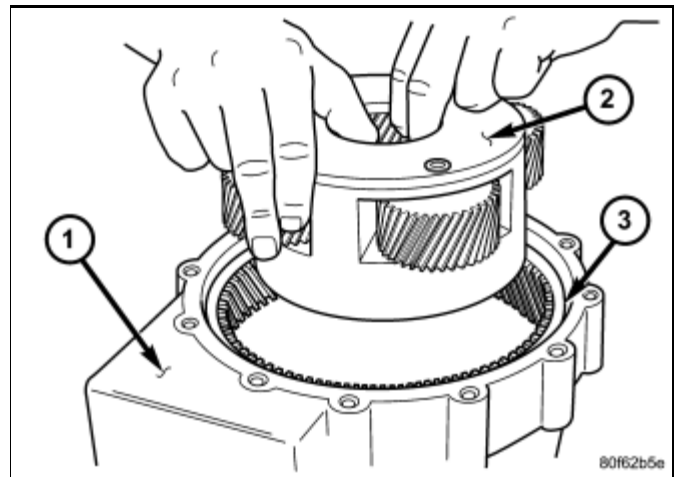
5. Remove front input retainer (1).



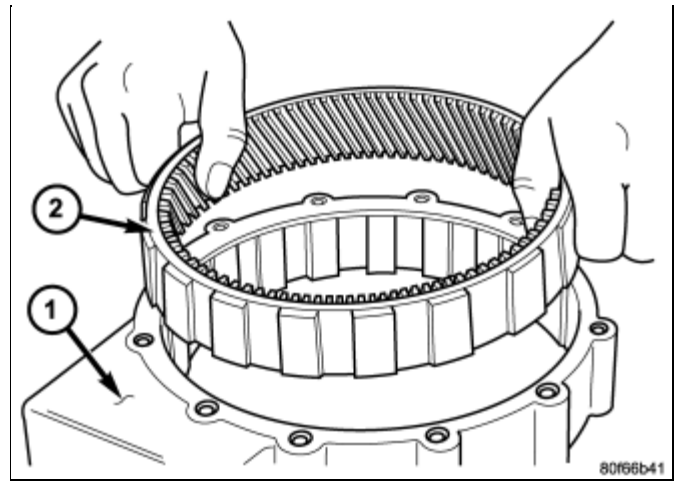
6. Remove the low range planetary (1) plastic spacer (2) from the planetary carrier or back side of the input retainer.



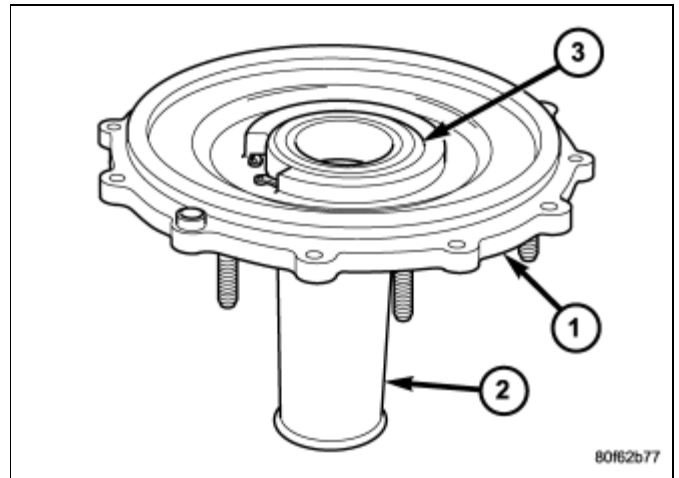
7. Remove the low range planetary gear set (2) from the front case half (1).



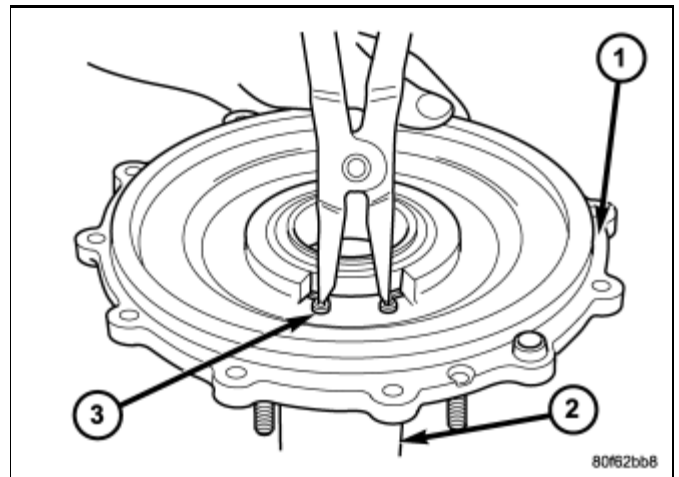
8. Remove the annulus gear (2) from the front case half (1).



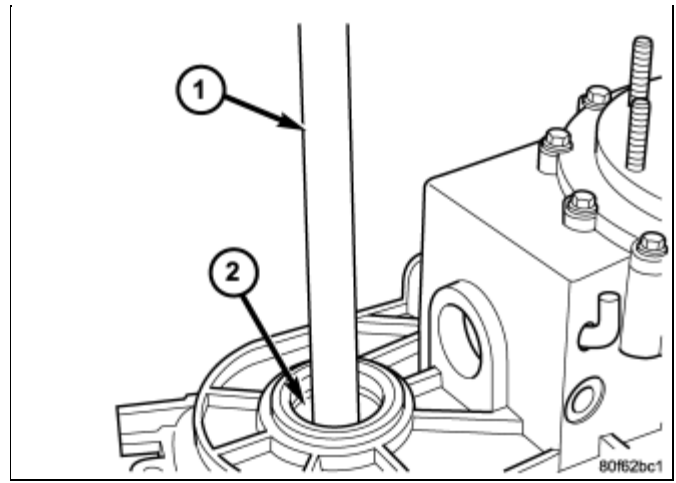
9. Support the input retainer (1) on Cup 8148 (2) as shown.



10. While using suitable snap-ring pliers to spread the input gear bearing snap-ring, press downward on the retainer (1) to remove the bearing (3).



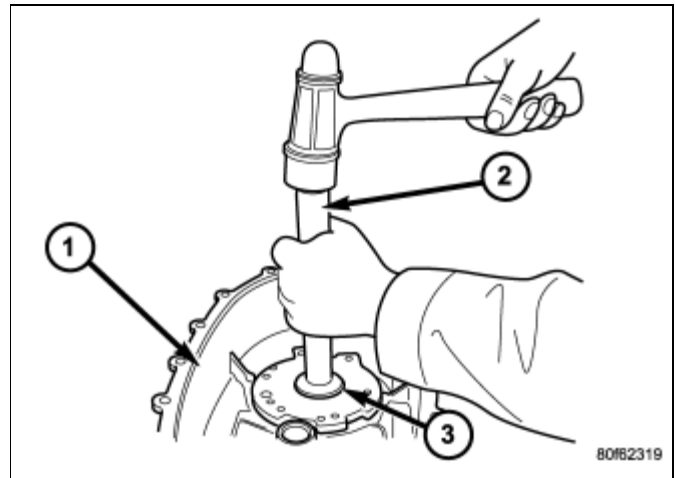
11. Remove the front output shaft bearing with Universal Handle C-4171 (1) and Installer 8239 (2).



12. Remove the rear output shaft bearing with Universal Handle C-4171 (2) and Installer 8239 (3).

CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.



INSPECTION

MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone, however, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear. Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged. Inspect the plastic washer on the inside, bottom of the planetary carrier. The washer is trapped by the pinion gears and the complete planetary will need to be replaced if the washer is worn or damaged.

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail. Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

Inspect the shift fork wear pads. The mode and range fork pads are serviceable and can be replaced if necessary.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

DRIVE CHAIN

Examine the drive chain and shaft bearings. replace the chain if stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear can be serviced separately.

FRONT-REAR CASES

Inspect the cases for wear and damage. Replace the input retainer seal, do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

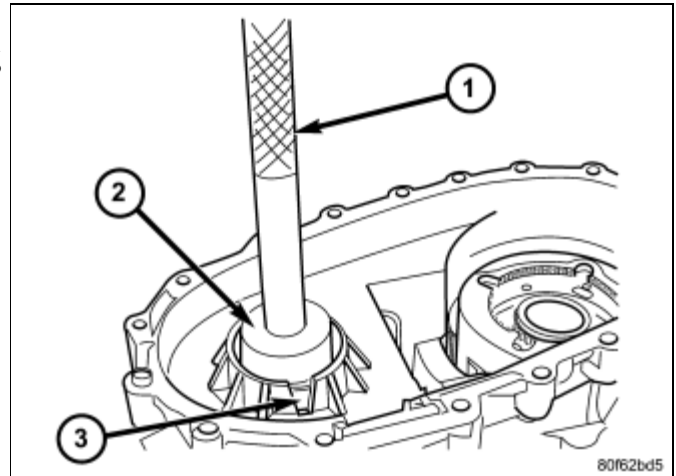
OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any evidence of debris or damage exists. Do not disassemble the pump from the rear case half as individual parts are not available and it will not be possible to reassemble the pump cover to the rear case half. The pump is only available as part of the rear case half assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

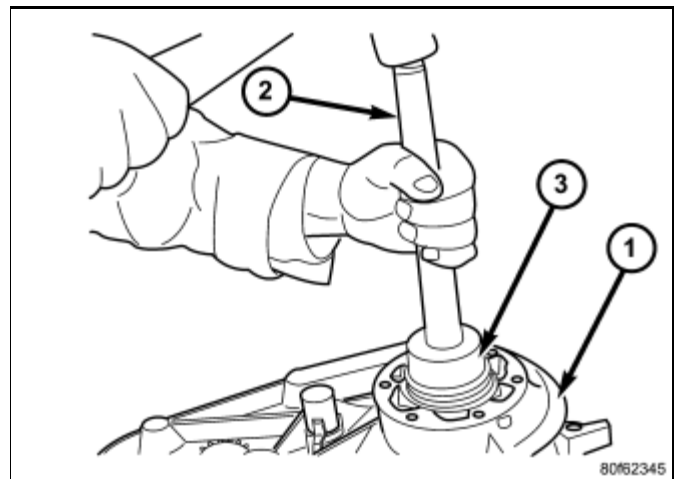
ASSEMBLY

BEARINGS AND SEALS

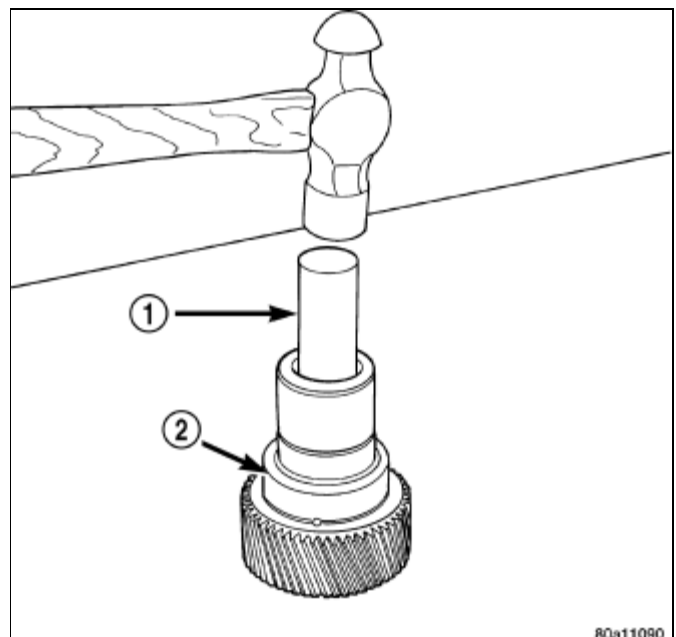
1. Position the input gear bearing in the input retainer bearing bore. Spread the snap-ring captured in the retainer with suitable snap-ring pliers and press the bearing into place. Verify that the snap-ring has engaged the groove in the bearing.
2. Start front output shaft bearing (3) in case. Then seat bearing with Universal Handle C-4171 (1) and Bearing Installer 6953 (2).



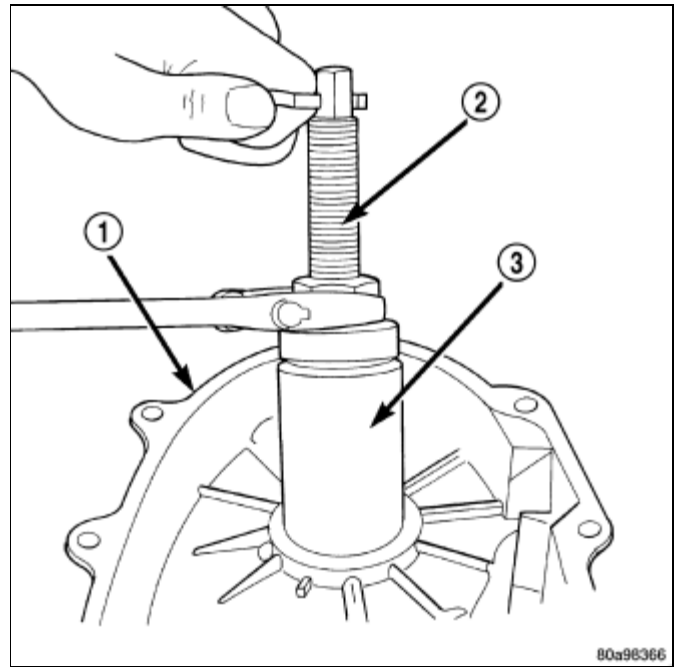
3. Install the front output shaft bearing retaining ring.
4. Install the rear output shaft bearing into the rear case half with Bearing Installer 6953 (3) and Universal Handle C-4171 (2).



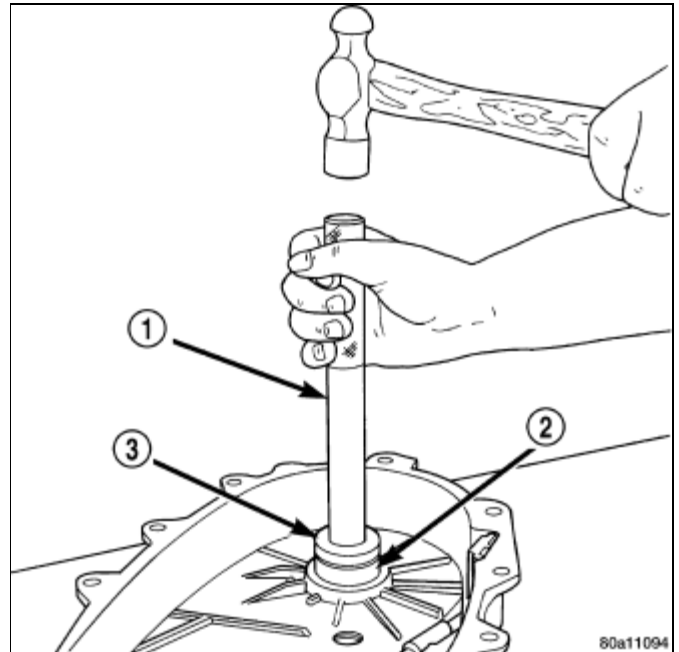
5. Remove the input gear pilot bearing using Remover Jaws 8240 and Cup 8148.
6. Remove the input gear cup plug with a suitable drift (1) and hammer inserted from the front of the input gear (2).



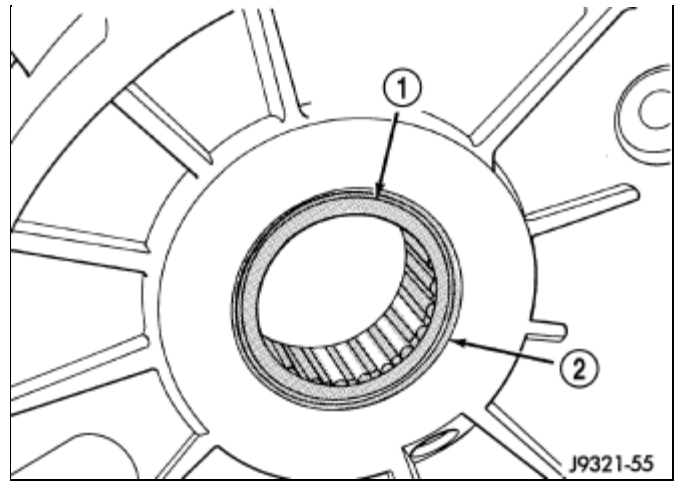
7. Install a new input gear cup plug with Cup Seal Installer 9045 and Universal Handle C-4171.
8. Install new input gear pilot bearing with Bearing Installer 9047 and Universal Handle C-4171.
9. Remove the front output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



10. Install new bearing with Universal Handle C-4171 (1) and Bushing Installer 5066 (3).

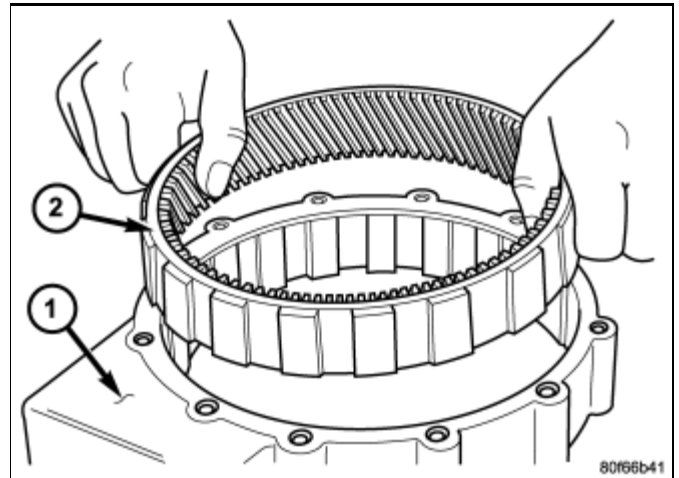


11. The bearing (1) bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (2).

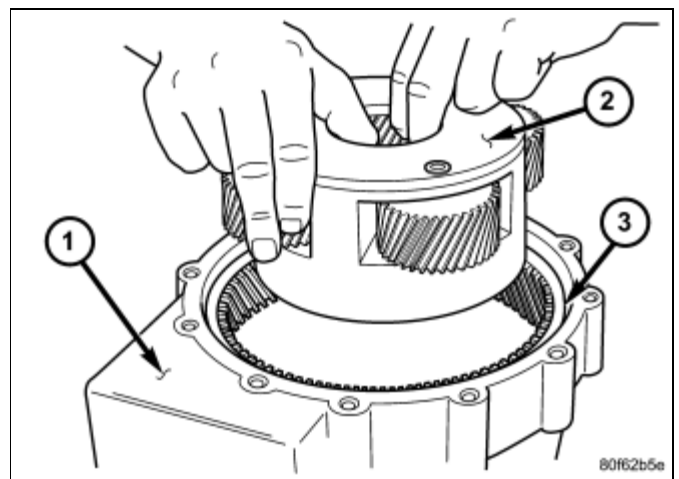


INPUT AND PLANETARY GEAR

1. Install the annulus gear (2) into the front case half (1).



2. Align and install low range planetary (2) assembly into the front case half (1). Be sure low range planetary pinions are engaged in annulus gear (3).

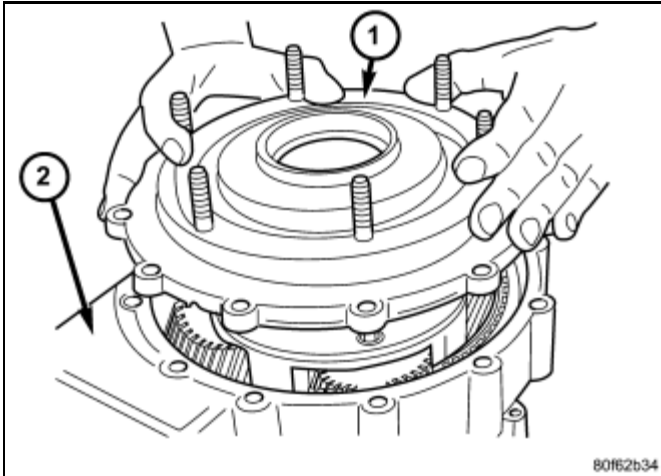


3. Install the low range planetary plastic spacer (2) onto the low range planetary carrier (1).
 4. Clean gasket sealer residue from retainer and inspect

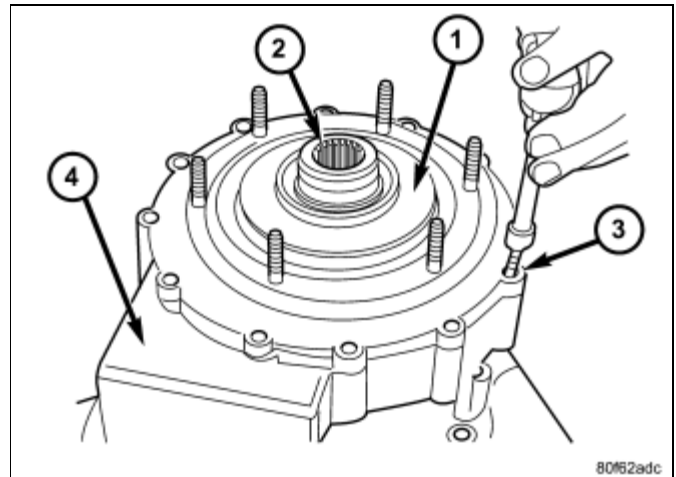
retainer for cracks or other damage.

5. Apply a 3 mm (1/8 in.) bead of MOPAR® Gasket Maker, or equivalent silicone adhesive, to sealing surface of retainer.

6. Install the front input retainer (1) onto the front case half (2).

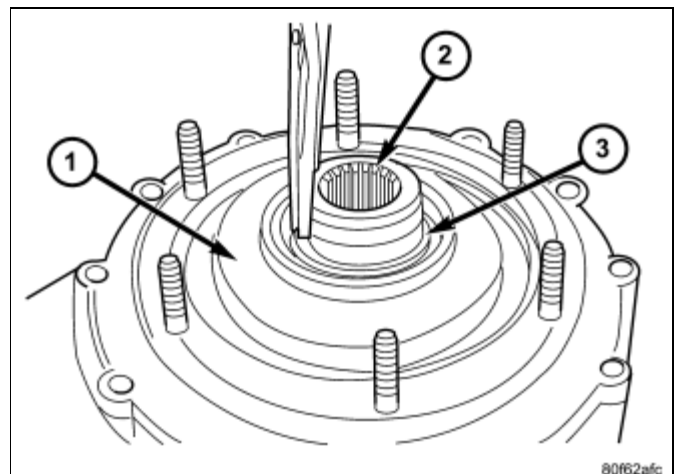


7. Install bolts (3) to hold retainer (1) to transfer case (4). Tighten to 21 N·m (16 ft. lbs.) of torque.

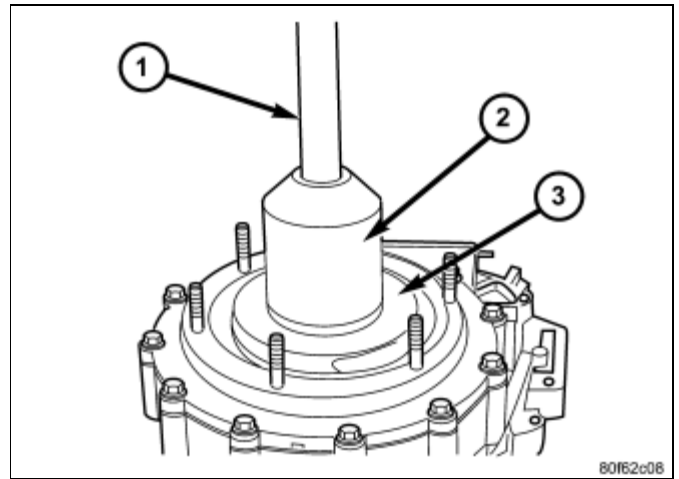


8. Install the input gear (2) to the low range planetary assembly and the input gear bearing.

9. Install the input gear retaining snap-ring (3) onto the input gear (2).

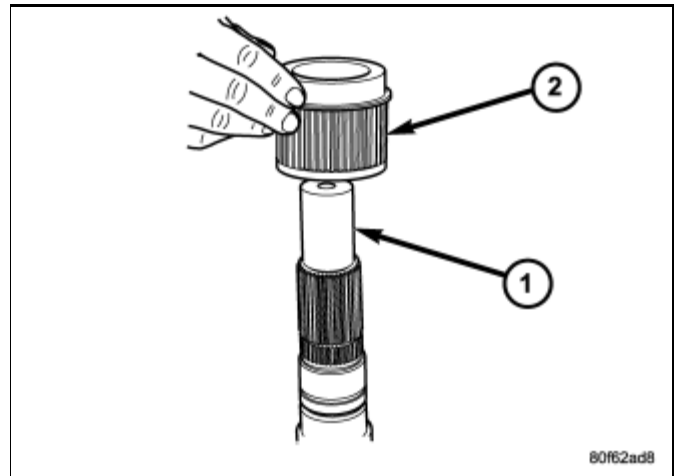


10. Install new oil seal in front input retainer with Seal Installer 8841 (2) and Universal Handle C-4171 (1).

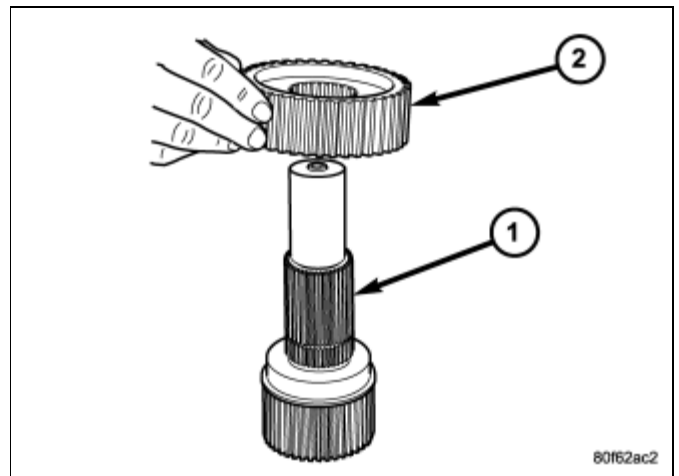


SHIFT FORKS AND MAINSHAFT

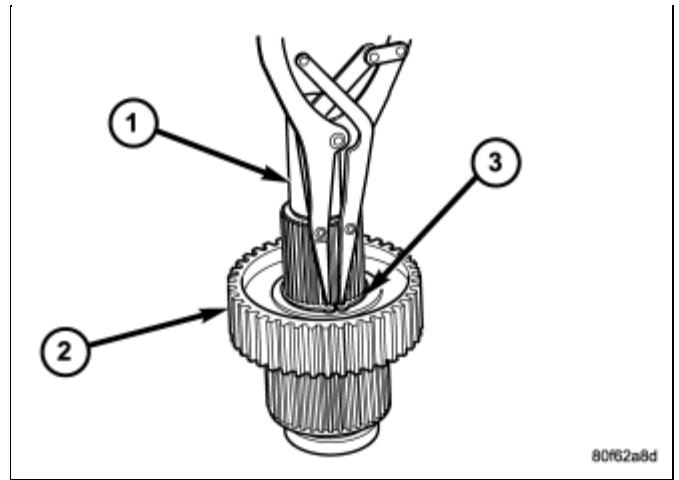
1. Lubricate mainshaft splines with recommended transmission fluid.
2. Install the drive sprocket drive hub (2) onto the mainshaft (1). Verify that the long shoulder is towards the front of the mainshaft.



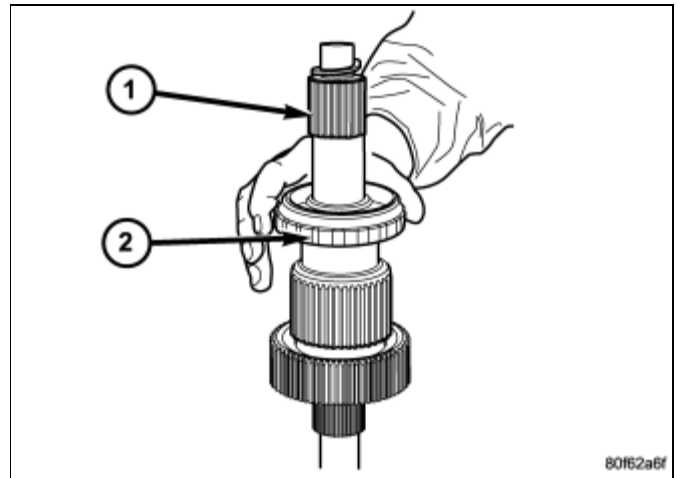
3. Install the mode hub (2) onto the mainshaft (1).



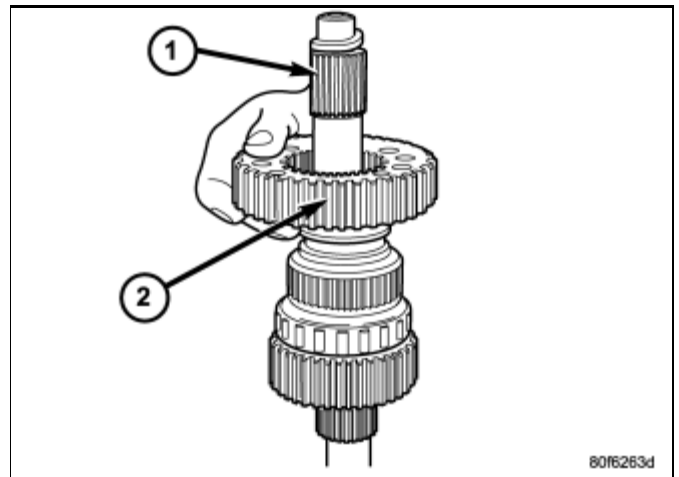
4. Install the mode hub snap-ring (3) onto the mainshaft (1).



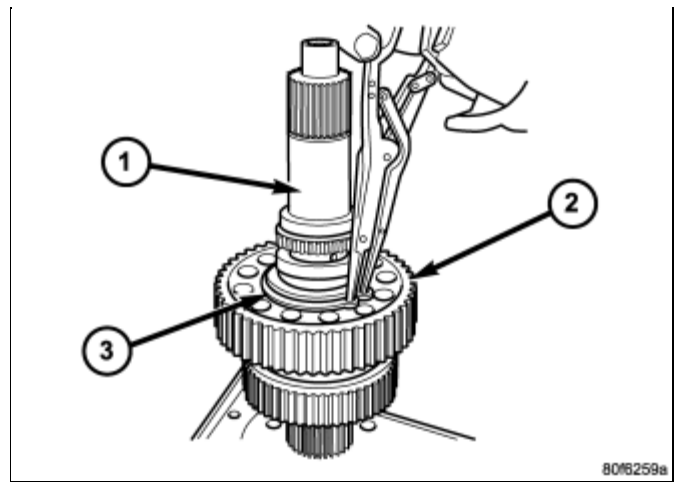
5. Rotate the mainshaft (1) 180° and install the sliding clutch gear (2) onto the drive sprocket drive hub.



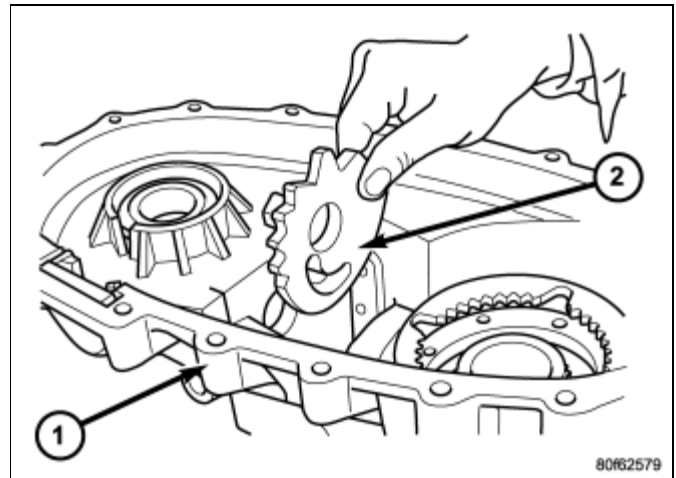
6. Install the mainshaft drive sprocket (2) onto the drive hub.



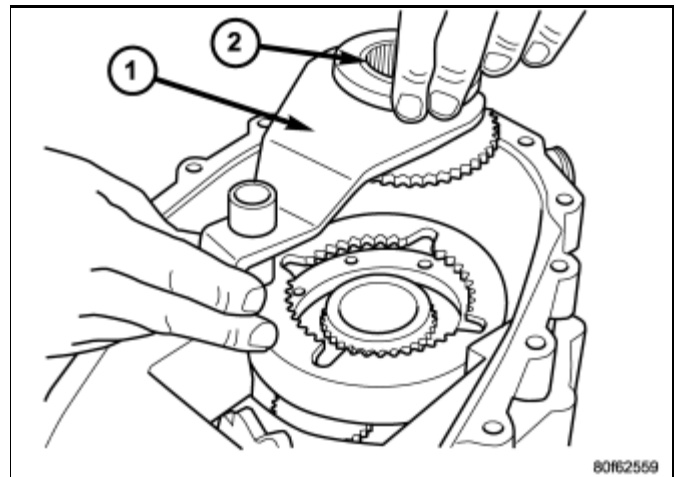
7. Install the mainshaft drive sprocket retaining ring (3) onto the drive hub.



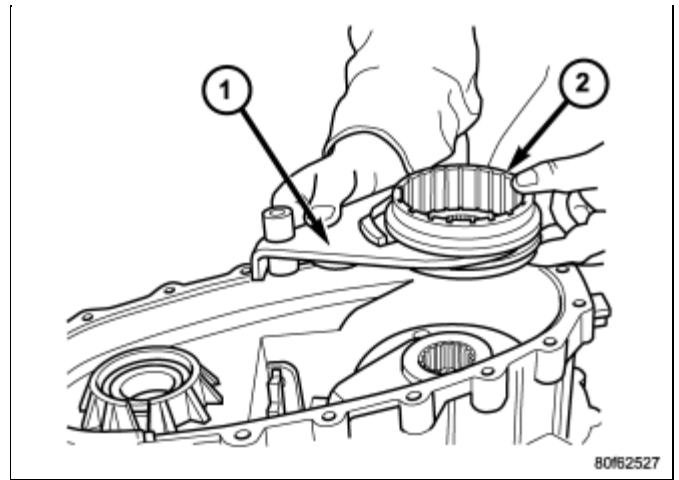
8. Support front case on wood blocks so case interior is facing up. Place blocks between mounting studs on forward surface of case.
9. Lubricate mainshaft components with transmission fluid.
10. Lubricate sector shaft with transmission fluid and install shift sector (2) in case (1). Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.



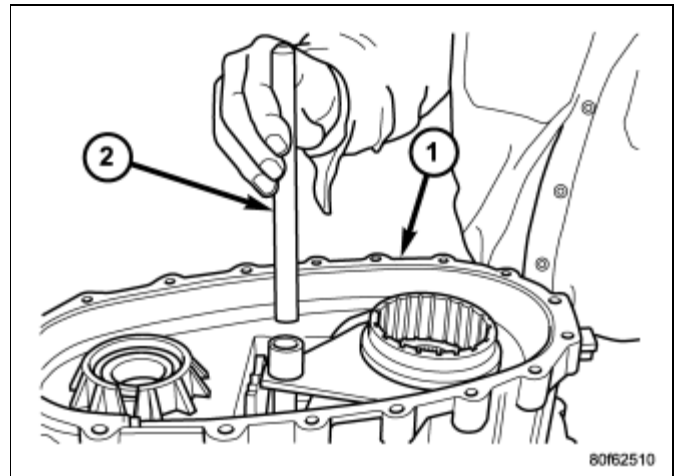
11. Assemble and install range fork (1) and hub (2). Be sure hub is properly seated in low range gear and engaged to the input gear.
12. Align and insert range fork pin in shift sector slot.



13. Install mode fork (1) and mode sleeve (2). Verify that the long side of the mode sleeve is towards the front of the transfer case.

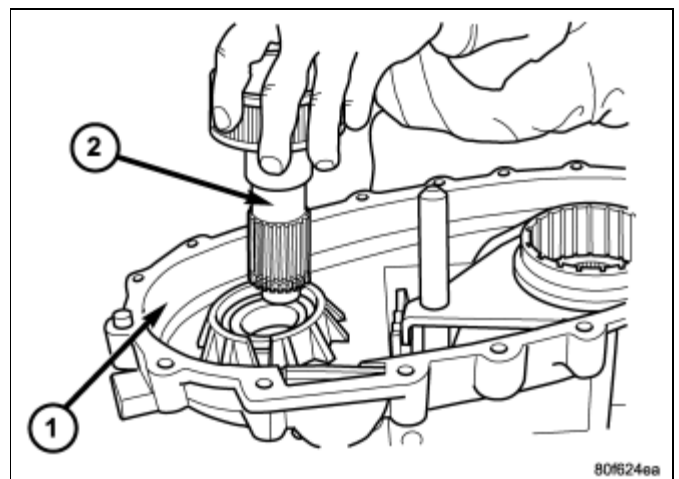


14. Install the shift rail (2) through the shift forks and into the shift rail pocket in the front case half (1).



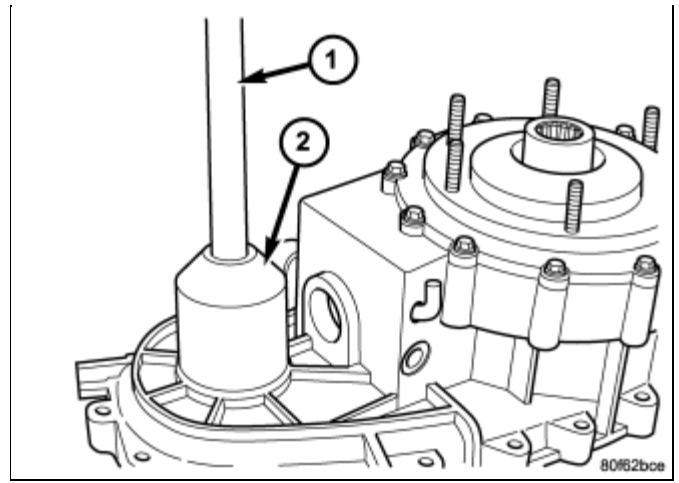
FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Install front output shaft (2) into the front output shaft bearing.

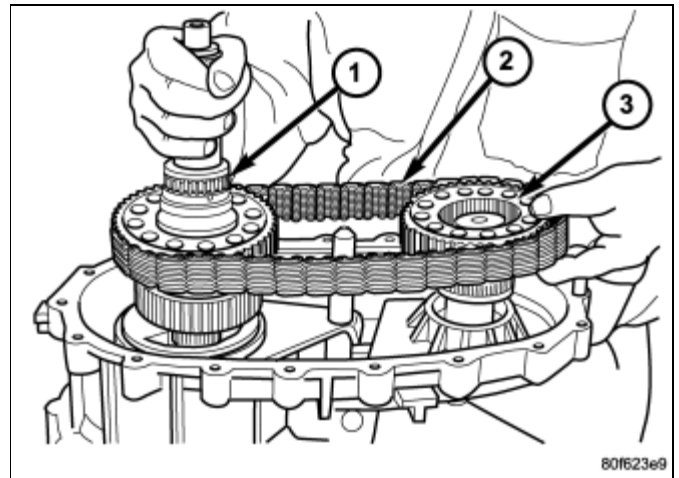


2. Install the front output shaft snap-ring onto the front output shaft.
3. Install new front output seal in front case with Seal

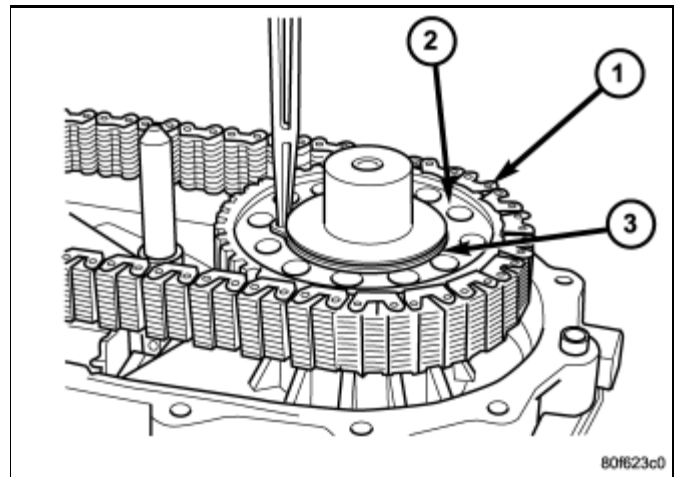
Installer 9041 (2) and Universal Handle C-4171 (1).



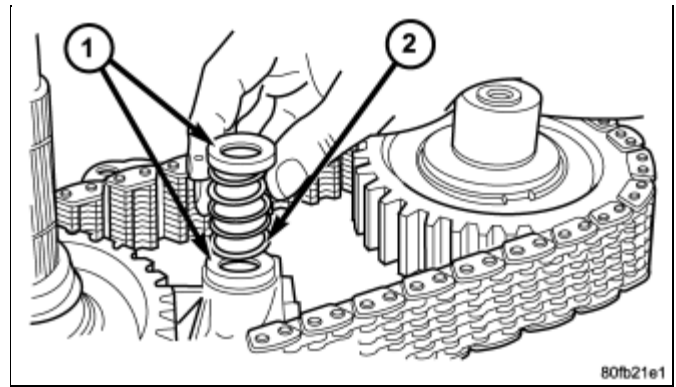
4. Insert front sprocket (3) in drive chain (2).
5. Install drive chain around mainshaft drive sprocket. Then position front sprocket over front output shaft.
6. Install the mainshaft (1) into the range hub and mode sleeve and seat the front drive sprocket onto the front output shaft.



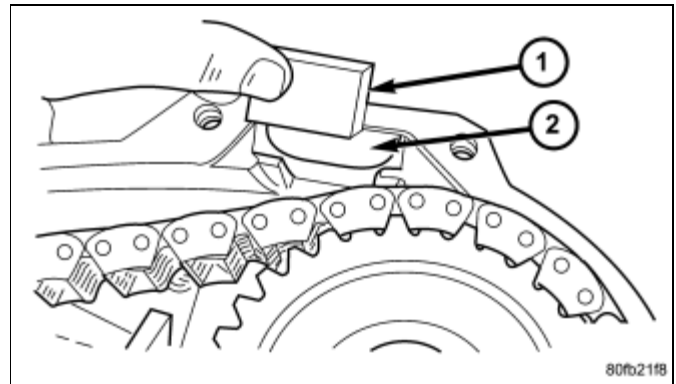
7. Install the front drive sprocket retaining ring (3).



8. Install spring (2) and cups (1) on shift rail.



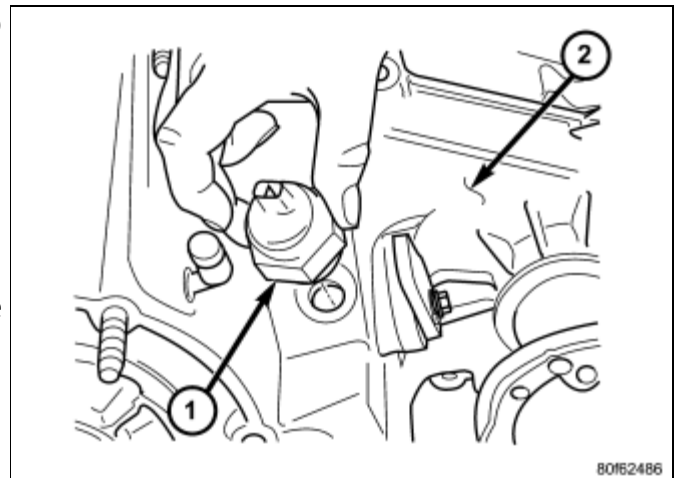
9. Insert magnet (1) in front case pocket (2).



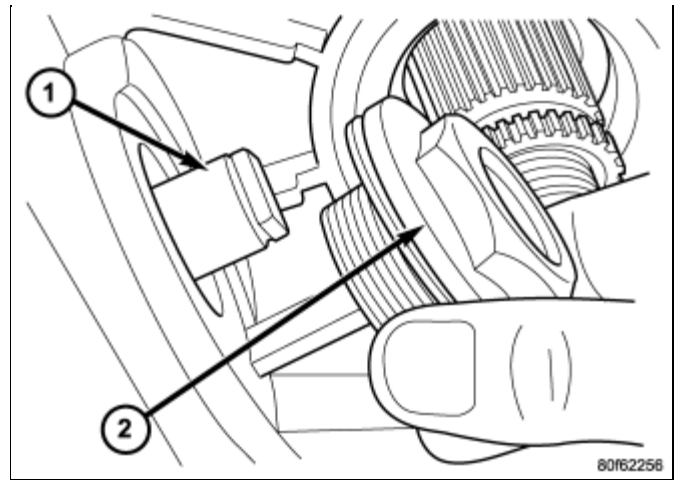
OIL PUMP AND REAR CASE

CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft inner bearing race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly **MUST** be replaced.

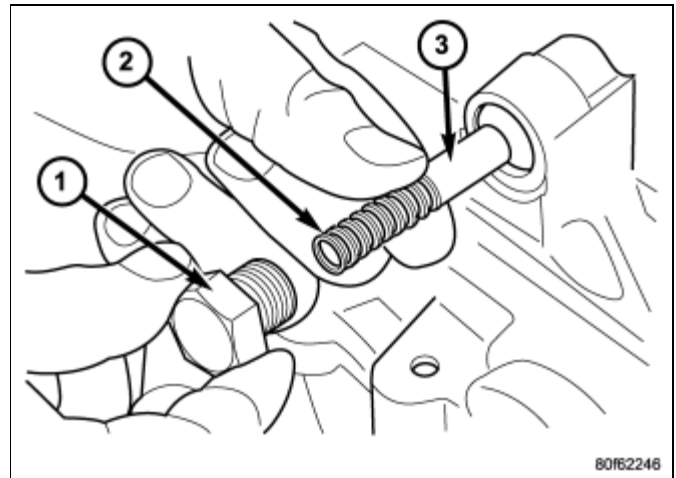
Lubricate the oil pump components before installation. Prime the oil pickup tube by pouring a little oil into the tube before installation.



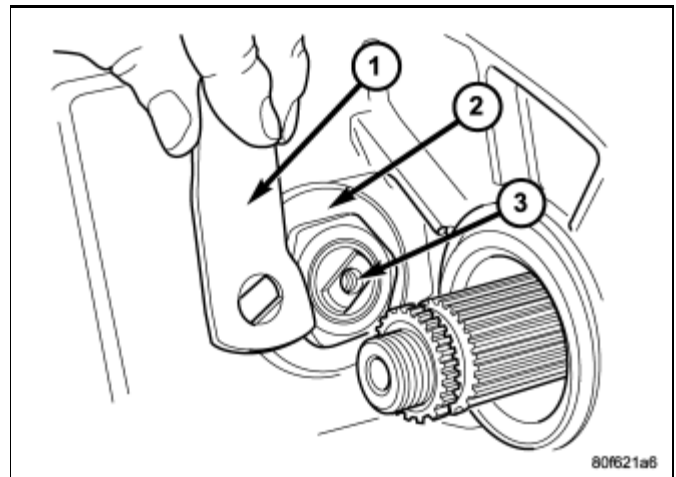
1. Install new o-ring in pickup tube inlet of oil pump.
2. Position oil pickup tube and filter in rear case. Be sure pickup filter is seated in case pocket and that pickup tube is aligned in case notches. Be sure hose that connects tube to filter is securely positioned.
3. Install the transfer case position sensor (1). Tighten the sensor to 20-34 N·m (16-25 ft.lbs.).
4. Install the shift sector support (2). Tighten the sector support to 27-42 N·m (20-30 ft.lbs.).



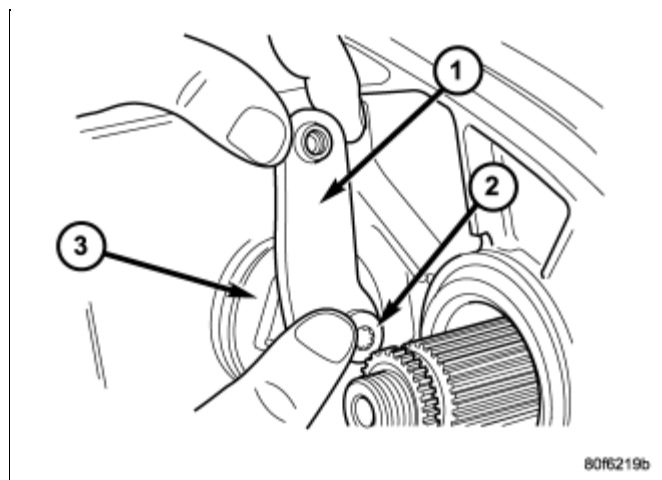
5. Install detente plunger (3) and spring (2) into the front case half.
6. Install new o-ring on detente plug (1) and install plug in front case. Tighten plug to 16-25 N·m (12-18 ft. lbs.).



7. Install shift lever (1) onto the shift sector (3).



8. Install the shift lever bolt (2). Tighten the bolt to 20-34 N·m (15-25 ft.lbs.)

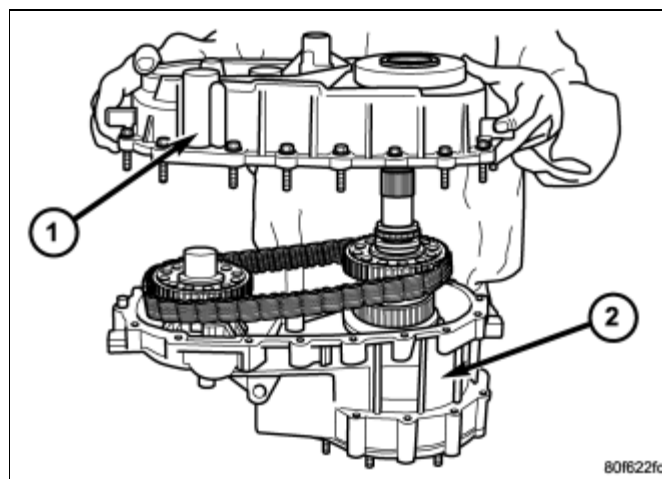


9. Shift the transfer case into a 4WD range. This will raise the mainshaft slightly and make installation of the rear case half much easier.

10. Verify that the transfer case alignment dowels are properly installed.

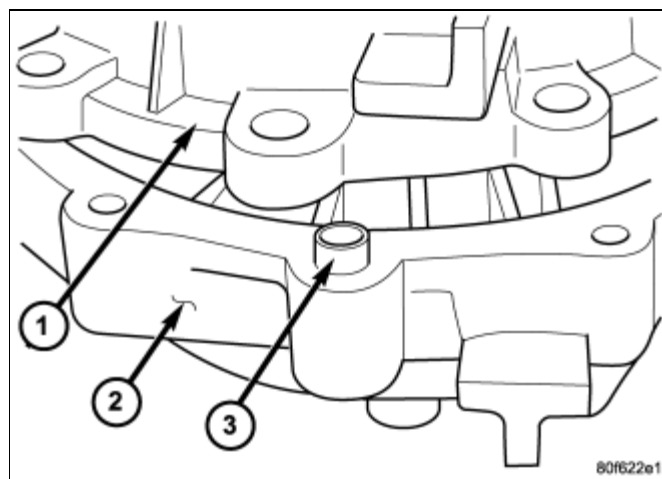
11. Apply bead of MOPAR® Gasket Maker, or equivalent, to mating surface of front case. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.

12. Align oil pump with mainshaft and align shift rail with bore in rear case. Then install rear case (1) and oil pump assembly. Be sure oil pickup tube remains in position during case installation.

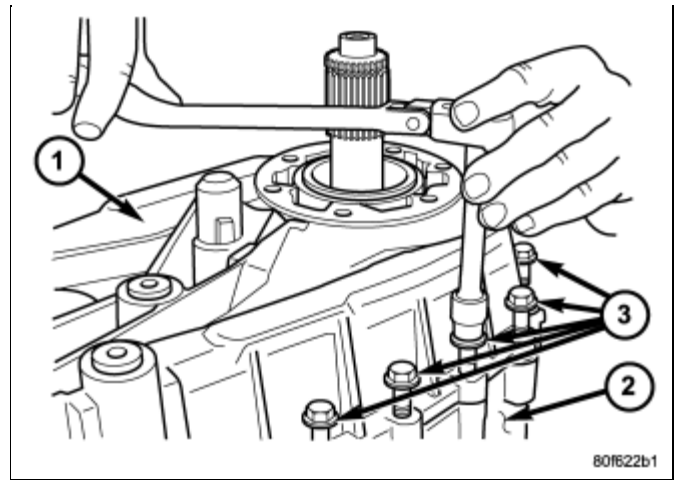


CAUTION: Verify that shift rail, and case alignment dowels (3) are seated before installing any bolts. Case could be cracked if shaft rail or dowels are misaligned.

13. Install 4-5 rear case-to-front case bolts to hold rear case in position. Tighten bolts snug but not to specified torque at this time.

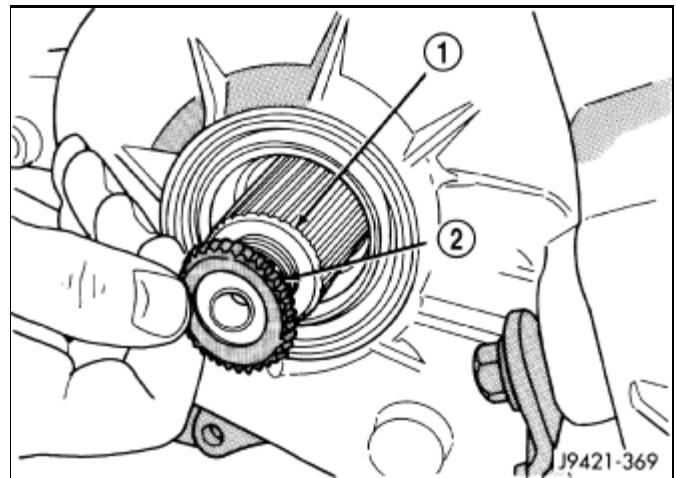


14. Apply Loctite™ 242 to remainder of rear case-to-front case bolt threads and install bolts (3). Tighten all bolts to 20-27 N·m (15-20 ft. lbs.).

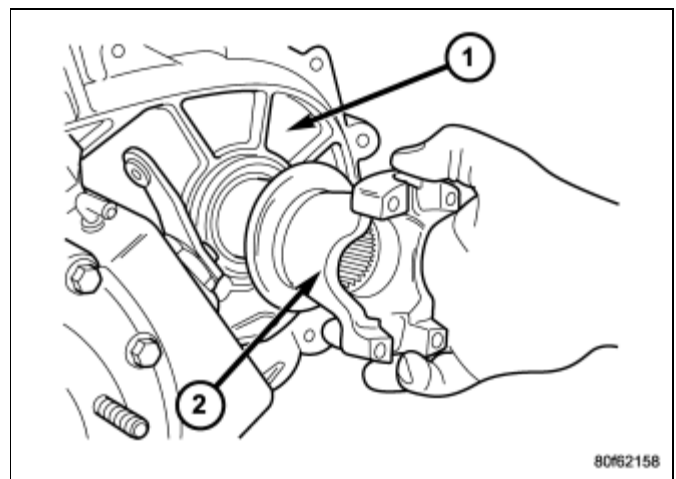


YOKE

1. Install yoke seal (2) onto front shaft (1).



2. Install yoke (2) onto front shaft. Then install and tighten a new yoke nut to 122-176 N·m (90-130 ft. lbs.) torque. Never re-use a yoke nut.



REAR EXTENSION

1. Clean mating surfaces of transfer case housing and the rear retainer of any original gasket material.
2. Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of rear case. Keep sealer bead width to

maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.

3. Align and install rear extension on rear case.

4. Apply MOPAR® Silicone Sealer to threads of rear extension bolts. Then install extension bolts. Tighten the extension bolts to 16-25 N·m (12-18 ft.lbs.).

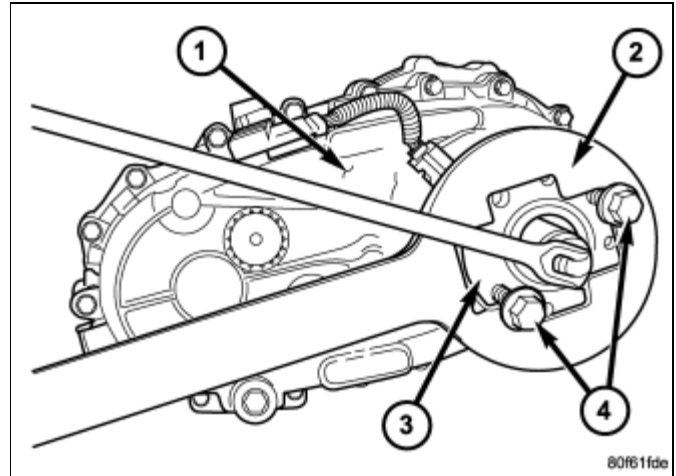
5. Install new seal in rear extension housing with Seal Installer 9041 and Universal Handle C-4171.

6. Install the rear companion flange (3) onto the output shaft.

7. Install bolts (4) into two threaded holes in the rear propeller shaft companion flange 180° apart.

8. Place the Holder 6719 (2) over the two bolts and use the Holder to install a new rear companion flange nut. Never re-use the companion flange nut once it has been installed.

Tighten the companion flange nut to 122-176 N·m (90-130 ft.lbs.).



INSTALLATION

1. Align and seat transfer case on transmission. Be sure transfer case input gear splines are aligned with transmission output shaft. Align splines by rotating transfer case rear output shaft yoke if necessary. Do not install any transfer case attaching nuts until the transfer case is completely seated against the transmission.

2. Install and tighten transfer case attaching nuts. Tighten nuts to 30-41 N·m (20-30 ft.lbs.).

3. Install rear crossmember.

4. Remove jack stand from under transmission.

5. Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

6. Connect vacuum harness and vent hose.

7. Connect shift rod to transfer case lever or floor shift arm. Use channel lock style pliers to press rod back into lever grommet.

8. Adjust shift linkage, if necessary.

9. Fill transfer case with recommended transmission fluid and install fill plug.

10. Install skid plate, if equipped. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)

11. Lower vehicle

SPECIFICATIONS

TRANSFER CASE - NV241OR

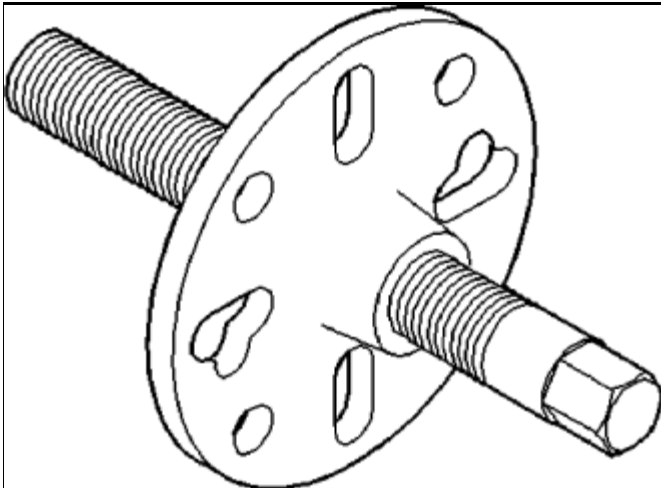
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-25	12-18	-
Plug, Drain/Fill	20-34	15-25	-

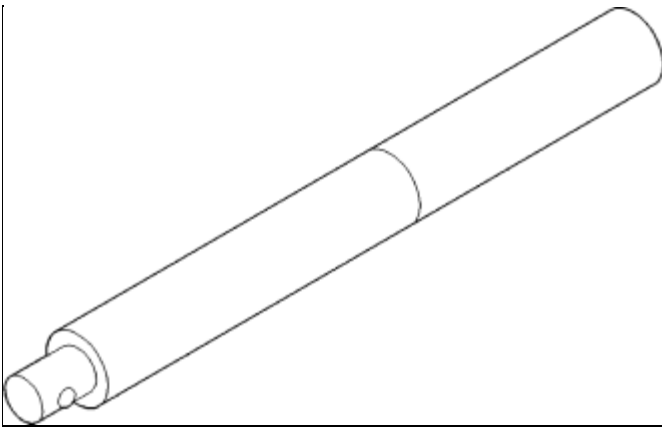
Bolt, Rear Extension	16-24	12-18	-
Bolt, Front Input Retainer	21	16	-
Bolt, Case Half	20-27	15-20	-
Nut, Front Yoke	122-176	90-130	-
Nut, Rear Companion Flange	258-312	190-230	-
Bolt, Shift Lever	20-34	15-25	-
Nuts, Mounting	30-41	20-30	-
Bolts, U-Joint	19	17	-
Support, Sector	27-42	20-30	-
Sensor, Transfer Case Position	20-34	16-25	-

SPECIAL TOOLS

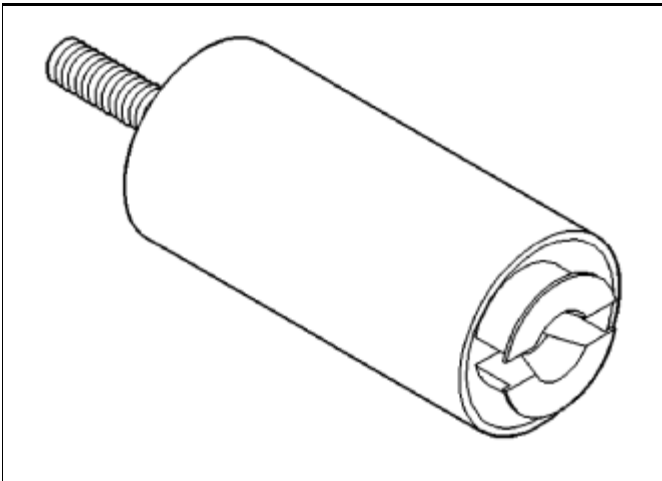
TRANSFER CASE - NV241



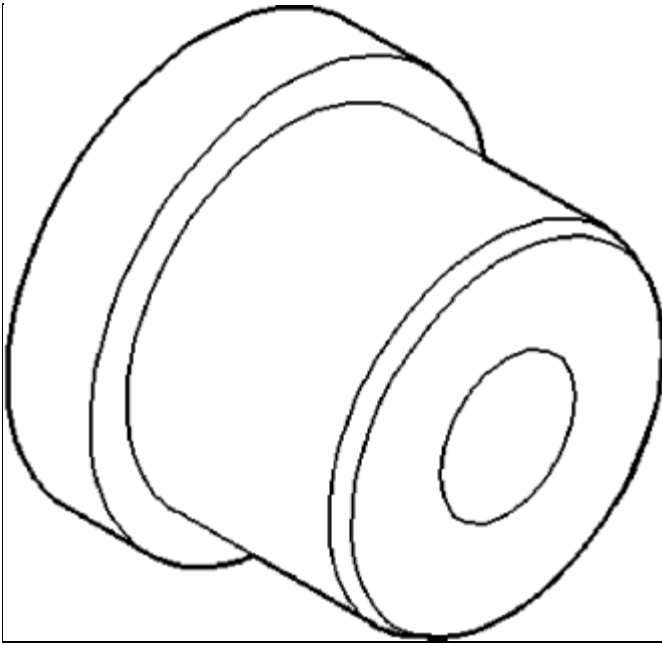
Puller - C-452



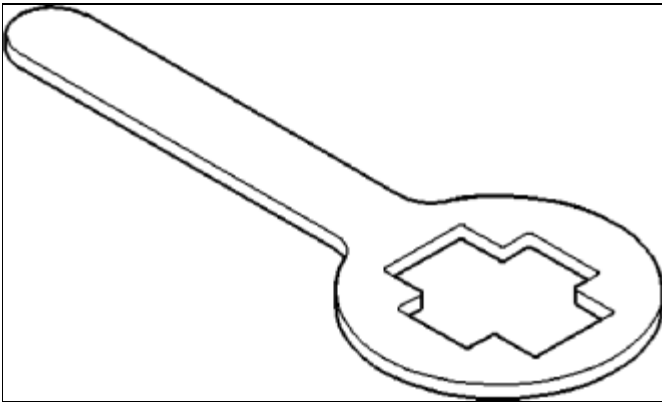
Handle, Universal - C-4171



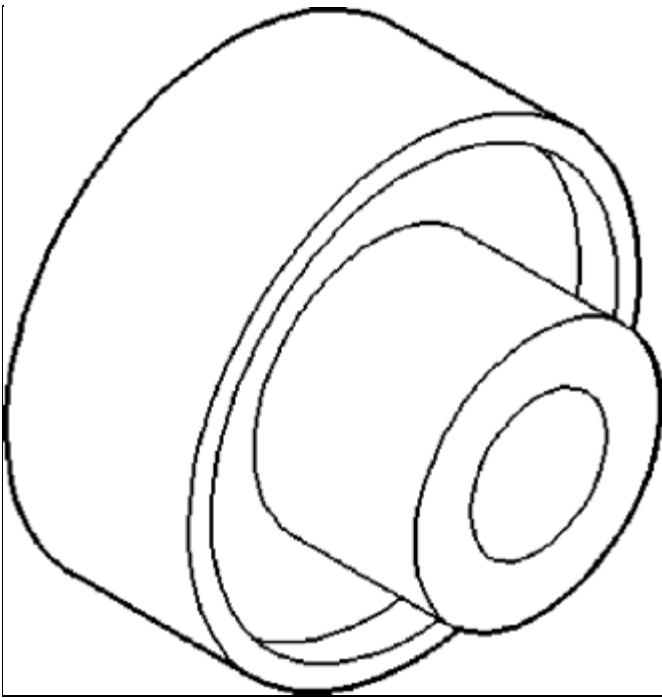
Remover - L-4454



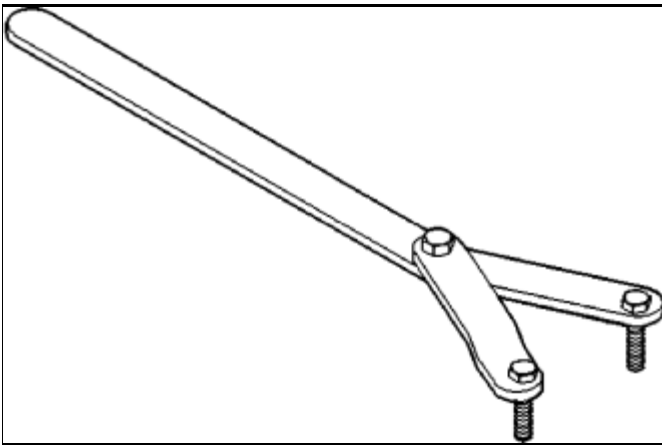
Installer, Bushing - 5066



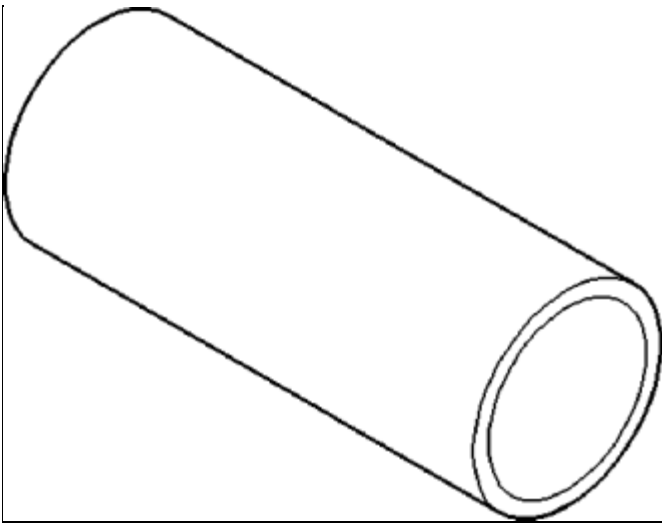
Holder, Yoke - 6719A



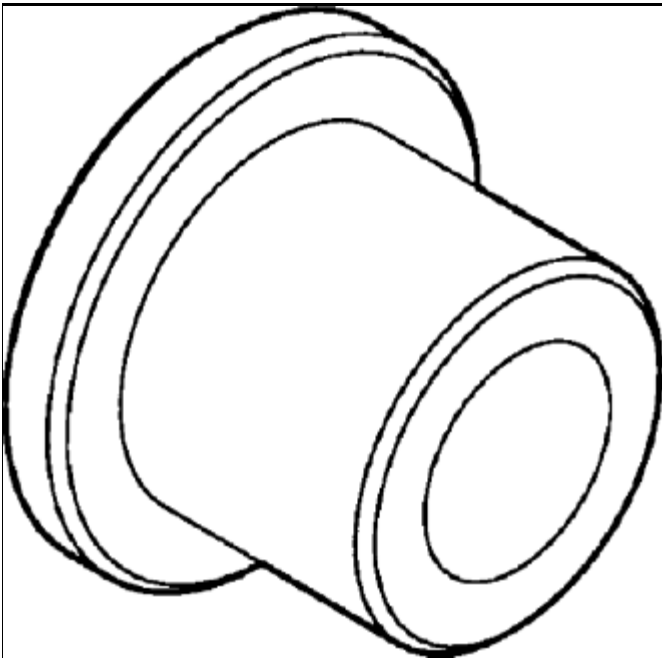
Installer, Bearing - 6953



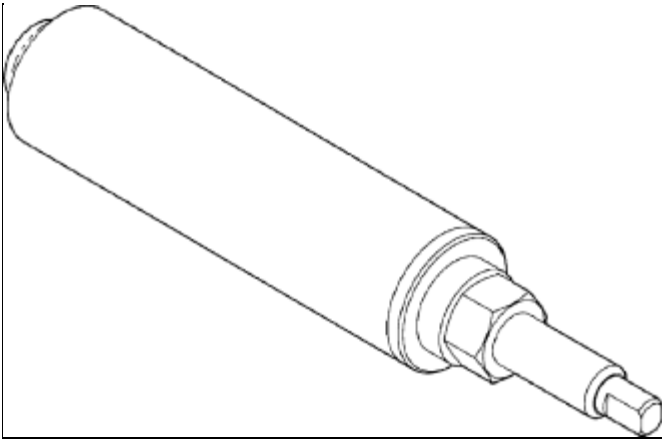
Spanner Wrench - 6958



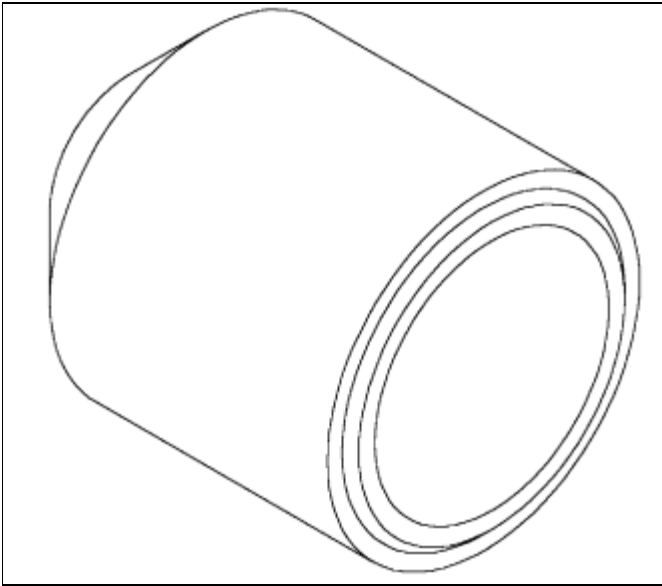
Cup - 8148



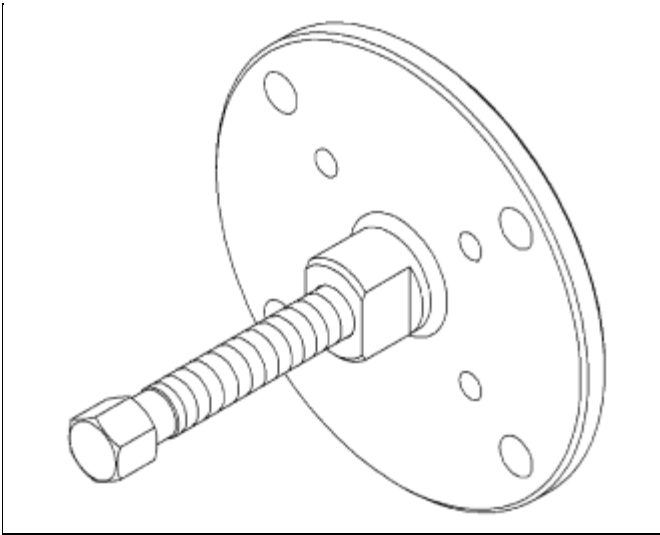
Installer, Bearing - 8239



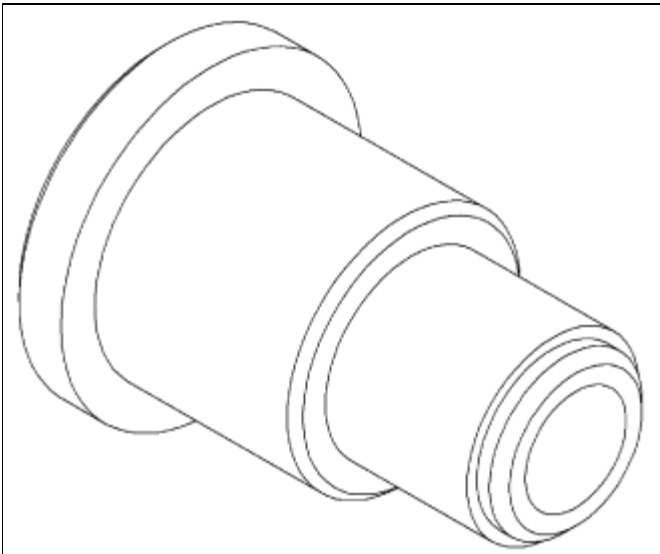
Remover - 8240



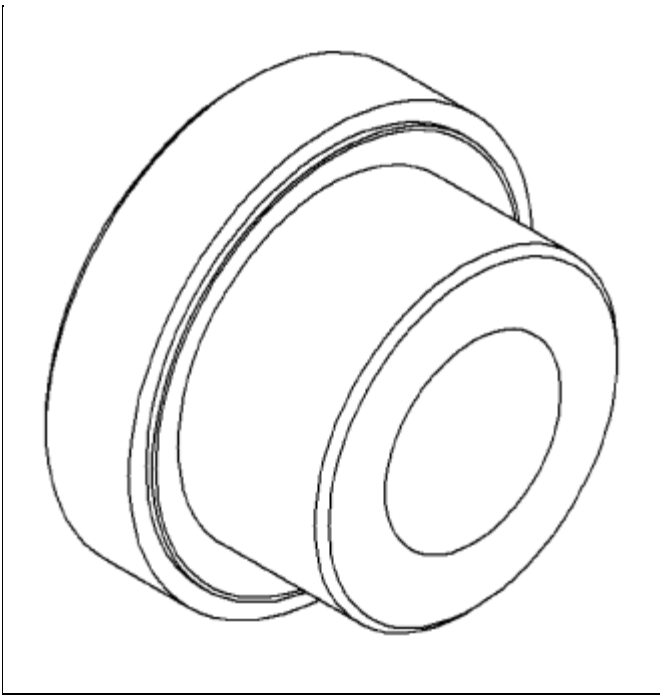
Installer, Seal - 8841



Flange Puller - 8992



Installer, Cup Seal - 9045



Installer, Bearing - 9047

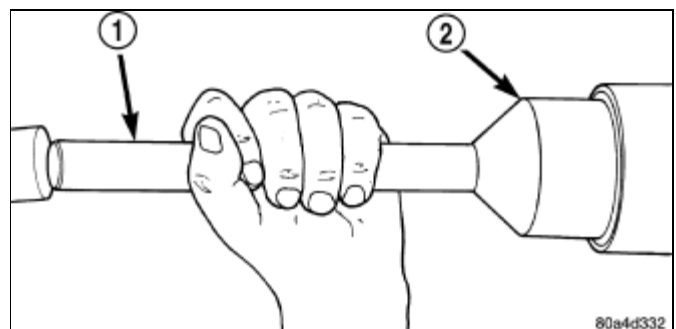
SEAL-REAR EXTENSION

REMOVAL

1. Raise and support vehicle.
2. Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove the rear companion flange from the output shaft.
4. Using a suitable pry tool or slide-hammer mounted screw, remove the rear extension seal.

INSTALLATION

1. Clean fluid residue from sealing surface and inspect for defects.
2. Using Seal Installer 9041 (2) and Universal Handle C-4171 (1), install seal in rear extension.
3. Install the companion flange onto the output shaft.
4. Install a new companion flange nut and tighten to 176-271 N·m (130-200 ft.lbs.).
5. Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
6. Verify proper transfer case fluid level.



7. Lower vehicle.

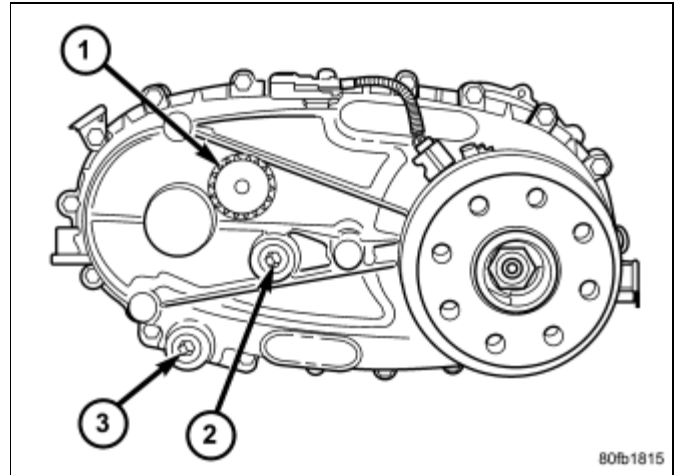
FLUID

STANDARD PROCEDURE - FLUID DRAIN AND FILL

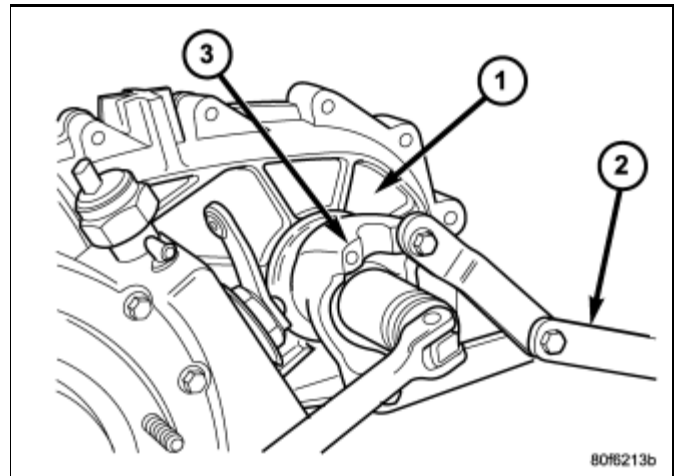
The fill (2) and drain plugs (3) are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

SEAL-FRONT OUTPUT SHAFT

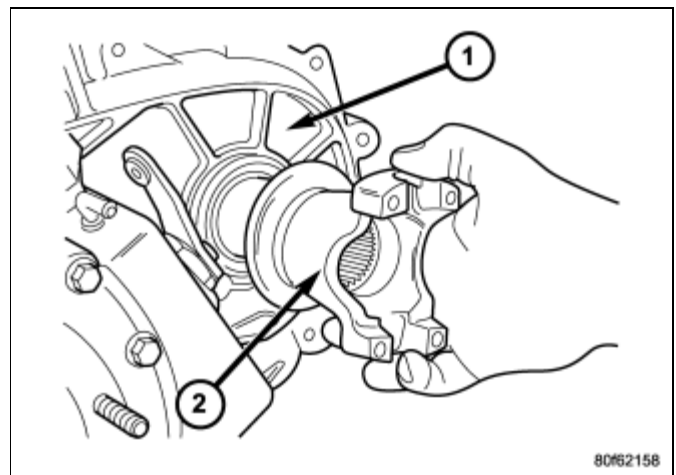
REMOVAL



1. Shift transfer case into NEUTRAL.
2. Raise vehicle.
3. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
4. Using Spanner Wrench 6958 (2), remove yoke nut. Discard nut after removal. It is not reusable.



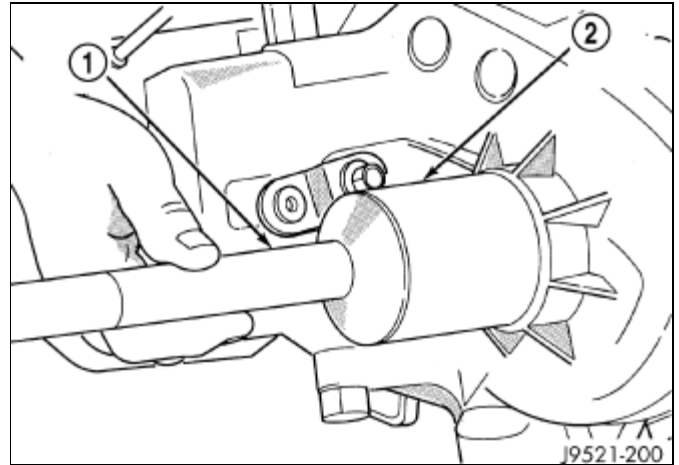
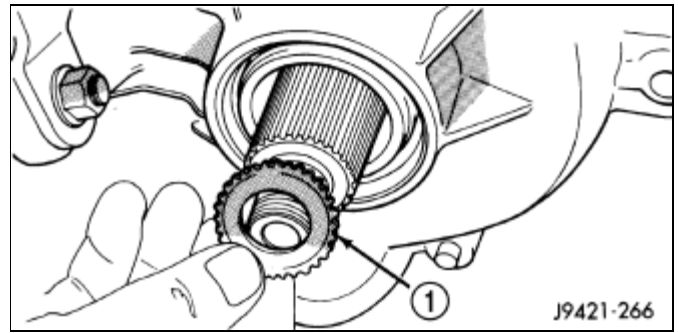
5. Remove yoke (2) from output shaft. Use puller C-452 if flange can not be removed by hand.



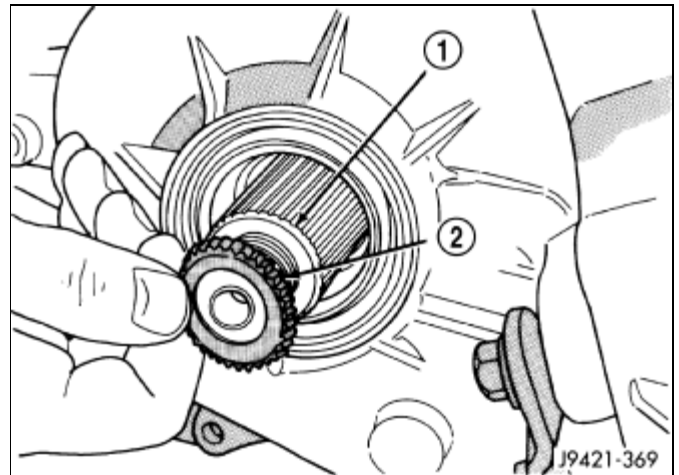
6. Remove yoke rubber seal (1) from front output shaft.
7. Remove front output shaft seal with suitable pry tool, or a slide hammer mounted screw.

INSTALLATION

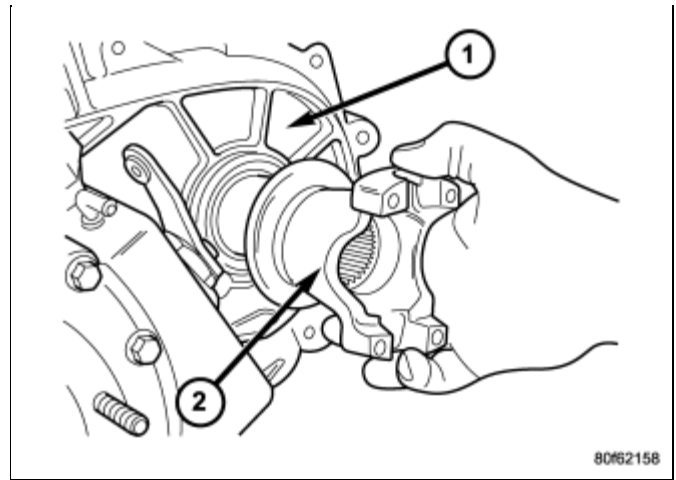
1. Install new front output seal in front case with Seal Installer 9041 (2) and Universal Handle C-4171 (1).



2. Install yoke seal (2) on front output shaft (1).



3. Install yoke (2) on front output shaft. Install a new yoke nut onto the front output shaft.

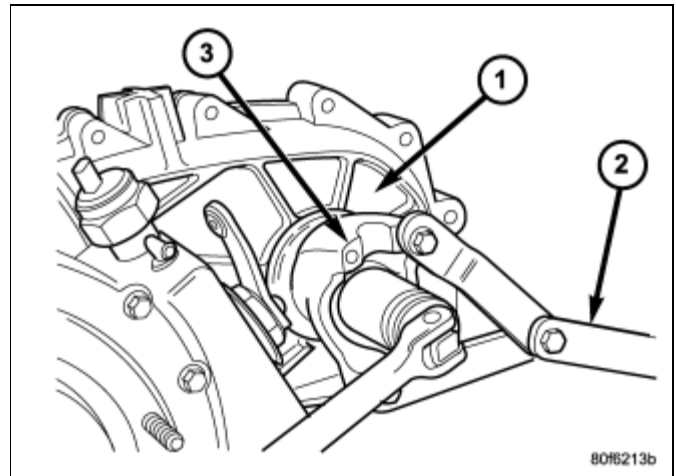


4. Using Spanner Wrench 6958 (2), tighten the yoke nut to 176-271 N·m (130-200 ft. lbs.) torque.
5. Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

SENSOR-POSITION

DESCRIPTION

The transfer case position sensor is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.



OPERATION

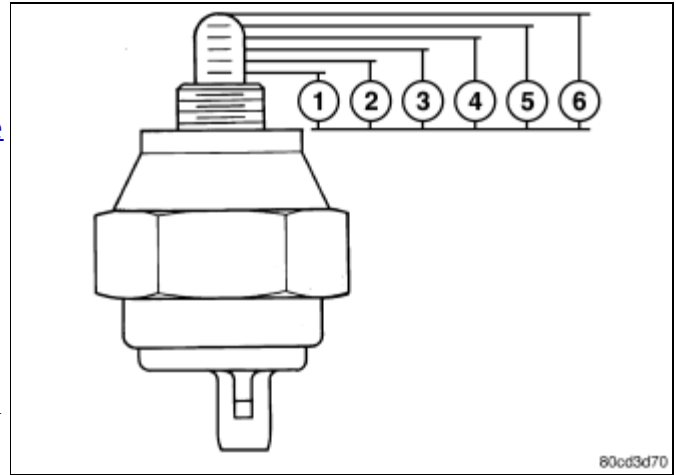
Operating Mode Versus Resistance

SENSOR POSITION	OPERATING MODE	SENSOR RESISTANCE (ohms)
1	2H	1124-1243
2	4H	650-719
3	NEUTRAL	389-431
4	4L	199-221
5	NOT USED	57-64

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the [Operating Mode Versus Resistance](#) table for the correct resistance (1-6) for each position.

REMOVAL

1. Raise and support the vehicle.
2. Disengage the transfer case position sensor connector from the position sensor.
3. Remove the position sensor from the transfer case.



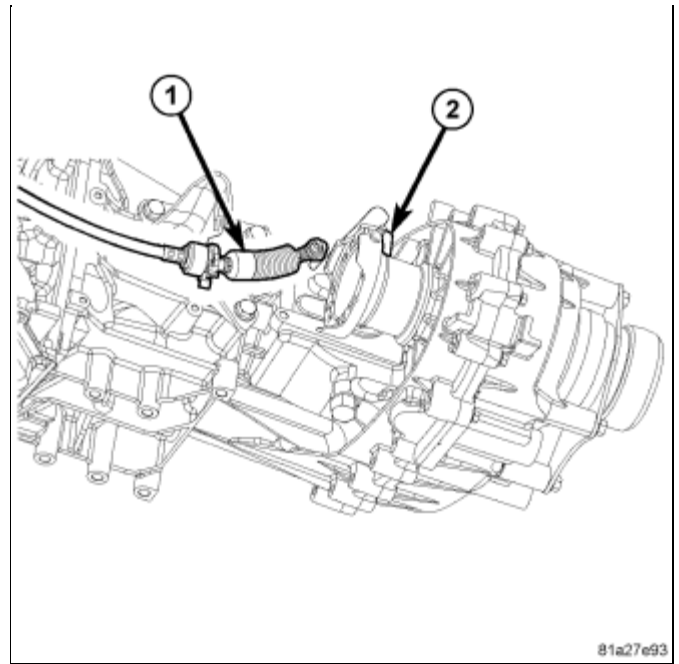
INSTALLATION

1. Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.
2. Install the transfer case position sensor into the transfer case. Torque the sensor to 20-34 N·m (15-25 ft.lbs.).
3. Engage the transfer case position sensor connector to the position sensor.
4. Lower vehicle.
5. Verify proper sensor operation.

CABLE-SHIFT

REMOVAL

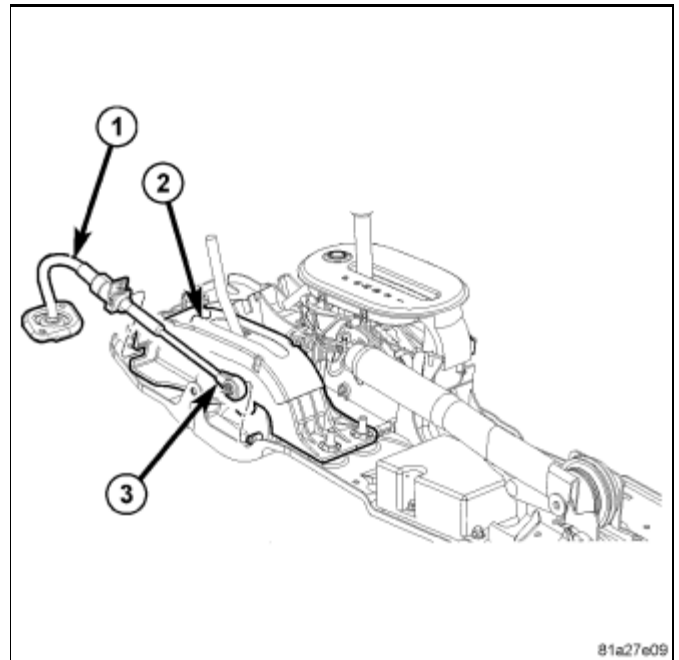
1. Shift transfer case into 4L.
2. Raise vehicle.
3. Remove clip securing the transfer case shift cable (2) to the shift cable support bracket.
4. Disengage any additional shift cable routing clips, if necessary.
5. Disengage the shift cable from the transfer case manual lever.



81a27e93

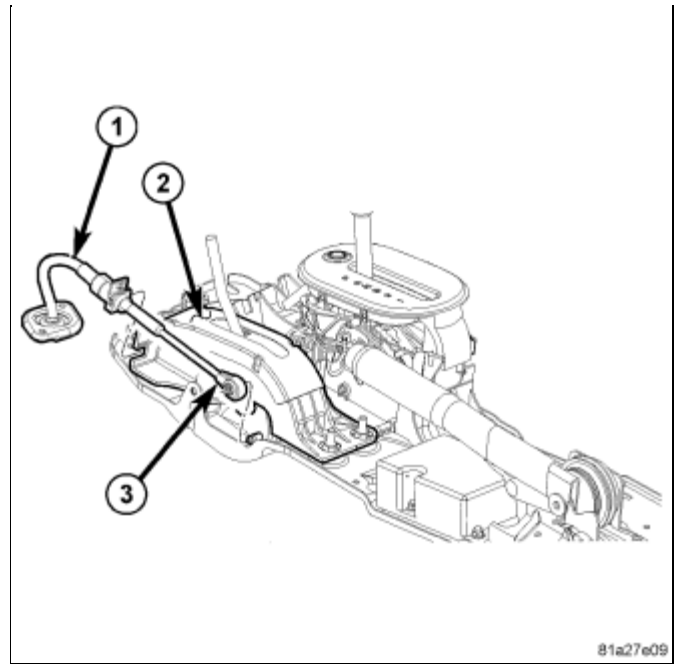
6. Lower the vehicle.
7. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
8. Disengage the transfer case shift cable from the shift lever pin and body.
9. Disengage the shift cable grommet from the floor and remove the shift cable from the vehicle.

INSTALLATION



81a27e09

1. Route the shift cable through the opening in the floor pan.
2. Connect the transfer case shift cable to the shift lever body and pin.
3. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)
4. Verify that the floor shifter is in the 4L position.



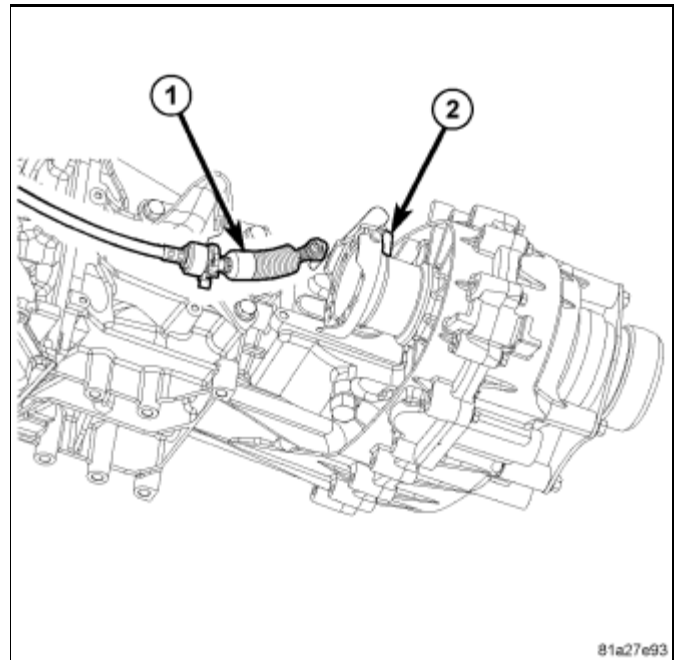
81a27e09

5. Raise vehicle.
6. Route the shift cable through the opening in the shift cable support bracket.
7. Install the cable and a new spring clip into the slot in the support bracket.
8. Install any additional routing clips on the shift cable.
9. Verify that the transfer case is in the 4L position. The 4L position for the transfer case is with the manual lever to the full rearward position.
10. Attach the shift cable to the transfer case manual lever.
11. Lower vehicle and check for proper transfer case shifter operation.

LEVER-SHIFT

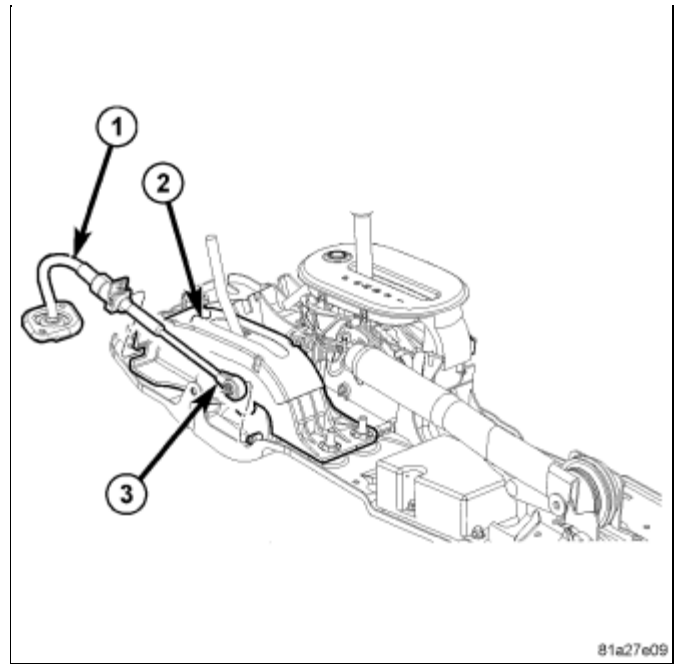
REMOVAL

SHIFT LEVER



81a27e93

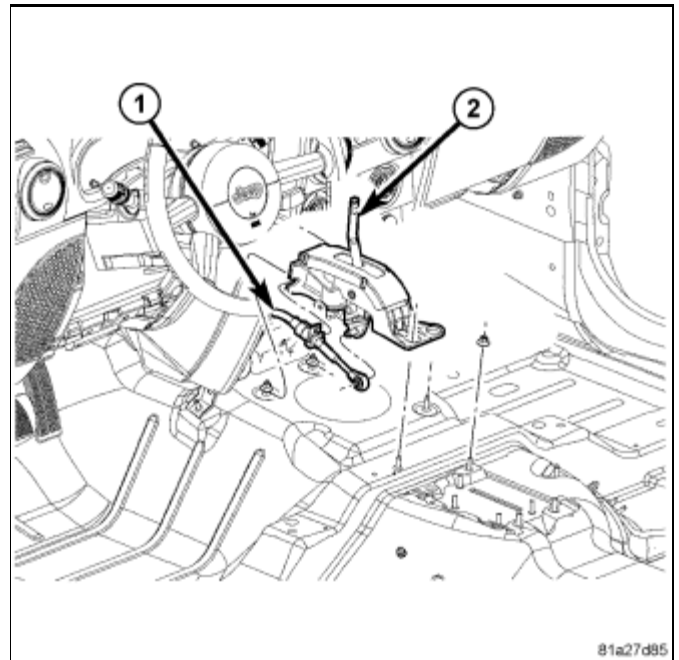
1. Shift transfer case into 4L.
2. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Disengage the transfer case shift cable from the shift lever pin and body.



81a27e09

4. Remove the nuts attaching lever assembly (1) to floorpan and remove assembly (2).
5. Remove the shifter mechanism from the vehicle.

REMOVAL

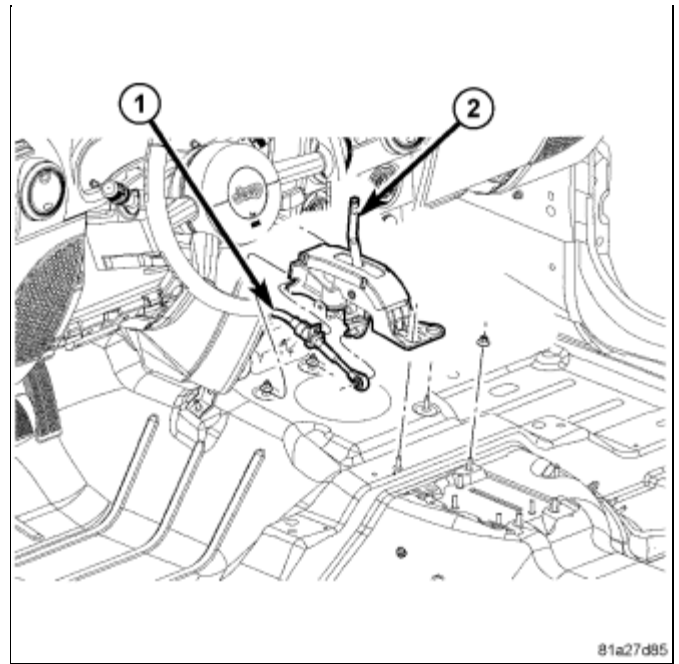


81a27d95

1. Pull up on gearshift knob with moderate force to remove from gearshift mechanism.

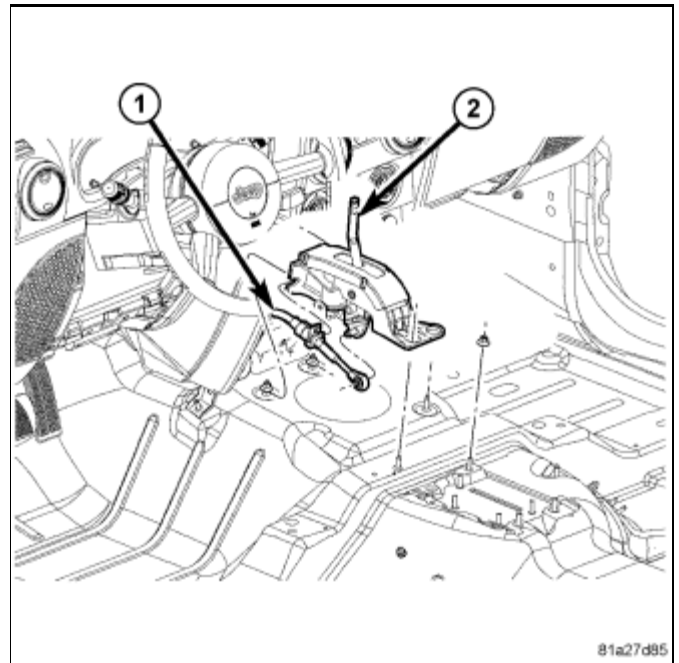
INSTALLATION

SHIFT LEVER



81a27d95

1. Position the shift mechanism over the shifter retaining studs on the floor pan.
2. Install the nuts to hold the shifter mechanism to the floor pan. Tighten the nuts to 11.9 N·m (105 in.lbs.).



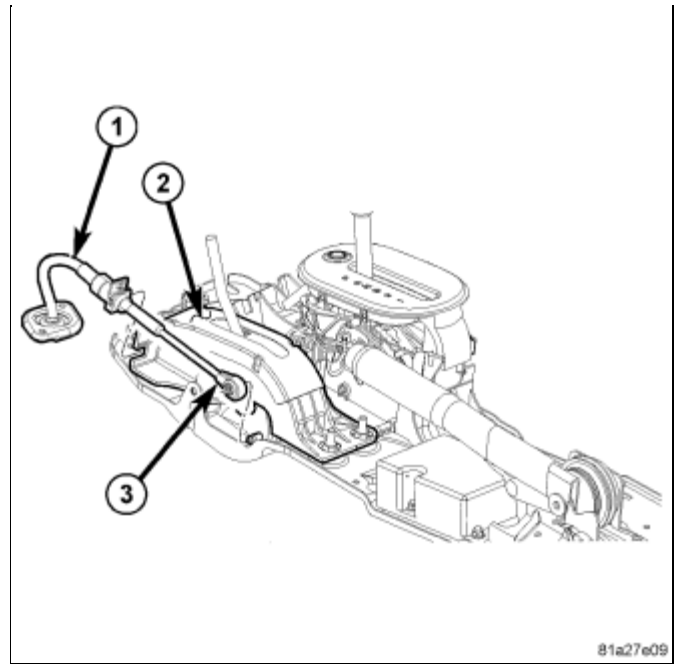
81a27d95

3. Verify that the floor shifter is in the 4L position.
4. Connect the transfer case shift cable to the shift lever body and pin.
5. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)
6. Check for proper transfer case shifter operation.

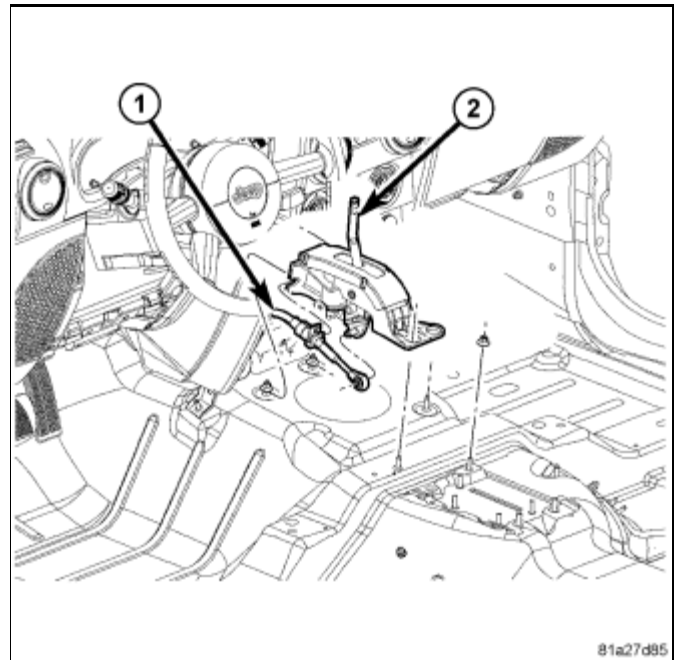
INSTALLATION

CAUTION: Do not strike the gearshift mechanism knob

during the installation procedure. Failure to follow this caution may result in gearshift mechanism damage.



1. Position knob hole over the gearshift mechanism and align the shift pattern.
2. Apply downward pressure by **HAND** on the knob to engage the gearshift mechanism.
3. Verify that shift pattern is aligned properly.



22 - TIRES/WHEELS

TIRES/WHEELS - ELECTRICAL DIAGNOSTICS

TIRE PRESSURE MONITORING - ELECTRICAL DIAGNOSIS

DIAGNOSIS AND TESTING

C0077- LOW TIRE PRESSURE

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

Continuously.

- **Set Condition:**

A low pressure condition will exist when the tire pressure falls below or is equal to the low pressure threshold value as specified for the vehicle.

Possible Causes
INTERMITTENT PERFORMANCE DTC
INCORRECT TIRE PRESSURE
TIRE PRESSURE SENSOR
WCM (SKREEM)

Diagnostic Test

1. DTC STATUS

NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.

NOTE:

If the following conditions are present:

- **Low Tire Pressure DTC**
- **Tire Pressure Sensor Internal DTC**
- **Spare Tire is not equipped with a Tire Pressure Sensor**
- **Spare Tire is currently on the vehicle**

Repair the tire and place it back on the vehicle.

Test drive the vehicle.

Turn the ignition on.

Is the TPM telltale lamp/Low pressure EVIC message on at this time?

Yes

- Go to [2](#)

No

- Go to [5](#)

2. LOW TIRE PRESSURE

NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.

NOTE: Seasonal temperature changes will affect tire pressure, and may have caused the tire pressure to fall below the low pressure warning threshold. Tire pressure should always be set based on cold inflation tire pressure (placard). This is defined as the tire pressure after a vehicle has not been driven for more than 3 hours, and in outside ambient temperatures.

Correct all tire pressure to the recommended specifications and wait 2 minutes.

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h. (24 km/h).

Use a TPM-RKE Analyzer tool 9936 to scan each tire pressure sensor, and make sure the Sensor IDs matches what is programmed into the WCM. The Sensor Identifications are located under “Data Display” for the “WCM Wireless Control Module”. If the sensor IDs does not match, following the programming steps outlined in the diagnostic scan tool for “Program Tire Sensor ID w/TPM Tool” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item.

NOTE: When scanning a sensor with a TPM-RKE Analyzer 9936 , replace the TPM sensor if the results show a “Damaged Accel”, “Damaged Temp”, or “Damaged Press”.

Is the TPM telltale lamp/Low pressure EVIC message on at this time?

Yes

- Go to [3](#)

No

- Test Complete.

3. TIRE PRESSURE SENSOR

NOTE: Before continuing, ensure the tire is free from any leaks or damage that would cause a low tire pressure condition. If a problem is found, repair as necessary and retest.

With the scan tool, go under “Data Display” for the “WCM Wireless Control Module” and find the compensated tire pressure values. Located underneath each Sensor Identification locations. If any compensated tire pressure values are equal or lower then the Tire Low Pressure Threshold. The corresponding TPM sensor needs to be located and replaced.

NOTE: The following tests are used to locate the Tire Pressure Sensor/Transmitter that is setting the low pressure fault. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing. Use one or more of the following methods below.

METHOD 1: Use a TPM-RKE Analyzer tool 9936 to scan each tire pressure sensor. If a suspected sensor has been located, lower the tire pressure to 20 PSI, wait for 2 minutes, and check the scan tool for changes to any compensated tire pressure values.

If there was a pressure change to any compensated tire pressure values, check to make sure that the TPM-RKE Analyzer is set correctly, and repeat the process on each wheel on the vehicle until the faulty Sensor/Transmitter has been identified.

NOTE: When scanning a sensor with a TPM-RKE Analyzer 9936 , replace the TPM sensor if the results show a “Damaged Accel”, “Damaged Temp”, or “Damaged Press”.

METHOD 2: Starting with the left front wheel, deflate the tire to 20 PSI, wait 2 minutes, and check the scan tool for changes to any compensated tire pressure values.

If there was a pressure change to any compensated tire pressure value, repeat this process on each wheel on the vehicle until the faulty Sensor/Transmitter has been identified.

Has the malfunctioning/faulty TPM sensor been located?

Yes

- Replace the Tire Pressure sensor.
- Perform the TPM verification (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

No

- Go To [4](#)

4. WIRELESS CONTROL MODULE

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

With the scan tool, read WCM/SKREEM DTC(s).

Drive the vehicle for a minimum of 10 minutes while maintaining a continuous speed above 15 mph (24 km/h).

During this time the system will learn the sensor IDs.

Are there any DTC(s) present?

Yes

- Repair not complete, refer to the appropriate symptom.
- Perform the TPM verification (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

No

- Repair is complete.

5. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h. (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Repair as necessary.
- Perform the TPM verification (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

No

- Test complete.

C1501–TIRE PRESSURE SENSOR 1 INTERNAL

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**

With vehicle speed greater than 15 MPH (24 km/h).

- **Set Condition:**

The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded within a maximum period of 10 minutes. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

Possible Causes
WRONG SENSOR
TEMPORARY SPARE TIRE IN USE
OUTSIDE INTERFERENCE
TIRE PRESSURE SENSOR
WIRELESS CONTROL MODULE (SKREEM)

Diagnostic Test

1. DTC STATUS IS ACTIVE

NOTE:

If the following conditions are present:

- Tire Pressure Sensor Internal DTC (Active)
- Spare Tire is not equipped with a Tire Pressure Sensor
- Spare Tire is currently on the vehicle

Repair the tire and place it back on the vehicle .

Test drive the vehicle.

If the DTC(s) reset continue with the diagnostic procedure.

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Is the DTC status Active at this time?

Yes

- Go to [2](#)

No

- Go to [4](#)

2. TIRE PRESSURE SENSOR

NOTE:

When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.

- 1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
- 2. Turn the ignition on.**
- 3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
- 4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.**

Once a fault/alert has set, it will establish the location of the tire pressure sensor/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Test Complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

Repair

- Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

4. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Return to the beginning of this test and perform the diagnostic procedure as necessary.

No

- Test complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

C1502–TIRE PRESSURE SENSOR 2 INTERNAL

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**

With vehicle speed greater than 15 MPH (24 km/h).

- **Set Condition:**

The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded within a maximum period of 10 minutes. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

Possible Causes
INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC
SPARE TIRE IN USE
TIRE PRESSURE SENSOR
WIRELESS CONTROL MODULE (SKREEM)

Diagnostic Test

1. DTC STATUS IS ACTIVE

NOTE:

If the following conditions are present:

- Tire Pressure Sensor Internal DTC (Active)
- Spare Tire is not equipped with a Tire Pressure Sensor
- Spare Tire is currently on the vehicle

Repair the tire and place it back on the vehicle.

Test drive the vehicle.

If the DTC(s) reset continue with the diagnostic procedure.

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Is the DTC status Active at this time?

Yes

- Go to [2](#)

No

- Go to [4](#)

2. TIRE PRESSURE SENSOR

NOTE:

When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.

- 1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
- 2. Turn the ignition on.**
- 3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
- 4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.**

Once a fault/alert has set, it will establish the location of the tire pressure sensor/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Test Complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

Repair

- Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

4. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Return to the beginning of this test and perform the diagnostic procedure as necessary.

No

- Test complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

C1503–TIRE PRESSURE SENSOR 3 INTERNAL

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

◦ **When Monitored:**

With vehicle speed greater than 15 MPH (24 km/h).

◦ **Set Condition:**

The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded within a maximum period of 10 minutes. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

Possible Causes
INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC
SPARE TIRE IN USE

TIRE PRESSURE SENSOR
WIRELESS CONTROL MODULE (SKREEM)

Diagnostic Test

1. DTC STATUS IS ACTIVE

NOTE:

If the following conditions are present:

- Tire Pressure Sensor Internal DTC (Active)
- Spare Tire is not equipped with a Tire Pressure Sensor
- Spare Tire is currently on the vehicle

Repair the tire and place it back on the vehicle.

Test drive the vehicle.

If the DTC(s) reset continue with the diagnostic procedure.

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Is the DTC status Active at this time?

Yes

- Go to [2](#)

No

- Go to [4](#)

2. TIRE PRESSURE SENSOR

NOTE:

When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.

1. Set all tire pressures to the recommended specifications and recheck for fault/alert.

2. Turn the ignition on.

3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

Once a fault/alert has set, it will establish the location of the tire pressure sensor/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Test Complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

Repair

- Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

4. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Return to the beginning of this test and perform the diagnostic procedure as necessary.

No

- Test complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

C1504–TIRE PRESSURE SENSOR 4 INTERNAL

For a complete wiring diagram **Refer to Section 8W**

Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**

With vehicle speed greater than 15 m.p.h. (24 km/h).

- **Set Condition:**

The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded within a maximum period of 10 minutes. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

Possible Causes
INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC
SPARE TIRE IN USE
TIRE PRESSURE SENSOR
WIRELESS CONTROL MODULE (SKREEM)

Diagnostic Test

1. DTC STATUS IS ACTIVE

NOTE:

If the following conditions are present:

- Tire Pressure Sensor Internal DTC (Active)
- Spare Tire is not equipped with a Tire Pressure Sensor
- Spare Tire is currently on the vehicle

Repair the tire and place it back on the vehicle.

Test drive the vehicle.

If the DTC(s) reset continue with the diagnostic procedure.

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Is the DTC status Active at this time?

Yes

- Go to [2](#)

No

- Go to [4](#)

2. TIRE PRESSURE SENSOR

NOTE:

When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.

1. Set all tire pressures to the recommended specifications and recheck for fault/alert.
2. Turn the ignition on.
3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.
4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

Once a fault/alert has set, it will establish the location of the tire pressure sensor/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

Yes

- Go to [3](#)

No

- Test Complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

Repair

- Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

4. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 MPH (24 km/h).

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

Does the DTC reset or is the status Active for this DTC?

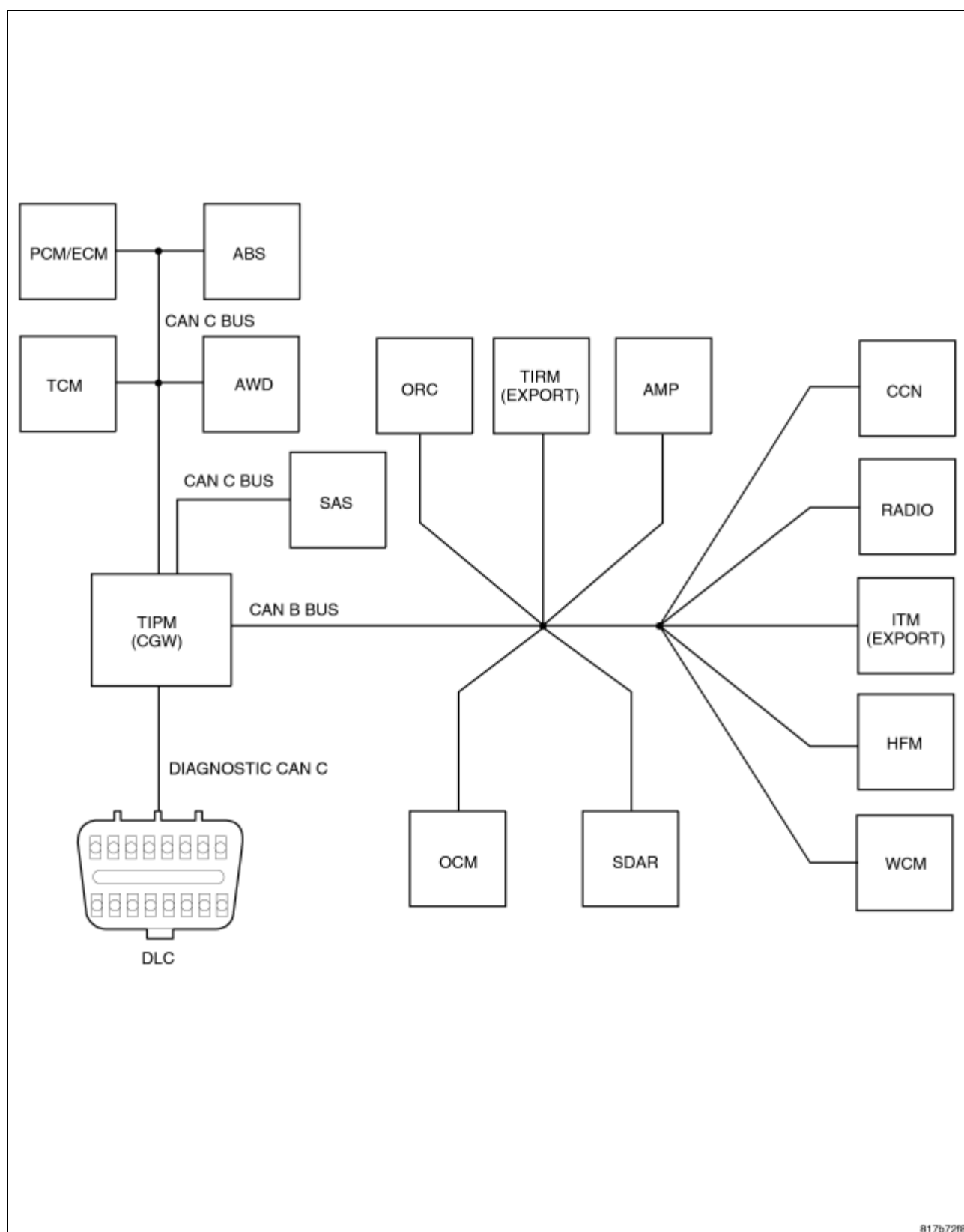
Yes

- Return to the beginning of this test and perform the diagnostic procedure as necessary.

No

- Test complete.
- Perform TPM VERIFICATION TEST. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE)

*STORED LOST COMMUNICATION DTC'S



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

Battery voltage between 10 and 16 volts.

IOD fuse installed.

TIPM is configured correctly.

- **Set Condition:**

Bus messages not received for approximately 2 to 5 seconds.

Possible Causes
CAN B BUS CIRCUITS OPEN OR SHORTED
CAN C BUS CIRCUITS OPEN OR SHORTED
DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES
TIPM NOT CONFIGURED CORRECTLY
POWER OR GROUND FROM THE REPORTING MODULE
MODULE THAT SET THIS DTC
PREVIOUS SERVICE PERFORMED WITHIN THE LAST 100 KEY CYCLES (FUSE/RELAYS REMOVED, WIRING SERVICE, BATTERY DISCONNECT)
LOW BATTERY/JUMP START CONDITION
IOD FUSE WAS REMOVED DURING SHIPPING
CHECK FOR RELATED TSB'S

Diagnostic Test

1. VERIFY DTC IS STORED

NOTE: Stored faults may indicate a customer perceived intermittent condition.

NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.

NOTE: Check for any TSB(s) related to the condition. If a TSB applies, perform the procedure outlined in the TSB before continuing.

With the scan tool, read stored DTC's.

Is this DTC stored?

Yes

- Go To [2](#)

No

- Diagnose the active DTC. Refer to the Table of Contents for a list of the symptoms.

2. CHECK THE ENVIRONMENTAL DATA

With the scan tool, read the loss of communication environmental data.

Does the loss of communication environmental odometer data match up to any of the previous service procedures listed in the possible causes or are there any stored CAN B or C hardware electrical, battery, ignition voltage, VIN missing/mismatch, TIPM configuration DTC's present with matching environmental data?

Yes

- These DTC's may have been the result of other service procedures performed. Clear DTC's.

No

- Go To [3](#)

3. VERIFY INTERMITTENT LOST COMMUNICATION DTC – WIRING CONCERNS

Turn the ignition on.

With the scan tool, select Network View and select Advanced.

Is there more than one ECU with stored DTC's “Logged Against” the module and one or more lost communication DTC's stored in the offending module?

Yes

- Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

No

- Go To [4](#)

4.

Turn the ignition on.

With the scan tool, select Network View and select Advanced.

Is there more than one ECU with stored DTC's "Logged Against" the module and NO lost communication DTC's stored in the offending module?

Yes

- Check for TSB(s) related to this offending module.

No

- Go To [5](#)

5. VERIFY INTERMITTENT LOST COMMUNICATION DTC – REPORTING MODULE

Turn the ignition on.

With the scan tool, select Network View and select Advanced.

Is there ONLY ONE ECU with stored DTC's "Logged Against" the module?

Yes

- Check for TSB(s) related to the module that set this DTC.

No

- Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

STANDARD PROCEDURE

TPM VERIFICATION

For a complete wiring diagram **Refer to Section 8W.**

Diagnostic Test

1. TPM

Was the WCM/SKREEM replaced during the test procedure?

Yes

- Go to [2](#)

No

- Go to [3](#)

2. WCM/SKREEM

NOTE: When entering the PIN, care should be taken because the SKREEM will only allow three consecutive attempts to enter the correct PIN. If three consecutive incorrect PIN's are entered the SKREEM will Lock Out the scan tool. To exit Lock Mode, the ignition key must remain in the Run position for one hour. All accessories must be off. A battery charger connected to the battery during this time period is recommended.

- Reconnect the previously removed and/or disconnected components and connectors.
- Obtain the vehicle's unique Personal Identification Number (PIN) assigned to its original SKREEM. This number can be obtained from the vehicle invoice or from the DaimlerChrysler Customer Center (Phone 1-800-992-1997).
- With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
- If the WCM/SKREEM was replaced, all the customer's keys must be programmed to the new module. Use the scan tool and the Program Key procedure
- With the scan tool, erase all DTCs. Perform 5 ignition key cycles, leaving the key on for at least 90 seconds per cycle.
- Drive the vehicle for a minimum of 10 minutes while maintaining a continuous speed above 15 mph (24 km/h). During this time the system will learn the new sensor ID code and will clear any DTC(s) automatically.
- With the scan tool, read WCM/SKREEM DTC(s).

Are there any DTC(s) present?

Yes

- Repair not complete, refer to the appropriate symptom.

No

- Repair is complete.

3. TIRE PRESSURE SENSOR/TIRE PRESSURE TRANSPONDER REPLACE

- Reconnect the previously removed and/or disconnected components and connectors.
- Drive the vehicle for a minimum of 10 minutes while maintaining a continuous speed above 15 mph (24 km/h). During this time the system will learn the new sensor ID code and will clear any DTC(s) automatically.
- With the scan tool, read TPM DTC(s).

Are there any DTC(s) present?

Yes

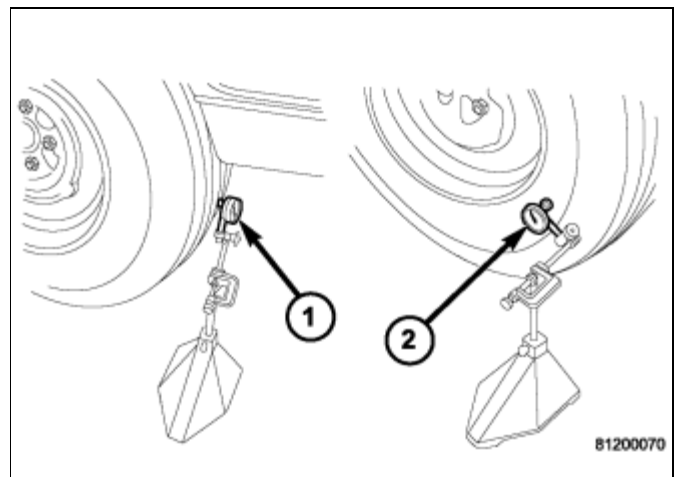
- Repair not complete, refer to the appropriate symptom.

No

- Repair is complete.

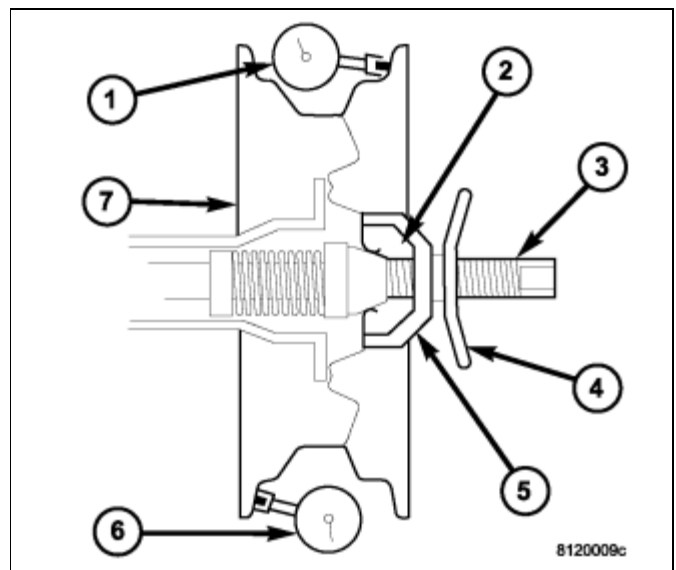
TIRES/WHEELS - SERVICE INFO**TIRES/WHEELS - SERVICE INFO****DIAGNOSIS AND TESTING****TIRE AND WHEEL RUNOUT**

Radial runout is the difference between the high and low points on the tire or wheel.



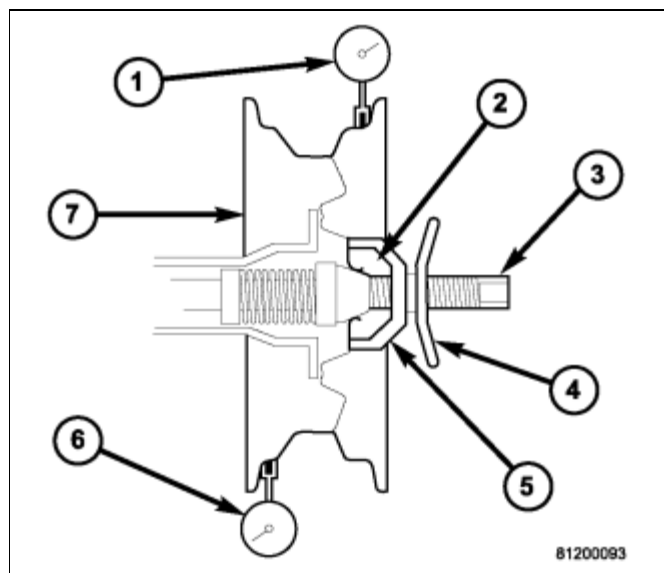
Lateral runout is the **wobble** of the tire or wheel.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.



Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).



METHOD 1 (RELOCATE WHEEL ON HUB)

1. Drive vehicle 10-15 minutes at highway speed to adequately warm tire to eliminate tire flat spotting from a parked position.

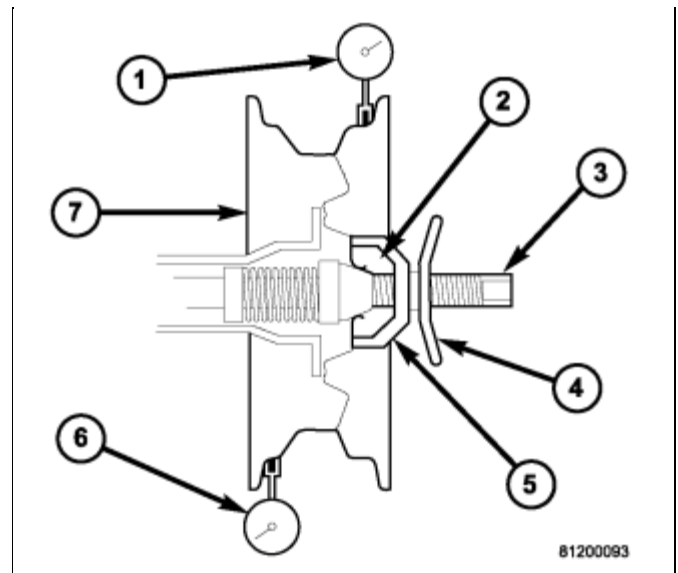
NOTE: Immediately following tire warm-up, lift vehicle off of ground to avoid flat spotting the tires. Flat spotted tires can lead to vibration and imbalance.

2. Check wheel bearings and adjust if adjustable or replace if necessary.
3. Check the wheel mounting surface.
4. Rotate wheel on the mounting, two studs over from the original position.
5. Tighten wheel nuts in a crossing pattern until all are properly torqued, to eliminate brake distortion.
6. Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

METHOD 2 (RELOCATE TIRE ON WHEEL)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

1. Remove tire from wheel and mount wheel on service dynamic balance machine.
2. Check the wheel radial runout.



3. Check the wheel lateral runout.

- STEEL WHEELS: Radial runout 0.031 in., Lateral runout 0.031 in. (maximum)
- ALUMINUM WHEELS: Radial runout 0.02 in., Lateral runout 0.02 in. (maximum)

4. If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout.

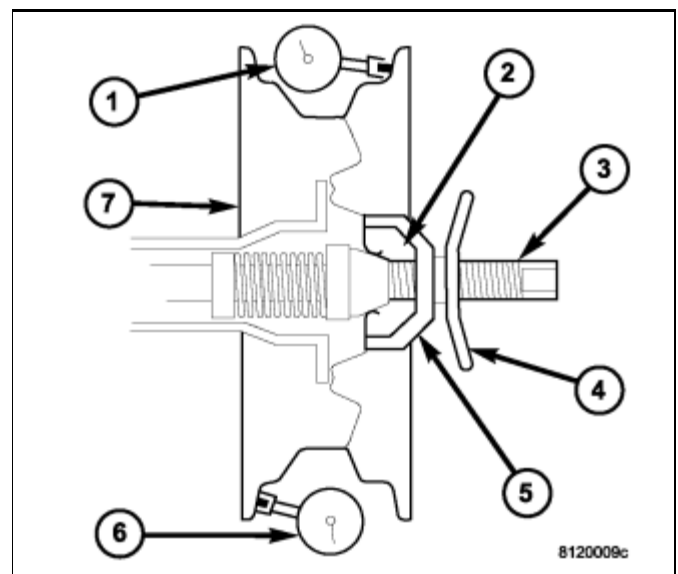
STANDARD PROCEDURE

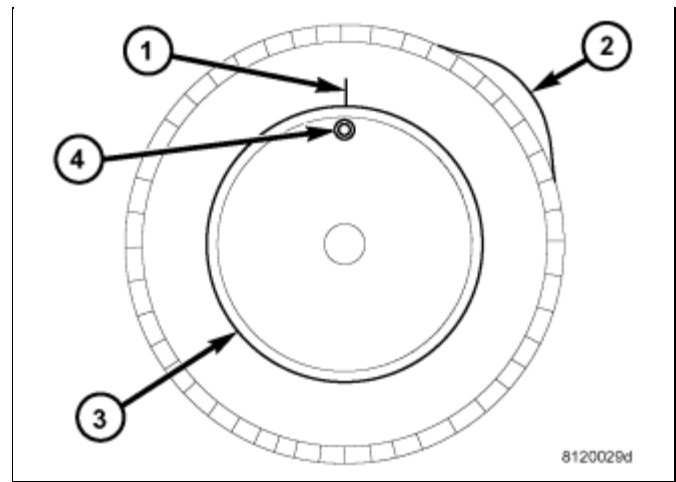
MATCH MOUNTING

Wheels and tires that are mounted means that the high spot of the tire is matched to the low spot on the wheel rim. Each are marked with a bright colored temporary label on the outboard surface for alignment. The wheel is also marked permanently on the inside of the rim in the tire well. This permanent mark may be a paint dot or line, a permanent label or a stamped impression such as an X. An optional location mark is a small spherical indentation on the vertical face of the outboard flange on some non styled base steel wheels. The tire must be removed to locate the permanent mark on the inside of the wheel.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

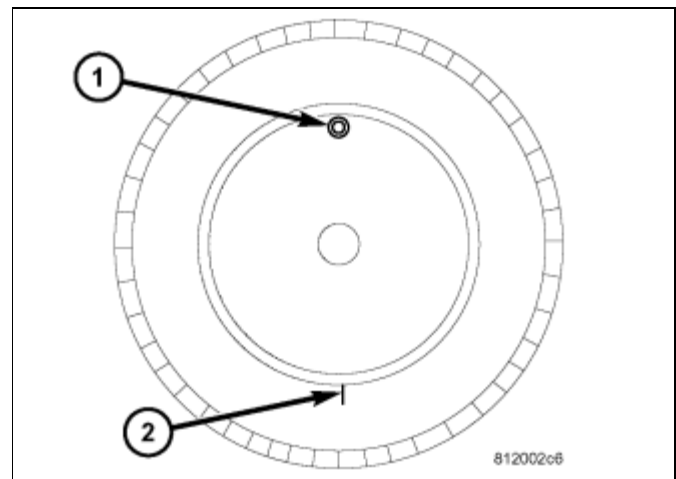
1. Remove the tire and wheel assembly from the vehicle and mount on a service dynamic balance machine.
2. Measure the total runout on the center of the tire tread rib (3) with a dial indicator. Record the indicator reading. Mark the tire to indicate the high spot (2). Place a mark on the tire at the valve stem (1) location (1).





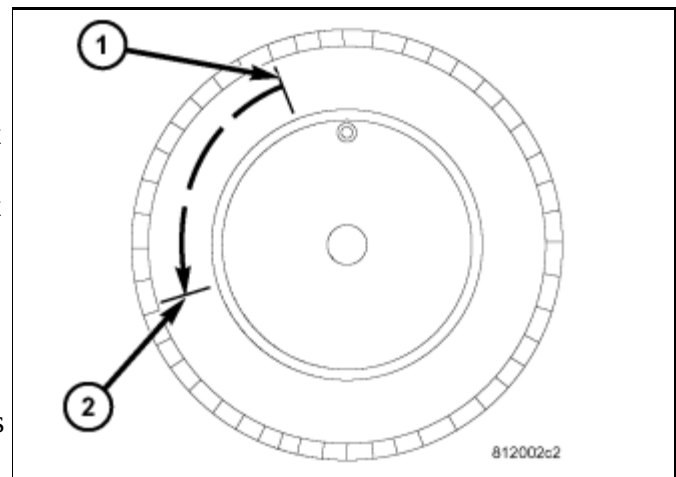
3. Break down the tire and remount it 180 degrees on the rim (1)(2).

4. Measure the total indicator runout again. Mark the tire to indicate the high spot.



5. If runout is still excessive, the following procedures must be done.

- If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot (1) to first (2). Break down the tire and remount it 90 degrees on rim in that direction. This procedure will normally reduce the runout to an acceptable amount, if not replace the rim.



TIRE AND WHEEL BALANCE

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

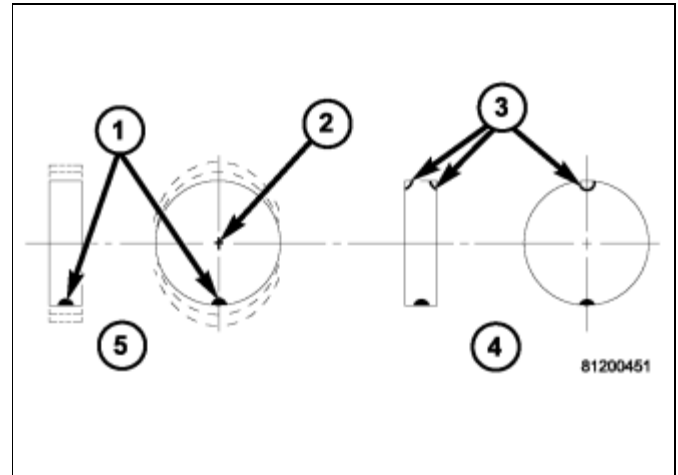
NOTE: Static should be used only when a two plane balancer is not available.

NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

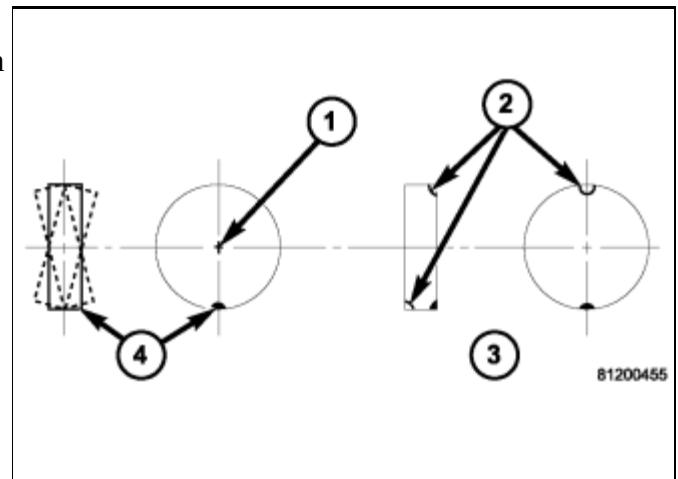
NOTE: 20" wheels do not have an outer flange. Apply adhesive weights on midplane surface

For static balancing, find the location of the heavy spot (1) causing the imbalance (5). Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance (4). Place half of this weight on the **inner** rim flange (3) and the other half on the **outer** rim flange (3).



For dynamic balancing (3), the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (2).

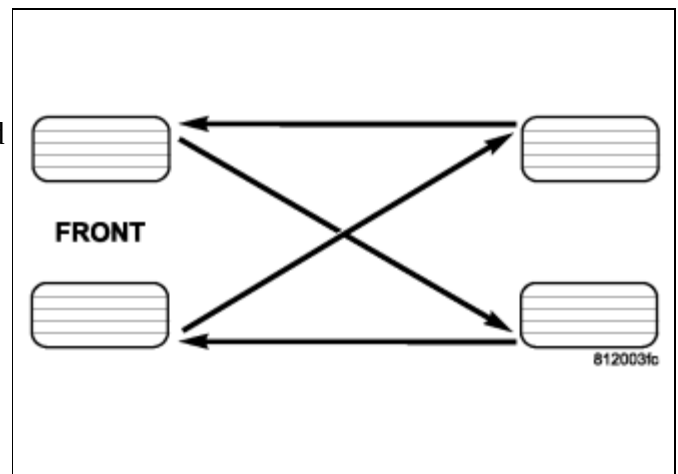
ROTATION



Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is shown in graphic. Other rotation methods can be used, but they will not provide all the tire longevity benefits.



TIRES

DESCRIPTION

TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

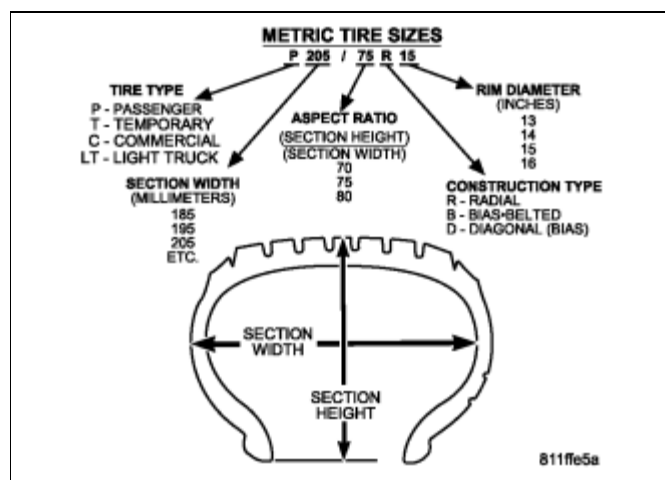
Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE). This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code.

Performance tires have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. These ratings are:

- **Q** up to 99 mph
- **S** up to 112 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **W** (consult the tire manufacturer for the specific speed rating)
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)



An All Season type tire will have either **M + S**, **M & S** or **M-S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 80 KPH (50 MPH) is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

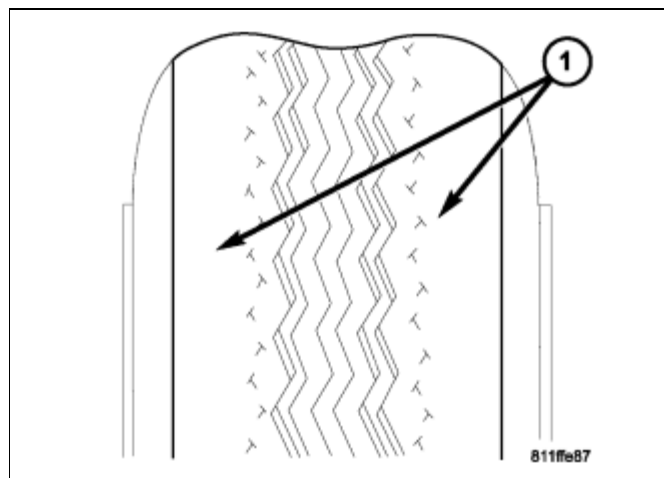
The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

TIRE INFLATION PRESSURES

WARNING: Over or under inflated tires can affect vehicle handling and tread wear. This may cause the tire to fail suddenly, resulting in loss of vehicle control.

Under inflation will cause rapid shoulder wear (1), tire flexing, and possible tire failure.

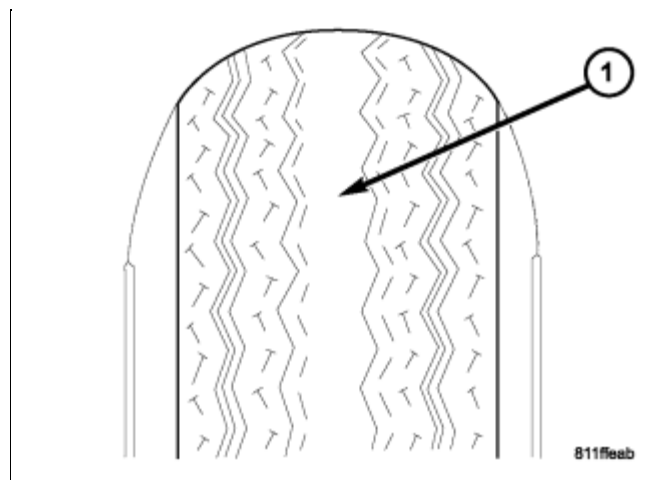


Over inflation will cause rapid center wear (1) reduction in the tire's ability to cushion shocks.

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the tire label



placard usually located on the drivers door latch pillar.

TIRE PRESSURE FOR HIGH SPEED

Refer to the Vehicles Owners Manual package.

SPARE / TEMPORARY TIRE

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 80 KMH (50 MPH). when using the temporary spare tire. Refer to Owner's Manual for complete details.

FULL SIZE, SPARE WHEEL WITH MATCHING TIRE

The spare is a full usage wheel with a matching tire. It can be used within the (posted legal) speed limits or distance limitations as of the rest of the vehicles four tires. Refer to Owner's Manual for complete details.

REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: Failure to equip the vehicle with tires having adequate speed capability can result in sudden tire failure.

DIAGNOSIS AND TESTING

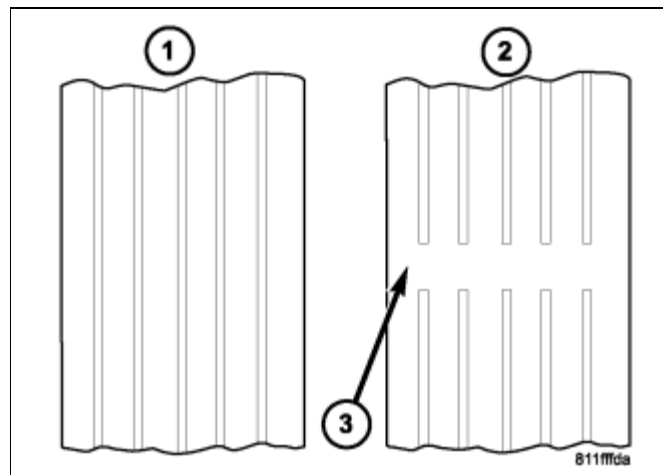
PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

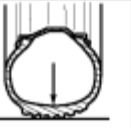
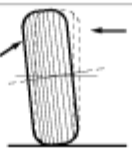
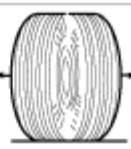
TREAD WEAR INDICATORS

Tread wear indicators (3) are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators (3) will appear as a 13 mm (1/2 in.) band.

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.



TIRE WEAR PATTERNS

CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT	1.  2. 						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION 	OVER-INFLATION OR LACK OF ROTATION 	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL  OR TIRE DEFECT*	LACK OF ROTATION OF TIRES OR WORN OR OUT- OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

* HAVE TIRE INSPECTED FOR FUTURE USE.

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Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other.

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread.

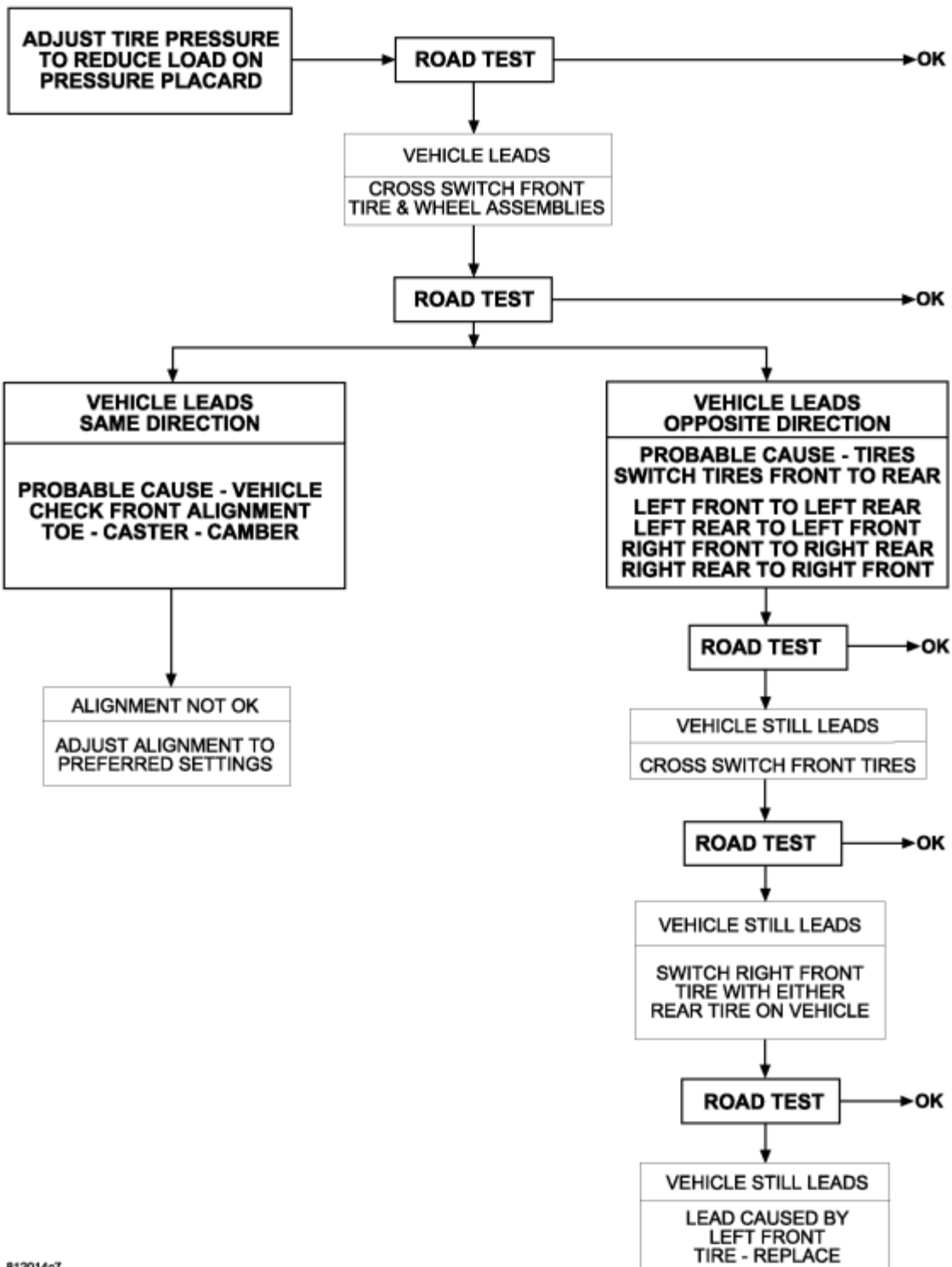
TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

TIRE/VEHICLE LEAD

Use the following Vehicle Lead Diagnosis And Correction Chart to diagnose and correct a vehicle lead or drift problem.



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STANDARD PROCEDURE

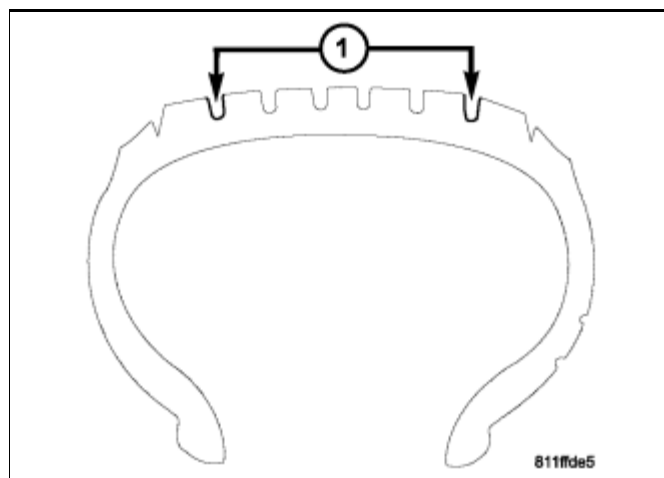
TIRE REPAIR AREA

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (1). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification.



CLEANING

TIRES

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.

SPECIFICATIONS

TIRE SIZE

DESCRIPTION	SPECIFICATION
TIRE	P225/75R16
TIRE	P245/75R16
TIRE	P255/75R17
TIRE	P255/70R18
TIRE	LT255/75R17
TIRE	245/75R16

TIRE

255/70R18

WHEELS

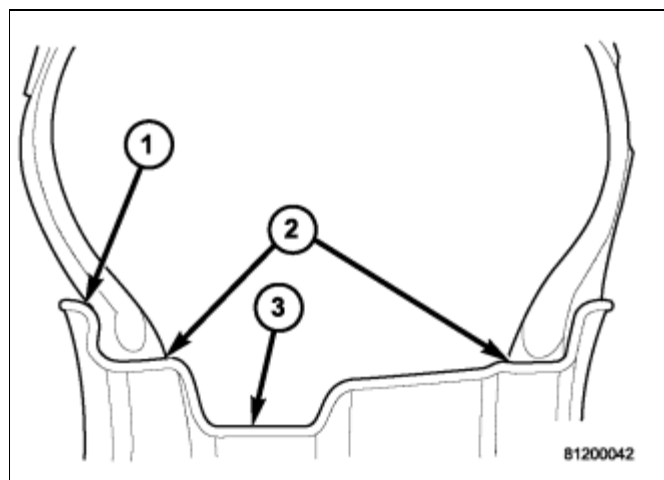
DESCRIPTION

WHEEL DESIGN

The rim size is on the vehicle safety certification label located on the drivers door shut face. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges (1) and rim drop well (3) called safety humps.

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.



The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: Failure to use equivalent replacement wheels may adversely affect the safety and handling of the vehicle. Used wheels are not recommended. The service history of the wheel may have included severe treatment or very high mileage. The rim could fail without warning.

WARNING: Daimlerchrysler corporation does not recommend that customers use “reconditioned” wheels (wheels that have been damaged and repaired) because they can result in a sudden catastrophic wheel failure which could cause loss of control and result in injury or death.

For Clarification:

- Cosmetic refinishing for the purpose of repairing a superficial flaw is an acceptable procedure providing it is limited to paint or clear coat only, the wheel is not modified in any way, and there is no exposure to paint curing heat over 200 degrees Fahrenheit.
- Damaged wheels are those which have been bent, broken, cracked or sustained some other physical damage which may have compromised the wheel structure
- Repaired indicates that the wheel has been modified through bending, welding, heating, straightening, or material removal to rectify damage.
- Re-plating of chrome plated wheels is not an acceptable procedure nor is chrome plating of original equipment painted or polished wheels, as this may alter mechanical properties and affect fatigue life.

STANDARD PROCEDURE

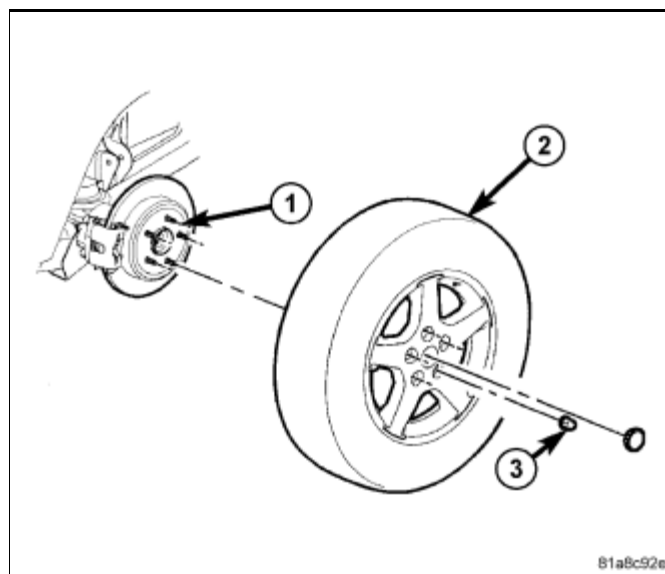
WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces (1). Ensure wheels (2) are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel (2), first position it properly on the mounting surface (1). All wheel nuts (3) should then be tightened just snug.

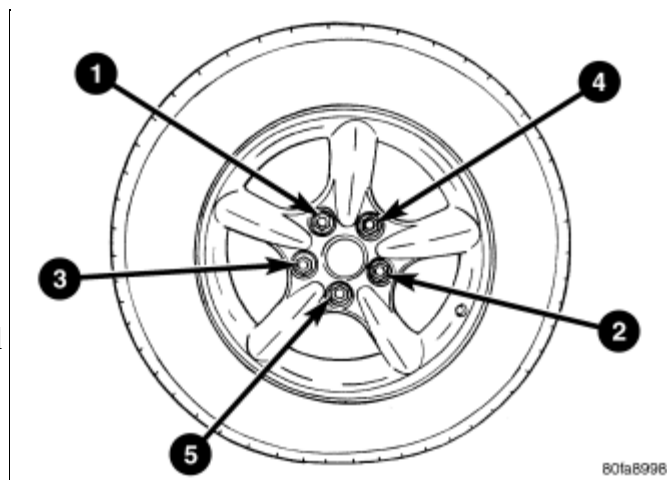


Gradually tighten them in sequence to the proper torque specification . **Never use oil or grease on studs or nuts.**

WHEEL REPLACEMENT

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.



Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

Wheels must be replaced if they have:

- Excessive runout
- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:

- Load carrying capacity
- Diameter
- Pilot Bore Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

SPECIFICATIONS

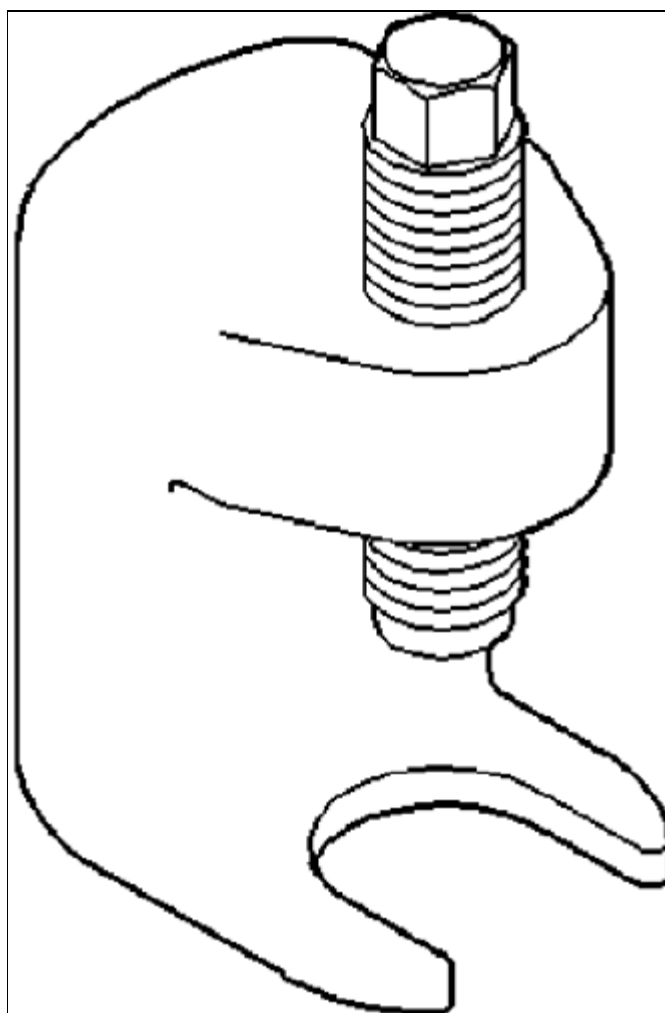
TORQUE CHART

SPECIFICATIONS

DESCRIPTION	N•m	Ft. Lbs.	In. Lbs.
Lug Nut 1/2 X 20 with 60° Cone	125-180	92-132	—
Spare Wheel Lug Nut	54-108	40-80	—

SPECIAL TOOLS

WHEELS



STUDS

REMOVAL

FRONT WHEEL STUD

CAUTION: Do not use a hammer to remove wheel studs.

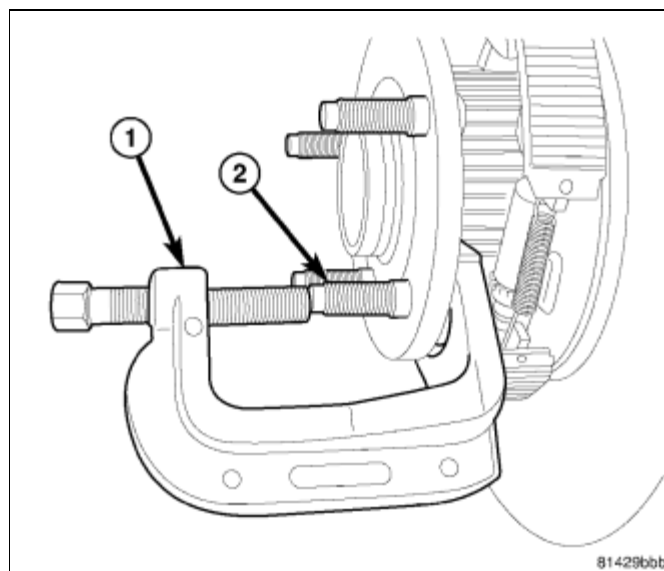
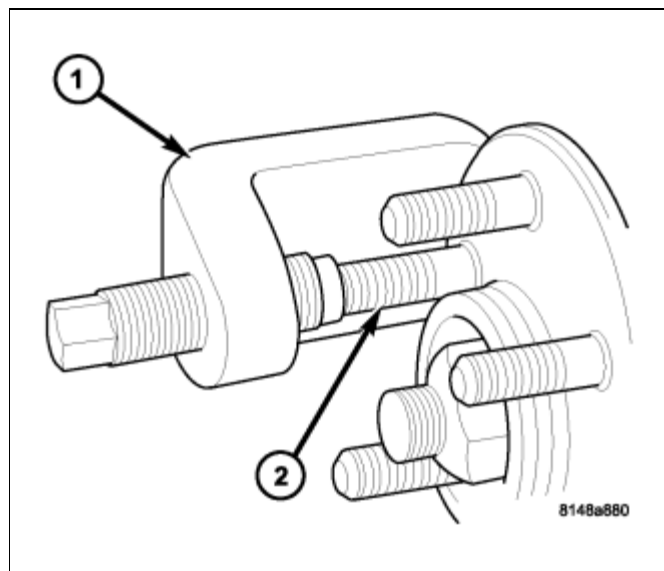
1. Raise and support vehicle.
2. Remove wheel and tire assembly.
3. Remove brake caliper, caliper adapter and rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
4. Remove stud (2) from hub with Remover C-4150-A (1).

REAR WHEEL STUD

CAUTION: Do not use a hammer to remove wheel studs.

1. Raise and support vehicle.
2. Remove wheel and tire assembly.

3. Remove brake caliper and rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
4. Remove stud (2) from hub with Remover 8677 (1).



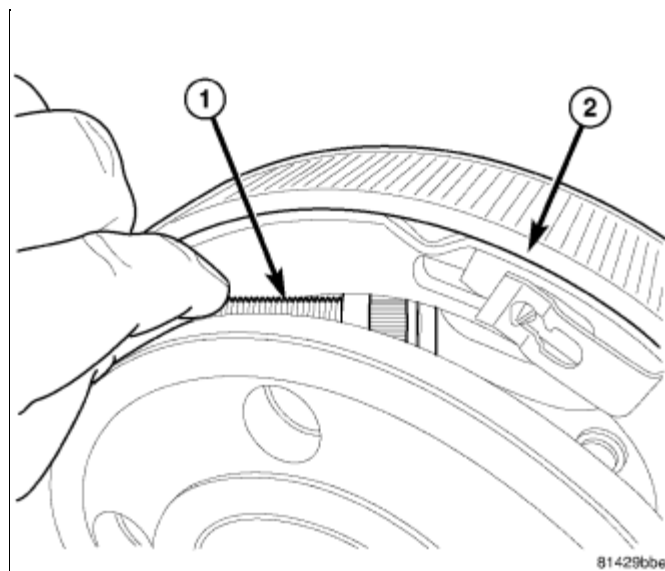
5. Remove the stud (1) from between the hub/bearing and brake shoes (2)

INSTALLATION

FRONT WHEEL STUD

CAUTION: Do not use a hammer to remove wheel studs.

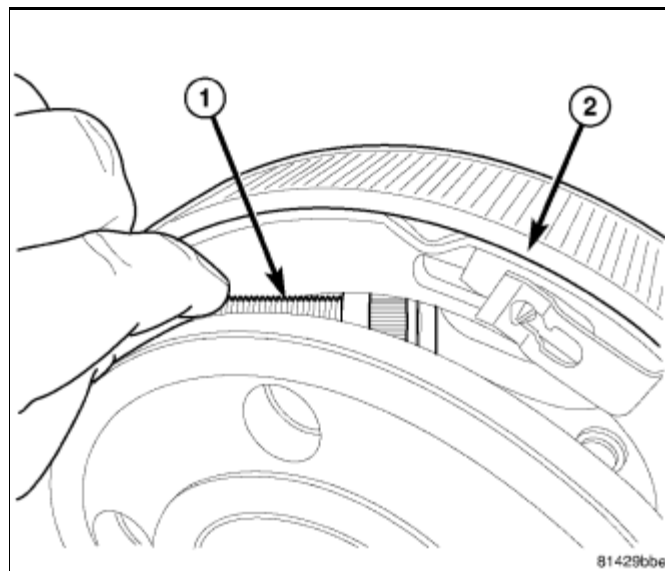
1. Install the new stud into the hub flange.



2. Install the three washers onto the stud, then install the lug nut with the flat side of the nut against the washers.
3. Tighten the lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.
4. Remove the lug nut and washers.
5. Install the brake rotor, caliper adapter, and caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
6. Install the wheel and tire assembly, use new lug nut on stud or studs that were replaced.
7. Remove the support and lower vehicle.

REAR WHEEL STUD

1. Install the new stud (1) into the hub flange by rotating the stud (1) in between the hub/bearing and park brake shoes (2).
2. Install the three washers onto the stud, then install the lug nut with the flat side of the nut against the washers.
3. Tighten the lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.
4. Remove the lug nut and washers.
5. Install the brake rotor and caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
6. Install the wheel and tire assembly, use new lug nut on stud or studs that were replaced.
7. Remove the support and lower vehicle.



TIRE PRESSURE MONITORING SYSTEM

DESCRIPTION

BASE TIRE PRESSURE MONITORING

This system will consist of Tire Pressure Monitoring (TPM) sensors attached to each wheel through the valve

stem mounting hole, a Wireless Control Module (WCM) and a yellow TPM telltale lamp. A TPM sensor shall be installed in the spare wheel if the vehicle is equipped with a matching full size spare wheel and tire assembly.

NOTE: The Tire Pressure Monitoring System (TPMS) will warn the driver of a low tire pressure based on the vehicle recommended cold placard pressure.

The tire pressure will vary with temperature by about 1 psi (6.9 kPa) for every 12°F (6.5°C). When the outside temperature decreases, the tire pressure will decrease. Tire pressure should always be set based on cold inflation tire pressure. This is defined as the tire pressure after a vehicle has not been driven for more than 3 hours - and in outside ambient temperature. The tire pressure will also increase as the vehicle is driven - this is normal and there should be no adjustment for this increased pressure.

The TPM System will warn the driver of a low tire pressure if the tire pressure falls below the low pressure warning threshold for any reason, including low temperature effects.

The TPM System will continue to warn the driver of low tire pressure as long as the condition exists, and will not turn off until the tire pressure is at or above recommended cold placard pressure. Once the low tire pressure warning has been illuminated, the tire pressure must be increased to the recommended cold placard pressure in order for the TPM warning lamp to be turned off. The system will automatically update and the TPM warning lamp will extinguish once the updated tire pressures have been received. The vehicle may need to be driven for up to 10 minutes above 15 mph (25 kph) to receive this information.

WIRELESS CONTROL MODULE (WCM)

The receiver circuit for the TPM system is integrated into the WCM. for non-remote start vehicles. For factory installed remote start vehicles, the remote start antenna is external to the WCM. The WCM can also include the Remote Keyless Entry (RKE) receiver, Remote Start (if equipped), and the Sentry Key Immobilizer (SKIM) receiver. All Four receivers share a number of common components. The WCM decodes the RF signals transmitted by each of the vehicle's tire pressure sensors. The decoded information is used to determine if "warning" or "fault" conditions exist within the TPM system.

The WCM communicates with the module that controls the "TPM telltale lamp", via the vehicle bus system.

Upon detection of a warning or fault condition, the WCM will send a request to illuminate or flash the yellow TPM telltale. Also, upon detection of a warning or fault condition, the display module will send a request to sound the "chime". A chime will only be requested once per ignition cycle per warning or fault condition detected.

The WCM will store all warning and fault conditions, placard pressure values, low-pressure threshold values and low pressure threshold hysteresis values in memory that can be accessed through diagnostic communication. If new sensors are introduced to the vehicle, the data stored for the sensor being replaced will be deleted.

The WCM will store all wheel sensor ID's and locations and faults in memory that can be accessed through diagnostic communication. All other data values transmitted from each active wheel sensor (not the spare tire) shall be stored in the WCM memory.

The WCM automatically learns and stores the sensor's ID while driving "within 10 minutes continuously above 15 m.p.h. (24 Km/h)" after a sensor has been replaced.

The learning sequence will initiate when the vehicle has been stopped for more then 20 minutes. A new TPM sensor ID can also be programmed directly into the WCM by using a RKE-TPM Analyzer in conjunction with a Scan Tool. Once the new TPM sensor ID has been programmed, the RKE-TPM Analyzer can be used to update the TPMS by activating the TPM sensor.

OPERATION

The tire pressure monitoring system is designed to operate without loss of function for all OEM tire construction for this vehicle. Tire Pressure Monitoring Sensors, mounted to each road wheel as part of the valve stem, transmit an RF signal indicating their individual pressure to a receiver located in the Wireless Control Module (WCM), commonly referred to as the Sentry Key Remote Entry Module (SKREEM). These transmissions occur approximately once every minute at speeds over 15 mph (24 km/h). If the TPM system detects that the tire pressure in any road tire is going low, beyond the Low Pressure (lamp) ON threshold (see placard table below), the TPM system will continuously illuminate an indicator lamp. If a system fault is detected, the indicator lamp will flash on/off for 75 seconds and then remain on solid.

If the WCM detects a warning or fault condition at ignition key "on" it will wait ten seconds +/- 10 % before sending the first request to illuminate the yellow TPM telltale lamp. This will assure that the display module has concluded its bulb check period. The display module will request a chime once per ignition cycle for each "warning" or "fault" condition detected. A "warning" or "fault" condition will remain enabled until the problem causing the condition is corrected and removed/reset.

The WCM shall continuously monitor for the receipt of tire pressure RF message transmissions from the TPM sensors during both the ignition key "on" and key "off" cycles. The TPM sensor ID's and the location of each sensor (e.g. Tire 1, Tire 2 etc.) are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required. The recommended "placard pressure", "low-pressure threshold" and "Hysteresis Pressure Values" for the tires installed on the vehicle, are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required.

The recommended "Placard Pressure", "Low-pressure Threshold", and "Hysteresis Pressure Values" for the tires installed on the vehicle, are stored in the non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required. To determine the pressure thresholds for a vehicle, refer to the Tire Inflation Pressure (Placard) Label, and then apply the placard pressure to the following table. The Low Pressure Off Threshold is defined as the Low Pressure On Threshold plus the Hysteresis Pressure Value.

TPM THRESHOLD PRESSURES

NOTE: To determine the pressure thresholds for a vehicle, refer to the Tire Inflation Pressure (Placard) Label found on the Driver's B-Pillar, then apply the placard pressure to the following table.

Placard Pressure (Cold) (PSI)	Low Pressure ON Threshold (PSI)	Low Pressure OFF Threshold (PSI)
28	22	26
29	23	27
30	24	28
31	25	29
32	25	29
33	26	30
34	27	31

35	28	32
36	29	33
37	29	34
38	30	35
39	31	36
40	32	37
41	33	38
42	34	39
43	35	40
44	36	41
45	36	41
46	37	43
47	38	44
48	38	45
49	39	45
50	40	47
51	41	48
55	44	52
60	48	57
65	52	62
70	56	67
75	60	72
80	64	77

DIAGNOSIS AND TESTING

TIRE PRESSURE MONITORING SYSTEM

All Tire Pressure Monitoring System Faults are specific to one location. If a "BATTERY LOW" fault is detected it will cause a loss of signal fault. If a "SENSOR FAILURE" fault is detected, the location will be displayed (Premium Systems). The appropriate sensor/transmitter can then be replaced. If a single sensor/transmitter cannot be detected by the WCM, replace that sensor transmitter. If none of the sensors/transmitters can be detected, refer to symptoms in the WCM section. For additional system description and diagnosis, refer to Tire Pressure Monitoring in the Body Diagnostic manual .

TIRE PRESSURE

Check the tire pressure yellow telltale in the instrument cluster. If the yellow telltale is illuminating continuously, adjust the air pressure as necessary to that listed on the Tire Inflation Pressure Label (Placard) provided with the vehicle. After adjusting air pressure in a tire, allow approximately two minutes for the message or yellow telltale to go out. Inspect all the tires for leaks. A water "dunk tank" or other water test may be used as long as any water at the valve core is removed once the procedure is complete. The water can be easily expelled from the core area by pushing in on the core for several seconds, allowing escaping air to drive out any moisture. Reinflate the tire as necessary. Always make sure the original valve stem cap is securely installed to keep moisture out of the sensor. If the yellow telltale is still illuminating continuously or if the yellow telltale is flashing on/off for 60 seconds, once every ten minutes while drive, there is a system fault detected (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - STANDARD PROCEDURE).

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Tire Pressure Sensor/Transmitter Mounting Nut	6	—	53

SENSOR

DESCRIPTION

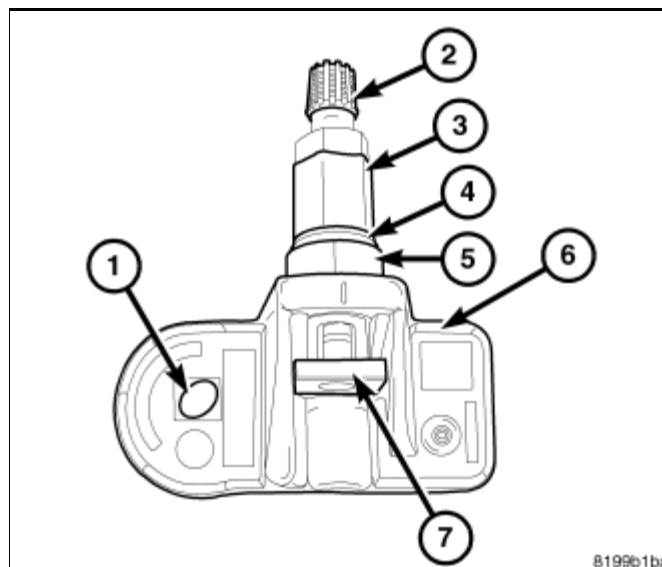
NOTE: On vehicles equipped with a Tire Pressure Monitoring System (TPMS), when the spare tire pressure sensor is replaced with a new pressure sensor, a diagnostic scan tool **MUST** be used to run a routine that will program the new pressure sensor ID into the Wireless Control Module (WCM), commonly referred to as the Sentry Key Remote Entry Module (SKREEM). Please copy the ID number off of the new pressure sensor before installing it into the spare tire. Then follow the programming steps outlined in the diagnostic scan tool for: "Learn Spare Tire Sensor ID" under Miscellaneous Functions for the "WCM/Wireless Control Module" menu item as appropriate. If a TPM-RKE Analyzer special tool is available, put the new spare tire pressure sensor into "Park" mode to conserve the battery life of the sensor. If a TPM-RKE Analyzer special tool is not available, rotate the spare tire with one of the road tires.

NOTE: If replacing the WCM, the spare tire must be dismounted from its wheel to access and note the spare tire pressure sensor ID. Alternatively, a TPM-RKE Analyzer Tool can be used to obtain the TPM sensor ID also. Then follow the programming steps outlined in the diagnostic scan tool for “Learn Spare Tire Sensor ID” under Miscellaneous Functions for the WCM wireless control module menu item as appropriate.

On vehicles equipped with Tire Pressure Monitoring System, one tire pressure sensor (6) is mounted to each wheel in place of the traditional tire valve stem. Each sensor has an internal battery that lasts up to 10 years. The battery is not serviceable. At the time of battery failure, the sensor must be replaced.

The TPM system operates on a 315 MHz radio frequency. The 315 MHz sensors can be easily identified by a black sensor body, with (an oval insignia) (1) and a grey valve cap (2).

The Export TPM system operates on a 433 MHz radio frequency. The 433 MHz sensors can be easily identified by a gray sensor body (with an oval insignia) and a black valve cap (2).



CAUTION: Although 315 MHz and 433 MHz sensors are identical in size and shape, they are not interchangeable. Always make sure the correct color sensor is being used. A RKE-TPM Analyzer can be used to determine the sensor's frequency without having to dismount the tire.

NOTE: Sensors may be identified by valve stem cap color. From the factory, 315 MHz sensors have a gray valve stem cap while 433 MHz sensors have a black valve stem cap. Otherwise, once mounted inside a tire and wheel assembly you are not able to visually tell the difference between a 315 MHz and 433 MHz sensor. The tire must be dismounted allowing visual inspection of the sensor body.

NOTE: If aftermarket wheels are installed and do not contain tire pressure sensors, the system will not function properly and the driver will be continuously notified of a system malfunction.

The TPM sensors are designed for original style factory wheels. **It is not recommended to install a tire pressure sensor in an aftermarket wheel. (This could cause sealing and system performance issues).**

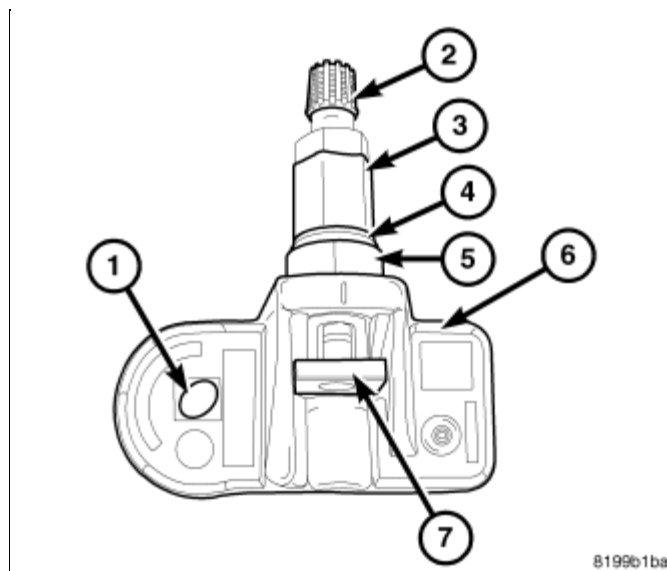
The serviceable components of the tire pressure sensor are:

- Sensor-To-Wheel Seal (4)
- Valve Stem Cap (2)
- Valve Stem Core
- Valve Stem Nut (3)

The valve stem caps and cores used are specifically designed for the tire pressure monitoring sensors. Although similar to standard valve stem caps and cores, they are different. The valve stem cap has a special seal inside to keep moisture and

corrosion out. The valve stem core has a special nickel coating to protect from corrosion.

OPERATION



NOTE: On vehicles equipped with a Tire Pressure Monitoring System (TPMS), when the spare tire pressure sensor is replaced with a new pressure sensor, a diagnostic scan tool **MUST** be used to run a routine that will program the new pressure sensor ID into the wireless control module (WCM), commonly referred to as the sentry key remote entry module (SKREEM). Please copy the ID number off of the new pressure sensor before installing it into the spare tire. Then follow the programming steps outlined in the diagnostic scan tool for: “Learn Spare Tire Sensor ID” under Miscellaneous Functions for the WCM wireless control module menu item as appropriate. If a TPM-RKE Analyzer special tool is available, put the new spare tire pressure sensor into “Park” mode to conserve the battery life of the sensor. If a TPM-RKE Analyzer special tool is not available, rotate the spare tire with one of the road tires

NOTE: If replacing the WCM, the spare tire must be dismounted from its wheel to access and note the spare tire pressure sensor ID. Alternatively, a TPM-RKE Analyzer Tool can be used to obtain the TPM sensor ID also. Then follow the programming steps outlined in the diagnostic scan tool for “Learn Spare Tire Sensor ID” under Miscellaneous Functions for the WCM wireless control module menu item as appropriate.

The battery operated tire pressure sensor is both a transmitter and a receiver. The TPM sensor can be forced to transmit if using a special tool such as a TPM-RKE Analyzer, or from a transponder. (Refer to 22 – TIRES/WHEELS/TIRE PRESSURE MONITORING/TRANSPONDER - OPERATION) The TPM-RKE Analyzer has the ability to change the sensor’s operating mode and to diagnose a faulty TPM sensor. Using a TPM-RKE Analyzer can take up to a minute to force a transmission from a sensor. The TPM sensor can be in one of the following modes:

- • **Sleep Mode** – This is the operating mode of a new TPM sensor. If placed on the vehicle as a road tire, the sensor will transmit once every 20 seconds when the vehicle is driven at speeds over 15 mph (24 km/h). If the vehicle is not moving, the sensor will only transmit on a pressure change greater than 1 PSI. Driving the vehicle continuously at this speed for more than 4 minutes will change the sensor state into 30 BLOCK MODE. The TPM sensor will not return to SLEEP MODE. Now, if the vehicle has been stopped for 20 minutes, the TPM sensor state will change to PARK MODE. If the vehicle is equipped with a full size matching spare tire and the spare tire sensor has been replaced, The sensor must be changed to Park Mode to conserve battery life. Either use a TPM-RKE Analyzer, or swap the spare tire with a road tire.
- • **Park Mode** – This is the correct operating mode when the vehicle is not moving. The sensor will transmit once every 13 hours to update the WCM, or will transmit on a 1 PSI delta change. The sensors will internally take a measurement of the tire pressure every minute to determine a change in tire pressure
- • **30 Block Mode** – If the vehicle has been stopped for more than 20 minutes, or if the sensor’s operating mode was forced to Park Mode using a TPM-RKE Analyzer, the sensor’s operating mode will transition from Park Mode to 30 Block Mode once the vehicle is driven over 15mph. In this mode, the sensor will

transmit once every 15 seconds when the vehicle is driven at speeds over 15 mph (24 km/h) for the first 30 transmissions. After about 8 minutes of continuous driving above 15 mph (24 km/h), the sensor's mode will change to Drive Mode

- • **Drive Mode** – In this mode, the sensor will transmit once every minute when the vehicle is driven at speeds over 15 mph (24 km/h). At any time the vehicle speed drops below 15 mph, the sensor will not transmit. The sensor mode will still be in drive mode when the sensor reaches speeds over 15 mph (24 km/h). If the vehicle has been stationary for more than 20 minutes, the TPM sensor will change to PARK MODE.

Each sensor's (transmitter) broadcast is uniquely coded so that the wireless control module (WCM) can monitor the state of each of the sensors on the four rotating road wheels. The WCM can automatically learn and store the sensor's ID while driving "within 10 minutes continuously above 15 m.p.h. (24 Km/h)" after a sensor has been replaced. The vehicle must be stationary for more than 20 minutes in order to initiate the learning sequence. The sensor IDs can also be programmed using the TPM-RKE Analyzer Tool. Scan each TPM sensor at each road wheel, and store each Sensor ID in the correct location. (LEFT FRONT, LEFT REAR, RIGHT FRONT, and RIGHT REAR) Connect the TPM-RKE Analyzer Tool to the Scan Tool. Then follow the programming steps outlined in the diagnostic Scan Tool for "Program Tire Pressure Sensor ID w/ TPM Tool" under "MISC" for the "WCM/WIRELESS CONTROL MODULE".

CAUTION

CAUTION: The TPMS has been optimized for the original equipment tires and wheels. TPMS pressures have been established for the tire size equipped on your vehicle. Undesirable system operation or sensor damage may result when using replacement equipment that is not of the same size, type, and/or style. After-market wheels can cause sensor damage. Do not use aftermarket tire sealants or balance beads if your vehicle is equipped with a TPMS, as damage to the sensors may result.

NOTE: After inspecting or adjusting the tire pressure always reinstall the valve stem cap. This will prevent moisture and dirt from entering the valve stem, which could damage the Tire Pressure Monitoring Sensor.

CAUTION: Tire pressure sensor valve stem caps and cores are specially designed for the sensors. Due to risk of corrosion, do not use a standard valve stem cap or core in a tire pressure sensor in place of the original equipment style sensor cap and core.

CAUTION: After inspecting or adjusting the tire pressure always reinstall the valve stem cap. This will prevent moisture and dirt from entering the valve stem, which could damage the Tire Pressure Monitoring Sensor.

CAUTION: Any time a sensor is to be reinstalled in a wheel, a new seal, cap and valve core must be installed on the stem to ensure air tight sealing.

NOTE: TPM thresholds have been established for the original tire size equipped on the vehicle. Use original size tires only to maintain system accuracy.

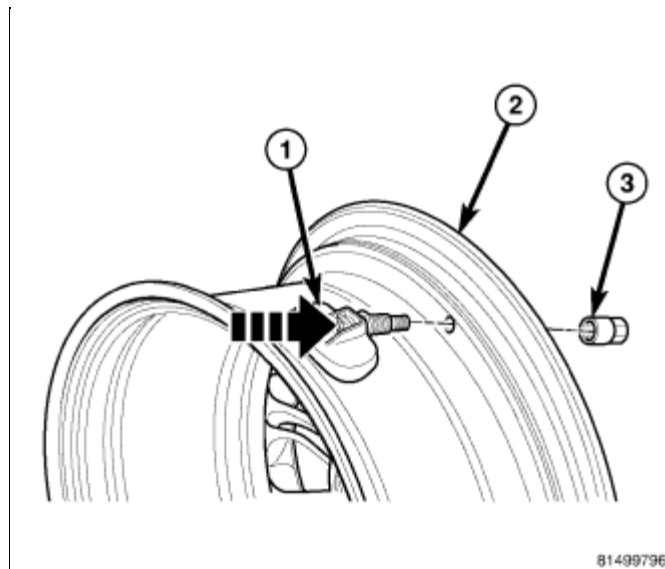
REMOVAL

1. Raise and support vehicle.
2. Remove the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

CAUTION: The cap used on this valve stem contains an O-ring seal to prevent contamination and moisture from entering the valve stem. Retain this valve stem cap for reuse. Do not substitute a regular valve stem cap in its place.

CAUTION: The valve stem used on this vehicle is made of aluminum and the core is nickel plated brass. The original valve stem core must be reinstalled and not substituted with a valve stem core made of a different material. This is required to prevent corrosion in the valve stem caused by the different metals.

3. Let the air out of the tire.
4. Remove the nut (3).
5. Push the sensor into the tire (1) (so the sensor is loose inside the tire).
6. Remove the tire from the rim.
7. Retrieve the sensor (1) from the tire.



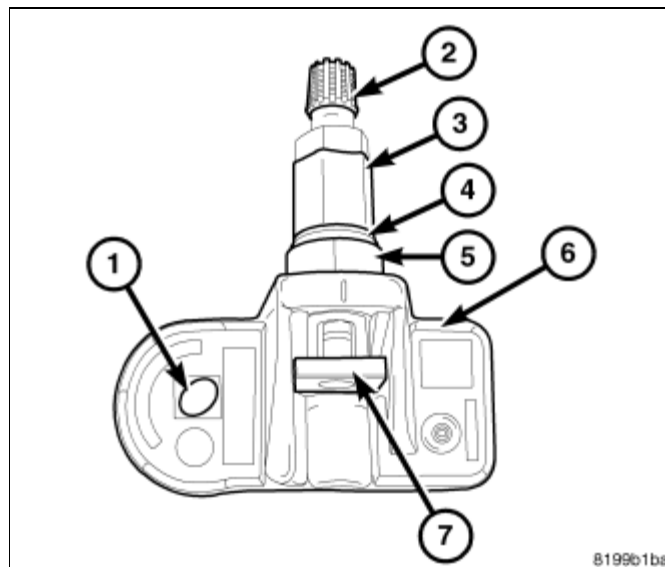
INSTALLATION

NOTE: If replacing the spare tire pressure sensor, take the time now to write down the tire pressure sensor ID.

NOTE: Before reinstalling an existing tire pressure sensor (6), replace valve cap (2), Nut (3), valve core and sensor seal (4) to ensure proper sealing.

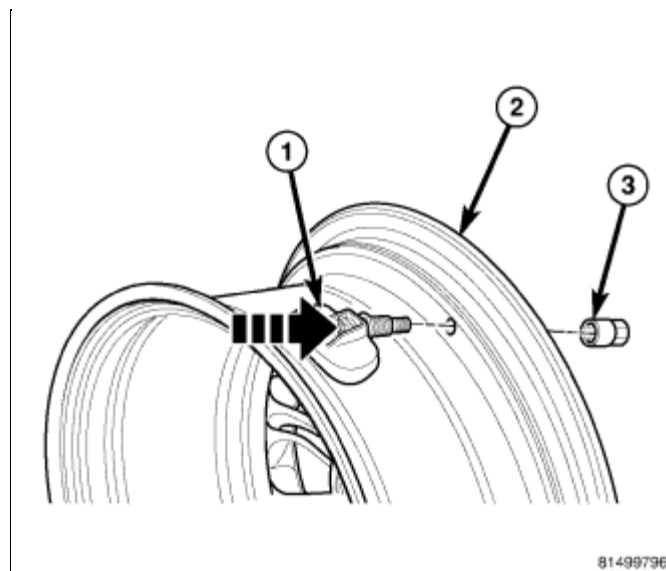
NOTE: The notch/flat should be lined up together and facing towards the wheel during installation.

1. Wipe area clean around sensor/valve stem mounting hole in wheel. Make sure surface of wheel is not damaged.



2. Insert sensor (1) through wheel (2) as shown keeping pressure against rear of metal valve stem (See Arrow). Potted side of sensor is to be positioned toward wheel. Damage to the sensor may occur if the sensor is installed incorrectly.

NOTE: A flat on the seal seat is used to key the seat to the sensor housing. The notch/flat should be lined up together and facing towards the wheel during installation.



3. Install sensor nut (3) and hand tighten.

NOTE: Before tightening sensor nut, push downward on sensor housing (2) in an attempt to make it flush with interior contour of wheel (1).

4. While holding sensor in position, tighten sensor nut to 6 N·m (53 in. lbs.).

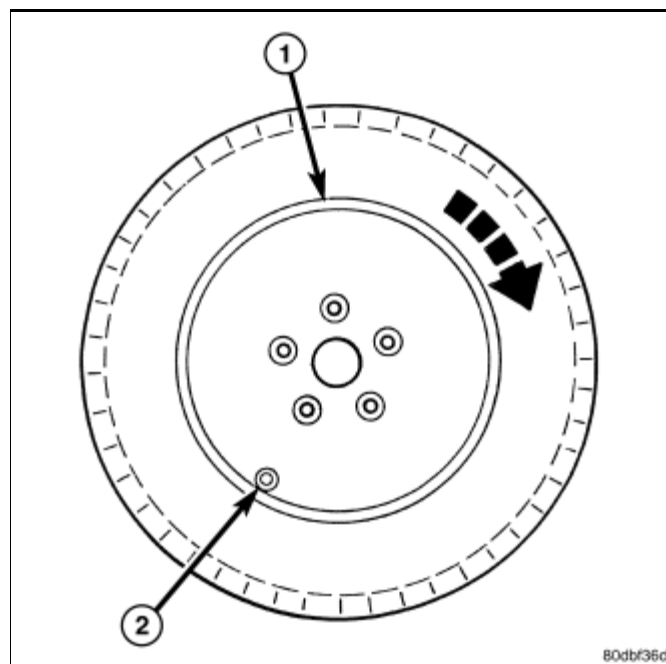
CAUTION: Over-tightening the sensor to as much as 10 N·m (88 in. lbs.) may result in sensor separation from the valve stem. Under this condition, the sensor may still function, however, the condition should be corrected immediately.

5. Mount tire on wheel following tire changer manufacturer's instructions, paying special attention to the following to avoid damaging tire pressure sensor:

a.

Rotating Wheel Tire Changers- Once the wheel is mounted to the changer, position the sensor valve stem (2) approximately 180° from the head of the changer (located at 1) in a clockwise direction before rotating the wheel (also in a clockwise direction) to mount the tire. Use this procedure on both the upper and lower tire beads.

b.



Rotating Tool Tire Changers - Position the wheel on the changer so that the sensor valve stem (1) is located

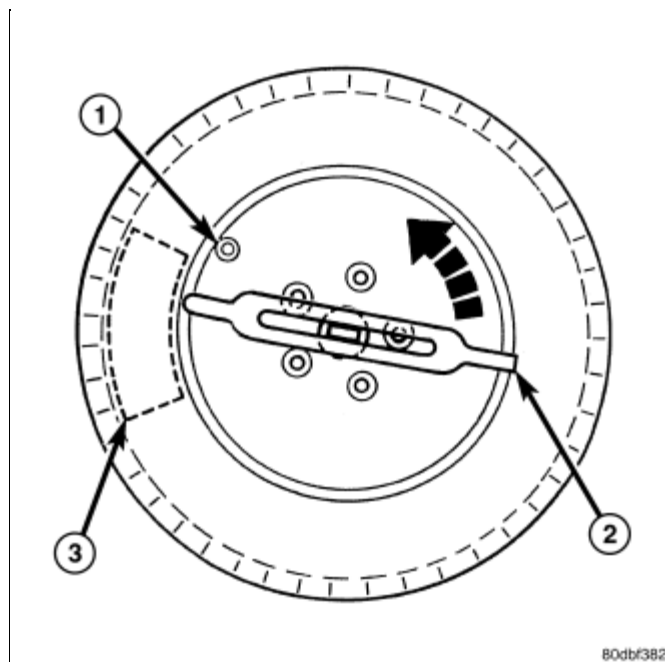
approximately 180° clockwise from the installation end of the mounting/dismounting tool (2) once the tool is mounted for tire installation. Make sure the sensor is clear of the lower bead breaker area (3) to avoid damaging the sensor when the breaker rises. Rotate the tool (2) in a counterclockwise direction to mount the tire. Use this procedure on both the upper and lower tire beads.

6. Adjust air pressure to that listed on Tire Inflation Pressure Label (Placard) provided with vehicle (usually applied to driver's side B-pillar). Make sure **original style** valve stem cap is securely installed to keep moisture out of sensor.

7. Install tire and wheel assembly on vehicle (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

8. Lower vehicle.

9. If the vehicle has been stationary for more than 20 minutes, drive the vehicle for a minimum of 10 minutes while maintaining a continuous speed above 15 mph (24 km/h). During this time, the system will learn the new sensor ID. A new sensor ID can also be programmed directly into the WCM by using a RKE-TPM Analyzer in conjunction with a Scan Tool. Once the new sensor ID has been programmed, the RKE-TPM Analyzer can be used to update the TPMS by activating the sensor.



NOTE: If a sensor cannot be trained, refer to appropriate diagnostic information.

SPARE TIRE SENSOR REPLACEMENT

NOTE: When the spare tire sensor is replaced on vehicles equipped with a Tire Pressure Monitoring System (TPMS) and a full-sized matching spare tire and wheel assembly, a diagnostic scan tool MUST be used to run a routine that will program the new pressure sensor ID into the Wireless Control Module (WCM), commonly referred to as the Sentry Key Remote Entry Module (SKREEM). Please copy the ID number off of the new pressure sensor before installing it into the spare tire. Then follow the programming steps outlined in the diagnostic scan tool for: “Learn Spare Tire Sensor ID” under Miscellaneous Functions for the (WCM) Wireless Control Module menu item as appropriate. If a TPM-RKE Analyzer special tool is available, put the new spare tire pressure sensor into “Park” mode. If a TPM-RKE Analyzer special tool is not available, rotate the spare tire with one of the road tires.

23 - BODY

BODY

DESCRIPTION - VEHICLE IDENTIFICATION

Throughout this group, references to the DaimlerChrysler Corporation vehicle family identification code are used when describing a procedure that is unique to that vehicle. Refer to Introduction Group of this manual for detailed information on vehicle identification. If a procedure is common to all vehicles covered in this manual, no reference will be made to a vehicle family code.

WARNING

SAFETY PRECAUTIONS AND WARNINGS

WARNING: Use an OSHA approved breathing filter when spraying paint or solvents in a confined area. Personal injury can result.

Avoid prolonged skin contact with petroleum or alcohol-based cleaning solvents. Personal injury can result.

Do not stand under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions can result.

Always have a fire extinguisher ready for use when welding.

Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.

Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline-based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.

Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.

Use of Heat During Repair

WARNING: Chrysler Group engineering's position on the use of heat during collision repair is as follows:

- Any body panel or frame component damaged which is to be repaired and reused, must be repaired using the "cold straightening" method. No heat may be used during the straightening process.
- During rough straightening prior to panel replacement, damaged panels or frame components may be heated to assist in body/frame realignment. The application of heat must be constrained to the

parts which will be replaced and not allowed to affect any other components.

This “no heat” recommendation is due to the extensive use of high strength and advanced high strength steels in Chrysler Group products. High-strength materials can be substantially and negatively affected from heat input which will not be obviously known to the repairer or consumer. Ignoring these recommendations may lead to serious compromises in the ability to protect occupants in a future collision event, reduce the engineered qualities and attributes, or decrease the durability and reliability of the vehicle. Failure to follow these instructions may result in serious or fatal injury. This statement supersedes any previously released information by the Chrysler Group.

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: Do not use electric shop lights or tools in water test area. Personal injury can result.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

1. Drive the vehicle to verify the general location of the wind noise.
2. Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

STANDARD PROCEDURE

BUZZ, SQUEAK & RATTLE

Buzz, Squeak & Rattles (BSR) may be caused by any one or more of the following and may be corrected as indicated:

- Loose fasteners should be tightened to specifications.
- Damaged or missing clips should be replaced.
- Damaged trim panels should be replaced.
- Incorrectly installed trim panels should be reinstalled properly.

Many BSR complaints such as loose trim, can be serviced using the Mopar® Parts BSR Noise Reduction Kit. This kit contains various tapes including foam, flock and anti-squeak used to eliminate noises caused by metal, plastic and vinyl components. Long life lubricants and greases can also be used on a variety of components. Refer to the [Buzz, Squeak & Rattle Kit](#) table for material contents and usage.

Buzz, Squeak & Rattle Kit

ITEM	FEATURES	APPLICATIONS	SERVICE TEMP
Itch And Squeak Tape	An abrasion resistant material thin enough to conform to most irregular surfaces. Stops most itches and squeaks.	Between metal and metal, metal and plastic, metal and vinyl, vinyl and plastic. Interior. Examples: Trim panels and bezels.	-40° to 107° C (-40° to

			225° F)
Black Nylon Flock	Nylon Flock with an aggressive acrylic adhesive. Provides for cushioning and compression fit, also isolates components. Water-resistant.	Between metal and metal, metal and plastic, vinyl and plastic. Examples: Pull cups, bezels, clips, ducts, top cover to glass, cowl panel.	-40° to 82° C (-40° to 180° F)
High Density Urethane Foam	Tear resistant, highly resilient and durable.	Between metal and metal, metal and plastic. Water-resistant. Examples: I/P, heavy metal rattles, isolating brackets.	-40° to 82° C (-40° to 180° F)
Open Cell Foam Tape	Soft foam conforms to irregular surfaces.	Wire harness and connector wrap. Examples: Seals, gasket, wiring, heat ducts.	-40° to 82° C (-40° to 180° F)
Closed Cell Low Density Foam Tape	Soft, conformable. Water-resistant.	Wherever bulk is needed. Prevents closing flutters and rattles when applied to door watershield. Examples: Door, I/P.	-40° to 82° C (-40° to 180° F)
NYE® Grease 880	Long life.	Suspensions. Examples: Strut bushings, sway bars.	-40° to 200° C (-40° to 390° F)
Krytox® Oil	Long life. Will not dry out or harm plastics or rubber.	When access is not possible, oil will migrate to condition. Vinyl, rubber, plastic, metal. Examples: Convertible top bushings, pull cups trim panel inserts.	-34° to 205° C (-30° to 400° F)
Krytox® Grease	Long life. Will not dry out or harm plastics or rubber.	Vinyl, rubber, plastic, metal, glass. Examples: Weather-strips, backlite and windshield moldings.	-34° to 205° C (-30° to 400° F)

STANDARD PROCEDURE - HEAT STAKING

1. Remove trim panel.
2. Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.
3. Heat stake the components.
 - a. If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
 - b. If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
4. Allow the repaired area to cool and verify the repair.

5. Install trim panel.

PLASTIC BODY PANEL REPAIR

There are many different types of plastics used in today's automotive environment. We group plastics in three different categories: Rigid, Semi-Rigid, and Flexible. Any of these plastics may require the use of an adhesion promoter for repair. These types of plastic are used extensively on DaimlerChrysler Motors vehicles. Always follow repair material manufacturer's plastic identification and repair procedures.

Rigid Plastics:

Examples of rigid plastic use: Fascias, Hoods, Doors, and other Body Panels, which include SMC, ABS, and Polycarbonates.

Semi-Rigid Plastics:

Examples of semi-rigid plastic use: Interior Panels, Under Hood Panels, and other Body Trim Panels.

Flexible Plastics:

Examples of flexible plastic use: Fascias, Body Moldings, and upper and lower Fascia Covers.

Repair Procedure:

The repair procedure for all three categories of plastics is basically the same. The one difference is the material used for the repair. The materials must be specific for each substrate, rigid repair material for rigid plastic repair, semi-rigid repair material for semi-rigid plastic repair and flexible repair material for flexible plastic repair.

Adhesion Promoter/Surface Modifier:

Adhesion Promoters/Surface Modifiers are required for certain plastics. All three categories may have plastics that require the use of adhesion promoter/surface modifiers. Always follow repair material manufacturer's plastic identification and repair procedures.

SAFETY PRECAUTION AND WARNINGS

WARNING:

- Eye protection should be used when servicing components. Personal injury can result.
- Use an OSHA approved breathing mask when mixing epoxy, grinding, and spraying paint or solvents in a confined area. Personal injury can result.

- **Avoid prolonged skin contact with resin, petroleum, or alcohol based solvents. Personal injury can result.**
- **Do not venture under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.**

NOTE:

- **When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.**
- **Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.**

RIGID, SEMI-RIGID, AND FLEXIBLE PLASTIC PARTS TYPES

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
ASA	ACRYLONITRILE STYRENE ACRYLITE	LURAN S	CONSOLES, GRILLES
ABS	ACRYLONITRILE BUTADIENE STYRENE	TERLURAN	"A" PILLARS, CONSOLES, GRILLES
ABS/PC	ABS/PC ALLOY	PULSE, PROLOY, BAYBLEND	DOORS, INSTRUMENT PANELS
ABS/PVC	ABS/PV ALLOY	PROLOY, PULSE, LUSTRAN, CYCLOVIN	DOOR PANELS, GRILLES, TRIM
BMC	BULK MOLDING COMPOUND	BMC	FENDER EXTENSIONS
EMA	EHTYLENE METHYL ACRYLATE/IONOMER	SURLYN, EMA, IONOMER	BUMPER GUARDS, PADS
METTON	METTON	METTON	GRILLES, KICK PANELS, RUNNING BOARDS
MPPO	MODIFIED POLYPHENYLENE OXIDE	MPPO	SPOILER ASSEMBLY
PA	POLYAMID	ZYTEL, VYDYNE, PA, MINLON	FENDERS, QUARTER PANELS
PET	THERMOPLASTIC POLYESTER	RYNITE	TRIM
PBT/PPO	PBT/PPO ALLOY	GERMAX	CLADDINGS
PBTP	POLYBUTYLENE THEREPTHALATE	PBT, PBTP, POCAN, VALOX	WHEEL COVERS, FENDERS, GRILLES
PBTP/EEBC	POLYBUTYLENE THEREPTHALATE/EEBC ALLOY	BEXLOY, "M", PBTP/EEBC	FASCIAS, ROCKER PANEL, MOLDINGS

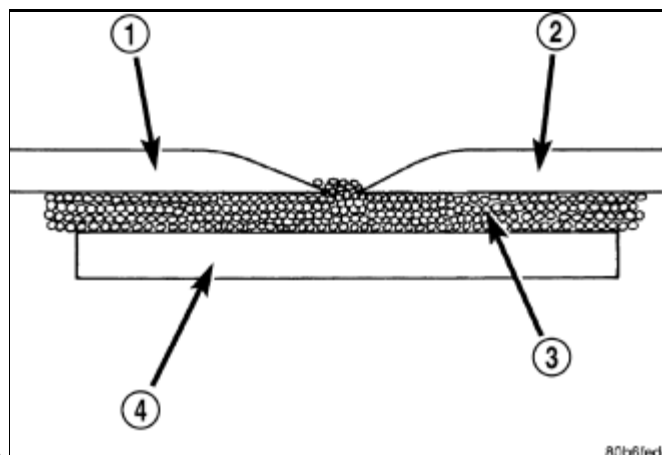
PC	POLYCARBONATE	LEXAN, MERLON, CALIBRE, MAKROLON PC	TAIL LIGHT LENSES, IP TRIM, VALANCE PANELS
PC/ABS	PC/ABS ALLOY	GERMAX, BAY BLENDS, PULSE	DOORS, INSTRUMENT PANELS
PPO	POLYPHENYLENE OXIDE	AZDEL, HOSTALEN, MARLEX, PRFAX, NORYL, GTX, PPO	INTERIOR TRIM, DOOR PANELS, SPLASH SHIELDS, STEERING COLUMN SHROUD
PPO/PA	POLYPHENYLENE/POLYAMID	PPO/PA, GTX 910	FENDERS, QUARTER PANELS
PR/FV	FIBERGLASS REINFORCED PLASTIC	FIBERGLASS, FV, PR/FV	BODY PANELS
PS	POLYSTYRENE	LUSTREX, STYRON, PS	DOOR PANELS, DASH PANELS
RTM	RESIN TRANSFER MOLDING COMPOUND	RTM	BODY PANELS
SMC	SHEET MOLDED COMPOUND	SMC	BODY PANELS
TMC	TRANSFER MOLDING COMPOUND	TMC	GRILLES
UP	UNSATURATED POLYESTER (THERMOSETTING)	SMC, BMC, TMC, ZMC, IMC, XSMC, UP	GRILLE OPENING PANEL, LIFTGATES, FLARESIDE FENDERS, FENDER EXTENSIONS
EEBC	ETHER/ESTER BLOCKED CO- POLYMER	EEBC	BUMPERS
EEBC/PBTP	EEBC/POLYBUTYLENE TEREPHTHALATE	EEBC, PBTP, BEXLOY	BUMPER, ROCKER PANELS
EMPP	ETHYLENE MODIFIED POLYPROPYLENE	EMPP	BUMPER COVERS
EPDM	ETHYLENE/PROPPYLENE DIENE MONOMER	EPDM, NORDEL, VISTALON	BUMPERS
EPM	ETHYLENE/PROPPYLENE CO-POLYMER	EPM	FENDERS
MPU	FOAM POLYURETHANE	MPU	SPOILERS
PE	POLYETHYLENE	ALATHON, DYLAN, LUPOLEN, MARLEX	—
PP	POLYPROPYLENE (BLENDS)	NORYL, AZDEL, MARLOX, DYLAN, PRAVEX	INNER FENDER, SPOILERS, KICK PANELS
PP/EPDM	PP/EPDM ALLOY	PP/EPDM	SPOILERS, GRILLES

PUR	POLYURETHANE	COLONELS, PUR, PU	FASCIAS, BUMPERS
PUR/PC	PUR/PC ALLOY	TEXIN	BUMPERS
PVC	POLYVINYL CHLORIDE	APEX, GEON, VINYLITE	BODY MOLDINGS, WIRE INSULATION, STEERING WHEELS
RIM	REACTION INJECTED MOLDED POLYURETHANE	RIM, BAYFLEX	FRONT FASCIAS, MODULAR WINDOWS
RRIM	REINFORCED REACTION INJECTED MOLDED	PUR, RRIM	FASCIAS, BODY PANELS, BODY TRIMS
TPE	THERMO POLYETHYLENE	TPE, HYTREL, BEXLOY-V	FASCIAS, BUMPERS, CLADDINGS
TPO	THERMOPOLYOLEFIN	POLYTROPE, RENFLEX, SANTOPRENE, VISAFLEX, ETA, APEX, TPO, SHIELDS, CLADDINGS	BUMPERS, END CAPS, TELCAR, RUBBER, STRIPS, SIGHT, INTERIOR B POST
TPP	THERMO-POLYPROPYLENE	TPP	BUMPERS
TPU	THERMOPOLYURETHANE, POLYESTER	TPU, HYTREL, TEXIN, ESTANE	BUMPERS, BODY SIDE, MOLDINGS, FENDERS, FASCIAS

PANEL SECTIONING

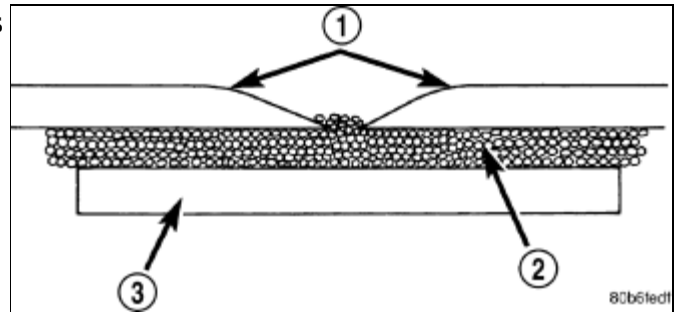
If it is required to section a large panel for a plastic repair, it will be necessary to reinforce the panel. To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be "V'd" at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

When bonding plastic panels, follow repair material manufacturers recommendations. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun. After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spreader, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

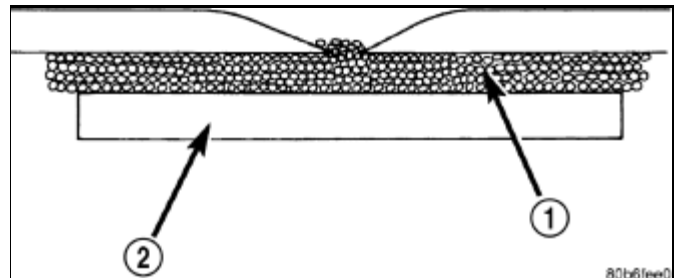


PANEL REINFORCEMENT

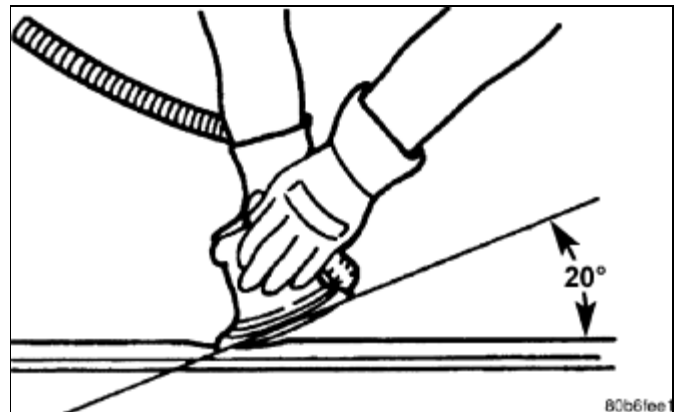
Structural repair procedures for rigid panels with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with structural adhesive. Semi-rigid or flexible repair materials should be used for semi-rigid or flexible backing reinforcement and open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the adhesive. Structurally, the more dry wall tape used, the stronger the repair.



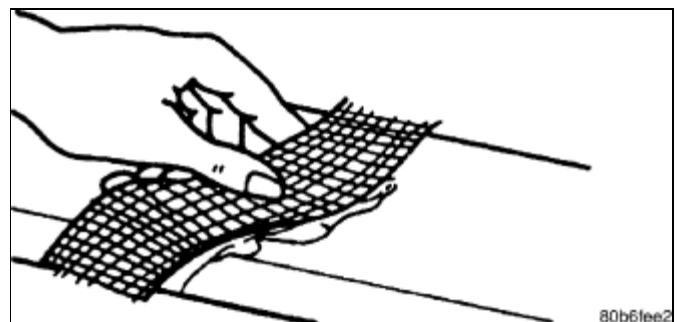
Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.



When repairing plastic, the damaged area is first "V'd" out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20° angle will increase the bonding surface for a repair. It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.



- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used.
- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when ever

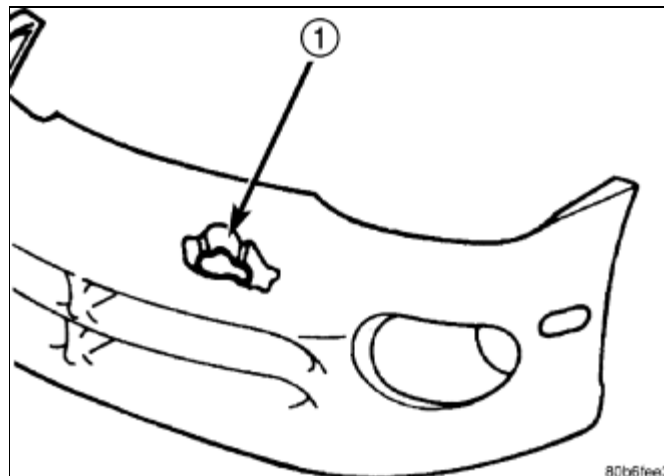


possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.

VISUAL INSPECTION

Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structures need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair: Puncture or Crack - Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind.

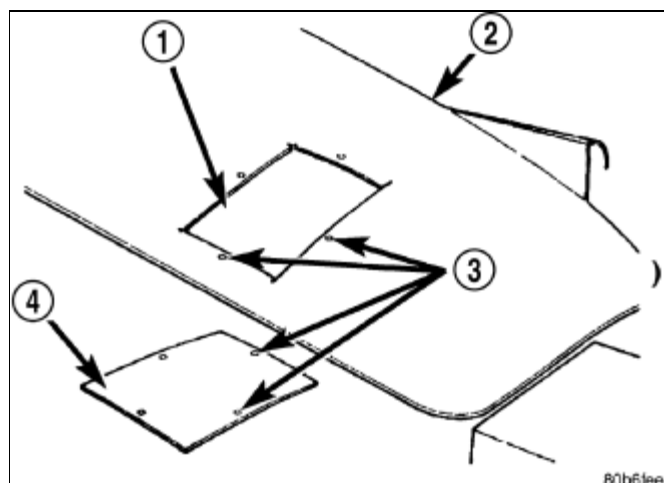


PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area with 360 grit wet/dry sandpaper, or equivalent, to assure adhesion of repair materials.

PATCHING PANELS

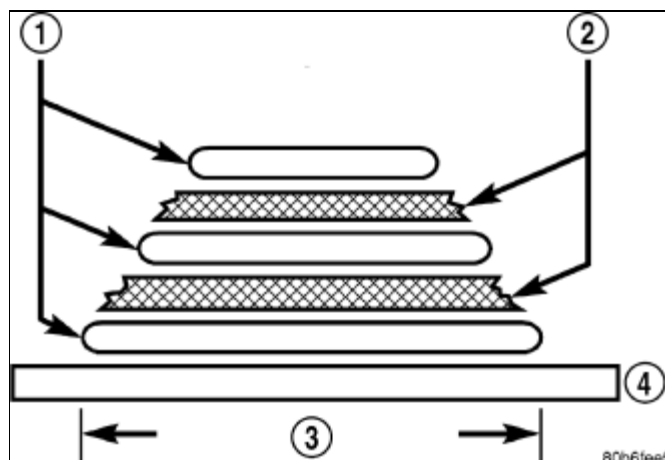
A panel that has extensive puncture type damage can be repaired by cutting out the damaged material. Use a suitable reciprocating saw or cut off wheel to remove the section of the panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20° to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.



PANEL PATCH FABRICATIONS

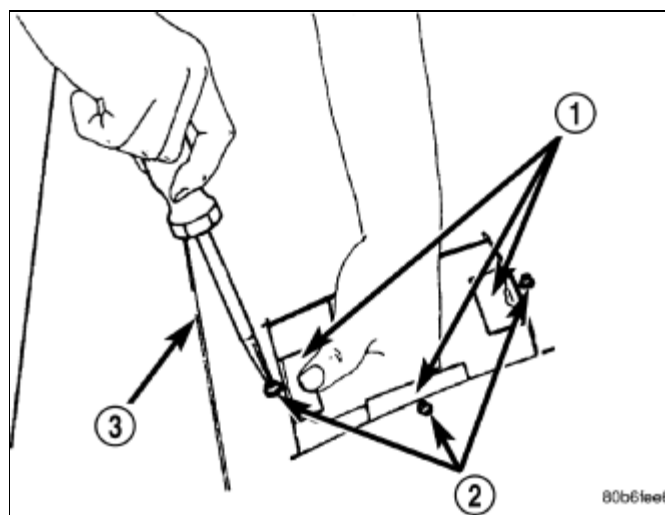
A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with adhesive and reinforcement mesh (dry wall tape). Perform the following operation if required:

1. Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required.
2. Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.
3. Apply a liberal coat of adhesive over the reinforcement mesh. If necessary apply a second or third coat of adhesive and mesh after first coat has cured. The thickness of the patch should be the same as the repair area.
4. After patch has cured, peel waxed paper or plastic from the back of the patch.
5. If desired, a thin film coat of adhesive can be applied to the back of the patch to cover mesh for added strength.

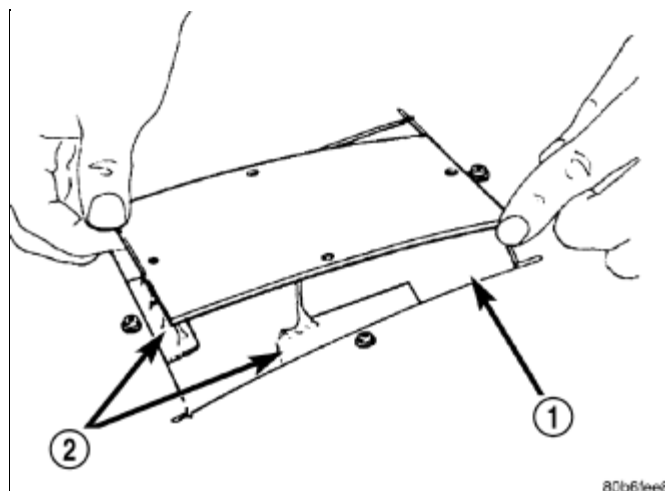


PANEL PATCH INSTALLATION

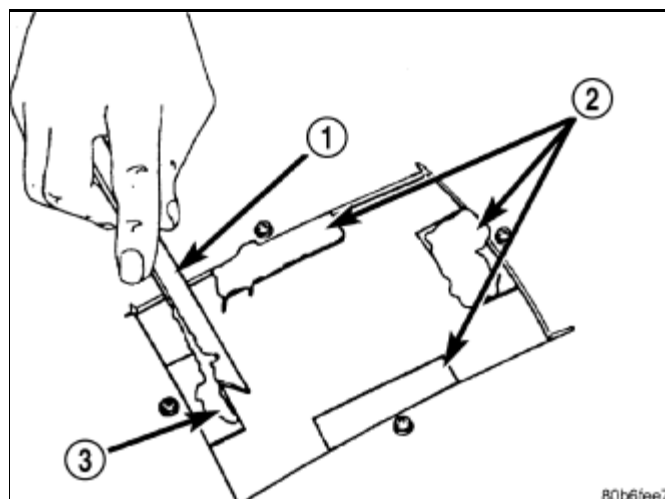
1. Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.
2. Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.
3. Using the pattern as a guide, cut the patch to size.
4. Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.
5. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole.
6. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) away from edge of patch across from holes drilled around cutout.
7. Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.
8. Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.
9. Mix enough adhesive to cover one side of all support squares.
10. Apply adhesive to cover one side of all support squares.
11. Using number 8 sheet metal screws, secure support squares to back side of body panel with adhesive sandwiched between the panel and squares.
12. Position patch in cutout against support squares and adjust patch until the gap is equal along all sides.



13. Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.

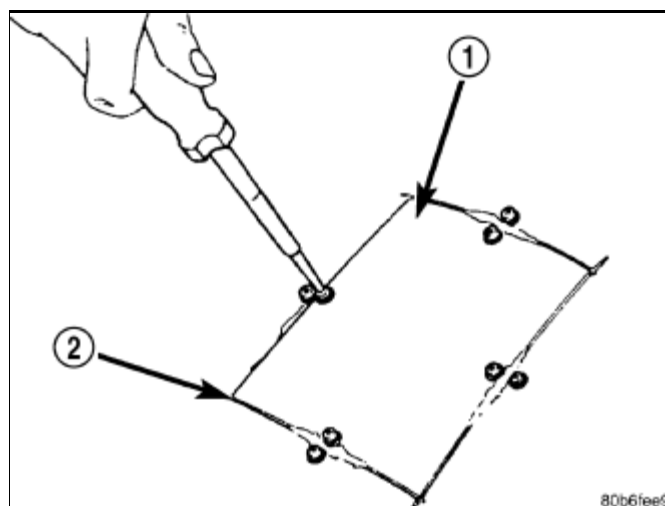


14. Apply a coat of adhesive to the exposed ends of the support squares.

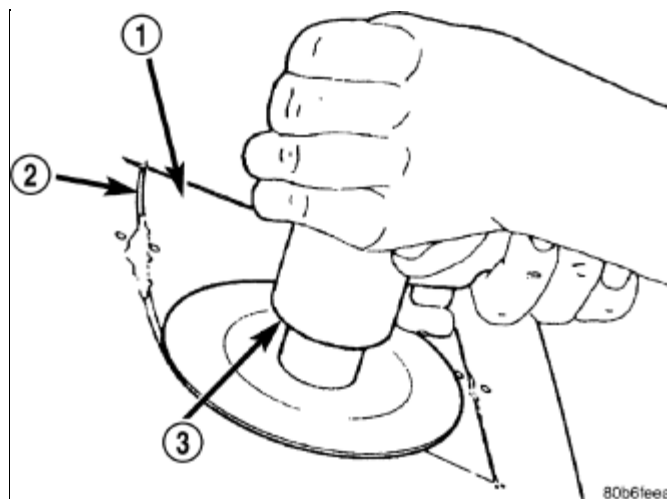


15. Install screws to hold the patch to support squares. Tighten screws until patch surface is flush with panel surface.

16. Allow adhesive to cure, and remove all screws.

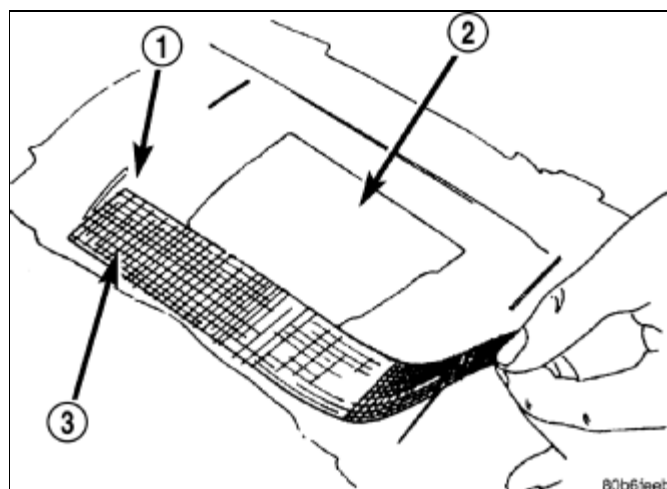


17. Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch. With compressed air, blow dust from around patch.

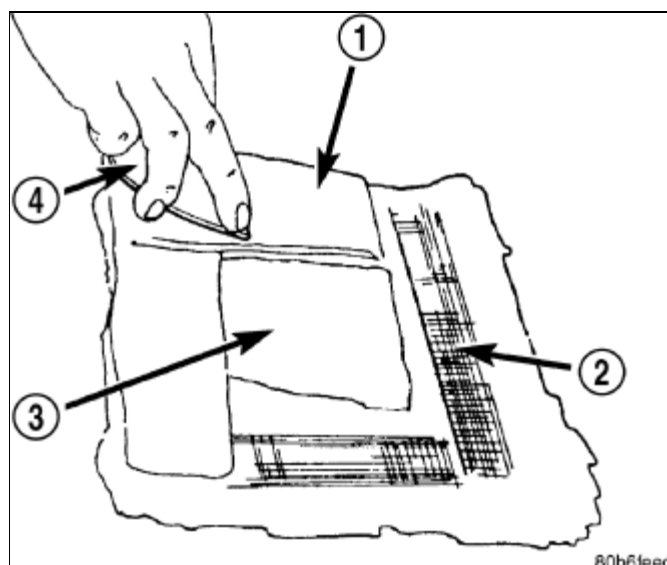


18. Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch.

19. Mix enough adhesive to cover the entire patch area.



20. Apply adhesive over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and adhesive to create a stronger repair.



PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

STANDARD PROCEDURE - BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

1. When necessary, lubricate the operating mechanisms with the specified lubricants.
2. Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.
3. Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.
4. The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.
5. The door lock cylinders should be lubricated twice each year (preferably autumn and spring):
 - Spray a small amount of lock cylinder lubricant directly into the lock cylinder.
 - Apply a small amount to the key and insert it into the lock cylinder.
 - Rotate it to the locked position and then back to the unlocked position several times.
 - Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

Component	Fluid, Lubricant, or Genuine Part
Hinges:	
Door And Hood	Mopar® Engine Oil
Liftgate	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Latches:	
Door, Hood/Safety Catch, Liftgate	Mopar® Multi-Purpose Lube NLG Grade 2 EP, GC-LB
Seat Regulator & Track	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Window System Components	Mopar® Spray White Lube
Lock Cylinders	Mopar® Lock Cylinder Lube
Parking Brake Mechanism	Mopar® Wheel Brg. Grease NLGI Grade 1, GC-LBB
Soft Top	Mopar® Soft Top Zipper Cleaner & Lubricant

SPECIFICATIONS - TORQUE

Description	N·m	Ft. Lbs	In. Lbs.
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A/C expansion valve nut	23	17	—
Backlite hinge bolts	10	—	90
Body isolator mounting bolts *	108	80	—
Body isolator to body nuts	54	40	—
Brake booster bracket nuts	18	13.5	—
Center OCS strain gauge stud nut	45	33	—
Door carrier plate screws	10	—	90
Door hinge pin nut	8.5	—	75
Door hinge to body bolts	28	21	—
Door hinge to hinge bolts	26	19	—
Door latch adjustment screw	3	—	26.5
Door latch mounting screws	8	—	71
Door latch striker bolts	26	19	—
Four door rear seat 40% inner seat back pivot nut	25	18.5	—
Four door rear seat center belt buckle bolt	61	45	—
Four door rear seat cushion pivot bolts	25	18.5	—
Four door rear seat front mounting fasteners	75	55	—
Four door rear seat headrest bolts	8	—	71
Four door rear seat inner latch floor bolts	25	18.5	—
Four door rear seat latch to back frame bolts	45	33	—
Four door rear seat outboard latch floor bolts	25	18.5	—
Four door rear seat rear mounting bolt	75	55	—
Four door rear seat rear mounting nuts	85	62.5	—
Four door rear seat cushion pivot bolt	25	18.5	—
Four door retractor screw	55	41	—

Four door seat cushion pivot bolt	25	18.5	—
Front door exterior handle nut	4.5	—	40
Front door glass run nut	10	—	90
Front door interior handle screw	8.5	—	75
Front seat back assembly bolts	47	34.5	—
Front seat belt anchor bolt	40	29.5	—
Front seat belt buckle bolt	50	37	—
Front seat belt turning loop screw	40	29.5	—
Front seat mounting bolts	75	55	—
Front seat riser nuts	28	21	—
Half door latch nut	4.5	—	40
Hard top front bolts	10.5	—	93
Hard top side bolts	18	13	—
Hood catch bracket nuts	7	—	62
Hood catch nuts	15	11	—
Hood hinge to body bolts	24	18	—
Hood hinge to hood bolts	26	19	—
Hood safety catch bolt	11	8	97
Instrument panel center support bracket fasteners	8	6	71
Instrument panel fence line nuts	12	9	—
Instrument panel side support bolts	11	8	—
Lower fender to sill bolts	12	9	—
Manual sifter bolt	33	24.5	—
OCS riser nuts	28	21	—
Outside rear view mirror bolts	13	10	—
Rear door exterior handle nut	4.5	—	40

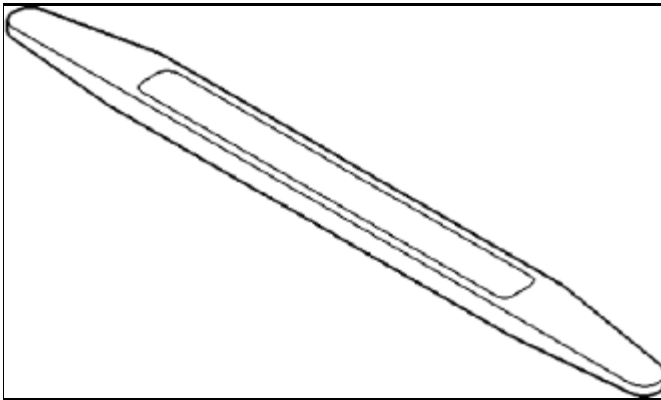
Rear door glass run bolt	12	9	—
Rear door glass run nut	10	—	90
Rear door interior handle screw	8.5	—	75
Rear view mirror set screw	2	—	18
Seat side airbag nuts	7	—	62
Side step bracket bolts	24	18	—
Side step sill nuts	12	9	—
Soft top pivot knuckle bolts	14	10	—
Speaker pod screws	10	—	90
Sport bar cross bar bracket bolts	19	14	—
Sport bar front cross bar bracket bolts	19	14	—
Sport bar rear bolts	19	14	—
Sport bar rear cross bar bracket bolts	19	14	—
Sport bar side bar bolts	19	14	—
Sport bar side bar to windshield frame bolts	23	17	—
Sport bar to B-pillar bolts	19	14	—
Steering column opening reinforcement plate bolts	11	8	—
Tailgate exterior handle nuts	4.5	—	40
Tailgate hinge to body bolts	26	19	—
Tailgate hinge to tailgate bolts	20	15	—
Tailgate latch screws	8	—	71
Tailgate stabilizer insert and cup bolts	10	—	90
Tailgate striker bolts	28	21	—
Two door rear seat back frame to cushion bolts	50	37	—
Two door rear seat back latch bolts	45	33	—

Two door rear seat center belt buckle bolt	55	41	—
Two door rear seat cushion to back bolts	50	37	—
Two door rear seat front latch cushion frame bolts	45	33	—
Two door rear seat rear latch nuts	10	—	90
Upper fender fasteners	5	—	44
Windshield frame hinge to body bolts	20	15	—
Windshield frame reinforcement bracket bolts	20	15	—

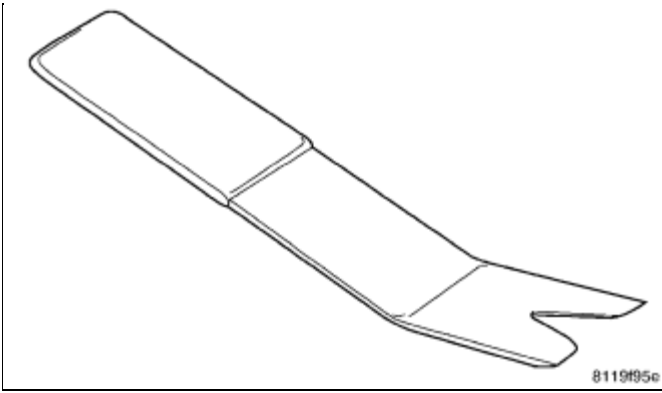
CAUTION: * Whenever a body isolator bolt requires servicing or tightening, it is necessary to remove the bolt and install new thread locker compound to the threads.

SPECIAL TOOLS

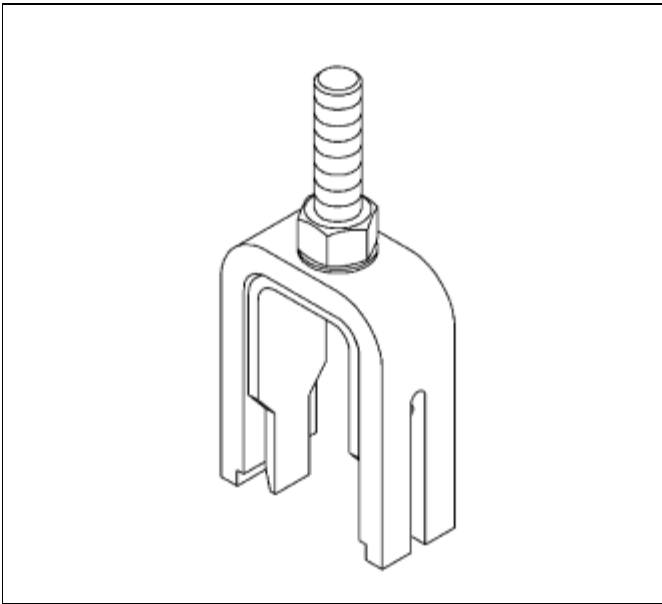
BODY



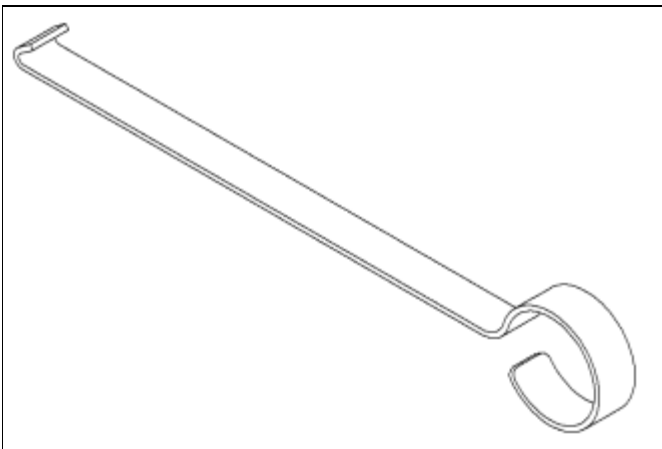
STICK, TRIM C 4755

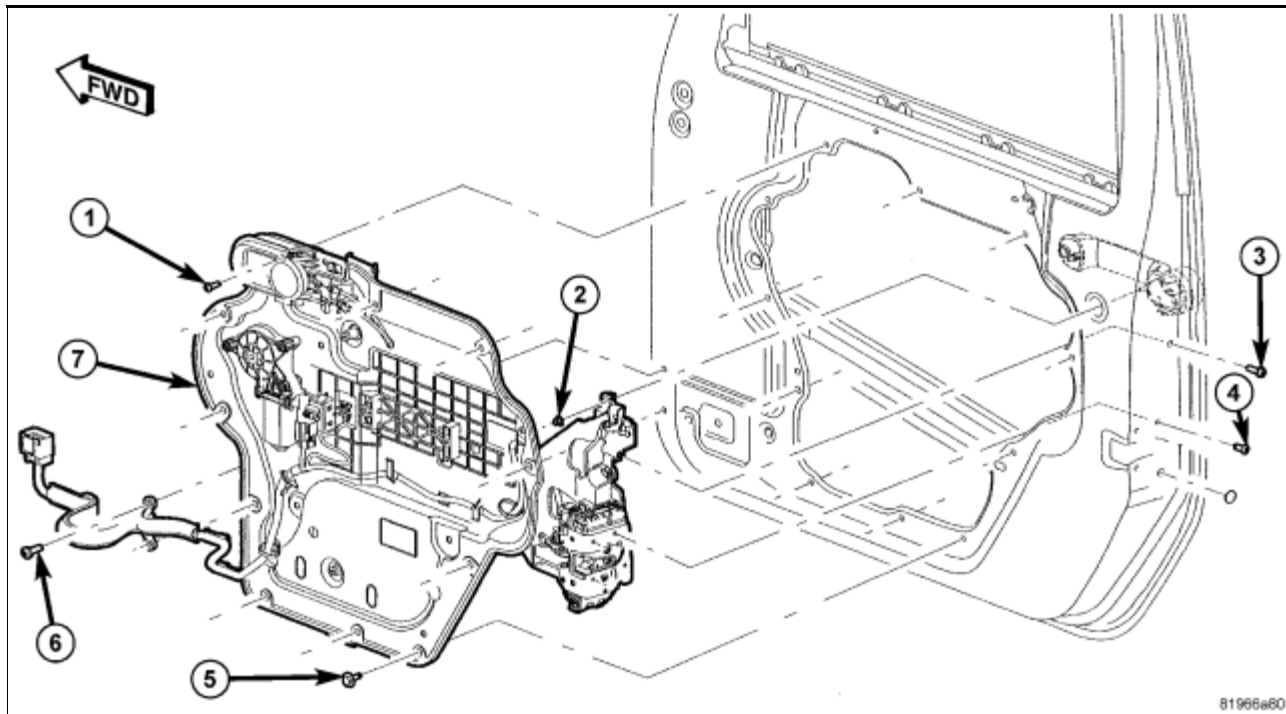


REMOVER, MOLDINGS C-4829-A

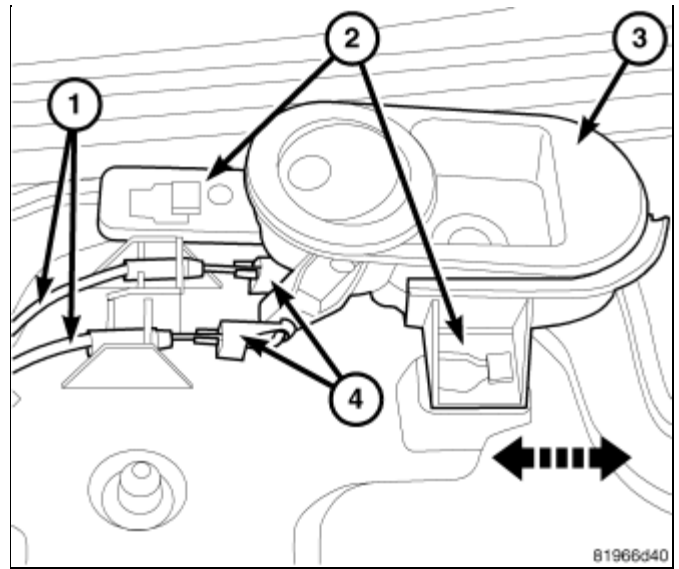


STRAIN GAUGE HOLDER 9689



REMOVER, OUTER DOOR BELT MOLDING 9093**DOOR - FULL FRONT****CABLE****REMOVAL**

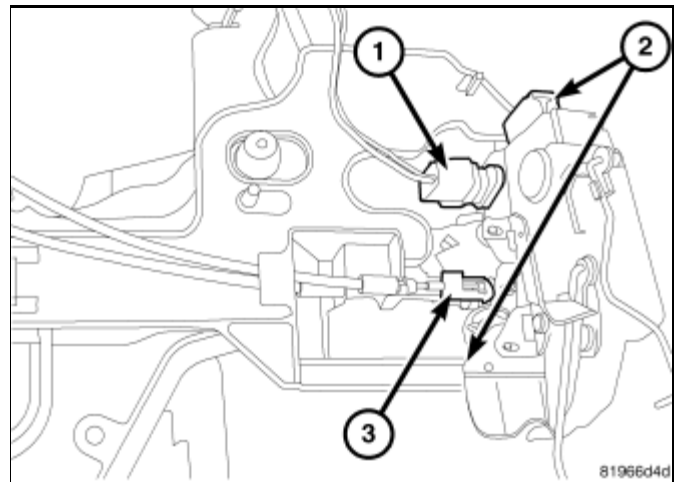
1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).
2. Release the cable clip at the inside handle (4) and disconnect the cable (1).



3. Release the clips (3) and disconnect the cable from the latch assembly.

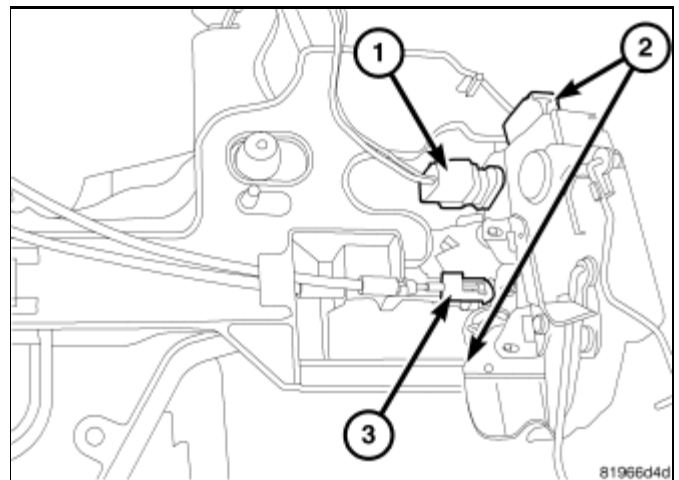
4. Remove the cable from the carrier plate.

INSTALLATION

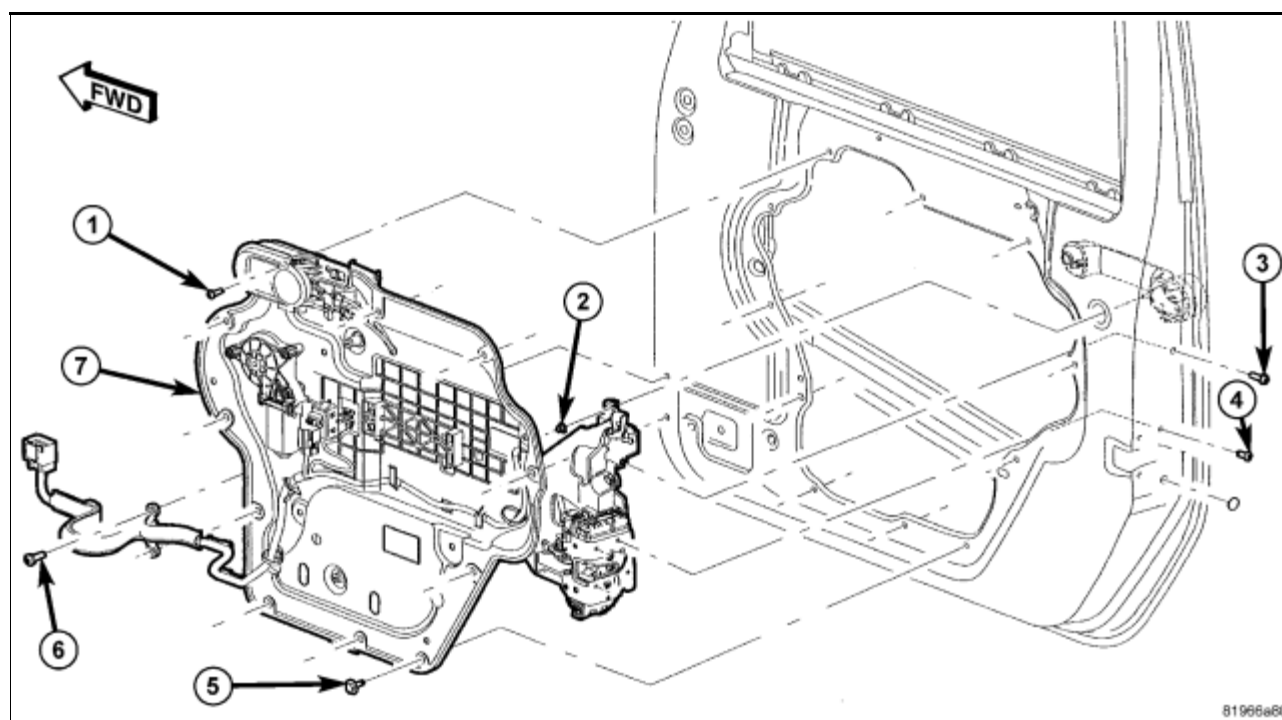
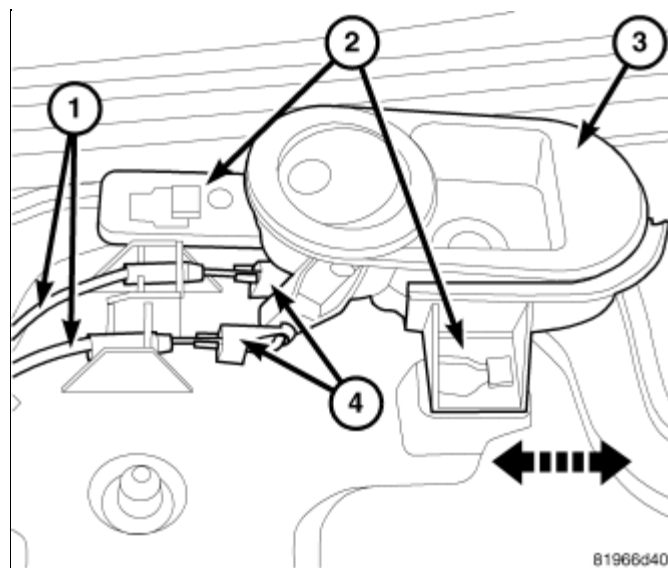


1. Install the cable onto the carrier plate and connect to the latch.

2. Secure the cable clip (3) fully.



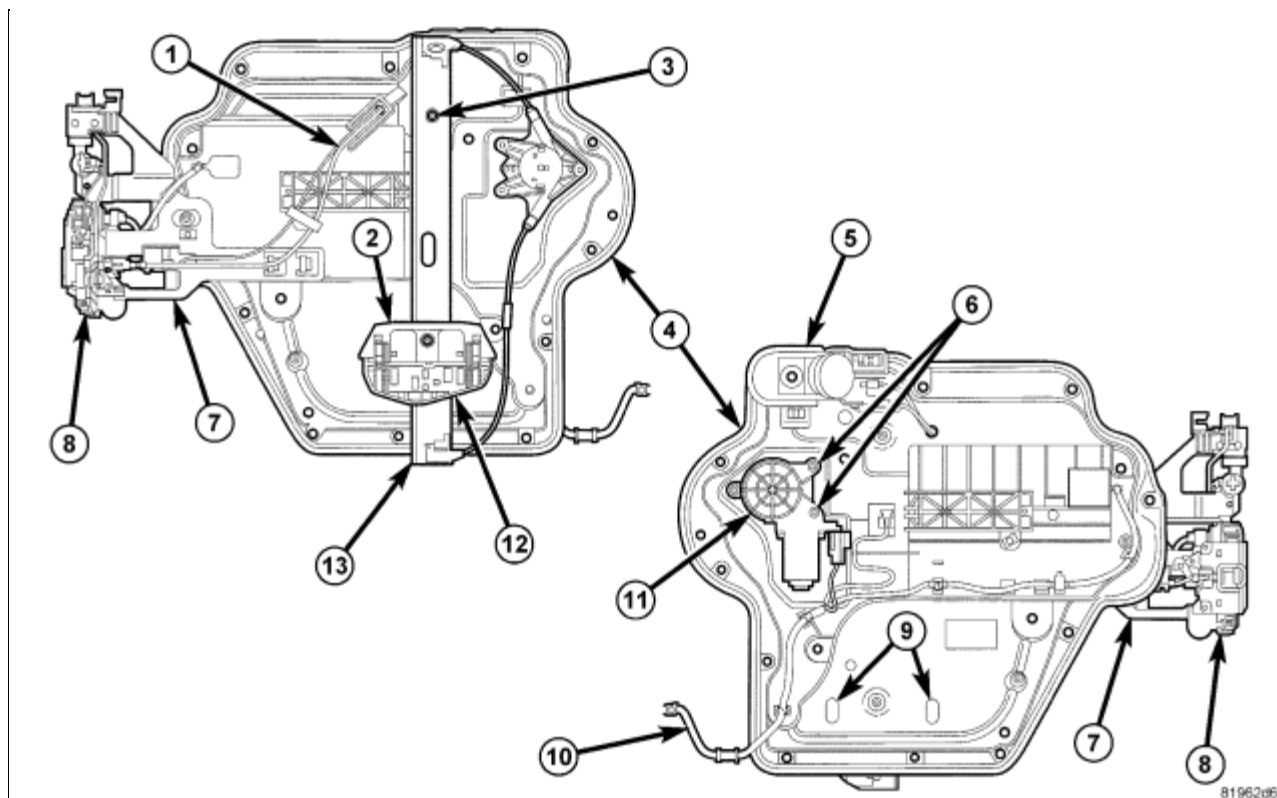
3. Connect the cable (1) to the interior handle (3) and secure the cable clip (4).



4. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).

CARRIER PLATE

DESCRIPTION



POWER CARRIER PLATE

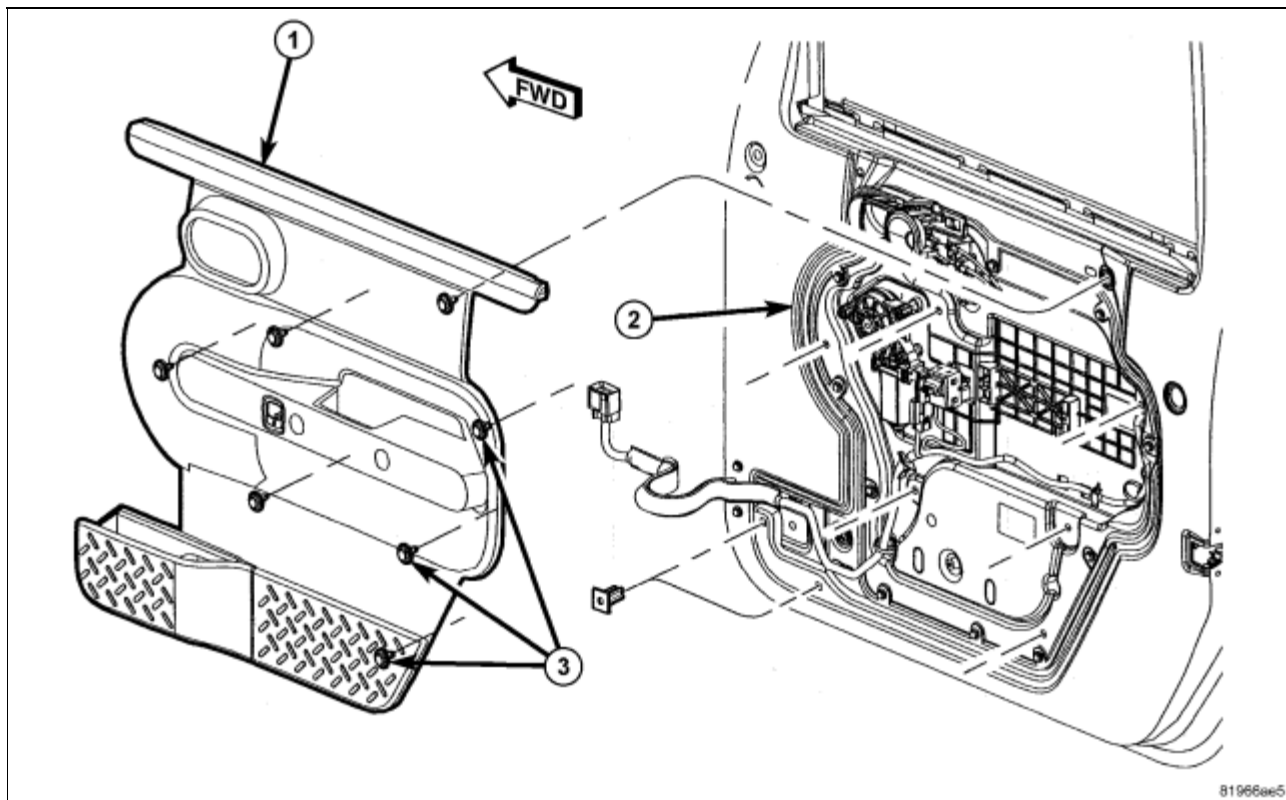
1 - LATCH & LOCK CABLES
2 - GLASS CLIP
3 - REGULATOR SCREWS
4 - CARRIER PLATE
5 - INSIDE HANDLE
6 - REGULATOR MOTOR SCREWS
7 - LATCH MOUNTING BRACKET
8 - LATCH
9 - GLASS DISCONNECT HOLES (PLUGS MUST BE REMOVED TO SERVICE GLASS)
10 - WIRE HARNESS
11 - MOTOR
12 - GLASS LIFT PLATE
13 - REGULATOR

NOTE: Full front door shown, full rear door similar.

Door carrier plates include the hardware, window regulators, latch, remote handle and links and wiring harness. In addition to providing manufacturing efficiencies, the door modules benefit the customer too. Having all the parts assembled into a module improves build accuracy and fit and finish between the components and trim as a result of greater communication between the release engineers and suppliers.

CAUTION: Care must be used when servicing the carrier plate that the seal isn't damaged.

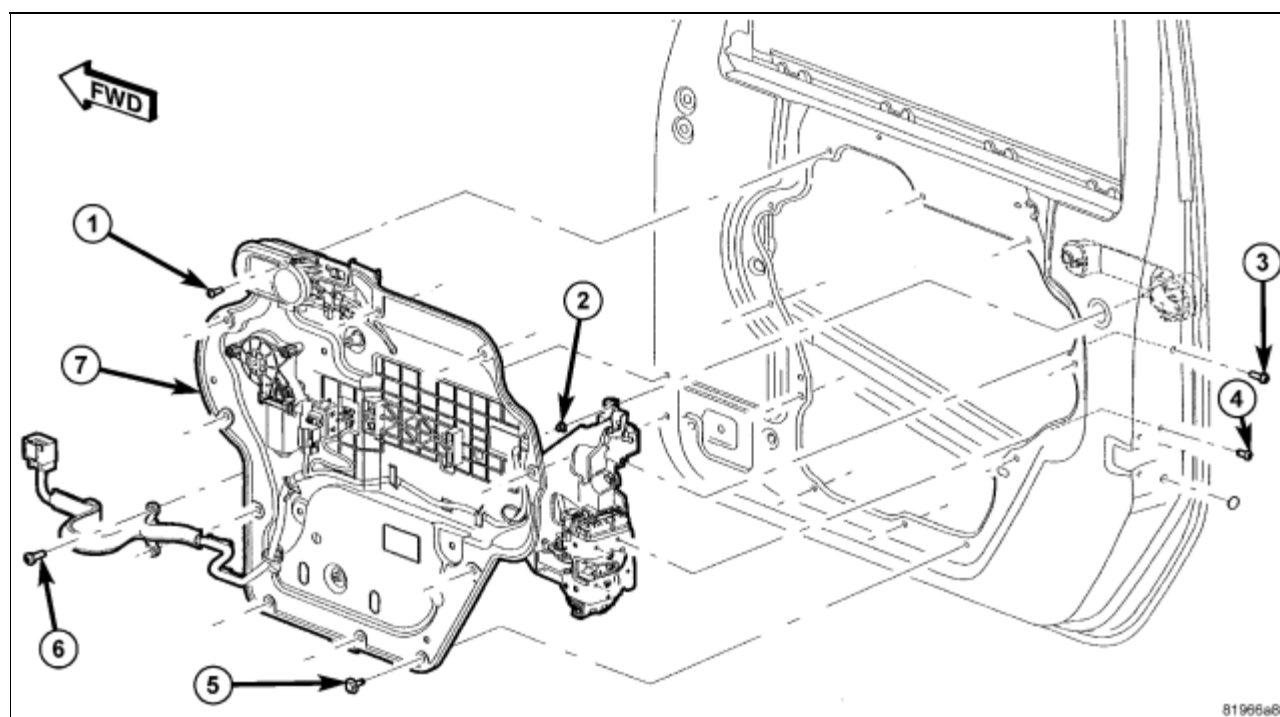
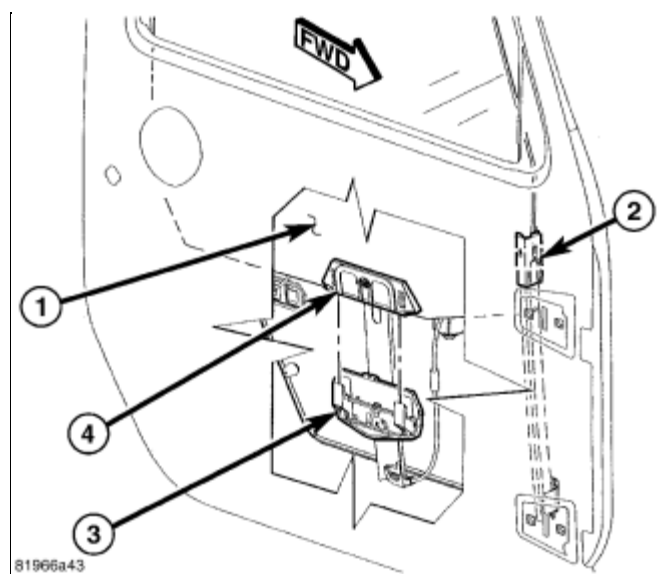
REMOVAL



1. Position the glass into the down position.
2. Remove the door trim panel, (Refer to 23 - BODY/DOOR - FULL FRONT/TRIM PANEL - REMOVAL).
3. If equipped, using a punch or similar tool, carefully remove the glass disconnect hole plugs, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - DESCRIPTION).
4. Release the two glass retainer tabs (3) and separate the glass clip (4) from the regulator lift plate and position into

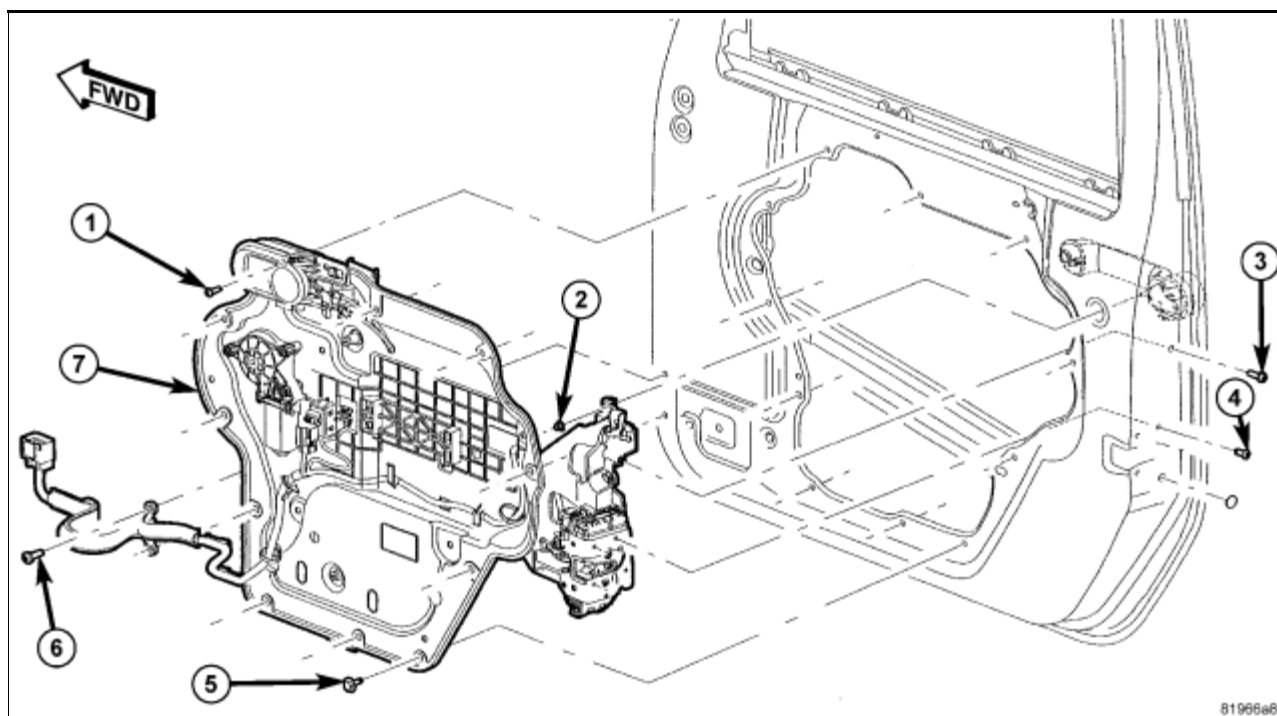
the full up position.

5. Position the glass (1) into the full up position and using tape or equivalent, secure the glass.



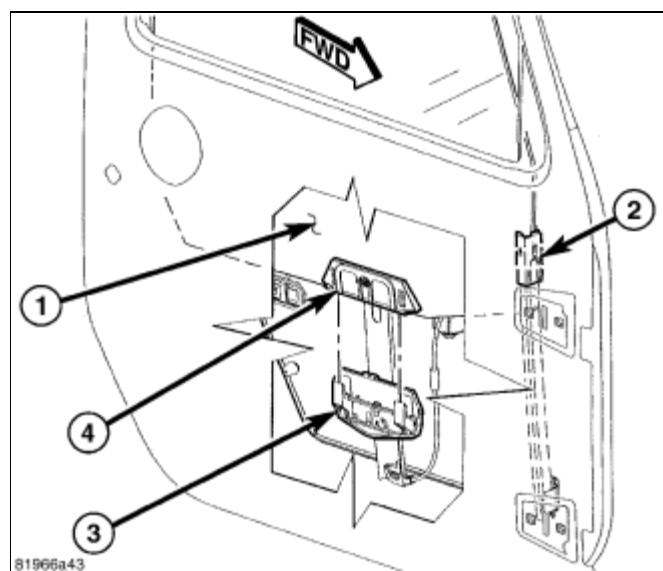
6. Disconnect the door wire harness at the A-pillar and separate the check strap from the hook.
7. Remove the screws (6) and separate the wire harness push pins from the door structure.
8. Remove the door handle screw (1).
9. Remove the latch screws (4).
10. Remove the rubber hole plug in the door and remove the nut (2).
11. Remove the upper latch bracket screw (3).
12. Remove the carrier plate screws (5) and remove the carrier plate assembly (7) from the door.

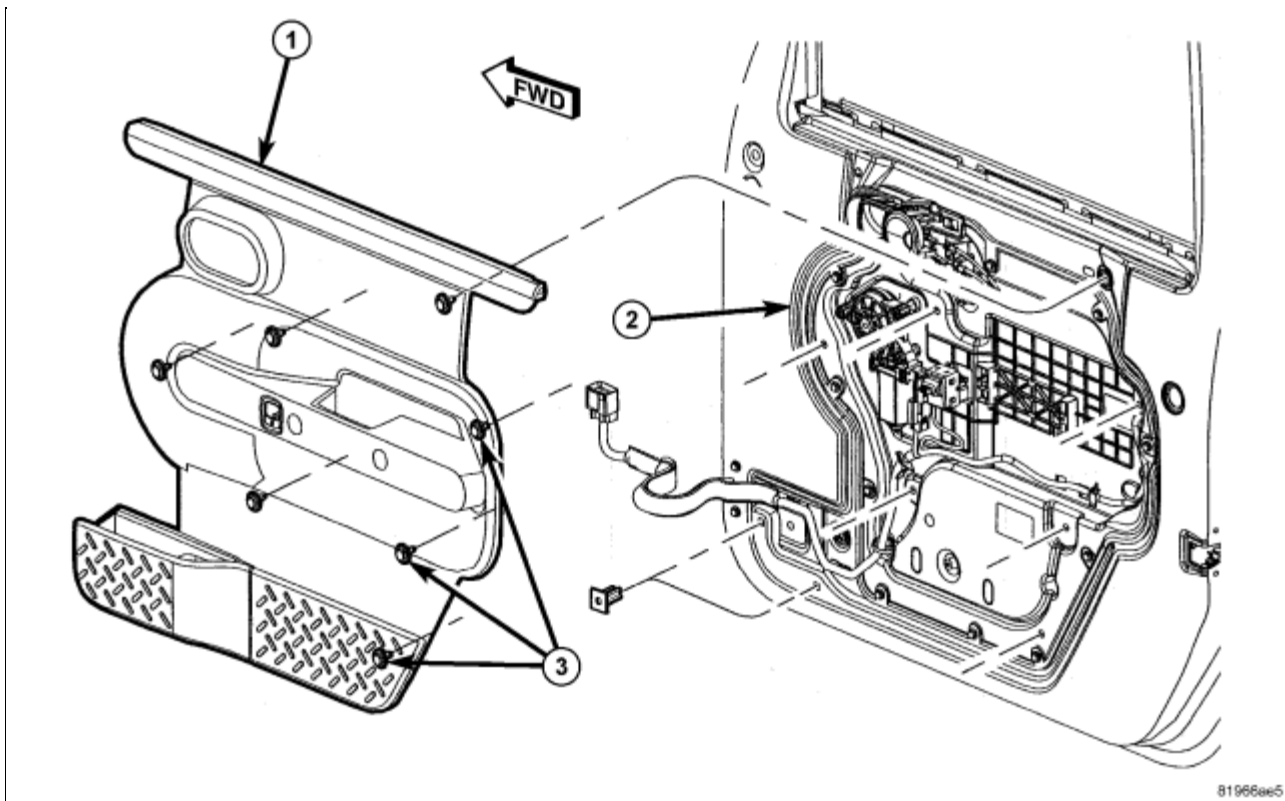
INSTALLATION



1. Place the latch assembly into the door opening and install the carrier plate (7) onto the door.
2. Install the latch screws (4) and tighten to 8 N·m (71 in. lbs.) top screws first.
3. Install the latch bracket screw (3).
4. Install the 10 carrier plate screws (5) and tighten to 10 N·m (90 in. lbs.).
5. Install the outside door handle nut (2) through the hole in the inner door and tighten to 4.5 N·m (40 in. lbs.).
6. Install the inside door handle screw (1) and tighten to 8.5 N·m (75 in. lbs.).

7. Slowly lower the glass (1) all the way down into the regulator lift plate (3) and seat the glass clip (4) fully until a snap sound is heard.
8. Seal the glass disconnect holes with a suitable foam tape or equivalent.

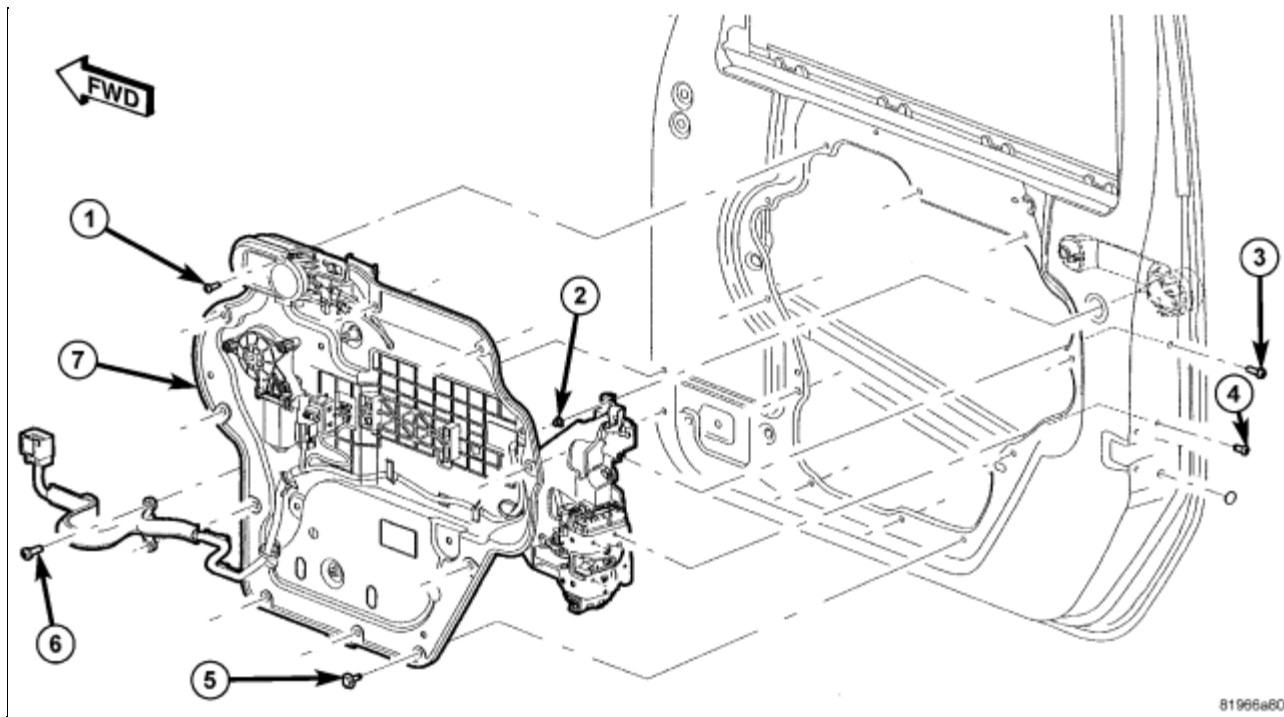




9. Install the trim panel (1), (Refer to 23 - BODY/DOOR - FULL FRONT/TRIM PANEL - INSTALLATION).

CYLINDER - DOOR LOCK

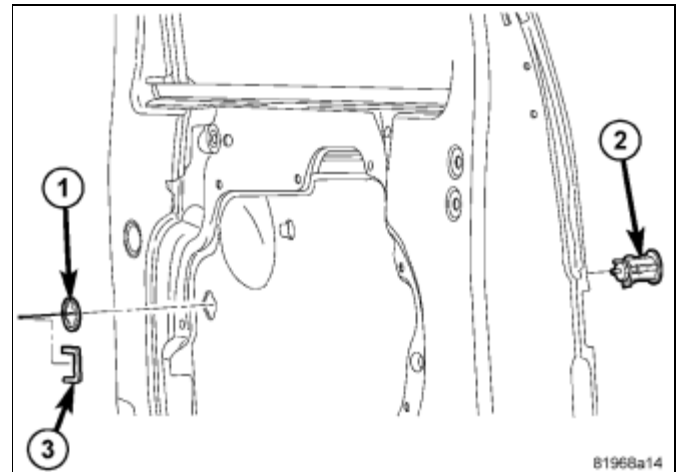
REMOVAL



1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).

2. Remove the clip (3) and separate the lock cylinder (2) and gasket (1) from the door.

INSTALLATION



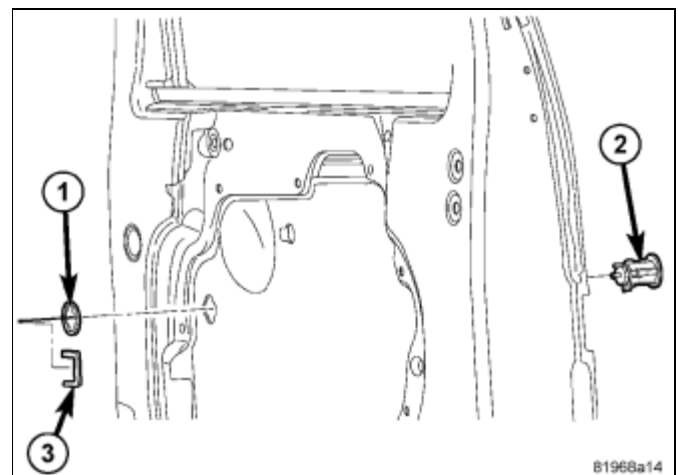
1. Assemble gasket (1) onto lock cylinder (2) until fully seated.

2. Install lock cylinder (2) into hole in outer door panel.

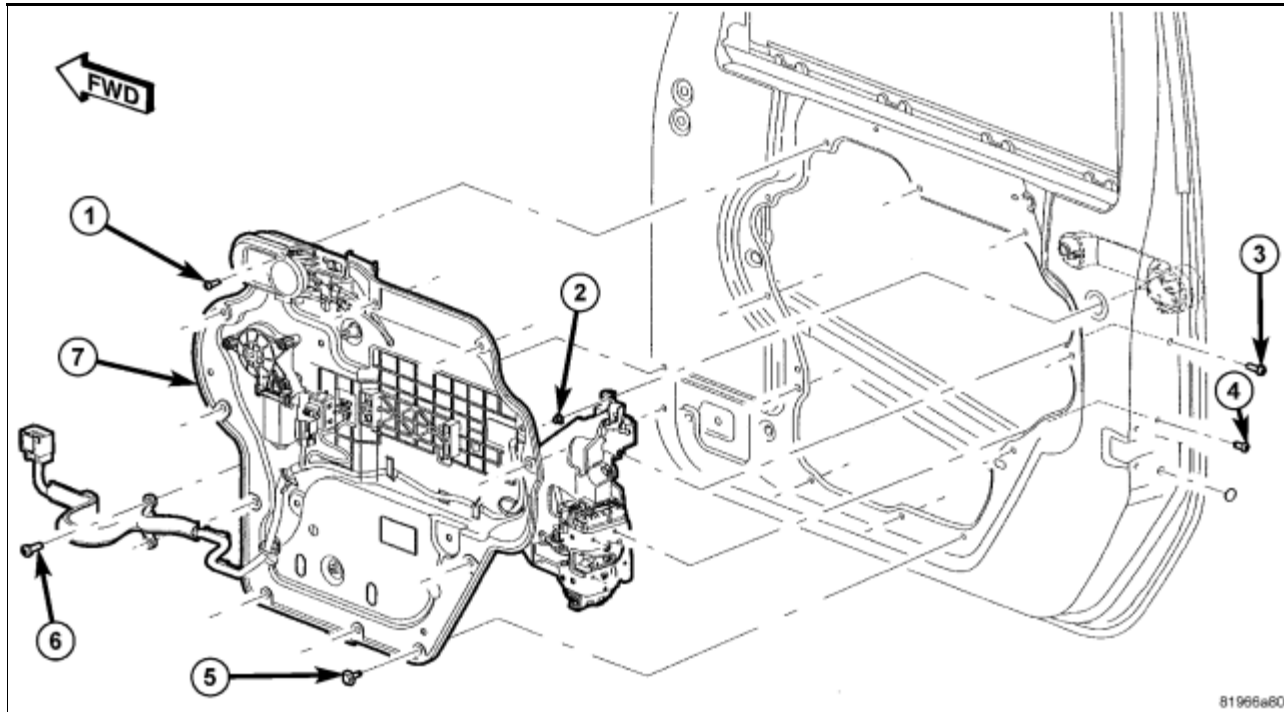
NOTE: Cylinder post must point forward.

NOTE: Cylinder drain hole must point down.

3. While holding lock cylinder (2) in place slide retainer clip (3) onto lock cylinder.



NOTE: Visually verify that pin on lock cylinder is engaged with bell crank on door module at door module install.

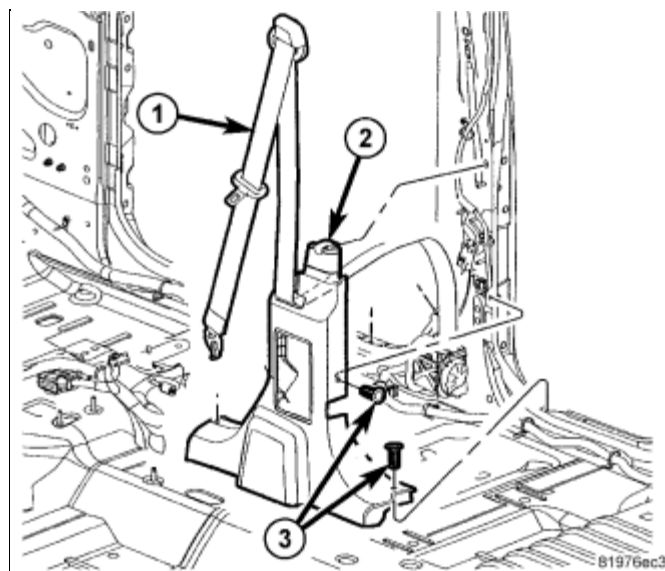


4. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).

DOOR

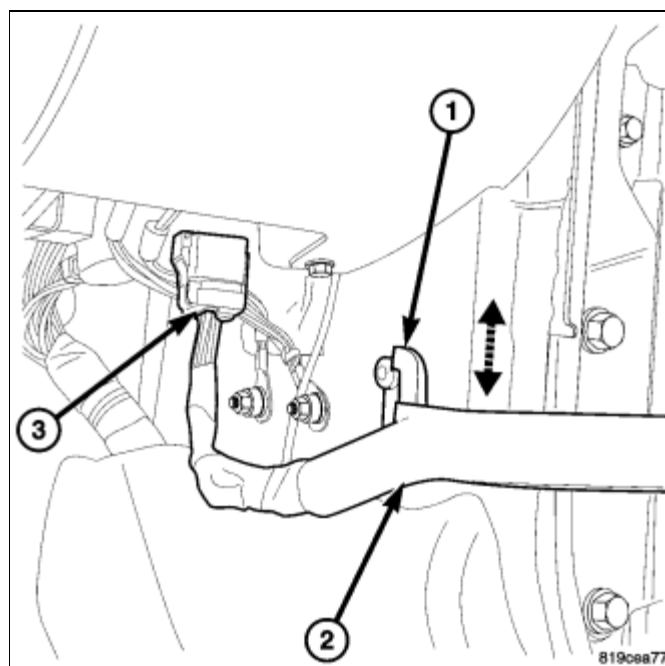
REMOVAL

1. Remove the lower B-pillar trim panel (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).



NOTE: Front door check strap shown, rear doors are similar.

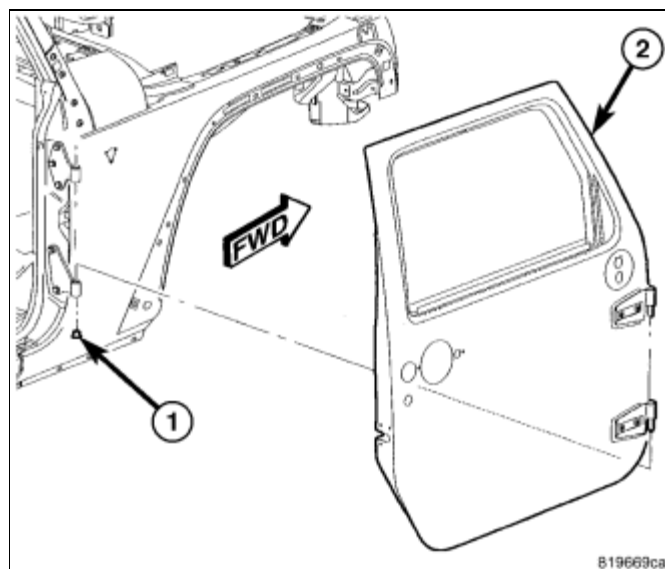
2. Disconnect the electrical connector (3) at the A-pillar cowl area and separate the check strap (2) from the footman's loop (1).



NOTE: Full front door shown, all others similar.

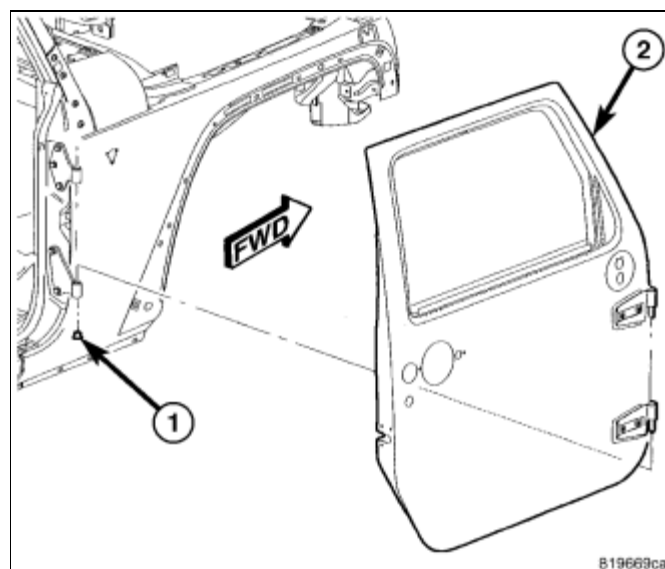
3. Remove the nuts (1) and lift the door (2) up off hinges and remove.

INSTALLATION



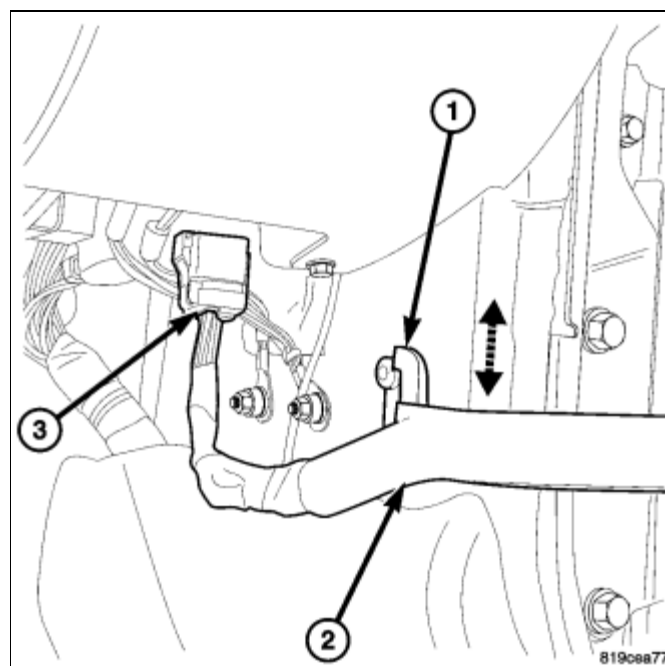
NOTE: Full front door shown, all others similar.

1. Align pins on door hinge to holes in hinge on body and position door into place.
2. Install the nuts (1) and tighten to 8.5 N·m (75 in. lbs.).
3. If necessary, adjust the door (2) (Refer to 23 - BODY/DOOR - HALF REAR/DOOR - ADJUSTMENTS)



NOTE: Front door check strap shown, rear doors are similar.

4. Secure the check strap (2) over the footman's loop (1) and connect the electrical connector (3).

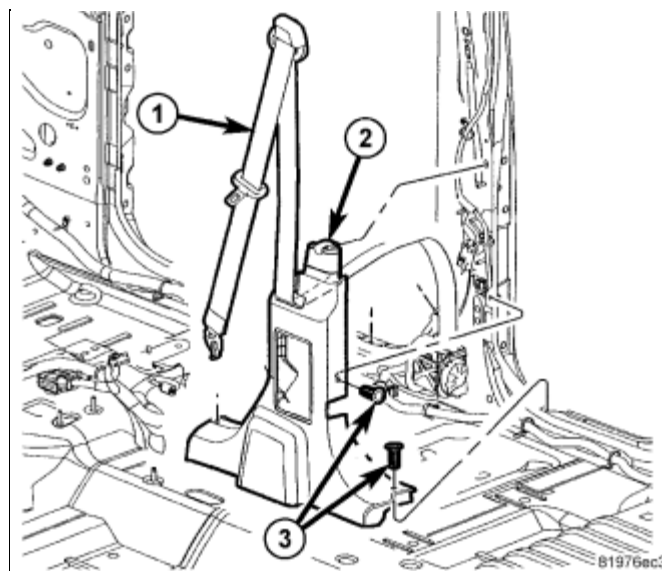


5. Install the lower B-pillar trim (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

ADJUSTMENTS

ADJUSTMENT

NOTE: For four door vehicles, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)



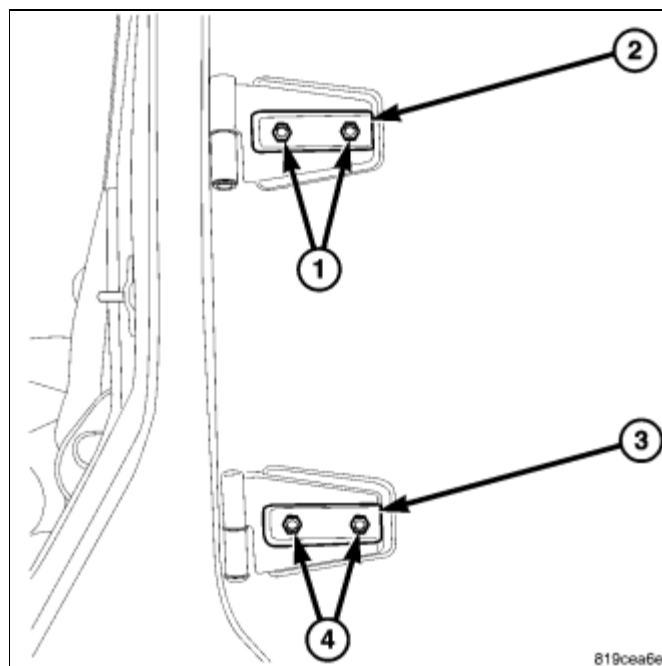
Full front door shown, all others similar.

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the door fasteners one hinge at a time and moving the door to the correct position.

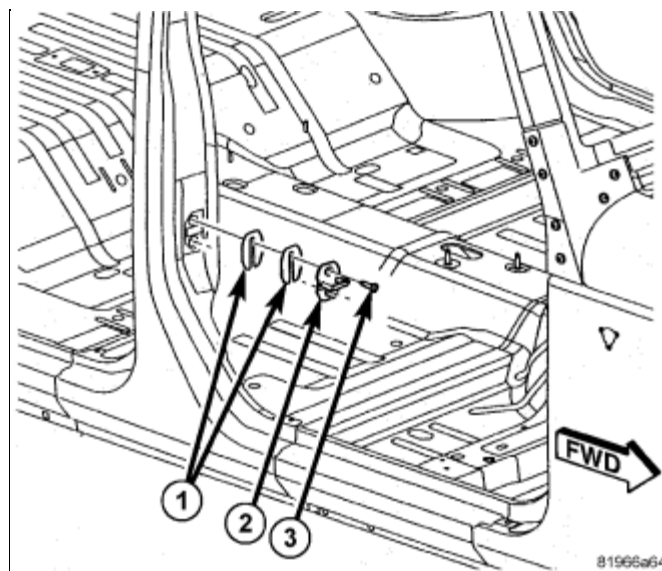
1. Support the door with a suitable lifting device.
2. Loosen the upper (1) and lower (4) hinge to door fasteners. (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge to door bolts to 26 N·m (19 ft. lbs.).



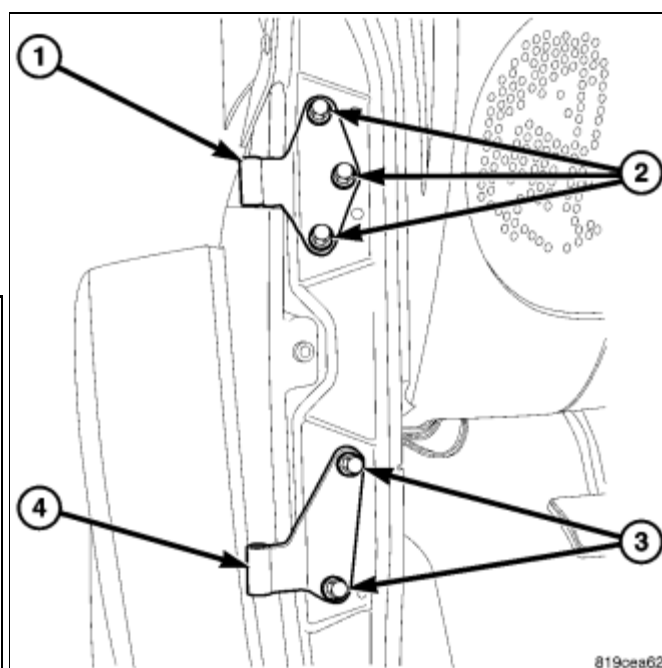
UP/DOWN

NOTE: Up/down door adjustment is done by loosening hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

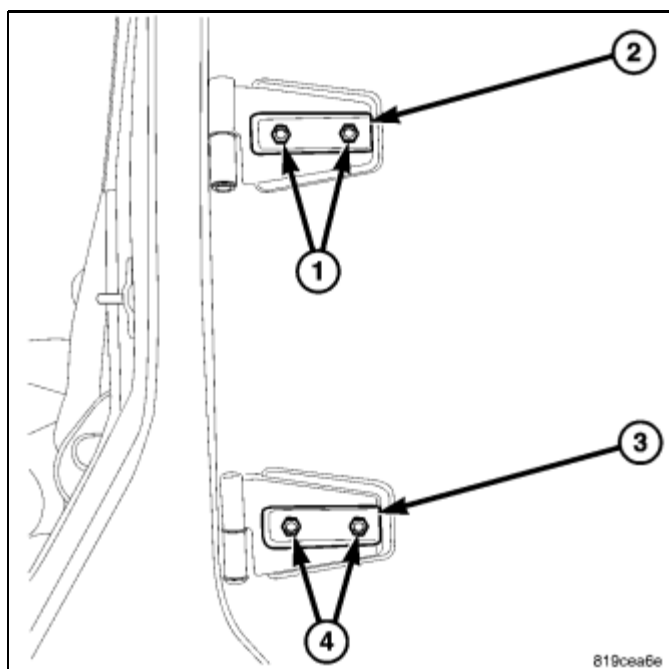
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. If necessary, loosen the hinge to hinge pillar fasteners (2) and (3). (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
4. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).



5. If

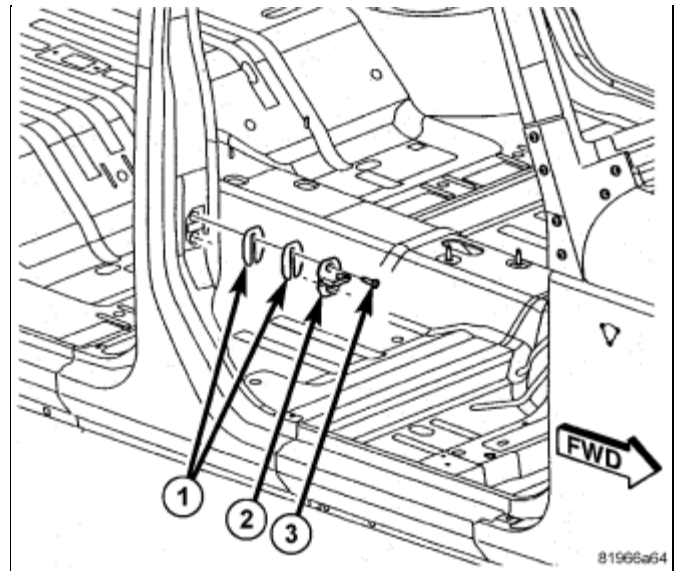


necessary, Loosen the hinge to door fasteners (1) and (4). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

6. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
7. Tighten the door to hinge fasteners to 26 N·m (19 ft. lbs.).

8. Tighten the latch striker bolts (3) 26 N·m (19 ft. lbs.). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER -

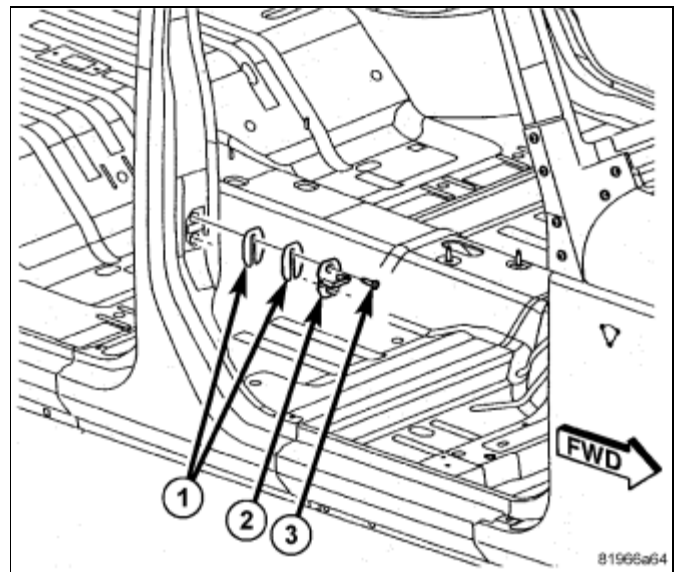
INSTALLATION)



IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to body fasteners one hinge at a time and moving the door to the correct position.

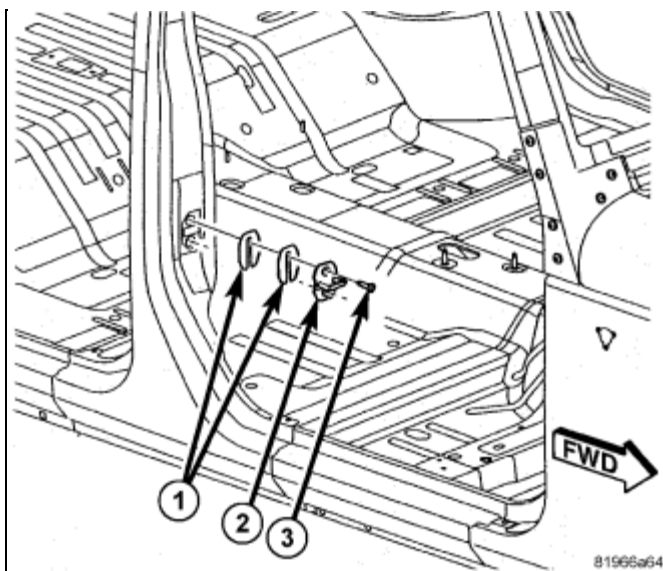
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



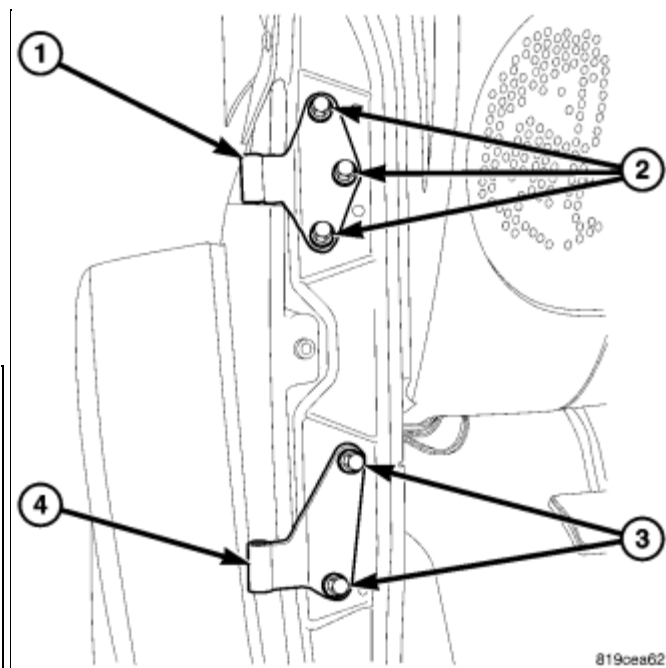
3. Loosen the hinge to body fasteners (2) and (3), (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).

6.
Tighten
the latch

striker
bolts (3)
to 26
N·m (19
ft. lbs.).
(Refer to
23 -

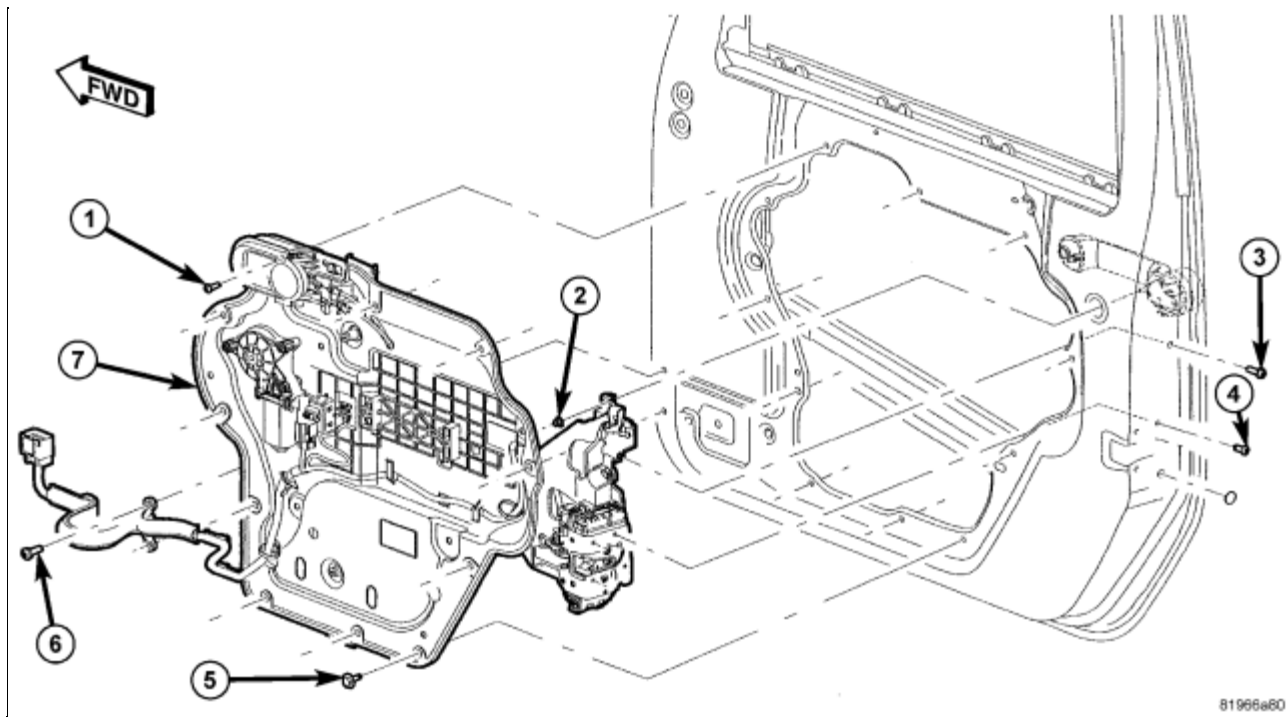


BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



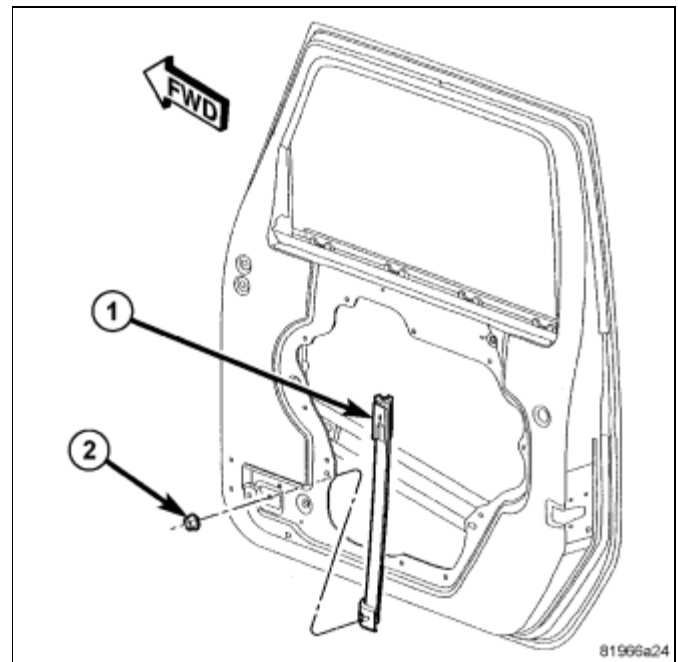
GLASS - DOOR

REMOVAL



1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).

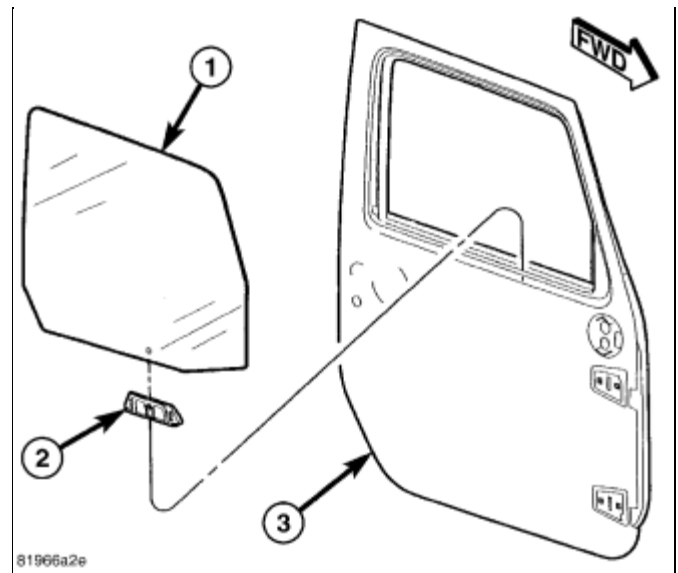
2. Remove the nut (2) and position the run channel (1) aside.



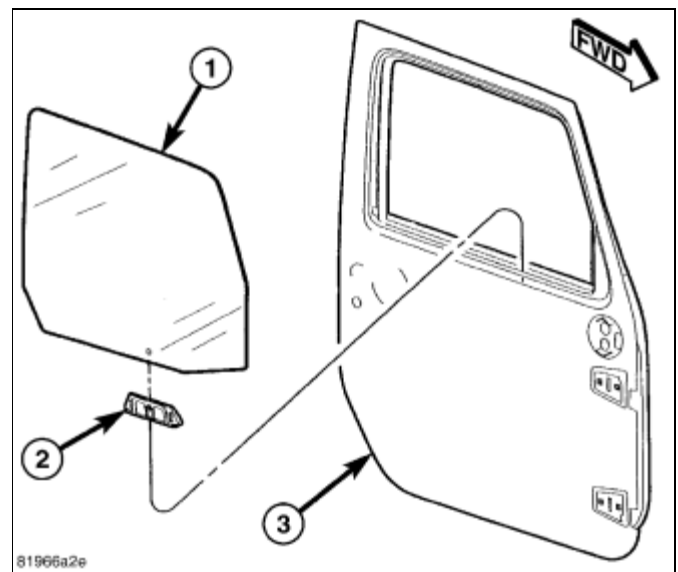
3. Separate the clip (2) from the glass (1) and lower the glass in the run channel.

4. Turn the glass so the front of the glass is facing down and remove the glass through the glass opening.

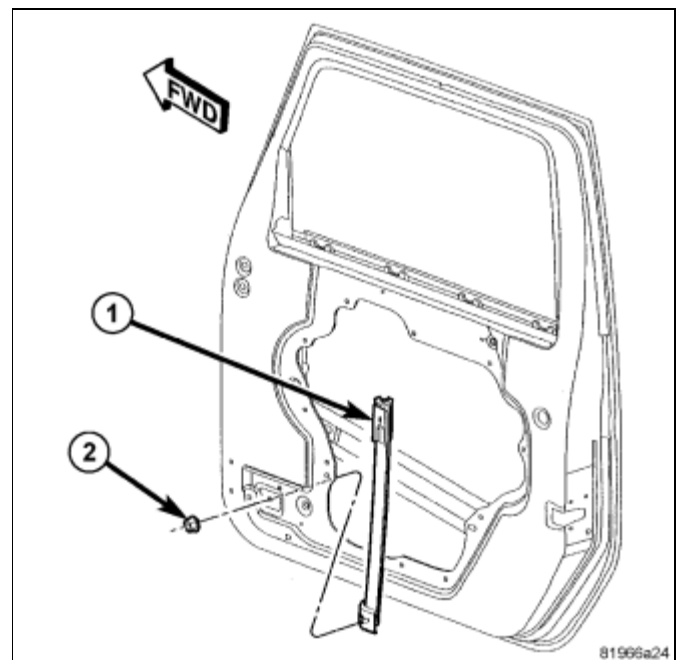
INSTALLATION

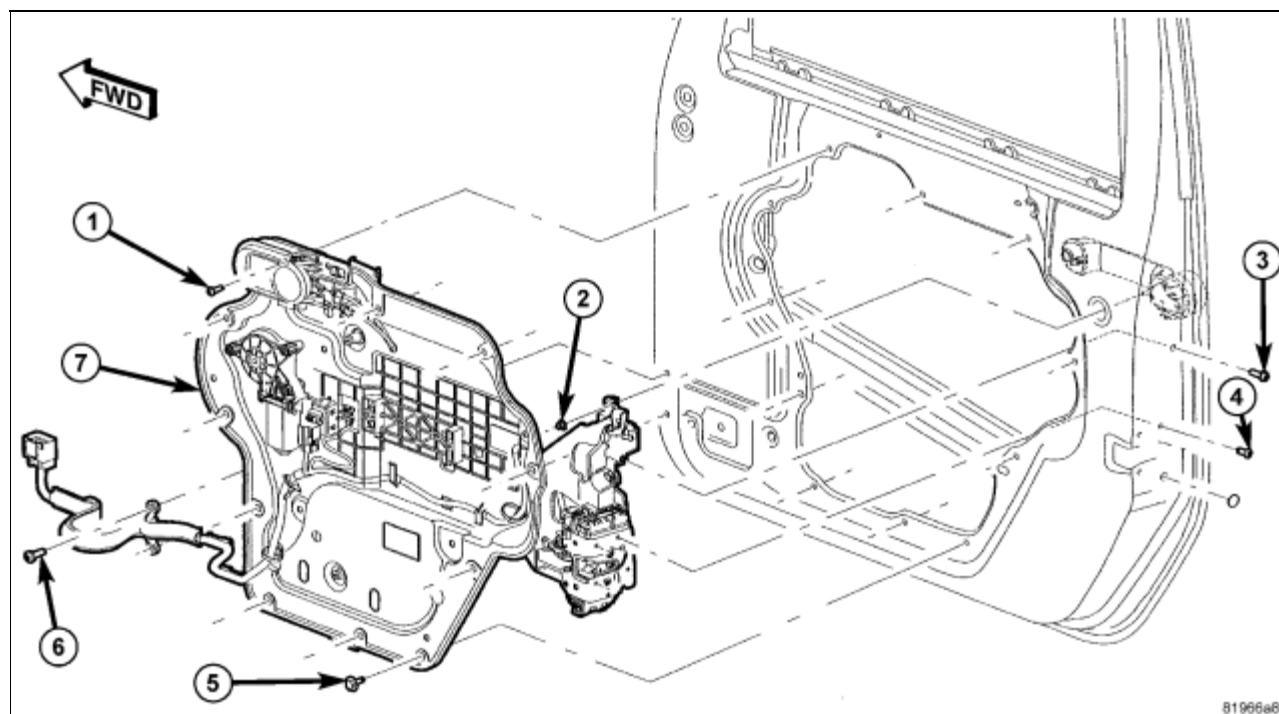


1. Install the glass (1) into the door (3), front and first.
2. Rotate glass into the correct orientation and push up into the weather seal.
3. Secure glass in the up position using tape or other suitable method.
4. Install the glass clip (2).



5. Position the glass run channel (1) back into place and install the nut (2).
6. Tighten the nut to 10 N·m (90 in. lbs.).

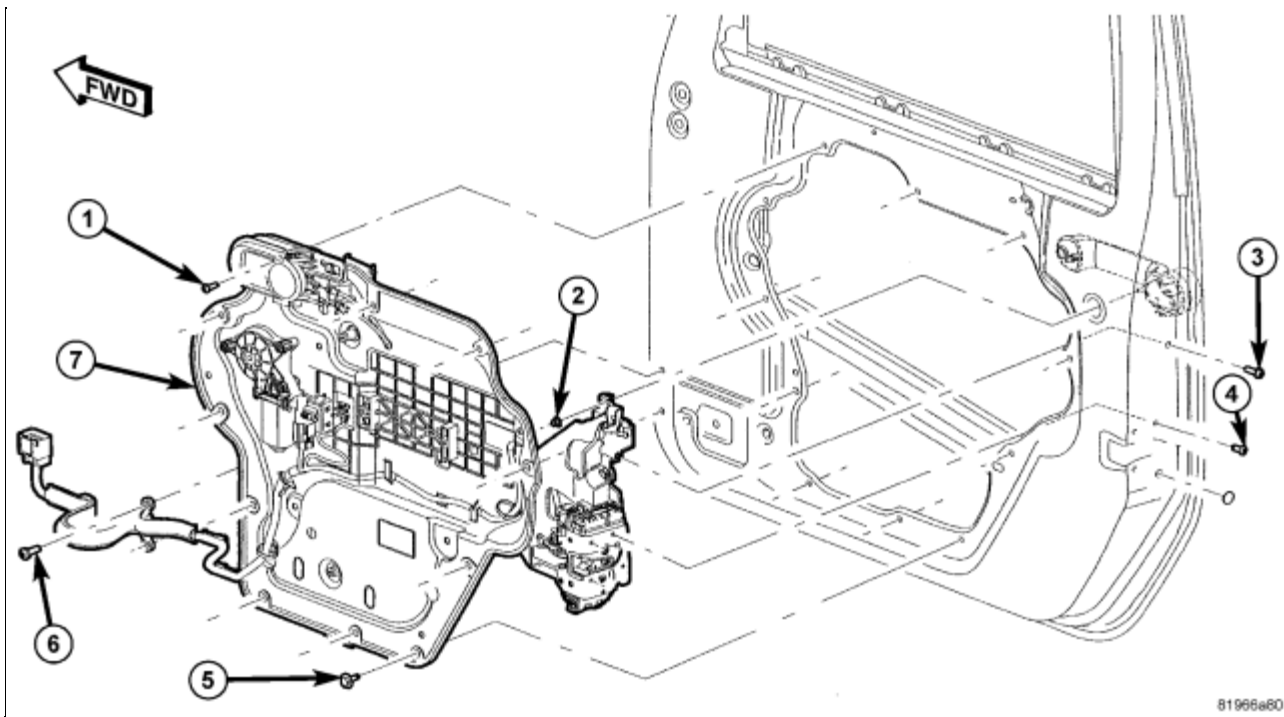




7. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).

HANDLE - EXTERIOR DOOR

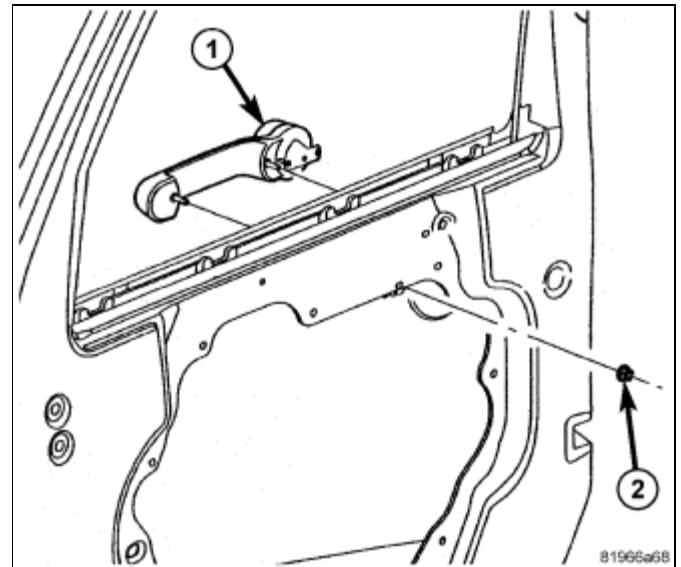
REMOVAL



1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).

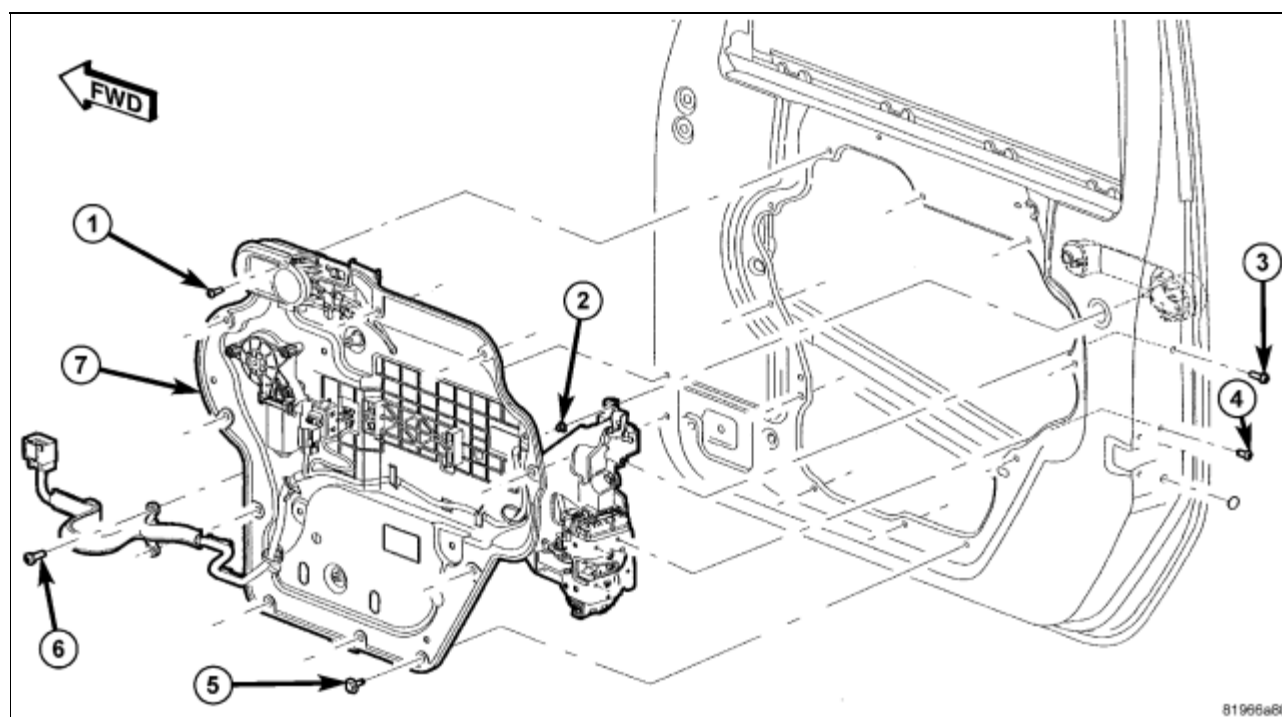
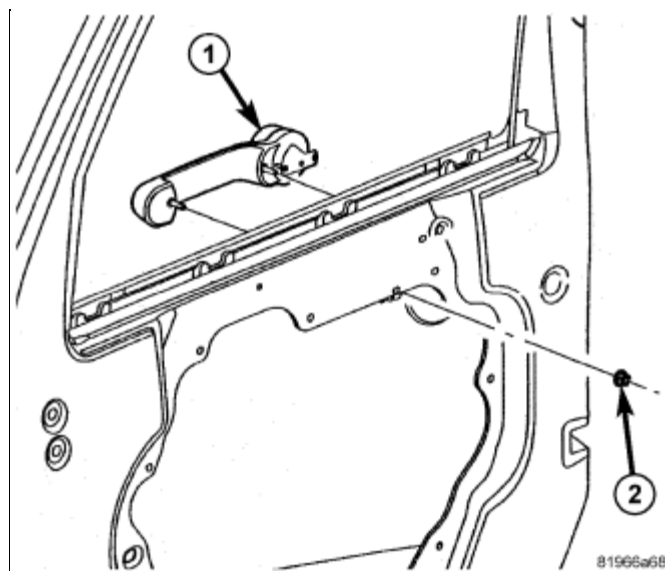
2. Remove the nut (2) and remove the handle (1).

INSTALLATION



1. Install the handle (1) and install the front nut (2).

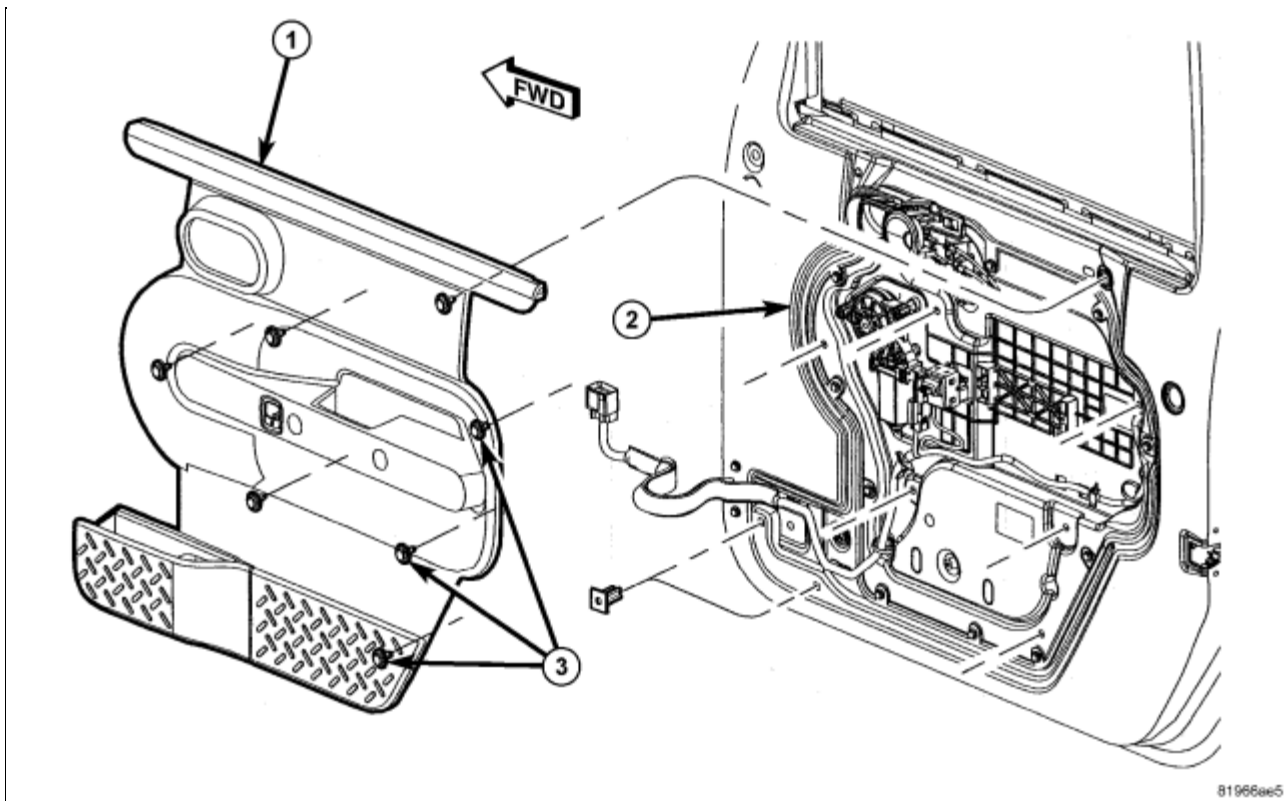
2. Tighten the nut to 4.5 N·m (40 in. lbs.).



3. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).

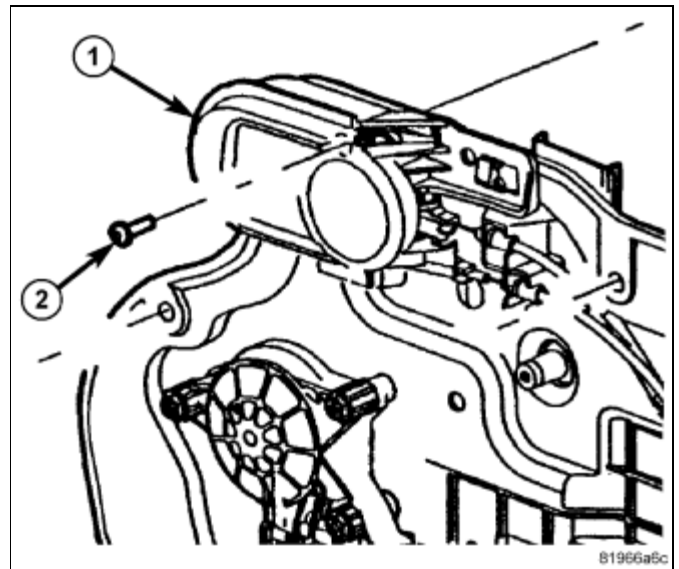
HANDLE - INSIDE RELEASE

REMOVAL



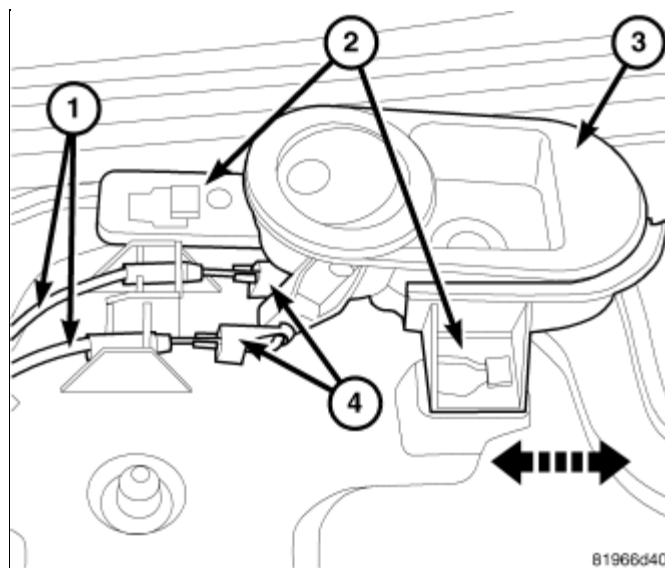
1. Remove the door trim panel, (Refer to 23 - BODY/DOOR - FULL FRONT/TRIM PANEL - REMOVAL).

2. Remove the screw (2) securing the handle (1) to the carrier plate.

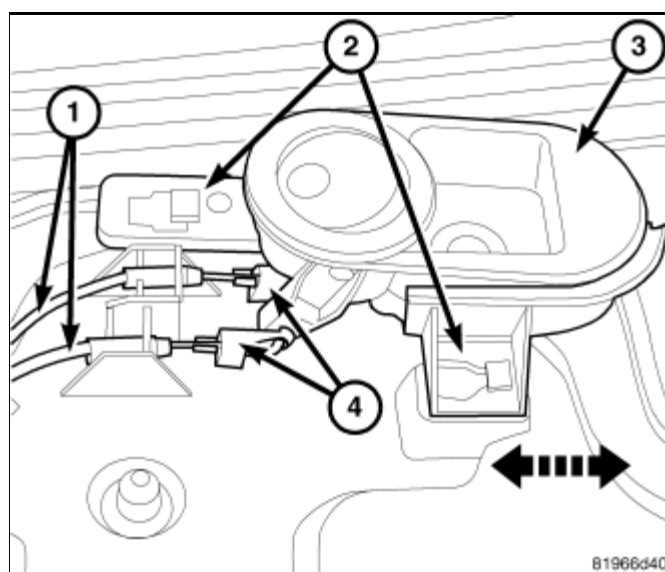


3. Disconnect the clips (4) and disconnect the cables (1).
4. Slide the handle (3) off of the retaining tabs (2) and remove.

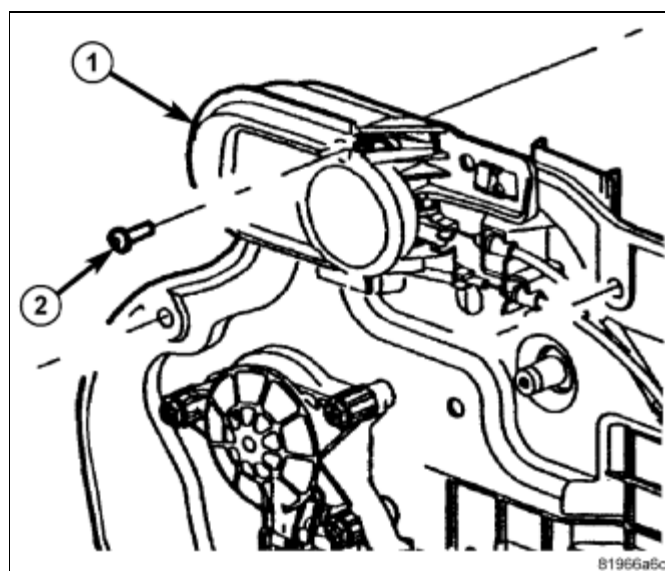
INSTALLATION

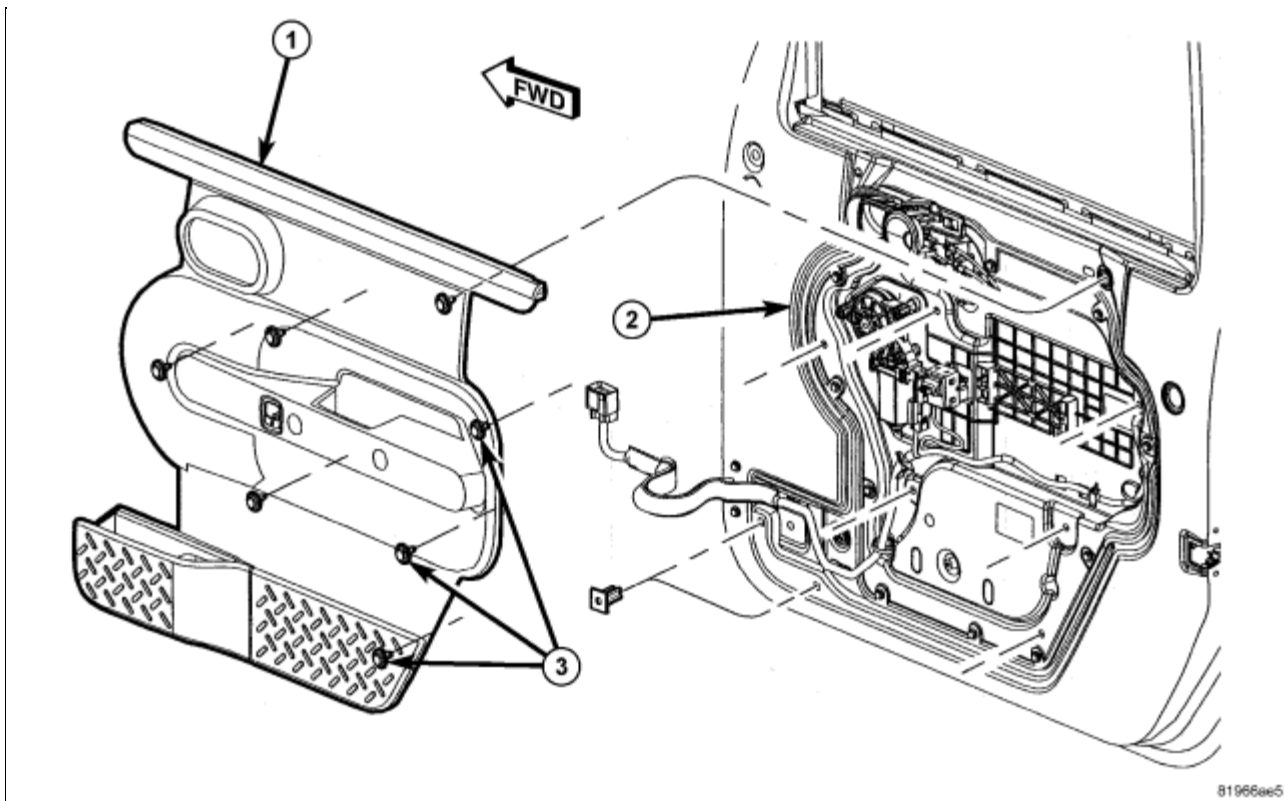


1. Position the handle (3) onto the carrier plate tabs (2) and slide into place fully.
2. Connect the cables (1) and secure the clips (4).



3. Install the inside door handle screw (2) and tighten to 8.5 N·m (75 in. lbs.).





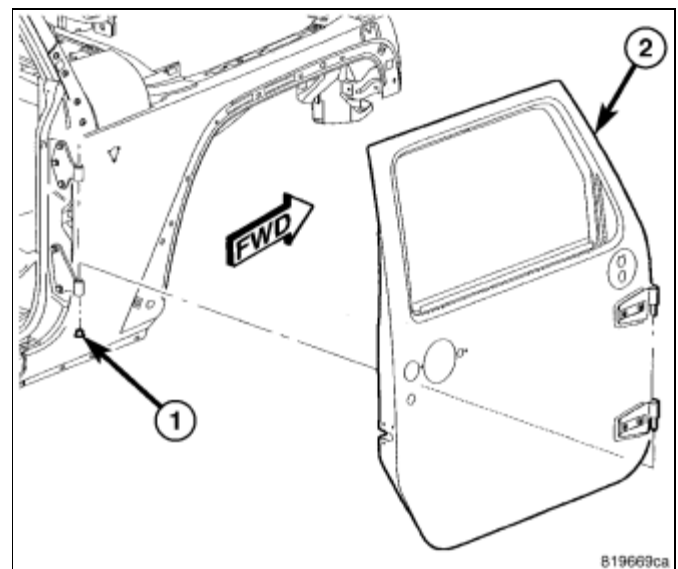
4. Install the trim panel (1), (Refer to 23 - BODY/DOOR - FULL FRONT/TRIM PANEL - INSTALLATION).

HINGE

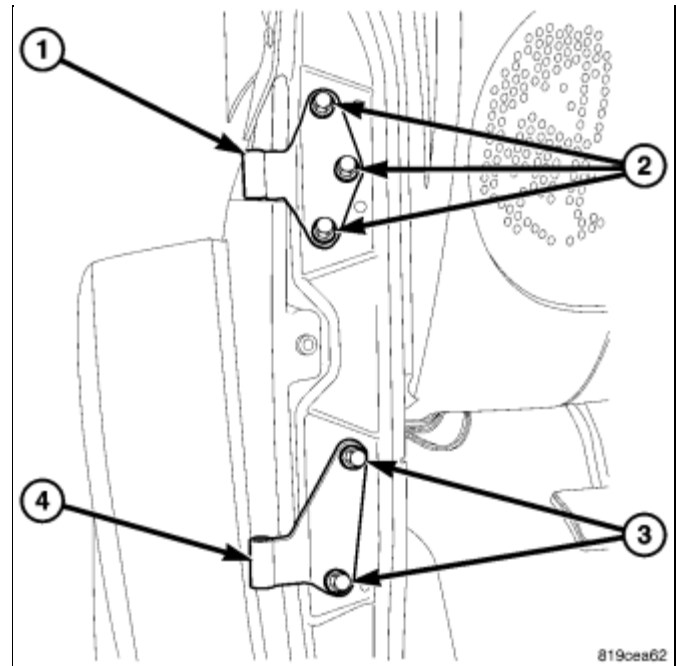
REMOVAL

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - REMOVAL).

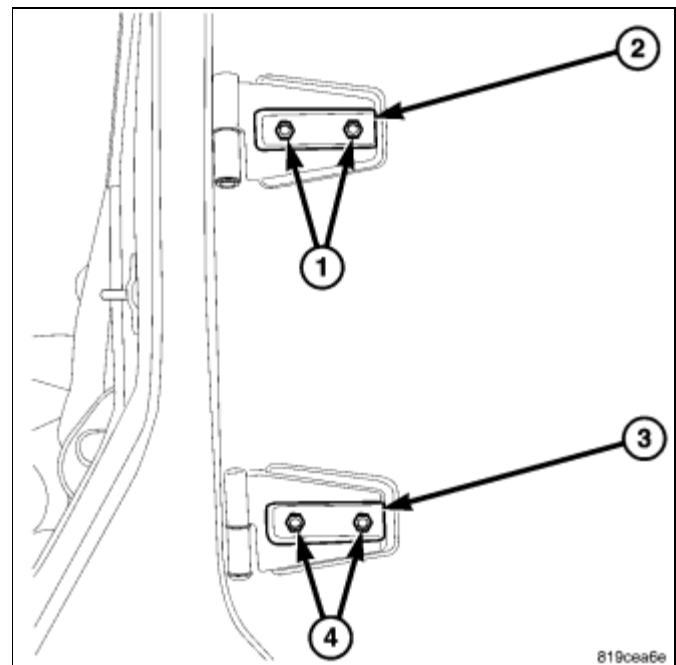


2. Using a grease pencil or equivalent, mark the body hinge (1) and (4) location and remove the bolts (2) and (3).



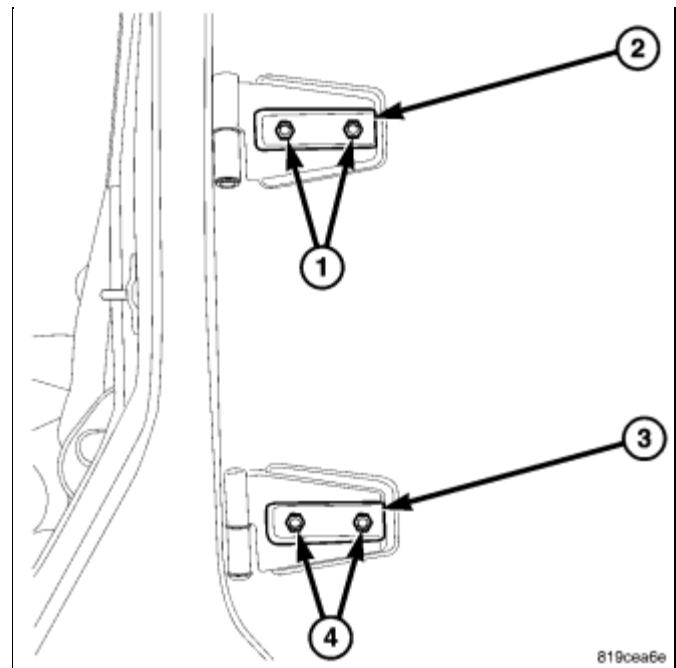
3. Using a grease pencil or equivalent, mark the door hinge (2) and (3) location and remove the bolts (1) and (4).

INSTALLATION



NOTE: A suitable body sealant should be used when removing or moving the hinges.

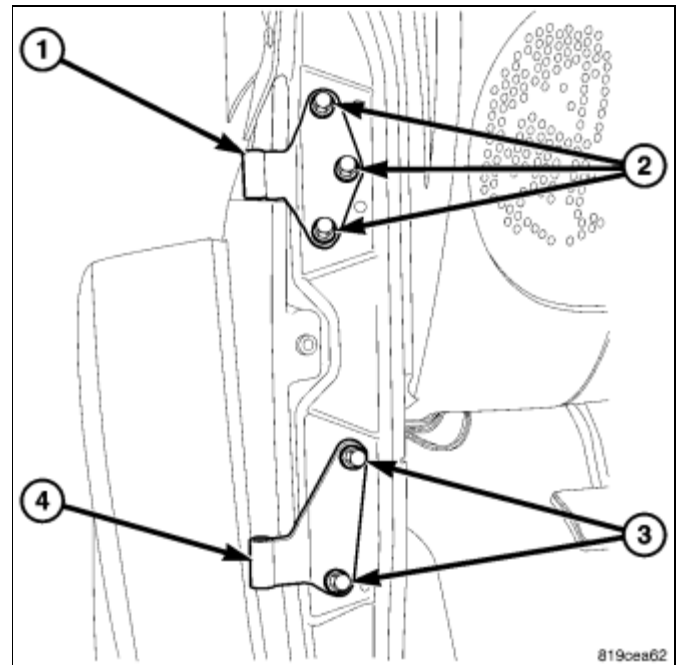
1. Install the door hinges (2) and (3), and install the bolts (1) and (4).
2. Align the hinges to the door using the reference marks made during the removal procedure and tighten the bolts to 26 N·m (19 ft. lbs.).



819cea6e

3. Install the body hinges (1) and (4), and install the bolts (2) and (3).

4. Align the hinges to the body using the reference marks made during the removal procedure and tighten the bolts to 28 N·m (21 ft. lbs.).

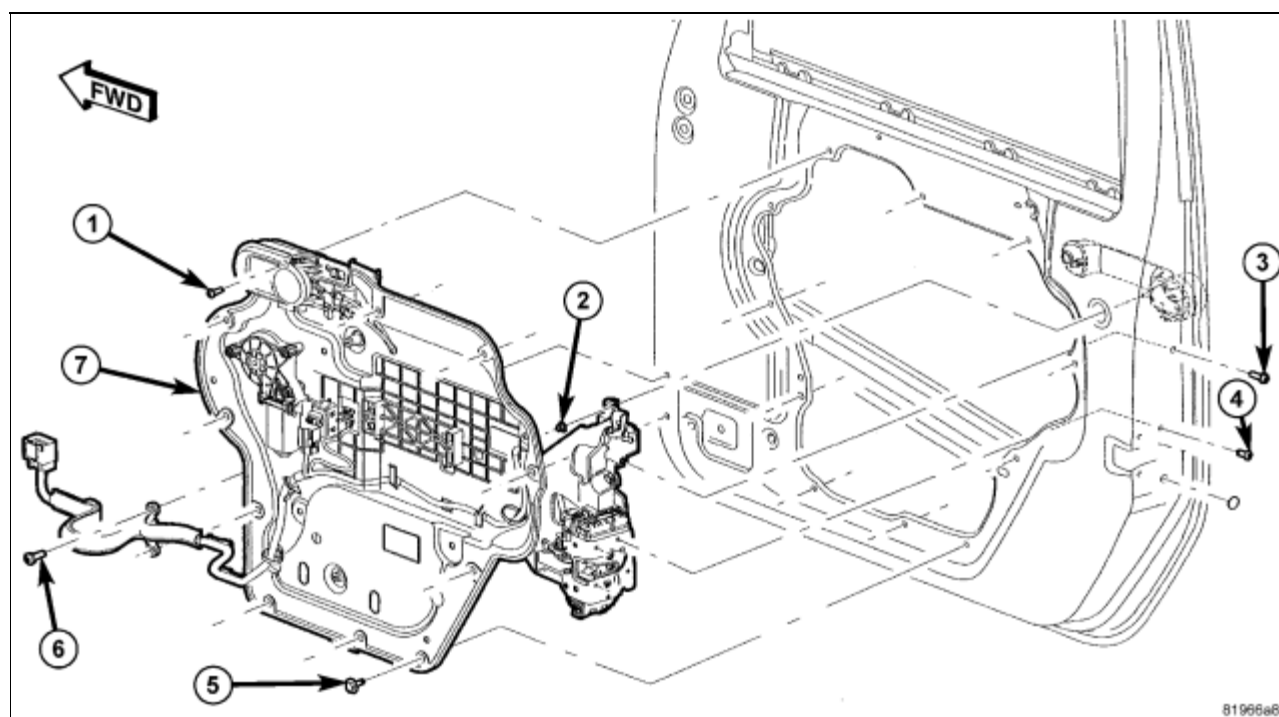
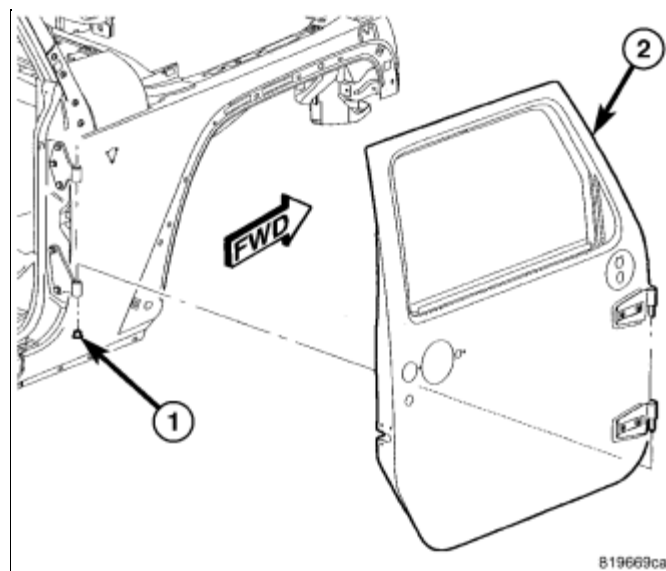


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5. Install the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - INSTALLATION).

LATCH

REMOVAL

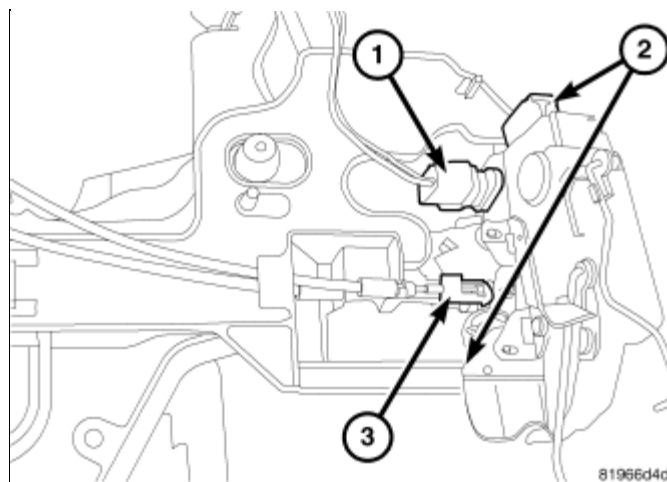


1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).

NOTE: Front door shown, rear door similar.

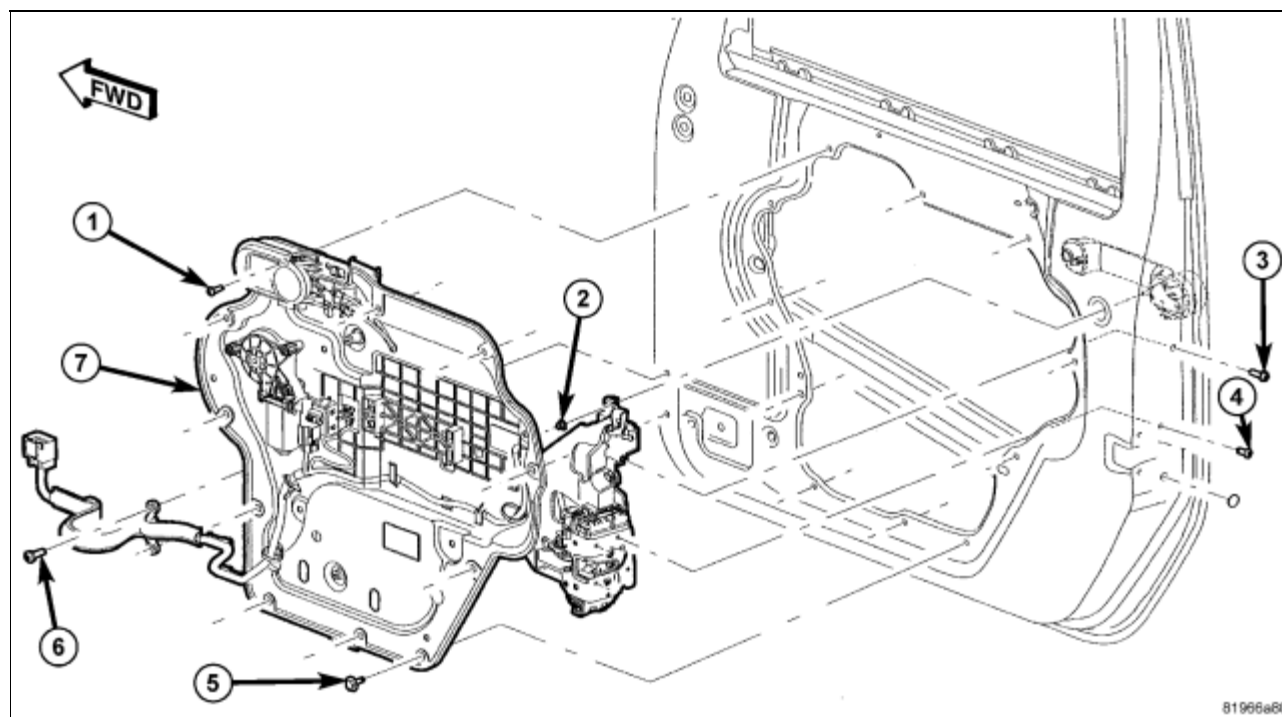
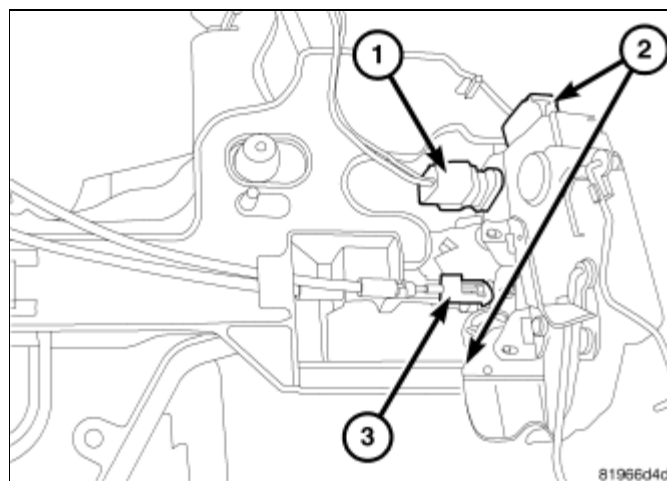
2. Disconnect the actuator rods.
3. Disconnect the electrical connector (1).
4. Disconnect the latch cables (3).
5. Slide the latch off the latch bracket tabs (2) and remove the latch.

INSTALLATION



NOTE: Front door latch shown, rear door similar.

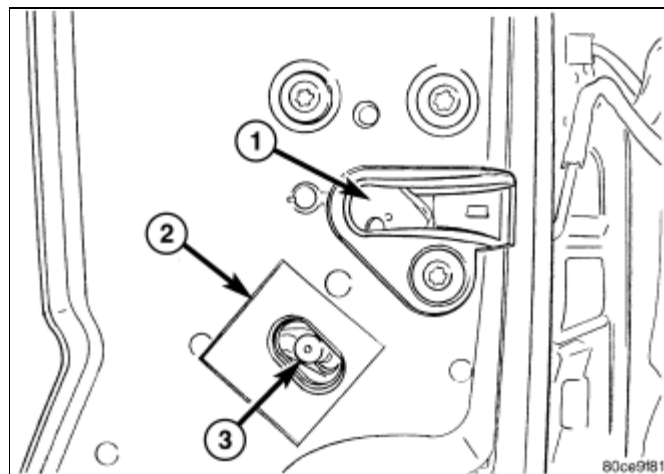
1. Install the latch onto the latch bracket tabs (2) and seat fully.
2. Connect the electrical connector (1).
3. Connect the latch cables (3).
4. Connect actuator rods.



5. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).
6. Adjust the front door latch, (Refer to 23 - BODY/DOOR - FULL FRONT/LATCH - ADJUSTMENTS).

ADJUSTMENTS

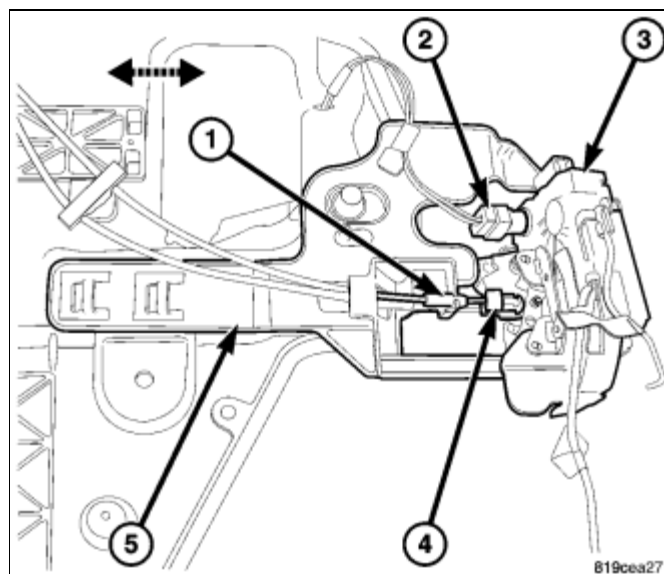
1. Locate the access hole in the door to adjust the door latch (1) and remove the mylar tape (2).
2. Loosen latch adjusting screw (3) through access slot in door shut face (1/2 to 1 full turn).
3. Operate the door handles several times to reduce any possible linkage binding and tighten the adjustment screw to 3 N·m (30 in. lbs.).
4. Operate the door handles again to verify proper operation and reinstall the mylar tape.



MOUNTING BRACKET - LATCH

REMOVAL

1. Remove the latch (3), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - REMOVAL).
2. Slide the latch bracket (5) off of the carrier plate tabs and remove.

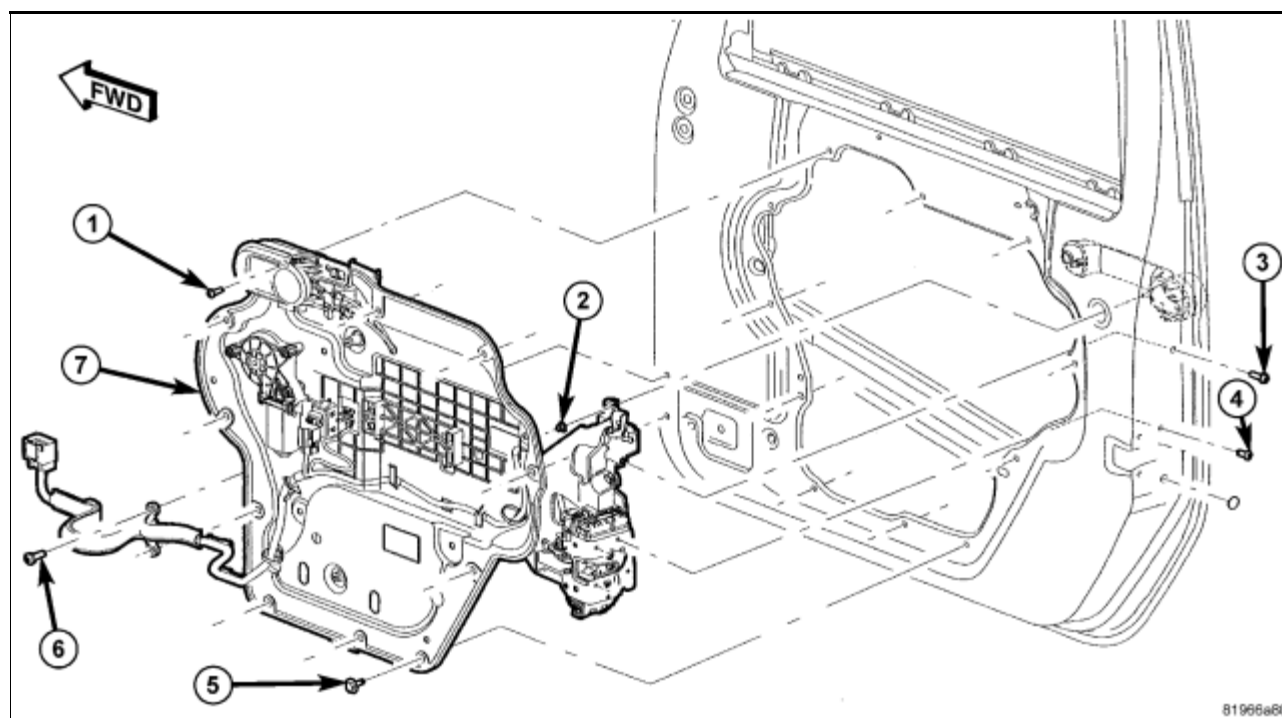
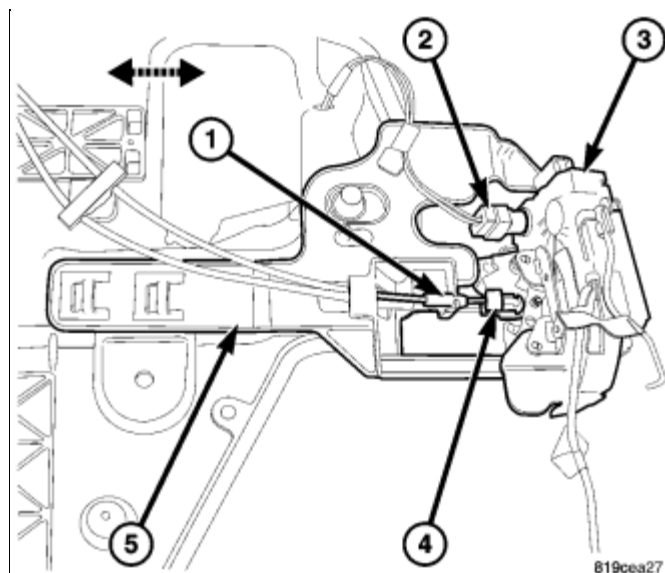


INSTALLATION

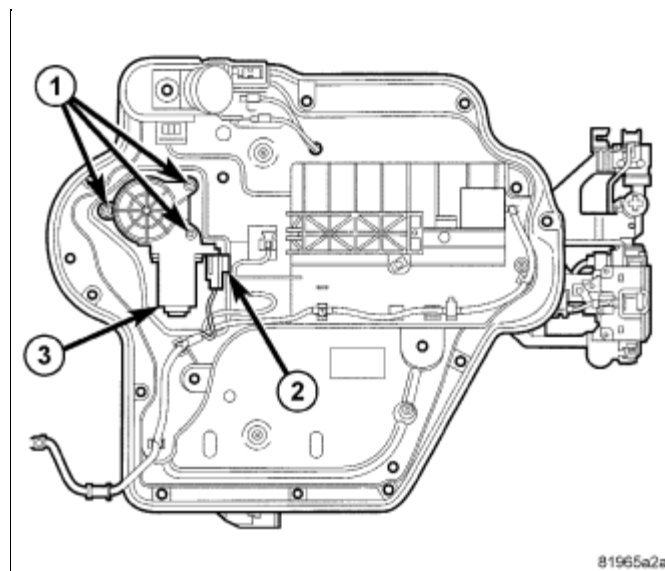
1. Slide the latch bracket (5) onto the carrier plate and secure fully.
2. Install the latch (3), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - REMOVAL).

REGULATOR - FRONT DOOR

WINDOW REMOVAL

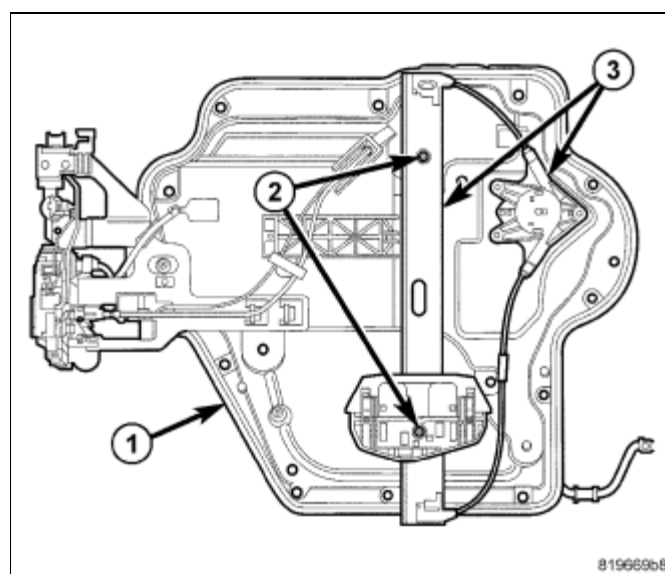


1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - REMOVAL).
2. Remove the screws (1) and disconnect the electrical connector (2).
3. Remove the motor (3).

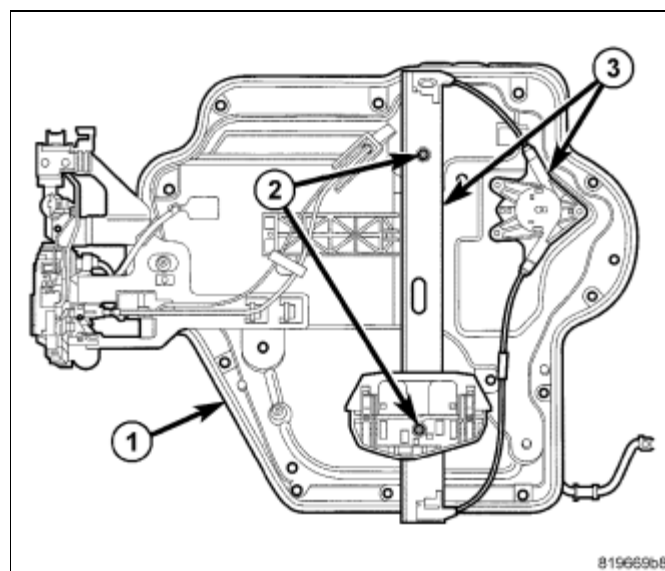


4. Remove the rail screws (2) and separate the lift regulator (3) from the carrier plate (1).

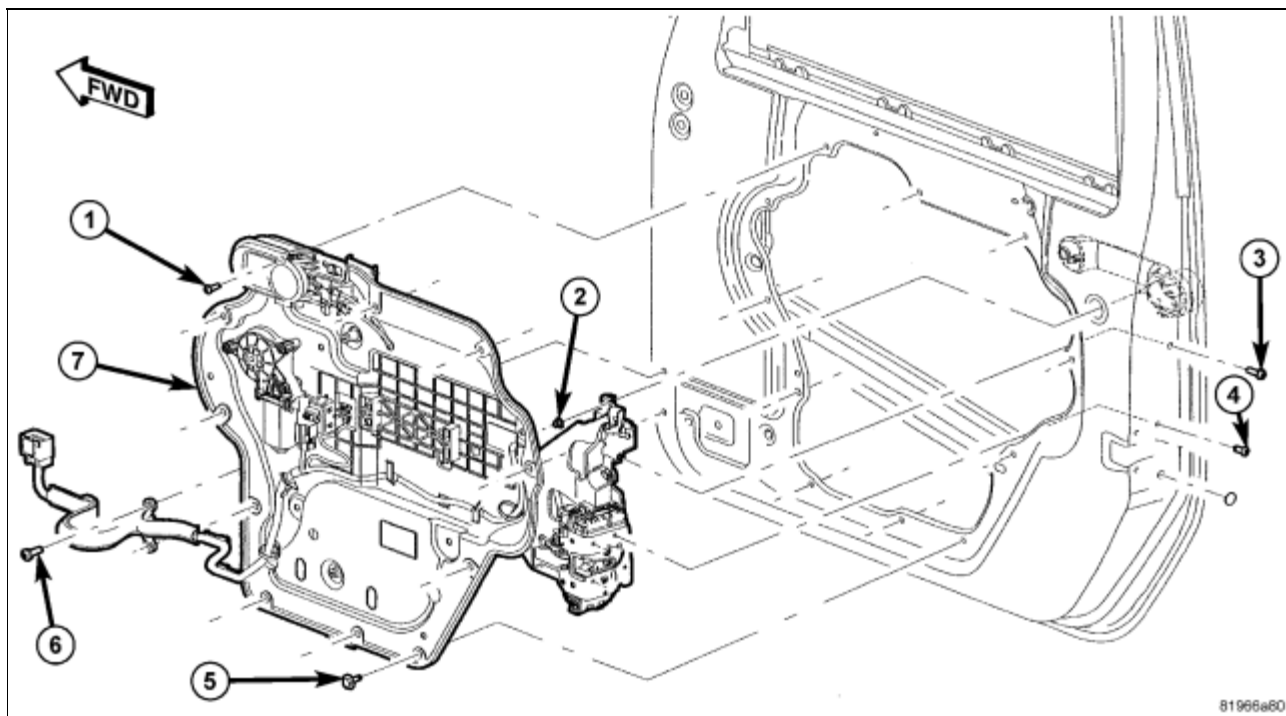
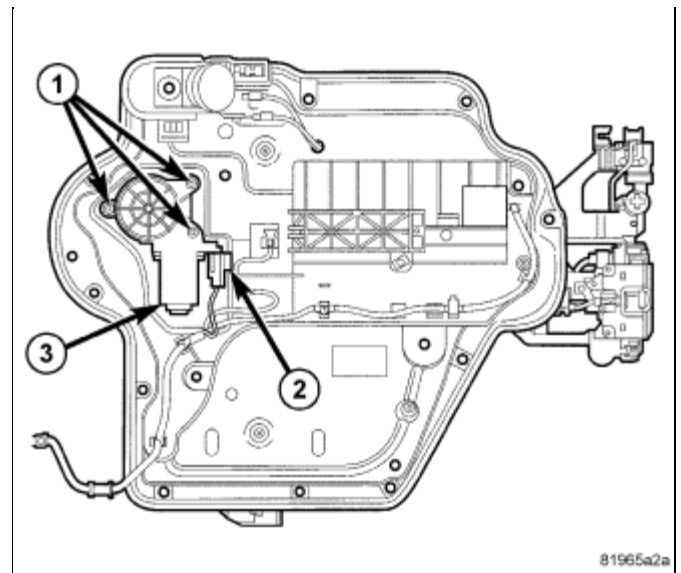
INSTALLATION



1. Position the regulator (3) onto the carrier plate (1) and install the screws (2).



2. Install the motor (3) and install the screws (1).
3. Connect the electrical connector (2).



4. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL FRONT/CARRIER PLATE - INSTALLATION).

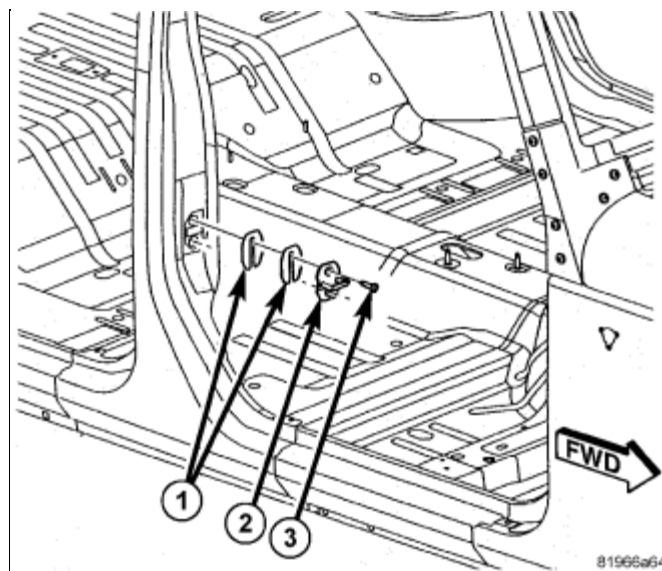
STRIKER - DOOR

REMOVAL

1. Remove the screws (3).

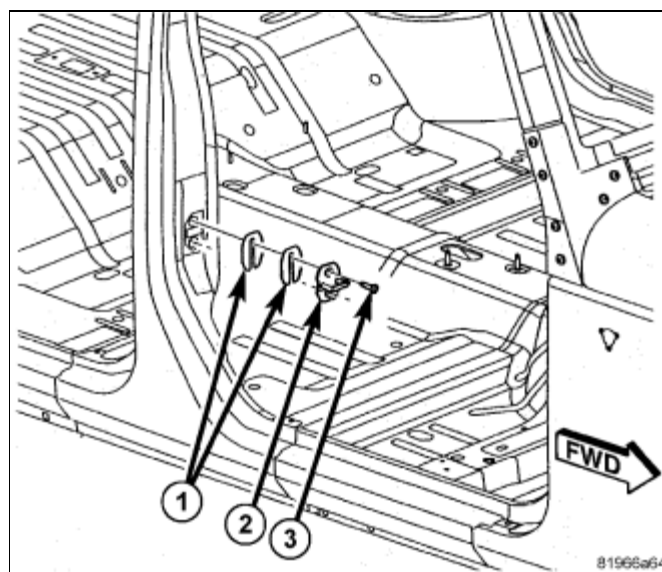
2. Remove the striker (2) and the shims (1), if equipped.

INSTALLATION



1. Install the shims (1), if equipped, and install the striker (2).
2. Install the screws (3) and tighten to 26 N·m (19 ft. lbs.).
3. If necessary, adjust the door latch striker (Refer to 23 - BODY/DOOR - FULL FRONT/STRIKER - ADJUSTMENTS).

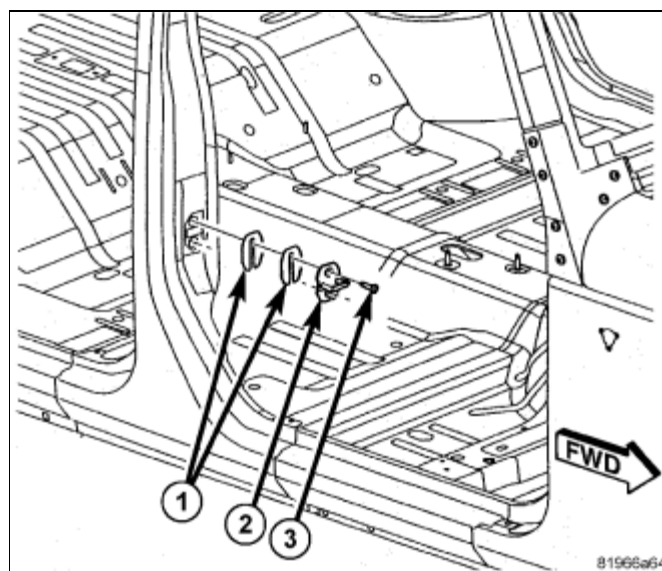
ADJUSTMENTS



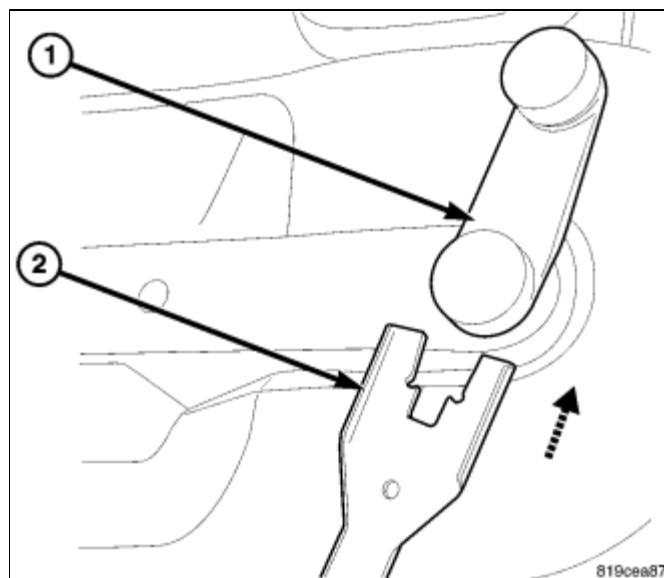
1. Using a grease pencil or equivalent, mark the location of the door latch striker (2) on the B-pillar to aid in adjustment.
2. Loosen the two screws (3) that secure the door latch striker to the B-pillar.
3. To adjust the rear gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 26 N·m (19 ft. lbs.), (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.

TRIM PANEL

REMOVAL

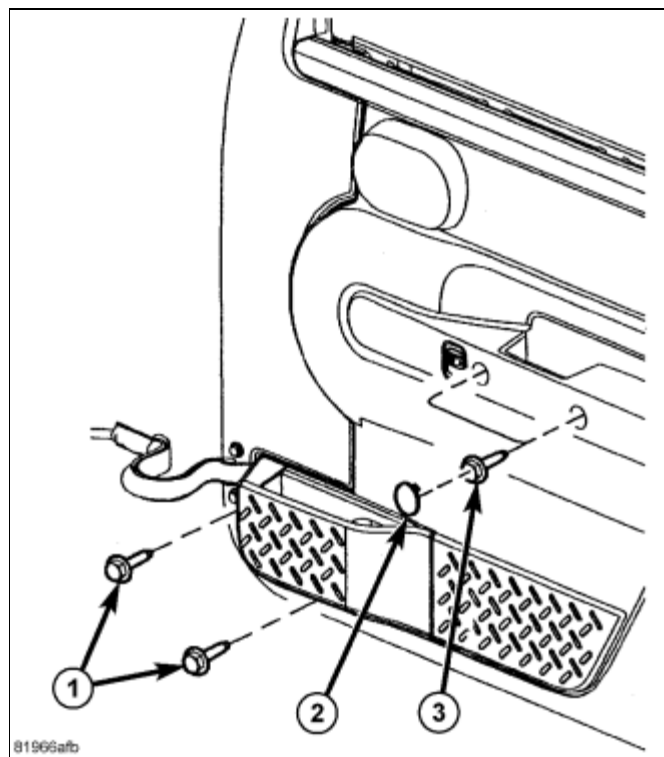


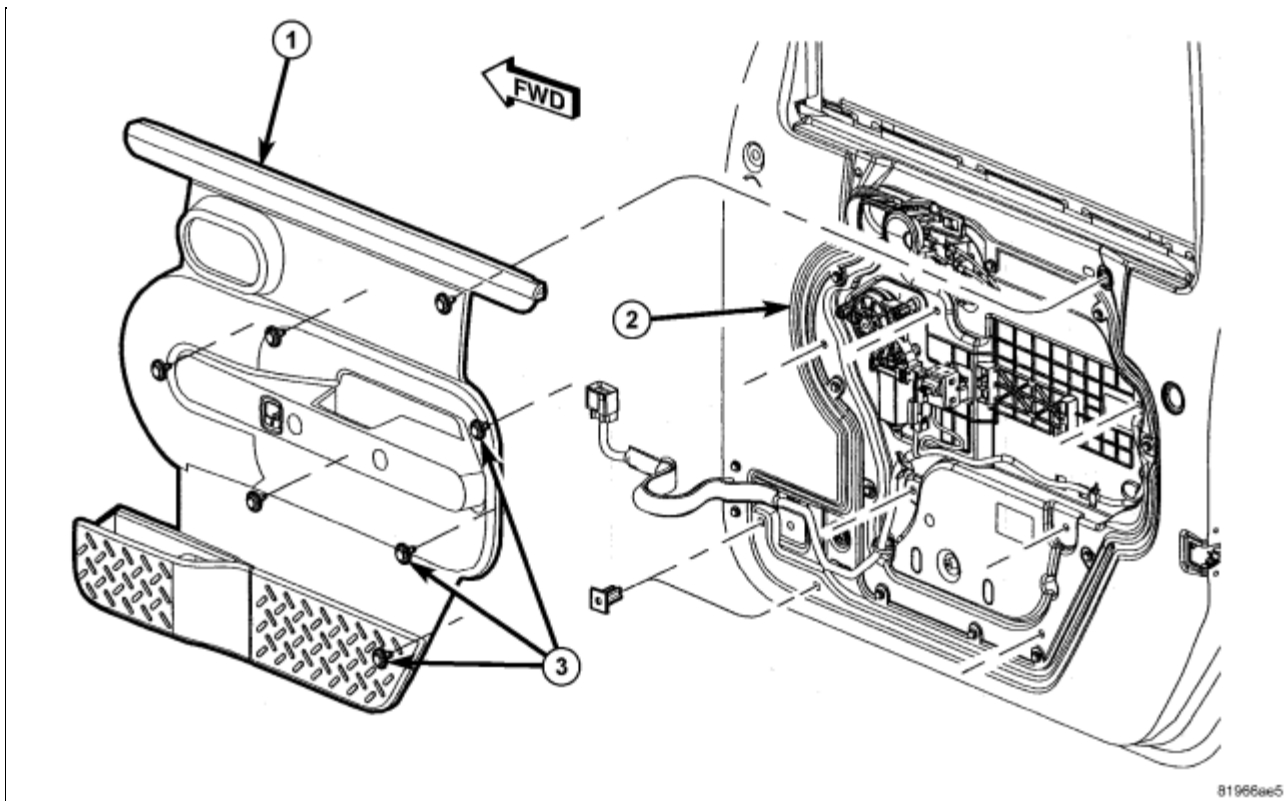
1. Using a standard window handle tool (2), release the handle clips and remove the handle (1) from the window lift mechanism, if equipped with a manual regulator.



NOTE: Full front door shown, rear door similar.

2. Remove the pull handle trim plugs (2) and remove the pull handle screws (3).
3. Remove the screws (1), if equipped.

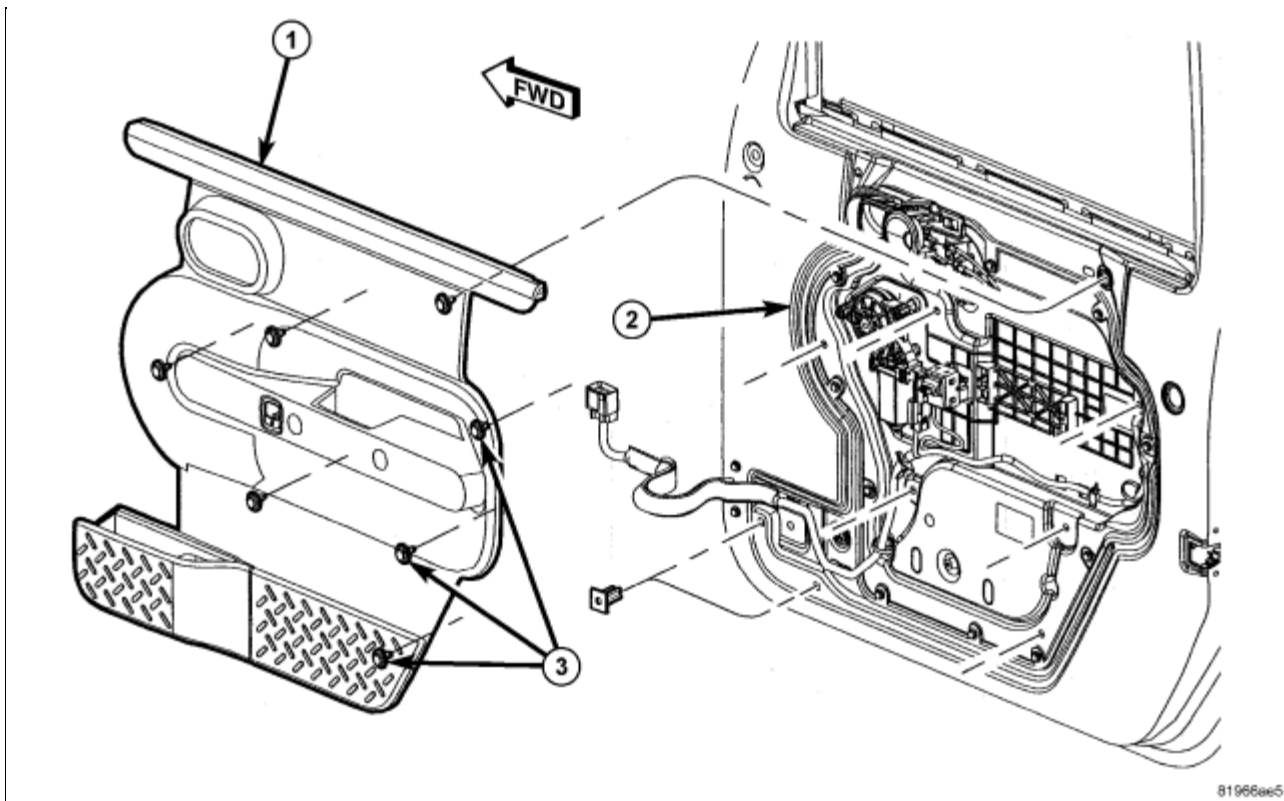




NOTE: Full front door shown, rear door similar.

4. Using a trim stick C-4829 or equivalent, starting at the bottom by the check strap, separate the push pin fasteners (3) and remove the trim panel (1).

INSTALLATION

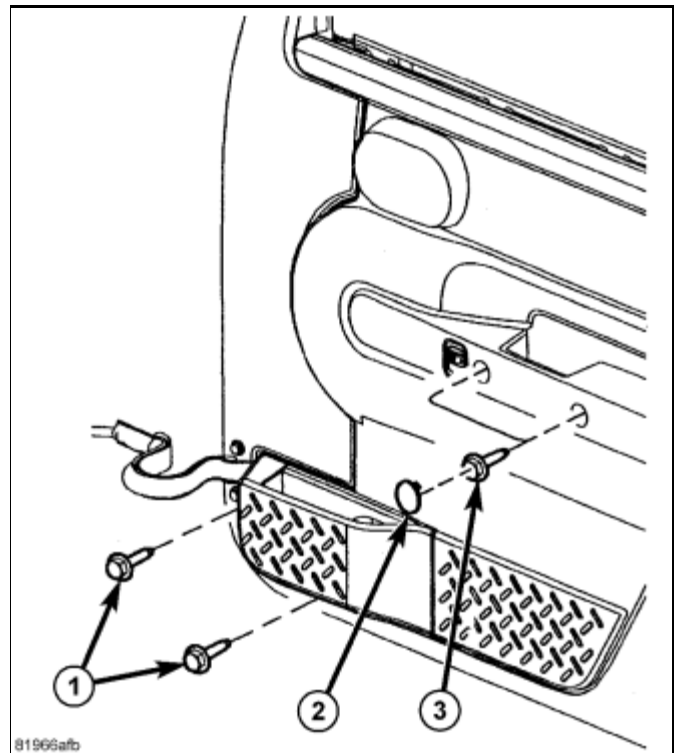


NOTE: Full front door shown, rear door similar.

1. Position the trim panel (1) into place and seat the push pin fasteners (3) fully.

NOTE: Full front door shown, rear door similar.

2. Install the pull handle screws (3) and install the trim caps (2).
3. Install the trim panel screws (1), if equipped.

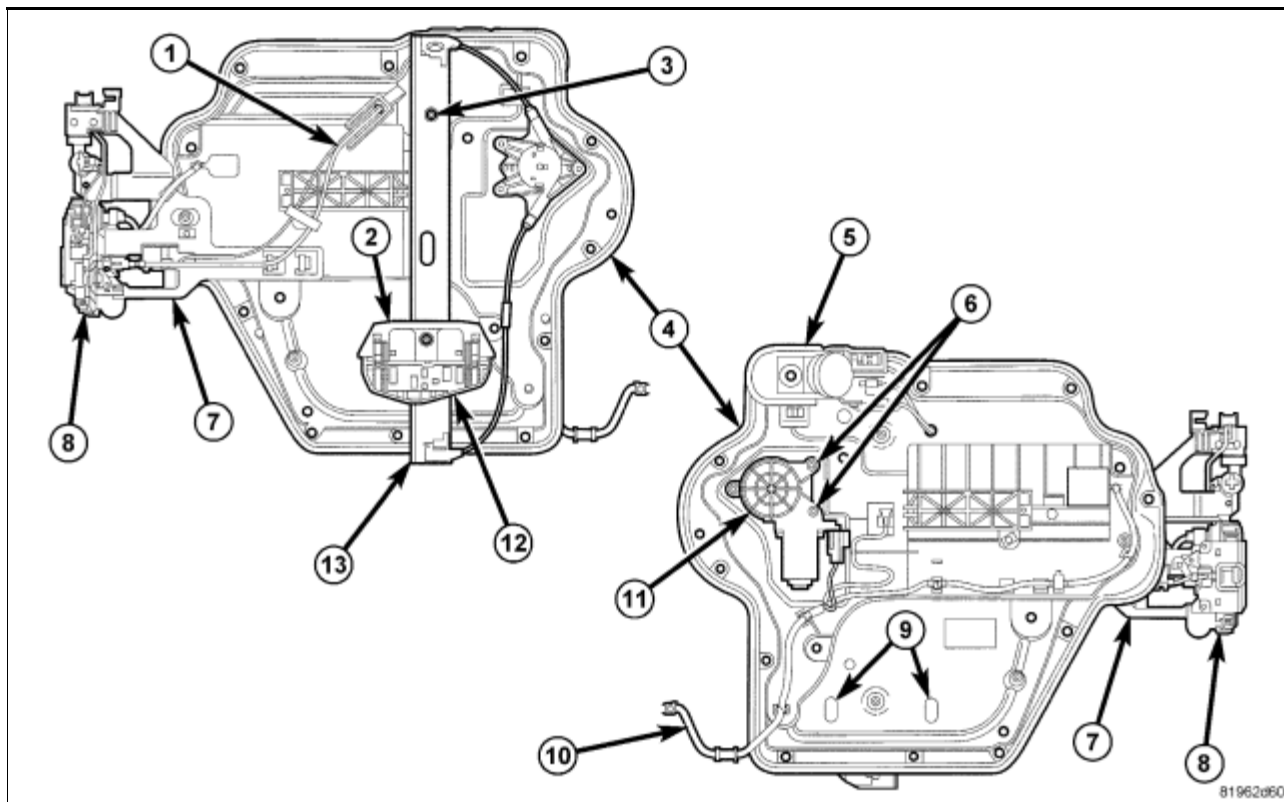
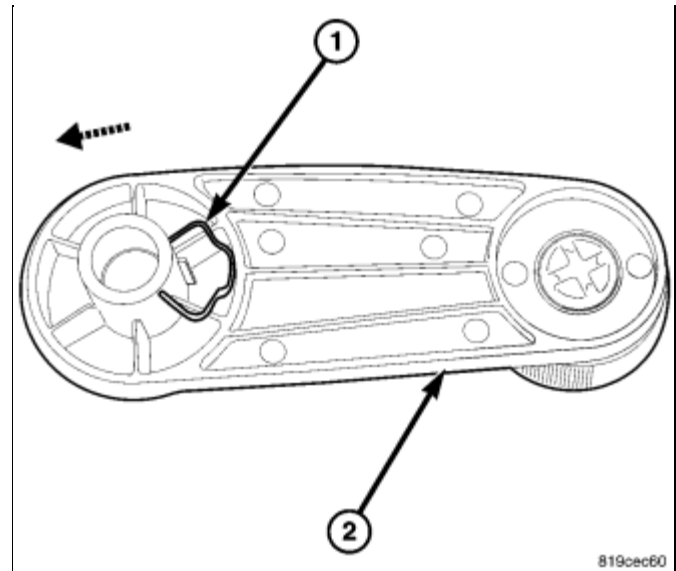


4. If equipped with a manual window regulator, position the window crank handle retaining clip (1) back into place and install the window crank handle (2) onto the lift mechanism shaft and seat fully.

DOOR - FULL REAR

CARRIER PLATE

DESCRIPTION



POWER CARRIER PLATE

1 - LATCH & LOCK CABLES

2 - GLASS CLIP

3 - REGULATOR SCREWS

4 - CARRIER PLATE

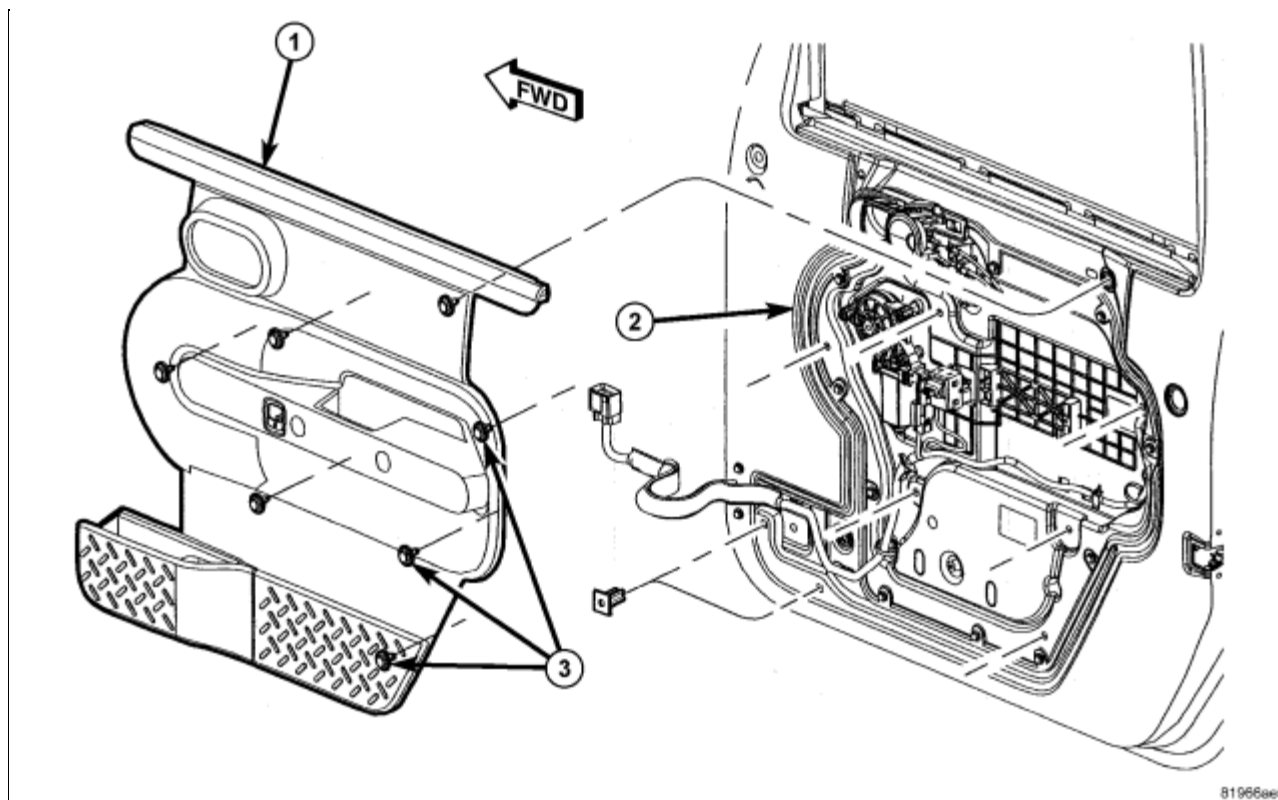
5 - INSIDE HANDLE
6 - REGULATOR MOTOR SCREWS
7 - LATCH MOUNTING BRACKET
8 - LATCH
9 - GLASS DISCONNECT HOLES (PLUGS MUST BE REMOVED TO SERVICE GLASS)
10 - WIRE HARNESS
11 - MOTOR
12 - GLASS LIFT PLATE
13 - REGULATOR

NOTE: Full front door shown, full rear door similar.

Door carrier plates include the hardware, window regulators, latch, remote handle and links and wiring harness. In addition to providing manufacturing efficiencies, the door modules benefit the customer too. Having all the parts assembled into a module improves build accuracy and fit and finish between the components and trim as a result of greater communication between the release engineers and suppliers.

CAUTION: Care must be used when servicing the carrier plate that the seal isn't damaged.

REMOVAL



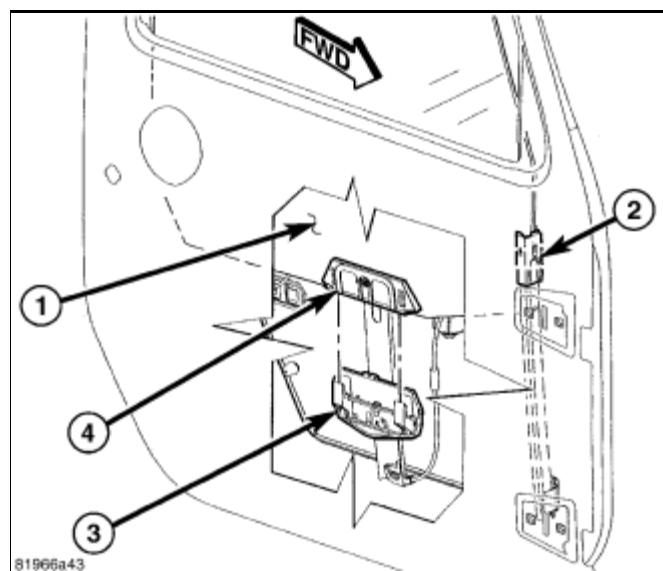
NOTE: Front door trim shown, rear door similar.

1. Position the glass into the down position.
2. Remove the trim panel (1), (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).

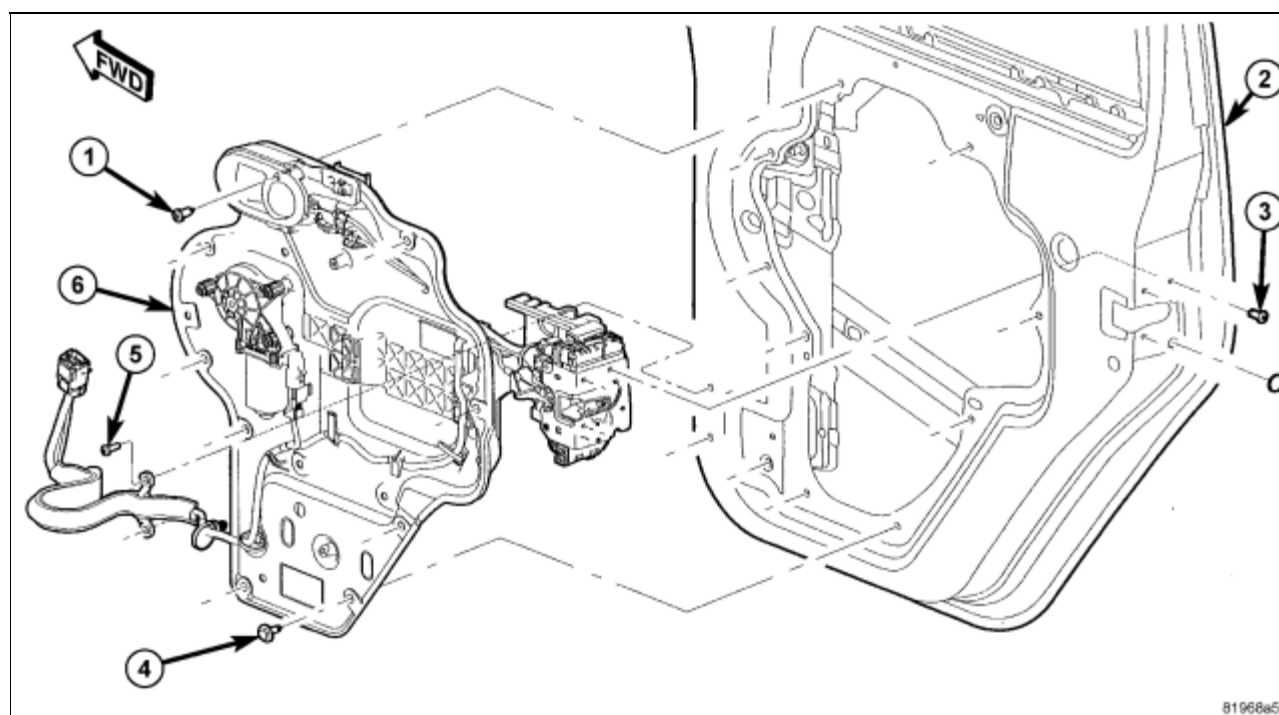
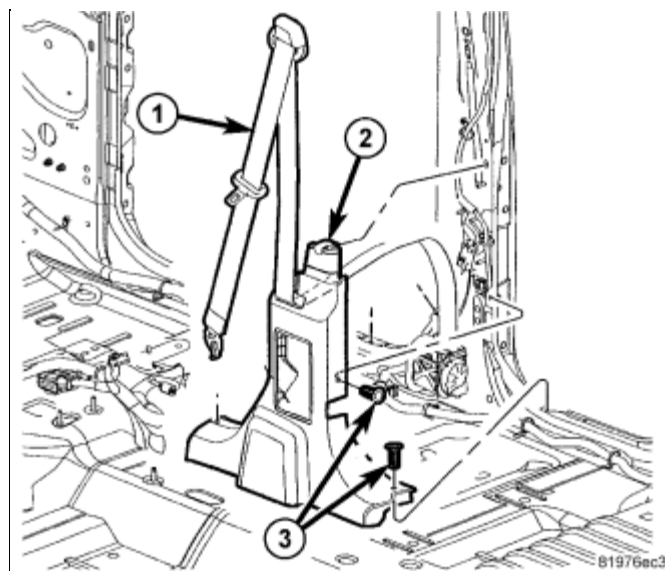
3. If equipped, using a punch or similar tool, carefully remove the glass disconnect hole plugs, (Refer to 23 - BODY/DOOR - FRONT/CARRIER PLATE - DESCRIPTION).

4. Release the two glass retainer tabs (3) and separate the glass clip (4) from the regulator lift plate and position into the full up position.

5. Position the glass (1) into the full up position and using tape or equivalent, secure the glass.

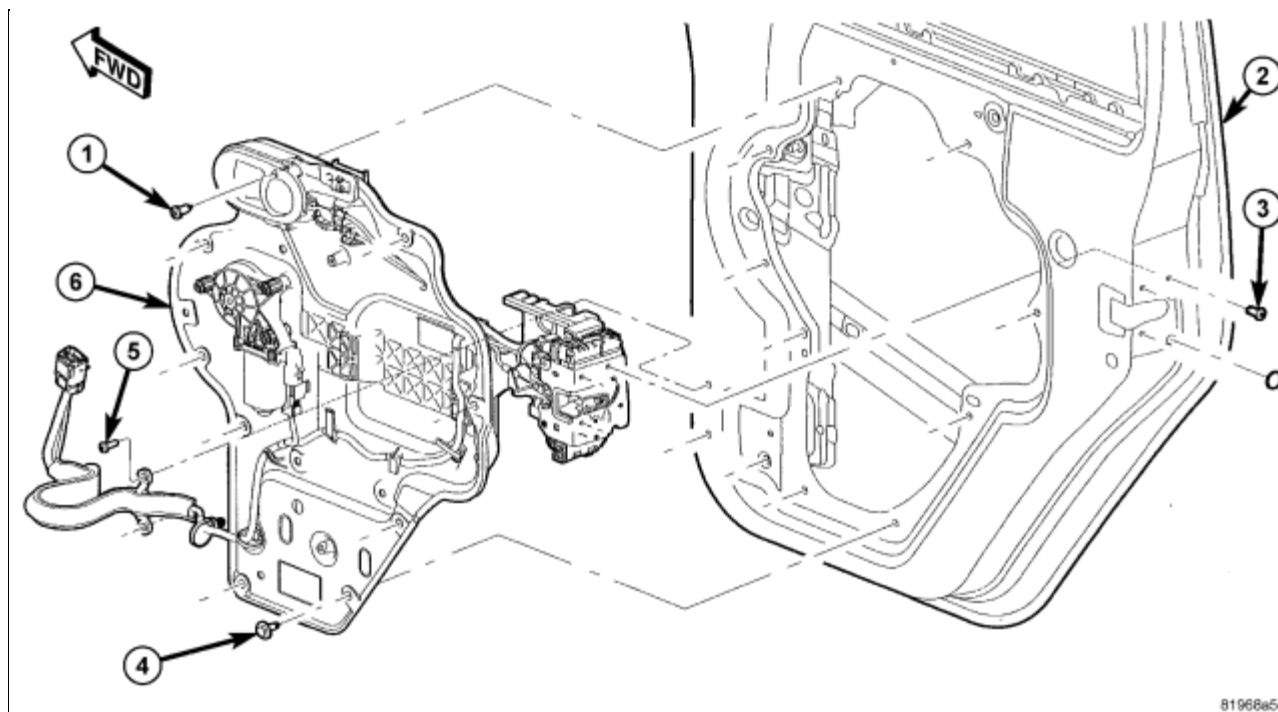


6. Remove the lower B-pillar trim panel (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).



7. Disconnect the door wire harness at the B-pillar and separate the check strap from the hook.
8. Remove the screws (5) and separate the wire harness push pins from the door structure.
9. Remove the door handle screw (1).
10. Remove the latch screws (3).
11. Separate the foam seal and disconnect the exterior handle rods from the access hole in the carrier plate.
12. Remove the carrier plate screws (4) and remove the carrier plate assembly (6) from the door.

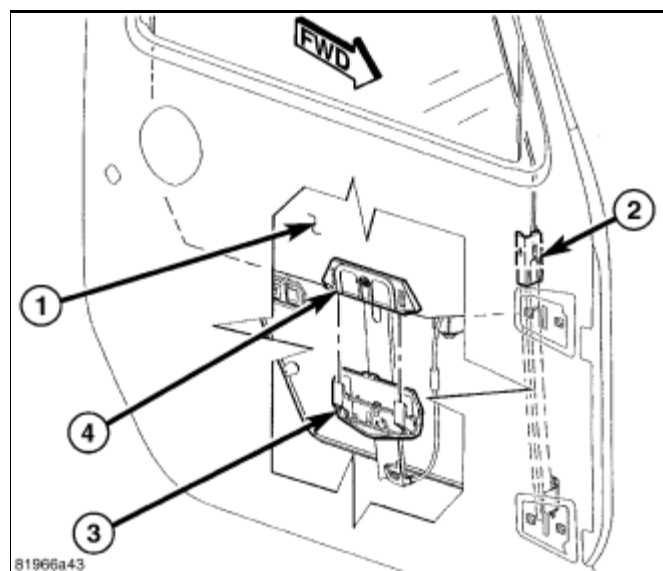
INSTALLATION

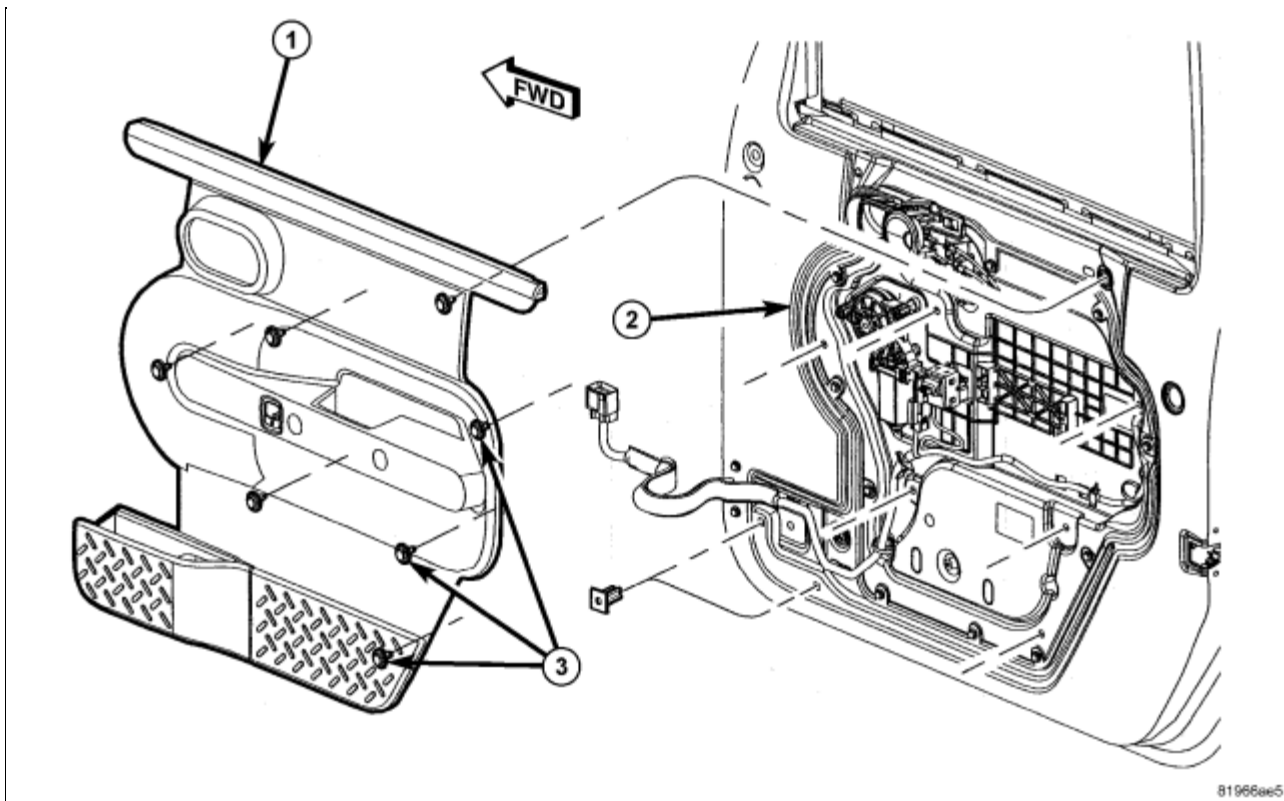


1. Place the latch assembly into the door opening and install the carrier plate (6) onto the door.
2. Install the latch screws (3) and tighten to 8 N·m (71 in. lbs.) top screws first.
3. Install the eight carrier plate screws (4) and tighten to 10 N·m (90 in. lbs.).
4. Install the inside door handle screw (1) and tighten to 8.5 N·m (75 in. lbs.).
5. Connect the exterior handle latch rods.
6. Replace the foam sealer over the access hole.
7. Install the wire harness onto the door and install the screws (5).
8. Connect the wire harness electrical connector at the B-pillar.

NOTE: Front door shown, rear door similar.

9. Slowly lower the glass (1) all the way down into the regulator lift plate (3) and seat the glass clip (4) fully until a snap sound is heard.
10. Seal the glass disconnect holes with a suitable foam tape or equivalent.





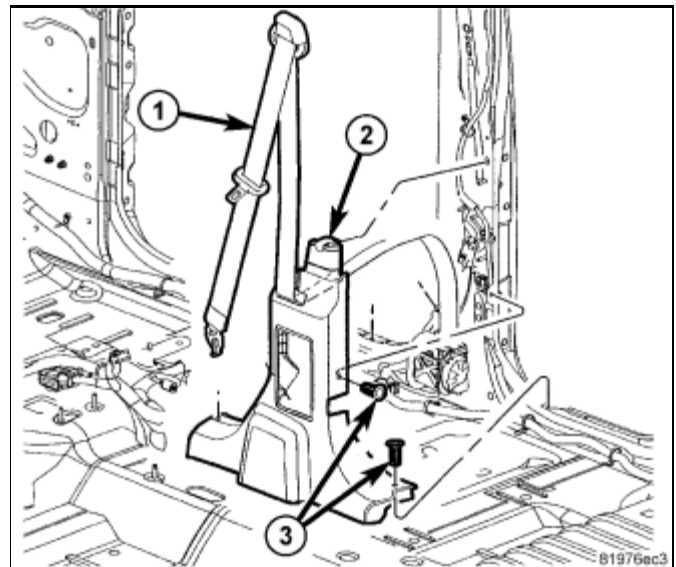
NOTE: Front door shown, rear door similar.

11. Install the door trim panel (1), (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

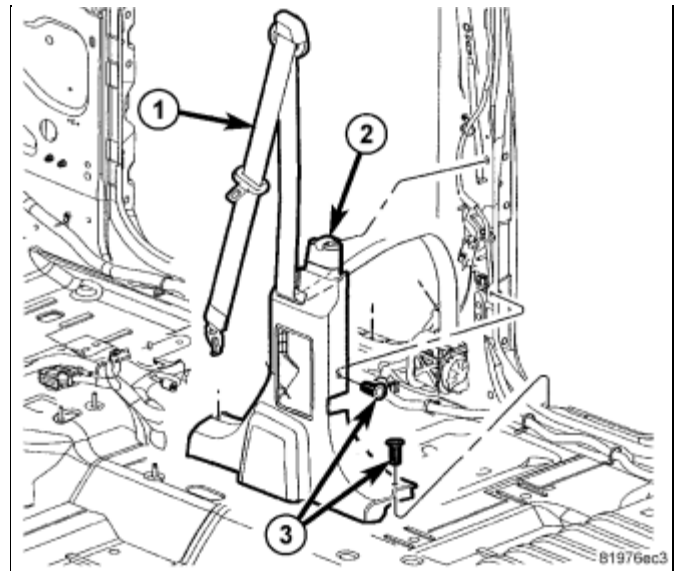
12. Install the lower B-pillar trim (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

DOOR

REMOVAL

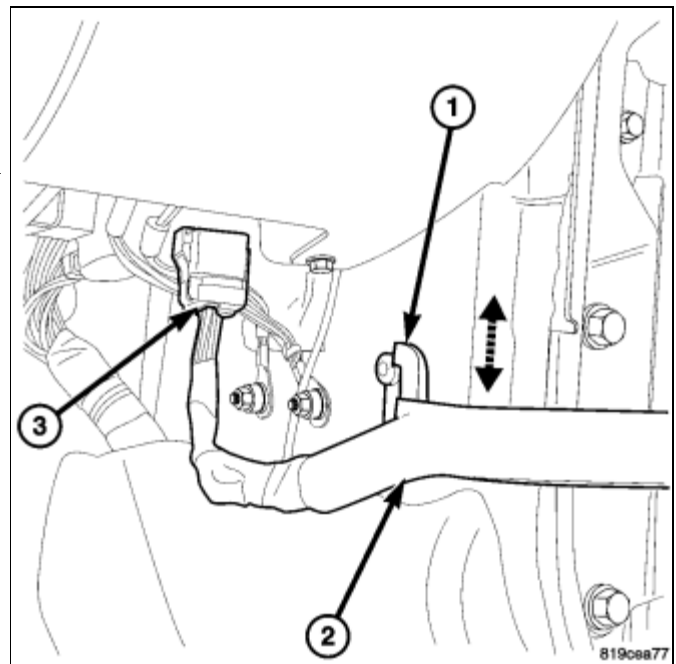


1. Remove the lower B-pillar trim panel (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).



NOTE: Front door check strap shown, rear doors are similar.

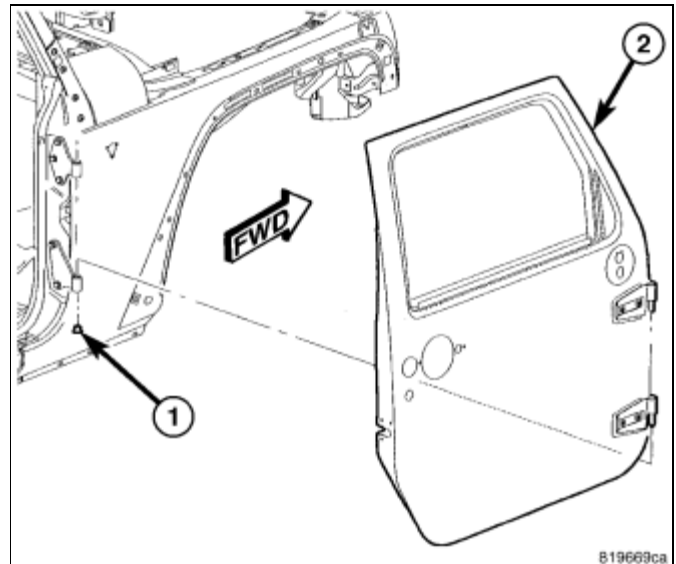
2. Disconnect the electrical connector (3) at the A-pillar cowl area and separate the check strap (2) from the footman's loop (1).



NOTE: Full front door shown, all others similar.

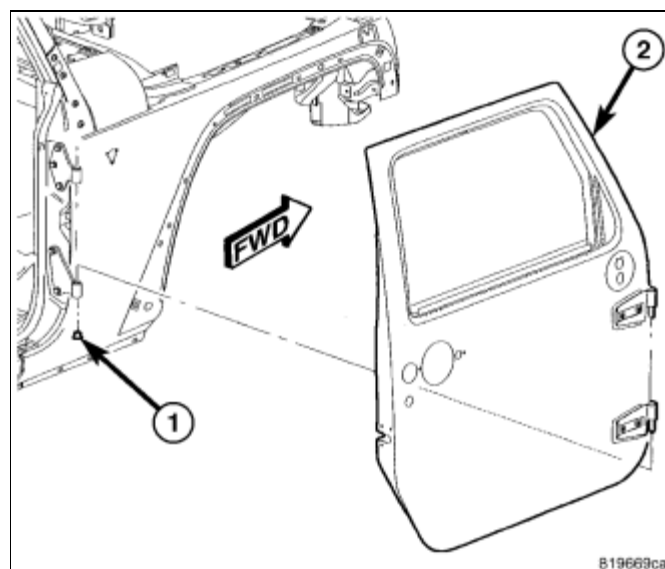
3. Remove the nuts (1) and lift the door (2) up off hinges and remove.

INSTALLATION



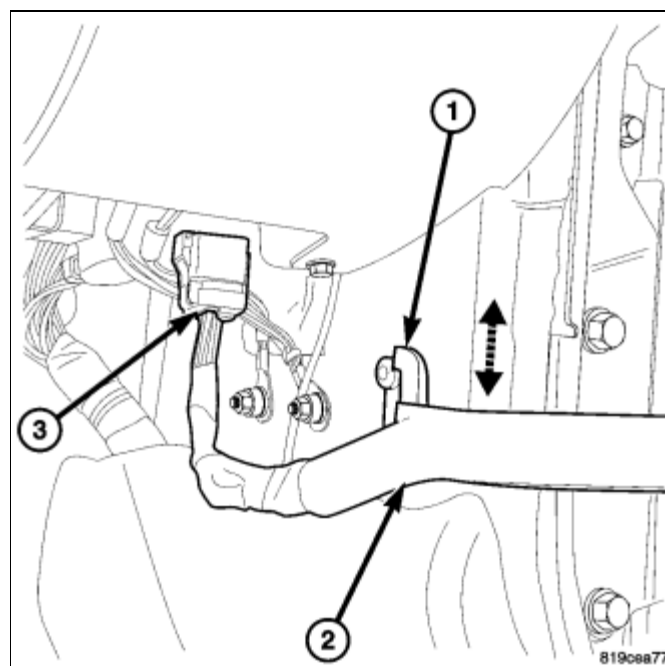
NOTE: Full front door shown, all others similar.

1. Align pins on door hinge to holes in hinge on body and position door into place.
2. Install the nuts (1) and tighten to 8.5 N·m (75 in. lbs.).
3. If necessary, adjust the door (2), (Refer to 23 - BODY/DOOR - FULL REAR/DOOR - ADJUSTMENTS)



NOTE: Front door check strap shown, rear doors are similar.

4. Secure the check strap (2) over the footman's loop (1) and connect the electrical connector (3).

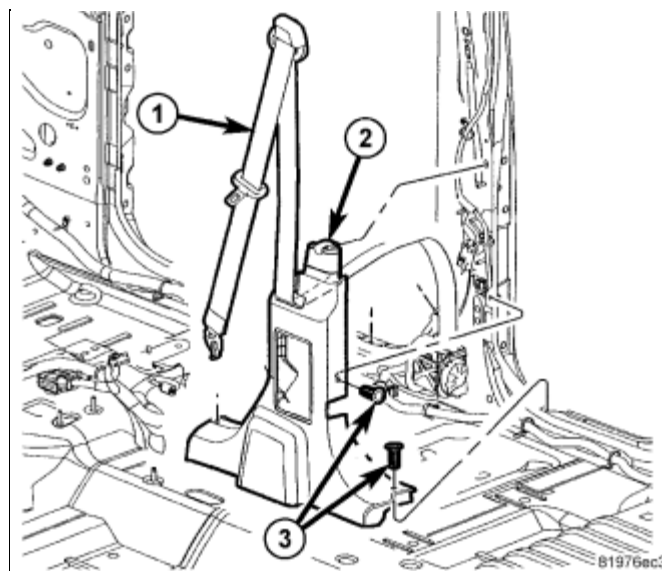


5. Install the lower B-pillar trim (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

ADJUSTMENTS

ADJUSTMENT

NOTE: For four door vehicles, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)



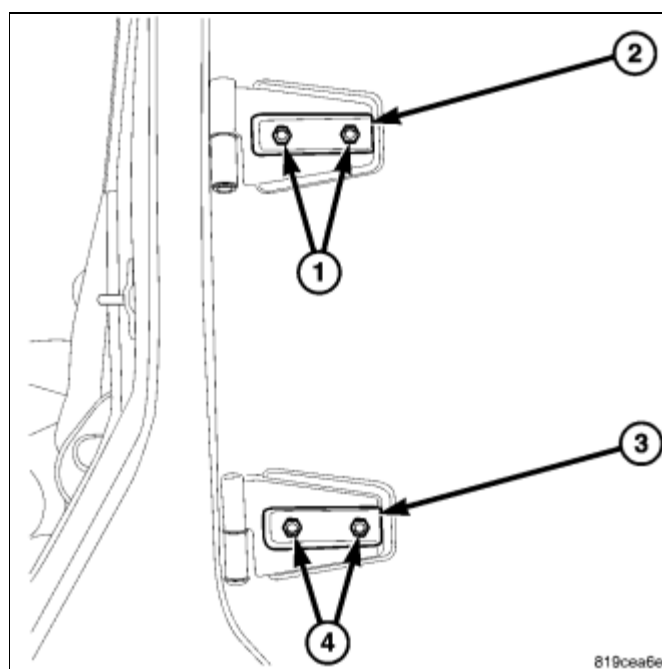
Full front door shown, all others similar.

- Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.
- During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.
- A suitable body sealant should be used when removing or moving the hinges.

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the door fasteners one hinge at a time and moving the door to the correct position.

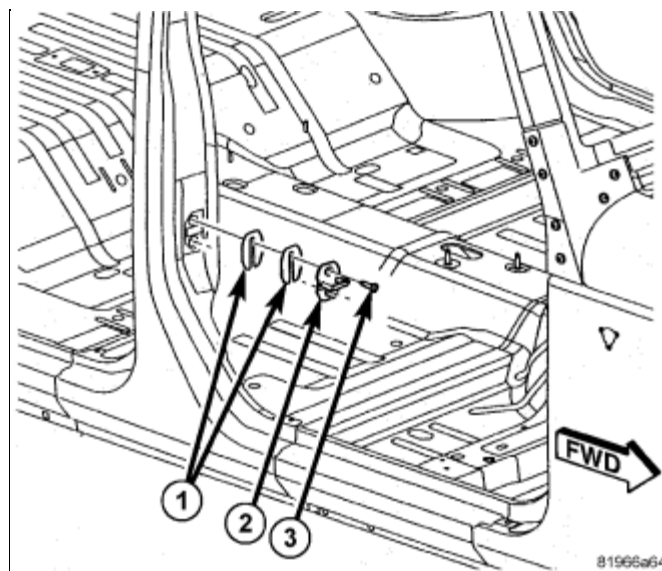
1. Support the door with a suitable lifting device.
2. Loosen the upper (1) and lower (4) hinge to door fasteners. (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge to door bolts to 26 N·m (19 ft. lbs.).



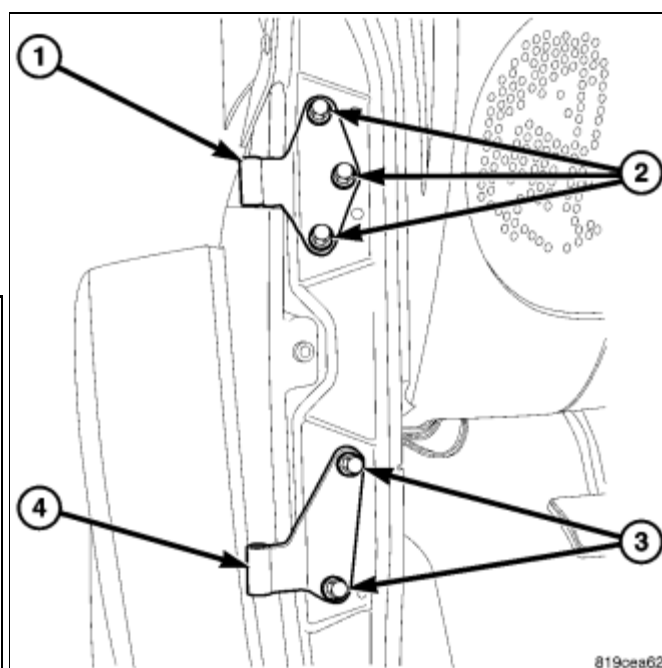
UP/DOWN

NOTE: Up/down door adjustment is done by loosening hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

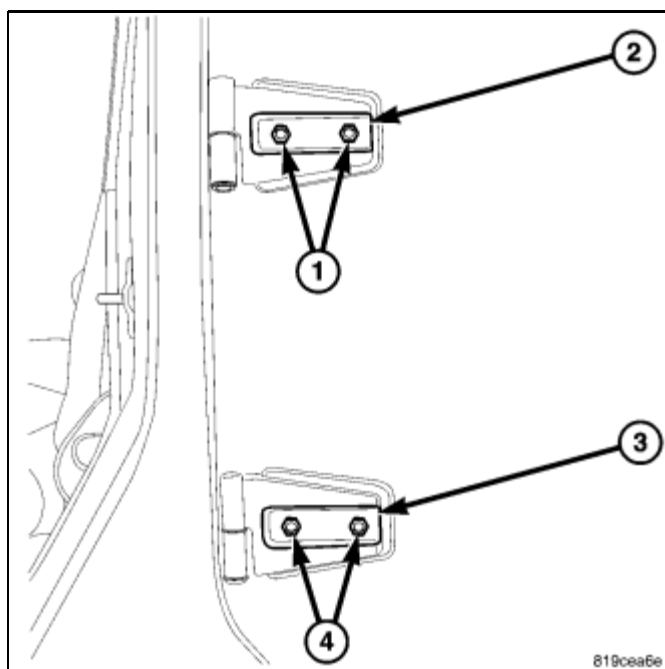
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. If necessary, loosen the hinge to hinge pillar fasteners (2) and (3). (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
4. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).



5. If

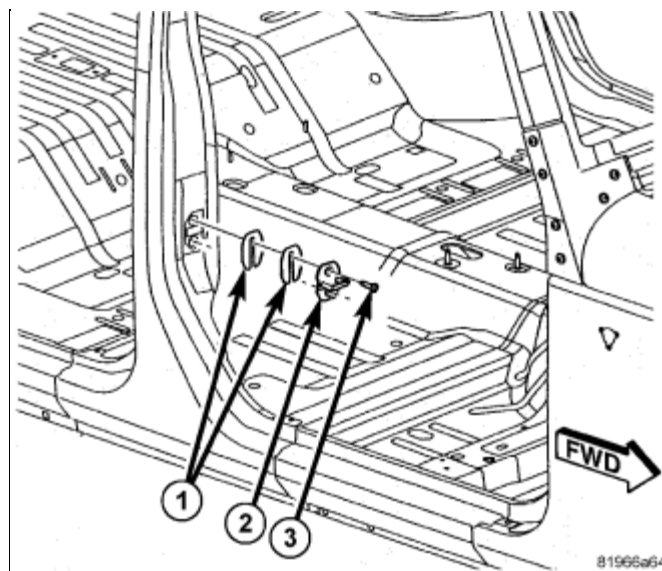


necessary, Loosen the hinge to door fasteners (1) and (4). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

6. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
7. Tighten the door to hinge fasteners to 26 N·m (19 ft. lbs.).

8. Tighten the latch striker bolts (3) 26 N·m (19 ft. lbs.). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER -

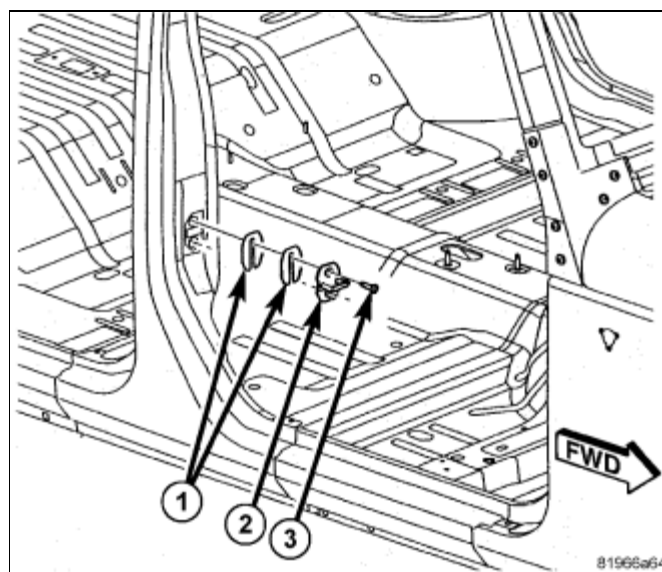
INSTALLATION)



IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to body fasteners one hinge at a time and moving the door to the correct position.

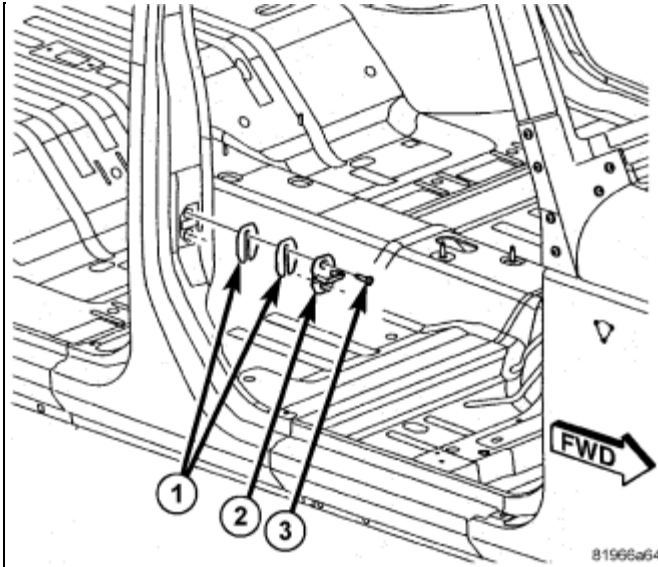
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



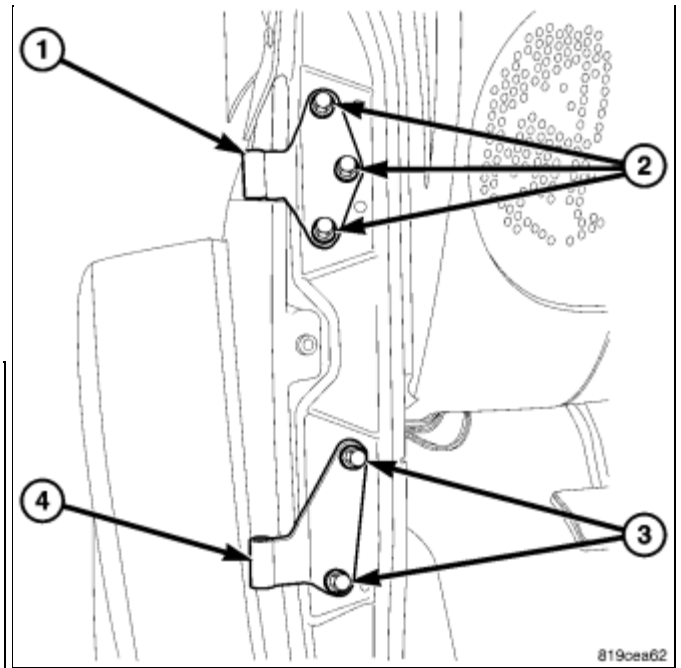
3. Loosen the hinge to body fasteners (2) and (3), (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).

6.
Tighten
the latch

striker
bolts (3)
to 26
N·m (19
ft. lbs.).
(Refer to
23 -

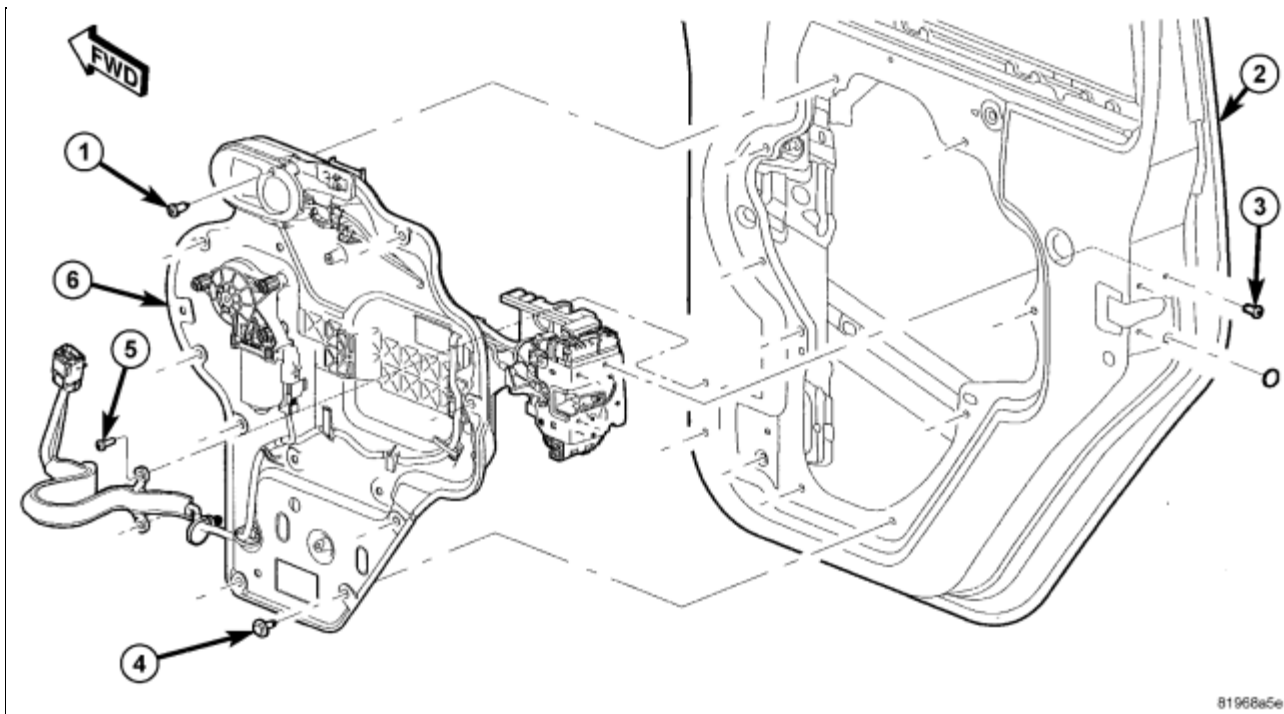


BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



GLASS - DOOR

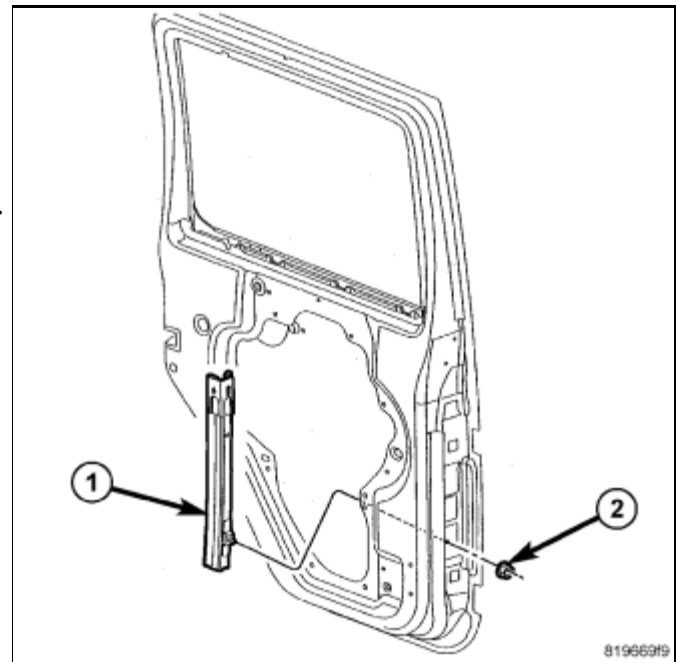
REMOVAL



1. Remove the carrier plate (6), (Refer to 23 - BODY/DOORS - REAR/CARRIER PLATE - REMOVAL)

2. Remove the nut (2) and position the run channel (1) aside.
3. Lower the glass into the bottom of the door.
4. Remove the outer belt molding.
5. Remove the stationary glass division bar bolt and separate the stationary glass and weatherstrip assembly from the door.
6. Remove the door glass from the door window opening.

INSTALLATION

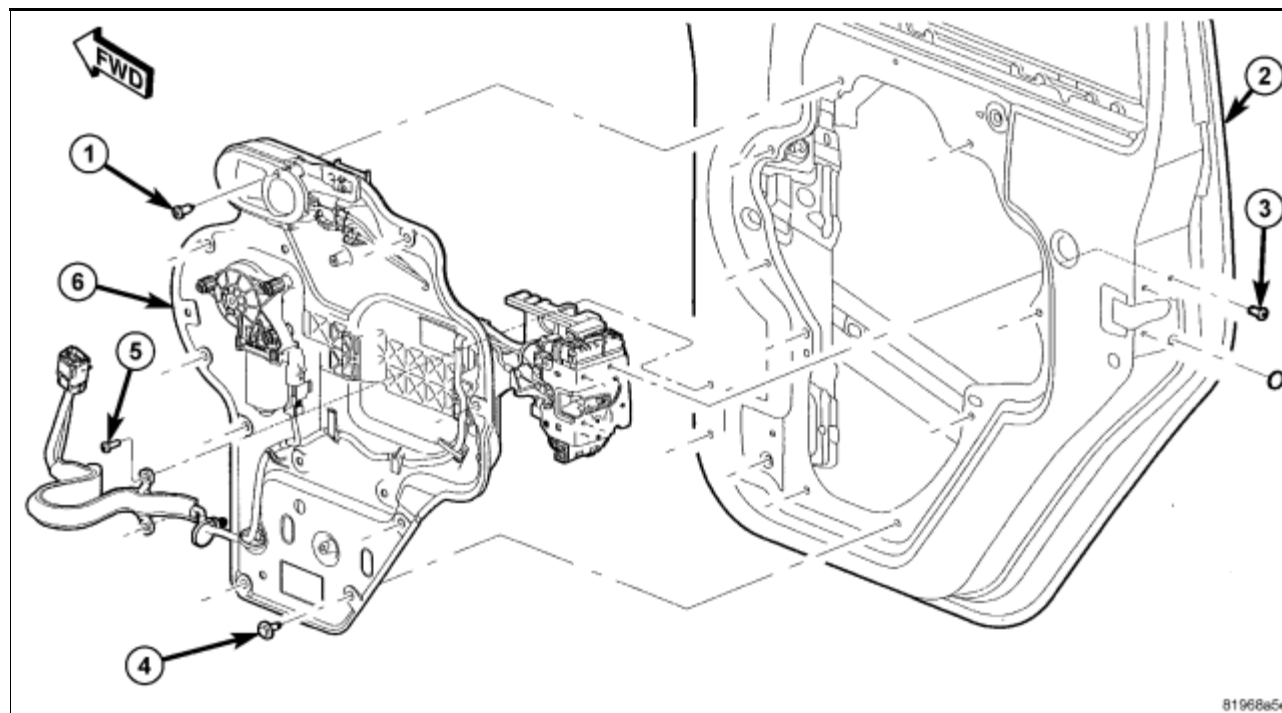
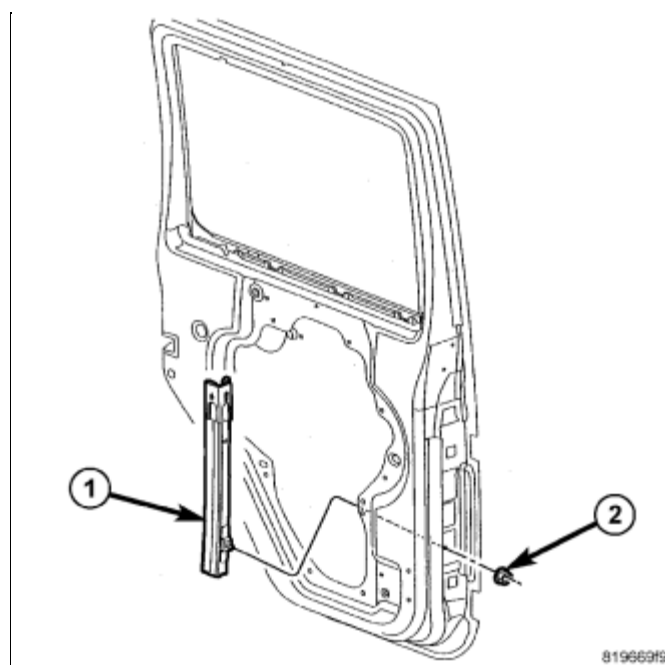


1. Install the door glass into the door through the window opening and position into the bottom of the door.
2. Install the stationary glass and weatherstrip and seat fully.
3. Install the division bar bolt and tighten to 12 N·m (9 ft. lbs.).
4. Install the outer belt molding.
5. Position the glass into the full up position and secure in

place using tape or other suitable device.

6. Install the glass run channel (1) and install the nut (2).

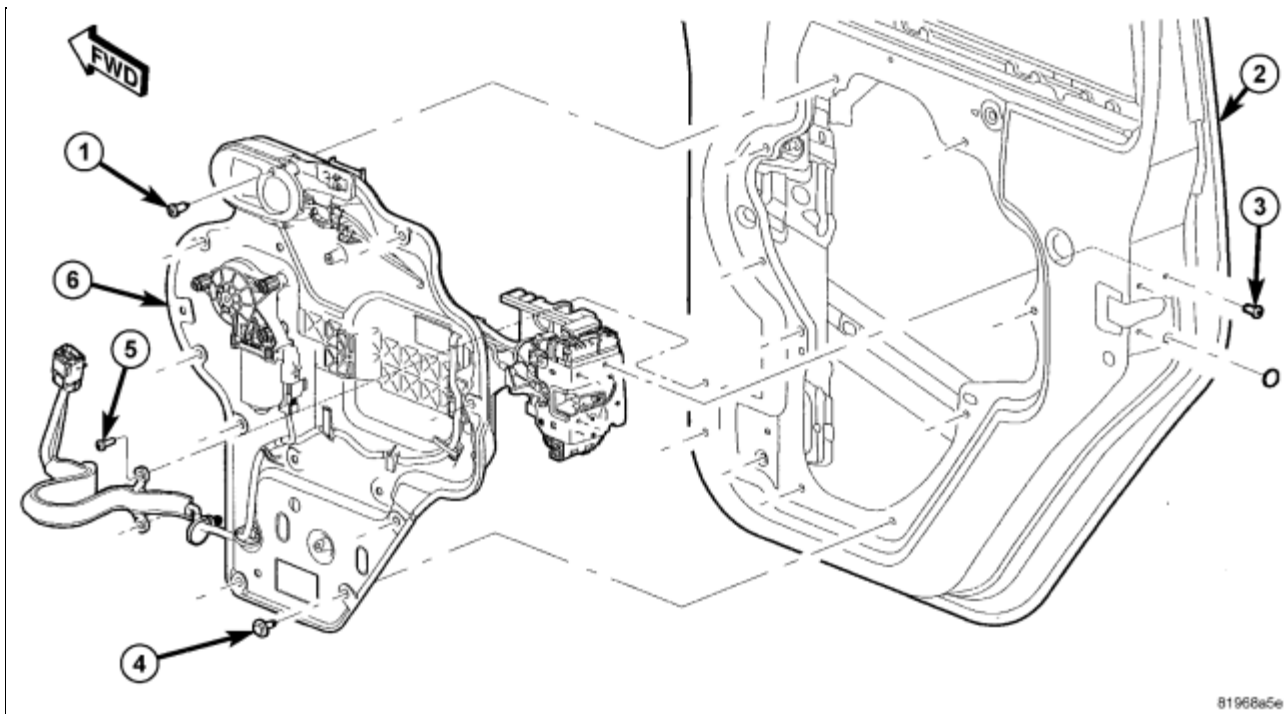
7. Tighten the nut to 10 N·m (90 in. lbs.).



8. Install the carrier plate (6), (Refer to 23 - BODY/DOORS - REAR/CARRIER PLATE - INSTALLATION).

HANDLE - EXTERIOR DOOR

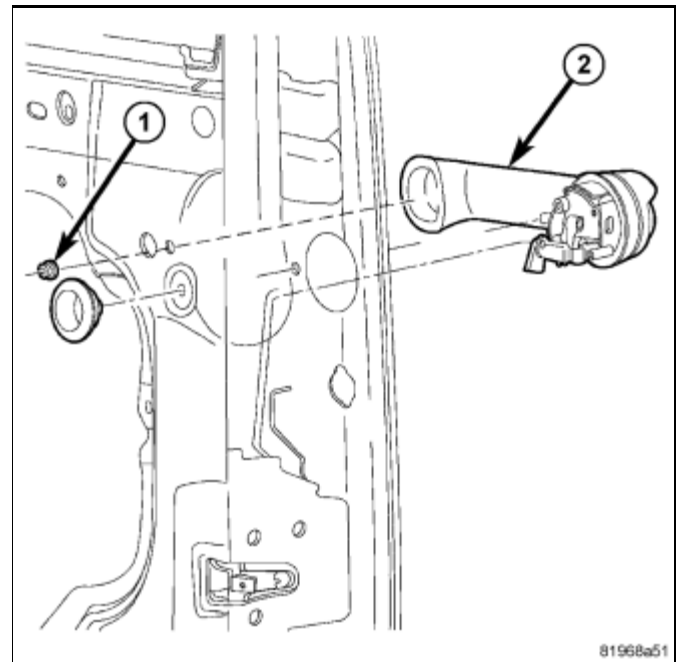
REMOVAL



1. Remove the carrier plate (6), (Refer to 23 - BODY/DOORS - REAR/CARRIER PLATE - REMOVAL)

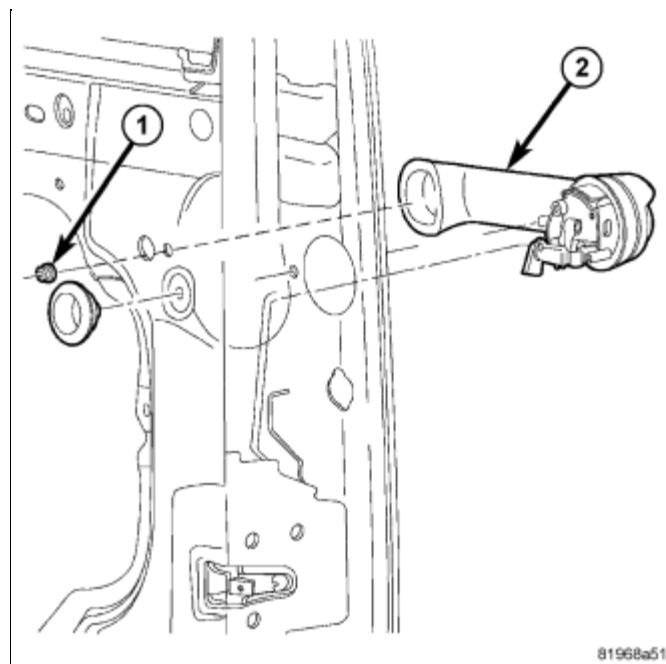
2. Remove the nuts (1) and remove the handle (2).

INSTALLATION

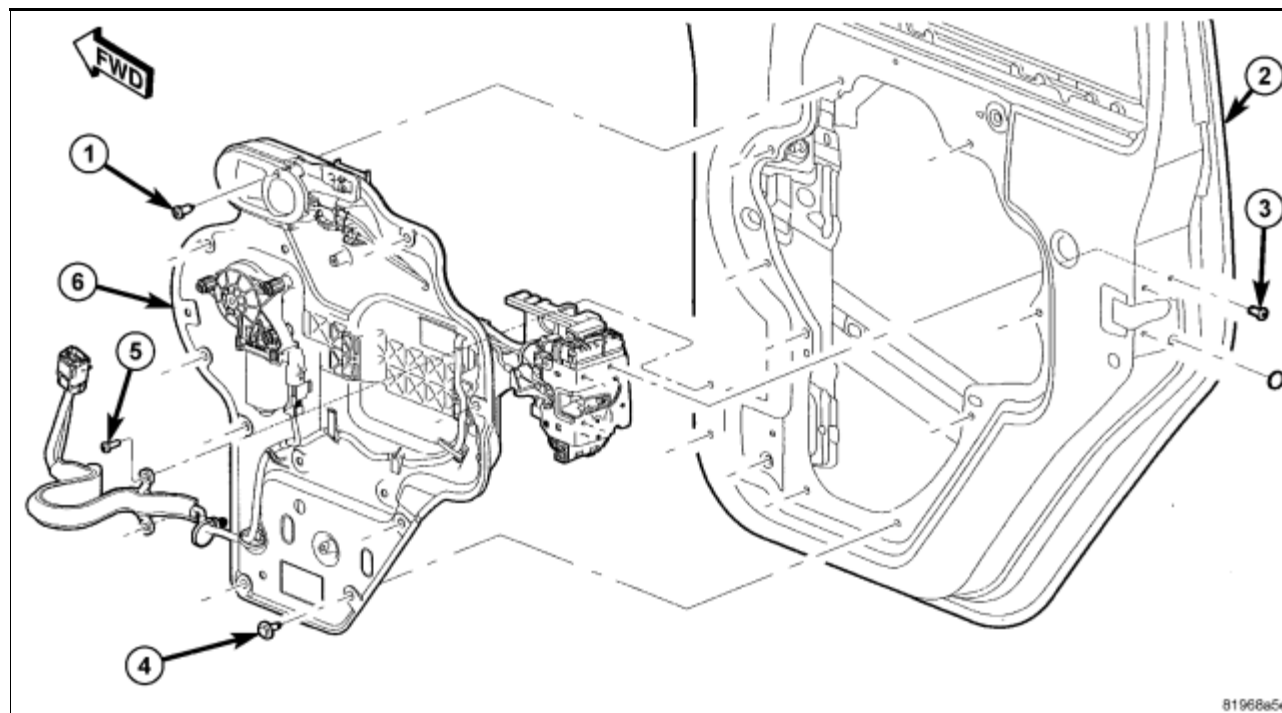


1. Install the handle (2) and install the nuts (1).

2. Tighten the nuts to 4.5 N·m (40 in. lbs.).



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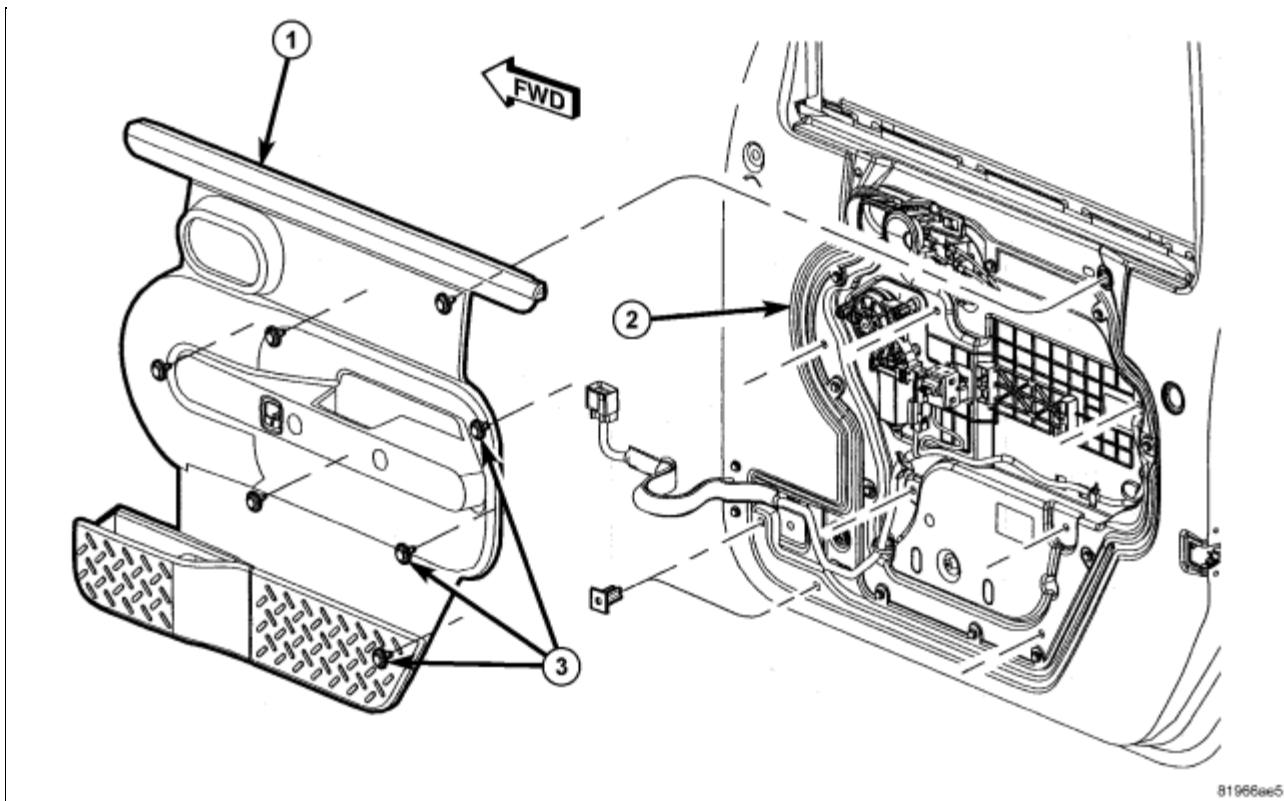


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3. Install the carrier plate (6), (Refer to 23 - BODY/DOORS - REAR/CARRIER PLATE - INSTALLATION).

HANDLE - INSIDE RELEASE

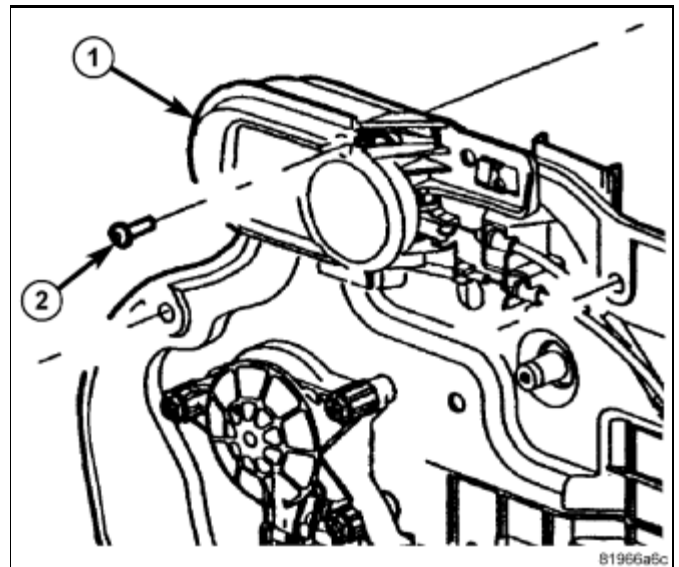
REMOVAL



NOTE: Front door shown, rear door similar.

1. Remove the door trim panel (1), (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).

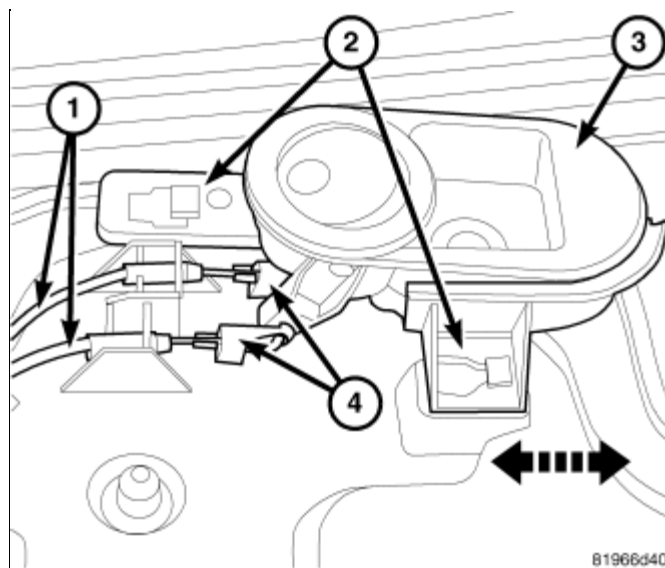
2. Remove the screw (2) securing the handle (1) to the carrier plate.



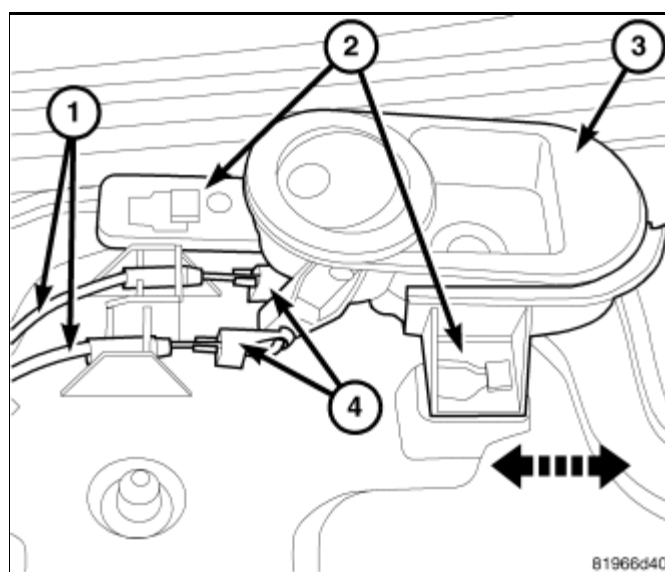
3. Disconnect the clips (4) and disconnect the cables (1).

4. Slide the handle (3) off of the retaining tabs (2) and remove.

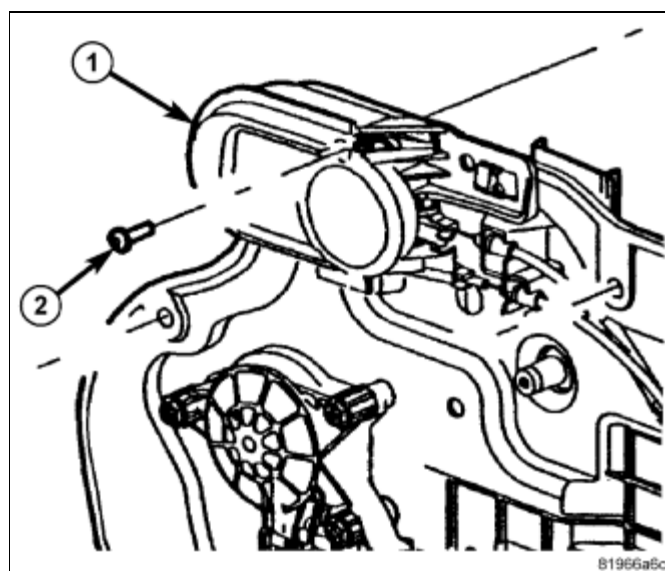
INSTALLATION

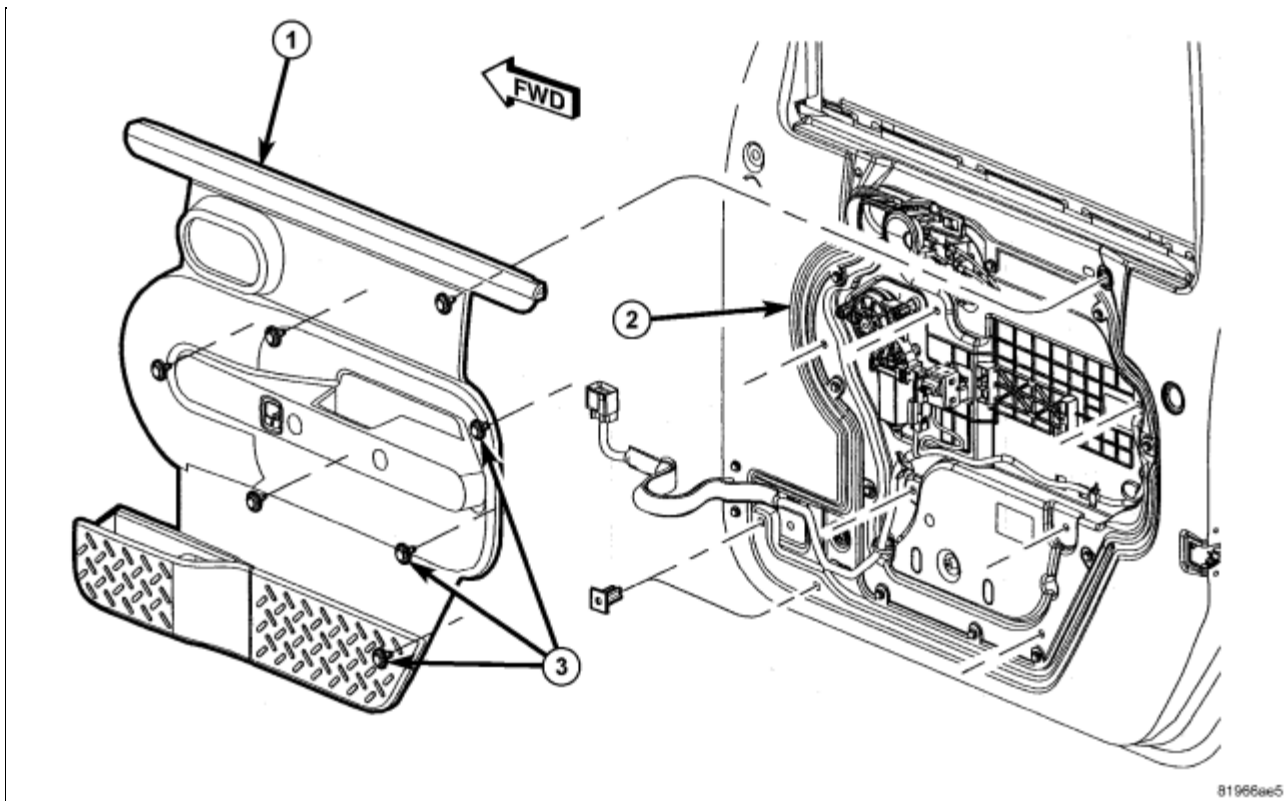


1. Position the handle (3) onto the carrier plate tabs (2) and slide into place fully.
2. Connect the cables (1) and secure the clips (4).



3. Install the inside door handle screw (2) and tighten to 8.5 N·m (75 in. lbs.).





NOTE: Front door shown, rear door similar.

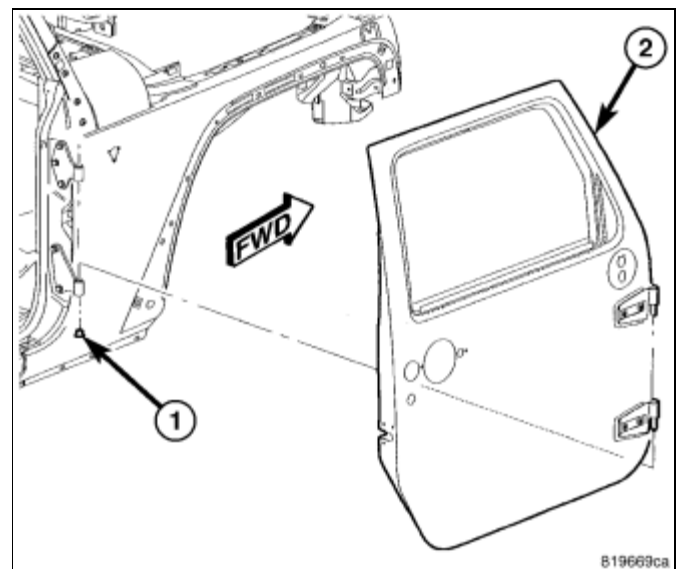
4. Install the trim panel (1), (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).

HINGE

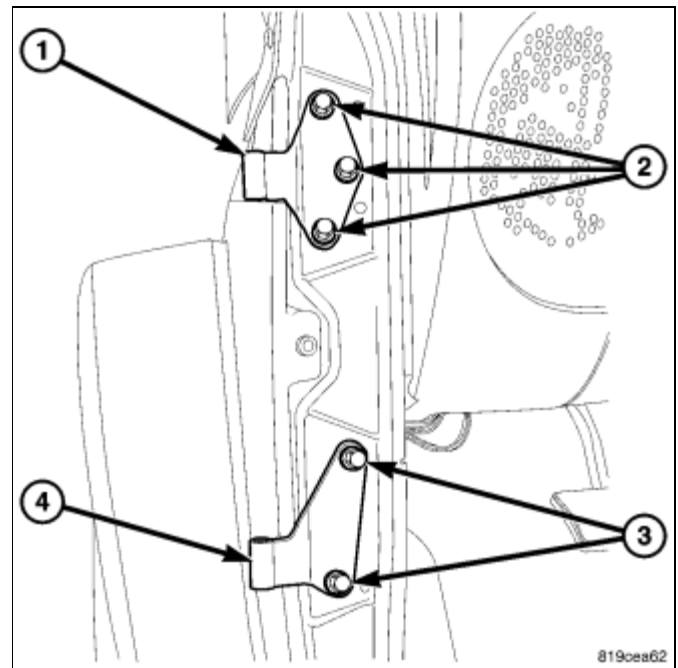
REMOVAL

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - REMOVAL).

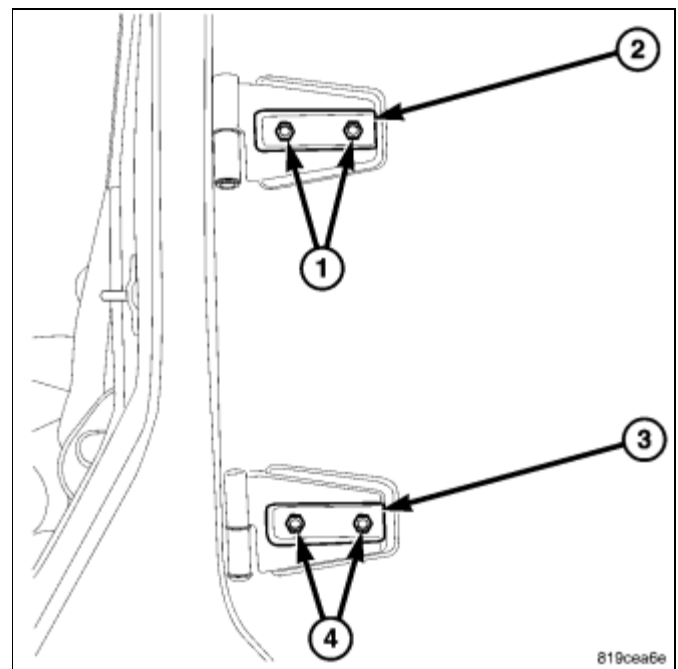


2. Using a grease pencil or equivalent, mark the body hinge (1) and (4) location and remove the bolts (2) and (3).



3. Using a grease pencil or equivalent, mark the door hinge (2) and (3) location and remove the bolts (1) and (4).

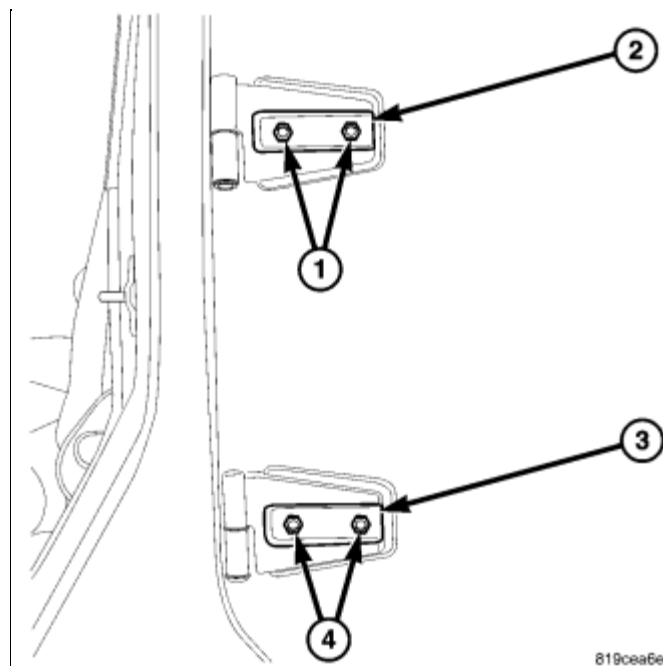
INSTALLATION



NOTE: A suitable body sealant should be used when removing or moving the hinges.

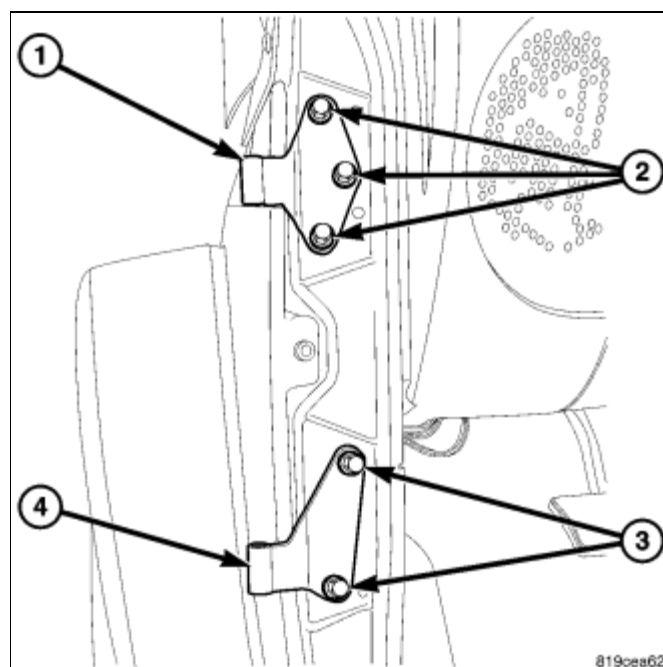
1. Install the door hinges (2) and (3), and install the bolts (1) and (4).

2. Align the hinges to the door using the reference marks made during the removal procedure and tighten the bolts to 26 N·m (19 ft. lbs.).



3. Install the body hinges (1) and (4), and install the bolts (2) and (3).

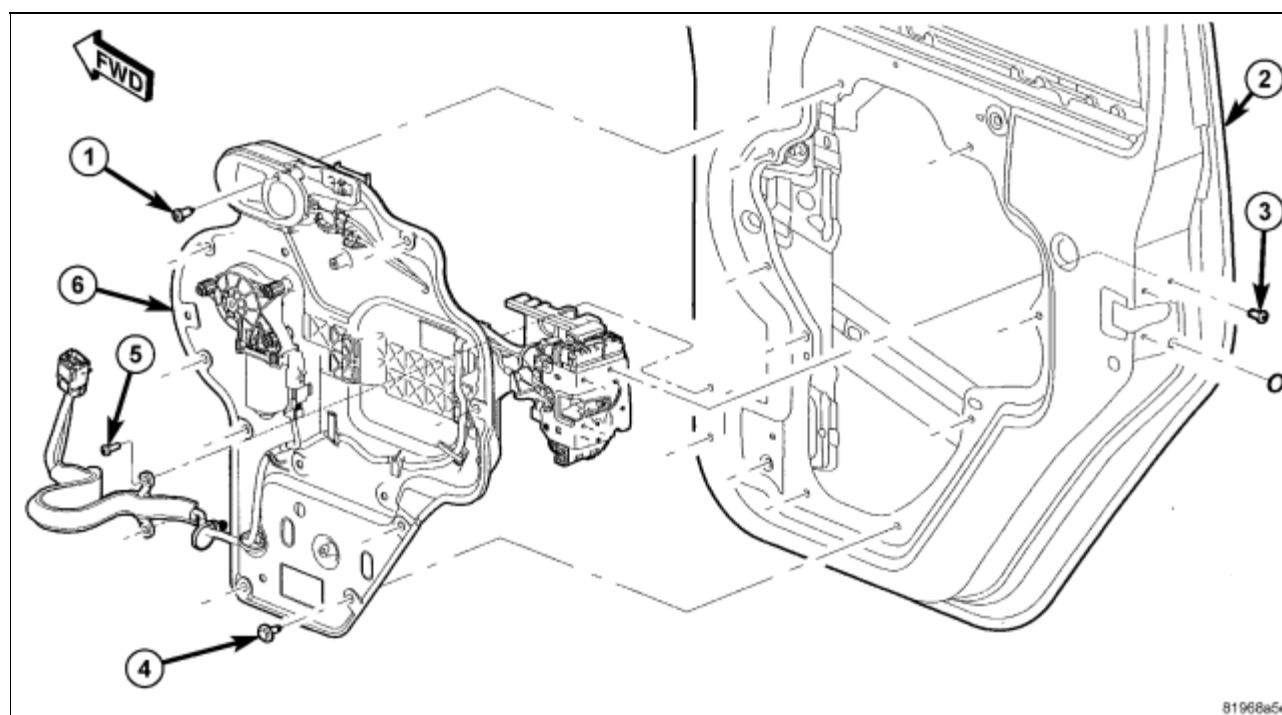
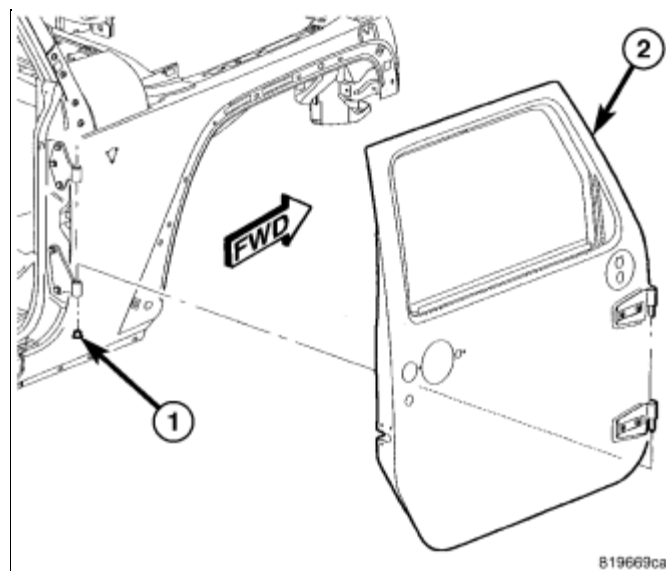
4. Align the hinges to the body using the reference marks made during the removal procedure and tighten the bolts to 28 N·m (21 ft. lbs.).



5. Install the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - INSTALLATION).

LATCH

REMOVAL

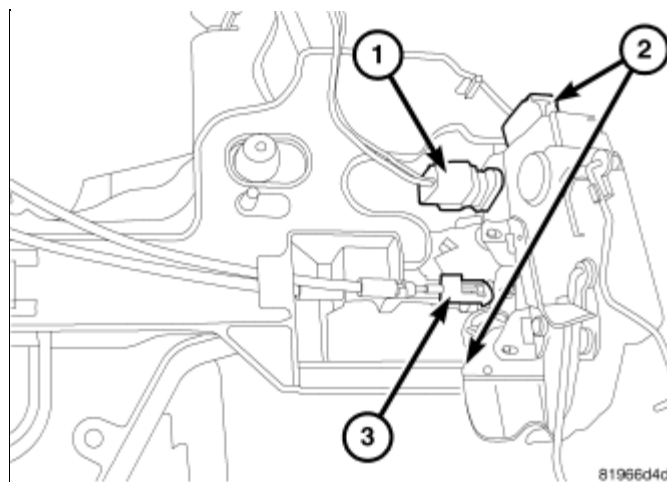


1. Remove the carrier plate (6), (Refer to 23 - BODY/DOOR - FULL REAR/CARRIER PLATE - REMOVAL).

NOTE: Front door shown, rear door similar.

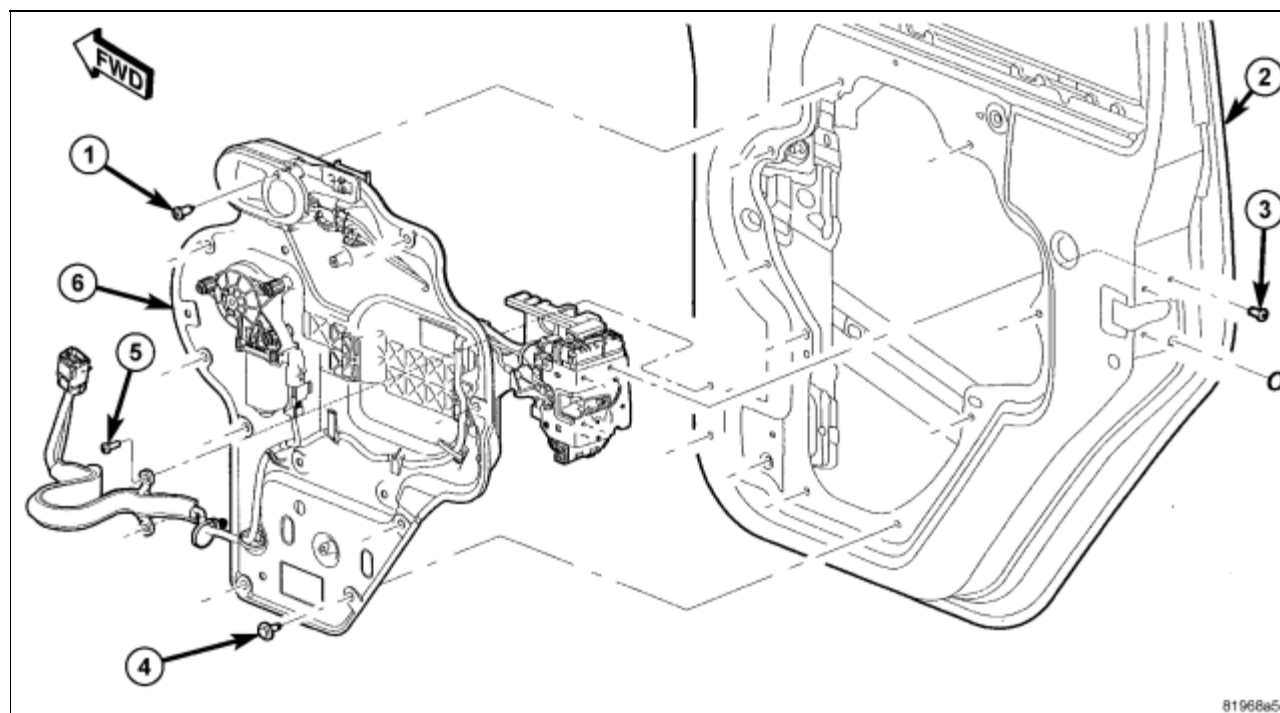
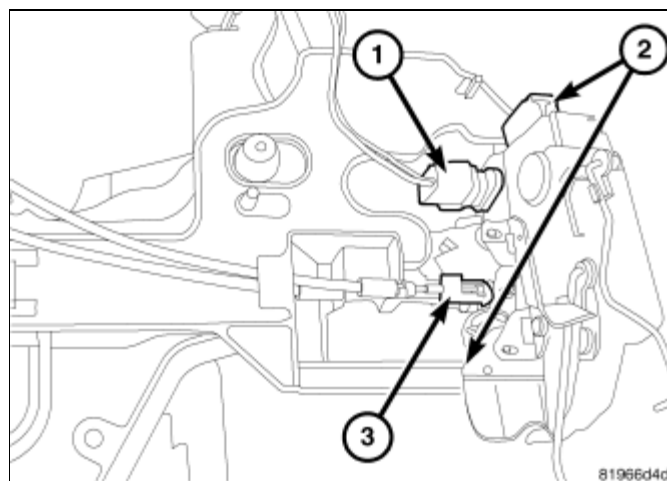
2. Disconnect the actuator rods.
3. Disconnect the electrical connector (1).
4. Disconnect the latch cables (3).
5. Slide the latch off the latch bracket tabs (2) and remove the latch.

INSTALLATION



NOTE: Front door latch shown, rear door similar.

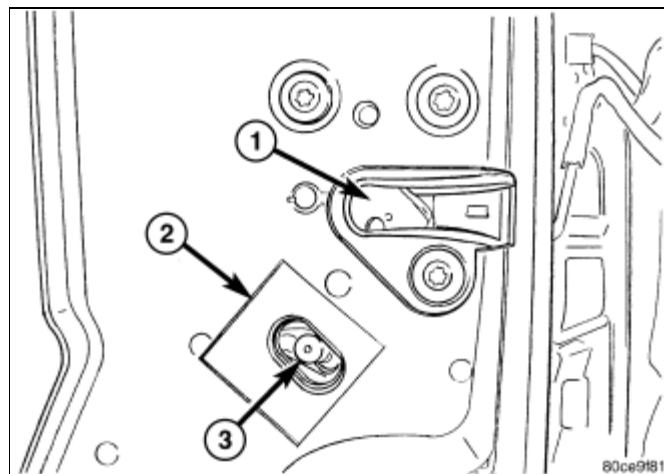
1. Install the latch onto the latch bracket tabs (2) and seat fully.
2. Connect the electrical connector (1).
3. Connect the latch cables (3).



4. Install the carrier plate (6), (Refer to 23 - BODY/DOOR - FULL REAR/CARRIER PLATE - INSTALLATION).
5. Adjust the door latch, (Refer to 23 - BODY/DOOR - FULL REAR/LATCH - ADJUSTMENTS).

ADJUSTMENTS

1. Locate the access hole in the door to adjust the door latch (1) and remove the mylar tape (2).
2. Loosen latch adjusting screw (3) through access slot in door shut face (1/2 to 1 full turn).
3. Operate the door handles several times to reduce any possible linkage binding and tighten the adjustment screw to 3 N·m (30 in. lbs.).
4. Operate the door handles again to verify proper operation and reinstall the mylar tape.

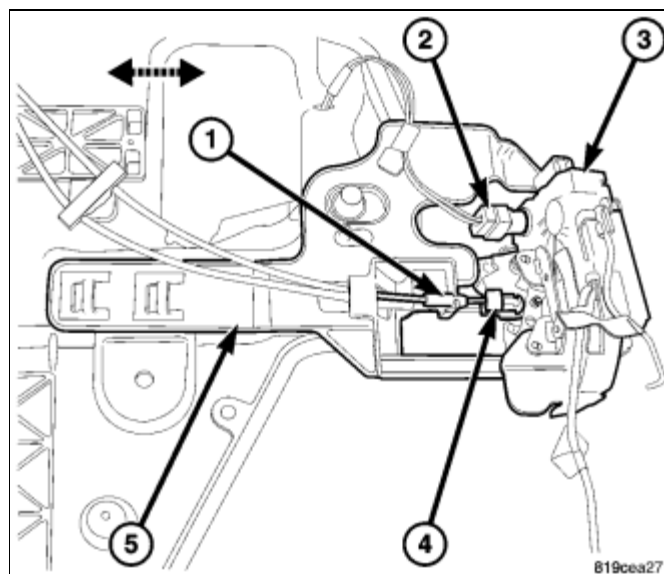


MOUNTING BRACKET - LATCH

REMOVAL

NOTE: Front door shown, rear door similar.

1. Remove the latch (3), (Refer to 23 - BODY/DOOR - FULL REAR/LATCH - REMOVAL)
2. Slide the latch bracket (5) off of the carrier plate tabs and remove.

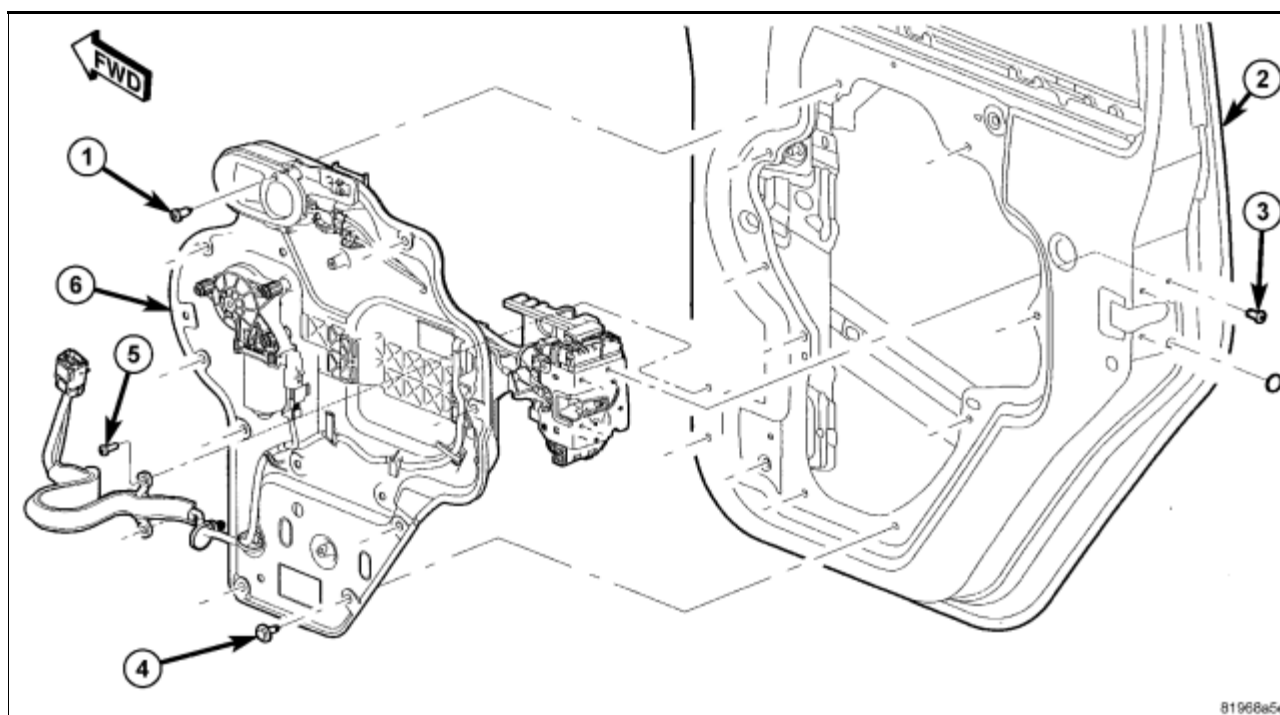
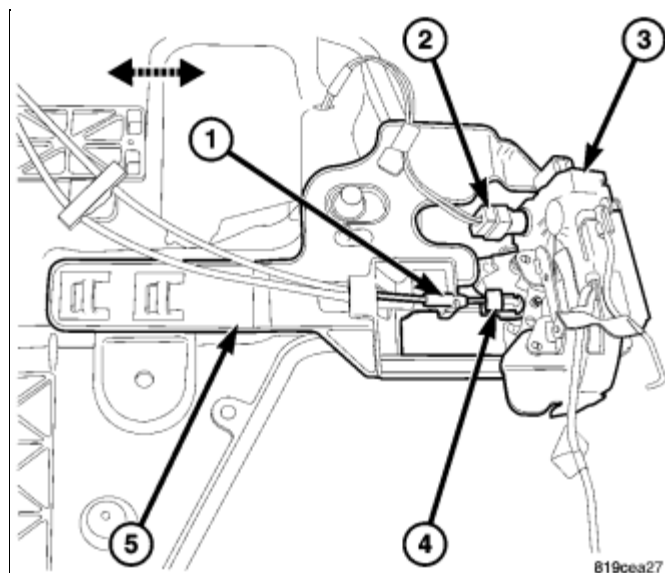


INSTALLATION

NOTE: Front door shown, rear door similar.

1. Slide the latch bracket (5) onto the carrier plate and secure fully.
2. Install the latch (3), (Refer to 23 - BODY/DOOR - FULL REAR/LATCH - INSTALLATION)

REGULATOR - REAR DOOR WINDOW REMOVAL

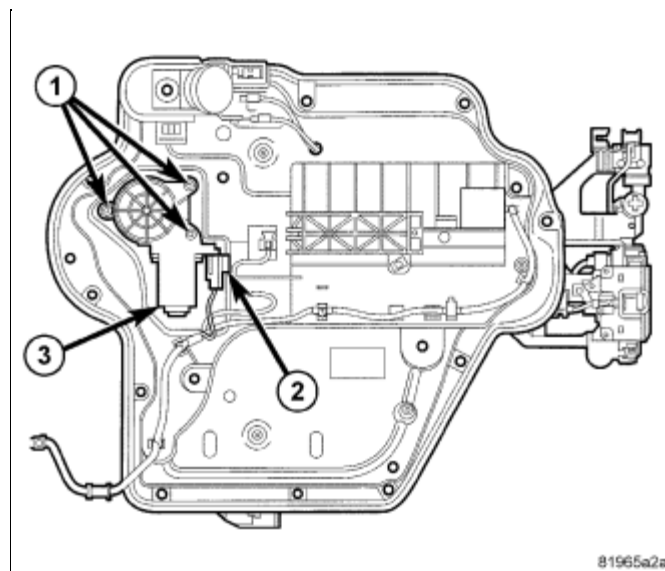


1. Remove the carrier plate, (Refer to 23 - BODY/DOOR - FULL REAR/CARRIER PLATE - REMOVAL).

NOTE: Front door shown, rear door similar.

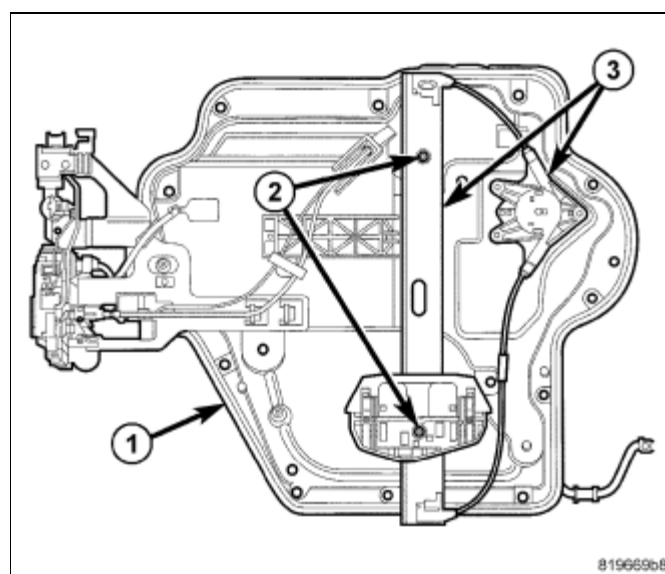
2. Remove the screws (1) and disconnect the electrical connector (2).

3. Remove the motor (3).



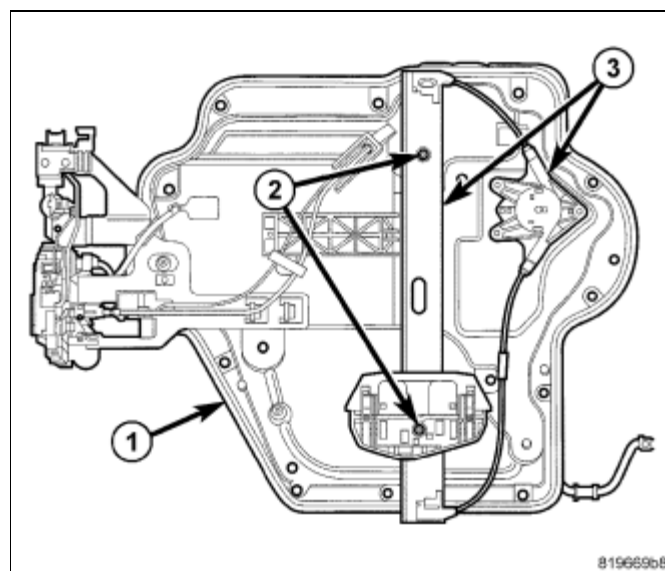
4. Remove the rail screws (2) and separate the lift regulator (3) from the carrier plate (1).

INSTALLATION



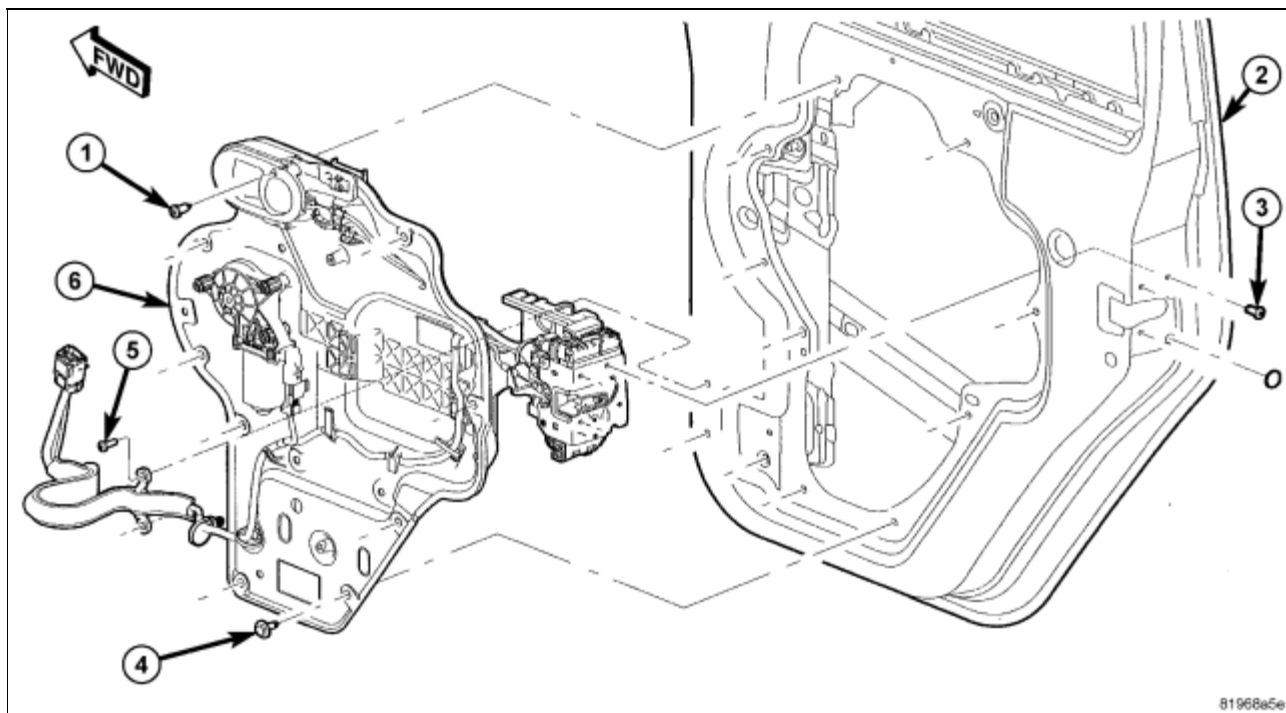
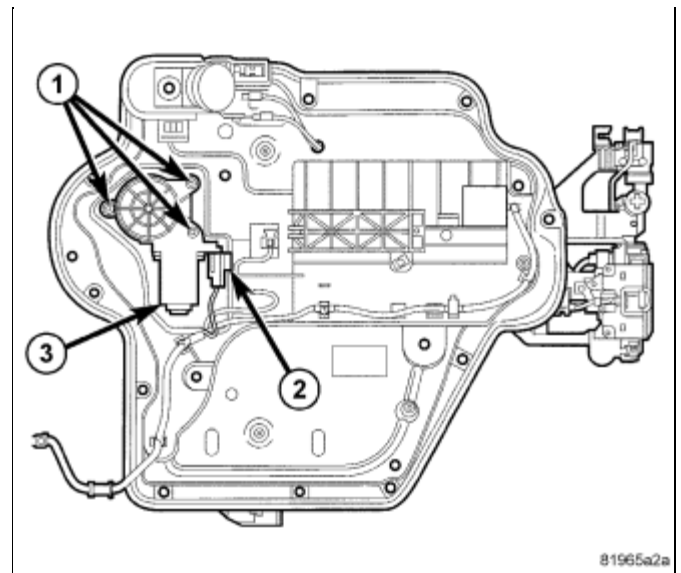
NOTE: Front door shown, rear door similar.

1. Position the regulator (3) onto the carrier plate (1) and install the screws (2).



NOTE: Front door shown, rear door similar.

2. Install the motor (3) and install the screws (1).
3. Connect the electrical connector (2).



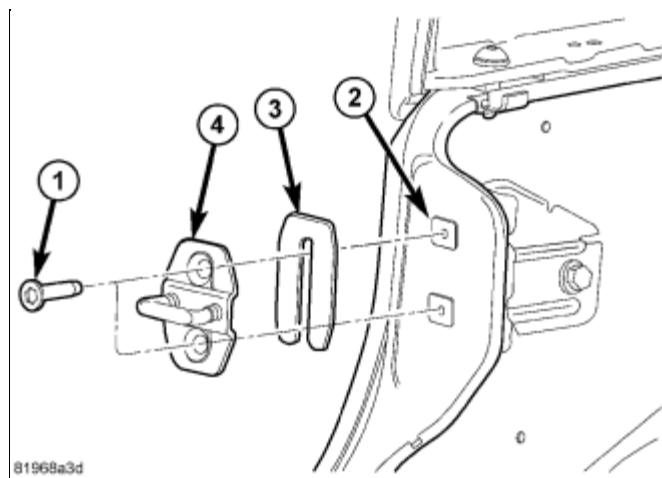
4. Install the carrier plate, (Refer to 23 - BODY/DOOR - FULL REAR/CARRIER PLATE - INSTALLATION).

STRIKER - DOOR

REMOVAL

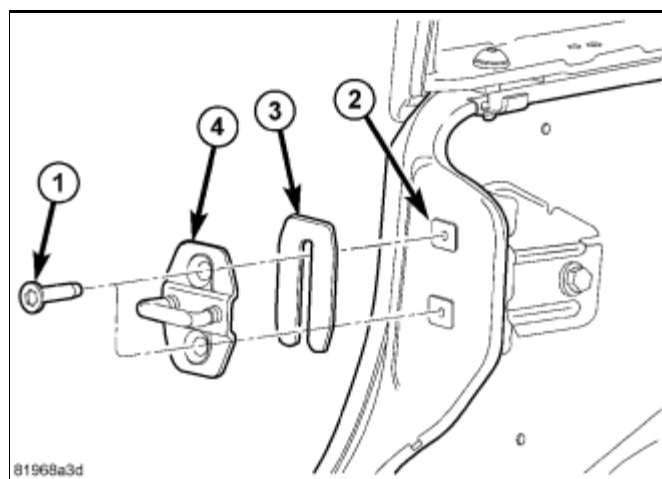
1. Remove the screws (1).
2. Remove the striker (4) and the shims (3), if equipped.

INSTALLATION



1. Install the shims (3), if equipped, and install the striker (4).
2. Install the screws (1) and tighten to 26 N·m (19 ft. lbs.).
3. If necessary, adjust the door latch striker,

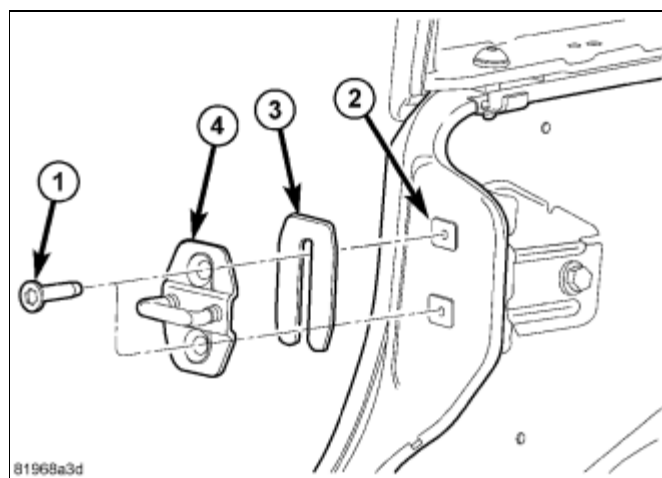
ADJUSTMENTS



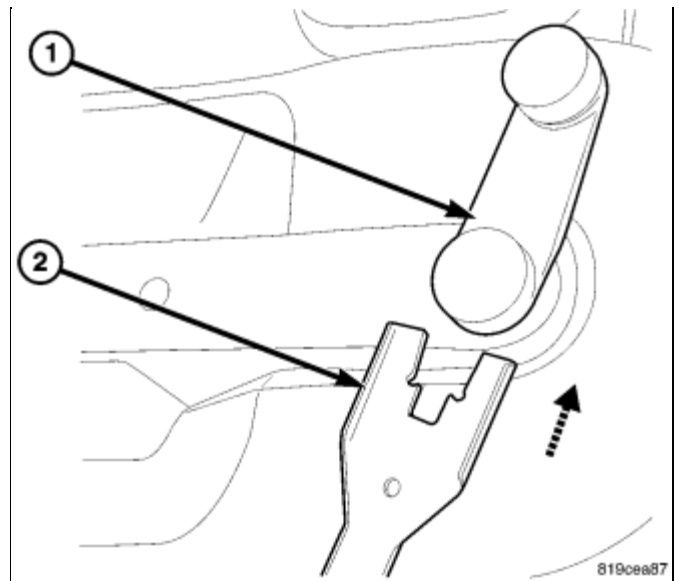
1. Using a grease pencil or equivalent, mark the location of the door latch striker (4) on the C-pillar to aid in adjustment.
2. Loosen the two screws (1) that secure the door latch striker to the C-pillar.
3. To adjust the rear gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 26 N·m (19 ft. lbs.), (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.

TRIM PANEL

REMOVAL

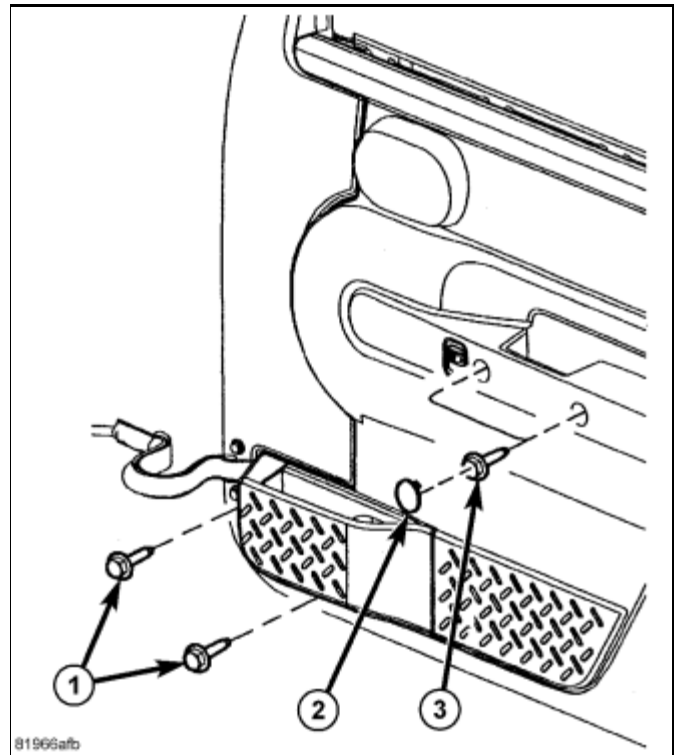


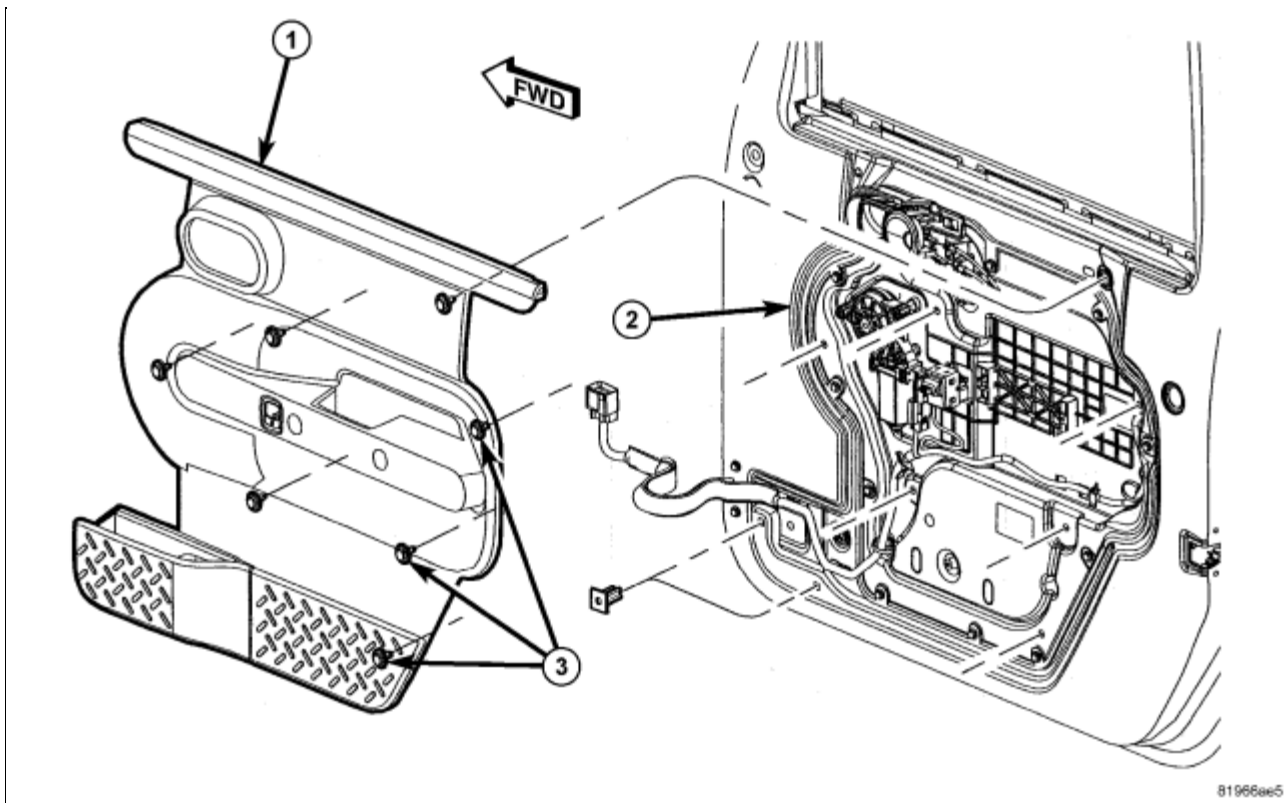
1. Using a standard window handle tool (2), release the handle clips and remove the handle (1) from the window lift mechanism, if equipped with a manual regulator.



NOTE: Full front door shown, rear door similar.

2. Remove the pull handle trim plugs (2) and remove the pull handle screws (3).
3. Remove the screws (1), if equipped.

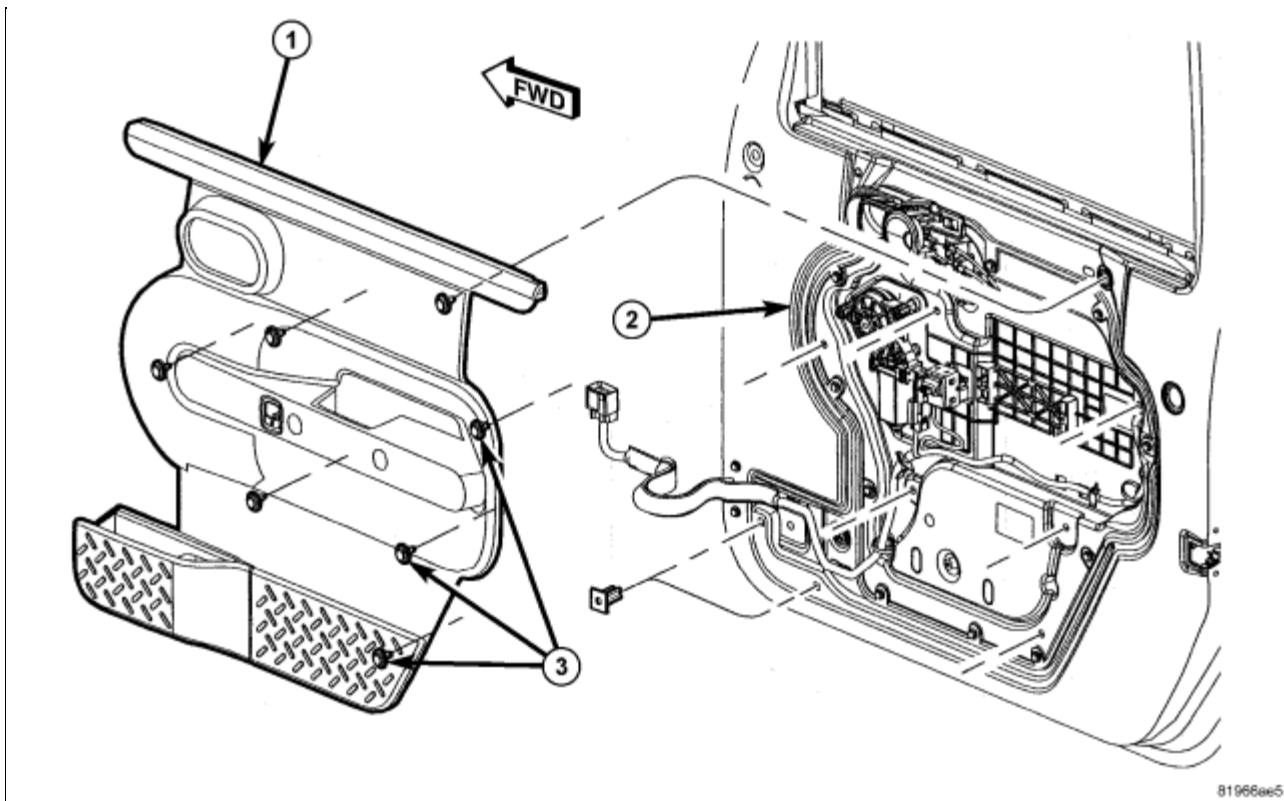




NOTE: Full front door shown, rear door similar.

4. Using a trim stick C-4829 or equivalent, starting at the bottom by the check strap, separate the push pin fasteners (3) and remove the trim panel (1).

INSTALLATION

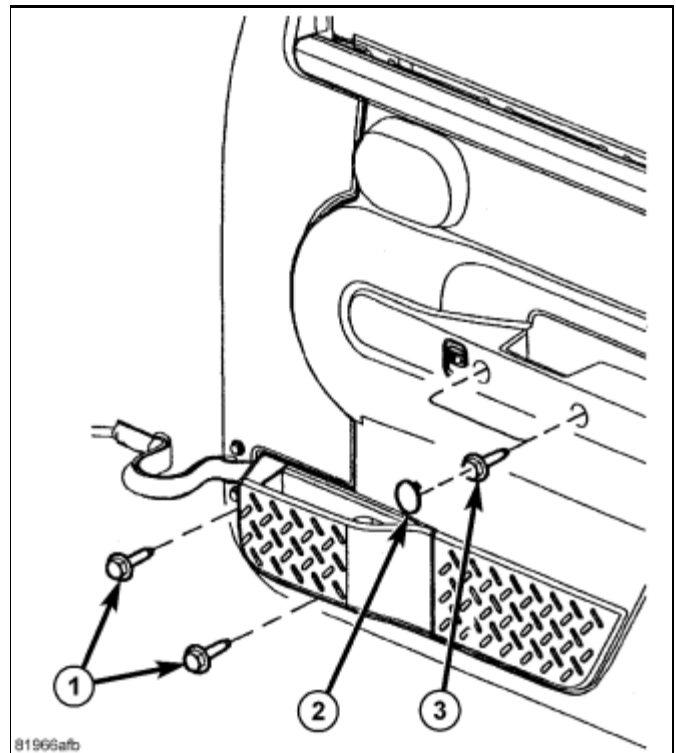


NOTE: Full front door shown, rear door similar.

1. Position the trim panel (1) into place and seat the push pin fasteners (3) fully.

NOTE: Full front door shown, rear door similar.

2. Install the pull handle screws (3) and install the trim caps (2).
3. Install the trim panel screws (1), if equipped.

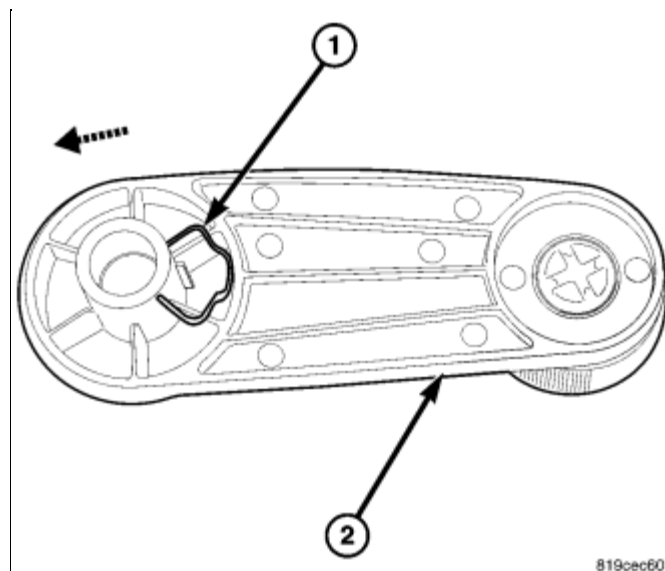


4. If equipped with a manual window regulator, position the window crank handle retaining clip (1) back into place and install the window crank handle (2) onto the lift mechanism shaft and seat fully.

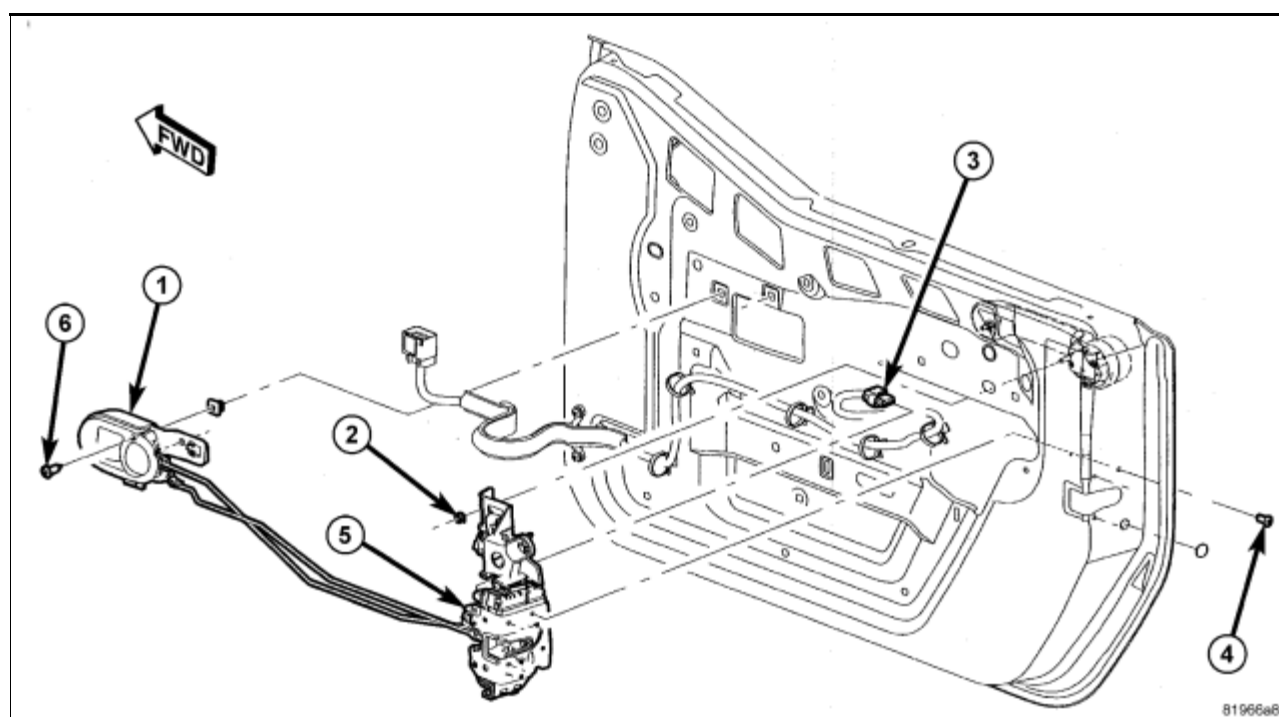
DOOR - HALF FRONT

CYLINDER - DOOR LOCK

REMOVAL



819cec60



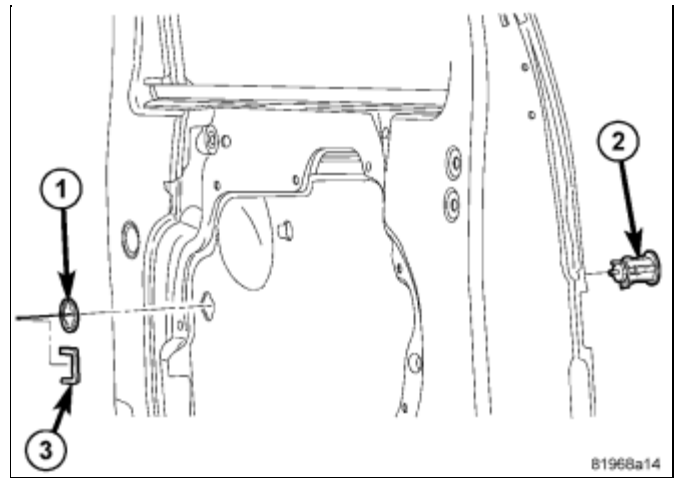
81966e8a

1. Remove the latch (5), (Refer to 23 - BODY/DOOR - HALF FRONT/LATCH - REMOVAL).

NOTE: Full door shown, half door similar.

2. Remove the clip (3) and separate the lock cylinder (2) and gasket (1) from the door.

INSTALLATION



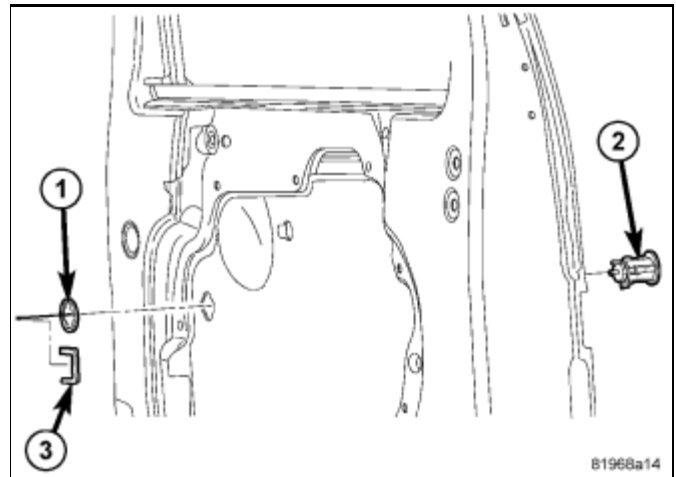
NOTE: Full door shown, half door similar.

1. Assemble gasket (1) onto lock cylinder (2) until fully seated.
2. Install lock cylinder (2) into hole in outer door panel.

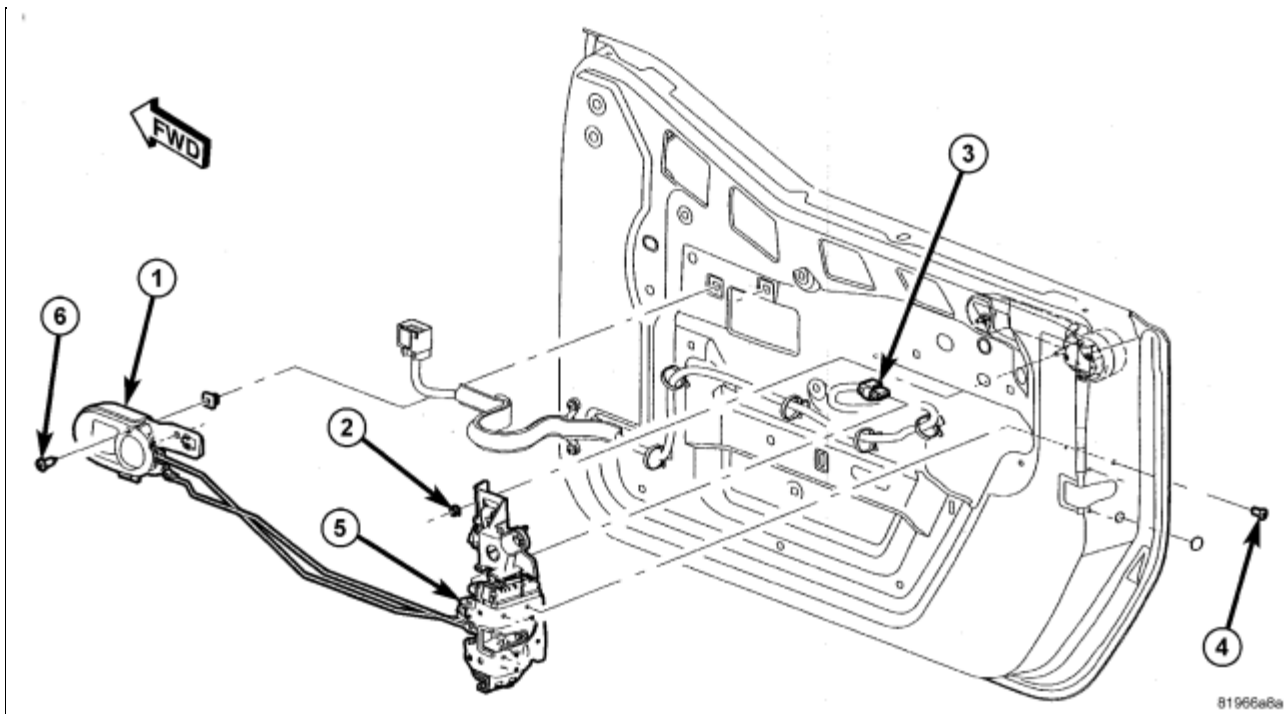
NOTE: Cylinder post must point forward.

NOTE: Cylinder drain hole must point down.

3. While holding lock cylinder (2) in place slide retainer clip (3) onto lock cylinder.



NOTE: Visually verify that pin on lock cylinder is engaged with bell crank on door module at door module install.

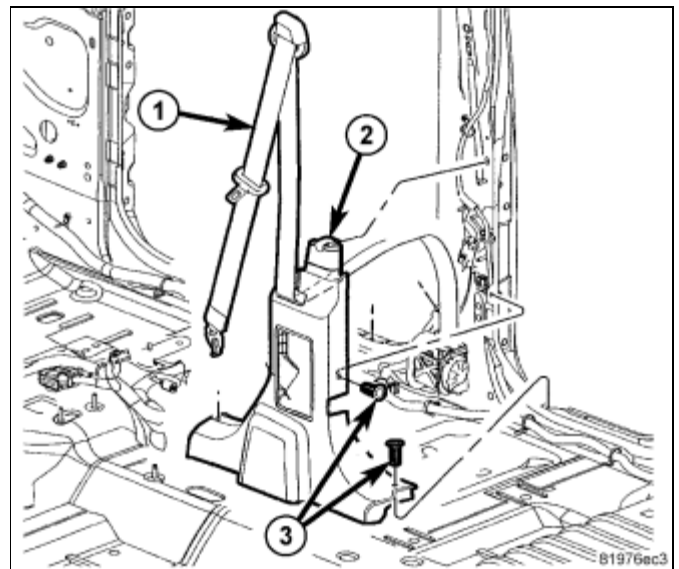


4. Install the latch (5), (Refer to 23 - BODY/DOOR - HALF FRONT/LATCH - INSTALLATION).

DOOR

REMOVAL

1. Remove the lower B-pillar trim panel (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).



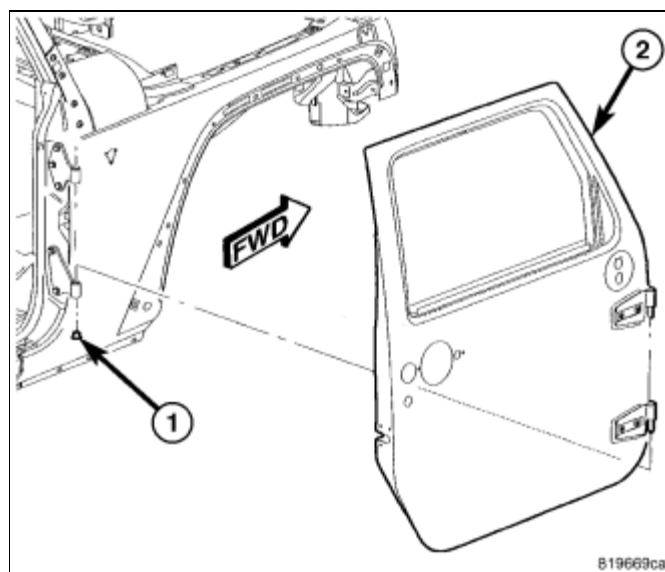
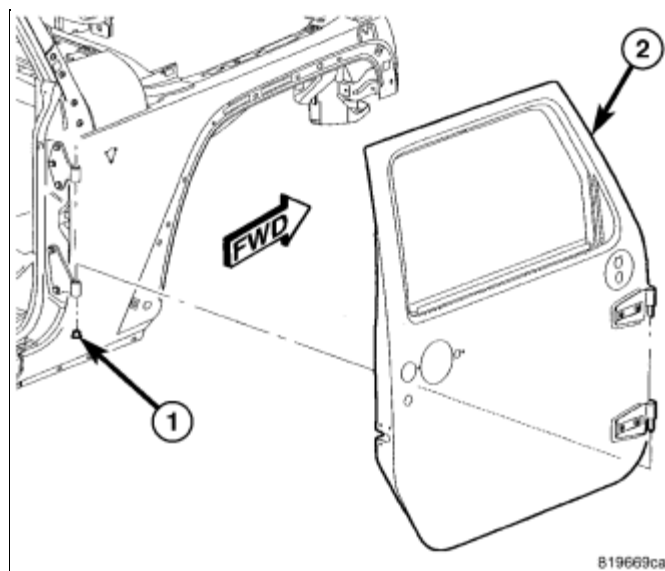
NOTE: Full front door shown, all others similar.

2. Open the door and disconnect the electrical connector at the B-pillar.
3. Separate the door harness from the footman's loop at the B-pillar.
4. Remove the nuts (1) and lift the door (2) up off hinges and remove.

INSTALLATION

NOTE: Full front door shown, all others similar.

1. Align pins on door hinge to holes in hinge on body and position door into place.
2. Install the nuts (1) and tighten to 8.5 N·m (75 in. lbs.).
3. Install the wire harness onto the footman loop and connect the electrical connector.
4. If necessary, adjust the door (Refer to 23 - BODY/DOOR-FRONT - ADJUSTMENTS).



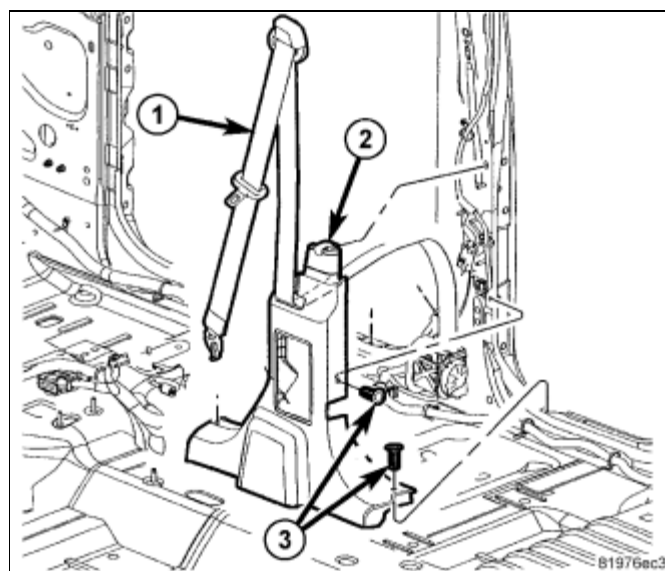
5. Install the lower B-pillar trim (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

ADJUSTMENTS

ADJUSTMENT

NOTE: For four door vehicles, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)

- Full front door shown, all others similar.
- Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.
- During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for



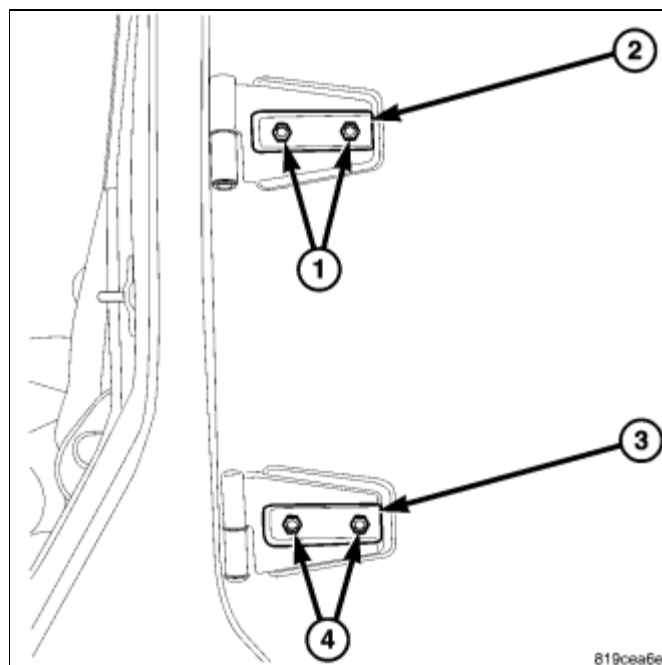
the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.

- A suitable body sealant should be used when removing or moving the hinges.

FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the door fasteners one hinge at a time and moving the door to the correct position.

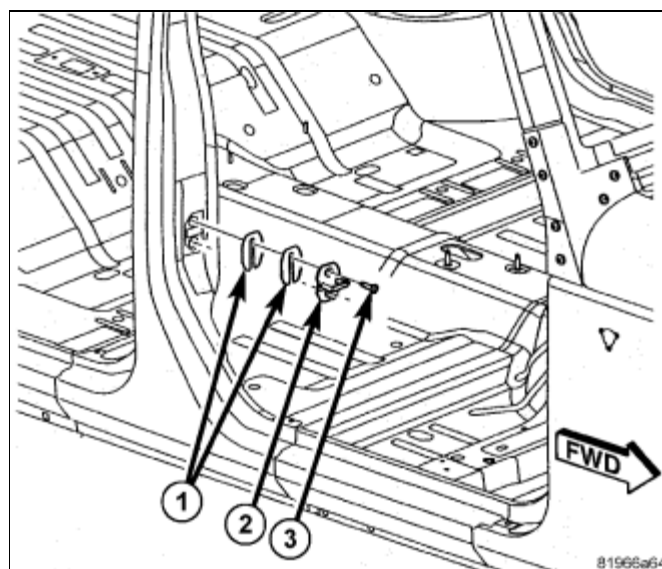
1. Support the door with a suitable lifting device.
2. Loosen the upper (1) and lower (4) hinge to door fasteners. (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge to door bolts to 26 N·m (19 ft. lbs.).



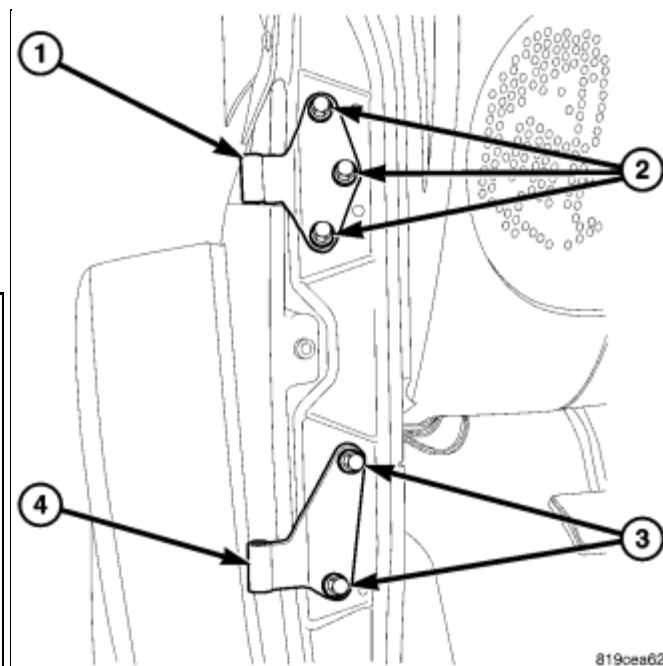
UP/DOWN

NOTE: Up/down door adjustment is done by loosening hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

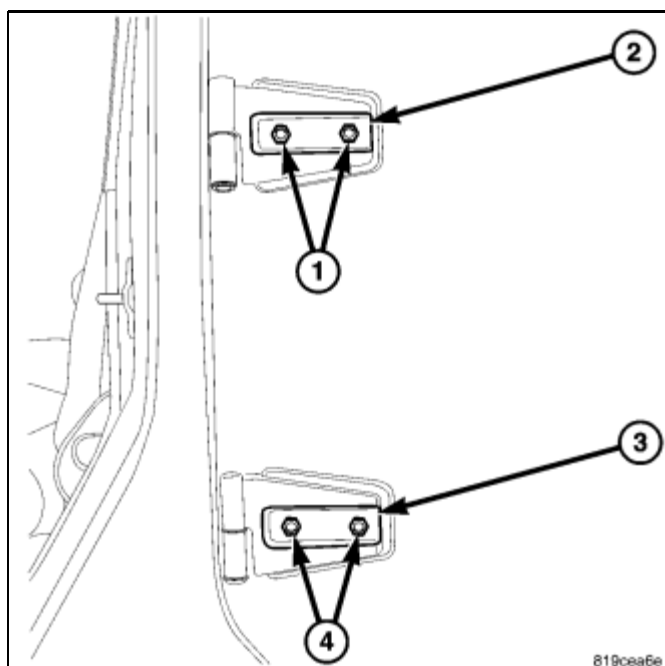
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. If necessary, loosen the hinge to hinge pillar fasteners (2) and (3). (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
4. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).



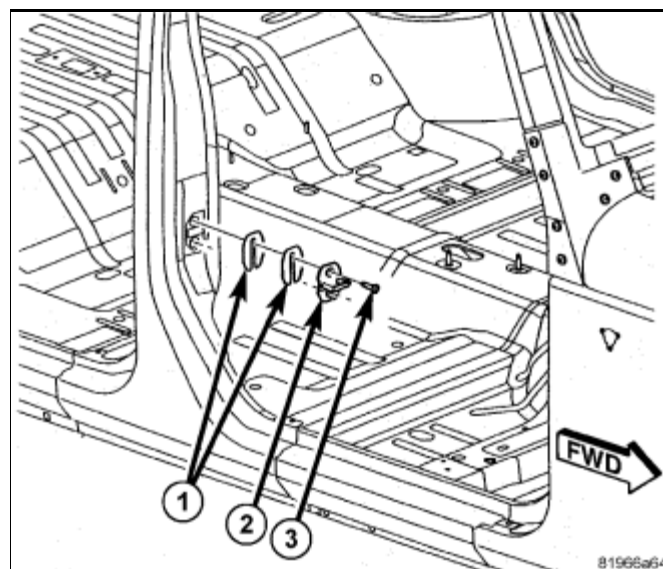
5. If



necessary, Loosen the hinge to door fasteners (1) and (4). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

6. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
7. Tighten the door to hinge fasteners to 26 N·m (19 ft. lbs.).

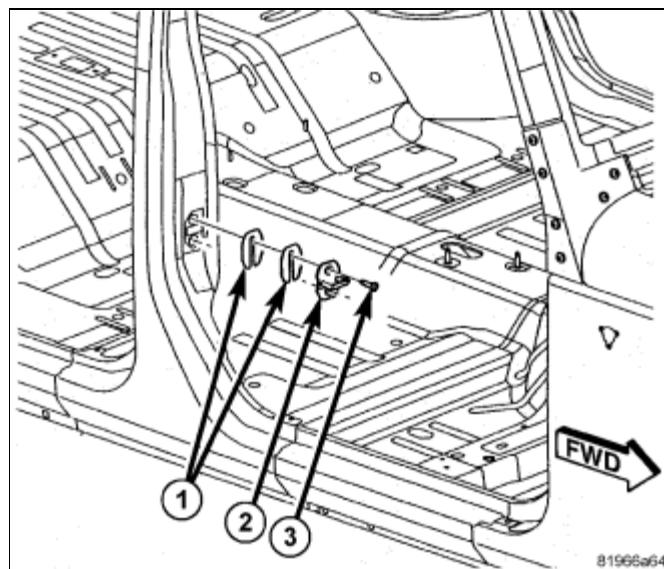
8. Tighten the latch striker bolts (3) 26 N·m (19 ft. lbs.). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



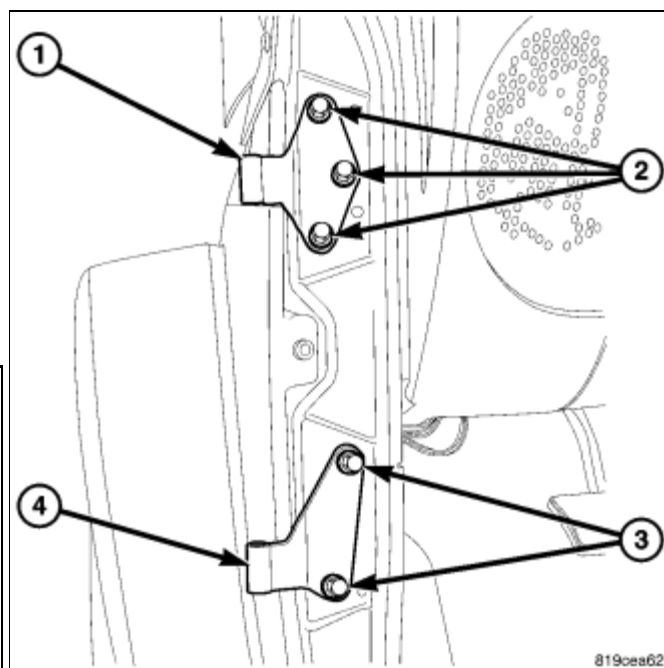
IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to body fasteners one hinge at a time and moving the door to the correct position.

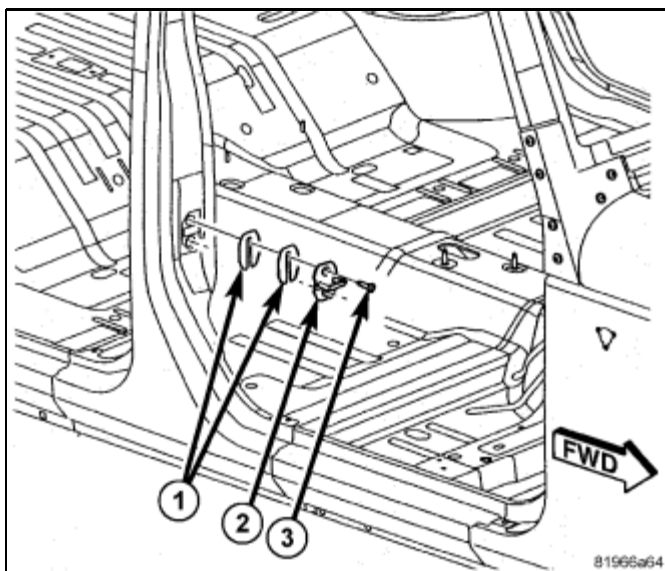
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. Loosen the hinge to body fasteners (2) and (3), (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).



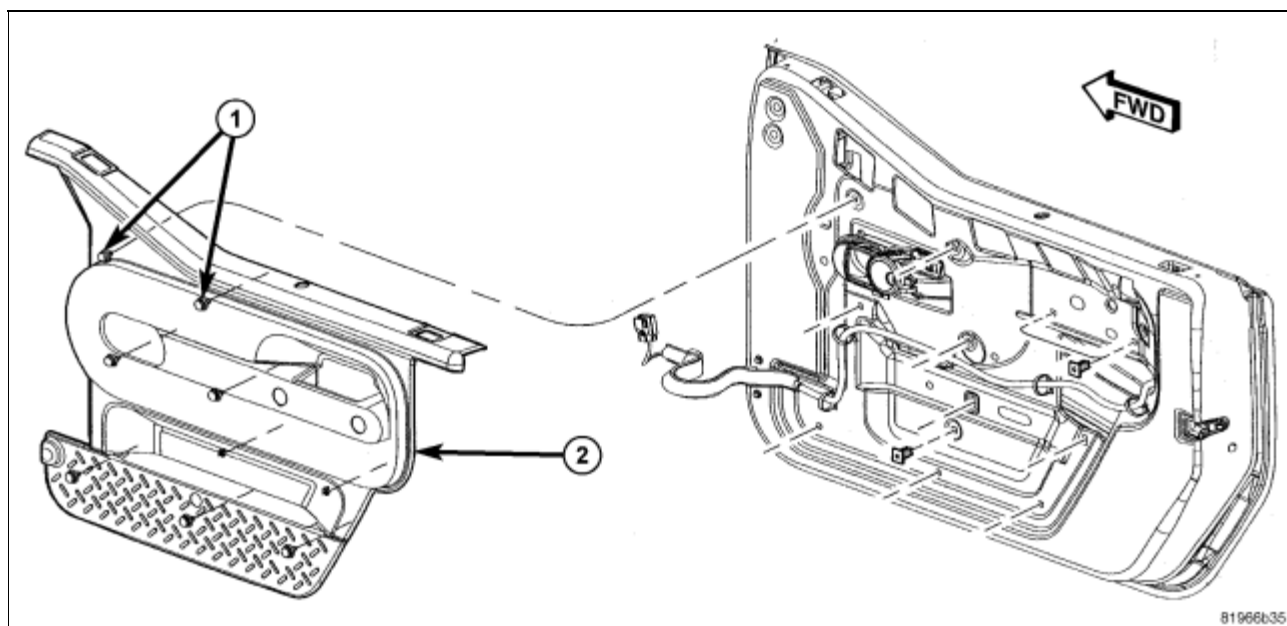
6. Tighten the latch striker bolts (3) to 26 N·m (19 ft. lbs.). (Refer to 23 -



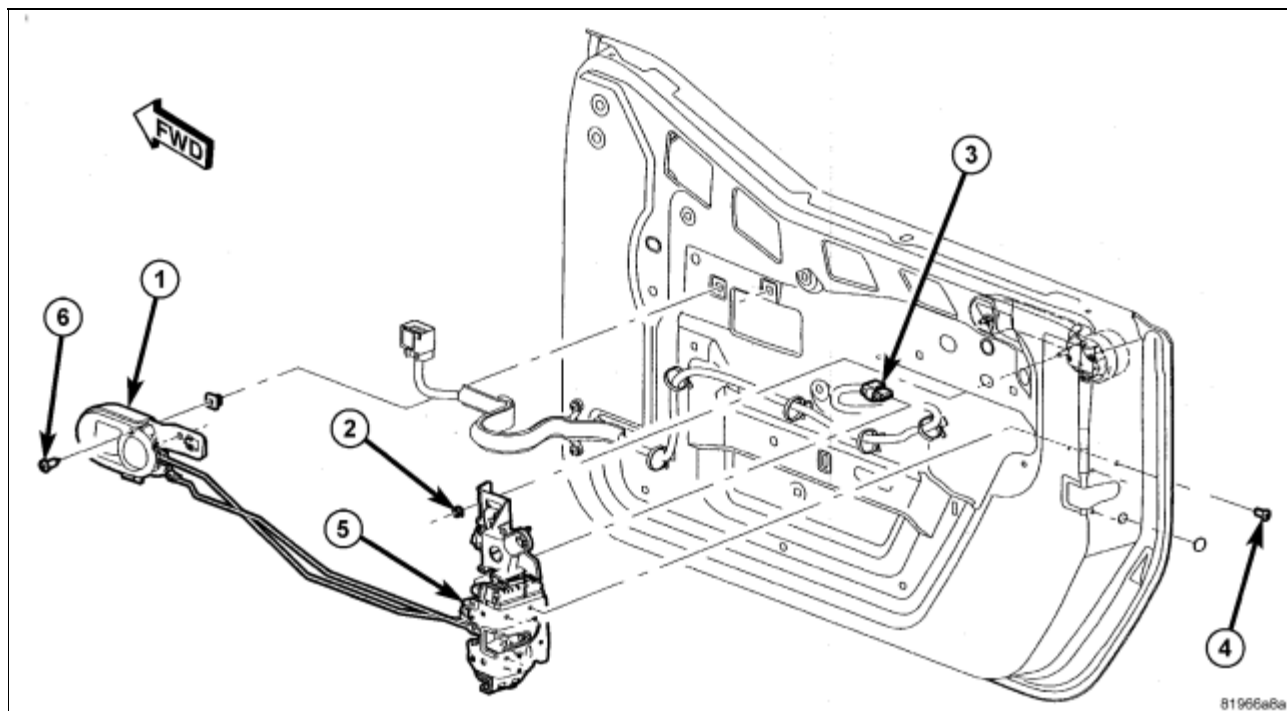
BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

HANDLE - EXTERIOR DOOR

REMOVAL



1. Remove the door trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - REMOVAL).



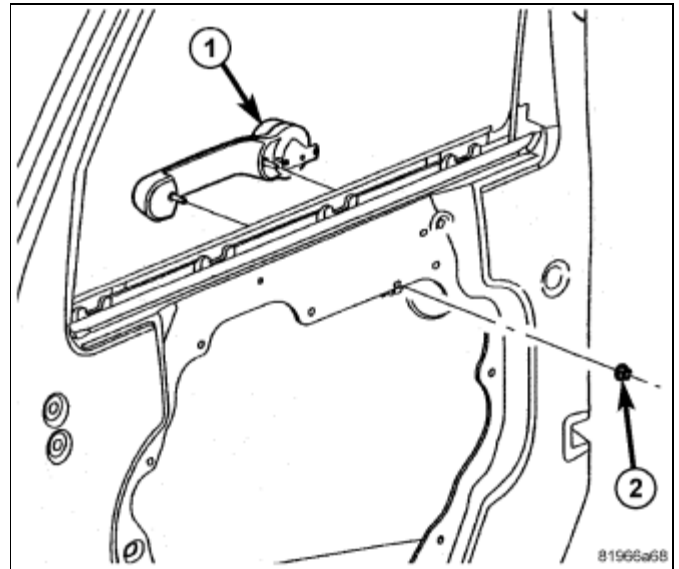
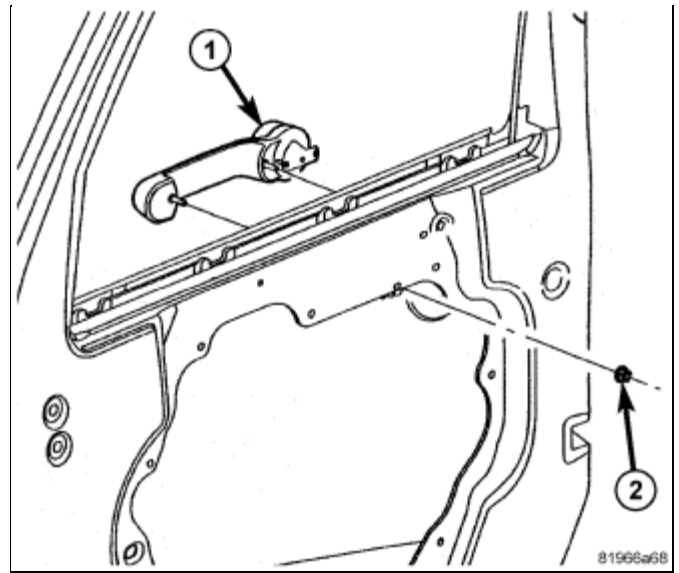
2. Remove the latch nut (2).

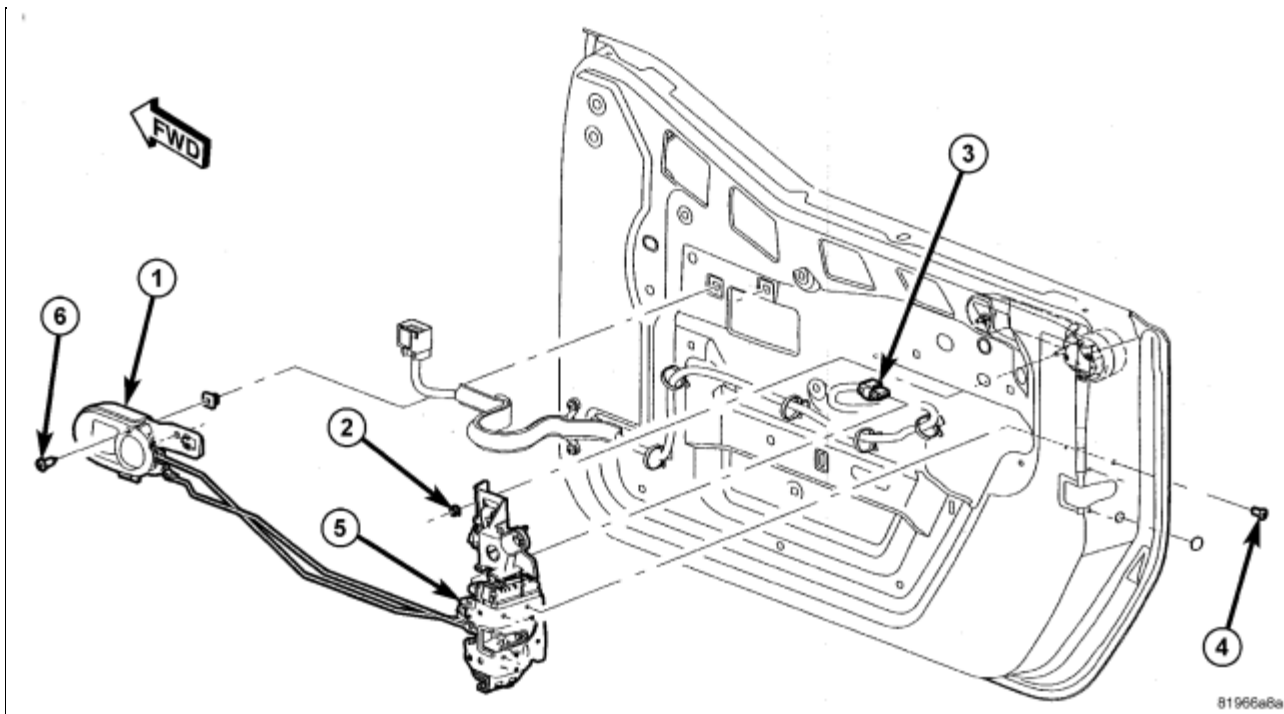
NOTE: Full front door shown, half door is similar.

3. Remove the remaining handle nut (2) and remove the handle (1).

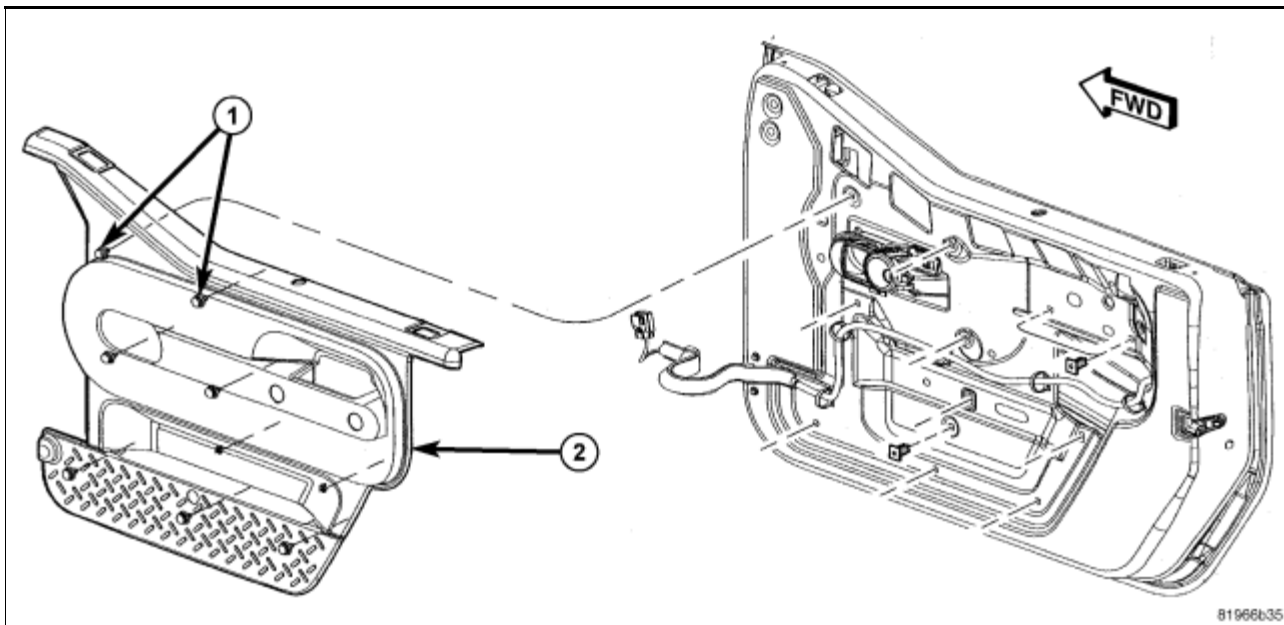
INSTALLATION

1. Install the handle (1) and install the front nut (2).
2. Tighten the nut to 4.5 N·m (40 in. lbs.).





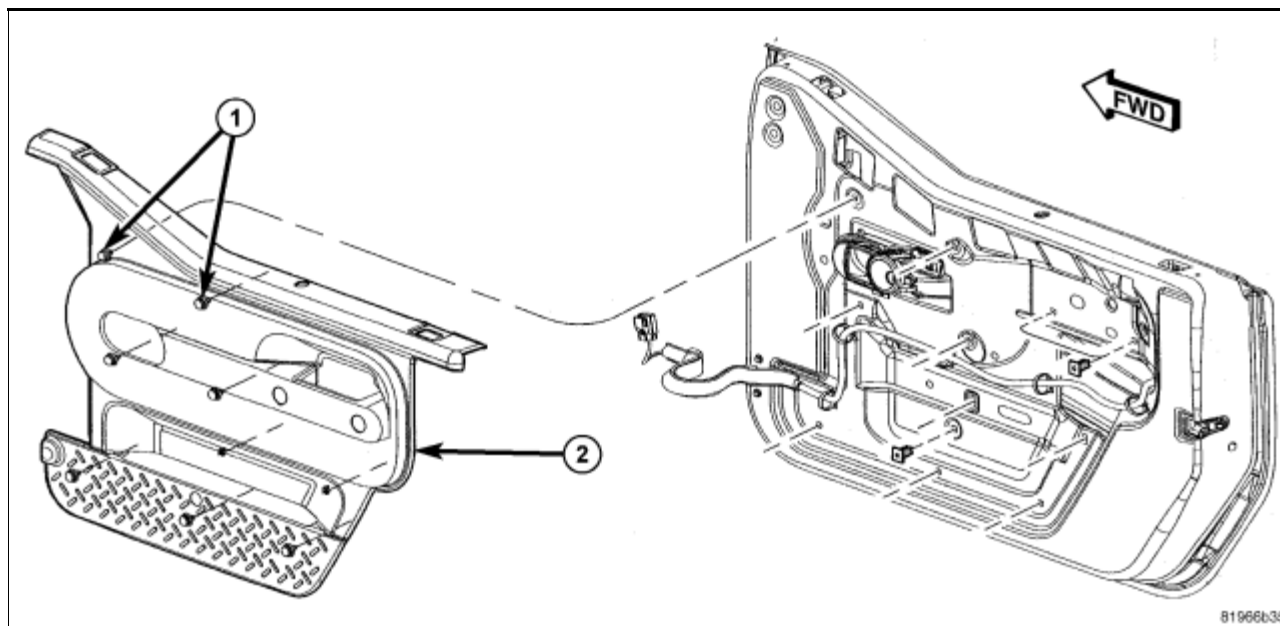
3. Install the rear nut (2).
4. Tighten the nut to 4.5 N·m (40 in. lbs.).



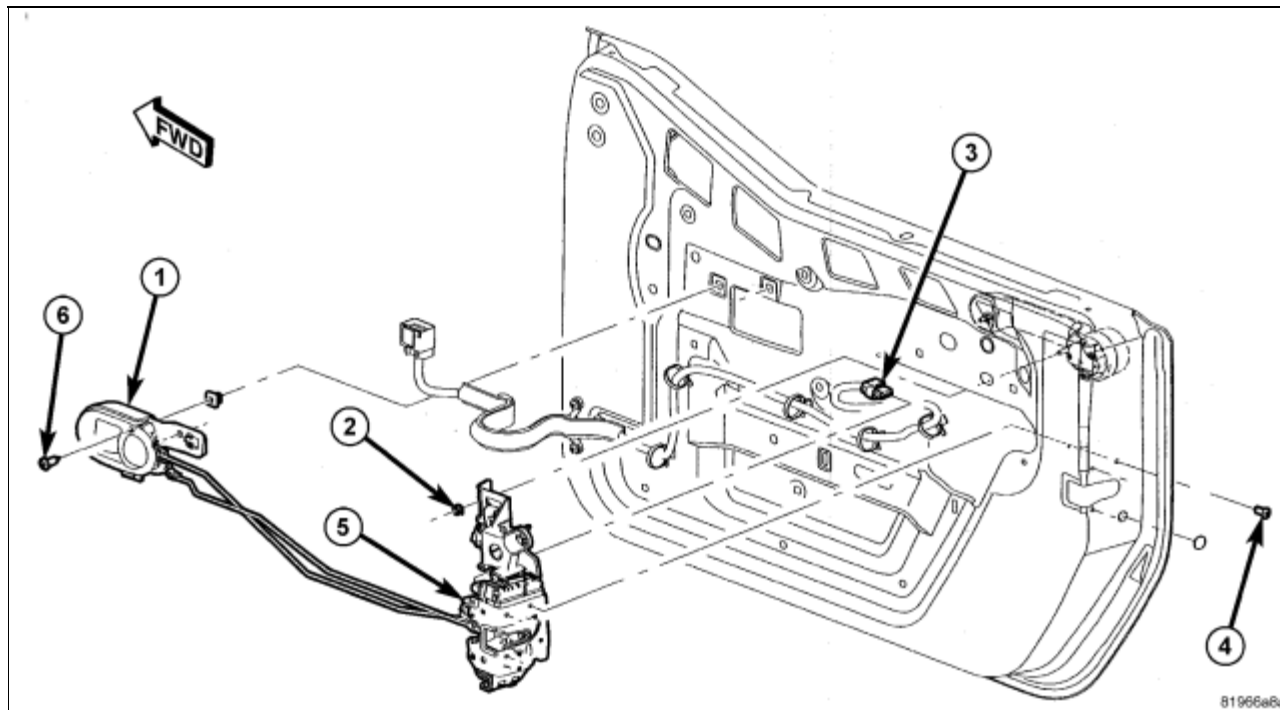
5. Install the trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - INSTALLATION).

HANDLE - INSIDE RELEASE

REMOVAL



1. Remove the door trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - REMOVAL).



2. Remove the inside handle screw (6).

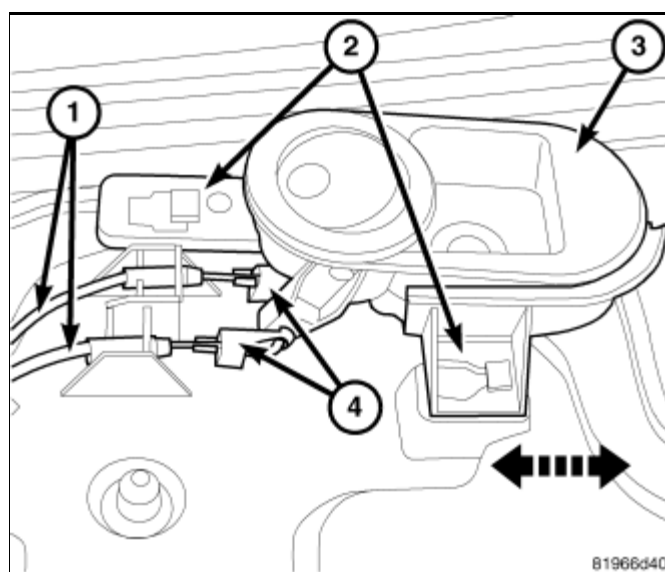
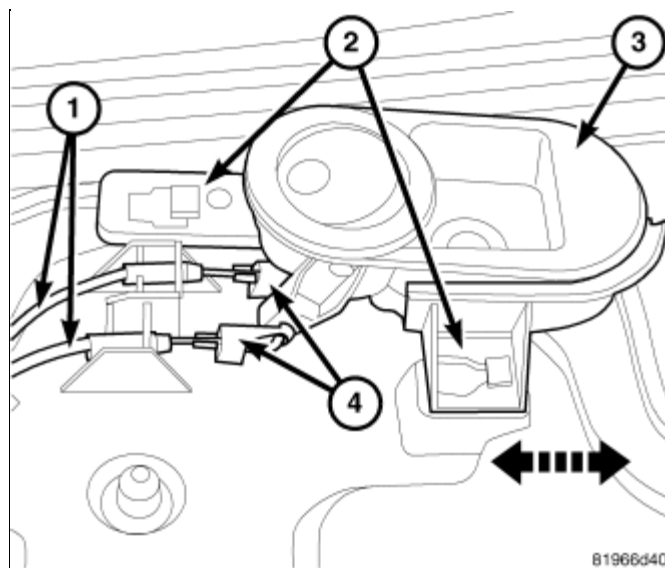
NOTE: Full front door shown, half door similar.

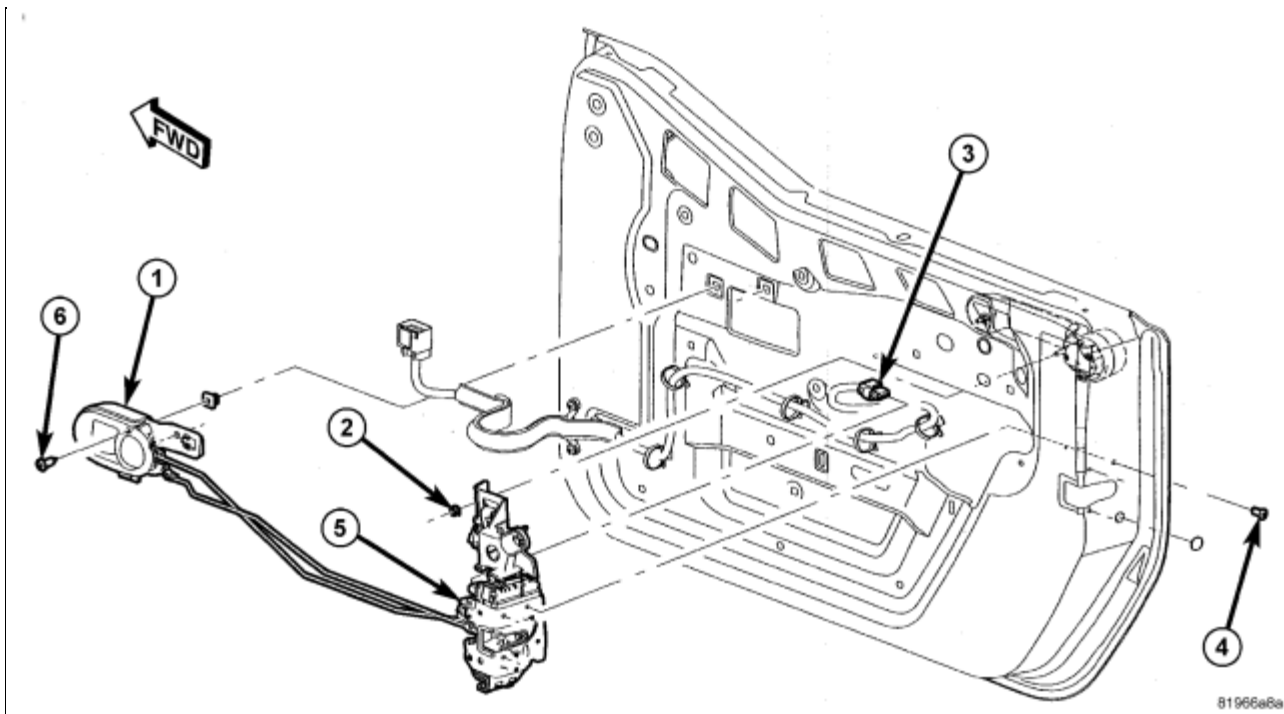
3. Release the clips (4) and disconnect the handle rods (1).
4. Slide the handle (3) off of the retaining tabs (2) and remove.

INSTALLATION

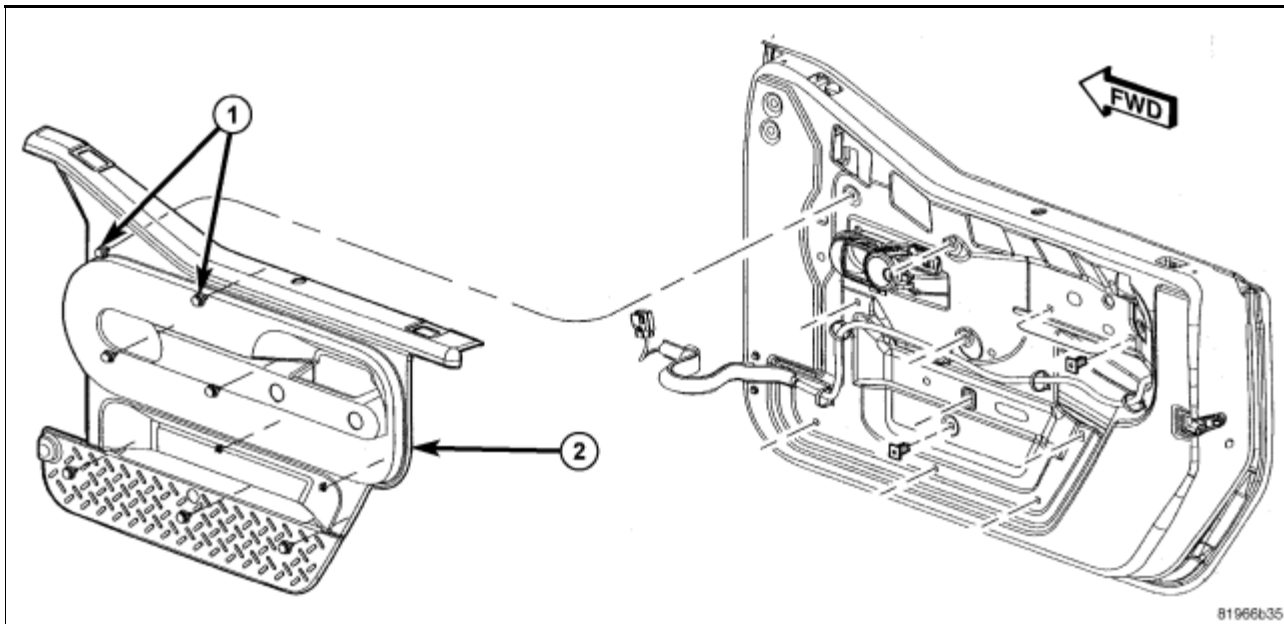
NOTE: Full door shown, half door similar.

1. Position the handle (3) onto the carrier plate tabs (2) and slide into place fully.
2. Connect the rods (1) and secure the clips (4).





3. Install the handle screw (6) and tighten to 8.5 N·m (75 in. lbs.).



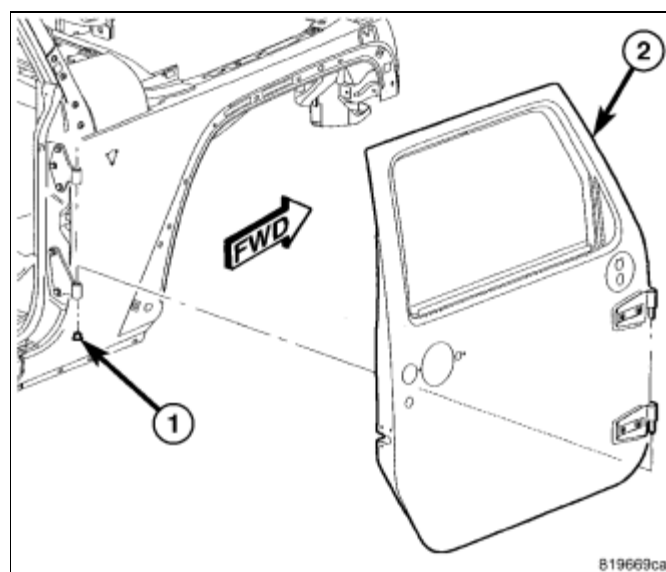
4. Install the trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - INSTALLATION).

HINGE

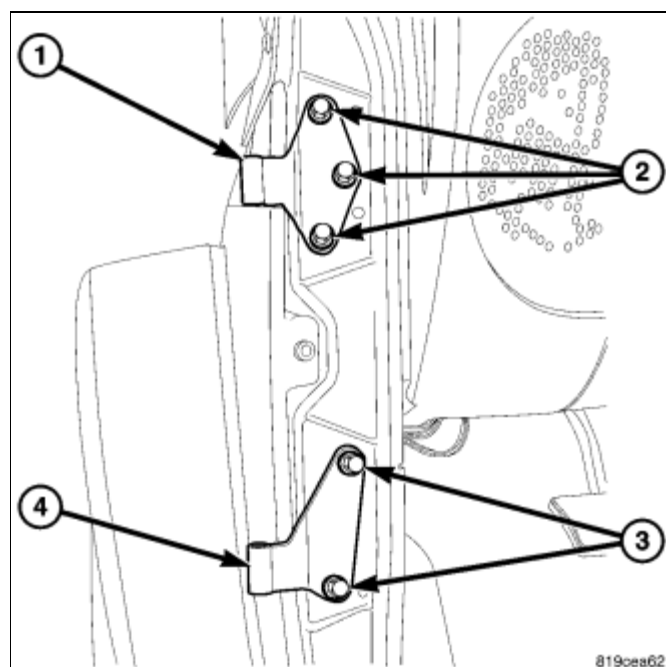
REMOVAL

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the door (2), (Refer to 23 - BODY/DOOR - HALF FRONT/DOOR - REMOVAL).

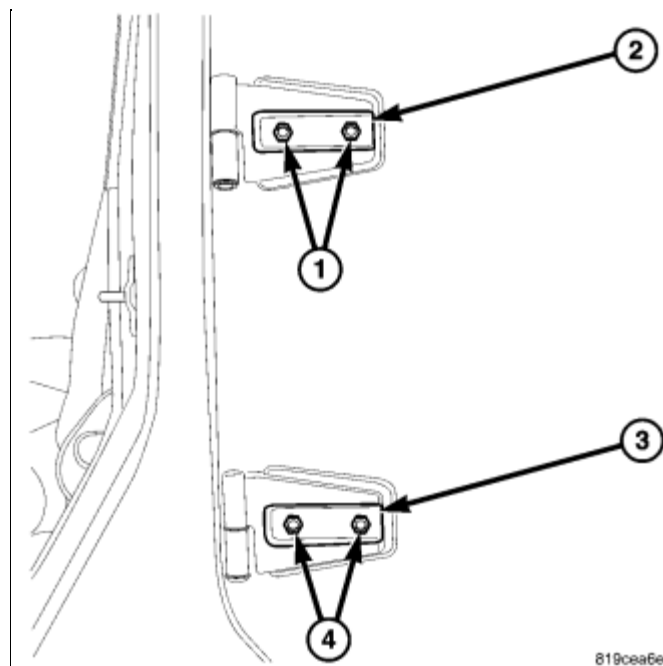


2. Using a grease pencil or equivalent, mark the body hinge (1) and (4) location and remove the bolts (2) and (3).



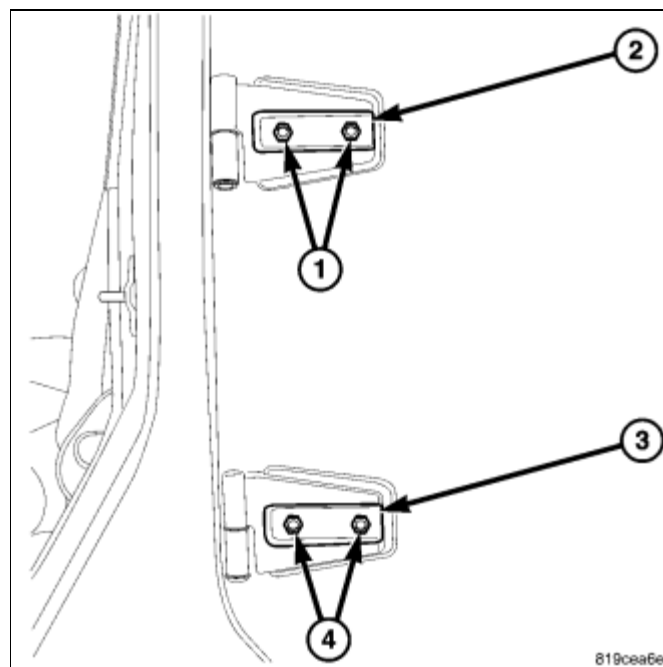
3. Using a grease pencil or equivalent, mark the door hinge (2) and (3) location and remove the bolts (1) and (4).

INSTALLATION

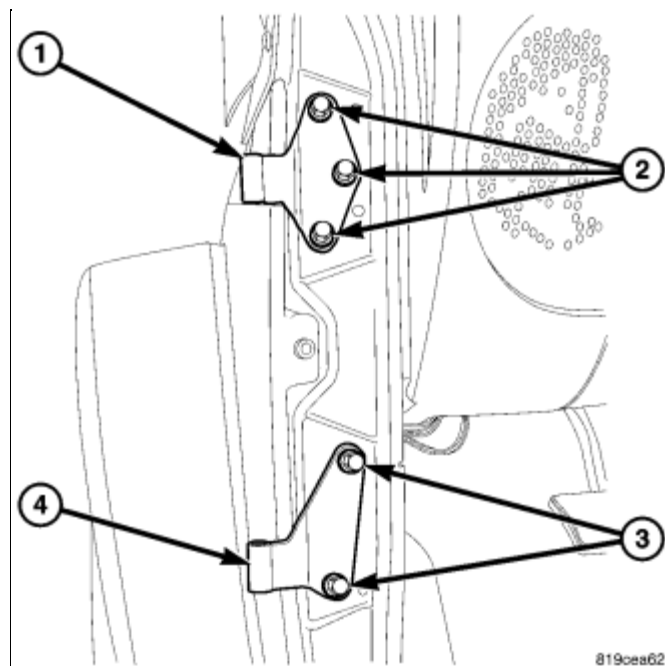


NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Install the door hinges (2) and (3), and install the bolts (1) and (4).
2. Align the hinges to the door using the reference marks made during the removal procedure and tighten the bolts to 26 N·m (19 ft. lbs.).



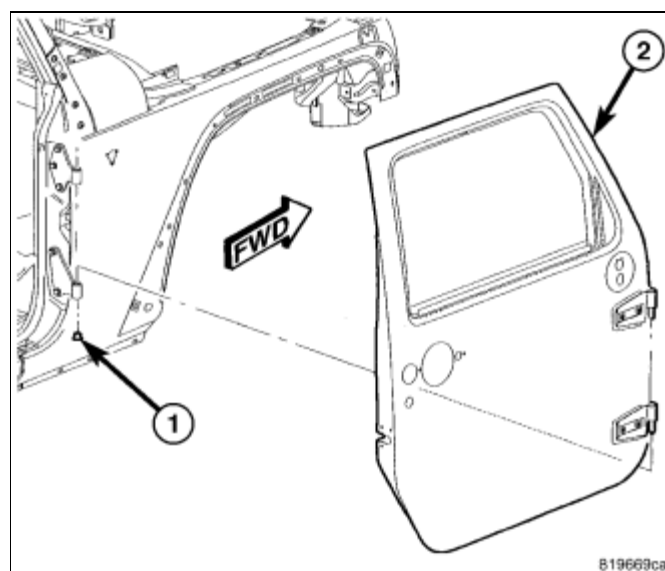
3. Install the body hinges (1) and (4), and install the bolts (2) and (3).
4. Align the hinges to the body using the reference marks made during the removal procedure and tighten the bolts to 28 N·m (21 ft. lbs.).

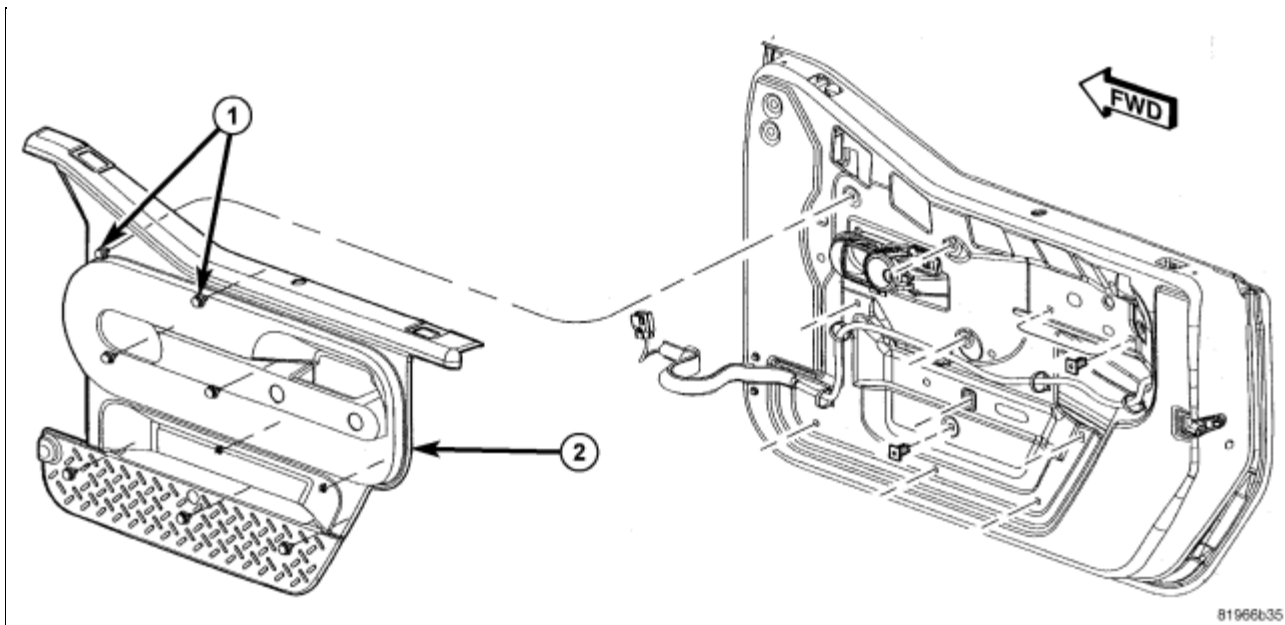


5. Install the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - INSTALLATION).

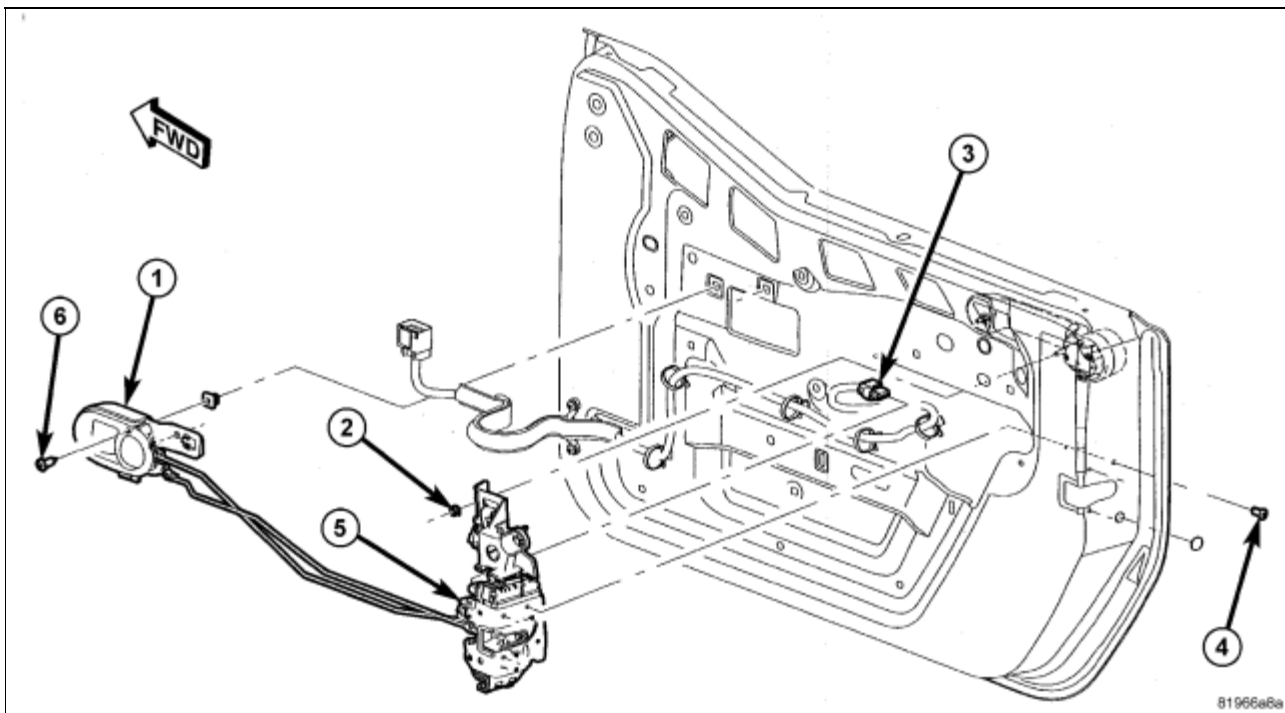
LATCH

REMOVAL





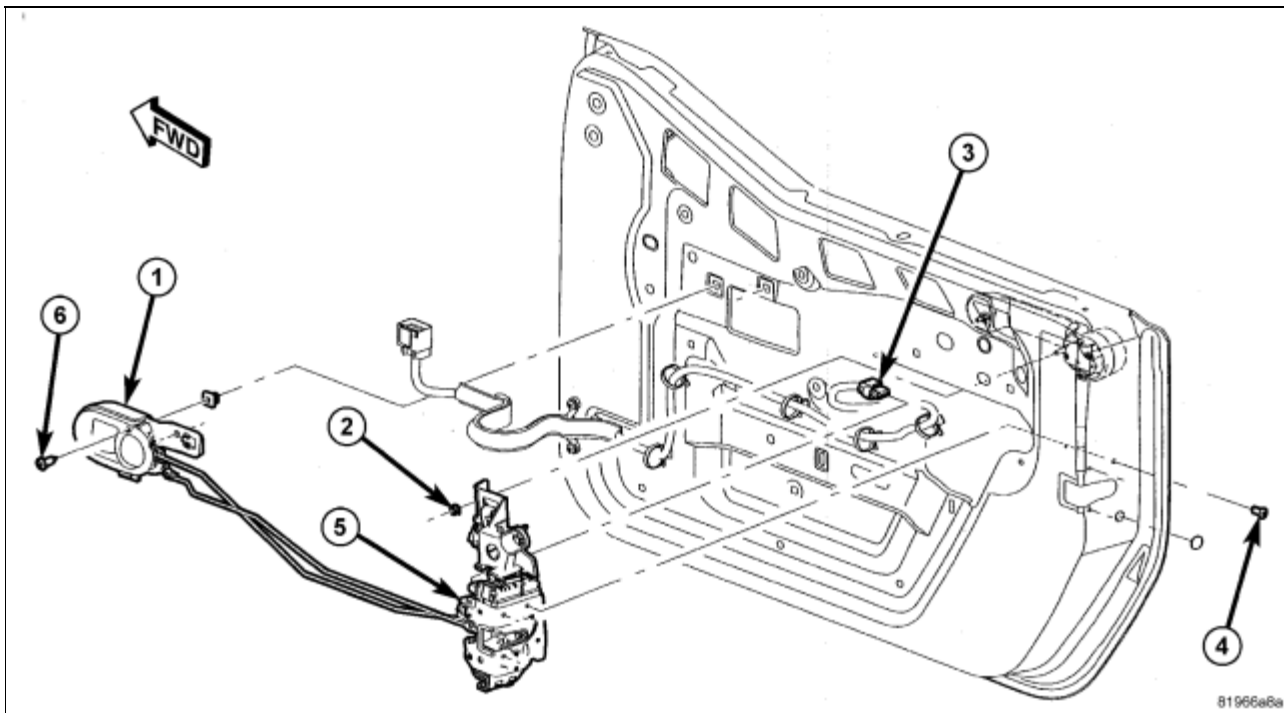
1. Remove the door trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - REMOVAL).



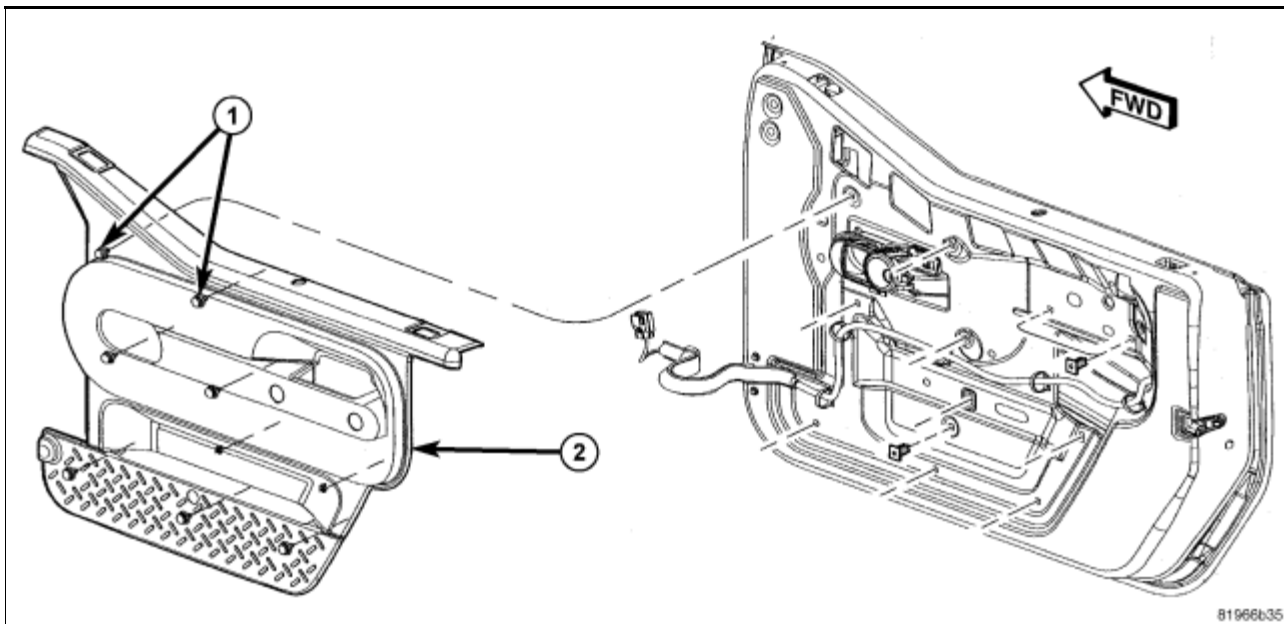
2. Remove the latch nut (2) and latch screws (4).

3. Disconnect the latch rods (5) and electrical connector (3) and remove the latch.

INSTALLATION



1. Install the latch screws (4) and tighten to 8 N·m (71 in. lbs.) top screws first.
2. Install the outside door handle nut (2) through the hole in the inner door and tighten to 4.5 N·m (40 in. lbs.).
3. Connect the electrical connector (3).
4. Connect the rods (5) and seat the clips fully.



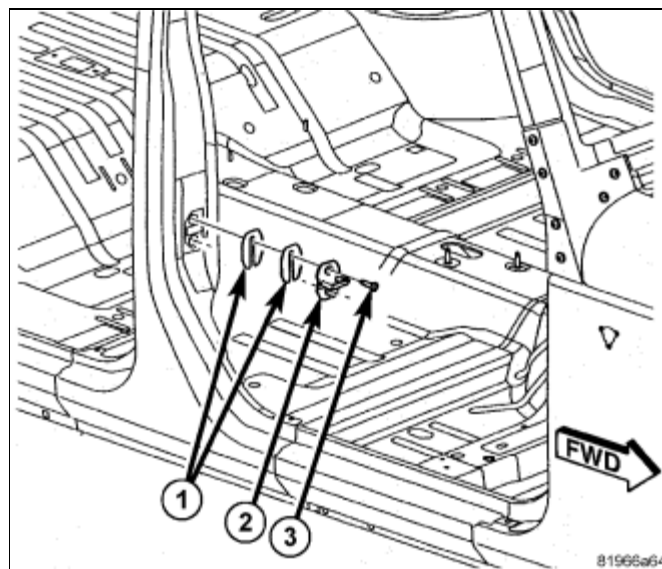
5. Install the trim panel (2), (Refer to 23 - BODY/DOOR - HALF FRONT/TRIM PANEL - INSTALLATION).

STRIKER - DOOR

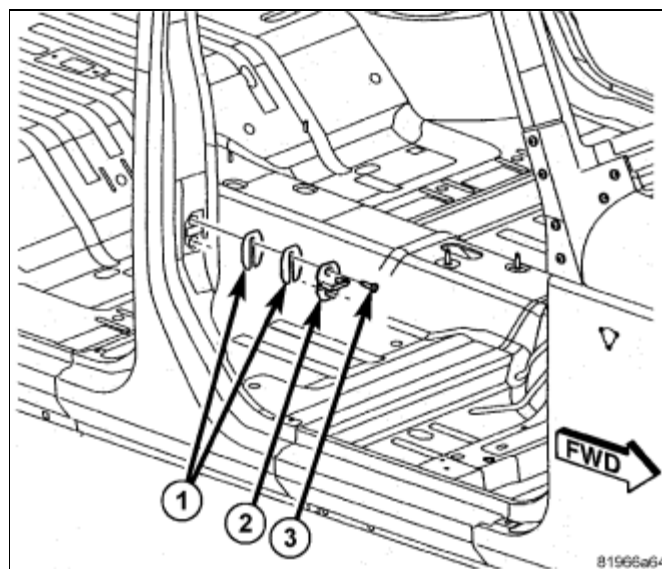
REMOVAL

1. Remove the screws (3).
2. Remove the striker (2) and the shims (1), if equipped.

INSTALLATION



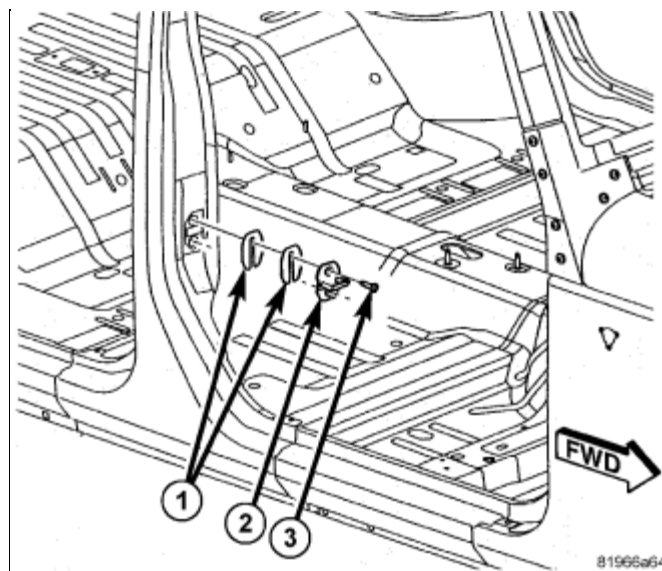
1. Install the shims (1), if equipped, and install the striker (2).
2. Install the screws (3) and tighten to 26 N·m (19 ft. lbs.).
3. If necessary, adjust the door latch striker (Refer to 23 - BODY/DOOR - FULL FRONT/STRIKER - ADJUSTMENTS).



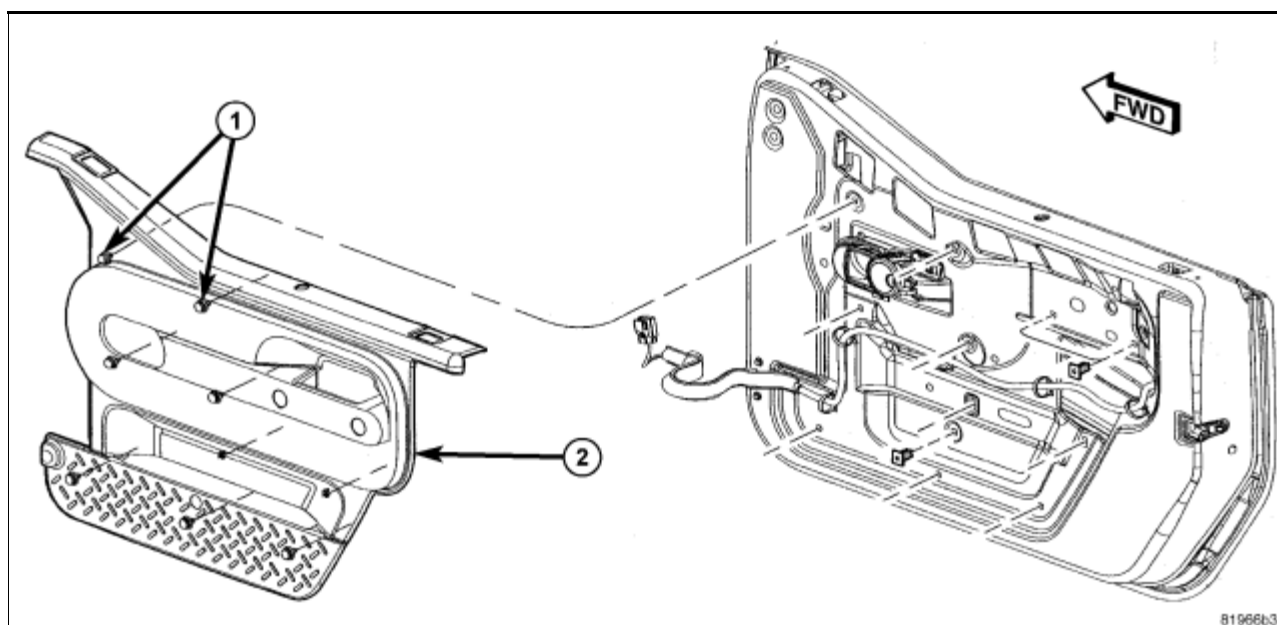
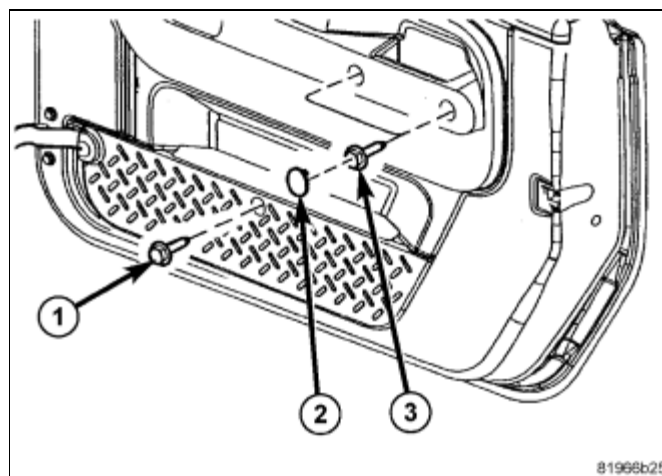
ADJUSTMENTS

1. Using a grease pencil or equivalent, mark the location of the door latch striker (2) on the B-pillar to aid in adjustment.
2. Loosen the two screws (3) that secure the door latch striker to the B-pillar.
3. To adjust the rear gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 26 N·m (19 ft. lbs.), (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.

TRIM PANEL REMOVAL

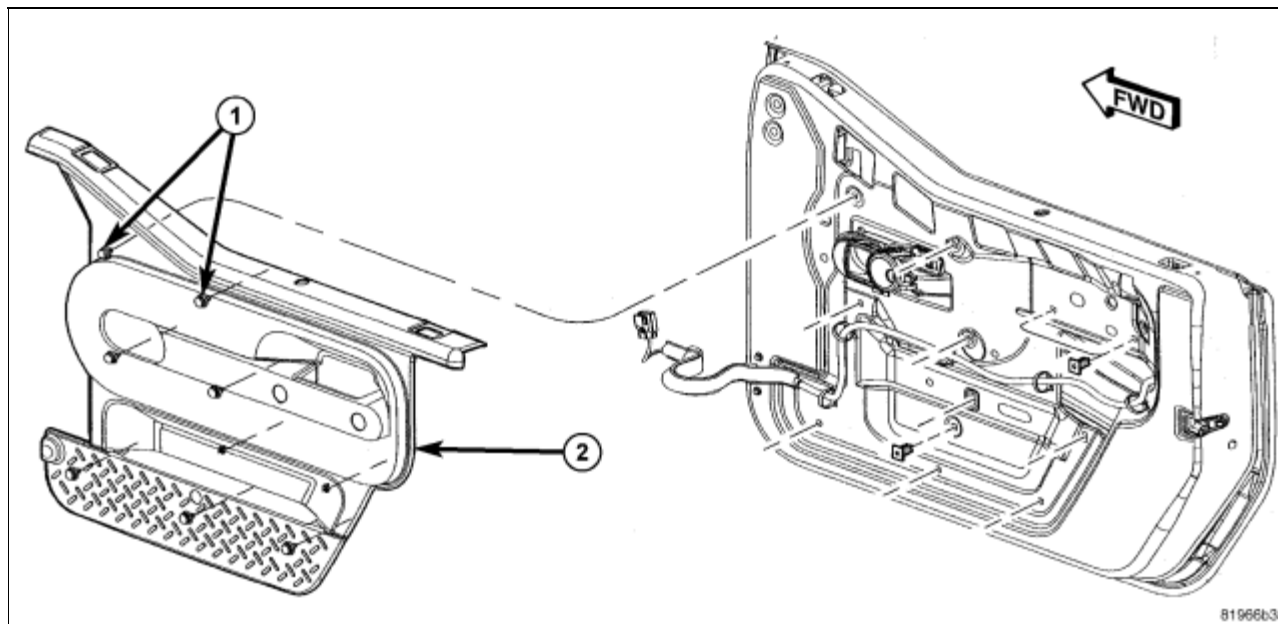


1. Remove the trim caps (2) and remove the pull handle screws (3).
2. Remove the lower screw (1).



3. Using a trim stick C-4829 or equivalent, separate the push pin fasteners (1) and remove the trim panel (2).

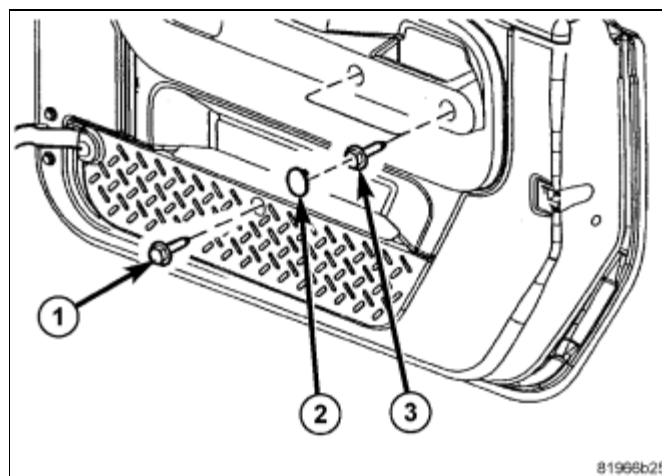
INSTALLATION



1. Position the trim panel (2) into place and seat the push pin fasteners (1) fully.

2. Install the lower screw (1).

3. Install the pull handle screws (3) and install the trim caps (2).

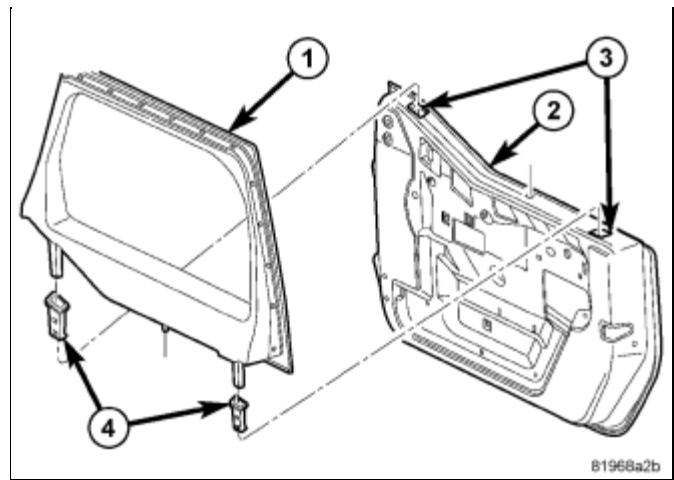


WINDOW

REMOVAL

1. Open the door (2) and lift the window (1) out of the mounting holes (3).

INSTALLATION

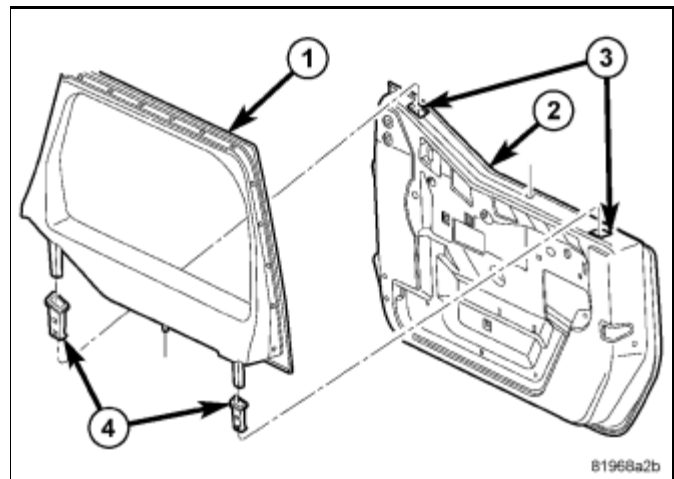


1. If necessary, install the grommets (4) into the door holes (3) and seat fully.
2. Install the window (1) into the grommets (4) and seat fully.

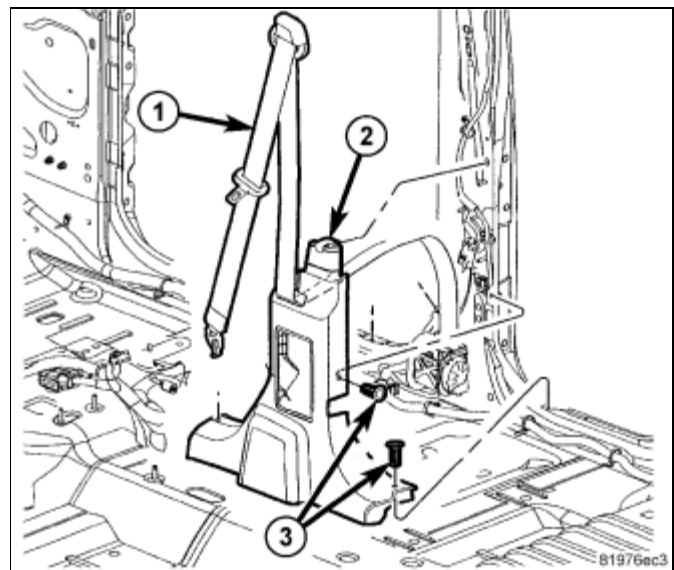
DOOR - HALF REAR

DOOR

REMOVAL

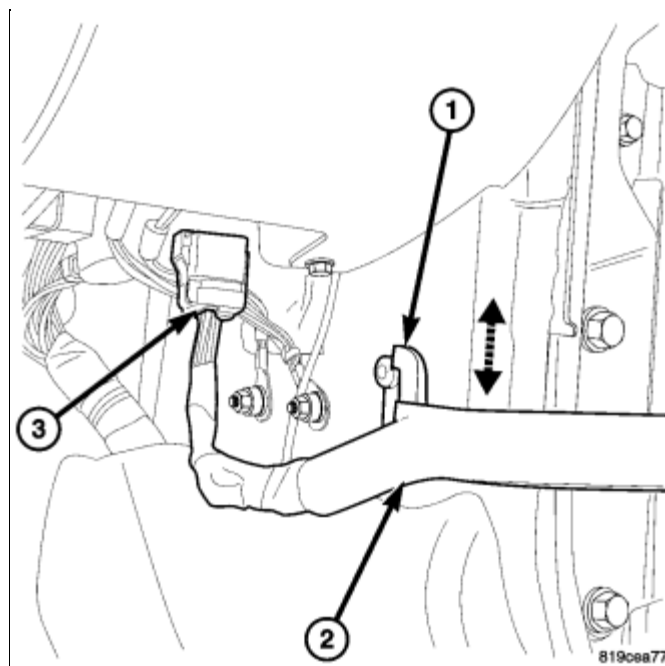


1. Remove the lower B-pillar trim panel (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).



NOTE: Front door check strap shown, rear doors are similar.

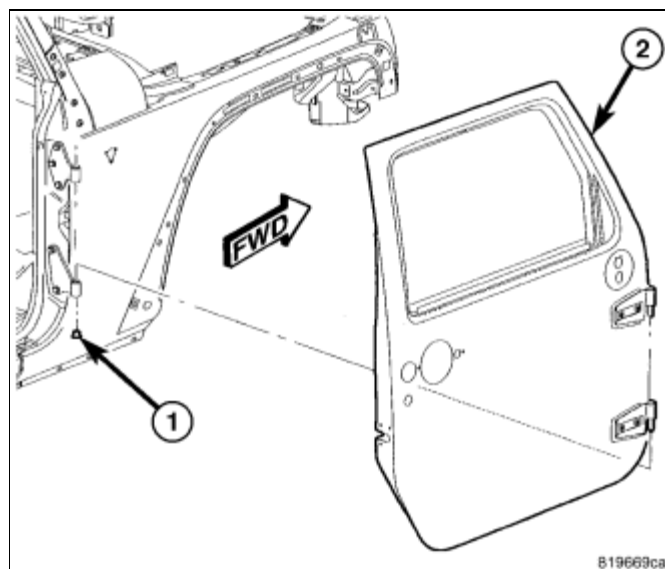
2. Disconnect the electrical connector (3) at the A-pillar cowl area and separate the check strap (2) from the footman's loop (1).



NOTE: Full front door shown, all others similar.

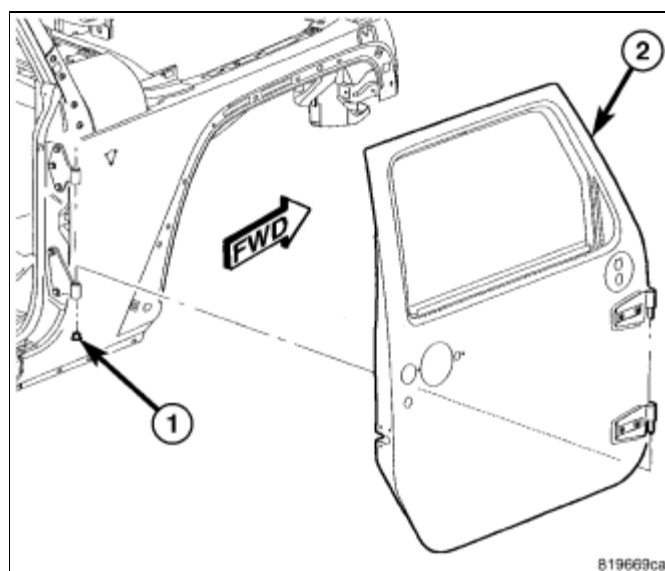
3. Remove the nuts (1) and lift the door (2) up off hinges and remove.

INSTALLATION



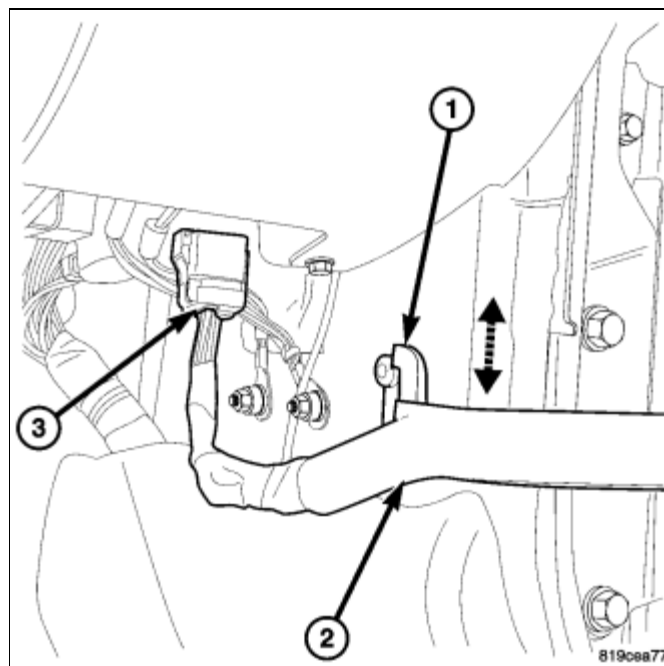
NOTE: Full front door shown, all others similar.

1. Align pins on door hinge to holes in hinge on body and position door into place.
2. Install the nuts (1) and tighten to 8.5 N·m (75 in. lbs.).
3. If necessary, adjust the door (2) (Refer to 23 - BODY/DOOR - HALF REAR/DOOR - ADJUSTMENTS)



NOTE: Front door check strap shown, rear doors are similar.

4. Secure the check strap (2) over the footman's loop (1) and connect the electrical connector (3).



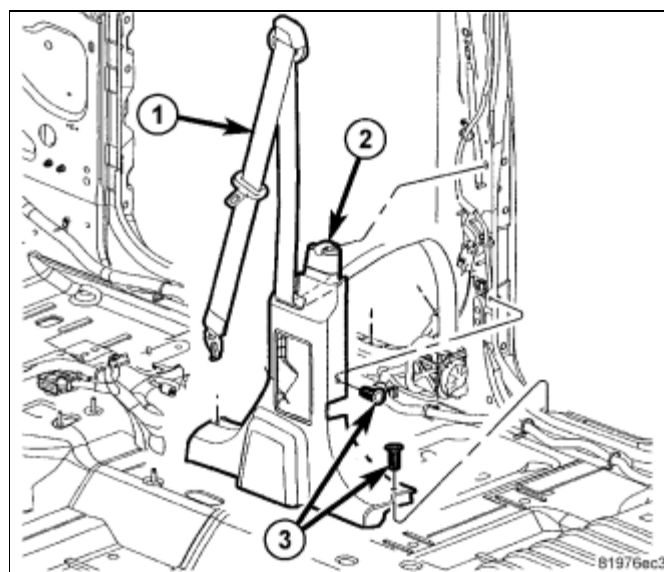
5. Install the lower B-pillar trim (2), (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

ADJUSTMENTS

ADJUSTMENT

NOTE: For four door vehicles, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)

- Full front door shown, all others similar.
- Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.
- During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.
- A suitable body sealant should be used when removing or moving the hinges.

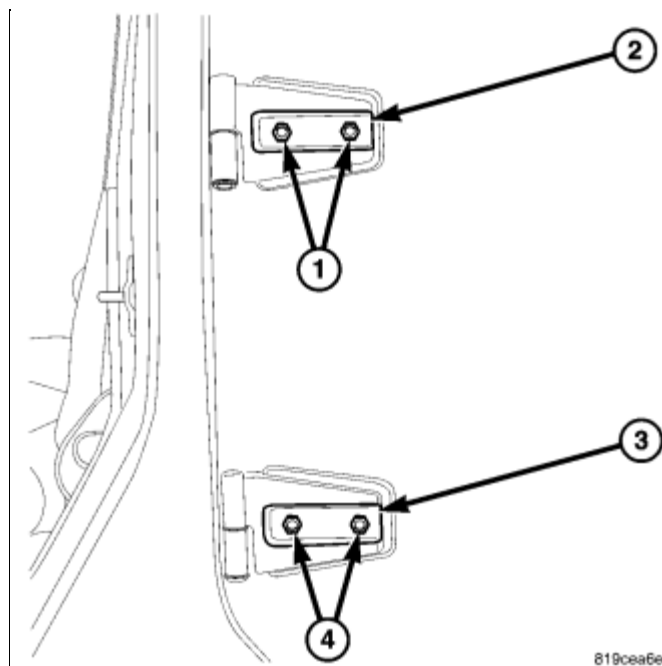


FORE/AFT

NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the door fasteners one hinge at a

time and moving the door to the correct position.

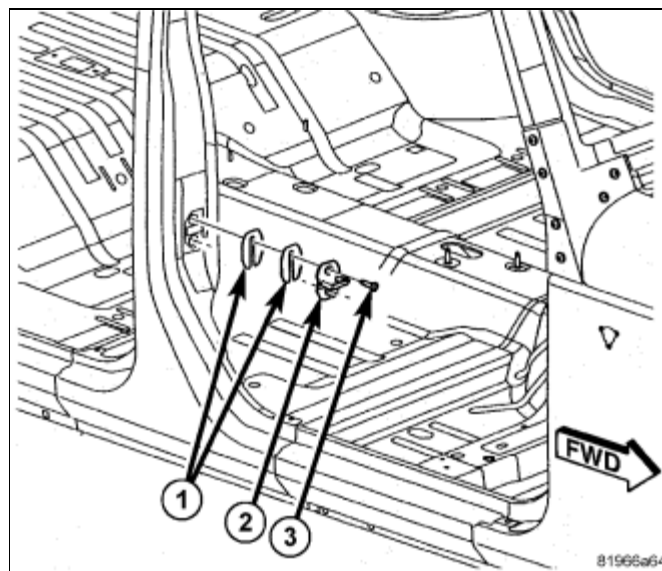
1. Support the door with a suitable lifting device.
2. Loosen the upper (1) and lower (4) hinge to door fasteners. (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge to door bolts to 26 N·m (19 ft. lbs.).



UP/DOWN

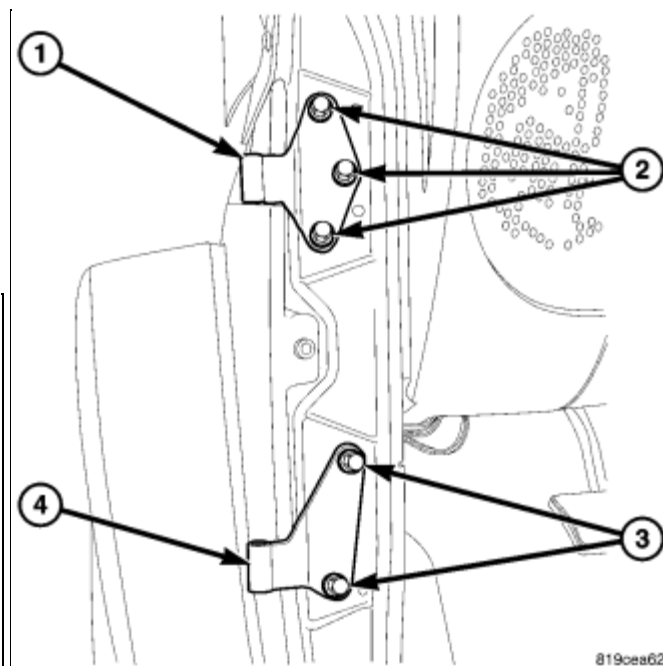
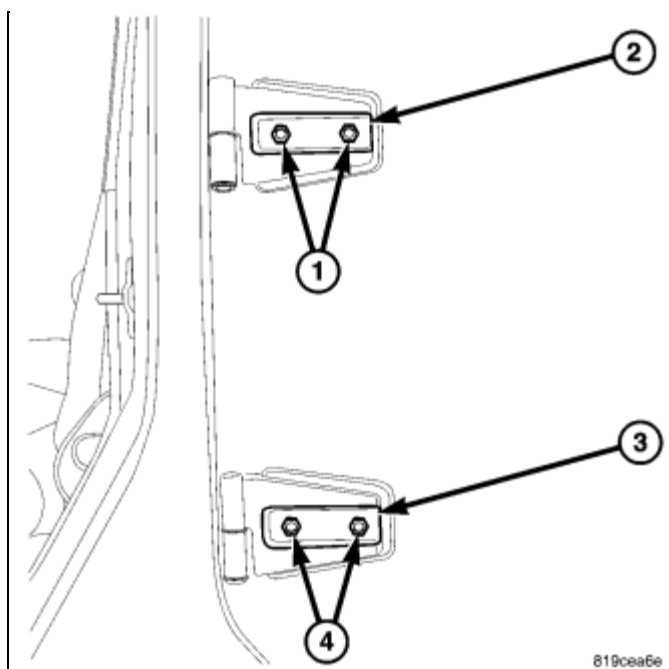
NOTE: Up/down door adjustment is done by loosening hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.

1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. If necessary, loosen the hinge to hinge pillar fasteners (2) and (3). (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
4. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).

5. If

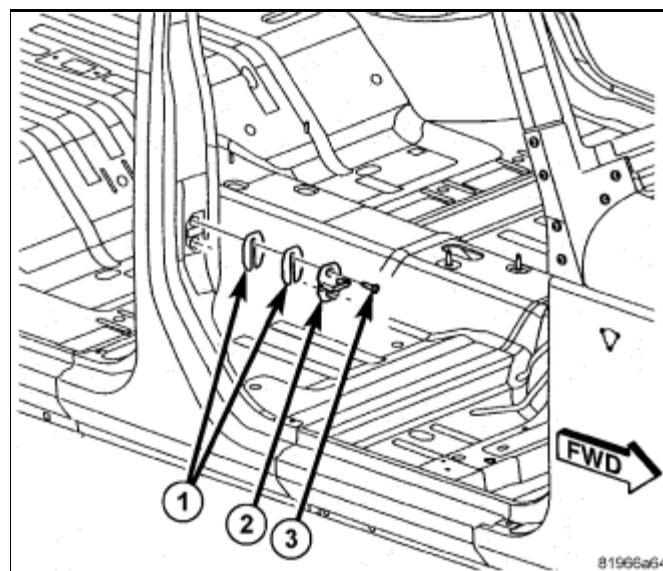


necessary, Loosen the hinge to door fasteners (1) and (4). (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

6. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

7. Tighten the door to hinge fasteners to 26 N·m (19 ft. lbs.).

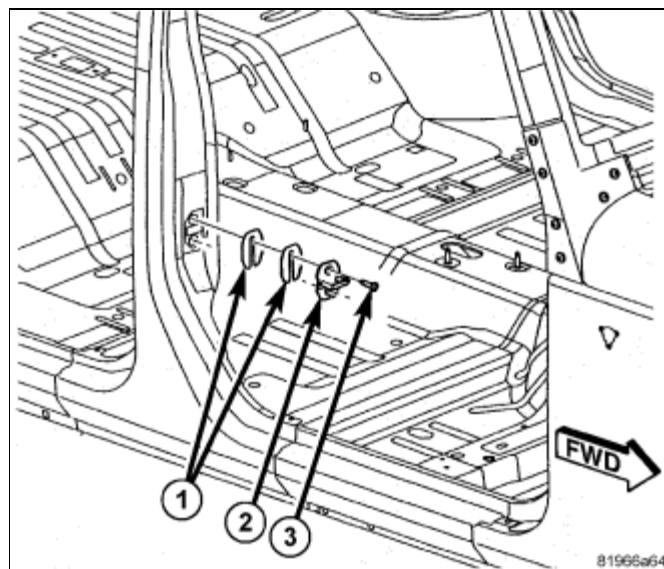
8. Tighten the latch striker bolts (3) 26 N·m (19 ft. lbs.).
(Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)



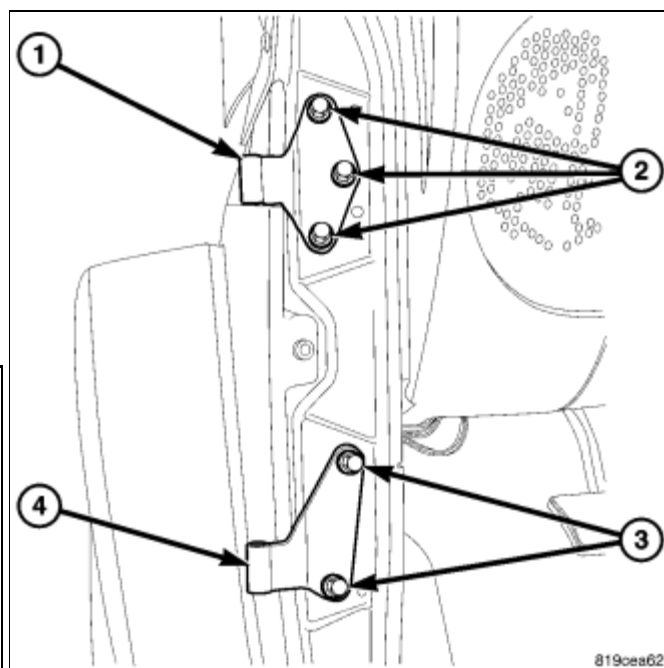
IN/OUT

NOTE: In/out door adjustment is done by loosening the hinge to body fasteners one hinge at a time and moving the door to the correct position.

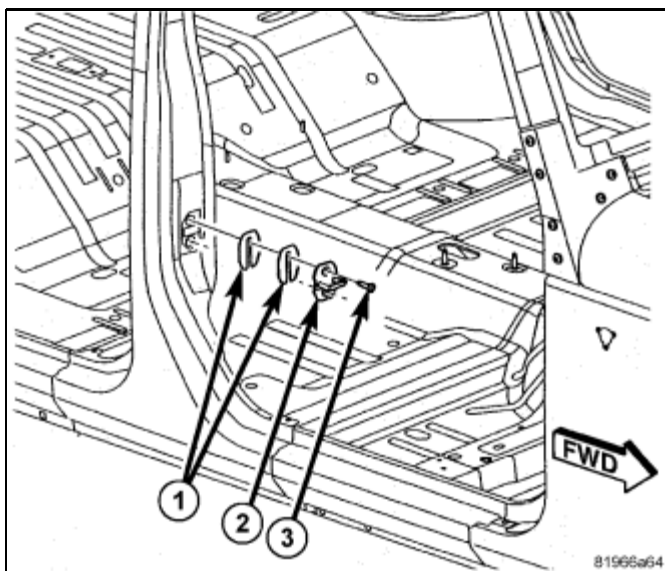
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts (3). (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)



3. Loosen the hinge to body fasteners (2) and (3), (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge to body fasteners to 28 N·m (21 ft. lbs.).



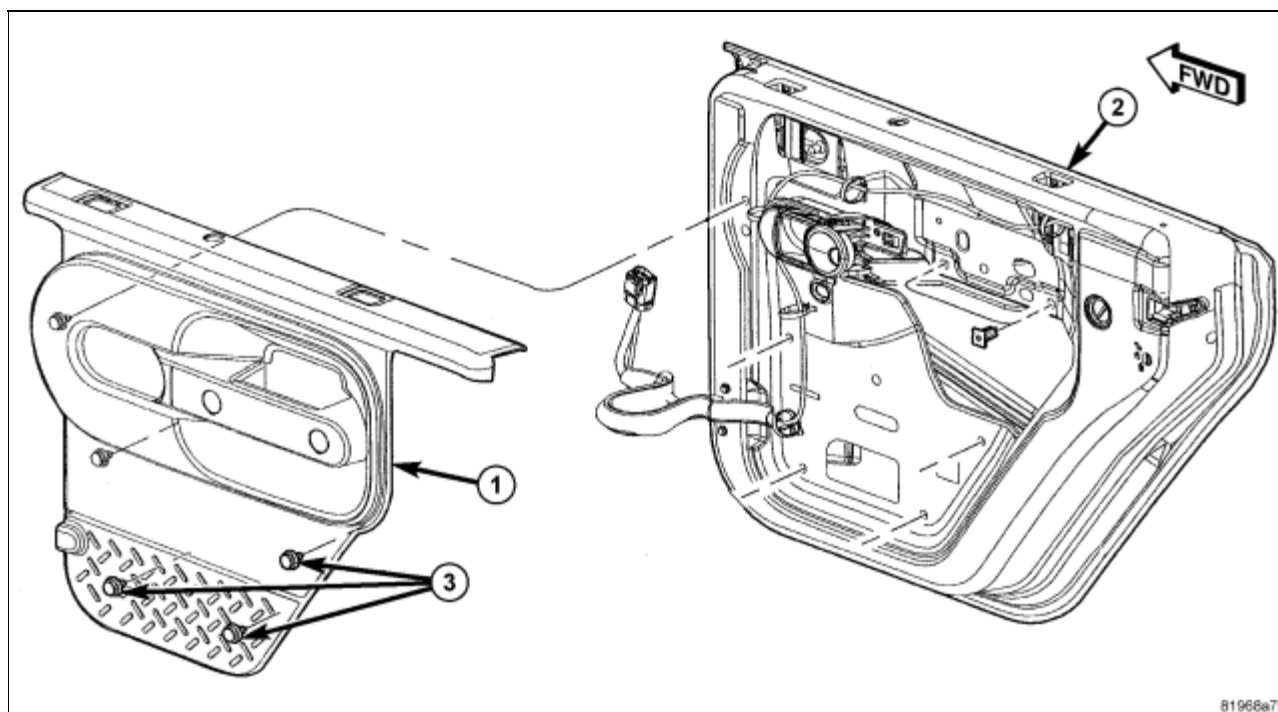
6. Tighten the latch striker bolts (3) to 26 N·m (19 ft. lbs.). (Refer to 23 -



BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

HANDLE - EXTERIOR DOOR

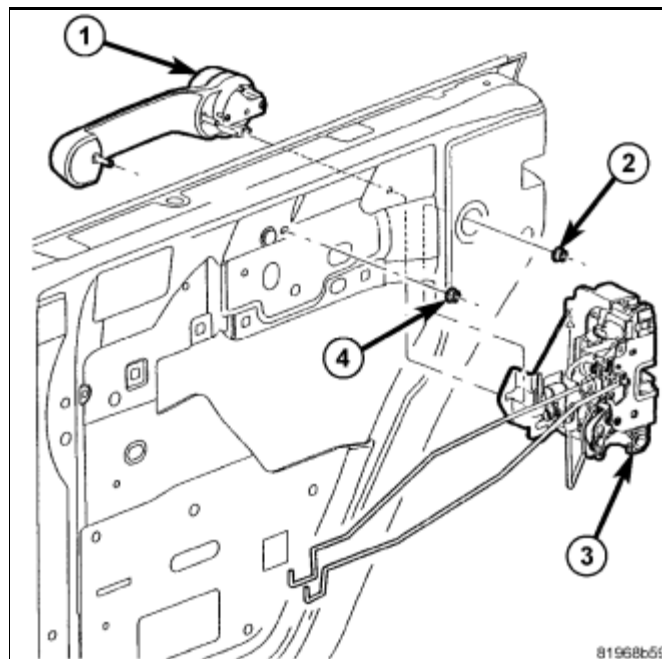
REMOVAL



1. Remove the trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - REMOVAL).

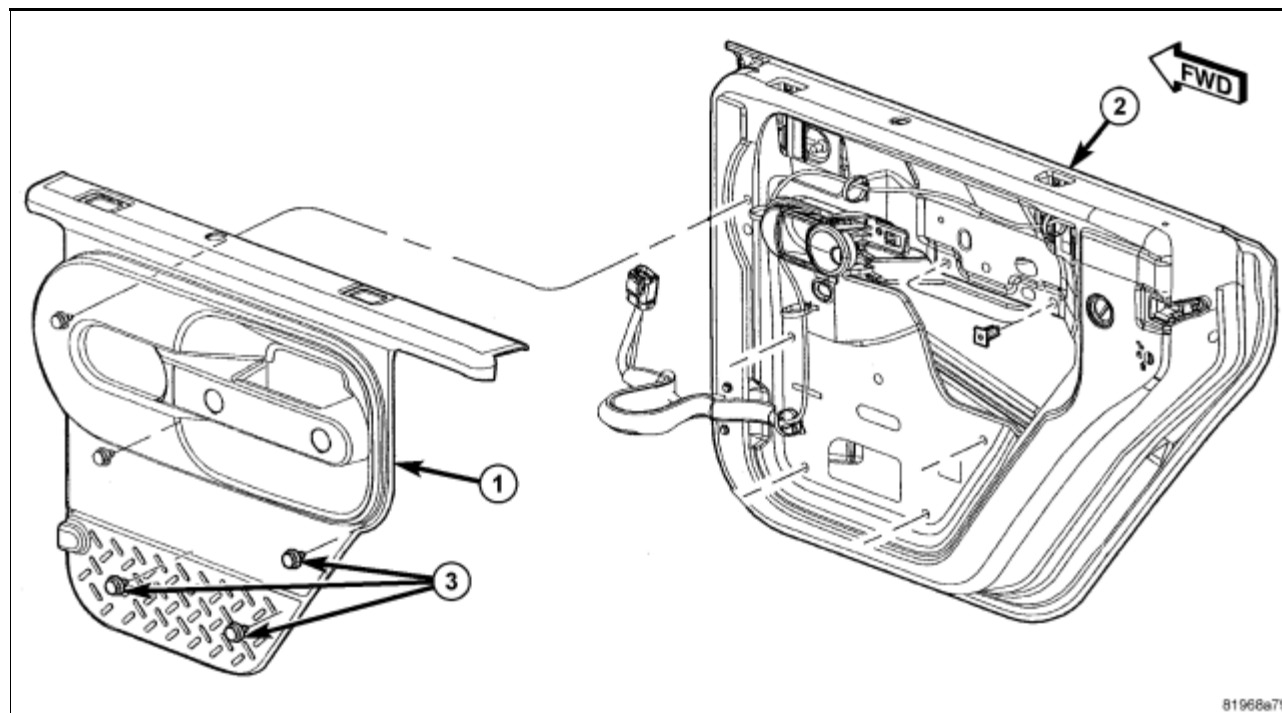
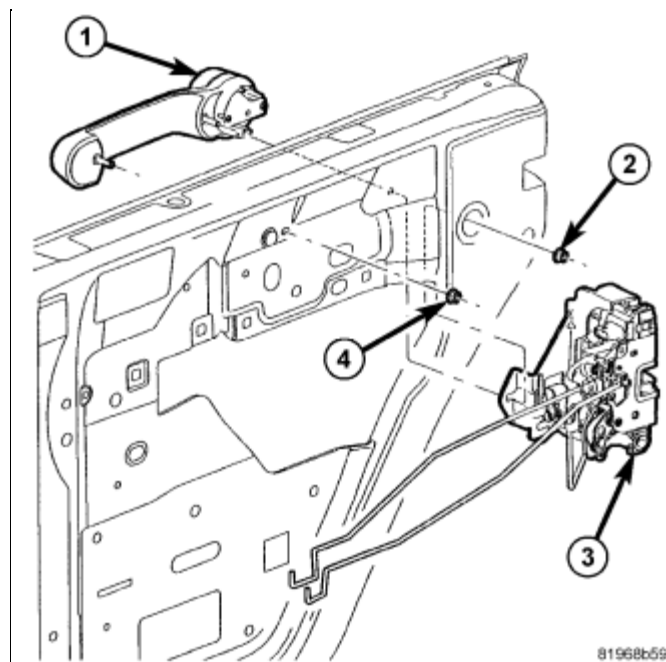
2. Remove the handle nuts (4) and (2) and remove the handle (1).

INSTALLATION



1. Install the handle (1) and install the nuts (4) and (2).

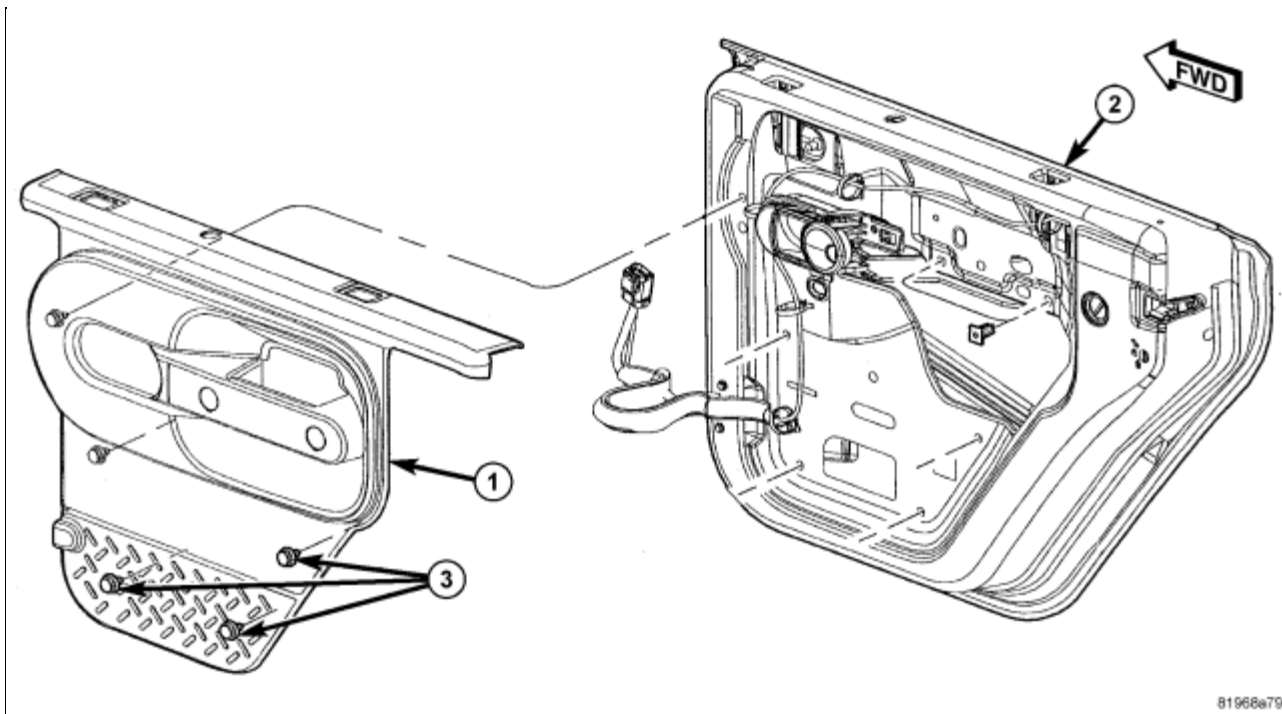
2. Tighten the nuts to, 4.5 N·m (40 in. lbs.).



3. Install the trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - INSTALLATION).

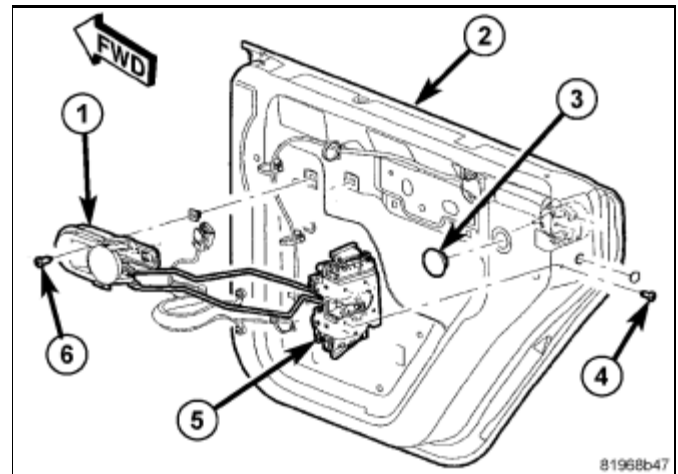
HANDLE - INSIDE RELEASE

REMOVAL



1. Remove the door trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - REMOVAL)

2. Remove the screw (6) securing the inside handle (1) to the door (2).

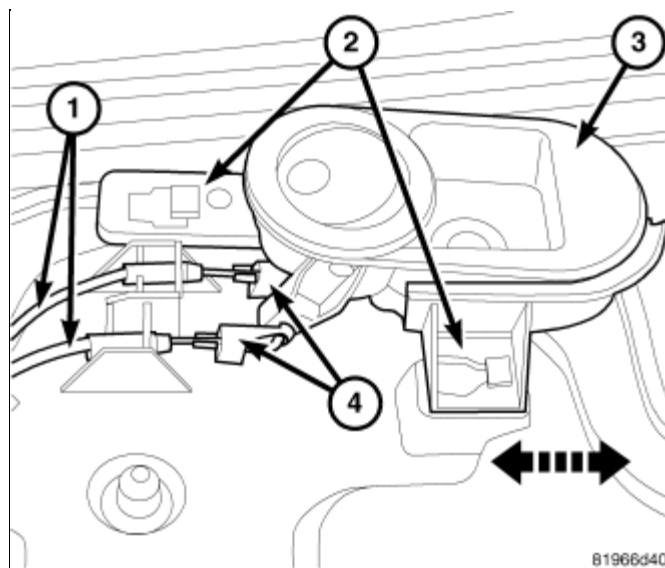


NOTE: Full front door shown, half door similar.

3. Release the clips (4) and disconnect the handle rods (1).

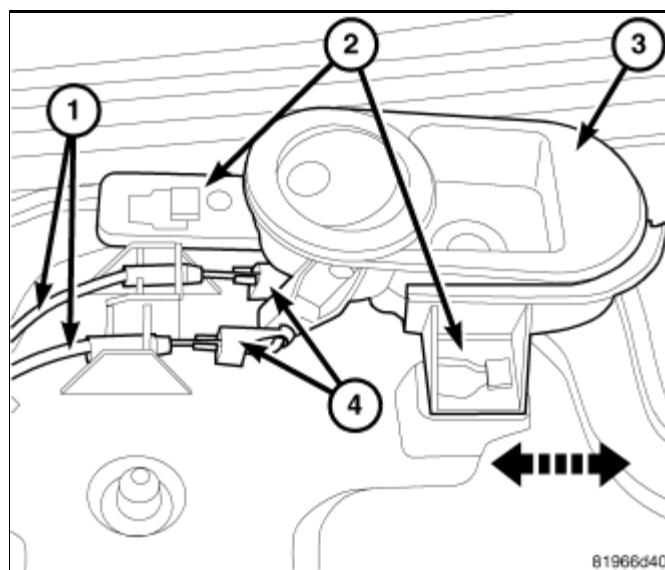
4. Slide the handle (3) off of the retaining tabs (2) and remove.

INSTALLATION

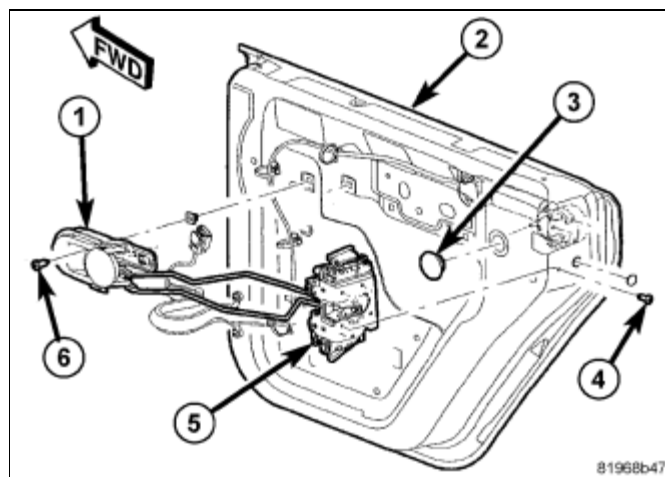


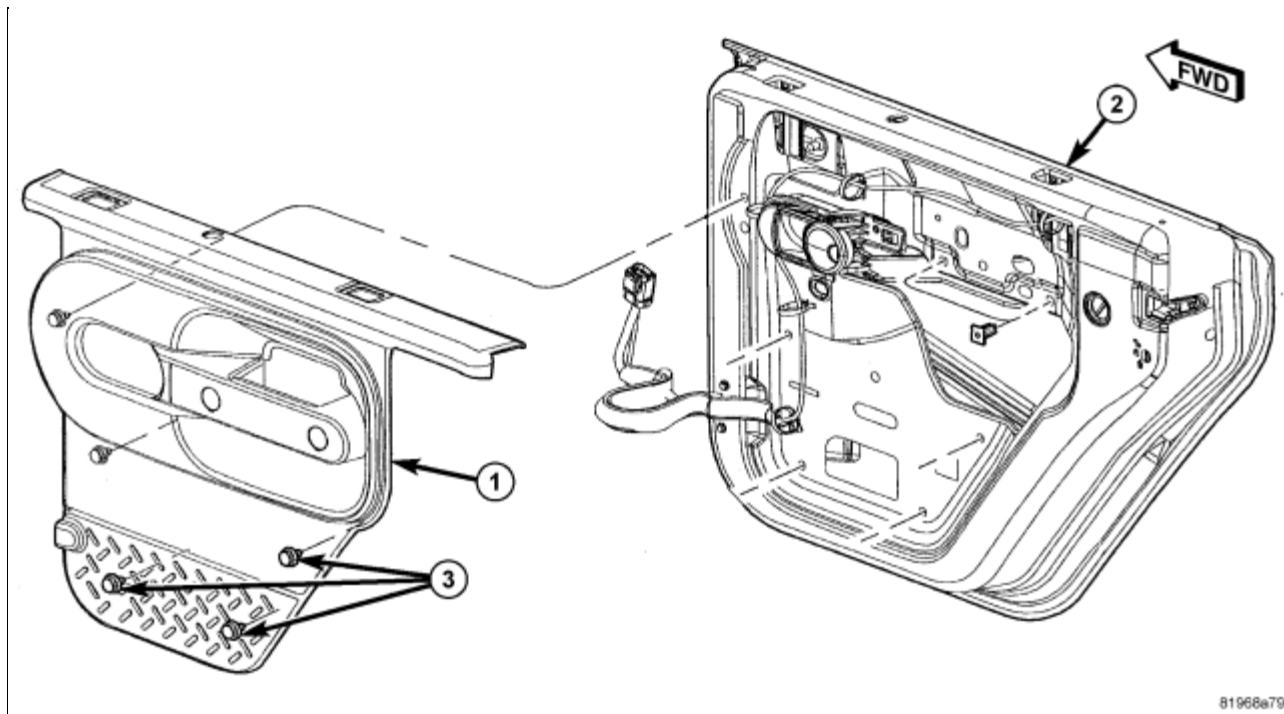
NOTE: Full door shown, half door similar.

1. Position the handle (3) onto the carrier plate tabs (2) and slide into place fully.
2. Connect the rods (1) and secure the clips (4).



3. Install the handle screw (6) and tighten to 8.5 N·m (75 in. lbs.).





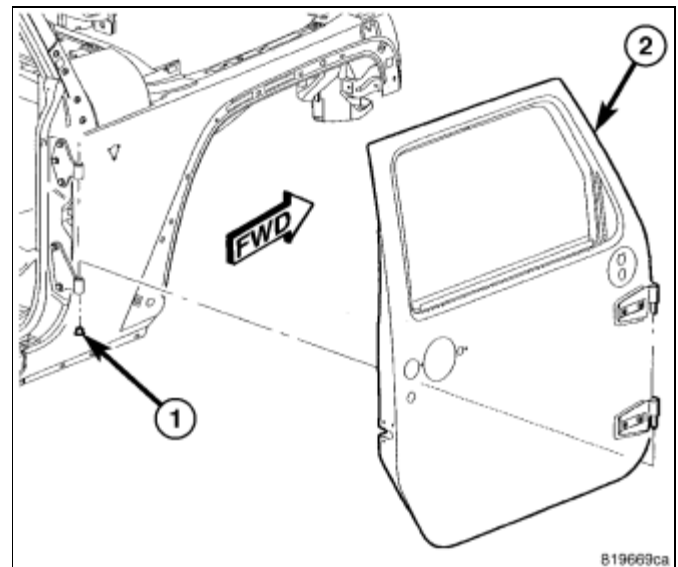
4. Install the trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - INSTALLATION)

HINGE

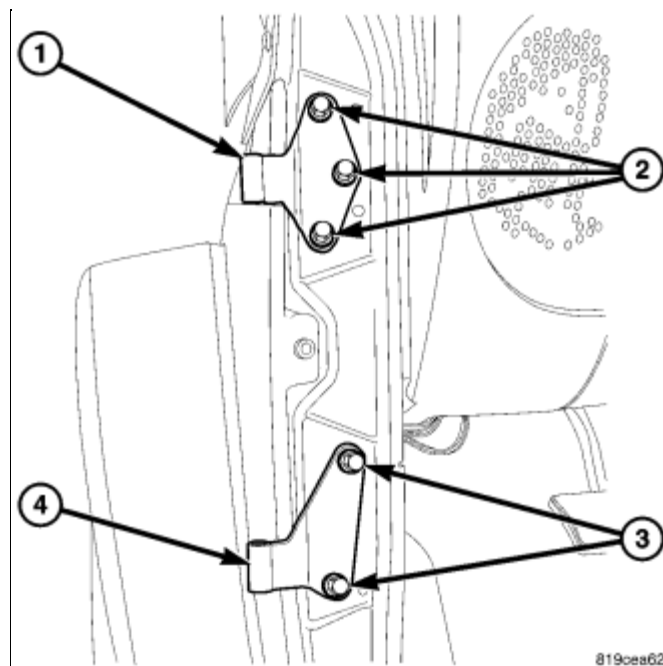
REMOVAL

NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Remove the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - REMOVAL).

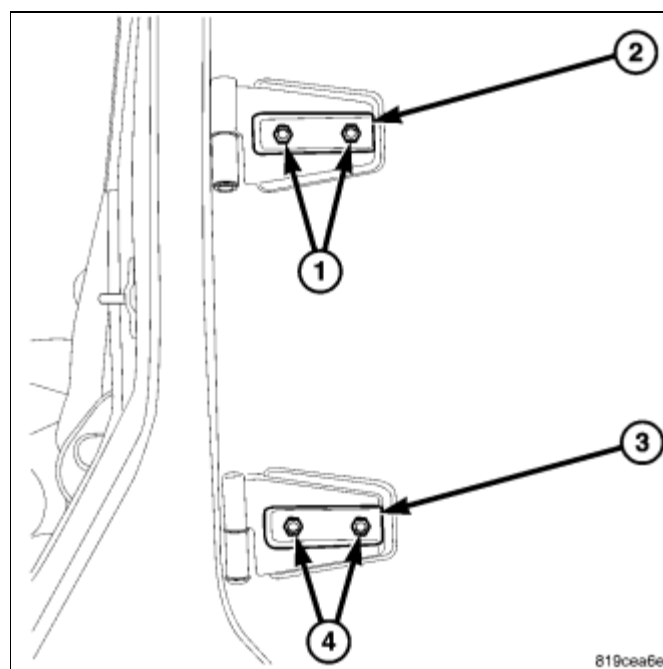


2. Using a grease pencil or equivalent, mark the body hinge (1) and (4) location and remove the bolts (2) and (3).



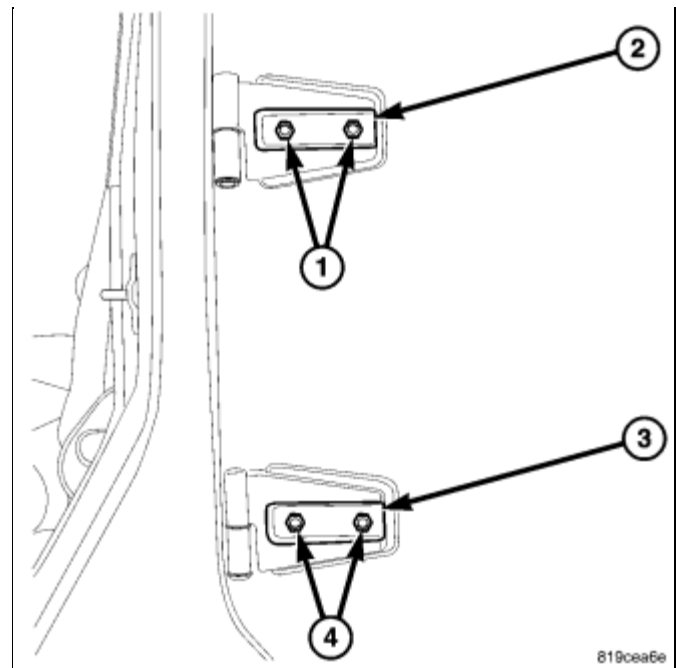
3. Using a grease pencil or equivalent, mark the door hinge (2) and (3) location and remove the bolts (1) and (4).

INSTALLATION



NOTE: A suitable body sealant should be used when removing or moving the hinges.

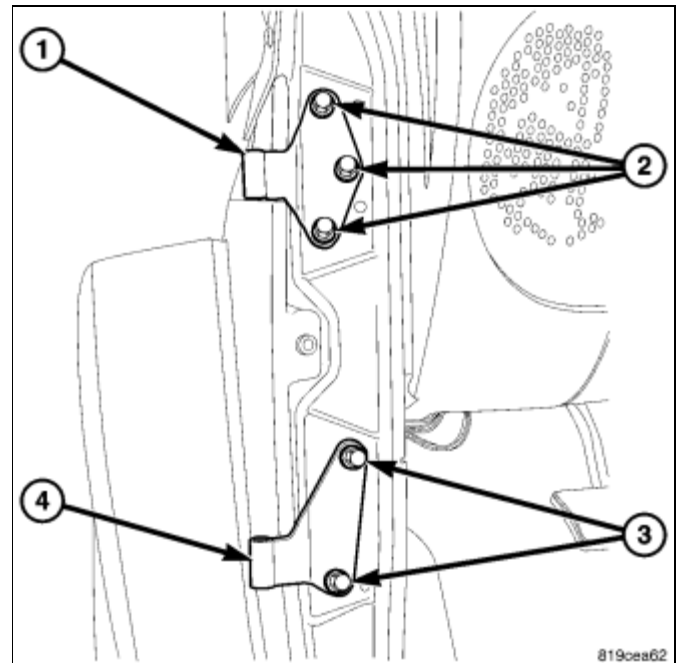
1. Install the door hinges (2) and (3), and install the bolts (1) and (4).
2. Align the hinges to the door using the reference marks made during the removal procedure and tighten the bolts to 26 N·m (19 ft. lbs.).



819cea6e

3. Install the body hinges (1) and (4), and install the bolts (2) and (3).

4. Align the hinges to the body using the reference marks made during the removal procedure and tighten the bolts to 28 N·m (21 ft. lbs.).

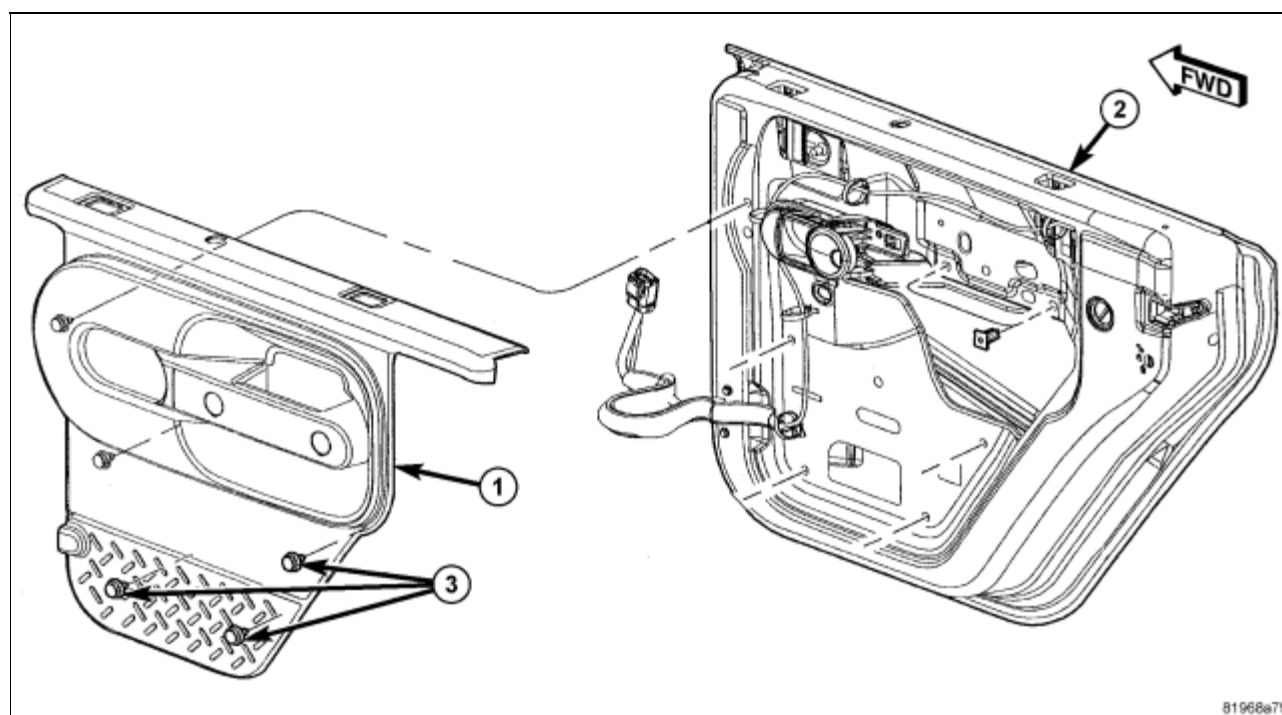
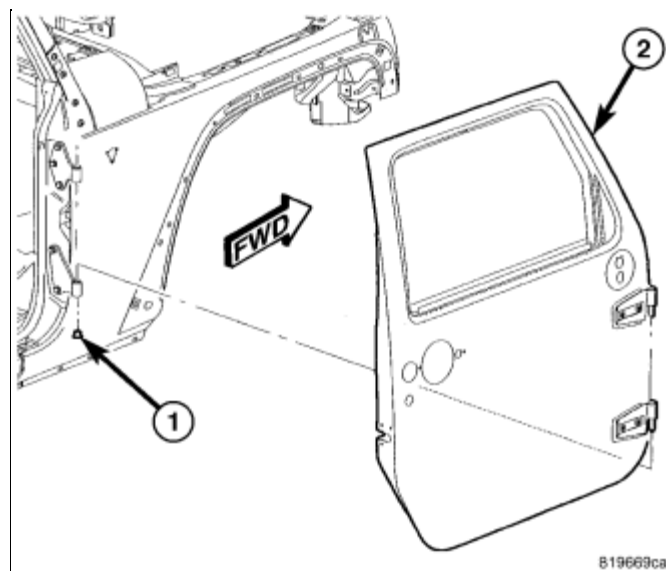


819cea62

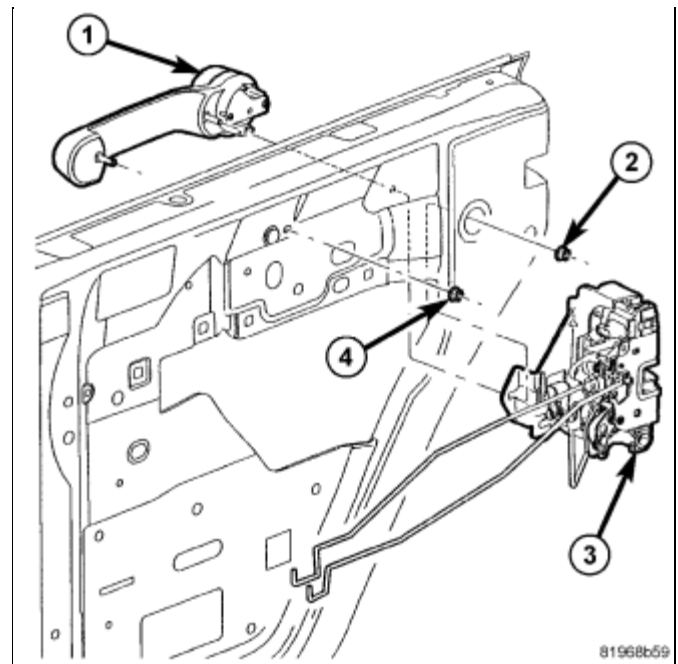
5. Install the door (2), (Refer to 23 - BODY/DOOR - FULL FRONT/DOOR - INSTALLATION).

LATCH

REMOVAL

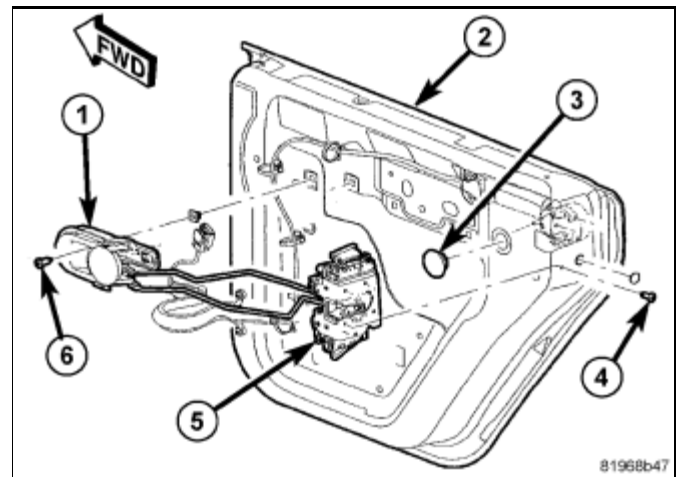


1. Remove the door trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - REMOVAL)
2. Remove the exterior handle nut (2).

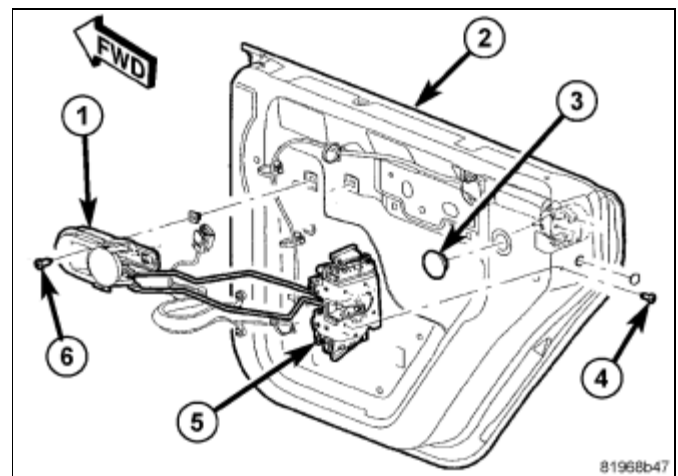


3. Disconnect the latch rods and electrical connector.
4. Remove the latch screws (4) and remove the latch from the door (2).

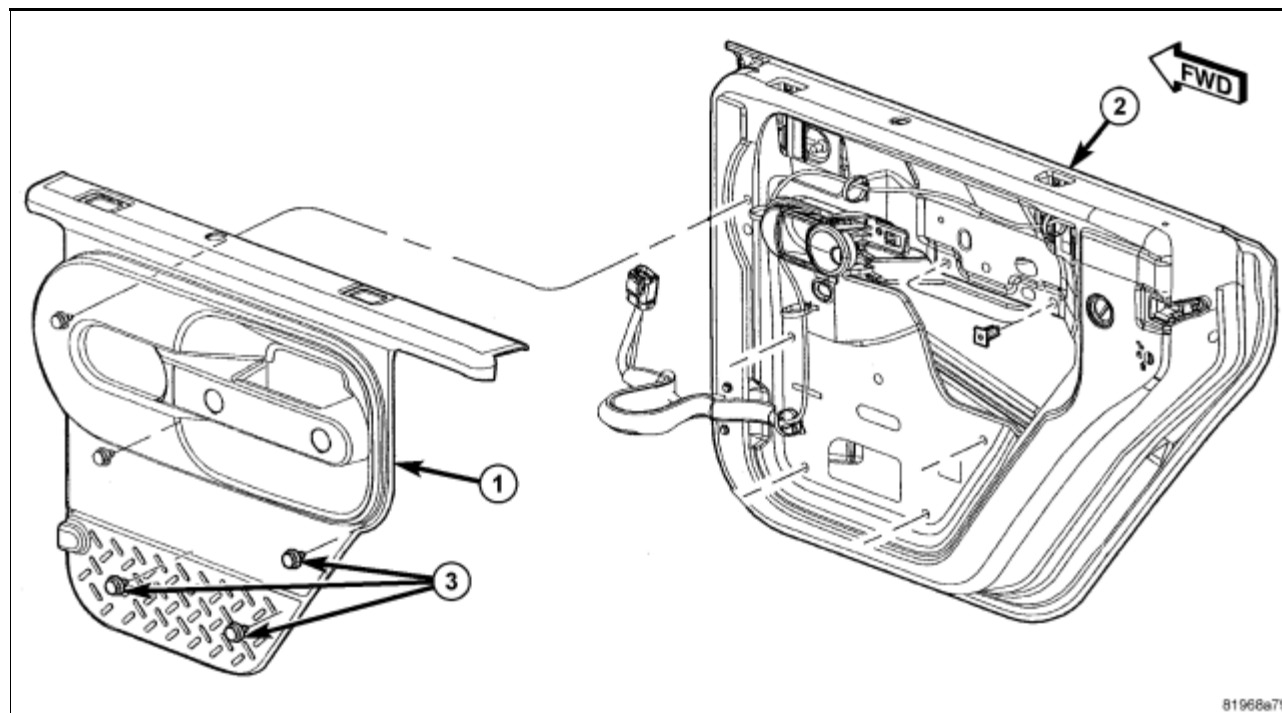
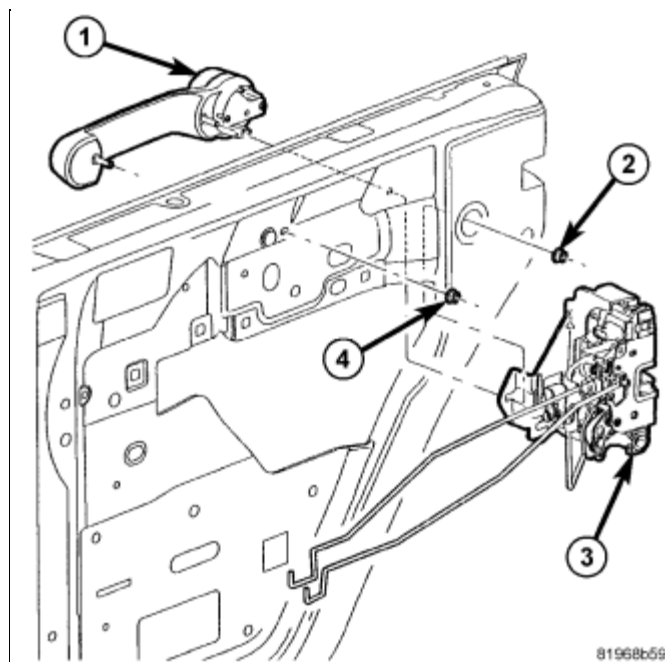
INSTALLATION



1. Install the latch screws (4) and tighten to 8 N·m (71 in. lbs.) top screws first.
2. Connect the electrical connector.
3. Connect the rods and seat the clips fully.



4. Install the rear exterior handle nut (2) and tighten to 4.5 N·m (40 in. lbs.).



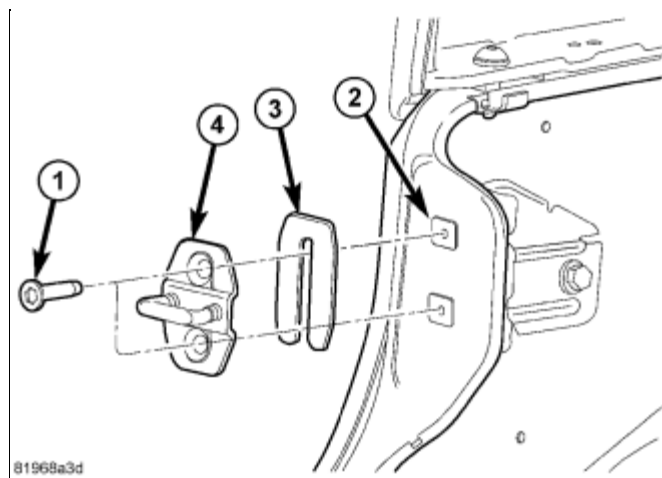
5. Install the trim panel (1), (Refer to 23 - BODY/DOOR - HALF REAR/TRIM PANEL - INSTALLATION).

STRIKER - DOOR

REMOVAL

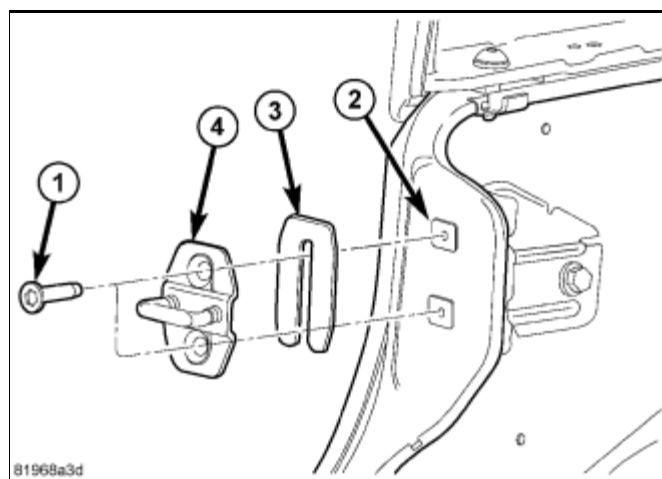
1. Remove the screws (1).
2. Remove the striker (4) and the shims (3), if equipped.

INSTALLATION



1. Install the shims (3), if equipped, and install the striker (4).
2. Install the screws (1) and tighten to 26 N·m (19 ft. lbs.).
3. If necessary, adjust the door latch striker,

ADJUSTMENTS

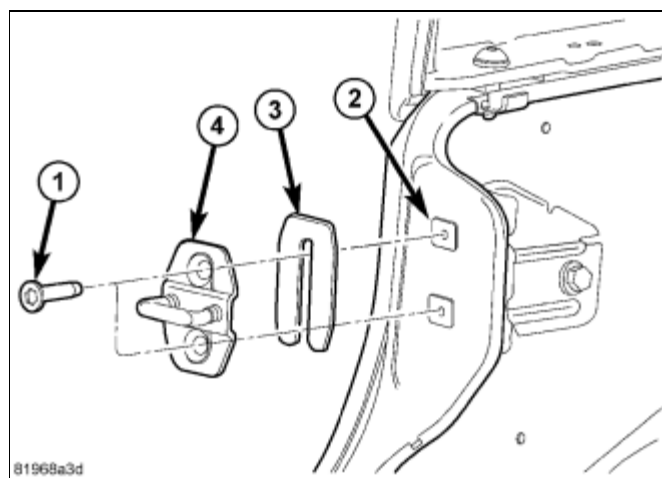


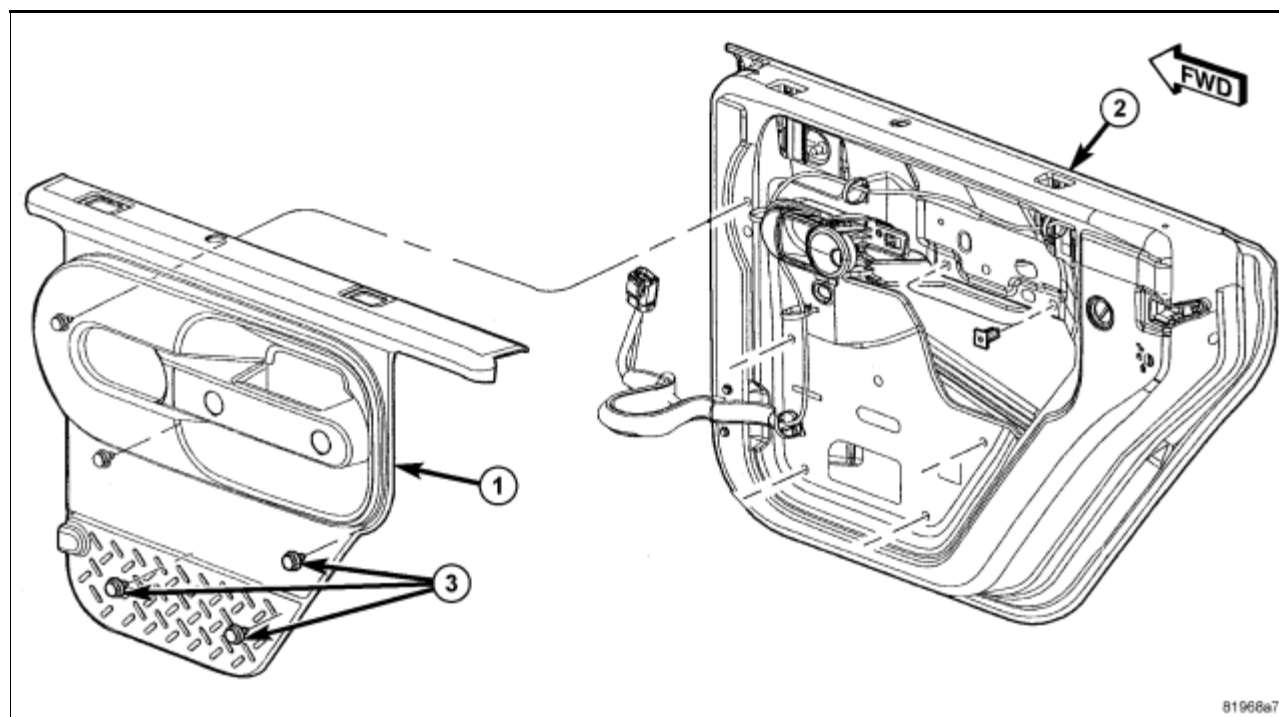
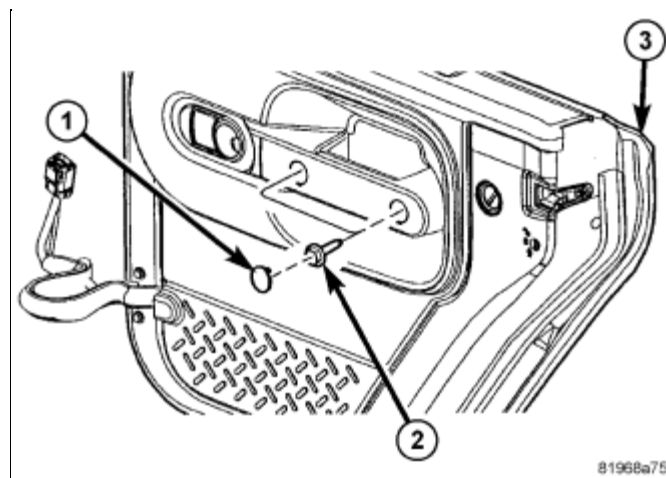
1. Using a grease pencil or equivalent, mark the location of the door latch striker (4) on the C-pillar to aid in adjustment.
2. Loosen the two screws (1) that secure the door latch striker to the C-pillar.
3. To adjust the rear gap and flush measurement, change the position of the door latch striker and then tighten the two bolts to 26 N·m (19 ft. lbs.), (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).
4. Verify correct door and latch position.

TRIM PANEL

REMOVAL

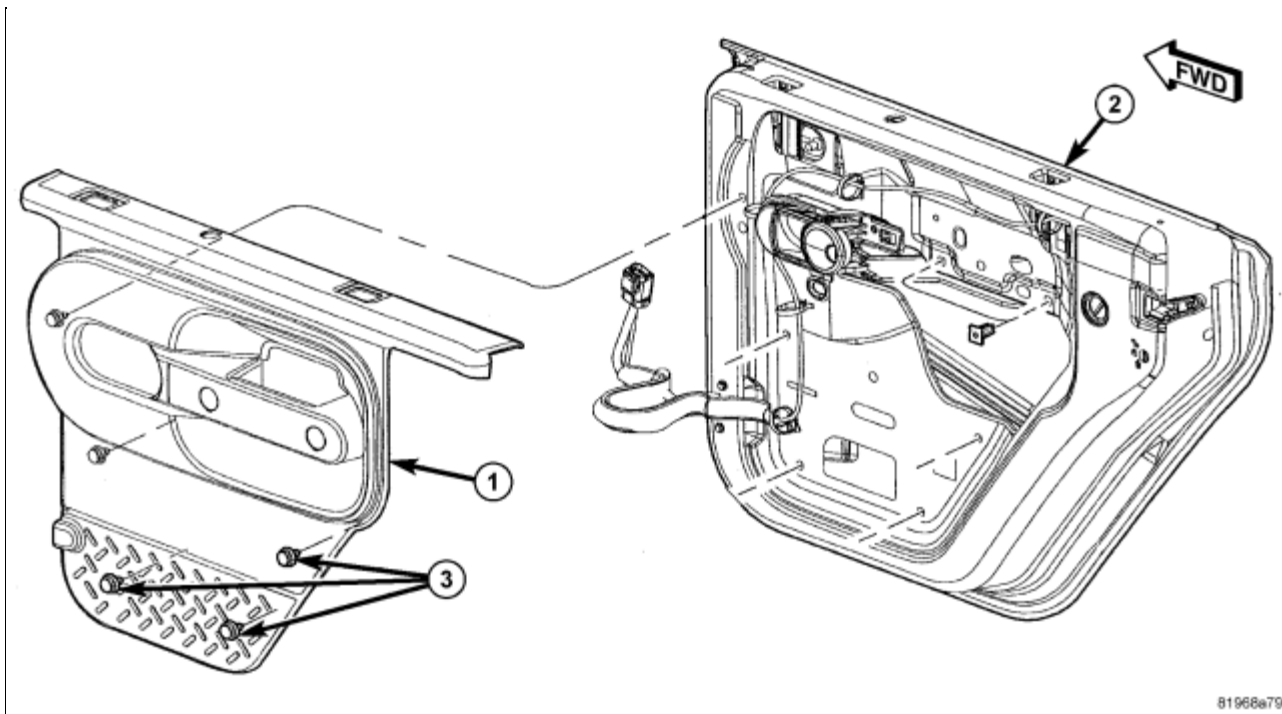
1. Remove the pull handle trim plugs (1) and remove the pull handle screws (2).





2. Using a trim stick C-4829 or equivalent, separate the all the push pin fasteners (3) and remove the trim panel (1).

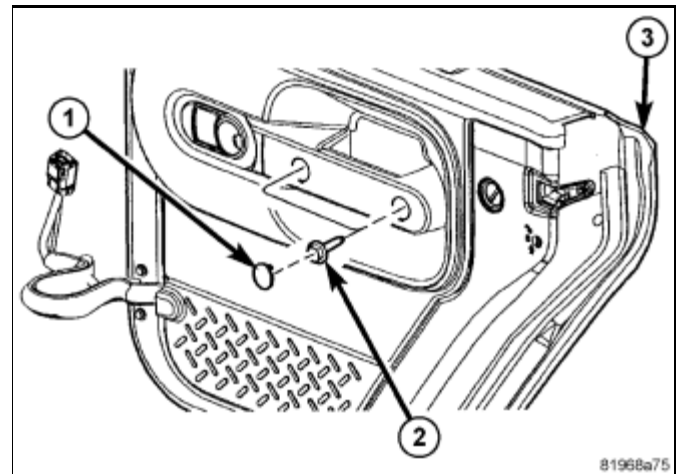
INSTALLATION



1. Position the trim panel (1) into place and seat the push pin fasteners (3) fully.

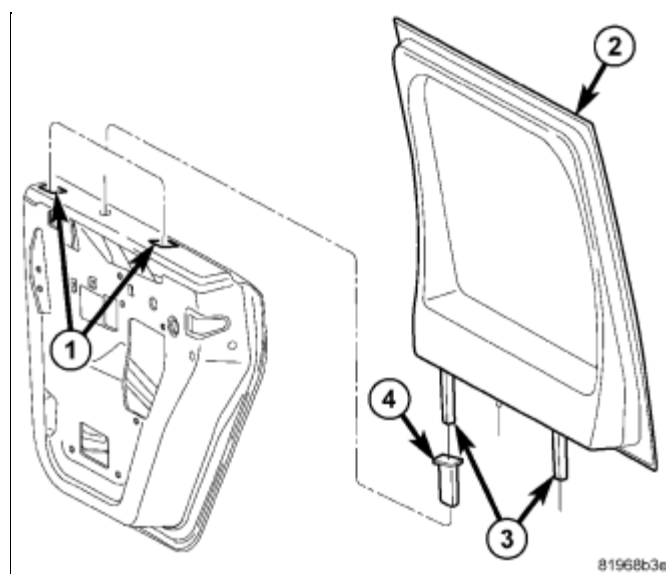
2. Install the pull handle screws (2) and install the trim caps (1).

WINDOW REMOVAL



1. Open the door and lift the window (2) out of the mounting holes (1).

INSTALLATION

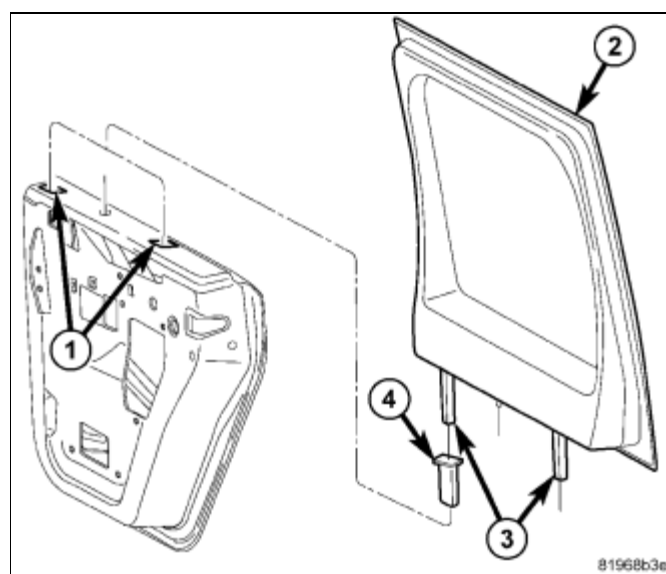


1. If necessary, install the grommets (4) into the door holes (1) and seat fully.
2. Install the window (2) into the grommets (4) and seat fully.

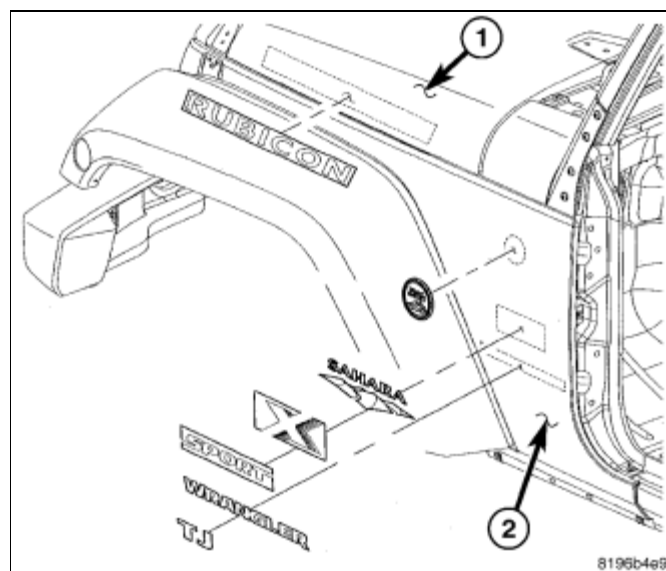
EXTERIOR

BODY DECALS

REMOVAL



1. Apply a length of masking tape on the body (2) and hood (1), parallel to the top edge of the nameplate to use as a guide, if necessary.



2. Apply a length of masking tape on the body (1), parallel to the top edge of the nameplate to use as a guide, if necessary.

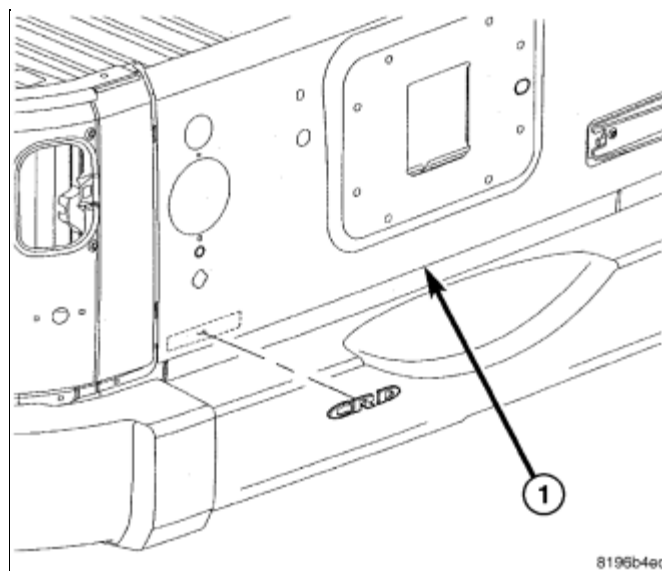
NOTE: Exterior nameplates are attached to body panels with adhesive tape.

3. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.

CAUTION: Use care when separating the emblem from the body surface to avoid scratching the paint.

4. Using a trim stick C-4755 or equivalent, behind the emblem to separate the adhesive backing from the body.

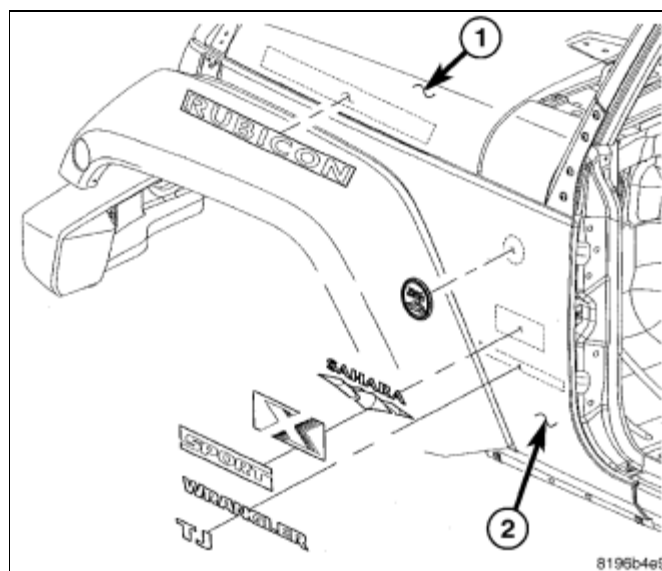
5. Clean adhesive residue from body with MOPAR® Super Clean solvent or equivalent.



INSTALLATION

NOTE: Make sure the body surface is completely clean before applying the emblem.

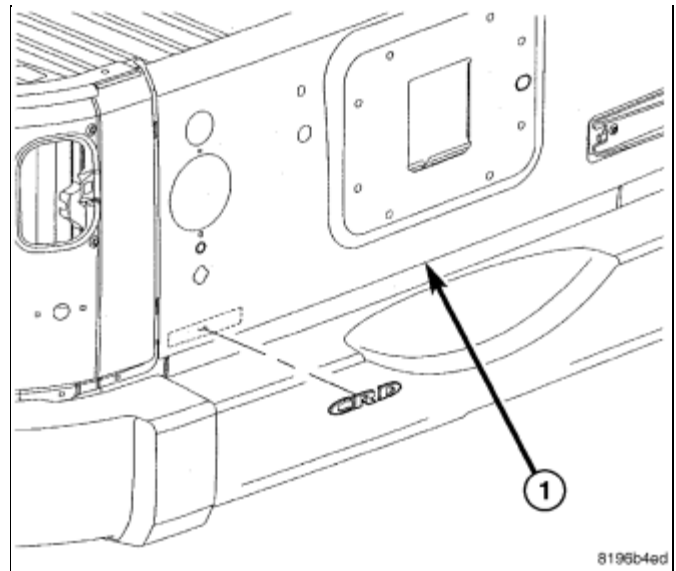
1. Remove protective cover from adhesive tape on back of emblem.
2. Position the correct emblem properly on the body (2) and hood (1).



3. Position the correct emblem properly on the body (1).
4. Press emblem firmly to the body with the palm of hand.
5. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.

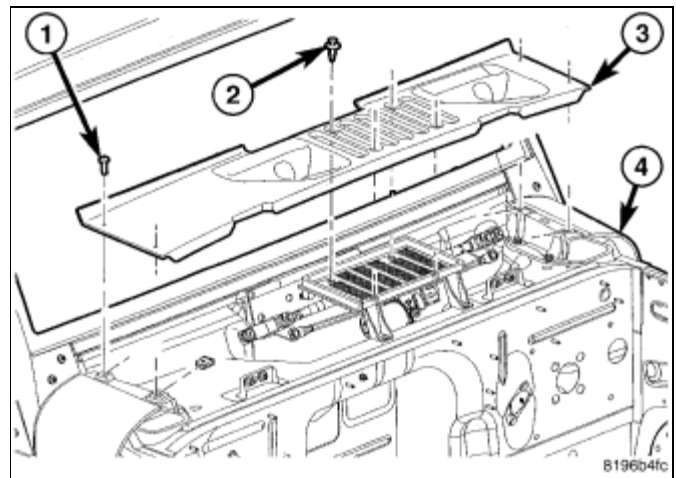
PANEL - COWL TOP

REMOVAL



1. Remove the wiper arms, (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL).
2. Remove the bolts (1) from the cowl trim panel (3).
3. Remove the push/pins (2) from the cowl trim panel (3).
4. Remove the cowl trim panel (3) from the body (4) of the vehicle.

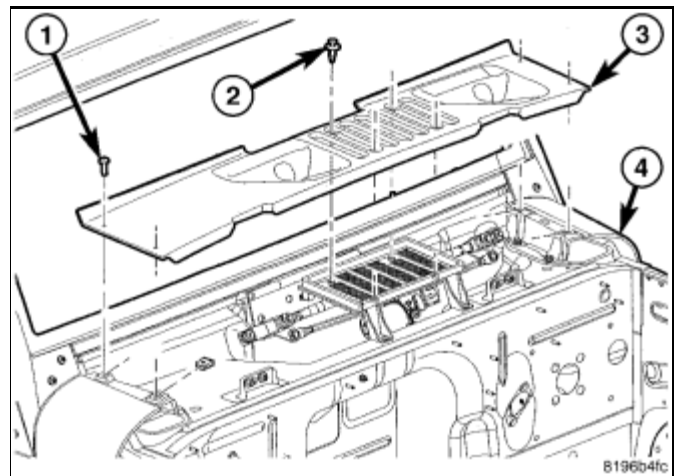
INSTALLATION



1. Install the cowl trim panel (3) to the body (4) of the vehicle.
2. Install the push/pins (2) to the cowl trim panel (3).
3. Install the bolts (1) to the cowl trim panel (3).
4. Install the wiper arms, (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION).

FRONT FENDER

REMOVAL



1. Remove the cowl top panel, (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - REMOVAL).
2. Remove the wheel flares, (Refer to 23 -

BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - REMOVAL).

3. Remove the wheelhouse splash shield, (Refer to 23 - BODY/EXTERIOR/SPLASH SHIELD - WHEELHOUSE - REMOVAL)

4. Remove the windshield frame bracket, (Refer to 23 - BODY/STATIONARY GLASS/PANEL - WINDSHIELD FRAME - REMOVAL).

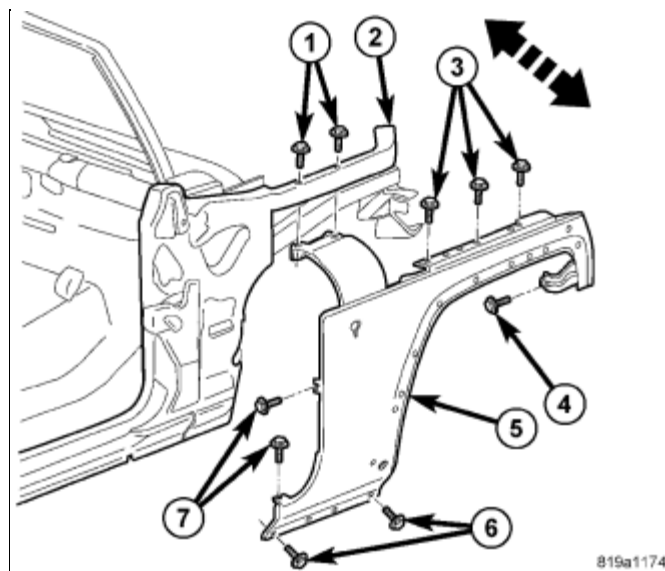
5. Remove the cowl bolts (1) and the upper bolts (3).

6. Remove rear bolts (7) from the door opening.

7. Remove the sill bolts (6).

8. Remove the wheelhouse bolt (4) and remove the fender (5).

9. Remove the antenna from the fender, if equipped, (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - REMOVAL).



INSTALLATION

1. If necessary, install the antenna onto the fender, (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - INSTALLATION).

2. Loosely install the fender (5) onto the front end sheet metal mounting structure (2).

3. Loosely install the cowl bolts (1) and the upper bolts (3).

4. Loosely install the door opening bolts (7).

5. Loosely install the wheelhouse bolt (4).

6. Loosely install the sill bolts (6).

7. Adjust the fender to the correct gap and flush dimensions, (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).

8. After correct fender gap and flush specifications are obtained, tighten all the upper fender fasteners (1, 3, 4 and 7) to 5 N·m (45 in. lbs.).

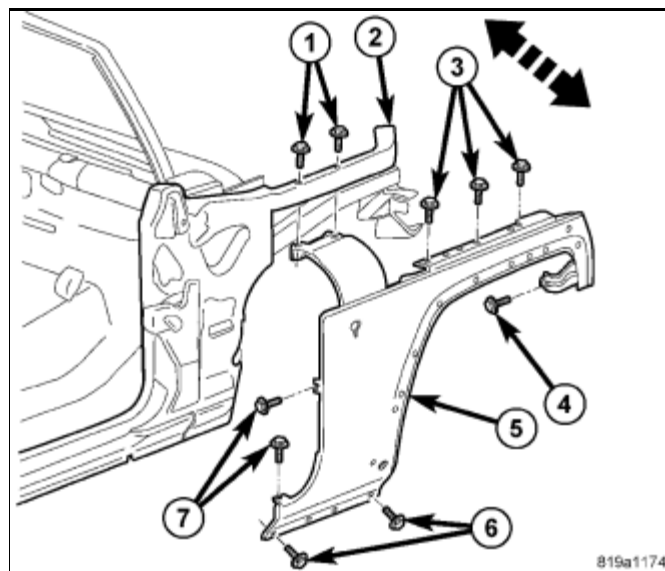
9. Tighten the lower sill bolts (6) to 12 N·m (9 ft. lbs.).

10. Install the windshield frame bracket, (Refer to 23 - BODY/STATIONARY GLASS/PANEL - WINDSHIELD FRAME - INSTALLATION).

11. Install the front wheelhouse splash shield, (Refer to 23 - BODY/EXTERIOR/SPLASH SHIELD - WHEELHOUSE - INSTALLATION).

12. Install the wheel opening flares, (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - INSTALLATION).

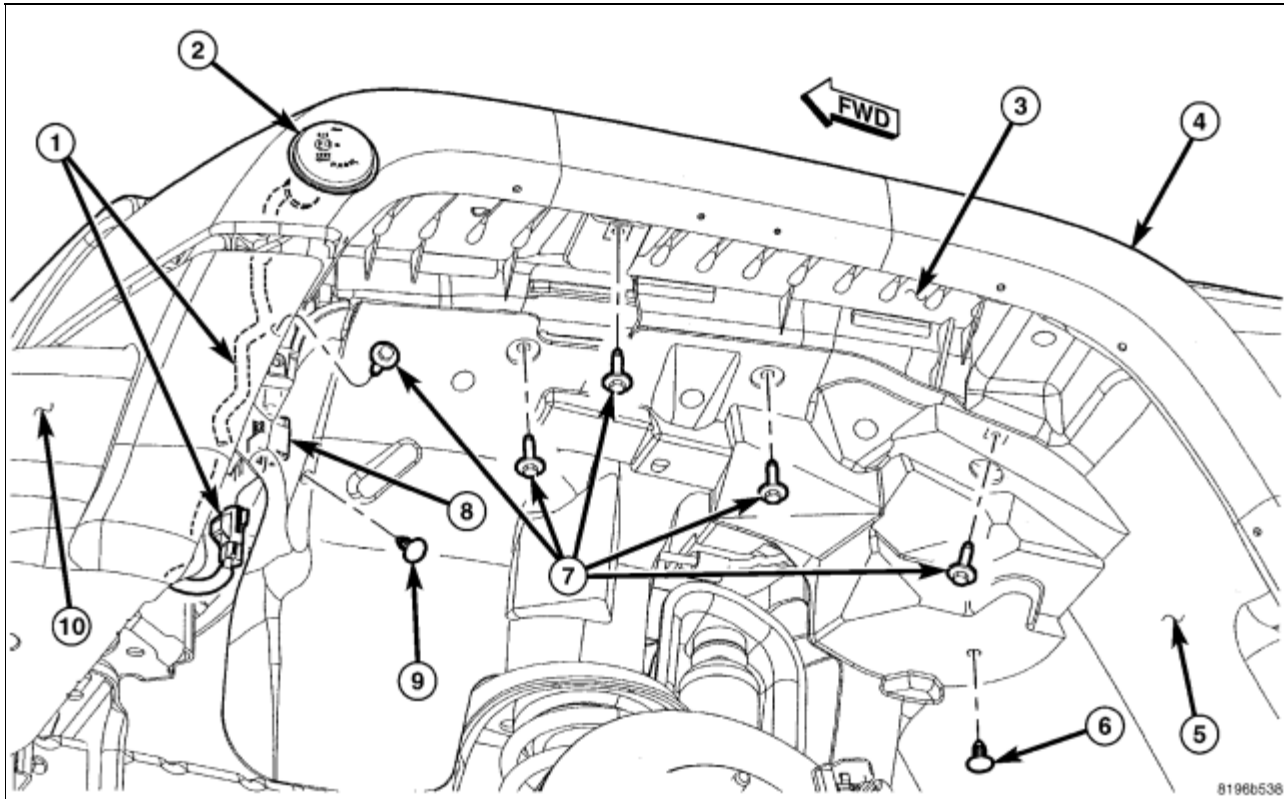
13. Install the cowl top panel, (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - INSTALLATION).



SPLASH SHIELD - WHEELHOUSE

REMOVAL

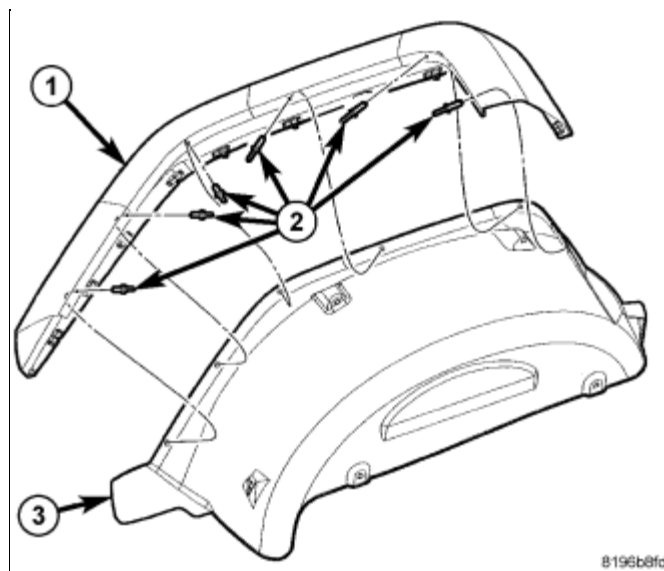
Front



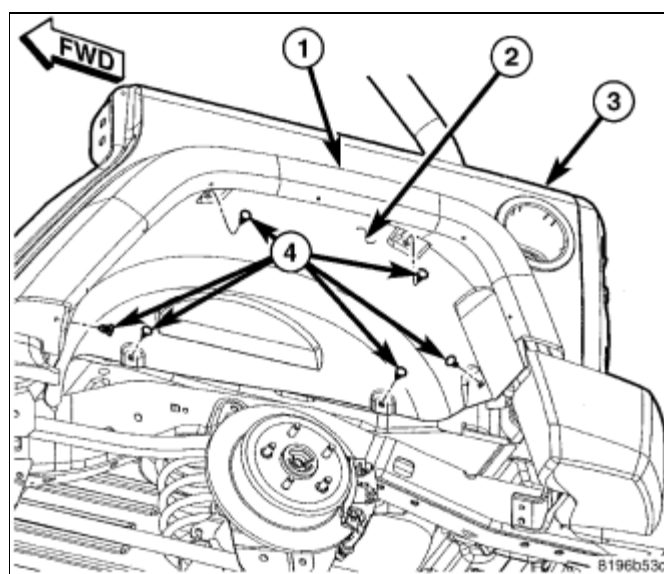
1. Raise and support the vehicle (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).
2. Remove the wheel and tire to gain access to the front wheel house liner.
3. Remove the all push/pins (6), (9) from the wheel house liner.
4. Remove the all bolts (7) from the wheel house liner.
5. Remove the wheel speed sensor harness (1) from the wheel house liner.
6. Remove front wheel house liner from front wheel house opening.

Rear

1. Remove the wheel flare rivets (2).

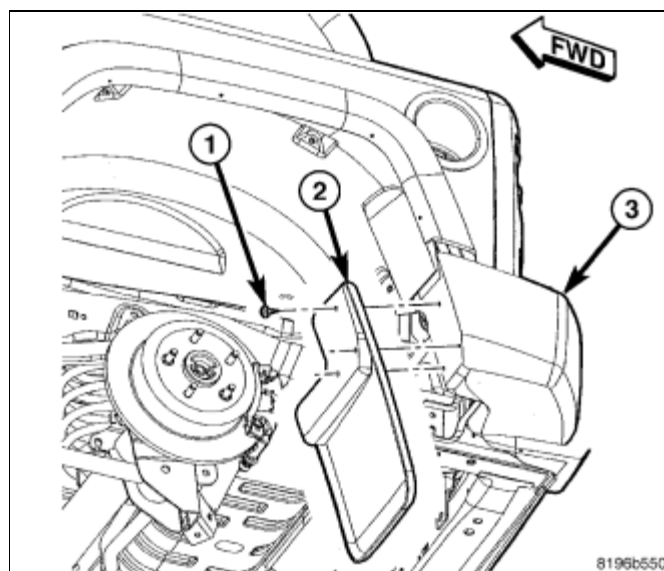


2. Remove the push pin fasteners (4) and remove the splash shield (2).

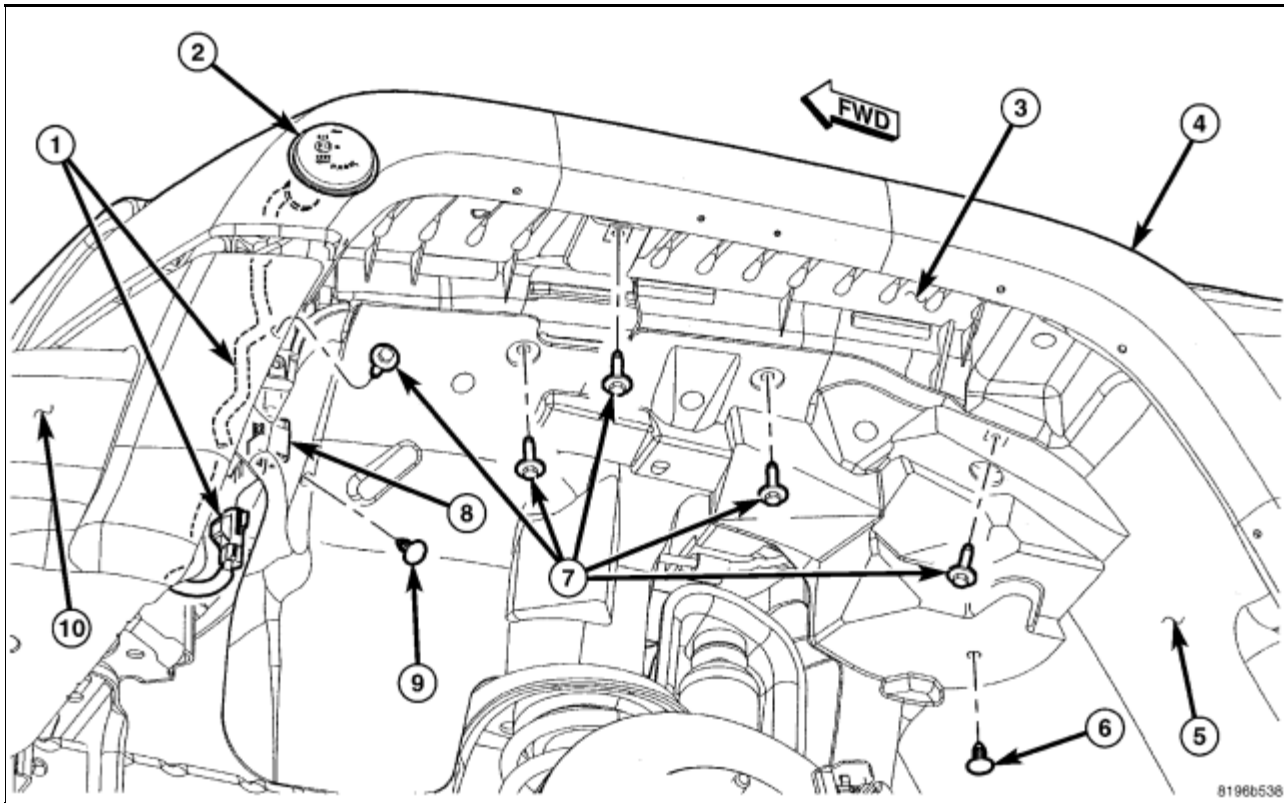


3. Remove the screws and remove the splash guard (2) if equipped.

INSTALLATION



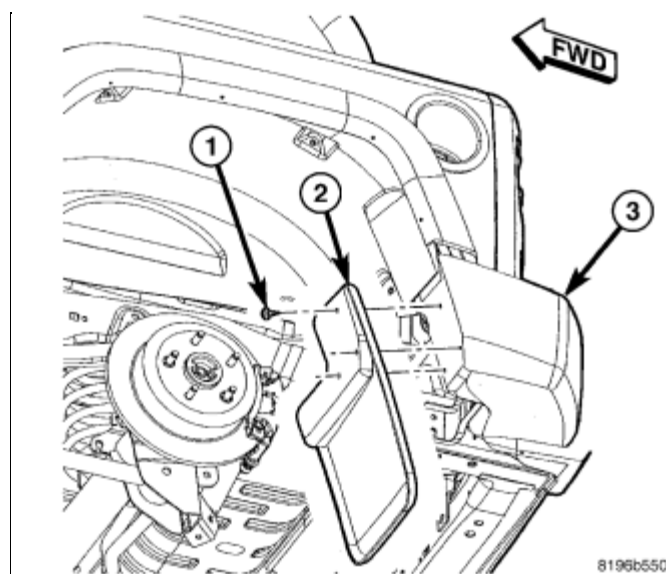
Front



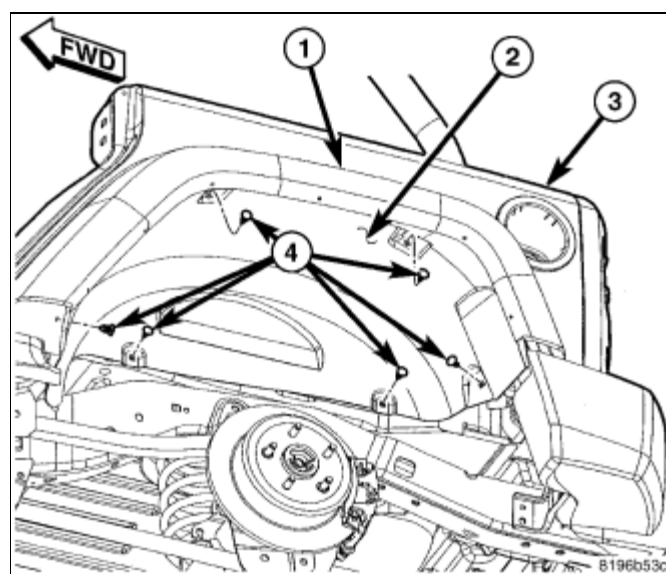
1. Install the front wheel house liner to front wheel house opening.
2. Install the wheel speed sensor harness (1) to the wheel house liner.
3. Install the push/pins (6), (9) to the wheel house liner.
4. Install the all bolts (7) to the wheel house liner and tighten to specifications.
5. Install wheel and tire and torque to specifications.

Rear

1. If equipped, install the splash guard (2) and install the screws.

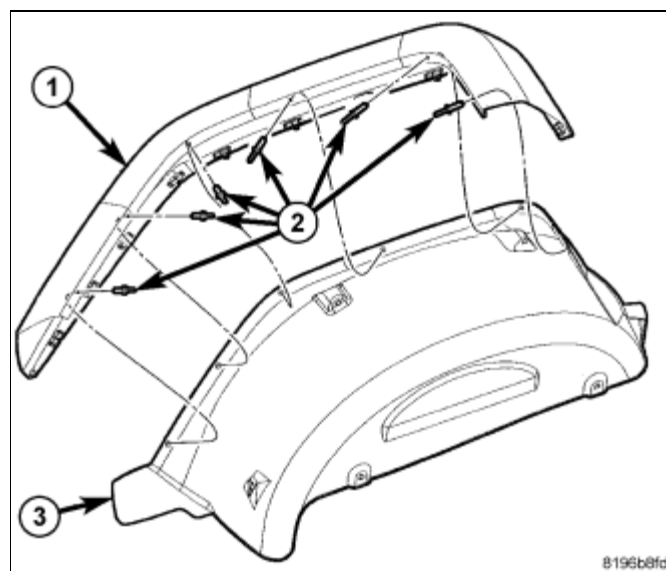


2. Install the splash shield (2) and install the push pin fasteners (4).



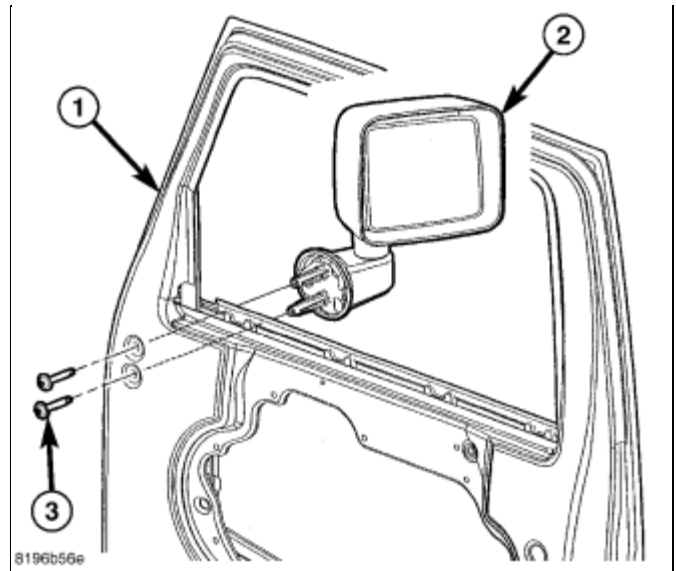
3. Install the flare molding rivets (2).

MIRROR - OUTSIDE REARVIEW REMOVAL



1. Remove the bolts (3) and separate the mirror (2) from the door (1).

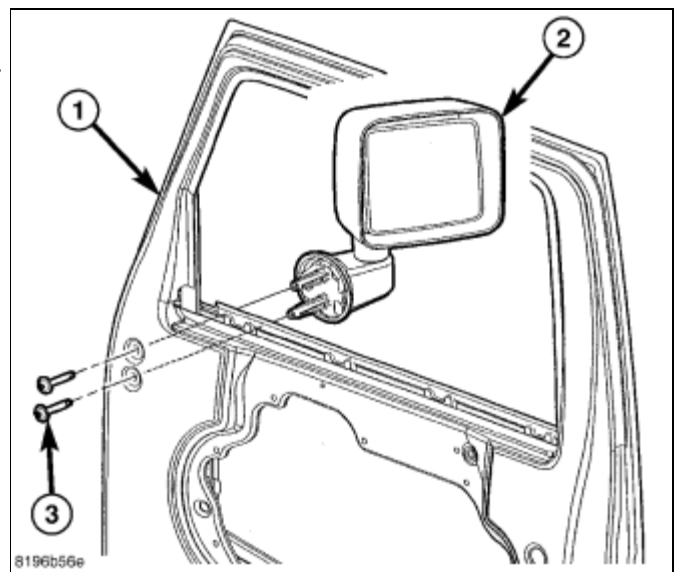
INSTALLATION



1. Install the mirror (2) onto the door and install the bolts (3).
2. Tighten the bolts to 13 N·m (9.5 ft. lbs.).

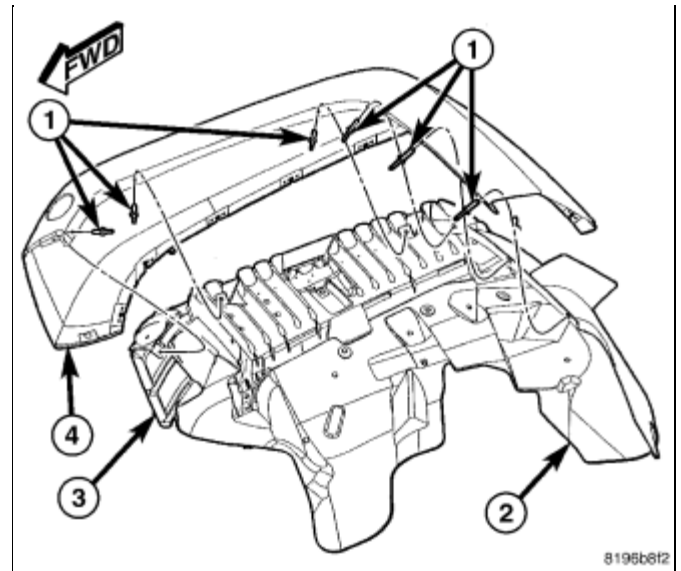
WHEEL OPENING FLARE MOLDING

REMOVAL

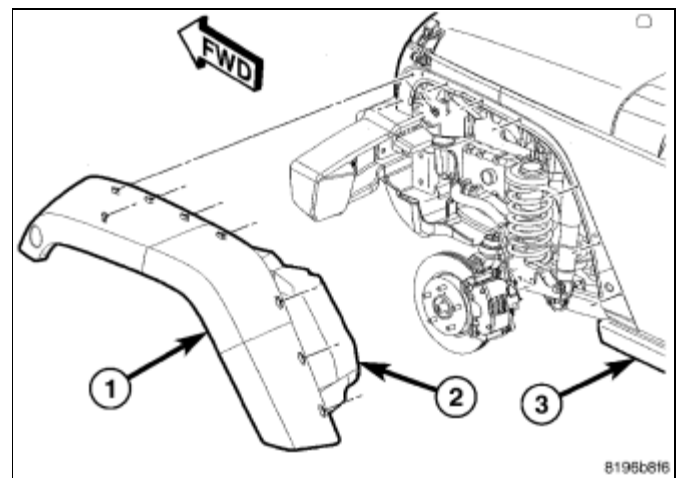


Front

1. Remove the rivets (1) securing the fender flares (4) to the support (3).

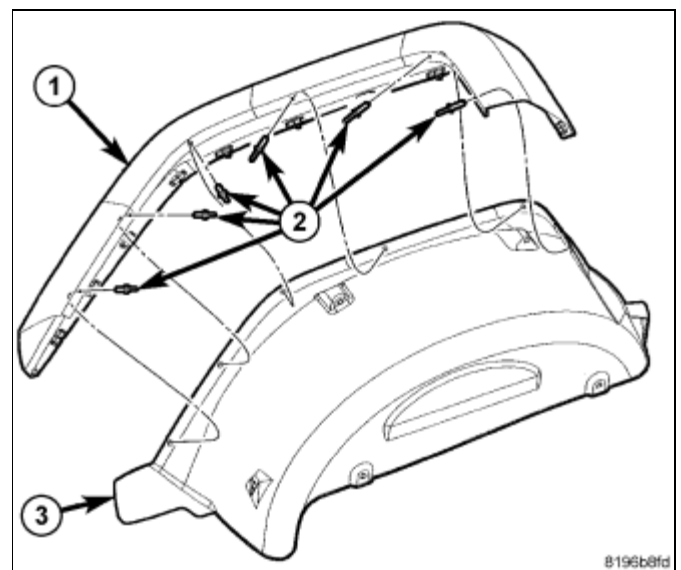


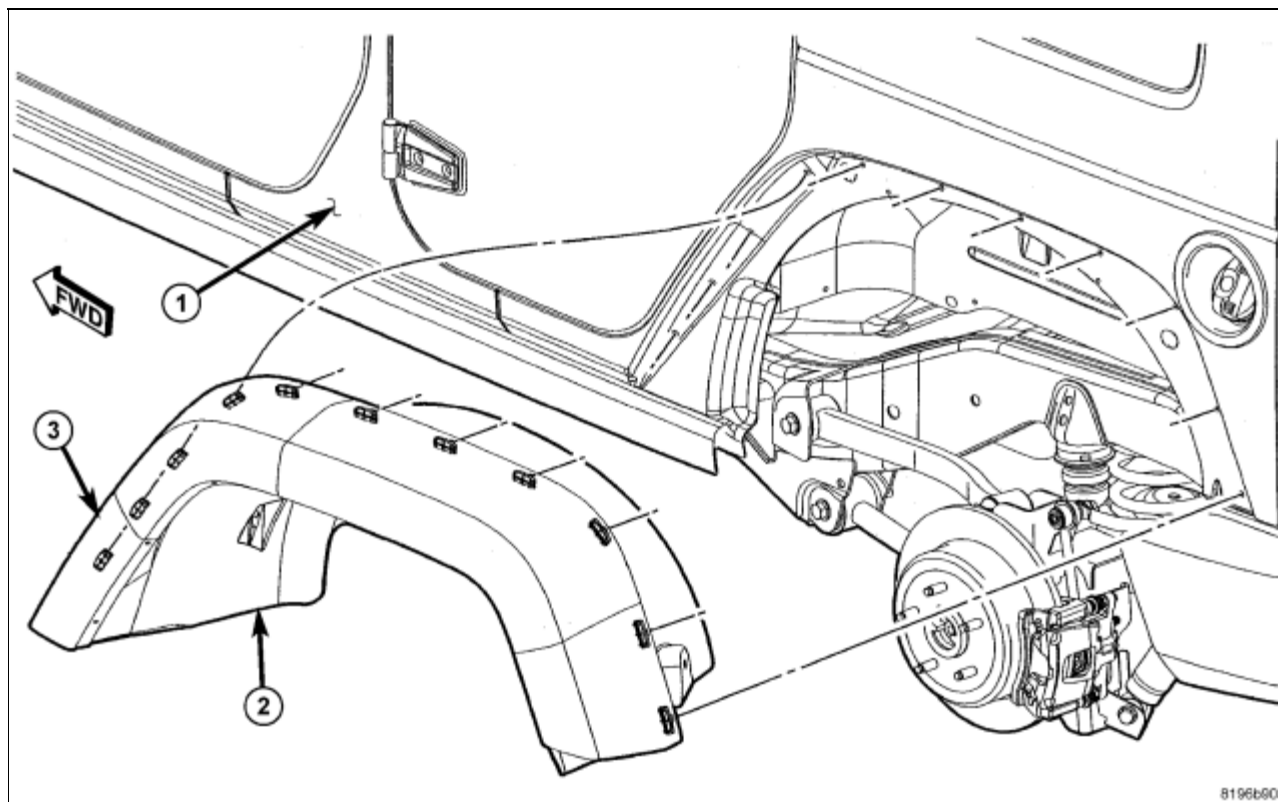
2. Using a trim stick C-4755 or equivalent, separate the clips attaching the flare (1) to the fender (3) and remove.
3. Disconnect the marker light electrical connector, if equipped.



Rear

1. Remove the rivets (2) attaching the flare (1) to the wheelhouse liner (3).



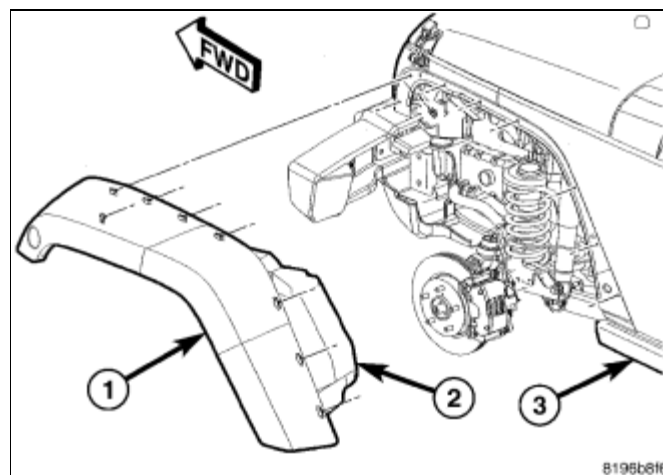


2. Using a trim stick C-4755 or equivalent, separate the clips attaching the flare (3) to the body (1).

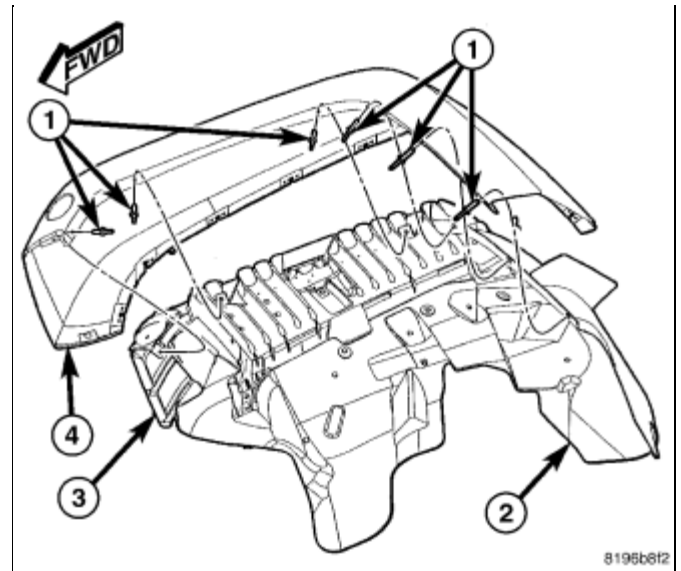
INSTALLATION

Front

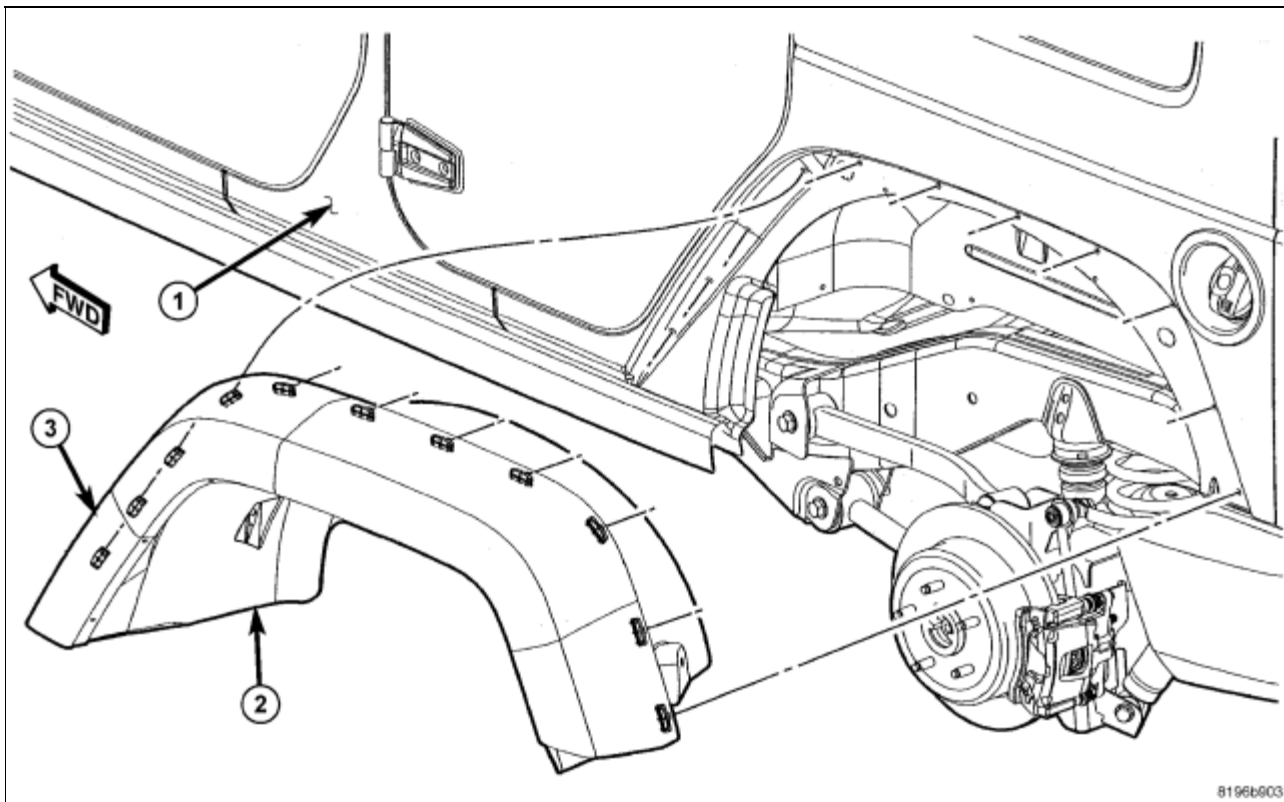
1. Connect the marker light electrical connector, if equipped.
2. Position the flare (1) onto the body (3) and seat the support clips fully.



3. Install rivets (1) attaching the flare (4) to the support (3).



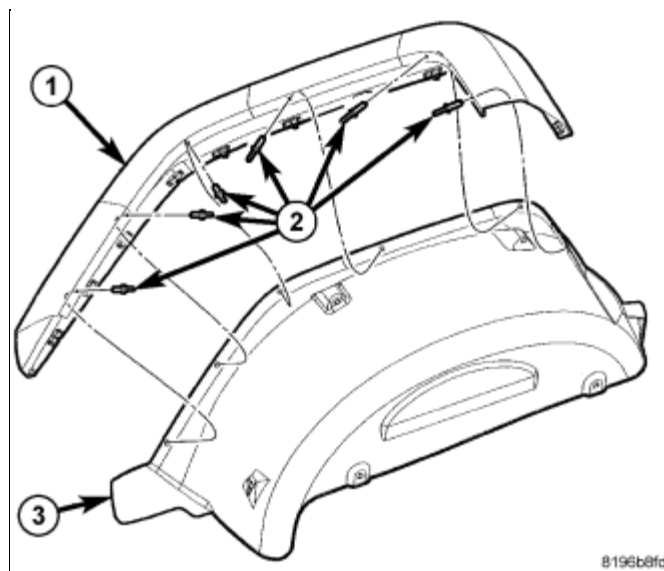
Rear



1. Position the flare (3) onto the body (1) and seat the support clips fully.

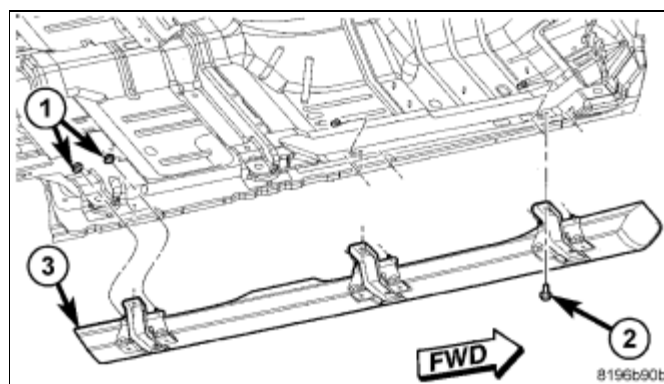
2. Install rivets (2) attaching the flare (1) to the wheelhouse splash shield (3)

SIDE STEP REMOVAL



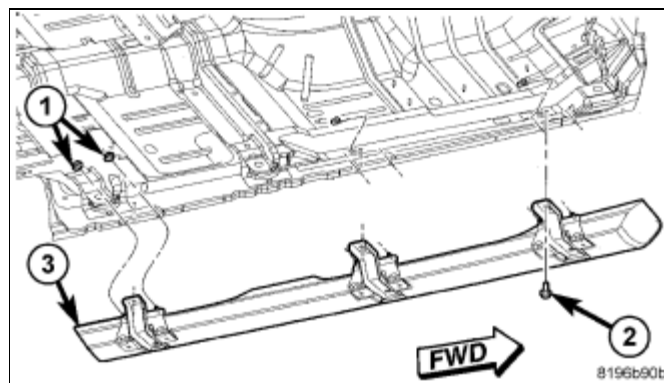
1. Remove the bolts (2).
2. Remove the sill nuts (1) and separate the step (3) from the sill flange.

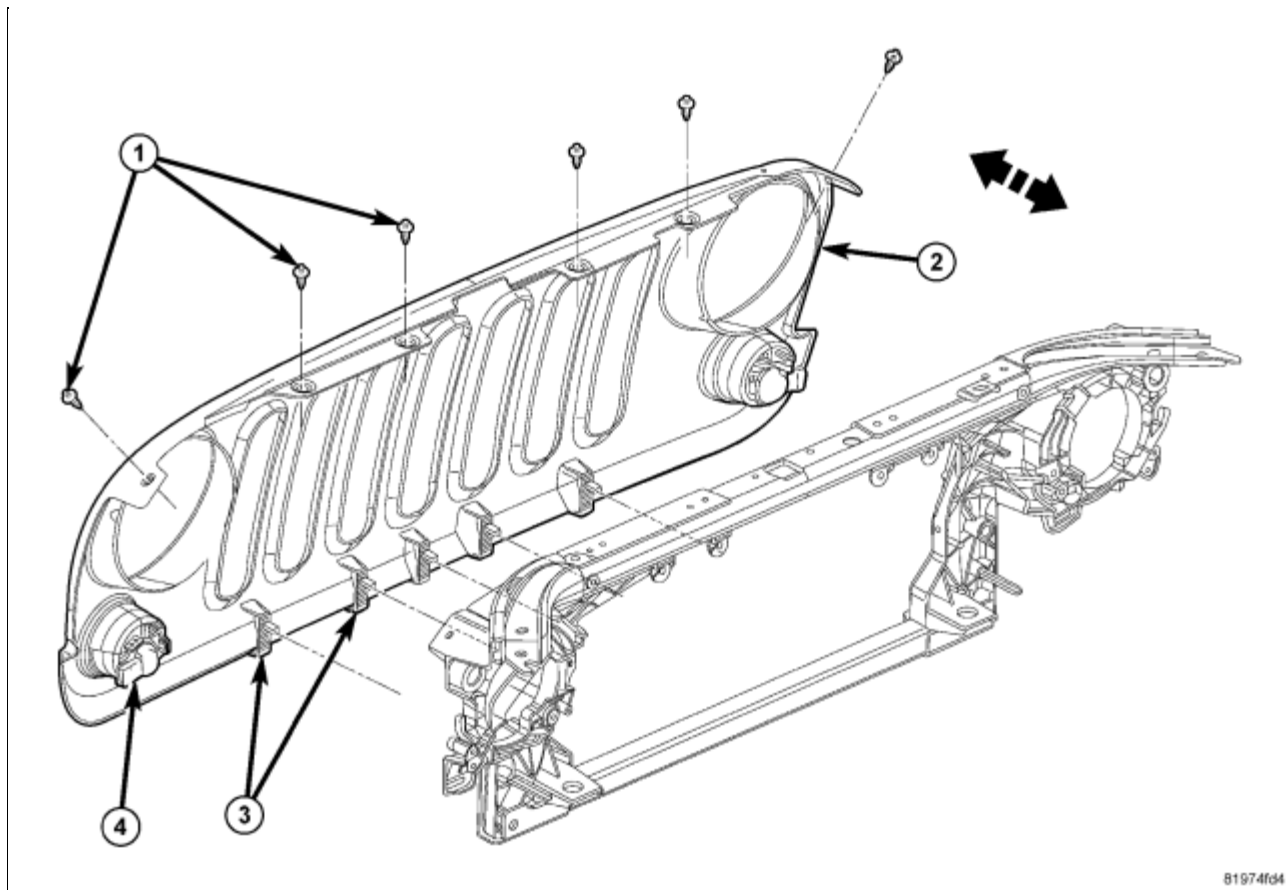
INSTALLATION



1. Position the side step studs through the holes in the body side flange.
2. Install the nuts (1) and tighten to 12 N·m (9 ft. lbs.).
3. Install the bolts (2) and tighten to 24 N·m (18 ft. lbs.).

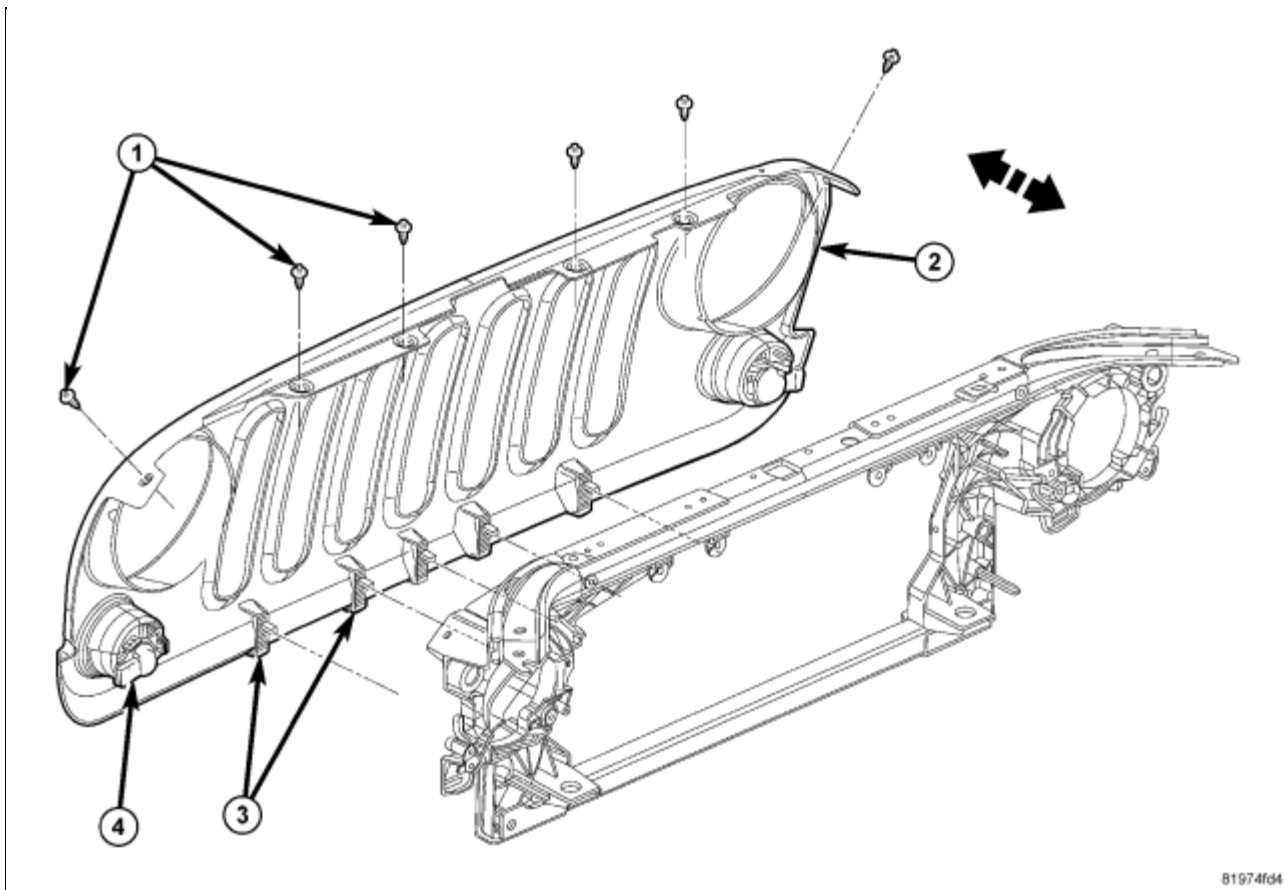
GRILLE REMOVAL





1. Twist the center of the push pin insert to release and remove the six push pin fasteners (1)
2. Using a trim stick C-4755 or equivalent, Release the lower clips (3) and separate the grille from the front end module.
3. Disconnect the electrical connectors (4).

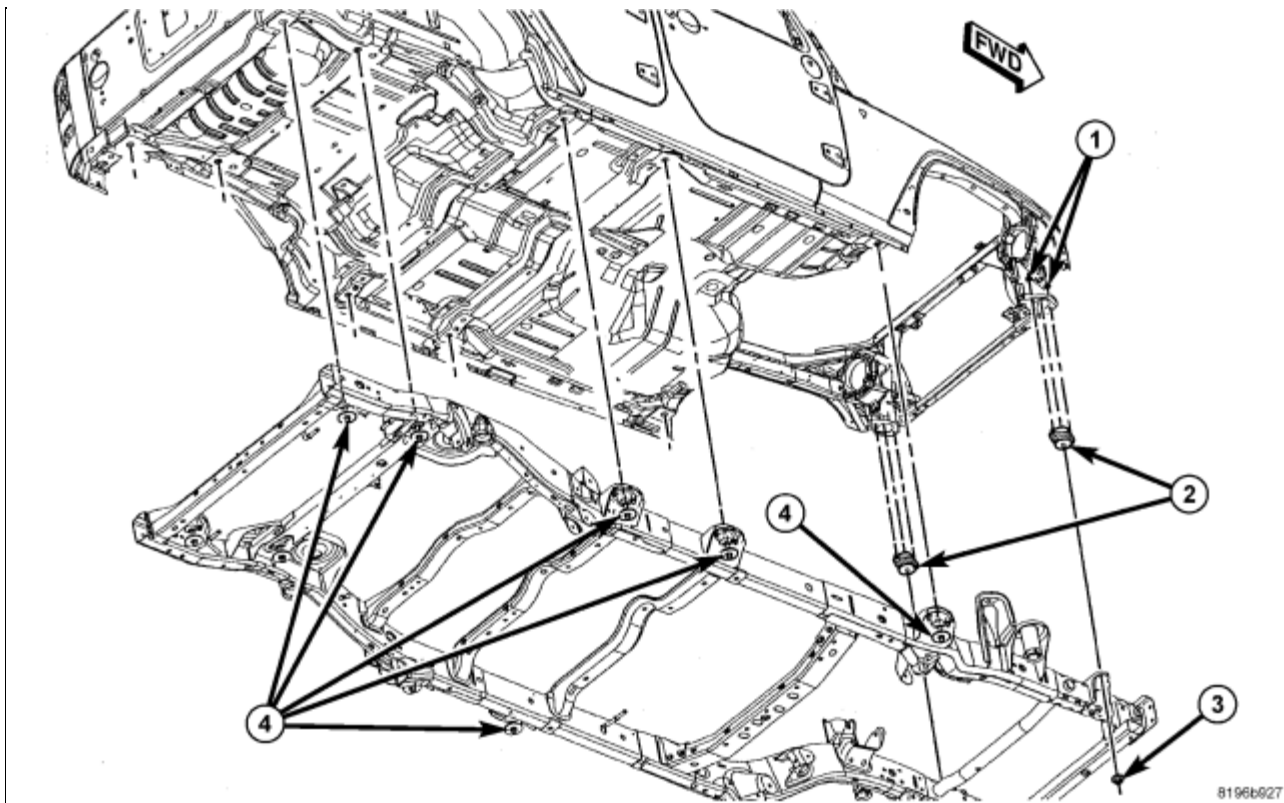
INSTALLATION



1. Connect the electrical connectors (4).
2. Position the grille (2) onto the front end module and seat the clips (3) fully.
3. Install the push pin fasteners (1).

BODY ISOLATORS

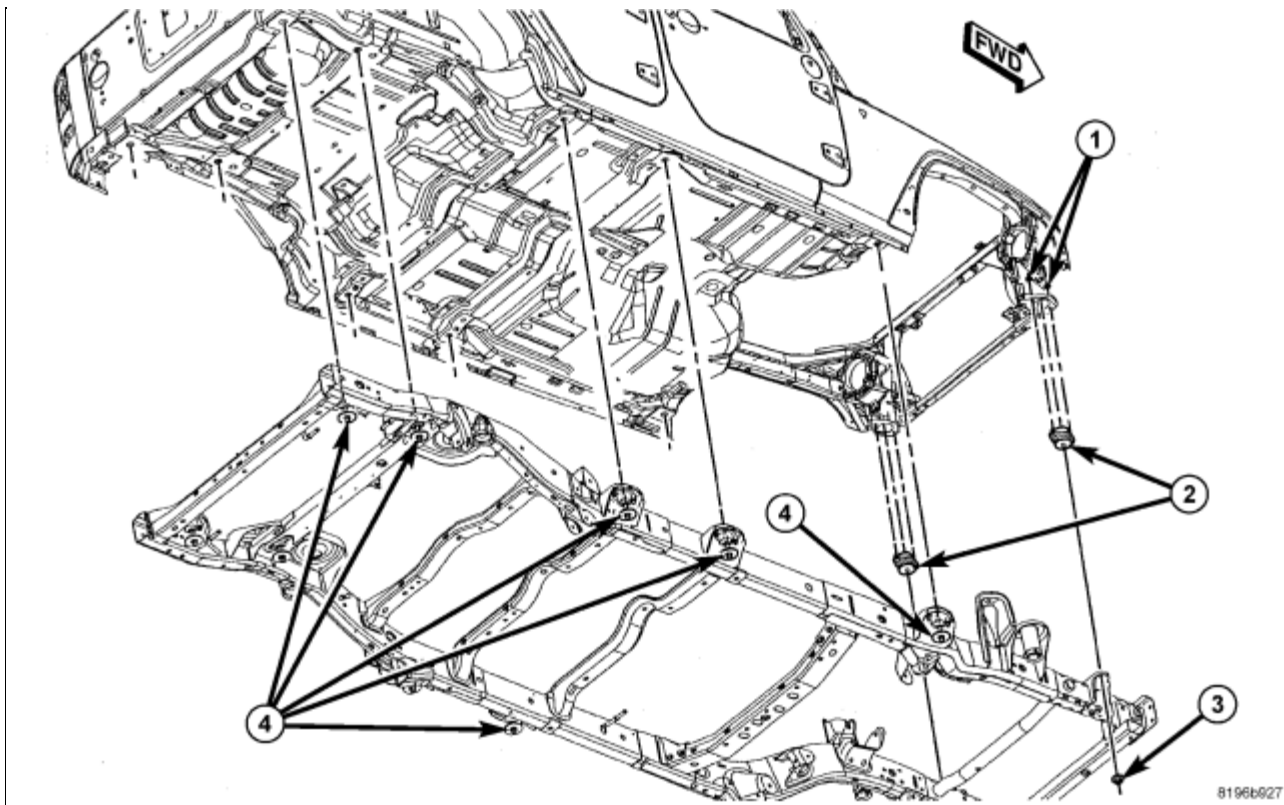
REMOVAL



NOTE: Four door model shown in the illustration. Body isolators for two door models are similar.

1. If removing the front isolators (2) remove the grille, (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
2. Loosen all body to frame mounting bolts (4) and nuts (3), (two door has 8 bolts and two nuts, four door has 10 bolts and two nuts).
3. Remove the mounting bolts (4) and isolator nuts (1) as necessary.
4. Using a floor jack and wooden block under the body sill, lift the body to gain access to the isolators and remove the isolators as necessary.

INSTALLATION



CAUTION: Whenever a body isolator bolt requires servicing or tightening, it is necessary to remove the bolt and install new thread locker compound to the threads.

NOTE: Four door model shown in the illustration. Body isolators for two door models are similar.

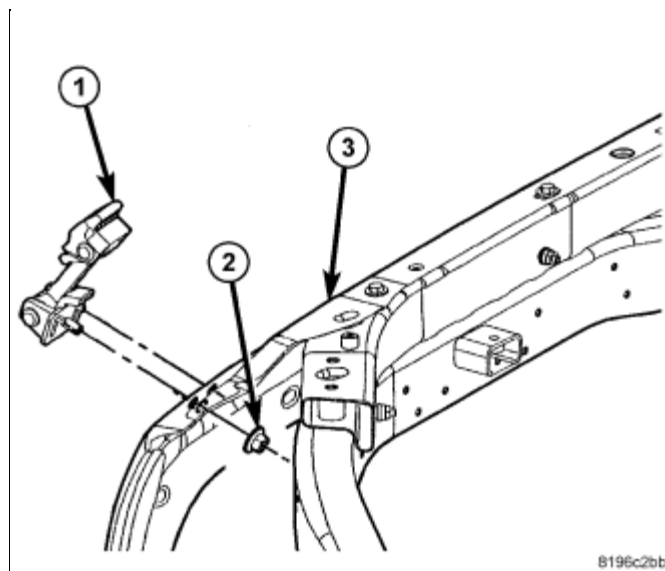
1. Position the isolators (2) under the body as necessary.
2. Lower the cab onto the isolators and install the isolator nuts (1).
3. Tighten the isolator nuts to 54 N·m (40 ft. lbs.).
4. Install the mounting bolts (4) and the isolator nuts (3) as necessary (two door has 8 bolts and two nuts, four door has 10 bolts and two nuts).
5. Tighten the mounting bolts (4) and nuts (3) to 108 N·m (80 ft. lbs.).
6. If necessary, install the grille, (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

HOOD

CATCH - HOOD

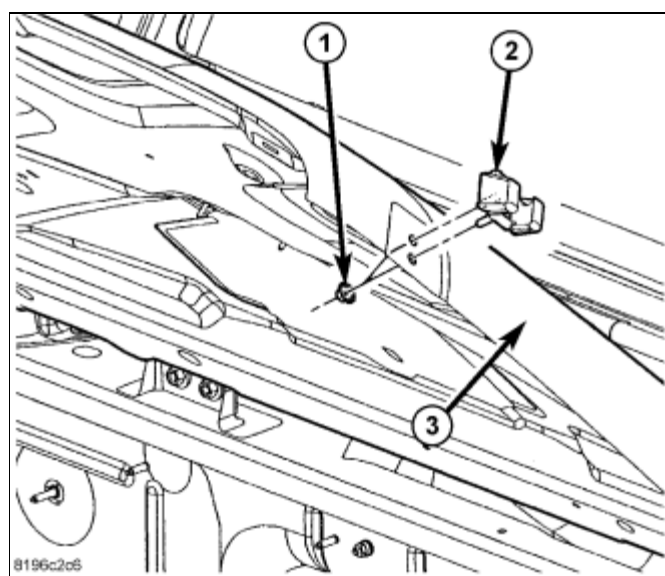
REMOVAL

1. Open the hood.
2. Remove the nuts (2) and remove the hood catch (1).

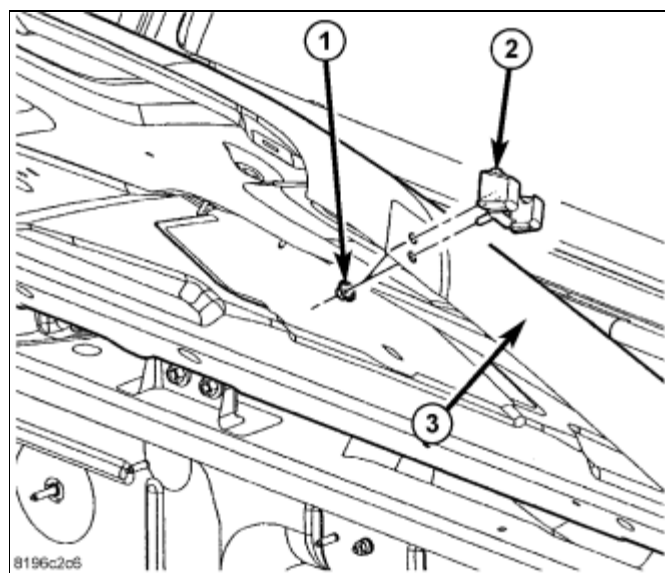


3. Remove the nuts (1) and remove the catch bracket (2).

INSTALLATION



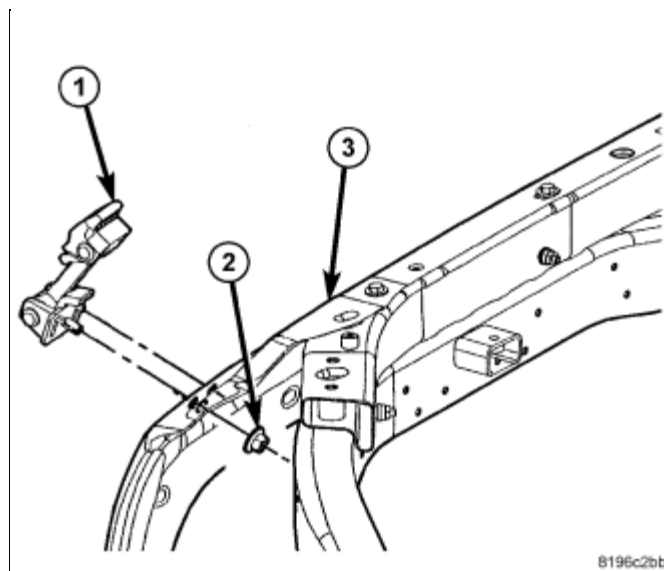
1. Install the catch bracket (2) and install the nuts (1).
2. Tighten the nuts to 7 N·m (5 ft. lbs.).



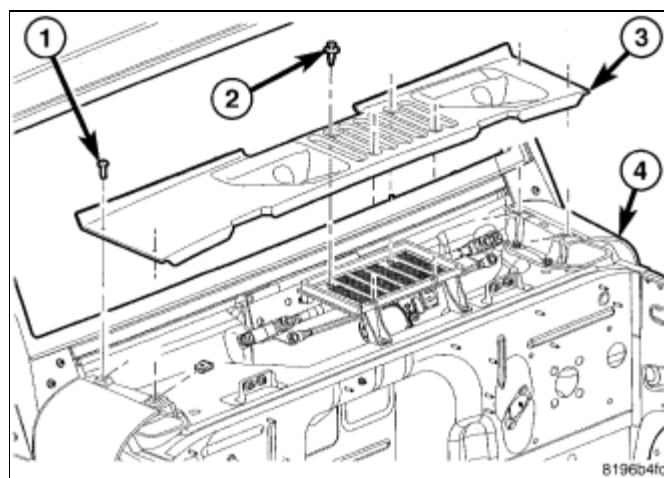
3. Install the hood catch (1) and install the nuts (2).
4. Tighten the nuts to 15 N·m (11 ft. lbs.).

HINGE

REMOVAL

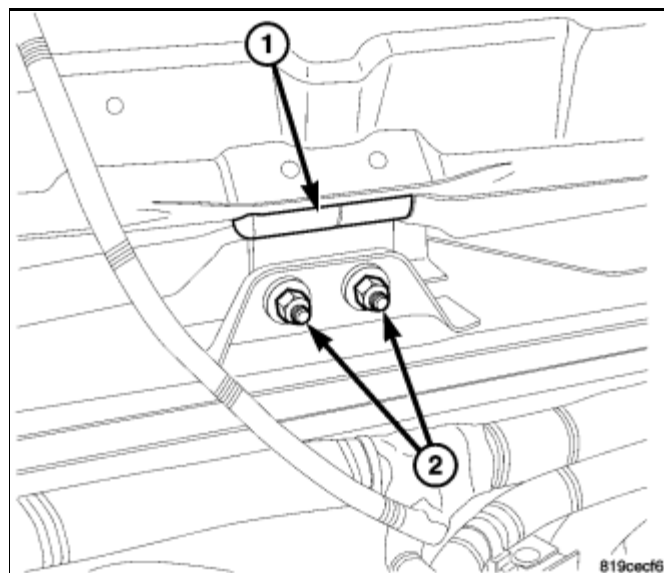


1. Remove the cowl top panel (3), (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - REMOVAL).



NOTE: It is not necessary to remove the hood to replace the hood hinges. Hood hinges can be replaced one at a time.

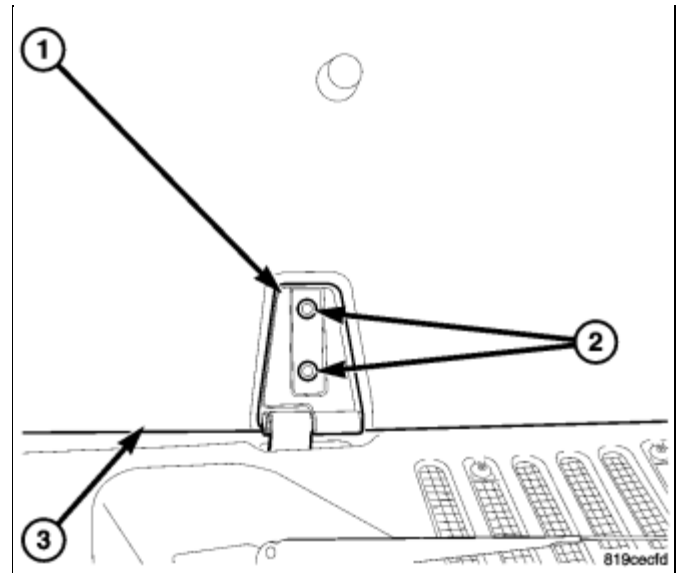
2. Support the hood with a suitable device.
3. Remove the hinge to body bolts (2).



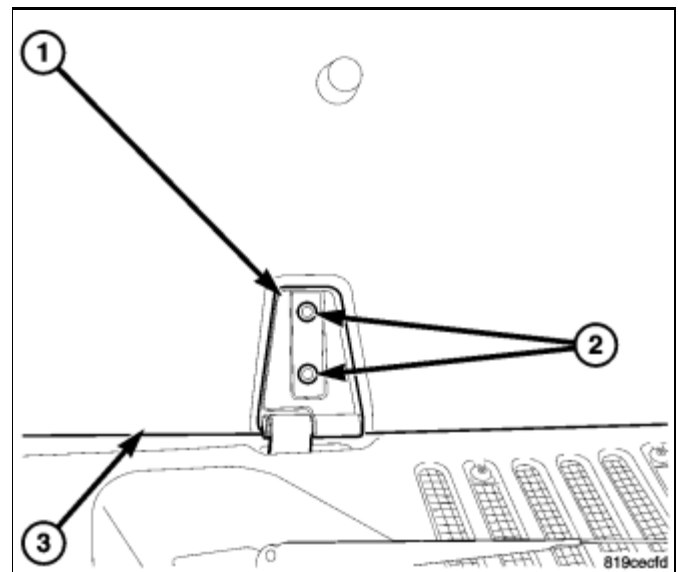
4. Using a grease pencil or equivalent, mark location of hood hinges (1) on hood (3) to aid installation.

5. Remove the hinge to hood bolts (2) and remove the hinge (1).

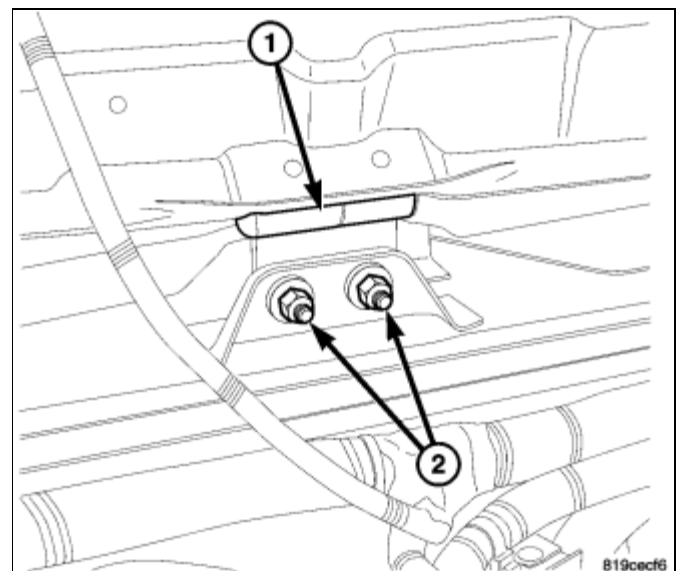
INSTALLATION



1. Position the hinge (1) onto the hood (3).
2. Install bolts (2) finger-tight.
3. Align hinges with installation reference marks made previously and tighten bolts to 26 N·m (19 ft. lbs.).



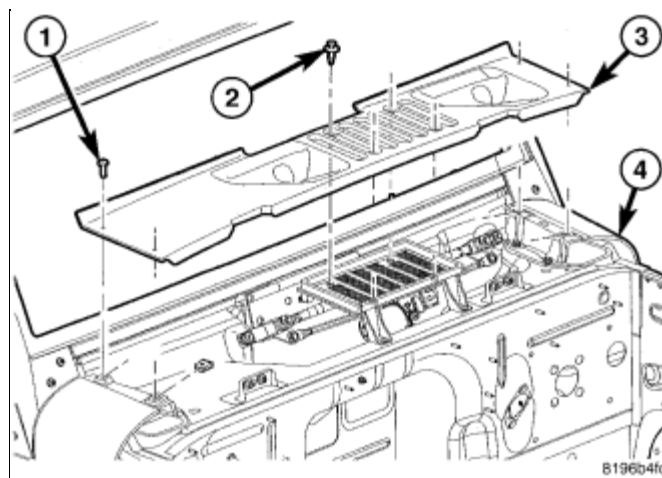
4. Install the hinge to body bolts (2).
5. Align hinges with installation reference marks made previously and tighten bolts to 24 N·m (17.5 ft. lbs.).
6. If required, adjust the hood to the correct position (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).



7. Install the cowl top panel (3), (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - INSTALLATION).

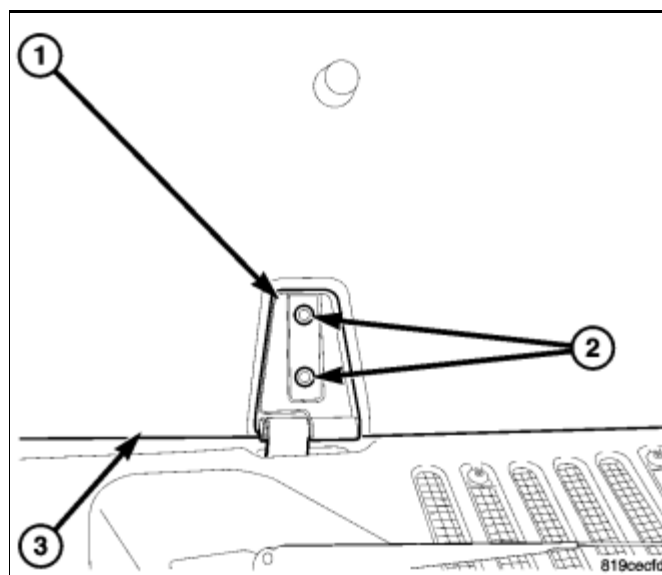
HOOD

REMOVAL



1. Raise hood.
2. Using a grease pencil or equivalent, mark location of hood hinges (1) on hood (3) to aid installation.
3. Remove bolts (2) attaching hinges to hood.
4. With the aid of a helper, remove hood (3) from vehicle.

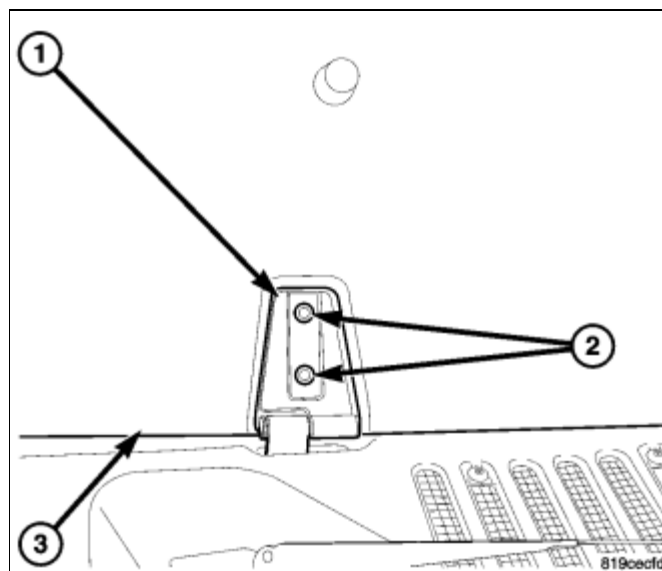
INSTALLATION



1. Position hood (3) on hinges (1).
2. Install bolts (2) finger-tight.
3. Align hinges with installation reference marks made previously and tighten bolts to 26 N·m (19 ft. lbs.).
4. If required, adjust the hood to the correct position (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).

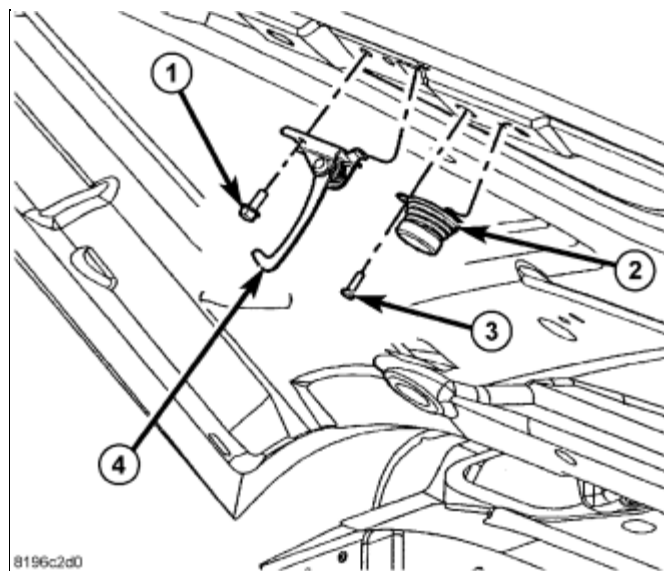
HOOK - SAFETY CATCH

REMOVAL



1. Remove the bolt (1) and remove the safety catch (4).

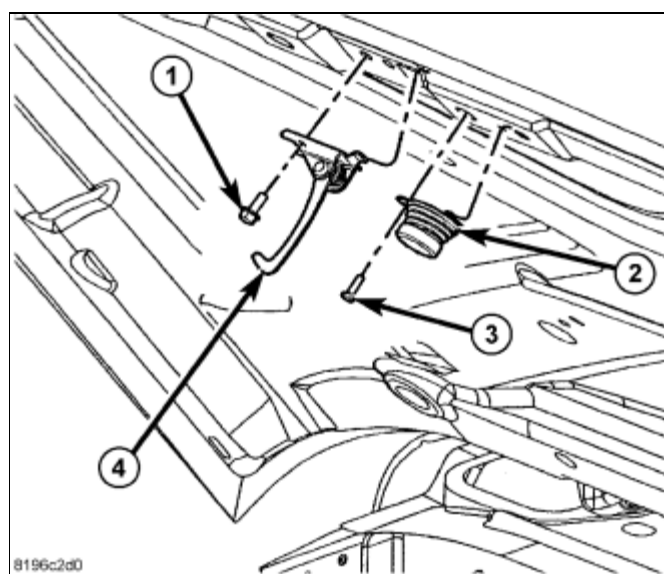
INSTALLATION



1. Install the safety catch (4) and install the bolt (1).
2. Tighten the bolt to 11 N·m (8 ft. lbs.).

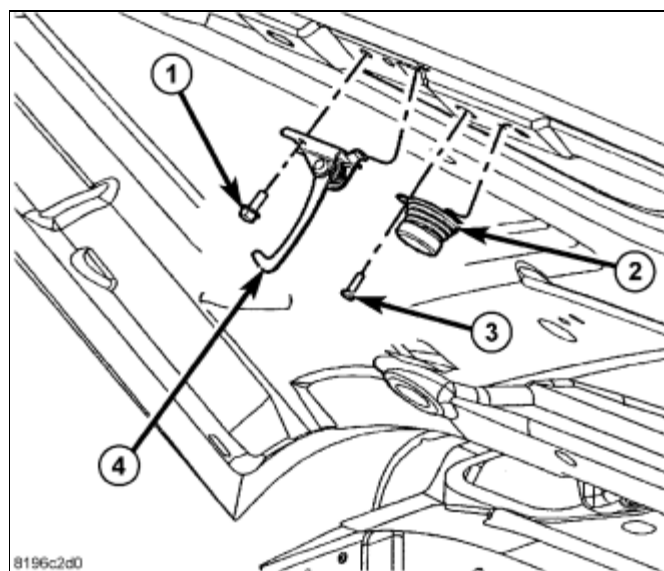
SPRING - HOOD POP UP

REMOVAL



1. Remove the bolt (3) and remove the hood spring (2).

INSTALLATION

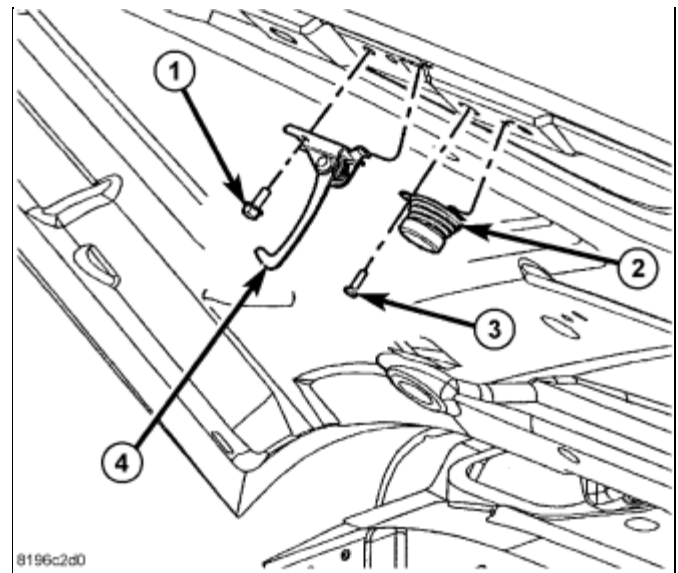


1. Install the spring (2) and install the bolt (3).

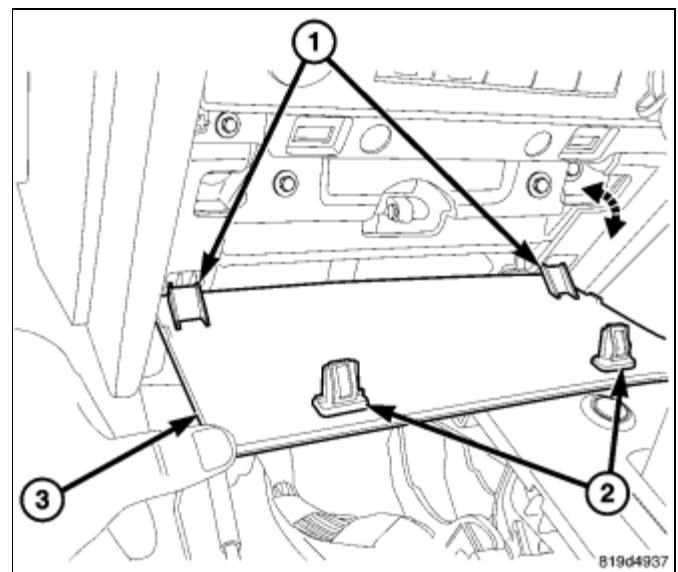
INSTRUMENT PANEL

CENTER BEZEL

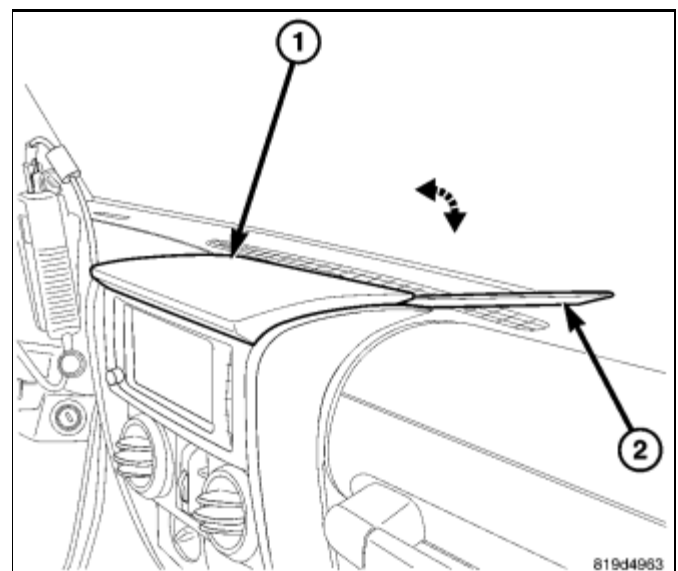
REMOVAL



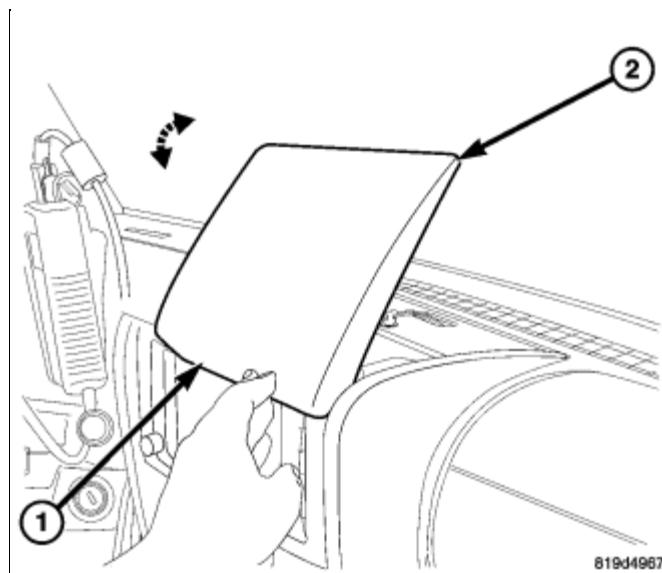
1. Using a trim stick C-4755 or equivalent, release the clips (2) and rotate the lower center trim (3) down and release the tabs (1).



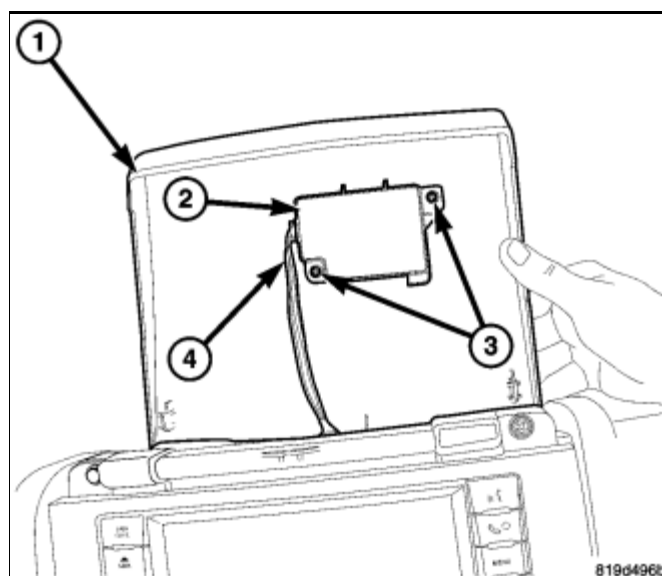
2. Using a trim stick C-4755 or equivalent (2), release the clips in the rear of the upper trim (1).



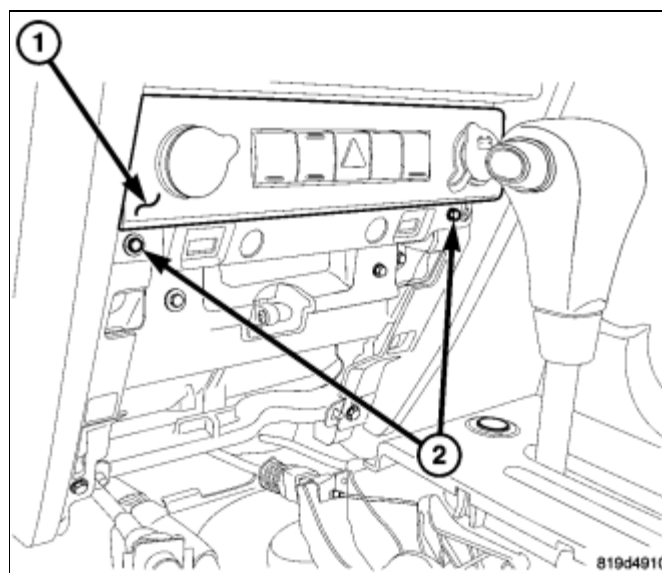
3. Rotate the upper trim (2) back and release the front (1).



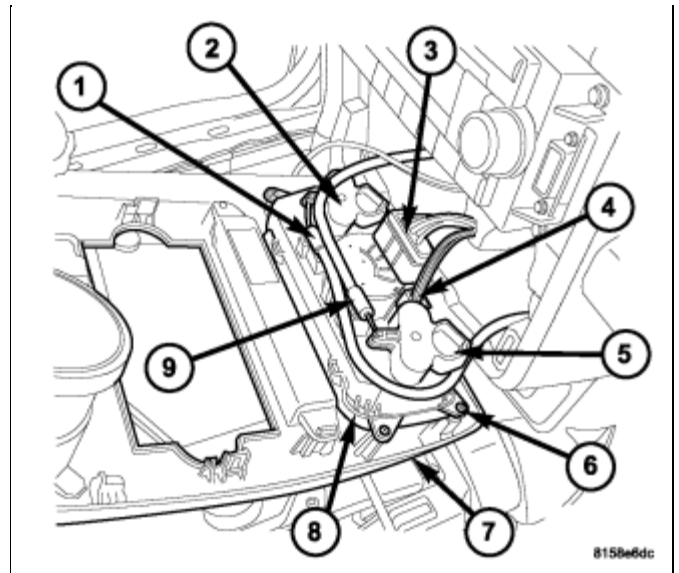
4. Disconnect the electrical connector (4) and remove the upper center cover (1).



5. Remove the screws (2) and using a trim stick C-4755 or equivalent, separate the center bezel (1).

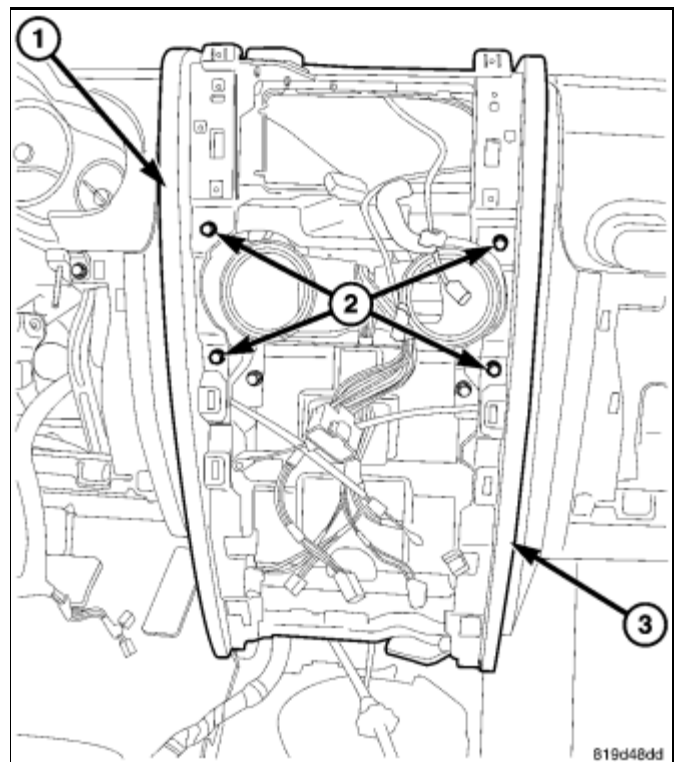


6. Disconnect the HVAC control cables (1 and 9) and disconnect the electrical connectors (3).

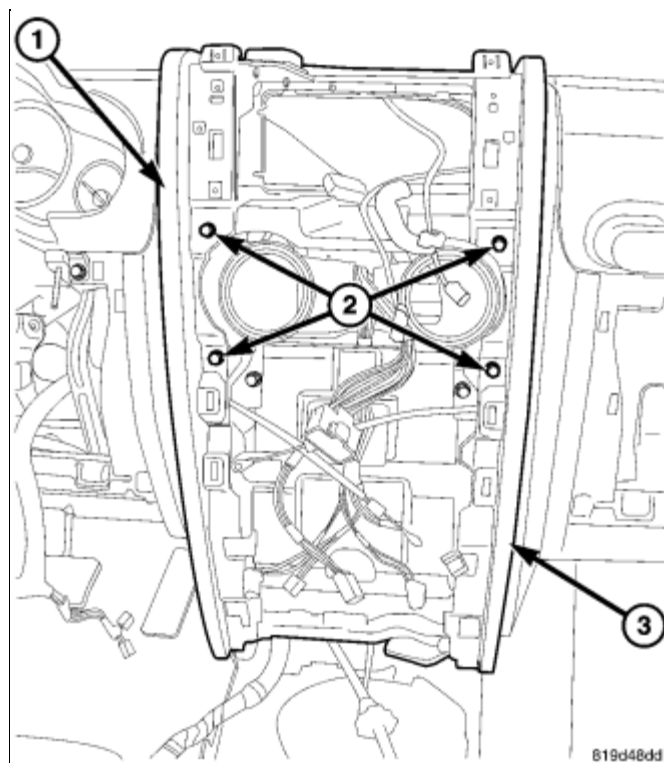


7. Remove the screws (2) and remove the center I/P trim panels (1 and 3).

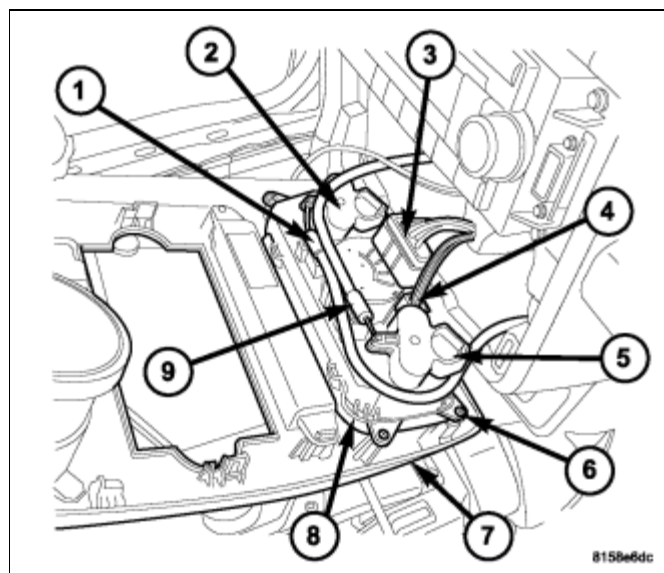
INSTALLATION



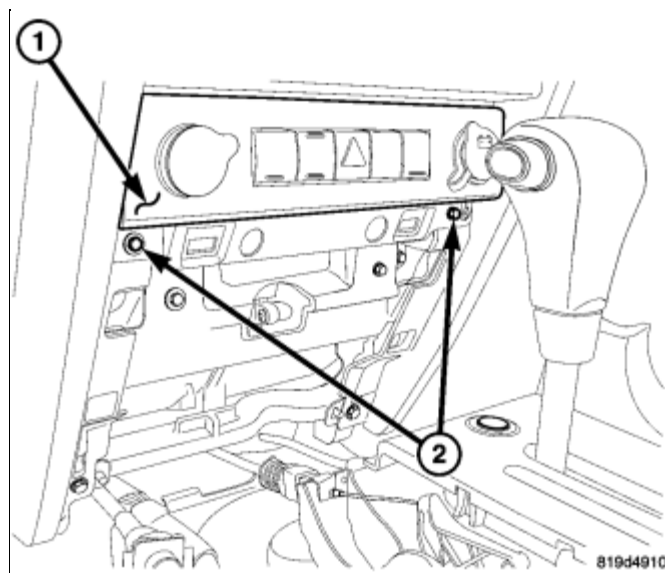
1. Install the center I/P trim panels (1 and 3) and install the screws (2).



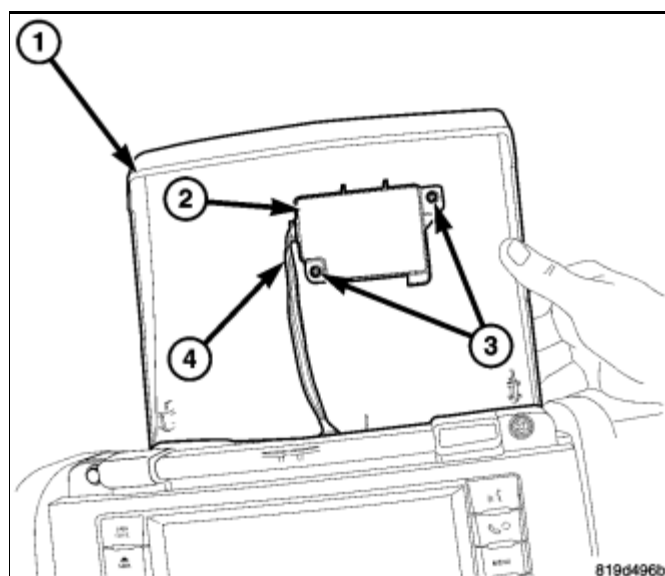
2. Install the radio, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
3. Connect the HVAC control cables (1 and 9) and connect the electrical connectors (3 and 4).



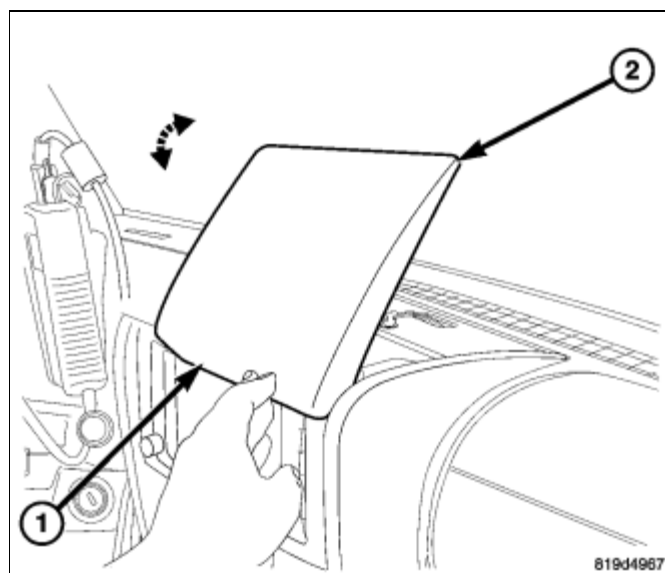
4. Position the center bezel (1) onto the I/P and seat the clips fully.
5. Install the lower screws (2).



6. Connect the electrical connector (4) and position the upper center cover onto the top of the I/P.



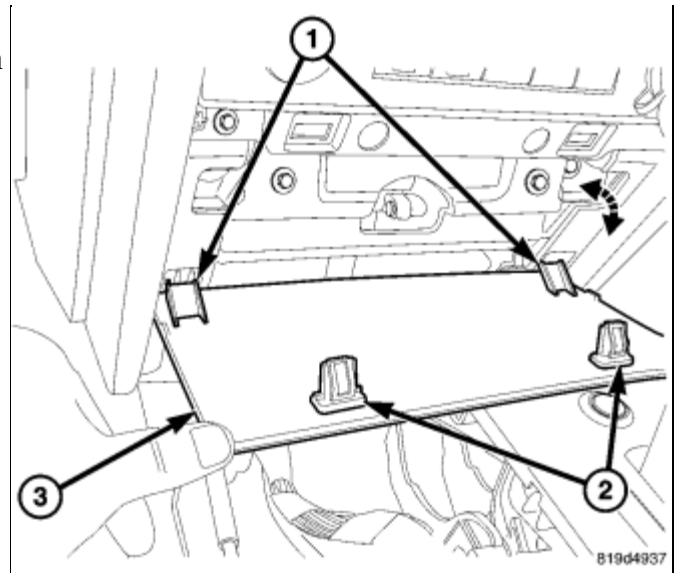
7. Position the front of the cover (1) onto the center support and rotate the trim (2) back and seat the clips fully.



8. Position the lower tabs (1) into the slots and rotate the trim (3) up and seat the clips (2) fully.

CLUSTER BEZEL

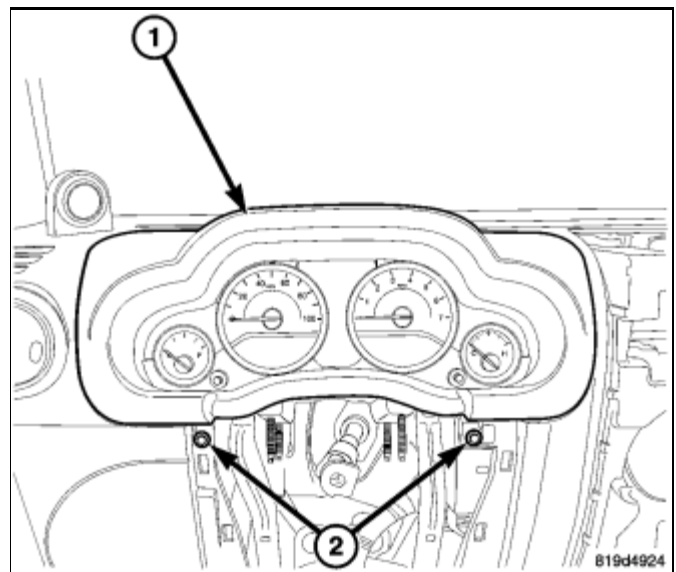
REMOVAL



1. Remove the steering column opening cover, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

2. Remove the screws (2), release the retaining clips and remove the bezel (1).

INSTALLATION



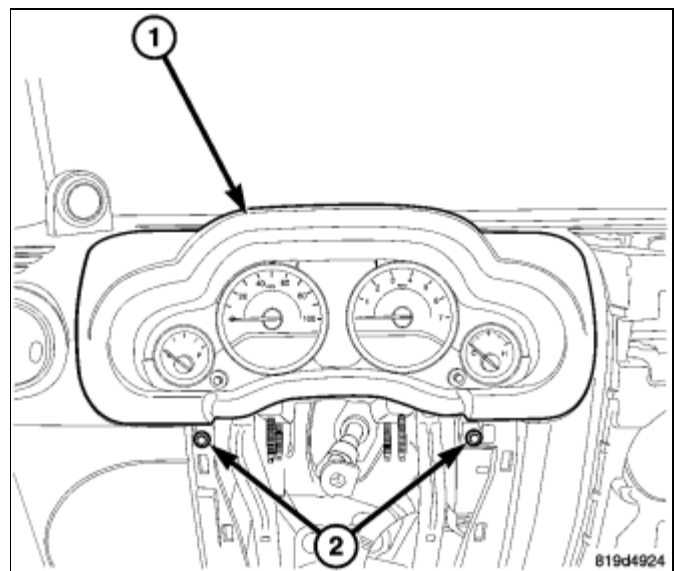
1. Position the bezel (1) into place and seat the clips fully.

2. Install the screws (2).

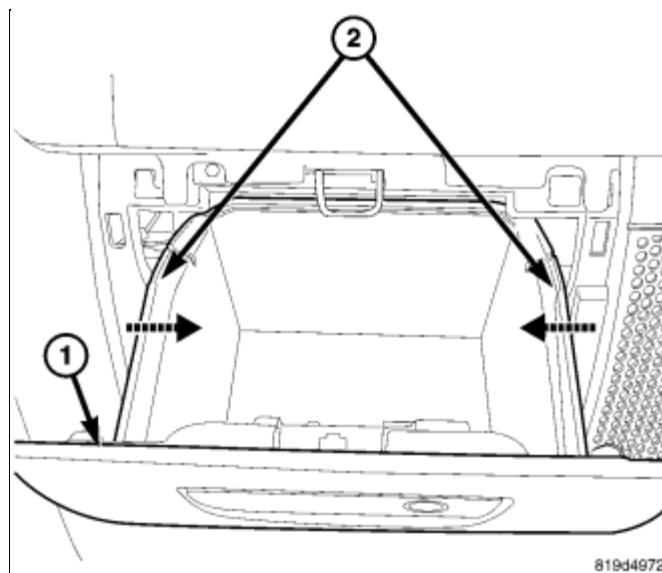
3. Install the steering column opening cover, (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

GLOVE BOX

REMOVAL

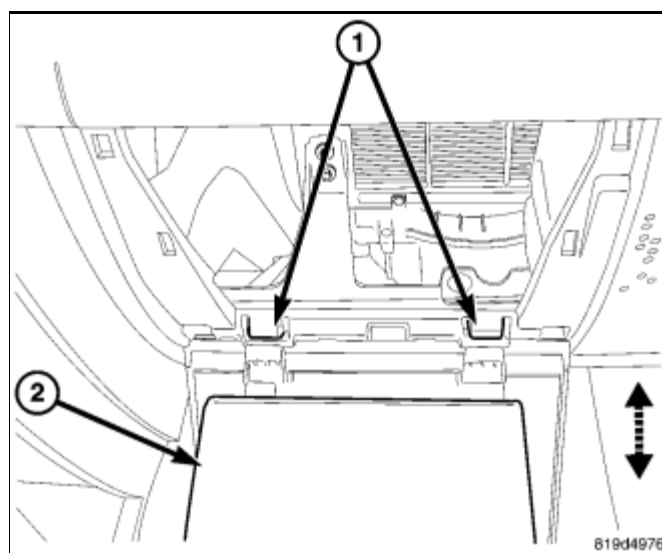


1. Open the glove box (1) and squeeze the stop tabs (2) inward.

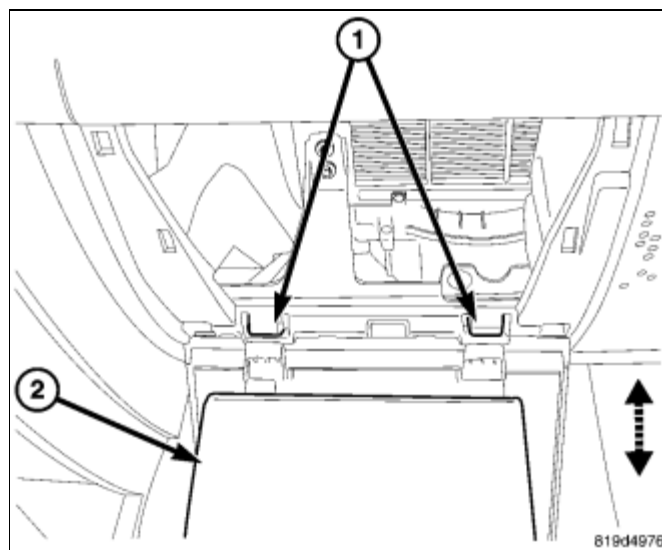


2. Lower the glove box (2) and release the hinges (1) and remove the glove box.

INSTALLATION



1. Position the glove box tabs onto the hinges (1).

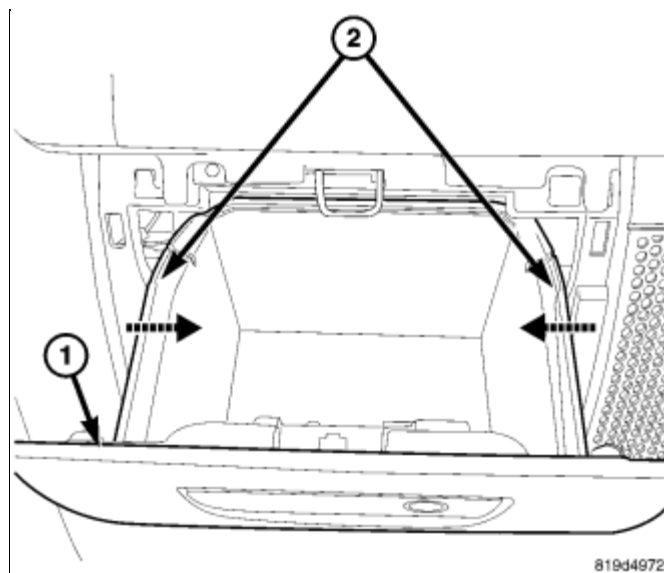


2. Close the box (1) and squeeze the stop tabs (2) inward and

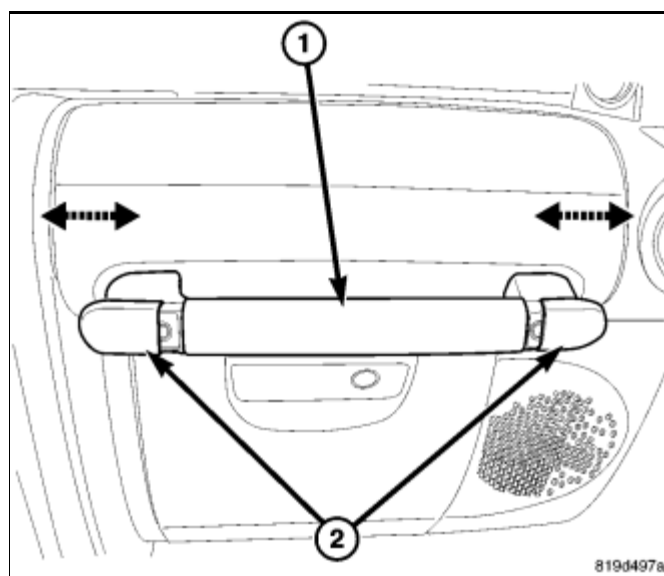
engage into the instrument panel.

GRAB HANDLE

REMOVAL

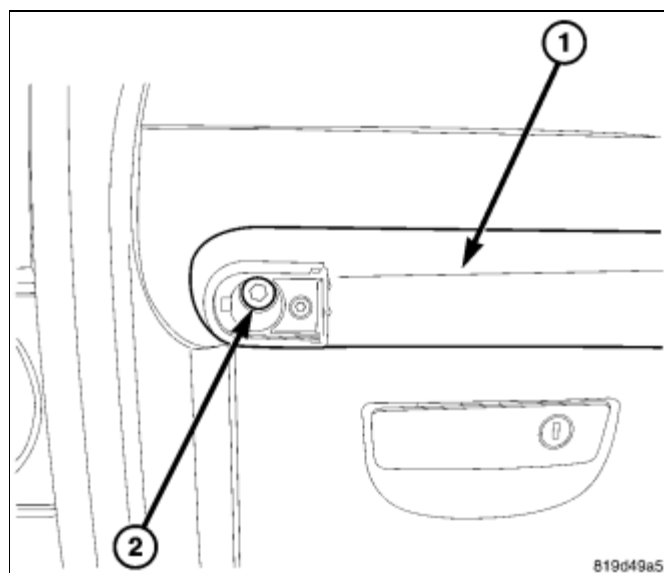


1. Using a trim stick C-4755 or equivalent, slide the grab handle trim caps (2) off the trim handle (1).

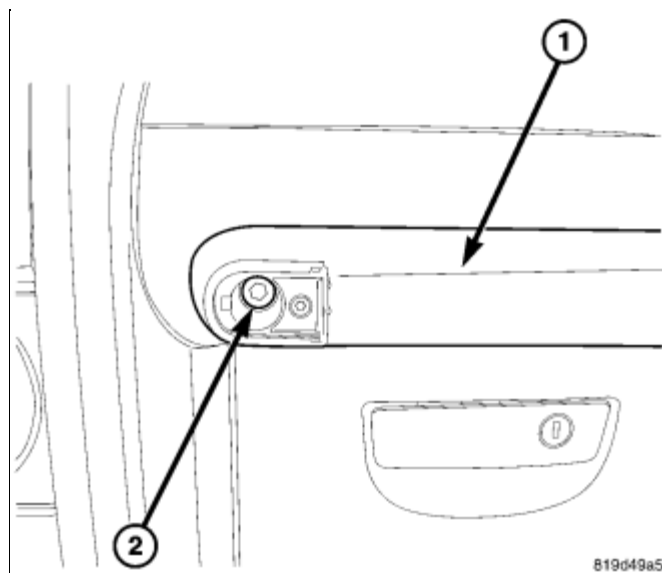


2. Remove the bolts (2) and remove the grab handle (1).

INSTALLATION

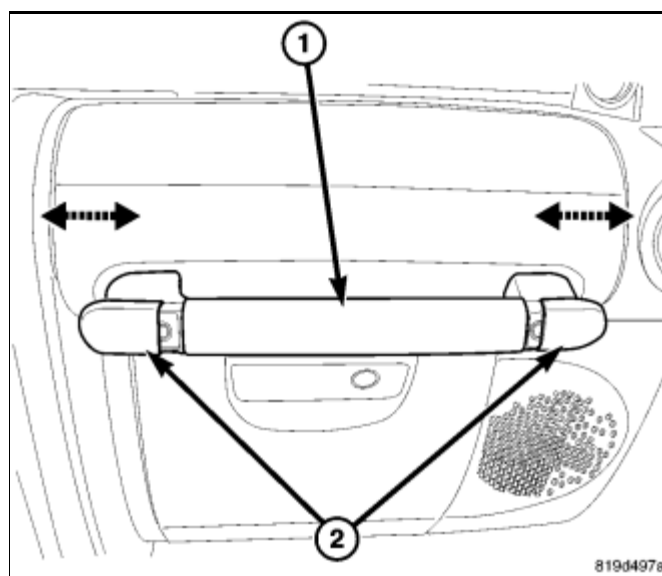


1. Install the grab handle (1) and install the bolts (2).



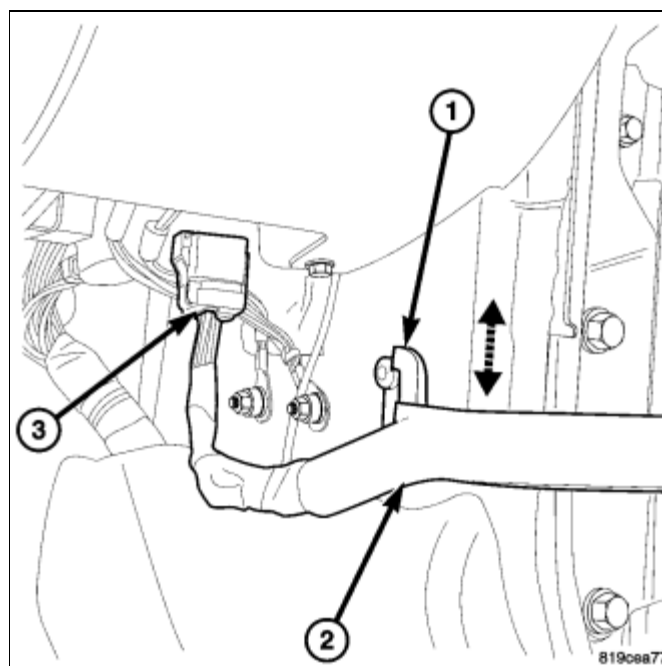
2. Install the trim caps (2) onto the handle (1) and slide into place.

INSTRUMENT PANEL ASSEMBLY REMOVAL

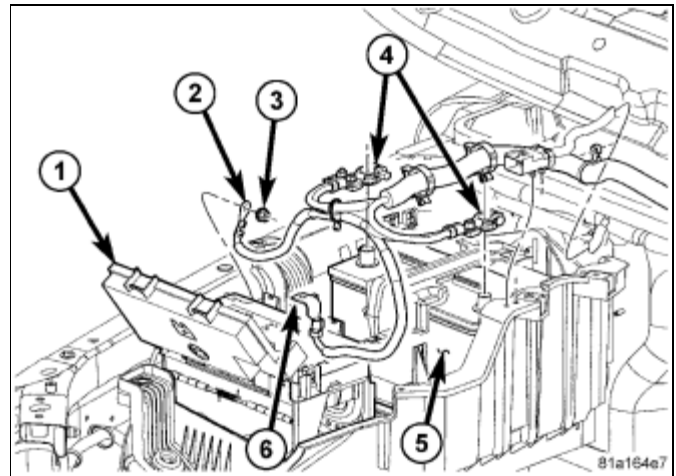


1. Disconnect the electrical connector (3) at the A-pillar cowl area and separate the check strap (2) from the footman's loop (1).

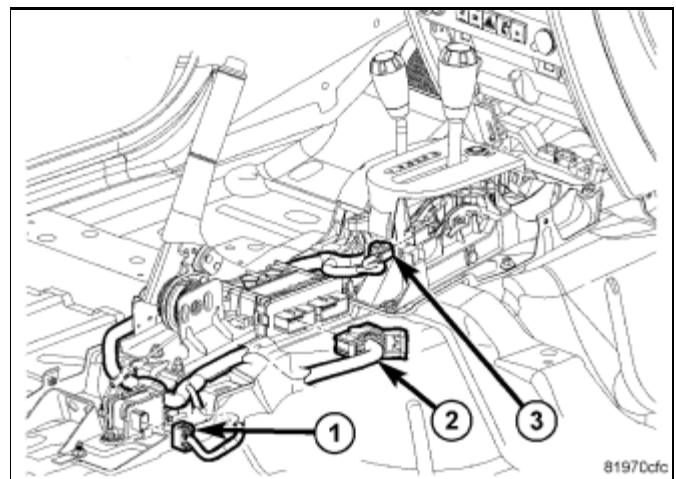
2. Open the doors past 90° to aid in removal of the I/P assembly.



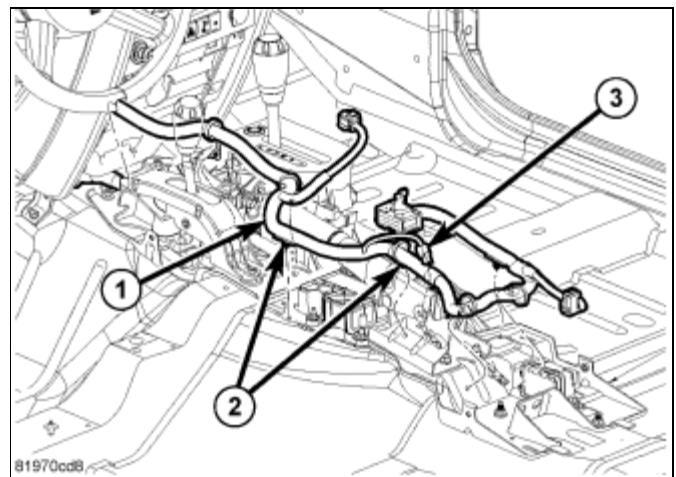
3. Disconnect and isolate battery negative cable.
4. Remove the center console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).



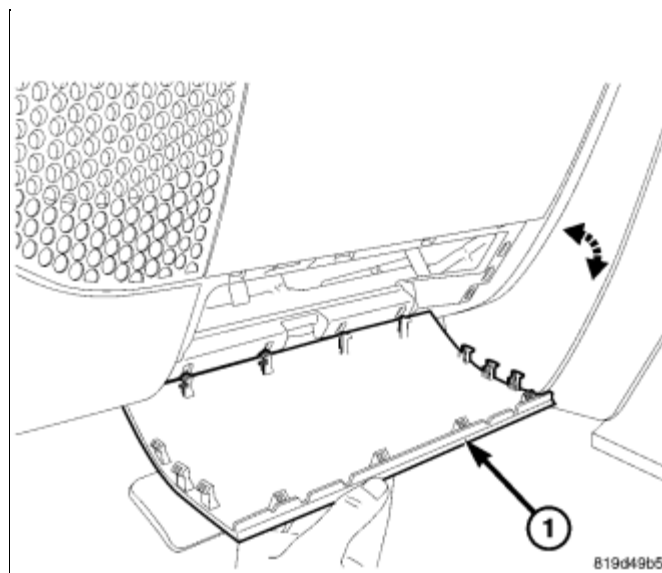
5. Disconnect the center I/P wire harness electrical connectors (1, 2 and 3).



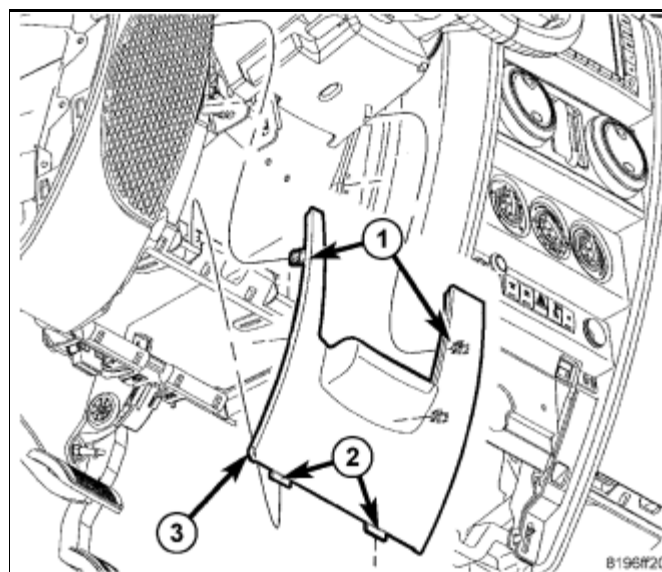
6. Release the push pin hangers (2) and position aside the harness (1).



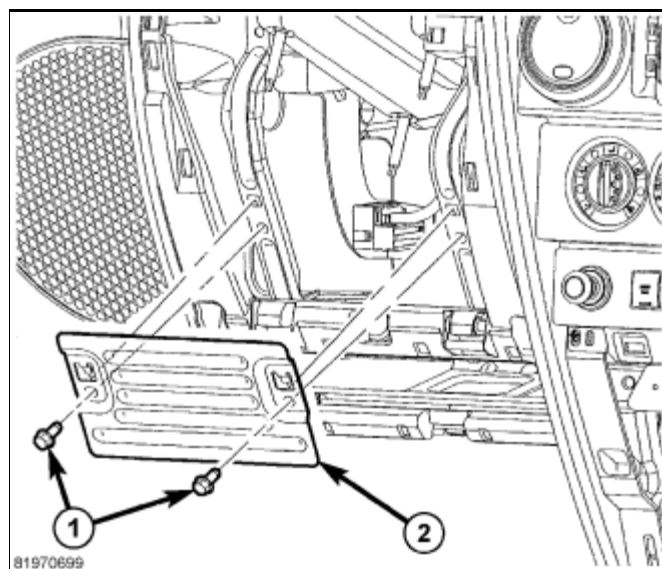
7. Using a trim stick C-4755 or equivalent, release the tabs and separate the lower steering column opening cover (1).



8. Using a trim stick C-4755 or equivalent, release the upper clips (1) and rotate the steering column opening cover (3) down and remove from lower tabs (2).



9. Remove the bolts (1) and remove the reinforcement plate (2).
10. Remove the amplifier, (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - REMOVAL).
11. Remove the steering column as necessary, (Refer to 19 - STEERING/COLUMN - REMOVAL).

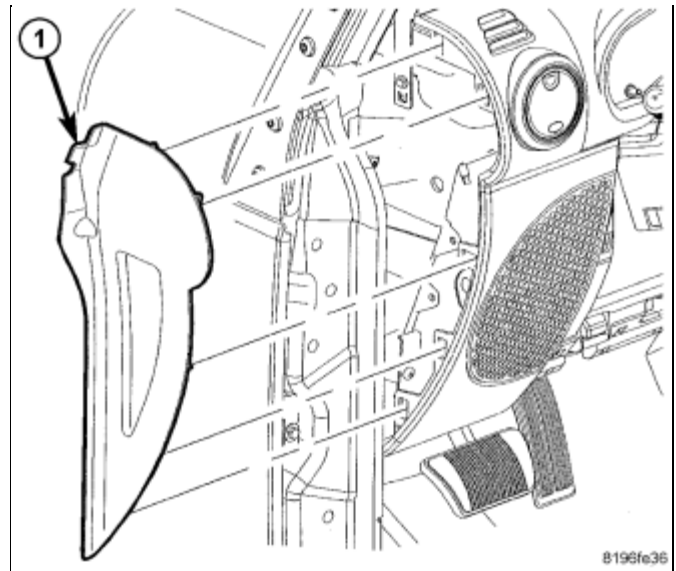


12. Using a trim stick C-4755 or equivalent, remove the end caps (1).

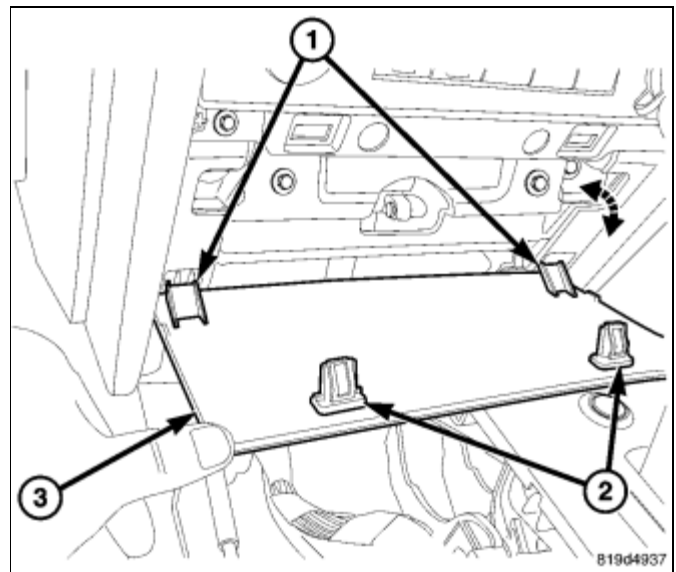
13. On automatic transmission vehicles, remove the shifter, (Refer to 21 -

TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/SHIFT MECHANISM - REMOVAL).

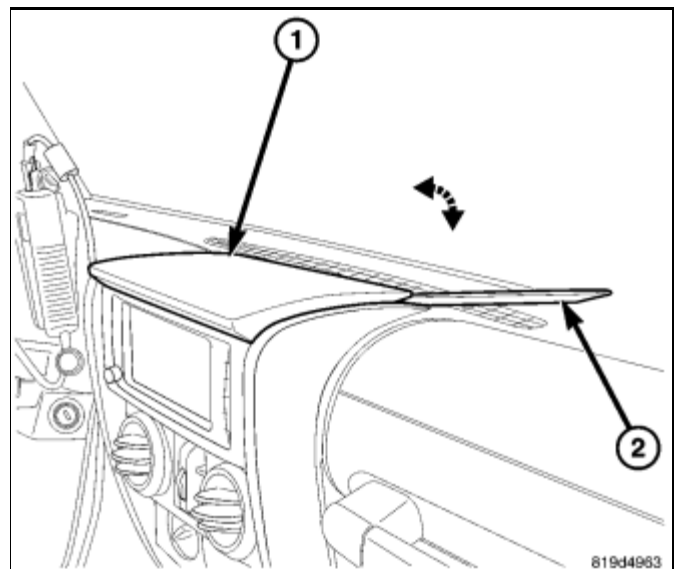
14. Remove the transference shifter, (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE/SHIFT LEVER - REMOVAL).



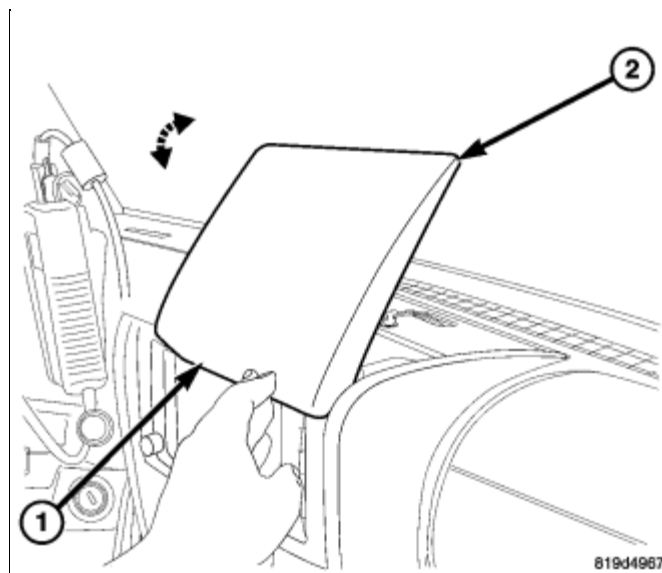
15. Using a trim stick C-4755 or equivalent, release the clips (2) and rotate the lower center trim (3) down and release the tabs (1).



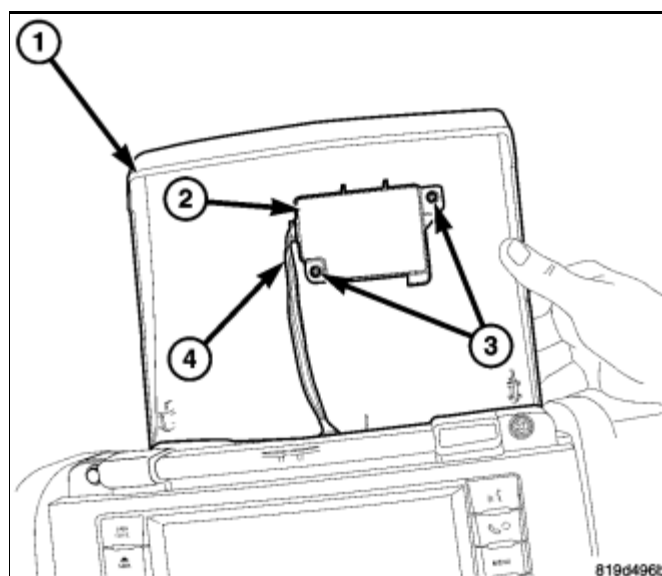
16. Using a trim stick C-4755 or equivalent (2), release the clips in the rear of the upper trim (1).



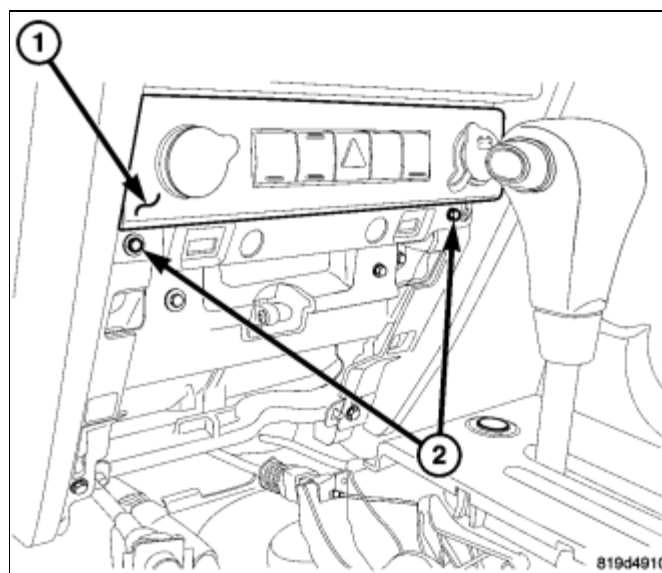
17. Rotate the upper trim (2) back and release the front (1).



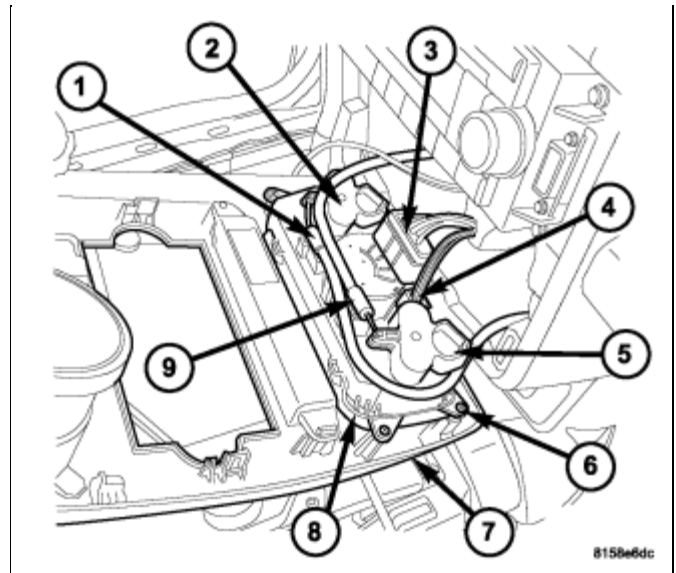
18. Disconnect the electrical connector (4) and remove the upper center cover (1).



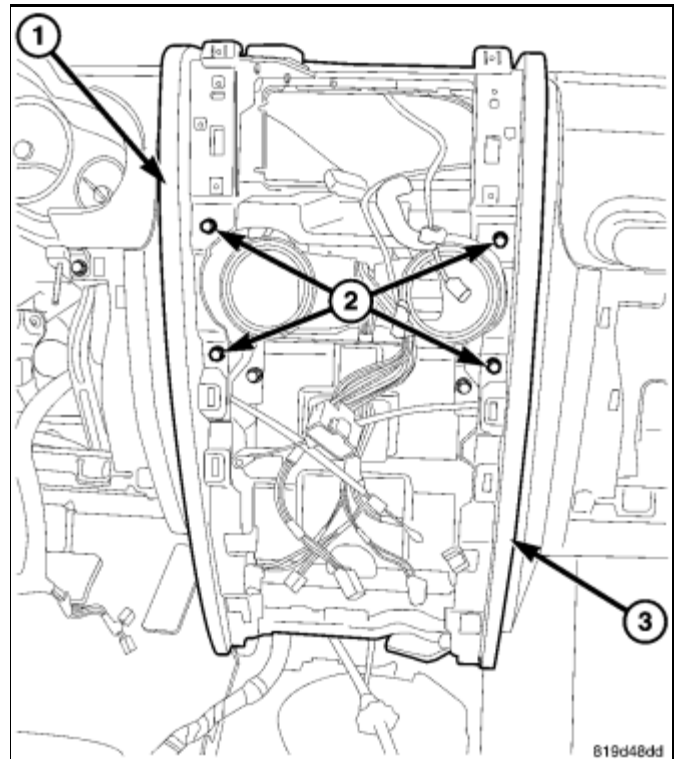
19. Remove the screws (2) and using a trim stick C-4755 or equivalent, separate the center bezel (1).



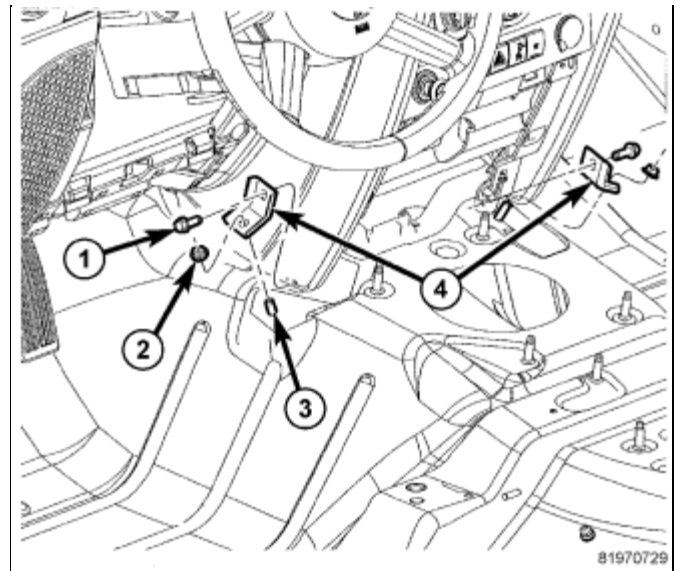
20. Disconnect the HVAC control cables (1 and 9) and disconnect the electrical connectors (3).
21. Remove the radio, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).



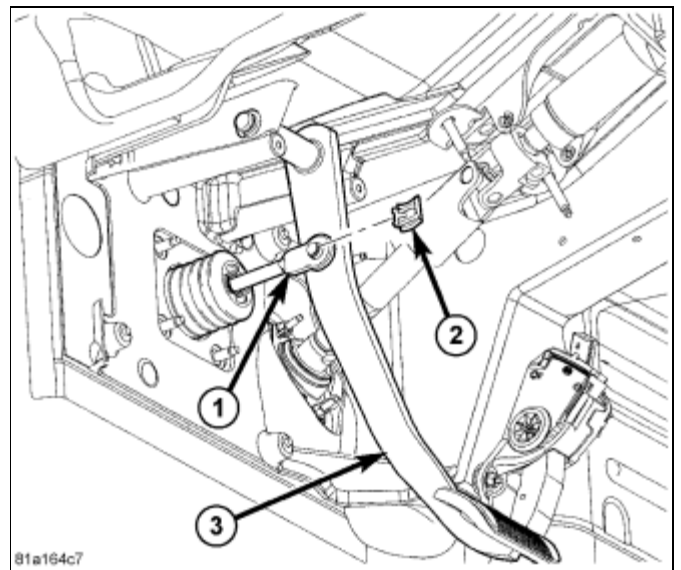
22. Remove the screws (2) and remove the center I/P trim panels (1 and 3).



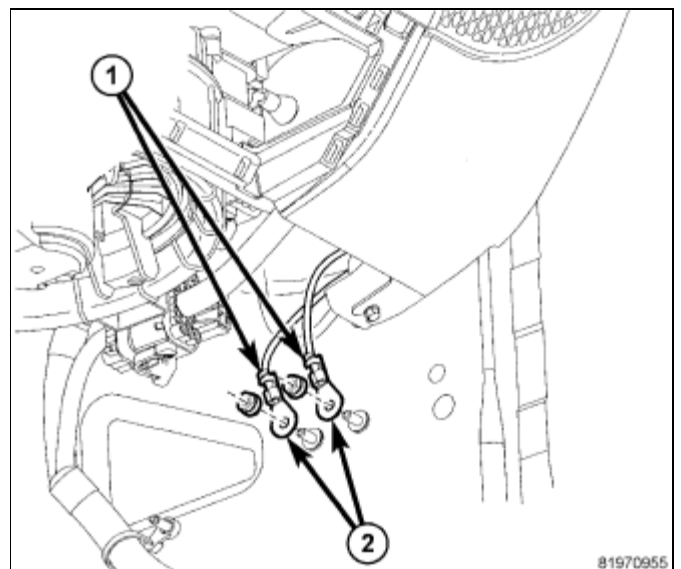
23. Remove the nuts (2) and bolts (1) and remove the center support brackets (4).



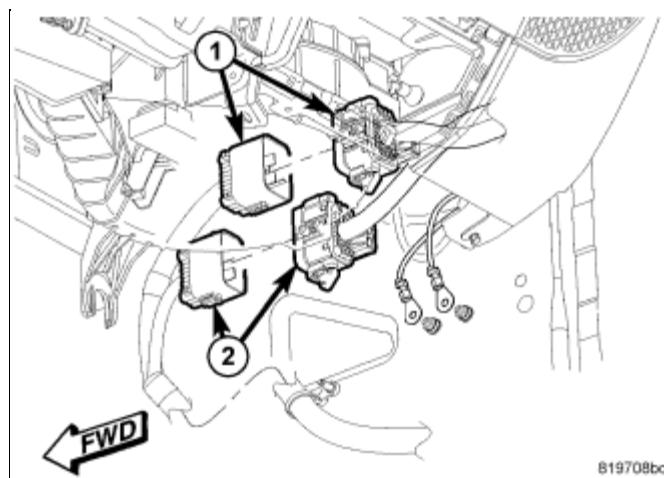
24. Remove the clutch pedal clip and separate the clutch pedal rod, if equipped.
25. Remove the brake pedal clip (2) and separate the brake pedal rod (1).



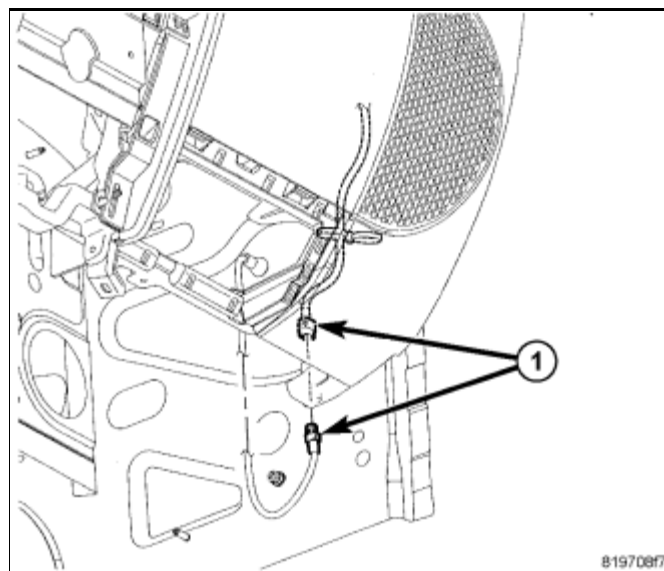
26. Remove the nuts and separate the grounds (2).



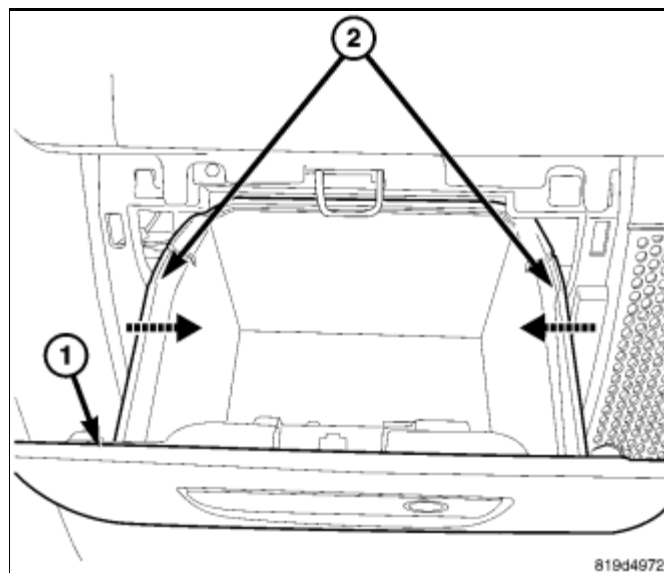
27. Disconnect the driver's side electrical connectors.
28. Disconnect the passenger side electrical connectors (1 and 2).



29. Disconnect the antenna connector (1).



30. Remove the glove box (1).

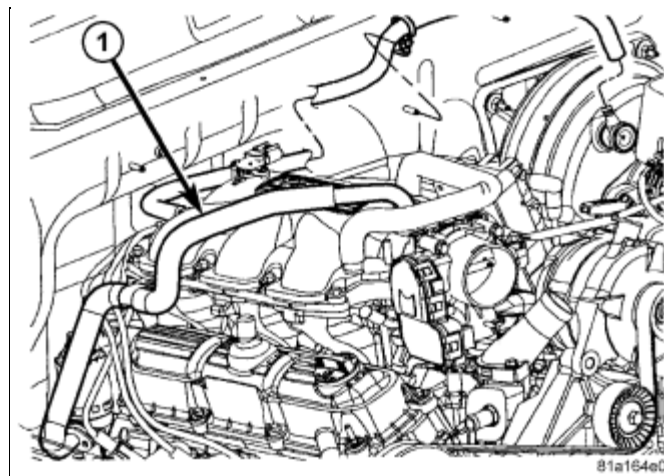


31. Drain the refrigerant, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD)

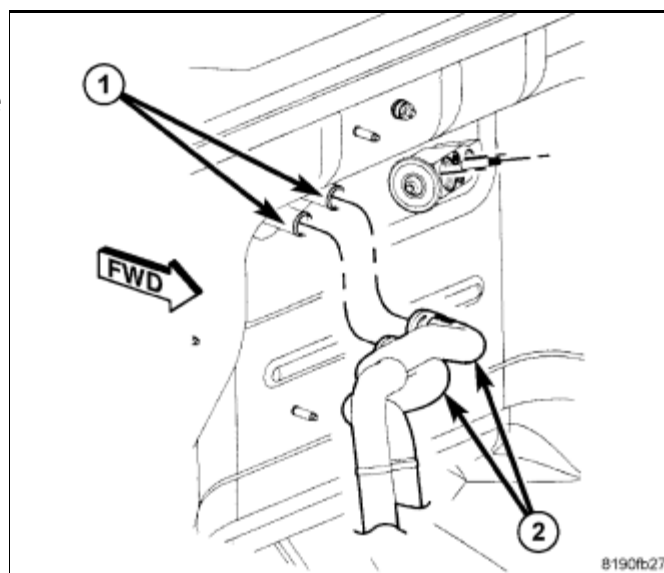
PROCEDURE).

32. Drain the coolant, (Refer to 7 - COOLING - STANDARD PROCEDURE).

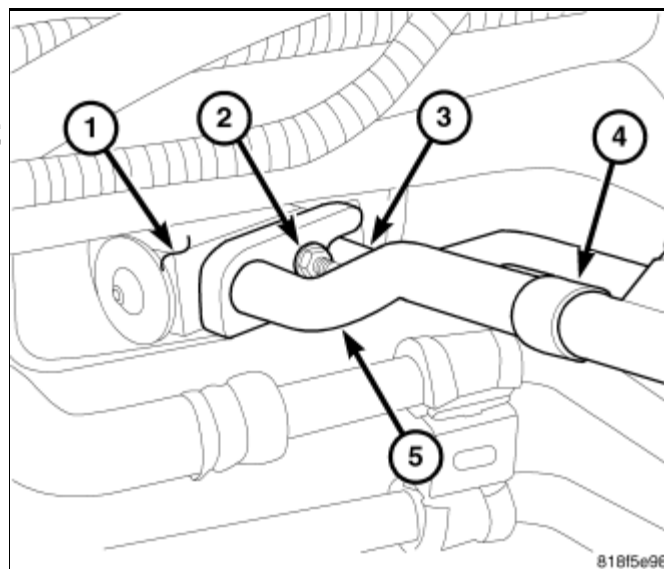
33. Remove the EGR tube (1), (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - REMOVAL).



34. Using cable-type spring clamp pliers or equivalent, release the hose clamps that secure the heater hoses (2) to the heater core tubes (1) and disconnect the hoses from the tubes. Install plugs in, or tape over the opened heater core tubes to prevent coolant spillage during HVAC housing assembly removal.

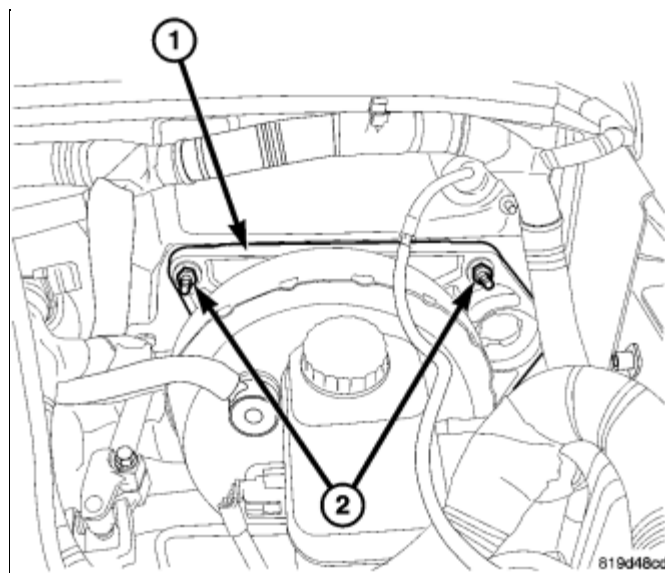


35. Remove the nut (2) that secures the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1).
36. Disconnect the A/C liquid and suction lines from the A/C expansion valve and remove and discard the O-ring seals.
37. Install plugs in, or tape over the opened refrigerant line fittings and the expansion valve ports.

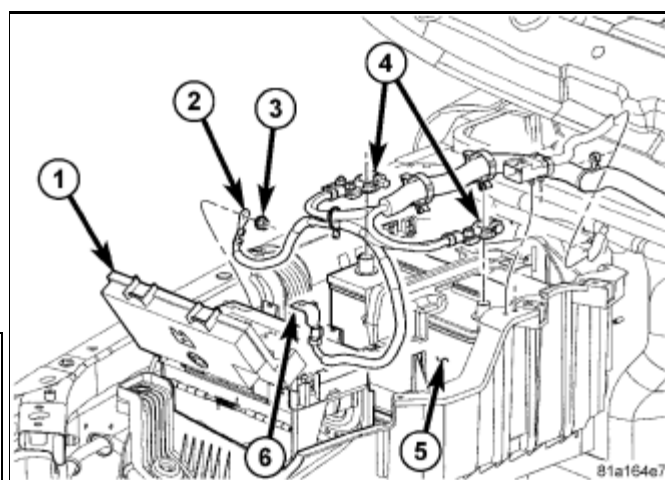


38. Position aside the harness at the brake booster.

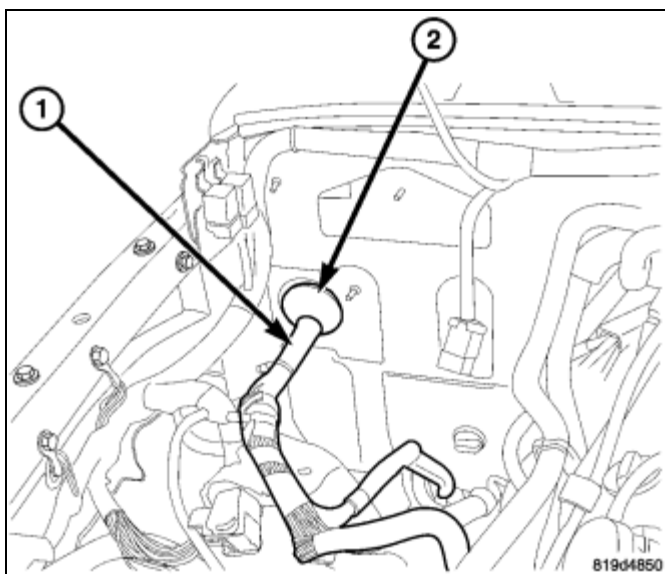
39. Remove the brake booster bracket nuts (2).



40. Disconnect the positive battery cable.
41. Remove the right side ground.
42. Position aside the power steering reservoir.
43. Remove the battery tray, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).

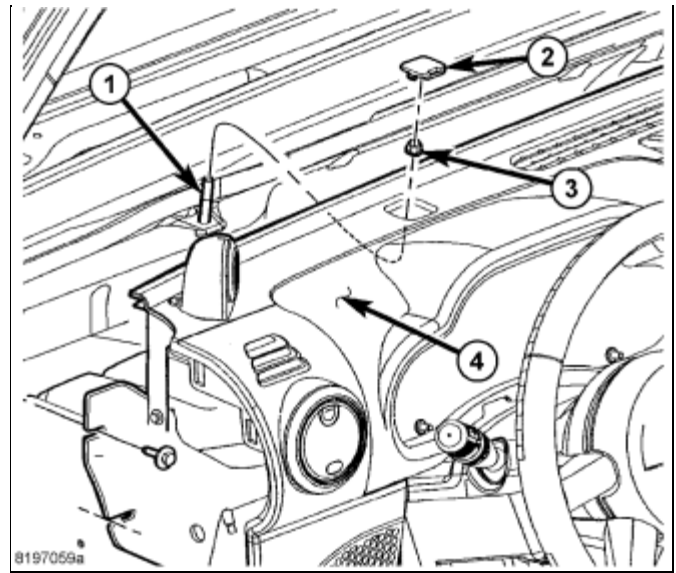


44. Release the wire harness grommet (2) and separate any

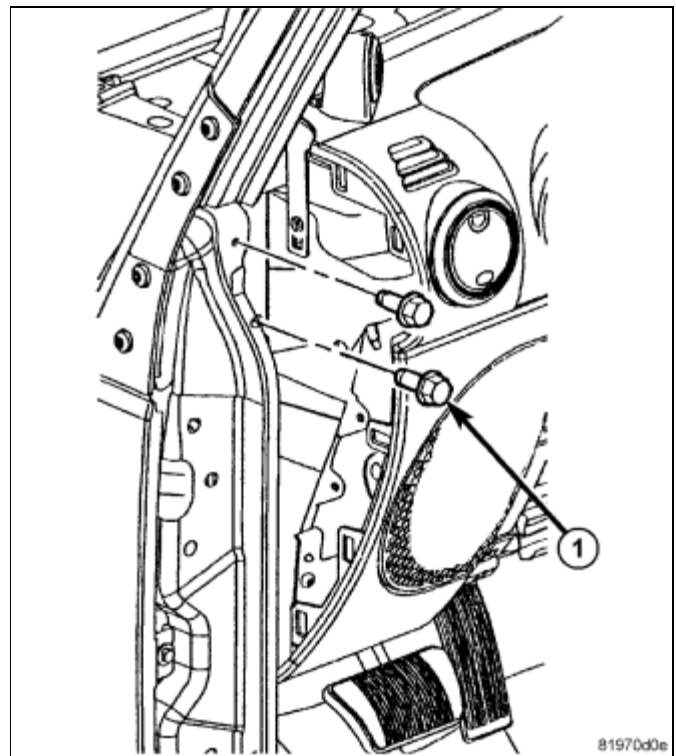


remaining support clips for the wires harness (1).

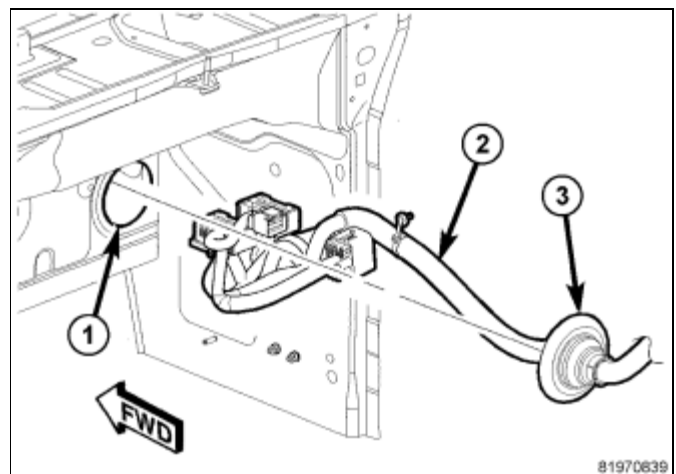
45. Remove the trim caps (2) and remove the fenceline nuts (3).



46. Remove the side support bolts (1) and position the I/P assembly back.

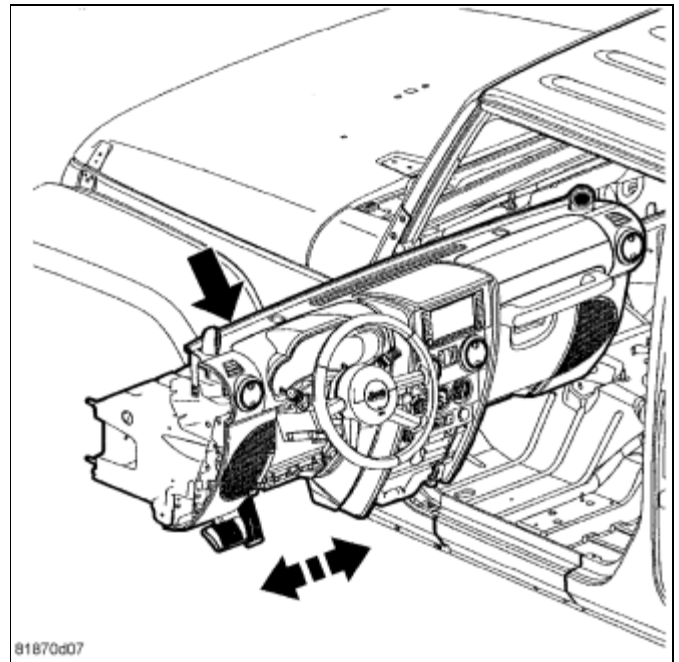


47. Pull the main wire harness (2) from the hole in the cowl (1).

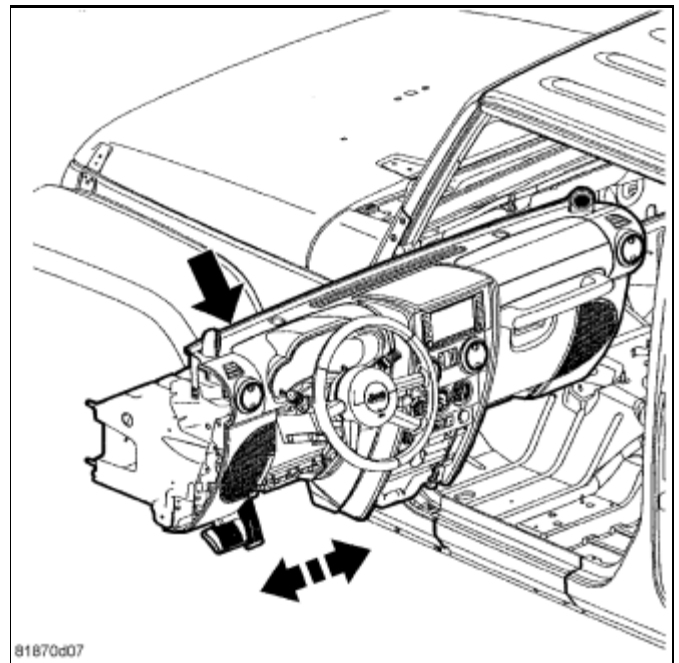


48. Remove the I/P from the vehicle.

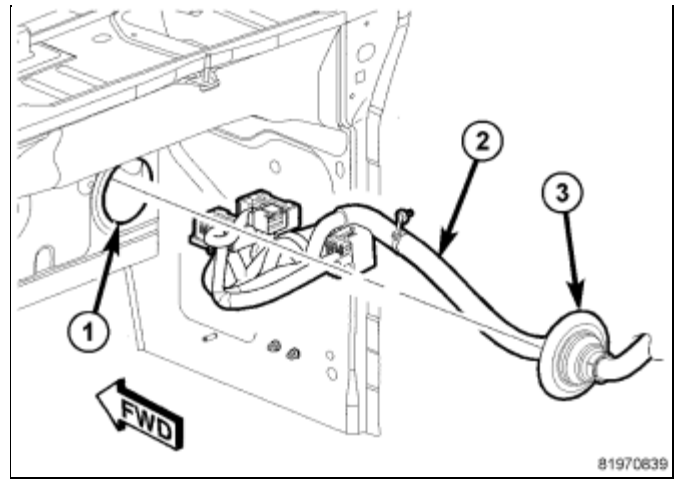
INSTALLATION



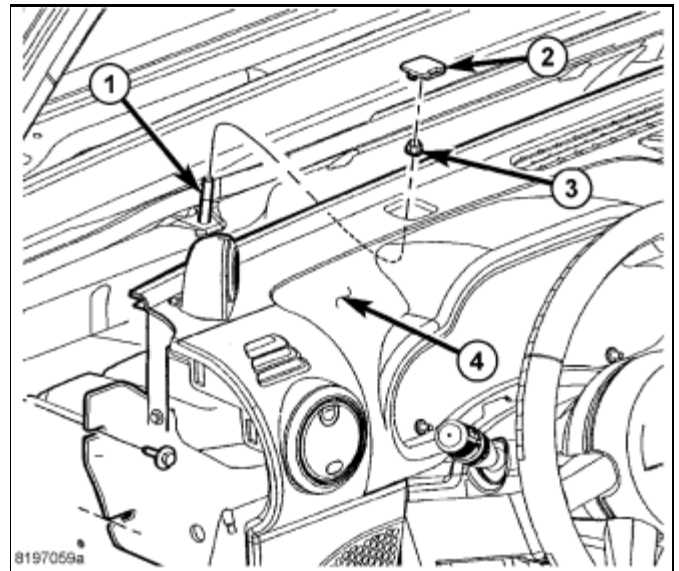
1. Position the I/P assembly into the vehicle and support back.



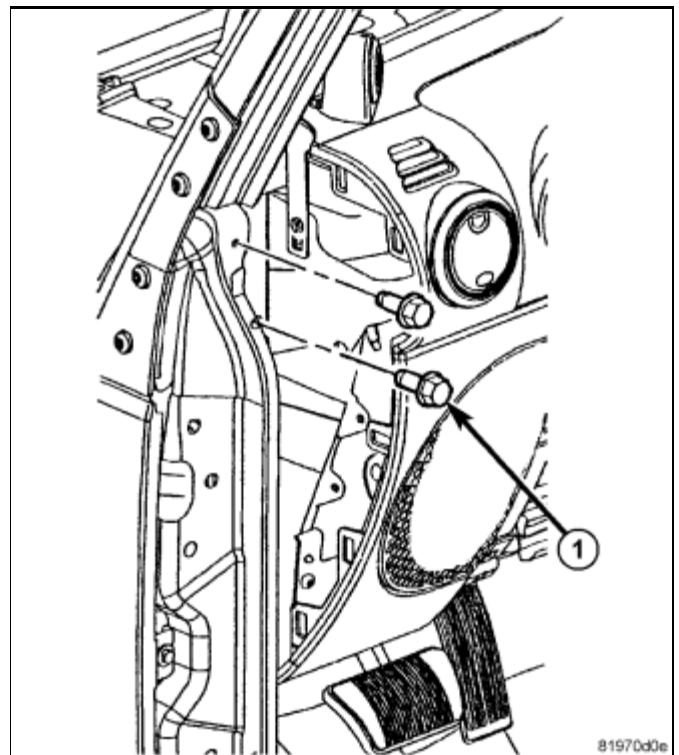
2. Position the wire harness (2) through the cowl panel (1) and seat the grommet (3) fully.



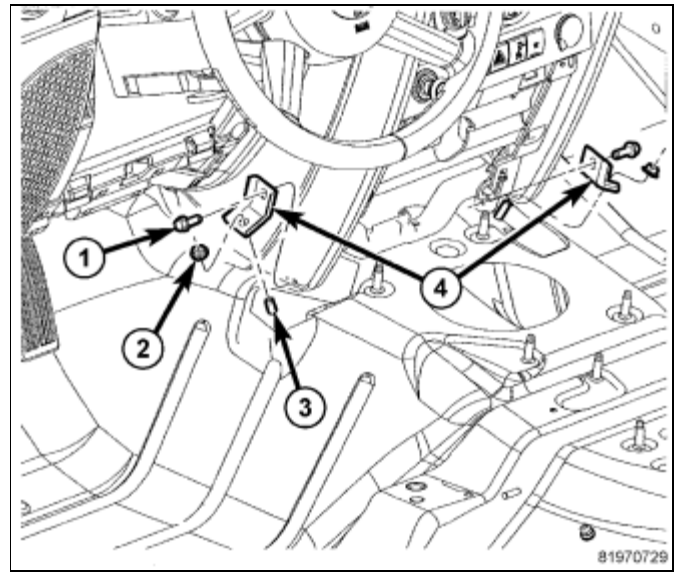
3. Loosely install the nuts (3) onto the fenceline studs (1).
4. Position the I/P assembly (4) back and carefully push the heater core and A/C lines and the brake booster support studs, through the cowl.
5. Position the I/P over the fenceline studs (1).



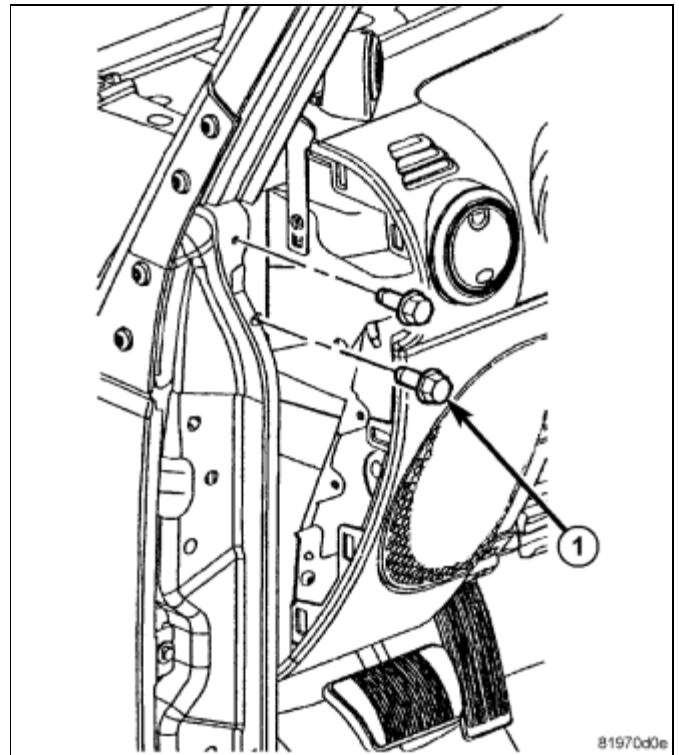
6. Loosely install the side support bolts (1).



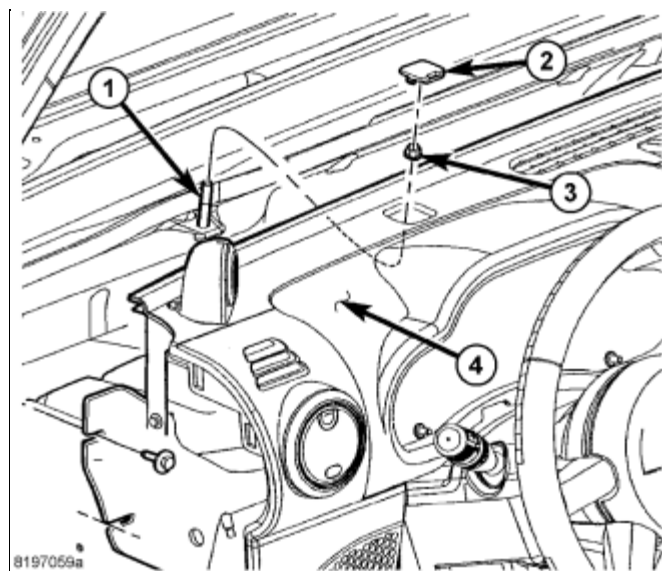
7. Install the center support brackets (4) over the studs (3) and install the bolts (1) and nuts (2).



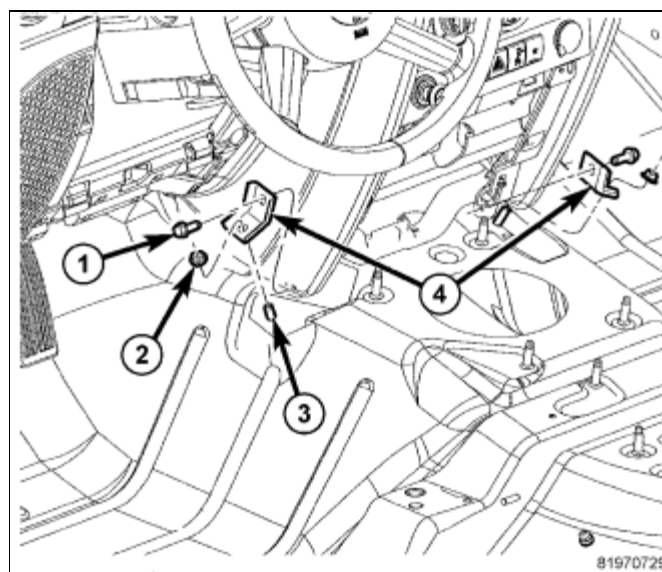
8. Tighten the side support bolts to 11 N·m (8 ft. lbs.).



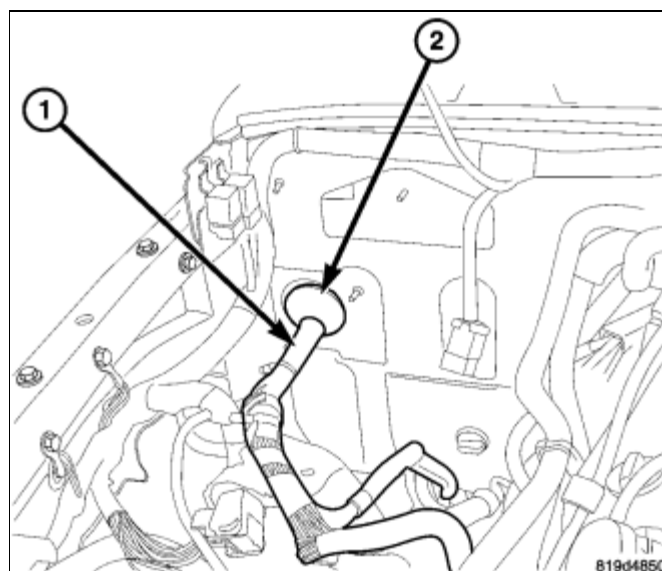
9. Tighten the fenceline nuts to 12 N·m (9 ft. lbs.).



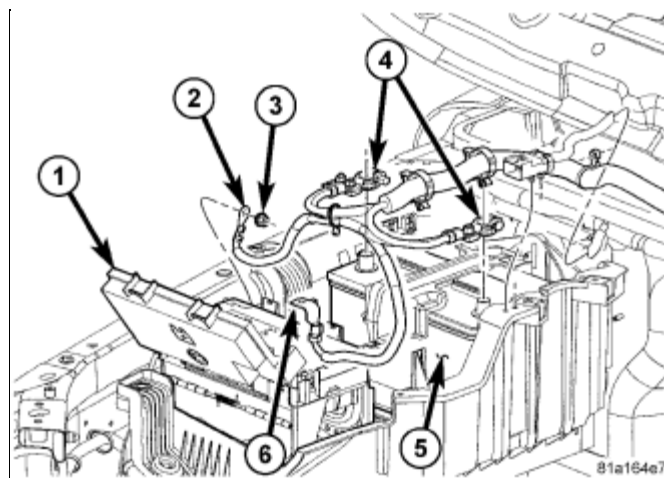
10. Tighten the bolts (1) and nuts (2) to 8 N·m (6 ft. lbs.).



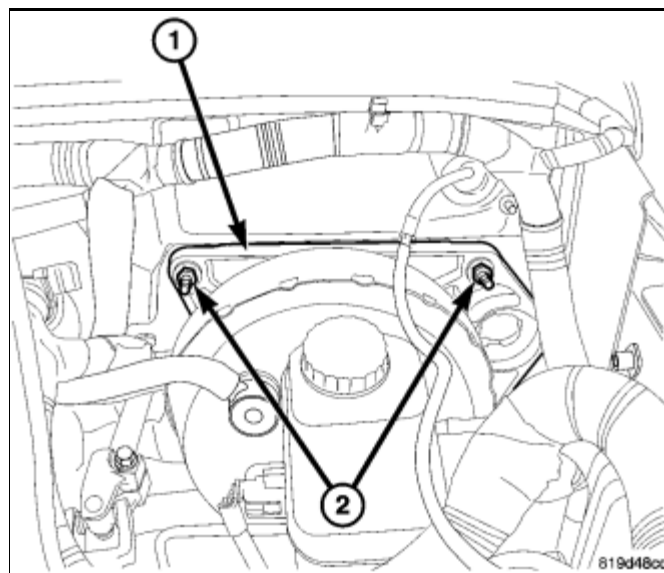
11. Position the main wire harness (1) back into place and seat all the support clips fully.



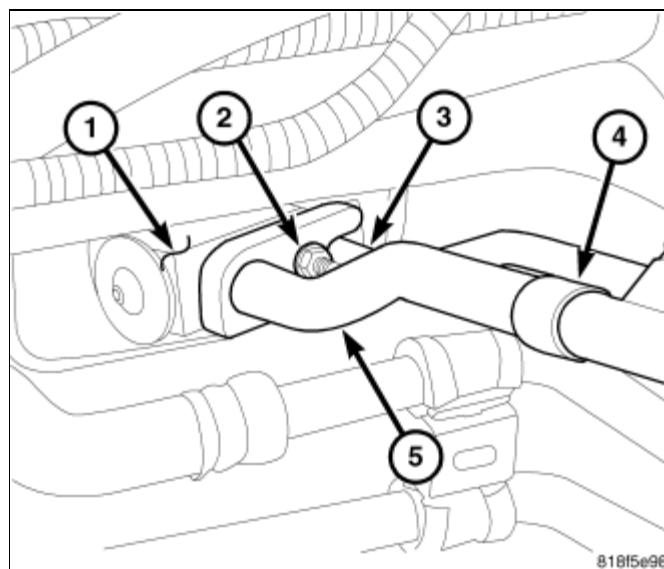
12. Install the battery tray, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).
13. Position the power steering reservoir back into place.
14. Install the right side grounds (2) and install the nuts (3).
15. Connect the positive battery cable (4).



16. Install the brake booster bracket nuts (2) and tighten to 18 N·m (13.5 ft. lbs.).
17. Position the wire harness back and secure the support clips fully.

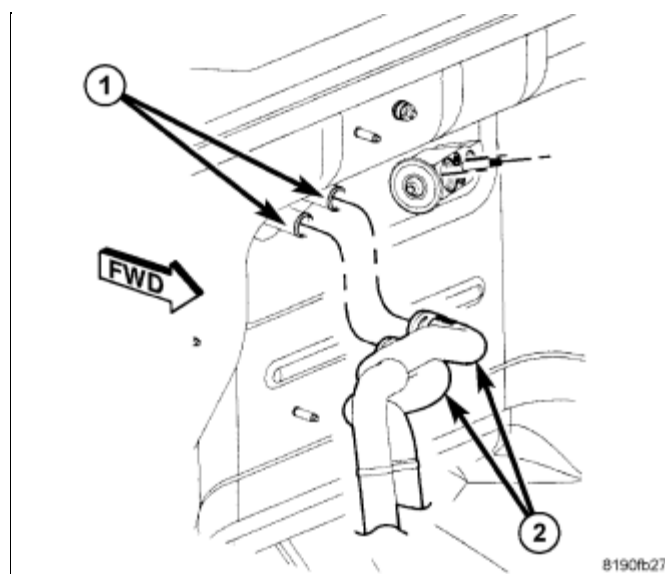


18. Remove the tape or plugs from the opened refrigerant line fittings and the expansion valve ports.
19. Lubricate new O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of special materials compatible to the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
20. Connect the A/C liquid line (3) and A/C suction line (5) onto the A/C expansion valve (1).
21. Install the nut (2) that secures the A/C liquid and suction lines to the A/C expansion valve. Tighten the nut to 23 N·m (17 ft. lbs.).



22. Remove the previously installed plugs or caps and connect the heater hoses (2) to the heater core tubes (1).

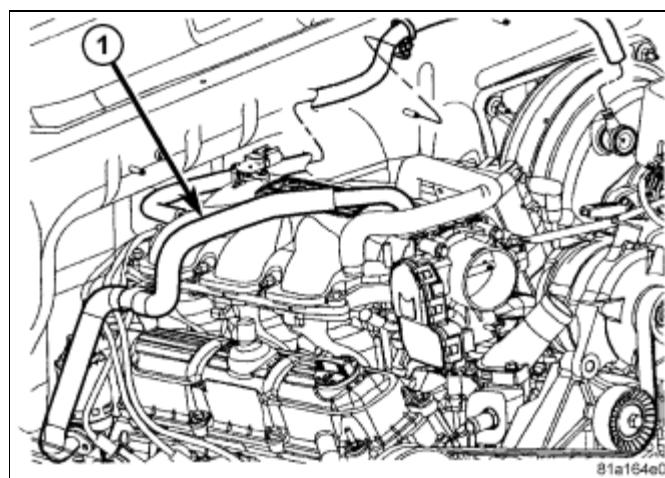
23. Using cable-type spring clamp pliers or equivalent, correctly position the two hose clamps that secure the heater hoses to the heater core tubes and engage the clamps to the tubes.



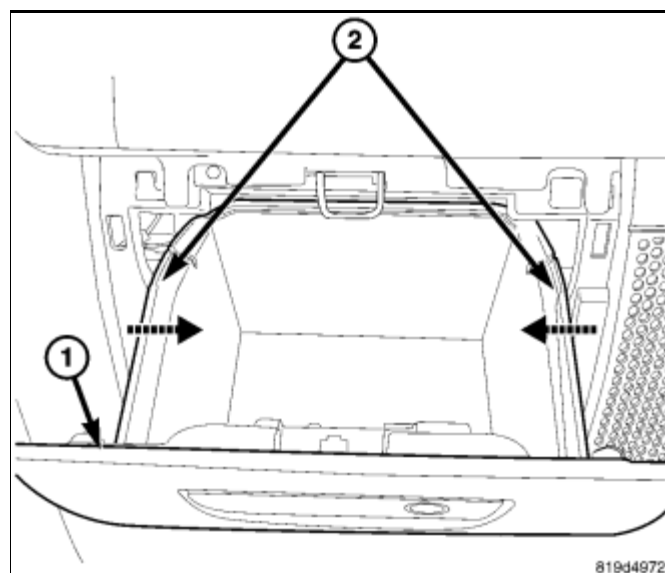
24. Install the EGR tube (1), (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - INSTALLATION).

25. Fill the coolant, (Refer to 7 - COOLING - STANDARD PROCEDURE).

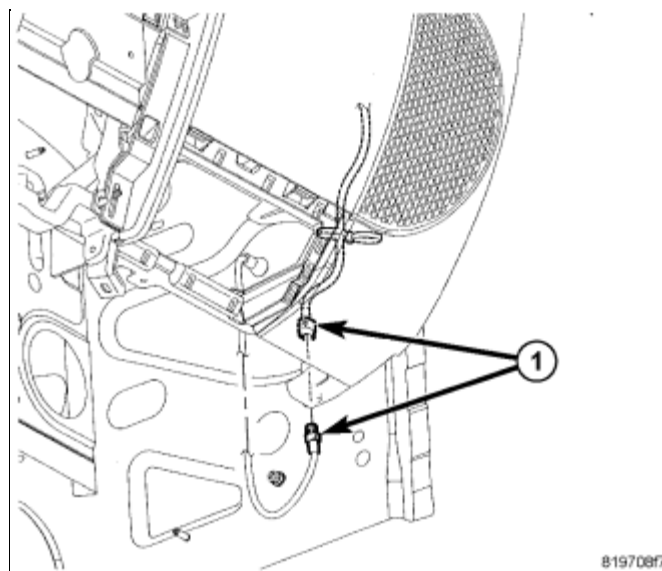
26. Evacuate the A/C system, (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).



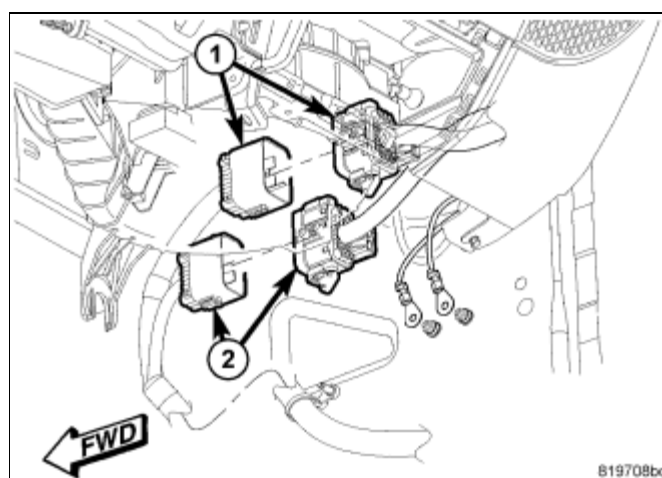
27. Install the glove box (1), (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).



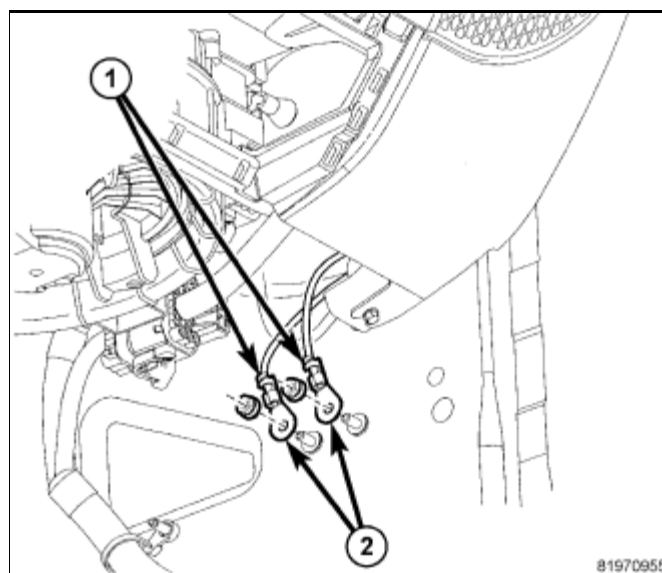
28. Connect the antenna connector (1).



29. Connect the electrical connectors (1 and 2).

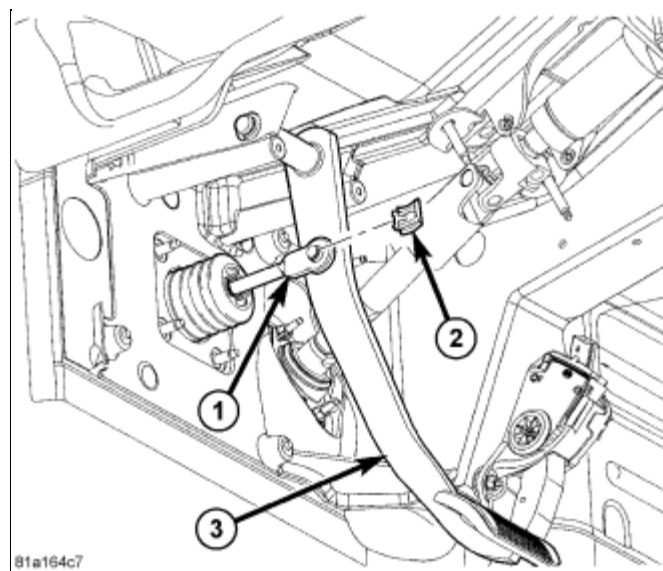


30. Connect the grounds (2) and install the nuts.
 31. Install the nut to the lower HVAC support bracket under the glove box.

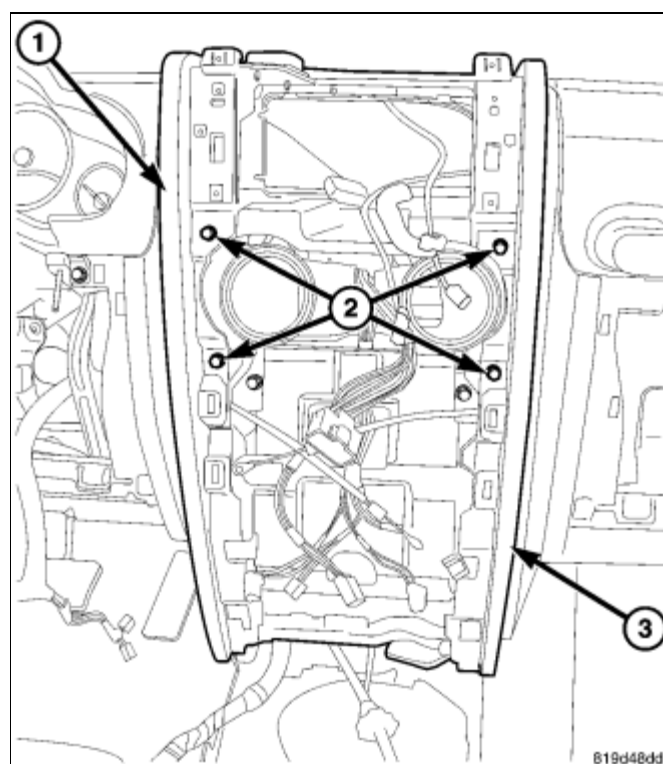


32. Connect the brake pedal rod (1) and install the clip (2).
 33. If equipped, connect the clutch pedal rod and install the

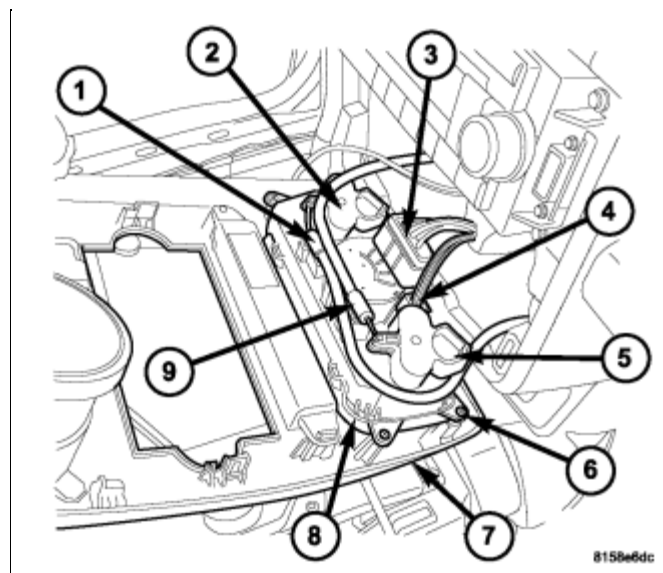
clip.



34. Install the center I/P trim panels (1 and 3) and install the screws (2).

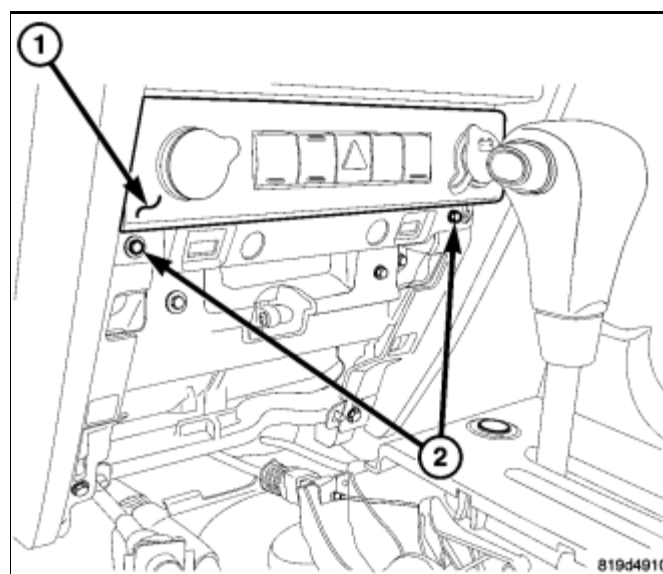


35. Install the radio, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
 36. Connect the HVAC control cables (1 and 9) and connect the electrical connectors (3 and 4).

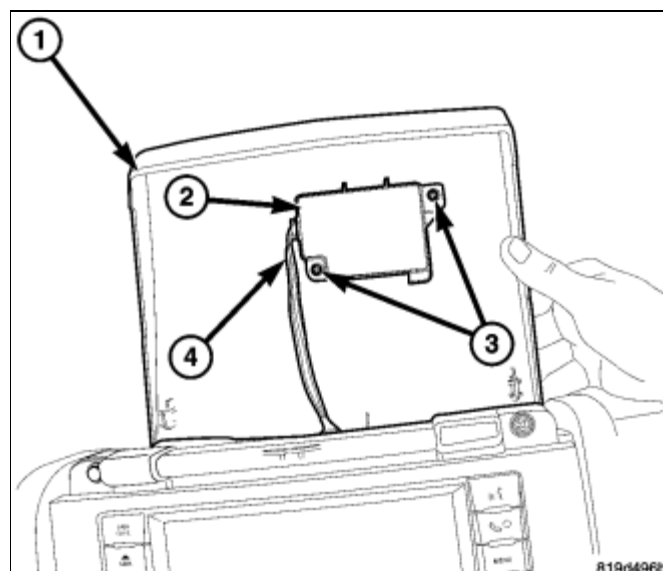


37. Position the center bezel (1) onto the I/P and seat the clips fully.

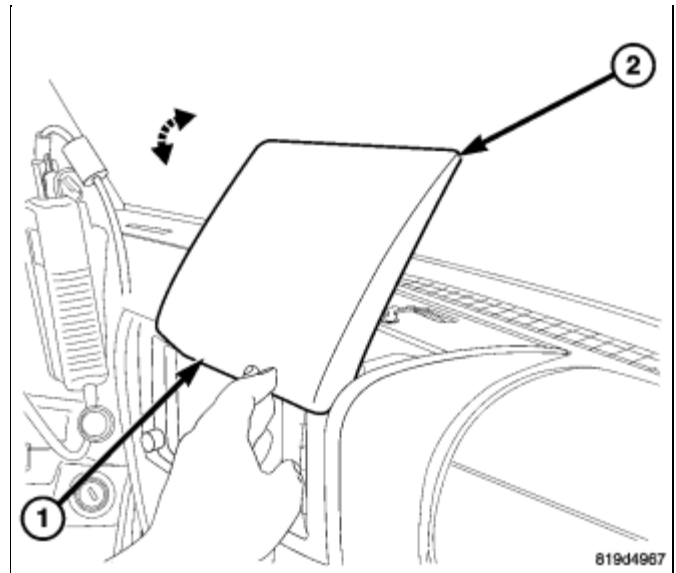
38. Install the lower screws (2).



39. Connect the electrical connector (4) and position the upper center cover onto the top of the I/P.



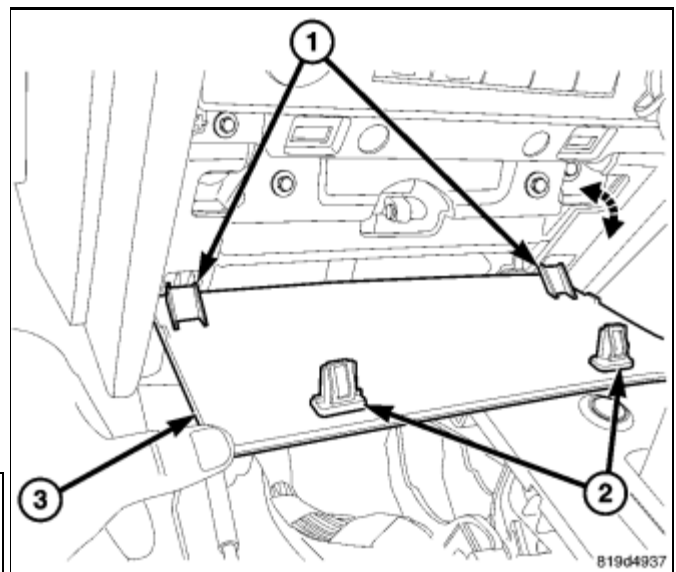
40. Position the front of the cover (1) onto the center support and rotate the trim (2) back and seat the clips fully.



41. Position the lower tabs (1) into the slots and rotate the trim (3) up and seat the clips (2) fully.

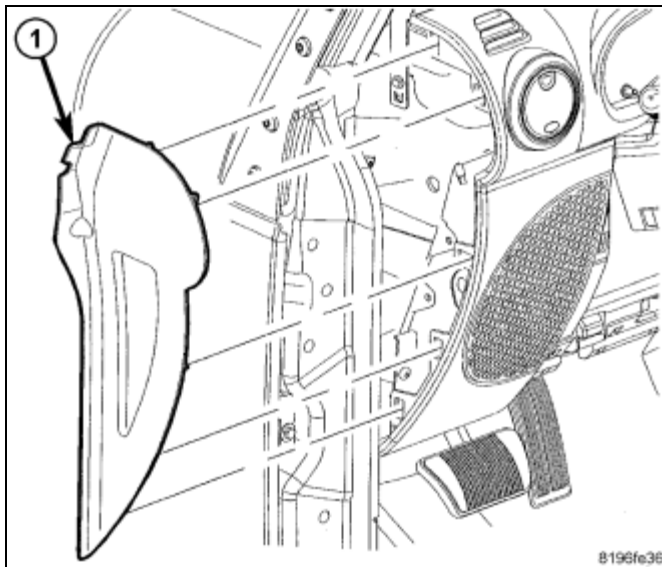
42. Install the transference shifter, (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE/SHIFT LEVER - INSTALLATION).

43. Install the automatic transmission shifter, if equipped, (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/SHIFT MECHANISM - INSTALLATION).



44. Position the end caps (1) onto the I/P and seat fully.

45. Install the steering column, (Refer to 19 -

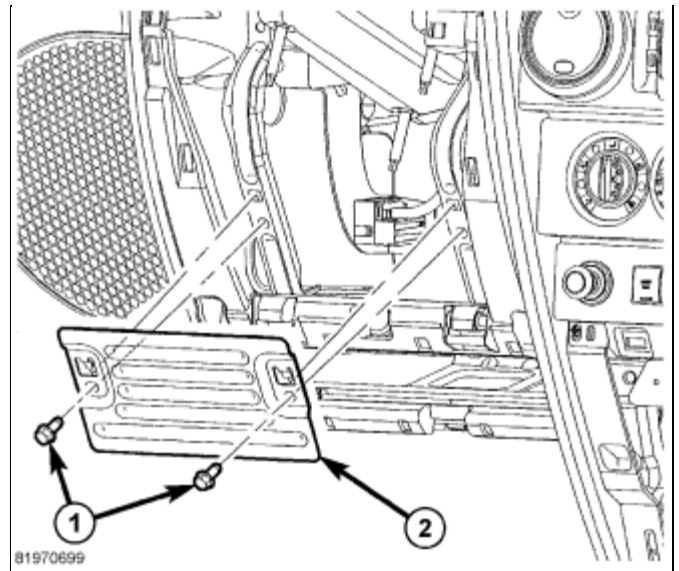


STEERING/COLUMN - INSTALLATION).

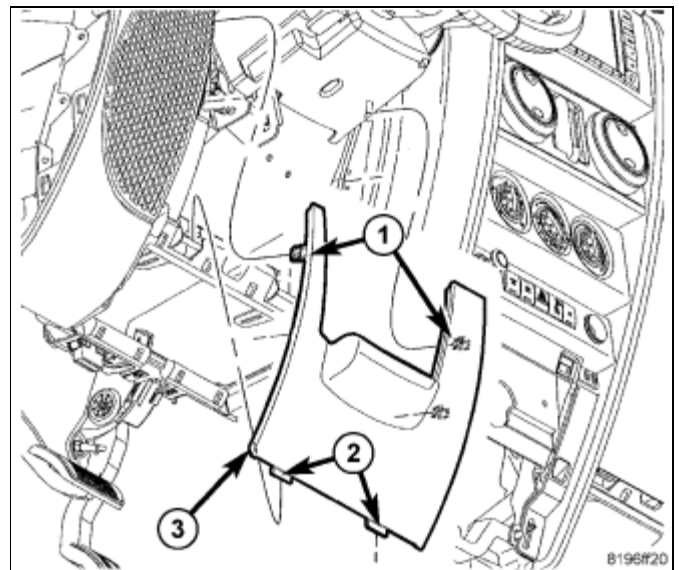
46. Install the amplifier, (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - INSTALLATION).

47. Install the reinforcement plate (2) and install the bolts (1).

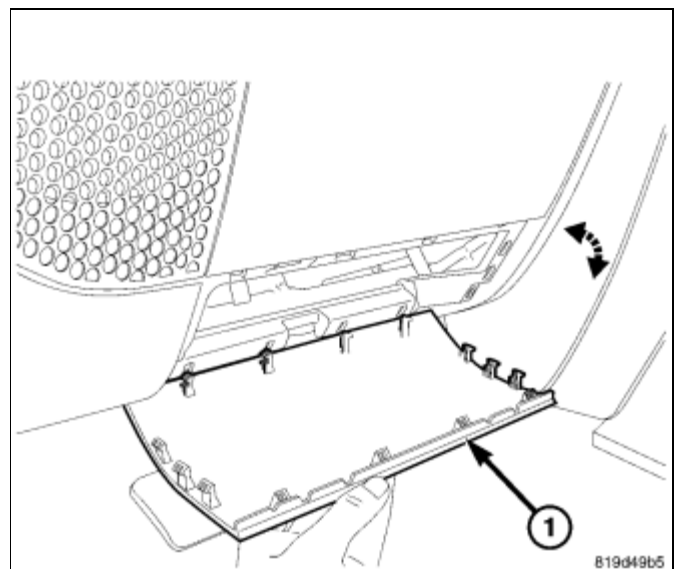
48. Tighten the bolts (1) to 11 N·m (8 ft. lbs.).



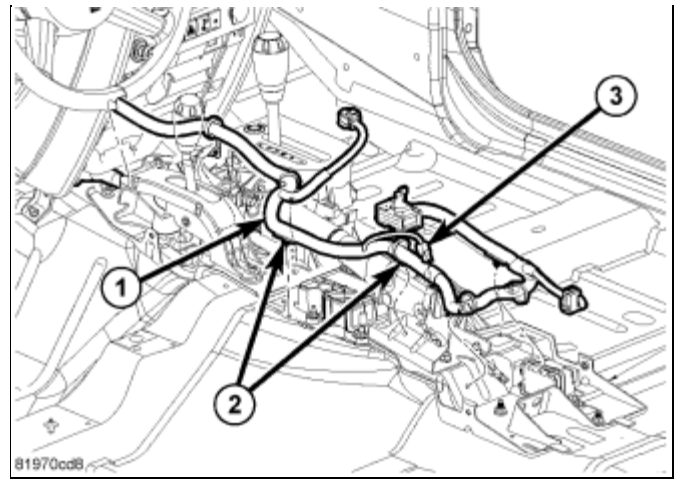
49. Position the steering column opening cover (3) onto the lower tabs (2), rotate up and seat the clips (1) fully.



50. Position the lower opening trim onto the I/P and seat the clips (1) fully.



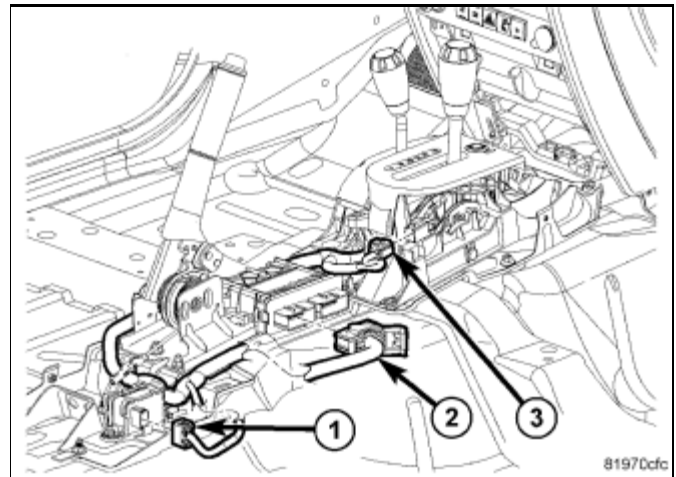
51. Position the center harness (1) back into place and seat the support clips (2) fully.



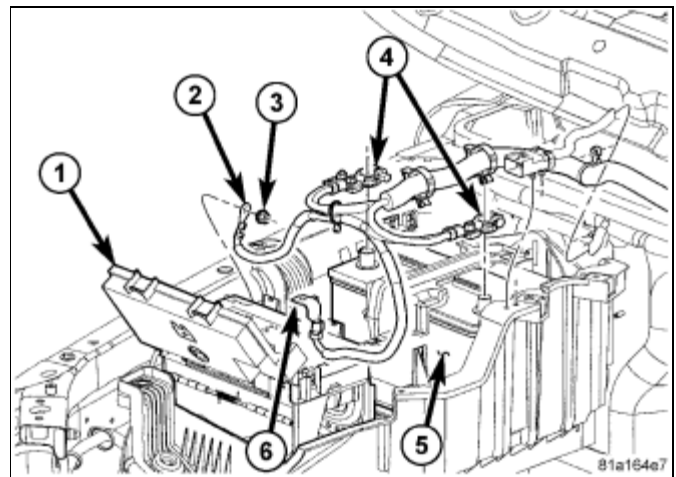
52. Connect the center harness electrical connectors (1, 2 and 3).

53. Install the center console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

54. Install the center console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)



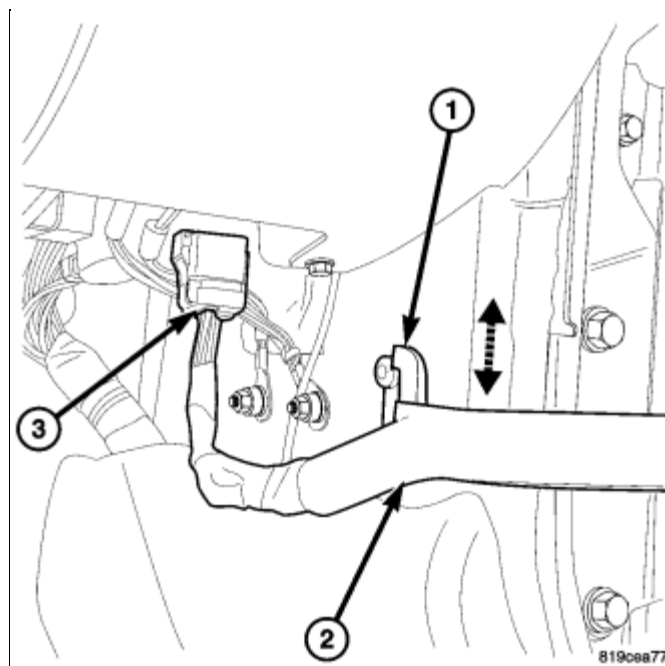
55. Connect the battery cables (4).



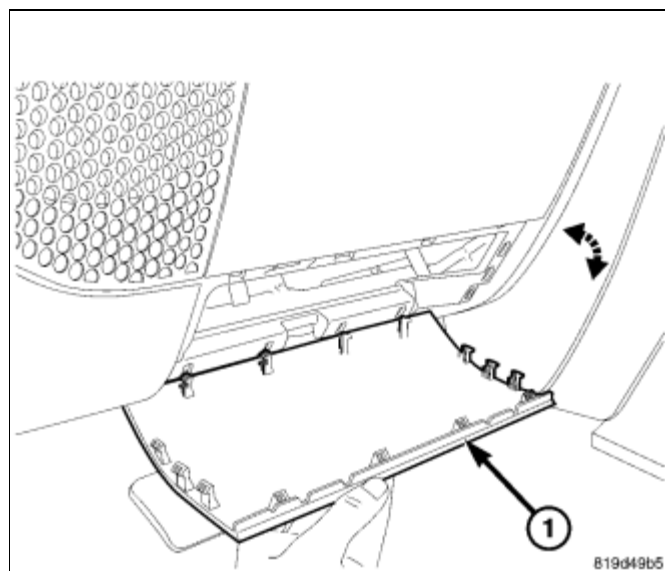
56. Secure the front door check straps (2) over the footman's loop (1) and connect the electrical connector (3).

STEERING COLUMN OPENING COVER

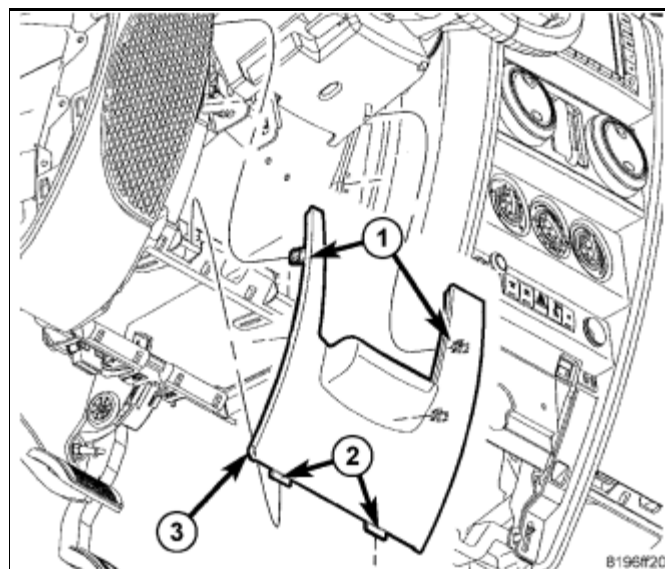
REMOVAL



1. Using a trim stick C-4755 or equivalent, release the tabs and separate the lower steering column opening cover (1).

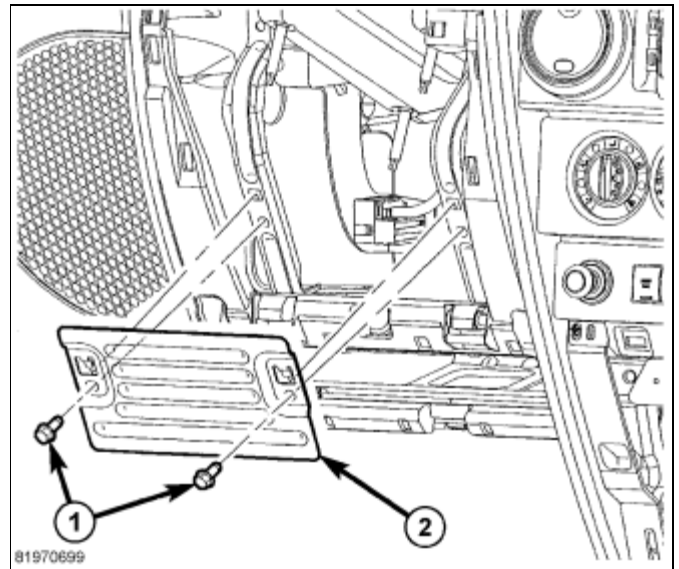


2. Using a trim stick C-4755 or equivalent, release the upper clips (1) and rotate the steering column opening cover (3) down and remove from lower tabs (2).

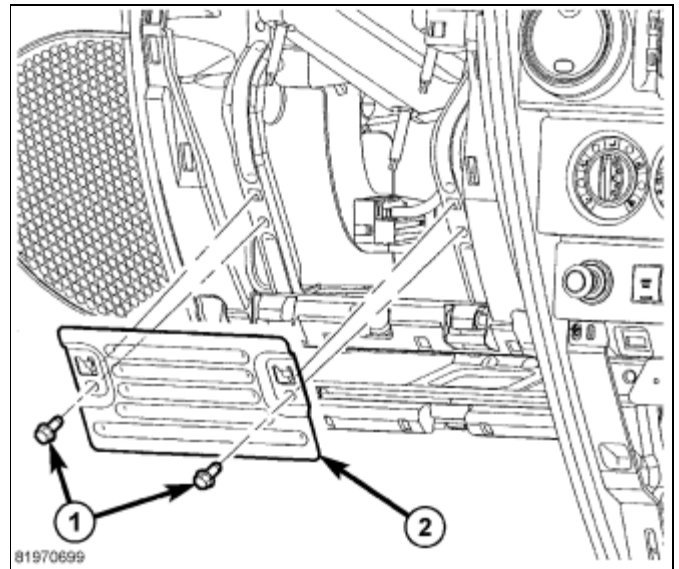


3. Remove the bolts (1) and remove the reinforcement plate (2).

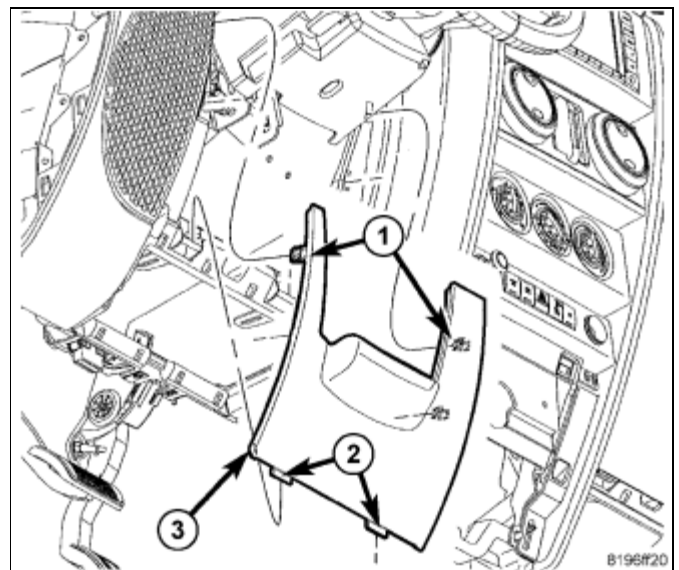
INSTALLATION



1. Install the reinforcement plate (2) and install the bolts (1).
2. Tighten the bolts (1) to 11 N·m (8 ft. lbs.).



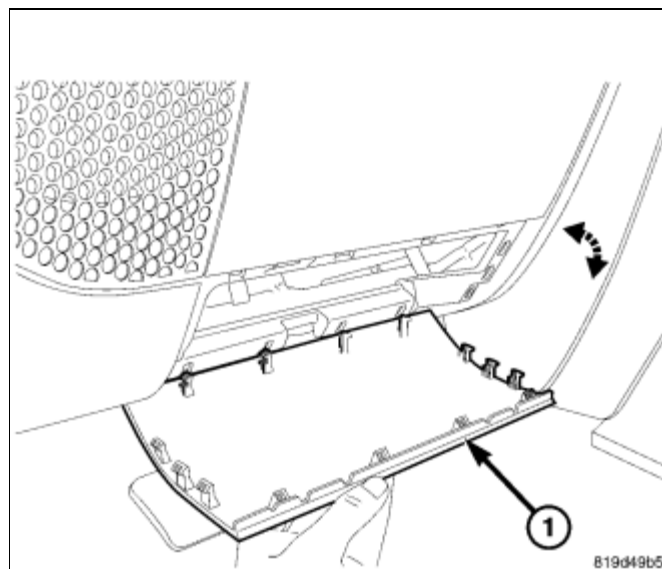
3. Position the steering column opening cover (3) onto the lower tabs (2), rotate up and seat the clips (1) fully.



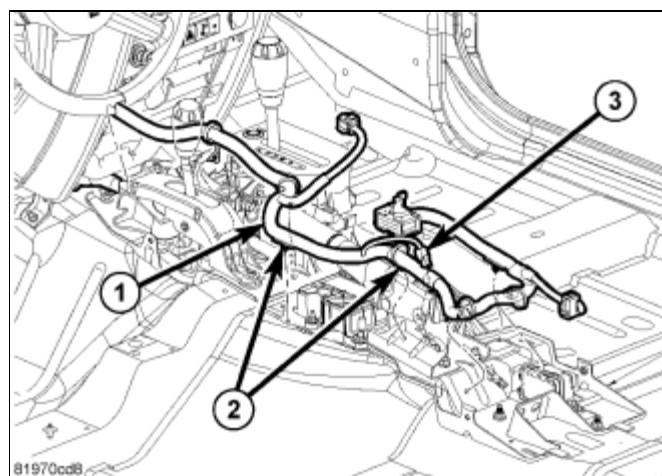
4. Position the lower opening trim onto the I/P and seat the clips (1) fully.

COVER

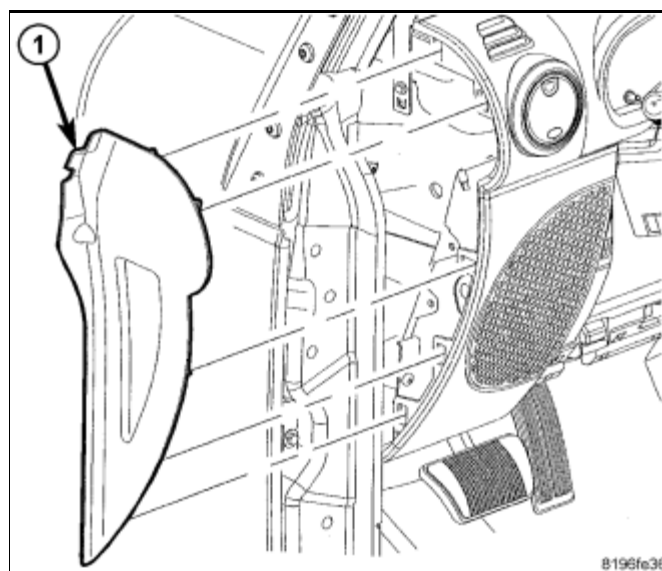
REMOVAL



1. Remove the center console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).
2. Disconnect the center harness (1) electrical connectors and position aside.
3. Remove the amplifier, (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - REMOVAL).
4. Remove the steering column as necessary, (Refer to 19 - STEERING/COLUMN - REMOVAL).



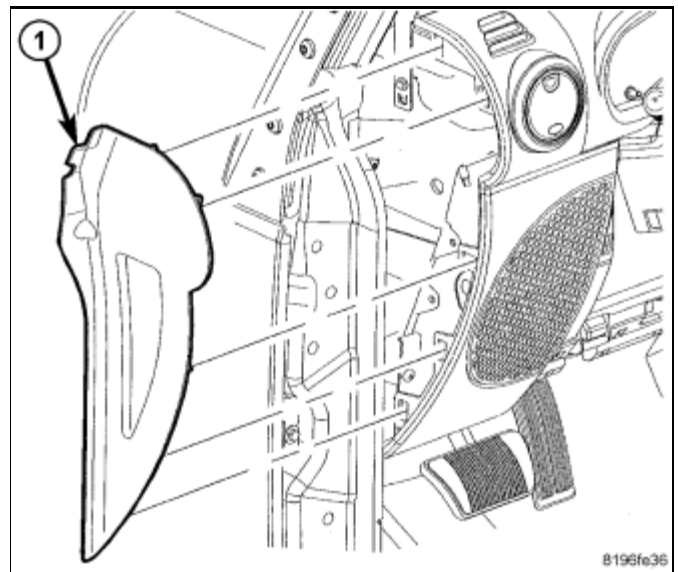
5. Using a trim stick C-4755 or equivalent, remove the end caps (1).
6. Remove the center trim, (Refer to 23 - BODY/INSTRUMENT PANEL/CENTER BEZEL - REMOVAL).
7. Remove the radio, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).
8. Remove the glove box, (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
9. Remove the upper I/P tweeter speakers, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).
10. Remove the cluster bezel, (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).
11. Remove the passenger air bag, (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL)
12. Remove the glove box striker.
13. Remove the screws securing the cover to the I/P reinforcement and remove the cover.



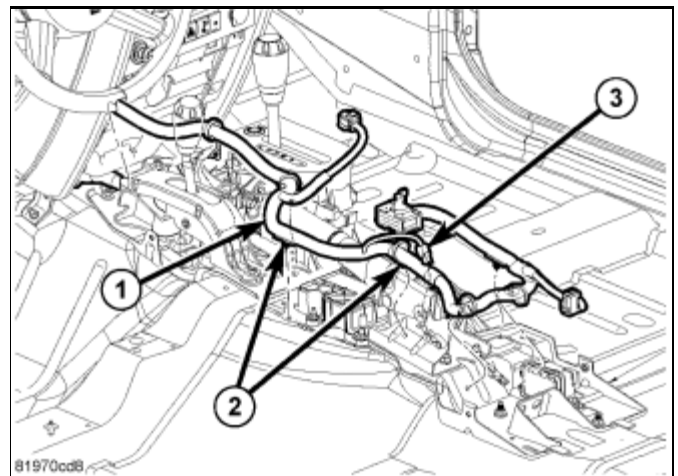
INSTALLATION

1. Position the cover over the I/P reinforcement and install the screws.
2. Install the glove box striker.
3. Install the passenger air bag, (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).
4. Install the cluster bezel, (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).
5. Install the upper I/P tweeter speakers, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).
6. Install the glove box, (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
7. Install the radio, (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
8. Install the center trim, (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

9. Position the end caps (1) into place and seat the clips fully.
10. Install the steering column, (Refer to 19 - STEERING/COLUMN - INSTALLATION).
11. Install the amplifier, (Refer to 8 - ELECTRICAL/AUDIO/AMPLIFIER - INSTALLATION).



12. Position the center harness (1) back into place, secure the support clips and connect the electrical connectors.
13. Install the center console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

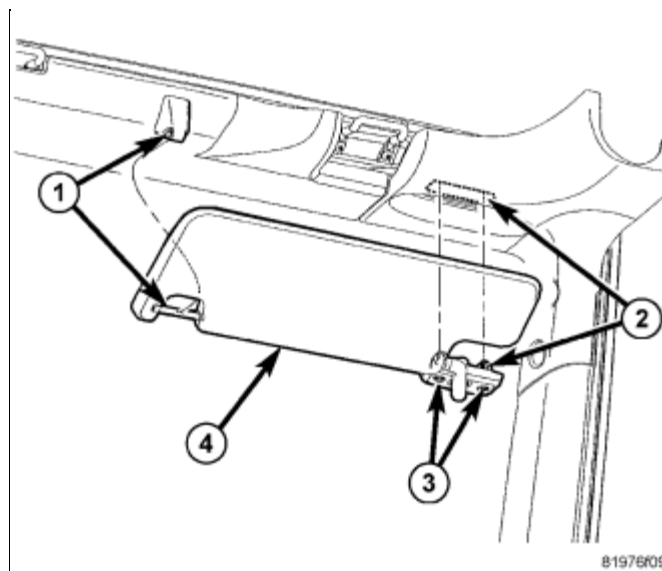


INTERIOR

A-PILLAR TRIM

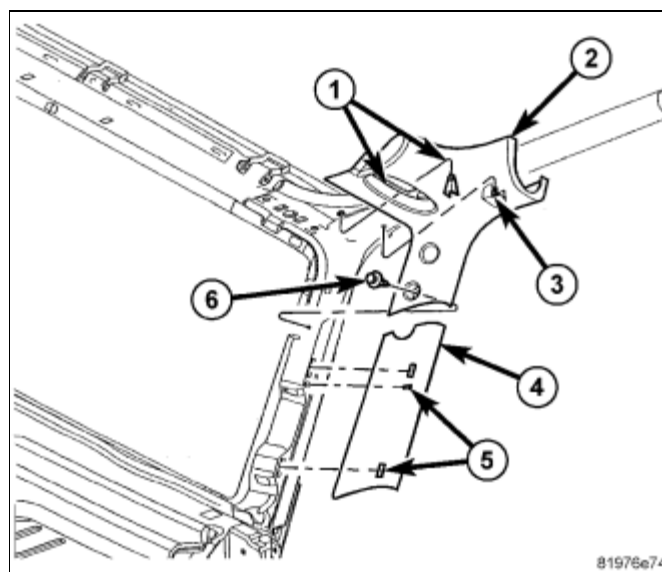
REMOVAL

1. Remove the sun visor (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).

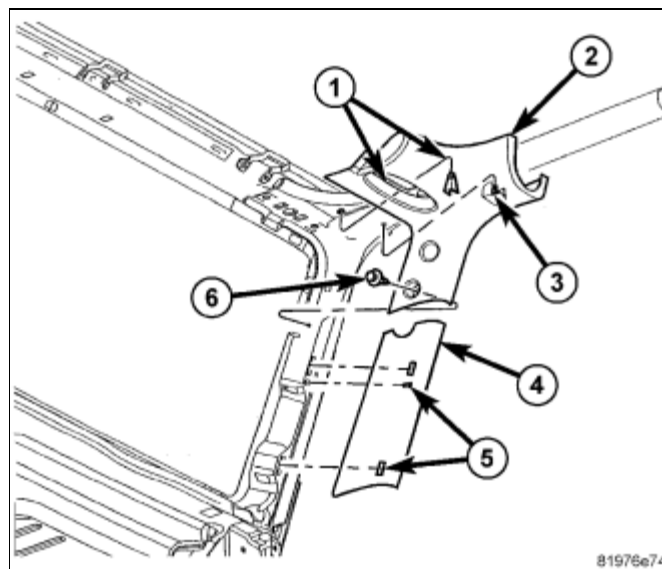


2. Remove the push pin fastener (6).
3. Using a trim stick C-4755 or equivalent, separate the retaining clips (3) and remove the upper A-pillar trim (2).
4. Using a trim stick C-4755 or equivalent, separate the retaining clips (5) and remove the lower A-pillar trim (4).

INSTALLATION



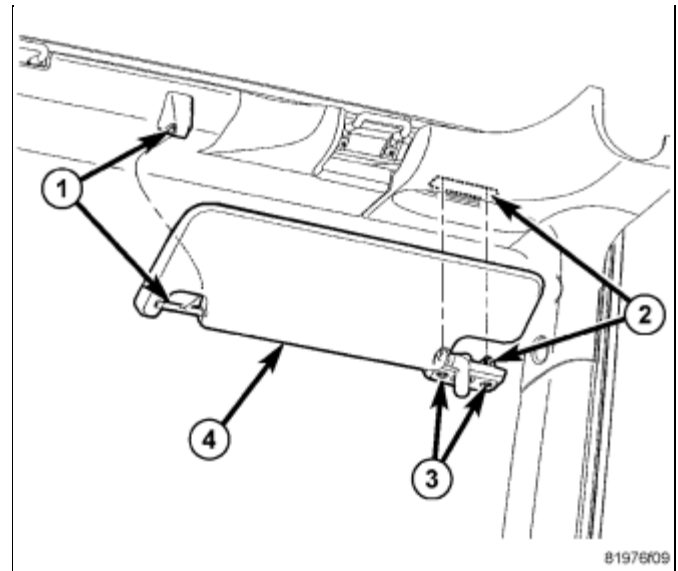
1. Position the lower A-pillar trim (4) onto the A-pillar and seat the clips (5) fully.
2. Position the upper A-pillar trim (2) onto the A-pillar and seat the clips (3) fully.
3. Install the push pin fastener (6).



4. Install the visor (4), (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).

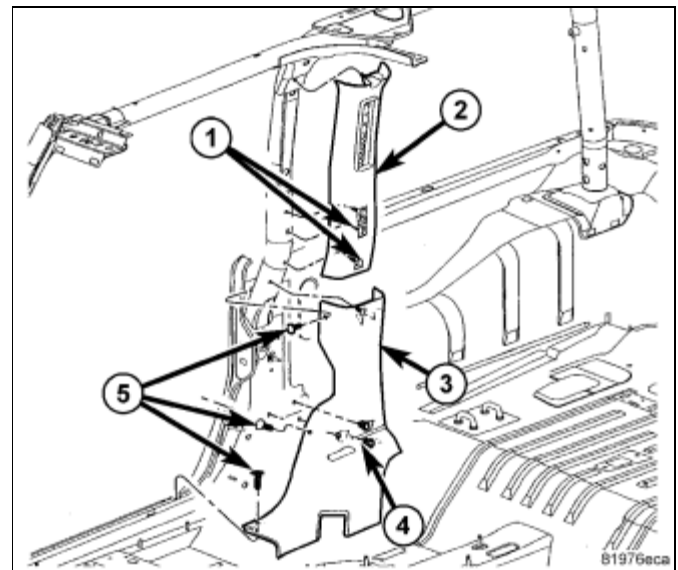
B-PILLAR TRIM

REMOVAL



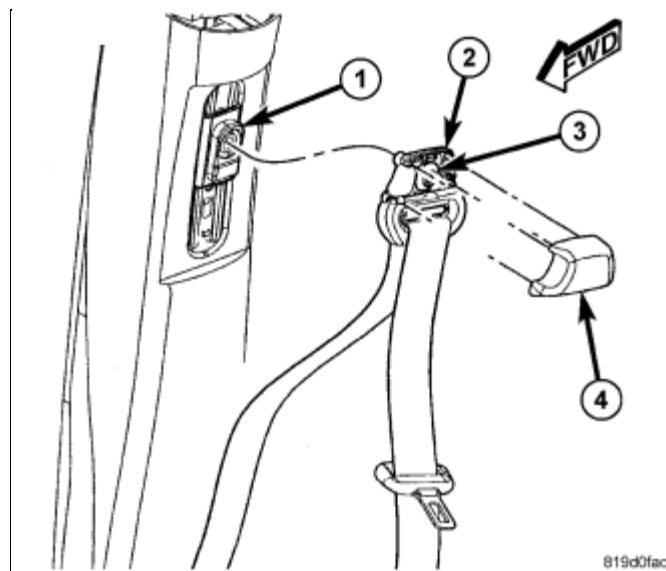
Two Door

1. Using a trim stick C-4755 or equivalent, separate the retaining clips (1) and remove the upper trim (2).
2. Remove the push pin fasteners (5).
3. Separate the retaining clips (4) and remove the lower B-pillar trim.

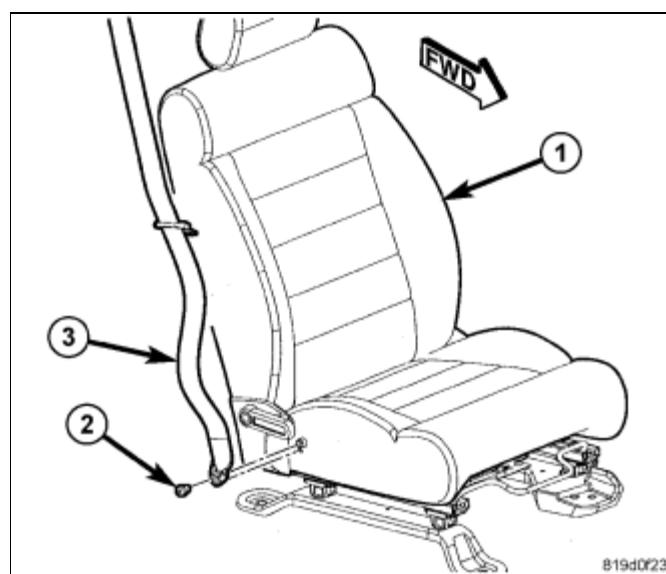


Four Door

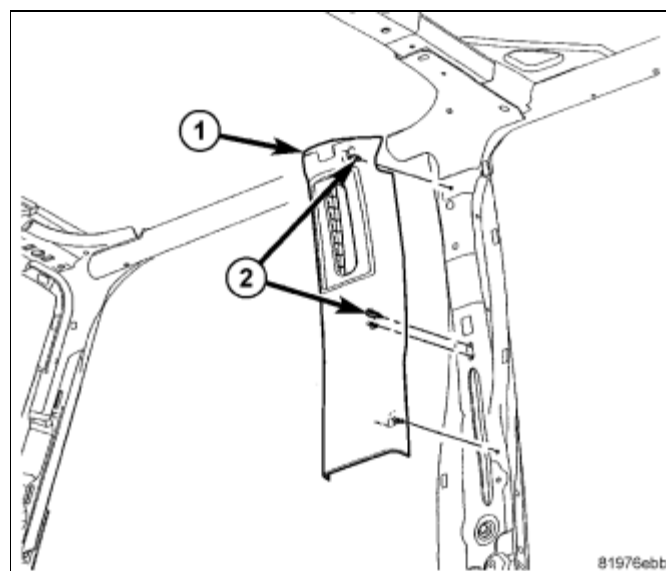
1. Remove the seat belt turning loop (2), (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT TURNING LOOP ADJUSTER - REMOVAL).



2. Remove the bolt (2) and disconnect the seat belt (3) from the seat (1).

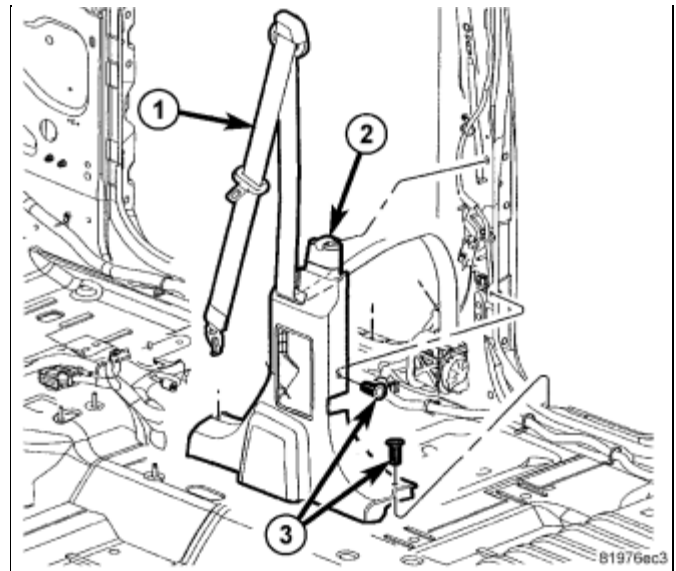


3. Using a trim stick C-4755 or equivalent, separate the retaining clips (2) and remove the upper B-pillar trim panel (1).



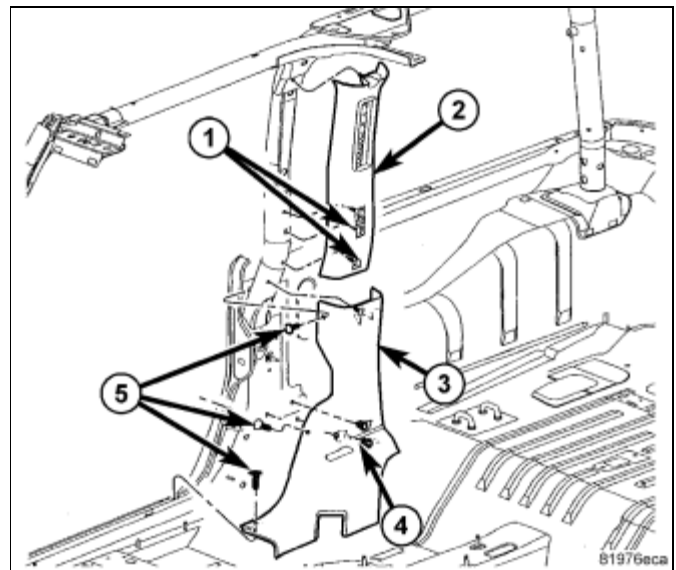
4. Remove the push pin fasteners (3) and separate the lower B-pillar trim panel (2).
5. Pull the seat belt (1) through the slot in the trim (2) and remove the trim.

INSTALLATION



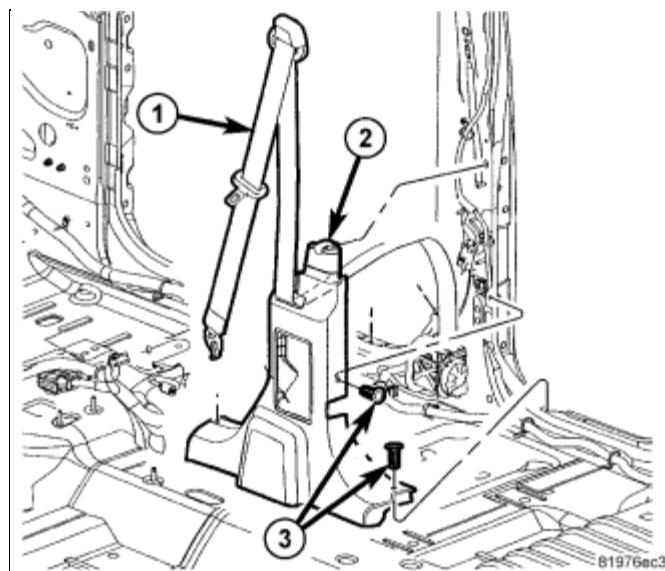
Two Door

1. Install the lower B-pillar trim (3) and seat the clips (4) fully.
2. Install the push pin fasteners (5).
3. Install the upper B-pillar trim (2) and seat the clips (1) fully.

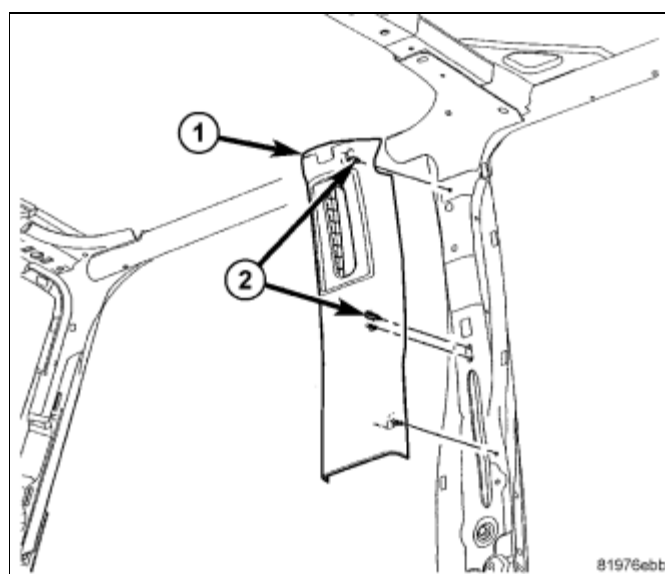


Four Door

1. Pull the seat belt (1) through the lower B-pillar trim (2) and position into place.
2. Seat the clips fully and install the push pin fasteners (3).



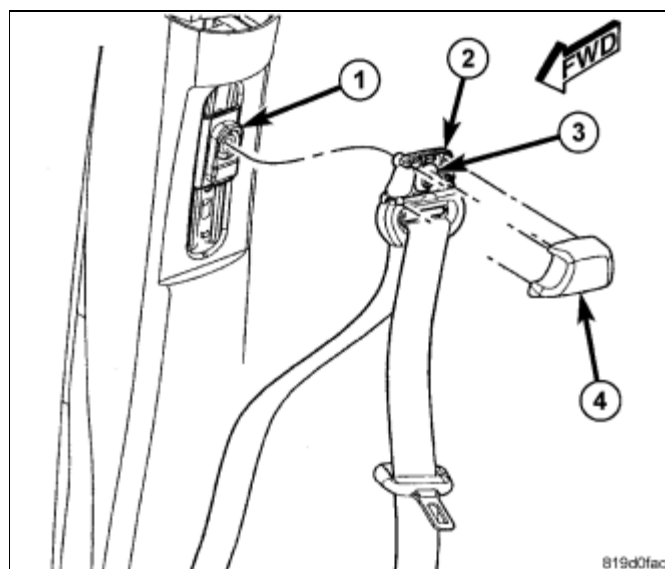
3. Position the upper B-pillar trim (1) into place and seat the clips (2) fully.



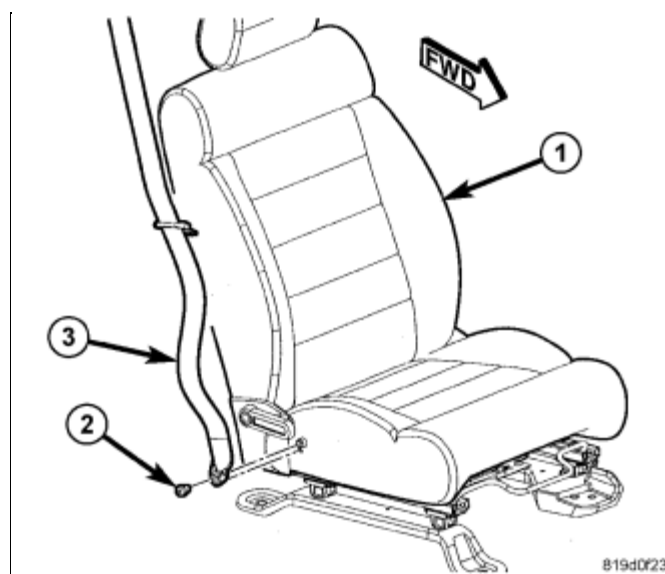
4. Position the seat belt turning loop (2) onto the height adjuster (1) on the upper sport bar. Be certain that the seat belt webbing between the retractor and the turning loop is not twisted.

5. Install and tighten the screw (3) that secures the turning loop to the height adjuster. Tighten the screw to 40 N·m (30 ft. lbs.).

6. Engage the upper edge of a new trim cover (4) over the top of the turning loop. Then squeeze the lower end of the trim cover and the turning loop together firmly and evenly until the engagement tabs of the trim cover snap into the slots of the turning loop.

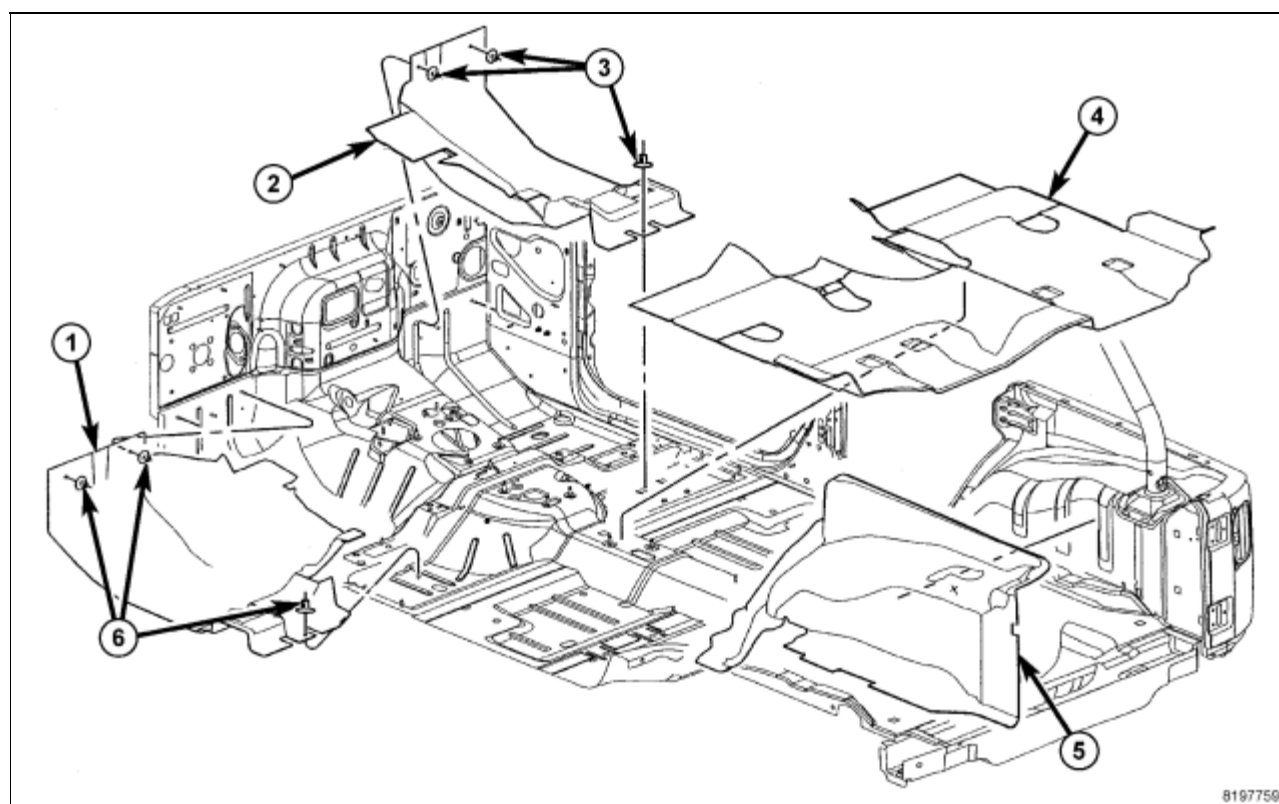


7. Position the seat belt (3) lower anchor to the mounting hole on the outboard side of the front seat (1) cushion frame. Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.
8. Install and tighten the screw (2) that secures the lower anchor to the seat. Tighten the screw to 40 N·m (30 ft. lbs.).



CARPETS AND FLOOR MATS

REMOVAL



Front Carpet

1. Remove the front seat for the side being worked on, (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
2. Remove the floor console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)
3. Remove cowl trim panel for the side being worked on, (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL)
4. Remove the lower B-pillar trim if required, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM -

REMOVAL).

5. Remove the stud caps (3) or (6) and remove the carpet (1) or (2) as necessary.

Rear Carpet

1. Remove the rear seats, (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)

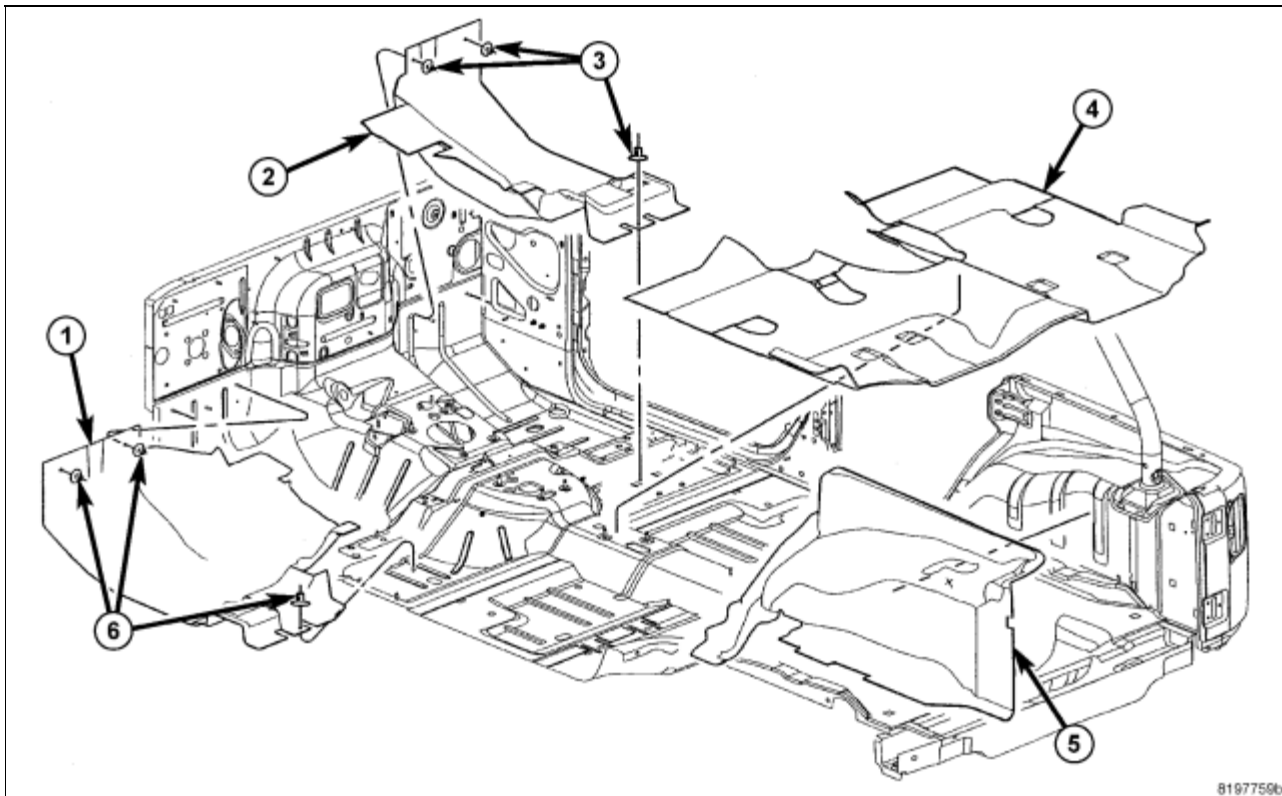
1. Remove the rear speaker if necessary, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).

2. Remove the wheelhouse carpets (5), if necessary.

3. Remove the load floor carpet if necessary, (Refer to 23 - BODY/INTERIOR/LOAD FLOOR CARPET - REMOVAL).

4. Remove the rear carpet (4).

INSTALLATION



Front Carpet

1. Install the carpet (1) or (2) and install the stud caps (6) or (3).

2. Install the lower B-pillar trim, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

3. Install the cowl trim panel, (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION).

4. Install the floor console, (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

5. Install the front seats, (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION).

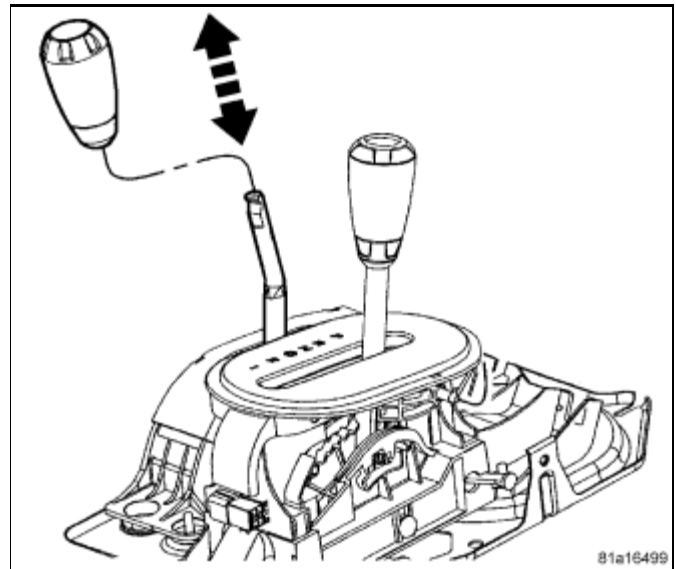
Rear Carpet

1. Install the rear carpet (4).
2. Install the wheelhouse carpets (5).
3. Install the load floor carpet, (Refer to 23 - BODY/INTERIOR/LOAD FLOOR CARPET - INSTALLATION).
4. Install the rear speaker, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).
5. Install the rear seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).

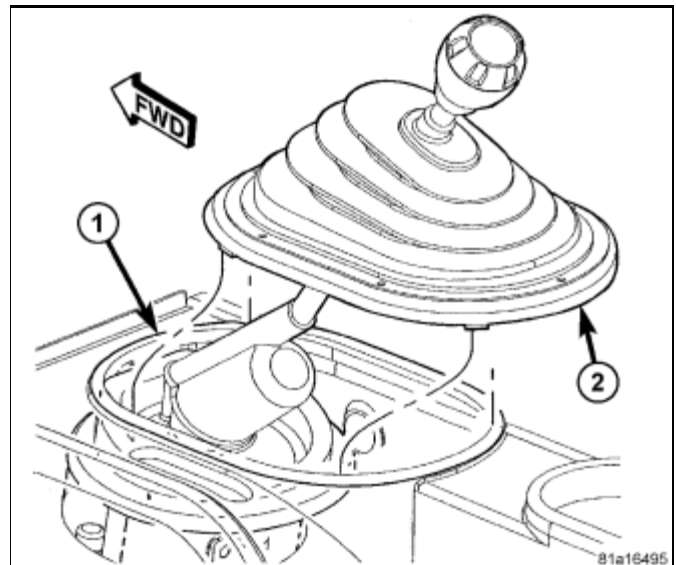
CONSOLE - CENTER

REMOVAL

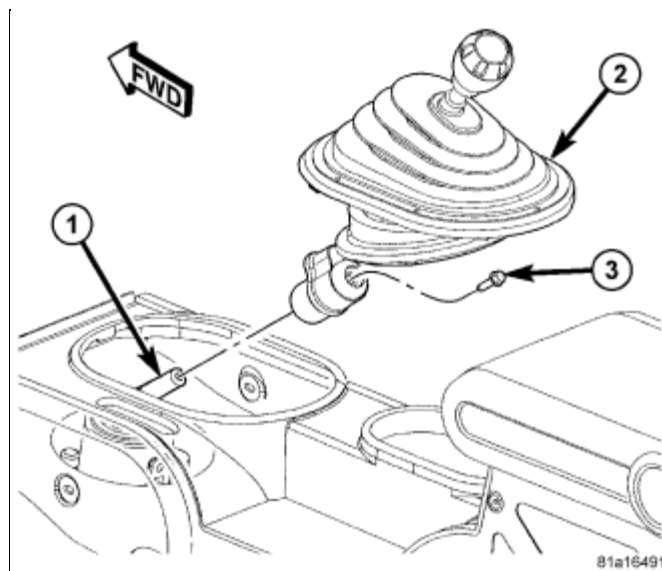
1. On 4x4 vehicles grasp the transfer case shifter knob and pull straight up and remove the knob.



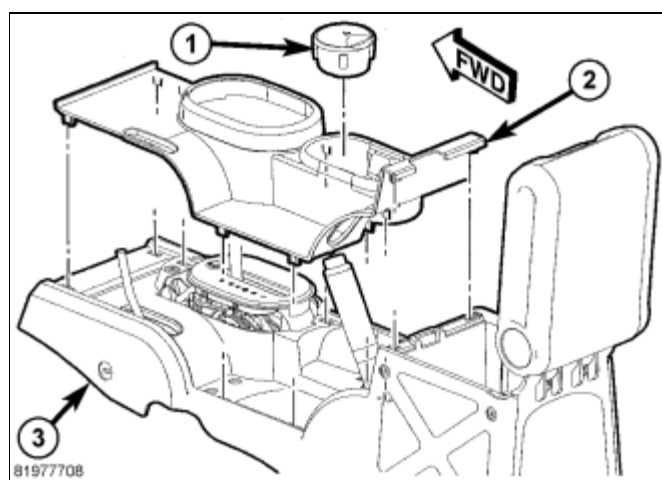
2. On manual transmission vehicles, using a trim stick C-4755 or equivalent, separate the shifter boot (2) from the console bezel (1).



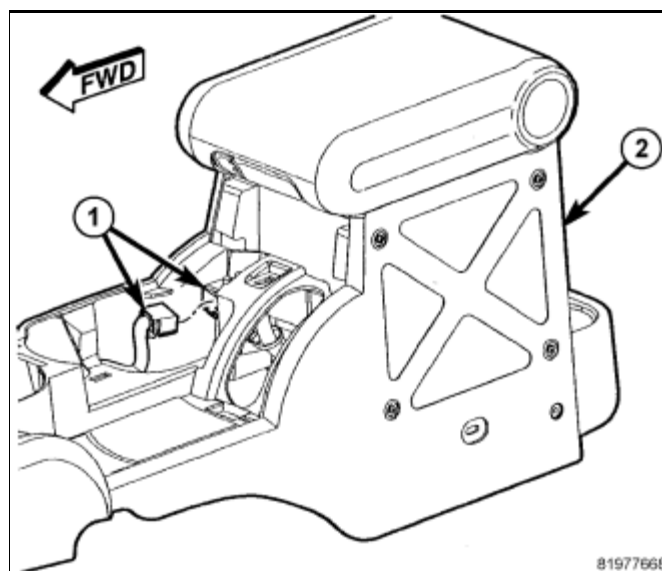
3. Remove the bolt (3) and remove the manual transmission shifter (2) from the shifter shaft (1).

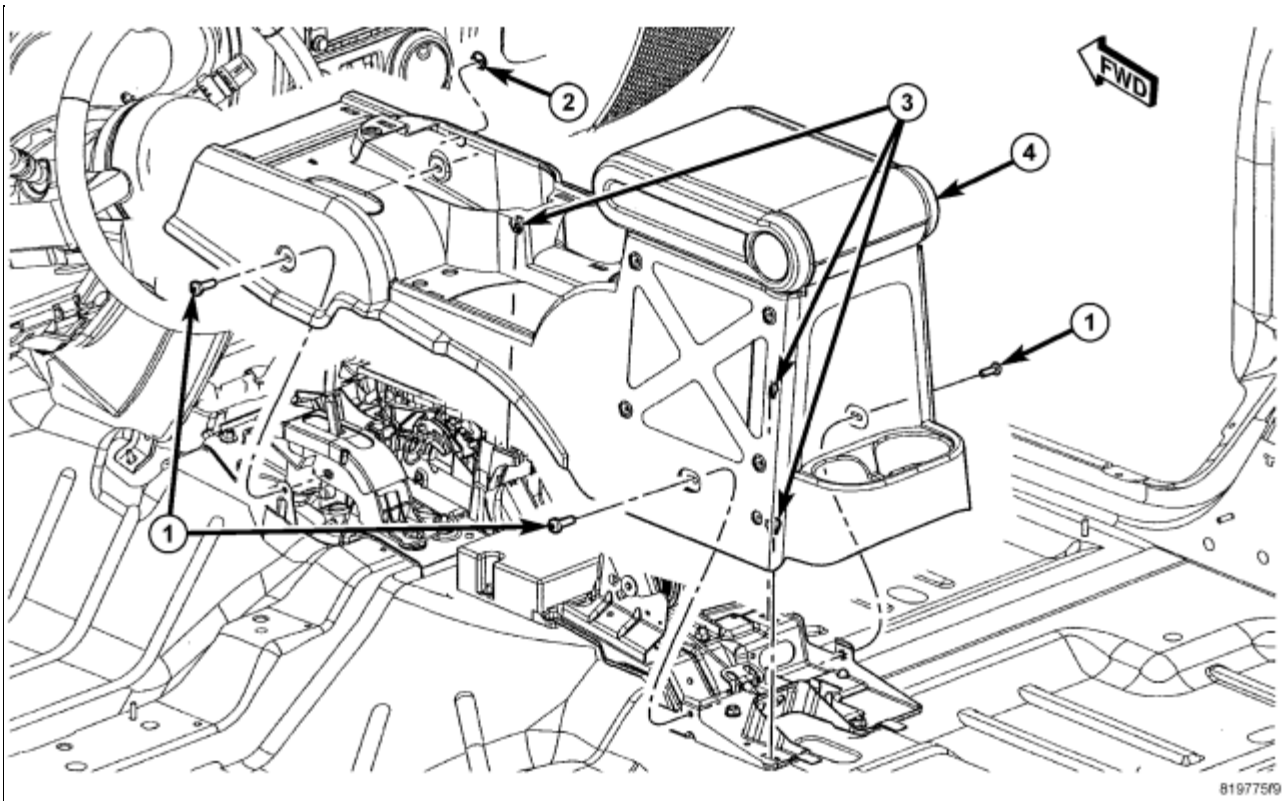


4. Remove the cup holder or ash receiver (1), if equipped.
5. Using a trim stick C-4755 or equivalent, remove the console bezel (2).



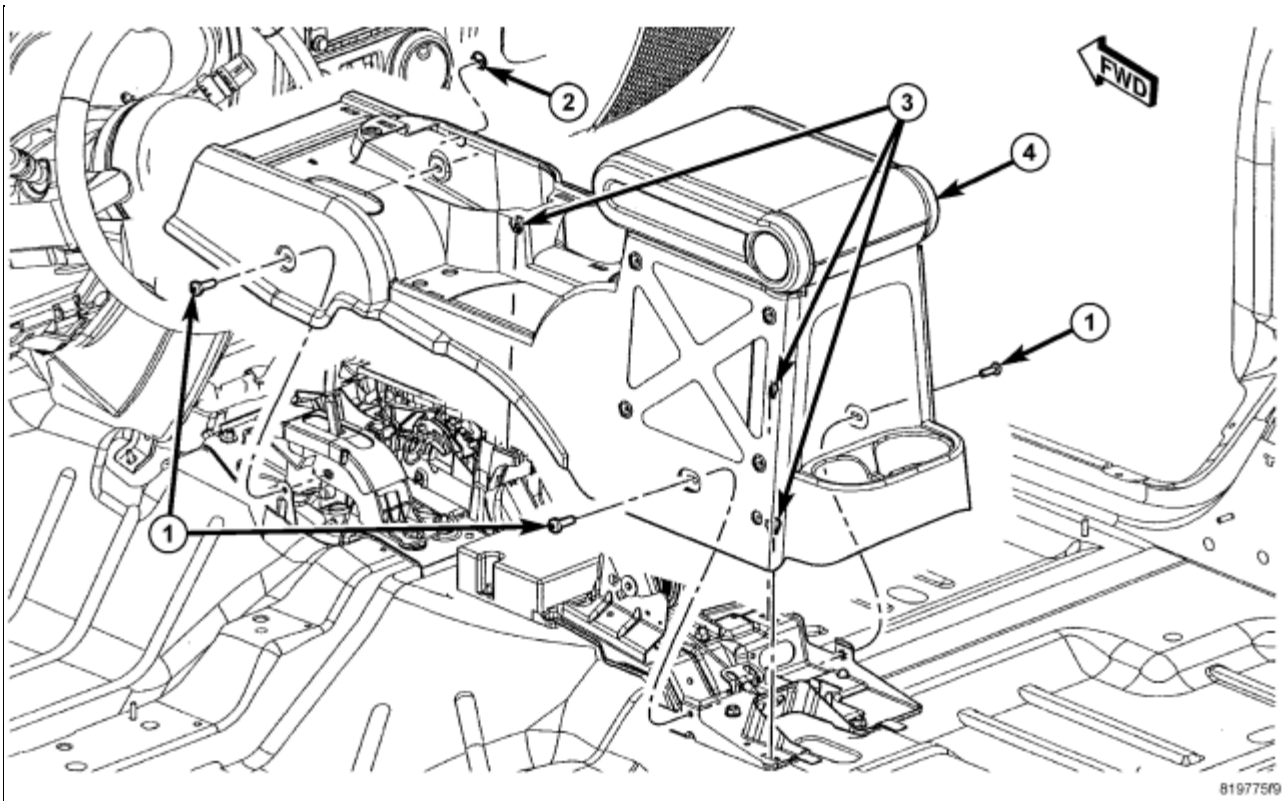
6. Disconnect the electrical connector (1).



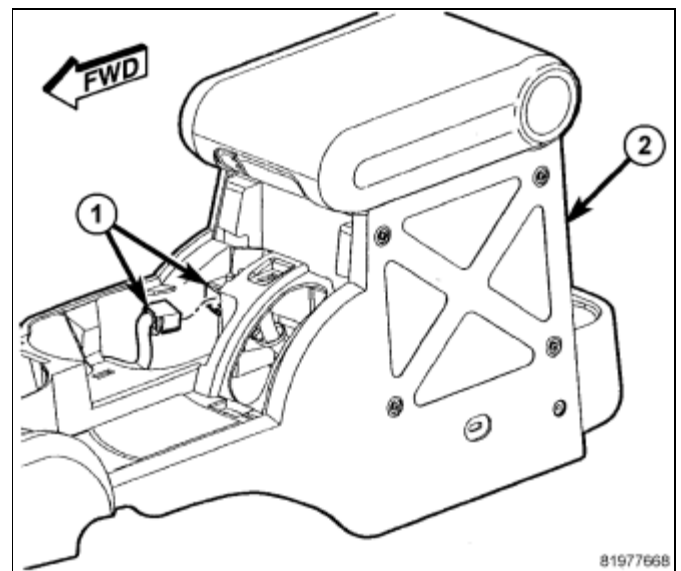


7. Remove the four console screws (1).
8. Lift the console (4) up off the clip retainers (3) and remove.

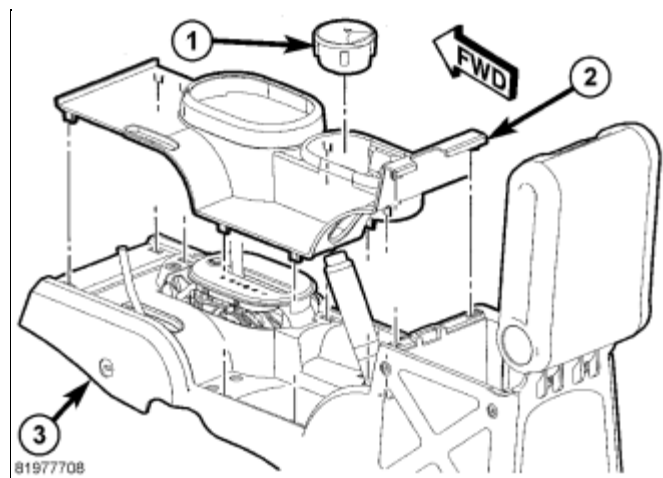
INSTALLATION



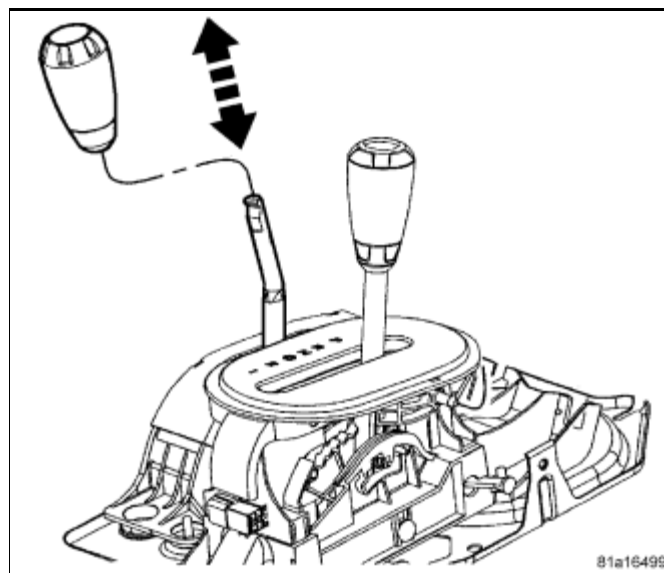
1. Position the console (4) over the shifters and brake levers and seat the clips (3) fully.
2. Install the four screws (1).
3. Connect the electrical connector (1).



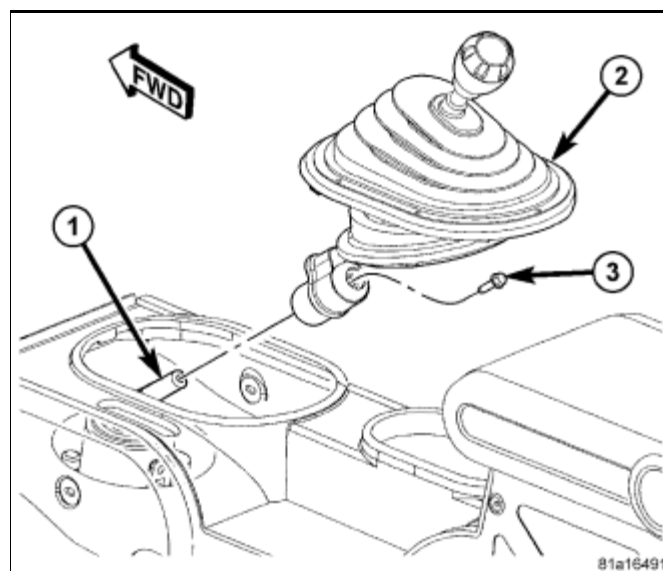
4. Position the bezel (2) over the shifters and brake lever and seat the clips fully.
5. Install the cup holder and ash receiver (1), if equipped.



6. If equipped, position the transfer case shifter knob onto the shift shaft and seat fully.



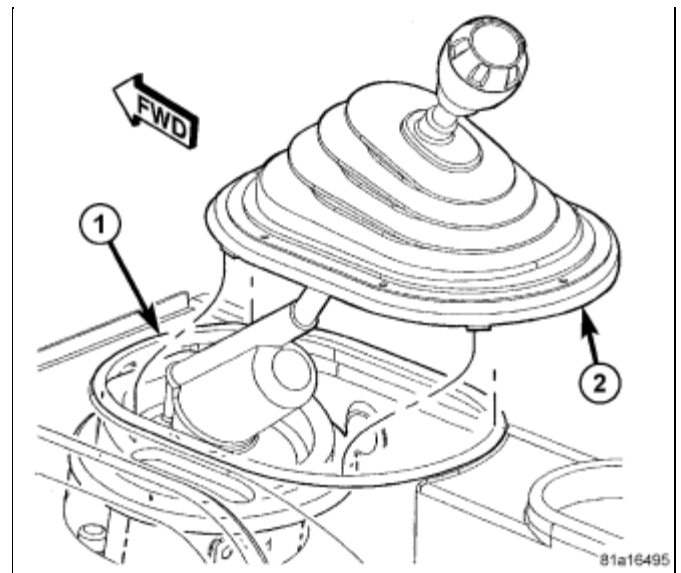
7. If equipped, position the manual transmission shifter handle (2) onto the shift shaft (1) and install the bolt (3).
8. Tighten the bolt (3) to 33 N·m (24.5 ft. lbs.)



9. Seat the shifter boot (2) onto the console bezel (1) and seat fully.

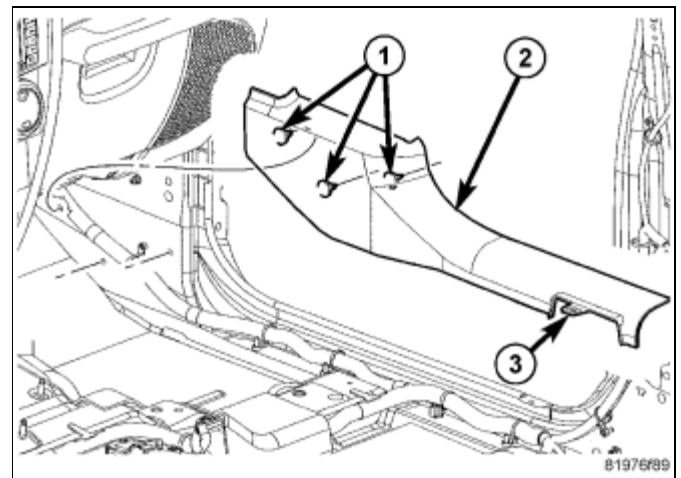
COWL TRIM COVER

REMOVAL



1. Position aside the lower B-pillar trim as necessary to gain access to the cowl trim, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).
2. Remove the push pin fastener (3) and separate the retaining clips (1).
3. Remove the cowl trim (2).

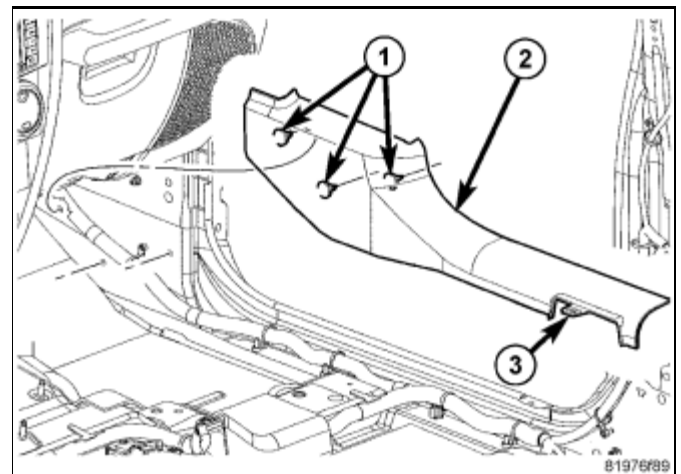
INSTALLATION



1. Position the trim (2) into place and seat the push pin fasteners (1) fully.
2. Install the push pin fastener (3).
3. Position the lower B-pillar trim back into place, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

LOAD FLOOR

REMOVAL



1. Open the load floor cover (1) and pull rearward and remove from the floor slots.
2. Remove the rear seats, (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)

3. Remove the rear speaker if necessary, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).
4. Remove the load floor carpet (2).

INSTALLATION

1. Install the load floor carpet (2).
2. Install the rear speaker, (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).
3. Install the rear seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).
4. Position the cover (1) tabs into the floor slots fully and close the cover.

MIRROR - INSIDE REAR VIEW

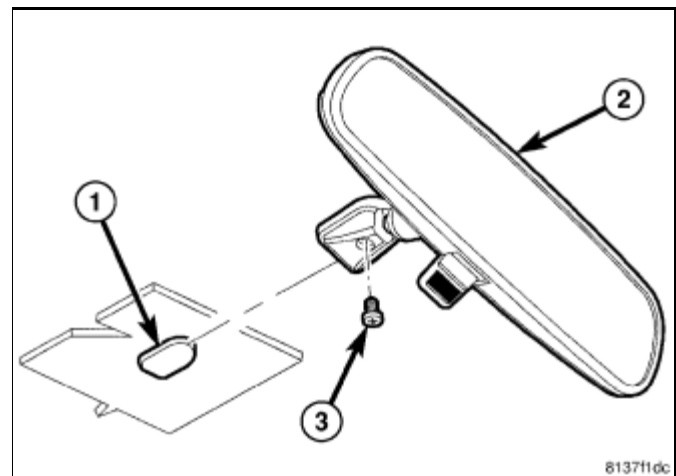
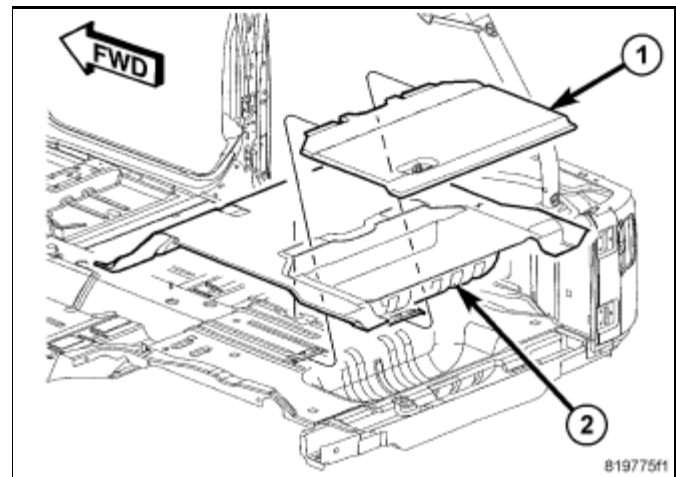
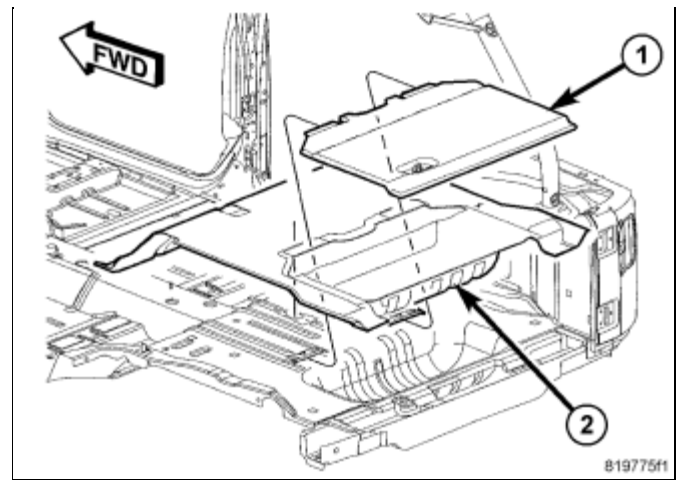
REMOVAL

1. Remove the set screw (3) that secures the rear view mirror (2) to the support bracket/button (1) on the inside of the windshield glass.
2. Slide the rear view mirror upward far enough to disengage it from the support bracket/button.

INSTALLATION

MIRROR

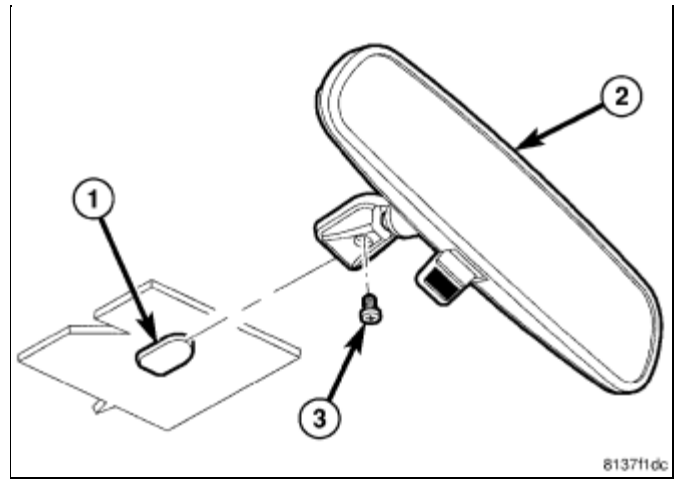
1. Position and slide the rear view mirror (2) downward over the support bracket/button (1) on the inside of the windshield glass.
2. Install and tighten the set screw (3) that secures the rear view mirror to the support bracket/button. Tighten the screw



to 2 N·m (17 in. lbs.).

SUPPORT BRACKET

NOTE: The rear view mirror support bracket (or button) is permanently bonded to the inside of the windshield glass. If the bracket should become separated from the glass, it may be re-bonded using the following procedure. This procedure requires the use of a Rear View Mirror Adhesive kit that is available through Mopar® in single application packages that include a two-part adhesive and an accelerant with applicator.



1. Mark the proper position for the mirror bracket on the outside of the windshield glass with a wax pencil. The residual adhesive on the inside of the glass from the prior mirror bracket installation can be used as a guide.
2. Clean the bracket contact area on the inside of the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.
3. Sand the bonding surface (the smaller side) of the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.
4. Apply accelerant to the bonding surface of the bracket according to the following instructions:
 - Crush the accelerant vial to saturate the felt applicator.
 - Remove the paper sleeve.
 - Apply accelerant to the bonding surface of the bracket.
 - Allow the accelerant to dry for five minutes.
 - Do not touch the bracket bonding surface after the accelerant has been applied.
5. Apply adhesive accelerant to the bracket contact area on the inside of the windshield glass. Allow the accelerant to dry for one minute. Do not touch the bracket contact area of the glass after the accelerant has been applied.
6. Install the bracket according to the following instructions:
 - Apply one drop of adhesive at the center of the bracket contact area on the inside of the windshield glass.
 - Apply an even coat of adhesive to the bonding surface of the bracket.
 - Align the bracket with the marked position on the windshield glass.
 - Press and hold the bracket in place for at least one minute.

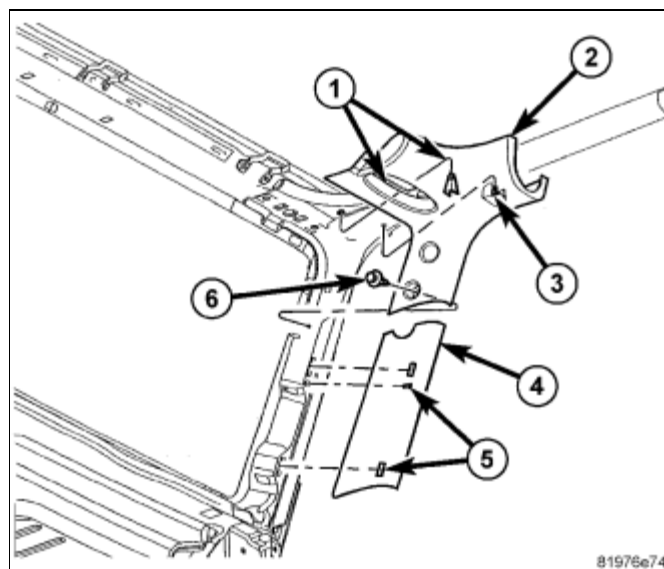
NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

7. Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.
8. Allow the adhesive to cure for an additional 8-10 minutes before reinstalling the mirror.

MOLDING - WINDSHIELD

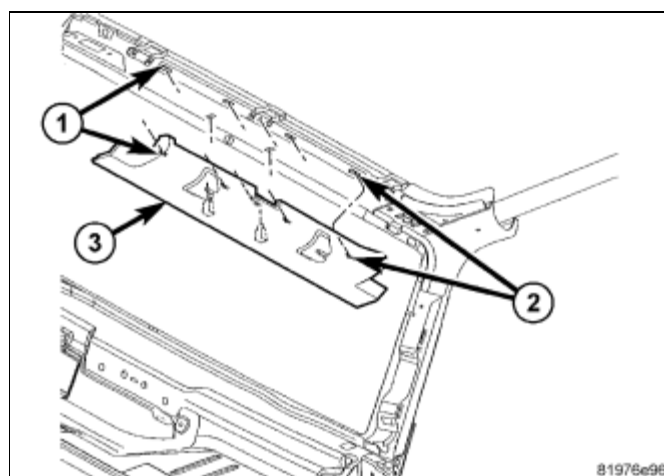
REMOVAL

1. Remove the upper A-pillar trim (2), (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

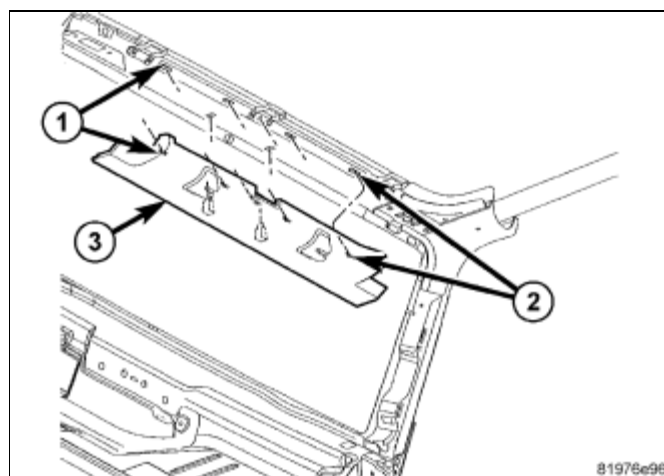


2. Using a trim stick C-4755 or equivalent, separate the retaining clips (1) and (2) and remove the windshield molding (3).

INSTALLATION



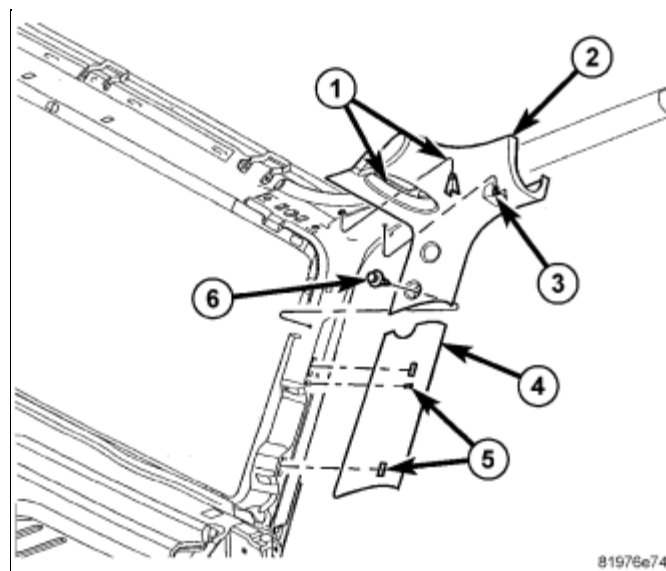
1. Position the windshield molding (3) onto the windshield header and seat the clips (1) and (2) fully.



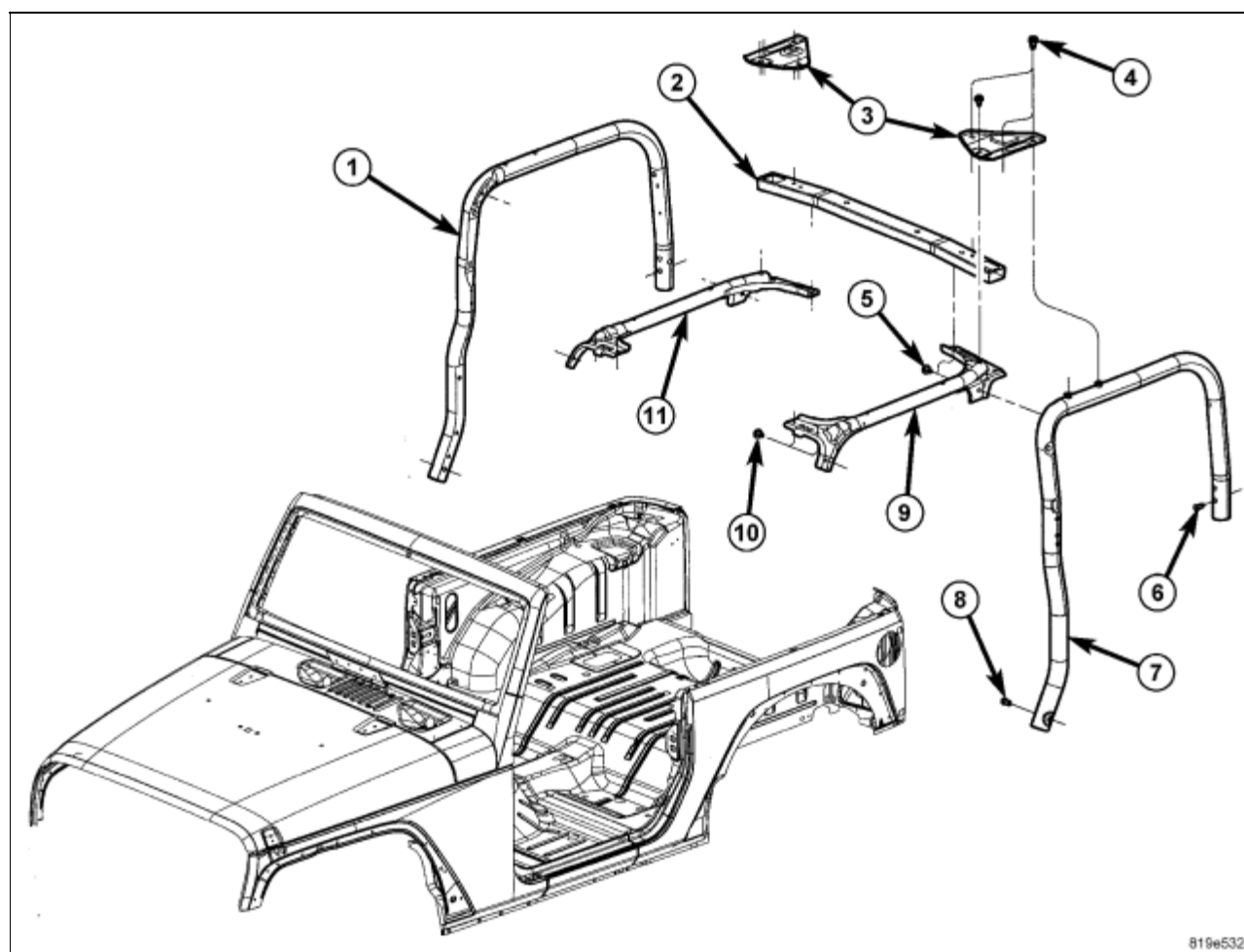
2. Install the upper A-pillar trim (2), (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)

SPORT BAR

DESCRIPTION



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819e5321

2 DOOR EXPLODED VIEW

1 - RIGHT SIDE SPORT BAR

2 - CROSS BAR

3 - UPPER CROSS BAR BRACKETS

4 - CROSS BAR BRACKET BOLTS 19 N·m (14 ft. lbs.)

5 - SIDE BAR TO SPORT BAR BOLTS 19 N·m (14 ft. lbs.)

6 - REAR SPORT BAR BOLTS 19 N·m (14 ft. lbs.)

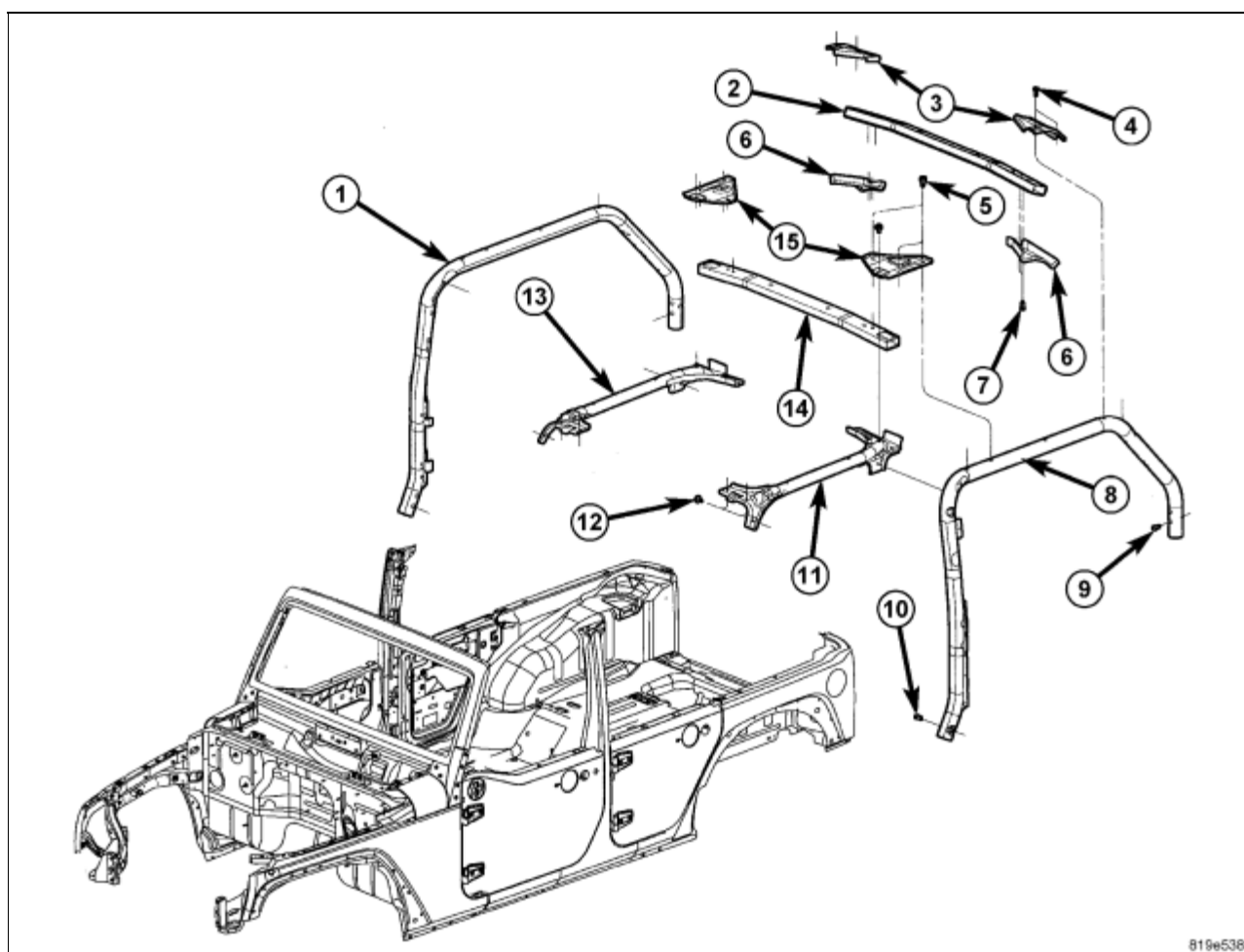
7 - LEFT SPORT BAR

8 - SPORT BAR TO B-PILLAR BOLTS 19 N·m (14 ft. lbs.)

9 - LEFT SIDE BAR

10 - SIDE BAR TO WINDSHIELD FRAME BOLTS 23 N·m (17 ft. lbs.)

11 - RIGHT SIDE BAR

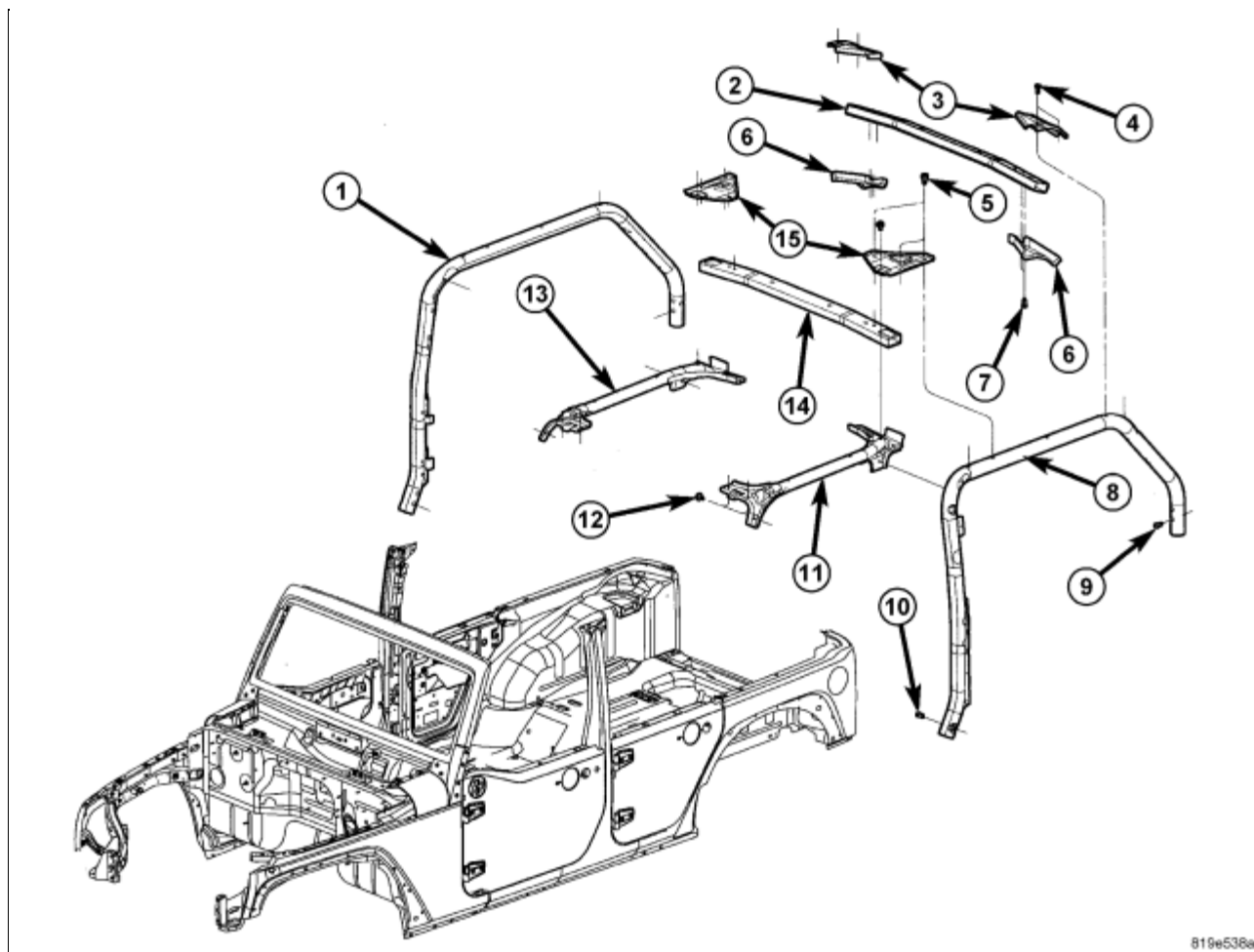


819e538a

4 DOOR EXPLODED VIEW

1 - RIGHT SIDE SPORT BAR
2 - REAR CROSS BAR
3 - REAR CROSS BAR BRACKETS
4 - REAR CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
5 - FRONT CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
6 - REAR CROSS BAR LOWER BRACKETS
7 - REAR CROSS BAR LOWER BRACKET BOLTS 19 N·m (14 ft. lbs.)
8 - LEFT SIDE SPORT BAR
9 - REAR SPORT BAR BOLTS 19 N·m (14 ft. lbs.)
10 - SPORT BAR B-PILLAR BOLTS 19 N·m (14 ft. lbs.)
11 - LEFT SIDE SPORT BAR
12 - SIDE BAR TO WINDSHIELD FRAME BOLTS 23 N·m (17 ft. lbs.)
13 - RIGHT SIDE BAR
14 - FRONT CROSS BAR
15 - FRONT CROSS BAR BRACKETS

REMOVAL



819e538a

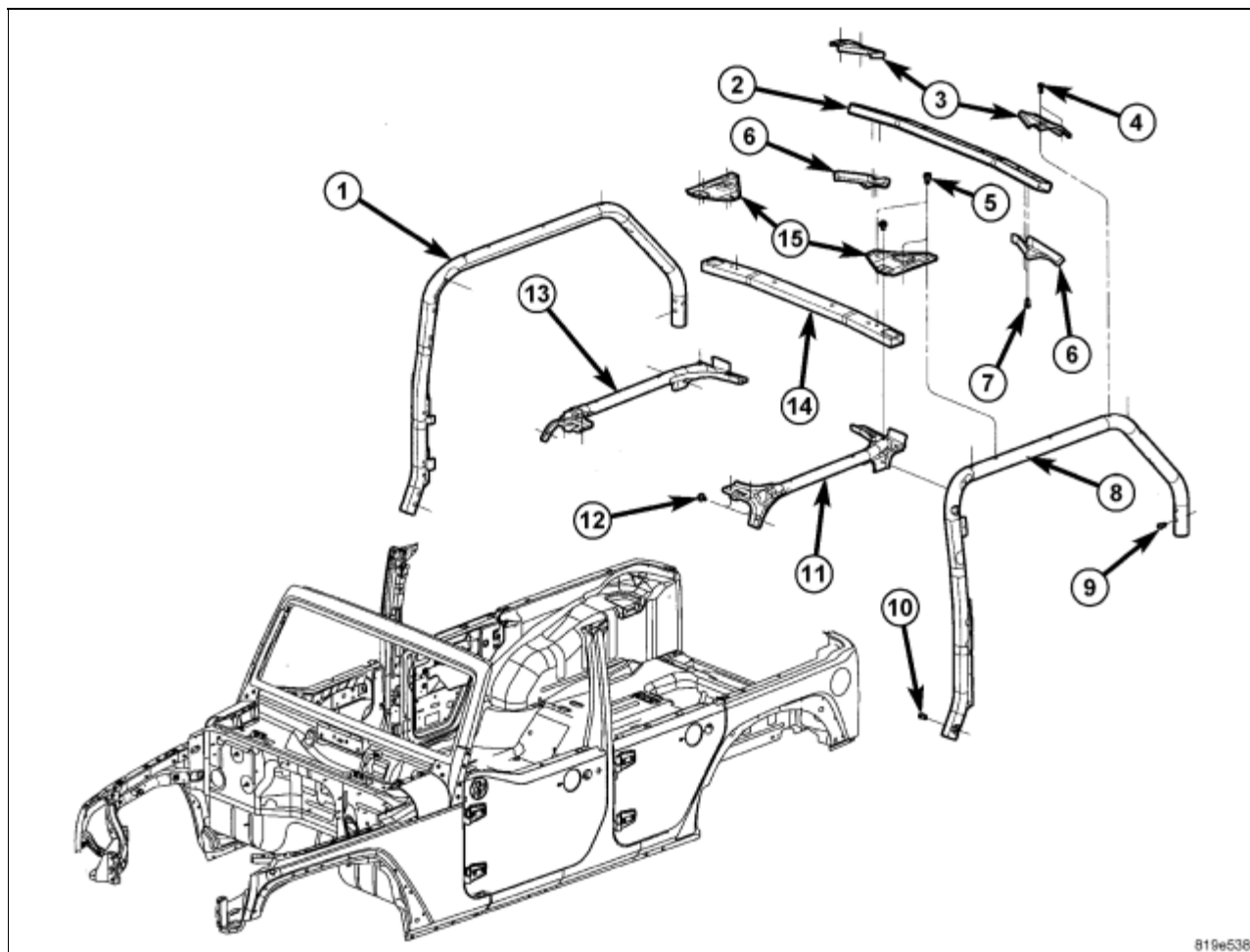
4 DOOR EXPLODED VIEW

1 - RIGHT SIDE SPORT BAR
2 - REAR CROSS BAR
3 - REAR CROSS BAR BRACKETS
4 - REAR CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
5 - FRONT CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
6 - REAR CROSS BAR LOWER BRACKETS
7 - REAR CROSS BAR LOWER BRACKET BOLTS 19 N·m (14 ft. lbs.)
8 - LEFT SIDE SPORT BAR
9 - REAR SPORT BAR BOLTS 19 N·m (14 ft. lbs.)
10 - SPORT BAR B-PILLAR BOLTS 19 N·m (14 ft. lbs.)

11 - LEFT SIDE SPORT BAR
12 - SIDE BAR TO WINDSHIELD FRAME BOLTS 23 N·m (17 ft. lbs.)
13 - RIGHT SIDE BAR
14 - FRONT CROSS BAR
15 - FRONT CROSS BAR BRACKETS

1. Remove the sport bar covers, (Refer to 23 - BODY/INTERIOR/SPORT BAR - COVERS - REMOVAL)
2. Remove the windshield frame bolts (12).
3. Remove the front cross bar bolts (5) and separate the cross bar (14) and brackets (15).
4. Remove the rear cross bar bolts (4) and (7) and separate the rear cross bar (2).
5. Remove the B-pillar trim, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).
6. Remove the B-pillar bolts (10)
7. Remove the rear bolts (9) and separate the side sports bars (1) and (8).

INSTALLATION



819e538a

4 DOOR EXPLODED VIEW

1 - RIGHT SIDE SPORT BAR
2 - REAR CROSS BAR
3 - REAR CROSS BAR BRACKETS
4 - REAR CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
5 - FRONT CROSS BAR BRACKETS BOLTS 19 N·m (14 ft. lbs.)
6 - REAR CROSS BAR LOWER BRACKETS
7 - REAR CROSS BAR LOWER BRACKET BOLTS 19 N·m (14 ft. lbs.)
8 - LEFT SIDE SPORT BAR
9 - REAR SPORT BAR BOLTS 19 N·m (14 ft. lbs.)
10 - SPORT BAR B-PILLAR BOLTS 19 N·m (14 ft. lbs.)
11 - LEFT SIDE SPORT BAR
12 - SIDE BAR TO WINDSHIELD FRAME BOLTS 23 N·m (17 ft. lbs.)
13 - RIGHT SIDE BAR
14 - FRONT CROSS BAR
15 - FRONT CROSS BAR BRACKETS

1. Install the sport bars (1) and (8) into the B-pillar and install the B-pillar (10) and rear bolts (9).
2. Install the rear cross bar (2), the brackets (3) and (6), and the bolts (4).
3. Install the side bars (11) and (13) and install the windshield frame bolts (12).
4. Install the front cross bar (14), the brackets (15) and the bolts (5).
5. Tighten the B-pillar (10) and rear bolts (9) to 19 N·m (14 ft. lbs.).
6. Tighten the cross bar bolts (4) and (5) to 19 N·m (14 ft. lbs.).
7. Tighten the windshield frame bolts to 19 N·m (14 ft. lbs.).
8. Install the sport bar covers, (Refer to 23 - BODY/INTERIOR/SPORT BAR - COVERS - INSTALLATION).
9. Install the B-pillar trim, (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

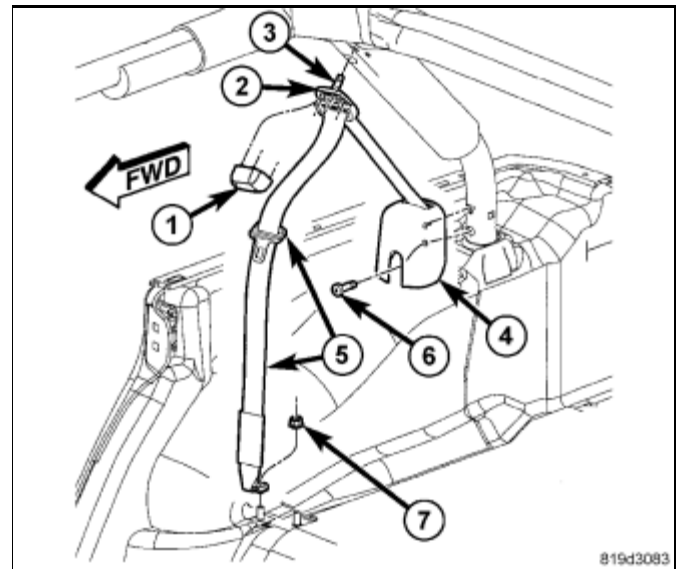
SPORT BAR - COVERS

REMOVAL

1. Remove the hard tops, if equipped, (Refer to 23 - BODY/REMOVABLE TOP/TOP - REMOVAL).
2. Remove the sport bar speaker pod, (Refer to 23 - BODY/INTERIOR/SPORT BAR - SPEAKER POD - REMOVAL).

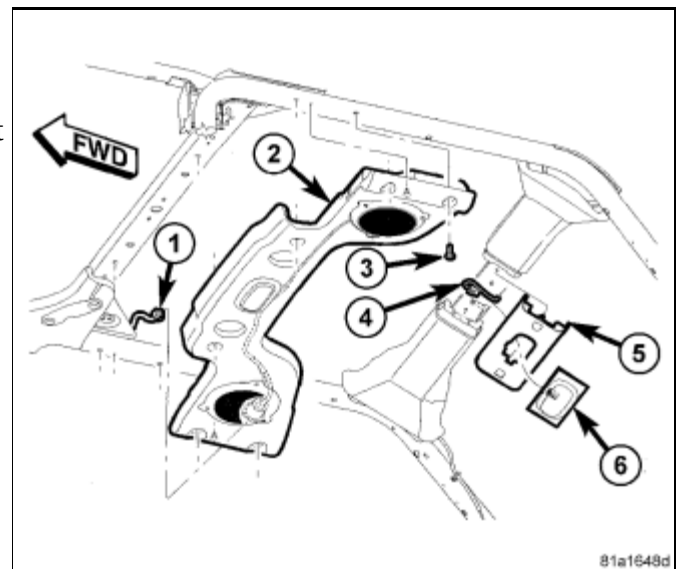
On four door vehicles;

3. Remove the seat belt retractor (4) and turning loop (2) as necessary, (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL).



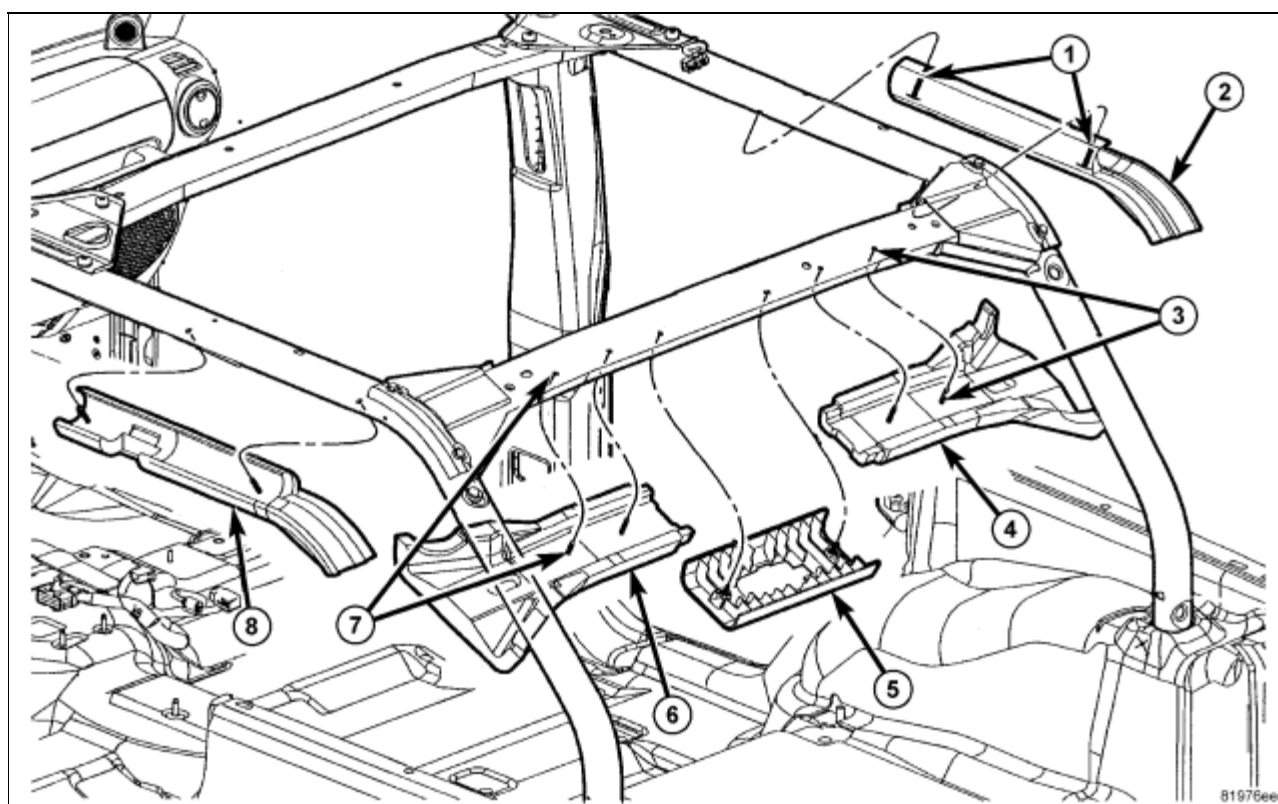
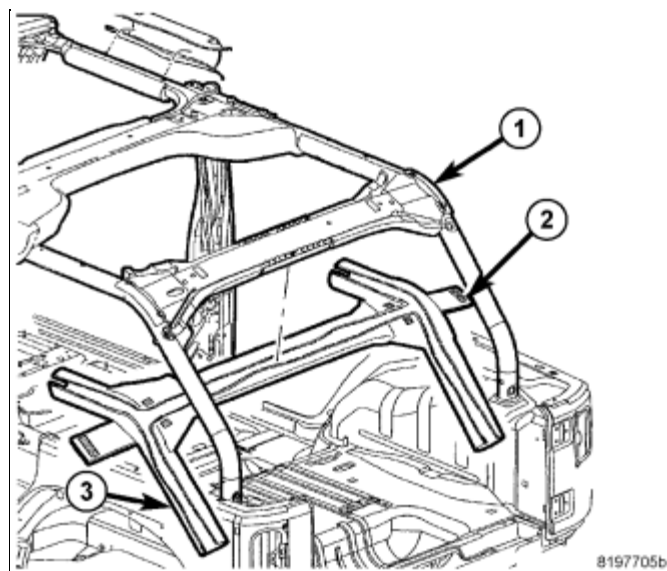
On four door vehicles;

4. If equipped, separate the rear dome light (6) from the sport bar cross bar and disconnect the electrical connector (4).



On four door vehicles;

5. Unzip the cover (2) and remove.

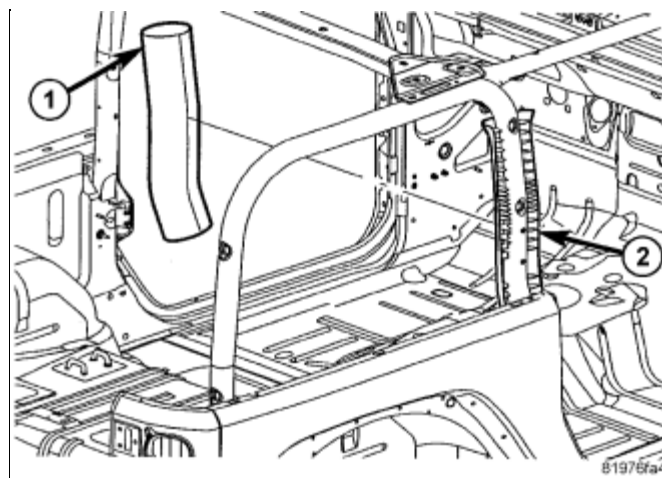


On four door vehicles;

6. Using a trim stick C-4829 or equivalent, separate the push pin fasteners and remove the interior lamp bezel (5).
7. Remove the cross bar trim (6) and (4).
8. Remove the side trim (2) and (8).

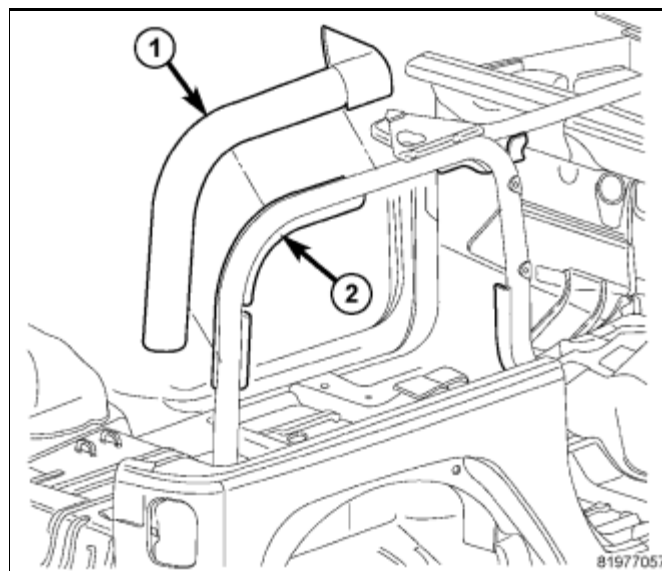
On two door vehicles;

9. Unzip the cover (1) and separate the trim (2).



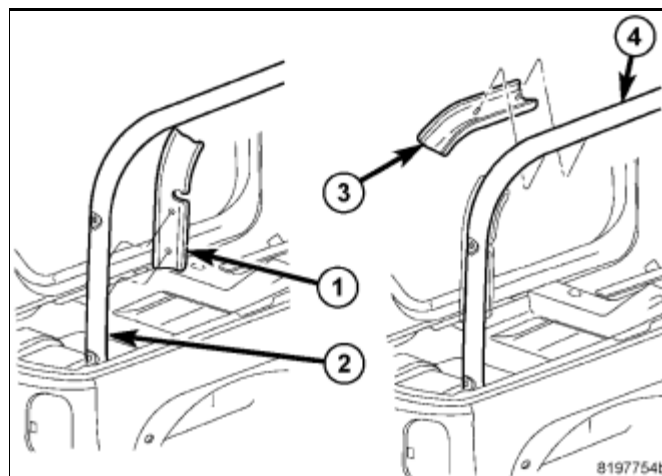
On two door vehicles;

10. Unzip the cover (1) and separate the trim (2).

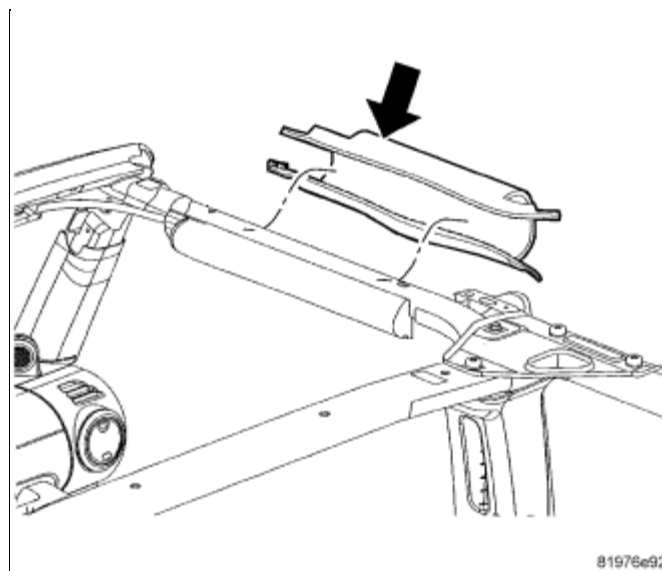


On two door vehicles;

11. Separate the trim (1) and (3).



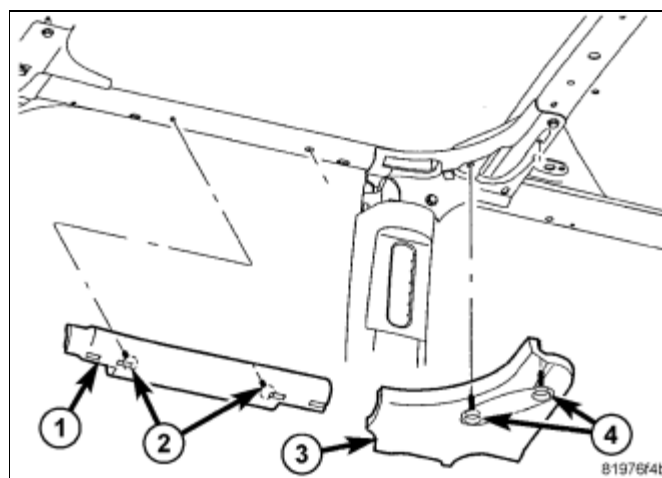
12. Unzip the side bar covers.



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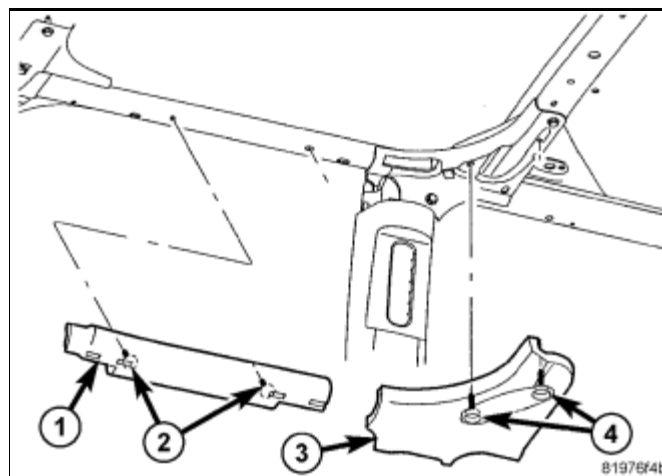
13. Using a trim stick C-4829 or equivalent, separate the push pin fasteners (2) and (4) and remove the trim (1) and (3).

INSTALLATION



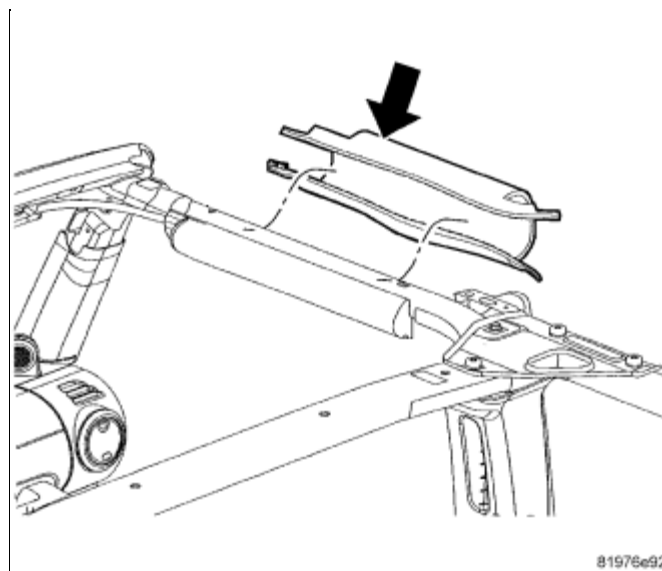
81976f4b

1. Position the trim (1) and (3) and seat fully.



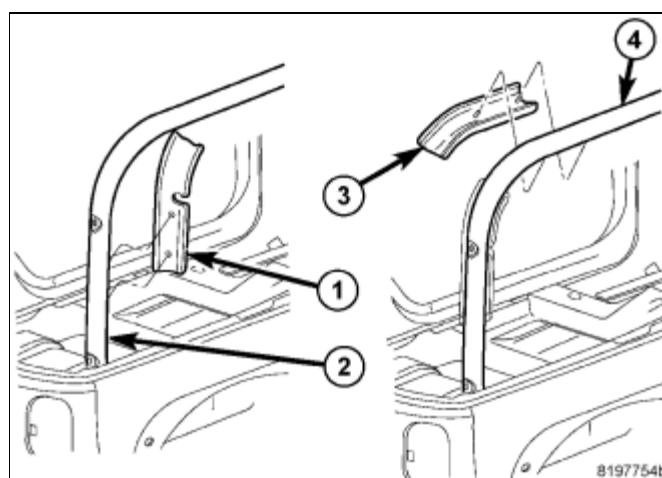
81976f4b

2. Position the side cover over the side bars and zip closed.



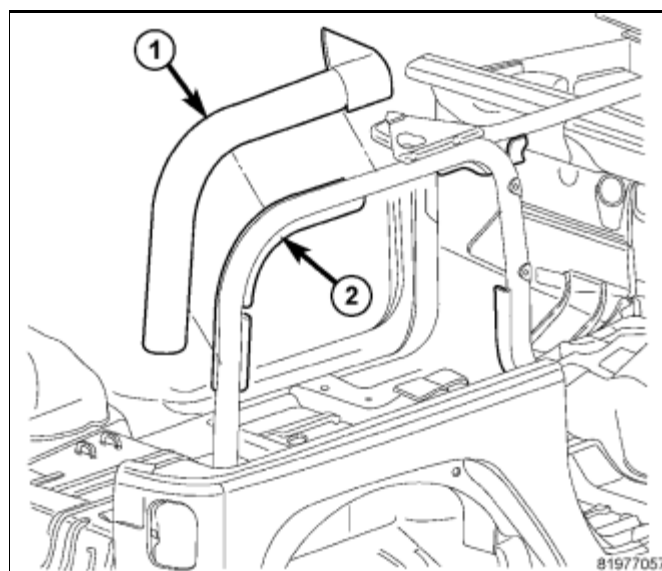
On two door vehicles;

3. Position the trim (1) and (3) onto the sport bars (4) and seat fully.



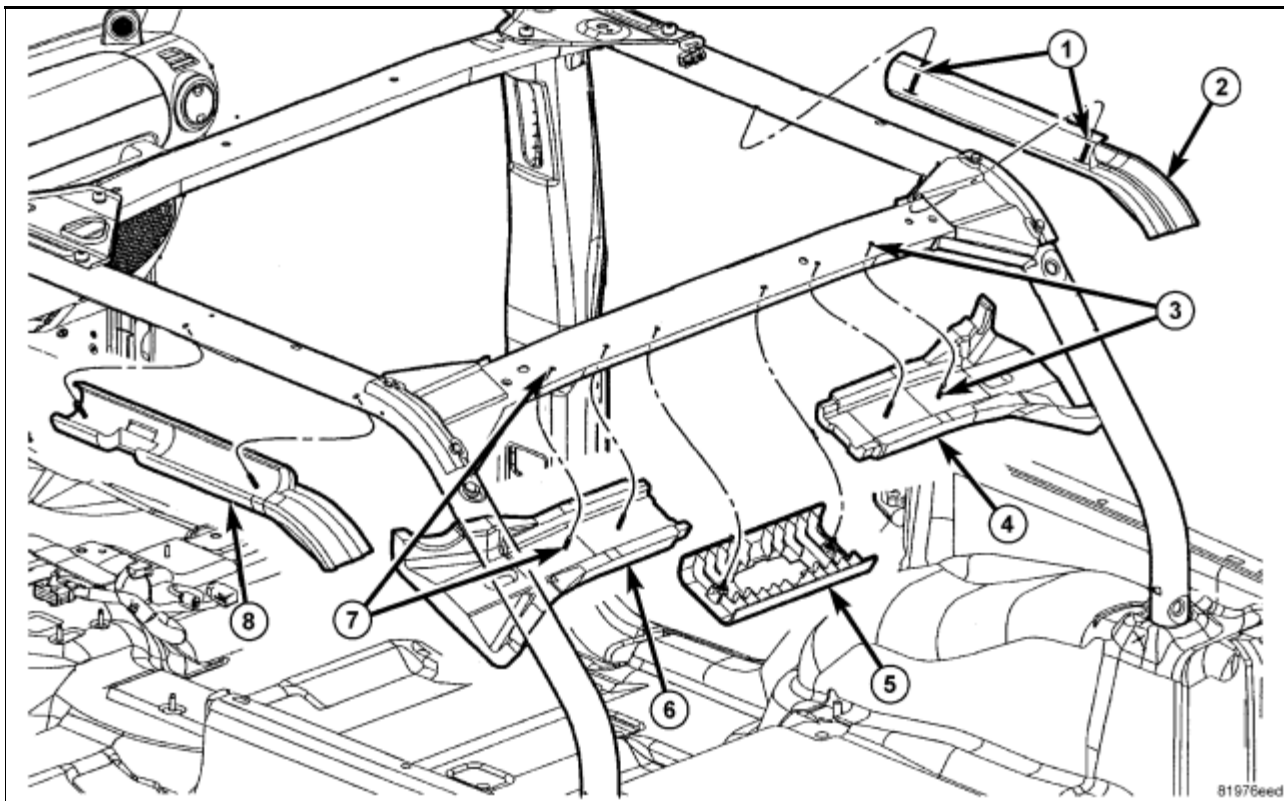
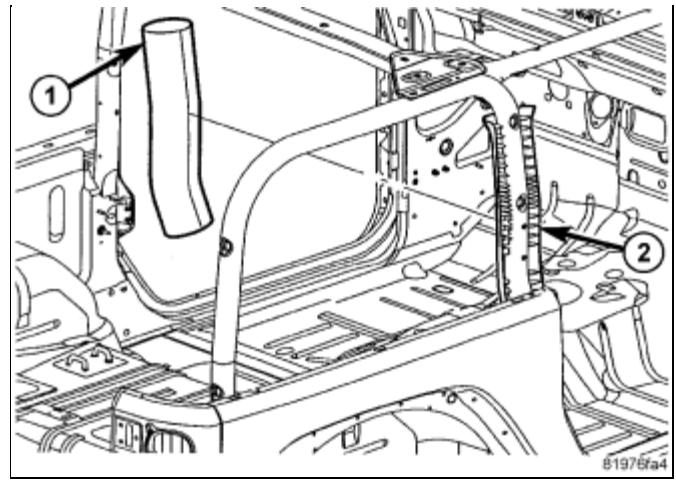
On two door vehicles;

4. Position the covers (1) onto the sport bar and zip closed.



On two door vehicles;

5. Position the trim (2) onto the sport bar.
6. Position the cover (1) onto the trim (2) and zip closed.

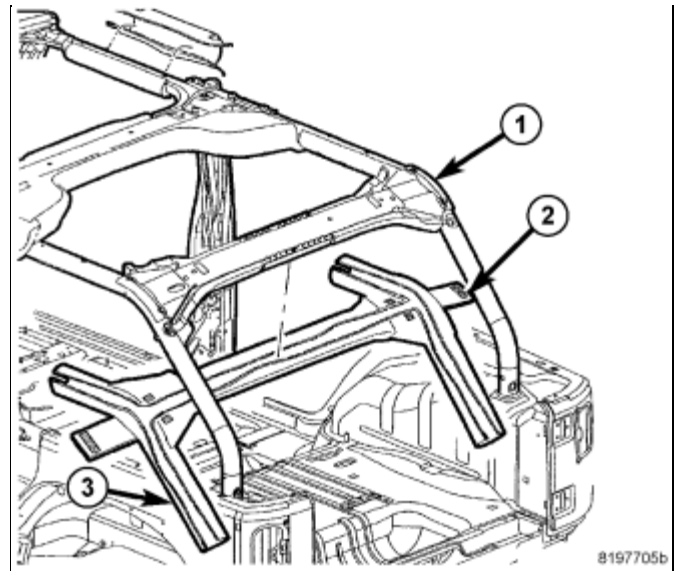


On four door vehicles;

7. Position the side trim (2) and (8) onto the sport bars and seat the push pin fasteners (1) fully.
8. Position the cross bar trim (4) and (6) onto the cross bar and seat the push pin fasteners (3) and (7) fully.
9. Position the interior lamp bezel (5) onto the cross bar and seat fully.

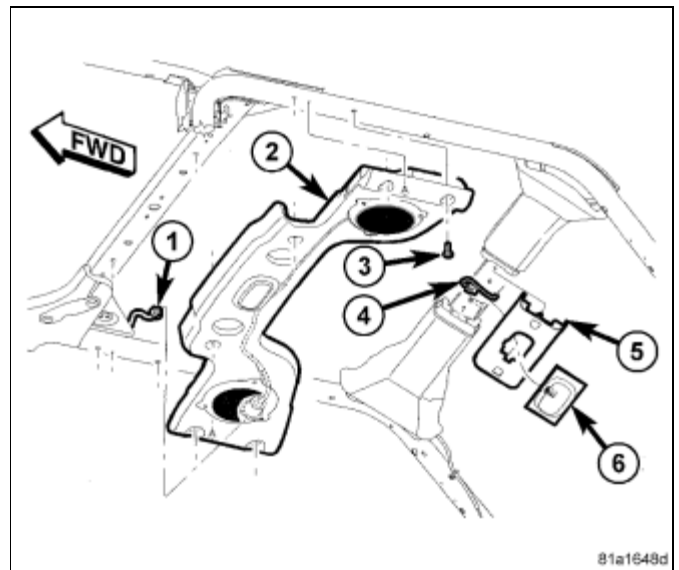
On four door vehicles;

10. Install the cover (2) and zip closed.



On four door vehicles;

11. If equipped, connect the electrical connector (4) and seat the rear dome light (6) onto the cross bar fully



On four door vehicles;

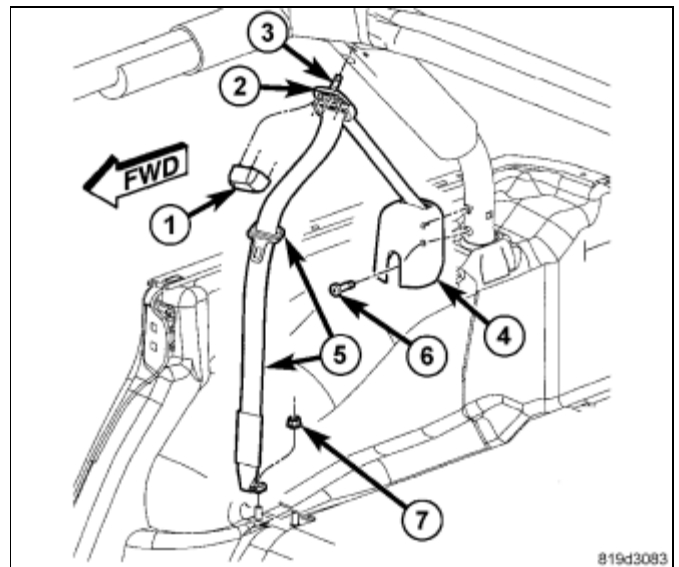
12. Install the seat belt retractor (4) and turning loop (2), (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)

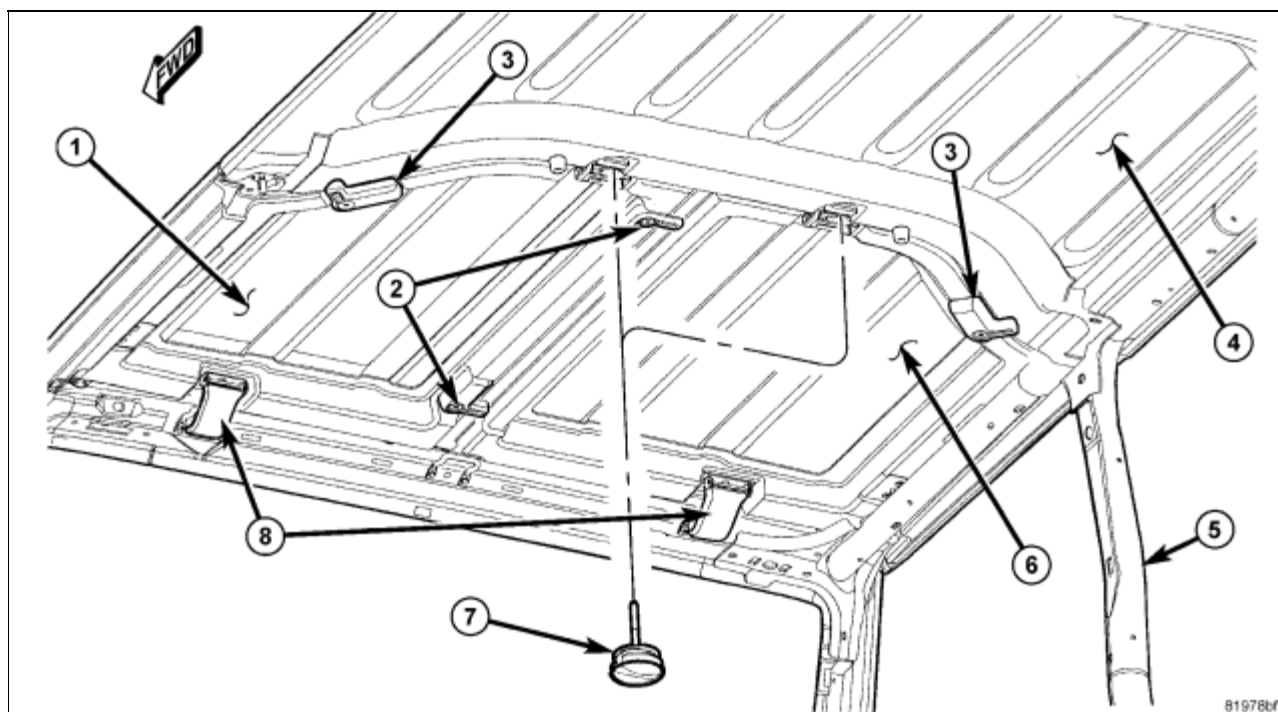
13. Install the sport bar speaker pod, (Refer to 23 - BODY/INTERIOR/SPORT BAR - SPEAKER POD - INSTALLATION).

14. Install the hard tops, if equipped, (Refer to 23 - BODY/REMOVABLE TOP/TOP - INSTALLATION).

SPORT BAR - SPEAKER POD

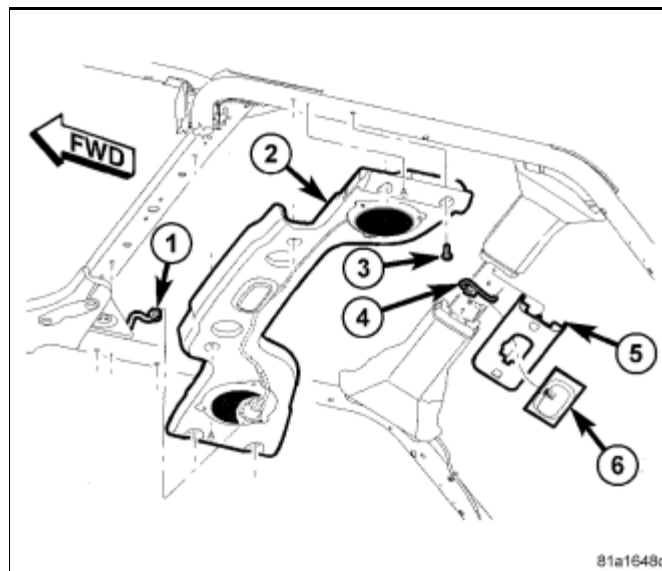
REMOVAL



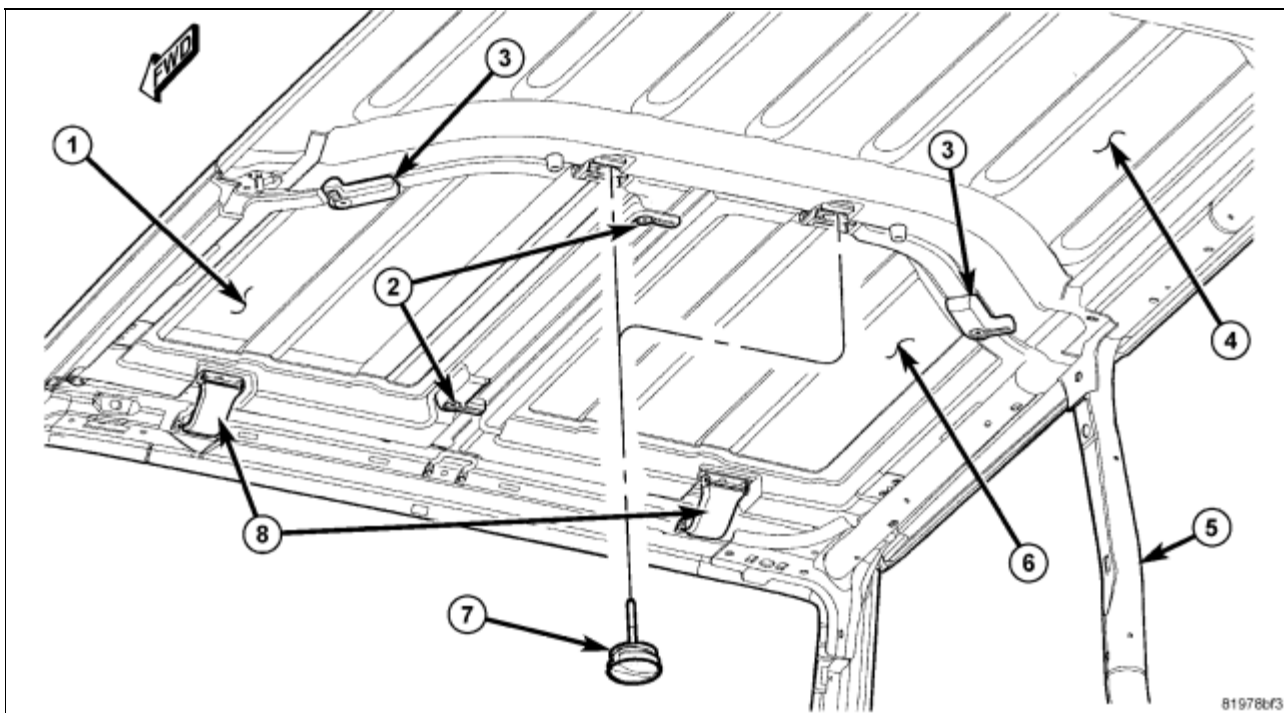
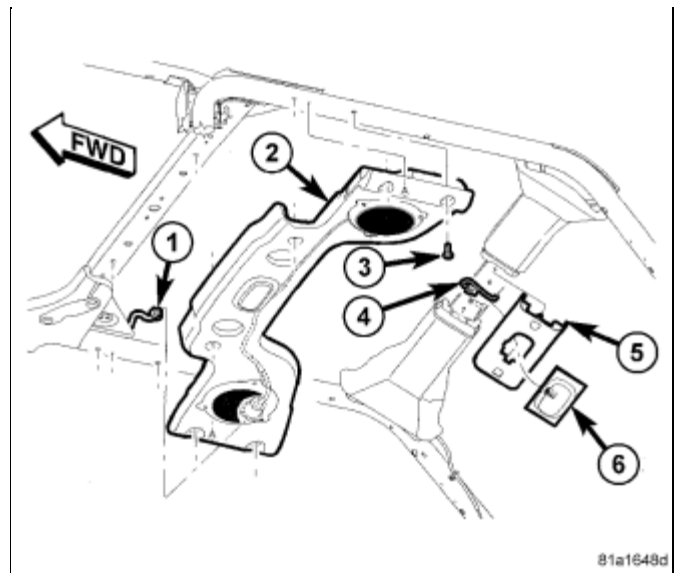


1. Remove the hard top thump screws (7), if equipped.
2. Remove the four screws (3) and lower the speaker pod (2).
3. Disconnect the electrical connector (1) and remove the speaker pod.

INSTALLATION



1. Connect the electrical connector (1) and position the speaker pod (2) onto the sport bar.
2. Install the four screws (3) and tighten to 10 N·m (90 ft. lbs.).

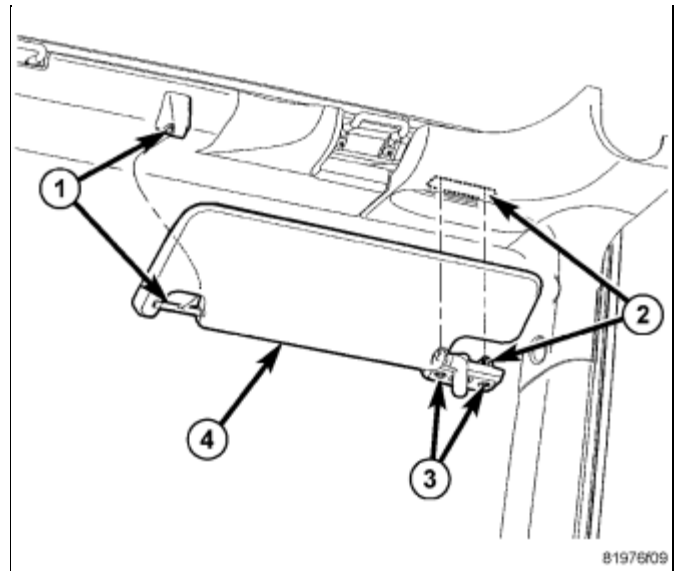


3. Install the hard top thumb screws (7).

SUNVISOR REMOVAL

1. Release the visor from the support (1).
2. Remove the screws (3) and remove the visor (4).

INSTALLATION



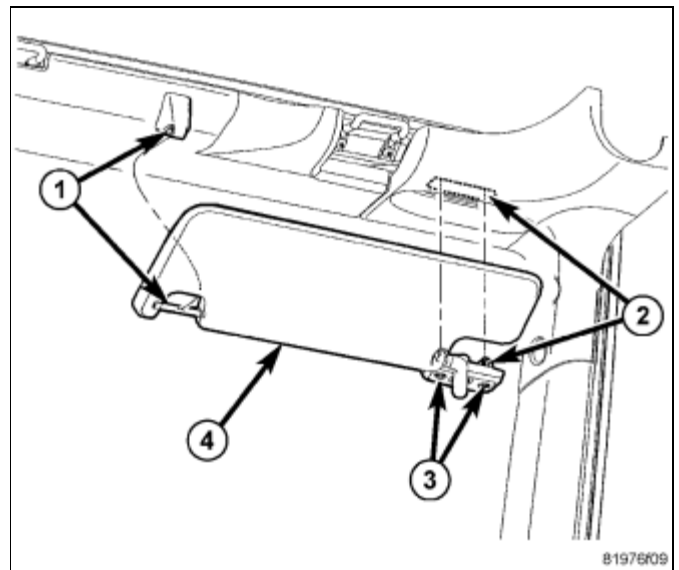
1. Position the visor (4) up to the windshield trim (2) and install the screws (3).
2. Secure the visor into the support (1).

PAINT

PAINT

SPECIFICATIONS - PAINT CODES

NOTE: Because of late model changes to the available paint colors (Refer to **VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION**) for the correct paint codes for each vehicle. (Refer to **23 - BODY/PAINT/PAINT CODE - DESCRIPTION**)



EXTERIOR COLORS

EXTERIOR COLOR	DAIMLERCHRYSLER CODE
Red Rock Crystal Pearlcoat	EEM
Flame Red Clearcoat	PR4
Light Graystone Pearlcoat	EDA
Rescue Green Metallic Pearlcoat	EJR
Jeep Green Metallic Clearcoat	EGJ

Steel Blue Metallic Clearcoat	DBM
Bright Silver Metallic Clearcoat	WSB/WS2
Black Clearcoat	DX8
Stone White Clearcoat	SW1

INTERIOR COLORS

INTERIOR COLOR	DAIMLERCHRYSLER CODE
Dark Khaki Medium Khaki	K
Dark Slate Gray/Medium Slate Gray	S

BASECOAT/CLEARCOAT FINISH

DESCRIPTION

On most vehicles a two-part paint application (basecoat/clearcoat) is used. Color paint that is applied to primer is called basecoat. The clearcoat protects the basecoat from ultraviolet light and provides a durable high-gloss finish.

CAUTION: Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.

PAINT CODE

DESCRIPTION

Exterior vehicle body colors are identified on the Vehicle Safety Certification Label which is located on the drivers door shut face. The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat. The codes listed in the Color Code Chart (Refer to 23 - BODY/PAINT - SPECIFICATIONS), are used for manufacturing purposes.

PAINT TOUCH-UP

DESCRIPTION

When a painted metal surface has been scratched or chipped, it should be touched up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch Up Paints and Clear Top Coat. For a

description of the paint codes, (Refer to 23 - BODY/PAINT - SPECIFICATIONS).

WARNING: Use an OSHA approved respirator and safety glasses when spraying paint or solvents in a confined area. Personal injury can result.

TOUCH UP PROCEDURE

1. Scrape loose paint and corrosion from inside scratch or chip.
2. Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.
3. Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the scratch or chip without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.
4. Cover the filler/primer with color touch up paint. Do not overlap touch up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch up paint to dry hard.
5. On vehicles without clearcoat, the touch up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.
6. On vehicles with clearcoat, apply clear top coat to touch up paint with the same technique as described in [STEP 4](#). Allow clear top coat to dry hard. If desired, [STEP 5](#) can be performed on clear top coat.

WARNING: Avoid prolonged skin contact with petroleum or alcohol – based cleaning solvents. Personal injury can result.

FINESSE SANDING, BUFFING & POLISHING

DESCRIPTION

Minor acid etching, orange peel, or smudging in clearcoat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clearcoat finish, if equipped. Basecoat paint must retain clearcoat for durability.

REMOVABLE TOP

REMOVABLE TOP

STANDARD PROCEDURE

HARD TOP REPAIR

NOTE: The hard top is manufactured from a sheet molded compound (SMC).

SMC is constructed using short fiberglass strands usually less than 5.08 cm (2 inches) long. Sheet stock of glass impregnated resin matting is placed into the mold and pressed under heat to flow material throughout the mold. Tooling is shear edge designed to mold to net (i.e. no trimming at periphery

required).

SMC is repairable in accordance with established procedures described within this manual. (Refer to 23 - BODY - STANDARD PROCEDURE - PLASTIC BODY PANEL REPAIR)

Hard Top Locators

There are two hard top locator devices positioned approximately 50 mm (2 in.) from the most forward attachment holes for both two door and four door models. There is an additional locator on the passenger side at the upper B-post mount on four door hard top models.

If the black four way locator is missing, replace. In the event that the rivet stud is damaged or missing, drill out and replace.

HARD TOP REPAIR

If it has been determined that the hard top can be repaired. The following required materials and procedures are to be used.

1. Use a grinder to remove the paint and outline the damaged area. Use a grade 150 grit disc for paint removal.
2. Grind the outlined surface area again with a 240 grit disc to prevent coarse scratches from appearing in the final finish.
3. If cracks extend from the hole, it will be necessary to stop-drill the crack(s) with a 3-mm (1/8-in) diameter drill bit. This will prevent the crack from spreading and allow repair material to be effective.
4. Position a fiberglass mat or cloth on the repair surface area. Cut the mat 2.5 cm (1 in.) larger than repair area but smaller than the outline area. Make the outline area larger if required.
5. Clean the outlined area.
6. Place the fiberglass cloth on aluminum foil.
7. Pour the fiberglass resin into a clean container.
8. Mix the appropriate amount of hardener and resin. Follow the manufacturers instructions.
9. Apply the hardener/resin mixture to both sides of the fiberglass cloth.
10. Place the fiberglass cloth over the repair area. Next, place the aluminum foil over the cloth using a plastic spreader to smooth-out the cloth and resin. Use firm pressure to remove air bubbles and to smooth-out the cloth. Remove the aluminum foil.
11. Allow the resin to cure.
12. Smooth-out the surface area to the contour of the hard top with a 150-grit disc.
13. Apply plastic filler to complete the repair. Finish smoothing the surface area with 240-320 grit paper.
14. Repeat the previous steps on the inside area of the hard top.
15. Featheredge the repaired surface area.
16. Prime the repaired surface area with PPG® Epoxy Primer, or an equivalent product.
17. Apply surface primer to the surface area.
18. Prime the surface area for the color coat.
19. Apply color coat to the repaired surface area.

HARD TOP FRACTURE REPAIR

If it has been determined that the hard top can be repaired. The following required materials and procedures are to be used.

1. Use a grinder to remove the paint and outline the damaged area. Use a grade 150 grit disc for paint removal.
2. Grind the outlined surface area again with a 240 grit disc to prevent coarse scratches from appearing in the final finish.
3. If cracks extend from the damaged area, it will be necessary to stop drill the cracks with a 3-mm (1/8-in) diameter drill bit. This will prevent the crack and/or fracture from spreading and allow repair material to be effective.
4. Bevel the edges of the crack/fracture on both sides with a rotary file.

NOTE: The edges should be beveled on the inside and outside of the top to ensure sufficient surface area for good bonding.

5. Complete the repairs with fiberglass cloth and resin as described in the hard top hole repair procedure. (Refer to 23 - BODY/REMOVABLE TOP - STANDARD PROCEDURE)

HARD TOP SAG REPAIR

Inspect the roof/hard top assembly for the presence of sag, or if the customer complains of water accumulation on the roof. Perform the following procedure to repair.

1. Remove front freedom panels to gain access to the rear hard top assembly.
2. Remove the six bolts that attach the hard top to the body for a two door or eight bolts that hold down the four door.
3. Depress tab on rear wiper motor connector and pull downward to disengage.
4. Make two marks on the inside of the hard top 6 cm (2.5 in.) on both sides of the center roof rib, directly above the sport bar.
5. Move the hard top back about 10 cm (4 in.) to expose the inner rib section.
6. Clean the roof area with isopropyl alcohol.
7. Install the foam repair blocks by removing the protective backing tape from the adhesive side. The foam blocks must be centered above the sport bar pad.
8. Move the hard top assembly back into position.
9. Inspect the hard top seals for damage and replace, if necessary.
10. Inspect the windshield header seal and make sure it is clean, undamaged, and free of debris.
11. Carefully position the hard top assembly on the vehicle making sure that the latches are not pinched between the windshield frame and top.

CAUTION: Do not over tighten the top bolts. Over tightening can cause cracking of the hardtop assembly.

12. Loosely install the six bolts on a two door or eight bolts on a four door. Ensure that the top is centered on the vehicle and locators are in place in the body side holes and tighten the bolts to 18 N·m (13.5 ft. lbs.).
13. Connect the wire wiper motor harness connector.
14. Connect the rear washer fluid hose.
15. Install front freedom panels.

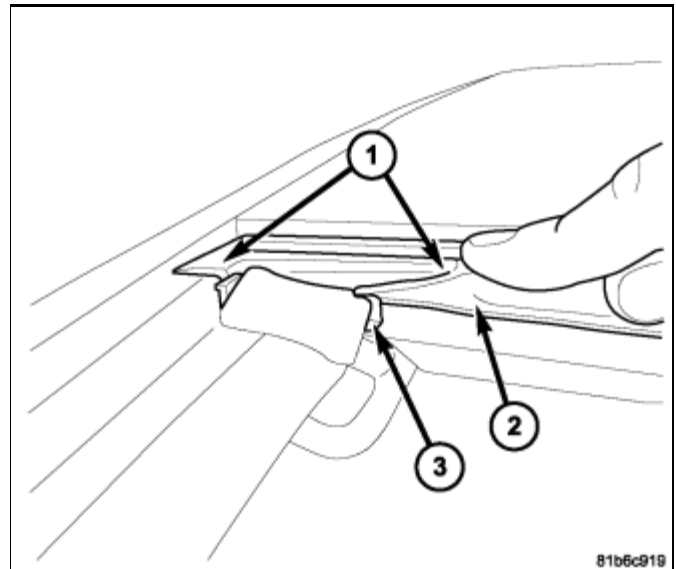
MODULAR HARD TOP FREEDOM PANEL WATER LEAKS

DIAGNOSIS:

1. Ensure that the Freedom Panels are correctly attached to the vehicle. The panels should be located and clamped in the correct sequence as described in the owner's manual. When installing the Freedom Panels always close the windshield latch first.
2. Have an assistant apply water across the hard top affected area with a hose for approximately 3-5 minutes while inspecting the interior of the hard top for waterleaks to determine general leak source location.
3. Water leaks at front center onto Instrument Panel (IP) and/or center console area are indicators of front center Freedom Panel leak path, but could also be a rear center Freedom Panel leak that travels forward. Review the information in the Repair Procedure below to determine if this has occurred.
4. Water leaks from Freedom Panel dial fasteners in speaker bar, leaks near the left or right B-pillar onto sport bar cloth covering, or onto front seats are indicators of leak paths from the rear center of the Freedom Panels. Review the information in the Repair Procedure below.
5. Water leaks at Upper B-pillar out board of the sport bar that drip onto the B-pillar hard trim panel is an indicator of a leak path between the hard top and the Freedom Panel or a leak path under the seal on the hard top. Review the information in the Repair Procedure below.
6. Water leaks at Upper B-pillar out board of the sport bar that drip onto the inner surface of the door panel at the B-pillar is an indicator of a leak path between the door and the Hard top/Freedom Panel intersection. Review the information in the Repair Procedure below.
7. Water leaks from the Upper A-pillar that drip onto the IP ends is an indicator of a leak path between the door inner panel and the Freedom Panel/windshield header intersection. There also could be a leak path at the windshield header area. These will need additional investigation. Review the information in the Repair Procedure below.

REPAIR PROCEDURE:

Freedom Panel Center & Rear Leaks

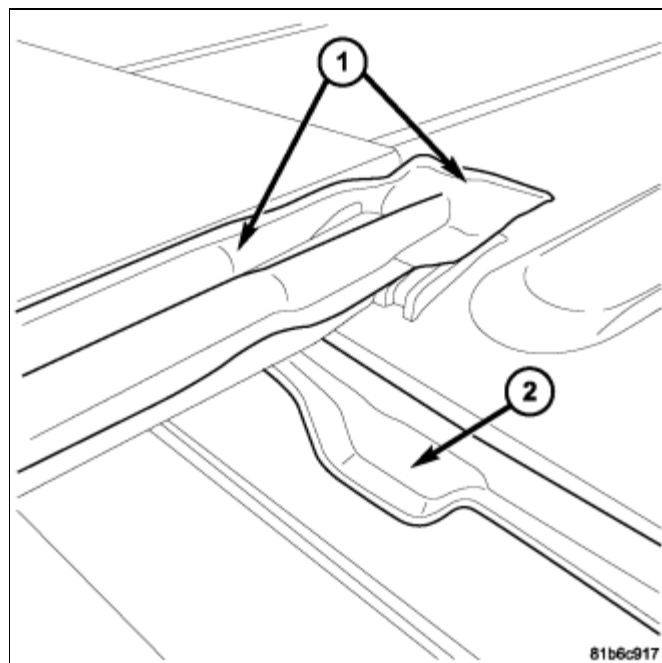


FREEDOM PANEL CENTER SEAL

1 - CENTER SEAL FRONT MOLDED DETAIL
2 - ADHESIVE TAPE RUNS ENTIRE LENGTH OF SEAL

3 - BUTYL

1. Remove left Freedom Panel.
2. Inspect the center seal that is attached to the right Freedom Panel. Look for water traces at the front molded detail area. Water collecting along the inboard edge of the panel could travel forward from the rear of the panel. If the seal is cut/torn/or otherwise damaged, replacement is required.
3. Lift up the outboard lip on the right Freedom Panel center seal near the front molded detail. Examine area for water entry under adhesive tape and/or butyl that is applied alongside of the tape. Note any areas for repair.

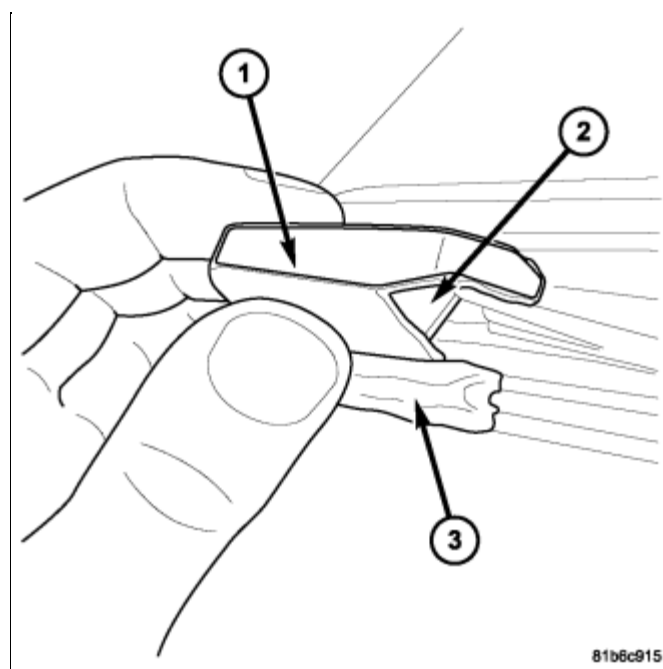


HARD TOP SEAL CUP AREA

1 - CENTER SEAL REAR MOLDED DETAIL

2 - HARD TOP SEAL CUP AREA

4. Perform similar examination on the rear molded detail area, looking for water traces near the adhesive tape and/or butyl.
5. If leaks to the interior were at the dial fasteners or the B-pillar area, and no water traces are found on the right Freedom Panel inboard edge or molded detail areas of the seal, look for water traces on the hardtop panel front flange directly below the Freedom Panels. Water collected here can indicate a leak under the Freedom Panel in the "cup" area of the hard top seal. This type of leak could be a leak path under the hard top seal center mold, or a path past the foam under the right Freedom Panel rear molded detail.

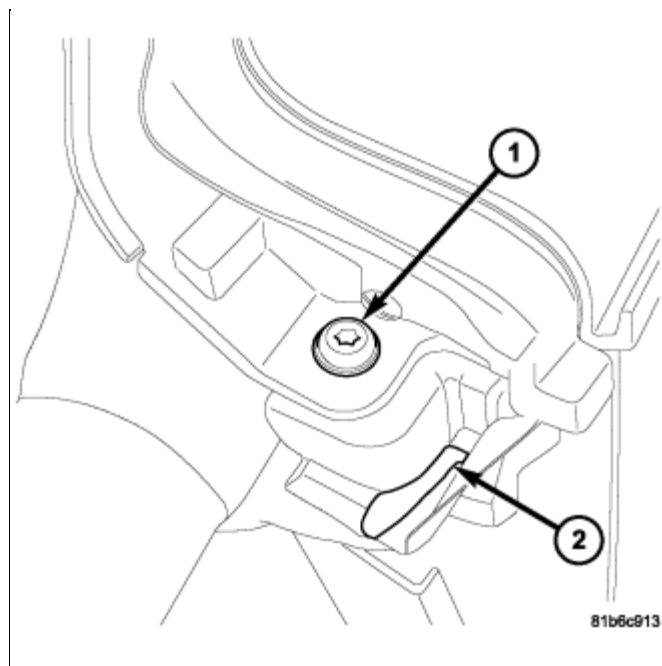


FOAM AND BUTYL LOCATION

1 - EDGE OF FOAM MUST NOT EXTEND PAST TIP OF "D" SECTION ON SEAL
2 - "D" SECTION
3 - BUTYL MUST BE PRESENT TO BLOCK WATER PATH BELOW "D" SECTION

6. Remove right Freedom Panel & set on work table, protecting edges & top surface from damage. Proceed with repairing the seal area on the right Freedom Panel.
7. IF center seal replacement is required, remove old seal and clean seal mounting surfaces of residual adhesive tape. Apply repair butyl. to the front and rear ends of the seal mounting zone. Remove tape liner from new seal. Locate seal at each end onto panel, pressurize each end. Proceed to pressurize center section, ensuring good, continuous adhesion.
8. If seal replacement is not required, add small amounts of repair butyl, to any areas of water entry found along the center seal of the Freedom Panel. Replace the foam on the front detail or the foam under the rear detail if it is damaged or missing with replacement closed cell foam in kit.
9. If the leak path is under the hard top seal center mold, repair with butyl sealer.
10. Replace the Freedom Panels on the vehicle, right side first, followed by the left side. Proceed to position and clamp them in the correct sequence according to the owner's manual. When installing the Freedom Panels always close the windshield latch first.
11. Retest to verify that the leak corrected.

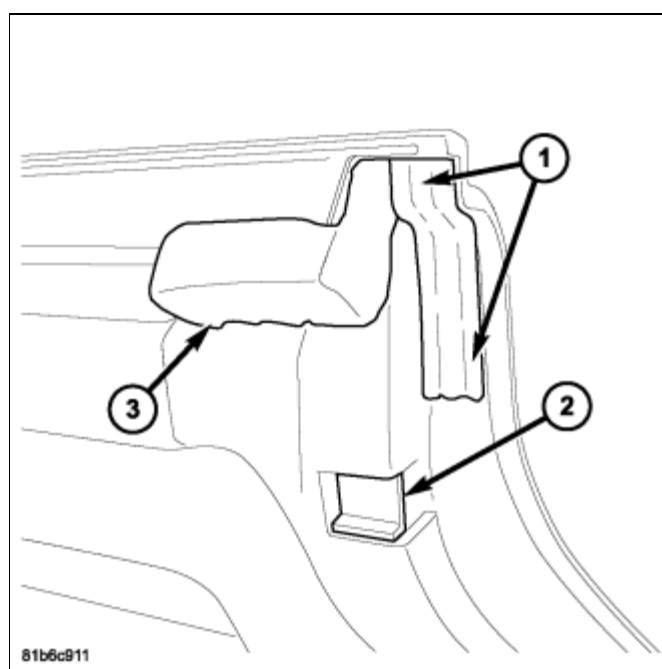
B-Pillar Inboard of the Freedom Panels Corner to Hard Top Leaks



B-PILLAR CUP (4 DOOR SHOWN)

1 - 4 DOOR ONLY
2 - B-PILLAR CUP SEAL

1. Remove Left & Right Freedom Panels.
2. Inspect end details of hard top end seal for water traces to determine leak path. Seals that have the “cup” distorted or rolled will create a leak path. Refit the seal to correct a distorted/rolled seal.
3. Water traces on the hard top corner and leading into the “cup” of the upper B-pillar molded detail (4 DR) near the fastener indicate a leak either under the hard top seal or between the hard top seal and the Freedom Panel.

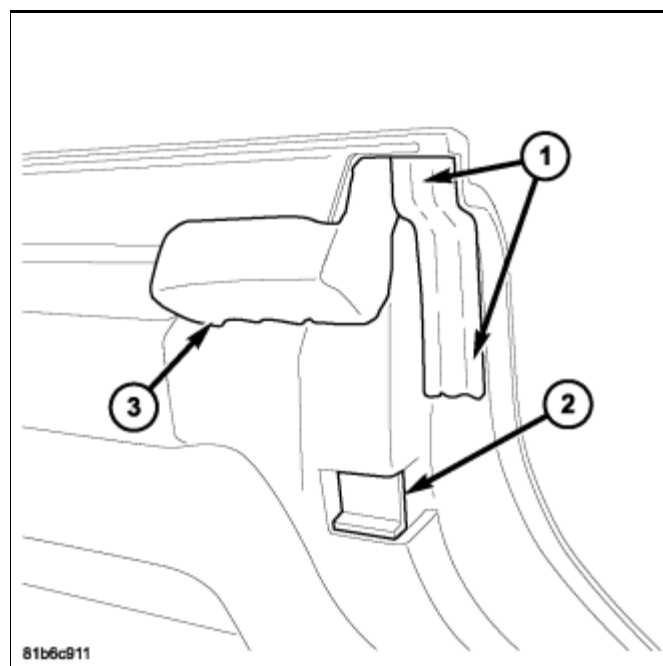


REAR CORNER FOAM OF FREEDOM PANEL

1 - HORIZONTAL SURFACE FOAM
2 - LOCATOR NOTCH
3 - PANEL TO B-PILLAR INTERFACE FOAM

4. If the water trace is under the hard top end seal leading into the “cup” of the upper B-pillar molded detail, dry off the area & apply butyl to close off the path under the seal to the hard top.
5. If the water trace is over the top of the hard top seal at the outboard corners, examine the rear outboard corners of Freedom Panel for damaged or missing foam. Replace if required.
6. If there is no leak under the hard top seal, no water trace at the outboard corners, and there is a water trace on hard top seal approximately 1 in. - 8 in. inboard of the corners, then inspect the hard top seal for distortion or flatness. There is an insert/stuffer inside the seal end that is 7 in. - 8.75 in. long. Verify that the insert is present and located all the way outboard to the hard top seal end. Shift insert outboard to support the hard top seal end if required.
7. If hard top seal is damaged, replace it using appropriate 2 door seal or 4 door seal(s).
8. Replace the Freedom Panels on the vehicle, right side first, followed by the left side. Proceed to position and clamp them in the correct sequence according to the owner’s manual.
9. Retest to verify that the leak corrected.

B-Pillar Outboard Freedom Panel Corner & Hard Top Leaks



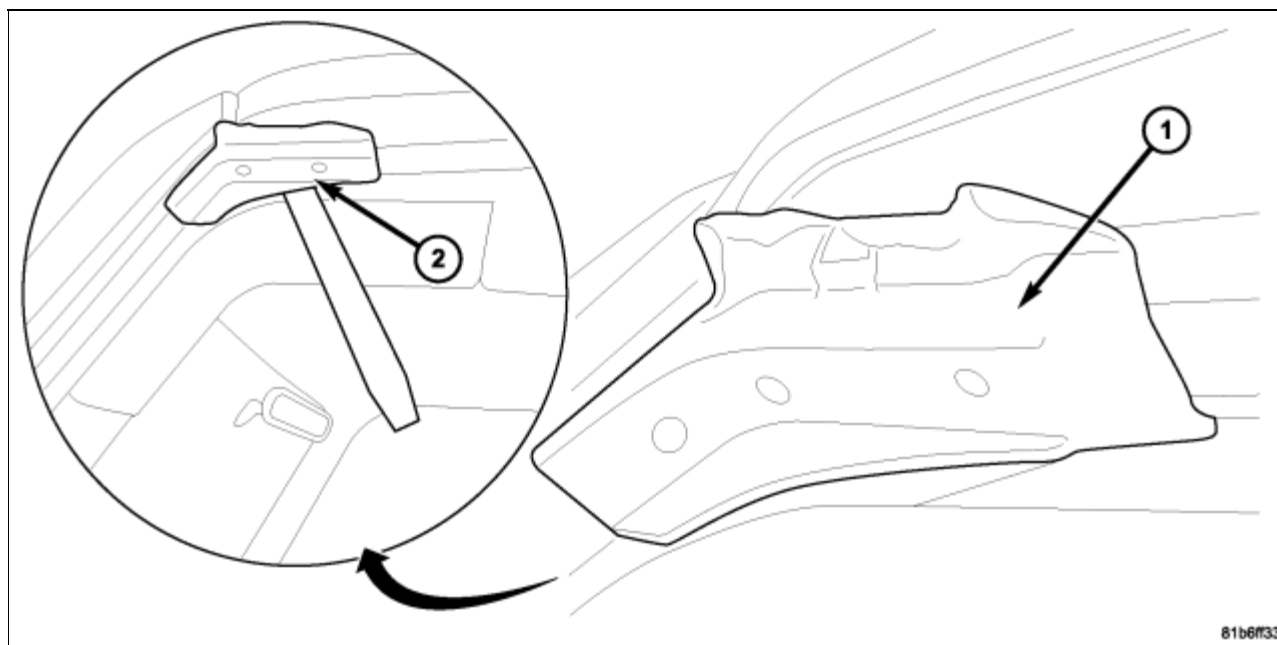
REAR CORNER FOAM OF FREEDOM PANEL

1 - HORIZONTAL SURFACE FOAM
2 - LOCATOR NOTCH

3 - PANEL TO B-PILLAR INTERFACE FOAM

1. Leaks tracing along the door inner panel near the upper rear corner indicate a path between the door & the hardtop/Freedom Panel intersection.
2. Examine the door to body fit for an over-flush condition. Refit if over-flush greater than 1.5 mm (1/16 in.).
3. Inspect end details of hard top end seal for water traces to determine leak path. Seals that have the “cup” distorted or rolled will create a leak path. Refit the seal to correct a distorted/rolled seal.
4. Examine the rear outboard corners of Freedom Panel for damaged or missing foam. Replace if required.
5. If hard top seal is damaged, replace it using appropriate 2 door seal or 4 door seal(s).
6. Replace the Freedom Panels on the vehicle, right side first, followed by the left side. Proceed to position and clamp them in the correct sequence according to the owner’s manual. When installing the Freedom Panels always close the windshield latch first.
7. Retest to verify that the leak corrected.

A-Pillar Outboard Freedom Panel Corner & Hard Top Leaks



HEADER SEAL TO FREEDOM PANEL TRANSITION

1 - EXCESSIVE STEP OFF

2 - BEND FLANGE TO OBTAIN SMOOTH TRANSITION

1. Water traces/drips onto the door trim panel near the handle indicate a door to body leak path.
2. Examine the door fit to body for an over-flush condition. Refit if over-flush greater than 1.5mm.
3. Examine the windshield header seal end detail to Freedom Panel for a smooth transition from the seal to the

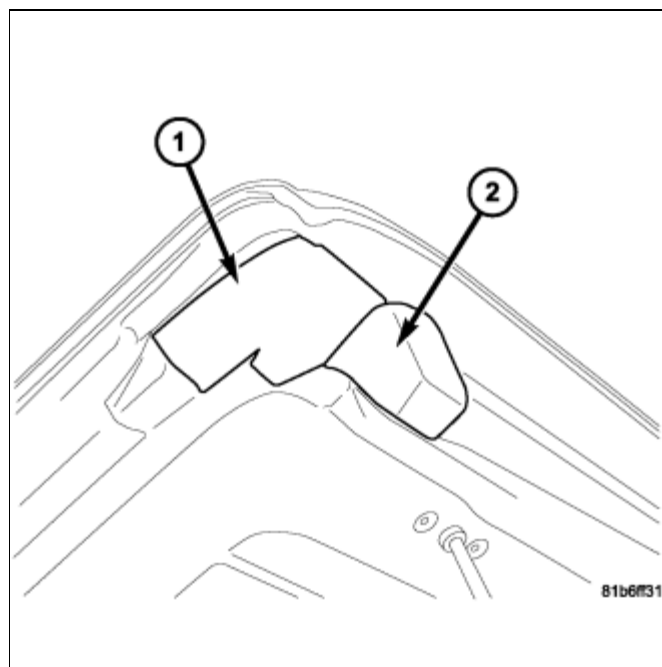
panel. A distorted/rolled seal or step off transition can lead to a leak. Refit the seal and/or bend the metal flange of the windshield frame that is to achieve a flush fit.

4. If water traces are on the end of the IP, the leak path is located between the windshield header and/or the windshield header seal and the Freedom Panel corner.

5. Remove left & right Freedom Panels.

6. Inspect end details of windshield header seal for water traces in the rear ward “cup” portion.

7. Water traces on the windshield header seal end detail rearward “cup” indicate a leak path from either the area between the Freedom Panel front corner or the windshield header seal.



FRONT CORNER OF FREEDOM PANEL

1 - PANEL TO WINDSHIELD FOAM
2 - PANEL TO A-PILLAR FOAM

8. Examine the front outboard corners of Freedom Panel for damaged or missing foam. Replace if required.

9. If no issues with the Freedom Panel corner, examine the windshield header seal end details to ensure it is sealed to the windshield frame. Carefully peel back the front lip of the seal and inspect for gaps in the adhesive tape and butyl that is located under the sealing lip across the windshield header. Repair with butyl as required.

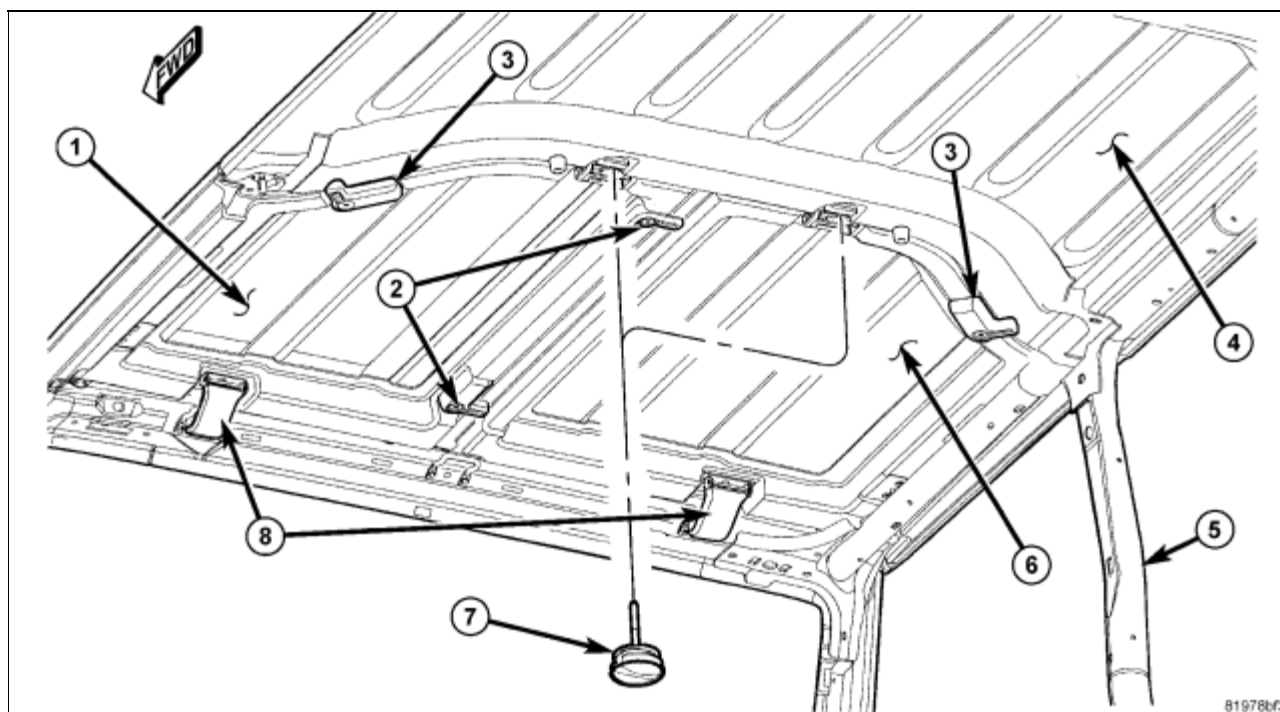
10. Replace the windshield header seal if damaged.

11. Replace the Freedom Panels on the vehicle, right side first, followed by the left side. Proceed to position and clamp them in the correct sequence according to the owner's manual. When installing the Freedom Panels always close the windshield latch first.

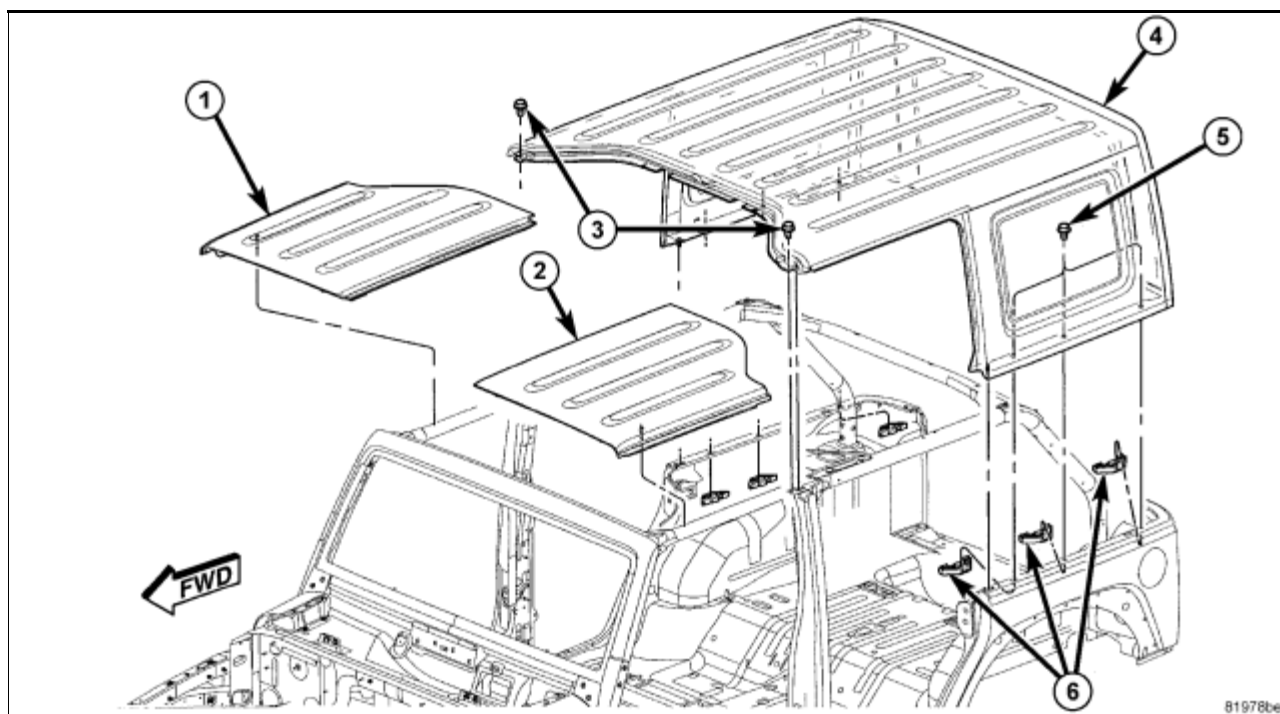
12. Retest to verify that the leak corrected.

HARD TOP

REMOVAL

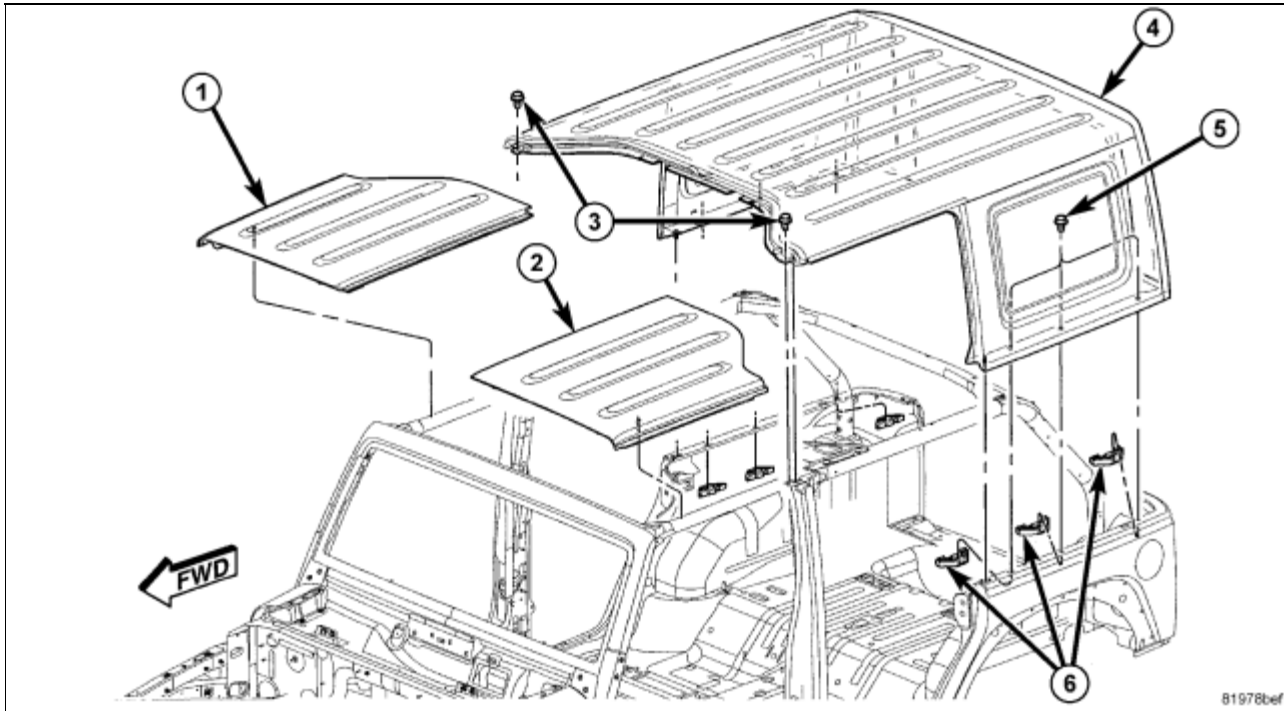


1. From inside the vehicle, release the center clamps (2).
2. Release the rear clamps (3).
3. Remove the rear thumb bolts (7).
4. Release the front top clamps (8).



5. Remove the modular tops (1) and (2).
6. On four door models, remove the two front bolts (3).
7. Remove the six side bolts (5) and remove the main hard top (4).

INSTALLATION



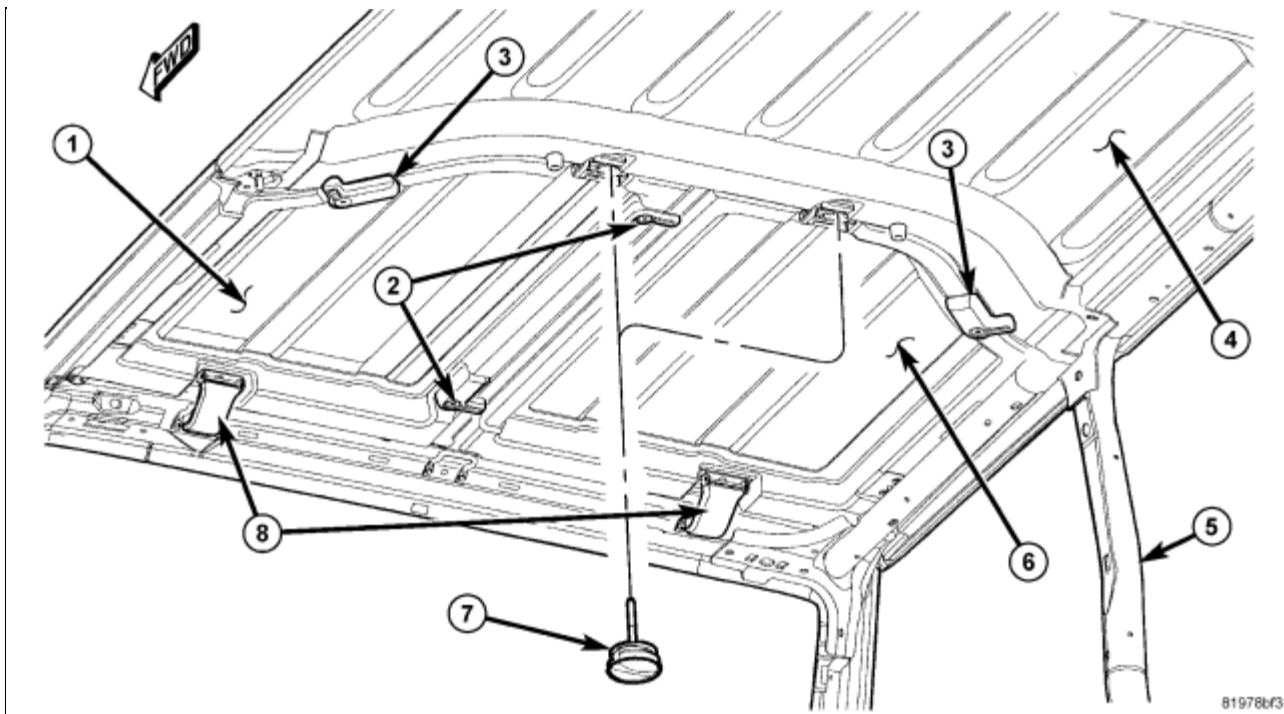
1. Install the main hard top (4) onto the vehicle and line up the alignment pins.

CAUTION: Make sure the B and C-pillar seals are not folded up and are positioned correctly.

2. Install the six side bolts (5).
3. On four door models, install the two front bolts (3).
4. Tighten the side bolts (5) from front to rear to 18 N·m (13.5 ft. lbs.)
5. On four door models, tighten the front bolts (3) to 10.5 N·m (7.5 ft. lbs.).

NOTE: Make sure all modular top latches are in the open position.

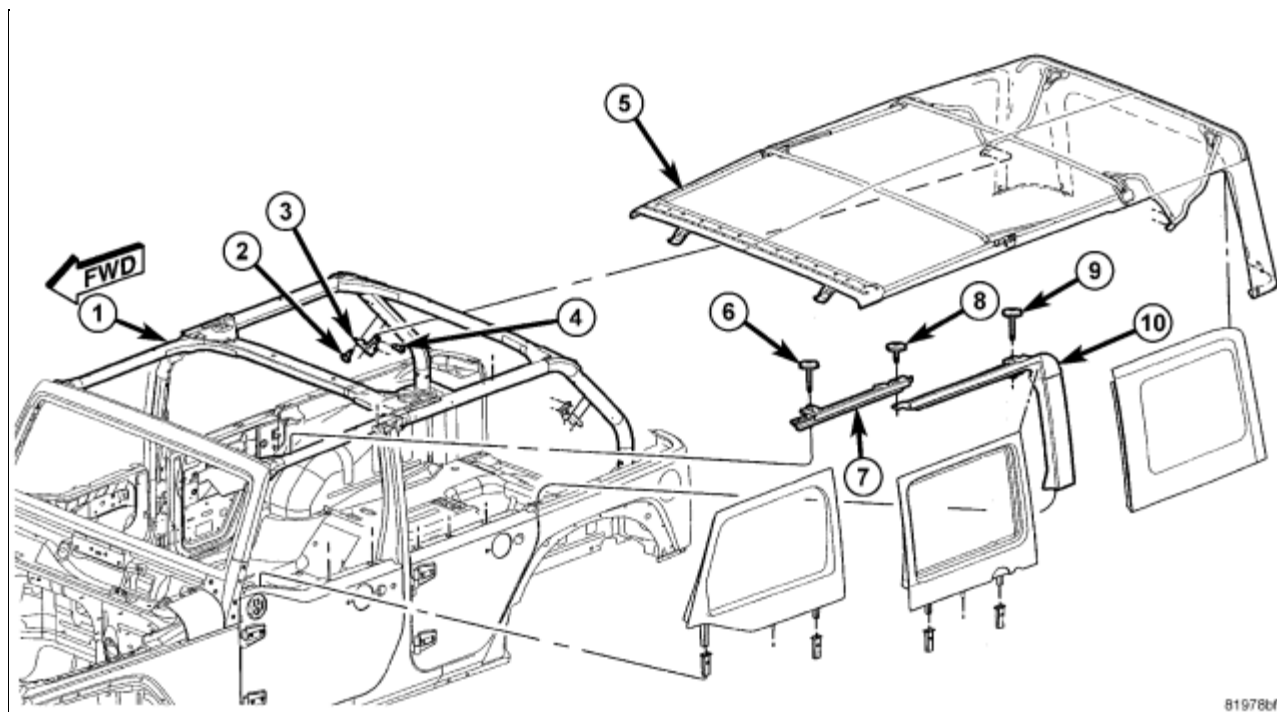
6. Position the modular tops (1) and (2) onto the vehicle with the right side top (1) being installed before the left side (2).



7. With the modular tops (1) and (6) installed correctly onto the alignment pins, secure the front latches (8).
8. Install and secure the rear thumb bolts (7).
9. Secure the rear clamps (3) fully.
10. Secure the center clamps (2) fully.

SOFT TOP

DESCRIPTION



FOUR DOOR SHOWN, TWO DOOR SIMILAR

1 - SPORT BAR ASSEMBLY
2 - PIVOT BRACKET BOLTS
3 - PIVOT BRACKETS
4 - PIVOT KNUCKLE BOLTS 14 N·m (10.5 ft. lbs.)
5 - FOUR DOOR SOFT TOP
6 - DOOR RAIL THUMB SCREW
7 - DOOR RAIL RETAINER
8 - DOOR RAIL THUMB SCREW
9 - REAR DOOR RAIL THUMB SCREW
10 - REAR DOOR RAIL RETAINER

Soft Top

Wrangler's Soft Top features the same construction as before and attaches and installs similar to the 2006 models. A storage bag for the plastic windows is available through MOPAR® for added convenience.

Sun Rider Soft Top

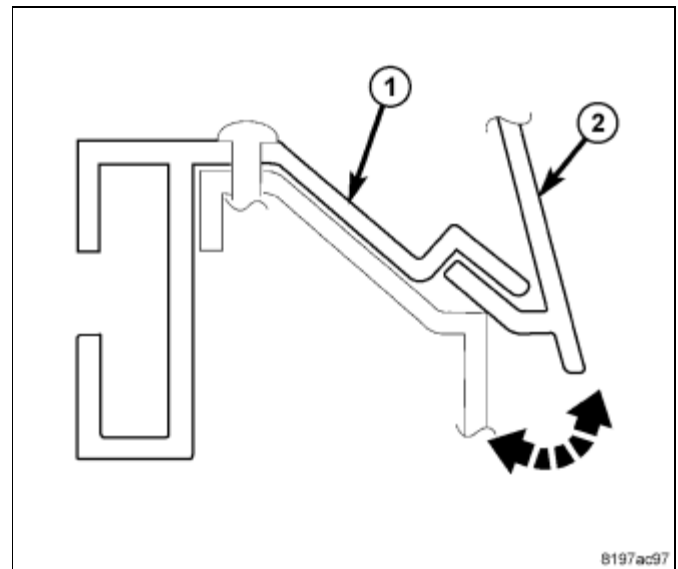
The Sun Rider Soft Top features the same construction as before and attaches and installs similar to the 2006 models. For added convenience, MOPAR® offers a storage bag for the removable plastic windows. The Sun Rider Top can be half or fully open. Wrangler Unlimited's soft-top opening extends above the rear seat occupants. The approximate dimensions of the open space for the Sun Rider Tops are as follows:

- Wrangler (two-door) 55 in. (1397 mm) wide by 30 in. (762 mm) long and opens above the first row only
- Wrangler Unlimited (four-door): 55 in. (1397 mm) wide by 60 in. (1524 mm) long and opens above first and second row occupants

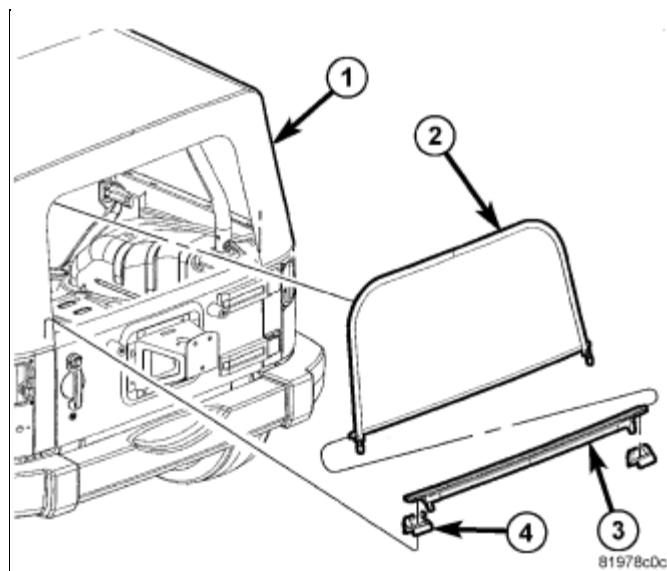
REMOVAL

Two Door

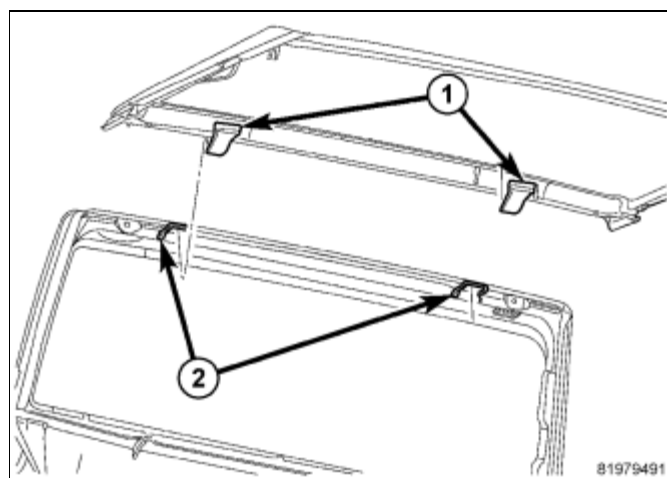
1. Separate the quarter windows hook and loop strips from the soft top and unzip the quarter windows.
2. Separate the quarter window sides (2) from the side rail retainers (1) and the door frame and remove the quarter window.



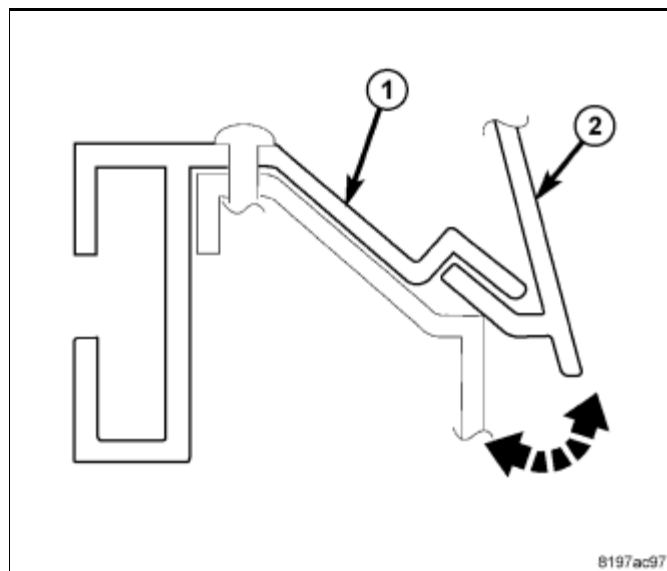
3. Unzip the rear window (2) and release window retainer from the rear tailgate retainer (3).



4. Release the front latches (1) from the windshield frame loops (2).

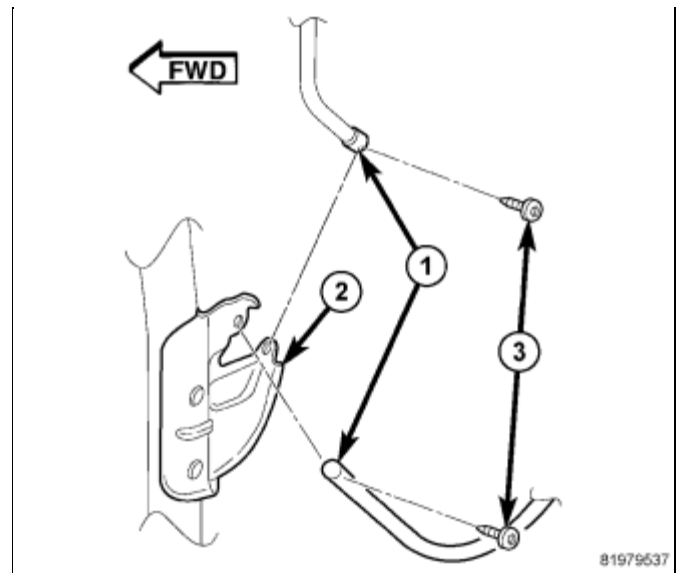


5. Release the soft top retainers (2) from the upper side and lower rear rail retainers (1).

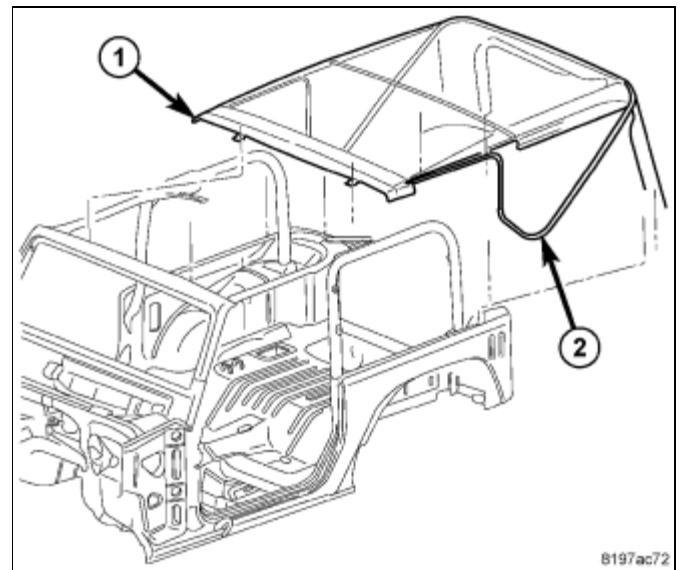


6. Fold the top into the down position.
7. Remove the pivot bracket bolts (3) from the pivot

knuckles (1).

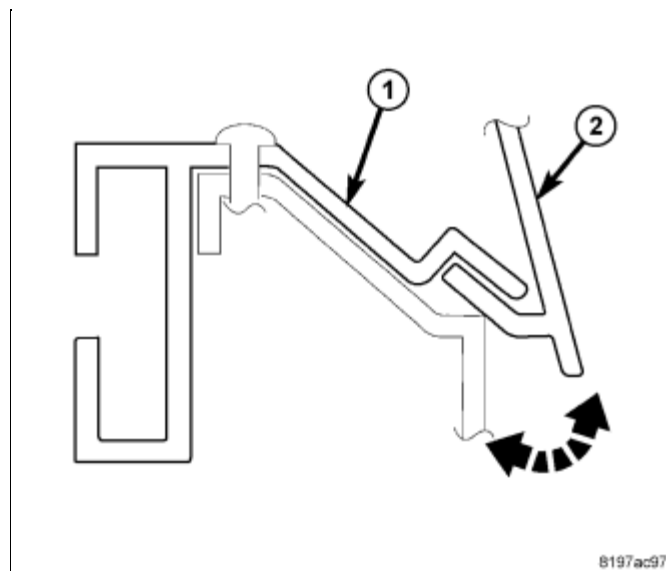


8. separate the knuckles (2) from the pivot brackets.
9. Remove the soft top (1) from the vehicle.

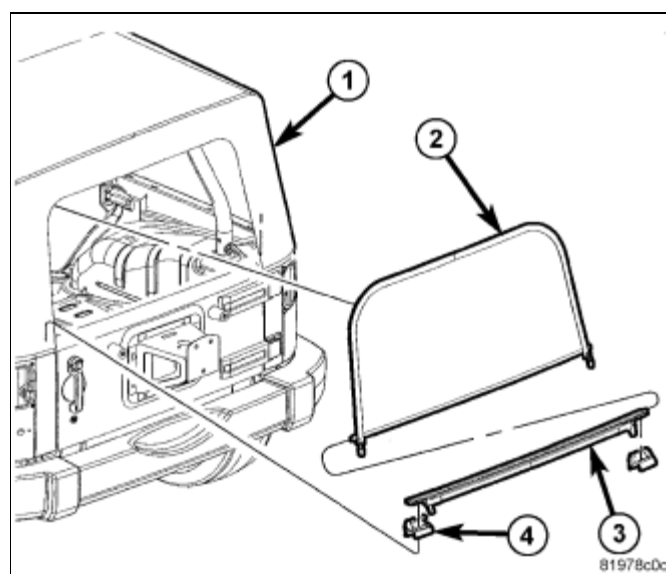


Four Door

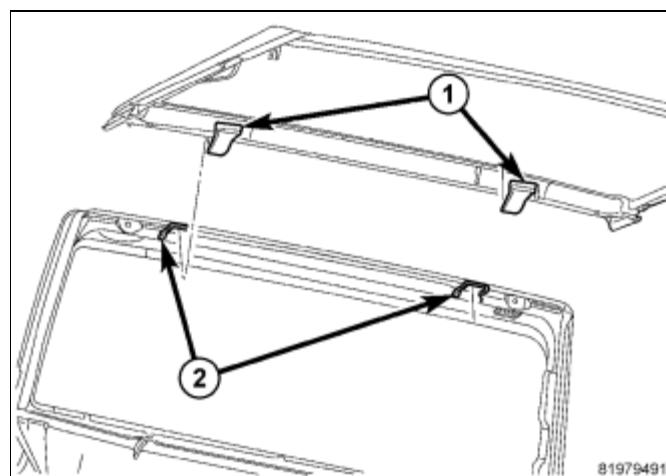
1. Separate the quarter windows hook and loop strips from the soft top and unzip the quarter windows.
2. Separate the quarter window sides (2) from the side rail retainers (1) and the door frame and remove the quarter window.
3. Unzip the rear window and release window retainer (2) from the rear tailgate retainer (1).



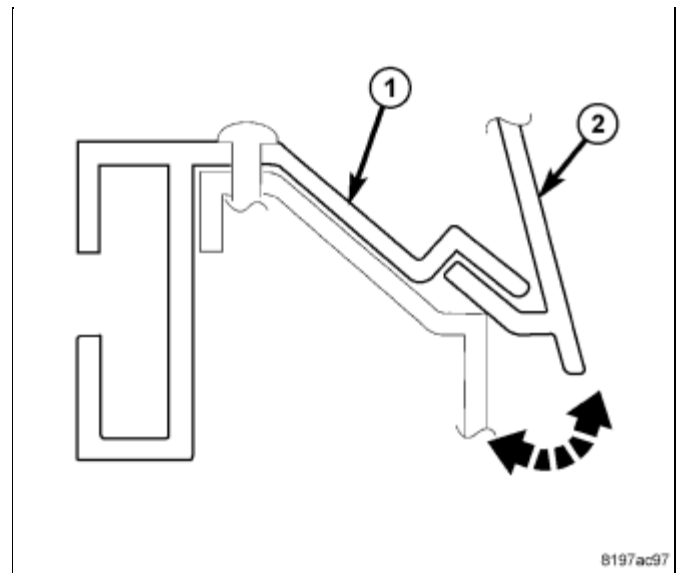
4. Unzip the rear window (2) and release window retainer from the rear tailgate retainer (3).



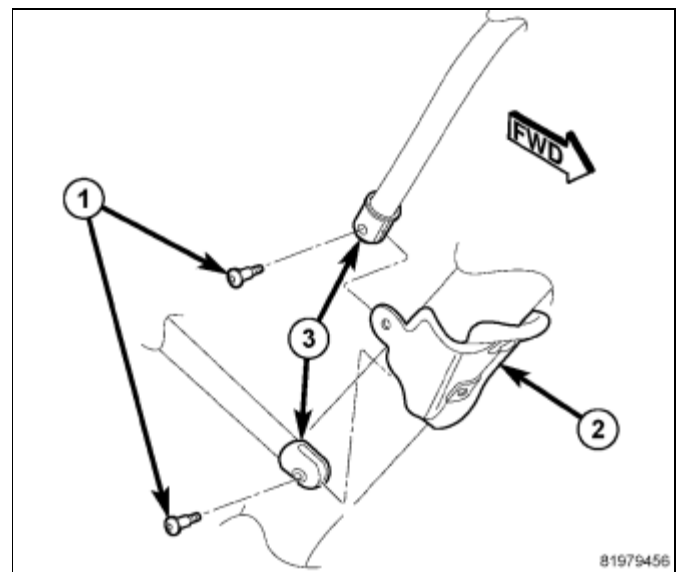
5. Release the front latches (1) from the windshield frame loops (2).

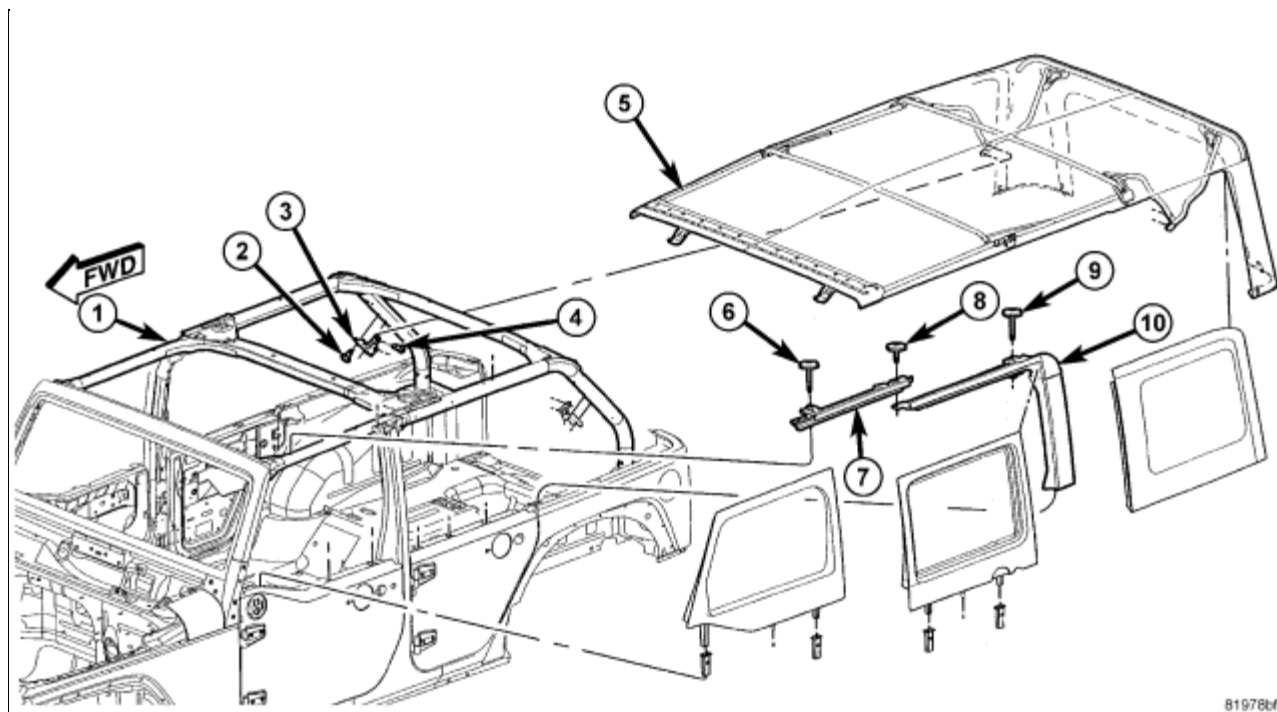


6. Release the soft top retainers (2) from the upper side and lower rear rail retainers (1).



7. Fold the top into the down position.
8. Remove the pivot bracket bolts (1) from the pivot knuckles (3) and separate the knuckles from the pivot bracket (2).





FOUR DOOR SHOWN, TWO DOOR SIMILAR

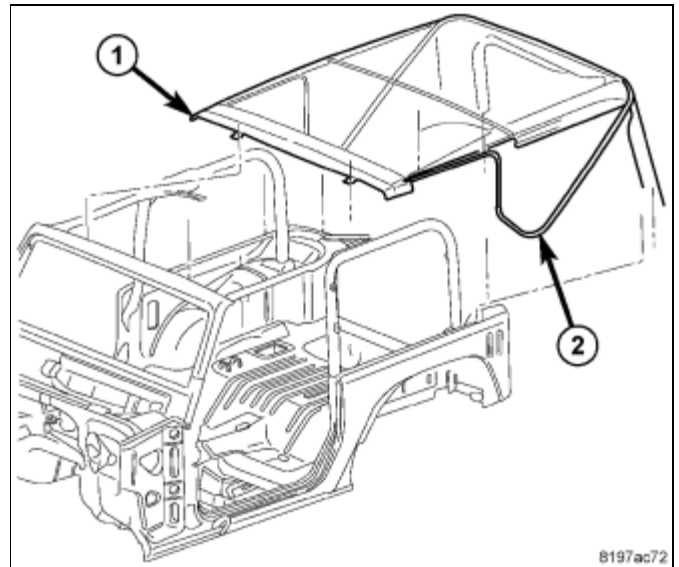
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7 - DOOR RAIL RETAINER
8 - DOOR RAIL THUMB SCREW
9 - REAR DOOR RAIL THUMB SCREW
10 - REAR DOOR RAIL RETAINER

9. Remove the soft top (5) from the vehicle.

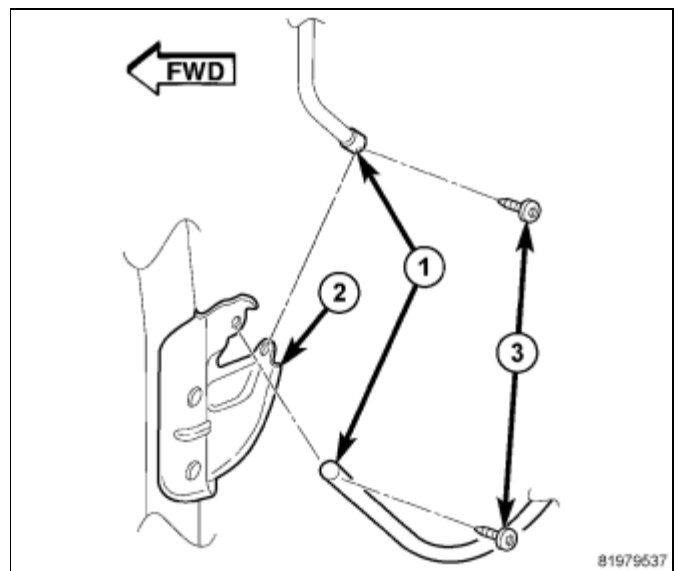
INSTALLATION

Two Door

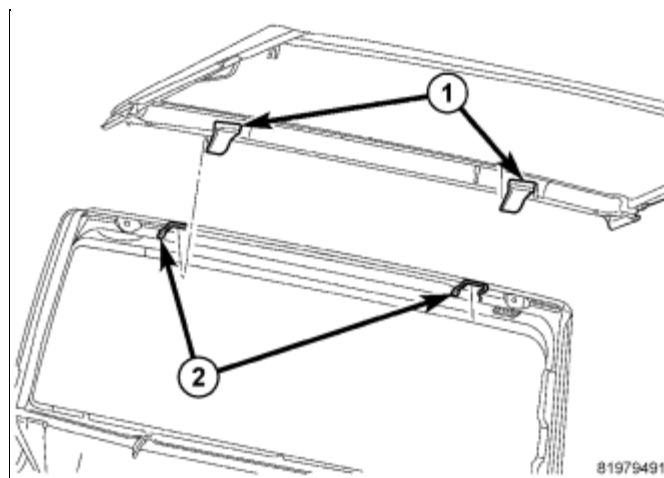
1. Position the soft top (1) onto the vehicle with the knuckles (2) positioned to attach to the knuckle brackets.



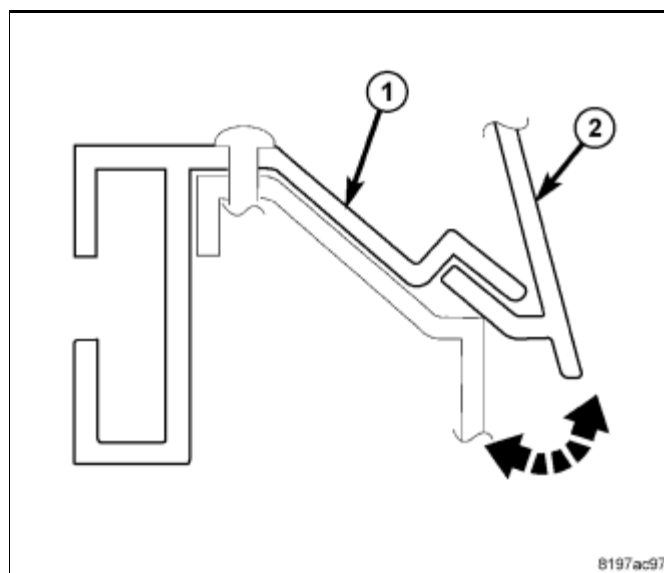
2. Position the knuckles (1) onto the knuckle bracket (2) and install the bolts (3).



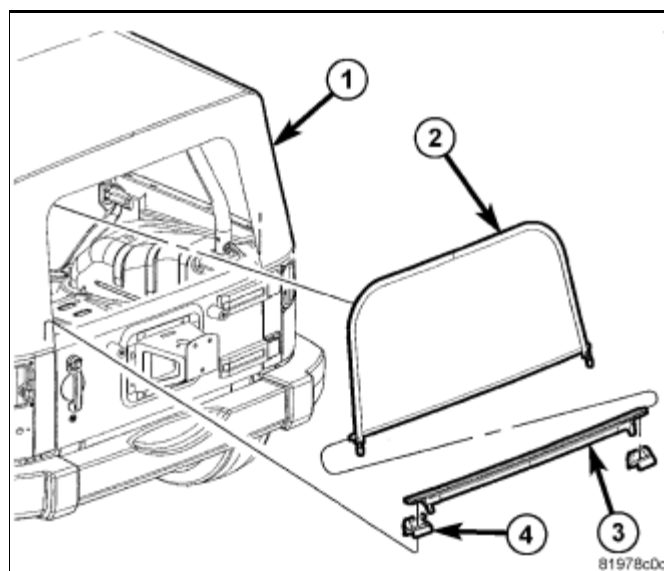
3. Fold the top up and secure the latches (1) to the windshield frame loops (2).



4. Secure the soft top retainers (2) for the upper side and lower rear rails (1).



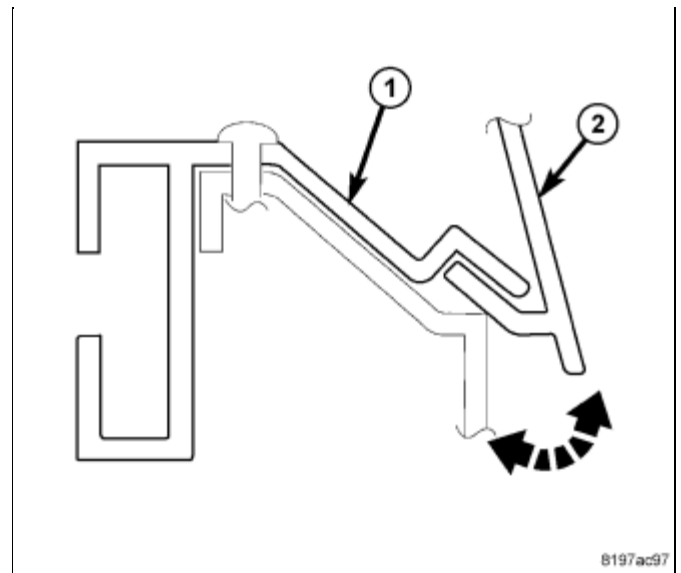
5. Zip the rear window (2) onto the soft top (1) and secure to the rail retainer (3).



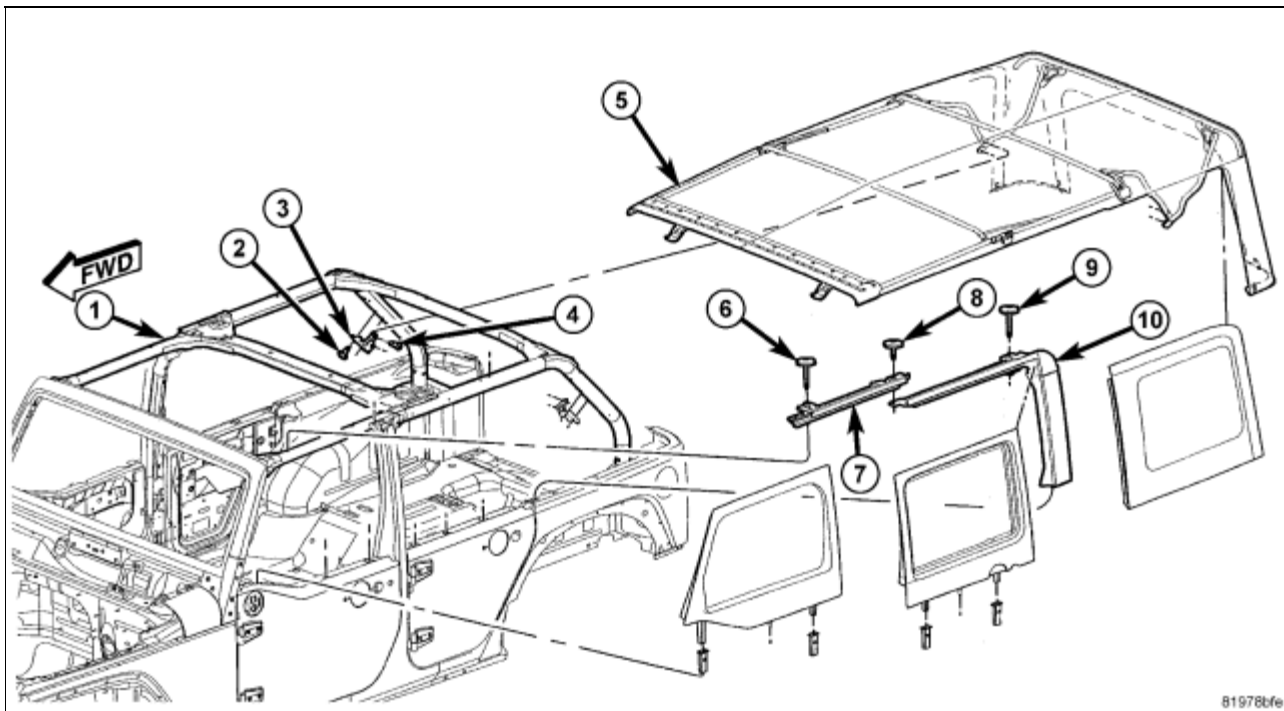
6. Zip the quarter windows onto the soft top and secure the window retainers (2) to the lower rails (1) and the door

frames.

7. Secure the quarter window hook and loop strips to the soft top.



Four Door



FOUR DOOR SHOWN, TWO DOOR SIMILAR

1 - SPORT BAR ASSEMBLY

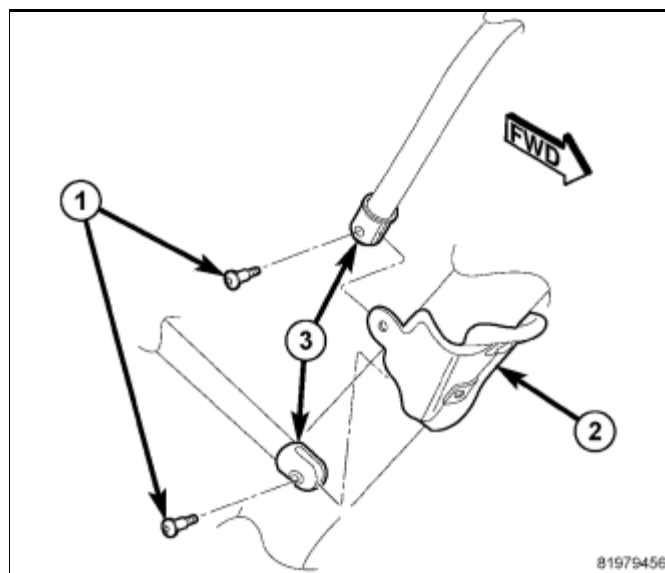
2 - PIVOT BRACKET BOLTS

3 - PIVOT BRACKETS

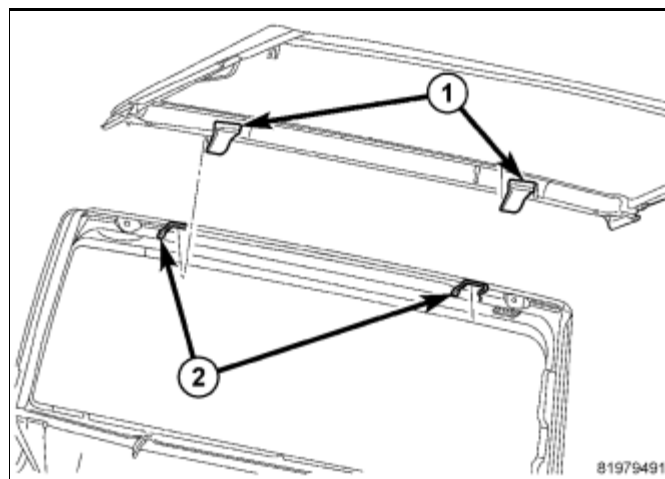
4 - PIVOT KNUCKLE BOLTS 14 N·m (10.5 ft. lbs.)
5 - FOUR DOOR SOFT TOP
6 - DOOR RAIL THUMB SCREW
7 - DOOR RAIL RETAINER
8 - DOOR RAIL THUMB SCREW
9 - REAR DOOR RAIL THUMB SCREW
10 - REAR DOOR RAIL RETAINER

1. Install the soft top (5) onto the vehicle.

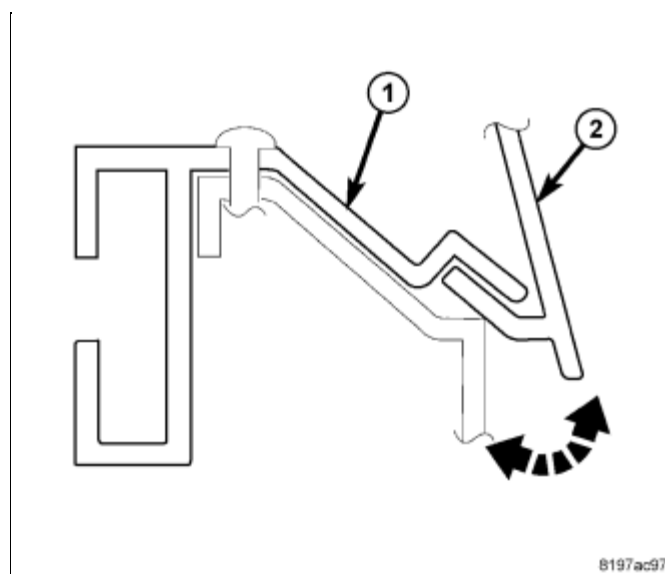
2. Position the knuckles (3) onto the knuckle bracket (2) and install the bolts (1).



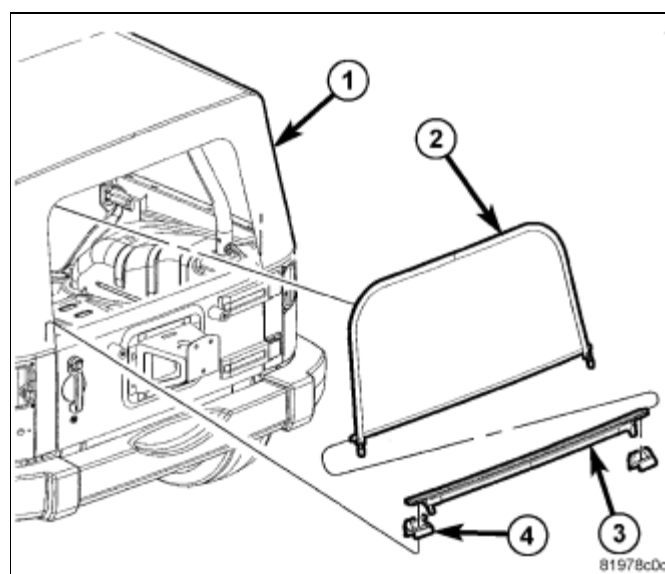
3. Unfold the top up and secure the latches (1) to the windshield frame loops (2).



4. Secure the soft top retainers (2) for the upper side and lower rear rails (1).

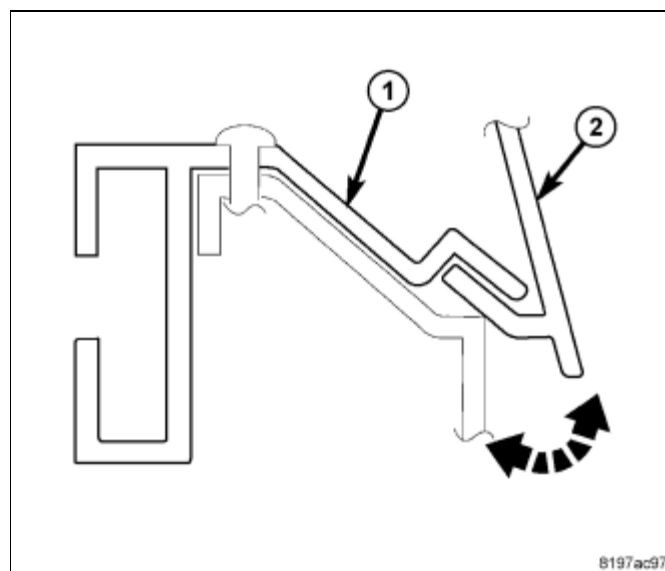


5. Zip the rear window (2) onto the soft top (1) and secure to the rail retainer (3).



6. Zip the quarter windows onto the soft top and secure the window retainers (2) to the lower rails (1) and the door frames.

7. Secure the quarter window hook and loop strips to the soft top.

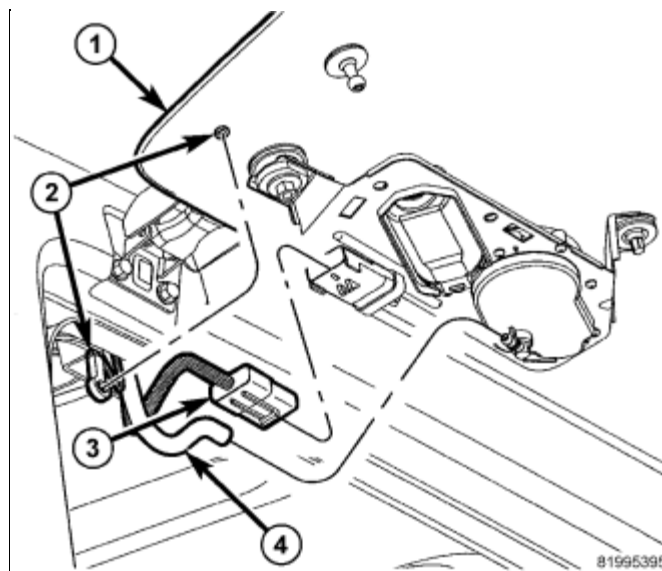


TAILGATE

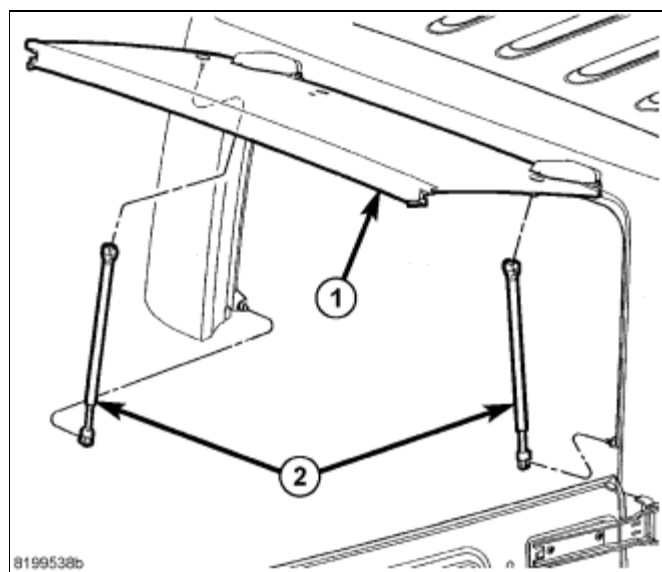
BACKLITE

REMOVAL

1. Disconnect the rear wiper motor electrical connectors (3).
2. Disconnect the washer hose (4).
3. Disconnect the rear window heater grid connector (2).

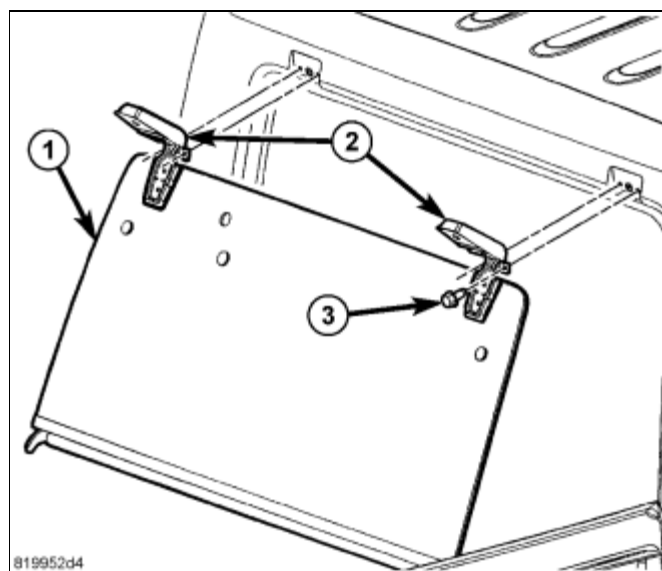


4. Remove the glass supports (2), (Refer to 23 - BODY/TAILGATE/SUPPORT CYLINDER - BACKLITE - REMOVAL).

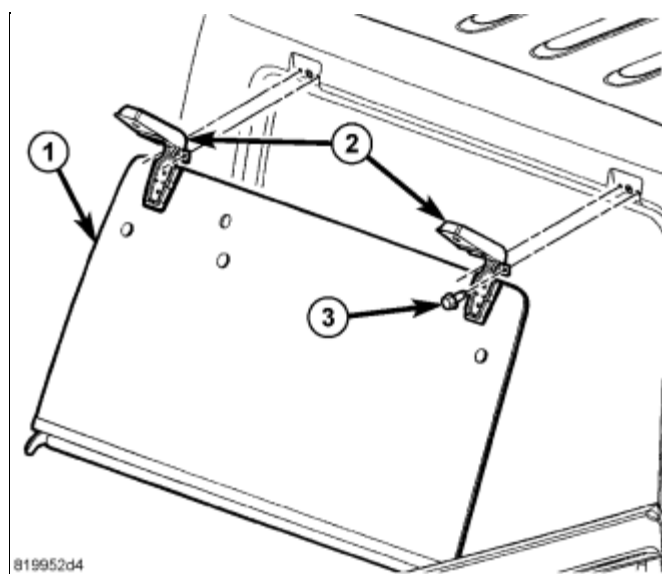


5. Using a trim stick C-4755 or equivalent, open the hinge trim covers (2).
6. Remove the bolts (3) and remove the backlite (1).

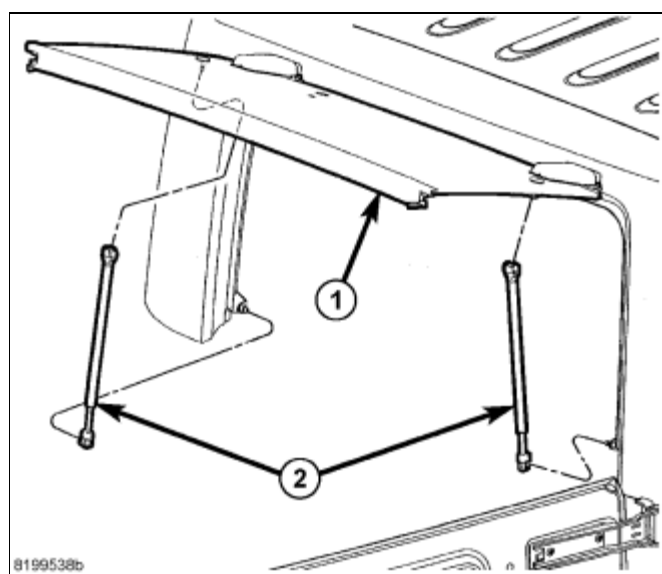
INSTALLATION



1. Position the backlite glass onto the hard top and install the bolts (3).
2. Tighten the bolts to 10 N·m (90 in. lbs.).
3. Position the trim covers (2) back onto the hinges and seat fully.



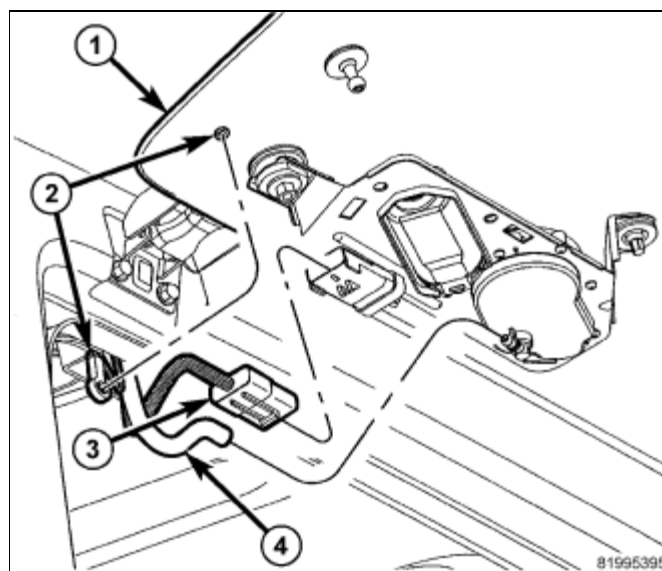
4. Install the glass support cylinders (2), (Refer to 23 - BODY/TAILGATE/SUPPORT CYLINDER - BACKLITE - INSTALLATION).



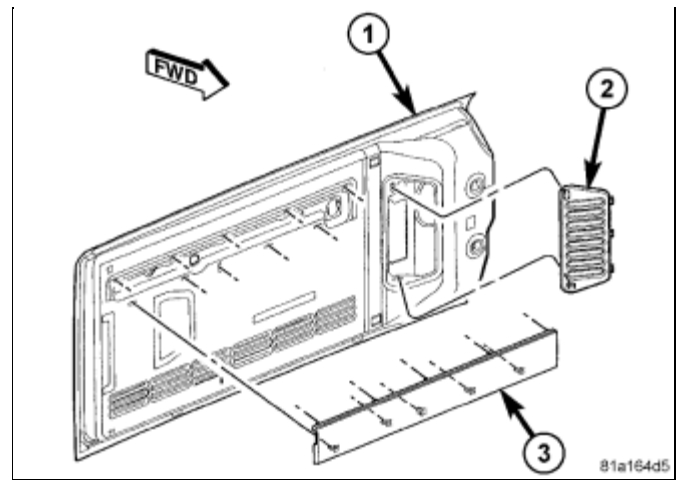
5. Connect the heated glass electrical connector (2).
6. Connect the rear wiper motor electrical connector (3).
7. Connect the washer hose (4).

HANDLE

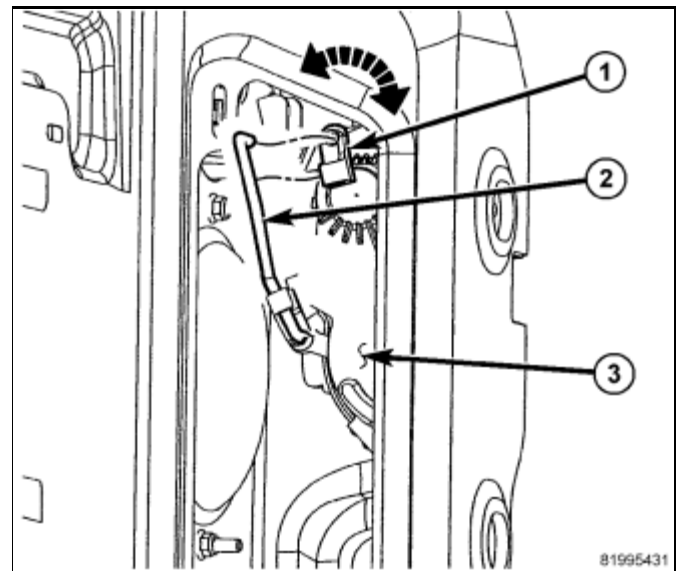
REMOVAL



1. Using a trim stick C-4755 or equivalent, remove the inner latch trim (2).

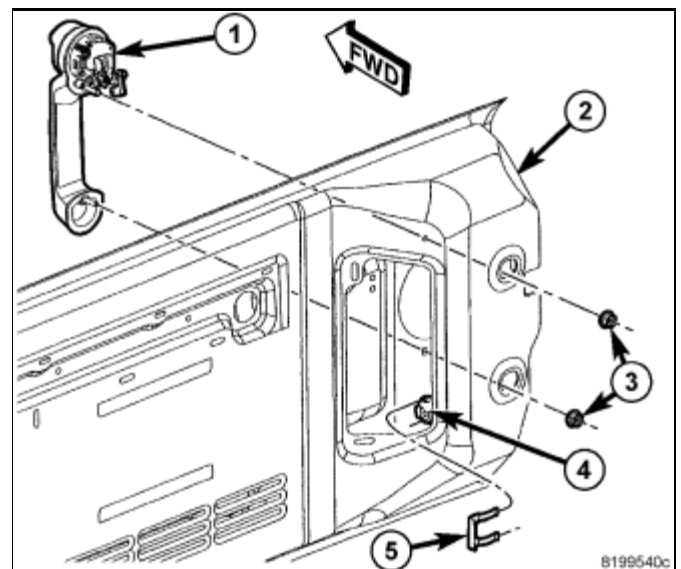


2. Disconnect the latch rod (2) from the handle (1).

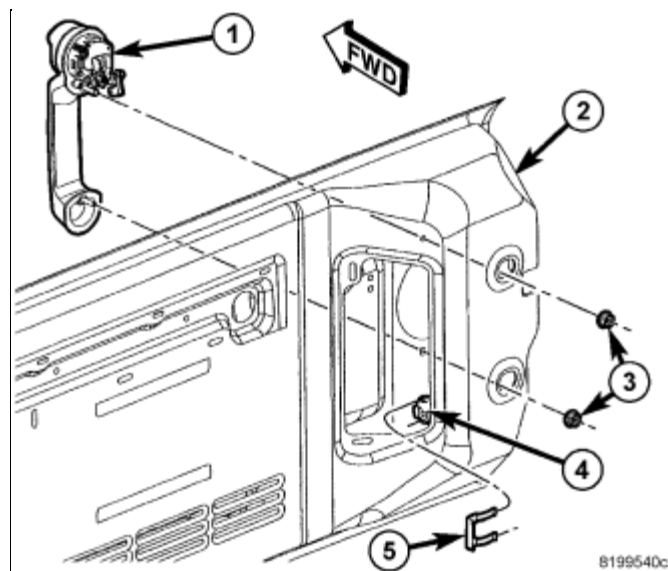


3. Remove the nuts (3) and remove the handle (1).

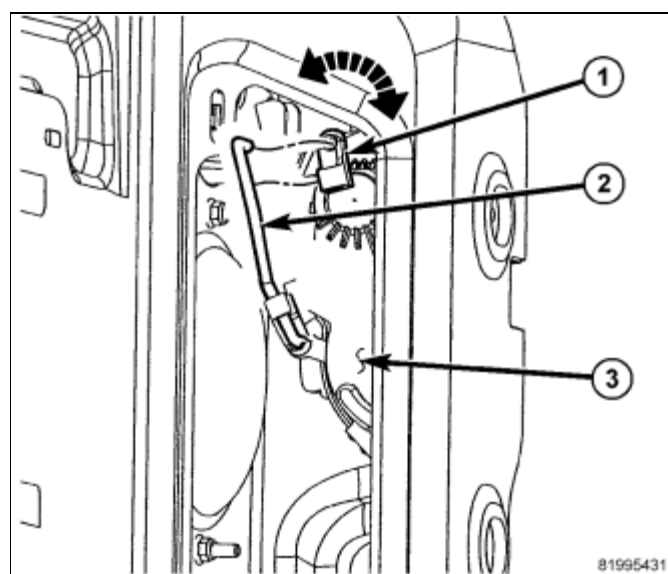
INSTALLATION



1. Install the handle (1) and install the nuts (3).
2. Tighten the nuts to 4.5 Nm (40 in. lbs.)



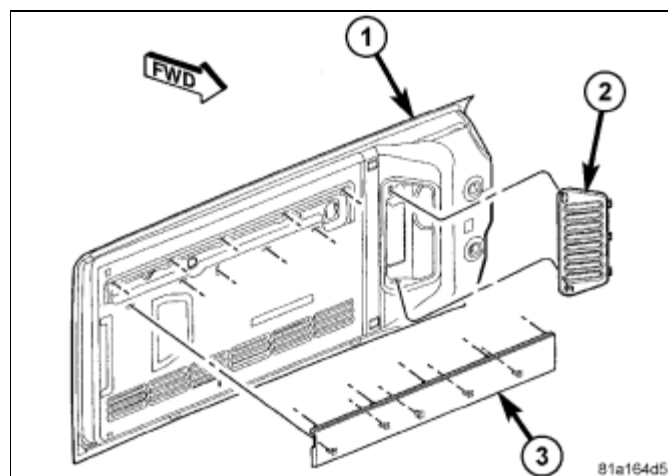
3. Connect the latch rod (2) to the handle (1).



4. Position the latch trim (2) onto the tailgate opening and seat fully.

HINGE

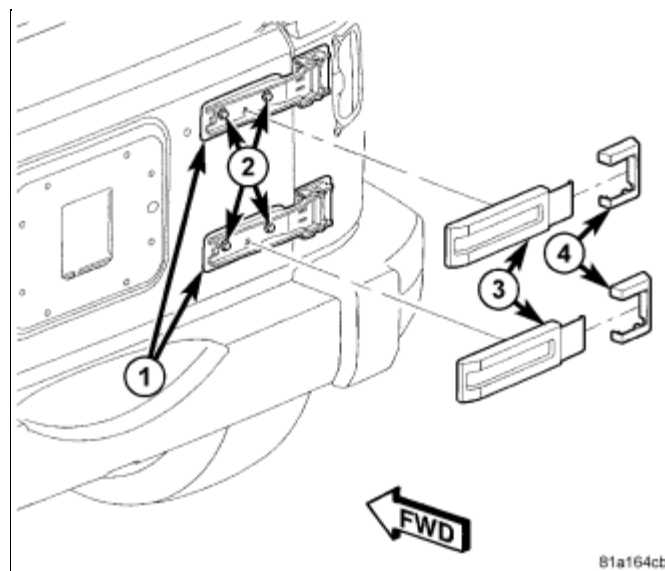
REMOVAL



NOTE: It is not necessary to remove the tailgate to replace the hinges if they are replaced one at a time.

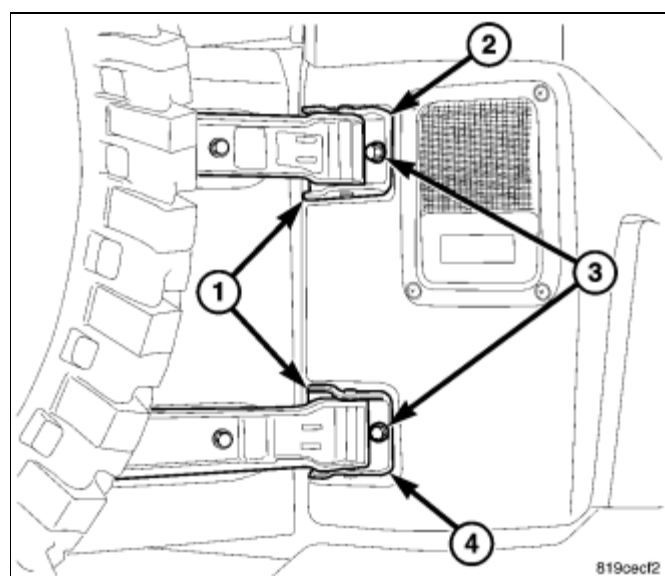
NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Using a trim stick C-4755 or equivalent, separate the hinge covers (3 and 4) from the hinges.
2. Using a grease pencil or equivalent, mark the position of the hinge (1) on the tailgate.
3. Remove the bolts (2) attaching the hinge to the tailgate.



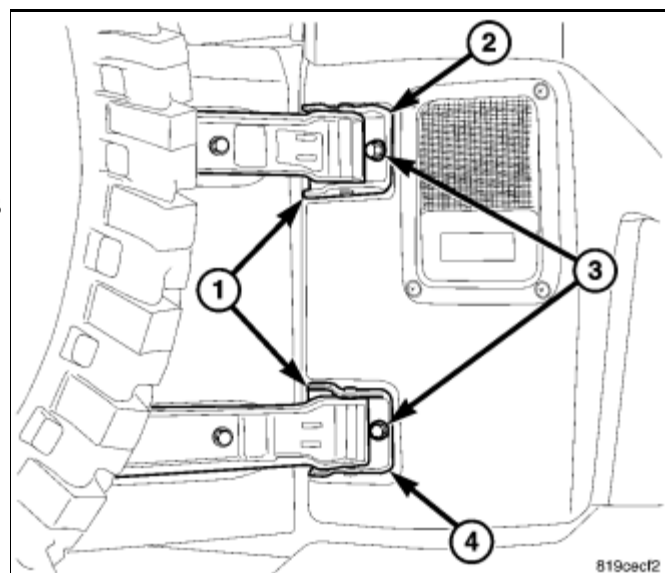
4. Remove the bolts (1 and 2) attaching the hinge to the body.

INSTALLATION

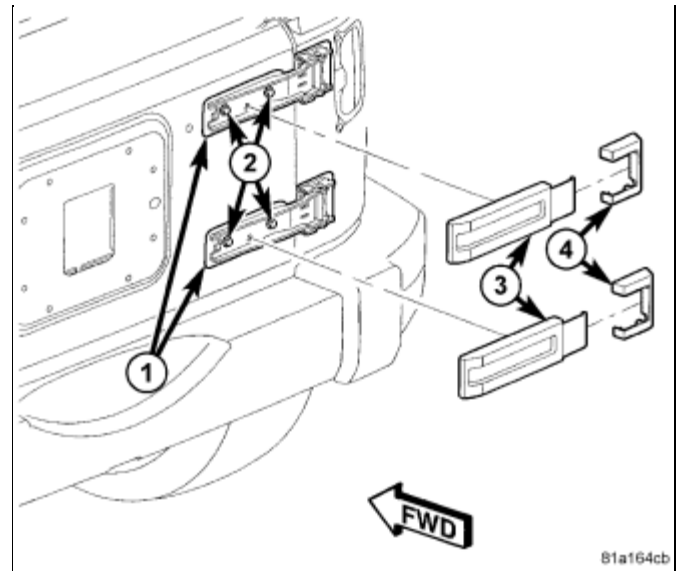


NOTE: A suitable body sealant should be used when removing or moving the hinges.

1. Align the hinges to the door using the reference marks made during the removal procedure and install the body bolts (1 and 2).



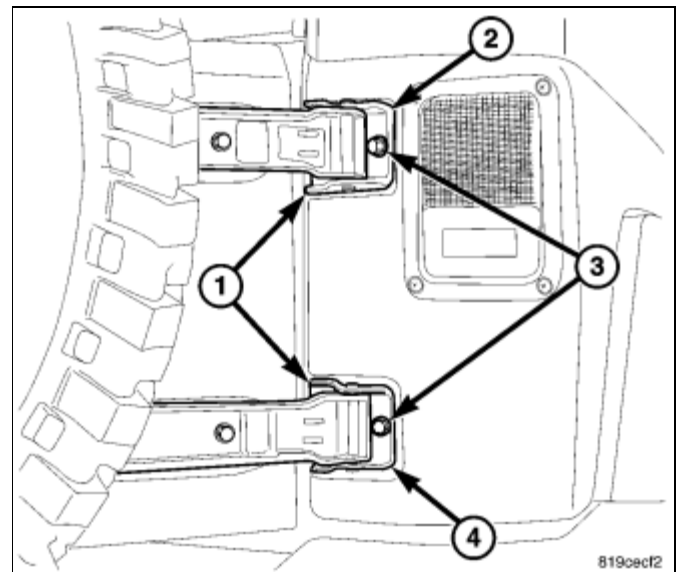
2. Install the bolts (2) and tighten to 20 N·m (15 ft. lbs.).



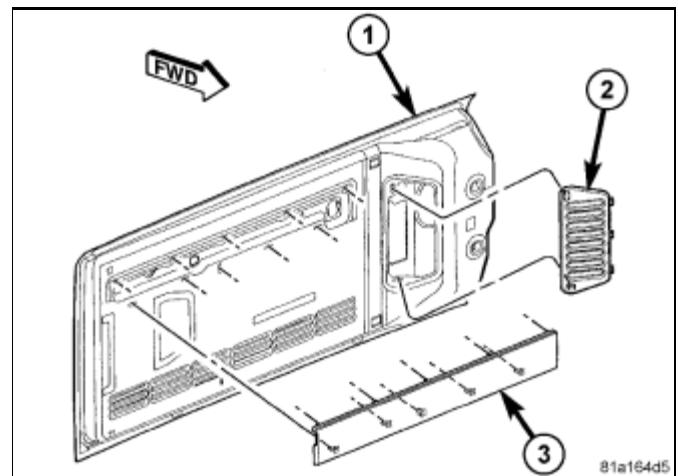
3. Tighten the body bolts to 26 N·m (19 ft. lbs.).
4. Adjust the tail gate if necessary, (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).

LATCH

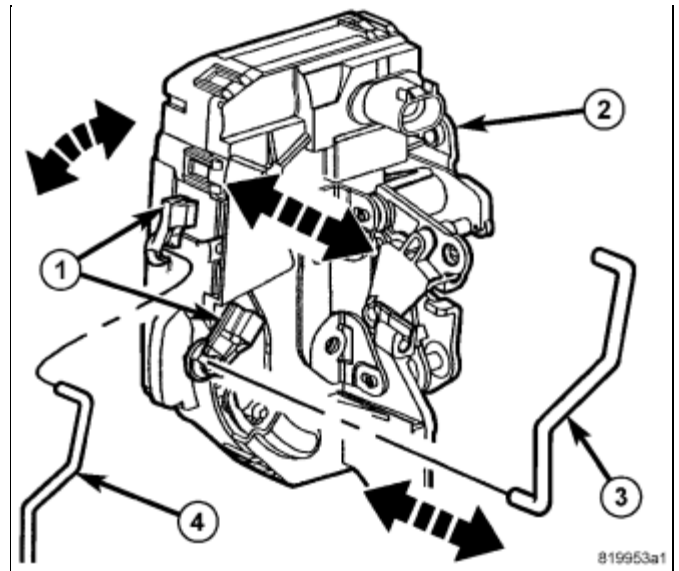
REMOVAL



1. Using a trim stick C-4755 or equivalent, remove the inner latch trim (2).

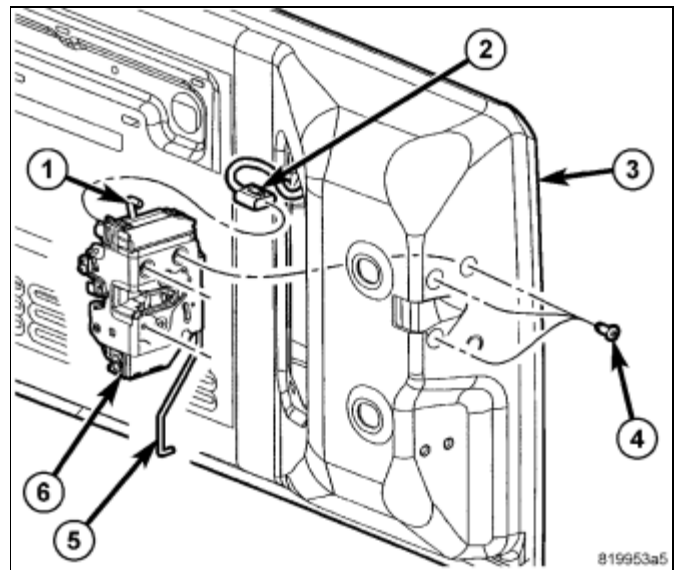


2. Release the rod clips (1) and disconnect the latch rods (3 and 4).

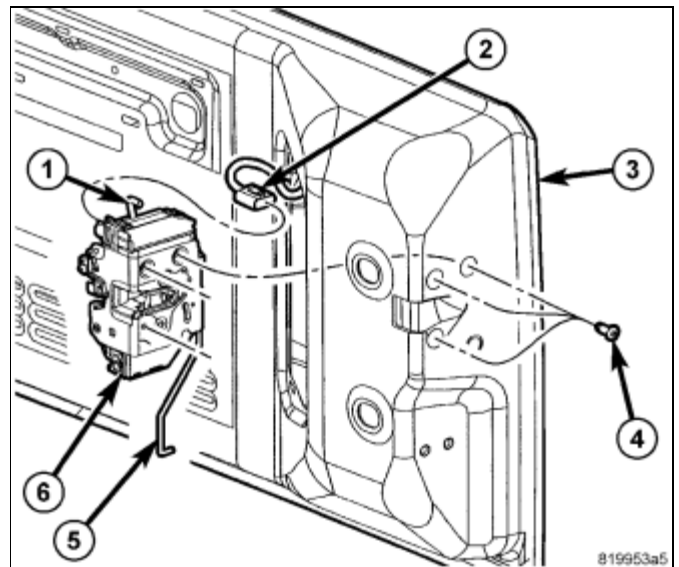


3. Remove the screws (4) and remove the latch (6).
4. Disconnect the electrical connector (2).

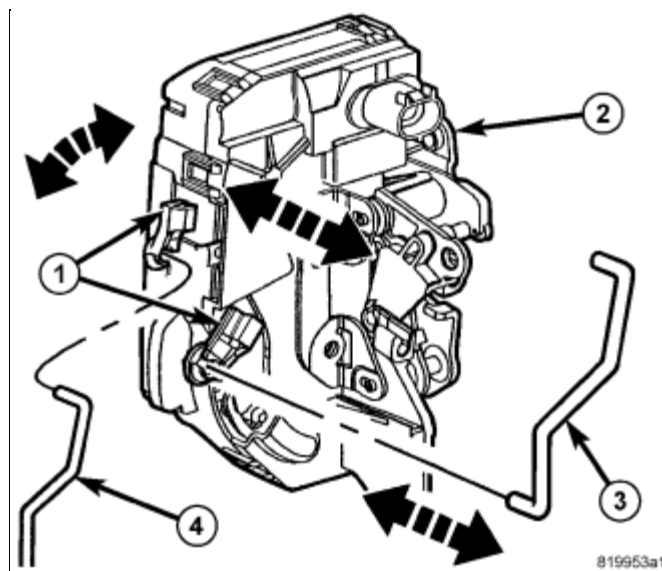
INSTALLATION



1. Connect the electrical connector (2) and install the latch into the tail gate (3).
2. Install the screws (4) and tighten to 8 N·m (71 in. lbs.).



3. Connect the latch rods (3 and 4) and secure the clips (1) fully.

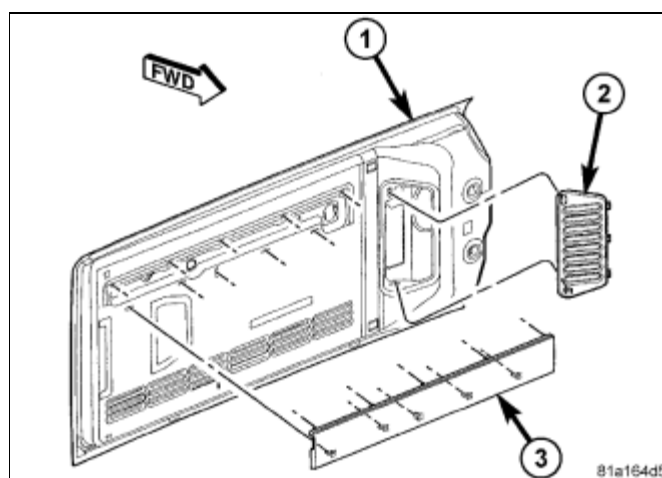


4. Position the latch trim (2) onto the tailgate opening and seat fully.

5. Adjust the latch if necessary, (Refer to 23 - BODY/TAILGATE/LATCH - ADJUSTMENTS).

ADJUSTMENTS

ADJUSTMENT



1. Locate access hole and remove the mylar tape (2) covering it.

2. Insert a 5/32" hex-wrench through hole and into adjustment screw (3). Loosen screw.

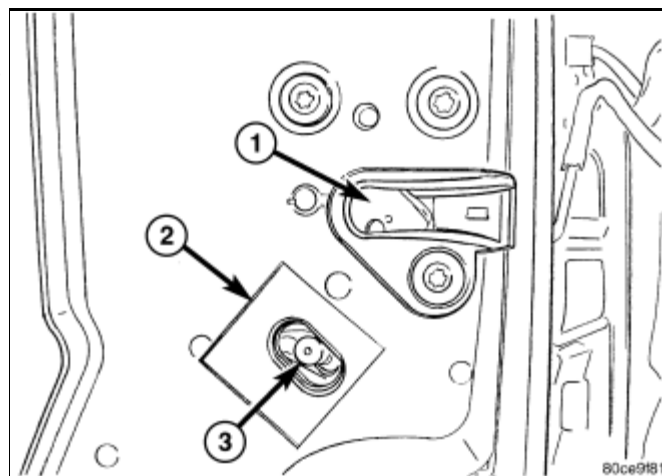
3. Operate outside handle several times to release any restriction because of mis-alignment.

4. Tighten adjustment screw to 3 N·m (30 in. lbs.).

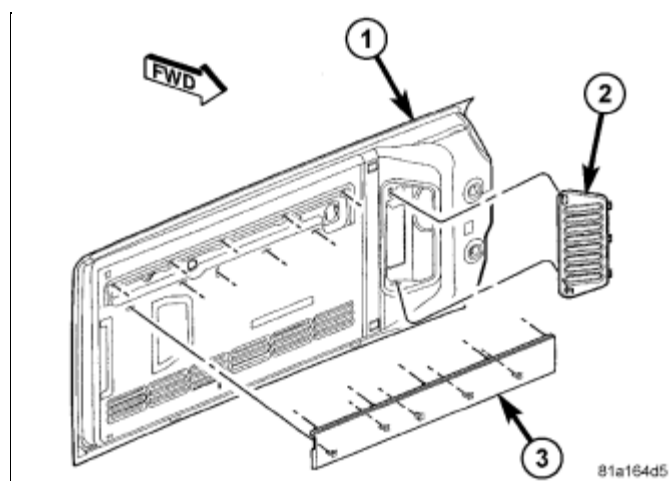
5. Test handle for proper operation.

LOCK CYLINDER

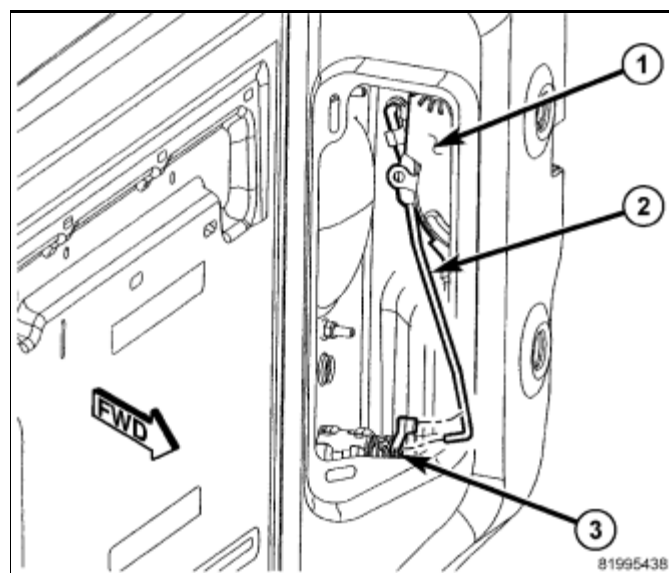
REMOVAL



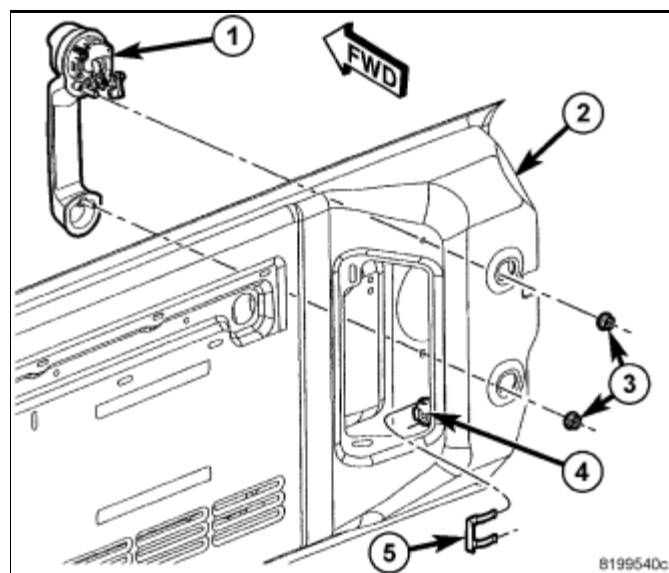
1. Using a trim stick C-4755 or equivalent, remove the inner latch trim (2).



2. Release the clip (3) and disconnect the lock rod (2).

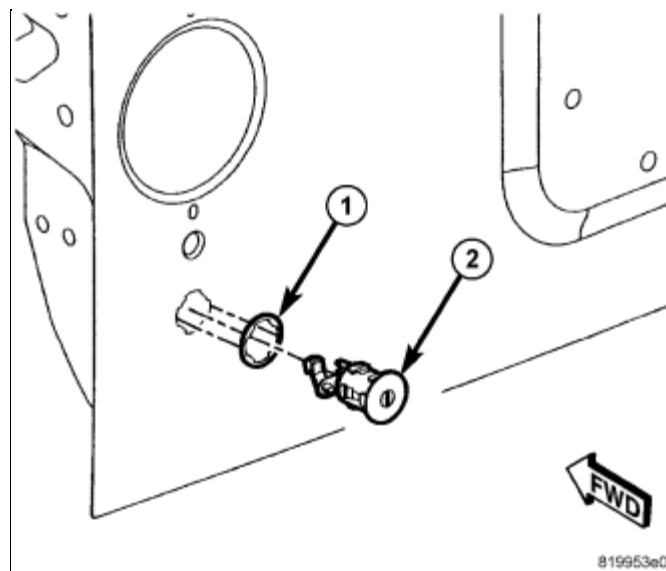


3. Remove the clip (5).

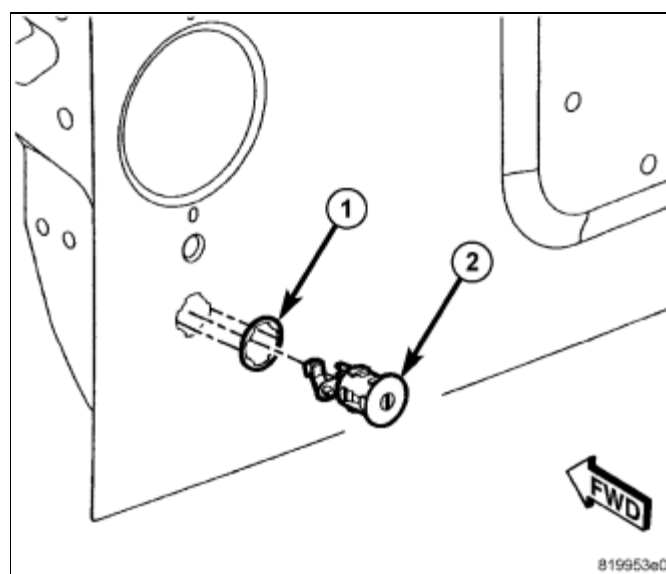


4. Remove the lock cylinder (2) and the gasket (1).

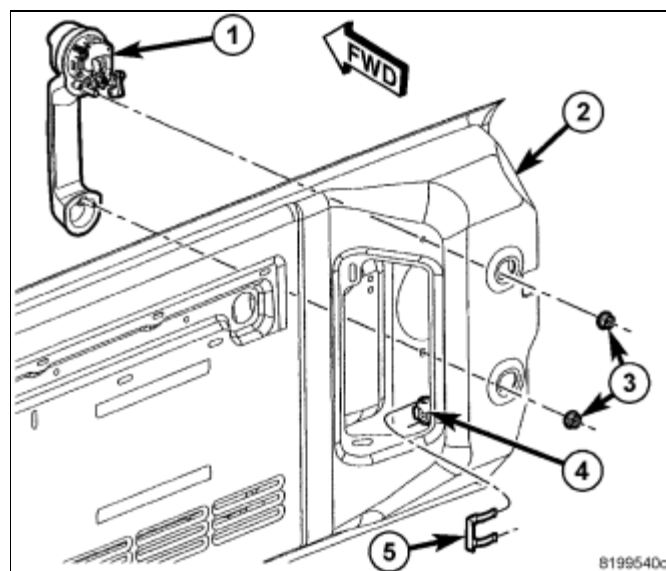
INSTALLATION



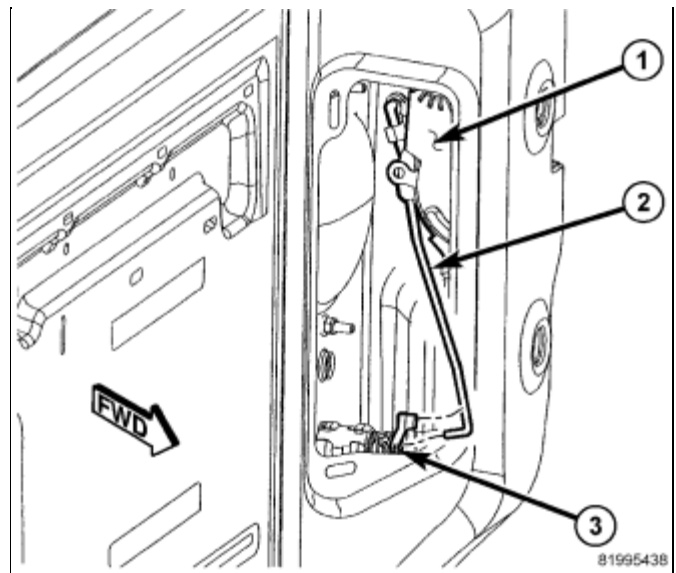
1. Install the gasket (1) and the lock cylinder (2).



2. Install the retaining clip (5) onto the lock cylinder (4).

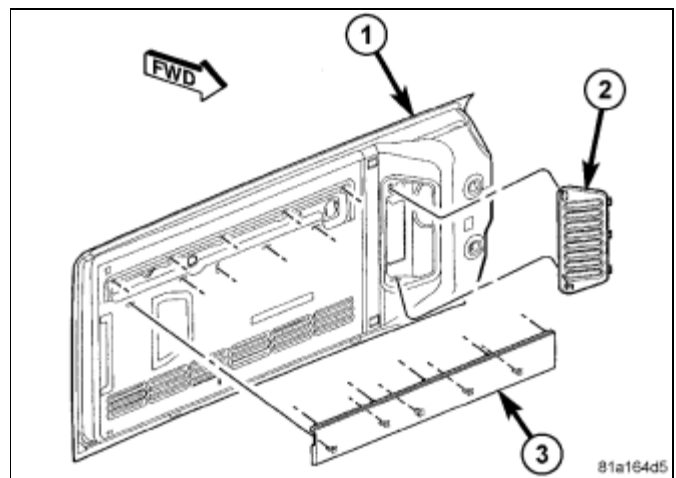


3. Connect the lock rod (2) to the lock cylinder and seat the clip (3) fully.

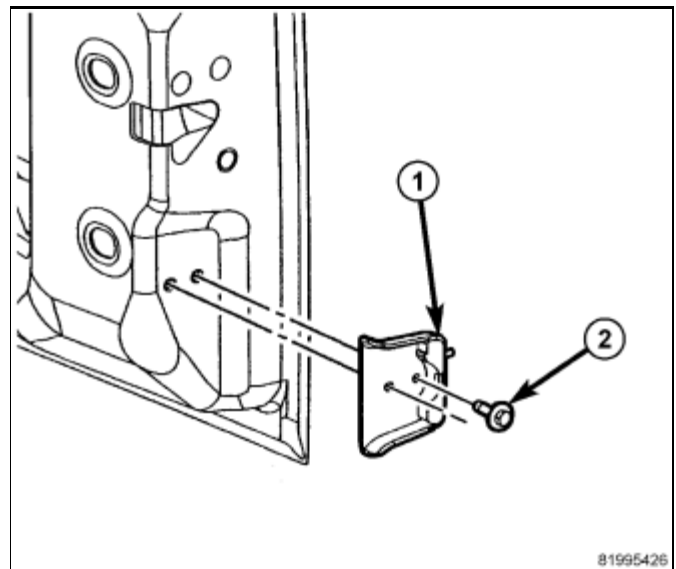


4. Position the latch trim (2) onto the tailgate opening and seat fully.

STRIKER REMOVAL



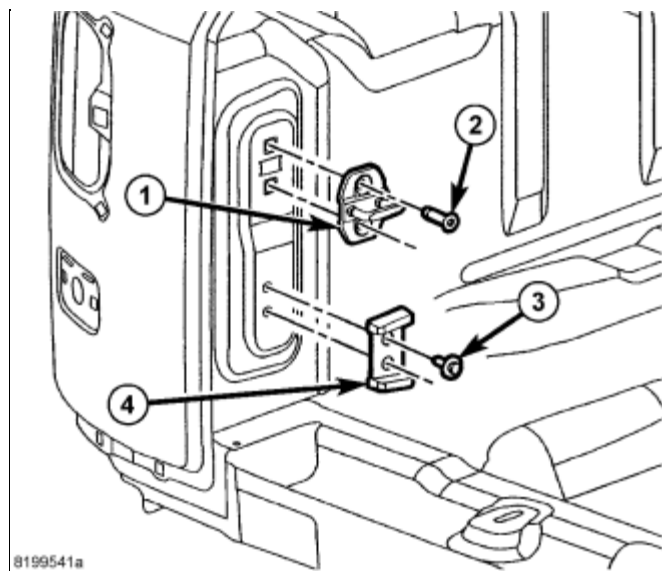
1. Open the tail gate.
2. Using a grease pencil or equivalent, mark the location of the stabilizer cup (1) and insert to aid installation.
3. Remove the bolts for the stabilizer cup and remove the cup.



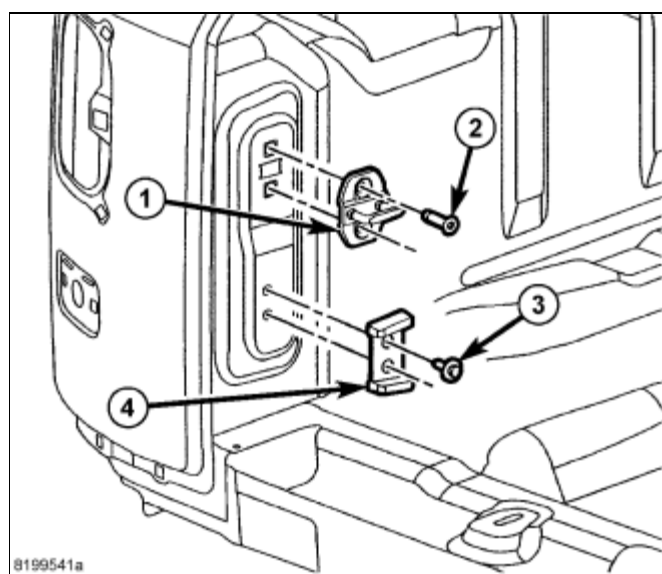
4. Using a grease pencil or equivalent, mark the position of the striker (1) to aid installation.

5. Remove the bolts (2) attaching the striker (1) to the body.
6. Remove the bolts (3) for the insert (4) and remove the insert.

INSTALLATION



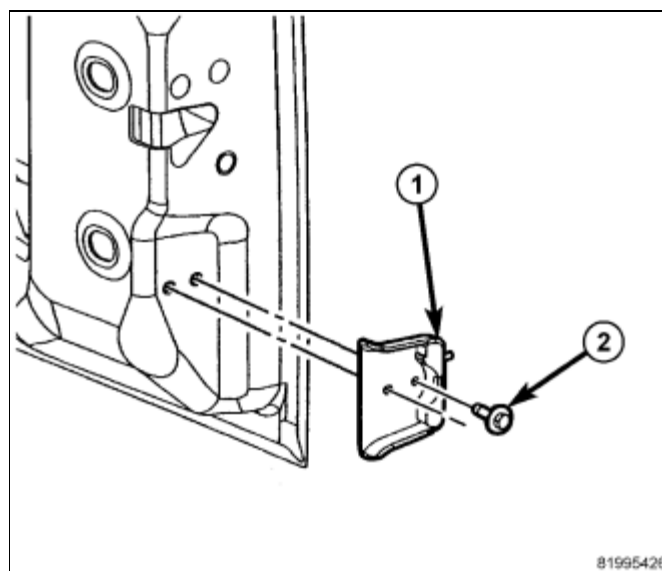
1. Install the striker and install the bolts.
2. Adjust the striker (1) and tighten the bolts (2) to 28 N·m (21 ft. lbs.), (Refer to 23 - BODY/TAILGATE/LATCH STRIKER - ADJUSTMENTS).
3. Adjust the tail gate if necessary, (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS).
4. Install the stabilizer insert (4) with the narrow end toward the rear of the vehicle and install the bolts (3).
5. Tighten the bolts to 10 N·m (90 in. lbs.).



6. Install the stabilizer cup (1) and loosely install the bolts.
7. Adjust the stabilizer (1) and tighten the bolts (2) to 10 N·m (90 in. lbs.), (Refer to 23 - BODY/TAILGATE/LATCH STRIKER - ADJUSTMENTS).

ADJUSTMENTS

ADJUSTMENT



Striker

NOTE: Stabilizer insert must be off when adjusting the striker.

1. Remove the stabilizer insert, (Refer to 23 - BODY/TAILGATE/LATCH STRIKER - REMOVAL)
2. Loosen the striker bolts.
3. Adjust the striker up/down so that it is centered within the latch opening.
4. Adjust the striker fore/aft so the swing gate is under flush to the body -0.5 mm (+/- 1.0 mm).
5. Adjust the striker cross-car engagement to the latch by adding 2.0 mm shims as necessary.

NOTE: Make sure the striker is not twisted within the latch opening. Striker should be parallel to the opening.

6. Tighten the striker bolts to 28 N·m (21 ft. lbs.).
7. Install the stabilizer insert, (Refer to 23 - BODY/TAILGATE/LATCH STRIKER - INSTALLATION).

Stabilizer

1. Adjust the insert up/down so that it is centered within the stabilizer cup.
2. Adjust the insert for/aft so the swing gate is 1.0 mm over flush to the D-pillar when the insert contacts the rubber bumper in the stabilizer cup.
3. Open the tail gate and tighten the bolts to 10 N·m (90 in. lbs.).

NOTE: Make sure the stabilizer cup and insert are parallel to each other and not twisted.

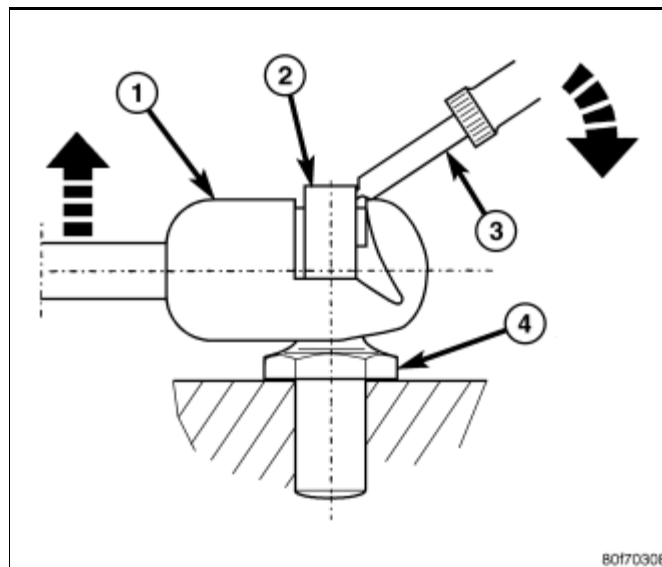
4. Close the tail gate and grab the beltline. Confirm minimal for/aft movement and that closing effort is not excessive. Readjust as required.

SUPPORT CYLINDER - BACKLITE

REMOVAL

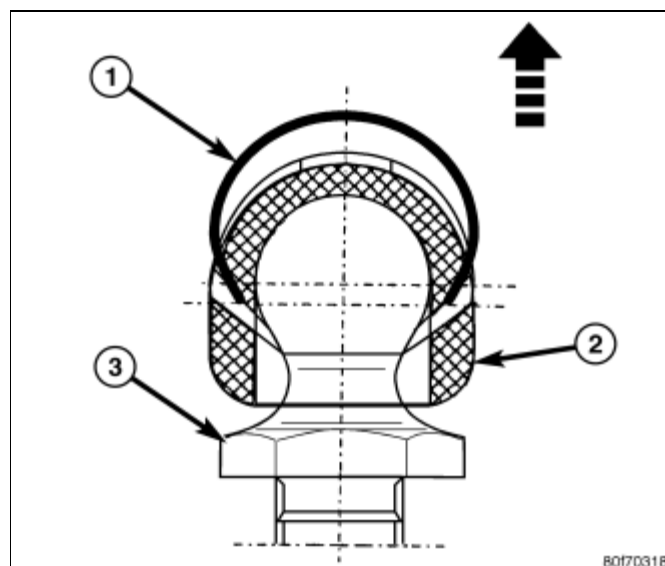
WARNING: Do not remove the liftgate support cylinders with the liftgate closed. The support cylinder pistons are operated by high pressure gas and could cause personal injury and/or vehicle damage if they are removed with the pistons compressed (liftgate closed). Once removed, do not attempt to disassemble or repair the support cylinders.

1. Open the backlite and support.
2. Using a small flat bladed tool (3), or equivalent, release the retaining clips (2) while pulling the ball socket (1) away from the ball stud (4).



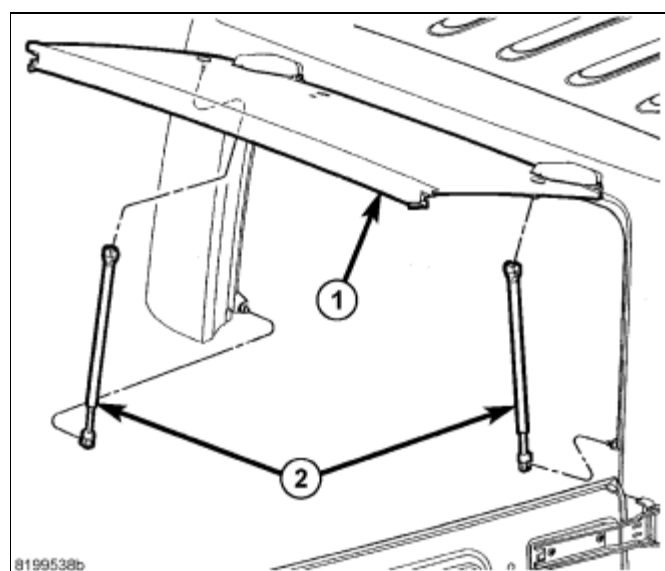
NOTE: Lift the clips (1) only enough to release the ball studs (3).

3. Remove the support cylinder from the upper and lower ball studs (3).



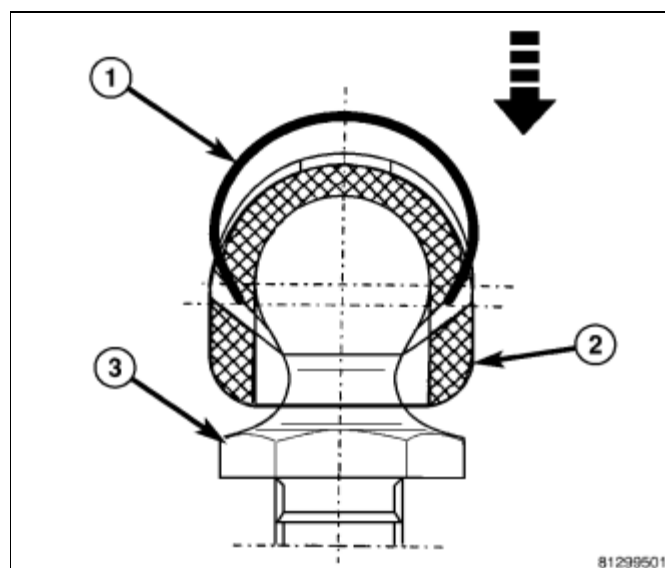
4. Remove the support cylinders (2) from the backlite (1).

INSTALLATION



WARNING: Do not remove the liftgate support cylinders with the backlite closed. The support cylinder pistons are operated by high pressure gas and could cause personal injury and/or vehicle damage if they are removed with the pistons compressed (backlite closed). Once removed, do not attempt to disassemble or repair the support cylinders.

1. Make sure the retaining clips (1) are seated into the ball socket (2) fully.
2. Install the support cylinder (2) over the ball studs (3) with the thin end connected to the body and the retaining clips snapping into place.



SEATS

SEATS

WARNING

WARNINGS - RESTRAINT SYSTEM

WARNING: To avoid serious or fatal injury on vehicles equipped with the Supplemental Restraint System (SRS), never attempt to repair the electrically conductive circuits or wiring components related to the SRS. Such repairs can compromise the conductivity and current carrying capacity of those critical electrical circuits, which may cause SRS components not to deploy when required, or to deploy when not required. Any wire harness containing broken, cut, burned or otherwise damaged electrically conductive SRS wiring, terminals or connector components must be removed and replaced with an entire new wire harness. Only minor cuts or abrasions of wire and terminal insulation where the conductive material has not been damaged, or connector insulators where the integrity of the latching and locking mechanisms have not been compromised may be repaired using appropriate methods.

WARNING: To avoid serious or fatal injury during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or ineffective buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or ineffective seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury on vehicles equipped with seat airbags, disable the Supplemental Restraint System (SRS) before attempting any Occupant Restraint Controller (ORC) diagnosis or service. The ORC contains a rollover sensor, which enables the system to deploy the seat airbags in the event of a vehicle rollover event. If an ORC is accidentally rolled during service while still connected to battery power, the seat airbags will deploy. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, disable the Supplemental Restraint System (SRS) before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the SRS. Failure to take the proper precautions could result in accidental airbag deployment.

WARNING: To avoid serious or fatal injury on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the Occupant Restraint Controller (ORC). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the Supplemental Restraint System (SRS) circuits and components.

WARNING: To avoid serious or fatal injury, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy

metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 17.24 kPa (2500 psi).

WARNING: To avoid serious or fatal injury when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.

WARNING: To avoid serious or fatal injury, replace all Supplemental Restraint System (SRS) components only with parts specified in the DaimlerChrysler Mopar® Parts Catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.

WARNING: To avoid serious or fatal injury, the fasteners, screws, and bolts originally used for the Supplemental Restraint System (SRS) components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the SRS. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar® Parts Catalog.

WARNING: To avoid serious or fatal injury when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.

CUSHION/COVER-CUSHION - FRONT

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - FRONT - DESCRIPTION).
3. Remove the front seat, (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
4. Remove the lift handle, if equipped.
5. Separate the J-straps from the seat cushion frame and remove the seat cushion and cover.
6. Remove the hog rings and separate the cover from the cushion.

INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - FRONT - DESCRIPTION).
3. Install the seat cushion cover onto the cushion and install new hog rings.
4. Install the cushion onto the seat cushion frame and connect the J-straps.
5. Install the front seat, (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION).

CUSHION/COVER-CUSHION - REAR

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING).
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - REAR - DESCRIPTION).
3. Remove the rear seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL).

Two Door

1. Remove the seat back frame to seat cushion assembly bolts and separate the seat back assembly.
2. Separate the J-straps and remove the cover and cushion assembly.
3. Remove the hog rings and separate the cushion and cover.

Four Door

1. Separate the rear seat sections.
2. Remove the seat cushion pivot bolts and separate the cushion from the back assembly.
3. Release the J-straps and separate the cushion assembly from the frame.
4. Remove the hog rings and separate the cover from the cushion.

INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING).
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - REAR - DESCRIPTION).

Two Door

1. Position the cover over the cushion and attach with new hog rings.
2. Position the seat cushion over the seat frame and fasten the J-straps.
3. Install the seat cushion onto the seat back frame and install the cushion assembly bolts.
4. Tighten the bolts to 50 N·m (37 ft. lbs.).
5. Install the seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).

Four Door

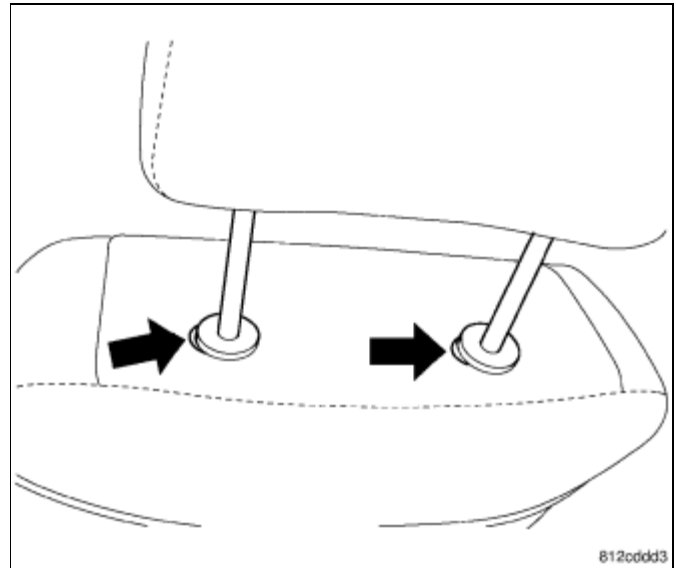
1. Position the cover over the cushion and attach with new hog rings.
2. Position the seat cushion over the seat frame and fasten the J-straps.
3. Install the seat cushion assembly onto the seat back assembly and install the pivot bolts.
4. Tighten the bolts to 25 N·m (18.5 ft. lbs.)
5. Position the seat halves back together.
6. Install the seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).

CUSHION/COVER-SEAT BACK - FRONT

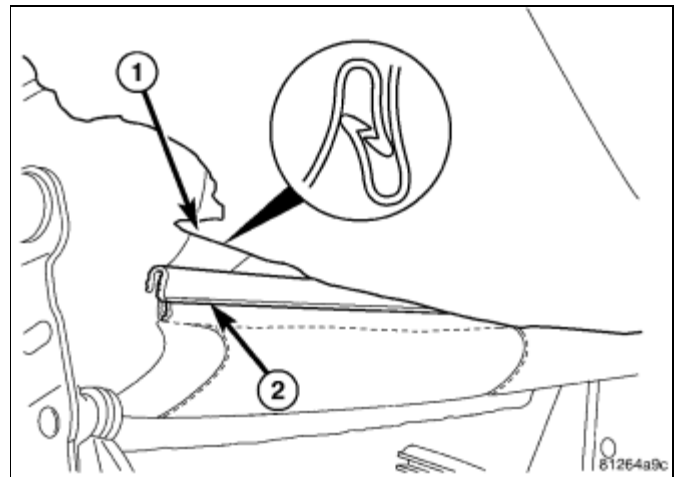
REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - FRONT - DESCRIPTION).
3. Remove the front seat, (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
4. Remove the seat recliner easy entry levers, if equipped.
5. Position aside the seat back cover and remove the seat back assembly bolts.
6. If equipped, disconnect the electrical connectors and remove the seat back.

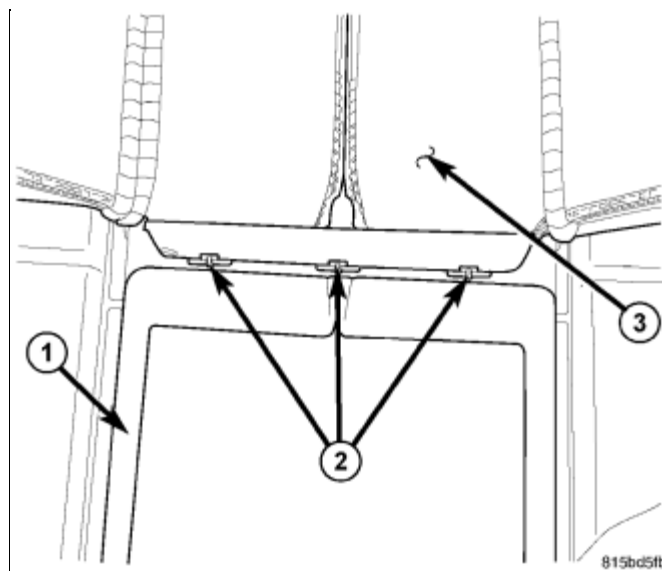
7. Push in the buttons on both headrest sleeves, pull the headrest up and remove.



8. Separate the J-straps (1 & 2) and pull cover up over frame.
9. Unzip the cover zippers.
10. On vehicles equipped with seat air bags, remove the air bag, (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT AIRBAG - REMOVAL).



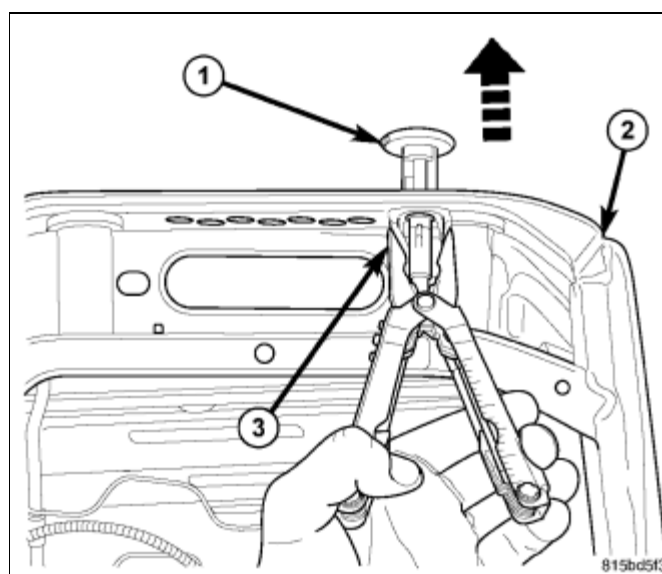
11. Cut off the hog rings (2) attaching the cover (3) to the cushion (1).



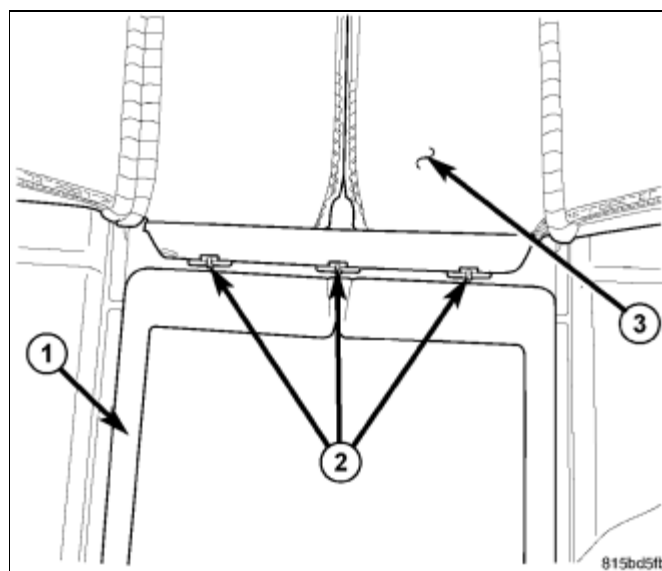
12. Squeeze the locking tab (3) and remove the headrest sleeves (1) and remove the cover.

INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - FRONT - DESCRIPTION).

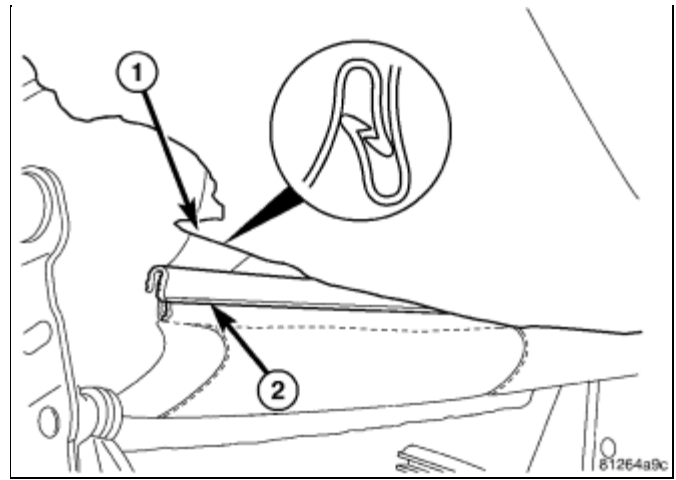


3. Position the seat back cover over the seat back frame.
4. Position the seat back cushion on the frame and position the cover over the cushion.
5. Attach the seat cover (3) to the seat back cushion (1) and install new hog rings.



6. On vehicles equipped with a seat airbag, install the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT AIRBAG - INSTALLATION).

7. Zip the rear cover zippers and connect the J-straps (1 & 2).



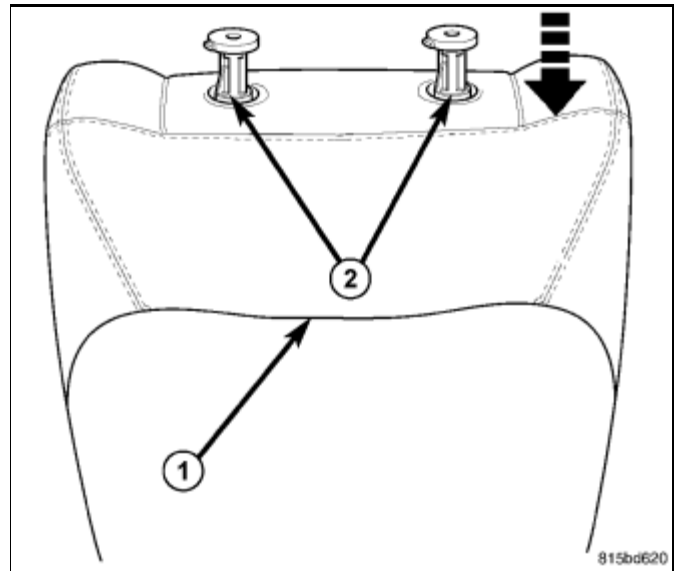
8. Position the headrest sleeves (2) and seat into the seat back (1) frame fully.

9. Position the seat back onto the seat cushion assembly and connect the electrical connectors if equipped.

10. Install the seat back assembly bolts and tighten to 47 N·m (34.5 ft. lbs.).

11. Connect the electrical connectors, if equipped.

12. Install the front seat, (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION)



CUSHION/COVER-SEAT BACK - REAR

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING).

2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - REAR - DESCRIPTION).

3. Remove the rear seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL).

4. Remove the headrest, (Refer to 23 - BODY/SEATS/HEADREST - REMOVAL).

Two Door

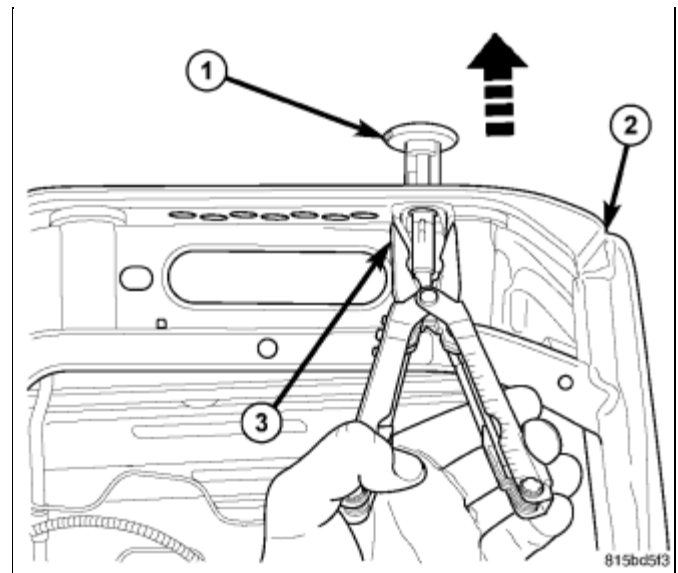
1. Remove the back frame to cushion bolts and separate the seat back assembly.

2. Separate the J-straps and unzip the cover.

3. Squeeze the locking tab (3) and remove the headrest sleeves (1).

4. Remove the seat cushion from the seat back frame.

5. Remove the hog rings and separate the cover from the cushion.



Four Door

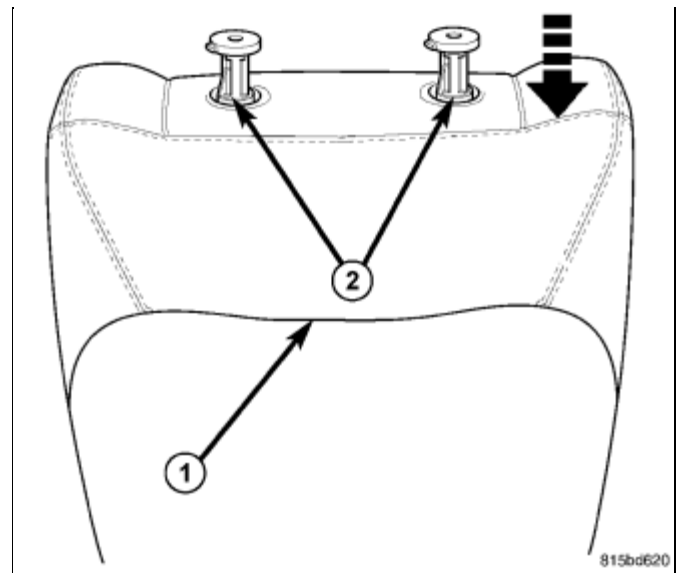
1. Separate the seat halves.
2. Remove the seat handle bezel.
3. Remove the screws and remove the release handle.
4. Remove the seat cushion pivot bolts and remove the seat cushion from the seat back assembly.
5. Remove the inner and outer latch covers.
6. Remove the seat belt bezel.
7. Separate the J-straps and unzip the cover.
8. Remove the seat cushion from the seat back frame.
9. Remove the hog rings and separate the cover from the cushion.

INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING).
2. For appropriate seat configuration illustrations, (Refer to 23 - BODY/SEATS/SEAT - REAR - DESCRIPTION).

Two Door

1. Position the cover over the cushion and attach with new hog rings.
2. Position the seat back cushion over the seat back frame, zip the cover and fasten the J-straps.
3. Seat the headrest sleeves (1) into the seat back fully.
4. Install the seat back assembly onto the seat cushion assembly and install the cushion bolts.
5. Tighten the bolts to 50 N·m (37 ft. lbs.).



Four Door

1. Position the cover over the cushion and attach with new hog rings.
2. Position the seat back cushion over the seat back frame, zip the cover and fasten the J-straps.
3. Install the seat belt bezel.
4. Install the inner and outer latch covers.
5. Install the seat cushion assembly onto the seat back assembly and install the pivot bolts.
6. Tighten the bolts to 25 N·m (18.5 ft. lbs.)
7. Position the release handle back and install the screws.
8. Install the release handle bezel.
9. Position the seat halves back together.

Two and Four Door

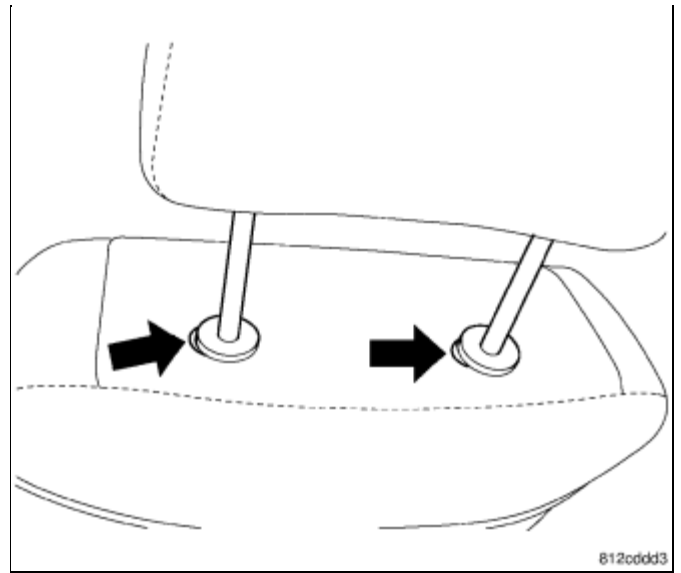
1. Install the seat, (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION).
2. Install the headrest, (Refer to 23 - BODY/SEATS/HEADREST - INSTALLATION).

HEADREST - FRONT AND TWO DOOR REAR

REMOVAL

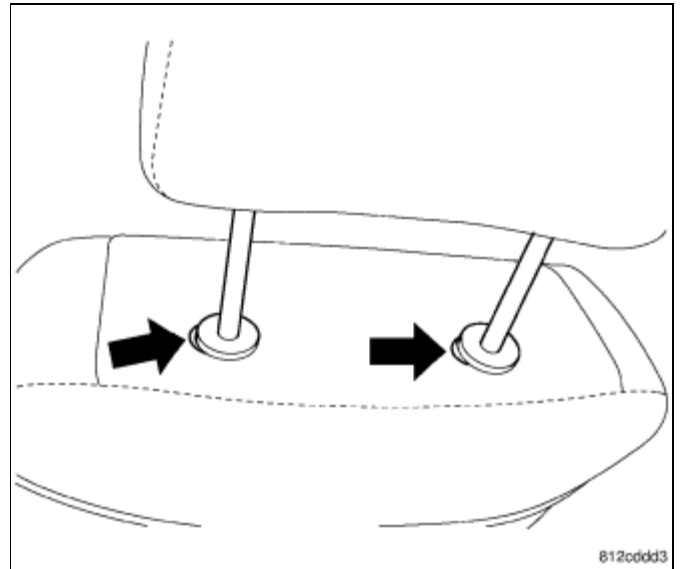
1. Push in the buttons on both headrest sleeves, pull the headrest up and remove.

INSTALLATION

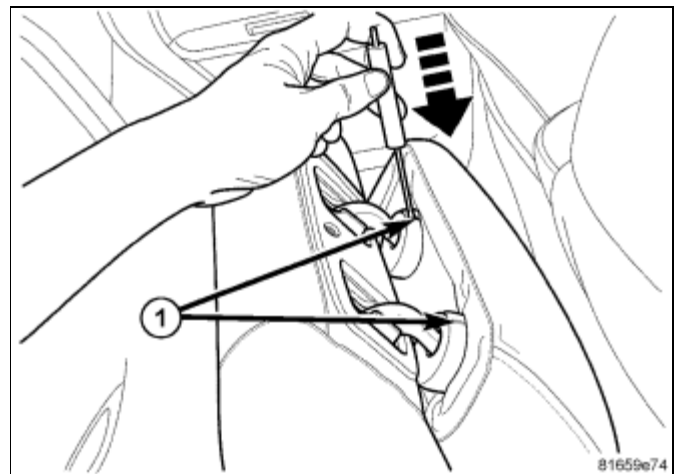


1. Press the headrest sleeve release buttons and install the headrest.

HEADREST - REAR FOUR DOOR REMOVAL

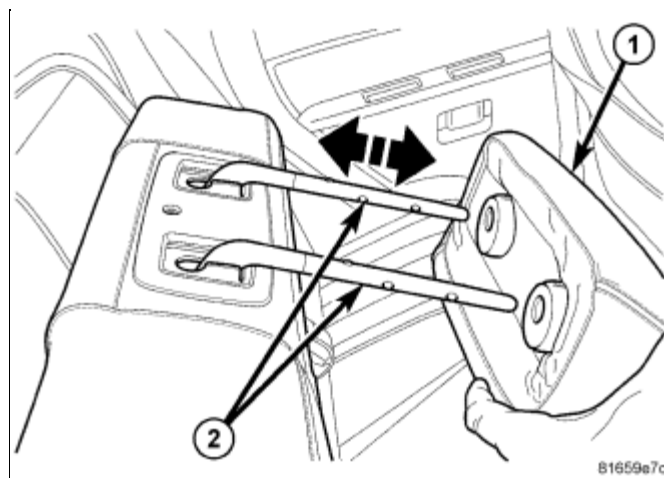


1. Release the seat back and fold forward far enough to release the headrest.
2. Using a small flat bladed tool or equivalent, release the headrest by pressing the tool into the slots (1) on the trim caps.



3. Remove the headrest (1) from the headrest bracket and hinge (2).

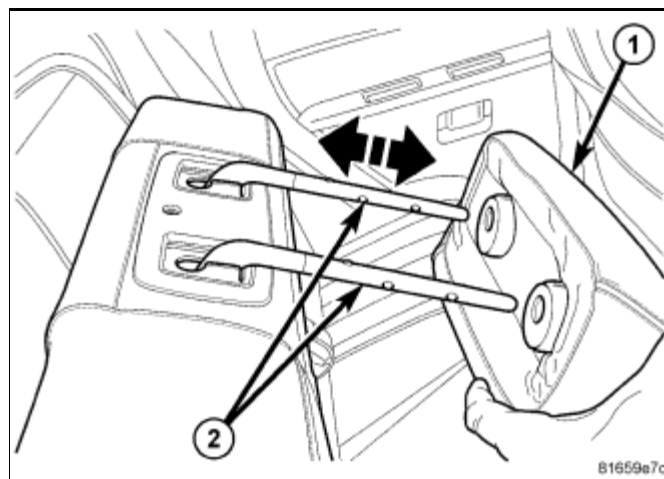
INSTALLATION

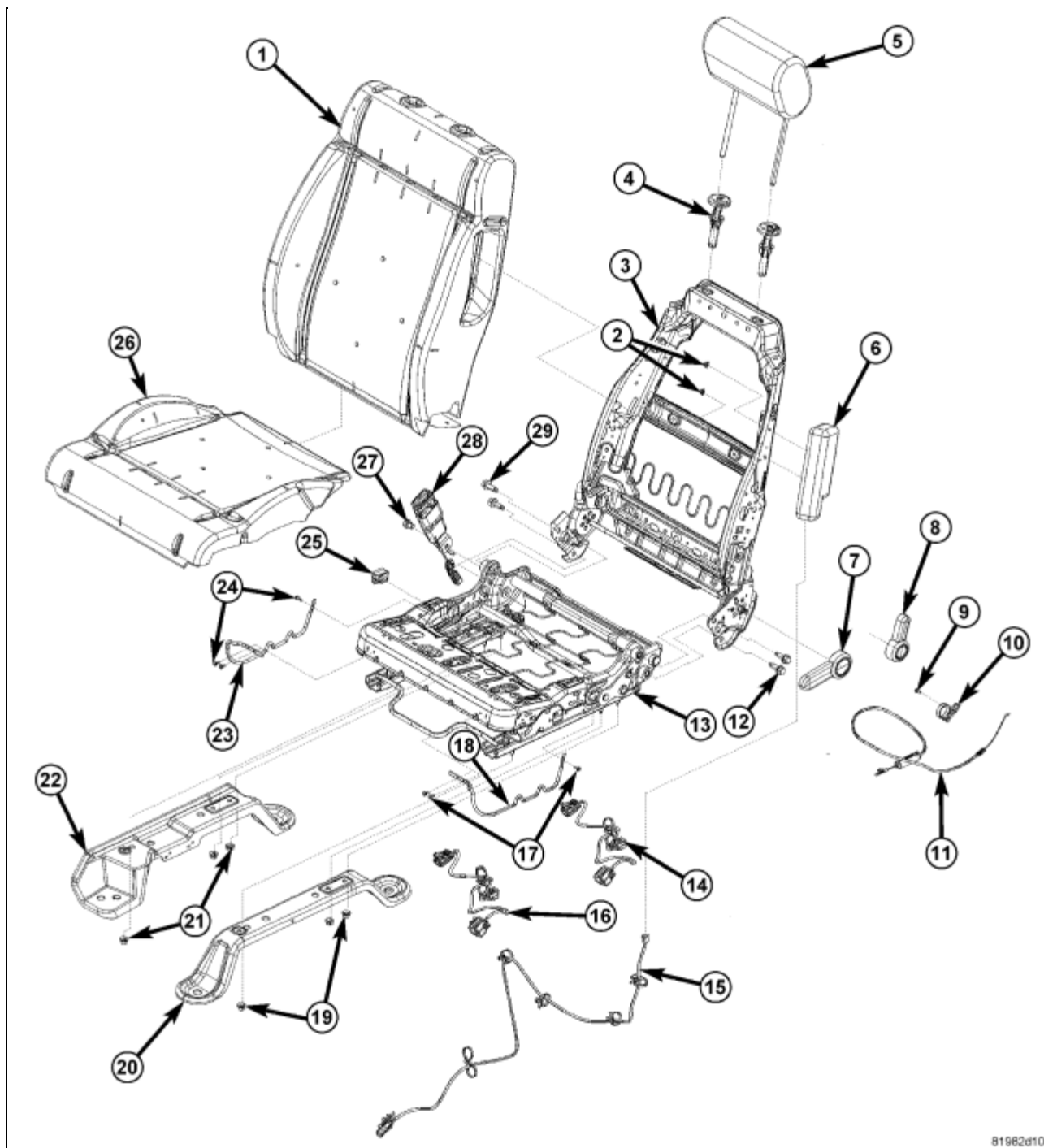


1. Position the headrest (1) onto the bracket and hinge assembly (2) and seat the headrest fully.

SEAT - FRONT

DESCRIPTION



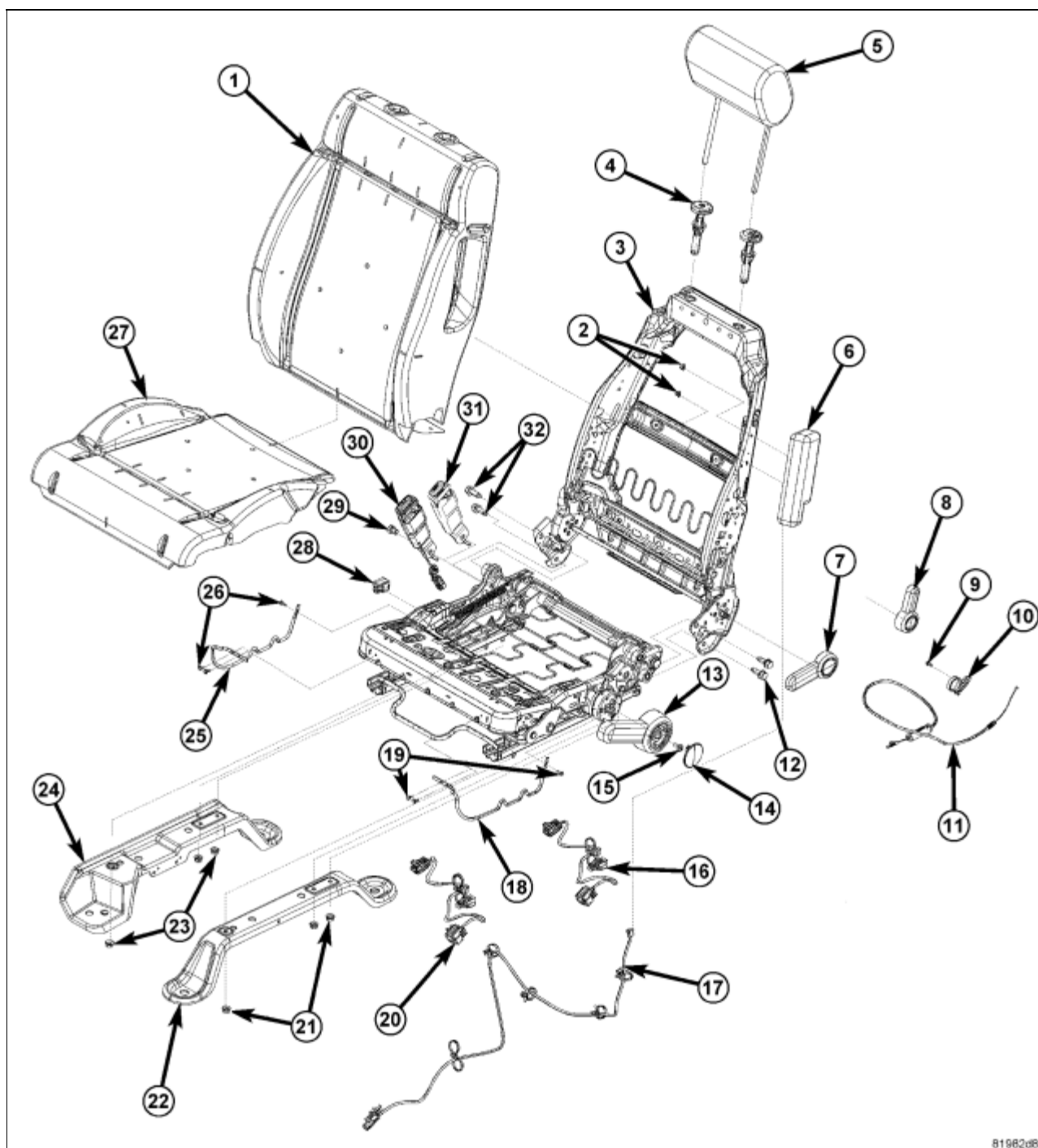


81982d10

LEFT HAND SEAT – 2 WAY ADJUSTER

1 - SEAT BACK CUSHION/COVER
2 - AIR BAG NUTS 7 N·m (5 ft. lbs.)
3 - SEAT BACK FRAME
4 - HEADREST SLEEVES

5 - HEADREST
6 - SEAT AIR BAG
7 - RECLINER HANDLE
8 - EASY ENTRY HANDLE
9 - SCREW
10 - EASY ENTRY CABLE ROUTER
11 - EASY ENTRY CABLE
12 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
13 - SEAT CUSHION FRAME
14 - WIRE HARNESS
15 - SEAT AIR BAG HARNESS
16 - WIRE HARNESS
17 - RIVETS
18 - TRIM ATTACHMENT WIRE
19 - RISER NUTS 28 N·m (20.5 ft. lbs.)
20 - OUTBOARD RISER
21 - RISER NUTS 28 N·m (20.5 ft. lbs.)
22 - INBOARD RISER
23 - TRIM ATTACHMENT WIRE
24 - RIVETS
25 - SEAT TRACK POSITION SENSOR
26 - SEAT CUSHION/COVER
27 - SEAT BELT BUCKLE BOLT 50 N·m (37 ft. lbs.)
28 - SEAT BELT BUCKLE
29 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)



81982d84

LEFT HAND SEAT – 4 WAY ADJUSTER

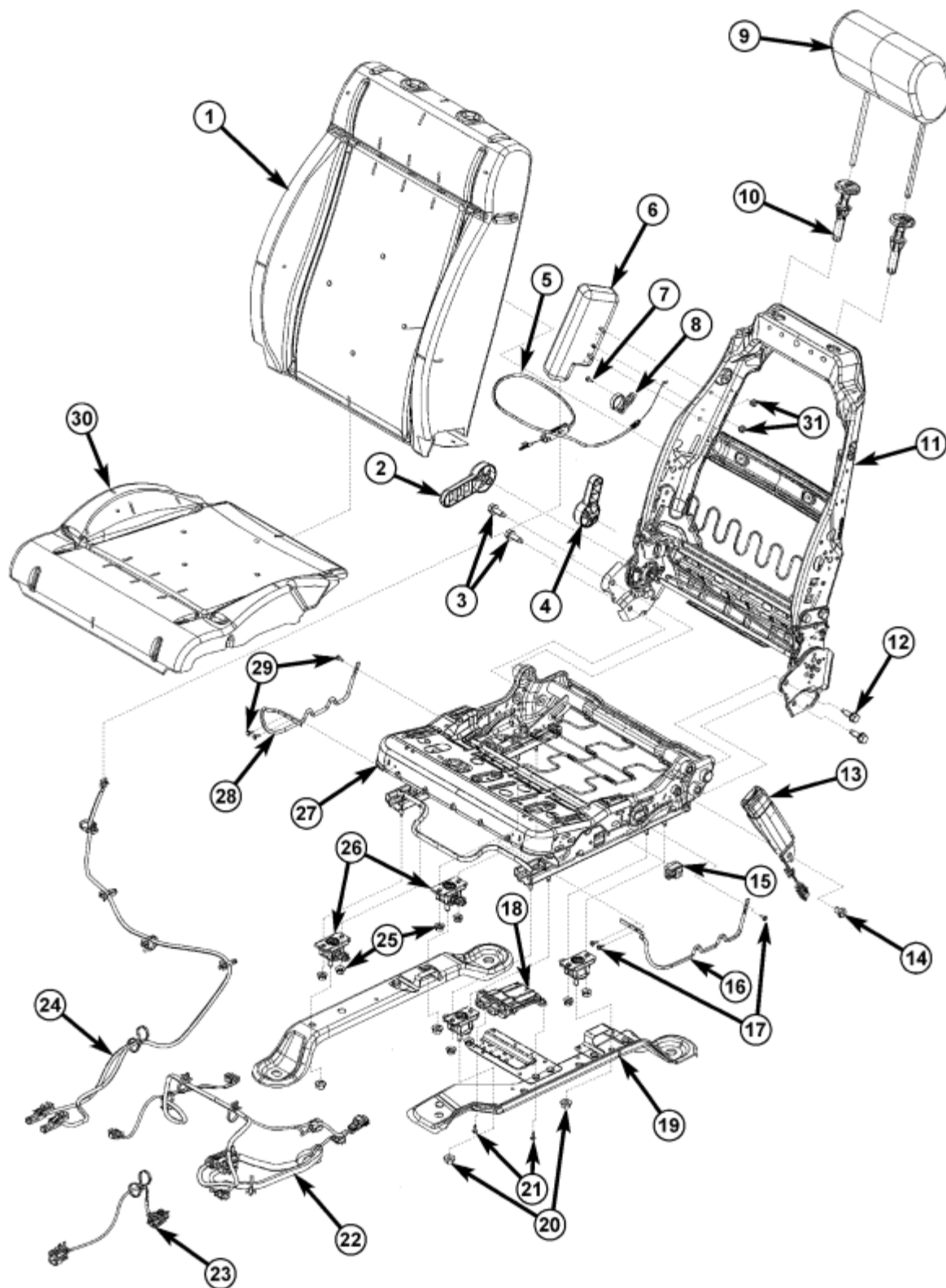
1 - SEAT BACK CUSHION/COVER

2 - AIR BAG NUTS 7 N·m (5 ft. lbs.)

3 - SEAT BACK FRAME

4 - HEADREST SLEEVES
5 - HEADREST
6 - SEAT AIR BAG
7 - RECLINER HANDLE
8 - EASY ENTRY HANDLE
9 - SCREW
10 - EASY ENTRY CABLE ROUTER
11 - EASY ENTRY CABLE
12 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
13 - LIFT HANDLE
14 - LIFT HANDLE CAP
15 - LIFT HANDLE SCREW
16 - WIRE HARNESS
17 - SEAT AIR BAG HARNESS
18 - RIVETS
19 - TRIM ATTACHMENT WIRE
20 - WIRE HARNESS
21 - RISER NUTS 28 N·m (20.5 ft. lbs.)
22 - OUTBOARD RISER
23 - RISER NUTS 28 N·m (20.5 ft. lbs.)
24 - INBOARD RISER
25 - TRIM ATTACHMENT WIRE
26 - RIVETS
27 - SEAT CUSHION/COVER
28 - SEAT TRACK POSITION SENSOR
29 - SEAT BELT BUCKLE BOLT 50 N·m (37 ft. lbs.)

30 - SEAT BELT BUCKLE
31 - SEAT BELT BUCKLE
32 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)



81982d1

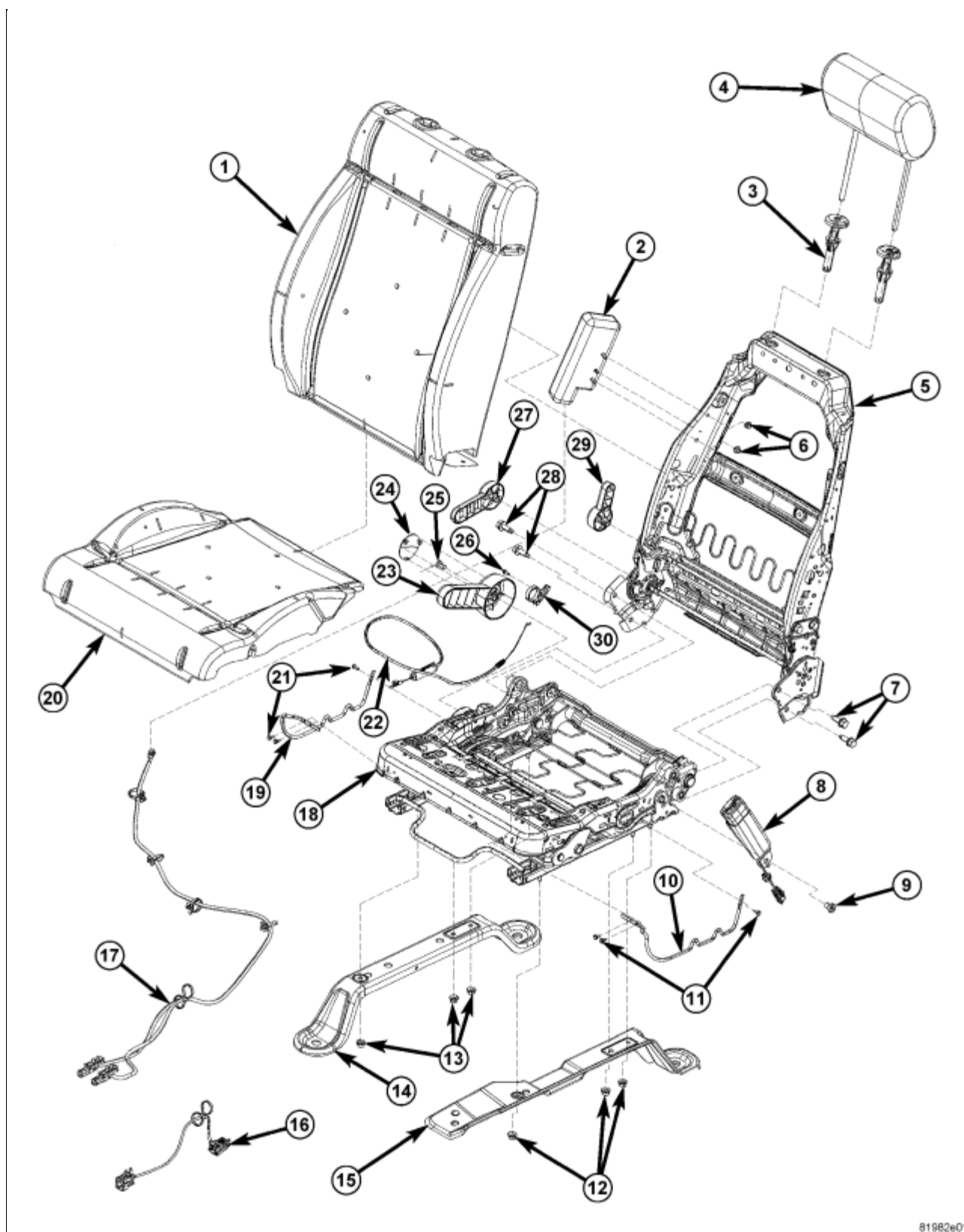
RIGHT HAND SEAT – 2 WAY ADJUSTER

1 - SEAT BACK CUSHION/COVER

2 - RECLINER HANDLE

3 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
4 - EASY ENTRY HANDLE
5 - EASY ENTRY CABLE
6 - SEAT AIR BAG
7 - SCREW
8 - EASY ENTRY CABLE ROUTER
9 - HEADREST
10 - HEADREST SLEEVE
11 - SEAT BACK FRAME
12 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
13 - SEAT BELT BUCKLE
14 - SEAT BELT BUCKLE BOLT 50 N·m (37 ft. lbs.)
15 - SEAT TRACK POSITION SENSOR
16 - TRIM ATTACHMENT WIRE
17 - RIVETS
18 - OCS MODULE
19 - INBOARD RISER
20 - CENTER OCS STRAIN GAUGE STUD NUT 45 N·m (33 ft. lbs.)
21 - MODULE SCREWS
22 - WIRE HARNESS
23 - WIRE HARNESS
24 - AIR BAG HARNESS
25 - OCS RISER NUTS 28 N·m (21 ft. lbs.)
26 - OCS STRAIN GAUGE (4)
27 - SEAT CUSHION FRAME

28 - TRIM ATTACHMENT WIRE
29 - RIVETS
30 - SEAT CUSHION/COVER
31 - AIR BAG NUTS 7 N·m (5 ft. lbs.)



81982e01

RIGHT HAND SEAT – 4 WAY ADJUSTER

1 - SEAT BACK CUSHION/COVER

2 - SEAT AIR BAG

3 - HEADREST SLEEVES
4 - HEADREST
5 - SEAT BACK FRAME
6 - AIR BAG NUTS 7 N·m (5 ft. lbs.)
7 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
8 - SEAT BELT BUCKLE
9 - SEAT BELT BUCKLE BOLT 50 N·m (37 ft. lbs.)
10 - TRIM ATTACHMENT WIRE
11 - RIVETS
12 - RISER NUTS 28 N·m (21 ft. lbs.)
13 - RISER NUTS 28 N·m (21 ft. lbs.)
14 - OUTBOARD RISER
15 - INBOARD RISER
16 - WIRE HARNESS
17 - SIDE AIR BAG WIRE HARNESS
18 - SEAT CUSHION FRAME
19 - TRIM ATTACHMENT WIRE
20 - SEAT CUSHION/COVER
21 - RIVETS
22 - EASY ENTRY CABLE
23 - LIFT HANDLE
24 - LIFT HANDLE CAP
25 - LIFT HANDLE SCREW
26 - SCREW
27 - RECLINER HANDLE

28 - BACK ASSEMBLY BOLTS 47 N·m (34.5 ft. lbs.)
29 - EASY ENTRY HANDLE
30 - EASY ENTRY CABLE ROUTER

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)

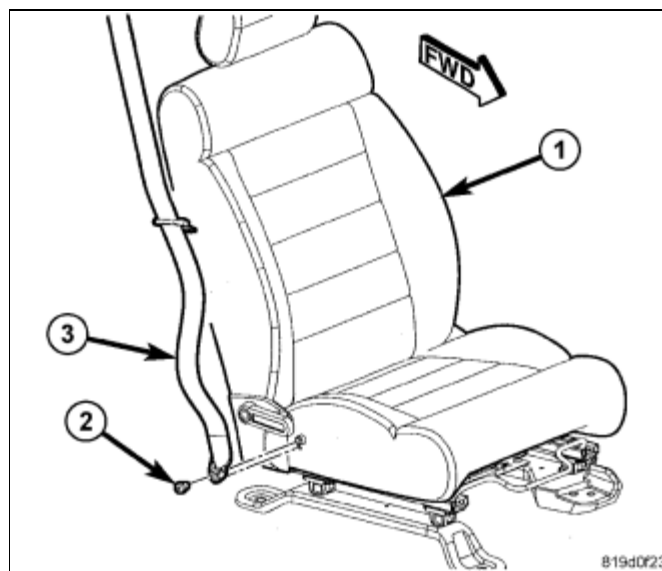
WARNING: The Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to follow these instructions may result in personal injury or death.

WARNING: The front passenger seat must be handled carefully as well. When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

WARNING: When the seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

NOTE: If equipped with a traveling seat belt anchor.

2. Adjust the front seat (1) to its most forward position for easiest access to the front seat belt (3) lower anchor and the B-pillar trim.
3. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
4. Remove the screw (2) that secures the lower anchor to the outboard side of the front seat cushion frame.



5. Remove the four seat bolts (2).
6. Tip the seat back and disconnect the electrical connectors (3).
7. Remove the seat.

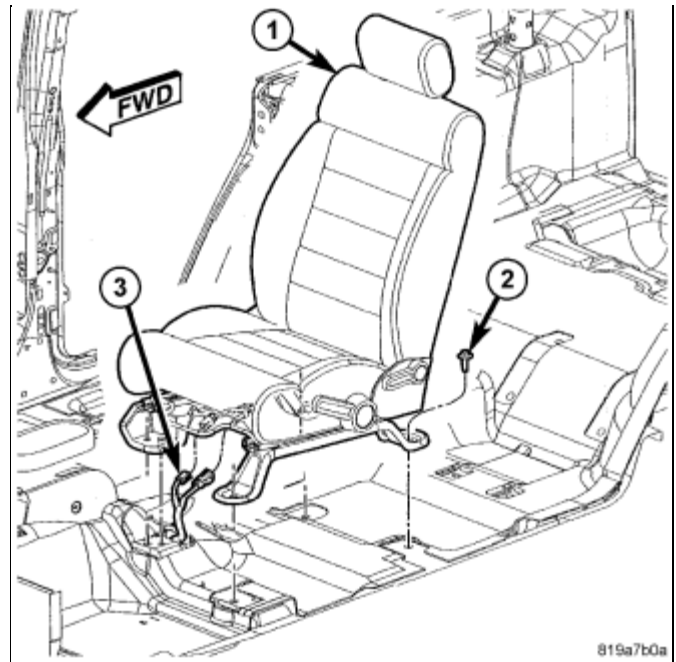
INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)

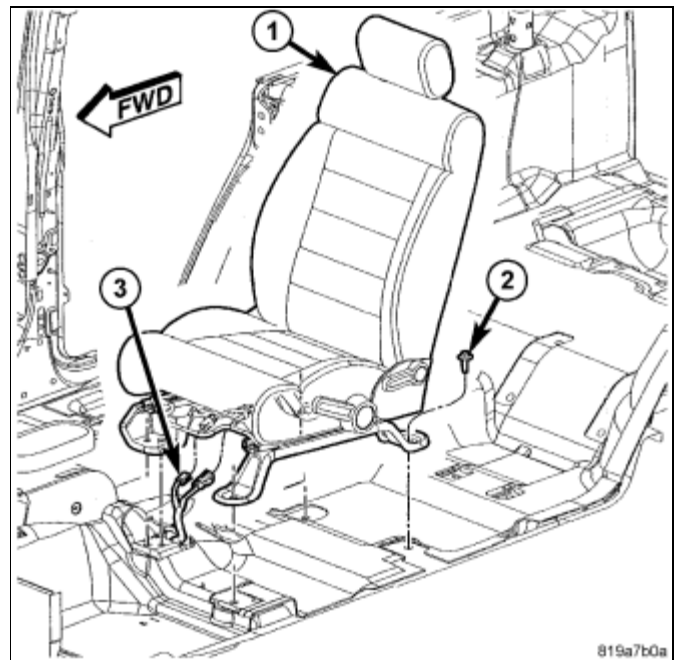
WARNING: The Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to follow these instructions may result in personal injury or death.

WARNING: The front passenger seat must be handled carefully as well. When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

WARNING: When the seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative. Failure to follow these instructions may result in personal injury or death.

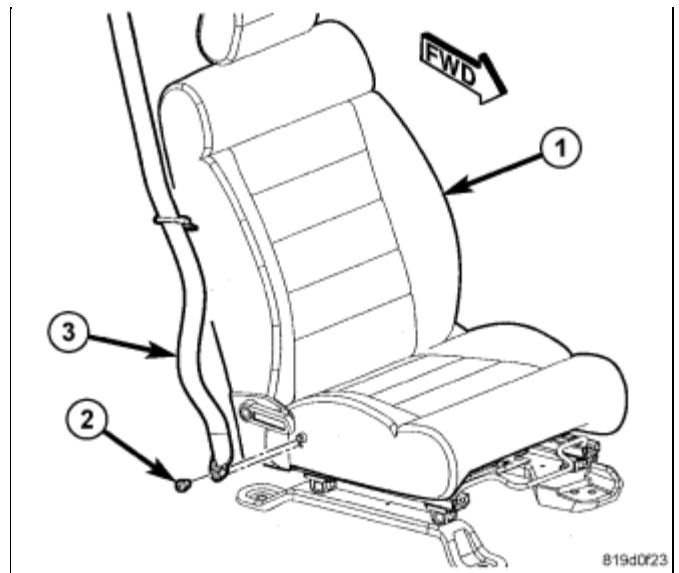


2. Position the seat into the vehicle and connect the electrical connectors (3), if equipped.
3. Install the bolts (2).
 - a. Adjust the seat rearward.
 - b. Tighten the front inboard bolt to 75 N·m (55 ft. lbs.).
 - c. Tighten the front outboard bolt to 75 N·m (55 ft. lbs.).
 - d. Adjust the seat forward.
 - e. Tighten the rear inboard bolt to 75 N·m (55 ft. lbs.).
 - f. Tighten the rear outboard bolt to 75 N·m (55 ft. lbs.).



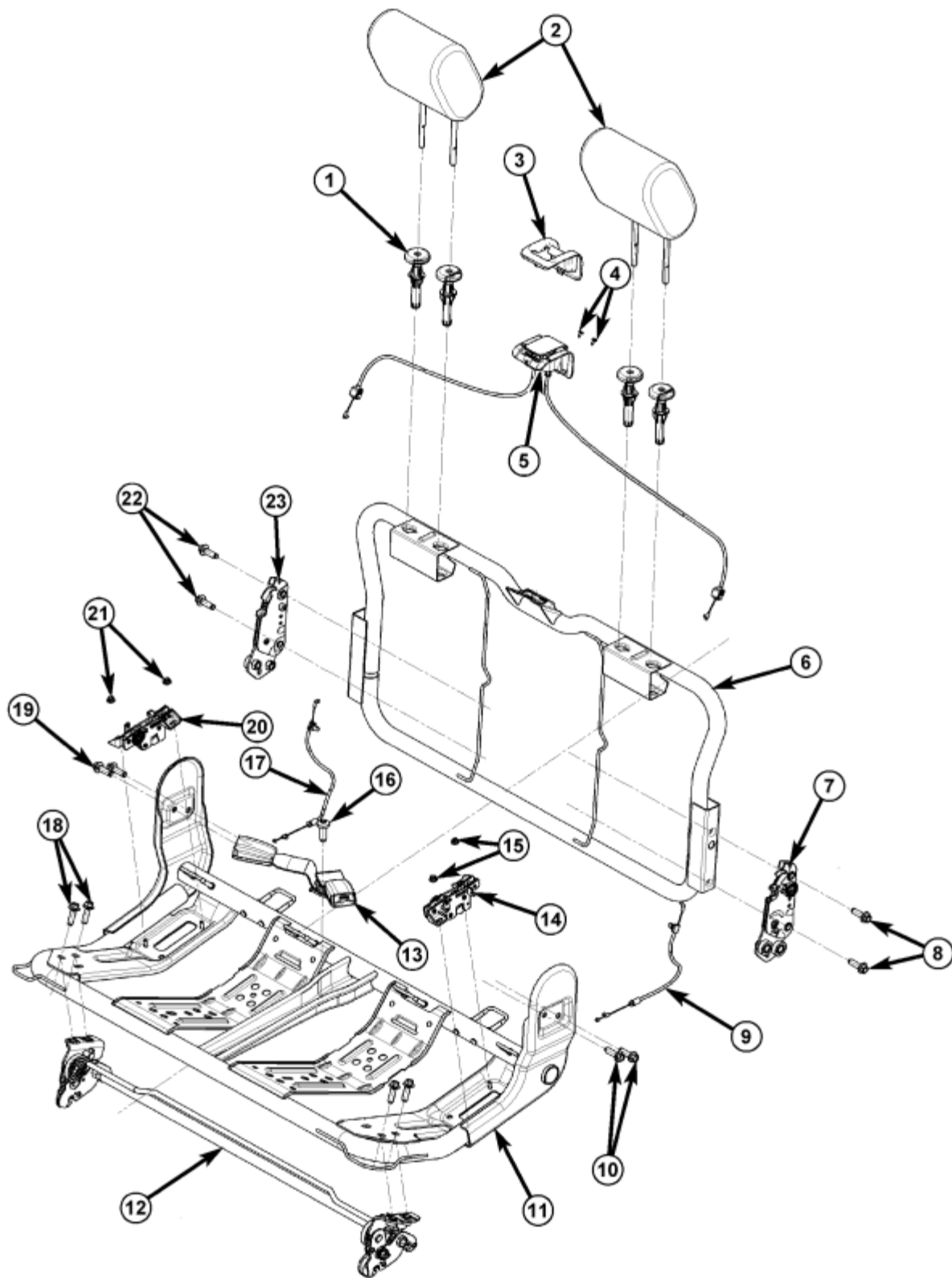
NOTE: If equipped with a traveling seat belt anchor.

4. Position the seat belt (3) lower anchor to the mounting hole on the outboard side of the front seat (1) cushion frame. Be certain that the seat belt webbing between the turning loop and the lower anchor is not twisted.
5. Install and tighten the screw (2) that secures the lower anchor to the seat. Tighten the screw to 40 N·m (30 ft. lbs.).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



SEAT - REAR

DESCRIPTION



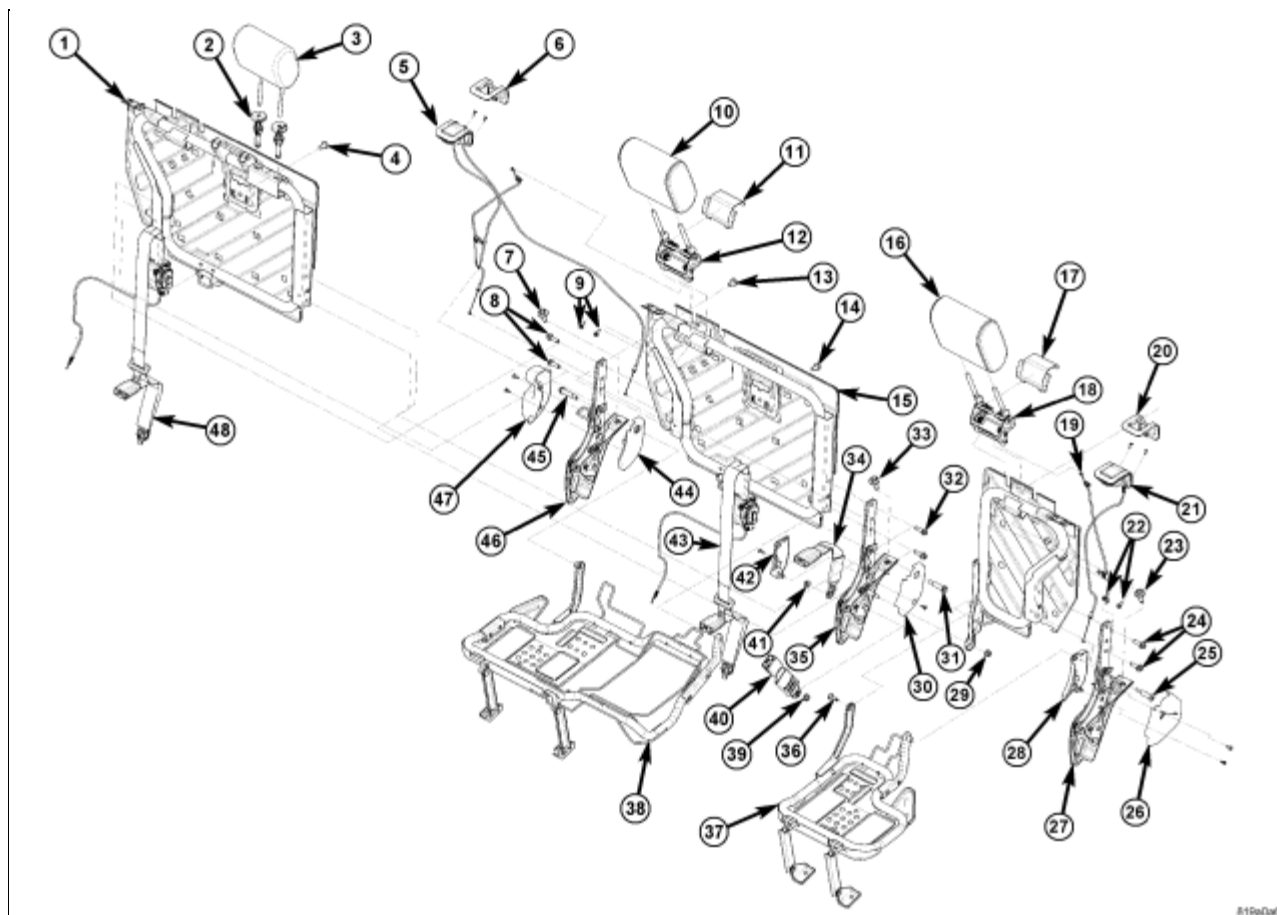
81983389

2 DOOR REAR

1 - HEADREST SLEEVES

2 - HEADRESTS

3 - RELEASE HANDLE BEZEL
4 - RELEASE HANDLE SCREWS
5 - RELEASE HANDLE
6 - SEAT BACK FRAME
7 - SEAT BACK LATCH
8 - SEAT BACK LATCH BOLTS 45 N·m (33 ft. lbs.)
9 - CABLE – BACK LATCH TO REAR FLOOR LATCH
10 - BACK FRAME TO CUSHION ATTACHMENT BOLTS 50 N·m (37 ft. lbs.)
11 - SEAT CUSHION FRAME
12 - FRONT LATCH
13 - CENTER BELT BUCKLES
14 - REAR LATCH – LEFT HAND
15 - REAR LATCH NUTS 10 N·m (90 in. lbs.)
16 - CENTER BELT BUCKLE BOLT 55 N·m (40.5 ft. lbs.)
17 - CABLE – BACK LATCH TO REAR FLOOR LATCH
18 - FRONT LATCH CUSHION FRAME BOLTS 45 N·m (33 ft. lbs.)
19 - BACK FRAME TO CUSHION ATTACHMENT BOLTS 50 N·m (37 ft. lbs.)
20 - REAR LATCH – RIGHT HAND
21 - REAR LATCH NUTS 10 N·m (90 in. lbs.)
22 - SEAT BACK LATCH BOLTS 45 N·m (33 ft. lbs.)
23 - SEAT BACK LATCH



4 DOOR REAR

1 - 60% SEAT BACK FRAME - EXPORT	25 - SEAT CUSHION PIVOT BOLT 25 N·m (18.5 ft. lbs.)
2 - EXPORT HEADREST SLEEVES	26 - OUTER LATCH COVER
3 - HEADREST - EXPORT	27 - OUTBOARD LATCH
4 - RETRACTOR SCREW 55 N·m (40.5 ft. lbs.)	28 - INNER LATCH COVER
5 - RELEASE HANDLE	29 - 40% INNER SEAT BACK PIVOT NUT 25 N·m (18.5 ft. lbs.)
6 - RELEASE HANDLE BEZEL	30 - INNER LATCH COVER
7 - OUTBOARD LATCH FLOOR BOLTS 25 N·m (18.5 ft. lbs.)	31 - SEAT CUSHION PIVOT BOLT 25 N·m (18.5 ft. lbs.)
8 - LATCH TO BACK FRAME BOLTS 45 N·m (33 ft. lbs.)	32 - LATCH TO BACK FRAME BOLTS 45 N·m (33 ft. lbs.)
9 - HEADREST BOLTS 8 N·m (71 in. lbs.)	33 - INNER LATCH FLOOR BOLTS 25 N·m (18.5 ft. lbs.)
10 - HEADREST	34 - 60% INBOARD BUCKLE
11 - HEADREST BEZEL	35 - INBOARD LATCH

12 - HEADREST BRACKET AND HINGE	36 - SEAT CUSHION PIVOT BOLT 25 N·m (18.5 ft. lbs.)
13 - RETRACTOR SCREW 55 N·m (40.5 ft. lbs.)	37 - 40% SEAT CUSHION FRAME
14 - RETRACTOR SCREW 55 N·m (40.5 ft. lbs.)	38 - 60% SEAT CUSHION FRAME
15 - 60% SEAT BACK FRAME	39 - BELT BUCKLE NUT 45 N·m (33 ft. lbs.)
16 - HEADREST	40 - 40% INBOARD BUCKLE
17 - HEADREST BEZEL	41 - BELT BUCKLE NUT 45 N·m (33 ft. lbs.)
18 - HEADREST BRACKET AND HINGE	42 - INNER LATCH COVER
19 - HEADREST RELEASE CABLE	43 - SEAT BELT RETRACTOR
20 - RELEASE HANDLE BEZEL	44 - INNER LATCH COVER
21 - RELEASE HANDLE	45 - SEAT CUSHION PIVOT BOLT 25 N·m (18.5 ft. lbs.)
22 - HEADREST BOLTS 8 N·m (71 in. lbs.)	46 - OUTBOARD LATCH
23 - OUTBOARD LATCH FLOOR BOLTS 25 N·m (18.5 ft. lbs.)	47 - OUTER LATCH COVER
24 - LATCH TO BACK FRAME BOLTS 45 N·m (33 ft. lbs.)	48 - SEAT BELT RETRACTOR

REMOVAL

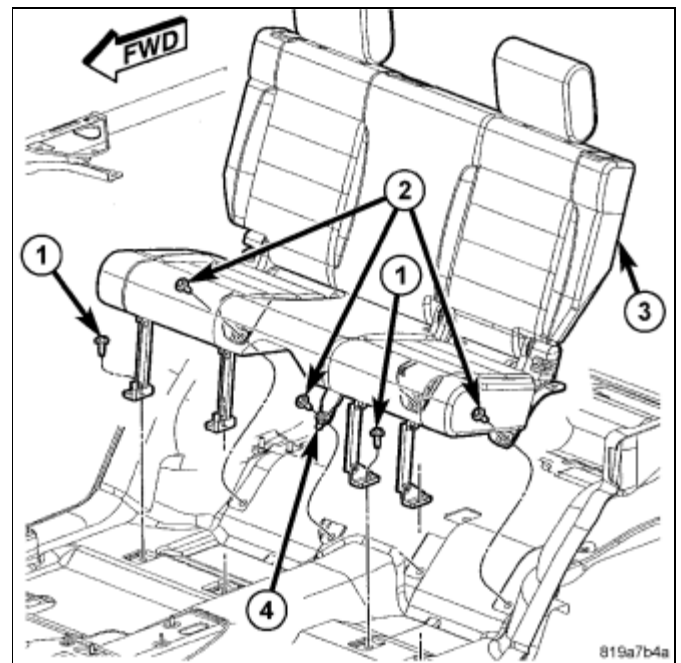
Two Door

1. Remove the rear subwoofer (if equipped), (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).
2. Lift the seat back release lever and fold seat back forward and release the rear latches (2).
3. Slowly flip the entire seat (1) forward.
4. Press down on release bar on each side to release the front latches (3), and pull seat out and away from lower bracket (4).
5. Remove seat from the vehicle.



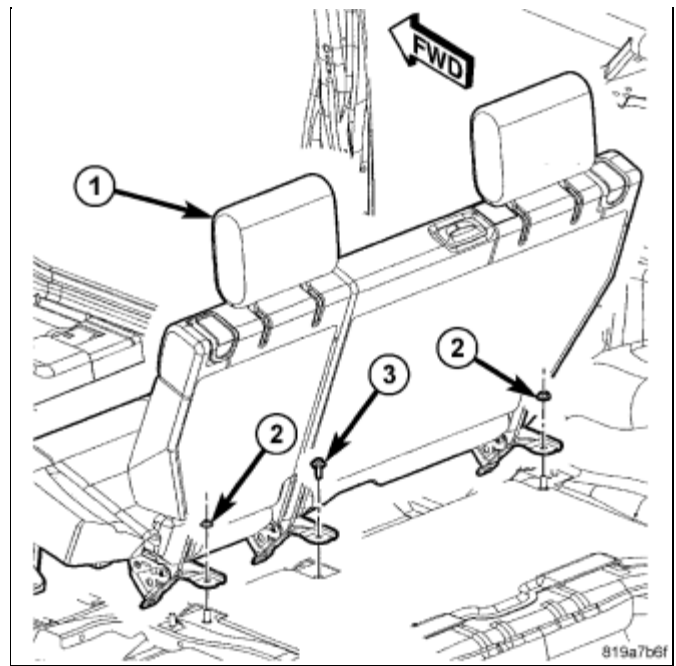
Four Door

1. Remove the four front leg bolts (1).
2. Remove the front rear bracket bolts (2).
3. Fold the seat backs (3) into the down position.



4. Remove the center bracket bolt (3).
5. Remove the outer bracket nuts (2) and remove the seat assembly through the tail gate.

INSTALLATION



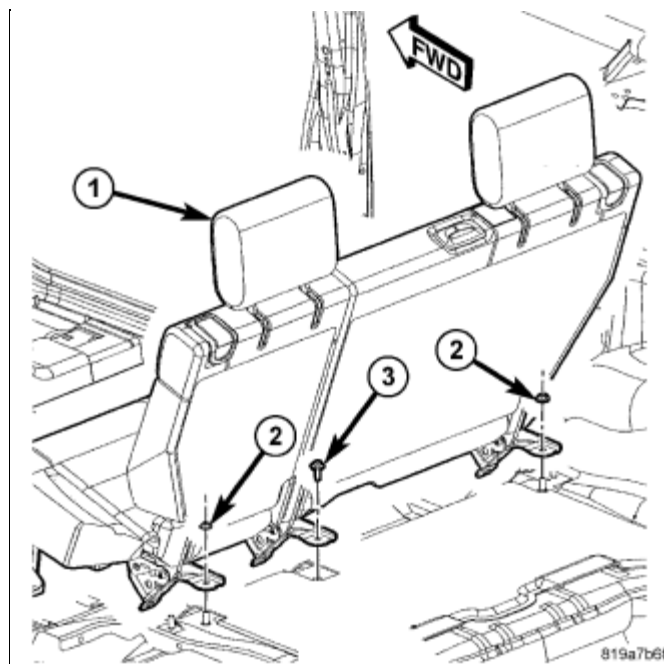
Two Door

1. Position the seat assembly into the vehicle and lock the rear of the front latches (3) into rear loop of the lower brackets (4).
2. Lift the seat upright and lock the front of the front latches (3) into the front loop of the lower brackets (4).
3. Position the seat assembly down and secure the rear latches (2).
4. Lift the seat back (1) into the upright position to lock the rear latches (2).



Four Door

1. Position the seat assembly into the vehicle and over the rear studs.
2. Install the nuts (2) and tighten to 85 N·m (63 ft. lbs.).
3. Install the bolt (3) and tighten to 75 N·m (55 ft. lbs.).



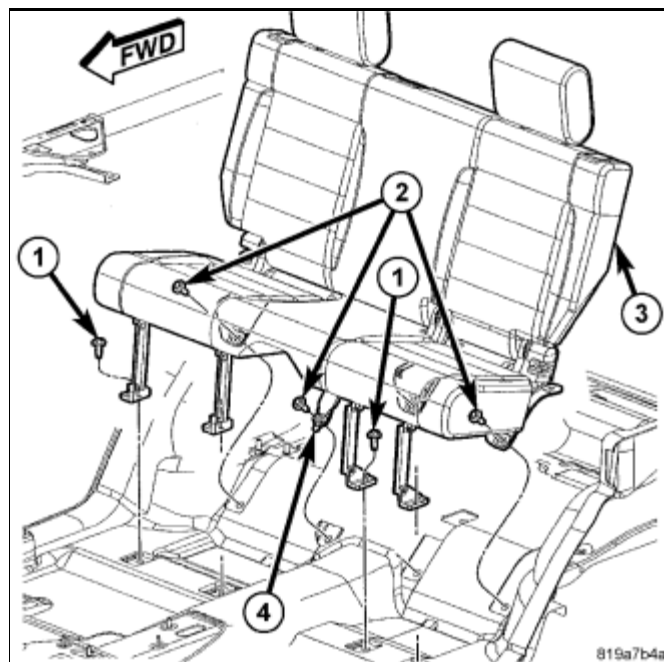
4. Install the rear bracket front screws (2) and tighten to 75 N·m (55 ft. lbs.).
5. Install the front bracket screws (1) and tighten to 75 N·m (55 ft. lbs.).
6. Install the center belt buckle (4) and make sure the tab is lined up with the slot in the plate.
7. Install the buckle bolt and tighten to 75 N·m (55 ft. lbs.).

STATIONARY GLASS

STATIONARY GLASS

WARNING

WINDSHIELD SAFETY PRECAUTIONS



WARNING: Do not operate the vehicle within 24 hours of windshield installation. It takes at least 24 hours for urethane adhesive to cure. If it is not cured, the windshield may not perform properly in an accident.

- Urethane adhesives are applied as a system. Use glass cleaner, glass prep solvent, glass primer, PVC (vinyl) primer and pinch weld (fence) primer provided by the adhesive manufacturer. If not, structural integrity could be compromised.
- DaimlerChrysler does not recommend glass adhesive by brand. Technicians should review product labels and technical data sheets, and use only adhesives that their manufacturer's warrant will restore a vehicle to the requirements of FMVSS 212. Technicians should also insure that primers and cleaners are compatible with the particular adhesive used.
- Be sure to refer to the urethane manufacturer's directions for curing time specifications, and do not use adhesive after its expiration date.

Vapors that are emitted from the urethane adhesive or primer could cause personal injury. Use them in a well-ventilated area.

- Skin contact with urethane adhesive should be avoided. Personal injury may result.
- Always wear eye and hand protection when working with glass.

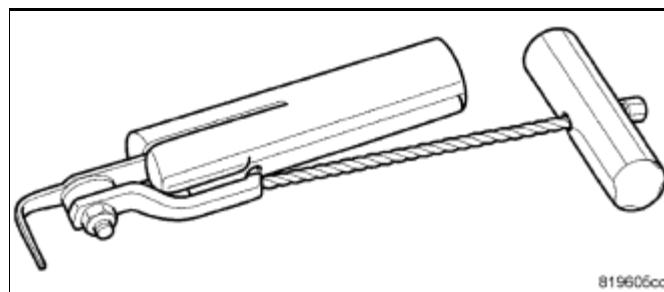
CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.

Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

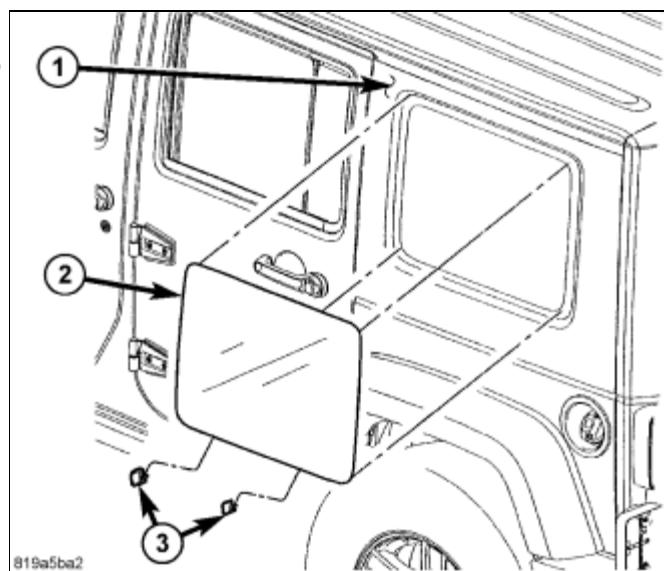
GLASS - QUARTER WINDOW

REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions (Refer to 23 - BODY/STATIONARY GLASS - WARNING).
2. Using a windshield removal tool with a cable pull handle, or equivalent, separate the glass adhesive from the inside of the vehicle.



3. Remove the glass (2) and the spacers (3) from the hard top (1).



INSTALLATION

WARNING: Allow the urethane at least 24 hours to cure before returning the vehicle to use.

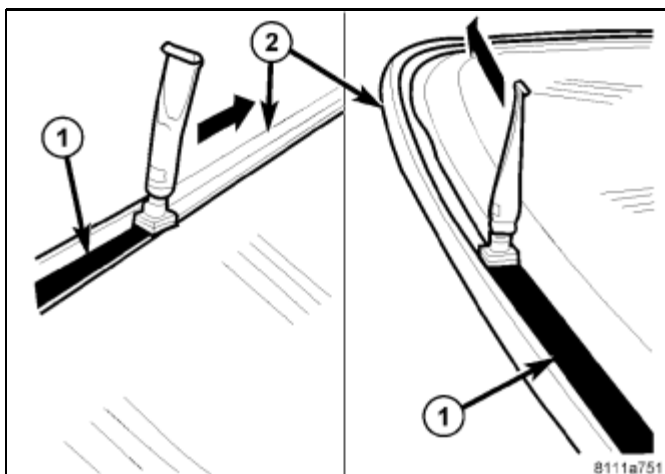
CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing quarter glass to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

NOTE: The quarter glass fence should be cleaned of most of its old urethane bonding material. A small amount of old urethane, approximately 1-2 mm in height, should remain on the fence. Do not grind off or completely remove all old urethane from the fence, the paint finish and bonding strength will be adversely affected.

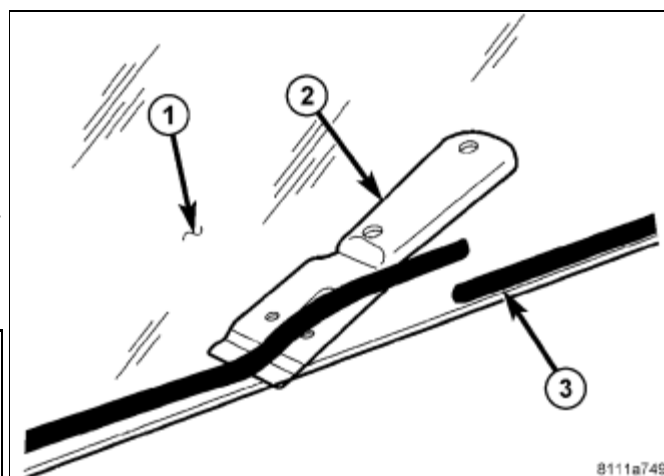
Glass Preparation - Installing A Previously Installed Quarter Glass

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/STATIONARY GLASS - WARNING)
2. Level old bead of quarter glass adhesive (3) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.

NOTE:
Typical
primer



installation shown.

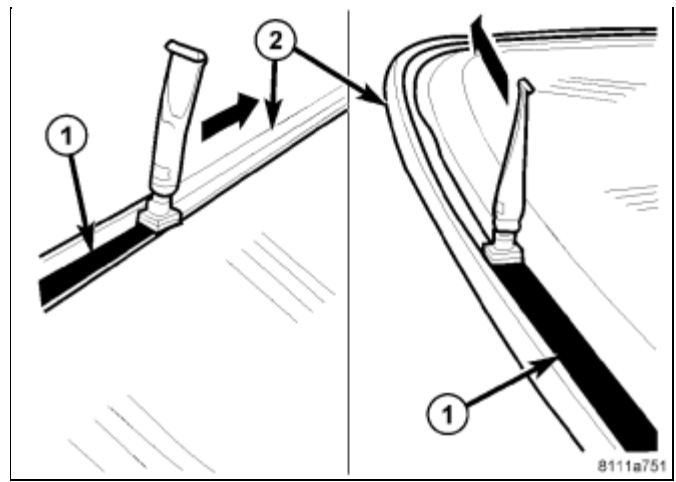


3. Clean and dry area of glass (2) to be re-glued with a suitable glass preparation solvent and rag.
4. Using a flash light, verify that glass primer is without damage.
5. Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed.
6. Apply primer (1) around the perimeter of the glass to a width of 18 mm (0.7 in.) and 6 mm (0.25 in.) from the edge.
7. Allow primer to air dry for at least 10 minutes.
8. Using a flash light, verify that glass primer is without damage.

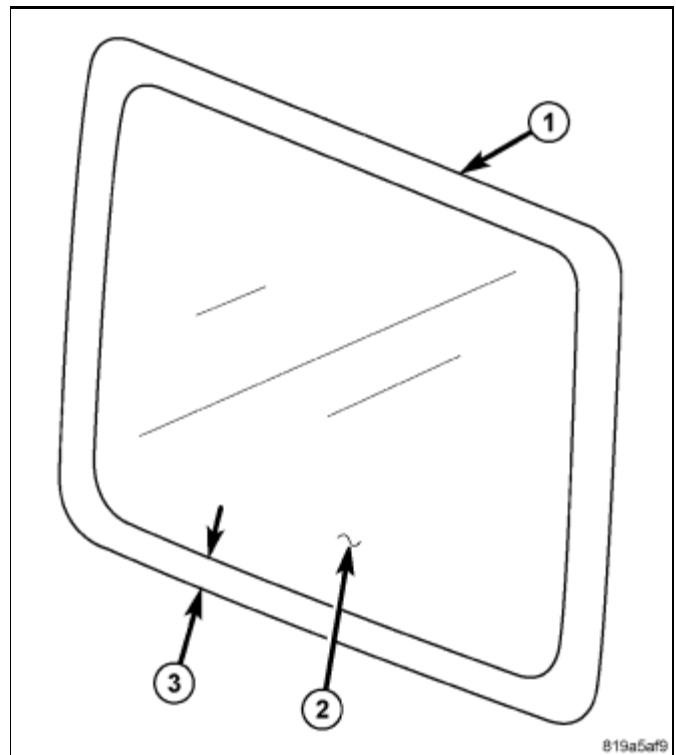
Glass Preparation - Installing A New Quarter Glass

NOTE: Typical primer installation shown.

1. Clean and dry area of glass (2) to be re-glued with a suitable glass preparation solvent and rag.
2. Apply primer to gluing surface at quarter glass seal.
3. Apply primer (1) around the perimeter of the glass to a width of 18 mm (0.7 in.) and 6 mm (0.25 in.) from the edge.
4. Allow primer to air dry for at least 10 minutes.
5. Using a flash light, verify that glass primer is without damage.



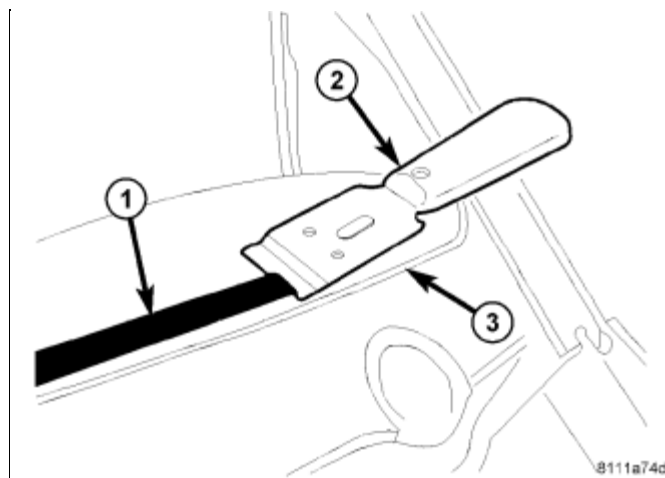
6. Apply a thin coat of blackout glass primer to the glass surface (2) to a width of 18 mm (0.7 in.) and 6 mm (0.25 in.) from the edge (3).
7. Allow primer to air dry for at least 20 seconds.



Quarter Glass Opening Preparation

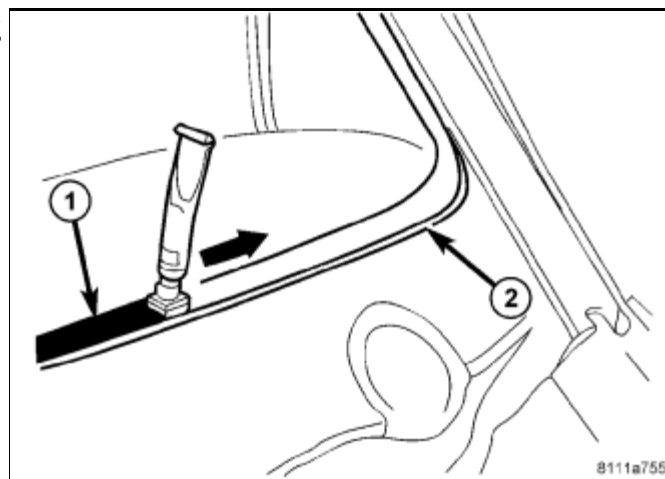
NOTE: Windshield opening shown, quarter glass opening similar.

1. Clean and vacuum quarter glass opening.
2. Level old bead of quarter glass opening adhesive (1) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.

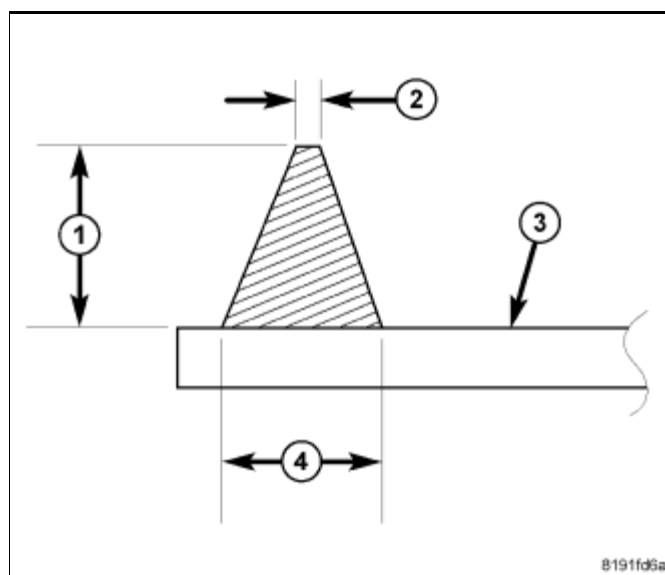


NOTE: Windshield opening shown, quarter glass opening similar.

3. Clean and dry area of quarter glass opening to be re-glued with a suitable glass preparation solvent and rag.
4. Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed.
5. Allow primer to air dry for at least 10 minutes.



Quarter Glass Installation



1 - ADHESIVE HEIGHT 12.7 mm (0.50 in)

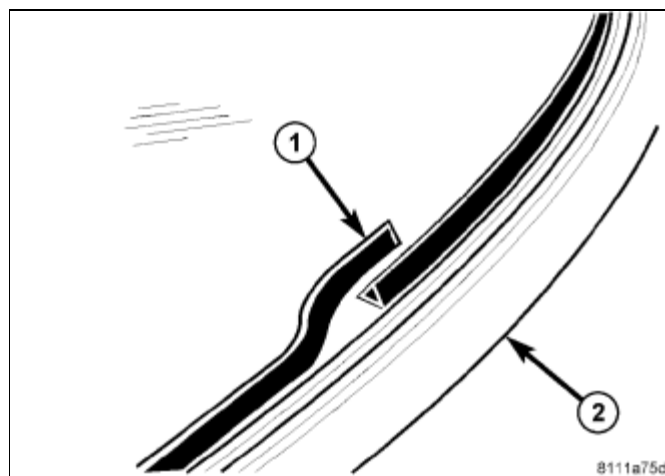
2 - ADHESIVE TIP WIDTH 3 mm (0.120 in)

3 - INNER WINDSHIELD SURFACE
4 - ADHESIVE WIDTH 9.5 mm (0.375 in)

1. Bead dimensions should be approximately 8.0 mm (0.315 in) wide (4) by 12.7 mm (0.50 in) in height (1).
2. Apply bead of adhesive with a triangular nozzle directly to the quarter glass seal starting at bottom in center of the quarter glass.
3. Locate the bead of adhesive onto the primed glass surface (3).

CAUTION: Always apply bead of adhesive to the quarter glass. Always install the quarter glass within 5 minutes after applying adhesive.

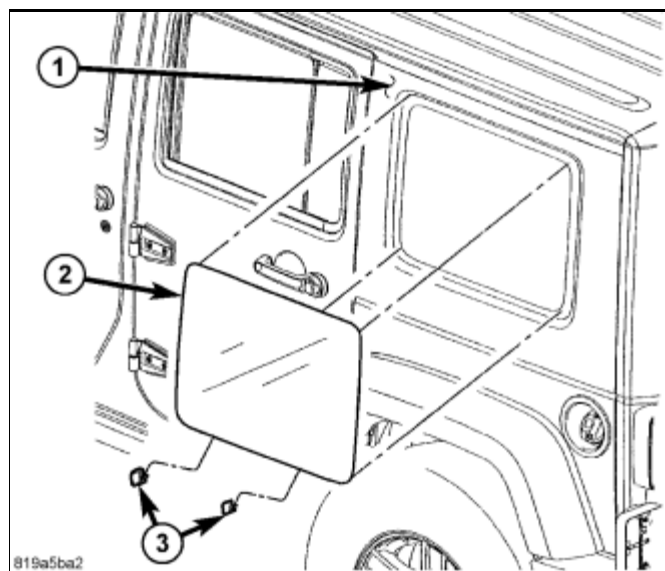
4. Allow end of adhesive bead (1) to run out parallel to the start of the bead and smooth ends flush.



5. Lift quarter glass into place in the center of the quarter glass opening and install over the alignment spacers (3).
6. Carefully lay down the quarter glass and press on.

CAUTION: It is no longer possible to move the quarter glass after installation. The quarter glass should never be pressed into place by more than one person, because the quarter glass can break if pressed simultaneously on both sides.

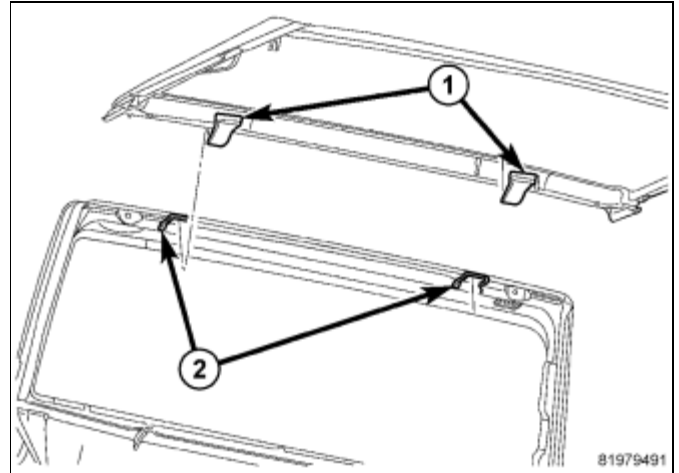
CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing quarter glass to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.



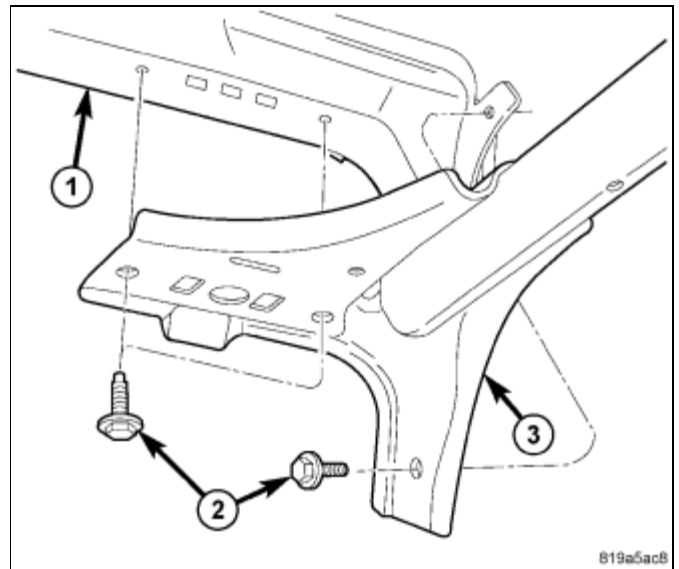
PANEL - WINDSHIELD FRAME

REMOVAL

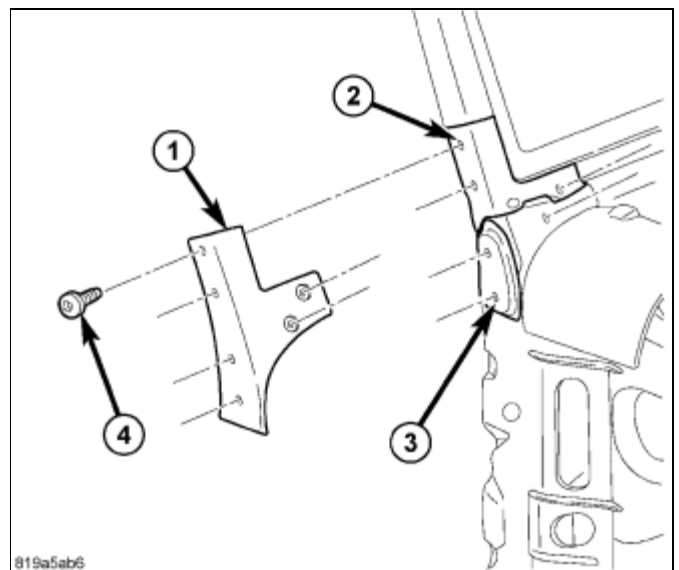
1. Remove the hard top, if equipped, (Refer to 23 - BODY/REMOVABLE TOP/TOP - REMOVAL).
2. If equipped, release the soft top latches (1) and fold the soft top back.



3. Remove the bolts (2) attaching the sport bar (3) to the windshield frame (1).

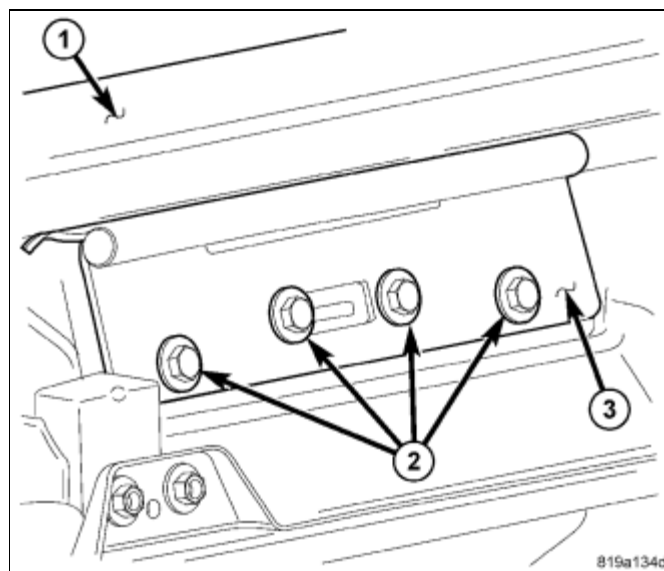


4. Remove the bolts (4) and remove the reinforcement brackets (1).

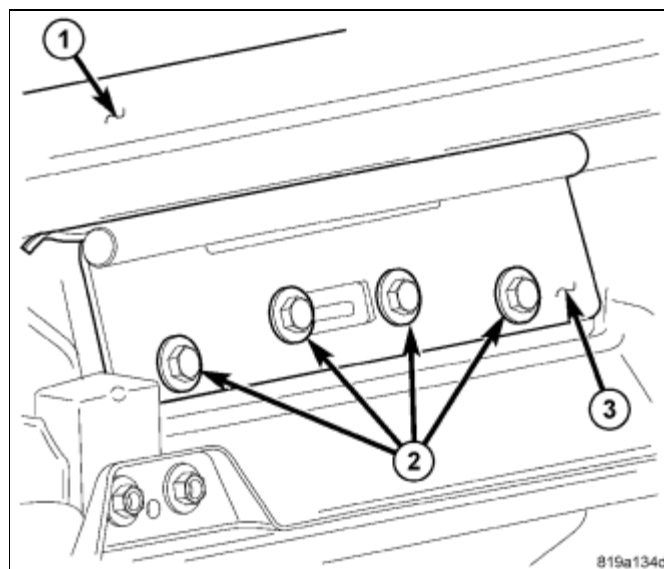


5. Remove the cowl top panel, (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - REMOVAL).
6. Remove the hinge bolts (2) and remove the windshield frame (1).

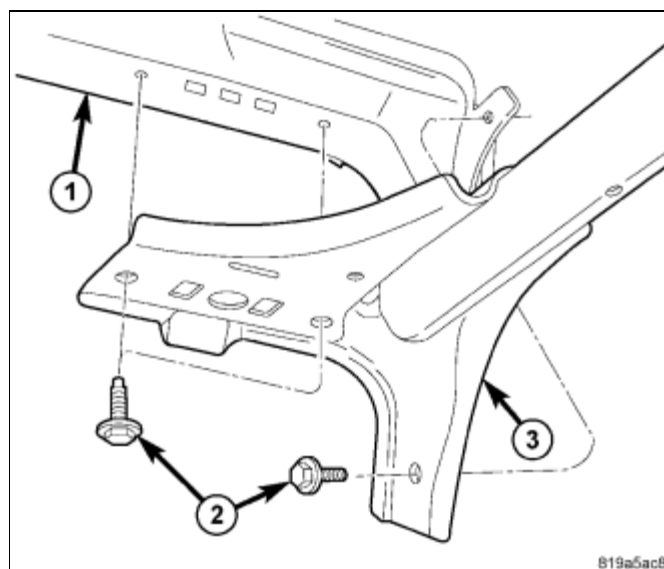
INSTALLATION



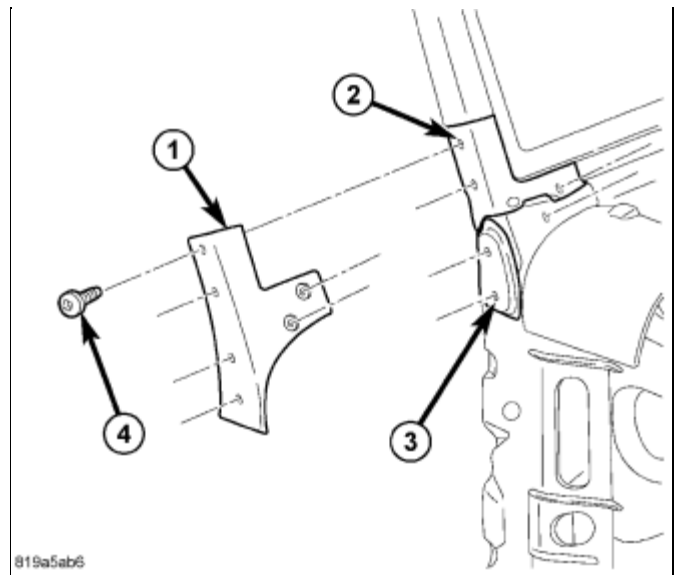
1. Install the windshield frame (1) onto the body and install the hinge (3) to body bolts (2).
2. Tighten the hinge bolts (2) to 20 N·m (15 ft. lbs.).



3. Fold the windshield down onto the hood and make sure that the hood to cowl weather seal is secured in place fully.
4. Rotate the windshield frame rearward until the header contacts the sports bar.
5. Install the sport bar bolts (2) and hand tighten.
6. Tighten the outboard upward bolt followed by the remaining bolts to 23 N·m (17 ft. lbs.).



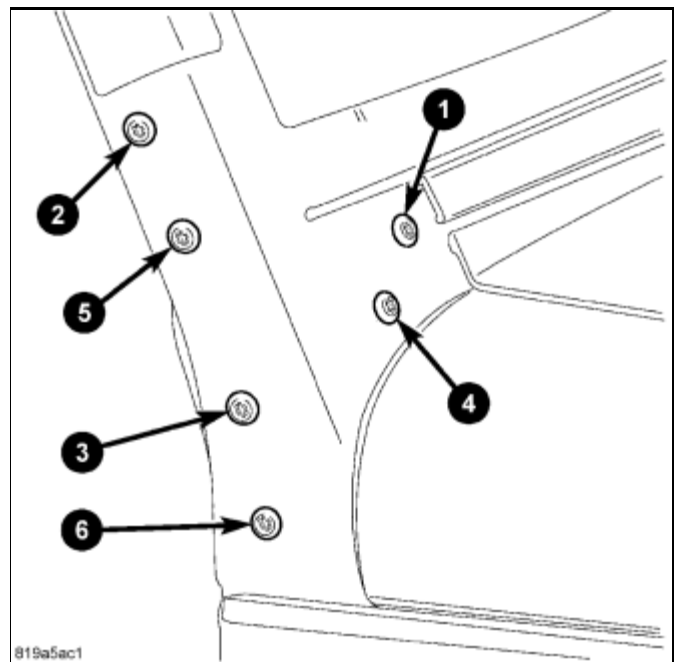
7. Install the reinforcement brackets (1) and install the bolts (4) hand tight.



8. Tighten the reinforcement bracket bolts to 20 N·m (15 ft. lbs.) using the sequence shown.

9. Install the cowl top panel, (Refer to 23 - BODY/EXTERIOR/PANEL - COWL TOP - INSTALLATION)

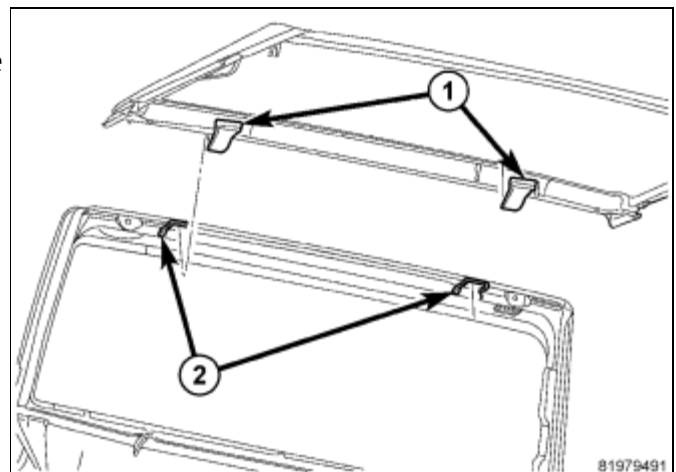
10. Install the hard top, if equipped, (Refer to 23 - BODY/REMOVABLE TOP/TOP - INSTALLATION)



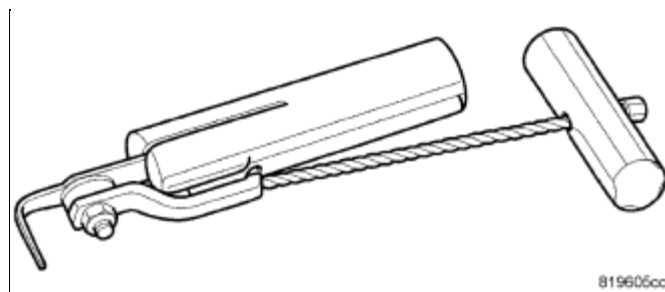
11. On vehicles with the soft top, close the top and secure the latches (1) to the windshield frame loops (2).

WINDSHIELD

REMOVAL



1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/STATIONARY GLASS - WARNING)
2. Remove rear view mirror, (Refer to 23 - BODY/INTERIOR/MIRROR - INSIDE REAR VIEW - REMOVAL).
3. Using a windshield removal tool with a cable pull handle, or equivalent, separate the glass adhesive from the inside of the vehicle.



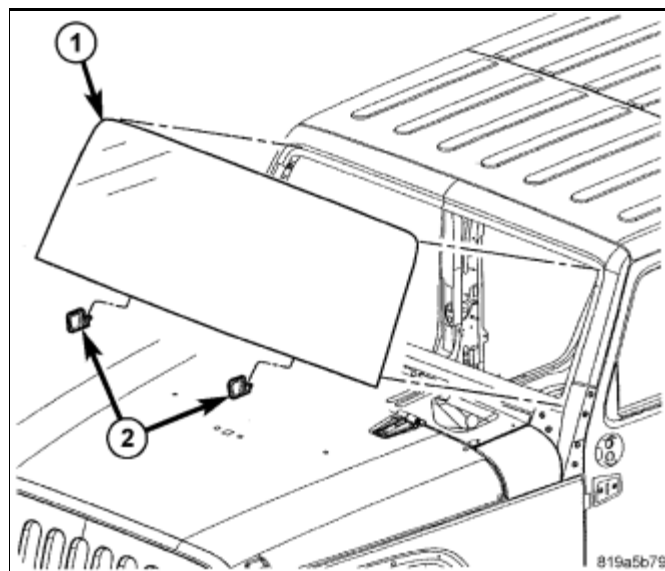
4. Carefully remove the windshield (1).

INSTALLATION

WARNING: Allow the urethane at least 24 hours to cure before returning the vehicle to use.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

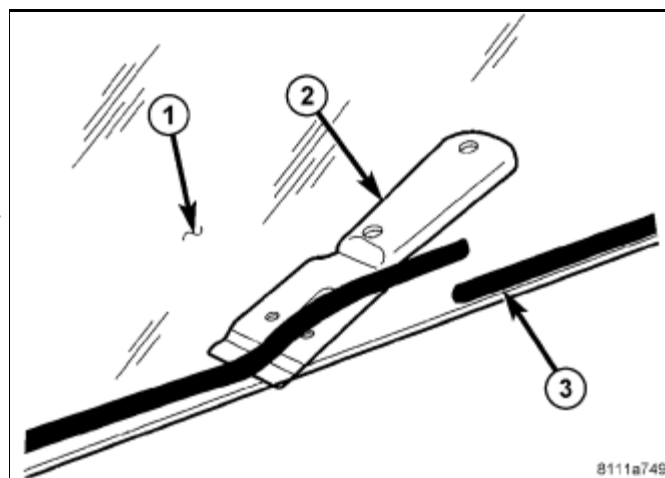
NOTE: The windshield fence should be cleaned of most of its old urethane bonding material. A small amount of old urethane, approximately 1-2 mm in height, should remain on the fence. Do not grind off or completely remove all old urethane from the fence, the paint finish and bonding strength will be adversely affected. Support spacers located on the cowl at the bottom of the windshield opening should be replaced with new parts. Replace any missing or damaged spacers around the perimeter of the windshield opening.



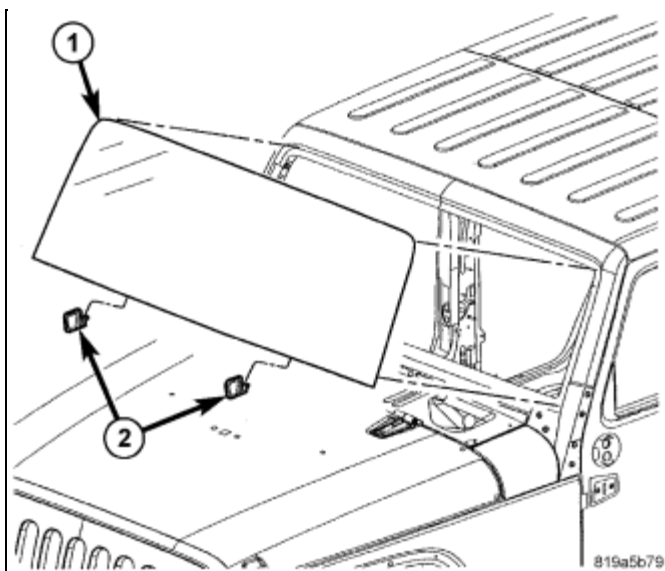
Windshield Preparation - Installing A Previously Installed Windshield

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/STATIONARY GLASS - WARNING)
2. Level old bead of windshield adhesive (3) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.

3. Apply four new spacers the top



and sides
of the
glass.
4. Install
the lower
spacer



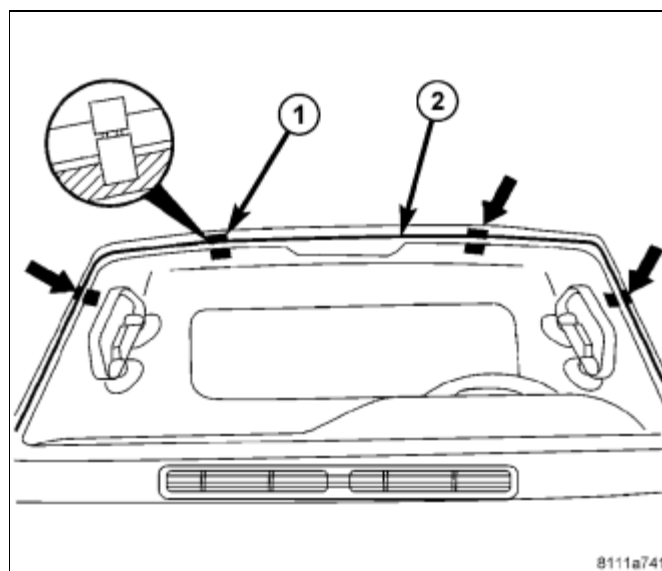
assemblies (2) onto the glass.

5. Position windshield (1) in center of windshield opening and resting on the lower spacers (2).

6. Apply adhesive tape (1) to the locations shown to aid with final installation.

7. Verify windshield gap is parallel to with windshield.

8. Cut tape with a sharp knife and remove windshield.

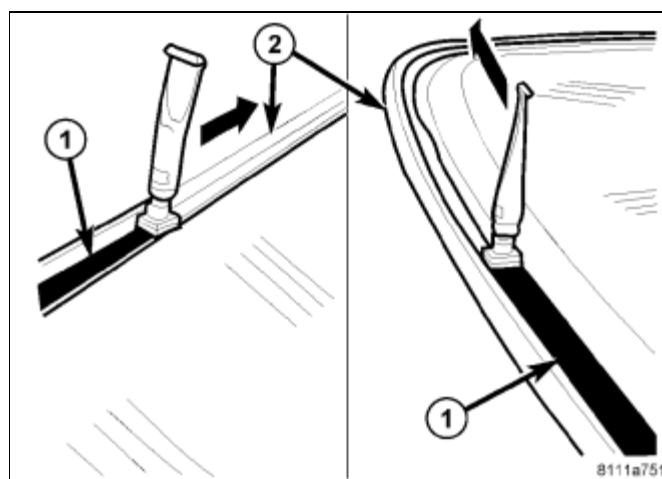


NOTE: Typical primer installation shown.

9. Clean and dry area of glass (2) to be re-glued with a suitable glass preparation solvent and rag.

10. Using a flash light, verify that glass primer is without damage.

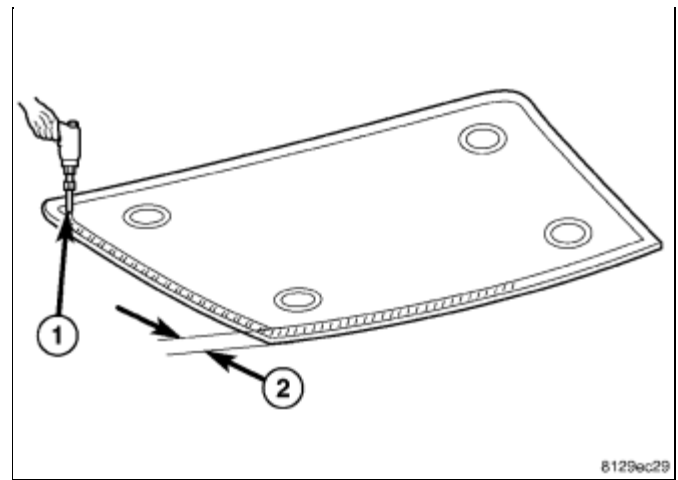
11. Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed.



12. Apply primer (1) around the perimeter of the glass to a width of 18 mm (0.7 in.) (2) and 6 mm (0.25 in) from the edge.

13. Allow primer to air dry for at least 10 minutes.

14. Using a flash light, verify that glass primer is without damage.

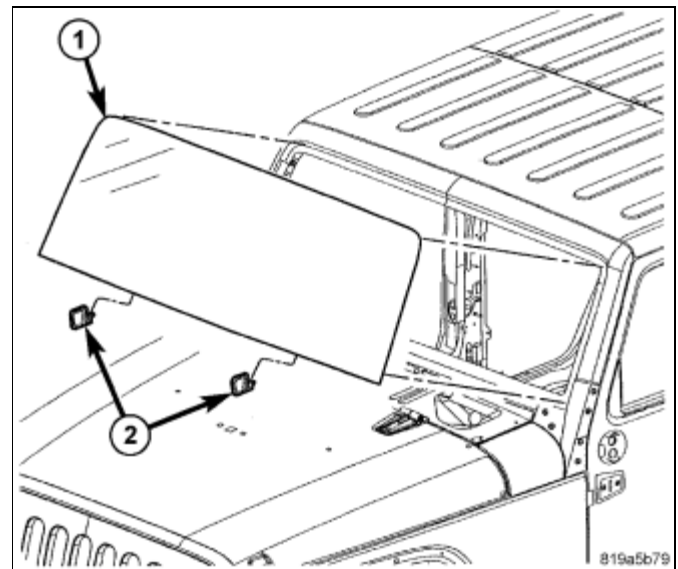


Windshield Preparation - Installing A New Windshield

1. Apply four new spacers the top and sides of the glass.

2. Install the lower spacer assemblies (2) onto the glass.

3. Position windshield (2) in center of windshield opening and resting on the side and lower spacers (2).



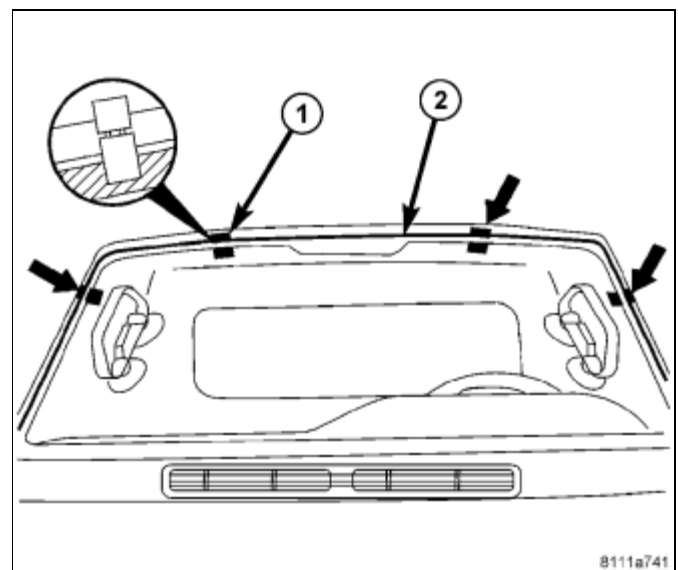
4. Clean and check windshield for damage.

5. Position windshield in center of windshield opening.

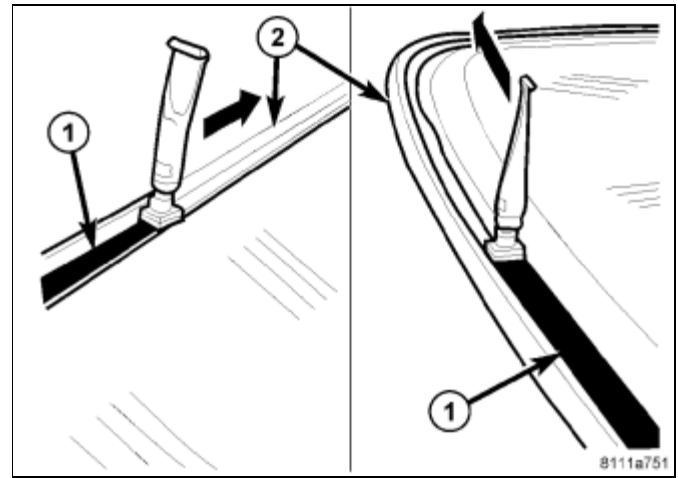
6. Apply adhesive tape to the locations shown to aid with final installation.

7. Verify windshield gap is parallel to with windshield.

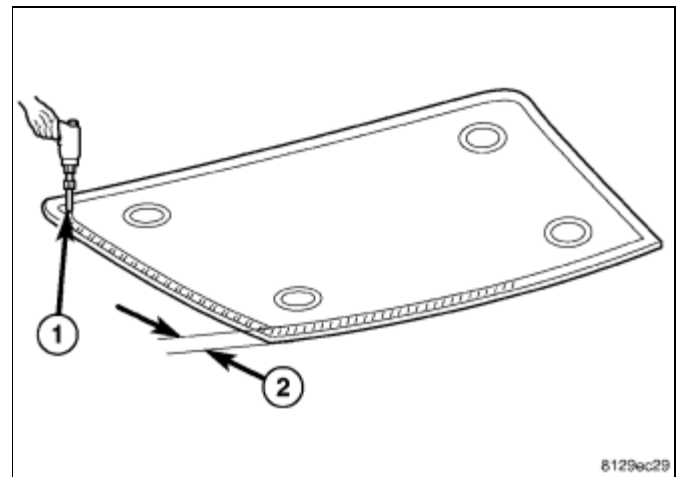
8. Cut tape with a sharp knife and remove windshield.



9. Clean and dry area of glass to be glued with a suitable glass preparation solvent and rag.
10. Apply primer to gluing surface at windshield seal.

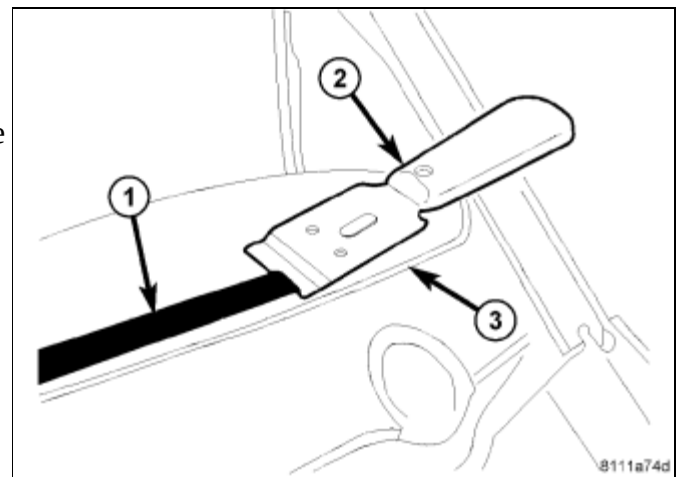


11. Apply primer (1) around the perimeter of the glass to a width of 18 mm (0.7 in.) (2) and 6 mm (0.25 in) from the edge.
12. Allow primer to air dry for at least 10 minutes.
13. Using a flash light, verify that glass primer is without damage.



Windshield Opening Preparation

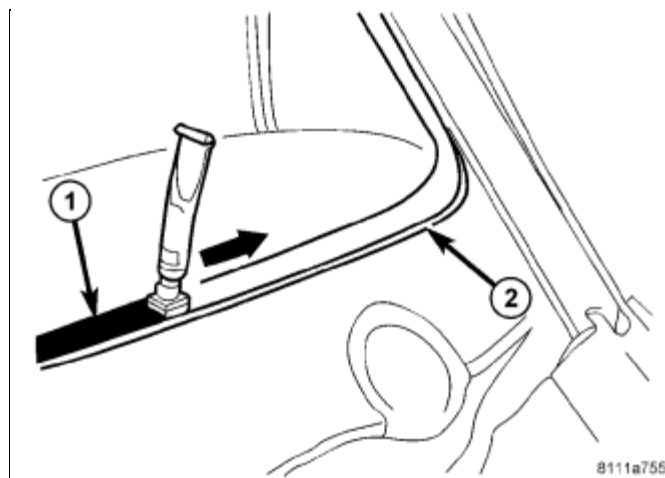
1. Clean and vacuum windshield opening.
2. Level old bead of windshield opening adhesive (1) to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive.



3. Clean and dry area of windshield opening to be re-glued with a suitable glass preparation solvent and rag.
4. Re-prime any damaged area. If old adhesive has been

exposed for more than 12 hours, entire adhesive area needs to be re-primed.

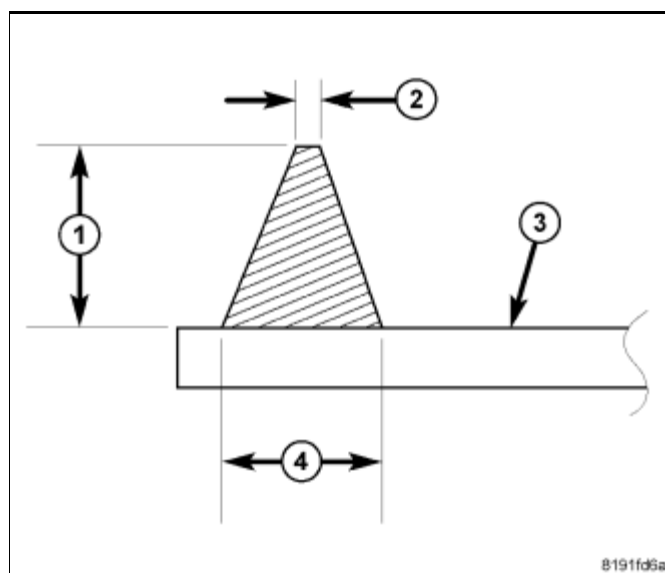
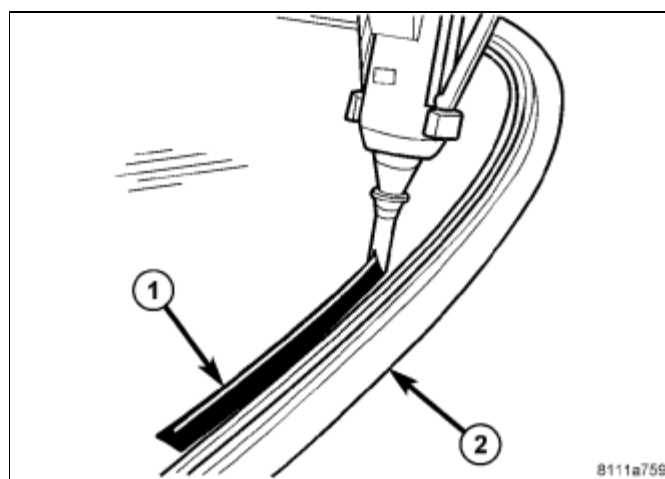
5. Allow primer to air dry for at least 10 minutes.



Windshield Installation

1. Apply bead of adhesive (1) with a triangular nozzle directly to the windshield seal starting at bottom in center of windshield.

CAUTION: Always apply bead of adhesive to the windshield. Always install the windshield within 5 minutes after applying adhesive.



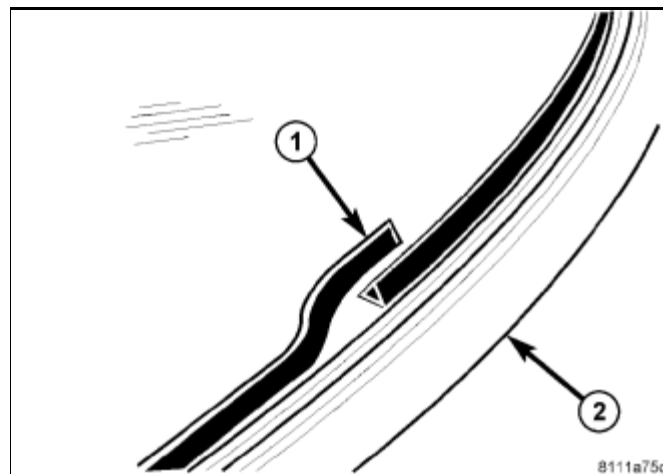
1 - ADHESIVE HEIGHT 12.7 mm (0.50 in)

2 - ADHESIVE TIP WIDTH 3 mm (0.120 in)

3 - INNER WINDSHIELD SURFACE
4 - ADHESIVE WIDTH 9.5 mm (0.375 in)

2. Bead dimensions should be approximately 9.5 mm wide (4) by 12.7 mm in height (1).

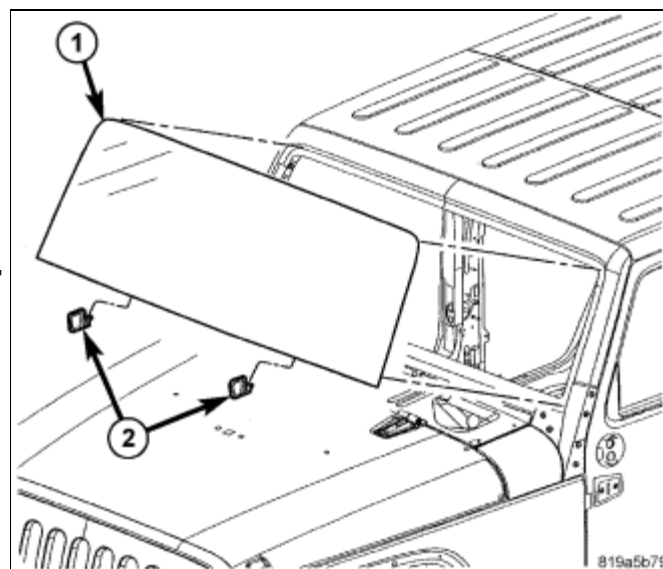
3. Allow end of adhesive bead to run out parallel to the start of the bead and smooth ends flush.



4. Lift windshield (1) into place in the center of the windshield opening and use the tape as a guide to aid installation of the windshield into the center of the cutout.
5. Carefully lay down windshield and press on.

CAUTION: It is no longer possible to move the windshield after installation. The windshield should never be pressed into place by more than one person, because the windshield can break if pressed simultaneously on both sides.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.



6. Install rear view mirror (Refer to 23 - BODY/INTERIOR/MIRROR - INSIDE REAR VIEW - INSTALLATION).

BODY STRUCTURE

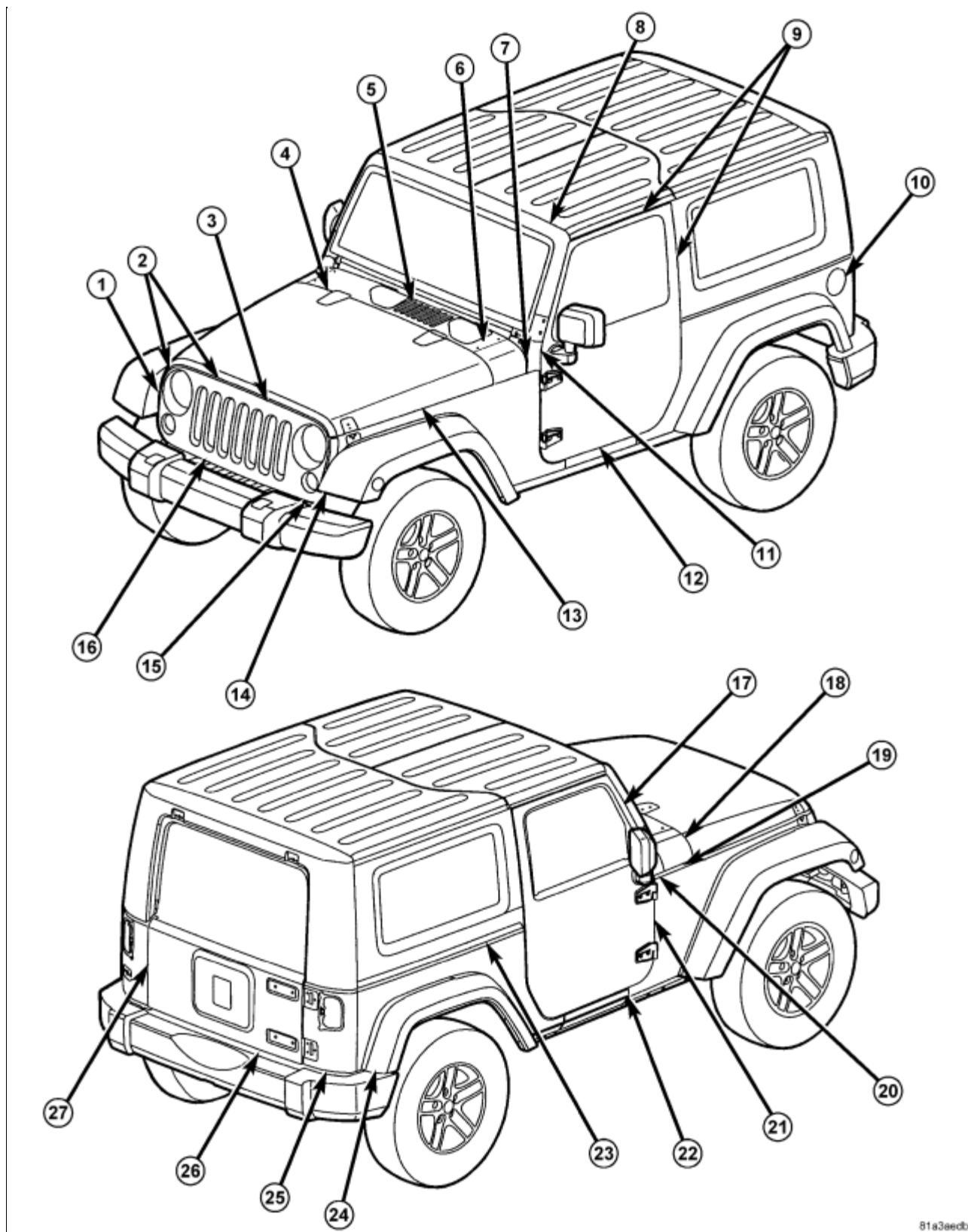
GAP AND FLUSH

SPECIFICATIONS

GAP AND FLUSH

INDEX

DESCRIPTION	FIGURE
TWO DOOR	TWO DOOR - JK72
FOUR DOOR	FOUR DOOR - JK74



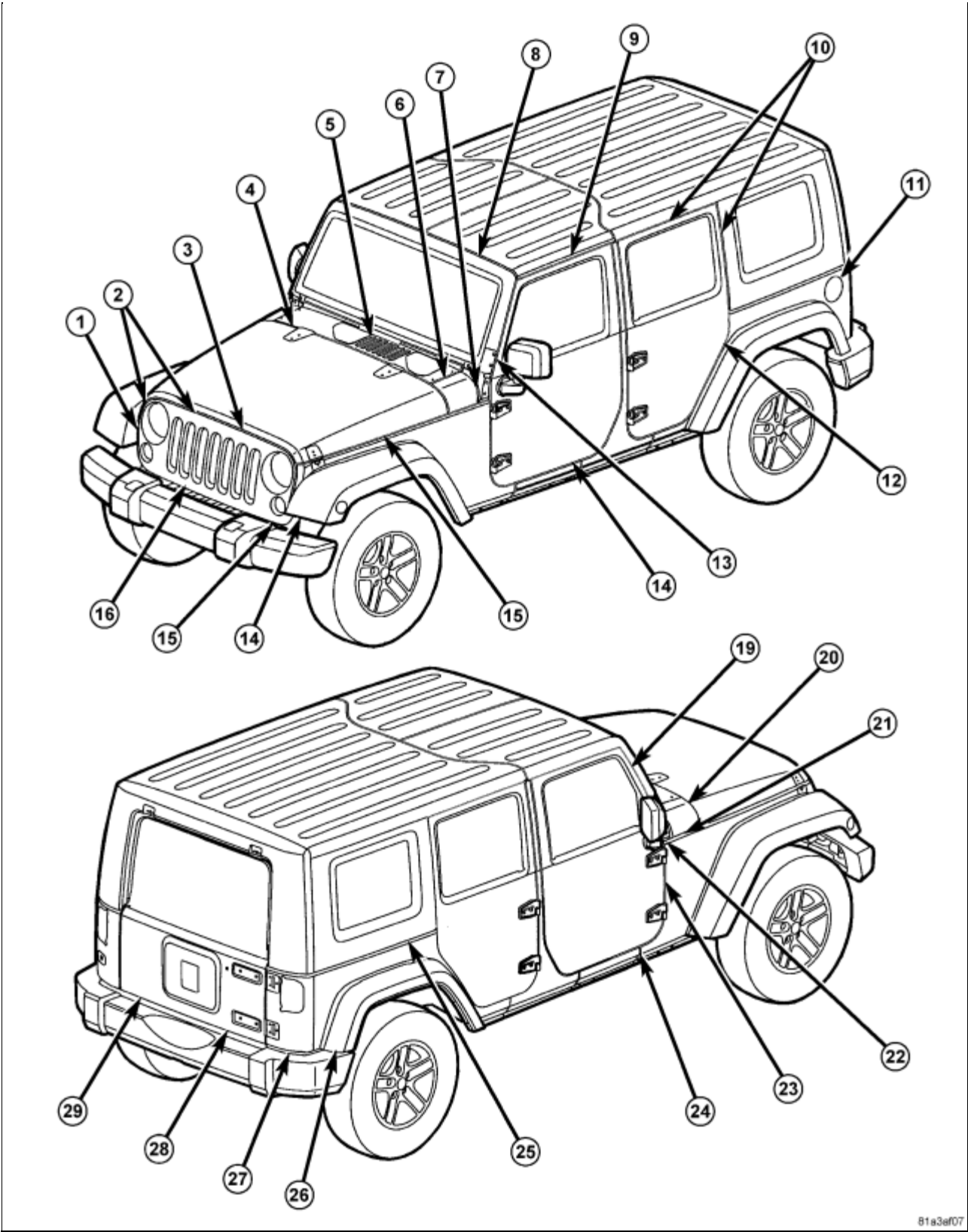
TWO DOOR - JK72

NOTE: All dimensions are in millimeters.

GAP AND FLUSH MEASUREMENTS

DIMENSION	DESCRIPTION	GAP	FLUSH
1	Fender to Grille	--	0.0 +/- 2.0
2	Hood/Fender to Grille	7.0 +/- 2.0 Parallel within 1.5 Side to Side 2.0	--
3	Hood to Grille	--	Hood O/F 1.0 +/- 2.0 Parallel within 1.5
4	Hood to Cowl Grille	7.0 +/- 2.0 Parallel within 1.5	0.0 +/- 2.0
5	Cowl Grille to Windshield	5.0 +/- 2.0 Parallel within 1.5	0.0 +/- 2.0
6	Cowl Grille to Cowl End Cap	5.5 +/- 1.5	0.0 +/- 1.5
7	Cowl Panel Windshield Reinforcement	To Windshield 4.0 +/- 1.5 Parallel within 1.5 To Cowl End Cap 3.0 +/- 2.0	--
8	Windshield to Hard/Soft Top	5.0 +/- 2.0 Parallel within 2.0	O/F 1.0 +/-2.0
9	Hard/Soft Top to Front Door	5.0 +/- 2.0 Parallel within 1.5	12.0 +/- 2.0 at Drip Rail 0.0 +/- 1.5 at Belt Line
10	Fuel Filler Door to Body Side	0.0 + 1.5/-0.0	--
11	Windshield Reinforcement to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
12	Front Door to Body Side	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5 Allow additional +/- 0.5 with Side Curtain
13	Hood to Fender	6.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
14	Fender/Wheel Flare to Fascia	16.0 +/- 4.0 Parallel within 3.0	--
15	Grille to Bumper	11.0 +/- 4.0 Parallel within 3.0	--
16	Grille to Valance Cover	13.0 +/- 4.0	--
17	Windshield to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5 Allow additional +/- 0.5 with Side Curtain

18	Hood to Cowl Grille End Cap	7.0 +/- 2.0 Parallel within 1.5	0.0 +/- 1.5
19	Cowl End Cap to Fender	5.5 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
20	Windshield Reinforcement to Fender	7.0 +/- 2.0	0.0 +/- 1.5
21	Fender to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
22	Fender to Body Side	5.0 +/- 1.5	0.0 +/- 1.5
23	Hard/Soft Top to Body	16.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
24	Rear Bumper to Wheel Flare	19.0 +/- 5.0	0.0 +/- 4.0
25	Rear Bumper to Body Side	13.0 +/- 3.0	--
26	Rear Bumper to Swing Gate	34.5 +/- 3.0 Parallel within 3.0	--
27	Swing Gate to Body	5.0 +/- 1.5 Parallel within 1.5 Side to Side 2.0	0.0 +/- 1.5 Parallel within 1.5



FOUR DOOR - JK74

NOTE: All dimensions are in millimeters.

DIMENSION	DESCRIPTION	GAP	FLUSH
-----------	-------------	-----	-------

1	Fender to Grille	--	0.0 +/- 2.0
2	Hood/Fender to Grille	7.0 +/- 2.0 Parallel within 1.5 Side to Side 2.0	--
3	Hood to Grille	--	Hood O/F 1.0 +/- 2.0 Parallel within 1.5
4	Hood to Cowl Grille	7.0 +/- 2.0 Parallel within 1.5	0.0 +/- 2.0
5	Cowl Grille to Windshield	5.0 +/- 2.0 Parallel within 1.5	0.0 +/- 2.0
6	Cowl Grille to Cowl End Cap	5.5 +/- 1.5	0.0 +/- 1.5
7	Cowl Panel Windshield Reinforcement	To Windshield 4.0 +/- 1.5 Parallel within 1.5 To Cowl End Cap 3.0 +/- 2.0	--
8	Windshield to Hard/Soft Top	5.0 +/- 2.0 Parallel within 2.0	O/F 1.0 +/-2.0
9	Hard/Soft Top to Front Door	5.0 +/- 2.0 Parallel within 1.5	12.0 +/- 2.0
10	Hard/Soft Top to Rear Door	5.0 +/- 2.0 Parallel within 1.5	12.0 +/- 2.0 at Drip Rail 0.0 +/- 1.5 at Belt Line
11	Fuel Filler Door to Body Side	0.0 + 1.5/-0.0	--
12	Rear Door to Body Side	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5 Allow additional +/- 0.5 with Side Curtain
13	Windshield Reinforcement to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
14	Front Door to Body Side	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5 Allow additional +/- 0.5 with Side Curtain
15	Hood to Fender	6.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
16	Fender/Wheel Flare to Fascia	16.0 +/- 4.0 Parallel within 3.0	--
17	Grille to Bumper	11.0 +/- 4.0 Parallel within 3.0	--
18	Grille to Valance Cover	13.0 +/- 4.0	--

19	Windshield to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5 Allow additional +/- 0.5 with Side Curtain
20	Hood to Cowl Grille End Cap	7.0 +/- 2.0 Parallel within 1.5	0.0 +/- 1.5
21	Cowl End Cap to Fender	5.5 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
22	Windshield Reinforcement to Fender	7.0 +/- 2.0	0.0 +/- 1.5
23	Fender to Door	5.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
24	Fender to Body Side	5.0 +/- 1.5	0.0 +/- 1.5
25	Hard/Soft Top to Body	16.0 +/- 1.5 Parallel within 1.5	0.0 +/- 1.5
26	Rear Bumper to Wheel Flare	19.0 +/- 5.0	0.0 +/- 4.0
27	Rear Bumper to Body Side	13.0 +/- 3.0	--
28	Rear Bumper to Swing Gate	34.5 +/- 3.0 Parallel within 3.0	--
29	Swing Gate to Body	5.0 +/- 1.5 Parallel within 1.5 Side to Side 2.0	0.0 +/- 1.5 Parallel within 1.5

OPENING DIMENSIONS

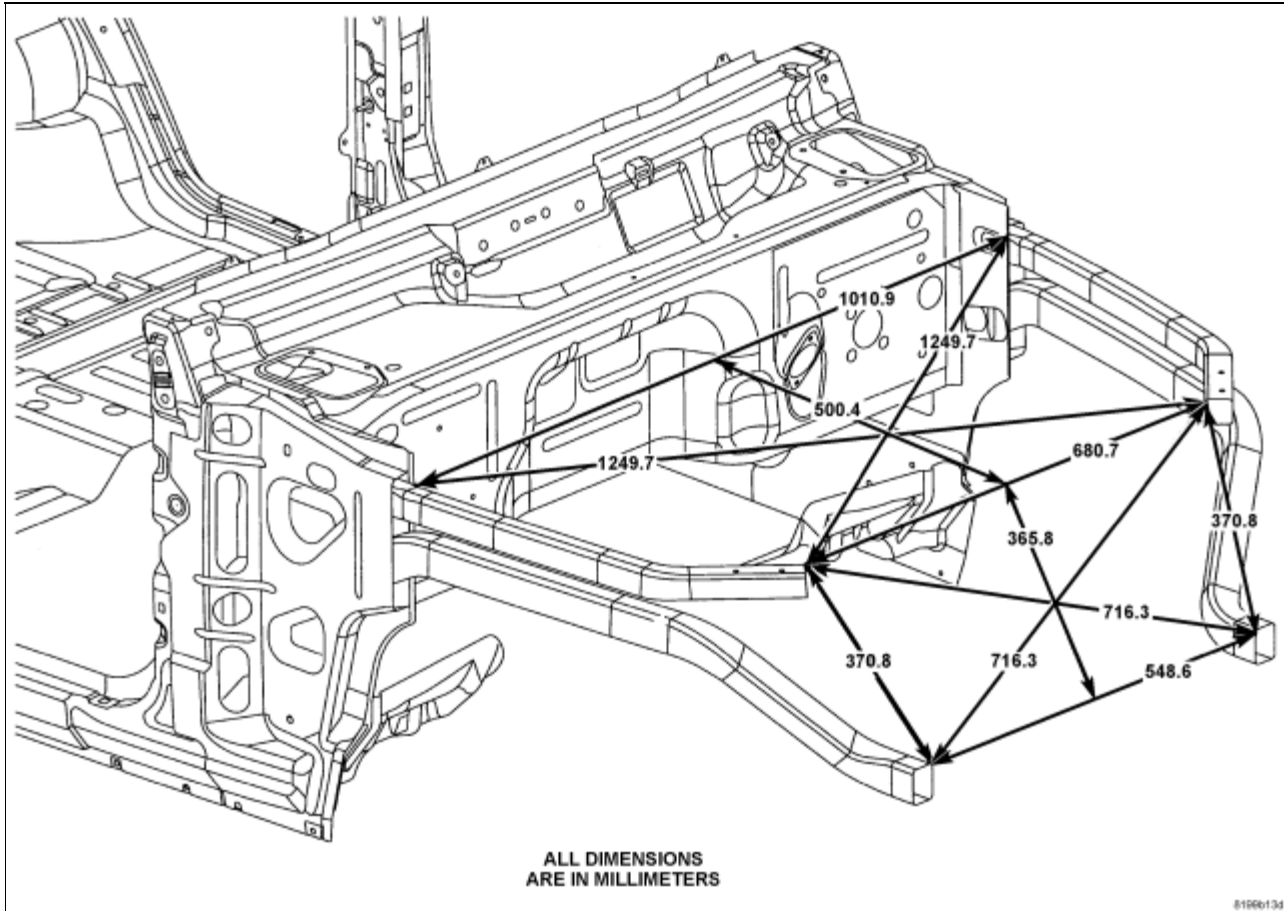
SPECIFICATIONS

BODY OPENING DIMENSIONS

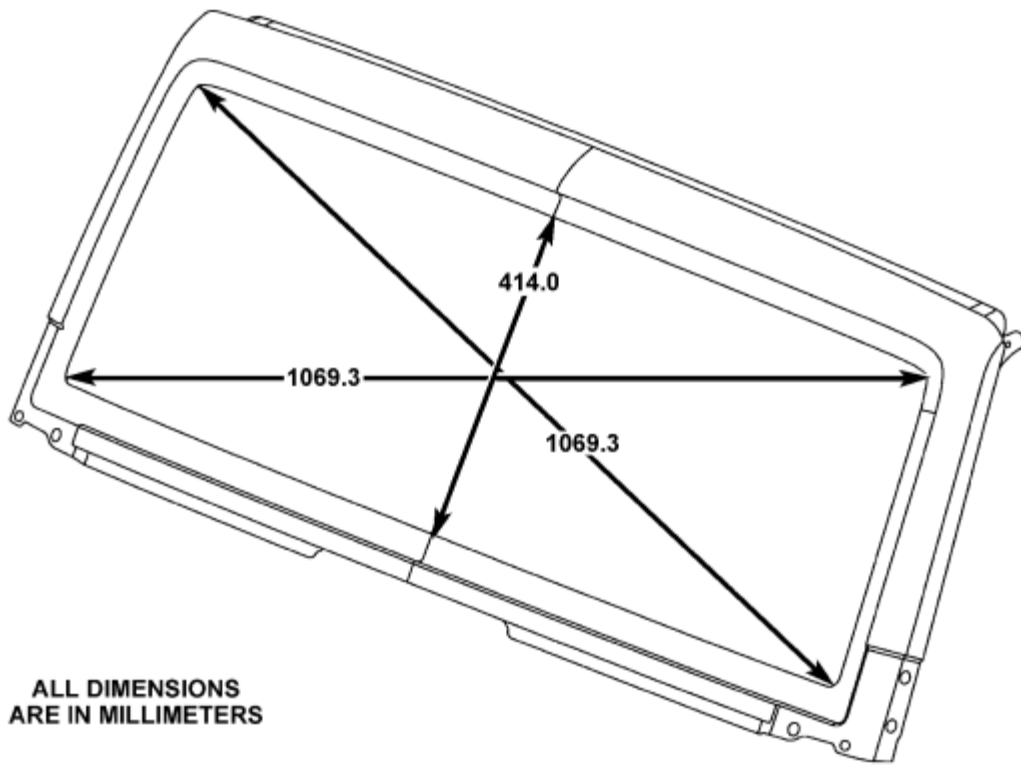
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DESCRIPTION	FIGURE
ENGINE BOX	ENGINE BOX
WINDSHIELD OPENING	WINDSHIELD OPENING
FRONT DOOR OPENING - JK72 ONLY	FRONT DOOR OPENING - JK72 ONLY
FRONT DOOR OPENING - JK74 ONLY	FRONT DOOR OPENING - JK74 ONLY

B-PILLAR CROSS/CAR - JK74 ONLY	B-PILLAR CROSS/CAR - JK74 ONLY
REAR DOOR OPENING - JK74 ONLY	REAR DOOR OPENING - JK74 ONLY
TAILGATE OPENING	TAILGATE OPENING

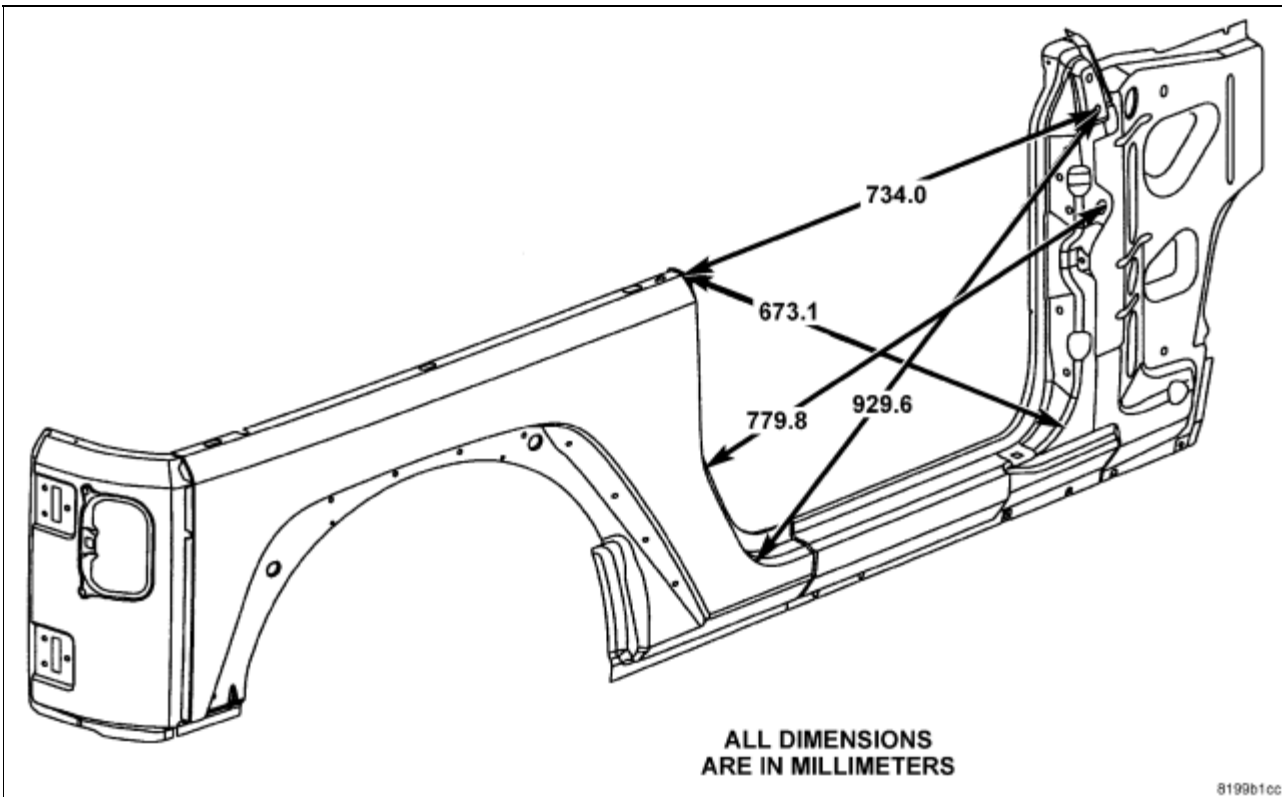


ENGINE BOX



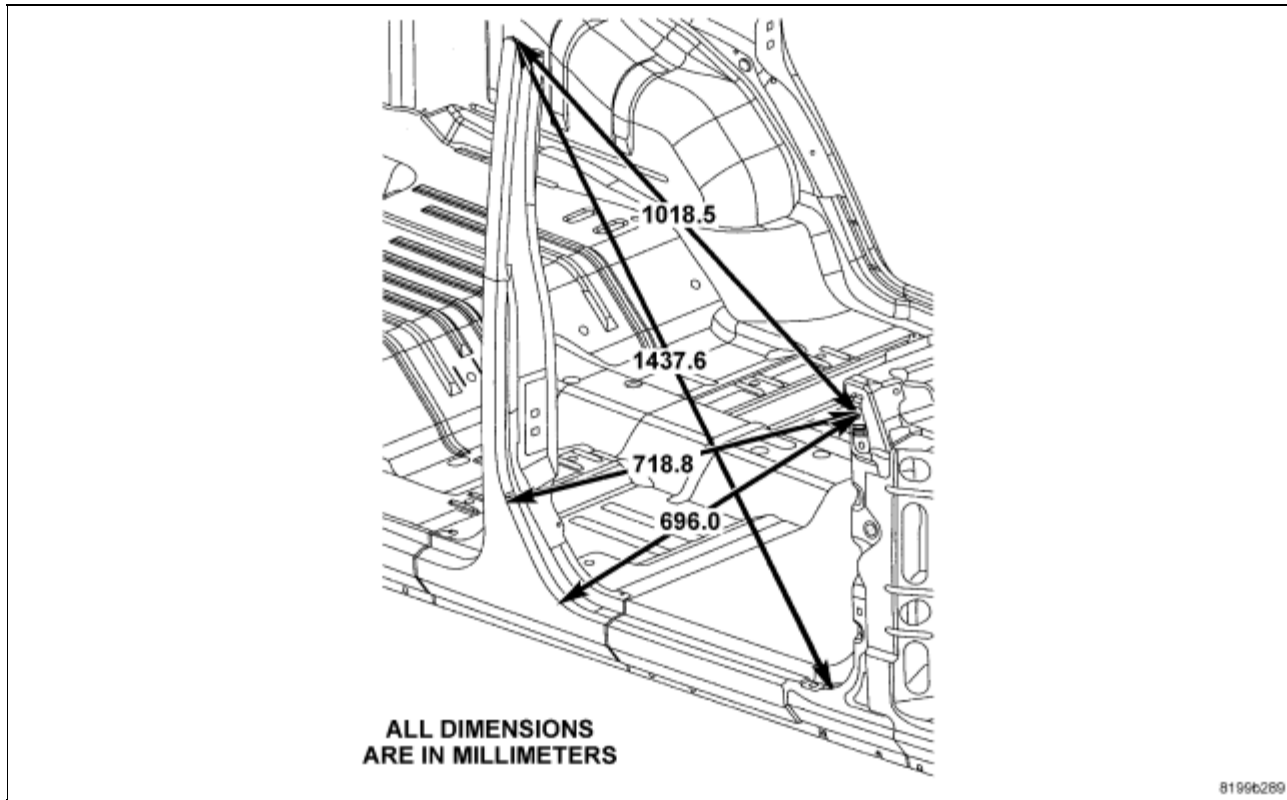
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WINDSHIELD OPENING

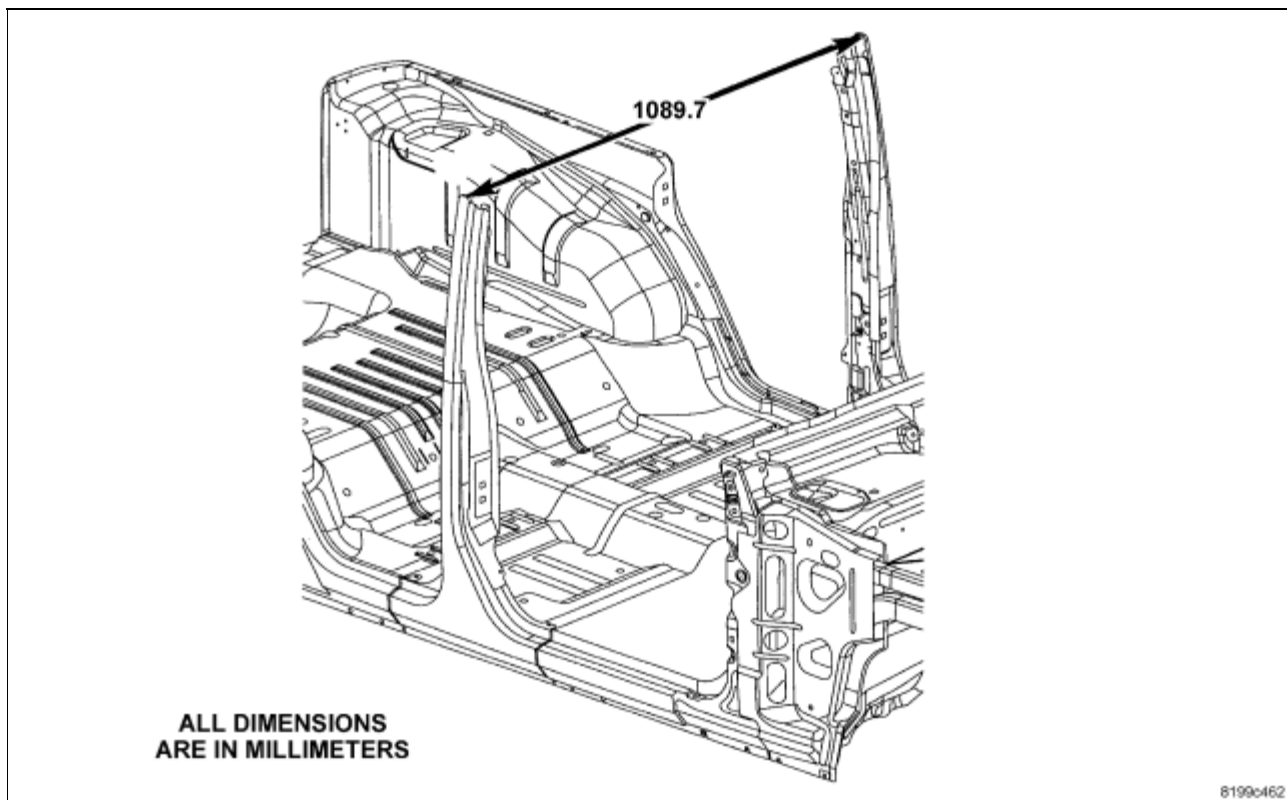


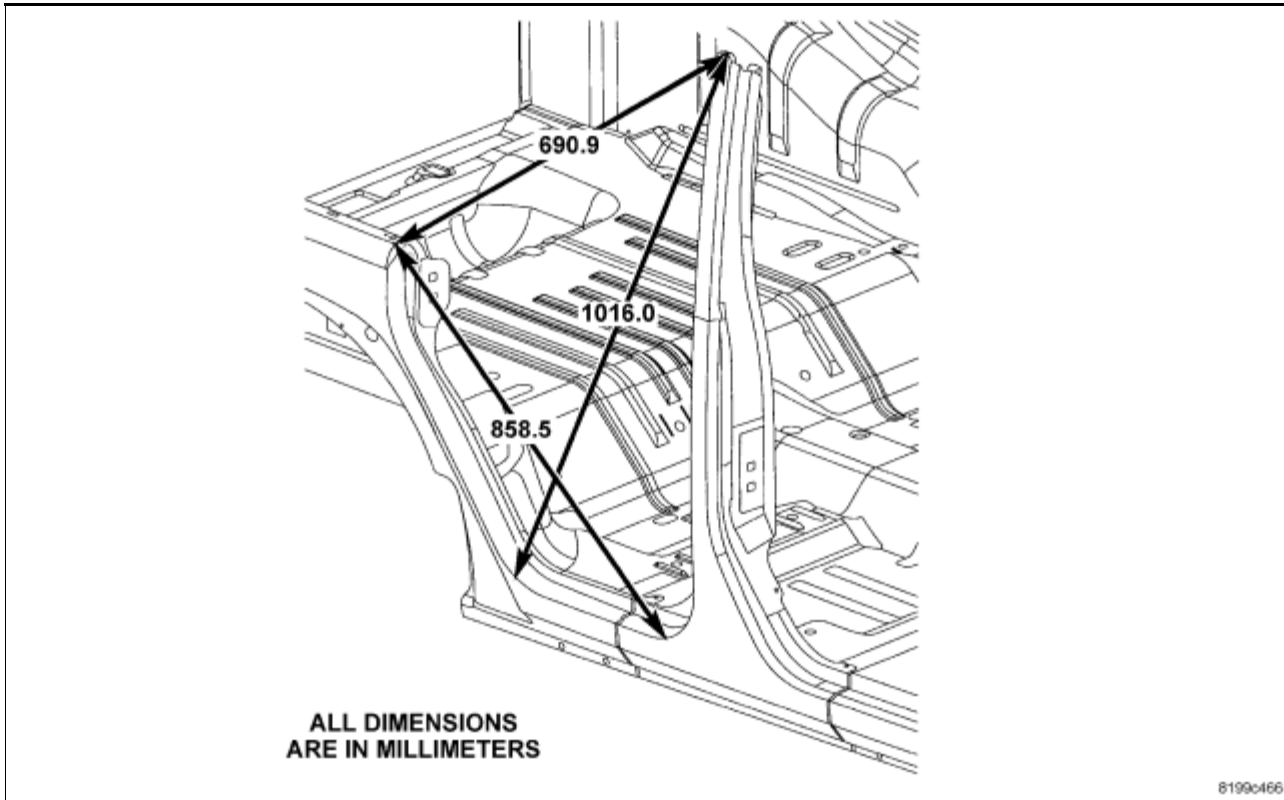
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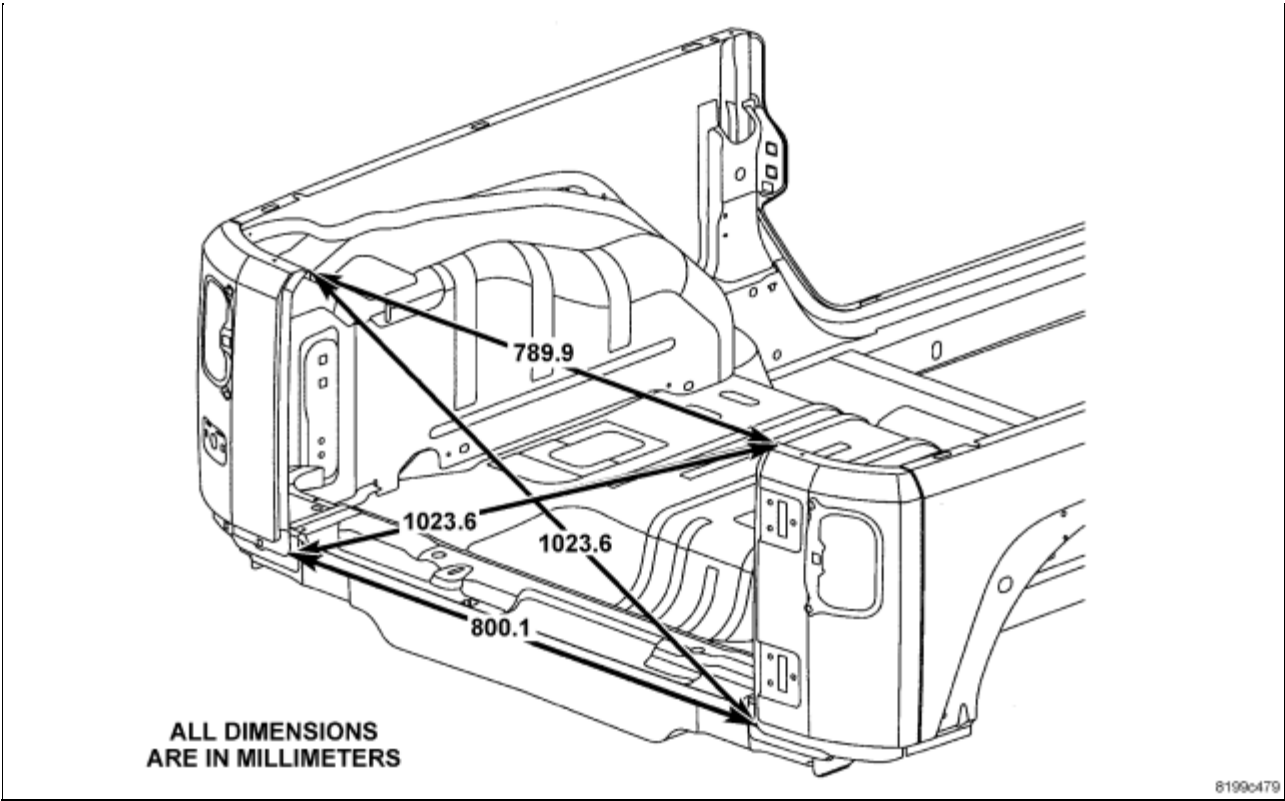
FRONT DOOR OPENING - JK72 ONLY



FRONT DOOR OPENING - JK74 ONLY



B-PILLAR CROSS/CAR - JK74 ONLY**REAR DOOR OPENING - JK74 ONLY**



TAILGATE OPENING

SEALER LOCATIONS

SPECIFICATIONS

SEALER LOCATIONS

DESCRIPTION	FIGURE
APPLICATION METHODS	APPLICATION METHODS
WINDSHIELD FRAME	WINDSHIELD FRAME
COWL/DASH/PLENUM (1 OF 2)	COWL/DASH/PLENUM (1 OF 2)
COWL/DASH/PLENUM (2 OF 2)	COWL/DASH/PLENUM (2 OF 2)
DASH/FRONT FLOOR	DASH/FRONT FLOOR
COWL SIDE/HYDROFORM	COWL SIDE/HYDROFORM
FRONT OUTER BODY SIDE APERTURE	FRONT OUTER BODY SIDE APERTURE
INNER SILL	INNER SILL

FLOOR PAN - JK72 ONLY	FLOOR PAN - JK72 ONLY
FLOOR PAN - JK74 ONLY	FLOOR PAN - JK74 ONLY
BELT RAIL REINFORCEMENT	BELT RAIL REINFORCEMENT
FRONT FLOOR/INNER SILL/COWL SIDE PANEL	FRONT FLOOR/INNER SILL/COWL SIDE PANEL
OUTER SILL/ROCKER PANEL	OUTER SILL/ROCKER PANEL
INNER SILL/FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK74 ONLY	INNER SILL/FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK74 ONLY
FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK72 ONLY	FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK72 ONLY
REAR QUARTER PANEL	REAR QUARTER PANEL



HOLD GUN NOZZLE IN DIRECTION OF ARROW IN ORDER TO EFFECTIVELY SEAL METAL JOINTS.



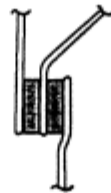
DO NOT HOLD GUN NOZZLE IN DIRECTION OF ARROW. SEALER APPLIED AS SHOWN IS INEFFECTIVE.



3 METAL THICKNESS



2 METAL THICKNESS



3 METAL THICKNESS



2 METAL THICKNESS

EXPOSED SURFACE
WORK SEAL ON METAL SURFACE TO GET GOOD ADHESIVE. EDGE MUST BE FEATHERED AS SHOWN.



SEALER MUST BE APPLIED AS ILLUSTRATED. TO LOCK SEAL IN PLACE, FORCE SEAL BEYOND HOLE.

HIDDEN SURFACE

EXPOSED SURFACE



HIDDEN SURFACE

SEALER INCORRECTLY APPLIED

SYMBOLS



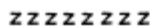
THUMBGRADEABLE SEALER



EXTRUDABLE THERMOPLASTIC



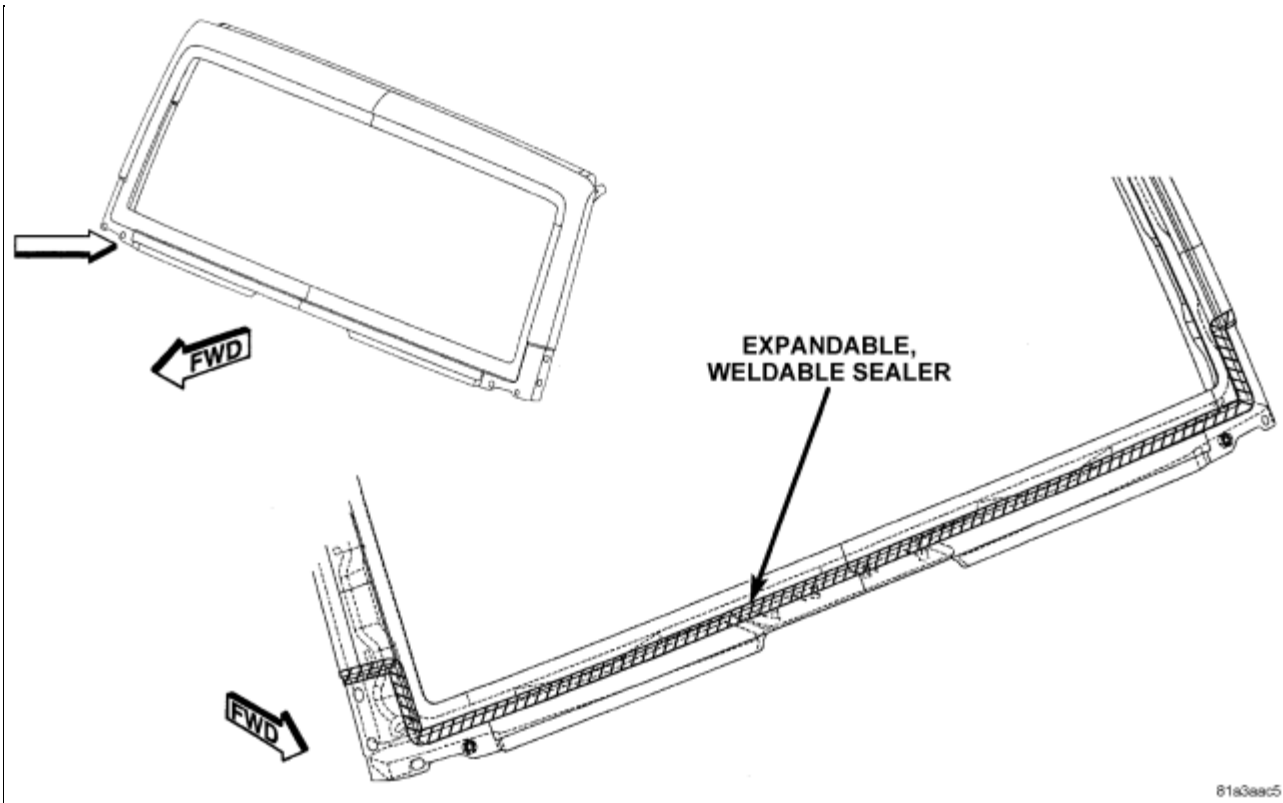
EXPOSED THERMOPLASTIC SEALANT



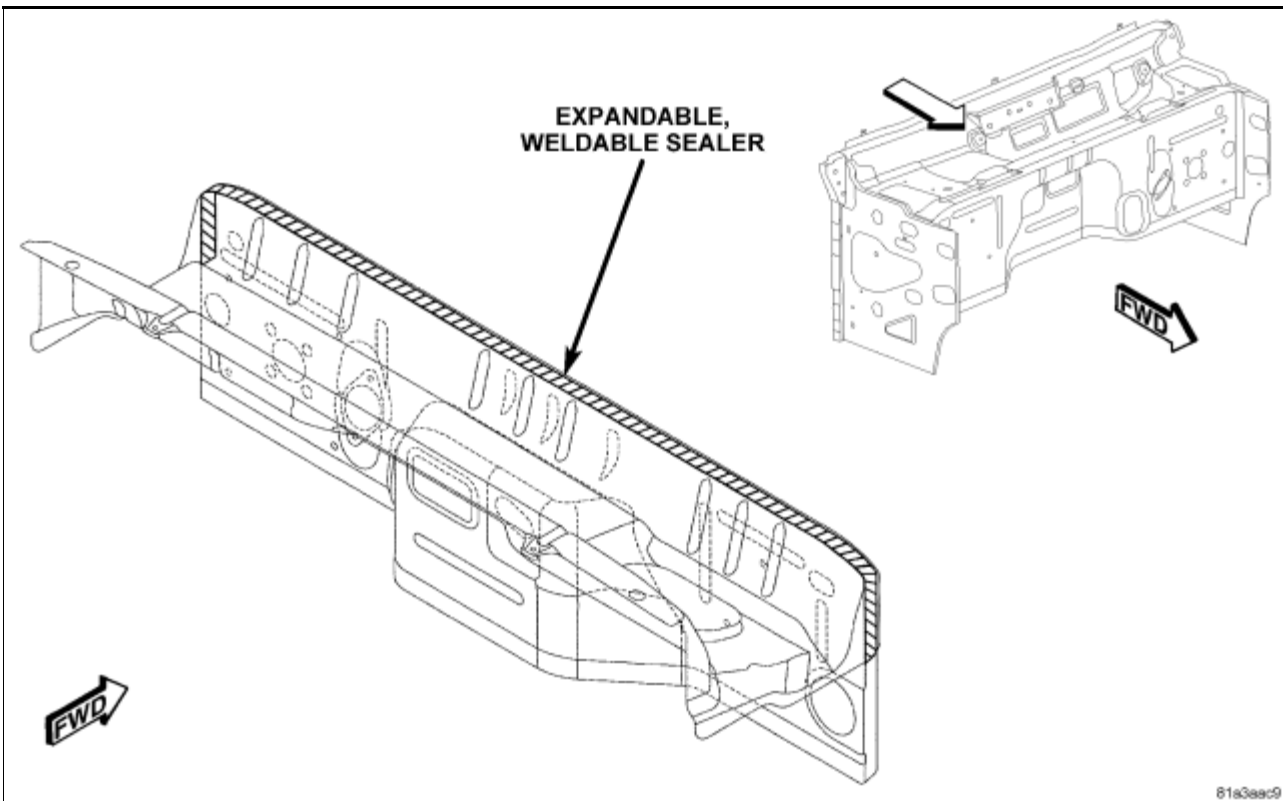
HIDDEN SEALANT

80866cc6

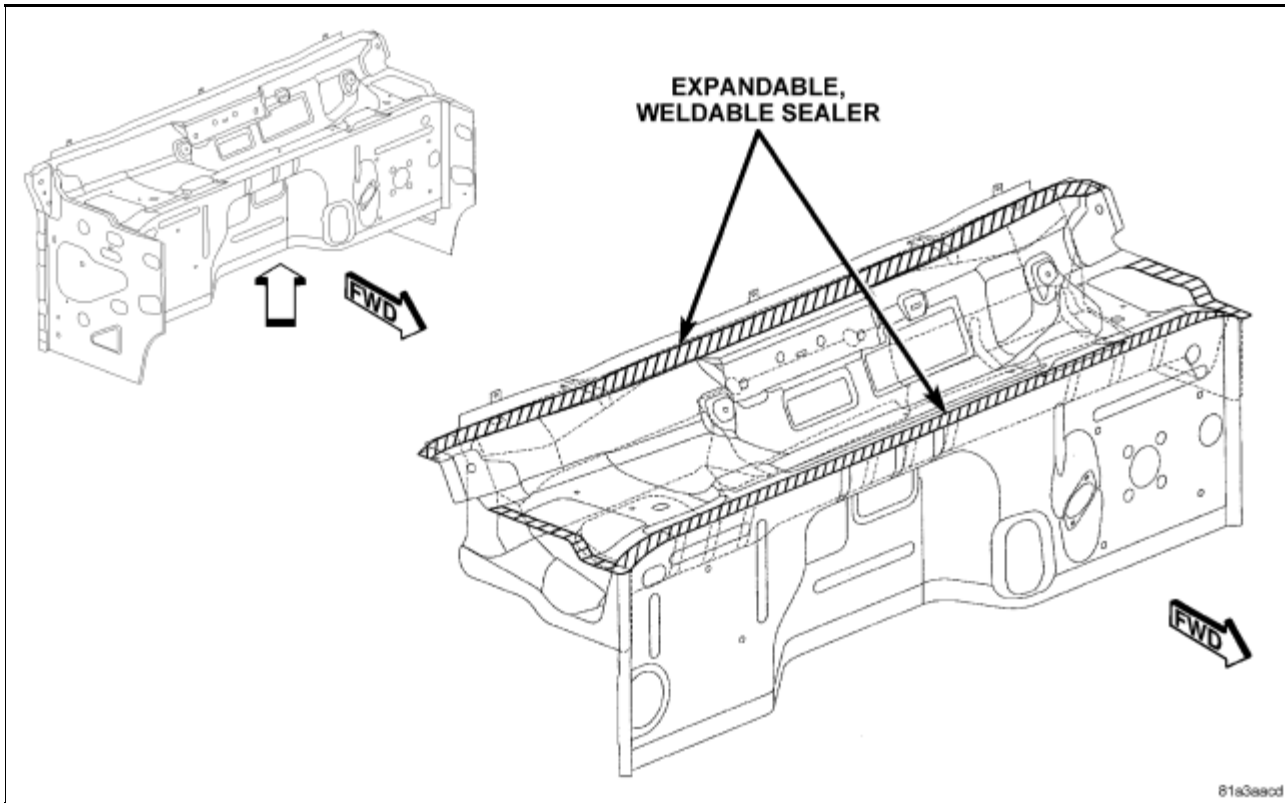
APPLICATION METHODS



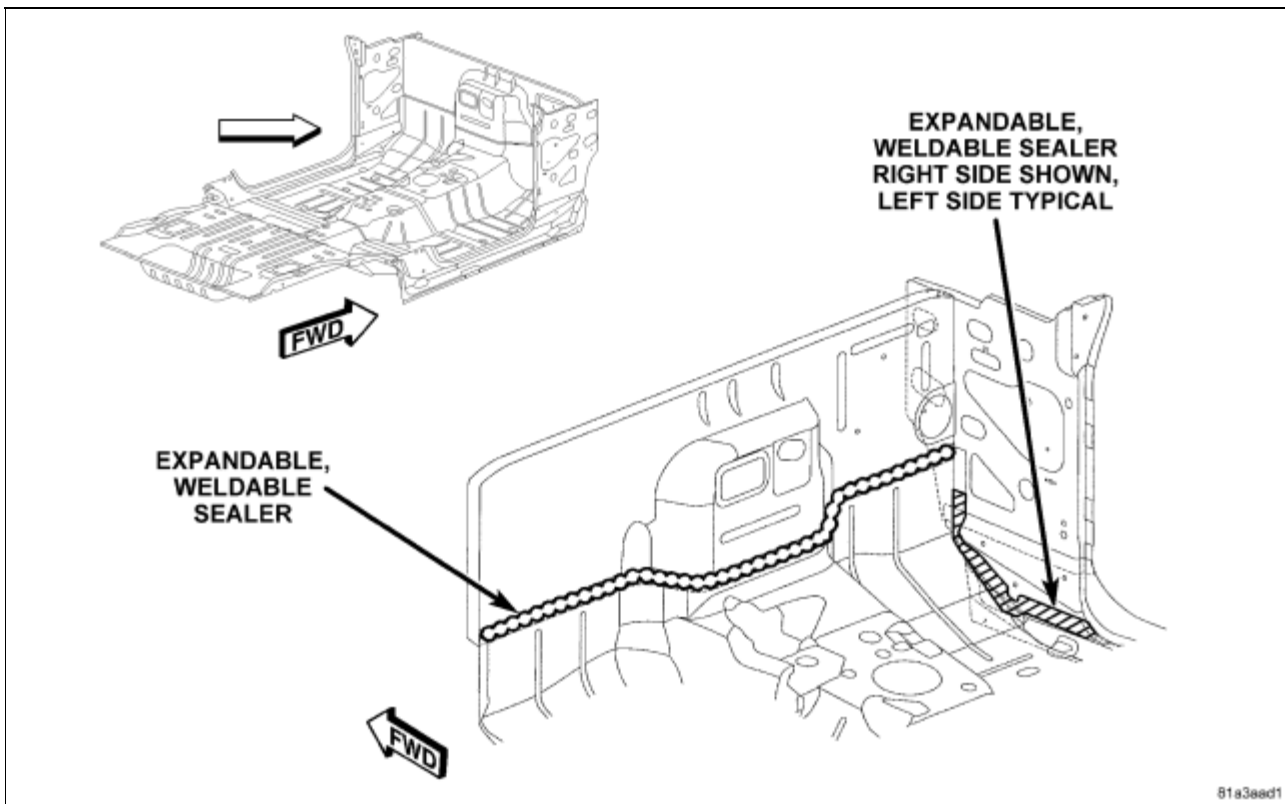
WINDSHIELD FRAME

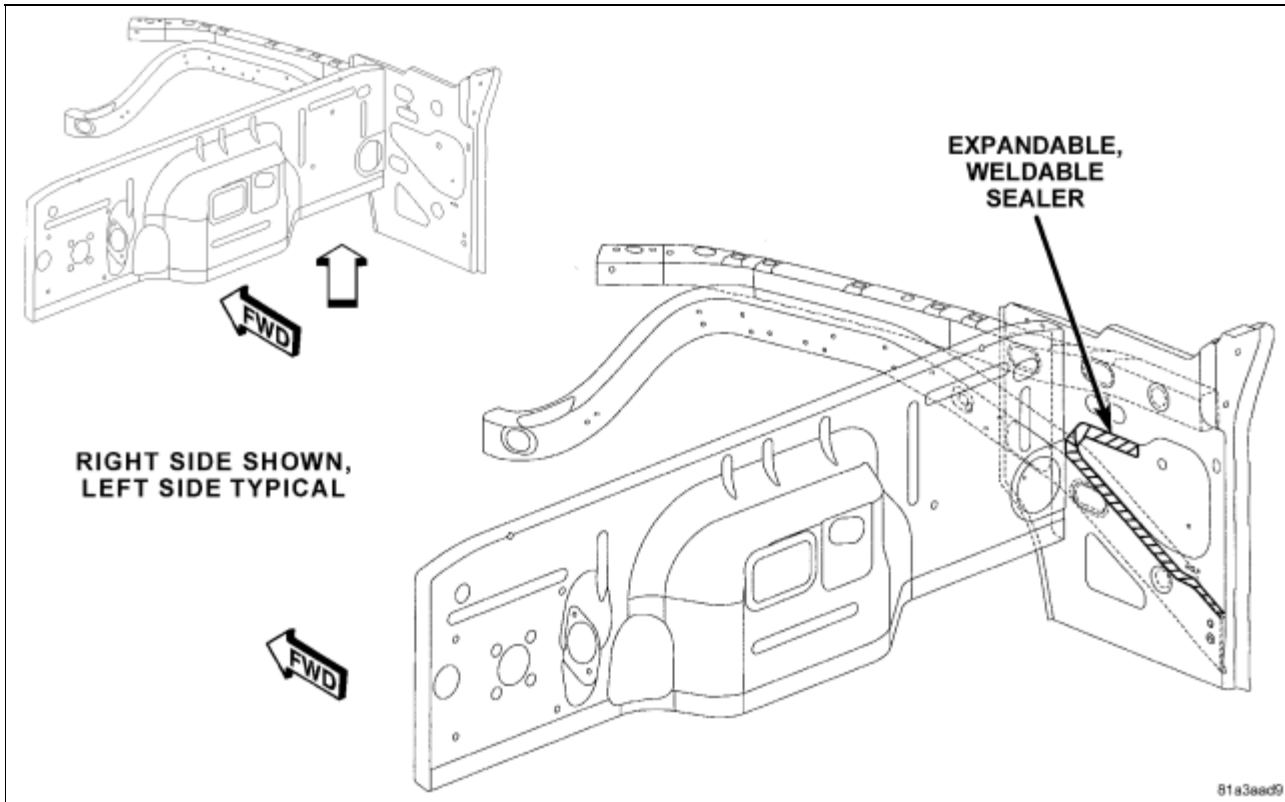


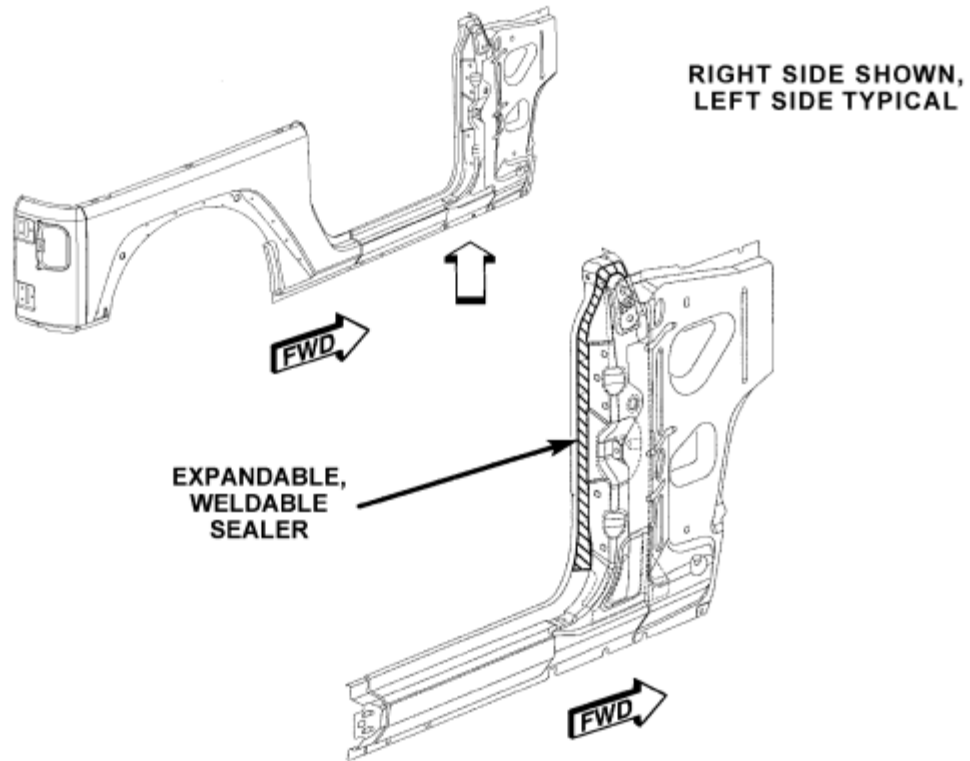
COWL/DASH/PLENUM (1 OF 2)



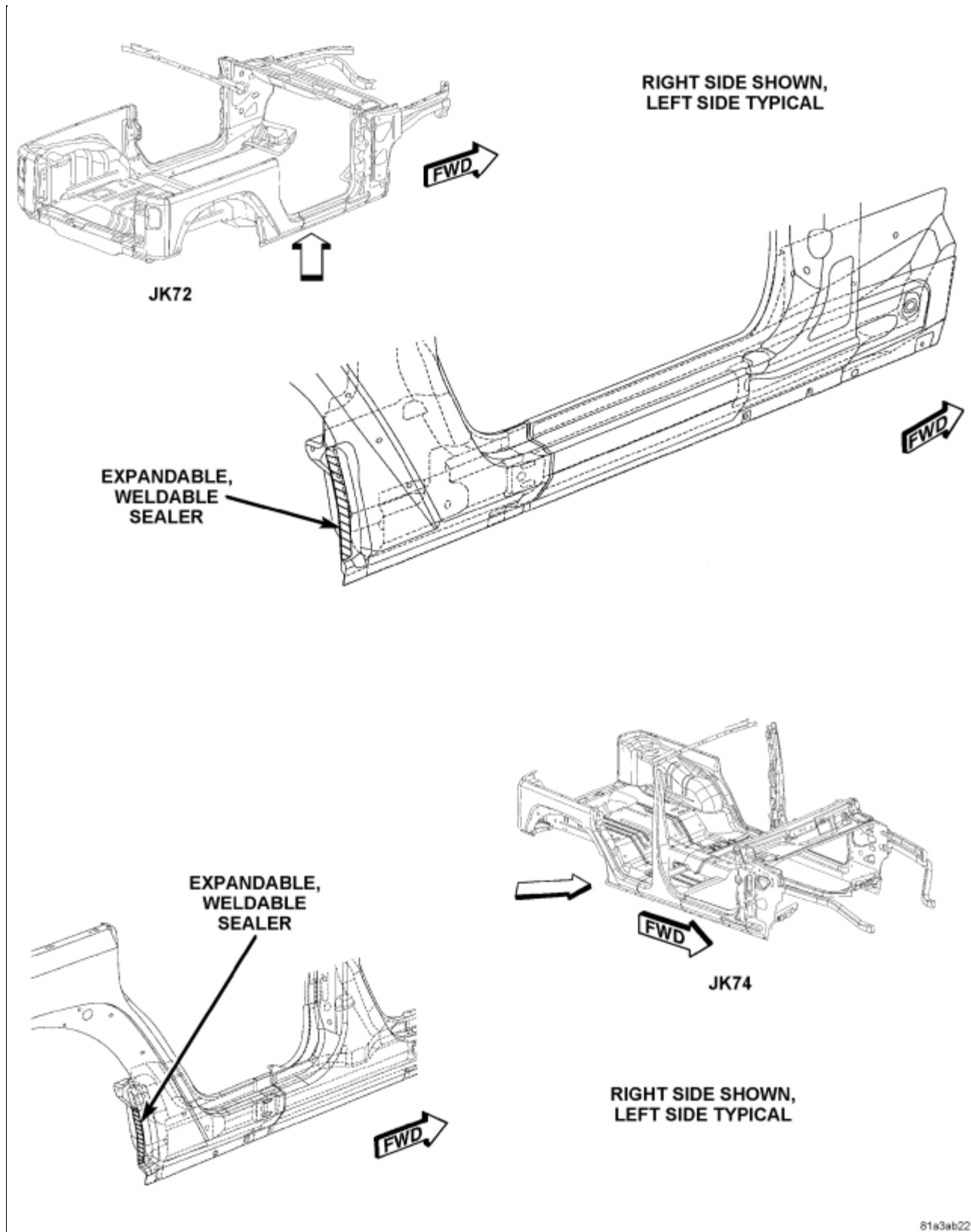
COWL/DASH/PLENUM (2 OF 2)



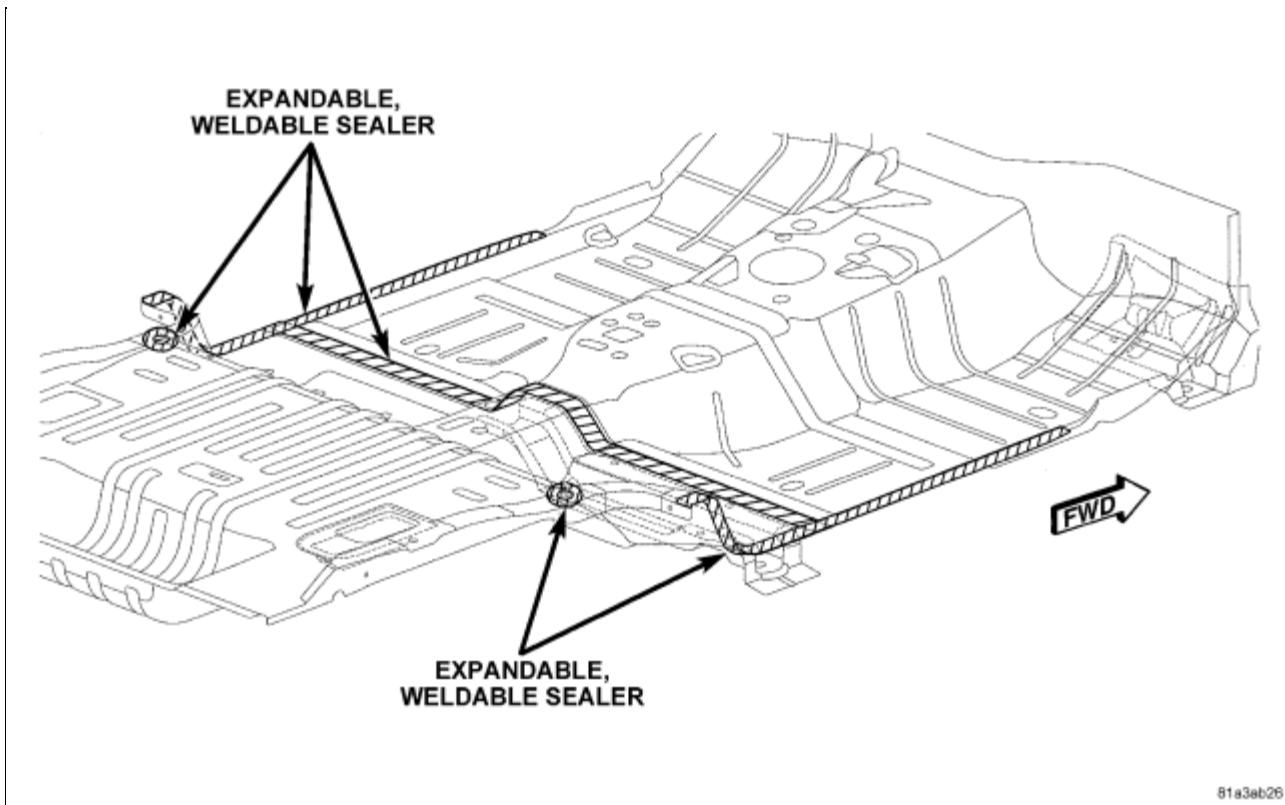
DASH/FRONT FLOOR**COWL SIDE/HYDROFORM**



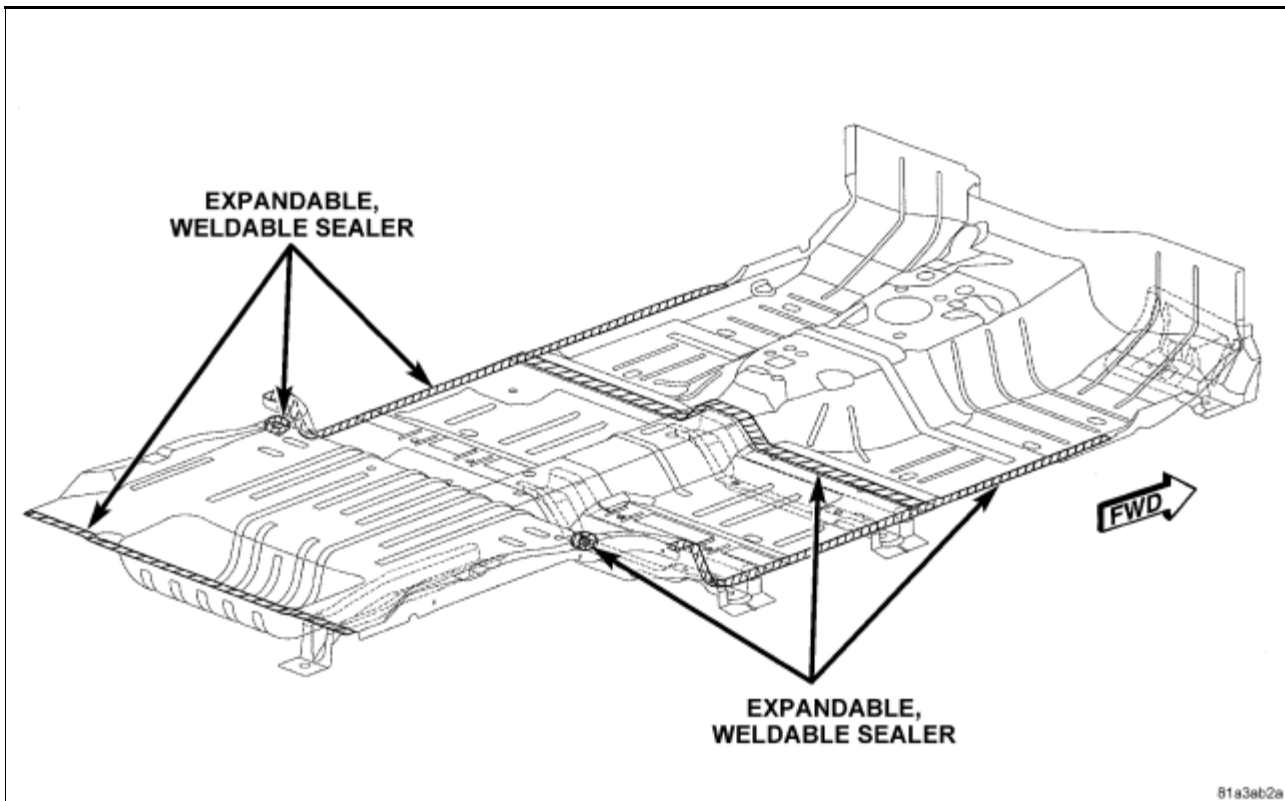
FRONT OUTER BODY SIDE APERTURE



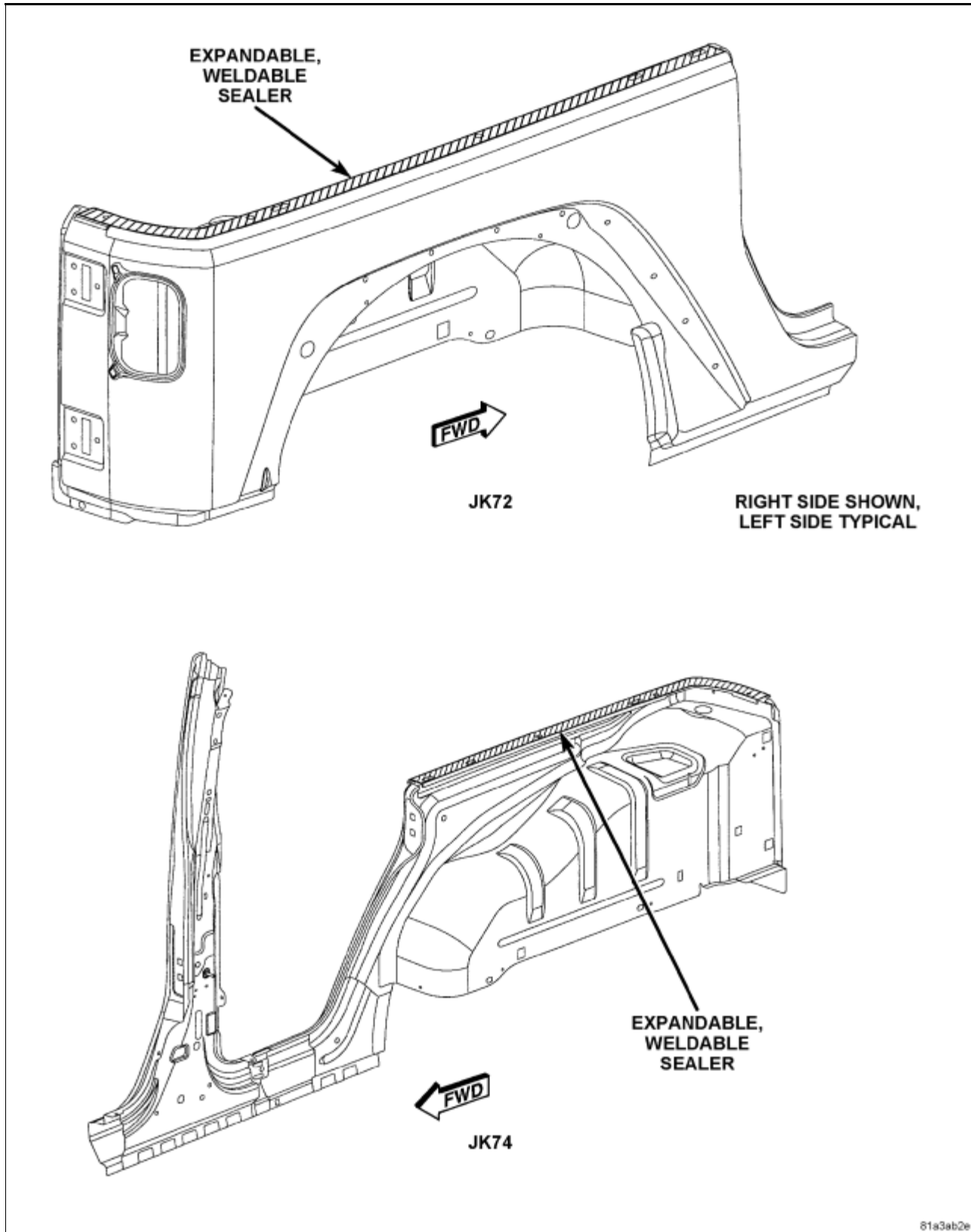
INNER SILL



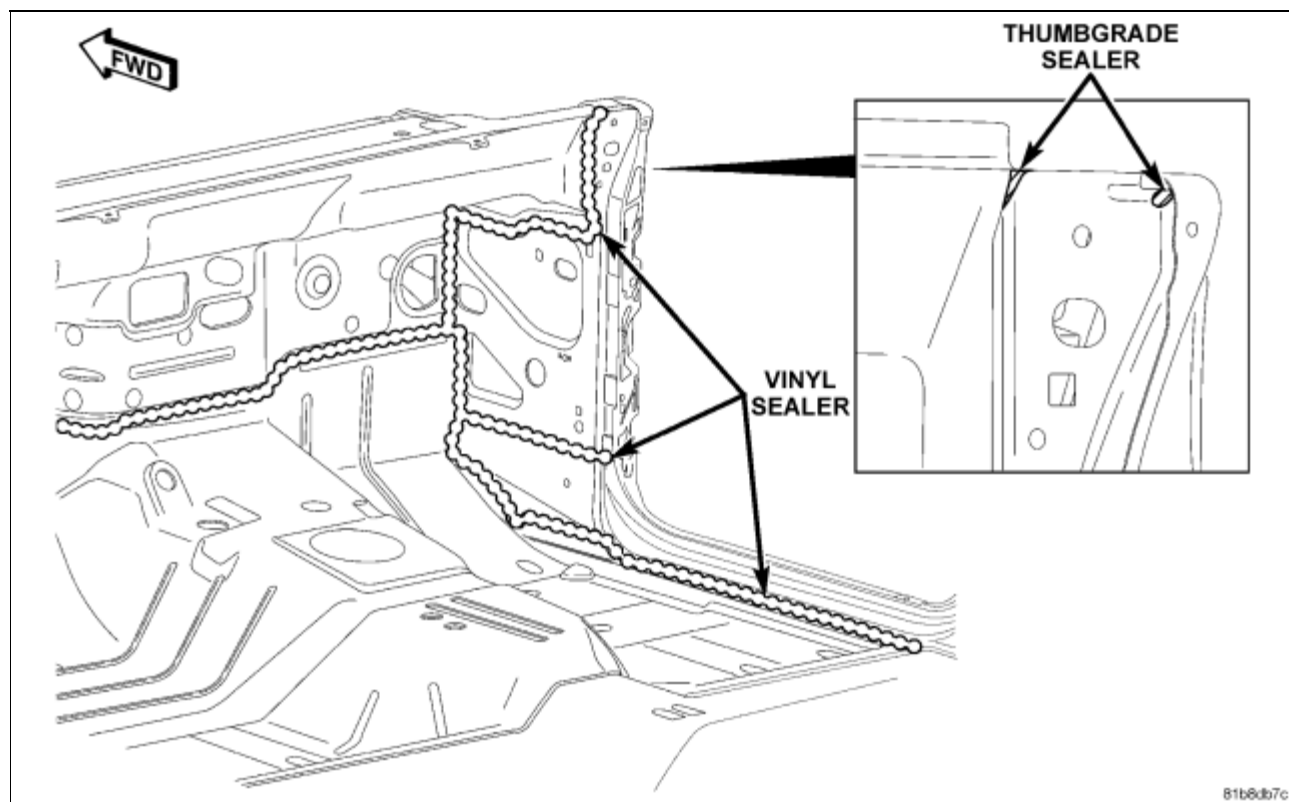
FLOOR PAN - JK72 ONLY



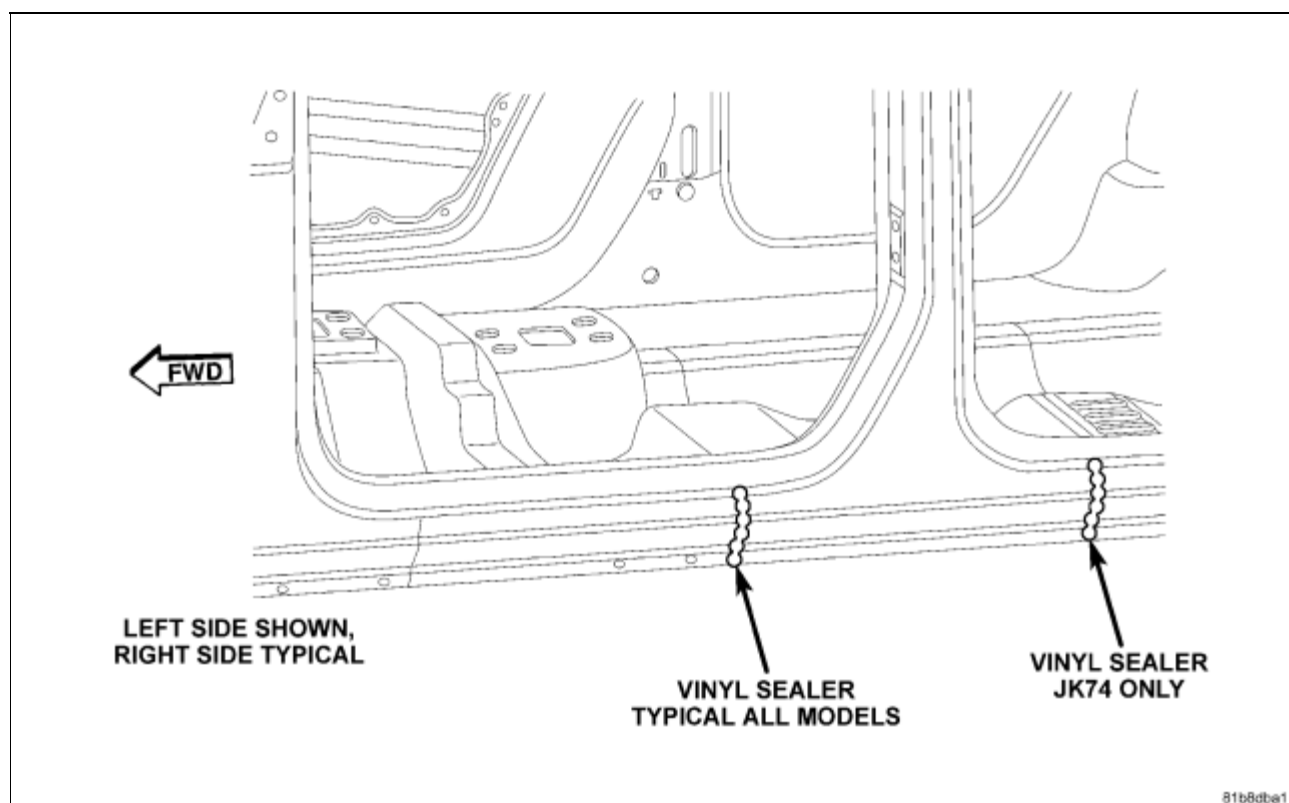
FLOOR PAN - JK74 ONLY

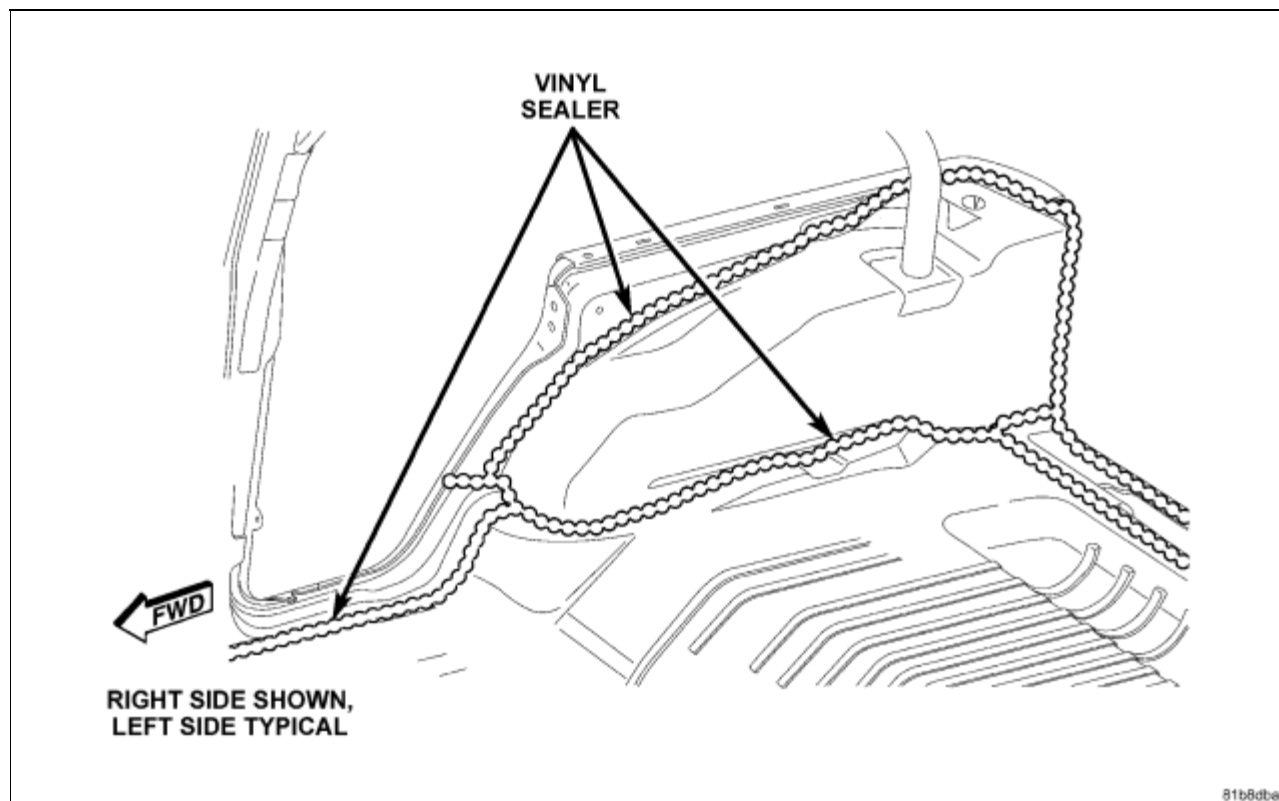


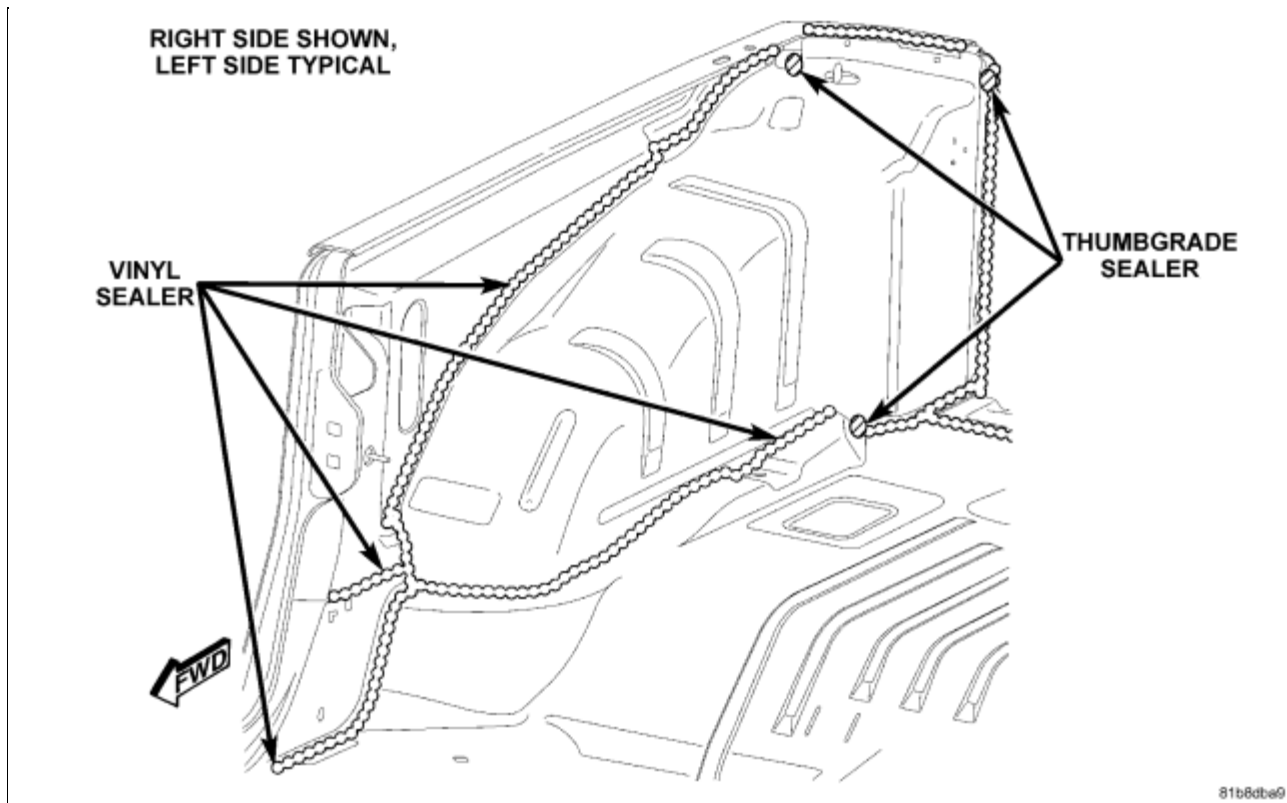
BELT RAIL REINFORCEMENT



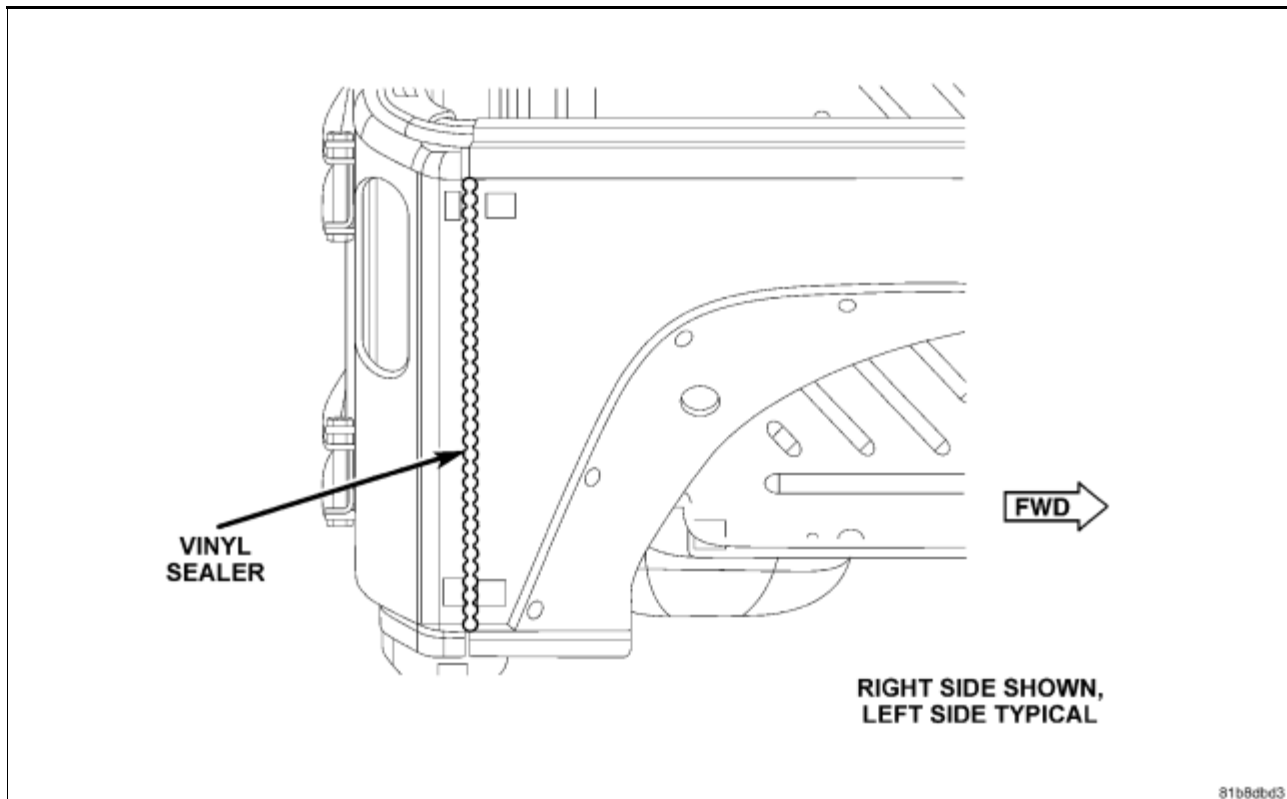
FRONT FLOOR/INNER SILL/COWL SIDE PANEL



OUTER SILL/ROCKER PANEL**INNER SILL/FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK74 ONLY**



FLOOR PAN/QUARTER PANEL/WHEELHOUSE - JK72 ONLY



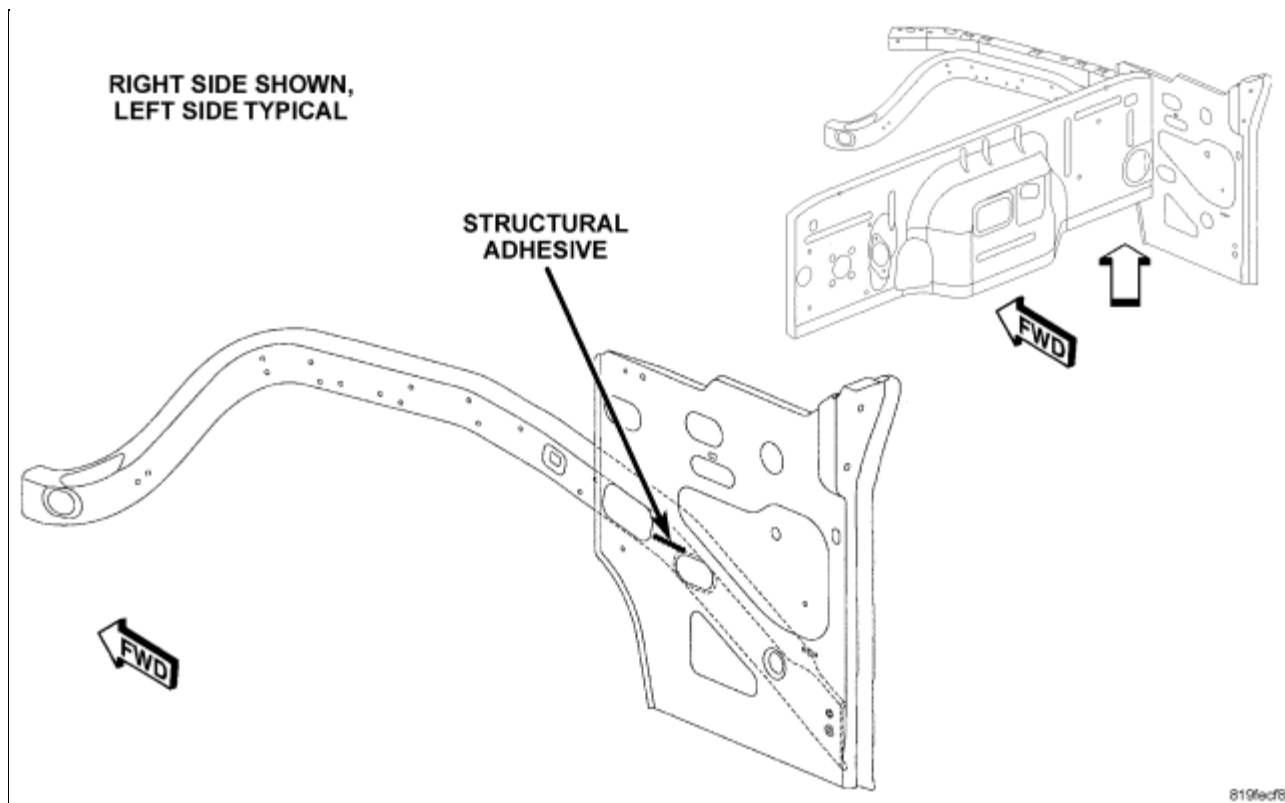
REAR QUARTER PANEL

STRUCTURAL ADHESIVE LOCATIONS

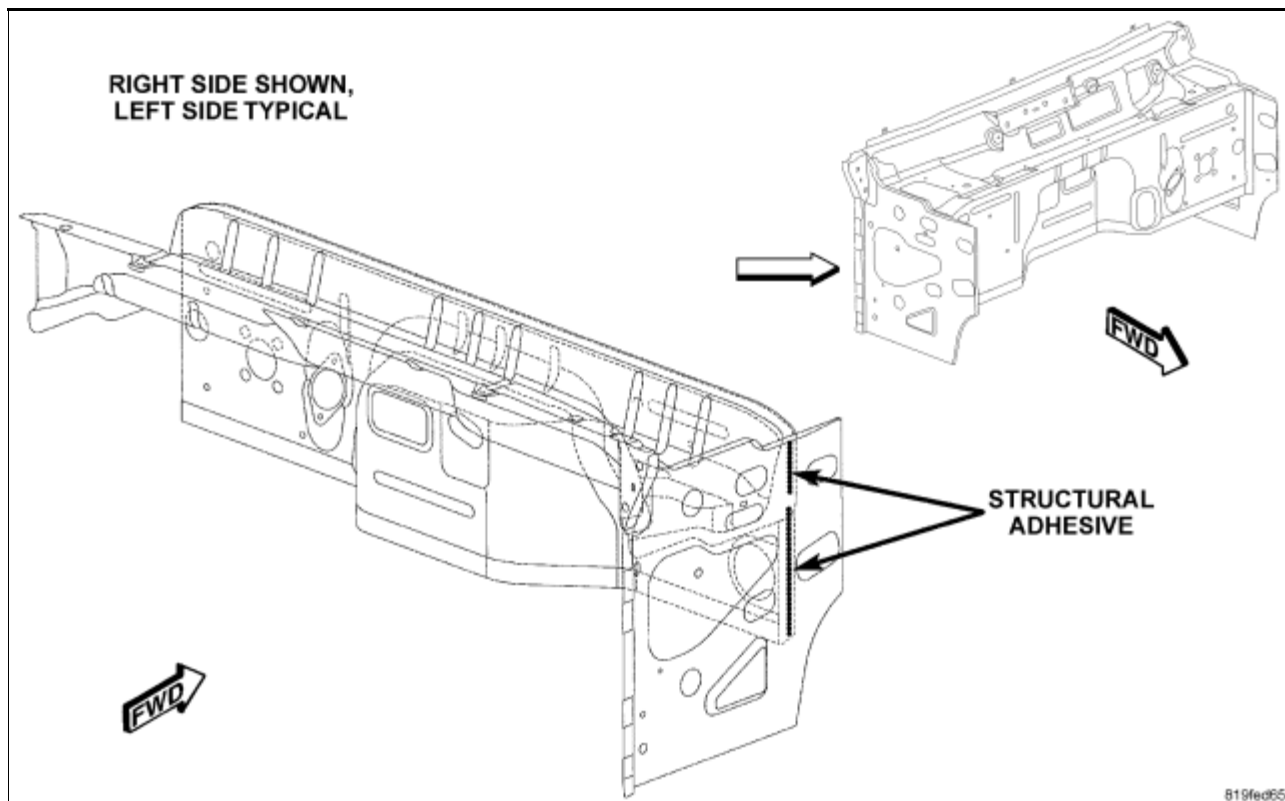
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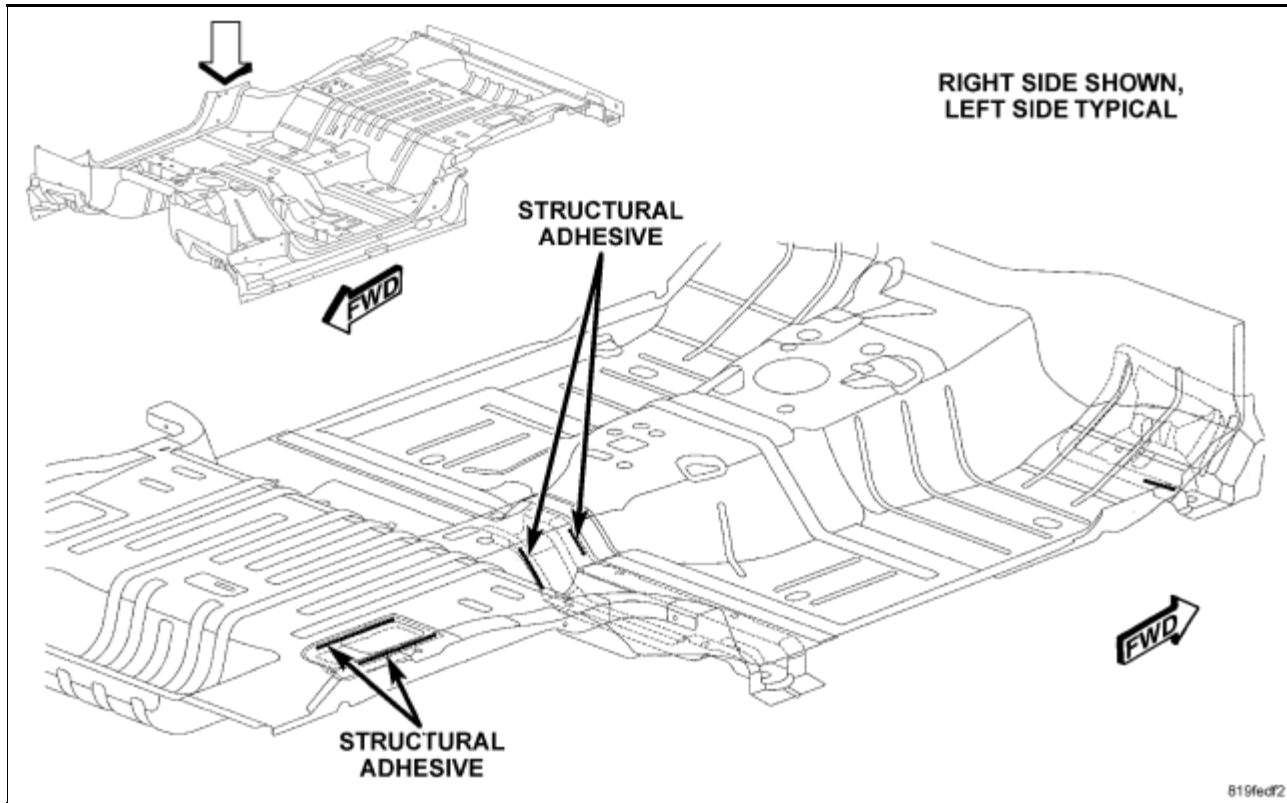
DESCRIPTION	FIGURE
UNDERBODY/HYDROFORM	UNDERBODY/HYDROFORM
COWL/DASH/PLENUM JK72	COWL/DASH/PLENUM JK72
LADDER & FLOOR ASSEMBLY JK72	LADDER & FLOOR ASSEMBLY JK72
UNDERBODY COMPLETE JK72	UNDERBODY COMPLETE JK72
BODY IN WHITE COMPLETE JK72	BODY IN WHITE COMPLETE JK72
COWL/DASH/PLENUM JK74	COWL/DASH/PLENUM JK74
LADDER AND FLOOR ASSEMBLY JK74	LADDER AND FLOOR ASSEMBLY JK74
UNDERBODY COMPLETE JK74	UNDERBODY COMPLETE JK74
BODY IN WHITE COMPLETE (1 OF 2) JK74	BODY IN WHITE COMPLETE (1 OF 2) JK74
BODY IN WHITE COMPLETE (2 OF 2) JK74	BODY IN WHITE COMPLETE (2 OF 2) JK74



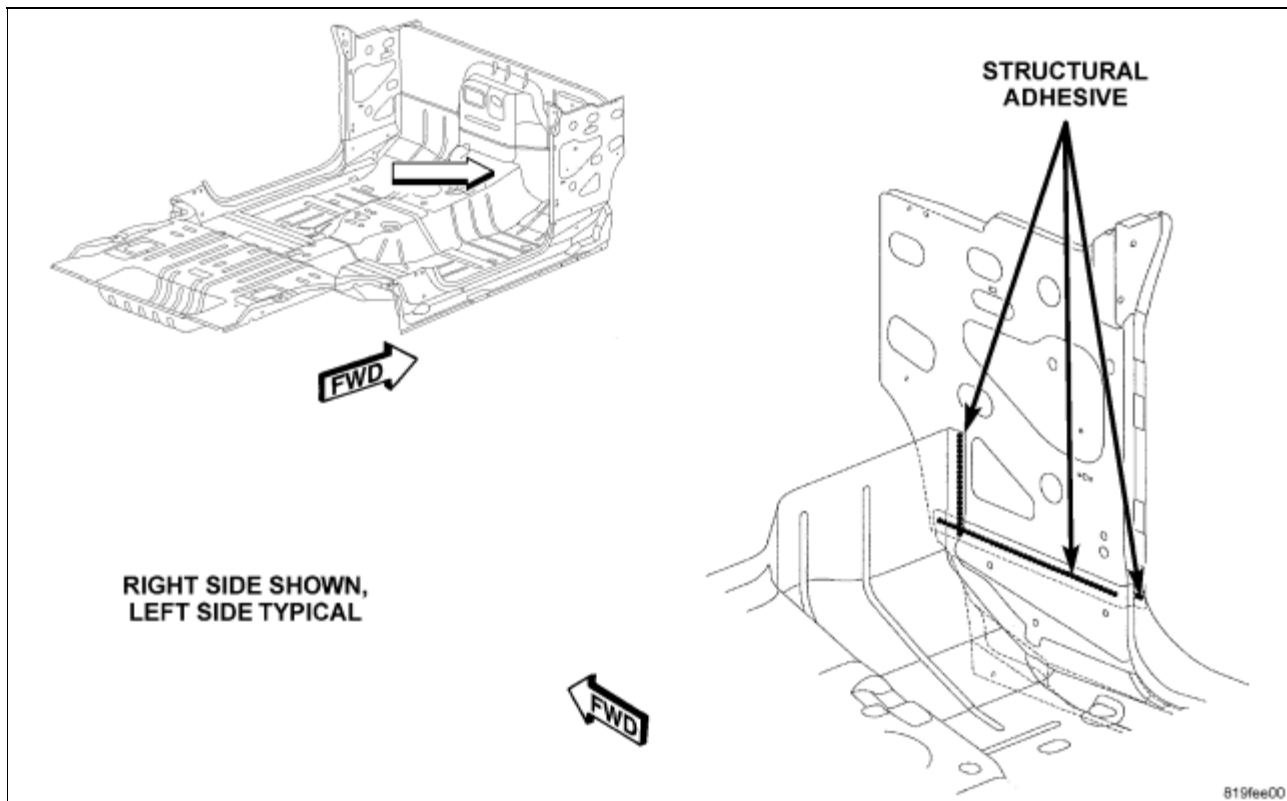
UNDERBODY/HYDROFORM

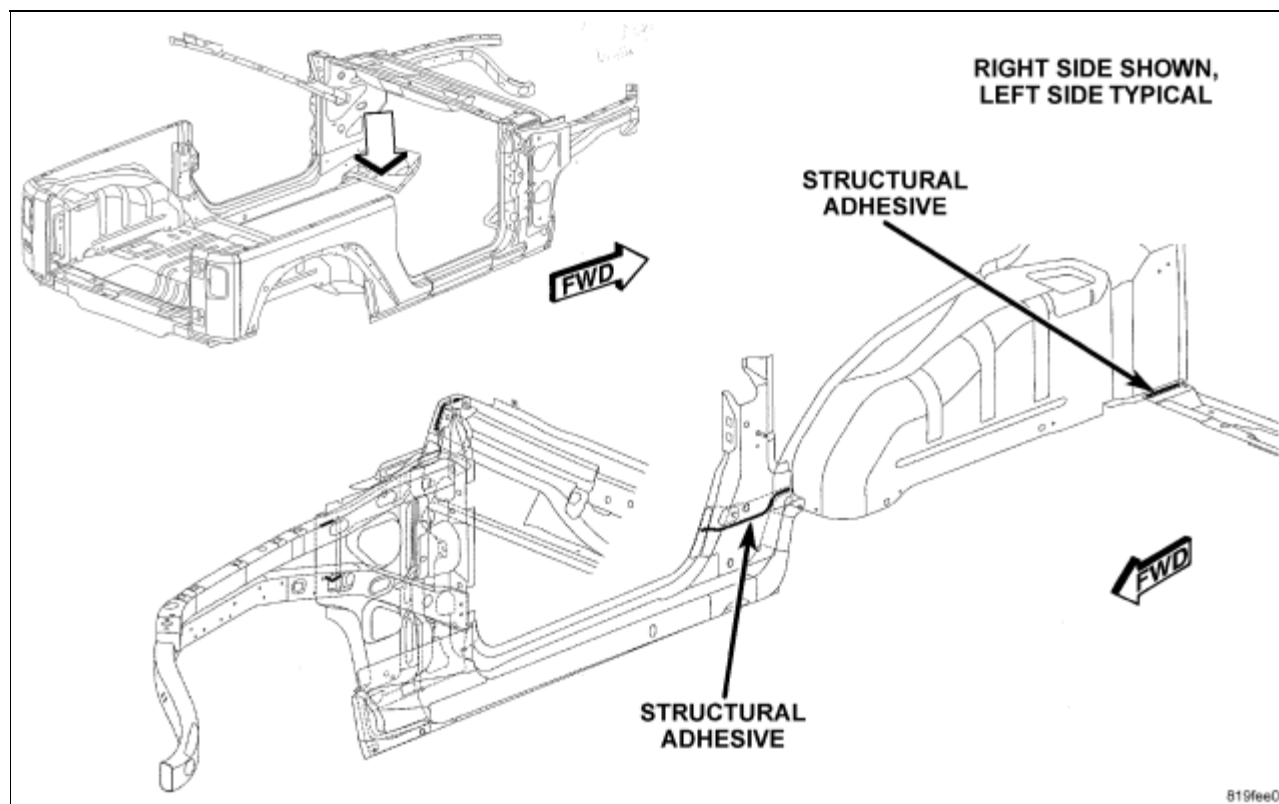


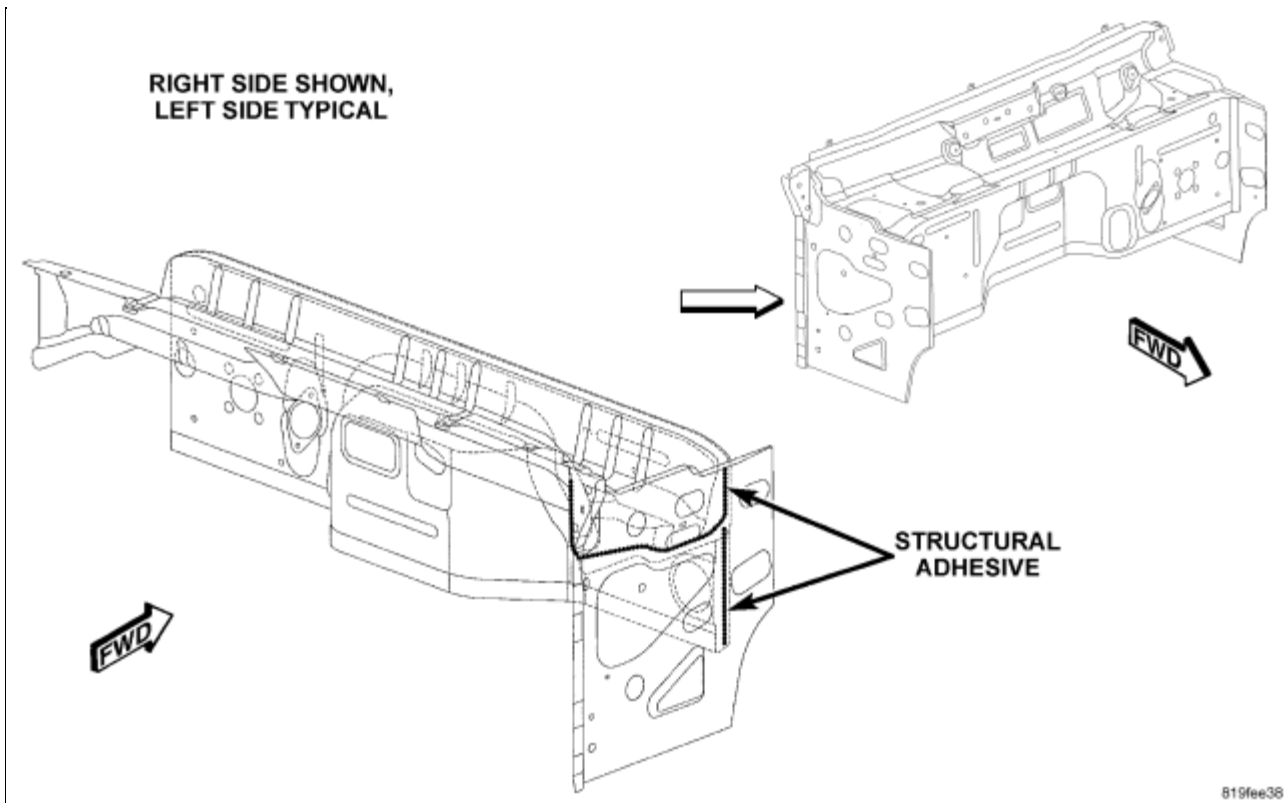
COWL/DASH/PLENUM JK72



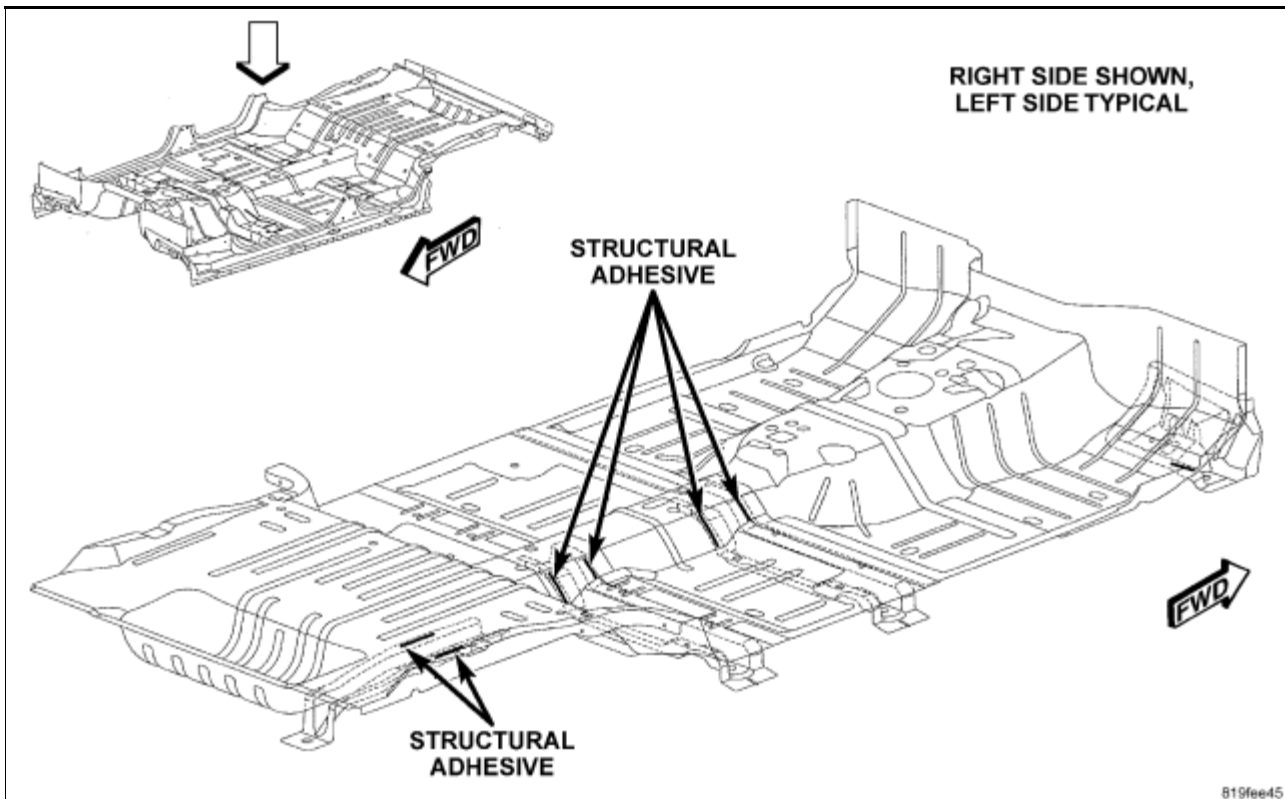
LADDER & FLOOR ASSEMBLY JK72



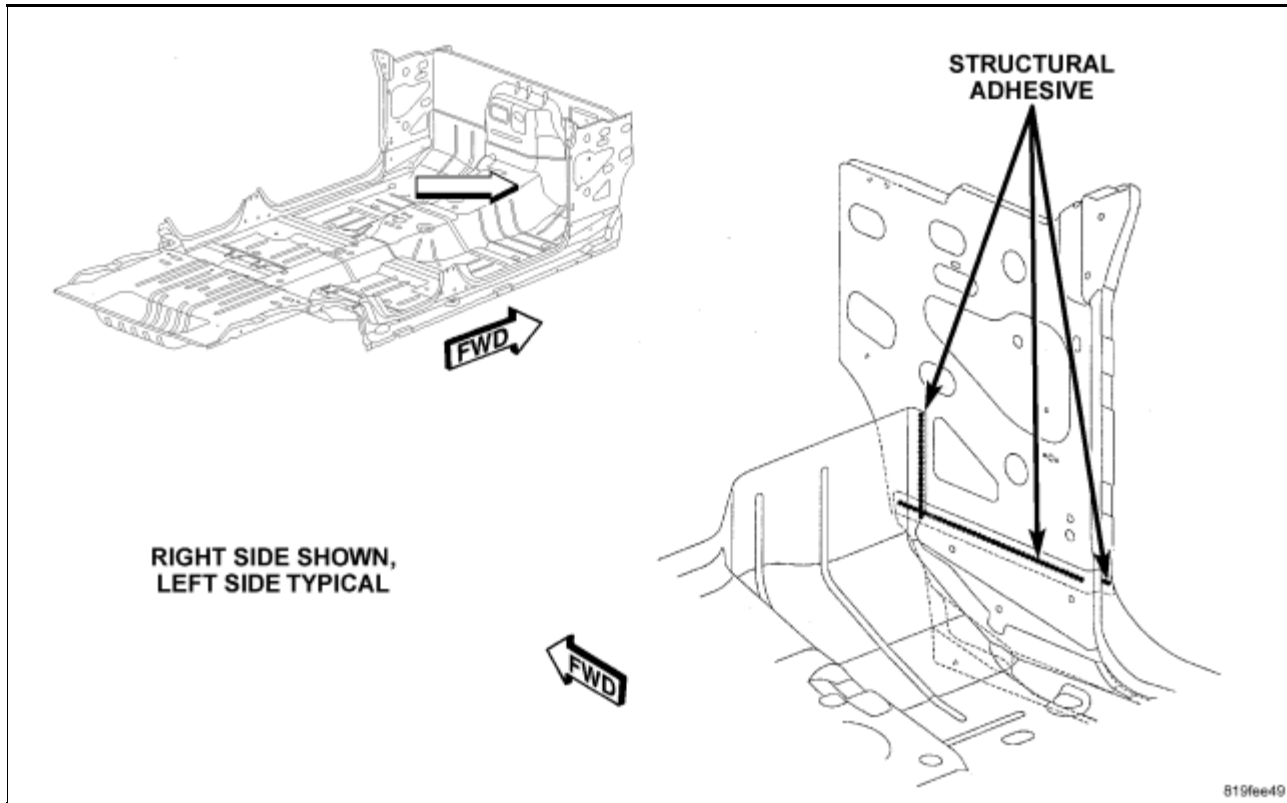
UNDERBODY COMPLETE JK72**BODY IN WHITE COMPLETE JK72**



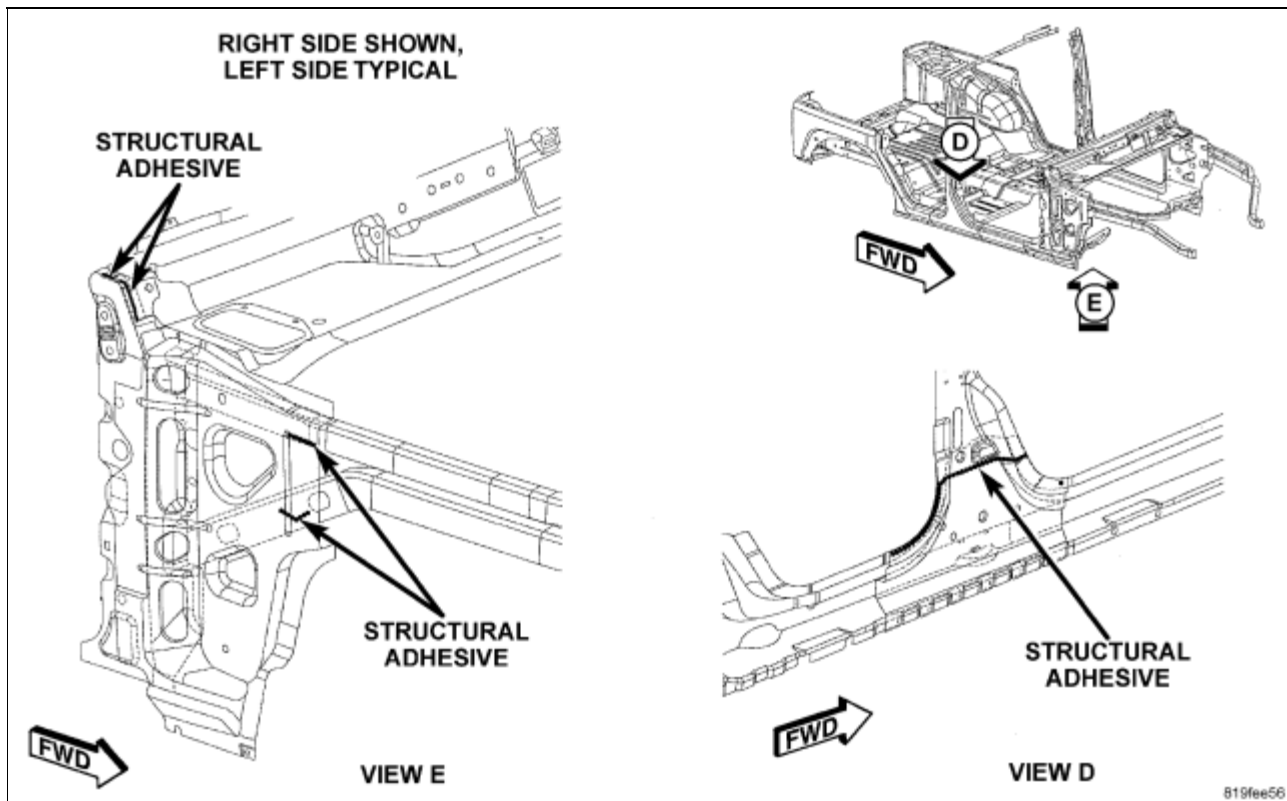
COWL/DASH/PLENUM JK74



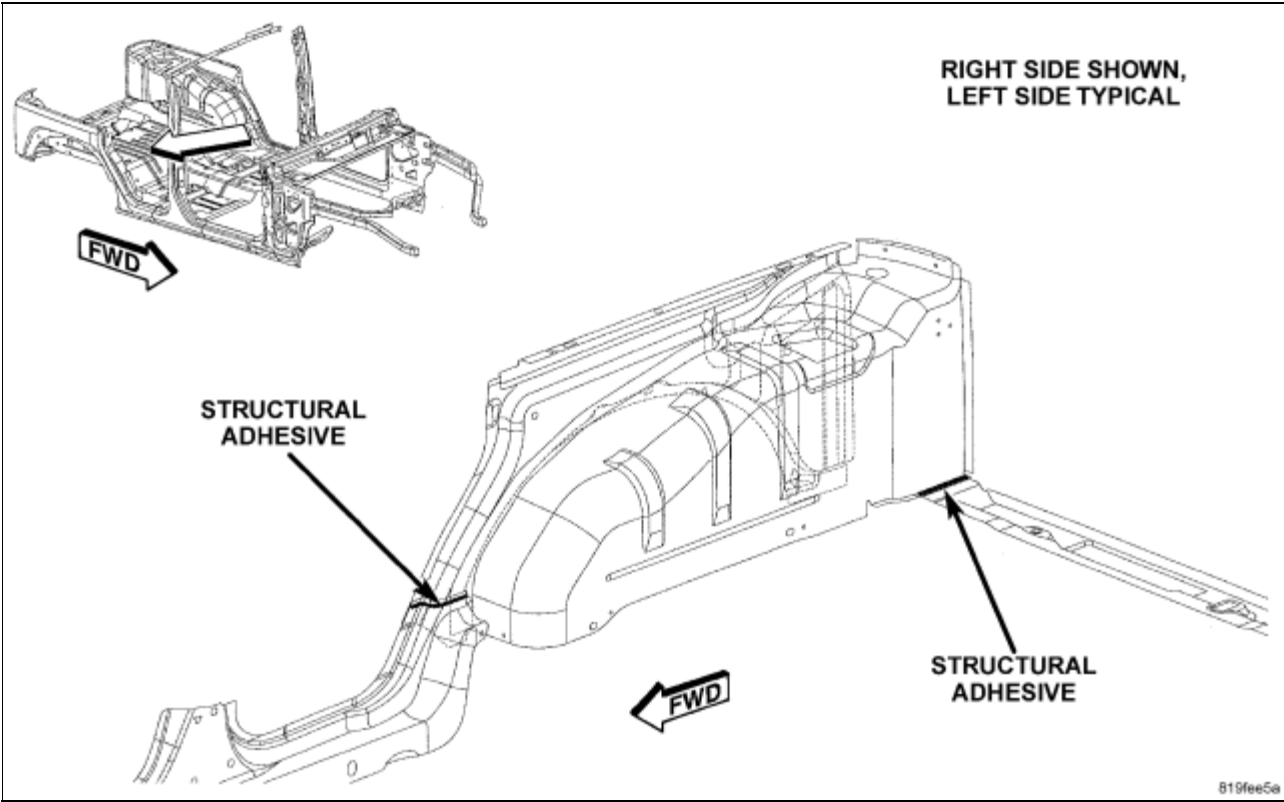
LADDER AND FLOOR ASSEMBLY JK74



UNDERBODY COMPLETE JK74



BODY IN WHITE COMPLETE (1 OF 2) JK74



BODY IN WHITE COMPLETE (2 OF 2) JK74

WELD LOCATIONS

SPECIFICATIONS

WELD LOCATIONS

DESCRIPTION	FIGURE
UNDERBODY/HYDROFORM COMPLETE	UNDERBODY/HYDROFORM COMPLETE
COWL/DASH/PLENUM (1 OF 4)	COWL/DASH/PLENUM (1 OF 4)
COWL/DASH/PLENUM (2 OF 4)	COWL/DASH/PLENUM (2 OF 4)
COWL/DASH/PLENUM (3 OF 4)	COWL/DASH/PLENUM (3 OF 4)
COWL/DASH/PLENUM (4 OF 4)	COWL/DASH/PLENUM (4 OF 4)

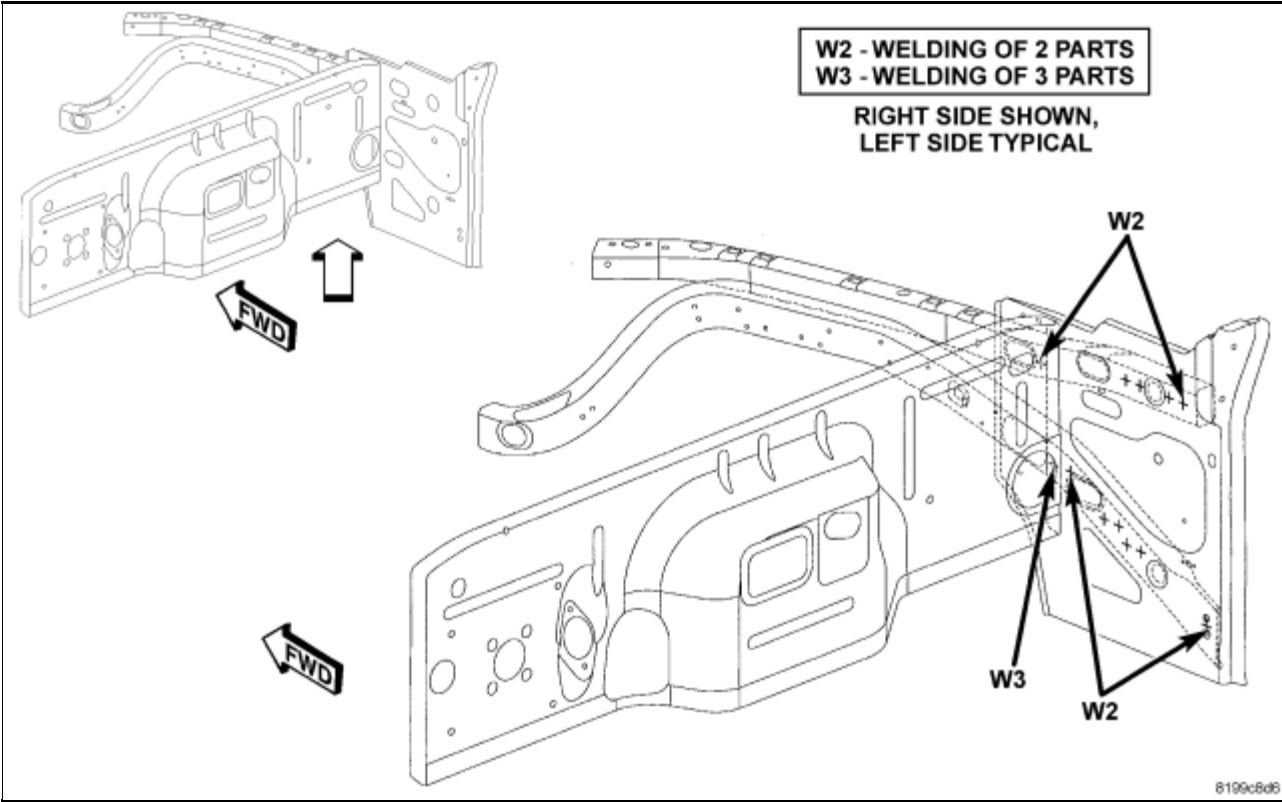
MISCELLANEOUS BODY (1 OF 7)	MISCELLANEOUS BODY (1 OF 7)
MISCELLANEOUS BODY (2 OF 7)	MISCELLANEOUS BODY (2 OF 7)
MISCELLANEOUS BODY (3 OF 7)	MISCELLANEOUS BODY (3 OF 7)
MISCELLANEOUS BODY (4 OF 7)	MISCELLANEOUS BODY (4 OF 7)
MISCELLANEOUS BODY (5 OF 7)	MISCELLANEOUS BODY (5 OF 7)
MISCELLANEOUS BODY (6 OF 7)	MISCELLANEOUS BODY (6 OF 7)
MISCELLANEOUS BODY (7 OF 7)	MISCELLANEOUS BODY (7 OF 7)
WINDSHIELD FRAME (1 OF 4)	WINDSHIELD FRAME (1 OF 4)
WINDSHIELD FRAME (2 OF 4)	WINDSHIELD FRAME (2 OF 4)
WINDSHIELD FRAME (3 OF 4)	WINDSHIELD FRAME (3 OF 4)
WINDSHIELD FRAME (4 OF 4)	WINDSHIELD FRAME (4 OF 4)
COWL/DASH/PLENUM (1 OF 4) - JK72	COWL/DASH/PLENUM (1 OF 4) - JK72
COWL/DASH/PLENUM (2 OF 4) - JK72	COWL/DASH/PLENUM (2 OF 4) - JK72
COWL/DASH/PLENUM (3 OF 4) - JK72	COWL/DASH/PLENUM (3 OF 4) - JK72
COWL/DASH/PLENUM (4 OF 4) - JK72	COWL/DASH/PLENUM (4 OF 4) - JK72
LADDER ASSEMBLY COMPLETE (1 OF 4)	LADDER ASSEMBLY COMPLETE (1 OF 4)
LADDER ASSEMBLY COMPLETE (2 OF 4)	LADDER ASSEMBLY COMPLETE (2 OF 4)
LADDER ASSEMBLY COMPLETE (3 OF 4)	LADDER ASSEMBLY COMPLETE (3 OF 4)
LADDER ASSEMBLY COMPLETE (4 OF 4)	LADDER ASSEMBLY COMPLETE (4 OF 4)
FRONT FLOOR ASSEMBLY (1 OF 4) - JK72	FRONT FLOOR ASSEMBLY (1 OF 4) - JK72
FRONT FLOOR ASSEMBLY (2 OF 4) - JK72	FRONT FLOOR ASSEMBLY (2 OF 4) - JK72
FRONT FLOOR ASSEMBLY (3 OF 4) - JK72	FRONT FLOOR ASSEMBLY (3 OF 4) - JK72
FRONT FLOOR ASSEMBLY (4 OF 4) - JK72	FRONT FLOOR ASSEMBLY (4 OF 4) - JK72
REAR FLOOR ASSEMBLY - JK72	REAR FLOOR ASSEMBLY - JK72
LADDER AND FLOOR ASSEMBLY (1 OF 6) - JK72	LADDER AND FLOOR ASSEMBLY (1 OF 6) - JK72

LADDER & FLOOR ASSEMBLY (2 OF 6) - JK72	LADDER & FLOOR ASSEMBLY (2 OF 6) - JK72
LADDER AND FLOOR ASSEMBLY (3 OF 6) - JK72	LADDER AND FLOOR ASSEMBLY (3 OF 6) - JK72
LADDER AND FLOOR ASSEMBLY (4 OF 6) - JK72	LADDER AND FLOOR ASSEMBLY (4 OF 6) - JK72
LADDER AND FLOOR ASSEMBLY (5 OF 6) - JK72	LADDER & FLOOR ASSEMBLY (5 OF 6) - JK72
LADDER AND FLOOR ASSEMBLY (6 OF 6) - JK72	LADDER AND FLOOR ASSEMBLY (6 OF 6) - JK72
UNDERBODY (1 OF 2) - JK72	UNDERBODY (1 OF 2) - JK72
UNDERBODY (2 OF 2) - JK72	UNDERBODY (2 OF 2) - JK72
UNDERBODY COMPLETE (1 OF 2) - JK72	UNDERBODY COMPLETE (1 OF 2) - JK72
UNDERBODY COMPLETE (2 OF 2) - JK72	UNDERBODY COMPLETE (2 OF 2) - JK72
BODY SIDE APERTURE - INNER (1 OF 6) - JK72	BODY SIDE APERTURE - INNER (1 OF 6) - JK72
BODY SIDE APERTURE - INNER (2 OF 6) - JK72	BODY SIDE APERTURE - INNER (2 OF 6) - JK72
BODY SIDE APERTURE - INNER (3 OF 6) - JK72	BODY SIDE APERTURE - INNER (3 OF 6) - JK72
BODY SIDE APERTURE - INNER (4 OF 6) - JK72	BODY SIDE APERTURE - INNER (4 OF 6) - JK72
BODY SIDE APERTURE - INNER (5 OF 6) - JK72	BODY SIDE APERTURE - INNER (5 OF 6) - JK72
BODY SIDE APERTURE - INNER (6 OF 6) - JK72	BODY SIDE APERTURE - INNER (6 OF 6) - JK72
BODY SIDE APERTURE - OUTER (1 OF 4) - JK72	BODY SIDE APERTURE - OUTER (1 OF 4) - JK72
BODY SIDE APERTURE - OUTER (2 OF 4) - JK72	BODY SIDE APERTURE - OUTER (2 OF 4) - JK72
BODY SIDE APERTURE - OUTER (3 OF 4) - JK72	BODY SIDE APERTURE - OUTER (3 OF 4) - JK72
BODY SIDE APERTURE - OUTER (4 OF 4) - JK72	BODY SIDE APERTURE - OUTER (4 OF 4) - JK72
BODY SIDE APERTURE - COMPLETE (1 OF 5) - JK72	BODY SIDE APERTURE - COMPLETE (1 OF 5) - JK72
BODY SIDE APERTURE - COMPLETE (2 OF 5) - JK72	BODY SIDE APERTURE - COMPLETE (2 OF 5) - JK72
BODY SIDE APERTURE - COMPLETE (3 OF 5) - JK72	BODY SIDE APERTURE - COMPLETE (3 OF 5) - JK72
BODY SIDE APERTURE - COMPLETE (4 OF 5) - JK72	BODY SIDE APERTURE - COMPLETE (4 OF 5) - JK72
BODY SIDE APERTURE - COMPLETE (5 OF 5) - JK72	BODY SIDE APERTURE - COMPLETE (5 OF 5) - JK72
BODY IN WHITE COMPLETE (1 OF 6) - JK72	BODY IN WHITE COMPLETE (1 OF 6) - JK72
BODY IN WHITE COMPLETE (2 OF 6) - JK72	BODY IN WHITE COMPLETE (2 OF 6) - JK72

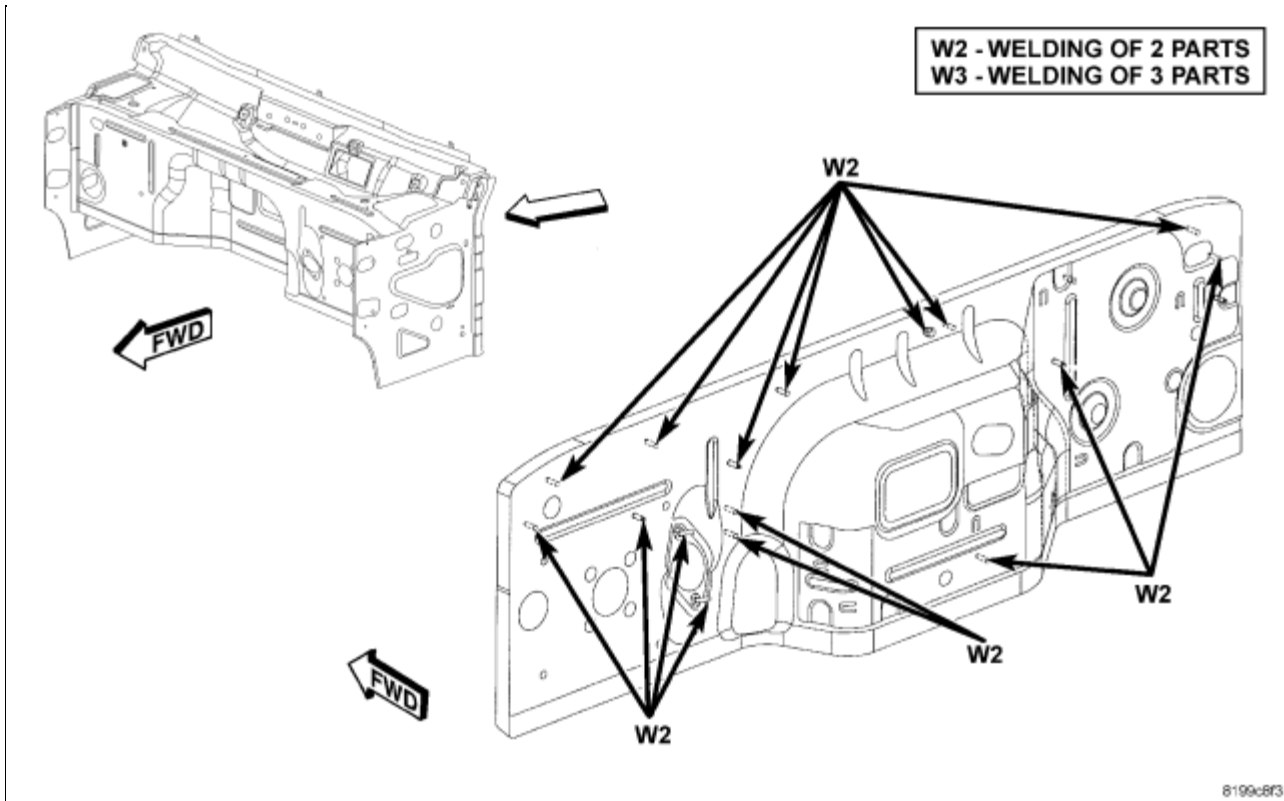
BODY IN WHITE COMPLETE (3 OF 6) - JK72	BODY IN WHITE COMPLETE (3 OF 6) - JK72
BODY IN WHITE COMPLETE (4 OF 6) - JK72	BODY IN WHITE COMPLETE (4 OF 6) - JK72
BODY IN WHITE COMPLETE (5 OF 6) - JK72	BODY IN WHITE COMPLETE (5 OF 6) - JK72
BODY IN WHITE COMPLETE (6 OF 6) - JK72	BODY IN WHITE COMPLETE (6 OF 6) - JK72
COWL/DASH/PLENUM (1 OF 4) - JK74	COWL/DASH/PLENUM (1 OF 4) - JK74
COWL/DASH/PLENUM (2 OF 4) - JK74	COWL/DASH/PLENUM (2 OF 4) - JK74
COWL/DASH/PLENUM (3 OF 4) - JK74	COWL/DASH/PLENUM (3 OF 4) - JK74
COWL/DASH/PLENUM (4 OF 4) - JK74	COWL/DASH/PLENUM (4 OF 4) - JK74
LADDER ASSEMBLY COMPLETE (1 OF 5) - JK74	LADDER ASSEMBLY COMPLETE (1 OF 5) - JK74
LADDER ASSEMBLY COMPLETE (2 OF 5) - JK74	LADDER ASSEMBLY COMPLETE (2 OF 5) - JK74
LADDER ASSEMBLY COMPLETE (3 OF 5) - JK74	LADDER ASSEMBLY COMPLETE (3 OF 5) - JK74
LADDER ASSEMBLY COMPLETE (4 OF 5) - JK74	LADDER ASSEMBLY COMPLETE (4 OF 5) - JK74
LADDER ASSEMBLY COMPLETE (5 OF 5) - JK74	LADDER ASSEMBLY COMPLETE (5 OF 5) - JK74
FRONT FLOOR ASSEMBLY (1 OF 3) - JK74	FRONT FLOOR ASSEMBLY (1 OF 3) - JK74
FRONT FLOOR ASSEMBLY (2 OF 3) - JK74	FRONT FLOOR ASSEMBLY (2 OF 3) - JK74
FRONT FLOOR ASSEMBLY (3 OF 3) - JK74	FRONT FLOOR ASSEMBLY (3 OF 3) - JK74
REAR FLOOR ASSEMBLY (1 OF 2) - JK74	REAR FLOOR ASSEMBLY (1 OF 2) - JK74
REAR FLOOR ASSEMBLY (2 OF 2) - JK74	REAR FLOOR ASSEMBLY (2 OF 2) - JK74
LADDER AND FLOOR ASSEMBLY (1 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (1 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (2 OF 7) JK74	LADDER AND FLOOR ASSEMBLY (2 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (3 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (3 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (4 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (4 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (5 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (5 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (6 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (6 OF 7) - JK74
LADDER AND FLOOR ASSEMBLY (7 OF 7) - JK74	LADDER AND FLOOR ASSEMBLY (7 OF 7) - JK74

UNDERBODY (1 OF 4) - JK74	UNDERBODY (1 OF 4) - JK74
UNDERBODY (2 OF 4) - JK74	UNDERBODY (2 OF 4) - JK74
UNDERBODY (3 OF 4) - JK74	UNDERBODY (3 OF 4) - JK74
UNDERBODY (4 OF 4) - JK74	UNDERBODY (4 OF 4) - JK74
UNDERBODY COMPLETE (1 OF 2) - JK74	UNDERBODY COMPLETE (1 OF 2) - JK74
UNDERBODY COMPLETE (2 OF 2) - JK74	UNDERBODY COMPLETE (2 OF 2) - JK74
BODY SIDE APERTURE-INNER (1 OF 6) - JK74	BODY SIDE APERTURE - INNER (1 OF 6) - JK74
BODY SIDE APERTURE-INNER (2 OF 6) - JK74	BODY SIDE APERTURE - INNER (2 OF 6) - JK74
BODY SIDE APERTURE-INNER (3 OF 6) - JK74	BODY SIDE APERTURE - INNER (3 OF 6) - JK74
BODY SIDE APERTURE-INNER (4 OF 6) - JK74	BODY SIDE APERTURE - INNER (4 OF 6) - JK74
BODY SIDE APERTURE-INNER (5 OF 6) - JK74	BODY SIDE APERTURE - INNER (5 OF 6) - JK74
BODY SIDE APERTURE-INNER (6 OF 6) - JK74	BODY SIDE APERTURE - INNER (6 OF 6) - JK74
BODY SIDE APERTURE-OUTER (1 OF 4) - JK74	BODY SIDE APERTURE - OUTER (1 OF 4) - JK74
BODY SIDE APERTURE-OUTER (2 OF 4) - JK74	BODY SIDE APERTURE - OUTER (2 OF 4) - JK74
BODY SIDE APERTURE-OUTER (3 OF 4) - JK74	BODY SIDE APERTURE - OUTER (3 OF 4) - JK74
BODY SIDE APERTURE-COMPLETE (1 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (1 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (2 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (2 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (3 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (3 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (4 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (4 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (5 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (5 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (6 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (6 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (7 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (7 OF 8) - JK74
BODY SIDE APERTURE-COMPLETE (8 OF 8) - JK74	BODY SIDE APERTURE - COMPLETE (8 OF 8) - JK74
BODY IN WHITE-COMPLETE (1 OF 8) - JK74	BODY IN WHITE - COMPLETE (1 OF 8) - JK74
BODY IN WHITE-COMPLETE (2 OF 8) - JK74	BODY IN WHITE - COMPLETE (2 OF 8) - JK74
BODY IN WHITE - COMPLETE (3 OF 8) - JK74	BODY IN WHITE - COMPLETE (3 OF 8) - JK74

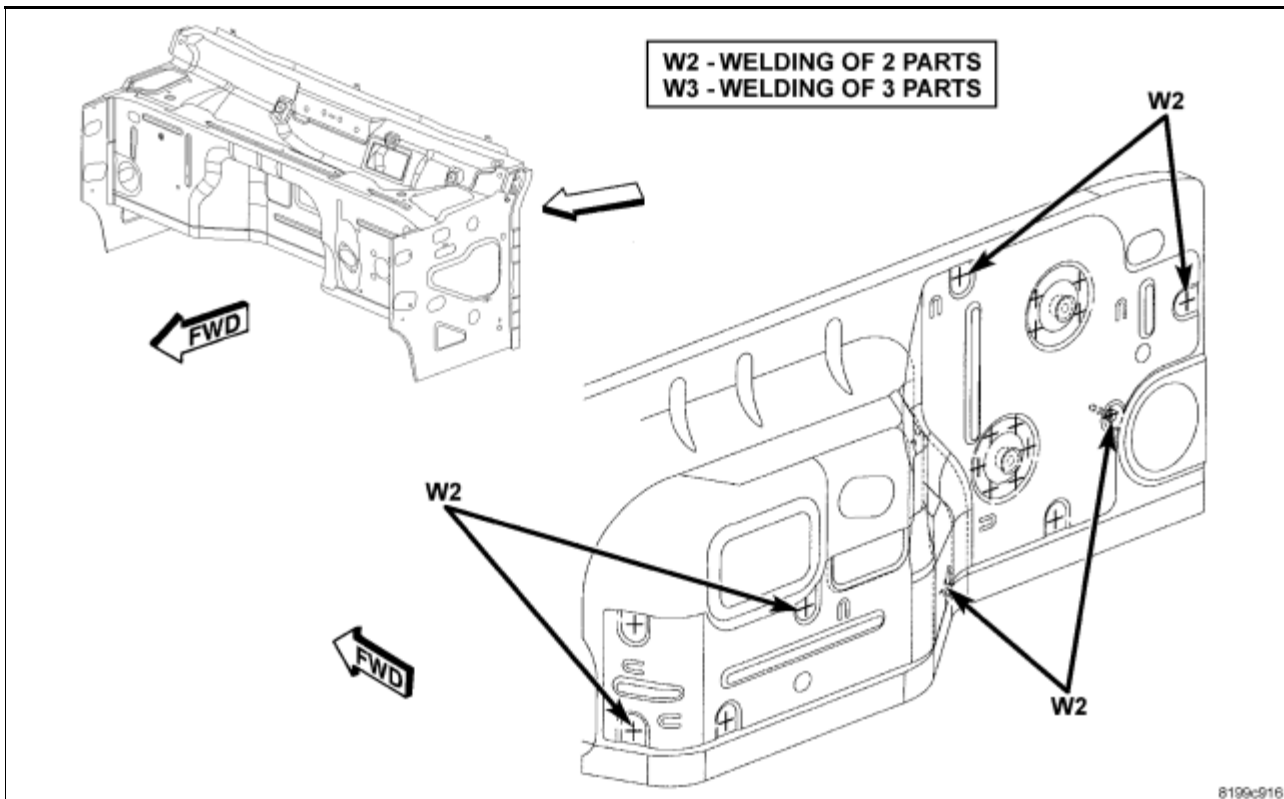
BODY IN WHITE-COMPLETE (4 OF 8) - JK74	BODY IN WHITE - COMPLETE (4 OF 8) - JK74
BODY IN WHITE-COMPLETE (5 OF 8) - JK74	BODY IN WHITE - COMPLETE (5 OF 8) - JK74
BODY IN WHITE-COMPLETE (6 OF 8) - JK74	BODY IN WHITE - COMPLETE (6 OF 8) - JK74
BODY IN WHITE-COMPLETE (7 OF 8) - JK74	BODY IN WHITE - COMPLETE (7 OF 8) - JK74
BODY IN WHITE-COMPLETE (8 OF 8) - JK74	BODY IN WHITE - COMPLETE (8 OF 8) - JK74



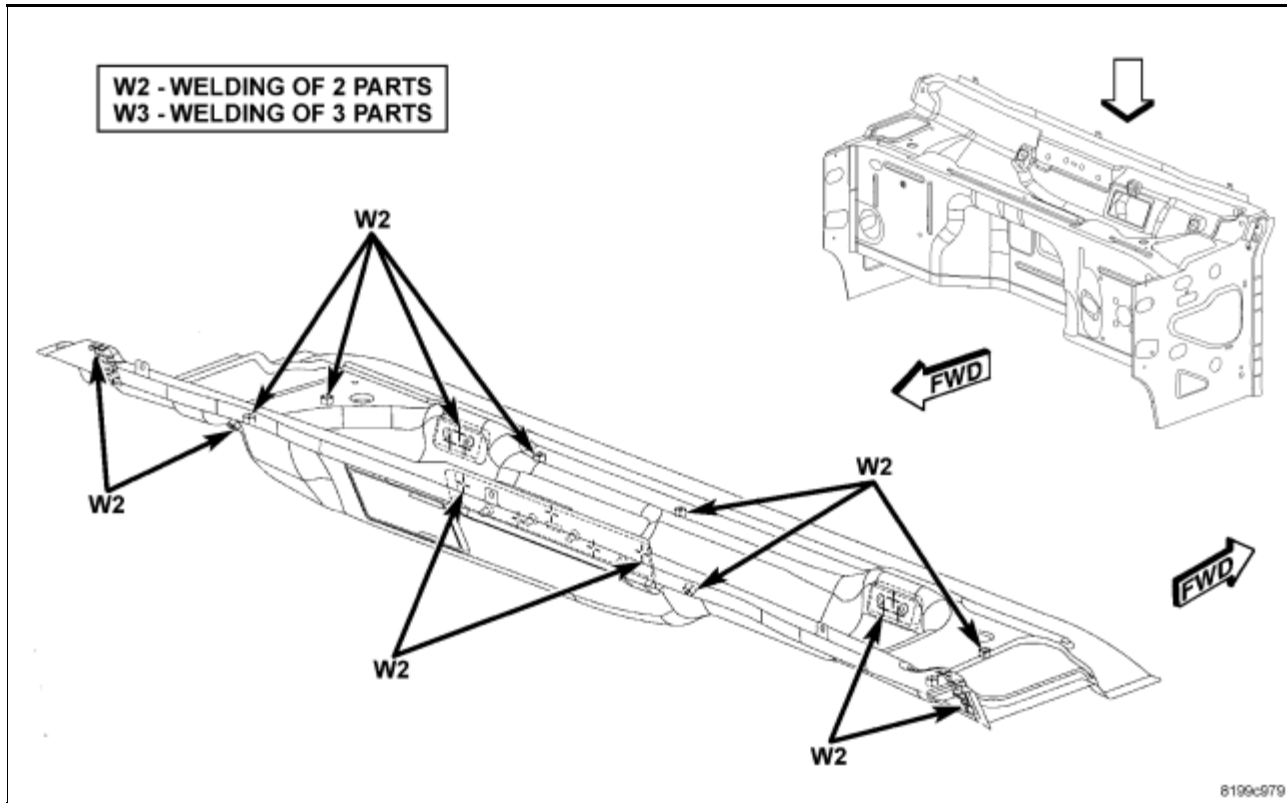
UNDERBODY/HYDROFORM COMPLETE



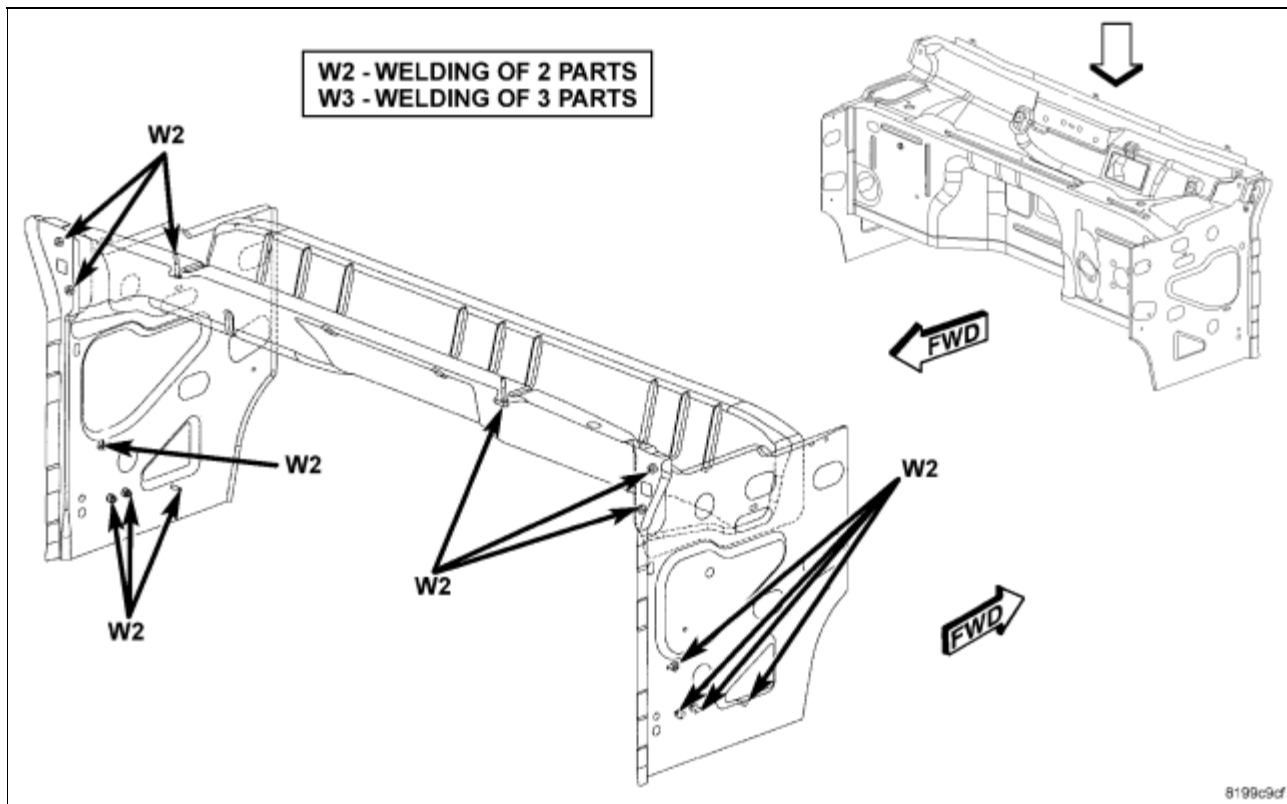
COWL/DASH/PLENUM (1 OF 4)

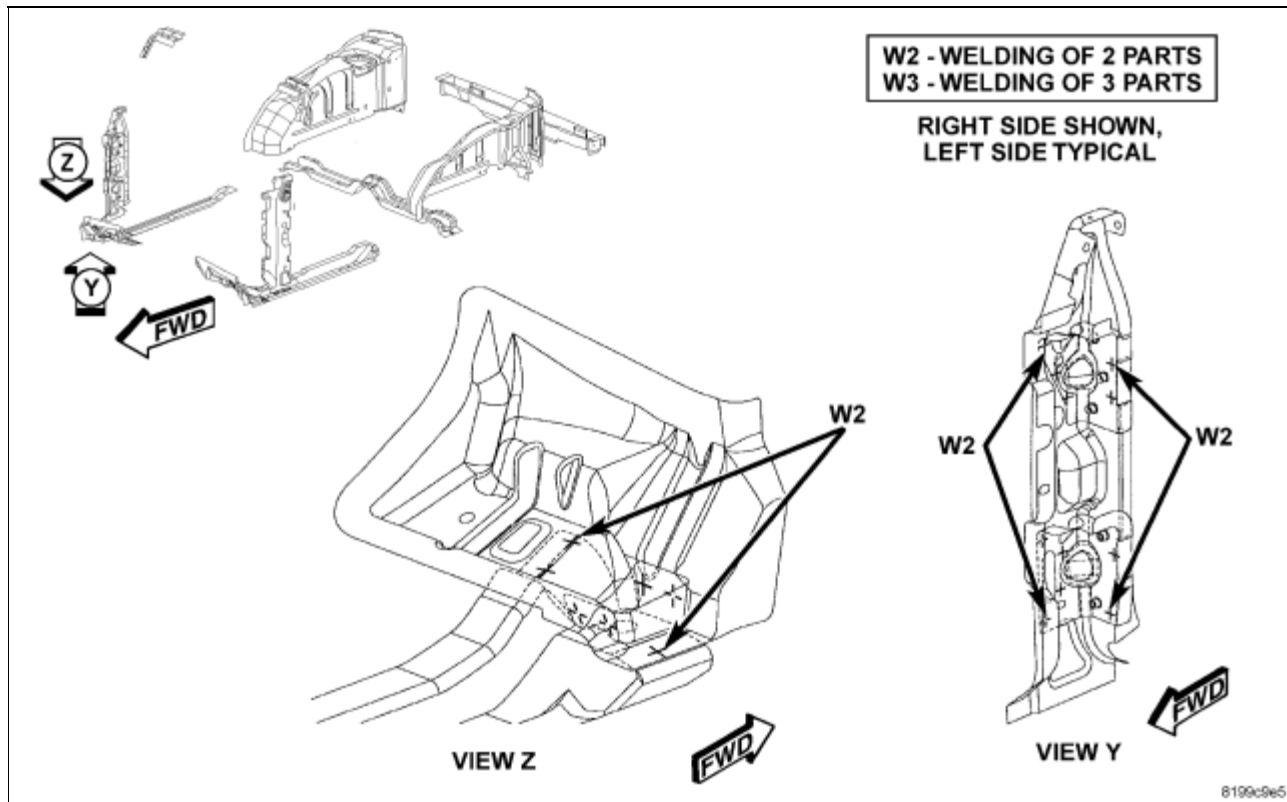


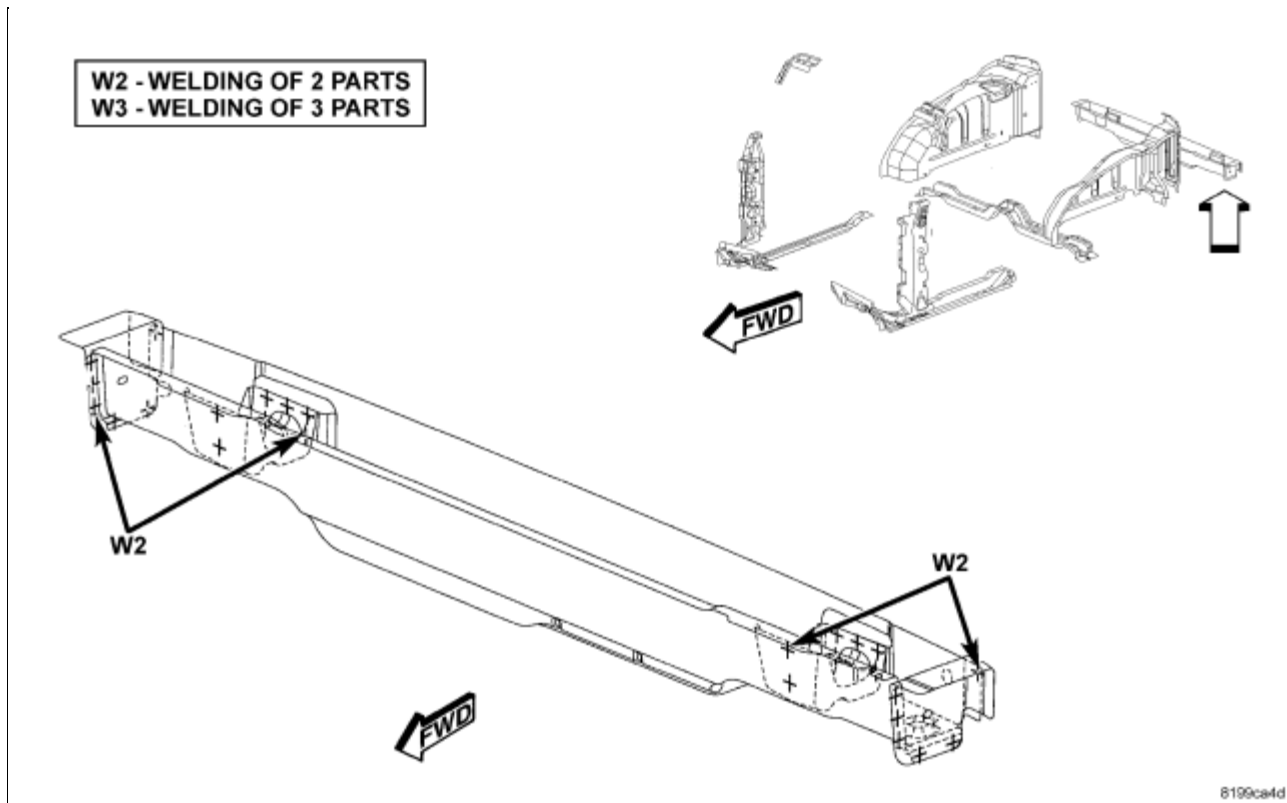
COWL/DASH/PLENUM (2 OF 4)



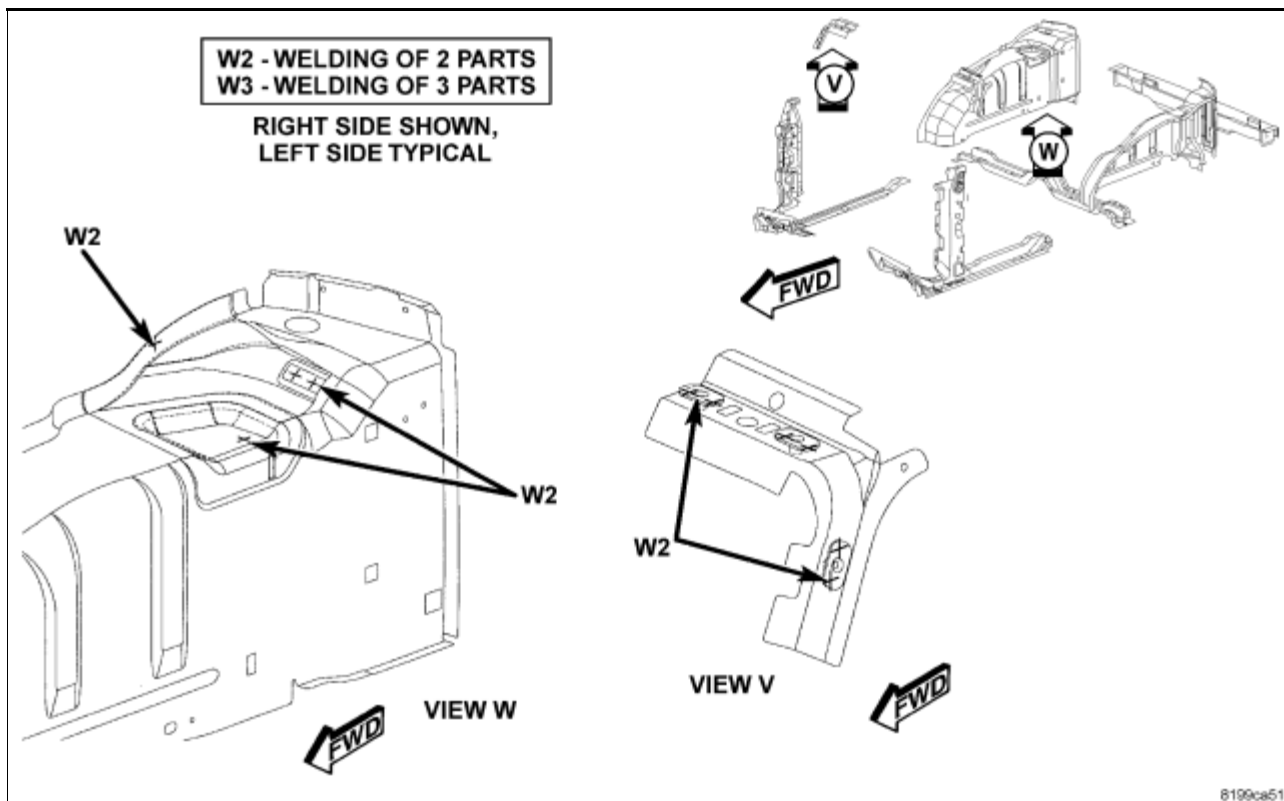
COWL/DASH/PLENUM (3 OF 4)



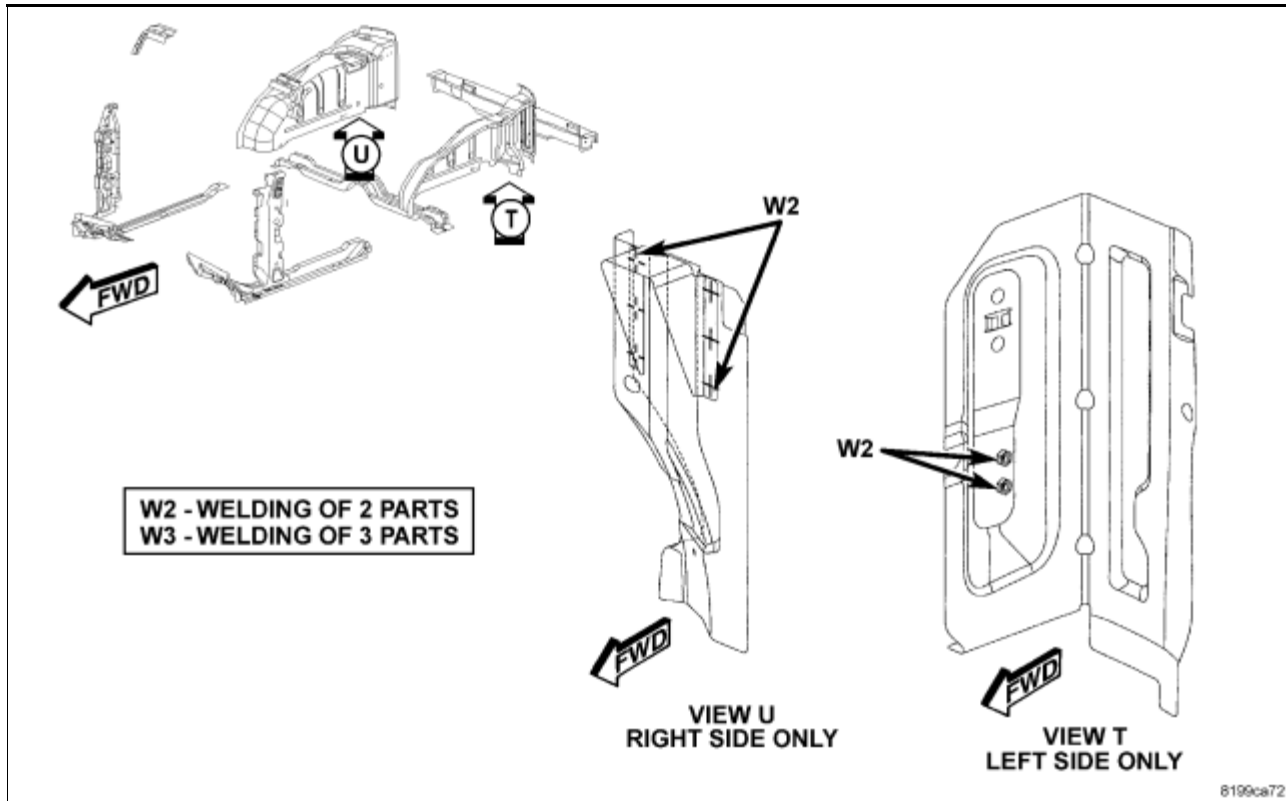
COWL/DASH/PLENUM (4 OF 4)**MISCELLANEOUS BODY (1 OF 7)**



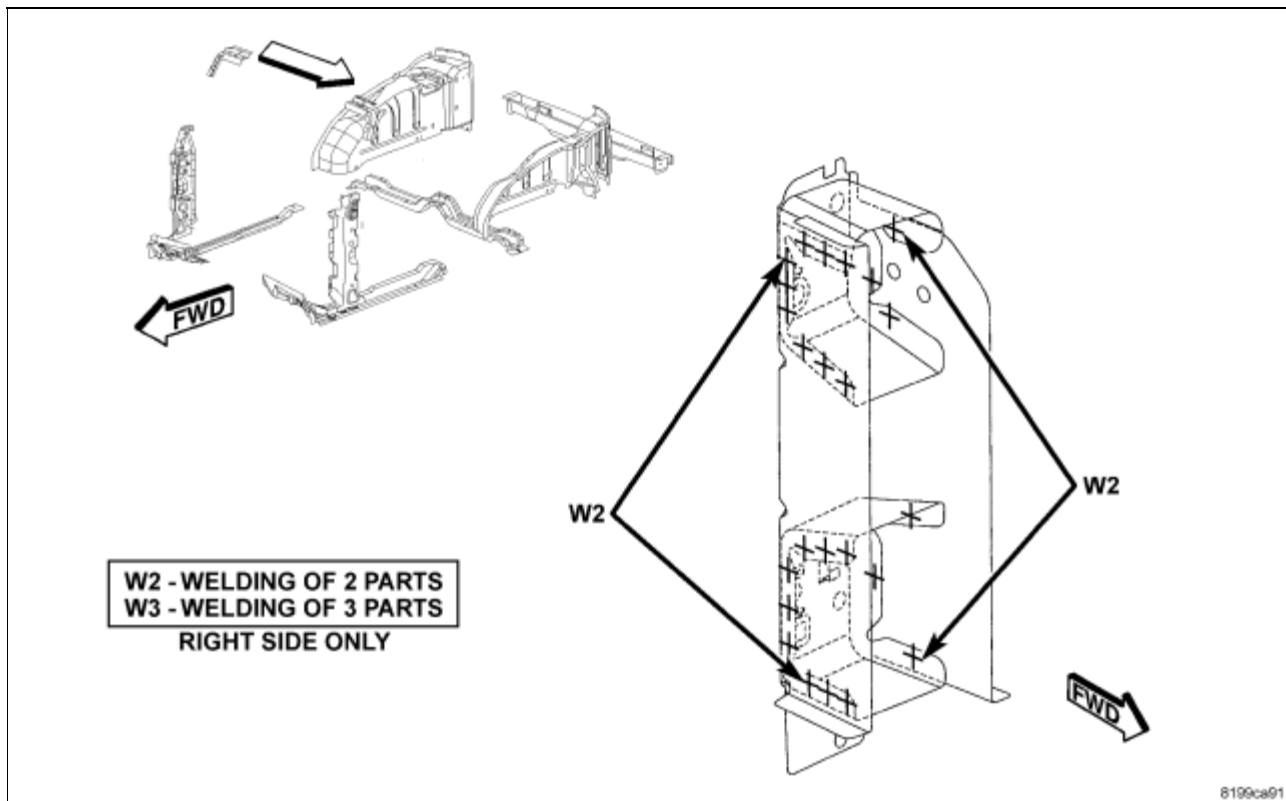
MISCELLANEOUS BODY (2 OF 7)

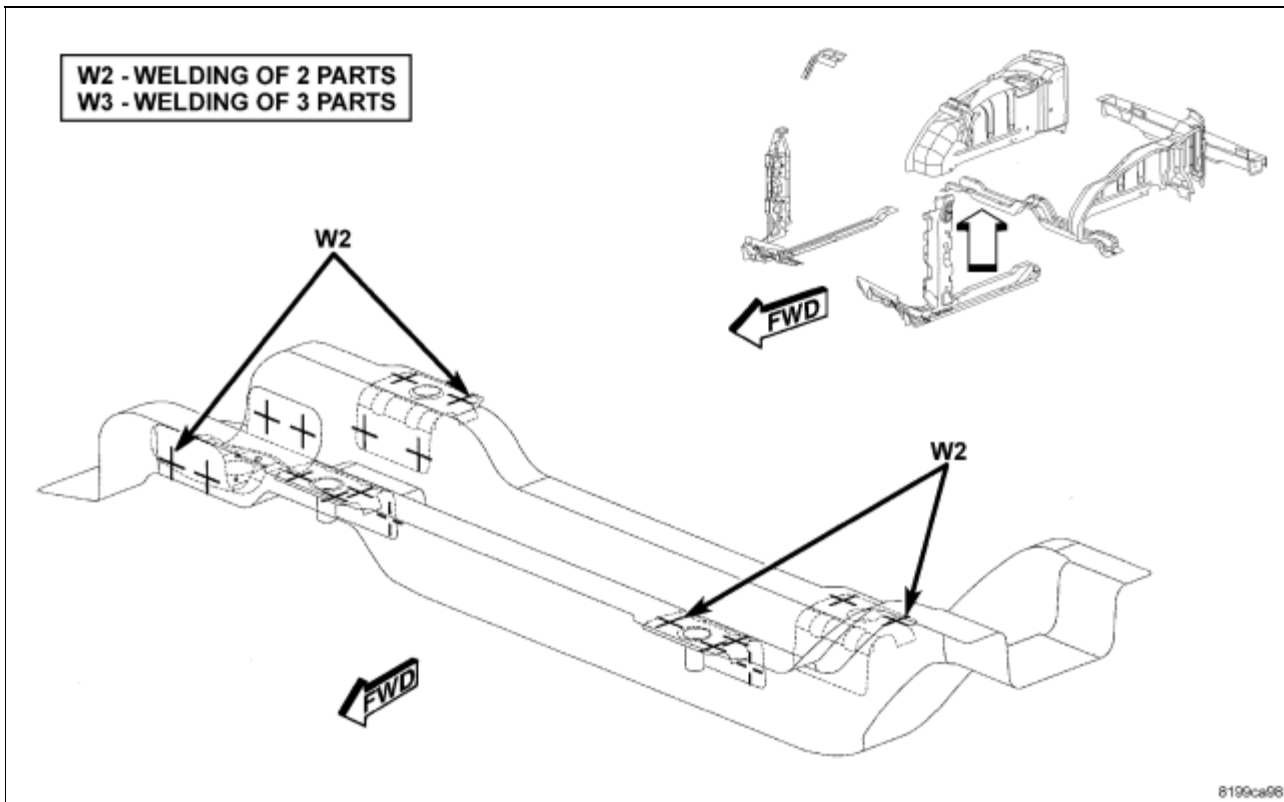


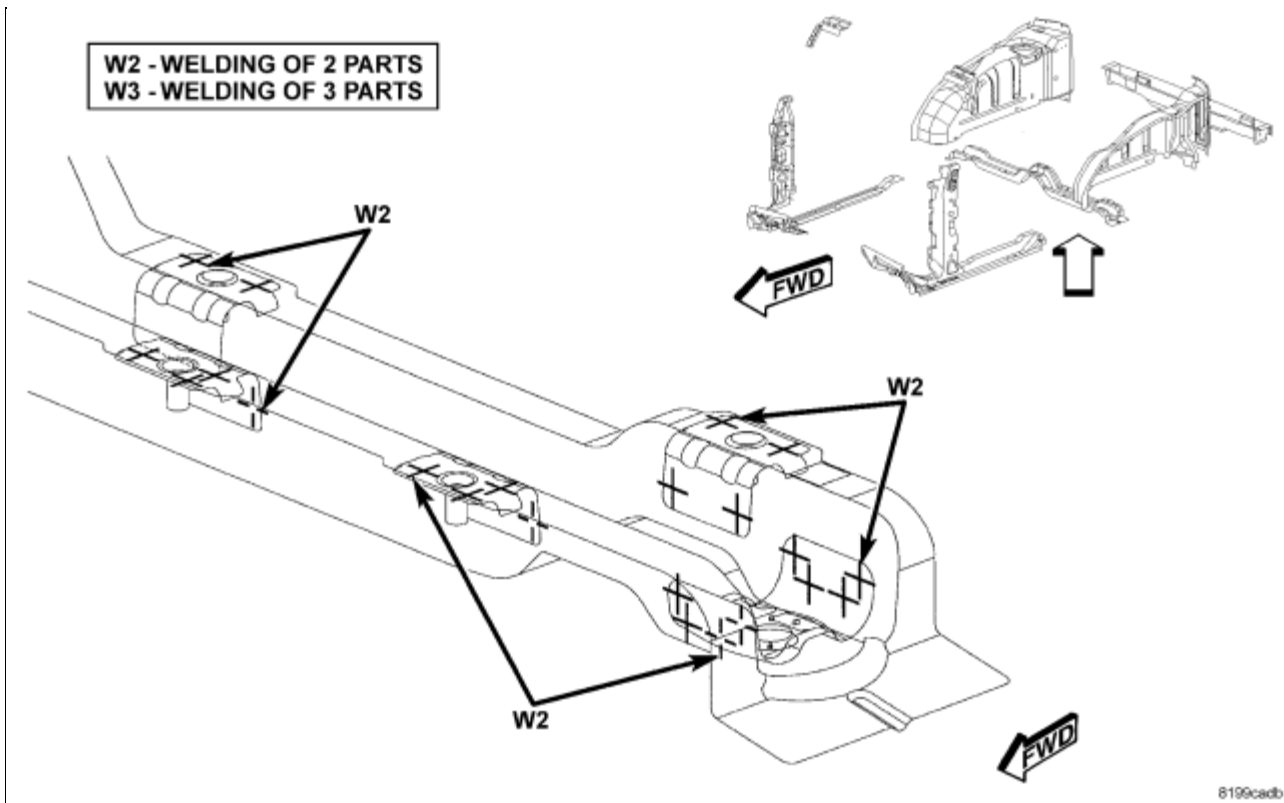
MISCELLANEOUS BODY (3 OF 7)



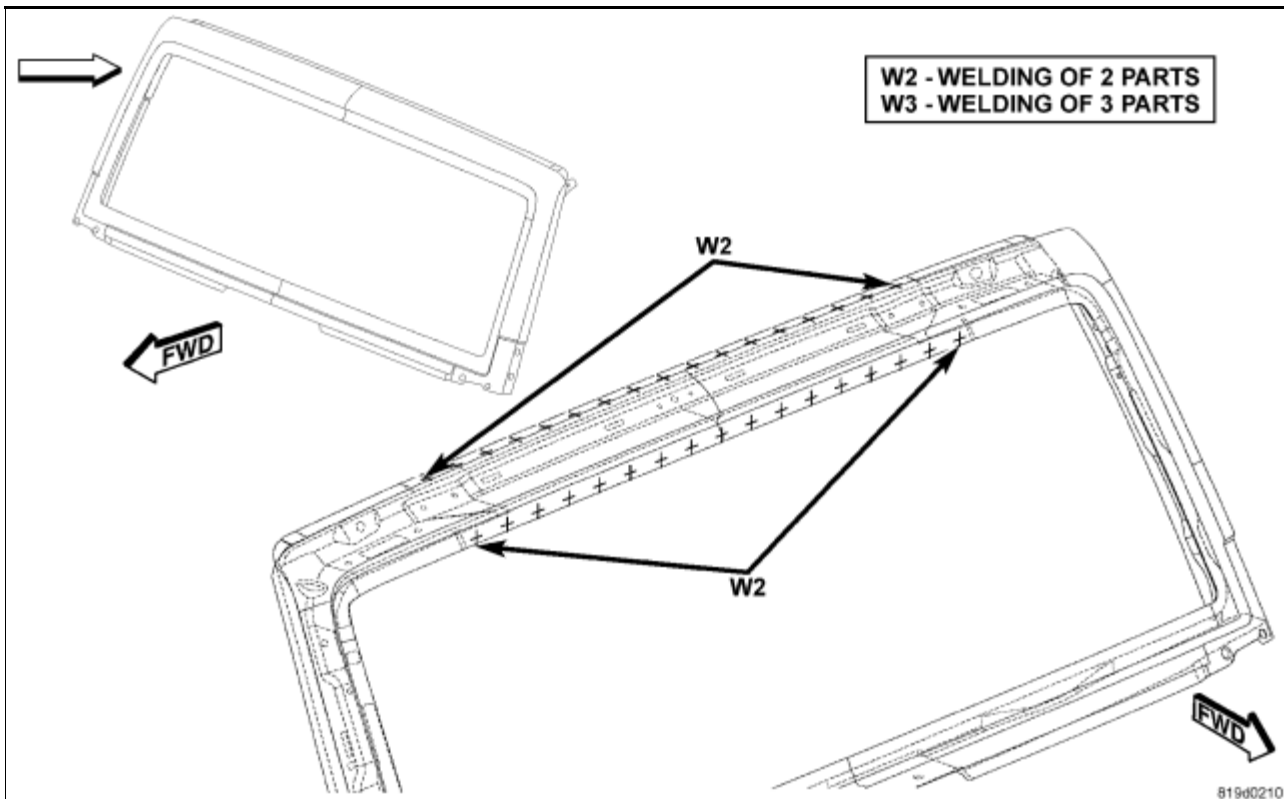
MISCELLANEOUS BODY (4 OF 7)



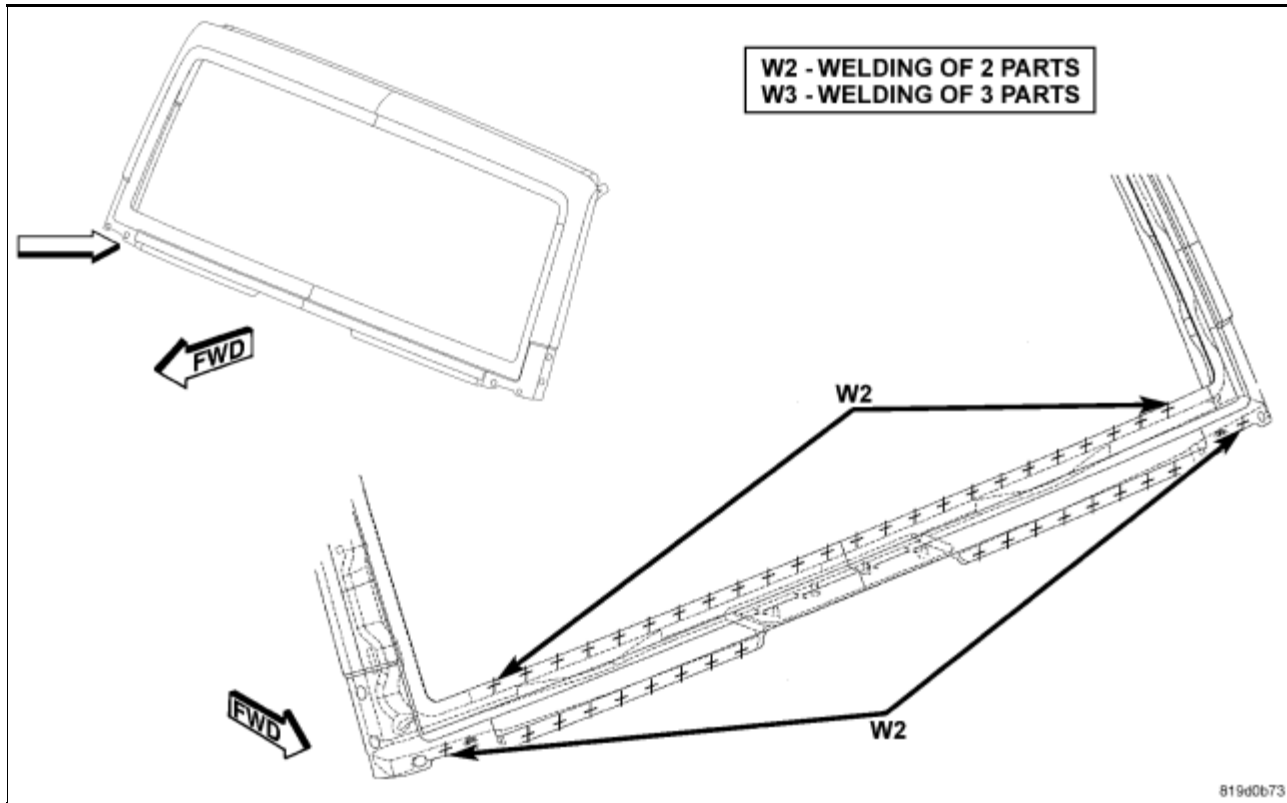
MISCELLANEOUS BODY (5 OF 7)**MISCELLANEOUS BODY (6 OF 7)**



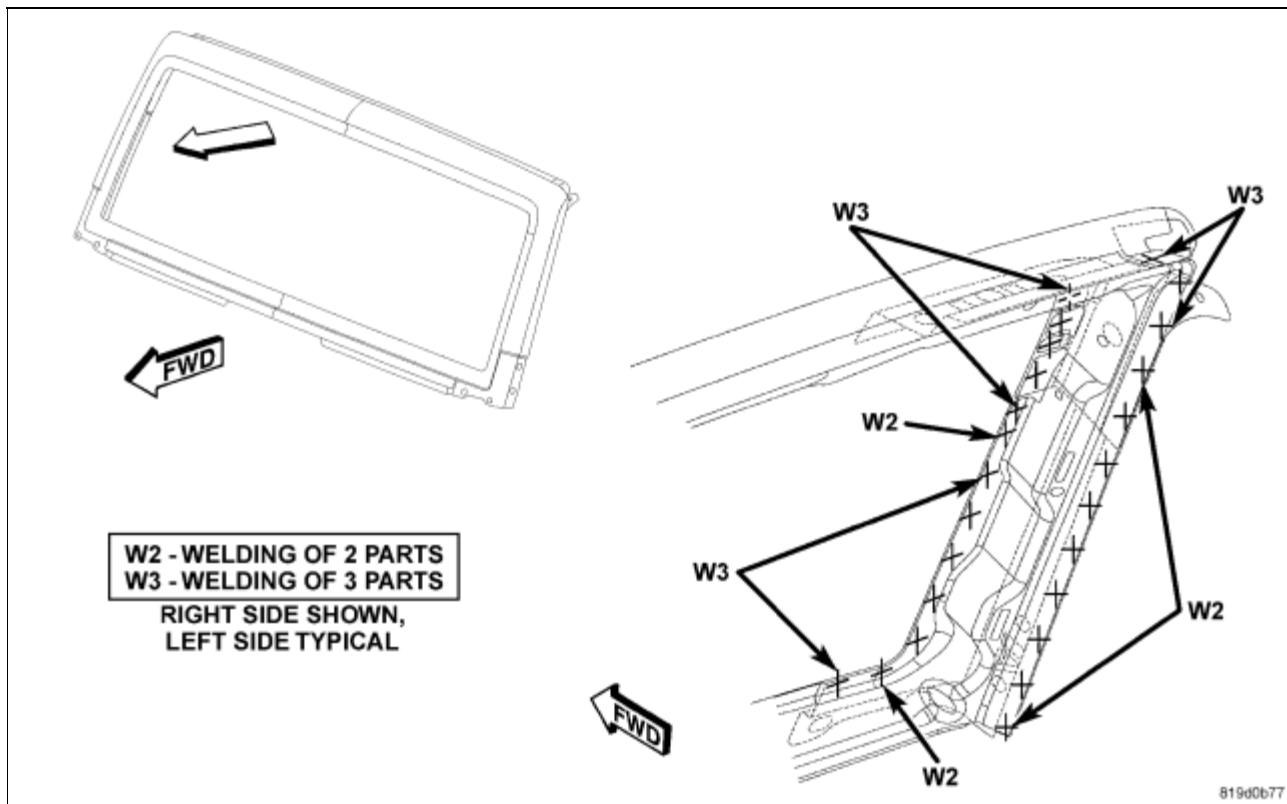
MISCELLANEOUS BODY (7 OF 7)

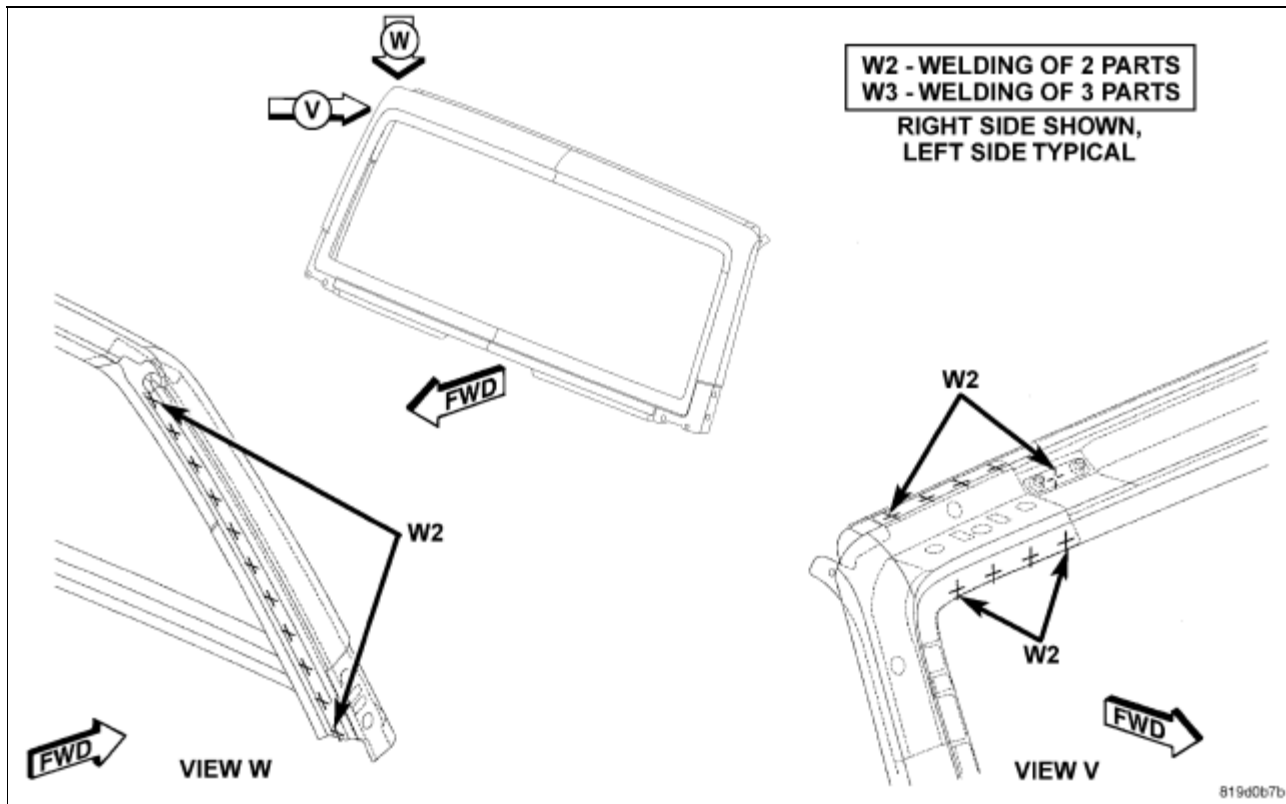


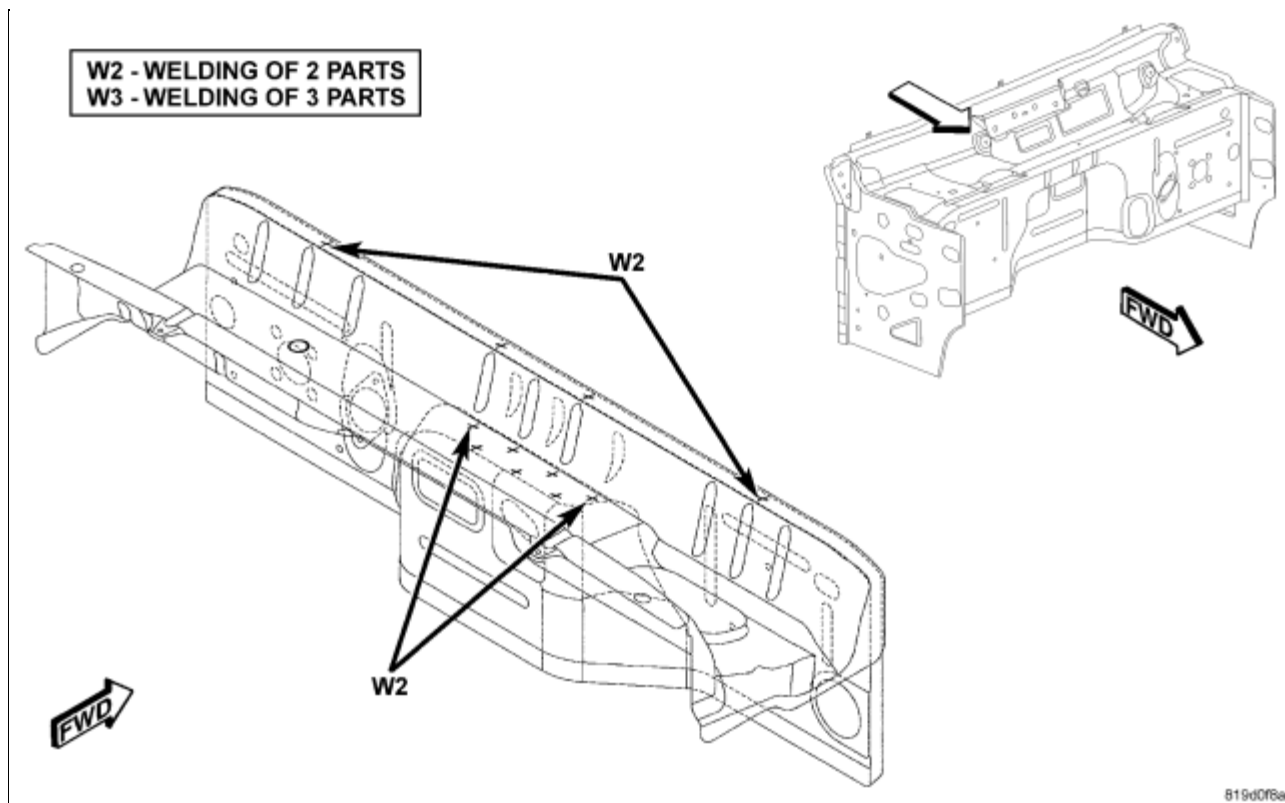
WINDSHIELD FRAME (1 OF 4)



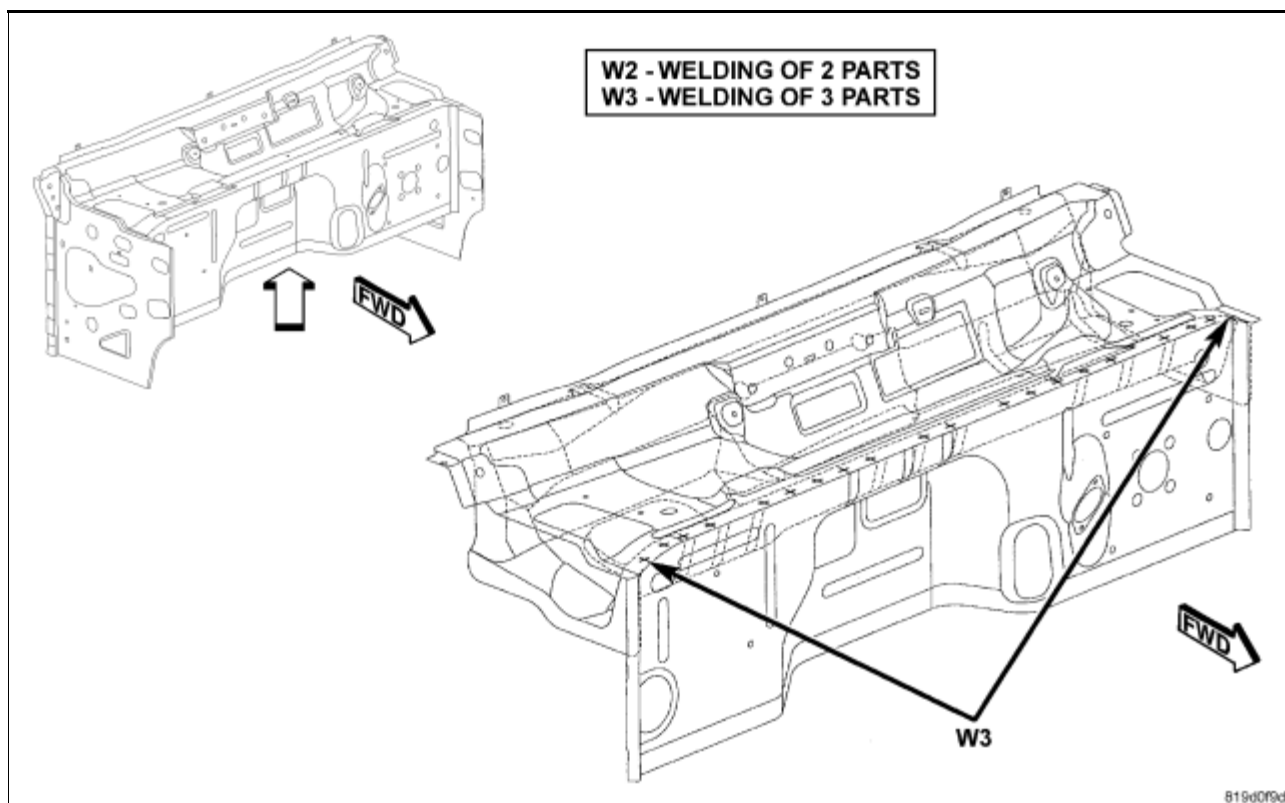
WINDSHIELD FRAME (2 OF 4)



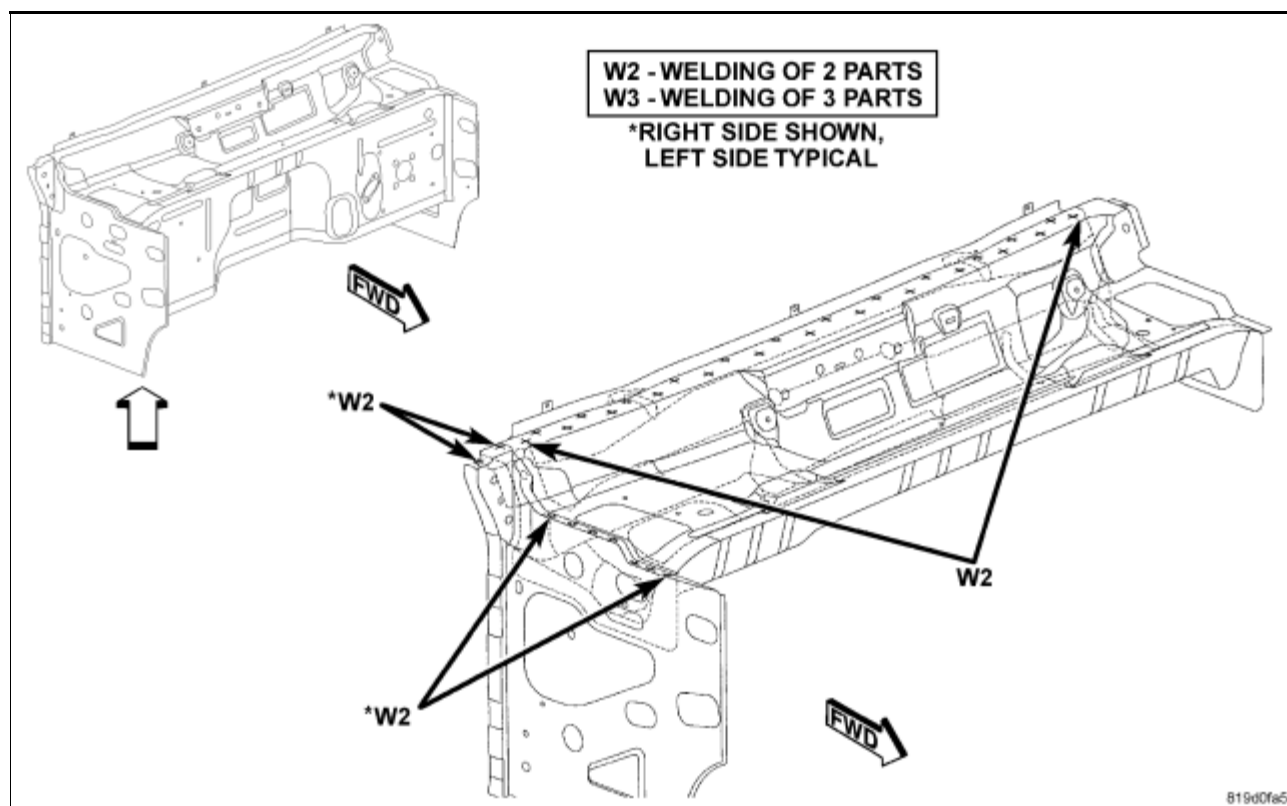
WINDSHIELD FRAME (3 OF 4)**WINDSHIELD FRAME (4 OF 4)**



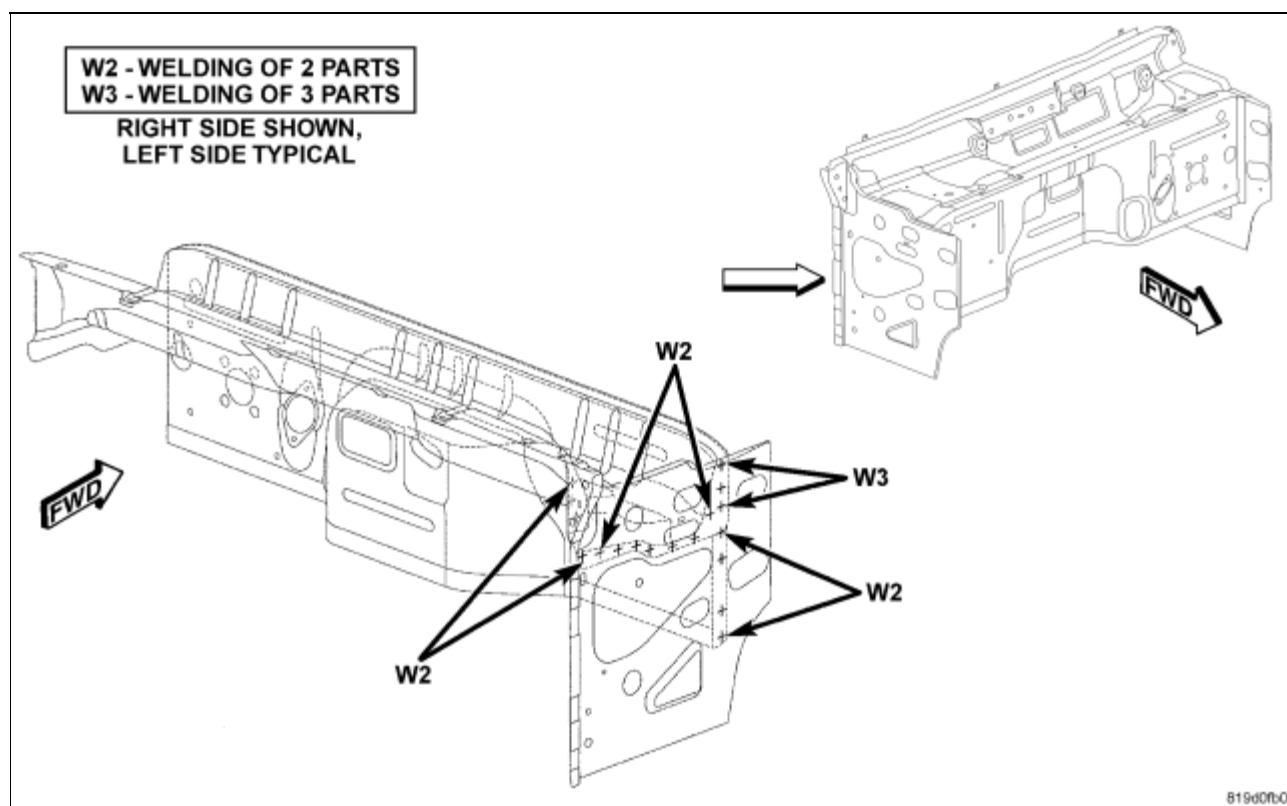
COWL/DASH/PLENUM (1 OF 4) - JK72

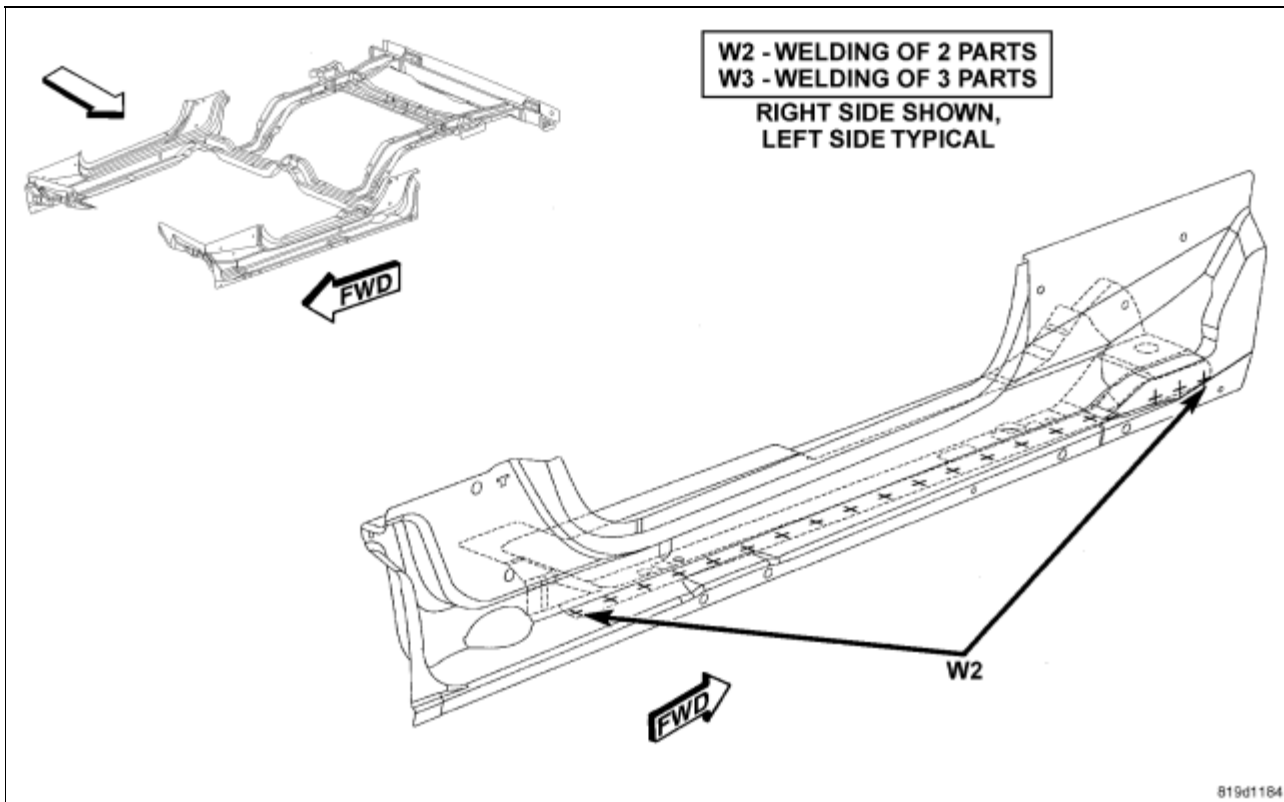


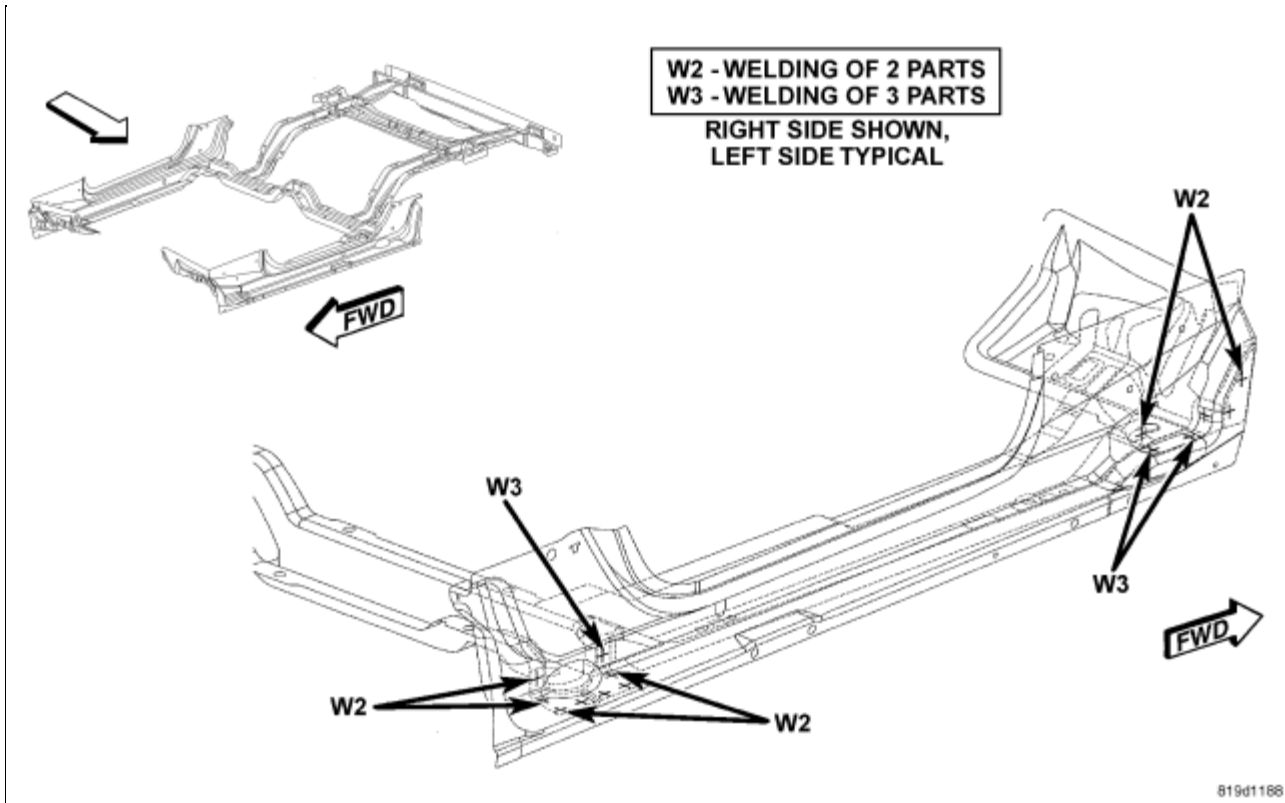
COWL/DASH/PLENUM (2 OF 4) - JK72



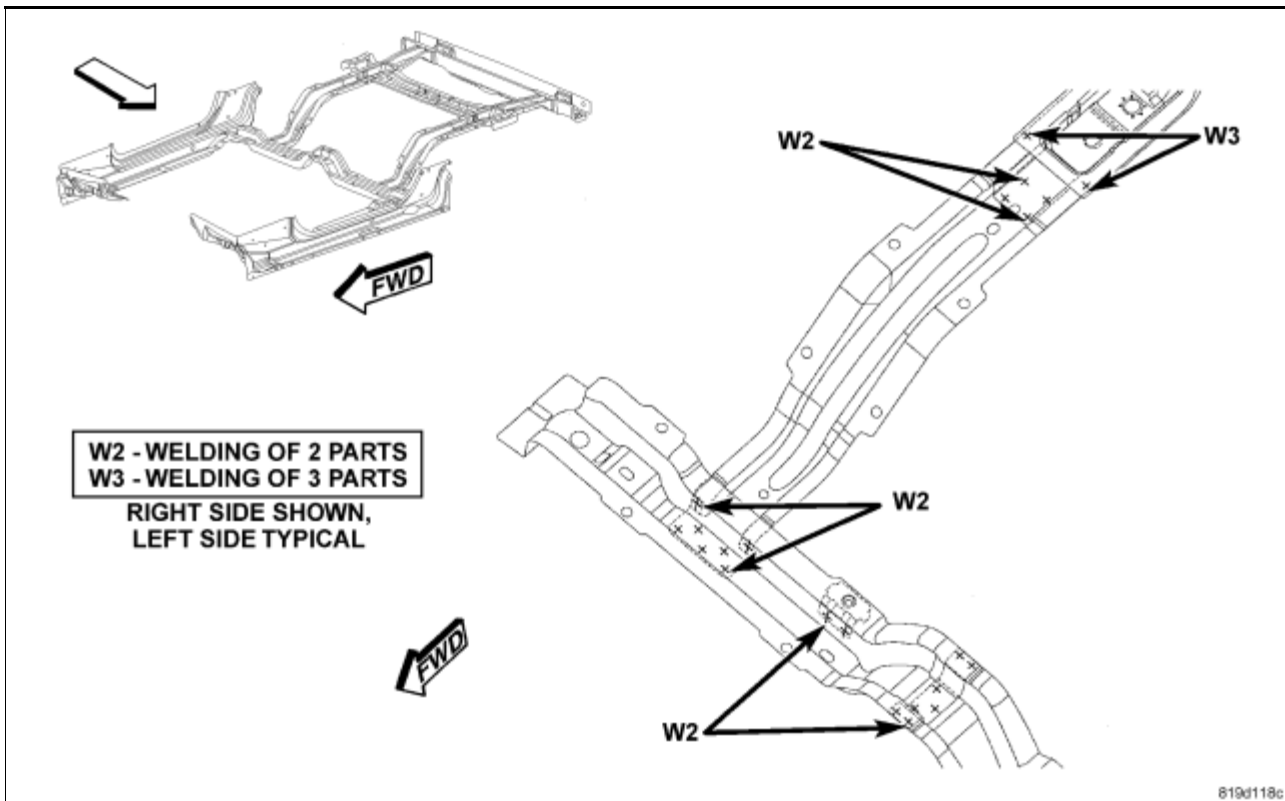
COWL/DASH/PLENUM (3 OF 4) - JK72



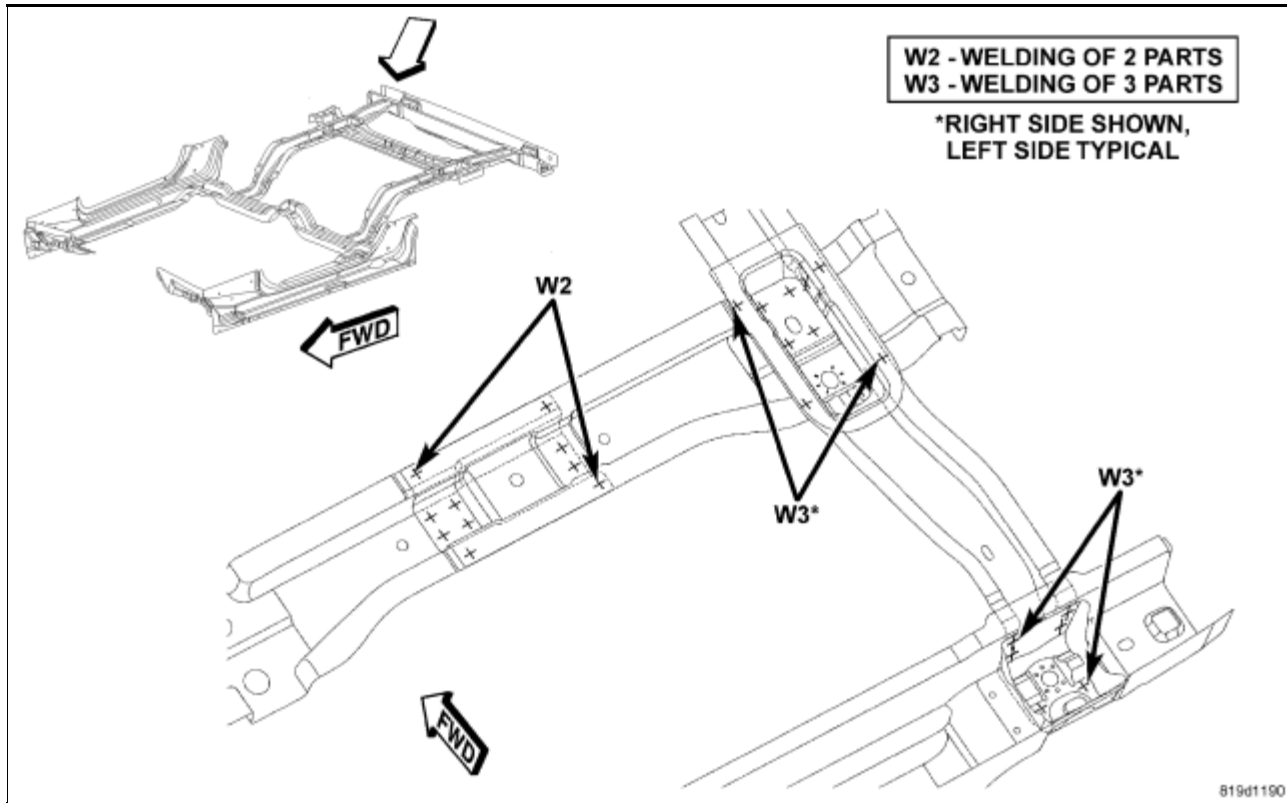
COWL/DASH/PLENUM (4 OF 4) - JK72**LADDER ASSEMBLY COMPLETE (1 OF 4)**



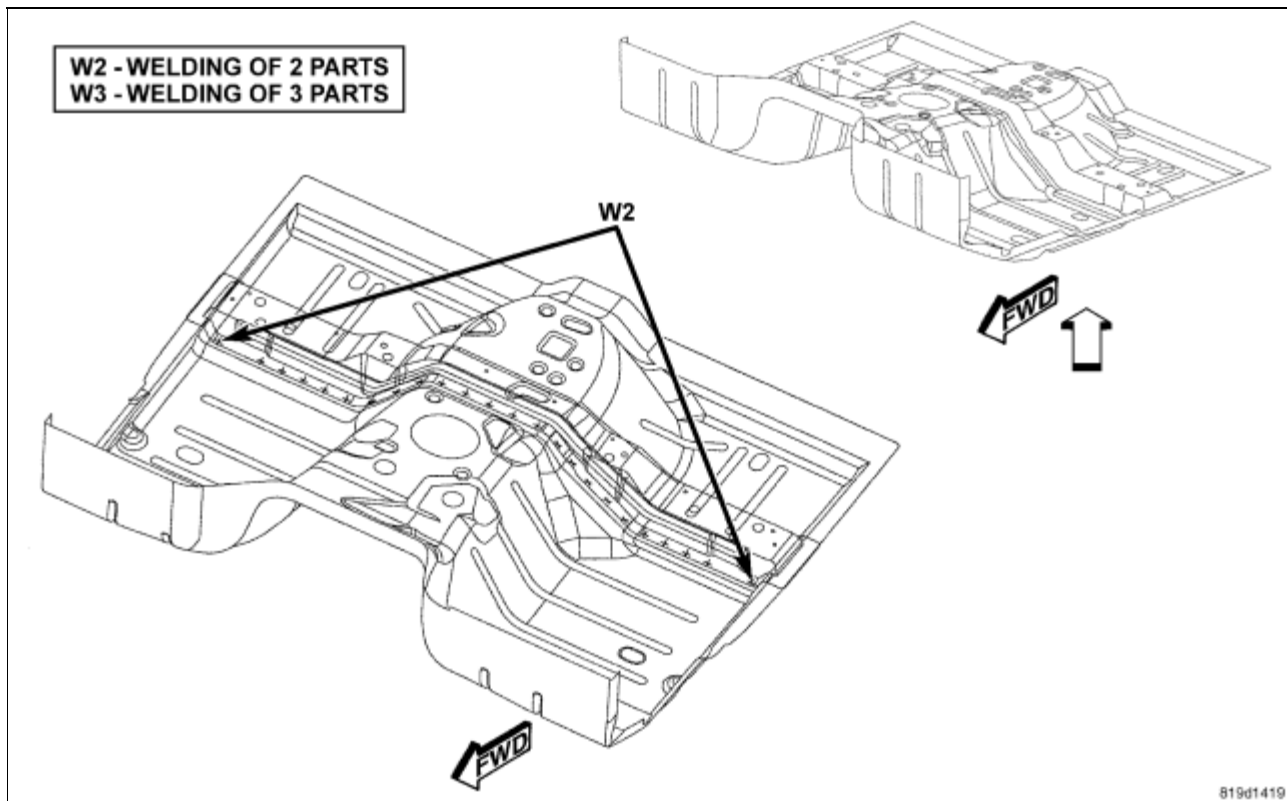
LADDER ASSEMBLY COMPLETE (2 OF 4)

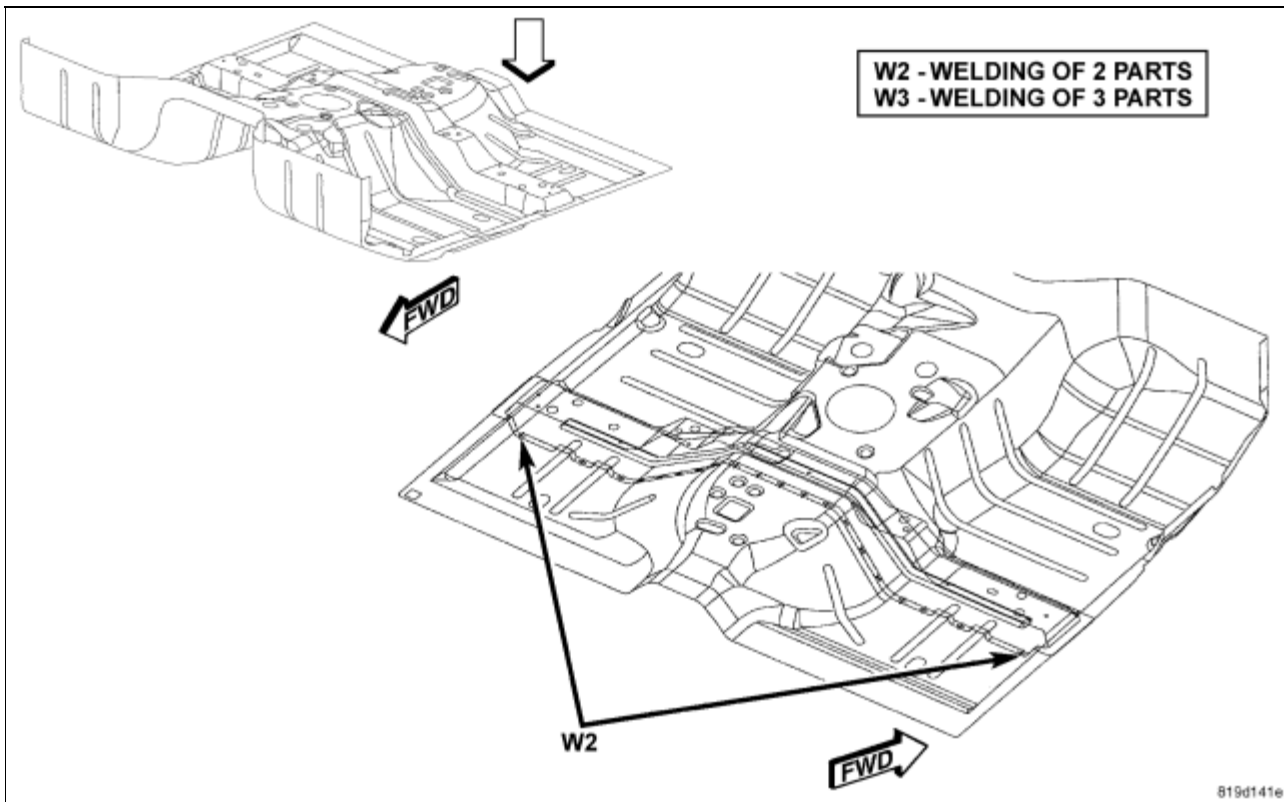


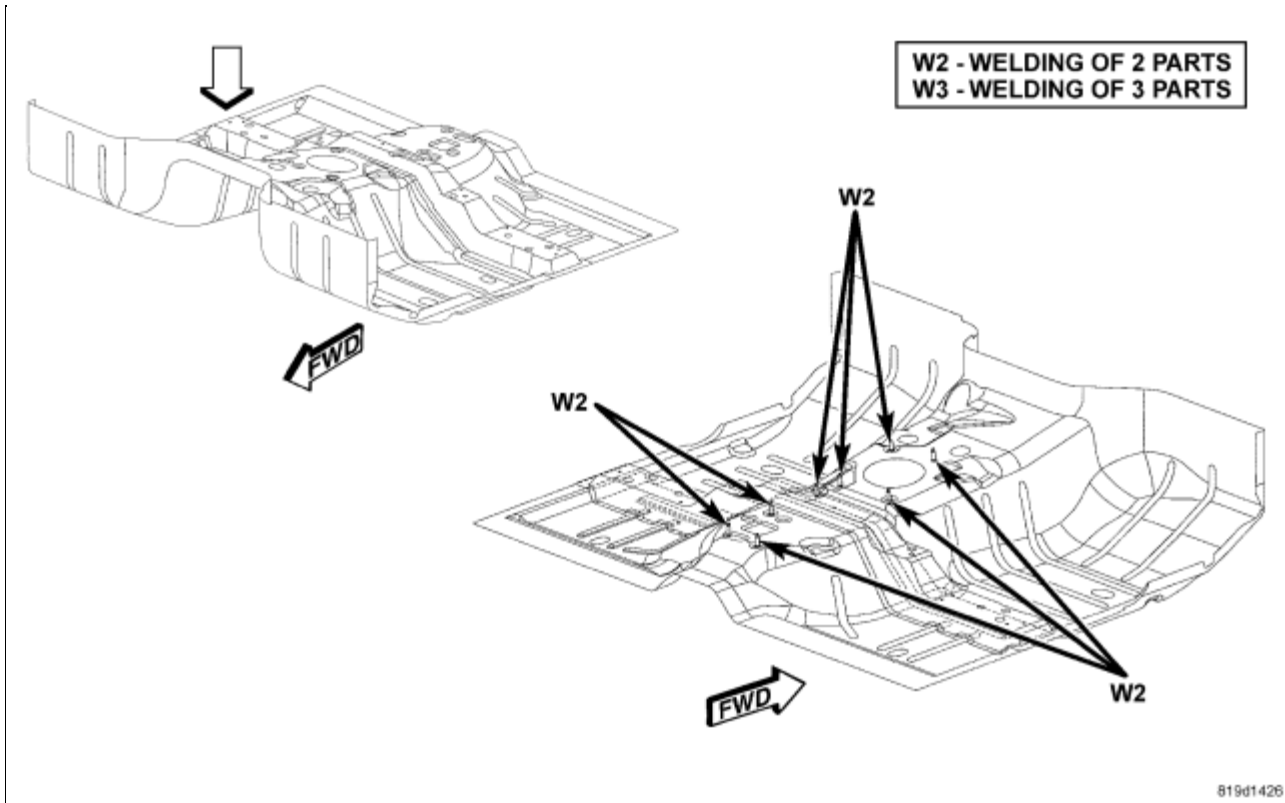
LADDER ASSEMBLY COMPLETE (3 OF 4)



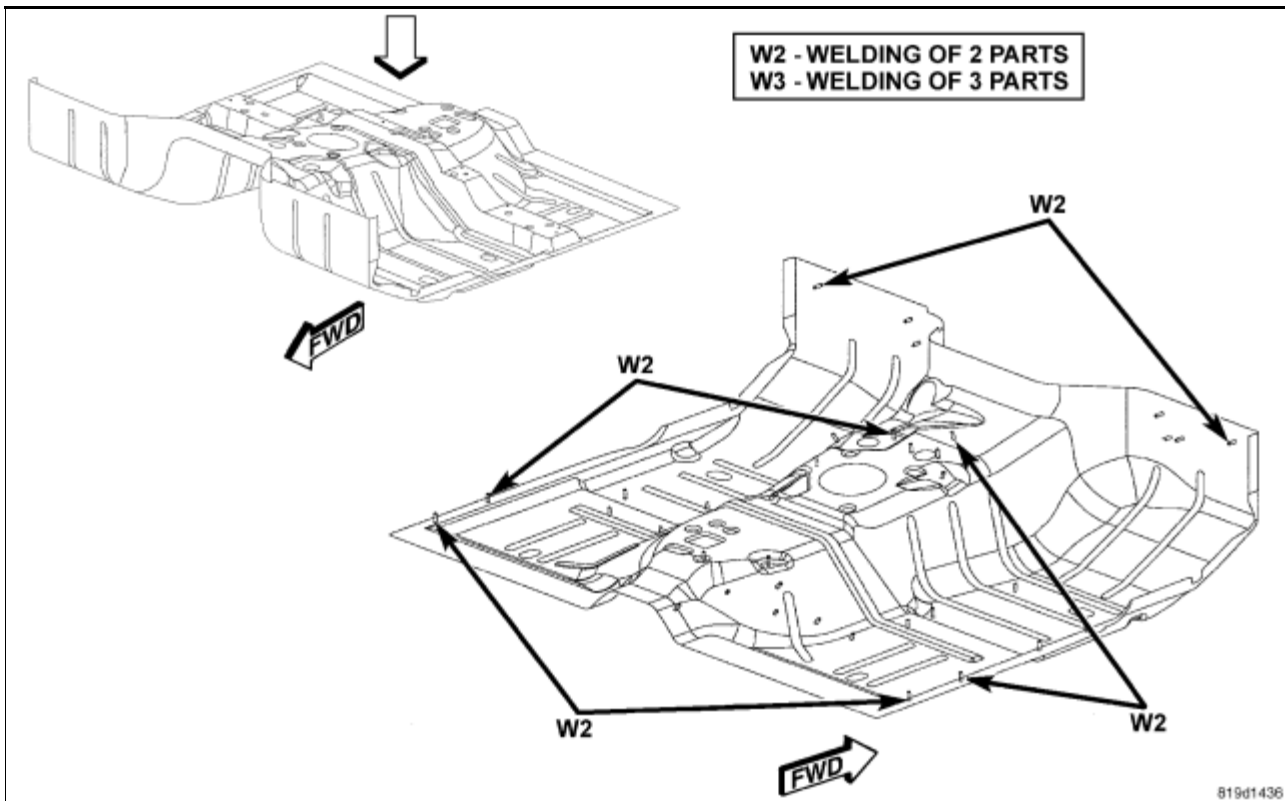
LADDER ASSEMBLY COMPLETE (4 OF 4)



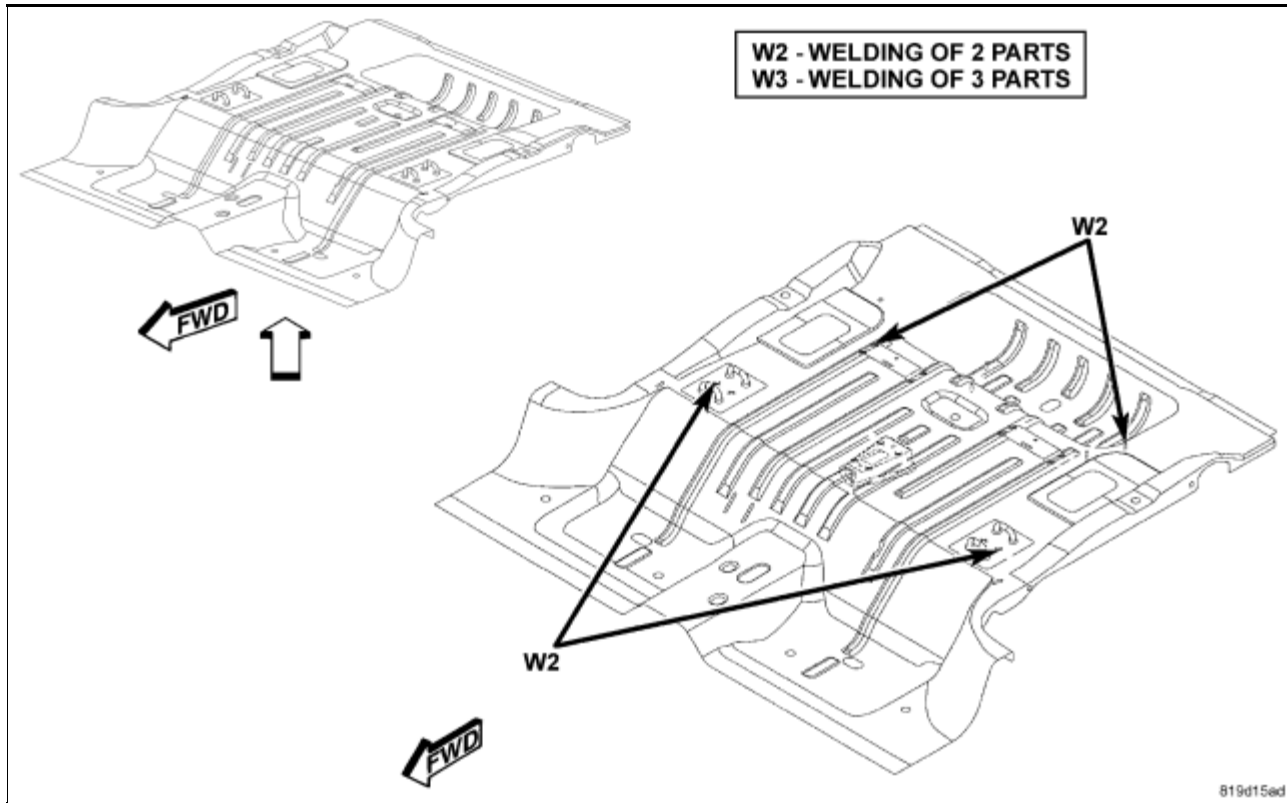
FRONT FLOOR ASSEMBLY (1 OF 4) - JK72**FRONT FLOOR ASSEMBLY (2 OF 4) - JK72**



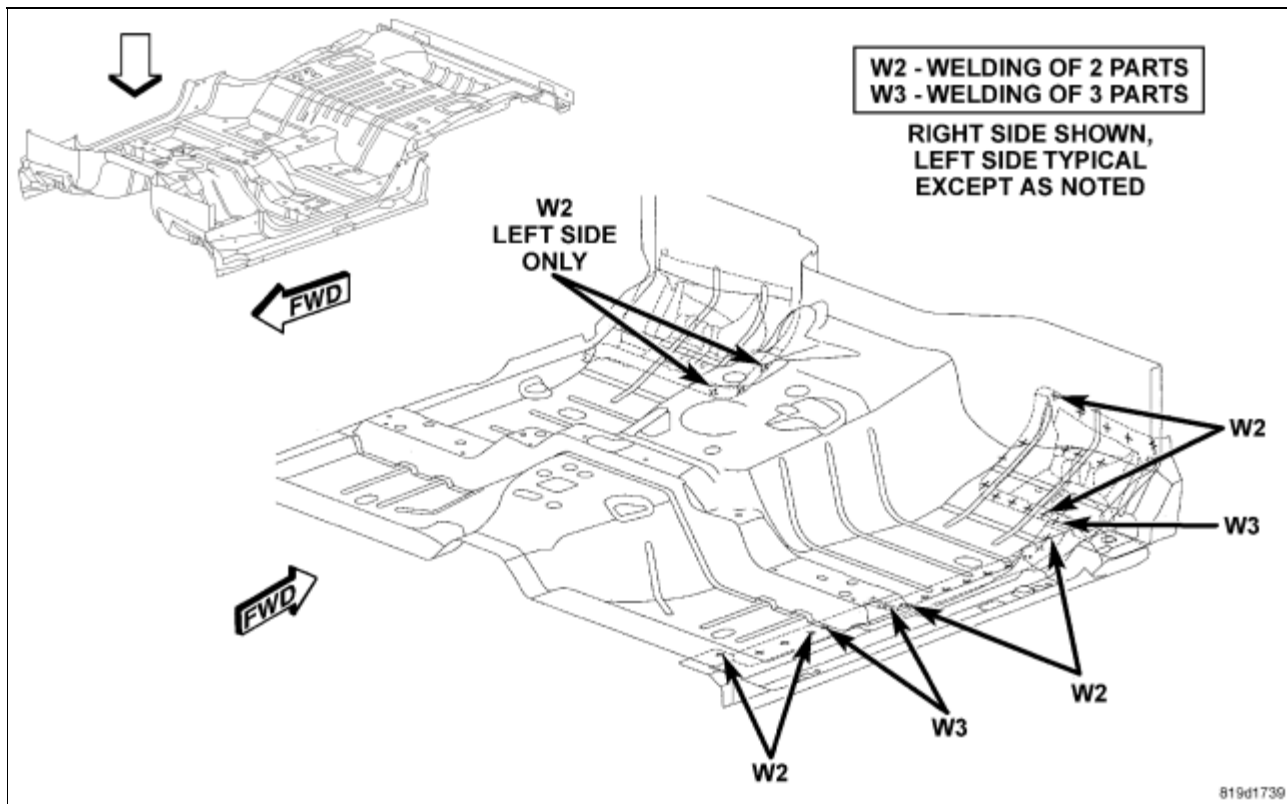
FRONT FLOOR ASSEMBLY (3 OF 4) - JK72

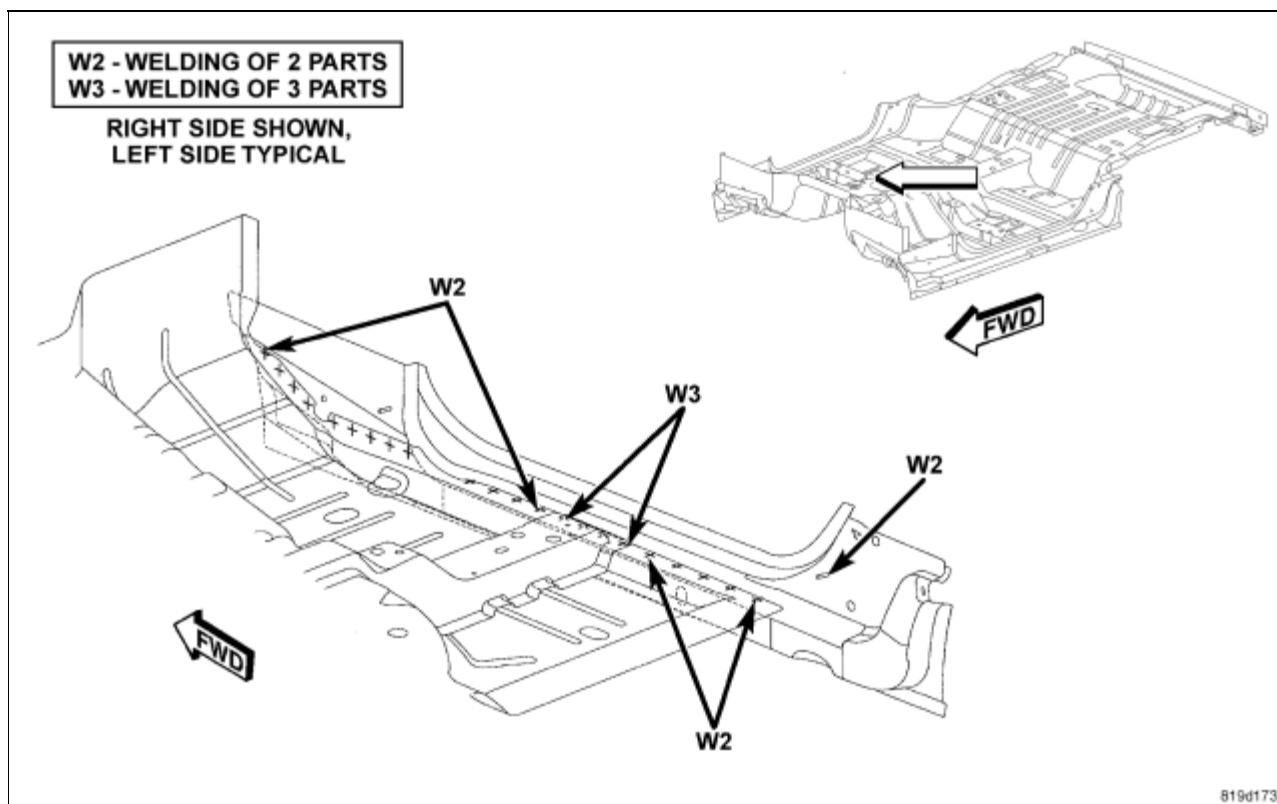


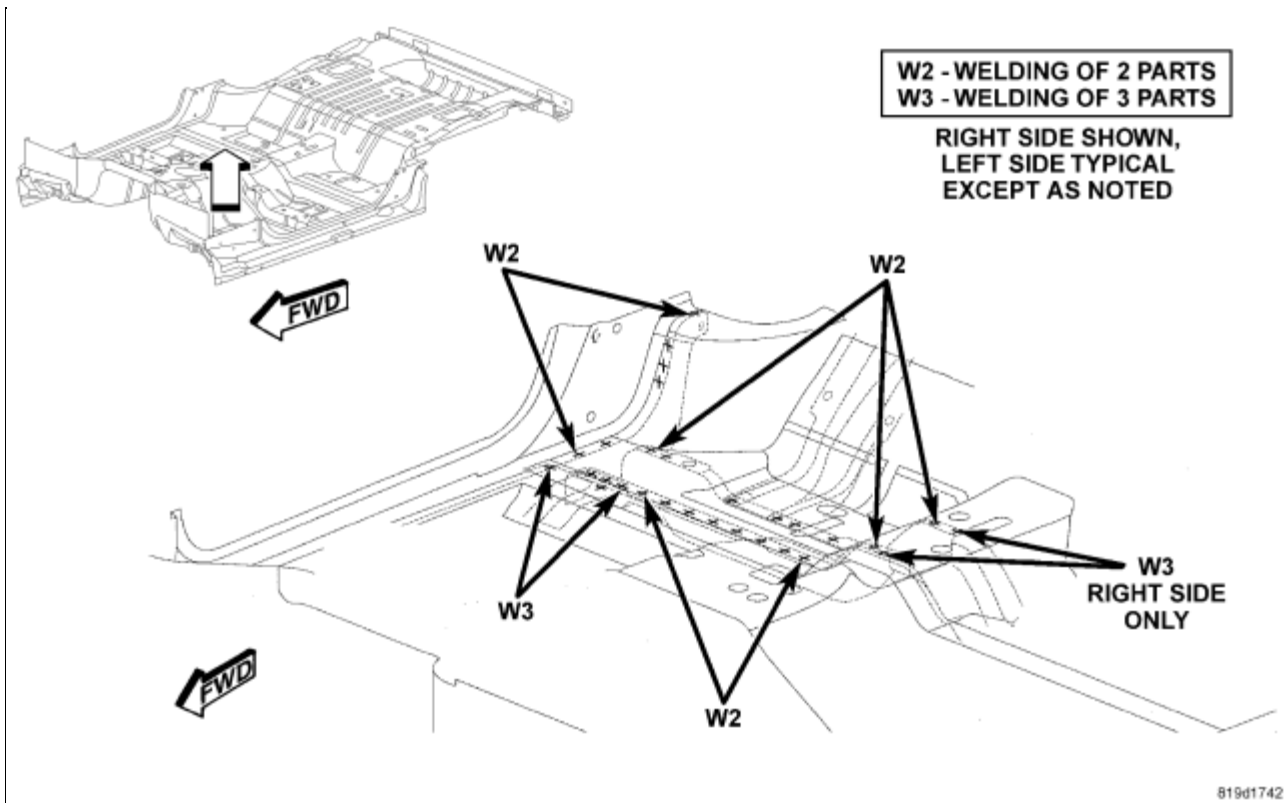
FRONT FLOOR ASSEMBLY (4 OF 4) - JK72



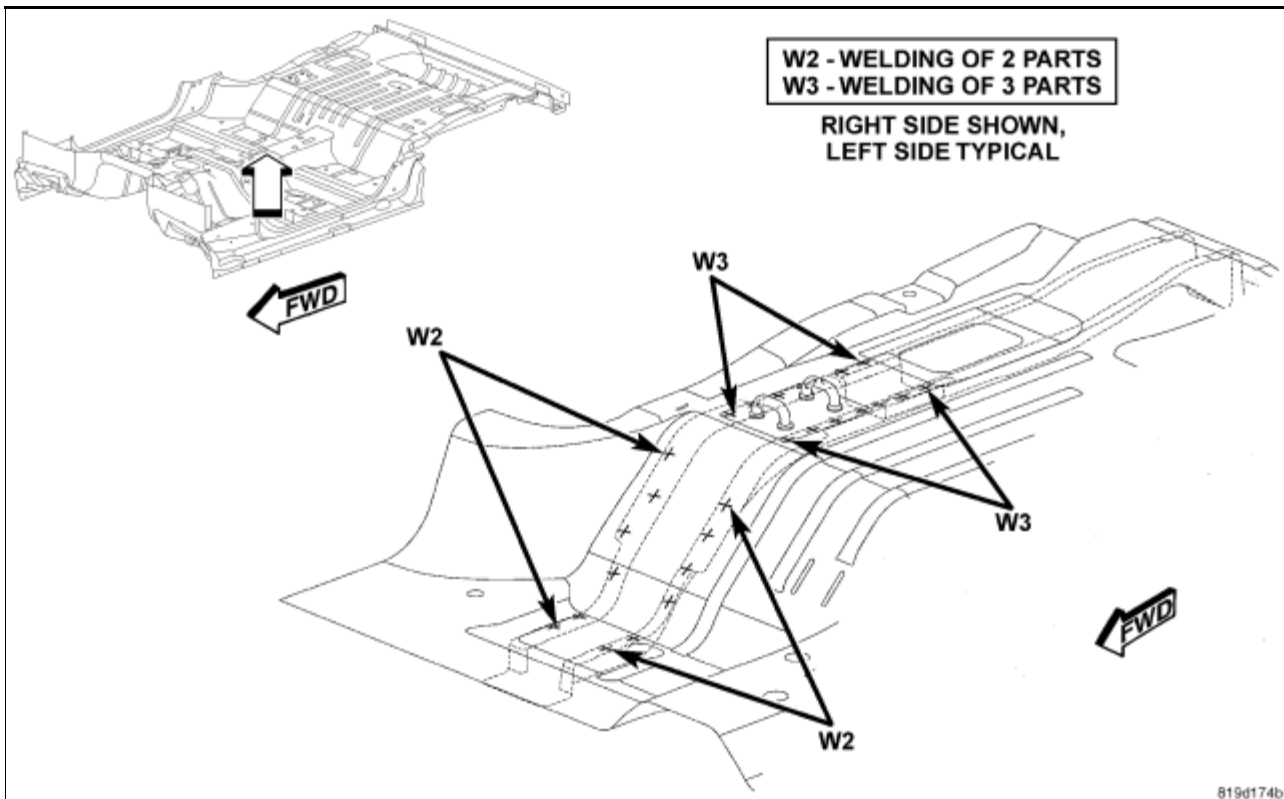
REAR FLOOR ASSEMBLY - JK72



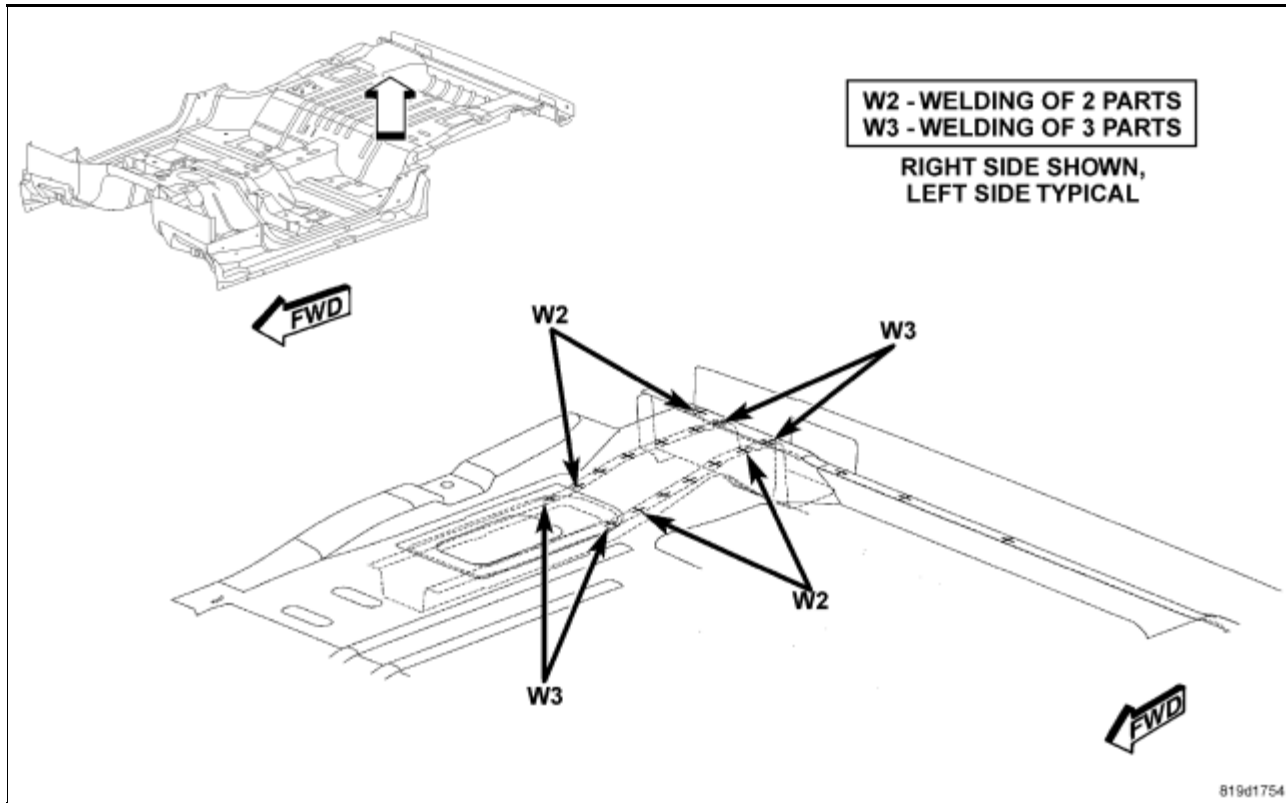
LADDER AND FLOOR ASSEMBLY (1 OF 6) - JK72**LADDER & FLOOR ASSEMBLY (2 OF 6) - JK72**



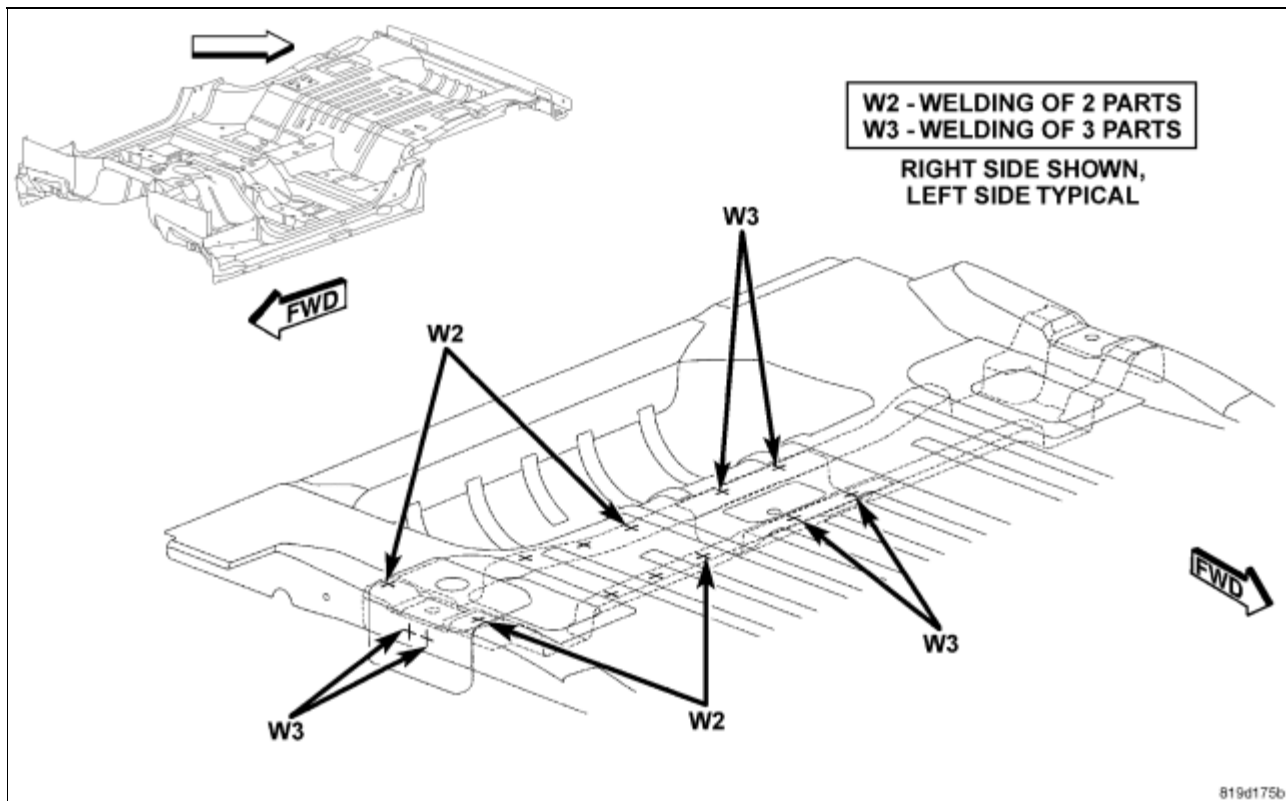
LADDER AND FLOOR ASSEMBLY (3 OF 6) - JK72



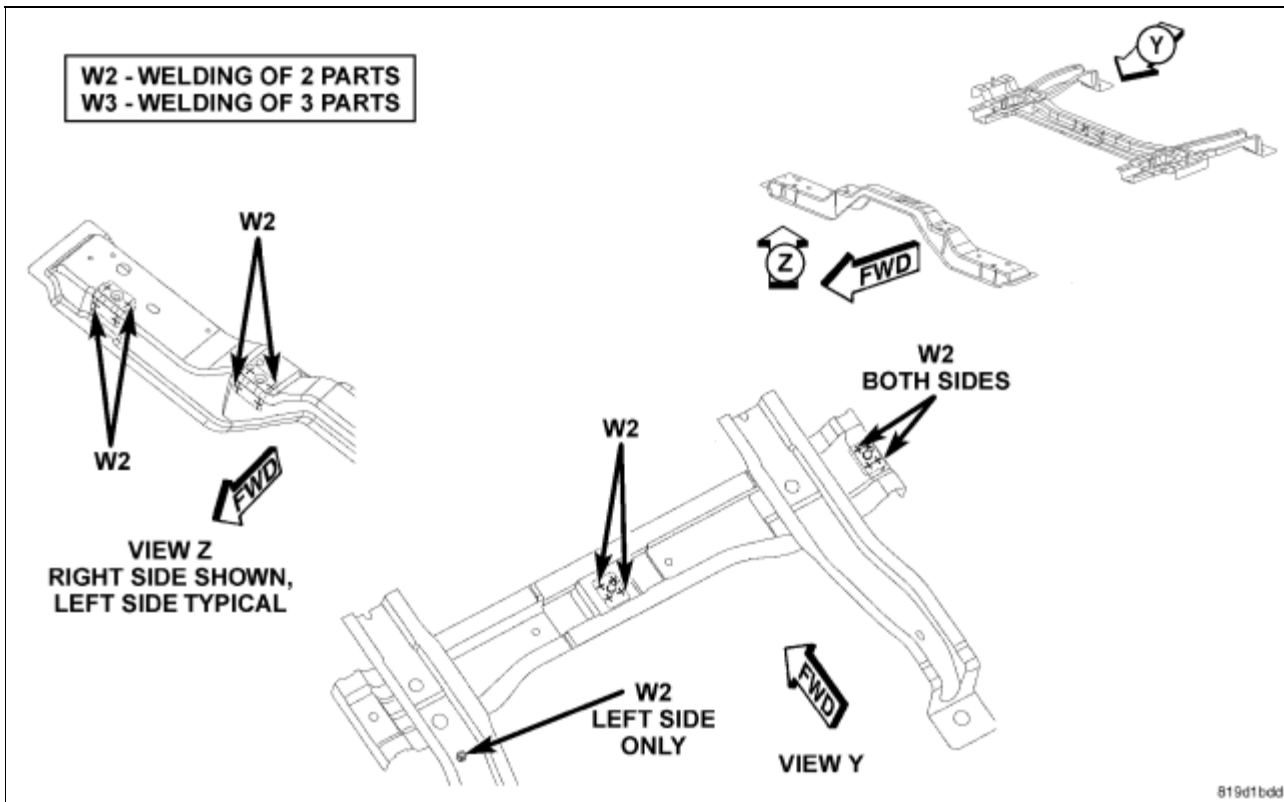
LADDER AND FLOOR ASSEMBLY (4 OF 6) - JK72



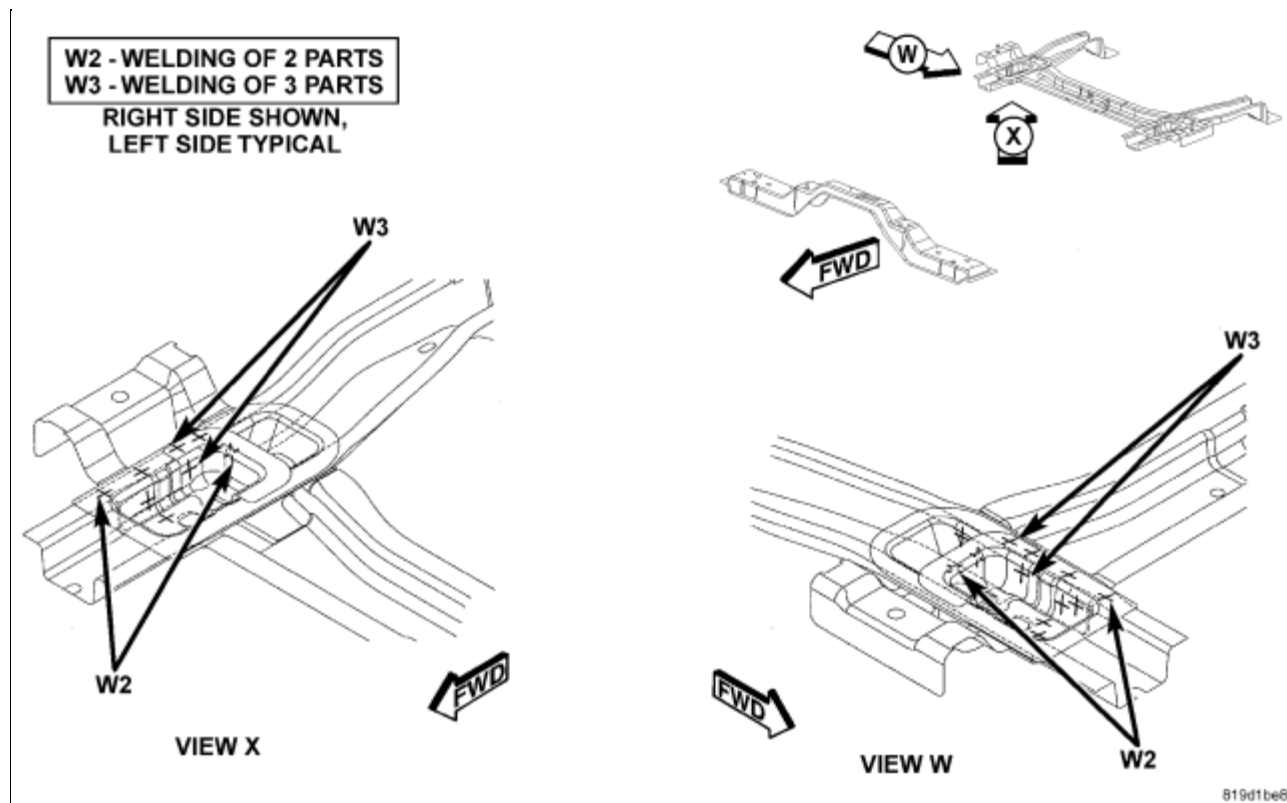
LADDER & FLOOR ASSEMBLY (5 OF 6) - JK72



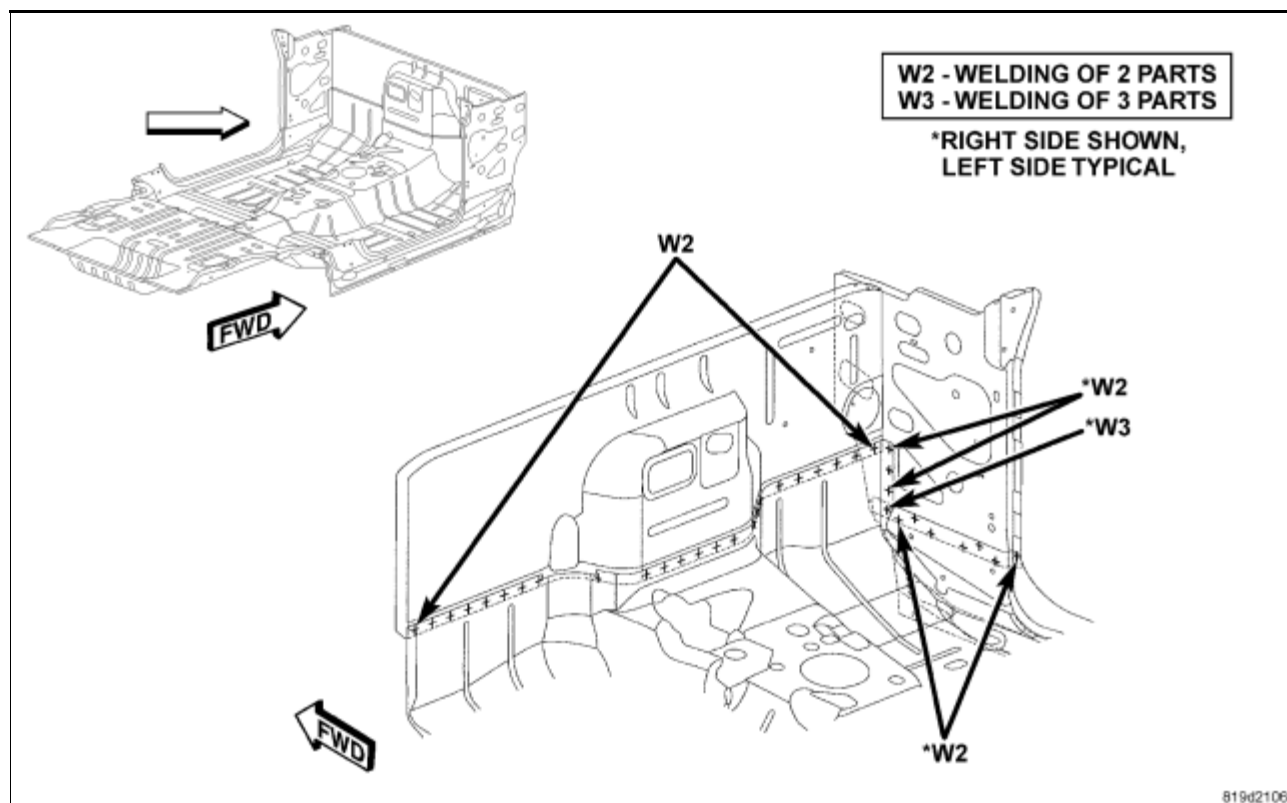
LADDER AND FLOOR ASSEMBLY (6 OF 6) - JK72



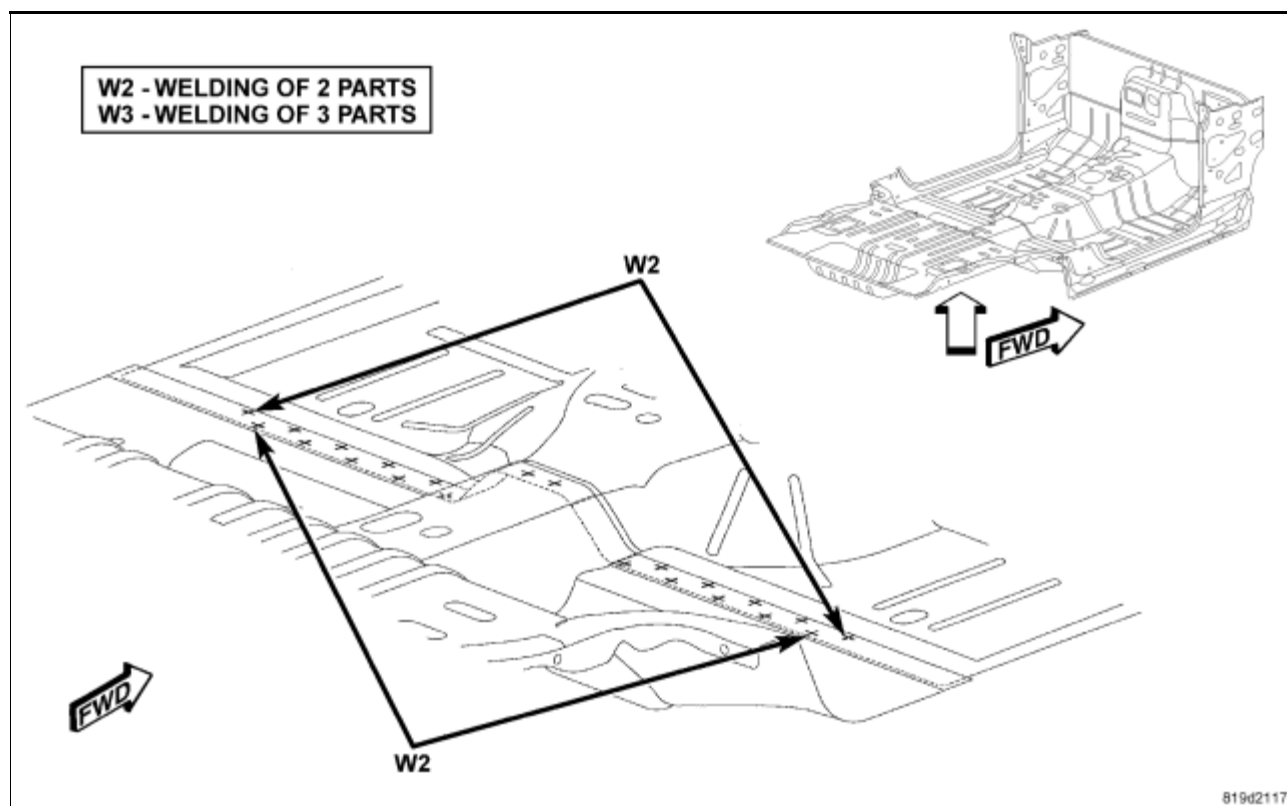
UNDERBODY (1 OF 2) - JK72



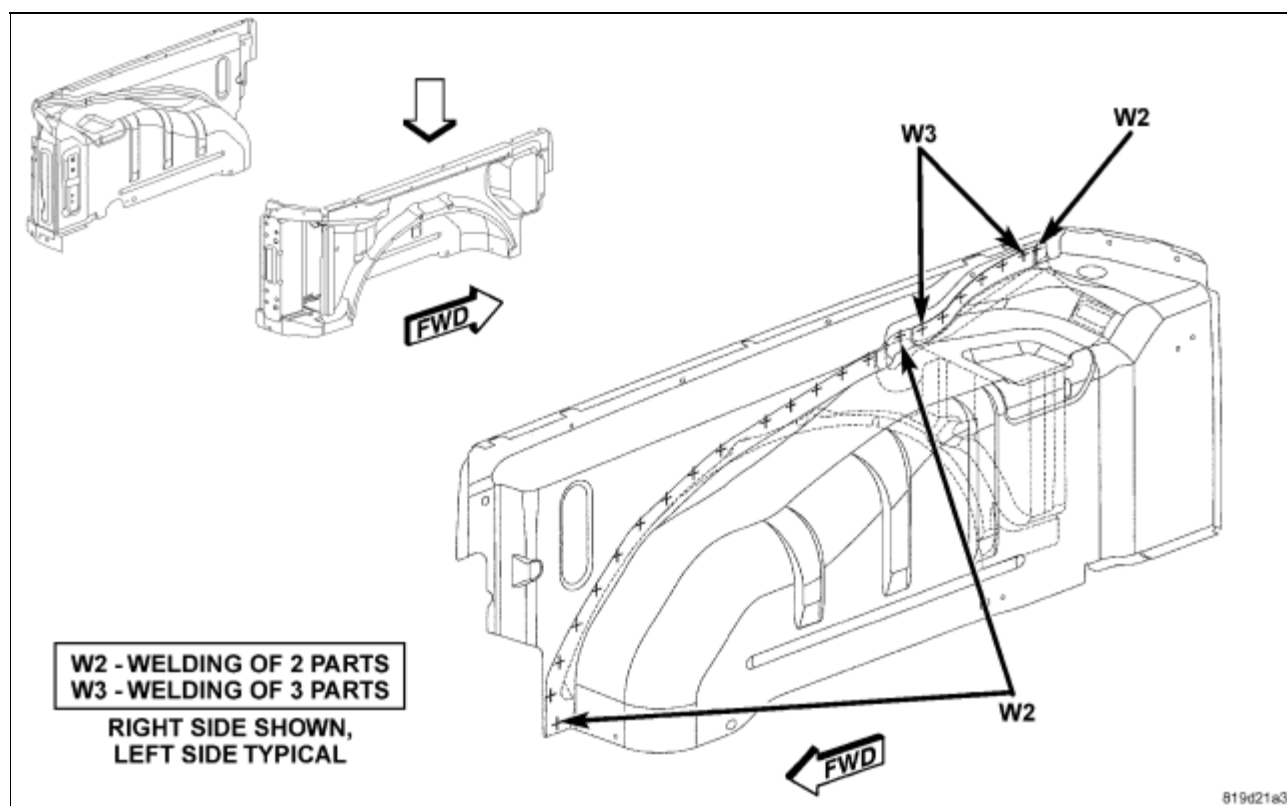
UNDERBODY (2 OF 2) - JK72

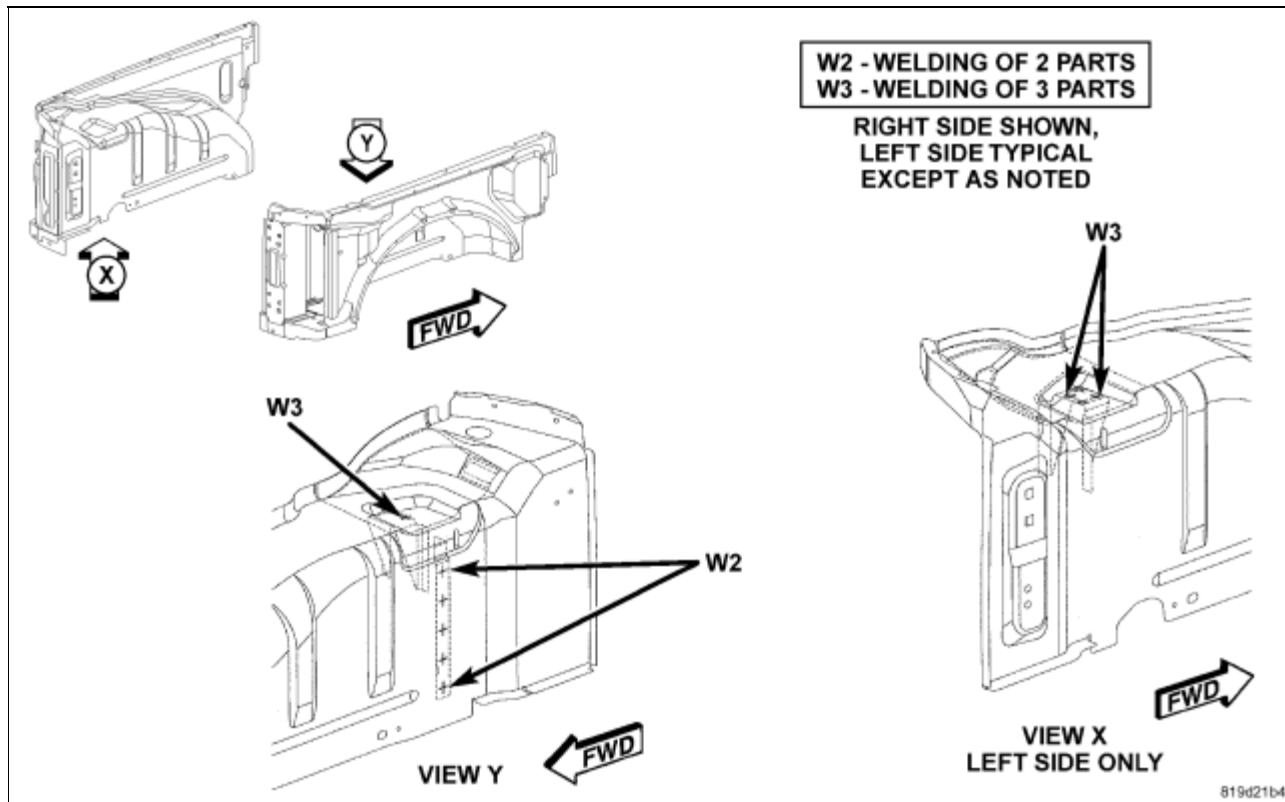


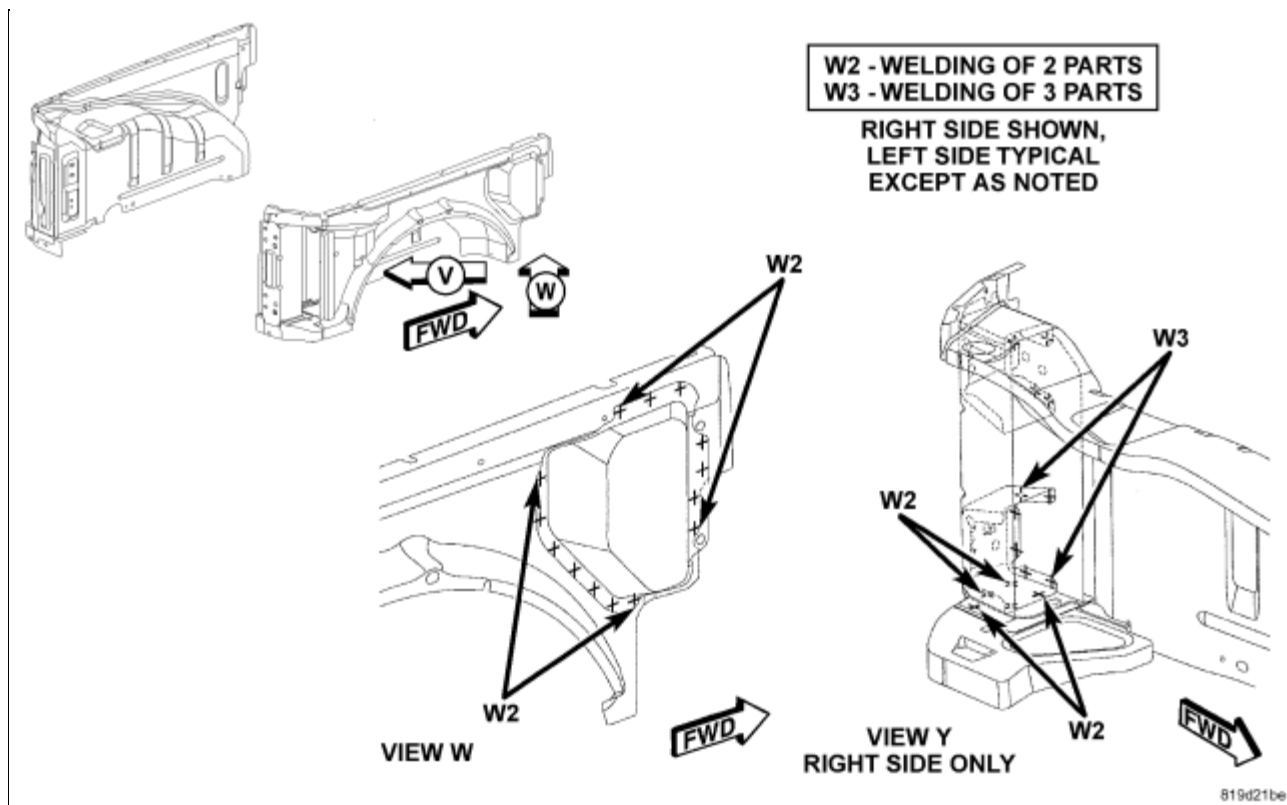
UNDERBODY COMPLETE (1 OF 2) - JK72



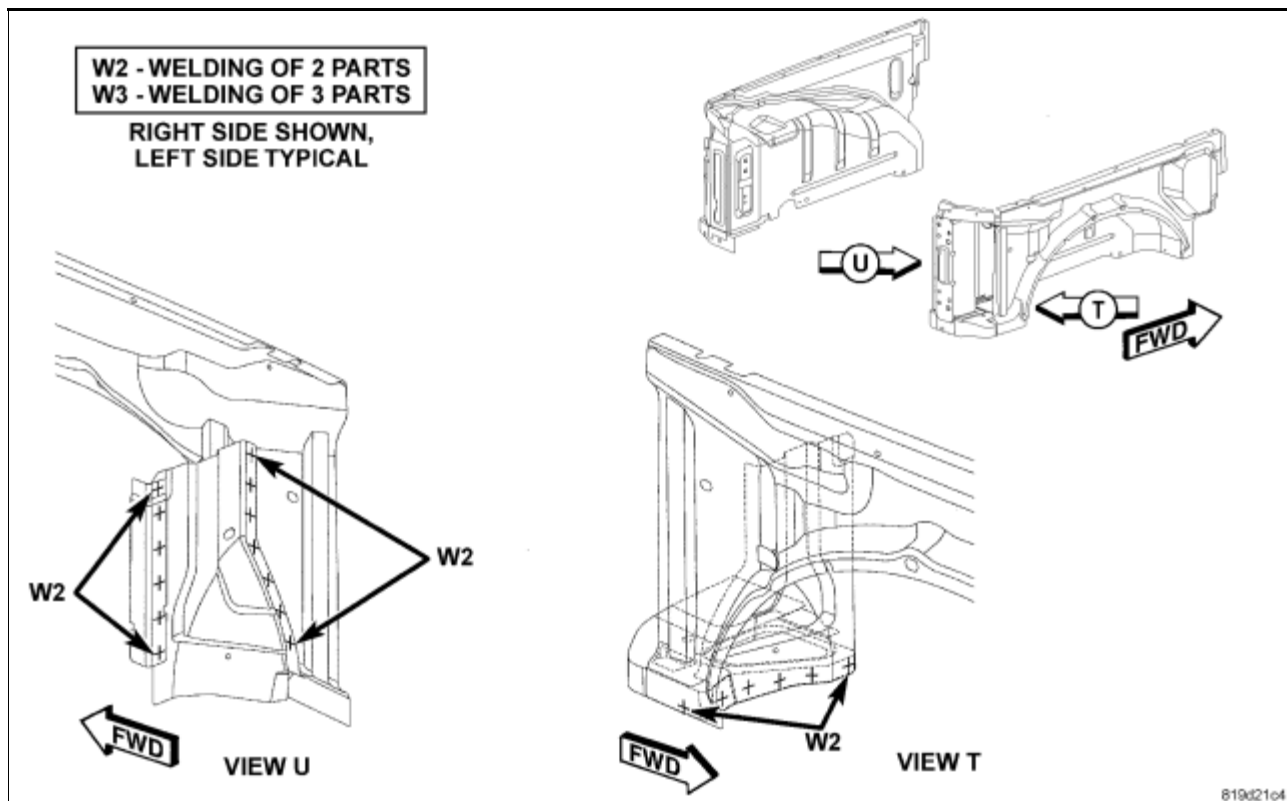
UNDERBODY COMPLETE (2 OF 2) - JK72



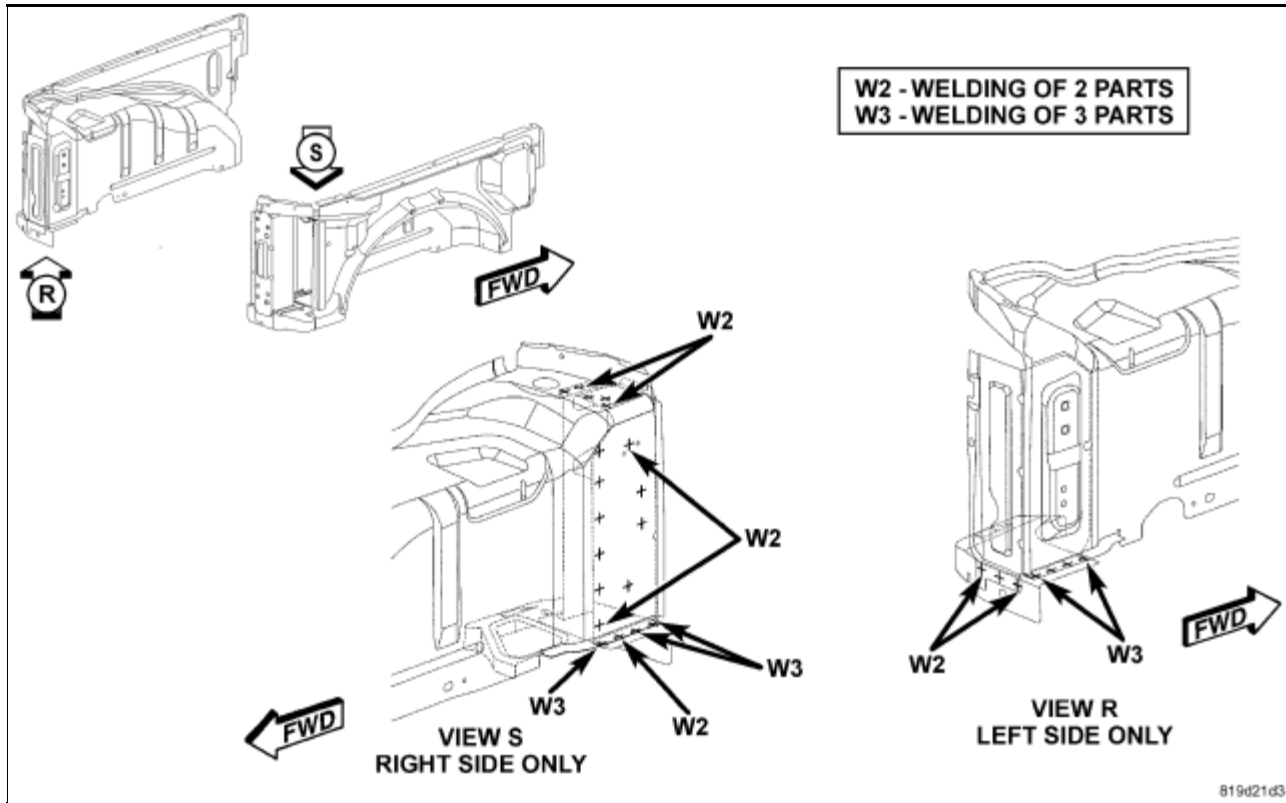
BODY SIDE APERTURE - INNER (1 OF 6) - JK72**BODY SIDE APERTURE - INNER (2 OF 6) - JK72**



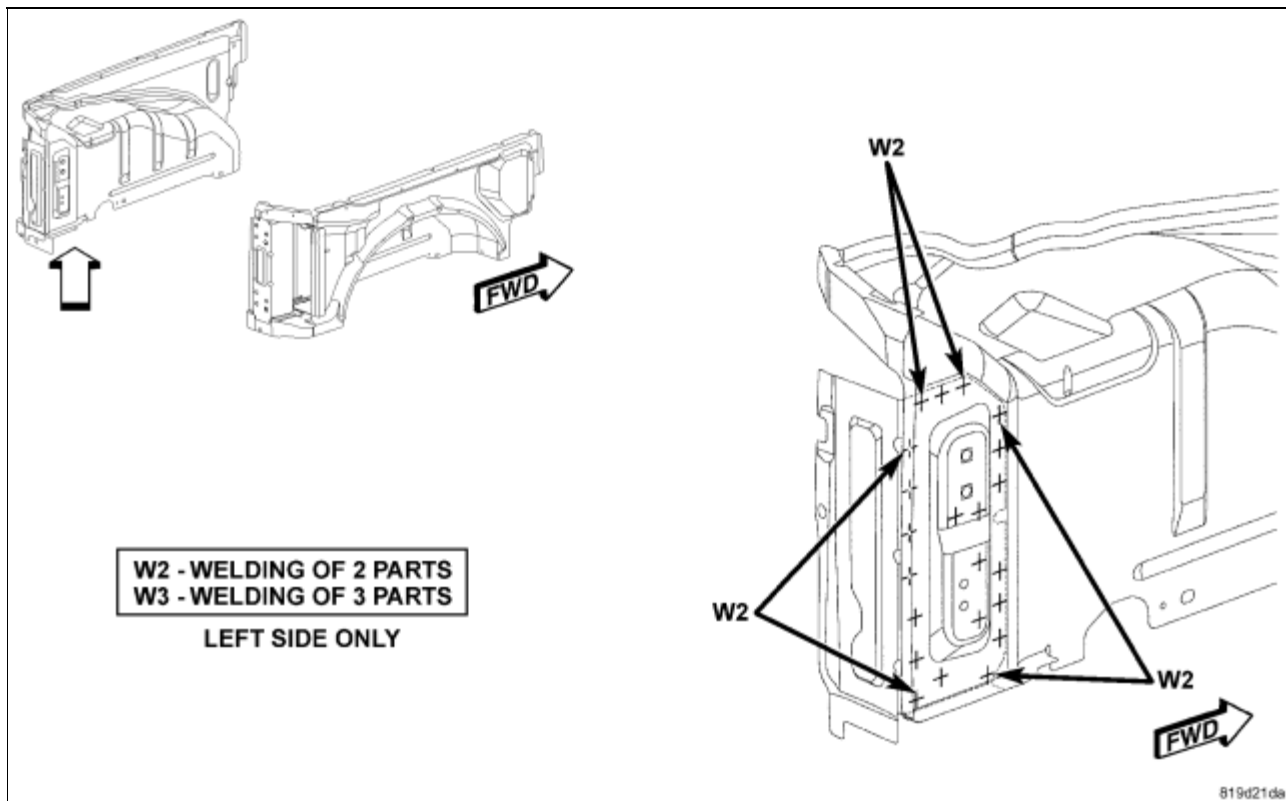
BODY SIDE APERTURE - INNER (3 OF 6) - JK72

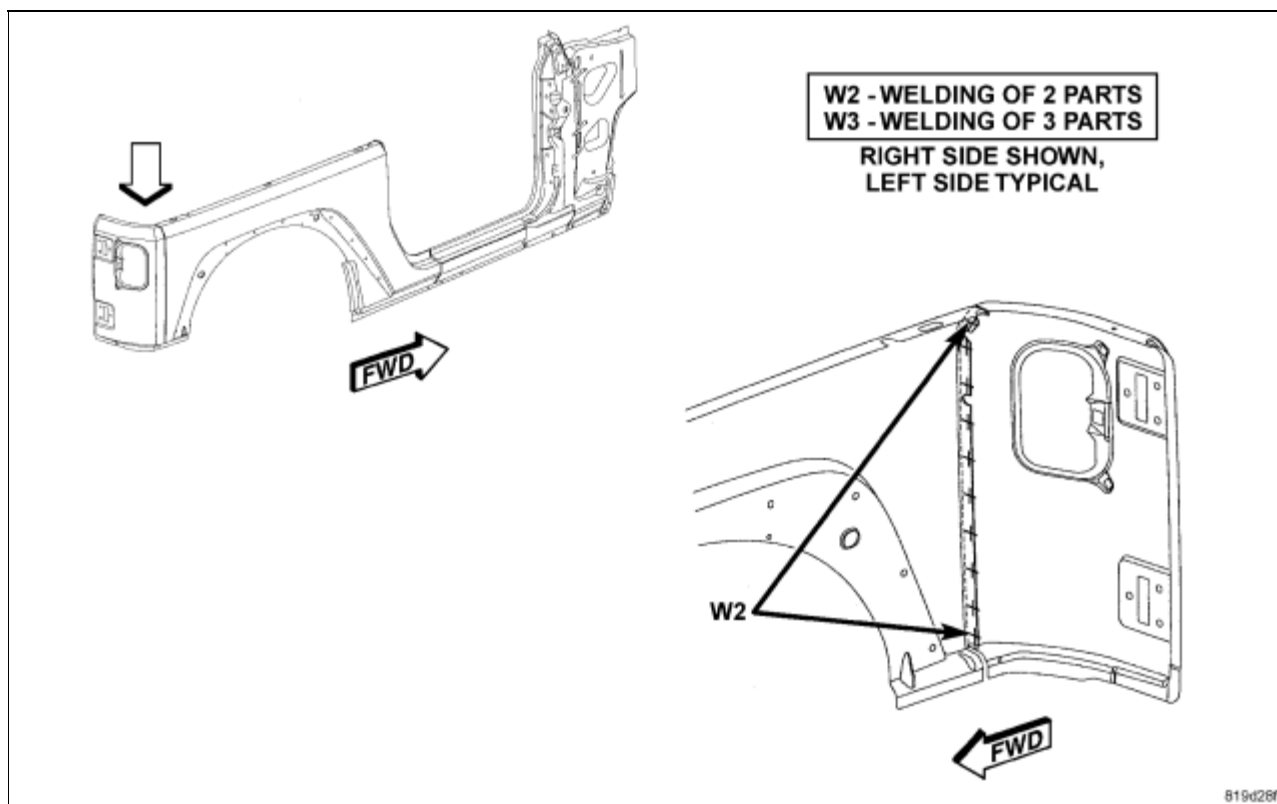


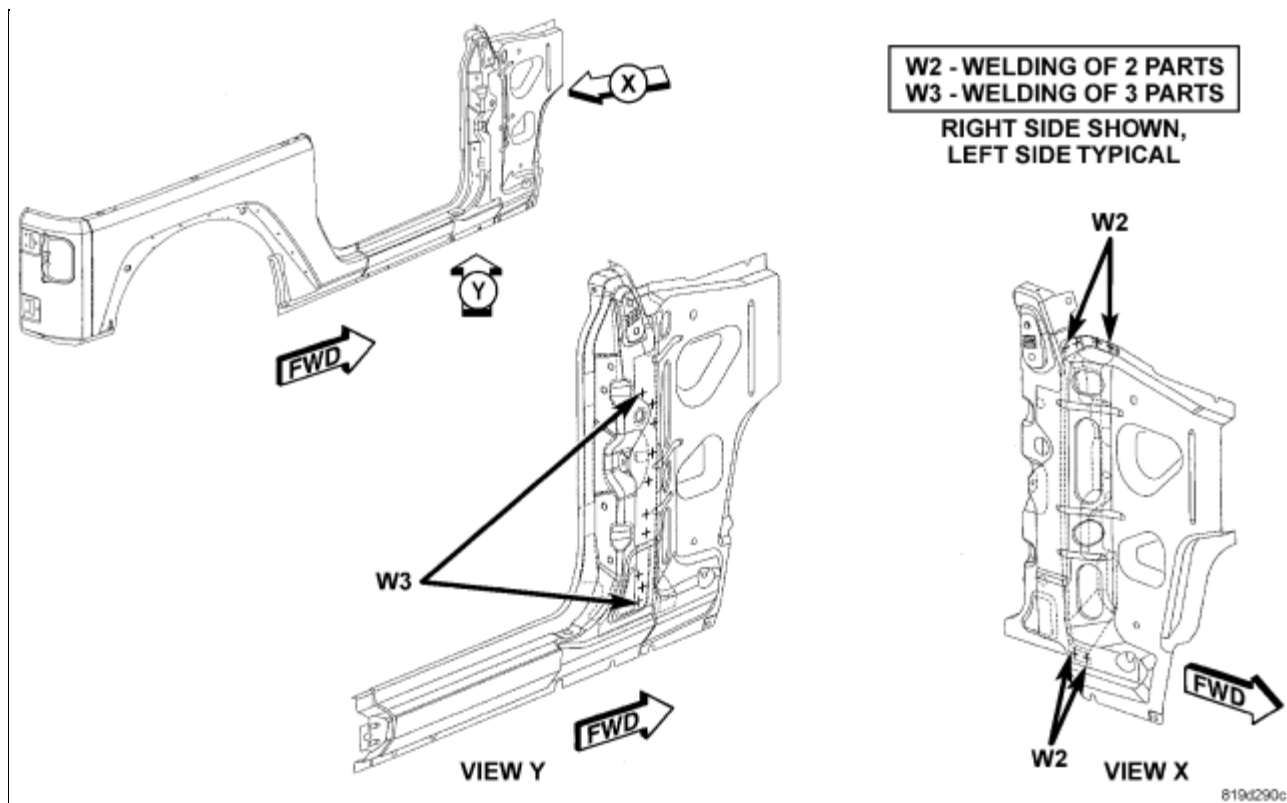
BODY SIDE APERTURE - INNER (4 OF 6) - JK72



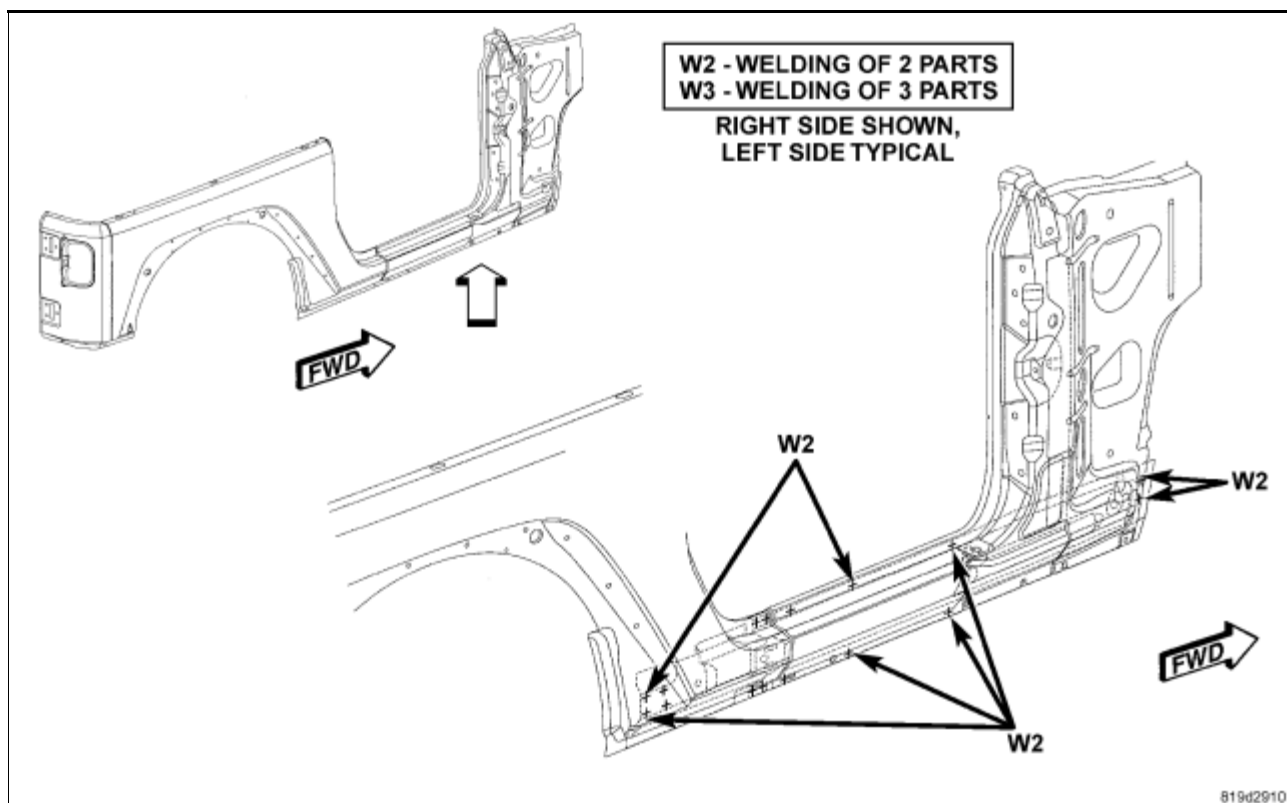
BODY SIDE APERTURE - INNER (5 OF 6) - JK72



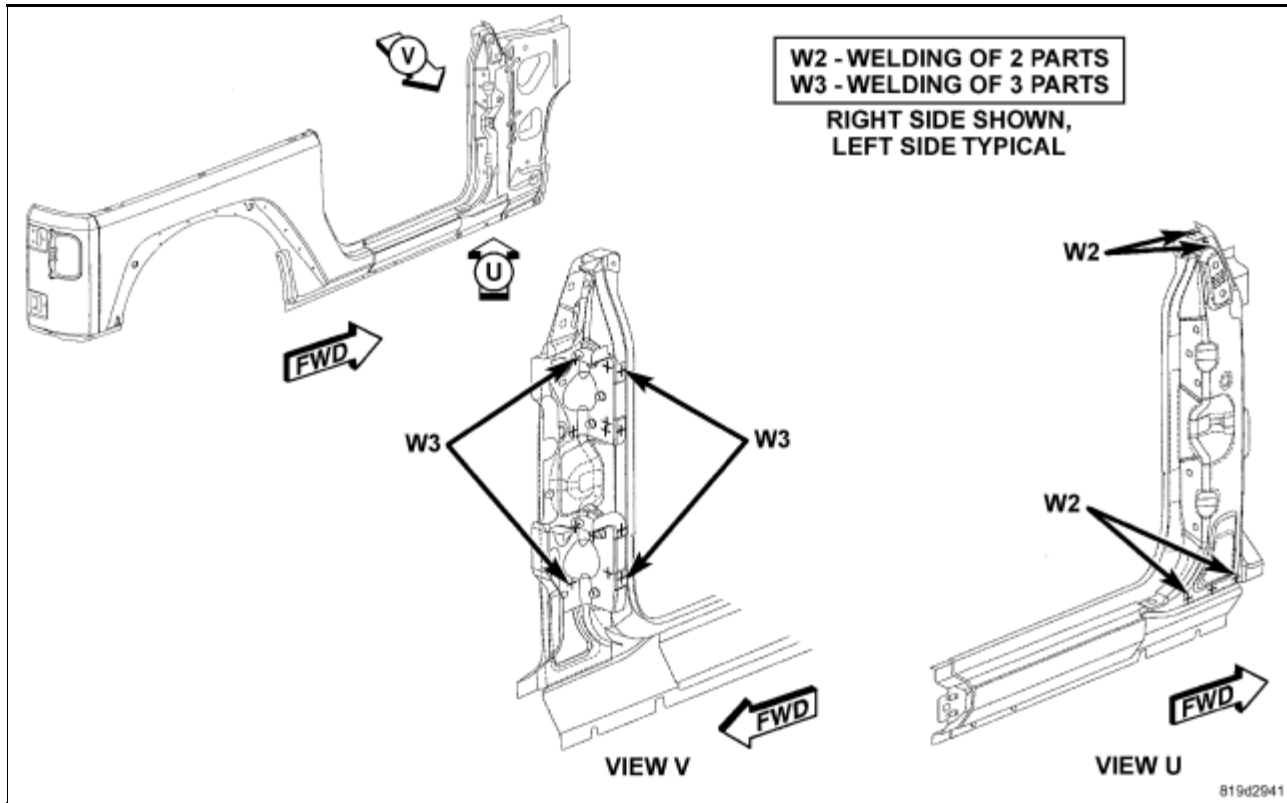
BODY SIDE APERTURE - INNER (6 OF 6) - JK72**BODY SIDE APERTURE - OUTER (1 OF 4) - JK72**



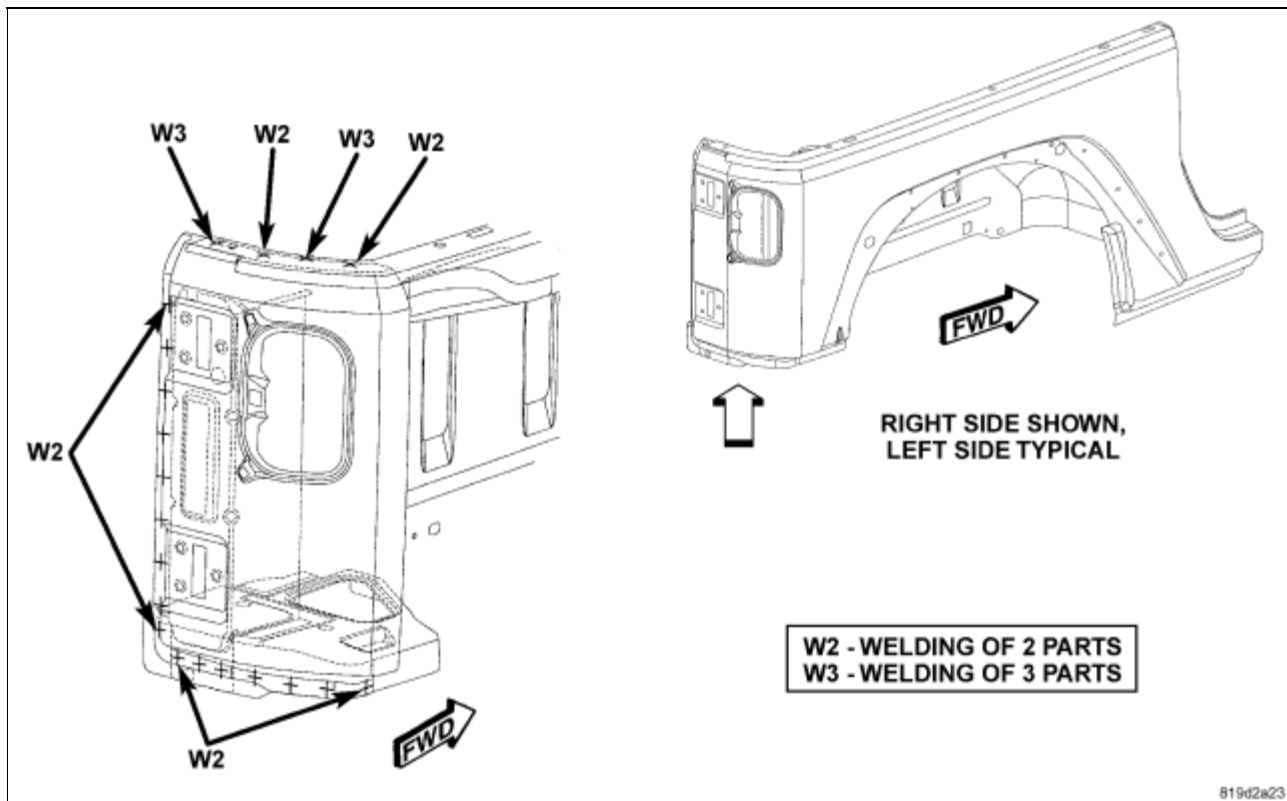
BODY SIDE APERTURE - OUTER (2 OF 4) - JK72

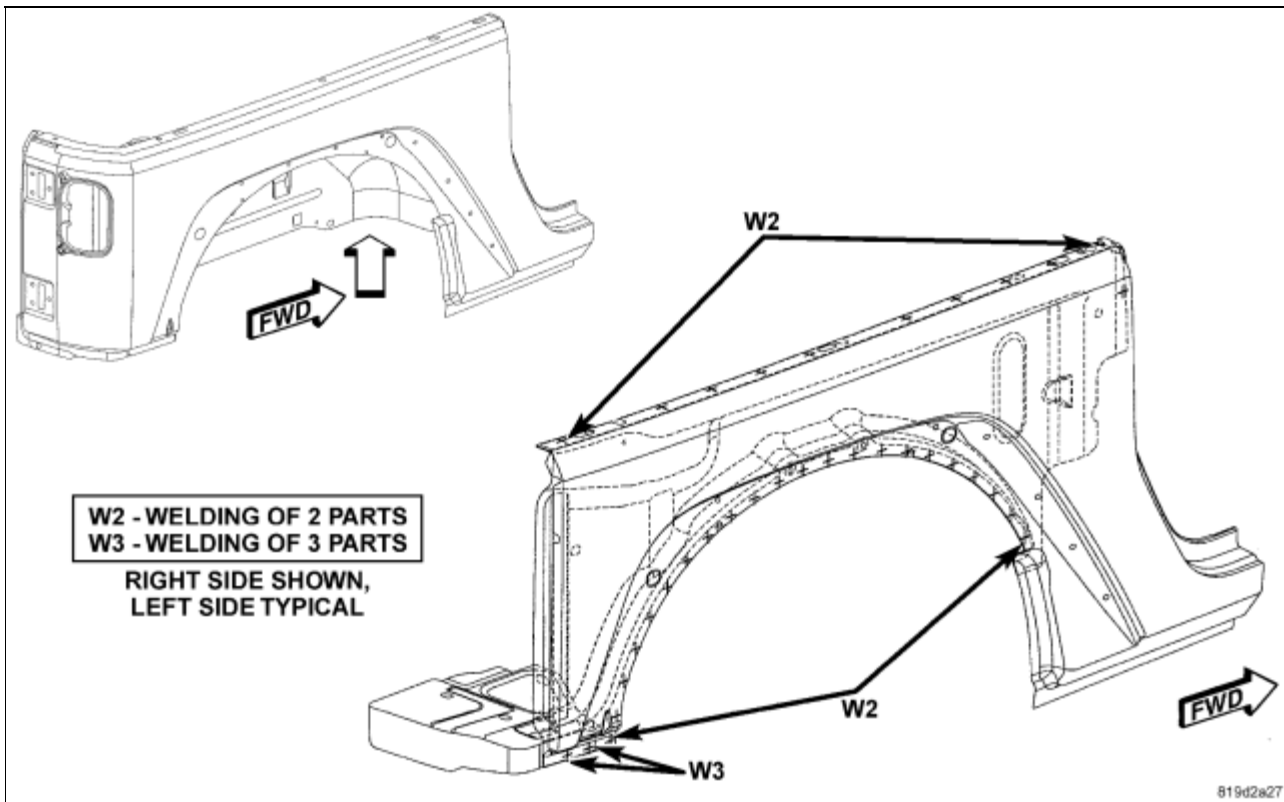


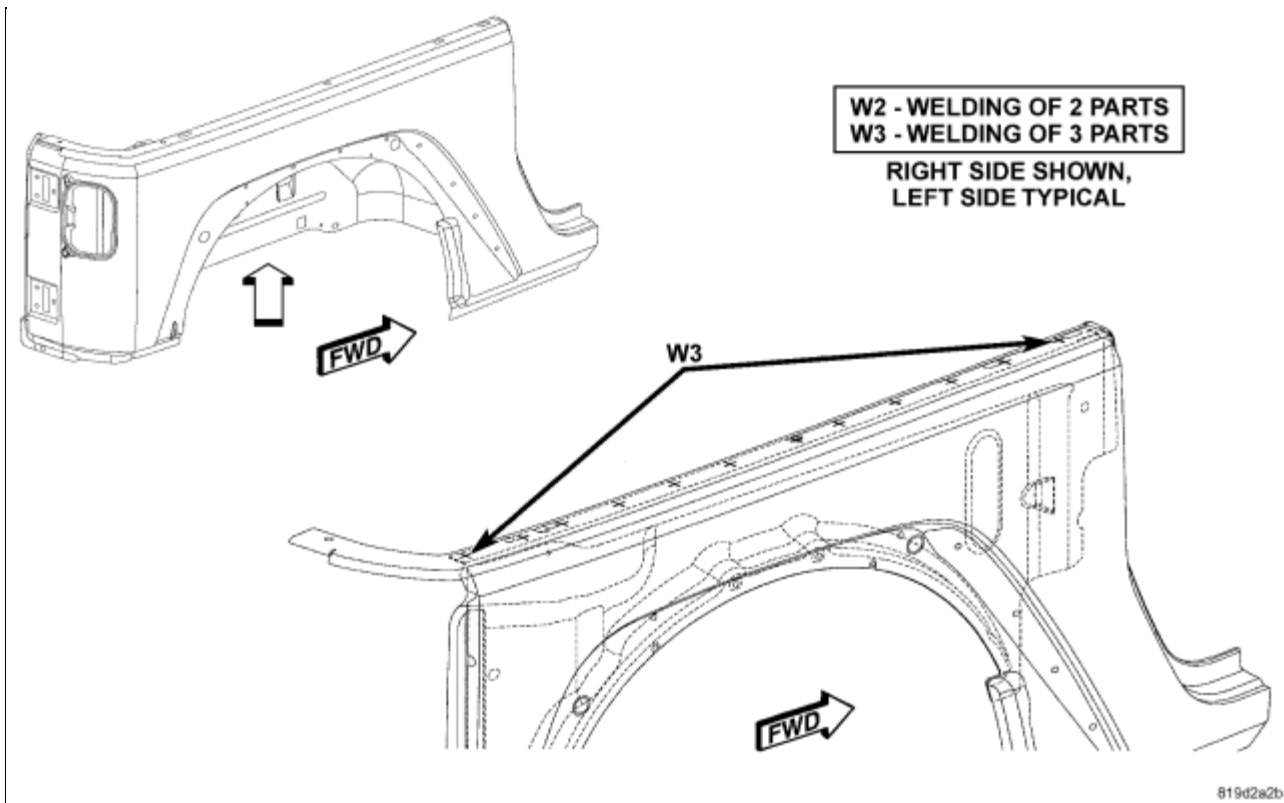
BODY SIDE APERTURE - OUTER (3 OF 4) - JK72



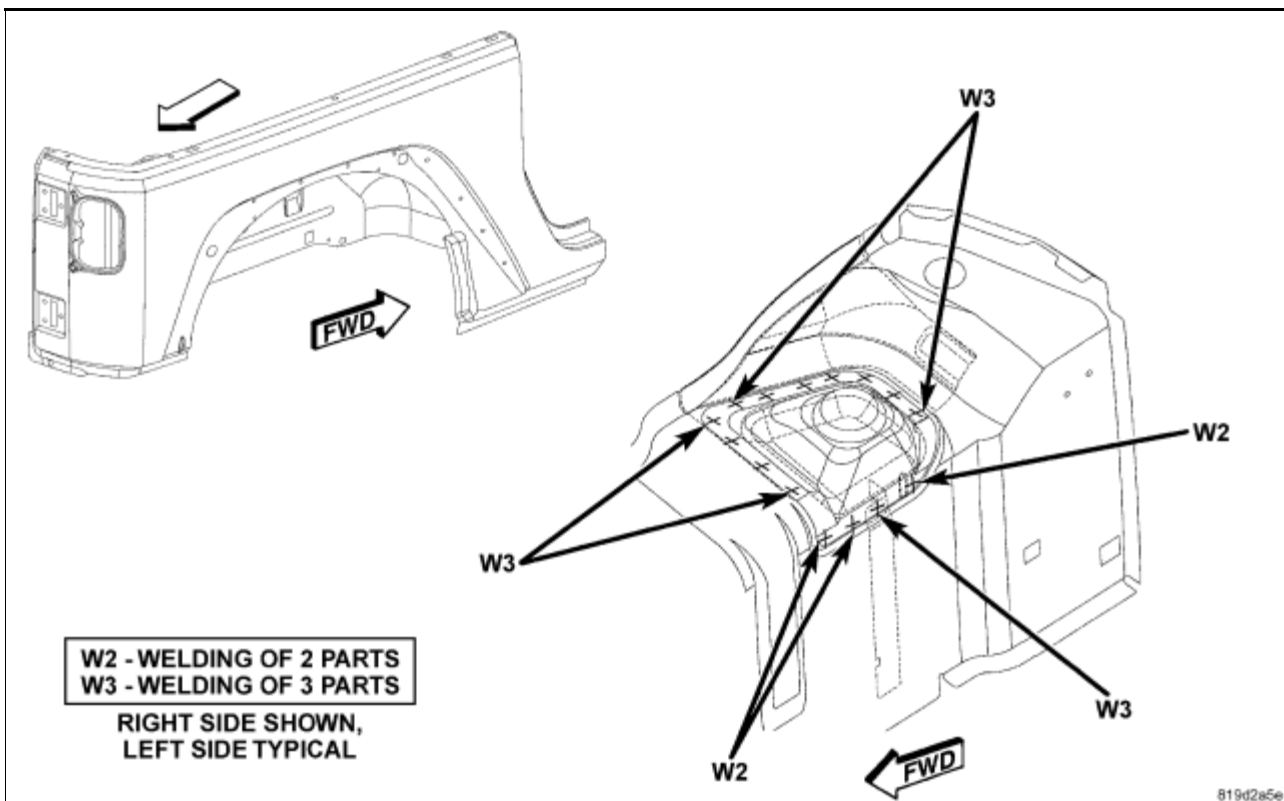
BODY SIDE APERTURE - OUTER (4 OF 4) - JK72



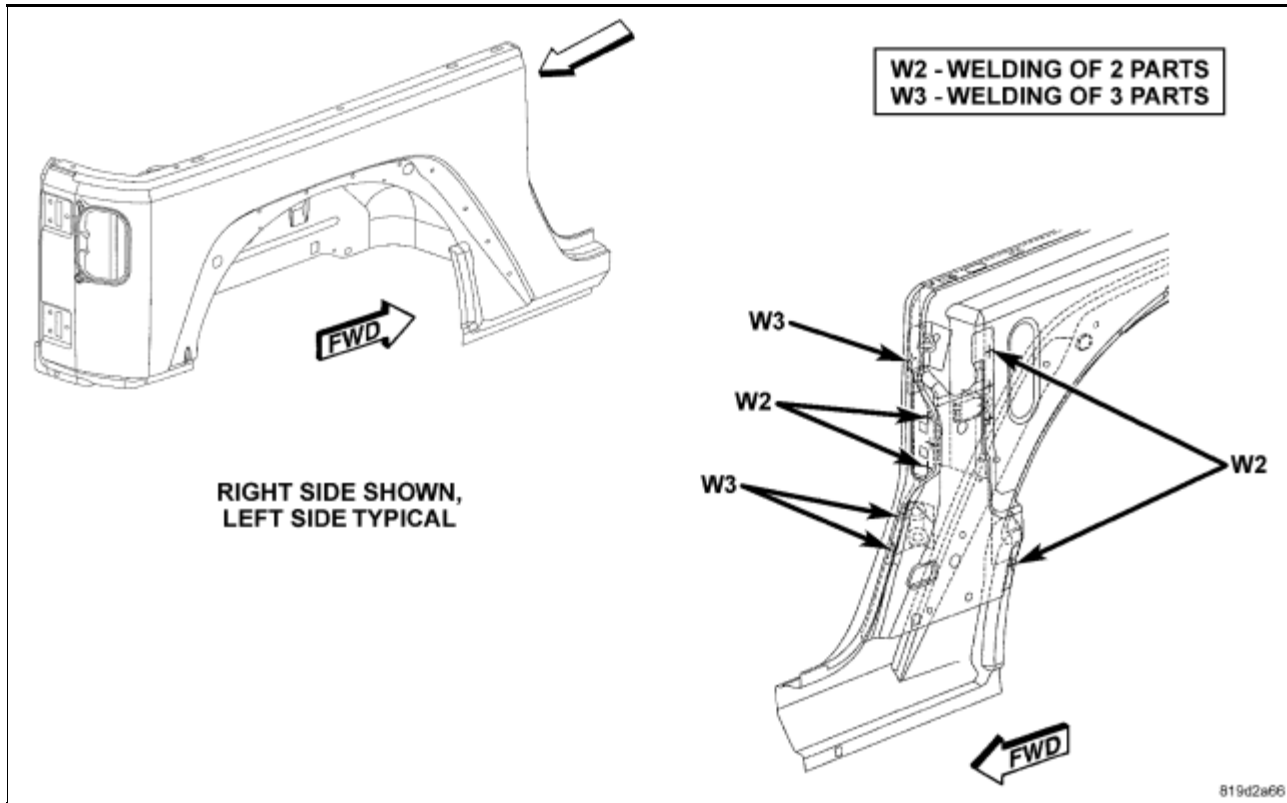
BODY SIDE APERTURE - COMPLETE (1 OF 5) - JK72**BODY SIDE APERTURE - COMPLETE (2 OF 5) - JK72**



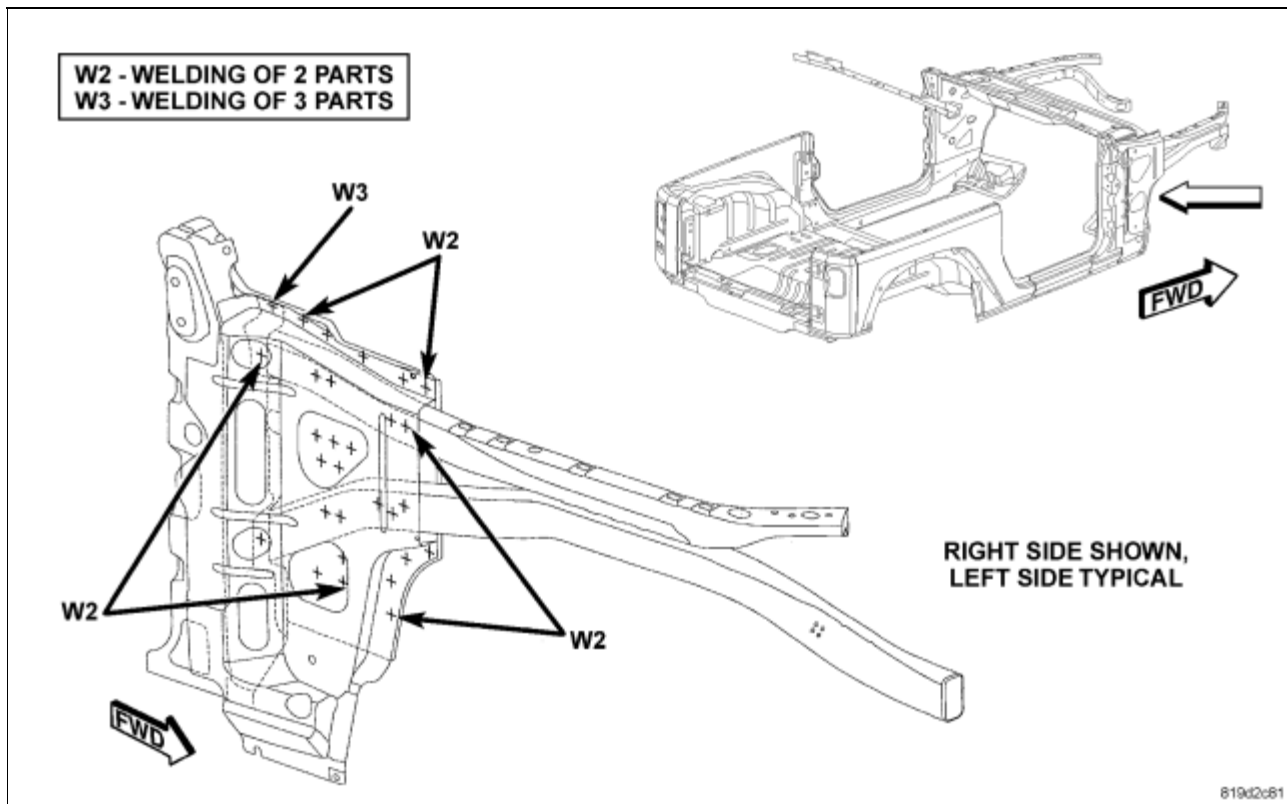
BODY SIDE APERTURE - COMPLETE (3 OF 5) - JK72

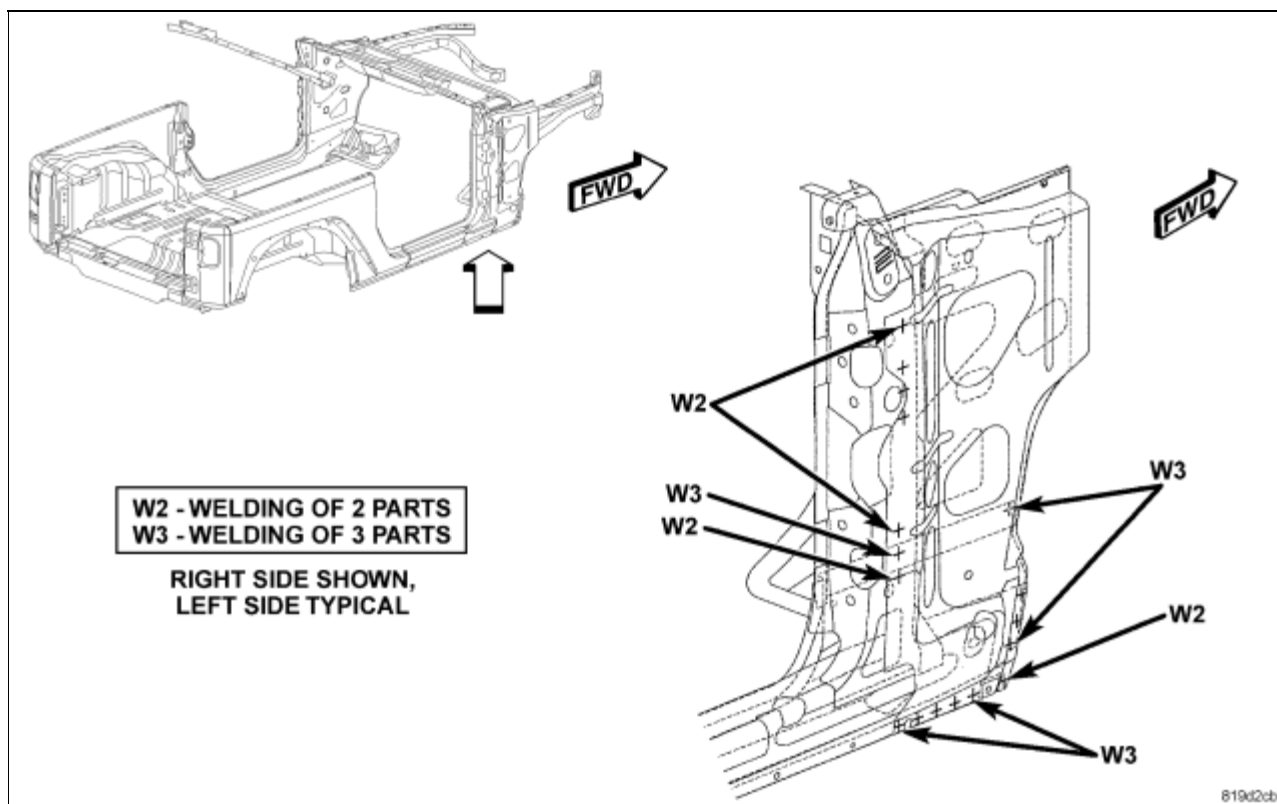


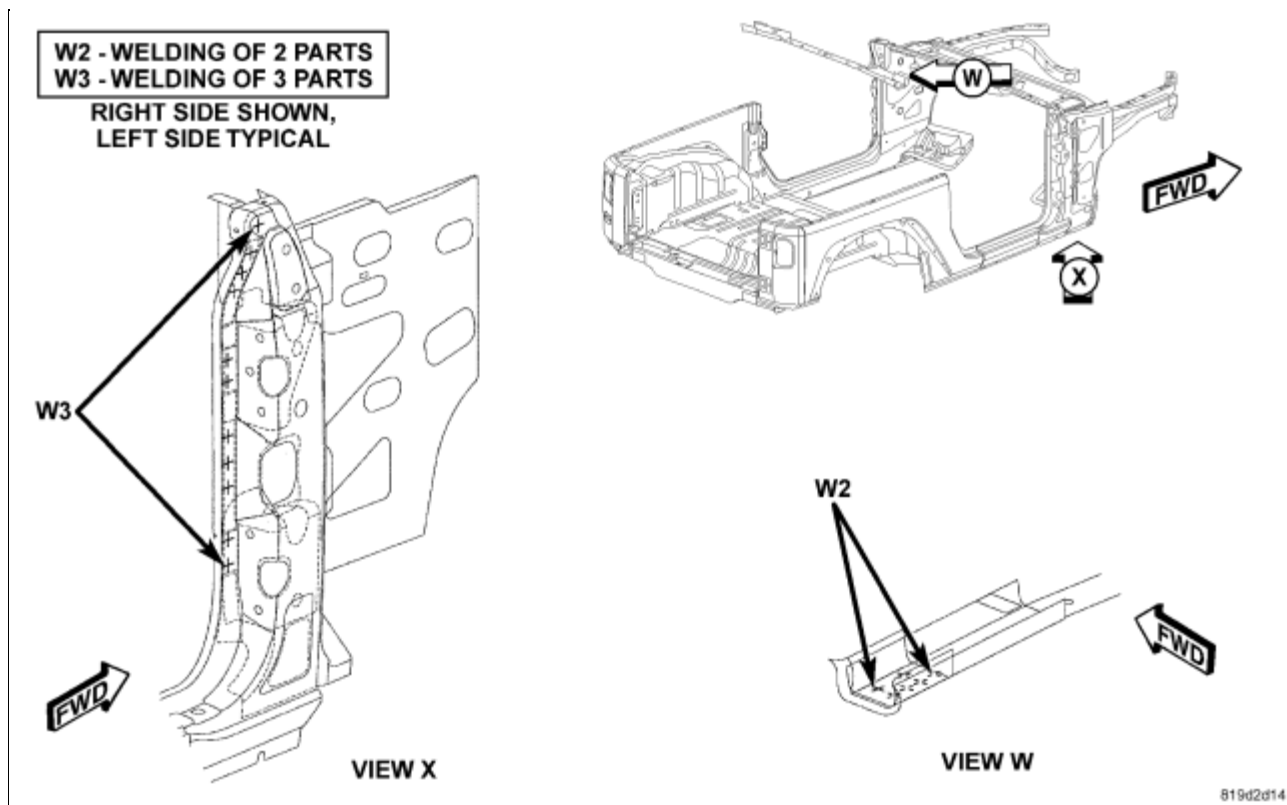
BODY SIDE APERTURE - COMPLETE (4 OF 5) - JK72



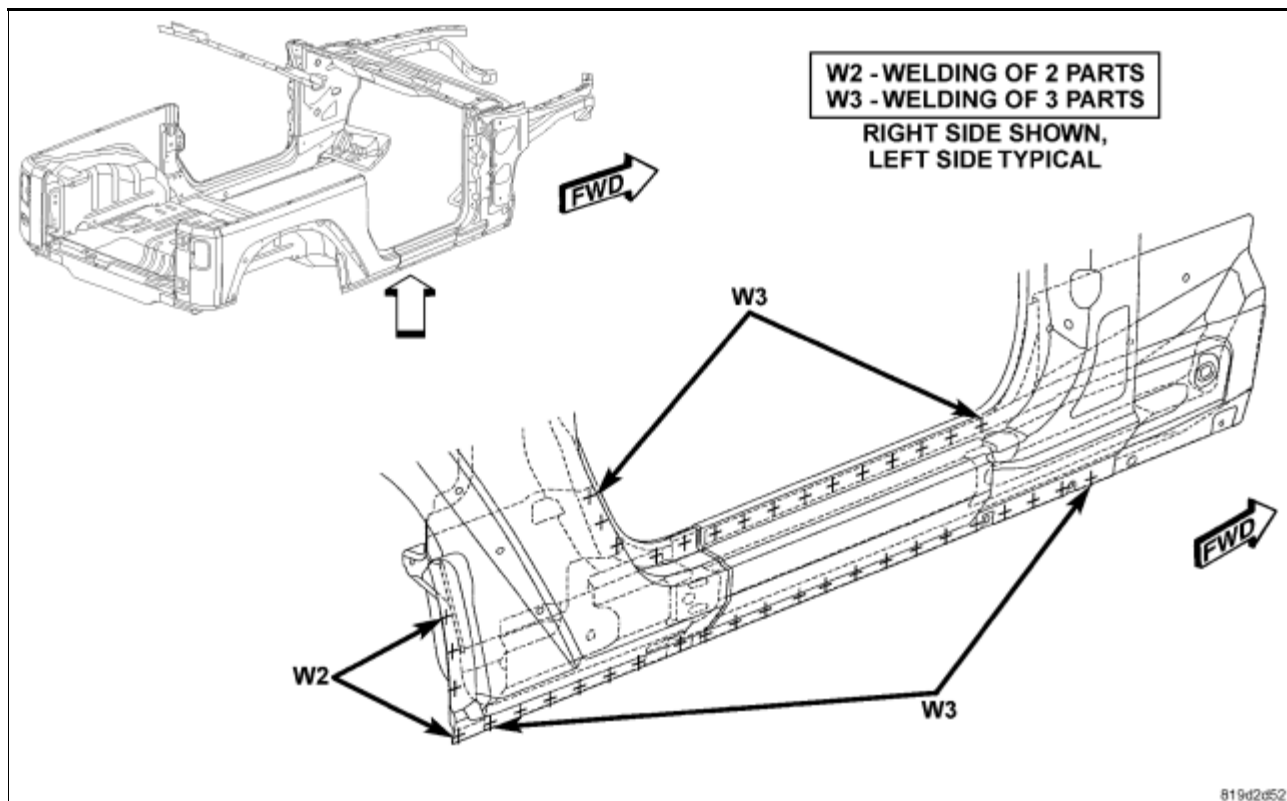
BODY SIDE APERTURE - COMPLETE (5 OF 5) - JK72



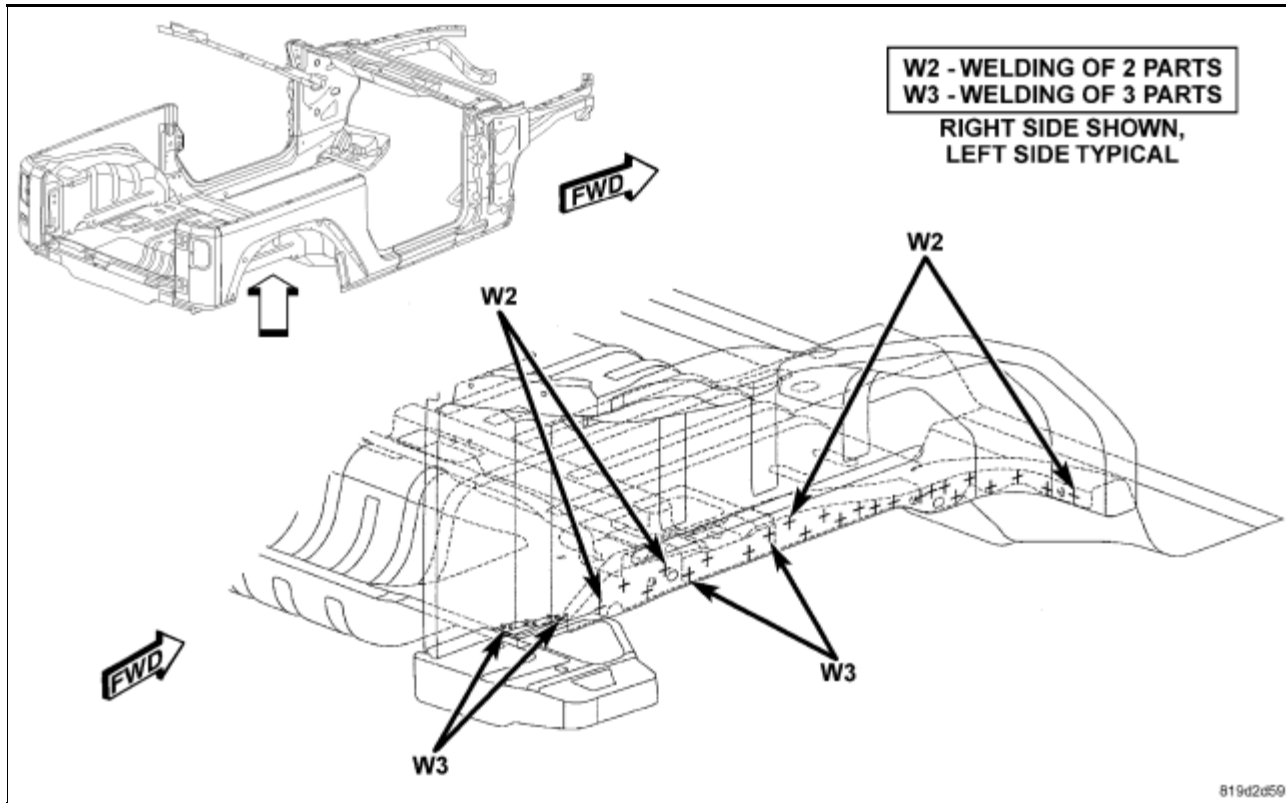
BODY IN WHITE COMPLETE (1 OF 6) - JK72**BODY IN WHITE COMPLETE (2 OF 6) - JK72**



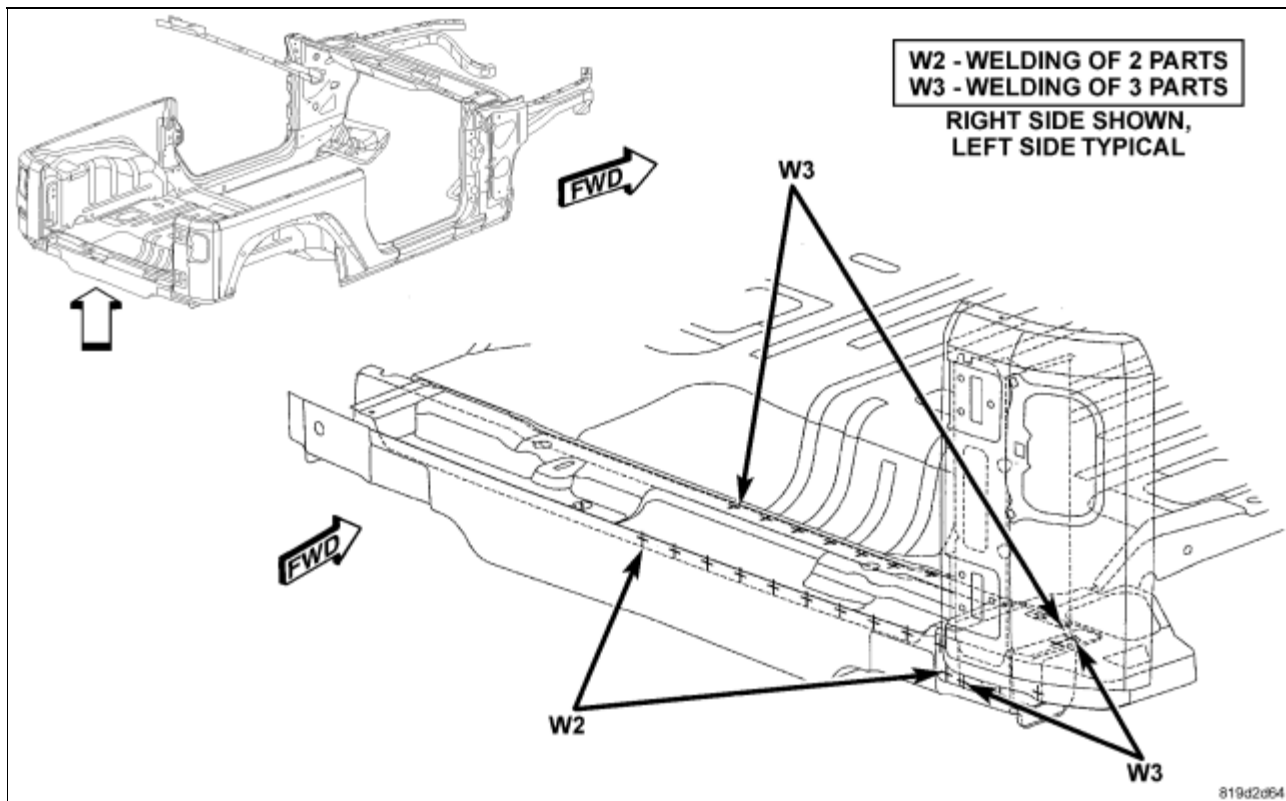
BODY IN WHITE COMPLETE (3 OF 6) - JK72

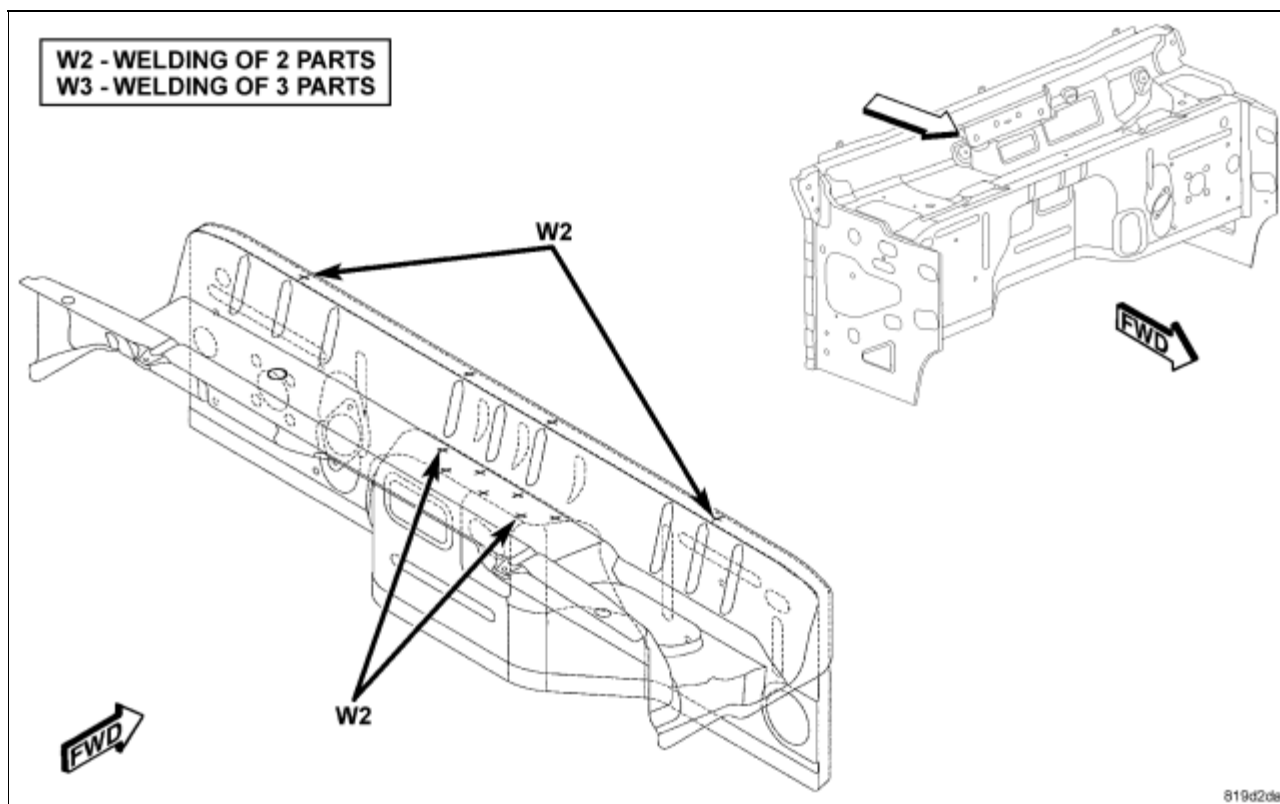


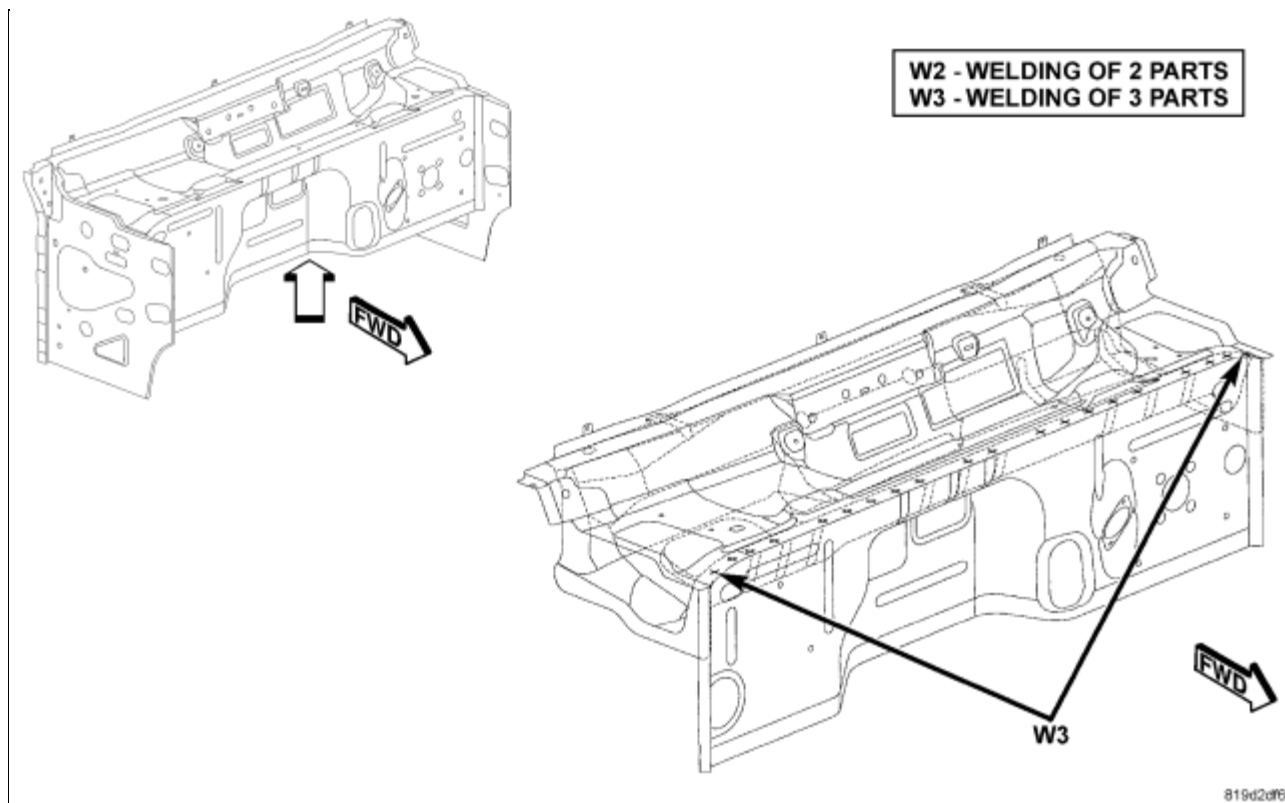
BODY IN WHITE COMPLETE (4 OF 6) - JK72



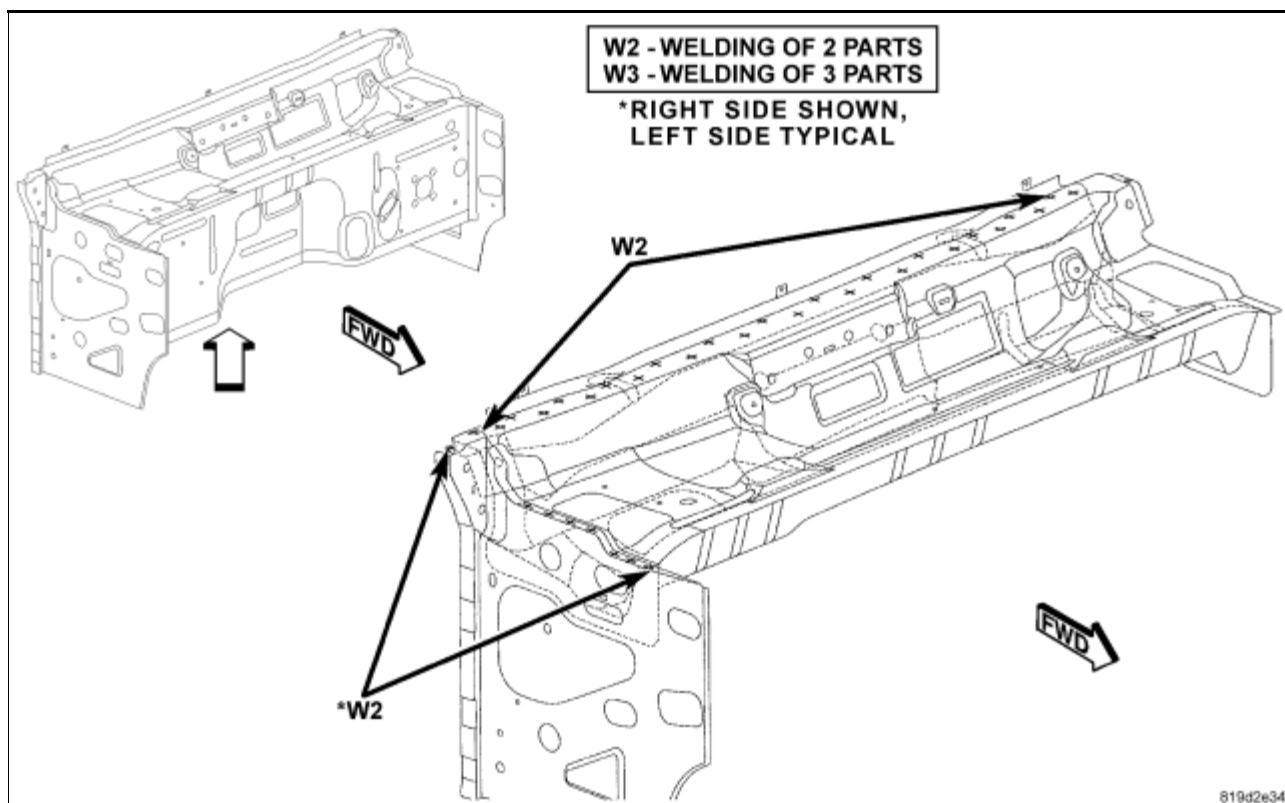
BODY IN WHITE COMPLETE (5 OF 6) - JK72



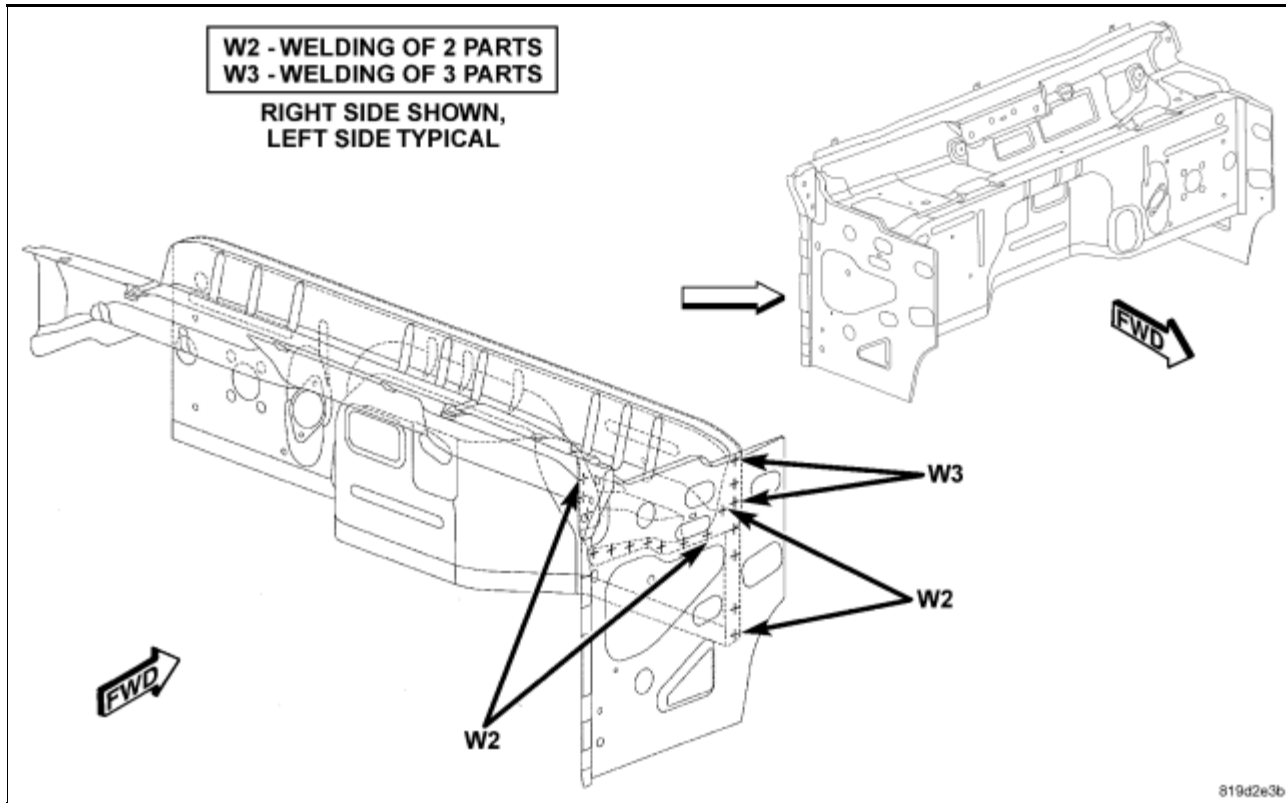
BODY IN WHITE COMPLETE (6 OF 6) - JK72**COWL/DASH/PLENUM (1 OF 4) - JK74**



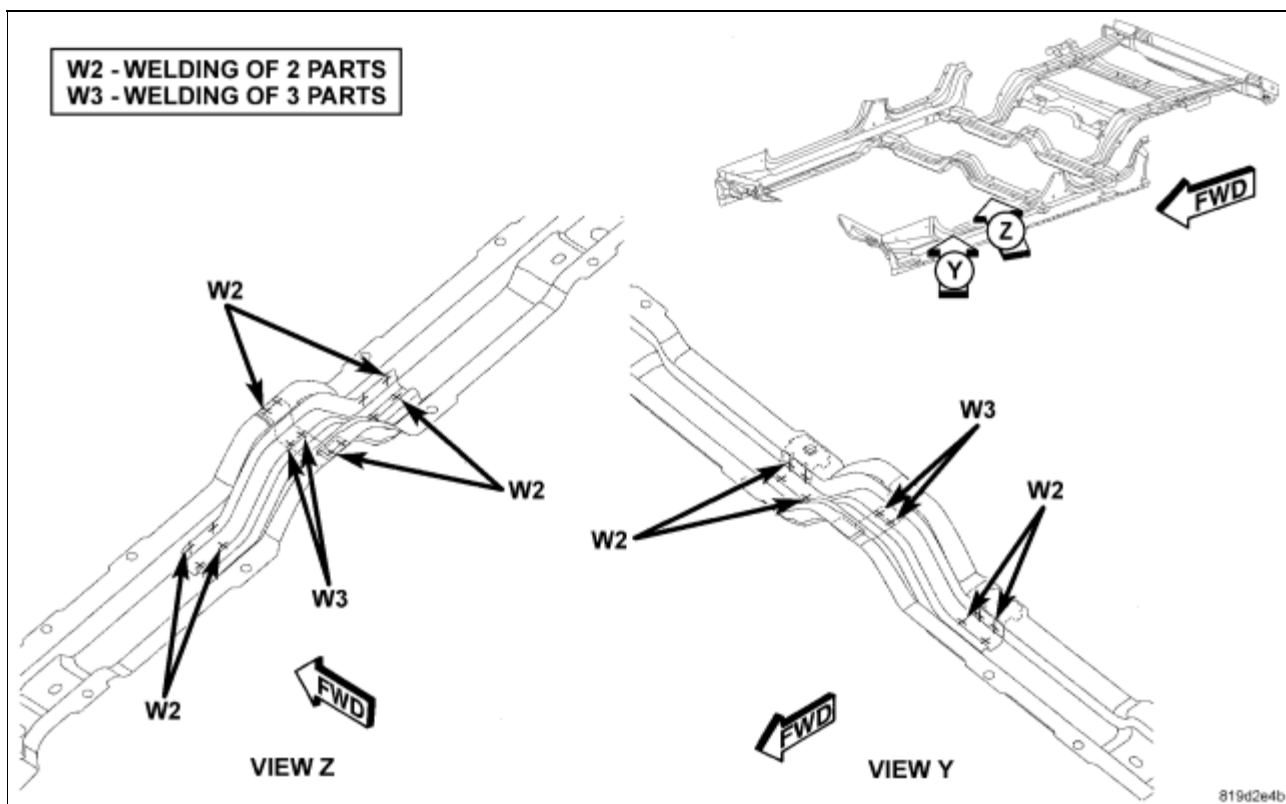
COWL/DASH/PLENUM (2 OF 4) - JK74

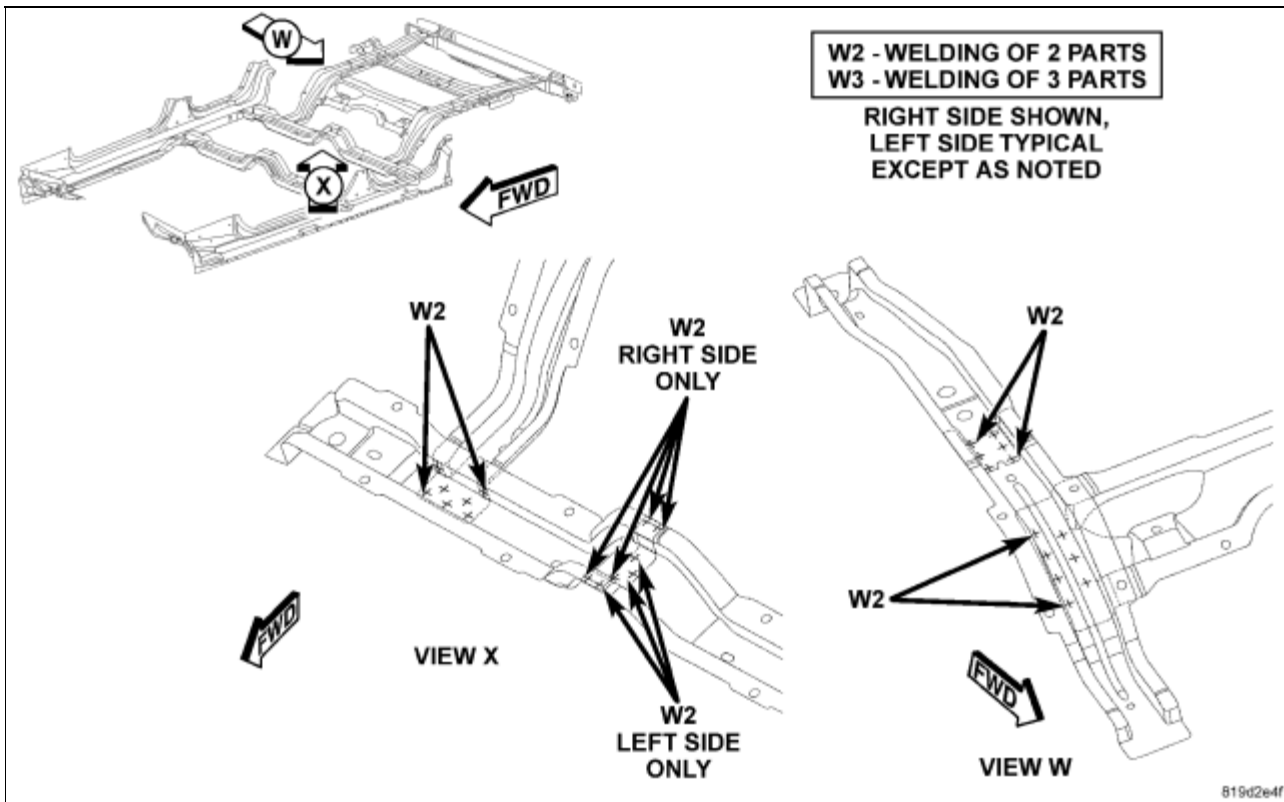


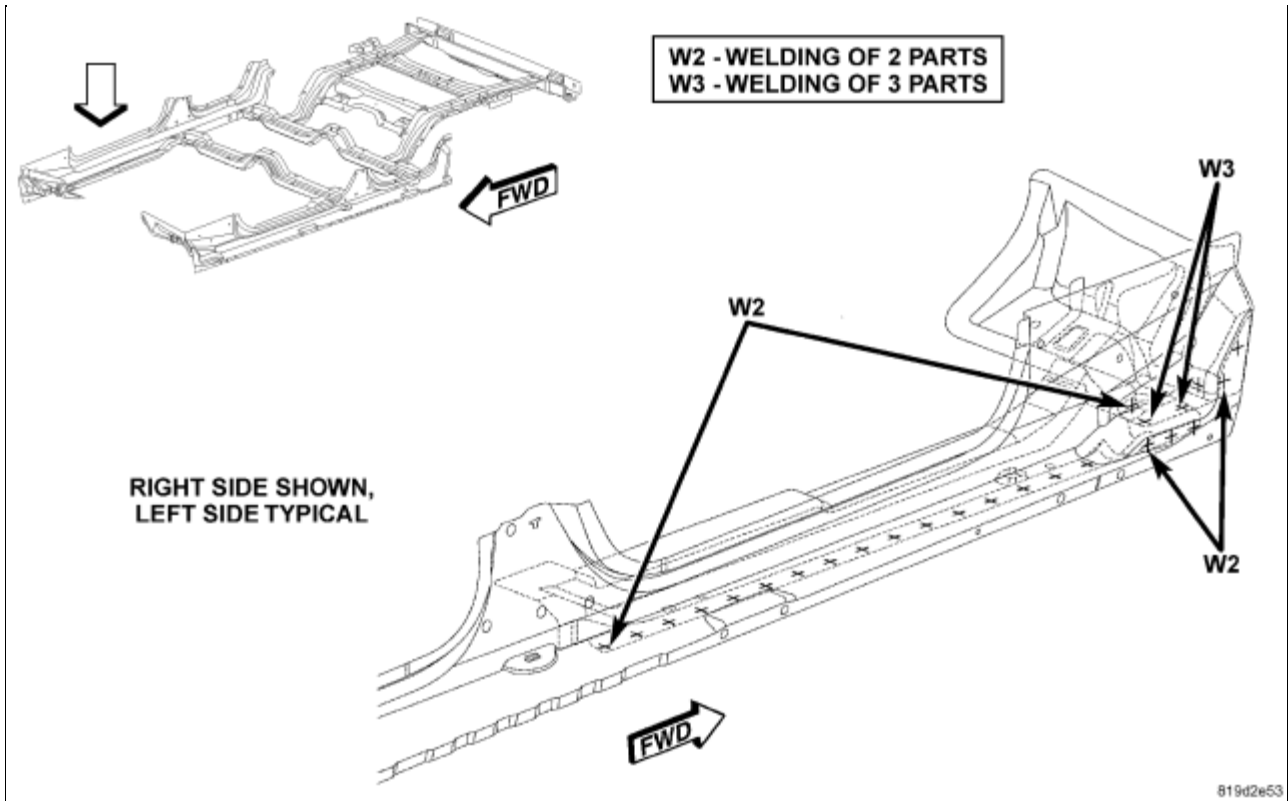
COWL/DASH/PLENUM (3 OF 4) - JK74



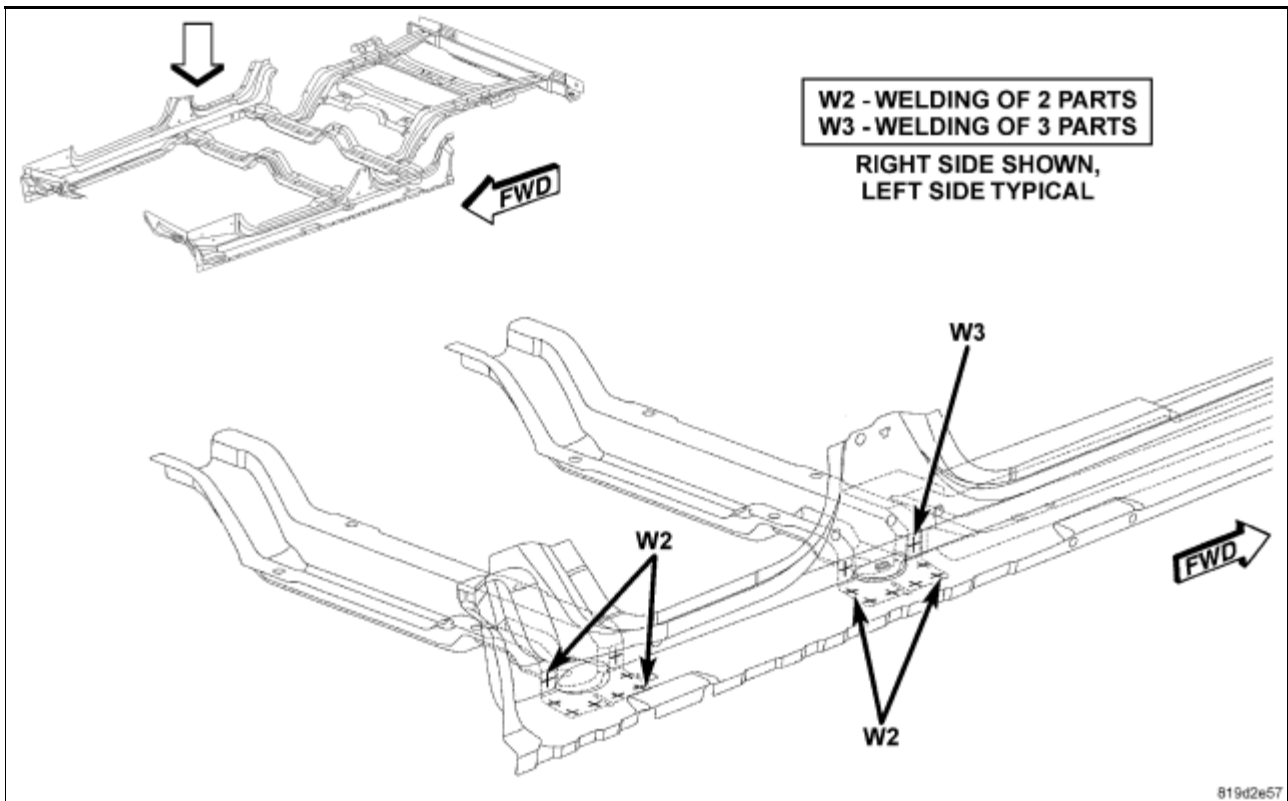
COWL/DASH/PLENUM (4 OF 4) - JK74



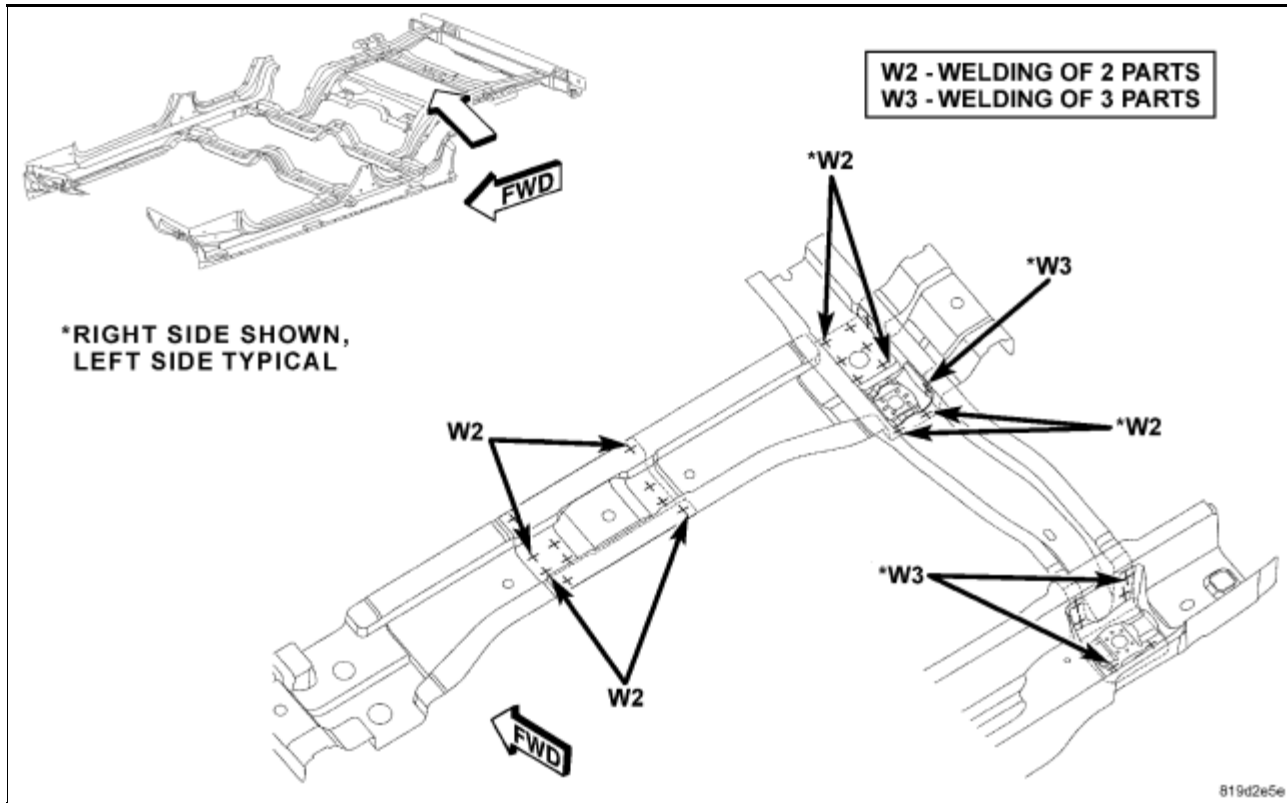
LADDER ASSEMBLY COMPLETE (1 OF 5) - JK74**LADDER ASSEMBLY COMPLETE (2 OF 5) - JK74**



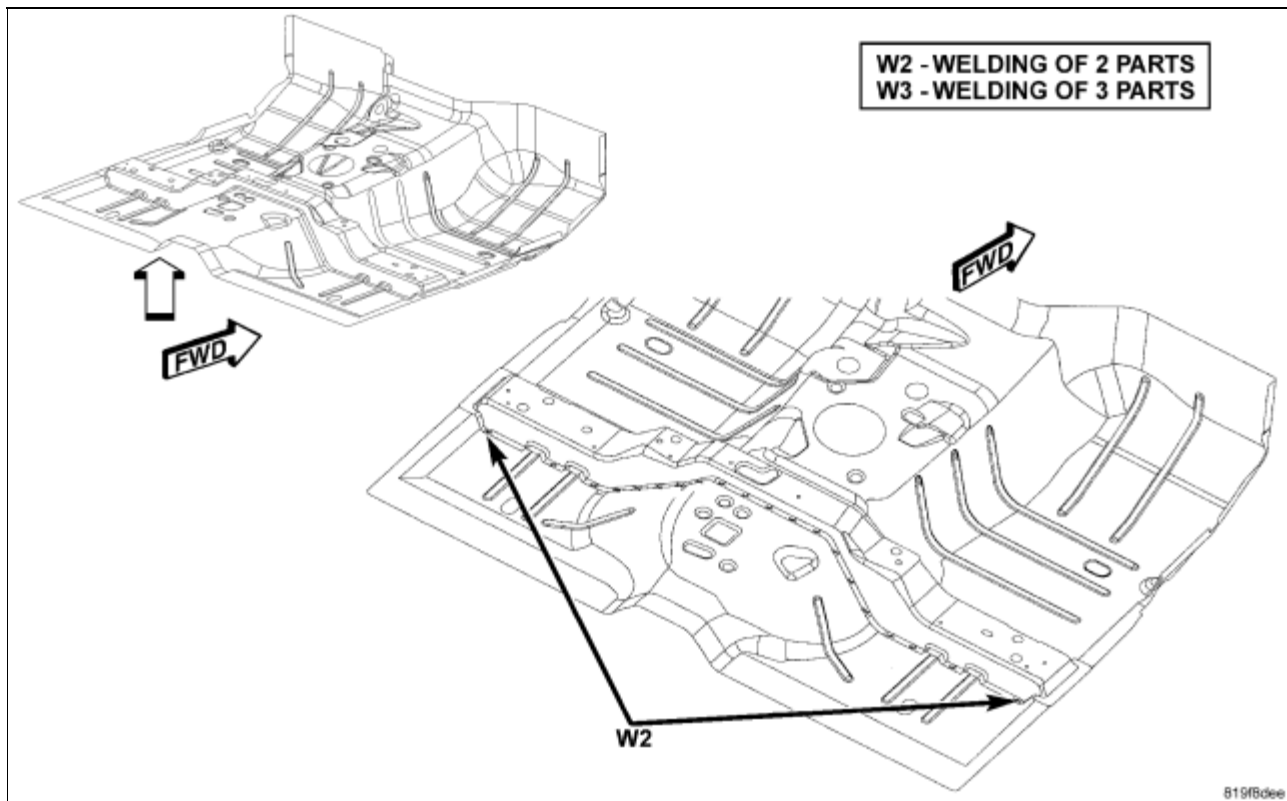
LADDER ASSEMBLY COMPLETE (3 OF 5) - JK74

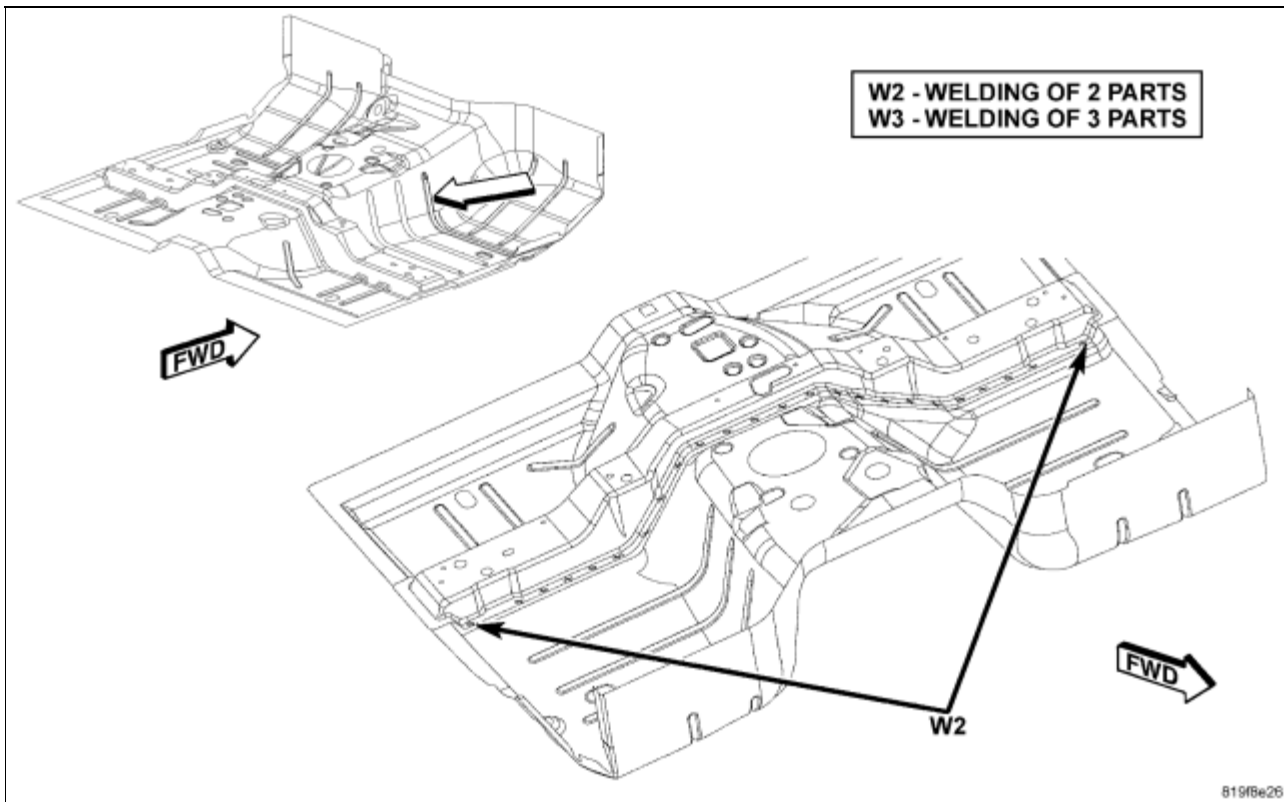


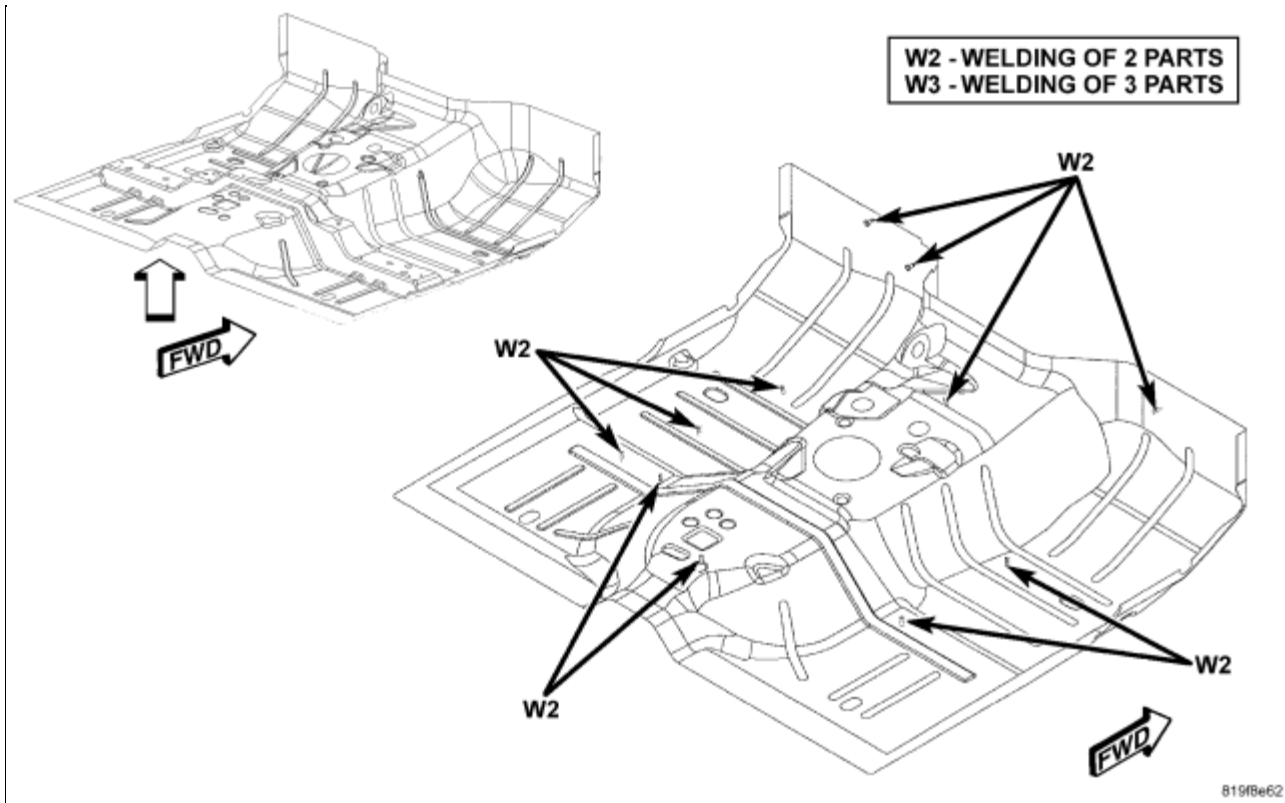
LADDER ASSEMBLY COMPLETE (4 OF 5) - JK74



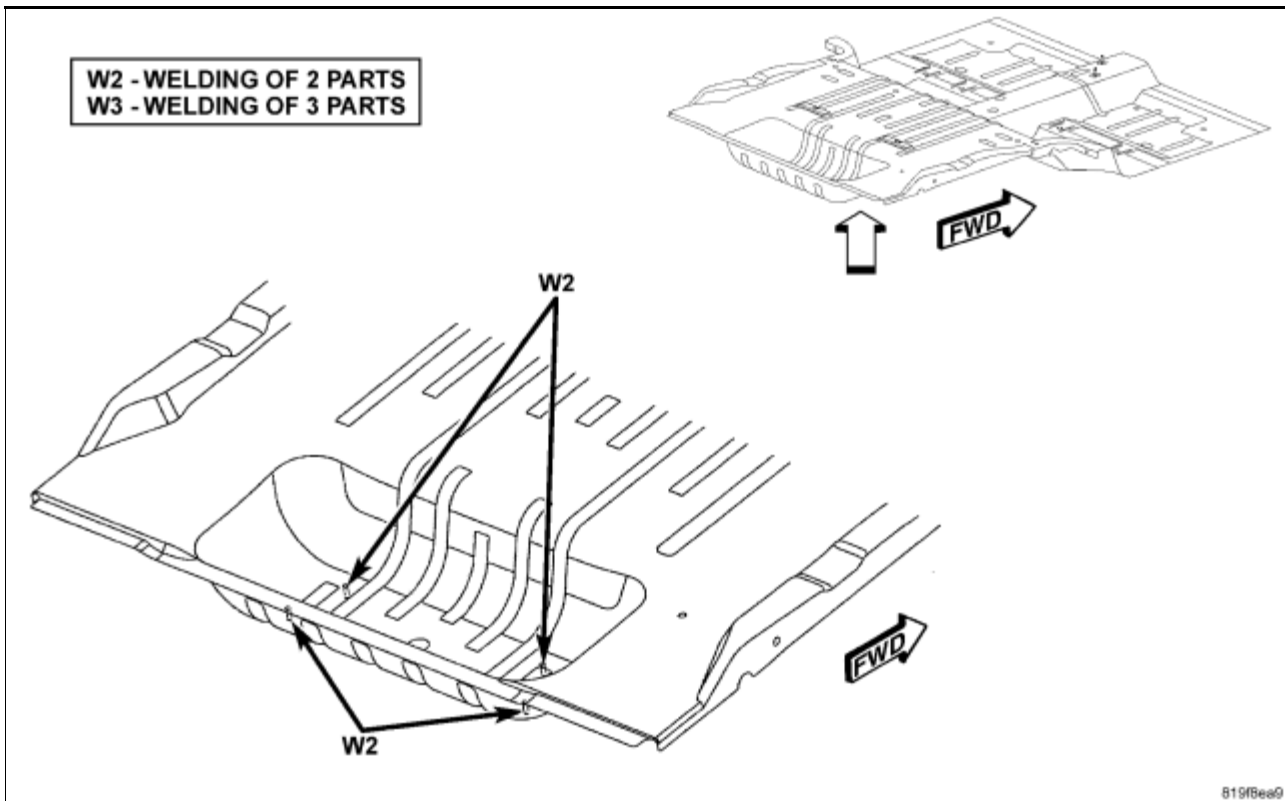
LADDER ASSEMBLY COMPLETE (5 OF 5) - JK74



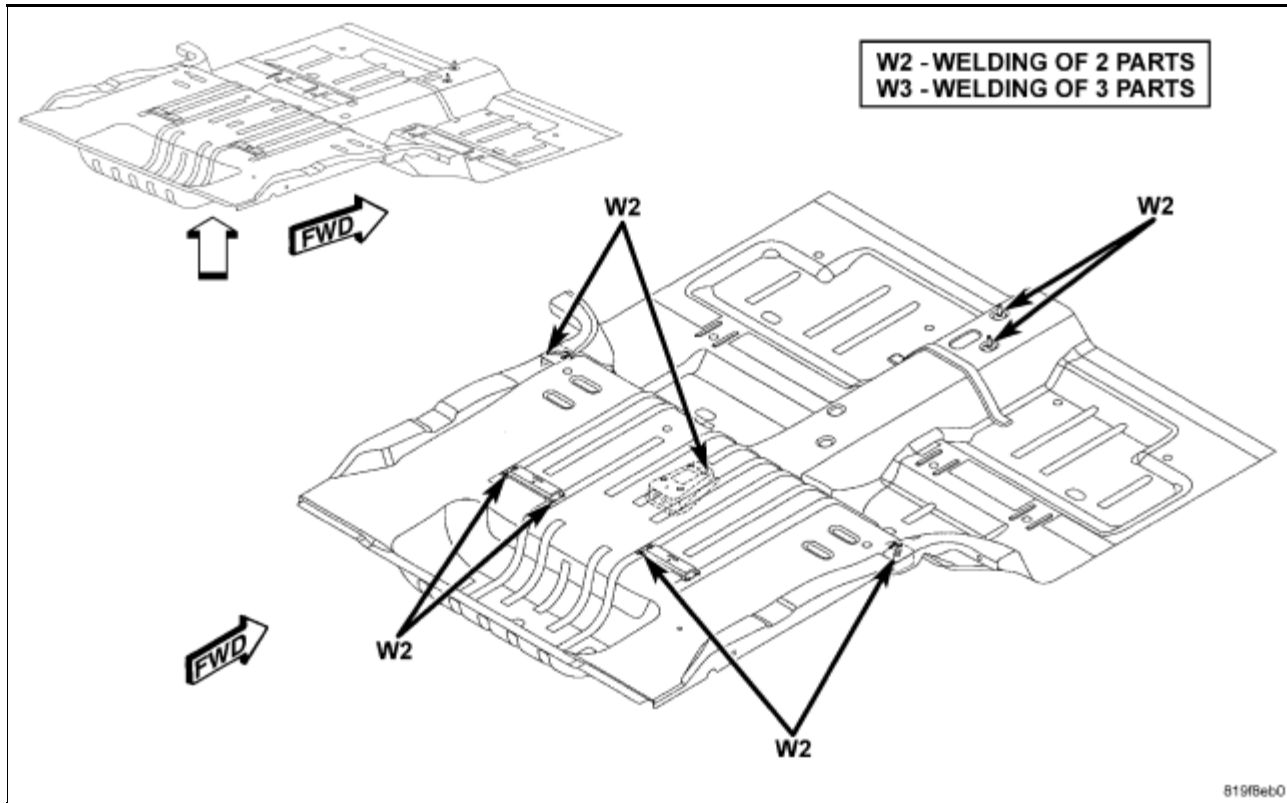
FRONT FLOOR ASSEMBLY (1 OF 3) - JK74**FRONT FLOOR ASSEMBLY (2 OF 3) - JK74**



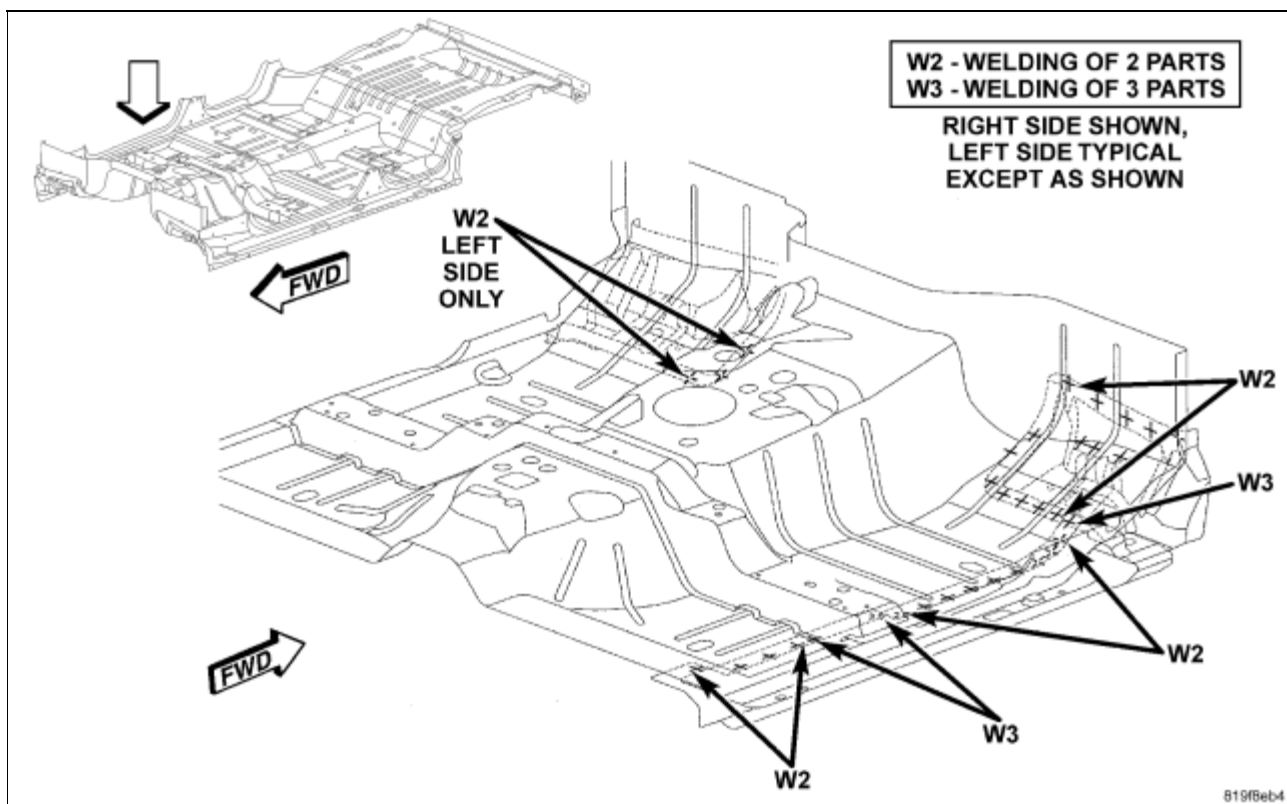
FRONT FLOOR ASSEMBLY (3 OF 3) - JK74

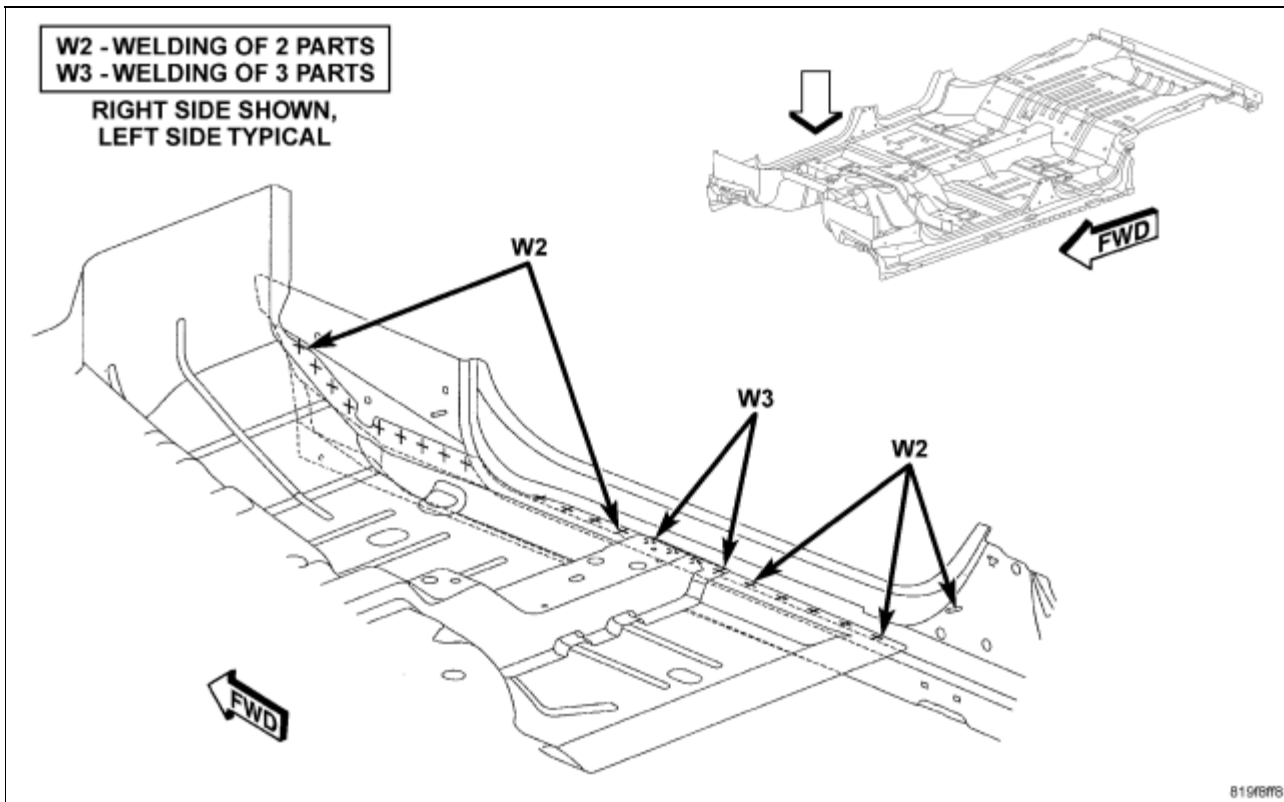


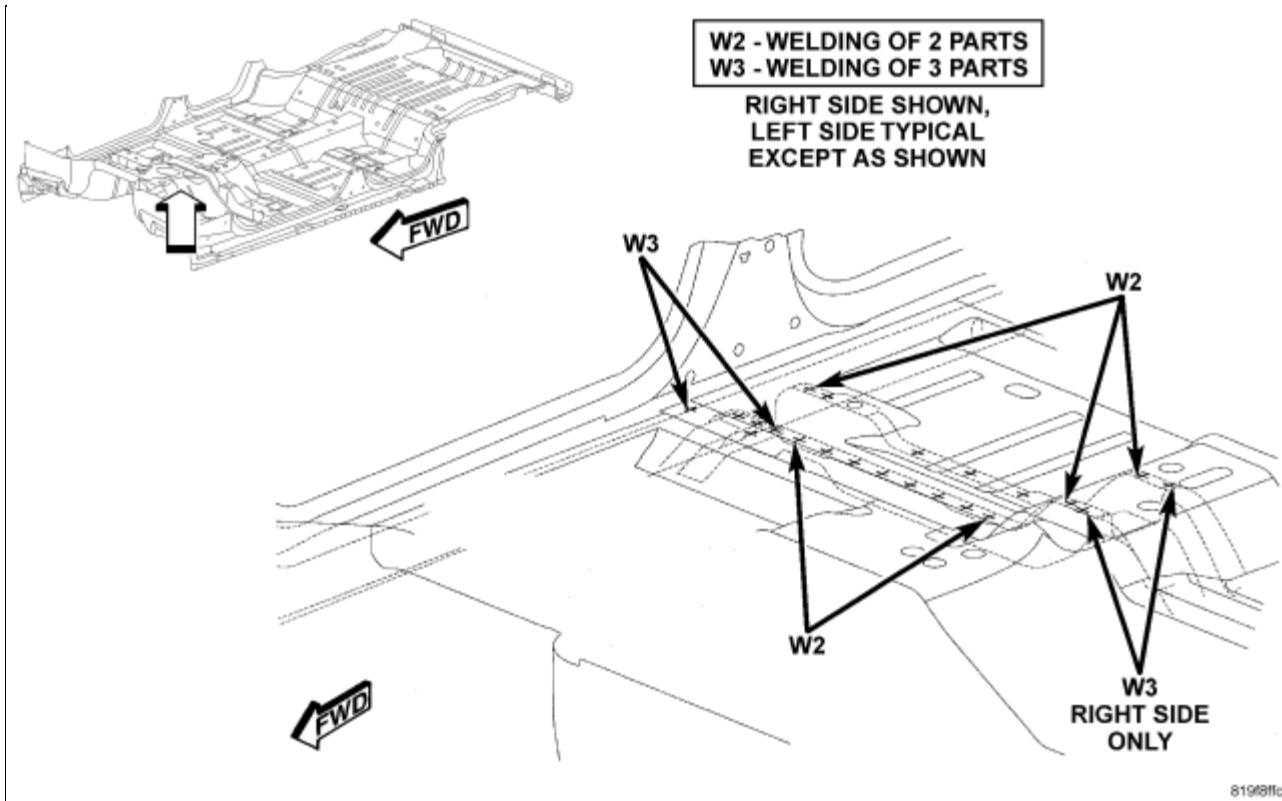
REAR FLOOR ASSEMBLY (1 OF 2) - JK74



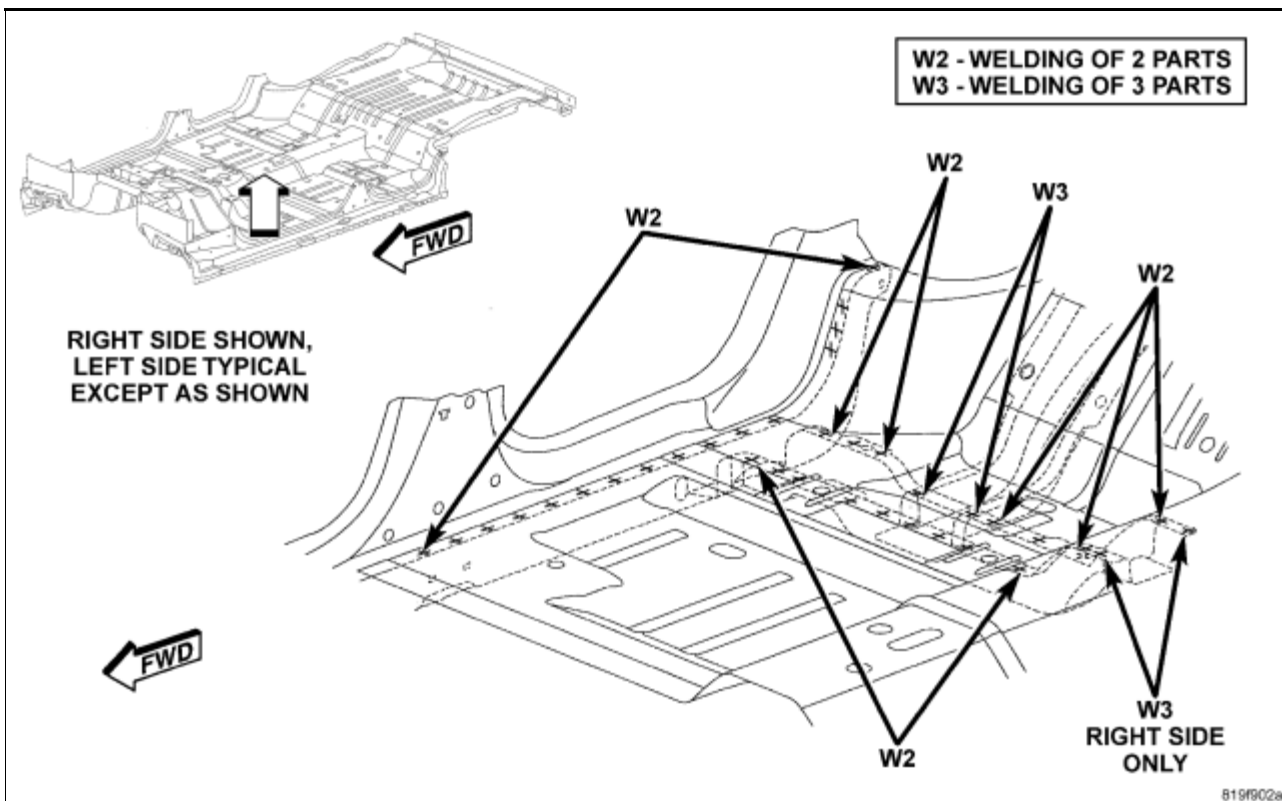
REAR FLOOR ASSEMBLY (2 OF 2) - JK74



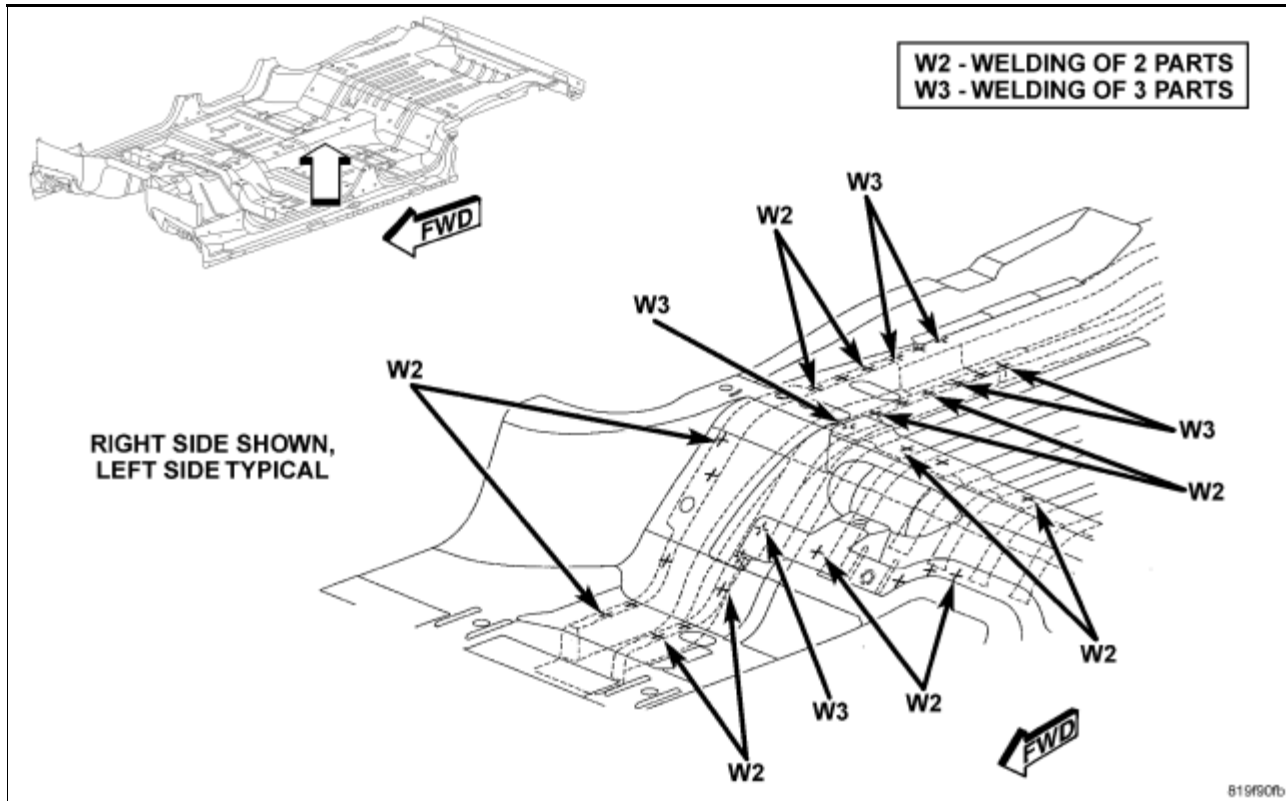
LADDER AND FLOOR ASSEMBLY (1 OF 7) - JK74**LADDER AND FLOOR ASSEMBLY (2 OF 7) - JK74**



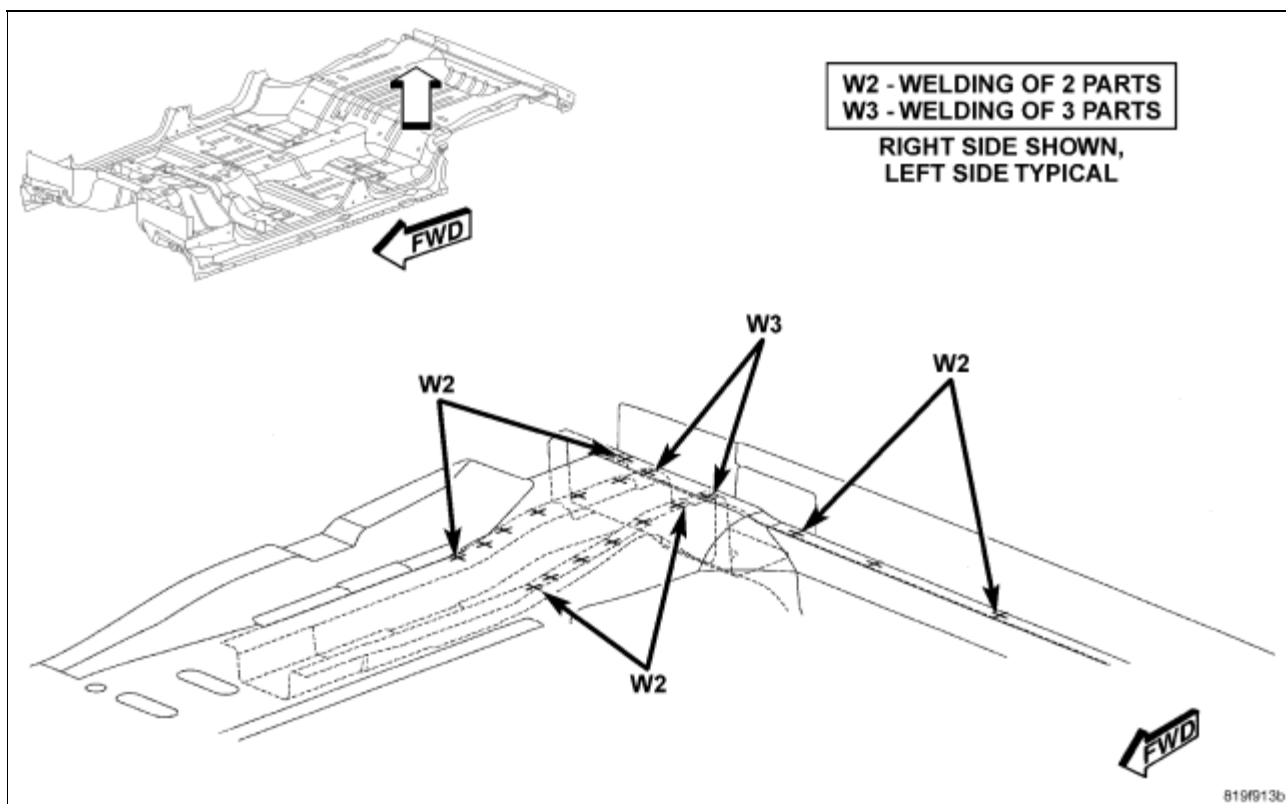
LADDER AND FLOOR ASSEMBLY (3 OF 7) - JK74

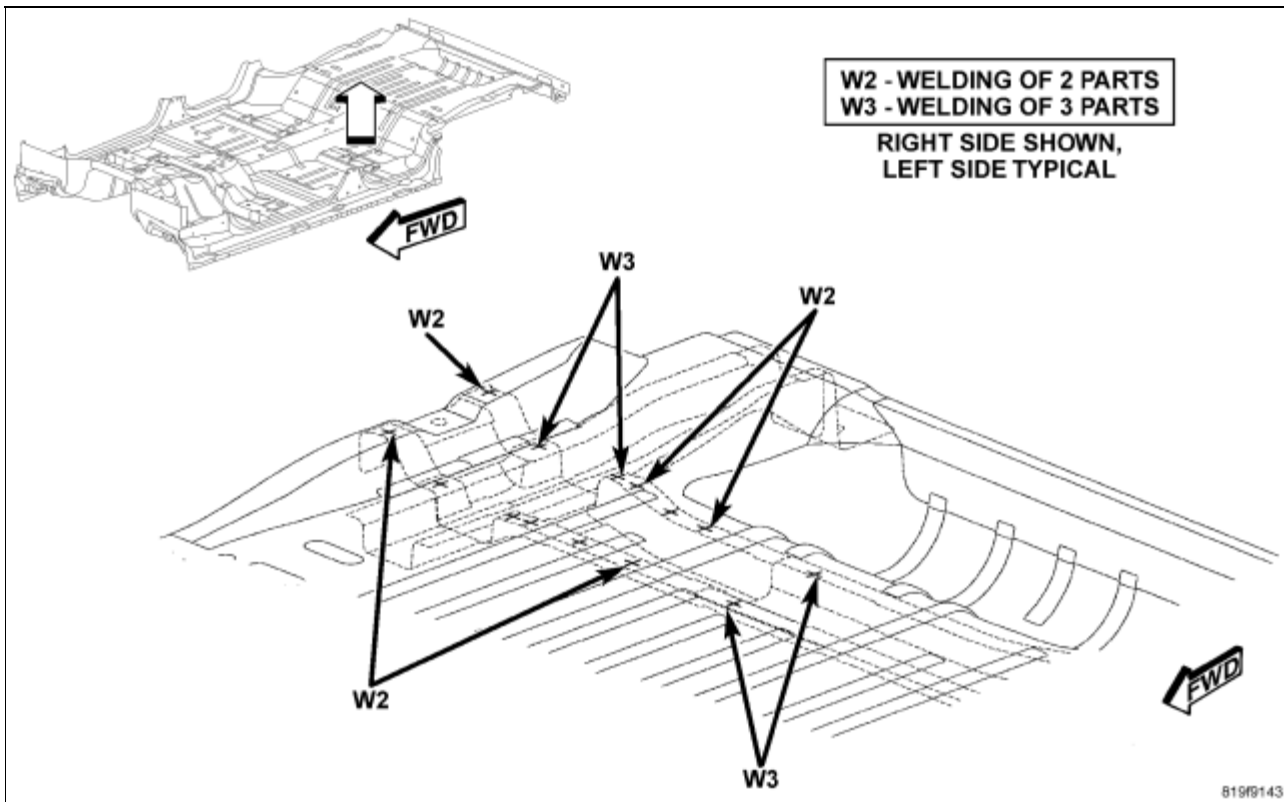


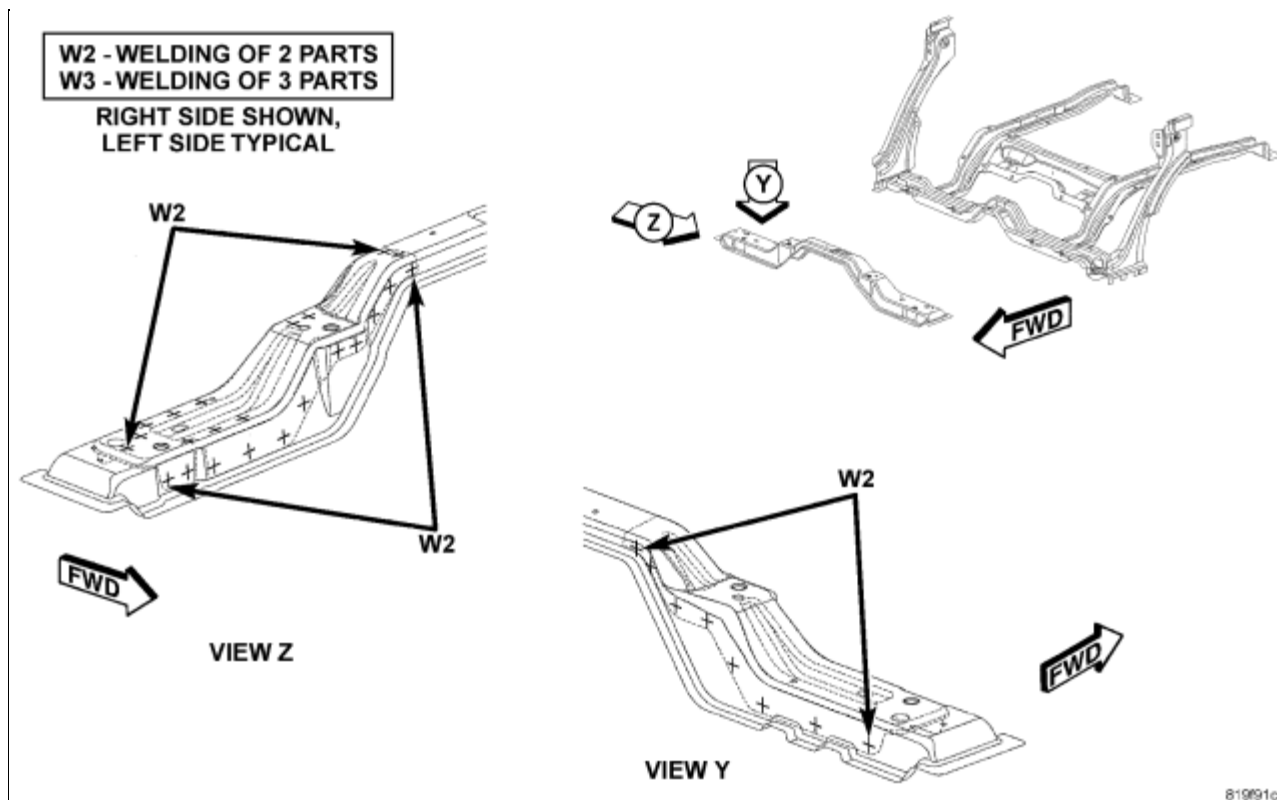
LADDER AND FLOOR ASSEMBLY (4 OF 7) - JK74



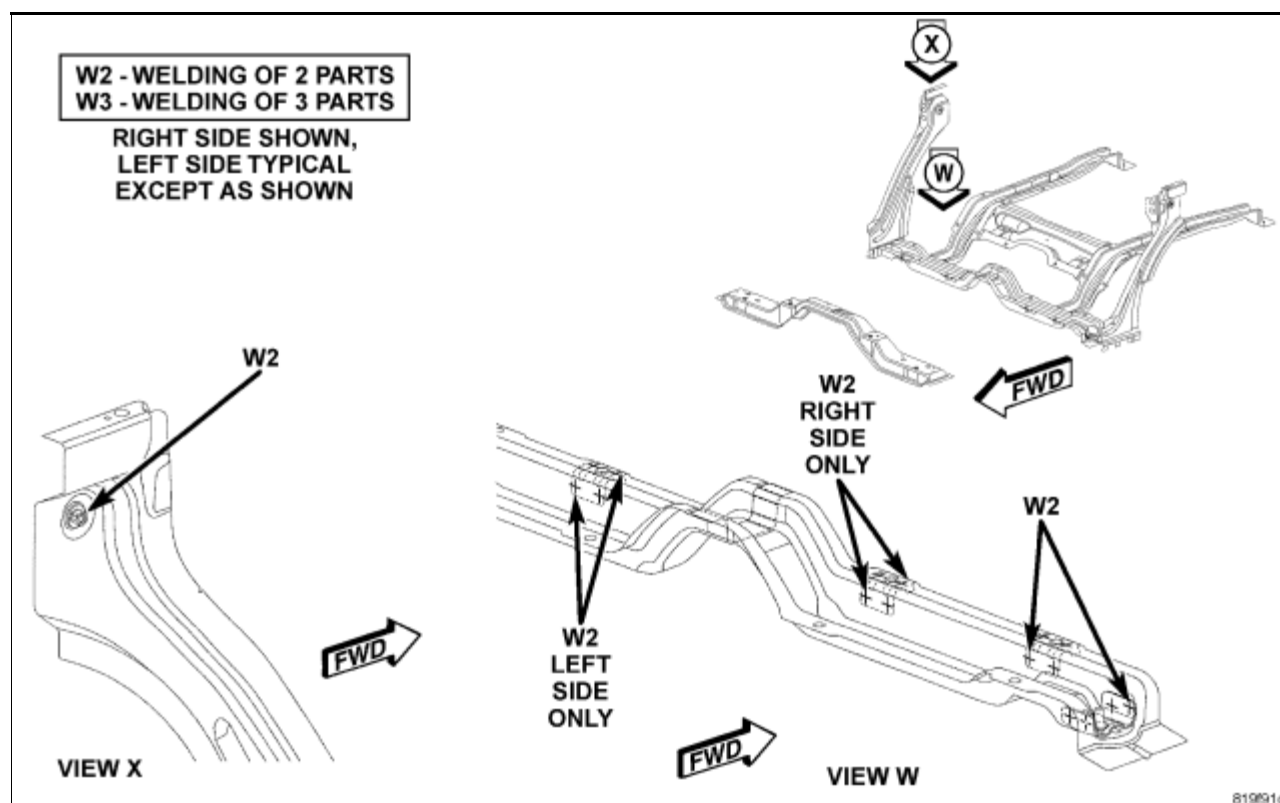
LADDER AND FLOOR ASSEMBLY (5 OF 7) - JK74



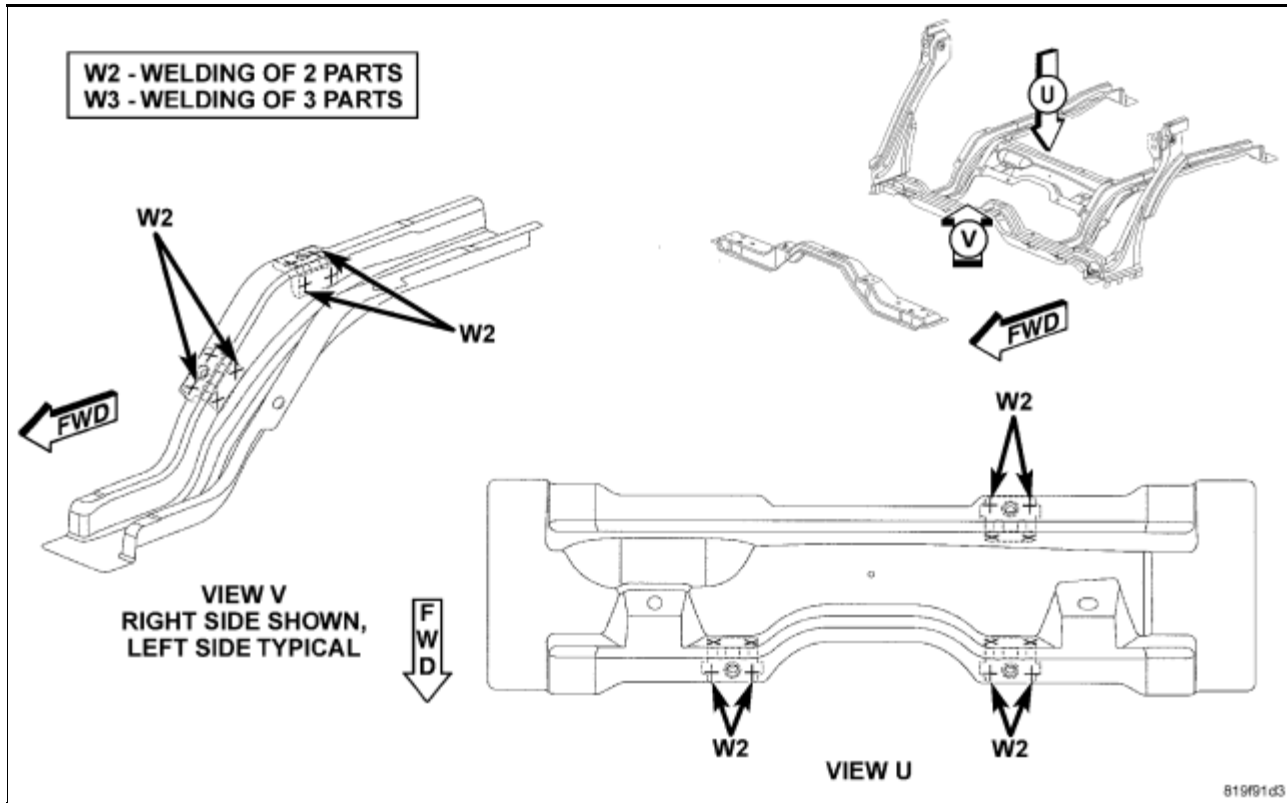
LADDER AND FLOOR ASSEMBLY (6 OF 7) - JK74**LADDER AND FLOOR ASSEMBLY (7 OF 7) - JK74**



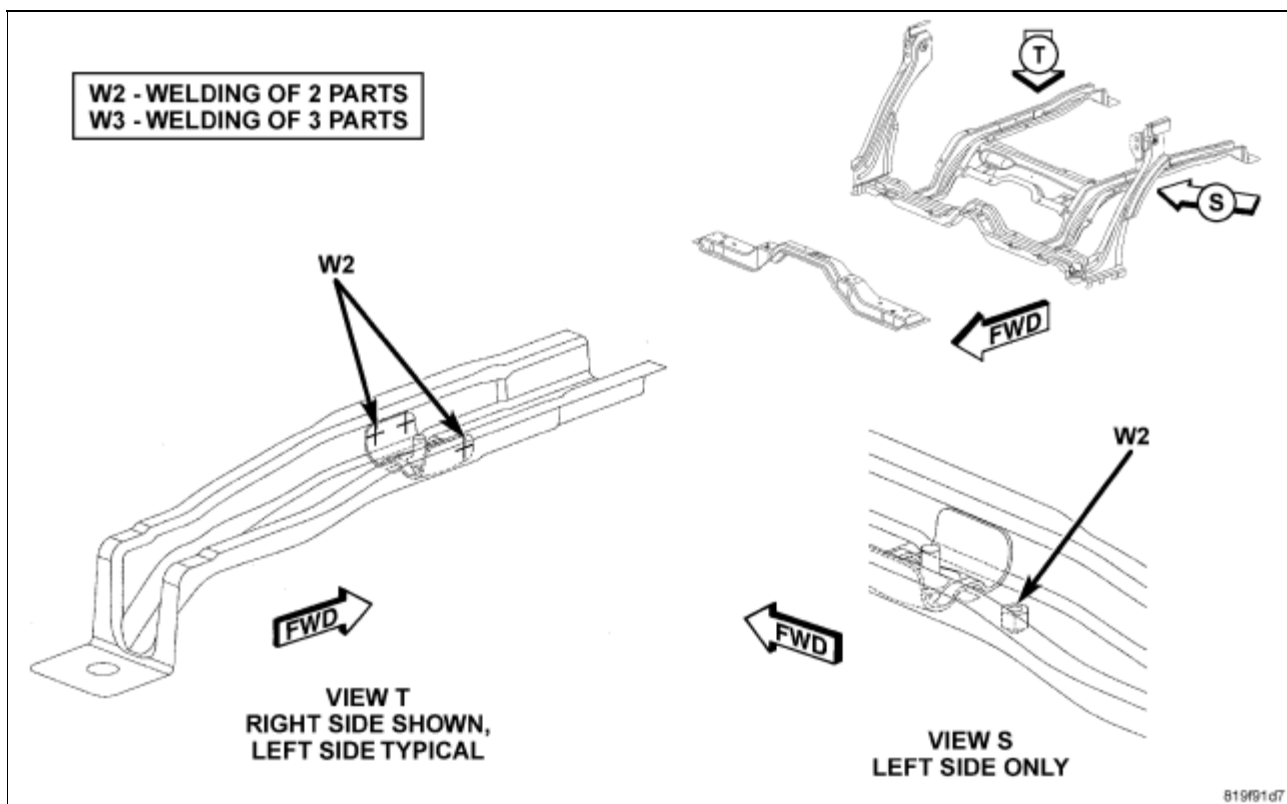
UNDERBODY (1 OF 4) - JK74

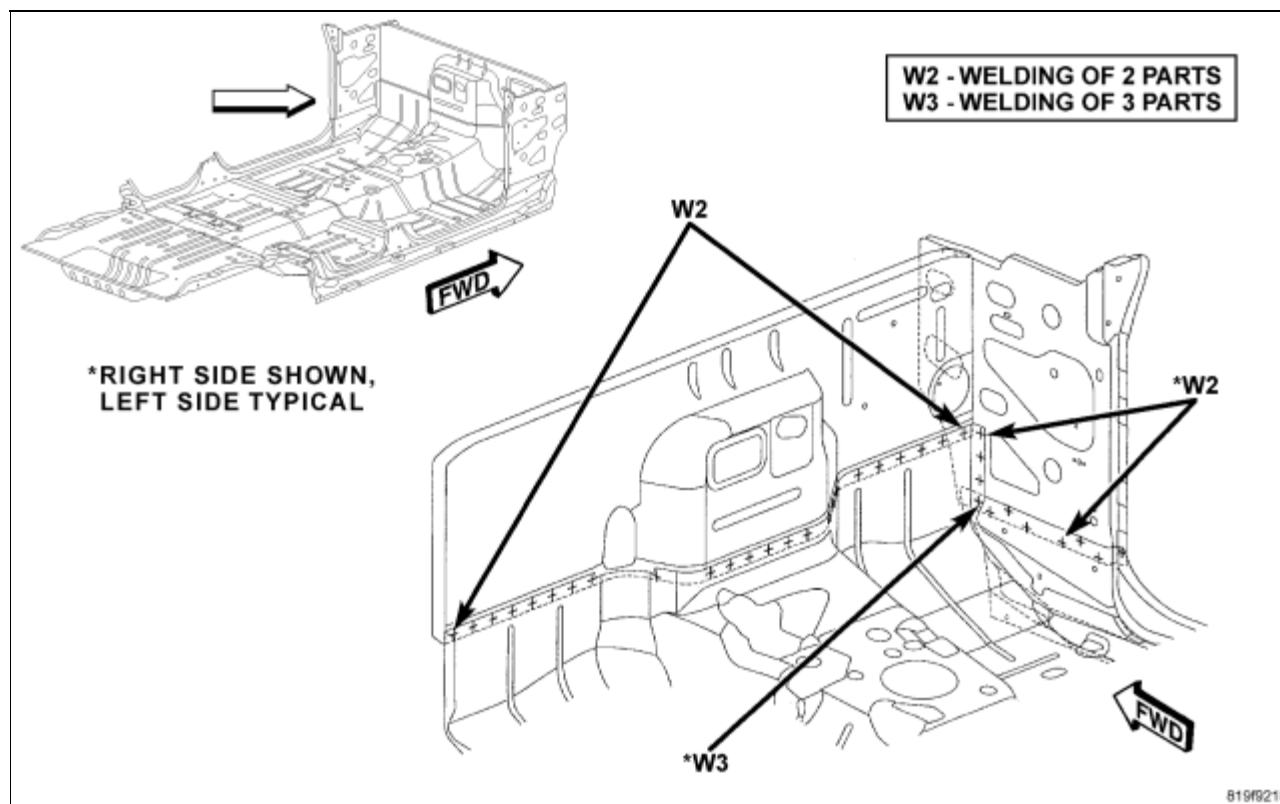


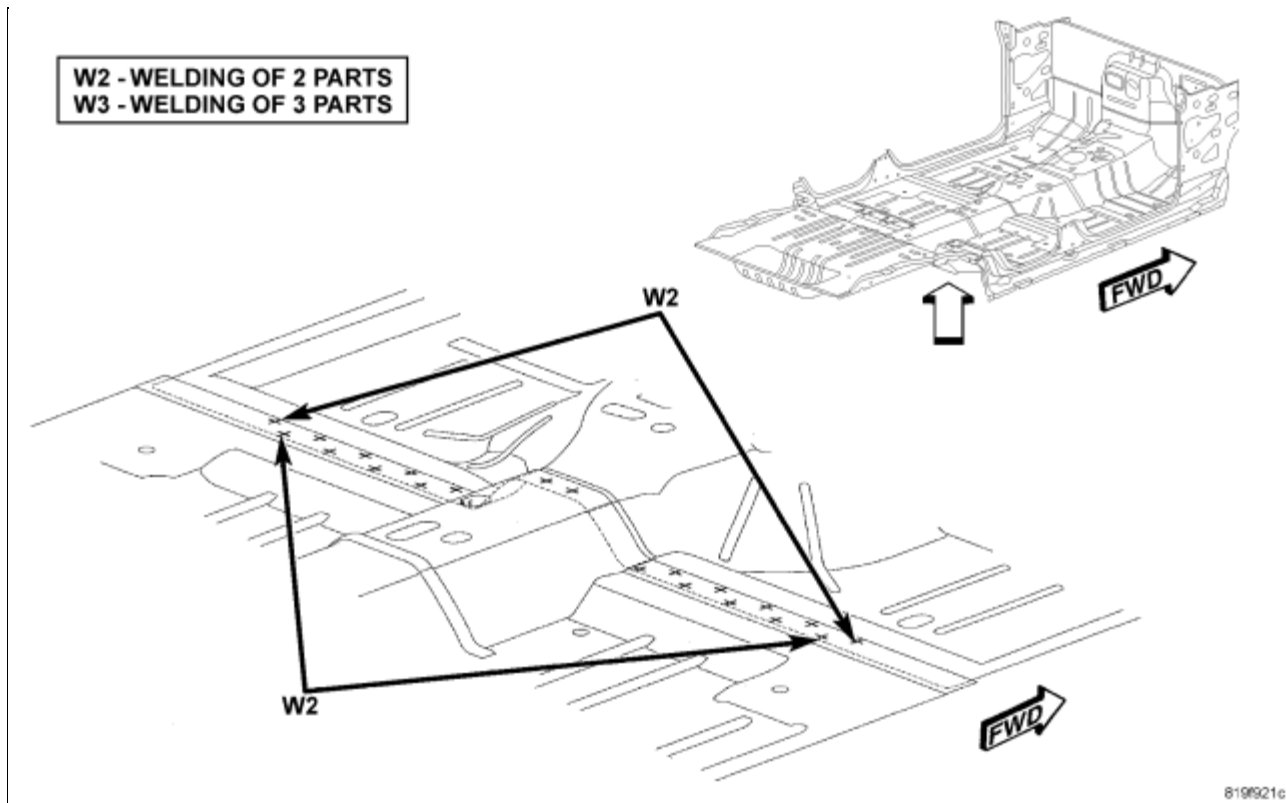
UNDERBODY (2 OF 4) - JK74



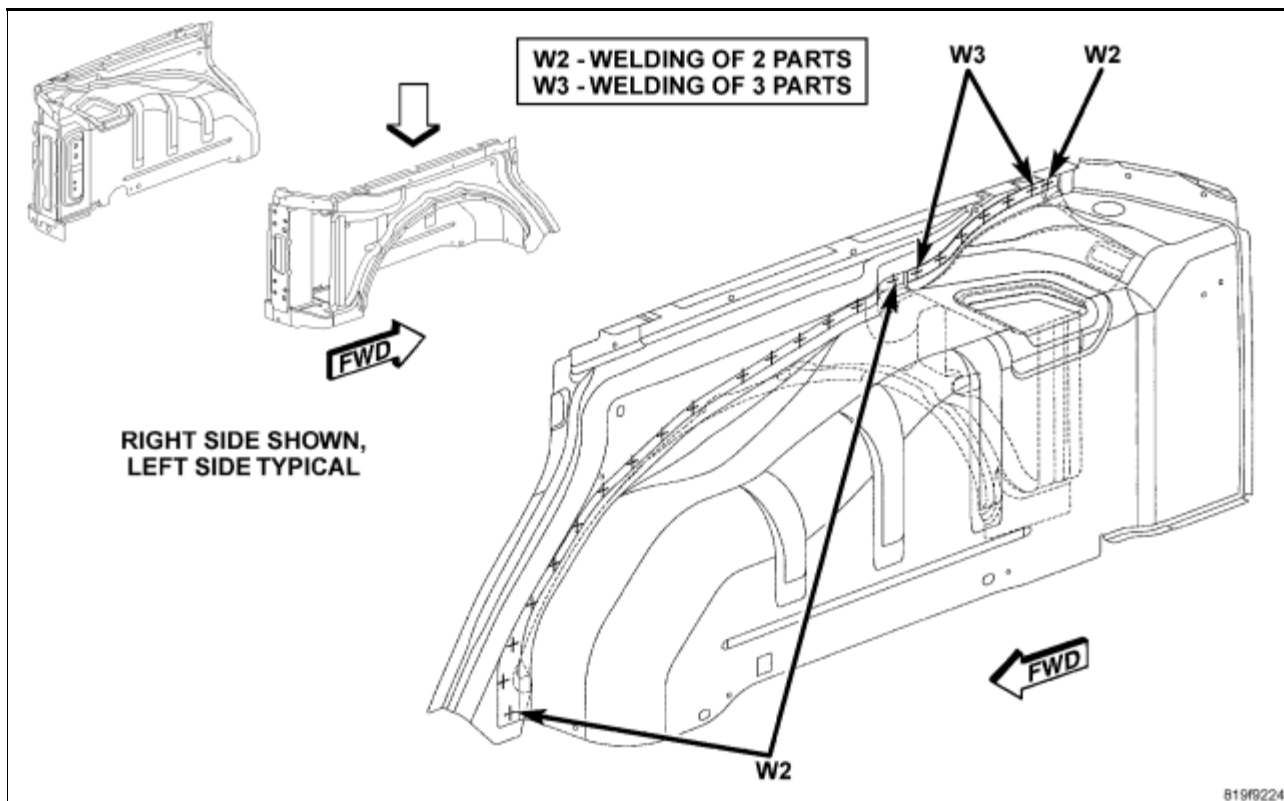
UNDERBODY (3 OF 4) - JK74



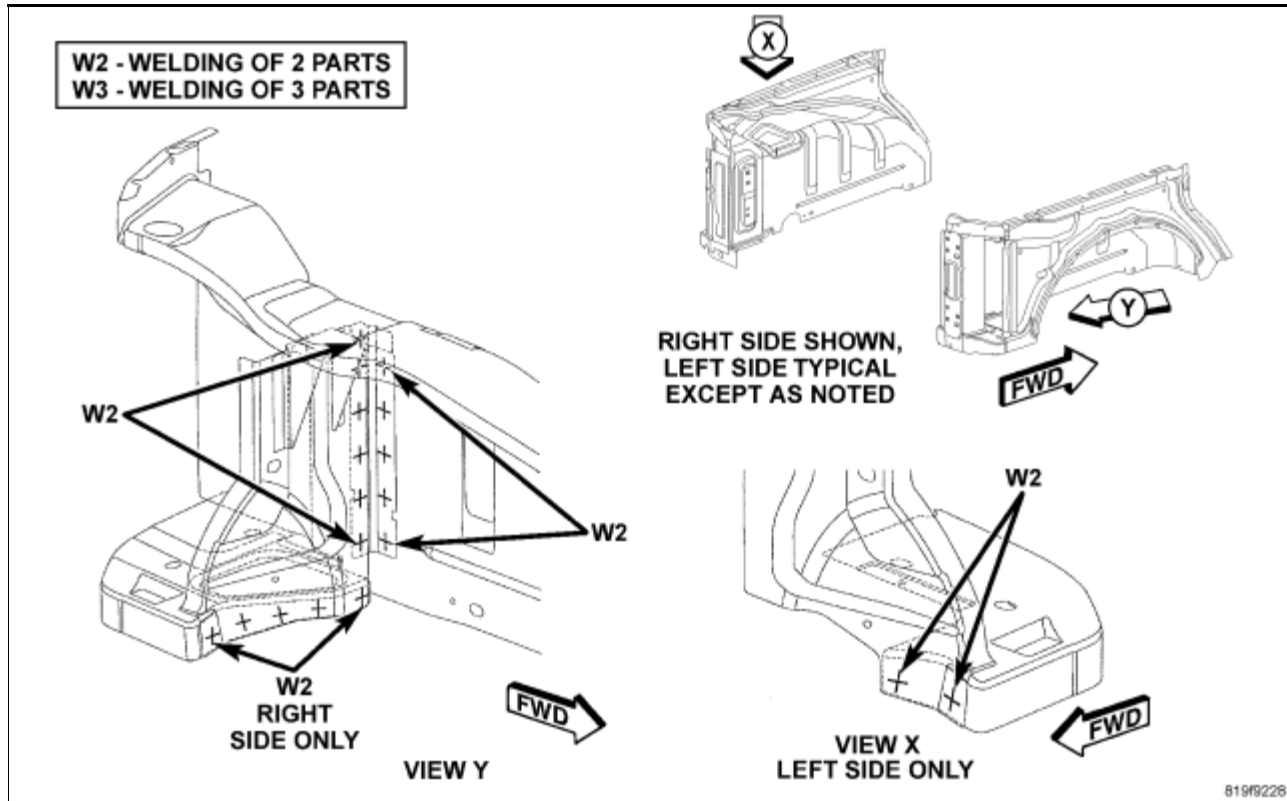
UNDERBODY (4 OF 4) - JK74**UNDERBODY COMPLETE (1 OF 2) - JK74**



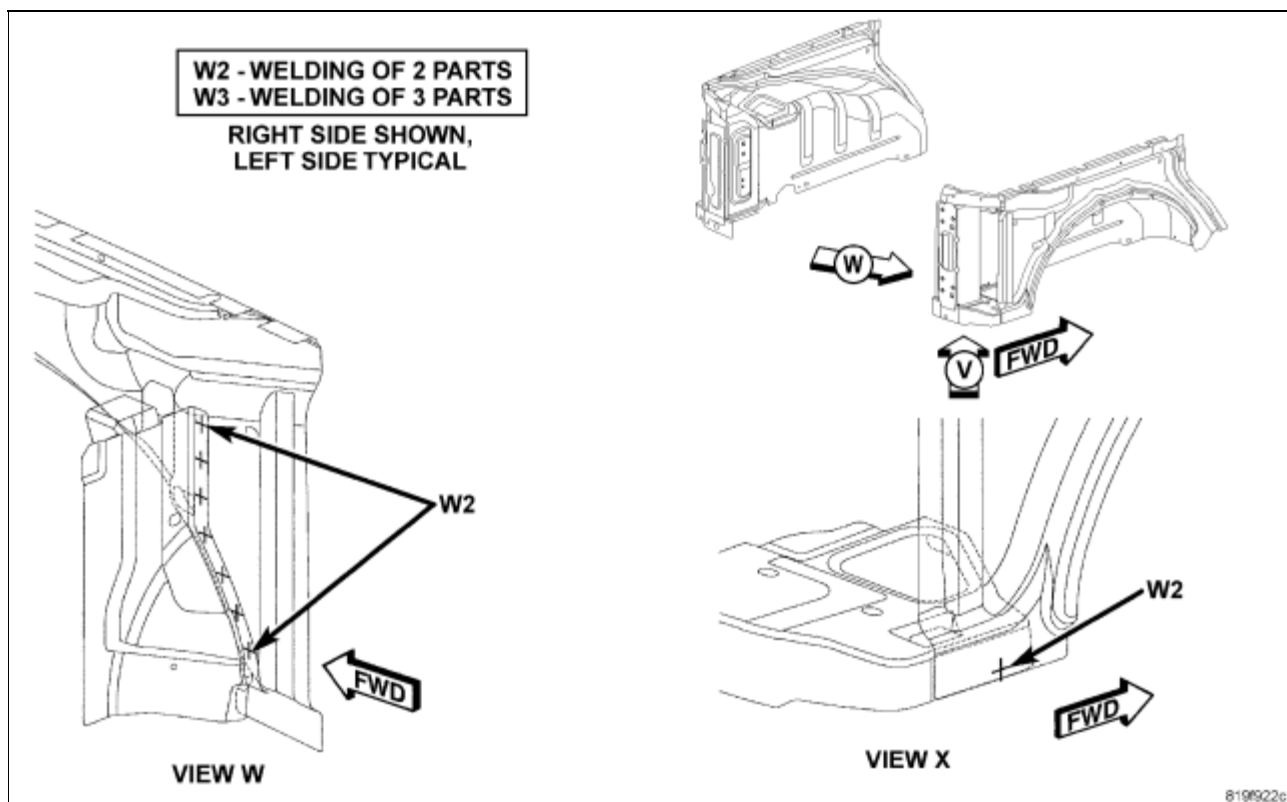
UNDERBODY COMPLETE (2 OF 2) - JK74

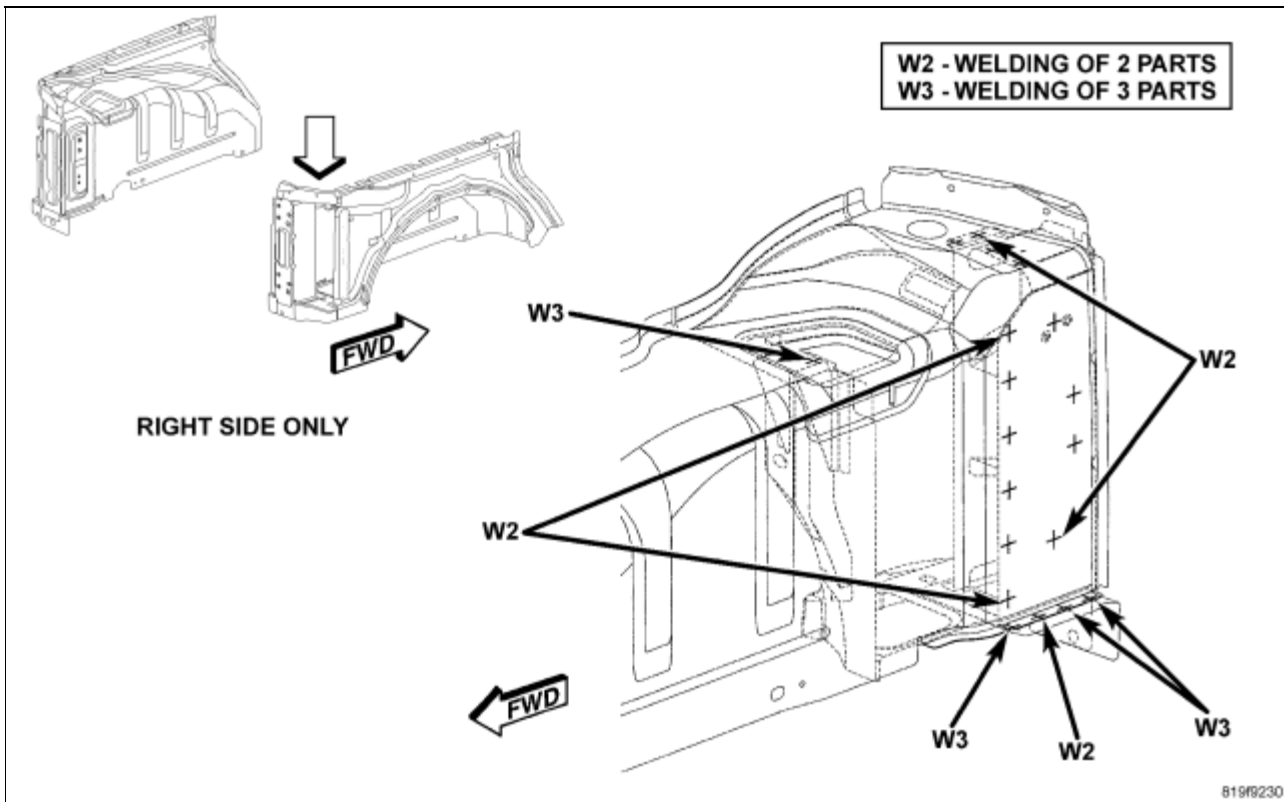


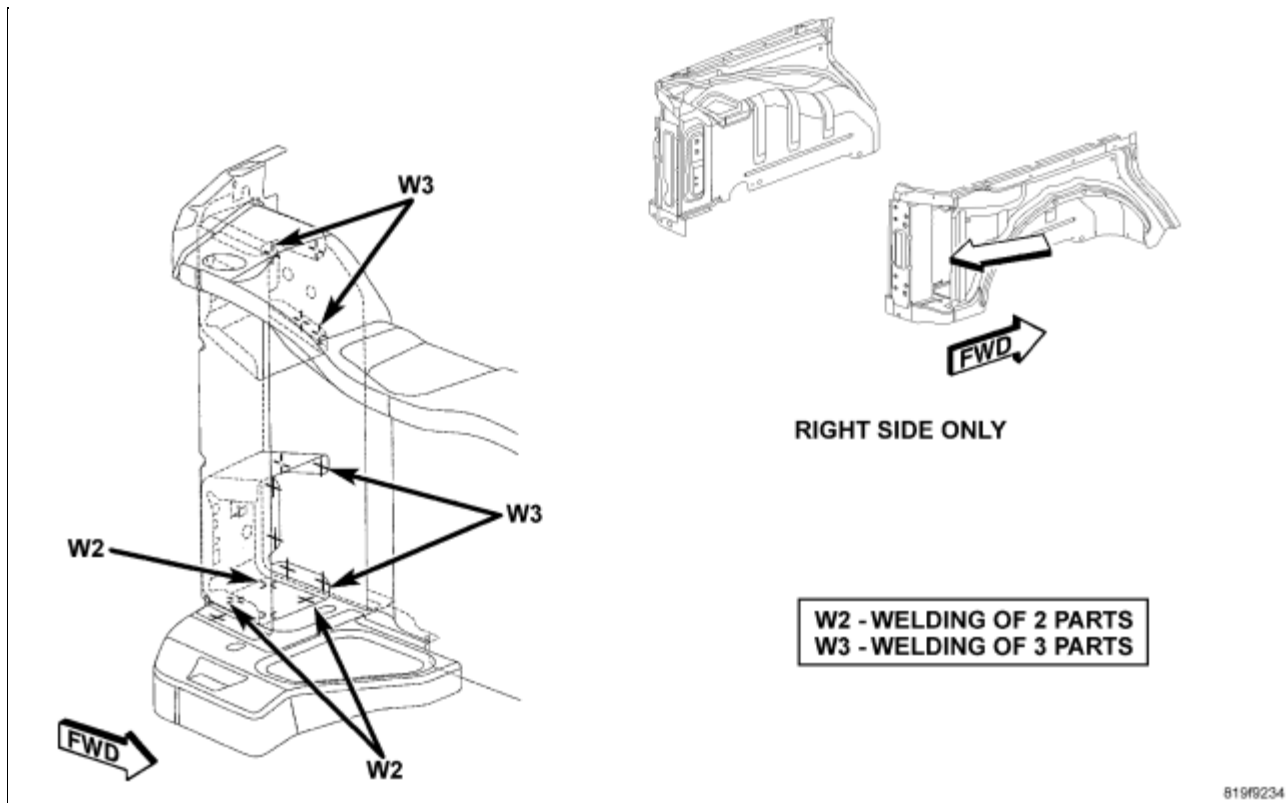
BODY SIDE APERTURE - INNER (1 OF 6) - JK74



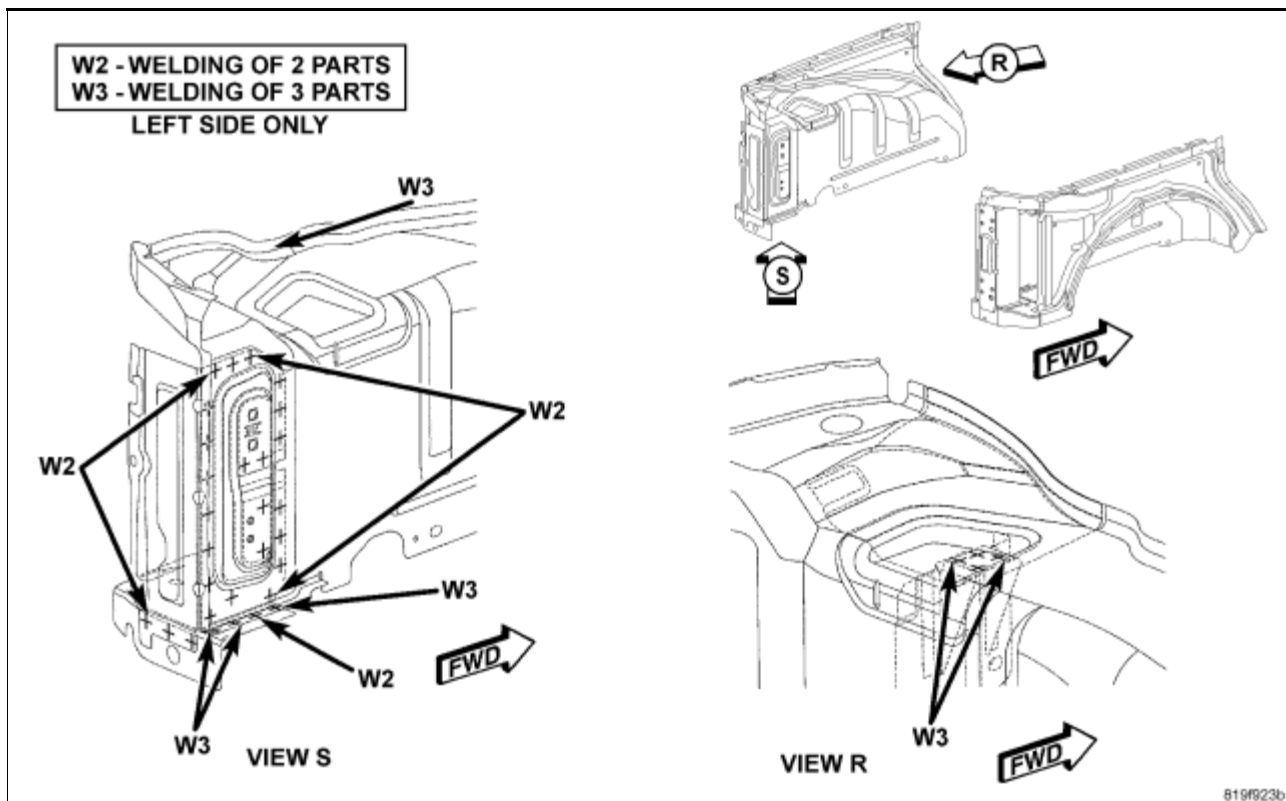
BODY SIDE APERTURE - INNER (2 OF 6) - JK74



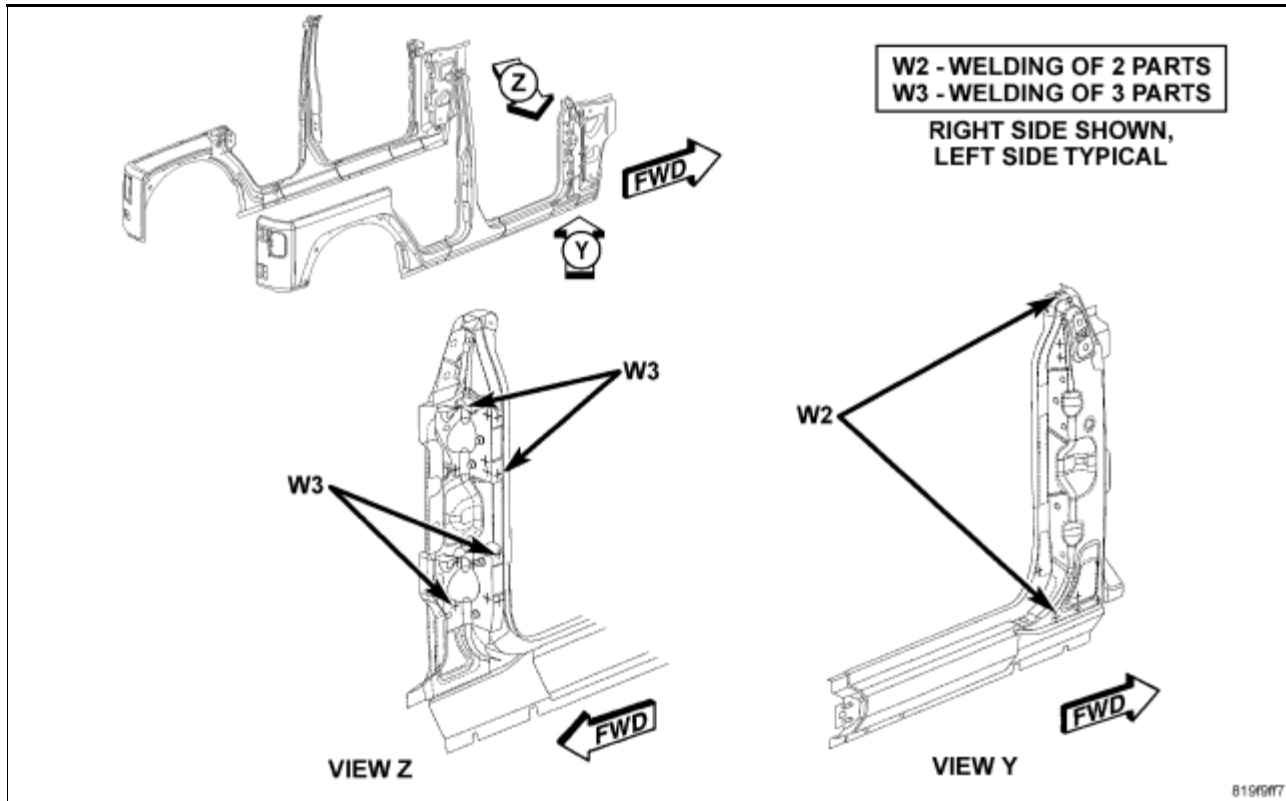
BODY SIDE APERTURE - INNER (3 OF 6) - JK74**BODY SIDE APERTURE - INNER (4 OF 6) - JK74**



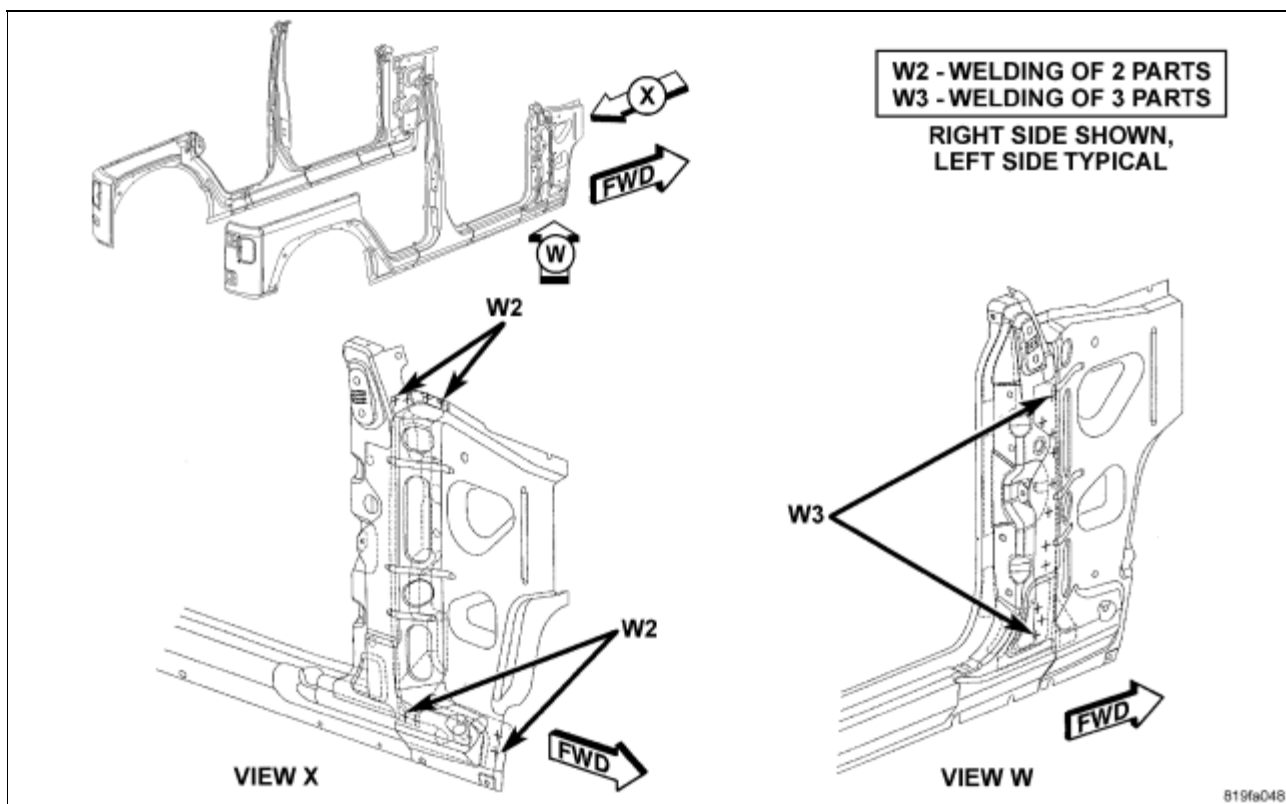
BODY SIDE APERTURE - INNER (5 OF 6) - JK74

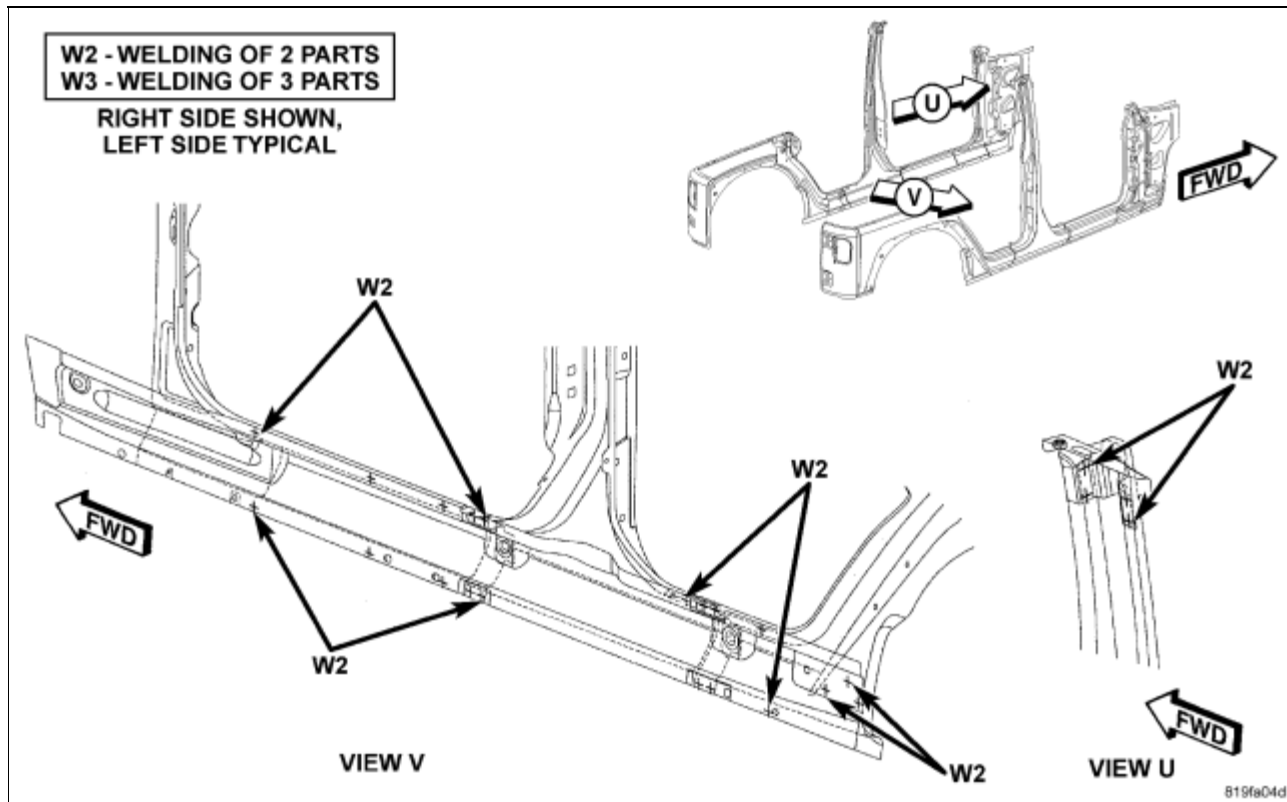


BODY SIDE APERTURE - INNER (6 OF 6) - JK74



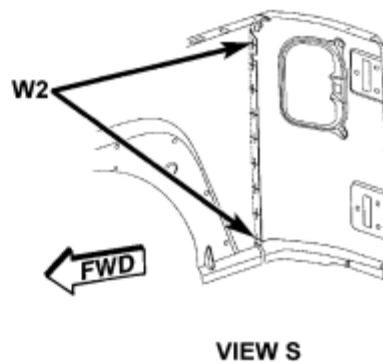
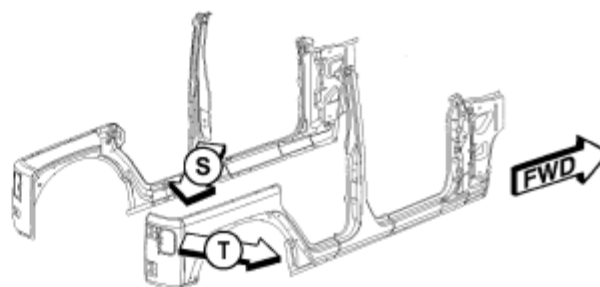
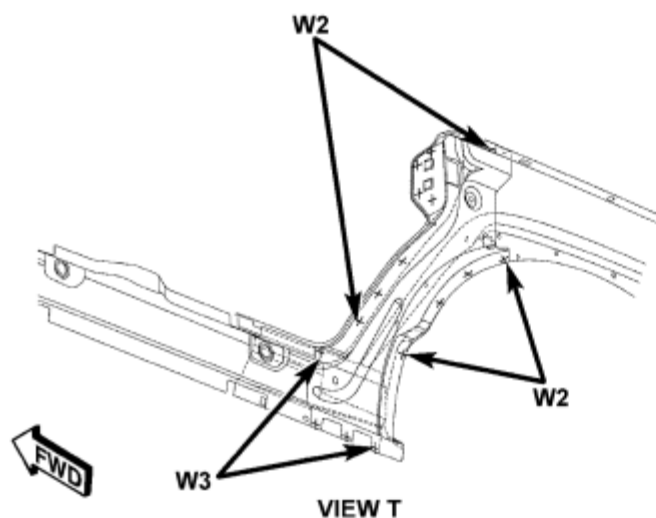
BODY SIDE APERTURE - OUTER (1 OF 4) - JK74



BODY SIDE APERTURE - OUTER (2 OF 4) - JK74**BODY SIDE APERTURE - OUTER (3 OF 4) - JK74**

W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS

RIGHT SIDE SHOWN,
LEFT SIDE TYPICAL

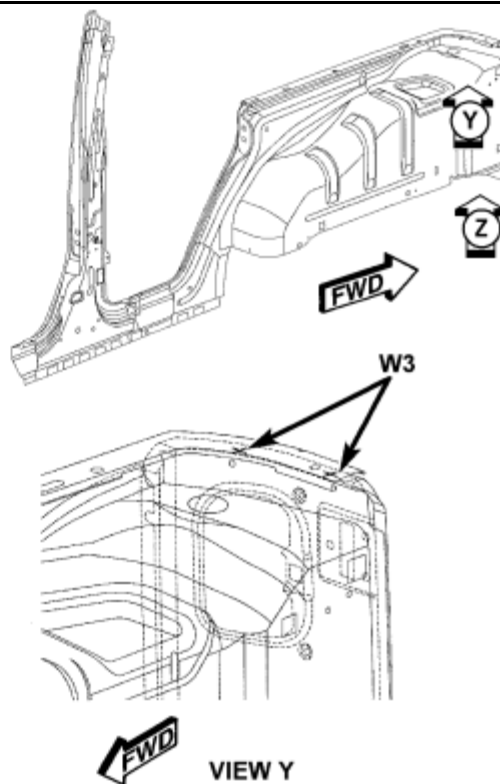
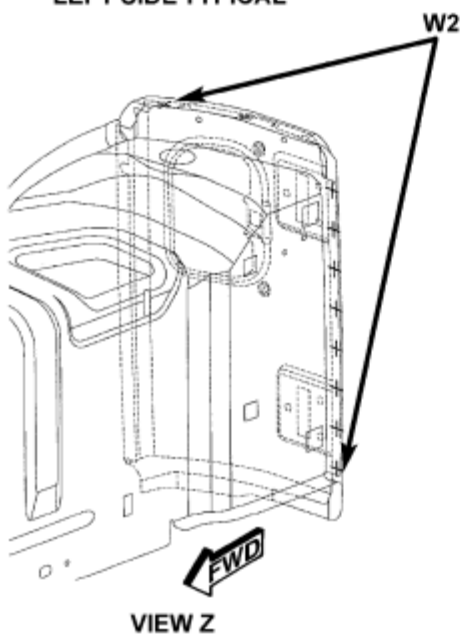


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BODY SIDE APERTURE - OUTER (4 OF 4) - JK74

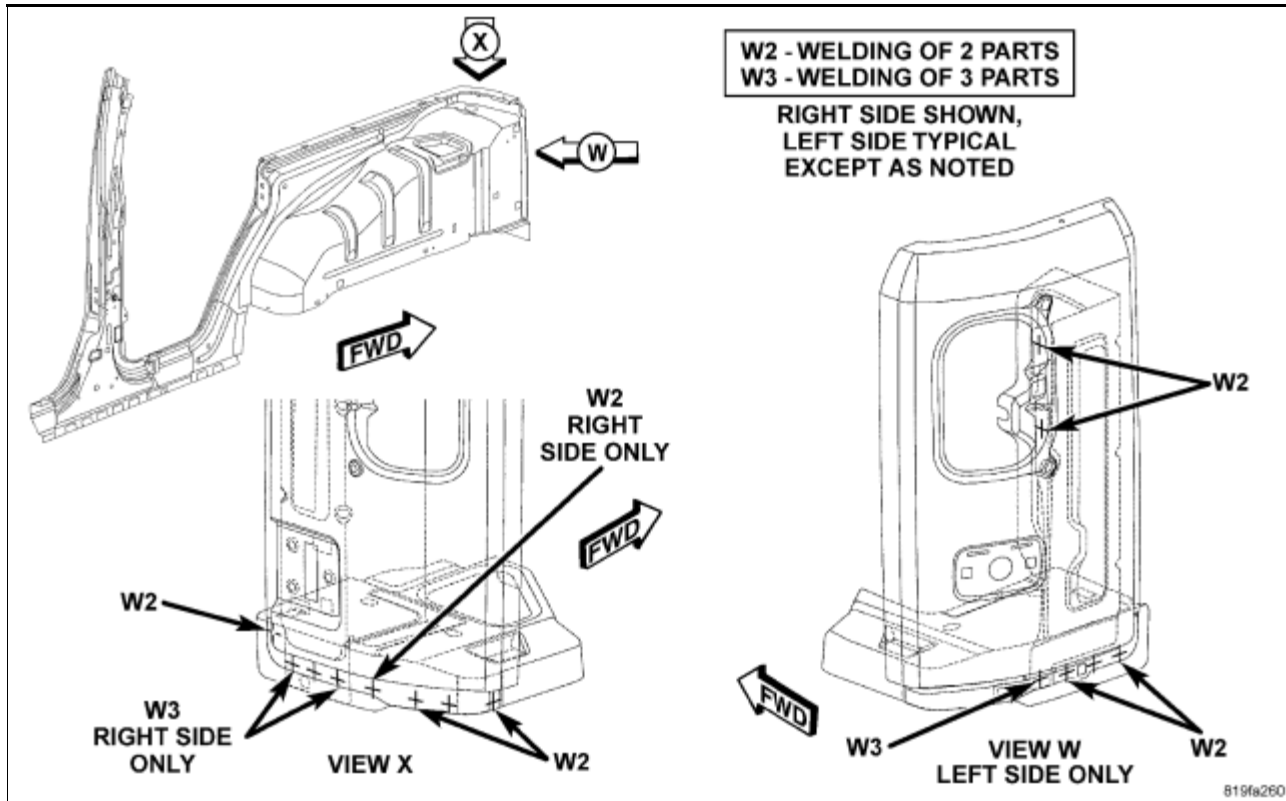
W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS

RIGHT SIDE SHOWN,
LEFT SIDE TYPICAL

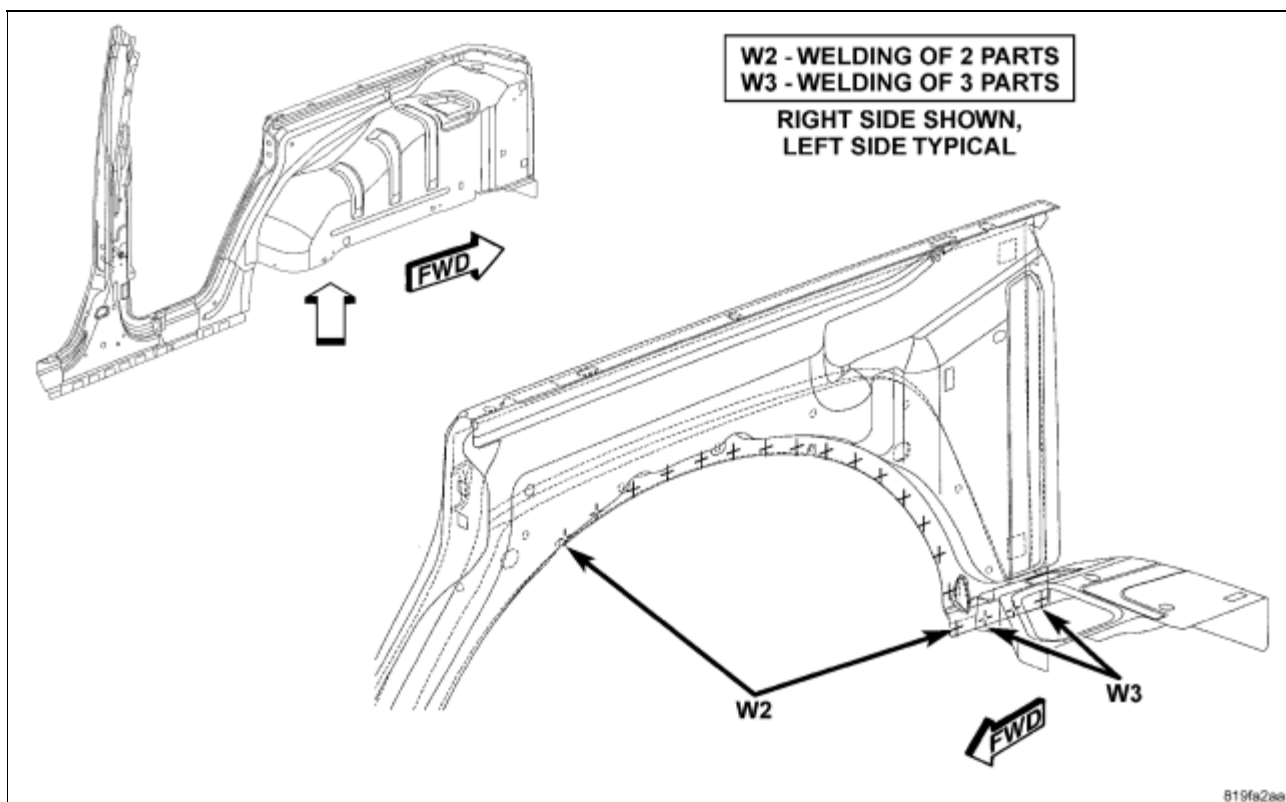


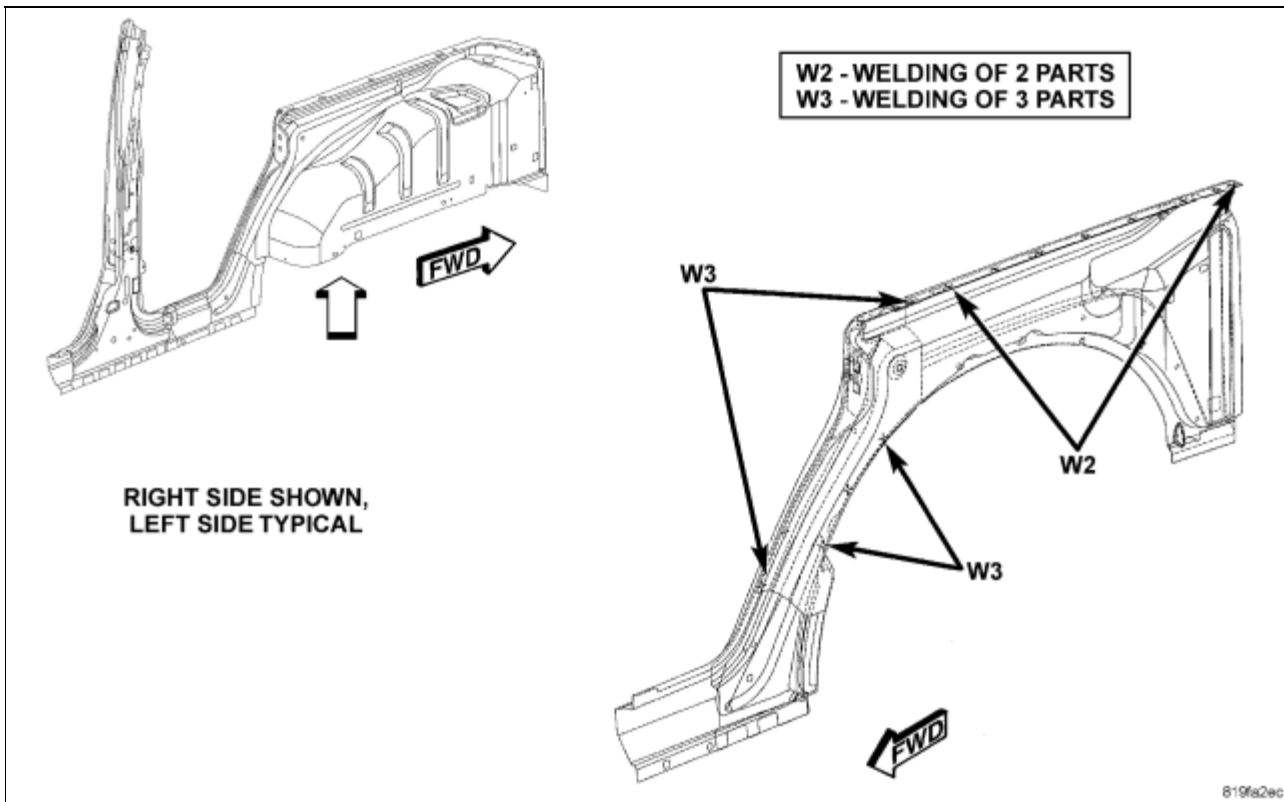
819fa230

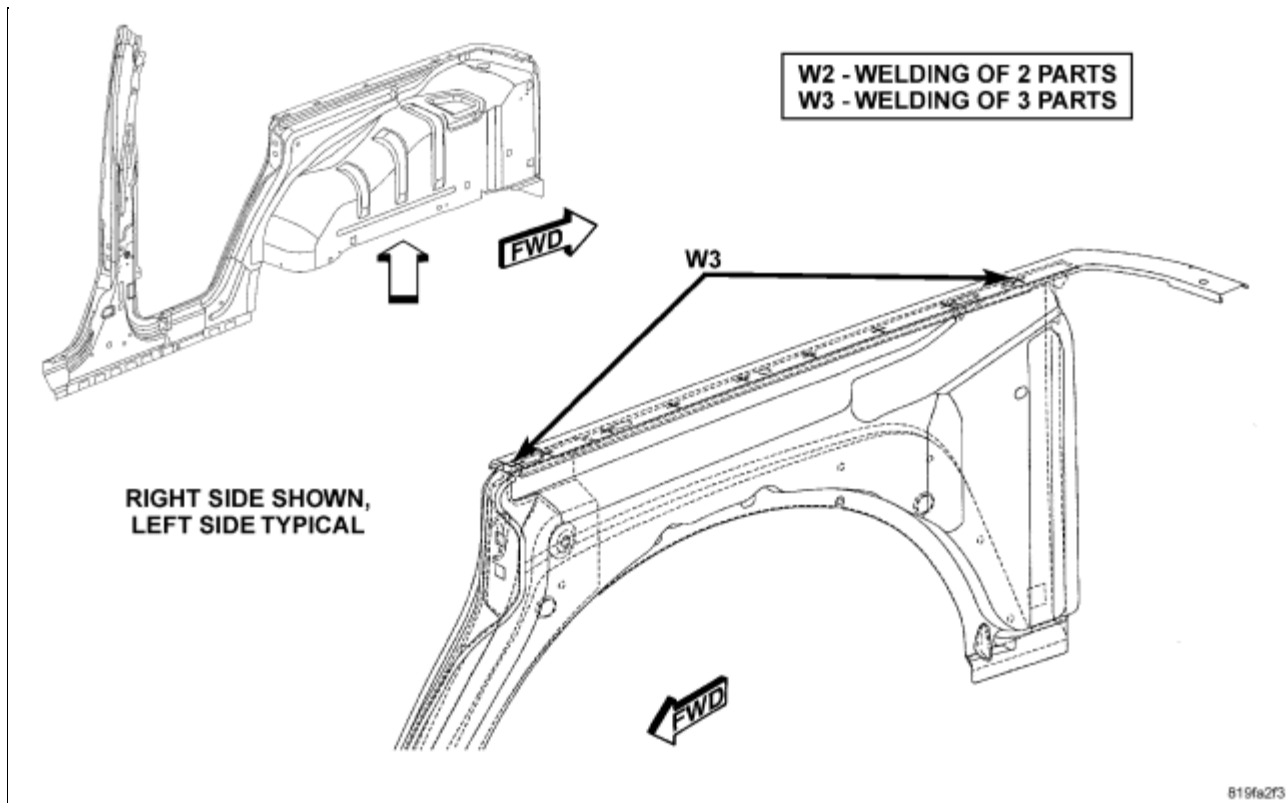
BODY SIDE APERTURE - COMPLETE (1 OF 8) - JK74



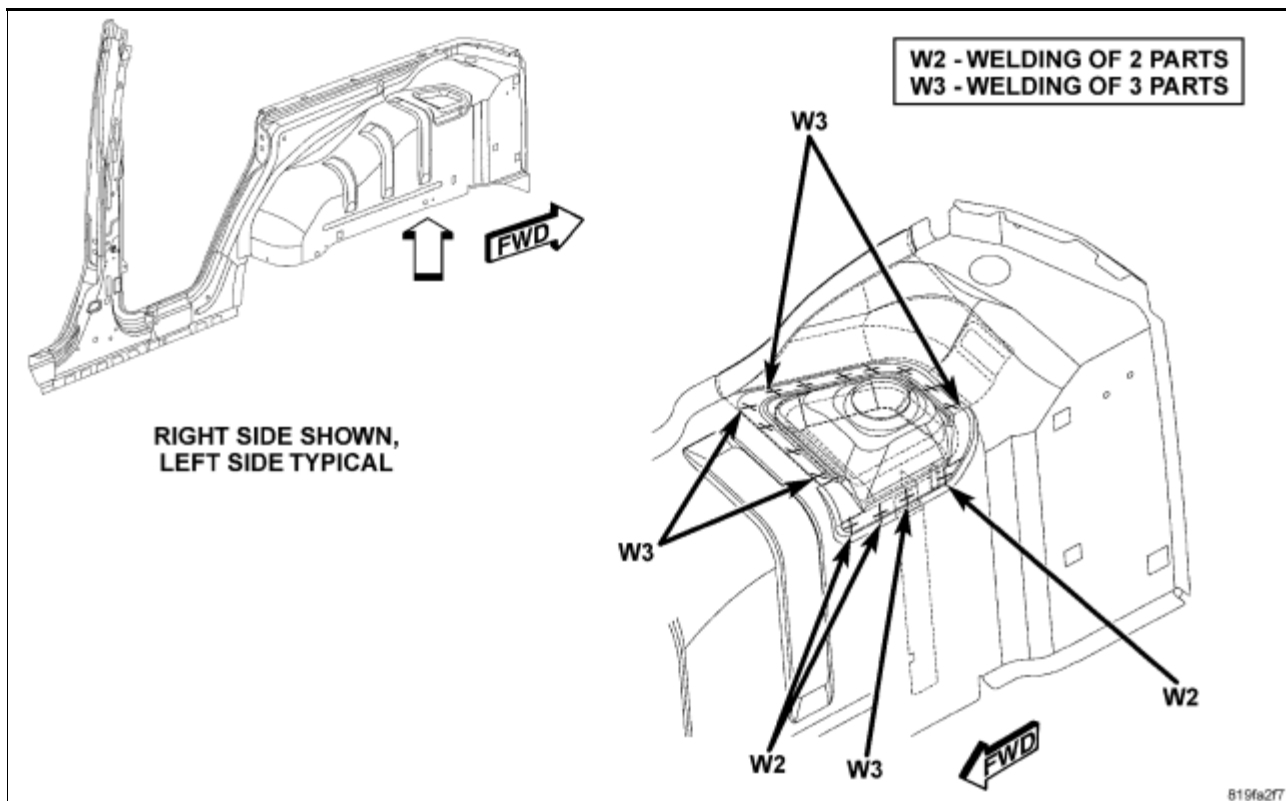
BODY SIDE APERTURE - COMPLETE (2 OF 8) - JK74



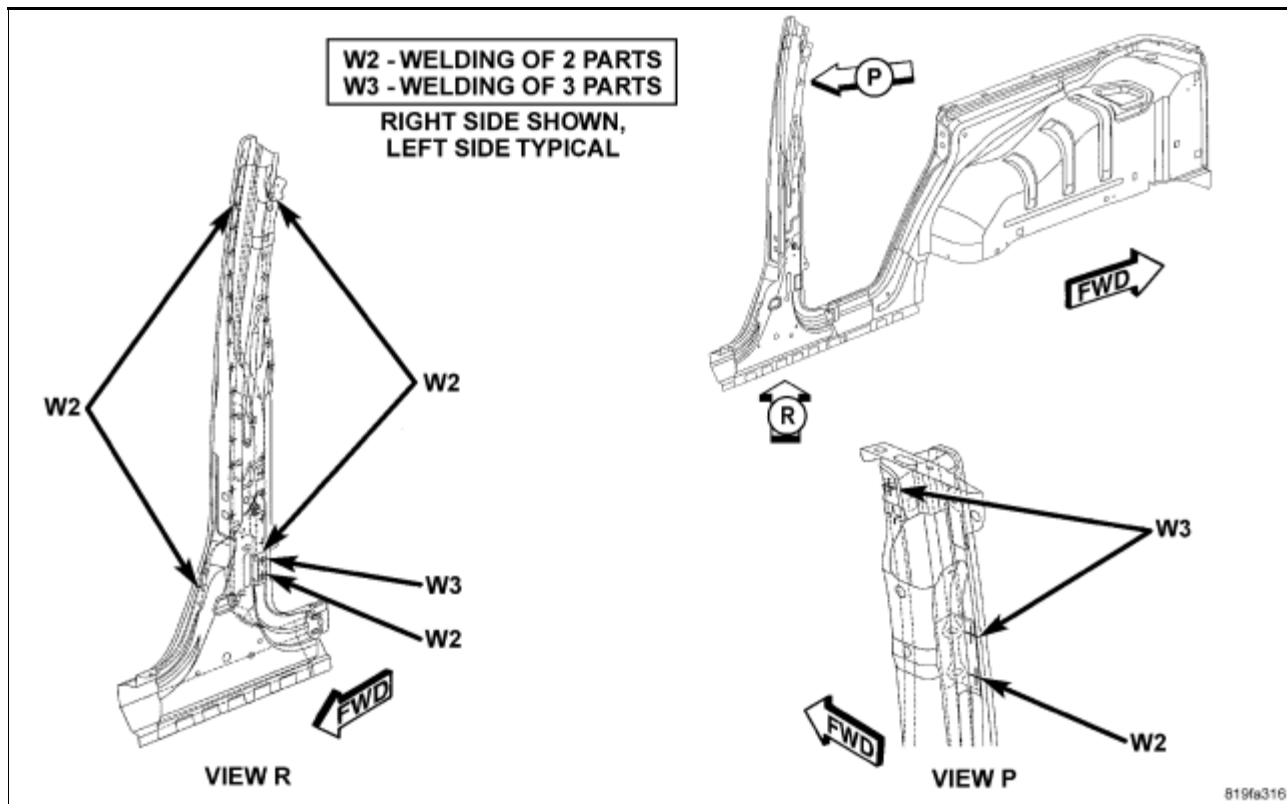
BODY SIDE APERTURE - COMPLETE (3 OF 8) - JK74**BODY SIDE APERTURE - COMPLETE (4 OF 8) - JK74**



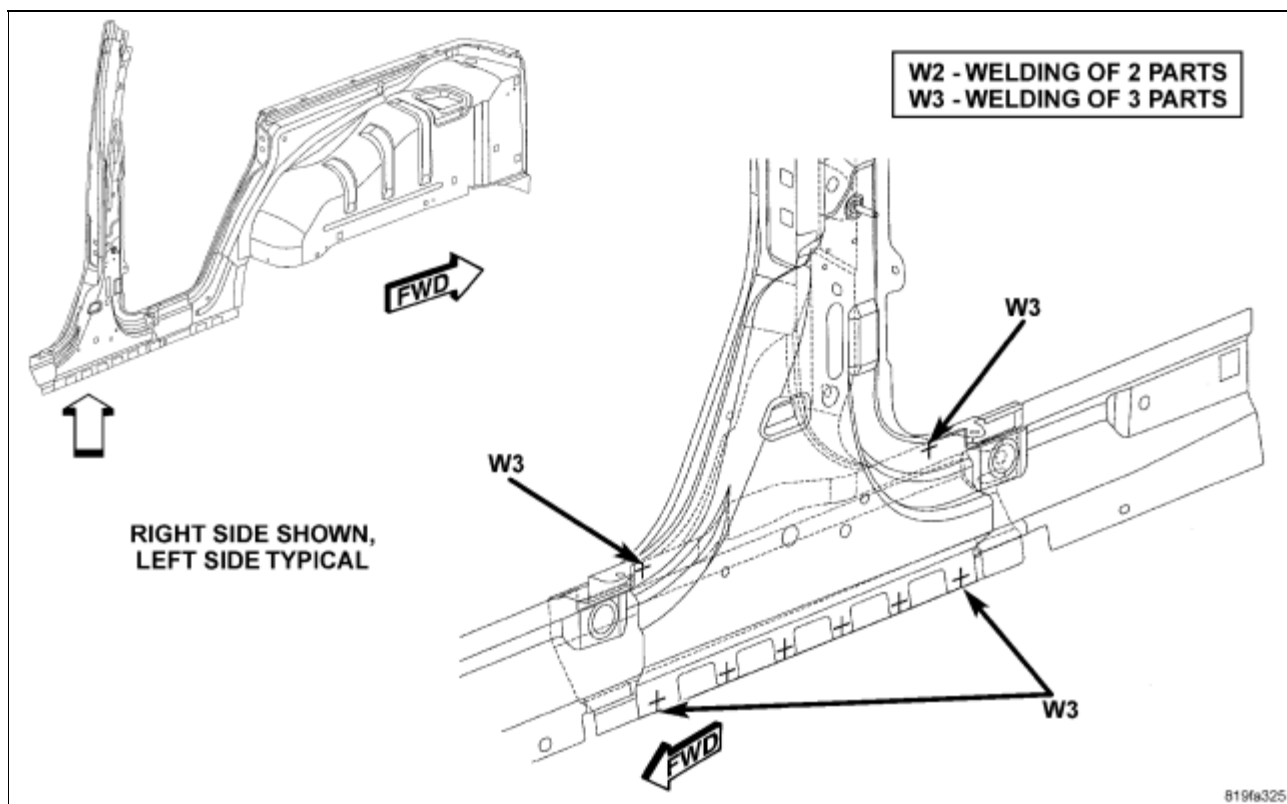
BODY SIDE APERTURE - COMPLETE (5 OF 8) - JK74

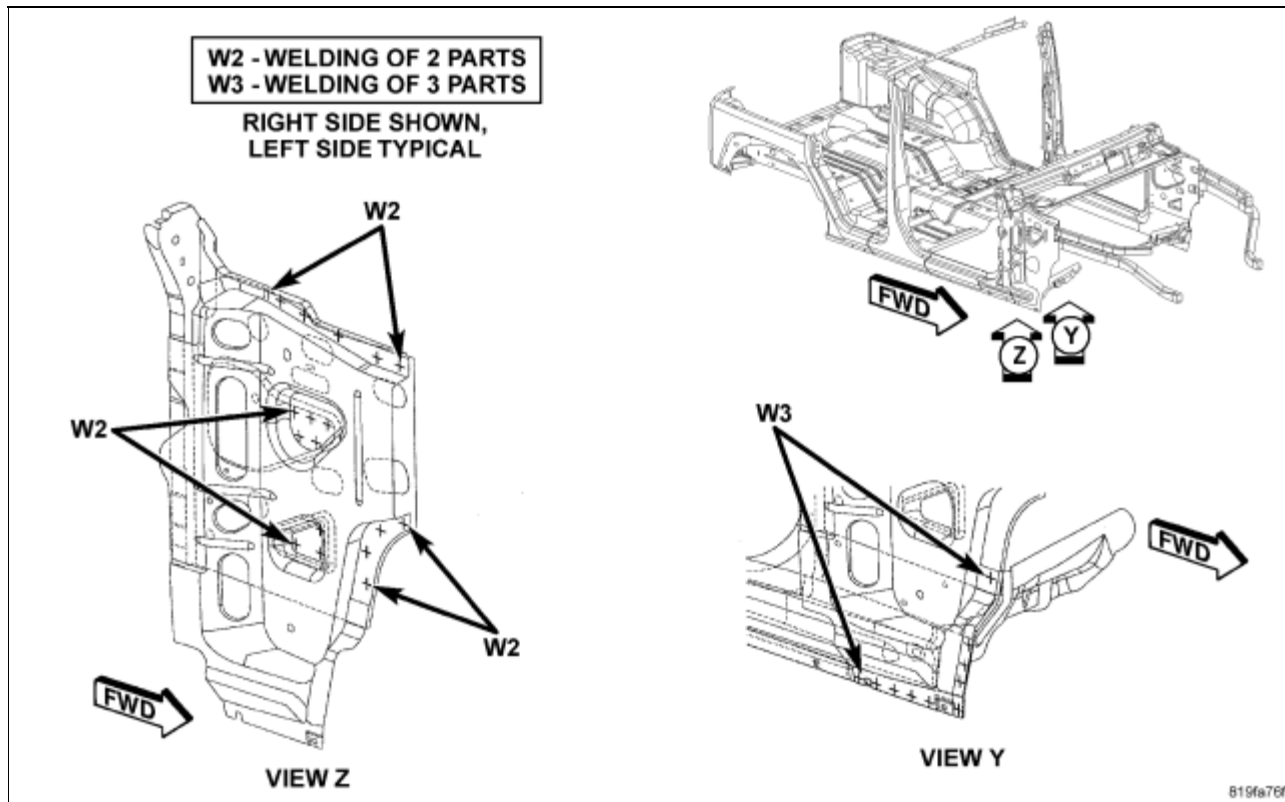


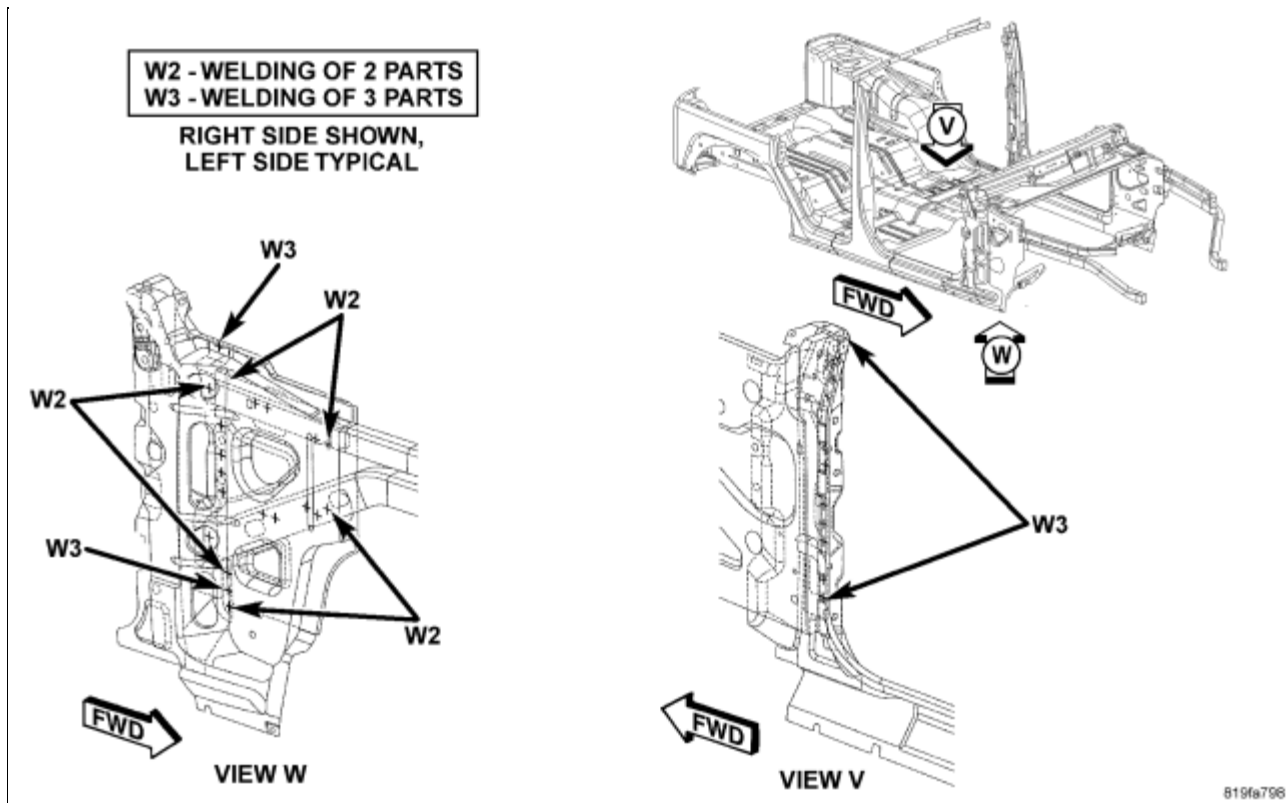
BODY SIDE APERTURE - COMPLETE (6 OF 8) - JK74



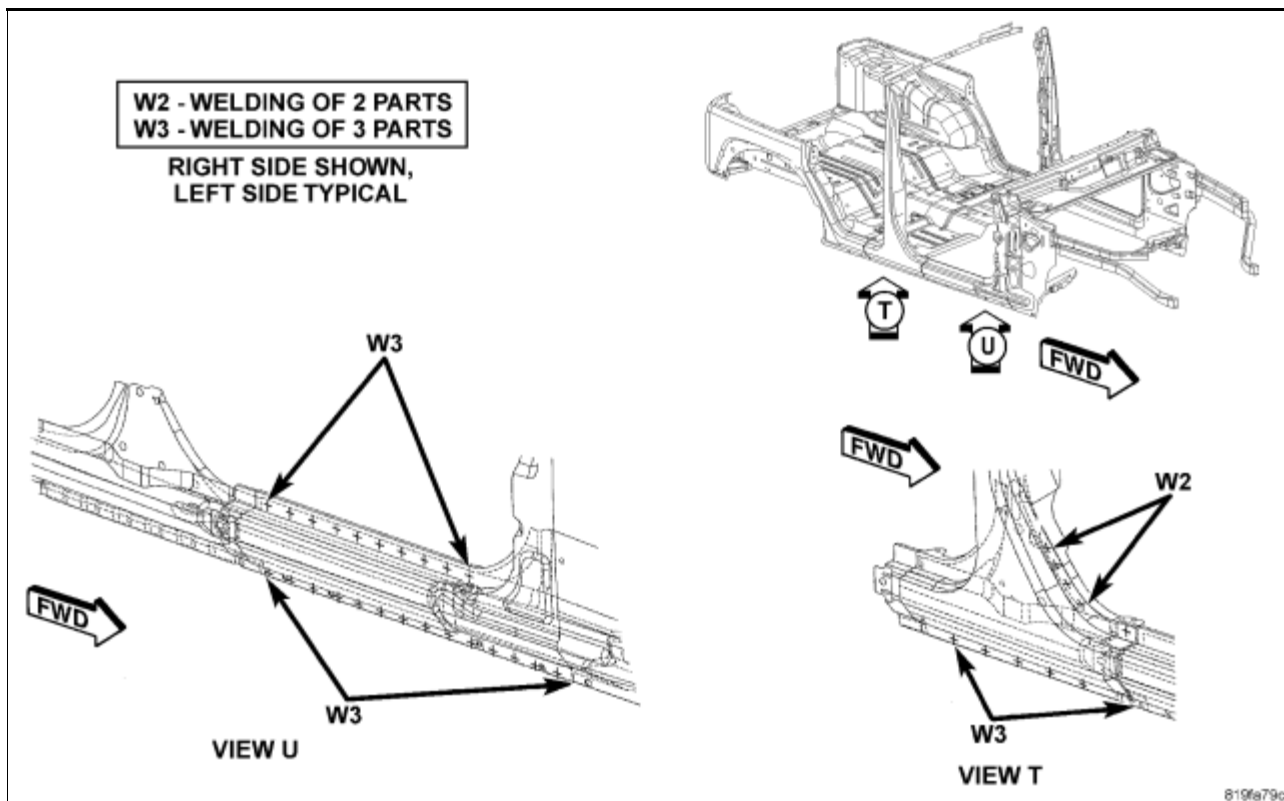
BODY SIDE APERTURE - COMPLETE (7 OF 8) - JK74



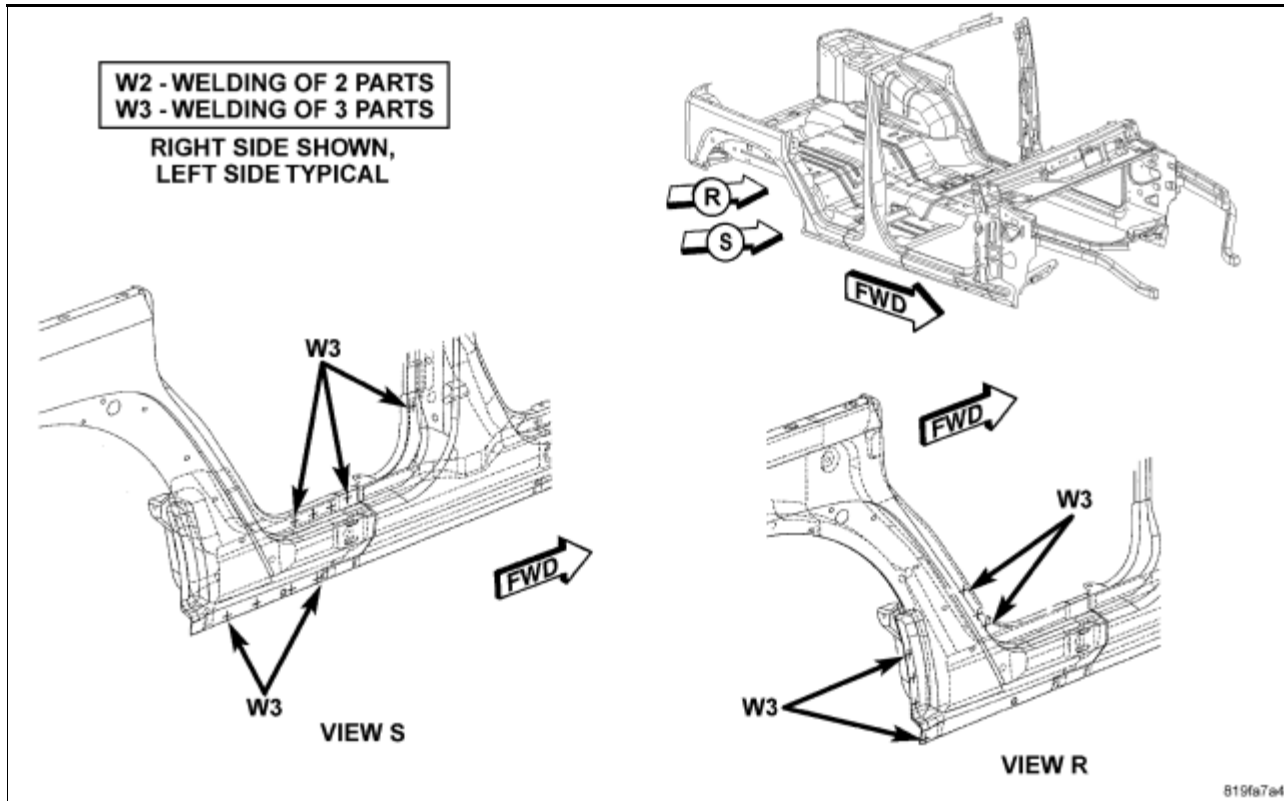
BODY SIDE APERTURE - COMPLETE (8 OF 8) - JK74**BODY IN WHITE - COMPLETE (1 OF 8) - JK74**



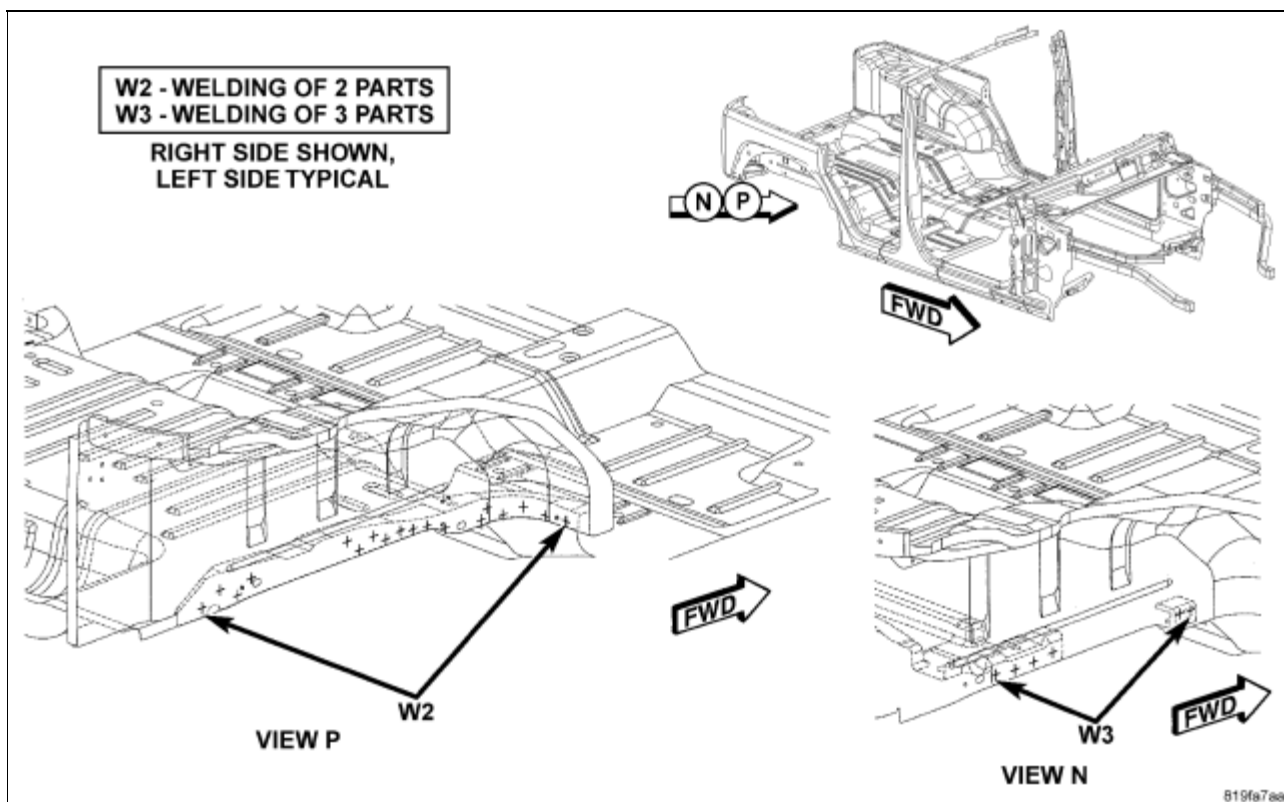
BODY IN WHITE - COMPLETE (2 OF 8) - JK74



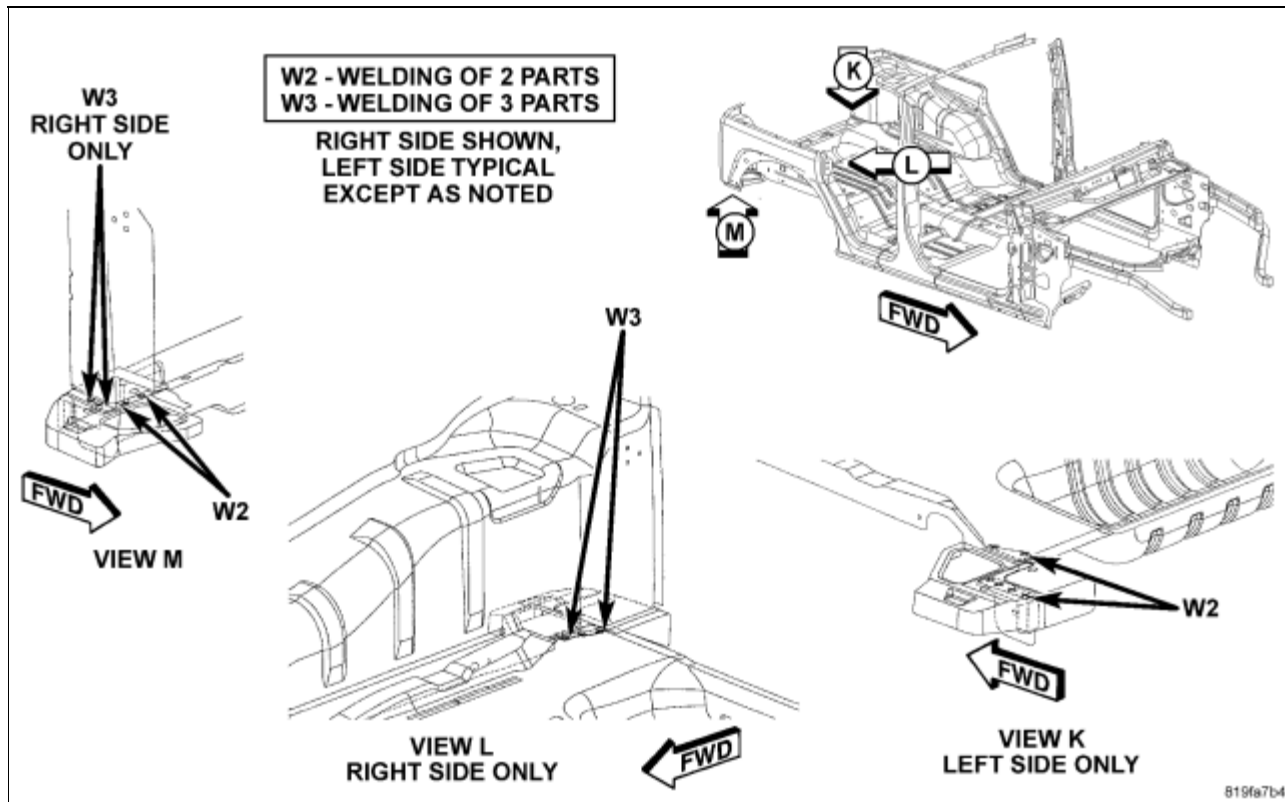
BODY IN WHITE - COMPLETE (3 OF 8) - JK74



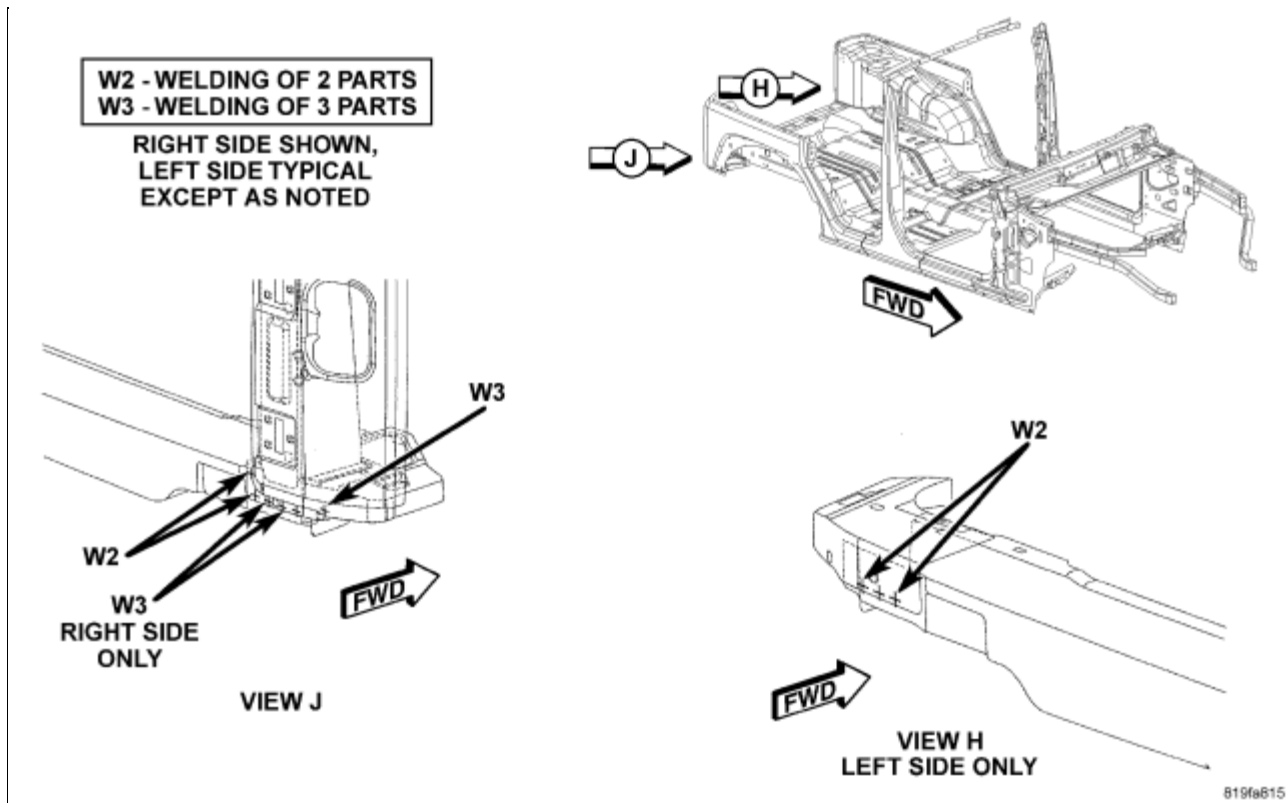
BODY IN WHITE - COMPLETE (4 OF 8) - JK74



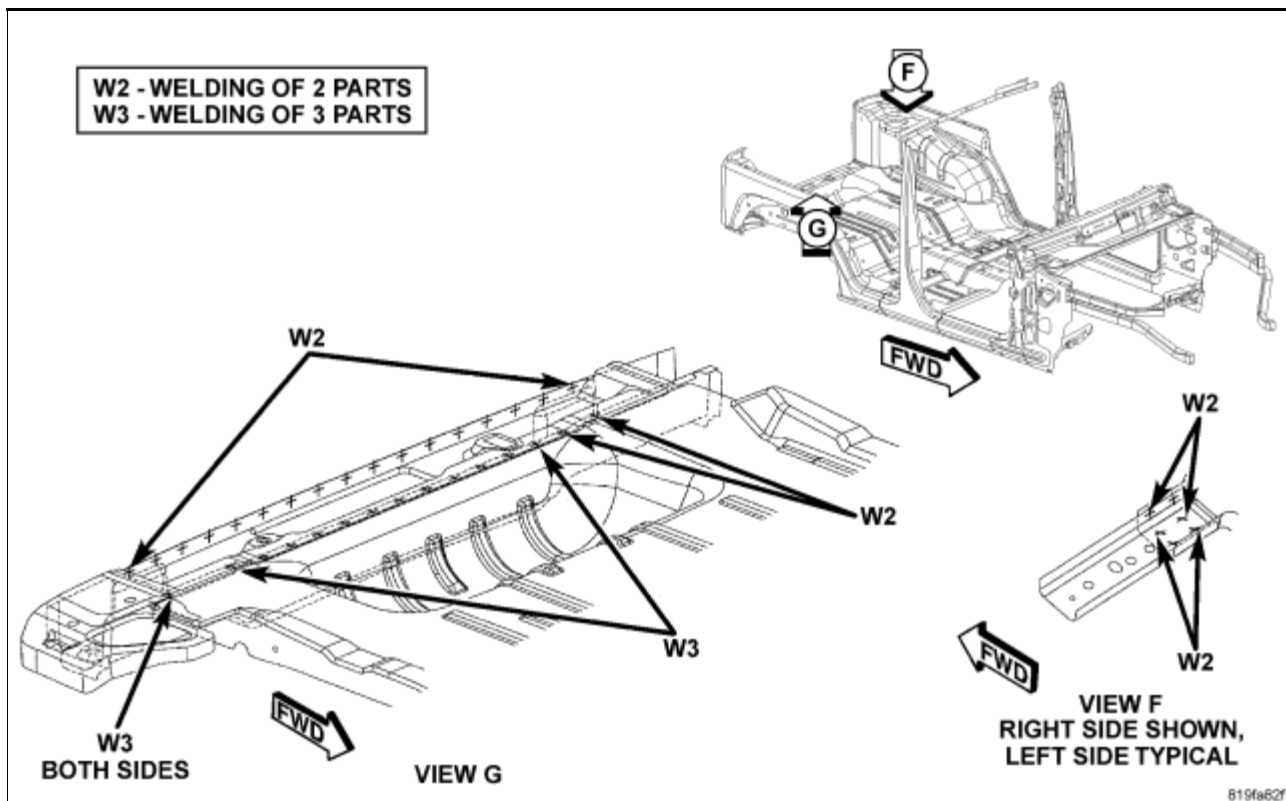
BODY IN WHITE - COMPLETE (5 OF 8) - JK74



BODY IN WHITE - COMPLETE (6 OF 8) - JK74



BODY IN WHITE - COMPLETE (7 OF 8) - JK74



BODY IN WHITE - COMPLETE (8 OF 8) - JK74

24 - HEATING & AIR CONDITIONING

HVAC - ELECTRICAL DIAGNOSTICS

HVAC - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW (CCN)

For a complete wiring diagram **Refer to Section 8W.**

Theory of Operation

The A/C mode switch input changes when the switch is pushed down. An active DTC indicates that the switch is stuck in a pushed position. A stored DTC indicates that the switch was stuck in a pushed position for more than two minutes, but has since returned to its normal state.

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the A/C mode switch is stuck in a pushed position for more than two minutes. This DTC has a maturing time of two minutes and a de-maturing time of two seconds. If the DTC's status changes from active to stored it will stay in memory for 100 ignition cycles.

Possible Causes
OBJECT HOLDING SWITCH IN A PUSHED POSITION
A/C HEATER CONTROL

Diagnostic Test

1. VERIFY B1001–A/C SWITCH REQUEST INPUT CIRCUIT LOW IS ACTIVE

Turn the ignition on.

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. INSPECT FOR OBJECT HOLDING SWITCH IN A PUSHED POSITION

Inspect the A/C Heater Control for an object holding the switch in a pushed position. If present, remove the object.

Turn the ignition on.

With the scan tool, erase HVAC DTCs.

Turn the ignition off, wait 10 seconds, and then turn the ignition on.

Wait two minutes, then with the scan tool, read HVAC DTCs.

Does the scan tool display this DTC as active?

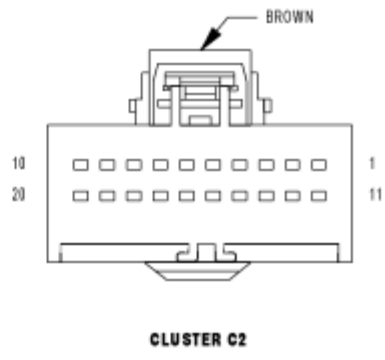
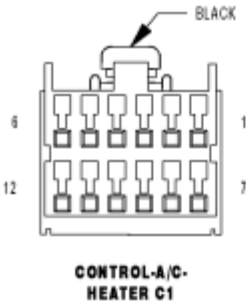
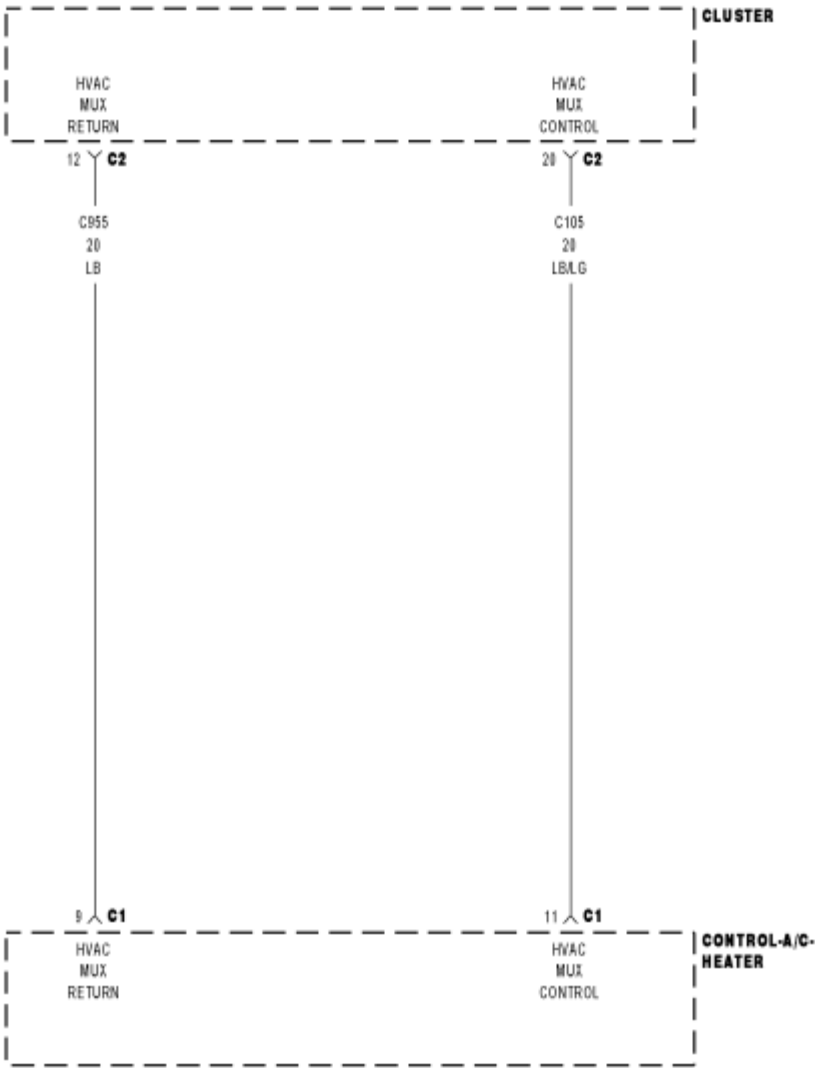
Yes

- Replace the A/C Heater Control in accordance with the service information.
- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

B1002–A/C SWITCH REQUEST INPUT CIRCUIT HIGH (CCN)



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For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Instrument Cluster (CCN) detects voltage above 4.5 volts for 10 seconds on the (C105) HVAC MUX Control circuit.

Possible Causes
(C105) HVAC MUX CONTROL CIRCUIT SHORTED TO VOLTAGE
(C105) HVAC MUX CONTROL CIRCUIT OPEN
(C955) HVAC MUX RETURN CIRCUIT OPEN
A/C HEATER CONTROL
INSTRUMENT CLUSTER (CCN)

Diagnostic Test

1. VERIFY DTC B1002–A/C SWITCH REQUEST INPUT CIRCUIT HIGH IS ACTIVE

Turn the ignition on.

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK THE (C105) HVAC MUX CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.
 Disconnect the Instrument Cluster C2 harness connector.
 Disconnect the HVAC Control Head C1 harness connector.
 Turn the ignition on.
 Measure the voltage of the (C105) HVAC MUX Control circuit.

Is there any voltage present?

Yes

- Repair the (C105) HVAC MUX Control circuit for a short to voltage.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. CHECK THE (C105) HVAC MUX CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off.
 Measure the resistance of the (C105) HVAC MUX Control circuit between the A/C Heater Control C1 harness connector and the Instrument Cluster C2 harness connector.

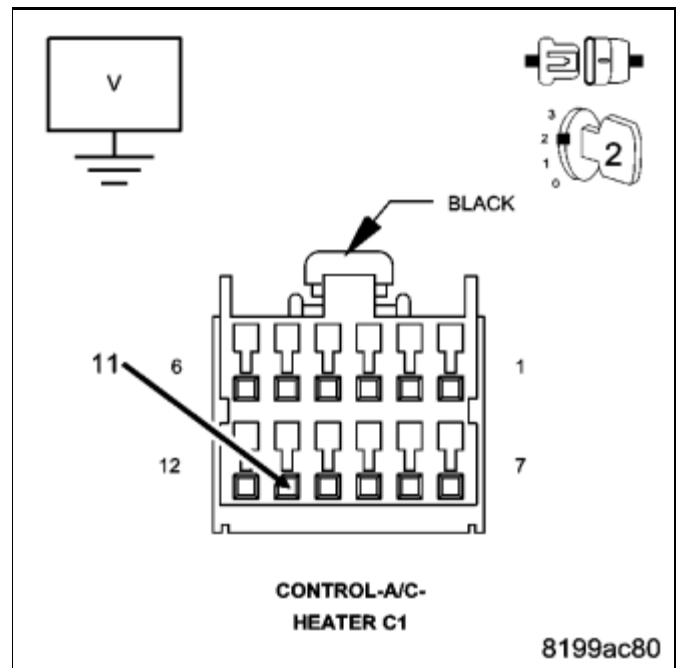
Does the ohm meter read open circuit?

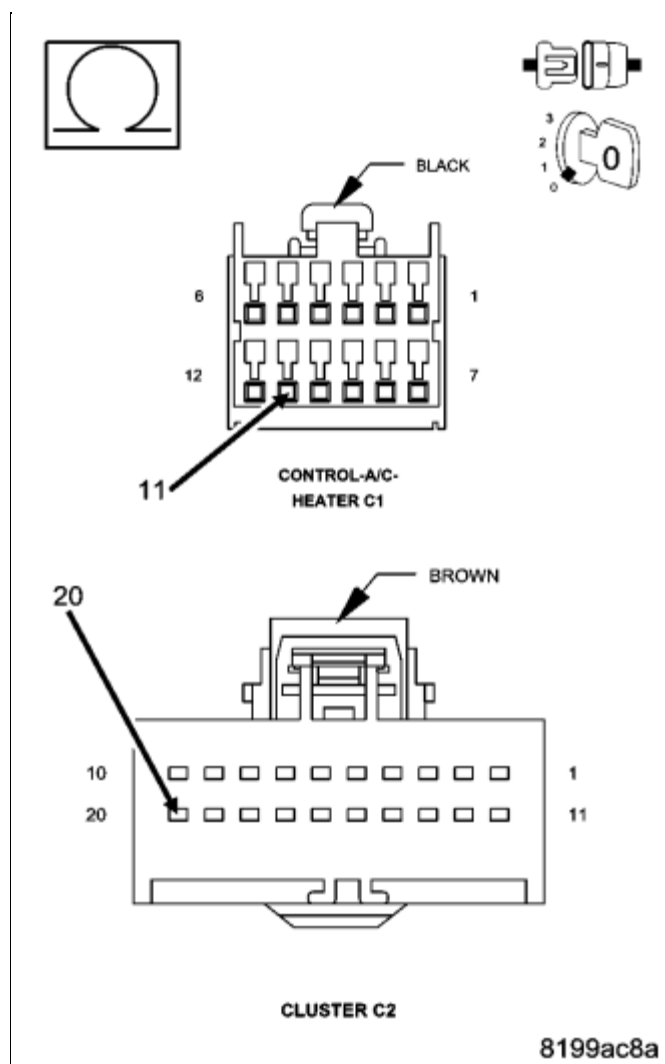
Yes

- Repair the (C105) HVAC MUX Control circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [5](#)





4. CHECK THE (C955) HVAC MUX RETURN CIRCUIT FOR AN OPEN

Measure the resistance of the (C955) HVAC MUX Return circuit between the A/C Heater Control C1 harness connector and the Instrument Cluster C2 harness connector.

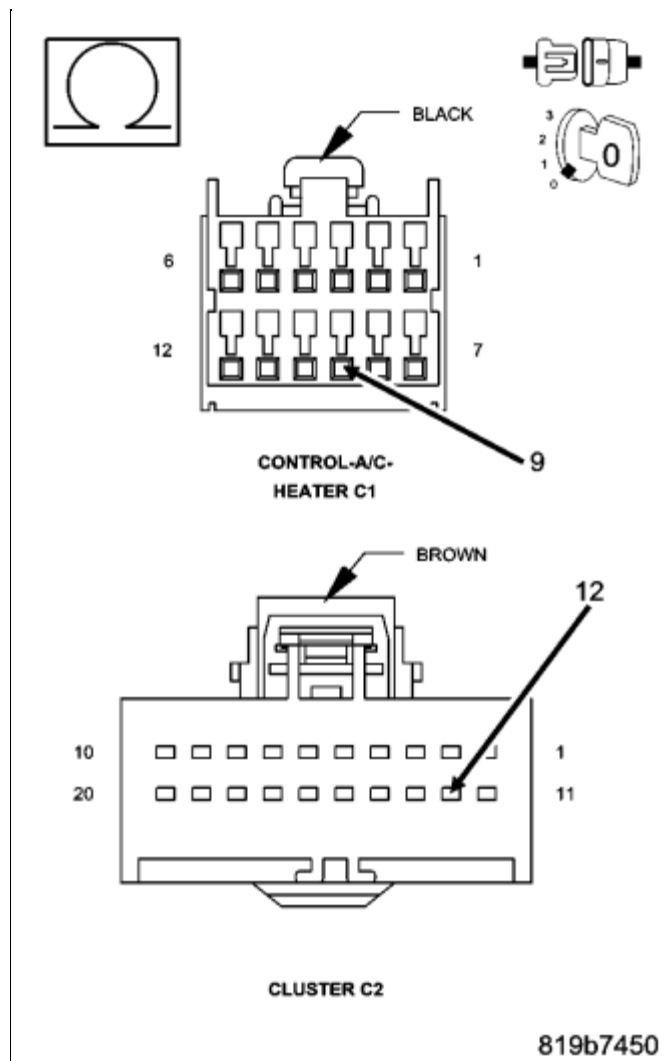
Does the ohm meter read open circuit?

Yes

- Repair the (C955) HVAC MUX Return circuit for an open.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [5](#)



5. CHECK THE OPERATION OF THE INSTRUMENT CLUSTER (CCN)

Reconnect the Instrument Cluster (CCN) harness connector.
Turn the ignition on.
With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

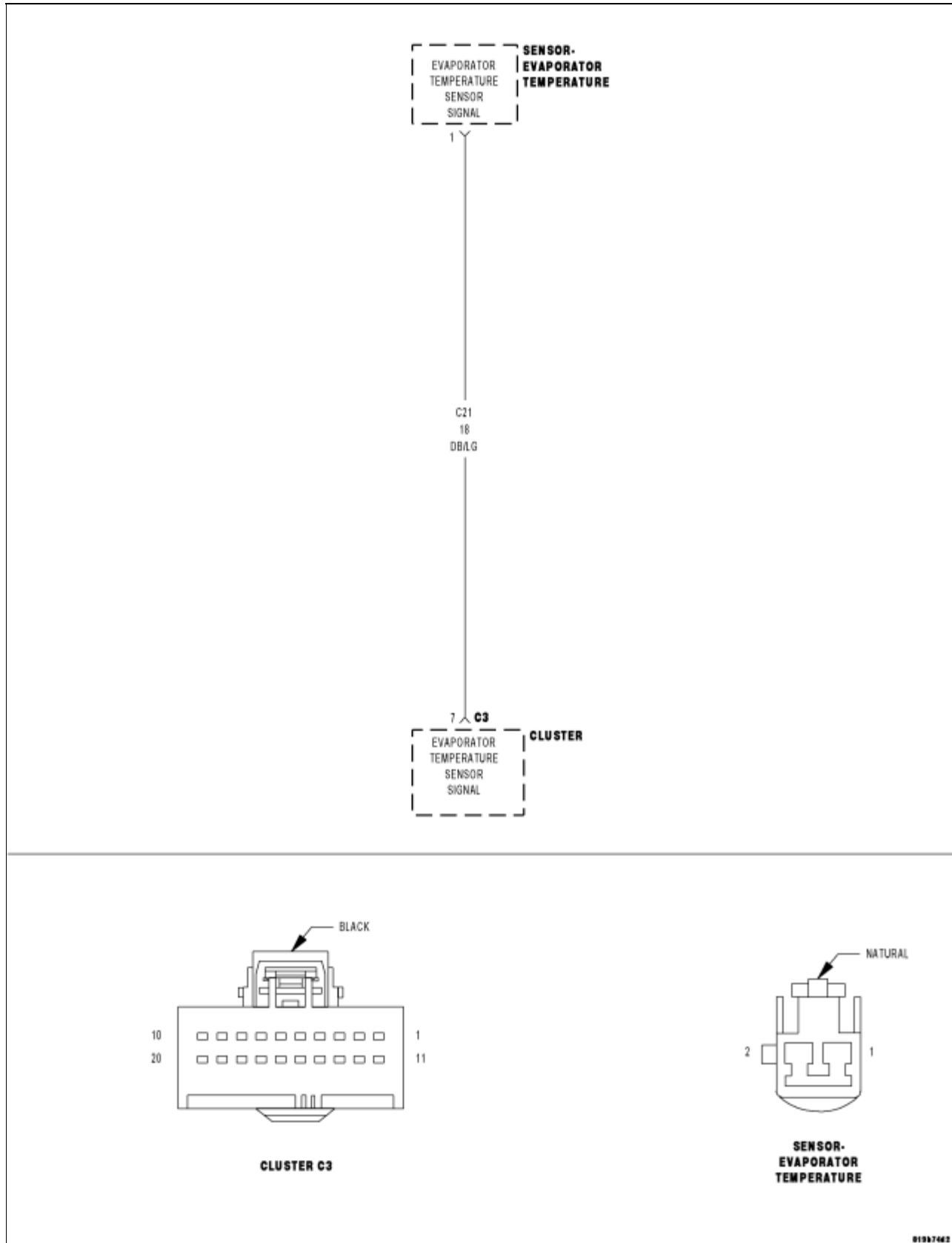
Yes

- Replace the Instrument Cluster (CCN) in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Replace the HVAC control head in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW (CCN)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Evaporator Temperature Sensor input is out of range toward the low voltage threshold.

Possible Causes
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
EVAPORATOR TEMPERATURE SENSOR
INSTRUMENT CLUSTER (CCN)

Diagnostic Test

1. VERIFY B1031–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT LOW IS ACTIVE

Turn the ignition on.

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR DTC WITH THE EVAPORATOR TEMPERATURE SENSOR HARNESS CONNECTOR DISCONNECTED

Turn the ignition off.
 Disconnect the Evaporator Temperature Sensor harness connector.
 Turn the ignition on.
 With the scan tool, erase DTCs.
 Turn the ignition off, wait 10 seconds, and turn the ignition on.
 With the scan tool, read DTCs.

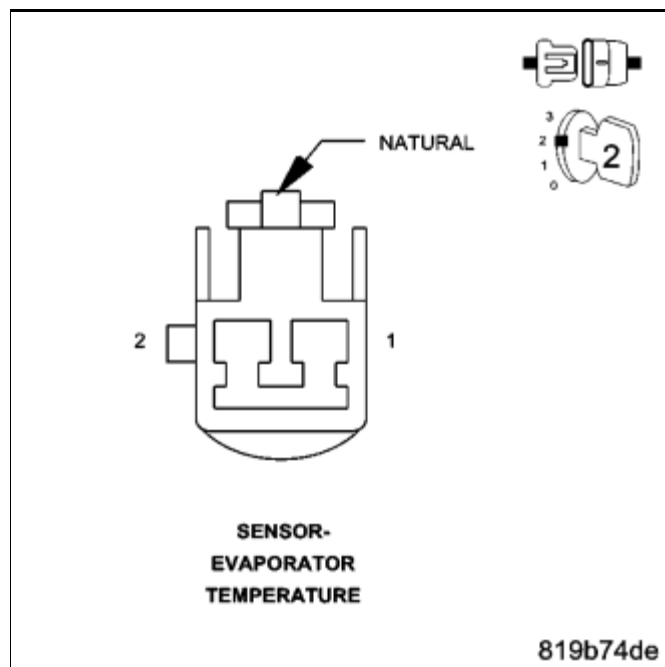
Does the scan tool display this DTC as active?

Yes

- Go To [3](#).

No

- Replace the Evaporator Temperature Sensor in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



3. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.
 Disconnect the Instrument Cluster (CCN) C3 harness connector.
 Measure the resistance between ground and the (C21) Evaporator Temperature Sensor Signal circuit and ground.

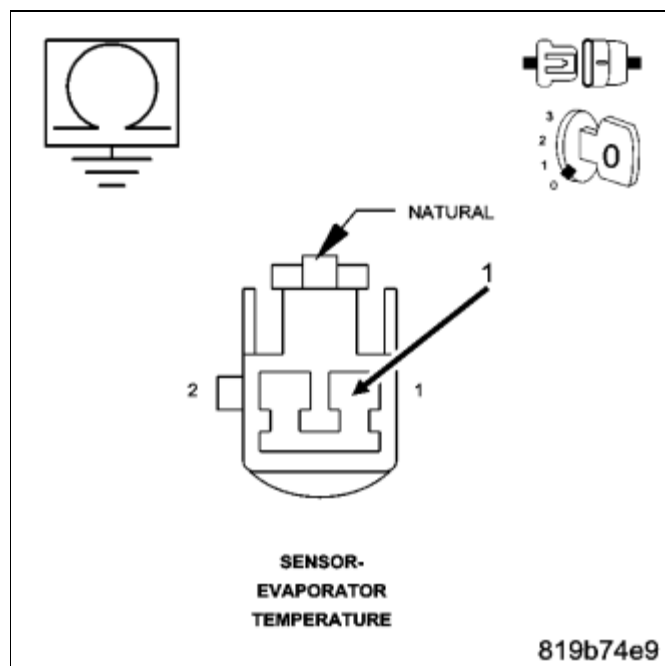
Does the ohm meter read open circuit?

Yes

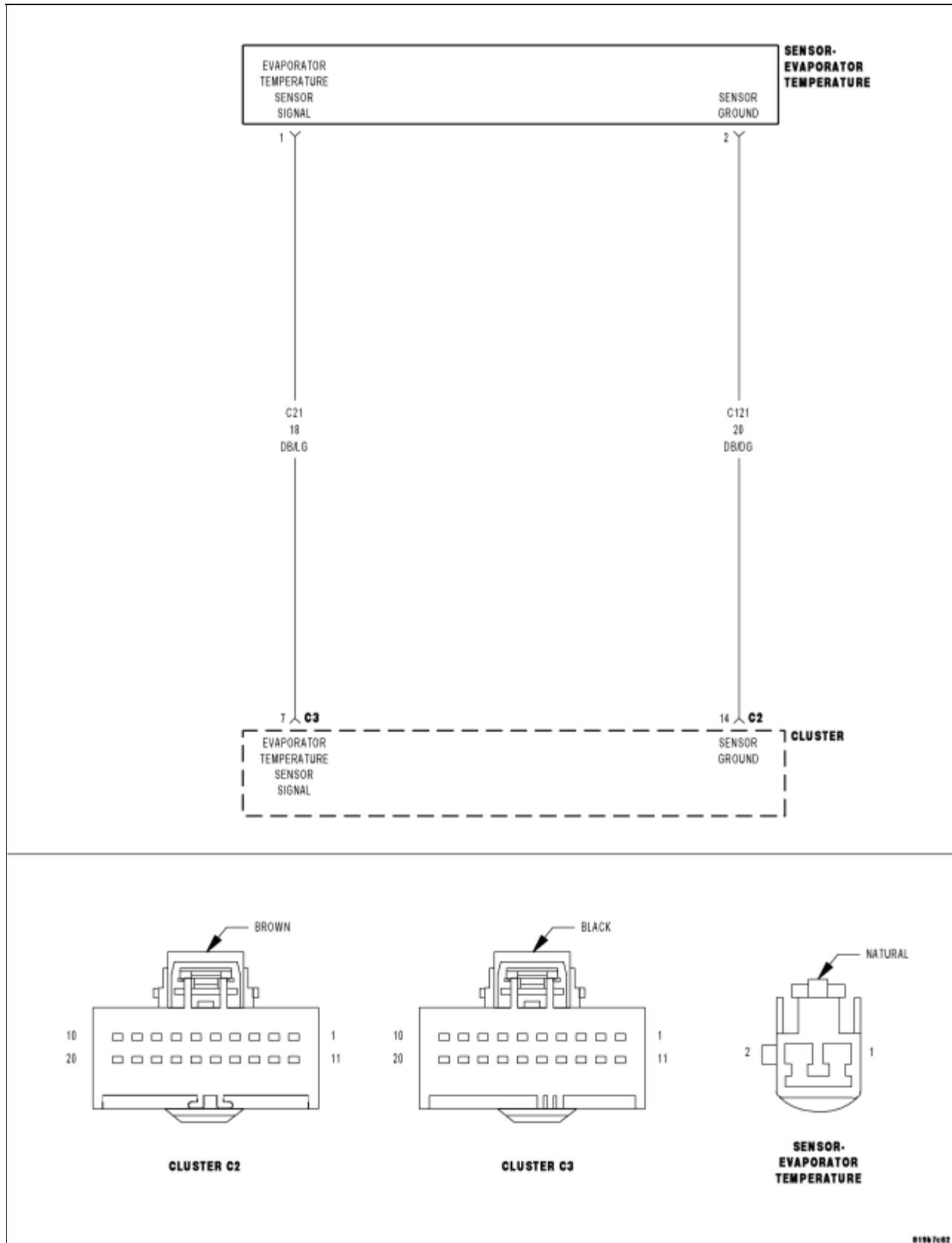
- Replace the Instrument Cluster (CCN) in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to ground.



B1032-EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH (CCN)



For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Evaporator Temperature Sensor input is out of range toward the high voltage threshold.

Possible Causes
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
(C121) SENSOR GROUND CIRCUIT OPEN
EVAPORATOR TEMPERATURE SENSOR
INSTRUMENT CLUSTER (CCN)

Diagnostic Test

1. VERIFY B1032–EVAPORATOR FIN TEMPERATURE SENSOR CIRCUIT HIGH IS ACTIVE

Turn the ignition on.

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

With the scan tool, read DTCs.

Does the scan tool display this DTC as active?

Yes

- Go To [2](#)

No

- Check for an intermittent condition by inspecting the related wiring harness for chafed, pierced, pinched, and partially broken wires. Also, inspect the related connectors for broken, bent, pushed out, spread, corroded, or contaminated terminals. Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

2. CHECK FOR DTC WITH THE EVAPORATOR TEMPERATURE SENSOR HARNESS CONNECTOR DISCONNECTED

Turn the ignition off.
 Disconnect the Evaporator Temperature Sensor harness connector.
 Turn the ignition on.
 With the scan tool, erase DTCs.
 Turn the ignition off, wait 10 seconds, and turn the ignition on.
 With the scan tool, read DTCs.

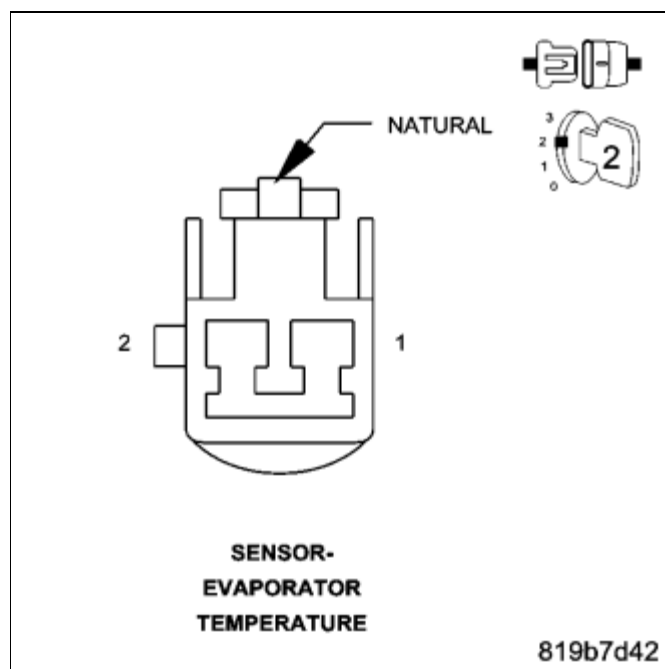
Does the scan tool display this DTC as active?

Yes

- Go To [3](#).

No

- Replace the Evaporator Temperature Sensor in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



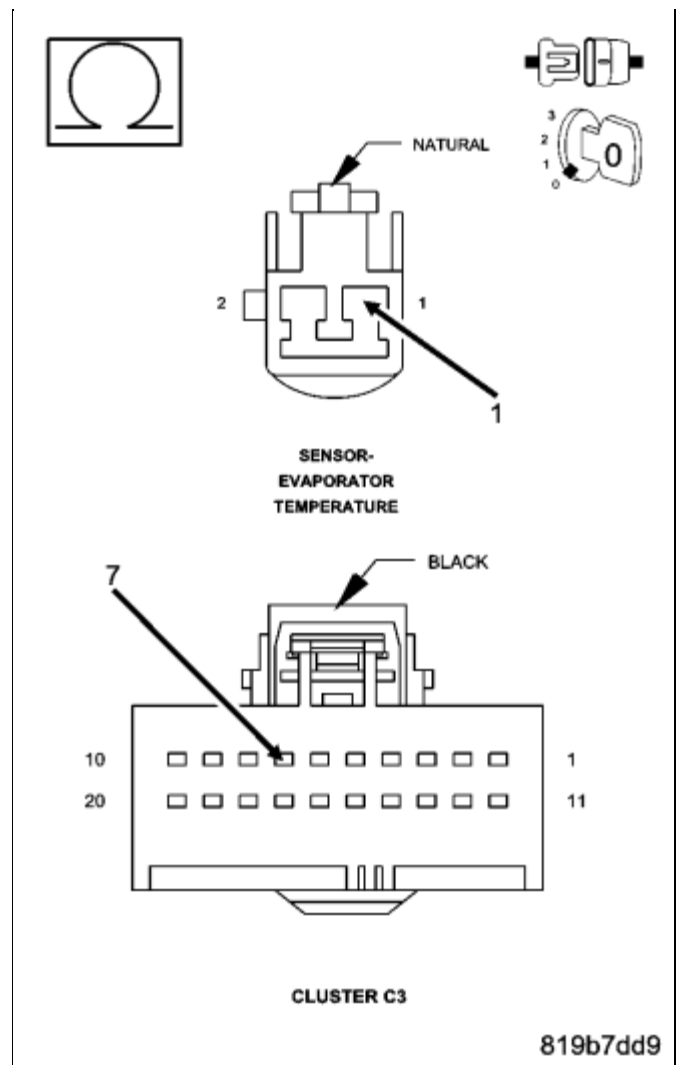
3. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the Instrument Cluster (CCN) C3 harness connector.
 Measure the resistance of the (C21) Evaporator Temperature Sensor Signal circuit between the Instrument Cluster (CCN) C3 harness connector and the Evaporator Temperature Sensor harness connector.

Does the ohm meter read open circuit?

Yes

- Repair the (C21) Evaporator Temperature Sensor Signal circuit for an open.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



No

- Go To [5](#).

4. CHECK (C21) EVAPORATOR TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT TO VOLTAGE

Using a volt meter check for voltage on the (C21) Evaporator Temperature Sensor Signal circuit.

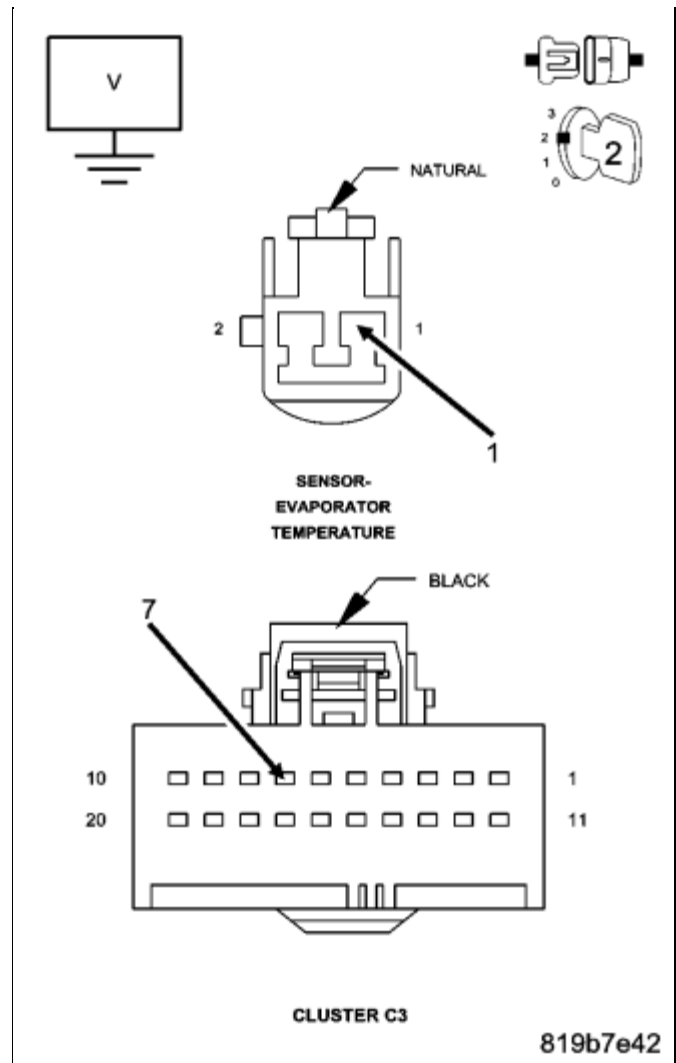
Does the volt meter read any voltage?

Yes

- Repair the (C21) Evaporator Temperature Sensor Signal circuit for a short to voltage.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [5](#).



5. CHECK (C121) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (C121) Sensor Ground circuit between the Instrument Cluster (CCN) C3 harness connector and the Evaporator Temperature Sensor harness connector.

Does the ohm meter read open circuit?

Yes

- Replace the Instrument Cluster (CCN) in accordance with the service information.
- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

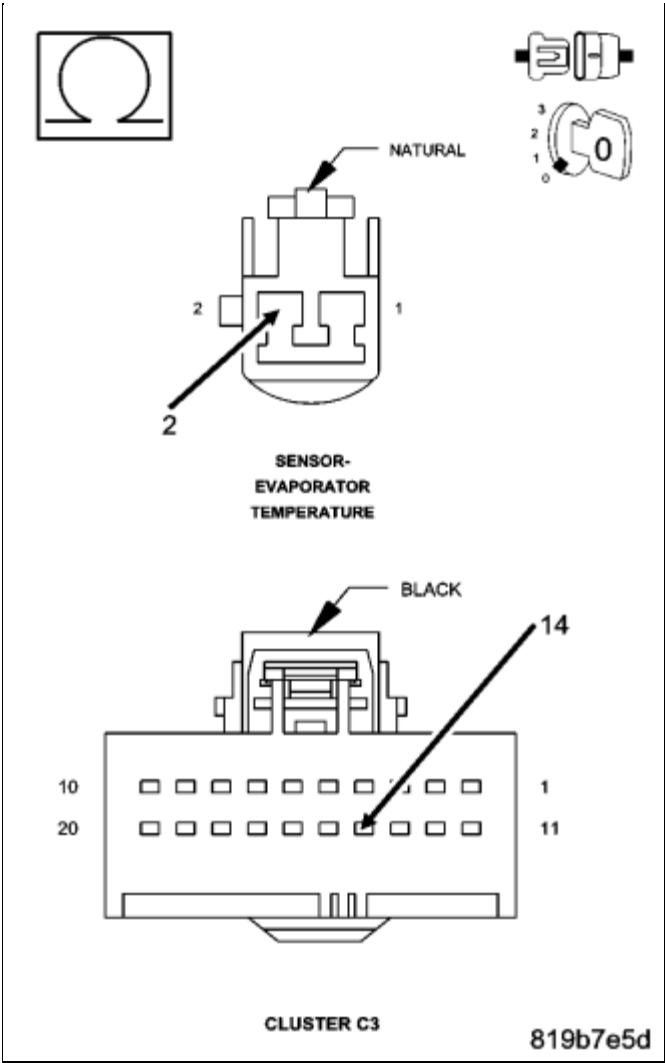
No

- Repair the (C121) Sensor Ground circuit for an open.

- Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

B10C1–A/C SELECT SWITCH STUCK (CCN)

For a complete wiring diagram **Refer to Section 8W.**



- **When Monitored:**

With the ignition on.

- **Set Condition:**

If the Instrument Cluster (CCN) detects that the A/C mode switch stays in a pushed position for more than 5 seconds.

Possible Causes
DTC B1001 OR B1002 ACTIVE IN THE CCN
OBJECT HOLDING A/C MODE SWITCH IN A PUSHED POSITION
SUBSTANCE CAUSING A/C MODE SWITCH TO GET STUCK IN A PUSHED POSITION
A/C HEATER CONTROL

Diagnostic Test

1. CHECK FOR ACTIVE DTC B1001 OR B1002 IN THE CCN

Turn the ignition on.

With the scan tool, read CCN DTCs.

Does the scan tool display active: B1001 or B1002?

Yes

- Diagnose and repair the DTC. Refer to the Table of Contents in this Section.

No

- Go To [2](#)

2. INSPECT THE A/C HEATER CONTROL FOR DAMAGE

Turn the ignition off.

Inspect the A/C Heater Control for damage.

Is the A/C Heater Control damaged?

Yes

- Replace the A/C Heater Control in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [3](#)

3. INSPECT FOR OBJECT OR SUBSTANCE CAUSING THE A/C MODE SWITCH TO STAY OR STICK IN A PUSHED POSITION

Inspect the A/C Heater Control for anything that would cause the A/C mode switch to stay or stick in a pushed position.

Is anything present that would cause the A/C mode switch to stay or stick in a pushed position?

Yes

- Repair as necessary.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Go To [4](#)

4. CHECK THE A/C MODE SWITCH & STATUS INDICATOR FUNCTION

Start the engine.

Turn the blower control on.

Press the A/C mode switch on and off several times while observing the A/C status indicator.

Does the A/C status indicator turn on and off?

Yes

- Go To [5](#)

No

- Replace the A/C Heater Control in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

5. VERIFY THAT DTC B10C1–A/C SELECT SWITCH STUCK IS STILL ACTIVE

Turn the ignition on.

With the scan tool, erase CCN DTCs.

Turn the ignition off, wait 10 seconds, and turn the ignition on.

With the scan tool, read CCN DTCs.

Does the scan tool display active: B10C1–A/C SELECT SWITCH STUCK?

Yes

- Replace the A/C Heater Control in accordance with the service information.
- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

No

- Perform the BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

HVAC - SERVICE INFORMATION

HVAC - SERVICE INFORMATION

DESCRIPTION

A manual temperature control (MTC) single zone type heating-A/C system or a manually controlled heater-only

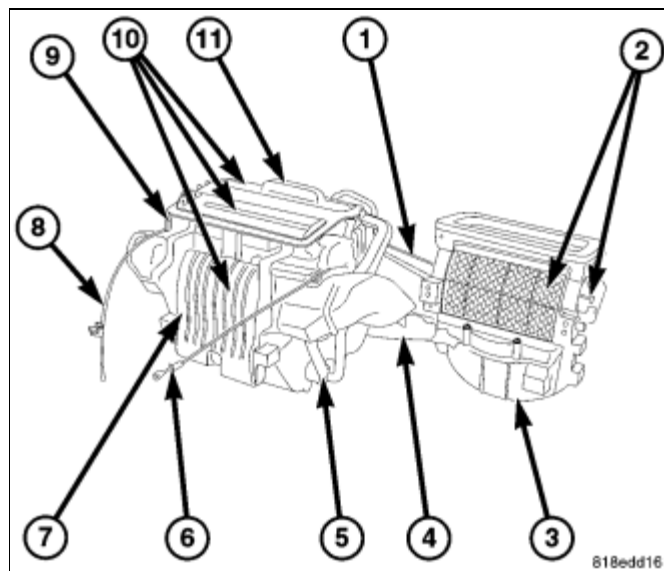
system is standard equipment on this model, depending on market.

To maintain the performance level of the heating, ventilation and air conditioning (HVAC) system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or A/C condenser will reduce the performance of the A/C and engine cooling systems.

The engine cooling system includes the radiator, thermostat, radiator hoses and the engine coolant pump. Refer to 7 - Cooling for more information before opening or attempting any service to the engine cooling system.

All vehicles are equipped with a common heater, ventilation and air conditioning (HVAC) housing (1). The heating-A/C system combines A/C, heating, and ventilating capabilities in a single HVAC housing mounted within the passenger compartment beneath the instrument panel. The HVAC housing includes:

- Recirculation-air door and actuator (2)
- Blower motor (3)
- Blower motor resistor (4)
- Heater core (5)
- Mode control cable (6)
- Blend-air door (7)
- Temperature control cable (8)
- Evaporator temperature sensor (A/C only) (9)
- Mode-air doors (10)
- A/C evaporator (A/C system only) (11)



On heater-only systems, the A/C evaporator is omitted from the HVAC housing and is replaced with an air restrictor plate.

NOTE: An electric positive temperature coefficient (PTC) heater is used on vehicles when equipped with the 2.8L diesel engine. The PTC heater unit compensates for the lower engine coolant temperatures produced by the diesel engine. The PTC heater unit is mounted in the HVAC air distribution housing, downstream of the heater core. For more information, (refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - DESCRIPTION).

Based upon the system mode selected, conditioned air can exit the standard heater-only or optional heater-A/C housing through one or a combination of the three main housing outlets: defrost, panel or floor. The defrost and panel outlets are located on the top of the HVAC air distribution housing and the floor outlets are located on each side of the distribution housing. Once the conditioned air exits the HVAC housing, it is further directed through molded plastic ducts to the various outlets within the vehicle interior. These outlets and their locations are as follows:

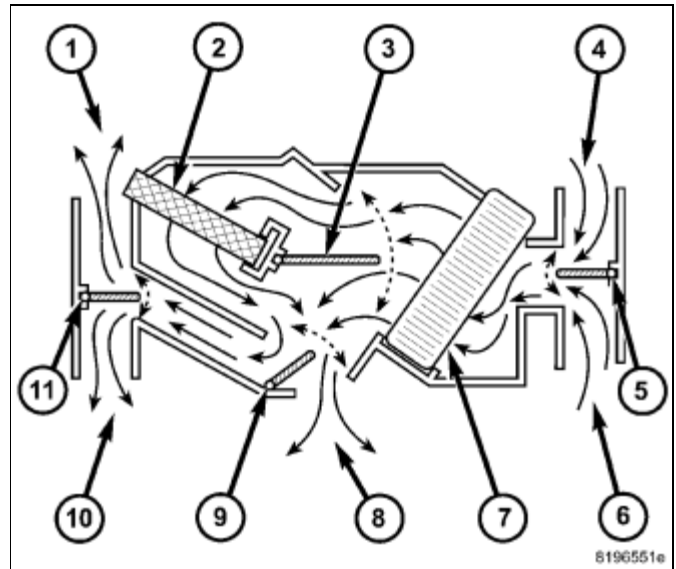
- **Defroster Outlet** - A single large defroster outlet is located in the center of the instrument panel, near the base of the windshield.
- **Side Window Demister Outlets** - There are two side window demister outlets, one is located at each outboard end of the instrument panel top cover, near the belt line at the A-pillars.
- **Panel Outlets** - There are four panel outlets in the instrument panel, one located near each outboard end of the instrument panel facing the rear of the vehicle and two located near the top of the instrument panel center bezel.
- **Front Floor Outlets** - There are two front floor outlets, one located on each side the floor panel center tunnel behind the instrument panel.

OPERATION

Both the manual temperature control (MTC) heating-A/C system and the heater-only system are blend-air type systems. In a blend-air system, a blend-air door controls the amount of conditioned air that is allowed to flow through, or around the heater core. The temperature control determines the discharge air temperature by operating the blend-air door. This design allows almost immediate control of output air temperature.

NOTE: Typical blend-air type HVAC system shown.

The heating-A/C system pulls outside (ambient) air through the fresh air intake (4) located at the cowl panel at the base of the windshield and into the air inlet housing above the heating, ventilation and air conditioning (HVAC) housing and when equipped with A/C, passes through the A/C evaporator (7). Air flow is then directed either through or around the heater core (2). This is done by adjusting the position of the blend-air door (3) with the temperature control located on the A/C-heater control in the instrument panel. Air flow is then directed out the floor outlet (8), instrument panel outlet (10) or the defroster outlet (1) in various combinations by adjusting the position of the mode-air doors (9 and 11) using the mode control located on the A/C-heater control. The temperature and mode control uses cables to operate the air doors.



The velocity of the air flow out of the outlets can be adjusted with the blower speed control located on the A/C-heater control.

NOTE: Recirculation mode will not operate when in the Floor, Mix or Defrost position and the recirculation indicator lamp will not illuminate.

The fresh air intake can be shut off by pressing the Recirculation button on the A/C-heater control when the control is set to Panel mode. This will operate the electrically actuated recirculation-air door (5), which closes off the fresh air intake. With the fresh air intake closed, the conditioned air within the vehicle is pulled back into the HVAC housing through the recirculation air intake (6) located within the passenger compartment.

When equipped with A/C, the A/C compressor can be engaged by pressing the A/C (snowflake) button on the A/C-heater control. It will automatically engage when the mode control is set in any Floor to Defrost position. This will remove heat and humidity from the air before it is directed through or around the heater core. The mode control on the A/C-heater control is used to direct the conditioned air to the selected system outlets.

The defroster outlet receives airflow from the HVAC housing through the molded plastic defroster duct, which is secured to the top of the instrument panel. The airflow from the defroster outlet is directed by fixed vanes in the defroster outlet grille and cannot be adjusted.

The side window demister outlets receive airflow from the HVAC housing through the defroster duct and molded plastic demister ducts. The airflow from the side window demister outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The side window demister outlet grilles are integral to the instrument panel cover and direct air from the HVAC housing through the outlets on the top corners of the instrument panel. The demisters operate when the mode control is set in any Floor to Defrost position.

The panel outlets receive airflow from the HVAC housing through the center air distribution duct and molded plastic panel outlet ducts. The airflow direction from each of the panel outlets can be adjusted by rotating the outlet and/or moving the shutters which are integral to each outlet. Airflow can be turned on or off through each outlet by closing the shutters completely.

The front floor receives airflow from the HVAC housing through molded plastic front floor ducts which are secured to each side of the HVAC air distribution housing. The airflow direction from the floor outlets can not be adjusted.

DIAGNOSIS AND TESTING

A/C PERFORMANCE

The A/C system is designed to provide the passenger compartment with low temperature and low humidity air. The A/C evaporator, located in the HVAC housing is cooled to temperatures near the freezing point. As warm damp air passes over the fins of the A/C evaporator, the air transfers its heat to the refrigerant in the evaporator coils and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an A/C system will be more effective in the Recirculation mode (max-A/C). With the system in the Recirculation mode, only air from the passenger compartment passes through the A/C evaporator. As the passenger compartment air dehumidifies, the A/C system performance levels rise.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the A/C system. When humidity is high, the A/C evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and coils. This reduces the amount of heat the A/C evaporator can absorb from the air. High humidity greatly reduces the ability of the A/C evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their A/C system on humid days. A performance test is the best way to determine whether the system is performing up to design standards. This test also provides valuable clues as to the possible cause of trouble with the A/C system. The ambient air temperature in the location where the vehicle will be tested must be a minimum of 21° C (70° F) for this test.

A/C PERFORMANCE TEST

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

NOTE: The work area ambient temperature must be above 21° C (70° F) and the evaporator temperature must be above 13° C (55° F) prior to conducting the A/C Performance Test.

1. Check for diagnostic trouble codes using a scan tool. If no DTCs are found in the powertrain control module (PCM) or engine control module (ECM) (depending on engine application) or the totally integrated power module (TIPM), go to [STEP 2](#). If any DTCs are found, repair as required, then proceed to [STEP 2](#).
2. Connect a tachometer and a manifold gauge set or an A/C recycling/charging station.
3. Operate the heating-A/C system under the following conditions.
 - Engine at idle and operating temperature
 - Doors or windows open
 - Transmission in Park or Neutral with parking brake set (depending on application)
 - A/C-heater controls set to Recirculation mode (max-A/C), full cool, panel mode, high blower and with A/C compressor engaged. If the A/C compressor does not engage, see the A/C System Diagnosis chart.
4. Insert a thermometer in the driver side center panel air outlet and operate the vehicle a minimum of ten minutes to allow the thermometer temperature to stabilize.
5. With the A/C compressor clutch engaged, compare the air temperature at the center panel outlet and the A/C compressor discharge pressure (high side) to the A/C Performance Temperature and Pressure chart. The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, use the readings obtained before the clutch disengaged.

A/C PERFORMANCE TEMPERATURE AND PRESSURE

Ambient Temperature	21° C (70° F)	27° C (80° F)	32° C (90° F)	38° C (100° F)	43° C (110° F)
Air Temperature at Center Panel Outlet	6 -15° C (42 - 59° F)	7 -18° C (45 - 64° F)	9 - 21° C (48 - 69° F)	11 - 22° C (52 - 72° F)	13 - 24° C (56 - 75° F)
A/C High Side Pressure	1034 - 1896 kPa (150 - 275 psi)	1207 - 2068 kPa (175 - 300 psi)	1379 - 2241 kPa (200 - 325 psi)	1551 - 2413 kPa (225 - 350 psi)	1724 - 2241 kPa (250 - 375 psi)
A/C Low Side Pressure	214 - 365 kPa (31 - 53 psi)	248 - 407 kPa (36 - 59 psi)	283 - 476 kPa (41 - 69 psi)	317 - 483 kPa (46 - 70 psi)	359 - 496 kPa (52 - 72 psi)

6. If the air outlet temperature fails to meet the specifications in the A/C Performance Temperature and Pressure chart, or if the A/C compressor discharge pressure is high, refer to the A/C System Diagnosis chart.

A/C SYSTEM DIAGNOSIS

Condition	Possible Causes	Correction
Rapid A/C compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system as required
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system as required.
	2. Open fuse.	2. Check the fuse in the junction block. Repair the shorted circuit or component and replace the fuse as required.
	3. Inoperative A/C	3. See A/C Compressor Clutch Field Coil in this group. Test the

	compressor clutch field coil.	compressor clutch field coil and replace as required.
	4. Improperly installed or inoperative A/C pressure transducer.	4. See A/C Pressure Transducer in this group. Test the transducer and replace as required.
	5. Improperly installed or inoperative Evaporator Temperature Sensor.	5. See Evaporator Temperature Sensor in this group. Correctly install or test and replace the sensor as required.
	6. Inoperative A/C-heater control, totally integrated power module (TIPM) or PCM/ECM.	6. Refer to the appropriate Electrical Diagnostic Procedures for testing of the A/C-heater control, TIPM or PCM/ECM. Test the module and replace as required.
Normal refrigerant pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level as required.
	2. Temperature control cable improperly installed or inoperative.	2. See Temperature Control Cable this group. Inspect the cable for proper operation. Replace the cable as required.
	3. Blend door inoperative or sealing improperly.	3. See HVAC Housing in this group. Inspect the blend door for proper operation and sealing. Repair as required.
	4. Blend door not in full cold position.	4. See Temperature Control Cable this group. Inspect the cable for proper operation. Replace the cable as required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system as required.
	2. Refrigerant flow through the A/C evaporator is restricted.	2. See A/C Evaporator in this group. Replace the restricted A/C evaporator as required.
	3. Inoperative A/C compressor.	3. See A/C Compressor in this group. Replace the compressor as required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. A/C condenser air flow restricted.	1. Check the A/C condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Clean, repair, or replace components as required.
	2. Refrigerant flow through the receiver/drier is restricted.	2. See Receiver/drier in this group. Replace the restricted receiver/drier as required.

	3. Inoperative radiator cooling fan.	3. Test the radiator cooling fan and replace as required. Refer to Group 7.
	4. Refrigerant system overcharged.	4. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level as required.
	5. Air in the refrigerant system.	5. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system as required.
	6. Engine overheating.	6. Test the engine cooling system and repair as required. Refer to Group 7.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping.	1. Inspect the accessory drive belt condition and tension. Replace the accessory drive belt or tensioner as required. Refer to Group 7.
	2. Inoperative A/C expansion valve.	2. See A/C Expansion Valve in this group. Replace the valve as required.
	3. Inoperative A/C compressor.	3. See A/C Compressor in this group. Replace the compressor as required.
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines.	1. See Liquid Line, Suction Line and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line as required.
	2. Restricted refrigerant flow through the A/C expansion valve.	2. See A/C Expansion Valve in this group. Replace the valve as required.
	3. Restricted refrigerant flow through the A/C condenser.	3. See A/C Condenser in this group. Replace the restricted condenser as required.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling for the procedures to check the engine coolant level and flow, engine coolant reserve/recovery system operation, accessory drive belt condition and tension, radiator air flow and the fan drive operation.

WARNING: Do not remove radiator cap when engine is hot, personal injury can result.

If vehicle has been run recently, wait 15 minutes before removing the radiator cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system pressure

stabilizes, remove the cap completely.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to and from the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control to the full hot position, the mode control to the floor position, and the blower motor control to the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the front floor outlets. Compare the test thermometer reading to the Heater Temperature Reference chart.

HEATER TEMPERATURE REFERENCE

Ambient Temperature		Minimum Floor Outlet Temperature	
Celsius	Fahrenheit	Celsius	Fahrenheit
16°	60°	54°	130°
21°	70°	56°	132°
27°	80°	57°	134°
32°	90°	58°	136°

If the heater outlet air temperature is below the minimum specification, refer to Group 7 - Cooling. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling for more information.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow are as follows:

- Low coolant level
- Inoperative water pump
- Inoperative thermostat
- Pinched or kinked heater hoses
- Improper heater hose routing
- Plugged heater hoses or supply and return ports at the cooling system connections
- Plugged heater core

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible causes of insufficient heat due to mechanical problems are as follows:

- Obstructed cowl air intake
- Obstructed heater system outlets
- Inoperative engine thermostat
- Inoperative blower motor system
- Inoperative A/C-heater control
- Inoperative temperature control cable
- Inoperative, obstructed or improperly installed blend-air door

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control on the A/C-heater control, the following could require service:

- Inoperative A/C-heater control
- Inoperative temperature control cable
- Inoperative, obstructed or improperly installed blend-air door
- Improper engine coolant temperature

SPECIFICATIONS

A/C SYSTEM

Item	Description	Notes
A/C Compressor	Zexel DKS-17DS	VC-46 PAG oil
Freeze-up Control	Evaporator Temperature Sensor	HVAC housing mounted - input to powertrain control module (PCM) or engine control module (ECM), depending on engine application
Low PSI Control	A/C Pressure Transducer	A/C discharge line mounted - input to powertrain control module (PCM) or engine control module (ECM), depending on engine application - PCM/ECM disengages compressor clutch below 0.451 volts
High PSI Control	A/C Pressure Transducer	A/C discharge line mounted - input to powertrain control module (PCM) or engine control module (ECM), depending on engine application - PCM/ECM disengages compressor clutch above 4.519 volts
	High Pressure Relief Valve	A/C Compressor mounted - opens at a discharge pressure over 3430 - 3930 kPa (497 - 570 psi)
R-134a Refrigerant Charge Capacity	0.51 kg (1.125 lbs).	Also see A/C Underhood Specification Label located in the engine compartment

A/C Clutch Coil Draw	3.3 amps	@ 12V $\pm$ 0.5V @ 25° C (77° F)
A/C Clutch Coil Resistance	4.2 $\pm$ 0.2 ohms	When measured across coil lead connector @ 25° C (77° F)
A/C Clutch Air Gap	0.30 - 0.60 mm (0.012 - 0.024 in.)	

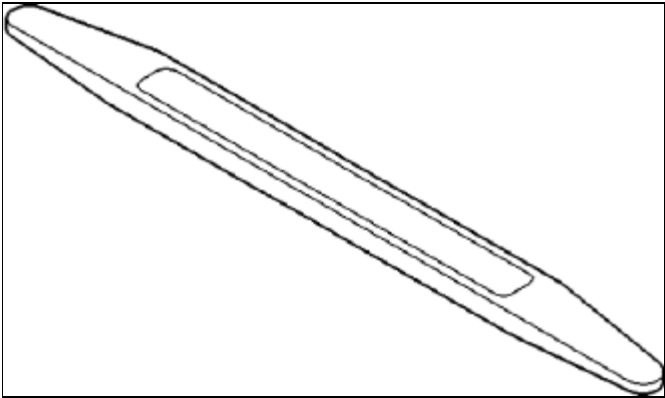
TORQUE

Description	N·m	Ft. Lbs.	In. Lbs.
All Screws NOT Listed Below	1.2	–	10
A/C Compressor Bolts	28	21	–
A/C Compressor Clutch Field Coil Screws	5	–	44
A/C Compressor Shaft Bolt	20	–	177
A/C Compressor Field Coil Connector Bracket Screw	4.3	–	38
A/C Condenser to Radiator Bolts	5	–	45
A/C Heater Control Screws	2	–	17
Air Inlet Housing to Instrument Panel Support Bolts	4	–	35
Blend Door Lever Screw	0.6	–	5
Discharge Line to Condenser Nut	23	17	–
Discharge Line to Compressor Nut	23	17	–
Expansion Valve Bolts	11	–	97
HVAC Housing to Instrument Panel Support Bolts	4	–	35
Liquid Line to Condenser Nut	23	17	–
Mode Door Cam Screw	0.6	–	5
Receiver/Drier to Condenser Bolt	22	16	–
Suction Line to Compressor Nut	23	17	–

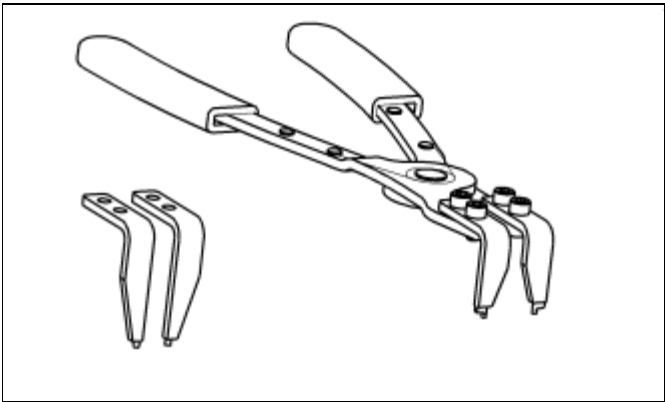
Suction and Liquid Lines to Expansion Valve Nut	8	–	70
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SPECIAL TOOLS

A/C SYSTEM



Trim Stick C-4755



Snap Ring Pliers 9764

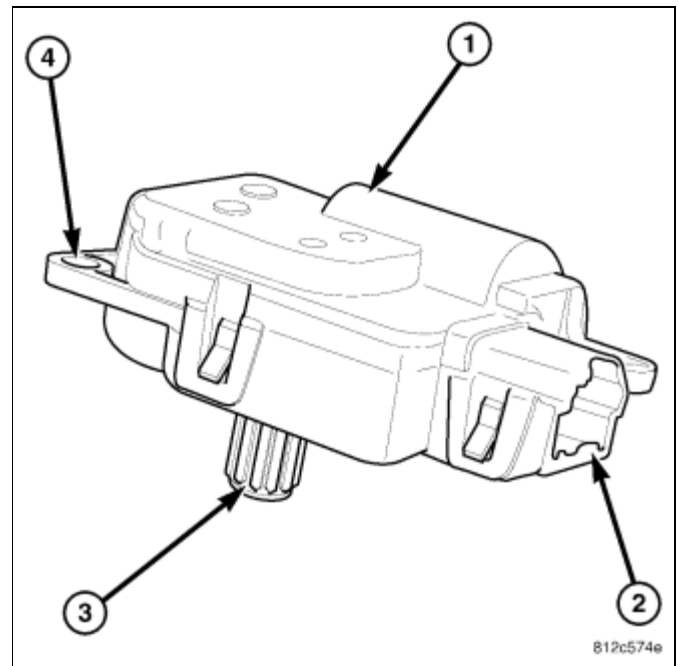
CONTROLS

ACTUATOR-RECIRCULATION DOOR

DESCRIPTION

The recirculation door actuator (1) is a reversible, 12 volt direct current (DC) servo motor, which is connected directly to the pivot shaft lever of the recirculation-air door. The recirculation door actuator is located on the right side of the HVAC air inlet housing.

The recirculation door actuator is contained within a black molded plastic housing with an integral wire connector receptacle (2), an output shaft with splines (3) that connect it to the recirculation door and three integral mounting tabs (4) that allow the actuator to be secured to the air inlet housing. The recirculation door actuator does not require mechanical indexing to the recirculation-air door, as it is electronically calibrated by the A/C-heater control.



OPERATION

The recirculation door actuator is connected to the A/C-heater control through the vehicle electrical system by a dedicated two-wire lead and connector of the instrument panel wire harness. The recirculation door actuator can move the recirculation-air door in two directions. When the A/C-heater control pulls the voltage on one side of the motor connection high and the other connection low, the recirculation-air door will move in one direction. When the A/C-heater control reverses the polarity of the voltage to the motor, the recirculation-air door moves in the opposite direction. Once the A/C-heater control makes the voltage to both connections high or both connections low, the recirculation-air door stops and will not move.

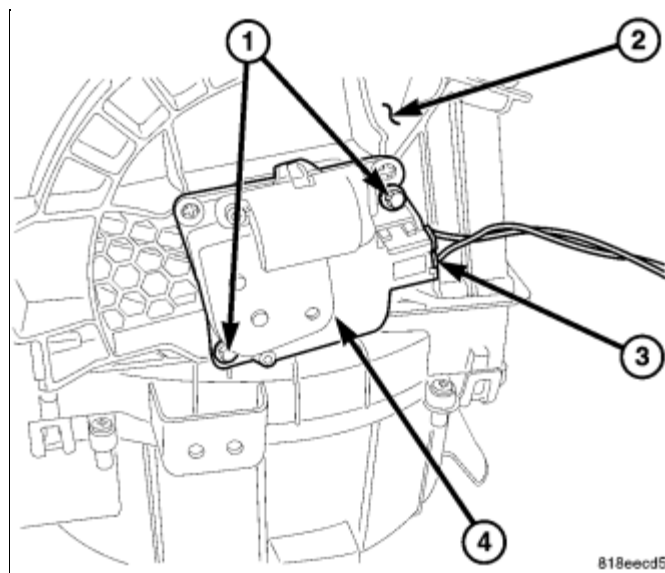
The recirculation door actuator cannot be adjusted or repaired and it must be replaced if inoperative or damaged.

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Illustration shown with instrument panel removed for clarity.

1. Disconnect and isolate the negative battery cable.
2. Remove the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
3. Remove the speaker from the passenger side of the instrument panel (refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).
4. Reach through glove box opening in the instrument panel

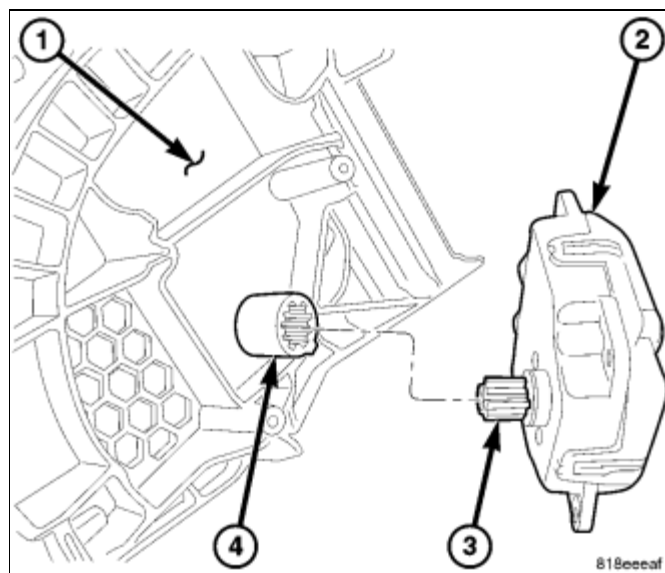


and remove the screws (1) that secure the recirculation door actuator (4) to the right side of the HVAC air inlet housing (2).

5. Remove the recirculation door actuator from the air inlet housing and disconnect the wire harness connector (3) from the actuator.
6. Remove the recirculation door actuator from the vehicle.

INSTALLATION

1. Position the recirculation door actuator (2) to the right side of the HVAC air inlet housing (1) and connect the instrument panel wire harness connector to the actuator.
2. Install the recirculation door actuator onto the air inlet housing. If necessary, rotate the actuator slightly to align the splines on the actuator output shaft (3) with those on the recirculation door pivot shaft adapter (4).



3. Install the two screws (1) that secure the recirculation door actuator (4) to the air inlet housing (2). Tighten the screws to 1.2 N·m (10 in. lbs.).
4. Verify the instrument panel wire harness connector (3) is securely attached to the recirculation door actuator.
5. Install the speaker to the passenger side of the instrument panel (refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).
6. Install the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

7. Reconnect the negative battery cable.

CABLE-MODE DOOR

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Whenever the mode control cable is removed from the HVAC housing, a new cable must be installed. Failure to replace the mode control cable when required can result in operating modes not being properly obtained.

NOTE: Illustration shown with instrument panel removed for clarity.

NOTE: LHD model shown. RHD model similar.

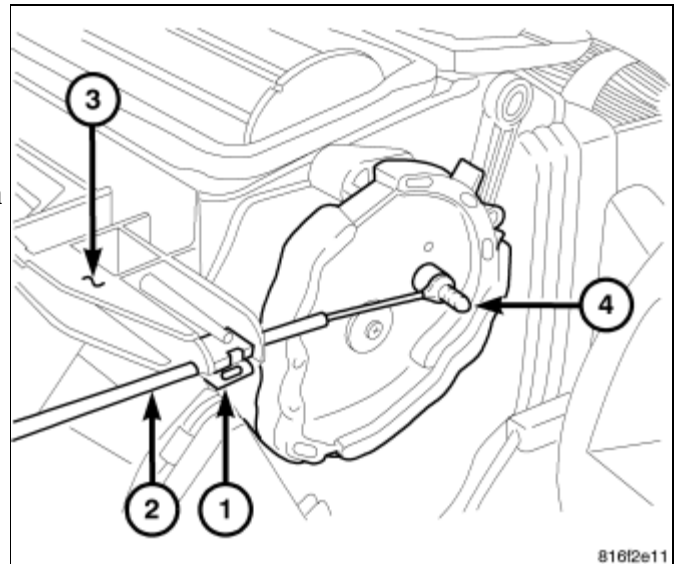
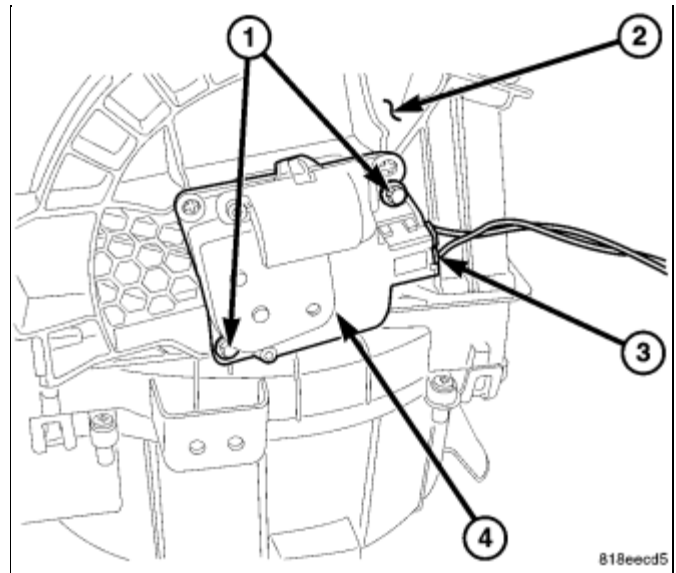
1. Disconnect and isolate the negative battery cable.

NOTE: To aid in reinstallation, note the installed position of the mode control cable to the A/C-heater control prior to removal of the cable.

2. Remove the instrument panel center bezel and disconnect the mode control cable from the A/C-heater control (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - REMOVAL).

3. On LHD models, remove the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

4. Disengage the metal retaining clip (1) that secures the mode control cable (2) from the right side of the HVAC air distribution housing (3).



NOTE: To aid in reinstallation, note the position of the mode control cable as it passes through the

instrument panel support prior to removal of the cable.

5. Disconnect the mode control cable from the mode door cam (4) and discard the cable and retaining clip.

INSTALLATION

NOTE: Whenever the mode control cable is removed from the HVAC housing, a new cable must be installed. Failure to replace the mode control cable when required can result in operating modes not properly obtained.

NOTE: Illustration shown with instrument panel removed for clarity.

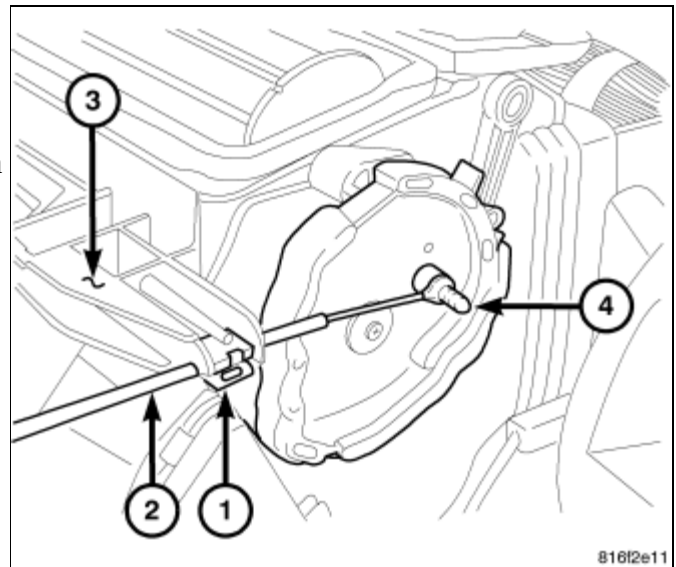
NOTE: LHD model shown. RHD model similar.

1. Position a new mode control cable (2) to the right side of the HVAC air distribution housing (3) through the opening in the instrument panel support.
2. Connect the mode control cable to the mode door cam (4).

3. Engage the metal retaining clip (1) to the right side of the HVAC air distribution housing. Make sure the retaining clip is fully engaged to the housing.

4. Connect the mode door control cable to the A/C-heater control and install the instrument panel center bezel (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - INSTALLATION).

5. Visually verify the mode door cam moves from the full defrost position to the full panel position and then back to the full defrost position using the mode control knob on the A/C-heater control. If OK, go to step 10. If not OK, proceed to step 6.



NOTE: Failure to adjust the mode control cable when required can result in operating modes not properly obtained.

6. Disengage the mode control cable from the metal retaining clip located on the right side of the HVAC housing.

7. Turn the mode control knob on the A/C-heater control to the full defrost position.

8. Reach behind the instrument panel and turn the mode door cam clockwise until it stops in the full defrost position and engage the mode control cable to the metal retaining clip. Make sure the cam is in the full defrost position and that the cable is fully engaged to the retaining clip.

9. Verify the mode door cam moves from the full defrost position to the full panel position and then back to the full defrost position as selected with the mode control knob on the A/C-heater control. If not, repeat steps 6 thru 9.

10. On LHD models, install the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

11. Reconnect the negative battery cable.

CABLE-TEMPERATURE CONTROL

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Whenever the temperature control cable is removed from the HVAC housing, a new cable must be installed. Failure to replace the temperature control cable when required can result in selected temperatures not properly obtained.

NOTE: Illustration shown with instrument panel removed for clarity.

NOTE: LHD model shown. RHD model similar.

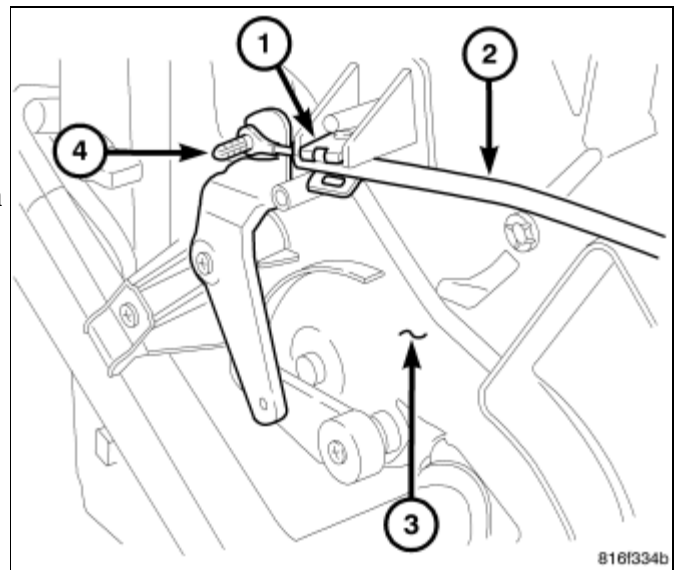
1. Disconnect and isolate the negative battery cable.

NOTE: To aid in reinstallation, note the installed position of the temperature control cable to the A/C-heater control prior to removal of the cable.

2. Remove the instrument panel center bezel and disconnect the temperature control cable from the A/C-heater control (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - REMOVAL).

3. On RHD models, remove the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

4. Disengage the metal retaining clip (1) that secures the temperature control cable (2) from the left side of the HVAC air distribution housing (3).



NOTE: To aid in reinstallation, note the position of the temperature control cable as it passes through the instrument panel support prior to removal of the cable.

5. Disconnect the temperature control cable from the blend door pivot lever (4) and discard the cable and retaining clip.

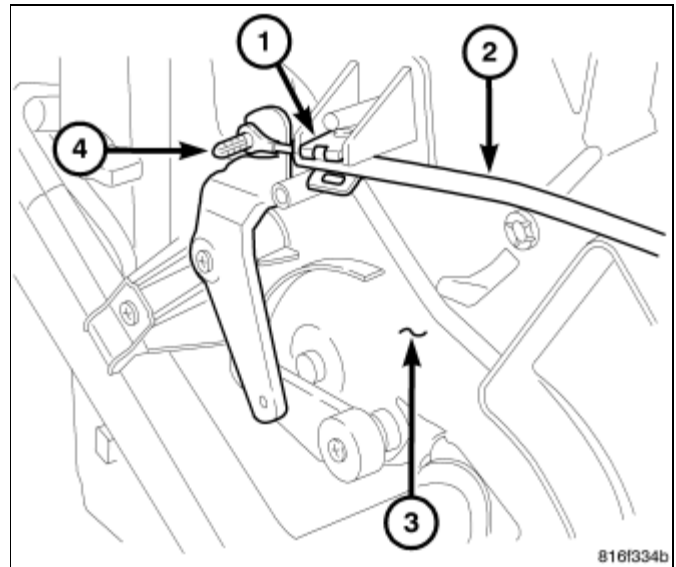
INSTALLATION

NOTE: Whenever the temperature control cable is removed from the HVAC housing, a new cable must be installed. Failure to replace the temperature control cable when required can result in selected temperatures not properly obtained.

NOTE: Illustration shown with instrument panel removed for clarity.

NOTE: LHD model shown. RHD model similar.

1. Position a new temperature control cable (2) to the left side of the HVAC air distribution housing (3) through the opening in the instrument panel support.
2. Connect the temperature control cable to the blend door pivot lever (4).
3. Engage the metal retaining clip (1) to the left side of the air distribution housing. Make sure the retaining clip is fully engaged to the housing.
4. Connect the temperature door control cable to the A/C-heater control and install the instrument panel center bezel (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - INSTALLATION).
5. Visually verify that the blend door pivot lever moves from the full hot position to the full cold position and then back to the full hot position using the temperature control knob on the A/C-heater control. If OK, go to step 10. If not OK, proceed to step 6.



NOTE: Failure to adjust the temperature control cable can result in full heating or cooling capabilities not properly obtained.

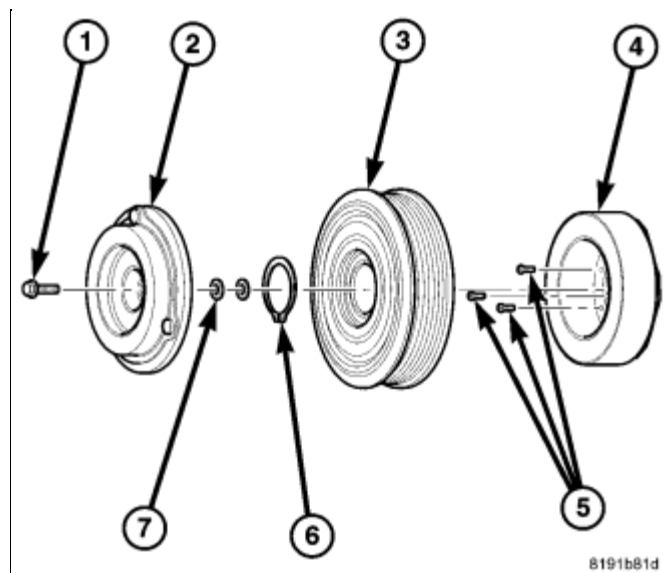
6. Disengage the temperature control cable from the metal retaining clip located on the left side of the HVAC housing.
7. Turn the temperature control knob on the A/C-heater control to the full hot position.
8. Reach behind the instrument panel and move the blend door pivot lever forward until it stops in the full hot position and engage the temperature control cable to the metal retaining clip. Make sure the lever is in the full hot position and that the cable is fully engaged to the retaining clip.
9. Verify that the blend door pivot lever moves from the full hot position to the full cold position and then back to the full hot position, as selected with the temperature control knob on the A/C-heater control. If not, repeat steps 6 thru 9.
10. On RHD models, install the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
11. Reconnect the negative battery cable.

CLUTCH-A/C COMPRESSOR

DESCRIPTION

The A/C compressor clutch assembly consists of a stationary electromagnetic field coil (4), bearing and pulley assembly (3), shims (7) and a clutch plate (2) that is splined to the compressor shaft and secured by a bolt (1). These components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt.

The A/C clutch field coil is retained to the front of the



compressor with three screws (5) and the A/C clutch bearing and pulley assembly is retained by a snap ring (6).

OPERATION

The A/C compressor clutch components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt. When the electromagnetic A/C clutch field coil is energized, it magnetically draws the clutch plate into contact with the clutch pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley assembly.

A/C compressor clutch engagement is controlled by the powertrain control module (PCM) in the engine compartment.

The A/C compressor clutch components cannot be repaired and must be replaced if found inoperative or damaged.

DIAGNOSIS AND TESTING

A/C COMPRESSOR CLUTCH COIL

The A/C compressor clutch coil electrical circuit is controlled by the powertrain control module (PCM) through the A/C clutch relay. The A/C clutch coil can be tested by either measuring clutch field coil resistance or by measuring current draw. Begin testing of a suspected compressor clutch coil problem by performing the preliminary checks.

PRELIMINARY CHECKS

1. If the A/C compressor clutch will not engage, refer to 24 - HVAC Electrical Diagnostics to perform the A/C System Performance Test, which is found within the HVAC System Test. If no diagnostic trouble codes (DTCs) are found in the A/C-heater control or the PCM, go to [STEP 2](#). If any DTCs are found, repair as required.
2. If the A/C compressor clutch still will not engage, verify the refrigerant charge level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS). If the refrigerant charge level is OK, go to [COIL RESISTANCE TEST](#) and/or [COIL CURRENT DRAW TEST](#). If the refrigerant charge level is not OK, adjust the refrigerant charge as required.

COIL RESISTANCE TEST

1. Disconnect and isolate the negative battery cable.

2. Disconnect the wire harness connector from the A/C clutch field coil connector.
3. Use an ohmmeter and measure the resistance of the clutch field coil at the field coil connector terminals.
4. Refer to the A/C Clutch Field Coil Specifications chart for the acceptable A/C clutch coil resistance. Specifications apply for a work area temperature of 25° C (77° F).
 - a. If the A/C clutch coil reading is below specifications, the coil is shorted and must be replaced.
 - b. If the A/C clutch coil reading is above specifications, the coil is open and must be replaced.

COIL CURRENT DRAW TEST

1. Verify the battery state of charge (refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - DIAGNOSIS AND TESTING).
2. Connect an ammeter (0 to 10 ampere scale selected) in series with the clutch field coil feed terminal. Connect a voltmeter (0 to 20 volt scale selected) to measure voltage across the battery and the clutch coil.
3. With the A/C-heater control in the A/C mode and the blower motor at low speed, start the engine and allow it to run at a normal idle speed.
4. The A/C clutch should engage immediately, and the clutch field coil supply voltage should be within two volts of the battery voltage. If the field coil supply voltage is OK, go to [STEP 5](#). If the field coil supply voltage is not within two volts of battery voltage, test the clutch field coil feed circuit for excessive voltage drop and repair as necessary.
5. Refer to the A/C Clutch Field Coil Specifications chart for the acceptable A/C clutch field coil current draw. Specifications apply for a work area temperature of 25° C (77° F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.
 - a. If the A/C clutch field coil current reading is zero, the coil is open and must be replaced.
 - b. If the A/C clutch field coil current reading is above specifications, the coil is shorted and must be replaced.

A/C CLUTCH FIELD COIL SPECIFICATIONS

A/C Compressor	Current Draw	Coil Resistance
Zexel DKS-17DS	3.3 amps @ 11.5 - 12.5 volts	4.2 ± 0.2 ohms

STANDARD PROCEDURE

A/C CLUTCH PLATE INSPECTION

NOTE: The A/C clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley and bearing assembly, or coil replacement.

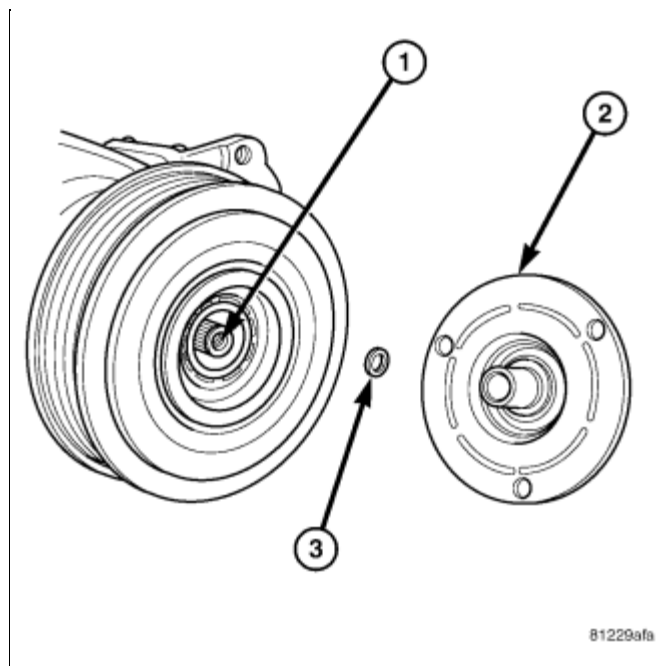
Examine the friction surfaces of the pulley and the clutch plate (2) for wear. The pulley and clutch plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the A/C compressor (1) for refrigerant oil. If refrigerant oil is found, the compressor shaft seal is leaking and the A/C compressor must be replaced.

Check the pulley bearing for roughness or excessive leakage of grease. Replace the pulley and bearing assembly, if required.

A/C CLUTCH BREAK-IN

After a new A/C compressor clutch has been installed, cycle the compressor clutch approximately 20 times (5 seconds on, then 5 seconds off). During this procedure, set the A/C-heater controls to the A/C Recirculation Mode, the blower motor in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

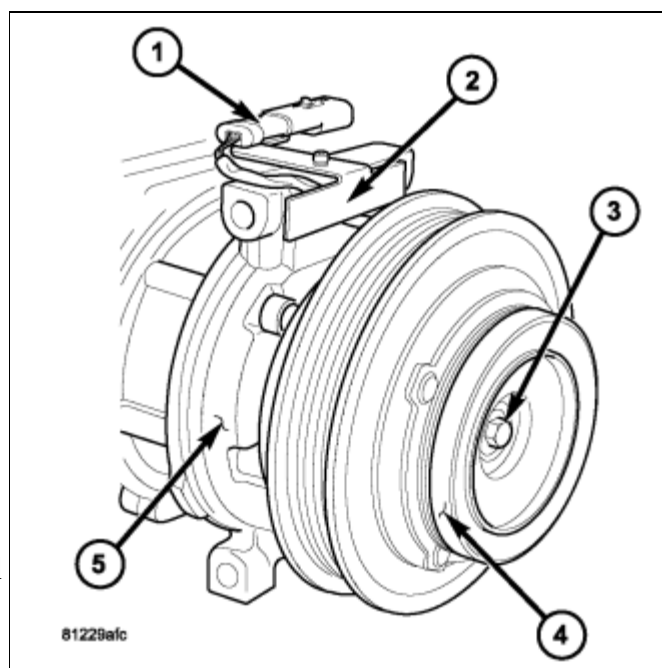


REMOVAL

NOTE: The compressor clutch assembly can be serviced with the refrigerant system fully-charged.

NOTE: Typical A/C compressor and clutch assembly shown in illustrations.

1. Disconnect and isolate the negative battery cable.
2. On 2.8L equipped models, remove the air cleaner housing (refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - REMOVAL).
3. On 3.8L equipped models, remove the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).
4. Remove the accessory drive belt (refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - REMOVAL).
5. Disconnect the engine wire harness from the compressor clutch field coil connector (1) located on the top of the A/C compressor (5).
6. Remove the screw that secures the connector bracket (2) to the A/C compressor and position the bracket and wire lead out of the way.



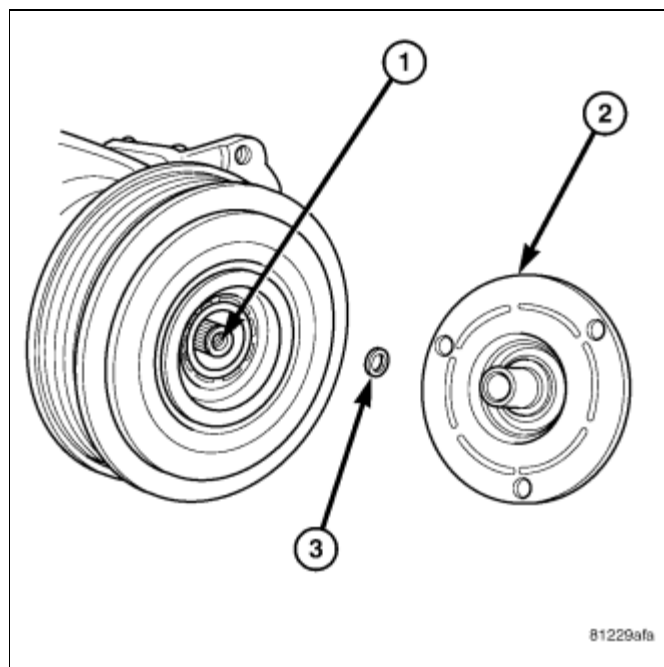
NOTE: A band-type oil filter wrench or a strap wrench may be used to hold the clutch plate from turning during compressor shaft bolt removal.

7. Hold the clutch plate (4) from turning and remove the compressor shaft bolt (3).

CAUTION: Do not pry between the clutch plate and the pulley and bearing assembly to remove the clutch plate from the compressor shaft as this may damage the clutch plate.

NOTE: Use care not to lose any clutch shim(s) during removal of the clutch plate, as they may be reused during the clutch plate installation process.

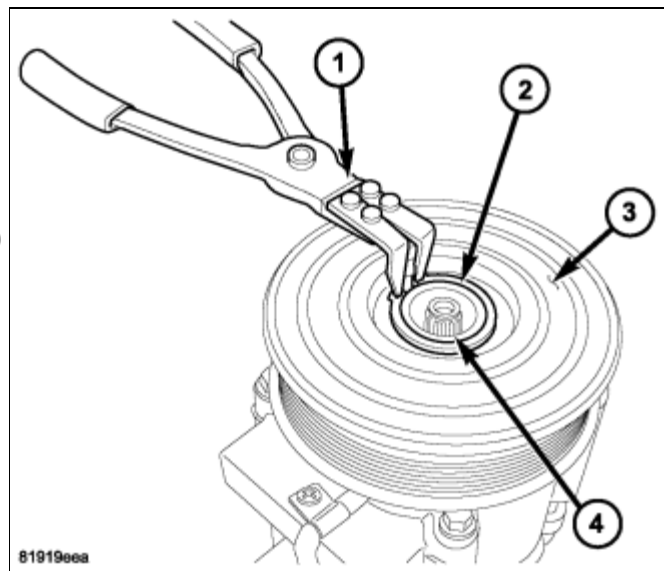
8. Tap the clutch plate (2) lightly with a plastic mallet to release it from the splines on the compressor shaft (1) and remove the clutch plate and shim(s) (3).



NOTE: The pulley and bearing assembly can be removed from the compressor by hand or, if required, with a two jaw puller.

9. Using Snap Ring Pliers 9764 or equivalent (1), remove the snap ring (2) that secures the pulley and bearing assembly (3) to the front of the A/C compressor (4).

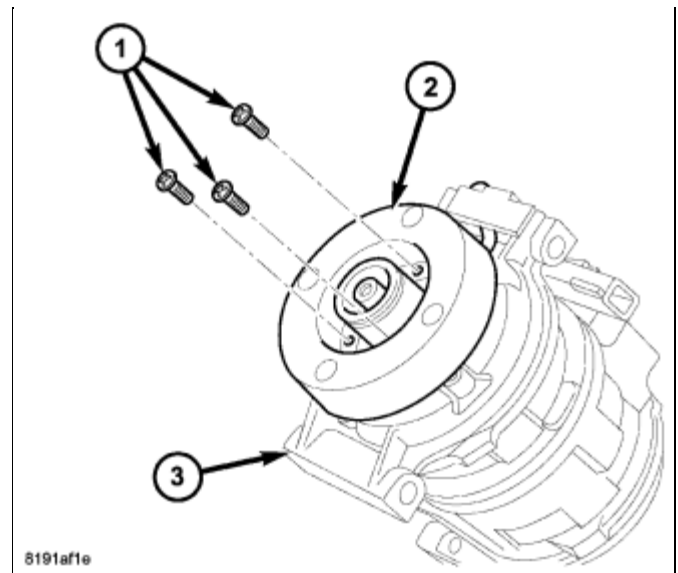
10. Remove the pulley and bearing assembly from the front of the A/C compressor. If required, install a two jaw puller and turn the puller center-bolt clockwise until the pulley and bearing assembly is completely removed.



11. Remove the three screws (1) that secure the compressor clutch field coil (2) to the front of the A/C compressor (3) and remove the field coil.

INSTALLATION

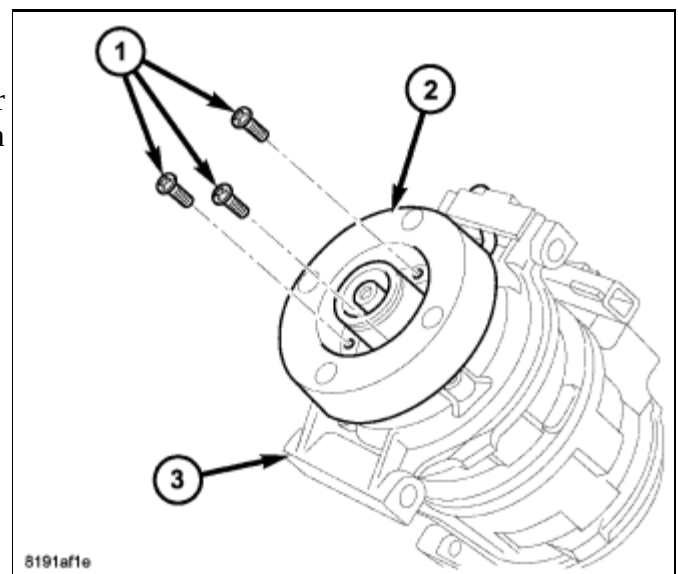
NOTE: Typical A/C compressor and clutch assembly shown in illustrations.



1. Align the dowel pin on the back of the compressor clutch field coil (2) with the hole in the front of the A/C compressor (3) and position the field coil onto the compressor. Be certain that the compressor clutch field coil wire lead is properly routed so that it is not pinched between the A/C compressor and the field coil.

CAUTION: The field coil retaining screws must be securely installed or they may vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.

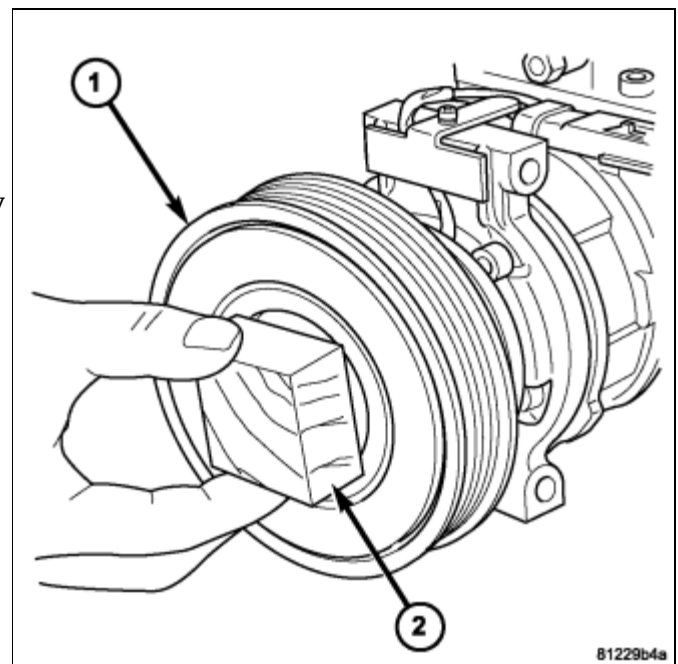
2. Install the three screws (1) that secure the compressor clutch field coil to the front of the A/C compressor. Tighten the screws to 5 N·m (44 in. lbs.).



CAUTION: Be certain to position the compressor clutch field coil wire lead so that it is not damaged during A/C compressor pulley and bearing installation.

CAUTION: When installing the pulley and bearing assembly, DO NOT mar the friction surfaces of the pulley or premature failure of the clutch will result.

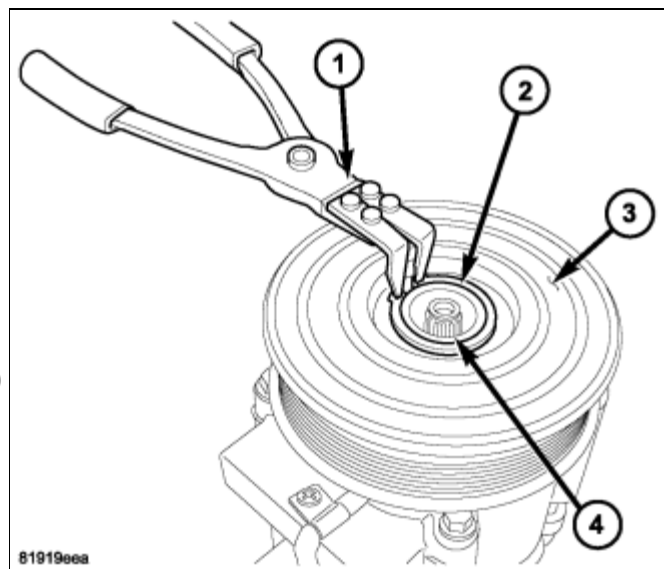
3. Install the pulley and bearing assembly (1) onto the front of the A/C compressor. If necessary, tap the pulley gently with a block of wood (2) placed on the pulley friction surface.



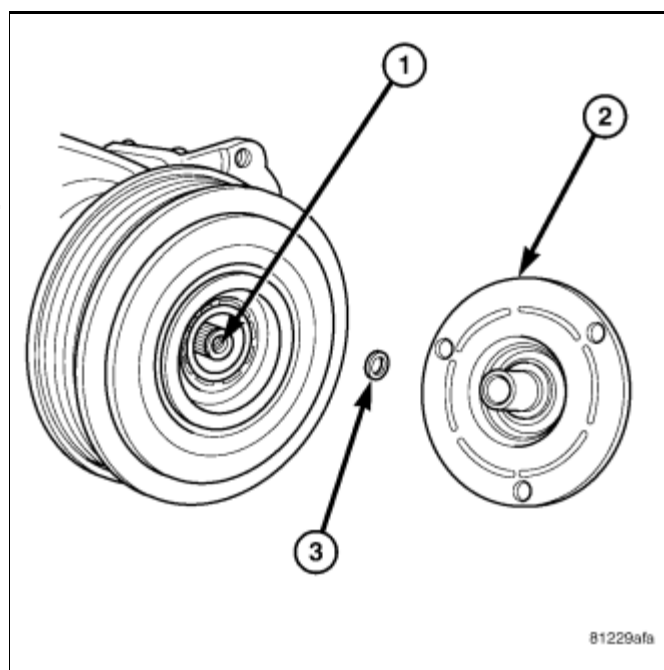
CAUTION: The snap ring must be fully and properly seated in the groove or it will vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.

NOTE: A new snap ring must be used to secure the pulley and bearing assembly to the A/C compressor. The bevel side of the snap ring must face outward.

4. Using Snap Ring Pliers 9764 or equivalent (1), install the snap ring (2) that secures the pulley and bearing assembly (3) to the front of the A/C compressor (4). Be certain that the snap ring is fully and properly seated in the groove.



5. If the original clutch plate (2) and pulley and bearing assembly are to be reused, reinstall the original shim(s) (3) onto the compressor shaft (1). If a new clutch plate and pulley and bearing assembly are being used, install a trial stack of shims 1.50 mm (0.059 in.) thick onto the compressor shaft.

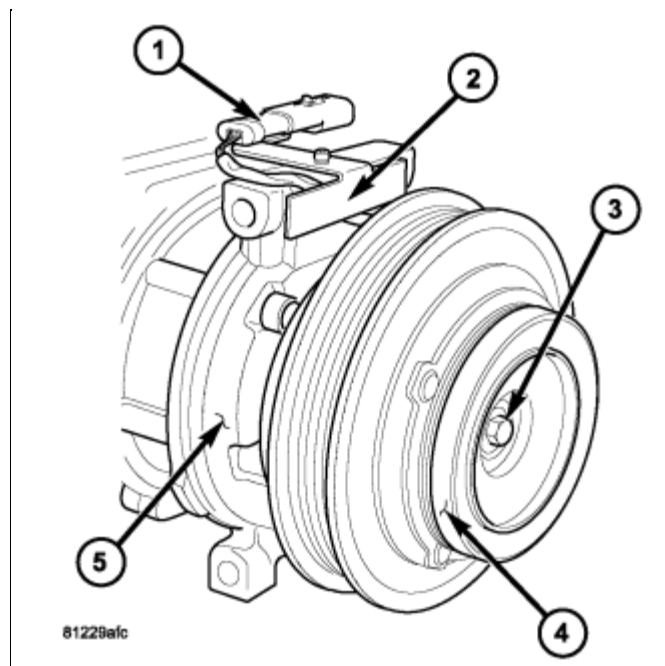


6. Install the clutch plate (4) onto the front of the A/C compressor (5).

7. Install the compressor shaft bolt (3). Tighten the bolt to 20 N·m (177 in. lbs.).

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is correct. Spin the pulley before performing a final check of the air gap.

NOTE: On models with the clutch plate recessed into the pulley, use a 90° wire gap gauge to measure the clutch air gap. On other models, use a blade type feeler gauge to



measure the air gap.

8. With the clutch plate assembled tight against the shim(s), measure the air gap between the clutch plate and the pulley and bearing assembly. The air gap should be between 0.30 - 0.60 mm (0.012 - 0.024 in.). If the air gap is not between specifications, add or subtract shims as needed until the correct air gap is obtained.

CAUTION: Be certain that the compressor clutch field coil wire harness is properly routed so that it is not pinched between the A/C compressor and the field coil connector bracket.

9. Carefully route the compressor clutch field coil wire lead and install the connector bracket (2) and retaining screw onto the A/C compressor. Tighten the screw to 4.3 N·m (38 in. lbs.).

10. Connect the engine wire harness to the compressor clutch field coil connector.

11. Install the accessory drive belt (refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - INSTALLATION).

12. On 2.8L equipped models, install the air cleaner housing (refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - INSTALLATION).

13. On 3.8L equipped models, install the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).

14. Reconnect the negative battery cable.

CONTROL-A/C HEATER

DESCRIPTION

NOTE: Typical A/C-heater control shown.

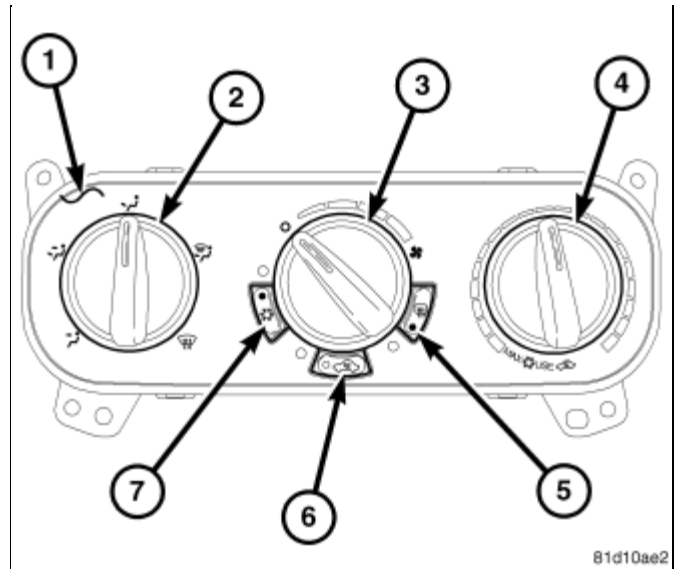
The A/C-heater control (1) for the manual temperature control (MTC) single zone system allows one temperature setting for the entire vehicle. All controls are identified by ISO graphic symbols.

The heating-A/C system uses a combination of electrical and cable operated controls. These controls provide the vehicle

operator with a number of setting options to help control the climate and comfort within the vehicle.

The A/C-heater control is located in the instrument panel and contains:

- a rotary control for mode control of the discharged air (2).
- a rotary control for blower motor speed selection and to turn the blower motor off (3).
- a rotary control for temperature control of the discharged air (4).
- a push-button control to turn the rear window defogger system on and off (5).
- a push-button control for recirculation control of the discharged air (6).
- a push-button control to turn the A/C system on and off (7).



The A/C-heater control cannot be repaired or adjusted and it must be replaced if found inoperative or damaged. The control knobs for the A/C-heater control are available for service replacement.

REMOVAL

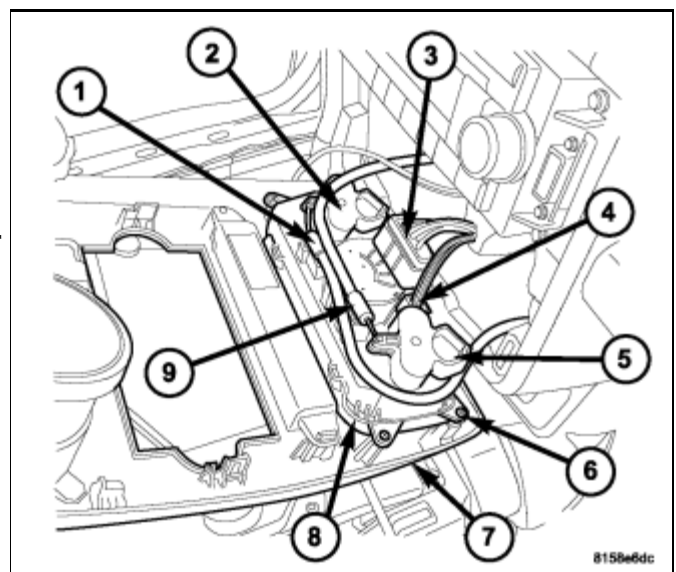
WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Typical A/C-heater control and center bezel shown.

1. Disconnect and isolate the negative battery cable.
2. Disengage the center bezel (7) from the instrument panel and disconnect the wiring harness connectors from the power outlets and any switches, as equipped (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - REMOVAL).

NOTE: To aid in reinstallation, note the installed positions of the control cables prior to removal.

3. Using a small screwdriver or similar tool, disengage the retaining clips that secure the control cables (1 and 9) to the



back of the A/C-heater control (8).

4. Using a small screwdriver or similar tool, disengage the retaining clips that secure the control cables to the mode control sector gear (2) and the temperature control sector gear (5).

5. Disconnect the wire harness connectors (3 and 4) from the rear of the A/C-heater control and place the center bezel on a work bench.

6. Remove the four screws (6) that secure the A/C-heater control to the back of the center bezel and remove the control.

INSTALLATION

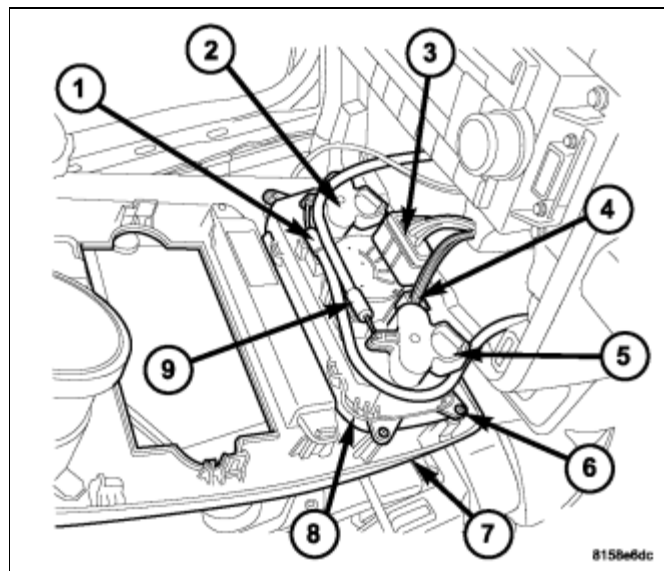
NOTE: Typical A/C-heater control and center bezel shown.

1. Install the A/C-heater control (8) into the instrument panel center bezel (7).

2. Install the four screws (6) that secure the A/C-heater control to the center bezel. Tighten the screws to 2 N·m (17 in. lbs.).

3. Position the center bezel to the instrument panel and connect the wire harness connectors (3 and 4) to the back of the A/C-heater control.

NOTE: Install the mode control cable onto the A/C heater control first. Then install the temperature control cable.



4. Connect the control cables (1 and 9) to the mode door control sector gear (2) and the temperature control sector gear (5) and fully engaged the retaining clips. Make sure the retaining clips are fully engage to the sector gears.

5. Connect the control cables to the back of the A/C-heater control and fully engage the retaining clips. Make sure the retaining clips are fully engaged to the back of the A/C-heater control.

6. Connect the wire harness connectors to the switches and power outlets, as equipped and install the center bezel to the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/BEZEL-CENTER - INSTALLATION).

7. Reconnect the negative battery cable.

RESISTOR-BLOWER MOTOR

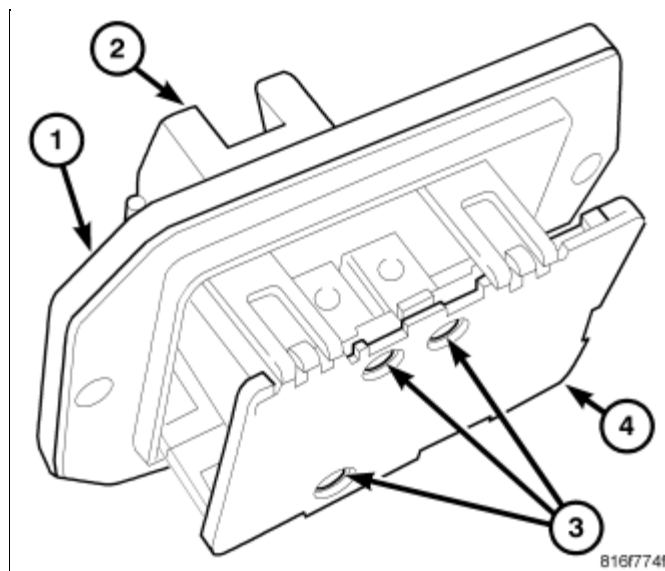
DESCRIPTION

The blower motor resistor is mounted to the HVAC housing on the passenger side of the vehicle. The blower motor resistor consists of a molded plastic mounting plate (1) with an integral wire connector receptacle (2). Concealed behind

the mounting plate are resistors (3) located between a two-piece stamped steel base (4).

OPERATION

The blower motor resistor is connected to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness. The blower motor resistor has three resistors, each of which will reduce the current flow through the blower motor to change the blower motor speed.



The blower motor control for the heating-A/C system directs the ground path for the blower motor through the correct resistor to obtain the selected speed. With the blower motor control in the lowest speed position, the ground path for the blower motor is applied through all of the resistors. Each higher speed selected with the blower motor control applies the blower motor ground path through fewer of the resistors, increasing the blower motor speed. When the blower motor control is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be adjusted or repaired and it must be replaced if found inoperative or damaged.

DIAGNOSIS AND TESTING

BLOWER MOTOR RESISTOR

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: For circuit descriptions and diagrams, refer to 8W - WIRING DIAGRAM INFORMATION. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the blower motor resistor (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RESISTOR-BLOWER MOTOR - REMOVAL).
3. Using an ohmmeter, check for continuity between all of the blower motor resistor terminals. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor speed control and the blower motor resistor or blower motor as required. If not OK, replace the inoperative blower motor resistor.

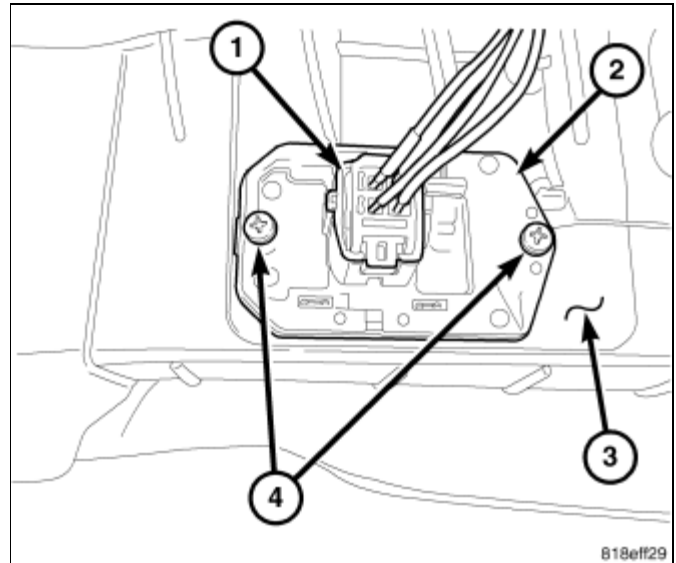
REMOVAL

WARNING: The blower motor resistor may get very hot during normal operation. If the blower motor was turned on prior to servicing the blower motor resistor, wait five minutes to allow the blower motor resistors to cool before performing diagnosis or service. Failure to take this precaution can result in possible personal injury.

CAUTION: Do not operate the blower motor with the blower motor resistor removed from the circuit. Failure to take this precaution can result in vehicle damage.

NOTE: LHD model shown. RHD model similar.

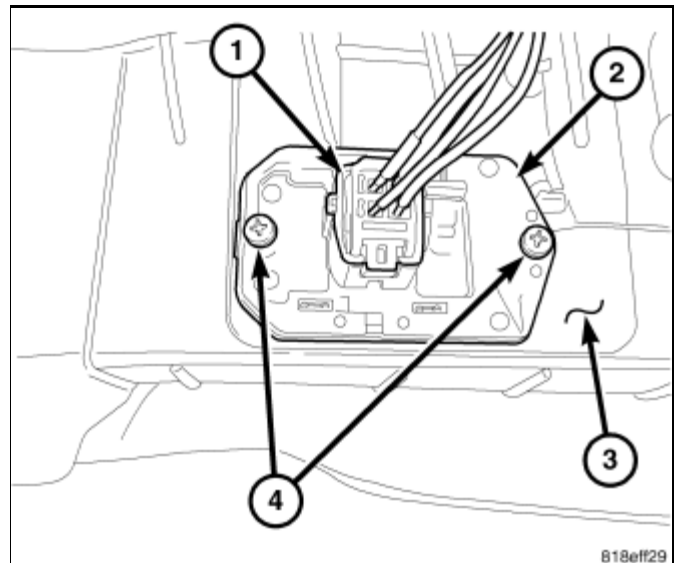
1. Disconnect and isolate the negative battery cable.
2. Remove the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
3. Reach through glove box opening in the instrument panel and disconnect the wire harness connector (1) from the blower motor resistor (2) located on the rear of the HVAC housing (3).
4. Remove the two screws (4) that secure the blower motor resistor to the HVAC housing and remove the resistor.



INSTALLATION

NOTE: LHD model shown. RHD model similar.

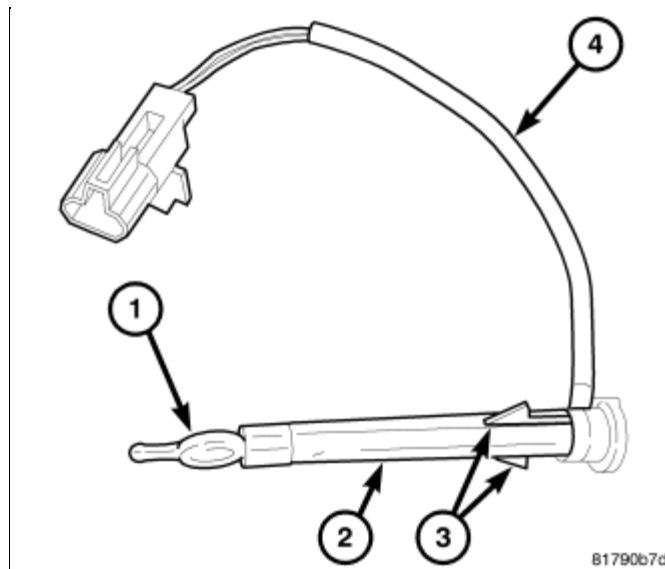
1. Position the blower motor resistor (2) onto the rear of the HVAC housing (3) through the glove box opening.
2. Install the two screws (4) that secure the blower motor resistor to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).
3. Connect the wire harness connector (1) to the blower motor resistor.
4. Install the glove box (refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
5. Reconnect the negative battery cable.



SENSOR-EVAPORATOR TEMPERATURE

DESCRIPTION

The evaporator temperature sensor measures the temperature of the conditioned air downstream of the A/C evaporator. The evaporator temperature sensor is an electrical thermistor (1) mounted on the end of a molded plastic housing (2) that is inserted into the driver side of the HVAC housing near the coldest point of the A/C evaporator. The evaporator temperature sensor is retained in the HVAC housing by two integral retaining tabs (3) and is connected to the vehicle electrical system by use of a wire lead and connector (4) with two terminals.



OPERATION

The evaporator temperature sensor monitors the surface temperature of A/C evaporator and supplies an input signal to the cabin compartment node (CCN). The CCN uses the evaporator temperature sensor input signal to optimize A/C system performance and to protect the A/C system from evaporator freezing. The evaporator temperature sensor will change its internal resistance in response to the temperatures it monitors and is connected to the CCN through sensor ground circuit and a 5-volt reference signal circuit. As the temperature of the A/C evaporator decreases, the internal resistance of the evaporator temperature sensor decreases.

The CCN uses the monitored voltage reading as an indication of evaporator temperature. The CCN is programmed to respond to this input by requesting the powertrain control module (PCM) or the engine control module (ECM) (depending on engine application) to cycle the compressor clutch off and on as necessary to optimize A/C system performance and to protect the A/C system from evaporator freezing (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - OPERATION for more information).

The evaporator temperature sensor is diagnosed using a scan tool (refer to 24 - HVAC Electrical Diagnostics for more information).

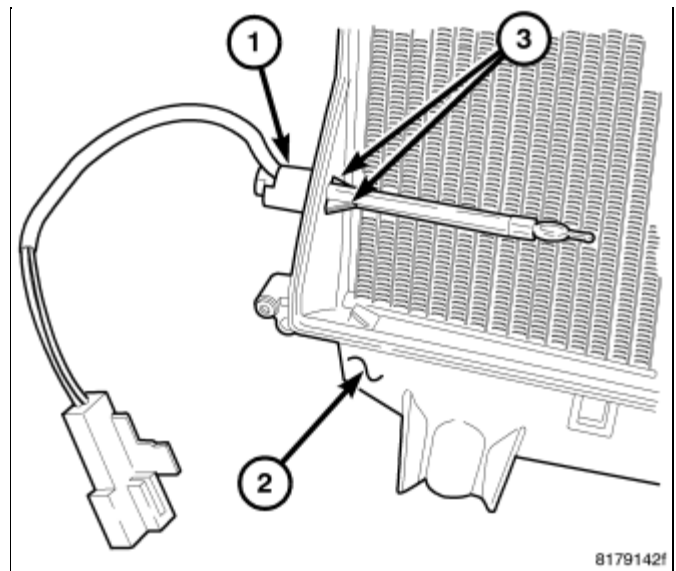
The evaporator temperature sensor cannot be adjusted or repaired and must be replaced if found inoperative or damaged.

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible serious or fatal injury.

NOTE: Illustration shown with air distribution housing removed for clarity.

NOTE: It is not necessary to remove and disassemble the HVAC housing to service the evaporator temperature sensor. The evaporator temperature sensor can be removed for service from underneath the instrument panel.

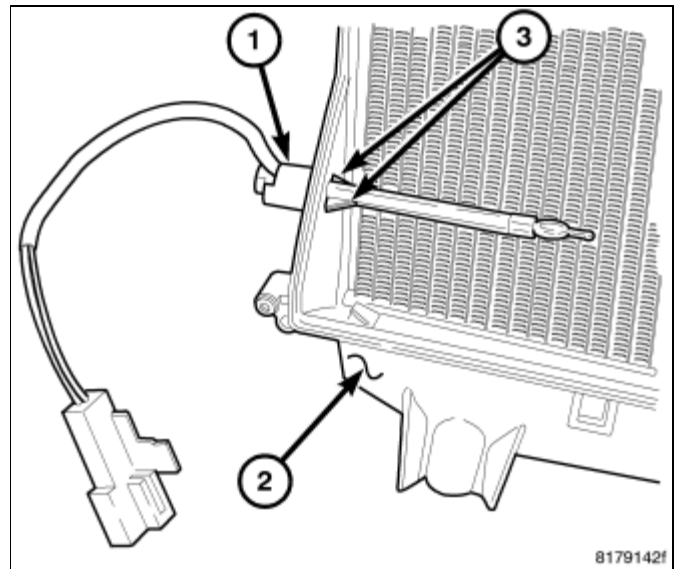


1. Disconnect and isolate the negative battery cable.
2. Reach up under the driver side of the instrument panel and disconnect the electrical connector for the evaporator temperature sensor (1) from the instrument panel wire harness.
3. Using needle nose pliers, disengage the two retaining tabs (3) that secure the evaporator temperature sensor to the HVAC housing (2) by carefully pulling the sensor straight out of the side of the HVAC housing.
4. Route the electrical connector and wire lead of the evaporator temperature sensor out from under the heater core tubes and remove the sensor from the vehicle.

INSTALLATION

NOTE: Illustration shown with air distribution housing removed for clarity.

1. Route the electrical connector and wire lead of the evaporator temperature sensor (1) under the heater core tubes located on the driver side of the HVAC housing (2).
2. Install the evaporator temperature sensor into the driver side of the HVAC housing. Make sure the retaining tabs (3) are fully engaged to the housing.
3. Connect the electrical connector for the evaporator temperature sensor to the instrument panel wire harness.
4. Reconnect the negative battery cable.



TRANSDUCER-A/C PRESSURE

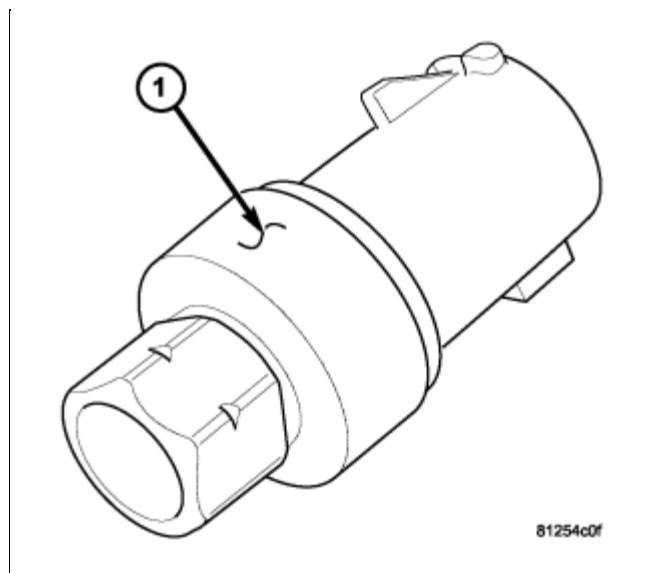
DESCRIPTION

The A/C pressure transducer (1) is a switch that is installed on a fitting located on the A/C discharge line. An internally threaded fitting on the A/C pressure transducer connects it to the externally threaded Schrader-type fitting on the A/C discharge line. A rubber O-ring seals the connection between

the A/C pressure transducer and the discharge line fitting. The A/C pressure transducer is connected to the vehicle electrical system by a molded plastic connector with three terminals.

OPERATION

The A/C pressure transducer monitors the pressures in the high side of the refrigerant system through its connection to a fitting on the A/C discharge line. The A/C pressure transducer will change its internal resistance in response to the pressures it monitors. A Schrader-type valve in the discharge line fitting permits the A/C pressure transducer to be removed or installed without disturbing the refrigerant in the A/C system.



The powertrain control module (PCM) or the engine control module (ECM) (depending on engine application) provides a five volt reference signal and a sensor ground to the A/C pressure transducer, then monitors the output voltage of the transducer on a sensor return circuit to determine refrigerant pressure. The PCM/ECM is programmed to respond to the A/C pressure transducer and other sensor inputs by controlling the operation of the A/C compressor clutch and the radiator cooling fan to help optimize A/C system performance and to protect the system components from damage. The PCM/ECM will disengage the A/C compressor clutch when high side pressure rises above 2971 kPa (431 psi) or fall below 206 kPa (30 psi). The A/C pressure transducer input to the PCM/ECM will also prevent the A/C compressor clutch from engaging when ambient temperatures are below about 1.0° C (50° F) due to the pressure/temperature relationship of the refrigerant. When the refrigerant pressure rises above 1655 kPa (240 psi), the PCM/ECM will actuate the cooling fan.

The A/C pressure transducer is diagnosed using a scan tool (refer to 9 - Engine Electrical Diagnostics for more information).

The A/C pressure transducer cannot be adjusted or repaired and it must be replaced if found inoperative or damaged.

REMOVAL

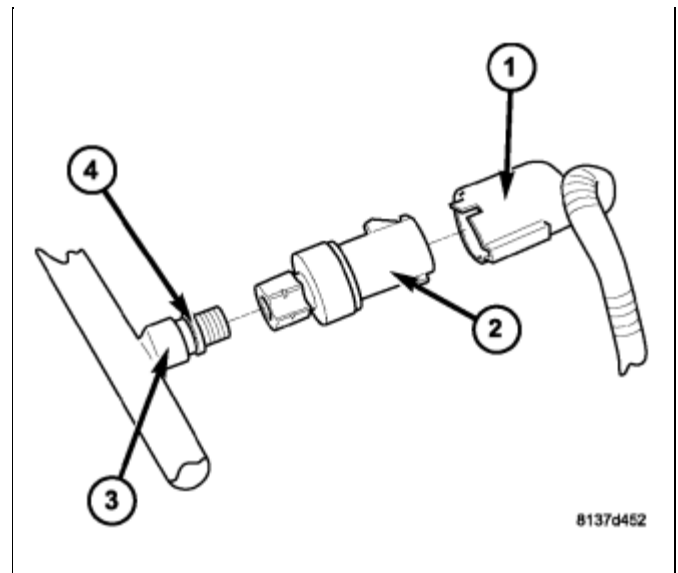
NOTE: It is not necessary to discharge the refrigerant system to replace the A/C pressure transducer.

NOTE: Typical A/C pressure transducer shown.

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the A/C pressure transducer located on the A/C discharge line (3) near the A/C compressor.
3. Remove the A/C pressure transducer from the fitting on the A/C discharge line and remove and discard the O-ring seal.

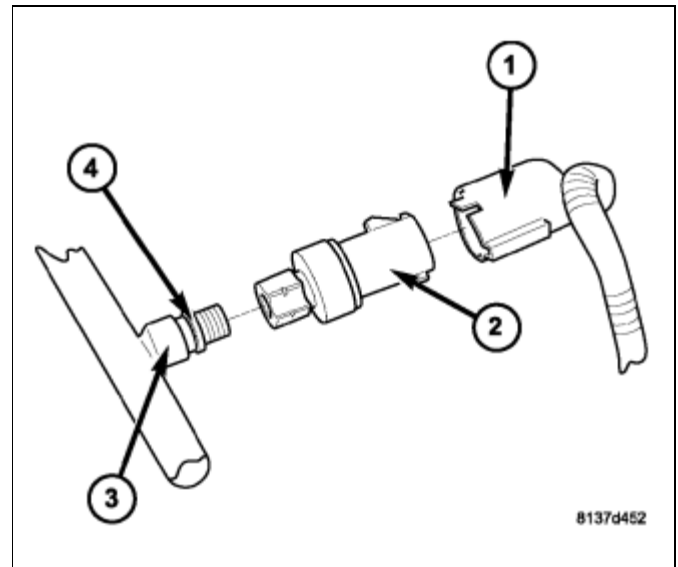
INSTALLATION

NOTE: Use only the specified O-ring as it is made of special material for R-134a. Use only refrigerant oil of the type required for the A/C compressor.



NOTE: Typical A/C pressure transducer shown.

1. Lubricate a new rubber O-ring seal (4) with clean refrigerant oil and install it onto the discharge line fitting (3).
2. Install the A/C pressure transducer (2) onto the A/C discharge line. Tighten the A/C pressure transducer securely.
3. Connect the wire harness connector (1) to the A/C pressure transducer.
4. Reconnect the negative battery cable.



DISTRIBUTION

DUCT-DEFROSTER

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

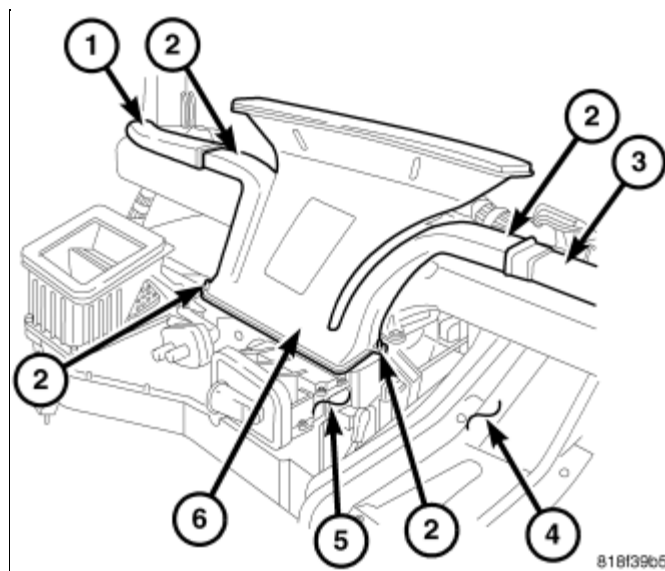
NOTE: LHD model shown. RHD model similar.

1. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT

PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

2. Remove the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/COVER - REMOVAL).
3. Remove the right and left demister ducts (1 and 3) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - REMOVAL).

NOTE: If the foam seal on the top of the HVAC housing is deformed or damaged, the seal must be replaced.



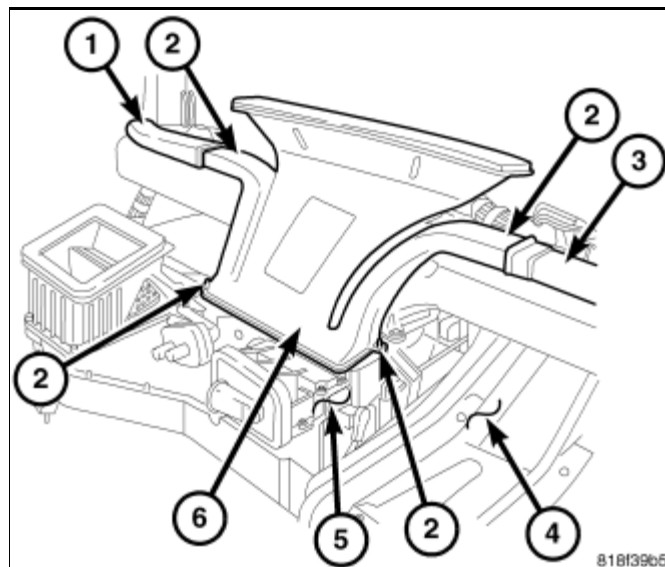
4. Remove the four screws (2) that secure the defroster duct (6) to the instrument support (4) and the HVAC housing assembly (5) and remove the duct.

INSTALLATION

NOTE: LHD model shown. RHD model similar.

NOTE: If the foam seal on the top of the HVAC housing is deformed or damaged, the seal must be replaced.

1. Position the defroster duct (6) to the top of the HVAC housing assembly (5).
2. Install the four screws (2) that secure the defroster duct to the HVAC housing assembly and the instrument panel support (4). Tighten the screws to 1.2 N·m (10 in. lbs.).
3. Install the right and left demister ducts (1 and 3) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - INSTALLATION).
4. Install the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/COVER - INSTALLATION).
5. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



DUCTS-FLOOR DISTRIBUTION

REMOVAL

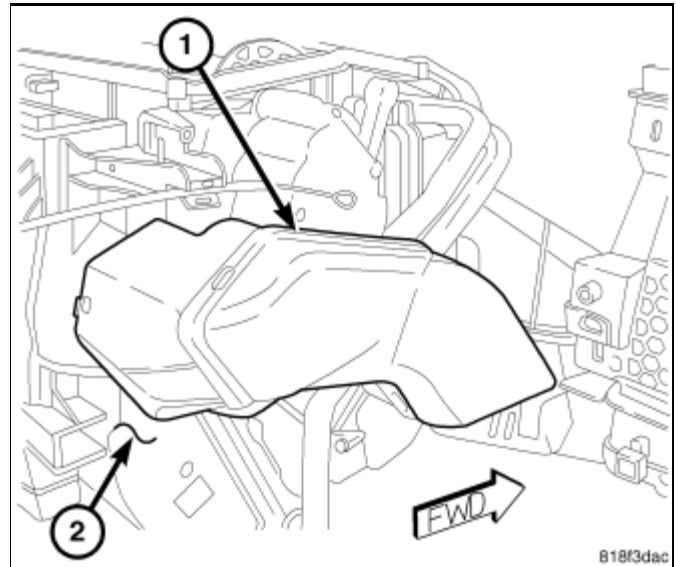
WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground)

cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.

NOTE: LHD model shown in illustrations. RHD model similar.

PASSENGER SIDE

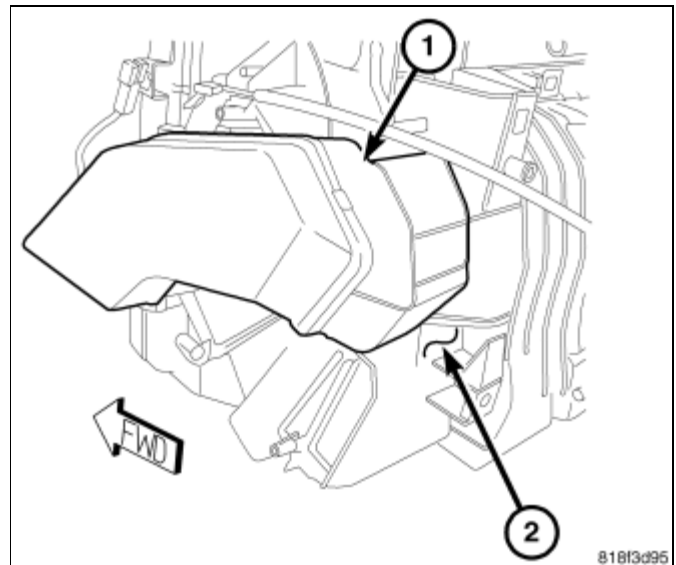
1. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT PANEL/ASSEMBLY-INSTRUMENT PANEL - REMOVAL).
2. Remove the HVAC housing assembly from the instrument panel (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
3. Disconnect the floor duct (1) from the passenger side of the air distribution housing (2) and remove the duct.



DRIVER SIDE

NOTE: Illustration shown with instrument panel removed for clarity.

1. Disconnect and isolate the negative battery cable.
2. Remove the steering column opening cover (refer to 23 - BODY/INSTRUMENT PANEL/COVER-STEERING COLUMN OPENING - REMOVAL).
3. Disconnect the floor duct (1) from the driver side of the air distribution housing (2) and remove the duct.

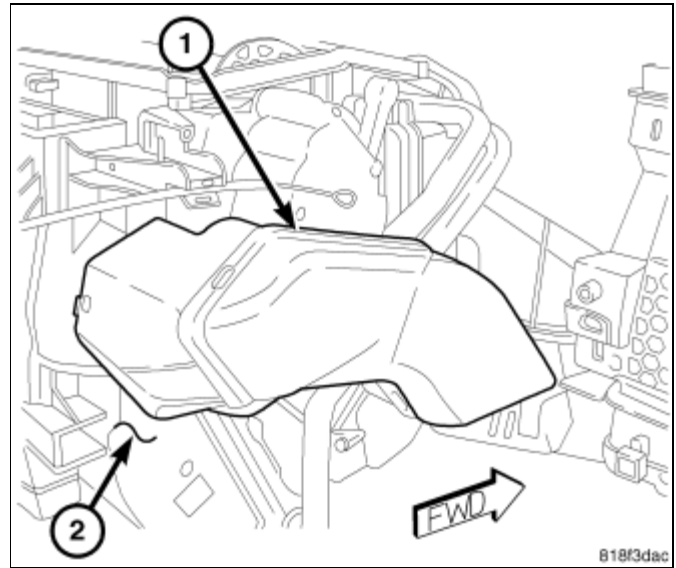


INSTALLATION

NOTE: LHD model shown in illustrations. RHD model similar.

PASSENGER SIDE

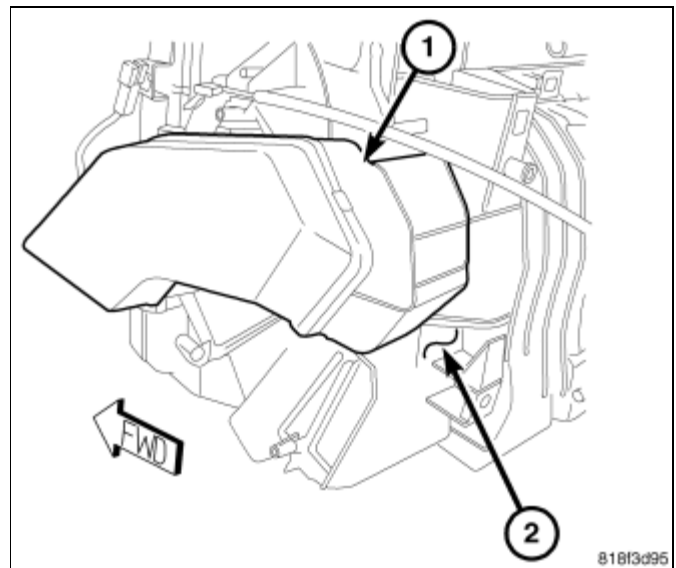
1. Connect the floor duct (1) to the passenger side of the air distribution housing (2). Make sure the duct is fully engaged to the housing.
2. Install the HVAC housing assembly into the instrument panel (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).
3. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/ASSEMBLY-INSTRUMENT PANEL - INSTALLATION).



DRIVER SIDE

NOTE: Illustration shown with instrument panel removed for clarity.

1. Connect the floor duct (1) to the driver side of the air distribution housing (2). Make sure the duct is fully engaged to the housing.
2. Install the steering column opening cover (refer to 23 - BODY/INSTRUMENT PANEL/COVER-STEERING COLUMN OPENING - INSTALLATION).
3. Reconnect the negative battery cable.



DUCT-INSTRUMENT PANEL

REMOVAL

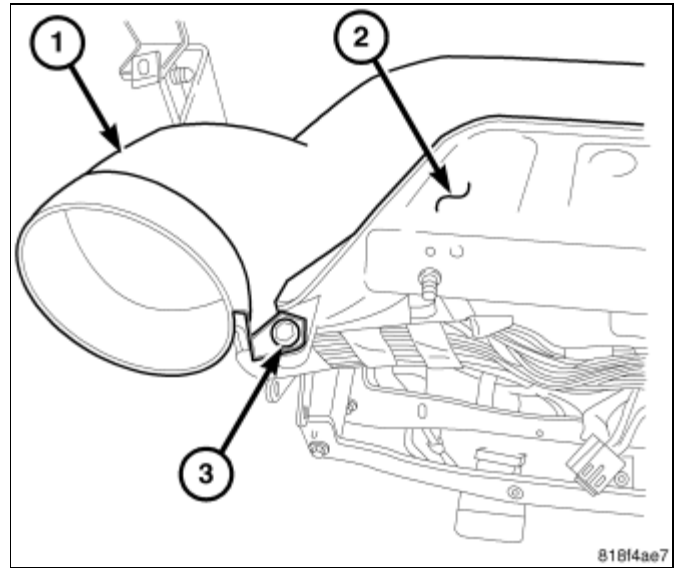
WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: LHD model shown in illustrations. RHD model similar.

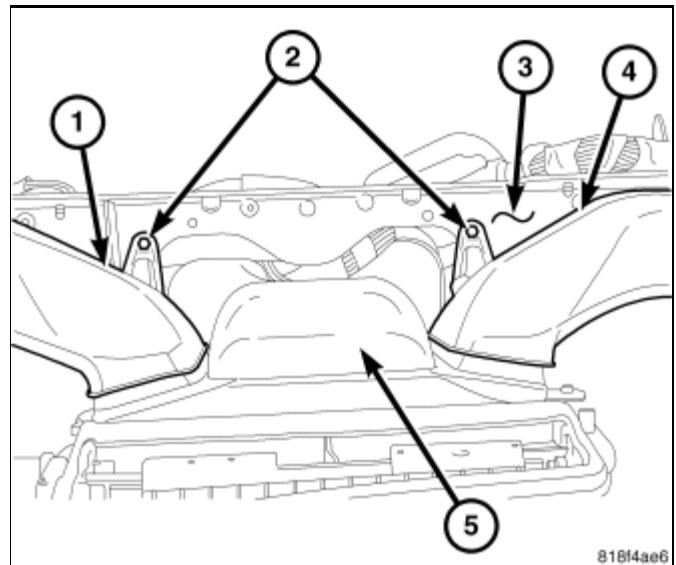
DRIVER AND PASSENGER SIDE

NOTE: Driver side instrument panel duct shown. Passenger side duct similar.

1. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANE COVER - REMOVAL).
3. Remove the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - REMOVAL).
4. Remove the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - REMOVAL).
5. Remove the screw (3) that secures the outlet end of each instrument panel duct (1) to the instrument panel support (2), as required.



6. Remove the screw (2) that secures each instrument panel duct (1 and 4) to the center of the instrument panel support (3), as required.
7. Disconnect each instrument panel duct from the center duct (5) and remove the panel ducts, as required.



CENTER

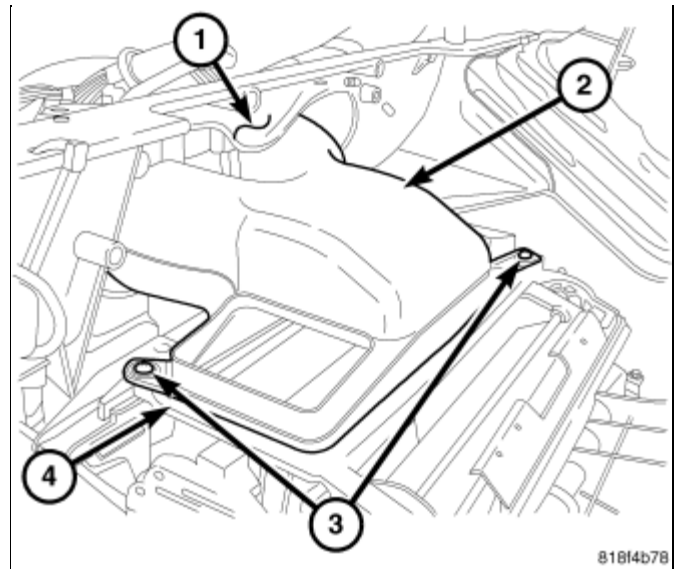
1. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the instrument panel cover (refer to 23 -

BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - REMOVAL).

3. Remove the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - REMOVAL).

4. Remove the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - REMOVAL).

5. Remove the driver and passenger side instrument panel ducts (refer to [DRIVER AND PASSENGER SIDE](#)).



NOTE: If a foam seal on the top of the HVAC housing is deformed or damaged, the seal must be replaced.

6. Remove the two screws (3) that secure the center duct (2) to the top of the HVAC housing assembly (4) and remove the duct from the instrument panel support (1).

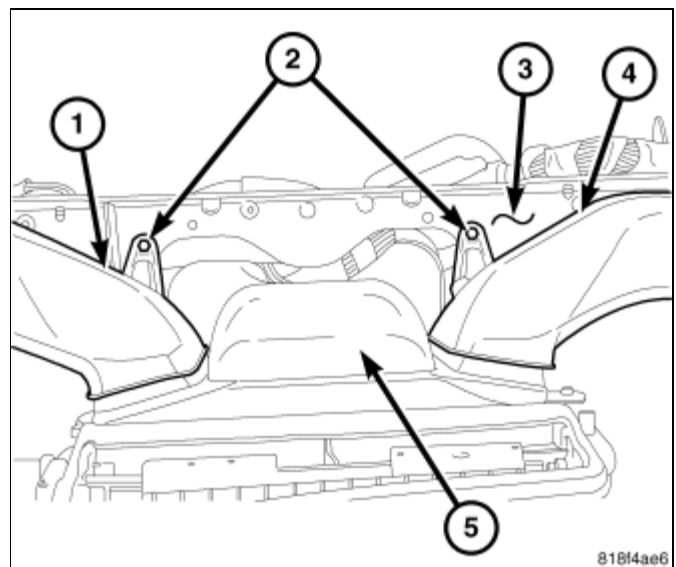
INSTALLATION

NOTE: LHD model shown in illustrations. RHD model similar.

DRIVER AND PASSENGER SIDE

NOTE: Driver side instrument panel duct shown. Passenger side duct similar.

1. Position the instrument panel ducts (1 and 4) to the top of the instrument panel support (3).
2. Connect the instrument panel ducts to the center duct (5). Make sure the ducts are fully engaged to each other.
3. Install the screw (2) that secures each instrument panel duct to the center of the instrument panel support. Tighten the screws to 1.2 N·m (10 in. lbs.).



4. Install the screw (3) that secures the outlet end of each

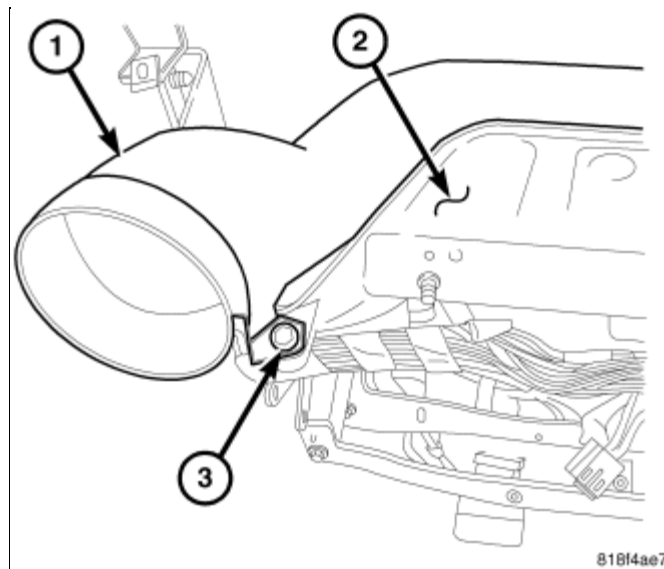
instrument panel duct (1) to the instrument panel support (2). Tighten the screws to 1.2 N·m (10 in. lbs.).

5. Install the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - INSTALLATION).

6. Install the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - INSTALLATION).

7. Install the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - INSTALLATION).

8. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



CENTER DUCT

NOTE: If the foam seal on the top of the HVAC housing is deformed or damaged, the seal must be replaced.

1. Position the center instrument panel duct (2) into the instrument panel support (1) and onto the top of the HVAC housing assembly (4).

2. Install the two screws (3) that secure the center duct to the HVAC housing assembly. Tighten the screws to 1.2 N·m (10 in. lbs.).

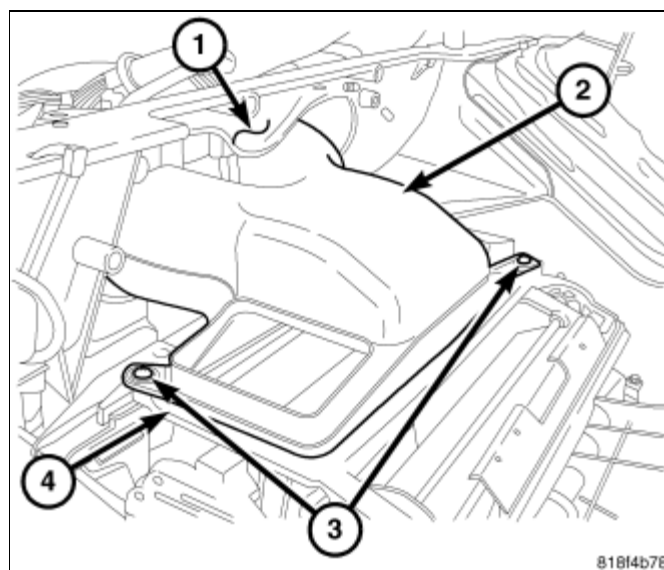
3. Install the driver and passenger side instrument panel ducts (refer to [DRIVER AND PASSENGER SIDE](#)).

4. Install the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - INSTALLATION).

5. Install the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - INSTALLATION).

6. Install the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - INSTALLATION).

7. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



DUCT-INSTRUMENT PANEL DEMISTER

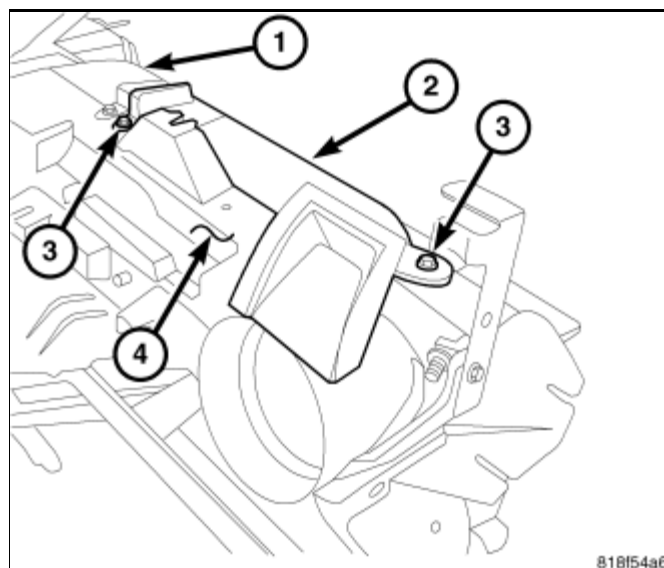
REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper

precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: Right side duct shown. Left side similar.

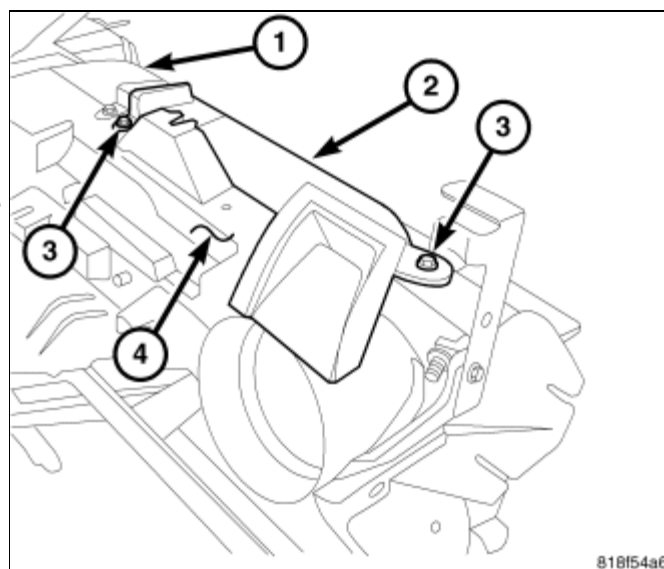
1. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - REMOVAL).
3. Remove the two screws (3) that secure each demister duct (2) to the instrument panel support (4), as required.
4. Disconnect each demister duct from the defroster duct (1) and remove the demister ducts, as required.



INSTALLATION

NOTE: Right side duct shown. Left side similar.

1. Position each demister duct (2) onto the top of the instrument panel support (4).
2. Connect each demister duct to the defroster duct (1). Make sure the ducts are fully engaged to each other.
3. Install the two screws (3) that secure each demister duct to the instrument panel support. Tighten the screws to 1.2 N·m (10 in. lbs.).
4. Install the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - INSTALLATION).
5. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



HOUSING-HVAC

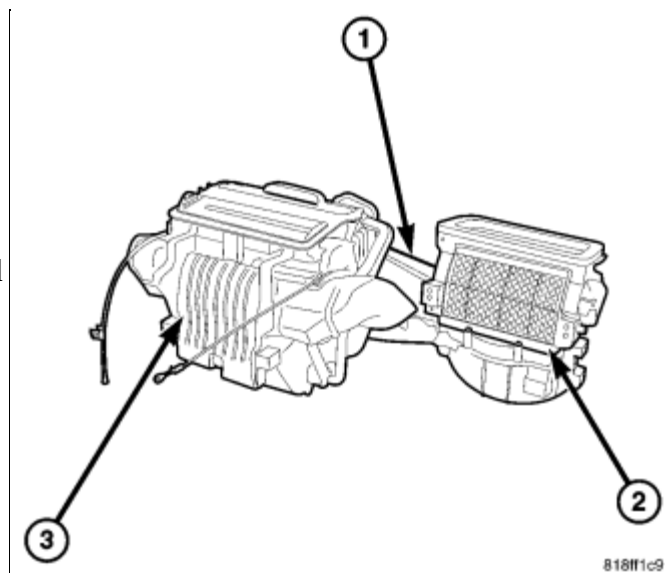
DESCRIPTION

NOTE: LHD model shown RHD model similar.

All models are equipped with a common HVAC housing

assembly that combines A/C and heating capabilities into a single unit mounted within the passenger compartment. The HVAC housing assembly consists of three separate housings:

- **HVAC housing** — The HVAC housing (1) is mounted to the back of the instrument panel and contains the A/C evaporator. The HVAC housing consists of an upper and a lower housing that are attached together and has mounting provisions for the air inlet housing, blower motor and the air distribution housing.
- **Air inlet housing** — The air inlet housing (2) is mounted to the passenger side end of the HVAC housing. The air inlet housing contains the recirculation-air door and actuator when equipped with A/C.
- **Air distribution housing** — The air distribution housing (3) is mounted to the rear of the HVAC housing and contains the heater core, blend-air and mode-air doors and door linkage.



The heating-A/C system is a blend-air type system. The blend-air door controls the amount of conditioned air that is allowed to flow through, or around, the heater core.

The A/C system is designed for the use of a non-CFC, R-134a refrigerant and uses an A/C evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. A temperature control determines the discharge air temperature by operating the temperature control cable, which moves the blend-air door. This allows an almost immediate control of the output air temperature of the system. The mode door cable operates the mode-air doors which direct the flow of the conditioned air out the various air outlets, depending on the mode selected. When equipped with A/C, the recirculation door actuator operates the recirculation-air door which closes off the fresh air intake and recirculates the air already inside the vehicle. The electric recirculation door actuator and the blower motor are connected to the vehicle electrical system by the instrument panel wire harness. The blower motor controls the velocity of air flowing through the HVAC housing assembly by spinning the blower wheel within the HVAC housing at the selected speed by use of the blower motor resistor, which is located in the HVAC housing behind the glove box.

The air distribution housing must be removed from the HVAC housing and disassembled for service of the blend-air and mode-air doors. The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door. The HVAC housing must be removed from the vehicle for service of the A/C evaporator and the heater core.

REMOVAL

HOUSING-AIR DISTRIBUTION

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and

(refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

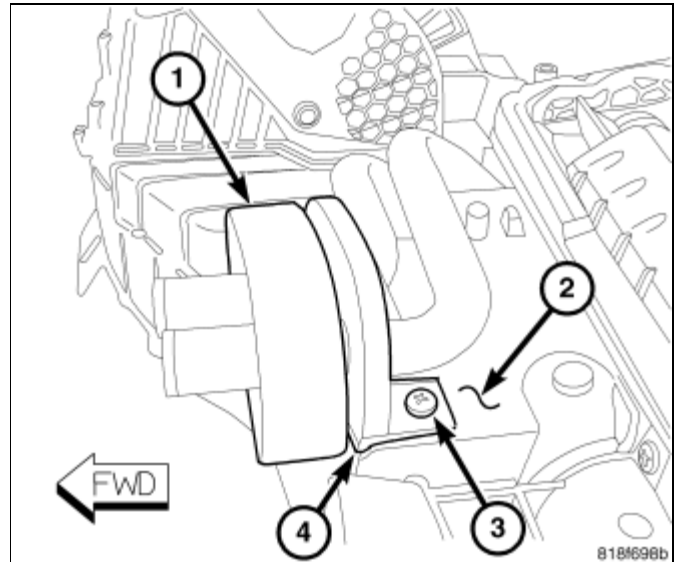
NOTE: The air distribution housing must be removed from the HVAC housing and disassembled for service of the blend-air and mode-air doors.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

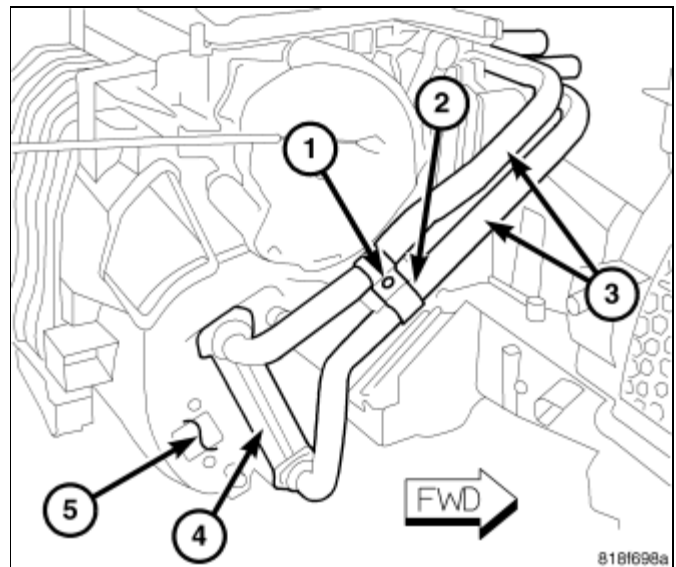
1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the floor distribution ducts from the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-FLOOR DISTRIBUTION - REMOVAL).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

3. Remove the foam seal (1) from the flange (4) located on the front of the HVAC housing (2).
4. Remove the screw (3) that secures the flange to the HVAC housing and remove the flange.



5. Remove the screw (1) that secures the bracket (2) retaining the heater core tubes (3) to the passenger side of the air distribution housing (5) and remove the bracket.
6. Carefully pull the heater core (4) out of the side of the air distribution housing.



7. Remove the two metal retaining clips (3) that secure the bottom of air distribution housing (2) to the HVAC housing (4).
8. Remove the seven screws (1) that secure the air distribution housing to the rear of the HVAC housing.
9. Remove the air distribution housing from the HVAC

housing.

10. If required, disassemble the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - DISASSEMBLY).

HOUSING-AIR INLET

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

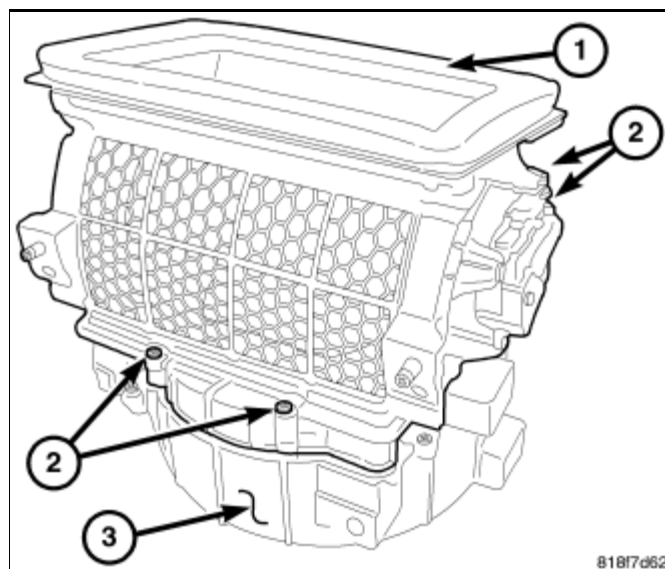
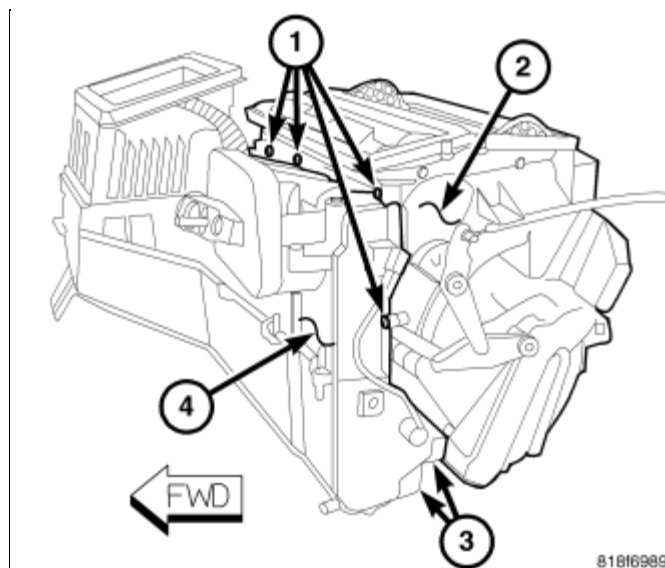
NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.

NOTE: LHD model shown. RHD model similar.

1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the four screws (2) that secure the air inlet housing (1) to the top of the HVAC housing (3) and remove the inlet housing from the HVAC housing.

NOTE: If the foam seal on the top of the inlet housing is deformed or damaged, the seal must be replaced.

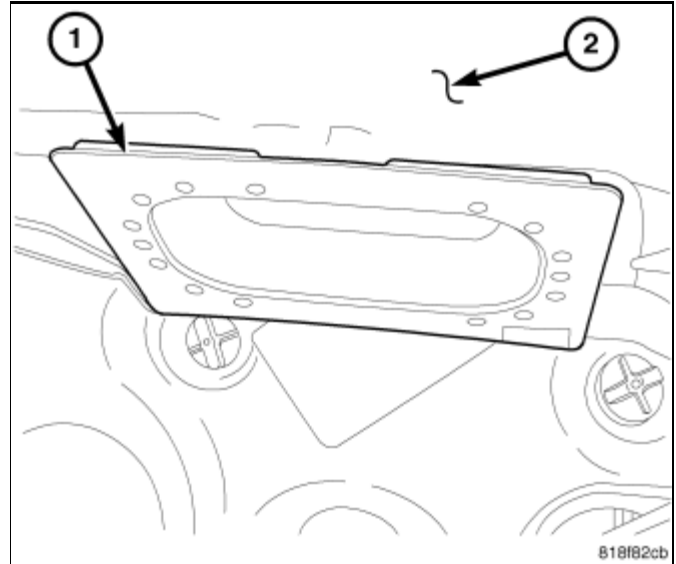
3. If required, disassemble the air inlet housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - DISASSEMBLY).



SCREEN-AIR INLET

NOTE: LHD model shown. RHD model similar.

1. Remove the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Disengage the retaining tabs that secure the air inlet screen (1) to the passenger compartment side of the cowl panel (2).
3. Pull the air inlet screen straight downward and remove the screen from the cowl panel.



HOUSING-HVAC

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

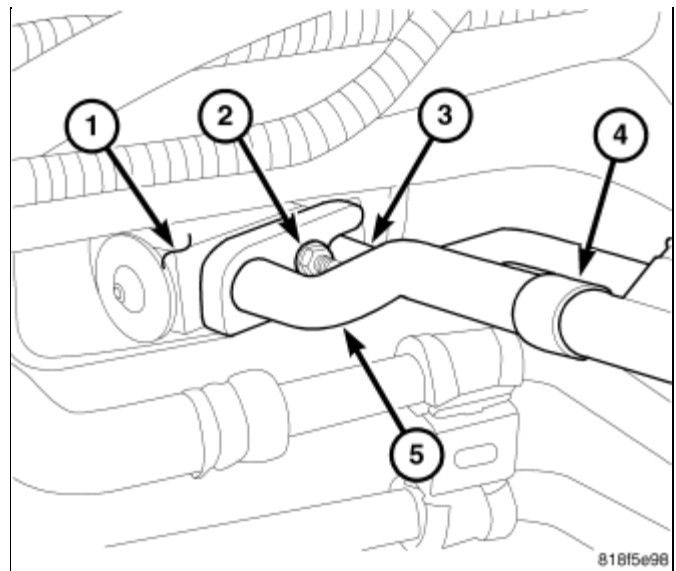
NOTE: The HVAC housing and instrument panel must be removed from the vehicle as an assembly.

NOTE: The HVAC housing must be removed from the instrument panel and disassembled for service of the A/C evaporator, air intake housing, mode-air and blend-air doors and the heater core.

NOTE: LHD model shown in illustrations. RHD model similar.

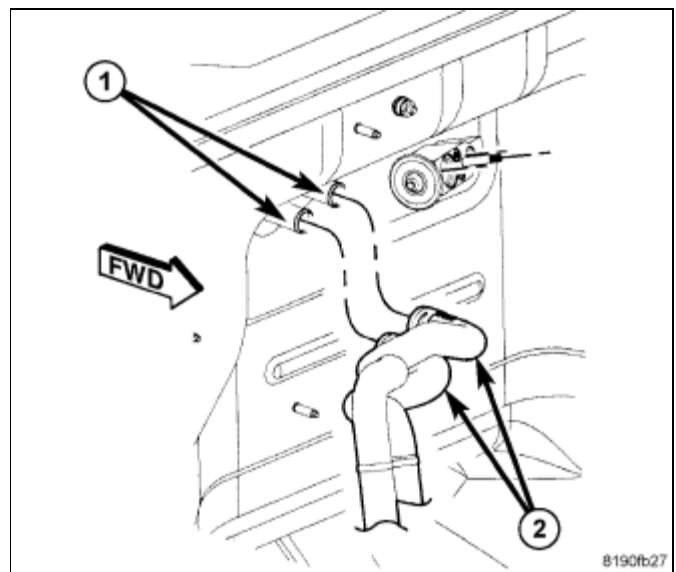
1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Partially drain the engine cooling system (refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE - DRAINING COOLING SYSTEM).
4. Remove the nut (2) that secures the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1).
5. Disconnect the A/C liquid and suction lines from the A/C expansion valve and remove and discard the O-ring seals.
6. Install plugs in, or tape over the opened refrigerant line

fittings and the expansion valve ports.



7. If equipped with the 3.8L engine, remove the upper intake manifold to help gain access to the hose clamps that secure the heater hoses to the heater core (refer to 9 - ENGINE/MANIFOLDS/MANIFOLD-INTAKE-UPPER - REMOVAL).

8. Using cable-type spring clamp pliers or equivalent, release the hose clamps that secure the heater hoses (2) to the heater core tubes (1) and disconnect the hoses from the tubes. Install plugs in, or tape over the opened heater core tubes to prevent coolant spillage during HVAC housing assembly removal.

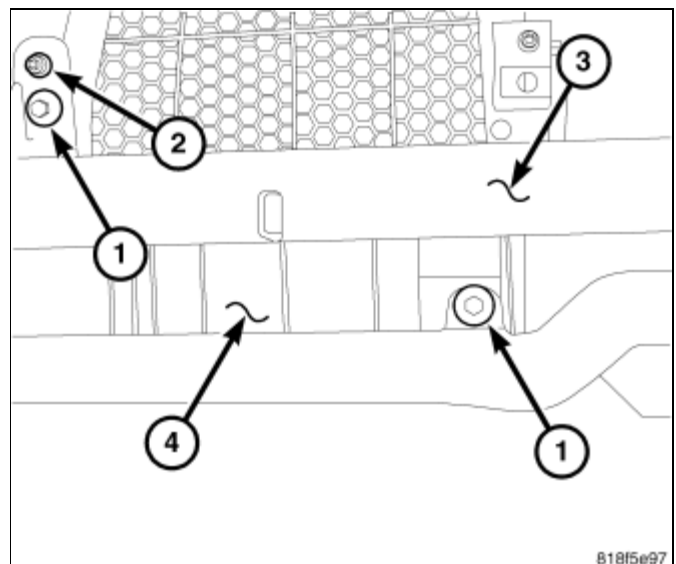


9. Remove the instrument panel and place it on a workbench (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

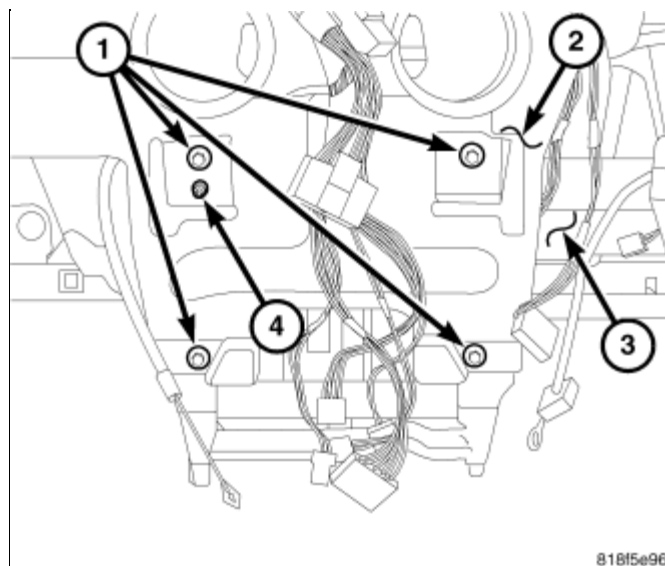
10. Remove the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - REMOVAL).

11. Disconnect the instrument panel wire harness connectors from the evaporator temperature sensor, blower motor resistor, blower motor and the recirculation door actuator.

12. Remove the two bolts (1) that secure the air inlet housing (4) to the passenger side of the instrument panel support (3). Use caution not to damage the housing alignment pin (2) during removal of the HVAC housing assembly from the support.



13. Remove the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - REMOVAL).
14. Remove the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - REMOVAL).
15. Remove the instrument panel ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL - REMOVAL).
16. Remove the four bolts (1) that secure the HVAC housing assembly (3) to the center of the instrument panel support (2) and remove the housing from the support. Use caution not to damage the housing alignment pin (4) during removal of the housing from the support.



DISASSEMBLY

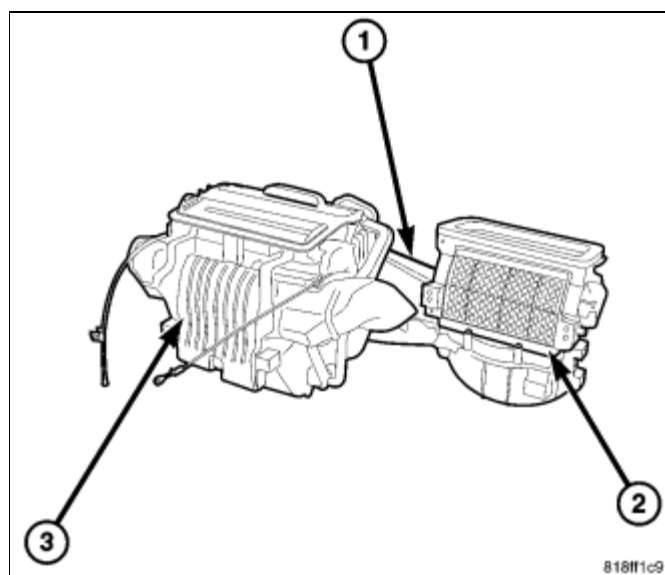
HOUSING-AIR DISTRIBUTION

NOTE: The air distribution housing must be removed from the HVAC housing and disassembled for service of the blend-air and mode-air doors.

NOTE: Whenever the control cables are removed from the HVAC housing, new cables must be installed. Failure to replace the control cables when required can result in selected temperatures and operating modes not properly obtained.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the air distribution housing (3) from the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - REMOVAL).
3. Remove the heater core from the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/CORE HEATER - REMOVAL).
4. If equipped with the 2.8L diesel engine, remove the electric positive temperature coefficient (PTC) heater unit from the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - REMOVAL).

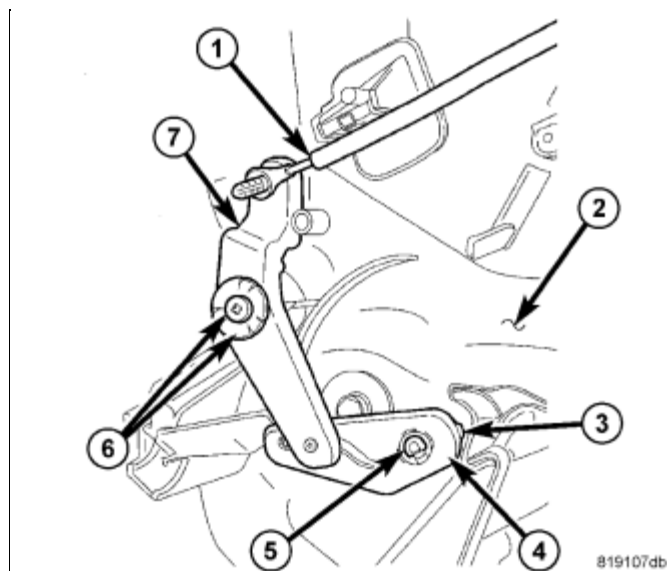


5. Remove the temperature control cable (1) from the left side of the air distribution housing (2) and discard the cable (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CABLE-TEMPERATURE CONTROL - REMOVAL).

6. Remove the screw and washer (6) that secures the blend door cable lever (7) to the air distribution housing and remove the cable lever.

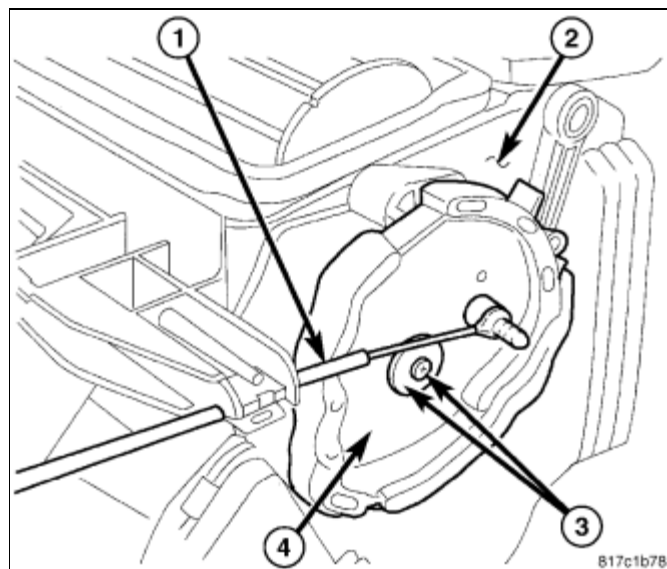
NOTE: To remove the blend door pivot lever, disengage the retaining tab and pull the lever straight off of the blend door pivot shaft.

7. Remove the blend door pivot lever (4) and washer (3) from the end of the blend door pivot shaft (5).



8. Remove the mode door cable (1) from the right side of the air distribution housing (2) and discard the cable (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CABLE-MODE DOOR - REMOVAL).

9. Remove the screw and washer (3) that secure the mode door cam (4) to the air distribution housing and remove the cam.

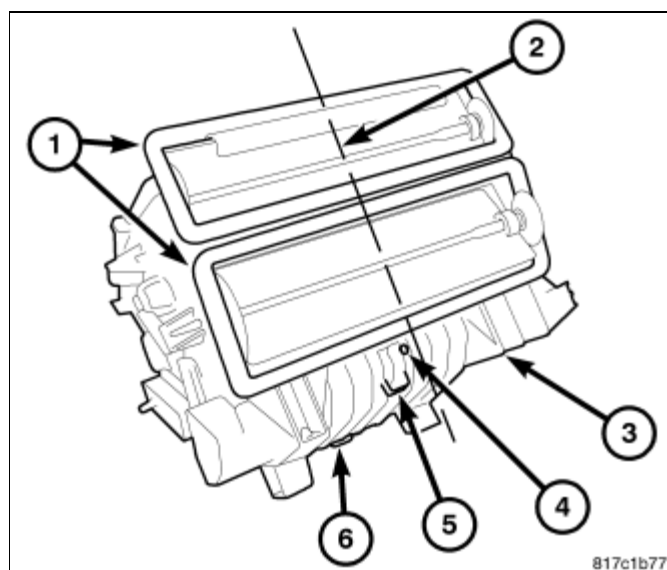


NOTE: If any foam seal on the air distribution housing outlets is deformed or damaged, the seal must be replaced.

10. Carefully cut the foam seals (1) along the parting line (2) of the two halves of the air distribution housing (3). If a seal is deformed or damaged, it must be replaced.

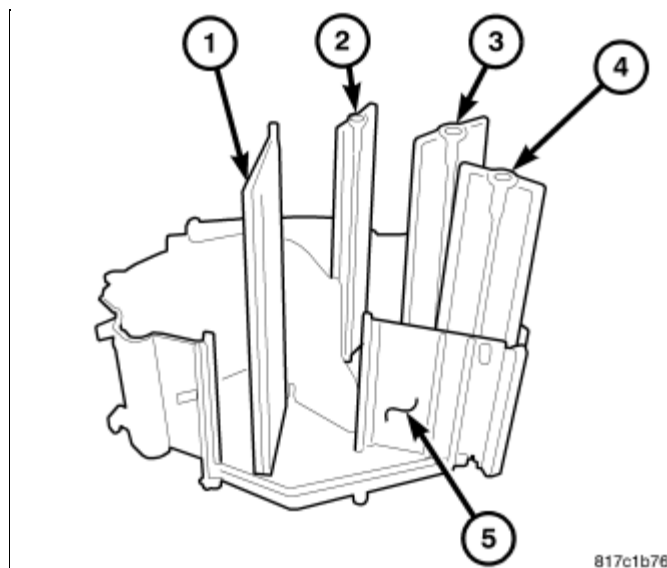
11. Remove the five screws (4) and one metal clip (5) that secure the two halves of the air distribution housing together.

12. Disengage the three plastic retaining tabs (6) that secure the two halves of the air distribution housing together and carefully separate the housing.



NOTE: If a seal on an air door is deformed or damaged, the air door must be replaced.

13. Disengage the air door(s) (1, 2, 3 and 4) from the mode door levers and remove the air doors from the air distribution housing (5).



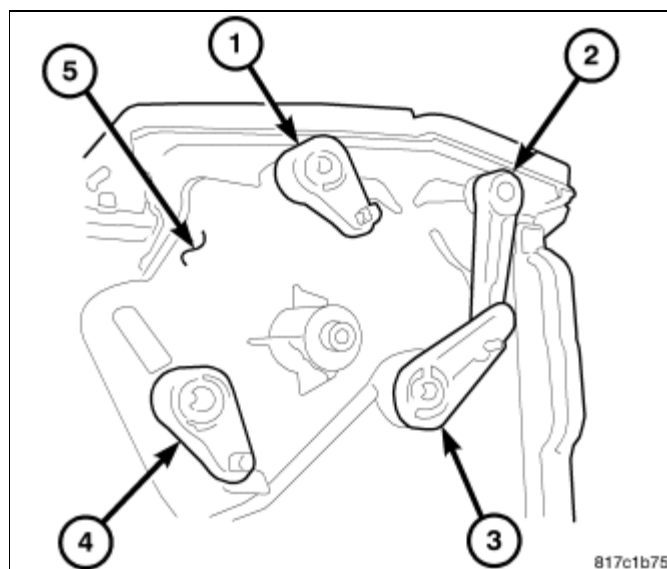
NOTE: To remove the mode door levers, disengage the lever retaining tabs located on the inside of the air distribution housing and pull the levers straight out of the housing.

14. Remove the four mode door levers (1, 2, 3 and 4) from the right side of the air distribution housing (5).

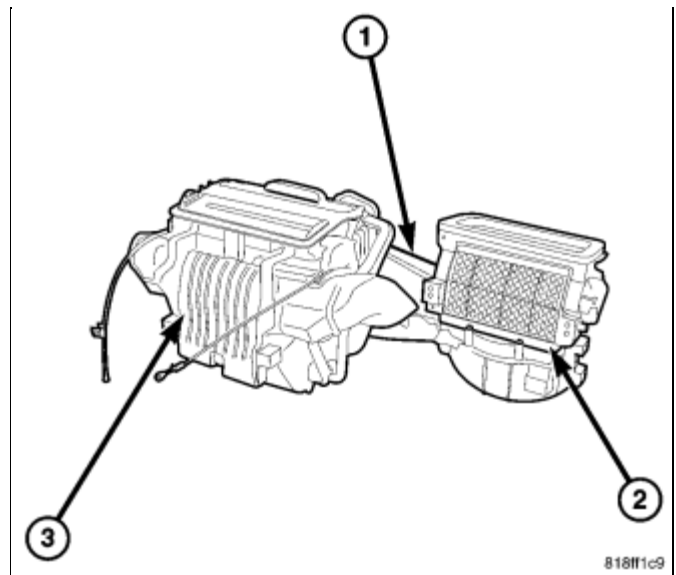
HOUSING-AIR INLET

NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.

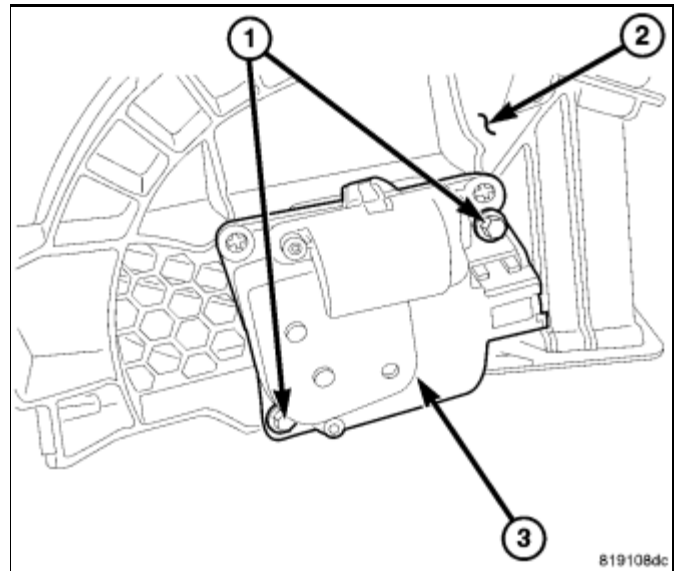
NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.



1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the air inlet housing (2) from the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - REMOVAL).



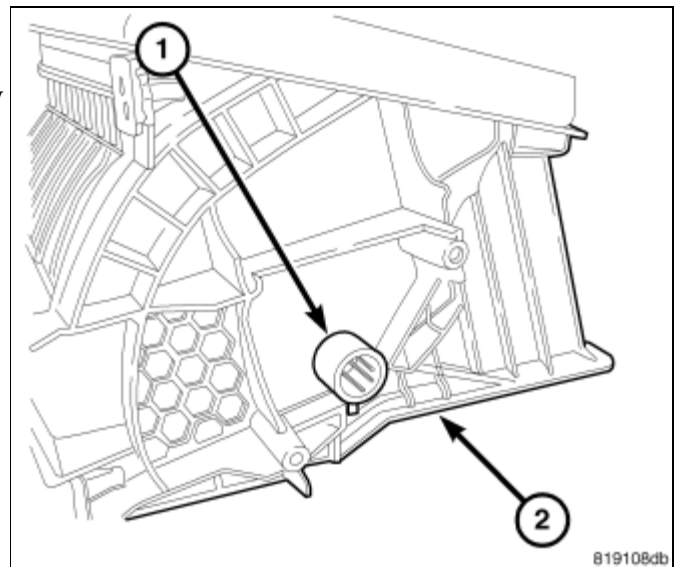
3. Remove the two screws (1) that secure the recirculation door actuator (3) to the right side of the air inlet housing (2) and remove the actuator.



4. To remove the recirculation door pivot shaft adapter (1) from the right end of the recirculation-air door, first carefully push down on the tab of the door lever pivot shaft adapter located inside of the air inlet housing (2), then pull the pivot shaft adapter straight out of the end of the recirculation-air door pivot shaft.

NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.

NOTE: If a rubber seal on the recirculation air-door is deformed or damaged, the air-door must be replaced.



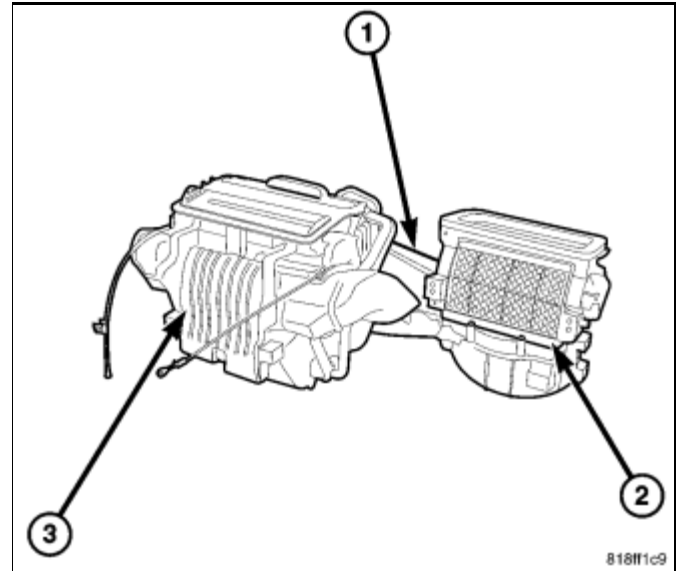
5. Carefully pinch the two ends of the recirculation air-door together and remove the air-door from the air inlet housing. If the seal on the recirculation air-door is deformed or damaged, the air-door must be replaced.

HOUSING-HVAC

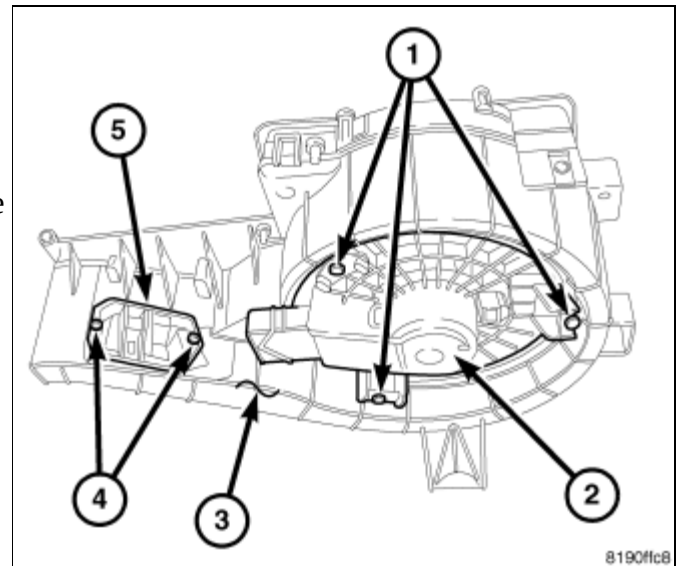
NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the A/C evaporator.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

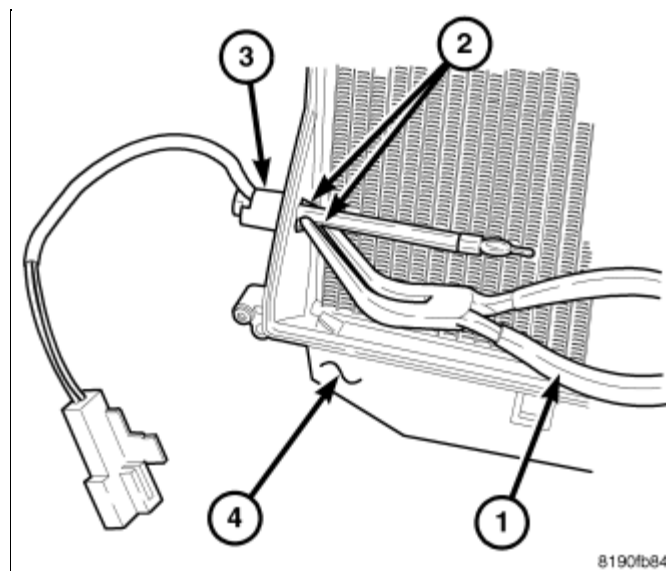
1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the air inlet housing (2) from the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - REMOVAL).
3. Remove the air distribution housing (3) from the HVAC housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - REMOVAL).



4. Remove the three screws (1) that secure the blower motor (2) to the bottom of the HVAC housing (3) and remove the blower motor.
5. Remove the two screws (4) that secure the blower motor resistor (5) to the back of the HVAC housing and remove the resistor.



6. Using needle nose pliers (1), disengage the two retaining tabs (2) that secure the evaporator temperature sensor (3) to the driver side of the HVAC housing (4) and remove the sensor.

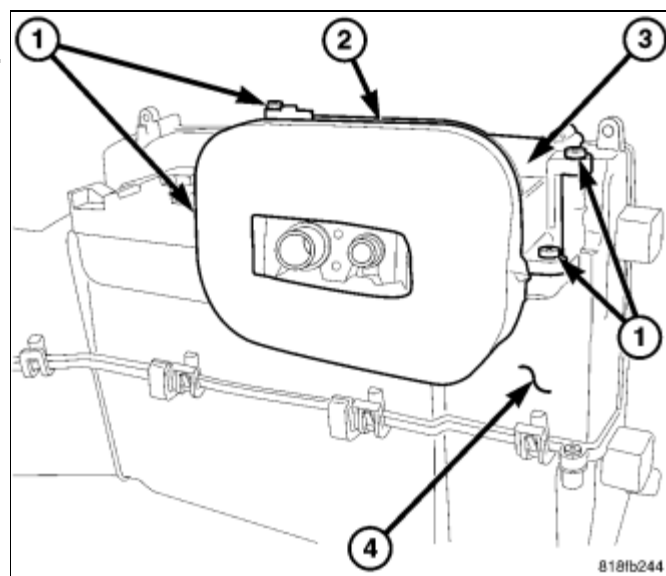


7. Remove the A/C expansion valve from the A/C evaporator (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/VALVE-A/C EXPANSION - REMOVAL).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

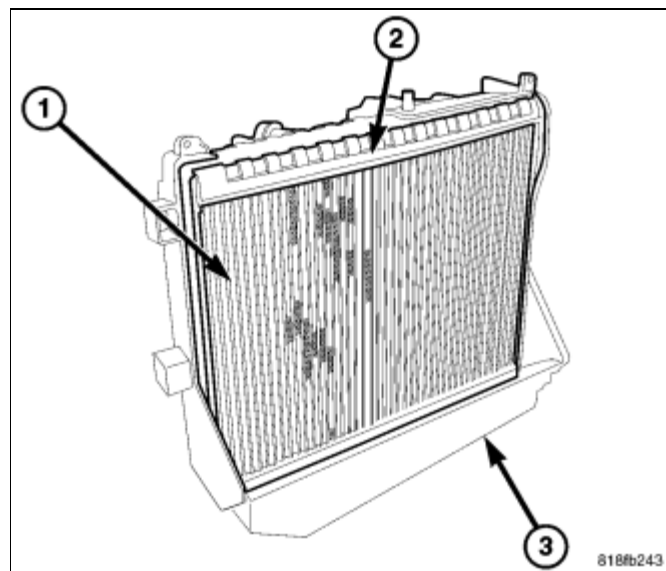
8. Remove the foam seal (2) from the flange (3) located on the top of the HVAC housing (4).

9. Remove the four screws (1) that secure the flange to the HVAC housing and remove the flange.



NOTE: If the foam insulator for the evaporator is deformed or damaged, it must be replaced.

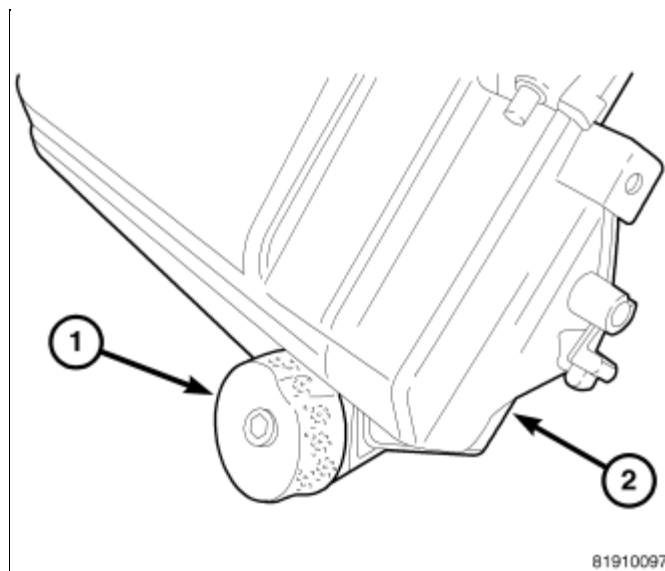
10. Carefully remove the A/C evaporator (1) and its insulator (2) from the HVAC housing (3).



NOTE: If the foam seal for the condensate drain is

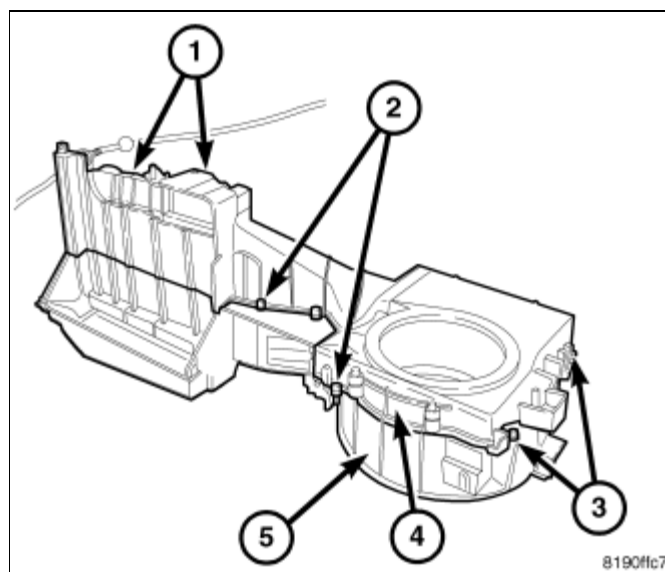
deformed or damaged, it must be replaced.

11. If required, remove the foam seal (1) from around the condensate drain located on the bottom of the HVAC housing (2).



12. Remove the two metal clips (1) and ten screws (2) that secure the two halves of the HVAC housing together (4 and 5).

13. Disengage the eight plastic retaining tabs (4) that secure the two halves of the HVAC housing together and separate the housing.



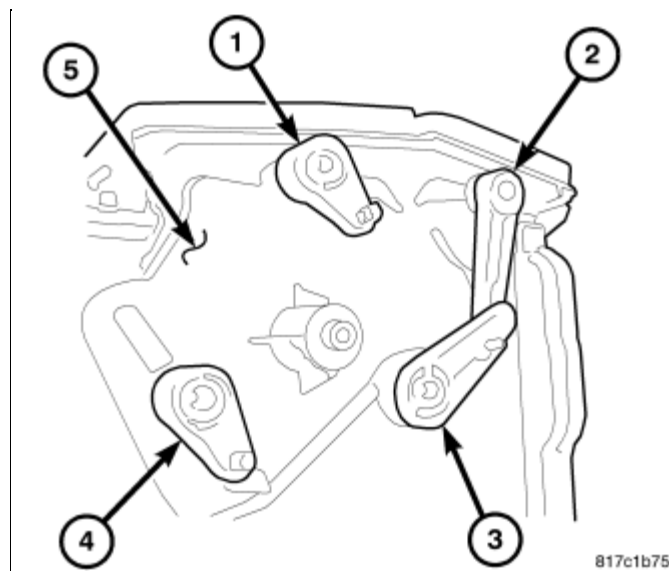
ASSEMBLY

HOUSING-AIR DISTRIBUTION

NOTE: Whenever the control cables are removed from the HVAC housing, new cables must be installed. Failure to replace the control cables when required can result in selected temperatures and operating modes not properly obtained.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

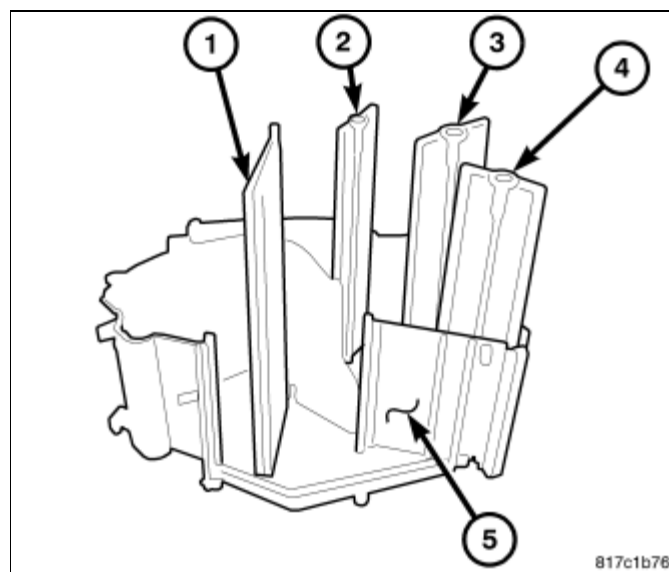
1. Install the four mode door levers (1, 2, 3 and 4) onto the right side of the air distribution housing (5). Make sure the lever retaining tabs are fully engaged to the housing.



NOTE: Properly position the air doors within the air distribution housing by first aligning the four mode door levers to the scribe lines located on the right outer side of the air distribution housing. Then, install the air doors onto the mode door levers with the UP mark on each air door facing toward the top of the housing.

NOTE: If a seal on an air door is deformed or damaged, the air door must be replaced.

2. Align the four mode door levers to the scribe lines on the right outer side of the air distribution housing (5) and install the air door(s) (1, 2, 3 and 4) onto the mode door levers with the UP mark on each air door facing toward the top of the housing.

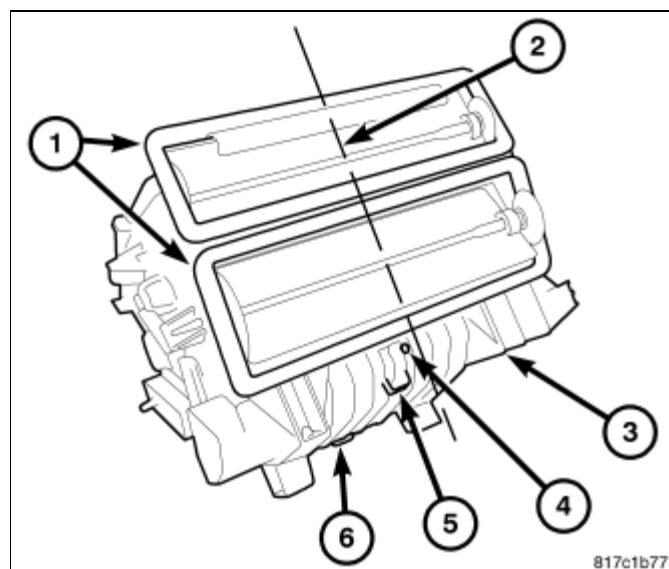


3. Align the air door(s) with the pivot shaft hole(s) in the air distribution housing (3) and install the two halves of the housing together. Make sure the three plastic retaining tabs (6) are fully engaged.

4. Install the five screws (4) and one metal clip (5) that secure the two halves of the air distribution housing together. Tighten the screws to 1.2 N·m (10 in lbs.). Make sure the metal clip is fully engaged to the housing halves.

NOTE: If any foam seal on the air distribution housing outlets is deformed or damaged, the seal must be replaced.

5. Inspect the foam seals (1), especially at the parting line (2). If a foam seal is deformed or damaged, it must be replaced.

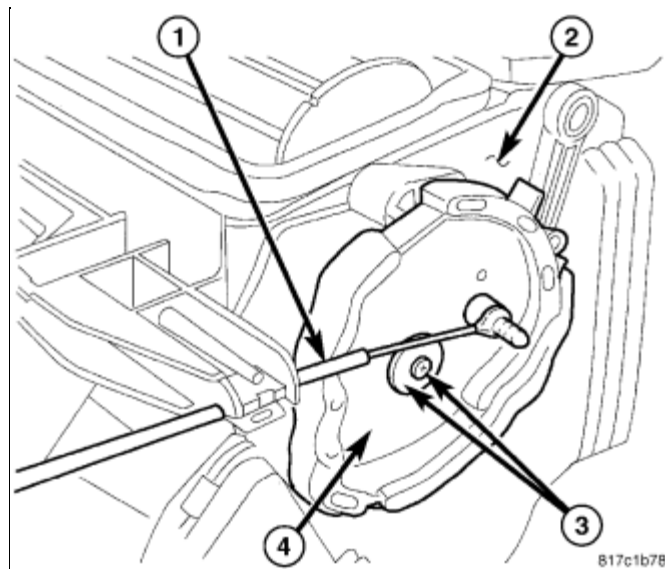


NOTE: Align the pins on the mode door levers with the grooves in the back of the mode door cam prior to installation of the cam.

6. Align the mode door levers on the right side of the air distribution housing (2) to the mode door cam (4) and install the cam onto the housing. Make sure the levers are correctly engaged to the cam.

7. Install the screw and washer (3) that secure the mode door cam to the air distribution housing. Tighten the screw to 0.6 N·m (5 in. lbs.).

8. Install a new mode door cable (1) (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CABLE-MODE DOOR - INSTALLATION).



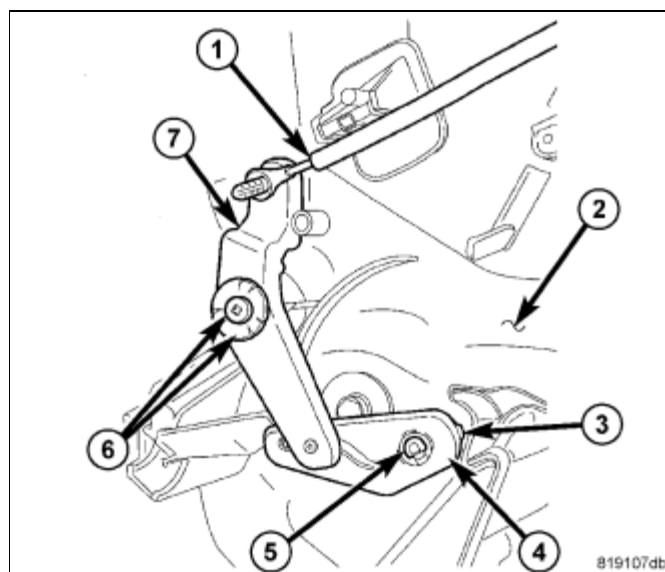
9. Install the washer (3) and the blend door pivot lever (4) onto the end of the blend door pivot shaft (5) located on the left side of the air distribution housing (2). Make sure the lever retaining tab is fully engaged to the pivot shaft.

NOTE: Align the pin on the blend door lever with the groove in the pivot lever prior to installation of the blend door lever.

10. Install the blend door lever (7) onto the air distribution housing. Make sure the levers are correctly aligned to each other.

11. Install the screw and washer (6) that secures the blend door lever to the air distribution housing. Tighten the screw to 0.6 N·m (5 in. lbs.).

12. Install a new temperature control cable (1) (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CABLE-TEMPERATURE CONTROL - INSTALLATION).

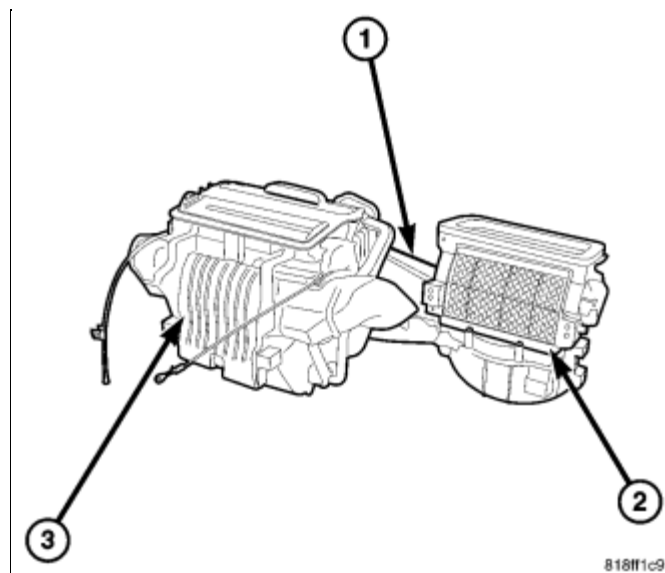


13. If equipped with the 2.8L diesel engine, install the electric positive temperature coefficient (PTC) heater unit (refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - INSTALLATION).

14. Install the heater core (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/CORE-HEATER - INSTALLATION).

15. Install the air distribution housing (3) onto the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - INSTALLATION).

16. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC -



HOUSING-HVAC ASSEMBLY - INSTALLATION).

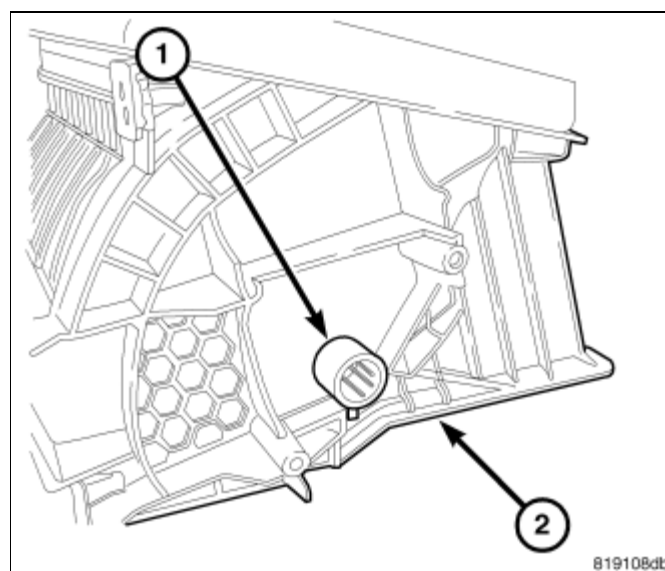
HOUSING-AIR INLET

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

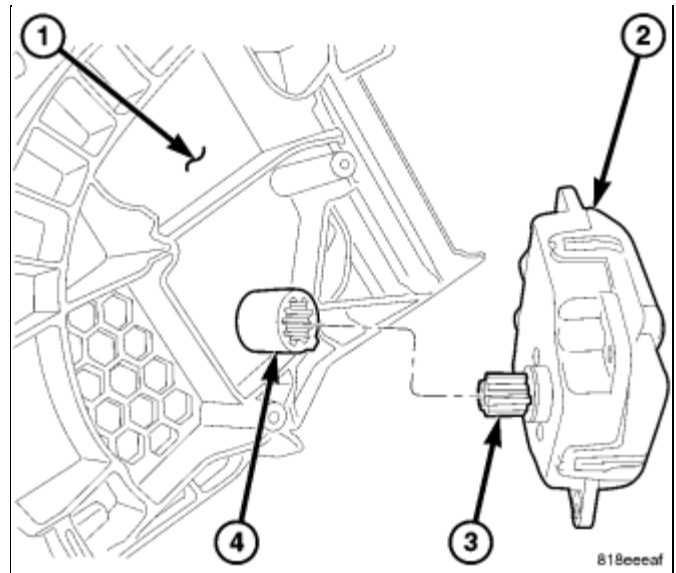
1. Carefully install the recirculation-air door into the air inlet housing (2) by pinching the two ends of the air-door together and aligning the pivot shafts of the air-door to the pivot shaft holes in the air inlet housing.

NOTE: Install the recirculation door pivot shaft adapter by carefully pushing it straight into the end of the recirculation door pivot shaft.

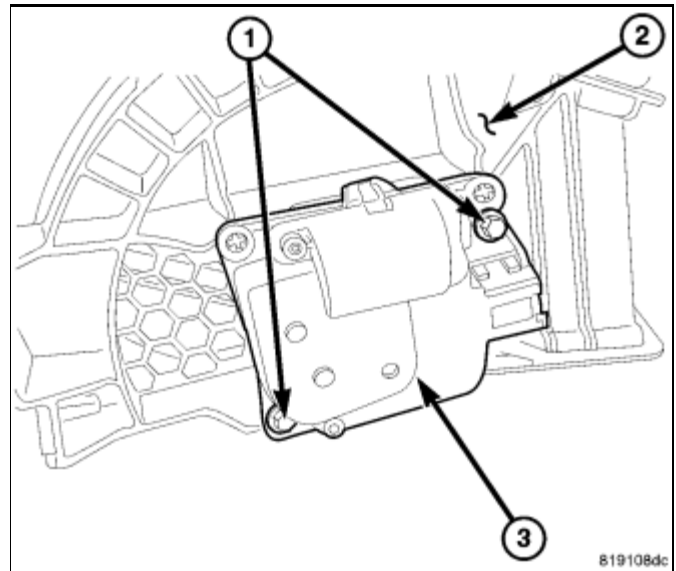
2. Install the recirculation door pivot shaft adapter (1) into the right side pivot shaft of the recirculation air-door. Make sure the adapter is fully engaged to the pivot shaft.



3. Install the recirculation door actuator (2) onto the right side of the air inlet housing (1). If necessary, rotate the actuator slightly to align the splines of the actuator output shaft (3) with those on the recirculation door pivot shaft adapter (4).



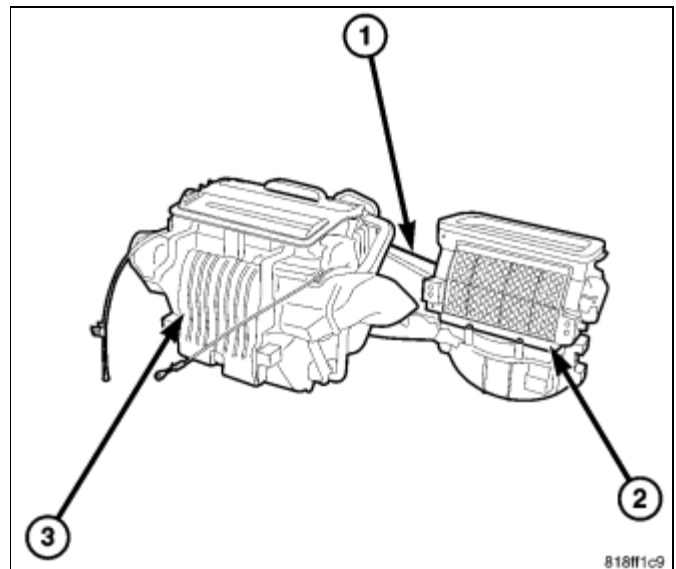
4. Install the two screws (1) that secure the recirculation door actuator (3) to the air inlet housing (2). Tighten the screws to 1.2 N·m (10 in. lbs.).



5. Install the air inlet housing (2) onto the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING- AIR INLET - INSTALLATION).
 6. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).

HOUSING-HVAC

NOTE: If the A/C evaporator is being replaced, add 50 milliliters (1.7 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

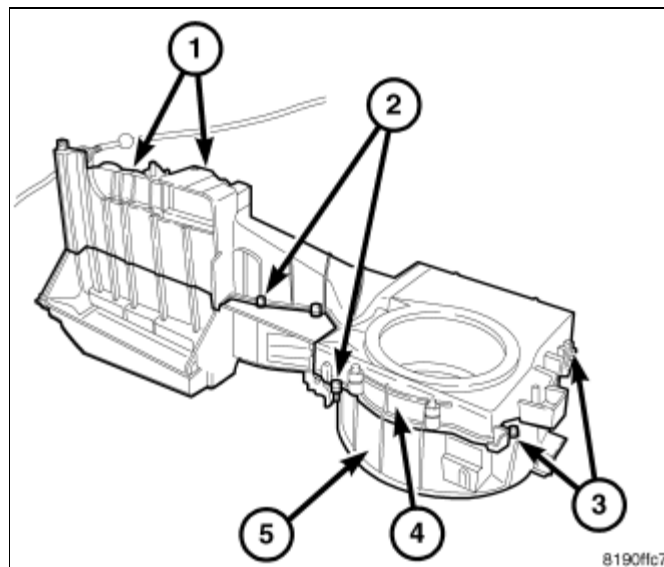


NOTE: Make sure that the evaporator drain within the HVAC housing is clean and unrestricted and that

the insulator is properly positioned.

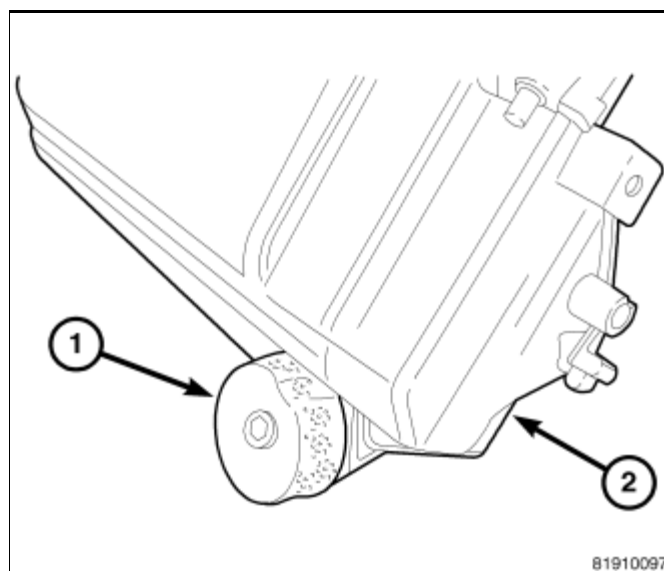
NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

1. Install the two halves of the HVAC housing (4 and 5) together and engage the eight plastic retaining tabs (4). Make sure the retaining tabs are fully engaged.
2. Install the ten screws (2) and two metal clips (1) that secure the two halves of the HVAC housing together. Tighten the screws to 1.2 N·m (10 in lbs.). Make sure the metal clips are fully engaged to the housing halves.



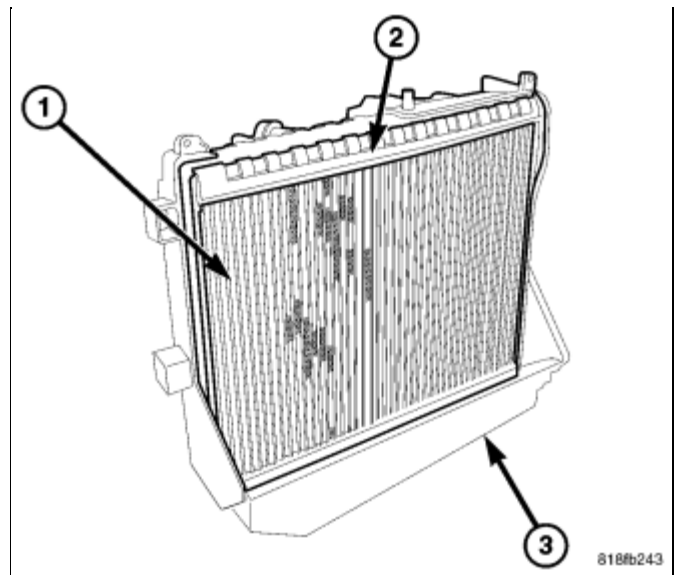
NOTE: If the foam seal for the condensate drain is deformed or damaged, it must be replaced.

3. If removed, install the foam seal (1) around the condensate drain located on bottom of the HVAC housing (2).



NOTE: If the foam insulator for the evaporator is deformed or damaged, it must be replaced.

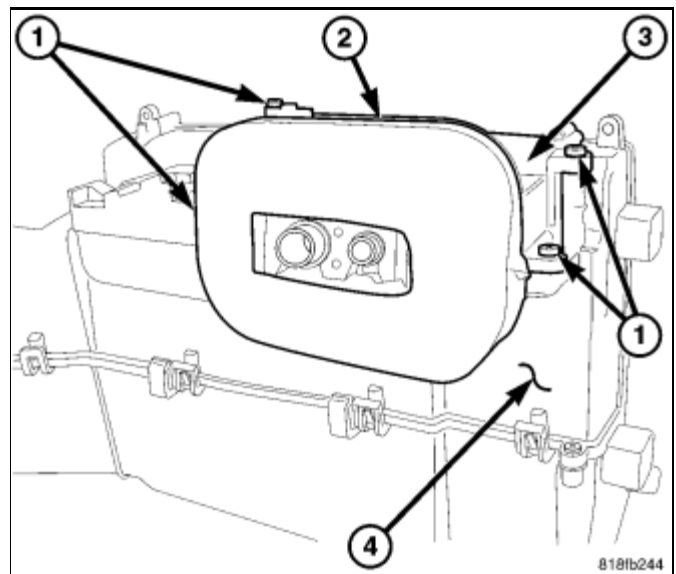
4. Install the A/C evaporator (1) into the HVAC housing (3). Make sure that the evaporator drain within the HVAC housing is clean and unrestricted and that the insulator (2) around the A/C evaporator is properly positioned.



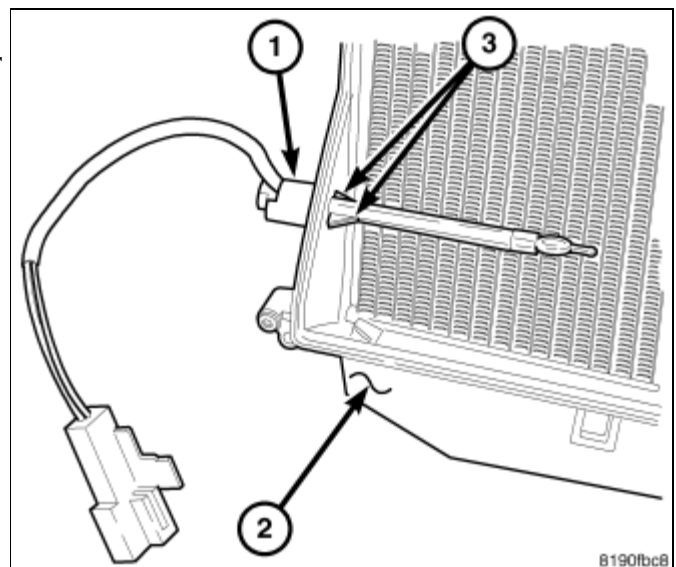
5. Install the flange (3) onto the top of the HVAC housing (4).
6. Install the four screws (1) that secure the flange to the HVAC housing. Tighten the screws to 1.2 N·m (10 in lbs.).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

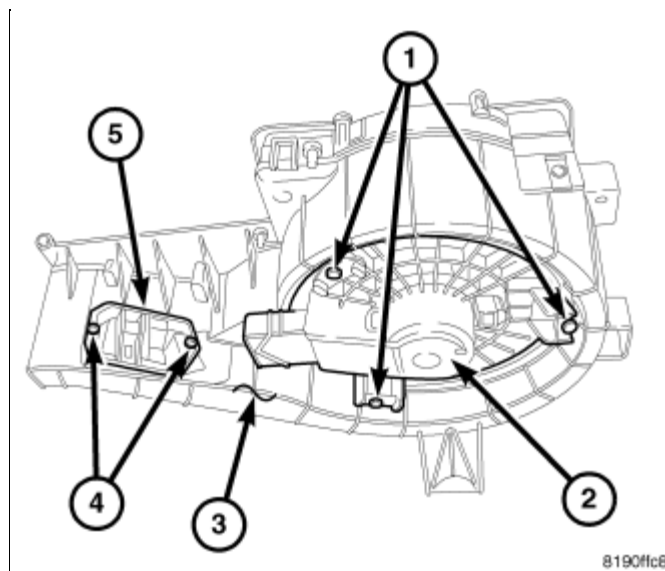
7. Install the foam seal (2) onto the flange.
8. Install the A/C expansion valve onto the A/C evaporator (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/VALVE-A/C EXPANSION - INSTALLATION).



9. Install the evaporator temperature sensor (1) into the driver side of the HVAC housing (2). Make sure the retaining tabs (3) are fully engaged to the housing.

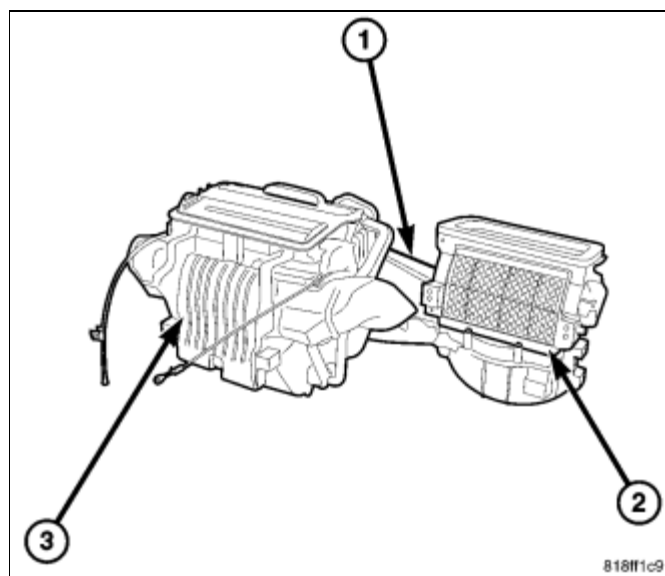


10. Position the blower motor (2) into the bottom of the HVAC housing (3).
11. Install the three screws (1) that secure the blower motor to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).
12. Position the blower motor resistor (5) into the HVAC housing.
13. Install the two screws (4) that secure the blower motor resistor to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).



14. Install the air inlet housing (2) onto the HVAC housing (1) (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING- AIR INLET - INSTALLATION).
15. Install the air distribution housing (3) onto the HVAC housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - INSTALLATION).

NOTE: If the heater core is being replaced, flush the cooling system (refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).



16. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).

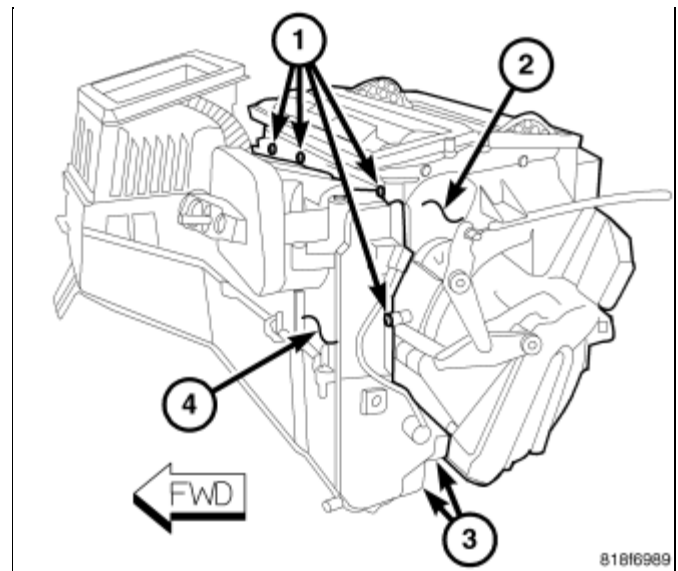
INSTALLATION

HOUSING-AIR DISTRIBUTION

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

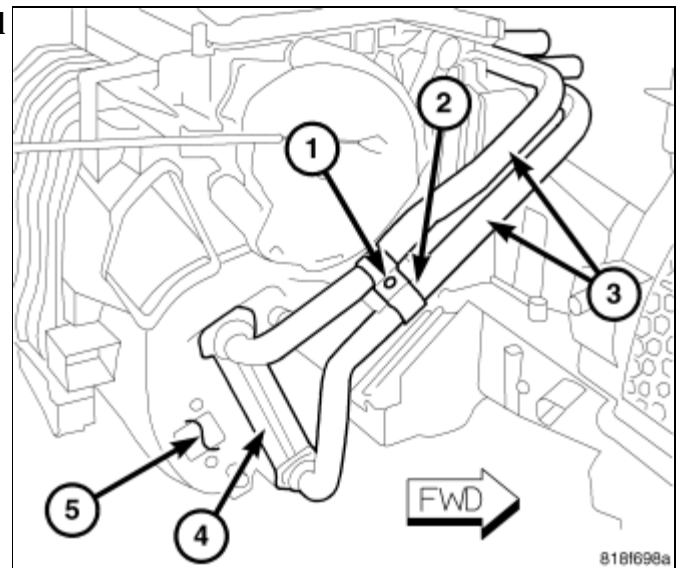
1. Position the air distribution housing (2) onto the rear of the HVAC housing (4).
2. Install the two metal retaining clips (3) that secure the bottom of the air distribution housing to the HVAC housing.
3. Install the seven screws (1) that secure the air distribution

housing to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).



NOTE: If the foam seals for the heater core are deformed or damaged, they must be replaced.

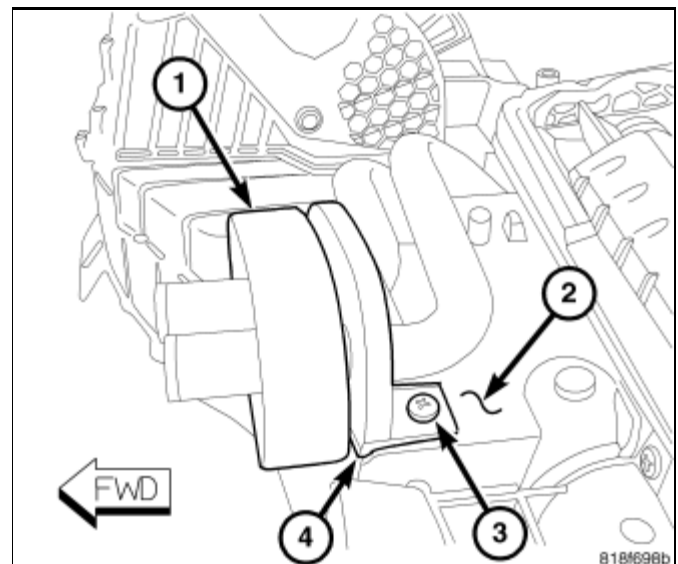
4. Carefully install the heater core (4) into the passenger side of the air distribution housing (5).
5. Install the retaining bracket (2) and the screw (1) that secures the heater core tubes (3) to the air distribution housing. Tighten the screw to 1.2 N·m (10 in. lbs.).



6. Position the flange (4) to the front of the HVAC housing (2).
7. Install the screw (3) that secures the flange to the HVAC housing. Tighten the screw to 1.2 N·m (10 in. lbs.).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

8. Install the foam seal (1) onto the flange.
9. Install the floor distribution ducts onto the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-FLOOR DISTRIBUTION - INSTALLATION).



NOTE: If the heater core is being replaced, flush the cooling system (refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).

10. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).

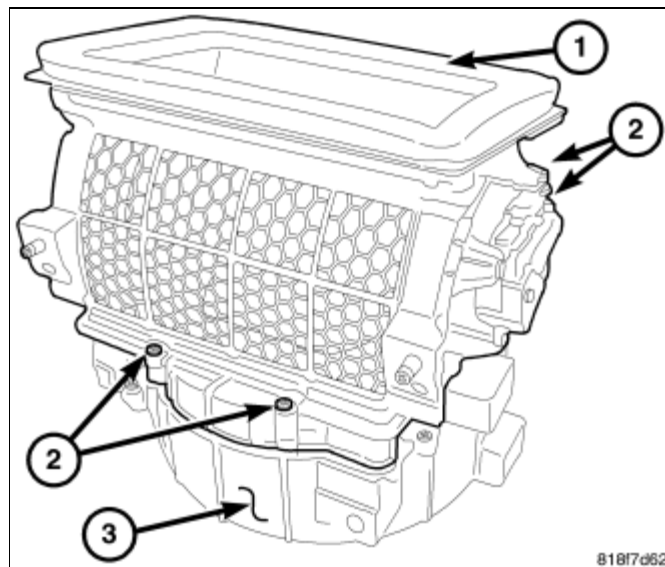
HOUSING-AIR INLET

NOTE: LHD model shown. RHD model similar.

1. Position the air inlet housing (1) onto the top of the HVAC housing (3).
2. Install the four screws (2) that secure the air inlet housing to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).

NOTE: If the foam seal on the top of the inlet housing is deformed or damaged, the seal must be replaced.

3. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).



SCREEN-AIR INLET

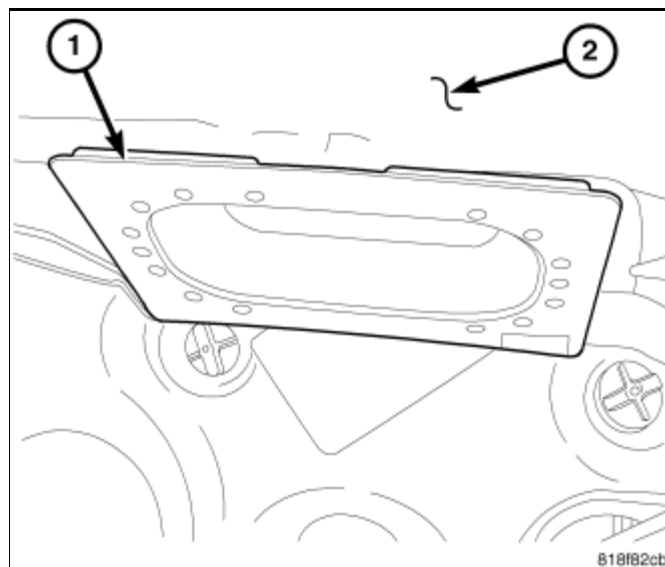
NOTE: LHD model shown. RHD model similar.

1. Position the air inlet screen (1) to the passenger compartment side of the cowl panel (2) and engage the retaining tabs that secure the screen to the cowl. Make sure the retaining tabs are fully engaged.

NOTE: Make sure the air inlet screen retaining tabs are fully engaged. Failure to fully engage the screen to the cowl and dash panel will result in a leak.

2. Push the air inlet screen upward to engage the retaining tabs that secure the screen to the dash panel. Make sure the retaining tabs are fully engaged.

3. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).

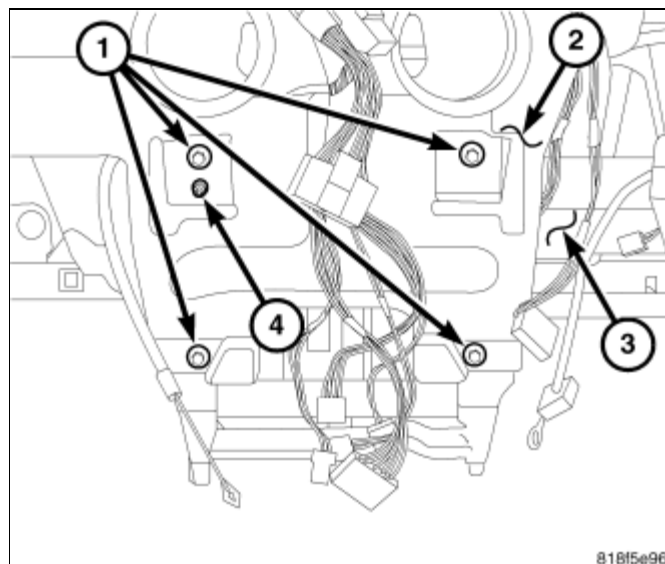


HOUSING-HVAC

NOTE: LHD model shown in illustrations. RHD model similar.

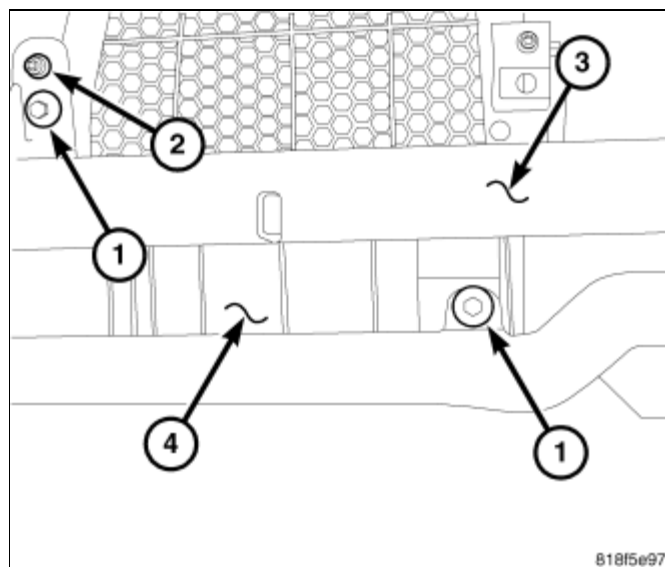
1. Position the HVAC housing assembly (3) into the instrument panel support (2). Be certain that the housing alignment pin (4) is correctly located.
2. Install the four bolts (1) that secure the HVAC housing assembly to the center of instrument panel support. Tighten the bolts to 4 N·m (35 in. lbs.).

NOTE: If a foam seal on the top of the HVAC housing is deformed or damaged, the seal must be replaced.

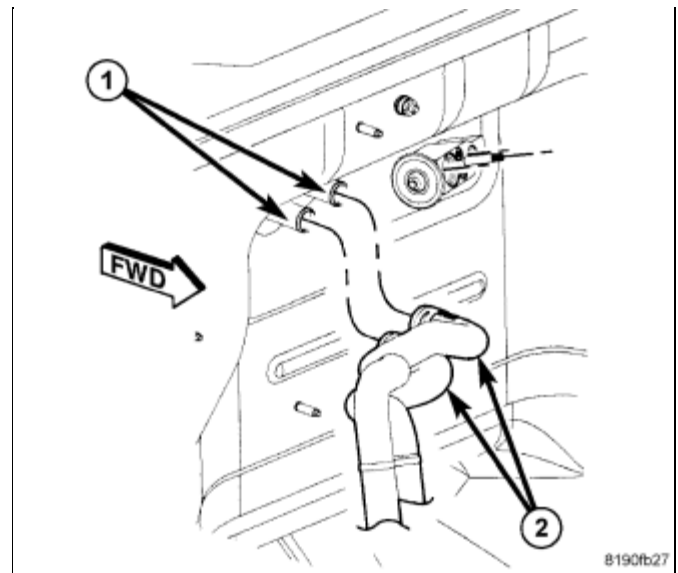


3. Install the instrument panel ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL - INSTALLATION).
4. Install the defroster duct (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCT-DEFROSTER - INSTALLATION).
5. Install the demister ducts (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-INSTRUMENT PANEL DEMISTER - INSTALLATION).

6. Verify that the housing alignment pin (2) is correctly located in the passenger side of the instrument panel support (3).
7. Install the two bolts (1) that secure the air inlet housing (4) to the instrument panel support. Tighten the bolts to 4 N·m (35 in. lbs.).
8. Connect the instrument panel wire harness connectors to the evaporator temperature sensor, blower motor resistor, blower motor and the recirculation door actuator.
9. Install the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - INSTALLATION).
10. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



11. Remove the previously installed plugs or caps and connect the heater hoses (2) to the heater core tubes (1).
12. Using cable-type spring clamp pliers or equivalent, correctly position the two hose clamps that secure the heater hoses to the heater core tubes and engage the clamps to the tubes.
13. If equipped with the 3.8L engine, install the upper intake manifold (refer to 9 - ENGINE/MANIFOLDS/MANIFOLD-INTAKE-UPPER - INSTALLATION).



14. Remove the tape or plugs from the opened refrigerant line fittings and the expansion valve ports.

15. Lubricate new O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of special materials compatible to the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

16. Connect the A/C liquid line (3) and A/C suction line (5) onto the A/C expansion valve (1).

17. Install the nut (2) that secures the A/C liquid and suction lines to the A/C expansion valve. Tighten the nut to 8 N·m (70 in. lbs.).

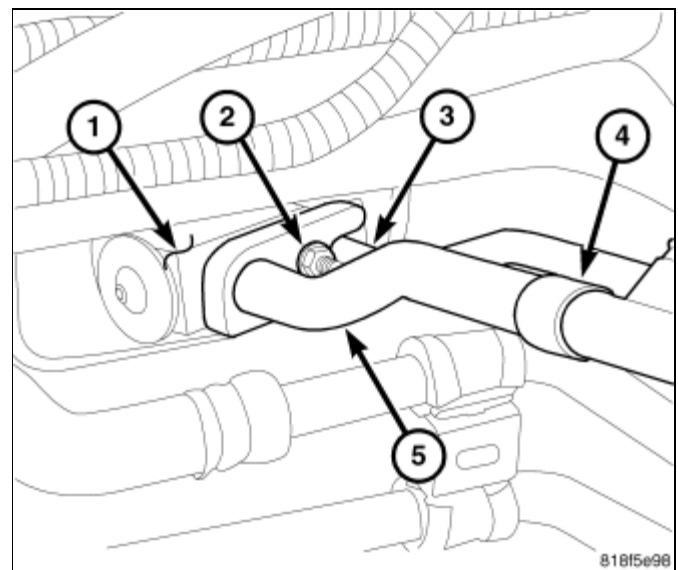
18. Reconnect the negative battery cable.

19. If the heater core is being replaced, flush the cooling system (refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).

20. Refill the engine cooling system (refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE - COOLING SYSTEM FILL).

21. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

22. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).



MOTOR-BLOWER

DESCRIPTION

The blower motor (1) is used to control the velocity of air moving through the HVAC housing by spinning the blower wheel (2) within the HVAC air inlet housing at the selected

speed.

The blower motor is a 12-volt, direct current (DC) motor mounted within a plastic housing with an integral wire harness connector (3) and three mounting tabs (4). The squirrel cage-type blower wheel is secured to the blower motor shaft and is positioned within the air inlet housing on the passenger side of the HVAC housing.

OPERATION

The blower motor is used to control the velocity of air moving through the HVAC housing by spinning the blower wheel within the HVAC air inlet housing at the selected speed.

The blower motor will operate whenever the ignition switch is in the Run position and the blower motor control is in any position except Off. The blower motor receives battery current through the totally integrated power module (TIPM) whenever the ignition switch is in the Run position.

Blower motor speed is controlled by regulating the ground path through or around the blower motor resistor and through the blower motor control located within the A/C-heater control.

The blower motor can be accessed for service from underneath the instrument panel.

NOTE: The blower motor is supplied with a 12V feed from the TIPM, through the blower motor resistor, whenever the ignition switch is in the RUN position. Due to an open circuit condition within the blower motor control switch the TIPM is UNABLE to detect an OPEN circuit for the blower motor.

The blower motor control system is diagnosed using a scan tool (refer to 24 - HVAC Electrical Diagnostics for more information).

The blower motor and blower motor wheel are factory balanced as an assembly and cannot be adjusted or repaired and must be replaced if found inoperative or damaged.

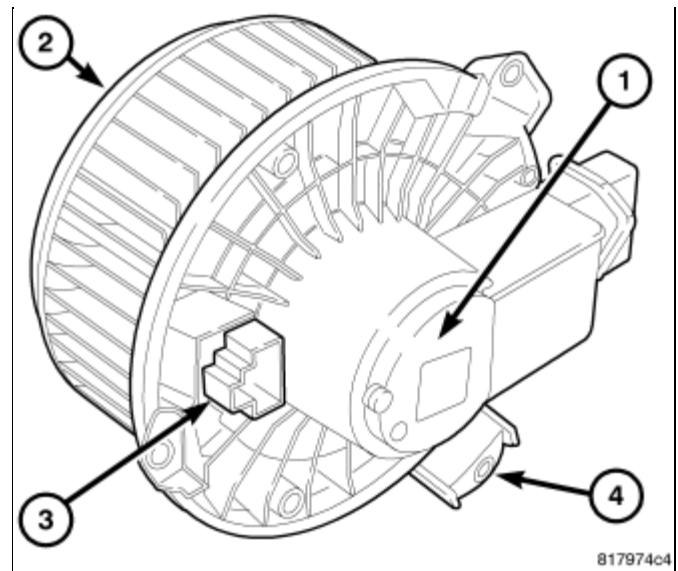
DIAGNOSIS AND TESTING

BLOWER MOTOR

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: The blower motor is supplied with a 12V feed from the TIPM, through the blower motor resistor, whenever the ignition switch is in the RUN position. Due to an open circuit condition within the blower motor control switch the TIPM is UNABLE to detect an OPEN circuit for the blower motor.

To determine if an open condition exists within the blower motor circuit wiring, it is necessary to disconnect the negative battery cable and check for continuity within the blower motor circuits using an ohmmeter. For circuit



descriptions and diagrams, refer to Air Conditioning/Heater in Group 8W - Wiring Diagrams.

OPERATION

Possible causes of an inoperative blower motor include:

- Open fuse
- Inoperative blower motor resistor
- Inoperative blower motor switch
- Inoperative blower motor
- Inoperative blower motor circuit wiring or wire harness connectors

NOISE

To determine if the blower motor is the source of the noise, simply switch the blower motor from Off to On. To verify that the blower motor is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material on fresh air inlet screen
- Foreign material in blower wheel
- Foreign material in HVAC housing
- Improper blower motor mounting
- Deformed or damaged blower wheel
- Worn blower motor bearings or brushes

VIBRATION

Possible causes of a blower motor vibration include:

- Improper blower motor mounting
- Foreign material in blower wheel
- Deformed or damaged blower wheel
- Worn blower motor bearings

REMOVAL

NOTE: The blower motor is located on the bottom of the passenger side of the HVAC housing. The blower motor can be removed from the vehicle without having to remove the HVAC housing.

NOTE: LHD model shown. RHD model similar.

1. Disconnect and isolate the negative battery cable.
2. From underneath the instrument panel, disconnect the instrument panel wire harness connector (3) from the blower motor (4).

3. Remove the three screws (2) that secure the blower motor to the bottom of the HVAC housing (1) and remove the blower motor.

INSTALLATION

NOTE: LHD model shown. RHD model similar.

1. Position the blower motor (4) into the bottom of the HVAC housing (1).
2. Install the three screws (2) that secure the blower motor to the HVAC housing. Tighten the screws to 1.2 N·m (10 in. lbs.).
3. Connect the instrument panel wire harness connector (3) to the blower motor.
4. Reconnect the negative battery cable.

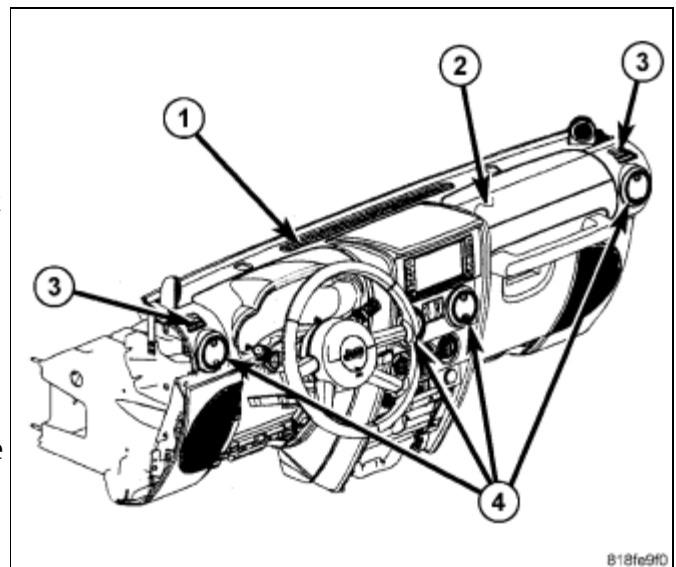
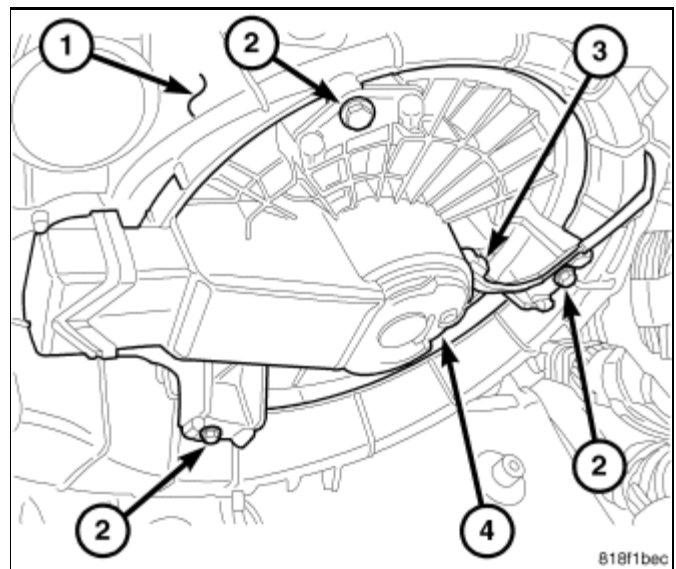
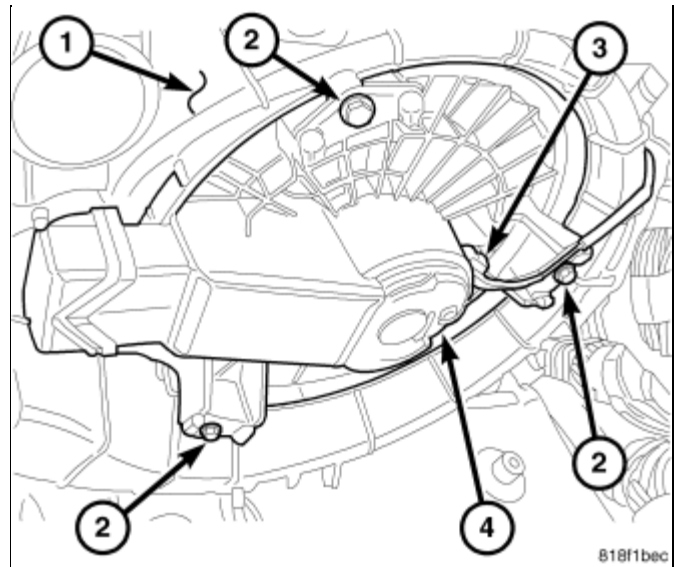
OUTLETS-AIR

DESCRIPTION

NOTE: LHD model shown. RHD model similar.

There is one defroster air outlet (1) located on the top of the instrument panel (2). The airflow from the defroster outlet is directed by fixed vanes in the outlet and cannot be adjusted. The defroster air outlet is not serviceable from the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - REMOVAL).

There are two side window demister air outlets (3). One located on each end of the instrument panel top cover. The airflow from the side window demister air outlets is directed by fixed vanes in the outlets and cannot be adjusted. The side window demister air outlets are not serviceable from the instrument panel cover (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL COVER - REMOVAL).



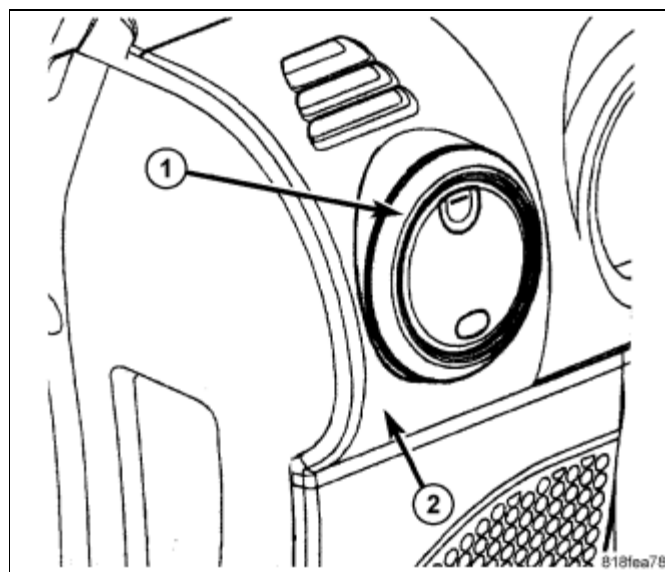
There are four round instrument panel air outlets (4). One air outlet is located near each outboard end of the instrument panel facing the rear of the vehicle and two air outlets are located at the top of the instrument panel center bezel. Each of the instrument panel air outlets contain movable vanes that can direct or shut off the flow of the conditioned air leaving each of the instrument panel outlets. Each instrument panel air outlet can be serviced separately.

REMOVAL

1. Rotate each air outlet (1) counter-clockwise to disengage its retaining tabs.

NOTE: If the foam seal on the air outlet is deformed or damaged, it must be replaced.

2. Carefully pull each air outlet straight out of the instrument panel (2).

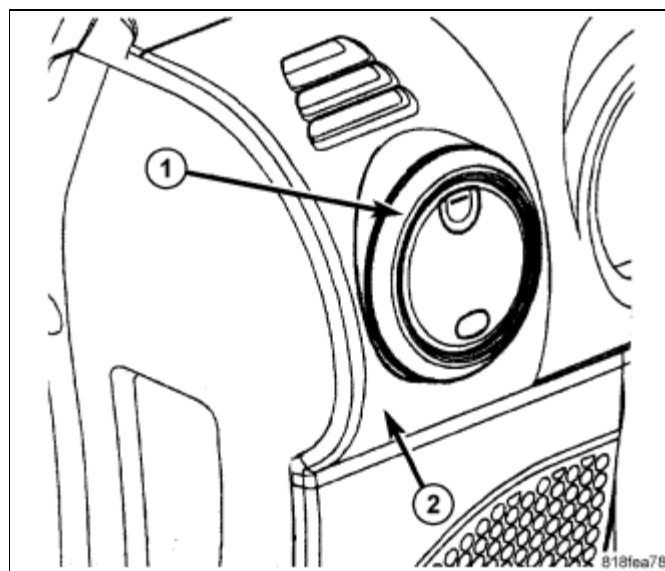


INSTALLATION

NOTE: If the foam seal on the air outlet is deformed or damaged, it must be replaced.

1. Position each air outlet (1) straight into the instrument panel (2).

2. Rotate each air outlet clockwise to engage its retaining tabs. Make sure the retaining tabs are fully engaged.



PLUMBING

PLUMBING

DESCRIPTION

The A/C refrigerant lines and hoses are used to carry the refrigerant between the various A/C system components. The refrigerant lines and hoses for the R-134a A/C system consist of a barrier-hose design with a nylon tube sandwiched between rubber layers. The nylon tube helps to contain the R-134a refrigerant, which has a small molecular structure. The ends of the refrigerant lines are made from lightweight aluminum and braze-less fittings.

Any kinks or sharp bends in the refrigerant lines and hoses will reduce the capacity of the entire A/C system and

can reduce the flow of refrigerant within the system.

OPERATION

High pressures are produced in a refrigerant system when the A/C compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

Depending on vehicle, model and market application, refrigerant lines are connected to each other or other A/C system components with block-type or quick-connect type fittings. To ensure the integrity of the refrigerant system, O-rings and/or gaskets may be used to seal the refrigerant system connections.

The refrigerant lines and hoses cannot be repaired and must be replaced if leaking or damaged.

WARNING

WARNING: The A/C system contains refrigerant under high pressure. Repairs should only be performed by qualified service personnel. Serious or fatal injury may result from improper service procedures.

WARNING: Avoid breathing the refrigerant and refrigerant oil vapor or mist. Exposure may irritate the eyes, nose, and/or throat. Wear eye protection when servicing the A/C refrigerant system. Serious eye injury can result from direct contact with the refrigerant. If eye contact occurs, seek medical attention immediately.

WARNING: Do not expose the refrigerant to open flame. Poisonous gas is created when refrigerant is burned. An electronic leak detector is recommended. Serious or fatal injury may result from improper service procedures.

WARNING: If accidental A/C system discharge occurs, ventilate the work area before resuming service. Large amounts of refrigerant released in a closed work area will displace the oxygen and cause suffocation and serious or fatal injury.

WARNING: The evaporation rate of R-134a refrigerant at average temperature and altitude is extremely high. As a result, anything that comes in contact with the refrigerant will freeze. Always protect the skin or delicate objects from direct contact with the refrigerant.

WARNING: The R-134a service equipment or the vehicle refrigerant system should not be pressure tested or leak tested with compressed air. Some mixtures of air and R-134a have been shown to be combustible at elevated pressures. These mixtures are potentially dangerous, and may result in fire or explosion causing property damage and serious or fatal injury.

WARNING: The engine cooling system is designed to develop internal pressures up to 145 kilopascals (21 pounds per square inch). Do not remove or loosen the coolant pressure cap, cylinder block drain plugs, radiator drain, radiator hoses, heater hoses, or hose clamps while the engine cooling system is hot and under pressure. Allow the vehicle to cool for a minimum of 15 minutes before opening the cooling system for service. Failure to observe this warning can result in serious burns from the heated engine coolant.

CAUTION

CAUTION: Never add R-12 to a refrigerant system designed to use R-134a. Do not use R-12 equipment or parts on an R-134a A/C system. These refrigerants are not compatible and damage to the A/C system will result.

CAUTION: Never use R-12 refrigerant oil in an A/C system designed to use R-134a refrigerant oil. These refrigerant oils are not compatible and damage to the A/C system will result.

CAUTION: The use of A/C system sealers may result in damage to A/C refrigerant recovery/evacuation/recharging equipment and/or A/C system. Many federal, state/provincial and local regulations prohibit the recharge of A/C systems with known leaks. DaimlerChrysler recommends the detection of A/C system leaks through the use of approved leak detectors and fluorescent leak detection dyes. Vehicles found with A/C system sealers should be treated as contaminated and replacement of the entire A/C refrigerant system is recommended. A/C systems found to be contaminated with A/C system sealers, A/C stop-leak products or seal conditioners voids the warranty for the A/C system.

CAUTION: Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

CAUTION: If equipped, do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

CAUTION: The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities. Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system. Keep service tools and the work area clean. Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug. This will prevent contamination from entering the A/C system.

CAUTION: Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.

CAUTION: Do not overcharge the refrigerant system. Overcharging will cause excessive compressor head pressure and can cause compressor noise and A/C system failure.

DIAGNOSIS AND TESTING

REFRIGERANT SYSTEM LEAKS

WARNING: R-134a service equipment or vehicle A/C system should not be pressure tested or leak tested with compressed air. Mixture of air and R-134a can be combustible at elevated pressures. These mixtures are potentially dangerous and may result in fire or explosion causing property damage, personal injury or death.

Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved service equipment meeting SAE requirements to discharge an R-134a system. If accidental system discharge occurs, ventilate work area before resuming service.

NOTE: If the A/C refrigerant system charge is empty or low, a leak in the A/C system is likely. Visually inspect all A/C lines, fittings and components for an oily residue. Oil residue can be an indicator of an A/C system leak location.

NOTE: The only way to correctly determine if the refrigerant system is fully charged with R-134a is to completely evacuate and recharge the A/C system.

Connect a suitable manifold gauge set and determine if the static A/C system pressure is above or below 345 kPa (50 psi) (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT). If less than 345 kPa (50 psi), proceed to [SYSTEM EMPTY](#). If greater than 345 kPa (50 psi), go to [SYSTEM LOW](#).

SYSTEM EMPTY

1. Evacuate the refrigerant system to the lowest degree of vacuum possible (approximately -88 kPa (-26 in. Hg) or greater vacuum) (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed to [STEP 2](#).
2. Prepare and dispense 0.284 kilograms (10 ounces) of R-134a refrigerant into the evacuated refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE) and proceed to [STEP 1](#) of the System Low procedure.

SYSTEM LOW

1. Position the vehicle in a wind-free work area. This will aid in detecting small leaks.
2. Operate the heating-A/C system with the engine at idle under the following conditions for at least 5 minutes.
 - Doors or windows open
 - Transaxle in Park or Neutral with the parking brake set (depending on application)
 - A/C-heater controls set to outside air, full cool, panel mode, high blower and with A/C compressor engaged

CAUTION: A leak detector only designed for R-12 refrigerant will not detect leaks in an R-134a refrigerant system.

3. Shut the vehicle Off and wait 2-7 minutes. Then use an electronic leak detector that is designed to detect R-134a refrigerant and search for leaks. Fittings, lines or components that appear to be oily usually indicate a refrigerant leak. To inspect the A/C evaporator for leaks, insert the leak detector probe into the drain tube opening or an air outlet. A dye for R-134a is available to aid in leak detection. Use only DaimlerChrysler approved refrigerant dye.

STANDARD PROCEDURE

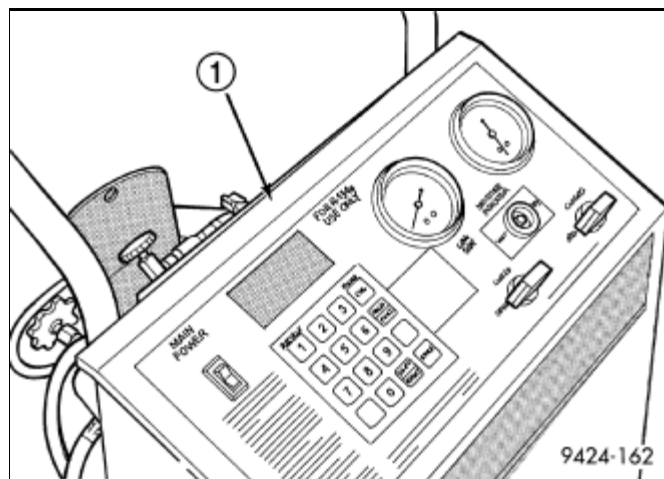
REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

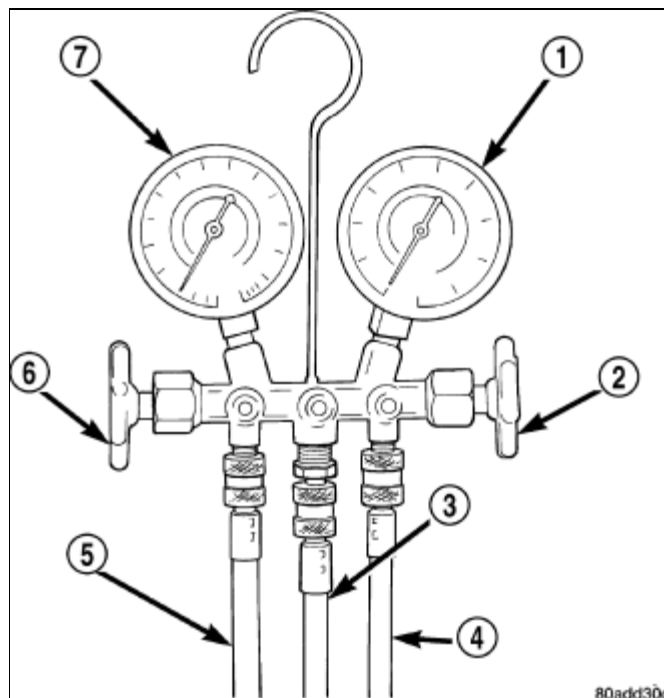
WARNING: Eye protection must be worn when servicing an air conditioning refrigerant system. Turn off

(rotate clockwise) all valves on the equipment being used, before connecting to or disconnecting from the refrigerant system. Failure to observe these warnings may result in personal injury or death.

When servicing the A/C system, an R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 must be used (1). Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.



A manifold gauge set (1) may be needed with some recovery/recycling/charging equipment. The manifold gauge set should have manual shut-off valves (2 and 6), or automatic back-flow valves located at the service port connector end of the manifold gauge set hoses (4 and 5). This will prevent refrigerant from being released into the atmosphere.



MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

- **LOW PRESSURE GAUGE HOSE** - The low pressure hose (Blue with Black stripe) attaches to the low side service port. This port is located on the A/C suction line near the A/C expansion valve at the rear of the engine compartment.
- **HIGH PRESSURE GAUGE HOSE** - The high pressure hose (Red with Black stripe) attaches to the high side service port. This port is located on the A/C liquid line near the left front of the engine compartment.
- **RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE** - The center manifold hose (Yellow,

or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

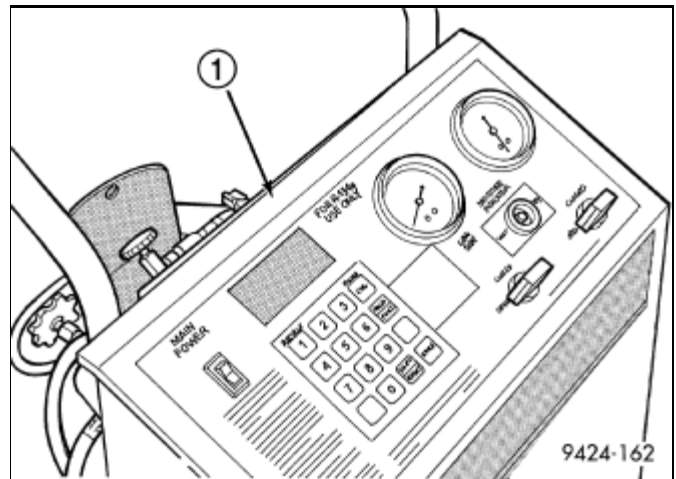
REFRIGERANT SYSTEM RECOVERY

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions may result in serious or fatal injury.

An R-134a refrigerant recovery/recycling/charging station (1) that meets SAE standard J2210 must be used to recover the refrigerant from the R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM EVACUATE

NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the A/C compressor.



If an A/C compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new A/C compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the A/C system and damage the A/C compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

1. Recover the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Connect a suitable charging station, refrigerant recovery machine or a manifold gauge set with vacuum pump and refrigerant recovery equipment (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT).
3. Open the suction and discharge valves and start the vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge to eliminate all moisture in system. When the suction gauge reads to the lowest degree of vacuum possible (approximately -88 kPa (- 26 in. Hg) or greater) for 30 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

4. Close all valves. Turn off and disconnect the vacuum pump.
5. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

REFRIGERANT SYSTEM CHARGE

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: The Underhood HVAC Specification Label contains the refrigerant fill specification of the vehicle being serviced.

After all refrigerant system leaks have been repaired and the refrigerant system has been evacuated, a refrigerant charge can be injected into the system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE - REFRIGERANT CHARGE LEVEL or the Underhood HVAC Specification Label for the proper amount of R-134a refrigerant).

An R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

CHARGING PROCEDURE

CAUTION: A small amount of refrigerant oil is removed from the A/C system each time the refrigerant system is recovered and evacuated. Before charging the A/C system, you **MUST** replenish any oil lost during the recovery process. Refer to the equipment manufacturer instructions for more information.

1. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
2. A manifold gauge set and an R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 should be connected to the refrigerant system.
3. Measure the proper amount of refrigerant and heat it to 52° C (125° F) with the charging station. See the operating instructions supplied by the equipment manufacturer for proper use of this equipment.
4. Open both the suction and discharge valves, then open the charge valve to allow the heated refrigerant to flow into the system.
5. When the transfer of refrigerant has stopped, close both the suction and discharge valves.
6. If all of the refrigerant charge did not transfer from the dispensing device, open all of the windows in the vehicle and set the heating-A/C system controls so that the A/C compressor is operating and the blower motor is running at its lowest speed setting. Run the engine at a steady high idle (about 1400 rpm).
7. Open the low-side valve to allow the remaining refrigerant to transfer to the refrigerant system.

WARNING: Take care not to open the discharge (high pressure) valve at this time. Failure to follow this warning could result in possible personal injury or death.

8. Disconnect the charging station and manifold gauge set from the refrigerant system service ports.
9. Reinstall the caps onto the refrigerant system service ports.

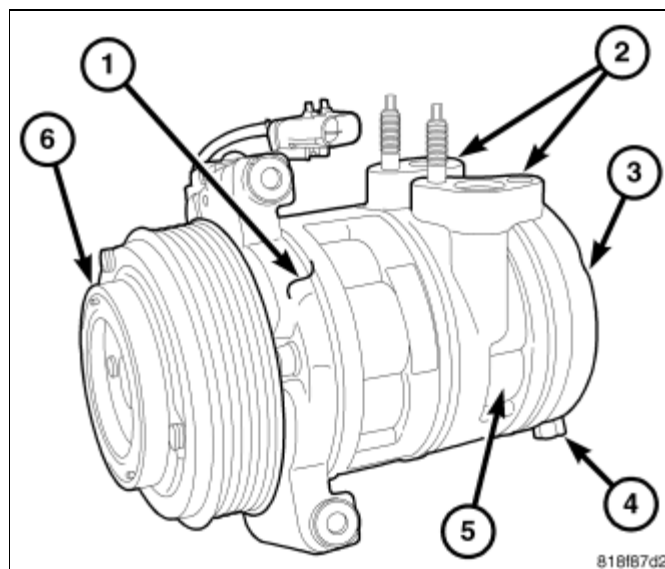
COMPRESSOR-A/C

DESCRIPTION

A/C COMPRESSOR

This A/C system uses a Zexel DKS-17DS ten cylinder, double-acting swash plate-type A/C compressor (1). This A/C compressor has a fixed displacement of 175.5 cubic centimeters (10.7 cubic inches) and has the suction and discharge ports (2) located on the compressor cylinder block (5).

The DKS-17DS compressor uses a electrically operated clutch (6) to engage and disengage it from the engine accessory drive belt. This A/C compressor also has an integral high pressure relief valve (4) located on the cylinder head (3) and a label which identifies the use of R-134a refrigerant.



HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor cylinder head at the rear of the A/C compressor (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - DESCRIPTION). This mechanical valve is designed to vent refrigerant from the A/C system to protect against damage to the A/C compressor and other A/C system components caused by condenser air flow restriction or an overcharge of refrigerant.

OPERATION

A/C COMPRESSOR

The A/C compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The A/C compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The A/C compressor draws in low-pressure refrigerant vapor from the A/C evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the A/C condenser through the compressor discharge port.

CAUTION: Be certain to adjust the refrigerant system oil level when replacing an A/C compressor (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level can prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C

compressor.

The A/C compressor cannot be repaired and must be replaced if inoperative or damaged. The compressor clutch, pulley and bearing assembly, and clutch field coil are available for service. If an internal failure of the A/C compressor has occurred, the A/C receiver/drier must also be replaced (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER/DRIER-A/C - REMOVAL).

HIGH PRESSURE RELIEF VALVE

The high pressure relief valve vents refrigerant from the A/C system when a discharge pressure of 3430 to 3930 kPa (497 to 570 psi) or above is reached. The high pressure relief valve closes with a minimum discharge pressure of 2990 kPa (4370 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the A/C system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the A/C system. If the high pressure relief valve vents refrigerant, it does not mean the valve is faulty.

The high pressure relief valve is factory-calibrated and cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the A/C compressor.

DIAGNOSIS AND TESTING**A/C COMPRESSOR NOISE**

When investigating an A/C system related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during A/C operation can often be misleading. For example: What sounds like a failed front engine bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon drive belt tension, drive belts can develop noises that are mistaken for an A/C compressor noise. Improper drive belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the accessory drive belt condition and tension as described in Cooling before beginning this procedure.

1. Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Turn the A/C compressor On and Off several times to clearly identify the compressor noise. Listen to the A/C compressor while the clutch is engaged and disengaged. Probe the A/C compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.
2. Loosen all of the compressor mounting hardware and retighten. Check the compressor clutch retainers. Be certain that the clutch field coil is mounted securely to the A/C compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap (refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CLUTCH-A/C COMPRESSOR - INSTALLATION).
3. To duplicate high-ambient temperature conditions (high head pressure), restrict the air flow through the A/C condenser. Install a manifold gauge set or a scan tool to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).
4. Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines and hoses for kinks or sharp bends that will restrict refrigerant flow, which can cause noises (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DESCRIPTION - REFRIGERANT LINES).

5. If the noise is from opening and closing of the high pressure relief valve, recover, evacuate and recharge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY), (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).
6. If the high pressure relief valve still does not seat properly, replace the A/C compressor (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - REMOVAL).

REMOVAL

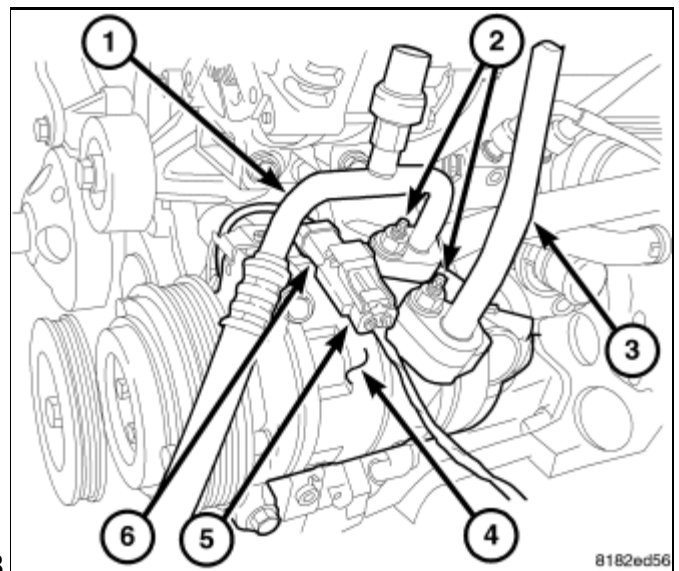
WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: The A/C compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch, clutch field coil or engine.

NOTE: 2.8L engine shown in illustrations. 3.8L engine similar.

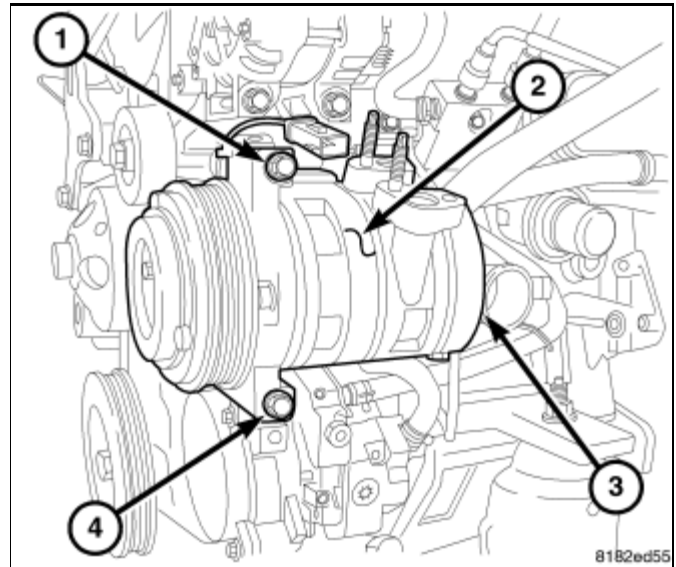
1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. On 2.8L equipped models, remove the air cleaner housing (refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - REMOVAL).
4. On 3.8L equipped models, remove the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).
5. Remove the accessory drive belt (refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
6. On 2.8L equipped models, remove the generator (refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
7. Remove the nuts (2) that secure the A/C discharge line (1) and A/C suction line (3) to the A/C compressor (4).
8. Disconnect the A/C discharge and suction lines from the A/C compressor and remove and discard the O-ring seals and gaskets.
9. Install plugs in, or tape over the opened refrigerant line fittings and compressor ports and position the refrigerant lines out of the way.
10. Disconnect the engine wire harness connector (5) from the field coil connector (6).



11. On 2.8L equipped models, remove the splash shield from the left front fender to gain access to the lower compressor retaining bolt (refer to 23 - BODY/EXTERIOR/ SPLASH SHIELD-WHEELHOUSE - REMOVAL).

12. Remove the front lower bolt (4) and the rear bolt (3) that secure the A/C compressor (2) to the mounting bracket.

13. Support the A/C compressor and remove the upper front bolt (1) that secures the A/C compressor to the mounting bracket and remove the compressor from the engine compartment.



INSTALLATION

CAUTION: If the A/C compressor is being replaced, be certain to adjust the refrigerant system oil level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

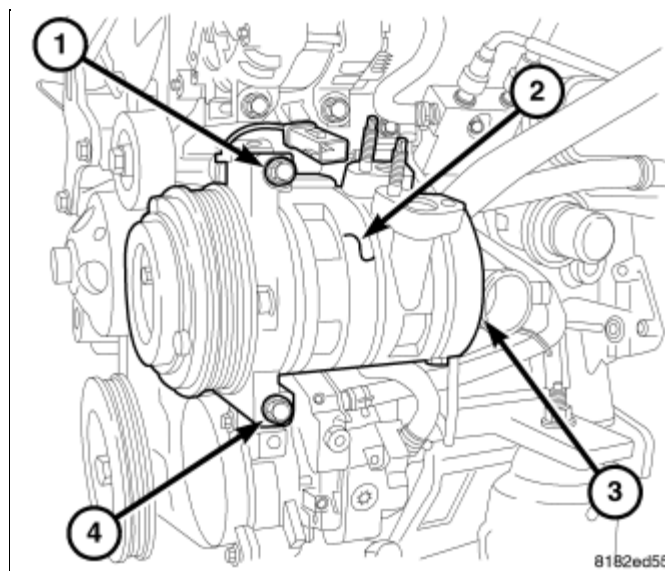
CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be removed from the new A/C compressor (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: 2.8L engine shown in illustrations. 3.8L engine similar.

1. If the A/C compressor (2) is being replaced, the refrigerant oil in the old compressor must be first drained and measured. Then the oil in the new A/C compressor must be drained. Finally, the new compressor must be refilled with the same amount of new refrigerant oil that was drained out of the old compressor (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL for more information). When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL



LEVEL). Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

2. Position the A/C compressor into the engine compartment.

3. Loosely install the three bolts (1, 3 and 4) that secure the A/C compressor to the engine. Tighten each of the fasteners to 28 N·m (21 ft. lbs.) using the following sequence:

- The upper bolt at the front of the compressor.
- The lower bolt at the front of the compressor.
- The bolt at the rear of the compressor.

4. On 2.8L equipped models, install the splash shield onto the left front fender (refer to 23 - BODY/EXTERIOR/SPLASH SHIELD-WHEELHOUSE - INSTALLATION).

5. Connect the engine wire harness connector (5) to the field coil connector (6).

6. Remove the plugs or tape from the opened refrigerant line fittings and compressor ports.

7. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the discharge and suction line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

8. Connect the A/C discharge line (1) and A/C suction line (3) to the A/C compressor (4).

9. Install the nuts (2) that secure the A/C discharge and suction lines to the A/C compressor. Tighten the nuts to 23 N·m (17 ft. lbs.).

10. On 2.8L equipped models, install the generator (refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

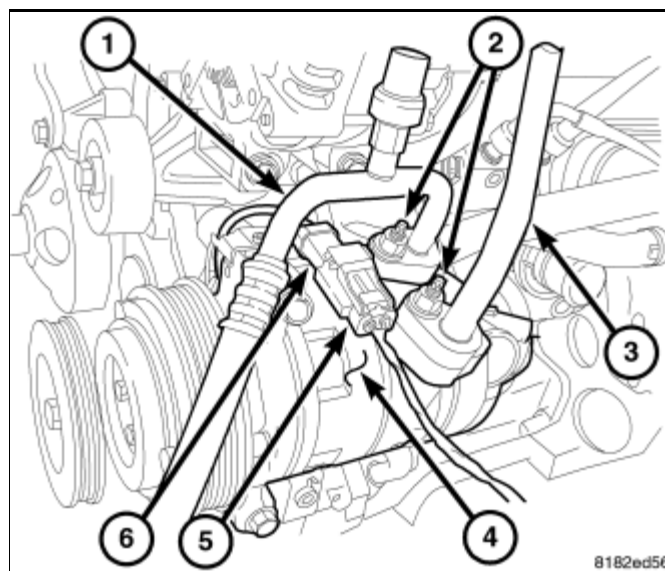
11. Install the accessory drive belt (refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

12. On 2.8L equipped models, install the air cleaner housing (refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - INSTALLATION).

13. On 3.8L equipped models, install the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).

14. Reconnect the negative battery cable.

15. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING -



STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

16. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

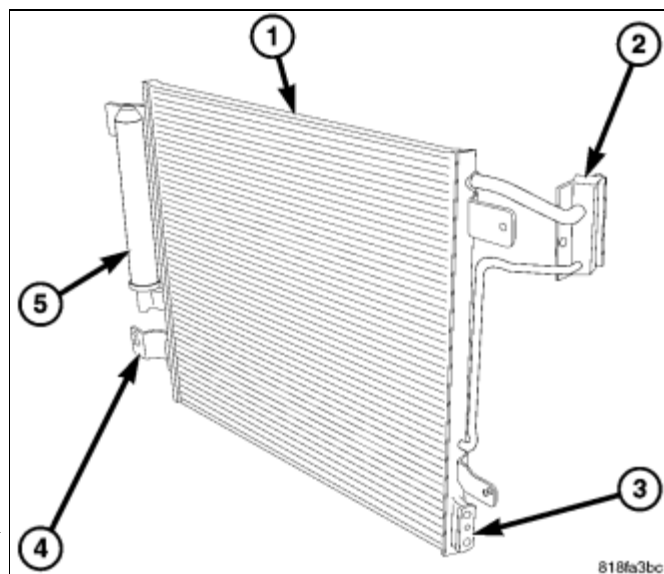
CONDENSER-A/C

DESCRIPTION

The A/C condenser (1) is located in the front of the engine compartment behind the grille. The A/C condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the A/C compressor to give up its heat to the air passing over the condenser fins, which causes the refrigerant to cool and change to a liquid state.

The A/C condenser is equipped with a tapping block for the refrigerant lines (2) and the integral automatic transmission fluid cooler (3) (when equipped with an automatic transmission), mounting brackets (4) that attach the condenser to the radiator and a replaceable receiver/drier (5).

The A/C condenser may be removed for service without removing the radiator from the vehicle when equipped with a manual transmission. When equipped with an automatic transmission, the radiator and condenser must be removed from the engine compartment as an assembly.



OPERATION

When air passes through the fins of the A/C condenser, the high-pressure refrigerant gas within the A/C condenser gives up its heat. The refrigerant then condenses as it leaves the A/C condenser and becomes a high-pressure liquid. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the A/C system. Therefore, it is important that there are no objects placed in front of the radiator grille openings at the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or A/C condenser service.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

The A/C condenser has no serviceable parts except for the O-ring seals and gaskets. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gaskets must be replaced whenever a refrigerant line is removed from the A/C condenser.

The A/C condenser cannot be repaired and must be replaced if found to be leaking or damaged.

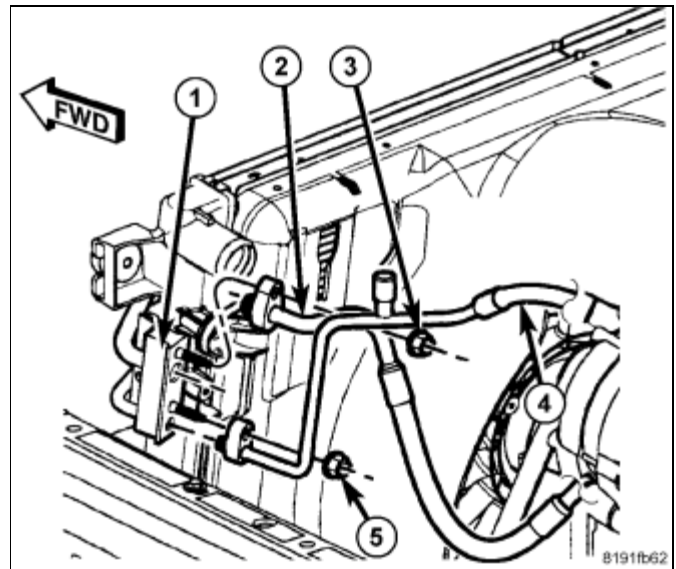
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

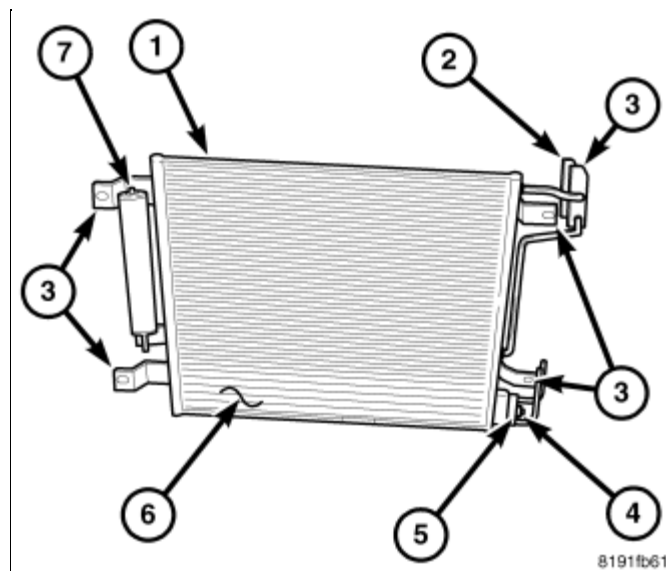
NOTE: Before removing the A/C condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the A/C condenser and the radiator. The air seals must be reinstalled in their proper locations in order for the A/C and engine cooling systems to perform as designed.

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).
4. On 2.8L equipped models, disconnect the air intake hose from the throttle body and position the hose out of the way.
5. Remove the nuts (3 and 5) that secure the A/C discharge line (2) and A/C liquid line (4) to the left side of the A/C condenser (1).
6. Disconnect the A/C discharge and liquid lines from the A/C condenser and remove and discard the O-ring seals and gaskets.
7. Install plugs in, or tape over the opened refrigerant line fittings and condenser ports.



NOTE: Illustration shown with A/C condenser removed for clarity.

8. Remove the grille (refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
9. Remove the upper radiator closure.
10. If equipped with an automatic transmission, remove the radiator and A/C condenser as an assembly and place it on a workbench (refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
11. Remove the bolts at the five locations shown (3) that secure the A/C condenser (1) to the radiator.



12. If equipped with an automatic transmission, separate the A/C condenser from the radiator.

13. If equipped with a manual transmission, remove the two bolts that secure the radiator to the upper radiator support and carefully push the top of the radiator rearward to provide clearance for the refrigerant line tapping block (2), then lift the A/C condenser out from the front of the engine compartment.

14. If required and equipped with an automatic transmission, remove the bolt (4) that secures the transmission cooler line adapter (5) to the left side of the automatic transmission fluid cooler (6).

15. If required, remove the A/C receiver/drier (7) from the right side of the A/C condenser (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER/DRIER-A/C - REMOVAL).

INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

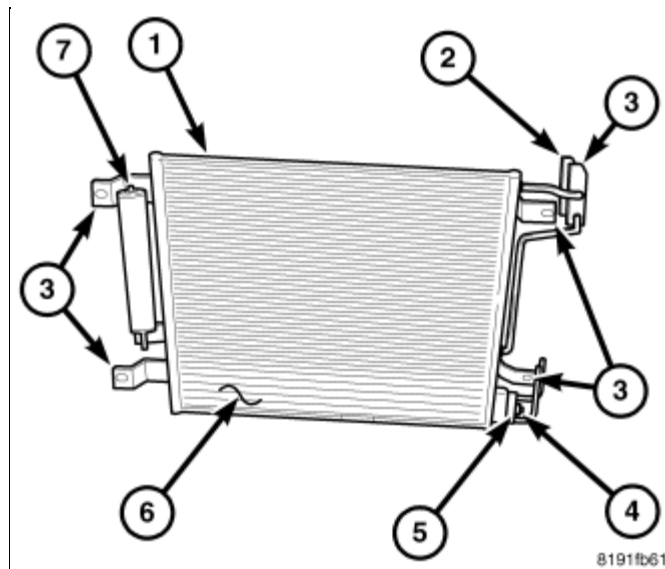
NOTE: If only the A/C condenser is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: Be certain that each of the radiator and condenser air seals are installed in their proper locations. These air seals are required for the A/C and engine cooling systems to perform as designed.

NOTE: Illustration shown with A/C condenser removed for clarity.

1. If removed, install the A/C receiver/drier (7) onto the right side of the A/C condenser (1) (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/RECEIVER/DRIER-A/C - INSTALLATION).
2. If removed and equipped with an automatic transmission, install the transmission cooler line adapter (5) using new O-rings to the left side of the automatic transmission fluid cooler (6) and install the retaining bolt (4). Tighten the bolt securely.
3. If equipped with a manual transmission, carefully push the top of the radiator rearward to provide clearance for the refrigerant line tapping block (2) and position the A/C condenser into the front of the engine compartment, then reposition the radiator and install the two bolts that secure the radiator to the upper radiator support. Tighten the bolts securely.
4. If equipped with an automatic transmission, position the A/C condenser to the front of the radiator on the workbench.
5. Install the bolts at the five locations shown (3) that secure the A/C condenser to the radiator. Tighten the bolts to 5 N·m (45 in. lbs.).
6. If equipped with an automatic transmission, install the radiator and A/C condenser as an assembly (refer to 7 - COOLING/ENGINE/RADIATOR - INSPECTION).
7. Install the upper radiator closure.
8. Install the grille (refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).



9. Remove the tape or plugs from the opened refrigerant line fittings and condenser ports.

10. Lubricate a new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the refrigerant line fittings. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

11. Connect the A/C discharge line (2) and A/C liquid line (4) to the left side of the A/C condenser (1) and install the retaining nuts (3 and 5). Tighten the nuts to 23 N·m (17 ft. lbs.).

12. On 2.8L equipped models, reconnect the air intake hose to the throttle body.

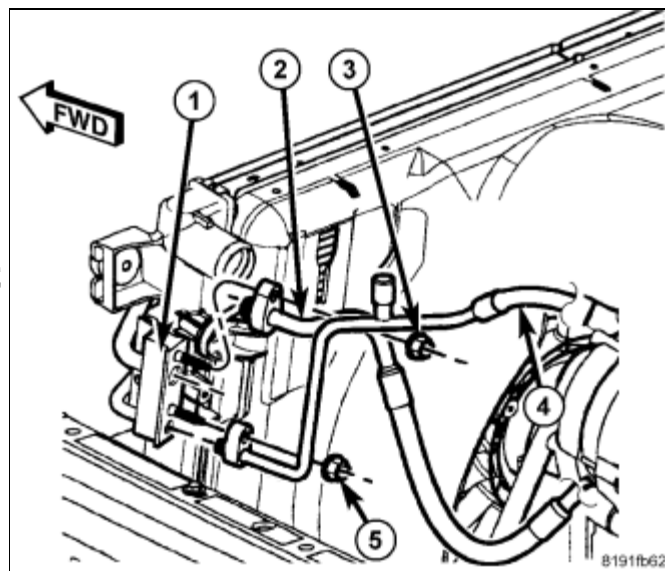
13. Install the coolant recovery container (refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).

14. Reconnect the negative battery cable.

15. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

16. If the A/C condenser is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

17. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING -



STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

18. If equipped with automatic transmission, check the automatic transmission fluid level and fill as required.

CORE-HEATER

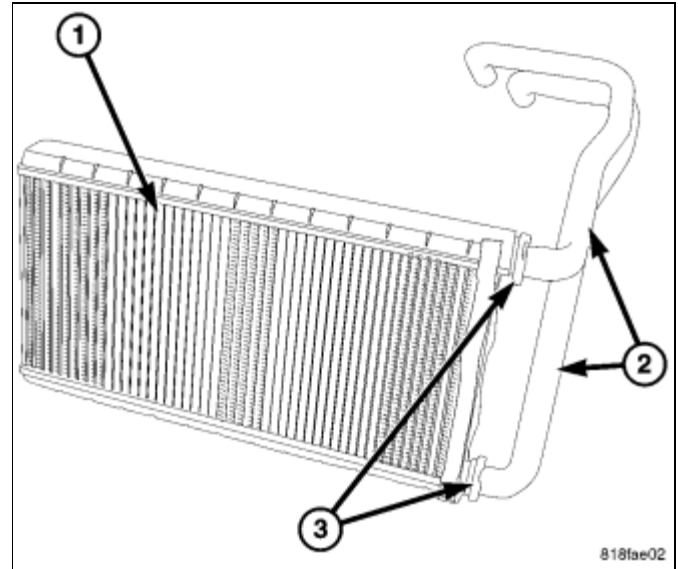
DESCRIPTION

NOTE: LHD model shown. RHD model similar.

The heater core (1) is mounted into the passenger side of HVAC air distribution housing, located behind the instrument panel. The heater core is a heat exchanger made of rows of tubes and fins and is secured into the air distribution housing by plastic retaining tabs.

The heater core tubes (2) are secured to the heater core by use of crimped fittings (3) and to the HVAC housing by a metal bracket and screw. The heater core tubes are not serviced separately from the heater core.

The HVAC housing assembly must be removed from the vehicle to service the heater core and tubes.



OPERATION

Engine coolant is circulated through the heater hoses to the heater core at all times. As the coolant flows through the heater core, heat is removed from the engine and is transferred to the heater core tubes and fins. Air directed through the heater core picks up the heat from the heater core fins. The blend-air door allows control of the heater output air temperature by regulating the amount of air flowing through the heater core. The blower motor speed controls the volume of air flowing through the HVAC housing.

The heater core cannot be repaired and it must be replaced if inoperative, leaking or damaged.

REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

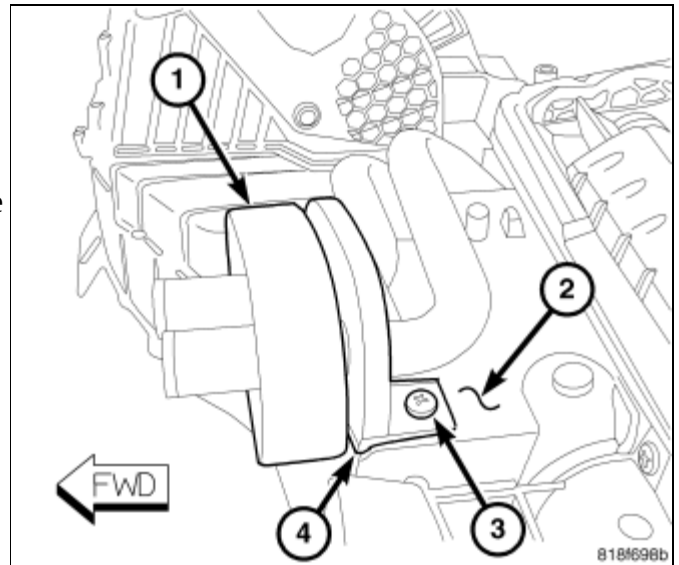
WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the floor distribution duct from the passenger side of the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-FLOOR DISTRIBUTION - REMOVAL).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

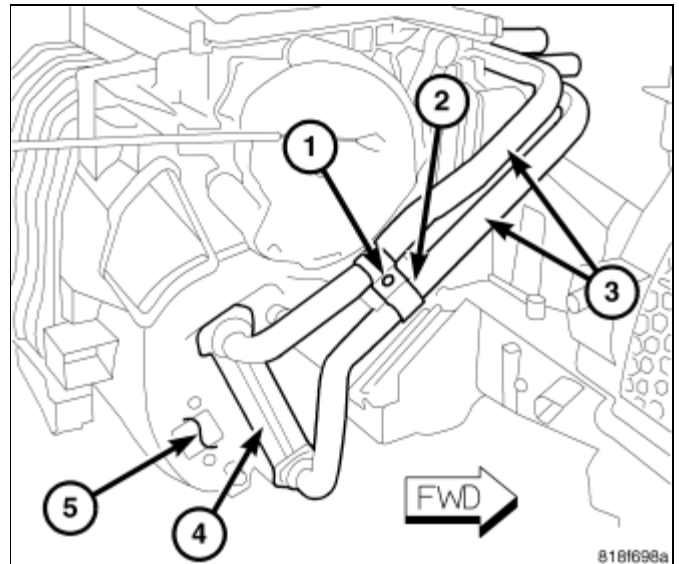
3. Remove the foam seal (1) from the flange (4) located on the front of the HVAC housing (2).
4. Remove the screw (3) that secures the flange to the HVAC housing and remove the flange.



5. Remove the screw (1) that secures the bracket (2) retaining the heater core tubes (3) to the passenger side of the air distribution housing (5) and remove the bracket.
6. Carefully pull the heater core (4) out of the side of the air distribution housing.

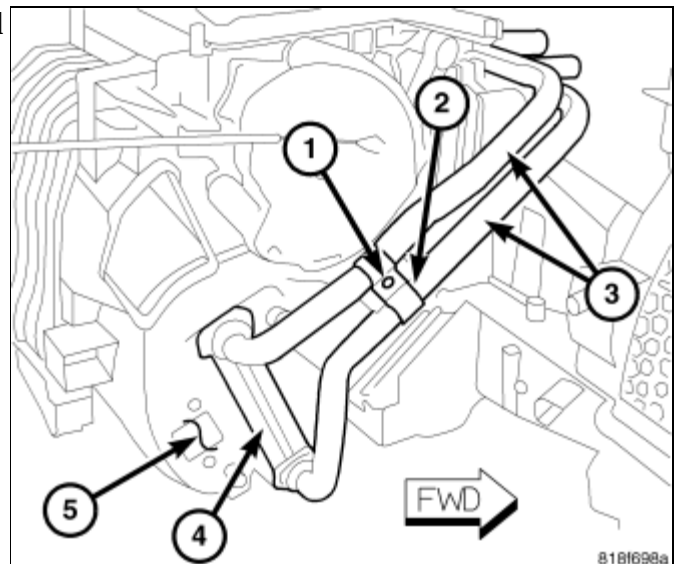
INSTALLATION

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.



NOTE: If the foam seals for the heater core are deformed or damaged, they must be replaced.

1. Carefully install the heater core (4) into the passenger side of the air distribution housing (5).
2. Install the retaining bracket (2) and the screw (1) that secures the heater core tubes (3) to the air distribution housing. Tighten the screw to 1.2 N·m (10 in. lbs.)



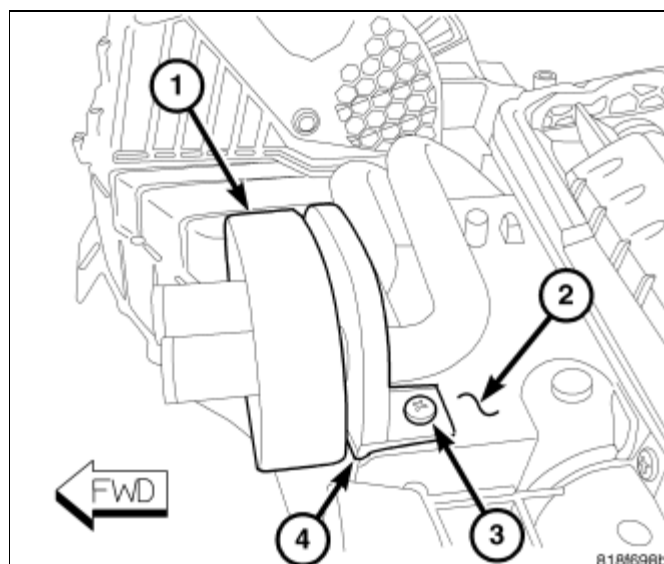
3. Position the flange (4) to the front of the HVAC housing (2).

4. Install the screw (3) that secures the flange to the HVAC housing. Tighten the screw to 1.2 N·m (10 in. lbs.).

NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

5. Install the foam seal (1) onto the flange.

6. Install the floor distribution duct onto the passenger side of the air distribution housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DUCTS-FLOOR DISTRIBUTION - INSTALLATION).



NOTE: If the heater core is being replaced, flush the cooling system (refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).

7. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).

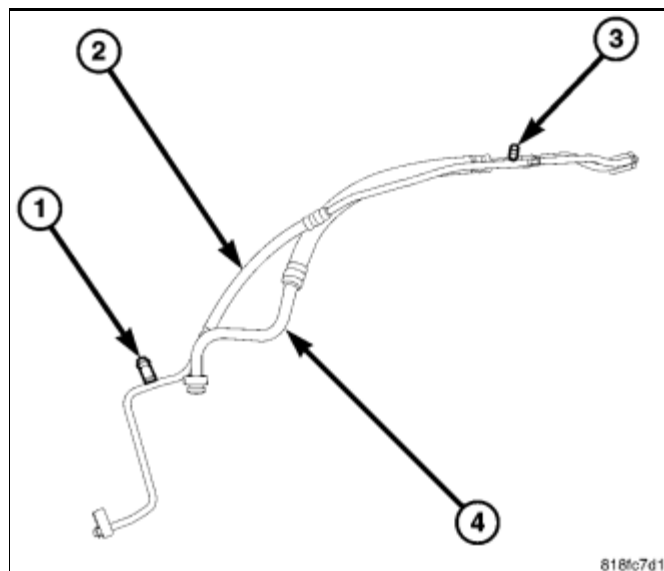
CORE-VALVE-SERVICE PORT

DESCRIPTION

Refrigerant system service ports are used to recover, recycle, evacuate, charge and test the A/C refrigerant system. Unique sizes are used on the two service ports for the R-134a refrigerant system to ensure the system is not accidentally contaminated with R-12 refrigerant or by service equipment used for R-12 refrigerant.

The high side service port (1) is located on the A/C liquid line (2) near the left front of the engine compartment. The low side service port (3) is located on the A/C suction line (4) near the A/C expansion valve at the dash panel. Both the high side and low side A/C service port valve cores are serviceable.

NOTE: The protective cap aids in service port sealing and helps protects the refrigerant system from contamination. Remember to always reinstall the protective cap onto the service port when refrigerant system service is complete.



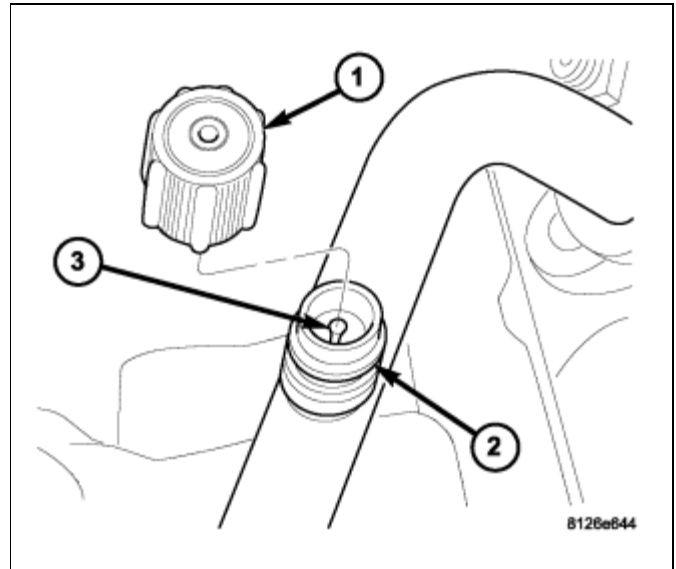
Each of the service ports has a threaded plastic protective cap installed over it from the factory. The service port caps are serviceable items.

REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions may result in serious or fatal injury.

NOTE: Typical A/C service port shown.

1. Remove the protective cap (1) from the service port (2).
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Using a Schrader-type valve core tool, remove the valve core (3) from the service port.
4. Install a plug in, or tape over the opened service port(s).



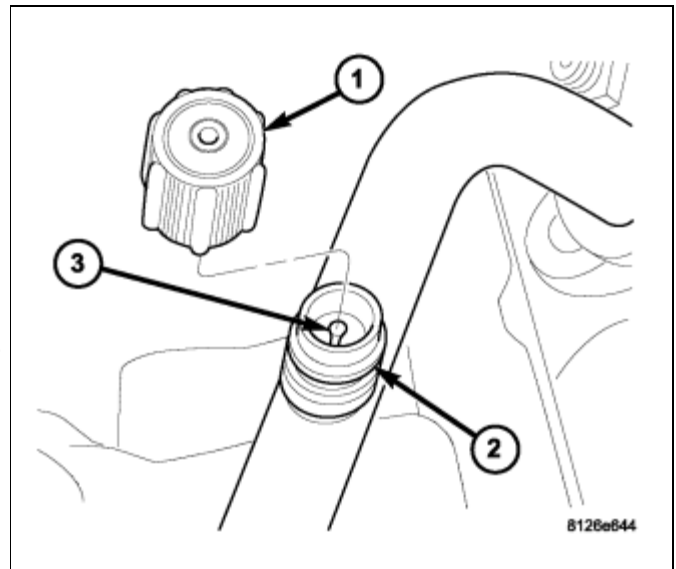
INSTALLATION

NOTE: Typical A/C service port shown.

1. Lubricate the valve core (3) with clean refrigerant oil prior to installation. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
2. Remove the tape or plug from the service port (2).

CAUTION: A valve core that is not fully seated in the A/C service port can result in damage to the valve during refrigerant system evacuation and charge. Such damage may result in a loss of system refrigerant while uncoupling the charge adapters.

3. Using a Schrader-type valve core tool, install and tighten the valve core into the service port(s).
4. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
5. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).



NOTE: The protective cap helps aid in service port sealing and helps protect the refrigerant system from contamination. Remember to always reinstall the protective cap onto the service port when refrigerant system service is complete.

6. Install the protective cap (1) onto the service port.

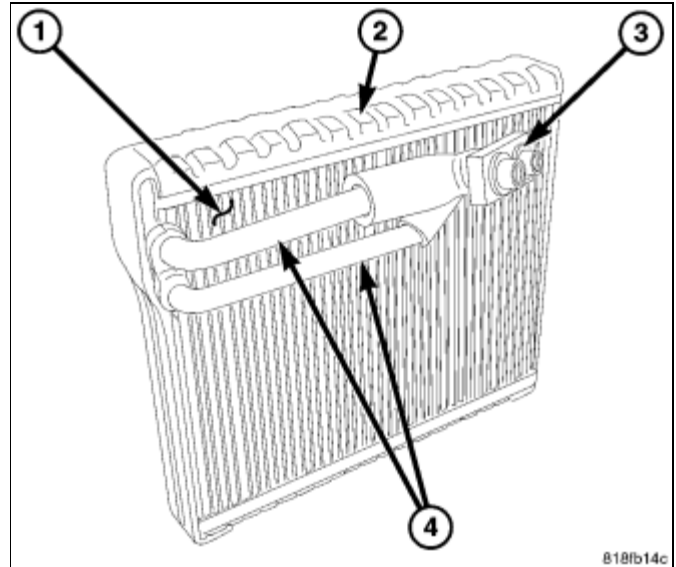
EVAPORATOR-A/C

DESCRIPTION

The A/C evaporator (1) is located within the HVAC housing, behind the instrument panel. The A/C evaporator and insulator (2) are positioned in the HVAC housing so that all air entering the housing must pass over the evaporator fins before it is distributed through the heating-A/C system ducts and outlets. However, air passing over the evaporator fins will only be conditioned when the A/C compressor is engaged and circulating refrigerant through the A/C evaporator.

The A/C evaporator tubes (4) are connected and sealed to the A/C expansion valve by use of rubber O-rings and a tapping block (3).

The A/C evaporator can only be serviced by removing and disassembling the HVAC housing.



OPERATION

Refrigerant enters the A/C evaporator from the A/C expansion valve as a low-temperature, low-pressure mixture of liquid and gas. As air flows over the fins of the A/C evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas when it leaves the A/C evaporator.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

The A/C evaporator has no serviceable parts except for the O-ring seals. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever an A/C expansion valve is removed from the A/C evaporator.

The A/C evaporator cannot be repaired and must be replaced if found to be leaking or damaged.

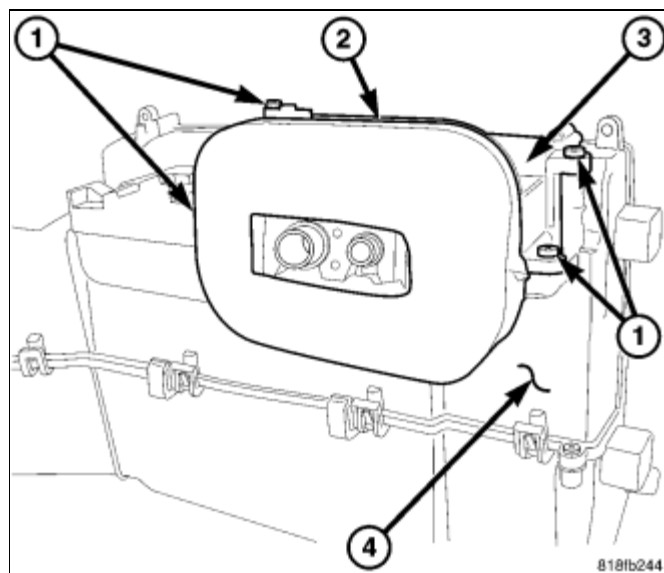
REMOVAL

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: LHD model with A/C shown in illustrations. RHD and heater-only models similar.

1. Remove the HVAC housing assembly and place it on a workbench (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION /HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - REMOVAL).
2. Remove the air distribution housing from the HVAC housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - REMOVAL).
3. Remove the A/C expansion valve from the A/C evaporator (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/VALVE-A/C EXPANSION - REMOVAL).



NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

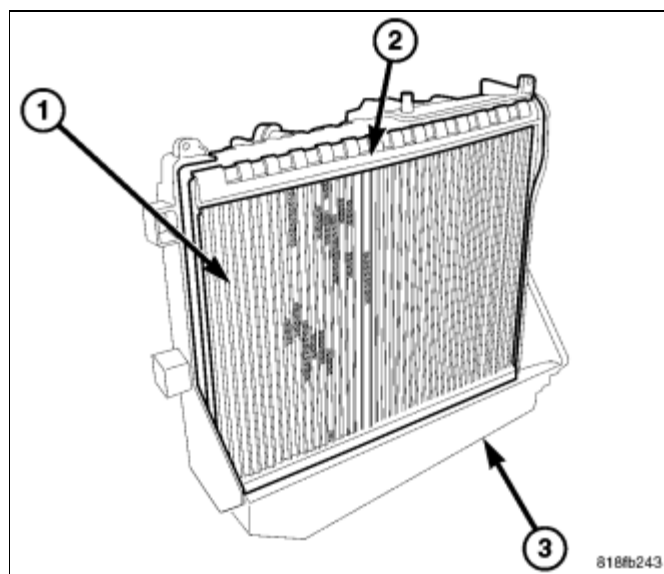
4. Remove the foam seal (2) from the flange (3) located on the top of the HVAC housing (4).
5. Remove the four screws (1) that secure the flange to the HVAC housing and remove the flange.

NOTE: If the foam insulator for the evaporator is deformed or damaged, it must be replaced.

6. Carefully remove the A/C evaporator (1) and its insulator (2) from the HVAC housing (3).

INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.



NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

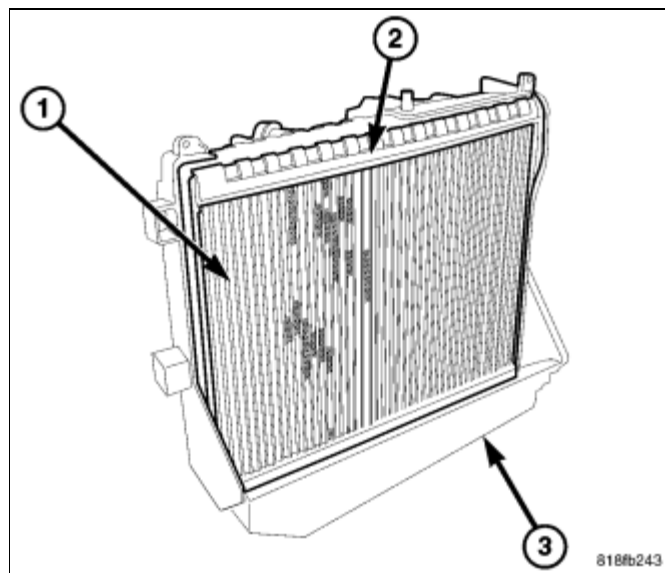
NOTE: If only the A/C evaporator is being replaced, add 50 milliliters (1.7 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: Make sure that the evaporator drain within the HVAC housing is clean and unrestricted and that the insulator is properly positioned.

NOTE: If the foam insulator for the evaporator is deformed or damaged, it must be replaced.

1. Install the A/C evaporator (1) into the HVAC housing (3). Make sure that the evaporator drain within the HVAC housing is clean and unrestricted and that the insulator (2) around the A/C evaporator is properly positioned.



2. Install the flange (3) onto the top of the HVAC housing (4).

3. Install the four screws (1) that secure the flange to the HVAC housing. Tighten the screws to 1.2 N·m (10 in lbs.).

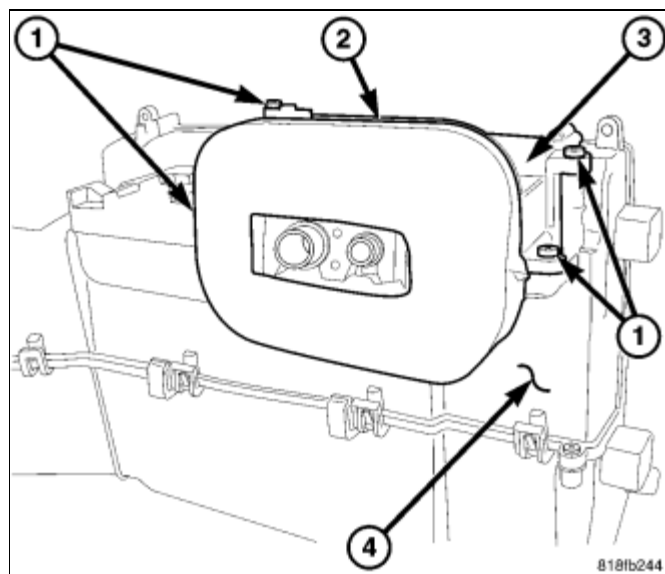
NOTE: If the foam seal for the flange is deformed or damaged, it must be replaced.

4. Install the foam seal (2) onto the flange.

5. Install the A/C expansion valve onto the A/C evaporator (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/VALVE-A/C EXPANSION - INSTALLATION).

6. Install the air distribution housing onto the HVAC housing (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR DISTRIBUTION - INSTALLATION).

7. Install the HVAC housing assembly (refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-HVAC ASSEMBLY - INSTALLATION).



8. If the A/C evaporator is being replaced, add 50 milliliters (1.7 fluid ounces) of refrigerant oil to the refrigerant system. When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

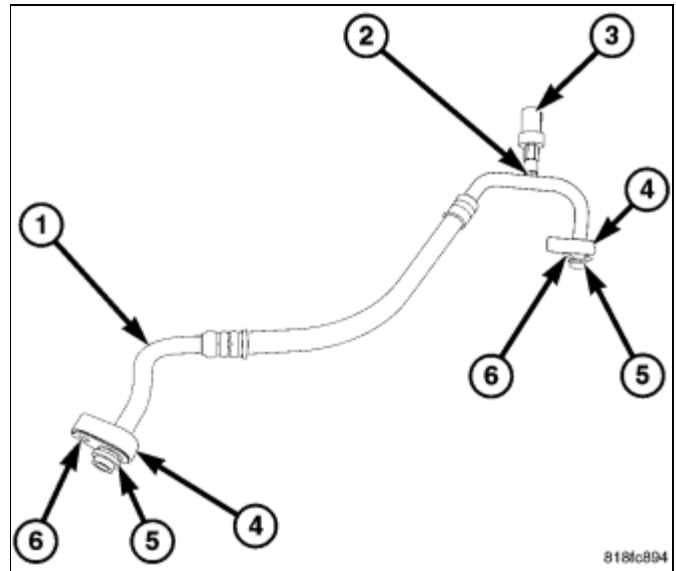
LINE-A/C DISCHARGE

DESCRIPTION

The A/C discharge line (1) is the refrigerant line that carries refrigerant from the A/C compressor to the A/C condenser. The A/C discharge line contains a fitting (2) for the A/C pressure transducer (3) and is secured to the A/C compressor and the A/C condenser by use metal fittings (4).

The A/C discharge line is sealed to the A/C compressor and to the A/C condenser by use of rubber O-ring seals (5) and metal gaskets (6). The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.



The A/C discharge line has no serviceable parts except the O-ring seals and gaskets. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gaskets must be replaced whenever the A/C discharge line is removed.

The A/C discharge line cannot be repaired and must be replaced if found to be leaking or damaged.

REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: 3.8L engine shown. 2.8L engine similar.

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM

RECOVERY).

3. Disconnect the engine wire harness connector (4) from the A/C pressure transducer (5) located on the A/C discharge line (2) near the A/C compressor (6).

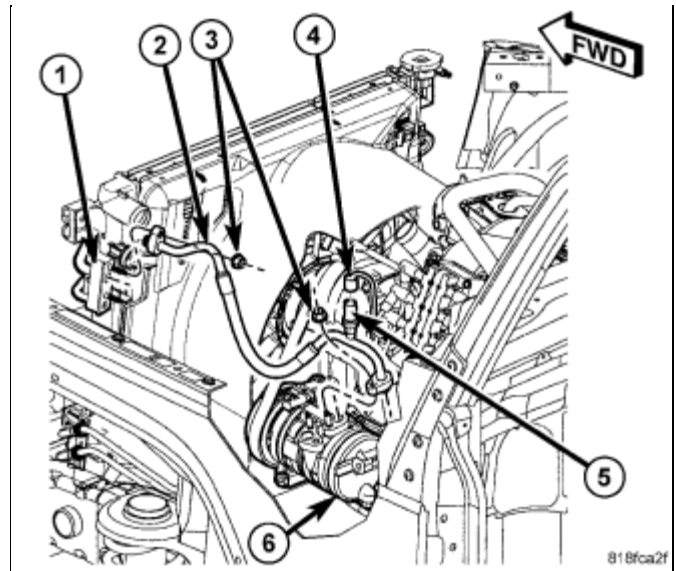
4. If required, remove the A/C pressure transducer from the A/C discharge line and remove and discard the O-ring seal.

5. On 2.8L diesel engines, disconnect the air intake hose from the throttle body and position the hose out of the way.

6. Remove the nuts (3) that secure the A/C discharge line to the A/C condenser (1) and A/C compressor.

7. Disconnect the A/C liquid line from the A/C condenser and A/C compressor and remove and discard the O-ring seals and gaskets.

8. Install plugs in, or tape over the opened discharge line fittings and condenser and compressor ports.



INSTALLATION

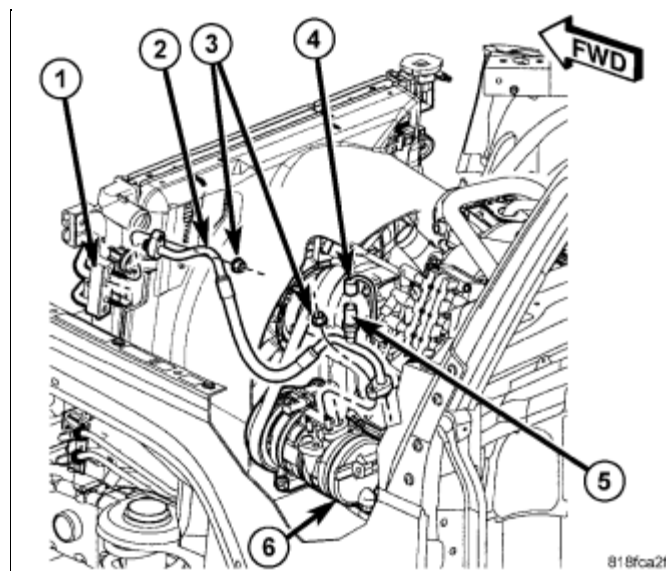
CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: 3.8L engine shown. 2.8L engine similar.

1. Position the A/C discharge line (2) into the engine compartment.
2. Remove the tape or plugs from the discharge line fittings and the condenser and compressor ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the discharge line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C discharge line to the A/C condenser (1)



and A/C compressor (6).

5. Install the nuts (3) that secure the A/C discharge line to the A/C condenser and the A/C compressor. Tighten the nuts to 23 N·m (17 ft. lbs.).

6. On 2.8L diesel engines, reconnect the air intake hose to the throttle body.

7. If removed, install the A/C pressure transducer (5) onto the A/C discharge line using a new O-ring seal. Tighten the A/C pressure transducer securely.

8. Connect the wire harness connector (4) to the A/C pressure transducer.

9. Reconnect the negative battery cable.

10. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

11. Adjust the refrigerant oil level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

12. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

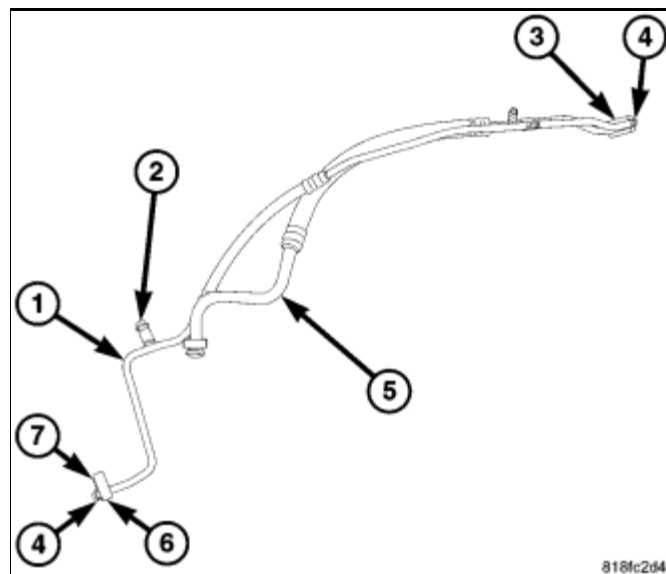
LINE-A/C LIQUID

DESCRIPTION

The A/C liquid line (1) is the refrigerant line that carries refrigerant from the A/C condenser to the A/C evaporator. The A/C liquid line contains the high side service port (2) and is secured to the A/C expansion valve by a tapping block (3) and to the A/C condenser by a metal fitting (6).

The A/C liquid line is sealed to the A/C condenser and the A/C expansion valve by use of rubber O-ring seals (4) and a metal gasket (7). The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.



The A/C liquid line has no serviceable parts except for the O-ring seals, gaskets, high-side service port valve and cap. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals and gaskets must be replaced whenever the A/C liquid line is removed.

The A/C liquid line cannot be repaired and must be replaced if found to be leaking or damaged.

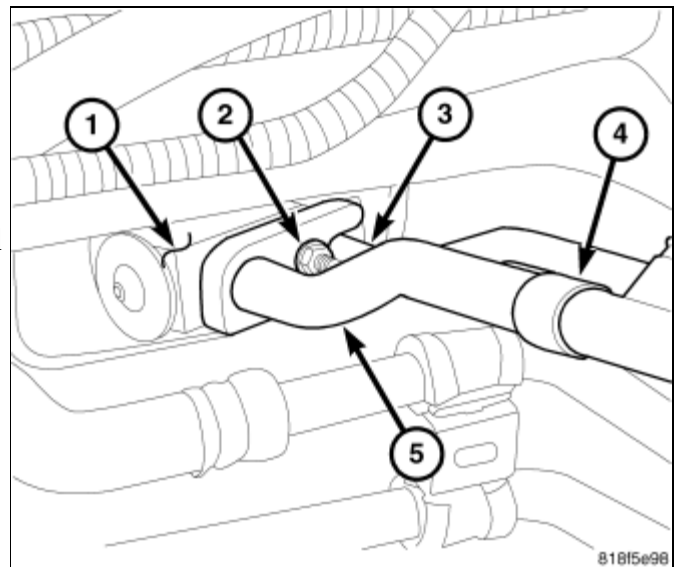
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: The A/C liquid line can be serviced separately from the A/C suction line.

NOTE: 3.8L engine shown in illustrations. 2.8L engine similar.

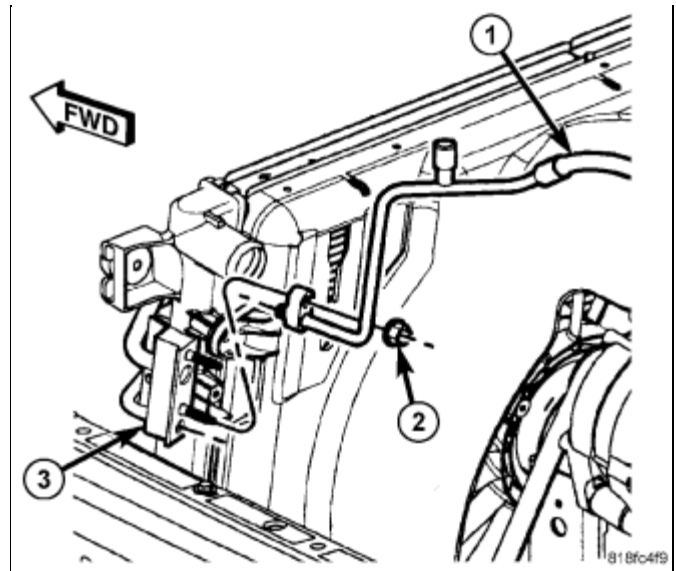
1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the nut (2) that secures the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1).
4. Disconnect the A/C liquid and suction lines from the A/C expansion valve and remove and discard the O-ring seals.
5. If required remove the retaining bracket (4) that secures the A/C liquid line to the A/C suction line and separate the liquid line from the suction line.



6. On 2.8L equipped models, disconnect the air intake hose from the throttle body and position the hose out of the way.
7. Remove the nut (2) that secures the A/C liquid line (1) to the tapping block of the A/C condenser (3) located in the left front of the engine compartment.
8. Disconnect the A/C liquid line from the A/C condenser and remove and discard the O-ring seal and gasket.
9. Install plugs in, or tape over the opened suction and liquid line fittings and the condenser and expansion valve ports.

INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 -



HEATING & AIR

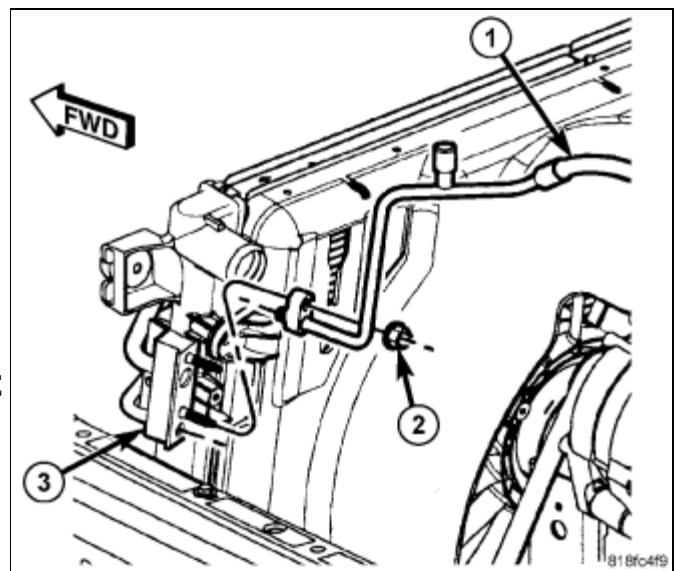
CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: 3.8L engine shown in illustrations. 2.8L engine similar.

1. Position the A/C liquid line (1) into the engine compartment.
2. Remove the tape or plugs from the opened suction and liquid line fittings and the condenser and expansion valve ports.
3. Lubricate a new rubber O-ring seals with clean refrigerant oil and install them and a new gasket onto the suction and liquid line fittings. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C liquid line to the A/C condenser (3) and install the retaining nut (2). Tighten the nut to 23 N·m (17 ft. lbs.).



5. If removed, install the A/C liquid line (3) into the tapping

block of the A/C suction line (5).

6. On 2.8L equipped models, connect the air intake hose to the throttle body.

7. Connect the A/C liquid line and A/C suction line to the A/C expansion valve (1) and install the retaining nut (2).

Tighten the nut to 8 N·m (70 in. lbs.).

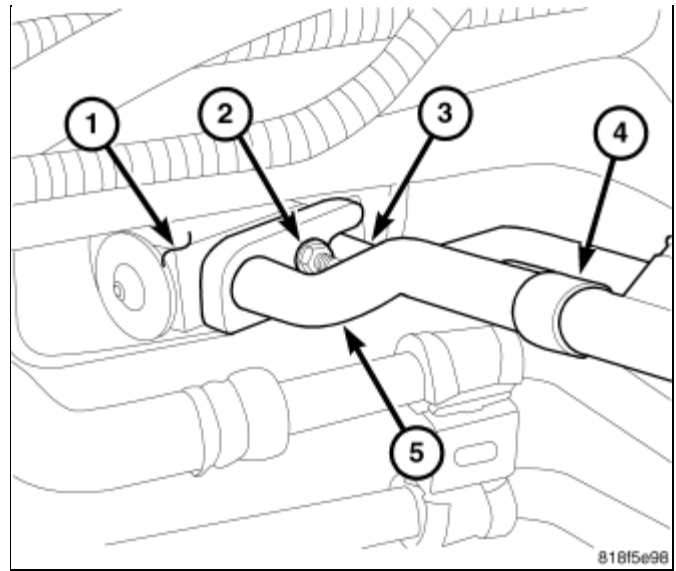
8. If removed, install the bracket (4) that secures the A/C liquid line to the A/C suction line.

9. Reconnect the negative battery cable.

10. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

11. Adjust the refrigerant oil level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

12. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).



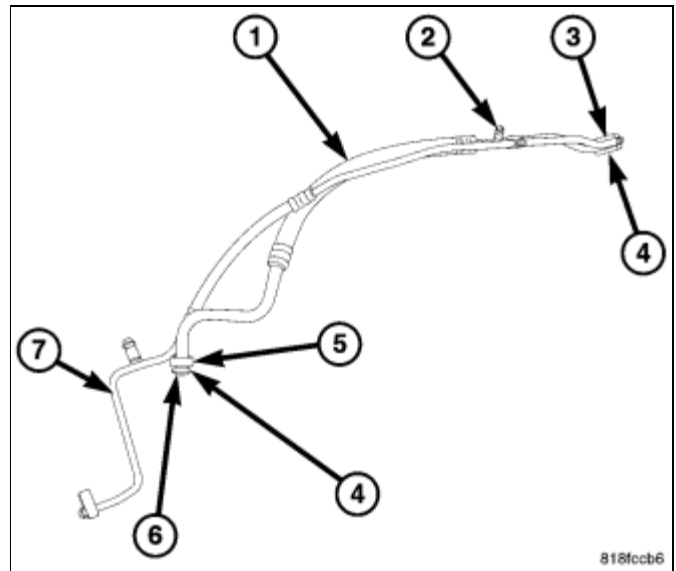
LINE-A/C SUCTION

DESCRIPTION

The A/C suction line (1) is the refrigerant line that carries refrigerant from the A/C evaporator to the A/C compressor. The A/C suction line contains the low side service port (2) and is secured to the A/C expansion valve by use of a tapping block (3) and to the A/C compressor by a metal fitting (5). The tapping block portion of the A/C suction also secures the A/C liquid line (7) to the A/C expansion valve.

The A/C suction line is sealed to the A/C expansion valve and A/C compressor by use of rubber O-ring seals (4) and a metal gasket (6). The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.



The A/C suction line can be serviced separately from the A/C liquid line and has no replaceable parts except for the O-ring seals, gaskets, low side service port valve and cap. The O-ring seals and gaskets must be replaced whenever the A/C suction line is removed.

The A/C suction line cannot be repaired and must be replaced if found to be leaking or damaged.

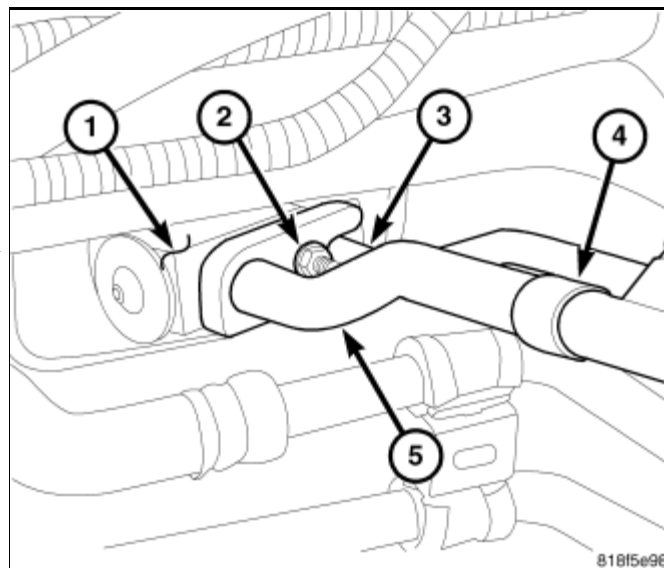
REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

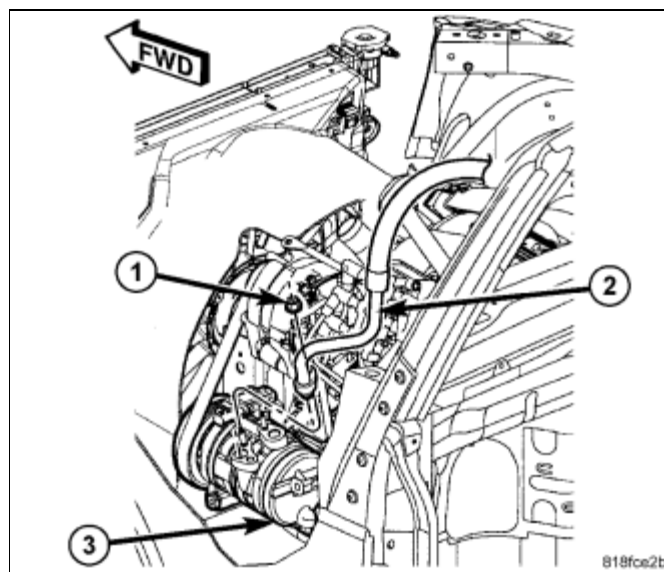
NOTE: The A/C liquid line can be serviced separately from the A/C suction line.

NOTE: 3.8L engine shown in illustrations. 2.8L engine similar.

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the nut (2) that secures the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1).
4. Disconnect the A/C liquid and suction lines from the A/C expansion valve and remove and discard the O-ring seals.
5. If required, remove the retaining bracket (4) that secures the A/C liquid line to the A/C suction line and separate the liquid line from the suction line.



6. On 2.8L diesel engines, disconnect the air intake hose from the throttle body and position the hose out of the way.
7. Remove the nut (1) that secures the A/C suction line (2) to the A/C compressor (3).
8. Disconnect the A/C suction line from the A/C compressor and remove and discard the O-ring seal and gasket.
9. Install plugs in, or tape over the opened liquid and suction line fittings and the compressor and expansion valve ports.



INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

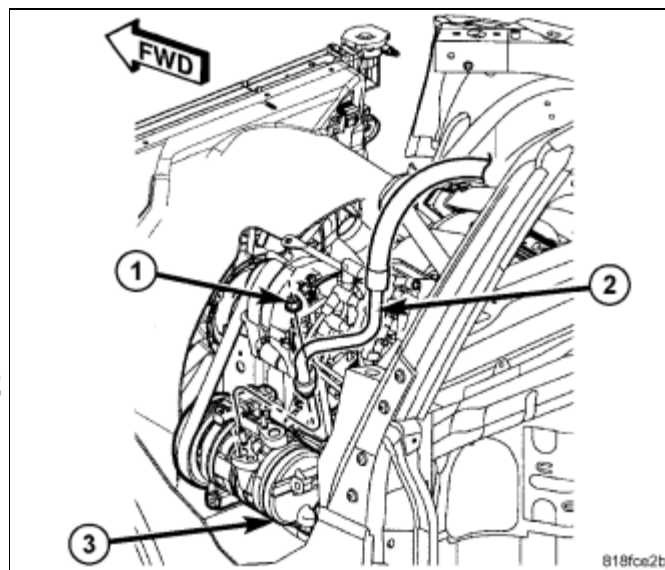
NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to

determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

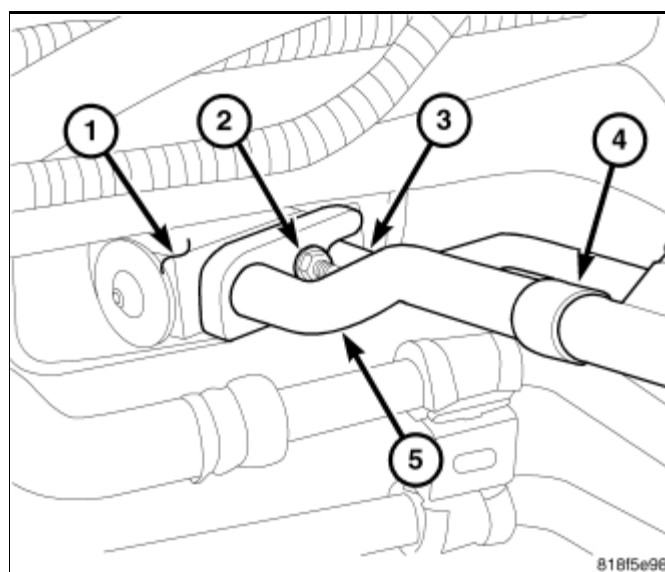
NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: 3.8L engine shown in illustrations. 2.8L engine similar.

1. Position the A/C suction line (2) into the engine compartment.
2. Remove the tape or plugs from the opened liquid and suction line fittings and the compressor and expansion valve ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and a new gasket onto the liquid and suction line fittings. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C suction line to the A/C compressor (3) and install the retaining nut (1). Tighten the nut to 23 N·m (17 ft. lbs.).
5. On 2.8L diesel engines, reconnect the air intake hose to the throttle body.



6. If removed, install the A/C liquid line (3) into the tapping block of the A/C suction line (5).
7. Connect the A/C liquid line and A/C suction line to the A/C expansion valve (1) and install the retaining nut (2). Tighten the nut to 8 N·m (70 in. lbs.).
8. If removed, install the bracket (4) that secures the A/C liquid line to the A/C suction line.
9. Reconnect the negative battery cable.
10. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
11. Adjust the refrigerant oil level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).
12. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).



OIL-A/C REFRIGERANT

DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, polyalkylene glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The Zexel DKS-17DS A/C compressor used in this vehicle is designed to use VC-46 PAG oil. Use only this type of refrigerant oil the refrigerant system.

OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause A/C compressor damage, and too much can reduce A/C system performance.

PAG refrigerant oil is more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

STANDARD PROCEDURE

REFRIGERANT OIL LEVEL

When an A/C system is assembled at the factory, all components except the A/C compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the A/C compressor is dispersed throughout the refrigerant system. The receiver/drier, A/C evaporator, A/C condenser and the A/C compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of refrigerant oil in the A/C system. This ensures proper lubrication of the A/C compressor. Too little oil will result in damage to the A/C compressor, while too much oil will reduce the cooling capacity of the A/C system and consequently result in higher discharge air temperatures.

CAUTION: The Zexel DKS-17DS A/C compressor used in this vehicle is designed to use VC-46 PAG refrigerant oil. Only refrigerant oil of the same type should be used to service the R-134a A/C system. Do not use any other refrigerant oil. The oil container should be kept tightly capped until it is ready for use and then tightly capped after use to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with, therefore, special effort must be used to keep all R-134a system components moisture-free. Moisture in the refrigerant oil is very difficult to remove and will cause a reliability problem with the A/C compressor.

NOTE: Most reclaim/recycling equipment will measure the lubricant being removed during recovery. This amount of lubricant should be added back into the system. Refer to the reclaim/recycling equipment manufacturers instructions.

It will not be necessary to check the oil level in the A/C compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when an A/C condenser, A/C evaporator or A/C receiver/drier is replaced. See the

Refrigerant Oil Capacities chart.

The refrigerant oil level in a new A/C compressor must first be adjusted prior to compressor installation. Refer to [COMPRESSOR OIL DRAIN PROCEDURE](#).

REFRIGERANT OIL CAPACITIES

COMPONENT NAME	ml.	oz.
Total System Fill	150 ml.	5.0 oz.
A/C Condenser	60 ml.	2.0 oz.
A/C Evaporator	60 ml.	2.0 oz.
A/C Receiver/Drier	30 ml.	1.0 oz.
A/C Compressor	Drain and measure the oil from the old compressor. Refer to COMPRESSOR OIL DRAIN PROCEDURE .	

COMPRESSOR OIL DRAIN PROCEDURE

CAUTION: Be certain to adjust the refrigerant system oil level when replacing an A/C compressor. Failure to properly drain and measure the refrigerant oil from the A/C compressor can prevent the A/C system from operating as designed and cause serious compressor damage.

The A/C compressor is filled with refrigerant oil from the factory. Use the following procedure to drain and measure refrigerant oil from the A/C compressor.

1. Drain all of the refrigerant oil from the old A/C compressor into a clean measured container.
2. Drain all of the refrigerant oil from the new A/C compressor into a clean measured container.
3. Refill the new A/C compressor with the same amount of refrigerant oil that was drained out of the old compressor. Use only clean refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Install the new A/C compressor onto the engine (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - INSTALLATION).

RECEIVER/DRIER-A/C

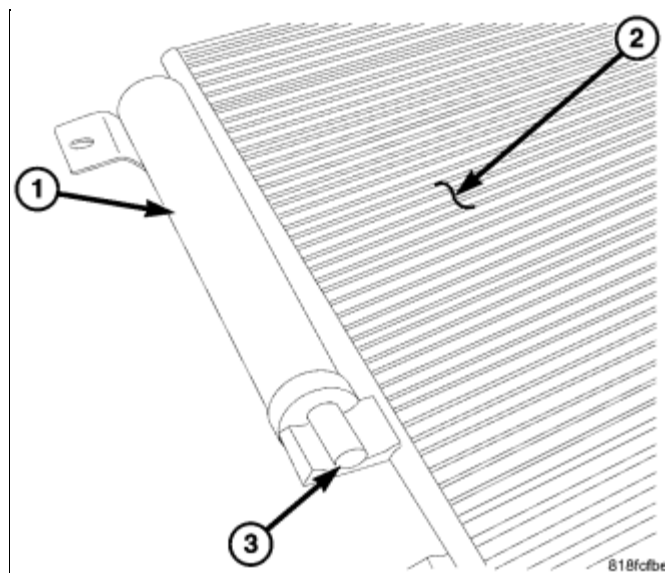
DESCRIPTION

The A/C receiver/drier (1) stores unnecessary refrigerant, filters the refrigerant, helps remove moisture from the refrigerant and retains any refrigerant vapor that may leave the A/C condenser (2) until it becomes a liquid. The A/C

receiver/drier is installed on the high-side of the A/C system and is connected directly to the right end of the A/C condenser by a bolt (3). The A/C receiver/drier can be serviced separately from the A/C condenser.

OPERATION

The A/C receiver/drier performs a filtering action to prevent foreign material in the refrigerant from contaminating the A/C expansion valve. Refrigerant enters the A/C receiver/drier as a high-pressure, low temperature liquid. Desiccant inside the A/C receiver/drier absorbs any moisture which may have entered and become trapped within the refrigerant system. In addition, during periods of high demand operation of the A/C system, the A/C receiver/drier acts as a reservoir to store surplus refrigerant.



CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

The A/C receiver/drier has no serviceable parts except for the O-ring seals. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever the A/C receiver/drier is removed.

The A/C receiver/drier cannot be repaired and must be replaced if found to be leaking or damaged, or if an internal failure of the A/C compressor has occurred.

REMOVAL

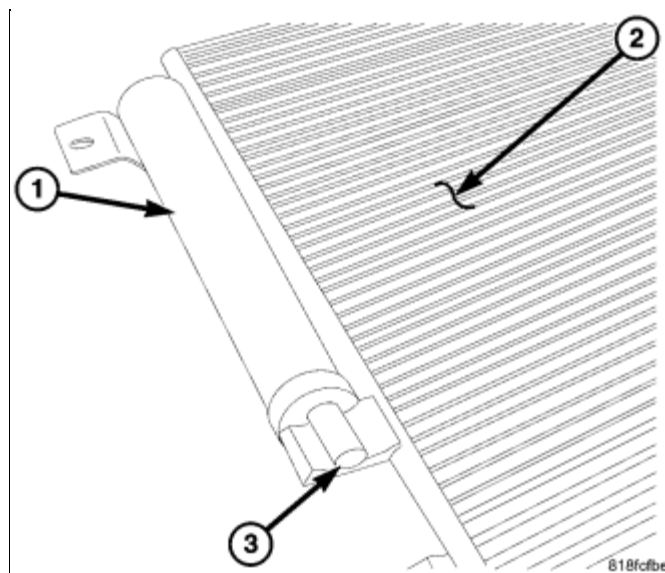
WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

NOTE: Illustration shown with A/C condenser removed from vehicle for clarity.

1. Disconnect and isolate the negative battery cable.

2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the grille (refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
4. Remove the bolt (3) that secures the A/C receiver/drier (1) to the right side A/C condenser (2).
5. Disconnect the A/C receiver/drier from the A/C condenser and remove and discard the O-ring seals.
6. Install plugs in, or tape over the opened receiver/drier fittings and the condenser ports.



INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

CAUTION: The A/C receiver/drier must be replaced if an internal failure of the A/C compressor has occurred. Failure to replace the A/C receiver/drier can cause serious damage to the replacement A/C compressor.

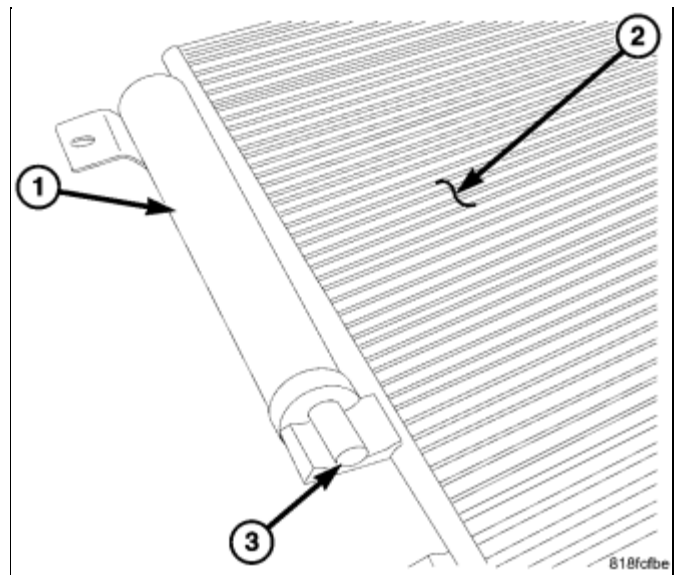
NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

NOTE: If only the A/C receiver/drier is being replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

NOTE: Illustration shown with A/C condenser removed from vehicle for clarity.

1. Remove the tape or plugs from the receiver/drier fittings and the condenser ports.
2. Lubricate new O-ring seals with clean refrigerant oil and install them onto the receiver/drier fittings. Use only the specified O-rings as they are made of a special material for



the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

3. Connect the receiver/drier (1) to the right end of the A/C condenser (2).

4. Install the bolt (3) that secures the receiver/drier to the A/C condenser. Tighten the bolt to 22 N·m (16 ft. lbs.).

5. Install the grille (refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

6. Reconnect the negative battery cable.

7. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

8. Add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/OIL-A/C REFRIGERANT - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

9. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

REFRIGERANT-A/C

DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY for more information).

OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an A/C system. Even a small amount of R-12 refrigerant added to an R-134a refrigerant system will cause A/C compressor failure, refrigerant oil sludge or poor A/C system performance. In addition, the polyalkylene glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a refrigerant system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the A/C compressor to identify that the A/C system is equipped with R-134a refrigerant.

STANDARD PROCEDURE

REFRIGERANT CHARGE LEVEL

Single Unit	0.51 kg (1.125 lbs.)
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VALVE-A/C EXPANSION

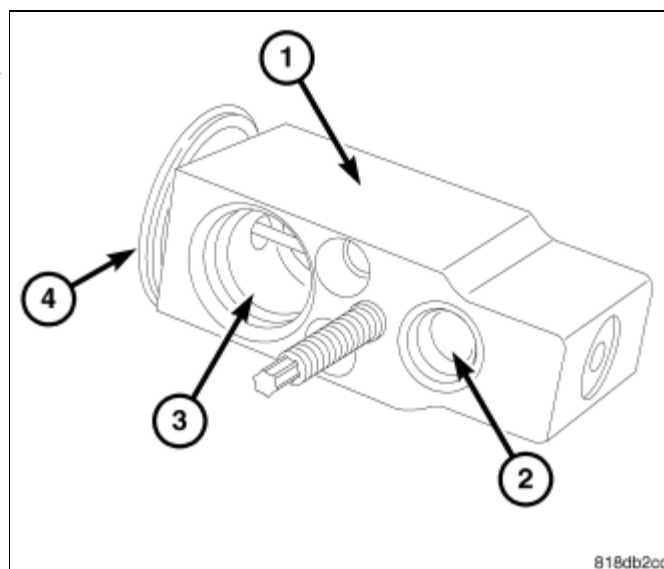
DESCRIPTION

The A/C expansion valve controls the amount of refrigerant entering the A/C evaporator. The A/C expansion valve is of a thermostatic expansion valve (TXV) design and consists of an aluminum H-valve type body (1) with an inlet port (2), outlet port (3) and an integral thermal sensor (4).

The A/C expansion valve is located between the A/C refrigerant lines and the A/C evaporator in the engine compartment.

OPERATION

The A/C expansion valve controls the high-pressure, low temperature liquid refrigerant from the liquid line and converts it into a low-pressure, low-temperature mixture of liquid and gas before it enters the A/C evaporator. A mechanical sensor in the A/C expansion valve monitors the temperature and pressure of the refrigerant leaving the A/C evaporator through the suction line, and adjusts the orifice size at the liquid line port to let the proper amount of refrigerant into the A/C evaporator to meet the vehicle A/C cooling requirements. Controlling the refrigerant flow through the A/C evaporator ensures that none of the refrigerant leaving the A/C evaporator is still in a liquid state, which could damage the A/C compressor.



NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

The A/C expansion valve is factory calibrated and cannot be adjusted or repaired and must be replaced if inoperative or damaged.

DIAGNOSIS AND TESTING

A/C EXPANSION VALVE

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

NOTE: The A/C expansion valve should only be tested following testing of the A/C compressor.

NOTE: Liquid COI is required to test the A/C expansion valve. This material is available from most welding supply facilities. Liquid COI is also available from companies which service and sell fire extinguishers.

When testing the A/C expansion valve, the work area and the vehicle temperature must be 21° to 27° C (70° to 85° F). To test the expansion valve:

1. Connect a charging station or manifold gauge set to the refrigerant system service ports. Verify the refrigerant charge level.
2. Close all doors, windows and vents to the passenger compartment.
3. Set the A/C-heater controls so that the A/C compressor is operating, the temperature control is in the highest temperature position, the mode-air doors is directing air output to the floor and the blower motor operating is operating at the highest speed.
4. Start the engine and allow it to idle. After the engine has reached normal operating temperature, allow the passenger compartment to heat up. This will create the need for maximum refrigerant flow into the A/C evaporator.
5. If the refrigerant charge is sufficient, the discharge (high pressure) gauge should read 827 kPa to 1655 kPa (120 psi to 240 psi). The suction (low pressure) gauge should read 207 kPa to 345 kPa (30 psi to 50 psi). If OK, go to [STEP 6](#). If not OK, replace the inoperative A/C expansion valve.

WARNING:

Protect the skin and eyes from exposure to liquid COI or personal injury can result.

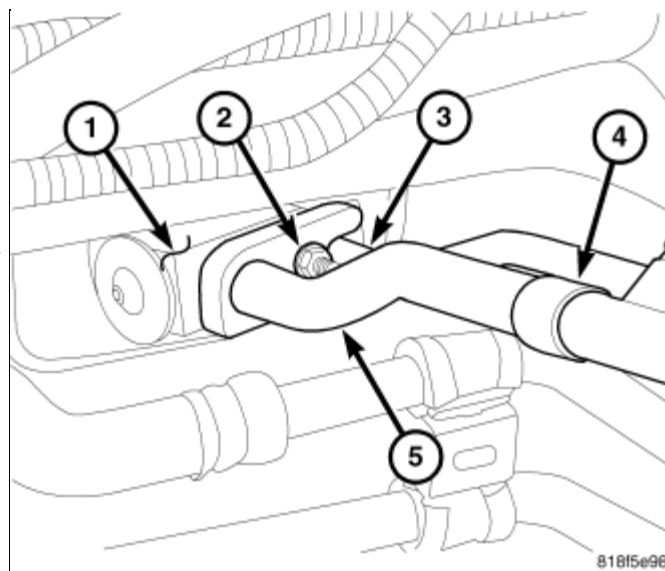
6. If the suction (low pressure) gauge reads within the specified range, freeze the A/C expansion valve for 30 seconds using liquid COI or another suitable super-cold material. **Do not spray R-134a or R-12 refrigerant on the A/C expansion valve for this test.** The suction (low pressure) gauge reading should drop by 69 kPa (10 psi). If OK, go to [STEP 7](#). If not OK, replace the inoperative A/C expansion valve.
7. Allow the expansion valve control head to thaw. The suction (low pressure) gauge reading should stabilize at 207 kPa to 345 kPa (30 psi to 50 psi). If not OK, replace the inoperative A/C expansion valve.
8. When expansion valve testing is complete, test the overall A/C system performance (refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE TEST).

REMOVAL

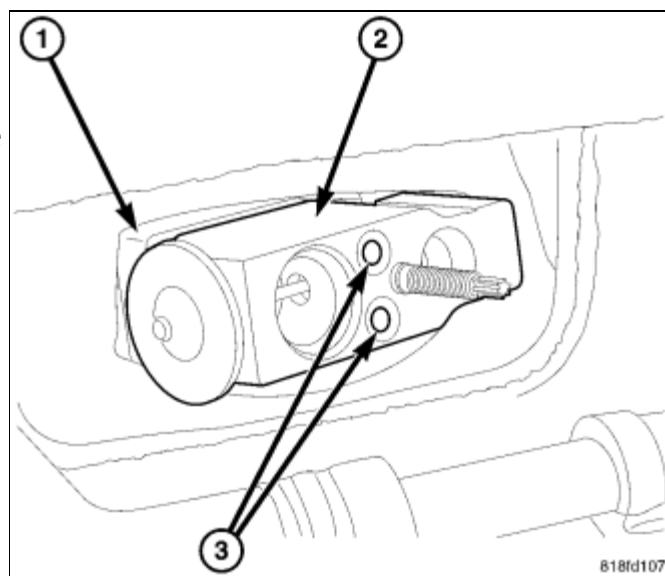
WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

1. Disconnect and isolate the negative battery cable.

2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the nut (2) that secures the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1).
4. Disconnect the A/C liquid and suction lines from the A/C expansion valve, remove and discard the O-ring seals and position the refrigerant lines out of the way.



5. Remove the two bolts (3) that secure the A/C expansion valve (2) to the evaporator tube tapping block (1).
6. Remove the A/C expansion valve from the evaporator tube tapping block and remove and discard the O-ring seals.
7. Install plugs in, or tape over the opened refrigerant line and evaporator tube fittings and all expansion valve ports.



INSTALLATION

CAUTION: Be certain to adjust the refrigerant oil level when servicing the A/C refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL). Failure to properly adjust the refrigerant oil level will prevent the A/C system from operating as designed and can cause serious A/C compressor damage.

NOTE: When replacing multiple A/C system components, refer to the Refrigerant Oil Capacities chart to determine how much oil should be added to the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

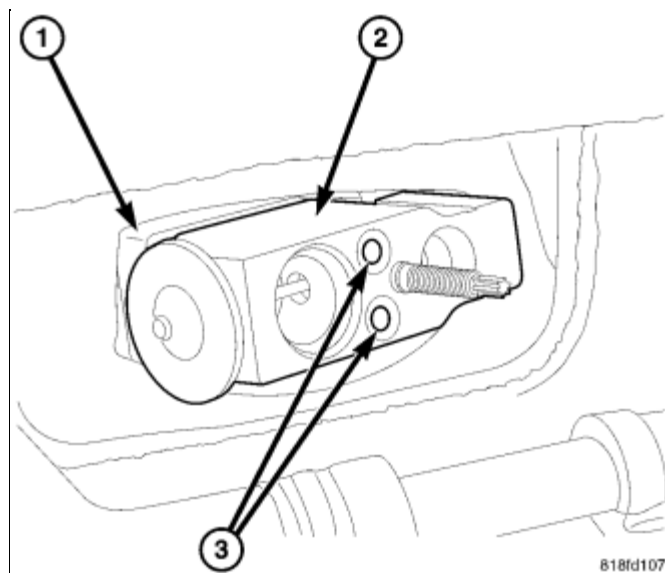
NOTE: Replacement of the refrigerant line O-ring seals and gaskets is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals and metal gaskets could result in a refrigerant system leak.

1. Remove the tape or plugs from the opened refrigerant lines and evaporator tube fittings and all of the expansion valve ports.
2. Lubricate new O-ring seals with clean refrigerant oil and

install them onto the refrigerant line and evaporator tube fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

3. Install the A/C expansion valve (2) onto the evaporator tube tapping block (1).

4. Install the two bolts (3) that secure the A/C expansion valve to the evaporator tube tapping block. Tighten the bolts to 11 N·m (97 in. lbs.).



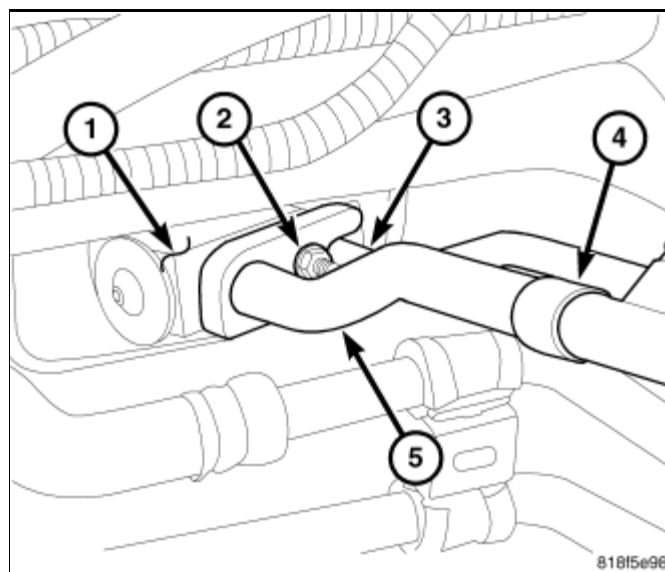
5. Connect the A/C liquid line (3) and A/C suction line (5) to the A/C expansion valve (1) and install the retaining nut (2). Tighten the nut to 8 N·m (70 in. lbs.).

6. Reconnect the negative battery cable.

7. Evacuate the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

8. Adjust the refrigerant oil level (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL).

9. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).



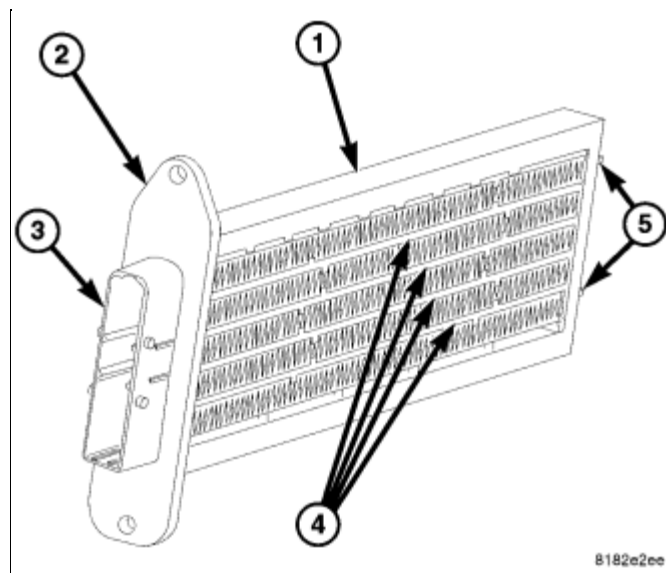
HEATER-CABIN

HEATER UNIT

DESCRIPTION

NOTE: LHD model shown. RHD model similar.

An electric positive temperature coefficient (PTC) heater unit (1) is used on vehicles when equipped with the 2.8L diesel engine. The PTC heater unit aids in passenger compartment heating by compensating for the lower engine coolant temperatures produced by the diesel engine. The PTC heater unit is mounted in the HVAC air distribution housing, downstream of the heater core and is controlled by the diesel



engine control module (ECM) and the totally integrated power module (TIPM) through two relays in diesel accessory fuse/relay block located below the left front fender.

The PTC heater consists of a molded plastic mounting plate (2) with an integral wire connector receptacle (3). Concealed behind the mounting plate are four heating elements with fins (4) that transfer the heat produced by the PTC heater to the conditioned air flowing within the air distribution housing. Two retaining tabs (5) are molded onto the opposite end of the heater unit to support the heater unit inside the air distribution housing. The PTC heater unit is connected to the vehicle electrical system through the instrument panel wire harness.

The PTC heater unit is accessed for service from underneath the instrument panel.

OPERATION

The positive temperature coefficient (PTC) heater unit dissipates 1 kW of electrical power through 4 heating bars. The totally integrated power module (TIPM) operates the three relays for the PTC heater unit. The PTC heater unit is split into two "banks". Each bank is driven separately based on alternator load. This allows for lower in-rush current and optimum battery charging. After a bank has been turned on, another bank can only be turned on 10 seconds after the previous. On average, the PTC banks are not switched more than 25 times for each vehicle start. Electrical power output is between 900-1050 W.

The control system for the PTC heater unit is diagnosed using a scan tool. Prior to replacing a PTC heater unit, check for any diagnostic trouble codes (DTCs) related to the ECM, TIPM and heating-A/C system (refer to 24 - HVAC Electrical Diagnostics for more information).

The PTC heater unit cannot be adjusted or repaired and must be replaced if found inoperative or damaged.

DIAGNOSIS AND TESTING

POSITIVE TEMPERATURE COEFFICIENT (PTC) HEATER UNIT

WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

Prior to replacing the positive temperature coefficient (PTC) heater unit, check for any diagnostic trouble codes (DTCs) related to the engine control module (ECM), totally integrated power module (TIPM) and the heating-A/C system and repair as necessary (refer to 24 - HVAC Electrical Diagnostics for more information).

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the PTC heater unit (refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - REMOVAL).
3. Using an ohmmeter, check for continuity between all of the PTC heater unit terminals. In each case there should be continuity. If OK, repair the wire harness circuits between the PTC heater unit and the TIPM. If NOT OK, replace the PTC heater unit.

REMOVAL

WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Failure to follow the warnings and cautions could result in possible personal injury or death.

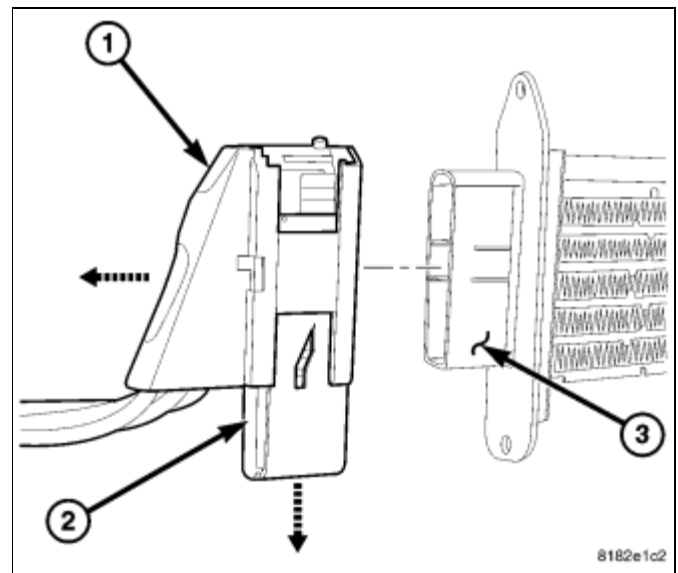
WARNING: Disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

NOTE: PTC heater shown removed from distribution housing for clarity.

1. Disconnect and isolate the negative battery cable.
2. Remove the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

NOTE: To disconnect the wire harness connector from the heater unit, pull downward on the connector lock while pulling the connector away from the heater unit.

3. Disengage the wire connector lock (2) that secures the wire harness connector (1) to the positive temperature coefficient (PTC) heater unit (3) located on the left side of the HVAC air distribution housing and disconnect the connector from the heater.



NOTE: LHD model shown. RHD model similar.

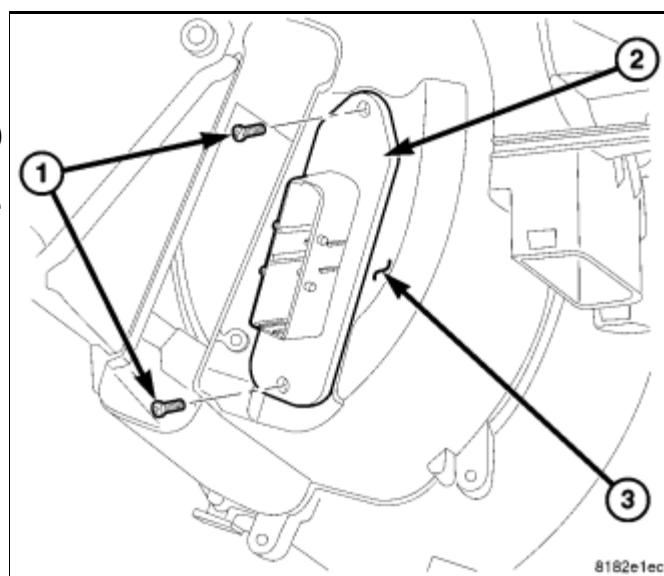
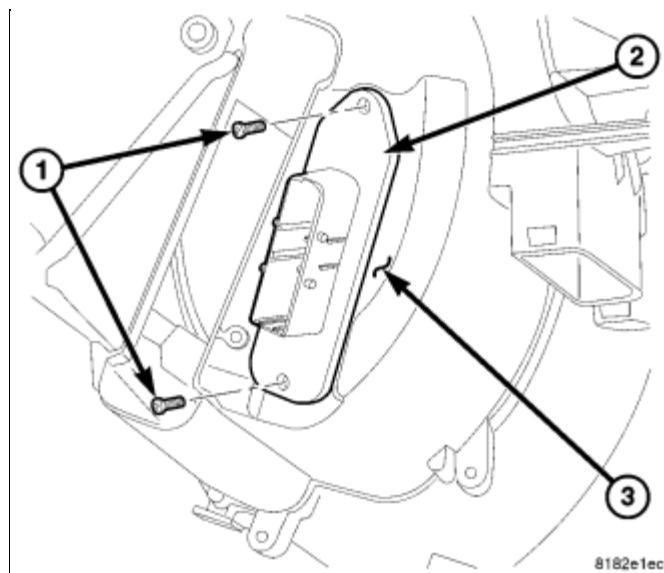
4. Remove the two screws (1) that secure the PTC heater unit (2) to the left side of the HVAC air distribution housing (3).
5. Carefully remove the PTC heater unit from the air

distribution housing by pulling it straight out of the housing.

INSTALLATION

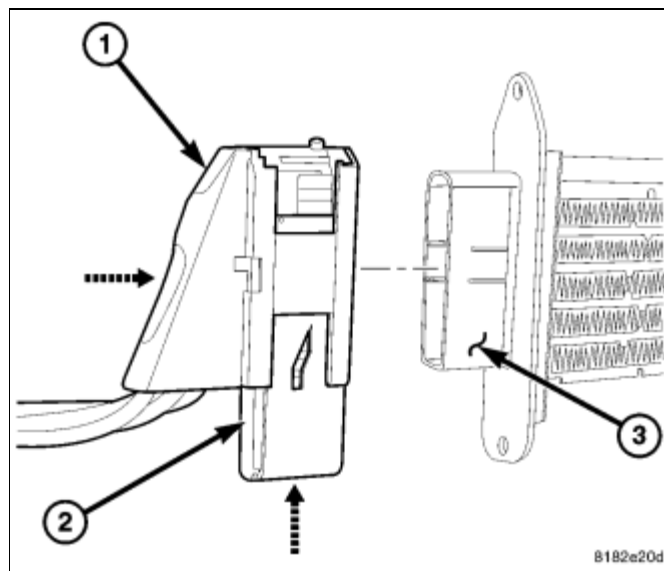
NOTE: LHD model shown. RHD model similar.

1. Carefully install the positive temperature coefficient (PTC) heater unit (2) into the left side of the HVAC air distribution housing (3). Make sure to position the two locator tabs on the end of the heater unit into the molded locator indentations on the right side of the air distribution housing.
2. Install the two screws (1) that secure the PTC heater unit to the air distribution housing. Tighten the screws to 1.2 N·m (10 in. lbs.).



NOTE: PTC heater shown removed from distribution housing for clarity.

3. Connect the wire harness connector (1) to the PTC heater unit (3) while pushing upward on the connector lock (2). Make sure the wire harness connector and lock are fully engaged.
4. Install the instrument panel (refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
5. Reconnect the negative battery cable.



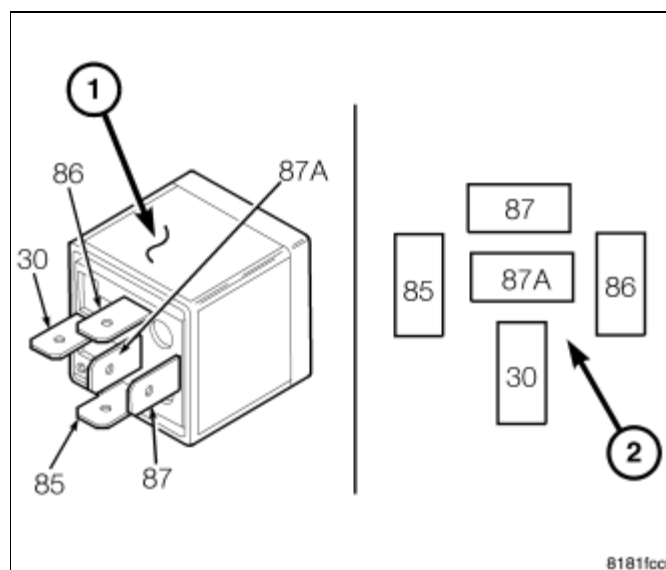
RELAY-HEATER UNIT

DESCRIPTION

Three relays (1) are used for the electric positive temperature coefficient (PTC) heater system when equipped with the 2.8L diesel engine. The relays are International Standards Organization (ISO)-type relays. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2). The PTC relays are electromechanical devices that switch fused battery current directly to the heating elements of the PTC heater unit. The PTC relays are energized by control circuits of the totally integrated power module (TIPM).

The PTC relays are located in the diesel accessory fuse/relay blocks at the rear of the engine compartment.

OPERATION



The ISO-standard relays used for the electric positive temperature coefficient (PTC) heater system are electromechanical switches that use a low current ASD power input to control the high current fused battery power output to the PTC heater unit. On each relay, the movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to one or more of the heating elements of the PTC heater.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The terminals for the PTC relays are connected to the vehicle electrical system through receptacles in the diesel accessory fuse/relay blocks. The inputs and outputs of the PTC relays include:

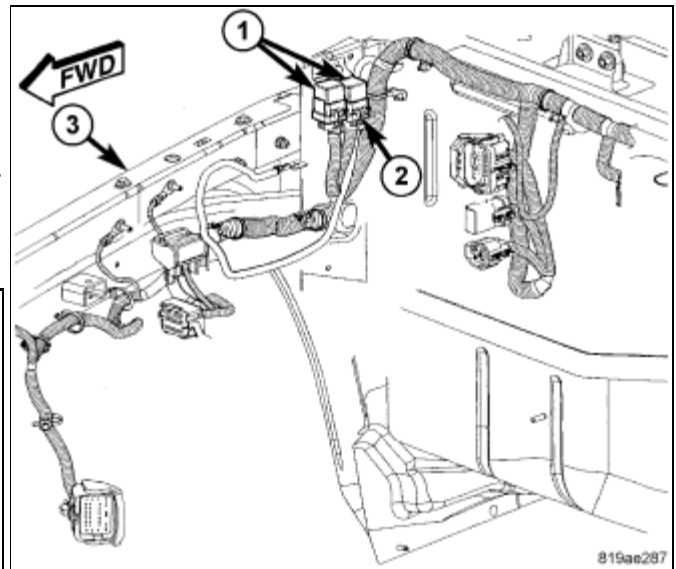
- Terminals (30) receive battery current through a fusible link at all times.
- Terminals (85) are connected to a ground circuit.
- Terminals (86) are connected to control circuits of the totally integrated power module (TIPM).
- Terminals (87) provide fused battery current to the PTC heating elements through the PTC relays only when the PTC relay coil is energized.
- Terminals (87A) are not connected to any circuit in this application, but provide battery current output only when the PTC relay coil is de-energized.

The three PTC relays cannot be repaired and must be replaced if found inoperative or damaged. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard relays and for complete TIPM and HVAC wiring diagrams.

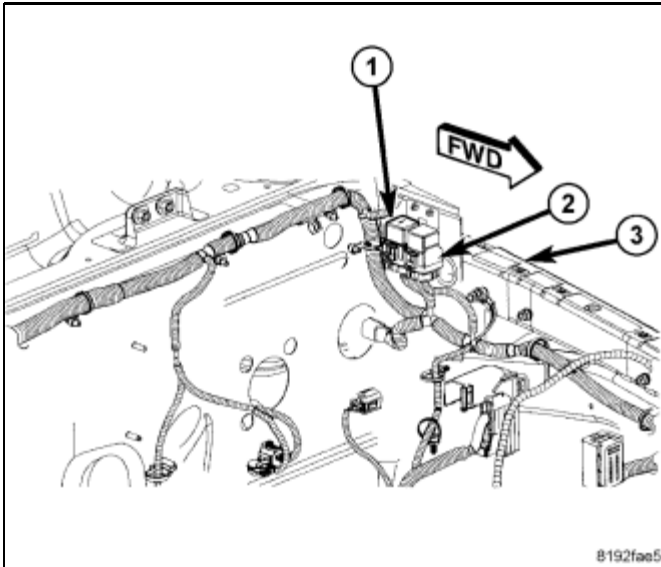
REMOVAL

NOTE: LHD model shown in illustrations. RHD model similar.

1. Disconnect and isolate the negative battery cable.
2. Remove the positive temperature coefficient (PTC) relays number 1 and 2 (1) as necessary from the diesel accessory fuse/relay block (2) located at the inner right front fender (3).



3. Remove the PTC relay number 3 (1) as necessary from the diesel accessory

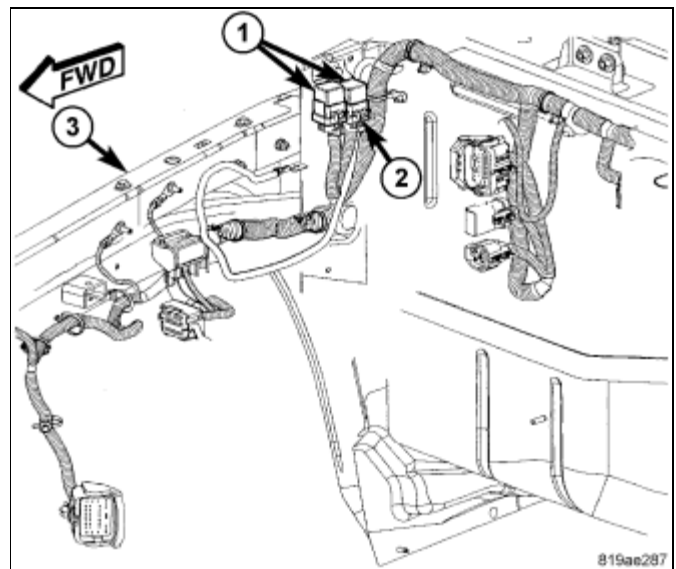


fuse/relay block (2) located at the inner left front fender (3).

INSTALLATION

NOTE: LHD model shown in illustrations. RHD model similar.

1. Position the positive temperature coefficient (PTC) relays number 1 and 2 (1) as necessary into the proper receptacle of the diesel accessory fuse/relay block (2) located on the inner right front fender (3).
2. Align the PTC relay terminals with the terminal cavities in the fuse/relay block and push down firmly on each relay until the terminals are fully seated.

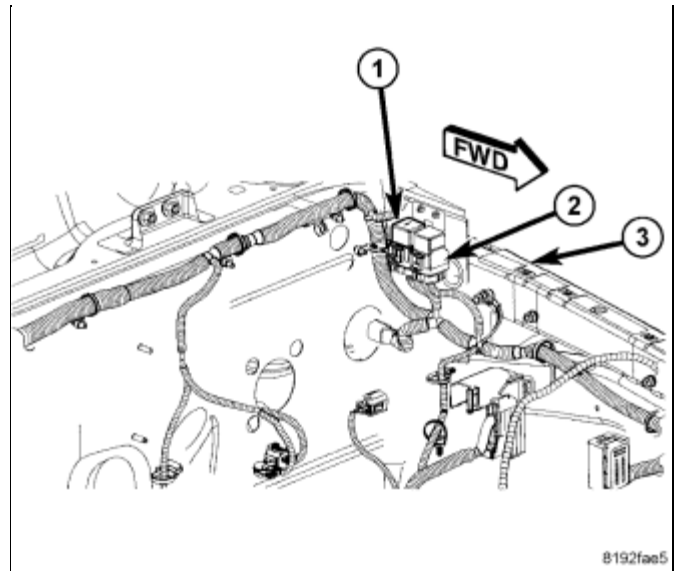


3. Position the PTC relay number 3 (1) as necessary into the

proper receptacle of the diesel accessory fuse/relay block (2) located on the inner left front fender (3).

4. Align the PTC relay terminals with the terminal cavities in the fuse/relay block and push down firmly on the relay until the terminals are fully seated.

5. Reconnect the negative battery cable.



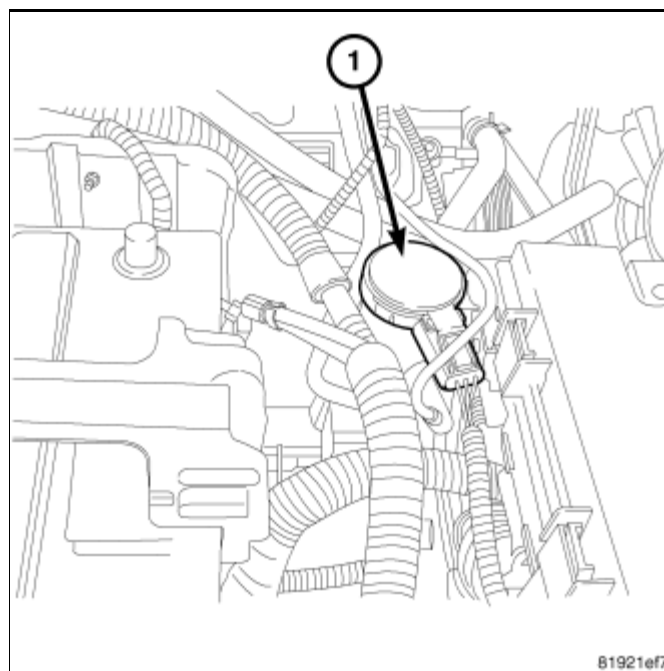
25 - EMISSIONS CONTROL

EVAPORATIVE EMISSIONS

SOLENOID - EVAP/PURGE

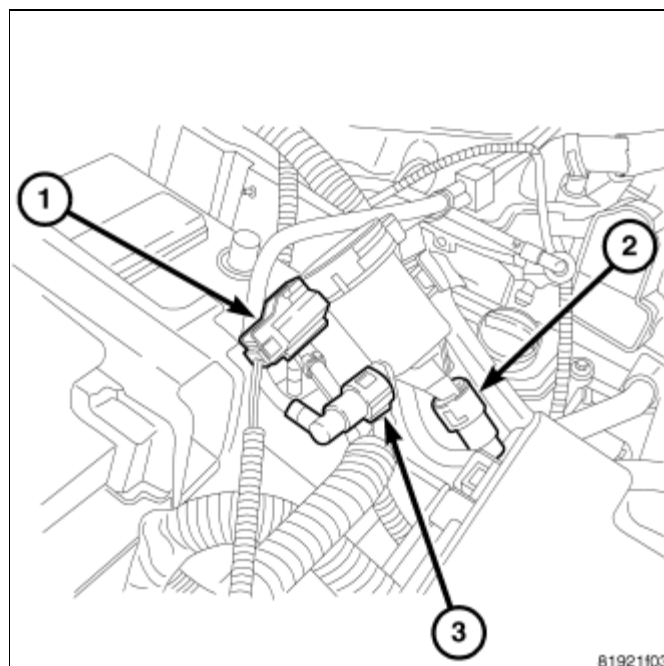
REMOVAL

The EVAP canister purge solenoid (1) is located near the battery.

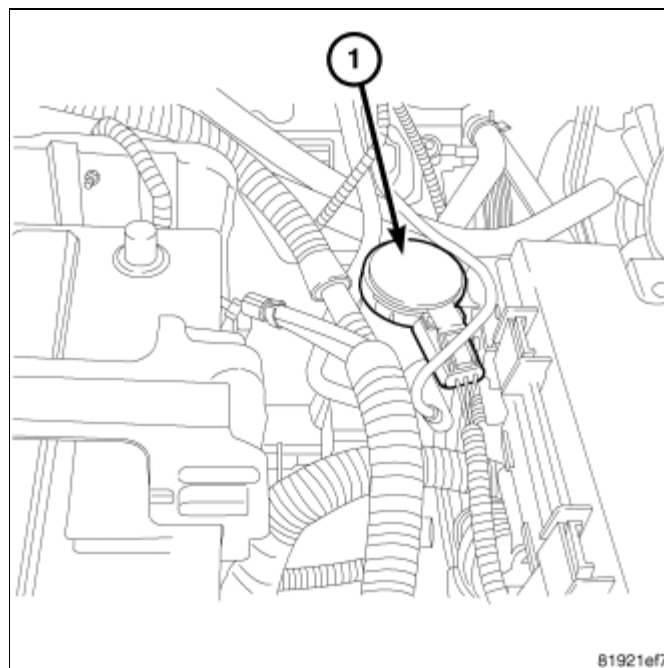


1. Lift the solenoid assembly from the tongue-type bracket.
2. Disconnect electrical connector (1).
3. Disconnect quick-connect fittings (2) and (3) from solenoid.

INSTALLATION



The EVAP canister purge solenoid (1) is located near the battery.

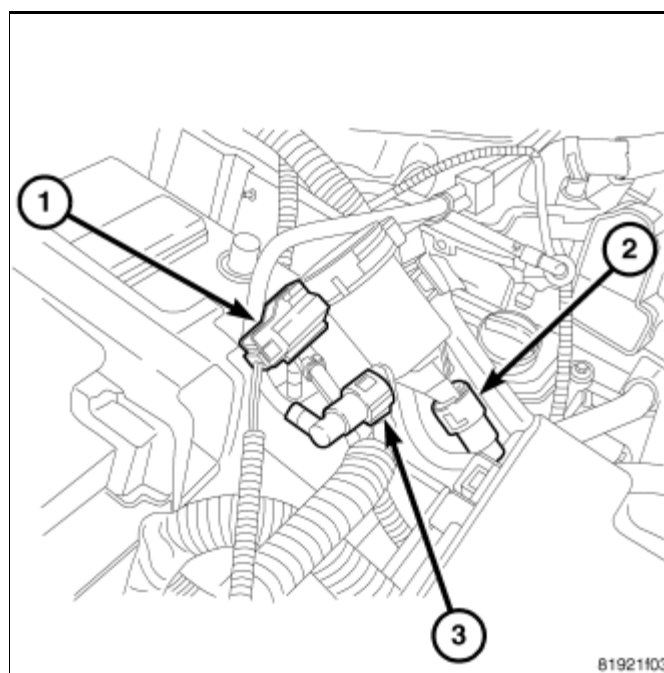


1. Connect quick-connect fittings (2) and (3) to solenoid.
2. Connect electrical connector (1).
3. Push solenoid assembly onto the tongue-type bracket.
4. **The vapor/vacuum lines and hoses must be firmly connected. Also check the vapor/vacuum lines at the ESIM switch and filter for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**

CAP - FUEL FILLER

DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. Certain models are equipped with a 1/4 turn cap.



OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with an ORVR system and an ESIM switch, the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.

ORVR

OPERATION

The ORVR (On-Board Refueling Vapor Recovery) system is used to remove excess fuel tank vapors. This is done while the vehicle is being refueled.

Fuel flowing into the fuel filler tube (approx. 1" I.D.) creates an aspiration effect drawing air into the fuel fill tube. During refueling, the fuel tank is vented to the EVAP canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the EVAP canister, the vehicle's computer controlled purge system draws vapor out of the canister for the engine to burn. The vapor flow is metered by the purge solenoid so that there is no, or minimal impact on driveability or tailpipe emissions.

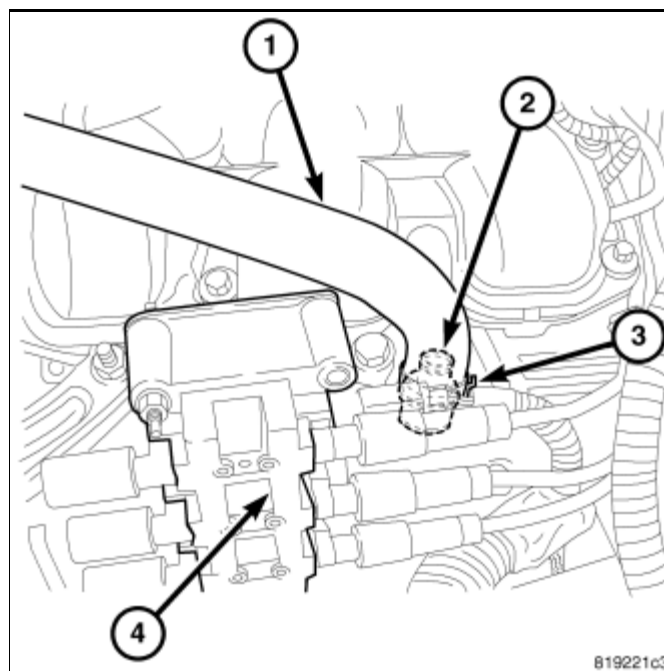
As fuel starts to flow through the fuel fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve and on to the vapor canister. Vapor is absorbed in the EVAP canister until vapor flow in the lines stops. This stoppage occurs following fuel shut-off, or by having the fuel level in the tank rise high enough to close the control valve. This control valve contains a float that rises to seal the large diameter vent path to the EVAP canister. At this point in the refueling process, fuel tank pressure increases, the check valve closes (preventing liquid fuel from spitting back at the operator), and fuel then rises up the fuel filler tube to shut off the dispensing nozzle.

VALVE - PCV 3.8L

REMOVAL

The PCV valve is located in the left valve cover (2) near the ignition coil (4).

1. Remove clamp (3).
2. Remove hose (1).
3. Remove PCV valve (2).



The PCV valve (1) is of typical metal construction.

INSTALLATION



1. Clean mounting hole in valve cover.
2. Install PCV valve (2) into valve cover.
3. Install hose (1) and clamp (3).

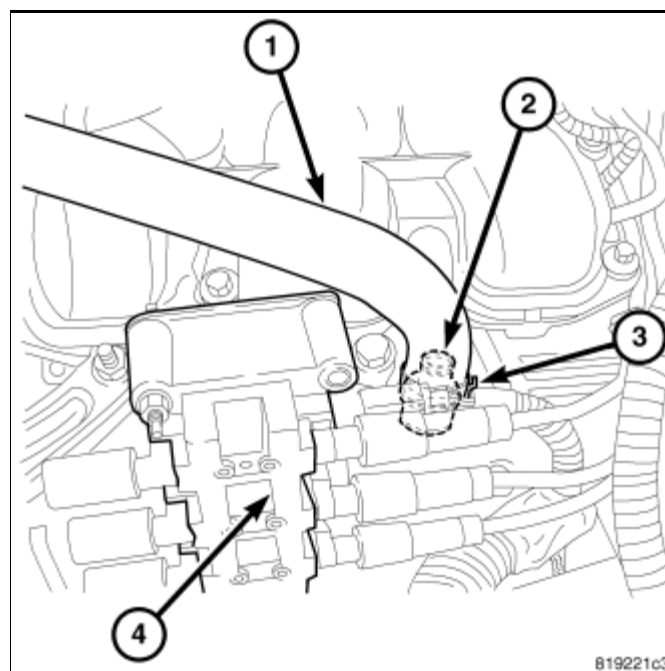
LINES - VACUUM

DESCRIPTION

A vacuum schematic for emission related items can be found on the VECI label. Refer to Vehicle Emission Control Information (VECI) Label for label location.

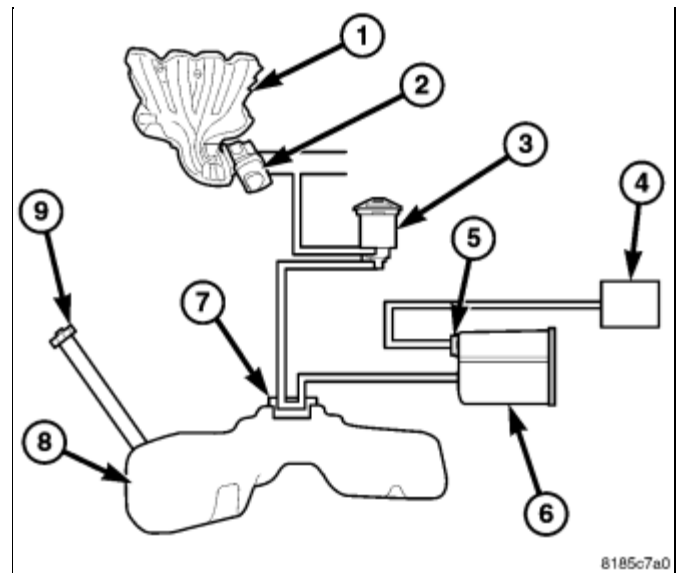
SWITCH-EVAP SYSTEM MONITOR

OPERATION

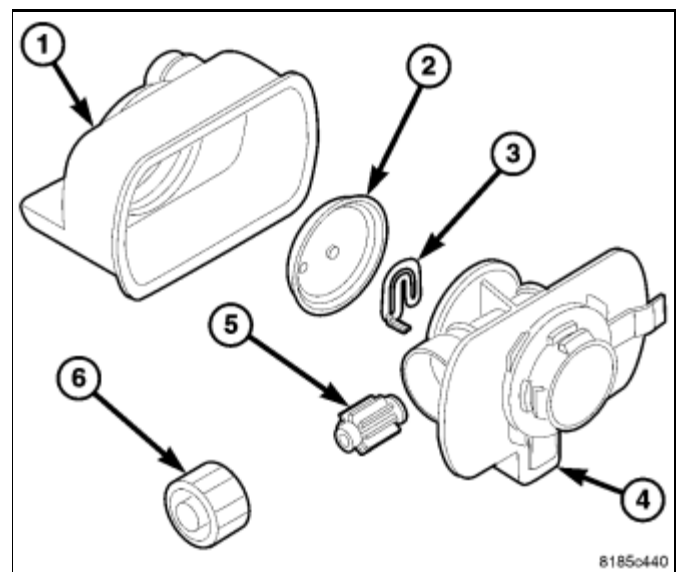


The ESIM (Evaporative System Integrity Monitor) is very similar to the NVLD. However, the design of the ESIM has been simplified and unlike the NVLD the ESIM does not require a solenoid. The ESIM mounts directly to the canister, eliminating the need for a mounting bracket. It is critical that the ESIM is mounted vertically. On vehicles where the canister is mounted on an angle, the ESIM requires an adaptor to maintain a vertical position. When the ESIM is installed vertically, the electrical connector is in the 3 o'clock

position.



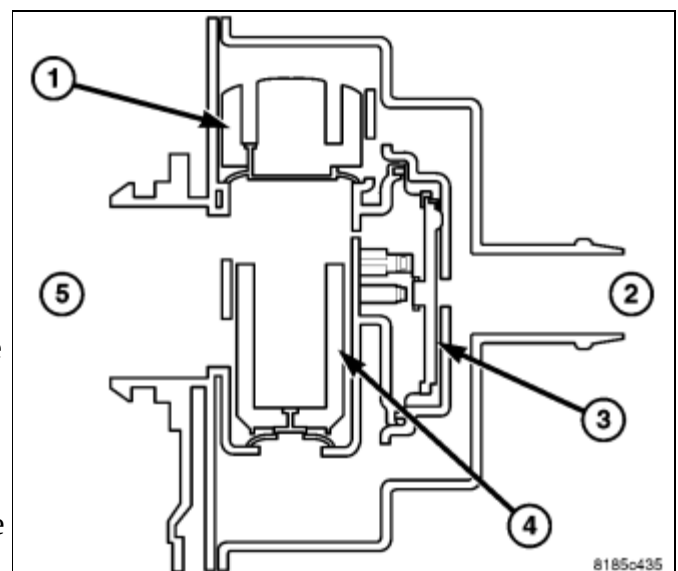
The ESIM assembly consists of a housing, a small weight and a large weight that serve as check valves, a diaphragm, a switch and a cover. There is one large weight and one small weight check valve in the ESIM assembly. A seal is attached at the end of each weighted check valve. The large weight check valve seals for pressure. The small weight check valve seals for vacuum. The weighted check valves are contained within the ESIM housing.



The ESIM (Evaporative System Integrity Monitor), while physically different than the NVLD system, performs the same basic function as the NVLD does – controlling evaporative emissions. The ESIM has been simplified because the solenoid used on the NVLD is not used on the ESIM.

The ESIM consists of housing, two check valves (sometimes referred to as weights), a diaphragm, a switch and a cover. The larger check valve seals for pressure and the smaller one seals for vacuum.

During refueling, pressure is built up in the evaporative system. When pressure reaches approximately .5 inches of water, the large check valve unseats and pressure vents to the fresh air filter.



Conversely, when the system cools, and the resulting vacuum lifts the small check valve from its seat and allows

fresh air to enter the system and relieves the vacuum condition. When a calibrated amount of vacuum is achieved in the evaporative system, the diaphragm is pulled inward, pushing on the spring and closing the contacts.

The ESIM conducts test on the evaporative system as follows: An engine off, non-intrusive test for small leaks and an engine running, intrusive test for medium/large leaks.

The ESIM weights seal the evap. system during engine off conditions. If the evap. system is sealed, it will be pulled into a vacuum, either due to the cool down from operating temperature or diurnal ambient temperature cycling. When the vacuum in the system exceeds about 1" H2O, the vacuum switch closes. The switch closure sends a signal to the PCM. In order to pass the non-intrusive small leak test, the ESIM switch must close within a calculated amount of time and within a specified amount of key-off events.

If the ESIM switch does not close as specified, the test is considered inconclusive and the intrusive engine running test will be run during the next key-on cycle. This intrusive test will run on the next cold engine running condition.

Conditions for running the intrusive test are:

- After the vehicle is started, the engine coolant temperature must be within 50°F (10°C) of ambient to indicate a cold start.
- The fuel level must be between 12% and 88%.
- The engine must be in closed loop.
- Manifold vacuum must be greater than a minimum specified value.
- Ambient temperature must be between 39°F and 98°F (4°C and 37°C) and the elevation level must be below 8500 feet (2591 meters).

The test is accomplished by the PCM activating the purge solenoid to create a vacuum in the evaporative system. The PCM then measures the amount of time it takes for the vacuum to dissipate. This is known as the vacuum decay method. If the switch opens quickly a large leak is recorded. If the switch opens after a predetermined amount of time, then the small leak matures. If the switch does not close, then a general evaporative failure is recorded. The purge monitor tests the integrity of the hose attached between the purge valve and throttle body/intake. The purge monitor is a two stage test and it runs only after the evaporative system passes the small leak test.

Even when all of the thresholds are met, a small leak won't be recorded until after the medium/large leak monitor has been run. This is accomplished by the PCM activating the purge solenoid to create a vacuum in the evaporative system. The PCM then measures the amount of time it takes for the vacuum to dissipate. This is known as the vacuum decay method. If the switch opens quickly a large leak is recorded. If the switch opens after a predetermined amount of time, then the small leak matures. If the medium/large leak test runs and the ESIM switch doesn't close, a general evaporative test is run. The purge solenoid is activated for approximately 10 seconds, increasing the amount of vacuum in the system. If the ESIM switch closes after the extended purge activation, a large leak fault is generated. If the switch doesn't close, a general evaporative system fault is generated.

The purge monitor tests the integrity of the hose attached between the purge valve and throttle body/intake. The purge monitor is a two stage test and it runs only after the evaporative system passes the small leak test.

Stage one of the purge monitor is non-intrusive. The PCM monitors the purge vapor ratio. If the ratio is above a calibrated specification, the monitor passes. Stage two is an intrusive test and it runs only if stage one fails. During the stage two test, the PCM commands the purge solenoid to flow at a specified rate to force the purge vapor ratio to update. The vapor ratio is compared to a calibrated specification and if it is less than specified, a one-trip failure is recorded.

The ESIM switch stuck closed monitor checks to see if the switch is stuck closed. This is a power down test that runs at key-off; when the PCM sees 0 rpm's, the purge solenoid is energized for a maximum of 30 seconds,

venting any vacuum trapped in the evaporative system. If the switch opens or was open before the test began, the monitor passes. If the switch doesn't open, the monitor fails. This is a two-trip MIL. The star scan tool can be used to force the ESIM switch stick closed monitor to run.

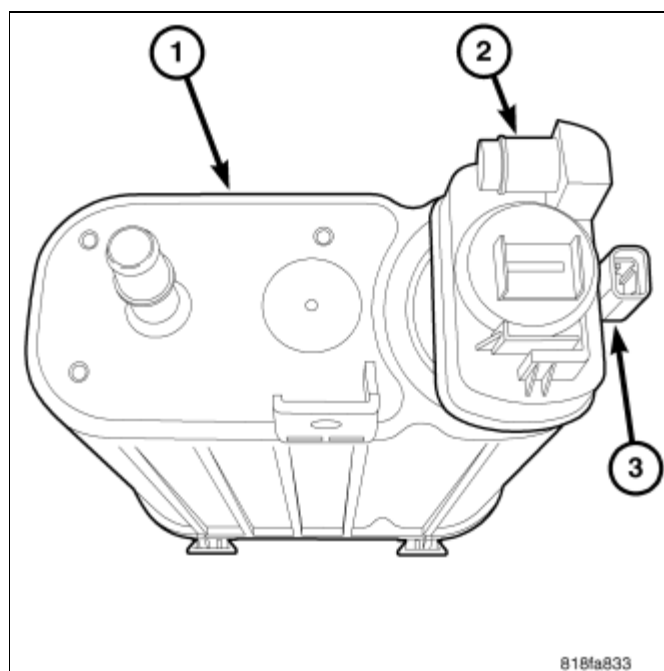
The PCM also uses the ESIM to detect a loose or missing gas cap. The PCM controller looks for a change in the fuel level (25% minimum) and then gas cap is loose or missing. If a medium/large leak is detected, a loose gas cap light illuminates and a pending one-trip fault code is set. On the PCM, this is a three-trip fault before the code matures

REMOVAL

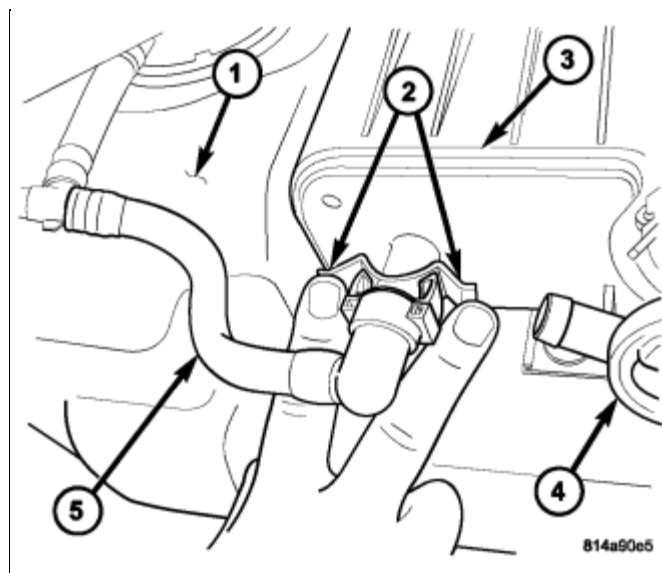
The ESIM (EVAP System Integrity Monitor) switch is attached to the EVAP canister and is usually not serviceable. Replace the switch by replacing the EVAP canister. Refer to EVAP canister removal/installation.

If servicing separately, refer to the following:

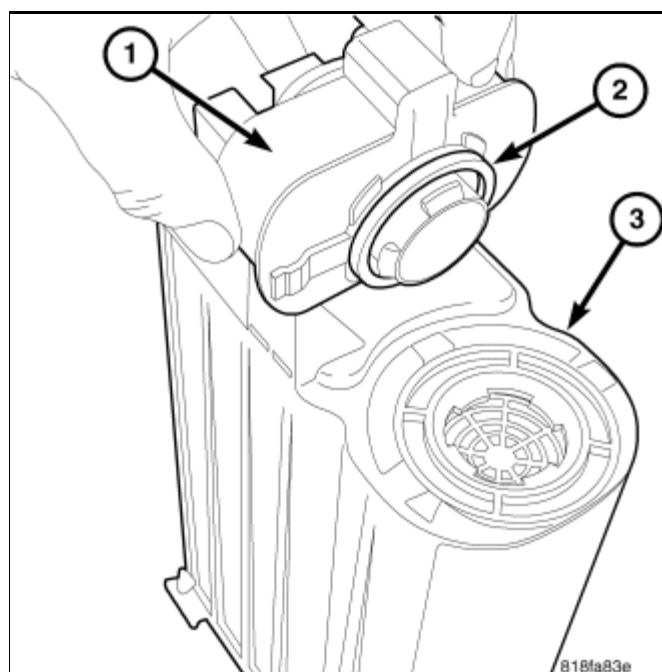
The ESIM switch (2) is located on the EVAP canister (1)
The picture displays a typical EVAP Canister and a typical ESIM switch.



1. Remove both plastic lines from switch by folding line tabs (2).



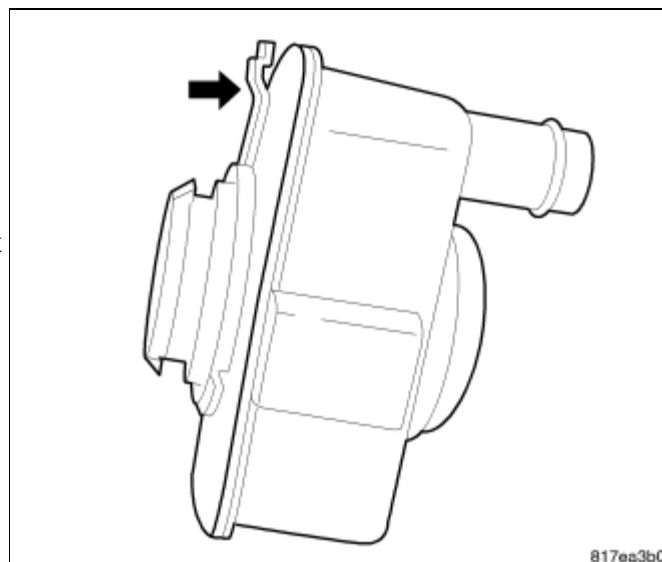
2. Disconnect electrical connector at switch.
3. Clean any dirt from ESIM switch and its lines.



4. A lock tab (see arrow) is used on the back of the switch. Push lock tab towards switch while rotating switch counterclockwise 1/4 turn for removal.
5. The fresh air lines and hoses from the ESIM must have a clear opening to the atmosphere. Check the fresh air lines, including the fresh air filter, for obstructions or restrictions at the ESIM. Also check the routing to the exit to atmosphere. If a restriction is present, the system will not allow free flow passage of clean air, and an early shut off of the fuel fill nozzle may occur during fuel fill.

INSTALLATION

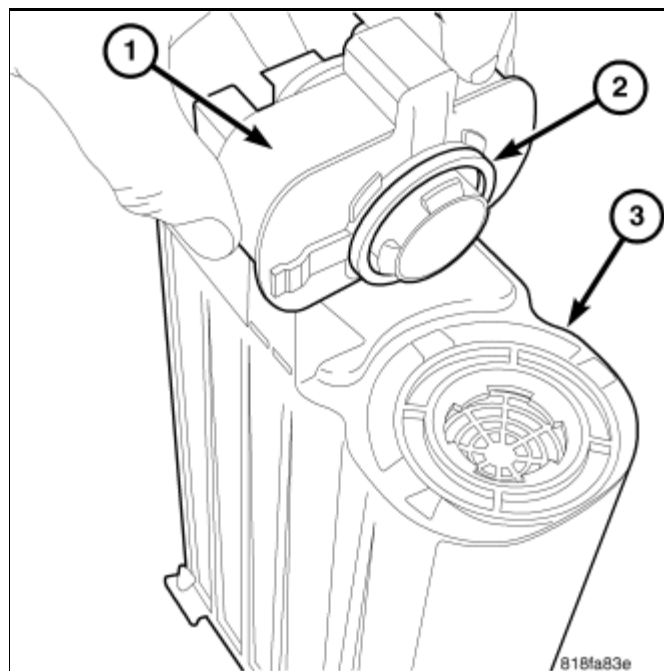
The following pictures display a TYPICAL EVAP



Canister and a typical ESIM switch. After installing any ESIM switch, the electrical connector on the switch must be in the 3 O'clock position. This step must be done for proper ESIM switch operation.

1. The fresh air lines and hoses from the ESIM must have a clear opening to the atmosphere. Check the fresh air lines, including the fresh air filter, for obstructions or restrictions at the ESIM. Also check the routing to the exit to atmosphere. If a restriction is present, the system will not allow free flow passage of clean air, and an early shut off of the fuel fill nozzle may occur during fuel fill.

2. Be sure O-ring (2) and EVAP canister opening are clean.



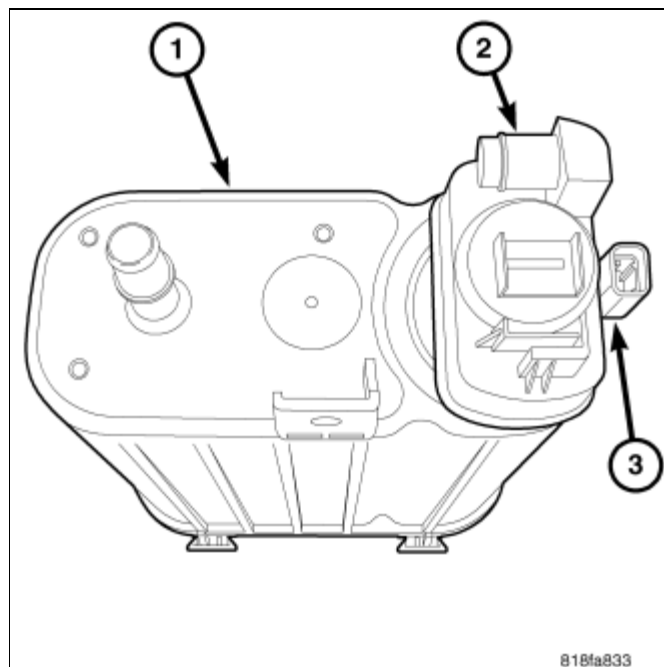
CAUTION: The electrical connector (3) on the ESIM switch must be in 3 O'clock position after installation. This step must be done for proper switch operation.

3. Position ESIM switch (2) into EVAP canister (1) and rotate until electrical connector is in 3 O'clock position (3).
4. Connect electrical connector.
5. Connect plastic lines to ESIM switch.

CANISTER - VAPOR

OPERATION

A maintenance free, EVAP canister is used on all vehicles. The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

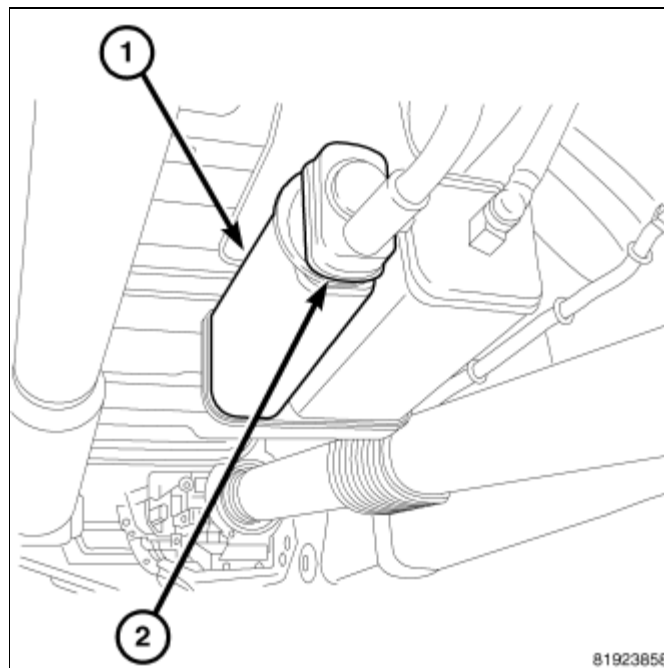


Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

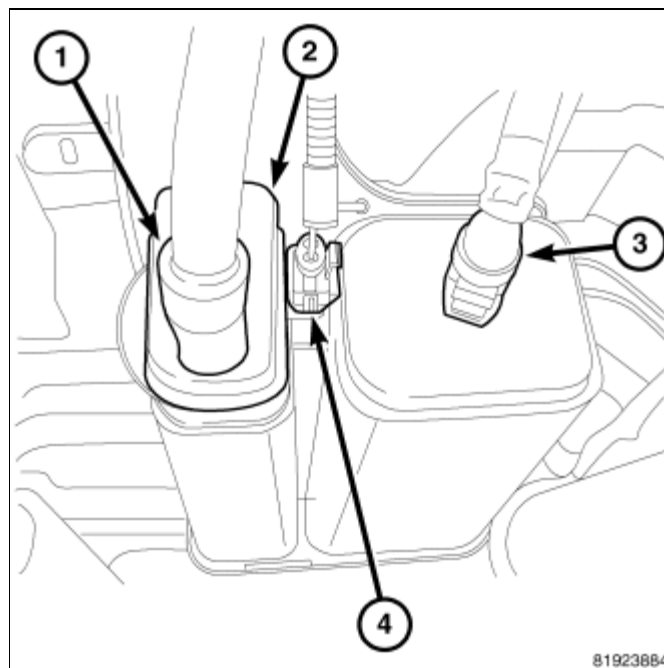
The EVAP canister is also to be considered as part of the ORVR system.

REMOVAL

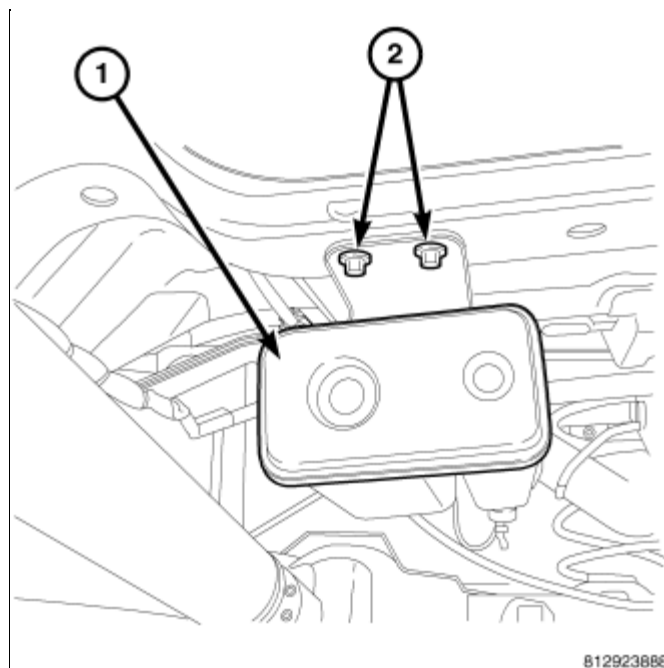
The EVAP canister (1) is located under the vehicle next to the rear prop shaft. The ESIM switch (2) is attached to the EVAP canister.



1. Raise and support vehicle.
2. Clean dirt or debris from canister vacuum lines.
3. Disconnect electrical connector (4) at ESIM switch (2).
4. Disconnect rubber hose (1) from ESIM switch.
5. Disconnect fitting (3) at EVAP canister.

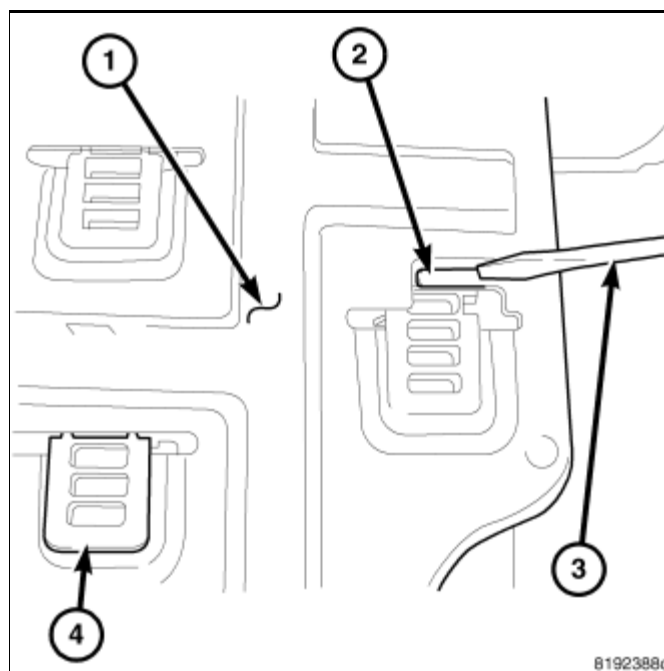


6. Remove two bolts (2) at front of canister mounting bracket (1).
7. Remove two bolts at rear of canister mounting bracket.

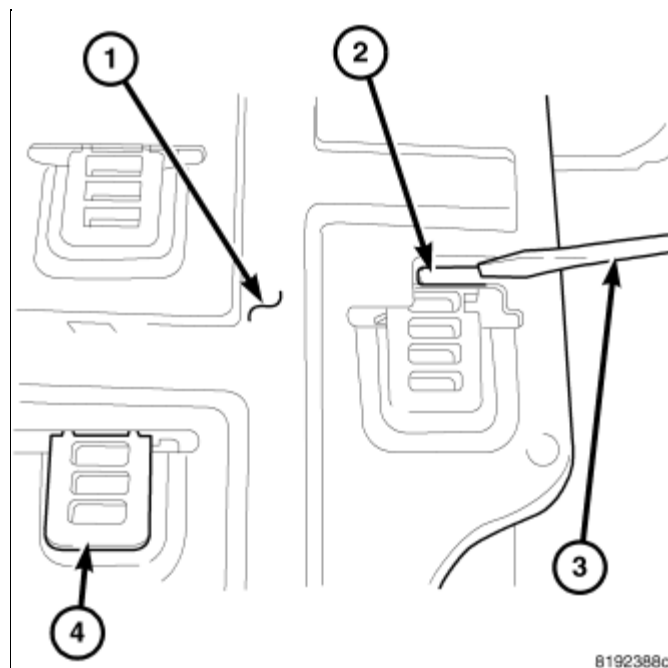


8. To separate EVAP canister (4) from mounting bracket (1), pry on lock-tab (2).

INSTALLATION

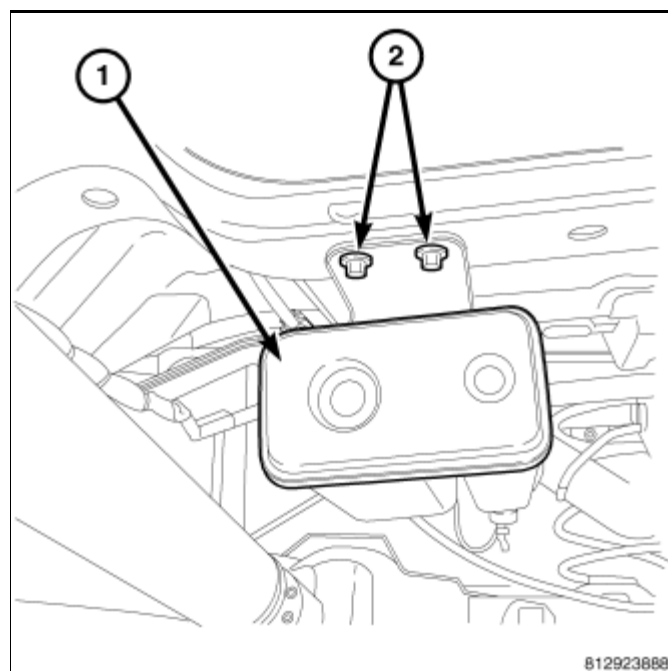


1. Attach canister to mounting bracket. Lock canister to mounting bracket by using lock tab (2).



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2. Install two bolts (2) at front of canister mounting bracket (1).
3. Install two bolts at rear of canister mounting bracket.



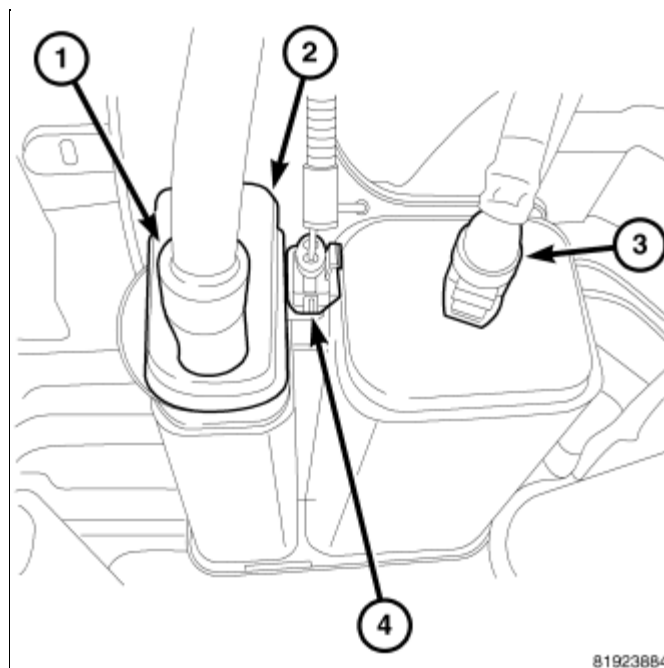
812923888

4. Connect electrical connector (4) to ESIM switch (2).
5. Connect rubber hose (1) to ESIM switch.
6. Connect fitting (3) to EVAP canister.
7. Lower vehicle.
8. **The vapor/vacuum lines and hoses must be firmly connected. Also check the vapor/vacuum lines at the ESIM switch, filter and EVAP purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**

HEATER-CRANKCASE 2.8L

DIESEL

REMOVAL

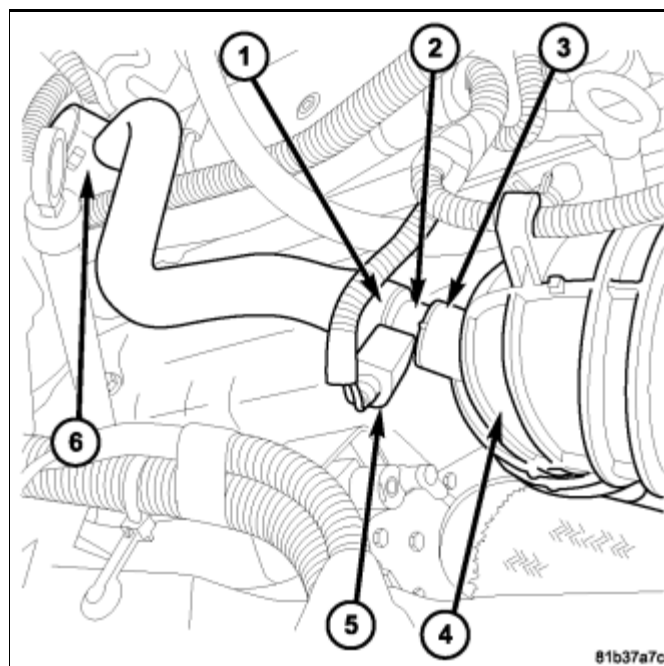


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The crankcase heater (2) is located in the hose (1) leading to the crankcase breather (6).

1. Disconnect electrical connector (5).
2. Separate hose (1) from heater.
3. Separate heater from hose (3).

INSTALLATION



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The crankcase heater (2) is located in the hose (1) leading to the crankcase breather (6).

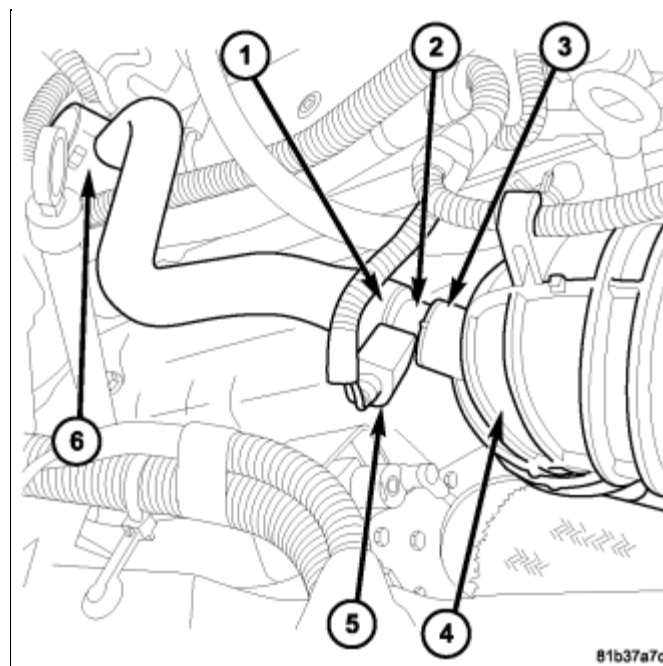
1. Twist heater (2) into hose (3).
2. Twist hose (1) into heater.
3. Connect electrical connector (5).

EXHAUST GAS RECIRCULATION - 3.8L

EXHAUST GAS RECIRCULATION - 3.8L

SPECIFICATIONS

TORQUE



DESCRIPTION	N·m	Ft. lbs.	Inch lbs.
EGR valve to adaptor 3.8L	22	-	200 ±25
EGR tube to EGR valve 3.8L	11.9	-	105 ±20
EGR tube to intake manifold 3.8L	11.9	-	105 ±20
EGR Pipe to EGR Bolts 2.8L Diesel	32.4	24	-
EGR Pipe to Exhaust Manifold 2.8L Diesel	27.5	21	-
EGR Valve Nuts 2.8L Diesel	32.4	24	-

VALVE - EGR 3.8L

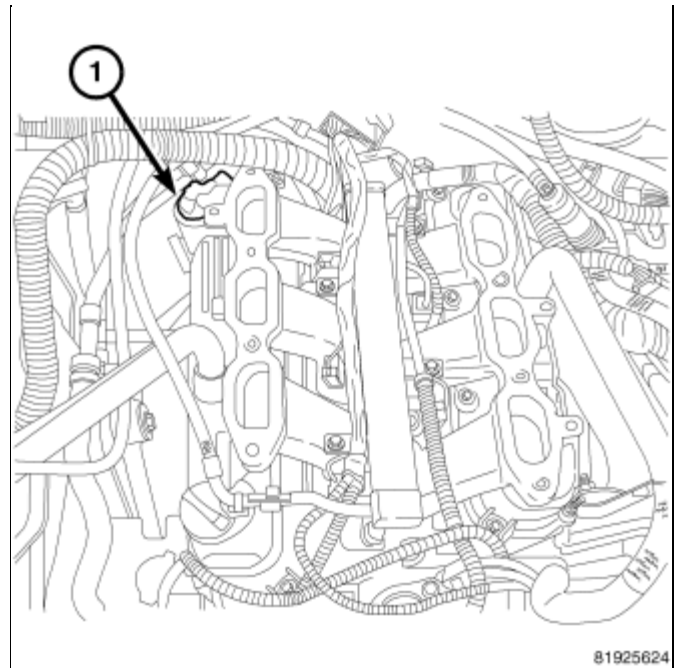
REMOVAL

The EGR valve and solenoid assembly (1) is attached to the rear of the right cylinder head.

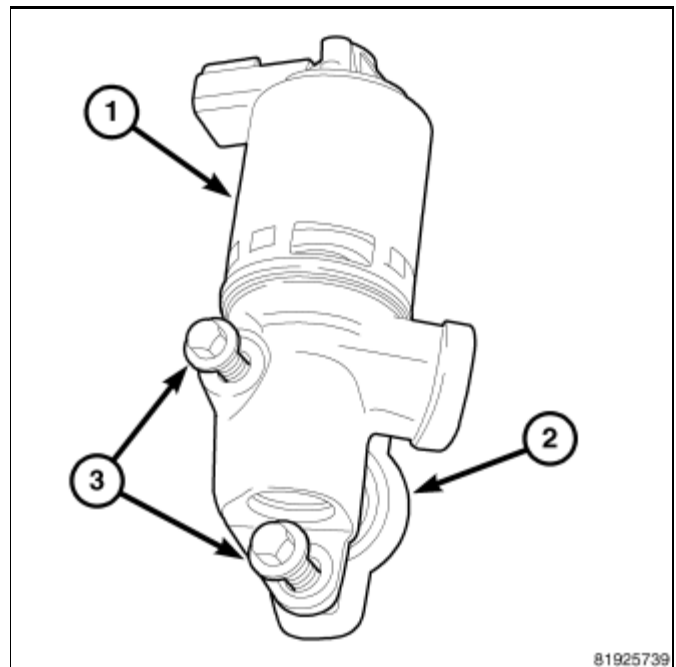
1. Use a diagnostic scan tool to record any DTC's

(Diagnostic Trouble Codes).

2. Disconnect and isolate the negative battery cable.

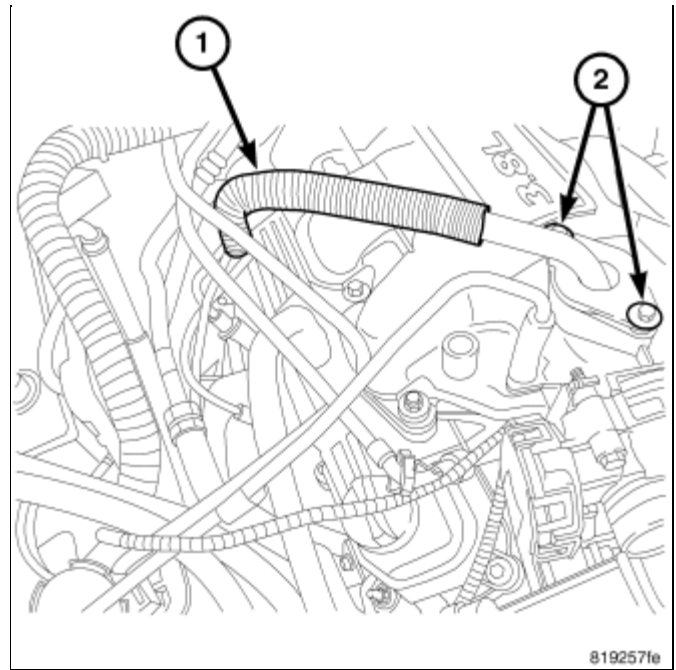


A metal gasket (2) is used between the EGR valve/solenoid assembly, and the right cylinder head.

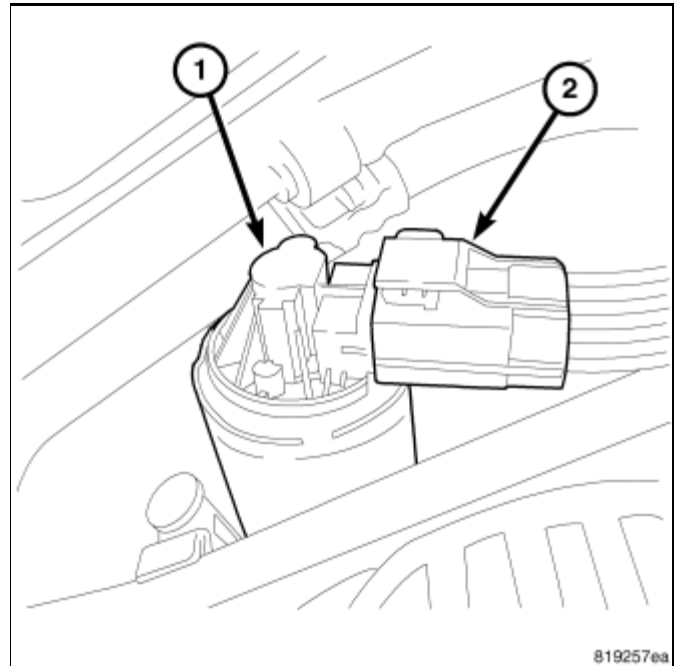


A metal tube (1) connects the EGR valve/solenoid assembly to the intake manifold.

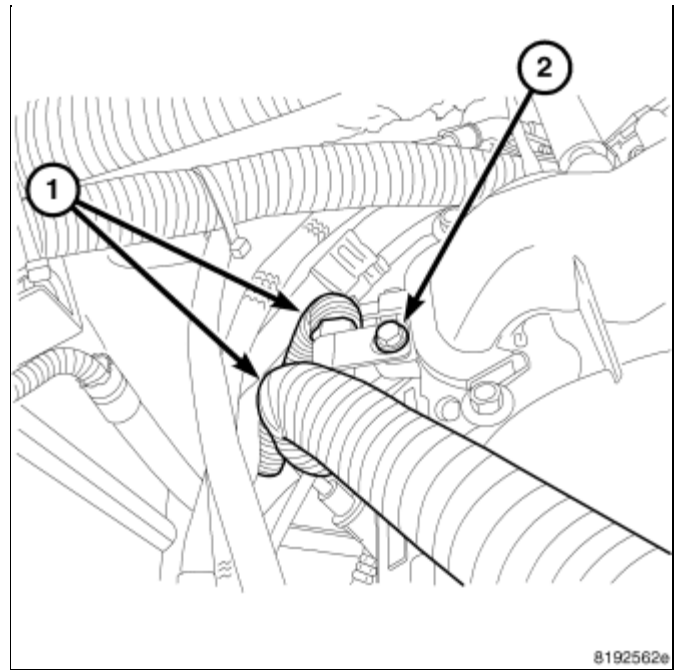
3. Remove the upper (plastic) half of the intake manifold.



4. Disconnect electrical connector (2) at EGR valve.

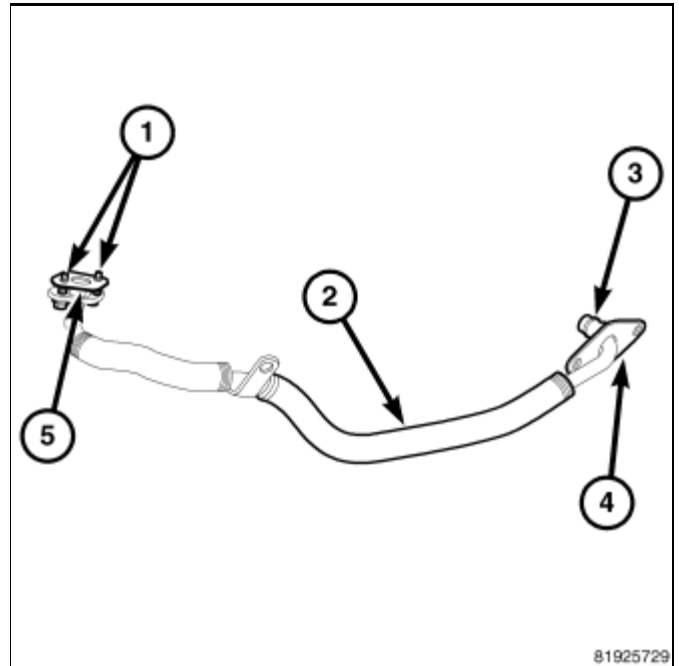


5. Remove tube mounting bolt (2).



6. Remove two tube mounting bolts (1) at EGR valve end of tube.

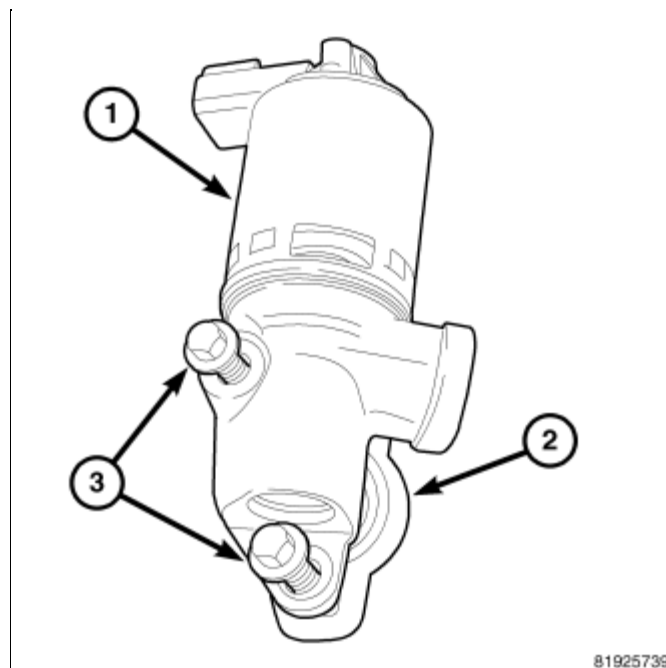
7. Remove and discard gasket (5) and O-ring (3).



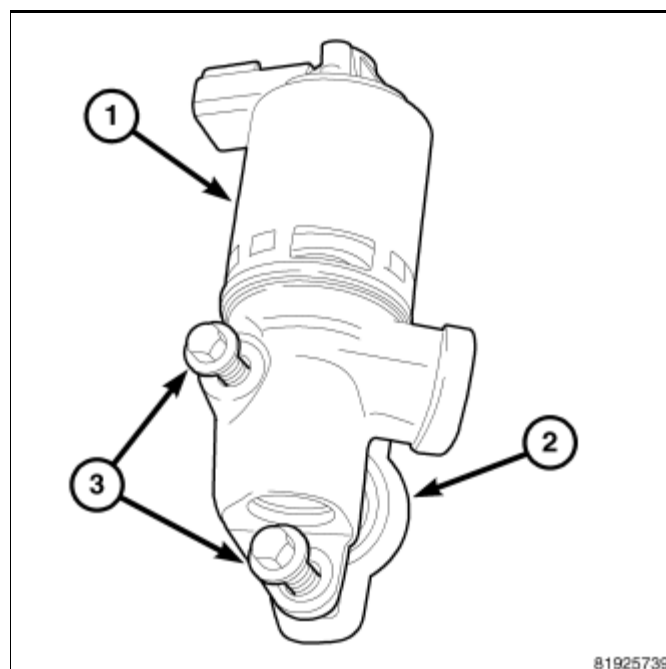
8. Remove two EGR valve mounting bolts (3).

9. Discard gasket (2).

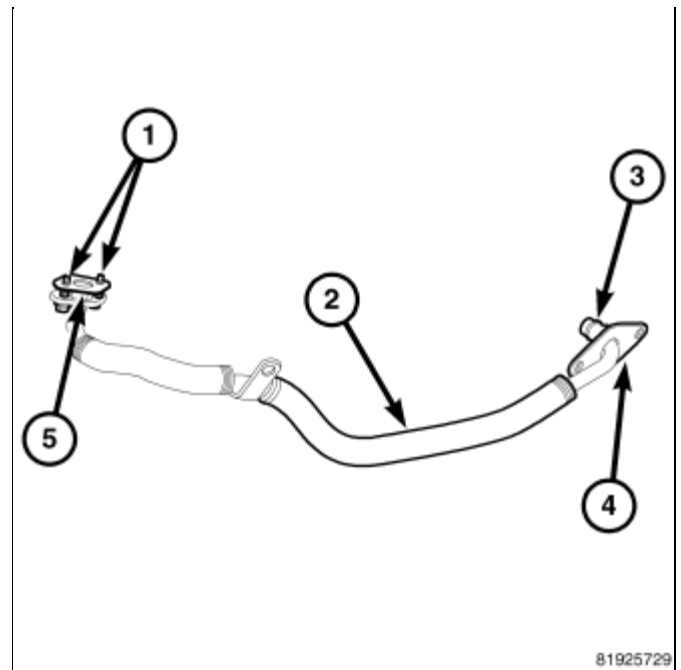
INSTALLATION



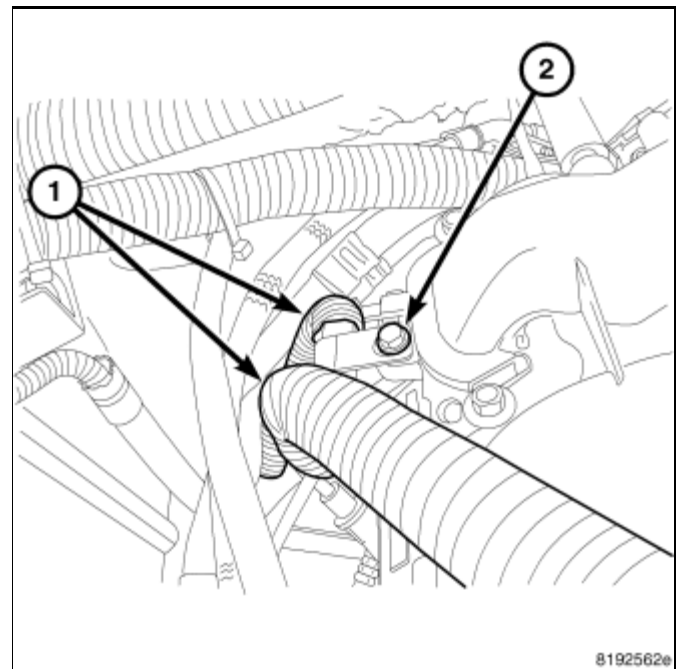
1. Clean gasket mounting area at rear of cylinder head and EGR valve.
2. Install new gasket (2).
3. Position EGR valve (1) to rear of cylinder head and install two EGR valve mounting bolts (3).



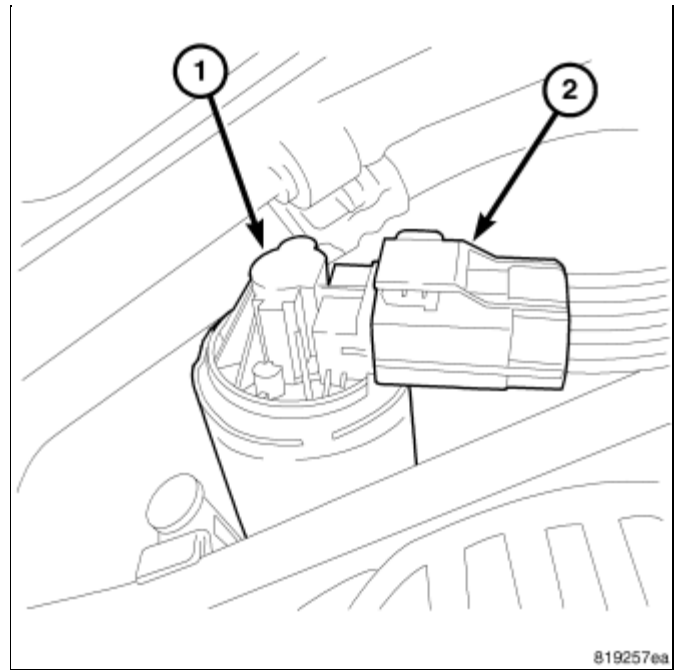
4. Clean gasket mounting areas at both ends of EGR tube.
5. Install new gasket (5) and new O-ring (3) to EGR tube.
6. Install two tube mounting bolts (1) at EGR valve end of tube.



7. Install tube mounting bolt (2).



8. Connect electrical connector (2) to EGR valve.



9. Install the upper (plastic) half of the intake manifold.
10. Install two tube flange bolts (2) at intake manifold.
11. Connect negative battery cable.
12. Using a diagnostic scan tool, erase any previously recorded DTC's (Diagnostic Trouble Codes).

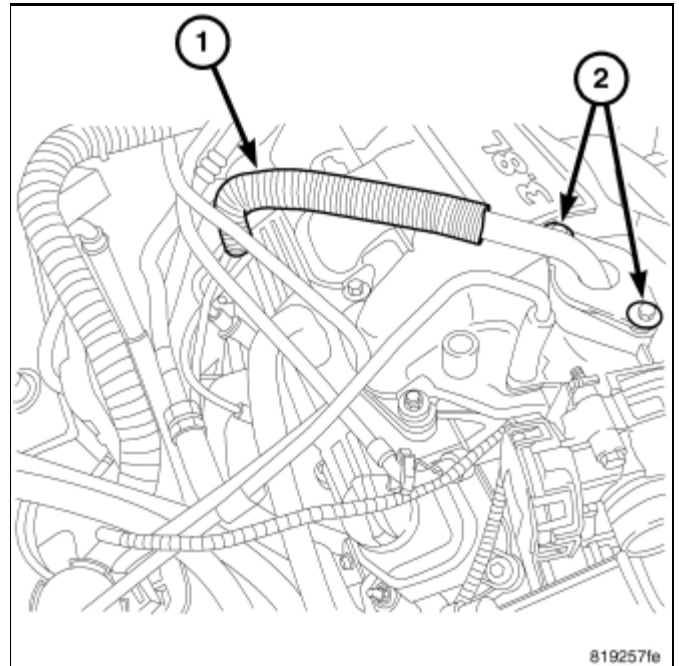
ON-BOARD DIAGNOSTICS

ON-BOARD DIAGNOSTICS

DESCRIPTION

GLOSSARY OF TERMS

APPS	Accelerator Pedal Position Sensor
AAT	Ambient Air Temperature
ABS	Anti-Lock Brake System
ASD	Auto Shut Down
BARO	Barometric
CGW	Central Gateway
CKP	Crankshaft Position Sensor



CMP	Camshaft Position Sensor
CMTC	Compass/Mini-Trip Computer
DCHA	Diesel Cabin Heater Assist
DLC	Data Link Connector
DTC	Diagnostic Trouble Code
EATX	Electronic Automatic Transaxle
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EGR	Exhaust Gas Recirculation
ETC	Electronic Throttle Control
GEN	Generator
GPEC	Global Powertrain Engine Controller
FCM	Front Control Module
FDCM	Final Drive Control Module
IAT	Intake/Inlet Air Temperature
IAC	Idle Air Control
IOD	Ignition Off-Draw
IPM	Integrated Power Module
JTEC	Jeep Truck Engine Controller
KS	Knock Sensor
LDP	Leak Detection Pump
MAP	Manifold Air Pressure
MDS	Multi Displacement System
MIC	Mechanical Instrument Cluster
MIL	Malfunction Indicator Lamp
MTV	Manifold Tuning Valve

NGC	Next Generation Controller
NVLD	Natural Vacuum Leak Detection
O2S	Oxygen Sensor
OBD	On Board Diagnostic
PDC	Power Distribution Center
PCI	Programmable Communication Interface
PCM	Powertrain Control Module
PCV	Positive Crankcase Ventilation
PEP	Peripheral Expansion Port
SBEC	Single Board Engine Controller
SCM	Steering Control Module
S/C	Speed Control
SKIM	Sentry Key Immobilizer Module
SKIS	Sentry Key Immobilizer System
SKREEM	Sentry Key Remote Entry Module
SKREES	Sentry Key Remote Entry System
SOL	Solenoid
SRV	Short Runner Valve
TCM	Transmission Control Module
TCC	Torque Converter Clutch
TIP	Throttle Inlet Pressure
TIPM	Totally Integrated Power Module
TP	Throttle Position
TPMS	Tire Pressure Monitor System
TRS	Transmission Range Sensor

VSS	Vehicle Speed Sensor/Signal
WCM	Wireless Control Module

OPERATION

OBD II MONITOR RUN PROCESS

The following procedure has been established to assist technicians in the field with enabling and running OBD II Monitors. The order listed in the following procedure is intended to allow the technician to effectively complete each monitor and to set the CARB Readiness Status in the least time possible.

NOTE:

Once the monitor run process has begun, do not turn off the ignition. By turning the ignition key off, monitor enabling conditions will be lost. EVAP Monitor runs after key off. By performing a Battery Disconnect, or Selecting Erase DTCs, the CARB Readiness and all additional OBD II information will be cleared.

Monitor Preliminary Checks:

1. Plug a scan tool into the vehicle's Data Link Connector (DLC).
2. Turn the ignition, KEY ON - ENGINE OFF. Watch for MIL lamp illumination during the bulb check. MIL lamp must have illuminated, if not, repair MIL lamp.
3. Using a scan tool check for Powertrain related DTCs.
 - Verify that No Emissions Related DTCs are Present. If an Emissions DTC is Present, the OBD II Monitors may not run and the CARB Readiness will not update.
 - The Emissions related DTC, will need to be repaired, then cleared. By clearing DTCs, the OBD Monitors will need to be run and completed to set the CARB Readiness Status.

Using the scan tool check the CARB Readiness Status.

Do all the CARB Readiness Status Locations read YES?

- YES - all monitors have been completed and this vehicle is ready to be I/M or Emission Tested.
- NO - then the following procedure needs to be followed to run/complete all available monitors.

NOTE:

Only the monitors, which are not YES in the CARB Readiness Status, need to be completed. Specific criteria need to be met for each monitor. The most efficient order to run the monitors has been outlined below, including suggestions to aid the process.

Evaporative Emission System Leak Detection with Purge Monitor

This monitor requires a cool down cycle, usually an overnight soak for at least 8 hours without the engine

running. The ambient temperature must decrease overnight - parking the vehicle outside is advised. To run this test the fuel level must be between 15-85% full. Criteria for EVAP monitor:

- Engine off time greater than one hour .
- Fuel Level between 15% and 85%.
- Start Up ECT and IAT within 10°C (18°F).
- Vehicle started and run until Purge Monitor reports a result.

NOTE: If the vehicle does not report a result and the conditions where correct. It may take up to two weeks to fail the small leak monitor. DO NOT use this test to attempt to determine a fault. Use the appropriate service information procedure for finding a small leak. If there are no faults and the conditions are correct this test will run and report a pass. Note the Small leak test can find leaks less than 10 thousands of an inch. If a small leak is present it takes approximately one week of normal driving to report a failure.

Catalyst / O2 Monitor

The Catalyst and O2 Monitor information are acquired and processed at the same time. Most vehicles will need to be driven at highway speed (less than 50 mph) (73km/h) for a few minutes. Some vehicles run the monitor at idle in drive. If the vehicle is equipped with a manual transmission, using 4th gear may assist in meeting the monitor running criteria.

- Engine RPM between 1200 to 3000.
- Engine temperature greater than 70°C (158°F)
- Engine run time greater than 92 seconds
- MAP between 10 - 20 kPa (7.5 - 15 Hg)
- Vehicle speed between 20 - 70 mph (29–103 km/h)

EGR Monitor

After the vehicle has reached the below conditions and during a throttle decel the EGR monitor will run.

- Engine RPM between 1375 - 2500
- Engine temperature greater than 70°C (158°F)
- Engine run time greater than 125 seconds
- Vehicle speed between 25 - 70 mph (37–103 km/h)

O2 Sensor Heater Monitor

This monitor is now continuously running once the heaters are energized. Pass information will be processed at power down.

Mis-Fire Monitor

The Misfire Monitor is a continuous two-trip monitor. The monitor uses two different tests/counters:

NOTE: The Adaptive Numerator must be learned before the PCM will run the Mis-Fire Monitor. The

PCM updates the Adaptive Numerator at every key-ON, and is relearned after battery disconnect. The Misfire Monitor will not run until the Adaptive Numerator has updated since the last battery disconnect. If the Adaptive Numerator is equal to the default value then the PCM knows that the Adaptive Numerator has not been learned and does not permit the Misfire Monitor to run. If the Adaptive Numerator exceeds a calibrated percentage, the PCM sets a DTC for CKP NOT LEARNED and illuminates the MIL.

- 200 Revolution Counter - Looks for misfire that can cause immediate catalyst damage.
- 1000 Revolution Counter - Looks for misfire that can cause emissions to increase 1.5 times the Federal Test Procedure (FTP) standards. This test must also identify misfire percentages that might cause a “durability demonstration vehicle” to fail an Inspection and Maintenance Program tailpipe emissions test.

EXHAUST GAS RECIRCULATION - 2.8L DIESEL

EXHAUST GAS RECIRCULATION - 2.8L DIESEL

SPECIFICATIONS

SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
EGR Mounting Bolts - 2.8L Diesel	15	11	—
EGR Airflow Control Valve - 2.8L Diesel	11	8	—

SPECIFICATIONS - TORQUE

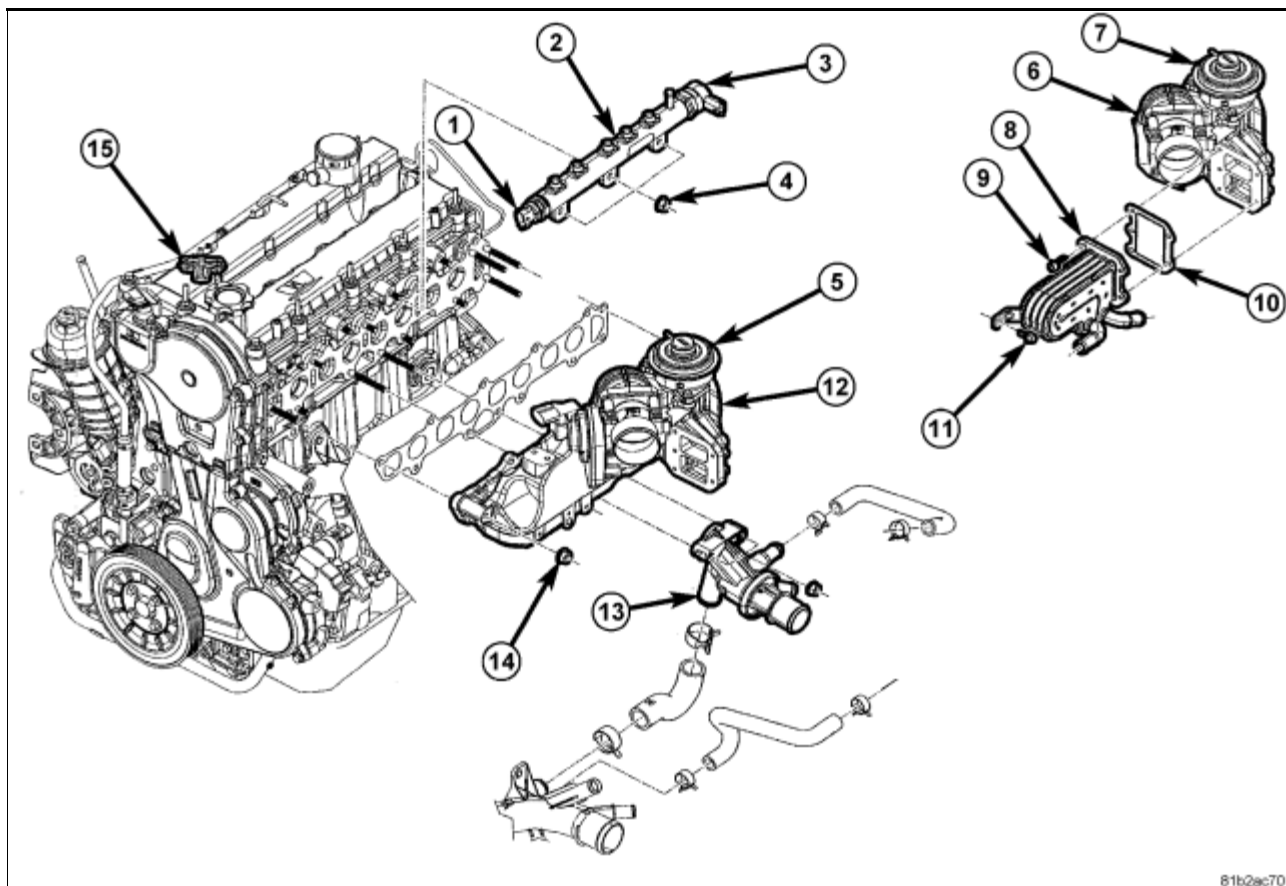
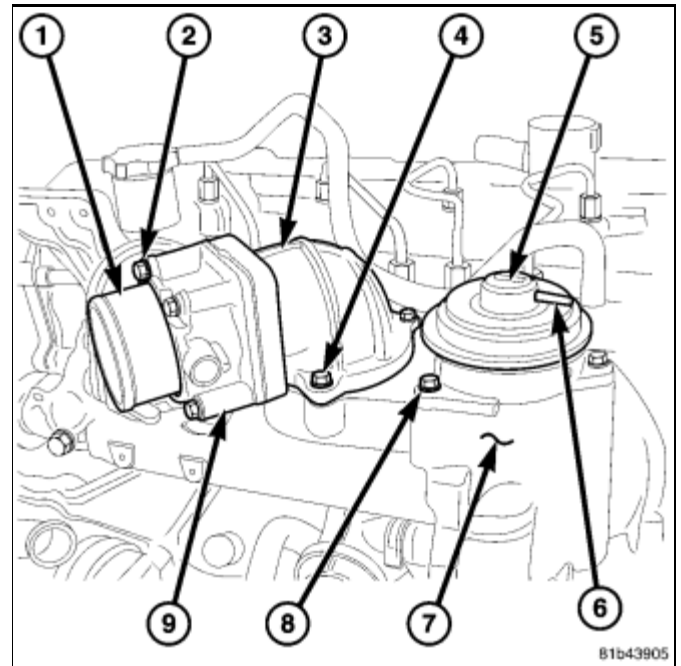
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
EGR Mounting Bolts - 2.8L Diesel	15	11	—
EGR Airflow Control Valve - 2.8L Diesel	11	8	—

VALVE - EGR 2.8L

REMOVAL

The EGR valve (5) is located at the rear of the intake manifold (7).



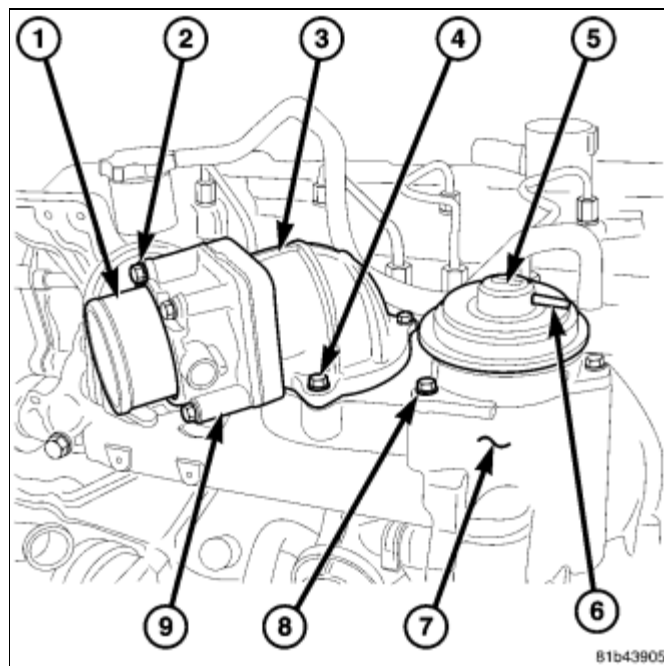
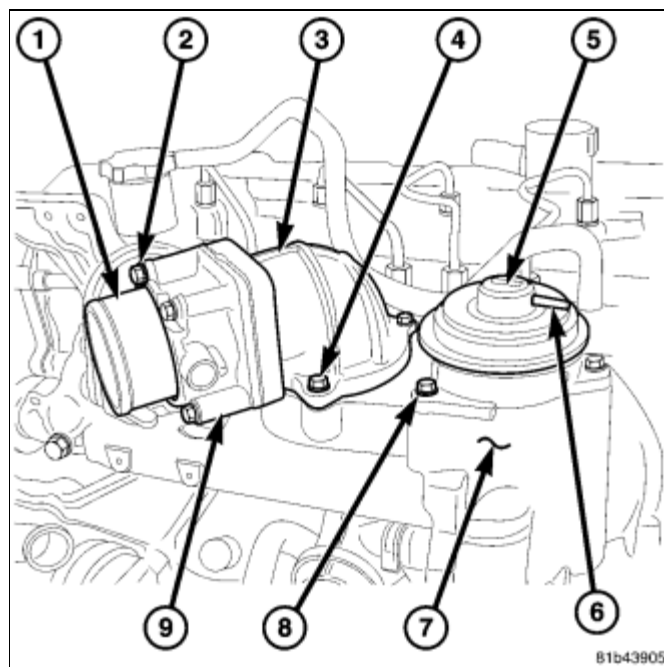
1. Disconnect and isolate negative battery cable at battery.
2. Remove plastic engine cover.
3. Relieve cooling system pressure and remove EGR cooler (8). Refer to Engine Cooling for removal procedures.

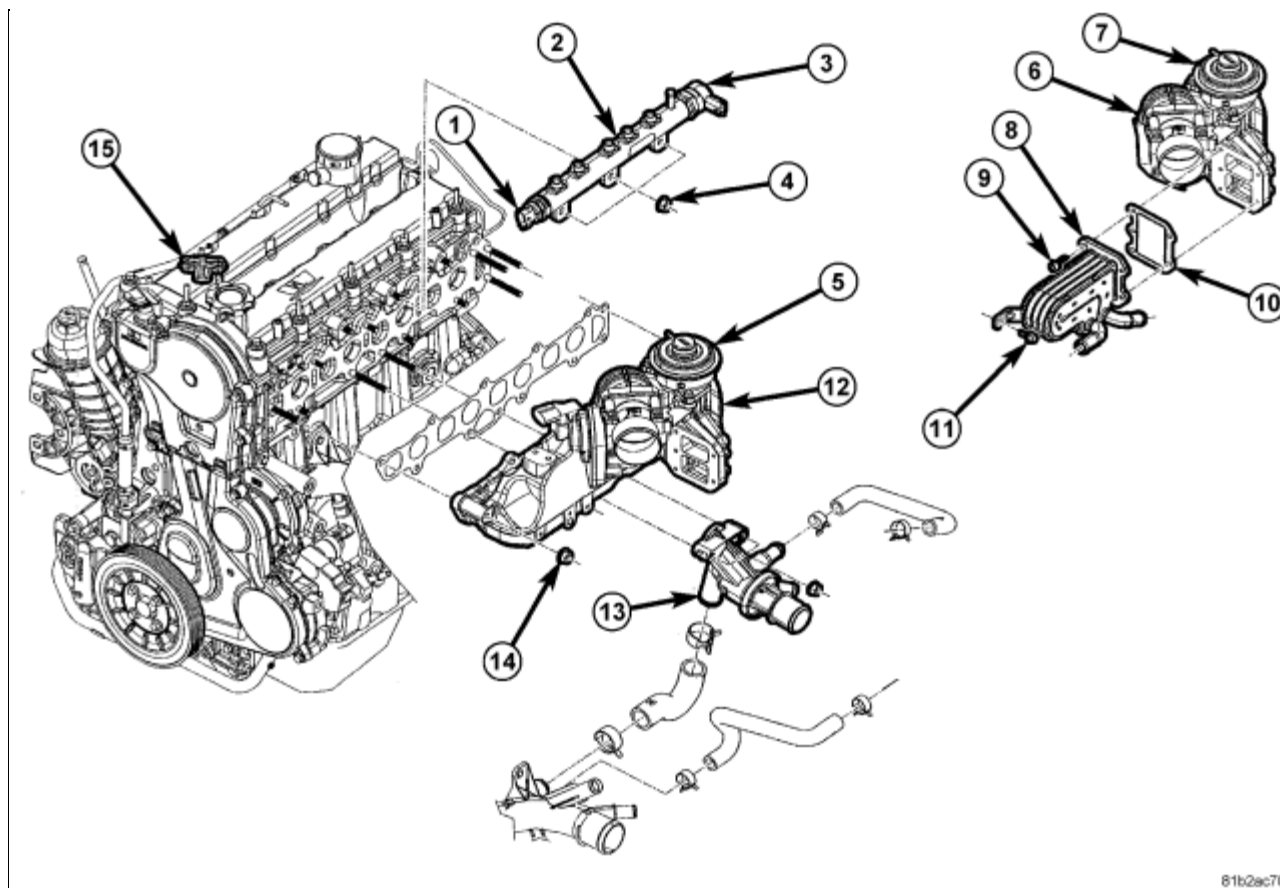
4. Remove vacuum line from fitting (6).
5. Remove EGR valve mounting bolts (8) and remove EGR valve (5) from intake manifold.
6. Remove and discard old mounting gasket located between EGR valve and intake manifold.
7. Clean mounting areas at bottom of valve and at top of intake manifold.

INSTALLATION

The EGR valve (5) is located at the rear of the intake manifold (7).

1. Clean mounting areas at bottom of EGR valve and at top of intake manifold.
2. Place new mounting gasket between EGR valve and intake manifold.
3. Install EGR valve (5) and mounting bolts (8) to intake manifold. Tighten bolts to 15 N·m (11 ft. lbs.) torque.
4. Connect vacuum line to fitting (6).





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5. Install EGR cooler (8). Refer to Engine Cooling for removal procedures.
6. Install plastic engine cover.
7. Connect and negative battery cable to battery.

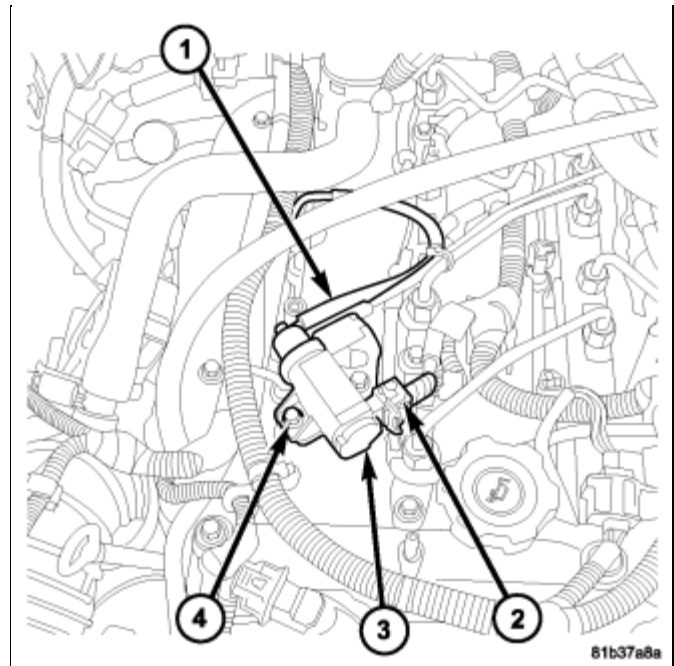
SOLENOID-EGR

REMOVAL

The EGR Solenoid (3) is located on the top of valve cover.

1. Remove plastic engine cover.
2. Disconnect electrical connector (2).
3. Disconnect vacuum/pressure lines (1).
4. Remove two mounting bolts (4) and remove solenoid.

INSTALLATION

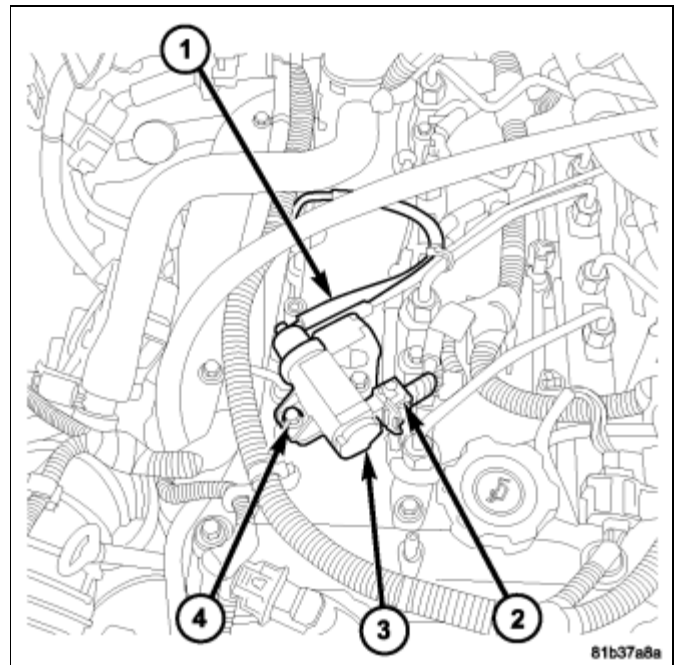


The EGR Solenoid (3) is located on the top of valve cover.

1. Position solenoid (3) to valve cover and install two mounting bolts (4).
2. Connect electrical connector (2).
3. Connect vacuum/pressure lines (1).
4. Install plastic engine cover.

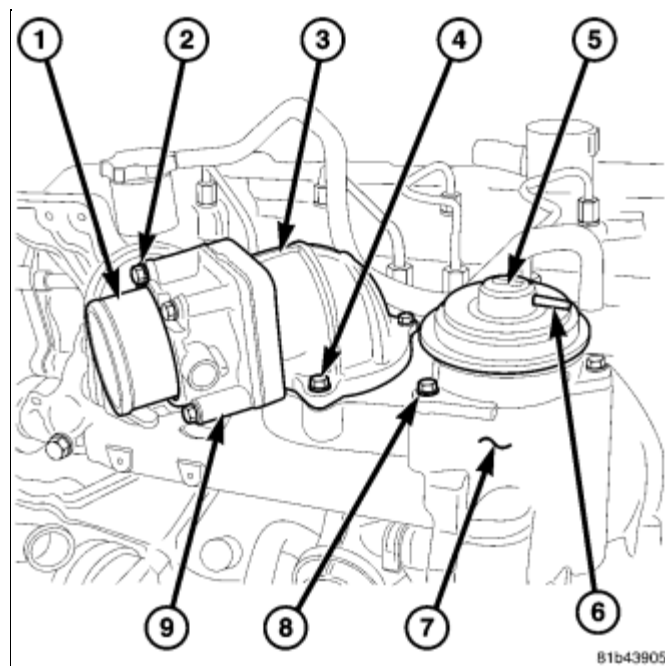
VALVE-EGR AIR FLOW CONTROL

REMOVAL

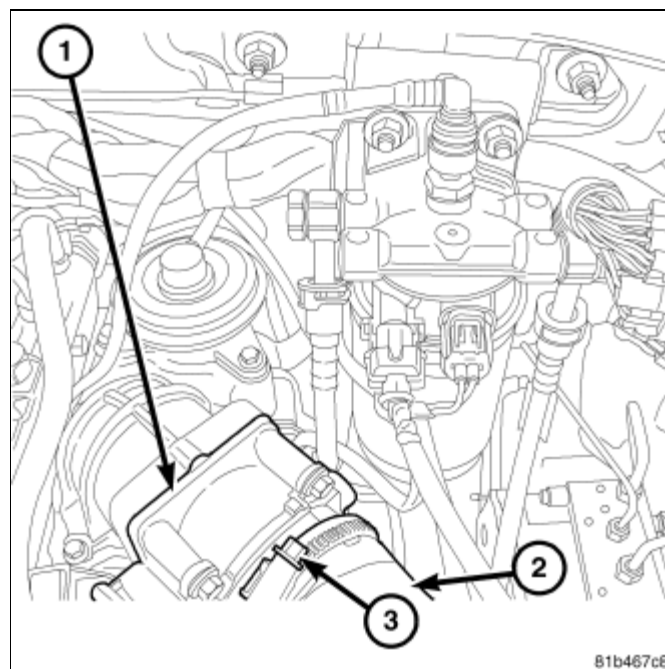


The EGR air control valve (9) is located near the center of the intake manifold (7). A cast intake housing (3) connects the control valve to the intake manifold.

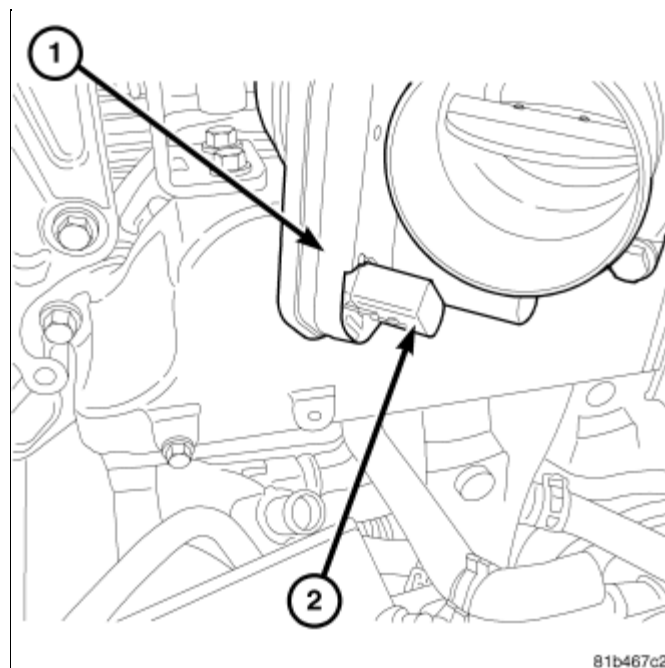
1. Disconnect and isolate negative battery cable at battery.
2. Remove plastic engine cover.



3. Remove rubber intake tube clamp (3).
4. Disconnect rubber tube (2) from air control valve (1).

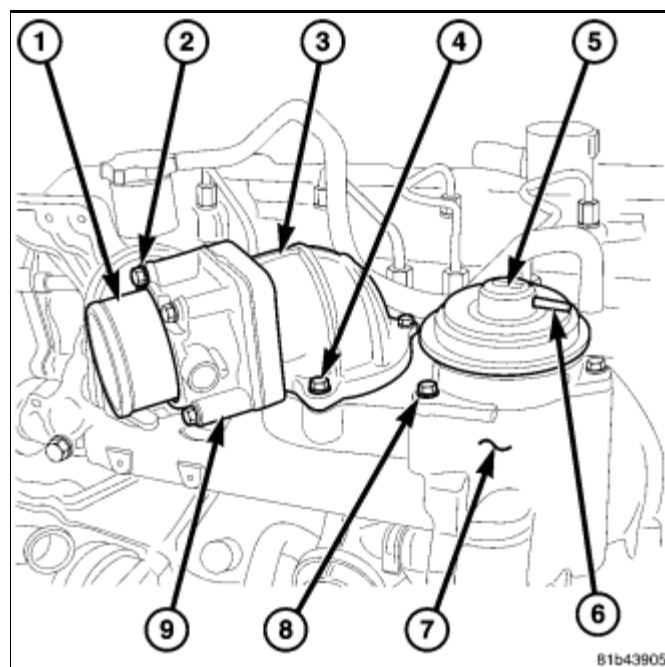


5. Disconnect air control valve electrical connector from control valve at point (2).



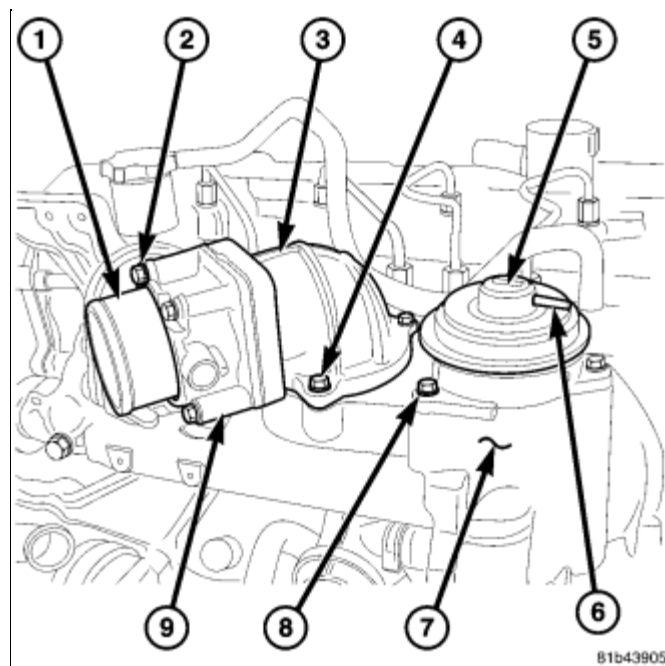
6. Remove EGR air control valve mounting bolts (2) and remove valve (9).
7. Remove and discard old mounting gasket located between EGR air control valve (9) and intake manifold connecting housing (3).
8. Clean mounting areas at bottom of air control valve and at intake manifold connecting housing (3).

INSTALLATION

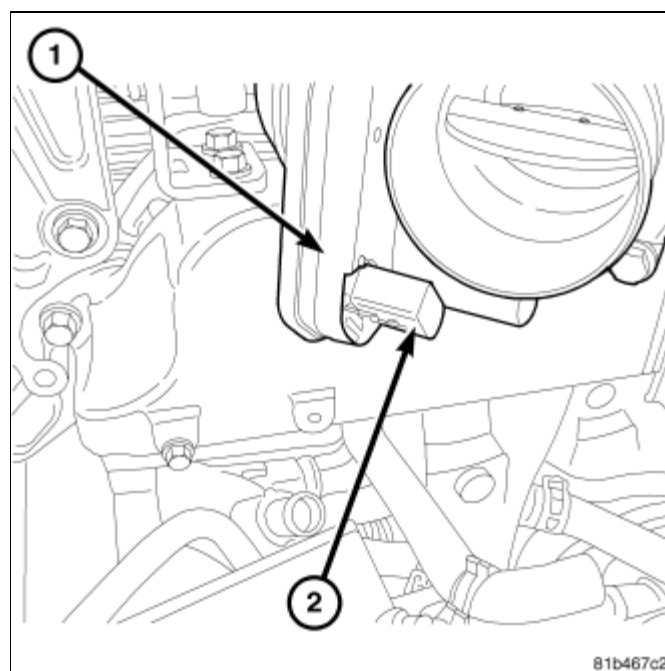


The EGR air control valve (9) is located near the center of the intake manifold (7). A cast intake housing (3) connects the control valve to the intake manifold.

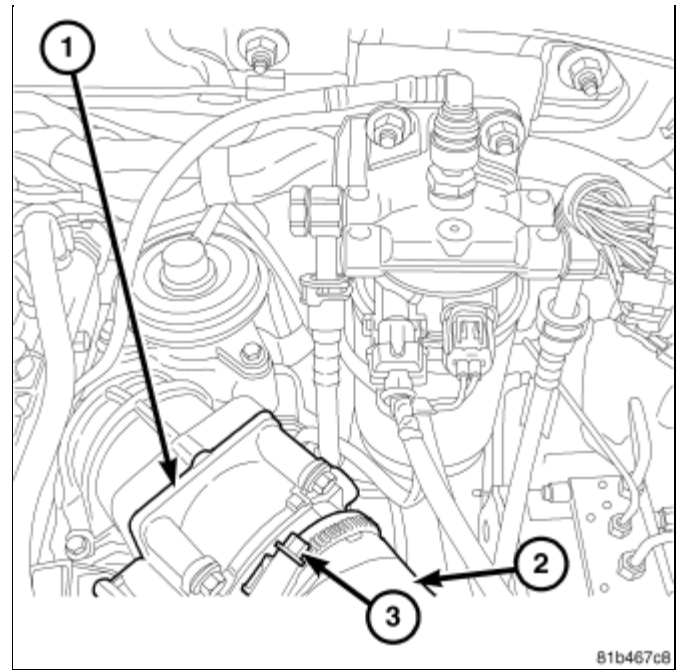
1. Clean mounting areas at bottom of air control valve and at intake manifold connecting housing (3).
2. Install new mounting gasket between EGR air control valve (9) and intake manifold connecting housing (3).
3. Install EGR air control valve and mounting bolts (2). Tighten bolts to 13 N·m (10 ft. lbs.) torque.



4. Connect air control valve electrical connector to control valve at point (2).



5. Connect rubber tube (2) to air control valve (1).
6. Install and tighten rubber intake tube clamp (3).
7. Install plastic engine cover.
8. Connect negative battery cable to battery.



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